



Innozinc
Technology
Introduction

Innozinc®

4th Generation Ceramic Galvanizing, A New Paradigm in
Corrosion Resistance

Technology introduction



Ceramic galvanizing Innozinc offers superior corrosion resistance and enables carbon and weight reduction through room-temperature processing. It is an innovative alternative to electro galvanizing and Hot-dip galvanizing.

Innozinc characteristics



- **Neutral Salt Spray Test(SST)**
[KS D 9502] 720hours
- **Cyclic Corrosion Test(CCT)**
[JIS H 8502] 80cycle



- **Lightweight** : Using room-temperature ionized galvanizing instead of Hot-dip methods enables lightweight design and coating, preventing bending and twisting.



- **Durability** : Ionized galvanizing ensures strong adhesion to the steel base material.
- **Workability** : No coating peeling after bending or grooving post-galvanizing.
- **Fastening Performance** : The thin ceramic zinc layer provides excellent fastening, tightening, and sealing strength.
- **Weldability** : Welding possible without coating removal, improving productivity and reducing costs.
- **Safety** : No need for zinc dross or burr removal, ensuring a clean finish.
Eliminates 500°C molten baths for worker safety.
Automated systems provide stable quality and efficient production control.



- **Carbon Emission Reduction** : No direct CO2 emissions as no fossil fuels are used.
Reduces carbon emissions by 65% compared to 500°C Hot-dip galvanizing operated year-round.
- **Galvanizing Fumes** : Unlike Hot-dip galvanizing, room-temperature processing generates no metal fumes.
- **Welding Fumes** : Harmful metal fumes and elements during welding are equivalent to those of regular steel.
- **Heavy Metals** : Complies with RoHS standards with no detection of six major heavy metals.

Differences in properties by galvanization specs

SPEC	Elec Galvanizing	Hot-dip Galvanizing	Innozinc
Corrosion Resistance (SST)	240hr	500hr	720 hours or more
Coating Thickness	8 or higher	50 ~ 77 μ m	8 or higher
Zinc coating weight	86g	550g	86g
Hardness	9H	9H	9H
Adhesion	5B	5B	5B
Color	Silver	Silver	Silver (Light yellow tint)
Top-Coat Adhesion	Good	Bad	Good
Fastening Performance	Good	Bad	Good
Weldability	Good	Bad	Good

Plating process

Innozinc Technology



- **Innozinc Galvanizing** : Multiple additives act during zinc layer formation to stabilize zinc and create a structure that promotes bonding with inorganic post-treatment.
- **Activation (+Stabilization)** : Removes impurities and oxide films after zinc layer formation, creating a thin passive layer that prevents corrosion.
- **Nano Inorganic Post-treatment** : Nano-scale inorganic solution penetrates and bonds within the zinc layer, forming a dense thin network structure on the surface.

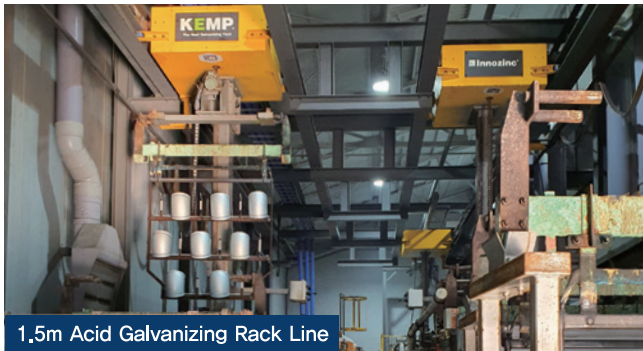
Innozinc facility



3.5m RACK LINE



BARREL LINE



1.5m Acid Galvanizing Rack Line

KEMP's facilities enable a wide range of surface treatments from small hardware such as fasteners to medium and large products like steel gratings and cable trays.

Scan the QR code below to learn more about the Innozinc process.



RACK Process



BARREL Process

Applications

Innozinc can be applied across various industries, including solar structures, shipbuilding and offshore, container components, telecommunications equipment, data centers, power transmission, construction, and onshore plants.

Containers

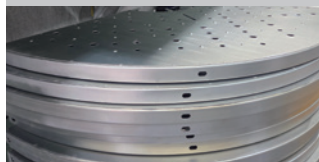


Locking Rod

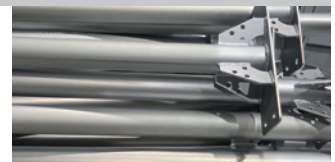


Container Bracket

Telecommunication Equipment



Foot Stand

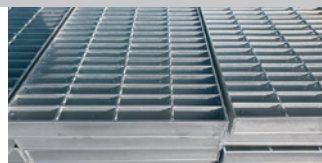


Pipes and Support

Data Centers



System Channel Bracket



Steel Grating

Power Transmission



Cable Support



Cable Hanger

Construction & Onshore Plants



Pipe



C-Channel



Angle



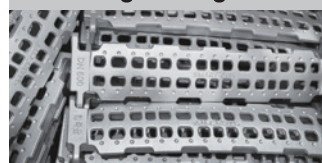
Pipe Fitting

Automotive



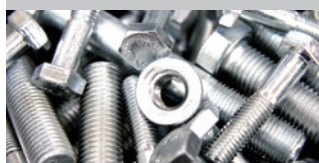
Brake Caliper

Road Engineering



Silent Trench, Road Grating

Other Hardware



Bolt

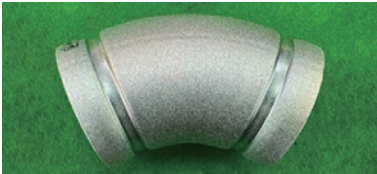
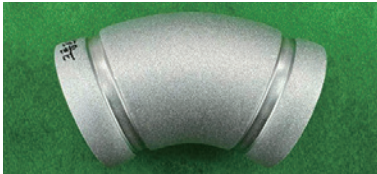


Nut

Comparison of corrosion resistance in salt spraying test (SST)

- **Electro galvanizing** : SST 480 hours with overall white and red rust
- **Hot-dip galvanizing** : SST 480 hours with overall white and partial red rust
- **Innozinc** : SST 480 hours with no defects

Electro galvanizing and Hot-dip galvanizing easily corrode because pure zinc oxidizes rapidly when exposed to salt. In contrast, Innozinc stabilizes zinc with inorganic ceramics, effectively slowing oxidation and enhancing corrosion resistance.

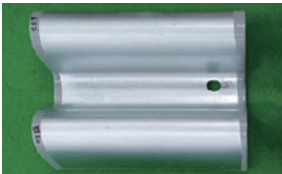
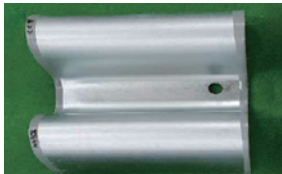
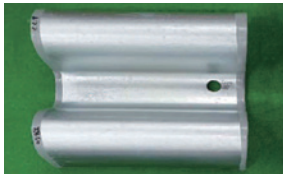
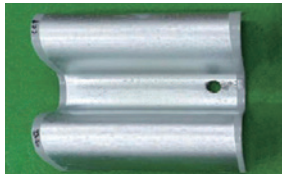
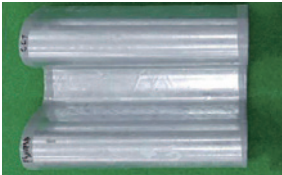
Classification	Electro galvanizing 8 μ m	Hot-dip galvanizing 80 μ m	Innozinc® 8 μ m
Before SST			
SST 480 hours			

Test method : [ASTM B 117] Salt spray(35±2°C, 5±1% NaCl)

Comparison of corrosion resistance in cyclic corrosion tests (CCT)

- **Innozinc** : Shining surface maintained even after 80cycles
- **Hot-dip galvanizing** : Significant white rust and a small amount of red rust after 40cycles

Even under repeated salt, drying, and humidity cycles, the inorganic ceramic bonded with zinc maintains high stability. Unlike SST, CCT alternates salt, drying, and humidity steps, offering more realistic and severe corrosion testing conditions.

Classification	Before CCT	40Cycle	64Cycle	80Cycle
Innozinc® 8 μ m				
Hot-dip galvanizing 80 μ m				

Test method : [JIS H 8502] CCT 80Cycle / 1Cycle : Salt spraying(35°C, 5% NaCl) 2hr - drying(60°C, 25% R,H) 4hr - Wetting(50°C, 98% R,H) 2hr

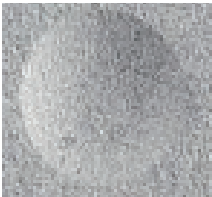
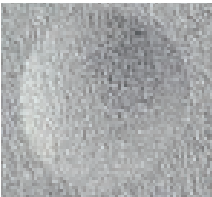
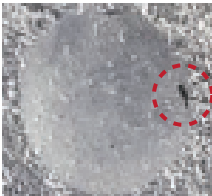
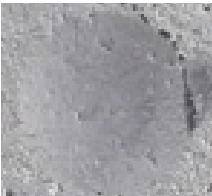
Actual Field Exposure Test Results

A comparison of locking rods mounted on containers operating in real marine environments such as the Indian, Atlantic, and Pacific Oceans showed:

- **Hot-dip galvanizing** : Significant surface oxidation observed
- **Innozinc galvanizing** : Almost no visible surface change

Innozinc® After 5 months of marine operation		Innozinc® [after 5 months of operation]	Hot-dip galvanizing [after 9 months of operation]
			
		Container built : 11/2024	Container built : 06/2024

Impact Resistance / flexibility resistance

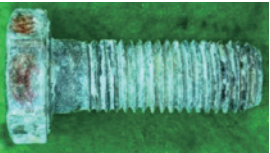
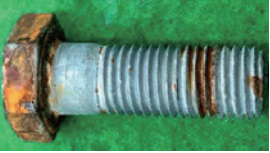
Classification	Impact Resistance Test	
	1	2
Innozinc® 8μm		
Hot-dip galvanizing 77μm		

Classification	flexibility resistance Test	
	1	2
Innozinc® 11μm		
Hot-dip galvanizing 51μm		

Test method : Impact Resistance Test [ISO 6272-1] When a 1kg mass is dropped from 1 meter, cracking or delamination in the coating layer are observed.
Flexibility resistance Test [ISO 20482, KS B 0812] (Erichsen cupping test) Using an anti-metal punch, galvanized test samples are pressurized until cracking occurs, and based on the punch movement distance, the layer axial force is measured.

- **Impact Resistance Test** : 2 types of galvanized items showed no surface defects near impact areas.
- **Flexibility resistance Test** : Innozinc shows excellent flexural resistance at 11.7 mm, compared to 7.0 mm for Hot dip galvanizing. Flexural performance is determined by coating thickness and adhesion to the substrate, Innozinc maintains strong bonding and stable coating even during processing and bending.

Corrosion Resistance Comparison by Coating Type after Bolt Damage

Test method	Classification	Before SST	SST 360hours	SST 720hours
1. Tooling 	Innozinc®			
2. Visual inspection after tooling 	Hot-dip galvanizing			
3. Salt spraying test SST 720hours	Zinc Flake Coating			

Test Method: Fastening and loosening repeated twice using a power tool → Salt Spray Test (ASTM B117) conducted for 720 hours.

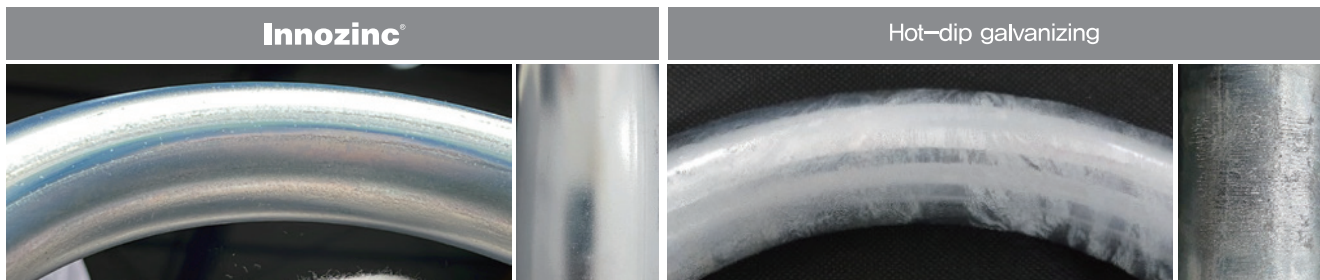
- **Innozinc** : White rust appeared after 360 hours of SST and remained up to 720 hours.
- **Hot-dip galvanizing** : Heavy white rust and partial red rust appeared after 360 hours.
- **ZFC** : Severe red rust occurred on the head and threads after 360 hours, spreading over the entire head by 720 hours.

The corrosion resistance of damaged bolts was evaluated in the order Innozinc > Hot-dip Galvanizing > ZFC.

Innozinc showed the least quality variation from surface damage, demonstrating superior corrosion resistance and durability even under physical impact or external wear.

Workability Comparison (Bending After Galvanizing)

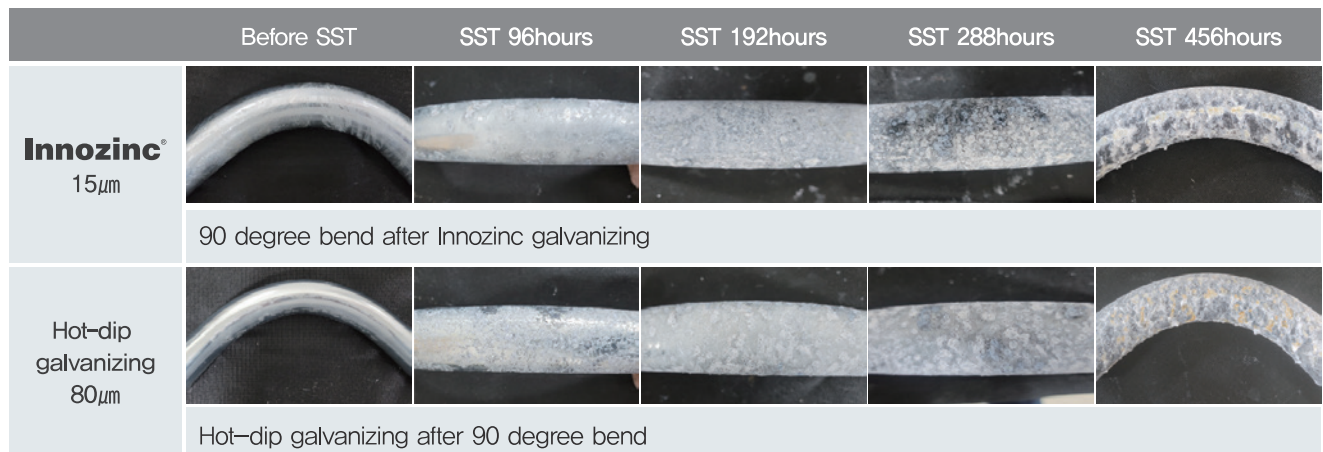
- **Innozinc** : Bending (fabrication) is possible after galvanizing, and due to excellent fabricability, there is no damage to the plating even when bending 140° after galvanizing
- **Hot-dip galvanizing** : Cracking occurs when bending after galvanizing, therefore bending after galvanizing is not possible



Corrosion Resistance of Bent Pipes

- **Innozinc (bending after galvanizing)**: Black rust at 288 hours SST, red rust at 456 hours SST
- **Hot-dip galvanizing (galvanizing after bending)**: black rust at 288 hours SST, red rust at 456 hours SST

Pipes bent after Innozinc galvanizing and those bent before Hot-dip galvanizing show equivalent or superior corrosion resistance.



Workability Comparison (Groove)

- **Innozinc** : Maintains a smooth surface with no abnormalities in the galvanizing film even after processing
- **Hot-dip galvanizing** : Damage to the galvanizing film such as peeling, lifting and crushing occurs after processing

Damage to the galvanizing causes corrosion of the pipe, and Innozinc has excellent impact resistance and flexibility, so even after grooving, there is no damage to the inner and outer surfaces, enabling long-term performance maintenance.



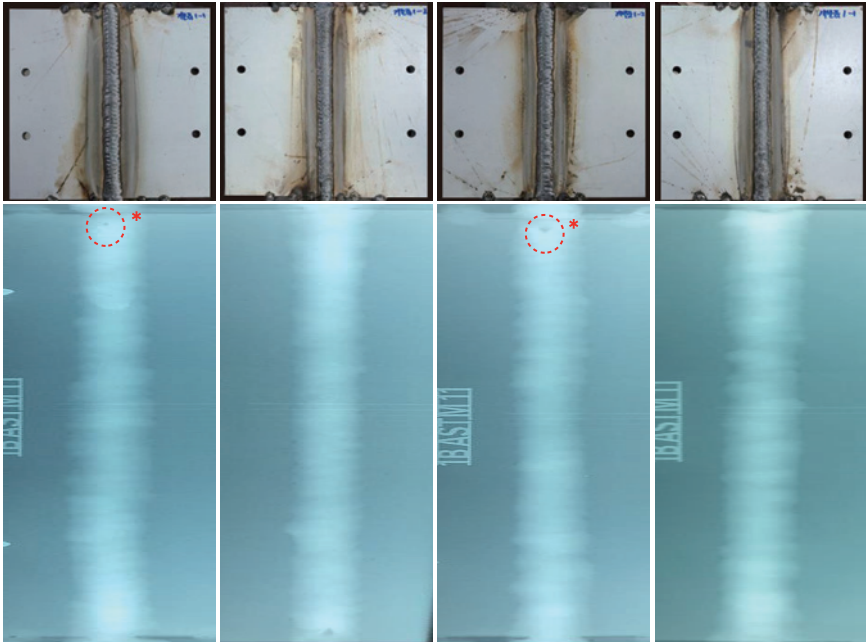
Weldability

Test method

1. Crack / undercut / overlap / void evaluation
2. Welding defect evaluation
3. Evaluation results derivation

Innozinc® Welding test

#1#2#3#4



Welding defect evaluation photos

REPORT OF RADIOGRAPHIC TESTING

Subject: WELDING TEST		Report No.: NDT 0000	
Material: Steel	Weld Type: Fillet	Weld Type: Fillet	Weld Type: Fillet
Equipment: Radiography	Exposure: 10-150kV	Exposure: 10-150kV	Exposure: 10-150kV
Technician: J. Kim	Inspector: J. Kim	Inspector: J. Kim	Inspector: J. Kim
Date: 2023-01-10	Date: 2023-01-10	Date: 2023-01-10	Date: 2023-01-10

Defect	Position	Size	Grade	Remarks	Result
Crack	Weld	0.5mm	1	Not detected	Pass
Undercut	Weld	0.5mm	1	Not detected	Pass
Overlap	Weld	0.5mm	1	Not detected	Pass
Void	Weld	0.5mm	1	Not detected	Pass

No defects

Welding defect test report

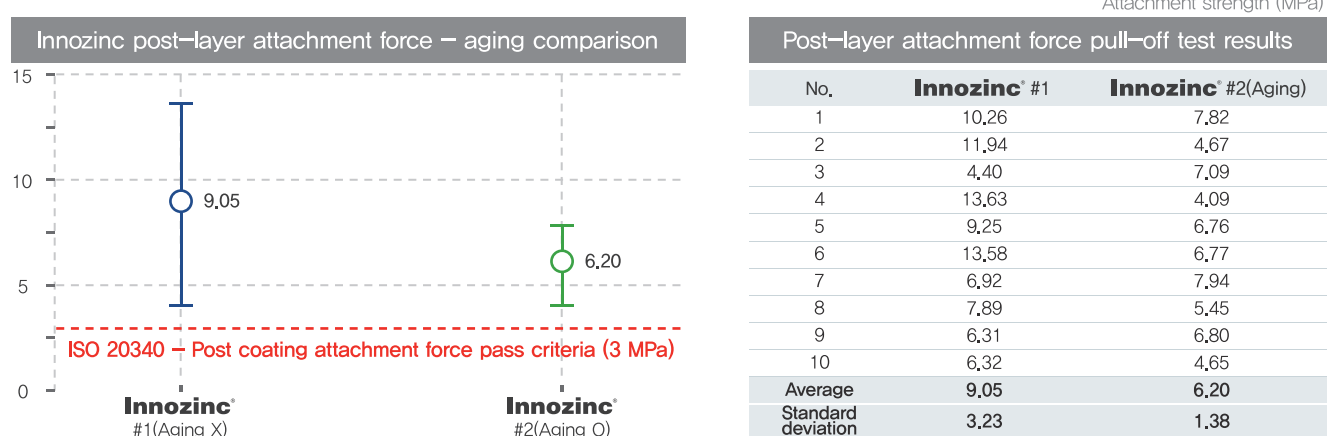
Innozinc test samples (4EA) were welded without the removal of the zinc layer, and test results confirmed the absence of defects.

* Cracks at the ends were not due to galvanization and thus excluded from the evaluation.

- **Hot dip galvanizing weldability** : Zinc with a low melting point first penetrates the welding area, thus creating holes, cracks, and other quality issues. In addition, while the post-plating zinc melts, a large amount of fumes are generated. For this reason, to weld a hot dip galvanized material, the galvanized layer must first be removed near the area to be welded or the area to be welded must be masked during galvanizing.
- **Innozinc weldability** : Ceramic layer improves welding performance and reduces the amount of foreign substances such as spatters, and there are less fumes generated. As such, it is possible to immediately weld without removing galvanized layer.

Subsequent Painting adhesion

According to the test results, Innozinc yields a high value exceeding 3Mpa, which is the attachment force required for the post-layer when considering the use of epoxy paint for a combination. Hot dip galvanizing is associated with paint delamination issues due to white rust, but Innozinc suppresses the generation of white rust in the zinc layer, thus maintaining the long-term attachment of post-paint.



Test method : ISO 20340 Paints and varnishes – Performance requirements for protective paint systems for offshore and related structures



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