

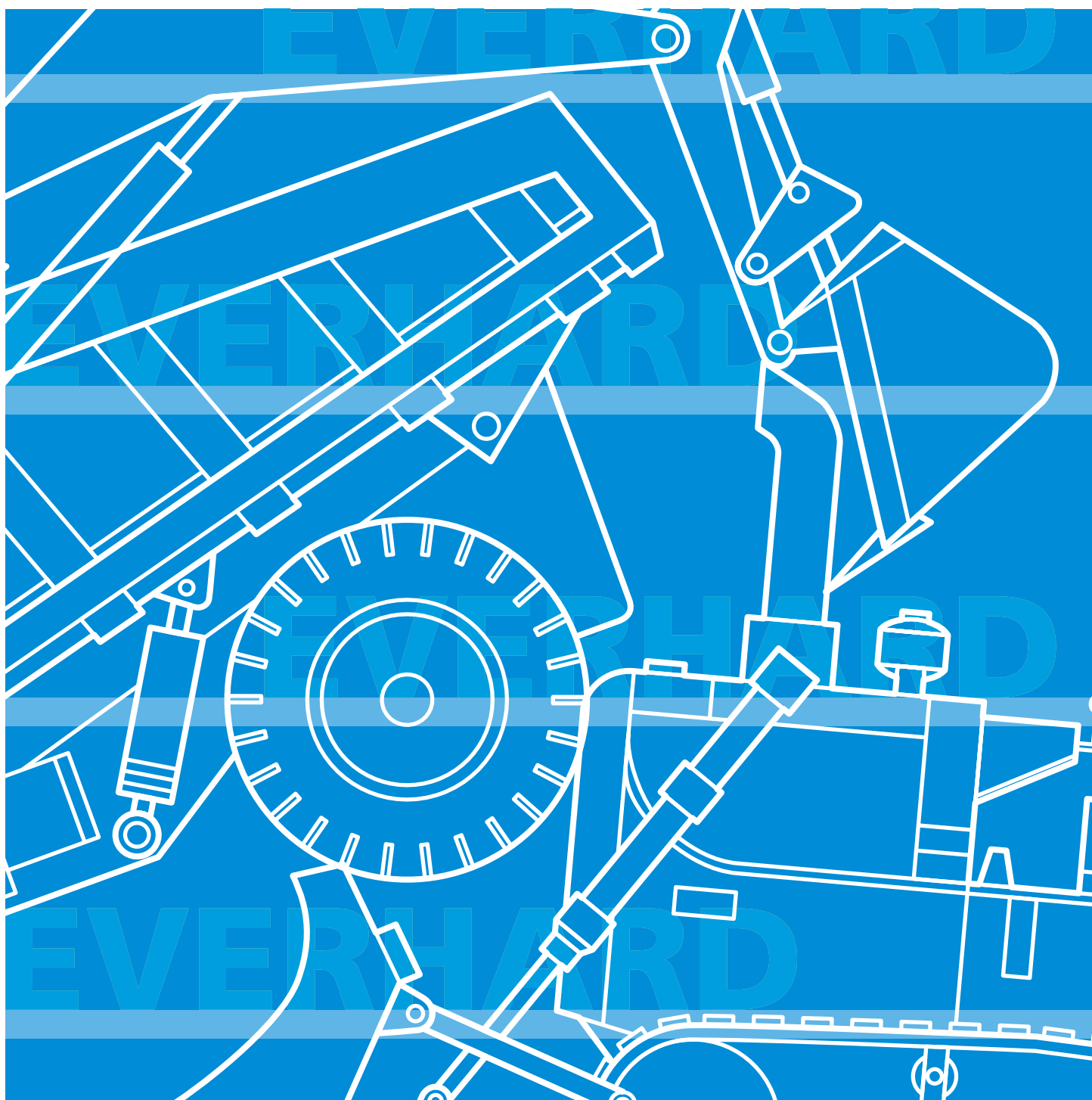


JFE

EVERHARD™

Abrasion-Resistant Steel Plate

- EVERHARD™, Reliable Forever -

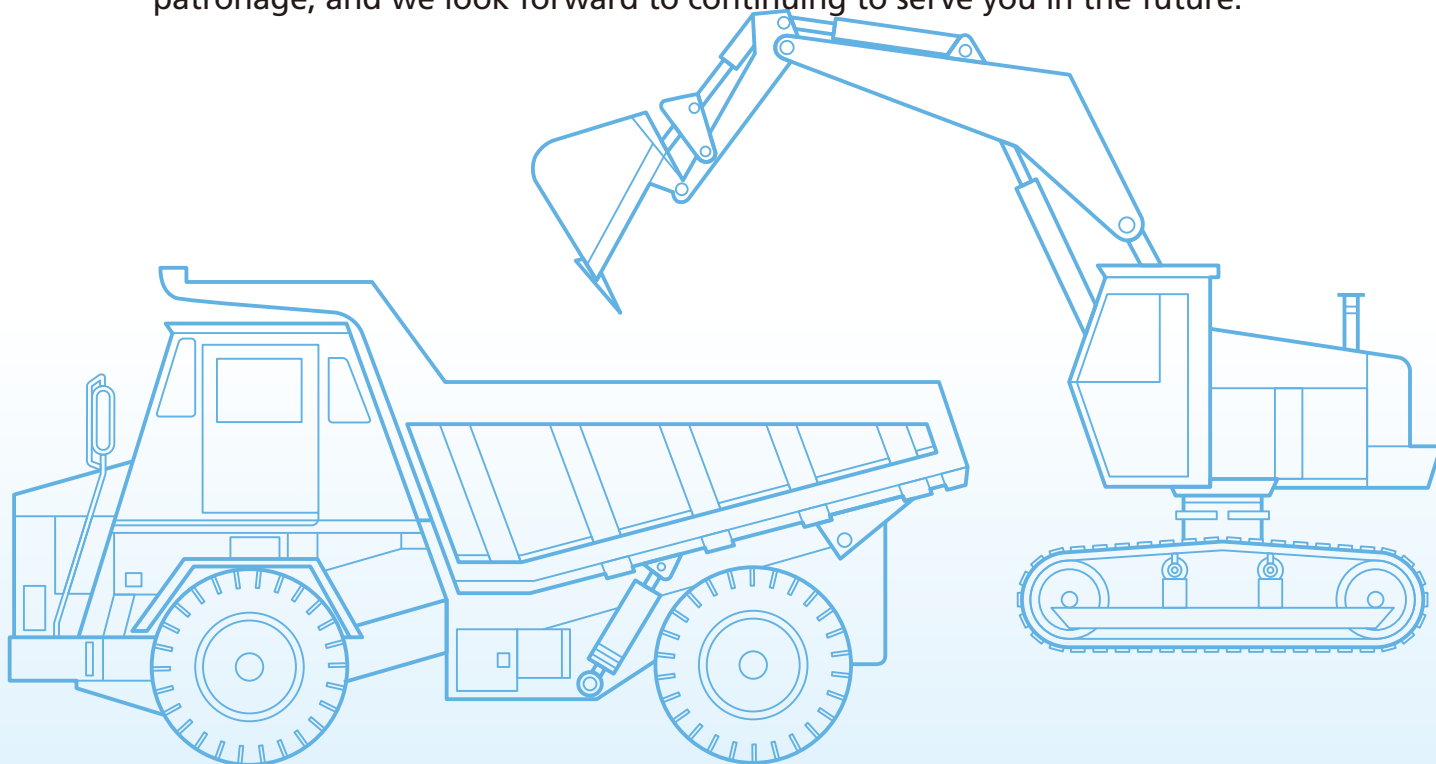


JFE Steel Corporation

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.



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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 two 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, it had been difficult to manufacture steel materials with abrasion resistance exceeding Brinell hardness 500 grade by conventional technologies due to problems with weldability and formability. 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.						1.50 max.	0.50 max.	0.10 max.											
	EVERHARD-C400	5 – 50.8		0.20 max.						0.40 max.	—	—											
		50.9 – 101.6		0.20 max.						1.20 max.	0.50 max.												
	EVERHARD-C450	5 – 50.8		0.25 max.						0.55 max.	1.60 max.	0.030 max.				0.030 max.	0.80 max.	—	—	0.020 max.	0.004 max.	—	
		50.9 – 101.6		0.25 max.						0.55 max.	1.60 max.	0.030 max.				0.030 max.	1.50 max.	0.50 max.					
	EVERHARD-C500	5 – 50.8		0.30 max.																			
		50.9 – 101.6		0.30 max.																			
EVERHARD-C550	6 – 32	0.35 max.																					
EVERHARD-C600	6 – 25.4	0.45 max.											0.80 max.	—	—								
High Toughness series	EVERHARD-C400LE	5 – 19	Controlled heat treatment	0.17 max.						0.40 max.	0.35 max.	—											
		19.1 – 32								0.40 max.	0.35 max.												
		32.1 – 60								1.20 max.	0.50 max.												
	EVERHARD-C450LE	5 – 19		0.23 max.						0.55 max.	1.60 max.	0.020 max.				0.010 max.	0.80 max.	0.35 max.	—	0.020 max.	0.004 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.	
	EVERHARD-C500LE	5 – 19		0.29 max.													0.80 max.	0.35 max.	—			0.55 max.	
		19.1 – 32															0.80 max.					0.58 max.	
		32.1 – 50.8															1.20 max.					0.50 max.	0.70 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													

() Please inquire for thicknesses shown in parentheses.

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

** Carbon equivalent $C_{eq} = C + Mn/6 + (Cu + Ni)/15 + (Cr + Mo + V)/5$

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)
		12 – 60		–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)
		12 – 50.8		–40	≥27	
	EVERHARD-C500LE	5 – 11.9	500±40	—	—	≤0.55 (5≤t≤19) ≤0.58 (19<t≤32) ≤0.70 (32<t≤50.8)
		12 – 32		–40	≥21	
32.1 – 50.8						
Super grade	EVERHARD-SP	5 – 65	401min.	—	—	—

() Please inquire for thicknesses shown in parentheses.

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

3. Appearance, shape, dimensions, mass and tolerances

In accordance with JIS G3193.



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/mm ²	Tensile strength N/mm ²	Elongation %	Test specimen	Testing direction	Bend radius = thickness x3	Testing direction	Absorbed energy vE Average J	Brinell hardness (29.42kN) Average of 5 points
EVERHARD-C400	19	JIS-5	T	1083	1246	21.0	JIS-1	L	Good	L	0°C 52	404
EVERHARD-C400LE	19	JIS-5	T	1058	1308	23.0	JIS-1	L	Good	L	-40°C 61	411
EVERHARD-C400LE	60	JIS-4	T	971	1096	21.0	JIS-1	L	Good	L	-40°C 189	416
EVERHARD-C450	19	JIS-5	T	1163	1316	20.0	JIS-1	L	Good	L	0°C 48	453
EVERHARD-C450LE	20	JIS-5	T	1121	1442	19.6	JIS-1	L	Good	L	-40°C 45	450
EVERHARD-C450LE	32	JIS-5	T	1106	1402	24.0	JIS-1	L	Good	L	-40°C 33	447
EVERHARD-C450LE	50	JIS-4	T	1008	1290	15.0	JIS-1	L	Good	L	-40°C 39	469
EVERHARD-C500	19	JIS-5	T	1297	1449	17.7	JIS-1	L	Good	—	—	508
EVERHARD-C500LE	20	JIS-5	T	1203	1681	17.0	JIS-1	L	Good	L	-40°C 42	502
EVERHARD-C600	6	JIS-5	T	1570	2055	10	—	—	—	—	—	—
EVERHARD-SP	35	JIS-5	T	1104	1352	10.7	JIS-1	L	Good	—	—	455
EVERHARD-360A	19	JIS-5	T	1147	1203	23.9	JIS-1	L	Good	L	0°C 156	388
EVERHARD-500A	20	JIS-5	T	1321	1516	22.9	JIS-1	L	Good	L	0°C 65	542

Direction: T (Transverse)
L (Longitudinal)



Maximum Available Sizes

Product length: m

Thickness (mm)	Width (mm)	1501	1801	2001	2201	2401	2601	2801	3001	3201	3401	3601	3801	4001	4201	4401	4601	4801	5001	5201
		-1800	-2000	-2200	-2400	-2600	-2800	-3000	-3200	-3400	-3600	-3800	-4000	-4200	-4400	-4600	-4800	-5000	-5200	-5300
5.0 – 5.9		9	9	9	9	9 (-2500)	—	—	—	—	—	—	—	—	—	—	—	—	—	—
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		22	20	18	16	14	14	12	—	—	—	—	—	—	—	—	—	—	—	—
12.0 – 12.9		22	20	18	16	14	14	12	—	—	—	—	—	—	—	—	—	—	—	—
13.0 – 13.9		22	20	18	16	14	14	12	—	—	—	—	—	—	—	—	—	—	—	—
14.0 – 22.0		22	20	18	16	14	14	12	—	—	—	—	—	—	—	—	—	—	—	—
22.1 – 24.0		24	22	22	20	18	16	14	12	—	—	—	—	—	—	—	—	—	—	—
24.1 – 26.0		25	24	22	22	20	18	16	14	12	—	—	—	—	—	—	—	—	—	—
26.1 – 28.0		25	25	24	24	22	22	20	18	16	14	12	—	—	—	—	—	—	—	—
28.1 – 30.0		25	25	25	25	25	24	22	20	20	18	18	16	16	—	—	—	—	—	—
30.1 – 35.0		25	25	25	25	25	25	24	22	22	22	20	20	20	18	18	18	—	—	—
35.1 – 40.0		25	25	25	25	25	25	25	24	22	22	22	20	20	20	19	18	—	—	—
40.1 – 45.0		25	25	25	25	25	25	25	25	24	23	22	20	19	19	18	17	16	16	—
45.1 – 50.8		25	25	25	25	25	25	25	23	22	20	20	18	17	17	16	15	15	14	—
50.9 – 60.0		25	23	23	21	24	22	20	19	18	17	16	15	14	14	13	13	12	11	—
60.1 – 70.0		22	19	20	18	20	19	17	16	15	14	14	13	12	12	11	11	10	10	—
70.1 – 80.0		19	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	—

— Please inquire for maximum product width.



Typical Applications

Industry	Applications
<p>Construction and Automotive Industries</p>	<ul style="list-style-type: none"> ● Bulldozer shovels and buckets Slush plates for bulldozers Exterior linings of bulldozer buckets ● Trailer beds ● Vessels for dump and cargo trucks ● Dredger buckets
<p>Cement and Mining</p>	<ul style="list-style-type: none"> ● 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)
<p>Chemical Industry</p>	<ul style="list-style-type: none"> ● Agitators for asphalt plants and finishers ● Sand conveyor pipe for sand cracking in naphtha cracking plants ● Sulfide mineral bucket elevators
<p>Steel and Gas</p>	<ul style="list-style-type: none"> ● 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
<p>Others</p>	<ul style="list-style-type: none"> ● Earth drills ● Shear liners

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.

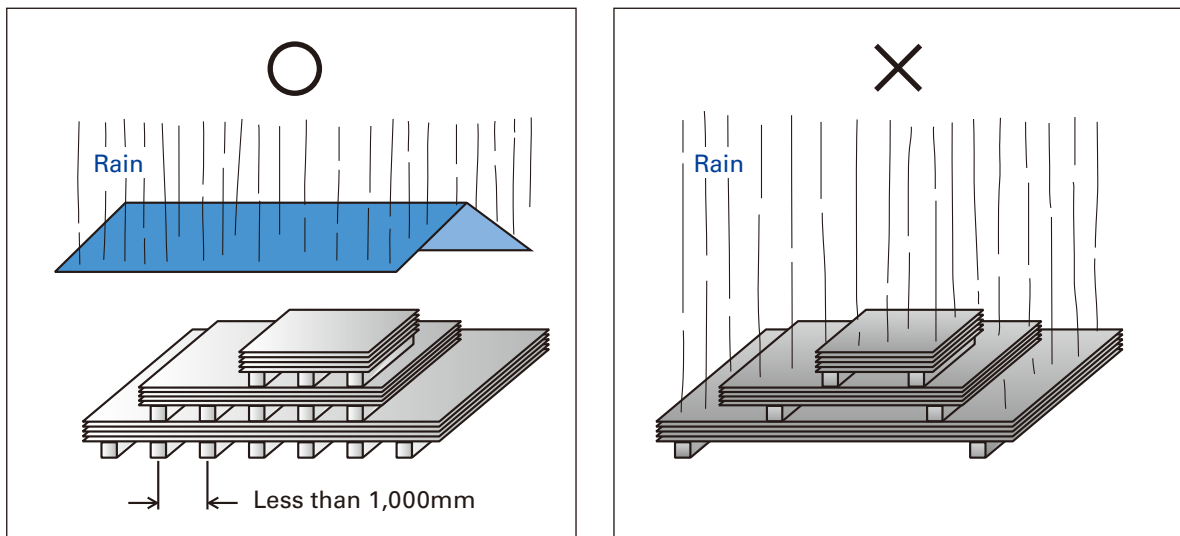
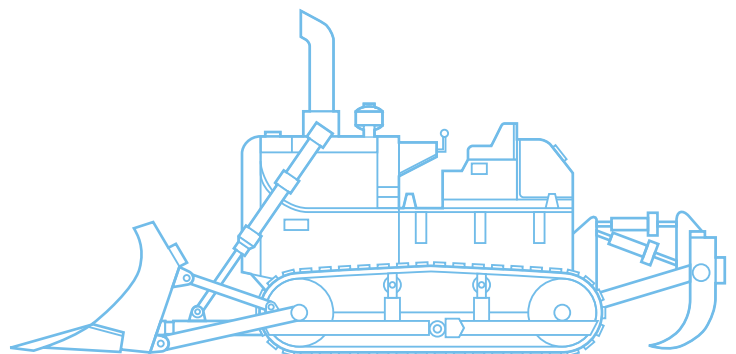


Fig. Recommended storage method



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) 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 CO₂ gas shielded arc welding. 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))



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 – 60	400±30
	EVERHARD-400LE	6(5) – 50.8	450±40	EVERHARD-C450LE	5 – 50.8	450±25
	EVERHARD-500LE	6(5) – 32	500 ⁺⁵⁶ ₋₂₃	EVERHARD-C500LE	5 – 50.8	500±40

() Please inquire for thicknesses in parentheses.

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