



# FALEX Four-Ball Extreme Pressure Test Machine

The Four-Ball EP Test measures a lubricant's extreme pressure properties under High Hertzian contact in pure sliding, or pure rolling, motion. The test is used to determine the load carrying properties of a lubricant at high test loads.



Three determinations are made:  
Load-Wear Index (LWI)  
Last Non-Seizure Load (LNSL)  
Weld Point (WP).

The Falex Four-Ball EP Test rotates a ½-inch diameter ball in contact with three similar balls held stationary in the test cup. The contact surfaces are covered with test lubricant, a load is applied and a timed test is performed. Normally, the wear scars on the three lower balls are measured and averaged. The test is

generally terminated at the load where the rotating ball 'welds' to the three stationary balls.

The Load-Wear Index (LWI) quantifies the wear protection at increasing loads. The Last Non-Seizure Load (LNSL) indicates the transition from elastohydrodynamic to boundary lubrication and metal to metal contact.

The Falex Four-Ball EP is available in two configurations:

**Standard System**, suitable for the ASTM and IP Standard Test Methods for Four Ball EP Testing

**High Performance System with Data Acquisition:**

for ASTM and IP Standard Test Methods for Four Ball EP Testing  
Optional Accessory Kits for Four Ball Wear Testing (ASTM D2266 and D4172) and Shear Stability Determinations (KRL Method)

The CEC L-45-A-99 (KRL) Test Method determines the shear stability of polymer-containing lubricating oils by the Four-Ball tester using a tapered roller bearing. The test results allow prediction of in-service permanent viscosity loss.

# FOUR-BALL EP FEATURES AND SPECIFICATIONS

<b>LOAD</b>	1000 kg max, applied using a lever arm and dead weight loading system
<b>SPEED</b>	1760 rpm Standard 100 to 1800 rpm with optional High Performance Upgrade
<b>MOTION</b>	Sliding Rolling (with optional rolling 4 ball race)
<b>TORQUE</b>	Measure and record test torque with optional High Performance Upgrade
<b>TEMPERATURE</b>	Controlled and recorded from ambient to 200°C with optional High Performance Upgrade
<b>SPACE REQUIREMENTS</b>	72 x 60 x 65 in [L x D x H] 183 x 152 x 165 cm
<b>POWER</b>	220 Volts, 60 Hz, Single Phase, 15 Amps. 50 Hz optional
<b>SHIPPING INFORMATION</b>	900 lb / 408 kg 56 x 36 x 65 in / 142 x 91 x 165 cm [L x W x H]

## STANDARD TEST METHODS

- ASTM D 2596: Standard Test Method for Measurement of Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method)
- ASTM D 2783: Standard Test Method for Measurement of Extreme-Pressure Properties of Lubricating Fluids (Four-Ball Method)
- ASTM D2266 Standard Test Method for Wear Preventive Characteristics of Lubricating Grease (Four Ball Method)
- ASTM D4172 Standard Test Method for Wear Preventive Characteristics of Lubricating Fluid (Four Ball Method)
- CEC L-45-A-99 Viscosity Shear Stability of Transmission Lubricants (Taper Roller Bearing Rig)
  - IP 239: Determination of Extreme Pressure and Anti-wear Properties of Lubricants - Four Ball Machine Method
- IP 300 (obsolete) Rolling Contact Fatigue Test for Fluids in a Modified Four-Ball Machine
- DIN 51350-1 Testing of lubricants;  
testing in the Shell-four-ball tester, general working principles
- DIN 51350-2 Testing of lubricants;  
testing in the Shell-four-ball tester, determination of welding load of fluid lubricants
- DIN 51350-4 Testing of lubricants; testing by the Shell four-ball tester; determination of welding load of consistent lubricants
- DIN 51350-6 Determination of shear stability of polymer-containing lubricating oils by the Shell Four-Ball tester

# FOUR-BALL EP COMPONENTS AND OPTIONS

## 018-001-012 FALEX FOUR-BALL EXTREME PRESSURE TEST MACHINE

- Two Speed Motor and Test Spindle
- Dead Weight Load System and Weights
- Digital Timer and Test Shut-off
- Ball Cup Assembly
- Test Stand
- Test Cup Table Fixture
- Torque Wrench
- Upper Ball Chuck

## 018-001-013 FALEX HIGH PERFORMANCE FOUR-BALL EXTREME PRESSURE TEST MACHINE with DATA ACQUISITION

### TORQUE MEASUREMENT

Test Torque Load Cell Assembly, Torque and Coefficient of Friction Display and Data Acquisition

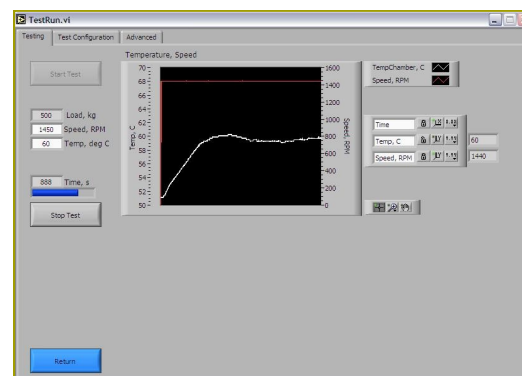
### TEMPERATURE CONTROL

Ball Cup Heater Assembly, Display and Data Acquisition

Automatic Temperature Start-Up, Maximum Temperature 200° C.

### VARIABLE DRIVE MOTOR

Variable Speed Motor Assembly, Display and Data Acquisition  
Maximum spindle speed 1800 rpm



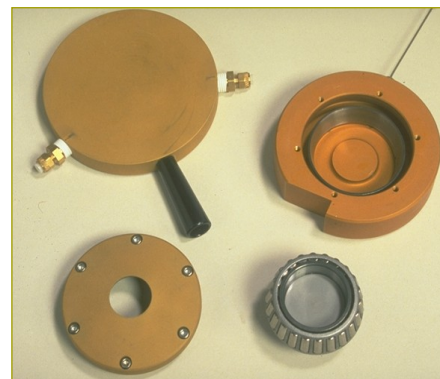
KRL Test Temperature Profile Displayed on the Falex Data acquisition SoftWEAR™

## F-1518-WTK FOUR BALL WEAR TESTING KIT

Accessories for Wear Testing using ASTM D2266 or D4172 Test Parameters. Includes precision test load assembly and Wear Test Cup

## 018-108-003 KRL MECHANICAL SHEAR STABILITY ADAPTER ASSEMBLY

The Mechanical Tapered Roller Bearing Shearing Device (KRL), determines shear loss of polymer containing multi-viscosity gear oils used in heavy duty manual transmissions and differentials. Meets CEC L-45-A-99 Viscosity Shear Stability of Transmission Lubricants (Taper Roller Bearing Rig)



KRL Test Adapter

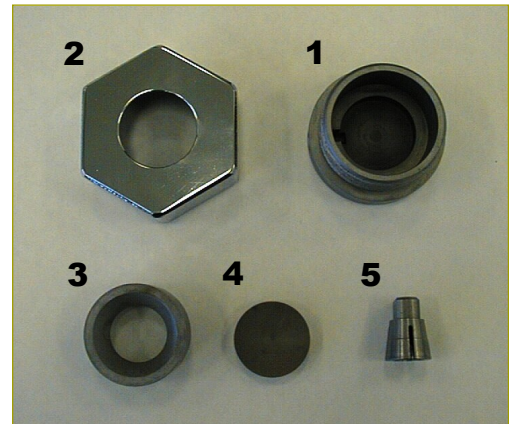
## F-1518-5A KRL TEMPERATURE CONTROLER

Refrigerated/Heated Recirculation System to control test temperature at 60°C for the Mechanical Shear Stability Adapter.

*Please inquire if you should require other temperature ranges.*

# FOUR-BALL EP ACCESSORIES

**018-099-002 BALL CUP ASSEMBLY**  
Ball Cup (018-015-002) - 1  
Ball Cup Nut (018-016-001) - 2  
Ball Clamp Ring (018-010-004) - 3  
Cup Disk (018-010-003) - 4



**018-099-005 BALL CUP ASSEMBLY with THERMOCOUPLE**  
Ball Cup (018-015-002)  
Ball Cup Nut (018-016-001)  
Ball Clamp Ring (018-010-004)  
Cup Disk (018-010-003)  
Thermocouple (F-1518-8) - not shown

**020-005-028 #28 BALL CHUCK - 5**  
Holds upper rotating 1/2 inch diameter ball during testing

**F-1518-4 DISC ADAPTER**  
Permits use of 1/4" diameter by 1/16" thick disks in place of lower balls for alternate material combinations.



**F-1519-6 DISC FIXTURE**  
For punching 1/4" diameter disc from 1/16" sheet stock (must be used with arbor press).

**019-109-005 THERMOCOUPLE ASSEMBLY**

**F-1518-9A ROLLING FOUR-BALL CUP ASSEMBLY**  
Accommodates lower rolling specimen race for testing under rolling conditions. Includes one lower specimen race (F-1518-9B). Purchase of F-1518-9, Pitting Detection Device, is strongly recommended.

**F-1518-VSA VIBRATION SENSOR ASSEMBLY**  
Used when determining onset of fatigue or test vibration when evaluating materials under rolling four-ball conditions. Dynamic Torque Measurement and Test Cut-off. Requires High Performance Data Acquisition and Control System.

# FALEX SCAR MEASUREMENT SYSTEMS

## F-1519-31A

### **HIGH PRECISION SCAR MEASUREMENT SYSTEM**

Includes binocular microscope with X-Y base and digital display of measurement accurate to 0.001 mm. System includes ball cup stand with single ball holder. An optional adapter allows for the reading of the ball scars without removal from the ball cup.

## F-1518-31B

### **DIGITAL SCAR MEASUREMENT SYSTEM with CCD CAMERA**

Includes a CCD camera and digital display of ball scar and capability of measurement on screen to 0.001 mm. System includes ball cup stand with single ball holder and CCD camera with USB port for recording scar diameters to Falex computerized data acquisition system or host computer. An optional adapter allows for reading the ball scars without removal from the ball cup.



# FALEX TEST SPECIMENS

## 006-500-161

### **FALEX TEST SPECIMEN BALLS**

AISI E 52100 steel. 500/box  
Balls conform to ASTM D2596 and, D2783.

## 018-500-001

### **BEARING TEST SPECIMEN**

for KRL Test CEC L-45-T-93

## F-1518-9B

### **ROLLING FOUR-BALL SPECIMEN RACE**

Replacement lower specimen race for evaluating materials under rolling conditions

Test balls and disks are available in a wide range of materials, surface finishes and hardness. Please contact Falex Corporation or a Technical Sales Representative for pricing and availability.



# For All of Your Lubricant and Materials Testing

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## Lubricants

- Pin and Vee Block
- Block-on-Ring
- Timken EP
- Tapping Torque
- Panel Coker
- High Temperature/High Speed Bearing
- Four Ball Wear
- Four Ball EP
- High Temperature Wheel Bearing
- Thermal Oxidation Stability (L60-1)
- Fretting Wear
- Hydrolytic Stability
- Grease Corrosion Test
- Isothermal Oxidation
- Hydraulic Fluid Pump Stand (Vickers and Conestoga)

## Fuels and Solvents

- Ball on Three Disk Fuel Lubricity
- Thin Film Evaporator
- Fuel Deposit Simulator

## Materials

- Journal Bearing
- Multi-Specimen
- Crossed Cylinders
- Low Velocity Friction Apparatus
- Pin on Disk
- Coefficient of Stoption
- Magnetic Media and Paper Wear
- Life Performance Face Clutch System
- Thin Coating Wear (Electrical Contacts)
- Dual Drive Rolling Contact Fatigue
- High Speed Bearing/Mechanical Clutch

## Abrasion and Erosion

- Dry Sand/Rubber Wheel
- Air Jet Erosion
- Miller Number Slurry

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