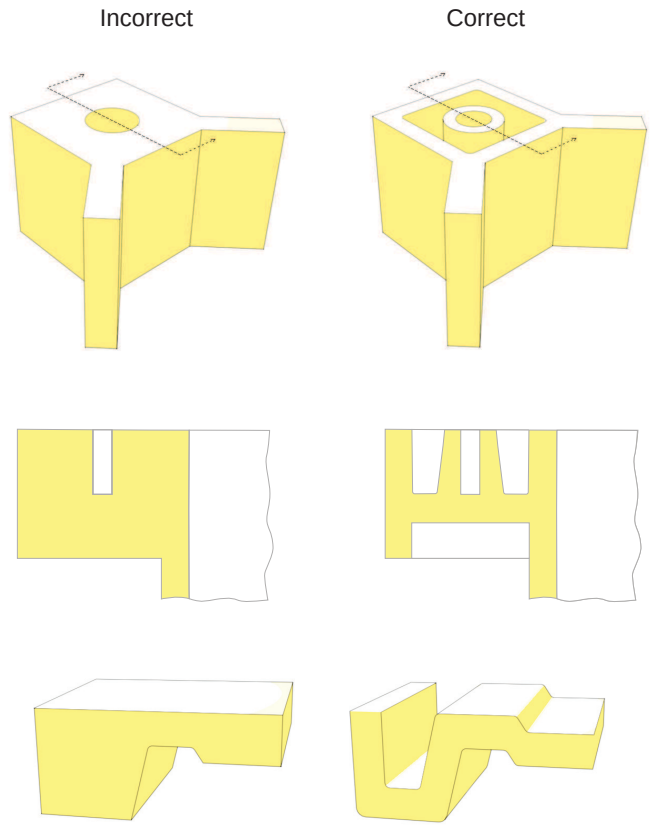
Basic design guidelines for plastic injection moulding

Plastika BEVC

Coring and wall thickness

Core out or redesign thick areas so that the walls have a uniform thickness. This helps prevent sink marks and other material defects.

Coring / uniform wall thickness



Core out thick sections as shown on the right.

Recommended wall thickness for the selected moulding material

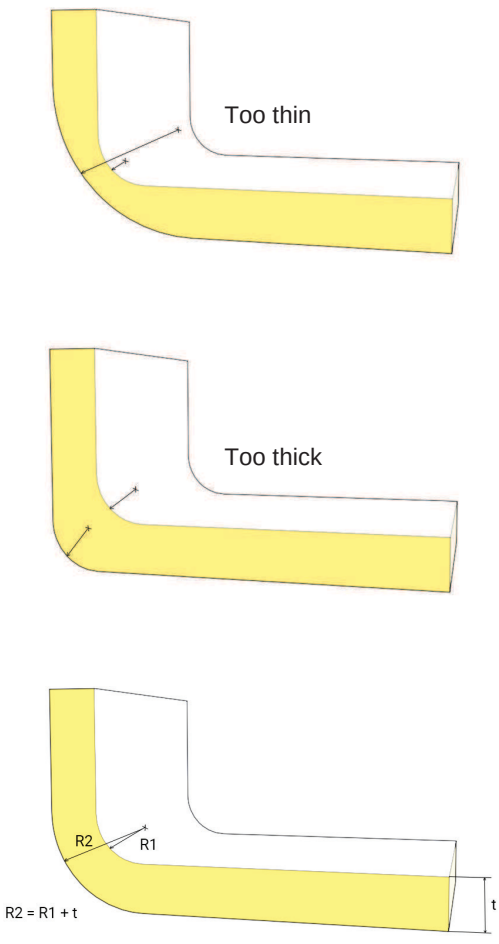
Selecting the appropriate material and following the recommended wall thickness for injection-moulded parts helps prevent sinking and warpage. We recommend following the guidelines in the table on the right, since suitable thicknesses vary depending on the material used:

Resin / Material	Millimetres
ABS	1,1 - 3,6
Acetal	0,8 - 3,0
Acrylic	0,6 - 12,7
Liquid Crystal Polymer	0,8 - 3,0
Long-fi ber Reinforced Plastics	1,9 - 25,4
Nylon	0,78 - 2,9
PC (Polycarbonate)	1.,0 - 3,8
Polyester	0,6 - 3,2
Polyethylene	0,8 - 5,1
Polyphenylene Sulfide	0,5 - 4,6
Polypropylene	0,6 - 3,8
Polystyrene	0,9 - 3,8
Polyurethane	2,0 - 19,1

Corner design

An outside radius that is one wall thickness greater than the inside radius will maintain a constant wall thickness through the corners. R2 = R1 + t

Corner design

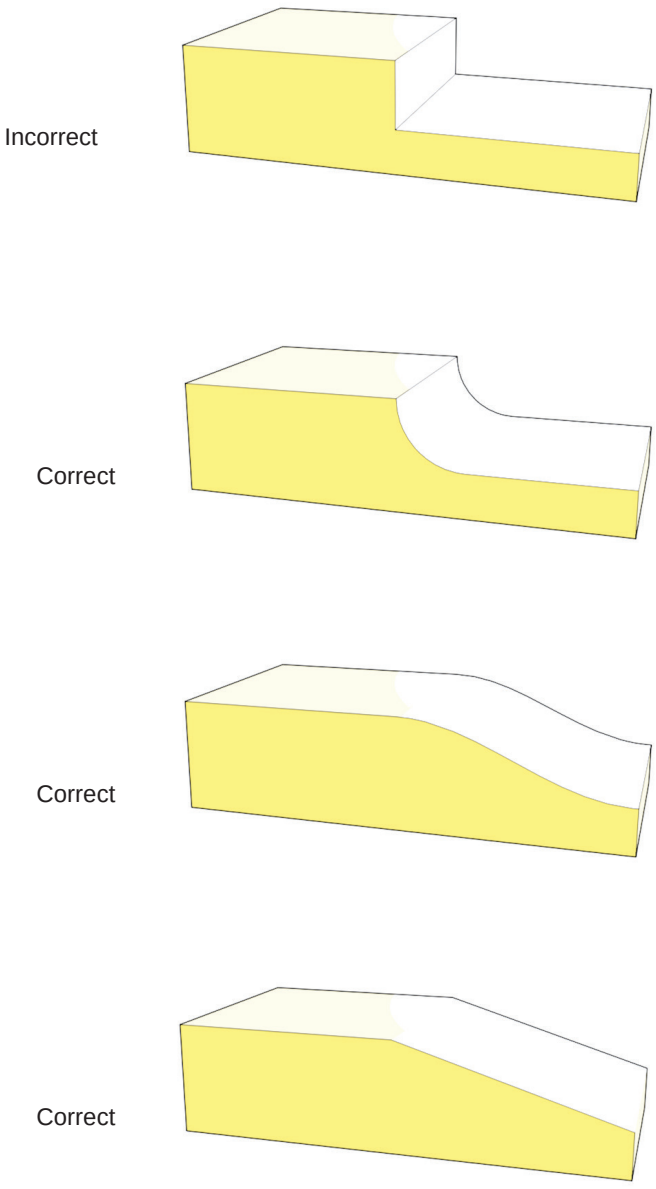


The inside and outside corner radii must originate from the same point.

Wall thickness transitions

Rounded or tapered wall-thickness transitions minimise differences in the product's appearance and smoothness. In addition, rounded transitions reduce moulding stresses and stress concentrations associated with sudden changes in wall thickness.

Thickness transition



Rounded transitions minimise differences in appearance.

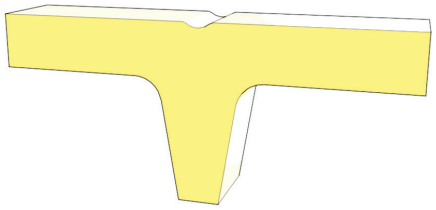
Ribs

Ribs provide greater strength and rigidity in moulded parts without increasing the overall wall thickness. Other uses include:

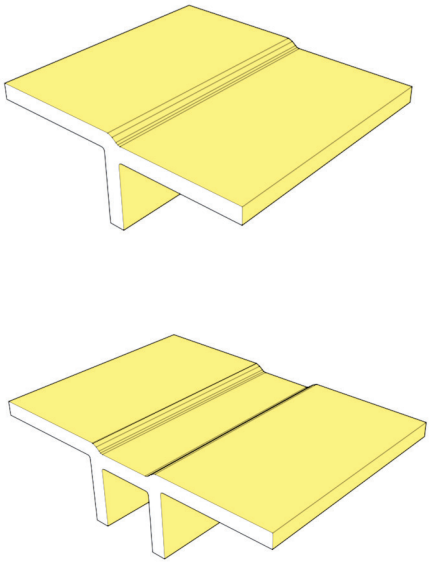
. acting as stops or guides for mechanisms;
. locating and retaining assembly components;
. providing alignment for mating parts.

Proper rib design involves five main factors: thickness, height, location, quantity and mouldability.

Ribs



Sink mark opposite a thick rib.



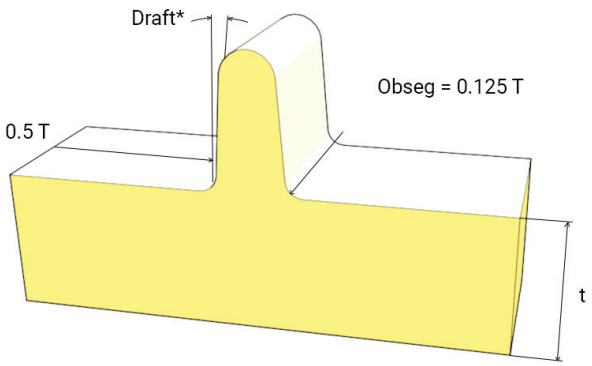
Offset rib to reduce the sink mark.

Ribs - continued

Rib thickness

Many factors determine the appropriate rib thickness. Thick ribs often cause sink marks and cosmetic problems on the opposite surface of the wall to which they are attached. Material, rib thickness, surface texture, colour, proximity to openings and different processing conditions determine the severity of sink marks. The figure on the right provides general rib-thickness guidelines for various materials. These guidelines are based on subjective observations under normal conditions and refer to thickness at the base of the rib. Smooth surfaces require thinner ribs.

Rib thickness

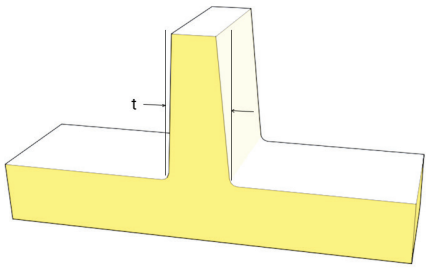


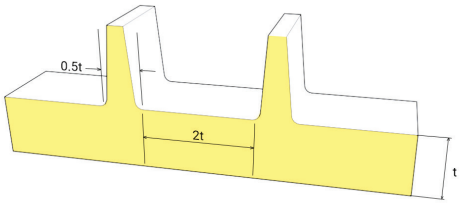
* minimalno 0.5 stopinje na stran

Rib location and quantity

The location and number of ribs are critical to a high-quality design. For example, ribs added to increase strength and prevent breakage can reduce the performance of an individual part and affect its proper operation. In addition, a rib network added to provide thickness can lead to cooling and warpage problems. It is generally much easier to add ribs than to remove them, so they should be used sparingly and added thoughtfully.

Multiple ribs

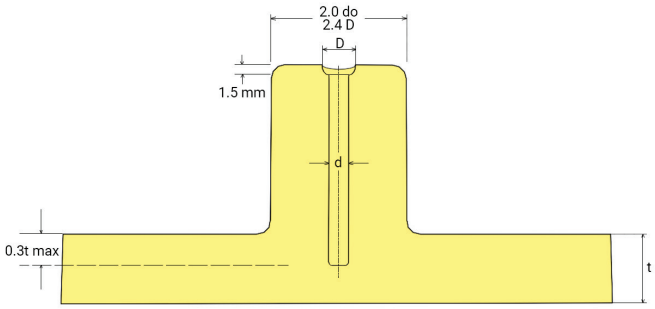


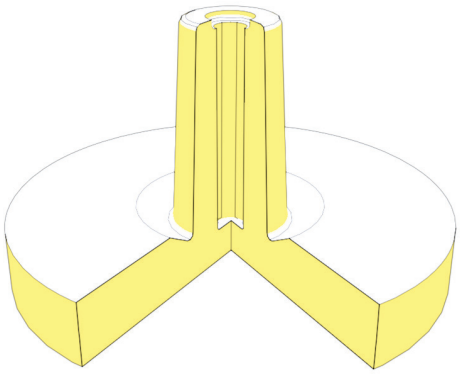


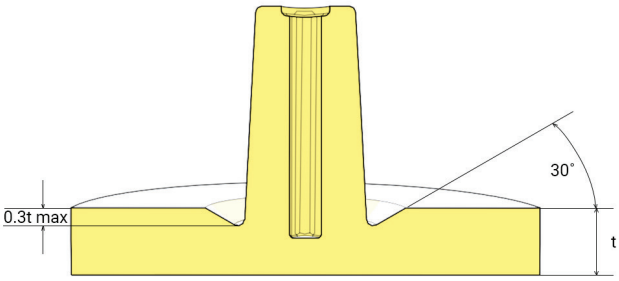
Replace large, unsuitable ribs with several shorter ribs.

Bosses - recesses

Bosses (recesses) are often designed as fastening and assembly points. The most common form consists of cylindrical projections with holes designed for screws, threaded inserts or other types of fastening hardware. In general, the outside diameter of a boss should be 2.0 to 2.4 times the outside diameter of the screw or insert.



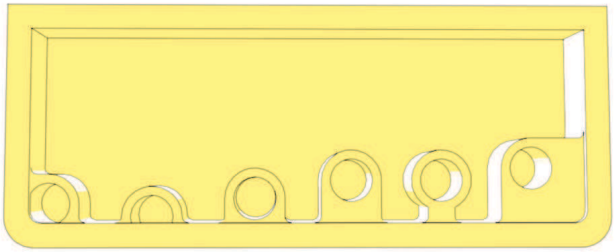




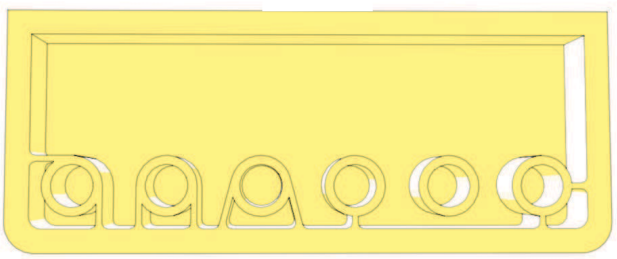
Avoid joining bosses directly to side walls, as this creates thick sections that often lead to sink marks. Bosses should be positioned separately from the side wall, with connecting ribs used for support where necessary. Try to use open boss designs near a wall.

Bosses - recesses

Incorrect



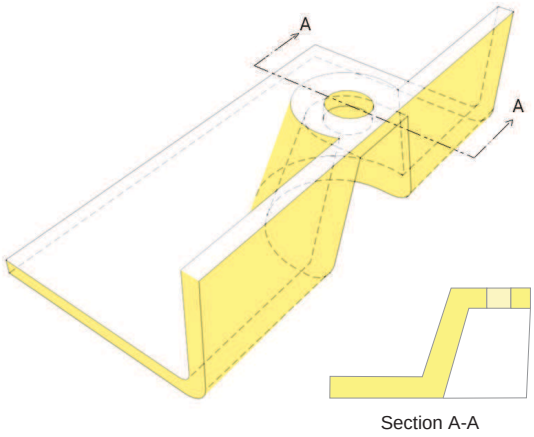
Correct



Bosses - continued

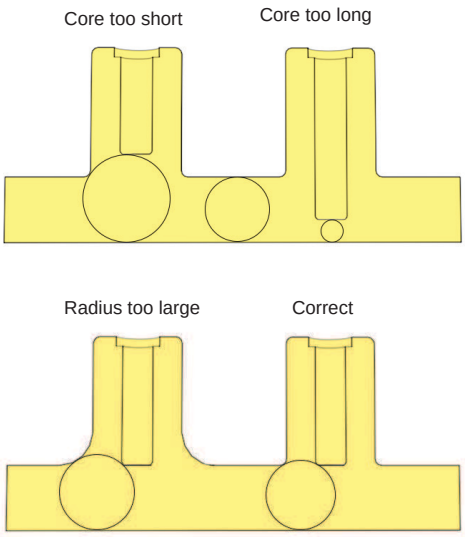
The hole should normally extend to the level of the base wall, even if the full depth is not required for assembly. Shallow holes can leave thick sections that result in sink marks. Deeper holes reduce the base-wall thickness, which can cause filling problems and defects. Because draft is required, tall bosses (at least five times their outside diameter) may cause filling problems at the top or excessive thickness at the base. In addition, the cores of tall bosses are difficult to cool and maintain.

Boss (recess) in the supporting wall



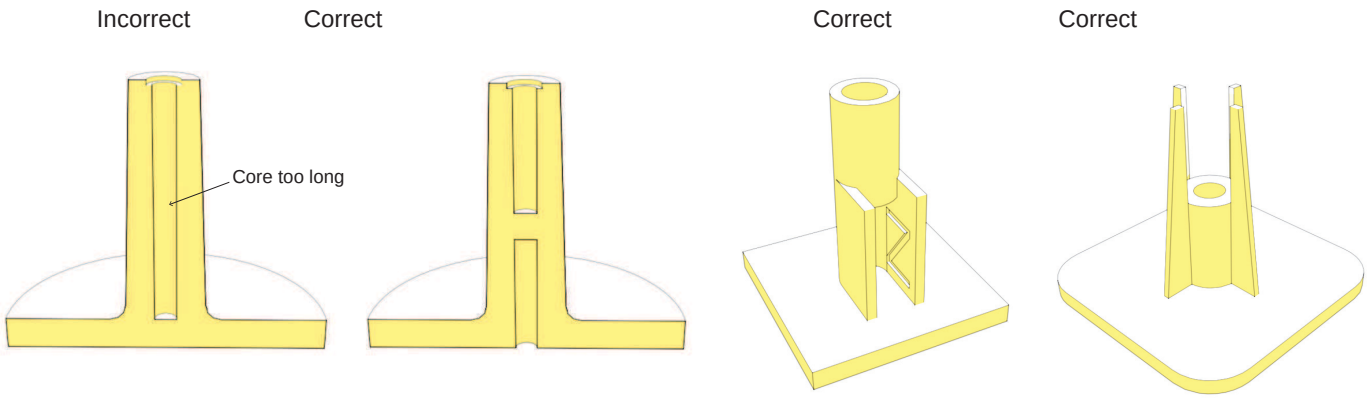
Open bosses maintain a uniform thickness in the supporting wall.

Core depth



Holes should extend to the level of the base wall.

Alternatives to an excessively long core



Options for shortening the core.

Draft-angle design

Draft design: Providing draft angles or tapers on product features such as walls, ribs, posts and recesses that lie parallel to the mould-release direction makes part ejection easier. The way a particular feature is formed in the mould determines the type of draft required. Features formed by blind holes or pockets (such as most recesses, ribs and posts) should taper as they extend into the mould. Surfaces formed by slides may not require draft if the steel moves away from the surface before ejection. Other mould draft-design guidelines include:

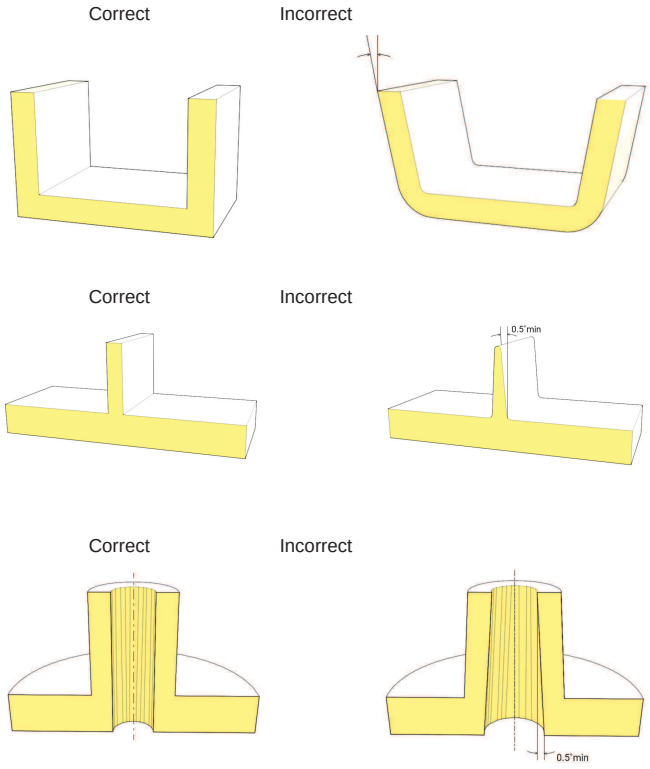
. Apply draft to all surfaces parallel to the moulding direction.

. Check walls and other features formed in both mould halves to make ejection easier and ensure an appropriate, uniform wall thickness.

. As a general rule, use the standard draft angle plus one additional degree of draft for every 0.001 inch of texture depth.

. For most materials, use a draft angle of at least half a degree. Allow one degree of draft whenever possible for easy ejection. SAN resins generally require one to two degrees of draft.

Draft (draft-angle design)



Draft-angle design guidelines.

Plastika BEVC d.o.o. I www.plastika-bevc.com I +386 (0)7 33 78 190 I info@plastika-bevc.com