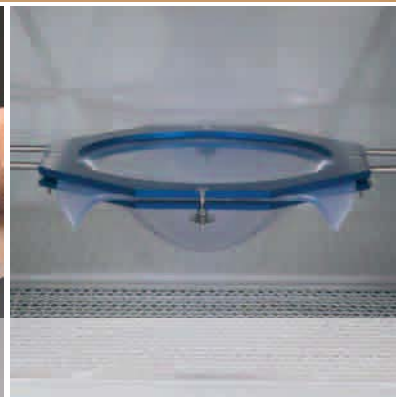
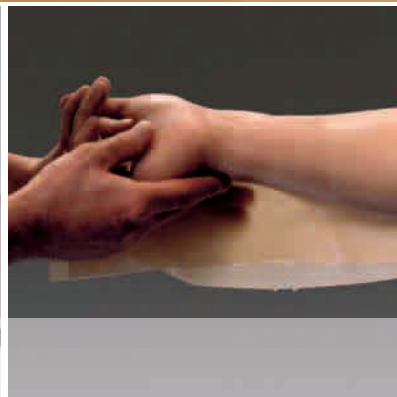


Otto Bock[®]

QUALITY FOR LIFE



Thermoplastics

in orthopedic technology





Technical information

Thermoplastics in orthopedic technology

Thermoplastics are finding ever wider use in the production of orthopedic aids because of their special properties, such as quick and easy processing, minimum weight, excellent hygienic characteristics as well as outstanding strength, stiffness and shape retention. Thermoplastics can also be reshaped at any time.

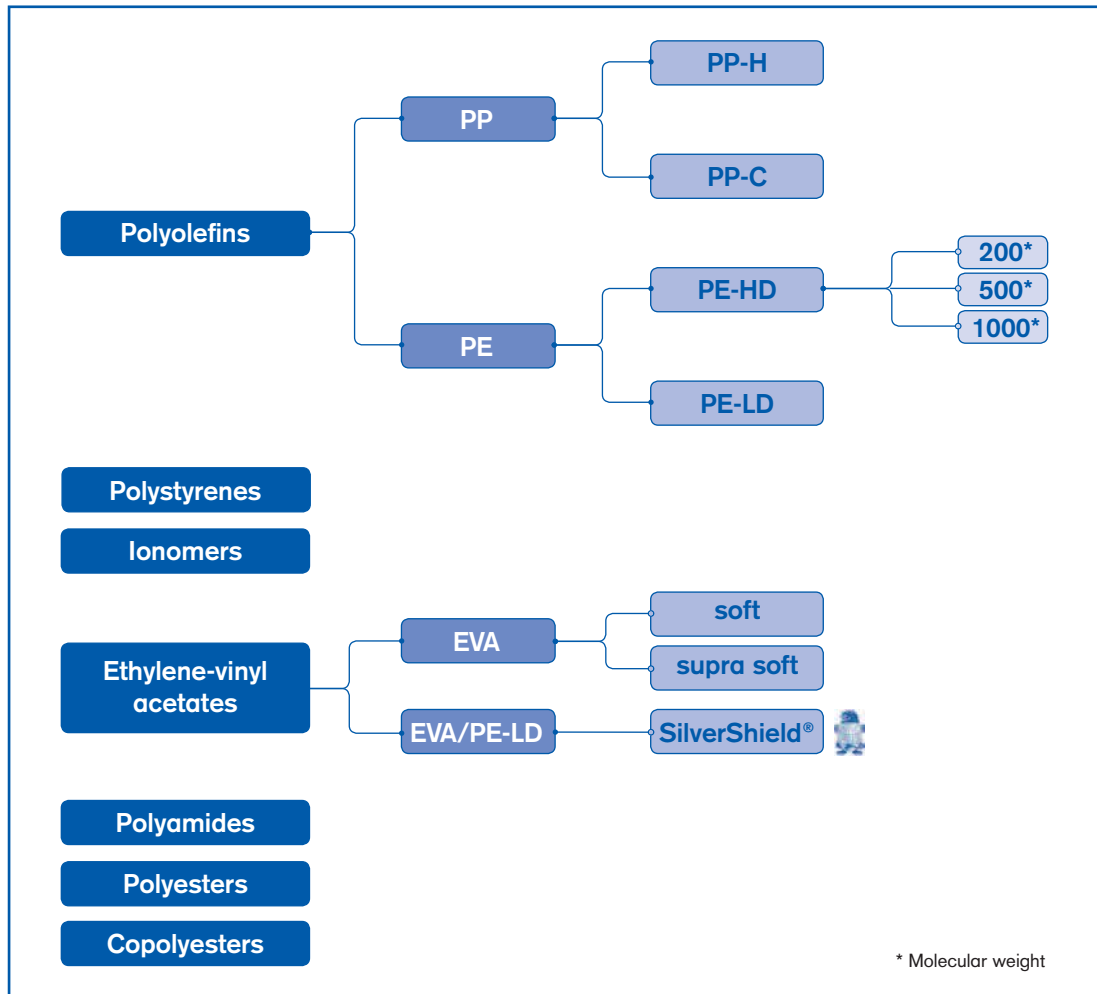
An ever-expanding range of materials is required with the growing number of applications for thermoplastics in the production of prosthetics and orthotics. At the same time, the development of increasingly high-quality plastics with extremely complex molecular structures allows for a wider variety of processing methods.

This section provides you with a comprehensive technical overview of the plastic sheeting available from Otto Bock.

The following technical overview describes treatment applications for thermoplastics and recommends ideal heating temperatures (heating plate, convection oven, and infrared oven) for each material.

Technical description of plastics

Plastics are listed and described according to their chemical compositions:



The symbols (body diagrams) used in the material description refer to the various applications for the plastic.

Shown from left to right are: lower extremity orthoses, spinal orthoses, upper extremity orthoses, lower limb prostheses, upper limb prostheses.



Lower extremity orthoses



Spinal orthoses



Upper extremity orthoses



Lower limb prostheses



Upper limb prostheses

Heating plastics

Precise temperature control is absolutely essential for safe heating of plastic sheeting material.

The heating devices offered by Otto Bock are designed using cutting-edge control technology to constantly ensure even temperature control, especially for ovens. Still, it is impossible to avoid small percentage deviations between the target value on the digital display and the actual reading on the supporting surface of the sheet material.

Deviations between target and actual values are no more than 5-10%, depending on the temperature.

To prevent the material from overheating, the control system keeps the actual value below the target value. We recommend calibrating all heating devices before initial use (this means comparing actual and target values for internal and display temperatures).







On the Otto Bock 759H4 Heating Plate, the temperature set on the temperature display corresponds to the temperature of the heating element, i.e., the supporting surface of the sheet material. Unlike ovens, heating plates must be tested for the correct temperature setting range using a piece of sample material.

Devices must be preheated to the required operating temperature before the material is inserted. The average time for preheating is 30 minutes.

The heating time specified in the material description cannot be applied linearly to other material thicknesses. This is because thermal conductivity decreases with increasing material thickness, and therefore disproportionately more heating time is required (e.g. approximately 15 minutes for 3 mm PE, about 35 minutes for 6 mm PE).

- ▶ For information on heating plastics in an infrared oven, see page 26.
- ▶ For more detailed information on areas of application and temperature recommendations for thermoplastic materials, see pages 6 and 7.

Information* about areas of application and temperature

							
Application examples/ Product names		FO	DAFO	AFO	Nighttime splint	Test KAFO	KAFO
ThermoLyn® Pedilon 616T73	LTT Polyester						
ThermoLyn® Trolene 616T3	PE-LD						●
ThermoLyn® PP Copolymer 616T120	PP-C		●	●	●		●
ThermoLyn® Polypropylene 616T20	PP-H	●	●	●			●
ThermoLyn® Polyethylene 200 616T19, 616T58, 616T60, 616T61, 616T62, 616T95, 616T97	PE-HD 200				●		●
ThermoLyn® RCH 500 616T22, 616T43, 616T44	PE-HD 500				●		●
ThermoLyn® RCH 1000 616T16	PE-HD 1000	●					
ThermoLyn® rigid 616T52	Polystyrene						
ThermoLyn® clear 616T83	Copolyester					●	
ThermoLyn® flexible 616T39, 5Z3	Ionomer						
ThermoLyn® soft 616T53	EVA						
ThermoLyn® supra soft 616T59	EVA						
ThermoLyn® soft, skin-colored, 616T69	EVA						
ThermoLyn® SilverShield® 616T200	EVA/LPDE						
ThermoLyn® Europlex 616T70	Polyamide	●					
ThermoLyn® PETG 616T183	Copolyester						








► This table shows the ideal heating temperature for each type of plastic.

* The information in this table applies only to plastics by Bock HealthCare GmbH in Duderstadt, Germany.

** The temperatures specified here are only recommendations by Otto Bock HealthCare GmbH and must be modified to suit your individual heating devices.

*** ThermoLyn® Pedilon must be heated in a bath of water at 60 °C / 140 °F.

recommendations** for thermoplastics

							Heating plate	Convection oven	Infrared oven
Orthosis bracket	Wrist orthosis	Corset with pads (TLSO)	Prosthetic test socket	Harmony® socket	Prosthetic inner socket	Inner socket for upper limb prosthesis			
	●						***		
●	●						125 °C 257 °F	125 °C 257 °F	125 °C 257 °F
	●	●					215 °C 419 °F	185 °C 365 °F	185 °C 365 °F
							215 °C 419 °F	185 °C 365 °F	185 °C 365 °F
	●	●					180 °C 356 °F	165 °C 329 °F	165 °C 329 °F
							195 °C 383 °F	185 °C 365 °F	185 °C 365 °F
							215 °C 419 °F	195 °C 383 °F	195 °C 383 °F
			●				-	170 °C 338 °F	170 °C 338 °F
			●				165 °C 329 °F	165 °C 329 °F	165 °C 329 °F
					●		-	165 °C 329 °F	165 °C 329 °F
					●		-	160 °C 320 °F	160 °C 320 °F
					●		-	155 °C 311 °F	155 °C 311 °F
						●	-	160 °C 320 °F	160 °C 320 °F
					●		-	150 °C 302 °F	150 °C 302 °F
		●					-	135 °C 275 °F	135 °C 275 °F
				●			-	170 °C 338 °F	160 °C 320 °F

Polyolefins

Polyolefins are pure hydrocarbon bonds. They are the plastic most frequently processed by orthopedic technicians. Polypropylene and poly-

ethylene are the most important types within the group of polyolefins.

Polypropylene

PP

PP

Polypropylene is characterized by a low specific weight and excellent stiffness. Thanks to its elasticity and excellent strength, this type of plastic is used very frequently (e.g. in dorsiflexion-assisting orthoses). However, it is difficult process because of its narrow temperature range and sensitive surface in a thermoplastic state. To achieve good results, high-perfor-

mance heating devices and precision application techniques must be used. Polypropylene can be used to produce very thin-walled, lightweight and stable orthotic components, especially when used with profiling elements. Splinting elements can also be inserted.

ThermoLyn® Polypropylene Homopolymer

PP-H

PP is a homopolymer, meaning its polymers (chains of molecules) are created from a monomer bond only. They are very strong and stiff and have a low impact value. This means great care must be taken during machining in order to avoid brittle fractures (stress concentration).

This plastic is preferred for manufacturing orthotic components that are placed under heavy stress (e.g. paralysis orthoses). The 400 × 400 mm sheets are suitable for making definitive sockets for lower limb prostheses.

PP-H



Properties (convection oven)

Forming temperature	185 °C / 365 °F
Heating time	2 – 3 minutes/mm
Density	0.91 g/cm ³
Shrinkage	Approximately 7 %
Bonding	Inseparable bonding, even with wire and 250 °C / 482 °F hot air

Form as supplied:

ThermoLyn® Polypropylene Homopolymer



Processing temperature 215 °C / 419 °F (heating plate), 185 °C / 365 °F (convection oven), 185 °C / 365 °F (infrared oven)

Article number	616T20
Length	400 mm
Width	400 mm
Thickness	10 mm, 12 mm, 15 mm
Color	Natural colors

Article number	616T20
Length	2,000 mm
Width	1,000 mm
Thickness	2 mm, 3 mm, 4 mm, 5 mm, 6 mm, 8 mm, 10 mm, 12 mm, 15 mm
Color	Natural colors

PP-C

ThermoLyn® Polypropylene Copolymer

PP-C

The ThermoLyn® PP copolymer is a thermo-plastic sheet material that uses copolymerization to combine the benefits of polypropylene and the toughness of polyethylene. The polypropylene copolymer (PP-C) obtained in this way features much more impact strength than a homopolymer polypropylene (PP-H), especially at low temperatures. The PP copolymer is easily thermoformed and heat-sealed and is ideal for placing around orthotic joints. The ThermoLyn®

PP copolymer can be used for a wide range of applications.

Possible applications include:

- AFOs (Ankle Foot Orthoses)
- KAFOs (Knee Ankle Foot Orthoses)
- FFOs (Functional Foot Orthoses)
- TLSOs (Thoracolumbosacral Orthoses)



Properties (convection oven)

Forming temperature	185 °C / 365 °F
Heating time	2 – 3 minutes/mm
Density	0.90 g/cm ³
Shrinkage	Approximately 5 %
Bonding	Inseparable bonding (cannot be bonded with PP Homopolymer 616T20)

Form as supplied:

ThermoLyn® Polypropylene Copolymer



Article number	616T120
Thickness	2 mm, 3 mm, 4 mm, 5 mm, 6 mm
Sheet size (Length x width)	2,000 x 1,000 mm
Color	Natural colors

Polyethylene PE

PE has the simplest molecular structure of any plastic. Orthopedic technology distinguishes between PE-HD (Polyethylene High Density) and PE-LD (Polyethylene Low Density). PE-HD is a high-density PE, and PE-LD is a low-density PE. Another distinguishing feature is molecular weight (e.g. ThermoLyn® RCH 500: high

molecular weight, good stiffness and rigidity, highly resistant to deformation during vacuuming process). The terms PE-HMW (High Molecular Weight, e.g. RCH 500) and PE-UHMW (Ultra High Molecular Weight, e.g. RCH 1000) are commonly used to refer to molecular weight.

PE

ThermoLyn® PE 200 PE-HD 200

ThermoLyn® PE 200 is a PE-HD with low molecular weight. Thanks to its good workability and a large choice of colors, this plastic enjoys

an especially wide range of applications (e.g. for corsets (TLSO), and positioning shells).

PE-HD 200



Properties (convection oven)

Forming temperature	165 °C / 329 °F
Heating time	2 – 3 minutes/mm
Density	0.96 g/cm³
Shrinkage	Approximately 8 %
Bonding	Inseparable bonding

Form as supplied:

ThermoLyn® Polyethylene 200 (PE-HD 200)



Hard polyethylene with low shrinkage, processing temperature of 180 °C / 356 °F (heating plate), 165 °C / 329 °F (convection oven), 165 °C / 329 °F (infrared oven)

Article number	616T95	616T19
Length	2,000 mm	2,000 mm
Width	1,000 mm	1,000 mm
Thickness	2 mm, 3 mm, 4 mm, 5 mm, 6 mm, 8 mm, 10 mm, 12 mm	2 mm, 3 mm, 4 mm, 5 mm, 6 mm
Color	Natural colors	Skin colors

Article number	616T58	616T60	616T61
Length	2,000 mm	2,000 mm	2,000 mm
Width	1,000 mm	1,000 mm	1,000 mm
Thickness	3 mm, 4 mm, 5 mm, 6 mm	3 mm, 4 mm, 5 mm, 6 mm	3 mm, 4 mm, 5 mm, 6 mm
Color	Blue	Red	Yellow

PE-HD
500

ThermoLyn® RCH 500

PE-HD 500

ThermoLyn® RCH 500 is a manufacturer's term describing a PE-HD with a medium molecular weight. The material has a homogenous structure, even quality as well as excellent rigidity and low tendency to shrink. Because of its good mechanical properties, this material is not as easy to shape as ThermoLyn® PE 200 616T95 in a thermoplastic state. However, it

features adequate weldability and exhibits good heating behavior, thus ensuring satisfactory processing. Thanks to its high strength and good friction characteristics, this plastic can be used along with Joint Screws 501A33 and Joint Bolts 505L1 as an overlapped joint for orthosis bushings. It comes in a variety of colors for customizing orthoses.



Properties (convection oven)

Forming temperature	185 °C / 365 °F
Heating time	3 min/mm
Density	0.95 g/cm ³
Shrinkage	Approximately 2 %
Bonding	Not permanently bonded

Form as supplied:

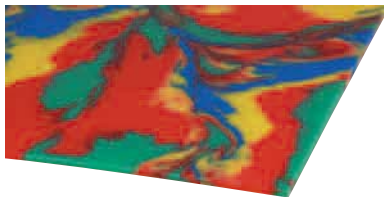
ThermoLyn® RCH 500 (PE-HD 500)



Homogenous thermoplastic with high level of stiffness, processing temperature of 195 °C / 383 °F (heating plate), 185 °C / 365 °F (convection oven), 185 °C / 365 °F (infrared oven)

Article number	616T43	
Length	950 mm	1,910 mm
Width	910 mm	910 mm
Thickness	2 mm, 3 mm, 4 mm, 5 mm, 6 mm	2 mm, 3 mm, 4 mm, 5 mm, 6 mm, 8 mm
Color	Red	Red

Article number	616T44	
Length	950 mm	1,910 mm
Width	910 mm	910 mm
Thickness	2 mm, 3 mm, 4 mm, 5 mm, 6 mm	2 mm, 3 mm, 4 mm, 5 mm, 6 mm, 8 mm, 10 mm
Color	Blue	Blue

ThermoLyn® RCH 500 (PE-HD 500)

Homogenous thermoplastic with high level of stiffness, processing temperature of 195 °C / 383 °F (heating plate), 185 °C / 365 °F (convection oven), 185 °C / 365 °F (infrared oven), special sizes or other thickness available upon request.

Article number	616T22	
Length	950 mm	1,910 mm
Width	910 mm	910 mm
Thickness	1 mm, 2 mm, 3 mm, 4 mm, 5 mm, 6 mm, 8 mm, 10 mm	1 mm, 2 mm, 3 mm, 4 mm, 5 mm, 6 mm, 7 mm, 8 mm, 10 mm
Color	Natural colors (N)	Natural colors (N)

Article number	616T22	
Length	950 mm	1,910 mm
Width	910 mm	910 mm
Thickness	2 mm, 3 mm, 4 mm, 5 mm, 6 mm, 8 mm	1 mm, 2 mm, 3 mm, 4 mm, 5 mm, 7 mm
Color	Skin colors (H)	Skin colors (H)

Article number	616T22	
Length	1,910 mm	
Width	910 mm	
Thickness	3 mm, 4 mm, 5 mm	
Color	Graffity (G)	

PE-HD
1000

ThermoLyn® RCH 1000

PE-HD 1000

ThermoLyn® RCH 1000 is a manufacturer's term describing a PE-HD with a high molecular weight. This material is highly durable and resistant to abrasions. It requires heavy deformation forces when processed in a thermoplastic state.

This material is often used as a stiffening insole for inner shoes. The shaping process is facilitated when vacuum-forming devices with rubber membranes are used.



Properties (convection oven)

Forming temperature	195 °C / 383 °F
Heating time	3.5 min/mm
Density	0.96 g/cm ³
Shrinkage	None
Bonding	Not permanently bonded (can only be friction-welded)

Form as supplied:

ThermoLyn® RCH 1000 (PE-HD 1000)



High-strength material with high abrasion resistance, can also be reshaped cold, processing temperature of 215 °C / 419 °F (heating plate), 195 °C / 383 °F (convection oven), 195 °C / 383 °F (infrared oven)

Article number	616T16	
Length	950 mm	1,910 mm
Width	910 mm	910 mm
Thickness	2 mm, 3 mm, 4 mm, 5 mm, 6 mm	2 mm, 3 mm, 5 mm, 6 mm
Color	Skin colors	Skin colors

► Other thicknesses are available upon request.

ThermoLyn® Trolene

PE-LD

This material is a PE-LD with good workability and flexibility. It also features a low molecular weight and good transparency. It is especial-

ly suitable for orthosis components that require little stiffness and a high level of flexibility. It is also used to make brackets for sockets.

PE-LD



Properties (convection oven)

Forming temperature	125 °C / 257 °F
Heating time	1 mm = 5 min, 2 mm = 6 min, 3 mm = 7 min
Density	0.92 g/cm ³
Shrinkage	Approximately 10 %
Bonding	Bonds very little

Form as supplied:

ThermoLyn® Trolene (PE-LD)



Flexible Polyethylene, opaque, processing temperature 125 °C / 257 °F for heating plates, convection ovens and infrared ovens.

Article number	616T3		
Length	1,000 mm	2,000 mm	40 mm
Width	500 mm	1,000 mm	32 mm
Thickness	1 mm, 2 mm	2 mm, 3 mm	2 mm
Color	Natural colors	Natural colors	Natural colors

PS

Polystyrene

ThermoLyn® rigid is a polystyrene (PS). This material is characterized by a high level of stiffness and security against fracture. This plastic also features good vacuum-forming characteristics and transparency. If a high-quality sur-

face is required, or if the welding seam must be reopened, the material can be processed with protective foil. ThermoLyn® rigid is used mainly in self-supporting test sockets (**for temporary use**).



Properties (convection oven)	
Forming temperature	170 °C / 338 °F
Heating time	2 min/mm
Density	1.01 g/cm ³
Shrinkage	Approximately 1 %
Bonding	Inseparable bonding

Form as supplied:

ThermoLyn® rigid (polystyrene)



Colorless, for fabricating self-supporting test sockets (for temporary use), processing temperature 170 °C / 338 °F in convection or infrared oven

Article number	616T52
Sheet size (length x width)	400 x 400 mm
Thickness	8 mm, 10 mm, 12 mm, 15 mm

Ionomer

ThermoLyn® flexible is an ionomer. Ionomers are copolymers of ethylene and acrylic acid (EAS) that contain active ionic bonds. This material features excellent flexibility and good transparency. Low shrinkage and outstanding working properties allow for a wide range of applications. It is slightly stiffer than ThermoLyn® soft 616T53.

This material is extremely useful for prosthesis sockets because it is highly flexible even at body temperature. It is not sensitive to cold and damp plaster models, thus ensuring excellent surface quality during processing.

EAS



Properties (convection oven)

Forming temperature	165 °C / 329 °F
Heating time	2 min/mm
Density	0.95 g/cm ³
Shrinkage	Approximately 3 %
Bonding	Inseparable bonding

Form as supplied:

ThermoLyn® flexible (ionomer)



Colorless, for producing flexible inner sockets for lower limb prostheses, processing temperature 165 °C / 329 °F in convection and infrared ovens

Article number	5Z3	616T39
Sheet size (length x width)	400 x 400	1,200 x 800
Thickness	4.7 mm, 6.3 mm, 8.5 mm, 11.5 mm	4.7 mm, 6.3 mm, 8.5 mm, 11.5 mm

Ethylene-vinyl acetate

ThermoLyn® soft, ThermoLyn® supra soft

This material is a copolymer of ethylene and vinyl acetate (EVA). When cooled down too quickly, this material exhibits increased shrinkage. ThermoLyn® soft's good flexibility and transparency is especially useful for producing flexible inner sockets for prostheses. The skin-colored (translucent)

material is used mainly for upper limb prosthetics. The material also features excellent surface quality and is comfortable to wear.

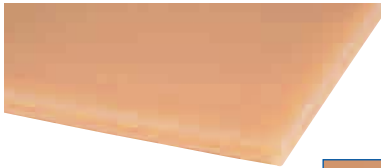
ThermoLyn® supra soft, on the other hand, has proven an excellent choice as a material for flexible transfemoral soft-walled inner sockets.



Properties (convection oven)		
Article number	616T53/69	616T59
Forming temperature	160 °C / 320 °F	155 °C / 311 °F
Heating time	2 min/mm	2 min/mm
Density	0.94 g/cm ³	0.93 g/cm ³
Shrinkage	Approximately 3 %	Approximately 3 %
Bonding	Inseparable bonding	Inseparable bonding

Form as supplied:

ThermoLyn® soft (EVA)



For production of flexible inner sockets for upper limb prostheses, high shrinkage if cooled down too quickly, translucent (color depends on skin color), processing temperature 160 °C / 320 °F in convection and infrared ovens

Article number	616T69
Sheet size (length x width)	400 x 400 mm
Thickness	6 mm, 8 mm, 10 mm, 12 mm
Color	Skin colors

For production of flexible inner sockets for lower limb prostheses, high shrinkage if cooled down too quickly, colorless, processing temperature 160 °C / 320 °F in convection and infrared ovens

Article number	616T53
Sheet size (length x width)	400 x 400 mm
Thickness	8 mm, 10 mm, 12 mm, 15 mm
Color	Colorless

ThermoLyn® supra soft (EVA)



For production of highly flexible transfemoral soft-walled inner sockets, processing temperature 155 °C / 311 °F in convection oven and infrared oven

Order number	616T59=10	616T59=12	616T59=15
Sheet size (length x width)	400 x 400 mm	400 x 400 mm	400 x 400 mm
Thickness	10 mm	12 mm	15 mm
Color	Colorless	Colorless	Colorless

EVA/
PE-LD

ThermoLyn® SilverShield® – Our antibacterial product line!



ThermoLyn® EVA/LPDE SilverShield® is supplied in the form of “pressed” sheets. This material is a soft polyethylene (76% PE-LD) and a copolymer of ethylene and vinyl acetate (24% EVA) featuring good workability and flexibility. Thanks to its low shrinkage, constancy of volume and outstanding working properties, it can be used for producing highly flexible inner sockets for prostheses.

In SilverShield® technology, silver is used during the manufacturing process to lend the plastic antimicrobial properties. The silver ions bonded to the plastic combat a wide range of pathogenic bacteria and ensure that the material is extremely easy on the skin. The antibacterial properties of the material are also excellent for reducing odor buildup.



Properties (convection oven)

Forming temperature	150 °C / 302 °F
Heating time	2 – 3 minutes/mm
Density	0.95 g/cm ³
Shrinkage	Approximately 1 %
Bonding	Inseparable bonding

Form as supplied:

ThermoLyn® EVA/LDPE SilverShield®



- Antimicrobial thanks to SilverShield® technology
- Natural colors
- Thermoplastically moldable at 150 °C / 302 °F
- Highly flexible material
- Very low shrinkage
- For production of flexible inner sockets for prostheses
- Dermatologically tested

Order number	616T200=9	616T200=12	616T200=16
Sheet size (length x width)	400 x 400 mm	400 x 400 mm	400 x 400 mm
Thickness	9 mm	12 mm	16 mm
Color	Natural colors	Natural colors	Natural colors

- ▶ Other sheet thicknesses available upon request.
- ▶ **As a pressed plastic, this material exhibits low shrinkage**

Polyamide

ThermoLyn® Europlex is a partially aromatic polyamide (PA) developed especially for orthopedic technology. It is a yellowy, translucent material. Compared to its predecessor Plexidur 0, this material features reduced hardness and increased toughness. Familiar properties such as transparency and a smooth surface have been retained.

This material's forming temperature of 135 °C / 275 °F must be adhered to strictly as it becomes milky and hard to form if overheated. It is typically used for shape-retaining components, insoles and pads for trunk orthoses.

PA



Properties (convection oven)

Forming temperature	135 °C / 275 °F
Heating time	1.5 min/mm
Density	1.08 g/cm ³
Shrinkage	Approximately 1 %
Bonding	No

Form as supplied:

ThermoLyn® Europlex (Polyamide)



Colorless, for producing insoles, thermoplastically moldable at 135 °C / 275 °F in convection and infrared oven

Article number	616T70
Sheet size (length × width)	2,050 × 1,200 mm
Thickness	2 mm, 3 mm, 4 mm

LTT

LTT Polyester

ThermoLyn® Pedilon is a low-temperature thermoplastic (LTT). This material has a linear polyester bond.

It is heated to 55-60 °C / 131-140 °F in a bath of water and is thermoplastically molded directly on the patient's body. This material features

excellent adhesive characteristics and recovers its shape very easily when reheated. Thanks to the special properties of this material, orthoses can be produced without making a plaster impression or making a model first.



Properties (convection oven)	
Forming temperature	60 °C / 140 °F (in water)
Heating time	1 min/mm (finished when transparent)
Density	1.10 g/cm ³
Shrinkage	None
Bonding	Yes, by applying pressure, works better with hairdryer

Form as supplied:

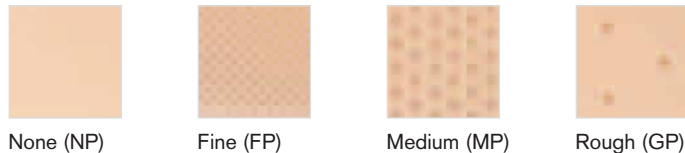
ThermoLyn® Pedilon (LTT Polyester)



Low-temperature polyester, can be stretched when heated, heat to 60°C / 140 °F in water bath.

Thanks to ThermoLyn® Pedilon's low forming temperature of 60 °C / 140 °F, it can be molded directly on the patient's body. This eliminates the need for making impressions or models, a time-consuming process. This sheet material is especially suitable for clinical use, when the patient must be treated immediately.

Article number	616T73									
Perforation	None (NP)		Fine (FP)		Medium (MP)		Rough (GP)			
Sheet size (L x W) (in cm)	60 x 43	90 x 60	60 x 43	60 x 43	60 x 45	60 x 43	60 x 45	90 x 60		
Thickness (in mm)	2	3.2 4	1.6 2	2	2.5 3.2	2	3.2	4		



None (NP) Fine (FP) Medium (MP) Rough (GP)

Copolyester

ThermoLyn® clear and ThermoLyn® PETG clear are fracture-proof and highly transparent copolyesters made of polyethylene terephthalate (PETG). This material features excellent impact strength and outstanding vacuum-forming properties.

ThermoLyn® clear is ideal for creating self-supporting test sockets and trial orthoses (**for temporary use**). ThermoLyn® PETG clear, by contrast, is used as a first layer in definitive sockets, e.g. for Harmony® fittings.

PETG



Properties (convection oven)

Article number	616T83	616T183
Forming temperature	165 °C / 329 °F	170 °C / 338 °F
Heating time	3 – 4 minutes/mm	3 mm = 12 min, 5 mm = 13 min
Density	1.27 g/cm ³	1.27 g/cm ³
Shrinkage	Approximately 1 %	Approximately 1 %
Bonding	Inseparable bonding	Inseparable bonding

Form as supplied:

ThermoLyn® clear (copolyester)



Colorless

The processing temperature for heating plates, convection and infrared ovens is 165 °C / 329 °F.

Thanks to the transparency of test sockets made of ThermoLyn® clear, the patient's fit and discoloration of the skin surface on the residual limb can be monitored more closely. By heating the socket, this thermoplastic can be reshaped at pressure points, for example.

Article number	616T83		
Sheet size (length × width)	1,250 × 1,025 mm	1,250 × 1,025 mm	1,250 × 1,025 mm
Thickness	3 mm	4 mm	6 mm
For producing	Scar compression masks		Trial orthoses

Article number	616T83				
Sheet size (length × width)	400 × 400 mm	400 × 400 mm	400 × 400 mm	400 × 400 mm	400 × 400 mm
Thickness	8 mm	10 mm	12 mm	15 mm	20 mm
For producing	Trial orthoses	Self-supporting test sockets (for temporary use)			

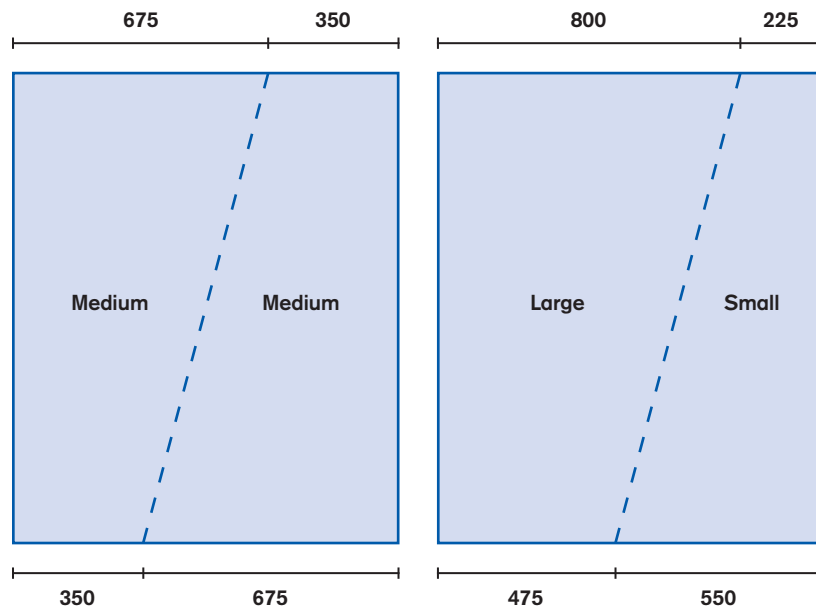
Thermolyn® PETG clear (copolyester)



For use as first layer in definitive sockets, e.g. for Harmony® fittings

Order number	616T183=3	616T183=5
Sheet size (length x width)	400 x 400 mm	400 x 400 mm
Color	Colorless	Colorless
Thickness	3 mm	5 mm

Cutting suggestions for 616T83 ThermoLyn clear 6 mm (1250 x 1025 mm sheet):



► Extremely little waste with trial orthoses (KAFOs)





Heating plastics in infrared ovens

Infrared ovens (701E20, 701E21, 701E22 and 701E23) and convection ovens have different characteristics. Unlike convection ovens, infrared ovens can heat plastics up to 300 % faster. And since no preheating is required, most plastics can be placed directly in a “cold” infrared

oven. Infrared ovens also have the added advantage of using very little energy. Heating the plastic from the inside out makes the material more flexible and therefore easier to mold, fold around edges and insert into undercuts.

Heating plastic materials



Certain criteria must be observed when heating plastics in an infrared oven.

The infrared oven should be set to the temperature specified for the material being heated.

Please consult your plastics supplier for recommendations on appropriate processing temperatures.

The user instructions for the infrared ovens (646A185=GB) describe how to adjust the digital temperature control.

Heating times for plastics are dependent on the following factors:

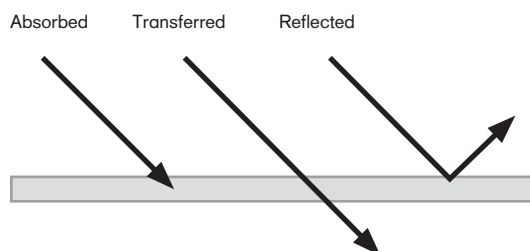
- Type of material
- Thickness of material
- Sheet size of material
- Ambient temperature in infrared oven (cold or preheated)
- Turn-on times of the infrared elements

Make sure that the plastic materials are not heated in the infrared oven for a **longer time than necessary**. Exceeding the heating time even for **only a short time** will **overheat** the plastic material. **Overheating** the material will make the plastic material too **“soft.”** During further processing, the plastic material will begin to **“drop down from the model.”**

Unlike **convection ovens**, in which an object is heated by ambient heat in a closed compartment, **infrared ovens generate infrared or thermal radiation** in the form of **electromagnetic waves**. The material is heated by the **absorption** of this electromagnetic energy.

All materials are characterized by specific absorption curves that demonstrate the relationship between wave length and absorption (degree of absorption).

To determine the ideal infrared radiation for an infrared oven with respect to wavelength and frequency, we need to know the absorption spectrum of the materials to be heated. Polyolefins such as PE or PP are the plastics mainly used in orthopedic technology. The absorption curves of these materials show that the ideal absorption of infrared radiation energy lies in the medial infrared spectrum at a wave length of approx. 3.5 μ .



Heating times for plastic materials

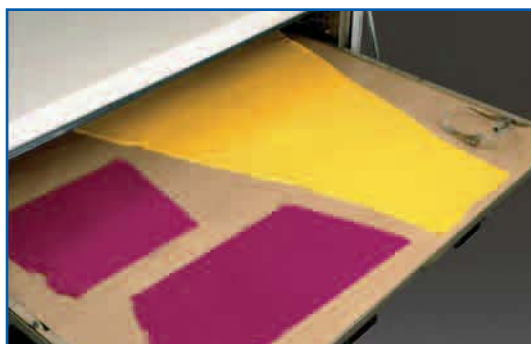
As a rule of thumb, heating times for plastic materials can be calculated as follows: 1 minute of heating time for every millimeter of thickness. The actual heating time, however, depends on the factors mentioned above. New plastic materials must be test-

ed using a material sample to ascertain the heating time.

To obtain the ideal temperature for further processing, it is necessary to observe the behavior of the material inside the oven.



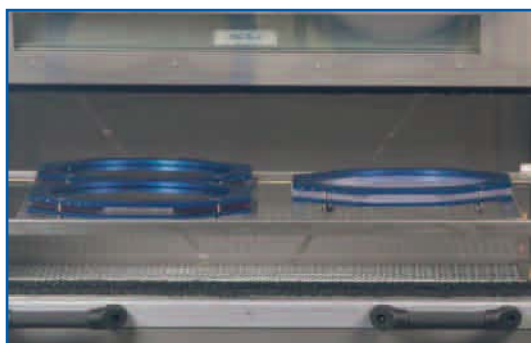
Depending on the material type, changes in discoloration (e.g., transparency) should be even when heating plastic sheet material. The illustration shows material which has **not** been heated through evenly.



Colored plastic material requires 30 to 40 % more heating than colorless or white material of the same thickness.



When heating the plastic material for vacuum forming, the **material should sag 10 - 12 cm**. If the material sags beyond that measure, it will overheat and flow from the model during vacuum forming or the wall of the inner socket will become uneven and have different thicknesses.



If using a single vacuum frame in the 701E20 or 701E21 Infrared Ovens (remove the Teflon-coated aluminum plate) put the frame in the center of the rear section of the trolley.

When heating **thin sheet materials** and ThermoLyn® rigid or soft, the infrared oven must be preheated to the specified temperature for that material. Wait until after the preadjusted temperature has been reached, then place

the thin sheet of ThermoLyn® (rigid or flexible) in the infrared oven. Make sure not to leave the door open too long when placing the plastic material in the oven.

Standard material heating times and temperatures for Otto Bock polyethylene (PE 200) and polypropylene (PP-H and PP-C) sheet materials in Infrared Oven 701E20:

Thickness	Plastic material		Heating time
	PE 200	PP-H/PP-C	
3 mm	165 °C / 329 °F	185 °C / 365 °F	3 – 5 minutes
4 mm	165 °C / 329 °F	185 °C / 365 °F	4 – 6 minutes
5 mm	165 °C / 329 °F	185 °C / 365 °F	5 – 8 minutes
6 mm	165 °C / 329 °F	185 °C / 365 °F	6 – 9 minutes
8 mm	165 °C / 329 °F	185 °C / 365 °F	8 – 12 minutes
10 mm	165 °C / 329 °F	185 °C / 365 °F	10 – 15 minutes
12 mm	165 °C / 329 °F	185 °C / 365 °F	12 – 18 minutes
15 mm	165 °C / 329 °F	185 °C / 365 °F	15 – 22 minutes

- We recommend contacting your plastics supplier concerning their recommendations on heating temperatures and heating times for specific materials.



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