



www.polymertechnology.com

5120 Parkway Drive
Menomonie, WI
(715) 235-1464

Design Guidelines

(SPECIFICATIONS AND GUIDELINES FOR MOLDED PLASTICS)

Although component design in thermoplastics is complex, following a few fundamental principles will help you minimize problems during molding and in part performance. Of course, the guidelines given here are general. Depending on the particular requirements of the part, it may not always be possible to follow all of our suggestions. But these guidelines, in furthering your understanding of the behavior of thermoplastics, can help you effectively resolve some more common design problems.

Nominal Wall Thickness

For parts made from most thermoplastics, nominal wall thickness should not exceed 4.0 mm. Walls thicker than 4.0 mm will result in increased cycle times (due to the longer time required for cooling), will increase the likelihood of voids and significantly decrease the physical properties of the part. If a design requires wall thicknesses greater than the suggested limit of 4.0 mm, structural foam resins should be considered, even though additional processing technology would be required.

In general, a uniform wall thickness should be maintained throughout the part. If variations are necessary, avoid abrupt changes in thickness by the use of transition zones, as shown in Figure 1 (located on page 3). Transition zones will eliminate stress concentrations that can significantly reduce the impact strength of the part. Also, transition zones reduce the occurrence of sinks, voids, and warping in the molded parts.

A wall thickness variation of plus or minus 25% is acceptable in a part made with a thermoplastic having a shrinkage rate of less than 0.01 mm/mm. If the shrinkage rate exceeds 0.01 mm/mm, then a thickness variation of plus or minus 15% is permissible.

Radii

It is best not to design parts with sharp corners. Sharp corners act

as notches, which concentrate stress and reduce the part's impact strength. A corner radius, as shown in Figure 2, will increase the strengths of the corner and improve mold filling. The radius should be in the range of 25% to 75% of wall thickness; 50% is suggested.

Draft Angle

So that parts can be easily ejected from the mold, walls should be designed with a slight draft angle. A draft angle of 1/2 degree draft per side is considered standard practice. The smaller draft angles cause problems in removing completed parts from the mold. However, any draft is better than no draft at all.

Parts with a molded-in deep texture, such as leather-graining, as part of their design require additional draft. Generally, an additional 1 degree of draft should be provided for every 0.025 mm depth of texture.

Ribs and Gussets

When designing ribs and gussets, it is important to follow proportional thickness guidelines. If the rib or gusset is too thick in relationship to the part wall, sinks, voids, warpage, weld lines (all resulting in high amounts of molded-in stress), and longer cycle times can be expected.

The location of the ribs and gussets also can affect mold design for the part. Keep gate location in mind when designing ribs or gussets. Ribs well-positioned in the line of flow, as well as gussets, can improve part filling by acting as internal runners. Poorly placed or ill-designed ribs and gussets can cause poor filling of the mold and can result in burn marks on the finished part. These problems generally occur in isolated ribs or gussets where entrapment of air becomes a venting problem.



www.polymertechnology.com

5120 Parkway Drive
Menomonie, WI
(715) 235-1464

Design Guidelines

(SPECIFICATIONS AND GUIDELINES FOR MOLDED PLASTICS)

Threads

Molded-in threads can be designed into parts made of engineering thermoplastic resins. Threads always should have radiused roots and should not have feather edges—to avoid stress concentrations. Figure 5 shows examples of good design for molded-in external and internal threads. Threads also form undercuts and should be treated as such when the part is being removed from the mold i.e., by provision of unscrewing mechanisms, collapsible cores, etc. Every effort should be made to locate external threads on the parting line of the mold where economics and mold reliability are most favorable.

Undercuts

Because of the rigidity of most engineering thermoplastic resins, under cuts in a part are not recommended. However, should a design require an undercut, make certain the undercut will be relieved by a cam, core puller or some other device when the mold is opened.

Bosses

Bosses are used in parts that will be assembled with inserts, self-tapping screws, drive pins, expansion inserts, cut threads, and plug or force-fits. Avoid stand-alone bosses whenever possible. Instead, connect the boss to a wall or rib with a connecting rib as shown in Figure 3. If the boss is so far away from a wall that a connecting rib is impractical, design the boss with the gussets as shown in Figure 4.

With these guidelines in mind, we encourage designs that:

- Minimize the number of different types of plastic in the component, aiding recycling.
- Reduce the combination of plastic and paint or decorative strips and finishes. This also aids recycling and disposal.
- Allow easy disassembly or replacement of the component.
 - Minimize the number of separate pieces in any assembly or sub-assembly.
- Optimize wall thickness to reduce material usage, while still meeting the key specification or primary functions.
- Identify the various types of plastic in an assembly by labeling or molding-in identification.
- Minimize the number of non-plastic inserts.
- Allow a part to be able to carry out more than one function.
 - Keeping these guidelines in mind, your plastics designs can be both proactive and beneficial in addressing environmental issues.

Source: "Designing with Thermoplastics", Dow Plastics, The Dow Chemical Company.

Figure 1—Suggested Design for Wall Thickness Transition Zone

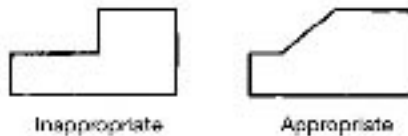


Figure 2—Suggested Design for Corner Radius

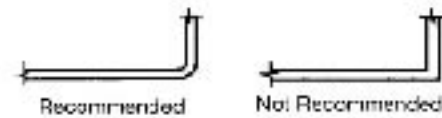
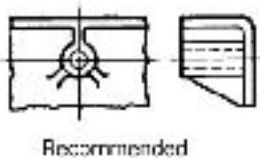
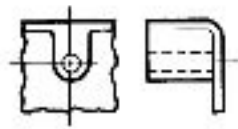


Figure 3—Recommended Design of a Boss Away From a Wall (with Gussets)

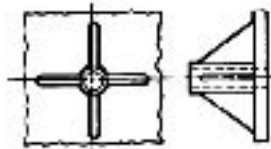


Recommended

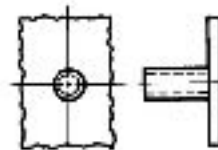


Not Recommended

Figure 4—Recommended Design of a Boss Near a Wall (with Ribs and Gussets)



Recommended



Not Recommended

Figure 5—Recommended Design for Molded-in Threads

External Threads

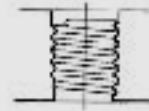


Recommended

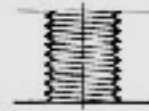


Not Recommended

Internal Threads



Recommended



Not Recommended