

2. Processing

Drying

Commonly, ABS resin is absorbent (hygroscopic) and absorbs moisture in proportion to environmental humidity. The absorbing process of moisture is reversible process. Therefore, wetted pellets can be removed moisture to environmental air with lower humidity. Dried pellets should absorb moisture until the amount touches equilibrium amount with the moisture in the air. The absorbing moisture content depends on the relative humidity in the air, how long the resin was exposed.

While “TOYOLAC” ABS resin is exposed to humidity, the moisture is absorbed onto surface and into inside of the pellets itself, recycled materials and molded parts. Typical equilibrium moisture of “TOYOLAC” general-purpose grade is around 0.2~0.3% at 23 °C , 50%RH, and 0.5~0.6% at 40 °C, 95%RH. The rate of absorbed moisture is depending on pellet size, shape and environmental temperature.

Non-dried ABS resin can cause silver streaking problem on molded parts. The recommendable moisture content for “TOYOLAC” general-purpose grades is less than 0.1%, more desirable is 0.05%. Generally, below drying conditions are recommended.

Drying Temperature : 80 ~ 90 °C
Drying Time : 3 ~ 5 hours

Typical drying variables by using oven with internal air circulation are shown Figure 2-1. It shows that higher moisture content in initial will be required longer drying time.

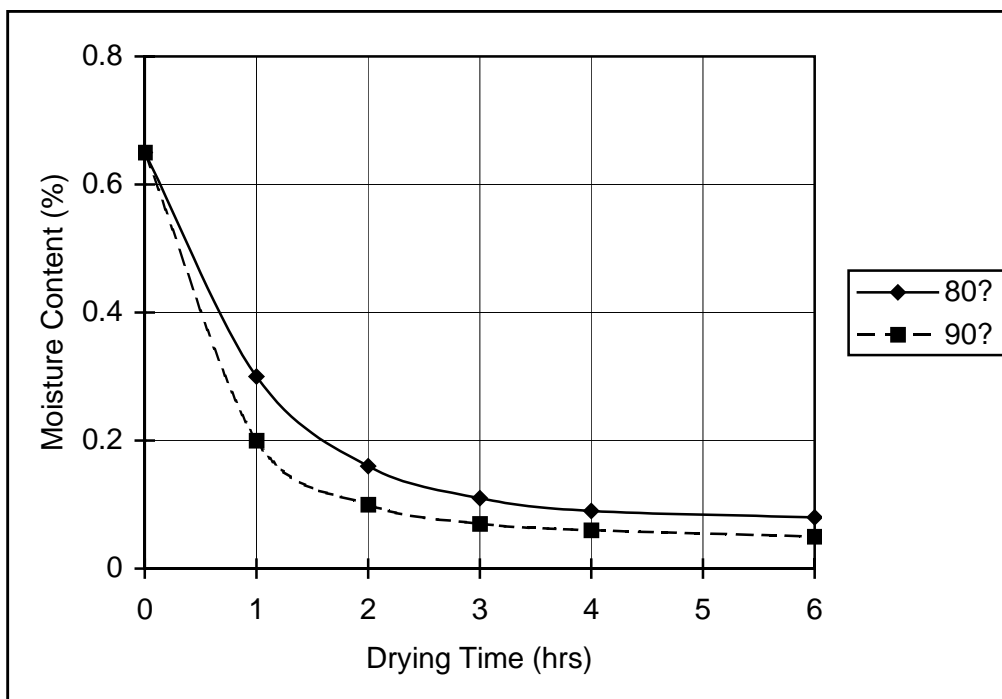


Fig 2-1 Drying Variables of “TOYOLAC” General Purpose Grade.

Mold Shrinkage

Generally, mold shrinkage is depending on actual molding conditions and dimension of molded parts. The mold shrinkage rate of “TOYOLAC” is shown as below table 1-4.

Table 1-4 Mold Shrinkage Rate of “TOYOLAC” GP Grades

Molding Temp.	Grades Measuring Point		“TOYOLAC”					
			250 -X10	500 -322	700 -314	700 -X01	100 -322	100 -X01
230°C	T.D.	A	0.44%	0.44%	0.46%	0.47%	0.47%	0.50%
		B	0.50%	0.49%	0.52%	0.53%	0.53%	0.53%
	M.D.	C	0.47%	0.47%	0.49%	0.50%	0.50%	0.54%
250°C	T.D.	A	0.50%	0.47%	0.49%	0.51%	0.50%	0.54%
		B	0.54%	0.53%	0.55%	0.57%	0.57%	0.58%
	M.D.	C	0.50%	0.50%	0.52%	0.53%	0.54%	0.59%

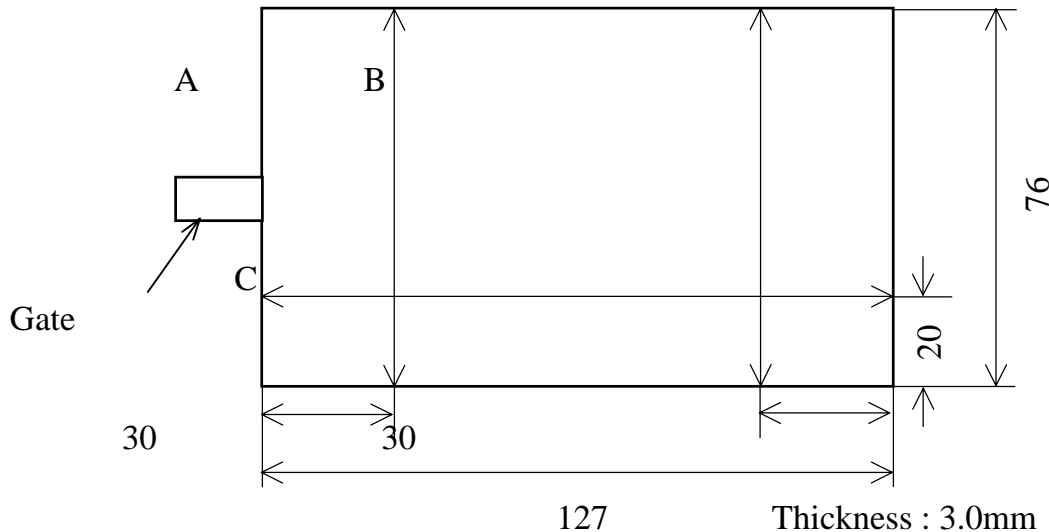
Those data are typical values that have been obtained using test pieces shown below figure. Therefore, it should be made own tests to determine the suitability of the mold shrinkage rate for the design.

<Molding Conditions>

- Molding Machine : Toshiba Machinery, IS50A
- Molding Temperature : 230, 250 °C
- Mold Temperature : 60 °C
- Injection Speed : Medium (FCV B-0 : fill-in time 2 sec.)
- Injection Pressure : Min. injection pressure + 0.98MPa
- Holding Time : 13 sec.
- Cooling Time : 30 sec.
- Mold Dimension : Refer to below figure

<Measurement method of test piece dimension>

Measure test piece dimension after 24 hours remaining under 23 °C , 50%RH



Spiral Flow Length

“TOYOLAC” ABS resin has excellent flow ability. The flow ability of “TOYOLAC” general purpose grades that are evaluated as the Spiral Flow Length, is shown as below figure for a function of the injection temperature with injection pressure as parameter. It is useful for comparing the flow ability of products under the same conditions even if this test has not been standardized.

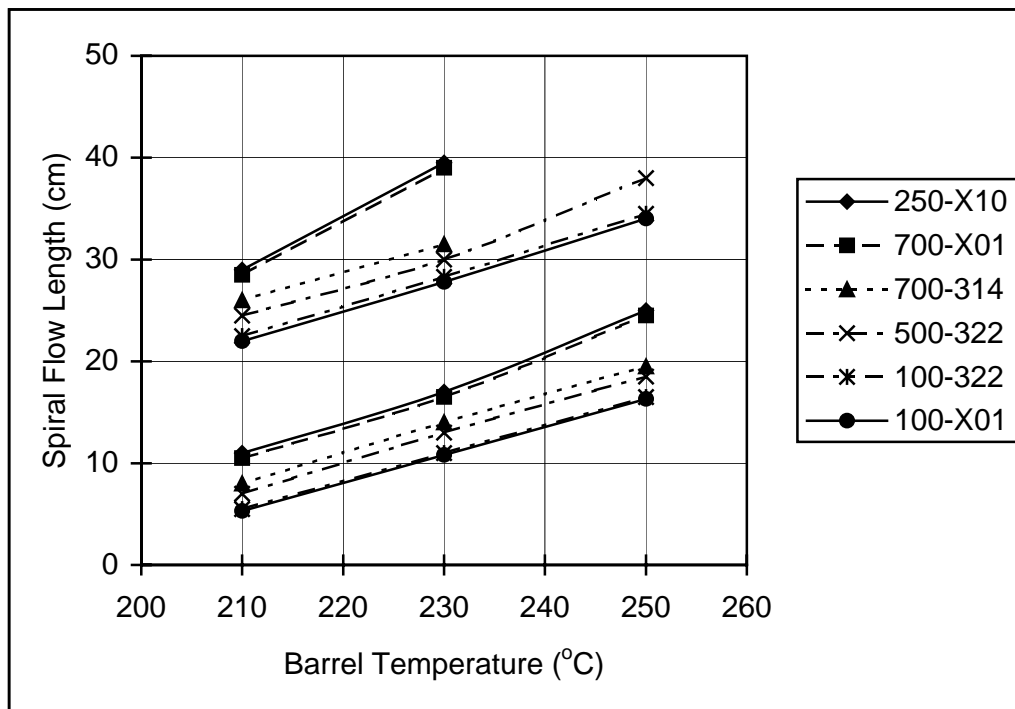


Fig 8. Spiral Flow Length of “TOYOLAC” GP Grades.

<Molding Conditions>

Molding Machine	: Toshiba Machinery, IS50A
Molding Temperature	: 210, 230, 250°C
Mold Temperature	: 60 °C
Injection Speed	: Medium (FCV B-0 : fill-in time 2 sec.)
Holding Time	: 13 sec.
Cooling Time	: 20 sec.
Mold Dimension	: 10W × 2mmt (Spiral Flow)

3. Molding (Injection)

Injection Temperature

Generally, the barrel temperature of injection molding machine should increase from the hopper to the nozzle gradually. “TOYOLAC” General Purpose Grades start softening around 90 ~ 110°C although it is depending on grades. Typical barrel setting temperature is shown as below.

Table 3-1 Typical Barrel Setting Temp. of “TOYOLAC” General Purpose Grades, and Flame Retardant Toyolac 844V-X05, 824V-X01, 834V-X01, NH82

Nozzle	Zone-4	Zone-3	Zone-2	Zone-1	Hopper
230 ~240 °C	230 ~240 °C	230 ~240 °C	220 ~230 °C	220 ~230 °C	210 ~220 °C

Table 3-2 Typical Barrel Setting Temp. of “TOYOLAC” Flame Retardant Toyolac 884-X01, 828-X01

Nozzle	Zone-4	Zone-3	Zone-2	Zone-1	Hopper
200 ~210 °C	200 ~210 °C	200 ~210 °C	190 ~200 °C	190 ~200 °C	180 ~190 °C

Table 3-3 Typical Barrel Setting Temp. of “TOYOLAC” High Heat Grades

Nozzle	Zone-4	Zone-3	Zone-2	Zone-1	Hopper
250 ~260 °C	250 ~260 °C	250 ~260 °C	240 ~250 °C	240 ~250 °C	240 ~250 °C

Table 3-4 Typical Barrel Setting Temp. of “TOYOLAC” Glass Fibre Grades

Nozzle	Zone-4	Zone-3	Zone-2	Zone-1	Hopper
240 ~250 °C	240 ~250 °C	240 ~250 °C	240 ~250 °C	230 ~240 °C	230 ~240 °C

It should be properly controlled according to the injection molding machines, the shapes and size of the products, and the mold structure. Temperature in excess of above recommended could result of discoloration or burn marks troubles. Those troubles are a sign of damage to the material. Melt temperature of resin should be between 230°C and 250°C. It should be checked frequently and maintained within above recommended range to prevent defect of appearance and mechanical properties.

If shutdown is required, remove the material from the machine and purge out completely to avoid burning trouble.

Injection Speed & Pressure

Injection speeds will be depending on products shape, gate structure and runner dimensions. Basically moderate injection speed is preferable in order to prevent orientation of rubber particles due to excessive shear.

Injection pressure should be controlled to mold full parts consistently with acceptable appearance. Many parameters affects injection pressure, such as injection temperature, products shape, nozzle and gate size, runner dimensions and mold temperature. Typical injection pressure range is 70~140MPa for “TOYOLAC” General Purpose Grades. It is important that injection pressure should drop off to holding pressure after fill-up immediately.

Mold Temperature

The mold temperature affects the surface quality and the level of residual stress in the molded products. To provide a molded product having excellent surface finish and less residual stress, the mold temperature should be controlled as high as possible, ranging between 40°C ~ 80°C. However, higher mold temperature may cause longer cycle time and warpage problem. It should be taken attention excessive mold temperature.

Purging

General maintenance and equipment cleaning should include frequent purging with natural color ABS resin or AS resin. If prolonged shut-down is required, reduce barrel temperature less than 150°C, remove the material from the injection machine and purge with natural ABS resin or AS resin. Continue this operation until hopper is empty throughout and confirm barrel temperature has been dropped less than 150°C.

Regrind

Runners, sprues and shot-shots of “TOYOLAC” ABS resin molded under proper molding conditions can be used for recycle materials. Those non-degraded regrind up to a 20% can be reprocessed with fresh pellets of the same grade. Please do not mix it up with other grades of “TOYOLAC” ABS resin or other plastics. And dry it up before reprocessing.

