TRIMMING - III - THICK-GAUGE[1]

As defined earlier, heavy-gauge or thick-gauge forming refers to parts formed from sheet having thicknesses greater than about 3 mm, 120 mils or 1/8-inch. Typically, heavy-gauge parts are formed from cut sheet, with the part and the unformed sheet around it being removed from the machine clamp frame to an off-line trimming station. The method of trimming depends on several factors including the number of parts that are to be trimmed, the accuracy and finish of the trimmed edge, the planarity of the trim line, and the extent of secondary cutting required.

Hand Trimming

Trimming using a handheld router was at one time the primary way of separating the product from the unformed sheet. Although largely supplanted by numerically controlled routers, hand trimming still has its place in prototyping or when a few parts are needed. Guides and tracking grooves improve the accuracy of the trim line.

Planar Trimming

For many parts, from refrigerator liners to garden ponds to skylights to tote boxes, the trim line is planar or linear. As a result, trimming is usually accomplished with fixed, horizontally mounted rotary saws, vertically mounted band saws, and even guillotines. For saw cutting, the part is usually manually moved into the saw. For guillotines, which are basically sheet cutting or shearing devices, the products to be trimmed are frequently robotically moved between the knives. In certain heavy-gauge forming operations, the trim device may be incorporated as part of the mold assembly, much like that in thin-gauge in-mold trimming.

Mechanical Trimming

The advent of the computer-programmed robotic trimming station has revolutionized heavy-gauge trimming technology in the past decades. The computer imparts speed, accuracy and reliability to the trimming process. Compared with hand routing, robotic trimming initially requires much greater technical skills to create the operational trim path, but very little additional labor thereafter. However, it must be kept in mind that robotic trimmers are very expensive, particularly when compared with handheld trimming devices. As a result, robotic trimming yields financial rewards usually when many identical parts are needed.

There are several variations on the computer-numerically-controlled or CNC router. Multiaxis stations include two- and three-axis machining stations, five-axis routing stations, and even linear motor-driven six-axis robots. All these devices require that the cutter path be preprogrammed in a language special to the device or class of devices. And care is required during setup to ensure that the device is indeed following the desired cutter path. Disaster can occur if the machine incorrectly interprets the code.

Drilling and Slotting - Secondary Cutting

In addition to separating the part from its trim, very frequently, holes must be cut in the part. Handheld drills, routers, and hole saws have performed these functions for decades. And frequently they still do. And now CNC devices are used. As with hand operations, the CNC devices frequently require tool changes to accomplish all trimming functions. These changes are automatically programmed into the computers.

Tooling for Trimming[2]

The nature of the polymer frequently dictates the type of tool to be used for trimming. For example, care must be taken to prevent microcracking when drilling or saw-cutting brittle polymers such as acrylics and styrenics. And when soft, easily flowed polymers such as polyethylene are trimmed, the cutter must move a hot sticky chip quickly away from the cut area to prevent it from rewelding itself. In addition, it is important to keep in mind the relationship between linear speed of travel, usually in inches/min, and cutter speed, usually in revolutions/minute. Excess in either of these variables can lead to poor quality cut surfaces. But going too slow can also lead to problems in poor efficiency and burned plastic. In short, it is always wise to work with companies that specialize in cutters specifically designed to cleanly cut a given type of plastic.

General Comments About Trimming

It was noted at the beginning of this three-part series that trimming involves mechanical fracture of plastic. Further, trimming has become an integral, if not formidable, part of the thermo-forming process. It should now be noted that there is a dearth of technical information but a substantial plethora of widely held beliefs on trimming methodologies. Perhaps an industry focus will aid trimming technology in a manner similar to that on heating technology.

Keywords: Router, multiaxis, trimming, secondary cutting

[1]Ed. Note: In the first part of this three-part series, we defined trimming as the means of separating the formed plastic part from the web, skeleton, or unformed sheet surrounding it. In the second part, we considered methods of trimming thin-gauge parts, including nip rolling, matched die cutting and punch and die cutting. Some concepts of successful thin-gauge trimming were included. In this section, we consider the more popular ways of trimming thick- or heavy-gauge parts.

[2]Many Industry Practice articles on cutters are found in back issues of TFQ.