



ユケン工業株式会社

Boric Acid Free Potassium Chloride Bath
METASU FZ - 300

September, 10th, 2008

YUKEN
INDUSTRY CO., LTD.



Y.HARADA

Classification of Zn Plating Bath Types

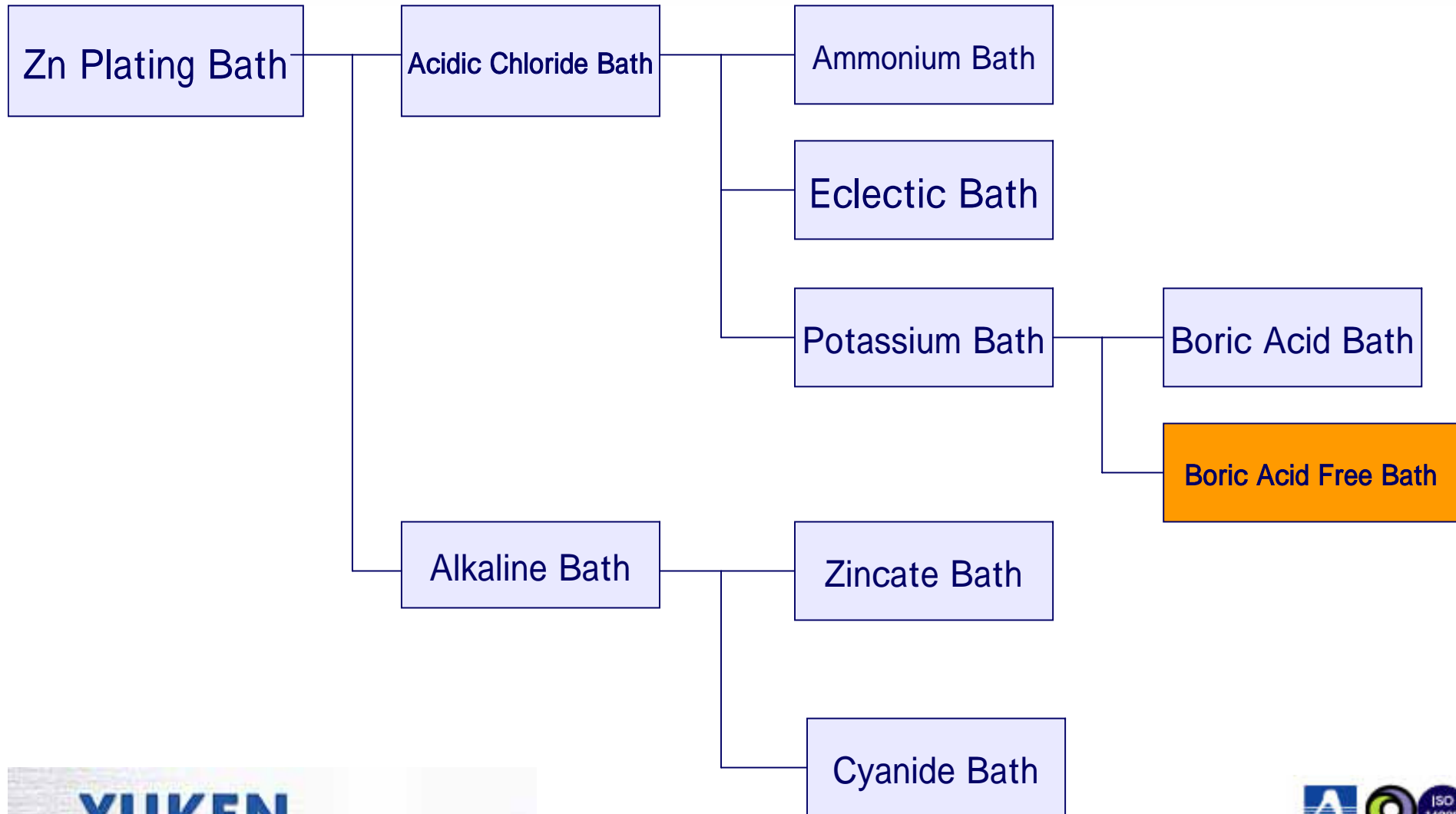
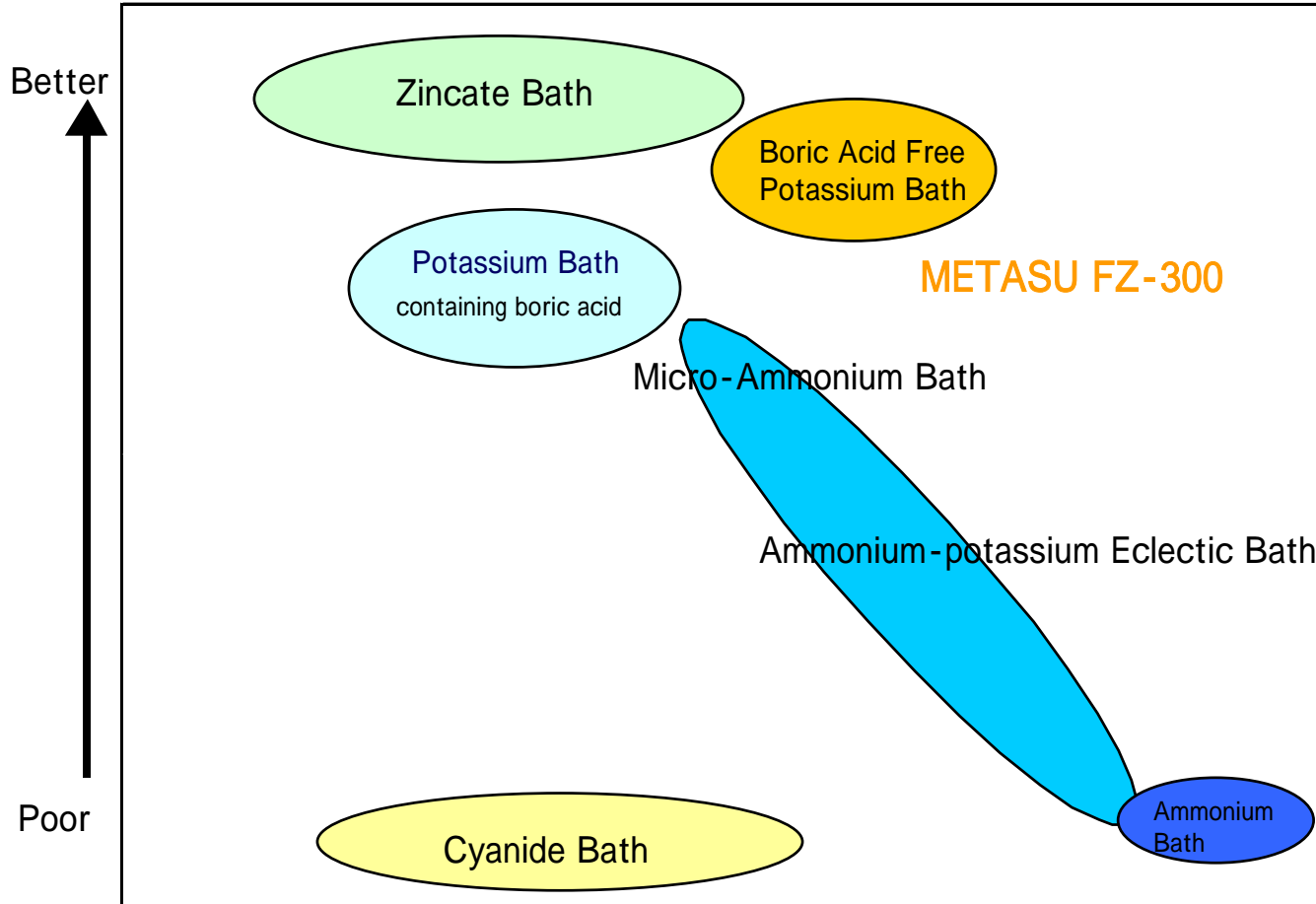


Figure for Each of Zn Plating Bath Types

Wastewater Treatment



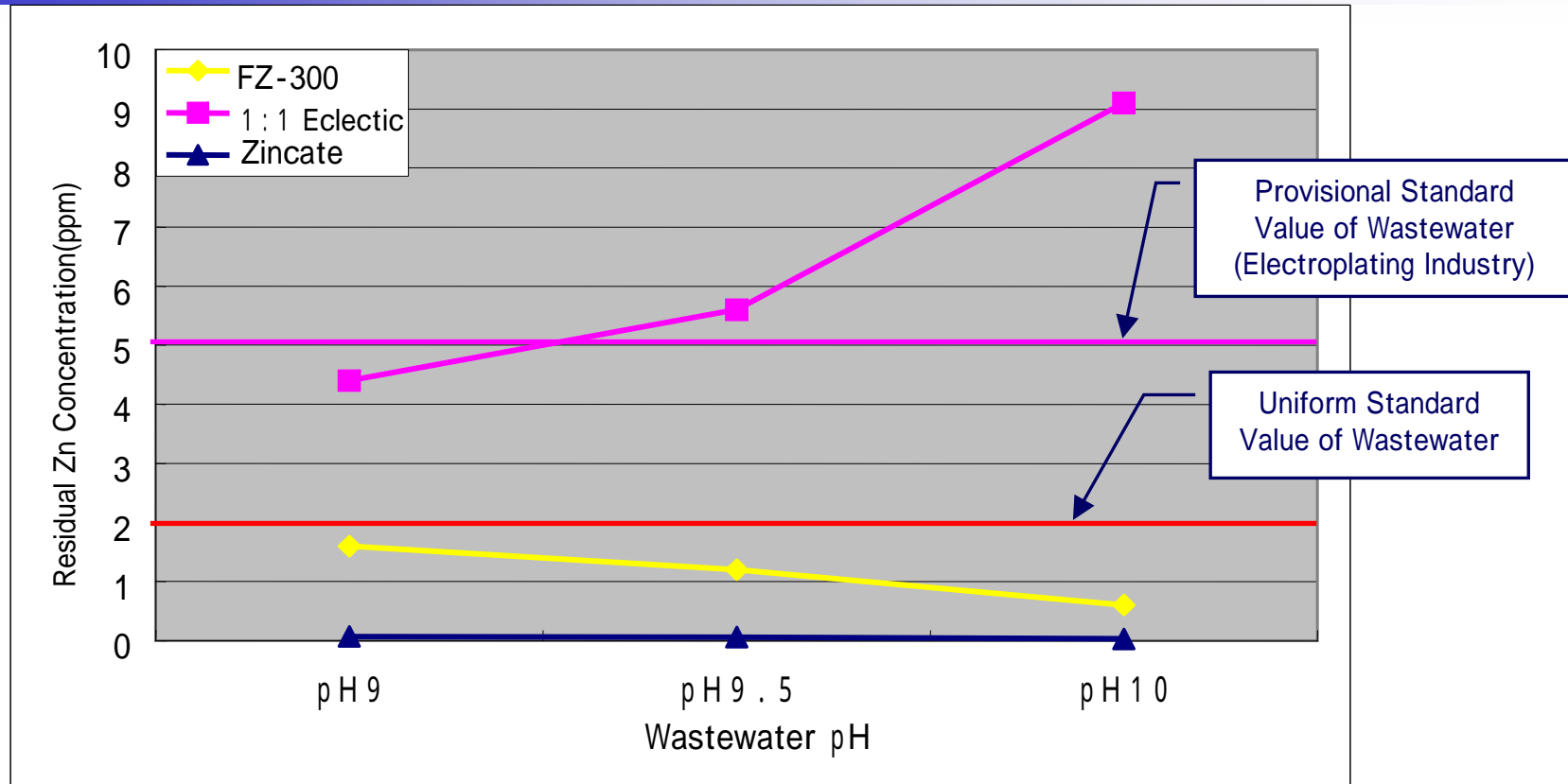
Action for Tighter Discharge Regulatory

Comparison for N, BOD in each bath

	N (mg / L)	B O D (mg / L)
F Z - 3 0 0	3 , 0 0 0	1 , 5 0 0
1 : 1 Eclectic Bath	2 7 , 3 0 0	2 , 5 0 0
Zincate Bath	3 , 0 0 0	1 , 5 0 0

F Z - 3 0 0 makes boric acid free potassium Bath, in which N and BOD are same level as those in zincate bath.

Excellent Zinc Deposition Property

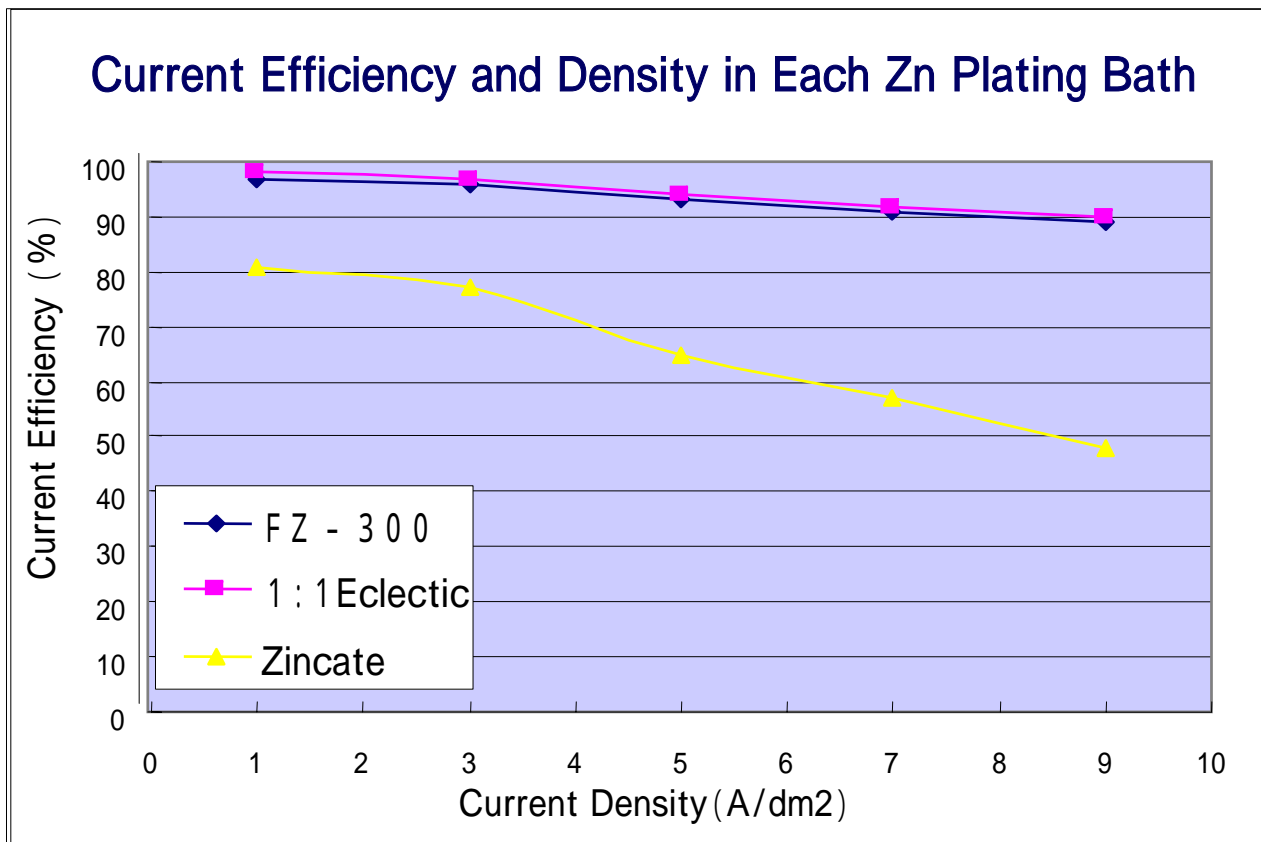


Zinc Deposition of FZ-300 bath is better than that of ammonium-potassium (1:1) eclectic bath.

Features of Boric Acid Free Chloride Bath

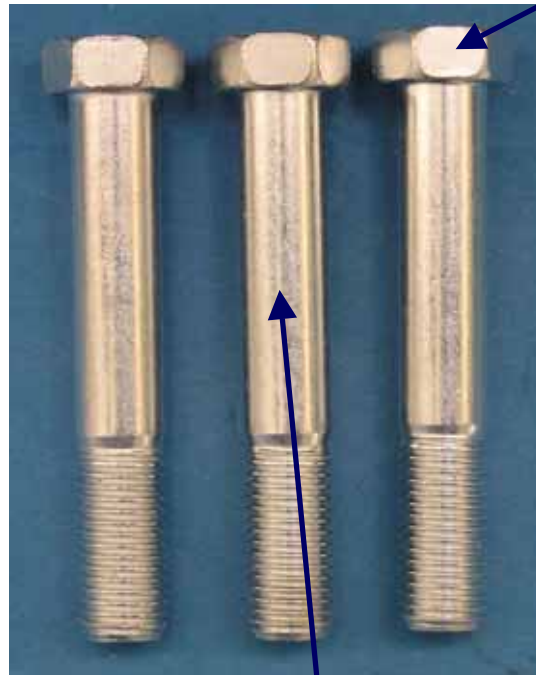
Advantages	Speedy plating rate No material selectivity Low bath voltage Excellent working conditions (low mist) Excellent covering power Excellent adhesion Immersion treatment is applicable. Excellent wastewater treatment (Zn deposition · Low N · Boron Free) Little Corrosion for Facilities No increase in plating solution
Disadvantages	Poor uniform electrodeposition

Cathode Current Efficiency in Each Plating Bath



FZ-300 is so excellent in the efficiency that little mist (gas) generates.

Excellent Productivity



Head

Shank

Plating Bath	Plating Thickness(μ m)		Time (min)
	Head	Shank	
FZ-300	8.63	4.35	45
1 : 1 Eclectic	8.54	4.62	45
Zincate	8.42	6.53	70

FZ-300 can reduce operation time by 35% compared with Zincate.

(The Bath capacity can be downsized by 35%)

Cathode Material and Its Current Efficiency

Emission rate of hydrogen gas is changed due to various hydrogen overvoltage based on each cathode material.

Hydrogen overvoltage of carbon materials is much lower than that of iron materials. It is so low on surface of carbon-rich materials such as cast iron that hydrogen gas actively generates; therefore, cathode current efficiency is reduced.

(Cathode current efficiency on each material in each plating bath-%)

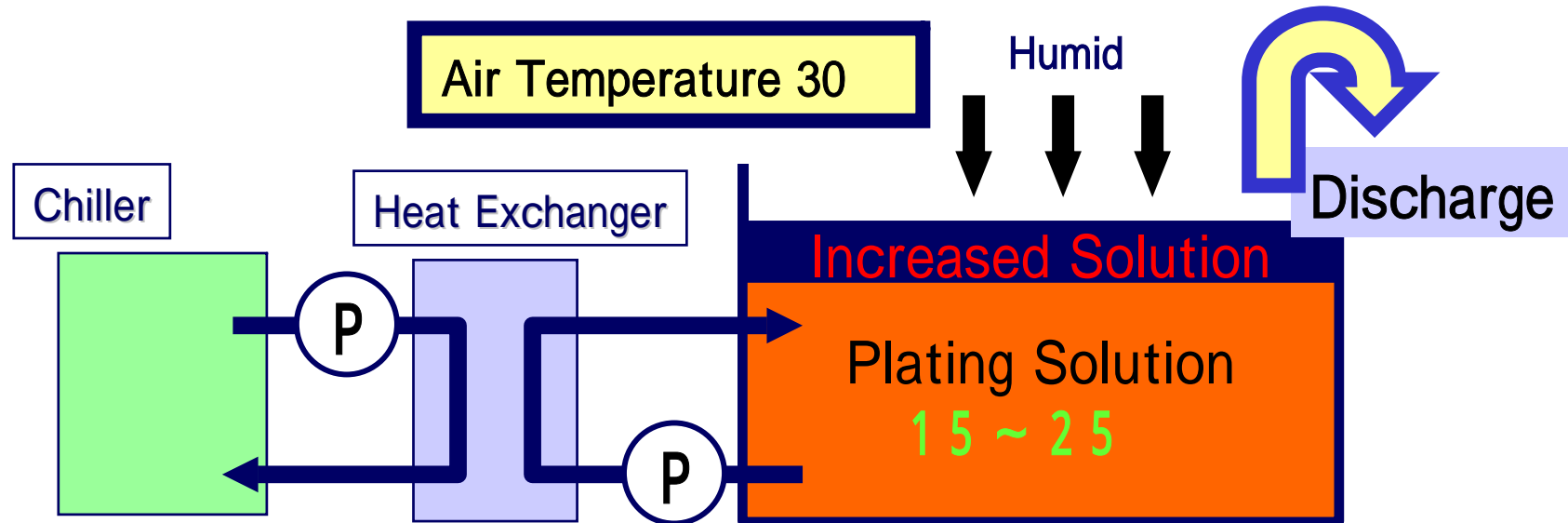
Plating Bath	Cast Iron	High Carbon Steel	Soft Iron
FZ - 300	50 ~ 80	70 ~ 90	90 ~ 99
1 : 1 Eclectic	50 ~ 80	70 ~ 90	90 ~ 99
Zincate	10 ~ 40	30 ~ 60	50 ~ 70

Low Bath Voltage

Plating Bath	Bath Voltage
FZ - 300	6.5 V
1 : 1 Eclectic	7 V
Zincate	10 V

Low voltage of FZ-300 bath enables to reduce electric consumption compared with zincate bath.

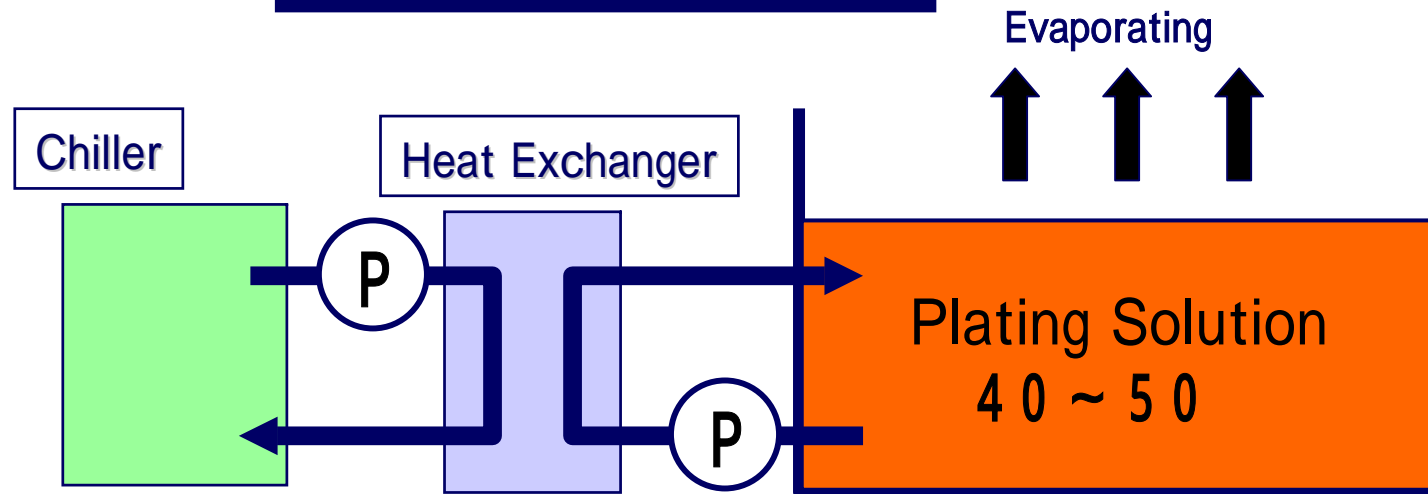
No Increase in Plating Solution in Summertime



Solutions in conventional chloride bath, which is cooled in operation, is increased specially in summertime.

No Increase in Plating Solution in Summertime

Air Temperature 30



Since high-temperature bath operation is applicable, the solution is not increased.

Wastewater by the operation and replenished chlorides can be reduced.

Increase or Decrease in Bath Temperature and Plating Solution

Temperature	Increase or Decrease in Solution
60	(Barrels may deform.)
40 ~ 45	Solution tends to be decreased even in summertime.
35 ~ 40	Solution amount is almost “balanced” in summertime.
25	Solution is increased in any production line.

Little Corrosion for Facilities

Pictures of Iron plates (SPCC) that have been immersed in three kinds of plating solution for a week



FZ-300



1 : 1 Eclectic



Zincate

FZ-300 shows less iron corrosion (for facilities) than 1:1 eclectic and no such a lot of white partials that generate in zincate.

Standard Bath Build-Up Condition

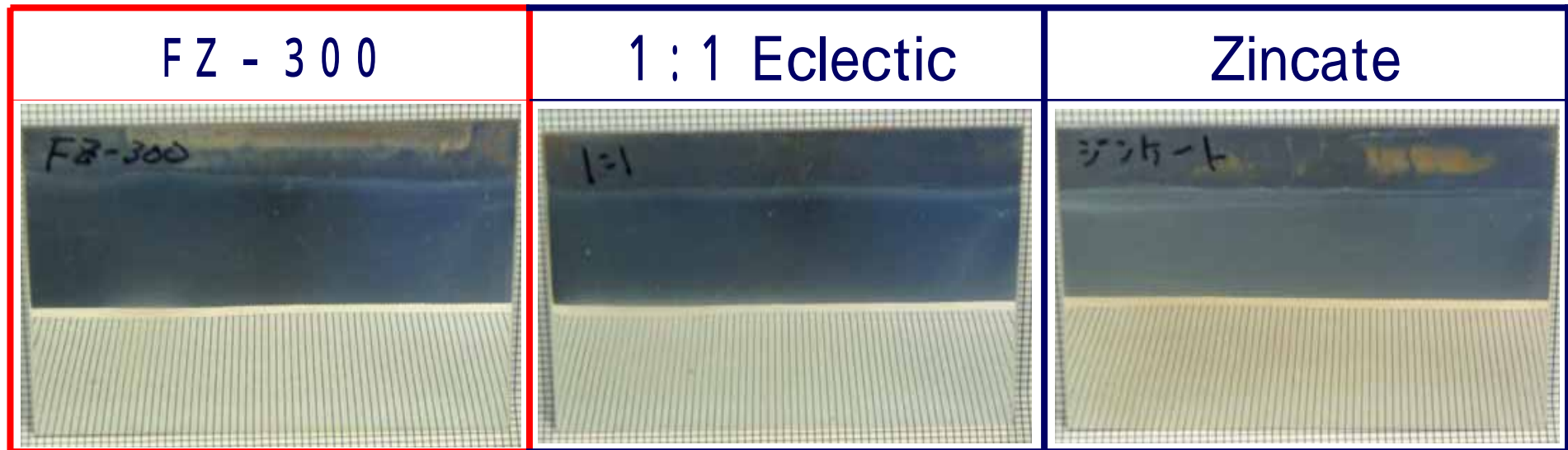
Items	Standard	Permissible Range
Zinc	30 g / L	25 ~ 40 g / L
Total Chlorine	160 g / L	150 ~ 170 g / L
FZ-300M	50 ml / L	40 ~ 90 ml / L
FZ-300GR	1 ml / L	1 ~ 3 ml / L

Zinc chloride and potassium chloride are used for bath build-up.
Boric acid or ammonium chloride are not.

Standard Operation Condition

Items		Standard Condition	Permissible Range
Bath Temperature		40	20 ~ 50
pH		5.8	5.5 ~ 6.1
Replenishment	FZ-300M	-	0.0 ~ 0.1 L/KAH
	FZ-300GR	0.3 L/KAH	0.2 ~ 0.4 L/KAH

Uniform Bright Appearance and Leveling









FZ - 300 can provide uniform bright appearance and leveling condition from high to low density area; therefore, uniform appearance of trivalent conversion coatings are also obtainable.

Excellent Conversion Treatment



More excellent and uniform black coatings are obtainable since the plating coating is compatible with trivalent Cr coatings compared with the others.

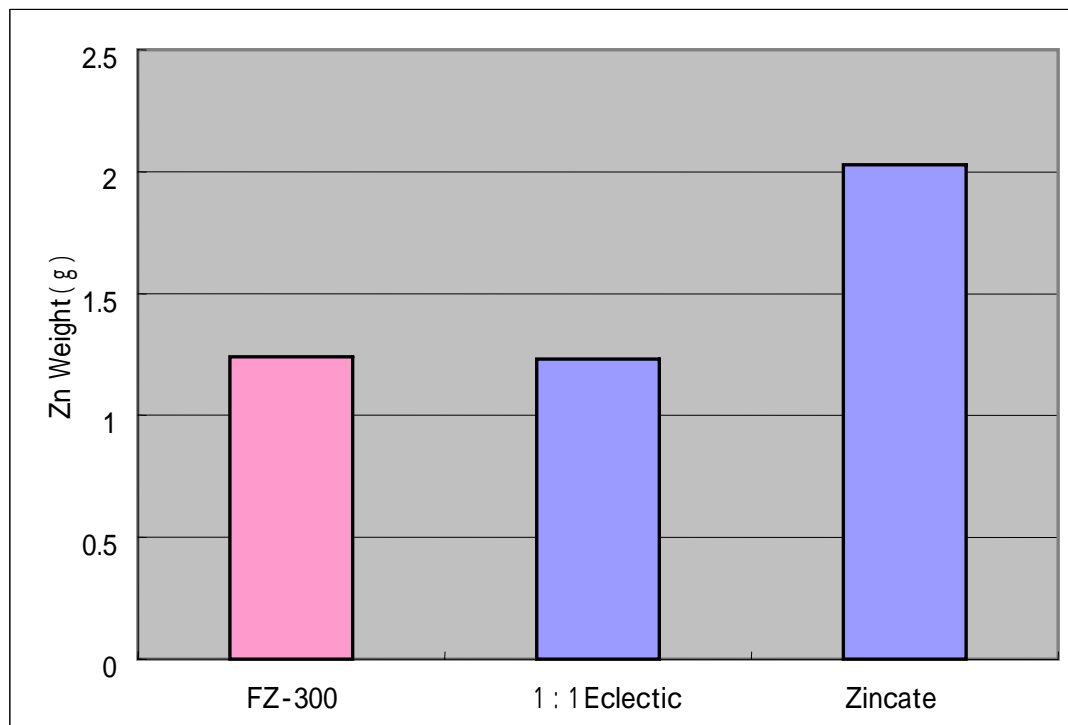
Corrosion Resistance Improvement of Trivalent Cr Black Conversion Coating

	FZ-300	1 : 1 Eclectic	Zincate
Cr Amount	5 . 2 %	4 . 6 %	3 . 9 %
72 hours			
288 hours			

Higher corrosion resistance is obtainable due to excellent compatibility with the conversion treatment. (Compared with ours)

Excellent Chipping Resistance

Zn partials chipped from plated bolts are weighed after the bolts in a plastic container are shake up and down.



Use of M10 bolt coated with 8 μ m thickness

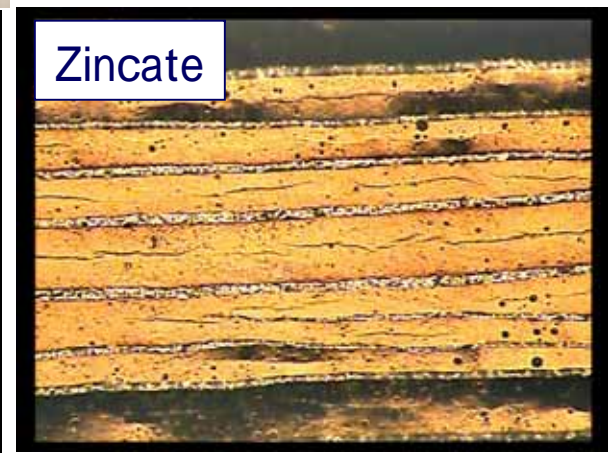
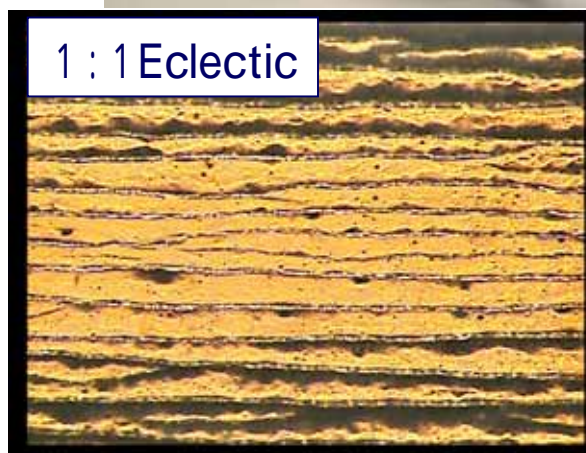
According to the amounts, chipping resistance of FZ-300 is more excellent.

Excellent Secondary Workability

Results of 180-degree Bending Test



Plating thickness : 8 μ m



Fine crack formation of FZ-300 by the test shows that it has better secondary workability than the others.

YUKEN
INDUSTRY CO., LTD.



Impure Metal Permissible Level

Impure Metal	FZ-300	1 : 1 Eclectic	Zincate
Fe ²⁺	<u>50</u> mg/L	<u>50</u> mg/L	<u>10</u> mg/L
Pb ²⁺	1mg/L	1mg/L	1mg/L
Cu ²⁺	5mg/L	5mg/L	5mg/L
Cr ⁶⁺	<u>2</u> mg/L	<u>2</u> mg/L	<u>1</u> mg/L

Higher permissible level of FZ-300 for impure metal is observed compared with zincate bath.

Less Electric Consumption

Plating Bath	Bath Voltage	Electric Cost	Cooling Cost	Total Cost
FZ - 300	6.5 V	¥ 154,440	Not need cooling down to 40	¥ 154,440
1 : 1 Eclectic	7 V	¥ 166,320	¥ 142,560	¥ 308,880
Zincate	10 V	¥ 237,600	¥ 142,560	¥ 380,160

FZ-300 consumes less electricity than zincate since the solution operated in low voltage bath need not be cooled down.

22days/month 12-hour Operation Current: 5,000A
Chiller output(30kW) Electric cost: ¥ 18/kWh

Reduction in CO₂ Discharge

Plating Bath	CO ₂ Discharge
FZ - 300	3.9 t / month
1 : 1 Eclectic	7.8 t / month
Zincate	9.5 t / month

The reduction of electric consumption enables to reduce CO₂ discharge by around 60% compared with zincate.

Calculated by 0.000452 (tCO₂/kWh), Emission coefficient for each electricity supplier in 2005, from Chubu Electric Power Company

Conclusion

- Boric acid free chloride bath, F Z - 3 0 0 is a completely new solution, which maintains the advantages of conventional chloride bath and overcomes the disadvantages.
- It is excellent in trivalent Cr conversion treatment.
- It is both eco- and business-friendly to reduce operation energy and CO₂.