NIPPON STEEL

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SuperDyma™
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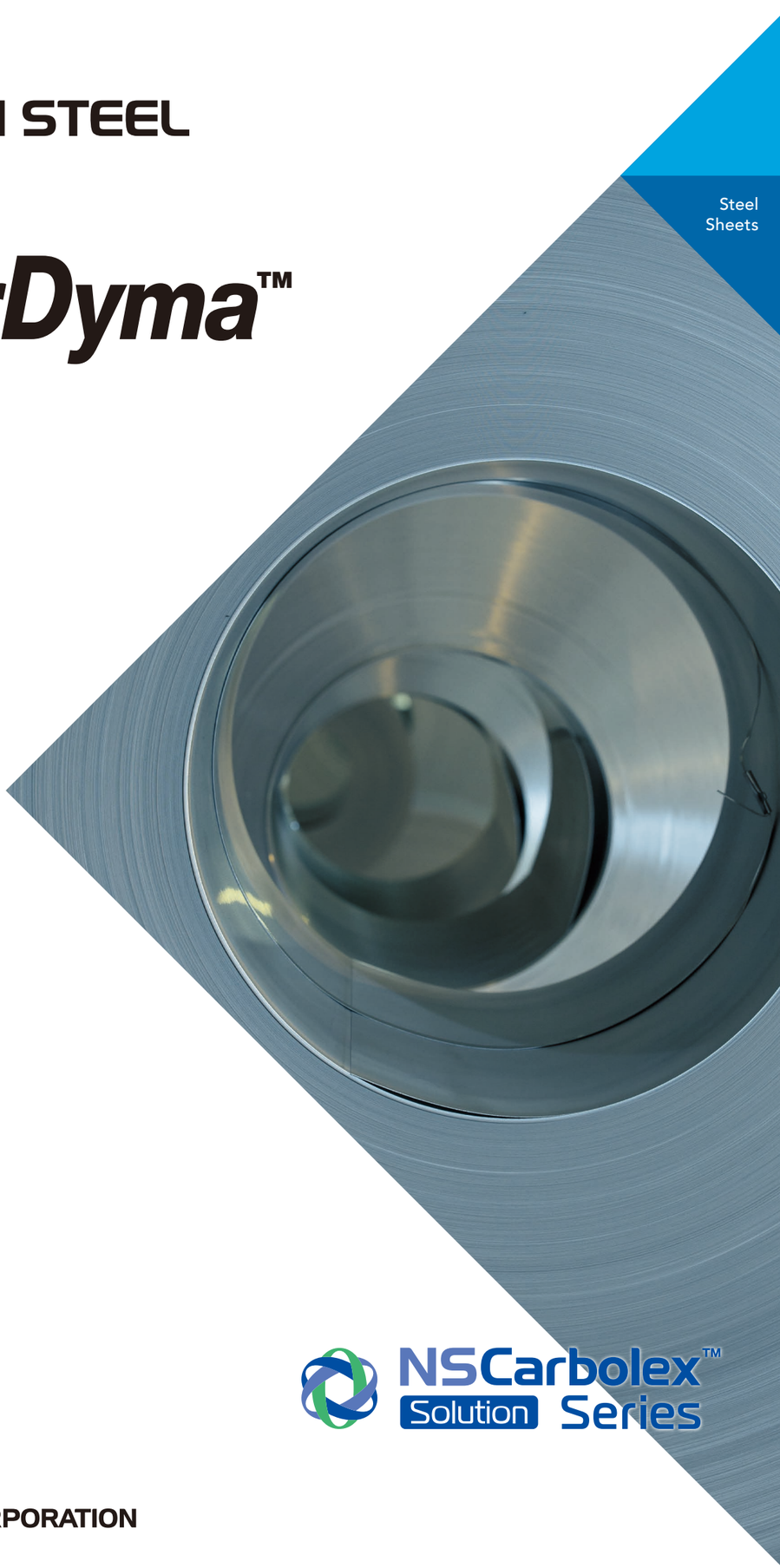
NIPPON STEEL

SuperDyma™

Steel Sheets



NET ZERO
NIPPON STEEL
Green Transformation
initiative

NSCarbolex™ Solution Series

NIPPON STEEL CORPORATION

SuperDyma™ Materials Catalog

※For **the Processed Products Catalog**, start from **the flip side**.

SuperDyma™ is a new type of highly corrosion-resistant coated steel sheet; its coating composition consists of zinc as the main substrate in combination with aluminum (about 11%), magnesium (about 3%), and a trace amount of silicon.

SuperDyma™

Feature 1

Exceptional Corrosion Resistance

- Both the flat and cut-end surfaces have high corrosion resistance.
- It has superb alkali resistance.

The coating composition of SuperDyma™ consists of conventional Zn with additional Aℓ, Mg, and Si. The combined effects of these additional elements help to improve corrosion resistance. In particular, the Si-Mg interaction significantly suppresses corrosion.

Feature 2

Excellent Workability

- It exhibits corrosion resistance in areas processed by bending and drawing.
- It is hard to scratch and has a beautiful finish.

SuperDyma™ has strong coating film adhesion that endures hard processing. The coating film has high hardness and scratch resistance, which makes the finish beautiful.

Feature 3

Cost Reduction and Shortened Delivery Times

- Post-coating and post-painting are unnecessary.
- It can substitute for stainless steel and aluminum.

Compared to products processed by after-coating and after-painting, SuperDyma™ offers the advantages of reduced total cost and potentially shorter delivery times. Additionally, thanks to its excellent red rust resistance, it can be used instead of stainless steel and aluminum.

JIS-certified Product

SuperDyma™ conforms to JIS G 3323* and has received the JIS Mark certification.

* Hot-dip zinc-aluminum-magnesium alloy coated steel sheets and strip

Hirohata Area of Setouchi Works
This plant has acquired the JIS certification "JIS G 3323" from JICQA.
The following shows a copy of the certificate.

Kimitsu Area of East Nippon Works
This plant has acquired the JIS certification "JIS G 3323" from JICQA.
The following shows a copy of the certificate.

SuperDyma™ has been praised for its advanced technology, performance, achievements, and contributions. The product has received the following awards.

- FY2012: National Commendation for Invention "Invention Award"
- FY2013: The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology "Award for Science and Technology (Development category)"
- FY2013: The 10th Eco-Products Awards "Chairperson's Award, Eco-Products Awards Steering Committee"

eco products awards 2013

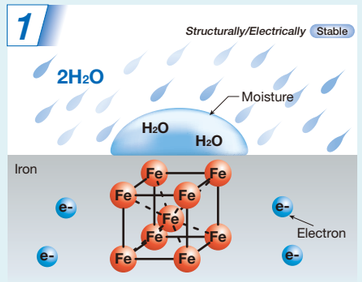
For details, refer to "Certifications and Awards" on page 34.

Contents

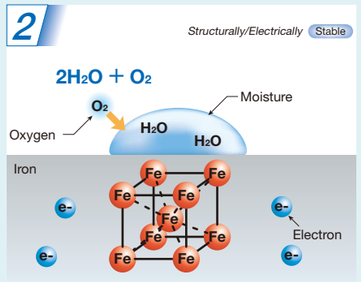
Mechanism of Rust Generation

Why does steel rust?

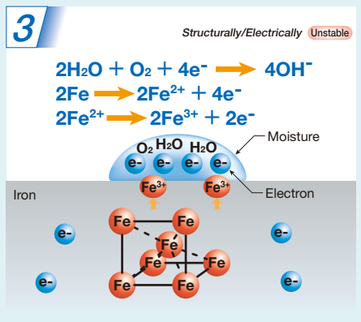
Metals combine with atmospheric oxygen to form oxides. Since 21% of the air is oxygen, it is virtually impossible for any metal to exist in pure form. Iron in its natural state exists as iron ore, an oxide, while steel is produced by using carbon (coke) to reduce iron ore. The resulting steel tends to react again with the oxygen in the air to cause oxidation—this oxidation of steel is the phenomenon called "rusting."



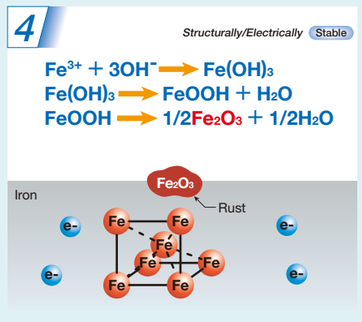
Iron (steel) is composed of iron (Fe) and electrons (e-).
When iron is exposed to rain and water, moisture is adsorbed onto the iron's surface.



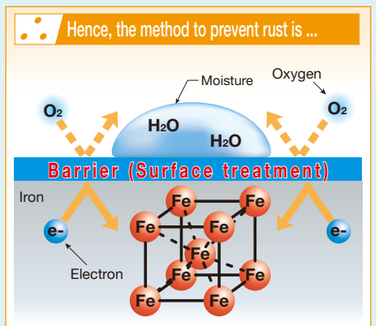
Because the moisture on the iron's surface is exposed to the atmosphere, oxygen in the atmosphere is absorbed into the moisture.



Because the moisture reacts chemically with oxygen, the moisture extracts the electrons from the iron necessary to produce OH^- anions in the moisture. The iron atoms (Fe) lose these electrons, transform into cations of Fe^{3+}, and dissolve into the moisture.



OH^- and Fe^{3+} bond together to generate $Fe(OH)_3$, and then the moisture (H_2O) runs out to generate rust (**Fe_2O_3**). This is the mechanism of rust generation.



The generation of rust can be prevented by forming a barrier over the iron's surface and suppressing the chemical reaction that causes rust.
Accordingly, iron is given **surface treatment** as a means to prevent rust from developing.

[For the types of surface treatments, refer to page 3.]
[For the corrosion resistance of SuperDyma™, refer to page 4.]

History of metallic coatings

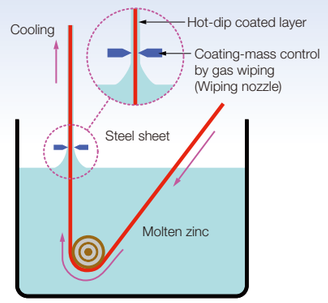
To prevent rusting, metallic coatings serve as "makeup" for materials' surfaces. The most typical metallic coating is galvanizing, or zinc coating, and it dates back to the early 1740s, when high-volume production of zinc ingots became possible in the United Kingdom owing to improvements in the zinc smelting process as well as the invention of the galvanizing method in France.

By nature, steel tends to return to an oxide when exposed to air. Before steel reaches the coating process, an iron oxide film forms on the steel's surface. This makes it difficult to deposit molten zinc onto the surface. To solve this problem, a flux (salt) was applied to the surface before the steel materials were immersed in molten zinc. This hot-dip galvanizing (flux) method was invented in 1837 and is the origin of today's continuous hot-dip galvanizing.

The flux method is suited to sheet-by-sheet galvanizing, but it does not lend itself to continuous production. In 1931, a new method was devised whereby cold-rolled coils were continuously heated at high temperature and reduced by hydrogen to clean their surfaces. This innovative technique is known as continuous hot-dip galvanizing, or the Sendzimir process. NIPPON STEEL introduced this method during the period from 1953 to 1954.

(Cited from NIPPON STEEL MONTHLY, June 2003: The Origin of Manufacturing Efforts to Combat Rust)

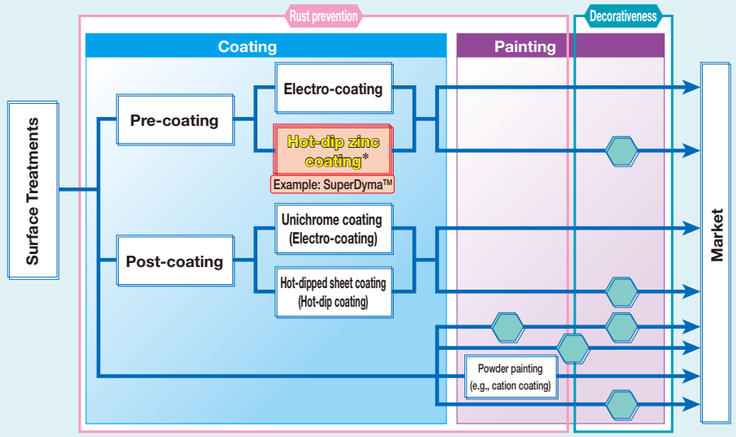
Setup for hot-dip coating



The metallic coating is deposited onto the surface of the steel sheets when they are immersed in molten metal. This method is applied to coat steel sheets that are intended for use in highly corrosive environments, such as automotive steel sheets and building materials.

(Cited from NIPPON STEEL MONTHLY, June 2003: The Origin of Manufacturing Efforts to Combat Rust)

Surface Treatments



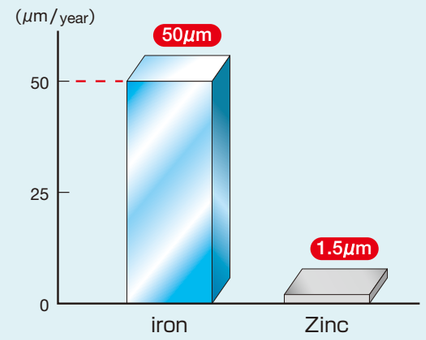
Surface treatments are broadly classified into two types: coating and painting.
There are two kinds of coating: pre-coating, in which steel is coated prior to fabrication, and post-coating, in which the coating is applied afterwards. Coating processes are classified into two types: electro-coating, whereby an electrolytic coating is provided, and hot-dip coating, whereby the steel is dipped into a molten coating material.
Steel sheets are put on the market after undergoing treatments for corrosion resistance and decorativeness.

*[The details are highlighted on page 4.]

Reference: How corrosion affects the service life of steel

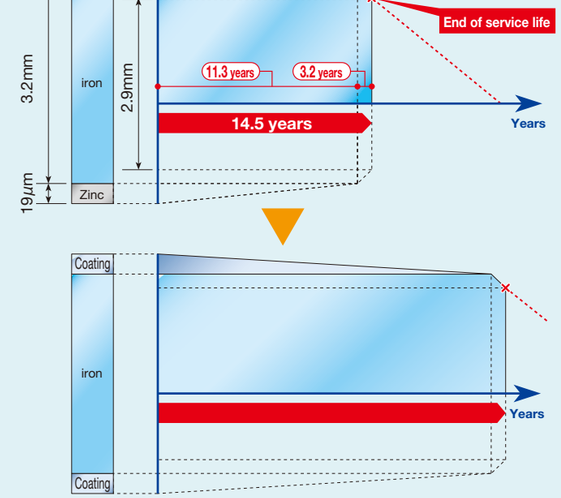
Annual corrosion rate

The following compares the annual corrosion rates for iron and zinc. In rural environments, while iron oxidizes to a depth of 50 μm annually, zinc demonstrates much better corrosion resistance by oxidizing to only 1.5 μm. For this reason, zinc is an effective material for surface treatment.

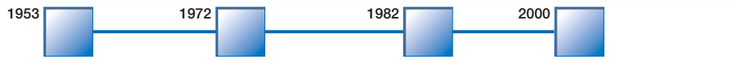


Service life of steel

The following gives an example of the service life of a hot-dip zinc coated steel sheet (thickness: 3.2 mm; Z27). This coated steel sheet offers an approximately 11-year service life when provided with a 19-μm zinc film. However, once the zinc coating has been lost, the steel still has a remaining service life of 3 years, which means the total service life is 15 years.
By providing this coated film with higher corrosion resistance, the overall service life of steelcan be prolonged.



History of surface treated steel sheets



Conventional coating methods include the hot-dip zinc coating using only zinc, the hot-dip zinc-5% aluminum alloy coating that adds 5%-aluminum to zinc, and GALVALUME® STEEL SHEET, which further increases the amount of aluminum to 55%.
Twenty years after launching our previous method, we started production of SuperDyma™, a completely new coated steel sheet with Al, Mg, and Si added to its coating composition.

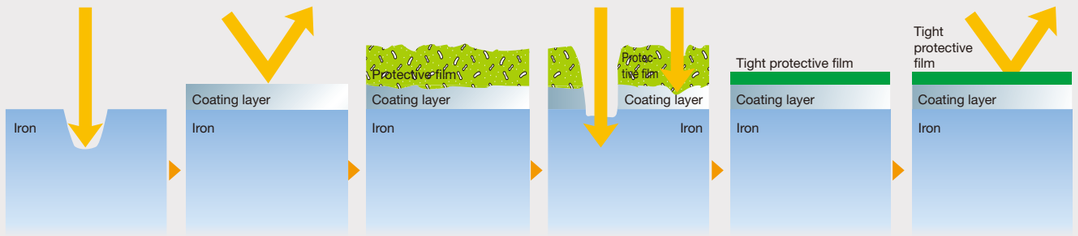
※ GALVALUME is an internationally recognized trademark of BIEC International Inc., and some of its licensed producers.

Corrosion Protection Mechanism

Corrosion protection mechanism on flat surfaces

SuperDyma™ is produced by adding Al, Mg, and Si to the conventional zinc coating; the composite effect of these added elements achieves high corrosion resistance.
Specifically, SuperDyma's™ capacity to protect against corrosion is enhanced by adding Mg, whose beneficial effect is demonstrated by NIPPON STEEL's DYMAZINC™, and Si to the conventional additive Al. Si is effective for improving the workability of coatings that contain Al and also enhances corrosion suppression through composite action with Mg.

Corrosion protection mechanism of flat surfaces



(1) To improve the corrosion resistance of steel sheets ···
(2) Coatings are effective.
(3) Coatings form a protective film to maintain corrosion resistance.
(4) If the formed protective film is coarse, moisture and oxygen will penetrate the film, causing the onset of corrosion.
(5) To enhance the coating's corrosion resistance, the protective film must be tight.
(6) SuperDyma's™ protective film is sufficiently tight to provide excellent corrosion resistance.

Comparison of coating corrosion losses (Outdoor exposure test results)

SuperDyma™ boasts of extremely high corrosion resistance.
In an outdoor exposure test, the corrosion loss after removing white rust was about 25% that of hot-dip zinc coating.

Outdoor exposure (in rural environments): Corrosion loss after five years

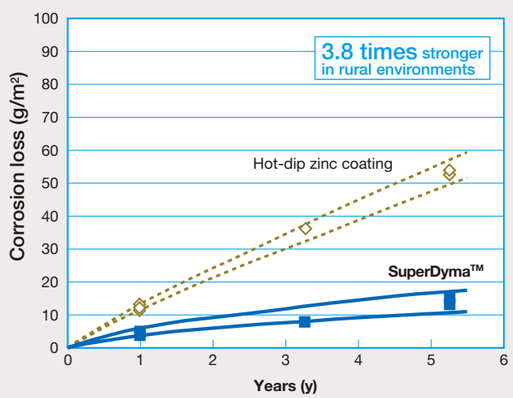
Sample	Coating type	Coating mass	Surface treatment
SuperDyma™	Zn-11%Aℓ-3%Mg-0.2%Si	K12 K27	No treatment
Hot-dip zinc coating	Zn	Z25 Z27	

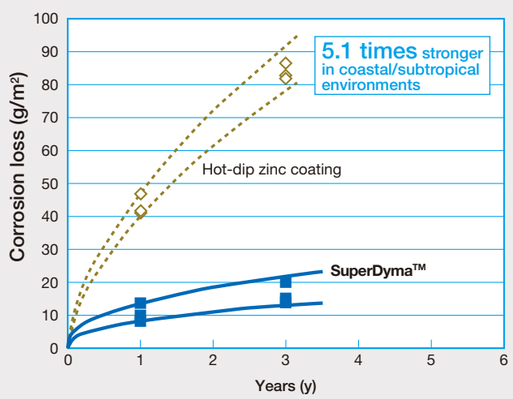
Place of exposure: NIPPON STEEL's Weathering Site at Kimitsu (rural environment)
Period of exposure: 63 months (Jun. 2001 to Sept. 2006)

Outdoor exposure (coastal/subtropical environments): Corrosion loss after three years

Sample	Coating type	Coating mass	Surface treatment
SuperDyma™	Zn-11%Aℓ-3%Mg-0.2%Si	K18	No treatment
Hot-dip zinc coating	Zn	Z27	

Place of exposure: Weathering Site Okinawa, NIPPON STEEL CORPORATION (coastal/subtropical environment)
Period of exposure: 36 months (Dec. 1999 to Sept. 2002)



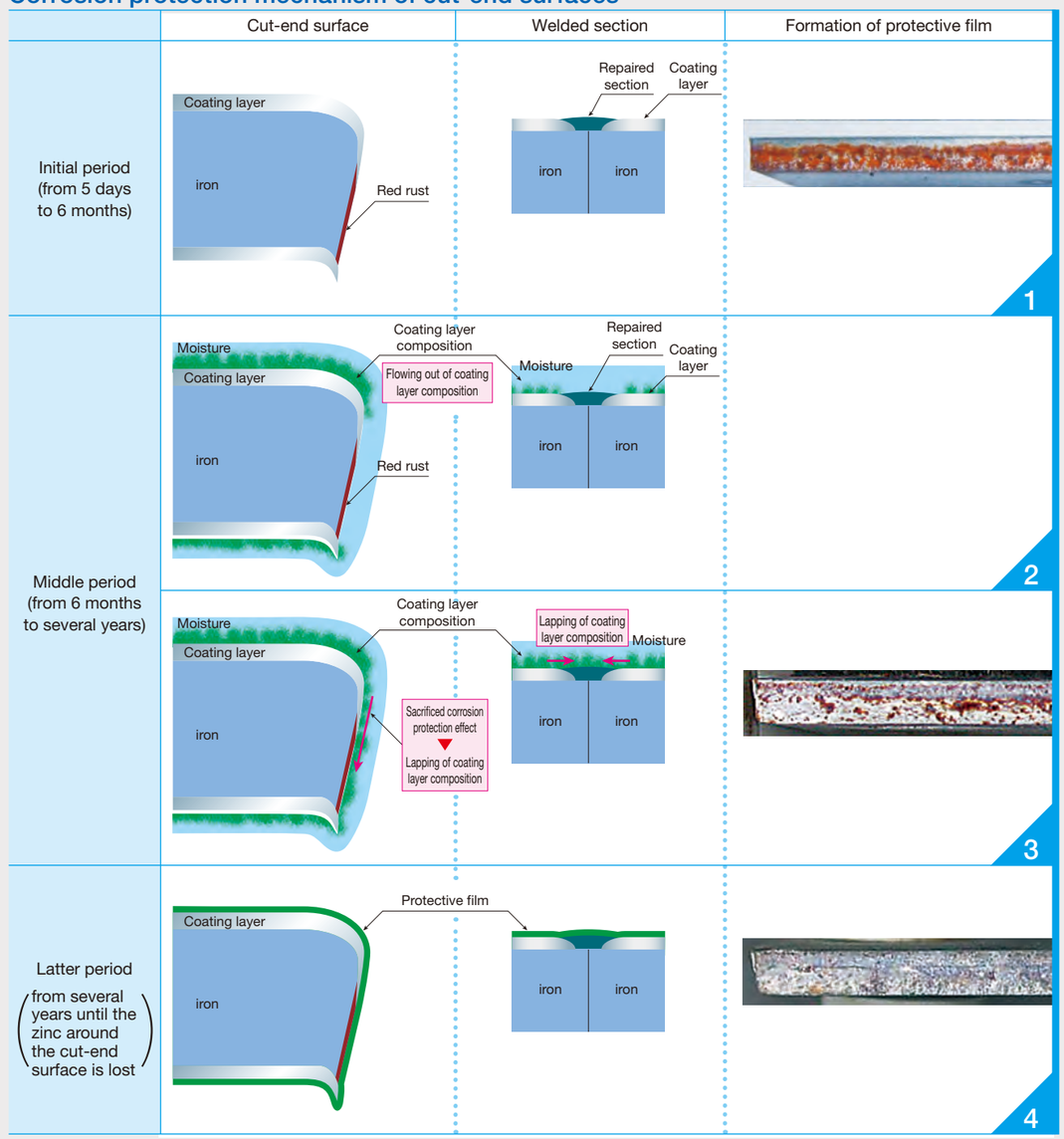


[Excerpted from the Certificate of MLIT Housing No. 342 Test Results, Special Assessment Method Certification, MLIT]

Corrosion protection mechanism of cut-end surfaces and of welded sections

Because the cut-end surface of SuperDyma's™ base metal is exposed, red rust sometimes occurs during the initial stage of application.
However, the composition of the coating around the cut-end surface is such that it leeches out to form a tight protective film comprised mainly of zinc hydroxide ($Zn(OH)_2$), basic zinc chloride ($ZnCl_2 \cdot 4Zn(OH)_2$), and magnesium hydroxide ($Mg(OH)_2$). This tight film covers the cut-end surface within several months. The film is low in electrical conductivity and effective in suppressing the development of corrosion at the cut-end surface. Moreover, the Si contained in the coating layer acts to accelerate the formation of the aforementioned protective film.

Corrosion protection mechanism of cut-end surfaces



Corrosion Resistance of Flat Surfaces

Comparison with conventional hot-dip zinc coated sheets

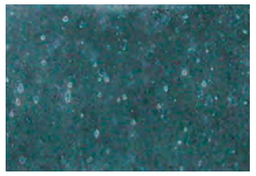
Although hot-dip zinc coated steel sheets also produce a protective film, such film has a rough texture, which allows for moisture and oxygen to penetrate and corrosion to grow as a result. By contrast, the dense protective film formed on the surface of SuperDyma™ arrests the corrosion process and stabilizes corrosion behavior.

Corrosion resistance of flat surfaces (Outdoor exposure test results: 3 years in Okinawa; no surface treatment)

A visual inspection of SuperDyma™ and various test pieces after three years of outdoor exposure in Okinawa found no red rust on SuperDyma™ sheets, thus exhibiting a good condition. In addition, SuperDyma™ generates less white rust compared to hot-dip zinc coated sheets, thus exhibiting the best performance.

Sample	Coating mass	Post-coating treatment
SuperDyma™	K18	No treatment
Hot-dip zinc coating	Z27	No treatment

Place of exposure: Okinawa
Period of exposure: 3 years (Dec. 1999 to Dec. 2002)

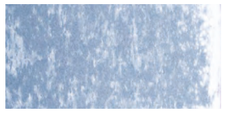
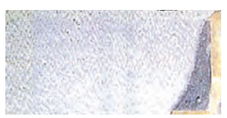
SuperDyma™ (JIS G 3323)	Hot-dip zinc coating (JIS G 3302)
	

Corrosion resistance of flat surfaces (JASO test results: Chromate-free sheets)

Sample	Coating type	Coating mass	Surface treatment	Thickness
SuperDyma™	Zn-11%Aℓ-3%Mg-0.2%Si	K18	Chromate-free treatment (QN)	1.6 mm
Hot-dip zinc coated sheet	Zn	Z27	Special chromate treatment	
Hot-dip Zn-5% Aℓ alloy coated sheet	Zn-5%Aℓ-0.1%Mg	Y18		
GALVALUME® STEEL SHEET	Zn-55%Aℓ	AZ150		

Test condition: Composite cycle corrosion test (JASO M609-91 method)
Repetition of the following steps (1) to (3) as a cycle

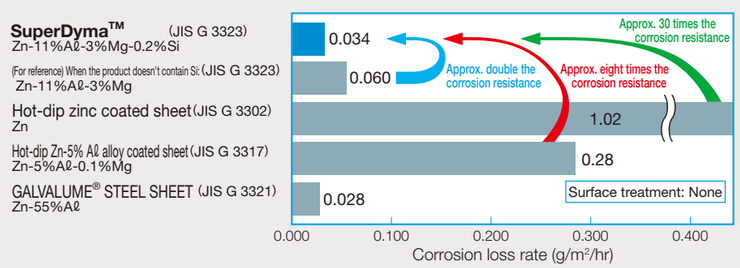
(1) Salt spray: 2 hours (5% NaCl, 35°C)
(2) Drying: 4 hours (60°C)
(3) Wetting: 2 hours (50°C, humidity of 95% or more)

Testing cycle	90cyc	180cyc
SuperDyma™ (JIS G 3323)		
Hot-dip zinc coated sheet (JIS G 3302)		
Hot-dip Zn-5% Aℓ alloy coated sheet (JIS G 3317)		
GALVALUME® STEEL SHEET (JIS G 3321)		

Coating film composition and corrosion resistance (Salt spray test [Test time: 500 h])

Corrosion resistance of flat surfaces

SuperDyma™ has extremely high corrosion resistance—about 30 times that of hot-dip zinc coated sheets (assessed by salt-spray tests to determine the corrosion loss rate).



Corrosion resistance of flat surfaces (Salt spray test results: Untreated sheets and chromate-free treated sheets)

Test time	120 h	240 h	500 h	1,000 h
SuperDyma™ (JIS G 3323) Coating mass Symbol: K18 No treatment				
Hot-dip zinc coated sheet (JIS G 3302) Coating mass Symbol: Z25 No treatment				

Test time	1,000 h	2,000 h
SuperDyma™ (JIS G 3323) Coating mass Symbol: K18 Chromate-free treatment (QN)		
Hot-dip Zn-5% Aℓ alloy coated sheet (JIS G 3317) Coating mass Symbol: Y12 Special chromate treatment		

Reference

Service life estimation of coated steel sheets

The service life of a coated steel sheet can be estimated by the following formula.

$$Y = Z \times 0.9 / \alpha$$

Y: Service life (years)
Z: Coating mass per side (g/m²)
α: Typical annual corrosion loss of coated film (g/m²·years)
Note: The value of α varies depending on the type and usage environment of the coated steel sheet.

This method of estimating the service life by the aforementioned formula is only theoretical. It is not a guarantee of product durability.

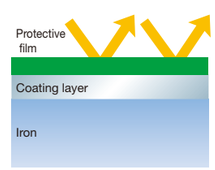
Corrosion Resistance of Flat Surfaces

Comparison with post-coated steel sheets

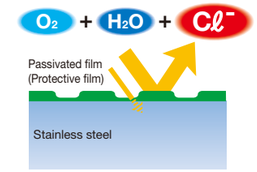
In the case of post-coated products with heavy zinc coatings of 550 g/m^2 per side (HDZ55), the protective film has a coarse texture that allows corrosion to progress over time until red rust forms.
By contrast, SuperDyma™ is free of red rust even with a 90-g/m^2 thick coating per side (K18); it offers corrosion resistance equivalent or superior to that of HDZ55.

Comparison with stainless steel

(Relationship between chlorine and stainless steel)
Stainless steel offers superb corrosion resistance thanks to surface passivation; however, it has the disadvantage of being vulnerable to salt. Meanwhile, the protective film formed on the surface of SuperDyma™ provides a strong barrier against salt corrosion. In terms of resistance to pitting corrosion and other properties that affect the service life of steel when used as a structural material, stainless steel is superior. By contrast, SuperDyma™ is far more advantageous in applications where resistance to red rust is the most important property, such as panel surfaces.



SuperDyma™



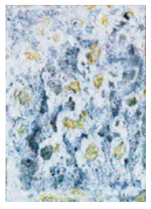
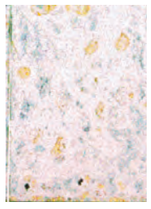
Stainless steel (SUS304)

Corrosion resistance of flat surfaces (JASO test results)

est condition: Composite cycle corrosion test (JASO M609-91 method)
Repetition of the following steps (1) to (3) as a cycle
(1) Salt spray: 2 hours (5% NaCℓ, 35ºC), (2) Drying: 4 hours (60ºC, humidity 30%), (3) High-temperature wetting: 2 hours (50ºC, humidity 98%)

Test cycle	30cyc	60cyc	90cyc
SuperDyma™ K18 Chromate-free treatment (QN)			
Post-coated sheet HDZ55 No treatment			

Corrosion resistance of flat surfaces (Salt spray test results)

Test time	1,000 h	2,000 h
SuperDyma™ K18 Chromate-free treatment (QN)		
Post-coated sheet HDZ55 No treatment		

Corrosion resistance of flat surfaces (JASO test results)

Test condition: Composite cycle corrosion test (JASO M609-91 method)
Repetition of the following steps (1) to (3) as a cycle
(1) Salt spray: 2 hours (5% NaCℓ, 35ºC), (2) Drying: 4 hours (60ºC, humidity 30%), (3) High-temperature wetting: 2 hours (50ºC, humidity 98%)

Test cycle	30cyc	60cyc	90cyc
SuperDyma™ K18 Chromate-free treatment (QN)			
Stainless steel SUS304			

Precautions when using both SuperDyma™ and stainless steel in combination

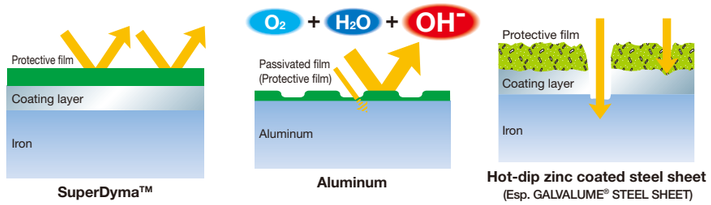
- When a SuperDyma™ sheet and a stainless steel sheet are in contact with each other, dissimilar metal contact corrosion may occur, which may cause rapid corrosion of SuperDyma™.
[Refer to "Corrosion Potential" on page 19.]
- To prevent such contact corrosion, we recommend applying a passivation treatment to the surface of the stainless steel sheet.
[Refer to "Fasteners selected for SuperDyma™" on page 36.]

Corrosion Resistance of Flat Surfaces

Comparison with GALVALUME® (in alkali environments)

(Relationship between alkali and aluminum/GALVALUME® STEEL SHEET)

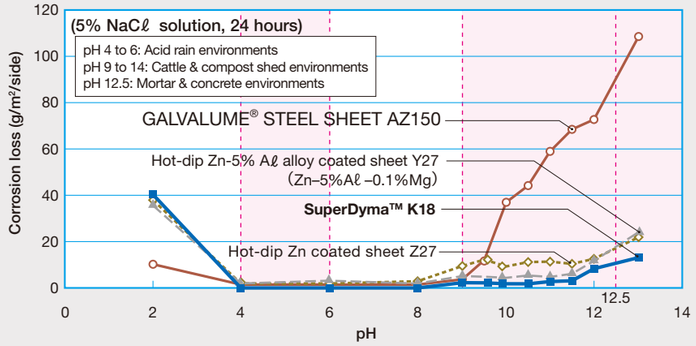
The exceptional corrosion resistance of aluminum is partly derived from the passivated film on its surface. GALVALUME® STEEL SHEET, with an alloy coating that is 55% aluminum, demonstrates similar effectiveness. However, aluminum exhibits poor alkali resistance.



Corrosion resistance in acid/alkaline environments

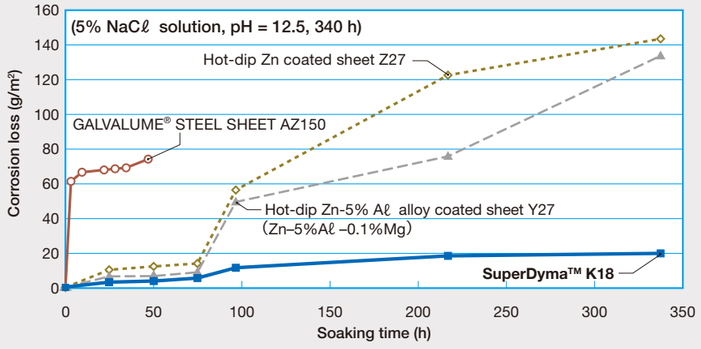
Under alkaline conditions with a relatively high pH, coated steel sheets generally corrode very quickly.

Test results indicate that SuperDyma™ exhibits the least corrosion loss compared to GALVALUME® STEEL SHEET and other materials. In alkaline environments (cattle and compost sheds, mortar and concrete), SuperDyma™ exhibits high corrosion resistance.



Corrosion resistance in strong alkaline environments

Under more severe conditions such as immersion in an alkaline solution with a strong pH of 12.5, ordinary metallic-coated steel sheets experience rapid corrosion over a period of 100 hours, while SuperDyma™ keeps the corrosion to a minimum after 300 hours.



Results of exposure tests in a pigpen

	Surface appearance	Microscope cross-section photographs
SuperDyma™		
GALVALUME® STEEL SHEET		

Test condition: Pigpen exposure period: About 21 months

Corrosion resistance of flat surfaces (JASO test results)

Sample	Coating layer	Coating mass	Surface treatment	Thickness
SuperDyma™	Zn-11%Aℓ-3%Mg-0.2%Si	K18	Chromate-free treatment (QN)	1.6 mm
GALVALUME® STEEL SHEET	Zn-55%Aℓ	AZ150	Special chromate treatment	

Test condition: Composite cycle corrosion test (JASO M609-91 method)

Repetition of the following steps (1) to (3) as a cycle

(1) Salt spray: 2 hours (5% NaCl, 35ºC)
(2) Drying: 4 hours (60ºC)
(3) Wetting: 2 hours (50ºC, humidity 95% or more)

Test cycle	90cyc	180cyc
SuperDyma™ Chromate-free treatment (QN)		
GALVALUME® STEEL SHEET		

Corrosion resistance of cut-end surfaces (Salt spray test results)

Test time	500 h
SuperDyma™ Coating mass: 90 g/m²/side	
GALVALUME® STEEL SHEET (Laboratory test sample) Coating mass: 90 g/m²/side	

Sample condition: Surface treatment: None

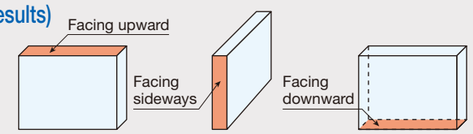
Corrosion Resistance of Cut-end Surfaces

Outdoor exposure test results

- In actual exposure environments outdoors, a slight degree of initial red rust occurs on cut-end surfaces. However, after a while, a stable protective film covers the cut-end surface, thus virtually arresting the long-term progress of corrosion.
- The effect of the protective film greatly slows the progress of red rust in the initial phase, and soon the cut-end surface is entirely covered by the film, making it inconspicuous.

Corrosion resistance of cut-end surfaces (Outdoor exposure test results)

Sample conditions SuperDyma™
Thickness : 3.2mm
Coating mass symbol : K27
Surface treatment : Chromate-free treatment (QN)
Exposure site Chiba Plant, KANEYASU Corporation



Period	Facing upward	Facing sideways (The lower side is on the left in the photograph.)	Facing downward
Original			
7 days			
14 days			
1 month			
2 month			
3 month			
4 month			
5 month			
6 month			
1 year			

※Ongoing

Sample conditions SuperDyma™
Thickness : 3.2mm
Coating mass per side : 90 g/m²/side (K18)
Surface treatment : None
Exposure site NIPPON STEEL's Weathering Site at Futtsu

Period	Facing upward	Facing sideways (The lower side is on the left in the photograph.)	Facing downward
8 months			
20 months			

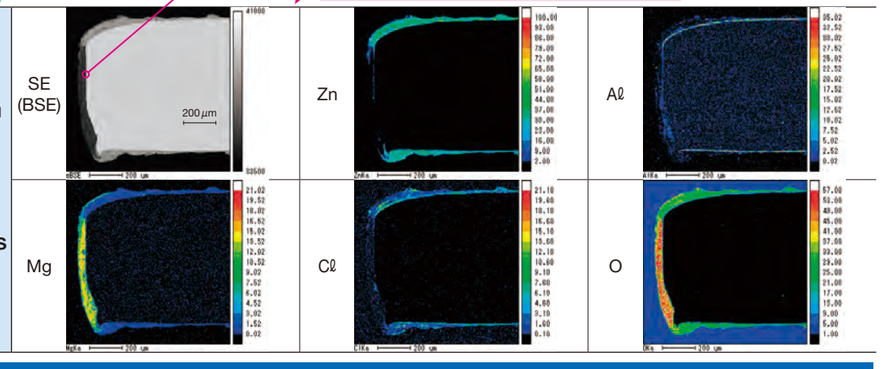
Reference

Investigation into the corrosion resistance of samples in actual-use exposure on cut-end surfaces

The cut-end surface was covered with dense, thick corrosion product.
A large amount of Mg was detected.

EPMA mapping

SuperDyma™
7 years
in Miyakojima
Exposed under the eaves



Sea salt exerts a large effect on under-the-eaves exposure because incoming salt is not washed away by rainwater.
The stronger the effect of sea salt, the denser and thicker the Mg-based corrosion product formed on the cut-end surface (exposure of iron) of a SuperDyma™ sheet.

Comparison with conventional hot-dip zinc coating

SuperDyma™ provides excellent corrosion resistance to cut-end surfaces.

Corrosion resistance of cut-end surfaces (Salt spray test results)

Sample conditions Thickness : 3.2mm
Surface treatment : None
Salt spray test 500 hours

Test time	500 h
SuperDyma™ (JIS G 3323) Coating mass: 90 g/m²/side	
Hot-dip zinc coated steel sheet (JIS G 3302) Coating mass: 100 g/m²/side	
Hot-dip Zn-5% Aℓ alloy coated steel sheet (JIS G 3317) Coating mass: 90 g/m²/side	
GALVALUME® STEEL SHEET (JIS G 3321) Coating mass: 90 g/m²/side	

Comparison with post-coated steel sheets

After 2,000 hours in a salt spray test, SuperDyma™ K18 was free of red rust on the cut-end surface.
(The test piece setting angle complies with JIS Z 2371 "Methods of salt spray testing.")

Corrosion resistance of cut-end surfaces (Salt spray test results)

Test time	Thickness	1,000 h	2,000 h
SuperDyma™ K18 Chromate-free treatment (QN)	1.6mm		
	3.2mm		
Post-coated sheet HDZ55 No treatment	1.2mm		
	6.0mm		

Repair coating on cut-end surfaces (Salt spray test results)

Sample conditions
SuperDyma™
Thicknesses : **4.5 and 6.0 mm**
Coating mass : **K18**
Surface treatment : Chromate-free treatment (**QN**)
Coating name
ZinkyCoat SD Spray
(NIPPON PAINT ANTI-CORROSIVE COATINGS CO., LTD.)

[For ZinkyCoat SD Spray, refer to page 38 of the Materials Catalog.]

Test time	Thickness	2,000 h
SuperDyma™ K18 (Repair-coated cut-end surface)	4.5mm	
	6.0mm	

Corrosion Resistance of Processed Sections

Corrosion resistance at bends

SuperDyma™ exhibits the same excellent corrosion resistance at bends as it does on flat surfaces.

Corrosion resistance at 1-t bends (Salt spray test results)

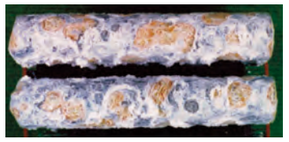
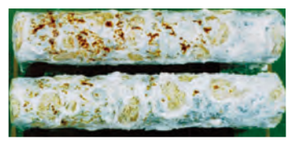
SuperDyma™ exhibits better corrosion resistance at bends than hot-dip zinc coated sheets and GALVALUME® STEEL SHEET.

Sample conditions Thickness: 0.8 mm, Surface treatment: none, Sample processing: 1-t bending

Test time	1,000 h
SuperDyma™ Coating mass: 90g/m²/side	
Hot-dip zinc coated steel sheet Coating mass: 135g/m²/side	
GALVALUME® STEEL SHEET Coating mass: 75g/m²/side	

Corrosion resistance at 1-t bends (Salt spray test results)

SuperDyma™ K18 exhibits higher corrosion resistance at bends than post-coated HDZ55.

Test time	1,000 h	2,000 h
SuperDyma™ K18 (Thickness: 1.6 mm) Chromate-free treatment (QN)		
Post-coated sheet HDZ55 (Thickness: 3.2 mm) No treatment		

Note: The post-coated sheets were coated after bending.

Corrosion resistance of cylindrically drawn sections

SuperDyma™ exhibits the same excellent corrosion resistance in cylindrically drawn areas as it does on flat surfaces.

Corrosion resistance of cylindrically drawn sections (JASO test results)

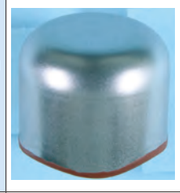
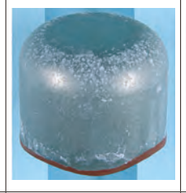
Sample	Thickness	Coating mass per side	Remarks
SuperDyma™	1.0 (mm)	95g/m²	Test product for practical use
Hot-dip zinc coated sheet		130g/m²	Product for practical use

Deep drawing test conditions

- Punch dia. 50ϕ
- Die shoulder R10
- Punch shoulder R10
- Drawing ratio 2.0
- Blank holding pressure 0.5t

Test condition: Composite cycle corrosion test (JASO M609-91 method)

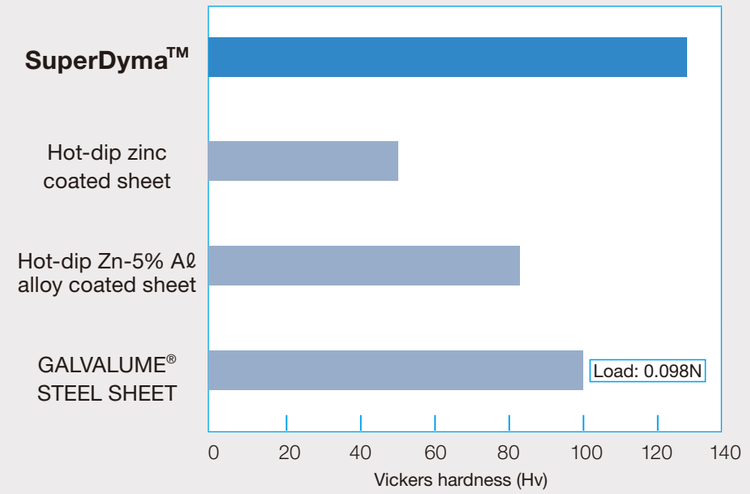
Repetition of the following steps (1) to (3) as a cycle
(1) Salt spray: 2 hours (5% NaCl, 35°C)
(2) Drying: 4 hours (60°C, humidity 30%)
(3) High-temperature wetting: 2 hours (50°C, humidity 98%)

Test cycle	Before test	30cyc	60cyc
SuperDyma™ Chromate-free treatment (QFK)			
Hot-dip zinc coated sheet			

Scratch Resistance

Scratch resistance

SuperDyma™ has a hard coating layer that offers high scratch resistance.



Examples of processed products

Comparison of corrosion resistance between a SuperDyma™ product and a hot-dip zinc coated product

Specimens

- Materials
  - **SuperDyma™ product:** SuperDyma™ with chromate-free treatment QN K06
  - Hot-dip zinc coated product: Hot-dip zinc coated sheet with chromate treatment Z06
- Form of specimen
  - Light gauge steel: Single ceiling joist

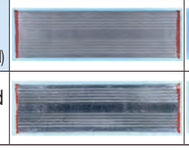
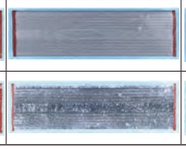
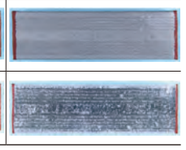
Corrosion resistance test

The test conditions and other information are described in the following table.

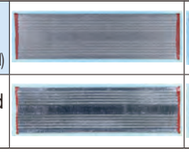
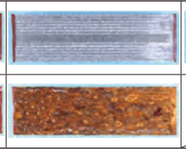
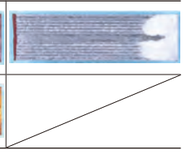
Test method	Test conditions
Swimming pool disinfectant spray test	Sodium hypochlorite 3mg/ℓ, 45°C (Use of a salt spray tester)
Composite cycle corrosion test (JASO M609-91 method)	(1) SST: NaCℓ 5%, 35°C, 2 h*1 (2) DRY: 60°C, 30%RH, 4 h (3) WET: 50°C, 95%RH, 2 h

*1: Composite cycle corrosion test with steps (1) to (3) as one cycle

Swimming pool disinfectant spray test results

Test time	Before test	500 h	1,000 h
SuperDyma™ product Chromate-free treatment (QN)			
Hot-dip zinc coated product			

JASO test results

Test cycle	Before test	60cyc	150cyc
SuperDyma™ product Chromate-free treatment (QN)			
Hot-dip zinc coated product			

The SuperDyma™ product exhibited higher red rust resistance on the surface than the hot-dip zinc coated sheet.

Weldability

Assessment of arc-welded sections

Assessment of arc-welded sections

Welding is performed under certain welding conditions, and welded sections are checked and it is certified that there are no problems for quality, such as strength and the internal states of welds.

Standard: NSDH400, Thickness: 3.2 mm, Coating mass symbol: K27

●Strength of arc-welded section (butt-welded joint tensile test)

Fracture

●Internal state of arc-welded section

Cross section of macrostructure

●Internal state of spot-welded section

Thickness: 3.2 mm, Nugget diameter (dn): 12.5 mm

*[For details, refer to the catalog "Welding of SuperDyma™" (technical document).]

Reference

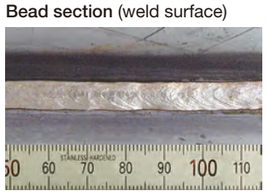
Welding material especially for SuperDyma™ [SF-309SD]

When welding SuperDyma™ with a common carbon steel welding material, the welded sections require repair painting because the corrosion resistance of the welds deteriorates faster than the base metal. This problem is solved by SF-309SD, the welding material especially for SuperDyma™. This stainless steel-based welding wire (containing flux) is best for welding SuperDyma™. It has high corrosion resistance thanks to its stainless steel-based composition, and it provides not only corrosion resistance equivalent to that of the base metal without repair painting but also ensures excellent performance of welded joints. Wire diameters of 0.9 and 1.2 mm are available.
SF-309SD is a seamless-type wire that contains flux.

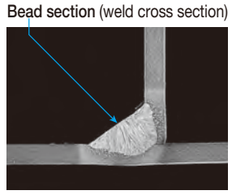
Features of the welding material especially for SuperDyma™

(1) The welded section itself provides corrosion resistance equivalent or superior to that of SuperDyma™, thus eliminating the need to perform repair painting.
(2) Its high strength provides tensile performance superior to that of the base metal.
(3) The wire contains flux, which gives it a smooth, favorable bead appearance.
(4) SF-309SD is a seamless-type wire that contains flux, which inhibits moisture absorption and ensures a stable pointing property for the wire.

Bead section (weld surface)



Bead section (weld cross section)



When using common stainless steel-based welding material, bead sections are likely to crack (weld metal embrittlement crack phenomenon), necessitating repair. Using the welding material especially for SuperDyma™ eliminates such embrittlement cracking of coating at bead sections in order to ensure corrosion resistance without requiring bead repair.

SuperDyma™ +Commercially available stainless steel-based welding material	SuperDyma™ +Welding material especially for SuperDyma™
	
Cracking	No cracking

Performance of weld joints

Corrosion resistance of weld beads (Salt spray test results)

Sample condition: Base metal: SuperDyma™
Test condition: Salt spray (JIS Z 2371): 1,000 hours (35ºC)

Welding material: For carbon steel	Welding material: For SuperDyma™
	

We have submitted an application for special certification of SF-309SD as a building material designated by the Minister of MLIT under the stipulation in Article 37-2 of the Building Standards Act.

Example of weld metal performance

Tensile strength (MPa)	Elongation
726	22%

Example of weld joint performance

Tensile strength (MPa)	Fracture position
422	Base metal

For inquiries about welding material FC-309SD and SF-309SD, contact

NIPPON STEEL WELDING & ENGINEERING CO., LTD.

Hokkaido	TEL 011 (241) 1855 FAX 011 (221) 0970	Nagoya	TEL 052 (564) 7236 FAX 052 (564) 4755	Shikoku	TEL 087 (811) 7977 FAX 087 (851) 2171
Tohoku	TEL 022 (222) 2850 FAX 022 (222) 0107	Osaka	TEL 06 (6531) 4641 FAX 06 (6531) 4656	Kyushu	TEL 092 (282) 6277 FAX 092 (282) 6288
Tokyo	TEL 03 (6388) 9100 FAX 03 (6388) 9101	Chugoku	TEL 082 (221) 5991 FAX 082 (221) 6274		

MAIL : nsw@weld.nipponsteel.com
URL : www.weld.nipponsteel.com

Assessment of spot-welds

The protective film of SuperDyma™ covers the weld as the number of cycles increases, thus suppressing the development of red rust.

Corrosion resistance of spot-welds (JASO test results)

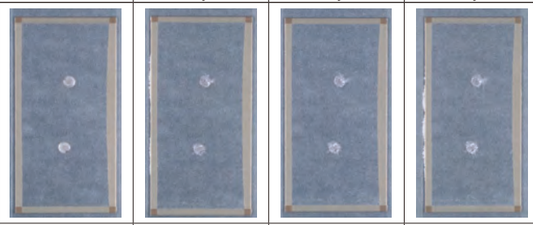
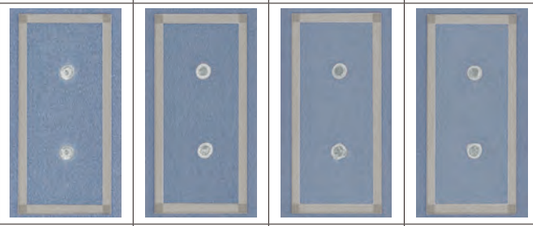
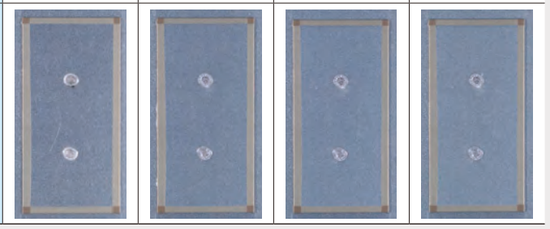
Sample conditions
Thickness : 0.8mm
Coating mass/side: 90g/m²
Post-treatment : QN, QA, and QFK

Test condition: Composite cycle corrosion test (JASO M609-91 method)
Repetition of the following steps (1) to (3) as a cycle
(1) Salt spray: 4 hours (5% NaCℓ , 35ºC)
(2) Drying : 2 hours (60ºC, humidity 30%)
(3) High-temperature wetting: 2 hours (50ºC, humidity 98%)

Welding conditions

Pressure	Squeeze	Up slope	Welding time	Hold	Cooling water	Current value
1,860N	30cyc	3cyc	7cyc	25cyc	2ℓ/min	13KA

Electrode applied : Obara type DHOM
Preliminary spotting: 20 dots

Test cycle	Before test	3cyc	6cyc	9cyc
SuperDyma™ Chromate-free treatment (QN)				
SuperDyma™ Chromate-free treatment (QA)				
SuperDyma™ Chromate-free treatment (QFK)				

Reference

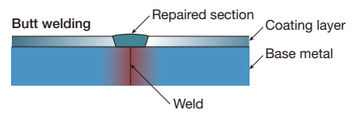
Corrosion resistance of repaired welds

Repaired welds of SuperDyma™ that use zinc-rich paint showed significantly higher corrosion resistance compared with repaired welds of hot-dip Zn-5% Al alloy coating using zinc-rich paint. The corrosion-inhibiting action of the protective film peculiar to SuperDyma™ most likely also worked on the repaired welds.

Assessment results for corrosion resistance of repaired welds (Salt spray test results)

Sample conditions Thickness : 0.8mm
Coating type: Hot-dip Zn-5% Aℓ alloy coating (Zn-5% Aℓ-0.1% Mg), SuperDyma™
Coating mass/side: Hot-dip Zn-5% Aℓ alloy coating 169 g/m², SuperDyma™ 160 g/m²

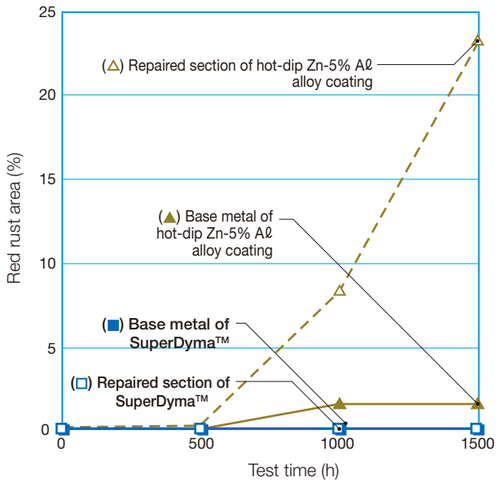
Test method Welding and repair of welds
I) After high-frequency butt welding, repair the weld by applying a coat of zinc-rich paint (refer to the figure below).



II) The repair coating film thicknesses are listed in the table below.

●Results of repair using zinc-rich paint

Product name	Repair film thickness (μm)
SuperDyma™	18.6
Hot-dip Zn-5% Aℓ alloy coating	17.6



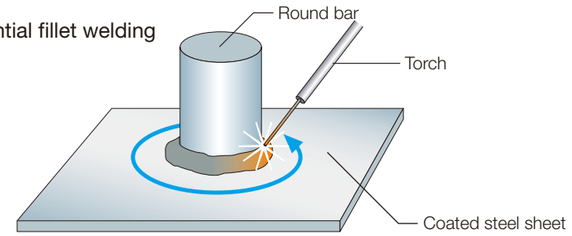
Weldability

Reference

Precautions

- As a thin coating of SuperDyma™ exhibits high corrosion resistance, there is no risk of disturbing welding due to a thick coating.
- SuperDyma™ requires optimal welding conditions when used with various welding methods (such as lapped fillet arc welding and spot welding).

Circumferential fillet welding



Note:

In the case of arc welding, while the weld bead will generally show shrinkage, a large internal tension force may be at work on the base metal in the vicinity of the bead, depending on the structure of the members to be welded. (Example: Circumferential fillet welding [see the figure on the right.])

When coated steel sheets such as SuperDyma™ are applied in such welding, the base metal in the vicinity of the bead may crack (Note 1). We recommend checking in advance before application. (We can provide advice on welding conditions and other matters.)

(Note 1) Liquid metal embrittlement phenomenon: Embrittlement caused by the penetration of molten metal into the grain boundary of iron upon which tensile stress is at work. This is also called zinc embrittlement.
(Note 2) When using steel sheets with a coating mass that exceeds K27 (coating mass symbol), reduce or remove the coating to a residual thickness equivalent to or less than that of K27 before starting the welding work.

Recommended welding conditions

Arc welding

(1) Welder

Use a carbon dioxide gas welder.

(2) Welding wire and shielding gas

We recommend using welding wires and shielding gas that meet the requirements in the table on the right.

Welder	Wire type	Shielding gas
Carbon dioxide gas welder	JIS Z 3312 YGW12	Carbon dioxide gas

Spot welding

When carrying out spot welding, the welding conditions must be optimized according to the sheet thickness. For example, for a thickness of 3.2 mm, we recommend the electrode and welding conditions (pressure, welding time, and current) listed in the table on the right.

Steel sheet	Spot welder	Electrode (mm)			Pressure (kN)	Welding time (cyc.) 50 Hz			Welding current (kA)
		Diameter (D)	Tip shape	Size		Sq.T	W.T	Ho.T	
Thickness 3.2mm	1 φ AC、150kVA	φ 25	CR (R75)	φ 11	8	30	65	35	14.0 ～ 6.5

Paintability

Paintability

- SuperDyma™ has excellent pre-treatability for painting.
- Painted SuperDyma™ has superb corrosion resistance and little susceptibility to corrosion-induced lifts of coating film on cut-end surfaces and cross-cut areas.

JASO test results (30 cycles)

Sample condition
Thickness: 0.8mm
Coating conditions:
Primer coat: Special modified epoxy resin-based primer paint (NIPPE PowerBind)
Top coat: Heat-curing acrylic resin-based top-coat paint (Super Lakku Eco)
Baking temperature: 160°C, 20 min per layer
Test conditions:
Composite cycle corrosion test (JASO M609-91 method)
Repetition of the following steps (1) to (3) as a cycle
(1) Salt spray: 2 hours (5% NaCl, 35°C)
(2) Drying: 4 hours (60°C, humidity 30%)
(3) High-temperature wetting: 2 hours (50°C, humidity 98%)

	SuperDyma™ K18-QN	SuperDyma™ K18-QA	SuperDyma™ K18-QFK	Hot-dip Zn coating Z22-ZC	GALVALUME® STEEL SHEET AZ150-R
					
Appearance of coating film	No abnormalities	No abnormalities	No abnormalities	No abnormalities	No abnormalities
Rust width (mm)	0.5	0	0.5	2.5	1.0
Bulge width (mm)	0.5	0	0.5	1.0	0.5
Stripping width (single side) (mm)	0	0	0	1.5	0

Corrosion Potential

Corrosion potential (Galvanized corrosion)

- When specific metals come into contact with other types of metal, corrosion accelerates—this phenomenon is called dissimilar metal corrosion.
- When two kinds of metals are in contact, the metal with the lower electric potential (less precious metal) will corrode. (Refer to the table below; for example, when iron is in contact with zinc, zinc corrodes.)

●Standard electrode electric potential (Reference: hydrogen electrode)

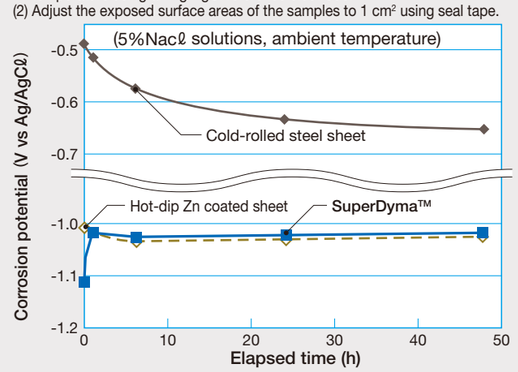
	Metal	Electric potential (V) (25°C)
↑ More precious	Hydrogen	0.000
	Nickel	-0.250
	Iron	-0.440
	Zinc	-0.763
	Aluminum	-1.662
Less precious ↓	Magnesium	-2.363

●Corrosion potential of SuperDyma™

- SuperDyma™, which contains magnesium, shows less noble potential attributable to $MgZn_2$ immediately after immersion, and then attains potential equivalent to that of a zinc-based coating in one hour (refer to the figure on the right). This is likely to be because the anodic dissolution of the coating is arrested under the influence of Mg-containing hydrate films that are formed in the initial stage of corrosion.
- This indicates that when SuperDyma™ comes into contact with dissimilar metals, its contact corrosion attributable to corrosion potential is about the same as that of an ordinary zinc-based coating.

Changes in corrosion potential over time

Measurement method
(1) Measure the immersion potential in 5% NaCℓ solutions at ambient temperature using an Ag/AgCl reference electrode.
(2) Adjust the exposed surface areas of the samples to 1 cm² using seal tape.



- Because SuperDyma™ is superior to conventional zinc coated sheets in corrosion resistance, the degree of contact corrosion is likely to be low.
- However, because the phenomenon of contact corrosion does occur, if bolts, rivets, or other members are to be used in contact with SuperDyma™, we recommend selecting those with electric potential equivalent to that of SuperDyma™ (such as post-coated products) or that have been provided with coating treatment.

[Refer to "Fasteners selected for SuperDyma™" on page 36 of the Materials Catalog.]

Corrosion Resistance Mechanism of Chromate-free Coating Film

Chromate-free treatment of SuperDyma™ is attained by applying a special film to SuperDyma™ in order to provide the following features.

(1) It contains absolutely no chromate.
SuperDyma™ is coated with a special film that does not contain any chromate.

(2) It excels in corrosion resistance.
The special film ensures corrosion resistance equivalent or superior to that of conventional normal chromate-treated steel sheets.

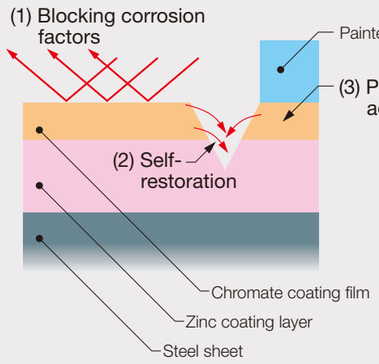
(3) The chromate-free treatment is categorized into three types.

Type	Chemical treatment symbol	Feature
Common use	QN	Thanks to the effects of the special film, its workability is equivalent to that of conventional chromate-treated steel sheets.
High bonding strength/ High paint adhesiveness	QA	Its workability is comparable to that of conventional chromate-treated steel sheets, and it excels in bonding strength and paint adhesiveness.
High corrosion resistance/ High workability	QFK	It has a low friction coefficient and is superior to conventional chromate-treated steel sheets in workability.

Corrosion resistance mechanism of conventional chromate-treated films and chromate-free treated films

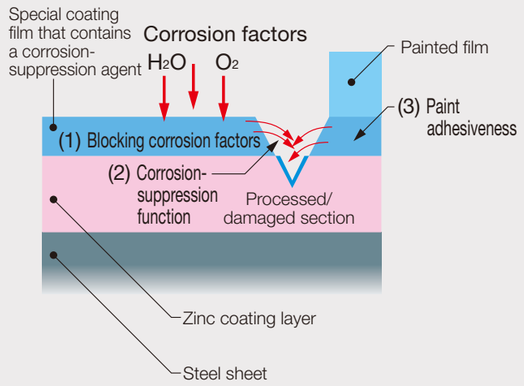
●Structure and function of coating films

Chromate coating film



When the coating film becomes damaged, soluble hexavalent chromium leaches out to offer a "self-restorative function" that repairs the film.

Chromate-free coating film



Corrosion resistance mechanism of chromate-free coating films
These films achieve their chromate-free property by employing a special film that uses carefully selected substances having the characteristic features of chromate films such as a barrier effect, self-restorative function, and paint adhesiveness.

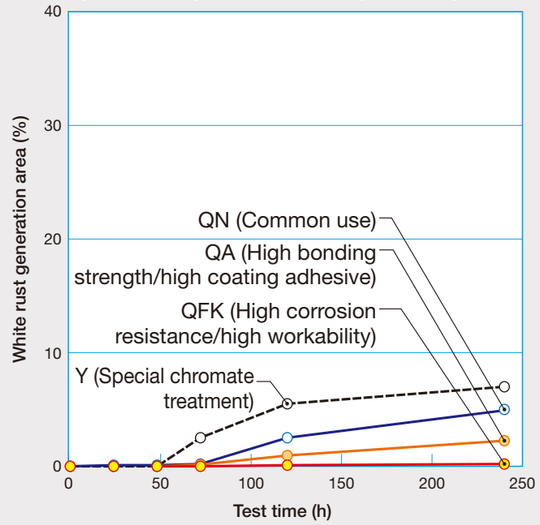
Functions of chromate coating films ●Barrier effect ●Self-restoration function → A special coating film that contains a corrosion-suppression agent provides similar effects.

Comparison of Chromate-free Treatment and Conventional Chromate Treatment

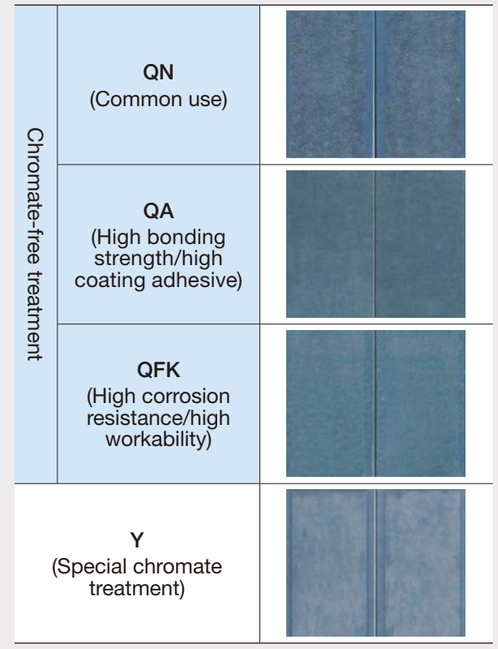
Corrosion resistance

Salt spray test (JIS Z 2371)

●Example of salt spray test results (flat sheet)



●Example of appearance after 120-h salt spray test (flat sheet)

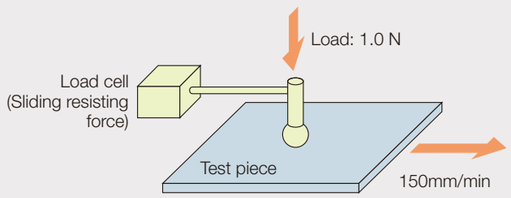


Lubricity

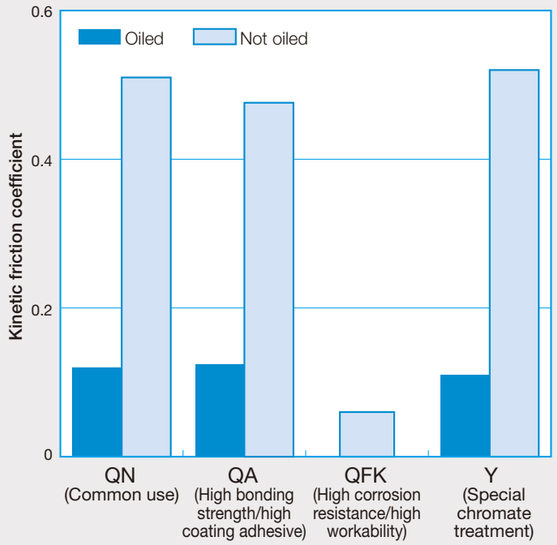
Kinetic friction coefficient

●Conceptual diagram of the kinetic friction coefficient measuring system

Sliding contact: SUS ball tip, diameter: 10 mm
Traveling speed: 150 mm/min
Load: 1.0 N
Oiling: No oiling or rust-prevention oil



●Example of kinetic friction coefficients



Comparison of Chromate-free Treatment and Conventional Chromate Treatment

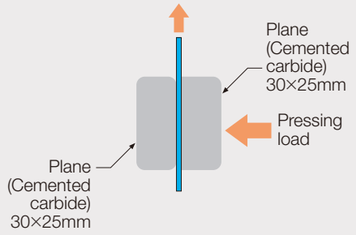
Lubricity (Plane sheet drawing test)

Sliding property

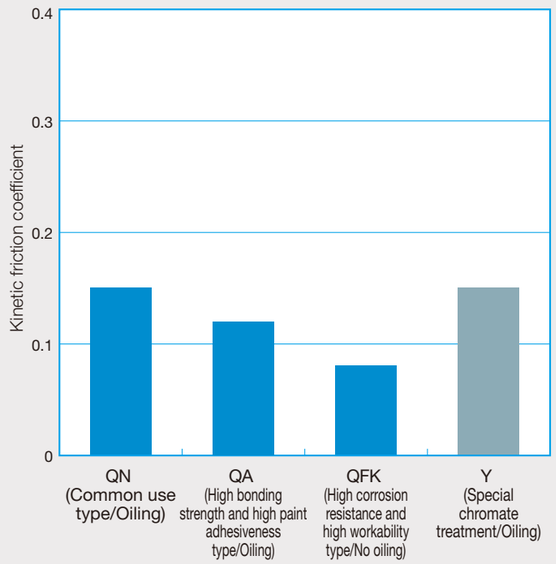
●Plane sliding system

Pressing loads : 0.3, 0.5, 0.7, and 1.0 t
Drawing speed : 200 mm/min
Drawing distance: 100 mm
Oiling*1 : Rust-preventive oil
Evaluation : Friction coefficient*2

*1: Oiling: QFK was measured with no oiling.
*2: Friction coefficient = (Each load vs. Each drawing load)/2



●Friction coefficient examples during plane sheet drawing



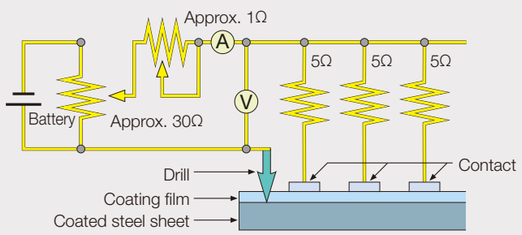
Conductivity

Surface insulation resistance test (JIS C 2550)

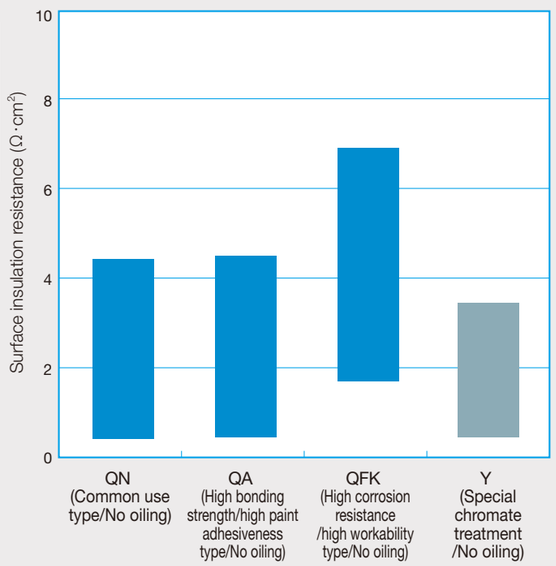
●Conceptual diagram of the surface insulation resistance measuring system

Test voltage: 0.5 V
Measuring current range:
0 to 1 A
Surface area of contact:
1 cm^2 × 10 contacts
Standard test pressure:
2 N/mm^2 ± 5%

RS=A (1/i–1)
RS : Surface insulation resistance value (Ω·cm^2/sheet) (Ω·cm^2/枚)
A : Total area of contacts = 10 (cm^2)
i :Average value of current (A)



●Example of surface insulation resistance test results



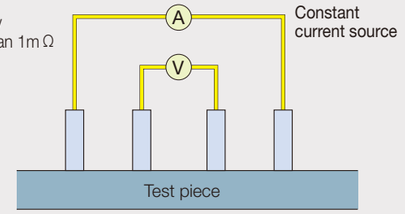
Conductivity (Grounding property)

LORESTA (4-probe type)

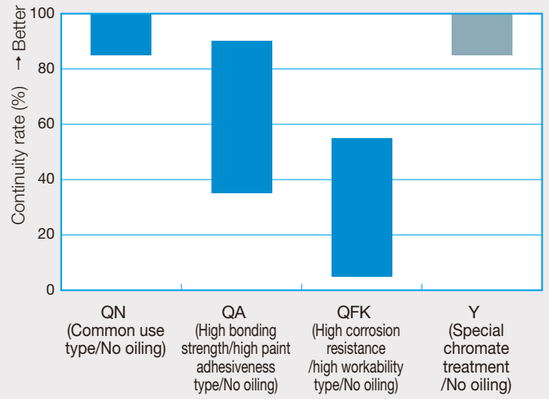
●Conceptual diagram of the contact resistance measuring system (LORESTA 4-probe type)

Tester : LORESTA MP-type (Dia Instruments Co., Ltd.)
Test current : 1 μA to 100 mA
Measuring resistance range: 10^6 to 10^{-2} Ω
Surface area of contacts: 2 mm in diameter × 4, Interpole distance of 5 mm
Contact load : 1.5 N/contact
Evaluation : Continuity rate (%) = Number of continuities*/20 tests × 100

* Continuity
= Less than 1m Ω



●Contact resistance (LORESTA 4-probe type) test results (conductivity rate)



Paintability

Paint adhesiveness

●Example of paint adhesiveness test results

Painting conditions

Paint type	Thickness of painted film	Baking condition
Melamine alkyd type	20 μm	120°C × 20 min

Paint name		Melamine alkyd			
Surface treatment		QN (Common use type)	QA (High bonding strength/high paint adhesiveness type)	QFK (High corrosion resistance /high workability type)	Y (Special chromate treatment)
Primary*	Cross-cut test	○	○	○	○
	Erichsen test	△	○	○	○
Testing method		Cross-cut test: After cross-cutting at 1-mm intervals, peel the film with adhesive tape. Erichsen test: After extruding the test piece by 7 mm, peel the film with adhesive tape.			
Judgment		◎No change ○Slight peeling △Considerable peeling ×Complete peeling			

* Primary: Evaluation after top painting

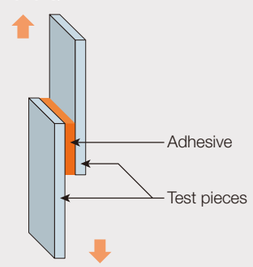
As paintability varies depending on the type of painting material used and the painting method employed, be sure to check the paint to be used in advance.
In addition, refrain from applying zinc phosphate for surface preparation because it may dissolve the coating film.
(Use untreated substrates that readily produce zinc phosphate films.)

Bonding strength

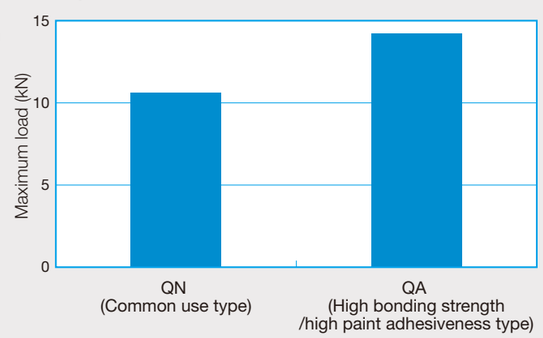
Tensile shear test

●Conceptual diagram of a tensile shear test

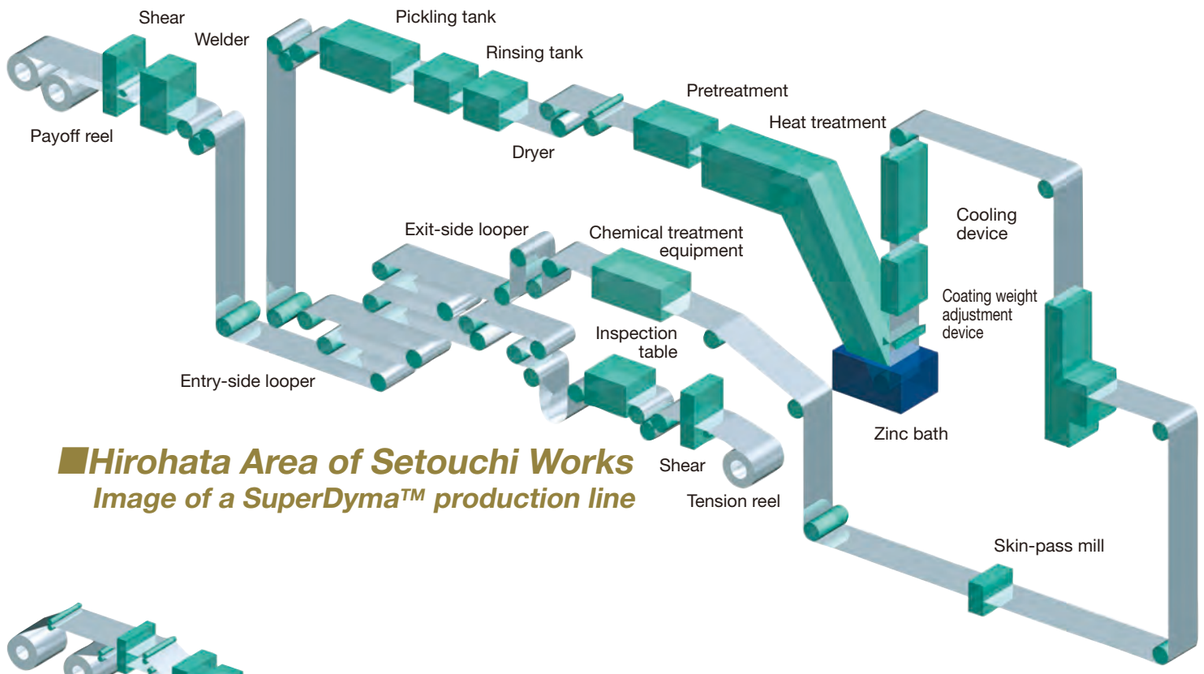
Adhesive : Acrylic resin adhesive
Testing method : Compliant with JIS K 6850 (Lap length: 50 mm)
Test pieces : QA and QN



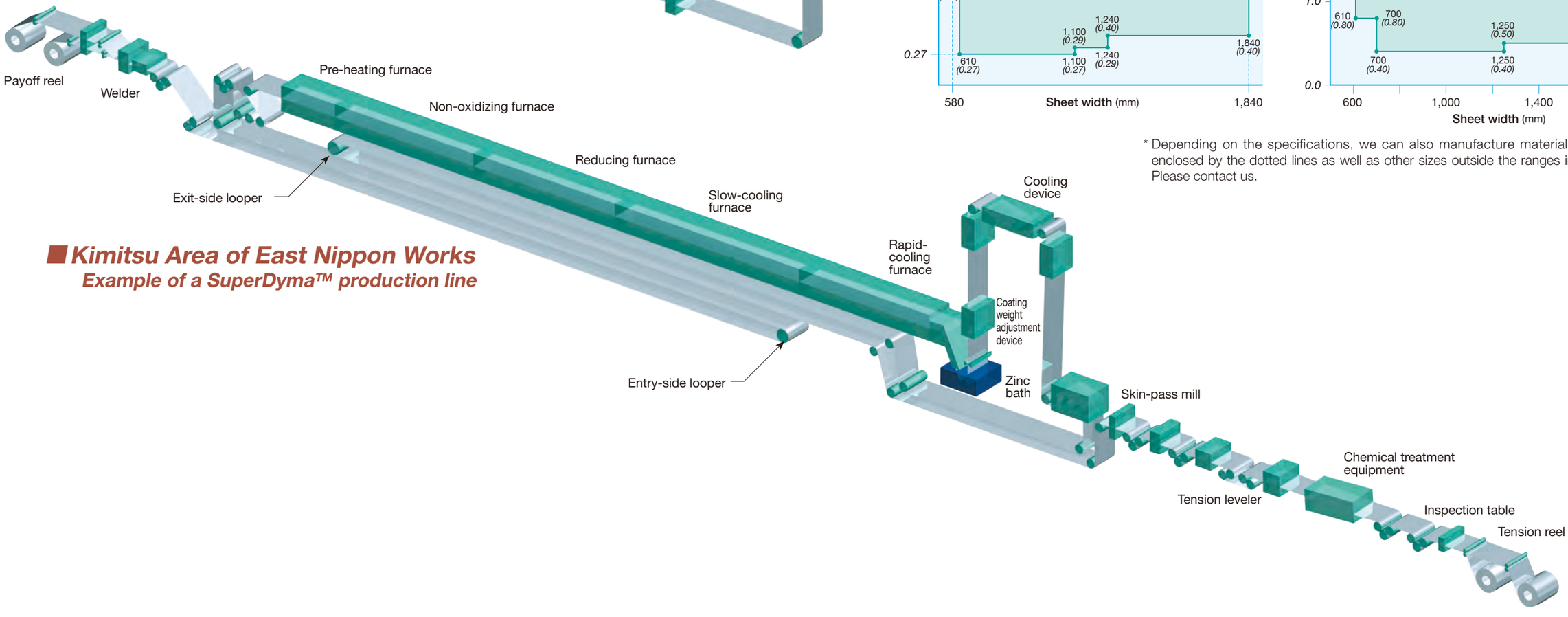
●Example of tensile shear test results



Production Process



■Hirohata Area of Setouchi Works
Image of a SuperDyma™ production line



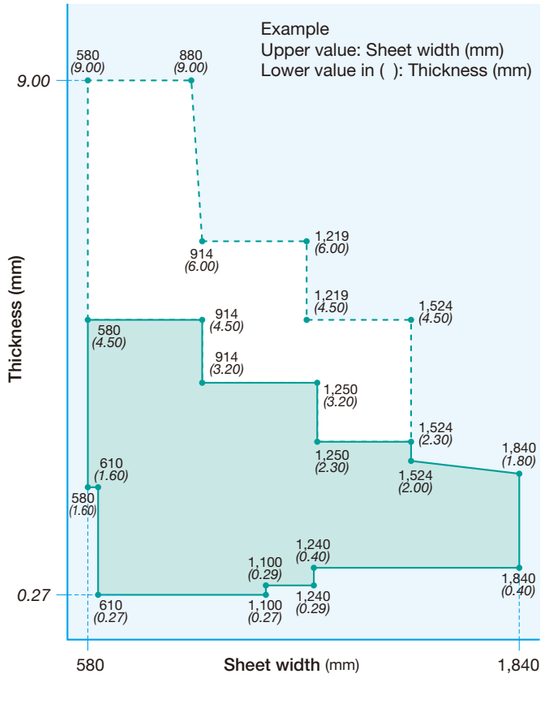
■Kimitsu Area of East Nippon Works
Example of a SuperDyma™ production line

Range of Producible Sizes

The range of producible sizes depends on the specifications. For details, please contact us.

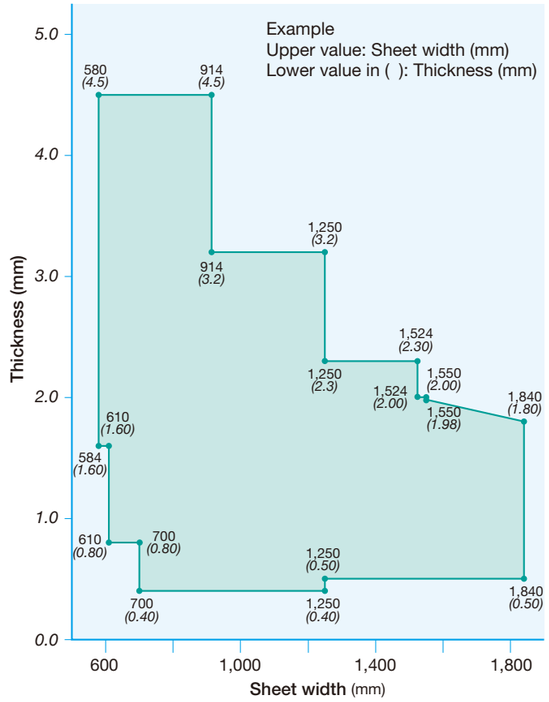
Examples of general materials

The range of producible sizes is as shown below.



Structural material 400N (Example of K27 QN)

The range of producible sizes is as shown below.



* Depending on the specifications, we can also manufacture materials in the ranges enclosed by the dotted lines as well as other sizes outside the ranges indicated above. Please contact us.

Standard (JIS) (Excerpted from JIS G 3323:2019)

In November 2012, the Japanese Industrial Standard JIS G 3323 (Hot-dip zinc-aluminum-magnesium alloy coated steel sheet and strip) was established.
SuperDyma™ complies with JIS G 3323 and has acquired the JIS Mark certification.
This catalog may use different table numbers and textual descriptions than the JIS standard book.
The excerpts herein may not be free of error. Please check whether they are correct by referring to the JIS standard book. If you find any text in this catalog to be questionable, refer to the JIS standard book, which is correct.

Types, symbols, and applicable nominal thicknesses

The symbols for types and applicable nominal thicknesses are shown in **Tables 1** and **2**. The nominal thicknesses represent the thicknesses of the base sheets before coating.

●Table 1: Type symbols and applicable nominal thicknesses (using hot-rolled base sheets[a]) Unit: mm

Type symbol	Applicable nominal thicknesses	Application
SGMHC	1.6 ≤ t ≤ 9.0	For general use
SGMH340		For high-strength general use
SGMH400		
SGMH440	1.6 ≤ t ≤ 6.0[b]	
SGMH490		
SGMH540		

Note [a]: For nominal thicknesses between 1.6 and 3.2 mm, if hot-rolled base sheets are not explicitly specified, cold-rolled base sheets that meet the specifications for hot-rolled base sheets may be used.

●Table 2: Type symbols and applicable nominal thicknesses (using cold-rolled base sheets) Unit: mm

Type symbol	Applicable nominal thicknesses	Application
SGMCC	0.20 ≤ t ≤ 3.2	For general use
SGMCH	0.20 ≤ t ≤ 1.2	For hard class general use
SGMCD1	0.40 ≤ t ≤ 2.3	For drawing use class 1
SGMCD2		For drawing use class 2
SGMCD3	0.40 ≤ t ≤ 2.3	For drawing use class 3
SGMCD4		For drawing use class 4, non-aging property[a]
SGMC340	0.25 ≤ t ≤ 3.2	For high-strength general use
SGMC400		
SGMC440		
SGMC490		
SGMC570	0.25 ≤ t ≤ 2.0	

Note [a]: "Non-aging property" refers to a property that generates no stretcher strain in processing.

Skin-pass treatment

The orderer may specify skin-pass treatment for achieving a smooth surface. In this case, the symbol shall be "S."

Coating mass

Both sides shall be coated with the same thickness. The coating mass symbols are listed in **Table 3**.

●Table 3: Minimum coating mass (total mass on both sides)
(Corresponds to Table 7 in JIS G 3323:2019) Unit: g/m²

Coating mass symbol	Triple-spot test avg. min. coating mass	Single-spot test min. coating mass
K06 [a]	60	51
K08	80	68
K10	100	85
K12	120	102
K14	140	119
K18	180	153
K20	200	170
K22	220	187
K25	250	213
K27	275	234
K35 [a]	350	298
K45 [a]	450	383

Coating masses K35 and K45 do not apply to SGMCD1, SGMCD2, SGMCD3, and SGMCD4.
Note [a]: This symbol applies only upon the agreement of the parties involved in delivery.

Chemical treatments

The types and symbols of chemical treatments for plates/sheets and coils are as shown in **Table 4**.

●Table 4: Types and symbols of chemical treatments
(excerpted from Table 10 in JIS G 3323:2019)

Chemical treatment type	Symbol
Chromate-free treatment[a]	[b]
Chromate treatment[c]	C
No treatment	M

Note [a]: Chromate-free treatment includes the "chromate-free treatment" and the "chromate-free phosphating treatment" specified in JIS G 3323:2012.
Note [b]: The symbol for chromate-free treatment shall be agreed upon between the parties involved in delivery. As the symbol, either the chromate-free treatment symbol "NC" or the chromate-free phosphating treatment symbol "NP" specified in JIS G 3323:2012 may be used.
Note [c]: Chromate treatment is planned to be deleted in the next revision.

Article 6 (Chemical treatment) in JIS G 3323 stipulates that "Types of chemical treatments not listed in the Table **[Types and symbols of chemical treatments]** may be agreed upon between the parties involved in delivery." In this case, **Table 5** can be applied if so agreed.

●Table 5: Types and symbols of chemical treatments based on agreements between the parties involved in delivery

Chemical treatment type	Symbol
No treatment	M
Chromate-free treatment (common use type)	QN
Chromate-free treatment (high bonding strength/high paint adhesiveness type)	QA
Chromate-free treatment (high corrosion resistance/high workability type)	QFK

Oiling

The types and symbols of oiling for plates/sheets and coils are as shown in **Table 6**.

●Table 6: Types and symbols of oiling
(Corresponds to Table 11 in JIS G 3323:2019)

Oiling type	Symbol
Oiling	O
No oiling	X

Mechanical properties (JIS)

Bendability

Plates/sheets and coils are tested for bendability using the bending test conditions listed in **Tables 7** and **8**. Test pieces shall have a width of 75 to 125 mm and a length about twice the width. In the test that bends the test piece in the longitudinal direction, no fractures or cracking (visible to the naked eye) shall occur over the external surface (the area 7 mm or more distant from both side edges).

●Table 7: Bending test conditions 1 (Corresponds to Table 8 in JIS G 3323:2019)

Type symbol	Bending angle	Inner gap of bending (Maximum number of sheets with the nominal thickness)					
		Nominal thickness 1.6 mm ≤ t < 3.0 mm			Nominal thickness 3.0 mm ≤ t		
		Coating mass symbol			Coating mass symbol		
		K06 ~ K27	K35	K45	K06 ~ K27	K35	K45
SGMHC	180°	1	2	2	2	2	2
SGMH340		1	1	2	2	2	3
SGMH400		2	2	2	3	3	3
SGMH440		3	3	3	3	3	3
SGMH490							
SGMH540							

●Table 8: Bending test conditions 2 (Corresponds to Table 9 in JIS G 3323:2019)

Type symbol	Bending angle	Inner gap of bending (Maximum number of sheets with the nominal thickness)								
		Nominal thickness t < 1.6 mm			Nominal thickness 1.6 mm ≤ t < 3.0 mm			Nominal thickness 3.0 mm ≤ t		
		Coating mass symbol			Coating mass symbol			Coating mass symbol		
		K06 ~ K27	K35	K45	K06 ~ K27	K35	K45	K06 ~ K27	K35	K45
SGMCC	180°	1	1	2	1	2	2	2	2	2
SGMCD1		1	–	–	1	–	–	–	–	–
SGMCD2		0 (close contact)	–	–	0 (close contact)	–	–	–	–	–
SGMCD3										
SGMCD4										
SGMC340		1	1	2	1	1	2	2	2	3
SGMC400		2	2	2	2	2	2	3	3	3
SGMC440		3	3	3	3	3	3	3	3	3
SGMC490										

Section 13.4.2 (Bending test) in JIS G 3323 stipulates that "The bending test may be omitted."
We will omit bending tests if not otherwise specified.

Tensile characteristics

The tensile characteristics of plates/sheets and coils are listed in **Tables 9** and **10**.
The test pieces and test methods shall conform to **JIS Z 2241** (Metallic materials – Tensile testing – Method of test at room temperature).

●Table 9: Tensile characteristics 1 (using hot-rolled base sheets) (Corresponds to Table 13 in JIS G 3323:2019)

Type symbol	Yield point or yield strength N/mm²	Tensile strength N/mm²	Elongation (%) Nominal thickness (mm)						Test piece/ direction
			1.6 ≤ t < 2.0	2.0 ≤ t < 2.5	2.5 ≤ t < 3.2	3.2 ≤ t < 4.0	4.0 ≤ t ≤ 6.0	6.0 < t	
SGMHC	–	–	–	–	–	–	–	–	–
SGMH340	245 ≤	340 ≤	20 ≤	20 ≤	20 ≤	20 ≤	20 ≤	20 ≤	JIS No. 5, rolling direction, or perpendicular to rolling direction
SGMH400	295 ≤	400 ≤	18 ≤	18 ≤	18 ≤	18 ≤	18 ≤	18 ≤	
SGMH440	335 ≤	440 ≤						–	
SGMH490	365 ≤	490 ≤	16 ≤	16 ≤	16 ≤	16 ≤	16 ≤		
SGMH540	400 ≤	540 ≤							

Note 1: For SGMHC, a yield point or yield strength of 205 N/mm² or more and a tensile strength of 270 N/mm² or more are sometimes used.
Note 2: 1 N/ mm² = 1 MPa

●Table 10: Tensile characteristics 2 (using cold-rolled base sheets) (Corresponds to Table 14 in JIS G 3323:2019)

Type symbol	Yield point or yield strength N/mm²	Tensile strength N/mm²	Elongation (%) Nominal thickness (mm)						Test piece/ direction
			0.25 ≤ t < 0.40	0.40 ≤ t < 0.60	0.60 ≤ t < 1.0	1.0 ≤ t < 1.6	1.6 ≤ t < 2.5	2.5 ≤ t	
SGMCC	–	–	–	–	–	–	–	–	–
SGMCH	–	–	–	–	–	–	–	–	–
SGMCD1	–	270 ≤	–	30 ≤	33 ≤	36 ≤	38 ≤	–	Test piece/ direction JIS No. 5, rolling direction
SGMCD2	–	270 ≤	–	36 ≤	38 ≤	39 ≤	40 ≤	–	
SGMCD3	–	270 ≤	–	38 ≤	40 ≤	41 ≤	42 ≤	–	
SGMCD4 [a]	–	270 ≤	–	40 ≤	42 ≤	43 ≤	44 ≤	–	
SGMC340	245 ≤	340 ≤	20 ≤	20 ≤	20 ≤	20 ≤	20 ≤	20 ≤	JIS No. 5, rolling direction, or perpendicular to rolling direction
SGMC400	295 ≤	400 ≤	18 ≤	18 ≤	18 ≤	18 ≤	18 ≤	18 ≤	
SGMC440	335 ≤	440 ≤	18 ≤	18 ≤	18 ≤	18 ≤	18 ≤	18 ≤	
SGMC490	365 ≤	490 ≤	16 ≤	16 ≤	16 ≤	16 ≤	16 ≤	16 ≤	
SGMC570	560 ≤	570 ≤	–	–	–	–	–	–	

Note 1: For SGMCC, a yield point or yield strength of 205 N/mm² or more and a tensile strength of 270 N/mm² or more are sometimes used.
Note 2: Because SGMCH is not annealed, it usually has a Rockwell hardness of 85 HRBW or more, or a Vickers hardness of 170 HV or more.
Note 3: 1 N/ mm² = 1 MPa
Note [a] SGMCD4 plates/sheets and coils shall not generate stretcher strain in processing for six months after production.

Specifications (Products Sold by NIPPON STEEL CORPORATION)

Dimensional tolerances (JIS)

Product thickness tolerances

The thicknesses of plates, corrugated sheets, and coils shall be the nominal thicknesses of their base sheets before coating, and their product thicknesses shall be the thicknesses of the base sheets after coating.
Product thickness tolerances shall apply to the value obtained by rounding the sum of the nominal base sheet thickness and the equivalent coating thickness shown in **Table 11** off to two decimal places according to rule A of **JIS Z 8401**.
Product thickness tolerances shall be in accordance with **Table 12**, **13**, or **14**.
The product thickness shall be measured at an arbitrary point more than 25 mm distant from the edge (cross-direction end).

●Table 11: Equivalent coating thicknesses (excerpted from Table 15 in JIS G 3323:2019)

Unit: mm

Category	Coating mass symbol												Reference
	K06	K08	K10	K12	K14	K18	K20	K22	K25	K27	K35	K45	Mass fraction of aluminum in coating film
2	0.016	0.021	0.027	0.033	0.036	0.044	0.051	0.054	0.062	0.068	0.082	0.101	More than 9.0% but 13.0% or less

●Table 12: Product thickness tolerances (using hot-rolled base sheets; for general use) **(Applies to SGMHC)** (Corresponds to Table 18 in JIS G 3323:2019)

Unit: mm

Nominal thickness	Width			
	W < 1,200	1,200 ≤ W < 1,500	1,500 ≤ W < 1,800	1,800 ≤ W < 2,000
1.60 ≤ t < 2.00	± 0.17	± 0.18	± 0.19	± 0.22
2.00 ≤ t < 2.50	± 0.18	± 0.20	± 0.22	± 0.26
2.50 ≤ t < 3.15	± 0.20	± 0.22	± 0.25	–
3.15 ≤ t < 4.00	± 0.22	± 0.24	± 0.27	–
4.00 ≤ t < 5.00	± 0.25	± 0.27	± 0.29	–
5.00 ≤ t < 6.00	± 0.27	± 0.29	–	–
6.00 ≤ t < 8.00	± 0.30	± 0.31	–	–
8.00 ≤ t ≤ 9.00	± 0.33	–	–	–

●Table 13: Product thickness tolerances
(using hot-rolled base sheets; for structural use)
(Applies to SGMH340, SGMH400, SGMH440, SGMH490, and SGMH540)
(Corresponds to Table 19 in JIS G 3323:2019)

Unit: mm

Nominal thickness	Width	
	W < 1,600	1,600 ≤ W < 2,000
1.60 ≤ t < 2.00	± 0.20	± 0.24
2.00 ≤ t < 2.50	± 0.21	± 0.26
2.50 ≤ t < 3.15	± 0.23	± 0.30
3.15 ≤ t < 4.00	± 0.25	–
4.00 ≤ t < 5.00	± 0.46	–
5.00 ≤ t < 6.30	± 0.51	–
6.30 ≤ t ≤ 9.00	± 0.56	–

●Table 14: Product thickness tolerances (using cold-rolled base sheets)
(Applies to SGMCC, SGMCH, SGMCD1 to SGMCD4, and SGMC340 to SGMC570)
(Excerpts from Table 20 in JIS G 3323:2019)

Unit: mm

Nominal thickness	Width				
	W < 630	630 ≤ W < 1,000	1,000 ≤ W < 1,250	1,250 ≤ W < 1,600	1,600 ≤ W
0.20 ≤ t < 0.25	± 0.04	± 0.04	± 0.04	–	–
0.25 ≤ t < 0.40	± 0.05	± 0.05	± 0.05	± 0.06	–
0.40 ≤ t < 0.60	± 0.06	± 0.06	± 0.06	± 0.07	± 0.08
0.60 ≤ t < 0.80	± 0.07	± 0.07	± 0.07	± 0.07	± 0.08
0.80 ≤ t < 1.00	± 0.07	± 0.07	± 0.08	± 0.09	± 0.10
1.00 ≤ t < 1.25	± 0.08	± 0.08	± 0.09	± 0.10	± 0.12
1.25 ≤ t < 1.60	± 0.09	± 0.10	± 0.11	± 0.12	± 0.14
1.60 ≤ t < 2.00	± 0.11	± 0.12	± 0.13	± 0.14	± 0.16
2.00 ≤ t < 2.50	± 0.13	± 0.14	± 0.15	± 0.16	± 0.18
2.50 ≤ t < 3.15	± 0.15	± 0.16	± 0.17	± 0.18	± 0.21
3.15 ≤ t ≤ 3.20	± 0.17	± 0.18	± 0.20	± 0.21	–

Width tolerances

Plate and coil width tolerances shall be in accordance with **Table 15**. **Table 15** assumes the use of conventional cutting methods.

●Table 15: Width tolerances (Corresponds to Table 21 in JIS G 3323:2019)

Unit: mm

Width	Applicable type symbols		
	SGMHC, SGMH340, SGMH400, SGMH440, SGMH490, SGMH540		SGMCC, SGMCH, SGMCD1 ~ SGMCD4, SGMC340 ~ SGMC570
	Tolerance A [a)]	Tolerance B [a)]	
W < 1,500	+ 25 0	+ 10 0	+ 7 0
1,500 < W			+ 10 0

Note [a)]: Usually, tolerance A applies to mill edges, while tolerance B applies to cut edges.

Types, symbols, and applicable nominal thicknesses

Thicknesses from 0.27 to 9.0 mm are available.
The types of plates/sheets and coils that use hot-rolled base sheets (hereafter referred to as HR base sheets) are in accordance with Table 1-1, while those that use cold-rolled base sheets (CR base sheets) are described in Table 1-2.

●Table 1-1: Types and symbols (using HR base sheets)

Type symbol	Nominal thickness (mm)	Application
NSDHC	1.60 ≤ t ≤ 9.00	For general use
NSDHP1	1.60 ≤ t ≤ 9.00	For drawing use class 1
NSDHP2	1.60 ≤ t ≤ 9.00	For drawing use class 2
NSDH340	1.60 ≤ t ≤ 9.00	For structural use
NSDH400	1.60 ≤ t ≤ 9.00	
NSDH440	1.60 ≤ t ≤ 9.00	
NSDH490	1.60 ≤ t ≤ 9.00	
NSDH540	1.60 ≤ t ≤ 9.00	

Remarks: Nominal thicknesses not listed in Table 1-1 may be agreed upon between the parties involved in delivery.

●Table 1-2: Types and symbols (using CR base sheets)

Type symbol	Nominal thickness (mm)	Application
NSDCC	0.27 ≤ t ≤ 2.30	For general use
NSDCH *	0.27 ≤ t ≤ 1.00	For hard class general use
NSDCD1	0.40 ≤ t ≤ 2.30	For drawing use class 1
NSDCD2	0.40 ≤ t ≤ 2.30	For drawing use class 2
NSDCD3	0.60 ≤ t ≤ 2.30	For drawing use class 3
NSDC340	0.27 ≤ t ≤ 2.30	For structural use
NSDC400	0.27 ≤ t ≤ 2.30	
NSDC440	0.27 ≤ t ≤ 2.30	
NSDC490	0.27 ≤ t ≤ 2.30	
NSDC570S	0.60 ≤ t ≤ 2.30	
NSDC570 *	0.27 ≤ t ≤ 2.00	

Remarks: 1. If the orderer requires a non-aging property for plates/sheets and coils of NSDCD3, "N" shall be added to the end of the symbol: NSDCD3N.
2. Nominal thicknesses not listed in Table 1-2 may be agreed upon between the parties involved in delivery.
3. For items marked with an asterisk (*), please contact us separately.

Skin-pass treatment

The orderer may specify skin-pass treatment for achieving a smooth surface.

Coating mass

The coating symbols and masses are as shown in Table 2.

●Table 2: Minimum coating mass on both sides and coating mass symbol for coating on both sides with the same thickness

Coating mass symbol	Triple-spot test avg. min. coating mass on both sides	Single-spot test min. coating mass on both sides
K06 *	60	51
K08	80	68
K10	100	85
K12	120	102
K14	140	119
K18	180	153
K20	200	170
K22	220	187
K25	250	213
K27	275	234
K35 *	350	298
K45 *	450	383

Remarks: The maximum coating mass may be agreed upon between the parties involved in delivery.
For items marked with an asterisk (*), please contact us separately.

Chemical treatments

The types and symbols of chemical treatment for plates/sheets and coils are as shown in Table 3.

●Table 3: Types and symbols of chemical treatments

Chemical treatment type	Symbol
No treatment	M
Chromate-free treatment (common use type)	QN
Chromate-free treatment (high bonding strength/high paint adhesiveness type)	QA
Chromate-free treatment (high corrosion resistance/high workability type)	QFK

Remarks: Types of chemical treatments not listed in Table 3 may be agreed upon between the parties involved in delivery.
* For details, please contact us.

Oiling

The types and symbols of oiling for plates/sheets and coils are as shown in Table 4.

●Table 4: Types and symbols of oiling

Oiling type	Symbol
Thick oiling	H
Normal oiling	N
Thin oiling	L
No oiling	X

Remarks: Types of oiling not listed in Table 4 may be agreed upon between the parties involved in delivery.

Mechanical properties

(Products sold by NIPPON STEEL)

Bendability

The bendability of plates/sheets and coils is as shown in Table 5. No separation, cracking (visible to the naked eye), or fractures in coated films shall occur over the external surface (the area 7 mm or more distant from both side edges).

●Table 5: Bendability

Type of base sheet used		Bending angle	180-degree bending							
		Nominal thickness	t < 1.6 mm			1.6 mm ≤ t < 2.3 mm			2.3 mm ≤ t	
HR base sheets	CR base sheets		Coating mass symbol							
			K27 or smaller	K35	K45	K27 or smaller	K35	K45	K27 or smaller	K35	K45
NSDHC	NSDCC		1	1	2	1	2	2	2	2	2
—	NSDCH		—	—	—	—	—	—	—	—	—
NSDHP1	NSDCD1		1	—	—	1	—	—	—	—	—
NSDHP2	NSDCD2		0	—	—	0	—	—	—	—	—
—	NSDCD3										
NSDH340	NSDC340		1	1	2	1	1	2	2	2	3
NSDH400	NSDC400		2	2	2	2	2	2	3	3	3
NSDH440	NSDC440		3	3	3	3	3	3	3	3	3
NSDH490	NSDC490										
NSDH540	—										
—	NSDC570S		—	—	—	—	—	—	—	—	—
—	NSDC570		—	—	—	—	—	—	—	—	—

Tensile characteristics

The yielding points, tensile strengths, elongation, and non-aging properties (only for CR base sheets) of plates/sheets and coils are shown in Tables 6 and 7.

●Table 6: Yielding points, tensile strengths, and elongation (using HR base sheets)

Type symbols	Yielding point (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)					Test piece
			Nominal thickness (mm)					
			1.6 ≤ t < 2.0	2.0 ≤ t < 2.5	2.5 ≤ t < 3.2	3.2 ≤ t < 4.0	4.0 ≤ t ≤ 6.0	
NSDHC	–	–	–	–	–	–	–	JIS No. 5 Rolling direction
NSDHP1	–	270 ≤	34 ≤	35 ≤	35 ≤	36 ≤	36 ≤	
NSDHP2	–	270 ≤	–	38 ≤	38 ≤	39 ≤	39 ≤	
NSDH340	245 ≤	340 ≤	20 ≤	20 ≤	20 ≤	20 ≤	20 ≤	
NSDH400	From 295 to 400	400 ≤	18 ≤	18 ≤	18 ≤	18 ≤	18 ≤	
NSDH440	335 ≤	440 ≤	18 ≤	18 ≤	18 ≤	18 ≤	18 ≤	
NSDH490	From 365 to 490	490 ≤	16 ≤	16 ≤	16 ≤	16 ≤	16 ≤	
NSDH540	400 ≤	540 ≤	16 ≤	16 ≤	16 ≤	16 ≤	16 ≤	

Test pieces: JIS No. 5, rolling direction

●Table 7: Yielding points, tensile strengths, elongation, and non-aging properties (using CR base sheets)

Type symbols	Yielding point (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)					Test piece
			Nominal thickness (mm)					
			0.27 ≤ t < 0.40	0.40 ≤ t < 0.60	0.60 ≤ t < 1.00	1.00 ≤ t < 1.60	1.60 ≤ t ≤ 2.30	
NSDCC	–	–	–	–	–	–	–	JIS No. 5 Rolling direction
NSDCH	–	–	–	–	–	–	–	
NSDCD1	–	270 ≤	–	30 ≤	33 ≤	36 ≤	38 ≤	
NSDCD2	–	270 ≤	–	36 ≤	38 ≤	39 ≤	40 ≤	
NSDCD3	–	270 ≤	–	38 ≤	40 ≤	41 ≤	42 ≤	
NSDC340	245 ≤	340 ≤	20 ≤	20 ≤	20 ≤	20 ≤	20 ≤	
NSDC400	From 295 to 400	400 ≤	18 ≤	18 ≤	18 ≤	18 ≤	18 ≤	
NSDC440	335 ≤	440 ≤	18 ≤	18 ≤	18 ≤	18 ≤	18 ≤	
NSDC490	From 365 to 490	490 ≤	16 ≤	16 ≤	16 ≤	16 ≤	16 ≤	
NSDC570S	450 ≤	570 ≤	10 ≤	10 ≤	10 ≤	10 ≤	10 ≤	
NSDC570	560 ≤	570 ≤	–	–	–	–	–	

Remarks: If the orderer requires a non-aging property for plates/sheets and coils of NSDCD3, we will guarantee the non-aging property for six months after shipment from the factory. The non-aging property refers to a property that generates no stretcher strain in processing.
Reference: 1. NSDCC usually has a yielding point of 205 N/mm^2 or more, and a tensile strength of 270 N/mm^2 or more.
2. NSDCH is not annealed. It usually has a Rockwell hardness of 85 HRB or higher, or a Vickers hardness of 170 Hv or higher (with an arbitrary test load).

Dimensional tolerances

(Products sold by NIPPON STEEL)

Product thickness tolerances

(1) Thickness tolerances shall apply to the sum of the nominal base sheet thickness and the equivalent coating thickness listed in Table 10.
(2) Thickness tolerances shall be in accordance with Tables 8-1, 8-2, or 9.
(3) Sheet thickness shall be measured at an arbitrary point more than 25 mm distant from the edge.

●Table 8-1: Thickness tolerances (using HR base sheets, for general use)

Nominal thickness (mm)	Width (mm)	
	W < 1,200	1,200 ≤ W < 1,250
1.60 ≤ t < 2.00	± 0.17	± 0.18
2.00 ≤ t < 2.50	± 0.18	± 0.20
2.50 ≤ t < 3.15	± 0.20	± 0.22
3.15 ≤ t < 4.00	± 0.22	± 0.24
4.00 ≤ t < 5.00	± 0.25	± 0.27
5.00 ≤ t < 6.00	± 0.27	± 0.29
6.00 ≤ t < 8.00	± 0.30	± 0.31
8.00 ≤ t ≤ 9.00	± 0.33	± 0.34

●Table 8-2: Thickness tolerances (using HR base sheets, for structural use)

Nominal thickness (mm)	Width (mm)
	W < 1,250
1.60 ≤ t < 2.00	± 0.20
2.00 ≤ t < 2.50	± 0.21
2.50 ≤ t < 3.15	± 0.23
3.15 ≤ t < 4.00	± 0.25
4.00 ≤ t < 5.00	± 0.46
5.00 ≤ t < 6.30	± 0.51
6.30 ≤ t ≤ 9.00	± 0.56

●Table 9: Thickness tolerances (using CR base sheets)

Nominal thickness (mm)	Width (mm)		
	W < 630	630 ≤ W < 1,000	1,000 ≤ W ≤ 1,250
t < 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

Remarks: Nominal thicknesses not listed in Table 9 may be agreed upon between the parties involved in delivery.

●Table 10: Equivalent coating thickness

Coating mass symbol	Equivalent coating thickness (mm)
K06	0.016
K08	0.021
K10	0.027
K12	0.033
K14	0.036
K18	0.044
K20	0.051
K22	0.054
K25	0.062
K27	0.068
K35	0.082
K45	0.101

Width tolerances

●Table 11: Width tolerances

mm

Width	Using HR base sheets		Using CR base sheets
	Mill edge (A)	Cut edge (B)	
W < 1,500	+ 25 0	+ 10 0	+ 7 0
1,500 < W			+ 10 0

Reference

Unit mass of sheets

Standard thickness (mm) \ Coating mass symbol	K06	K08	K10	K12	K14	K18	K20	K22	K25	K27	K35	K45
0.27	2.210	2.240	2.270	2.303	2.323	2.364	2.405	2.425	2.470	2.501	2.578	2.685
0.30	2.445	2.475	2.505	2.538	2.558	2.599	2.640	2.660	2.705	2.736	2.813	2.920
0.40	3.230	3.260	3.290	3.323	3.343	3.384	3.425	3.445	3.490	3.521	3.598	3.705
0.50	4.015	4.045	4.075	4.108	4.128	4.169	4.210	4.230	4.275	4.306	4.383	4.490
0.60	4.800	4.830	4.860	4.893	4.913	4.954	4.995	5.015	5.060	5.091	5.168	5.275
0.70	5.585	5.615	5.645	5.678	5.698	5.739	5.780	5.800	5.845	5.876	5.953	6.060
0.80	6.370	6.400	6.430	6.463	6.483	6.524	6.565	6.585	6.630	6.661	6.738	6.845
0.90	7.155	7.185	7.215	7.248	7.268	7.309	7.350	7.370	7.415	7.446	7.523	7.630
1.0	7.940	7.970	8.000	8.033	8.053	8.094	8.135	8.155	8.200	8.231	8.308	8.415
1.2	9.510	9.540	9.570	9.603	9.623	9.664	9.705	9.725	9.770	9.801	9.878	9.985
1.6	12.65	12.68	12.71	12.74	12.763	12.80	12.85	12.87	12.91	12.94	13.02	13.13
2.0	15.79	15.82	15.85	15.88	15.903	15.94	15.99	16.01	16.05	16.08	16.16	16.27
2.3	18.15	18.18	18.21	18.24	18.258	18.30	18.34	18.36	18.41	18.44	18.51	18.62
3.2	25.21	25.24	25.27	25.30	25.323	25.36	25.41	25.43	25.47	25.50	25.58	25.69
4.5	35.42	35.45	35.48	35.51	35.528	35.57	35.61	35.63	35.68	35.71	35.78	35.89
6.0	47.19	47.22	47.25	47.28	47.303	47.34	47.39	47.41	47.45	47.48	47.56	47.67
9.0	70.74	70.77	70.80	70.83	70.853	70.89	70.94	70.96	71.00	71.03	71.11	71.22

Notes: Unit mass of base sheet (kg/m^2) = Basic mass of base sheet × Thickness (mm)
Basic mass of base sheet = 7.85 (kg/mm·m^2)
Unit mass of sheet (kg/m^2) = Unit mass of base sheet (kg/m^2) + Coating mass constant

Coating mass symbol	K06	K08	K10	K12	K14	K18	K20	K22	K25	K27	K35	K45
Coating mass constant	0.090	0.120	0.150	0.183	0.203	0.244	0.285	0.305	0.350	0.381	0.458	0.565

Trademark Guidelines

Guidelines for the use of NIPPON STEEL CORPORATION's registered trademark SuperDyma™

NIPPON STEEL CORPORATION owns the registered trademark SuperDyma™.
When using our registered trademark SuperDyma™ in your product catalog, website, product packaging, documents, or other media, be sure to conform to these guidelines.
If you use our trademark in a way that differs from these guidelines, and third parties allege that you have infringed upon their trademark rights, please note that we can bear no responsibility.

Contact information: ●Sales representatives at the Head Office or Marketing Branch Offices of NIPPON STEEL CORPORATION, or
●SuperDyma™ Customer Support Center ➡Email: superdym@jp.nipponsteel.com ➡Phone: +81-3-6867-6844
* For details, visit the SuperDyma™ website.
➡URL: https://www.nipponsteel.com/en/product/index.html

How to use the trademark

1. If you plan to use our registered trademark SuperDyma™, be sure to contact one of our sales representatives in order to obtain agreement regarding the notation and content.

2. Regarding the notation of SuperDyma™ in your catalog or other item, ensure that said notation complies with all points of concern listed on the right, and clearly indicate that the trademark is the name of "a material used in your products," and that said material is manufactured and sold by NIPPON STEEL.

(1) In the media (e.g., your catalog), display your product name in the most conspicuous location.
(2) Design the notation so that everyone can see that SuperDyma® is a registered trademark of NIPPON STEEL in Japan and other countries.* Be sure to attach "TM" to the trademark where it is first used in the media or in other locations so that the mark is conspicuous.
* Notation method:
(i) SuperDyma™ (Note)
((Note): SuperDyma™ is the product name of NIPPON STEEL CORPORATION's highly corrosion resistant coated steel sheets.)
(ii) This product uses NIPPON STEEL's SuperDyma™.
(iii) This product uses SuperDyma™ highly corrosion resistant coated steel sheets.
(3) SuperDyma™ is a single word. Use of "Super_Dyma™" is not acceptable.

Usage Precautions

Inappropriate handling or application methods prevent SuperDyma™ from fully demonstrating its signature qualities. Mind the following usage precautions.

Loading/Unloading and storage

(1) Water leakage during loading/unloading or storage causes corrosion. Strictly avoid loading/unloading in the rain as well as exposure to seawater and dew condensation. In addition, avoid storing the product in the presence of high humidity or sulfur-dioxide. We recommend storing the product indoors under dry, clean conditions.
(2) Restore any broken or torn packaging.
(3) If coils or cut sheets are stored in piles for an extended time, their coated surfaces may become blackened. For this reason, we recommend using them promptly.

⚠ Warning
- Falling and rolling coils are very dangerous, as is the collapse of piled sheets. To prevent such accidents during storage, take due care to store products in a stable, secure condition.

Handling

(1) Handle products carefully so as not to damage the coatings or surface-treatment films.
(2) Perspiration and fingerprints impair paintability and corrosion resistance. If the product is exposed to either, carry out appropriate post-treatment and repair.

⚠ Caution
- When removing (cutting) coil binding hoops (bands) in order to use a coil, make certain that the end of the coil is directly beneath the coil center in order to prevent the end of the coil from suddenly springing out; alternately, be certain to perform removal in a location where safety can be ensured and no danger is posed if the coil end were to suddenly spring out and then expand outward.
- Coils are formed by winding flat sheets. When the binding hoops or other external forces that keep the sheet in coil form are removed and the coil end is freed, the coil end will spring out in order to return to a flat state. Further, in some cases the coil bindings loosen, which suddenly allows the coil to expand outward.
In such cases, workers may be injured and objects may be damaged in the vicinity of the coil.

Processing

(1) The application of certain kinds of extreme pressure agents as lubricants during press forming can cause corrosion of the coating layer. Check in advance before using such agents. When you cannot avoid the use of such agents, perform post treatments (e.g., degreasing) thoroughly and quickly.
(2) Severe damage to the surface layer during processing can adversely affect paintability and corrosion resistance.

Aging

Generally, steel sheets tend to deteriorate in quality over time (e.g., degraded workability, stretcher strain, and buckling). To avoid this, we recommend using sheets as soon as possible. However, this problem can be avoided by selecting products with aging resistance.

Color

When used without painting, hot-dip coated steel sheets generally suffer degradation in metallic luster (i.e., blackening) or changes in color over time. Note this point if you are considering use of SuperDyma™ to omit post-painting or as an alternative to stainless steel or aluminum.

Welding

(1) In resistance welding, because the electrodes are soiled by the pickup of zinc, they should be properly maintained and replaced as necessary.
(2) Welding generates fumes containing mainly zinc oxides. Although the effect of these fumes differs depending on the coating mass and the working environment, we recommend welding in a well-ventilated place.

Painting

Paintability differs depending on the paint type and painting method. Check in advance the paintability of the paint to be used.

Bonding

(1) Adhesiveness varies depending on the adhesive type and bonding method. Check in advance the adhesiveness of the adhesive to be used.
(2) If SuperDyma™ sheets are joined together with an adhesive and the joint is exposed to an environment containing organic solvents or similar substances or their vapors, the adhesive may dissolve, causing the joint to separate. If SuperDyma™ may be exposed to an environment containing organic solvents or similar substances or their vapors, join the sheets by welding or other methods instead of using adhesives.
(3) Some adhesives are flammable. Do not bring joints close to fire.
(4) Adhesives contain components that may poison or stimulate the skin or other body parts. Be sure to take protective measures in order to prevent adhesives from attaching to workers. Wear protective gloves, protective eyewear, and protective masks that block adhesives.
(5) When using adhesives, confirm their details by referring to adhesive manufacturers' material safety data sheets (MSDS).
(6) When joining a SuperDyma™ sheet with a sheet other than SuperDyma™, be sure to check the compatibility of the adhesive with the non-SuperDyma™ material. Some adhesives do not work on materials such as polyethylene and polypropylene.
(7) When heating SuperDyma™ in order to dry paint, take measures to prevent falling off during heating. The bonding strength may decrease in hot environments. Different adhesives have different temperature dependence characteristics. Check the adhesive to be used for the relationship between temperature dependence and the usage environment.
(8) Adhesives can cause unexpected failures or damage depending on their usage methods and usage conditions. To ensure safety, be sure to take measures to prevent separation and dropping off.

Other matters

(1) If the product is to be used at high temperatures for a long time, check the characteristics in advance.
(2) In the case of outdoor use, white spots may occur at a comparatively early stage (within several months) depending on the usage environment.

Unsuitable using environments for SuperDyma™

SuperDyma™ is not suitable for use in those environments listed below.
- Underwater, in running water, and environments with stagnant water (e.g., rainwater and alkali water)
- Environments with corrosive factors (e.g., volcanic ash, acid rain, industrial waste, exhausted smoke, gasses such as ammonia gas, and chemicals)

If used in such environments above, in some cases, SuperDyma™ cannot demonstrate its superiority, and red rust may occur sooner than in general usages.
Take measures to prevent adverse effects before use according to the details of the relevant case.

Ordering Guide

When placing an order, check the following items according to your intended application.

Standards

Select the most suitable material from among the standards described in this catalog according to the processing severity and method.

Coating mass

Select the most suitable coating mass according to the required corrosion resistance, usage conditions, and processing method.

Dimensions

Steel sheet dimensions (thickness, width, and length) are the basic condition that determines product yield. Design the product while referring to the range of available dimensions described in this catalog. Available dimensions are in 0.05-mm increments for thickness and 1-mm increments for width and length.

Coils

Select coils or cut sheets according to the shear and processing conditions.
Effective use of coils improves the product yield and enables continuous, automated operation. In the case of coils, however, some defective parts may unavoidably be included because they cannot be removed by inspection.

Edge finish

Select either mill edges or slit edges according to the usage conditions.

Surface treatment

Select the most suitable surface treatment from among those described in this catalog according to the post-processing treatment method and the usage conditions.

Oiling

Application of rust-preventive oil or non-oiling can be selected separately from the selection of surface treatment type. Oiling is recommended in order to improve intermediate-level rust resistance, to mitigate fingerprints and scratches during handling, and to maintain lubrication during press forming. Oiling is indispensable for steel sheets that do not undergo surface treatment.

Package mass

Specify the package mass according to the local loading/unloading capacity and workability. The larger coil mass per package, the better workability. For coils, specify the maximum mass (unit minimum mass if necessary).
The average package mass of actual shipments is determined by the maximum mass and the dimensions because the manufactured mass is divided.

Inside and outside coil diameters

For coils, specify the inside and outside coil diameters according to the specifications of the uncoilers on the shearing line. When selecting inside diameters, consider the occurrence of buckling and reel marks on the inner coil area based on the thickness.

Dimensional accuracy (Thickness, width, and length)

Manufactured products have dimensional accuracy for their thicknesses, widths, and lengths within the ranges described in this catalog. However, some cases require strict dimensional specifications because of assembly accuracy and the dimensional accuracy of parts, depending on the usage conditions of the finished products. In such cases, consult with us in advance before determining the specifications.

Applications, processing methods, and other matters

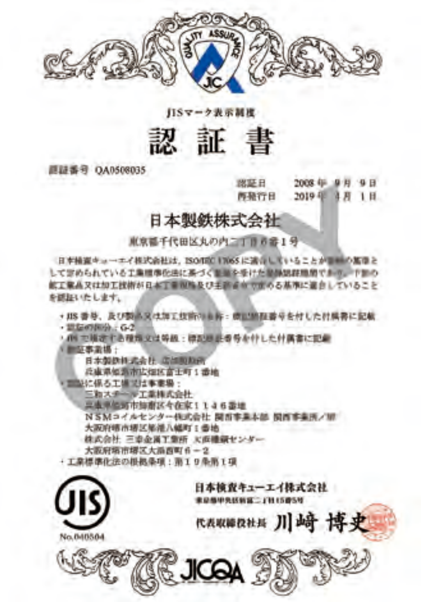
NIPPON STEEL implements quality control to better suit the intended application. To this end, we request that customers clarify their intended applications, processing methods, and other requirements.

Certifications and Awards

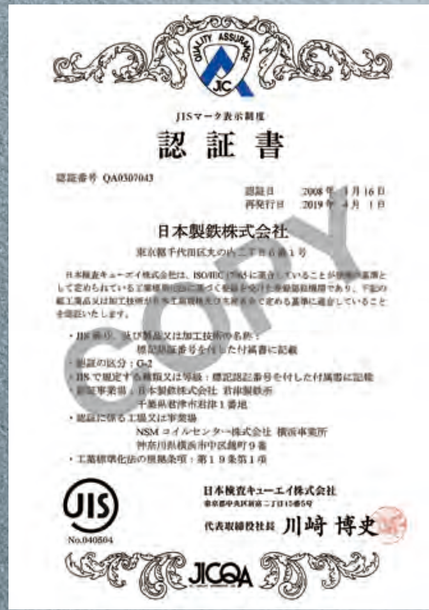
JIS certificates

SuperDyma™ has been certified to conform to the Japanese Industrial Standard JIS G 3323 (Hot-dip zinc-aluminum-magnesium alloy coated steel sheets and strip).

Hirohata Area of Setouchi Works
This plant has acquired the JIS certification of JIS G 3323 from JICQA.
A copy of the certificate is shown below.



Kimitsu Area of East Nippon Works
This plant has acquired the JIS certification of JIS G 3323 from JICQA.
A copy of the certificate is shown below.




Certificates under the Building Standards Act

Description	Approval numbers
SuperDyma™ has been certified by the Minister of Land, Infrastructure, Transport and Tourism as conforming to the provisions of Article 37-2 of the Building Standards Act.	Hirohata Area of Setouchi Works: MSTL-0069, MSTL-0362 Kimitsu Area of East Nippon Works: MSTL-0070, MSTL-0395

Hirohata Area of Setouchi Works


Kimitsu Area of East Nippon Works

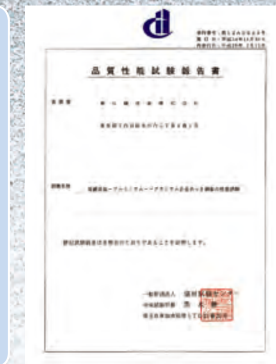

Production mill	Type symbol	Coating mass symbol	Thickness	Width	Surface treatment symbol (e.g., Y and QN)	Approval No.	Date of approval
Hirohata Area of Setouchi Works	NSDH400,NSDH490	K06～K45	1.6mm ≤ t ≤ 9.0mm	Not specified	Not specified	MSTL-0069	Jan. 28, 2002
Hirohata Area of Setouchi Works	NSDC400	K06～K45	0.4mm ≤ t ≤ 2.3mm	700mm～1700mm	Not specified	MSTL-0362	Mar. 19, 2012
Kimitsu Area of East Nippon Works	NSDH400,NSDH490	K06～K45	1.6mm ≤ t ≤ 2.3mm	Not specified	Not specified	MSTL-0070	Jan. 28, 2002
Kimitsu Area of East Nippon Works	NSDH400	K06～K45	2.3mm ≤ t ≤ 3.2mm	610mm～1840mm	Not specified	MSTL-0395	Dec. 27, 2012
Kimitsu Area of East Nippon Works	NSDC400,NSDC490	K06～K45	0.25mm ≤ t ≤ 2.3mm	Not specified	Not specified	MSTL-0070	Jan. 28, 2002

Special Assessment Method Certification under the Housing Quality Assurance Act (Issued on January 30, 2008)

SuperDyma™ has obtained special approval as a durable structural material for housing construction according to the provisions of Article 58-1 of the Housing Quality Assurance Act.

Performance Evaluation Report (Issued on November 30, 2012/Reissued on February 13, 2013)

The Japan Testing Center for Construction Materials (JTCCM) conducted 2,000-h neutral salt spray tests conforming to JIS Z 2371 (Methods of salt spray testing) on the following SuperDyma™ test pieces: (1) flat test pieces, (2) flat cross-cut test pieces, (3) 90-degree bending test pieces, and (4) 180-degree bending test pieces. JTCCM visually checked the test pieces for swelling of coating layers and red rust (which occurs due to substrate corrosion) every 500 h and issued a test report that found no abnormalities on all test pieces.



Construction Technology Review Certificate (Acquired on March 20, 2003/Content updated on June 24, 2019)

SuperDyma™ acquired the following technology review certificate from the Public Works Research Center.

Review certification

This technology has been reviewed in accordance with the intentions and goals of the development described above, and we conclude that SuperDyma™ has the following characteristics.

(1) Corrosion resistance
SuperDyma™ with a coating mass in the range of K18 to K45 satisfies the following items 1) to 3).
1) The corrosion resistance shall be superior to that of post-coating (JIS H 8641) HDZ55, and no red rust shall occur in the 2,000-h neutral salt spray test specified in JIS Z 2371.
2) With regard to bending, when a steel sheet is deformed by 1-t bending, the coating layer shall not separate, the corrosion resistance at the bent part shall be superior to that of post-coating (JIS H 8641) HDZ55, and no red rust shall occur in the 2,000-h neutral salt spray test specified in JIS Z 2371.
3) The corrosion resistance at the cut-end surface shall satisfy the following:
(i) For a sheet with a thickness of 1.6 mm or less, the corrosion resistance at the cut-end surface with no repair painting shall be equivalent to that of post-coating (JIS H 8641) HDZ55 in the 2,000-h neutral salt spray test specified in JIS Z 2371.
(ii) For a sheet with a thickness of 9.0 mm or less, the corrosion resistance at the cut-end surface with repair painting shall be superior to that of post-coating (JIS H 8641) HDZ55, and no red rust shall occur in the 2,000-h neutral salt spray test specified in JIS Z 2371.

(2) Shape and dimensional accuracy
SuperDyma™ with no heat distortion caused by coat can be manufactured.

(3) Lead time of processed products
Omitting post-coating processes shortens the lead time of processed products from order receipt to delivery.

Service: Review and certification of construction technology
(Civil engineering Materials, products, and technology for construction; road management technology)
Review and Certification of Construction Technology No. 0222 Public Works Research Center

Awards

SuperDyma™ has been praised for its advanced technology, performance, achievements, and contributions.
The product has **received the following distinguished awards**.

FY2012: **National Commendation for Invention "Invention Award*1"**

FY2013: **The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology "Prize for Science and Technology (Development category)*2"**

FY2013: **The 10th Eco-Products Awards "Chairperson's Award, Eco-Products Awards Steering Committee*3"**

*1: The National Commendation for Invention is hosted by the Japan Institute of Invention and Innovation (JIII). This Commendation originated as the first Imperial Commendation for Invention in 1919. Supported by the Ministry of Education, Culture, Sports, Science and Technology; the Ministry of Economy, Trade and Industry; the Japan Patent Office; the Japan Business Federation; the Japan Chamber of Commerce and Industry; the Japan Patent Attorneys Association; and the Asahi Shimbun Company; it commends persons who have achieved highly excellent, extremely original inventions; persons who have rendered distinguished services in the work of inventions; and persons who have greatly contributed to the promotion of excellent technology as well as to the guidance and development of human resources; for the purpose of contributing to the progress of science and technology as well as the development of industry. (Source: JIII's website)

*2: The Ministry of Education, Culture, Sports, Science and Technology (MEXT) presents the Commendation for Science and Technology by the Minister of MEXT to commend persons who have made distinguished achievements in the field of science and technology (e.g., research and development and the promotion of scientific studies) for the purpose of encouraging those engaged in science and technology, thereby contributing to raising the level of science and technology in Japan. (Source: MEXT website)

*3: The Eco-Products Awards were established in 2004 for the purpose of providing consumers with a wide range of information on environmentally friendly products and services (eco-products) by praising excellent products that give consideration to reduction of environmental load as well as the purpose of further promoting eco-products in Japan by supporting the efforts of companies that supply eco-products.

eco products awards 2013

To make the best use of SuperDyma™

Reference Fasteners selected for SuperDyma™

Highly corrosion-resistant SD Stainless Fasteners

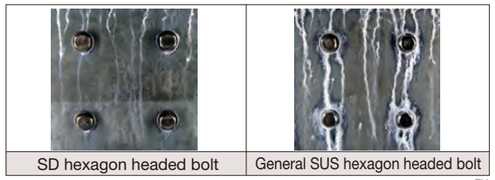
SUS guard treatment is applied to stainless fasteners to make SD Fasteners, which have improved corrosion resistance and are the best for SuperDyma™ steel sheets.

■SUS guard treatment
This original pretreatment improves the stainless steel surface properties and then chemically oxidizes the surface to generate a uniform, strong chromium oxide coating over the surface. It is a surface improvement treatment dedicated to stainless steel.

Examples of the SD Fastener Series

SD hexagon headed bolt **"Hard Bolt"** | SD concrete anchor **"TAP STAR"** | SD self-drill screw **"MB Techs"**

Contact corrosion test results (salt spray for 600 h) Test material (SuperDyma™ K27)



SD hexagon headed bolt | General SUS hexagon headed bolt

* SD hexagon headed bolts greatly suppress corrosion of SuperDyma™ due to the difference in voltage.

This section introduces fasteners used to join SuperDyma™ sheets. (Made by JPF Co., Ltd.)

Features of SD Fasteners

- These products further improve the corrosion resistance of stainless steel. They can be used for a long time in harsh corrosive environments such as coastal areas.
- SD stainless steel fasteners can be used for SuperDyma™ solar panel frames. SD Fasteners greatly suppress contact corrosion reliably.

Use case: Joining mega-solar panel frames

For inquiries about SD Fasteners, please contact
JPF Co., Ltd.
Marketing Dept., Sales Div.
TEL +81-3-3639-2600 FAX +81-3-3639-2606
MAIL : prd-info@jpf-net.co.jp
URL : www.jpf-net.co.jp

Reference Fasteners selected for SuperDyma™

Highly corrosion-resistant SD Fastening

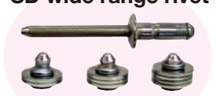
This section introduces fasteners for single-side work of joining SuperDyma™ steel sheets. (Made by Lobtex Fastening System Co., Ltd.)

High corrosion resistance | High performance | High strength | High vibration resistance

RUSPERT® Series

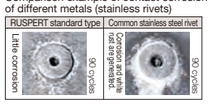
Blind rivet series

SD wide range rivet



* This photograph shows high-strength valve-type rivets.
3.0mm ⟷ 7.5mm

Comparison example of contact corrosion of different metals (stainless rivets)



SD eco S-bolt

A high-strength rivet made by applying high corrosion resistance surface treatment to a stainless steel shaft and a steel flange.

- Composite corrosion test (CCT) (JASO M609-91) Appearance after 50 cycles (Generally 50 CCT cycles correspond to 13 to 15 years in Tokyo.)
- No red rust generation. Stable anti-rust (corrosion prevention) performance

RUSPERT high-grade type

* The second layer is a tough film (about 15 μm).

SD Lock Certified by the Minister of Land, Infrastructure, Transport and Tourism

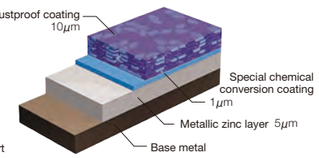
- Feature: High: strength connection by a single action
- Application: Joining members (e.g., closed-sectional areas) from a single side

Used in runway D of Haneda Airport.

ϕ10mm、ϕ12mm
Applicable thicknesses: 1 to 22 mm

■RUSPERT treatment
This surface treatment does not use a single substance to prevent rust; instead, it employs the synergy of three layers to achieve excellent performance in preventing contact corrosion of different metals. This high-grade anti-corrosion surface treatment technology goes well with SuperDyma™.

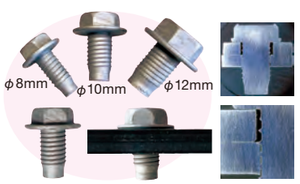
■NICOA treatment
This surface treatment builds a tough second layer with a thickness of about 15μm in which there is no difference in thickness between the flat area and the cut-end area. This high-grade anti-corrosion surface treatment is excellent in coating film followability responding to changes in the base metal.



* RUSPERT® and NICOA® are registered trademarks of Nihon Ruspert Co., Ltd.

DISGO Series

Tapping-type one-side bolt
SD Sure Twist (Patent pending)



- High application strength is ensured by plastically deforming the threads to the shape of the applied member.

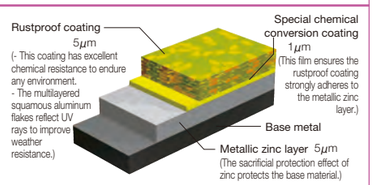
- **Anti-vibration performance**
Members with a certain minimum thickness conform to US National Aerospace Standard NAS3350.

- **Rustproof performance**
After 120 cycles in the composite cycle test (CCT) (JASO M609-91), no red rust was found.

* Equivalent to exposure for 40 years in a rural area

- **Waterproof performance**
Compliant with Japanese Industrial Standard JIS C 0920 IPX7

- **Application case**



For inquiries about high corrosion resistance SD Fastening, contact
Lobtex Fastening System Co., Ltd.
Head office TEL +81-3-5847-4100 FAX +81-3-5847-4101
URL : www.lobfs.com

Reference Bolts selected for SuperDyma™

Highly corrosion-resistant SG-coated bolts

This section introduces bolts used to join SuperDyma™ steel sheets. (Made by Kowa Kogyosho Co., Ltd.)

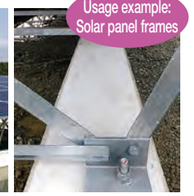
Features of SG coated bolts

- A hot-dip zinc-aluminum alloy coating is applied to common bolts. This provides higher corrosion resistance than hot-dip zinc coating and is optimal for harsh corrosive environments.
- The coating film is comprised mainly of zinc with about 12% aluminum and about 1% magnesium, which is roughly equivalent to SuperDyma's™ composition. Using them as joining bolts for SuperDyma™ sheets will never cause contact corrosion, thus ensuring high reliability.
- As it scarcely contains hazardous substances such as lead or cadmium, compliance with the RoHS Directives can be achieved.

■Product examples

M6 bolt | M8 bolt | M10 bolt | M30 bolt | M8U bolt

* For the available types and sizes, please visit our website.



Usage example: Solar panel frames

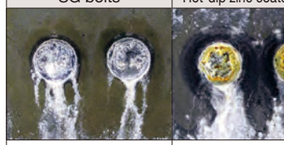
■Corrosion resistance

Composite cycle test (JASO M609)

- **Well suited to SuperDyma™**

The test was performed by applying various bolts to SuperDyma™ sheets (K27 with a thickness of 2.3 mm).

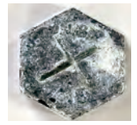
After 100 cycles

SG bolts	Hot-dip zinc coated bolts	SUS304 bolts
		
No contact corrosion. No red rust generation on the bolts.	No contact corrosion. Red rust generation on the bolts.	Contact corrosion generated. No red rust generation on the bolts.

Although white rust was generated on the SG bolts, the amount was significantly less than that of the SUS bolts, which indicates a good match. The SG bolts generated no red rust, demonstrating high corrosion resistance.

- **And scratch-resistant!**

After making scratches (width: approximately 1.5 mm) on SG coated bolts, a test was performed on them.



After 100 cycles

No red rust was generated in the scratched areas, which indicates that the SG coating protects the surface.

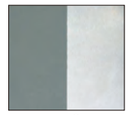
For inquiries about highly corrosion-resistant SG coated bolts, contact
Kowa Kogyosho Co., Ltd.
Mizuho Factory TEL +81-52-871-7141 FAX +81-52-871-6274
MAIL : s.g.mekki@at-kowa.co.jp
URL : www.at-kowa.co.jp

Reference Repair coating for SuperDyma™

ZinkyCoat SD

This section introduces repair coating for repairing welded areas and cut-end surfaces of SuperDyma™.

Coloring of ZinkyCoat SD



[Conventional product] Zinc-rich paint | **Super Dyma™**

ZinkyCoat SD (Sprayed coat) | **Super Dyma™**

Features of ZinkyCoat SD

- The hue matches NIPPON STEEL's SuperDyma™.
- The zinc-based special rust-resistant pigment exhibits excellent rust resistance.
- A brush type (can be air sprayed) and aerosol type are available.

Coating film characteristics

Item	Description
Resin	Epoxyester
Density	1.00±0.1
Nonvolatile content	39.0±1.5
Storage stability	6 months
Standard thickness	30μ

Paint properties (internal standard)

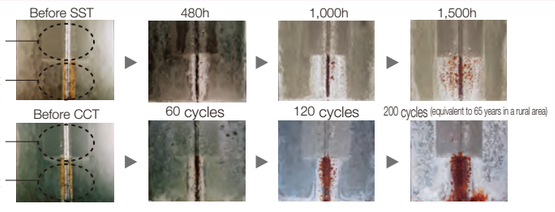
Item	Description
Salt spray test	No abnormalities for 480 h
Composite cycle test	No abnormalities after 60 cycles
Adherence test	100 / 100
Humidity test	No abnormalities
Dry-to-touch test	10分

ZinkyCoat SD for brush painting

ZinkyCoat SD spray

■ Net content
NET 4 kg set (for brush painting and for air spraying)
NET 300 mL/can (aerosol) 12 cans/box

Corrosion resistance of ZinkyCoat SD



For inquiries about ZinkyCoat SD, contact
NIPPON PAINT ANTI-CORROSIVE COATINGS CO., LTD.
Sales Div., Head Office
TEL +81-47-434-3113 FAX +81-47-433-9444
Osaka TEL +81-6-6455-9321 FAX +81-6-6455-9301
Fukuoka TEL +81-92-741-1501 FAX +81-92-741-1901
URL : https://www.np-boushoku.co.jp

* Before purchasing these products, please note that the products described in this section are subject to direct transactions between our customers and suppliers. We will not participate in such transactions, nor do we assume any responsibilities related to them. If any problem should occur in such a transaction, we ask our customers and suppliers to resolve the issue together.

Reference

Under-coating paint for SuperDyma™

NIPPE PowerBind®

This section introduces under-coating paint products to be used before conducting finish-coating on SuperDyma™ steel sheets.

Features of PowerBind

- Can be applied to various finish coating paint types.
- Does not contain hazardous heavy metal pigments (e.g., lead or chrome).
- Sick House Syndrome countermeasure product
  Formaldehyde emissions grade:
  F☆☆☆☆ (JPMA registration No. 2129)

SuperDyma™ steel sheet + Power Bind (Universal-type primer) +

- Melamine resin coating
- Acrylic resin coating
- Phthalic resin coating
- Urethane resin paint
- Epoxy resin coating
- Lacquer-type coating

Paint properties

Condition inside solvent	Good, no hard lumps
Density (20℃)	1.32±0.05
Viscosity (25℃)	65~75KU
Nonvolatile content	55±3%
Flash point	22℃
Ignition point	420℃ (for reference)

Volume: 16-kg oil can, 4-kg cylindrical can
Colors: Light gray (N7.5), white, and black

Indication

Danger sign	Class Ⅱ petroleum, Synthetic resin enamel coating
Degree of danger	Ⅲ
Organic solvent category	Contains class Ⅱ organic solvent
Organic substance indication	Xylene: 10 to 20%
	Butyl acetate: 5 to 10%
	Epoxy resin: Contained

For inquiries about PowerBind, contact

NIPPON PAINT CO., LTD

Tokyo Sales Office TEL +81-3-3740-1130 FAX +81-3-3740-1105
Nagoya Sales Office TEL +81-52-486-3005 FAX +81-52-481-4181
Osaka Sales Office TEL +81-6-6455-9121 FAX +81-6-6455-9258

MAIL : sugaya_npic2132@npc.nipponpaint.co.jp
URL : www.nippe-showbiz.com/function/power_b.html

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