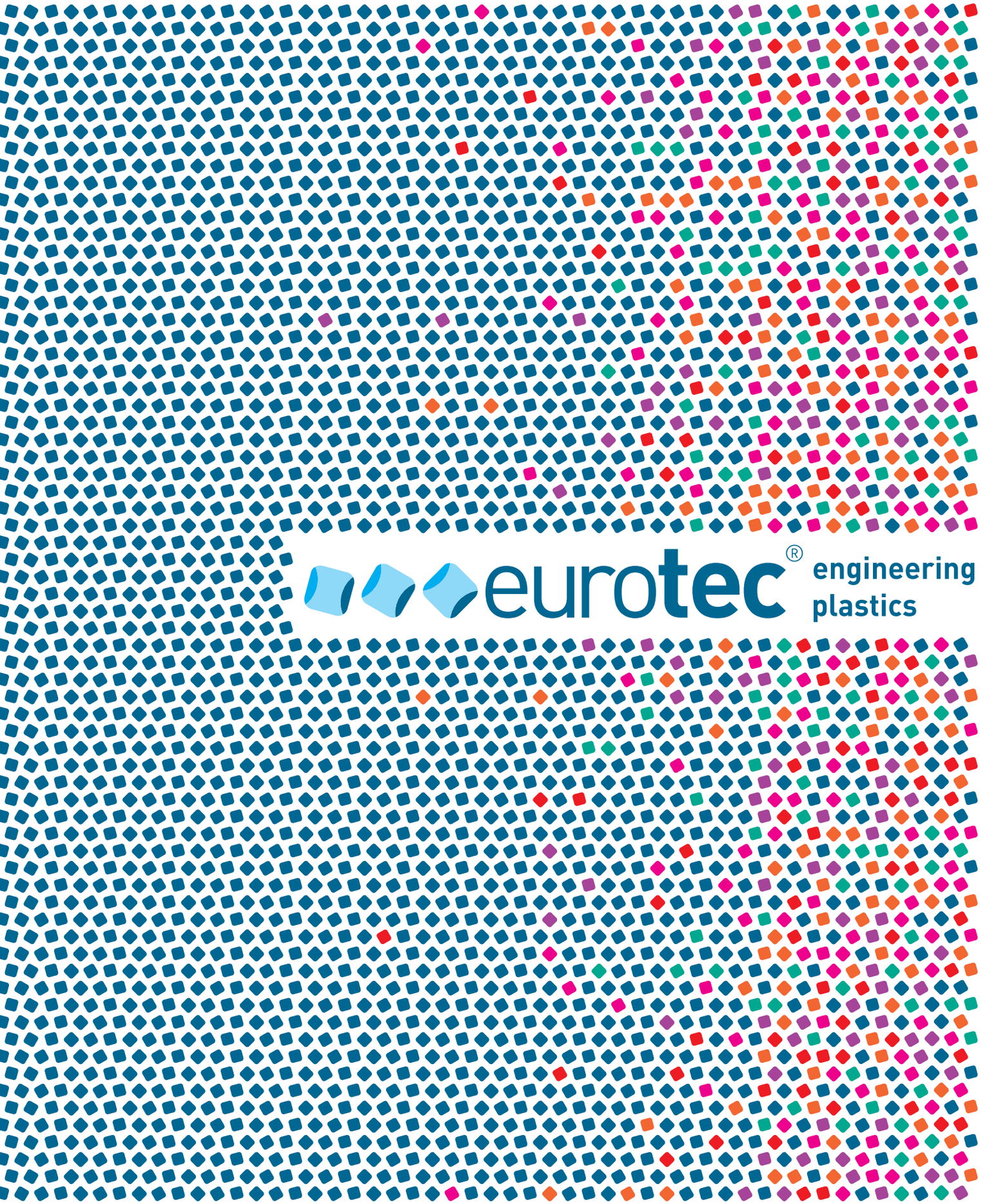
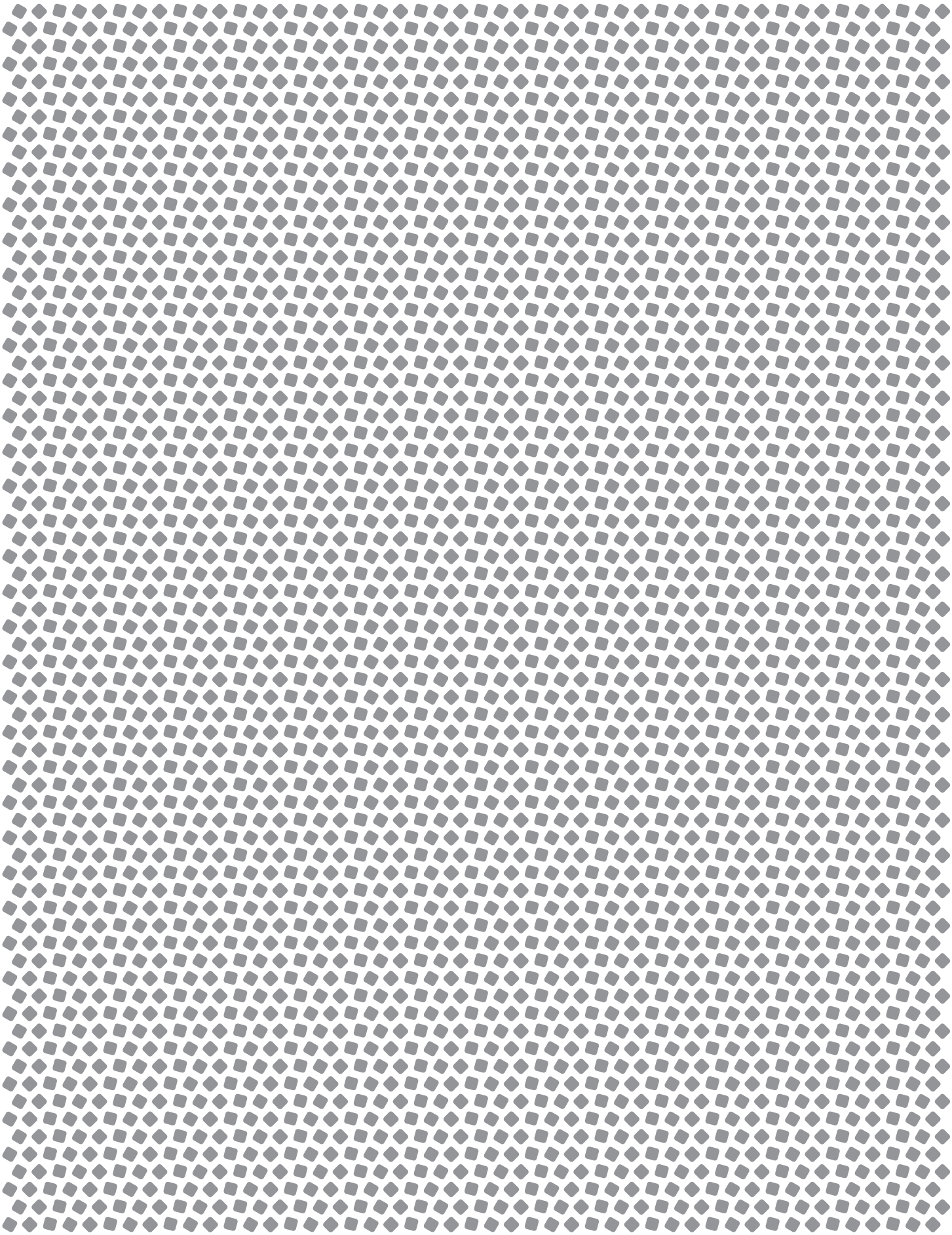

eurotec®
engineering
plastics



exclusively engineering plastics


Tecomid® PA
Tecomid® HT PPA
Tecodur® PBT
Tecopet® PET
Tecotek® PC
Tecolen® PP
Tecoform® POM

Eurotec is an independent compounder of engineering plastics that creates and offers intelligent solutions based on innovative products and tailor made services.

Eurotec, by targeting continuous improvement and full customer satisfaction;

Aims continuity in quality as the most important principle.

Provides solutions to customer needs by involvement of motivated, experienced and dynamic team.

Use latest technology for reliable production and R&D operations.

Forms all necessary preventive actions by using efficient resources and producing environmentally friendly products to protect our environment.

Follows all new trends in the industry and reacts immediately by developing new processes and products.

Presents competitive products in standard grades and also generates creative solutions for special demands.

Responds quickly for urgent orders by flexible production planning system.

Generates alternative logistics solutions for flawless and on-time deliveries.

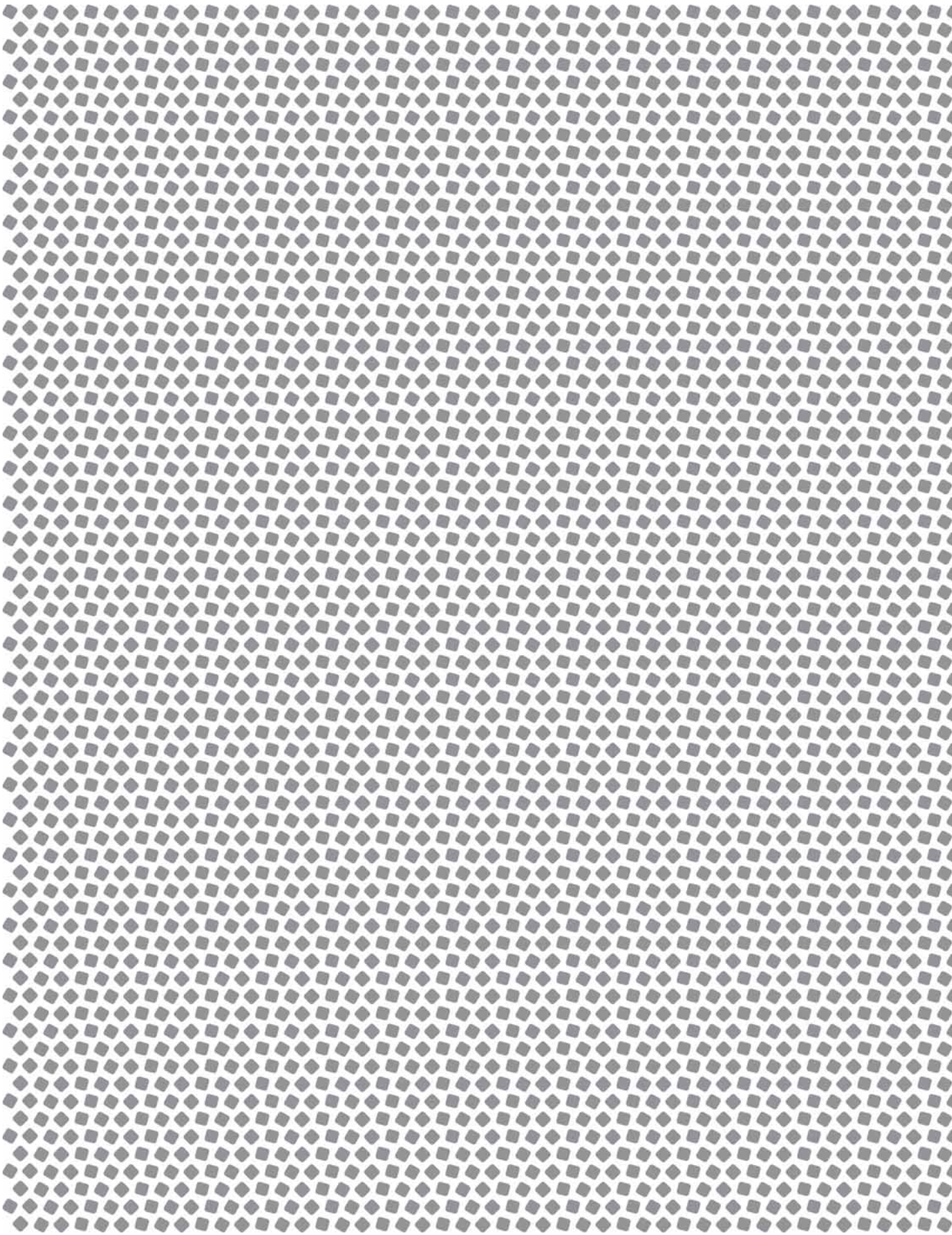
eurotec®;

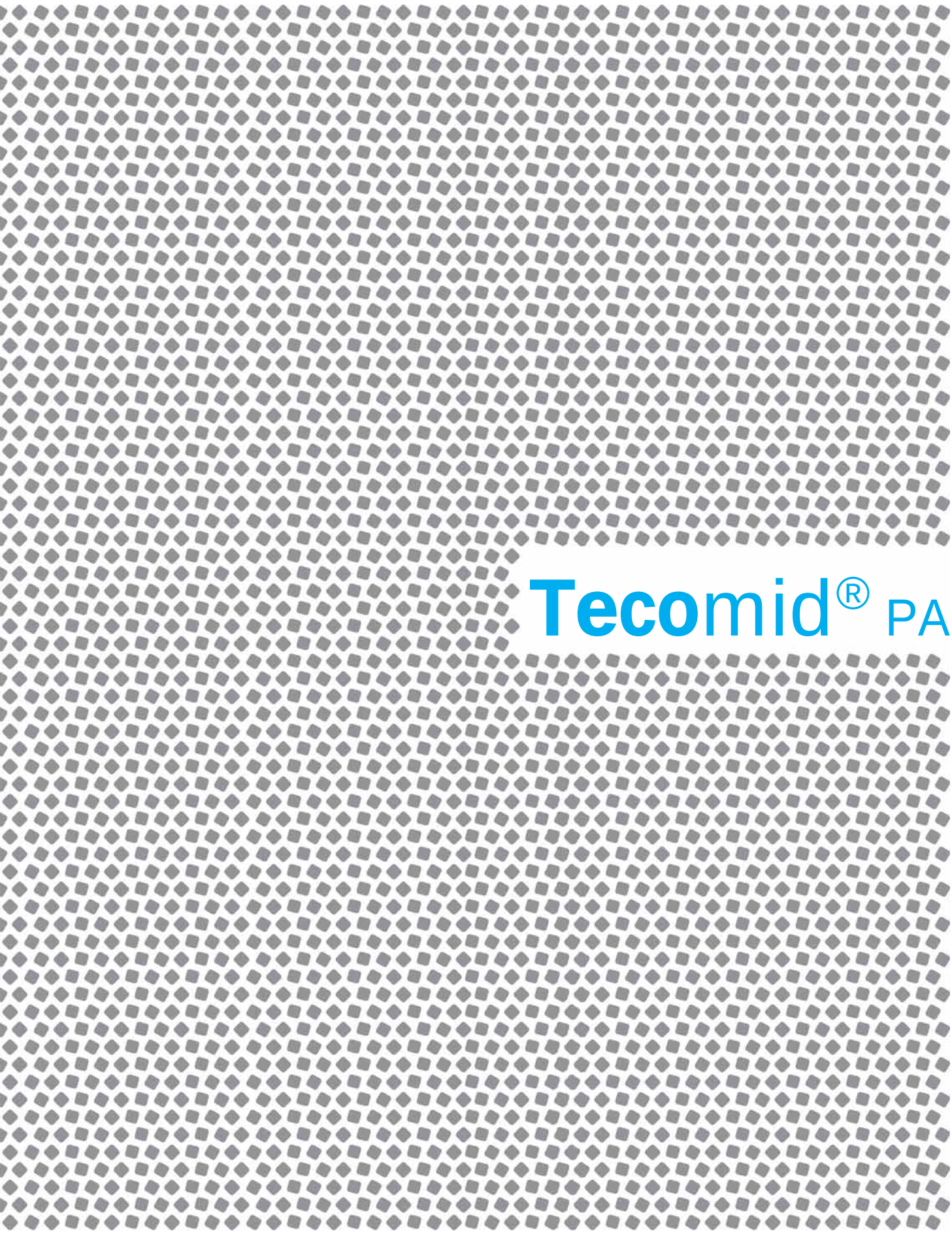
PA PPA PBT PET PC PP POM

Products add value to

- Automotive and transportation
- Electrical / Electronic
- Home appliances
- Sports and leisure
- Safety equipment
- Construction
- Garden and power tools
- Medical industry
- Construction and agricultural equipment
- Furniture

REACH TUV NORD ISO 9001 RoHS IMDS




Tecomid® PA

INTRODUCTION

Tecomid® is the registered trade mark for Polyamide (PA) compounds produced by Eurotec.

Eurotec is offering a wide range of Polyamide compounds and blends that are classified according to their chemical structure as;

Tecomid® NA (PA 6.6)
Tecomid® NB (PA 6)
Tecomid® NC (PA 6.6/6)

PROPERTIES

Our high quality technical compounds are able to meet the full range of requirements including product properties, process needs and end-use demands.

Key properties of Tecomid® resins offer;

Excellent stiffness/toughness balance
High mechanical strength
Very good thermal stability
Excellent flammability characteristics
Good electrical properties
High wear resistance and low friction
Very good chemical resistance
Good flow and processing properties

PRODUCTS

Tecomid® products are consisting of the most diverse characteristics with different modifiers, stabilizers, special additives and customized colours as;

Unreinforced
Standard impact to supertough
Glass fiber reinforced
Carbon fiber reinforced
Aramide fiber reinforced
Glass bead reinforced
Mineral filled and reinforced
Low warpage types
Flame retardant
Lubricated
Surface modified
Heat stabilized
UV/light stabilized
Electrical conductive
Laser markable
Speciality

APPLICATIONS

Due to excellent balance of properties, Tecomid® grades are suitable for an extensive range of industries like;

Automotive
Transportation
Electrical / Electronic
Furniture
Construction
Home appliances
Sports and leisure
Garden and power tools
Safety equipment
Medical

PACKAGING

Tecomid® grades are supplied in pellet form and packed in moisture proof 25 kg multi-layer bags. Other forms of packing like octabins and big-bags with PE or Aluminum in-liners are also available.

All packaging is tightly sealed by Eurotec before shipment and should be opened just before processing. It is also advised to be kept in dry environment below 50°C while protected from UV-light. In order to prevent condensation, packaging stored in cold areas should be allowed to warm up to room temperature before being opened.

SAFETY

Under normal conditions Tecomid® is not a toxic and hazardous material. During processing, necessary preventive actions should be held in case of contact with polymer melt or inhalation of the gases. Processing temperatures above 320 °C should be avoided. Detailed safety information can be found in our material safety data sheets (MSDS).


C UL US
LISTED 84C9
IND.CONT.EQ.
240V~ 3A
Pilot Duty A300 (720VA,120-240V AC)
Use 60 or 75°C
VDE

PROCESSING

Tecomid® compounds can be processed in all commercial injection molding machinery.

Injection Molding Machine

Selecting the proper design injection molding machine is important to have economic and quality moldings.

As a general rule, capacity of an injection molding machine should have 0.50 – 0.75 tons of clamping force for every square centimeter of projected shot area.

General purpose screw designs with compression ratios between 2.5:1 – 3.5:1, and screw size of minimum 20D are recommended. Standard nitride screws and barrels are not resistant to the abrasion of fillers, especially glass fibers. However, bi-metallic barrel liners and surface hardened screws show outstanding resistance to wear.

Standard nozzles can be used, however reverse taper nozzles are accomplished to prevent both drool and freezing. The temperature control of the nozzle is very important in order to avoid thermal loss or overheating. In general, nozzle diameters should be 3 to 6 mm depending on the size of the part.

Non return valves are necessary in order to obtain constant pressure and consistent moldings.

It is important to have precise temperature control for processing polyamides therefore several heating zones of the barrel are necessary.

Cooling system of the feed throat is important to prevent sticking of the granules and to have consistent feed of material to barrel. On the other hand, too low throat temperature will cause condensation, resulting hydrolysis and melt foaming. Temperatures between 60°C – 80°C are suggested.

When molding polyamide the shot size should be between 25% - 75% of barrel capacity. Shots larger than 75% may generate improper melting, where shots less than 25% will increase the residence time of the material in the machine that can cause degradation, brittleness and discoloration.

Residence time of Tecomid® compounds in the barrel at correct processing temperatures should not exceed 4 minutes.

Molding Conditions

For polyamide compounds, moisture content should be less than 0.2% before processing. Tecomid® compounded grades are manufactured with a maximum moisture content of 0.1%. Therefore products in moisture proof packs do not need pre-drying prior to processing.

As polyamides are hygroscopic and absorb moisture from the environment, materials stored in open packs or containers should be dried at 80°C for minimum 2 hours. Temperatures above 95°C will result in discoloration. In addition to that over drying will cause poor flow resulting molding problems and short shots.

Some guide recommendations for processing parameters are presented in Table 1.

The temperature of the melt in injection molding depends on barrel temperature settings, material residence time, screw design and speed. As it is difficult to estimate the effect of each parameter on melt temperature, it is suggested to be measured periodically with a pyrometer from the purged molten polymer. Tecomid® compounds should always be molded in a temperature-controlled mold. Uniform mold temperature within the cavity is very important to have good quality parts.

For un-reinforced polyamides the peripheral screw speed should be maximum 400 mm/s where for reinforced types it should not exceed 200 mm/s in order to minimize fiber breakage, material degradation and discoloring.

Back pressure should be as low as possible to protect material properties.

	Grade	Feed Throat Temperature (°C)	Processing Temperature (°C)	Mold Temperature (°C)	Hold Pressure (MPa)
Tecomid® NA (PA 6.6)	Un-reinforced	60-80	270-290	50-90	50-100
	Impact Modified	60-80	260-290	50-90	50-100
	Reinforced	60-80	270-300	70-110	50-100
	Flame Retardant	60-80	260-280	50-100	50-100
Tecomid® NB (PA 6)	Un-reinforced	60-80	240–260	40-80	50-100
	Impact Modified	60-80	230-260	40-80	50-100
	Reinforced	60-80	250-270	60–100	50-100
	Flame Retardant	60-80	230-250	40-90	50-100

Table 1. Recommended processing parameters for Tecomid®

The actual required injection pressure depends on many variables, such as melt and mold temperatures, part thickness and flow length. It is only necessary to have enough injection pressure to fill the cavity of the mold.

Due to crystalline nature of polyamides, it is required to use fast injection rates especially in reinforced grades. Slow injection rates can be used at the start-up of the injection to prevent jetting and burning of material.

The mold shrinkage of polyamide mostly depends on the holding pressure and the holding time. During this stage material melt is continuously pushed into the part cavity which compensates the shrinkage of the part during solidification. The level of holding pressures and time that depend mainly on the part thickness and runner geometry are generally 1:2 to 2:3 of the maximum injection pressure.

Effects of main processing parameters on material properties are shown in Table 2.

Processing Parameter	Weld Line Strength	Surface Quality	Cycle Time	Shrinkage	Sink Mark
Melt Temperature ↗	↗	↗	↗		
Mold Temperature ↗	↗	↗	↗	↗	
Hold Pressure ↗				↙	↙
Injection Speed ↗	↗	↗			

Table 2. Effect of processing parameters on material properties

Recycling

Regrind levels up to 25% can be reused depending on the application and requirements. However for flame retardant grades maximum 10% addition is recommended. Regrinds should be free of contamination, should not be thermally degradated and must be dry as molded, or be dried prior to reuse.

Tecomid®

				Unreinforced						Reinforced
PROPERTY	CONDITION	UNIT	STANDARD	**NA40 NL E** PA6.6, unfilled, natural	**NA40 NL IX** PA6.6, impact modified, natural	**NA40 NL IL** PA6.6, impact modified, natural	**NA40 NL IM** PA6.6, impact modified, natural	**NA40 NL IH** PA6.6, impact modified, natural	**NA30 NL RM** PA6.6, unfilled, MoS_2 modified, natural	**NA40 MR15 NL IL** PA6.6, 15% mineral reinforced, impact modified, natural
GENERAL										
Density	-	g/cm³	ISO 1183	1.14	1.10	1.09	1.07	1.04	1.15	1.23
Molding Shrinkage	Parallel / Normal	%	Eurotec	1.4 / 1.4	1.5 / 1.5	1.5 / 1.5	1.6 / 1.6	1.7 / 1.7	1.4 / 1.4	1.4 / 1.4
Moisture Content	-	%	ISO 15512	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Moisture Absorption	50% RH, 23 °C	%	ISO 62	2.7	2.2	2.2	2.1	2.0	2.6	2.0
MECHANICAL										
Stress at Break	+23°C	MPa	ISO 527	-	-	-	-	-	-	70
Strain at Break	+23°C	%	ISO 527	-	-	-	-	-	-	-
Tensile Modulus	+23°C	MPa	ISO 527	3200	2500	2300	2000	1500	3500	3250
Yield Strength	+23°C	MPa	ISO 527	85	65	60	55	50	85	-
Izod Impact, notched	+23°C	kJ/m²	ISO 180/1A	5	18	45	70	85	6	9
Izod Impact, notched	-30 °C	kJ/m²	ISO 180/1A	4	12	20	25	25	5	8
Izod Impact, un-notched	+23°C	kJ/m²	ISO 180/1U	NB	NB	NB	NB	NB	NB	-
Izod Impact, un-notched	-30 °C	kJ/m²	ISO 180/1U	NB	NB	NB	NB	NB	NB	-
THERMAL										
Melting Temperature	10 K/min	°C	ISO 11357	262	262	262	262	262	262	262
Heat Deformation Temperature	0.45 MPa	°C	ISO 75	210	-	-	-	-	220	-
Heat Deformation Temperature	1.80 MPa	°C	ISO 75	80	65	65	65	60	80	80
Vicat Softening Temperature	50N	°C	ISO 306	-	-	-	-	-	-	-
ELECTRICAL & FLAMMABILITY										
Volume Resistivity	-	Ohm.cm	IEC 60093	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15
Surface Resistivity	-	Ohm	IEC 60093	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13
Comparative Tracking Index	solution A	V	IEC 60112	600	600	600	600	600	-	550
Glow Wire Flammability Index	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Glow Wire Ignitability Temperature	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Flame Rating	0.75 mm	-	UL94	V2	HB	HB	HB	HB	HB	HB
Flame Rating	1.6 mm	-	UL94	V2	HB	HB	HB	HB	HB	HB

* Data are based on dry as molded

NA40 MF40 BK001 HS PA6.6, 40% mineral filled, heat stabilized, black	**NA40 GB30 NL HS** PA6.6, 30% glass bead reinforced, heat stabilized, natural	**NA40 KG30 NL 0B** PA6.6, 30% glass fiber/glass bead reinforced, natural	**NA40 GR13 NL100 MB** PA6.6, 13% glass fiber reinforced, impact modified, heat stabilized, natural	**NA40 GR14 NL MC** PA6.6, 14% glass fiber reinforced, impact modified, heat stabilized, natural	**NA40 GR15 NL HS** PA6.6, 15% glass fiber reinforced, heat stabilized, natural	**NA40 GR20 NL HS** PA6.6, 20% glass fiber reinforced, heat stabilized, natural	**NA40 GR25 NL HS** PA6.6, 25% glass fiber reinforced, heat stabilized, natural	**NA40 GR30 NL HS** PA6.6, 30% glass fiber reinforced, heat stabilized, natural	**NA40 GR30 NL HW** PA6.6, 30% glass fiber reinforced, hydrolysis stabilized, natural	**NA40 GR30 NL IH** PA6.6, 30% glass fiber reinforced, impact modified, natural	**NA40 GR30 NL RT** PA6.6, 30% glass fiber reinforced, PTFE modified, natural	**NA40 GR30 NL RM** PA6.6, 30% glass fiber reinforced, MoS_2 modified, natural
1.49	1.36	1.36	1.20	1.18	1.23	1.27	1.32	1.36	1.36	1.30	1.43	1.37
1.0 / 1.0	1.0 / 1.0	0.4 / 1.1	0.4 / 1.3	0.4 / 1.3	0.4 / 1.2	0.4 / 1.1	0.3 / 1.1	0.3 / 1.1	0.3 / 1.1	0.4 / 1.2	0.2 / 1.0	0.3 / 1.1
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1.5	1.9	1.9	2.2	2.0	2.3	2.1	2.0	1.9	1.9	1.5	1.5	1.8
70	85	150	115	100	130	150	170	185	185	130	170	185
2.5	-	3	4.5	5	3	3	3	3	3	4	2.5	3
8500	4500	7500	5000	4750	6250	7500	8500	10000	10000	8000	10000	10000
-	-	-	-	-	-	-	-	-	-	-	-	-
5	6	8	13	18	7	9	10	13	13	25	13	12
4	5	7	9	12	6	8	8	11	11	17	11	10
-	30	55	85	85	50	60	65	80	80	-	80	75
-	25	50	75	75	45	55	60	70	70	-	70	65
262	262	262	262	262	262	262	262	262	262	262	262	262
240	210	260	250	250	250	255	260	260	260	250	255	260
180	90	250	230	230	245	245	250	255	255	240	250	255
245	245	250	235	235	250	250	255	255	255	235	250	255
1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15
1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13
550	500	500	500	500	500	500	500	500	500	500	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB
HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB

Tecomid®

PROPERTY	CONDITION	UNIT	STANDARD	Reinforced						
				NA40 GR35 NL HS PA6.6, 35% glass fiber reinforced, heat stabilized, natural	**NA40 GR40 NL HS** PA6.6, 40% glass fiber reinforced, heat stabilized, natural	**NA40 GR40 NL RM** PA6.6, 40% glass fiber reinforced, MoS_2 modified, natural	**NA40 GR50 NL HS** PA6.6, 50% glass fiber reinforced, heat stabilized, natural	**NA40 GR50 NL RM** PA6.6, 50% glass fiber reinforced, MoS_2 modified, natural	**NAX0 GR60 NL** PA6.6, 60% glass fiber reinforced, natural	**NAX0 GR70 NL HS** PA6.6, 70% glass fiber reinforced, heat stabilized, natural
GENERAL										
Density	-	g/cm³	ISO 1183	1.41	1.45	1.46	1.57	1.58	1.70	1.85
Molding Shrinkage	Parallel / Normal	%	Eurotec	0.3 / 1.1	0.2 / 1.0	0.2 / 1.0	0.2 / 0.9	0.2 / 0.9	0.2 / 0.7	-
Moisture Content	-	%	ISO 15512	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Moisture Absorption	50% RH, 23 °C	%	ISO 62	1.8	1.6	1.5	1.3	1.3	1.0	-
MECHANICAL										
Stress at Break	+23°C	MPa	ISO 527	200	210	200	230	220	235	260
Strain at Break	+23°C	%	ISO 527	3	3	3	2.5	2.5	1.5	1.5
Tensile Modulus	+23°C	MPa	ISO 527	11000	13000	13000	16500	17000	20000	28000
Yield Strength	+23°C	MPa	ISO 527	-	-	-	-		-	-
Izod Impact, notched	+23°C	kJ/m²	ISO 180/1A	15	18	15	18	17	16	16
Izod Impact, notched	-30 °C	kJ/m²	ISO 180/1A	13	14	-	15	-	-	-
Izod Impact, un-notched	+23°C	kJ/m²	ISO 180/1U	90	100	-	100	-	-	-
Izod Impact, un-notched	-30 °C	kJ/m²	ISO 180/1U	80	85	-	90	-	-	-
THERMAL										
Melting Temperature	10 K/min	°C	ISO 11357	262	262	262	262	262	262	262
Heat Deformation Temperature	0.45 MPa	°C	ISO 75	260	260	260	260	260	260	260
Heat Deformation Temperature	1.80 MPa	°C	ISO 75	255	255	255	255	255	255	255
Vicat Softening Temperature	50N	°C	ISO 306	255	255	255	255	255	255	255
ELECTRICAL & FLAMMABILITY										
Volume Resistivity	-	Ohm.cm	IEC 60093	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15
Surface Resistivity	-	Ohm	IEC 60093	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13
Comparative Tracking Index	solution A	V	IEC 60112	500	500	-	500	-	-	-
Glow Wire Flammability Index	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Glow Wire Ignitability Temperature	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Flame Rating	0.75 mm	-	UL94	HB	HB	HB	HB	HB	HB	HB
Flame Rating	1.6 mm	-	UL94	HB	HB	HB	HB	HB	HB	HB

* Data are based on dry as molded

Flame Retardant

NA40 CR10 BK111 PA6.6, 10% carbon fiber reinforced, black	**NA40 CR20 BK111** PA6.6, 20% carbon fiber reinforced, black	**NA40 CR30 BK111** PA6.6, 30% carbon fiber reinforced, black	**NA40 KC50 BK111** PA6.6, 50% glass fiber / carbon fiber reinforced, black	**NA40 AR20 NL HS** PA6.6, 20% aramide fiber reinforced, heat stabilized, natural	**NA40 NL FA50** PA6.6, unfilled, flame retardant - halogen free, natural	**NA40 NL XA70** PA6.6, unfilled, flame retardant - halogen (RoHS compliant), heat stabilized, natural	**NA40 GR15 GR003 XA70** PA6.6, 15% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, grey RAL 7035	**NA40 GR25 GR003 XA70** PA6.6, 25% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, grey RAL 7035	**NA40 GR25 NL XA60** PA6.6, 25% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized, natural	**NA43 GR25 NL XA43** PA6.6, 25% glass fiber reinforced, flame retardant - red phosphorus, heat stabilized, natural, **UL registered**	**NA43 GR25 NL TD43** PA6.6, 25% glass fiber reinforced, flame retardant - red phosphorus, high impact, heat stabilized, natural	**NA30 GR50 BK002 XA40** PA6.6, 50% glass fiber reinforced, flame retardant, heat stabilized, black
1.18	1.22	1.27	1.52	1.19	1.18	1.36	1.51	1.58	1.39	1.40	1.38	1.56
0.3 / 1.1	0.3 / 1.1	0.2 / 1.0	-	-	1.3 / 1.3	1.2 / 1.2	0.4 / 1.1	0.3 / 1.1	0.3 / 1.1	0.2 / 1.0	0.2 / 1.0	0.2 / 0.8
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2.5	2.2	1.9	1.3	-	2.3	2.0	1.7	1.5	1.5	1.5	1.5	1.1
150	200	225	230	100	-	-	100	110	100	140	125	175
2.5	2.5	2	2	5	-	-	3	2.5	2	2.5	3	2
9000	15000	20000	20000	5000	3750	3750	6500	9000	9000	9000	8500	16000
-	-	-	-	-	80	80	-	-	-	-	-	-
5	8	10	13	5.5	5	6	7	8	7	8	12	12
-	-	-	-	-	4	5	6	7	6	7	10	11
-	-	-	-	-	-	-	-	-	40	50	-	-
-	-	-	-	-	-	-	-	-	-	45	-	-
262	262	262	262	262	262	262	262	262	262	262	262	262
-	-	-	-	-	225	230	-	-	-	250	245	260
235	245	250	255	220	85	90	240	245	240	245	240	250
-	-	-	-	-	245	245	-	-	-	-	-	250
<1E+5	<1E+4	<1E+3	<1E+5	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15
-	-	-	-	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13
-	-	-	-	-	600	225	225	225	600	>350	>350	>350
-	-	-	-	-	960	960	960	960	960	960	960	960
-	-	-	-	-	775	775	825	-	825	-	-	-
HB	HB	HB	HB	HB	V0	V0	V0	-	V0	V0	V0	V0
HB	HB	HB	HB	HB	V0	V0	V0	V0	V0	V0	V0	V0

Tecomid®

PROPERTY	CONDITION	UNIT	STANDARD	Unreinforced						
				NB40 NL E PA6, unfilled, natural	**NB40 NL IX** PA6, impact modified, natural	**NB40 NL IL** PA6, impact modified, natural	**NB40 NL IM** PA6, impact modified, natural	**NB40 NL IH** PA6, impact modified, natural	**NB50 BK001 IH** PA6, impact modified, black, extrusion grade	**NB50 NL IT** PA6, impact modified, supertough, natural, extrusion grade
GENERAL										
Density	-	g/cm³	ISO 1183	1.13	1.11	1.08	1.06	1.04	1.04	1.09
Molding Shrinkage	Parallel / Normal	%	Eurotec	1.2 / 1.2	1.3 / 1.3	1.3 / 1.3	1.4 / 1.4	1.5 / 1.5	1.5 / 1.5	-
Moisture Content	-	%	ISO 15512	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Moisture Absorption	50% RH, 23 °C	%	ISO 62	3.0	2.7	2.6	2.5	2.3	2.3	2.3
MECHANICAL										
Stress at Break	+23°C	MPa	ISO 527	-	-	-	-	-	-	-
Strain at Break	+23°C	%	ISO 527	-	-	-	-	-	-	>200
Tensile Modulus	+23°C	MPa	ISO 527	3000	2500	2250	2000	1500	1300	-
Yield Strength	+23°C	MPa	ISO 527	80	65	60	50	45	40	-
Izod Impact, notched	+23°C	kJ/m²	ISO 180/1A	6	17	45	55	75	80	NB
Izod Impact, notched	-30 °C	kJ/m²	ISO 180/1A	5	10	18	20	25	-	20
Izod Impact, un-notched	+23°C	kJ/m²	ISO 180/1U	NB	NB	NB	NB	NB	NB	NB
Izod Impact, un-notched	-30 °C	kJ/m²	ISO 180/1U	NB	NB	NB	NB	NB	NB	NB
THERMAL										
Melting Temperature	10 K/min	°C	ISO 11357	223	223	223	223	223	223	223
Heat Deformation Temperature	0.45 MPa	°C	ISO 75	180	-	-	-	-	-	-
Heat Deformation Temperature	1.80 MPa	°C	ISO 75	65	55	55	50	50	50	50
Vicat Softening Temperature	50N	°C	ISO 306	200	-	-	-	-	-	-
ELECTRICAL & FLAMMABILITY										
Volume Resistivity	-	Ohm.cm	IEC 60093	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15
Surface Resistivity	-	Ohm	IEC 60093	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13
Comparative Tracking Index	solution A	V	IEC 60112	600	600	600	600	600	600	-
Glow Wire Flammability Index	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Glow Wire Ignitability Temperature	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Flame Rating	0.75 mm	-	UL94	V2	HB	HB	HB	HB	HB	HB
Flame Rating	1.6 mm	-	UL94	V2	HB	HB	HB	HB	HB	HB

* Data are based on dry as molded

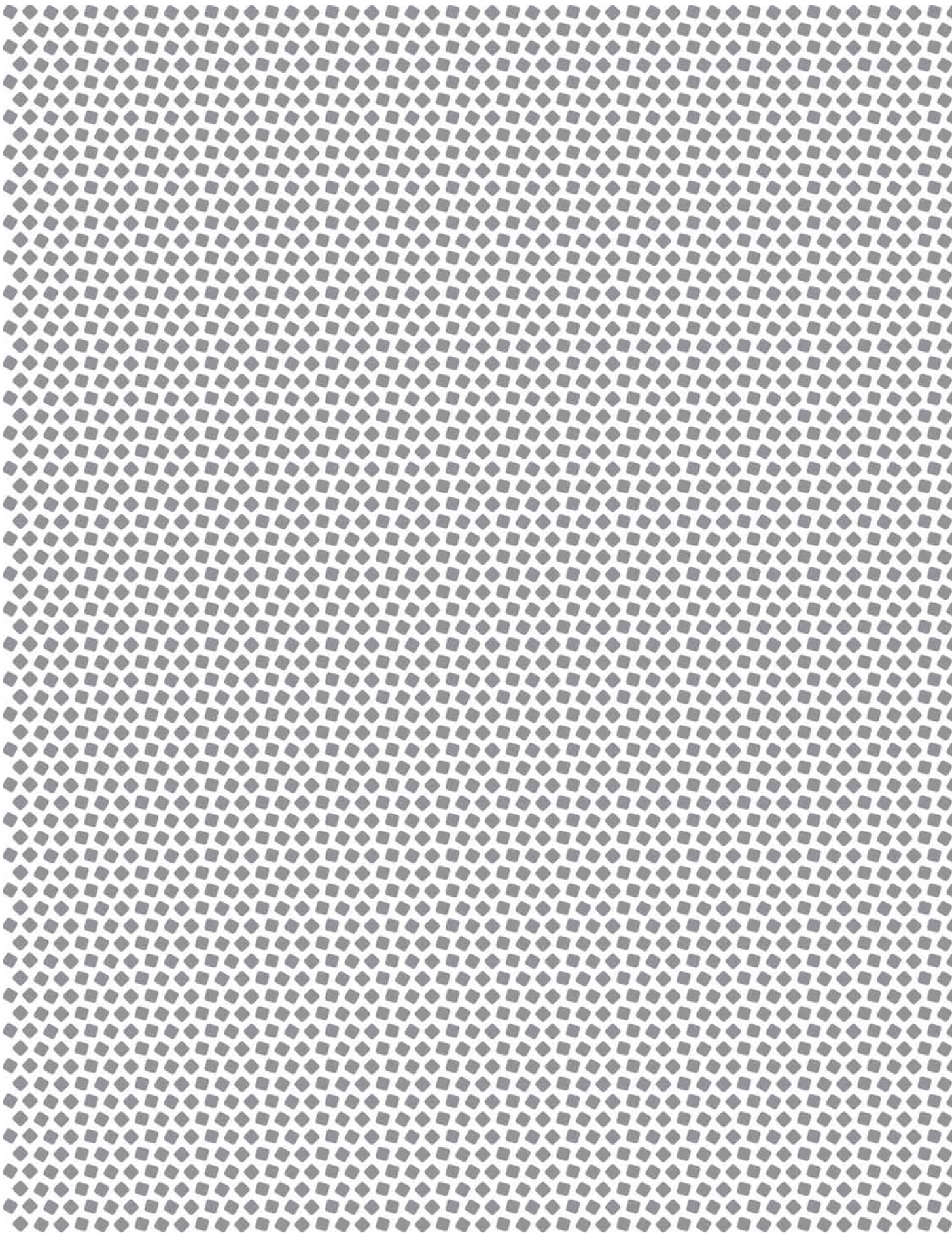
	Reinforced											
NB40 NL RM PA6, unfilled, MoS_2 modified, natural	**NB40 MR25 NL IL** PA6, 25% mineral reinforced, impact modified, natural	**NB30 MF30 BK001 HS** PA6, 30% mineral filled, heat stabilized, black	**NBX0 HF75 NL** PA6, 75% heavy filler, improved flexibility, natural	**NB40 KK40 NL** PA6, 40% glass fiber/mineral reinforced, natural	**NB40 GB30 NL** PA6, 30% glass bead reinforced, natural	**NB40 KG30 NL 0G** PA6, 30% glass fiber/glass bead reinforced, natural	**NB40 KG30 NL IX** PA6, 30% glass fiber/glass bead reinforced, impact modified, natural	**NB40 GR15 NL HS** PA6, 15% glass fiber reinforced, heat stabilized, natural	**NB40 GR15 NL MB** PA6, 15% glass fiber reinforced, impact modified, heat stabilized, natural	**NB40 GR20 NL** PA6, 20% glass fiber reinforced, natural	**NB40 GR25 NL** PA6, 25% glass fiber reinforced, natural	**NB40 GR30 NL** PA6, 30% glass fiber reinforced, natural
1.14	1.30	1.36	2.50	1.47	1.36	1.36	1.33	1.23	1.20	1.27	1.31	1.36
1.2 / 1.2	1.0 / 1.0	0.9 / 0.9	0.6 / 0.6	0.3 / 0.9	0.9 / 0.9	0.3 / 1.0	0.4 / 1.1	0.3 / 1.1	0.4 / 1.2	0.3 / 1.0	0.2 / 1.0	0.2 / 1.0
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2.9	2.0	2.0	0.8	1.8	2.1	2.1	2.1	2.5	2.3	2.4	2.2	2.1
-	60	70	35	110	70	110	100	125	110	145	160	175
-	25	3.5	-	2.5	10	5	5.5	3.5	4	3.5	3.5	3.5
3250	3250	6000	7500	8500	4500	5500	5500	6000	5500	7000	8500	9500
80	-	-	-	-	-	-	-	-	-	-	-	-
6	12	6	5	7	6	7	12	7	15	10	13	16
5	8	5	4	6	5	6	10	6	12	9	11	12
NB	-	40	-	50	50	-	-	45	75	60	80	95
NB	-	35	-	45	40	-	-	40	65	55	70	80
223	223	223	223	223	223	223	223	223	223	223	223	223
185	-	-	-	-	180	215	205	215	220	215	215	220
65	70	80	90	180	80	195	185	200	185	205	205	210
200	-	-	-	-	-	-	-	210	-	210	210	215
1E+15	1E+15	1E+15	-	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15
1E+13	1E+13	1E+13	-	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13
600	550	500	-	500	500	500	500	500	500	500	500	500
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB
HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB

Tecomid®

PROPERTY	CONDITION	UNIT	STANDARD	Reinforced						
				NB40 GR30 NL HW PA6, 30% glass fiber reinforced, hydrolysis stabilized, natural	**NB40 GR30 NL MB** PA6, 30% glass fiber reinforced, impact modified, heat stabilized, natural	**NB40 GR30 NL IM** PA6, 30% glass fiber reinforced, impact modified, natural	**NB40 GR45 NL HS** PA6, 45% glass fiber reinforced, heat stabilized, natural	**NB40 GR50 NL** PA6, 50% glass fiber reinforced, natural	**NB40 GR50 NL IL** PA6, 50% glass fiber reinforced, impact modified, natural	**NBX0 GR60 NL** PA6, 60% glass fiber reinforced, natural
GENERAL										
Density	-	g/cm³	ISO 1183	1.36	1.33	1.30	1.51	1.56	1.54	1.70
Molding Shrinkage	Parallel / Normal	%	Eurotec	0.2 / 1.0	0.3 / 1.1	0.3 / 1.1	0.2 / 0.9	0.1 / 0.9	0.2 / 0.9	0.1 / 0.8
Moisture Content	-	%	ISO 15512	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Moisture Absorption	50% RH, 23 °C	%	ISO 62	2.1	2.0	1.8	1.6	1.5	1.4	1.2
MECHANICAL										
Stress at Break	+23°C	MPa	ISO 527	175	150	135	200	220	200	225
Strain at Break	+23°C	%	ISO 527	3.5	4	4.5	2.5	2.5	3	2
Tensile Modulus	+23°C	MPa	ISO 527	9500	9000	8000	15000	16000	14000	20000
Yield Strength	+23°C	MPa	ISO 527	-	-	-	-	-	-	-
Izod Impact, notched	+23°C	kJ/m²	ISO 180/1A	16	20	28	20	20	22	18
Izod Impact, notched	-30 °C	kJ/m²	ISO 180/1A	12	15	18	18	18	20	15
Izod Impact, un-notched	+23°C	kJ/m²	ISO 180/1U	95	100	NB	110	110	NB	-
Izod Impact, un-notched	-30 °C	kJ/m²	ISO 180/1U	80	90	NB	100	100	NB	-
THERMAL										
Melting Temperature	10 K/min	°C	ISO 11357	223	223	223	223	223	223	223
Heat Deformation Temperature	0.45 MPa	°C	ISO 75	220	215	210	220	220	220	220
Heat Deformation Temperature	1.80 MPa	°C	ISO 75	210	200	195	215	215	210	215
Vicat Softening Temperature	50N	°C	ISO 306	215	210	205	215	215	210	215
ELECTRICAL & FLAMMABILITY										
Volume Resistivity	-	Ohm.cm	IEC 60093	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	-
Surface Resistivity	-	Ohm	IEC 60093	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	-
Comparative Tracking Index	solution A	V	IEC 60112	500	500	500	500	500	500	-
Glow Wire Flammability Index	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Glow Wire Ignitability Temperature	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Flame Rating	0.75 mm	-	UL94	HB	HB	HB	HB	HB	HB	HB
Flame Rating	1.6 mm	-	UL94	HB	HB	HB	HB	HB	HB	HB

* Data are based on dry as molded

Flame Retardant											Conductive	
NB40 NL FY50 PA6, unfilled, flame retardant - halogen & red phosphorus free, natural	**NB40 NL FY70** PA6, unfilled, flame retardant - halogen (RoHS compliant), natural	**NB40 NL FA50** PA6, unfilled, flame retardant - halogen free, natural	**NB40 NL FN70** PA6, unfilled, flame retardant - halogen (RoHS compliant), natural, suitable for IEC 60335-1 (E/E devices used for home appliances)	**NB40 MF20 GR003 FY70** PA6, 20% mineral filled, flame retardant - halogen (RoHS compliant), grey RAL 7035	**NB30 GR15 BK005 FS90** PA6, 15% glass fiber reinforced, flame retardant - halogen & red phosphorus free, low smoke & toxic gas grade	**NB40 GR15 NL XA70** PA6, 15% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, natural, **UL registered**	**NB40 GR20 NL XA70** PA6, 20% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, natural	**NB40 GR20 NL XA60** PA6, 20% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized, natural	**NB40 GR30 NL XA60** PA6, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized, natural	**NB40 GR30 NL XA70** PA6, 30% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, natural	**NB30 BK EF** PA6, unfilled, black, electrically conductive	**NB30 GR13 BK EF** PA6, 13% glass fiber reinforced, black, electrically conductive
1.16	1.20	1.18	1.45	1.45	1.67	1.53	1.50	1.34	1.39	1.62	1.18	1.27
1.1 / 1.1	1.1 / 1.1	1.0 / 1.0	0.9 / 0.9	0.9 / 0.9	0.3 / 0.7	0.3 / 0.9	0.3 / 0.9	0.3 / 0.9	0.2 / 0.8	0.2 / 0.8	1.1 / 1.1	0.3 / 1.0
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
2.7	2.7	2.6	2.0	1.7	1.1	1.7	1.7	1.7	1.5	1.4	2.5	2.0
70	70	70	70	60	70	100	125	100	120	125	70	90
-	-	-	-	3.5	2	2.5	3	2.5	2.5	2	-	3
3250	3250	3500	3750	5500	9000	7500	8000	8500	9500	12500	3000	6000
-	-	-	-	-	-	-	-	-	-	-	-	-
7	7	6	8	5	7	9	11	7	10	10	7	10
6	6	5	7	4	6	8	9	6	8	8	6	8
-	-	-	-	-	40	65	-	-	-	-	-	-
-	-	-	-	-	35	60	-	-	-	-	-	-
223	223	223	223	223	223	223	223	223	223	223	223	223
185	185	195	200	-	205	215	215	215	220	220	-	-
75	75	80	85	-	185	195	200	200	205	205	65	170
200	200	205	205	-	205	210	210	210	210	210	-	-
1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	<1E+5	<1E+3
1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	1E+13	-	-
600	-	600	-	-	-	-	-	600	600	-	-	-
960	960	960	960	960	960	960	960	960	960	960	-	-
775	775	775	850	800	850	825	800	800	800	825	-	-
V2	V2	V0	V0	V2	V0	V0	V1	V2	V0	V0	HB	HB
V2	V2	V0	V0	V2	V0	V0	V0	V0	V0	V0	HB	HB



Tecomid® HT PPA

INTRODUCTION

Tecomid® HT is the registered trade mark for Polyphthalamide (PPA) High Performance Polyamide compounds produced by Eurotec.

Eurotec is offering a wide range of Polyphthalamide compounds suitable for technical applications that require outstanding properties especially at high temperatures.

PROPERTIES

Our high quality technical compounds are able to meet the full range of requirements including product properties, process needs and end-use demands.

Key properties of Tecomid® HT resins offer;

- Excellent high temperature properties
- Very good chemical resistance
- Low moisture absorption (compared to PA6, PA6.6, PA4.6)
- Very high mechanical strength
- Good flammability characteristics
- Very good dimensional stability
- Good electrical properties
- High wear resistance and low friction
- Good flow and processing properties

PRODUCTS

Tecomid® HT products are consisting of the most diverse characteristics with different modifiers, stabilizers, special additives and customized colours as;

- Unreinforced
- Impact modified
- Glass fiber reinforced
- Carbon fiber reinforced
- Aramide fiber reinforced
- Glass bead reinforced
- Mineral filled and reinforced
- Low warpage types
- Flame retardant
- Lubricated
- Surface modified
- Heat stabilized
- UV/light stabilized
- Electrical conductive
- Speciality

APPLICATIONS

Due to excellent balance of properties, Tecomid® HT grades are suitable for an extensive range of industries like;

- Automotive
- Transportation
- Electrical / Electronic
- Construction
- Home appliances
- Sports and leisure
- Garden and power tools
- Safety equipment

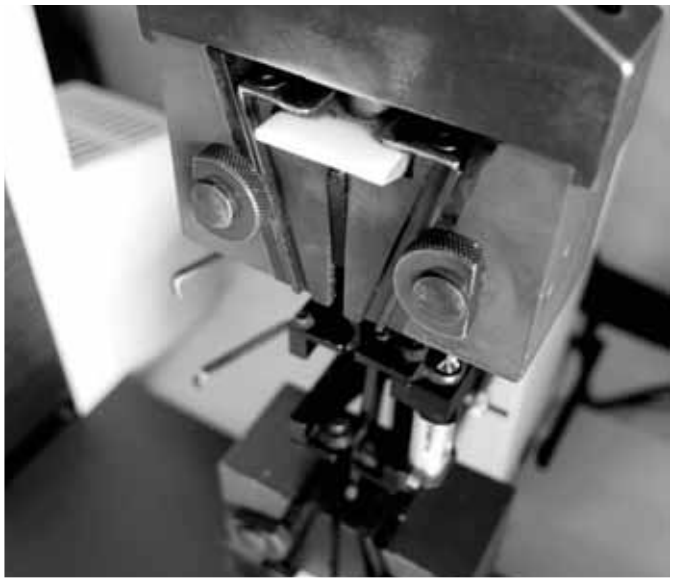
PACKAGING

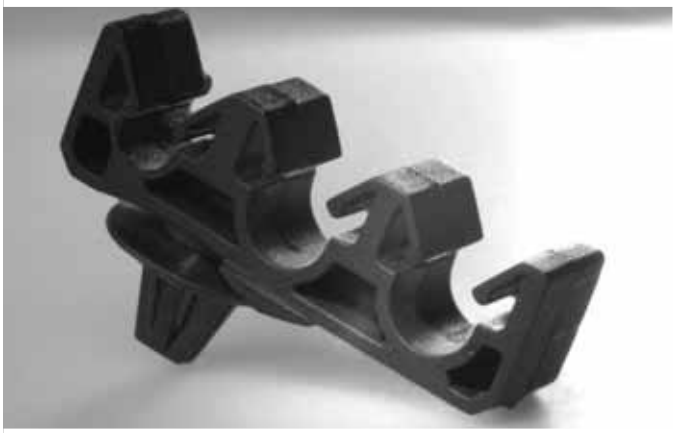
Tecomid® HT grades are supplied in pellet form and packed in moisture proof 25 kg multi-layer bags. Other forms of packing like octabins and big-bags with PE or Aluminum in-liners are also available.

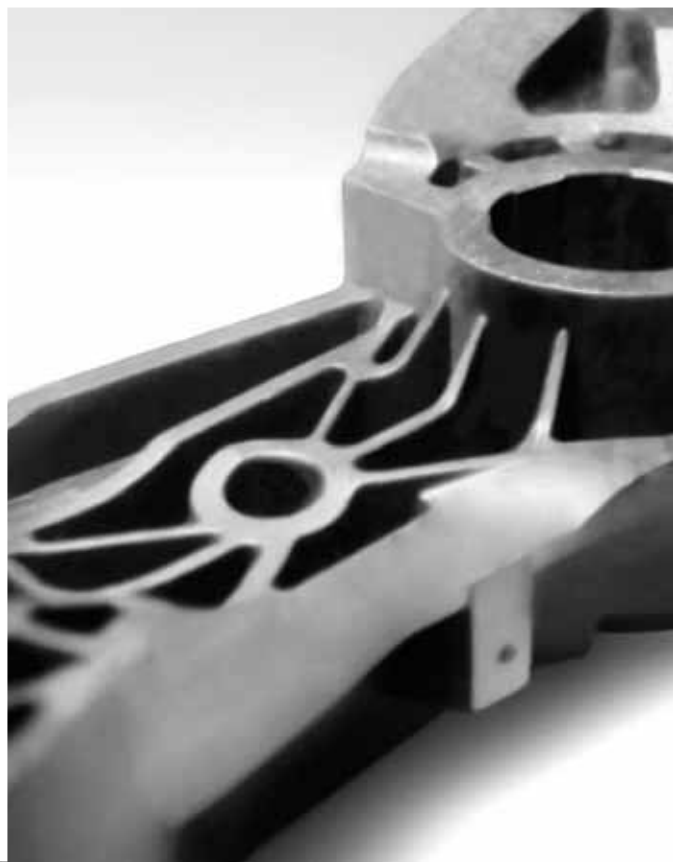
All packaging is tightly sealed by Eurotec before shipment and should be opened just before processing. It is also advised to be kept in dry environment below 50°C while protected from UV-light. In order to prevent condensation, packaging stored in cold areas should be allowed to warm up to room temperature before being opened.

SAFETY

Under normal conditions Tecomid® HT is not a toxic and hazardous material. During processing, necessary preventive actions should be held in case of contact with polymer melt or inhalation of the gases. Processing temperatures above 350 °C should be avoided. Detailed safety information can be found in our material safety data sheets (MSDS).







PROCESSING

Tecomid® HT compounds can be processed in all commercial injection molding machinery.

Injection Molding Machine

Selecting the proper design injection molding machine is important to have economic and quality moldings.

As a general rule, capacity of an injection molding machine should have 0.50 – 0.75 tons of clamping force for every square centimeter of projected shot area.

General purpose screw designs with compression ratios between 2.5:1 – 3.5:1, and screw size of 18D - 22D are recommended. Standard nitride screws and barrels are not resistant to the abrasion of fillers, especially glass fibers. However, bi-metallic barrel liners and surface hardened screws show outstanding resistance to wear.

Standard nozzles can be used, however reverse taper nozzles are accomplished to prevent both drool and freezing. The temperature control of the nozzle is very important in order to avoid thermal loss or overheating. In general, nozzle diameters should be 3 to 6 mm depending on the size of the part.

Non return valves are necessary in order to obtain constant pressure and consistent moldings.

It is important to have precise temperature control for processing Polyphthalamides therefore several heating zones of the barrel are necessary.

Cooling system of the feed throat is important to prevent sticking of the granules and to have consistent feed of material to barrel. On the other hand, too low throat temperature will cause condensation, resulting hydrolysis and melt foaming. Temperatures between 60°C – 80°C are suggested.

When molding Polyphthalamide the shot size should be between 30% - 60% of barrel capacity. Shots larger than 60% may generate improper melting, where shots less than 30% will increase the residence time of the material in the machine that can cause degradation, brittleness and discoloration.

Residence time of Tecomid® HT compounds in the barrel at correct processing temperatures should not exceed 4 minutes.

Molding Conditions

For Polyphthalamide compounds, moisture content should be less than 0.05% before processing. Tecomid® HT compounded grades are manufactured with a maximum moisture content of 0.1%. Therefore products need pre-drying prior to processing at 120°C for 4 hours. Temperatures above 120°C will result in discoloration and in addition to that, over drying will cause poor flow resulting molding problems and short shots.

The recommended pre-drying method is using desiccant driers where drying is independent of atmospheric environment. Controlling the performance of drying in desiccant driers depends on the dew point that indicates the proportion of water in the air. In order to obtain proper drying, values below –20°C for the dew point is suggested.

When using air circulating ovens, the quality of the drying depends on the atmospheric conditions. High relative humidity of air reduces the quality of drying and therefore circulating air ovens are not suggested to pre-dry PPA.

Some guide recommendations for processing parameters are presented in Table 1.

The temperature of the melt in injection molding depends on barrel temperature settings, material residence time, screw design and speed. As it is difficult to estimate the effect of each parameter on melt temperature, it is suggested to be measured periodically with a pyrometer from the purged molten polymer. Tecomid® HT compounds should always be molded in a temperature-controlled mold. Uniform mold temperature within the cavity is very important to have good quality parts.

	Grade	Feed Throat Temperature (°C)	Processing Temperature (°C)	Mold Temperature (°C)	Hold Pressure (MPa)
Tecomid® HT (PPA)	Un-reinforced	60-80	320 - 340	70-90	40-80
	Impact Modified	60-80	320 - 330	70-90	40-80
	Reinforced	60-80	320 - 340	140-180	40-80
	Flame Retardant	60-80	320 - 330	140-180	40-80

Table 1. Recommended processing parameters for Tecomid® HT

Maximum quality with minimized post-shrinkage is obtained by sufficient crystallinity. Tecomid® HT compounds need in general mold temperatures of 160 °C for optimum crystallization, surface aspect and dimensional stability.

For un-reinforced Polyphthalamides the peripheral screw speed should be maximum 400 mm/s where for reinforced types it should not exceed 200 mm/s in order to minimize fiber breakage, material degradation and discoloring.

Back pressure should be as low as possible to protect material properties.

The actual required injection pressure depends on many variables, such as melt and mold temperatures, part thickness and flow length. It is only necessary to have enough injection pressure to fill the cavity of the mold.

Due to crystalline nature of Polyphthalamides, it is required to use fast injection rates especially in reinforced grades. Slow injection rates can be used at the start-up of the injection to prevent jetting and burning of material.

The mold shrinkage of Polyphthalamide mostly depends on the holding pressure and the holding time. During this stage material melt is continuously pushed into the part cavity which compensates the shrinkage of the part during solidification. The level of holding pressures and time that depend mainly on the part thickness and runner geometry are generally 1:2 to 2:3 of the maximum injection pressure.

Effects of main processing parameters on material properties are shown in Table 2.

Processing Parameter	Weld Line Strength	Surface Quality	Cycle Time	Shrinkage	Sink Mark
Melt Temperature ↗	↗	↗	↗		
Mold Temperature ↗	↗	↗	↗	↗	
Hold Pressure ↗				↙	↙
Injection Speed ↗	↗	↗			

Table 2. Effect of processing parameters on material properties

Recycling

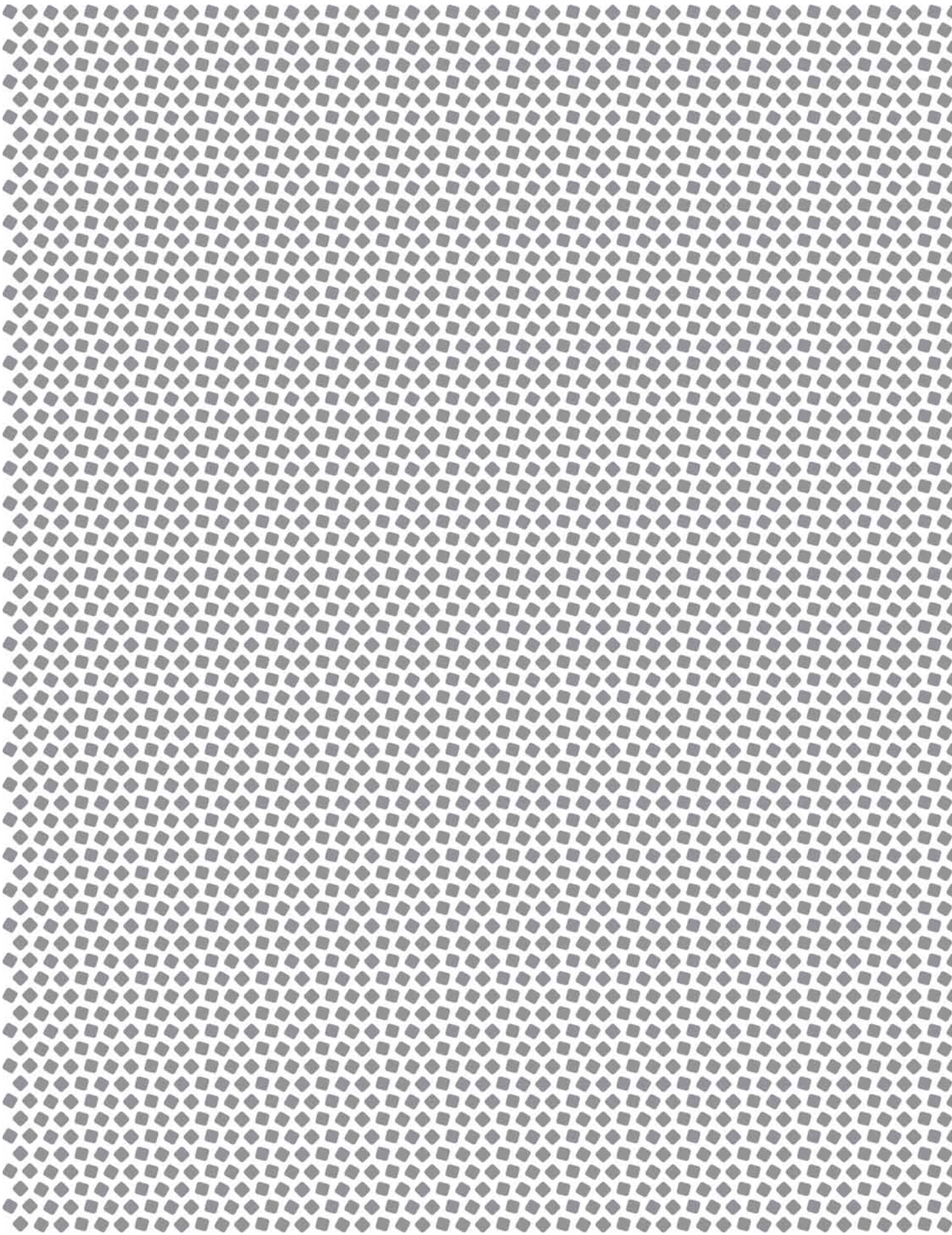
Regrind levels up to 25% can be reused depending on the application and requirements. However for flame retardant grades maximum 10% addition is recommended. Regrinds should be free of contamination, should not be thermally degradated and must be dry as molded, or be dried prior to reuse.

Tecomid® HT

PROPERTY	CONDITION	UNIT	STANDARD	Unreinforced		Reinforced		
				NT40 NL PPA, unfilled, natural	**NT40 NL MB** PPA, impact modified, heat stabilized, natural	**NT40 MR40 NL HS** PPA, 40% mineral reinforced, heat stabilized, natural	**NT40 GR15 NL HS** PPA, 15% glass fiber reinforced, heat stabilized, natural	**NT40 GR30 NL HS** PPA, 30% glass fiber reinforced, heat stabilized, natural
GENERAL								
Density	-	g/cm³	ISO 1183	1.20	1.15	1.54	1.31	1.43
Molding Shrinkage	Parallel / Normal	%	Eurotec	1.5 / 1.5	1.7 / 1.7	1.0 / 1.0	0.4 / 1.1	0.2 / 1.0
Moisture Content	-	%	ISO 15512	<0.2	<0.2	<0.2	<0.2	<0.2
Moisture Absorption	50% RH, 23 °C	%	ISO 62	2.4	2.2	1.4	2.0	1.7
MECHANICAL								
Stress at Break	+23°C	MPa	ISO 527	-	-	90	115	185
Strain at Break	+23°C	%	ISO 527	-	10	2	2	2
Tensile Modulus	+23°C	MPa	ISO 527	3500	2750	9000	7000	11000
Yield Strength	+23°C	MPa	ISO 527	90	80	-	-	-
Izod Impact, notched	+23°C	kJ/m²	ISO 180/1A	7	20	5	7	11
Izod Impact, notched	-30 °C	kJ/m²	ISO 180/1A	4	18	4	6	10
Izod Impact, un-notched	+23°C	kJ/m²	ISO 180/1U	-	-	-	-	-
Izod Impact, un-notched	-30 °C	kJ/m²	ISO 180/1U	-	-	-	-	-
THERMAL								
Melting Temperature	10 K/min	°C	ISO 11357	315	315	315	315	315
Heat Deformation Temperature	0.45 MPa	°C	ISO 75	-	-	-	300	305
Heat Deformation Temperature	1.80 MPa	°C	ISO 75	125	115	185	270	280
Vicat Softening Temperature	50N	°C	ISO 306	245	-	-	275	290
ELECTRICAL & FLAMMABILITY								
Volume Resistivity	-	Ohm.cm	IEC 60093	1E+15	1E+15	1E+15	1E+15	1E+15
Surface Resistivity	-	Ohm	IEC 60093	1E+13	1E+13	1E+13	1E+13	1E+13
Comparative Tracking Index	solution A	V	IEC 60112	600	600	550	550	550
Glow Wire Flammability Index	2 mm plaque	°C	IEC 60695	-	-	-	-	-
Glow Wire Ignitability Temperature	2 mm plaque	°C	IEC 60695	-	-	-	-	-
Flame Rating	0.75 mm	-	UL94	V2	HB	HB	HB	HB
Flame Rating	1.6 mm	-	UL94	V2	HB	HB	HB	HB

* Data are based on dry as molded

Reinforced			Flame Retardant	
NT40 GR50 NL HS PPA, 50% glass fiber reinforced, heat stabilized, natural	**NT40 GR60 NL HS** PPA, 60% glass fiber reinforced, heat stabilized, natural	**NT40 CR30 BK111 HS** PPA, 30% carbon fiber reinforced, heat stabilized, black	**NT40 NL XA60** PPA, unfilled, flame retardant - halogen & red phosphorus free, heat stabilized, natural	**NT40 GR30 NL XA60** PPA, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized, natural
1.63	1.76	1.31	1.24	1.45
0.2 / 0.7	0.1 / 0.6	0.1 / 0.8	1.1 / 1.1	0.2 / 0.9
<0.2	<0.2	<0.2	<0.2	<0.2
1.2	1.0	1.7	2.0	1.3
250	275	275	75	170
2	1.5	1.5	2	2
18000	22000	25000	4000	11500
-	-	-	-	-
14	15	8	4	8
13	14	7	3	7
-	-	-	-	-
-	-	-	-	-
315	315	315	315	315
305	305	-	-	-
290	290	290	130	280
295	295	-	-	-
1E+15	1E+15	<1E+3	1E+15	1E+15
1E+13	1E+13	-	1E+13	1E+13
550	550	-	600	600
-	-	-	960	960
-	-	-	775	850
HB	HB	HB	V0	V0
HB	HB	HB	V0	V0



Tecodur® PBT

INTRODUCTION

Tecodur® is the registered trade mark for Polybutylene terephthalate (PBT) compounds produced by Eurotec.

Eurotec is offering a wide range of PBT compounds and also blends with PET, PC and ASA.

PROPERTIES

Our high quality technical compounds are able to meet the full range of requirements including product properties, process needs and end-use demands.

Key properties of Tecodur® resins offer;

- Excellent stiffness and hardness
- Good mechanical strength
- Good creep and fatigue behaviour
- Very good thermal stability
- Excellent flammability characteristics
- Good electrical properties
- High wear resistance and low friction
- Good dimensional stability
- Very good chemical resistance
- Excellent flow and processing properties
- Low moisture absorption
- Very good surface finish

PRODUCTS

Tecodur® products are consisting of the most diverse characteristics with different modifiers, stabilizers, special additives and customized colours as;

- Unreinforced
- Impact modified
- Glass fiber reinforced
- Carbon fiber reinforced
- Glass bead reinforced
- Mineral filled and reinforced
- Low warpage types
- Flame retardant
- High tracing resistance
- Lubricated
- Surface modified
- Heat stabilized
- UV/light stabilized
- Electrical conductive
- Direct metallizable
- Laser markable
- Speciality

APPLICATIONS

Due to excellent balance of properties, Tecodur® grades are suitable for an extensive range of industries like;

- Automotive
- Transportation
- Electrical / Electronic
- Furniture
- Construction
- Home appliances
- Sports and leisure
- Garden and power tools
- Safety equipment
- Medical

PACKAGING

Tecodur® grades are supplied in pellet form and packed in moisture proof 25 kg multi-layer bags. Other forms of packing like octabins and big-bags with PE or Aluminum in-liners are also available.

All packaging is tightly sealed by Eurotec before shipment and should be opened just before processing. It is also advised to be kept in dry environment below 50°C while protected from UV-light. In order to prevent condensation, packaging stored in cold areas should be allowed to warm up to room temperature before being opened.

SAFETY

Under normal conditions Tecodur® is not a toxic and hazardous material. During processing, necessary preventive actions should be held in case of contact with polymer melt or inhalation of the gases. Processing temperatures above 300 °C should be avoided. Detailed safety information can be found in our material safety data sheets (MSDS).

PROCESSING

Tecodur® compounds can be processed in all commercial injection molding machinery.

Injection Molding Machine

Selecting the proper design injection molding machine is important to have economic and quality moldings.

As a general rule, capacity of an injection molding machine should have 0.50 – 0.75 tons of clamping force for every square centimeter of projected shot area.

General purpose screw designs with compression ratios between 2.0:1 – 3.5:1, and screw size of 17D to 23D are recommended. Standard nitride screws and barrels are not resistant to the abrasion of fillers, especially glass fibers. However, bi-metallic barrel liners and surface hardened screws show outstanding resistance to wear.

Due to reduced shear general purpose open nozzles that are as short as possible are suggested. The temperature control of the nozzle is very important in order to avoid thermal loss or overheating. In general nozzle diameters should be 3 to 6 mm depending on the size of the part.

It is important to have precise temperature control for processing PBT compounds therefore several heating zones of the barrel are necessary.

Cooling system of the feed throat is important to prevent sticking of the granules and to have consistent feed of material to barrel. On the other hand, too low throat temperature will cause condensation, resulting hydrolysis and melt foaming. Temperatures between 50°C – 70°C are suggested.

When molding PBT the shot size should be between 25% - 75% of barrel capacity. Shots larger than 75% may generate improper melting, where shots less than 25% will increase the residence time of the material in the machine that can cause degradation, brittleness and discoloration.

Residence time of Tecodur® compounds in the barrel at correct processing temperatures should not exceed 4 minutes.

Molding Conditions

For PBT compounds, moisture content should be less than 0.04% before processing. When there is a blend with PET or PC moisture content should not exceed 0.02%. Moisture causes immediate hydrolytic degradation during process which causes molecular weight reduction and thus reduction in resistance. Therefore Tecodur® grades should be dried at 120°C for 2 – 4 hours.

The recommended pre-drying method is using desiccant driers where drying is independent of atmospheric environment. Controlling the performance of drying in desiccant driers depends on the dew point that indicates the proportion of water in the air. In order to obtain proper drying, values below –20°C for the dew point is suggested.

When using air circulating ovens, the quality of the drying depends on the atmospheric conditions. High relative humidity of air reduces the quality of drying and therefore circulating air ovens are not suggested to pre-dry PBT.

Some guide recommendations for processing parameters are presented in Table 1.

The temperature of the melt in injection molding depends on barrel temperature settings, material residence time, screw design and speed. As it is difficult to estimate the effect of each parameter on melt temperature, it is suggested to be measured periodically with a pyrometer from the purged molten polymer. Tecodur® compounds should always be molded in a temperature-controlled mold. Uniform mold temperature within the cavity is very important to have good quality parts.

For un-reinforced PBT the peripheral screw speed should be maximum 300 mm/s where for reinforced types it should not exceed 200 mm/s in order to minimize fiber breakage, material degradation and discoloring.

	Grade	Feed Throat Temperature (°C)	Processing Temperature (°C)	Mold Temperature (°C)	Hold Pressure (MPa)
Tecodur® PB (PBT)	Un-reinforced	50-70	240 – 260	60 - 100	40 - 80
	Impact Modified	50-70	240 – 260	60 - 100	40 - 80
	Reinforced	50-70	250 - 270	60 - 100	40 - 80
	Flame Retardant	50-70	230 – 260	60 - 100	40 - 80
Tecodur® PB (blend)	Un-reinforced	50-70	230 - 270	50 - 110	40 - 80
	Impact Modified	50-70	230 - 270	50 - 110	40 - 80
	Reinforced	50-70	240 - 280	50 - 110	40 - 80
	Flame Retardant	50-70	230 – 260	50 - 110	40 - 80

Table 1. Recommended processing parameters for Tecodur®

Back pressure should be as low as possible to protect material properties.

The actual required injection pressure depends on many variables, such as melt and mold temperatures, part thickness and flow length. It is only necessary to have enough injection pressure to fill the cavity of the mold.

Due to crystalline nature of PBT, it is required to use fast injection rates especially in reinforced grades. Slow injection rates can be used at the start-up of the injection to prevent jetting and burning of material.

The mold shrinkage of PBT mostly depends on the holding pressure and the holding time. During this stage material melt is continuously pushed into the part cavity which compensates the shrinkage of the part during solidification. The level of holding pressures and time that depend mainly on the part thickness and runner geometry are generally 1:2 to 2:3 of the maximum injection pressure.

Effects of main processing parameters on material properties are shown in Table 2.

Processing Parameter	Weld Line Strength	Surface Quality	Cycle Time	Shrinkage	Sink Mark
Melt Temperature ↗	↗	↗	↗		
Mold Temperature ↗	↗	↗	↗	↗	
Hold Pressure ↗				↙	↙
Injection Speed ↗	↗	↗			

Table 2. Effect of processing parameters on material properties

Recycling

Regrind levels up to 25% can be reused depending on the application and requirements. However for flame retardant grades maximum 10% addition is recommended. Regrinds should be free of contamination, should not be thermally degradated and must be dried prior to reuse.

Tecodur®

PROPERTY	CONDITION	UNIT	STANDARD	Unreinforced						
				PB30 NL PBT, unfilled, natural, high viscosity, extrusion grade	**PB50 NL** PBT, unfilled, natural, high viscosity	**PB70 NL** PBT, unfilled, natural, high flow	**PB70 BK001 HS** PBT, unfilled, heat stabilized, black	**PB70 BK001 MC** PBT, unfilled, improved impact, heat stabilized, black	**PB70 NL IL** PBT, unfilled, impact modified, natural	**PB70 NL IM** PBT, unfilled, impact modified, natural
GENERAL										
Density	-	g/cm³	ISO 1183	1.31	1.31	1.31	1.31	1.28	1.26	1.22
Molding Shrinkage	Parallel / Normal	%	Eurotec	1.6 / 1.6	1.6 / 1.6	1.6 / 1.6	1.6 / 1.6	1.7 / 1.7	1.7 / 1.7	1.8 / 1.8
Moisture Content	-	%	ISO 15512	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Moisture Absorption	50% RH, 23 °C	%	ISO 62	0.2	0.2	0.2	0.2	0.2	0.2	0.2
MECHANICAL										
Stress at Break	+23°C	MPa	ISO 527	-	-	-	-	-	-	-
Strain at Break	+23°C	%	ISO 527	-	-	-	-	-	-	-
Tensile Modulus	+23°C	MPa	ISO 527	2500	2500	2500	2500	2250	2000	1750
Yield Strength	+23°C	MPa	ISO 527	55	55	55	55	50	45	40
Izod Impact, notched	+23°C	kJ/m²	ISO 180/1A	8	6	6	6	8	10	15
Izod Impact, notched	-30 °C	kJ/m²	ISO 180/1A	7	5	5	5	7	9	12
Izod Impact, un-notched	+23°C	kJ/m²	ISO 180/1U	NB	NB	NB	NB	NB	NB	NB
Izod Impact, un-notched	-30 °C	kJ/m²	ISO 180/1U	NB	NB	NB	NB	NB	NB	NB
THERMAL										
Melting Temperature	10 K/min	°C	ISO 11357	225	225	225	225	225	225	225
Heat Deformation Temperature	0.45 MPa	°C	ISO 75	-	-	-	-	-	-	-
Heat Deformation Temperature	1.80 MPa	°C	ISO 75	60	60	60	60	55	55	50
Vicat Softening Temperature	50N	°C	ISO 306	-	-	-	-	-	-	-
ELECTRICAL & FLAMMABILITY										
Volume Resistivity	-	Ohm.cm	IEC 60093	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16
Surface Resistivity	-	Ohm	IEC 60093	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14
Comparative Tracking Index	solution A	V	IEC 60112	-	-	-	-	-	-	-
Glow Wire Flammability Index	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Glow Wire Ignitability Temperature	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Flame Rating	0.75 mm	-	UL94	HB	HB	HB	HB	HB	HB	HB
Flame Rating	1.6 mm	-	UL94	HB	HB	HB	HB	HB	HB	HB

Reinforced

PB70 NL RT PBT, unfilled, PTFE modified, natural	**PB70 GB20 NL** PBT, 20% glass bead reinforced, natural	**PB70 GB30 NL** PBT, 30% glass bead reinforced, natural	**PB70 GR10 NL100** PBT, 10% glass fiber reinforced, natural	**PB70 GR15 NL100** PBT, 15% glass fiber reinforced, natural	**PB70 GR15 NL100 KA01** PBT/PET, 15% glass fiber reinforced, heat stabilized, natural, gas injection grade	**PB70 GR15 NL RT** PBT, 15% glass fiber reinforced, PTFE modified, natural	**PB70 GR20 NL100 HS** PBT, 20% glass fiber reinforced, heat stabilized, natural	**PB70 GR30 NL100** PBT, 30% glass fiber reinforced, natural	**PB70 GR30 NL100 IL** PBT, 30% glass fiber reinforced, impact modified, natural	**PB70 GR30 NL100 HT01** PBT/PET, 30% glass fiber reinforced, high heat stabilized, natural	**PB70 GR30 NL MB04** PBT/ASA, 30% glass fiber reinforced, heat & UV stabilized, natural	**PB70 GR35 NL100 HS01** PBT/PET, 35% glass fiber reinforced, heat stabilized, natural
1.33	1.45	1.52	1.37	1.41	1.43	1.43	1.45	1.53	1.47	1.55	1.40	1.58
-	1.4 / 1.4	1.2 / 1.2	0.6 / 1.2	0.5 / 1.1	-	-	0.4 / 1.1	0.3 / 1.1	0.3 / 1.1	-	0.4 / 0.7	-
<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
60	55	60	90	105	100	100	115	135	120	140	120	140
-	4	3.5	4	3	3	3	3	2.5	3.5	2.5	2.5	1.5
2750	3500	4000	4500	6000	6000	6000	7000	9500	8500	10000	9500	12000
-	-	-	-	-	-	-	-	-	-	-	-	-
5	4	4	6	7	6	7	8	11	15	9	11	9
-	3	3	5	6	5	6	7	9	12	8	9	8
-	35	35	45	50	40	-	55	65	-	-	-	-
-	30	30	40	45	35	-	50	55	-	-	-	-
225	225	225	225	225	225-255	225	225	225	225	225-255	225	225-255
-	170	180	210	215	210	215	220	220	215	215	210	215
60	70	80	180	195	175	190	205	205	195	195	155	195
-	185	190	200	205	-	210	210	215	-	-	-	-
1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16
1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB
HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB

Tecodur®

				Reinforced						Flame
PROPERTY	CONDITION	UNIT	STANDARD	**PB70 GR40 NL100** PBT, 40% glass fiber reinforced, natural	**PB70 GR45 NL100 HS01** PBT/PET, 45% glass fiber reinforced, heat stabilized, natural	**PB70 GR50 NL100** PBT, 50% glass fiber reinforced, natural	**PB70 GR50 BK002 CA01** PBT/PET, 50% glass fiber reinforced, heat & UV stabilized, black	**PB70 GR50 BK009 MX01** PBT/PET, 50% glass fiber reinforced, heat & UV stabilized, improved impact, black	**PB70 CR30 BK111** PBT, 30% carbon fiber reinforced, black	**PB70 NL XA20** PBT, unfilled, flame retardant - halogen (RoHS compliant), heat stabilized, natural
GENERAL										
Density	-	g/cm³	ISO 1183	1.63	1.68	1.72	1.73	1.73	1.41	1.42
Molding Shrinkage	Parallel / Normal	%	Eurotec	0.2 / 1.0	-	0.2 / 0.8	-	-	-	1.5 / 1.5
Moisture Content	-	%	ISO 15512	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Moisture Absorption	50% RH, 23 °C	%	ISO 62	0.1	0.1	0.1	0.1	0.1	0.2	0.2
MECHANICAL										
Stress at Break	+23°C	MPa	ISO 527	140	140	150	150	145	150	55
Strain at Break	+23°C	%	ISO 527	2	1.5	1.5	1.5	2	1.5	-
Tensile Modulus	+23°C	MPa	ISO 527	14000	16000	18000	19000	17000	24000	3000
Yield Strength	+23°C	MPa	ISO 527	-	-	-	-	-	-	-
Izod Impact, notched	+23°C	kJ/m²	ISO 180/1A	11	9	11	10	11	7	5
Izod Impact, notched	-30 °C	kJ/m²	ISO 180/1A	9	8	9	9	10	6	4
Izod Impact, un-notched	+23°C	kJ/m²	ISO 180/1U	-	-	-	-	-	45	-
Izod Impact, un-notched	-30 °C	kJ/m²	ISO 180/1U	-	-	-	-	-	40	-
THERMAL										
Melting Temperature	10 K/min	°C	ISO 11357	225	225-255	225	225-255	225-255	225	225
Heat Deformation Temperature	0.45 MPa	°C	ISO 75	220	215	220	215	210	-	165
Heat Deformation Temperature	1.80 MPa	°C	ISO 75	210	205	210	205	200	-	60
Vicat Softening Temperature	50N	°C	ISO 306	-	-	-	-	-	-	-
ELECTRICAL & FLAMMABILITY										
Volume Resistivity	-	Ohm.cm	IEC 60093	1E+16	1E+16	1E+16	1E+16	1E+16	<1E+3	1E+16
Surface Resistivity	-	Ohm	IEC 60093	1E+14	1E+14	1E+14	1E+14	1E+14	-	1E+14
Comparative Tracking Index	solution A	V	IEC 60112	-	-	-	-	-	-	225
Glow Wire Flammability Index	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	960
Glow Wire Ignitability Temperature	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Flame Rating	0.75 mm	-	UL94	HB	HB	HB	HB	HB	HB	-
Flame Rating	1.6 mm	-	UL94	HB	HB	HB	HB	HB	HB	V0

Retardant											Conductive	
PB70 NL SV20 PBT, unfilled, flame retardant - halogen (RoHS compliant), heat stabilized, natural	**PB70 NL TD22** PBT/PC, unfilled, flame retardant - halogen (RoHS compliant), impact modified, natural	**PB70 NL TD20** PBT, unfilled, flame retardant - halogen (RoHS compliant), impact modified, natural	**PB70 GR15 BK002 XA21** PBT/PET, 15% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, black	**PB70 GR17 BK002 FA20** PBT, 17% glass fiber reinforced, flame retardant - halogen (RoHS compliant), black	**PB70 GR20 NL100 XA20** PBT, 20% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, natural	**PB70 GR20 BK002 TD21** PBT/PET, 20% glass fiber reinforced, flame retardant - halogen (RoHS compliant), impact modified, black	**PB70 GR25 NL100 XA20** PBT, 25% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, natural	**PB70 GR30 NL XA70** PBT, 30% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, natural	**PB70 GR30 NL SV20** PBT, 30% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, natural, **UL registered**	**PB70 GR30 NL XA60** PBT, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized, natural	**PB70 GR15 BK EF** PBT, 15% glass fiber reinforced, black, electrically conductive	**PB70 GR23 BK EF** PBT, 23% glass fiber reinforced, black, electrically conductive
1.43	1.36	1.40	1.53	1.55	1.58	1.52	1.61	1.65	1.65	1.53	1.41	1.49
1.5 / 1.5	1.4 / 1.4	1.6 / 1.6	-	0.4 / 1.1	0.4 / 1.1	-	0.3 / 1.0	0.3 / 1.0	0.3 / 1.0	0.3 / 1.0	-	-
<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
60	50	45	100	100	120	100	125	130	130	100	80	70
-	-	-	2.5	3	3	3	2.5	2	2	2	2	1
3000	2500	2500	6500	6500	8000	7500	9500	11000	11000	11000	5500	10000
-	-	-	-	-	-	-	-	-	-	-	-	-
5	12	8	7	8	9	10	9	9	10	7	7	7
4	10	6	-	-	8	9	8	8	9	6	6	6
-	-	NB	-	-	-	65	60	60	65	35	-	-
-	-	NB	-	-	-	60	55	55	60	30	-	-
225	225	225	225-255	225	225	225-255	225	225	225	225	225	225
165	-	130	210	210	220	215	215	220	220	215	-	-
65	70	60	175	190	200	175	200	205	205	200	195	200
-	-	-	-	-	-	-	-	210	210	205	-	-
1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	-	-
1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	-	-
225	-	-	225	225	225	225	225	225	225	575	-	-
960	960	960	960	960	960	960	960	960	960	960	-	-
-	-	-	-	700	-	725	-	-	725	775	-	-
V0	V0	V2	-	V0	V2	V2	V2	-	V0	V0	HB	HB
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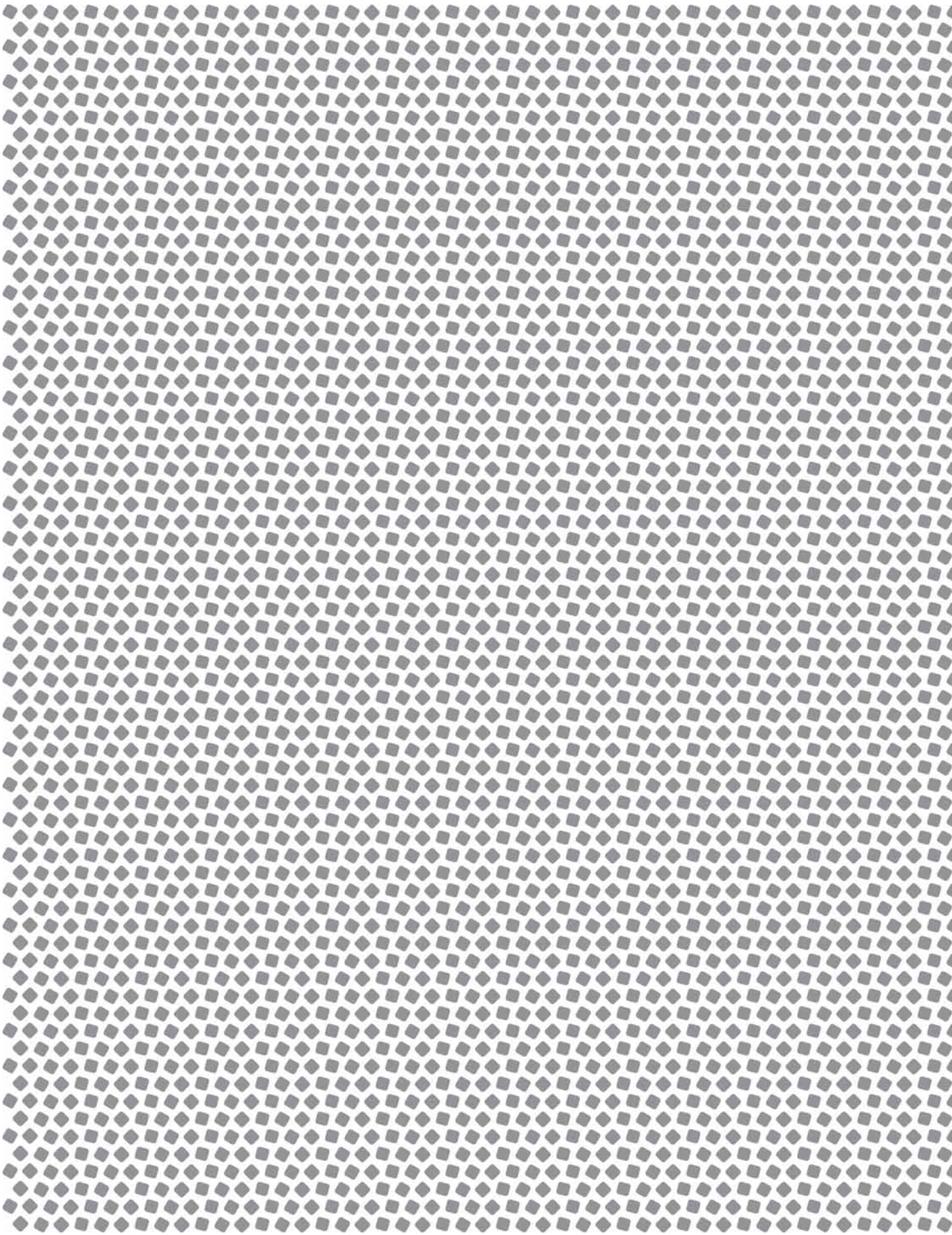

Tecopet® PET

INTRODUCTION

Tecopet® is the registered trade mark for Polyethylene terephthalate (PET) compounds produced by Eurotec.

Eurotec is offering a wide range of PET compounds which also includes post consumer value added recycled grades.

These cost effective products are giving our customers competitive advantages not only in material costs but also in environmental regulations and commitments.

PROPERTIES

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Key properties of Tecopet® resins offer;

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PRODUCTS

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- Flame retardant
- Surface modified
- Heat stabilized
- UV/light stabilized
- Electrical conductive
- Laser markable
- Speciality

APPLICATIONS

Due to excellent balance of properties, Tecopet® grades are suitable for an extensive range of industries like;

- Automotive
- Transportation
- Electrical / Electronic
- Furniture
- Construction
- Home appliances
- Sports and leisure
- Garden and power tools
- Safety equipment
- Medical

PACKAGING

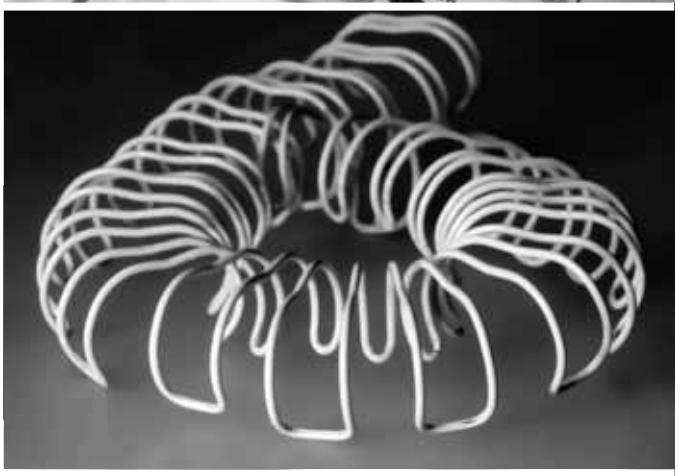
Tecopet® grades are supplied in pellet form and packed in moisture proof 25 kg multi-layer bags. Other forms of packing like octabins and big-bags with PE or Aluminum in-liners are also available.

All packaging is tightly sealed by Eurotec before shipment and should be opened just before processing. It is also advised to be kept in dry environment below 50°C while protected from UV-light. In order to prevent condensation, packaging stored in cold areas should be allowed to warm up to room temperature before being opened.

SAFETY

Under normal conditions Tecopet® is not a toxic and hazardous material. During processing, necessary preventive actions should be held in case of contact with polymer melt or inhalation of the gases. Processing temperatures above 320 °C should be avoided. Detailed safety information can be found in our material safety data sheets (MSDS).


VOLTAGE R. HIGH
R. LOW
START
STOP/RESET
ZERO

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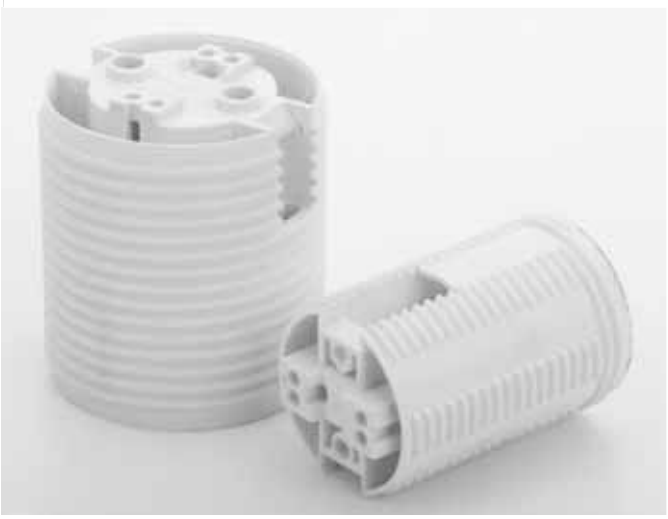

PROCESSING

Tecopet® compounds can be processed in all commercial injection molding machinery.

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Selecting the proper design injection molding machine is important to have economic and quality moldings.

As a general rule, capacity of an injection molding machine should have 0.50 – 0.75 tons of clamping force for every square centimeter of projected shot area.

General purpose screw designs with compression ratios between 2.0:1 – 3.5:1, and screw size of 17D to 23D are recommended. Standard nitride screws and barrels are not resistant to the abrasion of fillers, especially glass fibers. However, bi-metallic barrel liners and surface hardened screws show outstanding resistance to wear.

Due to reduced shear general purpose open nozzles that are as short as possible are suggested. The temperature control of the nozzle is very important in order to avoid thermal loss or overheating. In general nozzle diameters should be 3 to 6 mm depending on the size of the part.

It is important to have precise temperature control for processing PET compounds therefore several heating zones of the barrel are necessary.

Cooling system of the feed throat is important to prevent sticking of the granules and to have consistent feed of material to barrel. On the other hand, too low throat temperature will cause condensation, resulting hydrolysis and melt foaming. Temperatures between 50°C – 70°C are suggested.

When molding PET the shot size should be between 25% - 75% of barrel capacity. Shots larger than 75% may generate improper melting, where shots less than 25% will increase the residence time of the material in the machine that can cause degradation, brittleness and discoloration.

Residence time of Tecopet® compounds in the barrel at correct processing temperatures should not exceed 4 minutes.

Molding Conditions

For PET compounds, moisture content should be less than 0.02% before processing. Moisture causes immediate hydrolytic degradation during process which causes molecular weight reduction and thus reduction in resistance. Therefore Tecopet® grades should be dried at 120°C - 140°C for 4 hours.

The recommended pre-drying method is using desiccant driers where drying is independent of atmospheric environment. Controlling the performance of drying in desiccant driers depends on the dew point that indicates the proportion of water in the air. In order to obtain proper drying, values below –20°C for the dew point is suggested.

When using air circulating ovens, the quality of the drying depends on the atmospheric conditions. High relative humidity of air reduces the quality of drying and therefore circulating air ovens are not suggested to pre-dry PET.

Some guide recommendations for processing parameters are presented in Table 1.

The temperature of the melt in injection molding depends on barrel temperature settings, material residence time, screw design and speed. As it is difficult to estimate the effect of each parameter on melt temperature, it is suggested to be measured periodically with a pyrometer from the purged molten polymer. Tecopet® compounds should always be molded in a temperature-controlled mold. Uniform mold temperature within the cavity is very important to have good quality parts.

Maximum quality with minimized post-shrinkage is obtained by sufficient crystallinity. Therefore, for Tecopet® compounds minimum 90°C of mold temperature is necessary for optimum crystallization, surface aspect and dimensional stability. Mold temperatures in the range of 60 - 80°C will result in

	Grade	Feed Throat Temperature (°C)	Processing Temperature (°C)	Mold Temperature (°C)	Hold Pressure (MPa)
Tecopet® PT (PET)	Impact Modified	50-70	260 – 280	90 - 140	60 - 100
	Reinforced	50-70	270 – 290	90 - 140	60 - 100
	Flame Retardant	50-70	260 – 280	90 - 140	60 - 100

Table 1. Recommended processing parameters for Tecopet®

poor surface, lower shrinkage and warpage, however if the use temperature of the part exceeds 70°C dimensional change occurs with post-shrinkage.

For PET the peripheral screw speed should be maximum 200 mm/s in order to minimize fiber breakage, material degradation and discoloring.

Back pressure should be as low as possible to protect material properties.

The actual required injection pressure depends on many variables, such as melt and mold temperatures, part thickness and flow length. It is only necessary to have enough injection pressure to fill the cavity of the mold.

Due to crystalline nature of PET, it is required to use fast injection rates especially in reinforced grades. Slow injection rates can be used at the start-up of the injection to prevent jetting and burning of material.

The mold shrinkage of PET mostly depends on the holding pressure and the holding time. During this stage material melt is continuously pushed into the part cavity which compensates the shrinkage of the part during solidification. The level of holding pressures and time that depend mainly on the part thickness and runner geometry are generally 1:2 to 2:3 of the maximum injection pressure.

Effects of main processing parameters on material properties are shown in Table 2.

Processing Parameter	Weld Line Strength	Surface Quality	Cycle Time	Shrinkage	Sink Mark
Melt Temperature ↗	↗	↗	↗		
Mold Temperature ↗	↗	↗	↗	↗	
Hold Pressure ↗				↙	↙
Injection Speed ↗	↗	↗			

Table 2. Effect of processing parameters on material properties

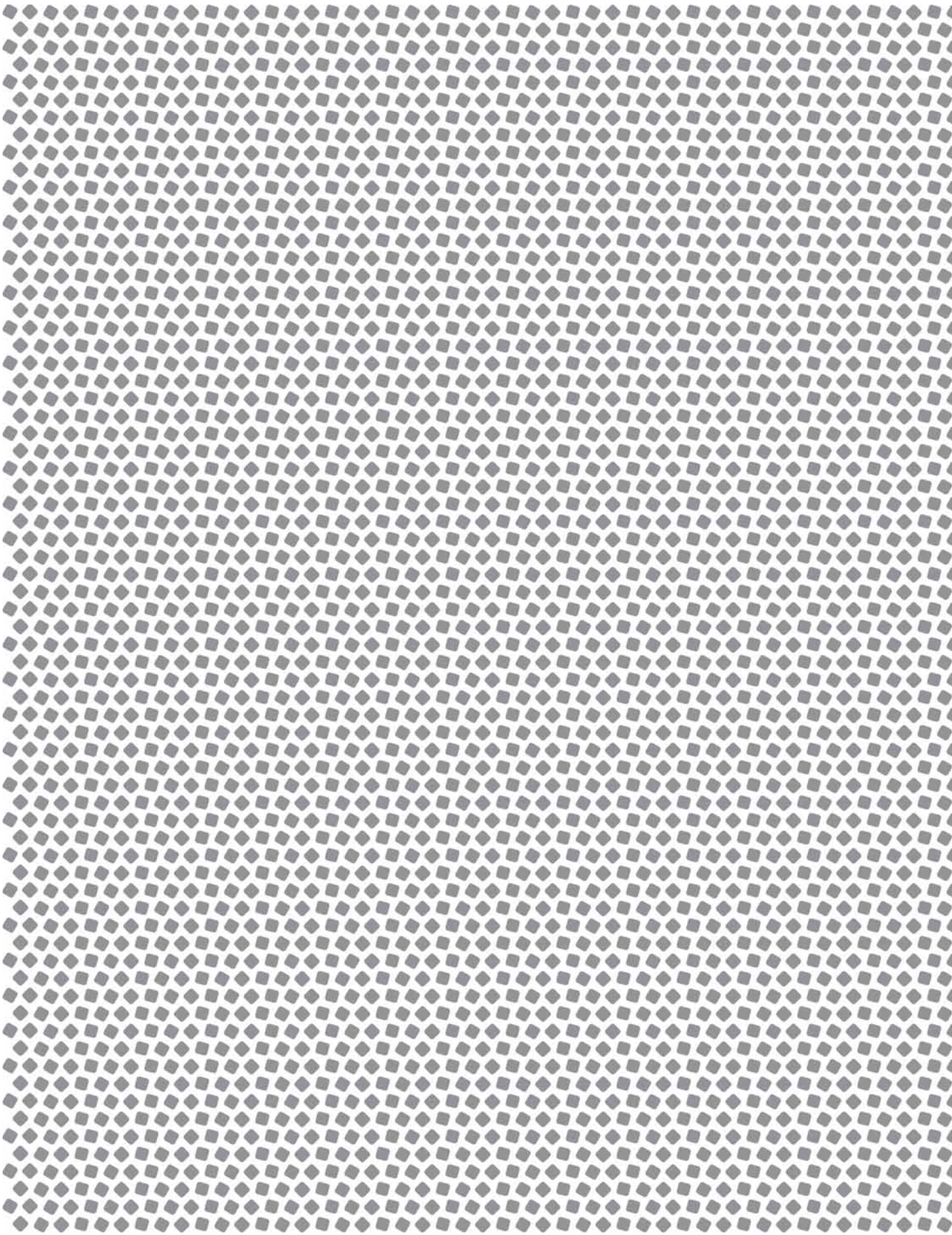
Recycling

Regrind levels up to 25% can be reused depending on the application and requirements. However for flame retardant grades maximum 10% addition is recommended. Regrinds should be free of contamination, should not be thermally degradated and must be dried prior to reuse.

Tecopet®

PROPERTY	CONDITION	UNIT	STANDARD	Prime Grades						
				PT70 GR15 NL100 PR PET, 15% glass fiber reinforced, heat stabilized, natural, fast crystallization grade	**PT70 GR15 NL100 MB** PET, 15% glass fiber reinforced, impact modified, heat stabilized, natural	**PT70 GR20 NL100 PR** PET, 20% glass fiber reinforced, heat stabilized, natural, fast crystallization grade	**PT70 GR30 NL100 HT** PET, 30% glass fiber reinforced, high heat stabilized, natural	**PT70 GR30 NL100 PR** PET, 30% glass fiber reinforced, heat stabilized, natural, fast crystallization grade	**PT70 GR30 NL100 MB** PET, 30% glass fiber reinforced, impact modified, heat stabilized, natural	**PT70 GR45 NL100 PR** PET, 45% glass fiber reinforced, heat stabilized, natural, fast crystallization grade
GENERAL										
Density	-	g/cm³	ISO 1183	1.44	1.40	1.48	1.59	1.58	1.50	1.69
Molding Shrinkage	Parallel / Normal	%	Eurotec	0.3 / 1.0	0.4 / 1.1	0.3 / 1.0	0.2 / 0.9	0.2 / 0.9	0.3 / 1.0	0.2 / 0.8
Moisture Content	-	%	ISO 15512	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Moisture Absorption	50% RH, 23 °C	%	ISO 62	0.2	0.2	0.2	0.2	0.2	0.2	0.2
MECHANICAL										
Stress at Break	+23°C	MPa	ISO 527	115	80	130	140	150	120	175
Strain at Break	+23°C	%	ISO 527	2.5	4	2.5	2	2.5	3	1.5
Tensile Modulus	+23°C	MPa	ISO 527	7000	5000	8500	11000	10500	8000	16000
Yield Strength	+23°C	MPa	ISO 527	-	-	-	-	-	-	-
Izod Impact, notched	+23°C	kJ/m²	ISO 180/1A	6	10	7	8	10	11	10
Izod Impact, notched	-30 °C	kJ/m²	ISO 180/1A	5	8	6	7	9	9	9
Izod Impact, un-notched	+23°C	kJ/m²	ISO 180/1U	-	-	-	30	55	-	-
Izod Impact, un-notched	-30 °C	kJ/m²	ISO 180/1U	-	-	-	25	45	-	-
THERMAL										
Melting Temperature	10 K/min	°C	ISO 11357	255	255	255	255	255	255	255
Heat Deformation Temperature	0.45 MPa	°C	ISO 75	-	-	-	240	245	-	-
Heat Deformation Temperature	1.80 MPa	°C	ISO 75	200	180	210	220	230	210	235
Vicat Softening Temperature	50N	°C	ISO 306	-	-	-	225	230	-	-
ELECTRICAL & FLAMMABILITY										
Volume Resistivity	-	Ohm.cm	IEC 60093	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16
Surface Resistivity	-	Ohm	IEC 60093	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14
Comparative Tracking Index	solution A	V	IEC 60112	250	250	250	250	250	250	250
Glow Wire Flammability Index	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Glow Wire Ignitability Temperature	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Flame Rating	0.75 mm	-	UL94	HB	HB	HB	HB	HB	HB	HB
Flame Rating	1.6 mm	-	UL94	HB	HB	HB	HB	HB	HB	HB

Prime Grades					Value Added Post Consumer Grades							
PT70 GR15 NL100 PS20 PET, 15% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, natural, fast crystallization grade	**PT70 GR30 NL100 XA20** PET, 30% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, natural	**PT70 GR30 NL100 XD70** PET, 30% glass fiber reinforced, flame retardant - halogen (RoHS compliant), long-term heat stabilized, natural	**PT70 GR30 NL100 PS20** PET, 30% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, natural, fast crystallization grade	**PT70 KK45 NL XA20 0B** PET, 45% glass fiber/mineral reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, natural	**PT74 GR20 BK002 DA** PET, 20% glass fiber reinforced, high heat stabilized, black	**PT74 GR30 BK002 DA** PET, 30% glass fiber reinforced, high heat stabilized, black	**PT74 GR45 BK002 PR** PET, 45% glass fiber reinforced, high heat stabilized, black, fast crystallization grade	**PT74 CR20 BK111 PR** PET, 20% carbon fiber reinforced, black, fast crystallization grade	**PT74 CR30 BK111 PR** PET, 30% carbon fiber reinforced, black, fast crystallization grade	**PT74 GR20 BK002 XA20** PET, 20% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, black	**PT74 GR30 BK002 XA20** PET, 30% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, black	**PT74 GR30 NL XA60** PET, 30% glass fiber reinforced, flame retardant - halogen & red phosphorus free, heat stabilized, natural
1.54	1.71	1.70	1.68	1.83	1.48	1.57	1.69	1.41	1.44	1.63	1.69	1.56
0.3 / 0.8	0.2 / 0.9	0.2 / 0.9	0.2 / 0.9	0.2 / 0.8	0.3 / 1.0	0.2 / 0.9	0.2 / 0.8	-	-	0.2 / 0.9	0.2 / 0.9	0.2 / 0.9
<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
90	140	130	120	100	120	150	140	150	180	100	130	100
2	1.5	2	1.5	1.5	2.5	2	1.5	2	1.5	2	2	1.5
7000	13000	12000	11500	13000	8000	11000	16000	15000	24000	8500	10500	12000
-	-	-	-	-	-	-	-	-	-	-	-	-
6	8	7	8	6	7	9	10	8	9	7	8	7
5	7	6	7	5	6	8	9	-	-	6	7	6
-	40	30	40	-	30	45	-	-	-	40	40	-
-	35	25	35	-	25	40	-	-	-	35	35	-
255	255	255	255	255	250	250	250	250	250	250	250	250
-	-	-	-	-	-	235	-	-	-	-	-	-
200	215	225	225	200	200	215	225	195	195	210	210	220
-	-	230	-	-	-	225	-	-	-	-	-	-
1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	1E+16	<1E+4	<1E+3	1E+16	1E+16	1E+16
1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	1E+14	-	-	1E+14	1E+14	1E+14
200	200	200	200	225	-	-	-	-	-	-	-	-
960	960	960	960	960	-	-	-	-	-	960	960	960
750	775	825	750	875	-	-	-	-	-	-	-	775
-	V0	V0	-	V0	HB	HB	HB	HB	HB	-	-	V0
V0	V0	V0	V0	V0	HB	HB	HB	HB	HB	V0	V0	V0



Tecotek® PC

INTRODUCTION

Tecotek® is the registered trade mark for Polycarbonate (PC) compounds produced by Eurotec.

Eurotec is offering a wide range of PC compounds and also blends with ABS, PBT, PET and ASA.

PROPERTIES

Our high quality technical compounds are able to meet the full range of requirements including product properties, process needs and end-use demands.

Key properties of Tecotek® resins offer;

- Excellent impact resistance
- High stiffness and hardness
- Good mechanical strength
- Very good dimensional stability
- High resistance to wear
- High heat deflection temperature
- Low mold shrinkage
- Good electrical properties
- Excellent flammability characteristics
- Low moisture absorption

PRODUCTS

Tecotek® products are consisting of the most diverse characteristics with different modifiers, stabilizers, special additives and customized colours as;

- Impact modified
- Glass fiber reinforced
- Glass bead reinforced
- Carbon fiber reinforced
- Flame retardant
- Lubricated
- Surface modified
- UV/light stabilized
- Electrical conductive
- Laser markable
- Speciality

APPLICATIONS

Due to excellent balance of properties, Tecotek® grades are suitable for an extensive range of industries like;

- Automotive
- Transportation
- Electrical / Electronic
- Construction
- Home appliances
- Sports and leisure
- Garden and power tools
- Safety equipment
- Medical

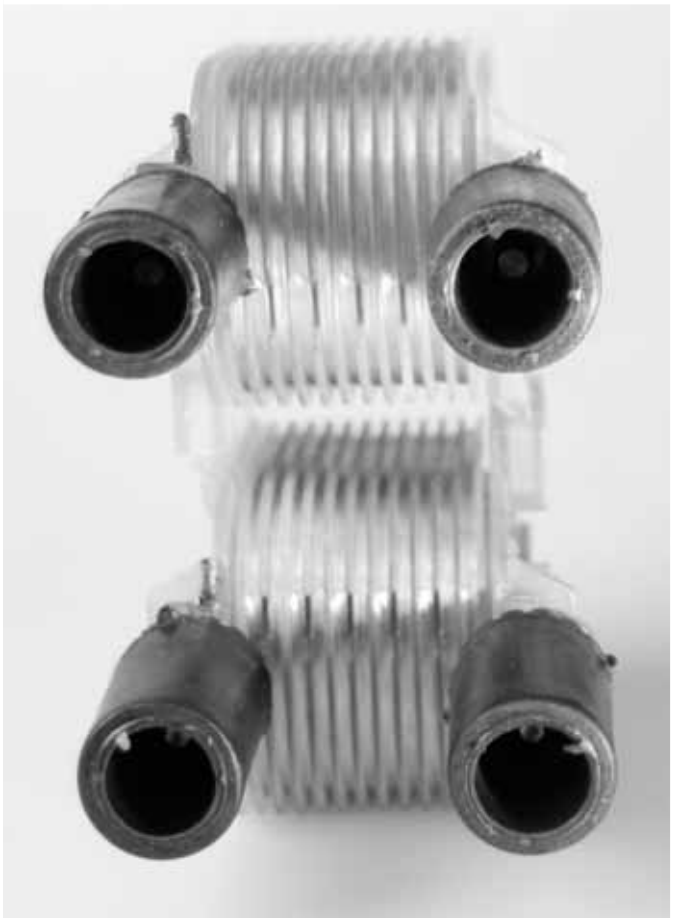
PACKAGING

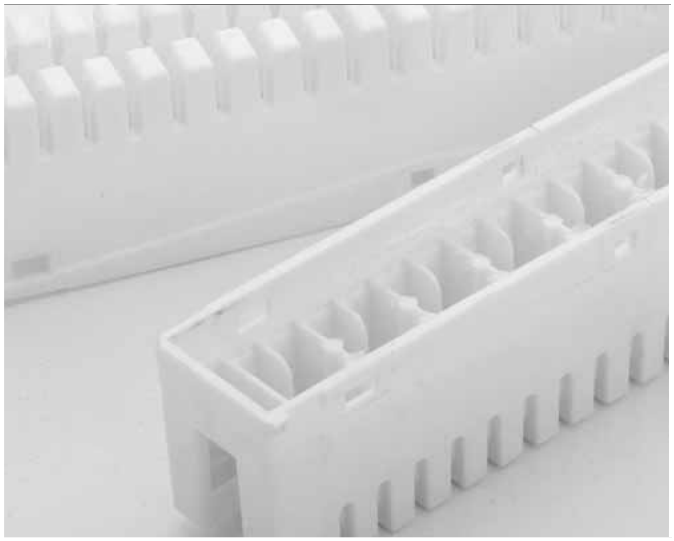
Tecotek® grades are supplied in pellet form and packed in moisture proof 25 kg multi-layer bags. Other forms of packing like octabins and big-bags with PE or Aluminum in-liners are also available.

All packaging is tightly sealed by Eurotec before shipment and should be opened just before processing. It is also advised to be kept in dry environment below 50°C while protected from UV-light. In order to prevent condensation, packaging stored in cold areas should be allowed to warm up to room temperature before being opened.

SAFETY

Under normal conditions Tecotek® is not a toxic and hazardous material. During processing, necessary preventive actions should be held in case of contact with polymer melt or inhalation of the gases. Processing temperatures above 320°C should be avoided. Detailed safety information can be found in our material safety data sheets (MSDS).





PROCESSING

Tecotek® compounds can be processed in all commercial injection molding machinery.

Injection Molding Machine

Selecting the proper design injection molding machine is important to have economic and quality moldings.

As a general rule, capacity of an injection molding machine should have 0.40 – 0.60 tons of clamping force for every square centimeter of projected shot area.

General purpose screw designs with compression ratios between 2.0:1 – 2.5:1, and screw size of 18D to 22D are recommended. Standard nitride screws and barrels are not resistant to the abrasion of fillers, especially glass fibers. However, bi-metallic barrel liners and surface hardened screws show outstanding resistance to wear.

Due to reduced shear general purpose open nozzles that are as short as possible are suggested. The temperature control of the nozzle is very important in order to avoid thermal loss or overheating. In general nozzle diameters should be 3 to 6 mm depending on the size of the part.

It is important to have precise temperature control for processing PC compounds therefore several heating zones of the barrel are necessary.

Cooling system of the feed throat is important to prevent sticking of the granules and to have consistent feed of material to barrel. On the other hand, too low throat temperature will cause condensation, resulting hydrolysis and melt foaming. Temperatures between 60°C – 80°C are suggested.

When molding PC the shot size should be between 30% - 80% of barrel capacity. Shots larger than 80% may generate improper melting, where shots less than 30% will increase the residence time of the material in the machine that can cause degradation, brittleness and discoloration.

Residence time of Tecotek® compounds in the barrel at correct processing temperatures should not exceed 4 minutes.

Molding Conditions

For PC compounds, moisture content should be less than 0.02% before processing. Moisture causes immediate hydrolytic degradation during process which causes molecular weight reduction and also surface defects like . Therefore Tecotek® grades should be dried at 120 °C for 3 – 4 hours.

The recommended pre-drying method is using desiccant driers where drying is independent of atmospheric environment. Controlling the performance of drying in desiccant driers depends on the dew point that indicates the proportion of water in the air. In order to obtain proper drying, values below –20°C for the dew point is suggested.

When using air circulating ovens, the quality of the drying depends on the atmospheric conditions. High relative humidity of air reduces the quality of drying and therefore circulating air ovens are not suggested to pre-dry PC.

Some guide recommendations for processing parameters are presented in Table 1.

The temperature of the melt in injection molding depends on barrel temperature settings, material residence time, screw design and speed. As it is difficult to estimate the effect of each parameter on melt temperature, it is suggested to be measured periodically with a pyrometer from the purged molten polymer. Tecotek® compounds should always be molded in a temperature-controlled mold. Uniform mold temperature within the cavity is very important to have good quality parts.

	Grade	Feed Throat Temperature (°C)	Processing Temperature (°C)	Mold Temperature (°C)	Hold Pressure (MPa)
Tecotek® PC (PC)	Unreinforced	60 – 80	260 – 300	80 - 100	60 - 120
	Reinforced	60 – 80	270 - 310	80 - 120	60 - 120
	Flame Retardant	60 – 80	250 - 290	80 - 100	60 - 120

Table 1. Recommended processing parameters for Tecotek®

For PC the peripheral screw speed should be maximum 200 mm/s in order to minimize fiber breakage, material degradation and discoloring.

Back pressure should be as low as possible to protect material properties.

The actual required injection pressure depends on many variables, such as melt and mold temperatures, part thickness and flow length. It is only necessary to have enough injection pressure to fill the cavity of the mold.

It is required to use medium to fast injection rates. Slow injection rates can be used at the start-up of the injection to prevent jetting and burning of material.

The mold shrinkage of PC mostly depends on the holding pressure and the holding time. During this stage material melt is continuously pushed into the part cavity which compensates the shrinkage of the part during solidification. The level of holding pressures and time that depend mainly on the part thickness and runner geometry are generally 1:2 to 2:3 of the maximum injection pressure.

Effects of main processing parameters on material properties are shown in Table 2.

Processing Parameter	Weld Line Strength	Surface Quality	Cycle Time	Shrinkage	Sink Mark
Melt Temperature ↗	↗	↗	↗		
Mold Temperature ↗	↗	↗	↗	↗	
Hold Pressure ↗				↙	↙
Injection Speed ↗	↗	↗			

Table 2. Effect of processing parameters on material properties

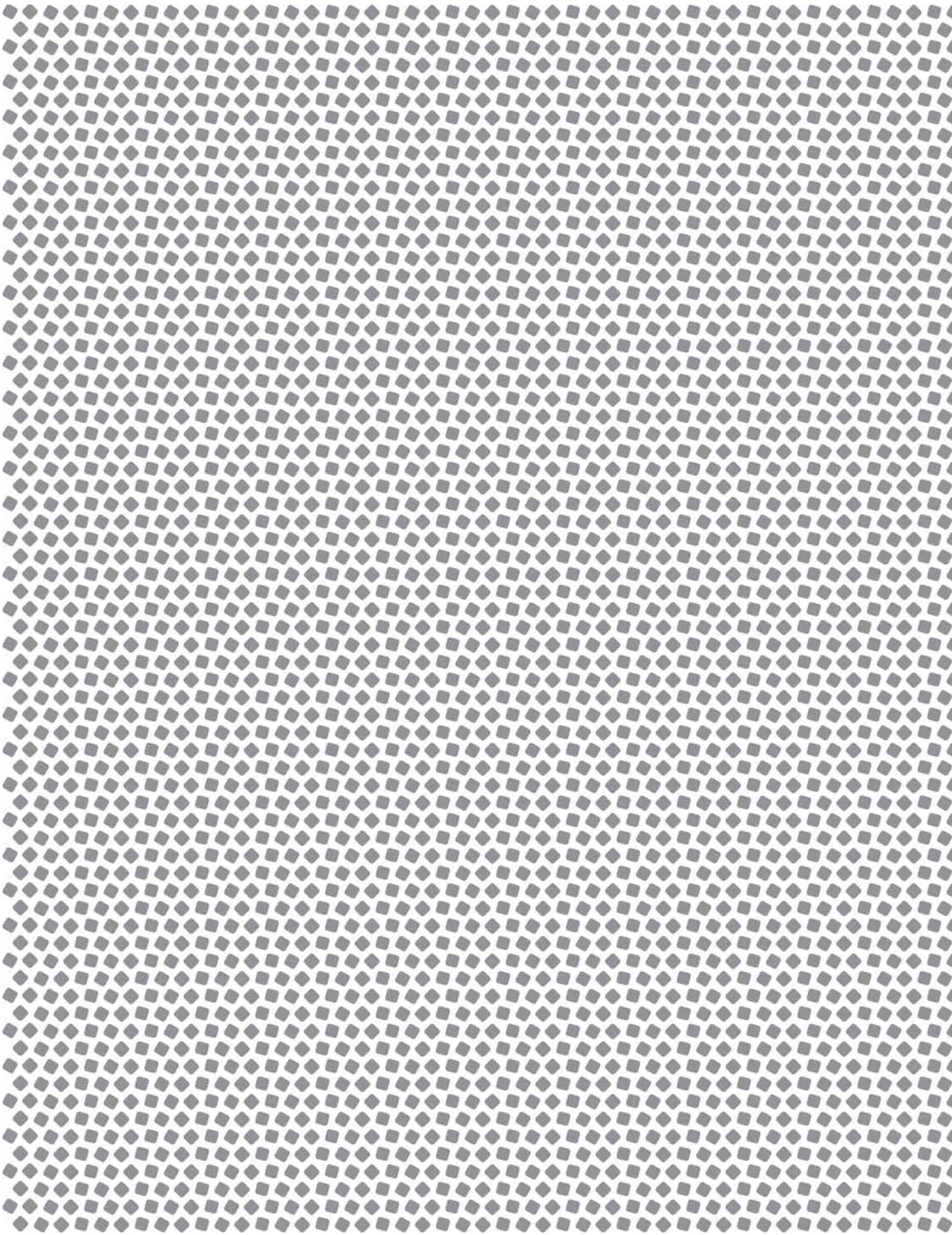
Recycling

Regrind levels up to 25% can be reused depending on the application and requirements. However for flame retardant grades maximum 10% addition is recommended. Regrinds should be free of contamination, should not be thermally degradated and must be dried prior to reuse.

Tecotek®

PROPERTY	CONDITION	UNIT	STANDARD	Prime Grades						
				PC30 NL RX PC, unfilled, improved flow & low temperature impact, natural	**PC30 NL VB03** PC/PET, unfilled, UV stabilized, high impact, natural	**PC40 NL VB02** PC/PBT, unfilled, UV stabilized, high impact, natural	**BC40 UF85 NL CE** PC/ABS, unfilled, heat & UV stabilized, natural, high heat grade	**BC40 UF65 NL CE** PC/ABS, unfilled, heat & UV stabilized, natural, standard grade	**BC40 UF45 NL CE** PC/ABS, unfilled, heat & UV stabilized, natural, easy flow grade	**PC40 GR10 NL** PC, 10% glass fiber reinforced, natural
GENERAL										
Density	-	g/cm³	ISO 1183	1.19	1.21	1.20	1.15	1.13	1.11	1.25
Molding Shrinkage	Parallel / Normal	%	Eurotec	0.6 / 0.6	0.8 / 0.8	1.0 / 1.0	-	-	-	0.5 / 0.5
Moisture Content	-	%	ISO 15512	<0.1	<0.1	<0.1	-	-	-	<0.1
Moisture Absorption	50% RH, 23 °C	%	ISO 62	0.2	0.2	0.2	-	-	-	0.2
MECHANICAL										
Stress at Break	+23°C	MPa	ISO 527	-	-	-	-	-	-	85
Strain at Break	+23°C	%	ISO 527	>50	>50	>50	>50	>50	>50	5
Tensile Modulus	+23°C	MPa	ISO 527	2250	2250	2250	2250	2250	2250	4000
Yield Strength	+23°C	MPa	ISO 527	65	55	55	60	55	50	-
Izod Impact, notched	+23°C	kJ/m²	ISO 180/1A	70	55	55	50	50	60	10
Izod Impact, notched	-30 °C	kJ/m²	ISO 180/1A	40	25	25	30	30	40	8
Izod Impact, un-notched	+23°C	kJ/m²	ISO 180/1U	NB	NB	NB	NB	NB	NB	-
Izod Impact, un-notched	-30 °C	kJ/m²	ISO 180/1U	NB	NB	NB	NB	NB	NB	-
THERMAL										
Melting Temperature	10 K/min	°C	ISO 11357	-	-	-	-	-	-	-
Heat Deformation Temperature	0.45 MPa	°C	ISO 75	140	120	110	-	-	-	140
Heat Deformation Temperature	1.80 MPa	°C	ISO 75	125	95	90	120	110	100	135
Vicat Softening Temperature	50N	°C	ISO 306	145	125	125	130	120	110	145
ELECTRICAL & FLAMMABILITY										
Volume Resistivity	-	Ohm.cm	IEC 60093	1E+15	1E+15	1E+15	1E+13	1E+13	1E+13	1E+15
Surface Resistivity	-	Ohm	IEC 60093	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15
Comparative Tracking Index	solution A	V	IEC 60112	-	-	-	-	-	-	175
Glow Wire Flammability Index	2 mm plaque	°C	IEC 60695	850	-	-	-	-	-	-
Glow Wire Ignitability Temperature	2 mm plaque	°C	IEC 60695	875	-	-	-	-	-	925
Flame Rating	0.75 mm	-	UL94	HB	HB	HB	HB	HB	HB	V2
Flame Rating	1.6 mm	-	UL94	HB	HB	HB	HB	HB	HB	V2

Prime Grades						Value Added Post Consumer Grades						
PC40 GR20 NL PC, 20% glass fiber reinforced, natural	**PC40 GR30 NL** PC, 30% glass fiber reinforced, natural	**PC40 NL FA70** PC, unfilled, flame retardant - halogen (RoHS compliant), natural	**PC30 NL TD70** PC, unfilled, flame retardant - halogen (RoHS compliant), impact modified, natural	**PC50 GR10 GR053 FA20** PC, 10% glass fiber reinforced, flame retardant - halogen (RoHS compliant), grey RAL 9002	**PC30 GR20 GR003 ZG20** PC, 20% glass fiber reinforced, flame retardant - halogen (RoHS compliant), grey RAL 7035	**BC43 UF65 NL CE** PC/ABS, unfilled, heat & UV stabilized, natural, standard grade	**PC43 GR10 BK002** PC, 10% glass fiber reinforced, black	**PC43 GR20 BK002** PC, 20% glass fiber reinforced, black	**PC43 GR30 BK002** PC, 30% glass fiber reinforced, black	**PC43 GR003 TD70** PC, unfilled, flame retardant - halogen (RoHS compliant), impact modified, light grey	**PC44 GR003 ZG70** PC, unfilled, flame retardant - halogen (RoHS compliant), light grey	**PC44 GR10 GR003 ZG70** PC, 10% glass fiber reinforced, flame retardant - halogen (RoHS compliant), light grey
1.33	1.41	1.23	1.21	1.29	1.38	1.13	1.25	1.33	1.41	1.22	1.23	1.31
0.5 / 0.5	0.4 / 0.4	0.5 / 0.5	0.6 / 0.6	0.5 / 0.5	0.5 / 0.5	-	0.5 / 0.5	0.5 / 0.5	0.4 / 0.4	0.6 / 0.6	0.5 / 0.5	0.5 / 0.5
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
0.2	0.2	0.2	0.2	0.2	0.2	-	0.2	0.2	0.2	0.2	0.2	0.2
115	135	65	60	80	95	-	85	110	130	60	65	80
3	2.5	>20	>50	4	2.5	>50	5	2.5	2	>20	>20	4
6500	9000	2750	2250	4000	7000	2250	4000	6500	9000	2250	2500	4500
-	-	-	-	-	-	45	-	-	-	-	-	-
12	14	8	50	11	10	35	11	13	15	35	10	6
10	12	-	20	9	8	20	9	11	12	15	8	5
-	-	-	NB	-	-	NB	-	-	-	NB	-	-
-	-	-	NB	-	-	NB	-	-	-	NB	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
145	145	140	105	140	145	-	140	145	145	105	135	135
140	140	120	95	130	135	105	135	140	140	95	120	130
145	145	140	130	140	145	120	145	145	145	130	140	145
1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+13	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15
1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15
175	175	225	225	175	175	-	175	175	175	225	225	175
-	-	960	960	960	960	-	850	850	850	960	960	960
925	925	-	900	900	925	-	875	875	875	875	925	900
V2	V2	-	V0	V0	V0	HB	-	-	-	V0	V0	V0
V2	V2	V0	V0	V0	V0	HB	-	-	-	V0	V0	V0



Tecolen® PP

INTRODUCTION

Tecolen® is the registered trade mark for Polypropylene (PP) compounds produced by Eurotec.

Eurotec is offering a specialty range of PP homopolymer and copolymer compounds.

PROPERTIES

Our high quality technical compounds are able to meet the full range of requirements including product properties, process needs and end-use demands.

Key properties of Tecolen® resins offer;

- Low density
- Very good impact resistance
- Excellent chemical resistance
- Good electrical properties
- Excellent processability
- Low moisture absorption
- Very good cost/performance ratio

PRODUCTS

Tecolen® products are consisting of the most diverse characteristics with different modifiers, stabilizers, special additives and customized colours as;

- Impact modified
- Glass fiber reinforced
- Glass bead reinforced
- Mineral reinforced
- Flame retardant
- Heat stabilized
- UV/light stabilized
- Electrical conductive
- Laser markable
- Speciality

APPLICATIONS

Due to excellent balance of properties, Tecolen® grades are suitable for an extensive range of industries like;

- Automotive
- Transportation
- Electrical / Electronic
- Furniture
- Construction
- Home appliances
- Sports and leisure
- Garden and power tools
- Safety equipment
- Medical

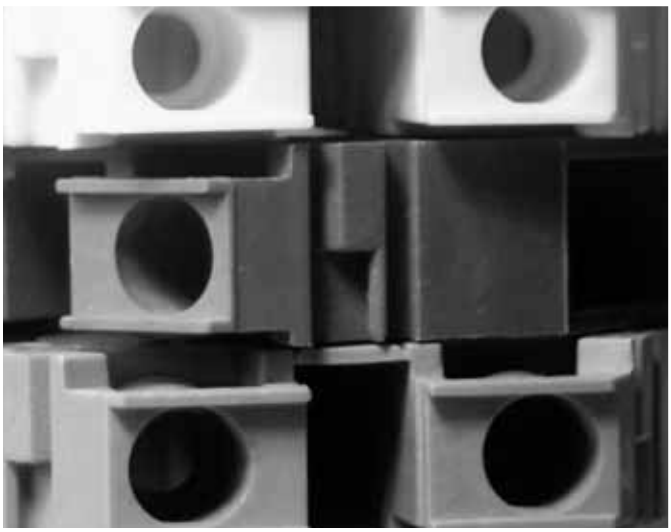
PACKAGING

Tecolen® grades are supplied in pellet form and packed in 25 kg PE bags. Other forms of packing like octabins and big-bags with in-liners are also available.

All packaging is tightly sealed by Eurotec before shipment and should be opened just before processing. It is also advised to be kept in dry environment below 50°C while protected from UV-light. In order to prevent condensation, packaging stored in cold areas should be allowed to warm up to room temperature before being opened.

SAFETY

Under normal conditions Tecolen® is not a toxic and hazardous material. During processing, necessary preventive actions should be held in case of contact with polymer melt or inhalation of the gases. Processing temperatures above 300°C should be avoided. Detailed safety information can be found in our material safety data sheets (MSDS).



PROCESSING

Tecolen® compounds can be processed in all commercial injection molding machinery.

Injection Molding Machine

Selecting the proper design injection molding machine is important to have economic and quality moldings.

As a general rule, capacity of an injection molding machine should have 0.3 – 0.5 tons of clamping force for every square centimeter of projected shot area.

General purpose screw designs with compression ratios between 2.5:1 – 3.0:1, and screw size of 16D to 24D are recommended. Standard nitride screws and barrels are not resistant to the abrasion of fillers, especially glass fibers. However, bi-metallic barrel liners and surface hardened screws show outstanding resistance to wear.

Standard nozzles can be used, however reverse taper nozzles are accomplished to prevent both drool and freezing. The temperature control of the nozzle is very important in order to avoid thermal loss or overheating. In general, nozzle diameters should be 3 to 6 mm depending on the size of the part.

It is important to have precise temperature control for processing polypropylene therefore several heating zones of the barrel are necessary.

Cooling system of the feed throat is important to prevent sticking of the granules and to have consistent feed of material to barrel. Temperatures less than 60°C are suggested.

When molding polypropylene the shot size should be between 30% - 70% of barrel capacity. Shots larger than 70% may generate improper melting, where shots less than 30% will increase the residence time of the material in the machine that can cause degradation, brittleness and discoloration.

Residence time of Tecolen® compounds in the barrel at correct processing temperatures should not exceed 4 minutes.

Molding Conditions

Polypropylene compounds absorbs very low amount of moisture and normally pre-drying is not necessary.

Some guide recommendations for processing parameters are presented in Table 1.

The temperature of the melt in injection molding depends on barrel temperature settings, material residence time, screw design and speed. As it is difficult to estimate the effect of each parameter on melt temperature, it is suggested to be measured periodically with a pyrometer from the purged molten polymer. Tecolen® compounds should always be molded in a temperature-controlled mold. Uniform mold temperature within the cavity is very important to have good quality parts.

For un-reinforced polypropylene the peripheral screw speed should be maximum 400 mm/s where for reinforced types it should not exceed 200 mm/s in order to minimize fiber breakage, material degradation and discoloring.

Back pressure should be as low as possible to protect material properties.

The actual required injection pressure depends on many variables, such as melt and mold temperatures, part thickness and flow length. It is only necessary to have enough injection pressure to fill the cavity of the mold.

	Grade	Feed Throat Temperature (°C)	Processing Temperature (°C)	Mold Temperature (°C)	Hold Pressure (MPa)
Tecolen® HP (PPHP)	Un-reinforced	<60	200 - 240	20 - 50	40 - 80
	Impact Modified	<60	200 - 240	20 - 50	40 - 80
	Reinforced	<60	200 - 240	20 - 50	40 - 80
	Flame Retardant	<60	200 - 240	20 - 50	40 - 80
Tecolen® CP (PPCP)	Un-reinforced	<60	200 - 240	20 - 50	40 - 80
	Impact Modified	<60	200 - 240	20 - 50	40 - 80
	Reinforced	<60	200 - 240	20 - 50	40 - 80
	Flame Retardant	<60	200 - 240	20 - 50	40 - 80

Table 1. Recommended processing parameters for Tecolen®

The mold shrinkage of polypropylene mostly depends on the holding pressure and the holding time. During this stage material melt is continuously pushed into the part cavity which compensates the shrinkage of the part during solidification. The level of holding pressures and time that depend mainly on the part thickness and runner geometry are generally 1:2 to 2:3 of the maximum injection pressure.

Effects of main processing parameters on material properties are shown in Table 2.

Processing Parameter	Weld Line Strength	Surface Quality	Cycle Time	Shrinkage	Sink Mark
Melt Temperature ↗	↗	↗	↗		
Mold Temperature ↗	↗	↗	↗	↗	
Hold Pressure ↗				↙	↙
Injection Speed ↗	↗	↗			

Table 2. Effect of processing parameters on material properties

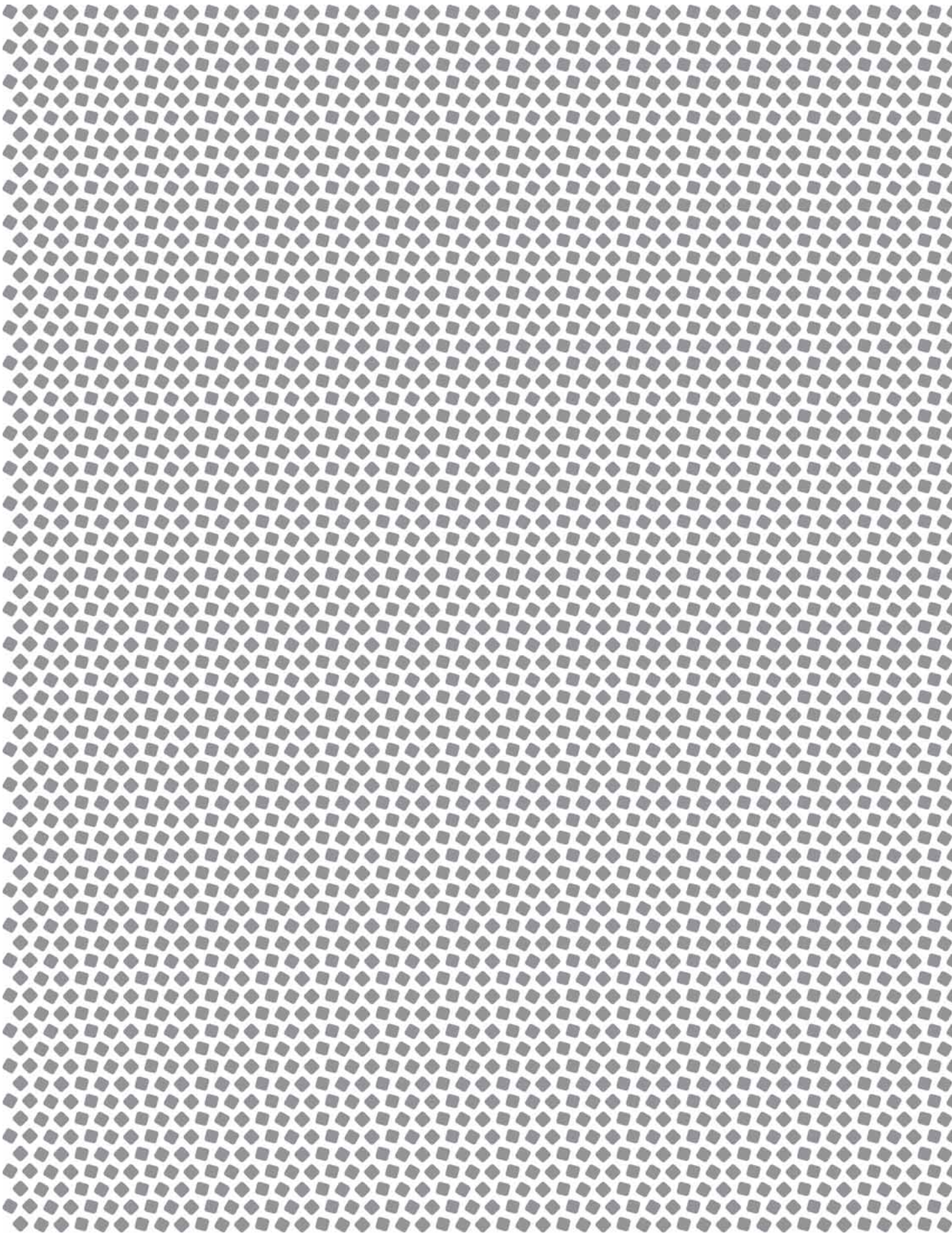
Recycling

Regrind levels up to 25% can be reused depending on the application and requirements. However for flame retardant grades maximum 10% addition is recommended. Regrinds should be free of contamination, should not be thermally degradated and must be dry as molded, or be dried prior to reuse.

Tecolen®

PROPERTY	CONDITION	UNIT	STANDARD	Copolymer						
				CP30 NL MY PPCP, impact modified, heat & UV stabilized, natural	**CP20 GB30 NL** PPCP, 30% glass bead reinforced, natural	**CP10 GR10 NL** PPCP, 10% glass fiber reinforced, natural	**CP10 GR15 NL** PPCP, 15% glass fiber reinforced, natural	**CP30 GR20 NL** PPCP, 20% glass fiber reinforced, natural, high flow grade	**CP10 GR30 NL** PPCP, 30% glass fiber reinforced, natural	**CP20 GR40 NL** PPCP, 40% glass fiber reinforced, natural
GENERAL										
Density	-	g/cm³	ISO 1183	0.90	1.11	0.96	0.99	1.03	1.11	1.20
Molding Shrinkage	Parallel / Normal	%	Eurotec	-	-	-	-	-	-	-
Moisture Content	-	%	ISO 15512	-	-	-	-	-	-	-
Moisture Absorption	50% RH, 23 °C	%	ISO 62	-	-	-	-	-	-	-
MECHANICAL										
Stress at Break	+23°C	MPa	ISO 527	-	20	45	50	70	75	80
Strain at Break	+23°C	%	ISO 527	>200	>50	7	6	5	5	5
Tensile Modulus	+23°C	MPa	ISO 527	750	1500	2500	3250	4250	5500	7000
Yield Strength	+23°C	MPa	ISO 527	15	-	-	-	-	-	-
Izod Impact, notched	+23°C	kJ/m²	ISO 180/1A	60	6	20	20	20	25	25
Izod Impact, notched	-30 °C	kJ/m²	ISO 180/1A	-	4	10	10	10	15	15
Izod Impact, un-notched	+23°C	kJ/m²	ISO 180/1U	NB	-	-	-	-	-	-
Izod Impact, un-notched	-30 °C	kJ/m²	ISO 180/1U	NB	-	-	-	-	-	-
THERMAL										
Melting Temperature	10 K/min	°C	ISO 11357	160 - 165	160 - 165	160 - 165	160 - 165	160 - 165	160 - 165	160 - 165
Heat Deformation Temperature	0.45 MPa	°C	ISO 75	-	-	-	-	-	-	-
Heat Deformation Temperature	1.80 MPa	°C	ISO 75	40	60	110	115	120	135	140
Vicat Softening Temperature	50N	°C	ISO 306	-	-	-	-	-	-	-
ELECTRICAL & FLAMMABILITY										
Volume Resistivity	-	Ohm.cm	IEC 60093	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15
Surface Resistivity	-	Ohm	IEC 60093	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15
Comparative Tracking Index	solution A	V	IEC 60112	-	-	-	-	-	-	-
Glow Wire Flammability Index	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Glow Wire Ignitability Temperature	2 mm plaque	°C	IEC 60695	-	-	-	-	-	-	-
Flame Rating	0.75 mm	-	UL94	HB	HB	HB	HB	HB	HB	HB
Flame Rating	1.6 mm	-	UL94	HB	HB	HB	HB	HB	HB	HB

Copolymer							Homopolymer					
CP10 GR50 NL PPCP, 50% glass fiber reinforced, natural	**CP30 NL XC30** PPCP, flame retardant - halogen (RoHS compliant), heat stabilized, natural	**CP30 NL XA80** PPCP, flame retardant - halogen free, heat stabilized, natural	**CP20 MF20 NL XA70** PPCP, 20% mineral filled, flame retardant - halogen (RoHS compliant), heat stabilized, natural	**CP20 MF20 NL XC30** PPCP, 20% mineral filled, flame retardant - halogen (RoHS compliant), heat stabilized, natural, **UL registered**	**CP20 GR20 NL XC30** PPCP, 20% glass fiber reinforced, flame retardant - halogen (RoHS compliant), heat stabilized, natural	**CP20 BK EC** PPCP, electrically conductive, black	**HP30 KG30 NL HS 0B** PPHP, 30% glass fiber/glass bead reinforced, heat stabilized, natural	**HP10 GR10 NL** PPHP, 10% glass fiber reinforced, natural	**HP10 GR20 NL** PPHP, 20% glass fiber reinforced, natural	**HP10 GR30 NL HS** PPHP, 30% glass fiber reinforced, heat stabilized, natural	**HP30 NL XC30** PPHP, flame retardant - halogen (RoHS compliant), heat stabilized, natural	**HP30 NL XA80** PPHP, flame retardant - halogen free, heat stabilized, natural
1.32	0.93	1.05	1.36	1.09	1.07	0.99	1.11	0.96	1.03	1.11	0.93	1.05
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
90	20	20	20	25	50	25	75	50	70	90	30	25
3	>100	-	10	40	5	-	3	6	4	3	>100	-
11000	1000	1750	3500	2250	4000	1250	5500	3000	5000	6250	1250	2500
-	-	-	-	-	-	-	-	-	-	-	-	-
20	60	10	15	10	25	60	10	6	10	14	8	3.5
15	10	4	5	3.5	-	-	-	-	-	-	3	2.5
-	-	-	-	75	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
160 - 165	160 - 165	160 - 165	160 - 165	160 - 165	160 - 165	160 - 165	165 - 170	165 - 170	165 - 170	165 - 170	165 - 170	165 - 170
-	-	-	-	-	-	-	-	-	-	-	-	-
145	50	60	60	55	90	50	145	130	140	155	65	60
-	-	-	-	-	-	-	-	-	-	-	-	-
1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	<1E+2	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15
1E+15	1E+15	1E+15	1E+15	1E+15	1E+15	<1E+2	1E+15	1E+15	1E+15	1E+15	1E+15	1E+15
-	-	600	-	-	-	-	-	-	-	-	-	600
-	960	960	960	850	850	-	-	-	-	-	960	960
-	775	875	725	775	800	-	-	-	-	-	775	875
HB	V2	V2	V0	V2	V2	HB	HB	HB	HB	HB	V2	V2
HB	V2	V0	V0	V2	V2	HB	HB	HB	HB	HB	V2	V0



Tecoform® POM

INTRODUCTION

Tecoform® is the registered trade mark for Polyacetal (POM) compounds produced by Eurotec.

Eurotec is offering a specialty range of POM compounds suitable for technical applications.

PROPERTIES

Our high quality technical compounds are able to meet the full range of requirements including product properties, process needs and end-use demands.

Key properties of Tecoform® resins offer;

- Excellent stiffness and hardness
- Good mechanical strength
- Very good toughness
- Excellent abrasion resistance and low friction
- Very good sliding properties
- Good dimensional stability
- Good creep and fatigue behaviour
- Good thermal stability
- Low moisture absorption
- Good electrical properties
- Very good chemical resistance
- Very good surface finish

PRODUCTS

Tecoform® products are consisting of the most diverse characteristics with different modifiers, stabilizers, special additives and customized colours as;

- Unreinforced
- Impact modified
- Glass fiber reinforced
- Carbon fiber reinforced
- Aramide fiber reinforced
- Glass bead reinforced
- Low warpage types
- Lubricated
- Surface modified
- Heat stabilized
- UV/light stabilized
- Electrical conductive
- Laser markable
- Speciality

APPLICATIONS

Due to excellent balance of properties, Tecoform® grades are suitable for an extensive range of industries like;

- Automotive
- Transportation
- Furniture
- Construction
- Home appliances
- Sports and leisure
- Garden and power tools
- Safety equipment

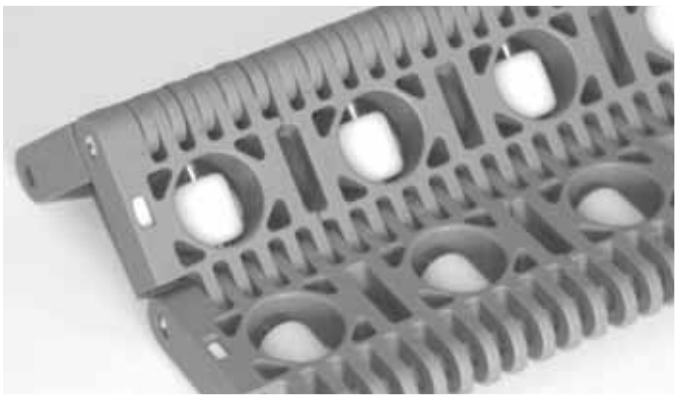
PACKAGING

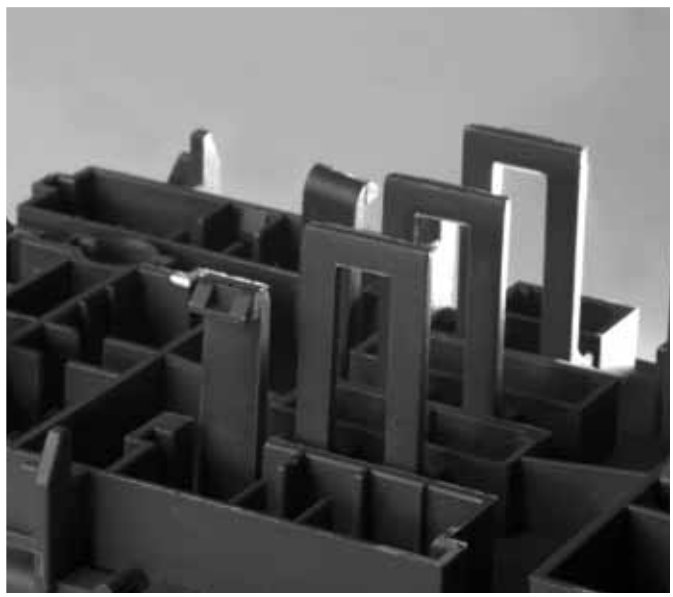
Tecoform® grades are supplied in pellet form and packed in moisture proof 25 kg multi-layer bags. Other forms of packing like octabins and big-bags with PE or Aluminum in-liners are also available.

All packaging is tightly sealed by Eurotec before shipment and should be opened just before processing. It is also advised to be kept in dry environment below 50°C while protected from UV-light. In order to prevent condensation, packaging stored in cold areas should be allowed to warm up to room temperature before being opened.

SAFETY

Under normal conditions Tecoform® is not a toxic and hazardous material. During processing, necessary preventive actions should be held in case of contact with polymer melt or inhalation of the gases. Processing temperatures above 240 °C should be avoided. Detailed safety information can be found in our material safety data sheets (MSDS).





PROCESSING

Tecoform® compounds can be processed in all commercial injection molding machinery.

Injection Molding Machine

Selecting the proper design injection molding machine is important to have economic and quality moldings.

As a general rule, capacity of an injection molding machine should have 0.50 – 1.0 tons of clamping force for every square centimeter of projected shot area.

General purpose screw designs with compression ratios between 2.0:1 – 2.5:1, and screw size of 17D to 23D are recommended. Standard nitride screws and barrels are not resistant to the abrasion of fillers, especially glass fibers. However, bi-metallic barrel liners and surface hardened screws show outstanding resistance to wear.

Due to reduced shear general purpose open nozzles that are as short as possible are suggested. The temperature control of the nozzle is very important in order to avoid thermal loss or overheating. In general nozzle diameters should be 3 to 6 mm depending on the size of the part.

It is important to have precise temperature control for processing POM compounds therefore several heating zones of the barrel are necessary.

Cooling system of the feed throat is important to prevent sticking of the granules and to have consistent feed of material to barrel. On the other hand, too low throat temperature will cause condensation, resulting hydrolysis and melt foaming. Temperatures between 30°C – 50°C are suggested.

When molding POM the shot size should be between 20% - 80% of barrel capacity. Shots larger than 80% may generate improper melting, where shots less than 20% will increase the residence time of the material in the machine that can cause degradation, brittleness and discoloration.

Residence time of Tecoform® compounds in the barrel at correct processing temperatures should not exceed 5 minutes.

Molding Conditions

POM compounds absorb very low amount of moisture and normally pre-drying is not necessary however due to poor storage conditions Tecoform® grades can be dried at 100 - 120°C for 3 – 6 hours.

Some guide recommendations for processing parameters are presented in Table 1.

The temperature of the melt in injection molding depends on barrel temperature settings, material residence time, screw design and speed. As it is difficult to estimate the effect of each parameter on melt temperature, it is suggested to be measured periodically with a pyrometer from the purged molten polymer. Tecoform® compounds should always be molded in a temperature-controlled mold. Uniform mold temperature within the cavity is very important to have good quality parts.

For un-reinforced POM the peripheral screw speed should be maximum 300 mm/s where for reinforced types it should not exceed 200 mm/s in order to minimize fiber breakage, material degradation and discoloring.

Back pressure should be as low as possible to protect material properties.

The actual required injection pressure depends on many variables, such as melt and mold temperatures, part thickness and flow length. It is only necessary to have enough injection pressure to fill the cavity of the mold.

	Grade	Feed Throat Temperature (°C)	Processing Temperature (°C)	Mold Temperature (°C)	Hold Pressure (MPa)
Tecoform® PO (POM)	Un-reinforced	30-50	180 – 220	60 - 100	80 - 100
	Impact Modified	30-50	170 – 210	60 - 80	80 - 100
	Reinforced	30-50	190 - 230	60 - 120	80 - 100

Table 1. Recommended processing parameters for Tecoform®

Due to high crystalline nature of POM, it is required to use fast injection rates especially in reinforced grades. Slow injection rates can be used at the start-up of the injection to prevent jetting and burning of material.

The mold shrinkage of POM mostly depends on the holding pressure and the holding time. During this stage material melt is continuously pushed into the part cavity which compensates the shrinkage of the part during solidification. The level of holding pressures and time that depend mainly on the part thickness and runner geometry are generally 1:2 to 2:3 of the maximum injection pressure. For processing very precise parts, injection and hold pressure can be set to be equal.

Effects of main processing parameters on material properties are shown in Table 2.

Processing Parameter	Weld Line Strength	Surface Quality	Cycle Time	Shrinkage	Sink Mark
Melt Temperature ↗	↗	↗	↗		
Mold Temperature ↗	↗	↗	↗	↗	
Hold Pressure ↗				↙	↙
Injection Speed ↗	↗	↗			

Table 2. Effect of processing parameters on material properties

Recycling

Regrind levels up to 20% can be reused depending on the application and requirements. Regrinds should be free of contamination, should not be thermally degradated and must be dried prior to reuse.

Tecoform®

				Unreinforced				Reinforced
PROPERTY	CONDITION	UNIT	STANDARD	**PO20 NL IL** POM copolymer, unfilled, impact modified, natural	**PO20 NL RT** POM copolymer, unfilled, PTFE modified, natural	**PO20 NL RM** POM copolymer, unfilled, MoS_2 modified, natural	**PO20 NL RW** POM copolymer, unfilled, surface modified, natural	**PO30 GB20 NL HS** POM copolymer, 20% glass bead reinforced, heat stabilized, natural
GENERAL								
Density	-	g/cm³	ISO 1183	1.32	1.50	1.42	1.38	1.52
Molding Shrinkage	Parallel / Normal	%	Eurotec	2.0 / 2.0	1.9 / 1.9	1.9 / 1.9	2.0 / 2.0	1.6 / 1.6
Moisture Content	-	%	ISO 15512	-	-	-	-	-
Moisture Absorption	50% RH, 23 °C	%	ISO 62	0.2	0.2	0.2	0.2	0.2
MECHANICAL								
Stress at Break	+23°C	MPa	ISO 527	-	-	-	-	50
Strain at Break	+23°C	%	ISO 527	-	-	-	-	20
Tensile Modulus	+23°C	MPa	ISO 527	1100	2500	2500	2250	3000
Yield Strength	+23°C	MPa	ISO 527	50	50	60	60	-
Izod Impact, notched	+23°C	kJ/m²	ISO 180/1A	16	7	7	8	6
Izod Impact, notched	-30 °C	kJ/m²	ISO 180/1A	14	6	6	7	5
Izod Impact, un-notched	+23°C	kJ/m²	ISO 180/1U	-	-	-	-	-
Izod Impact, un-notched	-30 °C	kJ/m²	ISO 180/1U	-	-	-	-	-
THERMAL								
Melting Temperature	10 K/min	°C	ISO 11357	165	165	165	165	165
Heat Deformation Temperature	0.45 MPa	°C	ISO 75	-	-	-	-	-
Heat Deformation Temperature	1.80 MPa	°C	ISO 75	70	100	100	100	110
Vicat Softening Temperature	50N	°C	ISO 306	-	-	-	-	-
ELECTRICAL & FLAMMABILITY								
Volume Resistivity	-	Ohm.cm	IEC 60093	1E+14	1E+14	1E+14	1E+14	1E+14
Surface Resistivity	-	Ohm	IEC 60093	1E+16	1E+16	1E+16	1E+16	1E+16
Comparative Tracking Index	solution A	V	IEC 60112	600	600	600	600	500
Glow Wire Flammability Index	2 mm plaque	°C	IEC 60695	-	-	-	-	-
Glow Wire Ignitability Temperature	2 mm plaque	°C	IEC 60695	-	-	-	-	-
Flame Rating	0.75 mm	-	UL94	HB	HB	HB	HB	HB
Flame Rating	1.6 mm	-	UL94	HB	HB	HB	HB	HB

Reinforced

PO30 GB30 NL HS POM copolymer, 30% glass bead reinforced, heat stabilized, natural	**PO20 GR10 NL HS** POM copolymer, 10% glass fiber reinforced, heat stabilized, natural	**PO20 GR20 NL HS** POM copolymer, 20% glass fiber reinforced, heat stabilized, natural	**PO20 GR25 NL HS** POM copolymer, 25% glass fiber reinforced, heat stabilized, natural	**PO20 AR10 NL HS** POM copolymer, 10% aramide fiber reinforced, heat stabilized, natural
1.58	1.47	1.54	1.57	1.40
1.5 / 1.5	0.5 / 1.8	0.4 / 1.7	0.4 / 1.6	-
-	-	-	-	-
0.2	0.2	0.2	0.2	-
50	90	115	120	70
10	4	3	2.5	7.5
3500	4500	7000	8000	3500
-	-	-	-	-
5	6	7	7	8
4	5	6	6	7
-	-	-	-	-
-	-	-	-	-
165	165	165	165	165
-	-	-	-	-
115	150	155	160	100
-	-	-	-	-
1E+14	1E+14	1E+14	1E+14	1E+14
1E+16	1E+16	1E+16	1E+16	1E+16
500	500	500	500	500
-	-	-	-	-
-	-	-	-	-
HB	HB	HB	HB	HB
HB	HB	HB	HB	HB

Chemical Agent	Concentration (%)	Temperature (°C)	PA	PPA	PBT	PET	PC	PP	POM
acetaldehyde	40	23	1				0	2	
acetic acid	5	23	2		2	2			2
acetic acid	10	23	1		2		2		1
acetic acid	25	23	0					2	
acetic acid	25	60	0					2	
acetic acid	50	23	0		1	1			
acetic acid	80	23	0					2	
acetic acid	95	23	0	0	0	0	0		0
acetone	100	23	2	2	0	0	0	2	2
acetone	100	50	2		0	0	0		2
acetylene	100	23	2		2	2	2	2	2
acrylic acid	100	60	0				0		0
alkyl alcohol	100	23	1		2	2	1	2	
alkyl benzene	100	23	2						2
alkyl chloride	100	23						2	
alkyl chloride	100	60						1	
amine	100	23	2		2	2			2
amino acid	100	23	2		2	2			2
ammonia	25	23	2		2	2		2	2
ammonia	100	23	2	2	1	1	0	2	2
ammonia	100	60	1		0	0	0	2	2
ammonium chloride	25	23	2					2	
aniline	100	23	1	1	1	1	1	2	
argon	100	23	2		2	2			2
benzene	100	23	2	2	2	2	0	1	2
benzene	100	60	2		0	0	0	1	2
benzoic acid	20	23	1		2	2	0	2	1
benzyl alcohol	100	23	1	0	0	0	0	2	2
benzylidene aldehyte	100	23	0				0		
biphenyl	100	23			0	0			2
bitumen	100	23	2		2	2			2
boric acid	10	23	1		2	2	2	2	1
boron trifluoride	100	23	0		0	0			0
brake fluid	100	23	2	2	2	2			2
bromine	100	23	0	0	0	0		0	0
bromochloro methane	100	23	2		2	2			2
butane	50	23	2	2	2	2	2	2	2
butanediol	100	23	2		2	2		2	2
butanol	100	23	2	2	1	1	2	2	2
butyl acetate	100	23	2		1	1	0	0	2
butyl phtlate	100	23	2		2	2		1	2
butyric acid	20	23	1		2	2	0	0	1
calcium chloride	20	23	0					2	2
calcium hydroxide	100	23	2		2	2		2	2
carbon dioxide	100	23	2		2	2		2	2
carbon disulfide	100	23	2				0	2	2
carbon monoxide	100	23	2		2	2		2	2
caustic soda	30	23	2				0	2	
caustic soda	30	60	0				0	2	
caustic soda	50	23	2		0	0	0	2	2

2 - good resistance // 1- limited resistance // 0 - poor resistance

Chemical Agent	Concentration (%)	Temperature (°C)	PA	PPA	PBT	PET	PC	PP	POM
chlorine	100	23	0	0	0	0	0	0	0
chloro acetic acid	10	23	0		0	0			0
chloro benzene	100	23	2	2	2	2	0	0	2
chloro methane	100	23	0		0	0	0	1	1
chloro sulfonic acid	50	23	0		0	0		0	0
chloro trifluor ethane	100	23	2		2	2			2
chloroform	100	23	0	0	0	0	0	0	
chromic acid	3	23	0				2	1	
chromic acid	10	23	0		0	0		1	0
chromic acid	50	23	0		0	0		1	0
citric acid	10	23	2	2	2	2	2	2	2
cleaning agent, (acidic)	100	23	1		2	2	0		1
cleaning agent, general	100	23	2		2	2	1	2	2
cresol	100	23	0		0	0	0		
cyclohexanol	100	23	1		2	2		2	2
decalin	100	23	2		1	1	2		
dibutyl ether	100	23	x		2	2			2
dibutyl phthalate	100	23	2		2	2	0		2
dichlorobenzene	100	23	2					1	
dichloroethane	100	23	2		0	0		1	2
diethly ether	100	23	2	2	2	2	0	1	2
diisopropyl ether	100	23	2		2	2			2
dimethyl ether	100	23	2		2	2		1	2
dimethyl sulfate	100	23						1	
ethane	100	23	2		2	2		2	2
ethanol	40	23	2	2	2	2	2	2	2
ethanol	100	23	1	2	2	2	2	2	2
ethanol	100	60	1					2	
ethyl acetate	100	23	2		0	0	0	2	2
ethyl chloride	100	23	2		0	0		1	
ethylene	100	23	2		2	2		2	2
ethylene chloride	100	23	2				0	1	
ethylene chlorohydrine	100	23	0				0	2	
ethylene glycol	100	23	2	2	2	2	2	1	2
ethylene oxide	100	23	1	2	2	2		1	2
fats	100	23	2	2	2	2			2
fluorine	100	23	0	0	0	0		0	0
formaldehyde	40	23	2	2	2	2	2	2	2
formaldehyde	100	23	2	1	2	2	2	1	2
formic acid	10	23	0	1	2	2	1	2	0
formic acid	80	23	0	0				2	
formic acid	80	60	0					1	
fuels, diesel	100	23	2	2	2	2	1		2
fuels, gasoline	100	23	2	2	2	2	1		2
gear oil	100	100	2		2	2			1
glycerol	100	23	2	2	2	2	1		2
glycol	50	100	1	1	0	0			2
glycol	100	23	2	2	2	2	2	2	2
heating oil	100	23	2	2	2	2			1
helium	100	23	2		2	2		1	2

Chemical Agent	Concentration (%)	Temperature (°C)	PA	PPA	PBT	PET	PC	PP	POM
helium	100	60	2						
heptane	100	23	2	2	2	2	2	0	2
hexacholoro benzene	100	60	0						2
hexane	100	23	2		2	2	2		2
hydraulic fluids	100	80	2	2	2	2			2
hydrochloric acid	5	23	0	0	2	2	2	2	1
hydrochloric acid	20	23	0	0	1	1	1	2	0
hydrofluoric acid	50	23	0		0	0			0
hydrogen	100	23	2		2	2	2	2	2
hydrogen chloride	100	23	0		0	0		2	0
hydrogen peroxide	30	23	0	0	2	2	2	2	0
hydrogen sulfide	100	23	0	1			2		0
isopropanol	100	23	2	2	2	2	1	2	2
isopropanol	100	60	2		1	1		2	2
kerosene	100	23	2	2	2	2		1	2
ketones	100	23	1		0	0			2
lactic acid	10	23	2	1	2	2	2	2	2
lithium salts	10	23	0		2	2			2
lubricating oils	100	23	2		2	2	2	2	1
lubricating oils	100	100	2		2	2			
magnesium hydroxide	100	23	2		2			2	
magnesium salts	5	23	2	2	2	2	2	2	2
magnesium sulfate	10	23	1					2	
manganese salts	10	23	1		2	2	2		
mercury	100	23	2		2	2	2	2	2
methane	100	23	2	2	2	2	2	1	2
methanol	100	23	2	2	2	2	0	2	2
methyl amine	100	23	2		2	2	2		
methyl chloride	100	23	2	2	1	1		0	
methyl ethyl ketone	100	23	2	2	1	1	0	0	2
methyl formate	100	23	2		2	2			2
mineral oil	100	23	2	2	2	2		2	2
naphthalene	100	23	2		2	2			2
natural gas	100	23	2		2	2		1	2
nitric acid	5	23	0		2	2	2		0
nitric acid	20	23	0	0	0	0	0	2	0
nitro benzene	100	23	1	1	1	1	2	1	1
octane	100	23	2		2	2			2
octene	100	23	2		2	2			2
oxalic acid	10	23	1		2	2	2		0
ozone	100	23	0	0	0	0	2	1	0
pentanole	100	23			2	2	2		2
petroleum	100	23	2	2	2	2	1	2	2
petroleum	100	60	2		2	2	1	0	2
phenol	100	23	0	0	0	0	0	2	0
phenylethanol	100	23	1				0		
phtalic acid	100	23	1		2	2			2
potassium bromide	5	23	1		2	2	2	2	2

2 - good resistance // 1- limited resistance // 0 - poor resistance

Chemical Agent	Concentration (%)	Temperature (°C)	PA	PPA	PBT	PET	PC	PP	POM
potassium chloride	5	23	2		2	2	2	2	2
potassium dichromate	10	23	1		1	1	2	2	2
potassium hydroxide	50	23	1		0	0	0	2	1
potassium nitrate	5	23	2		2	2	2	2	2
potassium permanganate	3	23	0	0	2	2	2	1	2
potassium sulfate	100	23	2					2	
propane	100	23	2	2	2	2	2	2	2
propionic acid	50	23	0		0	0	0		0
propionic acid	100	23	0		0	0	0	2	0
rainwater	100	23	2		2	2		2	2
refrigerator oil	100	23	2	2	2	2			2
silicone oil	100	23	2	2	2	2	2	2	2
sodium carbonate	5	23	2	2	2	2	2		
sodium chlorate	10	23	2	2	2	2	2	2	2
sodium hydrogencarbonate	15	23	2		2	2	2		2
sodium hydroxide	10	23	2	2	1	1		2	2
sodium hydroxide	10	90	0		0	0	0		1
sodium hypochlorite	20	23	0		1	1		2	0
sodium hypochlorite	20	60	0		0	0		1	0
sodium salt	5	23	2	2	2	2	2		2
steam	100	100	1		0	0			2
stearic acid	100	23	2		2	2		2	2
stearic acid	100	60						1	
styrene	100	23	2	2	2	2	0		2
sulfur	100	23	2	2	2	2	2		2
sulfur dioxide	100	23	1		2	2	1	2	0
sulfuric acid	5	23	0	1	2	2	2	2	1
sulfuric acid	60	23	0	0			2	2	
sulfuric acid	96	23	0	0	0	0	0	2	0
tetrahydrofuran	100	23	2		2	2	0	1	1
tetrahydronaphtaline	100	23					0	0	
toluene	100	23	2	2	2	2	0	1	2
trichloro ethane	100	23	2	1	0	0			0
trichloro ethylene	100	23	1	1	0	0	0	1	0
trichloro methane	100	23	1		0	0	0	1	0
turpentine oil	100	23	2		2	2	1		
urea	5	23	2	2	2	2		2	
urea	25	23	2	2	2	2	2	2	
uric acid	10	23	2	2	2	2	2		2
vinyl acetate	100	23						2	
water	100	23	2		2	2	2	2	2
water	100	60	2	2	1	1		2	2
xylene	100	100	2		0	0	0	0	2
zinc chloride	10	23	1	2	2	2	2	2	2
zinc chloride	10	60	0					2	
zinc chloride	50	23	0	1	1	1	2	2	2

Troubleshooting

Injection Molding Troubleshooting

		Black Specks	Silver Streaks (splay)	Air Streaks	Poor Surface Finish	Blush (flow mark)	Burns (diesel effect)	Discoloration	Gloss Difference	Blister	Bubbles - Void	Delamination
Machine	Melt Temperature	4 ↓	3 ↓	7 ↓	2 ↑	5 ↓↑	4 ↓	2 ↓	6 ↓↑	3 ↓	12 ↓	2 ↑
	Nozzle Temperature		7 ↓	8 ↓			5 ↓	3 ↓				
	Injection Pressure				4 ↑	1 ↑	3 ↓				1 ↑	
	Hold Pressure				5 ↑				3 ↓↑		2 ↑	
	Back Pressure	6 ↓	6 ↓					5 ↓				
	Injection Time											
	Holding Time				6 ↑				4 ↓↑			
	Cycle Time	5 ↓	9 ↓					6 ↓				
	Cooling Time				8 ↑							
	Injection Speed		5 ↓		3 ↑	2 ↓↑	2 ↓		5 ↓↑		6 ↓	3 ↓↑
	Clamping Force									4 ↓		
	Shot Size										8 ↑	
	Screw Speed		4 ↓				6 ↓	4 ↓		1 ↓		
	Check Screw - Barrel Wear	7		2								
	Check Heater Bands					4	7					
	Check Back Flow Valve			1			8				4	
	Check Dead Edges	8										
	Purge Cylinder	1	10					1				7
	Use Fixtures and Jigs											
Mold	Mold Temperature		8 ↓		1 ↑	6 ↓↑			2 ↓↑		3 ↑	1 ↑
	Make Even Mold Temperature				10	7						
	Check Venting		11	6		8	1	7	7	2	5	
	Runner - Sprue - Gate Size		12 ↑			9 ↑	9 ↑				7 ↑	
	Length of Sprue										9 ↓	
	Change Gate Location				9		10			6	10	
	Check Mold Surface				7				1			
Material	Dry Material		1	5		3					11	6
	Check Material Contamination	2	2	3				8		5		4
	Check Regrind Quality	3		4				9				5
	Check Material Flow Property											

Numbers show the squence of the necessary action

↑ : increase

↓ : decrease

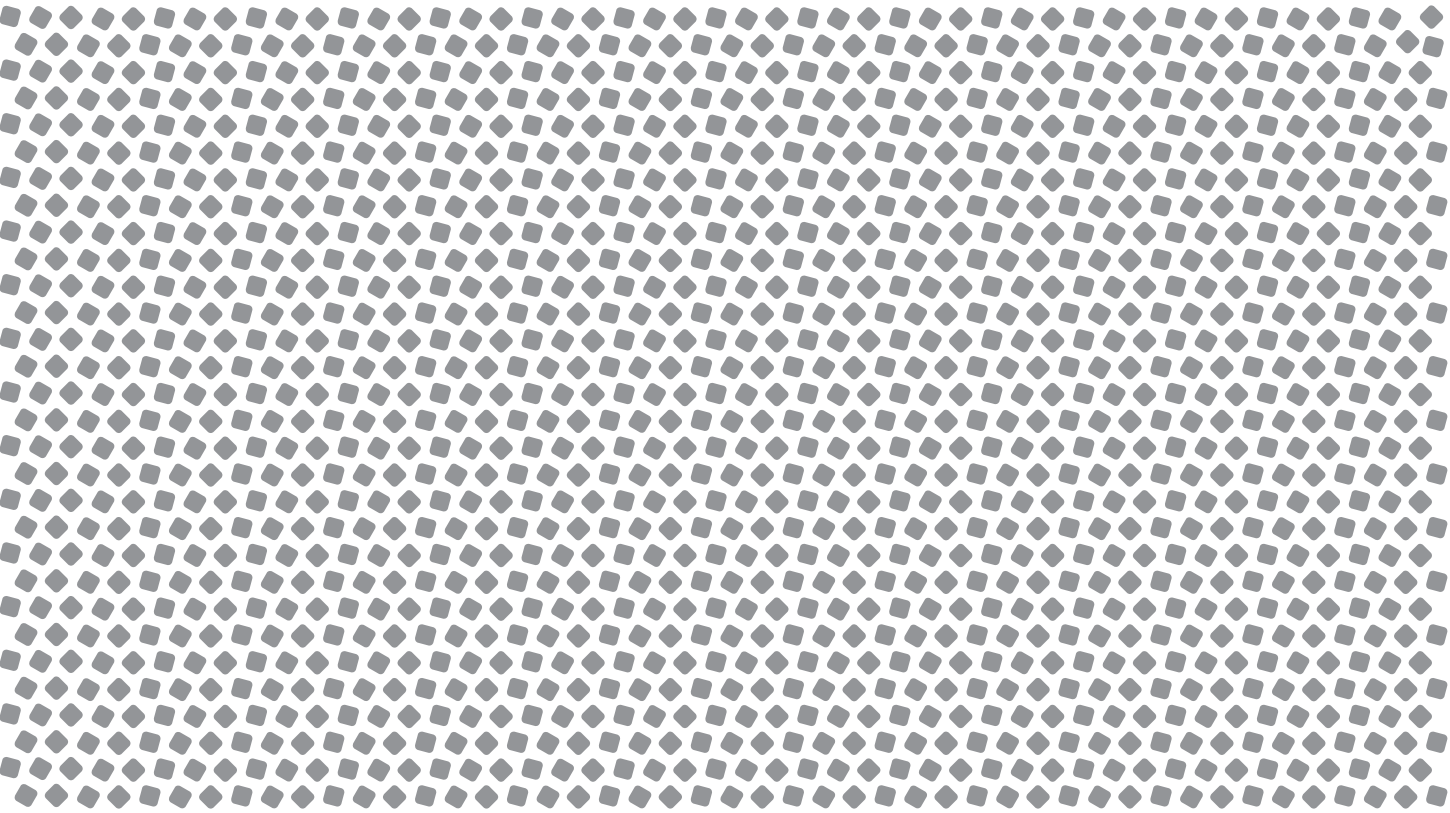
↓↑ : adjust

Brittleness	Cracking	Crazing	Ejector Pin Mark	Flash	Jetting	Record Grooves	Short Shot	Sink Mark	Weldline	Screw Recovery	Sprue Sticking	Sticking in Mold	Warpage	Odor
2 ↓↑	2 ↑	1 ↓↑	3 ↓	4 ↓	3 ↑	4 ↑	4 ↑	7 ↓	4 ↑			7 ↓	6 ↓	5 ↓
	4 ↑		4 ↓				5 ↑				5 ↓↑	9 ↓		6 ↓
4 ↓	5 ↓			2 ↓		2 ↑	2 ↑	4 ↑	1 ↑		1 ↓	1 ↓	4 ↓↑	
	6 ↓	3 ↓		8 ↓		3 ↑		2 ↑				2 ↓		
1 ↓				7 ↓						7 ↓				8 ↓
							3 ↑	6 ↑	2 ↑		2 ↓	3 ↓		
	7 ↓	4 ↓		5 ↓				3 ↑			3 ↓	4 ↓	5 ↑	
														7 ↓
			5 ↑								6 ↓↑	5 ↑	3 ↑	
	1 ↓↑	5 ↓↑	1 ↓	3 ↓	1 ↓	1 ↑	7 ↑	5 ↑	3 ↑			8 ↓		
				1 ↑										
				9 ↓			1 ↑	1 ↑				10 ↓↑		
3 ↓														
										1				4
					4					2				3
										3				
										4				
													9	
8 ↑	3 ↑	2 ↑	2 ↓	6 ↓	2 ↑	5 ↑	6 ↑	8 ↓	5 ↑		4 ↓	6 ↓	2 ↓↑	
								9					1	
				10			8	10	6					
					5 ↑		9 ↑	11 ↑	7 ↑				7 ↑	
									9 ↓					
		6			6			12	8				8	
				11		6						11		
7	9									6				
6	8							13		5				1
5								14						2
				12			10		10					

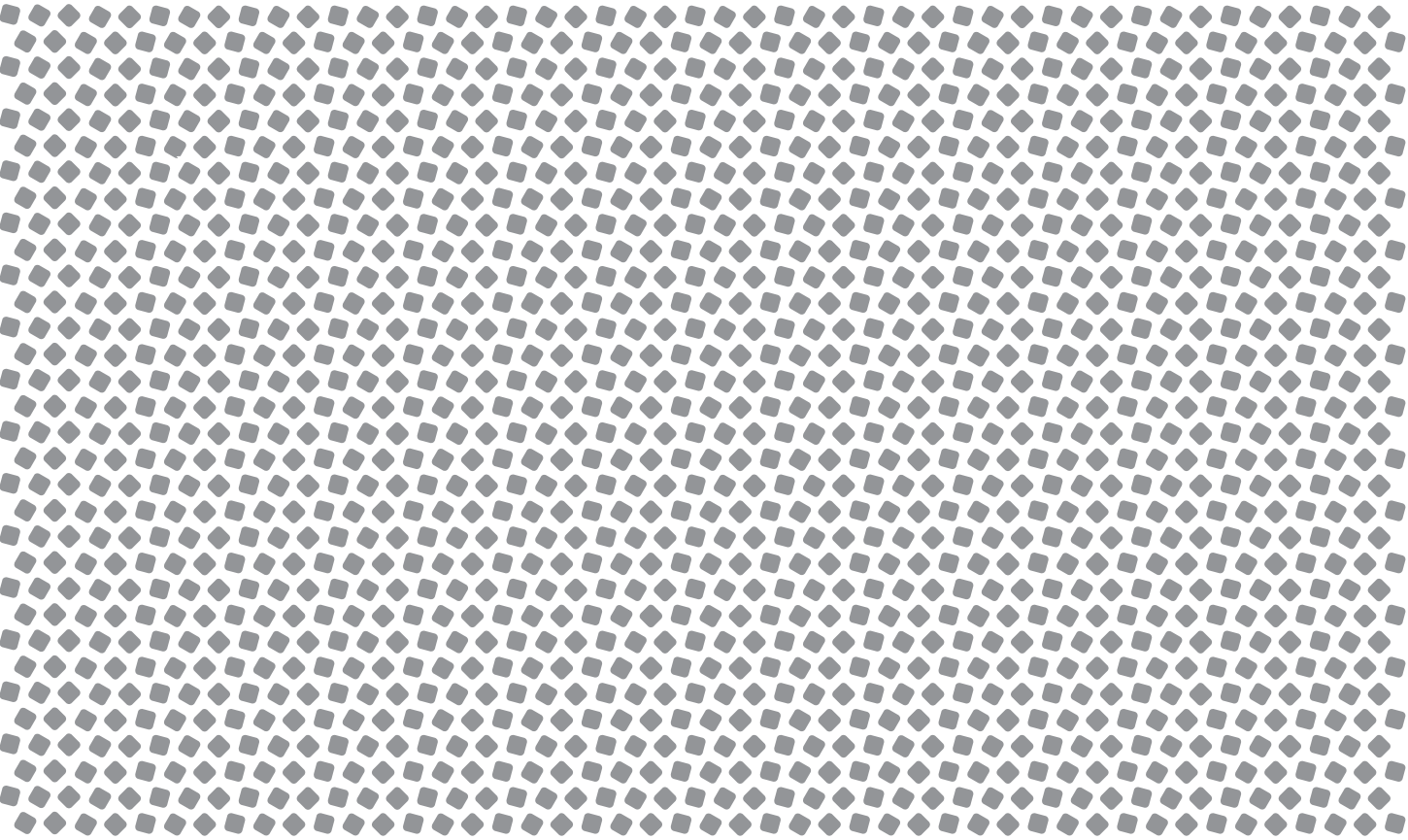
Processing Conditions

	Grade	Drying (°C/hr)	Maximum Moisture Content (%)	Feed Throat Temperature (°C)	Processing Temperature (°C)	Mold Temperature (°C)	Hold Pressure (MPa)	Back Pressure	Injection Speed	Maximum Screw Speed (rpm)
Tecomid® (PA 6.6)	Un-reinforced	80/2*	0.2	60 – 80	270 - 290	50 - 90	50 - 100	Low	Medium - Fast	400
	Impact Modified	80/2*	0.2	60 – 80	260 - 290	50 - 90	50 - 100	Low	Medium - Fast	400
	Reinforced	80/2*	0.2	60 – 80	270 - 300	70 - 110	50 - 100	Low	Fast	200
	Flame Retardant	80/2*	0.2	60 – 80	260 - 280	50 - 100	50 - 100	Low	Medium - Fast	200
Tecomid® (PA 6)	Un-reinforced	80/2*	0.2	60 – 80	240 - 260	40 – 80	50 - 100	Low	Medium - Fast	400
	Impact Modified	80/2*	0.2	60 – 80	230 - 260	40 - 80	50 - 100	Low	Medium - Fast	400
	Reinforced	80/2*	0.2	60 – 80	250 - 270	60 – 100	50 - 100	Low	Fast	200
	Flame Retardant	80/2*	0.2	60 - 80	230 - 250	40 - 90	50 - 100	Low	Medium - Fast	200
Tecomid®HT (PPA)	Un-reinforced	120/4	0.2	60 – 80	320 - 340	70 - 90	40 - 80	Low	Medium - Fast	400
	Impact Modified	120/4	0.2	60 – 80	320 - 330	70 – 90	40 - 80	Low	Low - Medium	400
	Reinforced	120/4	0.2	60 – 80	320 - 340	140 - 180	40 - 80	Low	Fast	200
	Flame Retardant	120/4	0.2	60 – 80	320 - 330	140 - 180	40 - 80	Low	Medium - Fast	200
Tecodur® (PBT)	Un-reinforced	120/2-4	0.04	50 – 70	240 – 260	60 - 100	40 - 80	Low	Medium - Fast	300
	Impact Modified	120/2-4	0.04	50 – 70	240 – 260	60 - 100	40 - 80	Low	Medium - Fast	300
	Reinforced	120/2-4	0.04	50 – 70	250 - 270	60 - 100	40 - 80	Low	Fast	200
	Flame Retardant	120/2-4	0.04	50 – 70	230 – 260	60 - 100	40 - 80	Low	Medium - Fast	200
Tecodur® (blend)	Un-reinforced	120/2-4	0.02	50 – 70	230 - 270	50 - 110	40 - 80	Low	Medium - Fast	300
	Impact Modified	120/2-4	0.02	50 – 70	230 - 270	50 - 110	40 - 80	Low	Medium - Fast	300
	Reinforced	120/2-4	0.02	50 – 70	240 - 280	50 - 110	40 - 80	Low	Fast	200
	Flame Retardant	120/2-4	0.02	50 – 70	230 – 260	50 - 110	40 - 80	Low	Medium - Fast	200
Tecopet® (PET)	Impact Modified	120-140/4	0.02	50 – 70	260 – 280	90 - 140	60 - 100	Low	Medium - Fast	200
	Reinforced	120-140/4	0.02	50 – 70	270 - 290	90 - 140	60 - 100	Low	Fast	200
	Flame Retardant	120-140/4	0.02	50 – 70	260 – 280	90 - 140	60 - 100	Low	Medium - Fast	200
Tecotek® (PC)	Unreinforced	120/3-4	0.02	60 – 80	260 – 300	80 - 100	60 - 120	Low	Medium - Fast	200
	Reinforced	120/3-4	0.02	60 – 80	270 - 310	80 - 120	60 - 120	Low	Medium - Fast	200
	Flame Retardant	120/3-4	0.02	60 – 80	250 - 290	80 - 100	60 - 120	Low	Medium - Fast	200
Tecolen® (PPHP)	Un-reinforced	-	-	<60	200 - 240	20 - 50	40 - 80	Low	Medium - Fast	400
	Impact Modified	-	-	<60	200 - 240	20 - 50	40 - 80	Low	Medium - Fast	400
	Reinforced	-	-	<60	200 - 240	20 - 50	40 - 80	Low	Medium	200
	Flame Retardant	-	-	<60	200 - 240	20 - 50	40 - 80	Low	Medium	200
Tecolen® (PPCP)	Un-reinforced	-	-	<60	200 - 240	20 - 50	40 - 80	Low	Medium - Fast	400
	Impact Modified	-	-	<60	200 - 240	20 - 50	40 - 80	Low	Medium - Fast	400
	Reinforced	-	-	<60	200 - 240	20 - 50	40 - 80	Low	Medium	200
	Flame Retardant	-	-	<60	200 - 240	20 - 50	40 - 80	Low	Medium	200
Tecoform® (POM)	Un-reinforced	100-120/3*	-	30 – 50	180 – 220	60 - 100	80 - 100	Low	Medium - Fast	300
	Impact Modified	80/3*	-	30 – 50	170 – 210	60 - 80	80 - 100	Low	Medium - Fast	300
	Reinforced	100-120/3*	-	30 – 50	190 - 230	60 - 120	80 - 100	Low	Medium - Fast	200

*products in moisture proof packs do not need pre-drying.



All information in this complete document presents current state of knowledge and experience. The information and data may not be valid when any mentioned material is used in combination with other materials. These data do not guarantee certain values since may vary on processing conditions and end-use conditions. All information and data are provided for reference purposes only and should not be used alone to create specification limits and design basis. It is strongly recommended to test the product under own processing conditions and test facilities to determine the suitability for the required application and use.



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