ND Industries, Inc.
Corporate Offices
1000 North Crooks Road
Clawson, MI 48017

RE: Potential 3M Material Supply Disruption

3M has recently announced that one of their suppliers has declared force majeure and has announced a discontinuation of the following 3M products:

- 3M™ Fastener Adhesive 2353B
- 3M™ Fastener Adhesive 2353Y
- 3M™ Fastener Adhesive 2510N
- 3M™ Fastener Adhesive 2510R

ND Equivalent Products

The following ND Industries microencapsulated epoxy products are fully available and can be specified as an equivalent.

3M Product	ND Equivalent Product	Color*
2353B	ND Microspheres 593sB	Blue
2353Y	ND Microspheres 593Y	Yellow
2510	ND Microspheres 1193SO	Burnt Orange
2510N	ND Microspheres 1193SN	Neutral

*Other colors are available upon request
Product performance comparison data is located on the following page.

Benefits of Working with ND Industries:

- **Industry Leader -** Customers can rely on ND Industries to continue as an industry leading provider of high quality fastener coating products and services, serving wide variety of industries, including automotive, electronics, aerospace, marine, military, construction, and appliance.

- **Product Variety -** ND Industries manufactures and applies a wide variety of materials onto fasteners and assemblies to aid in functions such as locking, sealing, masking, lubricating, and noise and vibration dampening.

- **R & D Department -** ND's in-house Research and Development team is comprised of degreed scientists and chemists dedicated to the development and testing of all our chemical formulations. The ND lab holds an A2LA ISO/IEC 17025:2005 accreditation and is able to assist customers by performing independent testing for a wide range of criteria.

- **Application Engineering Support -** ND's dedicated application engineering personnel are available to recommend and coordinate the implementation of solutions for fastener adhesive and sealing challenges.

- **Made in U.S.A. -** Many ND Industries material formulas, including microspheres, are manufactured in Troy, Michigan, U.S.A.. ND's chemical blending operation manufactures a wide variety of adhesives, microcaps, anaerobics, epoxies, urethanes, ultraviolets, acrylics, and more.

For answers to any questions you have regarding this issue, contact your ND Industries representative, or submit inquiries to info@ndindustries.com.

ND (593S & 1193S) / 3M (2353 & 2510) Product Performance Comparison

Installation Torque

Material	ND	3M
(Nm)	Installation Torque	
M12		
Dry Phos	1.6	2.0
Zinc Flake	1.7	2.0
M10		
Dry Phos	0.9	1.1
Zinc Flake	1.0	1.1
M8		
Dry Phos	0.5	0.9
Zinc Flake	0.6	0.7
M6		
Dry Phos	0.2	0.3
Zinc Flake	0.2	0.3

Break and Prevailing Torque

Material	ND				3M			
Cure Time	24 hours		72 hours		24 hours		72 hours	
(Nm)	Break	Prevail	Break	Prevail	Break	Prevail	Break	Prevail
M12								
Dry Phos	47.0	39.9	54.7	54.0	46.6	17.7	52.3	16.6
Zinc Flake	54.4	37.4	56.9	49.4	51.9	24.4	57.2	26.5
M10								
Dry Phos	33.9	25.4	34.6	28.6	25.7	9.9	34.6	10.9
Zinc Flake	34.6	19.8	38.1	24.4	29.7	11.3	30.7	14.8
M8								
Dry Phos	13.6	9.8	17.1	15.3	13.3	5.3	14.3	5.8
Zinc Flake	14.8	12.6	17.2	12.1	14.6	7.8	13.4	7.3
M6								
Dry Phos	4.4	3.3	6.1	4.6	5.1	1.8	5.7	1.7
Zinc Flake	4.6	3.0	5.6	3.4	5.3	2.4	5.4	2.9

Breakaway Torque, Various Conditions

Material	ND	3M
M10 fasteners (Nm)	Breakaway Torque	
500 Hour @ 135°C Heat Aging		
Dry Phos	33.9	39.6
Zinc Flake	42.4	44.1
Engine Oil 5W30 @ 120°C (168 hours)		
Zinc Flake	48.0	32.5
Brake Fluid @ 90°C (168 hours)		
Zinc Flake	45.2	20.4
50/50 Water/Antifreeze @ 90°C (168 hours)		
Zinc Flake	45.2	28.6
Diesel Fuel @ 25°C (168 hours)		
Zinc Flake	37.4	32.5

Breakloose Torque

Material	ND	3M
Cure Time	24 hours	
(Nm)	Breakloose Torque	
M10: Preload = 46.3 Nm		
Dry Phos	63.9	66.4
Zinc Flake	63.9	66.0
M8: Preload = 23.2 Nm		
Dry Phos	32.8	33.9
Zinc Flake	30.9	32.6
M6: Preload = 9.6 Nm		
Dry Phos	10.5	10.4
Zinc Flake	9.4	9.5

Coefficient of Thread Friction

Fastener	ND
M10 Zinc Flake	0.14
M10 Zinc Electroplate	0.16

Frequency - 12.5Hz

Clamp Force Retention vs. Vibration Material Comparison

Load Retention
Blank - 0.00%
ND Epoxy Microspheres - 78.2%
3M 2353 - 72.4%

2.7 kN = 85% Load Loss

Load (kN) / Cycles

Blank — ND Epoxy Microspheres — 3M 2353

All testing was conducted by the Research and Development Department of ND Industries, Inc.. Comparison data is intended as a guide. For product selection assistance, contact ND Industries.