

## PRODUCT DATA SHEET

### DESCRIPTION

Toray MS-1H is a carbon fiber/epoxy resin compression molding system using a high-modulus PAN carbon fiber. This is an excellent high stiffness molding compound that has been qualified to military and commercial applications. It has excellent out time stability and processes very well in small and thin cross-section parts. It is the performance alternative to MS-4H 25.4 mm (1") molding compound. MS-1H is offered with 25.4 mm (1") carbon fibers, or for smaller parts, a 12.7 mm (1/2") fiber version is available.

### PRODUCT TYPE

138°C (280°F) Fast Cure Intermediate-Modulus Compression Molding System

### SHELF LIFE

**Out Life:** 14 days at 25°C (77°F)

**Frozen Storage Life:** 6 months at -18°C (< 0°F)

Out life is the maximum time allowed at room temperature before cure.

### TYPICAL NEAT RESIN PROPERTIES

Fiber Length	12.7 mm (1/2") and 25.4 mm (1")
Density	1.48–1.52 g/cc
Thermal Expansion X,Y	7.2–12.6 ppm/°C (4–7 ppm/°F)
T <sub>g</sub> (by DSC)	191°C (375°F) post cured at 177°C (350°F)

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### MECHANICAL PROPERTIES (12.7 mm, 1/2" FIBER LENGTH)

Property	Condition	Method	Typical Results	
Tensile Strength 0°	RTD	ASTM D 3039	255.8 MPa	37.1 ksi
Tensile Modulus 0°	RTD	ASTM D 3039	68.9 GPa	10 Msi
Compressive Strength 0°	RTD	ASTM D 6484	226.1 MPa	32.8 ksi
Compressive Modulus 0°	RTD	ASTM D 6484	63.4 GPa	9.2 Msi
Flexural Strength 0°	RTD	ASTM D 6272	439.2 MPa	63.7 ksi
Flexural Modulus 0°	RTD	ASTM D 6272	68.9 GPa	10 Msi
Open-Hole Comp. Strength	RTD	ASTM D 6484	209.6 MPa	30.4 ksi
Compression after Impact	RTD	ASTM D 7137*	137.2 MPa	19.9 ksi
Notched Shear Strength	RTD	ASTM D 7079	166.9 MPa	24.2 ksi
Notched Shear Modulus	RTD	ASTM D 7079	17.9 GPa	2.6 Msi
Bolt Bearing Str. (Single Shear)	RTD	ASTM D 5961	664.0 MPa	96.3 ksi

All items are net molded coupons unless noted

\* Machine Molded

All properties based on a fiber volume of 48–50%

All properties based on the average of a 3 batch qualification. Full details are available upon request

Actual molding technique and conditions, fiber length, and part geometry will affect properties obtained

Above values derived after post cure of 177°C (350°F) for 1–2 hours

### BMC MOLDING GUIDELINES

1. Pre-weigh the desired amount of molding compound
2. Preheat the molding compound at 71°C ± 5.5°C (160°F ± 10°F) for 10 minutes
3. Form a mold charge to approximately fit the mold cavity
4. Place the charge in the mold cavity
5. Cure: 138–154°C (280–310°F). Pinch pressure 250 psi for 15–30 seconds
6. Close mold to 2000 psi for 15–30 minutes depending on part thickness
7. Post cure at 177°C (350°F) for 1–2 hours

### TROUBLESHOOTING

#### BLISTERING OR BUBBLES:

- ▶ Check mold surface temperature
- ▶ Increase molding pressure
- ▶ Check for moisture in the material

#### CRACKS OR STRESS MARKS:

- ▶ Check mold surface temperature
- ▶ Check cure time
- ▶ Clean mold surface and re-apply mold release
- ▶ Check ejection pressure, slow down ejection

#### FLOW MARKS:

- ▶ Close press sooner after charge has been placed in the cavity
- ▶ Increase press closure speed
- ▶ Check mold surface temperature

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### RESIN STARVATION:

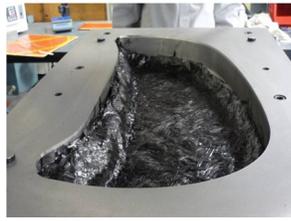
- ▶ Check material out time and staging temperature, keep charge material covered, and in plastic bags
- ▶ Adjust charge weight
- ▶ Clean mold surface and re-apply mold release

### VOIDS:

- ▶ Check charge set-up, shape, and weight
- ▶ Check mold surface temperature
- ▶ Check preheat time and temperature
- ▶ Check press closure time
- ▶ Clean mold surface and re-apply mold release

### THICK PART—UNEVEN DISTRIBUTION OF MATERIAL

- ▶ Pre-consolidate thick sections
- ▶ Spread molding compound in measured increments
- ▶ Evaluate if press capacity is large enough for even pressure across part



### GENERAL NOTES

Note that 25.4 mm, 12.7 mm, 6.35 mm (1", ½", and ¼") material will be slightly different with the longer chop length showing as bulkier than the shorter chop lengths. Generally, the material does not brick up (unless exposed to heat or warmth) and is typically free flowing as received once broken free of the packaging. Some centering or clumping is not uncommon; however, when cool, the material should crumble out of the packaging. The bulk volume of the uncured uncompressed material is ~5X that of the compressed/cured part.

When preheated, a preformed charge will shrink maybe 10% if no pressure of any kind is applied other than gravity. It may debulk down 20–30% if pressure is applied, even hand pressure.

- ▶ The calculated cured density of the material is ~1.483 g/cc (~92.6 lb/ft<sup>3</sup>)
- ▶ A 1.36 kg (3 lb) bag of 25.4 mm (1") material will measure out to a football shape when in a bag of ~304.8 mm x 254 mm x 127 mm, (~12" x 10" x 5")
- ▶ This loosely calculates to a 10 to 1 ratio; however, the bagged material is not rectangular in shape

Revised 07/2019

TORAY\_MS-1H\_PDS\_v2.0\_2019-07-09 Page 3/3

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