

### FEATURES AND BENEFITS

#### **Features and Benefits**

- Modified epoxy pre-preg qualified for space applications
- Controlled flow, net resin content material
- Medium toughness (CAI 28ksi/193 MPa)
- Mechanical properties of a 175°C (350°F) curing material when cured at 135°C (275°F)
- Dry service temperature of 150°C (300°F) when cured at 135°C (275°F)
- 8 weeks shop life at RT conditions
- Can be cured by vacuum only or under pressure
- Laminate and sandwich panel usage
- Co-curable with various space qualified adhesive materials

#### **Introduction**

Cycom® 950-1 is a controlled flow, 125°C (250°F) curing modified epoxy resin that can be cured under vacuum only conditions or in an autoclave or mechanical press. It exhibits the performance of a 175°C (350°F) curing epoxy when cured at 135°C (275°F) (curing at this temperature achieves maximum mechanical properties at elevated temperatures).

Due to its flow controlled formulation, long shelf life at ambient temperatures, wide cure temperature window and ability to be cured under vacuum only conditions, Cycom® 950-1 is an ideal candidate for applications such as large sandwich panel structures and repair applications. It is used in primary aircraft structures including helicopter fuselage, rotor components and wing structures, along with solar array panels and reflectors.

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# CYCOM® 950-1

## **Recommended Cure Cycles**

### **For Autoclave (Pressure) and Vacuum Only Curing:**

Apply full vacuum from start of cure cycle

Apply moulding pressure (if using) from start of cure cycle

Heat up rate 1 - 2°C/minute (3 - 5°F/minute) to 95 - 100°C (200 - 210°F).

Note: If large structures or thick laminates are being moulded, reduce heat up rate to 0.5 - 1°C/minute (1 - 3°F/minute) from start of cure cycle

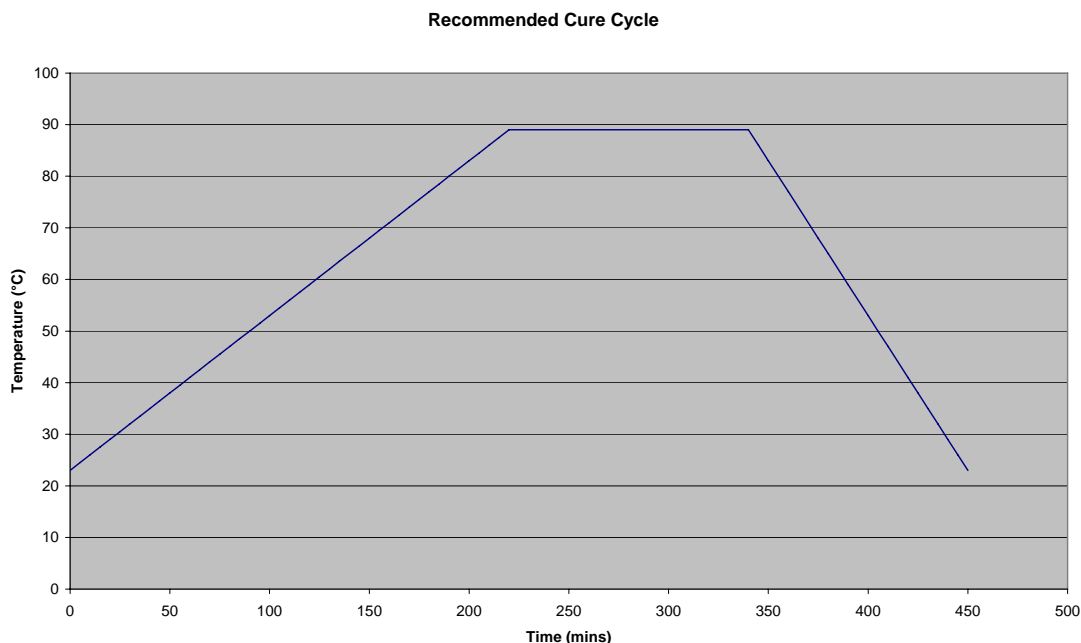
**For thick laminates in excess of 3mm (0.125"), a 60 minute dwell is recommended at 95 - 100°C (200 - 210°F)**

### **Heat up rate from 100°C (210°F) 0.5 - 1°C/minute (1 - 3°F/minute)**

Heat to 125°C (250°F) minimum - for optimum mechanical properties at a higher service temperature, it is recommended that the cure temperature should be 135 +/- 5°C (275 +/- 9°F).

Hold at curing temperature for 2 hours

Cool under vacuum at 3°C/minute (approx. 6°F/minute)



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# CYCOM® 950-1

## Cycom® 950-1 Neat Resin Data

Property	Mean Value
Tensile Strength, MPa/ksi	52.4 (7.6)
Tensile Modulus, GPa/msi	4.0 (0.6)
Tensile Strain to Failure, %	1.5
Outgassing TML, %	0.5 - 0.7
Outgassing RML, %	0.24
Outgassing CVCM, %	0.02 - 0.04
Onset Tg (extrapolated), °C/°F	167 (333)

## Mechanical Properties of Cycom® 950-1/High Strength Carbon UD material

### Cycom® 950-1/T300J UD

Autoclave Cured, Fibre Volume Content = 56%

Test Type	RT Dry	80°C (175°F Dry) Dry	93°C (200°F Dry) Dry
0° Tensile Str MPa/ksi	2044 (296)	1615 (234)	Not Available
0° Tensile Mod GPa/msi	126 (18.3)	128 (18.6)	Not Available
0° Comp Str MPa/ksi	1316 (191)	1002 (145)	980 (142)
0° Comp Mod GPa/msi	113 (16.4)	112 (16.2)	107 (15.5)
0° Flexural Str MPa/ksi	1478 (214)	1150 (167)	Not Available
0° Flexural Mod GPa/msi	112 (16.2)	107 (15.5)	Not Available
0° ILSS, MPa/ksi	92 (13.3)	74 (10.7)	63 (9.1)

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# CYCOM® 950-1

## **Mechanical Properties of Cycom® 950-1/High Modulus Carbon UD material**

### **Cycom® 950-1/M46J UD**

Autoclave Cured, Fibre Volume Content = 55%

<b>Test Type</b>	<b>RT Dry</b>	<b>80°C Dry (175°F Dry)</b>	<b>120°C Dry (250°F Dry)</b>	<b>132°C Dry (270°F Dry)</b>
0° Tensile Str MPa/ksi	1854 (269)	1789 (259)	Not Available	1879 (272)
0° Tensile Mod GPa/msi	234 (33.9)	231 (33.5)	Not Available	234 (33.9)
0° Comp Str MPa/ksi	849 (123)	674 (97.7)	898 (130)	815 (118)
0° Comp Mod GPa/msi	225 (32.6)	226 (32.8)	219 (31.8)	219 (31.8)
0° Flexural Str MPa/ksi	1364 (198)	1232 (179)	1154 (167)	1084 (157)
0° Flexural Mod GPa/msi	206 (29.9)	212 (30.7)	200 (29.0)	196 (28.4)
0° ILSS MPa/ksi	80 (11.6)	71 (10.3)	57 (8.3)	63 (9.1)

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# CYCOM® 950-1

## **Mechanical Properties of Cycom® 950-1/Ultra High Modulus Carbon UD material**

### **Cycom®950-1/M55J UD - Qualified for space applications**

Autoclave cured, Fibre Volume Content = 55%

<b>Test Type</b>	<b>-55°C (-67°F Dry) Dry</b>	<b>RT Dry</b>	<b>70°C (160°F Dry) Dry</b>
0° Tensile Str MPa/ksi	1664 (241)	1764 (256)	1765 (256)
0° Tensile Mod GPa/msi	293 (42.5)	298 (43.2)	296 (42.9)
90° Tensile Str MPa/ksi	Not Available	25 (3.6)	19 (2.7)
90° Tensile Mod GPa/msi	Not Available	5.9 (0.86)	5.3 (0.77)
0° Comp Str MPa/ksi	691 (100)	742 (108)	737 (107)
0° Comp Mod GPa/msi	266 (38.6)	250 (36.2)	243 (35.2)
90° Comp Str MPa/ksi	Not Available	193 (28.0)	Not Available
90° Comp Mod GPa/msi	Not Available	6.4 (0.93)	Not Available
0° Flexural Str MPa/ksi	1250 (181)	1141 (165)	1018 (148)
0° Flexural Mod GPa/msi	229 (33.2)	220 (31.9)	218 (31.6)
In Plane Shear Str MPa/ksi	71 (10.3)	84 (12.2)	79 (11.5)
In Plane Shear Mod GPa/msi	Not Available	3.1 (0.45)	Not Available
0° ILSS, MPa/ksi	64 (9.3)	66 (9.6)	63 (9.1)

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# CYCOM® 950-1

## **Mechanical Properties of Cycom® 950-1/High Strength Carbon Fabric material**

### **Cycom®950-1/3K T300 Plain Weave**

Autoclave cured, Fibre Volume Content = 49%

<b>Test Type</b>	<b>RT Dry</b>	<b>80°C Dry (175°F Dry)</b>	<b>93°C Dry (200°F Dry)</b>
Warp Tensile Str MPa/ksi	592 (85.8)	535 (77.6)	Not Available
Warp Tensile Mod GPa/msi	55 (8.0)	53 (7.7)	Not Available
Weft Tensile Str MPa/ksi	541 (78.5)	Not Available	492 (71.3)
Weft Tensile Mod GPa/msi	49 (7.1)	Not Available	52 (7.5)
Warp Comp Str MPa/ksi	575 (83.4)	492 (71.3)	Not Available
Warp Comp Mod GPa/msi	46 (6.7)	46 (6.7)	Not Available
Weft Comp Str MPa/ksi	528 (76.6)	465 (67.4)	447 (64.5)
Weft Comp Mod GPa/msi	42 (6.1)	43 (6.2)	43 (6.2)

### **Cycom®950-1/3K T300 5H**

Autoclave cured, Fibre Volume Content = 49%

<b>Test Type</b>	<b>RT Dry</b>	<b>80°C Dry (175°F Dry)</b>
Warp Tensile Str, MPa/ksi	678 (98.3)	624 (90.5)
Warp Tensile Mod GPa/msi	60 (8.7)	56 (8.1)
Warp Comp Str, MPa/ksi	621 (90.0)	563 (81.6)
Warp Comp Mod, GPa/msi	51 (7.4)	52 (7.5)
Warp Flexural Str, MPa/ksi	879 (127)	696 (101)
Warp Flexural Mod, GPa/msi	51 (7.4)	52 (7.5)
Warp ILSS, MPa/ksi	73 (10.6)	61 (8.8)

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# CYCOM® 950-1

## Mechanical Properties of Cycom® 950-1/Intermediate Modulus Carbon Fabric material

### **Cycom® 950-1/6K T800 2X2T**

Autoclave cured, Fibre Volume Content = 49%

Test Type	RT Dry	80°C (175°F Dry) Dry	120°C (250°F Dry) Dry
Warp Tensile Str MPa/ksi	979 (142)	Not Available	Not Available
Warp Tensile Mod GPa/msi	73 (10.6)	Not Available	Not Available
Warp Comp Str MPa/ksi	645 (93.5)	Not Available	573 (83.1)
Warp Comp Mod GPa/msi	69 (10.0)	Not Available	61 (8.8)
Warp Flex Str MPa/ksi	1147 (166)	965 (140)	822 (119)
Warp Flex Mod GPa/msi	69 (10.0)	65 (9.4)	58 (8.4)
Warp ILSS, MPa/ksi	80 (11.6)	62 (9.0)	61 (8.8)

### **Cycom® 950-1/6K T800 P**

Autoclave cured, Fibre Volume Content = 51%

Test Type	RT Dry	80°C (175°F Dry) Dry	132°C (270°F Dry) Dry
Warp Tensile Str MPa/ksi	941 (136)	924 (134)	911 (132)
Warp Tensile Mod GPa/msi	76 (11.0)	75 (10.9)	72 (10.4)
Warp Comp Str MPa/ksi	694 (101)	559 (81.0)	376 (54.5)
Warp Comp Mod GPa/msi	68 (9.9)	66 (9.6)	63 (9.1)
Warp Flex Str MPa/ksi	1031 (149)	819 (119)	485 (70.3)
Warp Flex Mod GPa/msi	60 (8.7)	65 (9.4)	60 (8.7)
Warp ILSS, MPa/ksi	69 (10.0)	60 (8.7)	43 (6.2)

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# CYCOM® 950-1

## **Mechanical Properties of Cycom® 950-1/Intermediate Modulus Carbon Fabric material**

### **Cycom® 950-1/6K IMS P**

Autoclave cured, Fibre Volume Content = 51%

<b>Test Type</b>	<b>RT Dry</b>
Warp Tensile Strength, MPa/ksi	1021 (148)
Warp Tensile Modulus, GPa/msi	69 (10.0)
Weft Tensile Strength, MPa/ksi	683 (99)
Weft Tensile Modulus, GPa/msi	61 (8.8)
Warp Comp Strength, MPa/ksi	777 (113)
Warp Comp Modulus, GPa/msi	69 (10.0)
Weft Comp Strength, MPa/ksi	523 (75.8)
Weft Comp Modulus, GPa/msi	59 (8.5)
Warp ILSS, MPa/ksi	63 (9.1)
In Plane Shear Strength, MPa/ksi	114 (16.5)
In Plane Shear Modulus, GPa/msi	3.5 (0.51)

### **Cycom® 950-1/6K T800 5H**

Autoclave cured, Fibre Volume Content = 51%

<b>Test Type</b>	<b>RT Dry</b>	<b>80°C (175°F Dry)</b>	<b>Dry</b>	<b>132°C (270°F Dry)</b>	<b>Dry</b>
Warp Tensile Str MPa/ksi	1065 (154)	1055 (153)		892 (129)	
Warp Tensile Mod GPa/msi	78 (11.3)	79 (11.4)		76 (11.0)	
Warp Comp Str MPa/ksi	647 (93.8)	603 (87.4)		350 (50.7)	
Warp Comp Mod GPa/msi	71 (10.3)	69 (10.0)		69 (10.0)	
Warp Flex Str MPa/ksi	1129 (164)	908 (132)		490 (71.0)	
Warp Flex Mod GPa/msi	71 (10.3)	69 (10.0)		70 (10.1)	
Warp ILSS, MPa/ksi	77 (11.2)	65 (9.4)		48 (7.0)	

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# CYCOM® 950-1

## **Mechanical Properties of Cycom® 950-1/High Modulus Carbon Fabric material**

### **Cycom® 950-1/6K M46J P**

Autoclave cured, Fibre Volume Content = 50%

<b>Test Type</b>	<b>RT Dry</b>	<b>80°C Dry</b> (175°F Dry)	<b>132°C Dry</b> (270°F Dry)
Warp Tensile Str, MPa/ksi	626 (90.8)	629 (91.2)	772 (112)
Warp Tensile Mod, GPa/msi	114 (16.5)	115 (16.7)	117 (17.0)
Warp Comp Str, MPa/ksi	370 (53.6)	386 (56.0)	281 (40.7)
Warp Comp Mod, GPa/msi	101 (14.6)	101 (14.6)	99 (14.3)
Warp Flex Str , MPa/ksi	598 (86.7)	508 (73.7)	364 (52.8)
Warp Flex Mod , GPa/msi	93 (13.5)	93 (13.5)	85 (12.3)
Warp ILSS, MPa/ksi	43 (6.2)	48 (7.0)	38 (5.5)

### **Cycom® 950-1/6K M46J 5H**

Autoclave cured, Fibre Volume Content = 50%

<b>Test Type</b>	<b>RT Dry</b>	<b>80°C Dry</b> (175°F Dry)	<b>132°C Dry</b> (270°F Dry)
Warp Tensile Str, MPa/ksi	759 (110)	708 (103)	817 (118)
Warp Tensile Mod, GPa/msi	120 (17.4)	115 (16.7)	126 (18.3)
Warp Comp Str, MPa/ksi	462 (67.0)	441 (63.9)	300 (43.5)
Warp Comp Mod, GPa/msi	104 (15.1)	102 (14.8)	101 (14.6)
Warp Flex Str , MPa/ksi	662 (96.0)	609 (88.3)	538 (78.0)
Warp Flex Mod , GPa/msi	97 (14.1)	101 (14.6)	88 (12.8)
Warp ILSS, MPa/ksi	49 (7.1)	50 (7.2)	44 (6.4)

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# CYCOM® 950-1

## **Mechanical Properties of Cycom® 950-1/Glass Fabric material**

### **Cycom® 950-1/G7781**

Autoclave cured, Fibre Volume Content = 45%

<b>Test Type</b>	<b>RT Dry</b>	<b>80°C (175°F Dry)</b>	<b>Dry</b>
Warp Tensile Str, MPa/ksi	471 (68.4)	449 (65.1)	
Warp Tensile Mod, GPa/msi	23.4 (3.4)	22.8 (3.3)	
Weft Tensile Strength, MPa/ksi	450 (65.2)	Not Available	
Weft Tensile Modulus, GPa/msi	21.4 (3.1)	Not Available	
Warp Comp Str, MPa/ksi	544 (78.9)	426 (61.8)	
Warp Comp Mod, GPa/msi	25.1 (3.6)	23.6 (3.4)	
Weft Comp Strength, MPa/ksi	481 (69.7)	Not Available	
Weft Comp Modulus, GPa/msi	23.6 (3.4)	Not Available	
Warp Flex Str, MPa/ksi	681 (98.7)	591 (85.7)	
Warp Flex Mod, GPa/msi	22.0 (3.2)	20.2 (2.9)	
Warp ILSS, MPa/ksi	67 (9.7)	54 (7.8)	
In Plane Shear Str, MPa/ksi	94 (13.7)	73 (10.6)	
In Plane Shear Mod, GPa/msi	4.2 (0.62)	3.1 (0.45)	

## **Mechanical Properties of Cycom® 950-1/Kevlar Fabric material**

### **Cycom® 950-1/K285**

Autoclave cured, Fibre Volume Content = 45%

<b>Test Type</b>	<b>RT Dry</b>	<b>80°C (175°F Dry)</b>	<b>Dry</b>	<b>132°C (270°F Dry)</b>	<b>Dry</b>
Warp Tensile Str, MPa/ksi	521 (75.5)	539 (78.1)		549 (79.6)	
Warp Tensile Mod, GPa/msi	33 (4.8)	31 (4.5)		30 (4.3)	
Warp Comp Str, MPa/ksi	205 (29.7)	167 (24.2)		132 (19.1)	
Warp Comp Mod, GPa/msi	29 (4.2)	27 (3.9)		25 (3.6)	
Warp Flex Str, MPa/ksi	460 (66.7)	462 (67.0)		391 (56.7)	
Warp Flex Mod, GPa/msi	12 (1.7)	11 (1.6)		8.1 (1.2)	
Warp ILSS, MPa/ksi	39 (5.6)	34 (4.9)		31 (4.5)	
In Plane Shear Str, MPa/ksi	97 (14.1)	87 (12.6)		73 (10.6)	
In Plane Shear Mod, GPa/msi	1.7 (0.25)	1.6 (0.23)		1.4 (0.20)	

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# CYCOM® 950-1

## **Mechanical Properties for vacuum cured laminates**

The following data was generated for a specific aerospace qualification programme and as such includes conditioned data that is not available for the material properties quoted above

### **Cycom®950-1 /High Strength Carbon UD material**

Vacuum cured, Fibre Volume Content = 57%

<b>Test Type</b>	<b>RT Dry</b>	<b>RT Wet</b>	<b>82°C Dry (180°F Dry)</b>	<b>82°C Wet (180°F Wet)</b>
0° Comp Str, MPa/ksi	1272 (184)	1344 (195)	1100 (159)	1096 (159)
0° Comp Mod, GPa/msi	107 (15.5)	108 (15.7)	107 (15.5)	111 (16.1)
0° Flex Str, MPa/ksi	1412 (205)	Not Available	988 (143)	Not Available
0° Flex Mod, GPa/msi	108 (15.7)	Not Available	106 (15.4)	Not Available
0° ILSS, MPa/ksi	102 (14.8)	81 (11.7)	80 (11.6)	63 (9.1)

Wet conditioning = 24 hour water boil

### **Cycom®950-1 /High Strength 8H Fabric material**

Vacuum cured, Fibre Volume Content = 55%

<b>Test Type</b>	<b>RT Dry</b>	<b>RT Wet</b>	<b>82°C Dry (180°F Dry)</b>	<b>82°C Wet (180°F Wet)</b>
Warp Comp Str, MPa/ksi	595 (86.3)	555 (80.5)	521 (75.5)	448 (65.0)
Warp Comp Mod, GPa/msi	65 (9.4)	59 (8.5)	61 (8.8)	61 (8.8)
Warp Flex Str, MPa/ksi	811 (118)	Not Available	650 (94.2)	Not Available
Warp Flex Mod, GPa/msi	60 (8.7)	Not Available	60 (8.7)	Not Available

Wet conditioning = 24 hour water boil

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# CYCOM® 950-1

## Cycom®950-1 /E Glass UD material

Vacuum cured, Fibre Volume Content = 49%

Test Type	RT Dry	RT Wet	82°C Dry (180°F Dry)	82°C Wet (180°F Wet)
0° Comp Str, MPa/ksi	1088 (158)	1021 (148)	1019 (148)	877 (127)
0° Comp Mod, GPa/msi	35 (5.1)	32 (4.6)	34 (4.9)	34 (4.9)
0° Flex Str, MPa/ksi	1150 (167)	Not Available	795 (115)	Not Available
0° Flex Mod, GPa/msi	34 (4.6)	Not Available	30 (4.3)	Not Available
0° ILSS, MPa/ksi	72 (10.4)	66 (9.6)	52 (7.5)	48 (7.0)

Wet conditioning = 24 hour water boil

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# CYCOM® 950-1

## Comparison between Autoclave and Vacuum bag curing for similar materials

### Cycom®950-1/High Strength Carbon UD material

	<b>Autoclave Cured (Fibre Volume = 56%)</b>	<b>Vacuum cured (Fibre Volume = 57%)</b>
0° Comp Str @ RT Dry, MPa/ksi	1410 (204)	1272 (184)
0° Comp Str @ 80°C Dry (175°F Dry), MPa/ksi	1125 (163)	1100 (159)
0° ILSS @ RT Dry, MPa/ksi	92 (13.3)	102 (14.8)
0° ILSS @ 80°C Dry (175°F Dry), MPa/ksi	74 (10.7)	80 (11.6)

### Cycom®950-1/High Strength Harness Weave Carbon Fabric material

	<b>Autoclave Cured (Fibre Volume = 49%)</b>	<b>Vacuum cured (Fibre Volume = 55%)</b>
Warp Comp Str @ RT Dry, MPa/ksi	621 (90.0)	595 (86.3)
Warp Comp Str @ 80°C Dry (175°F Dry), MPa/ksi	563 (81.6)	521 (75.5)
Warp Flex Str @ RT Dry, MPa/ksi	879 (127)	811 (118)
Warp Flex Str @ 80°C Dry (175°F Dry), MPa/ksi	696 (101)	650 (94.2)

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# CYCOM® 950-1

## **PRODUCT SAFETY INFORMATION**

Material Safety Data Sheets can be obtained from Cytec Engineered Materials, Ostringen, Germany by calling +49 7253 912871 or Cytec Engineered Materials, Wrexham, UK, by calling +44 1978 665200

## **PRODUCT HANDLING**

Refer to Cytec Engineered Materials Material Safety Data Sheet and product labels for this material

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