Astralloy
a NUCOR company

AstraWear 400F

A 400 BHN Wear Resistant Steel

Chemical Composition* – % Weight

C	Mn	P	S	Si	Ni	Cr	Mo	B
.16	1.55	.025	.010	.40	.80	.60	.50	.003

Physical Properties – Typical Values at 68°F

BHN Hardness	Tensile Strength	Yield Strength	Elongation in 2"	Charpy Test Toughness Index
360 – 444	180 ksi	145 ksi	16%	25 ft. lbs. Longitudinal @ -40°F 20 ft. lbs. Transverse @ -40°F

C Equivalent

$$C_{eq} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni+Cu}{15}$$

Thickness Range - in.	C.Eq
3/16 – 5/16	≤ .42
> 5/16 – .75	≤ .46
> .75 – 1.25	≤ .50
> 1.25 – 2.00	≤ .59

AstraWear 400F is a water tempered martensitic steel, with typical hardness of 400 BHN (42.5 HRC), which offers real response to wear from abrasion. Its resistance, high hardness, and high yield strength, make AstraWear 400F suitable for use in applications that require resistance to wear from scraping or moderate impact.

AstraWear 400F offers a real benefit for the service life of equipment and allows for significant reduction of design thickness because its resistance to wear makes it up to 3 times more durable than A572-50 (S355) grade. AstraWear 400F welds easily and has excellent forming properties, which combine to facilitate processing.

This steel is especially suited for applications in quarries, construction, mines, cement plants, and the iron and steel industry, among others.

Note: The data contained in this document is accurate at time of printing, and intended for use as a general guide.
* Typical maximum values. Mill certifications are available upon request.

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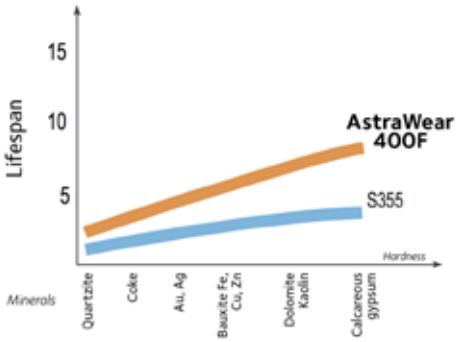
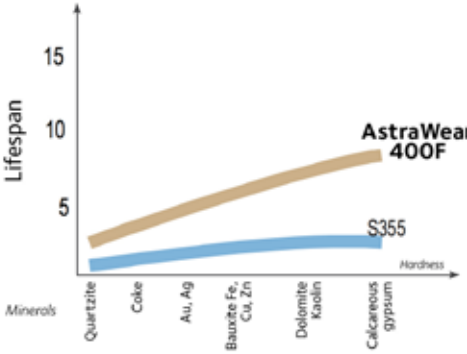
Wear Resistant Properties

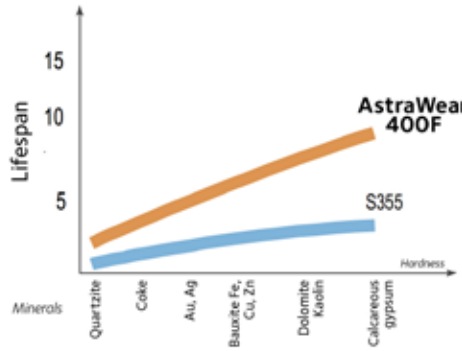
Low Energy Impact – Dry media



Low Energy Impact – Wet media



High Energy Impact



Wear test data

CUTTING

All classic thermal cutting processes are compatible with AstraWear 400F (gas, plasma, laser).

0.16 in. to 2 in. thick plates do not require preheating, provided thermal cutting is performed at temperatures above 60°F. When that is not possible or the plates are thicker than 2 in., preheating to 210° – 300°F is recommended.

Cutting with water jet or shearing can also be used.

	Thickness	
Cutting Temperature	0.16" – 2"	>2"
≥ 60°F	w/o preheating	Preheating 212° – 302°F
< 60°F	Preheating 212° – 302°F	

MACHINING

Drilling and grinding can be performed with super carburized steel with HSSCO high-speed cobalt bits, using an oil lubricant whenever possible. However, classic high-speed steels may be used. Typical cutting parameters are:

DRILLING		Ø = 0.40"	Ø = 0.80"	Ø = 1.18"
Cutting speed	ft/min	20 – 40	20 – 40	20 – 40
Rotation	rev/min	190 – 380	90 – 190	60 – 120
Feed	in/rev	0.00394	0.00787	0.01182

THREADING		Ø = 0.40"	Ø = 0.80"	Ø = 1.18"
Cutting speed	ft/min	6.5 – 13	6.5 – 13	6.5 – 13
Rotation	rev/min	60 – 120	30 – 60	20 – 40

GRINDING	Depth (in.)	Cutting speed (ft/min)	Feed (in/tooth)
HSSCO AR 12.0.5.5 (T15)	0.04 0.16 0.31	4.7 – 5.9 3.9 – 4.7 2.7 – 3.5	0.0031 0.0039 0.0059
F40M	0.04 – 0.20	2.7 – 7.9	0.0059 – 0.0138

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BENDING

Thanks to its high level of refinement (low sulfur and phosphorus content), AstraWear 400F is easy to bend; provided the following conditions are observed:

* Cutting (or grinding) of edges caused by gas cutting to limit hardened areas
* Sufficiently powerful equipment
* The minimum forming radius is respected
* The minimum plate temperature is 60°F

For plates under 0.75 in. thick, forming conditions are summarized in the following table:

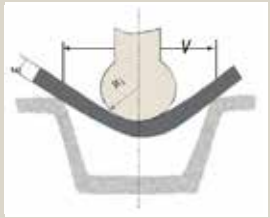
th = thickness	Perpendicular to grain direction	Parallel to grain direction
Inner bend radius R_i (min)	3 x th	4 x th
V die aperture (min)	10 x th	10 x th

For plates .75" – 2" thick, forming conditions are summarized in the following table:

th = thickness	Perpendicular to grain direction	Parallel to grain direction
Inner bend radius R_i (min)	3 x th	4 x th
V die aperture (min)	14 x th	14 x th

Please call regarding plates over 2 in.

Within these permissible bending parameters, the force required to shape a plate is a function of the length bent, metal thickness, die aperture, die shape (V or U), and punch shape.



The following table shows the bending forces, for minimum die aperture (V=10 th), required to bend plates in V for a 3.28 ft. bend.

Thickness (in)	Bending force required per foot of bend * (tons/ft)
0.20	22.251
0.40	44.197
0.60	66.447
	*± 10%

AstraWear 400F steel is unsuitable for thermo-forming at temperatures above 392°F.

WELDING

Thanks to a chemical analysis with low carbon content, AstraWear 400F offers outstanding welding characteristics. It can be welded under simple conditions with total safety.

Preparation for welding

The surfaces to be welded must be dry, clean, and sanded to eliminate remnants of rust, flaking, grease, or paint, as well as rough edges from gas cutting.

Welding process

Any conventional fusion welding method can be used, such as submerged arc welding (SAW), shielded metal arc welding (SMAW), flux-cored arc welding (FCAW), MIG, MAG (GMAW), and TIG (GTAW).

Heat input should be limited to 3.94 – 11.81 kJ/in with maximum interpass temperature between the preheating temperature and 390° – 430°F max.

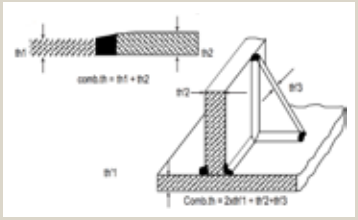
Welding consumable[s]

All products compliant with the following standards are acceptable:

Stick Electrodes	MIG-MAG	Gas Protected Flux Cored Wire	Submerged Arc Welding Wire Flux
AFNOR NF A81-340 EY50 1NiMo Bxxx1xTBH			NF A 81-322 FP/x xx/xx xB xSA31 47 05 04
ASW A5-5-81 E 70xx	A5-28 ER 70 S-x	A5-29 E 7xT5-x	A5-23 F7P4-Exxx-A2
DIN DIN 1913 E51 55 BX			

Conditions prior to heating – Combined thicknesses

AstraWear 400F can be welded without risk of fissures and without preheating up to a combined plate thickness of 0.4 in.



For greater thicknesses, the following conditions are recommended:

		1.18"	1.57"	1.96"	2.36"	2.75"	3.14"	3.54"	3.93"	4.33"
GMAW	5.9 kJ/in									
	11.8 kJ/in									
SMAW	3.9 kJ/in									
	7.9 kJ/in									
SAW	7.9 kJ/in									
	11.8 kJ/in									

Without preheating T°Plate > 40°F

With light preheating 165°F

With pre-post heating 210°F





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THICKNESS

AstraWear 400F is available in thicknesses ranging from 3/16" – 5".
Additional thicknesses are available upon request.

APPLICATIONS

* Quarries, construction, earth moving
  Separators, crushers, screens, bulldozers
* Cement plants
  Pails, crushers
* Mines, coal mines
  Backhoe, winding and unloading machines, conveyor belts
* Iron and steel industry
  Various decks, guide plates, and elevators

www.astralloy.com
Toll Free: 1.866.587.6970
Sales: 724.230.5100 | sales@astralloy.com