





Cold rolled steel sheets (CR) have fine surface and excellent workability. They are used for various purposes including automobiles, home appliances, furniture, office equipments, industrial machines and constructional materials. Due to the economic development and the advancement in consumers' level, the customers are gradually requiring high quality of diversified and functionalized products. We, POSCO-VIETNAM are making our best efforts to satisfy the customers with the optimum quality and continuous improvement in our products.

HISTORY

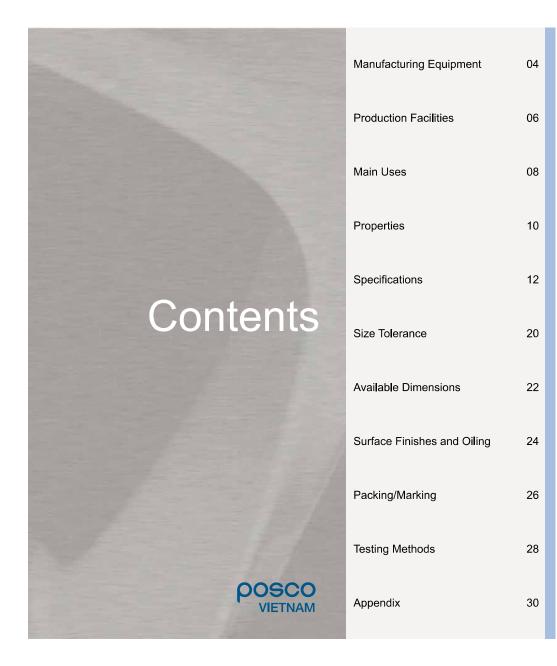
15.11.2006: Got approval Investment License from Vietnam government

30.03.2007: Finish ground leveling for CR Mill (21ha) 18.04.2007: Got approval captive port establishment

01.08.2007 : Ground Breaking Ceremony

31.09.2009 : Completion (FH 500,000 ton/year, CR 700,000 ton/year)

08.10.2010 : ISO 9001: 2008/ISO 14001:2004 Certified



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MANUFACTURING EQUIPMENT

POSCO - VIETNAM

Cold Rolled Steel

MANUFACTURING EQUIPMENT



Pickling

The hot-rolled coil passes through pickling line, where hydrochloric acid solution is used to remove surface scales for its smooth surface finish before further processing.



Pickling coils are rolled in the tandem cold rolled mill where they are processed into specified thickness. The critical point at this stage is to maintain uniform and precise flatness throughout the entire length of the coil. The rolling process is automatically controlled by the latest computer technology.





Electrolytic Cleaning

The main purpose of electrolytic cleaning is to remove the lubricant oil and dirt left on the cold rolled strip before annealing. Every trace of surface oil is removed by using the mechanical and chemical reactions while the cold rolled coil passes through alkaline solution.



Annealing

After cold-rolling, the steel strip is hard and brittle with its grains elongated in the rolling direction. To obtain the mechanical properties, the strip is passed through the furnace, the heating, soaking and cooling sections. By various heat cycles, extra deep drawing quality and high tensile strengthen steel can also be produced. There are normally two annealing types, that is batch and continuous annealing line has superior productivity.

Skin Pass Rolling

Skin pass rolling slightly reduces the size of the annealed coil to provide a degree of surface to remove some defects like stretcher strains which is easily generated on the strip passed an annealing process.



Finishing and Inspection

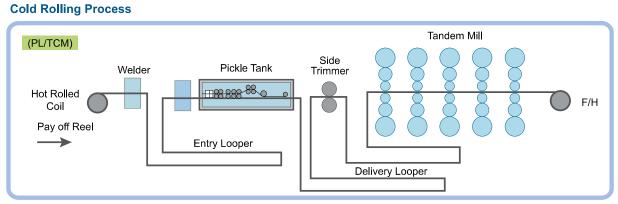
Production thickness, width and surface quality are checked during this stage. Product samples are also sent to the laboratory to test for mechanical properties, etc,...Oil is also applied to the product to prevent rust and they are packed for shipment.



PRODUCTION FACILITIES

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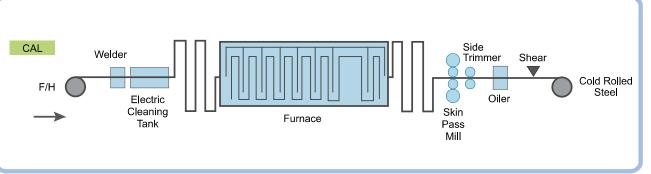
PRODUCTION FACILITIES





Des	Description PL/TCM		
Capacity	city(Mill.ton/y) 1.2		
TCM	И (Mill)	6Hi x 5Std	
Product size	THK (mm) WTH (mm) Weight (Ton)	0.125 ~ 2.0 700 ~ 1,570 Max.35	

Continuous Annealing Process





Desc	cription	CAL	
Capacity	/(Mill.ton/y)	0.7	
Product size	THK (mm) WTH (mm) Weight (Ton)	0.30 ~ 2.0 700 ~ 1,570 Max.35	

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OOSCO – VIETNAM Cold Rolled Steel

MAIN USES

MAIN USES

The usage presented in this section reflects the general use and shall be used as a reference. Please be sure to consult with our associates when making orders for specific usage.



Mild Cold Rolled Steel

This type of steel is used for general purposes. In particular, it is appropriate for manufacturing refrigerator doors, drums and furniture as well as for automobile roofs, fenders, hoods, quarters, oil pans and spring houses.



Steel for Structural Use

This structural steel does not need drawability but require high strength.



Steel for Porcelain Enameling

This product has two features as porcelain enameling such as heat resistance, corrosion resistance and surface gloss as well as steel product such as impact resistance, high ductility and formability. It is used for some components of home appliances, construction materials, kitchen appliances and bathtubs, etc.



High Tensile Strength Steel

irrawing, deep drawing and TRIP steels, depending on manufacturing methods and final usages. In teneral, commercial steel is used for automobile teats, rail levers and parking brakes. Deep drawing teel is appropriate for outer panels of an automobile, including fenders and hoods. TRIP steels used for car doors and bumpers.

PROPERTIES

PROPERTIES

Mild Cold Rolled Steel								
Classification	Specifications	Properties	Applications					
Class 1	SPCC	Use for the parts requiring bending, forming, light processing and welding, etc.	Refrigerator Doors, Drum, Furniture					
Class 2	SPCD	Used for drawing parts where more drawability than SPCC	Filter Housing					
	SPCE	Used for deep drawing parts where more drawability than SPCD						
Class 3	SPCEN	Guaranteed for non-aging deep drawing in which such properties do not change even after a long time has passed.	Roofs, Fenders and Hoods of Automobiles					
Class 3	*CSP3E	Used for deep drawing parts of automobiles where more drawability than SPCEN.	Deep Drawing Part					
	*CSP3X	Used for super deep drawing parts of automobiles which reguire more drawability than CSP3E	Side Panel of Automobiles Fuel Tanks of Motorcycles					

Note * POSCO Specifications

Steel for Structures & Hard Materials

Classification	Specifications	Properties	Applications
Structural Quality	CSP30 CSP32 CSP34 CSP37 CSP37P CSP58	Used in structural materials that strength is needed instead of draw ability (The minimum value of tensile strength is guaranteed)	
Hard quality	CSP1-H CSP1-4H CSP1-8H	The hardness of strip is guaranteed when a customer requests	Plating, Piping, Motor core Materials, etc.

Classification	Specifications	Properties	Applications
Porcelain Enameling	CESP-C	This product has superior workability, but no defects on the forcelain enameled surface, such as fish scales and blisters, etc, This product does not twist (called as 'sag') after baking at high temperature.	Washing machines, ovens, porcelain enameled bathtubs & tableware, pans, construction materials etc.,
High Streng	th Cold Rolle	d Steel	
Classification	Specifications	Properties	Applications
Commercial (Precipitation Strengthened steel)	CHSP45C	Adding hardening elements, such as Nb, Cr and V, to low carbon steel enhances its strength and yield point. It has excellent crack resistance and is used for structural purposes where strength is needed.	Seat, Rail levers, and Parking Brackets of automobiles
Drawing (Solid Solution Strengthened Steel)	CHSP35R CHSP40R CHSP45R	This is high strength steel with solid solution hardening elements, such as phosphate (P). It is used in automobile panels for its increased strength.	Center floor and brackets, etc.
Deep Drawing (Soild Solution Strengthened Steel)	CHSP35E CHSP40E CHSP45E	This is ultra-low carbon steel with special elements added. It has a high elongation rate and is used in deep draw parts of automobiles outer panels.	Outer panels of Doors and Fenders, ect.
Extra Deep Drawing (Solid Solution Strengthened Steel)	CHSP35ES CHSP40ES	As the ultra carbon steel added with some special elements, this product has superior high strength and elongation. It is possible to lighten an automobile by applying it to the parts for deep drawing.	Inner and Outer Materials of Roofs, Hood Members, etc.
Steel with Guaranteed YS (Yield Strength)	CHSP260Y CHSP340Y CHSP380Y	This product has a very high yield strength compared to the existing high strength steel types since it is manufactured with its ultra fine ferric structure by using some special chemical elements.	Kinds of Member-re- inforcing Materials

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POSCO - VIETNAM Cold Rolled Steel **SPECIFICATIONS**

: Thickness (mm)

SPECIFICATIONS

The product standards are subject to change.

Please be sure to confirm the recent standards when making orders or to consult our associates.

▶ POSCO Specifications

Mild Cold Rolled Steel

Temper Tensile Strength Classification Specifications (Mpa) Classifications A S Annealing Standard (275 ≤) 1/8 Full Hard Commercial Quality CSP1 8H Class 1 Н Full Hard Annealing Α Light Drawing Quality CSP1D (275 ≤) Standard S Α Annealing **Drawing Quality** Class 2 275 ≤ CSP2 S Standard Annealing Α 275 ≤ Deep Drawing Quality CSP3 Standard S Non-Aging Deep Annealing Α 275 ≤ CSP3N Class 3 **Drawing Quality** Standard S CSP3E S 275 ≤ Standard Non-Aging Super S CSP3X* Standard 265 ≤ Deep Drawing Quality CSP3Z* S Standard 255 ≤

O	ot	ote	ote.

- 1. Annealed and normal tempered CSP1 class steel is to be CSP1T in case that each or both of the values of the tensile test and Erichsen test are guaranteed according to customers requirements.
- 2. In case that surface quality is strictly require, "E" will be attached at the end of the specification. Ex CSP1D-E
- 3. [] is only for reference.
- 4. In case of CSP3N and CSP3E, non-aging property is guaranteed for six months after shipment.

	Е	Hard	Iness			
0.25 ~ 0.4	0.4 ~ 0.6	0.6 ~ 1.0	1.0 ~ 1.6 1.6 ~ 2.0		HRB	HV
(32)	(34)	(36)	(37)	(38)	-	-
		50 ~ 71	95 ~ 130			
		85 ≤	170 ≤			
33	35	37	38	39		-
34	36	38	39	40	-	
36	38	40	41	42	-	
36	38	40	41	42	-	÷
44	45	46	48	-	-	-
46	47	48	50	-	-	-
-	52	52	52	-	-	-

- 5. For steel less than 0.6mm in thickness, the tensile test shall generally be omited.
- 6. The specification with "*" require prior negotiation before ordering.
- 7.The tensile test: JIS No. 5 test pieces Rolling Direction. Bending test: No.3 test pieces Rolling Direction

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: Thickness (mm)

: Thickness (mm)

SPECIFICATIONS

▶ POSCO Specifications

Steel for Porcelain Enameling

Chemical Composition (wt %) Classification Specifications Thickness (mm) С Mn S Porcelain CESP - C ≤ 0.008 0.4 ~ 2.0 ≤ 0.50 ≤ 0.04 ≤ 0.04 Enameling

	Elongation	n, Min. (%)		T4 Di
0.4 ~ 0.6	0.6 ~ 1.0	1.0 ~ 1.6	1.6 ~ 2.0	Test Piece
38	40	41	42	JIS No.5 Rolling Direction

High Strength Cold Rolled Steel

Classification	Specifications	Thickness (mm)	Yield Point Min. (Mpa)	Tensile Strength Min. (Mpa)
	CHSP45C		275	440
	CHSP35R		187	340
	CHSP40R		236	390
	CHSP38R		220	372
	CHSP45R		275	440
	CHSP35E-E		167	340
	CHSP38E-E		155	370
Cald Dallad High	CHSP38		155	370
Cold Rolled High Strength Steel	CHSP40E		206	390
Sheets and Coils	CHSP40E-E	0.4 ~ 2.0 mm	206	392
Sileets and Colls	CHSP35E		245	440
	CHSP35ES		167	340
	CHSP35ES-E		167	340
	CHSP40ES		200	390
	CHSP220Y		220	340
	CHSP260Y		260	350
	CHSP300Y		300	380
	CHSP340Y		340	410
	CHSP380Y		380	460

Elongation, Min. (%)							
0.4 ~ 0.6	0.6 ~ 1.0	1.0 ~ 1.6					
22	23	24					
32	34	35					
29	31	32					
32	32	32					
15	15	15					
33	35	36					
33	34	36					
35	37	37					
30	32	33					
30	32	33					
-	29	31					
33	35	36					
33	35	36					
32	32	32					
28	28	28					
28	28	28					
22	22	22					
18	18	18					
18	18	18					

- 1. In case that surface rigid materials are being required on CHSP35E, CHSP40E. CHSP35E-E, CHSP40E-E are to be replaced instead of CHSP35E and CHSP40E
- 2. Chemical composition is subject to the agreement between manufacturer and customer.

- If not specified, surface finishing shall be treated in dull finishing
 Please enquire to technical staffs if you need other properties information such as bend ability, n, r, etc.

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Cold Rolled Steel
SPECIFICATIONS

: Thickness (mm)

SPECIFICATIONS

▶ JIS Specifications

JIS G 3141 Cold Rolled Steel Sheets.

Classification	Cifiti	Temper Classifications		Temper Chemical Composition (wt %)				
Classification	Specifications			С	Mn	Р	S	Strength (Mpa)
Commercial	Annealing Standard	A S					(270 ≤)	
Quality (Class 1)	SPCC	1/8 Hard	8	≤ 0.15*	≤ 0.60*	≤ 0.10*	≤ 0.05*	_
(5.2.5.1)		Hard	1					
Drawing Quality (Class 2)	SPCD	Annealing Standard	A S	≤ 0.12*	≤ 0.50*	≤ 0.040*	≤ 0.50*	≤ 0.12*
Dana Danuina	SPCE	Annealing Standard	A S	≤ 0.12*	≤ 0.45*	≤ 0.030*	≤ 0.30*	≤ 0.12*
Deep Drawing Quality (Class 3)	SPCF	Annealing Standard	A S	≤ 0.08*	≤ 0.45*	≤ 0.030*	≤ 0.30*	≤ 0.08*
,	SPCG	Annealing Standard	A S	≤ 0.02*	≤ 0.25*	≤ 0.020*	≤ 0.20*	≤ 0.02*

Note:

- Among the Class 1, the steel in annealed and normal tempering state is not applied to the value of tensile test.
 But if specified by customers [SPCCT], the value within [] can be applied.
- 2. The value with "*" are only for reference.
- Normal tempering among Class 3, if guaranteed non-aging property by specification, shall be written as SPCEN by adding "N" at the end of the specification.

	Hard	Iness					
0.25 ~ 0.30	0.30 ~ 0.40	0.40 ~ 0.60	0.60 ~ 1.0	1.0 ~ 1.6	1.6 ~ 2.0	HRB	HV
(28)	(31)	(34)	(36)	(37)	(38)	-	-
		50 ~ 71	95 ~ 130				
		•	-			85 ≤	170 ≤
30	33	36	38	39	40	-	-
32	35	38	40	41	42	-	-
-	-	40	42	43	44		-
-	-	42	44	-	-	-	-

- 4. Tensile test is applied to steel more than 30mm in width.
- 5. For steel less than 0.6mm in thickness, the tensile test shall generally be omitted.
- 6. When the normal tempering steel in Class 3 are specified as "non-aging", they will have a six month "non-aging" guarantee after shipment
- 7. The Tensile test pieces: JIS: No.5 Rolling Direction. Bending test: No.3 Test pieces Rolling Direction.

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POSCO - VIETNAM

Cold Rolled Steel

SPECIFICATIONS

SPECIFICATIONS

► ASTM A1008 Standards

ASTM Cold Roll Steel Sheets

Classification	Specifications							Chemical	Composition	on (wt %))	Mechanical (Nonmad		
Classification	Specifications	C(%)	Mn(%)	P(%)	S(%)	Si(%)	AI(%)	Cu(%)	Ni(%)	Cr(%)	Mo(%)	V(%)	Cb(%)	Ti(%)	N(%)	B(%)	Yield Strength (Mpa)	Elongation Min (%)	r _m value	n value
	A1008 CS Type A	≤ 0.1	≤ 0.6	≤ 0.025	≤ 0.035	-	-	≤ 0.2	≤ 0.2	≤ 0.15	≤ 0.06	≤ 0.008	≤ 0.008	≤ 0.025	-	-	140~275	30	-	-
Commercial Quality	A1008 CS Type B	0.02~0.15	0.6	≤ 0.025	≤ 0.035	-	-	≤ 0.2	≤ 0.2	≤ 0.15	≤ 0.06	≤ 0.008	≤ 0.008	≤ 0.025	-	-	140~275	30	-	-
	A1008 CS Type C	≤ 0.08	0.6	≤ 0.1	≤ 0.035	-	-	≤ 0.2	≤ 0.2	≤ 0.15	≤ 0.06	≤ 0.008	≤ 0.008	≤ 0.025	-	-	140~275	30	-	-
Drawing Quality	A1008 DS Type A	≤ 0.08	0.5	≤ 0.02	≤ 0.02	-	0.01 ≤	≤ 0.2	≤ 0.2	≤ 0.15	≤ 0.06	≤ 0.008	≤ 0.008	≤ 0.025	-	-	150~240	36	1.3~1.7	0.17~0.22
Drawing Quality	A1008 DS Type B	0.02~0.08	0.5	≤ 0.02	≤ 0.02	-	0.02 ≤	≤ 0.2	≤ 0.2	≤ 0.15	≤ 0.06	≤ 0.008	≤ 0.008	≤ 0.025	-	-	150~240	36	1.3~1.7	0.17~0.22
Deep Drawing Quality	A1008 DDS	≤ 0.06	0.5	≤ 0.02	≤ 0.02	-	0.01 ≤	≤ 0.2	≤ 0.2	≤ 0.15	≤ 0.06	≤ 0.008	≤ 0.008	≤ 0.025	-	-	115~200	38	1.4~1.8	0.20~0.25
Extra Deep Drawing Quality	A1008 EDDS	≤ 0.02	0.4	≤ 0.02	≤ 0.02	-	0.01 ≤	≤ 0.1	≤ 0.1	≤ 0.15	≤ 0.03	≤ 0.1	≤ 0.1	≤ 0.15	-	-	105~170	40	1.7~2.1	0.23~0.27

Note:

Where an ellipsis (-) appears in the table, there is no requirement, but the analysis result shall be reported

* These typical mechanical properties apply to the full range of steel sheet thicknesses. The yield strength tends to increase, the elongation decrease and some of the formability values tend to decrease as the sheet thickness decreases.

** The typical mechanical property values presented here are nonmandatory. They are provided to assist the purchaser in specifying a suitable steel for a given application. Values outside of these ranges are to be expected.

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Cold Rolled Steel
SIZE TOLERANCE

SIZE TOLERANCE

▶ Thickness Tolerance

POSCO Specifications

Unit(mm)

Thickness	250 and over under 400	400 and over under 630	630 and over under 1,000	1,000 and over under 1,250	1,250 and over under 1,570
Under 0.25	± 0.030	± 0.030	± 0.030	± 0.030	-
0.25 and over under 0.40	± 0.035	± 0.035	± 0.040	± 0.040	-
0.40 and over under 0.60	± 0.040	± 0.040	± 0.050	± 0.050	± 0.060
0.60 and over under 0.80	± 0.045	± 0.045	± 0.060	± 0.060	± 0.060
0.80 and over under 1.00	± 0.050	± 0.050	± 0.060	± 0.070	± 0.080
1.00 and over under 1.25	± 0.050	± 0.060	± 0.070	± 0.080	± 0.090
1.25 and over under 1.60	± 0.060	± 0.060	± 0.090	± 0.100	± 0.110

KS, JIS Specifications

Unit(mm)

Thickness	Under 630	630 and over under 1,000	1,000 and over under 1,250	1,250 and over under 1,570
Under 0.25	± 0.030	± 0.030	± 0.030	-
0.25 and over under 0.40	± 0.040	± 0.040	± 0.040	-
0.40 and over under 0.60	± 0.050	± 0.050	± 0.050	± 0.060
0.60 and over under 0.80	± 0.060	± 0.060	± 0.060	± 0.070
0.80 and over under 1.00	± 0.070	± 0.070	± 0.080	± 0.090
1.00 and over under 1.25	± 0.080	± 0.080	± 0.090	± 0.100
1.25 and over under 1.60	± 0.090	± 0.090	± 0.110	± 0.120

▶ Width Tolerance

POSCO Specifications, KS, JIS, Specifications

nit(mm)

EDGE TYPE	Width	Tolerance
MILL EDGE	Under 1,250	+ 7.0
MILL EDGE	1,250 and over	+10.0
SLIT FDGF	Under 1,250	+ 3.0
SLIT EDGE	1,250 and over	+ 4.0

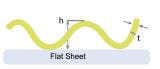
Note: F/H - Only Mill Edge possible

► Maximum Flatness

POSCO Specification, KS, JIS Specification

Unit(mm)

Classification WAVE EDGE CENTER Width Under 1,000 12(2) 8(2) 6(2) 10(2) 8(2) 1,000 and over under 1,250 15(3) 1,250 and over under 1,570 15(4) 12(3) 9(2)



*Flatness = h-t

Unit(mm)

Note:

- 1. In principle, the value within [] are applied to steel drawn by stretcher leveler.
- 2. Flatness is measured on a flat table. Flatness is the value except thickness of the steel from the maximum value of transformation.

▶ Maximum Camber

POSCO Specifications Ur

Unit(mm)

Classification Width	Coil
under 600	4/2000 for arbitrary length
600 and over	2/2000 for arbitrary length

Note: It is not applicable to abnormal parts of steel.

KS, JIS Specifications

Classification Coil

30 and over 8/2000 for arbitrary length
60 and over 600 4/2000 for arbitrary length
600 and above 2/2000 for arbitrary length

Note:

Width

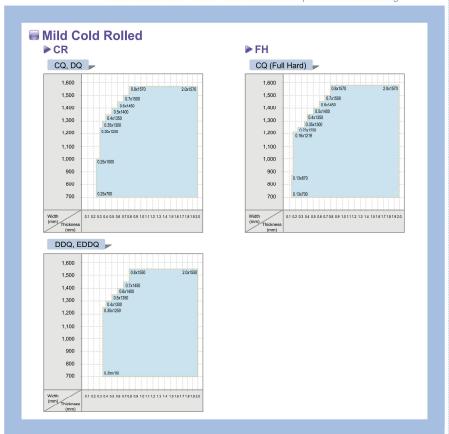
- 1. It is not applicable to abnormal parts of steel.
- Camber means bending from right and left against rolling direction and is estimated as show above.

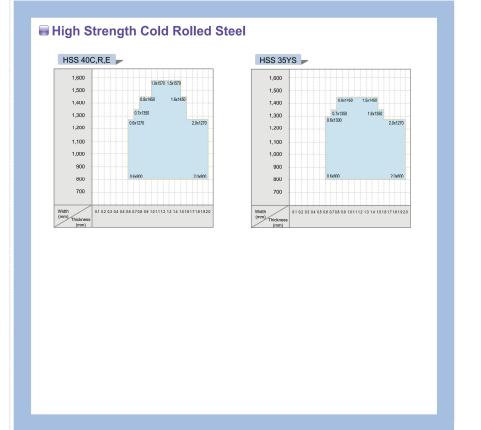
POSCO - VIETNAM 23
Cold Rolled Steel
AVAILABLE DIMENSIONS

AVAILABLE DIMENSIONS

The available sizes are subject to change.

Please consult with POSCO-VIETNAM contact person before ordering.





SURFACE FINISHES AND OILING

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SURFACE FINISHES AND OILING

Surface Finishes DULL

Dull finish, which is attained by attaching numerous fine grains onto the steel surface, is often called pear-skin finish or 'egg-shell texture'.

The grains are made by EDT method (Electro Discharge Texturing). The dull finish is useful in drawing because lubricant oil can be evenly spread over the entire surface, thereby reducing the possibility of friction. The fine grains also help boost paint adherence and extend the steel life

	Dull Finish Ra (µm)	
E5	E7	E9
1.00 ~ 1.80	0.70 ~ 1.30	0.40 ~ 0.80

Note: We do not guarantee in F/H Product

Oiling

It is recommended that customers use product promptly to avoid the possibility of rusting during storage or shipment. Customers can choose kind of oil and quantity.

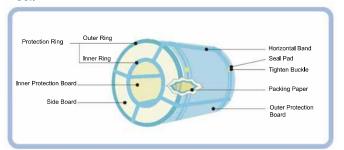
Oiling improves corrosion resistance but cannot be perfect way to protect products from rust. Also, non-oiled and DOS oiled products are easy to rusting so., POSCO strongly recommend to apply with general oil and use the products as soon as possible.

Classification	CODE	Oiling weight (mg/m²), both sides standard
Normal, HEAVY	AH	3,000 ~ 4,500
Normal, GENERAL	AG	1,800 ~ 3,000
Normal, LIGHT	AL	800 ~ 1,800
DOS-A	BD	80 ~ 140
DOS-A	BS	40 ~ 80
DOS-A	BU	10 ~ 25

Note: We do not guarantee in F/H Product

PACKING / MARKING

Coil



Precautions in Use

Please be cautious of the following matters while using cold rolled steel sheets in oder to maintain the characteristics as they are.

- Keep products away from moist or wet places and where and there is sharp fluctuations in temperature. Store products in a well-ventilated place and repair packing if broken or damaged while storing.
- Dry the storing place immediately in case that moisture or water smeared in it.
- · Be careful not to damage surface while transporting or working.
- Pay attention to working environments. Workability may not be good under environments of high temperatures, strong sulfuric acid gas or extreme smoke.
- Product quality may change and the period or product durability may be shortened
 if they are worked near a stove pipe where the temperature is very high.
 Such place of high temperatures should be avoided.
- · Maintain the shortest stocking period as possible.
- ** We POSCO-VIETNAM have various packing type. So, please consult with POSCO-VIETNAM contact person before ordering.

Marking



Cold Rolled Steel
TESTING METHODS

OOSCO-VIETNAM

TESTING METHODS

VR W W

P=Parallel Body Length=around 60mm L= Gauge Length W=Width R= Shoulder Radius=15mm Tensile Test A tensile test is a basic testing method to measure the yield point, the tensile strength and the elongation of a steel sheet. In case of a usual tensile test, some load is increased until the test piece is broken while some load is added to a fixed test piece.

Test Piece The kind and sizes, etc. of test pieces are specified in all of the specifications, such as KS, JIS and ASTM, etc. in order for you to prepare for test a tensile test. In case of a cold-rolled steel sheet, a way of selecting a test piece, which is specified in KS B 0801 No.5, is generally used.

Results from a Tensile Test

The results from a tensile test are used as the most basic standards to judge the workability and formability.

• Elongation (EI)

The higher the elongation is, the better the formability is

· Yield Point (YP)

The lower the yield point is, the better the shape of a final product is.

Yield Ratio (Yield Point/Tensile Strength, YR)

The lower the yield ratio is, the wider the gap between the yield point and the tensile strength is, and the wider the gap is, the better the shape freezing property of a steel sheet is when it is processed at the same strength level.

• Elastic Modulus (E)

An elastic modulus is inversely proportional to the inverse elasticity of a steel sheet. The lower the inverse elasticity is, the better the shape of a final product is.

. Working Hardening Exponent (n)

When some stress is put onto materials, a deformed part becomes hard in order for it to be constrained not to be deformed more and the force of deformation is spread to the other un-deformed parts in order for the whole parts of a material to be deformed evenly. Since the bigger the work hardening exponent is, the quicker and the evener the spread of deformation becomes, such kind of material is considered as the one with a good formability.

• Plastic Deformation Factor(r) : In wo/w

In to/t (wo, w=width before or after a test; to, t=thickness before or after a test)

The reduction ratio of the part in the thickness-wise direction is inversely proportional to the r_{value} , and the reduction ratio of the part in the width-wise direction is proportional to the r_{value} if the material has big r_{value} it is strong against crack and good drawing.

Weight Height Test Piece (Drawing Ratio)

DBTT (Ductile to Brittle Transition Test) Method

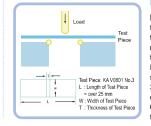
- Test flow: Cup forming (Blanking, Punching) → test temperature variety → drop weight test → Slit ruin observation (transition temperature is the temperature that slit ruin is not occurred)
- DBTT Rating Test Condition

Classification	Detail	Test Condition	Classification	Detail	Test Condition
Forming Condition	Blank Dia.(mm) Punch Dia. (mm) Punch Type Drawing Ratio	96 50 Flat Cup 1,92	Drop Weight Test	Load(kgf) Drop Height(m) Weight Type Test Pieces Position	4.44 0.99 Cylinder Type Laid on to the Side

* Drawing Ratio Range [1.7~2.16]: Blank Dia 85mm (1,7) ~ 108mm (2.16).

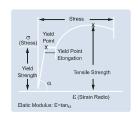
Bending Test The bend test is used judging the deformability [ductility] of the steel sheet, and is primarily conducted as follow: KS B 080 No.3 test specimens are used in the bend test for cold rolled steel sheet. In the bend test, the specimen is bent through a specified angle with a mandrel or a specified radius. Then the ductility of the sheet is judged by whether or not the specimen cracks on the outside of the bent portion. In the case of cold rolled sheet, the specimen is to be bent flat on itself through 180 degree.

Hardness Test The hardness of steel bears a certain relation to its other properties such as strength, wear resistance and drawability. Therefore, the hardness test often employed to judge those other properties because measures the characteristics of given steel sample comparatively.



Rockwell Hardness Test

In this test, a hard steel ball is forced into surface of the test specimen, first under a fixed minor load and than under a major load. On remove the major load, the permanent depth of impression is measure, and a number derived form the net increase in the depth of impression in the two operations is read directly on the Rockwell hardness B- scale and Rockwell superficial hardness 30T-scale. The B-scale is based on a steel ball 1/16 in. [1.558 mm] in diameter and a 100kg test-load. The 30T-scale consists of a 30kg test load and a steel ball of the same diameter. The B-scale is highly dependable when the test specimen is 0.762mm [0.030in] or thicker. For thicknesses less than 0.762mm, therefore, use of the 30T-scale is recommended.



POSCO - VIETNAM
Cold Rolled Steel
APPENDIX

APPENDIX

Thickness	Width*Length	762x1829	762x2438	762x3048	914x1829	914x2438	1219x3048	1219x1829	1219x2438	1219x3048
(mm)	Unit Weight (kg/m ²)	2.5x6	2.5x8	2.5x10	3x6	3x8	3x10	4x6	4x8	4x10
0.23	1.806	2.52	3.36	4.20	3.02	4.02	5.03	4.06	5.37	6.71
0.25	1.963	2.74	3.65	4.56	3.28	4.37	5.47	4.38	5.83	7.29
0.26	2.041	2.85	3.79	4.74	3.41	4.55	5.69	4.55	6.07	7.58
0.29	2.276	3.17	4.23	5.29	3.81	5.07	6.34	5.08	6.76	8.46
0.30	2.355	3.28	4.38	5.47	3.94	5.25	6.56	5.25	7.00	8.75
0.32	2.512	3.50	4.67	5.84	4.20	5.60	7.00	5.60	7.47	9.33
0.35	2.748	3.83	5.11	6.38	4.59	6.12	7.66	6.13	8.47	10.2
0.40	3.140	4.38	5.85	7.29	5.25	7.00	8.75	7.00	9.33	11.7
0.45	3.532	4.92	6.56	8.20	5.91	7.87	9.84	7.88	10.5	13.1
0.50	3.926	5.47	7.29	9.12	6.56	8.74	10.9	8.75	11.7	14.6
0.55	4.318	6.02	8.02	10.0	7.22	9.62	12.0	9.63	12.8	16.0
0.60	4.710	6.57	8.75	10.9	7.88	10.5	13.1	10.5	14.0	17.5
0.70	5.120	7.11	9.48	11.9	8.53	11.4	14.2	11.4	15.2	19.0
0.75	5.495	7.66	10.2	12.8	9.19	12.2	15.3	12.3	16.3	20.4
0.80	5.888	8.21	10.9	13.7	9.84	13.1	16.4	13.1	17.5	21.9
0.80	6.280	8.75	11.9	14.6	10.5	14.0	17.5	14.0	18.7	23.3
0.85	6.672	9.30	12.4	15.5	11.2	14.9	18.6	14.9	19.8	24.8
0.90	7.065	9.85	13.1	16.4	11.8	15.7	19.7	15.8	21.0	26.3
0.95	7.458	10.4	13.9	17.3	12.5	16.6	20.8	16.6	22.2	27.7
1.00	7.850	10.9	14.6	18.2	13.1	17.5	21.9	17.5	23.3	29.2
1.20	9.420	13.1	17.5	21.9	15.8	21.0	26.2	21.0	28.0	35.0
1.40	10.99	15.3	20.4	25.5	18.4	24.5	30.6	24.5	32.7	40.8
1.60	12.56	17.5	23.3	29.2	21.0	28.0	35.0	28.0	37.3	46.7
1.80	14.13	19.7	26.3	32.8	23.6	31.5	39.4	31.5	42.0	52.5
2.00	15.70	21.9	29.2	36.5	26.2	35.0	43.7	35.0	46.7	58.3

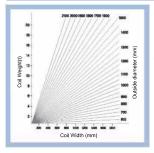


Diagram of relationship between Coil Widths, Outer Diameters and Weight

Note: this graph was determined by calculating the parameters of the steel in 20 inches [508mm] of length and having its main component at a space factor of 100%.

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173.7 184 154 44 18 157 45 41 18 173.7 184 154 44 18 157 45 18 173.7 184 154 44 18 157 45 18 173.7 184 154 44 18 157 45 18 173.7 184 154 44 18 157 45 18 173.7 184 154 44 18 157 45 18 173.7 184 154 18 173.7 185 151 151 151 151 151 151 151 151 151 | 30-T Hardness HV Hardness B F F HS 101/500) 80.8 235 202 55 88. 87. 79.5 224 193 53 87. 78.9 218 184 52 86. 78.2 214 179 51 85. 76.9 205 171 49 84. 76.3 200 167 48 84. 75.0 192 160 46 83. 75.0 192 160 46 83. 75.0 192 160 46 83. 75.0 192 160 46 83. 73.1 184 154 44 82. 73.7 184 154 44 82. 73.7 184 154 44 82. 73.1 180 151 43 81. 72.4 176 148 42 80. 71.8 173 145 41 80. 71.2 170 142 40 79. 70.5 166 140 39 79. 68.0 154 130 35 77. 68.0 154 130 35 77. 68.0 154 130 35 77. 66.0 154 130 35 77. 66.0 154 130 35 77. 66.0 154 130 35 77. 66.0 145 130 35 77. 66.0 145 130 35 77. 66.0 145 124 32 75. 66.4 142 122 31 74. 64.8 140 120 30 74. 64.8 140 120 30 74. 64.8 140 120 30 74. 64.8 140 120 30 74. 66.7 147 126 33 75. 66.4 142 122 31 74. 64.8 140 120 30 74. 64.8 140 120 30 74. 64.8 140 120 30 74. 65.1 137 118 28 73. 65.5 134 116 26 71. 65.6 127 110 29 68. 67. 60.9 125 109 18 67. 67. 71. 113 99 6 6. 60. 3 123 107 16 66. 59.0 119 104 12 64. 55.8 109 96 2 58. 55.2 107 95 0 57. 54.5 106 94 55.9 104 92 55.9 103 91 | 30-T Hardness H8 (10/500) B F 80.8 235 202 55 88.1 80.1 229 195 54 87.5 79.5 224 193 53 87.0 78.9 218 184 52 86.5 77.6 209 175 50 85.3 76.9 205 171 49 84.8 76.3 200 167 48 84.2 75.7 196 163 47 88.7 75.0 192 160 46 83.1 75.0 192 160 46 83.1 74.4 188 157 45 82.5 73.7 184 154 44 82.0 73.1 180 151 43 81.4 72.4 176 148 42 80.9 71.8 173 145 41 80.3 71.2 170 142 40 79.8 70.5 166 140 39 79.2 69.9 163 137 38 78.6 68.0 154 130 35 77.0 68.0 154 130 35 77.0 67.3 150 128 34 76.4 66.7 147 126 33 75.8 66.0 145 122 31 74.7 64.1 137 118 28 77.0 66.1 147 126 33 75.8 66.2 160 135 37 78.1 66.3 150 128 34 76.4 66.7 147 126 33 75.8 66.4 142 122 31 74.7 64.8 140 120 30 74.2 64.8 140 120 30 74.2 64.8 140 120 30 74.2 64.8 140 120 30 74.2 64.8 140 120 30 74.2 64.8 140 120 30 74.2 66.9 125 109 18 66.5 66.9 125 109 18 67.5 60.3 123 107 16 66.5 60.9 125 109 18 67.5 60.3 123 107 16 66.5 60.9 125 109 18 67.5 60.3 123 107 16 66.5 65.6 120 106 14 65.2 65.8 109 96 2 58.5 65.8 109 96 2 58.5 65.2 107 95 65.2 107 95 65.3 104 92 53.9 104 92 53.9 104 92 | 30-T Hardness HB(10/500) B F 80.8 235 202 55 88.1 80.1 229 195 54 87.5 79.5 224 193 53 87.0 78.9 218 184 52 86.5 78.2 214 179 51 85.9 77.6 209 175 50 85.3 76.9 205 171 49 84.8 76.3 200 167 48 84.2 75.7 196 163 47 83.7 75.0 192 160 46 83.1 75.0 192 160 46 83.1 77.4 188 157 45 82.5 73.7 184 154 44 82.0 73.1 180 151 43 81.4 72.4 176 148 42 80.9 71.8 173 145 41 80.3 77.2 170 142 40 79.8 69.9 163 137 38 78.6 69.2 160 135 37 78.1 68.6 156 130 35 77.0 68.0 154 130 35 77.0 67.3 150 128 34 76.4 66.7 147 126 33 75.8 66.0 154 130 35 77.0 67.3 150 128 34 76.4 66.7 147 126 33 75.8 66.0 145 124 32 75.3 66.0 145 124 32 75.3 66.1 137 118 28 73.1 63.5 134 116 26 71.9 62.8 132 114 24 70.8 62.9 129 112 22 69.7 61.6 127 110 29 68.6 60.9 125 109 18 67.5 60.3 123 107 16 66.4 59.6 120 106 14 65.2 59.0 119 104 12 64.1 55.8 109 96 2 58.5 57.1 113 99 6 60.8 55.2 107 95 55.2 107 95 55.2 107 95 55.2 107 95 55.5 106 94 55.9 109 96 2 58.5 55.2 107 95 55.2 107 95 55.2 107 95 55.2 107 95 55.2 107 95 55.2 107 95 55.2 107 95 55.2 107 95 55.2 107 95 57.4 | 80.8 235 202 55 88.1 87.5 79.5 224 193 53 87.0 78.9 218 184 52 86.5 78.2 214 179 51 85.9 76.9 205 171 49 84.8 76.3 200 167 48 84.2 75.0 192 160 46 83.1 75.0 192 160 46 83.1 77.4 188 157 45 82.5 73.7 184 154 44 82.0 9.7 73.1 180 151 43 81.4 72.4 176 148 42 80.9 71.8 173.7 145 41 80.9 71.8 173 145 41 80.9 71.8 173 145 41 80.9 71.2 170 142 40 79.8 66.0 154 130 35 77.0 66.0 154 130 35 77.0 67.3 150 128 34 76.4 66.7 147 126 33 75.8 66.0 154 130 35 77.0 67.3 150 128 34 76.4 66.7 147 126 33 75.8 66.4 142 122 31 74.7 66.8 140 150 150 128 34 76.4 66.7 147 126 33 75.8 66.4 142 122 31 74.7 66.7 147 126 33 75.8 66.4 142 122 31 74.7 66.7 147 126 33 75.8 66.4 142 122 31 74.7 66.7 147 126 33 75.8 66.4 142 122 31 74.7 66.7 147 126 33 75.8 66.4 142 122 31 74.7 66.5 133 118 16 26 71.9 66.5 134 116 26 71.9 66.5 128 132 114 24 70.8 66.7 19.6 60.9 125 109 18 67.5 60.9 125 109 18 67.5 60.9 125 109 18 67.5 67.1 113 99 6 60.8 65.5 120 106 14 65.2 69.7 65.5 109 96 55.2 107 65.5 109 96 55.2 107 65.5 109 96 55.2 107 55.1 101 8 61.9 55.4 111 98 44 55.3 104 92 53.2 103 91 | 80.8 235 H2 H3
 | 30-T Hardness HR(10/500) B F 3 80.8 235 202 55 88.1 579.5 224 193 53 87.0 578.9 218 184 52 86.5 78.2 214 179 51 85.9 476.9 205 1711 49 84.8 4.76.3 200 167 48 84.2 475.7 196 163 47 83.7 44 188 157 45 82.5 474.4 188 157 45 82.5 474.4 188 157 45 82.5 474.4 188 157 45 82.5 475.0 192 160 46 83.1 477.4 188 157 45 82.5 474.4 188 157 45 82.5 475.0 192 160 46 83.1 477.4 188 157 45 82.5 477.3 1 180 151 43 81.4 472.4 176 148 42 80.9 471.8 173 145 41 80.3 4771.2 170 142 40 79.8 470.5 166 140 39 79.2 466.9 163 137 38 78.6 475.5 166 156 133 36 77.5 36.6 156 156 133 36 77.5 36.6 156 156 133 36 77.5 36.6 156 156 133 36 77.5 36.6 156 156 133 36 77.5 36.6 156 156 133 36 77.5 36.6 156 156 133 36 77.5 36.6 156 128 37 78.1 46.8 156 156 133 36 77.5 36.6 156 133 36 77.5 37 88.1 476.4 36.6 156 156 133 36 77.5 37 88.1 476.4 36.6 156 156 133 36 77.5 37 88.1 476.4 36.5 156 128 37 78.1 476.4 36.5 156 128 37 78.1 476.4 36.5 156 128 37 78.1 476.4 36.5 156 128 37 78.1 476.4 36.5 156 128 37 78.1 476.4 36.5 156 128 37 78.1 476.4 36.5 156 128 37 78.1 476.4 36.5 156 128 37 78.1 476.4 36.5 156 128 37 78.1 476.4 36.5 156 156 156 127 110 29 68.6 22 69.7 36.5 156 156 120 106 14 65.2 25 109 106 14 65.2 25 109 106 14 65.2 25 109 106 14 65.2 25 107 105 109 104 12 64.1 25 105 109 104 12 64.1 25 105 109 104 12 64.1 25 105 109 104 12 64.1 12 65.5 106 104 105 105 105 105 105 105 105 105 105 105 | 30-T Hardness HB (10/500) B F 30 80.8 235 202 55 88.1 51 79.5 224 193 53 87.0 50 78.9 218 184 52 86.5 50 78.2 214 179 51 86.9 49 77.6 209 175 50 85.3 48 76.9 205 171 49 84.8 48. 76.3 200 167 48 84.2 47 75.7 196 163 47 88.31 46 75.0 192 160 46 83.1 46 73.7 184 154 44 82.0 44 73.1 180 151 43 81.4 44 72.4 176 148 42 80.9 43 771.2 170 142 40 79.8 42 70.5 166 140 39 79.2 41 69.9 163 137 38 78.6 41 69.2 160 33 77.5 39 68.0 154 130 35 77.0 39 68.0 154 130 35 77.0 39 67.3 150 128 34 76.4 38 68.0 154 130 35 77.0 39 67.3 150 128 34 76.4 38 68.6 156 133 36 77.5 39 67.3 150 128 34 76.4 38 68.6 156 133 36 77.5 39 67.3 150 128 34 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