Tefzel®
Fluoropolymer

Tefzel® HT-2181
Moulding and extrusion resin

Typical applications
Wire and cable primary insulation and injection moulded parts as electrical components, such as coil forms, sockets, connectors and switches. Laboratory equipment, such as tubing, valves, containers and dishes. Moulded items for chemical service, such as valve components, seal glands, pipe plugs, corrugated tubing, and film.

Description
Tefzel® HT-2181 is one of DuPont's melt processable modified copolymers of ethylene and tetrafluoroethylene (ETFE). Tefzel® HT-2181 is a general-purpose fluoropolymer resin, available in translucent 2,5 mm pellets.

Tefzel® fluoropolymers are high-performance resins that can be processed at relatively high rates compared to other fluoropolymer resins. They offer the excellent balance of properties characteristic of fluoropolymers: non-ageing characteristics, toughness, high temperature resistance, chemical inertness, very good dielectric properties, negligible moisture absorption and excellent weather resistance.

Tefzel® HT-2181 is a medium viscosity resin, and shows excellent mechanical strength, toughness and stress crack resistance. It can be processed by conventional thermoplastic techniques and is used for wire coatings as primary insulation, in certain cases for cable jacketing, and for injection-moulded parts. It is recommended for applications requiring mechanical toughness in harsh and high temperature environments.

Properly processed products made from virgin Tefzel® HT-2181 are inert to most solvents and chemicals, hydrolytically stable and weather resistant. Recommended upper use temperature is 150°C. Useful properties are retained at cryogenic temperatures.

Tefzel® HT-2181 meets the requirements of ISO 6722, class E (–40°C to +175°C) – unscreened low-tension cables for road vehicles.

Processing
Tefzel® HT-2181 may be converted by conventional melt processing techniques typical to those used for other thermoplastic resins, like extrusion, injection moulding, compression, transfer and blow moulding processes. Compared to other grades of Tefzel®, HT-2181 provides intermediate processing rates. In general, the melt viscosity of all grades of Tefzel® is reduced with increasing shear rate: this allows the use of pressure extrusion techniques.

As molten fluoropolymers are corrosive to most metals, the parts of the extruder and injection moulding machines, in contact with the molten resin, should be constructed of corrosion-resistant materials.

Machines should be capable of operating at temperatures of 315°C to 370°C and provide residence time for heating the resin to approximately 345°C.

Conventional single screw extruder/injection-moulding machine with length to diameter ratio (L/D) of 20:1 to 30:1 can be used to process Tefzel® HT-2181. Square pitch metering screw with 2,5:1 to 3:1 compression ratio should be used.

Safety precautions
Industrial experience has proven that adequate ventilation, in properly maintained processing and handling areas, will eliminate known hazards to personnel. Resin containers should be opened and used in well-ventilated areas.

Equipment used to process at melt temperatures should be provided with local exhaust ventilation to completely remove all fumes and vapours from the processing area. In addition, care should be exercised to avoid the contamination of cigarettes and other forms of smoking tobacco when using fluoropolymer resins. Before using fluoropolymer resins, read the Material Safety Data Sheet (MSDS) and the detailed information in "Guide for the safe handling of Fluoropolymer Resins" published by APME. Copies can be obtained through your local DuPont representative.

Storage and handling
The properties of Tefzel® HT-2181 resins are not affected by storage time. Ambient storage conditions should be designed to avoid airborne contamination and the formation of water condensation on the resin when it is removed from containers.

Packaging
Tefzel® fluoropolymer resins are packaged in 20,4 kg, single layer, plastic bags. For convenient shipment, orders of 510 kg pallets are recommended.

Typical Property Data for Tefzel® HT-2181

Property	Test method[1]		Unit	Typical Value
General				
Melt flow rate (MFR 297/5,0)	ISO 12086	D 3159	g/10 min	6,0
Specific gravity	ISO 1183	D 792		1,70
Bulk density		DuPont	g/l	1000
Mechanical				
Tensile strength, 23°C	ISO 12086	D 638	MPa	40
Ultimate elongation, 23°C	ISO 12086	D 638	%	300
Flexural modulus, 23°C	ISO 178	D 790	MPa	1000
Hardness, Shore durometer	ISO 868	D 2240	–	D67
Impact strength, notched Izod, 23°C	ISO 180	D 256	kJ/m^2	No break
Compressive strength, 23°C		D 695	MPa	38
Electrical				
Relative permittivity (1 kHz to 1 MHz)		D 1531		2,5–2,6
Dissipation factor, tg δ (1 kHz to 1 MHz)		D 1531		0,0008-0,009
Dielectric strength, short time (0,25 mm film)	IEC 243	D 149	kV/mm	70
Volume resistivity	IEC 93	D 257	$\Omega \cdot m$	$>10^{14}$
Arc resistance		D 495	s	122
Thermal				
Melting point		D 4591/D 3418	°C	265
Upper use temperature[2]		UL 746	°C	150
Flammability classification[3]		UL 94		94V-0
Limiting Oxygen Index	ISO 4589	D 2863	%	30–32
Coefficient of linear thermal expansion (0-100°C)		D 696	K^{-1}	$131 \cdot 10^{-6}$
Other				
Chemical resistance		D 543		Excellent
Water absorption, 24 h		D 570	%	0,007
Weathering resistance				Excellent

Note: Typical properties are not suitable for specification purposes.

1) ASTM unless otherwise specified.
2) UL 746 test method (Yellow card): Relative temperature index (RTI) UL 746 C (°C). These values give an indication of the long term behaviour of a plastic resin with respect to selected properties. Three different values are given for: electrical properties, mechanical properties with impact, mechanical properties without impact. For the latter, the value shows the upper use temperature in °C. The criterion is the temperature at which after 60000 h (7 years) the most sensitive mechanical property (tensile strength) drops to 50% of its initial value, at the minimum thickness for which the rating was obtained.
3) These results are based on laboratory tests, under controlled conditions, and do not reflect performance under actual fire conditions.

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L-10334 R.1 11.98 Orig. 01.96 ® DuPont registered trademark Printed in Switzerland

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