

4708



250-300°F (120-150°C) High T_g Epoxy Resin System

Typical applications

General aviation
Aerospace
Industrial
Sporting goods

Out life

30 days at 70°F (21°C)

Shelf life

6 months at 40°F (4°C)
12 months at 0°F (-18°C)

Description

4708 is a 250°F (121°C) to 300°F (149°C) cure, high T_g , controlled flow epoxy resin system specifically designed for out of autoclave processing. It provides versatile processing, excellent mechanical properties, and long out time. 4708 significantly surpasses the performance of traditional 250°F (121°C) cure resin systems with its high toughness and impact resistance.

Benefits/features

- Good dry and wet T_g performance
- Excellent mechanical properties
- Vacuum bag and autoclave curable

Application

The elevated T_g and excellent mechanical properties make 4708 an ideal product for general aviation, aerospace and industrial markets where products are required to retain their mechanical properties under demanding temperatures. Due to its exceptionally high wet T_g , it is particularly suited for applications where hot/wet performance is required.

4708 can be supplied as a matrix for most commercially available fibers (carbon, quartz, aramid, S-glass, E-glass, etc.) in both woven form (designated as NB) as well as unidirectional tape (designated as NCT). Woven fabrics are available in standard commercial widths up to 60 inches (1.5 m). Unitape widths up to 39 inches (1 m) are available in standard fiber weights ranging from 70-300 gsm (0.014-0.060 psf).

Recommended processing conditions

4708 can be cured at temperatures from 250°F to 300°F (121°C to 149°C) depending on part size and complexity. It was specifically designed for vacuum processing but may be cured in an autoclave.

Vacuum cure cycle

Cure cycle: Apply full vacuum, hold at RT for a minimum of 4 hours. Heat from RT to 265±10°F at 5°F/min (130±5.5°C at 2.8°C/min). When temperature reaches 255°F (124°C), hold at temperature for 2 hours. Cool to below 140°F (60°C).

Thicker parts may need to use step cure to reduce the possibility of an exotherm. Please contact MRCFAC's technical service for more information.



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Technical Data Sheet



Neat resin [values are average and do not constitute a specification]

Property	Value
Gel time @ 275°F (135°C), minutes	4 – 7
Specific gravity	1.25
Dry T _g (DMA, E'), °C (°F)	145 (293)
Wet T _g (DMA, E'), °C (°F)*	120 (248)
Tensile strength, ksi (MPa)	9.0 (62)
Tensile modulus, Msi (GPa)	0.47 (3.2)
Tensile strain, %	2.4
Poisson's ratio	0.38
Compressive yield strength, ksi (MPa)	19.1 (131)
Compressive yield modulus, Msi (GPa)	0.45 (3.1)
Compressive ultimate strength, ksi (MPa)	38.9 (268)

*14 days, 160°F water immersion

Mechanical data [values are average and do not constitute a specification]

MR60H Uni Carbon, 36%RC, vacuum bag cured, 120min at 265°F, norm. to 60%FV

Property	Test method	-65°F (-53°C)	RT	225°F (107°C)
0° Tensile strength, ksi (MPa)		401 (2760)	417 (2870)	-
0° Tensile modulus, Msi (GPa)	ASTM D3039	23.6 (162)	24.5 (168)	-
90° Tensile strength, ksi (MPa)		-	6.25 (43.1)	5.90 (40.6)
90° Tensile modulus, Msi (GPa)		1.28 (8.82)	1.15 (7.93)	1.19 (8.20)
0° Compressive strength, ksi (MPa)		248 (1710)	228 (1570)	189 (1300)
0° Compressive modulus, Msi (GPa)	ASTM D695mod	20.9 (144)	21.9 (151)	20.7 (142)
90° Compressive strength, ksi (MPa)		31.9 (220)	23.9 (164)	-
90° Compressive modulus, Msi (GPa)		1.39 (9.58)	1.23 (8.48)	-
0° Flexural strength, ksi (MPa)		-	229 (1570)	169 (1160)
0° Flexural modulus, Msi (GPa)	ASTM D790	-	22.4 (154)	22.6 (155)
90° Flexural strength, ksi (MPa)		-	13.7 (94.4)	9.50 (65.5)
* ±45° In-plane shear strength, ksi (MPa)	SACMA 5R-94	8.88 (61.2)	8.25 (56.8)	-
* ±45° In-plane shear modulus, Msi (GPa)		0.64 (4.4)	0.735 (5.06)	-
0° Short beam shear strength, ksi (MPa)	SACMA 8R-94	12.6 (86.8)	12.7 (87.5)	8.90 (61.3)
Open hole tensile strength, ksi (MPa)	ASTM D5766	66.1 (455)	76.3 (526)	-
Open hole tensile modulus, Msi (GPa)		-	7.30 (50.3)	-
Open hole compressive strength, ksi (MPa)	ASTM D6484	-	39.2 (270)	-
Compressive strength after impact, ksi (MPa)	ASTM D7136 ASTM D7137	-	27.7 (191)	-

* @5% strain

MR60H Uni Carbon, 36%RC, vacuum bag cured, 120min at 265°F, norm. to 60%FV

Property	Test method	180°F (82°C)	180°F (82°C) wet*
0° Tensile strength, ksi (MPa)		437 (3010)	433 (2980)
0° Tensile modulus, Msi (GPa)	ASTM D3039	24.3 (167)	24.1 (166)
90° Tensile strength, ksi (MPa)		-	3.63 (25.0)
90° Tensile modulus, Msi (GPa)		-	0.865 (5.96)
0° Compressive strength, ksi (MPa)		200 (1370)	181 (1240)
0° Compressive modulus, Msi (GPa)	ASTM D695mod	20.9 (144)	21.3 (146)
90° Compressive strength, ksi (MPa)		-	13.6 (93.7)
90° Compressive modulus, Msi (GPa)		-	1.01 (6.96)
0° Flexural strength, ksi (MPa)		184 (1260)	165 (1130)
0° Flexural modulus, Msi (GPa)	ASTM D790	21.5 (148)	21.9 (151)
90° Flexural strength, ksi (MPa)		-	8.10 (55.8)
** ±45° In-plane shear strength, ksi (MPa)	SACMA 5R-94	6.96 (48.0)	4.74 (32.6)
** ±45° In-plane shear modulus, Msi (GPa)		0.440 (3.03)	0.360 (2.48)
0° Short beam shear strength, ksi (MPa)	SACMA 8R-94	9.26 (63.8)	7.66 (52.8)
Open hole tensile strength, ksi (MPa)	ASTM D5766	82.8 (571)	77.0 (531)
Open hole tensile modulus, Msi (GPa)		7.55 (52.0)	7.40 (51.0)
Open hole compressive strength, ksi (MPa)	ASTM D6484	38.1 (262)	33.6 (231)

* 14 days, 160°F water immersion

** @5% strain

HS40 Uni Carbon, 145gsm, 35%RC, autoclave cured, 80 psi, 90min. at 275°F, norm. to 60%FV

Property	Test method	RT
0° Tensile strength, ksi (MPa)		345 (2370)
0° Tensile modulus, Msi (GPa)	ASTM D3039	37.3 (257)
Poisson's ratio		0.229 (1.57)
0° Compressive strength, ksi (MPa)	ASTM D695mod	186 (1280)
0° Compressive modulus, Msi (GPa)		36.8 (253)
0° Flexural strength, ksi (MPa)	ASTM D790	212 (1460)
0° Flexural modulus, Msi (GPa)		32.9 (226)
0° Short beam shear strength, ksi (MPa)	ASTM D2344	12.6 (86)



TR30S 3KPW Carbon fabric, 42%RC, autoclave cured, 80 psi, 90min. at 265°F, norm. to 60%FV

Property	Test method	RT
0° Tensile strength, ksi (MPa)	ASTM D3039	111 (765)
0° Tensile modulus, Msi (GPa)		9.6 (66)
0° Compressive strength, ksi (MPa)	ASTM D695mod	106 (731)
0° Compressive modulus, Msi (GPa)		8.8 (60)
0° Flexural strength, ksi (MPa)	ASTM D790	136 (937)
0° Flexural modulus, Msi (GPa)		8.8 (60)
0° Short beam shear strength, ksi (MPa)	ASTM D2344	9.6 (66)

AS-4C 3K 8HS Carbon fabric, 40%RC, vacuum bag cured, 120min. at 265°F, norm. to 60%FV

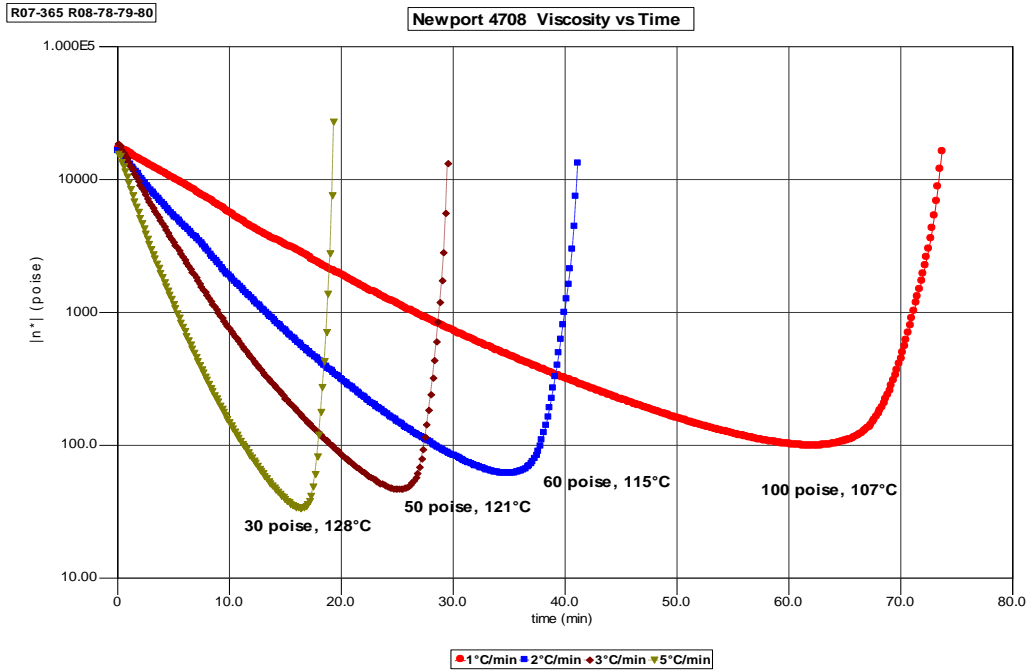
Property	Test method	RT	225°F (107°C)	180°F (82°C) wet	200°F (93°C) wet
0° Tensile strength, ksi (MPa)	ASTM D3039	118 (813)	100 (689)	100 (689)	-
0° Tensile modulus, Msi (GPa)		9.1 (62)	8.9 (61)	9.1 (62)	-
0° Compressive strength, ksi (MPa)	ASTM D695mod	103 (710)	75 (510)	74 (510)	65 (440)
0° Flexural strength, ksi (MPa)	ASTM D790	140 (965)	92 (630)	89 (610)	-
0° Flexural modulus, Msi (GPa)		8.2 (57)	7.4 (51)	7.5 (52)	-
0° Short beam shear strength, ksi (MPa)	SACMA 8R-94	9.9 (68)	6.1 (42)	6.4 (44)	5.5 (37)

7781 E-glass fabric, 38% RC, vacuum bag cured, 3°F/min., 120min. at 265°F, norm. to 60%FV

Property	Test method	RT	225°F (107°C)	180°F (82°C) wet	200°F (93°C) wet
0° Tensile strength, ksi (MPa)	ASTM D638 Type II	101 (696)	82 (565)	58 (400)	-
0° Tensile modulus, Msi (GPa)		4.7 (32)	5.1 (35)	4.7 (32)	-
0° Compressive strength, ksi (MPa)	ASTM D695mod	115 (793)	84 (579)	72 (496)	66 (455)
0° Compressive modulus, Msi (GPa)		5.0 (34)	-	4.9 (34)	-
0° Flexural strength, ksi (MPa)	ASTM D790	136 (938)	99 (683)	80 (552)	74 (510)
0° Flexural modulus, Msi (GPa)		4.6 (32)	4.3 (30)	4.3 (30)	4.2 (29)
0° Short beam shear strength, ksi (MPa)	SACMA 8R-94	13 (18)	8.8 (12)	5.7 (7.7)	4.5 (6.1)

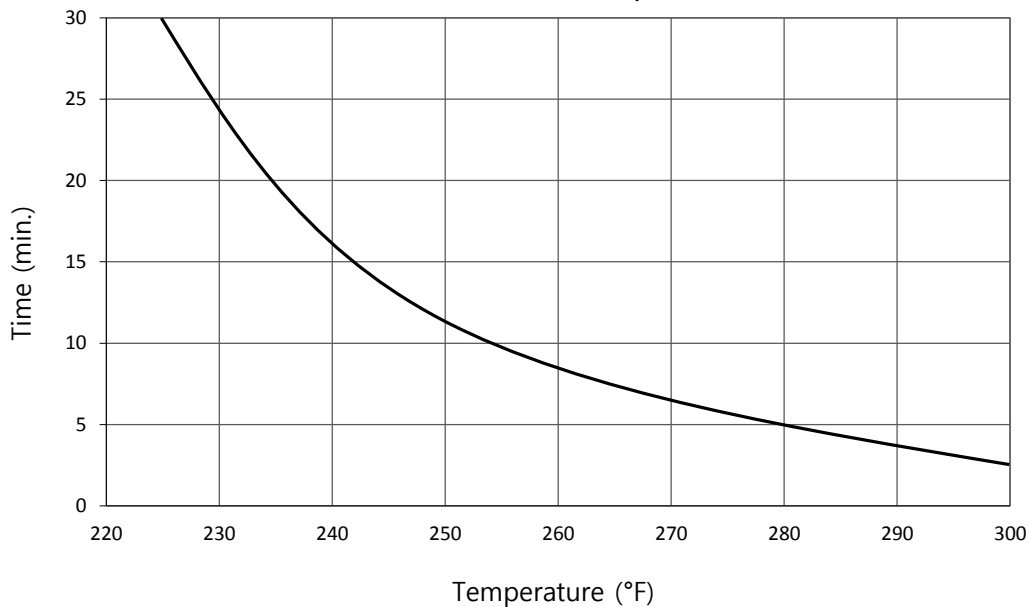
Viscosity profile

TA - AR2000 parallel plate rheometer



Gel curve

Gel time vs. temperature



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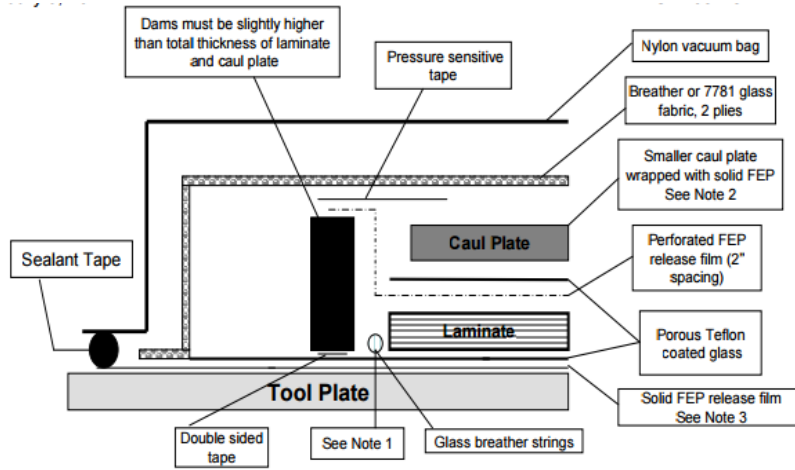
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Recommended bagging assembly



Notes:

1. Dams can consist of various materials (sealant tape, cork, other stiff materials, but silicone rubber is preferred). For volatile removal they can be wrapped with 7781 glass cloth, or alternatively, 3-4 glass breather strings can be placed against all edges between the dam and the laminate as shown in Fig.2. All materials must connect to the vacuum path. The edge of the dams must be slightly higher than the total thickness of the laminate and the caul (pressure) plate.
2. For optimum laminate quality, the caul (pressure) plate should be smaller than the actual laminate size by 0.25"-0.5" on each side. Recommended plates are made of stainless steel, 0.04" (1 mm) thick.
3. The tool does not require a release film if it has been treated with a release agent.

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