

**dryflex<sup>®</sup> fr**



**FLAME RETARDANT TPE**



## Dryflex® FR series - Flame Retardant Thermoplastic Elastomers

### Introduction

Dryflex® FR are a range of flame retardant thermoplastic elastomers (TPEs) designed to meet the most demanding applications where resistance to ignition and burning are important features.

Dryflex® FR compounds contain additives to give them better resistance to burning compared to general TPE grades. The range includes halogen, chlorine and antimony free grades which are low smoke and compliant with the Restriction of Hazardous Substances (RoHS) directives, offering flame retardancy without the use of polybrominated diphenyl ether (PBDE).

The Dryflex® FR range includes hardnesses from 50 Shore A to 60 Shore D and are designed to meet UL94 V0 rated flame retardancy at a variety of thicknesses.

Dryflex® FR compounds show excellent resistance to a variety of polar fluids such as water, aqueous systems and alcohols. In non-polar fluids, such as oil, resistance diminishes with increasing aromatic content. Weathering, including UV stability and ozone resistance is excellent. Although flame retardant materials can be self-extinguishing or slow burning, most materials will “burn” in extreme fire situations.

- Halogen, chlorine & antimony free grades
- 50 Sh A to 60 Sh D
- Low smoke emission
- RoHS compliant
- Designed to meet UL94 V0
- Soft touch
- Excellent weathering including UV resistance
- Fast cycle times
- Good chemical resistance

### Applications

Dryflex® FR grades are used in welding cables, plug tops, sockets, automotive components, electrical insulation, cords and connectors as well as appliance components.

### Processing

Dryflex® FR compounds can easily be processed using conventional thermoplastic equipment for extrusion and injection moulding.

The thermoplastic characteristics result in fast processing times and complete scrap recycling. They do not require pre-drying prior to processing.

### Industry Regulations

Dryflex® FR compounds are tailored to meet the specific demands of your application and aid in complying with current and expected restricted substance legislation and industry lists which prohibit the use of halogenated flame retardant additives.

### Made to Measure

In this guide we show typical properties for our most common grades, these tables are not exhaustive, and by no means list all available properties and materials. 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.

We have developed endless formulations to fulfill 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. Use this guide as an introduction to our Dryflex® FR series and contact us to discuss your specific requirements



## Flammability Testing

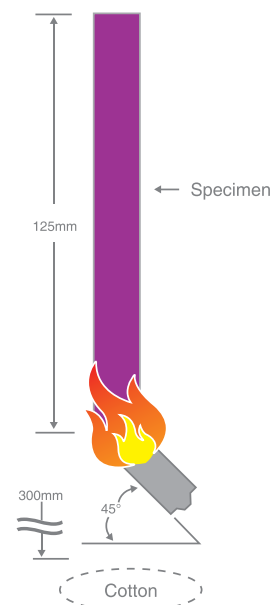
### UL94 / IEC 60605-11-10 / ISO 9772

“The Standard for Flammability of Plastic Materials for Parts in Devices and Appliances”, as described by Underwriters Laboratories (UL) is one of the most widely accepted flammability performance standards for plastic materials. This standard determines a materials ability to propagate or extinguish a flame once ignited.

### Vertical Testing (V0, V1 & V2)

The UL 94 Vertical Burn (VB) test is the most common for TPE materials for use in electrical applications. The test includes three classifications - V0, V1 and V2, V0 being the hardest to achieve. This test would be acceptable for portable, unattended, intermittent duty household appliances (such as coffee makers). A test bar is supported at one end in a vertical position. A burner flame is applied to the free end for two ten second intervals, separated by the time it takes for flaming to cease after the first application.

Classification	V0	V1	V2
Maximum flaming combustion for each sample	≤ 10 sec	≤ 30 sec	≤ 30 sec
Maximum flaming combustion for all five samples	≤ 50 sec	≤ 250 sec	≤ 250 sec
Cotton below ignited by flaming drips from any sample	no	no	yes
Allowable flaming and glowing combustion remaining for:	≤ 30 sec	≤ 60 sec	≤ 60 sec

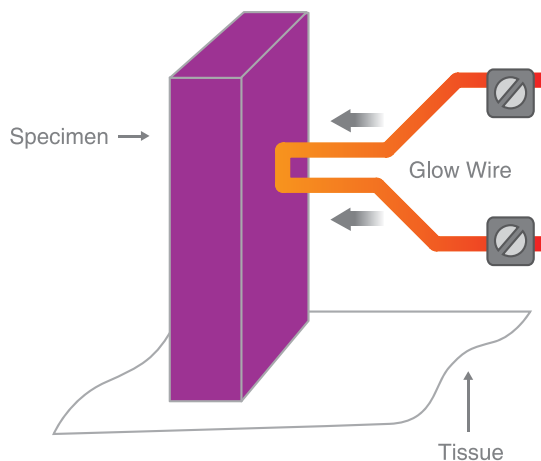


### Glow Wire Flammability Index in accordance with IEC 695-2-1

The glow wire test is used to simulate the effect of heat as may arise in malfunctioning electrical equipment, such as with overloaded or glowing components. The glow wire is heated via electrical resistance to a specified elevated temperature. A test specimen is held for 30 seconds against the tip of the glow wire with a force of 1 N. After the glow wire is removed, the time for the flames to extinguish is noted along with details of any burning drips. Material that surrounds the test material in application or a layer of tissue paper is placed beneath the specimen during the test to determine the effects of burning drips.

The material passes the test if one of the following apply.

- There is no flame and no glowing.
- Flames or glowing of the sample extinguish within 30 seconds after removal of the glow wire, and if the cotton or the paper underlay doesn't ignite or burn.





## Halogen Free

The 100, 200, 300 and 400 series are all Halogen Free as well as being chlorine, phthalate and antimony free. They are compliant with RoHS regulations, offering flame retardancy without the use of polybrominated diphenyl ether (PBDE).

### 100 Series: SEBS based, designed to meet UL94 V0 at 2mm and above

The 100 Series is designed for softer flame retardant applications such as seals, gaskets, cables and other flexible components.

Material	Hardness Shore A	Specific Gravity g/cm <sup>3</sup>	Modulus 100% MPa	Tensile Strength MPa	Elongation at Break %	Tear Strength N/mm	Compression Set %		Flame Retardant Rating	Glow Wire Temp °C
Test Method	ISO 868	ISO 2781	ISO 37 Average	ISO 37 Average	ISO 37 Average	ISO 34 (method C) Average	ISO 815 (type B) 24h at 23°C   24h at 100°C		UL94 <sup>1</sup> V0 2mm	IEC 695-2-1
FR 60A100	60	1.14	2.3	5.0	480	22	10	55	Pass	960
FR 70A100	70	1.13	2.8	6.0	460	27	13	57	Pass	960
FR 80A100	80	1.10	3.7	8.0	450	34	15	60	Pass	960
FR 90A100	90	1.09	5.7	11.5	450	52	23	64	Pass	960

<sup>1)</sup> Internal tests show materials to be compliant with UL requirements. Materials are not currently UL listed.

### 200 Series: SEBS based, designed to meet UL94 V0 at 3mm and above

As with the 100 series, the 200 series are ideal for softer applications, but where the flame retardancy requirements are not as high, offering a more economic solution.

Material	Hardness Shore A	Specific Gravity g/cm <sup>3</sup>	Modulus 100% MPa	Tensile Strength MPa	Elongation at Break %	Tear Strength N/mm	Compression Set %		Flame Retardant Rating	Glow Wire Temp °C
Test Method	ISO 868	ISO 2781	ISO 37 Average	ISO 37 Average	ISO 37 Average	ISO 34 (method C) Average	ISO 815 (type B) 24h at 23°C   24h at 100°C		UL94 <sup>1</sup> V0 3mm	IEC 695-2-1
FR 50A200	50	1.10	1.4	3.5	620	16	11	50	Pass	850
FR 60A200	60	1.11	1.7	5.2	550	23	11	52	Pass	850
FR 70A200	70	1.11	2.8	7.0	510	27	12	54	Pass	960
FR 80A200	80	1.08	3.8	8.5	480	38	14	58	Pass	960
FR 90A200	90	1.07	6.4	12.0	390	57	24	63	Pass	960

<sup>1)</sup> Internal tests show materials to be compliant with UL requirements. Materials are not currently UL listed.



**300 Series: TPO, designed to meet UL94 V0 at 1.5mm and above**

The 300 Series is ideal for more rigid flame retardant applications such as sockets, housings and connectors.

Material	Hardness Shore A or D	Specific Gravity g/cm <sup>3</sup>	Tensile Strength MPa	Elongation at Break %	Tear Strength N/mm	Flame Retardant Rating	Glow Wire Temp °C
Test Method	ISO 868	ISO 2781	ISO 37 Average	ISO 37 Average	ISO 34 (method C) Average	UL94 <sup>1</sup> V0 1.5mm	IEC 695-2-1
FR 90A300	90 A	1.04	8.0	200	70	Pass	960
FR 40D300	40 D	1.05	9.5	180	80	Pass	960
FR 50D300	50 D	1.05	12.0	100	105	Pass	960
FR 60D300	60 D	1.05	15.5	80	135	Pass	960

<sup>1)</sup> Internal tests show materials to be compliant with UL requirements. Materials are not currently UL listed.

**400 Series: TPO, designed to meet UL94 V0 at 2mm and above**

The 400 Series is designed for the more rigid applications, as with the 300 Series, but where the flame retardancy requirements are not as high, offering a more economic solution.

Material	Hardness Shore A or D	Specific Gravity g/cm <sup>3</sup>	Tensile Strength MPa	Elongation at Break %	Tear Strength N/mm	Flame Retardant Rating	Glow Wire Temp °C
Test Method	ISO 868	ISO 2781	ISO 37 Average	ISO 37 Average	ISO 34 (method C) Average	UL94 <sup>1</sup> V0 2mm	IEC 695-2-1
FR 90A400	90 A	1.00	8.5	230	72	Pass	850
FR 40D400	40 D	1.00	10.0	190	85	Pass	850
FR 50D400	50 D	1.00	13.0	100	115	Pass	850
FR 60D400	60 D	1.01	17.0	80	145	Pass	850

<sup>1)</sup> Internal tests show materials to be compliant with UL requirements. Materials are not currently UL listed.



## Halogenated Grades

Due to halogenated systems offering a higher degree of flame retardancy these grades provide even softer materials which meet the UL94 V0 requirements at lower thickness. These grades are also designed to have superior properties at elevated temperatures over the halogen free grades.

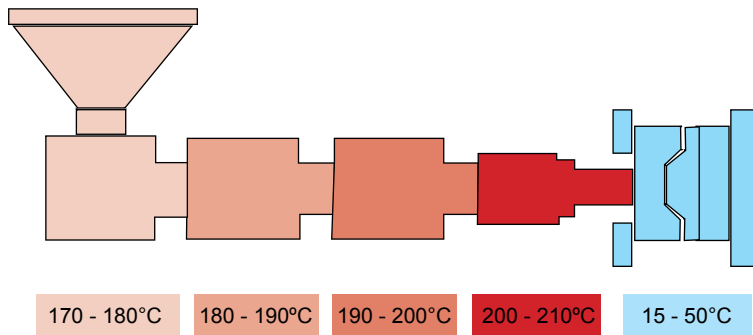
The Halogenated grades are all officially UL approved. For more information about our listed compounds please see [www.ul.com](http://www.ul.com) go to the 'Online Certifications Directory' and enter UL file number E238317.

Material	Hardness Shore A	Specific Gravity g/cm <sup>3</sup>	Modulus 100% MPa	Tensile Strength MPa	Elongation at Break %	Tear Strength N/mm	Compression Set % 24h at 23°C	Flame Retardant Rating
Test Method	ISO 868	ISO 2781	ISO 37 Average	ISO 37 Average	ISO 37 Average	ISO 34 (method C) Average	ISO 815 (type B)	UL94 <sup>1</sup> V0 1.5mm
8014-101	40	1.24	1.3	3.5	360	15	12	Pass
8013-101	50	1.26	1.7	4.9	300	17	11	Pass
8015-101	50	1.24	-	3.3	270	15	15	Pass

*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 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. Flame Retardancy testing should be carried out on the finished part. We retain the right to make changes without prior notice.*

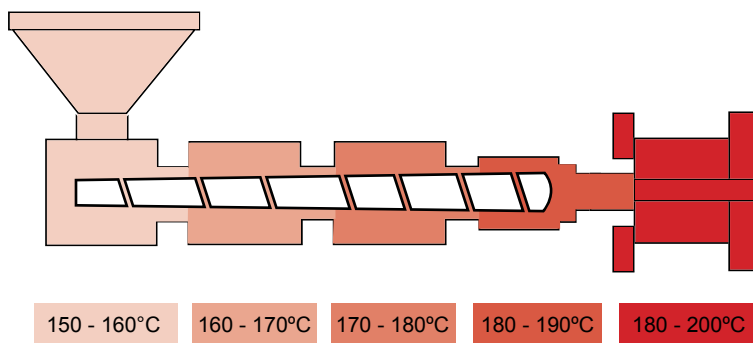


## Injection Moulding Guidelines



Injection Speed:	Medium - Fast
Injection Pressure:	Medium - Fast
Back Pressure:	Low - Medium
Holding Pressure:	Sufficient to pack the mould
Cooling:	Parts can be demoulded once temperature drops to approx. 100 °C

## Extrusion Guidelines



L/D Ratio:	20:1 - 25:1
Compression Ratio:	2.5 - 3.0
Breaker Plate / Screen:	Both should be used
Draw Down:	5 - 10%
Cooling:	Cold water bath

### General Information:

These grades may possibly require pre-drying depending on the specific compound. If poor surface finish, bubbles, voids or streaks are seen on the finished article then material should be dried for 2 to 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.

Venting of extrusion lines may be used as a method of preventing the build up of volatiles during continuous processing.

Under no circumstances should these materials be taken above 230°C as this may cause the flame retardant additive to react which may result in the release of gases or a deterioration the flame retardant properties of the material.

*This processing information is only intended as a guide. The actual parameters will depend on the machine used and the moulding being produced.*

Vita Thermoplastic Polymers (VTP) and VTC Elastoteknik AB are members of the VTC TPE Group

**Vita Thermoplastic Polymers (VTP)**

United Kingdom

t : 44 (0)161 654 6616

f : 44 (0)161 654 2333

sales@vtctpe.com

**VTC Elastoteknik AB**

Sweden

t : 46 (0) 532 60 75 00

f : 46 (0) 532 60 75 99

info@elastoteknik.se

**Paris Office**

France

t : 33 (0) 160 43 17 17

f : 33 (0) 160 43 11 13

pgruyer@aol.com

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