ArcelorMittal USA

Plate

AR-235: As-Rolled Abrasion Resistant Plate

AR-235 is an as-rolled plate with high carbon content, developed primarily to supply a low-cost material for high-abrasion applications.

Analysis and Availability:

Carbon	.40 - .50
Manganese	.60 - .90
Phosphorus	.040 Max.
Sulfur	.050 Max.
Silicon	.10 - .40

Flatness Tolerances:

1/2 commercial

Fabrication Characteristics:

AR-235 may be fabricated within reasonable limits with respect to machining, forming and welding. This steel provides abrasion resistance through careful control of chemical composition, without heat treatment. However, steels of this hardness cannot be fabricated as readily as conventional structural grades.

ArcelorMittal USA's abrasion-resisting steel AR-235 is sold on the basis of chemical analysis only. The number 235 signifies the approximate Brinell hardness.

Cutting:

Shearing

Ability to shear this material depends on a variety of factors, including thickness, width, length and temperature of the piece when sheared. Plates from the mill will be supplied with thermally cut edge.

Thermal Cutting

AR-235 can be cut with a gas torch, but a preheat of 300°F is required. The extreme heat of the torch has a tendency to harden the steel at point of contact. A flame-cut edge is more difficult to machine than other areas of the steel.

Machining:

When machining gas-cut edges to size, it is suggested that the cutting tool be set inside the torch-cut edge to remove this hardened area. When cut with a gas torch, the edge of a plate is hardened to a depth of 1/32 – 1/16 in. Such hardened areas may be removed by grinding.

Punching:

Holes may be punched in thicknesses up to approximately 3/8 in. However, the capacity rating of the punch will be about 60%. Generally, for best results, it is suggested that all holes be drilled rather than punched.

Bending and Forming:

AR-235 steel should be hot-formed at 1500°F to 1800°F and slow-cooled to minimize distortion. However, a limited amount of cold forming and bending can be done on plates up to 3/8 in. thick if proper precautions are taken as follows:

1. It is essential to condition the burned edges of plates before forming to remove notches and irregularities. Conditioning is most conveniently done by grinding. Also, it may be helpful to soften the edges by tempering with a torch.
   For severe bending, it may be necessary to completely remove the heat-affected area resulting from burning.
2. A forming radius of four times the plate thickness or greater should be used to 3/8 in. Over 3/8 in. should be 10 times.
3. Major forming should be done with the axis of the bend transverse to the rolling direction, not parallel to it. If bending in the opposite direction, more generous radius shall be used.
4. Proper allowance must be made for greater spring-back of abrasion-resisting grades as compared to conventional structural grade steels.
5. In cold weather, plates should be heated to 200°F to 300°F prior to forming.

Welding:

AR-235 can be successfully welded by conventional electric-arc welding processes, if proper precautions are taken and good shop practices are used.

The following procedures are suggested for welding:

1. For AR-235, preheating is required. A preheat and interpass temperature of 400°F minimum should be used.
2. Joints should be properly prepared, preferably by machining or grinding, and should be carefully fitted.
   Low hydrogen electrodes should be used for all welding procedures.
   The electrodes must be properly stored and dried. E11018M electrodes match the tensile strength of the plate.
   Where matching the tensile strength is not required, lower strength electrodes are recommended. For submerged arc welding, it is essential that the welding flux be properly dried.
3. After welding is complete, the seam should be slow-cooled to minimize cracking due to unequal contraction of material.
4. A post-weld, stress relief heat treatment at 1100°F is suggested.
5. If the weld is to be subjected to severe abrasion, the outer layer of the weld should be deposited with an abrasion-resistant weld overlay.

Information

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