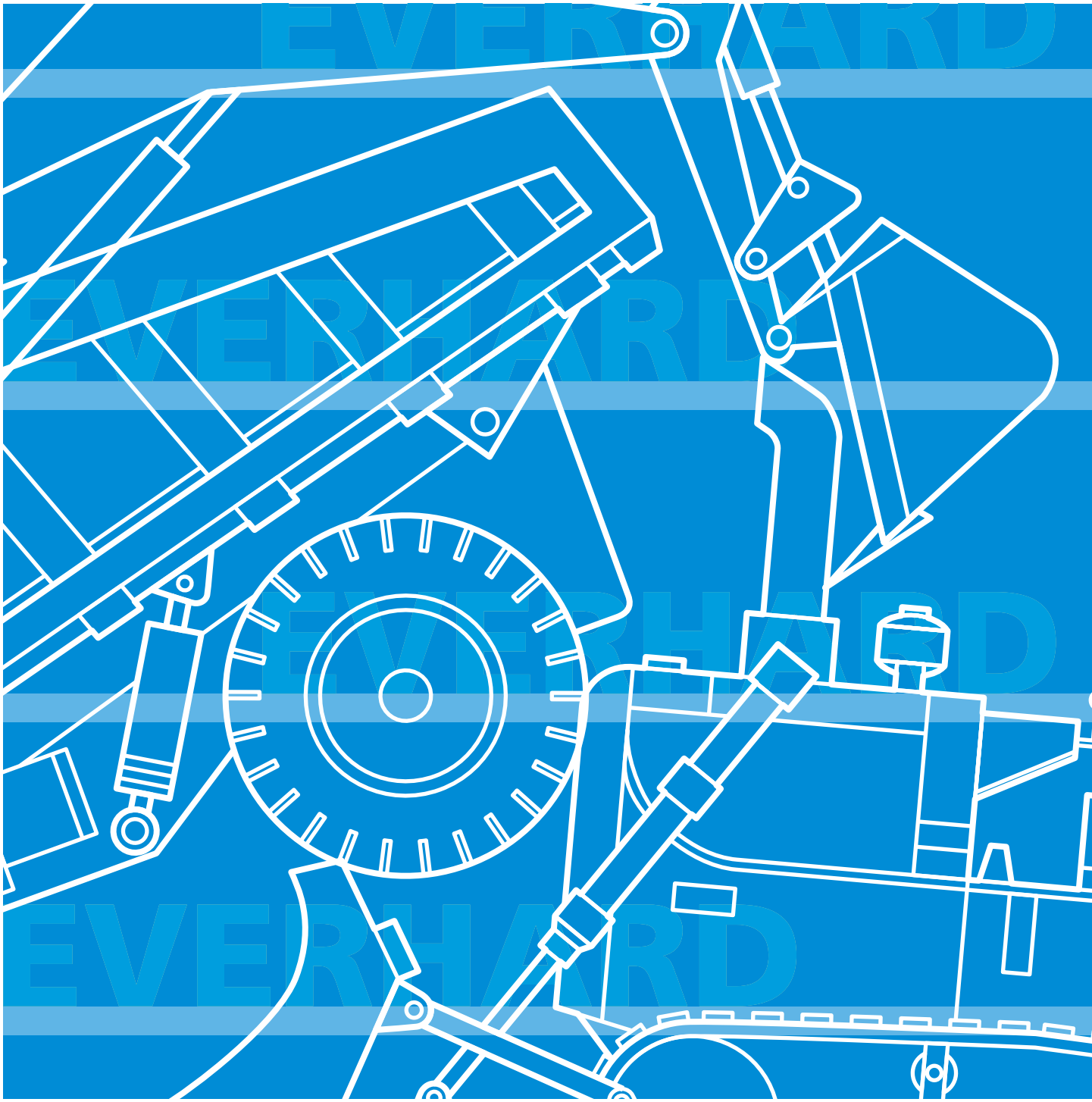
EVERHARD™
Abrasion-Resistant Steel Plate

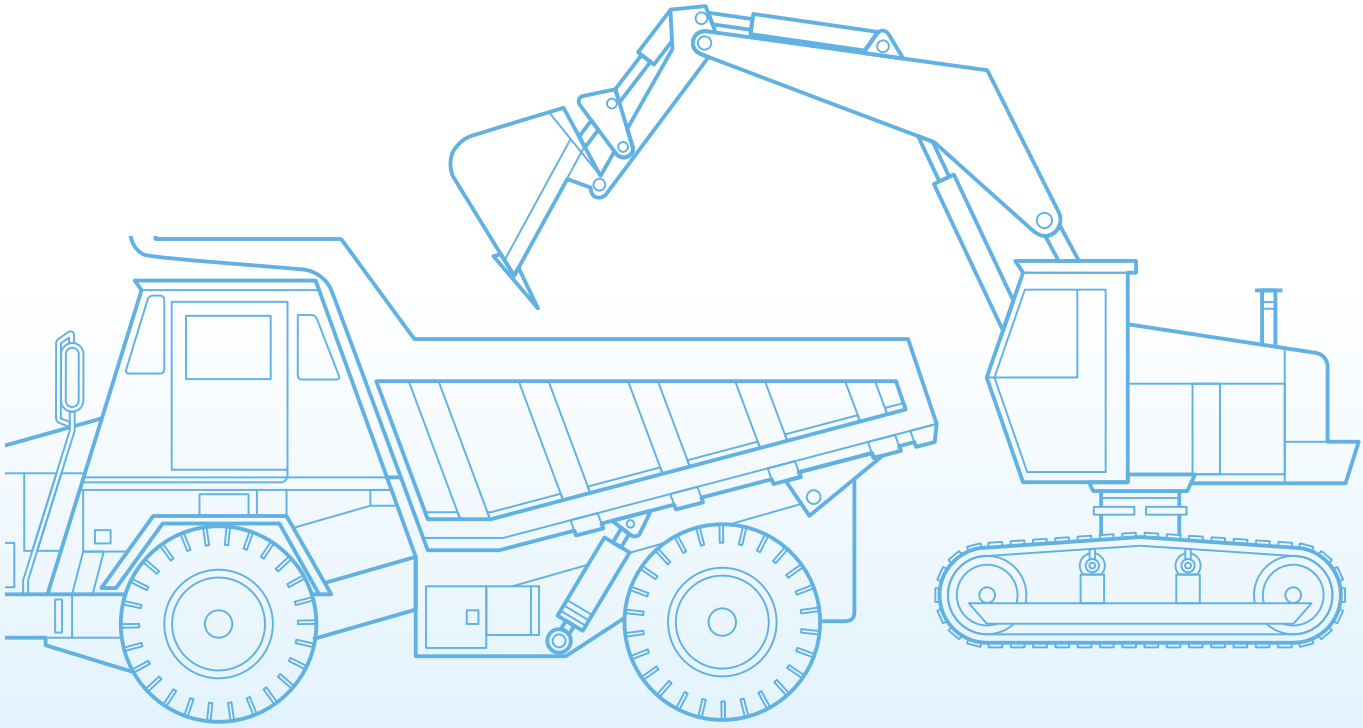
- EVERHARD™, Reliable Forever -



JFE Steel Corporation

JFE Steel Corporation began production and sales of abrasion-resistant steel plates in 1955, before any other company. Since that time, JFE's abrasion-resistant steel plates EVERHARD series have been widely used in key components of construction, mining, and agricultural machinery, as well as other critical applications.

JFE Steel has succeeded in developing super abrasion-resistant steel plate EVERHARD-SP with higher abrasion-resistance than that of the Brinell hardness 500 grade. In addition, JFE Steel has developed EVERHARD-C400LE, EVERHARD-C450LE and EVERHARD-C500LE, which are produced by the leading-edge manufacturing process and guarantees low temperature toughness at –40°C (–40°F). All these products have earned an outstanding reputation with customers. This catalog introduces JFE Steel's line-up of abrasion-resistant steel plates EVERHARD™. We appreciate your long time patronage, and we look forward to continuing to serve you in the future.



Contents

Special Features of EVERHARD™

A wide variety of available grades

EVERHARD is available in 6 grades of the Standard Series and 3 grades of the High Toughness Series, which guarantees low temperature toughness of –40°C (–40°F) and also considers internal hardness. With the addition of the super abrasion-resistant grade EVERHARD-SP to these two series, the EVERHARD product line includes a total of 10 grades.
The target value (average value) of Brinell surface hardness is used in the numerical figures in the grade names so that customers can easily understand the properties of each grade. By specifying narrow ranges of Brinell hardness, consideration is given to reducing variations in formability in customers' manufacturing processes.

Standard Series

In the Standard Series, priority is placed on the hardness of the steel with minimum addition of alloying elements to the chemical composition. The lineup now includes three new products; EVERHARD-C340, which focuses on formability in heavy-gauge products with thicknesses exceeding 100 mm, and EVERHARD-C550, EVERHARD-C600, which is designed especially for abrasion resistance in simple-shaped parts such as liners.

High Toughness Series

By applying a leading-edge manufacturing process, JFE Steel succeeded in developing an abrasion-resistant steel that guarantees low temperature toughness at –40°C (–40°F) in the product line up to Brinell 500 grade. These are the optimum products for applications where higher toughness or internal hardness is required, particularly for use in cold environment or in the cases with heavy impacts, etc. These materials can be used with confidence, as they also provide high weld cracking resistance performance.

Super Abrasion-Resistant Steel Plates (EVERHARD-SP)

Longer life of abrasion-resistant steel plates is constantly demanded by customers from the viewpoint of reducing running costs. However, because hardness is increased in order to improve abrasion resistance, weldability and formability were inevitably sacrificed. EVERHARD-SP, developed by JFE Steel, provides higher abrasion resistance than that of the Brinell hardness 500 grade without sacrificing weldability and formability.

Superb quality

JFE's abrasion-resistant steel plates are produced at the company's state-of-the-art steel works with the most advanced heat treatment technologies, based on long years of experience, under high level quality control. EVERHARD certainly provides not only excellent abrasion resistance, but also outstanding quality of weldability and formability.

Specifications of EVERHARD

EVERHARD is manufactured for non-structural application in which chemical composition of crude steel, Brinell hardness at the plate surface and toughness are specified and guaranteed. Tensile strength and elongation which are required for structural application are not specified and guaranteed. In case of any request for the tensile strength and/or elongation as reference, please refer to JFE Steel Technical Bulletins.

1. Chemical composition

Type	Brand name	Available thickness (mm)	Heat treatment	Chemical composition (%)*										
				C	Si	Mn	P	S	Cr	Mo	V	Ti	B	Ceq**
Standard series	EVERHARD-C340	38 – 160	Controlled heat treatment	0.20 max.	0.55 max.	1.60 max.	0.030 max.	0.030 max.	1.50 max.	0.50 max.	0.10 max.	0.020 max.	0.004 max.	—
	EVERHARD-C400	5 – 50.8		0.20 max.					0.40 max.	—	—			
		50.9 – 101.6							1.20 max.	0.50 max.				
	EVERHARD-C450	5 – 50.8		0.25 max.					0.80 max.	—	—			
		50.9 – 101.6							1.50 max.	0.50 max.				
	EVERHARD-C500	5 – 50.8		0.30 max.					0.80 max.	—	—			
		50.9 – 101.6							1.50 max.	0.50 max.				
	EVERHARD-C550	6 – 32		0.35 max.					0.80 max.	—	—			
	EVERHARD-C600	6 – 25.4		0.45 max.						—	—			
High Toughness series	EVERHARD-C400LE	5 – 19	Controlled heat treatment	0.17 max.	0.55 max.	1.60 max.	0.020 max.	0.010 max.	0.40 max.	0.35 max.	—	0.020 max.	0.004 max.	0.40 max.
		19.1 – 32							0.40 max.	0.35 max.				0.43 max.
		32.1 – 60							1.20 max.	0.50 max.				0.58 max.
		60.1 – 101.6							1.50 max.	0.50 max.				0.73 max.
	EVERHARD-C450LE	5 – 19		0.23 max.					0.80 max.	0.35 max.	—			0.50 max.
		19.1 – 32							0.80 max.	0.35 max.				0.53 max.
		32.1 – 50.8							1.20 max.	0.50 max.				0.65 max.
		50.9 – 80							1.50 max.	0.50 max.				0.75 max.
	EVERHARD-C500LE	5 – 19		0.29 max.					0.80 max.	0.35 max.	—			0.55 max.
		19.1 – 32							0.80 max.	0.35 max.				0.58 max.
		32.1 – 50.8							1.20 max.	0.50 max.				0.70 max.
		50.9 – 80							1.50 max.	0.50 max.				0.78 max.
Super grade	EVERHARD-SP	5 – 65	Controlled heat treatment	0.35 max.	0.55 max.	1.60 max.	0.030 max.	0.030 max.	0.50 – 1.50	Contains other alloying elements				

* Elements not shown in the table may be added when necessary. The chemical compositions shown here are based on molten steel analysis.

** Carbon equivalent Ceq = C+Mn/6+(Cu+Ni)/15+(Cr+Mo+V)/5

2. Mechanical properties

Type	Brand name	Thickness (mm)	Brinell hardness [guaranteed]* (29.42 kN) Average of 5 points	Charpy impact properties (2mmV)		Ceq (%)*** [guaranteed]
				Test temperature (C°)	Charpy absorbed energy (J) [guaranteed]**	
Standard series	EVERHARD-C340	38 – 160	340±30	—	—	—
	EVERHARD-C400	5 – 101.6	400±30			
	EVERHARD-C450	5 – 101.6	450±25			
	EVERHARD-C500	5 – 101.6	500±40			
	EVERHARD-C550	6 – 32	550±40			
	EVERHARD-C600	6 – 25.4	600±40			
High Toughness series****	EVERHARD-C400LE	5 – 11.9	400±30	—	—	≤0.40 (5≤t≤19) ≤0.43 (19<t≤32) ≤0.58 (32<t≤60) ≤0.73 (60<t≤101.6)
		12.0 – 101.6		–40	≥27	
	EVERHARD-C450LE	5 – 11.9	450±25	—	—	≤0.50 (5≤t≤19) ≤0.53 (19<t≤32) ≤0.65 (32<t≤50.8) ≤0.75 (50.8<t≤80)
		12.0 – 50.8		–40	≥27	
		50.9 – 80	410 – 475			
	EVERHARD-C500LE	5 – 11.9	500±40	—	—	≤0.55 (5≤t≤19) ≤0.58 (19<t≤32) ≤0.70 (32<t≤50.8) ≤0.78 (50.8<t≤80)
		12.0 – 50.8		–40	≥21	
		50.9 – 80	450 – 540			
Super grade	EVERHARD-SP	5 – 65	401min.	—	—	—

* Brinell hardness is the average value measured at 5 points.
The hardness is measured after grinding about 0.5 mm from the surface.
The measurement frequency is at least once per heat and thickness.
** In accordance with JIS Z 2242, JIS G 0416
*** Carbon equivalent Ceq = C+Mn/6+(Cu+Ni)/15+(Cr+Mo+V)/5
**** Core hardness could be guaranteed if customer would request.

3. Appearance, shape, dimensions, mass and tolerances

In accordance with JIS G 3193.

Typical Mechanical Properties of EVERHARD

Brand name	Thickness (mm)	Mechanical properties										
		Tensile test					Bending test			Charpy impact test		Hardness test
		Test specimen	Testing direction	Yield strength N/mm²	Tensile strength N/mm²	Elongation %	Test specimen	Testing direction	Bend radius = thickness ×3	Testing direction	Absorbed energy vE Average J	Brinell hardness* (29.42kN) Average of 5 points
EVERHARD-C400	19	JIS-5	T	1083	1246	21	JIS-1	L	Good	L	0°C 52	404
EVERHARD-C400LE	19	JIS-5	T	1058	1308	23	JIS-1	L	Good	L	−40°C 61	411
EVERHARD-C400LE	60	JIS-4	T	971	1096	21	JIS-1	L	Good	L	−40°C 189	416
EVERHARD-C450	19	JIS-5	T	1163	1316	20	JIS-1	L	Good	L	0°C 48	453
EVERHARD-C450LE	20	JIS-5	T	1121	1442	19	JIS-1	L	Good	L	−40°C 45	450
EVERHARD-C450LE	32	JIS-5	T	1106	1402	24	JIS-1	L	Good	L	−40°C 33	447
EVERHARD-C450LE	50	JIS-4	T	1008	1290	15	JIS-1	L	Good	L	−40°C 39	469
EVERHARD-C500	32	JIS-4	T	1205	1446	12	JIS-1	L	Good	L	0°C 33	522
EVERHARD-C500LE	20	JIS-5	T	1203	1681	17	JIS-1	L	Good	L	−40°C 42	502
EVERHARD-C550	25	JIS-5	T	1233	1522	12	—	—	—	L	0°C 34	549
EVERHARD-C600	16	—	—	—	—	—	—	—	—	L	0°C 30	608
EVERHARD-SP	35	JIS-5	T	1104	1352	10	JIS-1	L	Good	—	—	455

Direction: T (Transverse)
L (Longitudinal)

* Brinell hardness is the average value measured at 5 points.
The hardness is measured after grinding about 0.5 mm from the surface.
The measurement frequency is at least once per heat and thickness.

Maximum Available Sizes

Product length: m

Thickness (mm) \ Width (mm)	1501 –1800	1801 –2000	2001 –2200	2201 –2400	2401 –2500	2501 –2800	2801 –3048	3049 –3200	3201 –3400	3401 –3600	3601 –3800	3801 –4000	4001 –4200	4201 –4400	4401 –4600	4601 –4800	4801 –5000	5001 –5200	5201 –5300
5.0 – 5.9	9	9	9	9	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6.0 – 6.9	18	16	14	12	12	10	—	—	—	—	—	—	—	—	—	—	—	—	—
7.0 – 7.9	18	16	14	12	12	10	—	—	—	—	—	—	—	—	—	—	—	—	—
8.0 – 8.9	18	16	14	12	12	10	—	—	—	—	—	—	—	—	—	—	—	—	—
9.0 – 9.9	18	16	14	12	12	10	—	—	—	—	—	—	—	—	—	—	—	—	—
10.0 – 11.9	18	18	18	16	14	14	12	—	—	—	—	—	—	—	—	—	—	—	—
12.0 – 12.9	18	18	18	16	14	14	12	—	—	—	—	—	—	—	—	—	—	—	—
13.0 – 13.9	18	18	18	16	14	14	12	—	—	—	—	—	—	—	—	—	—	—	—
14.0 – 22.0	18	18	18	16	14	14	12	—	—	—	—	—	—	—	—	—	—	—	—
22.1 – 24.0	18	18	18	18	18	16	14	12	—	—	—	—	—	—	—	—	—	—	—
24.1 – 26.0	18	18	18	18	18	18	16	14	12	—	—	—	—	—	—	—	—	—	—
26.1 – 28.0	18	18	18	18	18	18	18	18	16	14	12	—	—	—	—	—	—	—	—
28.1 – 30.0	18	18	18	18	18	18	18	18	18	18	18	16	16	—	—	—	—	—	—
30.1 – 35.0	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	—	—	—
35.1 – 40.0	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	—	—	—
40.1 – 45.0	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	17	16	16	—
45.1 – 50.8	18	18	18	18	18	18	18	18	18	18	18	18	17	17	16	15	15	14	—
50.9 – 60.0	18	18	18	18	18	18	18	18	18	17	16	15	14	14	13	13	12	11	—
60.1 – 70.0	18	18	18	18	18	18	17	16	15	14	14	13	12	12	11	11	10	10	—
70.1 – 80.0	18	17	17	16	18	16	15	14	13	13	12	11	11	10	10	9.7	9.3	8.9	—
80.1 – 90.0	17	15	15	14	16	14	13	13	12	11	11	10	9.8	9.4	8.9	8.6	8.2	7.9	—
90.1 – 101.6	15	13	14	12	14	13	12	11	10	10	10	9.3	8.8	8.4	8.0	7.7	7.4	7.1	—
101.7 – 110.0	14	13	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
110.1 – 120.0	13	12	14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
120.1 – 130.0	12	11	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
130.1 – 140.0	10	9.7	11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
140.1 – 150.0	10	9.6	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
150.1 – 160.0	9.7	9.0	9.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

— Please inquire for maximum product width.

Typical Applications

Industry	Applications
Construction and Automotive Industries	● Bulldozer shovels and buckets Slush plates for bulldozers Exterior linings of bulldozer buckets ● Trailer beds ● Vessels for dump and cargo trucks ● Dredger buckets ● Attachment
Cement and Mining	● Lining material for ready-mixed concrete turbine mixer ● Paddle for above ● Conveyor chute for concrete mixing plant ● Pug mill for soil cement ● Conveyor pipe for solids (pneumatic pipelines for coal mines) ● Ball mill ● Scraper conveyor
Chemical Industry	● Agitators for asphalt plants and finishers ● Sand conveyor pipe for sand cracking in naphtha cracking plants ● Sulfide mineral bucket elevators
Steel and Gas	● BF top swivel chute BF stationary chute, liner, upper hopper liner, gate liner ● BF gas washing venturi scrubber, and septum valve ● Screens for ores, and switching damper Bypass chute for ore conveyors Chute for ore conveyors Tripper chute for ore conveyors ● Tripper chute for coke conveyors Coke conveyor chute, and stacker chute ● Lining for rotary mixers ● Drop chute receiver for blending conveyor in sintering plants Liner for vibro-feeders in sintering plants ● Raw material and sole roll feeders
Others	● Earth drills ● Shear liners ● Crusher

Storage

- EVERHARD plates should be stored so as to avoid bending and twisting. Use waterproof sheets to prevent rust and pitting due to corrosion, which can cause cracking. When using a waterproof sheet, ventilate occasionally to reduce humidity under the sheet.

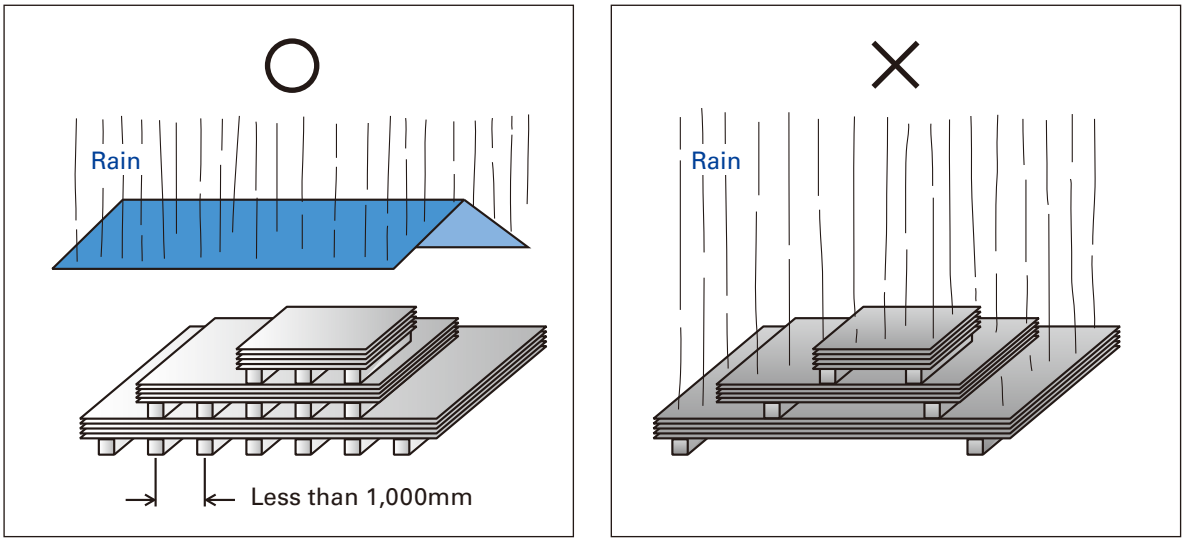
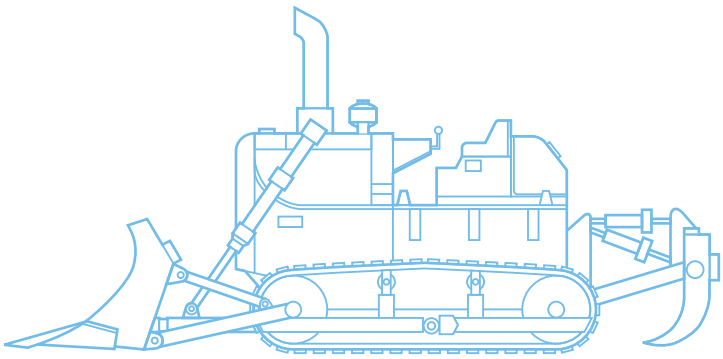


Fig. Recommended storage method



Primer Treatment of EVERHARD

JFE Steel also provides the EVERHARD with primer (paint) treatment upon request. As a shop primer, JFE normally uses SD ZINC 1000HA (S) (brown) manufactured by ALESCO (Kansai Paint Co., Ltd.). This primer consists of modified alkyl silicate binder and zinc (Zn) powder with improved performance. It displays excellent cutting properties and weldability, and also minimizes generation of pitting and blowholes during CO_2 gas shielded arc welding. On the other hand, customers who prioritize corrosion resistance can also select SD ZINC 1000 (gray).
In order to provide this performance, the thickness of the primer layer is strictly controlled within the optimum range.

Typical appearance of primer-treated Standard Series plate (EVERHARD-C500 (JFE-EH-C500))

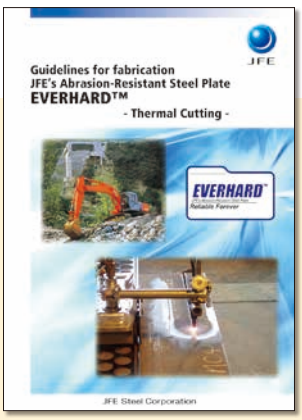
Guidelines for Fabrication

Because EVERHARD has high hardness and strength in comparison with general structural steel plates, it is necessary to select the proper processing conditions for fabrication. JFE Steel has prepared “Guidelines for fabrication” of EVERHARD products, summarizing the key points in connection with the fabrication of these steel materials. We hope that all customers will refer to these “Guidelines,” and they will be helpful in using EVERHARD effectively and with complete confidence.

Guidelines for Fabrication: “WELDING”

Guidelines for Fabrication: “BENDING”

Guidelines for Fabrication: “Machining”



Guidelines for Fabrication: “Thermal Cutting”

Comparison of conventional EVERHARD series and EVERHARD C series

- The following table shows a comparison of conventional EVERHARD series, including the Alloy Series which has been widely used for many years, and the EVERHARD C series.

Type	Conventional standards (will continue to be available for ordering in future)			EVERHARD C Series		
	Brand name	Thickness (mm)	Brinell hardness [guarantee]* (29.42kN) Average of 5 points	Brand name	Thickness (mm)	Brinell hardness [guarantee]* (29.42kN) Average of 5 points
Standard series	—	—	—	EVERHARD-C340	38 – 160	340±30
	EVERHARD-360	6(5) – 50.8	361min.	EVERHARD-C400	5 – 101.6	400±30
	EVERHARD-360A	6 – 101.6				
	EVERHARD-400	6(5) – 50.8	401min.	EVERHARD-C450	5 – 101.6	450±25
	EVERHARD-500	6(5) – 50.8	477min.	EVERHARD-C500	5 – 101.6	500±40
	EVERHARD-500A	6 – 101.6				
	—	—	—	EVERHARD-C550	6 – 32	550±40
				EVERHARD-C600	6 – 25.4	600±40
High Toughness series	EVERHARD-360LE	6(5) – 60	400^{+40}_{-39}	EVERHARD-C400LE	5 – 101.6	400±30
	EVERHARD-400LE	6(5) – 50.8	450±40	EVERHARD-C450LE	5 – 50.8 50.9 – 80.0	450±25 410 – 475
	EVERHARD-500LE	6(5) – 32	500^{+56}_{-23}	EVERHARD-C500LE	5 – 50.8 50.9 – 80.0	500±40 450 – 540

( ) Please inquire for thicknesses in parentheses.
* Brinell hardness is the average value measured at 5 points.
The hardness is measured after grinding about 0.5 mm from the surface.
The measurement frequency is at least once per heat and thickness.

Cat.No.C1E-004-14

JFE Steel Corporation

https://www.jfe-steel.co.jp/en/

HEAD OFFICE
Hibiya Kokusai Building, 2-3 Uchisaiwaicho 2-chome, Chiyodaku, Tokyo 100-0011, Japan Phone: (81)3-3597-3111 Fax: (81)3-3597-4860

■ ASIA PACIFIC

SEOUL
JFE Steel Korea Corporation
16th Floor, 41, Cheonggyecheon-ro, Jongno-gu, Seoul, 03188, Korea
(Youngpung Building, Seorin-dong)
Phone: (82)2-399-6337 Fax: (82)2-399-6347

BEIJING
JFE Steel Corporation Beijing
2018 Beijing Fortune Building, No.5, Dongsanhuan North Road, Chaoyang District, Beijing, 100004, P.R.China
Phone: (86)10-6590-9051 Fax: (86)10-6590-9056

SHANGHAI
JFE Consulting (Shanghai) Co., Ltd.
Room 801, Building A, Far East International Plaza, 319 Xianxia Road, Shanghai 200051, P.R.China
Phone: (86)21-6235-1345 Fax: (86)21-6235-1346

GUANGZHOU
JFE Consulting (Guangzhou) Co., Ltd.
Room 3901 Citic Plaza, 233 Tian He North Road, Guangzhou, 510613, P.R.China
Phone: (86)20-3891-2467 Fax: (86)20-3891-2469

MANILA
JFE Steel Corporation, Manila Office
23rd Floor 6788 Ayala Avenue, Oledan Square, Makati City, Metro Manila, Philippines
Phone: (63)2-8886-7432 Fax: (63)2-8886-7315

HO CHI MINH CITY
JFE Steel Vietnam Co., Ltd.
Unit 1704, 17th Floor, MPlaza, 39 Le Duan Street, Dist 1, HCMC, Vietnam
Phone: (84)28-3825-8576 Fax: (84)28-3825-8562

HANOI
JFE Steel Vietnam Co., Ltd., Hanoi Branch
Unit 1501, 15th Floor, Cornerstone Building, 16 Phan Chu Trinh Street, Hoan Kiem Dist., Hanoi, Vietnam
Phone: (84)24-3855-2266 Fax: (84)24-3533-1166

BANGKOK
JFE Steel (Thailand) Ltd.
22nd Floor, Abdulrahim Place 990, Rama IV Road, Silom, Bangrak, Bangkok 10500, Thailand
Phone: (66)2-636-1886 Fax: (66)2-636-1891

YANGON
JFE Steel (Thailand) Ltd., Yangon Office
Unit 05-01, Union Business Center, Nat Mauk Road, Bocho Quarter, Bahan Tsp, Yangon, 11201, Myanmar
Phone: (95)1-860-3352

SINGAPORE
JFE Steel Asia Pte. Ltd.
16 Raffles Quay, No.15-03, Hong Leong Building, 048581, Singapore
Phone: (65)6220-1174 Fax: (65)6224-8357

JAKARTA
PT. JFE STEEL INDONESIA
6th Floor Summitmas II, JL Jendral Sudirman Kav. 61-62, Jakarta 12190, Indonesia
Phone: (62)21-522-6405 Fax: (62)21-522-6408

NEW DELHI
JFE Steel India Private Limited
806, 8th Floor, Tower-B, Unitech Signature Towers, South City-I, NH-8, Gurgaon-122001, Haryana, India
Phone: (91)124-426-4981 Fax: (91)124-426-4982

MUMBAI
JFE Steel India Private Limited, Mumbai Office
603-604, A Wing, 215 Atrium Building, Andheri-Kurla Road, Andheri (East), Mumbai-400093, Maharashtra, India
Phone: (91)22-3076-2760 Fax: (91)22-3076-2764

BRISBANE
JFE Steel Australia Resources Pty Ltd.
Level28, 12 Creek Street, Brisbane QLD 4000 Australia
Phone: (61)7-3229-3855 Fax: (61)7-3229-4377

■ MIDDLE EAST

DUBAI
JFE Steel Corporation, Dubai Office
P.O.Box 261791 LOB19-1208, Jebel Ali Free Zone Dubai, U.A.E.
Phone: (971)4-884-1833 Fax: (971)4-884-1472

■ NORTH, CENTRAL and SOUTH AMERICA

HOUSTON
JFE Steel America, Inc.
750 Town & Country Blvd., Suite 705, Houston, TX 77024, U.S.A.
Phone: (1)713-532-0052 Fax: (1)713-532-0062

MEXICO CITY
JFE Steel de Mexico S.A. de C.V.
Ruben Dario #281-1002, Col. Bosque de Chapultepec, C.P. 11580, CDMX. D.F. Mexico
Phone: (52)55-5985-0097

RIO DE JANEIRO
JFE Steel do Brasil LTDA
Praia de Botafogo, 228 Setor B, Salas 508 & 509, Botafogo, CEP 22250-040, Rio de Janeiro-RJ, Brazil
Phone: (55)21-2553-1132 Fax: (55)21-2553-3430

2109R(2009) JTR
Printed in Japan