

3M Advanced Materials Division

# 3M™ Friction Shims

## Introduction

The demand for maximum power density, i.e. 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 for joining components to withstand higher shear forces or transmit higher torque in bolt connections. 3M™ Friction Shims offer a simple and cost-effective way to reliably transmit typically 3-5x higher torques or forces than conventional systems without requiring modifications to the joint design.

3M™ Friction Shims consist of a nickel-coated steel substrate with partially embedded diamonds. The diamonds indent into the mating surface and create a micro-scale interlock. The shims are easy to assemble and can be reused after disassembly. They are thin enough to fit within close engineering tolerances, creating possibilities for lightweight compact design while increasing maximum load and peak torque in bolt connections.

3M friction shims have proven effective in many industries, including automotive, general mechanical engineering, machine tools, marine engineering, wind and water power generators and aerospace. Our technical specialists have many years of application experience, and conduct in-house laboratory tests.

## Features

- Significantly increases the coefficient of static friction
- Function of 3M friction shims is not affected by an oil film
- Can be easily retrofitted
- Prevents fretting
- Dark grey color option for distinctive appearance
- Friction shim geometries can be tailored to customer specification

## Application

- Frictional joints
- Shear joints in chassis applications
- Flange joints
- Joints with central bolt
- Bolt connections
- Fastener systems
- Various mating surfaces: metallic, e-coated, and composite materials



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

## Application Notes

When 3M friction shims are used please note:

- For maximum performance, the mating surfaces must have roughness values  $R_z$  as given in the technical data sheet.
- Contact pressure of at least 50 MPa is recommended to achieve the maximum coefficient of static friction.
- 3M offers application engineering assistance and can conduct in-house friction testing

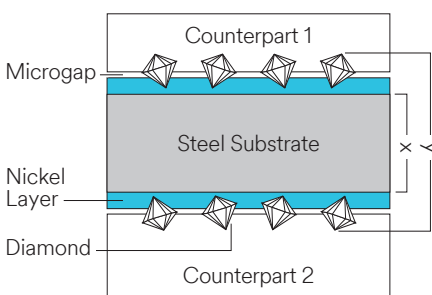
## Typical Physical Properties (Not for specification purposes)

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

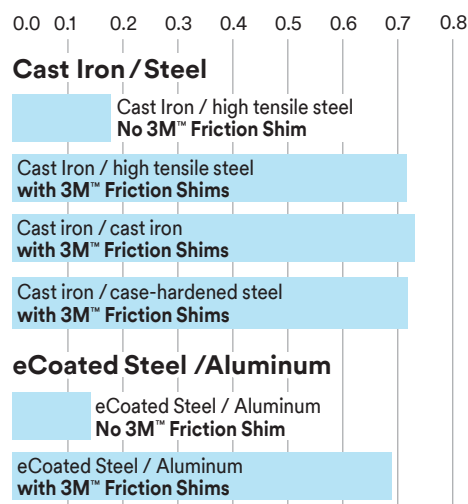
Surface Roughness $R_z$ or Average Surface Finish $R_a$ of Counterpart - (measurement transversal to direction of machining)	$R_z < 5.0 \mu\text{m}$ $R_a < 1.0 \mu\text{m}$	$R_z < 12.5 \mu\text{m}$ $R_a < 2.5 \mu\text{m}$	$R_z < 17.0 \mu\text{m}$ $R_a < 3.5 \mu\text{m}$	$R_z < 27.5 \mu\text{m}$ $R_a < 6.3 \mu\text{m}$
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	$p > 50 \text{ MPa}$	$p > 50 \text{ MPa}$	$p > 50 \text{ MPa}$	$p > 50 \text{ MPa}$
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

- Store 3M™ Friction Shims only in original packaging.
- Don't expose 3M friction shims to temperatures above 400°C.
- Dry storage recommended.
- Don't bend 3M friction shims.
- No mechanical treatment of 3M friction shims.
- Before assembling 3M friction shims, make sure no dirt residue is present.
- Check correct quantity during assembly.

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