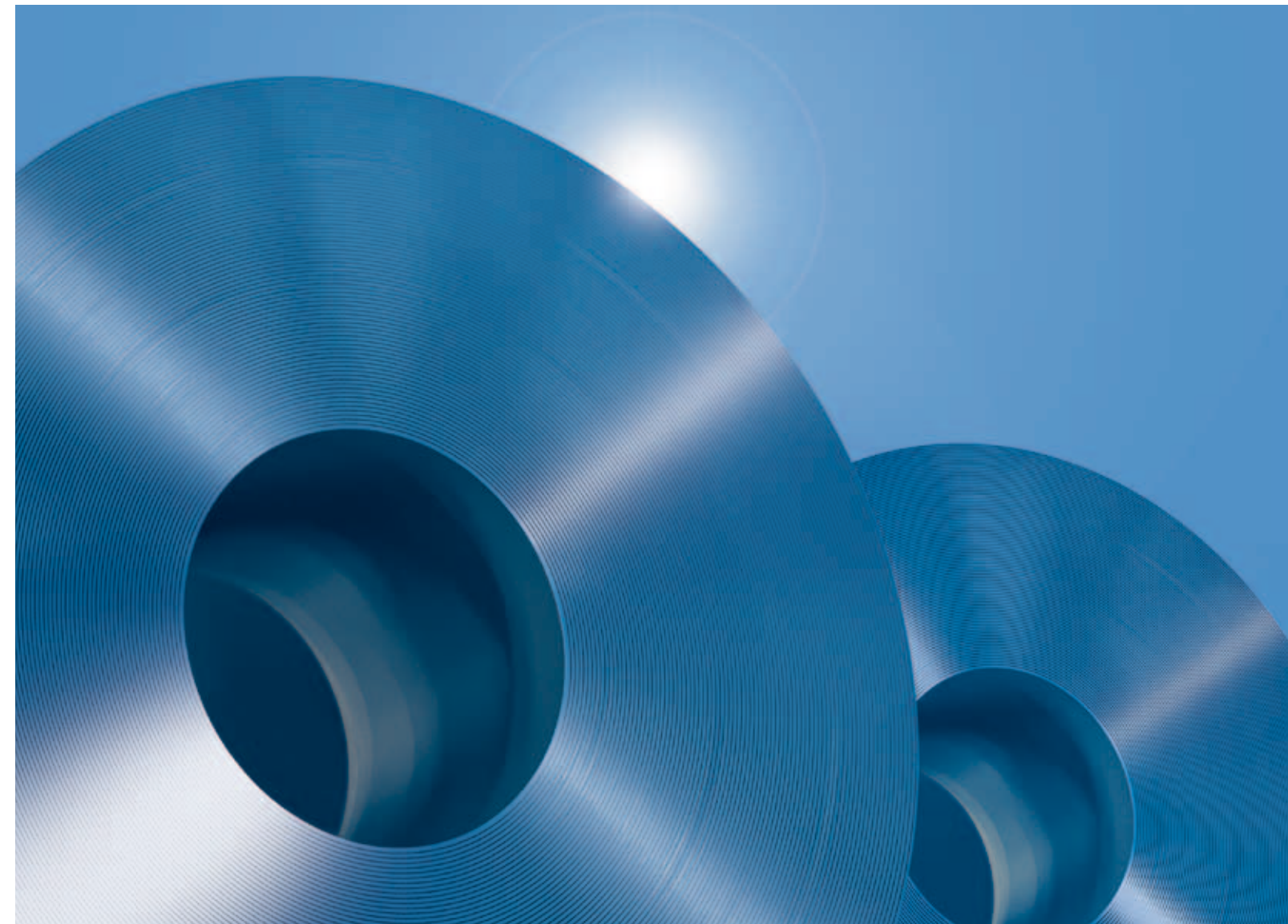


ECOKOTE™-S

Steel sheet coating with a tin-zinc alloy

NIPPON STEEL & SUMITOMO METAL

<http://www.nssmc.com/>



Foreword

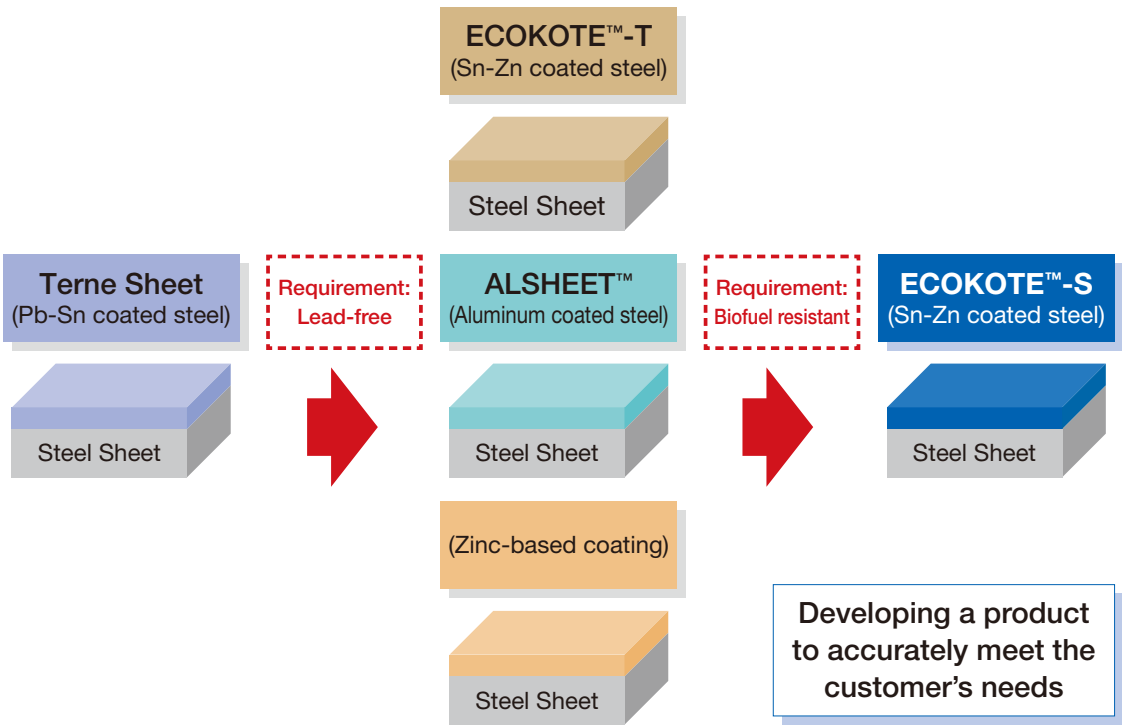
ECOKOTE™-S is a steel sheet that has been coated with an alloy of tin and zinc and is used in the manufacture of fuel tanks. ECOKOTE™-S harnesses the excellent corrosion-resistant properties of tin and zinc and offers superior corrosion-resistant performance compared with conventional metal products.

The diversification of automobile fuel continues apace, with fuel options such as ethanol-enriched gasoline and biofuels now readily available. ECOKOTE™-S possesses outstanding corrosion-resistance, even in these challenging corrosive environments (for example degraded biodiesel fuel and bioethanol-enriched gasoline, with its water content, are extremely corrosive), delivering a long service life for the fuel tank.

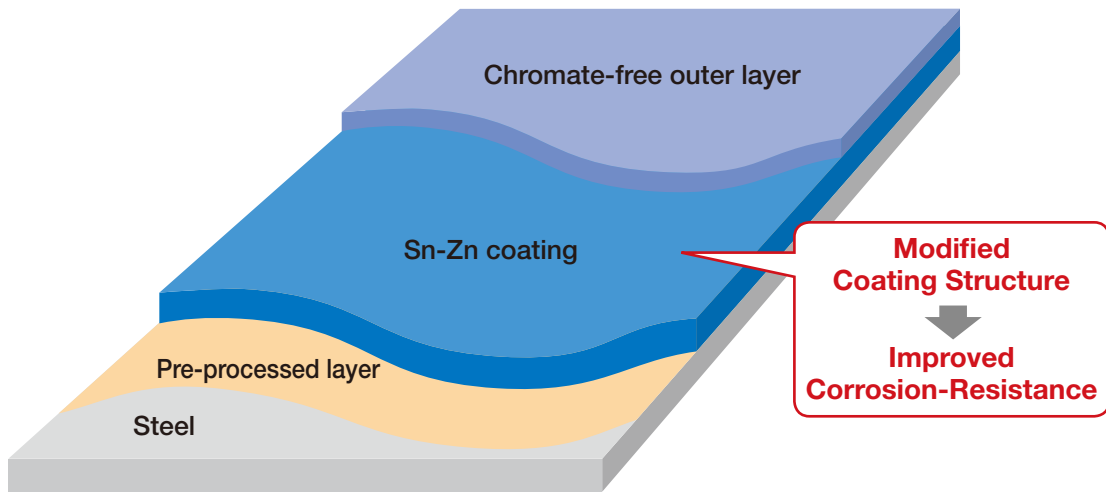
Moreover, ECOKOTE™-S contains no substances such as lead that place a burden on the environment and fuel permeability (where the active organic substances contained in the fuel permeate through the tank material, resulting in a substance that causes atmospheric pollution) is completely prevented, meaning that ECOKOTE™-S can be completely recycled. In addition to these factors, the energy required to manufacture ECOKOTE™-S is small, making it an ideal material to produce fuel tanks that are kind to the environment.

Characteristics

Transition to Steel Sheet for the Manufacture of Fuel Tanks



Cross-Section Showing the Structure of ECOKOTE™-S



Contents

Characteristics	1
Examples of the Product in Use	3
Manufacturing Location	3
The Manufacturing Process	4
List of Manufacturing Specifications	6
Product Quality	7
Precautions for Use	8
Packaging and Labeling	9
Order Guidelines	11

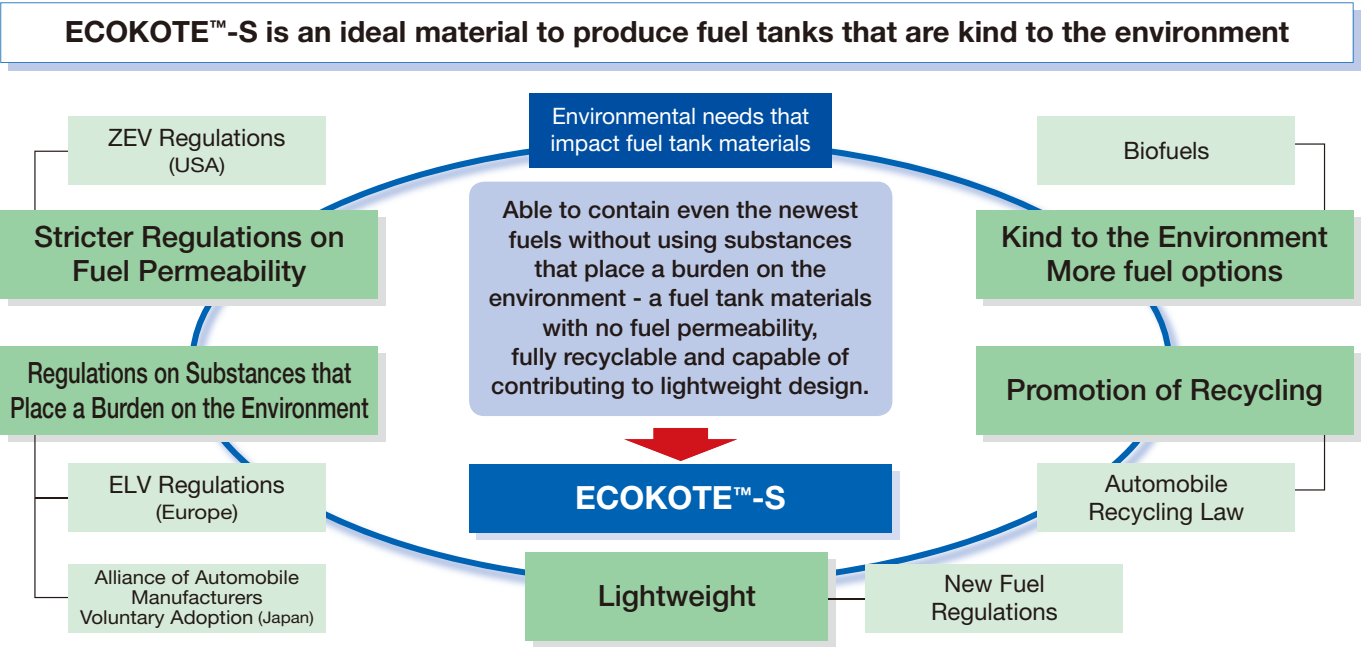
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■ ECOKOTE™-S and Environmental Responsiveness



■ Characteristics of ECOKOTE™-S as a Fuel Tank Material (1)

	ECOKOTE™-S (Sn-Zn coated steel)	ALSHEET™ (Aluminum coated steel)	Terne Sheet (Pb-Sn coated steel)	Plastic Resin
Stricter Regulations on Fuel Permeability	Sheet steel means no fuel permeability			Inferior capability for preventing fuel permeability
Promotion of Recycling	Sheet steel is simple to recycle			Not easy to recycle, degrades
Lightweight	Rigid composition means the same volume but a lighter weight			
Regulations on Substances that Place a Burden on the Environment	Does not include any substances that place a burden on the environment		Uses lead	Does not include any substances that place a burden on the environment
Increase in Fuels that are Kinder to the Environment	Excellent corrosion-resistance	Some biofuels corrode this material; it has become an issue		The main concerns are permeability and degradability

■ Characteristics of ECOKOTE™-S as a Fuel Tank Material (2)

	Internal Surface Corrosion Resistance			External Surface Corrosion	Press-Formability	Weldability	Coatability
	Degraded Gasoline	Degraded 20% FAME enriched	Degraded Ethanol enriched Gasoline				
ECOKOTE™-S (Sn-Zn coated steel)	Excellent	Excellent	Excellent	Excellent	Excellent	Fair	Excellent
ALSHEET™ (Aluminum coated steel)	Excellent	Excellent	x	Fair	Fair	Fair	Excellent
Terne Sheet (Pb-Sn coated steel)	Fair	Fair	Fair	Fair	Excellent	Good	Excellent

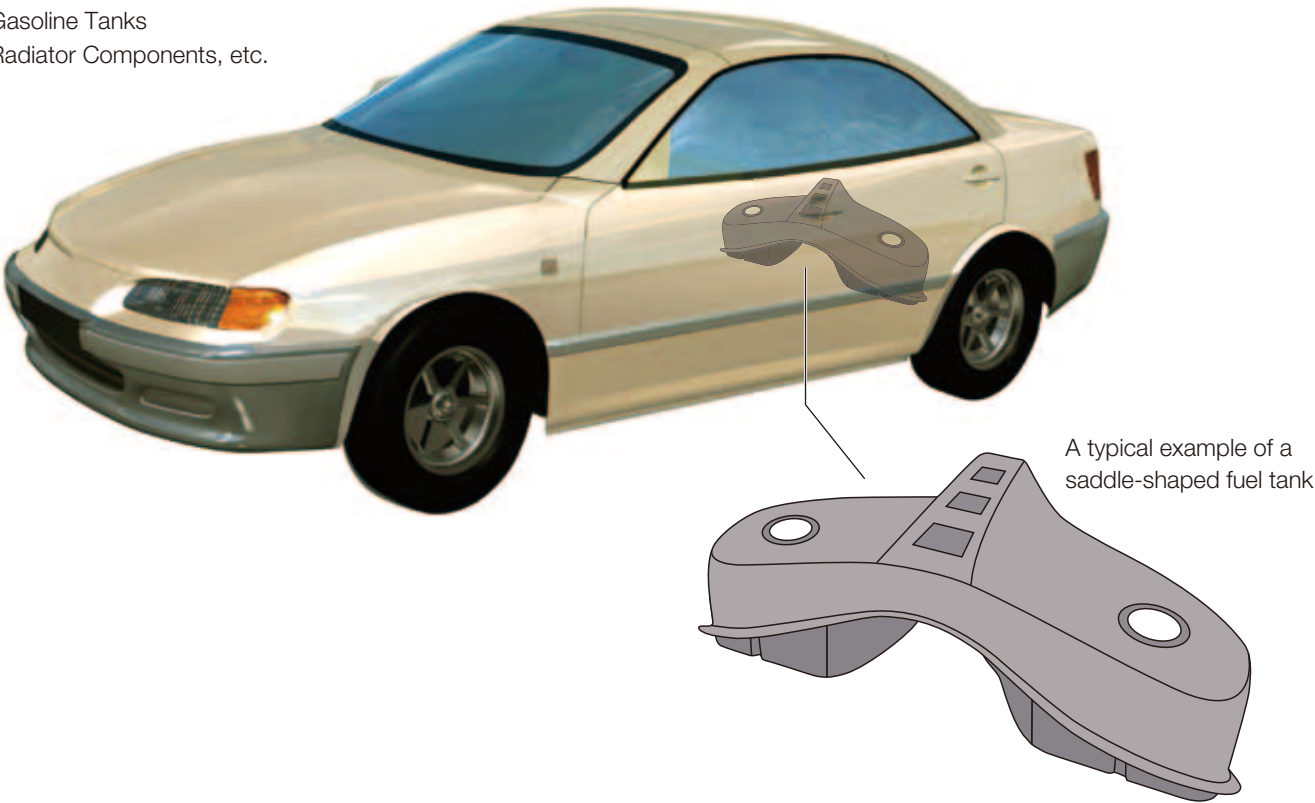
ECOKOTE™-S possesses excellent characteristics for the manufacture of fuel tanks

Examples of the Product in Use

ECOKOTE™-S can be used for broadly any purpose where corrosion resistance is called for. More specifically, ECOKOTE™-S is especially suited to environments low on corrosive products and that make use of its ease-of-use in pressing, such as in the manufacture of gasoline tanks. Moreover, due to its outstanding soldering characteristics, ECOKOTE™-S can also be used in the production of components for automobile radiators.

Components for Automobiles

- Gasoline Tanks
- Radiator Components, etc.

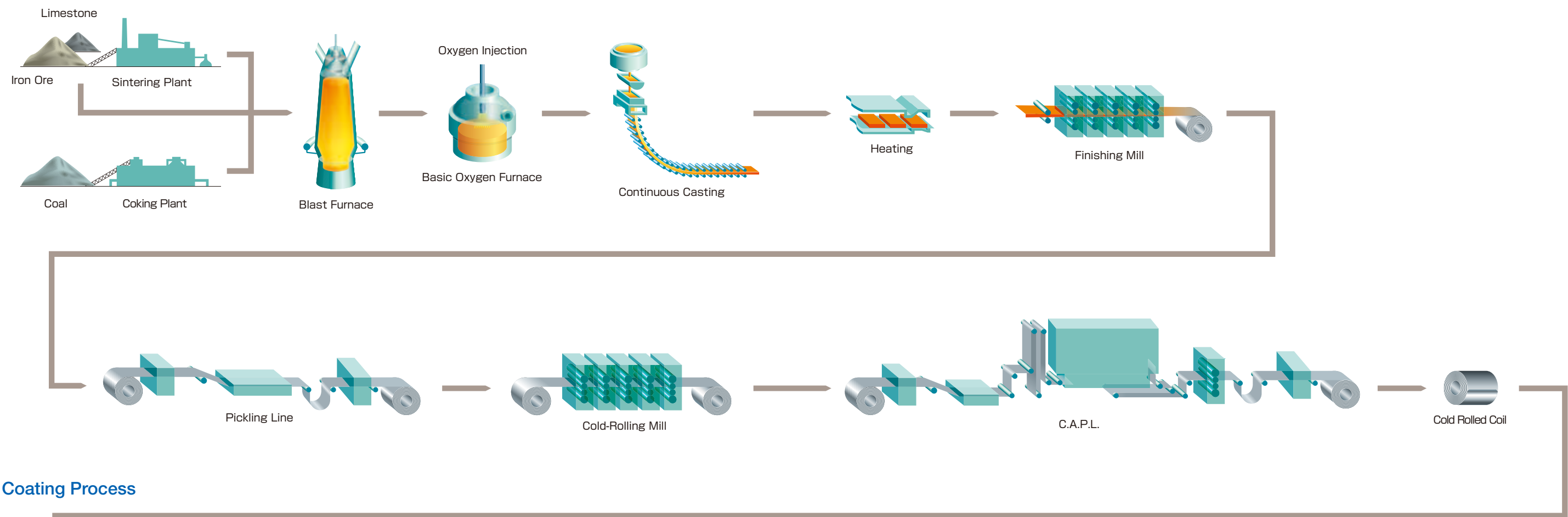


Manufacturing Location

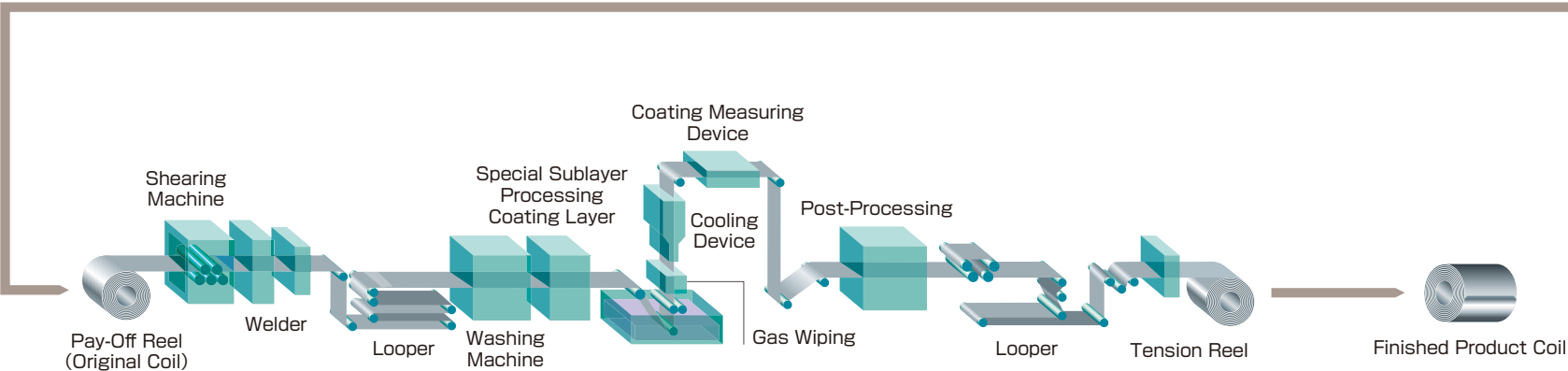


The Manufacturing Process

The process to manufacture the steel coil



Coating Process



List of Manufacturing Specifications

1. Specifications and Mechanical Properties

Spec	Tensile Strength (N/mm ²)	Yield Point (N/mm ²)			Extension (%)					
		0.40≤t<0.80	0.80≤t<1.00	1.00≤	0.40≤t<0.60	0.60≤t<0.80	0.80≤t<1.00	1.00≤t<1.20	1.20≤t<1.60	1.60≤
TZSC	270≤	250~370	240~360	230~350	31~43	32~44	33~45	34~46	34~47	35~
TZSD	270≤	135~235	125~225	115~215	36~48	37~49	38~50	39~51	39~52	40~
TZSE	270≤	130~215	120~205	110~195	38~50	39~51	40~52	41~53	41~54	42~
TZSF	260≤	120~195	110~185	100~175	—	44~53	45~54	46~55	46~56	—

Note: The tension test sample was a piece of JIS No. 5 in the direction of the rolling

2. Amount of Coating

Spec Code for Coating Amount	3 Part Minimum Coating Amount(Single Surface)	3 Part Maximum Coating Amount(Single Surface)
30/30	30g/m ²	50g/m ²

3. Surface Processing

Name of Process	Code
No processing	M
Special Non-Chromate Processing	QMT

4. Dimensions and Tolerance Intervals

The following table shows the standard thickness for the steel sheet and coil

Standard Thickness (mm)									
0.40	0.60	0.80	1.0	1.2	1.4	1.6	1.8	2.0	

Acceptable Variation/Range

(The sheet thickness is the sum of the standard display thickness and the thickness of the coating)
(unit: mm)

Display Thickness	Width	
	<1,000	1,000≤
0.40≤t<0.60	±0.05	±0.05
0.60≤t<0.80	±0.06	±0.06
0.80≤t<1.00	±0.06	±0.07
1.00≤t<1.20	±0.07	±0.08
1.20≤t<1.60	±0.09	±0.10
1.60≤t<2.00	±0.11	±0.12

Note: The location on the sheet that is measured to ascertain the thickness of the finished product is selected from an area 15mm within the edge of the sheet (at the broadest end).

Coating Thickness

(unit: mm)

Spec Code for Amount of Coating	30/30
Coating Thickness (Both Surfaces)	0.011

Tolerance Interval in Width

(unit: mm)

Width	Acceptable Variation
<1,250	0, +7

Tolerance Interval in Height

(unit: mm)

Height	Acceptable Variation
<2,000	0, +10
2,000≤t<4,000	0, +15

5. Steel Sheet Unit Mass





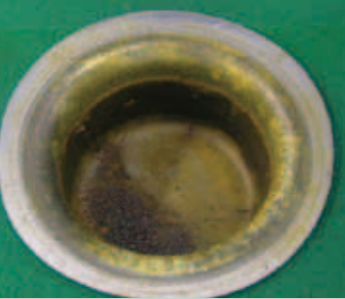


(unit: kg/m²)

Display Thickness (mm)	0.40	0.60	0.80	1.0	1.2	1.4	1.6	1.8	2.0
Spec Code for Amount of Coating	30/30	3.220	4.790	6.360	7.930	9.500	11.07	12.64	14.21

Product Quality

Evaluation of Corrosion to Interior Surface




Examples of corrosion resistance tests on the interior surfaces of fuel tank materials using several different types of fuel

	ECOKOTE™-S	Aluminum Coating	Terne Sheet
Degraded Gasoline + 10% Water 45°C x 1,000 hours			
Degraded Biodiesel + 10% Water (light oil enriched with 20% RME*) 90°C x 1,000 hours			
Ethanol + 1% Water Ethanol + 1% Water 45°C x 1,000 hours			

*RME = Rapeseed Methyl Ester

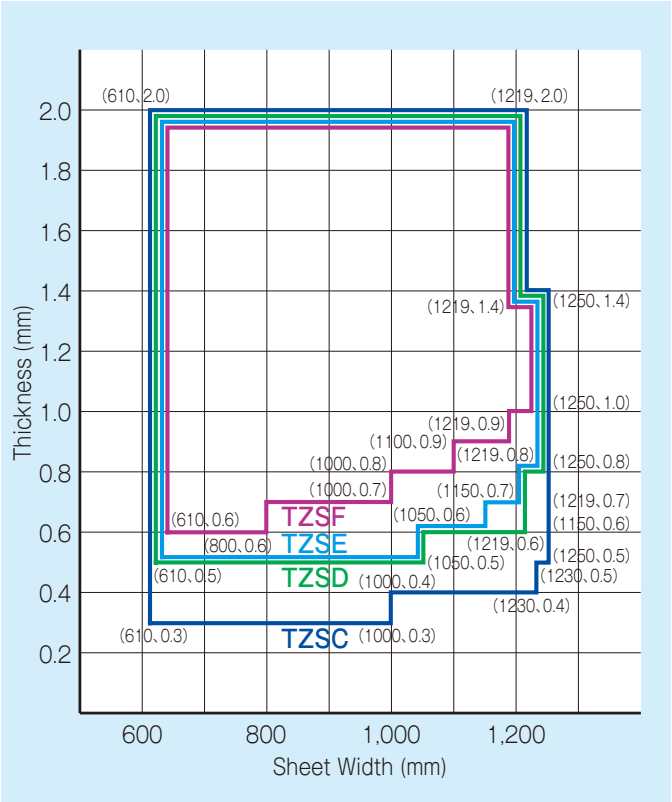
Evaluation of Corrosion to Exterior Surface

Examples of corrosion resistance tests on the exterior surfaces of fuel tank materials using 300 JASO-CCT cycles

Item Type	ECOKOTE™-S	Aluminum Coating	Terne Sheet
External Appearance			
Percentage of surface area with rust	<0.1%	60% (white rust)	30%
Pitting depth	0.25mm	0.40mm	0.45mm

JASO-CCT: 1 Cycle
5% Salt Water Spray (35°C): 2 hours; Drying (60°C, 40%RH): 4 hours; Damp environment (650°C, 90%RH): 2 hours

Manufacturing: Possible Range
Size (Thickness, Width)



*In the event that you require a sheet that falls outside of these parameters, please feel free to contact us.

Precautions for Use

Improper or irregular use of ECOKOTE™-S can result in its special characteristics not performing in the way that should be expected, so please bear the following points in mind when using ECOKOTE™-S.

Storage, Loading/Unloading

- 1. When loading or storing ECOKOTE™-S, the presence of water can lead to rusting. Please take serious care to ensure that ECOKOTE™-S is not unloaded during a rainstorm, or in the presence of seawater or condensation. Moreover, a highly humid environment, or an environment where sulfurous acid gases are present is not suitable for storage. An indoor storage area that is both clean and dry is recommended. In particular, once the packaging has been opened please ensure that no condensation forms on the steel when it is being stored. Moreover, please ensure that un-oiled products are given special attention when being stored. It is recommended that products are put to use as soon as possible.
- 2. Any damage to the packaging paper should be repaired and maintained.

Handling

- 1. The product should be handled with care, with particular attention paid to not damaging the outer film or coating layer.
- 2. Sweat, fingerprints, etc. if allowed to remain on the surface of the steel can damage the coating and adversely affect the corrosion-resistant properties of the product.
- 3. Unprotected sheets should be transported carefully and if moved by hand, handlers should wear gloves. In the unlikely event that the surface film or coating sustains damage, or if sweat or fingerprints make an impression on the surface, please consider post-processing or some repair/maintenance work.

Processing

- 1. Depending on the processing method employed, such as drawing or bending, the alloy coating may be soft enough to be affected by said processing. Attention should be paid to the following issues.
 - (1) During the drawing process, choose values that give abundant clearance and select a die radius at least 6 times the thickness of the sheet to ensure a good result.
 - (2) During either the drawing or bending process, please ensure that the coating surface is not directly pulled or drawn through the procedure.

Dies and the Die Radius (unit: mm)

Sheet Thickness	Drawing Formation		Pulled and Twisted
	Die Radius	Punch Radius	Die Radius
0.6	≤4	≤2	≤4
0.8	≤5	≤3	≤5
1.0	≤6	≤3	≤6

- 2. During the pressing process, when certain lubricating oils are applied as an extreme-pressure additive, this can lead to corrosion of the coating layer. Please ensure that this is checked prior to this procedure. Moreover, if there is no alternative to the use of a lubricating oil, please ensure that a resin is applied as a post-processing measure and that the resin is applied in sufficiently quantity.

Welding

With regard to resistance welding, the pick-up from the metal alloy coating can cause damage to the electrode, so please take proper care of this equipment and make changes when necessary. With regard to seam welding, using the Knurl drive method will prolong the working life of the electrodes.

Grease Removal

We recommend grease removal using weak alkali type pH-neutral detergents or organic weld grease removal agents. Of the removal agents available, strong alkali type agents can corrode the coating layer so please ensure that the agent is checked prior to this procedure.

Limitations

Conventional steel sheet will experience degradation of its material properties over time. In other words, the steel will lose its ability to be processed easily and may suffer stretcher strain as well as bending. In order to avoid these issues, it is recommended that the steel sheet be used as soon as possible. Moreover, customers who have selected the time-resistant option to cover their specifications need not concern themselves with this issue.

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	
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.
Spec Code	Specification	The spec code for the finished product is displayed (see note below)
Weight	Weight	The weight is displayed
Dimensions	Dimensions	The dimensions are displayed
Number of Sheets	Number of Sheets	Only for cut sheets
Quantity	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
Inspection Number	Inspection Number	Displayed on each package
Coil Number	Coil Number	Displayed for each production lot
Customer Name	Not shown	The customer name is displayed
Company and Works Name	Not shown	XXXX Works, NSSMC is displayed
Month and Date of Manufacture	—	The date of manufacture is displayed

Note: Notation Used for Specifications

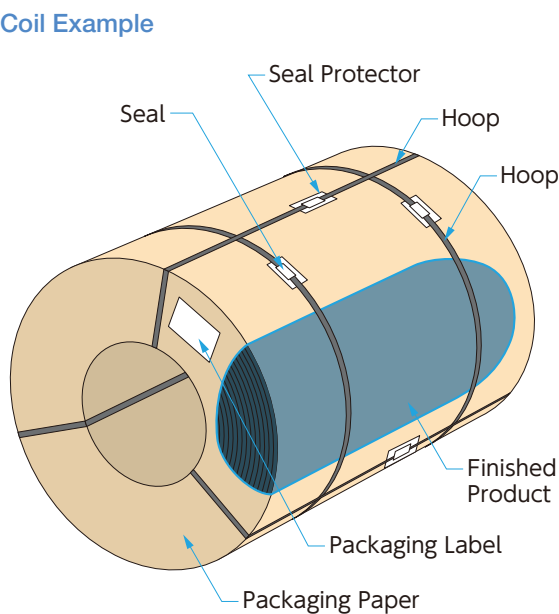
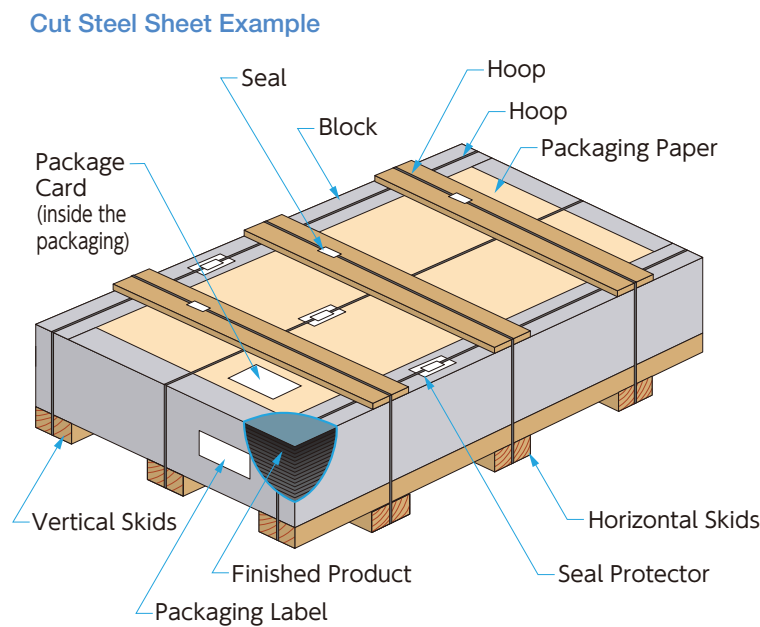
TZSD :

①②③④⑤


①:Spec Code②:Skin-Pass Code③:Surface Finish Code④:Surface Processing Code⑤:Oiling Code (When no oils are used, this is given the value X)

Note: In the event of no specific skin-pass being defined, all items following the surface finishing code are displayed on the left.

An Example of Packaging



Example of a Packaging Label

ECOKOTE™-S	
SPECIFICATION	COATING (G/M ²)
TZSD:D QMT N	30/30
SIZE	
0.7 X 850 X C	
GROSS MASS (ACT)	
3,010KG	
INSPECTION No.	COIL No.
2-6-T-1-0725	30-042440
 NIPPON STEEL & SUMITOMO METAL YAWATA WORKS MADE IN JAPAN	

Order Guidelines

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

Specifications

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

Weight

Depending on the degree of corrosion resistance, the conditions for use and the method of the processing to be undertaken, choose the most suitable specification from those available. If the emphasis is on corrosion resistance, a thick coating layer is recommended, alternatively if the emphasis is on the workability of the steel, then a thinner coating layer is recommended.

Oil

A suitable oil (choose from oil codes H through to M) can improve rust prevention properties, as well as protecting the steel from handling issues such as fingerprints and soiling as well as acting as a lubricant during the pressing process.

Dimensions

This is a basic condition for steel sheet: sheet thickness, width and length. Please make the most appropriate choice from the manufacturing ranges indicated in this catalog.

Coil

The fundamental choice here is whether to opt for steel coil or for steel sheets, depending on the use and processing to follow. In terms of stock utilization, the coil option is easier to work with, in addition to being better suited to the continuation of work processes and automation. However, with steel coil, defective portions of the steel cannot be removed following an inspection so customers are asked to understand and accept that a certain small portion of the steel coil may be classified as defective. Furthermore, both extremities of the coil steel are classified as off-gauge and as such off-gauge steel may end up part of or adjacent to a weld. Therefore please make the most appropriate selection based on inspection, classification and maintenance requirements.

Edge Finishing

Please indicate if the order requires a milled edge or a straight edge. If the customer wishes to have steel from our production line as is, please select the straight edge option.

Packing Units (Mass)

Please select the packing unit mass depending on loading capacity and working properties. Large unit mass can improve work properties. If the choice is coil steel, please select the largest unit mass (if necessary, the smallest unit mass is also an option). Furthermore, the mean unit mass that is actually shipped will be in proportion to the production unit mass and the dimensions of the steel manufactured.

Internal and External Radii

For coil steel, please specify the internal and external radii specifications for the uncoiler on the shearing line. When selecting the internal radius value, please consider the sheet thickness and the bend of the internal section of the coil as this can result in a reel mark being left on the steel. The standard value range as set by NSSMC lies between 20° to 24°.

Dimensions and Accuracy (Sheet thickness, width, length)

Dimension accuracy with regard to sheet thickness and width/length, etc. is implemented in accordance with the manufacturing ranges as stated in this catalog. However, depending on the purpose and conditions of use for the finished product in question, in some instances very strict specifications and dimensions are necessary due to accuracy requirements for assembly and/or components. Customers with these specific requirements are advised to contact NSSMC directly with their specifications.

Purpose, Processing Methods, etc.

NSSMC prides itself on the highest standards of quality control and our awareness of the ultimate purpose of the steel being manufactured helps us maintain these standards. Please kindly state clearly the purpose and the processing methods and conditions in your order form.

MEMO

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.[illegible]