

# Brightener for alkaline zincate type zinc plating

## Hyperzinc Series

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### Introduction

Since steel members are inexpensive and easy to process, they are used in various fields including automobiles, electric products, building materials, etc. However, untreated steel members are susceptible to rust and cannot maintain aesthetics and mechanical strength for a long period of time. Therefore, it is common for steel members to be subjected to rust prevention treatment.

Zinc plating is widely used as a typical rust prevention treatment for steel because it has a "sacrificial protection" effect to suppress corrosion of steel members by preferential corrosion of zinc, which has a larger ionization tendency than steel in a corrosive environment. Though there are various methods to apply galvanizing to steel, electro-galvanizing is suitable for mass treatment of articles with complicated shapes. Electro-galvanizing is a method of precipitating zinc on a surface by electrolyzing an article as a cathode in a plating solution and can be roughly classified into a "zincate bath," "cyanide bath," and "acid bath." "Zincate bath" which contains no poison even in those and is easy to treat wastewater has grown greatly in recent years.

Electro-galvanizing has a current density gradient due to the shape of the object to be processed and the positional relationship with the counter electrode, and variations in the plating film thickness with this may become a problem. "Hyperzinc" series is a uniform electrodeposition type zincate bath brightener which greatly improves that problem.

Incidentally, zinc plating is generally performed chemical conversion film treatment for protecting the plating film

after plating. In the past, "chromate treatment" using hexavalent chromium was used, but the use of hexavalent chromium was regulated by the ELV Directive which came into effect in 2000 and RoHS Directive which came into effect in 2006, and in recent years, it has shifted to "trivalent chromium conversion treatment" which does not use hexavalent chromium.<sup>1</sup>

We are developing trivalent chromium treatment agents as a "Tryner" series (see separate document).

### Product Summary

The JASCO Hyperzinc series is a brightener for alkaline zincate baths, and has a variety of distinctive products to provide optimal solutions for plating methods (barrel plating, rack plating), shapes and applications of articles, etc. (Table 1)

### Features of the Hyperzinc series

- Excellent uniform electrodeposition
- Uniform plating appearance
- Good compatibility with trivalent chromium conversion coatings
- Iron anode can be used.
- Wide operating range and easy bath management

In electroplating, the plating film thickness varies due to the high current density portion of the portion near the anode plate or the convex portion of the article and the low current density portion of the portion far from the anode

Table 1: Hyperzinc Lineup

Product name	Plating method	Features
Hyperzinc 300	Barrel plating	High conc. type, glossiness maintenance after baking
Hyperzinc 7900ABS		Highly resistant to bending or caulking with good film properties
Hyperzinc 7900L		Compatible with small items that tend to overlap
Hyperzinc 9000ABS	Rack plating	Highly resistant to bending or caulking with good film properties
Hyperzinc 9000FG		Have superior resistance to impure metals
Hyperzinc 9500		High conc. type, highly resistant to bending or caulking with good film properties

plate or the concave portion of the article. Hyperzinc shows the superior throwing power compared with the conventional zincate bath by inhibiting the plated precipitation in the high-current-density part and facilitating the plated precipitation in the low-current-density part<sup>1</sup> (Figure 1).

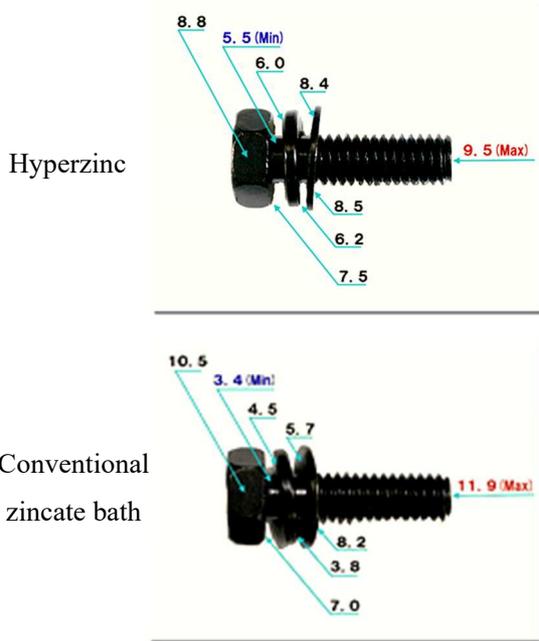


Figure 1: Comparison of film thickness distribution (barrel plating)

It is also excellent in the throwing power to deposit plating on the ultra-low current density portion, which is the inner surface of the pipe parts, and a uniform glossy plating appearance can be obtained from the high current density portion to the low current density portion. Figure 2 shows a comparison of the throwing power of the inner surface of the pipe when the anode is placed on only one side to create an extreme current density gradient and the pipe is plated.

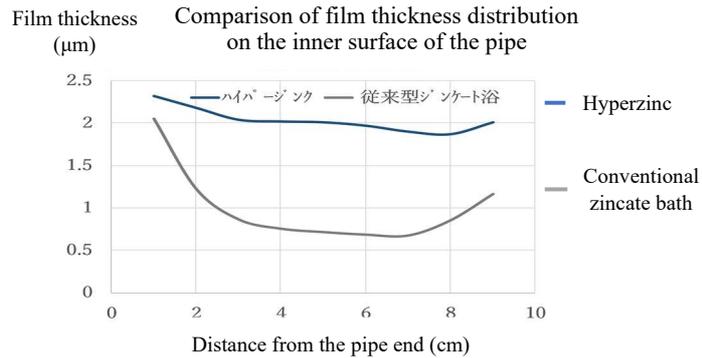
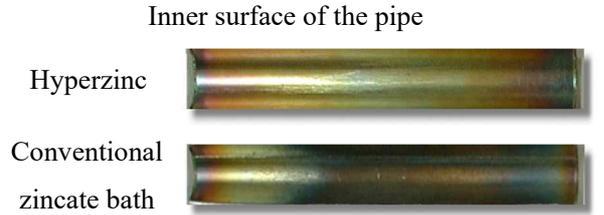
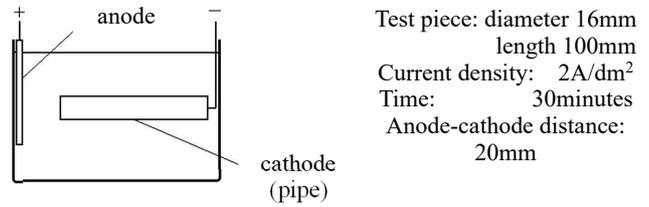


Figure 2: Comparison of plating throwing power of low current parts

Further, it is compatible with "trivalent chromium conversion treatment" and the chemical conversion film is easier to thicken than the conventional zincate bath, so that high corrosion resistance can be obtained (Figure 3).

### Treatment process

The general processes of electro-galvanizing are in the order of "pretreatment," "plating," and "post-treatment." "Pretreatment" is a step of removing stains and rust adhering to an article and is performed in the order of "degreasing" for removing oil stains, "pickling" for

SST (hr)	0hr	120hr	240hr	360hr	480hr
Hyperzinc					
Conventional zincate bath					

Figure 3: Comparison of corrosion resistance of hyperzinc and conventional zincate baths with trivalent chromium chemical conversion coating (JIS Z2371)

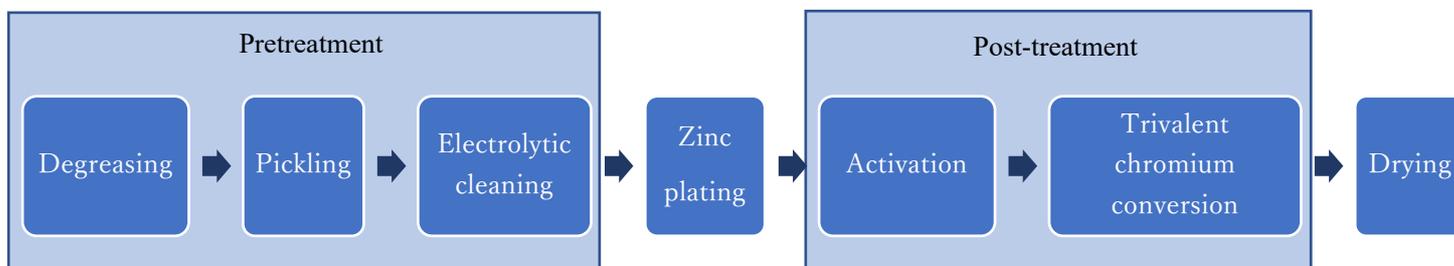


Figure 4: Zinc plating process (general processing process)

removing rust, and "electrolytic cleaning" for removing surface residues after pickling. "Plating" is a step of generating a plating film by electrolysis, "post-treatment" is a step of protecting a plating film, and in recent years, "trivalent chromium conversion treatment" is the mainstream.

The processes from pretreatment to post-treatment are generally carried out continuously (Figure 4).

### Mechanisms

The brightener of zinc plating is composed of a primary brightener which forms a uniform and smooth plating film by suppressing deposition of zinc by electrolysis and a secondary brightener which imparts brightness to the plating film. Primary brightener of Hyperzinc uses a special water-soluble polymer which exhibits higher the current density, the stronger the inhibiting force. By the primary brightener shifts the current density distribution in the article to the middle and low current density portions, plating thickness of these areas are increased, and plating thickness of high current density area is decreased. By this, it became possible to provide uniform plating thickness to wide current area compare with the conventional brightener.

In addition, when an iron anode is used in a conventional zincate bath, the oxidizing atmosphere around the anode is strong and the decomposition of the brightener is accelerated. Therefore, it is common to use a zinc anode in which the oxidizing atmosphere around the anode is unlikely to be strong, but a special water-soluble polymer used in Hyperzinc brightener is hardly decomposed even under an oxidation atmosphere, so that the iron anode can be used. Furthermore, to suppress the zinc concentration fluctuation caused by dissolution of the zinc anode, it was necessary to pull out the anode plate during a long-term operation rest, but in the case of the iron anode, it becomes unnecessary to pull out the anode.

### In closing

The JASCO Hyperzinc series has been marketed over 20 years as a pioneer of uniform electrodeposition type

brightener for zincate baths in Japan, and it is now well received by many customers both domestically and abroad. It continues to evolve day by day from the results cultivated in these large numbers of sites and is a brightener capable of responding to all needs of the site.

### Literature

1: Hideo Susa; *J. Surf. Finish. Soc. Jpn.* Vol. 70, No. 8, pp. 388-393 (2019)