

# SurTec® 616

## Thin Layer Manganese Phosphating

### Properties

- for immersion application
- suitable for steel substrates
- excellent lubrication and wear resistant properties
- for automotive parts, fasteners, washers and other moving components
- produces micro-crystalline layers
- uniform and adherent deposition
- excellent corrosion protection
- forms only very small amounts of sludge

### Application

The process SurTec 616 includes the following products:

- SurTec 616 M Make-Up Solution
- SurTec 616 R Replenishment Solution
- SurTec 612 S Accelerator
- H<sub>2</sub>O<sub>2</sub> (30 %) is used only for the initial make-up

make-up values:

SurTec 616 M Make-Up Solution	75 ml/l
SurTec 612 S Accelerator	0.3 ml/l
H <sub>2</sub> O <sub>2</sub> (30 %)	0.2 ml/l

analytical values:	Total Acid (TA)	36 Points	(34-38 Points)
	Free Acid (FA)	16 Points	(15-17.5 Points)
	TA · 2.5 / FA	5.8	(5.2-6.4)
	SurTec 612 S	0.27 ml/l	(0.25-0.3 ml/l)
	iron content	maximum 0.1 g/l	

make-up:

Steps for make-up:

1. Dissolve SurTec 616 M in water with strong agitation.
2. Pre-dilute SurTec 612 S in water and add it to the bath;  
e.g. for 1000 l bath:  
dissolve 0.3 l SurTec 612 S in 5 l water and add it to the bath.
3. Pre-dilute H<sub>2</sub>O<sub>2</sub> (30 %) in water and add it to the bath;  
e.g. for 1000 l bath:  
dilute 0.2 l H<sub>2</sub>O<sub>2</sub> (30 %) in 10 l water and add it to the bath.
4. After the recommended make up additions are done, analyse the desired parameters of the bath and adjust if necessary.  
If it is desired to modify these parameters, our technical staff will assist in changing the bath make-up proportions.

temperature: 97 °C (95-98 °C)  
 application time: 5-10 min  
 agitation: not recommended  
 tank material: out of stainless steel  
 filtration: periodically remove sludge filter sludge and return filtrate to bath  
 heating: necessary; stainless steel heaters (type 1.4571), or steel coated with PTFE  
 cooling: not applicable  
 exhaust: required for worker's protection  
 hint: The deposited layer weight varies from 1.5-5.5 g/m<sup>2</sup>.

recommended process sequence (for iron parts):

1. degreasing, e.g. SurTec 168/089 or SurTec 138/089
2. rinsing
3. pickling (optional), sulfuric acid combined with SurTec 422
4. rinsing
5. grain refinement, e.g. SurTec 616 V
6. **phosphating with SurTec 616**
7. rinsing
8. DI-water rinsing
9. drying < 110 °C

## Technical Specification

(at 20 °C)	Appearance	Density (g/ml)	pH-value (conc.)
SurTec 616 M	liquid, greenish	1.330 (1.31-1.35)	< 1
SurTec 616 R	liquid, greenish	1.295 (1.28-1.31)	< 1
SurTec 612 S	liquid, yellowish	1.214 (1.19-1.24)	10-12.5

## Maintenance and Analysis

Analyse and adjust Total Acid, Free Acid and SurTec 612 S regularly. The variation of FA-Points between the separate intervals should be 1 point at most.

In case of high throughput, use an automatic dosage system to avoid varying concentrations. Especially SurTec 612 S should be dosed continuously.

Replenish evaporation losses continuously by adding deionised water.

### 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 with approx. 50 ml deionised water.
3. Add 5 drops of indicator.
4. Titrate with 0.1 N sodium hydroxide solution from colourless to light pink.

calculation: consumption in ml = TA-Points

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

- reagents: 0.1 N sodium hydroxide solution  
indicator: bromophenol blue
- procedure: 1. Pipette 25 ml bath sample into a 250 ml Erlenmeyer flask.  
2. Dilute with approx. 50 ml deionised water.  
3. Add 5 drops of indicator.  
4. Titrate with 0.1 N sodium hydroxide solution from yellow to blue.
- calculation: consumption in ml = FA-Points
- correction: **1) FA-Points are below 15:**  
**a) and TA-Points are in the range of 32-38:**  
for each missing FA-Point:  
replenish 1.6 ml/l SurTec 616 R  
**b) and TA-Points are below 32:**  
for each missing FA-Point:  
replenish 5 ml/l SurTec 616 M  
**2) FA-Points are beyond 17.5:**
- work out by production of parts
  - dilute the bath
  - if necessary, add 0.16 g/l NaOH (pre-diluted with water, 10 %) to neutralise one FA-Point

### Iron (II) and SurTec 612 S Accelerator – Analysis by Titration

- reagents: 0.1 N potassium permanganate solution ( $\text{KMnO}_4$ )  
sulfuric acid (50 %)  
urea  
indicator: dimethylene yellow
- procedure: 1. Pipette 100 ml bath sample into a 500 ml Erlenmeyer flask.  
2. Dilute with approx. 20 ml deionised water.  
3. Add 5 ml sulfuric acid (50 %).  
4. Add 2 g urea and stir until the urea has dissolved.  
5. Titrate with 0.1 N potassium permanganate solution to a stable pink colour (for at least 15 s).  
consumption in ml = **B**  
6. Pipette 100 ml of the bath solution into 250 ml Erlenmeyer flask.  
7. Dilute with approx. 20 ml deionised water.  
8. Add 5 ml sulfuric acid (50 %).  
9. Titrate with 0.1 N potassium permanganate solution to a stable pink colour (for at least 15 s).  
consumption in ml = **A**
- calculation: **B** · 0.0558 = g/l Fe(II)  
**(A - B)** · 3.33 = ml/l SurTec 612 S

## Ingredients

SurTec 616 M and SurTec 616 R

- phosphoric acid
- nitric acid
- manganese salts

SurTec 612 S

- nitrite 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](#).

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

SurTec 616 M Make-Up Solution	100 kg
SurTec 616 R Replenishment Solution	100 kg
SurTec 612 S Accelerator	10 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:

<i>product</i>	<i>hazard designation</i>	<i>water hazard class</i>
SurTec 616 M	T - Toxic	WHC 2
SurTec 616 R	T - Toxic	WHC 2
SurTec 612 S	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>