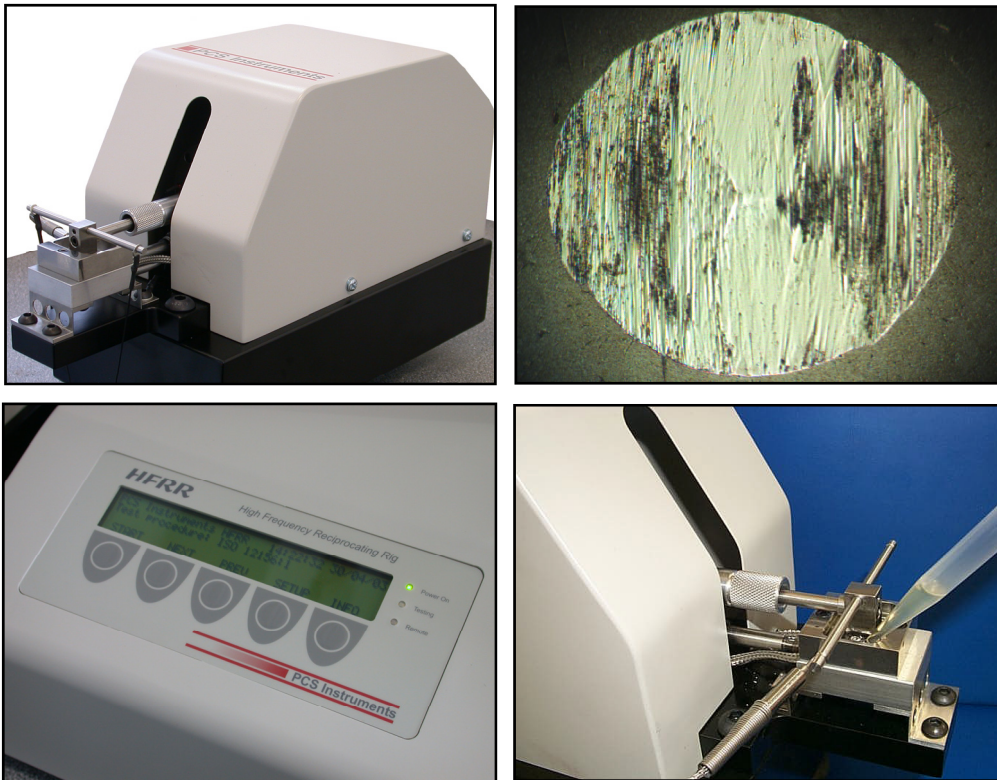


# HFRR High Frequency Reciprocating Rig



The HFRR is a microprocessor-controlled reciprocating friction and wear test system which provides a fast, repeatable assessment of the performance of fuels and lubricants.

It is the worldwide industry standard for testing diesel fuel lubricity.

# Fast and repeatable testing

The High Frequency Reciprocating Rig (HFRR) is a microprocessor-controlled reciprocating friction and wear test system which provides a fast, repeatable assessment of the performance of fuels and lubricants. It is particularly suitable for wear testing relatively poor lubricants such as diesel fuels and for boundary friction measurements of engine oils, greases and other compounds. It has become the industry standard test for diesel fuel lubricity and conforms to ASTM D6079, CEC F-06-A, ISO 12156, EN 590, JPI-5S-50 and IP 450.

## Components

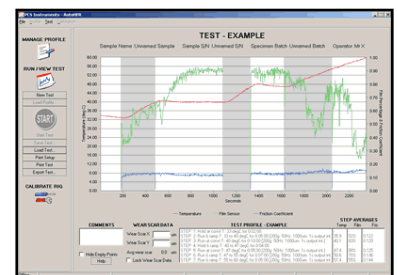
The system comprises the a mechanical unit, control unit and an optional PC. The control unit includes a keypad, LCD display and a built in microprocessor so that the complete test cycle can be automatically controlled directly from the unit. Alternatively the control unit can be connected to a PC to allow data logging, graphical representation of test parameters and results file storage. The unit also includes a humidity probe option, the output from which is automatically logged at the beginning and end of the test in accordance with the CEC F-06-A test method.



HFRR MECHANICAL UNIT

## AUTOHFR and High Temperature Option

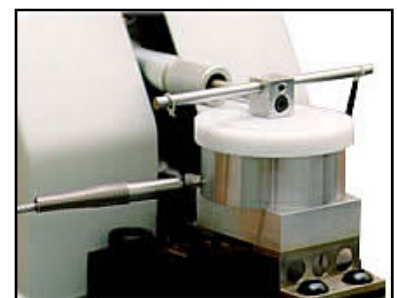
AUTOHFR control software allows the user complete flexibility when defining the test profile rather than the standard diesel fuel lubricity test procedures. Each profile is built up from a series of individual steps, and the temperature, frequency and stroke length can be varied during each step. The friction force between the specimens, the contact resistance (film) value and test fluid temperature are continuously displayed in a graphical format throughout the test. Data output is both graphical (which can be printed out using AUTOHFR) and formatted text (which can be manipulated in a spreadsheet). The standard HFRR instrument can perform tests at temperatures up to about 150°C. An optional high power heater box can be used which allows tests at up to 400°C to be performed.



AUTOHFR SCREENSHOT

## Gasoline Kit

The Gasoline Conversion Kit has been developed to allow for safer and more repeatable lubricity testing of gasolines. The high volatility of gasoline means that even at room temperature a significant fraction of the gasoline will evaporate from an open specimen holder, changing additive concentration in the remainder and posing an explosion hazard. Converting an existing HFRR to test gasoline is simple. With the use of the aluminium heater block extension, normal HFRR diesel lubricity testing can continue using the standard specimen holders after a quick calibration.



HFRR GASOLINE KIT IN SITU

## Features and Applications

The HFRR is easy to calibrate and follows a fully automated test control sequence, freeing up operator time. Test specimens are a single use ball and disc which conform to all international diesel fuel test standards. Specimens in other materials and to different specifications are available. Outside of diesel fuel testing, current HFRR applications include gasoline testing, measuring grease behaviour under boundary conditions, the evaluation of marine engine lubricants and investigations into fretting, both dry and in the presence of lubricant.

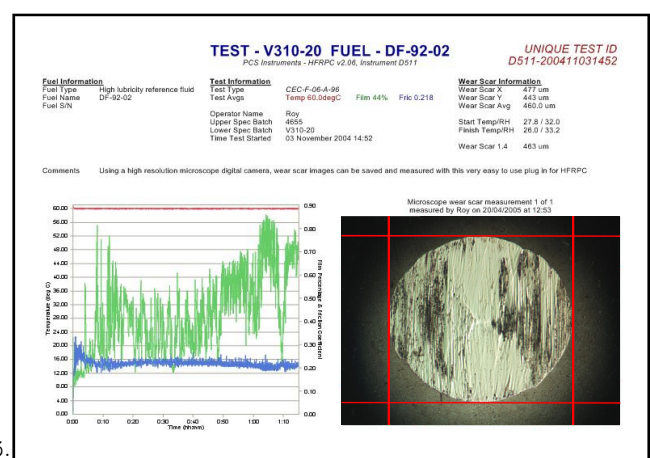
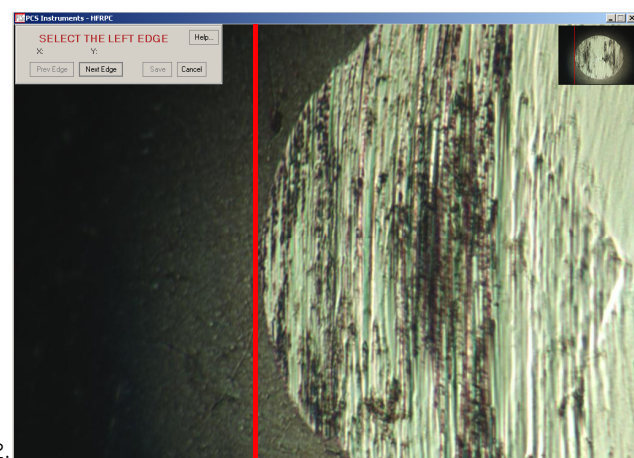
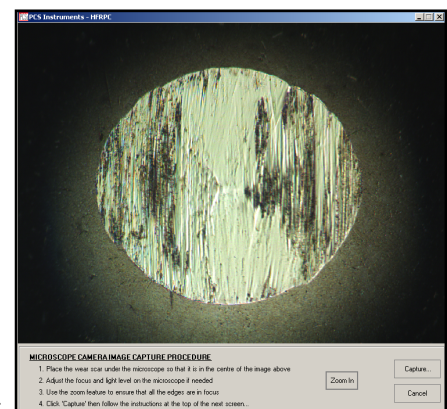
## Wear Scar Camera Package

The microscope camera is an optional accessory for HFRR which allows the user to capture calibrated images of a wear scar and measure the wear scar on the PC screen. The wear scar image and measurements are saved with the test data file and can be printed on the test report - see below. The camera functionality is an integral part of the HFRR software which allows test data files to be exchanged between labs and the measurements to be viewed and, if required, re-measured with full traceability.

The measurement process is quick and accurate. First an image of the wear scar is captured and then the X and Y dimensions of the scar are measured by clicking and dragging the cursor lines onto the outer limits of the wear scar. The image is viewed at high magnification on the PC screen making it much easier to correctly identify the edges of the wear scar. Once satisfied with the measurement the operator can add comments and the captured image is saved. Storing the image and measurements as part of the test data file allows test results to be easily reviewed at any time in the future - without the need to re-measure the wear scar.

### Images

1. Wear scar image of the ball after a test captured through the camera attached to the microscope.
2. Zoom in and position the cursor at the outer edge of the wear scar (a thumbnail of the complete image is shown in the top corner). Repeat for the other 3 edges.
3. Print-out of the friction and film trace, the wear scar measurement and the wear scar image after the test has been completed. The wear scar can be re-measured and saved again at any later time.



The package includes the camera and a microscope adaptor for the standard PCS microscope, all cables, software and a certified calibration target.

# Technical Specification

## Operating Conditions

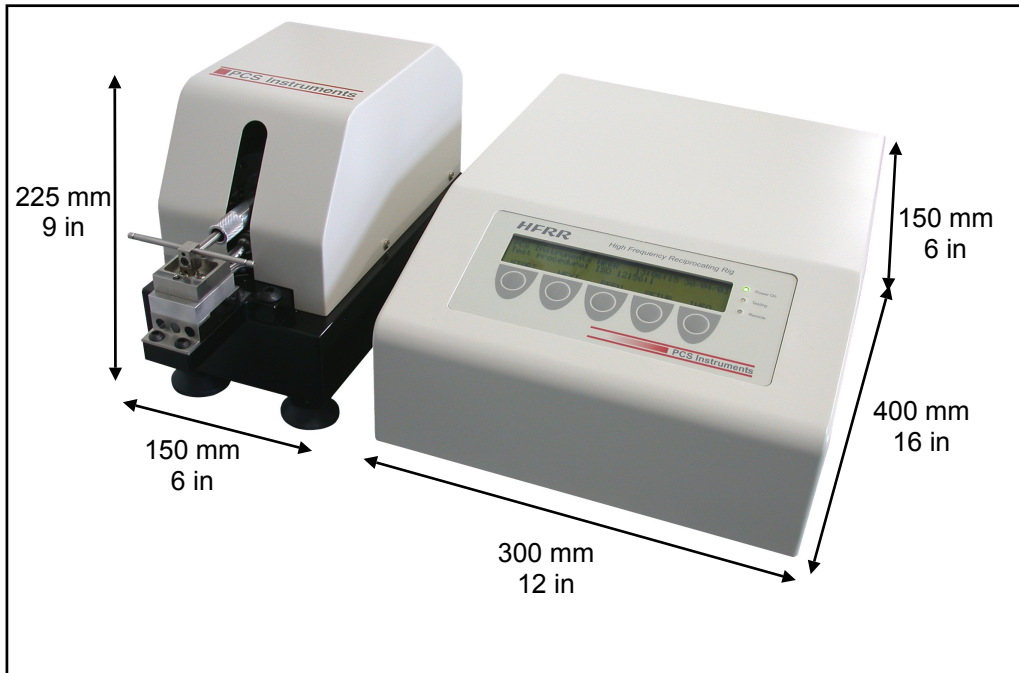
Frequency	10 to 200 Hz
Stroke Length	20 $\mu$ m to 2.0 mm
Load	0.1 to 1.0 kg with supplied weights
Maximum friction force	Dependent on amplitude - maximum 10.0 N
Temperature	Ambient to 150°C (400°C with high power heater option)
Standard upper specimen	6.0 mm diameter ball
Standard lower specimen	10.0 mm diameter x 3.0 mm thick disc

## Electrical

Mains Power	Universal (100 - 230 V)
Heaters	Two 24 V, 15 Watt cartridge heaters

## Weight and Dimensions

Control Unit	8 kg (18 lb)
Mechanical Unit	24 kg (53 lb)



## Optional Accessories

- Microscope - with certified micrometer and holder for upper specimen
- Wear Scar Camera package
- Humidity controlled cabinet - custom built to fit the HFRR and cables
- Mini-printer - allows test data to be printed from the standalone system
- Gasoline kit
- High power heater - allows testing at temperatures up to 400°C
- AUTOHFR - allows flexible user defined test profile to be created and run

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