Roll

PRODUCT GUIDE

HYUNDAI STEEL

CONTENTS

Company Overview

Roll

HYUNDAI STEEL

The 'H' symbol of Hyundai Steel highlights the company's mission for High Spirit, Harmony and Humanity. Like its shape, the firm axes on both sides signify Hyundai Steel's new and existing businesses and the company and clients, and the bridge in the middle balances both axes and their future growing in consolidation.

Hyundai Steel, in pursuit of Engineering the Future Beyond Steel, contributes to Korea's steel industry by realizing infinite potential of steel through relentless research and development.

Hyundai Steel's rolling roll, which was chosen as the world's first-class product in 2001, is an excellent product acknowledged not only in the domestic but also in global market.

Roll

Engineering the Future Beyond Steel

철, 그 이상의 가치창조

Hyundai Steel is always with the clients. The company realizes the vision of <Engineering the Future Beyond Steel> by providing optimized materials that exceed the expectations of clients based on its advanced technologies and differentiated product competitiveness.

Hyundai Steel Products & Application

Hyundai Steel offers outstanding products built around continuous research development and sophisticated technical skills that meet the demands from various steel-required industry fields.

Automobile

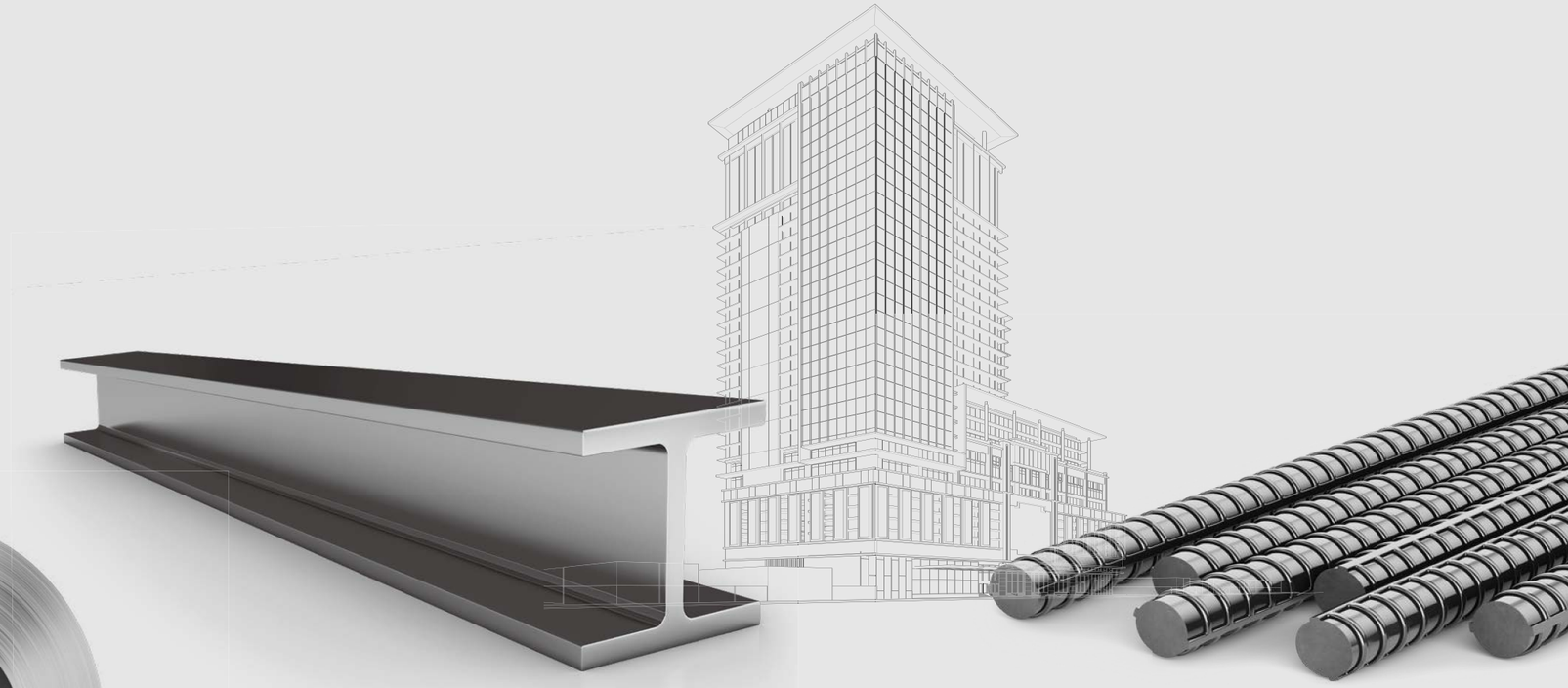
Cold Rolled Steel Rolled from hot rolled steel at ambient temperature, cold rolled steel has even thickness and fine surface. It is most widely used in the automotive material such as inner and outer car frames.

Automotive Parts Enhancing the strength and fuel efficiency, automotive parts require complicated techniques to reduce the weight and are applied to impact point, door inner plate and chassis parts.

Special Steel Special steels are employed in critical automotive parts such as crankshaft, connecting rod and many other gear parts where high intensity and durability are necessary.

Energy

Plate Plates are applied to build pressure vessel to extract, refine and store drilled oil or gas. Depending on different oil or gas types, pressure vessel must be able to stand high and low temperature and corrosion.

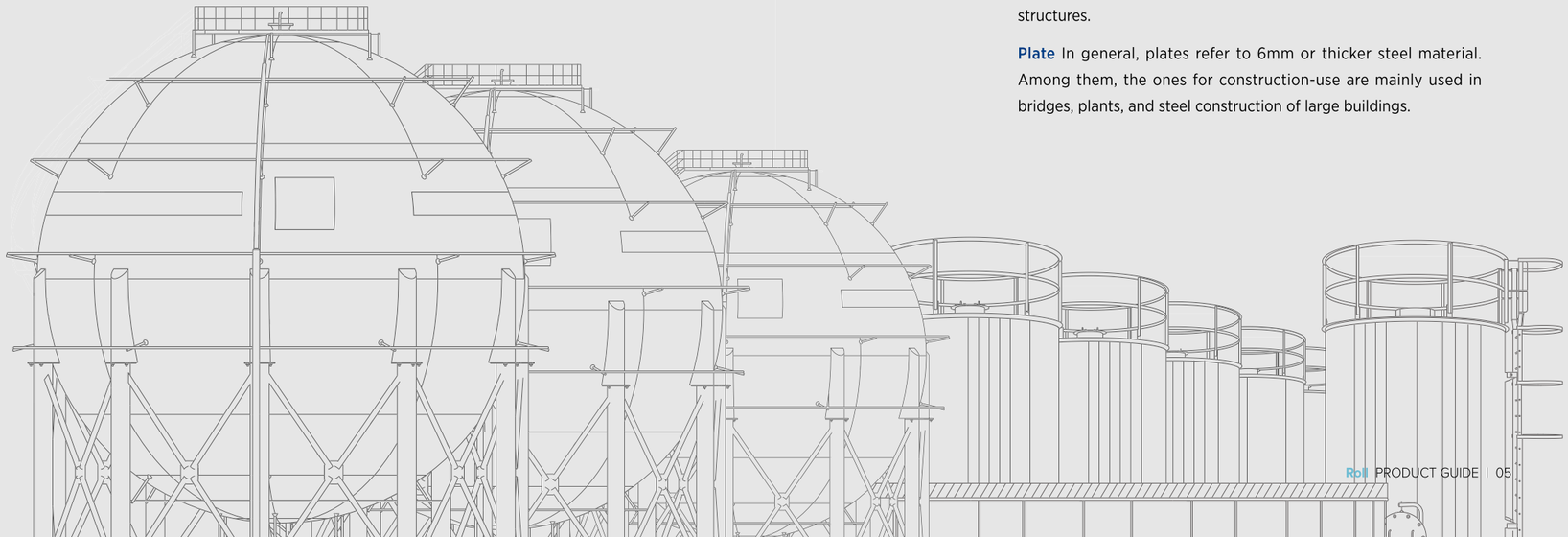


Construction

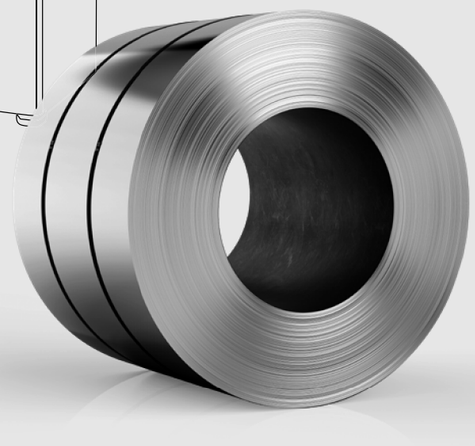
H-Section H-Section comprises the structure of a building as one of the main steel product. SHN is an H-Section with outstanding welding performance and impact resistance and its advantage is in reducing volume of steel materials used in comparison to other steel materials and shortening the construction period.

Reinforcing Bar Reinforcing Bar is also an important steel product for construction together with H-Section. High-intensity reinforcing bars reduce the volume being used thus raising construction efficiency. As thread bars do not need the process of making thread of screw when connecting, construction period can be shorter. As for earthquake-proof bars enhance stability of structures.

Plate In general, plates refer to 6mm or thicker steel material. Among them, the ones for construction-use are mainly used in bridges, plants, and steel construction of large buildings.



Home Appliances



Cold Rolled Steel Cold rolled steel for home appliance is applied to various products such as TV, refrigerator, outer panel of washer. With different designs, cold rolled coils have excellent machinability, high corrosion resistance and conductivity.

Stainless Steel Stainless steel is highly anti-rust compared to other materials. Its corrosion-proof ability exceeds from tens to thousands of times the regular steel and its great heat-resistance allows it to be widely used in home appliances such as dishwashers and washing machines.

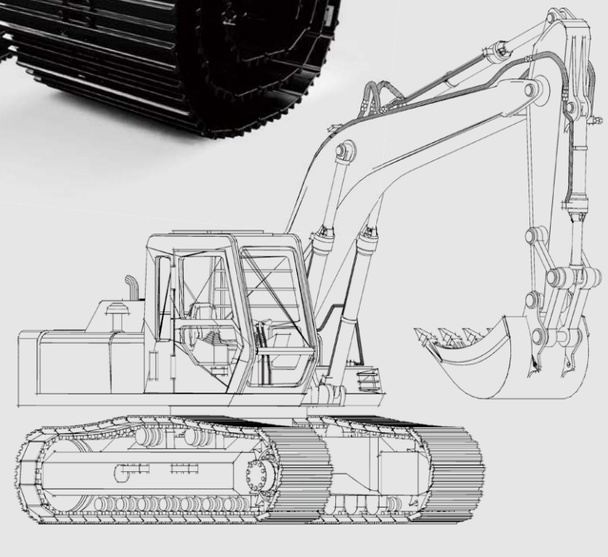
Others

Railway Rails Rails used in railroads for high-speed, regular and Maglev trains are higher in intensity compared to other sections and they have excellent abrasion resistance.

Track Shoe Assembly Built as substructure of an excavator, track shoe assembly is a high-strength/ precision product for stably sustain the weight on sandy and gritty sites and function on the slope.

Roll Attached to a rolling machine, rolls must have wear and heat resistance; durability to roll semi-finished products including slab and billet at a high temperature.

Sheet Pile Sheet pile plays a role as the stop gate against water and soil in civil engineering, works in river and the coast. The rigid connector of the pile enhances its water-proof ability.



Shipbuilding

Plate Ship plates show properties such as low temperature toughness and impact resistance and are usually applied to inner and outer walls, upper decks, and hatch covers of bulk carriers, container ships, and LNG ships. Hyundai Steel manufactures regular and high strength steels after its manufacturing process is approved by classification associations from different nations.

Section Depending on the shape, sections are classified into H-BEAM, I-BEAM, angle and channel. Used in reinforcement for vessel plate or deckhouse, sections are required to have high strength and shock absorption.

Manufacturing Work Sites


1


2


3


4


5


6

1

Incheon Plant

Being the pioneer in Korean steel industry, Incheon Plant is the world's largest single electric furnace plant and equipped with eco-friendly and high-efficiency facilities. Incheon North Port's steel pier, in particular, enhances cost efficiency.

Products H-Section, Re-Bar, Regular Section, Stainless Steel

2

Pohang Works

With its top level technology and high competitiveness, Pohang Plant is the only source manufacturing railroads for high-speed railways in Korea after successful development of Maglev train railroads as the second in the world.

Products H-Section, Re-Bar, Railway Rails, Round Steel, Rolls, Heavy Equipment

3

Dangjin Steelworks

Dangjin Steelworks, rewriting the history of Korean steel by being the first private corporation in Korea to run an integrated steel mill in 2010, is equipped with both blast and electric arc furnaces(EAF). Blast furnace process produces heavy plate, hot and cold rolled coils with three furnaces while steel scrap-fueled EAF produces Re-bars and special steels.

Products Hot Rolled Steel, Cold Rolled Steel, Heavy Plate, Re-Bar, Special Steel

4

Suncheon Plant

Suncheon plant boasts the world's largest single unit—1.2 million-ton-scale Continuous Annealing Line (CAL) with the annual capacity of producing 2-million-ton of cold rolled coils. Based on state of the art facilities including Continuous Hot-dip Galvanizing line (CGL), Electro Galvanizing Line (EGL) and Color Coating Line (CCL), different cold rolled coils for automobile, electronics and construction are produced.

Products Cold Rolled Steel, Hot-Dip Galvanizing Steel, Electro Galvanizing Steel, Color Steel

5

Yesan Plant (Consignment Production)

As the center of automobile weight-reduction products plant, Yesan Plant possesses twenty one Hot-Stamping machines and six TWB(Tailor Welded Blanks) equipments.

Products Automotive Lightweight Materials

6

Cheongdo Plant

Established from the perspective of the Chinese market's potential and infinite possibility, Cheongdo Plant is an integral overseas plant serving as the bridge for Hyundai Steel to enter into the global market.

Products Heavy Equipment

Company History

For more than six decades, Hyundai Steel rewrote the foundation of Korea's steel history. With the responsibility as the nation's top-notch steel maker, we will stay committed to bettering lives for people and opening a new chapter in the steel industry.

1950s

1953. 06. Korea Heavy Industry Corporation founded
1962. 11. Renamed as Incheon Heavy Industry Co., Ltd.
1964. 09. Incheon Steel Corporation (two-company system) established
1970. 04. Integrated as Incheon Steel

Panoramic view of Korea Heavy Industry Corporation in its early days

Blooming mill

1980s

1982. 03. Starting of H-section plant operation
1987. 05. Company opening

H-section plant

Panorama of Hyundai Machinery limited in Cheongdo, China

Completed stainless steel plant

1990. 09. Expansion of 120,000 ton stainless cold rolling mills completed
1999. 12. Establishment of Hyundai Machinery limited in Cheongdo, China

1990s

2001. 04. Launched as Hyundai Motor Group
2004. 10. M&A ceremony of Hanbo Steel Dangjin Plant
2006. 10. Ground-breaking ceremony of Integrated Steelworks

2000s

Ground-breaking ceremony of Integrated Steelworks

Chairman Chung Mong-Koo attending at the ceremony of the launching of Hyundai Motor Group

Launched closed-type raw materials handling system in 2009

2010. 01. Integrated Steelworks the 1st blast furnace firing ceremony
2010. 04. Integrated Steelworks completion ceremony
2010. 11. Integrated Steelworks the 2nd blast furnace firing ceremony
2013. 09. Integrated Steelworks the 3rd blast furnace firing ceremony
2015. 07. Merger of Hyundai HYSCO
2015. 10. Completion of special steel plant
2017. 11. Launching 'H-Core' earthquake resistant steel brand
2019. 04. Launching 'H-Solution' automotive specialized steel brand
2019. 11. Wear resistant steel brand WEAREX launching
2020. 09. High strength steel brand ULTREX launching
2022. 09. Premium construction steel brand H CORE Relaunchng

2010s

2010 the 2nd blast furnace firing ceremony

Participated in 2019 H-Solution Shanghai Motor Show

Hyundai Steel's rolling roll is used in hot rolling, heavy section, and bar section and its quality is acknowledged from not only domestic companies but also from overseas steel companies. Especially centrifugal tool steel roll for hot rolling once again proved Hyundai Steel's technology by being selected as the world's first-class product in 2001.

Roll

History of Roll Business

1950s

1953
Company Established

1970s

1975
Start Roll Production

1980s

1985
Installation of Vertical Spin Caster

1990s

1993
Development of HSS

1998
Development of Enhanced ICDP

2000s

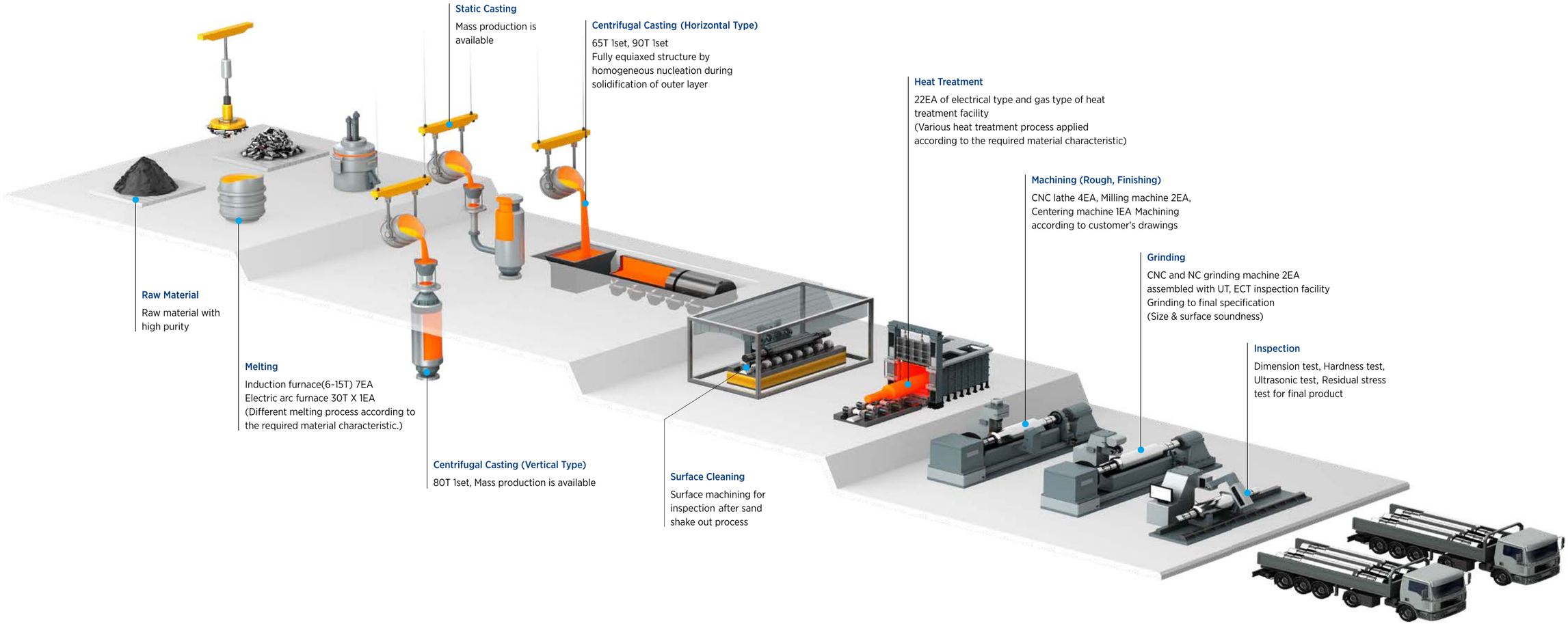
2006
Installation of Horizontal Spin Caster

2010s

2011
Installation of Wide Horizontal Spin Caster
(For Heavy Plate Mill Roll)

2015
Development of Hybrid HSS
(For Hot Strip Mill)

Manufacturing Process



PRODUCTION FACILITIES ORGANIZATION

Melting

Electric Arc Furnace
30T x 1EA

Induction Furnace
6T x 3EA
8T x 1EA
15T x 3EA

Heat Treatment

Heat Treatment Furnace
- 100T, Car Type x 7EA
- 80T, Car Type x 4EA
- 80T, Bell Type x 2EA
- 30T, Car Type x 7EA
- 20T, Car Type x 2EA

Casting

Vertical Spin Caster
80T, Max. 1600¢ x 1EA

Horizontal Spin Caster
65T, Max. 1600¢ x 1EA
90T, Max. 1600¢ x 1EA

Machining

Machining shop
- CNC Lathe x 3EA
- NC Lathe x 1EA
- CNC Milling M/C x 2EA
- Centering M/C x 1EA
- Grinding M/C x 2EA

QM & Inspection

QUALITY MANAGEMENT


1. Ultrasonic Test

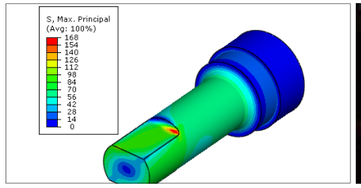

2. Hardness Test


3. Dimension Test

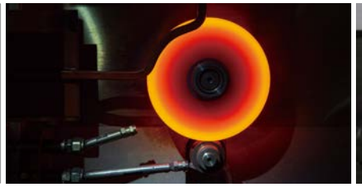

4. Eddy Current Test


5. X-ray Residual Stress


6. Microstructure Analysis



7. Stress Analysis


8. Abrasion Test


9. Thermal Shock Test

QUALITY ASSURANCE ORGANIZATION

QUALITY ASSURANCE				R&D
QA PART	LABORATORY	AS-CAST INSPECTION PART	FINAL INSPECTION PART	R&D
1. Establishment of Quality System 2. Quality Cost Control 3. Customer Quality Requirement Review 4. Internal Quality Audit	1. Chemical Analysis by Wet Type and Spectrometer 2. Mechanical Test	1. Inspection - Shape - Dimension - Hardness - Heat treatment	1. Inspection - Shape - Dimension - Hardness - Ultra Sonic Test - Eddy Current Test 2. Issue of Mill Certificate	1. Development of New Material 2. Development of of Process

EXPERIMENTAL & INSPECTION EQUIPMENT

Physical Properties Test

DESCRIPTION	SPEC'	Q'TY	MAKER
Universal Testing M/C	200, 100, 40Ton	3	Shimadzu
Impact Testing M/C	500 J	1	Tinius Olsen
Rockwell Hardness Tester	150Kg	1	Misawa Seiki
Brinell Hardness Tester	3000Kg	1	Tokyo
Vickers Hardness Tester	50Kg	1	Matsuzawa Seiki
Shore Hardness Tester	D Scale	10	
Equotip Hardness Tester	LD200~890	2	PROCEQ. LTD
Roughness Tester	300㎛	1	Mitutoyo
X-ray Residual Stress Tester	30kV, 6.67mA	1	Stress-Tech
Hot Rolling Simulator	Φ45 X 13	1	Geo-Sung
Thermal Shock Tester	15 X 25 X 45	1	R&B

Microscope

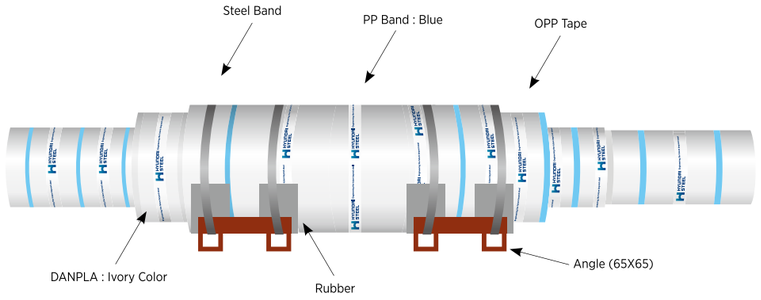
DESCRIPTION	SPEC'	Q'TY	MAKER
FE-TEM	Max. X 1,000,000	1	FEI
FIB (Focused Ion Beam)	Resolution : 4nm(30kv)	1	SII nano tech.
FE-SEM with EDS/EBSD	Max. X 2,000,000	1	FEI
	Max. X 500,000	1	Jeol
EPMA	Max. X 400,000	1	Shimadzu
Image Analyzer	Max. X 1,000	2	Clemex, IMT
Confocal Laser Scanning Microscope	Max. X 14,400	1	Olympus
Optical Microscope	Max. X 1,000	3	Leica, Nikon
Potable Optical Microscope	Max. X 500	2	Olympus, N.O.W

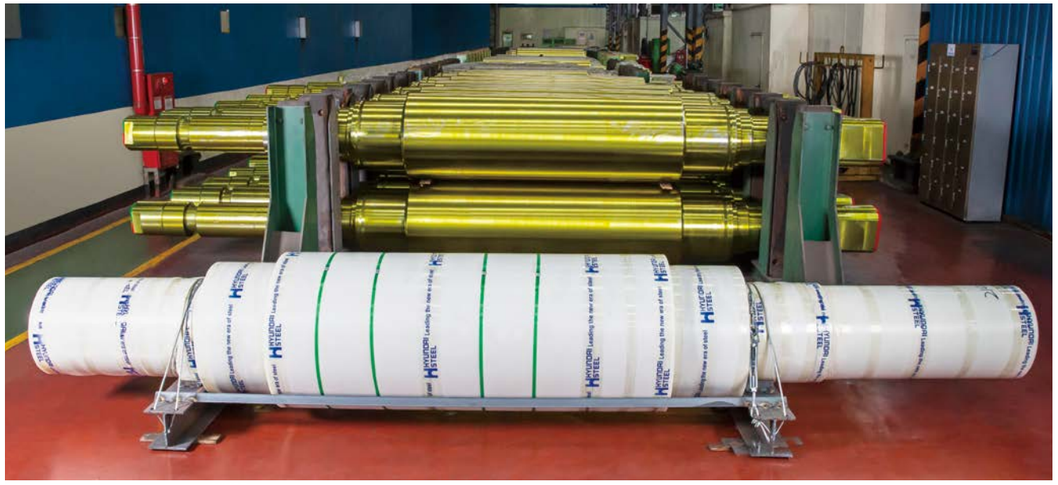
Spectrometer & Others

DESCRIPTION	SPEC'	Q'TY	MAKER
XRD	Target : Cu, Mo, Co	1	Rigaku
XRF	Element Range : B-U	1	Rigaku
Spectrometer	32 Channel	4	Baird, Spectro, OBLF
I.C.P	Focal Length	1	Thermo
C/S Analyzer	C : 0-5%, S : 0-30%	1	Leco
TGA	MAX. 1750℃	1	Eltra
DSC	MAX. 1400℃	1	Netzsch
CE Meter	MAX. 1400℃	1	Novacast
Dilatometer	10mm x 3φ	1	Thetha
Muffle Furnace	MAX. 1100℃	1	Samhwa
Ultra Sonic Tester (Analog)	0.5-25MHz	3	Krautkramer
Ultra Sonic Tester (Digital)	0.5-25MHz	3	Staveley, Olympus

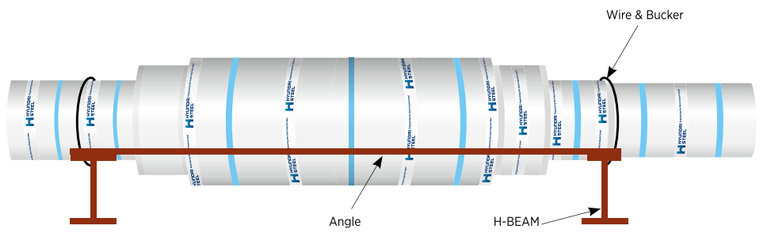
Packing

UNDER 15TON

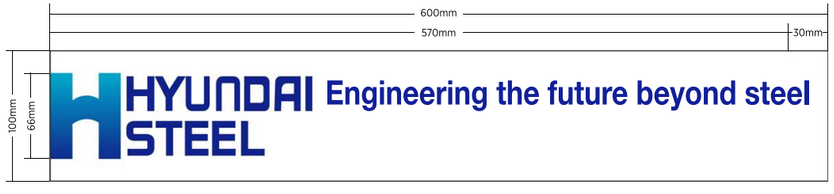




OVER 15TON



OPP TAPE



R&D Center

BUILDING NAME	AREA (m^2)	INVESTMENT (MILLION $)	RESEARCHER	STUDY DIVISION
Iron Research Building	13,000	72	200	Office
				Material Analysis Laboratory
Rolling Test Building	3,000			Simulation of Hot-Cold Rolling Process
Iron Research Building	2,000			Improve Sinter, Coke Quality
				Optimization of Blast Furnace Charging
Integration and Development Center	16,000	73	170	Automotive Applied Technology and Parts
				Environment and Energy Technology
				Steelmaking Process (New Process)

HYUNDAI STEEL R&D CENTER

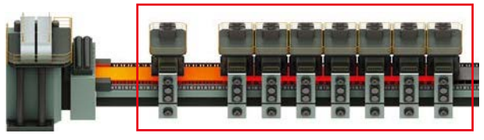
Backed by a wide variety of state-of-the-art testing facilities and a staff of over four hundred, Hyundai Steel's R&D Center develops technologies needed for production materials, parts processing, designs, and other uses. It also carries out research in collaboration with Hyundai Motor, Kia Motors.


Certificate of Registration
QUALITY MANAGEMENT SYSTEM - ISO 9001:2008


Certificate of Registration
ENVIRONMENTAL MANAGEMENT SYSTEM - ISO 14001:2004


Certificate of Registration
INFORMATION SECURITY MANAGEMENT SYSTEM - ISO/IEC 27001:2005

Adamite(ADM)



Characteristics

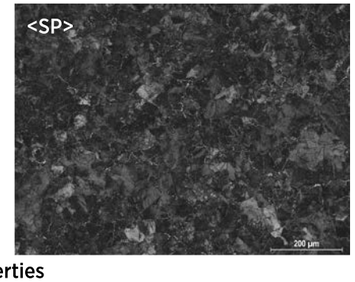
- Low carbon contents (~1.0%)
  Ferrite + Pearlite structure
  High toughness
  High thermal shock resistance
- High Carbon Cast Steel (1.1~2.5%)
  High wear resistance
  High crack resistance (GS)
  High sticking prevention (AG)

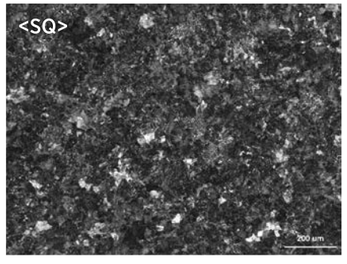
Typical Application

- Low Carbon Cast Steel (~1.0%)
  Roughing stand for section mill (BDM)
  Roughing stand for hot strip mill
- High Carbon Cast Steel (1.1~2.5%)
  Mainly used for section mill
  Roughing stand for hot strip mill
  Rail mill which requires deep grooves

Chemical Composition

MATERIAL CODE	C	Si	Mn	Ni	Cr	Mo
SP	0.50 / 1.00	0.30 / 1.00	0.60 / 1.10	RES.	0.80 / 1.20	0.20 / 0.60
SQ	0.50 / 1.00	0.30 / 1.00	0.60 / 1.10	0.70 / 1.30	0.80 / 1.20	0.20 / 0.60
AP	1.10 / 2.40	0.30 / 1.00	0.60 / 1.20	RES.	0.80 / 1.20	0.20 / 0.50
AQ	1.10 / 2.40	0.30 / 1.00	0.60 / 1.20	0.80 / 1.70	0.80 / 1.20	0.20 / 0.50
GS	1.20 / 2.20	0.80 / 1.70	0.50 / 1.20	0.50 / 2.00	0.50 / 1.50	0.20 / 0.50

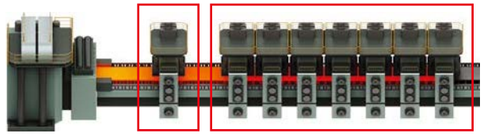


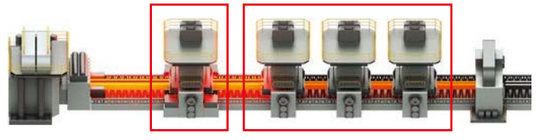


Mechanical Properties

MATERIAL CODE	BARREL HARDNESS (Hs)	NECK HARDNESS (Hs)	TENSILE STRENGTH (kgf/mm^2)	BENDING STRENGTH (kgf/mm^2)	ELONGATION (%)	IMPACT VALUE (kgm/cm^2)	COMPRESSIVE STRENGTH (kgf/mm^2)
SP	30 - 50	-	70 - 90	140 - 190	1.00 - 7.00	1.00 - 5.00	-
SQ	30 - 50		75 - 95	140 - 190	2.00 - 10.00	1.00 - 5.00	-
AP	40 - 60	-	35 - 55	60 - 160	0.10 - 3.00	0.10 - 1.50	-
AQ	40 - 60	-	40 - 60	60 - 180	0.10 - 3.00	0.10 - 1.50	-
GS	35 - 60	-	50 - 70	100-160	0.30 - 1.50	0.30 - 1.50	-

Adamite Sleeve(ADM(S))





Characteristics

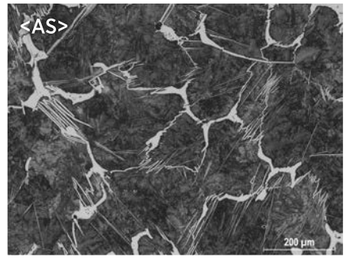
High carbon contents (1.1~2.5%)
High wear resistance
High sticking prevention (AG)

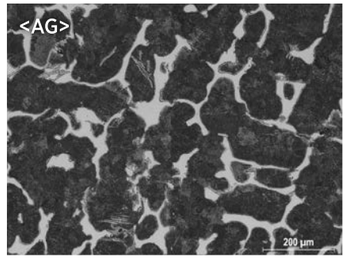
Typical Application

Mainly used for section mill
Roughing stand for hot strip mill

Chemical Composition

MATERIAL CODE	C	Si	Mn	Ni	Cr	Mo
AS	1.50 / 2.50	0.50 / 1.50	0.50 / 1.50	0.50 / 1.50	13.00 / 18.00	2.50 / 4.00
AG	1.50 / 2.50	1.00 / 2.00	0.50 / 1.50	1.00 / 2.00	1.00 / 2.00	0.30 / 1.50





Mechanical Properties

MATERIAL CODE	BARREL HARDNESS (Hs)	NECK HARDNESS (Hs)	TENSILE STRENGTH (kgf/mm^2)	BENDING STRENGTH (kgf/mm^2)	ELONGATION (%)	IMPACT VALUE (kgm/cm^2)	COMPRESSIVE STRENGTH (kgf/mm^2)
AS	50 - 70	-	50 / 70	70 - 120	0.10 - 1.00	0.10 - 1.00	-
AG	55 - 75	-	50 / 70	70 - 120	0.10 - 1.00	0.10 - 1.00	-

Ductile Cast Iron

Characteristics

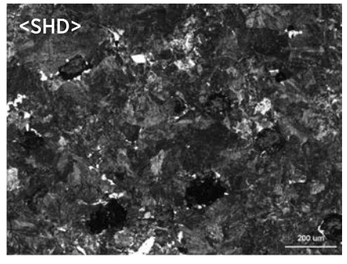
Nodular graphite in matrix
High impact strength
Higher hardness range than ADM
Specially heat treated

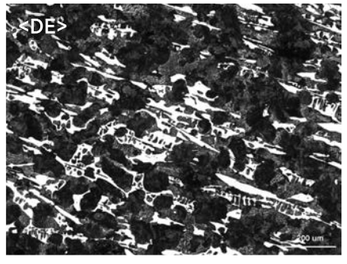
Typical Application

Section mill
Roughing stand for Bloom mill, Slab mill

Chemical Composition

MATERIAL CODE	C	Si	Mn	Ni	Cr	Mo
DA	3.00 / 3.50	1.60 / 2.30	0.30 / 1.20	2.00 / 3.00	0.05 / 0.30	0.30 / 1.00
DD, DE, DF, DG	3.00 / 3.50	1.50 / 2.20	0.30 / 1.20	1.20 / 3.80	0.20 / 1.00	0.30 / 1.00
SHD	3.00 / 3.50	1.50 / 2.20	0.30 / 1.20	1.20 / 3.80	0.20 / 1.00	0.30 / 1.00

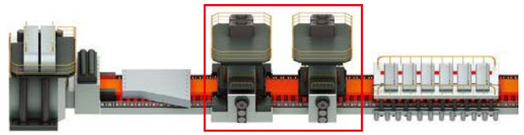




Mechanical Properties

MATERIAL CODE	BARREL HARDNESS (Hs)	NECK HARDNESS (Hs)	TENSILE STRENGTH (kgf/mm^2)	BENDING STRENGTH (kgf/mm^2)	ELONGATION (%)	IMPACT VALUE (kgm/cm^2)	COMPRESSIVE STRENGTH (kgf/mm^2)
DA	45 - 55	-	60 - 80	80 - 140	0.30 - 1.00	0.10 - 0.60	-
DD, DE, DF, DG	45 - 75	-	40 - 60	60 - 80	0.10 - 1.00	0.10 - 0.30	-
SHD	40 - 65	-	60 - 90	90 - 160	0.20 - 2.00	0.10 - 0.50	-

Indefinite Chilled Cast Iron (CHD, UWIC)



Characteristics

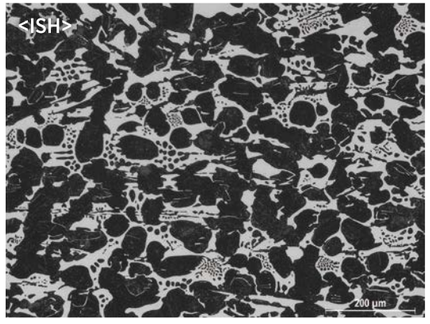
Gradual graphite precipitation
M_3C + MC + Graphite
High wear resistance
(For high rolling performance)

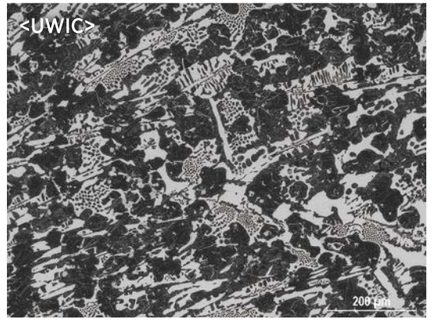
Typical Application

Finishing rear stand for hot strip mill
Plate mill

Chemical Composition

MATERIAL CODE	C	Si	Mn	Ni	Cr	Mo
ISH	3.00 / 4.00	0.50 / 2.50	0.30 / 1.20	3.00 / 5.00	1.00 / 2.00	0.20 / 2.00

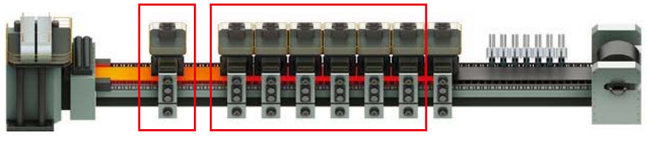




Mechanical Properties

MATERIAL CODE	BARREL HARDNESS (Hs)	NECK HARDNESS (Hs)	TENSILE STRENGTH (kgf/mm^2)	BENDING STRENGTH (kgf/mm^2)	AELONGATION (%)	IMPACT VALUE (kgm/cm^2)	COMPRESSIVE STRENGTH (kgf/mm^2)
ISH	65 - 85	35 - 50	40 - 60	60 - 80	0.10 - 1.00	0.10 - 1.00	230 - 250

High Chromium Iron/Steel (HCI, HCS)



Characteristics

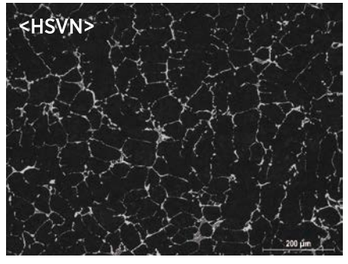
High wear resistance

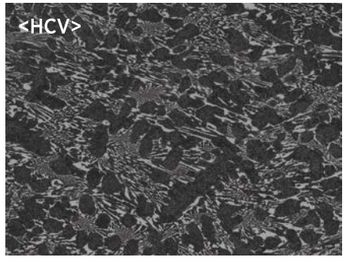
Typical Application

Finishing front stand for hot strip mill
Roughing stand for hot strip mill (Reversing)
Skinpass stand for hot strip mill
Plate mill

Chemical Composition

MATERIAL CODE	C	Si	Mn	Ni	Cr	Mo
HSVN	0.50 / 2.00	0.50 / 1.50	0.30 / 1.20	0.30 / 1.00	8.00 / 14.00	1.50 / 5.50
HCV	2.30 / 3.00	0.50 / 1.50	0.30 / 1.20	0.50 / 1.50	13.00 / 20.00	0.50 / 2.00
HCMV (SPM)	2.60 / 3.20	0.50 / 1.50	0.30 / 1.20	0.50 / 1.50	13.00 / 18.00	2.50 / 4.00

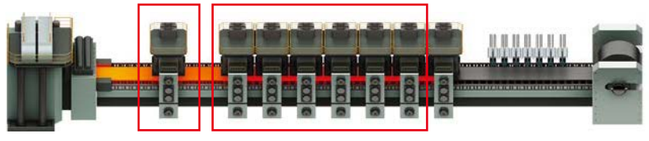




Mechanical Properties

MATERIAL CODE	BARREL HARDNESS (Hs)	NECK HARDNESS (Hs)	TENSILE STRENGTH (kgf/mm^2)	BENDING STRENGTH (kgf/mm^2)	ELONGATION (%)	IMPACT VALUE (kgm/cm^2)	COMPRESSIVE STRENGTH (kgf/mm^2)
HSVN	65 - 85	35 - 50	60 - 80	100 - 120	0.10 - 1.00	0.10 - 1.00	260 - 320
HCV	65 - 85	35 - 50	60 - 80	80 - 110	0.10 - 1.00	0.10 - 1.00	200 - 280
HCMV (SPM)	85 - 95	35 - 50	60 - 80	80 - 110	0.10 - 1.00	0.10 - 1.00	200 - 280

High Speed Steel (HSS)



Characteristics

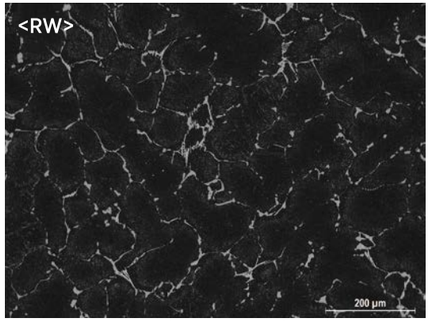
Presence of MC carbides
MC + M_2C + M_6C
High wear resistance
High resistance to thermal fatigue
※ Proper cooling is required

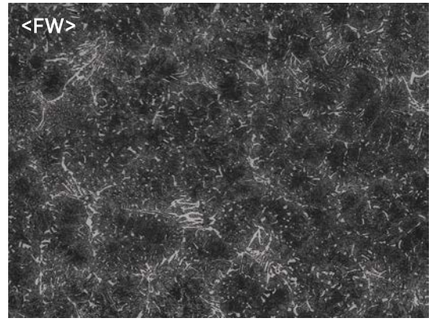
Typical Application

Roughing stand for hot strip mill
Finishing stand for hot strip mill

Chemical Composition

MATERIAL CODE	C	Si	Mn	Ni	Cr	Mo
TVN	1.00 / 2.20	0.50 / 1.50	0.30 / 1.20	0.30 / 2.00	3.00 / 8.00	2.00 / 6.00

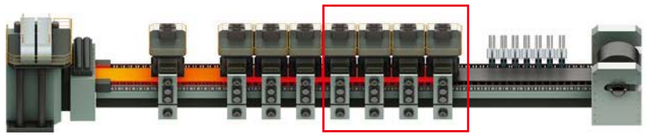




Mechanical Properties

MATERIAL CODE	BARREL HARDNESS (Hs)	NECK HARDNESS (Hs)	TENSILE STRENGTH (kgf/mm^2)	BENDING STRENGTH (kgf/mm^2)	ELONGATION (%)	IMPACT VALUE (kgm/cm^2)	COMPRESSIVE STRENGTH (kgf/mm^2)
TVN	75 - 90	35 - 50	70 - 100	100 - 130	0.10 - 1.00	0.10 - 1.00	300 - 320

Hybrid High Speed Steel (H-HSS)



Characteristics

EICDP + HSS
(Sticking resistance + Wear resistance)
MC + M_2C + M_3C + Graphite
Similar anti thermal shock to EICDP, HSS
Higher wear resistance than EICDP
(Higher rolling performance than EICDP)

Typical Application

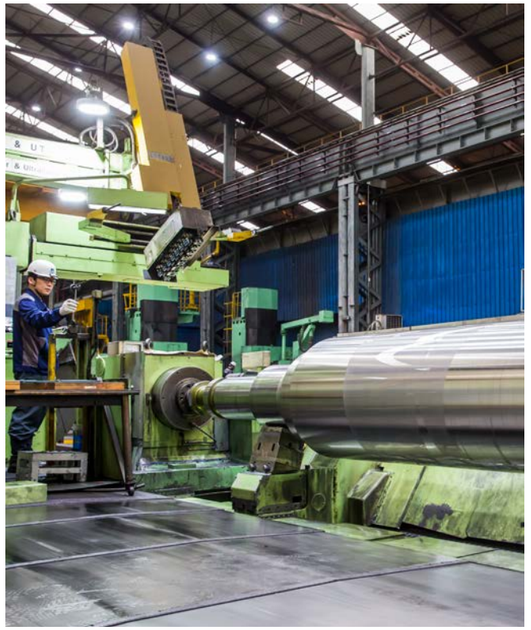
Finishing rear stand for hot strip mill

Chemical Composition

MATERIAL CODE	C	Si	Mn	Ni	Cr	Mo
HTN	3.00 / 4.00	0.50 / 2.50	0.30 / 1.20	3.00 / 5.00	1.00 / 2.00	1.00 / 3.00

Mechanical Properties

MATERIAL CODE	BARREL HARDNESS (Hs)	NECK HARDNESS (Hs)	TENSILE STRENGTH (kgf/mm^2)	BENDING STRENGTH (kgf/mm^2)	ELONGATION (%)	IMPACT VALUE (kgm/cm^2)	COMPRESSIVE STRENGTH (kgf/mm^2)
HTN	75 - 85	35 - 50	40 - 60	60 - 80	0.10 - 1.00	0.10 - 1.00	230 - 250



Application Table

Unit : Shore Hardness (Hs)

PRODUCT	TYPE OF STAND		TYPER OF ROLL	LOW CARBON CAST STEEL	HIGH ALLOY CAST STEEL			HIGH CHROMIUM		HIGH SPEED STEEL	ICDP	EICDP	DUCTILE CAST IRON		
				SP SQ	AS AG	AP AQ	GS	HSVN	HCV HCMV	TVN	ISH	ISH	DA	SHD	DD, DE DF, DG
Slabs	2 Hi			35/45			35/45							40/50	
Blooms	2 Hi			35/45			40/50							40/50	
Plate	4 Hi		Roughing Work Roll			45/55		70/80			65/80	70/80			
			Finishing Work Roll						70/80		65/80	75/85			
Plate (5M)	4 Hi		Roughing Work Roll								70/80	70/80			
			Finishing Work Roll								70/80	75/85			
Hot Strip Mill	Continuous		Scale Breakers			40/50	40/50								
			Roughing Work Roll			45/55	45/55	70/80		75/85					
			Front Stands Finishing Work Roll						70/80	75/85					
			Rear Stands Finishing Work Roll							75/85	75/85	75/85			
			Edger			45/55				75/85					50/60
	Reversing	2 Hi	Roughing			45/55									
		4 Hi	Roughing			45/55		70/80		75/85					
			Finishing						70/80	75/85	65/85	70/85			
Skin Pass & Temper	2 Hi, 4 Hi		Work Roll						85/95						
	4 Hi		Back-Up Roll								70/85	70/85			

※ Prior Discussion is Necessary

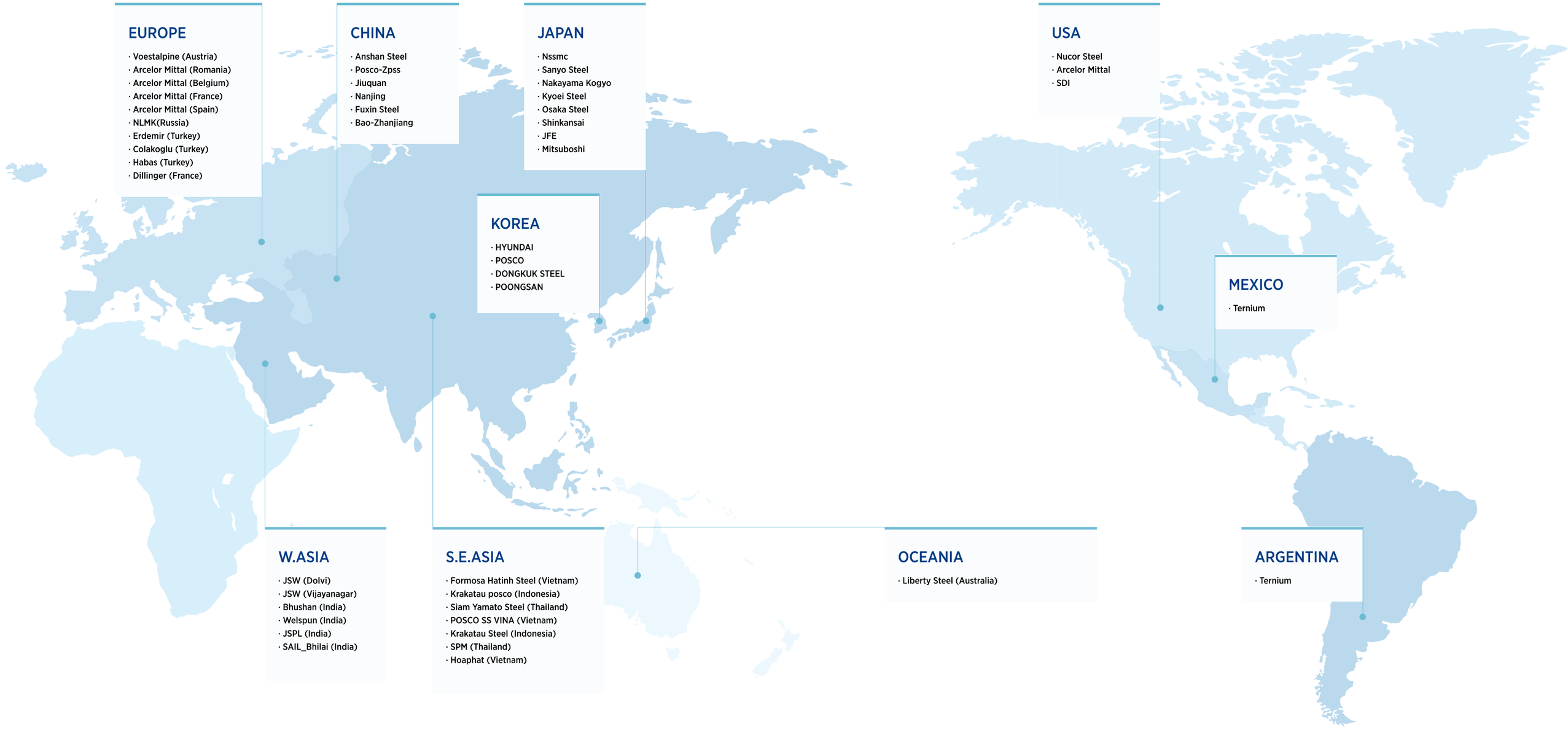
Application Table

Unit : Shore Hardness (Hs)

PRODUCT	TYPE OF STAND	TYPER OF ROLL	LOW CARBON CAST STEEL	HIGH ALLOY CAST STEEL			HIGH CHROMIUM		HIGH SPEED STEEL	ICDP	EICDP	DUCTILE CAST IRON		
			SP SQ	AS AG	AP AQ	GS	HSVNW	HCV HCMV	TVN	ISH	ISH	DA	SHD	DD, DE DF, DG
Billets / Bar	2Hi Continuous	Roughing	35/45		40/50	40/50						45/55	45/55	
		Intermediate			45/55	45/55								56/60
		Finishing							75/85					65/75
Beams	Universal	Horizontal Roughing		50/75										
		Horizontal Finishing		50/75										
		Horizontal Edger			50/60									50/60
		Vertical		50/75					70/80					50/65
Heavy Sections	2 and 3 Hi (Tandem)	Roughing	35/45		45/55									45/55
		Intermediate			45/55	45/55								50/60
		Finishing			50/60	45/60								55/65
Medium Sections	2 and 3 Hi (Tandem)	Roughing			45/55	45/55								45/55
		Intermediate			50/60	45/55								50/60
		Finishing			50/60	45/60								55/65
Light Section	2 and 3 Hi	Roughing			45/55	45/55						45/55		50/55
		Intermediate												55/65
		Finishing												60/70
Rod	2 and 3 Hi	Roughing			45/55							45/55		50/60
		Intermediate												55/65
		Finishing							75/85	70/80	75/85			60/70

※ Prior Discussion is Necessary

Customer



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- Arcelor Mittal (France)
- Arcelor Mittal (Spain)
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- Erdemir (Turkey)
- Colakoglu (Turkey)
- Habas (Turkey)
- Dillinger (France)

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- Anshan Steel
- Posco-Zpss
- Jiuquan
- Nanjing
- Fuxin Steel
- Bao-Zhanjiang

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- Sanyo Steel
- Nakayama Kogyo
- Kyoei Steel
- Osaka Steel
- Shinkansai
- JFE
- Mitsuboshi

KOREA

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- DONGKUK STEEL
- POONGSAN

USA

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- SDI

MEXICO

- Ternium

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- JSW (Vijayanagar)
- Bhushan (India)
- Welspun (India)
- JSPL (India)
- SAIL_Bhilai (India)

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- Formosa Hatinh Steel (Vietnam)
- Krakatau posco (Indonesia)
- Siam Yamato Steel (Thailand)
- POSCO SS VINA (Vietnam)
- Krakatau Steel (Indonesia)
- SPM (Thailand)
- Hoaphat (Vietnam)

OCEANIA

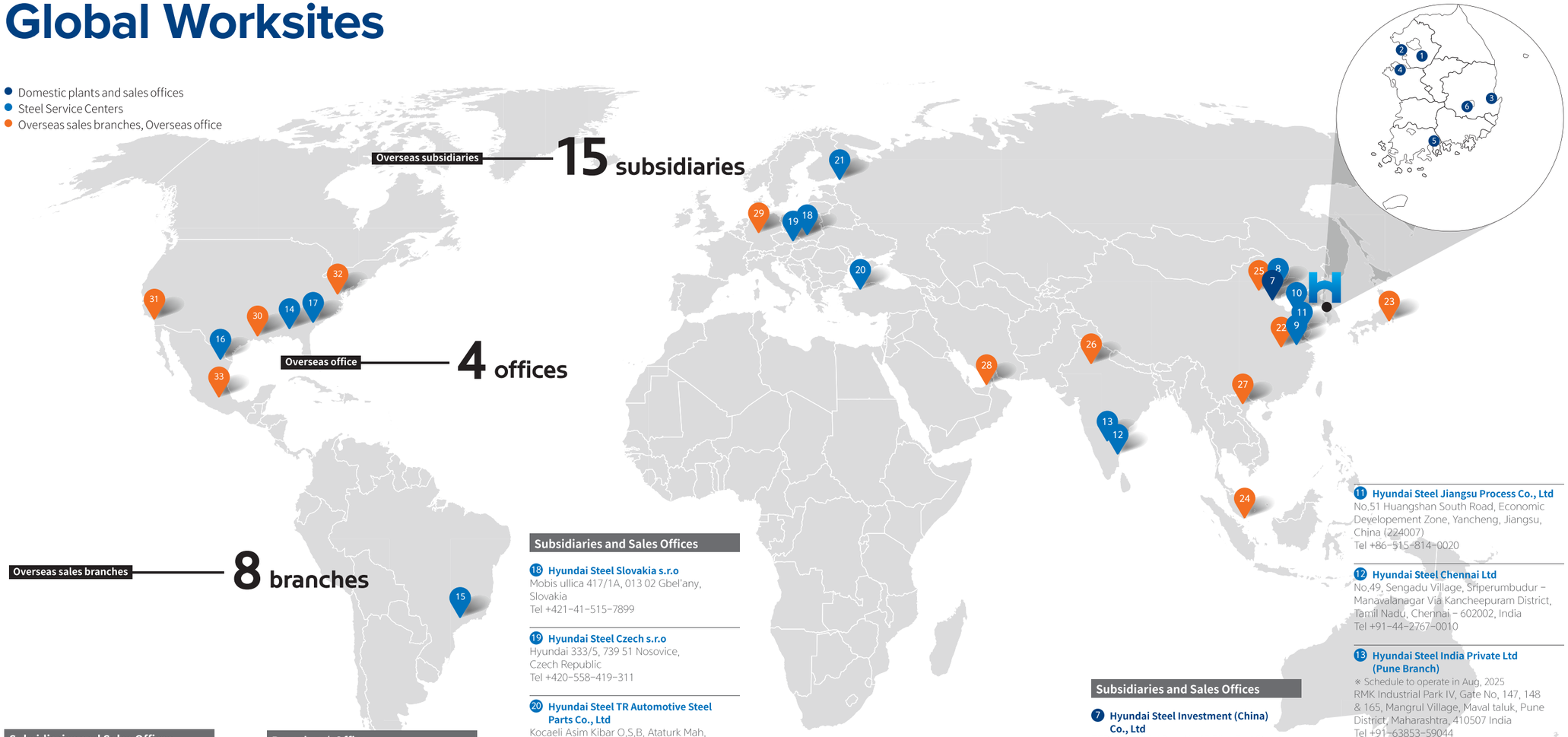
- Liberty Steel (Australia)

ARGENTINA

- Ternium

Global Worksites

- Domestic plants and sales offices
- Steel Service Centers
- Overseas sales branches, Overseas office



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