



Carbon Resource Guide

PLATE PRODUCTS

WEIGHTS & TYPES

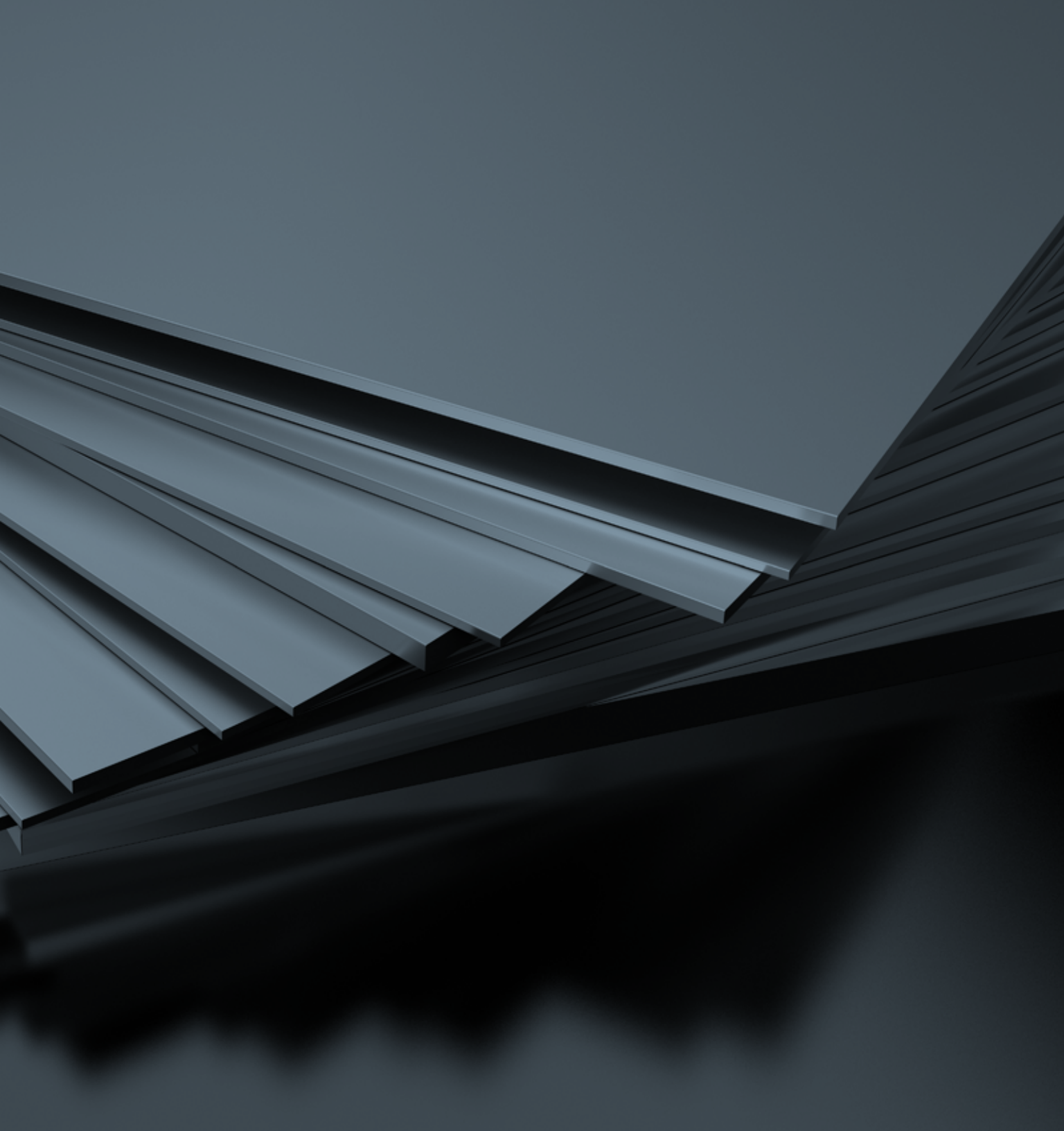
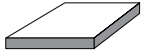


Plate Products



Hot Rolled ASTM-A36

Hot rolled plates made to ASTM-A36 are intended for use in structural applications. Plates ½" and under are normally sheared, while heavier plates are flame cut. Flame cutting is necessary when plate thickness exceeds mill shearing limits.

Analysis

Thickness	Carbon	Manganese	Phosphorus	Sulphur	Silicon
To ¾"	.25 Max.	.80/1.20	.04 Max.	.05 Max.	-----
¾ - 1 ½"	.25 Max.	.80/1.20	.04 Max.	.05 Max.	----
1 ½ - 2 ½"	.26 Max.	.80/1.20	.04 Max.	.05 Max.	.15/.30
2 ½ -4"	.27 Max.	.80/1.20	.04 Max.	.05 Max.	.15/.30
4" & Up	.29 Max.	.80/1.20	.04 Max.	.05 Max.	.15/.30

Applications

Carbon steel plates have so many and such varied uses that a comprehensive list of plate application would be impossible in these pages, however, a few uses are: tank, tubes, truck frames, railroad cars and many structural uses, such as: base plates, girders, etc.

Mechanical Properties

Tensile Strength (P.S.I.)	Yield Point (P.S.I.)	Elongation In 8 Inches
58,000 - 80,000	36,000 Minimum*	20%

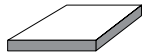
*Yield Point 32,000 P.S.I. for plates over 8 inches thick.

Mechinability

This grade is satisfactory for ordinary machining or drilling but it is not considered a free machining grade.

Weldability

These grades present no problems when using all welding processes. The quality is generally high for both welds and joints. Welding rod specification are dependent on conditions such as the thickness of the section to be welded, service requirements and design.



Abrasion Resistant Plates-Grade AR235

Grade AR235

“As Rolled” Abrasion Resistant Steel, also called A-R Steel, was developed to meet the many demands for a low cost abrasion resisting steel for the materials handling industry.

Analysis

Carbon	Manganese	Phosphorus	Sulphur	Silicon
.35 - .50	1.50 - 2.00	.05 Max.	.055 Max.	.15 - .35

Applications

In general, any member of a steel structure requiring material with exceptional resistance to abrasion, by either wet or dry materials is considered a suitable application of A-R steel. Unusually long life has been obtained by using A-R in a variety of parts

including wear plates, conveyor chutes, dredge pipes, screens, mixer drums, buckets and liner plates. Other applications include scrap metal baling machines, grave crushers, hoppers, farm implements, railroad cars and grader, mixer and scraper blades.

Typical Mechanical Properties

Tensile Strength (P.S.I.)	Yield Point (P.S.I.)	Elongation In 8 Inches	Reduction Of Area	Brinell Hardness
115,000	70,000	16%	35%	235

Shearing

A-R Steel has a higher hardness than structural carbon steel and shearing must be done with care. To ensure proper safety and the structural integrity of the finished product, we will assist you with heat number and source-mill information so that you can obtain accurate information from the producing mill prior to any attempt to shear this material.

Flame Cutting

Flame cutting A-R plate produces a brittle edge due to the quenching effect of the plate. In many application this is of little or no consequence. In applications where flame cut parts must be formed, however, specific procedures must be followed when cutting the parts to ensure the safety of workers and the integrity of the parts. To ensure proper safety and the structural integrity of the finished product, we will assist you with heat number and source-mill information so that you can obtain accurate information from the producing mill prior to any attempt to flame cut parts that must later be formed.

Drilling & Machinability

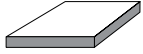
This steel can be drilled and machined satisfactorily with standard equipment. However, machine speeds and feeds must be reduced. High speed drills are necessary and should be kept cool with drilling compounds such as soluble oil or turpentine. For drilling this steel, the clearance rake of the drills should be less than that for steels of lower hardness.

Weldability

Abrasion Resistant Steel may be welded with proper precautions. Preheating is recommended and after welding it is good practice to stress relieve or normalize. To normalize, heat to 1650°F and allow to cool slowly in air. Normalizing is sometimes omitted when the welded part is not subject to severe vibration and stress. However, normalizing will prevent cracks, give uniform structure and will not reduce the abrasive-resisting qualities. The grade of welding rod to be used depends upon the thickness of section, designs, service, requirements, etc. To ensure proper safety and the structural integrity of the finished product, we will assist you with heat number and source-mill information so that you can obtain accurate information from the producing mill prior to welding this material.

Punching

A-R Steel can be punched successfully in thicknesses up to 1/2" at temperatures no lower than room temperature, but more power is required than for an equal thickness of mild structural steel. The possibility of fine cracks in the material around the hole makes it advisable to ream after punching. When holes are close together, as in the case of perforated screens, it is necessary to preheat before punching or to resort to drilling. If these precautions are not taken, it is possible that cracks may occur and may extend from one hole to the next. To ensure proper safety and the structural integrity of the finished product, we will assist you with heat number and source-mill information so that you can obtain accurate information from the producing mill prior to punching this materials.



Abrasion Resistant Steel Plates

High Brinell or Wear Plates are made from heat treated, high strength, abrasion resisting steels.

Analysis

Because these plates are made to a specific hardness range rather than to a specific ASTM grade, there is a wide range of chemistries found in these steels depending on the mill of origin.

Applications

This steel is used in application requiring high strength and high wear resistance. Good candidates for these steels are mining, earth moving equipments, loader buckets, cutting edges, chutes, slurry pipe, ore bins and similar uses.

Typical Mechanical Properties

Grade	Tensile Strength (P.S.I.)	Yield Point (P.S.I.)	Elongation Percent In 2"	Brinell Hardness
AR360	130,000	160,000	15	360
AR400	145,000	180,000	14	400
AR500	190,000	230,000	14	500

Fabrication

Due to the proprietary nature of High Brinell plate, procedures for welding, drilling and forming are specific to each mill's product and can be provided upon request.

Heat treated constructional alloy steels are low-carbon alloy steel with a level of strength substantially higher than that of the high-strength low alloy grades. This higher strength is obtained by heat treating, water quenching and tempering. The alloying elements and

amount of the alloy content vary among the grades depending upon the section thickness and desired properties. Their general weldability is improved by the lower carbon content.

The range of hardness for ASTM A-514 is Brinell 235 – 239. This range is sometimes referred to as "Regular Quality." If you have specific hardness requirements, please contact our sales office.

Typical Analysis of A514

Carbon	Manganese	Phosphorus	Sulphur	Silicon
.12 - .21	.70 - 1.00	.035 Max.	.040 Max.	.20 - .35
Chromium	Molybdenum	Vanadium	Titanium	Boron
.40 - .0065	.15 - .25	.03 - .08	.01 - .03	.0005 - .005

Mechanical Properties For Regular Quality

Tensile Strength (P.S.I.)	Yield Point (P.S.I.)	Elongation In 2"	Reduction of Area (Min. %)	
			3/4 Inch and Under	Over 3/4 Inch
110 to 130,000	100,000 Min.	18% Min.	40%	50%

Applications

Regular Quality is used in general structural applications where its greater strength permits reduction in weight by using smaller cross-sectional areas. It is for welded construction where procedures are suitable to maintain the properties of the plate.

321 and 360 Minimum Brinell Quality are for applications where higher hardness and strength in conjunction with increased resistance to impact abrasion are important.

Forming

Regular Quality can be cold-formed readily, provided sufficient power is available and allowance is made for greater spring back than with mild steel.

Warm forming may be done at temperatures below 1100°F without destroying the mechanical properties or toughness. Hot forming may be done at 1600-1800°F, but the formed part must be heat-treated to restore its original properties. To ensure proper safety and the structural integrity of the finished product we will assist you with heat number and source-mill information so that you can obtain accurate information from the producing mill prior to any attempt to form this material.

Thicknes of Material	Minimum radius
Up to 1" inclusive	Two Times Thickness
Over 1 inch to 2" inclusive	Three Times Thickness

Machinability

The cutting speed of Regular Quality is 65 surface feet per minute or approximately 40% of 1212.

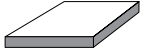
Weldability

Similar techniques to those used in structural carbon steels apply but precautions must be used. Hydrogen must be kept out of the welding operation. Large sections or those under high restraint should be preheated to temperatures not exceeding 400°F.

Heat Treating

Stress relieving may be performed by heating at temperatures up to 1100°F. If Regular Quality material is heated over 1100°F, it must be heat treated again to restore the original strength.

Austenize	Quench	Temper
1650° F to 1700° F	Agitated Water	1150° F to 1250° F



Medium Carbon Plates

C-1045 and C-1055

Analysis

	Carbon	Manganese	Phosphorus	Sulphur
C-1045	.43 - .50	.60 - .90	.04 Max.	.05 Max.
C-1055	.50 - .60	.60 - .90	.04 Max.	.05 Max.

Applications

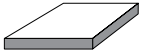
Medium carbon steel plates are generally used in parts for heavy construction, farm and industrial equipment for non-abrasive wearing parts.

Machinability

This grade is satisfactory for ordinary machining or drilling but is not considered a free machining grade.

Weldability

This quality presents no welding problems when using all welding processes. Welding rod specifications are dependent on welding conditions such as thickness, service requirements and design.



High Tensile Plates

ASTM A572 Grade 50

High Tensile Plates are tolled by various steel mills. These plates are high strength low alloy, intended primarily for weight reduction, or longer life, by means of greater strength.

Analysis (Typical)

	Carbon	Mn	P	Sulphur	Silicon	Cb
Gr. 50	.21 Max.	1.35 Max	.04 Max	.05 Max	.30 Max	.01 Min

Mechanical Properties (Typical)

	Tensile Strength (P.S.I.)	Yeild Point (P.S.I.)	Elongation In 2"
Gr. 50	65,000	50,000	Min. 23%



Pressure Vessel Quality Plate

A516 Grade 70

Availability of this material is limited. Check for availability.

Analysis (Typical)

	Carbon	Mn	Phosphorus	Sulphur	Silicon
A516 Gr. 70	.28 Max	.90 Max	.35 Max	.04 Max	.20

Mechanical Properties

	Tensile Strength (P.S.I.)	Yield Point (P.S.I.)	Elongation In 8"
A516 Gr. 70	70,000 - 90,000	38,000 Min.	17%

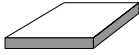
Applications

A516/70 is a carbon steel plate for boilers for stationary service and other pressure vessels. The maximum thickness under this specification is 6".

Weldability

These grades present no problems when using all welding processes. Welding quality is generally very high. Welding rod specifications depend on conditions such as thickness of section, service requirements and design.

Weights For Plate Products



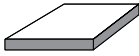
Weight Per Plate				Weight Per Plate				Weight Per Plate			
3/16 Inch				48	x	288	980.2	60	x	288	1531.2
7.66 Lbs. / Sq. Ft.				60	x	96	408.4	72	x	120	756.6
48	x	96	245.1					144 918.7			
120 306.4				144 612.6				240 1531.2			
144 367.7				240 1021.0				288 1837.4			
240 612.8				288 1225.2				360 2296.8			
288 735.4				72	x	96	490.1	84	x	240	1786.4
60	x	96	306.4	120 612.6				360 2679.6			
120 383.0				144 735.1				96	x	120	1020.8
144 459.6				240 1225.2				144 1225.0			
240 766.0				288 1470.2				240 2041.6			
288 919.2				360 1837.6				288 2449.9			
72	x	120	459.6	84	x	240	1429.4	360 3062.4			
144 551.5				360 2144.1				120	x	240	2552.0
240 919.2				96	x	96	653.4	360 3828.0			
288 1103.0				120 816.8				3/8 Inch			
360 1378.8				144 980.2				15.31 Lbs. / Sq. Ft.			
84	x	240	1072.4	240 1633.6				48	x	96	489.9
360 1608.6				288 1960.3				120 612.4			
96	x	120	612.8	360 2450.4				144 734.9			
144 735.4				120	x	240	2042.0	240 1224.8			
240 1225.6				360 3063.0				288 1469.8			
288 1470.7				5/16 Inch				60	x	96	612.4
360 1838.4				12.76 Lbs. / Sq. Ft.				120 765.5			
120	x	240	1532.0	48	x	96	408.3	144 918.6			
360 2298.0				120 510.4				240 1531.0			
1/4 Inch				144 612.5				288 1837.20			
10.21 Lbs. / Sq. Ft.				240 1020.8				72	x	120	918.6
48	x	96	326.7	60	x	96	510.4	144 1102.5			
120 408.4				120 638.0				240 1837.2			
144 490.1				144 756.6				288 2204.6			
240 816.8				240 1276.0				360 2755.8			

Weights For Plate Products (Continued)



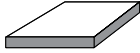
Weight Per Plate				Weight Per Plate				Weight Per Plate			
3/8 Inch				288	3430.6	120	x	240	5104.0		
15.31 Lbs. / Sq. Ft.				360	4288.2	360 7656.0					
84	x	240	2143.4	96	x	120	1633.6	3/4 Inch			
360 3215.1				144 1960.3				30.63 Lbs. / Sq. Ft.			
96	x	120	1224.8	240 3267.2				48	x	96	980.2
144 1469.8				288 3920.6				120 1225.2			
240 2449.6				360 4900.8				144 1470.2			
288 2939.5				120	x	240	4084.0	240 2450.4			
360 3674.4				360 6126.0				60	x	96	1225.2
120	x	240	3062.0	5/8 Inch				120 1531.5			
360 4593.0				25.52 Lbs. / Sq. Ft.				144 1837.8			
7/16 Inch				48	x	96	816.6	240 3063.0			
17.87 Lbs. / Sq. Ft.				120 1020.8				288 3675.6			
96	x	240	2859.2	144 1225.0				72	x	120	1837.8
144 1469.8				240 2041.6				144 2205.4			
1/2 Inch				288 3062.4				240 3675.6			
20.42 Lbs. / Sq. Ft.				60	x	96	1020.8	288 4410.7			
48	x	96	653.4	144 1531.2				360 7351.2			
120 816.8				240 2552.0				84	x	240	4288.2
144 980.2				288 3062.4				360 6432.2			
240 1633.6				72	x	120	1531.2	96	x	120	2450.4
288 1960.3				144 1837.4				240 4900.8			
60	x	96	816.8	240 3062.4				288 5881.0			
120 1021.0				288 3674.9				360 7351.2			
144 1225.2				360 4593.6				120	x	240	6126.0
240 2042.0				84	x	240	3572.8	360 9189.0			
288 2450.4				360 5359.2				7/8 Inch			
72	x	120	1225.2	96	x	120	2041.6	35.73 Lbs. / Sq. Ft.			
144 1470.2				144 2449.9				48	x	96	1143.4
240 2450.4				240 4083.2				120 1492.2			
288 2940.5				288 4899.8				144 1715.0			
360 3675.6				360 6124.8				240 2858.4			
84	x	240	2858.8								

Weights For Plate Products (Continued)

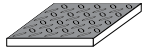


Weight per Plate				Weight Per Plate				Weight Per Plate			
7/8 Inch (Cont.)				288		4900.8		192		4900.8	
60	x	96	1429.2	72	x	120	2450.4		240		6126.0
		120	1786.5			144	2940.5		360		9189.0
		144	2143.8			240	4900.8	84	x	240	7147.0
		240	3573.0			288	5881.0		360		10720.5
		288	4287.6			360	7351.2	96	x	120	4084.0
		360	5395.5	84	x	240	5717.6		144		4900.8
72	x	120	2143.8			360	8576.4		192		6534.4
		144	2572.6	96	x	120	3267.2		240		8168.0
		240	4287.6			144	3920.6		360		12252.0
		288	5145.1			240	6534.4	1 3/8 Inch			
		360	6431.4			288	7841.3	56.15 Lbs. / Sq. Ft.			
84	x	240	5002.2			360	9801.6	96	x	240	8984.0
		360	7503.3	120	x	240	8168.0	1 1/2 Inch			
96	x	120	2858.4			360	12252.0	61.26 Lbs. / Sq. Ft.			
		144	3430.1	1 1/8 Inch				48	x	96	1960.3
		240	5716.8	45.95 Lbs. / Sq. Ft.						120	2450.4
		288	6860.2	96	x	240	7352.0		144		2940.5
		360	8575.2	1 1/4 Inch					192		3920.6
120	x	240	7146.0	51.05 Lbs. / Sq. Ft.					240		4900.8
		360	10719.0	48	x	96	1633.6		96		2450.4
1 Inch						120	2042.0	60	x	120	3063.0
40.84 Lbs. / Sq. Ft.						144	2450.4		144		3675.6
48	x	96	1306.9			192	3267.2		192		4900.8
		120	1633.6			240	4084.0		240		6126.0
		144	1960.3	60	x	96	2042.0	72	x	120	3675.6
		240	3267.2			120	2552.5		144		4410.7
		288	3920.6			144	3063.0		192		5881.0
60	x	96	1633.6			192	4084.0		240		4410.7
		120	2042.0			240	5105.0		360		11026.8
		144	2940.5	72	x	120	3063.0	84	x	240	8576.4
		240	4084.0			144	3675.6		360		12864.6

Weights For Plate Products (Continued)



Weight Per Plate				Weight Per Plate				Weight Per Plate			
1 1/2 Inch (Cont.)				240	8576.4	2 1/2 Inch					
96	x	120	4900.8	360	12864.6	102.1 Lbs. / Sq. Ft.					
		144	5881.0	84	x	240	10005.8	60	x	240	10210.0
		192	7841.3			360	15008.7	72	x	240	12252.0
		240	9801.6	96	x	120	5717.6	96	x	240	16336.0
1 5/8 Inch				144	6861.1	2 3/4 Inch					
66.36 Lbs. / Sq. Ft.				192	9148.2	112.3 Lbs. / Sq. Ft.					
96	x	240	10617.6	240	11435.2	3 Inch					
1 3/4 Inch				1 7/8 Inch				122.5 Lbs. / Sq. Ft.			
71.47 Lbs./ Sq. Ft.				76.57 Lbs. / Sq. Ft.				3 1/2 Inch			
48	x	96	2287.0	96	x	240	12251.2	142.9 Lbs. / Sq. Ft.			
		120	2858.8	2 Inch				4 Inch			
		144	3430.6	81.68 Lbs. / Sq. Ft.				163.36 Lbs. / Sq. Ft.			
		192	4575.1	60	x	240	8168.0	4 1/2 Inch			
		240	5717.6	72	x	240	9801.6	183.8 Lbs. / Sq. Ft.			
60	x	96	2858.8	84	x	240	11435.2	5 Inch			
		120	3573.5	96	x	240	13068.8	204.2 Lbs. / Sq. Ft.			
		144	4288.2	2 1/4 Inch				6 Inch			
		192	5717.6	91.89 Lbs. / Sq. Ft.				245.0 Lbs. / Sq. Ft.			
		240	7147.0	60	x	240	9189.0	8 Inch			
72	x	120	4288.2	72	x	240	11026.8	326.7 Lbs. / Sq. Ft.			
		144	5145.8	84	x	240	12864.6				
		192	6861.1	96	x	240	14702.4				



Floor Plate

Floor Plate is made of rolled carbon steel that has great structural strength and long wearing qualities. The practical safety tread pattern provides 4-way traction, easy cleaning, and drainage.

Analysis

Carbon	Manganese	Phosphorus	Sulphur
.10 - .25	.30 - .70	.50 Approximately	.05 Approximately

Typical Mechanical Properties

Ordinarily floor plates are not stress-carrying pieces, but typical physical properties are:

Tensile Strength (P.S.I.)	Yield Point (P.S.I.)	Elongation In 8 Inches
60,000	33,000	22%

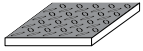
Applications

Diamond Floor Plate is extensively used in safety floors, step treads, walkways, truck beds, truck bumpers, conveyors, cover plates, running boards, can floors and truck tail gates.

Weldability

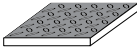
This material presents no welding problems when using all welding processes. The quality of the welds is generally extremely high for both welds and joints. Welding rod specifications are dependent on welding conditions such as the thickness of the sections to be welded, service requirements and design.

Floor Plate



Weight Per Plate				Weight Per Plate				Weight Per Plate				
16 Ga.				288	710.4	120	552.4					
3.00 Lbs. / Sq. Ft.				72	x 240	738.0	240	1104.8				
36	x	96	72.0	288	885.6	288	1325.8					
		120	90.0	3/16 Inch				60	x	120	690.5	
		144	108.0	8.71 Lbs. / Sq. Ft.				240	1381.0			
48	x	96	96.0	48	x	96	278.7	288	1657.2			
		120	120.0	120	348.4	72	x	240	1657.2			
		192	192.0	240	696.8	288	1988.6					
		240	240.0	60	x	96	348.4	96	x	240	2209.6	
14 Ga.				120	435.5	288	2651.5					
3.75 Lbs. / Sq. Ft.				240	871.0	3/8 Inch						
48	x	96	120.0	288	1045.2	16.37 Lbs. / Sq. Ft.						
		120	150.0	72	x	240	1045.2	48	x	96	523.8	
		192	240.0	288	1254.2	120	654.8					
		240	300.0	84	x	240	1219.4	240	1309.6			
12 Ga.				288	1463.3	48	x	288	1571.5			
5.25 Lbs. / Sq. Ft.				1/4 Inch				60	x	240	1637.0	
48	x	96	168.0	11.26 Lbs. / Sq.Ft.				288	1964.4			
		120	210.0	48	x	96	360.3	72	x	240	1964.4	
		192	336.0	120	450.4	288	2357.3					
		240	420.0	240	900.8	96	x	240	2619.2			
60	x	120	262.5	288	1081.0	288	3143.0					
		240	525.0	60	x	120	563.0	1/2 Inch				
1/8 Inch				240	1126.0	21.47 Lbs. / Sq. Ft.						
6.15 Lbs. / Sq. Ft.				288	1251.2	48	x	96	687.0			
36	x	120	184.5	72	x	240	1351.2	120	858.8			
48	x	96	196.8	288	1621.4	240	1717.6					
		120	246.0	96	x	240	1801.6	288	2061.1			
		240	492.0	288	2161.9	60	x	240	2147.0			
		288	590.4	5/16 Inch				288	2576.4			
60	x	120	307.5	13.81 Lbs. / Sq. Ft.				72	x	240	2576.4	
		240	615.0	48	x	96	441.9	288	3091.7			

Floor Plate (Continued)



Weight Per Plate	Weight Per Plate	Weight Per Plate
1/2 Inch (Cont.)	60 x 240 2658.0	60 x 240 3168.0
96 x 240 3435.2	72 x 240 3189.6	72 x 240 3801.6
288 4122.2	96 x 240 4252.8	96 x 240 5068.8
5/8 Inch	3/4 Inch	96 x 288 6082.6
26.58 Lbs. / Sq. Ft.	31.68 Lbs. / Sq. Ft.	
45 x 240 2126.4	48 x 240 2534.4	



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