Thermoplastic Vulcanisate Compounds

TPV
Dryflex® V - a whole range of possibilities...

Introduction

Dryflex V Thermoplastic Vulcanisate (TPV) compounds are high performance materials designed for demanding applications where improved durability, heat or fluid resistance are required.

What is TPV?

TPV compounds are the next step up in performance from TPO (Thermoplastic Polyolefin) compounds. They are also compounds of PP and EPDM rubber, however they have been dynamically vulcanised during the compounding process. They were originally conceived to bridge the gap between thermoplastic materials and vulcanised EPDM.

They are composed of a highly vulcanised rubber phase dispersed throughout a thermoplastic matrix and combine the processing ease, efficiency and recyclability of a thermoplastic with the improved flexibility, low compression set and resistance to aggressive fluids of a vulcanised rubber.

They have seen strong growth in automotive seals, pipe seals, and other applications where a heat resistance of up to 135°C is required. Hardness values range typically from 45 Shore A to 50 Shore D. TPVs also lend themselves to under-bonnet automotive applications where improved temperature and oil resistance is required.

Key benefits

- A wide range of hardness’
- Service temperatures of -60°C to 135°C
- Improved resistance to aggressive fluids such as oils, acids, bases and aqueous solutions
- Low compression set
- Low flex fatigue
- Lightweight parts
- Design flexibility
- Recyclability
- Excellent weathering and environmental resistance
- Adhesion to PP and PE in multi-component applications

Ease of processing

Dryflex V TPV compounds have excellent processing characteristics. They can be processed on standard thermoplastic equipment, with grades suitable for injection moulding, extrusion, blow moulding and thermoforming.

TPV or TPS?

Thermoplastic Vulcanisates (TPV) share many of the same characteristics as TPE compounds based on Styrenic Block Copolymers (TPS), such as soft-touch appeal, flexibility, recyclability etc. In certain applications, the higher thermal stability and chemical resistance of a TPV is not required and TPS based compounds will perform very well in these circumstances. Likewise, there are times when a TPS compound doesn’t have the strength and durability for a demanding environment.

As we manufacture both TPS and TPV compounds, we can offer the best solution for each application, we won’t over-specify when it is not needed.

Applications

TPV compounds are used extensively in a wide variety of market segments, including:

- Automotive interior, exterior and under-bonnet
- Electronics and appliances
- White goods
- Consumer goods
- Building and construction

Technical support & product development

Years of research, development and testing go into our products, to ensure we deliver optimum processing and end use application performance.

We deliver solutions in the field through a highly trained team of technicians. Their support and material expertise will help you deliver faster results whilst minimising trial and testing times.

In this guide we show typical properties for some of our most common grades, this is not exhaustive and does not list all available properties and materials. Please use this guide as an introduction to our Dryflex V TPV range, and contact us to discuss your specific requirements.

Contact

For further information about our Dryflex V TPV compounds, please contact TPV@elasto.co.uk
Custom made for you

Our aim is to supply a material that precisely matches application requirements and where an existing grade cannot satisfy the specific demands of your application, we have the proven expertise to customise a material that will.

Dryflex V TPVs are extremely versatile, our highly trained teams are constantly testing new polymers, additives, stabilisers and other ingredients to create unique material combinations. We have engineered formulations to suit specific applications with properties including flow characteristics, hardness, specific gravity, strength resistance, colour and aesthetics.

Colour

Due to the cured elastomer phase, TPV compounds can be notoriously difficult to colour. The addition of separate colour masterbatch can also have an unexpected effect on the physical properties and functionality of the compound.

Dryflex V TPV compounds are available in a range of pre-determined colours as well as black or natural. They are fully colour compounded, meaning fewer production steps for the processor and a consistent colour without any loss to properties or performance.

Degree of Vulcanisation

As part of our aim to supply customised compounds, we are able to alter the level of crosslinking of the elastomer phase in the TPV. This means we can offer the same range of general purpose materials with varying levels of vulcanisation.

Reasons for choosing a partially vulcanised product may include; better flow characteristics for injection moulding grades, improved surface appearance and aesthetics, less isotropic effects and enhanced tensile/elongation properties.

Haptics & Aesthetics

Dryflex V TPV compounds are shear thinning and have excellent flow characteristics, helping to eliminate flow lines in complex or thin-walled parts. Dryflex V TPV compounds are suitable for multi-component processing, with adhesion to olefinic polymers such as PP and PE. Allowing for soft-touch areas and tactile surface finishes.
Proven Performance in Demanding Environments

Compression Set
Dryflex V TPV compounds offer long-term low compression set. Shape retention is very good up to around 135°C.

Recovery to deformation at elevated temperatures is also very good due to the ‘spring back’ of the vulcanised elastomer.

Fig. 1 : Compression Set Behaviour of TPE and Elastomers

Oil Resistance
In terms of hydrocarbons and various oils, Dryflex V TPVs display good resistance at ambient and elevated temperatures.

The chemically crosslinked network structure slows down and sometimes prevents penetration into the EPDM domains.

Fig. 2 : Influence of Oil on TPE and Elastomers

UV & Weathering
Long-term, consistent performance over the life of the product – we understand the importance of durability, particularly when parts need to perform in demanding and high-stress environments. We have engineered Dryflex V TPV compounds to give long term aging resistance; including UV, ozone and weathering.

Testing & Accreditation
We accurately fingerprint and analyse our compounds using state of the art equipment to ensure consistency of our products and develop materials with superior performance. Testing can include Xenon-Arc accelerated weathering, this simulates the damaging effects of long term outdoor exposure by exposing test samples to varying conditions of the most aggressive components of weathering - light, moisture and heat.

Our advanced testing equipment ensures confidence in the long-term performance of our materials and allows us to test our materials to a wide range of industry standards.
A selection of Dryflex V compounds

Please find below a selection of some of most common grades, this list is not exhaustive as it is not possible to list all possible grades and properties here. More detailed physical properties such as heat aging and viscosity shear rates are included on individual datasheets, which are available on request.

Please use this guide as an introduction to our Dryflex V TPV compounds and contact us to discuss your specific requirements.

You can email us at TPV@elasto.co.uk

Dryflex VE Series
Designed for extrusion applications (for example automotive weatherseals and dynamic gaskets)
The grade references below are for black compounds, natural and coloured versions are also available

<table>
<thead>
<tr>
<th>Grade</th>
<th>Hardness Shore A</th>
<th>Specific Gravity g/cm³</th>
<th>Modulus 100% MPa</th>
<th>Tensile Strength MPa</th>
<th>Strain at Break %</th>
<th>Tear Strength N/mm</th>
<th>Compression Set %</th>
</tr>
</thead>
<tbody>
<tr>
<td>VE 55A101</td>
<td>55</td>
<td>0.97</td>
<td>2.0</td>
<td>5.0</td>
<td>430</td>
<td>19.5</td>
<td>18.0 / 23°C, 27.5 / 70°C, 34.0 / 100°C</td>
</tr>
<tr>
<td>VE 60A101</td>
<td>60</td>
<td>0.97</td>
<td>2.0</td>
<td>5.5</td>
<td>420</td>
<td>20.0</td>
<td>17.0 / 23°C, 28.0 / 70°C, 34.0 / 100°C</td>
</tr>
<tr>
<td>VE 65A101</td>
<td>65</td>
<td>0.97</td>
<td>2.5</td>
<td>6.5</td>
<td>500</td>
<td>24.0</td>
<td>19.5 / 23°C, 29.0 / 70°C, 35.5 / 100°C</td>
</tr>
<tr>
<td>VE 70A101</td>
<td>70</td>
<td>0.97</td>
<td>3.0</td>
<td>7.0</td>
<td>480</td>
<td>26.0</td>
<td>20.0 / 23°C, 30.0 / 70°C, 36.0 / 100°C</td>
</tr>
<tr>
<td>VE 75A101</td>
<td>75</td>
<td>0.97</td>
<td>3.0</td>
<td>7.5</td>
<td>520</td>
<td>30.5</td>
<td>21.0 / 23°C, 35.0 / 70°C, 41.0 / 100°C</td>
</tr>
<tr>
<td>VE 80A101</td>
<td>80</td>
<td>0.98</td>
<td>3.5</td>
<td>10.0</td>
<td>660</td>
<td>32.0</td>
<td>26.0 / 23°C, 38.0 / 70°C, 45.5 / 100°C</td>
</tr>
</tbody>
</table>

Dryflex V Series
General purpose TPV for use in extrusion, injection moulding and blow moulding
The grade references below are for black compounds, natural and coloured versions are also available

<table>
<thead>
<tr>
<th>Grade</th>
<th>Hardness Shore A or D</th>
<th>Specific Gravity g/cm³</th>
<th>Modulus 100% MPa</th>
<th>Tensile Strength MPa</th>
<th>Strain at Break %</th>
<th>Tear Strength N/mm</th>
<th>Compression Set %</th>
</tr>
</thead>
<tbody>
<tr>
<td>V 45A101</td>
<td>45</td>
<td>0.94</td>
<td>1.0</td>
<td>4.0</td>
<td>560</td>
<td>13.0</td>
<td>18.0 / 23°C, 29.0 / 70°C, 34.0 / 100°C</td>
</tr>
<tr>
<td>V 55A101</td>
<td>55</td>
<td>0.94</td>
<td>1.5</td>
<td>4.5</td>
<td>500</td>
<td>15.0</td>
<td>18.0 / 23°C, 27.0 / 70°C, 31.5 / 100°C</td>
</tr>
<tr>
<td>V 60A101</td>
<td>60</td>
<td>0.93</td>
<td>2.0</td>
<td>5.5</td>
<td>520</td>
<td>19.0</td>
<td>20.0 / 23°C, 30.0 / 70°C, 37.0 / 100°C</td>
</tr>
<tr>
<td>V 65A101</td>
<td>65</td>
<td>0.93</td>
<td>2.0</td>
<td>6.0</td>
<td>520</td>
<td>20.0</td>
<td>19.5 / 23°C, 32.0 / 70°C, 37.5 / 100°C</td>
</tr>
<tr>
<td>V 70A101</td>
<td>70</td>
<td>0.95</td>
<td>2.5</td>
<td>7.0</td>
<td>600</td>
<td>22.0</td>
<td>22.5 / 23°C, 37.0 / 70°C, 44.5 / 100°C</td>
</tr>
<tr>
<td>V 75A101</td>
<td>75</td>
<td>0.96</td>
<td>3.0</td>
<td>7.0</td>
<td>490</td>
<td>26.0</td>
<td>27.0 / 23°C, 39.0 / 70°C, 47.5 / 100°C</td>
</tr>
<tr>
<td>V 80A101</td>
<td>80</td>
<td>0.97</td>
<td>3.5</td>
<td>8.0</td>
<td>640</td>
<td>32.0</td>
<td>31.0 / 23°C, 41.0 / 70°C, 48.0 / 100°C</td>
</tr>
<tr>
<td>V 85A101</td>
<td>85</td>
<td>0.94</td>
<td>3.5</td>
<td>9.0</td>
<td>470</td>
<td>30.0</td>
<td>34.0 / 23°C, 40.0 / 70°C, 49.0 / 100°C</td>
</tr>
<tr>
<td>V 90A101</td>
<td>90</td>
<td>0.94</td>
<td>4.5</td>
<td>10.0</td>
<td>580</td>
<td>44.0</td>
<td>38.0 / 23°C, 48.0 / 70°C, 52.0 / 100°C</td>
</tr>
<tr>
<td>V 40D101</td>
<td>40</td>
<td>0.96</td>
<td>8.5</td>
<td>21.0</td>
<td>590</td>
<td>80.0</td>
<td>46.0 / 23°C, 52.0 / 70°C, 57.0 / 100°C</td>
</tr>
<tr>
<td>V 45D101</td>
<td>45</td>
<td>0.94</td>
<td>10.0</td>
<td>21.0</td>
<td>700</td>
<td>87.0</td>
<td>51.0 / 23°C, 54.0 / 70°C, 62.0 / 100°C</td>
</tr>
<tr>
<td>V 50D101</td>
<td>50</td>
<td>0.97</td>
<td>11.0</td>
<td>21.0</td>
<td>790</td>
<td>105.0</td>
<td>55.0 / 23°C, 58.0 / 70°C, 65.0 / 100°C</td>
</tr>
</tbody>
</table>
Processing

Dryflex V TPVs are easily processed on standard thermoplastics equipment. They require no vulcanisation and are 100% recyclable during production, making them easier to process than vulcanised EPDM with fewer steps. This means less energy is used and production is faster, which helps lower manufacturing costs and decrease waste. They can be extruded, injection moulded, blow moulded or thermoformed.

Dryflex V TPVs have a lower specific gravity compared to several alternative materials, you can therefore not only create lighter-weight parts, but you can also produce more parts per kilogram of material.

Injection Moulding Guidelines

<table>
<thead>
<tr>
<th>Injection Speed:</th>
<th>Medium - Fast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injection Pressure:</td>
<td>Medium</td>
</tr>
<tr>
<td>Back Pressure:</td>
<td>Low - Medium</td>
</tr>
<tr>
<td>Holding Pressure:</td>
<td>Sufficient to pack the mould</td>
</tr>
<tr>
<td>Cooling:</td>
<td>Can be demoulded when the parts have sufficiently cooled</td>
</tr>
</tbody>
</table>

| Temperature °C | 160 - 190 | 170 - 200 | 180 - 210 | 190 - 220 | 15 - 50 |

Extrusion Guidelines

| L/D Ratio: | 20:1 - 25:1 |
| Compress Ratio: | 2.5 - 3.5 |
| Breaker Plate / Screen: | Both should be used |
| Draw Down: | 5 - 10% |
| Cooling: | Cold water bath |

| Temperature °C | 160 - 190 | 170 - 200 | 180 - 200 | 180 - 210 | 190 - 220 |

General Information

Pre-drying of the material is recommended as the material is slightly hygroscopic and sometimes moisture can be sufficient to effect the processing. Suggested drying parameters are 3 hours at 80°C. Cycle times will be governed by temperature and section thickness. Care must be taken to allow sufficient cooling of the section prior to demoulding in order to prevent permanent distortion of the article.

All information given 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 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. Figures are indicative and can vary depending on the specific grade selected and production site. This processing information is only intended as a guide. The actual parameters will depend on the machine used and the moulding being produced.
About us

The HEXPOL TPE family is a leader in the development and manufacture of thermoplastic elastomers (TPE) and complimentary compounds.

With a strong heritage in the TPE market our companies include established names such as ELASTO and Müller Kunststoffe. We deliver a trusted combination of material know-how, R&D, production capability and comprehensive technical services. As part of the HEXPOL group of companies, we share an extensive global footprint covering EU, Asia-Pacific and NAFTA, enabling us to support our customers worldwide.

A comprehensive TPE product portfolio includes TPS, TPO, TPV, TPU and cork compounds and is led by global brands Dryflex®, Mediprene®, EPSeal®, Lifoprene® and Lifocork®. We support OEMs, moulders and designers at all stages of product development in the medical, electronic, automotive, caps & closures, construction and consumer markets.

Contact us...

This product guide serves as an overview of our products; we are continuously testing ingredients to create new material combinations with enhanced characteristics. Use this guide as an introduction to our products, if you do not see what you are looking for, please contact us and we will be happy to discuss your specific requirements.

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