KABLE KONTROL

Tefzel (ETFE) Cable Tie

Technical Specifications

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Overview

Kable Kontrol TEFZEL (ETFE) Cable Ties use **TEFZEL 207** fluoropolymer known for its excellent chemical resistance, high impact strength, and superior electrical properties. It is a copolymer of ethylene and tetrafluoroethylene (ETFE), making it more durable and mechanically tough compared to other fluoroplastics like PTFE. TEFZEL has a high operating temperature range (between (–76°F) - 338°F) excellent weatherability, and is resistant to UV radiation, making it ideal for outdoor applications. It is commonly used in wire insulation, aerospace, architectural coatings, and chemical processing equipment.

Kable Kontrol TEFZEL (ETFE) Cable Ties perform in high temperature, corrosive environments. Nuclear applications are possible because of the radiation resistance of Tefzel. Moisture absorption is low, providing uniformity of mechanical properties regardless of humidity. High impact strength and UV resistance are additional advantages. Outstanding electrical properties, solvent resistance, and excellent high temperature aging characteristics make Tefzel an ideal material for high performance electrical components.

Country of Origin: Thailand

Typical Property Data for DuPont Tefzel Fluoropolymer Resin Grade 207

Thermal Properties	*Test Method*	*Unit*	*Value*
Nominal Melting Point	D3159	°C	250-280
Flow Rate	D3159	g/10 min	30
Upper Service	UL746	°C	150
Mechanical Properties	*Test Method*	*Unit*	*Value*
Tensile Strength, 23°C	D3159	MPa (psi)	40 (5,800)
Specific Gravity	D792	-	1.7
Ultimate Elongation, 23°C	D3159	%	300
Flexural Modulus, 23 °C	D790	MPa (psi)	1000 (150,000)
Impact Strength, 23°C	D256	J/m (ft*lb/in)	No Break
Electrical Properties	*Test Method*	*Unit*	*Value*
Dielectric Strength, 0.25 mm	D149	V/0.001 in	1,700
Dielectric Constant, 1 MHz, 23°C	D150	-	2.6—2.8
Dissipation Factor, 1 MHz, 23°C	D150	-	0.009
Volume Resistivity	D257	ohm*m	(1 * 10^17)
General Properties	*Test Method*	*Unit*	*Value*
Water Absorption, 24 hr	D570	%	0.007
Weather and Chemical Resistance	-	-	Excellent
Limiting Oxygen Index	D2863	%	30-32

Note: Typical properties are not suitable for specification purposes.

Weather Resistance

Tefzel has excellent resistance to outdoor weathering. Long-term outdoor exposures show little detrimental effects.

Chemical Resistance

Tefzel has outstanding resistance to attack by chemicals and solvents that often cause rapid deterioration of other plastic materials. It is inert to many strong mineral acids, inorganic bases, halogens and metal salt solutions. Carboxylic acids, anhydrides, aromatic and aliphatic hydrocarbons, alcohols, aldehydes, ketones, ethers, esters, chlorocarbons, and classic polymer solvents have little effect on Tefzel. Under highly stressed conditions, some very low surface tension solvents tend to reduce the stress-crack resistance of the lower molecular weight products. Very strong oxidizing acids such as nitric, organic bases such as amines, and sulfonic acids at high concentrations and near their boiling points will affect Tefzel to varying degrees.

Pages 7 & 8 present data on the effect of various chemicals on the tensile properties of Tefzel and the weight gain, if any, during exposure.

Flame Resistance and Smoke

Tefzel is rated UL94 V-0 for unpigmented resins down to 0.062” thick. Its limiting oxygen index is 40 by ASTM D863, which mean that an atmosphere containing at least 30% oxygen is required to maintain combustion in a downward burning flame. By ASTM D635, Tefzel has an average time of burn of 10mm (0.39”)

Effects of Radiation

Tefzel is highly resistant to electron beam and gamma radiation. Tests have shown that both elevated temperatures and the presence of oxygen have a deleterious effect on physical properties when Tefzel is exposed to gamma radiation. The effect on physical properties when Tefzel is exposed to gamma radiation. The effect on physical properties is significantly decreased in an inert atmosphere, such as nitrogen.

Tefzel appears to be degraded much less with electron beam radiation than with gamma radiation at equivalent levels of total exposure.

Vacuum Outgassing

Under vacuum conditions, Tefzel gives off little gas at recommended maximum use temperatures. ***See below:***

Weight Loss, %	
Maximum (Generally accepted maximum 1%)	0.12
Minimum	0.04
Average	0.07
Volatile Condensable Material Weight (VCMW), %	
Maximum	0.02
Minimum	0.00
Average	0.01

*Tests consist of exposing 30 mil thick specimens for 24 hours in a hard vacuum at 149° C and measuring weight loss and the volatile gases that are collected in liquid air traps.

Permeability

Tests measured on 4 mil thick film per ASTM D1434 at 25°C shown the following permeabilities

Material	*Permeability, cm^3/100 in^2•24 h•atm/mil*
Carbon Dioxide	250
Nitrogen	30
Oxygen	100
*Multiply by 15.5 to obtain cm^3/m^2•day•atm	
Water vapor transmission by ASTM E96 is 1.65 g/100in^2•24 h/mil.	

Hydrolytic Stability and Water Absorption

Hydrolytic stability is indicated by lack of deterioration in physical properties after long periods of exposure to boiling water. Using room temperature tensile strength and elongation as control properties, Tefzel is essentially unaffected after 3,000 hours of exposure to boiling water. ***See below:***

Tensile Strength

Product	*psi*	*MPa*	*Elongation, %*
Tefzel 200 (no exposure)	5,800	40	145
3,000 hours boiling water	5,790	40	135
Tefzel HT-2004 (no exposure)	11,890	82	7
1,000 hours exposure*	8,960	60	5
2,000 hours exposure*	8,360	57.6	5
3,000 hours exposure*	8,110	55.8	5

***Measured at 23°C after immersion in boiling water**

Actual Laboratory Tests on

Chemical Compatibility of DuPont Tefzel With Representative Chemicals

Chemical	Boiling Point °C / °F	Test Temperature °C / °F	Days	Retained Properties		
				Tensile Strength	Elongation	Weight Gain
Acid/Anhydrides						
Acetic Acid (Glacial)	118 | 244	118 | 244	7	82	80	3.4
Acetic Anhydride	139 | 282	139 | 282	7	100	100	0
Trichloroacetic Acid	196 | 384	100 |212	7	90	700	0
Aliphatic Hydrocarbons						
Mineral Oil	-	180 | 356	7	90	60	0
Naphtha	-	100 | 212	7	100	100	0.5
Aromatic Hydrocarbons						
Benzene	80 | 176	80 | 176	7	100	100	0
Toluene	110 | 230	110 | 230	7	-	-	-
Functional Aromatics						
O-Cresol	191 | 376	180 | 356	7	100	100	0
Amines						
Aniline	185 | 365	120 | 248	7	81	99	2.7
Aniline	185 | 365	120 | 248	30	93	82	-
Aniline	185 | 365	180 | 356	7	95	90	-
N-Methyl Aniline	195 | 383	120 | 248	7	85	95	-
N-Methyl Aniline	195 | 383	120 | 248	30	100	100	-
N, N-Dimethyl Aniline	190 | 374	120 | 248	7	82	97	-
n-Butylamine	78 | 172	78 | 172	7	71	73	4.4
Di-n-Butylamine	159 | 318	120 | 248	7	81	96	-
Di-n-Butylamine	159 | 318	120 | 248	30	100	100	-
Di-n-Butylamine	159 | 318	160 | 320	7	55	75	-
Tri-n-Butylamine	216 | 421	120 | 248	7	81	80	-
Tri-n-Butylamine	216 | 421	120 | 248	30	100	100	-
Pyridine	116 | 240	116 | 240	7	100	100	1.5
Chlorinated Solvents						
Carbon Tetrachloride	78 | 172	78 | 172	7	90	80	4.5
Chloroform	62 | 144	61 | 142	7	85	100	4.0
Dichloroethylene	77 | 170	32 | 90	7	95	100	2.8
Methylene Chloride	40 | 104	40 | 104	7	85	85	0
Freon 113	46 | 115	46 | 115	7	100	100	0.8
Ethers						
Tetrahydrofuran	66 | 151	66 | 151	7	86	93	3.5
Aldehyde/Ketones						
Acetone	56 | 132	56 | 132	7	80	83	4.1
Acetophenone	201 | 394	180 | 356	7	80	80	1.5
Cyclohexanone	156 | 312	156 | 312	7	90	85	0
Methyl Ethyl Ketone	80 | 176	80 | 176	7	100	100	0
Esters						
n-Butyl Acetate	127 | 260	127 | 260	7	80	60	0
Ethyl Acetate	77 | 170	77 | 170	7	85	60	0
Polymer Solvents						
Dimethylformamide	154 | 309	90 | 194	7	100	100	1.5
Dimethylformamide	154 | 309	120 | 248	7	76	92	5.5
Dimethylsulfoxde	189 | 373	90 | 194	7	95	90	1.5
Other Organics						
Benzyl Alcohol	205 | 401	120 | 248	7	97	90	-
Benzoyl Chloride	197 | 387	120 | 248	7	94	95	-
Benzoyl Chloride	197 | 387	120 | 248	30	100	100	-
Decalin	190 | 374	120 | 248	7	89	95	-
Phthaloyl Chloride	276 | 529	120 | 248	30	100	100	-

(continued)

Actual Laboratory Tests on

Chemical Compatibility of DuPont Tefzel With Representative Chemicals

Chemical	Boiling Point °C / °F	Test Temperature °C / °F	Days	Retained Properties		
				Tensile Strength	Elongation	Weight Gain
Acid/Anhydrides						
Hydrochloric (Conc)	106 | 223	23 | 73	7	100	90	0
Hydrochloric (Conc)	106 | 223	106 | 223	7	96	100	0.1
Hydrobromic (Conc)	125 | 257	125 | 257	7	100	100	-
Hydrofluoric (Conc)	-	23 | 73	7	97	95	0.1
Sulfuric (Conc)	-	100 | 212	7	100	100	0
Sulfuric (Conc)	-	120 | 248	7	98	95	0
Sulfuric (Conc)	-	150 | 302	*	98	90	0
Aqua Regia	-	90 | 194	*	93	89	0.2
Nitric—25%	100 | 212	100 | 212	14	100	100	-
Nitric—50%	105 | 221	105 | 221	14	87	81	-
Nitric—70% (Conc)	120 | 248	23 | 73	105	100	100	0.5
Nitric—70% (Conc)	120 | 248	60 | 140	53	100	100	-
Nitric—70% (Conc)	120 | 248	120 | 248	2	72	91	-
Nitric—70% (Conc)	120 | 248	120 | 248	3	58	5	-
Nitric—70% (Conc)	120 | 248	120 | 248	7	0	0	-
Chromic	125 | 257	125 | 257	7	66	25	-
Phosphoric (Conc)	-	100 | 212	7	-	-	-
Phosphoric (Conc)	-	120 | 248	7	94	93	0
Halogens						
Bromine (Anhy)	59 | 138	23 | 73	7	90	90	1.2
Bromine (Anhy)	59 | 138	57 | 135	7	99	100	-
Bromine (Anhy)	59 | 138	57 | 135	30	94	93	3.4
Chloine (Anhy)	-	120 | 248	7	85	84	7
Bases						
Ammonium Hydroxide	-	66 | 150	7	97	97	0
Potassium Hydroxide (20%)	-	100 | 212	7	100	100	0
Sodium Hydroxide (50%)	-	120 | 248	7	94	80	0.2
Peroxides						
Hydrogen Peroxide (30%)	-	23 | 73	7	99	98	0
Salt-Metal Etchants						
Ferric Chloride (25%)	104 | 220	100 | 212	7	95	95	0
Zinc Chloride (25%)	104 | 220	100 | 212	7	100	100	0
Other Inorganics						
Sulfuryl Chloride	68 | 115	68 | 155	7	86	100	8
Phosphoric Trichloride	75 | 167	75 | 167	7	100	98	-
Phosphoric Oxychloride	104 | 220	104 | 220	7	100	100	-
Silicon Tetrachloride	60 | 140	60 | 140	7	100	100	-
Water	100 | 212	100 | 212	7	100	100	0
Miscellaneous						
Skydrol	-	149 | 300	7	100	95	3.0
Aerosafe	-	149 | 300	7	92	93	3.9
A-20 Stripper Solution	-	140 | 284	7	90	90	-

*Exposed for 6 Hours.

NOTES: Change in properties –15% is considered insignificant. Samples were 10-15 mil micro tensile bars. TS/E and wt. gain determined within 24 hours after removal from exposure media.

Effects of Heat Aging

Polymeric materials are affected to some degree when exposed to elevated temperatures for long periods of time. The following diagram shows how room temperature tensile strength is affected by exposure time and temperatures. These data were obtained on specimens exposed to no mechanical stress during aging and so a directly pertinent only to a device, e.g., a wire, which is exposed to temperature with little or no load, and then is mechanically stressed at room temperature. ***See below:***

Figure 18. Retention of Room Temperature Tensile Elongation After Aging—DuPont™ *Tefzel*®

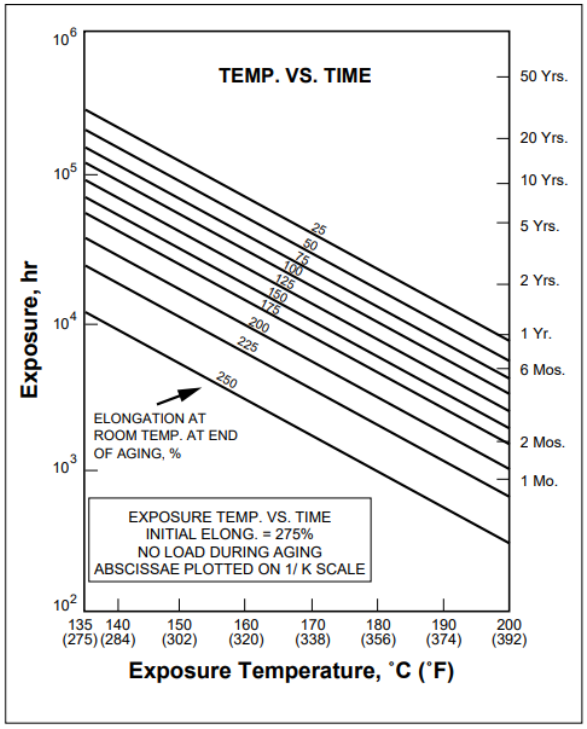


Figure 19. Retention of Room Temperature Tensile Strength After Aging—DuPont™ *Tefzel*®

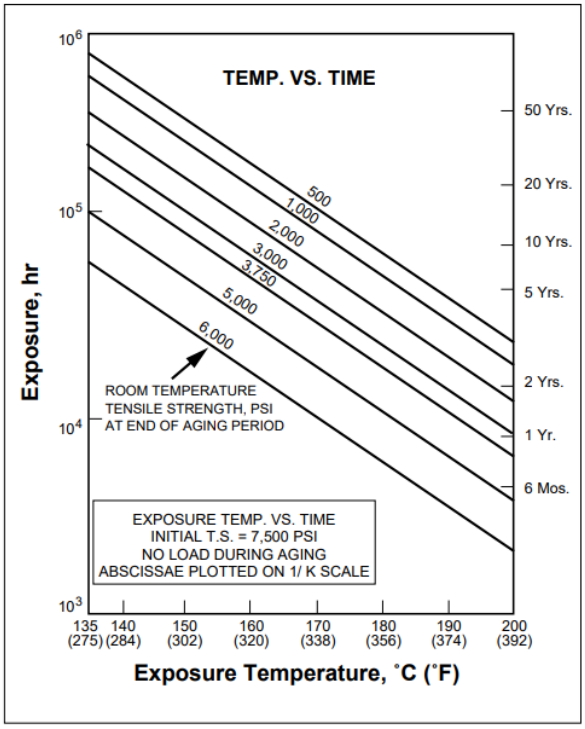
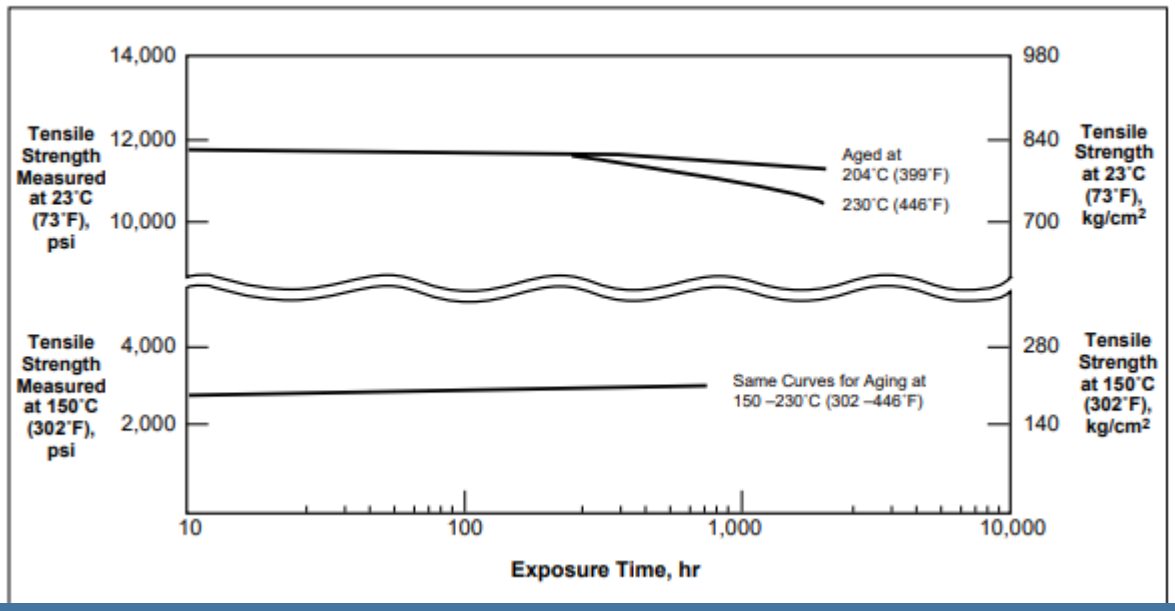


Figure 20. Effect of Heating of DuPont™ *Tefzel*® (All values of elongation between 5 and 10% regardless of test temperature) (no load during aging)



Effect of Temperature Aging on Izod Impact Strength

Temperature (°C)	*Aging*	*Izod Impact Strength (J/m)*
23	As molded	491
23	168 hours at 150°C	491
23	168 hours at 180°C	416

Loss of Weight with Aging

The weight loss of Tefzel below the melting point is from 0.1 to 0.3% most of which is moisture. ***See below:***

Initial Weight Loss of DuPont Tefzel Resins Above 300°C

Temperature (°C)	*Tefzel 200 wt loss, %/hr*
300	0.05
330	0.26
350	0.86
370	1.60

***Measured at 23°C after immersion in boiling water**

American Society for Testing and Materials (ASTM) Specs

ASTM standards are used and accepted worldwide and cover areas such as metals, paints, plastics, textiles, petroleum, construction, energy, the environment, consumer products, medical services, devices and electronics, advanced materials and much more.

Kable Kontrol Tefzel (ETFE) Cable Ties have the following ASTM Specifications:

- **ASTM-D2633—**Provides testing procedures to evaluate the physical, mechanical, and electrical properties of thermoplastic materials used in wire and cable insulation or jackets. The tests help ensure that the materials meet required performance specifications for durability, flexibility, resistance to environmental factors, and electrical insulation properties.
- **ASTM-D3159 Type 1—**Defines the requirements for ethylene-tetrafluoroethylene (ETFE) modified fluoropolymer insulated wires and cables. Type 1 refers to a specific category of modified ETFE insulation with certain characteristics, including high dialectic strength, resistance to high temperatures, chemical resistance, and mechanical durability.

UL Standards & Engagement

UL standard is a published set of best practices for manufacturing and testing the safety, security, and sustainability of a product or system, developed and voted on by experts across industries and interests.

Kable Kontrol Tefzel (ETFE) Cable Ties have the following UL Specifications:

- **UL83—**Specifies the requirements for THHN, THWN, and other thermoplastic-insulated building wires used in electrical applications. Covers 600V-rated insulated conductors for general-purpose electrical wiring.
- **UL94V-0—**A flammability rating from UL 94, the Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances Testing. Flames must stop within 10 seconds after removing the ignition source. Burning material should not produce flaming drips that could ignite other materials. Glow after flame extinguishes should not exceed 30 seconds.

Contact Our Sales Team Today!

Call 1-877-733-4202 or

Email info@kablekontrol.ca