



## MICROPITTING TESTER

# Micropitting Tester - ToronTribo™ MP

Micropitting tester studies micropitting fatigue in rolling contact materials, serving gear manufacturers, bearing producers, and lubricant developers working with high-load rolling and rolling-sliding contacts. The ToronTribo™ MP presses a central test roller against contact surfaces under controlled load and slip conditions, reproducing the thin-film, mixed-lubrication contact found between meshing gear teeth and rolling bearing elements. The three-surface contact configuration drives a high number of contact cycles per test, shortening test duration compared to single-contact fatigue rigs.

The tester covers a contact stress range up to 3500 MPa with force indication accuracy within  $\pm 1$  percent, and an independently adjustable slip-roll ratio from 0 percent (pure rolling) to 200 percent (pure sliding). Speed ranges from 5 to 3000 rpm with stepless control, and both line contact and point contact configurations are available to match different gear and bearing geometries. Oil circulation lubrication with measurable oil temperature lets engineers evaluate how lubricant film formation affects micropitting resistance under realistic thermal conditions.

Gear and bearing manufacturers, industrial and automotive lubricant formulators, and materials research laboratories use the ToronTribo™ MP to evaluate anti-pitting and anti-micropitting performance of gear oils and industrial lubricants. Manual emergency stop and automatic shutdown on time, revolution count, friction torque, vibration signal, or oil temperature protect the test setup during extended, high-cycle test runs.

## APPLICATIONS

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### Micropitting Tester - ToronTribo™ MP Applications

The ToronTribo™ MP supports micropitting and rolling contact fatigue evaluation for gears, bearings, and the lubricants that protect them.

- Industrial Gear Oil Development: screens candidate gear oils for micropitting resistance under controlled slip-roll ratio and contact stress conditions
- Wind Turbine Gearbox Lubricant Qualification: evaluates lubricants intended for wind turbine gearboxes, where low film thickness and high duty cycles make micropitting a significant failure mode
- Rolling Bearing Material and Lubricant Testing: assesses how bearing steel and lubricant combinations resist micropitting under rolling and rolling-sliding contact
- Automotive Driveline Lubricant Testing: supports development of gear oils for transmissions and differentials exposed to mixed rolling-sliding gear tooth contact
- New Energy Vehicle Lubricant Development: evaluates lubricants formulated for electric and hybrid vehicle drivetrains under high-speed rolling contact conditions
- Gear and Bearing Surface Treatment Evaluation: compares how coatings, carburizing, and other surface treatments influence micropitting initiation and progression
- Materials Science and Failure Mechanism Research: investigates how contact stress, slip ratio, and lubrication regime interact to drive micropitting damage accumulation



## FEATURES

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### Micropitting Tester - ToronTribo™ MP Key Features

The ToronTribo™ MP combines a triple-contact configuration with independently adjustable slip ratio and lubrication control.

- Three-Surface Contact Configuration: generates a high number of contact cycles per test, shortening the time needed to reach measurable micropitting damage
- Independently Adjustable Slip-Roll Ratio: sets sliding contact from 0 percent (pure rolling) to 200 percent (pure sliding), matching a wide range of gear and bearing kinematic conditions
- High-Stress Contact Testing: reaches contact stress levels up to 3500 MPa for evaluating materials and lubricants under demanding rolling contact loads
- Dual Contact Geometry Support: switches between line contact and point contact configurations to match different gear and bearing designs
- Oil Circulation Lubrication with Temperature Monitoring: maintains and measures oil temperature during circulation lubrication for realistic thermal test conditions
- Wide Stepless Speed Range: operates from 5 to 3000 rpm, accommodating both low-speed and accelerated micropitting test protocols
- Comprehensive Automatic Shutdown Protection: stops testing automatically based on time, revolution count, friction torque, vibration signal, or oil temperature, in addition to manual emergency stop

## THEORY & METHOD

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### Theory and Method

Micropitting develops in rolling and rolling-sliding contacts operating under thin oil film, mixed-lubrication conditions, the same conditions commonly found between meshing gear teeth and inside rolling element bearings. When the lubricant film separating two contacting surfaces becomes thin relative to the surface roughness, individual asperities on the opposing surfaces make repeated contact under load. Each of these micro-scale contacts experiences its own cycle of stress, and over enough cycles, small fatigue cracks initiate at the surface and propagate to produce the characteristic shallow pits that define micropitting damage.

The ToronTribo™ MP reproduces this mechanism using a three-surface contact configuration, in which a central test roller contacts multiple counterface surfaces simultaneously under a controlled normal force. Because the tester drives the roller and the counterfaces with independent control, it can set any slide-roll ratio from pure rolling to pure sliding, letting engineers match the test to the kinematic conditions of a specific gear mesh or bearing contact. The triple-contact arrangement also multiplies the number of stress cycles generated per revolution, accelerating micropitting damage accumulation compared to a single-contact test rig.

Lubricant film thickness relative to surface roughness, often expressed as the specific film thickness or lambda ratio, is one of the strongest known influences on micropitting risk. Running the same material pair at different combinations of speed, temperature, and slip ratio changes the lubricant film thickness at the contact, letting engineers map how sensitive a given gear oil or bearing lubricant is to the thin-film conditions where micropitting becomes likely. This makes the test especially useful for evaluating extreme pressure additive packages and anti-wear chemistry designed specifically to protect against micropitting rather than gross scuffing or wear.

## TECHNICAL SPECIFICATIONS

### Micropitting Tester - ToronTribo™ MP Technical Specifications

| Parameter          | Specification                  |
|--------------------|--------------------------------|
| Normal Force Range | 0 to 3500 MPa (contact stress) |

| Parameter                        | Specification                                                                                                          |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Error in Normal Force Indication | $\leq \pm 1\%$                                                                                                         |
| Slip-Roll Ratio                  | 0% (pure rolling) to 200% (pure sliding), freely adjustable                                                            |
| Speed Range                      | 5 to 3,000 rpm, stepless                                                                                               |
| Speed Indication Error           | $\leq \pm 10$ rpm                                                                                                      |
| Contact Methods                  | Line contact and point contact                                                                                         |
| Friction Medium                  | Oil lubrication (circulating, measurable oil temperature, adjustable speed)                                            |
| Shutdown Modes                   | Manual (emergency stop button); automatic (time, revolution count, friction torque, vibration signal, oil temperature) |



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