

MANGABRAZE

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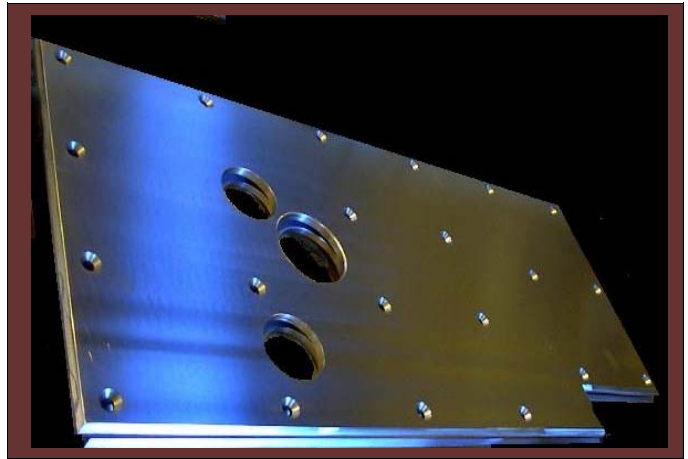
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Special points of interest:

- Mangabrazе significantly reduces costs and downtime with a high alloy chemistry that balances high hardness and toughness.
- High levels of Nickel and Manganese make Mangabrazе the steel that lasts.
- Lack of toughness is most often the cause of wear-related failure – Mangabrazе is the solution to this problem.
- Mangabrazе comes in a wide range of stocked sizes, up to four inches thick. Custom sizes can be made to your specifications.

MANGABRAZE OUTLASTS AR PLATE

Mangabrazе is a proprietary grade of wear-resistant alloy plate, field-proven for over 50 years in providing the longest life in heavy industrial wear applications. Unlike common abrasion-resistant plate, which focuses on **hardness** alone, the unique, rich chemistry of Mangabrazе also develops work-hardening **toughness** to resist fracture, the most common cause of wear failure.



BENEFITS OF MANGABRAZE (360-425 BHN) AND E-Z BRAZE (285-340 BHN)

Mangabrazе and E-Z Brazе are engineered alloys, not generic AR plates with fancy names. The high levels of Nickel (1 1/2%) and Manganese (2%) allow special mill processing which increases depth of hardness.

Mangabrazе is made in controlled electric furnaces to minimize impurities, which detract from a material's toughness. The molten metal is vacuum-degassed to draw off impurities (e.g. sulfides). Any microscopic impurities that remain are then refined to neutralize their effects upon the steel. This process is known as "inclusion shape control," and is the same type of process used in refining impurities in the most critical applications (e.g. airplane landing gear). This process also increases the ability of the plate to resist weld cracks.

High levels of Manganese are added to allow the formation of extremely hard alloy carbides, which resist wear similar to the way carbide tool bits resist wear.

High levels of Nickel are added to promote deeper, more uniform hardening. Because of the low levels of Nickel, commercial AR plate products are only able to develop irregular surface levels of hardness. Note that in recent mill evaluations heavy sections of Mangabrazе actually displayed increased hardness toward the mid-area of thickness.

Manganese and Nickel together, present in the levels established for Mangabrazе, allow the employment of a very high-temperature tempering process, which follows heat treatment. This process removes mill rolling stresses and has the unique ability to add toughness to the steel. In steels that do not have the rich chemistry of Mangabrazе, a lower temperature tempering process must be used to remove the thermal stress caused by heat treatment, resulting in decreased toughness in the steel.

In severe service this combination of Manganese and Nickel also promotes additional "cold-working" hardness of up to 17% of the as-delivered hardness. This additional hardening allows the plate to "self-polish," providing the added benefit of minimizing drag when moving bulk materials.

There are many AR plate products that are economically produced to what is commonly referred to as the "Chrome-Manganese-Boron" formula. This formula does not produce a steel in the class of Mangabrazе. Close inspection of their composition reveals that they are all very similar. The hardening ability of moderate amounts of Boron to achieve an erratic, not uniform, low-depth hardness that lacks toughness and is unpredictable in service.

STOCKING SIZES

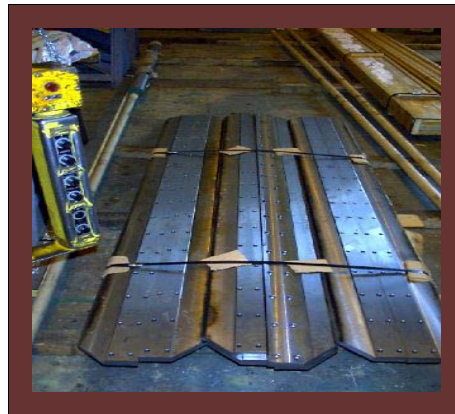
Thick.	4x4 ft	4x8 ft	4x12 ft	4x24 ft	6x8 ft	6x12 ft	6x24 ft	8x12 ft	8x24 ft
3/16									
1/4									
3/8									
1/2									
5/8									
3/4									
7/8									
1									
1-1/8									
1-1/4									
1-1/2									
1-3/4									
2									
2-1/2									
4									

Sizes available
 Sizes not available

Also available in 1/8" X 5 ft X 10/12 ft.

COMMON APPLICATIONS FOR MANGABRAZE

"Mangabraze is a custom-made product, not a re-branded trade-named commercial grade plate."



Liners can be provided fabricated and completely machined, as needed.

- ◆ Back Up Plates
- ◆ Bucket Lips & Liners
- ◆ Bulldozer Blades
- ◆ Chute Liners for coal, wood chips, ore, gravel, cement, etc.
- ◆ Concrete Mixer Liners
- ◆ Scrap Baler Liners
- ◆ Scraper Blades
- ◆ Scrap Box Liners
- ◆ Skip Car Liners
- ◆ Steel Mill (machined, chock, roll and housing)
- ◆ Truck Box Liners
- ◆ Wear Bars,

CHEMISTRY

C	MN	P	S	Si	Ni	Mo	V	B	AL
.24	2.0	.015	.015 max*	.30	1.50	.20	.010	.003 max	.020

*typical sulfur content is .006

TYPICAL MECHANICAL PROPERTIES

Hardness	360-425 BHN
Tensile	210,000 psi
Yield	190,000 psi
% of elongation	18%
Reduction in area	45%

*also available in 280-325 BHN E-Z Braze for ease of fabrication.

Typical Charpy V-Notch Impact (ft/lbs)	Longitudinal	Transverse
At 72°F	30-47	16-32
At -50°F	16-20	10-13

WHAT MAKES MANGABRAZE LAST LONGER?

The Need for Hardness AND Toughness

Toughness is not often discussed by distributors of standard grades of AR plate, such as AR400 or AR500 and their various trade names. Hardness is their primary focus for wear resistance. Hardness is defined as the resistance to penetration, and is necessary where hard or sharp materials are in motion against a solid surface.

However, the “harder the better” idea is not always true. Wear research has demonstrated that the main way solid surfaces wear out cannot be prevented merely by hardness. Most wear is caused by fracture, defined as the abrupt removal of material by breaking, chipping, or cutting. Examples of fracture wear include knife edges, blades and concrete surfaces. These items are worn **not** by a gradual removal of the surface or by penetration by hard, sharp objects, but by a chipping and breaking away of the surface particles by fracture. The property that resists fracture is toughness, largely sacrificed in the making of AR plate, but engineered from the start in Mangabraz.

With hard facing and overlays, other engineers have tried to achieve what has always been there in Mangabraz. But why deal with the numerous problems encountered with overlay?

This custom made plate, exclusive to Baldwin, is specially milled for toughness as well as hardness. The 2% level of Manganese (compared to 1% in generic AR plate) allows for the formation of carbides, highly compact binary compounds of carbon and heavy metals, that promote high degrees of wear resistance such as those used in metal-cutting carbide tool bits.

The 1 1/2% level of Nickel (compared to trace - 0.1% in generic AR plate) promotes

deeper, more uniform hardening by essentially acting as structural supports within the steel.

What results is a steel that will not crack and will not wear out. *Mangabraz* is a long-lasting plate that can greatly reduce cost over the long term, can save valuable time, and can prevent the headaches that result from applied plate failure.

Useful Terms

- *Wear* is defined as damage to a solid surface resulting from motion between that surface and any contacting substance.

Types of Wear*:

1. *Abrasion* is a type of wear caused by hard particles or protrusions being forced against a surface.
2. *Surface fatigue* or *fracture* occurs when there is extensive and repeated friction between the solid surface and a substance repeatedly sliding or rolling upon it.

Principles of Wear Resistance:

1. *Hardness* is the resistance to penetration or abrasion.
2. *Toughness* is the resistance to internal fracture created by extensive use.

Only Mangabraz has both.

*other types of wear include erosion and adhesive wear

“Mangabraz will be a long-lasting plate that can greatly reduce cost over the long term, can save valuable time, and may prevent the headaches that result from applied plate failure.”

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Specialty Steels for Industry

"Consider using Mangabraze as a wear-resistant, fracture-resistant tool steel. It outperforms O-1, A-2 and D-2 in many liner applications at a much lower cost."



If you are looking for a specialty steel supplier that has the quality and the experience to fulfill your unique material needs, then look no further. Merging in 1986 from two of the leading alloy steel companies in the U.S., Baldwin International has become the recognized leader in finding answers for your maintenance problems. No other company can provide the



unique materials, generations of experience and the on-site assistance that we provide daily to our customers.

For almost 50 years, Baldwin International has been developing unique materials that provide longer life and less down time in maintenance applications of shafting, wear liners, and steel fabrications. Unlike steel suppliers that provide a whole gamut of "generic" steels, we have "enhanced" materials, engineered for specific needs, and the wisdom to guide you in your selection.

Please check out some of our products and the related information, and contact us for any further questions that you may have. We would be happy to have one of our experienced representatives at your service.

MACHINING INFORMATION

Machining	High Speed Tooling – reduce feed and speed to minimize work hardening
Welding	Low Hydrogen – E7018, 8018 – request detailed welding data
Flame Cutting	Standard Torch – oxyacetylene – minimize heat

Technical Data

Mangabraze Heat Treatment

Hardening	1575°F - 1600°F
Quench Media	water, oil
Tempering	850°F
Annealing	1425°F - 1575°F
Stress Relieving	800°F - 900°F
Normalizing	1500°F - 1600°F

Baldwin can fabricate to your specifications as well. Call for further details or fax/mail us your drawings.