

# RHODUNA® Diamond Bright

## Operating Instructions

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### Rhodium Concentrate with 2 g Rh/100 ml

#### Brilliant-white rhodium for decorative applications

- Ultra-bright coatings with previously unattained lightness and brilliance
- Good covering speed
- Excellent throwing power
- Layer thicknesses of up to 5 µm can be deposited
- For rack and barrel operation

### Electrolyte Characteristics

RHODUNA® Diamond Bright deposits brilliant-white, ultra-bright coatings of previously unattained lightness and brilliance. It is additionally characterized by high covering speed and excellent throwing power. Furthermore, from RHODUNA® Diamond Bright layer thicknesses of up to 5 µm can be deposited crack-free.

Rhodium can be directly deposited on silver, gold, copper and copper alloys, nickel and nickel alloys. When plating tin, lead, zinc, aluminium and iron, intermediate nickel coatings of some µm thickness are absolutely essential. Strike nickel plating is advantageous with all substrates.

Rhodium content:	2 g/l	(1.6 – 3 g/l)
pH-value:	< 1	
Temperature:	40 °C	(RT – 65 °C)
Current density:	1 – 2 A/dm <sup>2</sup>	(0.5 – 10 A/dm <sup>2</sup> )
Voltage:	2 volts	(2 – 4 volts)
Deposition speed:	0.08 µm/min at 1 A/dm <sup>2</sup>	0.10 µm/min at 2 A/dm <sup>2</sup>
Deposition rate:	9.4 mg rhodium/Amin at 1 A/dm <sup>2</sup> ,	5.9 mg rhodium/Amin at 2 A/dm <sup>2</sup>
Current efficiency:	44 % at 1 A/dm <sup>2</sup>	27 % at 2 A/dm <sup>2</sup>

### Coating Characteristics

Coating:	Rhodium
Colour:	Brilliant white
Hardness:	Approx. 800 – 900 HV
Density of coating:	Approx. 12.4 g/cm <sup>3</sup>
Max. coating thickness:	Approx. 3 – 5 µm

### Form of Supply

Electrolyte makeup:	a) RHODUNA® Diamond Bright Rhodium Concentrate (2 g Rh/100 ml; containing acid) 100 ml for 1 litre of electrolyte with 2 g/l Rh Storage stability: min. 2 years
	b) RHODUNA® Diamond Bright Additive Solution 100 ml for 1 litre of electrolyte Storage stability: min. 2 years

Electrolyte replenishment:	b) RHODUNA® Diamond Bright Replenisher Solution 100 ml containing 5 g rhodium Storage stability: min. 2 years
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### Electrolyte Makeup

Makeup sequence:	For 1 litre of RHODUNA® Diamond Bright electrolyte with 2 g/l Rh:  Slowly stir 100 ml of RHODUNA® Diamond Bright Rhodium Concentrate (2 g Rh/100 ml) into 750 ml of deionized water. Then add 100 ml of RHODUNA® Diamond Bright Additive Solution and fill up to 1 litre with deionized water.
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### Operating Conditions

Electrolyte density:	1.023 g/cm <sup>3</sup> when newly made up, slowly rising
Sulphuric acid content:	30 g/l after electrolyte makeup with 2 g/l Rh
Product agitation:	Optional. Mechanical tapping to dislodge adhering hydrogen bubbles is recommended.
Barrel plating:	RHODUNA® Diamond Bright is also suitable for barrel plating.  Recommended standard values: Current density: approx. 1 A/dm <sup>2</sup> Voltage: 6 - 9 volts Temperature: 40 °C Deposition speed: approx. 0.03 µm/min This value is given as a rough guide only since the deposition speed depends on type and rotation of the barrel as well as shape and number of parts in the barrel.
Loading per litre:	Max. 1 A/l

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## Calculation of Coating Thickness and Plating Time

Coating weight in mg =  $\frac{\text{surface in cm}^2 \times 1.2 \times \text{coating thickness in } \mu\text{m}}{\text{deposition rate in mg/Amin} \times \text{current in amperes}}$

Plating time in minutes =  $\frac{\text{required coating weight in mg}}{\text{deposition rate in mg/Amin} \times \text{current in amperes}}$

## Electrolyte Replenishment

The rhodium content of the electrolyte should be constantly kept at 2 g/l. Replenish at the latest when 20 % of the rhodium content (= 0.4 g/l Rh) have been consumed.

Per 1 g of Rh deposited, add to the electrolyte:

20 ml/l RHODUNA® Diamond Bright Replenisher Solution (5 g Rh/100 ml)

At 1 A/dm<sup>2</sup> (44 % current efficiency), 1 g of rhodium will be deposited after a charge transfer of 106 ampere-minutes, at 2 A/dm<sup>2</sup> after 171 ampere-minutes (values for 40 °C).

## Electrolyte Monitoring and Correction

Keep the electrolyte clean. Cover when not in use and remove the platinized titanium anodes from the electrolyte. Store in a closed bottle when not in use for a longer period of time. Filter turbid electrolytes.

Always correct the **rhodium content** with RHODUNA® Diamond Bright Replenisher Solution (5 g Rh/100 ml).

An **active carbon treatment**, e.g. for removing organic contaminants, can be carried out without any significant loss of rhodium. Add 2 g of active carbon per litre of electrolyte in a separate tank, stir for 2 hours at operating temperature and then filter.

The important organic components withdrawn from the rhodium electrolyte during this treatment can be easily replenished by adding RHODUNA® Diamond Bright Replenisher Solution.

Avoid all **metallic contaminants** (silver and copper in particular) and the drag-in of cyanide!

## Special Process Hints

**Pre-treatment:** Etch, grind, polish etc. the base metal to achieve the desired initial surface condition. Pre-degrease the parts, e.g. in an alkaline cleaning solution or an ultrasonic bath. Rinse, then degrease electrolytically, rinse under running water, and finally with deionized water.

**Strike nickel plating:** RHODUNA® Diamond Bright can be directly deposited on silver, gold, copper and copper alloys, nickel and nickel alloys. When plating tin, lead, zinc, aluminium and iron, intermediate nickel coatings of some micrometres thickness are absolutely essential.

After strike nickel plating, rinse thoroughly. Each rinsing operation before rhodium plating should consist of rinsing under running water followed by rinsing with deionized water.

**Acid dip:** After degreasing or strike nickel plating, dip the workpieces in 5 vol.% sulphuric acid (chemically pure) at room temperature before hanging them into the rhodium electrolyte to ensure that no alkalis are dragged into the rhodium electrolyte.

If particularly great difficulties are encountered in wetting after strike nickel plating, repeat the electrolytic degreasing and acid dip treatments. The last step before rhodium plating should always be an acid dip treatment.

**Rhodium plating:** After the acid dip, drain the workpieces quickly, **connect to current** and hang into the rhodium electrolyte without intermediate rinsing. Any adhering hydrogen bubbles should be continually removed.

**Post-treatment:** Allow the electrolyte fluid to drain off thoroughly. Rinse in deionized water, then in running water and - if possible - also in hot water. Dry immediately. Use the first recovery rinse water for topping up the rhodium electrolyte.

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## Equipment

Electrolyte tanks:	Tanks of acid-proof materials, preferably polypropylene.
Accessories:	All plastic parts coming into contact with the electrolyte, e.g. electrolyte tanks, rack insulation, barrels, pumps and hoses, prior to use must be acidified in 5 - 10 % cold sulphuric acid for approx. 24 hours.  <b>Very important:</b> Prior to use, filter cartridges must be boiled in 10 % sulphuric acid for approx. 3 hours. Then they are inserted into the pump and thoroughly rinsed with water. It is essential to change the water several times.
Product agitation:	Optional. Mechanical tapping to dislodge adhering hydrogen bubbles is recommended.
Anodes:	Platinized titanium, e. g. PLATINODE® coated with 2.5 µm of platinum, or iridium mixed metal oxide MMO, e.g. PLATINODE® 177 or 187. We recommend removing the anodes from the electrolyte during non-plating periods (during the night).  Ratio of anode area to parts area at least 1 : 1.
Current source:	Infinitely variable, with current display and ampere-hour meter; residual ripple < 5 %.
Exhaust system:	Required for large electrolytes (strongly acidic electrolyte mists entrained by evolution of hydrogen).

## 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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