Science. Applied to Life.™

Technical Data Sheet

3M Advanced Materials Division

3M™ Friction Shims

Introduction

The demand for maximum power density – the transmission of greater force and torque in increasingly compact designs – poses a major challenge to engineers across a variety of industries. 3M manufactures friction-enhancing solutions to help manage higher shear forces or increase torque transfer in bolted connections. 3M™ Friction Shims offer a simple and cost-effective way to reliably handle up to 5× higher shear forces or transmit up to 5× higher torque than conventional systems with no modification to the joint design required.

3M™ Friction Shims consist of a nickel-coated steel substrate with partially embedded diamond particles. When placed between two mating surfaces in a bolted connection and applied with pressure, the diamonds "bite" into each surface to create a microform fit. Shims are easy to assemble and can be reused after disassembly. They fit within most engineering tolerances, allowing for lightweight, compact designs while increasing maximum load and peak torque in bolted connections.

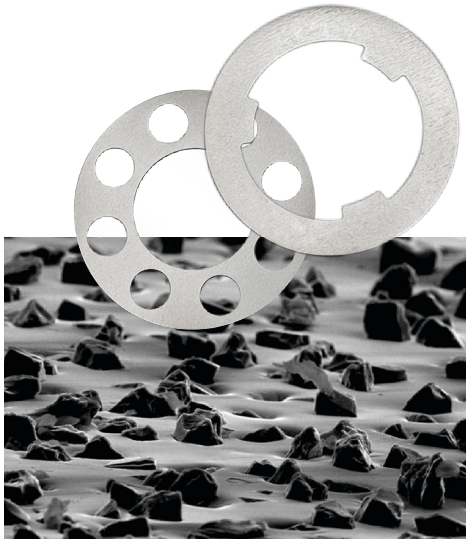
3M™ Friction Shims have proven effective in many industries, including automotive, general mechanical engineering, machine tools, marine engineering, wind energy, hydropower and aerospace. They are produced by experienced technical specialists in facilities that are ISO 9001 and 14004 as well as IATF 16949 certified.

Features

- Enhance friction coefficients by up to 5×
- Work with dissimilar mating surfaces
- Fit most existing engineering tolerances for easy retrofitting
- Prevent fretting
- Geometries can be tailored to customer specifications
- Pre-attachment solutions include 3D clip shims and 2D shims with tabs

Applications

- Shear joints in chassis applications
- Torsional joints
- Flange joints
- Joints with central bolt
- Bolted connections
- Fastener systems
- Various mating surfaces: aluminum, e-coated (cathodic-dip-coated), painted and composite-material surfaces.



3M™ Friction Shims and SEM photo of nickel coating and diamond particles

Application Notes

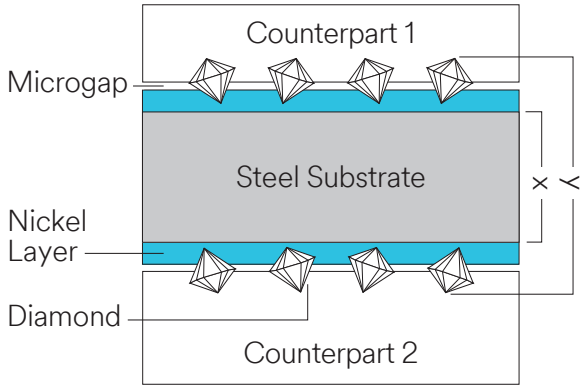
When 3M friction shims are used please note:

- For maximum performance, the roughness of the mating counterparts should match the roughness values of the friction shim grades given in the application requirements below.
- 3M offers application engineering assistance and can conduct in-house friction testing.

Typical Physical Properties (Not for specification purposes)

Property	3M™ Friction Shims			
	Grade 10	Grade 25	Grade 35	Grade 55
Color	Silver gray metallic	Silver gray metallic	Silver gray metallic	Silver gray metallic
Substrate Material	C60 S/C75 S	C60 S/C75 S	C60 S/C75 S	C60 S/C75 S
Thickness of Substrate (x)	0.1 mm ± 0.01 mm (others upon request)	0.1 mm ± 0.01 mm (others upon request)	0.1 mm ± 0.01 mm (others upon request)	0.1 mm ± 0.01 mm (others upon request)
Processing of Substrate	Laser cutting or stamping	Laser cutting or stamping	Laser cutting or stamping	Laser cutting or stamping
Layer Material	Nickel phosphorus	Nickel phosphorus	Nickel phosphorus	Nickel phosphorus
Hard Particle Type	Diamond	Diamond	Diamond	Diamond
Mean Particle Size	10 µm	25 µm	35 µm	55 µm
Diamond Concentration on the Surface (avg.)	8 – 16%	8 – 25%	10 – 30%	20 – 60%
Hardness of Nickel-Phosphorus Layer	400-600 HV 0.025	400-600 HV 0.025	400-600 HV 0.025	400-600 HV 0.025
Thickness of Nickel-Phosphorus Layer	5 – 9 µm	13 – 17 µm	14 – 22 µm	22 – 30 µm
Total Thickness of Coated Shim (y) (based on substrate thickness of 0.1 mm ± 0.01 mm)	0.13 mm ± 0.02 mm	0.16 mm ± 0.02 mm	0.19 mm ± 0.03 mm	0.23 mm ± 0.05 mm
Application Requirements				
Surface Roughness R_z or Average Surface Finish R_a of Counterpart - (measurement transversal to direction of machining)	R_z < 5.0 µm R_a < 1.0 µm	R_z < 12.5 µm R_a < 2.5 µm	R_z < 17.0 µm R_a < 3.5 µm	R_z < 27.5 µm R_a < 6.3 µm
Suitable for E-coated Surfaces	No	No	Yes	Yes
Waviness Height of the Counterpart (total height of W-profile)	Should be smaller than R_z	Should be smaller than R_z	Should be smaller than R_z	Should be smaller than R_z
Minimum Contact Pressure for Maximum Performance	p > 50 MPa	p > 50 MPa	p > 50 MPa	p > 50 MPa
Maximum Service Temperature	400°C	400°C	400°C	400°C

3M™ Friction Shim Cross Section



Typical Coefficient of Static Friction

(Not for specification purposes)

Results of a series of tests on the coefficient of static friction with and without 3M™ Friction Shims.

Handling Instructions

Storage and handling

- Store 3M™ Friction Shims in their original 3M packaging.
- Dry storage is recommended.
- Avoid mechanical treatment of shims. Do not cut, twist or bend them.
- Do not expose shims to temperatures above 400 °C (752 °F).
- Only 3D shims can be handled in bulk.

Assembly

- 3M™ Friction Shims can operate effectively under various contact pressures. To achieve the maximum coefficient of static friction, a contact pressure of 50 MPa or above is recommended.
- Avoid shim movement relative to mating surfaces during assembly.
- Only one shim should be used in a connection. Do not use shims as spacers or stack one on top of another.
- Before assembly, make sure no dirt residue is present.

3M Advanced Materials Division

3M Center
St. Paul, MN 55144 USA

Phone 1-800-367-8905
Web www.3M.com/frictionshims