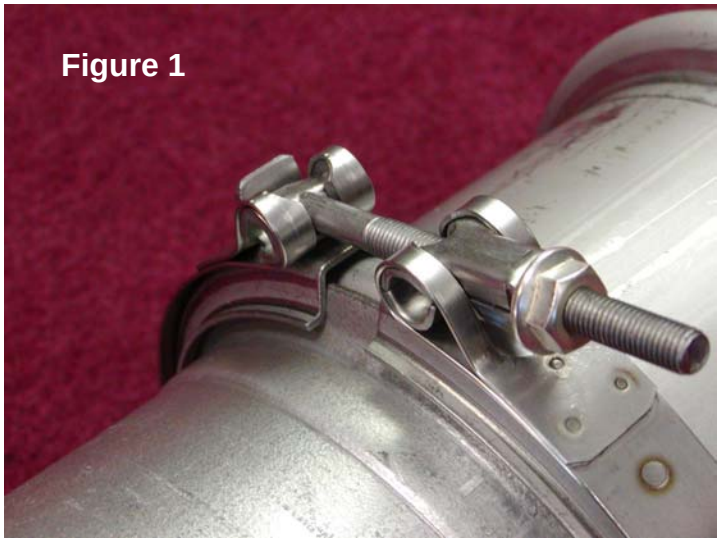
The History behind the Marman Clamp/Bead: A **Marman clamp** (see Figure 1) is a type of heavy-duty band clamp that allows two flat cylindrical interfaces to be simply clamped together using a ring clamp; also known as a "Marman ring". Marman clamps are commonly used as a quick-disconnect style of clamp, such as in wide-diameter fuel lines. Another example is their use in space vehicles, for example on the Cassini Plasma Spectrometer on the Cassini orbiter. The Marman clamp was first produced by Herbert Marx, better known by his stage name of Zeppo Marx as one of the Marx Brothers, after the inventor first approached him with the device. It was manufactured by his company Marman Products. At the time it was designed to secure cargo during transport. The U.S. Military used it to transport the atomic bombs used at the end of the Second World War. Marman clamps are found in many modern moving vehicles, though the screw band type clamp is becoming more popular. Reference: From Wikipedia, the free encyclopedia



There are several methods available for forming the variations on the 20 degree large bead form that seem to be appearing everywhere on metal tube these days. We will discuss two here for the sake of quality of the finished part. We could include segmented tooling, however the tooling marks on the bead do not provide for a smooth sealing surface. Applications of this form range from diesel truck exhaust and DPF canister components, aircraft bleed air ducting, turbocharger inlet and outlet, and any other air management tubing requiring a leak tight seal. The advantages of this style connection are that components may be disconnected from the system, replaced, and reconnected without destruction of the fittings. The clamp also allows for small adjustments in orientation of the components where alignment is critical. Some OEM manufacturers and aftermarket parts suppliers have adopted this form to their parts, and the application will dictate which method is used to manufacture them. Checking print specs for words like “uniform wall thickness throughout” and critical tolerances will determine which forming method, equipment and tooling are necessary. Let’s compare the differences between rotary/spinning and progressive ram forming.

Rotary/Spin Forming:
(see Figure 2) This method of forming large beads is fast, easy, and economical. Rotary forming produces a very smooth finish on the mating surfaces. The tooling set consists of a set of clamp jaws to maintain the nominal diameter of the tube, and a rotary forming “head” which contains a profiled roller to match the ID profile of the bead. The tooling segments expand while turning inside the tube forcing the rollers and material into the OD bead groove profiled into the clamp jaws. While machine cycle times are typically 8-10 seconds or less, the disadvantage to this system is that the material is stretched, or thinned by 30-50% at the peak of the bead (see Figure 3), and some applications may not allow thinning of the material. This process also has problems forming tight corner radii as compared to the progressive ram form. If a reduced diameter lead-in lip or pilot is required, a separate operation is needed to reduce the tube. One inch of straight length before bend is needed for forming to prevent a weld on formal part.

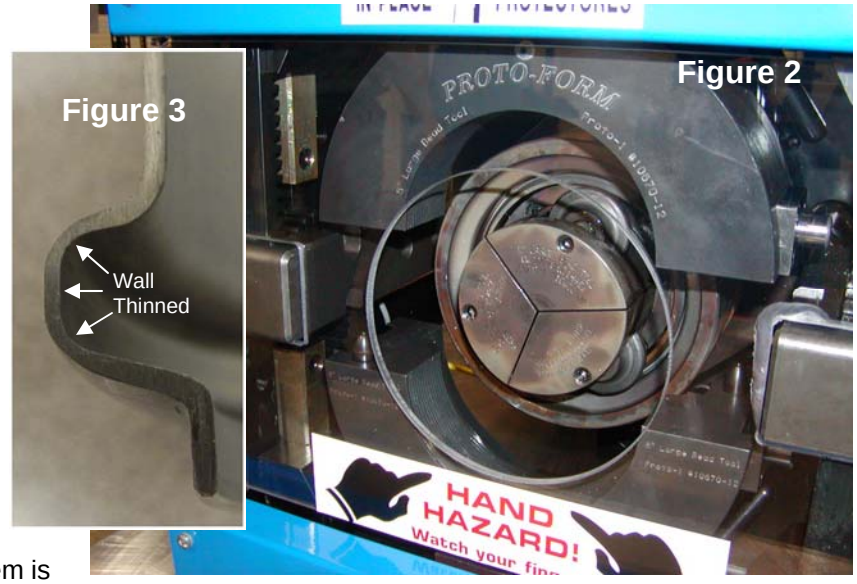


Figure 2

Figure 3

Progressive Ram Forming:
(see Figure 4) The progressive ram forming process has some distinct advantages over rotary/spinning process. The main advantage is the wall thickness throughout the bead remains the nominal wall thickness (see Figure 5). Other advantages include the ability to form tighter corner radii and reduce the lead-in lip all in one process. The ram process also has some disadvantages, mainly being the cycle time is double that of a rotary forming process. Another obstacle is the lack of support for the inside bead profile. The lack of support may allow variation of the bead profile, unless using a secondary rotary finishing tool to complete the process.

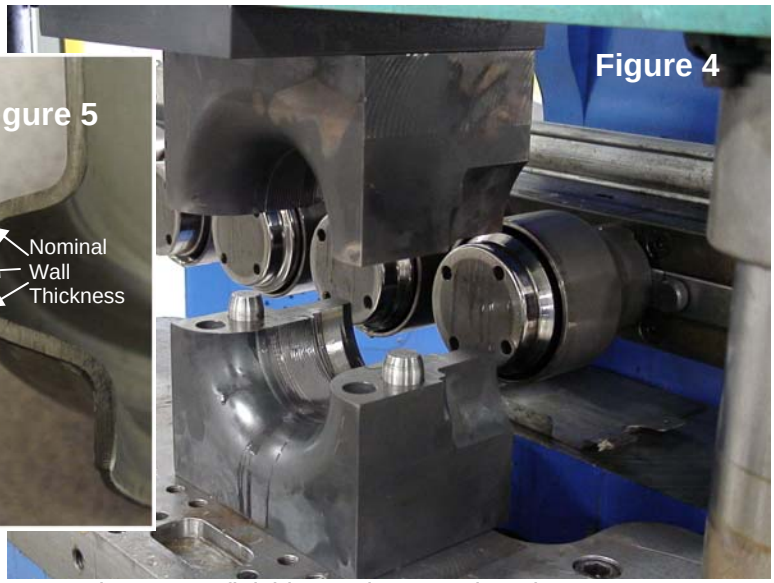


Figure 4

Figure 5

The method you choose will be dictated by material, wall thickness specifications and tolerances. The best results are obtained using a combination of both processes: The bead shape and any reduction or expansion of the lead in is performed by ram forming. The bead profile is then 'ironed out' against the die to correct the bead profile and sealing surface. Before you start making parts, check your prints and material specs carefully, and if no spec is present, check with your customer to explain the difference – your customer and you will both benefit.

John Schwochert is the founder and president of Proto-1 Manufacturing, LLC, 10 Tower Road, Winneconne, WI 54986, 920-582-4491, js@proto1mfg.com, www.proto1mfg.com.