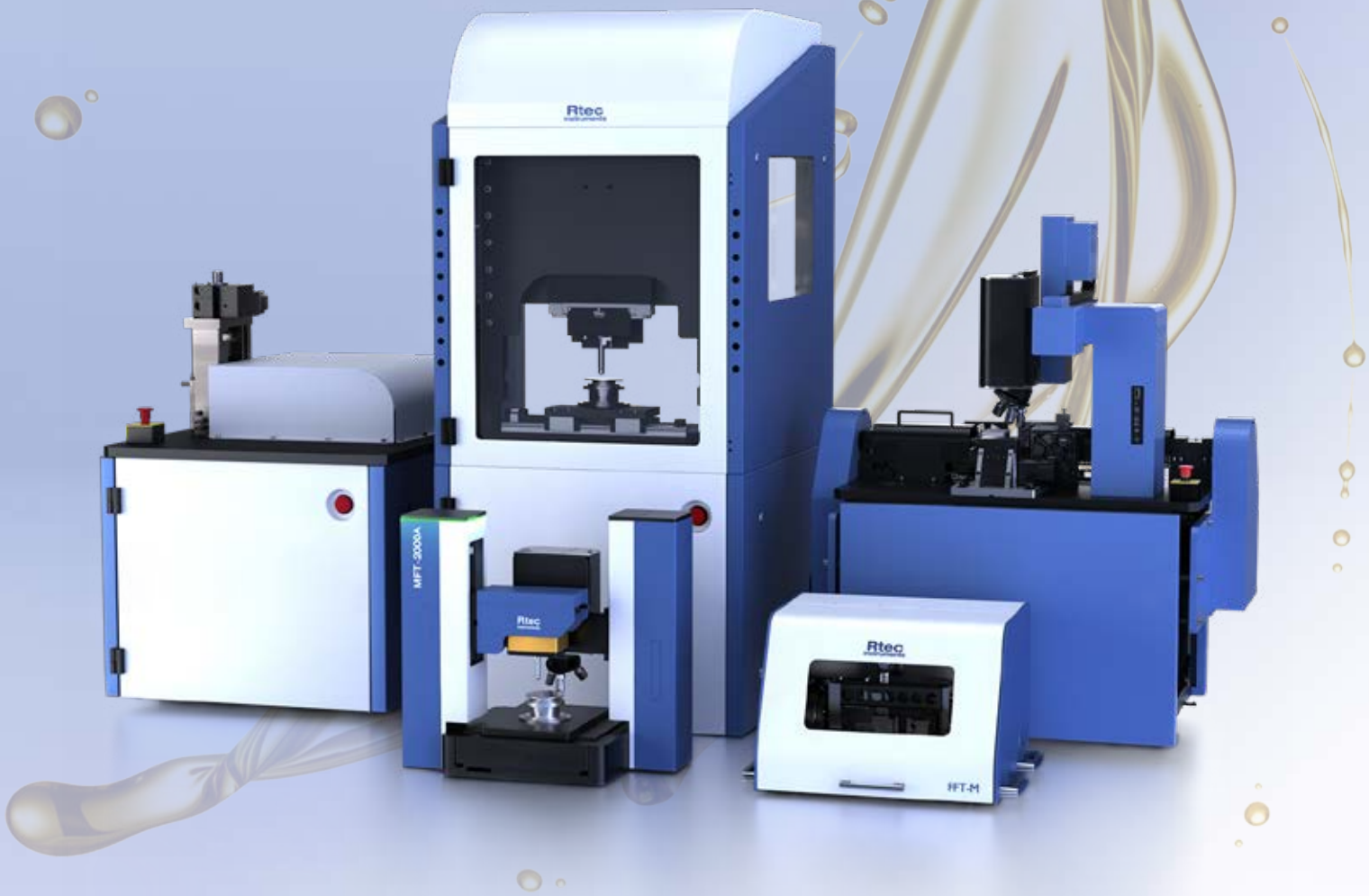
Rtec instruments

Testing Lubricants, Fuels, Greases and Metalworking Fluids



Test Methodologies:
Ball-on-Disk, Block-on-Ring, 4-Ball, Timken Test, Mini Traction Machine Fretting, HFRR, SRV Test, Twin Roller, Tapping Torque, Contact Fatigue, Linear Reciprocating, Three Roller, Micropitting

ACCREDITED MSCB-132
Certified ISO 9001:2015

Rtec-Instruments

Full Range of Solutions for Testing Lubricants

At Rtec-Instruments, we offer a comprehensive range of advanced instruments tailored to meet the needs of tribological development and quality control for lubricants and fuels. Our solutions facilitate effective testing and enhancement of lubricants, fuels, greases, and metalworking fluids across various industries, ensuring precision and reliability in friction, wear, and lubrication analysis.

Whether integrated into multi-functional systems or available as standalone units, our measurement capabilities provide complete solutions for your surface analysis needs.

E-tribology (electrical tribology) represents the future of measurement technologies, and we have ensured that all our tribology modules are fully compatible with advanced electrical measurement techniques.

Compliance with multiple related ASTM, DIN, and ISO standards in the lubricant and fuel industry ensures that measurements are conducted in accordance with globally recognized best practices. This guarantees consistency and accuracy across various systems and environments, facilitating reliable comparisons and benchmarking.

It also helps minimize errors and discrepancies, reducing the risk of product failures, safety concerns, and additional costs due to rework or compliance challenges. By adhering to these standardized testing methods, companies can achieve seamless technology integration worldwide, enhance market access, and strengthen their reputation for quality and excellence.

ASTM INTERNATIONAL

Pin and Ball-on-Disk (-120°C up to 1’200°C)

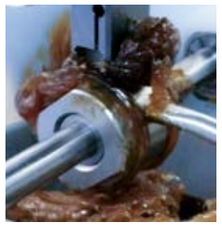
Ball-on-disk and **Pin-on-disk tribology** tests are commonly used to evaluate lubricants as first step, because they provide reliable and standardized methods for assessing friction, wear, and lubrication performance under controlled conditions.

Mini Traction Machine (Rolling to Sliding Tribology)

The **Mini-Traction Machine** is widely used in the tribology of lubricants because it provides detailed insights into lubrication performance, including frictional and fluid film forming behavior at different lubrication regimes, and surface interactions under a wide range of conditions, such as traction or Stribeck-type curves.

Elastohydrodynamic (EHD) Interferometer

An Elastohydrodynamic (EHD) interferometer is a specialized instrument used in tribology to measure fluid film forming behavior and fluid film thickness in mixed rolling-sliding. It combines optical interferometry and tribological testing to study the lubricant film thickness and its viscometric properties.



Block-on-Ring (Timken Test, EP Test, Cutting Tools Testing)

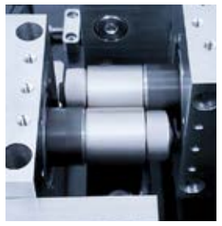
The Block-on-Ring (BoR) tribology test is used to evaluate both lubricants and greases as it provides a robust, controlled, and versatile method for analyzing their performance under varying conditions.

Upper Rotary Module (4-Ball, Thrust Washer, Tapping Torque)

With upper rotary module, **4-Ball Test** (Friction, Wear and Extreme Pressure), **Thrust Washer Test, KRL Test and Tapping Torque** test can be conducted. They are widely used for evaluating lubricants and greases to measure wear prevention, extreme pressure (EP) performance and friction reduction of lubricants and greases.

Fretting (SRV Test and HFRR)

The **SRV** (Schwingung, Reibung, Verschleiß) and **HFRR** (High-Frequency Reciprocating Rig) tests are specialized tribology methods used to evaluate friction, wear, extreme pressure (EP) and lubrication performance of oils and greases under controlled under high-frequency, linear reciprocating motion.



Twin Roller and Micropitting Three Roller Tester

The use of **2-Roller** or **Micropitting Tester** setups in lubricant tribology testing is intended to simulate traction and Stribeck-type curves under varying slip-rolling ratios. Furthermore, they enable the study of contact fatigue and the qualification of the effect of additives and base oils on the fatigue resistance of alloys and coatings under high Hertzian contact pressure.

An Indispensable Tool for Tribology

One Platform for Endless Possibilities

Tribology is the study of friction, wear, and lubrication, and plays a crucial role in the development of lubricants, fuels, greases, and metalworking fluids.

The Multi-Function Tribometer (MFT-5000) is a highly versatile instrument that supports a wide range of tribometry testing options, making it an essential tool for lubricant analysis. Its efficient design integrates multi-modules, such as: Pin-on-Disk, Mini Traction Machine, and SRV Testing, making it an invaluable asset for laboratories focused on developing high-quality lubricants as well as QC tool for lubricant and fuel.

For added versatility, optional environment modules (cooling, heating or humidity as well as high pressures or vacuum) are available, with or without electrified measurements.

Select the setup that best aligns with your specific requirements!

The MFT Tribometer Series are designed to measure a wide range of phenomena across various applications, including:

1. **Fuel and Lubricant Tribology**
   - Hydrodynamic Lubrication (HL)
   - Elastohydrodynamic Lubrication (EHL)
   - Boundary Lubrication (BL)
   - Mixed Lubrication
2. **Grease Tribology**
   - Rolling Contact Tribology
   - Boundary Tribology
   - Fretting
3. **Metalworking Fluid Tribology**
   - Lubrication Performance
   - Cooling Efficiency
   - Boundary and Anti-Wear Properties
   - Surface Interaction Behavior
   - Additive Performance

Each category requires specific tribological properties tailored to the application, operating conditions, and performance needs.

Electrified Tribology Testing

Unmatched solution in the market

The **Electrified MFT Series Tribometers** are specifically designed to address the evolving needs of modern industries by integrating advanced measurement tools and techniques. Equipped with features such as a potentiostat, galvanostat, and cutting-edge capabilities for AC/DC, impedance, ECR, and arcing measurements, these tribometers offer exceptional precision and versatility.

Rtec-Instruments is a leading pioneer in electrification development. Today, we are proud to offer the widest range of electrified tribological modules on the market catering to all type of electrification requirements.

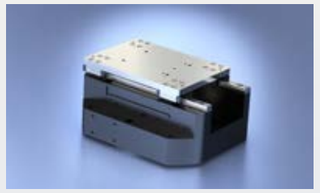
- **Effects of amperage and voltage:**
  Test conductivity, dielectric properties and resistance to electrostatic discharges (arcing), breakdown voltage.
- **Electric Motor Compatibility:**
  Ensures that lubricants minimize wear and stray current damage in motors.
- **Thermal Performance:**
  Evaluates the stability of lubricant and grease under combined thermal and electrical loads.
- **Renewable Energy Applications:**
  Addresses issues like electrical erosion in bearings for wind turbines.
- **Next-Generation Lubricants:**
  Enables the development of lubricants optimized for electric drive systems.

Our **commercial tribology solutions** are designed to address the evolving needs of modern industries by integrating advanced measurement tools and techniques. With the inclusion of potentiostat, galvanostat, and cutting-edge capabilities for AC, DC, impedance, ECR and arcing measurements, we deliver unmatched precision and versatility.

Let us help you to optimize performance and drive innovation technology in tribology !

Commonly Used Drives

Rotary Drive



Fast Reciprocating Drive

Block-on-Ring Drive

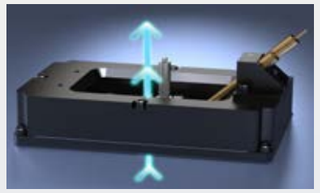
Fretting Drive

Mini-Traction Machine

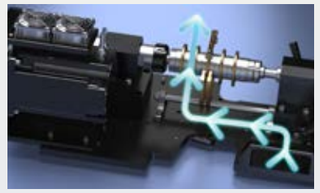
Upper Rotary Drive

Electrified Modules

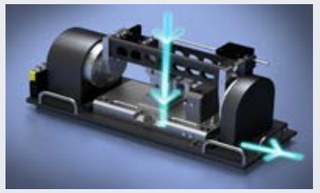
E-Rotary Drive



E-Fast Reciprocating Drive



E-Block-on-Ring Drive



E-SRV Drive

E-Mini-Traction Machine

E-4-Ball

Multi-Function Tribometer

One Solution for All Tribology Needs

Lubricant

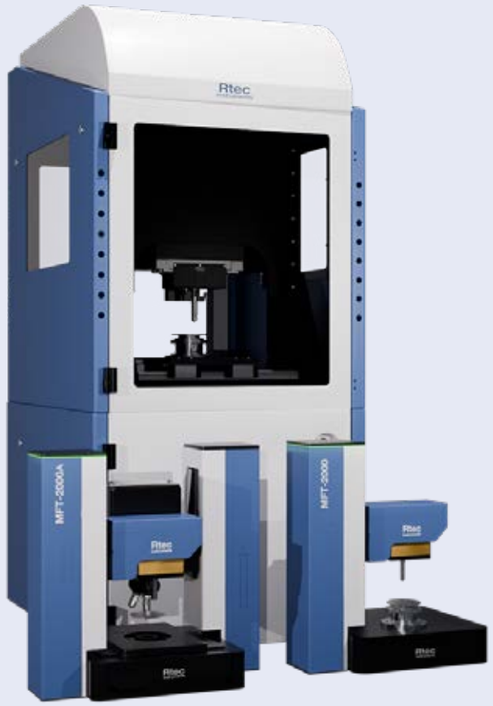
Fuel

Transportation

Lifestyle

1. Choose your modules:

- Rotating
- Linear reciprocating
- Block-on-Ring
- Fretting (SRV or HFRR)
- Upper Rotary (4 Ball)
- Mini Traction Machine
- EHD Interferometer



2. Choose your Environmental Conditions:

- Heating chamber
- Cooling chamber
- Humidity
- Controlled atmosphere
- Vacuum
- High Pressure
- Corrosive environments

All-in-one

or Standalone

Motor industry

Powertrain

4. Choose your options:

- 2D Microscope
  3D Confocal, WLI Profiler
- Acoustic Emission
- Electric Contact Resistance
- Electrification for AC, DC, Arcing

3. Choose your load cell:

- 2D Capacitive Force sensor
- 2D Force and Torque sensor
- 1D + 1D force sensor
- Piezo sensor
- Bridge sensor
- Multi-Axis 6D Force and Torque Sensor

Food and Beverage

Industrial

Biomaterial

Green and sustainable

Pin and Ball-on-Disk Tribology

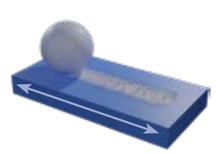
With Rotary and Fast Linear Drive

Pin and Ball-on-Disk Tribometers are versatile and widely used tools for evaluating lubricant performance.

They provide:

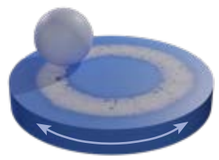
- **Real-World Simulation:**
  Recreate sliding conditions found in numerous tribological conditions providing the Coefficient of Friction (COF) between two materials in moving contact.
- **Comprehensive Measurements:**
  Assess friction coefficient, wear resistance, and lubricant film formation under various lubrication regimes, including hydrodynamic, elastohydrodynamic (EHL), boundary, and mixed lubrication.
- **Standardized Testing:**
  Comply with ASTM, ISO or DIN standards, ensuring reliable, reproducible, and comparable results.

Adaptability:
Operates in dry, wet, or lubricated conditions, with options for testing at high or low temperatures and the integration of advanced features, such as electrical conductivity or oil film thickness measurement.

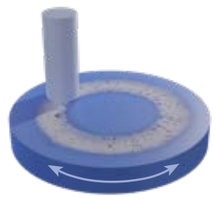


Ball-on-Plate

Pin-on-Plate



Ball-on-Disk



Pin-on-Disk

Ideal for lubricant formulation, additive evaluation, and quality control in research and industrial applications.

Setup:

Test Parameters:

- **Load (Force Applied):**
  Affects contact pressure and wear rate
- **Sliding Speed:**
  Influences friction, wear and heat generation
- **Track Radius:**
  Determines contact path and wear distribution.
- **Temperature:**
  Impacts material behavior and lubricant performance.
- **Humidity:**
  Affects oxidation and tribochemical reactions.

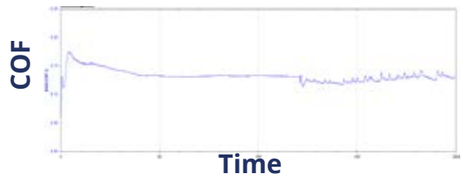
Materials:

- **Pin Material:**
  Must be representative of the intended application (e.g., metals, ceramics, polymers).
- **Disk Material:**
  Should match the real-world counterpart for meaningful results.
- **Surface Roughness:**
  Affects initial contact and wear mechanisms.

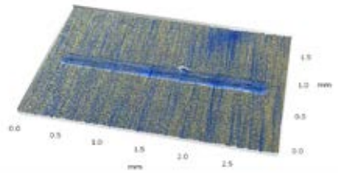
Lubrication & Environment:

- **Dry vs. Lubricated Testing:**
  Lubricants effect friction and wear characteristics.
- **Controlled Atmosphere:**
  Some tests require vacuum, inert gas or controlled humidity.

Pin-on-Plate with lubricant



Pin-on-Plate results (COF = 0.14)
COF vs time



3D image of a linear reciprocating wear

Properties Measured

- Friction coefficient
- Wear volume and wear rate
- Tribofilm formation
- Tribological profiles of lubricants
- Tribological mapping under controlled conditions
- Stribeck-type curves

Specifications

- Load: from *1 mN up to 5’000 N*
- Speed: from *0.001 up to 12’000 rpm*
- Temperature range: *-120°C up to 1’200°C*

Important International Standards

ASTM G99-23
Standard test method for wear testing with a Pin-on-Disk apparatus

ASTM G133-22
Standard test method for linearly reciprocating Ball-on-Flat sliding wear

DIN 50324:1992-07
Tribology; testing of friction and wear model test for sliding friction of solids (ball-on-disc system)

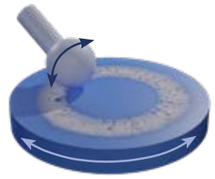
DIN ISO 7148-2:2014
Plain bearings - Testing of the tribological behavior of bearing materials

ISO 20808:2016
Fine ceramics (advanced ceramics, advanced technical ceramics) — Determination of friction and wear characteristics of monolithic ceramics by ball-on-disc method

ISO 18535:2016
Diamond-like carbon films — Determination of friction and wear characteristics of diamond-like carbon films by ball-on-disc method in contact under sliding conditions using a POD tribometer

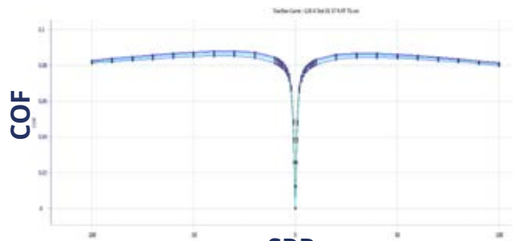
Mini Traction Machine

For Low and High Loads



A Mini Traction Machine is a specialized tribometer designed to study the behavior of lubricants and materials under rolling and sliding contact conditions. It measures and analyzes critical tribological parameters:

- **Coefficient of Friction / Traction Coefficient**
  Measures the ratio of frictional force to normal load during rolling and sliding contact.
- **Film Thickness**
  Assesses the thickness of the lubricant fluid film between contacting surfaces.
- **Lubricant Rheology and Performance**
  Examines the behavior of lubricants under Hertzian contact pressure, speed, and temperature.
- **Friction and Wear Behavior**
  Studies the interaction between surfaces in motion and measures material loss over time. Stribeck-type curve Simulates the fluid film forming behavior as function of operating conditions and surface topography Rolling vs. Sliding Interaction
- **Rolling vs. Sliding Interaction**
  Simulates different combinations of rolling and sliding ratios to replicate real-world operating conditions in gears, cams, rolling bearings, rail/wheel system, and other machinery.
- **Thermal and Electrical Effects**
  Incorporated temperature control to study performance under thermal stress including the impact of electrical effects.

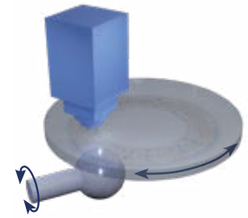


Traction curve with Mini traction module

The Mini Traction Machine is a versatile tool for understanding and optimizing lubricant performance under sliding rolling ratio different.

EHD Lubricant Thickness, SLIM

With Nanometer Resolution



An **Elastohydrodynamic (EHD)** Interferometer is a specialized instrument used to study the behavior of lubricants in elastohydrodynamic lubrication (EHL) conditions, where high Hertzian contact pressures and small contact areas occur, such as in rolling or sliding contacts in bearings, gears, or camshaft systems.

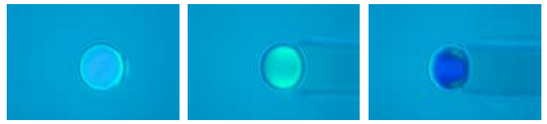
EHD interferometry relies on optical interference to measure the lubricant film thickness and spatial distribution between two surfaces in relative motion under load.

Measurements:

- **Film Thickness:**
  Determined from the interference fringes, providing nanometer-scale accuracy
- **Pressure Distribution:**
  Calculated indirectly using known material properties and film deformation.

Applications:

- Studying **lubricant film formation** and breakdown under high load or shear
- Evaluating lubricant formulations and additives.
- Investigating wear and fatigue mechanisms in EHL contacts.
- Optimizing designs for rolling-element bearings, gears, and similar systems.
- Indirect calculation of pressure-viscosity coefficient of fluids.



Lubricant film thickness during a test

EHD interferometry is a powerful tool for understanding and improving lubrication performance in critical applications.

Properties Measured

- Friction coefficient
- Wear
- Tribofilm formation
- Stribeck curve
- Traction curve

Specifications

- Load: *0 to 200 N, High Load up to 2'000 N*
- Speed: *-6 to 6 m/s*
- Sliding-Rolling Ratio (SRR): +/- 200 %
  (more on request: 10,000 %)
- Temperature range: *Ambient to 150 °C **
- Test sample volume: *35 ml (less in option)*

* (Below ambient with cooling option)

Properties Measured

- Friction coefficient
- Tribofilm formation
- Stribeck curve
- Traction curve
- Lubricant film thickness

Specifications

- Load: *0 to 200 N*
- Speed: *-6 to 6 m/s*
- Sliding-Rolling Ratio (SRR): *-200 % to +200 %*
- Temperature range: *Ambient to 150 °C **

4-Ball Testing

With Upper Rotary Drive

The **4-Ball Test** is a standard tribological test used to evaluate the wear-prevention, load-carrying capacity, and friction-reducing properties of lubricants and greases. It is widely used in industries such as automotive, aerospace, and manufacturing to assess the performance of oils, greases, and other lubricants under high-Hertzian contact stress conditions.

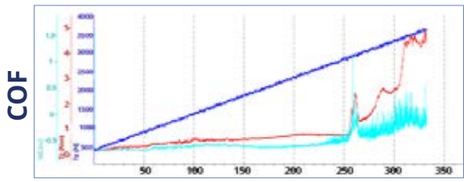
Setup:

Three stationary steel balls form a triangular contact geometry, with a fourth rotating ball pressed against them in the center under controlled load and speed.

Types of Testing:

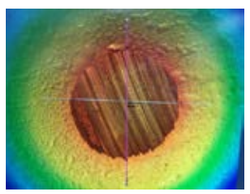
- **Wear Test:**
  Measures wear scar diameter on the stationary balls including friction coefficient.
- **Extreme Pressure (EP) Test:**
  Determines the “Last non-seizure load” that a lubricant can handle before failure (weld point) and calculates the load-wear index.

Applications:
Used to compare lubricants and additives interacting with materials and select products for high-load applications.



Typical 4 Ball Wear Curve (392 N, 60 min, 1’200 rpm)

Extreme Pressure Test



Central Ball Wear

This standardized test is essential for evaluating lubricant performance under extreme conditions.

Properties Measured

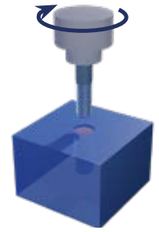
- Wear scar diameter
- Weld load (scuffing)
  (failure point under increasing pressure)
- Last non-seizure load
- Friction coefficient

Specifications

- Load: *0 to 10’000 N*
- Speed: *up to 5’000 rpm*
- Temperature range: *Ambient to 150 °C*

Tapping Torque, Thrust Washer

With Upper Rotary Drive



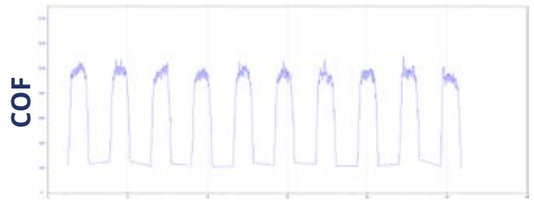
Tapping Torque, Twist Compression

During forming and machining, the tapping torque module characterizes friction, wear, torque, etc. The test involves tapping or drilling with taps of various standard sizes on materials of choice. Twist compression is designed to measure friction and adhesion in metal forming. The test involves slowly rotating a ring on top of the material to be tested.

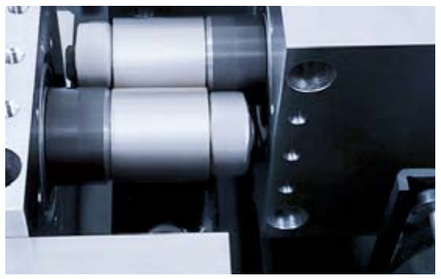
This test provides valuable data for improving performance and reliability in tapping operations.

Thrust Washer

This test evaluates friction and wear parameters of self-lubricated materials in thrust washers, per ASTM D3702.



Typical Tapping Torque Curve



Tapping Torque Test Setup

This test provides valuable data for improving performance and reliability in tapping operations.

Properties Measured

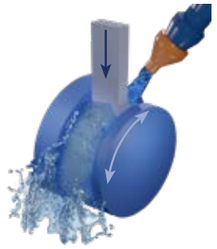
- Tapping Torque:
  Lower values indicate better lubrication and reduced friction
- Torque profile:
  Tracks variations during threading
- Thread quality:
  Assesses surface finish and accuracy

Specifications

- Maximum torque: *5.3 Nm*
- Integrated torque sensor range upon request
- Lower liquid collection pan: *25 x 18 cm*

Cutting Tool Testing

With Block-on-Ring module



Cutting Tool Testing evaluates the performance of cutting tools, coatings, and cutting fluid under **simulated machining conditions**.

Setup:

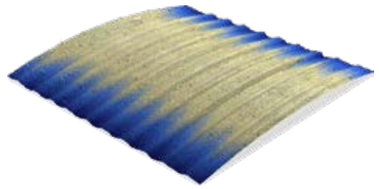
A block, made of tool material or coated with the tested material, presses against a rotating ring (workpiece material).
Controlled loads, speeds, and lubrication simulate real cutting conditions.

Measurements:

- **Wear Rate:**
  Amount of material lost from the block.
- **Friction Coefficient:**
  Friction between the block and tools.
- **Heat Generation:**
  Indicates thermal resistance of the tool material.
- **Surface condition after machining:**
  Evaluate the surface finish and the damage

Applications:

- Evaluating tool coatings or materials for wear resistance and friction performance.
- Comparing cutting fluids or lubricants.
- Optimizing cutting tool performance for machining tasks.



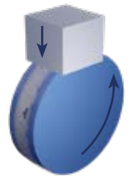
Surface condition after testing

Test Setup with Metal Working Fluids

This method is cost-effective for screening tool materials before full-scale machining tests

Timken Test and EP Test

With Block-on-Ring module



The **Timken Test** is a standardized method used to evaluate the load-carrying capacity and anti-wear properties of lubricants, oils, or greases. It measures the **performance of samples** under high-pressure and sliding contact conditions. The test is particularly useful for determining a lubricant's ability to prevent wear and scuffing under extreme pressure.

Procedure:

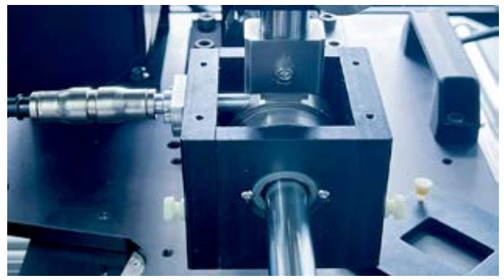
The load is gradually increased until scuffing or wear is observed on the block.
The test continues until the lubricant fails to protect the surfaces.

Measurements:

- **OK Load:**
  The maximum load at which no visible scuffing occurs.
- **Weld Load:**
  The load at which the surfaces seize due to lubricant failure assessing the EP performance of lubricant.
- **Wear Scars on the Block:**
  Examined to determine lubricant effectiveness.

Applications:

The test evaluates lubricants and greases for heavy-duty applications like gears and bearings, assessing their extreme-pressure and wear protection properties.



Timken BOR Setup

It is a standardized method for comparing lubricant and grease performance.

Properties Measured

- Friction coefficient
- Wear and tool life
- Metal fluid tribology
- Surface roughness (with 3D module)

Specifications

- Load: *up to 5'000 N*
- Speed: *from 0.1 to 8'000 rpm*
- Temperature range: *-50°C up to 500°C*

Properties Measured

- Friction coefficient
- Wear
- Extreme pressure

Specifications

- Load: *up to 5'000 N*
- Speed: *up to 8'000 rpm*
- Temperature range: *-50°C up to 500°C*

SRV Testing

With Fretting or Fast Linear module

SRV Testing (short for Schwingung, Reibung, Verschleiß in German, meaning «Oscillation, Friction, Wear») evaluates the **friction, wear, and lubrication performance** of materials, coatings or lubricants under controlled conditions. It is widely used in industries like automotive, aerospace, and manufacturing to simulate real-world tribological conditions.

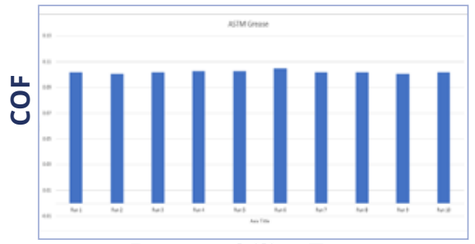
Setup:

An upper sample (e.g., ball, pin, or disc) is pressed against a flat surface (e.g., disc or plate) and linearly oscillates under a controlled load, frequency, and temperature.

Applications:

Tests lubricants, coatings, and materials for components, like gears, bearings, and seals, piston ring/cylinder liners, synchronizer, plastic chassis joints, noise of brake fluids simulating real-world tribological conditions.

E-SRV setup on MFT-5000



Repeatability Tests

ASTM 5707 SRV Grease Data Repeatability

The SRV Tester is ideal for optimizing materials and lubricants for durability and efficiency.

Properties Measured

- Coefficient of friction (COF)
- Wear volume or wear scar diameter
- Load carrying capacity
- Lubricant´s tribofilm formation
- Temperature and humidity effects
- Friction induced noise

Specifications

- Load: *0 to 2’000 N*
- Oscillating Frequency: *Up to 500 Hz*
- Temperature range: *Ambient to 900 °C*

High-Frequency Reciprocating Rig

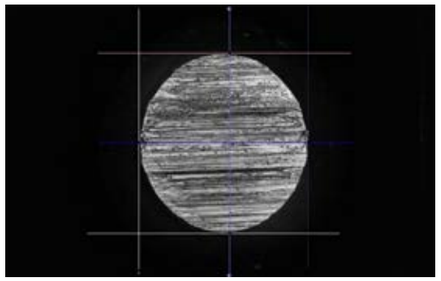
Lubricity Tester, HFRR

The **HFRR** test device is used to evaluate the lubricity of fuels, particularly diesel and aviation fuels.

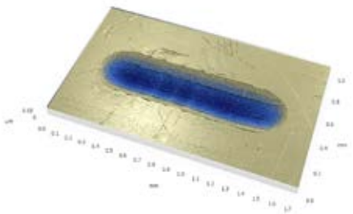
It measures the fuel’s ability to reduce friction and wear under controlled conditions, which is critical for high-pressure pumps and fuel-injection systems.

Setup:

- A steel test ball is placed in reciprocating motion against a fixed steel test disk under a specified load.
- A small amount of test fluid (fuel or lubricant) is introduced between the two surfaces (2 ml).
- The test is conducted at high frequency (50 Hz) and controlled temperature (typically 60°C for diesel fuel).
- After a set duration (75 minutes), the wear scar on the ball is measured under a microscope.
- The larger the wear scar diameter (WSD), the lower the lubricity of the test fluid.



Wear Mark on Ball



Wear Mark on Disk

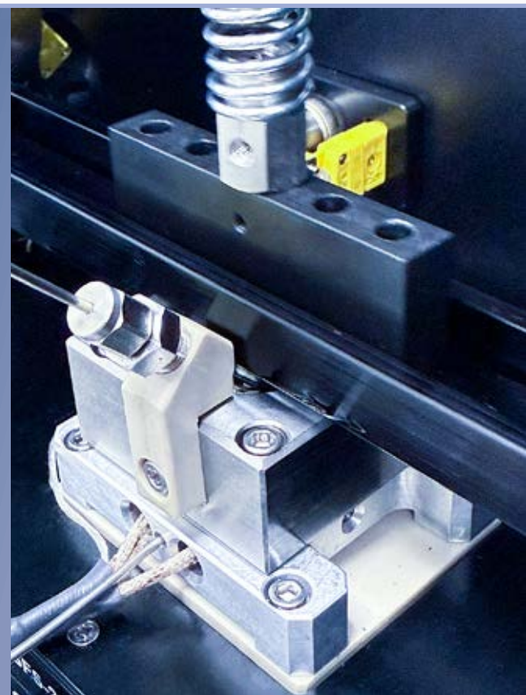
HFRR testing is vital for assessing fuel additives and ensuring diesel fuel compliance with industry standards.

Properties Measured

- Lubricity of fuels and lubricants
- Wear scar diameter (WSD)
- Coefficient of friction
- Tribofilm formation

Specifications

- Load: *0 to 20 N*
- Oscillating Frequency: *Up to 200 Hz*
- Temperature range: *-50 to 150 °C*



Twin-Roller Tester

Standalone Twin Roller Tester

The **Twin Roller Tester** is a specialized device designed to simultaneously assess friction behavior, wear and contact fatigue (RCF) of lubricants in interaction with materials or coatings under slip-rolling contact and high Hertzian contact pressures. It replicates the conditions encountered in applications such as gears, cams, toroidal gears, rolling bearings, rail friction, and rolling mills.

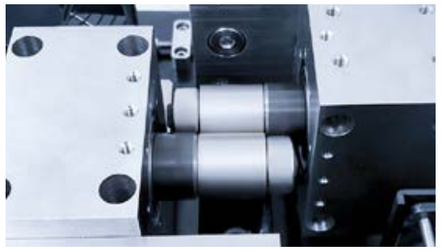
Setup:
Two cylindrical rollers, both rotating under a predefined slip ratio, are pressed together with a controlled load. The ratio between rolling or sliding motion is variable.

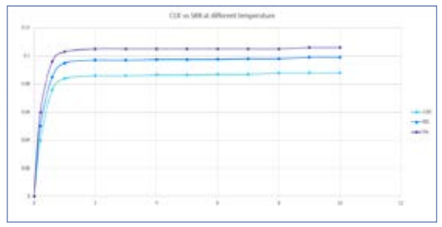
Conditions:
Adjustable speed, load, temperature, and lubrication regime.

Measurements:

- **Friction Coefficient** (as traction or Stribeck-types): Evaluates the lubricant's efficiency.
- **Wear Volume by In-line 3D Profiler and slip-rolling resistance (pitting):** Assesses material loss or surface degradation
- **Temperature Rise:**
  Indicates heat generation under load

Applications:
Test of lubricants, coatings, and materials for wear resistance, friction performance, and load-carrying capacity as well as slip-rolling contact fatigue resistance.





The Twin Roller Tester is ideal for studying rolling-contact phenomena and optimizing lubrication or material performance.

Properties Measured

- Rolling Contact Fatigue (RCF)
- Pitting and micropitting creation
- Fatigue testing
- Wear volume
- Traction and Stribeck-type friction curves

Specifications

- Load: *up to 5'000 N*
- Torque: *50 Nm*
- SRR: *0 % (pure rolling) up to 200% (Pure sliding)*
- Entrainment speed: *4 m/s*
- Oil temperature: *up to 150°C*

Three-Roller Tester

Standalone Micropitting Tester

The **Three Roller Tester** evaluates the performance of lubricants, materials, or coatings under rolling and sliding contact conditions involving three rollers. It is commonly used to simulate complex tribological interactions in systems like gears, toroidal gears, rolling bearings, and rolling mills.

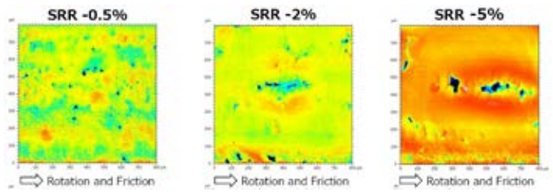
Setup:
Three rollers are arranged in a triangular configuration, with one or more rollers driven to create relative motion under controlled load and speed simulating the time-lapse effect on the small roller.

Conditions:
Adjustable load, speed, temperature, and lubrication regime.

Measurements:

- **Friction Coefficient:**
  Indicates the lubricant's efficiency.
- **Wear or Scuffing:**
  Evaluates material or coating resistance against fatigue.

Applications:
Tests lubricant formulations, assesses wear resistance, and evaluates rolling-contact systems for durability and against contact fatigue.



This tester is particularly useful for simulating more realistic multi-contact conditions than single or dual-roller setups.

Properties Measured

- Rolling Contact Fatigue (RCF)
- Macro-pitting and micro-pitting creation
- Fatigue testing
- Wear resistance
- Frictional efficiency

Specifications

- Load: *up to 5'000 N*
- Torque: *50 Nm*
- SRR: *0 % (pure rolling) up to 200% (Pure sliding)*
- Entrainment speed: *4 m/s*
- Oil Temperature: *up to 150°C*

MFT-5000

Everything You Need in One Powerful Tribometer

Industry Standard Platform

The patented (US10132733B2) Rtec-Instruments Multi Function Tribometer (MFT-5000) is globally regarded as the most versatile and technologically advanced tribometer.

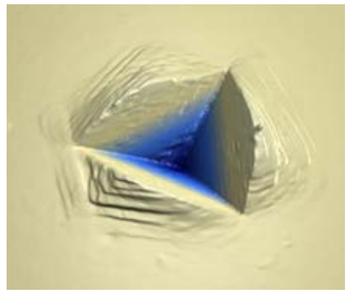
The tribometer offers breakthrough technology in tribology equipment— featuring ultra low resolution from nano to macro scales and patented (US10775247B1) negligible thermal drift capacitance type force sensors. It boasts the highest speeds, widest environmental control range, and ultra accurate stroke control.

Additionally, the patented integrated **3D profilometer** enables nanoscale or microasperity-level analysis by measuring surface changes over time.

Unrivaled Multi-Purpose Performance

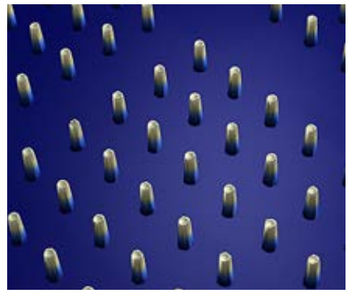
Tribology

- Friction coefficient
- Wear rate/ wear volume
- Material durability
- Tribological profile



Mechanical Tests

- Hardness
- Elastic modulus
- Coating adhesion
- Scratch resistance



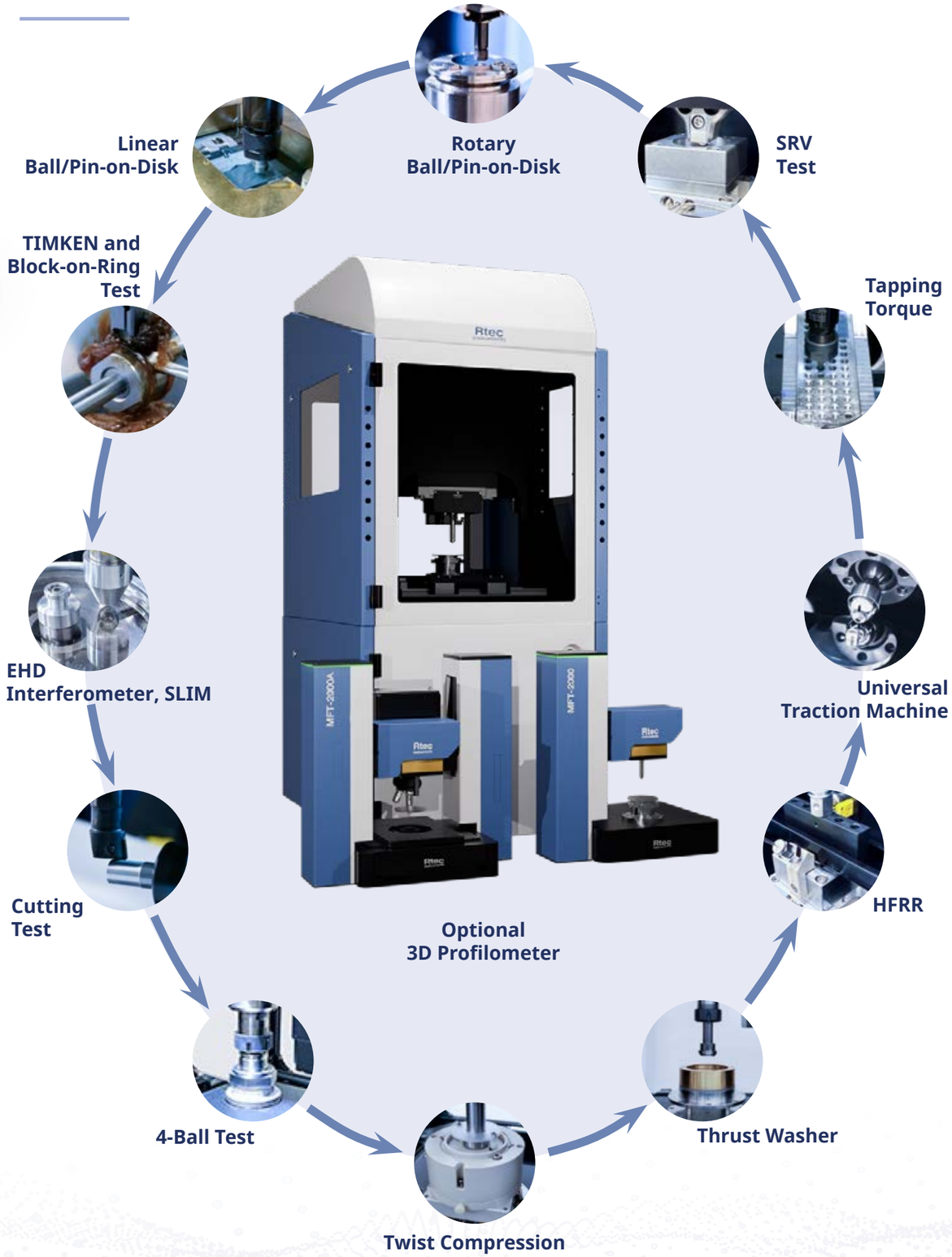
3D Imaging

- Surface topography
- Failure analysis
- Morphology
- Defect analysis

Patented In-line 3D Profilometer with Automatic Stitching Technology Optimized for Tribology Testing (US10024776B2).

The Only All-in-One Tribometer

Redefining Tribology



International Standardized Tribometric Tests

Consistency, Reliability and Comparability of Results

International tribometric standards for lubricant testing ensure consistent quality, reliable performance, and global compatibility. They provide a common framework for evaluating lubricants, making it easier to compare products, facilitate trade, and ensure compliance with safety and environmental regulations

Here is a list on the main standards:

4-Ball, Friction, Wear and Extreme Pressure

ISO	20623	Determination of the extreme-pressure and anti-wear properties of lubricants	4-Ball
DIN	51350-1	Testing in the four-ball tester - Part 1: General working principles	4-Ball
ASTM	D2266	Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method)	4-Ball
ASTM	D2783	Measurement of Extreme-Pressure Properties of Lubricating Fluids	4-Ball
ASTM	D2266	Wear Preventive Characteristics of Lubricating Grease	4-Ball
ASTM	D2596	Measurement of Extreme-Pressure Properties of Lubricating Grease	4-Ball
ASTM	D4172	Wear Preventive Characteristics of Lubricating Fluid	4-Ball
ASTM	D5183	Determination of the Coefficient of Friction of Lubricants Using the Four-Ball	4-Ball

Other, homologue tests: IP239, PSA-Renault D55-1078 and D55-1136, GB/T 3142-2019, GB/T 12583-98, NB/SH/T 0189-2017, NB/SH/T 0189-2017, SH/T 0202-1992, SH/T 0204-1992, SH/T 0762-2005, JB/T 9395-2017, JIS K2220.

Shear stability of lubricating oils containing polymers:

DIN	51350-6	SHELL Four-Ball, Shear stability of polymer-containing oils	4-Ball
CEC-L	45-A-99	(KRL) Viscosity Shear Stability of Transmission Lubricants	4-Ball
ISO	26422	Determination of shear stability of lubricating oils containing polymers	4-Ball TR [1]

TIMKEN (Block-on-Ring; BOR)

ASTM	D2509	Measurement of Load-Carrying Capacity of Lubricating Grease (IP236)	BOR [2]
ASTM	D2782	Measurement of Extreme-Pressure Properties of Lubricating Fluids (IP240)	BOR
DIN	51434	Testing under boundary lubricating conditions with the Timken tester	BOR
JIS	K2519	Load carrying capacity of lubricating oils	BOR

FALEX Block-on-ring

ASTM	G77	Ranking Resistance of Materials to Sliding Wear Using Block-on-Ring Wear Test	BOR
ASTM	D2714	Calibration and Operation of the Falex Block-on-Ring Friction and Wear Testing	BOR
ASTM	D2981	Wear Life of Solid Film Lubricants in Oscillating Motion	BOR
ASTM	D3704	Wear Preventive properties of Greases oscillating motion	BOR
DIN	51347	Testing in the mixed friction area with the Brugger lubricant tester	BOR
ISO	7148-1	Testing of the tribological behavior of bearing materials - Part 1	BOR

Tapping torque and cutting tool testing

ASTM	D5619	Comparing Metal Removal Fluids Using the Tapping Torque Test Machine	TTM [3]
ASTM	D8288	Standard Test Method for Comparison of Metalworking Fluids	TTM

[1] Tapered roller bearing in 4-ball machine *[2] BOR = Block-on-Ring* *[3] TTM = Tapping Torque Machine*

Greases

ASTM	D2266	Wear Preventive Characteristics of Lubricating Grease	4-Ball
ASTM	D2596	Measurement of Extreme-Pressure Properties of Lubricating Grease	4-Ball
JIS	K2220	Load carrying capacity by four-ball test	4-Ball
DIN	51350-4	Testing in the four-ball tester - Part 4: Determination of welding load	4-Ball
DIN	51350-5	Testing in the four-ball tester - Part 5: Determination of wearing characteristics	4-Ball
IP	239	Determination of EP and Anti-Wear Properties of Lubricating Fluids and Greases	4-Ball
ASTM	D2509	Load carrying capacity by Timken -Block on ring	BOR
ASTM	D3704	Wear Preventive properties of Greases oscillating motion	BOR
DIN	51434	Testing under boundary lubricating conditions with the Timken tester - Part 3	BOR
ASTM	D5707	Measurement of friction and wear of grease (ISO 19291 - mode 3)	SRV Test
ASTM	D5706	Measurement of EP of greases (ISO 19291 - mode 4)	SRV Test
ASTM	D7420	Tribo Properties of Grease Lubricated Plastic Socket Suspension Joints	SRV Test
ASTM	D7594	Determining Fretting Wear Resistance of Lubricating Greases	SRV Test
ASTM	D8317	Measuring Friction and Wear Properties of Greases Under Rolling	SRV Test

Lubricants, Fluids, Oils

ASTM	D6425	Measuring Friction and Wear Properties of EP Lubricating (ISO 19291- mode 1)	SRV Test
ASTM	D7421	Measurement of EP Properties of Fluids (ISO 19291- mode 2)	SRV Test
DIN	51834-2	Friction, Wear Properties of EP lubricating oils	SRV Test
DIN	51834-3	Tribological behavior of lubricant (ASTM D7755)	SRV Test
DIN	51834-4	Friction Wear behavior of lubricant oil with cylinder roller on disk (ASTM D8316)	SRV Test
DIN	51834-5	Quantification of the friction-induced noise of brake fluids in EPDM-metal contacts	SRV Test
ASTM	D8227	Determining the COF of Synchronizer Lubricated by Mechanical Transmission Fluids (MTF)	SRV Test
ISO	20120	Determination of the COF of synchronizer lubricated by manual transmission fluids (MTF)	SRV Test
ASTM	D8503	Determining the scuffing temperature limit of engine oils	SRV Test
ASTM	D2782	Measurement of EP Properties of Fluids	BOR
ASTM	D4172	Wear Preventive Characteristics of Lubricating Fluid	4-Ball
ASTM	D5183	Determination of the Coefficient of Friction of Lubricants	4-Ball
ASTM	D2783	Measurement of Extreme-Pressure Properties of Lubricating Fluids	4-Ball
DIN	51350-2	Testing in the four-ball tester - Part 2: Determination of welding load of liquid lubricants	4-Ball
DIN	51350-3	Testing in the four-ball tester - Part 3: Determination of wearing characteristics	4-Ball
VW	PV144	Pitting load capacity of liquid lubricants	4-Ball
JIS	K2220	Load carrying capacity by four-ball test	4-Ball
IP	239	Determination of EP and Anti-Wear Properties of Lubricating Fluids and Greases	4-Ball
IP	300	Rolling Contact Fatigue Tests for Fluids	4-Ball
DIN	51350-6	SHELL Four-Ball, Shear stability of polymer-containing oils	4-Ball
VW	PV1454	Determination of steady-state temperature of an axial ball bearing	4-Ball
CEC-L	A-99	KRL [4], Viscosity Shear Stability of Transmission Lubricants	4-Ball
ASTM	G77	Ranking Resistance of Materials to Sliding Wear	BOR
ASTM	D2714	Calibration and Operation of the Falex Block-on-Ring Friction and Wear Testing Machine	BOR

[4] KRL= Kegelrollenlager (tappered roller bearing)

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