

F161™

Resin Systems for Advanced Composites

Product Data

Description

F161 is a structural, heat resistant and electrical grade epoxy formulation designed for autoclave curing. F161 is a high temperature, laminate grade epoxy resin with a 350°F (177°C) cure. F161 is unique in that it was the first resin system to meet all types and classes of MIL-R-9300 B.

Features

Uncured

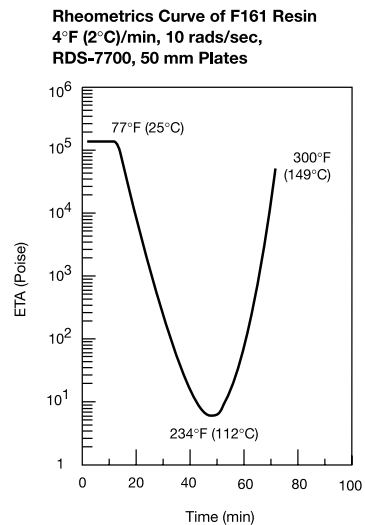
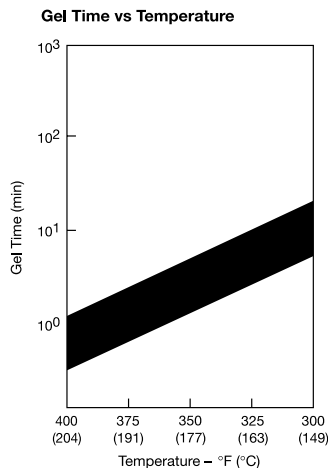
- Moderate Viscosity During Cure
- Adaptable to Offer Good Tack and Drape for Processing
- Can Be Adapted for Use on Various Weaves and Fiber Reinforcements
- Nonburning System Available (Bromine Added)

Cured

- Heat Resistant Properties
- Excellent Heat Aging Properties, Adaptable to Tooling
- Electrical Grade Formulation
- Certified to MIL-R-9300 B, Types I and II, Grades O and D, Form B

Neat Resin Properties

Specific gravity	1.243
T _g dry	386°F (197°C)
T _g wet	305°F (152°C)
Equilibrium moisture absorption	2.8%
Linear coefficient of thermal expansion	2.6 x 10 ⁻⁵ in/in/°F (4.68 x 10 ⁻⁵ cm/cm/°C)
Tensile strength	8.7 ksi (60 MPa)
Tensile modulus	0.52 msi (3.59 GPa)
Tensile strain	2.2%
Fracture toughness, K _{1C}	0.394 ksi √in (0.433 MPa √m)
Strain energy release rate, G _{1C}	0.262 in-lb/in ² (0.0459 kJ/m ²)
Gel time @ 350°F (177°C)	1-7 min



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F161™ Product Data

Availability

Form	Hexcel Designation	Fiber	Fiber Areal Wt. lbs/ft ² (g/m ²)	Weave	Count Warp x Fill	Available Widths Standard Width, in (cm)
Glass Fabrics	120-38"-F161	450-1/2	377 (115)	Crowfoot MIL-C-9084 TYVIII	60 x 58	38", 50", 60" (96.5, 127, 152.4)
	1581-38"-F161	150-1/2	992 (303)	8 Harness Satin MIL-C-9084 TYVIII A	57 x 54	38", 50", 60", 72" (96.5, 127, 152.4, 182.9)
	7781-38"-F161	75-1/0	992 (303)	8 Harness Satin MIL-C-9084 TYVIII B	57 x 54	38", 50", 60", 72" (96.5, 127, 152.4, 182.9)
Kevlar® Fabrics	K120-38"-F161	Kev. 49 195	198 (61)	Plain	34 x 34	38", 50", 60" (96.5, 127, 152.4)
	K285-38"-F161	Kev. 49 1140	557 (170)	Crowfoot	17 x 17	38", 50", 60" (96.5, 127, 152.4)
	K281-38"-F161	Kev. 49 1140	557 (170)	Plain	17 x 17	38", 50", 60" (96.5, 127, 152.4)
Glass Tapes	T2E285-12"-F161	E-Glass 1062	933 (285)	n/a	n/a	12", 3"-24" (30.5, 7.6-61)
	T2S265-12"-F161	S-2 Roving	868 (265)			
Kevlar	T7D150-12"-F161	Kev. 49 7100	491 (150)			

Note: Alternatively, glass and Kevlar weaves may be used with the F161 resin system. Consult your nearest Hexcel Sales Representative for additional information.

Physical Properties

Property	Glass Fabrics		Kevlar Fabrics	
	1581	7781	120	285
Material description				
% Flow @ 350°F 50 psi (177°C, 345 kPa)	15-25	15-25	20-30	20-30
% Resin content (dry)	33-39	34-40	52-58	47-53
Cured thickness per ply – in (cm)	0.0109 (0.028)	0.0115 (0.029)	0.0039 (0.010)	0.0097 (0.025)
% Fiber volume	43.4	41.2	44.0	47.9

Mechanical Properties (Autoclave Cure)

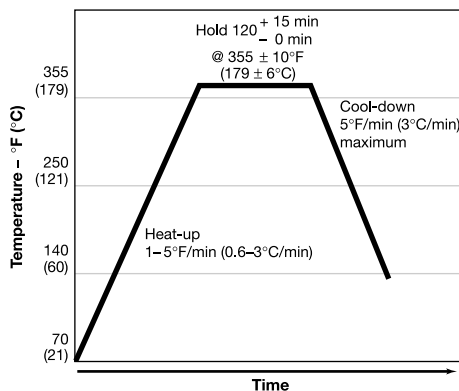
Property	Temp °F (°C)	Glass Fabrics			Kevlar Fabrics			
		120	1581	7781	120		285	
					Dry	Wet	Dry	Wet
Tensile strength, ksi (MPa)	-65 (-54)				57.0 (393)		56.8 (392)	
Tensile modulus, msi (GPa)	-65 (-54)				3.96 (27.3)		3.66 (25.2)	
Tensile strength, ksi (MPa)	75 (24)	66 (455)	61.5 (424)	63.5 (438)	59.5 (410)	57.9 (399)	62.1 (428)	57.9 (399)
Tensile modulus, msi (GPa)	75 (24)	3.1 (21)	3.95 (27.2)	4.02 (27.7)	3.76 (25.9)	3.61 (24.9)	3.85 (26.5)	3.64 (25.1)
Tensile strain	75 (24)		15,560	15,800	15,800	16,000	16,100	15,900
Tensile strength, ksi (MPa)	270 (132)				48.4 (334)	37.6 (259)	50.6 (349)	37.5 (259)
Tensile modulus, msi (GPa)	270 (132)				3.17 (21.9)	2.69 (18.6)	3.58 (24.7)	3.55 (24.5)
Tensile strength, ksi (MPa)	350 (177)	58 (400)	53 (365)	47.8 (330)	34.5 (238)	27.5 (190)	40.8 (281)	36.7 (253)
Tensile modulus, msi (GPa)	350 (177)	2.5 (18)	2.96 (20.4)	3.54 (24.4)	2.76 (19.0)	2.59 (17.9)	3.16 (21.8)	2.93 (20.2)
Compression strength, ksi (MPa)	-65 (-54)				32.2 (222)		28.9 (199)	
Compression modulus, msi (GPa)	-65 (-54)				3.49 (24.1)		3.59 (24.8)	
Compression strength, ksi (MPa)	75 (24)	70 (482)	66.1 (456)	68.0 (469)	28.9 (199)	20.2 (139)	44.6 (308)	18.5 (128)
Compression modulus, msi (GPa)	75 (24)	3.0 (21)	3.98 (27.4)	4.37 (30.1)	3.88 (26.8)	3.04 (21.0)	4.07 (28.1)	2.85 (19.7)
Compression strength, ksi (MPa)	270 (132)				17.0 (117)	10.2 (70)	15.1 (104)	10.3 (71)
Compression modulus, msi (GPa)	270 (132)				2.67 (18.4)	2.27 (15.7)	2.49 (17.2)	2.20 (15.2)
Compression strength, ksi (MPa)	350 (177)	43 (296)	40.0 (276)	39.2 (270)	13.1 (90)	7.5 (52)	12.3 (85)	7.6 (52)
Compression modulus, msi (GPa)	350 (177)	2.9 (20)	3.30 (22.8)	3.21 (22.1)	2.45 (16.9)	2.03 (14.0)	2.26 (15.6)	1.75 (12.1)
Short beam shear strength, ksi (MPa)	-65 (-54)				4.95 (34)		4.26 (29)	
Short beam shear strength, ksi (MPa)	75 (24)				4.95 (34)	5.23 (36)	4.28 (30)	4.38 (30)
Short beam shear strength, ksi (MPa)	270 (132)				3.83 (26)	2.21 (15)	3.39 (23)	2.49 (17)
Short beam shear strength, ksi (MPa)	350 (177)				2.73 (19)	2.30 (16)	2.06 (14)	1.61 (11)
Long beam ultimate, lb/in (kg/m)	-65 (-54)				115 (2054)		183 (3268)	
Long beam flex ult., lb/in (kg/m)	75 (24)	191 (34)	264 (48)		90 (1607)		144 (2572)	
Long beam flex ult., lb/in (kg/m)	270 (132)				33 (539)		59 (1054)	

All mechanical property values are based on the calculated fiber volume, found on the previous table.

Reported property values are averages to which no statistical assurance should be associated. While Hexcel believes that the data contained herein are factual, the data are not to be taken as a warranty or representation for which Hexcel assumes legal responsibility. They are offered solely for your consideration, investigation, and verification.

Cure Cycle

Cure Procedure



I. Autoclave only (typical cure cycle at left)

- A. Edge bleed and surface bleed.
- B. Apply 22 in (74 kPa) Hg vacuum minimum to vacuum bag.
- C. Apply 45 ± 5 PSIG (310 ± 34 kPa) pressure.
- D. Vent vacuum bag to atmosphere when pressure reaches 20 PSIG (138 kPa).
- E. Below 140°F (60°C) release pressure and remove part.

II. Autoclave and Postcure (optional)

- A. Cure as above except hold for 60 minutes at 355°F (179°C).
- B. Debag and cure for 3 hours at 400°F (204°C) in an air circulating oven.



Storage

F161 prepreg should be sealed in a polyethylene bag and refrigerated, preferably below 32°F (0°C). Following removal from refrigerated storage, allow the prepreg to reach room temperature before opening the polyethylene bag to avoid moisture condensation. Shelf life: 6 months at 0°F (-18°C), 3 months at 40°F (4°C).

Shipping

Prepreg fabric and tape are generally shipped in sealed polyethylene bags in insulated containers packed with dry ice or refrigerated shipment.

Disposal of Scrap

Disposal of this material should be in a secure landfill in accordance with state and federal regulations.

Handling and Safety Precautions

Hexcel recommends that customers observe established precautions for handling epoxy resins and fine fibrous materials. Operators working with this product should wear clean, impervious gloves to reduce the possibility of skin contact and to prevent contamination of the material.

Airborne graphite as a result of sawing, grinding, etc., can present electrical shorting hazards; refer to NASA Technical Memorandum 78652. Material Safety Data Sheets (MSDS) have been prepared for all Hexcel products and are available to company safety officers on request from your nearest Hexcel Sales Office.

Important

Hexcel Corporation makes no warranty, whether expressed or implied, including warranties of merchantability or of fitness for a particular purpose. Under no circumstances shall Hexcel Corporation be liable for incidental, consequential, or other damages arising out of a claim from alleged negligence, breach of warranty, strict liability or any other theory, through the use or handling of this product or the inability to use the product. The sole liability of Hexcel Corporation for any claims arising out of the manufacture, use, or sale of its products shall be for the replacement of the quantity of this product which has proven to not substantially comply with the data presented in this bulletin. Users should make their own assessment of the suitability of any product for the purposes required. The above supercedes any provision in your company's forms, letters, or other documents.

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