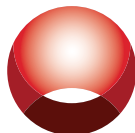




HAVILAND ZINCS



Haviland
PRODUCTS COMPANY

ACID ZINC CHLORIDE

HP Radiance AZ

- Produces a brilliant level and ductile deposit from Boric Acid or Potassium-Ammonium salt bath formulations.
- Tolerant to high temperature operation up to 120°F. Works well in either rack or barrel operations
- Contains a special compound that insures an extremely bright yet ductile deposit at higher current densities.
- Simple two component system for easy bath control and maintenance.
- Free of complexing agents. Has excellent rinsing characteristics for reduced drag-out and improved chromate receptivity.
- Very low foaming even with vigorous air agitation or evaporative recovery.

OPERATING PARAMETERS

	Barrel		UNIT
	Min	Max	
Zinc Metal	3	5	Oz/Gal
Total Chloride Ion* (from Potassium)	17	20	Oz/Gal
Boric Acid	3	5	Oz/Gal
HP RADIANCE AZ CARRIER	3	6	% by vol
HP RADIANCE AZ BRIGHTNER	0.03	0.1	% by vol
pH (Electrometric)	4.8	5.8	pH
Temperature	75	110	°F

**To raise the total chloride 1.0oz/gal requires 2.1oz/gal Potassium Chloride utd.(KCL)*

Potassium- Ammonium

	RACK or BARREL		UNIT
	Min	Max	
Zinc Metal	2	5	Oz/Gal
Total Chloride Ion* (from Potassium)	16	20	Oz/Gal
HP RADIANCE AZ CARRIER	3	5	% by vol
HP RADIANCE AZ BRIGHTNER	0.05	0.15	% by vol
pH (Electrometric)	5.0	5.8	pH
Temperature	75	110	°F

**Requires a MINIMUM of 4 oz/gal (30 g/l) Ammonium Chloride and operates at an optimum of 6 oz/gal (45 g/l).*

BATH MAKE-UP

	Per 100 gallons	Per 100 Liters
Zinc Chloride 62.5%	7 gal	7 liters
Potassium Chloride	234 lbs	21 kg
Boric Acid	25 lbs	3 kg
HP Radiance AZ Carrier	5 gal	5 liters
HP Radiance AZ Brightener	4-10 fl oz	115 - 300 ml

Potassium- Ammonium

	Per 100 gallons	Per 100 Liters
Zinc Chloride 62.5%	7 gal	7 liters
Potassium Chloride	169 lbs	23 kg
Boric Acid	47 lbs	6 kg
HP Radiance AZ Carrier	5 gal	5 liters
HP Radiance AZ Brightener	4-10 fl oz	115 - 300 ml

1. Prior to make-up of HP Radiance AZ plating bath, the process tank should be thoroughly cleaned and leached for a period of 24 hours with a solution of 5% by volume HCl.
2. Fill the bath approximately 70% of the working volume with hot water.
3. While mixing, slowly add the appropriate amount of zinc chloride, potassium chloride, and either boric acid or ammonium chloride.
4. After the salts are dissolved, add the required amount HP Radiance AZ Carrier and Brightener.
5. Adjust to operating volume with water.

Recommended total chloride range for **potassium-ammonium** salt bath should be as follows:

Zin Metal Concentrations	Unit	Total Chlorine Level
2.0 – 3.0	oz/gal	16 - 18
3.0 – 5.0	oz/gal	18 - 20

Total chloride ion can be controlled by adding a mixture of 80% by weight potassium chloride and 20% by weight ammonium chloride. Two ounces / gallon of this mixture will yield one ounce per gallon of chloride ion.

Ammonium Chloride/Potassium Chloride or Boric acid are chemical additions required during normal operation. They should be added regularly based on periodic analysis for chloride or boric acid.

The following equivalents should be noted when maintaining the chloride content of the bath:

- Ammonium Chloride contains 66% chloride.
- Potassium Chloride contains 48% chloride.
- 62.5% liquid zinc chloride contains 78 ounces per gallon (586 g/L) chloride and 72 oz/gal (541 g/L) zinc (as metal).

E.g. To raise the total chloride 1.0 oz/gal, add 0.34 oz/gal Ammonium Chloride (NH4CL) and 1.75 oz/gal Potassium Chloride (KCL).

Only high grade Untreated Potassium Chloride (KCl) must be used in making up an operation of **HP RADIANCE AZ**. KCl cannot contain harmful or organic additives.

MAINTENANCE ADDITIONS:

- **HP RADIANCE AZ BRIGHTENER** is maintained in the bath at the rate of one gallon per 15,000 to 20,000 ampere-hours. Additions are made every 2 - 4 hours or continuously with use of an addition agent pump.
- **HP RADIANCE AZ CARRIER** is primarily lost through drag-out but may also be lost due through frequent treatment for iron. The most efficient and effective way to replace **HP RADIANCE AZ CARRIER** is to add it in conjunction with **HP RADIANCE AZ BRIGHTENER** as follows:
 - **LOW DRAG-OUT/LOW IRON CONTAMINATION** (Most Rack Baths)
 - Add 1/2 gallon **AZ CARRIER** with each 1 gallon **AZ BRIGHTENER**
 - **MEDIUM DRAG-OUT** (Most Barrel Baths, Some Rack Baths)
 - Add 1 gallon **AZ CARRIER** with each 1 gallon **AZ BRIGHTENER**
 - **HIGH DRAG-OUT/HIGH IRON CONTAMINATION** (Some Barrel Baths)
 - Add 2 gallons **AZ CARRIER** with each 1 gallon **HP RADIANCE AZ BRIGHTENER**

Note: Maintenance of HP RADIANCE AZ additives should be checked by the periodic use of Hull-cell evaluations.

ACID ZINC CHLORIDE

HP Lus AZ

- Produces brilliant, level, ductile deposits from a straight boric acid or mixed potassium ammonium salt formulation.
- Free of complexing agents and has excellent rinsing characteristics
- Tolerant to high temperature operation of up to 110°F.
- Very low foaming even with vigorous air agitation or evaporative recovery.

OPERATING PARAMETERS

	RACK OR BARREL		UNIT
	Min	Max	
Zinc Metal	3	5	Oz/Gal
Total Chloride Ion* (from Potassium)	17	20	Oz/Gal
HP LUS AZ CARRIER	1	2	% by vol
HP LUS AZ BRIGHTNER	0.03	0.1	% by vol
pH (Electrometric)	4.8	5.8	pH
Temperature	70	110	°F

Potassium- Ammonium

	Barrel		UNIT
	Min	Max	
Zinc Metal	3	5	Oz/Gal
Total Chloride Ion* (from Potassium)	17	20	Oz/Gal
Boric Acid	3	5	Oz/Gal
HP RADIANCE AZ CARRIER	3	6	% by vol
HP RADIANCE AZ BRIGHTNER	0.03	0.1	% by vol
pH (Electrometric)	4.8	5.8	pH
Temperature	75	110	°F

BATH MAINTENANCE INFORMATION

The total chloride ion can be controlled by adding a mixture of 80% by weight potassium chloride and 20% by weight ammonium chloride. Two ounces per gallon of this mixture will yield one ounce per gallon of chloride ion.

Ammonium chloride and potassium chloride or boric acid are the only chemical additions required in the bath during normal operation. They should be added on a regular basis based on periodic analysis of the bath.

Ammonium chloride contains 66% chloride. Potassium chloride contains 48% chloride.

****Note –** Only untreated potassium chloride must be used in making up and replenishing HP Lus AZ baths and must not contain any harmful or organic additives. Only high purity zinc chloride should be used. Low-grade chemicals will cause performance issues in the process.

RECOMMENDED EQUIPMENT

- Tanks: PVC or rubber-lined, mild steel
- Agitation: Mechanical or air.
- Filtration: continuous filtration of 15 microns is recommended for routine operation. If carbon treatment or other purification is necessary, 5-10 micron filters should be substituted.
- Ventilation: spray is inherently corrosive due to low pH. The use of fiberglass, PVC, or polyethylene ventilation equipment and exhaust fans is recommended to prolong equipment life.

BATH MAKE-UP

	Per 100 gallons	Per 100 Liters
Zinc Chloride 62.5%	7 gal	7 liters
Potassium Chloride	234 lbs	31 kg
Boric Acid	25 lbs	3 kg
HP LUS AZ CARRIER	5 gal	1 liters
HP LUS AZ BRIGHTENER	4-10 fl oz	115 - 300 ml

Potassium- Ammonium

	Per 100 gallons	Per 100 Liters
Zinc Chloride 62.5%	7 gal	7 liters
Potassium Chloride	169 lbs	23 kg
Boric Acid	23 lbs	6 kg
HP Radiance AZ Carrier	1 gal	1 liters
HP Radiance AZ Brightener	4-10 fl oz	115 - 300 ml

1. Prior to make-up of HP Lus AZ plating bath, the process tank should be thoroughly cleaned and leached for a period of 24 hours with a solution of 5% by volume HCl.
2. Fill the bath approximately 70% of the working volume with hot water.
3. While mixing, slowly add the appropriate amount of zinc chloride, potassium chloride, and either boric acid or ammonium chloride.
4. After the salts are dissolved, add the required amount HP Lus AZ Carrier and Brightener.
5. Adjust to operating volume with water.

MAINTENANCE AND PROCESS CONTROL

HP Lus AZ Brightener is maintained in the bath at the rate of 1 gallon per 15,000-25,000 ampere-hours (1 liter per 4,000-6,600 amp hrs). Additions should be made every two to four hours of operation or continuously through the use of an addition agent pump.

HP Lus AZ Carrier is primarily lost through drag-out but may also be lost due to frequent treatment for iron. The most efficient and effective way to replace **HP Lus AZ Carrier** is to add it in conjunction with **HP Lus AZ Brightener**.

***Note –** Maintenance of HP Lus AZ additives should be checked by the use of periodic hull-cell evaluations.

pH: Maintained within the operating limits with dilute hydrochloric acid. Care should be taken during pH adjustment as the pH changes quite rapidly with small additions of acid. Hydrochloric acid should be diluted with equal parts water prior to adding to the bath to avoid localized precipitation of addition agents. The pH should be checked using a meter and not pH paper.

ALKALINE NON-CYANIDE ZINC

HAVTECH ZN 1 MIXSingle Component Process

- Extremely bright, “one component” alkaline non-cyanide Zinc plating system that produces lustrous deposits over a wide range of current densities.
- Works equally well in both rack and barrel installations.
- Accepts all chromate and passivation conversion coatings, including black, olive drab and all trivalent passivates.

OPERATING PARAMETERS

Optimum Rack Concentration	COMPONENT	Optimum Barrel Concentration
1.3 oz/gal	Zinc Metal	1.5 oz/gal
16 oz/gal	Caustic Soda	18 oz/gal
3% By Volume	HAVTECH ZN 1 MIX	2.0% By Volume

MAINTENANCE AND PROCESS CONTROL		
Ampere Hours / Gallon	HAVTECH ZN 1 MIX	Ampere Hours / Liter
18,000 - 28,000		4,800 - 7,400

10 - 25 Amps/Ft²	Current Density	10 - 20 Amps/Ft²
70 -110	Temperature °F	70 -110

ALKALINE NON-CYANIDE ZINC

HAVTECH ZN 1Two Component Process

- Extremely bright, “two component” alkaline non-cyanide Zinc plating system that produces lustrous deposits over a wide range of current densities.
- Works equally well in both rack and barrel installations.
- Accepts all chromate and passivation conversion coatings, including black, olive drab and all trivalent passivates.

OPERATING PARAMETERS

Optimum Rack Concentration	COMPONENT	Optimum Barrel Concentration
1.3 oz/gal	Zinc Metal	1.5 oz/gal
16 oz/gal	Caustic Soda	18 oz/gal
1% By Volume	HAVTECH ZN 1-A	1% By Volume
1.25% By Volume	HAVTECH ZN 1-B	1.25% By Volume

Addition Agent	Ampere Hours/ Gallon	Ampere Hours/ Liter
Havtech ZN1-A	30,000-60,000	7,900-15,800
Havtech ZN1-B	15,000-30,000	3,950-7,900

10 – 25 Amps/Ft²	Current Density	5 - 10 Amps/Ft²
70 -110	Temperature °F	70 -110

ALKALINE NON-CYANIDE ZINC

HAVASTAR ZN GLEAM MIXSingle Component Process

- An extremely bright, simple to use, singe component alkaline non-cyanide zinc plating system designed to produce lustrous deposits over a wide range of current densities.
- Works equally well in both rack and barrel installations.
- Accepts all chromate and passivation conversion coatings, including black, olive drab and all trivalent passivates.

OPERATING PARAMETERS

Optimum Rack Concentration	COMPONENT	Optimum Barrel Concentration
1.3 Oz/Gal	Zinc Metal	1.5 Oz/Gal
16 Oz/Gal	Caustic Soda	18 Oz/Gal
4.0% By Volume	HAVTECH ZN GLEAM MIX	3.0% By Volume
10 – 25 AMPS/FT²	Current Density	5 - 10 AMPS/FT²
85	Temperature °F	85

MAINTENANCE SCHEDULE:

HAVASTAR ZN GLEAM MIX

- 1 gallon per 10,000 –17,000 amp/hours or based on efficiency / coverage required.

ALKALINE NON-CYANIDE ZINC

HAVASTAR ZN GLEAMTwo Component Process

- An extremely bright, simple to use, “two component” alkaline non-cyanide zinc plating system designed to produce lustrous deposits over a wide range of current densities.
- Works equally well in both rack and barrel installations.
- Accepts all chromate and passivation conversion coatings, including black, olive drab and all trivalent passivates.

OPERATING PARAMETERS

Optimum Rack Concentration	COMPONENT	Optimum Barrel Concentration
1.3 Oz/Gal	Zinc Metal	1.5 Oz/Gal
16 Oz/Gal	Caustic Soda	18 Oz/Gal
1.0% By Volume	HAVTECH ZN GLEAM-A	1.0% By Volume
1.25% By Volume	HAVTECH ZN GLEAM-B	1.5% By Volume
10 – 25 AMPS/FT²	Current Density	5 - 10 AMPS/FT²
85	Temperature °F	85

MAINTENANCE SCHEDULE:

HAVASTAR ZN GLEAM A

- 1 gallon per 30,000 – 60,000 amp/hours or based on efficiency / coverage required.

HAVASTAR ZN GLEAM B

- 1 gallon per 15,000 – 30,000 amp/hours or based on efficiency / coverage required.

Enhanced Zinc Cyanide Plating Processes

HP Havaplate CN

- High speed cyanide zinc plating process
- Fine-grained and uniform deposits over a wide range of current densities. Contains an aldehyde additive for superior brightness especially in the low to mid current densities.
- Readily accept post plate treatments complexing agents.
- Superior brightness, especially in the low to mid current densities.
- Suitable for both rack and barrel plating.
- Operates over a wide cyanide concentration range.

OPERATING PARAMETERS

Range	FACTOR	Optimum
1-3 oz/gal	Zinc Metal	1.5 oz/gal
3.5 - 16 oz/gal	Sodium Cyanide	5.5 oz/gal
3 - 4:1	NaCN: Zn Ratio	3 - 2:1
10 - 14 oz/gal	Sodium Hydroxide	12 oz/gal
1.5 - 2.5%	Havaplate CN	2% by volume
65 -120 °F	Temperature	65 -120 °F

- 2:1 Anode to Cathode ratio

RECOMMENDED EQUIPMENT

- Tanks: Steel
- Agitation: Mechanical agitation only
- Anodes: Zinc Balls / Slabs
- Filtration: Continuous

SOLUTION MAKE-UP

	Per 100 gallons	Per 100 Liters
Zinc Cyanide	22.5 lbs	2.7 kg
Sodium Cyanide	15.5 lbs	1.9 kg
Caustic Soda	63.0 lbs	7.55 kg

SOLUTION MAKE-UP (Preparation with USP- grade Zinc Oxide)

	Per 100 gallons	Per 100 Liters
Zinc Oxide	16 lbs	2.7 kg
Sodium Cyanide	35 lbs	1.9 kg
Caustic Soda	47 lbs	5.5 kg

The Zinc Oxide should be slurried in a minimum amount of water in a separate make up tank. Each ingredient and water should be added to one-third make up volume, stir until all zinc oxide dissolves, then dilute to final volume and homogenize.

ADDITION AGENTS

Ampere Hours / Gallon	Havaplate CN	Ampere Hours / Gallon
20,000 - 25,000		22,500

HAVAPLATE CN is employed to produce uniform brightness and leveling of the zinc deposits.

OPERATING PRECAUTIONS

FILTRATION:

Good solution filtration is essential in order to ensure high quality, smooth copper deposits. Continuous filtration through filter aid and activated carbon at an hourly rate equal to the capacity of the tank, will generally keep the solution free of suspended metallic particles, dirt and organic contamination. The filter should first be pre-coated with the filter aid, followed by an activated carbon slurry of 1-3 lbs/100 gallons (1-3 kg/1000L) of plating solution. Smaller additions of carbon on a weekly basis are recommended, if the capacity of the filter permits. The filter should be inspected and repacked periodically.

ZINC CONTENT:

The zinc concentration greatly influences the operating limits of the process and should be held within the specified range for optimum performance. A low metal concentration will cause burning of the deposit in the high current density areas. This is corrected by a reduction of amperage, but results in a proportional loss of plating speed.

ALKALI CONTENT:

Sodium hydroxide is used at makeup and maintenance of the hydroxide content. A low hydroxide concentration may result in inferior anode corrosion and poor conductivity. Concentrations in excess of the recommended range will influence the hardness and brightness of the deposit.

CARBONATES:

Carbonate is formed by absorption of carbon dioxide from the air, hydrolysis and the electrolytic decomposition of cyanide. The permissible carbonate concentration will vary depending on the operation, but normally a concentration of 10 oz/gal can be tolerated without difficulty. An excess reduces the bright current density range and increases the tendency to produce granular deposits. Carbonates may be removed by chemical precipitation with calcium hydroxide or by chilling the solution. Recommendations for carbonate removal should be obtained from your Haviland Products representative, if this becomes necessary.

CHROMIUM:

Chromium is a common contaminant in cyanide copper plating solutions. The source may be due to poorly maintained racks, incomplete stripping of contacts or poorly ventilated chromium baths that are in the proximity of the zinc solution. Chromium contamination will cause dull streaks or step plate in the mid current density area or possibly an overall dullness depending on its concentration. Chrome Reducer G should be added at a rate of 1 lb / 1,000 gal when chromium contamination is encountered. Sodium Hydrosulfire is not compatible with cyanide processes.

ALKALINE ZINC OPERATING NOTES

Regardless of the Haviland Alkaline Non-Cyanide Zinc Plating Process you choose, the following operating, testing and maintenance procedures

CAUSTIC/ZINC RATIO

- Higher caustic to zinc ratio favors low current density brightness.
- Lower caustic to zinc ratios favors high current density areas.

ZINC METAL

- Higher zinc metal concentrations will give brighter deposits in high current density areas generally used for rack plating.
- Zinc generating system utilizing steel anodes and an exterior zinc-generating tank is highly recommended.

MAINTAINING THE ZINC LEVEL

The dissolution rate of zinc metal in the plating bath is determined by caustic soda content, anode area, temperature, agitation, drag-in/drag-out rate and electrical current. The use of a generator tank is highly recommended to control and maintain the metal at optimal levels. If a generator tank is not used, the zinc anodes must be partially or entirely removed from the plating tank during an extended bath shut-down to stop zinc metal build-up. Literature and technical information on zinc generator tanks can be obtained by contacting a Technical Representative at **Haviland Products Company**.

OPERATING TEMPERATURE

- High temperatures cause excessive brightener consumption, loss of brightness in the low current densities and poor covering and throwing power.
- Low temperatures cause a loss of plating efficiency.

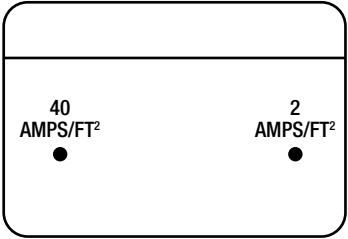
HULL CELL EVALUATION

- Non-agitated 2 ampere - 5 minute panel
- An optional non-agitated 5 ampere -3 minute panel may be used to identify high current burning.
 - Hull cell panels (steel or zinc anodes can be used).

PLATE DISTRIBUTION TEST FOR TO HELP DETERMINE THE HAVTECH ZN I MIX COMPONENT CONTENT

- Non-agitated 1 ampere-15 minute panel
 - Hull cell panel using a steel anode.
 - The solution should be maintained as close as possible to the working bath temperature.
 - Rinse panel under cold water and dry. Do not dip in a nitric or chromate solution.
 - With Hull cell ruler, measure thickness at 2 ASF (0.21 ASD) and 40 ASF (4.32 ASD).
- See panel diagram.

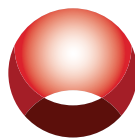
Calculate the current density thickness (CDT) ratio by dividing the thickness of the High Current reading (80 ASF/8.64 ASD) by the Low Current reading (4 ASF/0.43 ASD). The optimum CDT ratio is approx. 1.5 to 2.5. A ratio above 2.5 is an indication of low **BRIGHTENER MIX** or **'A' COMPONENT**.



This test should be used for evaluating the level of BRIGHTENER MIX or 'A' COMPONENT relative to the zinc metal and general bath efficiency. Caustic soda content, chromium contamination, bath temperature, poor filtration, HAVASTAR PURIFIER overload, and organic contaminants may all have an effect this test.

PRE-PLATE TREATMENT

Cleaning and pickling solutions be maintained at their optimum operating conditions. Parts must be clean and free from oil films and soils prior to plating.



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