



# Automotive Structural Adhesives

## Scotch-Grip™ Fastener Adhesives 2353, 4844 (Normal Temp Formula)

Data Sheet

June 2000

### General Description



3M Scotch-Grip™ Fastener Adhesives are microencapsulated, room temperature curing adhesives which enhance the anchorage of threaded fasteners. The adhesives are designed to be coated on the fasteners and dried; they remain dormant until the shearing action of engaging the fastener into a nut or threaded cavity breaks the capsules and allows the adhesive to cure. Typical applications are fasteners for the engine compartment or safety-related parts.

Product Features	Performance Advantages	Customer Benefits
Epoxy chemistry	High torque values on coated fasteners  Environmental resistance (to heat, automotive fluids, vibration, thermal and mechanical shock)	Robust, structural bonding performance
2-part (microencapsulated)	Extended shelf life (bulk adhesive and coated fasteners)  Controlled reactivity (adhesive activates and cures upon insertion)  Reusability (additional capsules break with each re-insertion)	Convenient handling by the end-users
Flow coatable formula	Allows controlled application to fasteners; viscosity can be adjusted to achieve target coating weights  Penetrates oil coatings  Fast drying  Bonds to a broad range of fastener finishes	Broad handling, dispensing and drying windows for the applicators

# Data Sheet 2353/4844

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<b>Product Descriptions</b>	2353 (blue)	<b>Normal Temp Formula.</b> Designed for applications where the service temperature will not exceed 240°F (116°C)*.
	4844 (yellow)	
	2510 (orange) 2510N (neutral)	

**High Temp Formula.** Designed for applications where the service temperature might reach continuously up to 300°F (149°C), or intermittently up to 400°F (204°C). Refer to separate data page.

*\* While the functional service temperature upper limit for 2353/4844 is 240°F (116°C) the product can be exposed to temperatures as high as 350°F (177°C). At the higher temperatures there will be loss of adhesion but no damage to the adhesive. When temperature is lowered again, adhesion will be regained.*

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<b>Physical Properties</b>	<b>Bulk adhesive</b>	<b>2353/4844</b>
	Density	8.6 lbs/gallon (1030 kg/m <sup>3</sup> )
	% solids	59%
	Viscosity <sup>1</sup>	1600-2400 cps
	Solvent base	Toluene

<sup>1</sup>Brookfield viscometer, RVF #4 spindle at 20 rpm.

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<b>Handling/ Process Properties</b>	<b>Bulk adhesive</b>	<b>2353/4844</b>
	Container sizes	5 gal (18.9 l) pails
	Shelf life	6 months from date of receipt by customer

Shelf life can be extended by re-mixing the adhesive regularly so that capsules do not coagulate on the bottom of the pails. Adhesive which is more than 6 months from the date of receipt should be checked for performance prior to application on fasteners.

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Storage conditions                      Store pails at 40°-100°F (4°-38°C)

**PROTECT FROM FREEZING;** storage below 32°F (0°C) for extended periods will freeze the adhesive and make it totally unusable. Storage above 120°F (49°C) will shorten the shelf life of the adhesive. Inventory should be rotated on a FIFO (first in, first out) basis.

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**Coated fasteners**

Shelf life                                      1 year from date of adhesive application

Shelf life can be as long as 4 years, depending on the storage conditions. Fasteners which are more than 1 year from the date of adhesive application should be checked for performance prior to use.

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Storage conditions                      Store coated fasteners at 40°-100°F (4°-38°C)

**Performance Properties**

**Prevailing In Torque (PIT)**

2353/4844

initial<sup>1</sup>

1 ft-lb (1.4 Nm)

**Break-Loose Torque (BLT)**

initial<sup>1</sup>

41 ft-lbs (55.8 Nm)

**Break-Away Torque (BAT)**

initial<sup>1</sup>

14 ft-lbs (19.0 Nm)

heat aging<sup>2</sup>

No change ( $\pm 10\%$  of initial value)

cycles<sup>3</sup>

No change ( $\pm 10\%$  of initial value)

water immersion<sup>4</sup>

No change ( $\pm 10\%$  of initial value)

gasoline immersion<sup>5</sup>

No change ( $\pm 10\%$  of initial value)

hot motor oil immersion<sup>6</sup>

No change ( $\pm 10\%$  of initial value)

transmission fluid immersion<sup>7</sup>

No change ( $\pm 10\%$  of initial value)

anti-freeze immersion<sup>8</sup>

No change ( $\pm 10\%$  of initial value)

**Prevailing Out Torque (POT)**

initial<sup>1</sup>

11 ft-lbs (15.0 Nm)

**NOTE:** These properties are representative of the products' performance, and are supported by laboratory test data. However, the values reported are not intended to be used for specification purposes.

<sup>1</sup> 24 hours at room temperature

<sup>2</sup> 3 weeks at 220°F (104°C)

<sup>3</sup> Conditioned under 3 of the following cycles: 1 1/2 hours at -68°F (-56°C), 1 hour at 350°F (177°C), and 1 1/2 hours at 75°F (24°C)

<sup>4</sup> Immersion in distilled water for 1 week at 75°F (24°C)

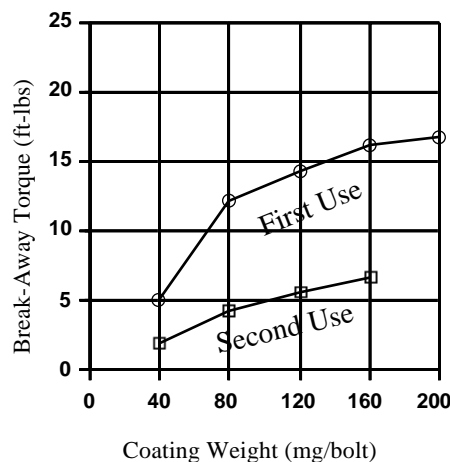
<sup>5</sup> Immersion in regular, unleaded gasoline for 1 week at 75°F (24°C)

<sup>6</sup> Immersion in SAE 30 motor oil for 1 week at 220°F (24°C)

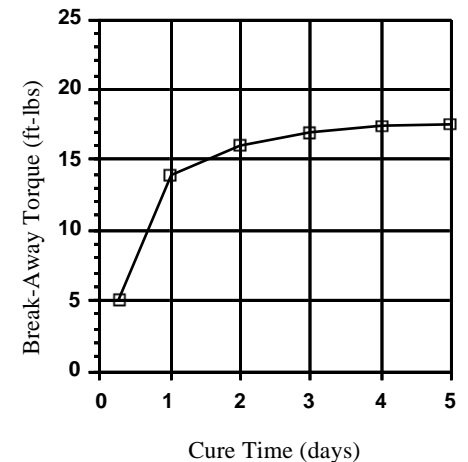
<sup>7</sup> Immersion in transmission fluid for 1 week at 75°F (24°C)

<sup>8</sup> Immersion in a 50% solution of ethylene glycol in water for 1 week at 120°F (49°C)

Break-Away Torque (initial) vs Adhesive Coating Weight



Break-Away Torque vs Cure Time (at room temperature)



## Definition of Terms

*Prevailing In Torque (PIT):* The maximum torque reading obtained during insertion of a bolt into a nut prior to seating, i.e., before fully torquing the bolt into place.

*Break-Loose Torque (BLT):* The initial torque reading obtained when a bolt is unscrewed after it has been seated, i.e., fully torqued into place.

*Break-Away Torque (BAT):* The initial torque reading obtained when a bolt is unscrewed after it has NOT been seated.

*Prevailing Out Torque (POT):* The maximum torque reading obtained when a bolt is being removed, excluding the BLT value; typically the value during the first full rotation of the bolt.

## OEM Approvals

2353 meets the requirements of IFI 125 and the following automotive specifications:

General Motors	6175M
Ford	ESA-M2G200-A ESS-M11P24-A2 WX-200 <sup>1</sup>
Chrysler	PF-6616 MS-CC76

<sup>1</sup> Except for 1 hour Break-Loose Torque values on M5 and M6 bolts; however, 2353 has been approved to the WX-200 specification.

## Health and Safety

**Health and Safety Information:** Read all Health Hazard, Precautionary, and First Aid statements found in the Material Safety Data Sheet and/or product label prior to handling or use.

\*\* Performance tests are run using standard test procedures. The values presented are typical values not to be used for specification purposes.

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# Automotive Sealants

## Scotch-Grip™ Thread Sealant 4291

Data Sheet

June 2000

### General Description



3M™ Automotive Scotch-Grip™ Thread Sealant 4291 is a water-based product designed to be pre-applied to threaded fasteners. It has excellent resistance to automotive fluids and can withstand high temperatures and pressures. Typical applications are threaded fasteners for the engine compartment.

Product Features	Performance Advantages	Customer Benefits
Synthetic polymer chemistry	Extended shelf life (12 months on coated fasteners)	Robust sealing performance
	Excellent resistance to automotive fluids, high temperatures (up to 300°F / 149°C) and pressures (up to 150 psi / 10.5 kg/cm <sup>2</sup> )	
	Can be used on both pipe and straight threads	
Water-based	No VOCs	
Flow-coatable formula	Allows controlled application to fasteners; viscosity can be adjusted to achieve target coating weights	Broad handling, dispensing and drying windows for the applicators

### Physical Properties (prior to application)

<b>Color</b>	White
<b>% solids</b>	59% by weight (approximate)
<b>Flash point</b>	None
<b>Density</b>	9.25 lbs/gallon (1110 kg/m <sup>3</sup> )
<b>Viscosity<sup>1</sup></b>	400-1200 cps
<b>Form</b>	Flowable liquid

<sup>1</sup>Brookfield viscometer, RVF #4 spindle at 20 rpm.

# Data Sheet 4291

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## Handling/Process Properties

### Bulk sealant 4291

Container sizes	5 gallon (18.9 liter) pails
Shelf life	6 months from date of receipt by customer
Storage conditions	Store pails at 60°- 80°F (15°-27°C)

**PROTECT FROM FREEZING;** storage below 32°F (0°C) for extended periods will freeze the sealant and make it unusable. Storage above 120°F (49°C) will shorten the shelf life of the sealant. Inventory should be rotated on a FIFO (first in, first out) basis.

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### Coated fasteners 4291

Shelf life	12 months
Storage conditions	Store coated fasteners at 40°-100°F (4°- 38°C)

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## Performance Properties

### Chemical Resistance<sup>1</sup> 4291

gasoline (room temperature)	No leaks
motor oil (300°F/149°C)	No leaks
transmission fluid (300°F/149°C)	No leaks
anti-freeze (266°F/130°C)	No leaks
brake fluid (300°F/149°C)	No leaks
diesel fuel #2 (room temperature)	No leaks
hot water (200°F/93°C)	No leaks
toluene (room temperature)	No leaks

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### Fluid Tightness<sup>2</sup>

gasoline (room temperature)	150 psi / no leaks
motor oil (300°F/149°C)	150 psi / no leaks
transmission fluid (300°F/149°C)	150 psi / no leaks
anti-freeze (250°F/121°C)	150 psi / no leaks
hot water (200°F/93°C)	150 psi / no leaks

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### High Pressure Resistance<sup>3</sup>

1200+ psi (84+ kg/cm <sup>2</sup> )	No leaks
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**Note:** These properties are representative of the product's performance and are supported by laboratory test data. However, the values reported are not intended to be used for specification purposes.

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**Test Methods**

- <sup>1</sup> 3/8 inch (9.5 mm) pipe plugs were coated with 4291 and then installed into 3/8 inch (9.5 mm) pipe tees at a seating torque of 20 inch-lbs (2.3 Nm). The assemblies were then immersed for 42 days in the specified solvents/chemicals. After the conditioning period, the assemblies were pressurized with air to 58 psi (4.1 kg/cm<sup>2</sup>) and immersed in water to check for leaks.
- <sup>2</sup> 3/8 inch (9.5 mm) bolts were coated with 4291 and then installed in the mating nuts. The assemblies were then immersed for 28 days in the specified solvents/chemicals. After the conditioning period, the assemblies were tested to MIL-S-46163 (Fluid Tightness Test for Anaerobic Adhesive/Sealants), where the assemblies are placed in a test fixture with pressurized soapy water. Assemblies are required to pass 50 psi (3.5 kg/cm<sup>2</sup>) with no leaks.
- <sup>3</sup> 3/8 inch (9.5 mm) bolts were coated with 4291 and then installed in a 3/8 inch (9.5 mm) thick test plate. The test plate was immediately attached to a test fixture and hydraulic (water) pressure was slowly applied until water leakage occurred.

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**Health and Safety**

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# Automotive Structural Adhesives

## Scotch-Grip™ Fastener Adhesives 2510, 2510N (High Temp Formula)

Data Sheet

June 2000

### General Description



3M Scotch-Grip™ Fastener Adhesives are microencapsulated, room temperature curing adhesives which enhance the anchorage of threaded fasteners. The adhesives are designed to be coated on the fasteners and dried; they remain dormant until the shearing action of engaging the fastener into a nut or threaded cavity breaks the capsules and allows the adhesive to cure. Typical applications are fasteners for the engine compartment or safety-related parts.

Product Features	Performance Advantages	Customer Benefits
Epoxy chemistry	High torque values on coated fasteners  Environmental resistance (to heat, automotive fluids, vibration, thermal and mechanical shock)	Robust, structural bonding performance
2-part (microencapsulated)	Extended shelf life (bulk adhesive and coated fasteners)  Controlled reactivity (adhesive activates and cures upon insertion)  Reusability (additional capsules break with each re-insertion)	Convenient handling by the end-users
Flow coatable formula	Allows controlled application to fasteners; viscosity can be adjusted to achieve target coating weights  Penetrates oil coatings  Fast drying  Bonds to a broad range of fastener finishes	Broad handling, dispensing and drying windows for the applicators

# Data Sheet 2510/2510N

Page 2

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<b>Product Descriptions</b>	2353 (blue) 4844 (yellow)	<b>Normal Temp Formula.</b> Designed for applications where the service temperature will not exceed 240°F (116°C)*. Refer to separate data page.
	2510 (orange) 2510N (neutral)	<b>High Temp Formula.</b> Designed for applications where the service temperature might reach continuously up to 300°F (149°C), or intermittently up to 400°F (204°C).

*\* While the functional service temperature upper limit for 2353/4844 is 240°F (116°C) the product can be exposed to temperatures as high as 350°F (177°C). At the higher temperatures there will be loss of adhesion but no damage to the adhesive. When temperature is lowered again, adhesion will be regained.*

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<b>Physical Properties</b>	<b>Bulk adhesive</b>	<b>2510/2510N</b>
	Density	8.4 lbs/gallon (1006 kg/m <sup>3</sup> )
	% solids	52%
	Viscosity <sup>1</sup>	900-1500 cps
	Solvent base	Toluene

<sup>1</sup>Brookfield viscometer, RVF #4 spindle at 20 rpm.

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<b>Handling/Process Properties</b>	<b>Bulk adhesive</b>	<b>2510/2510N</b>
	Container sizes	5 gal (18.9 l) pails

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Shelf life	6 months from date of receipt by customer Shelf life can be extended by re-mixing the adhesive regularly so that capsules do not coagulate on the bottom of the pails. Adhesive which is more than 6 months from the date of receipt should be checked for performance prior to application on fasteners.
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Storage conditions	Store pails at 40°-100°F (4°-38°C) <b>PROTECT FROM FREEZING;</b> storage below 32°F (0°C) for extended periods will freeze the adhesive and make it totally unusable. Storage above 120°F (49°C) will shorten the shelf life of the adhesive. Inventory should be rotated on a FIFO (first in, first out) basis.
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<b>Coated fasteners</b>	
Shelf life	1 year from date of adhesive application Shelf life can be as long as 4 years, depending on the storage conditions. Fasteners which are more than 1 year from the date of adhesive application should be checked for performance prior to use.

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Storage conditions	Store coated fasteners at 40°-100°F (4°-38°C)
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**Performance Properties**

**Prevailing In Torque (PIT)**

**2510/2510N**

initial<sup>1</sup> 2 ft-lb (2.7 Nm)

**Break-Loose Torque (BLT)**

initial<sup>1</sup> 35 ft-lbs (47.6 Nm)

**Break-Away Torque (BAT)**

initial <sup>1</sup>	12	ft-lbs	(16.3	Nm)
heat aging <sup>2</sup>	25	ft-lbs	(34.0	Nm)
cycles <sup>3</sup>	32	ft-lbs	(43.5	Nm)
water immersion <sup>4</sup>	33	ft-lbs	(44.9	Nm)
gasoline immersion <sup>5</sup>	24	ft-lbs	(32.6	Nm)
hot motor oil immersion <sup>6</sup>	23	ft-lbs	(31.2	Nm)
transmission fluid immersion <sup>7</sup>	32	ft-lbs	(43.5	Nm)
anti-freeze immersion <sup>8</sup>	25	ft-lbs	(34.0	Nm)
at 275°F/135°C	7	ft-lbs	(9.5	Nm)

**Prevailing Out Torque (POT)**

initial<sup>1</sup> 9 ft-lbs (12.2 Nm)

**NOTE:** These properties are representative of the products' performance, and are supported by laboratory test data. However, the values reported are not intended to be used for specification purposes.

<sup>1</sup> 72 hours at room temperature

<sup>2</sup> 3 weeks at 302°F (150°C)

<sup>3</sup> Conditioned under 3 of the following cycles: 1 hour at 302°F (150°C), 2 hours at -22°F (-30°C), and 1 hour at 75°F (24°C)

<sup>4</sup> Immersion in distilled water for 1 week at 75°F (24°C)

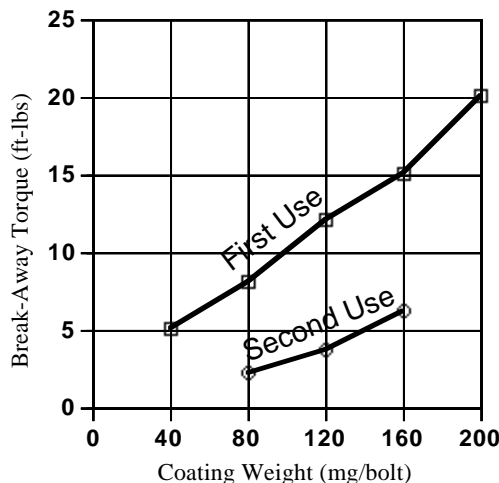
<sup>5</sup> Immersion in regular, unleaded gasoline for 1 week at 75°F (24°C)

<sup>6</sup> Immersion in SAE 30 motor oil for 1 week at 302°F (150°C)

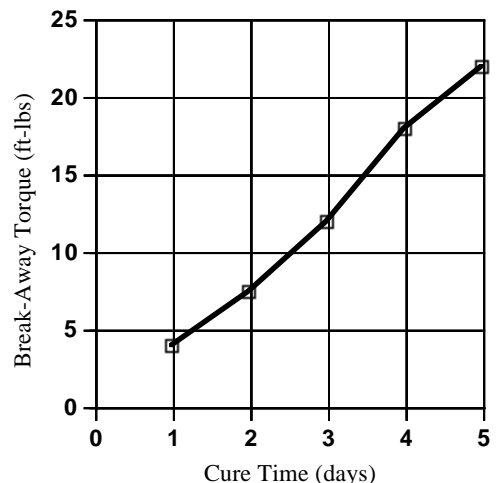
<sup>7</sup> Immersion in transmission fluid for 1 week at 302°F (150°C)

<sup>8</sup> Immersion in a 50% solution of ethylene glycol in water for 1 week at 212°F (100°C)

**Break-Away Torque (initial) vs Adhesive Coating Weight**



**Break-Away Torque vs Cure Time (at room temperature)**



## Definition of Terms

*Prevailing In Torque (PIT):* The maximum torque reading obtained during insertion of a bolt into a nut prior to seating, i.e., before fully torquing the bolt into place.

*Break-Loose Torque (BLT):* The initial torque reading obtained when a bolt is unscrewed after it has been seated, i.e., fully torqued into place.

*Break-Away Torque (BAT):* The initial torque reading obtained when a bolt is unscrewed after it has NOT been seated.

*Prevailing Out Torque (POT):* The maximum torque reading obtained when a bolt is being removed, excluding the BLT value; typically the value during the first full rotation of the bolt.

## OEM Approvals

2510 meets the requirements of IFI 125 and the following automotive specifications:

General Motors	6193M
Ford	ESA-M2G200-A ESS-M11P24-A1
Chrysler	PF-6616 MS-CC76

## Health and Safety

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