



# HARP

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# HIGH ABRASION RESISTANT PLATES

Grade	Thickness (mm)	Heat Treatment	Chemical Composition (max %)										Mechanical Properties			
			C	Si	Mn	P	S	Cr	Mo	V	Ti	B	Tensile Test			Hardness Test
													Yield Point (kgf/mm <sup>2</sup> )	Tensile Strength (kgf/mm <sup>2</sup> )	Elongation %	Brinell hardness Load 3,000kg Average of 5 values
HARP 250	12	as rolled	0.48	0.18	0.75	0.0009	0.001						33.8	55.0	16.0	200
HARP 320	19	controlled heat treatment	0.12	0.36	1.46	0.03	0.005	0.25			0.010	0.002	98.1	104.9	19.9	300
HARP 400	19	"	0.21	0.34	1.60	0.03	0.004	0.23			0.008	0.002	118.6	134.2	19.8	400
HARP 500	20	"	0.32	0.23	1.07	0.005	0.002	0.49			0.010	.002	132.3	147.8	17.7	500
HARP 500A*	20	"	0.30	0.31	0.64	0.014	0.001	0.91	0.22	0.044	0.012	0.001	134.7	154.6	22.9	500

INCOPHIL has pioneered in armoring bank vans using HARP 500A. It was the plate used in the renowned "Popemobile" built in the Philippines that was used by Pope John Paul II during his visit for the World Youth Day in January 15, 1995.

## APPLICATIONS:

ASPHALT DRYER WEAR STRIPS  
 BANG BOARDS  
 BUCKET LIPS  
 BULLDOZER BLADES  
 CHAIN DRAG SKID BARS  
 CHUTE LINER STRIPS  
 CHUTE SIDES  
 COAL SCREENS  
 CONCRETE MIXER SPIRAL STRIPS  
 CONVEYOR BUCKETS  
 CONVEYOR PLATES  
 CRUSHER HAMMERS  
 DIESEL LOCOMOTIVE WEAR PLATES  
 DRAG LINE BUCKET STRIPS  
 DRAGLINE BOTTOMS  
 DRAGLINE BUCKETS  
 DRAGLINE STRIPS  
 DREDGE PIPE RELINERS  
 DREDGE PUMPS  
 DUMP TRUCK BEDS  
 FAN BLADES

FAN HOUSING RELINERS  
 FEED GRINDING MILLS  
 FOUNDRY SHAKEOUT MACHINES  
 GRAVEL CHUTES  
 GRAVEL SCREENS  
 HOPPERS  
 LINER PLATES  
 LOG CONVEYORS  
 MINE DIGGER TEETH  
 MIXER BLADES  
 ORE CHUTES  
 PEDESTAL & JOURNAL BOX LINERS  
 PUG MILL KNIVES  
 PUG MILL LINING PLATES  
 PULP WOOD CHUTES  
 QUARRY & MINE STRIPS  
 RACE BARS  
 RELINER BARS FOR CRUSHERS  
 RELINERS  
 ROLLERS  
 ROTO PLATES

SAND BLAST PLATES  
 SAND CHUTES  
 SCARIFIER TEETH  
 SCRAPPERS  
 SHOT BLAST PLATES  
 SHOVEL BUCKET WEAR BARS  
 SHOVEL BUCKETS  
 SKID CONVEYORS  
 SLUICE PIPES  
 SPOUTS  
 STEEL MILL EQUIPMENT  
 STONE CHUTES  
 STREET SWEEPER SHOES  
 TONGS  
 TRAILER BOTTOMS  
 TRENCHING MACHINE TEETH  
 TRUCK BED STRIPPING BARS  
 TRUCK BOTTOMS  
 WEAR PLATES  
 WEAR STRIPS ON PAVING MACHINES  
 WHEELABRATOR PARTS

## Standard Sizes

Grade	Thickness (mm)	Width (ft)	Length (ft)
HARP 250	3.2-25	4, 8	8, 12, 16, 20
HARP 320	3.2 -25	"	"
HARP 400	6-50	"	"
HARP 500	6-50	4, 5, 8	8, 10, 12, 16, 20
HARP 500A	10	4	8, 12, 16, 20

### Gas Cutting

- Due to the hardness of HARP plates, care must be exercised to prevent "notches" during gas cutting which may cause the steel plate to crack.
- Increase the gas and oxygen pressure and cut slowly in a range where notches will not occur.
- Notches that occurred during cutting may result in cracks. In such cases, use a grinder or other tools to create a smooth finish.
- Avoid interrupting the cutting process for more than several hours.
- A thin hardened layer of less than 3mm will be formed on the gas cut surface due to heat effects.
- When cutting the HARP 400, 500 or 500A which are 19mm or over in thickness, with the surrounding temperature during cutting at below 20°C, it is recommended that you either preheat the steel plate at a temperature not above 200°C or postheat the steel plate.

### Bending

- The minimum bending radius changes with the hardness level. Due to the high hardness of HARP, a bending radius of 3 to 5 times that of the ordinary steel must be allowed. For HARP 400, 500 and 500A, cold working is possible but extra care must be observed.
- The spring back is large. This must be fully considered during the working process.
- To prevent cracks during bending, remove with a grinder or similar tool, notches on cut surface, hardened layer from gas cutting and burrs for shearing.

### Hot Working

- Avoid hot working on HARP 400, 500 and 500A to maintain fixed hardness level. These plates are given special controlled heat treatment.

### Machining and Shearing

- Super hardened tools are recommended for machining. Machining conditions will vary according to the hardness level of the steel plate, the tool and cutting method used. As hardness level increases, it is necessary to decrease the cutting depth and fuel spread.
- Use up to several times the shearing force required for ordinary plate, depending on the hardness level of the steel plate.

### Weldability

- Conventional shielded metal arc welding or CO2 arc welding maybe adopted to weld joints satisfactorily.
- Recommended welding material for arc welding with covered electrodes is AWS E 7016-G, AWS E 9016-G or AWS 11016-G while AWS grade ER 70S-G or AWS ER110-G is recommended for gas shielded arc welding.
- Preheating changes with chemical composition, thickness of plate and the conditions of the area for welding.
- Postheating is not needed normally if hardfacing welding is not done. If hardfacing welding is employed, postheat at 150-200°C for about five minutes.
- Remove rust, oil, slag and other materials from weld area.
- Before use, redry welding electrodes at 350-400°C for approximately an hour.
- Cracks may result if arc striking is done on the surface area of the base metal. It is recommended to use either the back step welding or waste arcing method.
- Keep the arc length as short as possible.
- Tack welding can be performed but keep the bead length 50mm or over.

Note: The material contained in this brochure is for general information only. It is not intended as a substitute for the competent professional assistance which is a requisite to any specific application. While every effort has been made to insure its accuracy, manufacturer makes no express or implied warranty of any kind with respect to the information contained in this publication or the materials referred therein.

### TYPICAL APPLICATIONS BY INDUSTRIES

Industry	Applications
<b>Steel and Gas</b>	<ul style="list-style-type: none"> <li>· BF top swivel chute</li> <li>· BF stationary chute, liner, upper, hopper liner, gate liner</li> <li>· BF gas washing cventuri scrubber and septane valve</li> <li>· Screens for ores and switching damper</li> <li>· Bypass chute for ore conveyors</li> <li>· Chute for ore conveyors</li> <li>· Tripper chute for ore conveyors</li> <li>· Tripper chute for coke conveyors</li> <li>· Coke conveyor chute and stacker chute</li> <li>· Lining for rotary mixers</li> <li>· Drop chute receiver for blending conveyor in sintering plants</li> <li>· Liner for vibro-feeders in sintering plants</li> <li>· Raw material and sole role feeders</li> </ul>
<b>Cement and Mixing</b>	<ul style="list-style-type: none"> <li>· Lining material for ready-mixed concrete turbine mixer</li> <li>· Paddle or above</li> <li>· Conveyor chute for concrete mixing plant</li> <li>· Pug mill for soil cement</li> <li>· Conveyor pipe for solids (pneumatic pipelines for coal mines)</li> </ul>
<b>Construction and Automotive Industries</b>	<ul style="list-style-type: none"> <li>· Bulldozer shovels and buckets</li> <li>· Slush plates for bulldozers</li> <li>· Exterior linings of bulldozer buckets</li> <li>· Trailer beds</li> <li>· Vessels for dump and cargo trucks</li> <li>· Dredger buckets</li> </ul>
<b>Chemical Industry</b>	<ul style="list-style-type: none"> <li>· Agitators for asphalt plants and finishers</li> <li>· Sand conveyor pipe for sand cracking in naphta cracking plants</li> <li>· Sulfide mineral bucket elevators</li> </ul>
<b>Others</b>	<ul style="list-style-type: none"> <li>· Earth drills</li> <li>· Shear liners</li> </ul>

Exclusive Distributor:



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# STEINSTAHL machinery steels

Type	AISI	DIN	JIS	Chemical Composition Min/Max%								Mechanical Properties				
				C	Mn	P	S	Si	Cr	Ni	Mo	Yield Strength(Mpa)	Tensile Strength(Mpa)	Elongation5D%	Hardness BHN*	
Steinstahl 045	1045	C <sub>45</sub>	S <sub>45</sub> C	0.43/0.50	0.60/1.00	/0.040	/0.050						355	517	15	180 - 250
Steinstahl 140	4140	<sub>42</sub> Cr-M <sub>04</sub>	SCM <sub>440</sub>	0.38/0.43	0.75/1.00	/0.035	/0.040	0.15/0.30	0.80/1.10			0.15/0.25	690	885	21	180 - 250
Steinstahl 337	4340	<sub>34</sub> CrNiMo <sub>6</sub>	SNCM <sub>447</sub>	0.38/0.45	0.60/0.80	/0.035	/0.040	0.15/0.30	0.70/0.90	1.65/2.00		0.20/0.30	690	885	15	180 - 250

\* could be hardened to max. of 550 BHN

## Characteristics / Typical Applications

- **Medium carbon** type steels are selected for uses where higher mechanical properties are needed. They are frequently hardened or strengthened by heat treatment or cold work.
- **Steinstahl 140** is a chrome-molybdenum steel. It contains chromium, which gives hardness and toughness to the steel. The molybdenum improves forging, machining and strength. Molybdenum also makes steel red hard and air hardening. Noted for high strength and hardness, they are used for structural parts where welding is to be done.
- **Steinstahl 337** contains nickel. Together with the other alloying elements it improves fatigue failure, resistance to corrosion, toughness and impact properties. Nickel, chromium and molybdenum combined improve hardening characteristics in steel.
- Typical uses are connecting rods, axles, gears, shafts, pinions, and medium and large parts requiring high degree of strength, toughness and hardness.

## Availability:

Solid bars readily available and stocked in fixed or random lengths. Hollow bars of these materials according to customer's specific requirement as to outside and inside diameter up to 10 feet in length are available on special orders.

## Metric length measurement:

Unit	Inches	Feet	Millimeter	Centimeter	Meter
one inch	1	0.0833	25.4	2.54	0.0254
one foot	12	1	304.8	30.48	0.3048
one millimeter (mm)	0.03937	.00328	1	0.1	0.001
one centimeter (cm)	0.3937	.0328	10	1	.01
one meter	39.37	3.2809	1000	100	1

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# STAINLESS STEELS

Steel is made stainless by the addition of alloying elements such as chrome, nickel and molybdenum. Stainless steel has a "non-rusting quality" --- its ability to resist the effects of weather, atmosphere, water and solutions like acids, salts and alkalis. This resistance is attained by alloying the steel primarily with chromium and some other alloying elements such as nickel, molybdenum, manganese, titanium, niobium, copper and nitrogen.

Different alloying elements gives rise to different structures as they solidify. In the case of stainless steels, there are three classifications: austenitic, ferritic and martensitic. The austenitic types exhibit very good weldability. These are alloyed with both chromium and nickel, although other elements are occasionally included.

## Type No: AISI: 310S DIN: 1.4845 JIS: SUS 310S high temperature steel

Chemical Composition							Mechanical Properties			
C	Si	Mn	Ni	Cr	Mo	Cu	Yield Strength (kfg/mm <sup>2</sup> )	Tensile Strength (kfg/mm <sup>2</sup> )	Elongation %	Hardness HB
<=0.08	<=1.50	<=2.00	19.00 22.00	24.00 26.00			> =21	> =53	> =40	> =187

### Characteristic:

- Austenitic
- oxidation resistant
- nickel based alloy
- corrosion resistant
- scaling temp. 1150° C
- good weldability

### Sizes available:

#### Bars:

diameter (inch): ¼, 3/8, ½, 5/8, 3/4  
length (ft): 20

#### Plates:

thickness: 6mm, 9mm, 12mm, 15mm  
width (ft): 4, 5 length (ft): 8, 10

### Applications:

- furnaces, parts of furnaces and furnace accessories
- components in waste gas systems such as recuperators, guide plates, fans, etc.
- combustion chambers in oil or gas fired furnaces for air heating upstream of drying equipment and for combustion of poisonous and malodorous industrial gases.

## Type No: AISI: 304 DIN: 1.4301 JIS: SUS 304

Chemical Composition							Mechanical Properties			
C	Si	Mn	Ni	Cr	Mo	Cu	Yield Strength (kfg/mm <sup>2</sup> )	Tensile Strength (kfg/mm <sup>2</sup> )	Elongation %	Hardness HB
<=0.08	<=1.00	<=2.00	8.00 10.00	18.00 20.00			> =21	> =53	> =40	> =187

### Characteristics:

- standard austenitic
- heat resistant
- general corrosion resistant
- scaling temp 875°C

### Standard sizes

#### Bars:

diameter (inch): 1/8 - 10  
length (ft): 20 ft for 6 inch dia. rods and smaller sizes  
random length for bigger dia. rods

#### Plates:

thickness: 6mm, 9mm, 12mm, 15mm  
width (ft): 4, 5 length (ft): 8, 10  
· cut sizes maybe available on a case to case basis

### Typical Application:

- for equipment utilizing strong oxidizing acid