What **Engineers** Should Know About **Bending Steel**

With these tips under your belt, you'll be ahead of the curve on your next bending or rolling project.

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HOW MUCH DO YOU KNOW ABOUT BENDING STRUCTURAL STEEL? Do you know what you need to show on construction drawings to transfer the idea of what the result should actually look like? Do you know how tight of a radius you can roll a W12×19, and what to expect it to look like? If you have bending questions, who do you ask? AISC's bender-roller committee is taking steps to address these questions, which are coming up more and more within the structural steel industry.

Bender = Fabricator?

Not so! The bender is typically a specialty subcontractor of the fabricator. Benders receive the steel from the fabricator (or sometimes furnish it themselves), and then ship the curved steel back to the fabricator. Benders usually have limited fabrication capabilities, such as hole drilling and plate welding, but they are generally used for smaller jobs that usually are not structural in nature. Typical fabrication is still carried out through the main project fabricator who organizes the steel package from procurement through delivery to the site for erection.

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There's only one type of bending, right?

Nope! There are five typical methods of bending in the industry: rolling, incremental bending, hot bending, rotary-draw bending, and induction bending. Each method has its advantages. Some methods are more commonly used in the steel construction industry, while others are more common in the automobile or manufacturing industries:

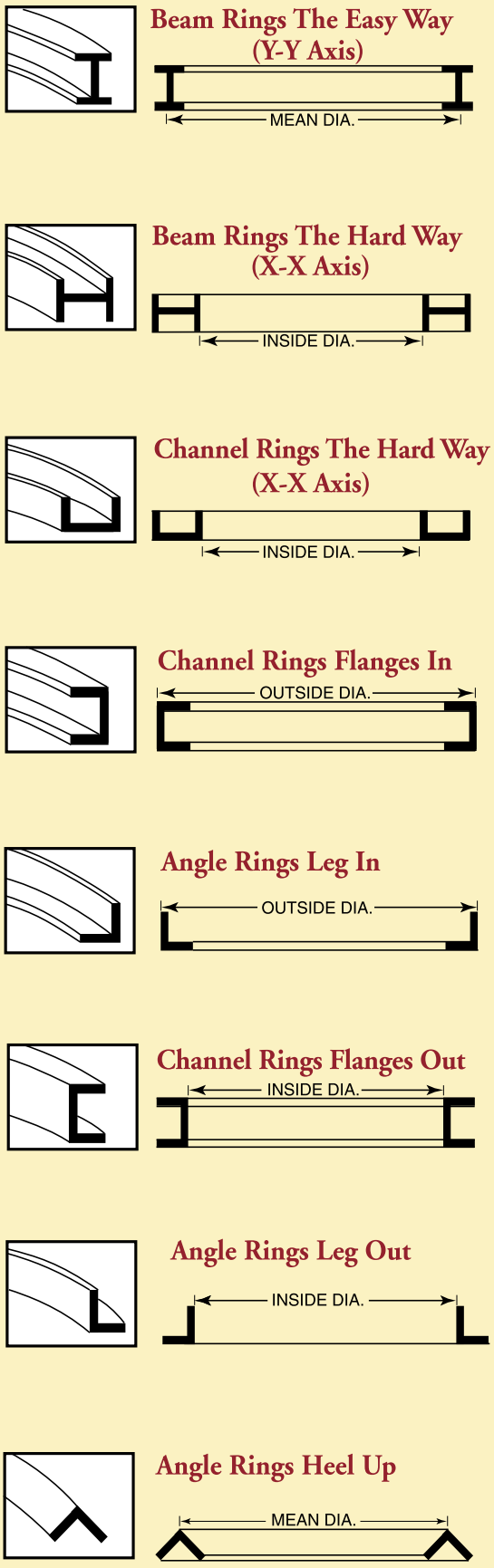
- **Rolling (cold bending)** is the typical method of curving steel for construction and is usually the most economical for rolling members with tighter radii. A steel member is placed in a machine and curved between three rolls. Cold bending may also be called "pyramid rolling" because of the three rolls' pyramid arrangement. Bending occurs when the distance between these rolls is manipulated before each successive pass.
- **Incremental bending** or gag pressing is usually used for cambering and curving to very large radii. Bending is achieved by applying point loads with a hydraulic ram or press at the member's third point.
- **Hot bending** is where a structural member is heated directly and then bent. The heat source could be a direct flame or furnace. This application is used extensively in repair.
- **Rotary-draw bending** is where the structural member is bent by rotating it around a die. The member is clamped into a form and then is drawn through the machine until the bend is formed. This method produces tight radii and is mainly used for complicated bends in the machine and parts industry.
- **Induction bending** uses an electric coil to heat a short section of a structural member, and then that member is drawn through a process similar to rotary-draw and cooled with water directly after. In some cases, this process can produce a smaller, tighter radius.

What about construction drawings?

Have you worked on a building project that included bent steel and then had to answer RFIs because you were not exactly sure what the detailer or bender needed to produce that curved member? Here are several very important but very simple items that should be included on construction drawings when dealing with curved steel.

- **What are you trying to bend—what is the member shape and size?** This is simple and straightforward, but the benders often see requests for an estimate without a member size, and there is a big difference between bending a W8×10 and a W40×215. Plus, don't forget to list the grade of steel for the member, and if it must be domestically produced.
- **How about the orientation of the member?** The table at right shows several different member shapes with common terminologies.
  - "Easy way" is bending a member around its weak axis, and "hard way"

Common Terminology and Essential Dimensions for Curving Common Hot-Rolled Shapes



is bending around the strong axis;
- "Flanges in" or "flanges out" refers to the direction of the flanges on channels, angles, and tees;
- When an angle is curved on its diagonal, is the heel (the intersection of each leg) oriented in, out, or up?

➜ Note whether the section is going to be used in an AESS (architecturally exposed structural steel) application—tolerances will be tighter and more attention will be paid to possible imperfections or distortions. Of course, this could increase the cost of bending, so be sure it's specified sparingly—such as when the steel is within 20'-0" of the viewer's eye level.

➜ Be sure to label the correct radius. If you have a W8×10 bent the hard way and you need the inside radius to be 10', then label that on the drawings.

➜ A final item to note is the trimming requirement. If you have a 25' length of beam, only 22' to 23' of that beam may be bent due to the placement requirements within the bending machine. Note the total length of beam needed on the drawings for the estimator, material purchaser, and detailer. The last thing you want to hear from the field is that the beam is short.

Ask the Experts

What if you have a spiral channel stringer for a staircase that needs to be bent in both directions? How do you go about detailing that properly? What about that thin-walled HSS tube? Can it be bent to a 16' radius without buckling the walls?

Contact an AISC member bender-roller with specific questions like these. AISC member bender-rollers can lend their expertise and work through a solution with you. Realize that your client is coming to you because you are an expert in engineering or architecture—so go to an expert in bending.

For a list of AISC member bender-rollers, please visit **www.aisc.org/benders** or see pages 63-66 in this month's issue. And, as always, AISC's Steel Solutions Center is available to answer any and all questions concerning structural steel within one business day. Contact the Steel Solutions Center at 866.ASK.AISC or at solutions@aisc.org.