The Cutting Edge

For those of you who came in late, we have been examining the various aspects of part design. In this lesson, we focus on the edge or periphery of the part. The first thing we need to realize is that the part we've just thermoformed is still attached to the plastic that held it in the clamp frame while it was being formed. This is true whether the entire assembly, formed part and edge material, is removed to a separate fixture or whether the formed part is punched from the trim material immediately after forming. We've discussed trimming in earlier tutorials. In this tutorial, we discuss the characteristics of the edge itself.

Registration

Trimming devices need to trim the part where the designer wanted it trimmed. This means that the trim line and the trim device must register. The accuracy of registration is a design issue. In heavy gauge forming, it is impractical to ask a trim device to trim within thousandths of the design trim line everywhere along the trim line. Heavy-gauge parts may be fixtured between the time they are formed and the time they are trimmed. Fixturing allows for some residual stress relaxation and often improves the trim registry. In thin-gauge forming, the trim device should be able to trim very close to the design trim line. Because many thin gauge parts are axisymmetric, meaning that the trim line is round, registration focuses on the degree of ovality of the formed trim line prior to the trimming step. Thin-gauge parts are often trimmed within minutes of being formed. Certain polymers such as polypropylene continue to crystallize after forming. As a result, the design trim line and the final part edge peripheral location may be quite different.

Heavy-Gauge Cut Edge

The nature of the final cut edge depends strongly on the trimming device. In many robotic trimming steps, the edge is rough-cut initially. This edge finish may be adequate if the cut edge of the part is completely hidden in the final assembly. Polycarbonate skylights that are edged in aluminum are examples. Often the product requires a smoother edge. For robotic trimming to achieve the desired edge, the rough-cut edge is routed a second time while the part remains on the trim fixture.

In some applications, the edge must be as smooth as the overall plastic surface. Here are some ways of achieving a very smooth, even polished edge.

- Fine grit sanding followed by Crocus cloth or 1200-grit polishing
- The above method, followed by pumice polishing
- For certain plastics, a light wipe with a mild solvent will smooth trim cuts. Care must be taken to minimize the amount of solvent that is absorbed into the polymer.
- Flame-polishing is popular with transparent amorphous plastics such as acrylics and polycarbonates. Flame-polishing is not recommended with plastics such as PVC.
- Laser cutting. The laser is a high-intensity beam that cuts plastic by melting and vaporizing it. The cut line is usually very smooth.

Thin-Gauge Cut Edge

Thin-gauge trimming is substantially simpler than heavy-gauge trimming. Nevertheless, the trim edge characteristics can be quite important to the customer. There are three major issues with the cut edges of thin-gauge parts:

- Trim dust and fibers, known as angel hair and fuzz.
- Microcracks that can grow into the formed part as it is flexed
- Jagged edges that can cut or abrade the user

Edge and surface contamination are often the results of problems in the trimming step. But not always. It is very difficult to trim polystyrene without generating very tenacious trim dust. It is often difficult to trim polypropylene or PET without generating fibers and fuzz. Adding antistatic agents to PS, either as an additive that is compounded into the polymer or as a topical coat to the sheet prior to forming, helps the trim dust problem. If fuzz and fibers are objectionable to the customer, they are often minimized by passing the container edges through a hot air knife. The heat shrivels the fibers to microscopic size.

Microcracks and jagged edges can also be "healed" by heating the edges with hot air. One approach is to collect and nest a stacked, counted number of parts and pass the stack though a hot air tunnel prior to packaging or boxing for shipment. ■

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