



TORONTECH



## FZG GEAR OIL SCUFFING TESTER

## **FZG Gear Oil Scuffing Tester - ToronTribo™ FZG**

FZG gear oil scuffing tester determines the scuffing load-carrying capacity of lubricating oils using standard FZG test gears, serving lubricant formulators, gear manufacturers, and industrial oil laboratories. The instrument runs a pair of standard gears under progressively increasing load stages while monitoring tooth surface condition, identifying the load stage at which a lubricant's protective film breaks down and scuffing damage begins. Dual-speed drive and precise oil temperature control reproduce the defined test conditions that international gear oil test methods require.

The tester covers a torque range up to 1000 N·m at fixed speeds of 1440 and 2880 rpm, with oil temperature control from room temperature to 90°C and tooth surface temperature monitoring up to 260°C. Immersion and circulating oil lubrication modes let operators match the test to different lubricant delivery methods, while manual or automatic shutdown control, triggered by time or friction, protects the gears and instrument during extended test runs.

Lubricant manufacturers, gearbox producers, and industrial testing laboratories use this tester to rank gear oils by scuffing resistance, determine root and flank bearing capacity for gears of different materials, and assess shear stability of lubricating oils under sustained mechanical load. Results support both product development and compliance testing against internationally recognized gear oil specifications.

### **APPLICATIONS**

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## **FZG Gear Oil Scuffing Tester - ToronTribo™ FZG Applications**

The FZG gear oil scuffing tester supports lubricant and gear material evaluation for industries relying on heavily loaded gear contacts.

- Industrial Gear Oil Formulation: ranks candidate lubricants by scuffing load stage to support extreme pressure additive development and formulation screening
- Automotive Driveline Lubricant Testing: evaluates gear oils intended for manual transmissions, differentials, and other high-load automotive gear applications
- Wind Turbine Gearbox Lubricant Qualification: assesses scuffing and wear protection of lubricants used in wind turbine gearboxes operating under sustained heavy load
- Marine and Industrial Gearbox Testing: supports lubricant selection for marine propulsion gears and heavy industrial gear drives
- Gear Material and Surface Treatment Comparison: determines root and flank bearing capacity of gears made from different materials or surface treatments
- Lubricant Shear Stability Testing: evaluates how mechanical shear affects the viscosity and protective performance of gear oils over extended operation
- OEM Lubricant Specification Compliance: generates scuffing load stage data required for OEM and industry gear oil approval programs



# Standards

The FZG gear oil scuffing tester supports test procedures aligned with internationally recognized ISO, DIN, and ASTM standards for gear oil scuffing and load-carrying capacity evaluation.

- ASTM D5182-19 - Standard Test Method for Evaluating the Scuffing Load Capacity of Oils (FZG Visual Method)
- DIN 51354-1:1990 - Lubricant Testing, FZG Gear Test Bench, General Working Principle
- DIN 51354-2 - Testing of Lubricants, FZG Gear Rig, Test Method A/8.3/90 for Lubricating Oils
- ISO 14635-1-2000 - Gears, FZG Test Procedures, Part 1: FZG Test Method A/8.3/90 for Relative Scuffing Load-Carrying Capacity of Oils

## FEATURES

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### FZG Gear Oil Scuffing Tester - ToronTribo™ FZG Key Features

The FZG gear oil scuffing tester combines standardized test conditions with precise load, speed, and temperature control.

- High Torque Capacity: applies up to 1000 N·m of torque to reproduce the progressive load stages required by standard FZG scuffing test methods
- Dual-Speed Drive: runs at 1440 or 2880 rpm to match different FZG test procedures and pitch line velocity requirements
- Precise Oil Temperature Control: maintains oil temperature from room temperature to 90°C for accurate reproduction of standard initial test conditions
- Tooth Surface Temperature Monitoring: tracks tooth surface temperature up to 260°C, giving direct insight into thermal conditions at the contact during each load stage
- Dual Lubrication Modes: supports both immersion and circulating oil lubrication to match different lubricant delivery methods

- Automatic and Manual Shutdown Control: stops testing based on time or friction force, or allows manual control for operator-supervised test sequences
- Standard Gear Compatibility: accommodates standard FZG test gears for direct comparability with internationally recognized test results

## THEORY & METHOD

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### Theory and Method

Gear scuffing occurs when high surface pressure and sliding velocity at the tooth contact generate enough frictional heat to break down the lubricant film separating the gear flanks. Once the film fails, the exposed metal surfaces make direct contact under load, causing localized welding and tearing that leaves visible scuffing damage across the tooth surface. Because scuffing resistance depends heavily on the lubricant's extreme pressure additives and film strength, gear oil performance in this failure mode cannot be predicted from viscosity alone.

The FZG test method addresses this by running a standard pair of gears, gear type A with a 20 mm face width and 91.5 mm center distance, through twelve progressively increasing load stages at a fixed pitch line velocity of 8.3 meters per second and initial oil temperature of 90°C. Each load stage runs for a set duration, after which the tooth flanks are inspected for scuffing damage. The tester applies each load stage through its dual-speed drive and torque system while maintaining the specified oil temperature, and testing continues until the summed width of scuffing damage across the sixteen pinion teeth equals or exceeds one gear-tooth width, defining the failure load stage.

This failure load stage becomes the lubricant's scuffing rating, a relative measure of how much load the oil can support before its protective film breaks down. Because the test uses identical standard gears and fixed running conditions, engineers can directly compare failure load stages across different lubricants, additive packages, or gear material and surface treatment combinations, isolating the lubricant's contribution to scuffing resistance from other variables.

TECHNICAL SPECIFICATIONS

FZG Gear Oil Scuffing Tester - ToronTribo™ FZG Technical Specifications

| Parameter                           | Specification                              |
|-------------------------------------|--------------------------------------------|
| Maximum Torque                      | 1000 N·m                                   |
| Spindle Motor                       | Dual-speed motor                           |
| Speed                               | 1,440 rpm / 2,880 rpm                      |
| Oil Temperature Control             | Room temperature to 90°C                   |
| Tooth Surface Temperature Detection | Room temperature to 260°C                  |
| Lubrication Methods                 | Immersion and circulating oil lubrication  |
| Sample Size                         | Standard FZG gear                          |
| Shutdown Control Mode               | Manual or automatic (time, friction, etc.) |



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