



ARGONAUT

Bright Silver Plating Solution.

INTRODUCTION

PMD Argonaut Bright Silver Plating Solution produces a fully bright, pure silver deposit on plated or polished substrates. The bright throwing power of the solution is exceptionally high giving a brilliant deposit even on deeply recessed work. The brightness is maintained with two separate addition agents. PMD Argonaut Bright Silver Plating Solution contains no alloying brighteners, therefore deposit resistivity is equivalent to pure silver enabling the process to be used for electrical, electronic or microwave purposes as well as for the more normal decorative applications.

The solution will operate over a wide range of silver concentrations and is suitable for both rack and barrel applications.

APPLICATION

The solution is recommended for the bright plating of cutlery and other tableware, for jewellery, medallions and statuary. The bright throw makes Argonaut especially suitable for holloware and deep drawn components such as trophies and goblets.

In the technical field the deposit is suitable for p.c.b.'s, connectors and contacts, switch gear and high frequency applications such as waveguides.

BENEFITS

- Excellent throw giving bright deposits over a wide operating range.
- Ease of control.
- High purity deposit gives conductivity equal to pure silver.
- Ideal for both decorative and industrial applications.

SOLUTION MAKE -UP

PMD Argonaut Bright Silver Solution is normally supplied ready to use with brighteners and an appropriate silver content required by the customer. However, if the solution is to be stored, the Brighteners are supplied separately. When ordering PMD Argonaut Bright Silver Solution, it is necessary to state whether the solution is to be supplied ready for use or for storage and to specify the silver content required depending on the use of the process, either rack, barrel or a special requirement.

OPERATING DATA

	Rack	Barrel
Silver	35 – 40g/L	20 - 25g/L
Free potassium cyanide	100 – 120g/L	100 - 120g/L
Potassium Carbonate	100g/L Max	
Temperature	20 – 30°C	
Cathode current density	0.5 – 2.5 ASD	0.1 – 0.5 ASD
Agitation	Work movement	
Extraction	Essential	
Deposition rate	1µm/ min at 1.6 ASD	

EQUIPMENT

Tanks	PVC, polypropylene or lined mild steel.
Heaters	Titanium or PTFE immersion heaters with thermostatic control.
Filtration	Continuous filtration through 5µm filter cartridge giving 2 solution turnovers / hour.
Agitation	Cathode agitation of 2-4m/minutes with a stroke length of 8–10 cm.
Rectification	DC with smoothed current.
Anodes	Silver minimum purity 99.97% in polypropylene anode bags.

INSTALLATION

It is essential that the tanks to be used for Argonaut are thoroughly cleaned and leached before any product is introduced.

If in any doubt as to the cleaning procedure please contact PMD Technical Department.

1. Half fill tank with DI water.
2. Add the potassium cyanide and stir until fully dissolved.
3. Add the 54% silver cyanide and stir until fully dissolved.
4. Add 2g/L activated carbon, mix thoroughly then filter until all carbon is removed.
5. Add the Argonaut PA and SA Additive and stir.
6. Make up to volume with DI water and mix thoroughly.
7. Heat to operating temperature.



MAINTENANCE AND CONTROL

The solution should be analysed regularly and replenished as necessary. (See analysis methods).

Argonaut PA Additive is consumed by electrolysis and also by decomposition on standing.

Argonaut SA Additive is lost only by drag-out.

Recommendations for maintenance of these Addition Agents are therefore only a general guide and will vary according to the manner of operation, i.e. regular, spasmodic, rack, barrel etc. However, the following figures can be used as a basis:-

Argonaut PA Additive (Solid)	100 gm/1000 amp. hours
Argonaut SA Additive	5 ml/1000 amp. hours

See appendix for the effect on Hull Cell panels of imbalance of the Brightener System and other variables.

NOTES

Preparation of Argonaut PA Additive (Liquid)

To prepare 1 litre:-

1. Dissolve 70 gm potassium hydroxide in 800 ml water.
2. Heat to 49 - 51 Deg. C (IMPORTANT) and dissolve 125 gm Argonaut PA Additive (Solid).
3. Allow to stand overnight then adjust the volume to 1 litre.
4. Filter into a storage container through a cotton or nylon anode bag.

Argonaut PA Additive (Liquid) does not have an indefinite life and it is advisable to prepare only enough material for one week's consumption.

ANALYSIS METHODS

1. Silver Content

Reagents

Concentrated sulphuric acid.
Concentrated nitric acid,
2%(w/v) ammonium ferric sulphate solution.
0.1N Ammonium thiocyanate (standard volumetric solution)



Method

1. Pipette a 10.0ml aliquot of the plating solution into a 250ml conical flask.
2. In a fume cupboard, add 20ml concentrated sulphuric acid and 5ml concentrated nitric acid.
3. Heat until the heavy fumes of sulphuric acid persist.
4. Allow to cool to room temperature.
5. Carefully add 90mls DI water and allow to cool.
6. Add 3mls concentrated nitric acid.
7. Add 2mls 2% ammonium ferric sulphate solution.
8. Titrate to a pink end point with 0.1N ammonium thiocyanate solution.
9. Record titre = t mls.

Calculation

$$t \times 1.08 = \text{g/L silver}$$

Replenishment

For every 1g/L silver required add 1.85g/L 54% silver potassium cyanide.

2. Free Potassium Cyanide

Reagents

5% (w/v) Potassium iodide solution
0.1N silver nitrate (standard volumetric solution)

Method

1. Pipette a 2.0ml aliquot of the plating solution into a 250ml conical flask.
2. Add 80mls DI water and 10mls of 5% potassium iodide solution.
3. Titrate with 0.1N silver nitrate solution until the solution is turbid.
4. Record titre = t mls.

Calculation

$$t \times 6.6 = \text{g/L free potassium cyanide.}$$

Replenishment

For every 1g/L potassium cyanide required add 1g/L potassium cyanide.

NOTES



- Pre-treatment.** Mirror bright deposits will be obtained from polished substrates which are clean and grease free. Matt surfaces will have a semi-bright finish after plating.
- Carbonate** As the PMD Argonaut Bright Silver Solution ages, in common with all cyanide solutions, there is a gradual increase in the concentration of potassium carbonate. There is no clearly defined limit at which excessive carbonate concentrations begin to affect the brightness of deposits, but as an approximate value, concentrations above 100 gm/L are liable to give rise to loss of brightness particularly at high current densities. A certain amount of carbonate is useful in that it stabilizes pH within the range 11.5 to 12.5 and increases conductivity. In barrel plating operations it is often possible to produce satisfactory deposits at carbonate levels in excess of 100 g/L.
- Silver strike.** To ensure good adhesion a silver strike is recommended prior to the Argonaut bath. A typical make up is
- | | |
|------------------------------|--------|
| 54% silver potassium cyanide | 5g/L |
| Potassium cyanide | 120g/L |

This solution is typically used at 0.5 ASD rack and 0.1 – 0.3 ASD barrel.

DISPOSAL

Dispose of in accordance with the local authority requirements.

PRODUCT FAMILIES

The following products are referred to in this data sheet.

PRODUCT NAME	PRODUCT NUMBER
Argonaut Silver solution	148003
Argonaut PA Additive (Solid)	152001
Argonaut PA Additive (Liquid)	155001
Argonaut SA Additive	154001
54% Silver potassium cyanide	119002
80.5% silver cyanide	119001

Whilst every endeavour has been made to ensure that the information given in this data sheet is correct, PMD Chemicals Limited gives no warranty, express or implied, relating to the use or performance of this product.



APPENDIX

ARGONAUT BRIGHT SILVER

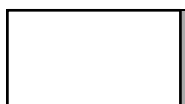
TROUBLE SHOOTING GUIDE

OPERATING CONDITIONS:

Hull Cell	-	267 or 320 mls capacity
Temperature	-	25°C
Current	-	1 amp.
Time	-	10 minutes
Anode	-	Silver
Cathode	-	Polished Brass Panel, Silver Flashed.



Bright



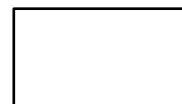
Semi -Bright



Dull



Burnt



Streaked

5	2.8	1.2	0.4	0.2 A/dm ² (approx)
50	28	12	4	2 A/ft ²



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NORMAL DEPOSIT

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BASIC COMPOSITION NORMAL
ADDITION AGENT SA NORMAL.
ADDITION AGENT PA LOW.

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AS ABOVE WITH ADDITION
AGENT PA HIGH.

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BASIC COMPOSITION NORMAL.
ADDITION PA NORMAL
ADDITION AGENT SA LOW.

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BASIC COMPOSITION NORMAL.
BRIGHTENERS NORMAL.
pH HIGH.



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BRIGHTENERS NORMAL.
SILVER HIGH.

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BRIGHTENERS NORMAL
SILVER LOW.

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BRIGHTENERS NORMAL.
FREE CYANIDE LOW.

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HIGH CARBONATES.

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HIGH SODIUM ION
CONCENTRATION



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INORGANIC IMPURITIES

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SUSPENDED PARTICLES