

thermoplastic elastomers

# Injection Moulding

HARD FACTS ABOUT AN ELASTIC MATERIAL

**dryflex<sup>®</sup>**

## TPE-Styrene Based Material in 30 Shore A – 50 Shore D

The VTC TPE Group have developed a complete range of materials - the S-series, which can be used advantageously in most applications. The material is easy to process and is ideal for injection moulding but can also be extruded. The following information should only be regarded as advisory. Please contact the VTC TPE Group for further information.

## SBS Based Materials – 400S

The 400S-series is a good alternative for indoor applications and disposable articles that do not have high requirements for ageing and heat resistance. The raw materials are specially selected for a fast and stable manufacturing process. The 400S-series covers grades from 50 Shore A to 50 Shore D in natural and black colours but they can easily be coloured in any shade.

Service temperature range, Shore A	-50°C – +75°C
Service temperature range, Shore D	-40°C – +75°C
Weather resistance, air-ageing	Moderate
Bonding to PP	Excellent
Specific gravity	1.04 g/cm <sup>3</sup>
Shrinkage	0.8 – 2.0%
Processing temperature -Injection moulding	170°C – 210°C
Chemical Resistance	Good (excluding organic solvents, aromatic- and vegetable oils).

Material	Hardness Shore A or D	Colour	Tensile Strength MPa	Specific Gravity g/cm <sup>3</sup>	Elongation at Break %	Tear Strength N/mm	Modulus 100% MPa	Modulus 300% MPa	MFR 2.16kg/190°C g/10 min
Test Method	ASTM D 2240 <sup>1</sup>		ASTM D 638	ASTM D 792	ASTM D 638	ASTM D 624	ASTM D 638	ASTM D 638	ASTM D 1238
400501S	50 A	Natural	2	1.04	>500	20	1	2	8
402501S	50 A	Black	2	1.04	>500	20	1	2	8
400601S	60 A	Natural	3	1.04	>500	27	2	3	8
402601S	60 A	Black	3	1.04	>500	27	2	3	8
400701S	70 A	Natural	4	1.04	>500	32	3	4	8
402701S	70 A	Black	4	1.04	>500	32	3	4	8
400801S	80 A	Natural	6	1.04	>500	42	4	5	8
402801S	80 A	Black	6	1.04	>500	42	4	5	8
400901S	90 A	Natural	8	1.04	>500	55	6	7	8
402901S	90 A	Black	8	1.04	>500	35	6	7	8
420351S	35 D	Natural	9	1.04	>400	67	7	8	4
422351S	35 D	Black	9	1.04	>400	67	7	8	4
420401S	40 D	Natural	10	1.04	>400	77	9	9	4
422401S	40 D	Black	10	1.04	>400	77	9	9	4
420451S	45 D	Natural	12	1.04	>400	89	11	11	4
422451S	45 D	Black	12	1.04	>400	89	11	11	4
420501S	50 D	Natural	13	1.04	>400	105	12	12	4
422501S	50 D	Black	13	1.04	>400	105	12	12	4

<sup>1)</sup> 4mm

All the above information about chemical and physical properties consists of values measured in tests on injection moulded test specimens. We provide written and illustrated advice in good faith. This should however only be regarded as being advisory, and does not absolve the customer from doing their own tests and trials, to determine the suitability of the material for the intended applications. We retain the right to make changes without prior notice.

## SEBS Based Materials – 500S Unfilled Qualities

The 500S-series is very favourable when transparency and good scratch resistance are required, as well as when there are high surface finish requirements. Unfilled grades have excellent flow- and mechanical properties, such as elongation, compression set, tensile- and tear strength. The low density entails lower weight compared to the 600S- and 660S-series. Unfilled compounds are available in hardness from 0 Shore A to 55 Shore D in translucent and black colours but they can easily be coloured in any shade.

Service temperature range	-50°C – +125°C
Weather resistance, air-ageing	Excellent
Food contact <sup>1</sup>	OK
Bonding to PP	Excellent
Specific gravity	0.89 g/cm <sup>3</sup>
Shrinkage	0.8 – 2.0%
Processing temperature -Injection moulding	180°C – 210°C
Chemical Resistance	Good (excluding organic solvents, aromatic- and vegetable oils).

<sup>1</sup>Compounds that are in compliance with the food regulations are available in hardness ranging from 30 Shore A to 90 Shore A, in increments of 5 Shore, in translucent and black.

Material	Hardness Shore A	Colour	Tensile Strength MPa	Specific Gravity g/cm <sup>3</sup>	Elongation at Break %	Tear Strength N/mm	Compr. set 23°C/72h %	Modulus 100% MPa	Modulus 300% MPa	MFR 2.16kg/190°C g/10 min
Test- Method	ASTM D 2240 <sup>1</sup>		ASTM D 638	ASTM D 792	ASTM D 638	ASTM D 624	ASTM D 395	ASTM D 638	ASTM D 638	ASTM D 1238
500300S	30	Transl.	3	0.89	>600	16	10	1	2	3
502300S	30	Black	3	0.89	>600	16	10	1	2	3
500350S	35	Transl.	4	0.89	>600	17	10	1	2	3
502350S	35	Black	4	0.89	>600	17	10	1	2	3
500400S	40	Transl.	5	0.89	>600	18	10	1	2	3
502400S	40	Black	5	0.89	>600	18	10	1	2	3
500450S	45	Transl.	6	0.89	>600	18	10	1	2	1
502450S	45	Black	6	0.89	>600	18	10	1	2	1
500500S	50	Transl.	6	0.89	>600	22	15	1	2	1
502500S	50	Black	6	0.89	>600	22	15	1	2	1
500550S	55	Transl.	6	0.89	>600	24	20	2	3	1
502550S	55	Black	6	0.89	>600	24	20	2	3	1
500600S	60	Transl.	7	0.89	>600	25	20	2	3	2
502600S	60	Black	7	0.89	>600	25	20	2	3	2
500650S	65	Transl.	8	0.89	>600	28	20	2	3	2
502650S	65	Black	8	0.89	>600	28	20	2	3	2
500700S	70	Transl.	9	0.89	>600	32	25	3	4	2
502700S	70	Black	9	0.89	>600	32	25	3	4	2
500750S	75	Transl.	10	0.89	>600	37	25	3	5	2
502750S	75	Black	10	0.89	>600	37	25	3	5	2
500800S	80	Transl.	11	0.89	>600	40	25	4	5	2
502800S	80	Black	11	0.89	>600	40	25	4	5	2
500850S	85	Transl.	14	0.89	>600	50	30	5	6	3
502850S	85	Black	14	0.89	>600	50	30	5	6	3
500900S	90	Transl.	14	0.89	>600	60	30	6	7	3
502900S	90	Black	14	0.89	>600	60	30	6	7	3

<sup>1</sup> 4mm

All the above information about chemical and physical properties consists of values measured in tests on injection moulded test specimens. We provide written and illustrated advice in good faith. This should however only be regarded as being advisory, and does not absolve the customer from doing their own tests and trials, to determine the suitability of the material for the intended applications. We retain the right to make changes without prior notice.

## SEBS Based Materials – 600S Filled Qualities

The most significant features of the 600S-series are the improved heat stability and that the material enables an easy and secure pigmenting for the customer. A filled material reduces the stickiness and sink marks on thick details but has limited scratch resistance. Compounds in the 600S-series are available in hardness from 25 Shore A to 90 Shore A in natural and black colours but they can easily be coloured in any shade.

Service temperature range	-50°C – +125°C
Weather resistance, air-ageing	Excellent
Food contact <sup>1</sup>	OK
Overmoulding to PP	Excellent
Specific gravity	1.16 – 1.18 g/cm <sup>3</sup>
Shrinkage	0.8 – 2.0%
Processing temperature -Injection moulding	180°C – 210°C
Chemical Resistance	Good (excluding organic solvents, aromatic- and vegetable oils).

<sup>1</sup>Compounds that are in compliance with the food regulations are available in hardness ranging from 30 Shore A to 90 Shore A, in increments of 5 Shore, in natural and black.

Material	Hardness Shore A	Colour	Tensile Strength MPa	Specific Gravity g/cm <sup>3</sup>	Elongation at Break %	Tear Strength N/mm	Compr. set 23°C/72h %	Modulus 100% MPa	Modulus 300% MPa	MFR 5kg/190°C g/10 min
Test Method	ASTM D 2240 <sup>1</sup>		ASTM D 638	ASTM D 792	ASTM D 638	ASTM D 624	ASTM D 395	ASTM D 638	ASTM D 638	ASTM D 1238
600300S	30	Natural	3	1.17	>600	14	11	1	2	25
602300S	30	Black	3	1.17	>600	14	11	1	2	25
600350S	35	Natural	3	1.17	>600	15	11	1	2	25
602350S	35	Black	3	1.17	>600	15	11	1	2	25
600400S	40	Natural	5	1.17	>600	18	11	1	2	15
602400S	40	Black	5	1.17	>600	18	11	1	2	15
600450S	45	Natural	6	1.17	>600	18	13	1	2	15
602450S	45	Black	6	1.17	>600	18	13	1	2	15
600500S	50	Natural	6	1.16	>600	25	18	1	2	10
602500S	50	Black	6	1.16	>600	25	18	1	2	10
600550S	55	Natural	6	1.17	>600	25	18	2	3	10
602550S	55	Black	6	1.17	>600	25	18	2	3	10
600600S	60	Natural	7	1.18	>600	30	20	2	3	10
602600S	60	Black	7	1.18	>600	30	20	2	3	10
600650S	65	Natural	7	1.17	>600	30	20	3	4	10
602650S	65	Black	7	1.17	>600	30	20	3	4	10
600700S	70	Natural	8	1.16	>600	32	26	3	4	10
602700S	70	Black	8	1.16	>600	32	26	3	4	10
600750S	75	Natural	9	1.16	>600	33	27	3	4	10
602750S	75	Black	9	1.16	>600	33	27	3	4	10
600800S	80	Natural	9	1.16	>600	38	27	4	5	10
602800S	80	Black	9	1.16	>600	38	27	4	5	10
600850S	85	Natural	13	1.17	>600	41	27	5	6	10
602850S	85	Black	13	1.17	>600	41	27	5	6	10
600900S	90	Natural	13	1.16	>600	50	34	5	6	5
602900S	90	Black	13	1.16	>600	50	34	5	6	5

<sup>1</sup> 4mm

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## SEBS Based Materials – 660S Semi-filled Qualities

The 660S-series is recommended when the properties of the produced detail requires the advantages of the 500S-series in combination with the 600S-series. A semi filled material can therefore combine the advantages of the other two series. The material has good flow and mechanical properties as well as reasonable scratch resistance. Compounds in the 660S-series are available in hardness from 20 Shore A to 90 Shore A in natural and black colours but they can easily be coloured in any shade.

Service temperature range	-50°C – +125°C
Weather resistance, air-ageing	Excellent
Food contact <sup>1</sup>	OK
Overmoulding to PP	Excellent
Specific gravity	1.05 g/cm <sup>3</sup>
Shrinkage	0.8 – 2.0%
Processing temperature -Injection moulding	180°C – 210°C
Chemical Resistance	Good (excluding organic solvents, aromatic- and vegetable oils).

<sup>1</sup>Compounds that are in compliance with the food regulations are available in hardness ranging from 30 Shore A to 90 Shore A, in increments of 5 Shore, in natural and black.

Material	Hardness Shore A	Colour	Tensile Strength MPa	Specific Gravity g/cm <sup>3</sup>	Elongation at Break %	Tear Strength N/mm	Compr. set 23°C/72h %	Modulus 100% MPa	Modulus 300% MPa	MFR 5kg/190°C g/10 min
Test Method	ASTM D 2240 <sup>1</sup>		ASTM D 638	ASTM D 792	ASTM D 638	ASTM D 624	ASTM D 395	ASTM D 638	ASTM D 638	ASTM D 1238
660300S	30	Natural	3	1.05	>600	14	10	1	2	20
662300S	30	Black	3	1.05	>600	14	10	1	2	20
660350S	35	Natural	3	1.05	>600	14	10	1	2	20
662350S	35	Black	3	1.05	>600	14	10	1	2	20
660400S	40	Natural	5	1.05	>600	15	13	1	2	20
662400S	40	Black	5	1.05	>600	15	13	1	2	20
660450S	45	Natural	6	1.05	>600	15	13	1	2	15
662450S	45	Black	6	1.05	>600	15	13	1	2	15
660500S	50	Natural	6	1.05	>600	20	15	1	2	10
662500S	50	Black	6	1.05	>600	20	15	1	2	10
660550S	55	Natural	6	1.05	>600	22	17	2	3	10
662550S	55	Black	6	1.05	>600	22	17	2	3	10
660600S	60	Natural	7	1.05	>600	22	17	2	3	10
662600S	60	Black	7	1.05	>600	22	17	2	3	10
660650S	65	Natural	7	1.05	>600	25	20	3	4	10
662650S	65	Black	7	1.05	>600	25	20	3	4	10
660700S	70	Natural	8	1.05	>600	29	25	3	4	10
662700S	70	Black	8	1.05	>600	29	25	3	4	10
660750S	75	Natural	9	1.05	>600	33	25	3	5	15
662750S	75	Black	9	1.05	>600	33	25	3	5	15
660800S	80	Natural	9	1.05	>600	38	28	4	5	15
662800S	80	Black	9	1.05	>600	38	28	4	5	15
660850S	85	Natural	13	1.05	>600	41	31	5	6	10
662850S	85	Black	13	1.05	>600	41	31	5	6	10
660900S	90	Natural	13	1.05	>600	50	31	6	7	7
662900S	90	Black	13	1.05	>600	50	31	6	7	7

<sup>1</sup> 4mm

All the above information about chemical and physical properties consists of values measured in tests on injection moulded test specimens. We provide written and illustrated advice in good faith. This should however only be regarded as being advisory, and does not absolve the customer from doing their own tests and trials, to determine the suitability of the material for the intended applications. We retain the right to make changes without prior notice.

## Presentation of Tests

The tests described on the following pages illustrate the properties of Dryflex® in terms of compression set, rheology, flammability, bulk and surface resistivity, glow wire index and fogging.

### Compression Set

The compression set value of a material is a function of time, temperature and hardness. Compression set values increase with temperature. The excellent compression set of the softer Dryflex® materials make them suitable for many applications in which vulcanised rubber is used at present. Measurement is carried out in accordance with ASTM D395. Contact VTC TPE Group for information on materials with optimised compression set properties.

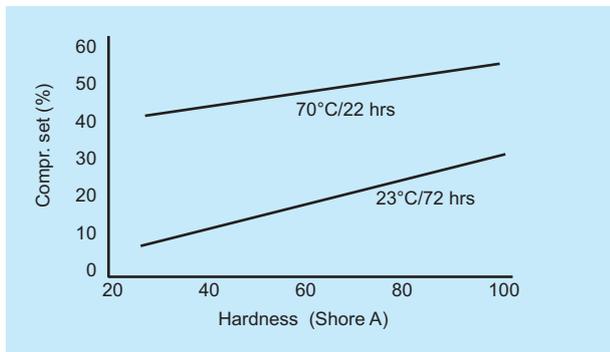


Figure 1. Compression set values v. hardness.

### Rheology

The viscosity of a Dryflex® material is strongly influenced by the shear rate. The material flows more easily at higher shear rates; in other words it is self-thinning (Figure 2). A softer material flows more easily than a harder material. The viscosity is also influenced by the filler content. An unfilled material flows more easily than a filled material. The viscosity is analysed using a Rheotester 1000 s-1\* at 190°C using a capillary tube 30 mm in length and 1 mm in diameter.

\* Reciprocal seconds.

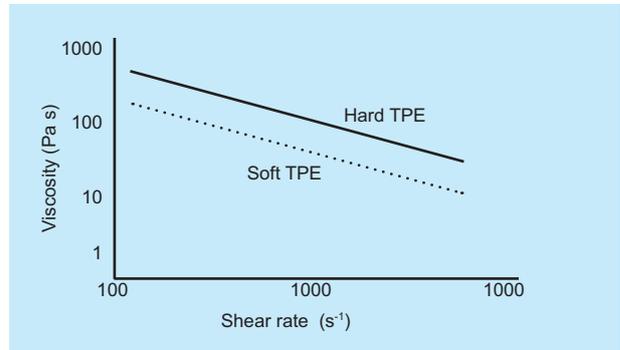


Figure 2. Viscosity at different shear rates.

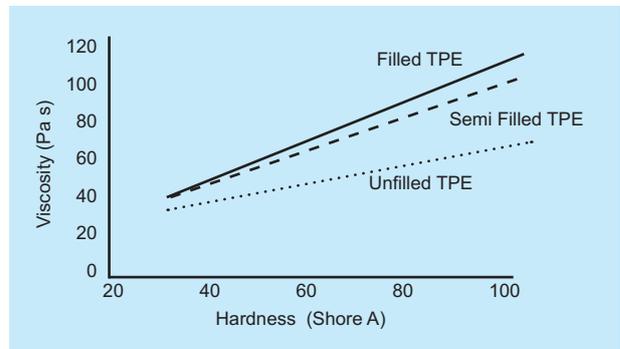


Figure 3. Viscosity at different hardnesses at 1000 s<sup>-1</sup>.

**Flammability**

Hardness and fill factor influence the flammability of a Dryflex® material. A hard and filled material burns more slowly than a soft and unfilled material does (Figure 4). Flammability is measured in accordance with SS-ISO 3795:1991.

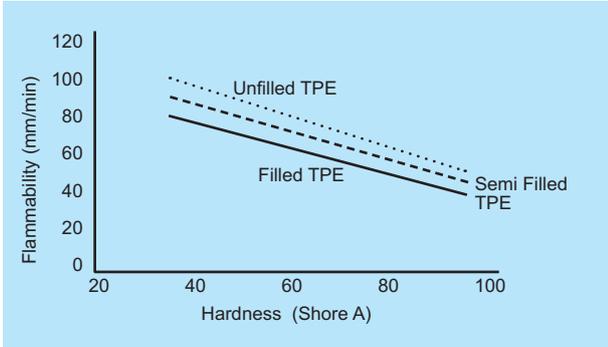


Figure 4. Flammability v. hardness.

**Electrical tests**

Surface resistivity and bulk resistivity. Resistivity is a measure of the insulation resistance of a material. All Dryflex® SEBS materials are insulating (> 1015 ohm). Resistivity varies somewhat with fill factor, an unfilled material is more insulating than a filled material. Measurements are carried out in accordance with IEC 93:1980. Please see figure 5.

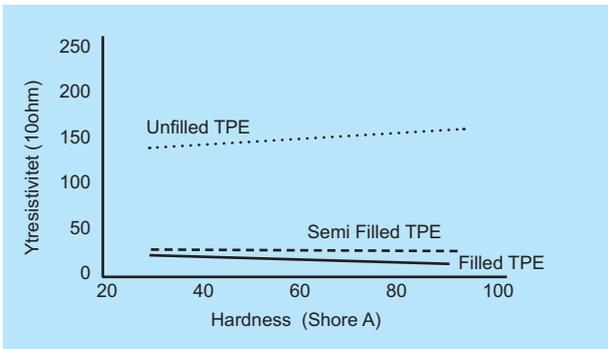


Figure 5. Surface resistivity v. hardness.

**Glow Wire Test**

All Dryflex® SEBS materials have a minimum GWFI (Glow Wire Flammability Index) of 700°C for 2 mm test coupons. The results show that there is no difference between soft and hard materials or between filled and unfilled materials. GWFI is measured in accordance with IEC 695-2-1.

**Fogging**

Dryflex® SEBS materials fulfill several of the fogging requirements in the automotive industry.

**Comments**

All information regarding chemical and physical properties is based on values derived from tests on injection moulded test specimens. We give the best possible verbal and written advice based on testing. However, this should be regarded as advisory only and does not absolve the purchaser from the responsibility of carrying out his own tests and trials to determine the suitability of a material in proposed applications. We reserve the right to make changes without prior notice.

## Other Injection Moulding Grades

The VTC TPE Group have developed endless formulations to fulfil different properties and application requirements to optimise the finished component. Grades with improved compression set properties, high temperature resistance or more cost efficient values are an essential part of today's wide product spectrum. To achieve the best cost/performance ratio, many modified SEBS and/or SBS grades are available, especially designed to meet our customers' high demands. Please contact the VTC TPE Group for further information.

Vita Thermoplastic Polymers (VTP), VTC Elastoteknik AB and VTC Franceschetti Elastomeri are members of the VTC TPE Group.  
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For further information about distributors who sell Dryflex® compounds, please visit [www.vtctpe.com](http://www.vtctpe.com)

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