PRIMION 240

ALKALINE NON-CYANIDE ZINC PROCESS

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1 de 11	06/2002	F. DAL POZ		C. DE VAL	1	

COVENTYA S.A.S.
51, rue Pierre. BP 310. F – 92111 CLICHY Cedex – Tél. : + 33 (0)1 47 15 73 00 – Fax : + 33 (0)1 42 70 12 65
Société par Actions Simplifiée au capital de 1 200 400 € - 433 420 577 RCS Nanterre . N° T.V.A. FR 23 433 420 577
http://www.coventya.com

1 - INTRODUCTION

PRIMION 240 is the new alkaline non-cyanide zinc process for bright zinc electrodeposition with an exceptional throwing power.

© Completely cyanide-free process, zinc and sodium/potassium hydroxide system, not toxic with an easier waste water treatment;
Mainly for decorative purpose, thanks to its brightness and bright throwing power;
Assures a higher deposition rate at the same zinc concentration compared to previous processes;
Always obtains an excellent metal distribution with very similar thicknesses at high and low current density, allowing an important zinc saving;
© Additives compatible with sodium and potassium hydroxide;
© Blue passivability with products based on trivalent chromium;
Easily passivable with yellow, green or black chromium passivates based on hexavalent chromium;
© Suitable for rack and barrel.

Comparison between sodium and potassium hydroxide

- According to the specific plant exigencies and finishing aims, It's important to consider the main practical differences in use of sodium or potassium hydroxide.
- the potassium hydroxide permits a higher cathode performance at high, medium and low current density of a 25 % (average value) over all spectrum; same performance at low-very low (0,2 A/dm^2);
- a slight more brightness for potassium hydroxide at the same brightener content;
- same good metal distribution;
- potassium hydroxide limit: potassium carbonate not crystallizable;

2 – MAKE-UP

Make-up based on zincate solution

• BE CAREFUL: making the bath is suitable to utilise tap water but with hardness lower than 25°F.
Anyway, It's suitable, especially if an important decorative effect is required, to use demineralized water for the zincate and initial bath preparation at least.

• Dip zinc anodes into steel spirals or baskets in order to create the pile-effect within the two metals and improve zinc dissolution.
When zincate solution is about 30g/l zinc, it can be put in the tank.

• Repeat until the right zinc solution quantity for the whole volume is obtained.
The quantity of zinc area to dip is calculated as follows:

$$\text{Amperes} \times 0{,}24 = \text{dm}^2 \text{ of zinc to dip}$$

- Amperes* are the amperes indicated by the amperometer of the rectifier during electrolysis.

This formula is based on the calculation:
70 % of cathodic efficiency and a zinc anodes dissolution rate of 3,5 g/dm^2 at hour at 25°C

• Check that concentration ratio between zinc and sodium hydroxide would be respected as indicated by parameters and, if necessary, correct.
• Allow the solution to cool to 25°C at least.
• Add the calculated quantity of PRIMION PURIFIER 1 and 2.
• Add the PRIMION 240 BASE and BRI quantities
• Check the anodes.
• Fill up to the required volume.

Process with sodium hydroxide

Per 1.000 litres of volume	Rack	Barrel
Zinc	9 Kg.	9 Kg.
Sodium hydroxide	130 Kg.	130 Kg.
PRIMION 240 PURIFIER 1	4 l.	4 l.
PRIMION 240 PURIFIER 2	6 l.	6 l.
PRIMION 240 BASE	8 l.	8 l.
PRIMION 240 BRI	1,5 l.	1,5 l.

Process with potassium hydroxide

Per 1.000 litres of volume	Rack	Barrel
Zinc	9 Kg.	9 Kg.
Potassium hydroxide 100%	160 Kg.	180 Kg.
PRIMION 240 PURIFIER 1	4 l.	4 l.
PRIMION 240 PURIFIER 2	6 l.	6 l.
PRIMION 240 BASE	8 l.	8 l.
PRIMION 240 BRI	1,5 l.	1,5 l.

3 – OPERATING CONDITIONS

3.1 Temperature

Technical applications 20 ÷ 35 °C
Decorative applications 20 ÷ 28 °C

Operating at temperature higher than 30°C, the bright throwing power decreases particularly at low current density, causing a higher additives consumption.
Temperature lower than 20 °C limits the conductivity and the current efficiency.

3.2 Current density

➔ Barrel cathodic current density : 0,5 ÷ 0,8 A/dm^2
➔ Rack cathodic current density : 1,0 ÷ 2,5 A/dm^2

3.3 Anode/Cathode ratio: 1 :1

The anodes must be not wider than 150 mm.
In the barrel treatment is important to calculate the anodic area in order to avoid the anode/cathode ratio lower than 1:2.
If the anodic surface with steel plates is inadequate, you must foresee anodes in net or rod for a wider anodic surface.

3.4 Barrel velocity: 4 ÷8 rpm

Slow down the rotation means improve the deposition rate.
It's not always possible when the pieces tend to easily pack.

3.5 Ampere/l ratio. : 0,5 - 0,7 A/l

¬ **Classic**

	Rack	Barrel
PRIMION 240 BASE	1,0 ÷ 1,5 l	0,8 ÷ 1,1 l
PRIMION 240 BRILL	0,5 ÷ 1,0 l	0,3 ÷ 0,8 l
PRIMION 240 PURIFIER 1	0,3 ÷ 0,5 l	0,3 ÷ 0,5 l
PRIMION 240 PURIFIER 2	0,3 ÷ 0,5 l.	0,3 ÷ 0,5 l.

↑ Easier

	Rack	Barrel
PRIMION 240 REPLENISHER	2,0 ÷ 3,0 l	2,0 ÷ 2,5 l
PRIMION 240 PURIFIER 2	0,3 ÷ 0,5 l.	0,3 ÷ 0,5 l.

4 - PARAMETERS

4.1 Process with sodium hydroxide

Parameters	Optimum	Range
Zinc	9 g/l	7 - 14 g/l
Sodium hydroxide	130 g/l	120 - 140 g/l
Sodium carbonate	20 g/l	10 - 70 g/l

4.2 Process with potassium hydroxide

Parameters	Optimum	Range
Zinc	9 g/l	7 - 11 g/l
Potassium hydroxide100%	160 g/l	150 - 190 g/l
Potassium carbonate	25 g/l	15 - 90 g/l

5 – MAINTENANCE

5.1 Maintenance (per 10.000 Ah)

You can choose between two possibilities for replenishment:

← Classic with all additives: Base, Bri. Purifier 1 and Purifier 2;

↑ Easier with only two additives: Replenisher and Purifier 2.

Suitable particularly for rack plants' replenishment where the decorative aspect is the most important.

5.2 Sodium hydroxide and potassium hydroxide concentrations

The consumption is proportional to the drag out.

Make analytical control.

5.3 Zinc concentration

Its concentration must be regulated by electrochemical dissolution in the auxiliary tank following the indications at chapter 2.

5.4 Carbonate concentration

The maximum critical concentration is at about 70 g/l (sodium hydroxide) and 90 g/l (potassium hydroxide).

It limits the current efficiency and bright throwing power.

Reduce the content means periodical cool crystallisation during œolest periods or continuous by crystallisation vessels.

For the electrolyte based on potassium hydroxide, where the carbonate's crystallisation is not possible, dilution is the only possible action.

6 - ADDITIVES FUNCTION

The complete and general management of the process provides additives as follows:

© PRIMION 240 BASE
© PRIMION 240 BRI
© PRIMION 240 REPLENISHER
© PRIMION 240 PURIFIER 1
© PRIMION 240 PURIFIER 2

All additions for replenishment and corrections MUST be directly put into the working tank and not in the auxiliary tank for zinc dissolution.

It is advisable to employ a measuring pump for a better management and, consequently, a saving in products' utilisation.
It is recommended not to mix PRIMION 240 PURIFIER 2 additive with other process additives.

6.1 PRIMION 240 BASE

It's employed in the process make-up and replenishment.
It's the most important additive to obtain a good deposition and metal distribution.
It regulates the cathodic efficiency at different current densities.
However, the necessary quantity for the make-up is strictly related to the zinc concentration.

© 1 g/l of Zinc corresponds to 0,9 ml/l of Base

Its function is to regulate the internal stress of the deposit.
In combination with the brightener, assures a better brilliance.

The consumption depends on:
* Drag out
* Zinc concentration
* Thickness uniformity required.

However, the consumption must be within 2,0 l per 10.000 Ah.
An analysis of the operative cycle situation is strongly recommended as contaminants like surfactants, inhibitors, grease and oils, could cause an anomalous consumption.

6.2 PRIMION 240 BRI

Brightener; with base it maintains the brightness over the whole current density range.
The consumption must be below 1,5 l per 10.000 Ah.

6.3 PRIMION 240 REPLENISHER

Complete additive for the process replenishment with the best decorative performance: brightness over the whole current density range.
However, it must be always combined with PRIMION 240 PURIFIER 2 in replenishment.
PRIMION 240 BASE will be eventually added as occasional correction after analytical control; e.g. after an anomalous increase of zinc content.

6.4 PRIMION 240 PURIFIER 1

This additive acts as purifier for contaminating metals (e.g. lead) and improves the other additives' actions at low current density.
Its consumption is directly related to the purity of the zinc utilised.
The REPLENISHER contains the consumption quantity of PURIFIER 1

If, notwithstanding the normal replenishment, the low current density areas remain dark or dull, integrate the quantity indicated in the previous table at chapter 3, adding PRIMION 240 PURIFIER as follows:

- Every 100 Kg. Sodium hydroxide : 5 l
- After 2 days stop: 0,5 ml/l

6.5 PRIMION 240 PURIFIER 2

Additive that improves the other additives efficiency, particularly if hard water is used.
In order to maintain constant the aesthetic level of the deposit, is recommended to continuously add it in quantities with the other additives, obviously not mixing the products.
An additional quantity should be added, particularly after breaks, after sodium or potassium hydroxide additions and when the zinc concentration increases.
The make-up quantity is 6 ml/l.
With reference to sodium hydroxide additions:

- Every 100 Kg. Sodium hydroxide 10 l

7 - CONTAMINATIONS

Metals like steel, nickel, cadmium and copper are relatively insoluble in PRIMION 240 solution and, in theory, precipitate; it's possible, however, to have a temporary solubility (some ppm) of these metals.
It's better, then, to prevent pollution.
The PRIMION 240 process doesn't contain strong chelating and complexing agents, but, in order to prevent problems, it's recommended to avoid drag out of electrolytic cleaners, which could contain complexants.

8 – CONVERSION

® A conversion of electrolytes at medium – low or micro content of cyanide/ferrocyanide in PRIMION 240 is not possible.
® It's possible to convert the OKLANE, KALANE processes series into PRIMION 240.
Other cyanide-free alkaline zinc electrolytes transformation must be estimated by our Laboratories.

9 – CYCLE

The recommended cycle assures the best functionality.
Should be careful in the pretreatment phases as well, that is important for adhesion, a very important factor to assure protection and corrosion resistance.

Steel material cycle	Rack	Barrel
1 – Hot soak cleaner or Anodic cleaner	5 ÷ 10 min 2 ÷ 4 min	10 ÷ 15 min 4 ÷ 6 min
2 – Rinsing		
3 – Acid pickling: hydrochloric or sulphuric	10 ÷ 20 min	20 ÷ 30 min
4 – Cathodic acid pickling: sulphuric	2 ÷ 4 min	
5 – Rinsing		
6 – Anodic cleaner	2 ÷ 4 min	2 ÷ 4 min
7 – Rinsing		
8 – Acid activation: hydrochloric acid 2 ÷ 3%	20 ÷ 30 sec	20 ÷ 30 sec
9 – Rinsing		
10 – PRIMION 240	30 ÷ 50 min	45 ÷ 90 min
11 – Rinsing		
12 – Acid activation: Nitric acid 0,25 ÷ 0,5%	20 ÷ 30 sec	20 ÷ 30 sec
13 – Rinsing		
14a – Blue passivation	FINIDIP 137	FINIDIP 137
14b – Iridescent passivation	Your choice	Your choice
14c – Green passivation	Your choice	AQUAVERT N°3
14d – Black passivation	BF N°5	BF N° 5

- The rinsing indication is not the positions' number but the function.
- The neutralisation between the electrolytic cleaner and PRIMION 240 is used in eliminating the possible surface oxidizations caused by the anodic one.
- Use nitric activation for blue and yellow passivations.
- Use sulphuric activation for green and black passivations.

10 - EQUIPMENT

* Mild steel tanks PVC lined.
* Heating and cooling equipment is recommended.
* Filtration: filter pump. Filtration speed should be 2 to 3 tank turnovers per hour.

A continuous filtration is not strictly necessary; anyhow its utilisation is useful to avoid roughness problems on pieces and to improve the appearance and brightness of the deposits. Meraklon cartridge filters are recommended.

* Aspiration: recommended.
* Anodes: zinc anodes 99,9% dipped in steel baskets or spirals are strongly recommended.
* Auxiliary tank: steel linked to other electrolysis tanks through a pump.

11 – SAFETY ASPECTS

The solution is strongly alkaline and caustic; be careful in case of sprays.
Wear eye/face protection, gloves etc.
In case of solution or products spreading, wash with water.
Is strongly recommended to follow the recommendations specified whether on the packaging label or in the safety data sheet.

12 – WASTE WATER TREATMENT

Reduce the pH to 10-10,5 to precipitate zinc.

13 – SHELF-LIFE

24 months from date of manufacture if products are kept tightly closed and protected from warm.