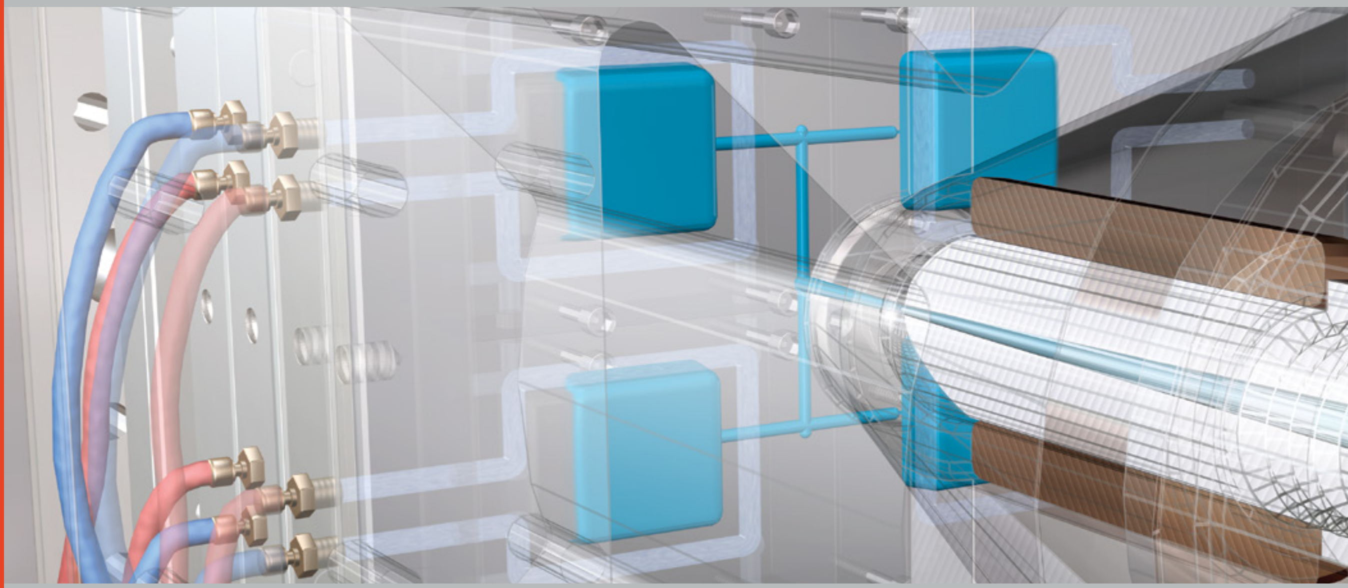
REFERENCE SERIES: DESIGN

Rib Design for Injection Molding



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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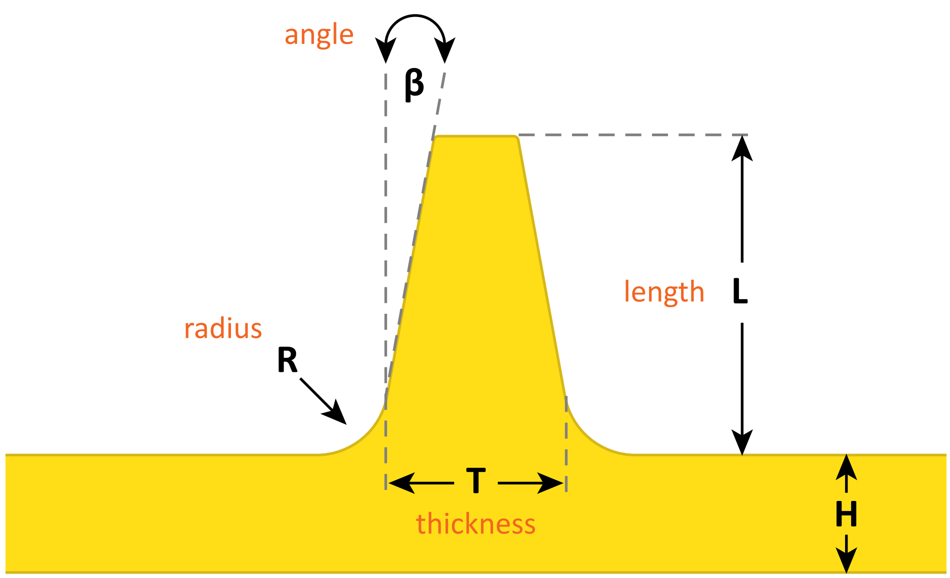
RIB DESIGN CONSIDERATIONS

Ribs are an important factor in Injection Molded Part Design. Improper rib design can result in weak ribs or unsightly sink marks.

There are four important factors in Rib Design:

- Thickness
- Length
- Radius
- Angle

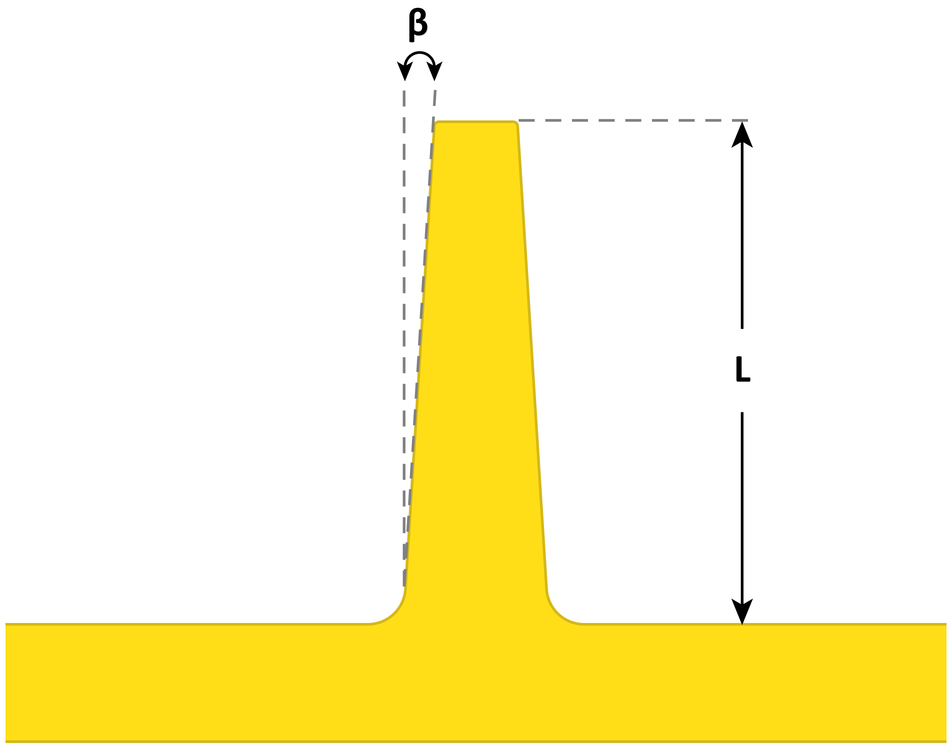
Many material suppliers provide guidelines for recommended rib thickness, length, angle, and radius. These guidelines give upper and lower limits common to that specific material.



The Thickness, represented by **T**, is the thickness of the bottom of the rib. The thickness should be between 40 and 80% of the wall thickness, represented by **H**. The length of a rib is represented by **L**.

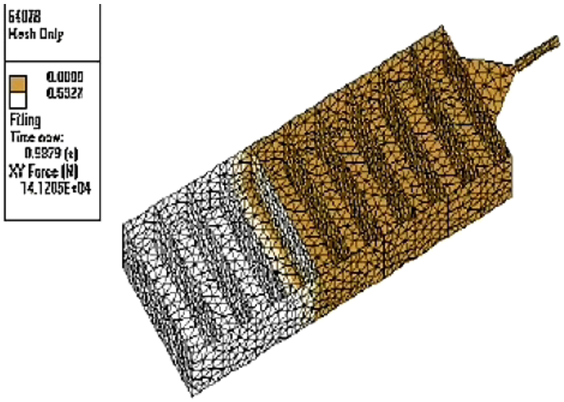
The rib length determines much of its strength. Longer ribs can significantly increase the rib strength. Unfortunately, longer ribs can be difficult to mold.

Longer ribs cannot use large **Draft Angles**, represented by **β**. The draft angle is used to reduce the amount of force required to remove the rib from the mold. Longer ribs are more difficult to remove during Ejection. On parts with large draft angles and long ribs, the draft angle causes the top of the rib to be significantly thinner. This results in a loss of strength and rigidity in the rib.



In addition, longer ribs can interfere with the flow of material in the mold.

If the rib is placed across the direction of flow, the flow of material can be severely interrupted, as the material must fill the rib before the mold is filled.



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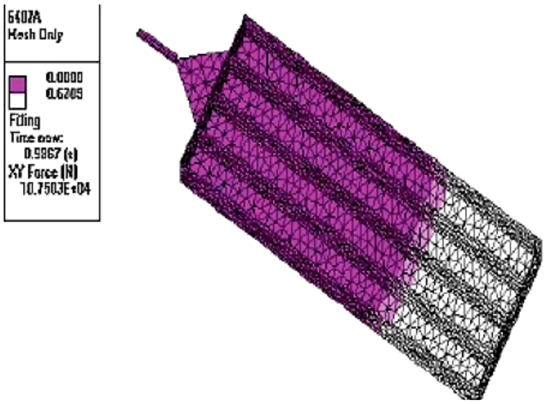
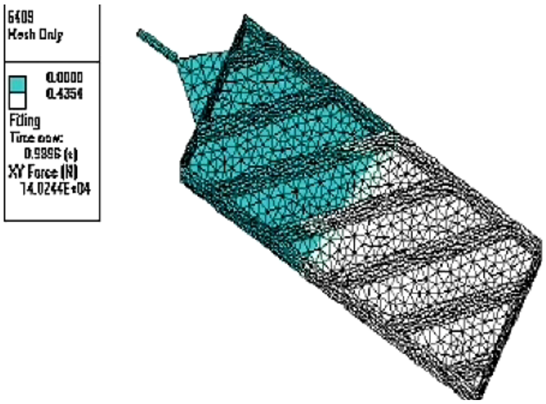
If the ribs are placed in the direction of flow, the material can fill the rib as it fills the mold cavity. This promotes a better, more consistent flow through the cavity.

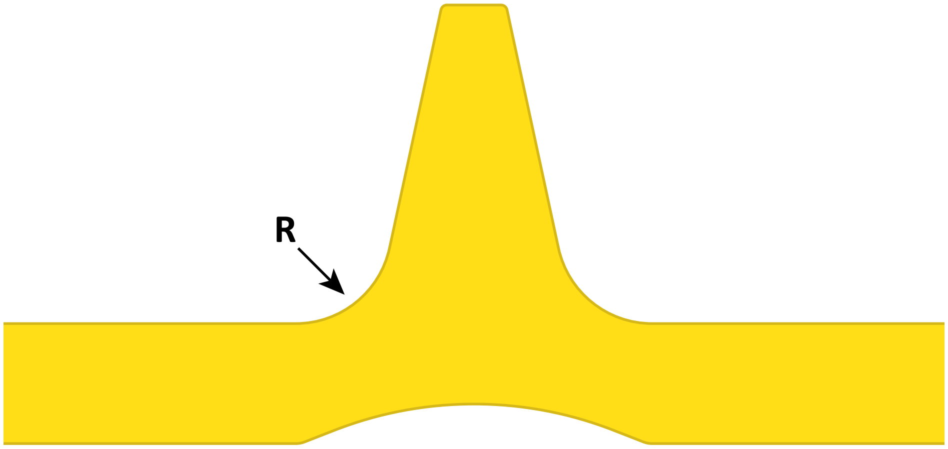
If both Cross-flow and In-flow ribs are required, it is sometimes better to angle the ribs. In this example the ribs are angled 45° to the direction to flow. This type of rib design allows the designer to use the strength of perpendicular ribs with less interference in the material flow.





The rib radius, represented by **R**, is critical to rib strength. Without a radius, the corner of the rib would be a stress concentration. This would weaken the rib and reduce its strengthening benefits.

Unfortunately, increasing the rib radius also increases the width of the bottom of the rib. This has the same effect as increased rib thickness. Increased rib radii tend to create Sink Marks. Therefore, a thicker rib requires a smaller radius. On the other hand, if a smaller rib is used, a larger radius may be acceptable.



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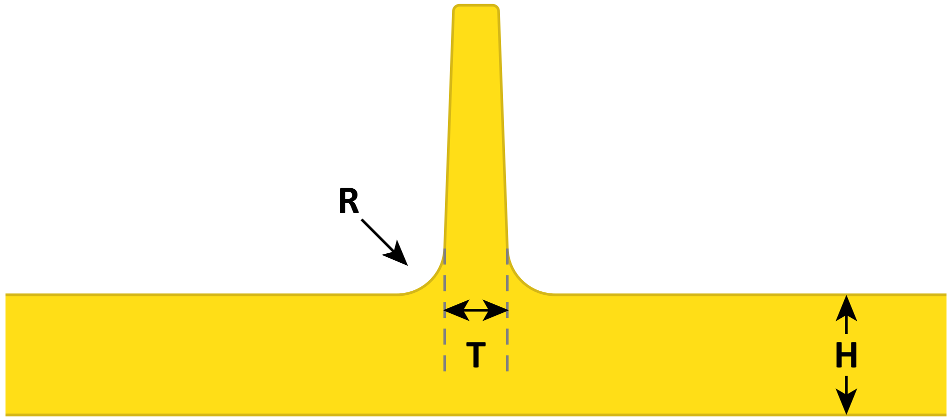
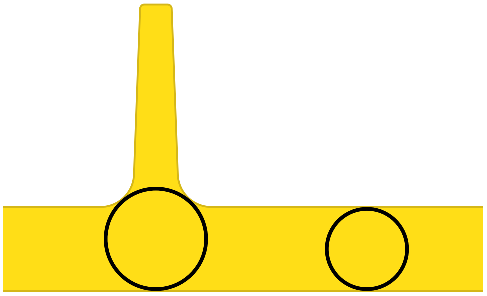
This is an example of proper rib design. A properly designed rib has about 50% to 60% of the wall thickness with an adequate radius.



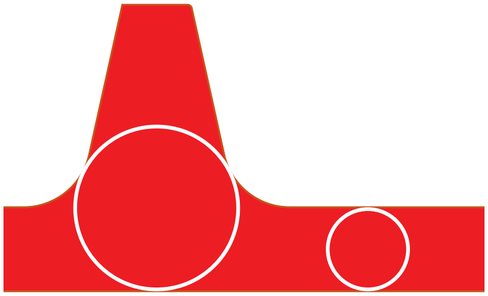
One way to evaluate Rib Design for Sink Marks is to use the Circle Diagram. This method uses a circle drawn in the center of the part wall to evaluate the rib design.

The circle represents the relative amount of material which must be cooled. Since the shrinkage rate increases as the part thickness increases, a larger circle would indicate more shrinkage, and a larger sink mark. With proper rib design, only a small sink mark is present.

In the case of a wide rib with the same radius, or the same width with a larger radius, the circle will be much larger. These designs would result in a large sink mark on the part wall.

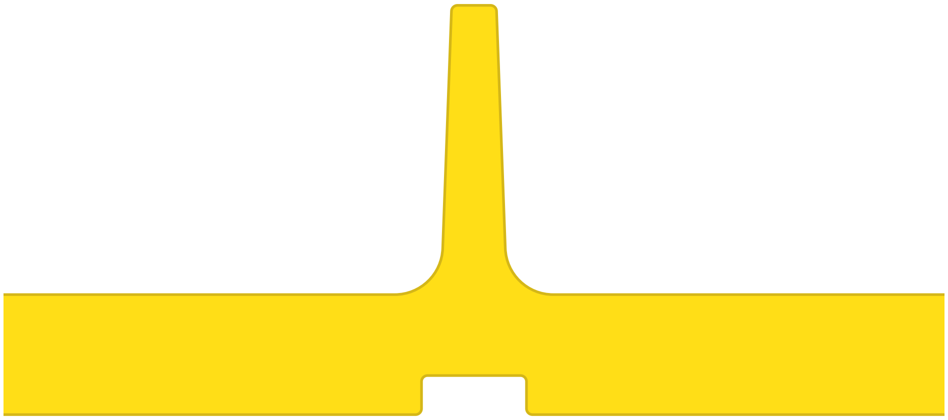


Proper Rib Design



Improper Rib Design

Sometimes, sink marks need to be disguised. One easy method of disguising a Sink Mark is to add grooves to the part in the direction of the rib. These not only disguise the sink mark, but also can reduce the circle size, which evens out the shrinkage.



Another method is to add surface texture to the side opposite of the rib. Surface texture increases the light diffraction and makes the sink mark less noticeable.