

Amodel® AT-1002 HS

polyphthalamide

Amodel® AT-1002 HS is a neat, toughened, heat stabilized polyphthalamide (PPA) resin that offers superior retention of properties after humid thermal aging; high impact at low temperature and better mechanical properties than many unreinforced thermoplastic polyester and nylon resins.

This material was specifically designed for automotive electrical/electronic applications such as connectors, sockets and sensors.

• Natural: AT-1002 HS NT

General			
Material Status	Commercial: Active		
Availability	 Africa & Middle East Asia Pacific Europe	Latin AmericaNorth America	
Additive	Heat StabilizerImpact Modifier	LubricantMold Release	
Features	Chemical ResistantDuctileHeat StabilizedHot Water Moldability	 Impact Modified Low Temperature Impact Resistance Low Warpage Lubricated 	
Uses	Automotive ApplicationsAutomotive ElectronicsAutomotive Under the Hood	Machine/Mechanical PartsMetal ReplacementValves/Valve Parts	
RoHS Compliance	• RoHS Compliant		
Automotive Specifications	 DELPHI MS008756 Color: NT Nati FORD WSS-M98P14-A3¹ GM GMP.PPA.015 Color: Natural 	• GM GMW16799P-PI • IMDS ID 11974222 C	
Appearance	 Natural Color 		
Forms	 Pellets 		
Processing Method	 Water-Heated Mold Injection M 	Iolding	
Physical	Dry	Conditioned Unit	Test method
Density	1.13	g/cm³	ISO 1183/A
Molding Shrinkage			ASTM D955
Flow	2.0	%	
Across Flow	2.1	%	
Water Absorption (24 hr)	0.50	%	ASTM D570
Mechanical	Dry	Conditioned Unit	Test method
Tensile Modulus			
	2760	2760 MPa	ASTM D638
23°C	2760	MPa	ISO 527-1
100°C	2100	MPa	ISO 527-1

Tensile Stress Yield, 100°C 75.2 MPq ISO 527-2 Vield, 100°C 33.6 MPq ISO 527-2 Break, 23°C 68.3 MPq ISO 527-2 Break, 23°C 68.3 MPq ISO 527-2 Break, 23°C 68.3 MPq ISO 527-2 Probability ISO 178 Probability ISO 179 Probability ISO 179 Probability ISO 179 Probability ISO 179 Probability	Mechanical	Dry	Conditioned	Unit	Test method
Yield, 100°C 38.6 MPa (SO 527-2 Break, 23°C) 68.3 MPa (SO 527-2 MPa) 100 527-2 MPa (SO 527-2 MPa) 100 527-2 MPa (SO 527-2 MPa) ASTM D638 MPa (SO 527-2 MPa) ASTM D640 MPa (SO 527-2 MPa) ASTM D790 MPa (SO 527-2 MPa) ASTM D790 MPa (SO 527-2 MPa) ASTM D790 MPa (SO 517-2 MPa) ASTM D790 MPa (SO 517-	Tensile Stress	,			
Break, 23°C 68.3 MPa ISO 527-2 83.4 76.5 MPa ASTM D638 Tensile Strain ISO 527-2 Yield, 23°C 5.0 % Yield, 100°C 3.7 % Yield, 100°C 15 % Break, 23°C 15 % Yield, 23°C ASTM D790 23°C 2280 MPa ISO 178 100°C 1720 MPa ISO 178 Flexural Strength 103 73.1 MPa ASTM D790 23°C 79.3 MPa ISO 178 100°C 49.6 MPa ISO 178 Shear Strength 64.1 57.2 MPa ASTM D790 Shear Strength 64.1 57.2 MPa ASTM D792 Impact Dry Conditioned Unit Test method Charpy Unnotched Impact Strength 13 kJ/m² ISO 179/lea Charpy Unnotched Impact Strength kJ/m² ISO 180/la Unnotched Izod Impact kJ/m² ISO 180/la	Yield, 23°C	75.2		MPa	ISO 527-2
Tensile Strain ISO 527-2 Yield, 23°C 5.0 % Yield, 100°C 3.7 % Break, 23°C 15 % Break, 23°C 15 % Flexural Modulus MPa 1SO 178 2210 2280 MPa ASTM D790 23°C 2280 MPa 1SO 178 100°C 1720 MPa 1SO 178 100°C 79.3 MPa 1SO 178 100°C 49.6 MPa 1SO 178 Shear Strength 64.1 57.2 MPa ASTM D790 Shear Strength 64.1 57.2 MPa ASTM D792 Impact Dry Conditioned Unit Test method Charpy Notched Impact Strength (23°C) 13 kJ/m² ISO 179/leA Charpy Unnotched Impact Strength (23°C) 13 kJ/m² ISO 180/la Unnotched Izod Impact Strength (23°C) 13 kJ/m² ISO 180/la Unnotched Izod Impact Strength (23°C) kJ/m² ISO 180/la <td>Yield, 100°C</td> <td>38.6</td> <td></td> <td>MPa</td> <td>ISO 527-2</td>	Yield, 100°C	38.6		MPa	ISO 527-2
Tensile Strain	Break, 23°C	68.3		MPa	ISO 527-2
Yield, 23°C 5.0 % Yield, 100°C 3.7 % Yield, 100°C 3.7 % Yield, 100°C 3.7 % Yield, 100°C 15 % Yield, 100°C 15 % Yield, 100°C 15 % Yield, 23°C 15 % Yield, 23°C 2280 MPa ASTM D790 150 178 180 178 180 178 180 178 180 178 180 178 180 178 180 178 180 178 180 178 180 178 180 178 180 178 180 178 180 178 180 178 180 179 180 178 180 179		83.4	76.5	MPa	ASTM D638
Yield, 100°C Break, 23°C 3.7 — % — % Flexural Modulus — 2210 2280 MPa ASTM D790 23°C 2280 — MPa 1SO 178 100°C 1720 — MPa 1SO 178 100°C 79.3 — MPa 1SO 178 100°C 49.6 — MPa 1SO 178 100°C 49.6 — MPa 1SO 178 Shear Strength 64.1 57.2 MPa ASTM D790 Shear Strength 13 — kJ/m² 1SO 179/led Charpy Notched Impact Strength (23°C) 13 — kJ/m² ISO 179/led Charpy Unnotched Impact Strength (23°C) 13 — kJ/m² ISO 179/led Notched Izod Impact — 140 150 J/m ASTM D256 23°C 13 — kJ/m² ISO 180/lu Unnotched Izod Impact Strength (23°C) 13 — kJ/m² ISO 180/lu Unnotched Izod Impact Strength (23°C) 4448 4003 N ASTM D2763 Penetration Impact 2 4448 4003 N ASTM D3763	Tensile Strain				ISO 527-2
Break, 23°C 15 % Flexural Modulus 2210 2280 MPa ASTM D790 23°C 2280 MPa ISO 178 100°C 1720 MPa ISO 178 Flexural Strength MPa ASTM D790 23°C 79.3 MPa ISO 178 100°C 49.6 MPa ISO 178 Shear Strength 64.1 57.2 MPa ASTM D792 Impact Dry Conditioned Unit Test method Charpy Notched Impact Strength (23°C) 13 kJ/m² ISO 179/leA Charpy Unnotched Impact Strength (23°C) 13 kJ/m² ISO 179/leA Notched Izod Impact 140 150 J/m ASTM D256 23°C 13 kJ/m² ISO 180/la Unnotched Izod Impact Strength (23°C) 13 kJ/m² ISO 180/la 10 Instrumented Dart Impact (123°C) kJ/m² ISO 180/la 10 Instrumented Dart Impact (123°C) 54.2 47.5 J ASTM D368 10 Felection Temperat	Yield, 23°C	5.0		%	
Flexural Modulus	Yield, 100°C	3.7		%	
2 2210 2280 MPa ASTM D790 23°C 2280 MPa ISO 178 100°C 1720 MPa ISO 178 Flexural Strength MPa ISO 178 103 73.1 MPa ASTM D790 23°C 79.3 MPa ISO 178 100°C 49.6 MPa ISO 178 Shear Strength 64.1 57.2 MPa ASTM D732 Impact Dry Conditioned Unit Test method Charpy Notched Impact Strength 13 kJ/m² ISO 179/1eA Charpy Unnotched Impact Strength 13 kJ/m² ISO 179/1eA Charpy Unnotched Impact Strength 13 kJ/m² ISO 180/1eA Unnotched Izod Impact 140 150 J/m ASTM D26 23°C 13 kJ/m² ISO 180/1u Unnotched Izod Impact Strength 54.2 47.5 J ASTM D3763 Instrumented Dart Impact 54.2 47.5 J ASTM D3763 Penetration Impact²	Break, 23°C	15		%	
23°C 1700°C 1720 MPa 150 178 100°C 1720 MPa 150 178 150 179 150 179	Flexural Modulus				
100°C 1720 MPa ISO 178 103 73.1 MPa ASTM D790 23°C 79.3 MPa ISO 178 100°C 49.6 MPa ISO 178 100°C 100°C 100°C 100°C 100°C 13° 100°C 100°C 100°C 100°C 13° 100°C 100°C 100°C 100°C 100°C 13° 100°C 100°C 100°C 100°C 100°C 100°C 100°C 100°C 100°C 100°C 100°C 100°C 100°C 100°C 100°C 100°C		2210	2280	MPa	ASTM D790
Flexural Strength	23°C	2280		MPa	ISO 178
Description	100°C	1720		MPa	ISO 178
23°C 79.3 MPa ISO 178 100°C 49.6 MPa ISO 178 Shear Strength 64.1 57.2 MPa ASTM D732 Impact Dry Conditioned Unit Test method Charpy Notched Impact Strength (23°C) 13 kJ/m² ISO 179/1eA Charpy Unnotched Impact Strength (23°C) 140 150 J/m ASTM D256 23°C 13 kJ/m² ISO 180/1a Unnotched Izod Impact Strength (23°C) 13 kJ/m² ISO 180/1a Unnotched Izod Impact Strength (23°C) 54.2 47.5 J ASTM D3763 Instrumented Dart Impact (70tal Energy) 54.2 47.5 J ASTM D3763 Penetration Impact² 4448 4003 N ASTM D3763 Thermal Dry Conditioned Unit Test method Deflection Temperature Under Load 0.45 MPa, Annealed 163 °C ASTM D648 1.8 MPa, Unannealed 118 °C ASTM D648 1.8 MPa, Annealed 121 °C ASTM D648 <t< td=""><td>Flexural Strength</td><td></td><td></td><td></td><td></td></t<>	Flexural Strength				
100°C 49.6 MPa		103	73.1	MPa	ASTM D790
Shear Strength 64.1 57.2 MPa ASTM D732 Impact Dry Conditioned Unit Test method Charpy Notched Impact Strength (23°C) 13 kJ/m² ISO 179/1eA Charpy Unnotched Impact Strength (23°C) 140 150 J/m ASTM D256 23°C 13 kJ/m² ISO 180/1a Unnotched Izod Impact Strength (23°C) 13 kJ/m² ISO 180/1a Unnotched Izod Impact Strength (23°C) 54.2 47.5 J ASTM D3763 Instrumented Dart Impact (Total Energy) 54.2 47.5 J ASTM D3763 Penetration Impact² 4448 4003 N ASTM D3763 Thermal Dry Conditioned Unit Test method Deflection Temperature Under Load 0.45 MPa, Annealed 163 °C ASTM D648 1.8 MPa, Unannealed 118 °C ISO 75-2/Af 1.8 MPa, Annealed 121 °C ASTM D648 1.8 MPa, Annealed 121 °C ASTM D648 1.8 MPa, Annealed 121 °C ASTM E31	23°C	79.3		MPa	ISO 178
Impact Dry Conditioned Unit Test method Charpy Notched Impact Strength (23°C) 13 kJ/m² ISO 179/leA Charpy Unnotched Impact Strength (23°C) kJ/m² ISO 179/leU Notched Izod Impact 140 150 J/m ASTM D256 23°C 13 kJ/m² ISO 180/la Unnotched Izod Impact Strength (23°C) kJ/m² ISO 180/lu Instrumented Dart Impact (Total Energy) 54.2 47.5 J ASTM D3763 Penetration Impact² 4448 4003 N ASTM D3763 Thermal Dry Conditioned Unit Test method Deflection Temperature Under Load 0.45 MPa, Annealed 163 °C ASTM D648 1.8 MPa, Unannealed 118 °C ASTM D648 1.8 MPa, Annealed 121 °C ASTM D648 Melting Temperature 315 °C ASTM D3418 CLTE Flow: 0 to 100°C 7.8E-5 cm/cm/°C Flow: 100 to 200°C 1.3E-4 cm/cm/°C Flow: 100 to 200°C 1.3E-4	100°C	49.6		MPa	ISO 178
Charpy Notched Impact Strength (23°C) 13 kJ/m² ISO 179/leA Charpy Unnotched Impact Strength (23°C) kJ/m² ISO 179/leU Notched Izod Impact kJ/m² ISO 179/leU 23°C 13 kJ/m² ISO 180/la Unnotched Izod Impact Strength (23°C) kJ/m² ISO 180/la Instrumented Dart Impact (Total Energy) 54.2 47.5 J ASTM D3763 Penetration Impact² 4448 4003 N ASTM D3763 Thermal Dry Conditioned Unit Test method Deflection Temperature Under Load 163 °C ASTM D648 1.8 MPa, Annealed 118 °C ISO 75-2/Af 1.8 MPa, Annealed 121 °C ASTM D648 Melting Temperature 315 °C ASTM D3418 CLTE ASTM E831 ASTM E831 Flow: 0 to 100°C 7.8E-5 cm/cm/°C Flow: 100 to 200°C 1.3E-4 cm/cm/°C Transverse: 0 to 100°C 9.3E-5 cm/cm/°C	Shear Strength	64.1	57.2	МРа	ASTM D732
Charpy Unnotched Impact Strength (23°C)	Impact	Dry	Conditioned	Unit	Test method
Notched Izod Impact Izo Iz		13		kJ/m²	ISO 179/1eA
140 150 J/m ASTM D256 23°C 13 kJ/m² ISO 180/IA Unnotched Izod Impact Strength (23°C) kJ/m² ISO 180/IU Instrumented Dart Impact (Total Energy) 54.2 47.5 J ASTM D3763 Penetration Impact² 4448 4003 N ASTM D3763 Thermal Dry Conditioned Unit Test method Deflection Temperature Under Load 163 °C ASTM D648 1.8 MPa, Annealed 118 °C ISO 75-2/Af 1.8 MPa, Annealed 121 °C ASTM D648 Melting Temperature 315 °C ISO 11357-3 ASTM D3418 °C ISO 11357-3 ASTM D3418 CLTE ASTM E831 Flow : 0 to 100°C 7.8E-5 cm/cm/°C Flow : 100 to 200°C 1.3E-4 cm/cm/°C Transverse : 0 to 100°C 9.3E-5 cm/cm/°C				kJ/m²	ISO 179/1eU
23°C 13 kJ/m² ISO 180/IA Unnotched Izod Impact Strength (23°C) kJ/m² Iso 180/Iu Instrumented Dart Impact (Total Energy) 54.2 47.5 J ASTM D3763 Penetration Impact² 4448 4003 N ASTM D3763 Thermal Dry Conditioned Unit Test method Deflection Temperature Under Load 163 °C ASTM D648 1.8 MPa, Annealed 118 °C ISO 75-2/Af 1.8 MPa, Annealed 121 °C ASTM D648 Melting Temperature 315 °C ISO 11357-3 ASTM D3418 CLTE ASTM E831 Flow : 0 to 100°C 7.8E-5 cm/cm/°C Flow : 100 to 200°C 1.3E-4 cm/cm/°C Transverse : 0 to 100°C 9.3E-5 cm/cm/°C	Notched Izod Impact				
Unnotched Izod Impact Strength (23°C) kJ/m² ISO 180/10 Instrumented Dart Impact (Total Energy) 54.2 47.5 J ASTM D3763 Penetration Impact² 4448 4003 N ASTM D3763 Thermal Dry Conditioned Unit Test method Deflection Temperature Under Load 163 °C ASTM D648 1.8 MPa, Unannealed 118 °C ISO 75-2/Af 1.8 MPa, Annealed 121 °C ASTM D648 Melting Temperature 315 °C ISO 11357-3 ASTM D3418 CLTE ASTM E831 cm/cm/°C Flow : 0 to 100°C 7.8E-5 cm/cm/°C Flow : 100 to 200°C 1.3E-4 cm/cm/°C cm/cm/°C Transverse : 0 to 100°C 9.3E-5 cm/cm/°C	·	140	150	J/m	ASTM D256
Instrumented Dart Impact (Total Energy) 54.2 47.5 J ASTM D3763	23°C	13		kJ/m²	ISO 180/1A
Total Energy S4.2 47.5 3 ASTM D3763				kJ/m²	ISO 180/1U
Penetration Impact 2 4448 4003 N ASTM D3763 Thermal Dry Conditioned Unit Test method Deflection Temperature Under Load 0.45 MPa, Annealed 163 °C ASTM D648 1.8 MPa, Unannealed 118 °C ISO 75-2/Af 1.8 MPa, Annealed 121 °C ASTM D648 Melting Temperature 315 °C ISO 11357-3 ASTM D3418 °C ASTM E831 CLTE ASTM E831 Flow: 0 to 100°C 7.8E-5 cm/cm/°C Flow: 100 to 200°C 1.3E-4 cm/cm/°C Transverse: 0 to 100°C 9.3E-5 cm/cm/°C		54.2	47.5	J	ASTM D3763
Thermal Dry Conditioned Unit Test method Deflection Temperature Under Load 0.45 MPa, Annealed 163 °C ASTM D648 1.8 MPa, Unannealed 118 °C ISO 75-2/Af 1.8 MPa, Annealed 121 °C ASTM D648 Melting Temperature 315 °C ISO 11357-3 ASTM D3418 CLTE ASTM E831 Flow : 0 to 100°C 7.8E-5 cm/cm/°C Flow : 100 to 200°C 1.3E-4 cm/cm/°C Transverse : 0 to 100°C 9.3E-5 cm/cm/°C		ΛΛΛΩ	4003	N	ASTM D2762
Deflection Temperature Under Load 0.45 MPa, Annealed 163 °C ASTM D648 1.8 MPa, Unannealed 118 °C ISO 75-2/Af 1.8 MPa, Annealed 121 °C ASTM D648 Melting Temperature 315 °C ISO 11357-3 ASTM D3418 CLTE ASTM E831 Flow : 0 to 100°C 7.8E-5 cm/cm/°C Flow : 100 to 200°C 1.3E-4 cm/cm/°C Transverse : 0 to 100°C 9.3E-5 cm/cm/°C	r eneration impact	4440	4003	IN	A31W D3703
0.45 MPa, Annealed 163 °C ASTM D648 1.8 MPa, Unannealed 118 °C ISO 75-2/Af 1.8 MPa, Annealed 121 °C ASTM D648 Melting Temperature 315 °C ISO 11357-3 ASTM D3418 CLTE ASTM E831 Flow : 0 to 100°C 7.8E-5 cm/cm/°C Flow : 100 to 200°C 1.3E-4 cm/cm/°C Transverse : 0 to 100°C 9.3E-5 cm/cm/°C	Thermal	Dry	Conditioned	Unit	Test method
1.8 MPa, Unannealed 118 °C ISO 75-2/Af 1.8 MPa, Annealed 121 °C ASTM D648 Melting Temperature 315 °C ISO 11357-3 ASTM D3418 CLTE ASTM E831 Flow: 0 to 100°C 7.8E-5 cm/cm/°C Flow: 100 to 200°C 1.3E-4 cm/cm/°C Transverse: 0 to 100°C 9.3E-5 cm/cm/°C	Deflection Temperature Under Load				
1.8 MPa, Annealed 121 °C ASTM D648 Melting Temperature 315 °C ISO 11357-3 ASTM D3418 CLTE ASTM E831 Flow: 0 to 100°C 7.8E-5 cm/cm/°C Flow: 100 to 200°C 1.3E-4 cm/cm/°C Transverse: 0 to 100°C 9.3E-5 cm/cm/°C	0.45 MPa, Annealed	163		_	ASTM D648
Melting Temperature 315 °C ISO 11357-3 ASTM D3418 CLTE ASTM E831 Flow: 0 to 100°C 7.8E-5 cm/cm/°C Flow: 100 to 200°C 1.3E-4 cm/cm/°C Transverse: 0 to 100°C 9.3E-5 cm/cm/°C	1.8 MPa, Unannealed	118		°C	ISO 75-2/Af
ASTM D3418 CLTE	1.8 MPa, Annealed	121		°C	ASTM D648
Flow: 0 to 100°C 7.8E-5 cm/cm/°C Flow: 100 to 200°C 1.3E-4 cm/cm/°C Transverse: 0 to 100°C 9.3E-5 cm/cm/°C	Melting Temperature	315		°C	
Flow: 100 to 200°C 1.3E-4 cm/cm/°C 7ransverse: 0 to 100°C 9.3E-5 cm/cm/°C	CLTE				
Transverse : 0 to 100°C 9.3E-5 cm/cm/°C	Flow: 0 to 100°C	7.8E-5		cm/cm/°C	
, ,	Flow: 100 to 200°C	1.3E-4			
Transverse : 100 to 200°C 1.4E-4 cm/cm/°C	Transverse : 0 to 100°C	9.3E-5			
	Transverse : 100 to 200°C	1.4E-4		cm/cm/°C	

polyphthalamide

Electrical	Dry	Conditioned Unit	Test method	
Surface Resistivity	8.0E+13	2.5E+13 ohms	ASTM D257	
Volume Resistivity	1.2E+16	7.0E+14 ohms·cm	ASTM D257	
Dielectric Strength	17	17 kV/mm	ASTM D149	
Dielectric Constant			ASTM D150	
60 Hz	3.30	3.80		
1 MHz	3.30	3.80		
Dissipation Factor			ASTM D150	
60 Hz	4.0E-3	0.018		
1 MHz	0.016	0.035		
Comparative Tracking Index	> 600	> 600 V	ASTM D3638	
High Voltage Arc Tracking Rate (HVTR)	12.0	12.0 mm/min	UL 746A	
Flammability	Dry	Conditioned Unit	Test method	
Flame Rating ³	НВ		UL 94	
Injection		Dry Unit		
Drying Temperature	110 °C			
Drying Time	4.0 hr			
Suggested Max Moisture	0.030 to 0.060 %			
Rear Temperature	304 °C			
Front Temperature	324 °C			
Processing (Melt) Temp	321 to 329 °C			
Screw Speed	100 to 200 rpm			
Screw Compression Ratio	2.5:1.0			

Injection Notes

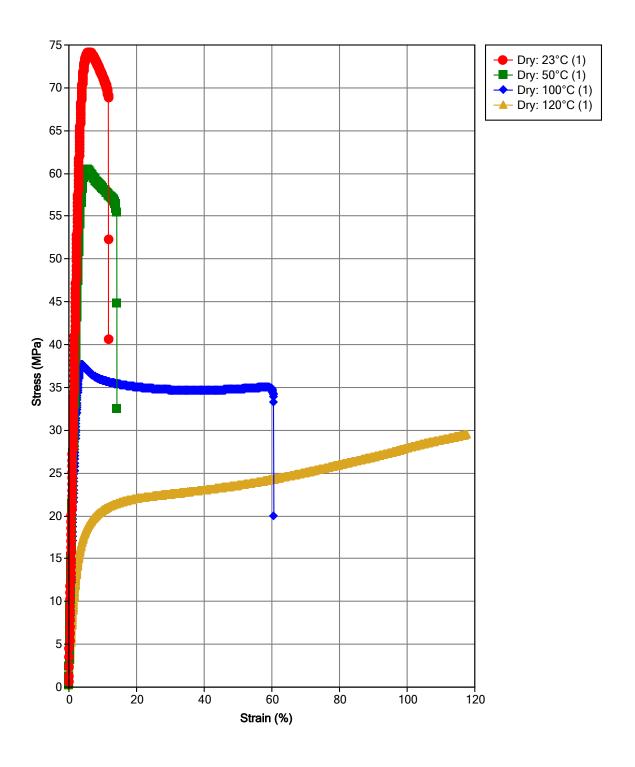
INJECTION RATE: 1 to 3 in/sec

HOLDING PRESSURE: 50% of injection pressure

STORAGE:

• Amodel® compounds are shipped in moisture-resistant packages at moisture levels according to specifications. Sealed, undamaged bags should be preferably stored in a dry room at a maximum temperature of 50°C (122°F) and should be protected from possible damage. If only a portion of a package is used, the remaining material should be transferred into a sealable container. It is recommended that Amodel® resins be dried prior to molding following the recommendations found in this datasheet and/or in the Amodel® processing guide.

Isothermal Stress vs. Strain (ISO 11403)



Data Notes (1) - 2 in/min (50 mm/min)

Amodel® AT-1002 HS polyphthalamide

Notes

Typical properties: these are not to be construed as specifications.

- ¹ Approval listed in Ford MATS system to this fuel performance specification, as well as to Ford WSS-M98P14-A7.
- ² Maximum Load
- ³ This rating is not intended to reflect hazards presented by this or any other material under actual fire conditions.

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