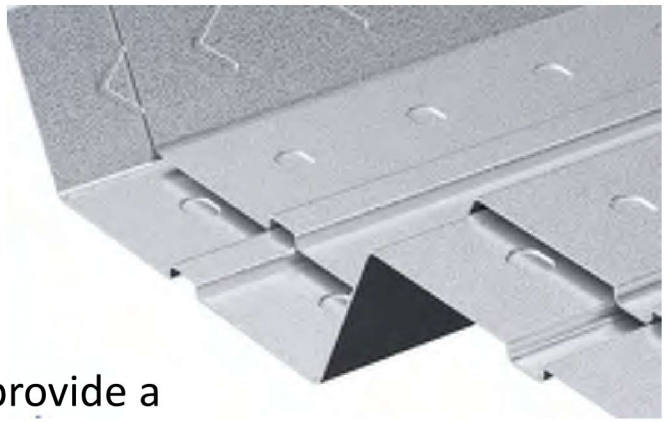
Magnesium Containing Zinc-Aluminium alloys



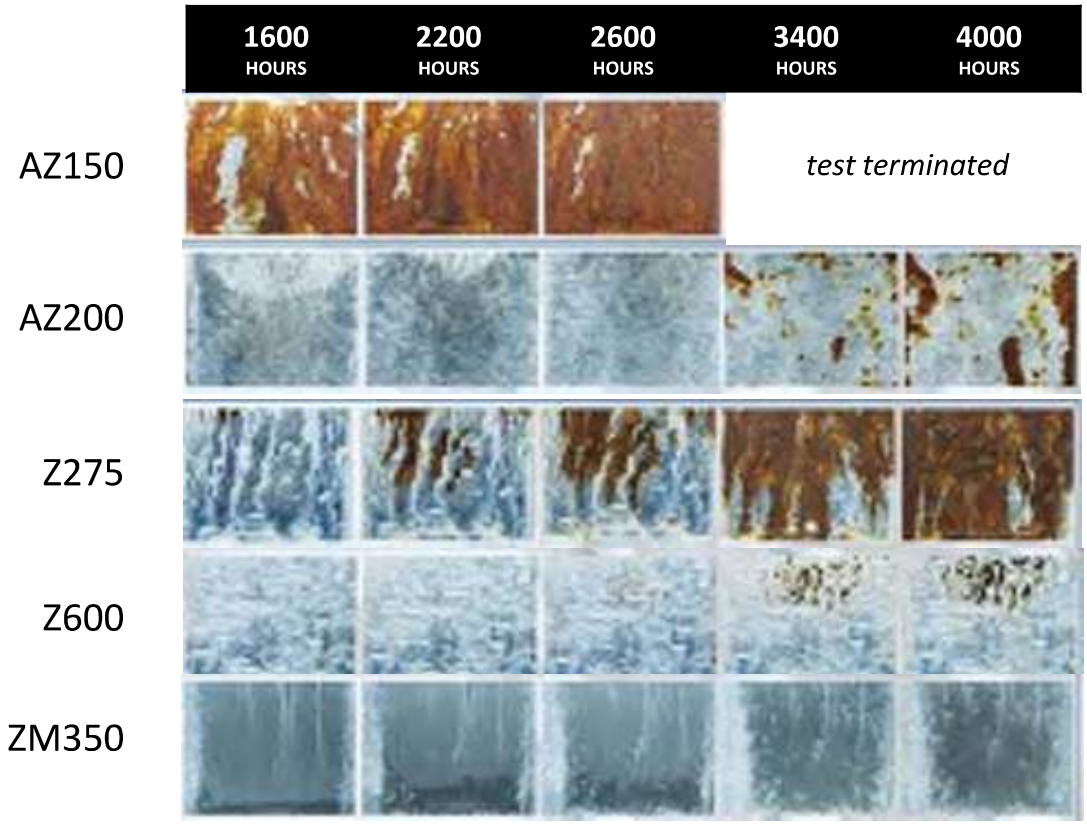
- Magnesium containing Zinc-Aluminium alloys are highly corrosion resistant coated steels, with an alloy composition of Zinc, 5% Aluminium, and 3% Magnesium.
    - They have been developed to provide a breakthrough solution in surface corrosion and cut edge protection, suitable for aggressive environments.
- The Magnesium in Zinc- Aluminium systems accelerates the formation of a highly resistant crystalline film, which is extremely stable protecting against ongoing corrosion.

    $Mg_{3+} \rightarrow Mg(OH)_3$
    $Zn_{3+} \rightarrow Zn(OH)_3 \rightarrow Zn_2(OH)_3Cl_2H_2O$

- Offers improved cut edge corrosion performance given the addition of Magnesium which changes the corrosion mechanics.
- With significantly improved corrosion resistance in harsh environments, including chemical, salt water, and marine, suitable for applications in C5 environments.
    - Can replace post HDG applications at competitive costs.
    - Offers extraordinary abrasion resistance

Comparative Corrosion Performance of Magnesium Containing Zinc-Aluminium Alloys

Accelerated Salt Spray – 5% NaCl @ 35^{O}C - ISO9227, JISZ2371, ASTMB117



46 month exposure – Severe Marine (Shellharbour) – Z200, Z275, ZM180

WARRANTY - HOT-DIPPED ZINC-ALUMINIUM-MAGNESIUM ALLOY COATED STEEL

APPLICATION – STEEL SUB-FLOORS

WARRANTY DURATION – 10 YEARS

Selection Steel hereby undertakes that Hot-Dipped Zinc-Aluminium-Magnesium products with coating mass ZM300 or heavier (as designated by AS1397:2021) intended for use in sub-floor systems will not perforate or show corrosion to structural failure for 10 years from the date this order is shipped from designated manufacturing mill under normal weather conditions.

THIS WARRATY IS SUBJECT TO THE FOLLOWING TERMS AND CONDITIONS:

- The product is prime product and can be identified back to the appropriate manufacturing mill (via a physical steel brand or input pack numbers).
- The products must be installed, used and maintained in strict accordance with relevant guidelines, all applicable industry standards, and the Building Code of Australia current at the date of installation.
- All flashings, fasteners or components fixed to or used with the products must be manufactured from materials which are compatible with zinc or zinc alloy coated steels.
- All fasteners used for fixing products must offer similar corrosion performance to the sub-floor system. Screw fasteners must all be suitable for ISO 9223 Category 3.
- The products, as supplied, must not at any time come into contact with an incompatible material.
- With respect to proximity to salt marine influences, this Warranty does not apply if the Host Dwelling is located less than 1000m from the high-water mark of "surf" and/or "exposed" marine influences.
- To make a claim under this Warranty, proof of original ownership of sub-floor products must be provided.
- The owner of the Host Dwelling grants the right to access the building site to inspect and conduct such tests of the sub-floor during construction of the Host Dwelling as are necessary, and at any time after a claim is made. Under this Warranty, any issues with the performance of the sub-floor made from the products must be accompanied by consent from any other party affected by Selection Steel's right to access the defective End Product.
- Sufficient ventilation under the sub-floor must be evident to protect against condensation and accumulated moisture.
- Sub-Floor must not come into contact with soils or deleterious matter of any kind during the life of the Host Dwelling.

This Warranty does not cover perforation or corrosion causing structural failure, wholly or partly due to an event or cause beyond the reasonable control of Selection Steel, including without limitation each of the following:

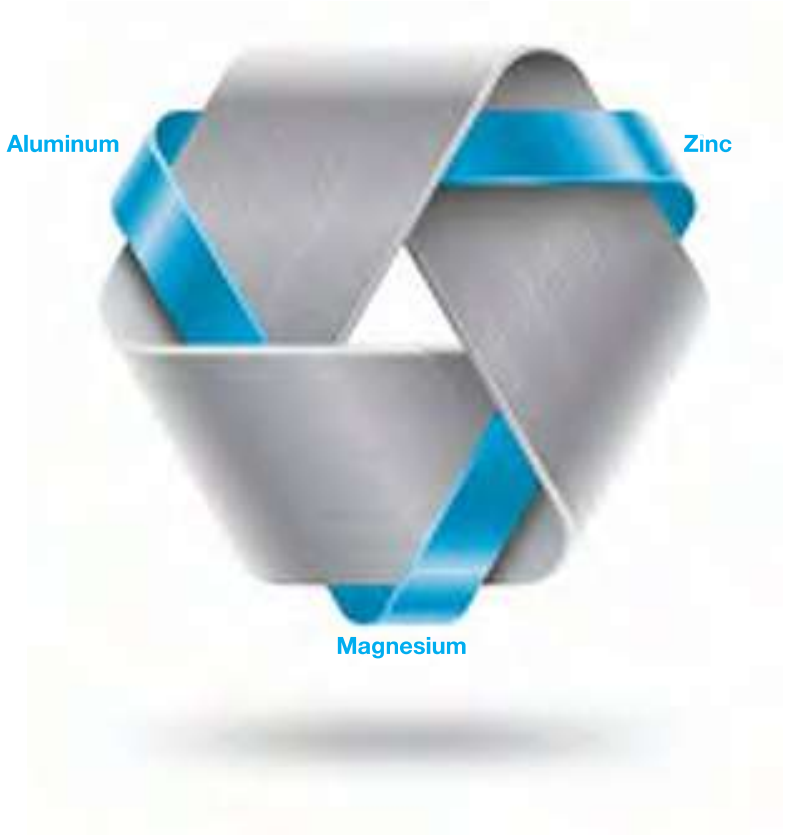
- Aesthetic surface corrosion including white corrosion product or red rust on cut edges;
- Degradation of the sub-floor as a result of prolonged exposure to the external environment during storage, or erection and the intervening period prior to cladding of the structure;
- Failure due to the retention of moisture by any adjoining building materials;
- Corrosion of the sub-floor resulting from the degradation of other materials, components or corroded fasteners;
- Defects attributed to faulty design, method of manufacture or installation; mechanical, chemical or other damage sustained during transport, handling, storage, erection or subsequent to erection;
- Contact with soil, ash, fertilizer, moisture retaining substances, lead or copper and other dissimilar metals, liquid from copper flashings or copper pipes, chemical or other agents, fumes, liquids or solids, green or wet timber or treated timber.
- Failure to remove debris and/or allow free drainage of water (including condensation) from all surfaces of the End Product;
- Failure to Install, use and maintain the sub-floor (including components outlined below) in accordance with industry guidelines and applicable industry standards;
- Installations subject to severe industrial or unusually corrosive environments at any time in the future;
- Accidental or intentional damage by a person or animal; earthquakes, hurricanes, tornadoes, cyclones, typhoons, gales, lightning, hail, fires, flood and other similarly extreme “acts of God”.
- Sub-Floor must be separated from any ground moisture.
- The application of post-applied paint treatments or systems to the End Product
- This Warranty does not cover products used in the sub-floor space between a suspended floor of a building and the ground.
- This Warranty does not apply to products for steel framing or roof battens.
- This Warranty does not apply to products installed in corrosive environments with corrosiveness above C2 (as defined in ISO 9223, and typically < 100m from marine).
- This Warranty does not apply to products installed in areas exposed directly or indirectly to corrosive chemicals, acid rain, ash, smoke, dust, cement, asphalt, fertilizers, flame retardants or water retention, high humidity, dew salt, cold storage, near high heat sources, coal, desert, or where snow falls continuously or intermittently.
- Under no circumstances shall Selection Steel be liable for labour costs or other costs associated with any problems related to the defective product or any specific, direct or indirect damage caused by the defective product.

[END]

Patent Number : 10-1758715

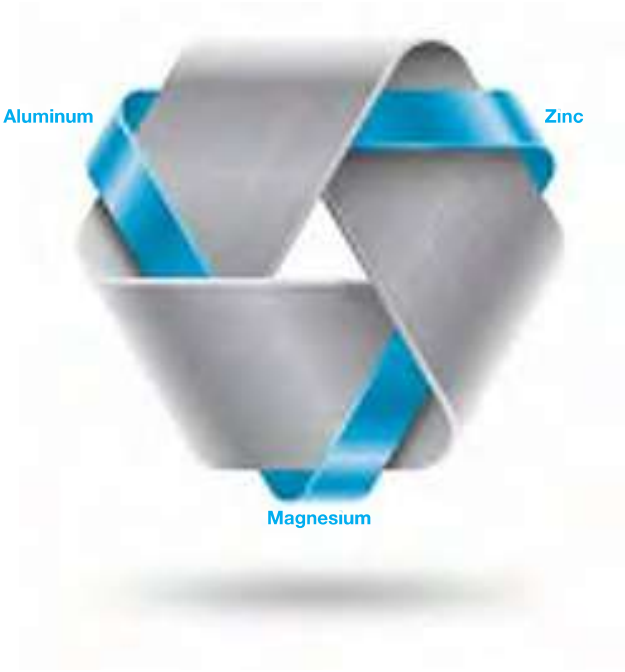
GIX

NEXT GENERATION HOT-DIP **GALVANIZED** STEEL



DONGKUK STEEL

What is GIX



GIX is an alloy of zinc, aluminum and magnesium hot-dip coated on steel plate, designed for all applications requiring high corrosion resistance. The alloy plating of GIX is composed of the optimum aluminum and magnesium ratio, proven over a long period of time.

GIX is the product of top-level plating technology of Dongkuk Steel, which has excellent surface appearance and 5~7 times higher corrosion resistance compared to the existing GI.

94%
Zinc

4%
Aluminum

2%
Magnesium

Corrosion Resistance
Due to the effect of alloyed magnesium and aluminum, GIX maintains sacrificial corrosion of zinc method in stabled condition and performs excellent corrosion resistance, definitely in the surface of the plating and even in the scratched part and cross section, which are caused by the bending process and field installation.

Workability
GIX is superior to GI in various processes, such as roll forming, press, and welding. It can be applied directly to the processing and assembling work environment designed for existing GI.

Paintability
GIX has strong adhesion between plating layer and paint.
Excellent performance is delivered, when it is used as a base plate for powder coating after processing and PCM colored steel plate for construction interior and exterior.

Aesthetic Appearance
Due to the addition of magnesium and aluminum, GIX's spangle miniatures and gloss increases far superior, which makes differentiated exterior from GI.
In addition, it can be used as an exterior material without additional painting due to its excellent corrosion resistance, and its unique metallic texture delivers aesthetic satisfaction.

Schematic image

GIX Plating Layer

Zn-Al-Mg Alloy Coating	Coating Thickness
60g/m^2	9㎛
80g/m^2	12㎛
100g/m^2	15㎛
120g/m^2	19㎛
140g/m^2	22㎛
180g/m^2	28㎛
200g/m^2	31㎛
220g/m^2	35㎛
250g/m^2	39㎛
275g/m^2	43㎛
310g/m^2	49㎛

Post Process

Chromate Cr6+
Chromate Cr3+
Anti Finger Print (Cr-Free)
Anti Finger Print (Cr Type)
Oiling

Substrate Iron Specifications

Thickness	0.24 ~ 2.3mm
Width	600 ~ 1,270mm
Length	600 ~ 5,000mm
Material	CQ, CQ-Full, DQ, EDDQ, Gr-A,B,C,D,E

Production Specifications

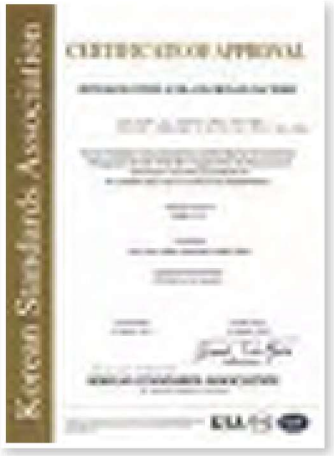
Production Capacity	300,000ton / Year
Unit Weight	22ton MAX
Coil Inner Diameter	508 / 610mm
Coil Outer Diameter	2,100mm MAX

Certifications

Korean Patent

Korean Patent

KS Certificate

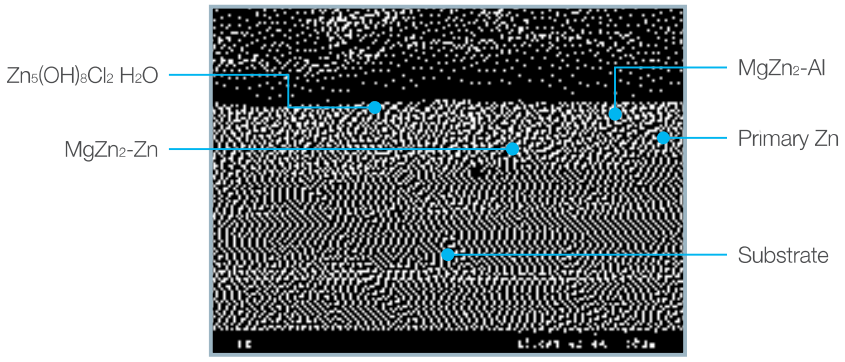


KS Certificate

GIX Plating Layer Composition and Corrosion Resistance Improvement Process

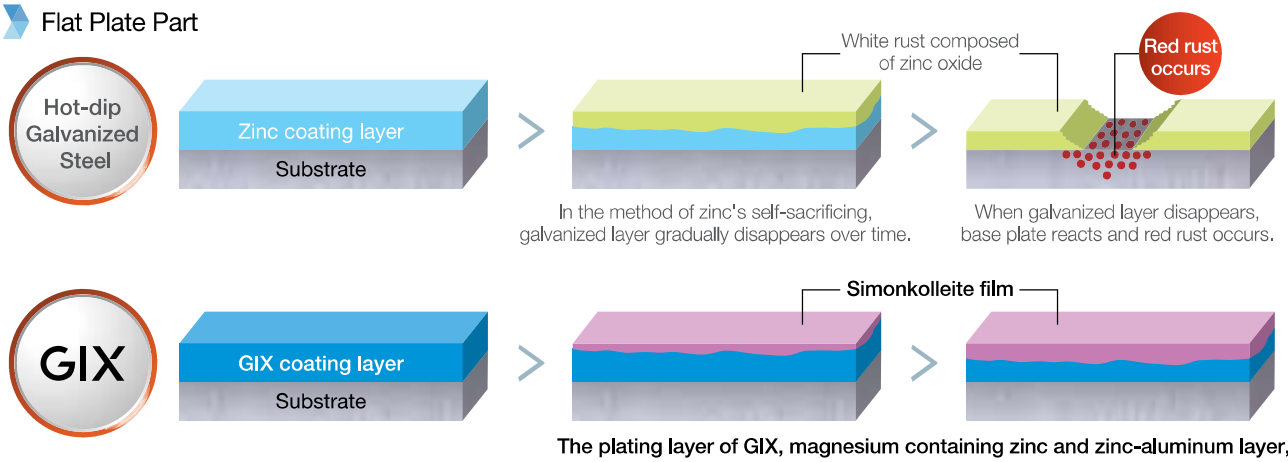
Magnesium containing plating layer **promotes the formation of Simonkolleite ($Zn_5(OH)_8Cl_2\ H_2O$)**, which has high stability in sacrificial reactions of zinc. This stable Simonkolleite is formed like a thin film on the surface of the **plating, which significantly delays the corrosion reaction of the aluminum and zinc alloyed plating layer**.

GIX Cross Section Plating Layer Diagram



GIX Corrosion Prevention Mechanism

Flat Plate Part



The plating layer of GIX, magnesium containing zinc and zinc-aluminum layer, forms Simonkolleite film on top of the plating to prevent the consumption of zinc over time.

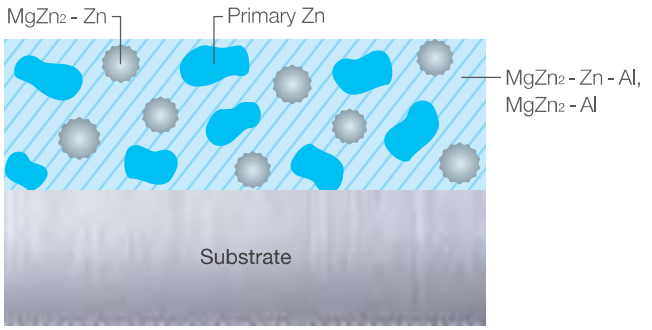
Cross Section (Salt spray test result on cross section)

Division	1,000H or more	3,000H or more	Result
GI			For existing GI, when red rust occurs partially on the base plate that is exposed in the air, corrosion does not stop and continues.
GIX			On the other hand, even if the cross section of the base plate is exposed to the air and red rust occurs, the zinc coating containing the magnesium of GIX immediately covers the exposed area to effectively prevent corrosion.

※ Tested Product : Plating Amount 300g / Chromated / 1.6T

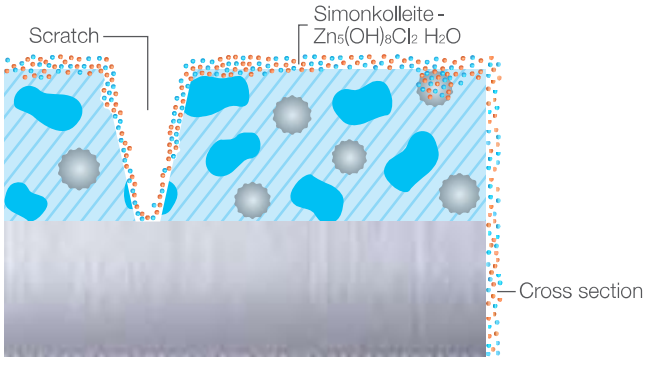
Self-sealing
Activate Mechanism

How does GIX prevent the corrosion of steel substrate on cross section and scratched part?



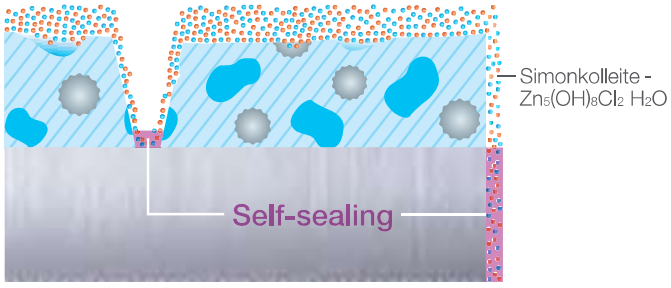
1

The entire plating layer effectively protects the steel substrate and prevents corrosion.
When GIX is installed outside and begins to corrode in natural state, magnesium alloy ($MgZn_2$) will react first.



2

$MgZn_2$ promotes the formation of Simonkolleite, a corrosion product. This Simonkolleite is formed like a film on the exposed part, and this acts to prevent corrosion on cross section and scratched part.



3

Afterward, zinc in the plated layer is consumed as self-sacrificial corrosion, and part of aluminum acts as a passive film to protect the steel plate from the external environment. Such interaction of zinc, aluminum, and magnesium effectively protects steel substrate in more severe environments.

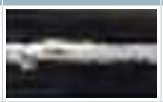
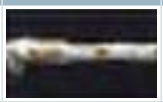
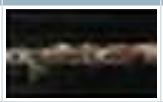
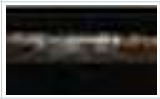
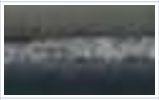
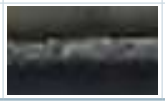
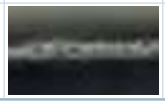
Product Corrosion Resistance Comparison

Flat Surface Corrosion Resistance Test Result

※ Testing Method : According to ASTM B117-73

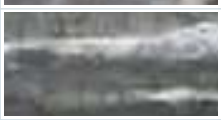
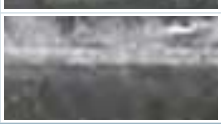
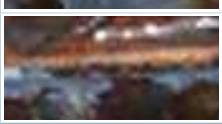
Division	Plating Amount	500H or more	1,000H or more	1,500H or more	2,000H or more	3,000H or more	3,500H or more	4,000H or more	5,000H or more
GI	120g								
GIX	120g								
Other Company's High Corrosion Resistant Ternary-Steel Plate	120g								
GI	180g								
GIX	180g								
GI	275g								
GI (Chromate)	300g								
GIX	275g								

Corrosion Resistance on Cross Section Test Result

Division	Plating Amount (Thickness)	500H or more	1,000H or more	1,500H or more	2,000H or more	3,000H or more	3,500H or more	4,000H or more
GI	120g (0.8T)							
GIX	120g (0.8T)							
GI	180g (0.8T)							
GIX	180g (0.8T)							
GI	275g (1.0T)							
GIX	275g (1.0T)							
GI (Chromate)	300g (1.6T)							
GIX	120g (0.5T)							
Other Company's High Corrosion Resistant Ternary-Steel Plate	120g (0.5T)							

Corrosion Resistance on 0T Bending Processed Part Test Result

※ Test Product Thickness : 0.6T

Division	Plating Amount	500H or more	1,000H or more	1,500H or more	3,000H or more	3,500H or more
GI	120g					
GIX	120g					
Other Company's High Corrosion Resistant Ternary-Steel Plate	120g					

Corrosion Resistance on Welded Part of Pipe Test Result

Division	Plating Amount 300g/m² + Piping Resin	
	GI	GIX
200H or more		
500H or more		
1,000H or more		
2,000H or more		
5,000H or more		

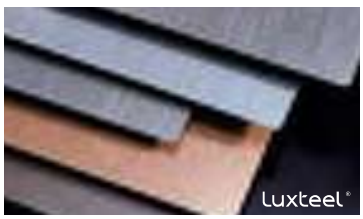
※ Testing Method : Catalyst 5% salt water test (Cycle Spray – Spray 8 hours, pause 16 hours)

Application Case

Applications of Colored Plate

When GIX is used as the base plate of various colored products, performance doubles and life span significantly increases, comparing to existing painted GI products with equivalent plating amount, and performs best in harsh environments, including coastal areas.

Please experience the result of Dongkuk Steel's top coating technology combined with GIX; the high-performance Luxteel.



Construction Applications

GIX contributes to the production of clean and renewable energy by providing advanced solutions to the structure of solar panels that are exposed to harsh environments.

It is also suitable for a variety of architectural applications, such as building walls, rain gutters, structural light-weight steel and side rails on the road.
Especially, when used in coastal areas and agricultural buildings that are vulnerable to corrosion, it performs excellent corrosion resistance.

Agricultural Applications

GIX is also applicable to various agricultural materials.
It is used for various agricultural supports and greenhouse pipes including vineyards, and maximizes the life span of the product.

Especially, it performs higher durability in various pens, including poultry farms, where large amount of ammonia gas is emitted.
In addition, environmental effect is minimized by remarkably reduced use of zinc, compared to GI with the same level of corrosion resistance.

Home Electronics Applications with High Corrosion Resistance

Based on its high paintability and corrosion resistance, GIX can be used in a wide range of home electronics and other electronic devices,
and significantly increases life span of devices compared to existing GI.

In addition, due to the high workability of GIX,
products can be utilized in various forms.

Dimension Tolerances

Thickness Tolerances

Thickness	Width		
	W < 630	630 ≤ W < 1,000	1,000 ≤ W < 1,270
T < Below 0.25	± 0.04	± 0.04	± 0.04
0.25 ≤ T < 0.40	± 0.05	± 0.05	± 0.05
0.40 ≤ T < 0.60	± 0.06	± 0.06	± 0.06
0.60 ≤ T < 0.80	± 0.07	± 0.07	± 0.07
0.80 ≤ T < 1.00	± 0.07	± 0.07	± 0.08
1.00 ≤ T < 1.25	± 0.08	± 0.08	± 0.09
1.25 ≤ T < 1.60	± 0.09	± 0.10	± 0.11
1.60 ≤ T < 2.00	± 0.11	± 0.12	± 0.13
2.00 ≤ T < 2.30	± 0.13	± 0.14	± 0.15
2.30 ≤ T	± 0.15	± 0.16	± 0.17

Width Tolerances

When cold-rolled plate is used	
W ≤ 1,500	W > 1,500
0, +7	0, +10

Length Tolerances

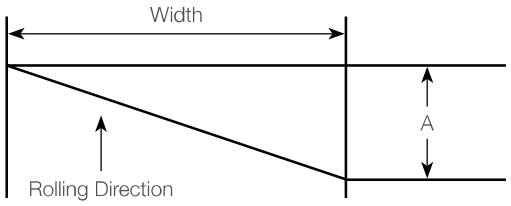
When cold-rolled plate is used
0, +15

Shape Tolerances

– Linearity

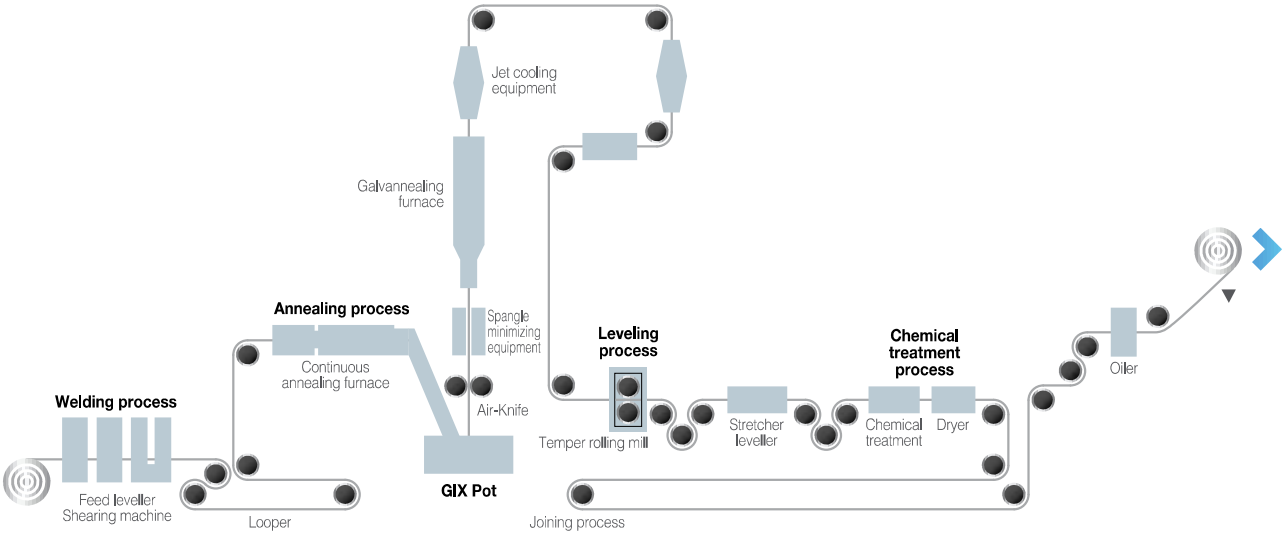
Width	Types		
	Bow	Edge Wave	Center Wave
W < 1,000	12 or less	8 or less	6 or less
1,000 ≤ W < 1,250	15 or less	9 or less	8 or less
1,250 ≤ W < 1,600	15 or less	11 or less	8 or less

– Squareness

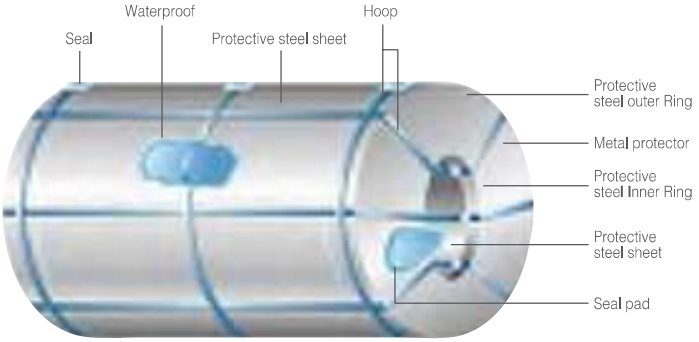


Squareness is indicated as A/W × 100 (%) of the figure, and it should not exceed 1%.

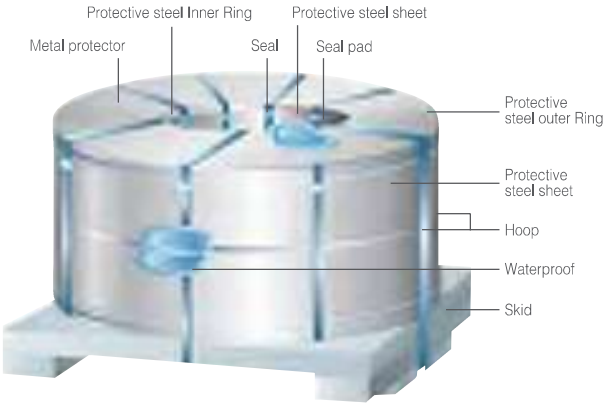
GIX Production Process



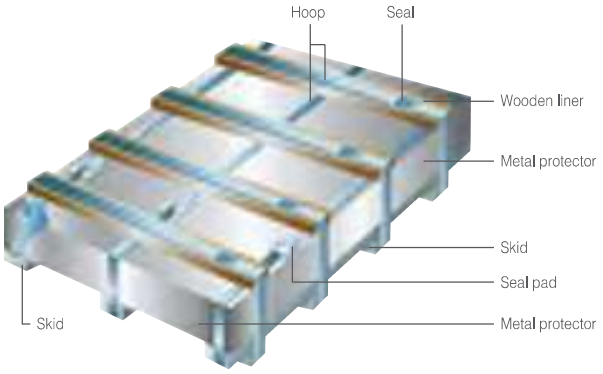
Standard Packaging



• Horizontal Type •



• Vertical Type •



• Sheet •

www.luxteel.com www.dongkuk.com

DONGKUK STEEL

Domestic

Head Office
FERRUM TOWER, 19, Eulji-ro 5-gil,
Jung-gu, Seoul, Korea
Tel : 82-2-2222-0114 Fax : 82-2-317-9200~5

Busan Plant
102, Sinseon-ro, Nam-gu, Busan, Korea
Tel : 82-51-640-5114
Fax : 82-2-317-9209

Joongbu Office
21, Jangsannam-ro, Dalseo-gu, Daegu, Korea
(Beop-jo Building 903)
Tel : 82-53-557-4064 Fax : 82-2-317-9200~5

Busan Office
102, Sinseon-ro, Nam-gu, Busan, Korea
Tel : 82-51-640-5967, 5958
Fax : 82-2-317-9200~5

Honam Office
DONGKUK STEEL, Floor 10th, 282, Mujin-daero,
Gwangsan-gu, Gwangju, Korea
Tel : 82-62-943-1973~9 Fax : 82-2-317-9200~5

Overseas Subsidiaries

Corporation in U.S.A
LOS ANGELES BRANCH
DONGKUK INTERNATIONAL, INC.
19750 Magellan Drive Torrance, CA. 90502, U.S.A
Tel : 1-310-523-9595 Fax : 1-310-523-9599

New York Branch
NEW YORK OFFICE
DONGKUK INTERNATIONAL, INC.
400 Kelby Street, 11th Floor, Fort Lee, NJ 07024, U.S.A
Tel : 1-201-592-8600 Fax : 1-201-947-3999

Corporation in Japan
TOKYO BRANCH
DONGKUK CORPORATION
7Floor, PMO Nihonbashi Kayaba-cho, 3-11-10,
Chuo-ku, Tokyo 103-0025, Japan
Tel : 81-3-5623-5723 Fax : 81-3-5623-5722

Coil Center in Mexico
DONGKUK STEEL MEXICO SA DE CV
Av. Internacional #303 Parque Industrial Huinala,
Apodaca, Nuevo Leon, Mexico C.P. 66645
Tel : 52-81-8145-2122 Fax : 52-81-8145-4350

Coil Center in India
DONGKUK STEEL INDIA PVT LTD.
B-3/2, Ecotech-1, Extension, Greater Noida,
UP-201 308, India
Tel : 91-120-481-8156 Fax : 91-813-037-6465

Coil Center in Thailand
DONGKUK STEEL (THAILAND) LTD.
Pinthong Industrial Estate Project 3, NO. 217/9 Moo 6,
Bowin, Sriracha, Chonburi 20230, Thailand
Tel : 66-38-110-570 Fax : 66-38-110-577

Main Office in China
SALES DIVISION IN CHINA
13F, No.39 Dongting Rd, Xishan Zone, Wuxi,
Jiangsu, China, Zip 214000
Tel : 86-510-8101-2003 Fax : 86-510-8101-2020

Dongkuk Steel China
DONGKUK STEEL CHINA CO., LTD.
Xiagang Zone Jiangyin Riverside Economy
Development Area, Jiangyin City, Jiangsu, China 214442
Tel : 86-510-8603-2308 Fax : 86-510-8603-2318~9

Corporation in Brazil
CSP(Companhia Siderúrgica do Pecém)
Rodovia CE 422, S/N, Km 11.5,
São Gonçalo do Amarante, CE, Brazil CEP 62670-000
Tel : 55-85-3033-3800 Fax : 55-85-3033-3899

Vol 1.0 Mar. 2018