



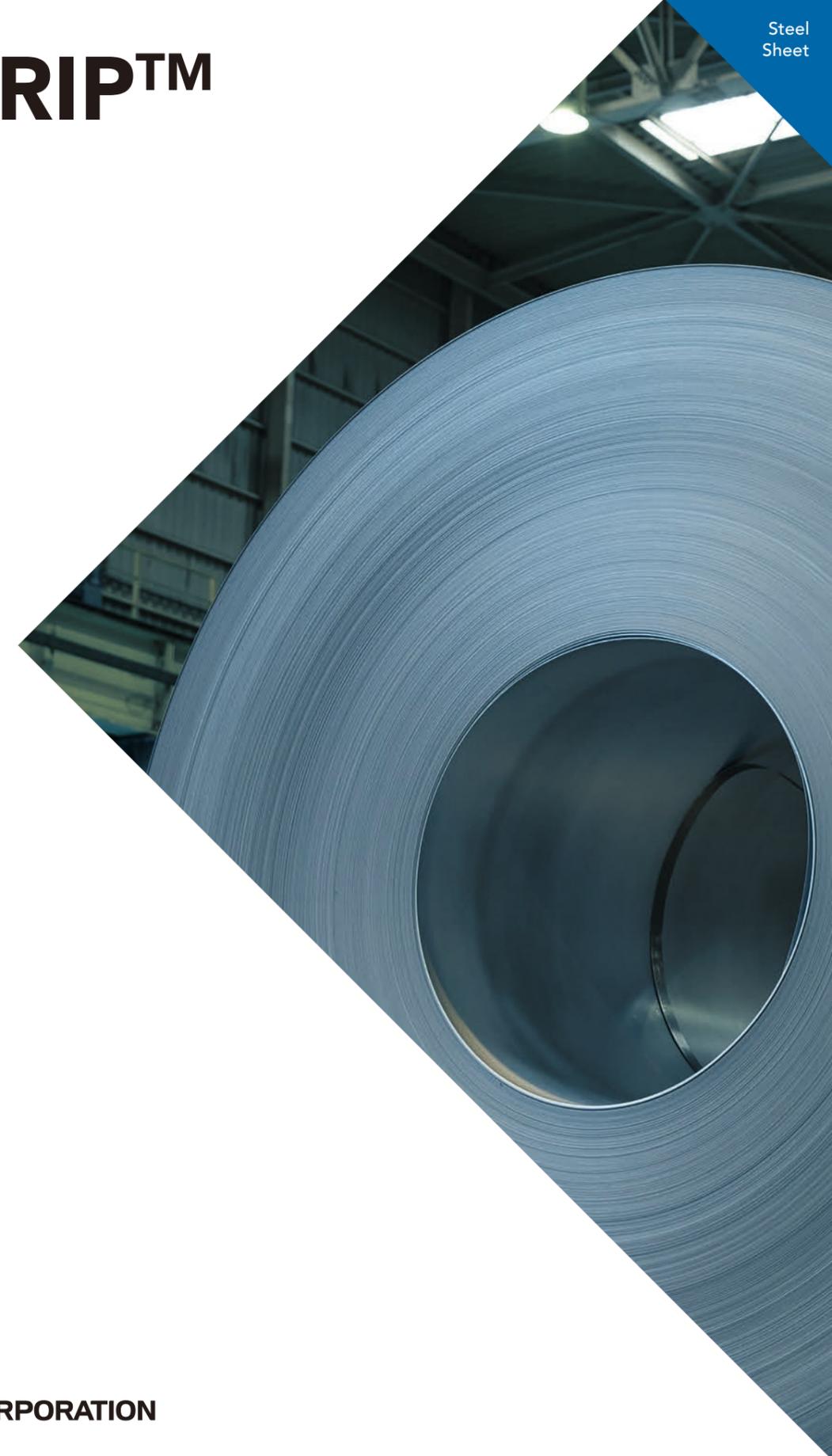
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DURGRIP™

Galvannealed

Steel
Sheet



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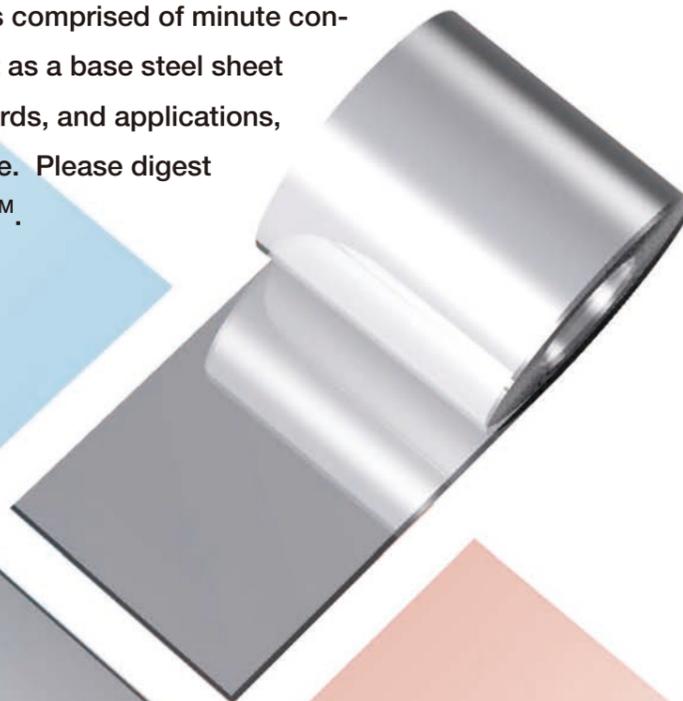
DURGRIP™
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NIPPON STEEL CORPORATION

Introduction

Galvanized steel sheet was previously better known as corrugated iron, which was mainly used for roofing and siding materials, as well as sundry goods, but its uses have recently expanded across a wider range of fields.

Among other types, DURGRIP™ – which is an alloyed hot-dip galvanized steel sheet – affords superior coating and welding performance than existing hot-dip galvanized steel sheet, and is widely used in vehicles, electrical equipment, and construction materials, etc. DURGRIP™ is heat-processed after hot dipping, and electroplated with a zinc-iron alloy. This surface is comprised of minute concave and convex irregularities, making this perfect as a base steel sheet for painting purposes. The characteristics, standards, and applications, etc. of DURGRIP™ are introduced in this catalogue. Please digest the details to confirm the superiority of DURGRIP™.



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Characteristics

1. Excellent corrosion-resistance properties

The degree of protection afforded by the steel sheet is every bit as good as conventional hot-dip galvanized steel sheet, but in addition, this surface has greater adhesion to paint, and after applying such coating, its corrosion resistance is further enhanced.

2. Superior painting efficacy

The ability of paint to adhere to this surface is markedly improved thanks to the slightly rough surface after Zn-Fe plating, making this optimal as a base steel sheet for painting.

3. Ease of welding

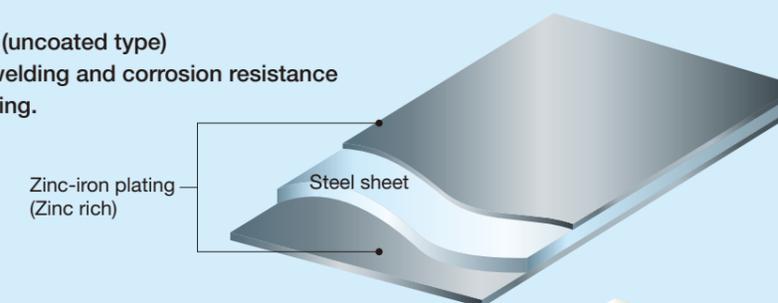
The Zn-Fe plating makes this product easier to weld than ordinary galvanized steel sheet.

4. Choice of materials available for wide range of applications

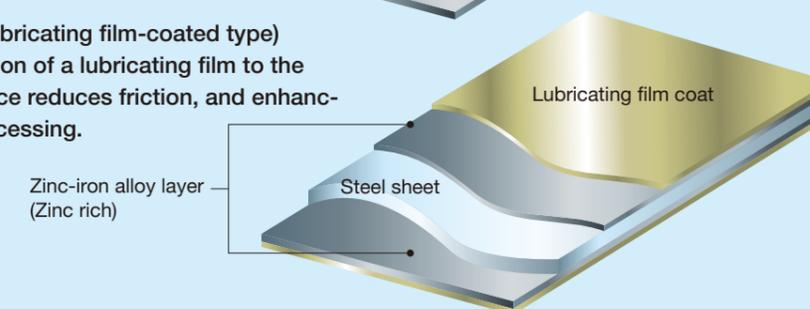
Select from a versatile range of materials designed to accommodate diverse needs, such as automotive, electrical equipment, and construction materials.

Two types of DURGRIP are available, namely uncoated and lubricating film-coated.

DURGRIP (uncoated type)
Superior welding and corrosion resistance after painting.



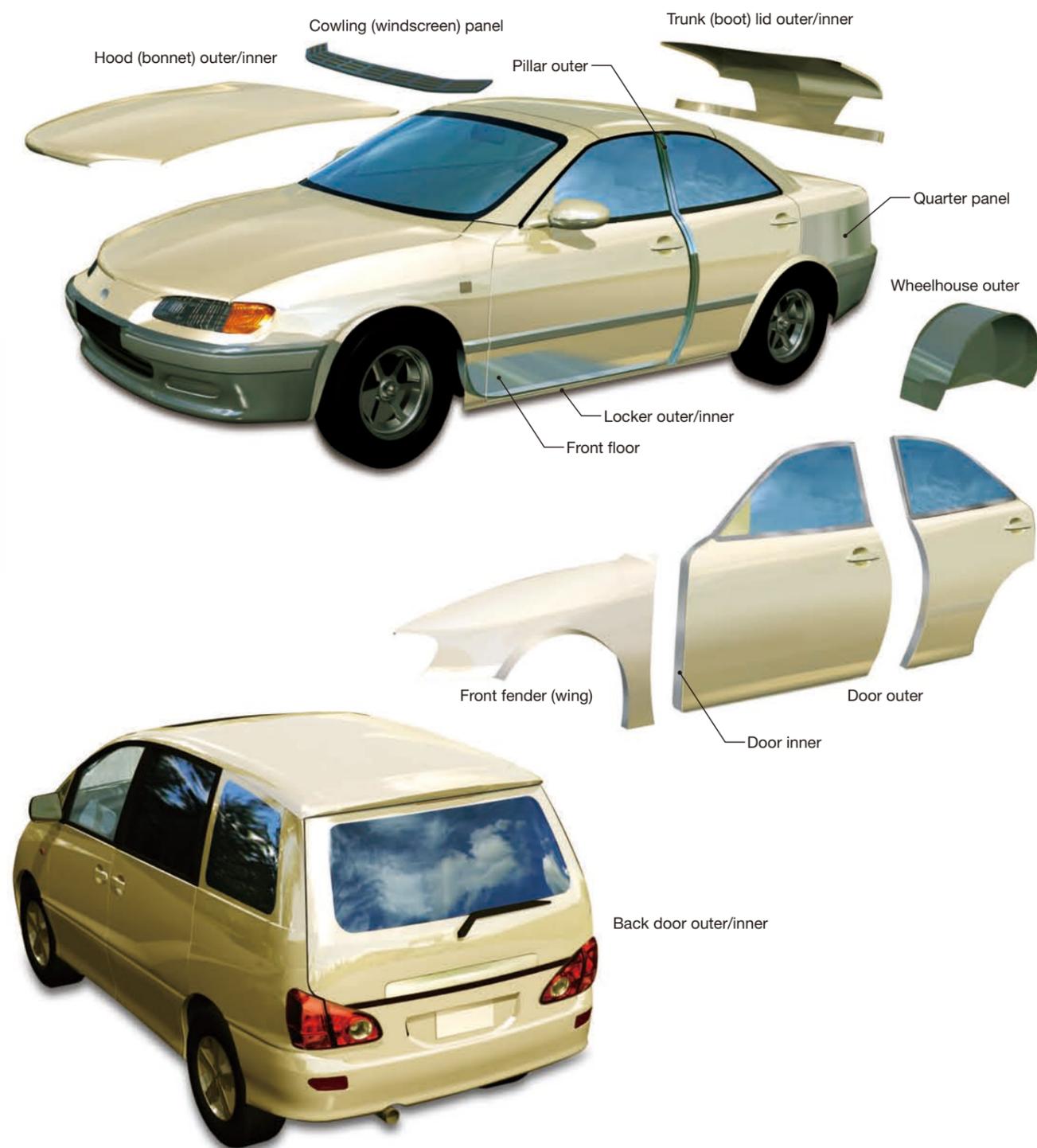
DURGRIP (lubricating film-coated type)
The application of a lubricating film to the plating surface reduces friction, and enhances press processing.



Examples of Product Uses

DURGRIP is a superior hot-dip galvanized steel sheet in terms of its corrosion-resistance after painting and weldability, making it well suited to uses requiring painted or welded components, notably for construction materials, vehicles, and electrical equipment.

Examples of applications for automotive components (Car exposed panels, unexposed panels, and parts)



Examples of applications for electrical equipment

- Washing machines
- Fridges
- Air conditioners
- Vending machines (external, side, back and bottom panels, parts)

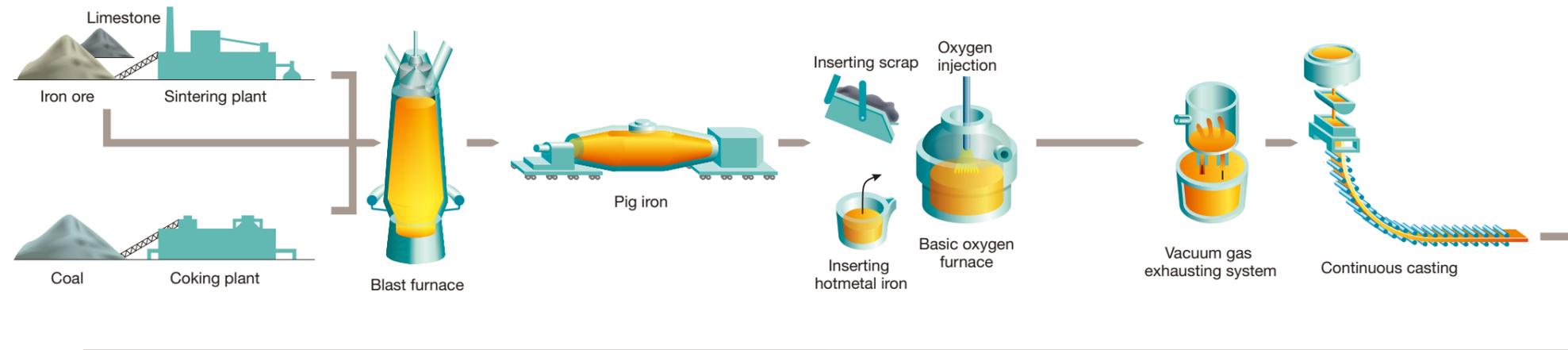


Examples of applications for architecture and furniture

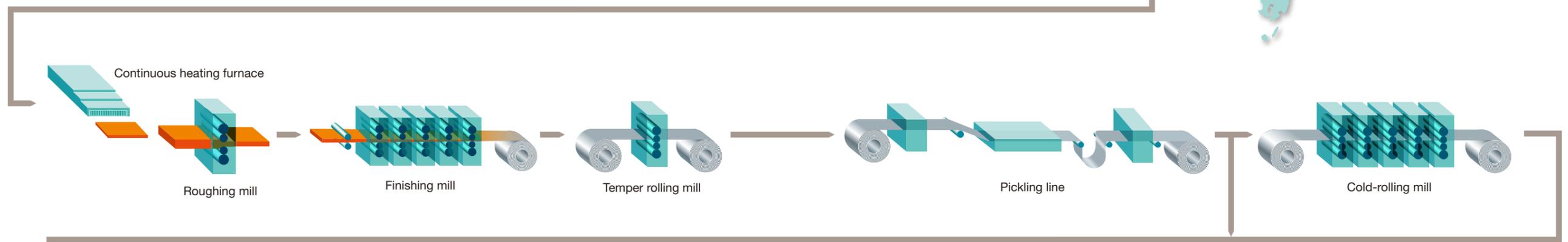
- Signboards, doors, sashes, shutters
- Cabinets, steel furniture
- OA equipment, etc.



Manufacturing Processes

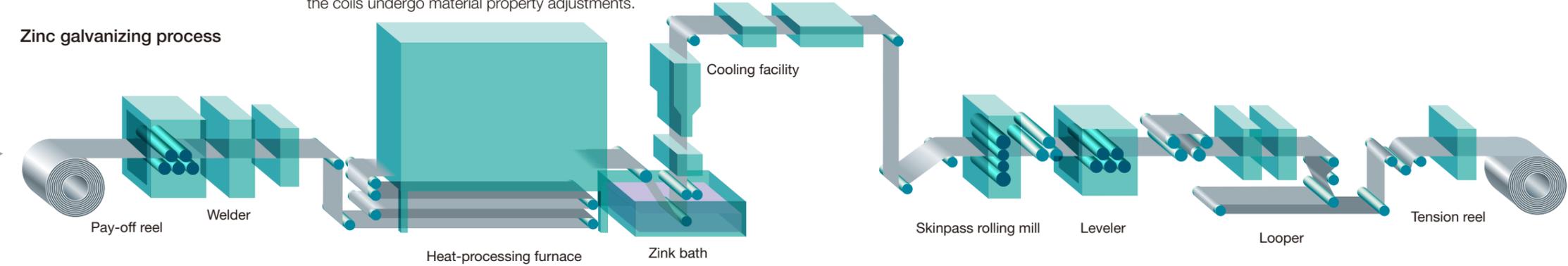


Manufacturing Location



Annealing
 In the heat-processing furnace, coils used for the base metal are subjected to surface treatments such as the cleansing of rolling oil and other deposits and the removal of oxides, and then, the coils undergo material property adjustments.

Zinc galvanizing process



Base Metal
 Hot-rolled or cold-rolled coils that comply with specific standards are used as the base metal for DURGRIP.

Hot-dip Galvanizing
 After the surfaces of the base metal are cleaned, the coils are immersed in a molten zinc bath to provide the zinc coating. The coating mass is adjusted by a gas wiping system immediately after the hot-dip galvanizing.

Alloying Process
 After passing through the zink bath, the sheet is appropriately heated in the alloying equipment to create an even zinc-iron alloy coating.

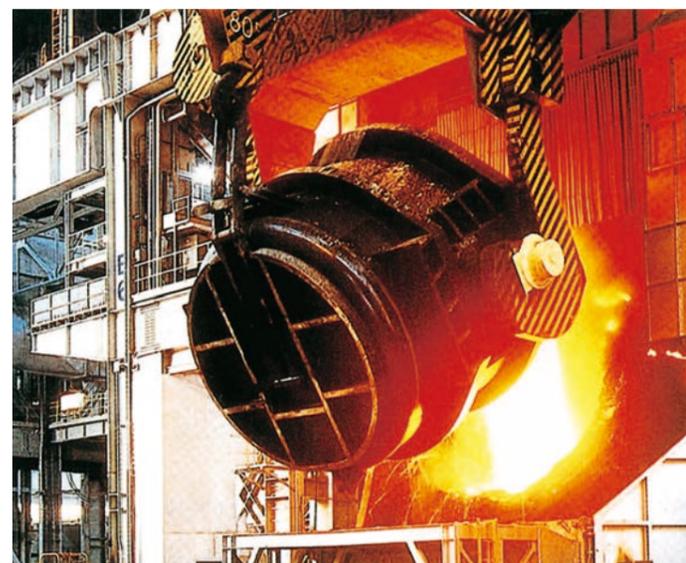
Surface Treatment
 DURGRIP is subjected to lubricating film-coated treatment or chromate-free treatment as required.



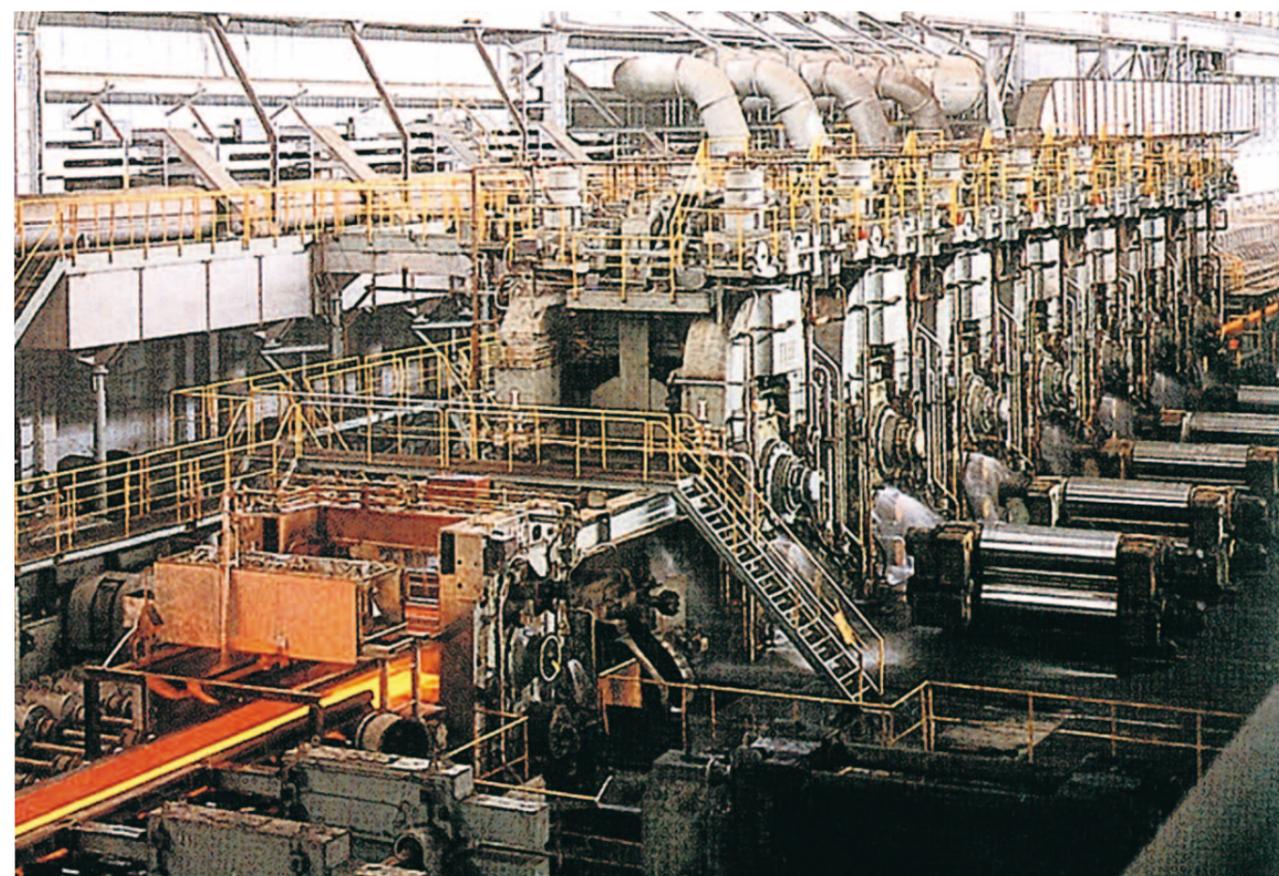
Manufacturing Equipment

Constant Casting from the Blast Furnace

Pig iron is extracted through the chemical reaction of iron ore and coke. In order to process the extracted pig iron into strong yet flexible steel to meet the quality requested by customers, surplus carbon and impurities must be removed, and the chemical constituents adjusted through four processes – namely pre-molten iron treatment, rotating furnace, secondary refining, and constant casting – to create “slabs” as the interim material.



Rotating furnace



Hot rolling

From Hot Rolling to Acid Pickling

In the rolling process, base metals (hot-rolled coils) with minimal surface scratches or internal defects that are good for processing are manufactured by strictly controlling the temperature and roll surface, etc. All processes – from insertion through heating the furnace to completion of coiling – are computer controlled, with the quality of each product precisely controlled with dynamic and swift management.

Hot-rolled coils used for base metals continuously undergo acid pickling, and any scaling on the surface (iron oxide film) is removed to prepare for beautiful surfaces in the latter process.

Cold Rolling

For orders that require a cold-rolled base metal, the sheets are processed to the prescribed thickness by cold rolling after acid pickling.

The important points for cold-rolling quality are the sheet thickness accuracy and flatness. We manufacture high quality cold-rolled coils as base metal with to a fine degree of tolerance in sheet thickness by using superior automated sheet thickness controllers and cutting-edge shape controllers.



Cold rolling



Constant hot-dip galvanizing (Annealing)



Constant hot-dip galvanizing (Plating)

Electrolytic Cleaning, Annealing, Plating, Post-processing

Any oil that becomes attached in the cold-rolling process is removed by electrolytic cleaning, which is followed by annealing and plating. Crystalline structures in cold-rolled coils are stretched in the rolling direction creating a hard but fragile material. In the annealing process, it is heated and kept in a gaseous reducing atmosphere to recrystallize, and materials suited to the standards set for the purpose and usage application are manufactured. Next, they are immersed in a molten zinc galvanizing tank for the zinc coating. The coating mass is adjusted by gas wiping immediately after the hot-dip galvanizing.

After the addition of this coating, they are heated appropriately in the alloying equipment, the iron fuses into the coating layer to form an alloyed coating of zinc and iron, which affords superior characteristics in terms of corrosion resistance, painting, and welding. Additionally, the provision of a lubricating film coating can enhance pressing for some customers.

Manufacturing Specifications

Type (JIS Specifications) JIS G-3302-2010 (abstract)

Cold-rolled Base Metal Coils

Type	Designation	Nominal thickness (mm)
Commercial	SGCC	0.25 ~ 3.2
Drawing	Grade 1 SGCD1	0.40 ~ 2.3
	Grade 2 SGCD2	0.40 ~ 2.3
	Grade 3 SGCD3	0.60 ~ 2.3
Structural	340N class SGC340	0.25 ~ 3.2
	400N class SGC400	0.25 ~ 3.2
	440N class SGC440	0.25 ~ 3.2

- Notes:
- Nominal thicknesses other than those listed in the above table are subject to agreement between the producer and purchaser.
 - On the above type designations, F04~F12 indicates the coating mass, but F10 and F12 are not applicable to Drawing Grades 1, 2, and 3.

Type (NIPPON STEEL Standards)

Cold-rolled Base Metal Coils

Type	Designation	Equivalent JF Standards
Commercial	NSACC	—
Drawing	Grade 1 NSAC270C	JAC270C
	Grade 2 NSAC270D	JAC270D
	Grade 3 NSAC270E	JAC270E
	Grade 4 NSAC270F	JAC270F
	Grade 5 NSAC270G	JAC260G
Drawing, high strength, bake-hardened type	340N class NSAC340BH	JAC340H
Commercial, high strength	340N class NSAC340	—
	400N class NSAC400	—
	440N class NSAC440	—
Drawing, high strength	340N class NSAC340R	JAC340W
	370N class NSAC370R	—
	390N class NSAC390R	JAC390W
	440N class NSAC440R	JAC440W
Automotive, high strength	590N class NSAC590N	JAC590R
High burring, high strength	440N class NSAC440B	JAC440A
	590N class NSAC590B	JAC590A
Deep drawing, high strength	340N class NSAC340E	JAC340P
	370N class NSAC370E	—
	390N class NSAC390E	JAC390P
	440N class NSAC440E	JAC440P
Low yield ratio, high strength	590N class NSAC590D	JAC590Y
	780N class NSAC780D	JAC780Y
	980N class NSAC980D	JAC980Y
	1180N class NSAC1180D	JAC1180Y
High formability, high strength	590T class NSAC590T	JAC590T
	780T class NSAC780T	JAC780T
Hot Stamping	1500 class NSSQA1500	—

- Notes:
- If NSAC270E, NSAC270F, and NSAC270G are covered by a non-aging guarantee, they are tagged with an N at the end of the designation code to create NSAC270EN, NSAC270FN, and NSAC270GN. Non-aging refers to properties that do not cause stretcher strains during press forming, and are guaranteed for six months after manufacture.
 - When the above types are selected, 030-090 is applied as the coating mass designation code for equal coatings on both sides.

Hot-rolled Base Metal Coils

Type	NIPPON STEEL designation	Nominal thickness (mm)
Commercial	SGHC	1.6 ~ 4.5
Structural	340N class SGH340	1.6 ~ 4.5
	400N class SGH400	1.6 ~ 4.5
	440N class SGH440	1.6 ~ 4.5

- Note:
- On the above type designations, F04~F12 indicates the coating mass.

Hot-rolled Base Metal Coils

Type	Designation	Equivalent JF Standards
Commercial	NSAHC	—
Commercial automotive use	NSAH270C	JAH270C
Drawing	Grade 1 NSAH270D	JAH270D
	Grade 2 NSAH270E	JAH270E
Commercial, high strength	340N class NSAH340	—
	400N class NSAH400	—
	490N class NSAH490	—
Commercial automotive, high strength	310N class NSAH310N	—
	370N class NSAH370N	JAH370W
	440N class NSAH440N	JAH440W
Automotive drawing, high strength,	490N class NSAH490R	—
	590N class NSAH590R	JAH590R
High burring, high strength	440N class NSAH440B	JAH440A
	590N class NSAH590B	JAH590A
	780N class NSAH780B	JAH780A
For use in steel pipes	270N class NSAHT270	—
	340N class NSAHT340	—
	410N class NSAHT410	—
	490N class NSAHT490	—

- Notes:
- When the above types are selected, 030-090 is applied as the coating mass designation code for equal coatings on both sides.

Coating Mass

(Unit: g/m²)

Type of Coating	Coating mass (designation)	Minimum coating mass			
		Both sides (triple spot method)	Both sides (one spot method)	Obverse side (triple spot method)	Reverse side (triple spot method)
Equal coating on both sides (designation on both sides) [JIS]	F04	40	34	—	—
	F06	60	51	—	—
	F08	80	68	—	—
	F10	100	85	—	—
	F12	120	102	—	—
	(F18)	180	153	—	—
Equal coating on both sides (designation on one side) [NIPPON STEEL standards]	030	—	—	20	20
	045	—	—	30	30
	060	—	—	40	40
	080	—	—	55	55
	090	—	—	60	60

- Notes:
- Please consult us in advance about any coating mass designations in parentheses.
 - In the case of differentiated coating masses, mass designation codes with the opposite obverse/reverse codes are also available. i.e.: 030/045 ⇔ 045/030

Surface Treatments (JIS Standards)

Type of surface treatment	Designation
Chromate treatment	C
Chromate-free treatment	NC
No Treatment	M

Skin-Pass Rolling (JIS Standards and NIPPON STEEL Specifications)

Type	Designation
Specification for Skin-Pass Rolling	S
No Specification for Skin-Pass Rolling	—

Surface Treatments (NIPPON STEEL Specifications)

Type of surface treatment	Designation
Chromate treatment	C
Chromate-free treatment (organic, general-purpose)	QM
Chromate-free treatment (inorganic, lubricant)	FN
Automotive lubricant treatment	L, V
No Treatment	M

Oiling (NIPPON STEEL Specifications)

Type	Designation
Heavily oiled	H
Normally oiled	N
Lightly oiled	L
Non-oiled	X

Oiling (JIS Standards)

Type	Designation
Oiled	O
Non-oiled	X

Coating mass and applicable thickness

Coating mass Thickness (mm)	F04 030	F06 045	F08 060	F10 070	F12 090	F18 120
0.35						
0.4						
0.5						
0.55						
0.6						
0.8						
1						
1.4						
1.6						
2						
3						
3.2						
4.5						

- : Can be manufactured
□ : Please consult us in advance

Manufacturing Specifications

Size Tolerance

Thickness tolerances are applied to the total values of nominal plate thickness and corresponding coating thickness.

Cold-rolled Base Metal

(units: mm)

Nominal thickness	Width				
	<630	630≤t<1,000	1,000≤t<1,250	1,250≤t<1,600	1,600≤
<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≤	±0.17	±0.18	±0.20	±0.21	—

Note: Thickness shall be measured from an optimal spot at least 25 mm inside the edge.

Base Metal (Hot-Rolled Coils)

Commercial quality using hot-rolled coils

(Unit: mm)

Nominal thickness	Width			
	<1,250	1,250≤t<1,500	1,500≤t<1,800	1,800≤t<2,300
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	±0.27
3.15≤t<4.00	±0.22	±0.24	±0.27	±0.28
4.00≤t<5.00	±0.25	±0.27	—	—
5.00≤t<6.00	±0.27	±0.29	—	—
6.00≤	±0.30	±0.31	—	—

Notes:

- Thickness shall be measured from an optional spot 25 mm or more inside from the edge.
- This tolerance shall be applied to widths under 2,000 mm.

Corresponding Coating Thickness

Coating mass designation	F04	F06	F08	F10	F12	F18	030	045	060	090
Corresponding coating thickness	0.008	0.013	0.017	0.021	0.026	0.034	0.008	0.012	0.016	0.026

Note: The corresponding coating thickness is calculated using a density of 7.1 g/m² and the calculated value is rounded down to the third decimal place according to JIS Z 8401.

Width Tolerances

(unit: mm)

Classification of Width	Base Metal	In the case of using hot-rolled coils	
		In the case of using cold-rolled coils	Classification of tolerance A (mill edge) / Classification of tolerance B (cut edge)
≤1,500	+7 0	+25 0	+10 0
1,500<	+10 0		

Note: 1. In the case of using hot-rolled coil base metal, "B" is commonly used as the classification of tolerance. 2. Classification of Tolerance A: Mill edge B: Cut edge

Cold-rolled Base Metal with tensile limit lowered to 780 N/m²

(Unit: mm)

Nominal thickness	Width	
	<1,250	1,250≤t<1,600
0.60≤t<0.80	±0.08	±0.09
0.80≤t<1.00	±0.09	±0.10
1.00≤t<1.25	±0.11	±0.12
1.25≤t<1.60	±0.12	±0.14
1.60≤t<2.00	±0.14	±0.16
2.00≤t≤2.30	±0.16	±0.18

Note:

Thickness shall be measured from an optimal spot at least 25 mm inside the edge.

Base Metal (Hot-Rolled Coils)

Structural quality using hot-rolled coils

(Unit: mm)

Nominal thickness	Width	
	<1,600	1,600≤t<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	±0.35
4.00≤t<5.00	±0.46	—
5.00≤t≤6.00	±0.51	—

Note:

Thickness shall be measured from an optional spot 25 mm or more inside from the edge.

Mechanical Properties (JIS Standards) JIS G 3302-2012 (abstract)

Base Metal (Cold-Rolled Coils)

Type	Designation	Tensile Test								Test piece (JIS)	
		Yield point (N/mm ²)	Tensile strength (N/mm ²)	Elongation (%)							
				Nominal thickness (mm)							
Commercial	SGCC	(205≤)	(270≤)	—	—	—	—	—	—	No. 5 rolling direction	
Drawing	Grade 1	SGCD1	—	270≤	—	34≤	36≤	37≤	38≤		—
	Grade 2	SGCD2	—	270≤	—	36≤	38≤	39≤	40≤		—
	Grade 3	SGCD3	—	270≤	—	38≤	41≤ (40≤)	43≤ (41≤)	44≤ (42≤)	—	
Structural	40N class	SGC340	245≤	340≤	20≤	20≤	20≤	20≤	20≤	20≤	No. 5 rolling direction or perpendicular to the rolling direction
	400N class	SGC400	295≤	400≤	18≤	18≤	18≤	18≤	18≤	18≤	
	440N class	SGC440	335≤	440≤	18≤	18≤	18≤	18≤	18≤	18≤	

Notes:

- Figures in parentheses are for reference.
- Figures in parentheses are JIS Standards, but NIPPON STEEL guarantees the upper values.
- If non-aging is specified for SGCD3, it is guaranteed for six months after shipping from the manufacturer.
- Tensile tests are not generally conducted for nominal thicknesses of less than 0.25 mm.

Base Metal (Hot-Rolled Coils)

Type	Designation	Tensile Test				
		Yield point (N/mm ²)	Tensile strength (N/mm ²)	Elongation (%) Nominal thickness (1.6 mm≤)	Test piece (JIS)	
Commercial	SGHC	(205≤)	(270≤)	—	No. 5 rolling direction	
Structural	340N class	SGH340	245≤	340≤	20≤	No. 5 rolling direction or perpendicular to the rolling direction
	400N class	SGH400	295≤	400≤	18≤	
	440N class	SGH440	335≤	440≤	18≤	

Note: Figures in parentheses are for reference.

Length Tolerances

(unit: mm)

In the case of using cold-rolled coils	In the case of using hot-rolled coils
+15 0	+15 0

Manufacturing Specifications

Mechanical Properties (NIPPON STEEL Specifications)

Base Metal (Cold-rolled Coils)

Type	Designation	Yield Point or Yield Resistance (N/mm ²)	Tensile Strength (N/mm ²)	Bake-hardening value (N/mm ²)	Hole expansion rate (%)	Tensile Test								Test piece / Test direction	
						Elongation (%)									
						Nominal Thickness (mm)									
		0.25≤t<0.40	0.40≤t<0.60	0.6≤t<0.8	0.8≤t<1.0	1.0≤t<1.2	1.2≤t<1.6	1.6≤t<2.0	2.0≤t<2.5	2.5≤					
Commercial	NSACC	(205≦)	(270≦)			—	—	—	—	—	—	—	—	—	JIS No. 5 rolling direction
Drawing	Grade 1	NSAC270C	—	270≦		—	34≦	36≦	36≦	37≦	37≦	38≦	38≦	39≦	
	Grade 2	NSAC270D	—	270≦		—	36≦	38≦	38≦	39≦	39≦	40≦	40≦	41≦	
	Grade 3	NSAC270E ^{a)}	—	270≦		—	38≦	41≦	41≦	43≦	43≦	44≦	44≦	44≦	
	Grade 4	NSAC270F ^{a)}	—	270≦		—	40≦	43≦	43≦	45≦	45≦	46≦	46≦	46≦	
	Grade 5	NSAC270G ^{a)}	—	270≦		—	43≦	46≦	46≦	48≦	48≦	49≦	49≦	49≦	
Commercial, high strength	340N class	NSAC340	245≦	340≦		(20≦)	20≦	20≦	20≦	20≦	20≦	20≦	20≦	20≦	
	400N class	NSAC400	295≦	400≦		(18≦)	18≦	18≦	18≦	18≦	18≦	18≦	18≦	18≦	
	440N class	NSAC440	335≦	440≦		(18≦)	18≦	18≦	18≦	18≦	18≦	18≦	18≦	18≦	
Drawing, high strength, bake-hardened type	340N class	NSAC340BH	(195≦)	340≦	30≦	—	32≦	34≦	35≦	36≦	37≦	38≦	39≦	39≦	
Drawing, high strength	340N class	NSAC340R	185≦	340≦		—	32≦	34≦	35≦	36≦	37≦	38≦	39≦	39≦	
	370N class	NSAC370R	205≦	370≦		—	31≦	33≦	34≦	35≦	36≦	37≦	38≦	38≦	
	390N class	NSAC390R	225≦	390≦		—	29≦	31≦	32≦	33≦	34≦	35≦	36≦	36≦	
	440N class	NSAC440R	265≦	440≦		—	27≦	29≦	30≦	30≦	31≦	31≦	32≦	32≦	
Automotive manufacturing, high strength	590N class	NSAC590N	390≦	590≦		—	—	17≦	17≦	18≦	18≦	18≦	19≦	19≦	
	High burring, high strength	440N class	NSAC440B	265≦	440≦		(60≦)	—	27≦	29≦	30≦	31≦	31≦	32≦	32≦
Deep drawing, high strength	590N class	NSAC590B	as per table on the right	590≦		(45≦)	—	—	14~29	15~30	16~31	17~32	17≦	17≦	
	340N class	NSAC340E	165≦	340≦	—	—	—	32≦	34≦	35≦	36≦	37≦	—	—	
	370N class	NSAC370E	205≦	370≦	—	—	—	31≦	33≦	34≦	35≦	36≦	—	—	
	390N class	NSAC390E	225≦	390≦	—	—	—	29≦	31≦	32≦	33≦	34≦	—	—	
Low yield ratio, high strength	440N class	NSAC440E	265≦	440≦	—	—	—	27≦	29≦	30≦	31≦	—	—	—	
	590N class	NSAC590D	as per table on the right	590≦	—	—	—	—	17~32	18~33	19~34	20~35	21≦	21≦	
	780N class	NSAC780D	as per table on the right	780≦	—	—	—	—	12~25	13~26	14~27	15~28	16≦	16≦	
980N class	NSAC980D	as per table on the right	980≦	—	—	—	—	—	9~20	10~21	11~22	12≦	12≦	—	

Designation	Yield point or yield resistance (N/mm ²)		
	Nominal thickness (mm)		
	0.60≤t<0.80	0.80≤t<1.00	1.00≤t<2.3
NSAC590B	370~590	360~580	350~570
NSAC590D	325~470	315~460	305~450
NSAC780D	420~645	410~635	400~625
NSAC980D	—	590~930	580~920

- Notes:
- For the paint bake-hardening value (BH amount), the yield point increase amount is shown after a 2% pre-strain and heating at 170°C for about twenty minutes.
 - Data for hole expansion is for reference. Details may be agreed upon between the producer and purchaser. The hole expansion rate is as per on JFS T 1001 (hole expansion test method).
 - Figures in parentheses are for reference.
 - Figures in parentheses may be agreed upon between the producer and purchaser.
 - If non-aging is specified for NSAC270E, NSAC270F, and NSAC270G, they are guaranteed for six months after manufacture. Non-aging refers to properties that do not cause stretcher strains during press forming.

Base Metal (Hot-rolled coils)

Type	Designation	Yield Point or Yield Resistance (N/mm ²)	Tensile Strength (N/mm ²)	Hole expansion rate (%)	Tensile Test					Test piece / Test direction	
					Elongation (%)						
					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≤					
Commercial	NSAHC	(205≦)	(270≦)	—	—	—	—	—	—	—	JIS No. 5 rolling direction
Commercial, automotive	NSAH270C	(≦333)	270≦	—	29≦	29≦	29≦	31≦	31≦		
Drawing	Grade 1	NSAH270D	—	270≦	—	32≦	33≦	35≦	37≦	39≦	
	Grade 2	NSAH270E	—	270≦	—	33≦	35≦	37≦	39≦	41≦	
Commercial, high strength	340N class	NSAH340	245≦	340≦	—	20≦	20≦	20≦	20≦	20≦	
	400N class	NSAH400	295≦	400≦	—	18≦	18≦	18≦	18≦	18≦	
	440N class	NSAH440	335≦	440≦	—	18≦	18≦	18≦	18≦	18≦	
	490N class	NSAH490	365≦	490≦	—	16≦	16≦	16≦	16≦	16≦	
Commercial, automotive, high strength	310N class	NSAH310N	(185≦)	310≦	—	33≦	34≦	36≦	38≦	40≦	
	370N class	NSAH370N	225≦	370≦	—	32≦	33≦	35≦	36≦	37≦	
	400N class	NSAH400N	255≦	400≦	—	31≦	32≦	34≦	35≦	36≦	
	440N class	NSAH440N	305≦	440≦	—	29≦	30≦	32≦	33≦	34≦	
High burring, high strength	440N class	NSAH440B	305≦	440≦	(70≦)	29≦	30≦	32≦	33≦	34≦	

Base Metal (Hot-rolled coils)

Type	Designation	Yield Point or Yield Resistance (N/mm ²)	Tensile Strength (N/mm ²)	Hole expansion rate (%)	Tensile Test					Test piece / Test direction	
					Elongation (%)						
					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≤					
Drawing, automotive, high strength	490N class	NSAH490R	345≦	490≦	—	22≦	23≦	24≦	25≦	27≦	JIS No. 5 perpendicular to rolling direction
	590N class	NSAH590R	440≦	590≦	—	17≦	18≦	18≦	—	—	

Type	Designation	Yield Point or Yield Resistance (N/mm ²)	Tensile Strength (N/mm ²)	Tensile Test			Test piece / Test direction	
				Elongation (%)				
				Nominal Thickness (mm)				
		1.4≤t<1.6	1.6<t≤3.0	3.0<t≤4.5				
For use in steel pipes	270N class	NSAHT270	—	270≦	30≦	32≦	35≦	JIS No. 5 rolling direction
	340N class	NSAHT340	—	340≦	25≦	27≦	30≦	
	410N class	NSAHT410	—	410≦	20≦	22≦	25≦	
	490N class	NSAHT490	—	490≦	15≦	18≦	20≦	

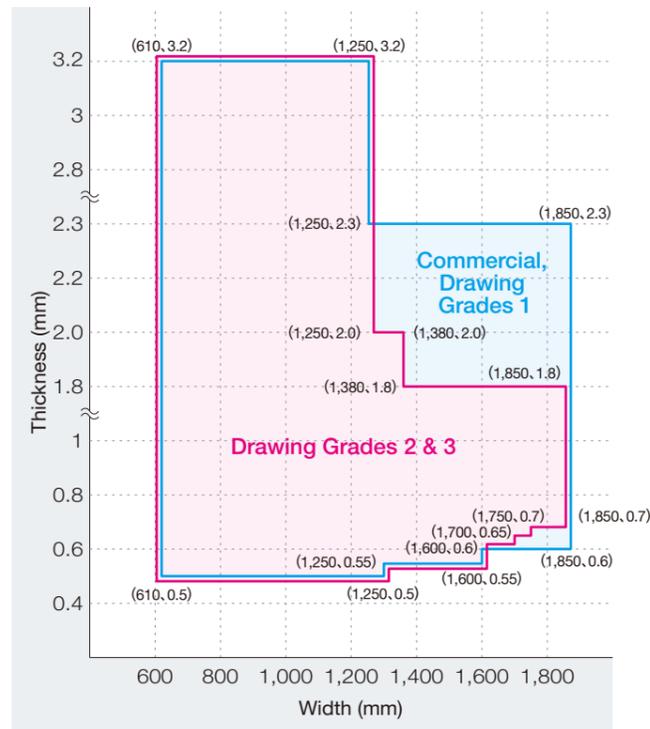
- Notes:
- Data for hole expansion is for reference. Details may be agreed upon between the producer and purchaser. The hole expansion rate is as per on JFS T 1001 (hole expansion test method).
 - Figures in parentheses are for reference.

Scope of Manufacturing

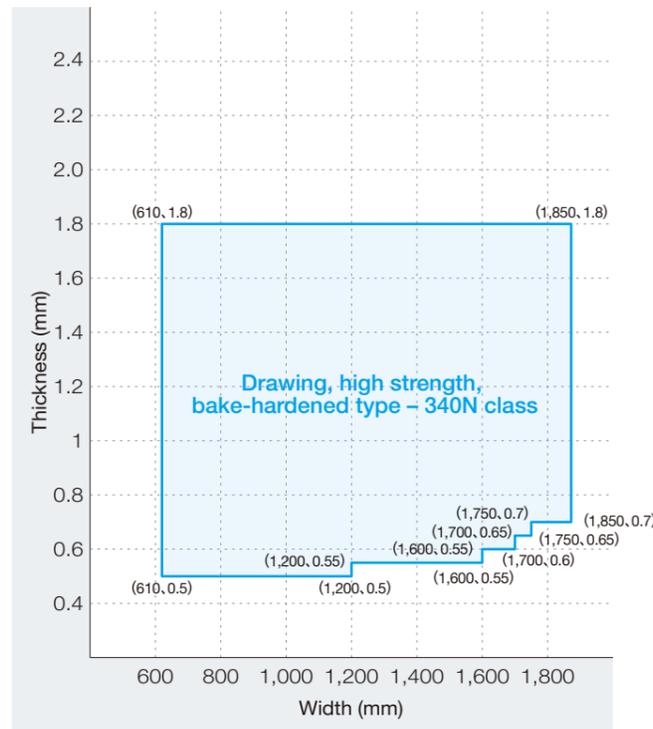
Available Sizes for Nominal Thickness and Width

For orders other than shown, please consult us in advance per product.

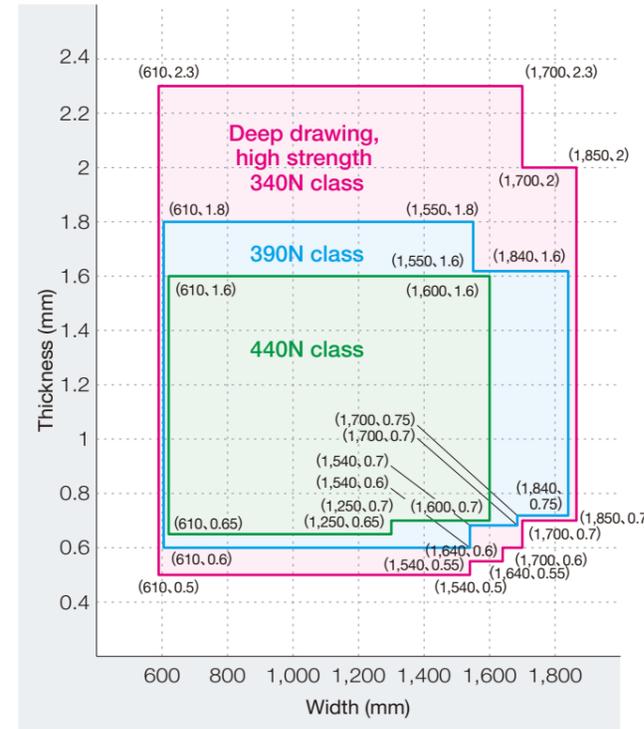
Commercial, Drawing Grades 1, 2 and 3
(base metal: cold-rolled coils)



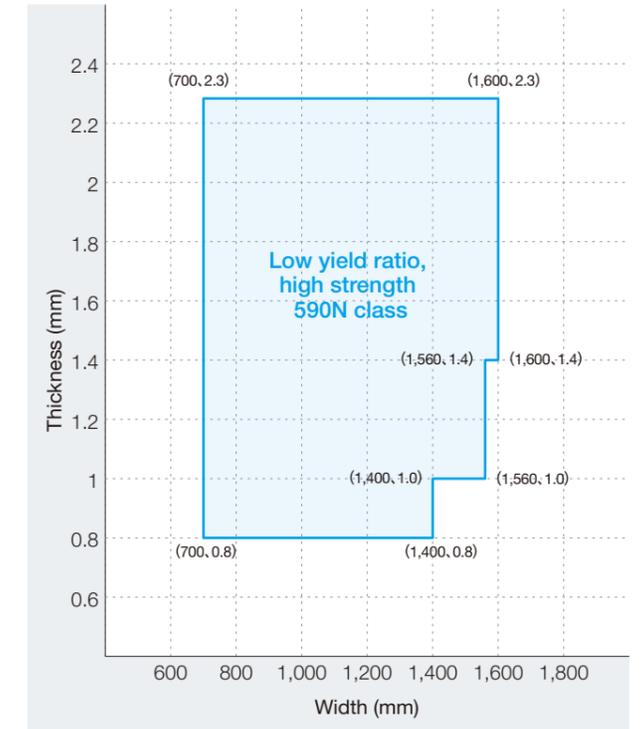
Drawing, high strength, bake-hardened type – 340N class
(base metal: cold-rolled coils)



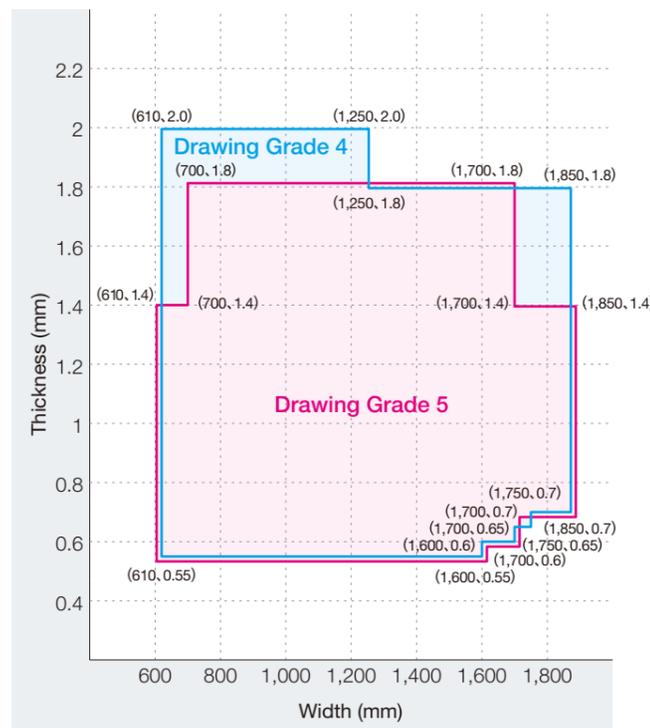
Deep drawing, high strength – 340N, 390N & 440N classes
(base metal: cold-rolled coils)



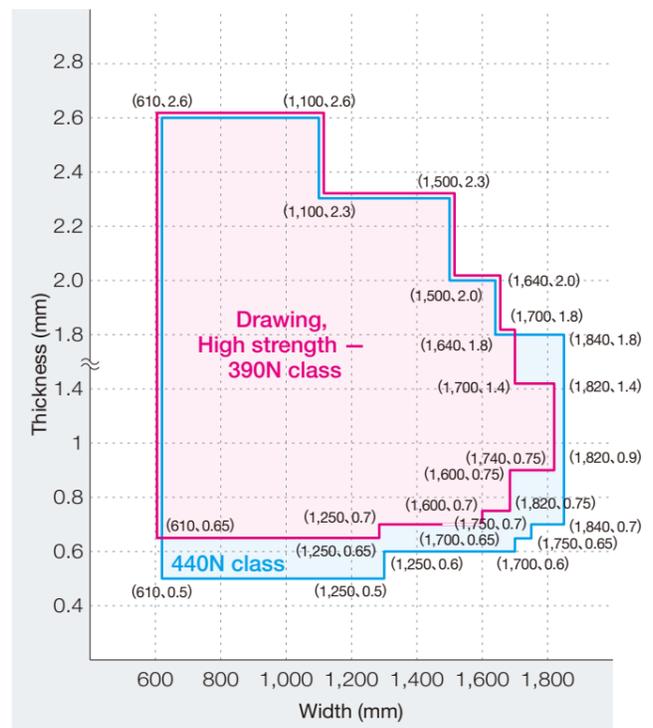
Low yield ratio, high strength – 590N class
(base metal: cold-rolled coils)



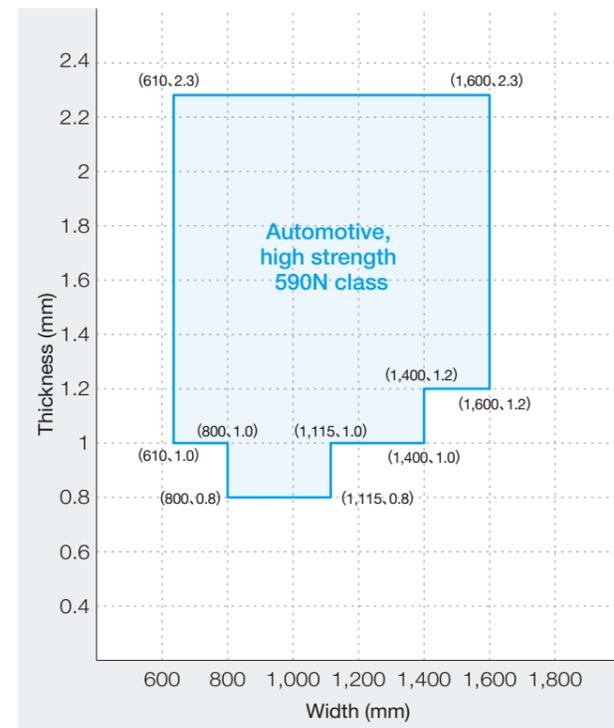
Drawing Grades 4 and 5
(base metal: cold-rolled coils)



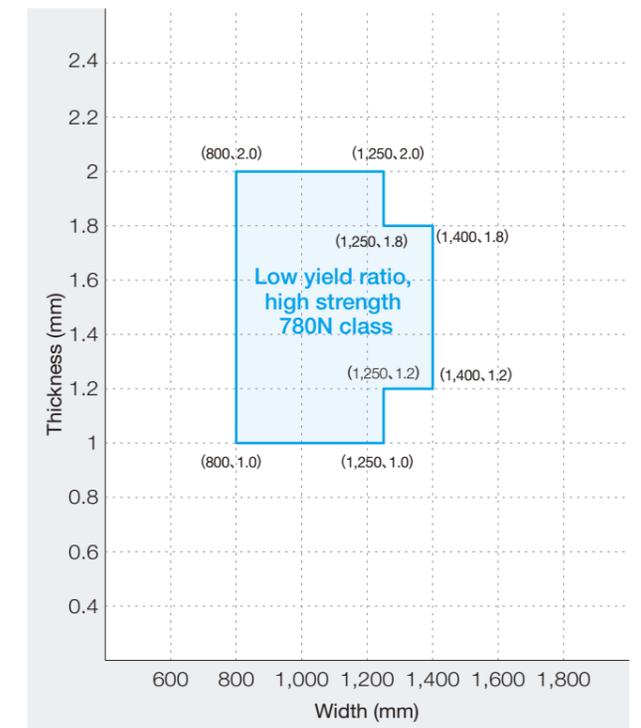
Drawing, High strength – 390 & 440N classes
(base metal: cold-rolled coils)



Automotive, high strength – 590N class
(base metal: cold-rolled coils)



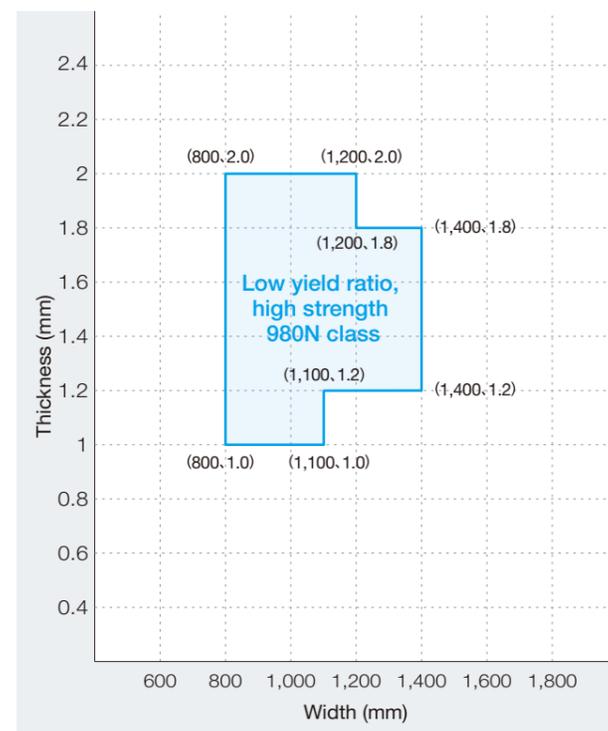
Low yield ratio, high strength – 780N class
(base metal: cold-rolled coils)



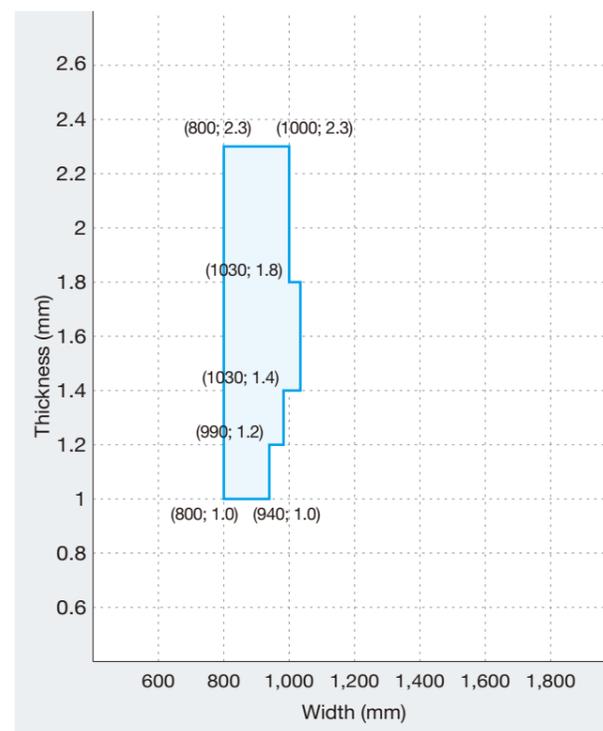
Scope of Manufacturing

Available Sizes for Nominal Thickness and Width

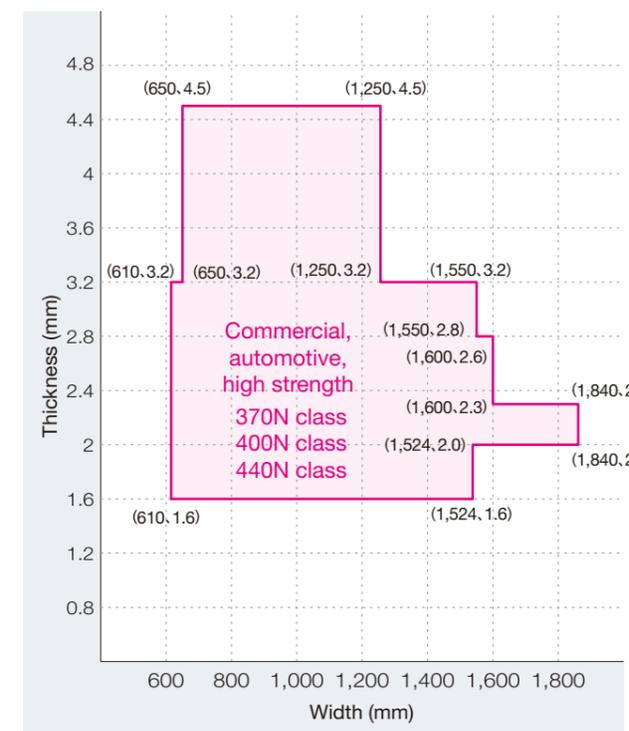
Low yield ratio, high strength – 980N class
(base metal: cold-rolled coils)



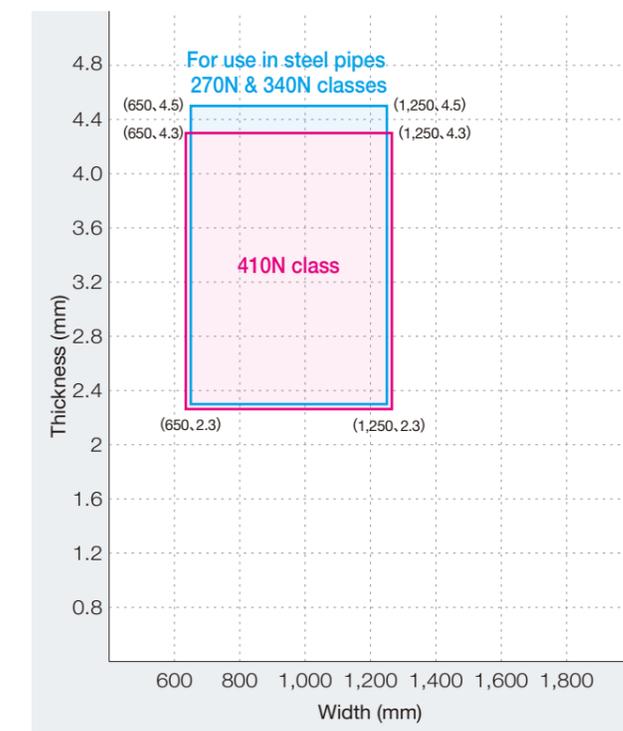
Row yield ratio, high strength – 1180N class
(base metal: cold-rolled coils)



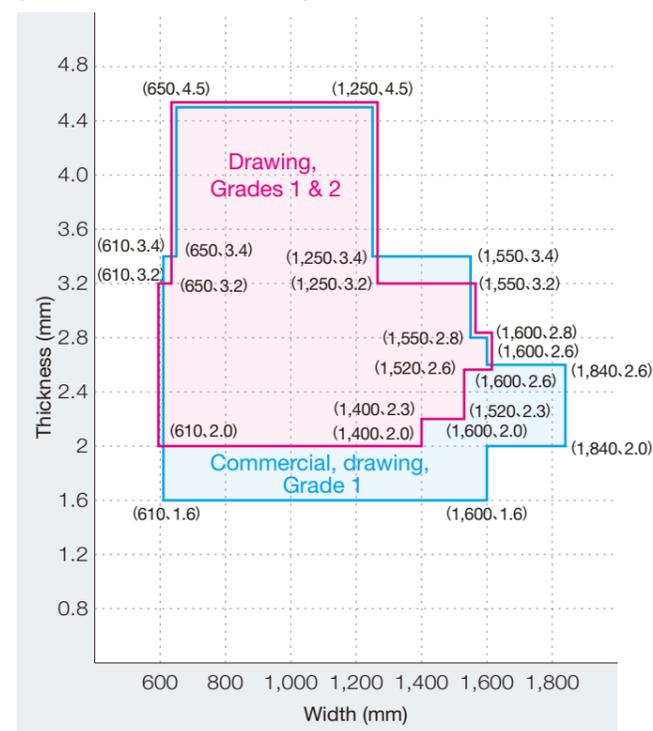
Commercial, automotive, high strength – 370N, 400N & 440N classes
(base metal: hot-rolled coils)



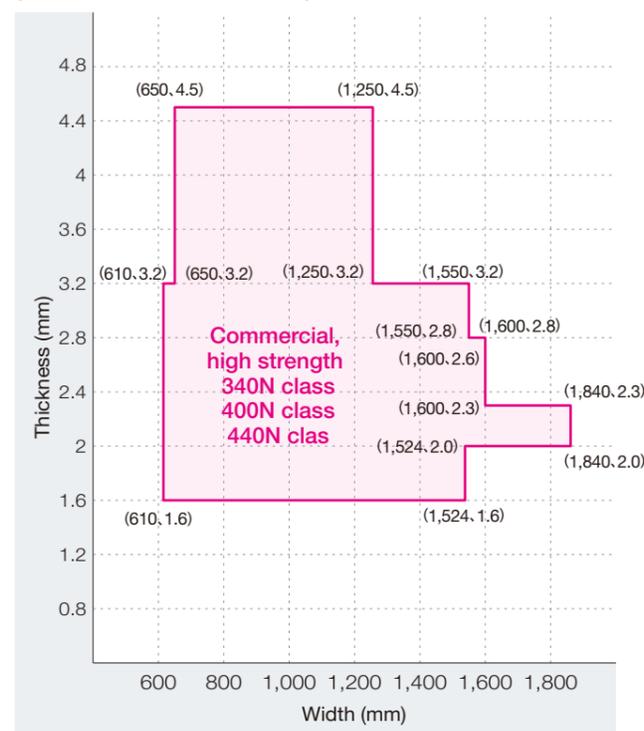
For use in steel pipes – 270N, 340N & 410N classes
(base metal: hot-rolled coils)



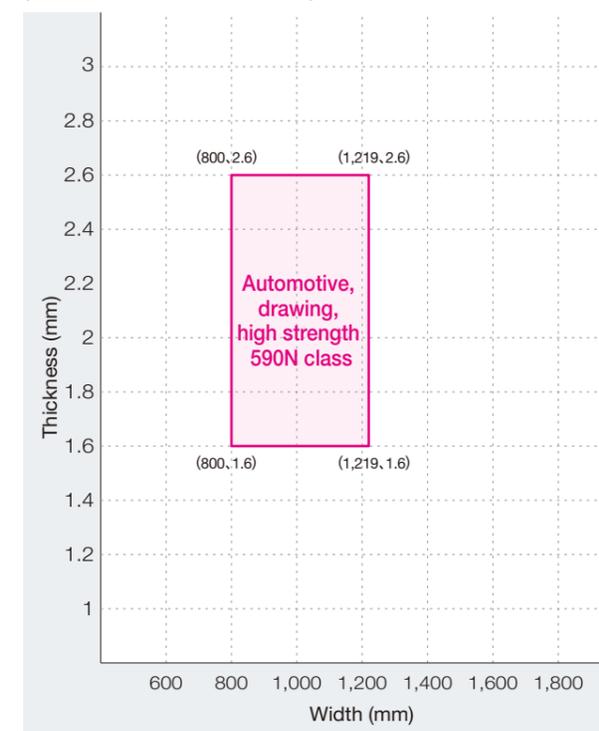
Commercial, drawing, Grades 1, 2 & 3
(base metal: hot-rolled coils)



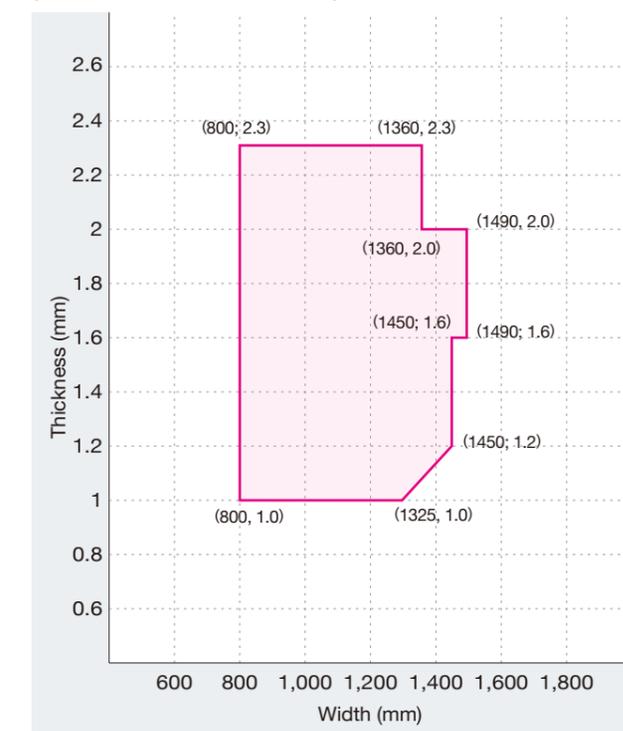
Commercial, high strength – 340N, 400N & 440N classes
(base metal: Hot-rolled coils)



Automotive, drawing, high strength – 590N class
(base metal: hot-rolled coils)



Hot Stamping – 1500 class
(base metals: Hot-rolled coils)

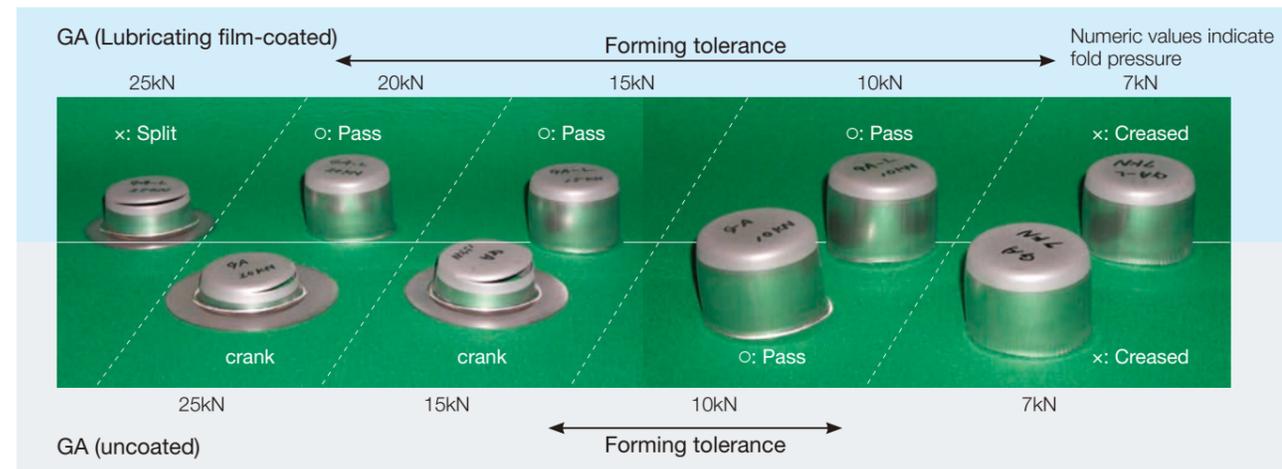


Quality Attributes

Press Formability

DURGRIP is widely used from simple bending to advanced drawing in the same way as the hot- and cold-rolled steel sheets of the base metal that is used. Select an appropriate material grade with due consideration for the shape of the parts used. A lubricating film-coated type can also be selected.

Press Formability

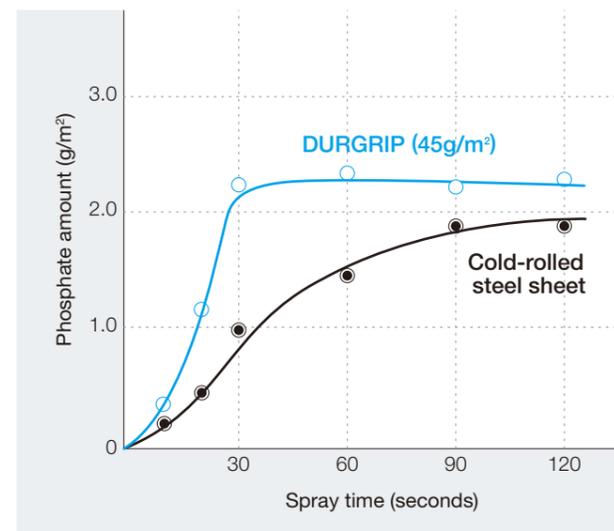


Painting

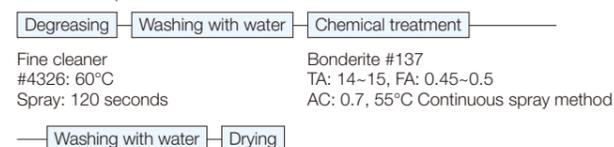
Phosphate treatment

Even phosphate treatment can be applied to the surface of NS Silver Alloy. (P comparison: Proportion of $Zn_2Fe(PO_4)_2 \cdot 4H_2O$ within the film crystal)

An example of DURGRIP's phosphate treatment



Treatment processes:



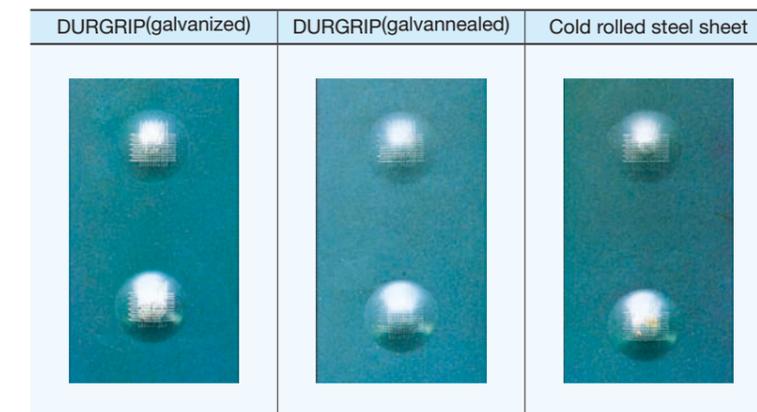
Phosphate film type examples

	DURGRIP	Cold rolled steel sheet
Immersed type Treatment conditions: Immersed type Scanning electron microscope image x400		
Spray type Treatment conditions: Continuous spray method Bonderite #137 TA: 14-15 FA: 0.45-0.5 AC: 0.7, 55°C Scanning electron microscope image x300		

Paint adhesion

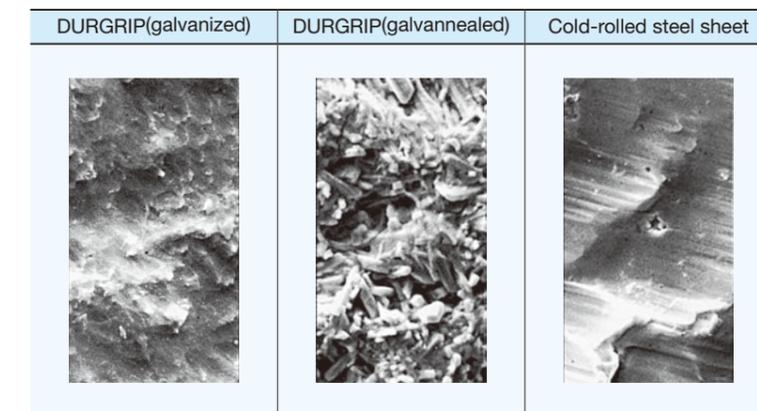
DURGRIP has minute concave and convex imperfections on the surface, so paint adheres very well.

Examples of paint adhesion (Initial adhesion)



Treatment conditions: Dipping phosphate treatment, Cation ED 20 μ printing
Assessment test: After drawing a grid pattern, Erichsen bulging, Sellotape peeling

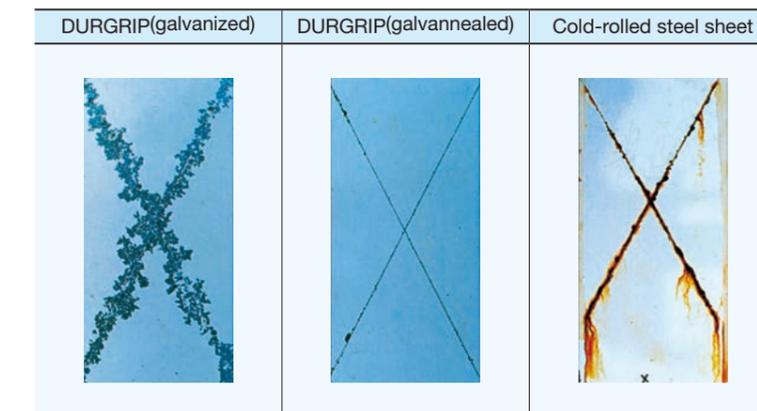
Examples of exterior appearance of base metal surface before painting (scanning electron microscope image x1,000)



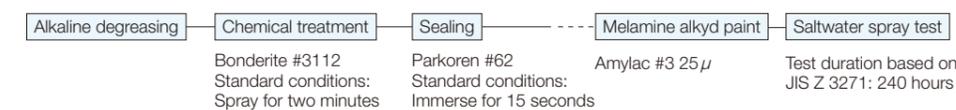
Corrosion-resistance of general painting

The DURGRIP coating is formed at almost δ 1 equivalence ($FeZn_7$; iron density: 10%). Accordingly, there are minute concave and convex imperfections on the surface, and a thicker inert oxide film is applied than in the case of galvanized sheets that are not subject to alloying treatment, ensuring much greater corrosion resistance when painted in most cases.

Examples of corrosion resistance when painted (Saltwater spray test)



Painting processes:



Quality Attributes

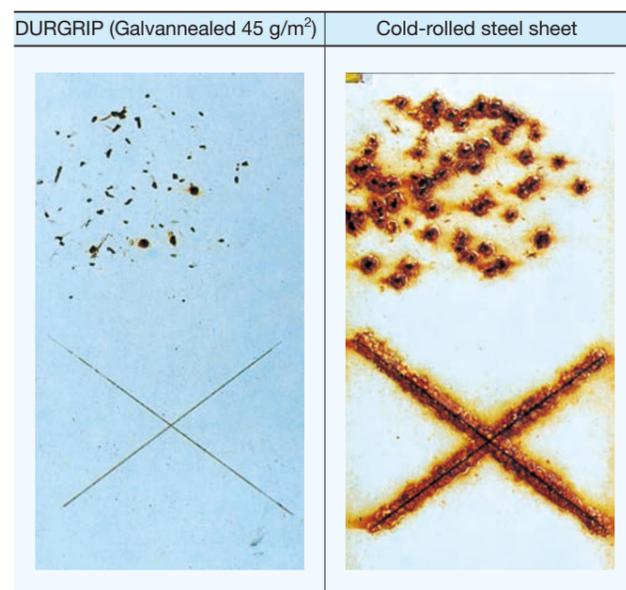
Corrosion resistance for electro-deposition coating

DURGRIP efficiently prevents swelling of paint coatings and scabbing in damaged areas with various corrosion-resistance tests implemented on the assumption of use as internal or external automotive panels.

(1) Chipping corrosion resistance

The following photos show the results for saltwater spray tests and exposure to air, and the performance of DURGRIP is clearly superior.

Examples of triple-coated corrosion resistance to chipping



Sample preparation process

Bonderite #137, Spray for two minutes

Electron #7000 20 μ

Amylac TP16R 25 μ

Amylac #030 30 μ

Test method

Immersion in 38° warm water for 120 hours

Chipping and cross cutting

Exposure to the elements for six months, 3% NaCl sprayed daily

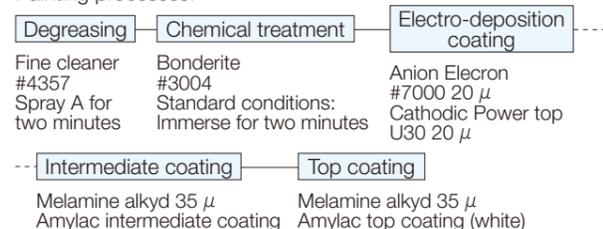
(2) Corrosion due to repeated drying and wetting

In practice, these materials are subject to repeated drying and wetting, so a promotion test that combines wet/dry cycles is close to reality.

Saltwater spray exposure test results are presented in the following photos.

Type	DURGRIP (Galvanized)	DURGRIP (Galvannealed)	Cold-rolled steel sheet
Single electro-deposition coating			
Triple coating (Melamine alkyd)			

Painting processes:



Test method: Saltwater spray/exposure to air, 3% saltwater spray once a day

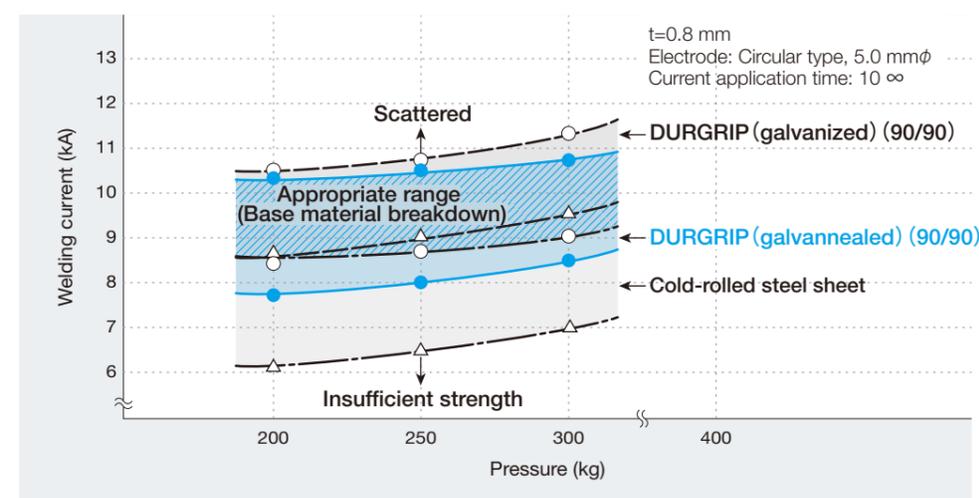
Welding

When resistance welding of galvanized steel sheet is compared with cold-rolled steel, in general, the appropriate welding condition will be a high heat input zone. This is because the zinc itself is a soft metal with a low melting point, and thus melts and diffuses in the initial stages of electrification, while heat generation is minimized for overlapping areas since less electrical current is required.

Direct spot welding

An example of conditions for appropriate welding of galvanized steel sheet is shown below. Appropriate welding current range for galvanized steel sheet is higher than that for cold-rolled steel sheet.

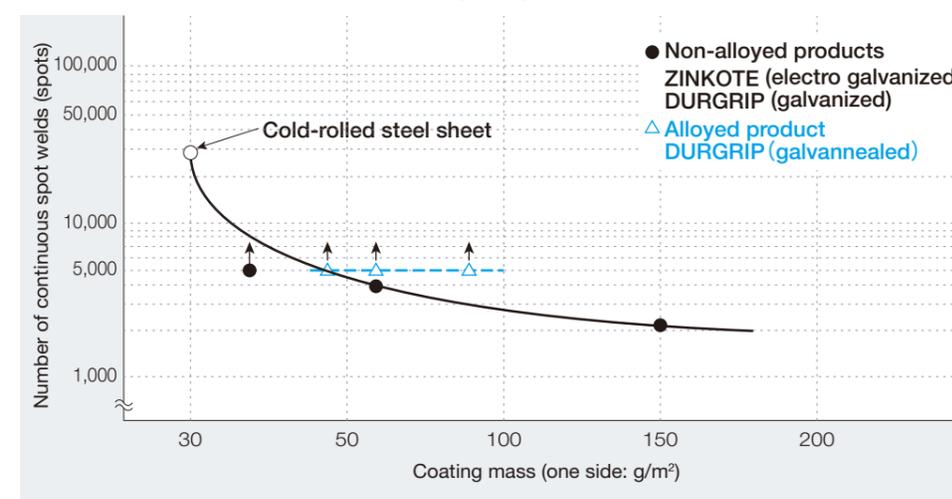
An example of conditions for appropriate welding of galvanized steel sheet



Continuous spot weldability:

With continuous spot welding, when the number of spots is greater, the tip of the electrode is more easily contaminated with the zinc-iron alloy, and thus its weldability deteriorates. The thicker this protective coating is, the more evident this tendency becomes. If electroplated to create a thinner coating, continuous spot welding of some 5,000 spots or more is possible, but with thicker coatings, the tip of the electrode must be cleaned appropriately. In this respect, our DURGRIP is comparatively beneficial, and work can continue for at least 5,000 spots.

Example of continuous spot weldability for galvanized steel sheets



Usage Precautions

If inappropriately handled or used, hot-dip galvanized sheet cannot demonstrate their characteristic properties. Please pay attention to the following usage precautions.

Storage and Loading/Unloading

1. Exposure to water during loading/unloading and storage may cause corrosion. Strictly avoid loading/unloading during rain and prevent exposure to seawater and condensation. Also, avoid storage in atmospheres of high humidity or sulfur dioxide. Indoor storage under dry, clean conditions is recommended.
2. Broken or torn packaging paper must be repaired.

Warning!

- Falling and rolling coils are very dangerous, as is the collapse of piled sheets.

Handling

1. This product must be handled carefully to avoid damaging the coating or film treatment on the surface. Perspiration and fingerprints may impair paint adhesion and corrosion resistance.
2. In these cases, post-processing or repairs must be implemented if necessary.

Press Forming

1. When applying severe press forming, there are cases in which the coating film is damaged. Prior confirmation is requested when such press forming is applied.
2. In press forming, some types of extreme pressure additives contained in lubricating oil can cause melting and corrosion of the surface coating films and base metals. Prior confirmation is requested when such additives are used. Excessive damage to surface layers during press forming will adversely affect paint adhesion and corrosion resistance.

Attention!

- When removing (cutting) the coil binding hoops (bands) prior to use, make sure that the end of the coil is pinned down directly beneath the center of the coil in order to prevent the end of the coil from suddenly springing out of the coil end; alternatively, be certain to remove the binding in a location where safety can be assured and no danger would be posed if the coil end were to spring out upon release.
- Coils are formed by winding flat sheets. When the binding hoops or other external restraints that keep the sheet in coil form are removed and the coil end is freed, the end of the coil will spring out to return to its flat state. Furthermore, there have also been cases when the coil bindings work loose, allowing the coil to spring out. Such cases may endanger people nearby and cause damage, so great care must be paid when removing the coil binding hoops (bands).

Welding and Brazing

1. In resistance welding, because the electrodes are soiled by the pick up of zinc, they should be properly maintained and replaced at regular intervals. In seam welding, the service life of electrodes can be extended by using a knurl-gear driving system.
2. In welding, fumes consisting mainly of zinc oxides are generated. Although the effect of these fumes will differ depending on the working environment, it is recommended that welding be conducted in a well-ventilated place.
3. In brazing, avoid high-temperature brazing using silver and other brazing fillers. Penetration of zinc alloy into crystal boundaries can occur, thereby causing brittle fracture in some cases.

Degreasing

1. The use of weak alkaline-type and organic solvents and non-ionic-type detergents is recommended for degreasing. Some types of degreasing agents such as strong alkaline agents cause melting of the coating films and corrosion of the zinc. Prior confirmation is requested when such agents are used.
2. In the case of degreasing at high temperatures (more than 60°C) or using ultrasonic cleaning, there are cases in which the coating film is damaged. Due care should be taken to prevent this.
3. Conduct sufficient drying after degreasing. Handling in an insufficiently dry state may cause the coating film to peel off.
4. In alkali ion cleaning, there are cases in which oily substances remaining in the cleaning water may adversely affect the coating film. Prior confirmation is requested when such cleaning is applied.

Painting

DURGRIP is a steel sheet to be painted. It is not intended for use without prior coating.

Aging

Generally, steel sheets tend to show deterioration in quality over time. For example: degraded formability, stretcher stains, and coil breaks. To avoid this, usage at the earliest possible time is recommended. However, this problem can be avoided if products with aging resistance are selected.

Others

1. Prior confirmation is requested when the product is to be exposed to high temperature conditions for a long time.
2. Avoid using in acid and strong alkaline environments. (There are cases in which phosphate zinc and other chemical treatments used for treating the base steel sheets for painting can have high acidity and cause the film to melt.)

Ordering Guidelines

When placing an order, please confirm the following in accordance with the purpose of the order.

Specifications

Depending on the severity and method of fabrication to be undertaken, choose the appropriate specification from those shown in this catalog.

Coating Mass

Select the most suitable coating mass according to the required corrosion resistance, application conditions, and fabrication methods.

Dimensions

The size of galvanized steel sheets (thickness, width and length) is the basic condition for product yield. Design the product with reference to the range of available sizes described in this catalog. Sizes are available in 0.05-mm increments for thickness and 1-mm increments for width and length.

Coil

Select coils or cut-length sheets according to shear and fabrication conditions.

The selection of coils will effectively improve product yield by allowing continuous and automated operation. In the case of coils, however, some defective parts may unavoidably be included because their removal, based on inspection, is impossible.

Edge Finish

Please indicate if the order requires a milled edge or a slit edge.

Surface Treatment

Select the most suitable surface treatment from among those described in this catalog according to the treatment method after fabrication and the application conditions.

Oiling

The decision whether or not to apply rust-preventing oil can be made separately from the kind of surface treatment. Oiling is recommended in order to improve intermediate rust resistance, to mitigate fingerprints and damage during handling, and to maintain lubrication during press forming. Meanwhile, oiling is indispensable for galvanized sheets lacking surface treatment.

Package Mass

Specify the package mass according to the local loading/unloading capacity and work efficiency. The heavier the coil mass, the higher the work efficiency. In the case of coils, specify the maximum mass (unit minimum mass if necessary).

Internal and External Diameters

In the case of coils, specify the inside and outside coil diameters according to the specifications of the uncoilers on the shearing line.

When selecting inside diameters, it is necessary to consider the occurrence of break and reel marks on the area of the inside diameter, depending on the thickness.

Dimensional Accuracy (Sheet thickness, width, length)

Dimensional accuracy of thickness, width and length is guaranteed within the range of sizes described in this catalog. However, there are cases that require strict size specifications with respect to assembly accuracy and dimensional accuracy of the parts, depending on the application conditions of the finished products. In such cases, please consult us in advance to clarify your specifications.

Applications, Fabrication Methods and Other Issues

NIPPON STEEL implements quality control to better suit the intended application. For that purpose, it is requested that the intended application, fabrication method, and any other requirements be clearly indicated.

Packaging and Labeling

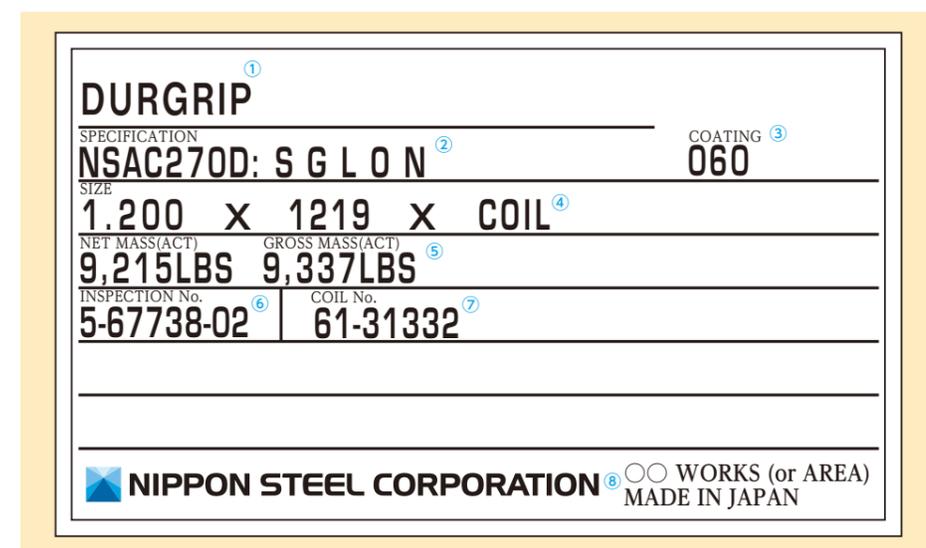
The finished product is packaged and shipped as per normal procedure for steel to ensure that it is handled and stored with care prior to its use. The external layer of packaging consists of a packaging label that contains details of the finished product that it is affixed to. Furthermore, the Package Card is also included, which is the warranty for the product in question.

The Package Card is used when taking receipt of the product and confirming its condition. The information contained on the Package Card and labels is detailed herein.

Packaging Labels and Package Cards

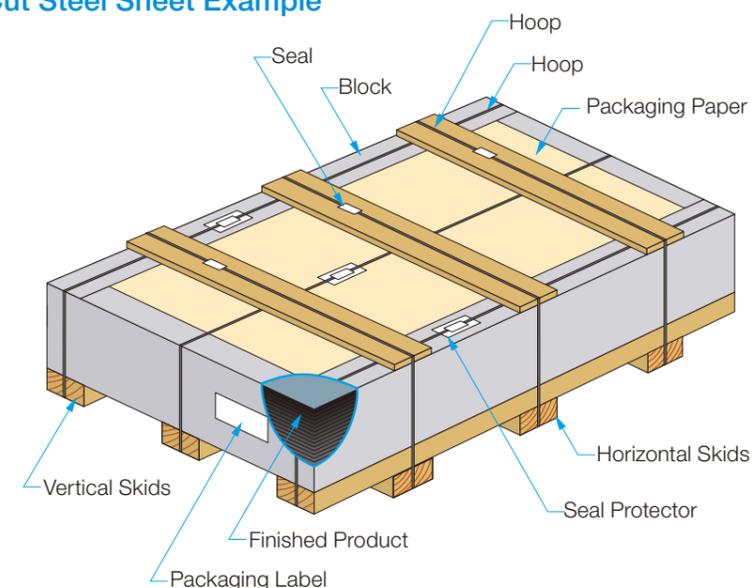
Item	Title Name	Notation Method
	Packaging Label	
① Product Name	Not shown	Product name is displayed
Class/Grade	Not shown	Class and grade of materials used are displayed
JIS Certification Mark, JIS Certifying Body, JIS Certification Number	Not shown	Only the applicable materials are displayed.
② Spec Designation	Specification	The spec code for the finished product is displayed (see note below)
③ Coating	Weight	The weight is displayed
④ Dimensions	Dimensions	The dimensions are displayed
Number of Sheets	Number of Sheets	Only for cut sheets
⑤ Mass	Net Quantity	This is displayed depending on the contractual arrangements (actual quantity or estimated value)
Length	Length	Contractual estimate or specific coil length is displayed
⑥ Inspection Number	Inspection Number	Displayed on each package
⑦ Coil Number	Coil Number	Displayed for each production lot
Month and Date of Manufacture	—	The date of manufacture is displayed
Customer Name	Not shown	The customer name is displayed
⑧ Company and Works Name	Not shown	"(Location Name) WORKS (or AREA), NIPPON STEEL CORPORATION" is displayed

Example of a Packaging Label

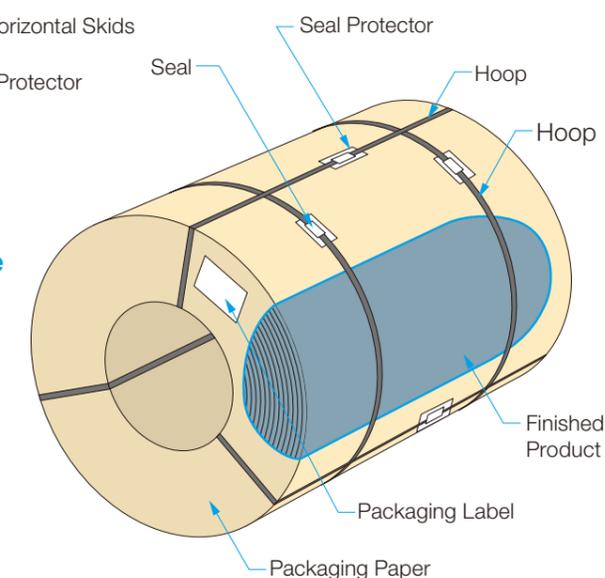


An Example of Packaging

Cut Steel Sheet Example



Coil Example



Note: Notation Used for Specifications

For JIS Standards

JIS G 3302 SGCD2 : S M O(N)

- ① : Spec Number
- ② : Spec Designation
- ③ : Skin-pass Code
- ④ : Surface Treatment Code
- ⑤ : Oiling Designation

For NIPPON STEEL Specifications

NSAC270D : S G L O N

- ① : Spec Number
- ② : Skin-pass Code
- ③ : Surface Finish Code
- ④ : Surface Treatment Code
- ⑤ : Oiling Designation (When no oils are used, this is given the value X)
- ⑥ : Code for the amount of oil to be applied