TRIMMING - II - THIN-GAUGE[1]

What is Used to Trim Thin Sheet?

The steel rule die is the most common method of trimming thin-gauge sheet. The steel rule die is basically a special-grade steel strip that has been sharpened on one edge. The strip is bent to the contours of the trim line on the part. It is then mounted in a base plate. This assembly is then attached to the trim platen. The specific details about the steel rule die, the base plate and the assembly depend strongly on the trimming equipment. For high production, punch-and-die or matched metal die assemblies are used. For these assemblies, sharpened machined or forged hardened steel dies are used.

Thin-Gauge Trim Techniques

The simplest thin-gauge trimming machine consists of a horizontal motor-driven roller and a rigid table. The gap between the roller and the table is manually adjustable. The sheet containing the formed parts is placed in a fixture and a base plate, usually of plywood, containing the steel rule die, is placed atop the plastic and fixture. The entire assembly is then hand-fed through the roller. The nip pressure forces the steel rule die into the plastic and the parts are cut free. This technique is ideal for prototype operation.

At the other end of the spectrum, trimming presses are employed. The sheet containing the formed parts is fed continuously between reciprocating platens. A steel cutting die is forced against the trim die line. If the press employs matched metal dies, the cutting die edge squeezes the sheet against a steel backing plate until it is cut through. The steel backing plate is usually spring-loaded so that the cutting die edge is not striking an immovable surface. If the press employs a punch-and-die arrangement, the punching die edge essentially pinches the plastic against an immovable die. As the plastic is cut through, the punch passes inside the immovable die.

There are horizontal trim presses, where the plastic sheet is fed vertically into the horizontally reciprocating platens, and vertical trim presses, where the plastic is fed horizontally into vertically reciprocating platens. For parts where holes and slots are needed, multiple trim presses are used. The first press cuts the slots or holes and the second press trims the part from the web.

There are many other trim techniques that fall between the hand-operated trim press and the automated in-line multiple trim press. For example, in-mold or in-situ trimming has become popular, following its acceptance in Europe more than a decade ago. Here, the trim die is part of the mold. As the sheet is stationed over the mold cavity, the trim die moves against it, pinning it to the mold cavity. In this fashion it acts as a hold-down fixture, cavity isolator, or grid. Once the part has been formed, the trim die continues into the plastic, separating the part from the web. With micrometer gapping on new presses, millions of cuts without replacing the dies are possible. Steel rule dies and forged dies are used in in-mold trimming.

THERMOFORMING 101

Successful Thin-Gauge Trimming

Typical thin-gauge trimming problems are angel hair or very fine fibers, fuzz, dust, and edge microcracks. These are usually related to a mismatch between the nature of the cutting edge of the trim die and the cutting characteristics of the polymer. Cutting edge sharpness is always critical, but so is the edge bevel. And the rigidity and planarity of the trim die is also important, particularly for deep and very long, linear cuts. As we discussed in the first part, soft, gummy plastics tend to "flow" away from the cutting edge, whereas brittle plastics tend to form dust and edge cracks. Certain polymers, such as PET and PETG, benefit by being cut hotter, but that is not always possible.

Registration problems can be severe if the plastic has significant shrinkage and orientation after leaving the forming press. PP and CPET are classic examples. Even with multiple molded-in registration posts, substantial set-up time may be needed to correctly position the in-line trim dies. Small processing changes, such as sheet temperature, forming time, and mold temperature, may lead to mis-registration.

Keywords: steel rule die, forged die, machined die, trim press, trim problems

[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 this part, we consider methods of trimming thin-gauge parts.