
AR400 & AR500 Abrasion Resistant Wear Plate – Technical Material Specification

1.0 Material Overview & Common Uses

AR400 and AR500 are quenched and tempered, through-hardened abrasion resistant (AR) steel plates. AR400 offers a nominal hardness of 360–440 HBW, while AR500 provides 450–540 HBW. These grades are not structural steels; they are engineered specifically for high-wear environments where impact and sliding abrasion are primary failure modes.

Common industrial applications include: dump truck liners, chute liners, bucket liners, crusher components, conveyor skirting, wear plates for mining and aggregate equipment, heavy equipment buckets, and material handling systems. AR500 is preferred for high-impact applications such as ballistic armor and shredder hammers.

2.0 Core Technical Properties & Sizing

- Hardness (AR400): 360–440 HBW (Brinell) per ASTM E10.
- Hardness (AR500): 450–540 HBW (Brinell) per ASTM E10.
- Density: 7.85 g/cm³ (0.284 lb/in³).
- Yield Strength (AR400): 100 ksi (690 MPa) minimum.
- Yield Strength (AR500): 120 ksi (827 MPa) minimum.
- Tensile Strength (AR400): 140 ksi (965 MPa) minimum.
- Tensile Strength (AR500): 180 ksi (1241 MPa) minimum.
- Elongation in 2 inches (AR400): 12% minimum.
- Elongation in 2 inches (AR500): 8% minimum.
- Standard plate thickness: 1/8 inch (3.2 mm) to 2 inches (50.8 mm).
- Standard plate width: 48, 60, 72, 96 inches (1219, 1524, 1829, 2438 mm).
- Standard plate length: 96, 120, 144, 240 inches (2438, 3048, 3658, 6096 mm).
- Thickness tolerance (hot rolled): ±0.010 inch for thicknesses up to 0.375 inch; ±0.015 inch for 0.376–0.750 inch; ±0.020 inch for 0.751–1.000 inch; ±0.030 inch for 1.001–2.000 inches.
- Flatness tolerance: 1/4 inch in any 36 inch length (6.4 mm per 914 mm) as delivered, unless specified as 'flattened' or 'precision leveled'.
- Chemical composition (typical, weight %): Carbon 0.15–0.30, Manganese 0.60–1.50, Silicon 0.15–0.60, Chromium 0.30–1.50, Molybdenum 0.10–0.60, Boron 0.0005–0.005, Sulfur 0.030 max, Phosphorus 0.025 max.

3.0 Processing, Machinability & Application

AR400 and AR500 are difficult to machine due to high hardness and abrasiveness. Carbide or ceramic tooling is mandatory. High-speed steel (HSS) tools will wear rapidly and are not recommended for production work. Flood coolant is essential to manage heat and extend tool life.

- **Cutting:** Plasma cutting is the primary method. Use a high-definition plasma system with oxygen or nitrogen for clean edges. Laser cutting is possible up to 1/2 inch thickness with high-power fiber lasers. Waterjet cutting is ideal for precision profiles without heat-affected zone (HAZ).
- **Machining feed rates (carbide):** For turning, use 0.004–0.012 inch/rev at 150–250 SFM. For milling, use 0.002–0.006 inch/tooth at 200–350 SFM. Reduce speeds by 20–30% for AR500 vs AR400.
- **Drilling:** Use carbide-tipped or solid carbide drills with a 135-degree split point. Peck drilling recommended for depths over 3x diameter. Feed: 0.002–0.006 inch/rev at 80–150 SFM.
- **Welding:** Preheat is required for thicknesses over 1/2 inch (12.7 mm). Preheat temperature: 200–400°F (93–204°C) for AR400; 300–500°F (149–260°C) for AR500. Use low-hydrogen electrodes (E7018 or E11018) or filler metals (ER70S-6 for MIG). Post-weld heat treatment (PWHT) is generally not recommended as it may reduce base metal hardness.
- **Forming:** Cold forming is possible but limited. Minimum bend radius for AR400: 4x thickness for 90-degree bends; AR500: 6x thickness. Hot forming (1600–1800°F, 871–982°C) is preferred for tight radii. Avoid forming below 200°F (93°C) to prevent cracking.
- **Thermal cutting edge quality:** Acceptable dross must be removable with a light hammer or grinder. Reject if dross is adherent and requires heavy grinding or if edge hardness exceeds 600 HBW in the HAZ.

4.0 Common Defects & Quality Control

- Reject if surface hardness deviates more than ± 20 HBW from the specified range (AR400: 360–440 HBW; AR500: 450–540 HBW) when tested per ASTM E10.
- Reject if any longitudinal or transverse cracks are visible under 5x magnification on the plate surface or edges.
- Reject if surface pitting exceeds 0.005 inch (0.13 mm) depth or if pits are clustered (more than 3 pits within a 1 inch diameter circle).
- Reject if delamination is detected via ultrasonic testing (UT) per ASTM A578 Level B.
- Reject if flatness exceeds 1/4 inch in 36 inches (6.4 mm per 914 mm) unless a tighter tolerance is specified in the purchase order.
- Reject if thickness is out of tolerance by more than 0.010 inch for plates under 0.375 inch, or 0.030 inch for plates over 1.000 inch.
- Reject if chemical composition deviates from the specified ranges for carbon, manganese, chromium, molybdenum, or boron by more than 0.02% absolute.
- Reject if the plate exhibits 'orange peel' surface texture or excessive scale that cannot be removed by standard shot blasting.

5.0 Storage, Handling & WHMIS Guidelines

- Store indoors in a dry, climate-controlled environment below 60% relative humidity. Avoid direct contact with concrete floors; use wooden dunnage or plastic pallets to prevent moisture wicking.
- Shelf life: Indefinite when stored properly. However, surface rust may form after 6 months in humid conditions. Apply a light rust-preventive oil (e.g., LPS-3 or equivalent) if storing longer than 3 months.
- FIFO (First In, First Out) protocol: Rotate stock by date of receipt. Use older plates first to minimize surface oxidation and handling damage.
- WHMIS Classification: This product is not classified as a hazardous material under WHMIS 2015 in its solid form. However, grinding, welding, or thermal cutting generates hazardous fumes and particulates.
- Mandatory PPE during processing: Safety glasses with side shields, welding helmet with appropriate shade (minimum #10 for arc welding), heavy-duty leather welding gloves, flame-resistant clothing (FRC), and hearing protection when cutting or grinding.
- Respiratory protection: When welding or grinding, use a NIOSH-approved N95 respirator or half-face respirator with P100 filters. For confined spaces or heavy fume generation, use a supplied-air respirator.

- Ventilation: Ensure local exhaust ventilation (LEV) is in place for all welding and cutting operations. Maintain air velocity of at least 100 ft/min at the source of fume generation.
- Handling: Use mechanical lifting equipment (overhead crane, forklift) for plates over 50 lbs. Use spreader bars or lifting clamps rated for the plate weight. Never lift plates by hand alone if they exceed 50 lbs.
- First aid: For cuts from sharp edges, clean wound thoroughly and apply sterile bandage. Seek medical attention if cut is deep or if metal particles are embedded. For inhalation of fumes, move to fresh air and seek medical attention if symptoms persist.

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