Estane® Engineered Polymers

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Lubrizolについて

- 1928年　Lubrizol Corporation 設立(本社：米国オハイオ州)
- 1959年　日本ルーブリゾール　設立
- 1959年　B.F. Goodrich & CompanyがTPUを商業化
- 2001年　Noveon 設立（B.F. Goodrichより独立)
- 2003年　NoveonがThermedicsを買収
- 2004年　LubrizolがNoveonを買収
- 2005年　中国 上海のTPU製造工場操業開始
- 2007年　Noveon部門をLubrizol Advanced Materialsへ変更
- 2008年　韓国SK ChemicalのTPU/CP部門、米国Dow ChemicalのTPU部門を買収
- 2011年　Berkshire HathawayがLubrizolを買収
- 2011年　スペインMerquinsa買収
- 2012年　LSP事業部門新設

（Medical TPUを移管、Estane TPUはEngineered Polymers)

Lubrizol Corp. 売上 約US$6Billion、従業員 約7,000名

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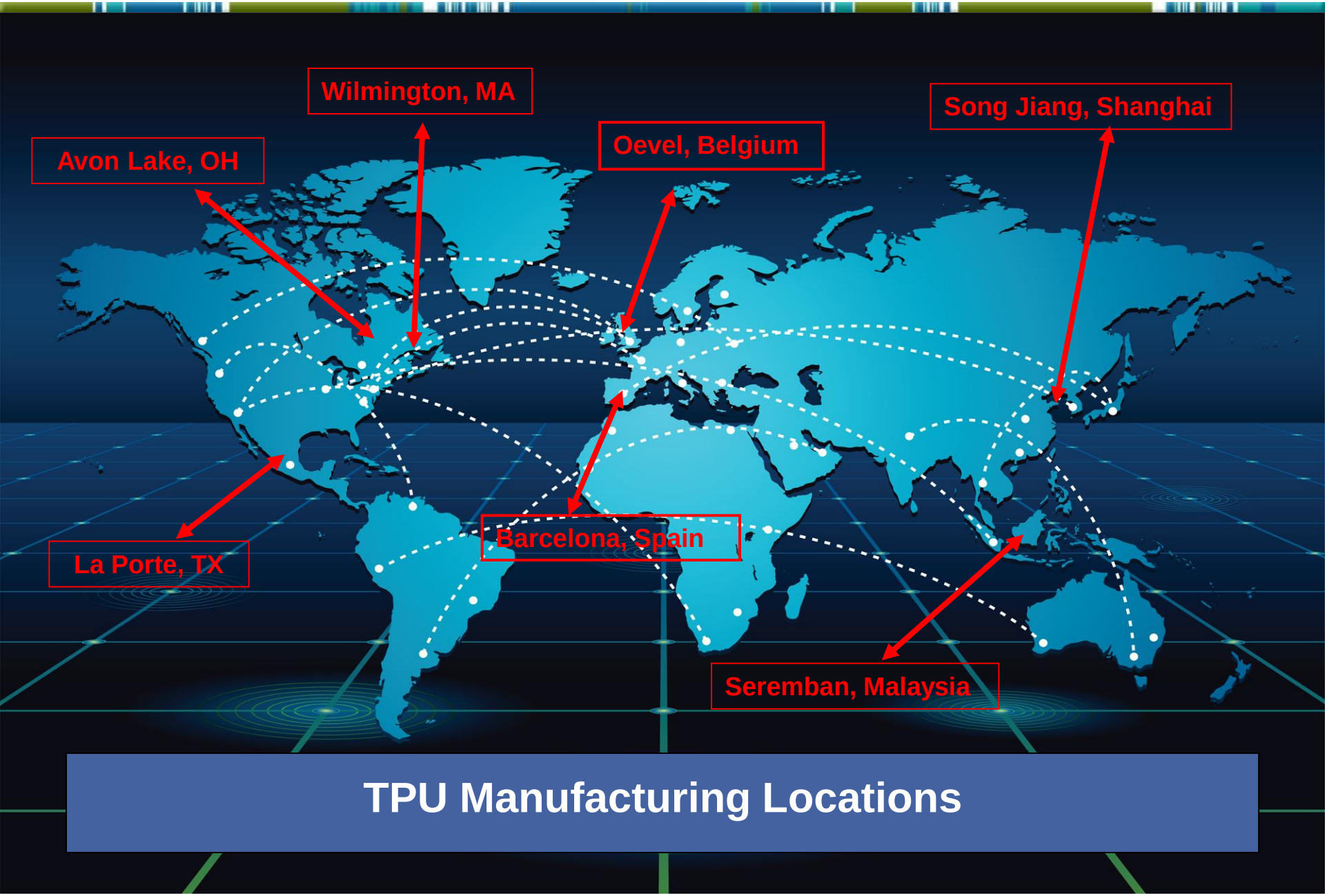

TPU Manufacturing Locations

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LubrizolのTPUの種類

- 芳香族TPU
  - ECO (Pearlcoat)
  - ポリエステル系 (Estane, Pearlcoat)
  - ポリエーテル系 (Estane, Tecothane, Tecoplast, Pellethane, Pearlcoat)
  - ポリカプロラクトン系 (Estane, Pearlcoat)
  - 強化TPU (Estaloc, Isoplast)
  - TPU アロイ (Estagrip)
  - エーテル・カプロ ハイブリッド (Pearlcoat)
- 脂肪族TPU
  - ポリエーテル系 (Estane, Tecoflex, Tecophilic, Pearlcoat)
  - ポリカーボネイト系 (Estane, Carbothane)
  - ポリカプロラクトン系 (Estane)

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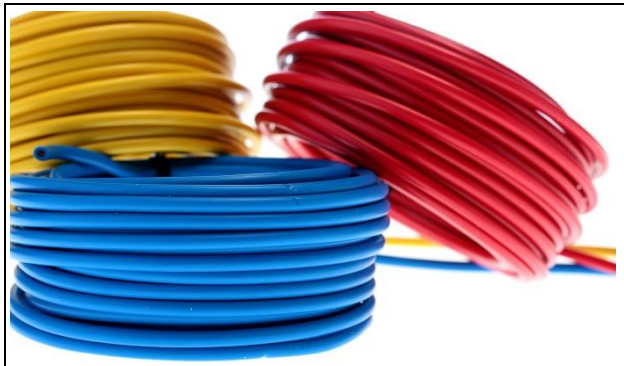
脂肪族 / 芳香族 TPU？

脂肪族 –

無黄変、耐UV性、耐摩耗性



芳香族 –

機械的物性良好、耐薬品性、耐摩耗性、

耐破断性

芳香族＝一般的＝どこでも持ってる
脂肪族＝無黄変＝特殊＝特にLubrizolが強い

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エステル？ エーテル？ ？？？

ポリエステル系: 耐油、耐ガソリン、耐薬品、耐摩耗性、バリア性、接着性、Bioベース(Pearlcoat)

ポリエーテル系: 耐加水分解性、耐水性、低温での柔軟性、耐カビ性、耐摩耗性、耐UV

ポリカプロラクトン系: 圧縮永久歪み良好、機械物性と耐水性のバランス、耐水性、耐溶剤性、耐塩素、旧Dow/Merquinsaの製品群に豊富

ポリカーボネート系: ポリエステルとポリエーテルの良いとこどり

用途に応じて最適なグレードを提案

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ところでTPUって？

TPU＝

Thermoplastic

Polyurethane

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TPE(熱可塑性エラストマー)-Family

Block copolymers

ポリマーの中にソフトとハードセグメントがある

- TPU
- TPC

(ポリエステルエラストマー)

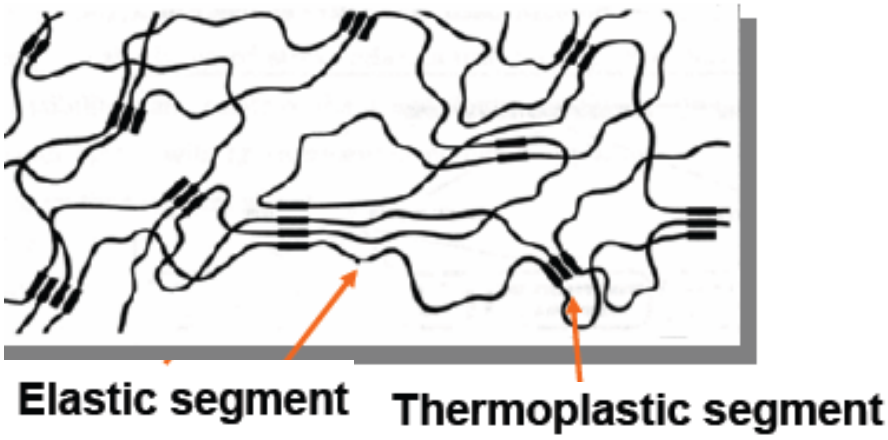
Elastomer blends

エラストマーとプラスチックのコンパウンド

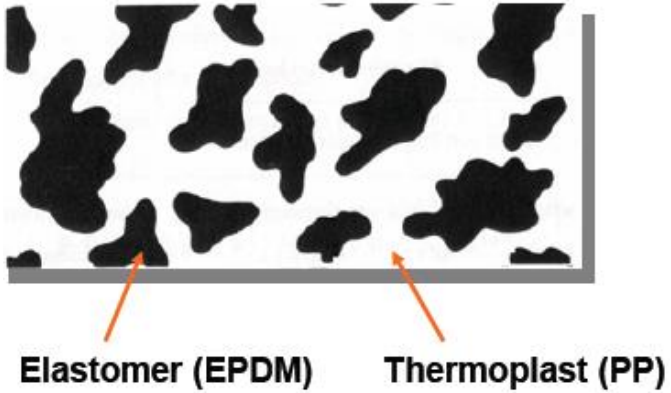
TPE-O

- TPE-V

Structure of block-copolymers



Strukture of elastomerblends



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ところでTPUって？

TPU＝

熱可塑の

ウレタンエラストマー

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TPUの物性比較

TPU TYPE	LOW TEMP. PROPS	HEAT STABILITY	UV STABILITY	HYDROLITIC STABILITY	CHEMICAL RESISTANCE	FUNGUS RESISTANCE	PRICE
ESTER	G	E	G	P	E	P	LOW
CAPA	G	E	F	F	E	P	HIGH
ETHER	E	F	F	E	F	E	HIGH

E = EXCELLENT **G** = GOOD **F** = FAIR **P** = POOR

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Processes

Blow Molding	Calendering	Extrusion	Fabric Coating
Film & Sheet	Injection Molding	Overmolding	Solution Process

Versatility

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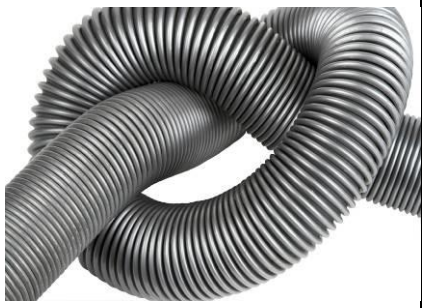
Technologies

Chemical Resistant 	Easy-to-Extrude (ETE)	Flame Retardant	Glass Reinforced
High Moisture Vapor Transmission (HMVT)	Hyperdispersants	Optical Urethanes	Soft Elastic

Creating value for our customers

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ESTANE ENGINEERED POLYMERS

Injection Molding

TPU PRODUCTS & PROPERTIES	ASTM	2355-75A Ester Clear	58134 Ester Opaque	58130 Ester Opaque	58133 Ester Opaque	S160D Ester Clear	58137 Ester Opaque
Hardness (Shore)	D-2240	*83A*	94A/45D	50D	55D	63D	67D
Tensile Strength (psi)	D-412	5100	5800	6000	5900	6400	6000
Elongation (%)	D-412	530	500	450	450	480	430
100% Modulus	D-412	710	1300	1600	2100	3100	3100
Tg (°F by DSC)		-44	-51	-40	-22	N/A	5
Vicat (°F)	D-1525	171	290	290	340	320	370
Flex Mod (psi)	D-790	N/A	8600	13,000	23,000	N/A	54,000
Taber Abrasion, mg loss (Wheel Type)	D-3389	28 (H22)	62 (H18)	62 (H18)	34 (H18)		41 (H18)
Key Attributes		Clarity	Fast Cycling	Fast Cycling	Fast Cycling Black version available	Fast Cycling	Fast Cycling Black version available
Typical Applications		General Use	General Use	General Use	General Use	General Use	General Use
Stabilization		Hydrolytic	Hydrolytic	Hydrolytic	Hydrolytic		Hydrolytic

- ASTM Test Methods and More Property Information Available on Product Data Sheet
- DSC – Differential Scanning Calorimeter

04/2013

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ESTANE® THERMOPLASTIC POLYURETHANES

Injection Molding Engineered Polymers

TPU PRODUCTS & PROPERTIES:	ASTM	2103-70A	MVT 75AT3	58300	58315	58887	58810	2103-55D	2103-65D	ETE 75DT3
		Ether	Ether	Ether	Ether	Ether	Ether	Ether	Ether	Ether
Hardness (Shore)	D-2240	72A	75A	82A	85A	87A	45D	55D	65D	75D
Appearance		Clear	Opaque	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Tensile Strength (psi)	D-412	3,600	5,000	5,500	7,000	7,500	5,500	6,400	5,800	5,900
Elongation (%)	D-412	730	700	650	570	500	530	430	360	330
100% Modulus	D-412	440	600	700	900	1000	1300	2400	2800	3,200
Tg (°F by DSC)		-92	-90	-58	-58	-49	-47			
Vicat (°F)	D-1525	168		162	180	201	194	219	242	
Flex Mod (psi)	D-790	n/a	n/a	3,110	n/a	6,200	5,500	25,000	34,000	
Taber (mg loss - Wheel Type)	D-3389	3 (H22)	20 (H18)	22 (H18)	37 (H18)	40 (H18)	41 (H18)	80 (H22)	90 (H22)	68 (H18)
Key Attributes		High MVRT Low temp flexibility, High elasticity	High MVRT Low temp flexibility, High elasticity	Low temp flexibility Available in Black	Low temp flexibility	Balanced properties	Balanced properties	Load bearing capacity	Low temp impact	
Typical Applications		Grips, Seals, Rollers	Tool handle, Grips, Rollers	General Use	General Use	General Use	General Use	General Use	General Use	
Stabilization			UV	UV	UV	UV	UV			
Specification			USP CL VI, FDA	USP CL VI, FDA NSF 61	USP CL VI, FDA NSF 61	USP CL VI, FDA NSF 61				

- ASTM Test Methods and More Property Information Available on Product Data Sheets
- DSC – Differential Scanning Calorimeter

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ESTANE® THERMOPLASTIC POLYURETHANES

Injection Molding – Caprolactone

TPU PRODUCTS & PROPERTY	ASTM	2102-75A	2102-80A	2102-90A	58149	2102-55D	2102-65D
		Ester	Ester	Ester	Ester	Ester	Ester
Appearance		Clear	Clear	Clear	Opaque	Clear	Clear
Hardness (Shore)	D-2240	77A	84A	94A	95A	58D	65D
Tensile Strength (psi)	D-412 / D-638	5400	5800	6500	4900	7200	6400
Elongation (%)	D-412 / D-638	540	580	440	440	420	390
100% Modulus	D-412 / D-638	700	800	1600	2000	2400	2900
Tg (°F by DSC)		-39	-40	-15	-30	N/A	N/A
Vicat (°F)	D-1525	179	185	243	300	245	288
Flex Mod (psi)	D-790	N/A	N/A	12000	9200	25000	37000
Taber Abrasion mg loss (Wheel Type)	D-3389	20 (H22)	10 (H22)	10 (H22)	38 (H18)	60 (H22)	120 (H22)
Key Attributes		Fast cycle, Hydrolysis resistance, Low compression set	Fast cycle, Hydrolysis resistance, Low compression set	Fast cycle, Hydrolysis resistance, Low compression set	High temp. performance, Hydrolysis resistance, Low compression set	Fast cycle, Hydrolysis resistance, Load bearing	Fast Cycle, Hydrolysis resistance
Typical Applications		Seals, Gaskets, Overmolding, Impact modification	ID Tags, Seals, Overmolding	Hydraulic seals, Belts, ID tags, grommets	Hydraulic seals	Wheels, Belts, Seals	Wheels, Belts

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ESTANE
THERMOPLASTIC POLYURETHANES

Selection Guide

Injection Molding – Engineering Thermoplastics

TPU PRODUCTS & PROPERTIES:	ASTM	Estaloc® ETPU			Isoplast® ETPU						
		59104	59300	59600	101	301	202EZ	302EZ	101 LGF40	202 LGF40	101 LGF60
Description		Reinforced	Reinforced	Reinforced	Impact Modified		Impact Modified		Reinforced	Reinforced	Reinforced
Appearance		Opaque	Opaque	Opaque	Opaque	Clear	Opaque	Clear	Opaque	Opaque	Opaque
Specific Gravity	D-792	1.33	1.45	1.65	1.19	1.20	1.20	1.20	1.50	1.51	1.71
Tensile Strength (psi)	D-638	7,100	12,000	14,000	7,000	9,000	10,000	12,000	27,000	27,000	33,000
Ultimate Elongation (%)	D-638	30	20	13	160	140	90	30	1.8	2	2
Flex Mod (psi)	D-790	180,000	420,000	740,000	260,000	340,000	320,000	330,000	1,500,000	1,500.000	2,200,000
Izod Impact, Notched	D256										
73 F		8.7	8.0	7.2	24	2.4	10	2	5	8	16
-40 F		1.3	2.4	3.5	3	0.8	3	1.1	--	8	16
Key Attributes		Good low temp impact	Dimensional stability, Black version available	Dimensional stability, Black version available	High heat resistance & chemical resistance	High heat resistance & chemical resistance Resistance	High heat resistance & chemical resistance Resistance	High heat resistance & chemical resistance Resistance	High rigidity & heat resistance	High rigidity Black version available	High rigidity Available in black only
Typical Applications			Heavy equipment parts	Heavy equipment parts		Diesel fuel filter		Diesel fuel filter	Metal replacement	Metal replacement	Metal replacement

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Product Family	Product	Description	Appearance	Hardness	Tensile Strength	Comment
Caprolactone	2102-75A	Ester	Clear	77A	5400	Low compression set
	2102-80A	Ester	Clear	84A	5800	Fast cycle
	2102-90A	Ester	Clear	94A	6500	Hydrolysis resistant
	58149	Ester	Opaque	95A	4900	High temperature performance
	2102-55D	Ester	Clear	58D	7200	Load bearing
	2102-65D	Ester	Clear	65D	6400	Fast Cycling
Polyester	T460AH	Ester	Clear	60A	2700	Plasticizer-free
	58238	Ester	Opaque	75A	7000	High elasticity
	2355-75A	Ester	Clear	83A	5100	Clarity
	58134	Ester	Opaque	94A / 45D	5800	Fast cycling
	58130	Ester	Opaque	50D	6000	Fast cycling
	58133	Ester	Opaque	55D	5900	Black version available
	S160D	Ester	Clear	63D	6400	Fast cycling
	58137	Ester	Opaque	67D	6000	Black version available
Polyether	2103-70A	Ether	Clear	72A	3600	Low temperature flexibility
	MVT 75AT3	Ether	Opaque	75A	5000	Low temperature flexibility
	58300	Ether	Clear	82A	5500	Black version available
	58315	Ether	Clear	85A	7000	Low temperature flexibility
	58887	Ether	Clear	87A	7500	Balanced properties
	58810	Ether	Clear	45D	5500	Balanced properties
	2103-55D	Ether	Clear	55D	6400	Load bearing capacity
	2103-65D	Ether	Clear	65D	5800	Low temperature impact
	ETE 75DT3	Ether	Clear	75D	5900	

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Product Family	Product	Description	Appearance	Specific Gravity	Tensile Strength	Comment
Estaloc® ETPU	59104	Reinforced	Opaque	1.33	7100	Good low temperature impact
	59300	Reinforced	Opaque	1.45	12000	Dimensional stability
	59600	Reinforced	Opaque	1.64	14000	Dimensional stability
Isoplast® ETPU	101	Impact Modified	Opaque	1.19	7000	Chemical resistance
	301		Clear	1.20	9000	High heat resistance
	202EZ	Impact Modified	Opaque	1.20	10000	Chemical resistance
	302EZ		Clear	1.20	12000	High heat resistance
	101 LGF40	Reinforced	Opaque	1.50	27000	High rigidity
	202 LGF40	Reinforced	Opaque	1.51	27000	Black version available
	101 LGF60	Reinforced	Opaque	1.71	33000	Black ONLY

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自動車用途		
用途	製品名	特徴
Automotive Parts	Pearlcoat ECO D12T85	植物由来原料を使ったTPU、ECO TPU
	Pearlcoat ECO D12T90	
	pearlcoat ACTIVA D118K	ソフトタッチ用 硬度70A
	Pearlcoat 11T80	ABS/PC、ナイロンへの密着性良好
	Pearlcoat 11T85	
	Pearlcoat 91T85	ライトカラー用無黄変用途、脂肪族TPU
	Pearlcoat 11T85UV	ファーストサイクル、耐UV性
	Pearlcoat 11T95P	ファーストサイクル、塗装可能
	Pearlcoat 11T93	低比重、低圧縮永久歪み、ファーストサイクル
	Pearlcoat 11H94	
	Pearlcoat 11T75D	硬度77D
	Pearlcoat 11T65D	硬度64D
	Pearlcoat 11T60D	硬度58D
	Pearlcoat CLEAR 15N85	硬度85A、 低Tg、 ゴム弾性
	Pearlcoat D91T80	脂肪族TPU、ライトカラー用途

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スポーツ & レジャー		
用途	製品名	特徴
サッカーシューズソール	Pearlcoat 11T93	接着性が非常に良い、ファーストサイクル
ゴルフボール	Pearlcoat 11T95P	強靭
	Pearlcoat CLEAR 15N85	
その他	Pearlcoat ECO 12T95	植物由来原料を使ったTPU、ECO TPU
	Pearlcoat 16N60D	硬度60D、エーテルTPU
ペイントバール ゴーグル	Pearlcoat CLEAR 15N85	耐加水分解性良好
ローラーブレード	Pearlcoat 11T95P	接着性が非常に良い、ファーストサイクル
スキー ゴーグル	Pearlcoat CLEAR 15N85	透明性に優れてる

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工業製品		
用途	製品名	特徴
その他	Pearlcoat 16N60D	硬度60D、エーテルTPU
ふるい	Pearlcoat 11T85	ファーストサイクル
	Pearlcoat 11T95P	
	Pearlcoat CLEAR 15N80	耐加水分解性
	Pearlcoat CLEAR 15N85	
シール、パッキン	Pearlcoat D11H92S	低圧縮永久歪み
	Pearlcoat D11H95S	
	Pearlcoat 11H94	
	Pearlcoat 11H98	
	Pearlcoat 11T95P	ファーストサイクル、低比重
	Pearlcoat 11T93	
	Pearlcoat 11T60D	
	Pearlcoat CLEAR 15N85	耐加水分解性
タイヤ、ホイール	Pearlcoat 11T85	ファーストサイクル、高結晶性
	Pearlcoat 11T95P	
	Pearlcoat 11T93	
	Pearlcoat 11T60D	

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動物IDタグ		
用途	製品名	特徴
動物IDタグ (長期間用)	Pearlcoat 15N95UV	高耐加水分解性、耐候性、機械特性良好
動物IDタグ (短期間用)	Pearlcoat ECO D12T85	植物由来原料を使ったTPU、ECO TPU
	Pearlcoat ECO D12T90	
	Pearlcoat ECO 12T95	
	Pearlcoat 11T85UV	カプロラクトン コポリマーTPU
	Pearlcoat 11T95P	
	Pearlcoat 11T93	
その他　インジェクション用途	Pearlcoat ECO D12T85	植物由来原料を使ったTPU、ECO TPU
	Pearlcoat ECO D12T90	
	Pearlcoat ECO 12T95	
	Pearlcoat 11T85	
	Pearlcoat 11T95P	
	Pearlcoat 11T93	
	Pearlcoat 11T60D	

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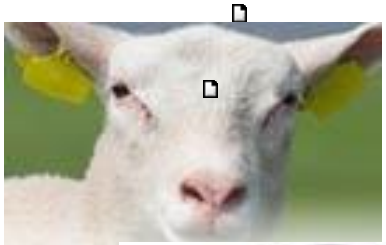

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ESTANE ENGINEERED POLYMERS

Selection Guide
Extrusion - Ester

- Suitable for Sheet/Film Extrusion
- Proper Melt Strength
- Excellent Quality Consistency

Properties	ASTM No.	Units	Standard Ester for Extrusion						
			S185A-45	X585A-31	X585A-4	X590A-31	X595A-3FR	X595A-31	X595A-11
Physical									
Hardness	D2240	Shore A	87	86	87	91	94	95	97
Specific Gravity	D792	g/cm³	1.20	1.20	1.20	1.21	1.22	1.22	1.22
Mechanical									
Tensile Stress	D412	kgf/cm²							
at 100% elongation			75	55	70	85	120	130	135
at 300% elongation			160	95	150	160	210	250	240
Tensile Strength	D412	kgf/cm²	350	300	480	450	400	450	500
Ultimate Elongation	D412	%	560	770	650	700	550	600	550
Tear Resistance (Die C)	D624	kgf/cm	110	95	110	115	115	145	130
Compression Set	D395	%							
23°C X22hr			15	25	15	20	15	20	20
70°C X22hr			45	65	40	60	60	45	50
Thermal									
Vicat Softening Temperature	D1525	°C	110	90	95	100	105	100	115
Remark				USP6		USP6		USP6	

* Test samples were annealed at 100°C and 24 hours at room temperature before testing.
* *These are typical values and should not be used for specifications.

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押出グレード

ESTANE ENGINEERED POLYMERS

Selection Guide
Extrusion - Ether

- Suitable for Sheet/Film Extrusion
- Proper Melt Strength
- Excellent Quality Consistency

Properties	ASTM	Units	Standard Ether for Extrusion						
			R180A-1	R185A-30	R185A-20	R190A-30	R190A-3	R190A-4	R195A-8
Physical									
Hardness	D2240	Shore A	83	85	87	93	93	93	95
Specific Gravity	D792	g/cm³	1.08	1.10	1.10	1.10	1.11	1.11	1.13
Mechanical									
Tensile Stress	D412	kgf/cm²							
at 100% elongation			50	60	60	100	100	100	115
at 300% elongation			80	110	100	180	170	170	200
Tensile Strength	D412	kgf/cm²	250	320	320	320	370	370	430
Ultimate Elongation	D412	%	790	760	700	550	680	680	600
Tear Resistance (Die C)	D624	kgf/cm	80	105	95	165	110	110	130
Compression Set	D395	%							
23°C X22hr			15	20	15	15	15	15	15
70°C X22hr			45	40	45	50	50	50	45
Thermal									
Vicat Softening Temperature	D1525	°C	82	86	90	110	110	110	125
Remark			USP6	USP6	USP6	USP6			

* Test samples were annealed at 100 and 24 hours at room temperature before testing.
* *These are typical values and should not be used for specifications.

押出グレード

ESTANE
THERMOPLASTIC POLYURETHANES

Estane® TPU Hose, Tube & Profile grades Ester

09-10

Physical Properties	Unit	Test method	54351	54353	58213	58437	58271	58610	58206	58447	58277
			capro	capro	ester	ester	ester	ester	ester	ester	ester
Hardness	Shore	ISO 868	A/1: 84 D/1: -	A/1: 90 D/1: -	A/1: 76 D/1: -	A/1: 86 D/1: -	A/1: 86 D/1: -	A/1: 86 D/1: -	A/1: 87 D/1: -	A/1: 90 D/1: 44	A/1: 93 D/1: 49
Specific Gravity	g/cm^3	ISO 2781	1.16	1.17	1.18	1.18	1.19	1.20	1.20	1.19	1.19
Tensile Strength at break	MPa	ISO 527-3/5/500	42	55	25	39	42	37	46	46	47
Tensile stress at											
50% elongation	MPa		4.3	6.6	2.7	5.1	5.1	4.8	4.6	7.0	8.9
100% elongation	MPa		5.0	7.7	3.2	5.8	6.0	5.3	5.0	8.0	10.0
300% elongation	MPa		7.5	13.0	4.9	10.6	8.0	8.0	9.0	14.5	17.4
Elongation at break	%		530	590	700	540	650	625	600	540	550
Tear Strength nicked	kN/m	ISO 34-1B	65	80	45	60	60	70	70	85	100
Abrasion Resistance	mm^3	ISO 4649-B	30	40	70	35	70	35	35	40	55
Vicat Softening Point A50	℃	ISO 306	66	88	70	75	74	55	75	95	74
Brittle Point	℃	ISO 812	-65	-65	-65	-65	-65	-65	-65	-65	-65
Special Features								Profile	Clarity	High Heat	

Extruded strips; 1 mm thickness
Please be aware that listed values are “typical (average) values” and should/can not be applied for specification purposes.

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押出グレード

ESTANE
THERMOPLASTIC POLYURETHANES

Estane® TPU Hose, Tube & Profile grades Ether

09-10

Physical Properties	Unit	Test method	58201	58300	58214	58315	58197	58311	58887	APT88AT3	58212	58888
			ether	ether	ether	ether	ether	ether	ether	ether	ether	ether
Hardness	Shore	ISO 868	A/1: 82 D/1: -	A/1: 83 D/1: -	A/1: 85 D/1: -	A/1: 85 D/1: -	A/1: 85 D/1: -	A/1: 87 D/1: -	A/1: 88 D/1: -	A/1: 88 D/1: -	A/1: 94 D/1: 42	A/1: 88 D/1: -
Specific Gravity	g/cm^3	ISO 2781	1.11	1.10	1.11	1.12	1.12	1.12	1.13	1.16	1.15	1.13
Tensile Strength at break	MPa	ISO527-3/5/500	39	28	35	37	42	42	42	47	36	38
Tensile stress at												
50% elongation	MPa		3.8	4.1	5.0	5.0	4.9	4.9	6.0	7.0	10.0	5.5
100% elongation	MPa		4.6	5.4	6.0	6.0	5.9	5.9	7.0	9.0	11.4	6.4
300% elongation	MPa		7.1	8.3	9.0	9.0	9.1	9.1	11.3	17.0	18.4	9.7
Elongation at break	%		680	725	650	650	655	655	600	500	530	640
Tear Strength nicked	kN/m	ISO 34-1B	45	50	55	55	55	55	65	53	95	60
Abrasion Resistance	mm^3	ISO 4649-B	45	70	45	35	35	35	40	65	40	45
Vicat Softening Point	°C	ISO 306 (A50)	60	60	67	73	73	73	79	85	80	80
Brittle Point	°C	ISO 812	-65	-65	-65	-65	-65	-65	-65	-65	-65	-65
Special Features				UV	Low Friction	UV			UV	High Heat		High Heat

Extruded strips; 1 mm thickness

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押出グレード

Type: **Estane® Breathable Film Compounds**

Physical Properties	Unit	Test method	MVT75AT3	X-1181	58237	58245	58252
Polyester / ether	-	-	ether	ester	ether	ether	ether
Hardness	Shore	ISO 868	A/1: 75 D/1: -	A/1: 85 D/1: -	A/1: 90 D/1: -	A/1: 82 D/1: -	A/1: 72 D/1: -
Specific Gravity	g/cm^3	ISO 2781	1.08	1.24	1.23	1.21	1.20
Tensile Strength	MPa	ISO527-	40	48	40	27	21
Tensile Stress at							
50% elongation	MPa		3.1	5.1	6.0	3.7	2.2
100% elongation	MPa		4.6	6.2	7.0	4.5	2.8
300% elongation	MPa		8.1	11.0	12.9	7.8	4.7
Ultimate Elongation	%		675	600	590	770	850
Tear Strength nicked	kN/m	ISO 34-1B	32	52	45	35	27
Abrasion Loss	mm^3	ISO 4649-B	43	36	42	50	80
Kofler Melting Point	℃	Lubrizol	163	171	181	161	158
M V T properties							
- 38℃/90%RH, desiccant	g/m^2. day	DIN 53122	3500	4500	6000	10000	15000
- 23℃/50%RH, upright	g/m^2. day	ASTME-96B	650	250	900	1200	1300
- 23℃/50%RH, inverted	g/m^2. day	ASTME-	840	250	-		-
Special Features			LOW MVT	LOW SWELL	MEDIUM MVT	HIGH MVT	HIGH MVT

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押出グレード

ESTANE
THERMOPLASTIC POLYURETHANES

Estane® TPU
Easy-to-Extrude (ETE)

09-10

Physical properties	Unit	Test method	55DS3	60DS3	45DT3	50DT3	55DT3	60DT3	70DT3	75DT3
			ester	ester	ether	ether	ether	ether	ether	ether
Hardness	Shore	ISO 868	A/1: - D/1: 55	A/1: - D/1: 60	A/1: - D/1: 45	A/1: - D/1: 50	A/1: - D/1: 55	A/1: - D/1: 60	A/1: - D/1: 70	A/1: - D/1: 75
Specific Gravity	g/cm^3	ISO 2781	1.22	1.23	1.14	1.15	1.16	1.17	1.18	1.18
E-modulus 1 mm/min.	MPa	ISO 527	104	130	47	63	87	173	420	1092
Tensile Strength at break	MPa	ISO 527-3/5/500	39	43	38	37	33	36	42	41
Tensile stress at										
50% elongation	MPa		12.9	16.1	9.2	10.0	11.3	17.5	20.4	25.4
100% elongation	MPa		14.0	17.6	10.8	11.8	12.8	19.9	21.3	26.4
300% elongation	MPa		24.6	27.5	18.8	20.5	20.2	27.1	35.8	29.9
Elongation at break	%		545	470	550	515	520	435	355	345
Tear Strength nicked	kN/m	ISO 34-1B	130	150	100	105	110	160	175	240
Abrasion Resistance	mm^3	ISO 4649-B	84	63	66	81	75	86	81	68
Vicat Softening Point	℃	ISO 306 (A50)	113	95	85	85	93	85	99	50
Max. Burst Pressure 23℃ (1)	Bar	ISO 7628/1	60	62	32	38	42	52	86	90

Extruded strips; 1 mm thickness
(1) tubes : 6 mm diameter; 1 mm wall thickness
Please be aware that listed values are "typical (average) values" and should/can not be applied for specification purposes.

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ESTANE
THERMOPLASTIC POLYURETHANES

Estane® TPU Hot Melt

09-10

Physical Properties	Unit	Test method	T5662	UB 410	5717	UB 310	T5649	5648	X1088	T5743
			ester	ester	ester	ester	ester	ester	ester	ester
Hardness	Shore	ISO 868	A/1: 63 D/1: -	A/1: 68 D/1: -	A/1: 70 D/1: -	A/1: 95 D/1: -	A/1: 95 D/1: -	A/1: - D/1: 40	A/1: - D/1: 45	A/1: - D/1: 45
Specific Gravity	g/cm^3	ISO 2781	0.995	1.18	1.19	1.16	1.17	1.16	1.21	1.21
Tensile Strength at break	MPa	ISO 527-3/5/500	7	13	10	22	-	-	31	31
Tensile stress at										
50% elongation	MPa		1.6	2.1	2.0	4.7	-	-	5.3	5.3
100% elongation	MPa		2.4	2.6	2.5	4.9	-	-	5.6	5.6
300% elongation	MPa		3.8	4.1	4.1	5.8	-	-	6.1	6.1
Elongation at break	%		1350	750	760	540	-	-	700	700
Tear Strength Nicked	kN/m	ISO 34-1B	6.8	26	30	60	-	-	60	60
Kofler Melting Point	℃	Lubrizol	118	86	80	96	90	95	45	60
Special Features			Water repellent	Low temp flex		Low temp flex				

Extruded strips; 1 mm thickness
Please be aware that listed values are "typical (average) values" and should / can not be applied for specification purposes.

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押出グレード

ESTANE
THERMOPLASTIC POLYURETHANES

Estane® TPU Cable & Wire – Zero Halogen Flame Retardant grades

09-10

Physical properties	Unit	Test method	ZHF78AT3	ZHF80AT3	ZHF85AT5	ZHF90AT2	58244	ZHF92AT3	ZHF95AT3
			ether	ether	ether	ether	ether	ether	ether
Hardness	Shore	ISO 868	A/1: 78 D/1: -	A/1: 82 D/1: -	A/1: 84 D/1: -	A/1: 90 D/1: -	A/1: 92 D/1: 39	A/1: 92 D/1: -	A/1: 96 D/1: -
Specific Gravity	g/cm^3	ISO 2781	1.13	1.12	1.15	1.24	1.19	1.22	1.24
Tensile Strength at break	MPa	ISO 527-3/5/200	46	46	54	30	28	20	15
Tensile stress at									
50% elongation	MPa		3.8	4.0	5.2	8.0	7.0	7.5	9.3
100% elongation	MPa		4.6	4.9	6.2	9.0	8.0	8.2	9.9
300% elongation	MPa		7.6	9.1	10.9	13.7	8.6	11.0	12.9
Elongation at break	%		650	600	555	520	580	530	400
Tear Strength nicked	kN/m	ISO 34-1B	39	40	49	85	56	55	66
Abrasion Resistance	mm^3	ISO 4649-A	36	38	47	38	97	98	142
Vicat Softening Point	℃	ISO 306 (A50)	60	65	80	85	60	86	80
Oxygen Index	%	ASTM D2863	24	25	24	24	28	33	37
Vertical Burn Test		UL94	V0	V2	V2	V2-3 mm	V0-3 mm	V0-2mm	V0
Yellow card			/	Yes	/	Yes	Yes	/	Yes
Special Features			ZERO HALOGEN						

Extruded strips; 1 mm thickness

Please be aware that listed values are " typical (average) values" and should/can not be applied for specification purposes.

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ESTANE
THERMOPLASTIC POLYURETHANES

Selection Guide
Calendering Engineered Polymers

TPU PRODUCTS & PROPERTIES	ASTM	54610 Ester	54640 Ether	54600 Ester
Hardness (Shore)	D-2240	85A	85A	92A
Specific Gravity	D-792	1.20	1.13	1.22
Tensile Strength (psi)	D-412 / D-638	5400	6600	8500
Elongation (%)	D-412 / D-638	620	520	490
Tensile stress at 100% strain (psi)	D-412 / D-638	770	900	1400
Tensile stress at 300% strain (psi)	D-412 / D-638	1200	1700	3600
Tensile Set (%)	D-412 / D-638	11	---	28
Compression Set (%), 23ºC	D-395	30	---	25
Compression Set (%), 70ºC	D-395	80	---	72
Graves Tear (lb/in)	D-624 (die C)	610	390	640
Tg (°C by DSC)		-25	-56	-20
Koffler Melt Point (°C)	D-1525	115	145	140
Taber (mg. H18, 1000g)	D-3389 B	34	37	45
COMMENTS		Wide processing window		Wide processing window, Good physical properties

July 2010

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押出グレード

ESTANE ENGINEERED POLYMERS

Film, Sheet & Fabric Product Guide
Soft, Aromatic (Metric Units)

TPU PRODUCTS & PROPERTIES:	ASTM	58213	58238	5701	5708	54610	58206	58271	58245	5714	58300	58630	58202	58284	58309	58311	58315	58325
		Ester	Ester	Ester	Ester	Ester	Ester	Ester	Ether	Ether	Ether	Ether	Ether	Ether	Ether	Ether	Ether	Ether
Hardness (Shore)	Shore	75A	75A	85A	85A	85A	85A	85A	80A	80A	82A	82A	85A	85A	85A	85A	85A	85A
Specific Gravity	D-792	1.18	1.17	1.21	1.20	1.20	1.20	1.21	1.21	1.11	1.10	1.13	1.25	1.10	1.13	1.13	1.12	1.12
Tensile Strength (MPa)	D-412 / D-638*	38	48	49	42	37	48	52	31	31	38	41	28	48	45	46	48	52
Elongation (%)	D-412 / D-638*	680	680	460	490	625	550	540	700	530	650	640	650	550	570	520	570	600
Tensile Set (%)	D-412 / D-638*	6	4	11		11	10	13	10	15	11	15	17	8	19	14	14	10
Compression Set (%)	D-395*								17	24	24	24	25	19	22	18	22	28
Tg (°C by DSC)	(°F by DSC)	-30	-45	-28	-33	-25	-32	-25	-37	-38	-50	-50	-45	-44	-46	-49	-50	-44
Vicat (°C)	D-1525*			70	100				68	71	72	70	68	92	96	94	81	81
Flex Mod (MPa)	D-790*										21		42		29	97	31	28
Taber (H-18, 1000g)	D-3389 B*	6.4	21				20	34	60		22	60	155	83	21		37	63
COMMENTS		Blend with PVC, good adhesive	Highly elastic, rubber like	Low temp, & high abrasion resistance	Low temp flex, chemical resistant	Good physical properties, calendering	Good flex, low temp & weathering	Good physical & adhesive properties	High moisture vapor transmission, low temp	Low temp, high flex, fungal resistance	Hydrolysis resistance, good low temp & abrasion	Good hydrolysis resistance, low temp	HFR, good low temp. V0, LOI 32	Matte finish, superior durability	Good physical properties, reduced surface tack, NSF listed	Good heat, abrasion, cut resistance FDA compliant	Very good physical properties, low temp, NSF 61 listed	High melt strength for thick sheet extrusion

- HMVT – High Moisture Vapor Transmission
- HFR – Halogenated Flame Retardant
- *ASTM test methods and more property information available on product data sheets
- DSC – Differential Scanning Calorimeter
- *Tested per DIN Standard

06/2011

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押出グレード

ESTANE ENGINEERED POLYMERS

Film, Sheet & Fabric Product Guide
Hard, Aromatic (Metric Units)

TPU PRODUCTS & PROPERTIES:	ASTM	5713	58226	58277	58887	58244	58237	58215	58211	58219	ETE 50DT3	ETE 60DT3	58091
		Ester	Ether	Ether	Ether	Ether	Ether	Ether	Ether	Ether	Ether	Ether	Ester
Hardness	Shore	40D	92A	92A	87A	90A	90A	90A	90A	92A	50D	60D	70D
Specific Gravity	D-792	1.20	1.21	1.22	1.12	1.19	1.22	1.14	1.29	1.14	1.16	1.17	1.15
Tensile Strength (MPa)	D-412/D-638*	38	62	62	52	14	35	66	28	62	60	54	29
Elongation (%)	D-412/D-638*	600	500	450	500	600	550	450	340	470	420	460	160
Tensile Set (%)	D-412/D-638*		21	20	18	29	18	20	53	16	24	37	
Compression Set (%)	D-395*				23	40	17	24	37	23	28	25	
Tg	°C by DSC	-43	-25	-20	-45	-45	-24	-40	-38	-45	-33	-17	-11
Vicat (°C)	D-1525*	95			94	70	88	120	90	105	129	132	
Flex Mod (MPa)	D-790*				43			97			74	138	
Taber (H-18, 1000g)	D-3389 B*		40	50	40	40	40	43	235	40	81	60	47
COMMENTS		Inks, lacquers & hot melt adhesives	Excellent physical properties & good chemical resistance	Excellent physical properties & good chemical resistance	Excellent physical properties, low temp, performance and clarity	NHFR, V0, LOI 28, low smoke	HMVT, good physical properties and clarity	Excellent physical properties & hydrolysis resistance	HFR, V0, LOI 32	Excellent physical properties, NSF 61 listed, hydrolysis resistance	Hard TPU, melt stability, low temp flexibility, high transparency, UV stable	Hard TPU, melt stability, low temp flexibility, high transparency, UV stable	High stiffness, TPU alloy

- *ASTM Test Methods and More Property Information Available on Product Data Sheets
- DSC – Differential Scanning Calorimeter
- HMVT – High Moisture Vapor Transmission
- HFR – Halogenated Flame Retardant
- NHFR – Non-Halogenated Flame Retardant
- *Tested per DIN Standard

05/2012

押出グレード

ESTANE ENGINEERED POLYMERS

Selection Guide
Low Gel - Metric

TPU PRODUCT & PROPERTIES	ASTM	2103-80AEF Ether	2103-80AEN Ether	2103-84AEN Ether	2103-90AEF Ether
Hardness (Shore)	D-2240	86A	85A	90A	89A
Specific Gravity	D-792	1.12	1.10	1.12	1.14
Tensile Strength (Mpa)	D-412 / D-638	53.7	46.8	53.0	54.4
Elongation (%)	D-412 / D-638	590	500	500	420
Tensile stress at 100% strain (Mpa)	D-412 / D-638	6.5	5.6	7.5	10.1
Tensile stress at 300% strain (Mpa)	D-412 / D-638	11.9	10.5	16.1	26.5
Tensile Set (%)	D-412 / D-638	14	13	21	13
Compression Set (%), 23°C	D-395	26	23	26	29
Compression Set (%), 70°C	D-395	77	83	74	77
Graves Tear (KN/m)	D624 (die C)	82	74	94	102
Tg (°C by DSC)	Lubrizol	-36	-34	-36	-29
Koffler Melt Point (°C)	D-1525	133	120	146	171
Taber (mg. H18, 1000g)	D-3389 B	57	54	83	100
COMMENTS		Very low gel film grade	Very low gel film grade	Very low gel film grade	Very low gel film grade

09/2011

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チューブ＆ホース		
用途	製品名	特徴
消防、ペイント、ガーデン ホース	Pearlcoat CLEAR 15N85	非常に柔軟、耐加水分解、耐薬品性
	Pearlcoat 16N85UV	耐加水分解、耐バクテリア Pearlcoat 16N85UV は耐UV、FDAグレード
	Pearlcoat 16N95UV	
油圧チューブ	Pearlcoat 11T85E	耐摩耗性、耐グリース、耐油性、伸び、クリープ特性良好 屋外用途向け、耐加水分解、耐バクテリア性
	Pearlcoat 11T92EM	
	Pearlcoat 11T93	
	Pearlcoat 12T92E	
	Pearlcoat 16N95UV	
空気チューブ	Pearlcoat 11T98	バースト強度が高い、耐加水分解、耐バクテリア
	Pearlcoat 11H98	
	Pearlcoat 16N95UV	
ワイヤーホース	Pearlcoat 11T80	PVCとの密着性良好、耐摩耗、FDAグレード
	Pearlcoat 11T85E	
	Pearlcoat MAXI 12T85E	ポリエステルグレード
	Pearlcoat 12T92E	
	Pearlcoat 16N80	耐加水分解、耐バクテリア

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フィルム & シート		
用途	製品名	特徴
粘着フィルム	Pearlcoat 12F75UV	耐熱、耐洗濯性、低融点
	pearlcoat DIPP 119	ソフト、低融点
	Pearlcoat 12K85A	インフレ 85A
	Pearlcoat 12K92A	耐熱グレード
	pearlcoat 125K	中融点カレンダーブレード
	pearlcoat 126K	
	pearlcoat 127K	
脂肪族(無黄変)	Pearlcoat D91F88	透明、無黄変、フィルムグレード
エラスティック フィルム	Pearlcoat CLEAR 15N70	硬度72A、T-die・インフレフィルム
	Pearlcoat CLEAR 15N80	硬度82A、T-die・インフレフィルム
	Pearlcoat CLEAR 15N85	硬度85A、破断強度
その他	pearlcoat ACTIVA D118K	ソフトタッチ

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ラミネーション		
用途	製品名	特徴
コンベア ベルト	Pearlcoat 12K92A	インフレ、T-die フィルムグレード
	Pearlcoat 12K85A	
	pearlcoat 125K	FDAグレード、高耐摩耗性、生産性(低融点)
	pearlcoat 127K	
インフレータブル (空気でふくらます)	Pearlcoat 16N80	耐候性、耐微生物性
	pearlcoat 163K	FDA認証グレード
	pearlcoat 168K	
その他	pearlcoat ACTIVA D118K	高品質、ソフトタッチ
合成皮革	pearlcoat 125K	カレンダーグレード、硬度85A＆94A、合成皮革用(トップ、フォーム層)
	pearlcoat 126K	
布、生地	Pearlcoat 11T85E	高融点 86Aグレード
	Pearlcoat 12K85A	中融点、カレンダーグレード、テキスタイルコーティング
	Pearlcoat 12K92A	インフレ、T-die フィルムグレード
	pearlcoat 126K	カレンダーグレード、下水パイプライナー、耐スチレンモノマー
	Pearlcoat 16N80	耐候性、耐微生物性 、屋外用
	pearlcoat 162K	
	pearlcoat 168K	

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Profiles		
用途	製品名	特徴
その他	Pearlcoat 16N95UV	エーテル
コンベアベルト	Pearlcoat 11T98	コンベアベルト
	Pearlcoat 11T85E	
	Pearlcoat 11T92E	
タイミングベルト	Pearlcoat 12T92E	カプロラクトン＆エーテル コポリマー

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Sheathings & Others		
用途	製品名	特徴
電線被覆	**Pearlcoat 16N80**	エーテルTPU、防カビ、耐加水分解、 ケン化 値 (SN) of < 200 mg KOH/g (VDE282-10)
その他押し出し成型	**Pearlcoat 11T85E**	カプロラクトン コポリマー、硬度86A、91A、98A
	Pearlcoat 11T92EM	
	Pearlcoat 11T98	
	Pearlcoat 16N95UV	

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押出グレード

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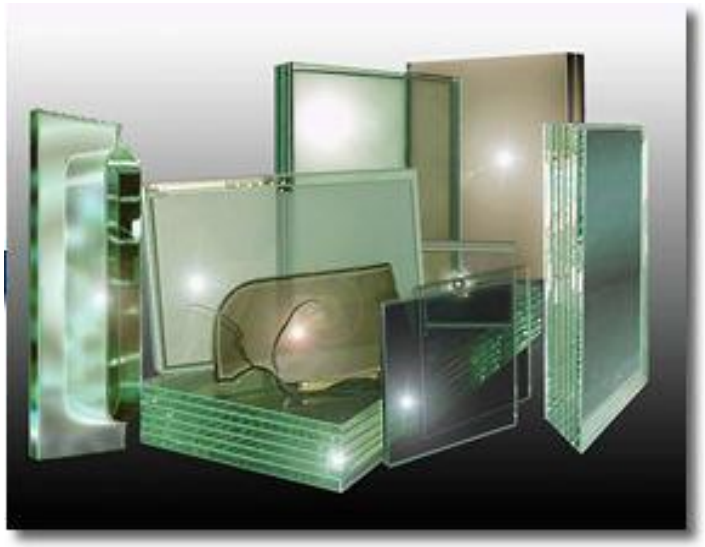

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代表グレード

MVT80NT1, MVT90NT1	高透湿、スズフリー
ZHF95AT3, ZHF90AT3	ノンハロ、難燃
ALR CL87AV	無黄変、フィルム
AG8451	無黄変、中間膜
T460A	低高度66A、可塑剤フリー
S395A-27N	高透明、射出、エステル、FDA
ISOPLAST ETPU	高硬度>80D、耐水、耐油、バリア
ECO D12T80	Bio TPU、植物由来原料、低比重
Pearlcoat 11T98	Pneumatic Tube用

硬度62A~80D、エステル系・エーテル系・カプロラクトン系、芳香族/脂肪族、押出/射出など
用途に合った各種TPUグレードをグローバルの工場から供給可能です。

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