Riteflex®

Thermoplastic polyester elastomer (TPE-E)

Product Benefits

- Full Range of Shore D Hardness
- High Mechanical Strength
- Flexibility and Durability at Low Temperatures
- Chemical Resistance and Retention of Properties
- Tough and Resilient
- Superior Electrical Properties

Ticona

Performance Driven Solutions™

Riteflex® TPE combines elasticity with toughness and memory desired in extruded profiles, monofilaments and film applications.

Thermoplastic polyester elastomer (TPE-E)

Get All of the Benefits of Thermoset Elastomers Plus Processing Ease and Recyclability

Thermoplastic elastomers (TPEs) are high-performance materials capable of meeting requirements that go beyond the reach of many thermoset rubbers, especially in the areas of thermo-oxidative and chemical resistance.

This is achieved by combining crystalline (hard) and amorphous (soft) segments to offer properties of thermoset elastomers, while still providing the processing ease, recyclability and regrind re-use capabilities of thermoplastics.

Riteflex® TPEs combine toughness and resilience along with excellent resistance to creep, impact, tear and flex fatigue. They perform well over a wide range of temperatures, from -40°C to 120°C (-40°F to 250°F), and deliver good impact resistance at low temperatures, while retaining useful properties at high temperatures. Riteflex TPEs also offer excellent chemical resistance to common solvents, fuels, oils and greases, dilute acids and bases.

Riteflex polymers are available in a 400 and 600 product series and both offer a wide range of Shore D hardnesses. The 400 series, at equivalent hardness, provides a higher melting point, greater flexibility and flex fatigue.

Ticona has developed the Riteflex TPE MT9000 series of materials to meet the exacting demands of medical technology applications. These grades can withstand all common sterilization methods from autoclaving to gamma radiation treatment.

Specialty Riteflex TPE products can also be made, such as heat-stabilized grades. These resins may also be compounded with fillers and/or reinforcements such as fiberglass. Colored formulations can be provided.

Processing

Riteflex materials are compatible with conventional processing techniques, particularly injection molding and extrusion. Optimum run temperatures range from 175°C to 260°C (347°F to 500°F), depending on the specific process and the grade selected. The PBT backbone offers predictable melting points and good heat stability for precise processability.

Grade Characteristics

		Preferred method of processing		Shore hardness	Melting point	
Riteflex TPE Product series	Grade	Injection molding	Extrusion	Scale D	[°C]	[°F]
400 series	430	x	x	30	170	338
	440	x	x	40	192	378
600 series and	635	x	x	35	163	325
all MT grades	640	x	x	40	171	340
	647	x	x	47	187	369
	655	x	x	55	200	392
	663	x	x	63	210	410
	672	x	x	72	214	417
	677	x	x	77	217	423

Riteflex TPE is delivered as ready-to-process, natural pellets.
For black coloration and weathering stabilized formulations, masterbatches are available.

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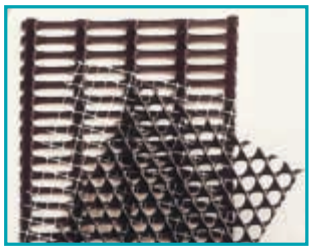


Application Areas

- Hose and tubing
- Seals and gaskets
- Belts
- Energy absorbing devices
- Wire coating
- Fasteners
- Film and sheet
- Electrical/Electronic connectors
- Monofilaments

Properties		Units	Method
Physical properties			
Density		g/cm³	ISO 1183
Mass flow index MFR, 2.16kg at (°C)		g/10 min	ISO 1133
Water Absorption, 24 h Immersion		%	ISO 62
Mold Shrinkage, flow		%	ISO 294
Mechanical properties			
Yield stress*		MPa	ISO 527
Elongation at yield*		%	ISO 527
Nominal elongation at break*		%	ISO 527
Stress	at 5% strain	MPa	ISO 527
	at 10% strain	MPa	ISO 527
	at 50% strain	MPa	ISO 527
Tensile stress at break		MPa	ISO 527
Tensile modulus		MPa	ISO 527
Flexural modulus	at -40°C	MPa	ISO 178
	at 23°C	MPa	ISO 178
	at 100°C	MPa	ISO 178
Flexural strength		MPa	ISO 178
Charpy impact strength	at +23°C	kJ/m²	ISO 179
	at -30°C	kJ/m²	ISO 179
Charpy notched impact strength	at +23°C	kJ/m²	ISO 179
	at -30°C	kJ/m²	ISO 179
Izod notched impact strength	at -40°C	kJ/m²	ISO 180
	at +23°C	kJ/m²	ISO 180
Initial Tear Resistance,	Die C, parallel	kN/m	ISO 34
Hardness, Durometer D (maximum)		Shore D	ISO 868
Thermal properties			
Melting Temperature (10K/min)		°C	ISO 11357
Heat Deflection Temperature		°C	ISO 75
Coefficient of linear thermal expansion 23 – 80°C (longitudinal)		K⁻¹	ISO 11359 DIN 53752
Vicat Softening Temperature VST/B/50 10N, 50°C/h		°C	ISO 306
Electrical properties			
Relative Permittivity at 1 MHz			IEC 60993
Dissipation Factor at 1 MHz			IEC 60250
Dielectric Strength P25/P75		kV/mm	IEC 60243
CTI		V	IEC 60122
Volume Resistivity		Ω*cm	IEC 60092
Surface Resistivity		Ω	IEC 60093
Flammability			
UL Rating			UL 94
Test Specimen Thickness		mm	
ASTM Data			
Bashore Resilience		%	D2632
Taber Abrasion (H-18 wheel, 1000 g weight)		mg/1000 cycles	D1044

* at 50 mm/min

430	440	635	640	647	655	663	672	677
		MT9635	MT9640	MT9647	MT9655	MT9663	MT9672	MT9677
1.005	1.11	1.14	1.15	1.17	1.19	1.24	1.26	1.29
11 (200°C)	13 (220°C)	6 (190°C)	10 (220°C)	10 (220°C)	9 (220°C)	10 (230°C)	13 (240°C)	15 (240°C)
0.6	0.5	0.6	0.5	0.5	0.4	0.3	0.2	0.2
		0.8-1.0	1.2-1.4	1.3-1.8	1.6-1.9	1.7-2.0	1.7-2.2	1.8-2.2
no Yield	no Yield	no Yield	no Yield	12	15	21	30	37
no Yield	no Yield	no Yield	no Yield	32	28	22	19	15
>550	>550	>500	>500	>500	>450	>400	>250	>250
1	2	3	3	6	8	13	21	32
2	4	5	5	9	12	18	27	36
4	7	8	8	12	15	19	25	26
13	18	17	17	28	30	36	38	43
32	55	70	75	155	200	350	600	1100
190	270	110	115	320	710	1910	2460	2560
22	45	65	85	125	205	395	490	1300
12	26	30	32	58	86	150	210	240
0.9	1.7	2.4	3.0	4.3	7.1	12.5	16.0	37.9
NB	NB	NB	NB	NB	NB	NB	NB	NB
NB	NB	NB	NB	NB	NB	NB	NB	71
NB	NB	NB	NB	NB	150p	105p	19c	9.4
NB	NB	NB	NB	NB	65p	22	4.5c	4.5c
NB	NB	NB	NB	NB	NB	7c	4.8c	4.7c
NB	NB	NB	NB	NB	NB	74p	16c	8,5
75	96	83	84	122	124	160	193	250
30	40	35	40	47	55	63	72	77
170	192	163	171	187	200	210	214	217
43	47	52	56	62	75	114	118	129
$2.0 \cdot 10^{-4}$	$2.4 \cdot 10^{-4}$	$2.2 \cdot 10^{-4}$	$2.2 \cdot 10^{-4}$	$2.0 \cdot 10^{-4}$	$2.0 \cdot 10^{-4}$	$1.8 \cdot 10^{-4}$	$1.4 \cdot 10^{-4}$	$1.4 \cdot 10^{-4}$
75	127	105	119	155	176	194	205	213
5.1	4.9	4.7	4.7	4.6	4.4	4.0	3.7	3.3
0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.04
24.9	25.5	13	13	13	14	14	28.4	16
>600	>600	>600	>600	>600	>600	>600	>600	>600
$2.2 \cdot 10^{10}$	$2.4 \cdot 10^{11}$	$5.0 \cdot 10^{12}$	$5.0 \cdot 10^{12}$	$5.0 \cdot 10^{12}$	$4.0 \cdot 10^{12}$	$2.0 \cdot 10^{13}$	$1.5 \cdot 10^{13}$	$2.5 \cdot 10^{14}$
$1.1 \cdot 10^{14}$	$1.5 \cdot 10^{15}$	$1.6 \cdot 10^{15}$	$3.0 \cdot 10^{15}$	$1.9 \cdot 10^{15}$	$3.8 \cdot 10^{15}$	$1.4 \cdot 10^{16}$	$1.8 \cdot 10^{17}$	$1.9 \cdot 10^{17}$
HB	HB	HB	HB	HB	HB	HB	HB	HB
1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
65	59	60	59	53	48	40	40	40
		121	90	67	65	62	30	30

Injection Molding

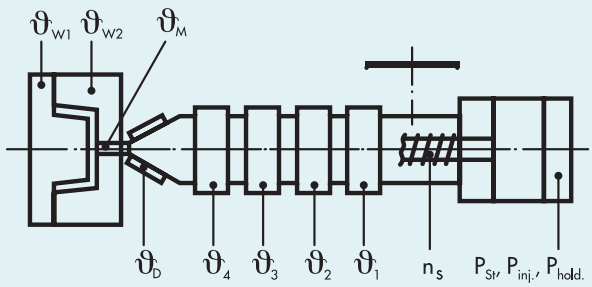
For optimum results, the moisture content of virgin and regrind materials should not exceed .05% in processing. Drying should be carried out in a dehumidifying oven at 105-110°C (221-230°F) for four hours with material layer depths not to exceed 3 cm (1 to 1.5 inches). Good quality, cleanly segregated, dry regrind can be added to the virgin material in proportions up to 25%.

Extrusion

When properly dried, Riteflex resins can be extruded into semi-finished products such as round bars, profiles and film, as well as cable and wire sheathing.

A conventional single screw extruder is recommended, along with a breaker plate and a screen pack to ensure thermal homogeneity in the melt. (See charts below for recommended conditions.)

Injection molding conditions

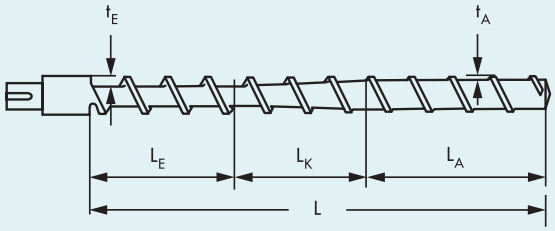


	Riteflex TPE 635, MT9635	Riteflex TPE 640, 430, MT9640	Riteflex TPE 647, 440, MT9647	Riteflex TPE 655, 663, 672, 677, MT9655, MT9663, MT9672, MT9677
ϑ_1 =	155–170°C	160–180°C	190–200°C	200–215°C
ϑ_2 =	170–180°C	180–200°C	200–210°C	215–230°C
ϑ_3 =	170–180°C	180–200°C	200–215°C	215–240°C
ϑ_4 =	170–190°C	180–205°C	200–215°C	215–240°C
ϑ_D =	170–190°C	180–205°C	200–215°C	215–240°C
ϑ_M =	170–190°C	180–205°C	200–215°C	215–240°C

Maximum residence time in the cylinder: 5-10 min
$P_{inj.}$ = low to medium
$P_{hold.}$ = 0–5 bar
n_S = 60–125 min^{-1}

Injection rate: high
ϑ_{W1}, ϑ_{W2} = 25–50°C
(for Riteflex 677 and MT9677: 40–95°C)
Nozzle design: preferably free-flow

Recommended extruder screw



– Feed zone
– Compression zone
– Metering zone
– Flight depth ratio (or compression ratio)
– Flight depth

L_E = (0.25 to 0.33) · L
L_K = (0.25 to 0.33) · L
L_A = (0.33 to 0.5) · L
$\frac{t_E}{t_A}$ = 3.5 to 4
t_A = 2.5 mm

Riteflex TPE Recommended Extrusion Temperature Set-up

Recommended Temperature Range (deg. C)

Riteflex TPE Grade(s)	635 MT9635	430 640 MT9640	440 647 MT9647	655 MT9655	663 MT9663	472 672 677 MT9672 MT9677
Melt Point (°C)	163	170 171	192 187	200	210	221 217 217
Zone 1	165-180	170-185	195-210	205-220	215-230	225-240
Zone 2	170-185	175-190	200-215	210-225	220-235	230-245
Zone 3	175-190	180-195	205-220	215-230	225-240	235-250
Zone 4	175-190	180-195	205-220	215-230	225-240	235-255
Zone 5	175-190	180-200	205-225	215-235	225-245	235-260
Adapter	175-195	180-200	205-225	215-235	225-245	235-260
Die	175-195	180-200	205-225	215-235	225-245	235-260
Melt Temperature	175-195	180-200	205-225	215-235	225-245	235-260

Grades can be consolidated into similar ranges. Adapter can also be referred to as breaker plate. MTs will be the same as its counterpart.

Good electrical properties make Riteflex® TPE an ideal candidate for sheathing cables.

Ticona

Performance Driven Solutions™

World-Class Engineering Polymers

- Celanex® thermoplastic polyester (PBT)
- Celcon® and Hostaform® acetal copolymer (POM)
- Celstran® and Compel® long fiber reinforced thermoplastics (LFRT)
- Fortron® polyphenylene sulfide (PPS)
- GUR® ultra-high molecular weight polyethylene (UHMW-PE)
- Impet® thermoplastic polyester (PET)
- Riteflex® thermoplastic polyester elastomer (TPC-ET)
- Vandar® thermoplastic polyester alloy (PBT)
- Vectra® liquid crystal polymer (LCP)

Please consult the nearest Ticona Sales Office, or call the numbers listed above for additional technical information. Call Customer Services for the appropriate Materials Safety Data Sheets (MSDS) before attempting to process our products. Ticona engineering polymers are not intended for use in medical or dental implants.

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