

# SurTec® 856

## Barrel Nickel

### Properties

- very high quality of the deposited nickel layers
- coatings are very active and easy to chromium plate
- very good throwing power and metal distribution
- deposits "white" nickel
- not foaming
- insensitive against impurities
- process is easy to handle and to control (additives can be premixed)
- stable brightener system, very much reduced in building up of break down products
- additive system contains no formalin

### Application

The process SurTec 856 includes the following products:

- SurTec 850 A Nickel Carrier is the basis of the additive system
- SurTec 856 Brightener for Barrel Nickel gives brightness and levelling to the layer
- SurTec 850 L Nickel Wetter is used especially for air agitated baths and for barrel application
- SurTec 850 D Nickel Ductilizer works together with the Brightener to reach white nickel layers and a high gloss, the process can also work without ductilizer
- SurTec 850 LCD Nickel Purifier is used to correct impurities of zinc and copper

make-up values:

nickel sulfate · 6 H <sub>2</sub> O	240 g/l	
nickel chloride · 6 H <sub>2</sub> O	70 g/l	
boric acid	45 g/l	
SurTec 850 A Carrier	8 ml/l	(6-10 ml/l)
SurTec 856 Brightener	0.25 ml/l	(0.1-0.5 ml/l)
SurTec 850 L Wetter	1 ml/l	(1-5 ml/l)
SurTec 850 D Ductilizer	as required	(0-0.5 ml/l)
analytical values:		
nickel (Ni <sup>2+</sup> )	70 g/l	(60-75 g/l)
chloride (Cl <sup>-</sup> )	20 g/l	(15-25 g/l)
boric acid	45 g/l	(40-45 g/l)

make-up:

Steps for make-up:

1. In a separate tank, dissolve nickel salts and boric acid in very hot (at least 60 °C) deionised water of about 1/3 of the final volume, stirring well.
2. Add 5 g/l active carbon and stir again for about 2 hours.
3. Allow it to settle and filter into the active tank.
4. Fill up to the final volume with deionised water.
5. Do dummy plating for about 4 hours at 0.4 A/dm<sup>2</sup>, then check the ductility by plating a test panel.
6. If the test panel is ductile enough, the additives can be added, if not, dummy plating has to be continued further.

temperature:	55°C	(40-60°C)
pH-value:	4.5	(4.0-4.8)
	adjust with sulfuric acid or increase by plating	
cathodic		
current density:	1.5 A/dm <sup>2</sup>	(0.5-2.5 A/dm <sup>2</sup> )
anodic		
current density:	0.3 A/dm <sup>2</sup>	(0.2-1 A/dm <sup>2</sup> )
current efficiency:	98 %	
deposition rate:	0.22 µm/min at 1 A/dm <sup>2</sup>	
anodes:	pure nickel anodes according to DIN 1702, with anode bag out of pre-cleaned PP	
ratio		
anode : cathode:	2:1	
agitation:	barrel rotation with 6-12 rpm or additionally air agitation (oil free!)	
tank material:	steel tanks coated with plastic or PVC reinforced material	
filtration:	continuously: 4-5 x the bath volume per hour; pore size: 5-10 µm	
heating:	made of porcelain, hard glass, Teflon or titanium	
exhaust:	required for worker's protection	

recommended process sequence (for iron parts):

- hot degreasing  
*emulsifying:* SurTec 188 + SurTec 415  
*demulsifying:* SurTec 188 + SurTec 089
- hydrochloric acid pickling with SurTec 424
- anodic electrolytic cleaning with SurTec 188
- acid dip with SurTec 481
- if required: Semi Bright Nickel Process SurTec 854
- Nickel Process SurTec 856**
- No rinsing with DI-water if chromium plating follows!
- Decorative Chromium Process SurTec 871
- drying

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

## Technical Specification

(at 20 °C)	Appearance	Density (g/ml)	pH-value (conc.)
SurTec 850 A	liquid, yellowish	1.102 (1.09-1.12)	4.0 (3-5)
SurTec 856	liquid, yellowish	1.066 (1.05-1.08)	4.5 (3.5-5.5)
SurTec 850 L	liquid, yellowish	1.003 (0.99-1.02)	4.2 (3-5)
SurTec 850 D	liquid, colourless	1.035 (1.02-1.05)	3.3 (2-5)
SurTec 850 LCD	liquid, colourless-yellowish	1.008 (1.00-1.01)	4.5 (3-5)

## Maintenance and Analysis

Compensate evaporation losses by deionised or distilled water.

The analytical values must be restrained: A loss of nickel or boric acid leads to burnings, an excess of boric acid leads to pitting. A loss of chloride causes a low anodic dissolution. A low pH-value decreases the levelling power, a high pH-value leads to burnings.

Excessive **SurTec 850 A Nickel Carrier** will have nearly no effect (neither positive nor negative); a lack will lead to milky haze and brittle nickel layers.

A lack of **SurTec 856 Brightener** results in weak brightness and bad levelling. Never add more than 0.2 ml/l at a time. Excess will lead to bad adhesion of the layer and even to double nickel layers.

A lack of **SurTec 850 D Nickel Ductilizer** (tool) can be seen in weak brightness and levelling. An excess will result in an orange peeling effect.

Pores and irregular marks on perfectly pre-treated parts indicate a lack of **SurTec 850 L Nickel Wetter**.

Dark deposits, especially in the low current densities show a lack of **SurTec 850 LCD Nickel Purifier** (tool). 1 ml SurTec 850 LCD corrects impurities of 100 mg copper or 50 mg zinc.

### 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.

### Nickel – Analysis by Titration

reagents: 0.1 mol/l EDTA (Titrplex III)  
ammonia solution (conc.)  
indicator: murexide

procedure: 1. Pipette 1 ml bath sample into a 250 ml Erlenmeyer flask.  
2. Dilute with approx. 100 ml deionised water.  
3. Add 12 ml ammonia solution.  
4. Add a spatula tip of indicator.  
5. Titrate with 0.1 M EDTA from yellow to violet.

calculation: consumption in ml · 5.87 = g/l nickel

correction: rise by 1 g/l = addition of 4.8 g/l nickel sulfate · 6 H<sub>2</sub>O  
or: 4.1 g/l nickel chloride · 6 H<sub>2</sub>O

### Chloride – Analysis by Titration

reagents: 0.1 N silver nitrate solution  
indicator: potassium chromate solution (5 %)  
or: 5 g K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> + 95 g NaHCO<sub>3</sub>

procedure: 1. Pipette 1 ml bath sample into a 250 ml Erlenmeyer flask.  
2. Dilute with approx. 100 ml deionised water.  
3. Add some indicator (pH-value has to be between 6.5 and 10.5).  
4. Titrate with 0.1 N silver nitrate solution from yellow to brown.

calculation: consumption in ml · 3.54 = g/l chloride

correction: rise by 1 g/l = addition of 3.0 ml/l HCl (30 %)  
or: 3.4 g/l nickel chloride · 6 H<sub>2</sub>O

## Boric Acid – Analysis by Titration

reagents:	0.1 N NaOH solution EDTA sodium salt mannitol NaOH solution (15 %)
procedure:	1. Pipette 2 ml bath sample into a 250 ml Erlenmeyer flask. 2. Dilute with approx. 50 ml deionised water. 3. Add 2-4 g EDTA salt. 4. Adjust the pH-value to pH 7.9 with 15 % NaOH solution. 5. Add so much mannitol to the <b>clear</b> solution, until the pH is not changing more than 0.1 points (approx. 10 g). 6. Titrate with 0.1 N NaOH solution to pH 7.9 again.
calculation:	consumption in ml · 3.09 = g/l boric acid

## 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 per 10,000 Ah can be taken as estimated average consumption:

SurTec 850 A	1-2 l
SurTec 856	1.5-3 l
SurTec 850 L	approx. 0.2 l

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

SurTec 850 A Carrier	30 kg
SurTec 856 Brightener	60 kg
SurTec 850 L Wetter	25 kg
SurTec 850 D Ductilizer	30 kg
SurTec 850 LCD Purifier	30 kg

## 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 850 A	-	WHC 0
SurTec 856	Xi - Irritant	WHC 1
SurTec 850 L	Xn - Harmful	WHC 1
SurTec 850 D	-	WHC 1
SurTec 850 LCD	-	WHC 1

## 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>

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## Trouble Shooting

problem	possible cause	remedy
burnings	a) current density is too high	lower the current density
	b) agitation is insufficient	improve the agitation
	c) Carrier content is too low	increase the Carrier content
	d) metal content is too low	add nickel sulfate
	e) content of boric acid is too low	add boric acid
cloudy or hazy depositions	a) pretreatment is insufficient	check the pretreatment, improve the rinsing procedure
	b) bath temperature is too high	lower the temperature
	c) metal content is too high	reduce the anode surface, work out excessive nickel
	d) Carrier content is too high	work out
	e) current density is too low	amplify the current density
	f) content of Brightener is too low	add Brightener
	g) improper agitation	adjust speed and/or type of agitation
insufficient throwing power	a) metal content is too high	reduce the anode surface, work out excessive nickel
	b) too much additives	work out at pH 3.8
	c) organic impurities	treat with active carbon
turbid bath solution	a) bath temperature is too high	lower the temperature
	b) filtration is insufficient	improve the filtration
	c) content of boric acid is too high	filtrate the bath solution at 25°C
	d) iron impurities	treat with peroxide at high pH-value
	e) calcium impurities	add potassium fluoride to precipitate calcium

<b>problem</b>	<b>possible cause</b>	<b>remedy</b>
pitting	a) agitation is insufficient	improve the agitation
	b) metal content is too low	add nickel sulfate
	c) current density is too high	lower the current density
	d) content of wetting agent is too low	add wetting agent
	e) calcium impurities	add potassium fluoride to precipitate calcium
insufficient layer thickness	a) metal content is too low	add nickel sulfate
	b) current density is too low	amplify the current density
	c) defective contacts	check the contacts and clean them
	d) anode surface is too small	enlarge the anode surface
	e) too much Brightener	work out at pH 3.8
	f) plating time is too short	prolong the plating time
double nickel	a) too much Brightener	work out at pH 3.8
	b) pH-value is too high	adjust with sulfuric acid
	c) contacts are bad	check the contacts and clean them
yellowish Ni layer	a) iron impurities	treat with peroxide at high pH-value
	b) iron is in spare rinse	refill spare rinse freshly
hazy in the lcd	content of Brightener is too low	add Brightener
hazy in the hcd	a) content of Carrier is too low	add Carrier
	b) organic impurities	treat with active carbon
rough depositions	a) contamination with anode sludge	check the anode bags, filtrate the bath solution
	b) iron impurities	treat with peroxide at high pH-value
	c) pretreatment is insufficient	improve the pretreatment
brittle Ni layer	a) content of brightener is too high	work out at pH 3.8
	b) organic impurities	treat with active carbon
dark in the lcd	a) zinc impurities	plate selectively in the lcd or add SurTec 850 LCD
	b) copper impurities	plate selectively in the lcd or add SurTec 850 LCD