Steel SolutionsCenter

Do you 992?

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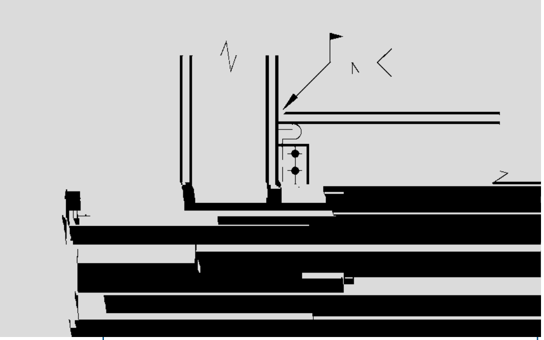
ASTM A992 has become the standard material specification for wide-flange steel shapes. Here's why.

In just five years, ASTM A992 50 ksi steel has become the dominant material specification for wide-flange shapes, solidly displacing ASTM A36 wide flanges. In fact, ASTM A992 is so commonly rolled that it now costs less than ASTM A36 wide-flange shapes—and you would be hard-pressed to find an ASTM A36 wide flange with a yield as low as 36 ksi.

Starting in the 1970s, the steel industry in the United States began to use increasing amounts of recycled materials in the production of structural shapes. Today's structural steels consist of more than 95 percent recycled material. The reliance on recycled materials resulted in a trend towards increased yield strengths. By the 1990s, ASTM A36 material had significantly higher yield strengths—and less ductility, because tensile strength remained essentially constant—than ASTM A36 steel produced in the early 1970s.

To take advantage of this inherent "bonus" strength, the steel industry began to transition towards 50 ksi steel in 1997, with the release of AISC Technical Bulletin No. 3. Technical Bulletin No. 3 provided special requirements for ASTM A572 grade 50 steel that created a 50 ksi material suitable for both seismic and non-seismic building applications. The bulletin placed an upper limit on yield strength (ensuring ductility) and tightened a few mechanical properties (requirements absent from the A572 specification). In effect, the bulletin created an early version of ASTM A992, which was released in 2000.

Today's version, ASTM A992-01, includes a yield strength range of 50 ksi to 65 ksi, a minimum tensile strength of 65 ksi and a maximum yield-to-tensile strength ratio of 0.85. In addition, it requires a maximum carbon equivalent of 0.45 (0.47 for Group 4 and 5 shapes).



For joints in special moment frames, inelastic deformations in beams and column panel zones are more reliably attained with ASTM A992 wide-flange shapes.

DESIGN BENEFITS

prequalified base metal per AWS D1.1:02 Table 3.1.

"Designers should specify it is because it has more restrictive criteria as it relates to chemical composition and tensile requirements," said Mike Engestrom, technical marketing director for Nucor-Yamato Steel. "Also, ASTM A992 now has an equivalent bridge steel, grade ASTM A709 Grade 50S."

The inclusion of a maximum yield strength and a maximum yield-to-tensile strength ratio assures material ductility, particularly important in high-seismic applications (when R is greater than 3). Inelastic deformations in beams and column panel zones, such as the special moment frame joint in the figure, left, are more reliably attained with ASTM A992 wide-flange shapes. Also, all high-seismic moment connections in FEMA 350 have been prequalified for use with ASTM A992 beams and columns.

EXPANDED SCOPE

"Although the original ASTM A992-00 was for W-shapes only, the current A992-01 covers rolled steel, structural shapes for use in building framing, bridges, or for general structural purposes," Engestrom said. ASTM A992-01 was expanded in scope to cover rolled structural steel shapes such as M, S, HP, channels and angles. However, a recent AISC survey verified that rolling mills do not plan to expand production of ASTM A992 beyond wide-flange shapes. Therefore, ASTM A36 is still the preferred material specification for M, S, HP, C, MC and L shapes, as is noted in the 3rd edition LRFD Manual, Tables 2-1 through 2-4. More specific information on the availability of structural steel shapes, as well as rolling mill contact information, is available on the web at www.aisc.org/shapeavailability.

What about "groups"?

Wide-flange shapes have historically been classified into "groups" based on web thicknesses, because tension specimens were taken from the webs. However, the committees governing both ASTM A6 (for shapes) and ASTM A992 (for material) are discussing eliminating the "group" classifications for wide-flange shapes. Why?

In ASTM A6-02, the location from which structural shape tension tests were taken was moved from the web to the flange for most of the wide-flange sections in use. This was done because engineers design for flexure using the extreme fiber stress, and the thicker flanges usually have a lower yield stress than the thinner webs. Taking the tensile specimens from the flange is more conservative and obtains a more direct measure of the property (yield point/strength) that engineers need for design. In the meantime, the "groups" table remains in ASTM A6-02 as a vestige of the old web-sampling provisions.

A992 TODAY

ASTM A992 is referenced as an acceptable material in 1999 AISC LRFD Specification in section A3. Also, AISC has issued Supplement No. 1 for the 1989 ASD Specification to ASTM A992 material. Both the 1999 LRFD Specification and ASD Supplement No. 1 can be downloaded free at www.aisc.org. ASTM A992 steel is here to stay—it's the material standard for strength, weldability and availability for wide-flange shapes.★

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