ArcelorMittal USA

Plate

HPS 100W: High Strength Steels for Bridges

The High Performance Steel (HPS) Steering Committee (AISI/FHWA/U.S. Navy) has developed a new steel grade for 100 ksi (690 MPa) minimum yield strength applications in bridges; HPS 100W. ArcelorMittal USA Plate mills can now produce this grade to 4 in. (100 mm) in thickness. This grade has been produced in full-sized plates and has been evaluated in full plate girder testing. HPS 100W has been found to have higher toughness, better weldability and better predicted atmospheric corrosion behavior (weathering) than the current grade ASTM A709 Grade 100W. Initial applications for HPS 100W have taken place in Nebraska, West Virginia, New York and North Carolina.

Tensile Requirements

Yield strength (minimum)	100 ksi (690 MPa)
Tensile strength (minimum)	110 – 130 ksi (760 – 895 MPa)
Elongation in 2" (50 mm) minimum	18%

Charpy V-Notch Impact Toughness Requirements (FCM - Fracture Critical Member)

Non FCM	25 ft-lbs. Min. @ -30°F (34 J @ -34°C) (all Zones)
FCM	35 ft-lbs. Min. @ -30°F (48 J @ -34°C) (all Zones)

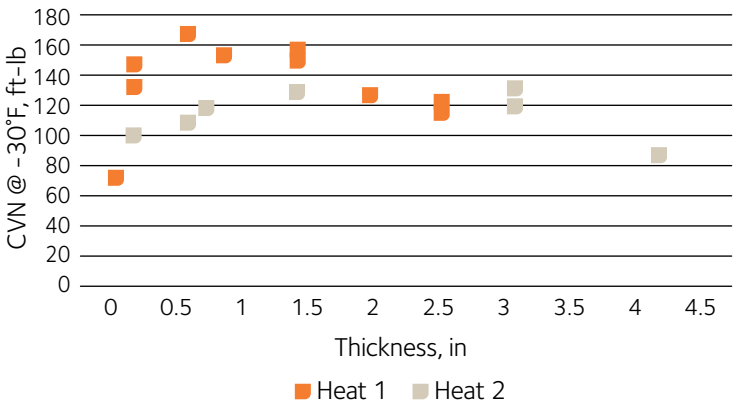
HPS 100W bridge in Nebraska.
Photo: Professor Atorod Azizinamini

Chemical Composition Requirements
(maximums unless a range is shown)

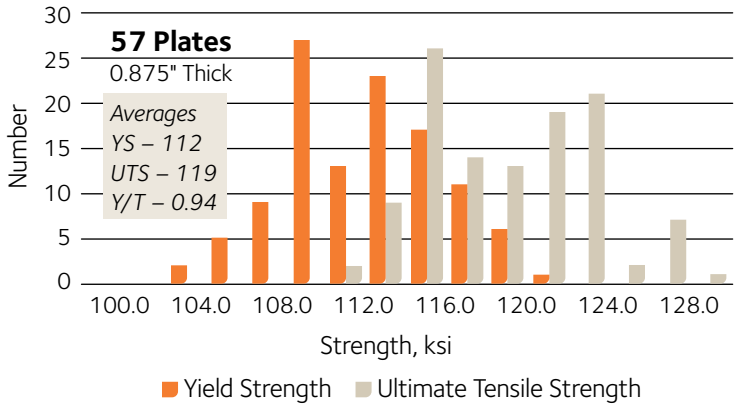
Element	Composition %
Carbon (C)	0.08
Manganese (Mn)	0.95 – 1.50
Phosphorus (P)	0.015
Sulfur (S)*	0.006
Silicon (Si)	0.15 – 0.35
Copper (Cu)	0.90 – 1.20
Nickel (Ni)	0.65 – 1.00
Chromium (Cr)	0.40 – 0.65
Molybdenum (Mo)	0.40 – 0.65
Vanadium (V)	0.04 – 0.08
Aluminum (Al)	0.02 – 0.05
Nitrogen (N)	0.015
Niobium (Nb)	0.01 – 0.03

* *All HPS 100W is calcium treated for sulfide shape control*

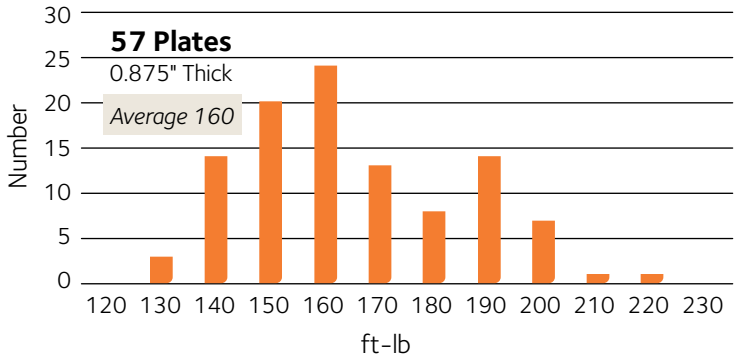
Production Results HPS 100W



Production Results HPS 100W Tensile Property Data



Production Results HPS 100W CVN Data @ -30˚F



Size Availability

3/16 to 4 in. (4.8 – 100 mm) thick; available to as long as 540 in. (13.7 m); as wide as 175 in. (4.4 m) depending on thickness and weight; refer others to ArcelorMittal USA Plate offices. HPS 100W is produced by quenching and tempering.

Welding

The chemistry of HPS 100W has lower carbon content than A709-100W and thus is considered to be much more weldable. The U.S. Navy has used similar low carbon Cu-Ni alloy steels in applications with little or no preheat. In most applications, the welding consumables will dictate preheat requirements. Thus, under- matched welding is encouraged. Specific welding guidelines are being developed by industry. Refer to the following web link for the latest information. http://www.steel.org/Content/NavigationMenu/Construction/Bridges/Bridges.htm

Approval

HPS 100W was added to ASTM A709-04a and later editions and in AASHTO M270-05 and later. This steel would be most useful for depth control over piers in long span girder bridges or controlling the size of high-stressed elements in long span steel truss bridges.

Reference

1. "Development of an Improved HPS 100W Steel for Bridge Applications", A. D. Wilson, et al, ASM International Conference on Microalloyed Steels, 2002, Columbus, OH.
2. "Production Experience with New Heavy Plate Grades for Bridges and Shipbuilding Using Microalloying", A. D. Wilson, AIST Conference on Microalloying, 2007, Pittsburgh.

Information

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HPS 100W bridge in Nebraska
Photo: Professor Atorod Azizinamini

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