



# A-HFRR

## *Automated Diesel Fuel Lubricity Test System*

ASTM D6079

ASTM D7688

ISO 12156 (A, B)

IP 450



- **All in one: control unit, climate chamber, test module, air preparation unit, computer, storage chamber for balls-plates in a single case**
- **Specified temperature and humidity are automatically maintained in the climate chamber**
- **Embedded PC: displays test parameters and processes**
- **Several tests can be carried out using a single disk plate by its repositioning in the device**
- **Automatic calculation of wear scar WS 1.4**
- **Microscope with measurement capabilities conforming to one of two methods: method A - with a digital camera, method B with visual observation**
- **The most compact instrument on the market**

## Test procedure

The A-HFRR (High Frequency Reciprocating Rig) is based on devices that have been used for many years in the Tribology (Friction and Lubrication) Department of the Faculty of Engineering at Imperial College London.

Systems of this type are used to determine the lubricity of a sample during slow cyclic sliding. The A-HFRR system has proven particularly useful in assessing the lubricity of diesel fuels.

The A-HFRR system uses an electromagnetic motor to provide low-amplitude oscillations of a moving specimen pressed against a stationary specimen. The amplitude and frequency of these vibrations can be changed. In this case, the friction force between the samples and the voltage drop at the point of contact between them are measured.

The lower, fixed specimen is secured in a small tray containing the lubricant to be tested. The lower specimen holder is equipped with an electric heater. Testing specimen of various shapes is possible. The reference materials for testing diesel fuels are a 6 mm ball for the upper specimen and a 10 mm disc for the lower specimen.

## When using the A-HFRR, you have two main reasons to be sure of the test results you get:

Our rig outperforms leading devices in both repeatability and reproducibility, while also having a better mechanical design.

The temperature and humidity in the climate chamber are fully controlled by the device, thus the risk of human error is mitigated.

## The advantages of the A-HFRR system

Best repeatability and reproducibility of measurement results;

The possibility of assessing the wear spot of standard samples using only one measurement;

A very small amount of lubricant is sufficient, so testing of experimental lubricating fluids is possible;

The ability to observe the formation of a thin film because of surface additives through the change in voltage at the point of contact;

The ability to measure sliding friction at large amplitudes of specimen movement, as well as wear due to friction using the same system.



## A-HFRR = Monoblock: control unit, climate chamber, test module, air preparation unit, computer, storage chamber for balls-plates in a single case

We know that many laboratories have problems with space, so we tried to make the instrument compact. The device has relatively small dimensions and weight, so it can be easily placed on a regular table.

## Automatic maintenance of the set temperature and humidity in the climate chamber

The device has the ability to automatically maintain the temperature and humidity without operator intervention. The climate chamber has humidification, dehumidification, cooling and heating functions. The innovative dehumidification and cooling system is small in size and does not require maintenance throughout its life.

The screenshot shows the 'Method editor' interface with the following parameters:

- Method Name: ISO 12156
- Chamber temperature, °C: 23.0
- Frequency, Hz: 50
- Air humidity, %: 50
- Stroke length, mm: 1.00
- Sample temperature, °C: 60.0
- Test time, min: 75
- Applied load, g: 200

Buttons: Back, Save

## Integrated data processing and color touchscreen display

The built-in data processing system automatically controls the process and analyses the test results. This system allows you to build graphs with a choice of parameters and scaling, and also automatically calculates WS1.4. The A-HFRR is capable of remote firmware updates. Data export to LIMS can be performed after analysis is complete, or data can be saved to the internal memory for up to 2000 experiments.

The screenshot shows the 'Test results' interface with the following data:

- User: Admin
- Method: FOCT P IICO 12156
- Sample name: CON
- Test time: 01:15:00
- Air humidity, %: 52.8 (Before the test), 40.3 (After the test)
- Air temperature, °C: 25.3 (Before the test), 24.9 (After the test)
- MWSD: 395
- HCF: 60.00
- AVP: 1.49
- WS1.4: 389.86

Buttons: Exit, Export, Graph, Print

## Several tests on one plate for research purposes

The ability to carry out several tests on one plate by changing its position in the device. The plate holder design allows multiple tests to be carried out, which can significantly help save on consumables.

The screenshot shows the 'High Frequency Reciprocating Rig' interface with the following parameters:

- User: Admin
- Sample name: SAMPLE
- Method: ISO 12156
- Sample temperature, °C: 25.2
- Air humidity, %: 21
- Air temperature, °C: 24.5

Buttons: Test parameters, Settings, Results, Start



<b>Methods</b>	ISO 12156 (A, B), ASTM D7688, ASTM D6079, IP 450
<b>Frequency</b>	10...200 Hz
<b>Stroke length</b>	20 µm...2 mm
<b>Load</b>	0... 1000 g, using weights in increments of 100 g
<b>Maximum friction force</b>	Amplitude dependent, maximum 10 N
<b>Temperature</b>	Ambient... +150 °C
<b>Ball requirements</b>	6 mm diameter
<b>Plate requirements</b>	10 mm diameter, 3 mm thickness
<b>Condition monitoring system</b>	Multilevel access, control of humidity and air temperature in the climate chamber, sample temperature sensor installation control, door position control, calculation of WS1.4
<b>Power supply</b>	100-240V, 50/60 Hz, 320 W
<b>Heaters</b>	Two 24 W cartridge heaters
<b>Climate chamber characteristics</b>	Humidification up to 80% dehumidification down to 30% heating up to 35 °C cooling down to +15 °C
<b>Custom functions</b>	Chemically resistant 7 inch color touch screen storage for up to 2000 experiments the ability to transfer data to LIMS. Keyboard and mouse connectivity barcode scanner connectivity
<b>Connections</b>	1 x Ethernet, RJ 45, 4 x USB, Bluetooth, Wi-Fi
<b>Accessories</b>	Set of equipment for determining the lubricity of gasoline, printer, standard solution, ball-plate test specimen
<b>Dimensions WxDxH</b>	550x500x850 mm excluding the wear scar measurement system
<b>Weight</b>	60 kg