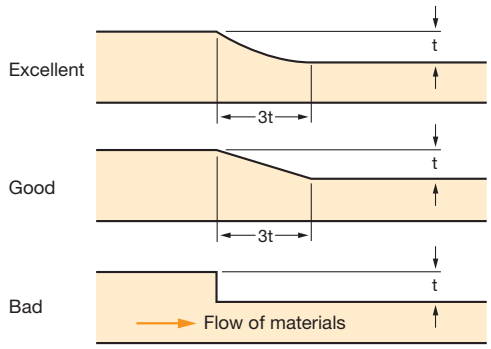
Multilon® Product Design

Multilon is used in a wide variety of fields. The following are some examples of applications, and recommendations for designs using Multilon.

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 sink, 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.

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 for thick section.



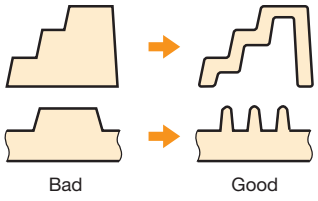
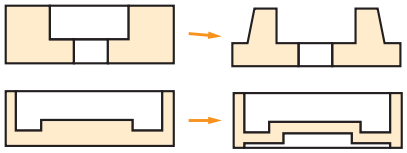


Fig.1 Wall thickness variation



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.

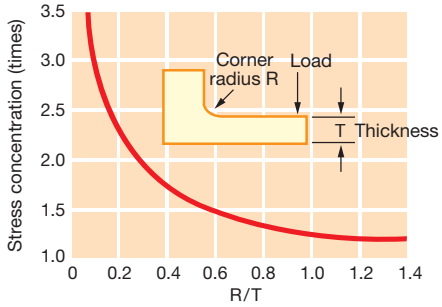


Fig.2 Stress concentration at corners

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 thick 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

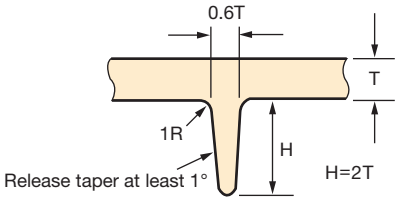
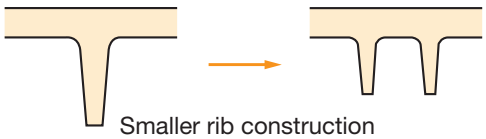
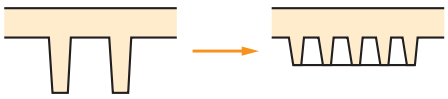


Fig.3 Standard rib



Smaller rib construction



Lattice linkage rib

Boss

Since residual stress when molded, load, and difference of thermal expansion coefficient with metal are centered onto the screw boss and insert boss, sufficient material thickness is required when designing.
For the screw boss, the inner diameter of the boss should be designed to be the pitch diameter of the screw.

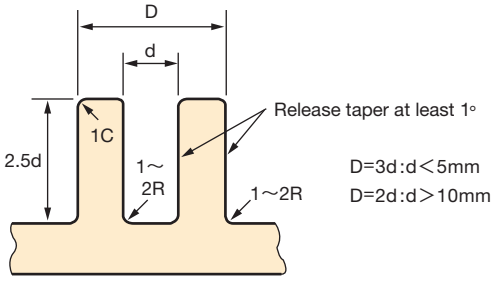


Fig.4 Standard screw boss diameter

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. 5).
For embossing molds, a larger release taper may be required, depending on the roughness of the embossing.

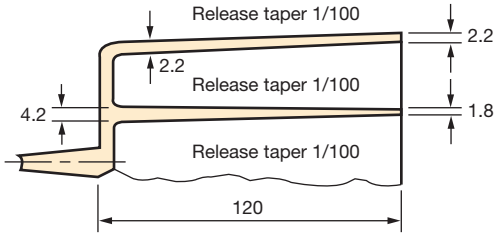


Fig.5 Standard Mold Release Taper

Sprue

Sprue shape varies with the size of molded products and the molding machine to be used. Illustrated in Figure 6 is a standard sprue shape.

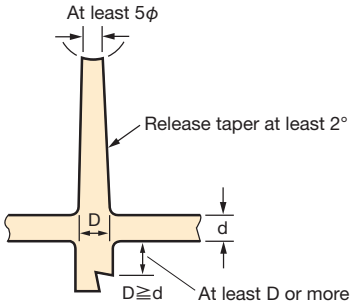
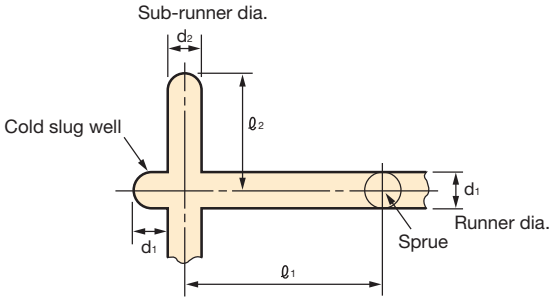


Fig.6 Standard Runner

Runner

Runner shape varies with the size of molded products and the molding machine to be used. The length of the runner should be kept as short as possible. Branched runners should be balanced. A cold-slug well should be provided for the branch and the bent section of the runner.



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 ℓ_1	Runner dia. d_1
less than 70	6
70～200	8
more than 200	more than 10

Sub-runner length ℓ_2	Sub-runner dia. d_2
less than 70	6

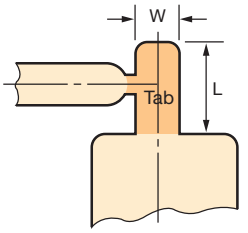
Fig.7 Standard Runner Shape

Gate

With regard to shapes and position of the gate, careful consideration should be given so that a sufficient amount of resin may be filled, molded products may be easily detached, and finishing may be done without any difficulty. The following are examples of typical gate shapes and designs used for Multilon.

● Tab gate

This reduces haze around the gate section, jetting and residual stress (Fig.8).



W : 7～10mm
L : 15～20mm

Tab thickness should be 1/2 - 1/3 of molded product thickness.

Fig.8 Example of Standard Tab Gate

● Fan gate

This eliminates jetting (Fig.9)

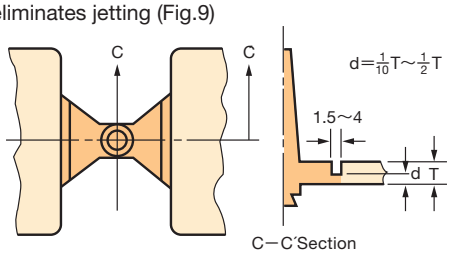
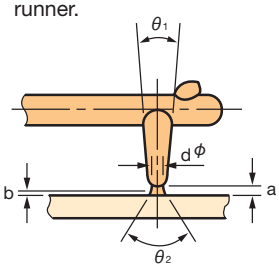


Fig.9 Example of Standard Fan Gate

● Pin-point and submarine gates

These can detach automatically molded product from the runner.



Molded product / Symbol	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.10 Example of Standard Pin-point Gate

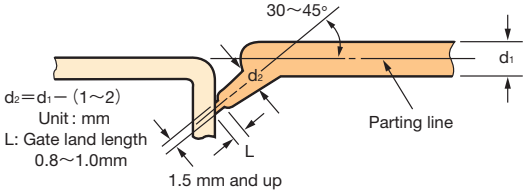


Fig.11 Example of Standard Submarine Gate

● Ring and diaphragm gates

These eliminate weld around the cylinder.

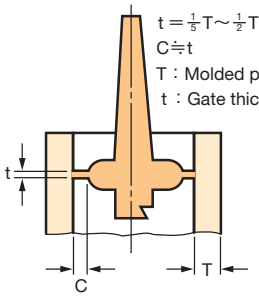


Fig.12 Example of Standard Ring Gate

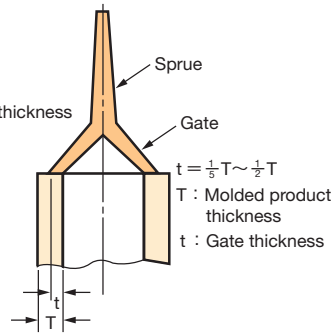


Fig.13 Example of Standard Diaphragm Gate

Ejection

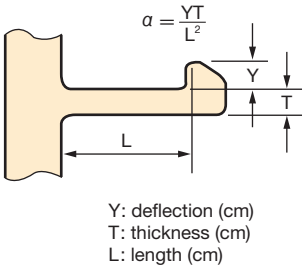
Multilon exhibits a high heat distortion temperature and strength, aiding ejection. However, when ejection is made under force, internal distortions may occur. In this case, it is recommended that the position and the number of ejector pins should be reconsidered to facilitate uniform molding ejection.

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 strain coefficient α relating to deformation on assembly can be obtained from the structural formula for a cantilever beam (Fig.14). 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.



Grades	Strain coefficient α
T-2716 T-2754 MK-1000A MK-2055	0.021
T-3750 T-2711J T-2760B T-2810R T-2830R T-2850R	0.020
T-3615Q TN-3616Q	0.019
TN-7000 TN-7295 TN-7500	0.018
TN-7570Z TN-7504 R-2010	0.017
TN-3713B	0.016
R-2020	0.014
TN-3715B R-2030	0.011
DN-7730M	0.008
RN-7740M	0.007

Fig.14 A Standard Snap-fit Joint

Insert

Multilon enables the insertion of very strong metals. However, as thermal expansion coefficient of metals differs from that of Multilon, distortions may occur due to the difference in cooling shrinkage, causing cracks around insert part.
For resins with lower cold flow like polycarbonates, distortions create large stresses that produce cracks. If the metals are heated to about 200°C, the difference in cooling shrinkage is reduced and cracks can be prevented. In designing insert boss, the outside diameter of the insert metal should be "d". (Fig.15)

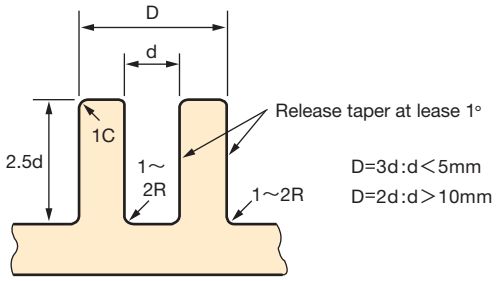


Fig.15 Standard screw boss diameter

Ultrasonic welding

Ultrasonic welding needs only a very short time of less than one second for welding and is very easy to handle. As a result, this method is becoming more and more popular. In order to obtain good bonding results, an energy director should be provided at the jointing parts of the workpiece (Fig.16). After bonding, annealing treatment should be given and residual stress be relaxed.

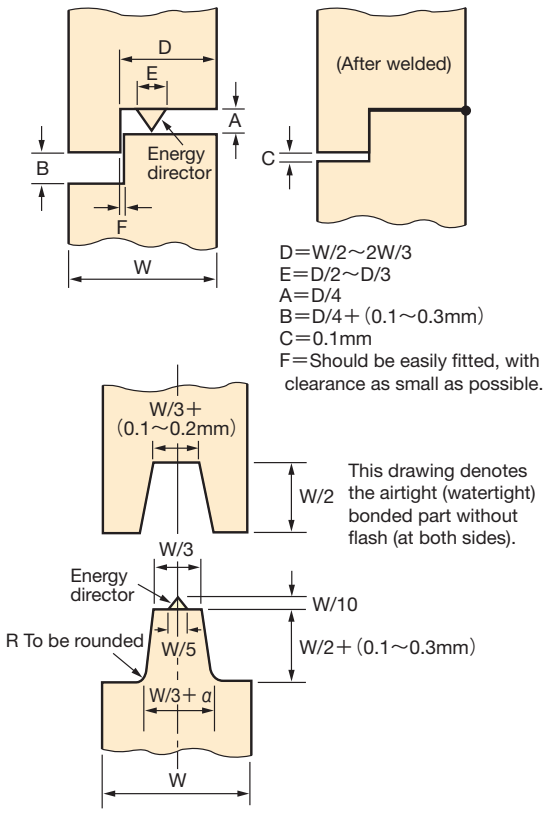


Fig.16 Joint Parts Design