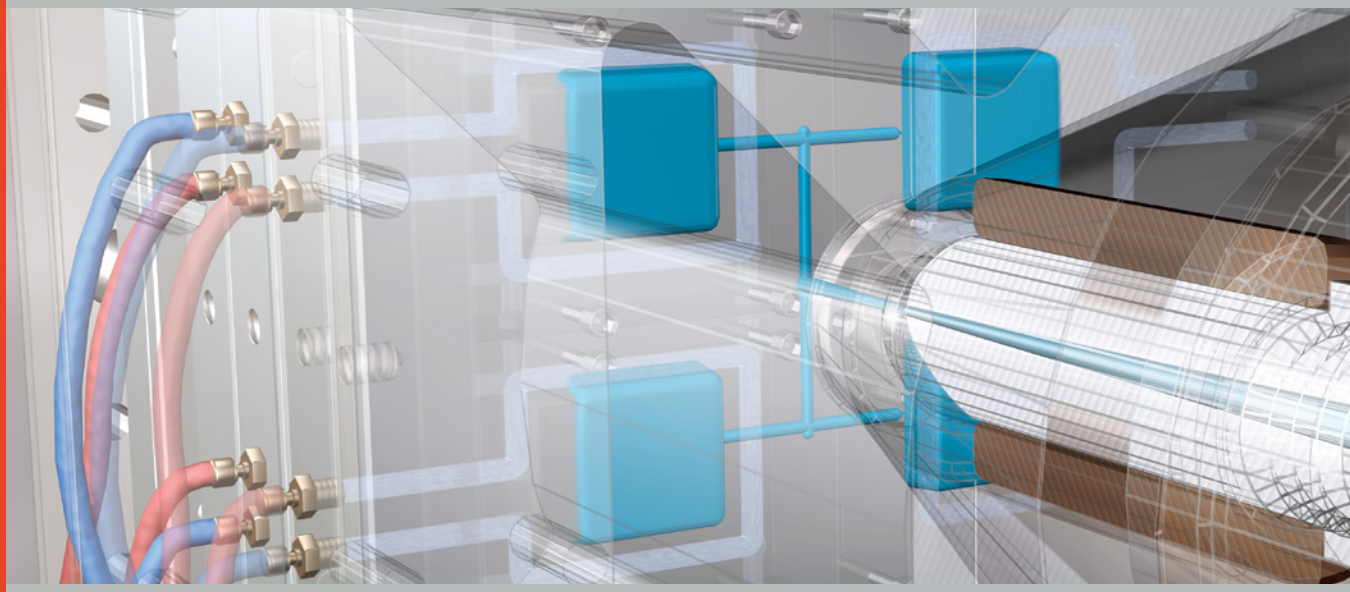
REFERENCE SERIES: DESIGN

Best Practices for Thickness Transitions



nexeo plastics

Created exclusively for **Nexeo Plastics** by Routsis Training, this free guide contains excerpts from Routsis's ***Mold & Part Design Courses***.

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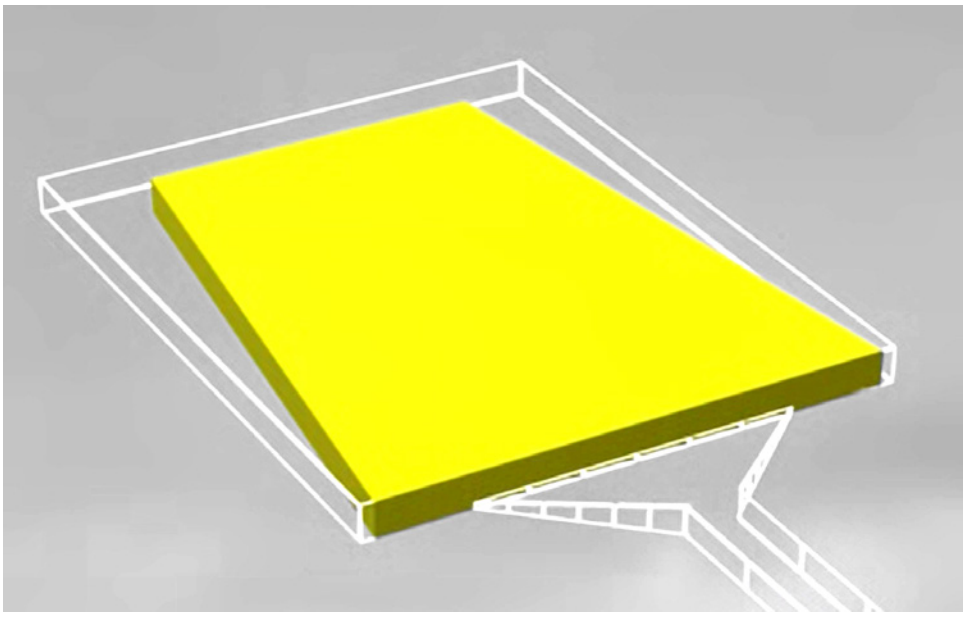
CAVITY PRESSURE & DIMENSIONAL STABILITY

Variations in cavity pressure during fill can cause differential stresses. Large parts typically experience a large pressure loss, which creates a large **Pressure Differential** throughout the part. Such parts can have large **Stress Differentials** as well. The high pressures around the gate area allow more material to be packed near the gate.

This is an exaggerated example of how **Shrinkage** occurs in a square plaque due to the pressure differential. Around the gate area, the plaque gets adequate packing, and therefore has low shrinkage. The part shrinks more away from the gate, and the resultant part has a trapezoidal shape.

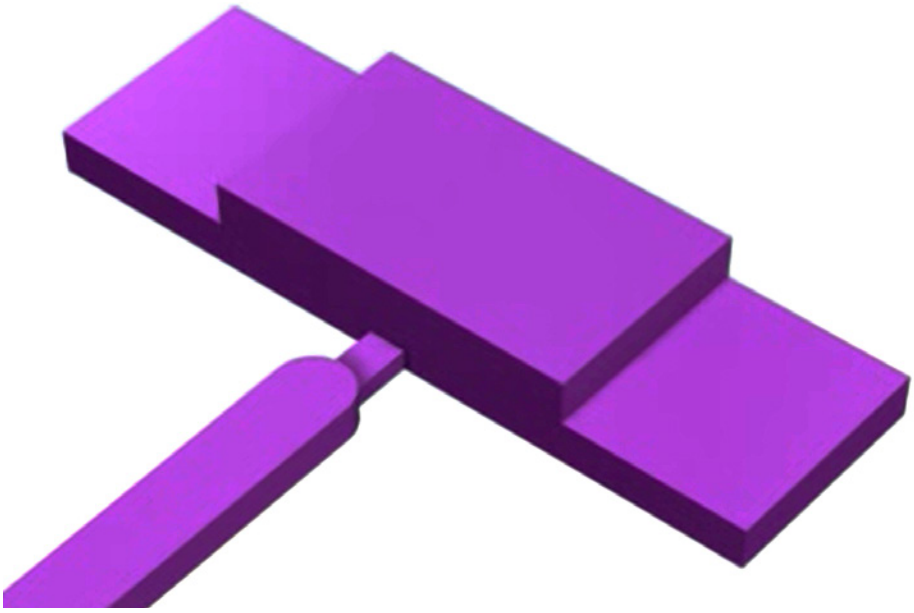


There are some methods used to minimize the pressure differential throughout the part and minimize shrinkage and warpage.

Gating at Thicker Section

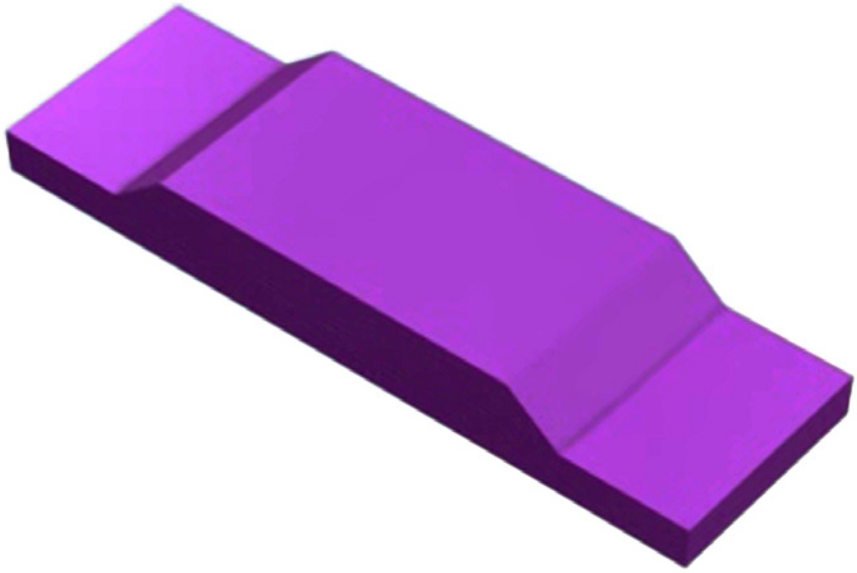
Gating from thinner sections can result in large pressure losses before the material reaches the thick section.

In contrast, gating from the thicker sections can reduce pressure loss as the thick portion of the cavity is filled. In addition, higher pressures can be applied to the thick sections where the extra packing is needed.



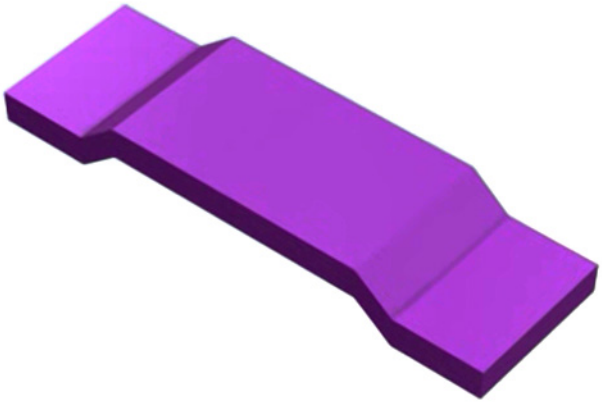
Thickness Transitions

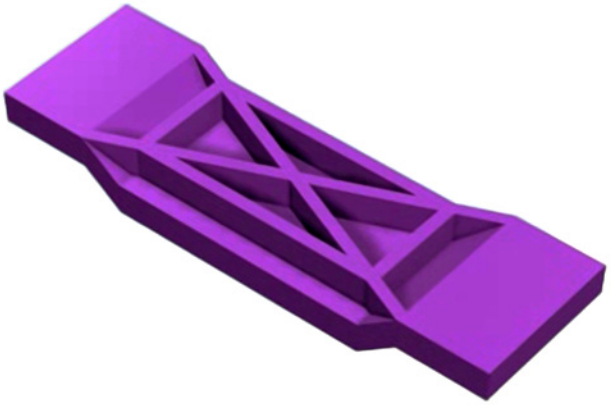
Since thicker sections shrink differently than thin sections, quick transitions create large stress differentials in a small area. Using gradual transitions from the thick to thin sections of the part can reduce stresses in the part.



Whenever possible, try to maintain a constant wall thickness. This will help reduce shrinkage and maintain lower stress differentials in the part.

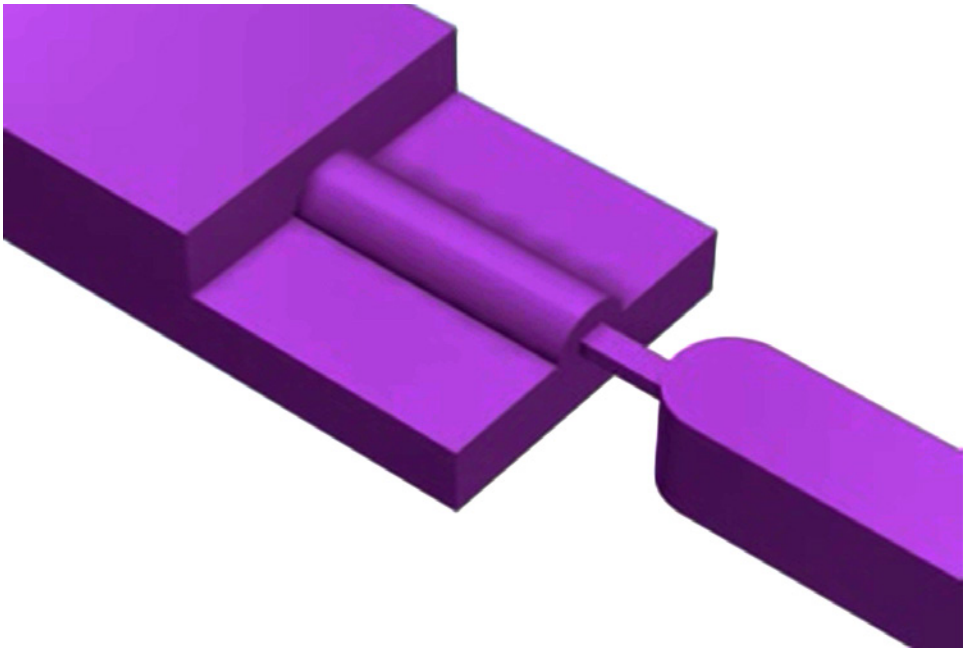
In many applications, ribs and strengthening walls are acceptable substitutes for thicker walls. These techniques reduce material use, cycle time, and improve the dimensional stability of the part.





Flow Leaders

Adding Flow Leaders to the part can also lower pressure differentials. Flow leaders allow larger volumes of polymer to flow to other portions of the mold — reducing the pressure loss through the cavity.



Multiple Gates

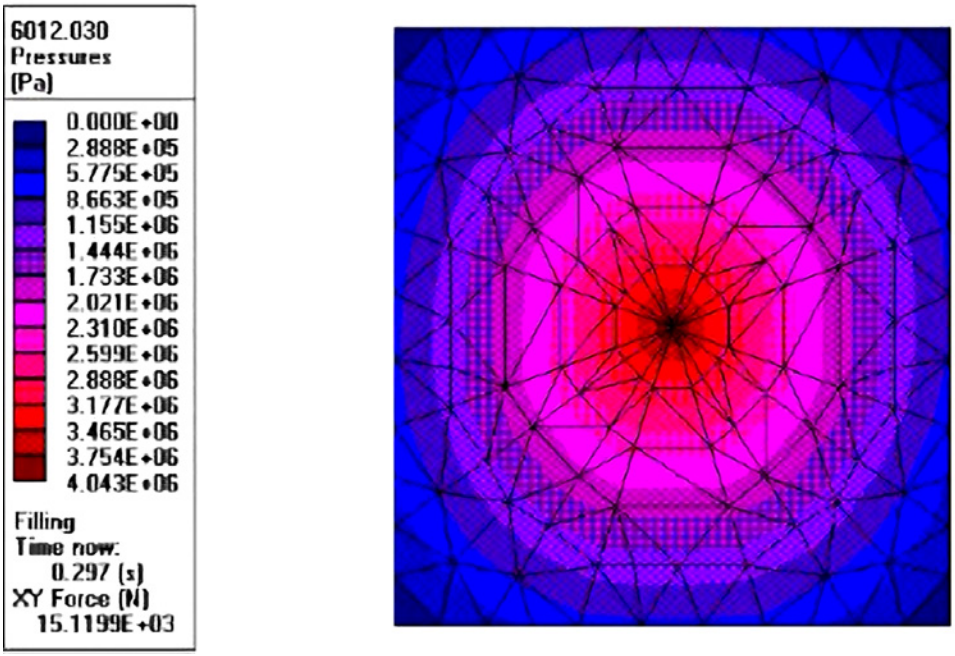
Multiple gates can also help reduce warpage. Multiple gates reduce the pressure losses experienced during injection and lower the overall stress differential.

Wall Thickness

Modifying the wall thickness can reduce the pressure differential. A standard box gated in the center is likely to warp — due to the pressure differential across the top.

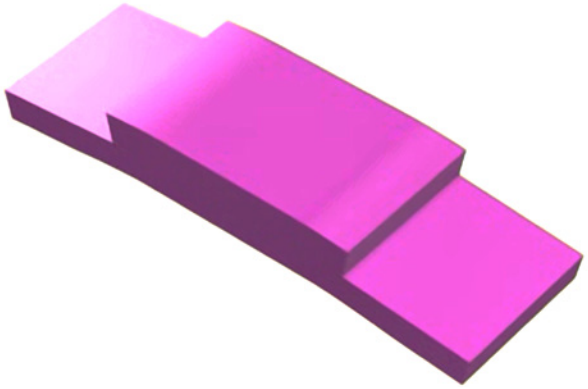
In the case of this box, the Pressure Drop at the corners of the top is higher than that on the sides due to the longer flow lengths. By increasing the thickness or adding Flow Leaders to the corners, the Pressure Drop can be evenly distributed over the top of the box.

Mold filling software packages can help you determine the dimensions required to improve pressure distribution throughout the part.



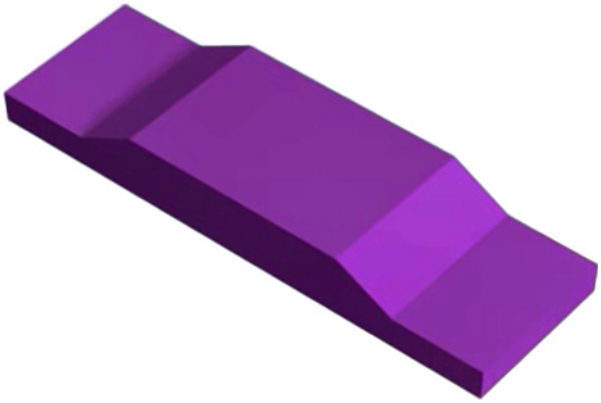
Design Factors

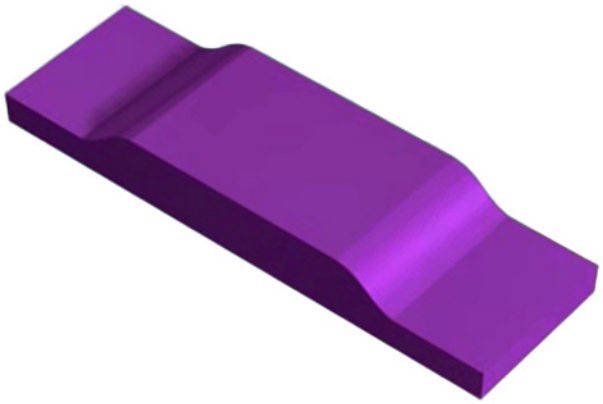
Thickness transitions can pose many problems. Transitions from thick to thin areas of the part should be gradual. The part shown has very sharp thickness transitions. These sharp transitions result in large stress differentials at the transition site due to the quick change in Cooling and Shrinkage. These concentrated stresses cause the part to warp.



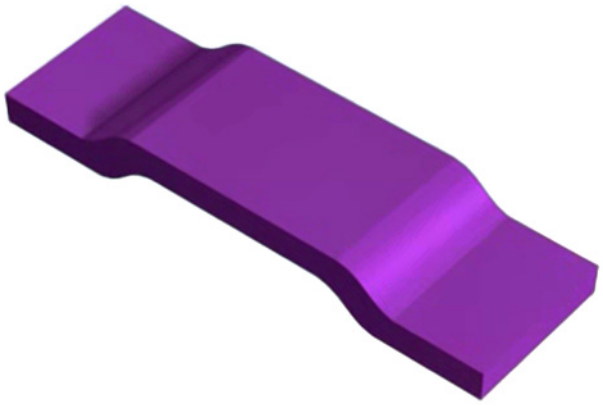
Using gradual transitions for the same part reduces the stress concentrations by distributing the stress over a larger area — reducing warpage.

Sharp corners also act as stress concentrations due to the quick changes at the corner. By rounding off the corners at the transitions, part warpage can be further reduced.





When possible, maintain a consistent wall thickness by coring out the back of the part. This reduces all of the thickness transitions in the part.



If the thick section is necessary, due to structural requirements, strengthening ribs can be added to the underside. These ribs can be designed to provide virtually the same strength as the thick section while using significantly less material. The ribs allow a constant wall thickness without significantly increasing the cooling and cycle times.

Ribs can also be added to the sides so that the part appears as it did with the thick section. Adding ribs to a part can be an excellent method of reducing the Part Weight, Warpage, and Cycle Time without sacrificing part strength.