

***“TOYOLAC”* FRTP Resin Series**

TECHNICAL GUIDE

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1. INTRODUCTION

“TOYOLAC” FRTP series are designed and developed to meet the need of high rigidity requirement of plastic parts. To produce glass fibre reinforced grade, glass fibre is added into ABS polymer or AS copolymer. Addition of glass fibre improves the rigidity, hardness, dimensional stability and heat resistant ability of ABS and AS copolymer.

Below are the specialties of “TOYOLAC” FRTP series:

1. Enable user to achieve high precision moulded parts as FRTP has a smaller shrinkage rate and thus they are dimensionally stable.
2. FRTP has excellent thermal distortion property as they are rigid and have higher heat distortion temperature level.
3. FRTP is allowed to be used outdoor as it has a good weather resistant ability.

2. FEATURE OF “TOYOLAC” FRTP SERIES

“TOYOLAC” FRTP ABS resin are categorised as in *Table 1*.

Table 1: Categories of “TOYOLAC” FRTP Resin

Types	Grade	Features
Glass Fibre Reinforced	100G-10	10% Glass Fibre Reinforced ABS
	100G-20	20% Glass Fibre Reinforced ABS
	100G-30	30% Glass Fibre Reinforced ABS
	100G-10T1	10% Glass Fibre Reinforced ABS, High flow
	ASG-10	10% Glass Fibre Reinforced AS
	ASG-20	20% Glass Fibre Reinforced AS
	ASG-30	30% Glass Fibre Reinforced AS
	ASG-20 HF	20% Glass Fibre Reinforced AS, High flow
	ASG-30 HF	30% Glass Fibre Reinforced AS, High flow

Each user of material or design or both should make his own tests to determine the suitability of the material or any material for the design, as well as the suitability of the material or design or both his own particular use.

3. APPLICATIONS OF “TOYOLAC” FRTP SERIES

“TOYOLAC” Glass Fibre Reinforced ABS Application

Type	Typical Applications
100G-10	Structural Parts Camera, Audio Products, Printer & other OA Machines, etc.
100G-20	
100G-30	

“TOYOLAC” Glass Fibre Reinforced AS Application

Type	Typical Applications
ASG-10	Structural Parts of Electrical Goods Components, Air-Conditioner Cooling Fan (Cross-Flow Fan, Propeller Fan & etc.), Reel for Pan-Cake of Magnetic Tapes & etc.
ASG-20	
ASG-30	

Propeller Fan



Cross-Flow Fan



Characteristic

- Good Mouldability
 - Flowability
- Easy Handling
 - Less Power
- Smooth Appearance

4. TYPICAL PHYSICAL PROPERTIES OF “TOYOLAC” FRTP SERIES

Table 2a: Typical Physical Properties of “TOYOLAC” Glass Fiber Reinforced ABS resin

GLASS FIBRE REINFORCED GRADE 纤维强化型							
Property 代表物性	Test Method 试验法	Test Condition 试验条件	Units 单位	Glass Fiber Reinforced ABS Resin 玻璃纤维强化 ABS 树脂			High Flow Glass Fiber Reinforced ABS Resin 高流动玻璃 纤维强化 ABS 树脂
			Type 型号	100G-10	100G-20	100G-30	100G-10T1
ISO STANDARD							
Melt Flow Rate 流动系数	ISO 1133	240°C/10 kg	g/10min	24	16	13	45
Charpy Impact Strength (notched) 缺口冲击强度	ISO 179/1eA	23°C / 50 %RH	kJ/m ²	9	7	5	9
Deflection Temperature Under Load 热变形温度	ISO 75	1.8 MPa / 120°C/hr	°C	97	101	103	97
Tensile Strength 引张强度;降伏点	ISO 527	5 mm/min	MPa	75	95	107	68
Tensile Elongation at Break 拉伸伸长率			%	>2	>2	>2	>2
Tensile Modulus 拉伸模数		1 mm/min	MPa	5100	7300	9600	4200
Flexural Strength 弯曲强度	ISO 178	2 mm/min	MPa	129	156	174	110
Flexural Modulus 弯曲模数				4600	6600	8700	4000
Density 比重	ISO 1183	23°C	kg/m ³	1110	1180	1260	1110
Glass Content 玻纤含量	Toray Method 东丽法	-	%	10	20	30	10
Flammability 燃烧性	UL94 File No. E41797			HB	HB	HB	HB

Table 2b: Typical Physical Properties of “TOYOLAC” Glass Fiber Reinforced AS resin

GLASS FIBRE REINFORCED GRADE 纤维强化型									
Property 代表物性	Test Method 试验法	Test Condition 试验条件	Units 单位		Glass Fiber Reinforced AS Resin 玻璃纤维强化 AS 树脂			High Flow Glass Fiber Reinforced ABS Resin 高流动 玻璃纤维强化 AS 树脂	
			Type 型号	ASG-10	ASG-20	ASG-30	ASG-20 HF	ASG-30 HF	
ISO STANDARD									
Melt Flow Rate 流动系数	ISO 1133	240°C / 10 kg	g/10min	32	22	16	37	29	
Charpy Impact Strength (notched) 缺口冲击强度	ISO 179/1eA	23°C / 50 %RH	kJ/m ²	5	5	5	5	5	
Deflection Temperature Under Load 热变形温度	ISO 75	1.8 MPa / 120°C/hr	°C	95	106	107	105	106	
Tensile Strength 引张强度;降伏点	ISO 527	5 mm/min	MPa	93	112	122	107	114	
Tensile Elongation at Break 拉伸伸长率			%	>2	>2	>2	>2	>1	
Tensile Modulus 拉伸模数			MPa	6300	8800	11300	8400	11200	
Flexural Strength 弯曲强度	ISO 178	2 mm/min	MPa	136	172	185	156	185	
Flexural Modulus 弯曲模数				5800	7900	10200	7800	10500	
Density 比重	ISO 1183	23°C	kg/m ³	1150	1220	1300	1210	1300	
Glass Content 玻纤含量	Toray Method 东丽法	-	%	10	20	30	20	30	
Flammability 燃烧性	UL94 File No. E41797			HB	HB	HB	HB	HB	

Note: The above values are typical data for the products under specific test conditions and not intended for use as limiting specifications.

「以上数据谨代表在特定条件下所得的测定值的代表例」

Flexural Properties

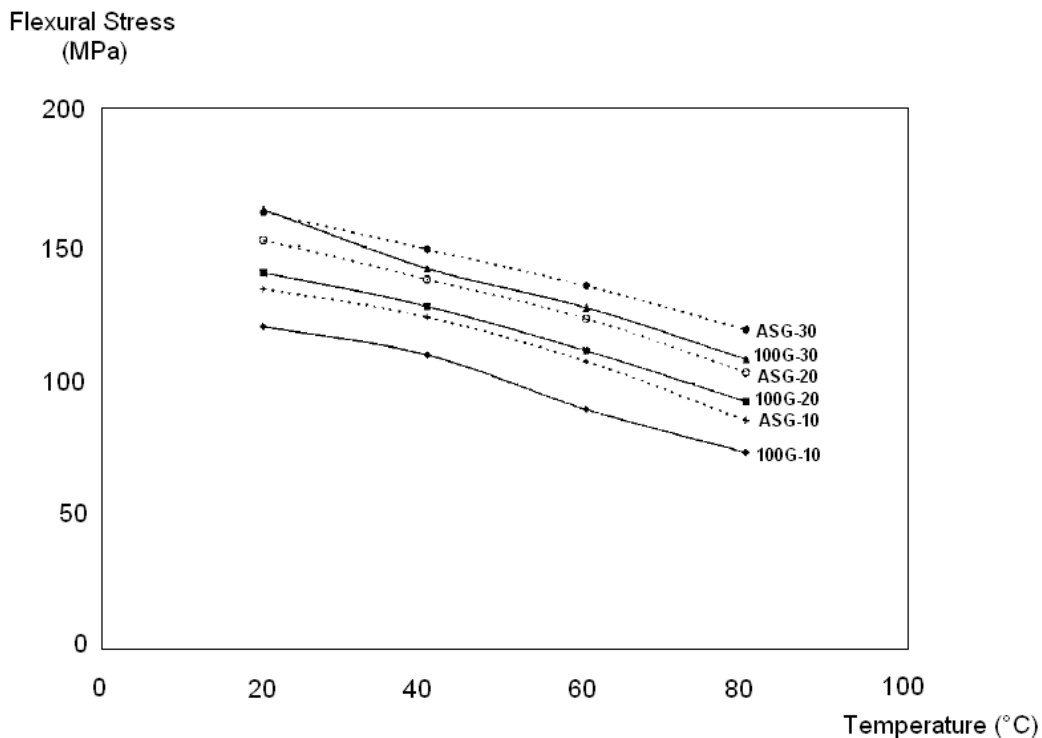


Figure 1: Flexural Stress versus Temperature

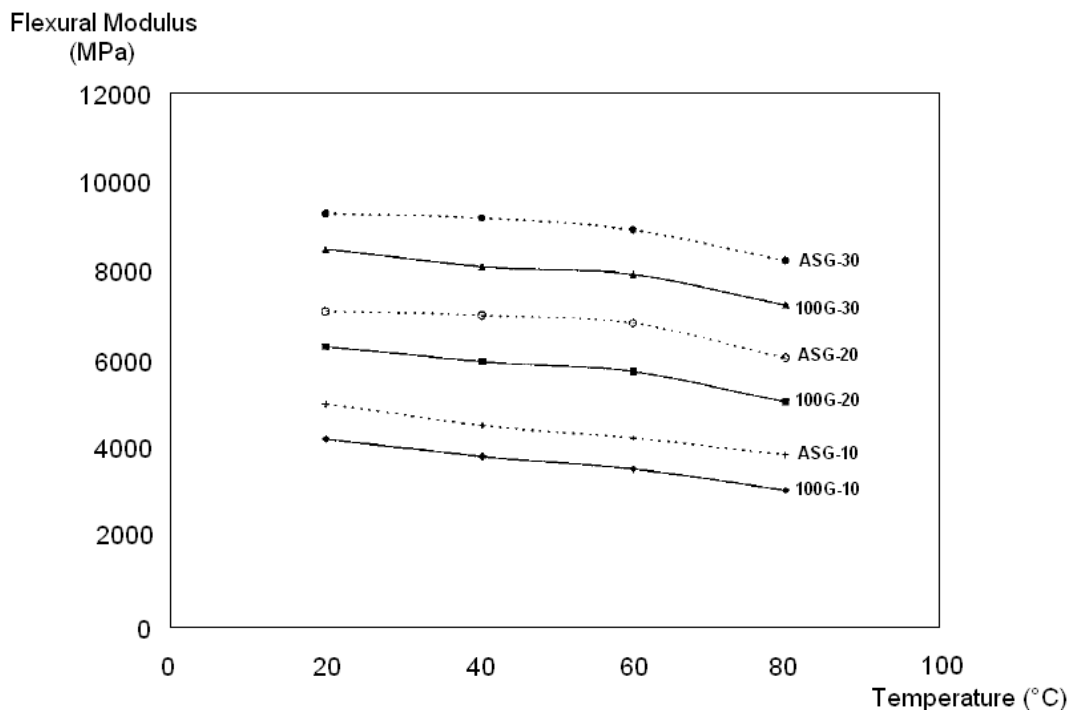


Figure 2: Flexural Modulus versus Temperature

5. PROCESSING

Drying

ABS resin is hygroscopic in which moisture absorption occurs in proportion to environmental humidity. The water absorption process is a reversible process. Moisture of wet pellets will dissipate to the environment of lower humidity whereas dry pellets will absorb moisture to the amount touches equilibrium amount with the moisture in the air. The moisture absorption content depends on the relative humidity in the air and the period of time the resin was exposed. While “TOYOLAC” FRTP resin is exposed to humid, the moisture is absorbed onto surface and into the pellets itself, recycled materials or moulded parts. Typical equilibrium moisture of “TOYOLAC” FRTP grade is around 0.2~0.3% at 23°C, 50%RH, and 0.5~0.6% at 40°C, 95%RH. The moisture absorption rate depends on pellet size, shape and environmental temperature. Non-dried ABS resin can cause silver streak problem on moulded parts. The recommendable moisture content for “TOYOLAC” FRTP grades is less than 0.1%, more desirable is 0.05%. Generally, below drying conditions are recommended.

Drying Temperature: 80 ~ 90 °C
Drying Time: 2 ~ 4 hrs

Mould Shrinkage

Measure position:

Calculation:

Flow direction = $100 \cdot (L_m - L_s) / L_m$

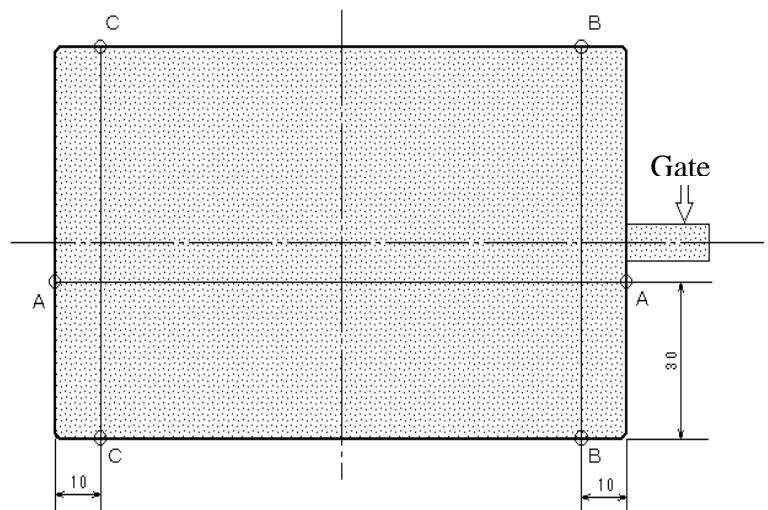
Transverse direction = $100 \cdot (W_m - W_s) / W_m$

L_m = Length of mold

W_m = Width of mold

L_s = Length of test plate after conditioning

W_s = Width of test plate after conditioning



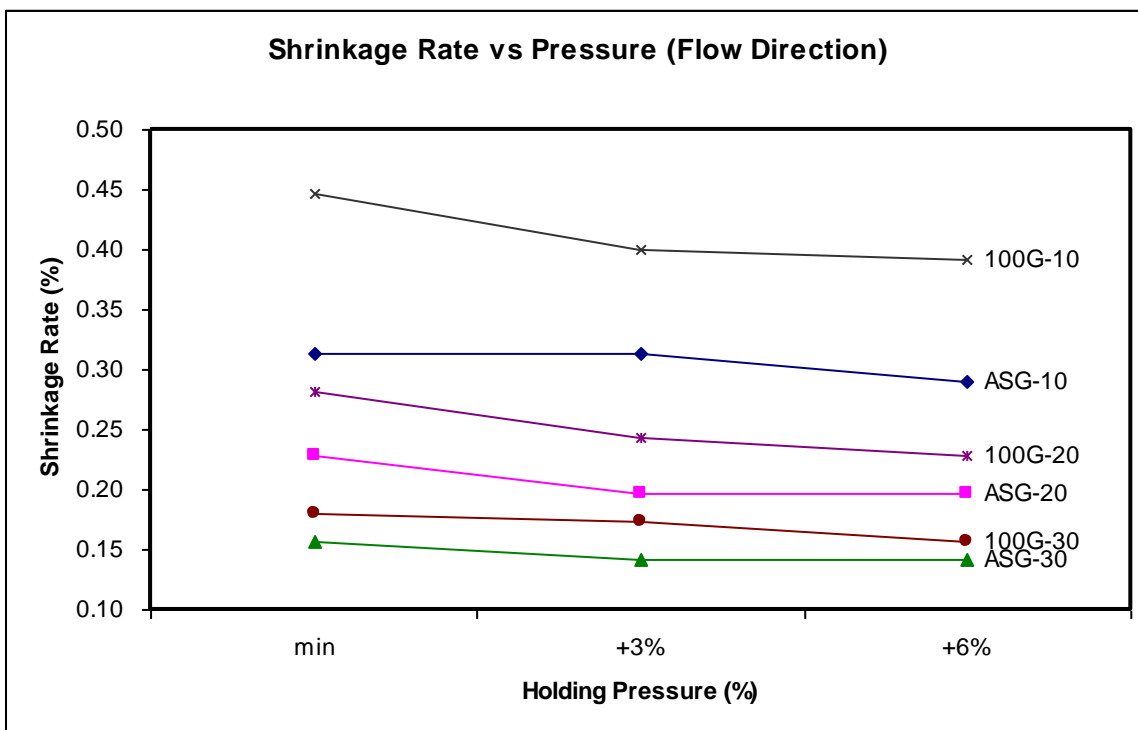


Figure 3: Shrinkage Rate versus Holding Pressure

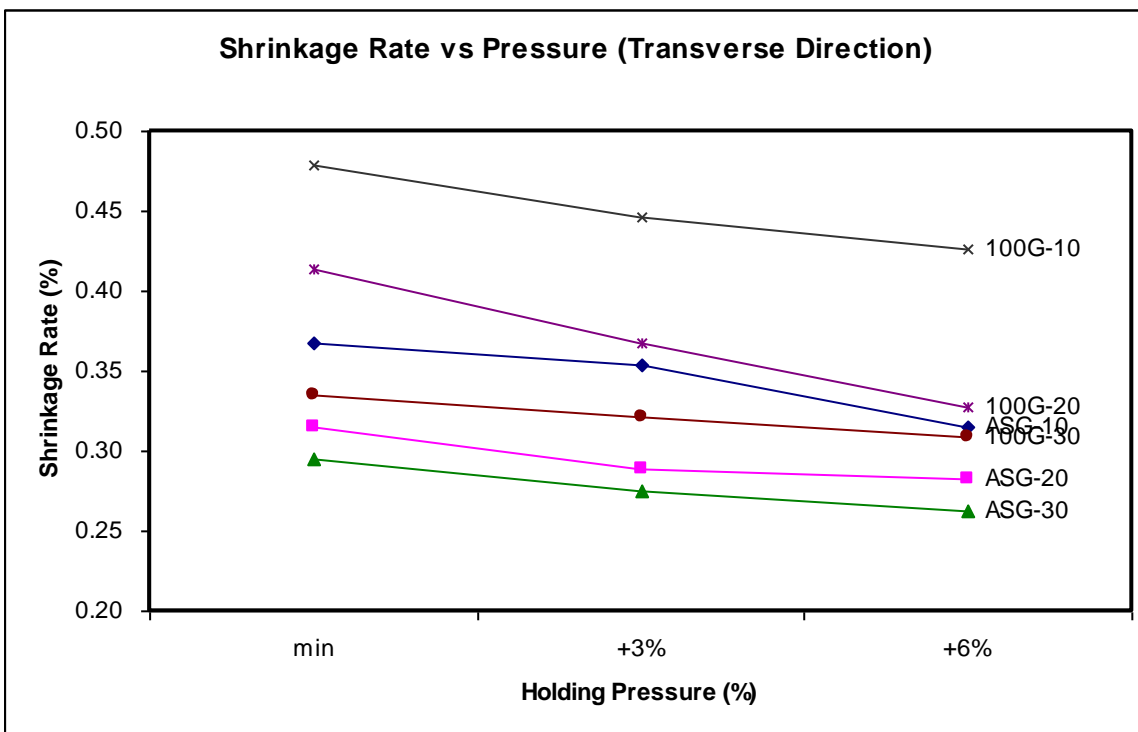


Figure 4: Shrinkage Rate versus Holding Pressure

Moulding Condition:

1. Moulding Machine : Nissei ES4000-36E
2. Moulding Temperature : 250°C
3. Mould Temperature : 80°C
4. Holding Pressure : Minimum pressure, +3%, +6%
5. Test Piece Dimension : 127 x 76 x 3t mm
6. Measure Method : Measure test piece dimension after 24 hours conditioning at 23°C, 50% RH

Linear Expansion Coefficient

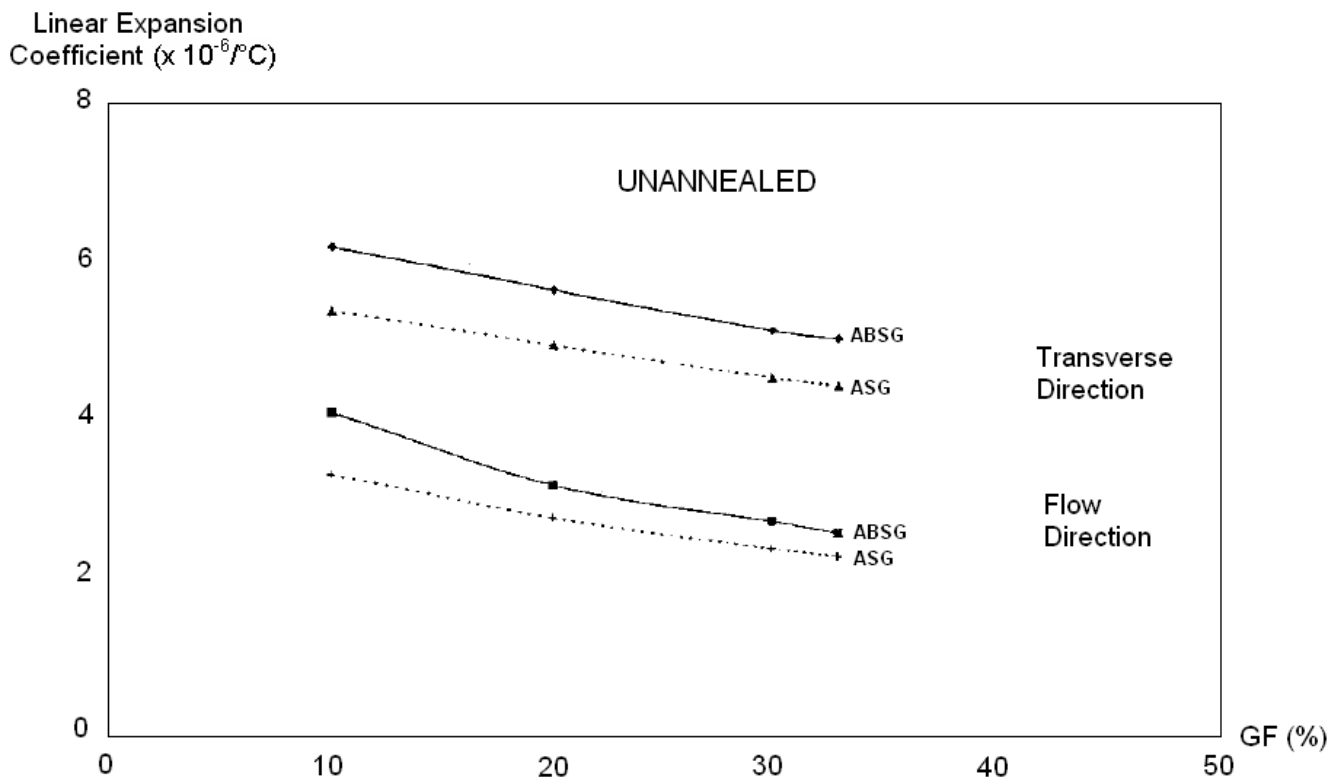


Figure 5: Linear Expansion Coefficient versus Glass Fibre Content

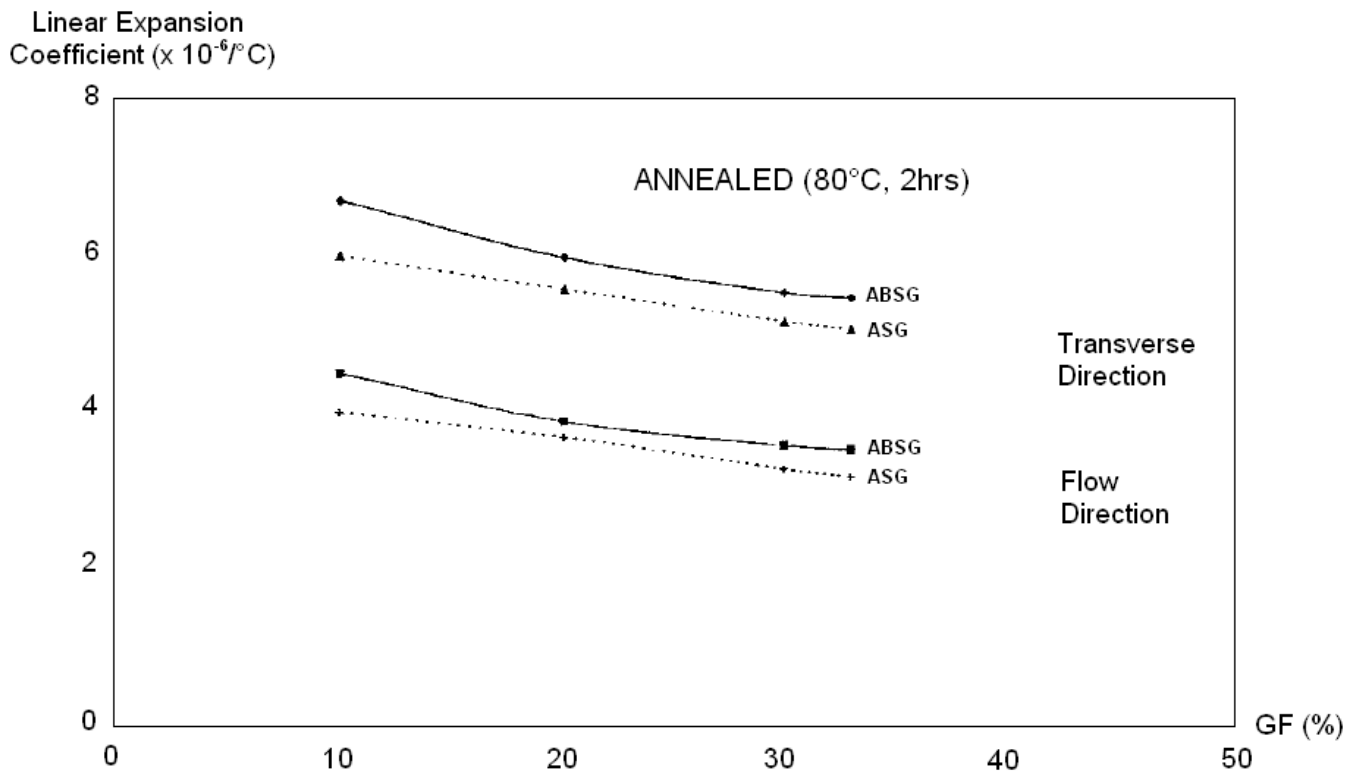


Figure 6: Linear Expansion Coefficient versus Glass Fibre Content

Moulding Condition:

1. Moulding Machine : Toshiba IS-50A
2. Moulding Temperature : 250°C
3. Mould Temperature : 80°C
4. Injection Speed : E-0 (*higher speed*)
5. Test Piece Dimension : 220 x 70 x 2t mm (*one pin point gate*)

6. INJECTION MOULDING

Injection Temperature

The barrel temperature of injection moulding machine should increase from the hopper to the nozzle gradually.

Table 3: Recommended Barrel Setting Temperature

Nozzle (°C)	Zone 4 (°C)	Zone 3 (°C)	Zone 2 (°C)	Zone 1 (°C)	Feed Zone (°C)
250 ~ 270	250 ~ 270	250 ~ 270	240 ~ 260	240 ~ 260	240 ~ 260

It should be properly controlled according to the injection moulding machines, the shapes and size of the products, and the mould 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 250°C and 270°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.

Mould Temperature

The mould temperature affects the surface quality and the level of residual stress in the moulded products. To provide moulded product having excellent surface finish and less residual stress, the mould temperature should be controlled as high as possible, ranging between 70°C ~ 90°C. However, higher mould temperature may cause longer cycle time and warpage problem. It should be taken attention excessive mould temperature.

Injection Speed & Pressure

Injection speeds will be depending on products shape, gate structure and runner dimensions. Moderate injection speed is preferable in order to prevent orientation of rubber particles due to excessive shear. Injection pressure should be controlled to mould full parts consistently with acceptable appearance. Many parameters affects injection pressure, such as injection temperature, products shape, nozzle and gate size, runner dimensions and mould

temperature. Typical injection pressure range is 70~140MPa for “TOYOLAC” FRTP Grades. It is important that injection pressure should drop off to holding pressure after fill-up immediately.

Purging

General maintenance and equipment cleaning should include frequent purging with natural colour 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” FRTP resin moulded under proper moulding 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” resin or other plastics. And dry it up before reprocessing.

Important Notes:

1. In as much as Toray Plastics (Malaysia) Sdn. Bhd. has no control over the use to which other may put this material, it does not guarantee that the same result as those described herein will be obtained. Nor does Toray Plastics (Malaysia) Sdn. Bhd. guarantee the effectiveness or safety of any possible or suggested design for articles of manufacturer as illustrated herein by any photographs, technical drawing and the like. Each user of the material or design or both should make his own tests to determine the suitability of the material or any material for the design, as well as suitability or suggested uses of the material or design described herein are not to be construed as constituting a license under any Toray Plastics (Malaysia) Sdn. Bhd. patent covering such use or as recommendations for use of such material or design in infringement of any patent.

2. The material described here is not recommended for medical application involving any implantation inside the human body. Material Safety Data Sheet (MSDS) for the materials concerned should be referred to before any use.