

# AURUNA® 536 LC

## Operating Instructions

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- gold bath for the deposition of Au/Fe coatings; nickel-free!
- for coating thicknesses up to 2 µm
- for technical and decorative applications
- low gold content (2 g/l)
- easy bath maintenance

### Bath Characteristics

AURUNA® 536 LC is a weakly acidic electrolyte with a low gold content of 2 g/l.

The bath is preferably used for decorative and technical applications with a low coating thickness (up to approx. 2 µm). For the deposition of thicker layers we recommend our ultra-fast gold bath AURUNA® 536.

Apart from the high hardness of 180 HV and the good abrasion properties of its coatings, the bath has a good throwing power. It is very well suited for the deposition of thin layers in rack and barrel operation.

The coatings can be soldered and have a low contact resistance which is long-time stable.

Bath type:	weakly acidic
Gold content:	2 g/l (1 - 3 g/l)
pH value:	4.0 (3.8 - 4.2)
Temperature:	50 °C (± 2 °C)
Current density:	1 - 3 A/dm <sup>2</sup>
Deposition speed:	approx. 0.1 µm/min

### Coating Characteristics

Coating:	Gold-iron
Alloy composition:	approx. 99.5 % of gold, 0.5 % of iron (weight %)
Colour:	colour of pure gold
Hardness:	approx. 180 HV 0.025
Density of the coating:	approx. 17.5 g/cm <sup>3</sup>
maximum coating thickness:	2 µm
Classification acc. to ASTM B 488-01:	type II, code C (corresponds to type II, grade C accord. to MIL-G-45204 C)

### Form of Supply

- |                     |                                                                                                                                                                           |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bath makeup:        | a) AURUNA® 536 LC Initial Concentrate<br>200 ml for 1 l of bath, gold-free<br>Storage stability: min. 3 years                                                             |
|                     | b) AURUNA® Basic Additive C<br>95 g for 1 l of bath<br>Storage stability: unlimited                                                                                       |
|                     | c) AURUNA® Potassium Gold Cyanide 68.2 %<br>2 g of Au, i.e. 2.93 g of AURUNA® Potassium Gold Cyanide 68.2 % are required for 1 l of bath.<br>Storage stability: unlimited |
| Bath replenishment: | d) AURUNA® Potassium Gold Cyanide 68.2 % (as item c)<br>1.47 g per 1 g of gold deposited                                                                                  |
|                     | e) AURUNA® 536 LC Replenisher Solution, gold-free<br>3 ml per 1 g of gold deposited<br>Storage stability: min. 2 years                                                    |
| for corrections:    | f) AURUNA® Density Correction Salt 1<br>For correction of the bath density<br>Storage stability: unlimited                                                                |
|                     | g) For pH corrections citric acid and potassium hydroxide solution (both chemically pure) should be available.                                                            |

### Bath Makeup

- |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Makeup sequence: | To make up 1 l of bath, dilute 200 ml of AURUNA® 536 LC Initial Concentrate to approx. 700 ml with deionized water and dissolve 95 g of AURUNA® Basic Additive C in it. Only after this add 2.93 g of AURUNA® Potassium Gold Cyanide 68.2 % (2 g of Au), previously dissolved in warm deionized water.<br>Finally fill up to 1000 ml with deionized water. If necessary, adjust the pH value of the electrolyte to 4.0 with potassium hydroxide solution resp. citric acid (both chemically pure). |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

# AURUNA® 536 LC

## Operating Conditions

Gold content:	2 g/l (1 – 3 g/l)
Operating temperature:	50 °C (± 2 °C)
pH value:	4.0 (3.8 - 4.2)
	To be adjusted with potassium hydroxide solution or citric acid (both chemically pure).
Bath density:	1.08 – 1.09 g/cm <sup>3</sup> (10.7 – 12°Bé) at 20 °C
	If the bath density drops under 1.07 g/cm <sup>3</sup> (9.5°Bé), it must be re-adjusted with AURUNA® Density Correction Salt 1 (only necessary in the case of high drag-out losses). Per litre of bath volume, approx. 25 g of AURUNA® Density Correction Salt 1 are required to increase the density by 0.01 g/cm <sup>3</sup> .
	Then the pH value must be readjusted to nominal value with citric acid (chemically pure).
Product agitation:	vigorous product agitation is required
Bath agitation:	electrolyte agitation as vigorous and uniform as possible is recommended air agitation is permitted
Filtration:	continuous filtration of the bath is recommended
Current density:	1 - 3 A/dm <sup>2</sup> Working in the range between 1 - 3 A/dm <sup>2</sup> is possible.
Deposition rate: Deposition speed:	Deposition speed and deposition rate depend on current density and Au content of the bath. The values can be taken from the following tables.

**Table I**

Deposition speed [µm/min]			
Gold content	1 A/dm <sup>2</sup>	2 A/dm <sup>2</sup>	3 A/dm <sup>2</sup>
1 g/l	0.06	0.08	0.09
2 g/l	0.11	0.12	0.12
3 g/l	0.15	0.16	0.15

**Table II**

Deposition rate [mg/Amin]			
Gold content	1 A/dm <sup>2</sup>	2 A/dm <sup>2</sup>	3 A/dm <sup>2</sup>
1 g/l	10	7	5
2 g/l	20	10.5	7
3 g/l	27	14	9

**Table III**

Plating time for 1 µm (minutes)			
Gold content	1 A/dm <sup>2</sup>	2 A/dm <sup>2</sup>	3 A/dm <sup>2</sup>
1 g/l	17	12.5	12
2 g/l	9	8.5	8.5
3 g/l	7	6.5	7

The given values can only be regarded as guidelines, because the true values are influenced by equipment, parts and agitation. Particularly in the case of barrel applications due to the deviating operating conditions differences are possible.

## Calculation of Coating Thickness and Plating Time

$$\text{Coating weight in mg} = \text{surface in cm}^2 \times 1.75 \times \text{coating thickness in } \mu\text{m}$$

Plating time:

The plating time required for the deposition of the desired coating thickness can be taken from the tables (see above). If the Au content has either been partially extracted or increased, the plating time has to be modified according to the tables.

## Bath Replenishment

Per 1g of pure gold deposited, the following replenishments are required:

1.47 g of AURUNA® Potassium Gold Cyanide 68.2 % 3 ml of AURUNA® 536 LC Replenisher Solution

In order to reach a uniform coating thickness, the replenishments should be carried out in a way that the gold content remains within the limits 1 and 3 g/l (take Tables I - III into consideration!).

## Bath Monitoring and Correction

Analytical control: Analytical control of the concentrations of Au and Fe.

pH adjustment with citric acid resp. KOH (both chemically pure).

Correction of the bath density:

To increase the density by 0.01 g/cm<sup>3</sup> per 1 litre of bath volume, add 25 g of AURUNA® Density Correction Salt 1.

The analytical laboratory of the supplier is available for the analytical control of further essential bath components.

# AURUNA® 536 LC

## Special Process Hints

### Important:

The deposition speed increases with  
 rising current density  
 rising gold content  
 rising pH value

Matt-brown deposits especially at edges and corners of the articles mean a current density which is too high. Slight brownish hazes occur at a too low current density or at too high a pH value.

Barrel plating: When using the bath for barrel plating, the low gold content is favourable not only to reduce drag-out losses but it also results in a more uniform distribution of the coating thickness. A particularly fast deposition is disadvantageous with this application. But a sufficiently high current density must be applied also in the case of barrel plating in order to prevent hazes on the articles in low current density areas. For high demands on the distribution of the coating thickness we recommend the use of AURUNA® 526 or AURUNA® 527 (gold-cobalt resp. gold-nickel electrolyte specially for barrel application).

Pretreatment: Thoroughly rinse the parts after electrolytic degreasing, possibly rinse in 1 % to 5 % citric acid, or pregild in an acidic bath (AURUNA® 551). Then rinse again thoroughly, finally in de-ionized water, and immerse the parts in the gold bath with the current switched on.

## Equipment

Bath tanks: plastic, preferably polypropylene

All parts coming into contact with the electrolyte must be resistant to weak acids. Plastic equipment, e.g. tank, pump, hoses, filter cartridges, etc. before use should be rinsed in diluted acid (e.g. 5 % sulphuric acid) for several hours and subsequently cleaned of the contaminated acid by intensive rinsing with water which should be changed several times.

Heating: immersion heaters with coating of porcelain, quartz, or Teflon equipment for temperature control

Filtration: continuous filtration of the electrolyte is recommended

Anodes: platinized titanium, e.g. PLATINODE® coated with 1.5 µm of platinum

ratio anode area : article area at least 2 : 1

Rectifier: with sufficient capacity, with current display, possibly amperehour meter

### Note

Our information relating to the storage stability refers to storage in closed original storage containers under the conditions stated on the label.

## Precautionary Measures/Safety Hints

For information on safety, please see the corresponding Material Safety Data Sheets! The valid accident prevention regulations and safety information must be observed.

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