

## MTM<sup>®</sup> 44-1

MTM44-1 is a high performance, 180°C (356°F) curing, toughened epoxy resin formulated for the production of primary and secondary aircraft structures.

MTM44-1 can be processed via low pressure vacuum bag Out-of-Autoclave (OoA) moulding or autoclave moulding.

Advantages of MTM44-1 include excellent Tg retention under wet conditions, low density and a high level of damage tolerance.

MTM44-1 meets NASA outgassing requirements and can be used in space structures.

### Features and Benefits

- 21 days out life at 21°C (70°F) (also validated as 21 days up to 28°C and beyond 21 days for temperatures less than 28°C. Contact Solvay for further information).
- 12 months storage at -18°C (0°F)
- Meets NASA outgassing standards when tested to ECSS-Q-ST-70-02C
- Low density offers 2-4% weight saving compared to standard aerospace matrices
- Available in unidirectional prepreg for hand lay-up, ATL and AFP
- Available in fabric formats
- Out-of-Autoclave (OoA) or autoclave cure
- 130°C (266°F) or 180°C (356°F) initial cure options
- 190°C (374°F) dry Tg following 180°C (356°F) cure
- 150°C (302°F) wet Tg following 180°C (356°F) cure
- Excellent damage tolerance
- Compatible FM 309-1 OoA adhesive film

### RELATED DOCUMENTS

- De-bulking guidelines (TDS1036)
- MTM44-1 and MTM45-1 lay-up and bagging guidelines (TDS1043)
- Autoclave processing lay-up and bagging guidelines (TDS1037)
- FM309-1 Adhesive Film
- SM905 Surfacing Film

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## CURE CYCLE

### Oven vacuum bag cure

Vacuum bag pressure	Minimum of 980 mbar (29"Hg) <sup>*</sup>
Ramp rate	1 to 2°C (1.8 to 3.6°F)/minute
Recommended cure cycle	2 hours at 130°C (266°F) + 2 hours at 180°C (356°F)
Cool down	Maximum of 3°C (5.4°F)/minute to 60°C (140°F)

<sup>\*</sup>This is the ideal vacuum level, however, it is recognised that it is not always possible to attain. If in doubt, please contact our technical support staff for advice.

### Autoclave cure

Vacuum bag pressure	Minimum of 980 mbar (29"Hg) <sup>*</sup>
Autoclave pressure	6.2 bar (90 psi) <sup>**</sup>
Ramp rate	1 to 2°C (1.8 to 3.6°F)/minute
Recommended cure cycle	2 hours at 180°C (356°F)
Cool down	Maximum of 3°C (5.4°F)/minute to 60°C (140°F)

<sup>\*</sup>This is the ideal vacuum level, however, it is recognised that it is not always possible to attain. If in doubt, please contact our technical support staff for advice.

<sup>\*\*</sup>If producing sandwich panels, apply the maximum pressure allowable for the honeycomb type.

### Alternative cure cycle

Temperature	Duration
130°C (266°F)	4 hours

Notes:

- The alternative cure cycle is suitable for autoclave and oven vacuum bag cures.
- The alternative cure cycle is recommended when using tooling that cannot withstand 180°C.
- Parts cured using the alternative cure cycle must be post-cured for 2 hours at 180°C (356°F)

## POST-CURE

Following a 130°C (266°F) initial cure, the material will be in a relatively low state of cure. To develop full mechanical performance and maximum Tg, parts must be post-cured to 180°C (356°F) for 2 hours.

Ramp rate	0.3°C (0.5°F)/minute
Post-cure cycle	2 hours at 180°C -0/+5°C (356°F -0/+9°F) <sup>*</sup>
Cool down	2°C (3.6°F)/minute to 60°C (140°F)

<sup>\*</sup> Temperature must be measured by the lagging thermocouple attached to the part.

Notes:

- Parts may be loaded into a pre-heated oven or heated at 3°C (5.4°F)/minute to the initial cure temperature.
- Large components should be adequately supported to avoid distortion.

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**PHYSICAL PROPERTIES**

Test	Sample/test conditions	Results
Cured resin density		1.18 g/cm <sup>3</sup>
DMA E' onset Tg, SACMA	Dry Wet* Skydrol†	190°C (374°F) 155°C (311°F) 190°C (374°F)
Resin gel time	At 130°C (266°F)	140 minutes
Viscosity	At 80°C (176°F) At 130°C (266°F) At 140°C (284°F) At 160°C (320°F)	200 Pa.s 10 Pa.s 6 Pa.s 1.5 Pa.s
Moisture pick-up (cast resin)	At 25°C (77°F)/60%RH At 60°C (140°F)/60%RH	1.46% ± 0.01% 1.45% ± 0.05%
Moisture pick-up (MTM44-1/M55J 32%)	At 25°C (77°F)/60%RH At 60°C (140°F)/60%RH	0.39% ± 0.02% 0.39% ± 0.01%
Outgassing (MTM44-1/M55J 32%) Test Method ECSS-Q-ST-70-02C	Total mass loss (TML) Recovered mass loss (RML) Water vapour release (WVR) Collected volatile condensable material (CVCM)	0.307% 0.056% 0.251% 0.002%

\*14 days immersion at 70°C (158°F)

Note:

All data generated on samples cured for 2 hours at 180°C (356°F)

**MECHANICAL PROPERTIES**

Cure cycle: 2 hours at 180°C (356°F), oven vacuum bag cure.

Test conditions: Room temperature, dry

Test	Test method	Units	145 g/m <sup>2</sup> 12k HTS5631UD	268 g/m <sup>2</sup> 24k IMS5131 UD	283 g/m <sup>2</sup> 3k HTA5131 5-HS Fabric (CF0604)
0° Tensile modulus	ASTM D3039	GPa (msi)	128.9 (18.6)	174.6 (25.3)	62.6 (9)
0° Tensile strength		MPa (ksi)	2159 (313)	2738 (397)	927 (134.4)
0° Compressive modulus	ASTM D695 (MOD)	GPa (msi)	123.2 (17.8)	147.2 (21.3)	59.4 (8.6)
0° Compressive strength		MPa (ksi)	1330 (192.8)	1459 (211.5)	729 (105.7)
In-plane shear modulus (IPSM)	ASTM D3518	GPa (msi)	4.11 (0.6)	3.60 (0.5)	3.98 (0.58)
In-plane shear strength (IPSS)		MPa (ksi)	112.7 (16.3)	76 (11)	133 (19.3)
0° Flexural modulus	CRAG 200	GPa (msi)	121.9 (17.7)	154.9 (22.4)	57.1 (8.2)
0° Flexural strength		MPa (ksi)	1958 (238.9)	1874 (271.7)	1181 (171.2)
0° Interlaminar shear strength (ILSS)	ASTM D2344	MPa (ksi)	106.6 (15.4)	109.4 (15.8)	75.4 (10.9)

All data, except for ILSS and IPSS & IPSM normalised to 55%Vf for fabric reinforced samples and 60%Vf for unidirectional reinforced samples.

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**Hot/wet laminate performance**

Test	Test method	Units	Test conditions	Stitched NCF HTS5631 UD	134g/m <sup>2</sup> 12k HTS5631 UD	285g/m <sup>2</sup> 6k HTA5131 2x2 Twill Fabric
0° Interlaminar shear strength (ILSS)	EN2563	MPa (ksi)	RT/dry 120°C (248°F)/dry* 120°C (248°F)/wet*	96 (13.9) 68 (9.86) 50 (7.25)	94 (13.6) 58 (8.4) 50 (7.25)	69 (10) 48 (6.9) 39 (5.6)

\* Equilibrium at 70°C (158°F)/85% R.H.

**Open hole compression strength**

Test	Test method	Units	Test conditions	134g/m <sup>2</sup> 12k HTS5631 UD	268g/m <sup>2</sup> 24k IMS5131 UD	285g/m <sup>2</sup> 6k HTA5131 2x2 Twill Fabric
OHC – Quasi-isotropic	LIS/MECH/280	MPa (ksi)	RT/dry	311 (45.1)	304 (44.1)	319 (46.3)

Unidirectional data normalised to 60% Vf, fabric data to 55% Vf.

**Compressive strength after impact (CSAI)**

Test	Test method	Units	Test conditions	32-ply 145g/m <sup>2</sup> 12k HTS5631 UD	16-ply 268g/m <sup>2</sup> 24k IMS5131 UD	16-ply 283g/m <sup>2</sup> 3k HTA5131 5-HS Fabric (CF0604)
CSAI– Quasi-isotropic	SRM 2R-94 Impact 6.7J/mm	MPa (ksi)	RT/dry	259 (37.6) [32 J]	247 (35.8) [28 J]	329 (47.7) [33.5 J]

Unidirectional data normalised to 60% Vf, and fabric data to 55% Vf.

[J] = Actual impact energy for test laminate.

**AVAILABILITY**

MTM44-1 is available as a fabric prepreg, unidirectional prepreg or slit tape.

**STORAGE**

Out life\* at 21°C (70°F) 21 days

Storage at -18°C (0°F) 12 months from date of manufacture

\*Out life refers to accumulated time out of the freezer before the part is cured.

Note:

The actual freezer storage life and out life are dependent on a number of factors, including; fibre type, format and application. For certain formats, it may be possible for the storage life and out life to be longer than stated. Please contact our technical support staff for advice.

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## EXOTHERM

MTM<sup>®</sup> 44-1 prepregs are reactive formulations which can undergo severe exothermic heat up during the initial curing process if incorrect curing procedures are followed.

Great care must be taken to ensure that safe heating rates, dwell temperatures and lay-up/bagging procedures are adhered to, especially when moulding solid laminates in excess of 10mm (0.4in) thickness. The risk of exotherm increases with lay-up thickness and increasing cure temperature. It is strongly recommended that trials, representative of all the relevant circumstances, are carried out by the user to allow a safe cure cycle to be specified. It is also important to recognise that the model or tool material and its thermal mass, combined with the insulating effect of breather/bagging materials can affect the risk of exotherm in particular cases.

## HEALTH & SAFETY

Please refer to the product SDS for safe handling, personal protective equipment recommendations and disposal considerations.

