Y-site design

Y-sites are typical of many IV line components that are manufactured using Eastar™ and Eastman Tritan™ copolyesters. They are chosen for these applications because of their good combination of toughness, chemical resistance, and gamma or EtO sterilizability.

The Y-site design shown in Figure 1 is typical of those found in the industry. Although parts can be manufactured and used successfully by applying the rules of uniform wall thickness and placing radii in sharp corner locations, the design could be made more durable.

Specifics of the design of this part may create difficulties with cooling during processing. Note that the two core pins meet directly under the thickest section where the two "tubes" come together. Ends of core pins are always the hottest areas; this, combined with the thick section, creates those specific cooling problems. This area may be subject to voids, sink marks, and higher levels of residual stress.

Figure 1 Typical Y-site design 1

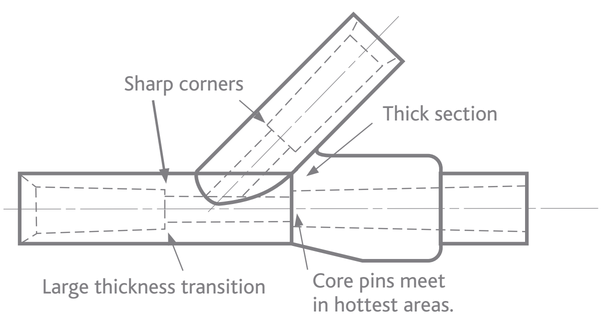
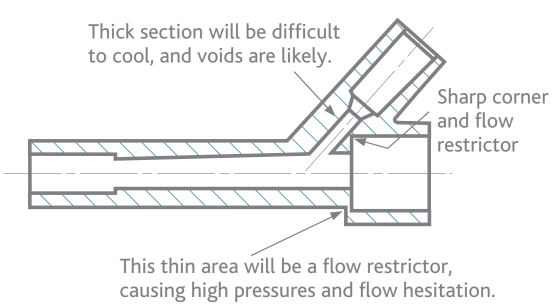


Figure 2 shows a Y-site design that suffers not only from thick sections and sharp corners but also from thin areas. These thin areas will serve as flow restrictors and will make it difficult to fill and pack out the part properly.

Figure 2 Typical Y-site design 2

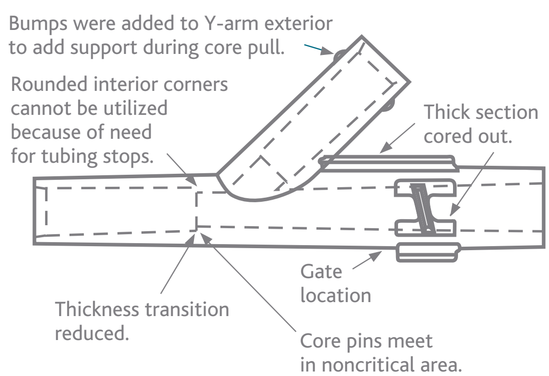


The design in Figure 3 is a good example of the optimized part design resulting from collaboration between Eastman and our customers when designing a series of Y-sites that are manufactured using Eastar™ copolyester. This figure shows improved design features of a large-bore version. Efforts have been made to provide a relatively uniform wall thickness. To improve cooling, the thick "sleeve" of the Y-site has been cored out into a series of ribs that can be formed without any slides or side action by utilizing a stepped parting line. The core pins have been redesigned to meet away from the thickest section of the part.

The end result is a Y-site that has improved performance, better processing characteristics, and a unique appearance.

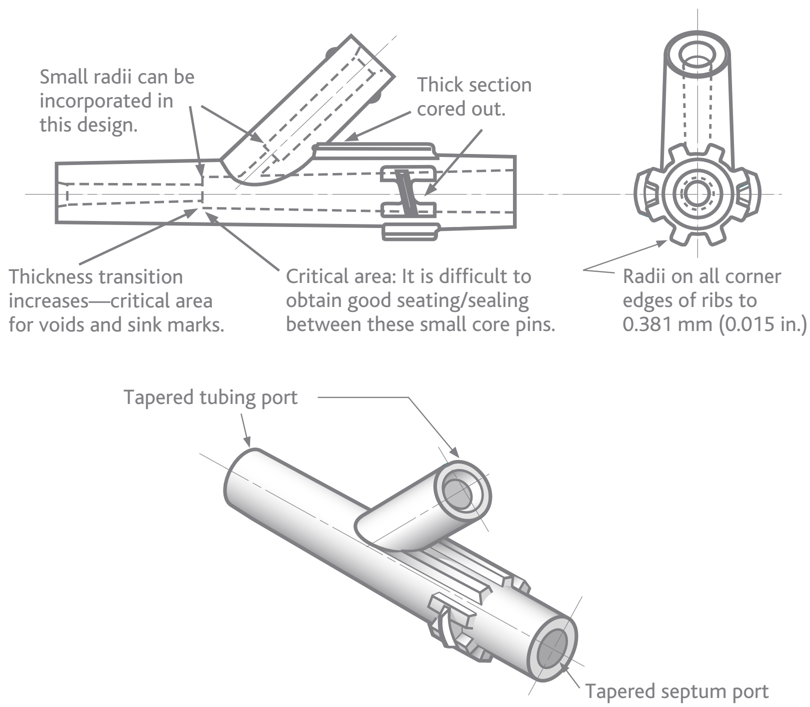
In the large-bore design, the interior corners could not be rounded since a flat edge was needed to serve as a tubing stop. The small core pin in the "Y-arm" was very difficult to cool, causing some sticking during ejection. The part was modified, adding two external bumps to provide support to the arm during core pull. Some companies improve the ejection of small core pins by using high-heat-transfer metals, special cooling techniques, and/or low-friction coatings.

Figure 3 Optimized Y-site design (large bore)



Another Y-site (Figure 4) required small-bore diameters in two of the tube sections, which presented additional challenges. The thickness transition increased where the two core pins came together, making this area susceptible to sink marks or voids if not packed out properly. When two small core pins meet in the mold, it can be difficult to obtain good seating and sealing between them. The pins expand and contract as they heat and cool and may be prone to galling in the mating "wear" area. Thus, this area needs to be periodically inspected for flash.

Figure 4 **Optimized Y-site design (small bore)**



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