

# SurTec® 615

## Manganese Phosphating

for Iron and Steel

### Properties

- concentrated liquid additive
- produces a dark grey/black manganese phosphating layer
- good corrosion protection in combination with suitable post-treatments
- decorative layer with better corrosion resistance as a blackening layer
- very good friction properties for lowering abrasion at machine parts
- excellent basis layer for following coating and oiling
- easy process handling
- IMDS-number: 9502076

### Application

SurTec 615 is applied in immersion process.

make-up value:	100 ml/l	(corresponds to 132 g/l)
analytical values:	Total Acid (TA)	50-60 Points
	Free Acid (FA)	12-15 Points
	Free Acid Ratio (FAR)	4-5
	Iron(II)	max. 7 Fe-Points (corresponds to max. 4 g/l Fe)
make-up:	Steps for make-up:	
	1. Fill 2/3 of deionised water into the tank.	
	2. Add the calculated amount of SurTec 615.	
	3. Fill up to the final volume.	
temperature:	97°C	(95-98°C)
pH-value:	2.0	(1.9-2.1)
application time:	5-30 min	
layer thickness:	> 2 µm	
layer weight:	> 5 g/m <sup>2</sup>	
agitation:	not necessary	
filtration:	not necessary	
heating:	out of chromium nickel steel (type No. 1.4571)	
cooling:	not necessary	
exhaust:	required for worker's protection	

hints:

Layer thickness, structure of the crystals and blackness depends on the raw-material and on the pretreatment of the parts (e.g. hardening).

For some applications it can be necessary to use a pre-dip (SurTec 615 V). Pre-dip as well as bath parameters influence the thickness of the layer.

For high layer thickness smaller batches and a bigger bath volume should be used.

At high layer thickness and too much throughput, the concentration of Mn(II) will decrease. This will reduce the Free Acid Ratio (FAR), the pH-value will decrease and the bath solution will become more aggressive.

In order to correct the Free Acid Ratio (FAR), manganese carbonate has to be added.

For higher layer thicknesses and for better bath and process stability, it sometimes can be preferable to use higher Total Acid Points (up to 100).

recommended process sequence

1. high alkaline cleaning (e.g. SurTec 138 / 089)
2. rinsing
3. pickling (e.g. SurTec 088 in each 10 %vol H<sub>2</sub>SO<sub>4</sub> and H<sub>3</sub>PO<sub>4</sub>)
4. rinsing
5. optionally: pre-dip in SurTec 615 V (to reach thick layers)
6. **Phosphating in SurTec 615**
7. rinsing
8. oiling (e.g. SurTec 590)
9. 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 (at 10 g/l)
SurTec 615	liquid, green	1.300 (1.25-1.35)	approx. 2.5

## Maintenance and Analysis

Analyse and adjust the Total Acid Points and the iron content regularly.

If necessary, remove the sludge (depending on the throughput).

Replenish evaporation losses continuously by adding DI-water.

Correct the additives in between short cycles, so that no more than 2 Total Acid Points have to be added at the same time. Best is a continuous addition of the additives.

Occasionally, the tank and the heating system have to be cleaned. Allow the precipitated sludge to settle. Pump the supernatant liquid into an empty tank (e.g. an empty rinsing tank). After cleaning, pump back the phosphating bath. Replenish missing bath volume with deionised water. Analyse the total acid points and correct them.

### 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.

### Total Acid (TA) – Analysis by Titration

reagents:	0.1 N sodium hydroxide solution indicator: phenolphthalein
procedure:	1. Pipette 10 ml bath sample into a 250 ml Erlenmeyer flask. 2. Dilute to approx. 70 ml with deionised water. 3. Add 5 drops of indicator. 4. Titrate with 0.1 N sodium hydroxide from colourless to pink.
calculation:	consumption in ml = TA-Points
correction:	For each missing TA-Point = addition of 2 ml/l SurTec 615 (corresponds to 2.7 g/l SurTec 615)

### Free acid (FA) – Analysis by Titration

reagents:	0.1 N sodium hydroxide solution indicator: bromophenol blue
procedure:	1. Pipette 10 ml bath sample into a 250 ml Erlenmeyer flask. 2. Dilute to approx. 70 ml with deionised water. 3. Add 2-3 drops of indicator. 4. Titrate with 0.1 N sodium hydroxide solution from yellow to blue.
calculation:	consumption in ml = FA-Points

### Free Acid Ratio (FAR)

$$TA / FA = FAR$$

If the FAR is too low, add manganese carbonate.

### Iron – Analysis by Titration

reagents:	sulfuric acid (30-40 %) 0.1 N potassium permanganate solution (0.02 mol/l)
procedure:	1. Pipette 10 ml bath sample into a 250 ml Erlenmeyer flask. 2. Dilute to approx. 70 ml with deionised water. 3. Add 10 ml sulfuric acid. 4. Titrate with 0.1 N potassium permanganate solution from colourless to light red.
calculation:	consumption in ml = Fe-Points consumption in ml · 0.56 = g/l Fe(II)
correction:	If the iron content rises above 4 g/l (7 Fe-Points), some of the Fe(II) has to be oxidised with peroxide (H <sub>2</sub> O <sub>2</sub> ) to Fe(III). The Fe(III) will precipitate as phosphate.  reduction of the iron content by 1 Fe-Point (0.56 g/l Fe): addition of 0.8 ml/l peroxide (35 %) (Pre-dilute peroxide 1:5 in deionised water and add it slowly to the bath, mix well)  Afterwards add as much g/l manganese carbonate as there was added peroxide (35 %) before, e.g. for 0.8 ml/l H <sub>2</sub> O <sub>2</sub> , also 0.8 g/l MnCO <sub>3</sub> are required.  The correction of the iron content should be done at the end of a working day, thus the precipitated iron(III)phosphate is allowed to settle and will not disturb the phosphating process by producing a yellow mud on the surface of the parts.

## Ingredients

- salts of manganese
- phosphoric acid
- salts of nickel

## 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](#).

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

SurTec 615                      140 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 615	T - Toxic N - Dangerous for the environment	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>