Product Design

Panlite is a widely accepted engineering plastic because of its fine mechanical characteristics, wide range of temperature adaptability, and good dimensional stability. The following are typical examples of applications for practical design utilizing Panlite.

Product thickness

The thickness of molded products is usually 1-4 mm. If there is, however, any irregular wall thickness, the thick wall section sometimes sinks and bubbles are apt to show up in the center. It is therefore recommended that the rib construction should be adopted to the thick wall section. Also drastic changes of thickness should be avoided and uniformity in thickness should be maintained (Fig. 31).
Main considerations for thickness in designing are as follows.
(1) Maintain thickness as uniform as possible.
(2) Avoid drastic changes in thickness.
(3) Adopt rib construction to the thick wall section.

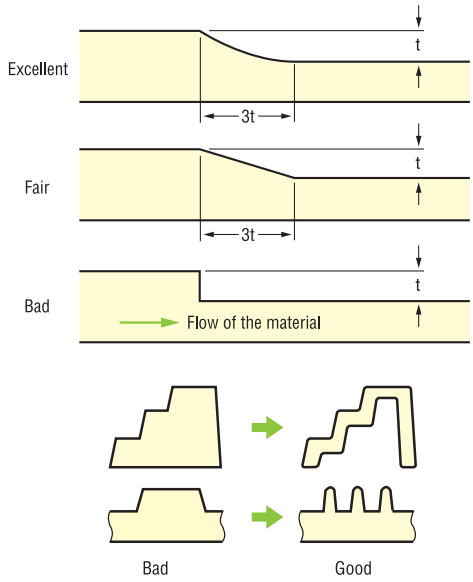
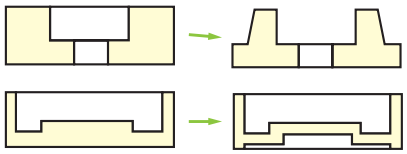


Fig. 31 Wall Thickness Change



Corner R/T

Since stress is concentrated around the corners, avoid designing sharp corners and increase the corner R/T to above 0.3R/T, or preferably above 0.5R/T.

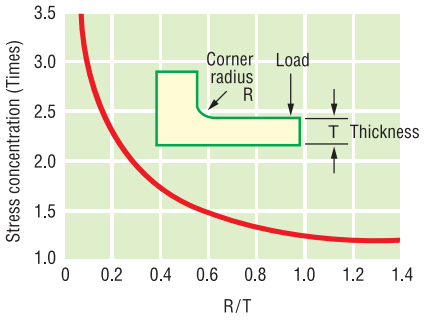


Fig. 32 Stress Concentration at the Corner Part

Rib

To reduce thickness of the designed product, rib construction is recommended as an efficient method of product reinforcement. The main considerations for rib construction design are as follows.
(1) Construction of two or more smaller ribs as opposed to a single independent rib.
(2) Lattice structure to increase strength.
(3) Reduce rib thickness to below that of the base material.
(4) R reinforcement at the foot of the rib.

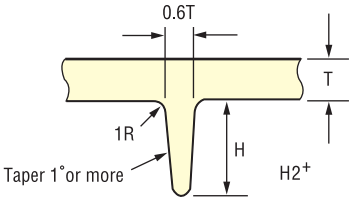
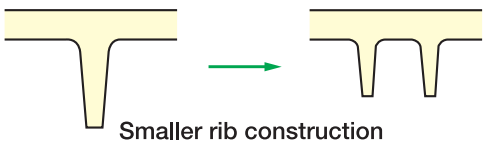


Fig. 33 Standard rib



Smaller rib construction

Lattice linkage rib

Boss design (Press-in)

Since residual stress when molded, load, and difference of thermal expansion coefficient are centered onto the screw boss and insert boss, sufficient material thickness is required when designing.
For screw bosses, it is recommended that the design inside diameter of the boss should be the effective diameter of the screw. For an insert boss, the value of the outside diameter of the insert metal "d" should be used.

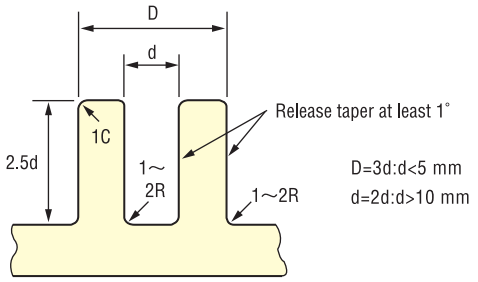


Fig. 34 Screw Boss Radius

Mold release taper

Since the mold shrinkage rate of Panlite is as low as 0.5-0.7%, sufficient mold release taper is required.
The standard taper on one side is about 1/100 (Fig. 35)
For embossing molds, a larger taper may be required depending on the roughness of the embossing.

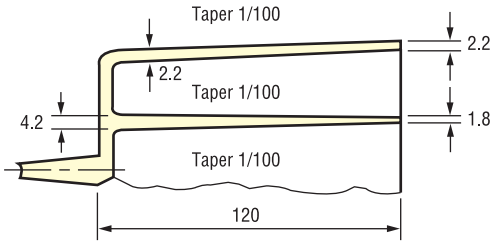


Fig. 35 Standard Mold Release Taper

Sprue

Sprue shape varies with the size of molded products and the molding machine used. Illustrated in the drawings here are standard shape.

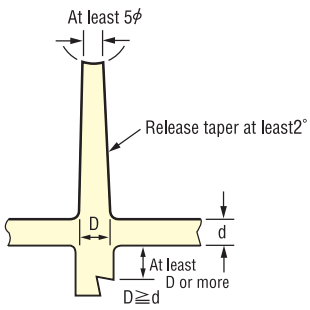
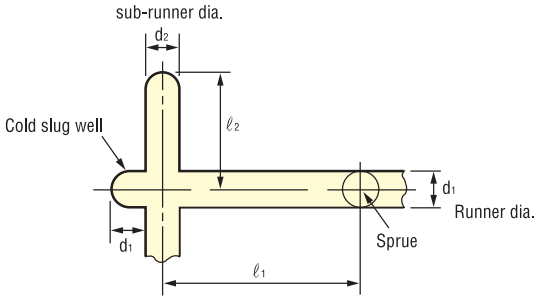


Fig. 36 Standard Sprue and Runner

Runner

Runner shape varies with the size of the molded products and the type of molding machine. The length of the runner should be kept as short as possible. In case the runner has branches, the balance of the runner should be maintained. A cold-slug well should be provided at branches and bent sections.



The runner and sub-runner should be designed in diameter and length, as recommended below. Cold-slug well should be provided at the bent section.

(mm)

Runner length ℓ1	Runner dia d1
less than 70	6
70~200	8
more than 200	more than 10

Sub-runner length ℓ2	Sub-runner dia d2
less than 70	6

Fig. 37 Standard Runner Shape

Gate

With regard to shapes and locations of the gate, consider how the resin fills, how the molded products can be easily detached, and how finishing can be facilitated without difficulty. The following are examples of typical gate shapes and designs used for Panlite.

● Tab gate
This reduces haze around the gate, jetting and residual stress.

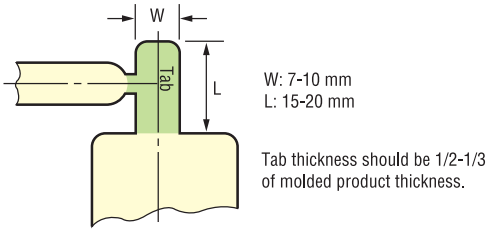


Fig. 38 Example of Standard Tab Gate

● Fan gate
This eliminates jetting.

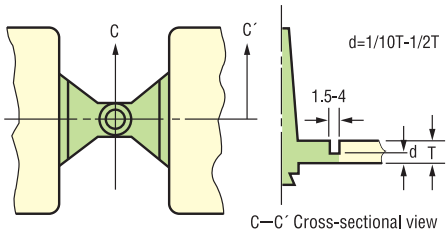
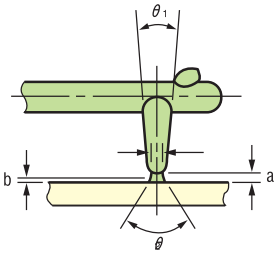


Fig. 39 Example of Standard Fan Gate

● Pin-point and submarine gates

These can detach the molded product automatically from the runner.



Symbol \ Molded product	Small product	Large product
θ_1°	20～30	20～30
θ_2°	90	60
a mm	0.6～1	1～3
b mm	0.3～0.5	0.5～2
d mm	1.0～2.0	more than 2.5

Fig. 40 Example of Standard Pin-point Gate

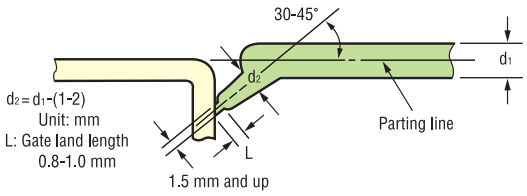


Fig. 41 Example of Standard Submarine Gate

● Ring and diaphragm gates

These eliminate the weld around the cylinder.

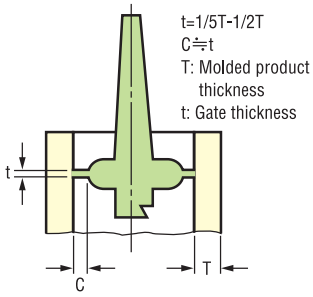


Fig. 42 Example of Standard Ring Gate

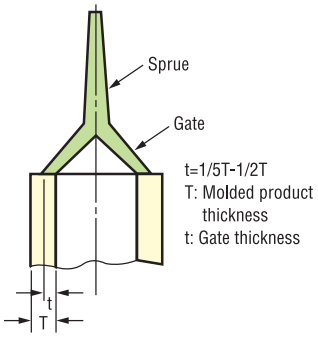


Fig. 43 Example of Standard Diaphragm Gate

Ejection

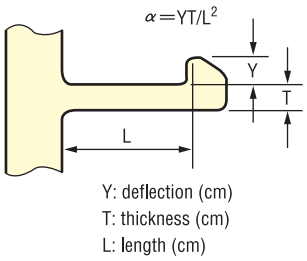
Since Panlite has a high load-deflection temperature and strength, ejection can be easily accomplished. However, when the ejection is made by force, it may cause internal distortion problems. In this case, it is recommended that the position and the number of ejector pins should be set to allow uniform ejection of the molded products.

Air vent (venting)

An air vent must be provided in order to prevent short shots and gas burns. The vent should be provided at the point at which where the gas is last pressured, such as the runner terminal or the point where the short shot or air-pocket is apt to occur.
The vent depth is 0.03mm - 0.05mm, and the width usually ranges from 5 - 10mm when provided at the parting line. Please also provide a vent near the insertion pin and ejector pin.

Design standards of snap fit parts

Bring deformation after assembly to nearly nothing (zero) so that the coefficient of strain (α) by the deformation (Y) on assembly may become lower than values shown here. The coefficient of strain (α) by the deformation on assembly can be obtained from the structure calculating formula of cantilever beam (Fig. 44). Each corner must be rounded enough to prevent cracking caused by stress concentration. If loads are applied repeatedly to these parts, use data of repeated fatigue (bending) instead of the coefficient of strain (α).



Grade	Coefficient of strain α
L-1225Y	0.020
G-3410R	0.016
G-3420R	0.012
G-3430R	0.011

Fig. 44 A Standard Snap-fit Joint

Insert

Panlite enables the insertion of very strong metals. However, since the thermal expansion coefficient of metals differs from that of Panlite, distortion may occur due to differences in cooling shrinkage, causing cracks around the insert.
In case a metal piece is inserted in molding with Panlite, if the metals are heated to about 200°C, the difference in cooling shrinkage is reduced and cracks can be prevented. In designing insert bosses the value of the outside diameter of the insert metal "d" should be used (Figure 45).

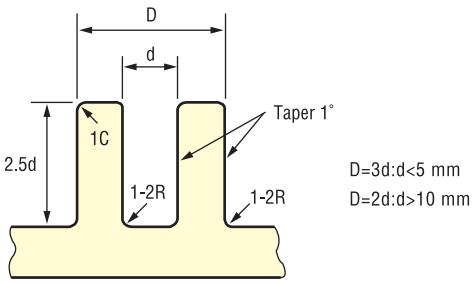


Fig. 45 Standard Insert Boss