

HFRR

High Frequency Reciprocating Rig

From Fuel Lubricity to Advanced Tribology



ASTM D6079 & ISO 12156
• Fuel Lubricity • Fretting •
Tribology • Reciprocating
Friction

More Than Lubricity

The Complete HFRR Platform

The HFRR-1000 is Rtec Instruments' next-generation benchtop High Frequency Reciprocating Rig, engineered for laboratories that demand more than standard compliance. Combining real-time closed-loop force and stroke control with advanced inline sensing, it delivers the precision, repeatability, and flexibility required for both routine fuel lubricity qualification and cutting-edge tribology research. From diesel and biofuel screening to fretting analysis and electro-tribology, the HFRR-1000 performs where conventional testers reach their limits.

Key Features

01 - Closed-Loop Load Control

Closed-loop servo force control replaces dead weights for fully automated, programmable load profiles and improved repeatability.

02 - Voice Coil Flexure Design

A bearing-free voice coil flexure delivers ultra-precise motion control up to 200 Hz without rolling friction or mechanical wear, ensuring high signal fidelity.

03 - Precision Stroke Control (10 μm – 2.8 mm)

Real-time 1 nm LVDT feedback delivers superior stroke accuracy and repeatability for applications from fuel lubricity to micro-fretting.

04 - Dual Piezo Friction Measurement

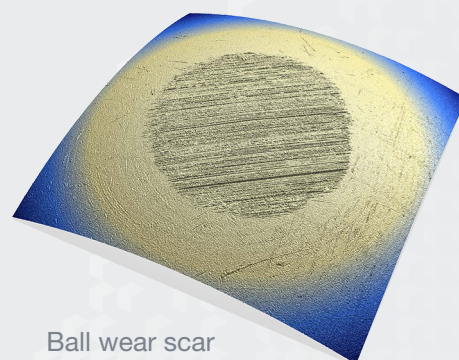
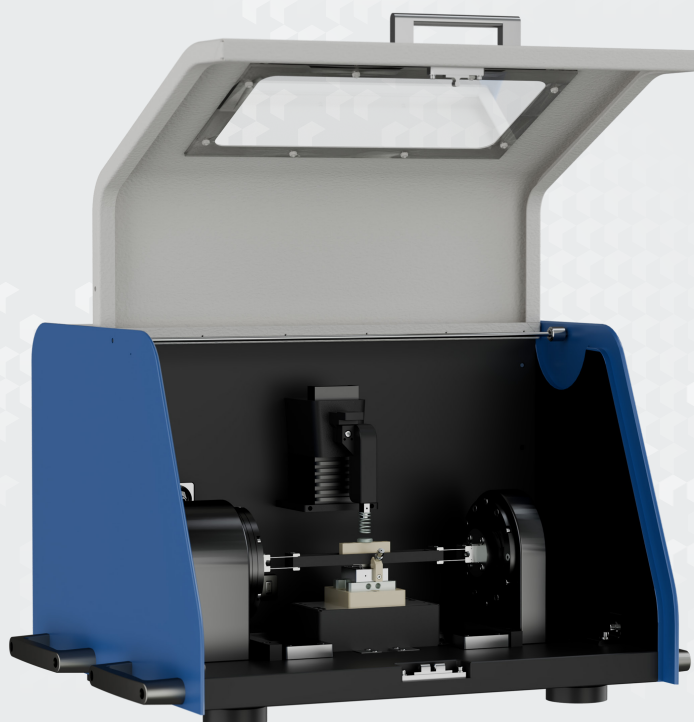
Dual piezo sensors deliver high-resolution friction data for reliable detection of lubrication transitions and early surface damage.

05 - Closed-Loop Environmental Control

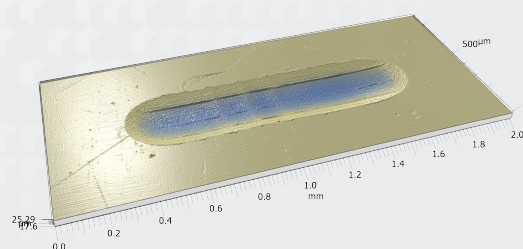
Integrated humidity, temperature, and inert gas control eliminate external accessories, simplifying setup while ensuring stable, repeatable test conditions.

06 - Electrified Testing - EV Ready

Fully insulated for electro-tribology with simultaneous DC/AC bias, impedance, and ECR measurements for advanced EV drivetrain research.



Ball wear scar



Sample wear

Software

The HFRR-1000 ships with a Windows-based recipe software that makes standard testing as simple as one click, while giving advanced users full control over every test parameter. Automated report generation, real-time inline endpoint definition, and multi-file statistical comparison eliminate manual data handling and ensure full traceability between operators and laboratories.

- One-click ASTM D6079 and ISO 12156 protocol
- Full parameter control per step: force, stroke, frequency, temperature, humidity
- Real-time endpoints based on friction, AE, ECR, or temperature
- Automated standardized reports with wear scar data 3D wear scar mapping and FFT-M high-frequency analysis

Why HFRR-1000?

The HFRR-1000 was designed from the ground up to go beyond what conventional reciprocating testers can offer. Every design choice — from the bearing-free voice coil drive to the integrated environmental chamber — reflects a commitment to precision, reliability, and research flexibility that no dead-weight system can match.

No Dead Weights

Fully automated, programmable force control for superior repeatability.

1 nm Stroke Resolution

Exceptional motion accuracy across the industry's widest stroke range.

10 µm–2.8 mm Stroke

From ASTM lubricity testing to advanced micro-fretting applications.

Dual Piezo Friction Sensing

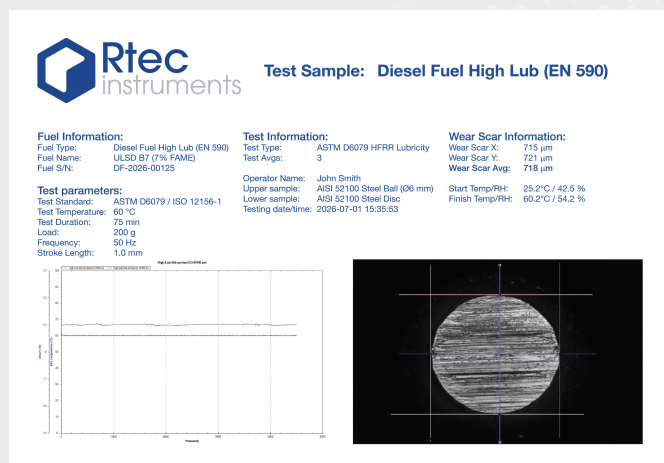
Detect lubrication failure and surface damage before visible wear.

Integrated Environmental Control

Stable humidity, temperature, and atmosphere without external accessories.

Electro-Tribology Ready

Simultaneous electrical and tribological measurements for EV research.



Rtec-Instruments HFRR Automated Report

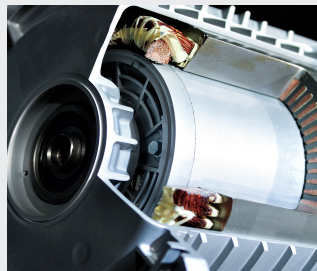
Applications

The High Frequency Reciprocating Rig (ASTM D6079, ISO 12156) has become the reference instrument for evaluating the lubricity of conventional diesel fuels. Today, renewable fuels, electrification, and low-carbon technologies are expanding the role of HFRR far beyond fuel lubricity testing.



Fuel

ASTM D6079, ISO 12156, diesel, biodiesel



EV / E-Motor

Contact electrification, ECR, bearings



Grease & Additive

Fretting, additives, film durability



Aerospace

Oscillating contacts, coatings, lubricants

Technical Specifications

Test parameters:

Frequency	10 – 200 Hz
Stroke amplitude	10 μ m – 2.8 mm
Displacement resolution	1 nm (LVDT)
Force control	Closed-loop servo (no dead weights)
Force profiles	Constant / Linear / Step
Test modes	Fretting · Wear · Lubricity · Linear Friction

Sensors:

Friction measurement	Dual piezoelectric sensors
Acoustic emission	Optional Inline AE sensor
Electric contact resistance	Optional Inline ECR sensor
Position measurement	LVDT (real-time feedback)

Environment:

Humidity control	5 – 95% RH (closed-loop)
Temperature	Ambient to high temp. (-40°C - 400°C available)
Atmosphere	Air / inert gas

Software:

Platform	Windows — recipe-based
Test programs	Standard + fully customizable
Inline endpoints	Friction · AE · ECR · °C
Analysis	Statistical + wear scar
Data export	Binary / ASCII

Standards:

Fuel lubricity	ASTM D6079 · ISO 12156
Fretting / wear	DIN 51834
Certified specimens	Balls · Disks · Reference oil

Leading innovation
in surface and
materials testing.



Agent / distributor



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