Friction & Wear Test Systems

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Test Equipment

Universal Multi-Function Wear Test System **UFW200**
Multi-Purpose Wear Test System **MPW110**
Micro Friction Test System **MFW120**
Four-Ball Wear Test System **FBW130**
Block-on-Ring Wear Test System **BRW140**
Cam & Tappet Wear Test System **CTW150**
Reciprocating Friction Wear Test System **RFW160**
Friction Coefficient Measuring System **FCMS170**
Abrasive Wear Test System **ABW180**
Slurry Erosion Test System **SEW190**
Dry Sand Erosion Test System **SEW190D**
Multi-Function Adhesion / Scratch Test System **AST210**
Scratch Test System **SCRT800**
Universal Multi-Function Wear Test System – UFW200

**General Information**
The **UFW200** system evaluates four types of friction and wear – rotation, reciprocating, Block-on-Ring, and scratch. It identifies wear situations incurred by rotating, reciprocating, abrasiveness, fretting, galling, and seizure. The UFW200 system is able to carry out tests in multiple environments by controlling areas such as temperature, humidity, pressure, etc.

The system reveals friction and wear characteristics for various materials including metal, ceramic, compound materials, coatings, as well as nano and bio material.

The pressure load can be configured to adjust to load applications ranging from a light to heavy load by the use of a static load device.

Temperature and humidity can be adjusted during testing using hot air convection heat. The system is configured to measure wear loss and friction coefficient in real time during wear testing and results are simultaneously stored in a computer.

The UFW200 series performs both the module test and the friction and wear test on one machine resulting in more reliable data.

**Multi-Function Tests**
- Static and dynamic friction test
- Adhesive, abrasive and scratch wear test
- Multi-cycle, multi-axis fatigue wear test
- Pull-off adhesion wear test

**Test Modes**
- Pin-on-Disc (One Pin) (ISO 7148, ASTM G99)
- Ball-on-Disc (One Ball) (ISO 7148)
- Sliding Contact Wear
- Bearing Life
- Block-on-Ring
- Scuffing Wear
- Reciprocating Motion Test
- Scratch
Universal Multi-Function Wear Test System – UFW200

◆ Rotation Module
  - Pin-on-Disc (One Pin) (ISO 7148, ASTM G99)
  - Ball-on-Disc (One Ball) (ISO 7148)
  - Four-Ball

Pin/Ball-on-Disc Test
  - **Upper Pin or Ball Specimen**
    - Stationary or automatic positioning on disc radius
    - RPM 0 – 1,000rpm
  - **Automatic Radius Positioning**
    - Range: 70mm
    - Resolution: 0.1mm

◆ Block-on-Ring Test Module
  - Upper Block: 5mm x 15mm x 10mm
  - Lower Ring: dia. 20-70 mm
  - Rotation Speed: 1 – 1,000 rpm

Block/Pin/Ball-on-Ring Test
  - **Upper Pin**: dia. 3 – 10 mm
  - Flat, spherical or conical end

◆ Linear Reciprocation Module
  - Upper Pin/Ball/Block
  - Distance: 0 – 50mm
  - Reciprocating Frequency: 0.1 – 50 Hz
  - Reciprocating Stroke: 0.1 – 25mm

Wear and Fretting Tests
  - **Upper Pin/Ball/Block Specimen**
    - Stationary or automatic positioning on disc radius
  - **Automatic Radius Positioning**
    - Range: 50mm
    - Resolution: 1㎛

Engine Tests
  - **Upper piston ring**: stationary
  - **Lower cylinder liner**: reciprocating

◆ System Software

◆ Sample Fixture
**General Information**

The MPW110 system is a Macro Scale Wear Tester and while used to primarily perform Pin-on-Disc or Ball-on-Disc tests, it can also be used to perform Thrust Washer, Four-Ball, Ball-on-Flat, and oscillating tests as well. The temperature and humidity within the test environment is set prior to the test and can even be adjusted during testing. Temperature is precisely controlled up to ±1° using PID control.

The equipment is manufactured to evaluate the friction and wear characteristics for various materials including metal, ceramic, composites, coatings, nano and bio materials.

To adjust the load application range from light load to heavy load, the pressure load is configured by a two-stage lever.

The system is configured to measure wear loss and friction coefficient in real time during testing and the results can be simultaneously stored in a computer.

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**Control Parameters**

- Rotation Speed (rpm)
- Load (kgf)
- Temperature (°)
- Humidity (%)
- Time (sec)
- Cycle
- Lubricant Chamber Temperature
- Microsoft Windows XP Compatible
- User-friendly screen configuration
- Average and Peak Curve Readings
- Real Time Data Display and Storage
- Can modify parameters during test

**Recorded Parameters**

- Rotation speed (rpm)
- Friction force (N)
- Sliding speed (m/sec)
- Wear loss (㎛)
- Sliding distance (m)
- Temperature (stage, specimen surface: °)
- Test time (sec)
- Test cycle (cycle)
- Friction coefficient (µ)
Multi-Purpose Wear Test System – MPW110

- **Test Modes**
  - Pin-on-Disc (One Pin or Three Pin) (ISO 7148, ASTM G99)
  - Ball-on-Disc (One Ball or Three Ball) (ISO 7148)
  - Thrust Washer (ASTM D3702)
  - Ball-on-Flat Test (ASTM G133)

- **Software**

- **Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Load Capacity</td>
<td>1,000 N (optional 10,000 N)</td>
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<tr>
<td>Min. Load Capacity</td>
<td>2 N</td>
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<tr>
<td>Friction Sensor</td>
<td>50 N or 200 N</td>
</tr>
<tr>
<td>Wear Loss Measuring Sensor</td>
<td>±0.5 μm</td>
</tr>
<tr>
<td>Rotation Speed</td>
<td>1 – 1,500 rpm (optional 3,000 rpm)</td>
</tr>
<tr>
<td>Heating Range</td>
<td>RT150°C (optional 1100°C)</td>
</tr>
<tr>
<td>Humidity Control Range</td>
<td>30 – 90% R.H ±5%</td>
</tr>
<tr>
<td>End Mode</td>
<td>Time, cycle, friction</td>
</tr>
<tr>
<td>Power</td>
<td>AC 220 V, single phase</td>
</tr>
<tr>
<td>Size</td>
<td>W 700 X D 450 X H 700 mm (adjustable)</td>
</tr>
<tr>
<td>Weight</td>
<td>≈ 200 kg</td>
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</tbody>
</table>
Micro Friction Test System – MFW120

◆ General Information
The MFW120 system is a Micro Scale Wear Tester to evaluate wear resistance characteristics for newly developed nano, bio, ultrathin coatings, metal, non-metal, and plastic materials.

A spherical pin or ball is generally used as the counter material on the rotating disc. It can perform diverse tests simply by changing the jig.

The two-jaw disc can work with round or rectangular type discs. Adjusting the heat and humidity for the test environment is controlled via a connected computer which also collects data.

The pressure load is set using the lever ratio through an applied load range from a minimum of 1 g (0.01 N) to a maximum of 1 kg (10N). This system is ideal for evaluating the wear resistance of ultrathin coatings, nano materials, or bio materials since it can handle very low loads and is designed for simple specimen manufacturing and testing. The system observes and stores rotation speed, friction force, friction coefficient, linear velocity, friction distance, wear track diameter, temperature, and humidity in real time.

When the specimen is an odd shape or size, the specimen can be modified by using the jig (optional feature). Using various chamber installations, it can test a variety of lubrication conditions.

◆ Control Parameters
- Rotation speed (rpm)
- Temperature (°)
- Time (sec)
- Load (N)
- Humidity (%)
- Cycle

◆ Recorded Parameters
- Rotation speed (rpm)
- Sliding speed (m/sec)
- Temperature (°)
- Friction force (N)
- Sliding distance (m)
- Test time (sec)
- Friction coefficient (µ)
- Test cycle (cycle)

◆ System Software & Graphic Display
- Rotation speed (rpm)
- Sliding speed (m/sec)
- Temperature (°)
- Test cycle (cycle)

◆ Test Modes
- Spherical Pin-on-Disc
- Ball-on-Disc
- Spherical Pin

◆ Specifications
| Load Range | 1 gf – 1 kgf (0.01 – 10 N) |
| RPM | 10 – 400 rpm |
| Temperature | RT100°C ±2°C |
| Pin | Spherical pin Ø 5 × L 20 mm |
| Ball | Ø 1/8", Ø 1/4", Ø 1/2" |
| Size | W 500 X D 300 X H 440 mm |
| Power | AC 220V, Single Phase |
| Weight | ≈ 25kg |

Friction Force
Friction Coefficient
Temperature (optional)
Humidity (optional)
Dry and Wet Tests
Four-Ball Wear Test System – FBW130

**General Information**
The FBW130 performs Four-Ball testing according to ASTM D2783, ASTM D2266, ASTM D4172 and ASTM D2596 standards. It is manufactured with sufficient frame strength and the use of air pressure for heavy test loads ensures smooth pressure application.

By using the Four-Ball test method and the extreme pressure properties measurement method, it measures the wear resistance characteristics and extreme-pressure performance for a diverse range of lubrication oils and greases.

Also, this equipment performs the Load-Wear Index (Mean-Hertz Load) and Weld Point, by means of the Four-Ball Extreme-Pressure (EP) Test.

Lubrication oils are evaluated using AISI standard Steel No. E-52100 (bearing steel) 12.7 mm, grade 25 EP (Extra Polish) Rockwell C hardness 64-66 as its default test steel ball.

**Control Parameters**
- Rotation speed (rpm)
- Load (N)
- Temperature (°)
- Time (sec)
- Cycle

**Recorded Parameters**
- Rotation Speed (rpm)
- Friction Force (N)
- Temperature (°)
- Test Time (sec)
- Test Cycle (cycle)
- Friction Coefficient (µ)

**Test Modes**

**Accessories**
- Wear scar measuring system
- Four-Ball Jig: ASTM D2596

**Specifications**

<table>
<thead>
<tr>
<th></th>
<th>Max. 8,000 N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Range</td>
<td></td>
</tr>
<tr>
<td>RPM</td>
<td>30 – 2,000 rpm</td>
</tr>
<tr>
<td>Temperature</td>
<td>RT100°C ±2°C</td>
</tr>
<tr>
<td>Test Ball</td>
<td>12.7 mm steel ball</td>
</tr>
<tr>
<td>Optional Ball</td>
<td>Ø 3 1/8&quot;, Ø 5/16&quot;, Ø 1/2”</td>
</tr>
<tr>
<td>Loading Method</td>
<td>Air Pressure</td>
</tr>
<tr>
<td>Optional Function</td>
<td>100 kgf at 20,000 rpm</td>
</tr>
<tr>
<td></td>
<td>300 kgf at 15,000 rpm</td>
</tr>
<tr>
<td></td>
<td>600 kgf at 3,000 rpm</td>
</tr>
<tr>
<td></td>
<td>800 kgf at 1,700 rpm</td>
</tr>
<tr>
<td>Weight</td>
<td>≈ 25kg</td>
</tr>
<tr>
<td>Friction Force</td>
<td></td>
</tr>
<tr>
<td>Friction Coefficient</td>
<td></td>
</tr>
<tr>
<td>Dry and Wet Tests</td>
<td></td>
</tr>
</tbody>
</table>
**General Information**

The BRW140 system measures sliding wear and rolling wear characteristics. It is configured to perform testing according to ASTM G77, ASTM D2714 and ASTM D3704 standards.

It also measures rolling fatigue wear by rolling contact through two rolling test methods, controlled by a jig change.

This test system can measure the static coefficient of friction and kinetic coefficient of friction according to the counter-material and can be used to measure the lubricating characteristics of oil. The system is designed to precisely measure friction force and is devised to harmonize according to specimen size, which can be changed during a rotation-type roller or Block-on-Ring test so that it is not affected by the size of the specimen.

**Control Parameters**
- Rotation/Oscillation Speed
- Load (N)
- Temperature (°)
- Time (sec)
- Cycle

**Recorded Parameters**
- Rotation/Oscillation Speed (m/sec)
- Slip Ratio (%)
- Load (N)
- Friction force (N)
- Temperature (°)
- Test Time (sec)
- Test Cycle (cycle)
- Friction Coefficient (µ)

**Setting Parameters**
- Counter (cycle)
- Speed (rpm, m/sec)
- Temperature (°)
- Time (sec)
- Distance (m)

**Application**
- Sliding Contact Wear
- Rolling Contact Wear
- Gear Wear
- Bearing Life
- Scuffing Wear
- Friction Test
- Friction Coefficient

**Test Modes**
Block-on-Ring Wear Test System – BRW140

Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
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<tbody>
<tr>
<td>Load Range</td>
<td>Max. 4,000 N</td>
</tr>
<tr>
<td>Speed</td>
<td>Max. 1,000 rpm (optional 6,000 rpm)</td>
</tr>
<tr>
<td>Heating Range</td>
<td>Room Temperature – 200°C</td>
</tr>
<tr>
<td></td>
<td>(lubrication chamber)</td>
</tr>
<tr>
<td>Oscillation Test Speed</td>
<td>7.9±0.16 m/min</td>
</tr>
<tr>
<td>Angle of Oscillation</td>
<td>30° – 90°</td>
</tr>
<tr>
<td>Test Ring</td>
<td>Type S-10</td>
</tr>
<tr>
<td>Test Block</td>
<td>Type H-30</td>
</tr>
<tr>
<td>Data Acquisition Rate</td>
<td>Max. 1000 Hz</td>
</tr>
</tbody>
</table>

Software & Graphic Display

The main control and settings screen are set to control test conditions and continuously observe test results.

Wear test equipment for heavy loading bearing material using hydraulic systems. It can accommodate heavy loads with low speed testing.

Exclusive test equipment for Block-on-Ring. Performs stable friction wear test.
Cam & Tappet Wear Test System – CTW150

◆ General Information

The CTW150 system checks the wear characteristics of a cam and tappet in a vehicle engine.

By using cam and tappet systems used in actual vehicles, this system implements rotation and friction conditions, thereby imitating actual vehicle driving conditions.

This system is designed to test tappets by installing rod type or roller type tappets. It can simulate various types of cam and tappet wear status by interchanging the cam and tappet according to the necessary size and shape.

This device is designed to lubricate each part of the cam and tappet smoothly to simulate engine operation and is designed to force lubrication to each part when required.

Through each sensor, it is able to monitor friction force, friction coefficient, vibration, temperature change, etc. Testing can be stopped at a specified mode to perform a purpose-driven test.

For rod type testing, the cam contacts with tappet rotation inside the vehicle. It is designed to move the center of contact according to the size of cam and tappet to mimic the same conditions under engine operations.

The contact angle between the cam and tappet should always be the same and a level meter is installed to maintain conditions during the interchange and installation of new specimens.

◆ Control Parameters
- Rotation Speed (rpm)
- Load (N)
- Temperature (°)
- Test Time
- Test Cycle
- Vibration

◆ Recorded Parameters
- Friction Torque
- Rotation Speed (rpm)
- Sliding Speed (m/sec)
- Sliding Distance (m)
- Temperature (°)
- Test Time
- Test Cycle
- Vibration

◆ Applications
- Cam and Tappet Test
- Block-on-Ring Test
  (ASTM 3704, ASTM G77)
- Bearing Life Test

◆ Test Modes
## Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
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<tbody>
<tr>
<td><strong>Load Range</strong></td>
<td>Max. 10,000 N</td>
</tr>
<tr>
<td><strong>Load Control</strong></td>
<td>Motor and spring force manual control</td>
</tr>
<tr>
<td></td>
<td>Load control screw</td>
</tr>
<tr>
<td></td>
<td>LM guide for lever control</td>
</tr>
<tr>
<td><strong>Rotation Speed</strong></td>
<td>30 – 3,000 rpm</td>
</tr>
<tr>
<td><strong>Speed Control</strong></td>
<td>PWM method</td>
</tr>
<tr>
<td><strong>Lubricant Flow Method</strong></td>
<td>Jet or Deposition</td>
</tr>
<tr>
<td><strong>Heating Range</strong></td>
<td>Ambient to 150°C (oil chamber heating) Cartridge Heater</td>
</tr>
<tr>
<td><strong>Vibration Sensor (optional)</strong></td>
<td>Frequency Response 3 – 7,000 Hz Acceleration range: ±100g</td>
</tr>
<tr>
<td><strong>Friction Force</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Lubrication Chamber and Pump</strong></td>
<td></td>
</tr>
</tbody>
</table>
Reciprocating Friction Wear Test System – RFW160

◆ General Information
The RFW160 system evaluates friction and wear characteristics of material by reciprocating motion and it is developed to perform various contact conditions at high and low speeds.

The motor-operated reciprocating motion system is specially designed to solve the common problem of instable speed of three-point link devices. It enables stable reciprocating friction testing. This device strokes up to 40 mm and is designed to be driven by the high speed vibrator for frequencies above 30 Hz.

Data acquisition of RFW160 system uses National Instrument’s DAQ module, which enables computer-based control. It can collect a lot of data, which allows for identification of changing friction force and friction surface during the wear test. In addition, it can accommodate low capacity testing or high capacity testing according to the pressure load selection.

Data acquisition systems normally store data at above 100 Hz. It is configured using a USB serial port and it is designed to handle a maximum of 1 KHz of data acquisition.

◆ Control Parameters
- Load
- Frequency (Hz)
- Temperature (°)
- Test Time
- Test Cycle

◆ Recorded Parameters
- Friction Torque
- Load
- Sliding Speed (m/sec)
- Friction Coefficient (µ)
- Temperature (°)
- Test Time
- Test Cycle
- Wear

◆ Sample Adaptor & Accessories
- Upper and Lower Roller Sample
  - Roller Size: 35 – 50 mm
- Ball and Roller Sample
  - Ball Size: 6 – 12.7 mm
- Block-on-Ring Sample
  - Block Size: 5 mm x 5 mm x 20 mm (adjustable)

◆ Test Modes
Reciprocating Friction Wear Test System – RFW160

Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
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<tr>
<td>Load Range</td>
<td>2.5 – 50 N</td>
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<tr>
<td>Load Control</td>
<td>Motor and Spring Force Control</td>
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<tr>
<td>Temperature Range</td>
<td>Ambient – 150°C</td>
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<tr>
<td>Heating Power Cartridge</td>
<td>400 W</td>
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<tr>
<td>Temperature Sensor</td>
<td>K-type Thermocouple</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>1 – 30 Hz or 30+ Hz (optional)</td>
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<tr>
<td>Stroke</td>
<td>Max. 40mm</td>
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<tr>
<td>Friction Transducer</td>
<td>Piezo Electric Type</td>
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<td>Place Specimen</td>
<td>80 mm x 30 mm x 5 mm</td>
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<tr>
<td>Software</td>
<td>Neo-Plus Sequence Control</td>
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<tr>
<td></td>
<td>Data Acquisition Software</td>
</tr>
</tbody>
</table>

Area Contact
Line Contact
Point Contact
Interface Neo-Plus Serial Link Interface Module

Software

Operating system is designed to be user-friendly.

The static load device enables the load weight to be controlled and fixed. The Hz load controls the sine wave.
**General Information**

The FCMS170 system measures static friction coefficient for all materials. The test material is placed on top of the flat plate and the friction coefficient is measured as it pulls the object with the desired test speed. It is able to measure metal, ceramic, plastic, fabric, electronic material, rubber, paper, etc.

Depending on the options selected, the system can perform dry or wet tests. The friction speed range is 100 – 200 mm/min and is configured to test according to ASTM D1894 and KS M ISO 8295 standards.

**Control Parameters**
- Friction Speed (mm/min)
- Load (N)
- Dry and Wet Conditions
- Temperature (°)
- DAQ Rate

**Recorded Parameters**
- Friction Speed (mm/min)
- Friction Force (N)
- Friction Coefficient (µ)

**System Information**
- Microsoft Windows XP Compatible
- User-friendly Screen Configuration
- Average and Peak Curve Readings
- Real-time Data Display and Storage
- Can modify parameters during test

**Test Modes**

**Specifications**

<table>
<thead>
<tr>
<th>Load Range</th>
<th>100 gf – 10kgf (0.1 – 100 N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>100 – 200 mm/min</td>
</tr>
<tr>
<td>Temperature</td>
<td>Ambient</td>
</tr>
<tr>
<td>Size</td>
<td>W 440 mm x D 300 mm x H 550 mm</td>
</tr>
<tr>
<td>Electricity</td>
<td>AC 220V, Single Phase</td>
</tr>
<tr>
<td>System Weight</td>
<td>≈ 25kg</td>
</tr>
</tbody>
</table>

Dry and Wet Conditions
- Metal, Rubber, Plastic, Ceramic, Fabric, Paper, Film, Electronic Materials, etc.

Friction Force / Friction Coefficient
Abrasive Wear Test System – ABW180

◆ General Information
The ABW180 system evaluates the wheel abrasive wear characteristics of various materials such as metal, ceramic, plastic, fabric, rubber, and paper.

It fixes the test specimen to a rotating plate and an abrasive wheel, which is the counter-material, then contacts the specimen for specified time to measure the amount of abrasion.

◆ Control Parameters
- Load (250, 500, 1,000gf)
- Test Time (sec)
- Test Cycle
- Abrasive Wheel Grit

◆ Accessories
- Abrasive Wheel Dressing Kit: Diamond Dresser
- Vacuum Aspiration System
- Abrasive Wheel Set
- Precision Balancer (0.1 mg)

◆ Test Modes
- Evaluates wheel abrasive wear characteristics according to ASTM, ISO, JIS, NFG, UNE standards.
- User-friendly electronic touch pad

◆ Specifications

<table>
<thead>
<tr>
<th>Load Range</th>
<th>250 g, 500 g, 1,000 g</th>
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</thead>
<tbody>
<tr>
<td>Speed</td>
<td>70 rpm</td>
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<tr>
<td>Electricity</td>
<td>AC 220V, Single Phase</td>
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<tr>
<td>System Weight</td>
<td>≈ 15kg</td>
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<tr>
<td>Dry and Wet Conditions</td>
<td>Metal, Rubber, Plastic, Ceramic, Fabric, Paper, Film, Electronic Materials, etc.</td>
</tr>
<tr>
<td>Friction Force / Friction Coefficient</td>
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</tbody>
</table>
Slurry Erosion Test System – SEW190

◆ General Information
The SEW190 system measures surface damage in dry, wet or corrosive conditions using SiC, Al₂O₃, SiO₂ powder or sand. This equipment measures the slurry erosion condition for various materials.

Related standards and test specifications that can be measured using this system are:
- ASTM G73, G75 – Liquid Impingement Erosion Testing and Slurry
- ASTM D3451 – Polymeric Powders and Powder Coatings
- JIS H8503 – Wear Resistance for Metallic Coatings
- ISO 7784 – Paints and Varnishes: Determination of Resistance to Abrasion

◆ Control Parameters
- Rotation Speed: max. 3,000 rpm (m/sec)
- Base Rotation Speed: max. 2,000 rpm
- Sand/Water Rate: cm³/cm³
- Impingement Angle Control
- Test Duration (hr/min/sec)

◆ Accessories
- Angular Plate
- Test Fixture
- Dryer

◆ Test Modes
- ASTM G73, G75, ASTM D3451, JIS H8503, ISO 7784

◆ Specifications

<table>
<thead>
<tr>
<th>Specified Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotating Speed</td>
<td>Max. 3,000 rpm</td>
</tr>
<tr>
<td>Slurry Pot</td>
<td></td>
</tr>
<tr>
<td>Butterfly Propeller Speed</td>
<td>Max. 2,000 rpm</td>
</tr>
<tr>
<td>Sample Fixing and Orientation Angle</td>
<td>15°, 30°, 45°, 60°, 75°, 90°</td>
</tr>
<tr>
<td>Rotating Arm</td>
<td></td>
</tr>
<tr>
<td>Sample Size</td>
<td>30 mm x 5 mm x 2 mm (2 ea.)</td>
</tr>
</tbody>
</table>
Dry Sand Erosion Test System – SEW190D

**General Information**
The SEW190D system measures surface damages by projecting a specified amount of SiC, Al₂O₃, SiO₂ powder or sand onto the surface sample. This equipment measures the sand erosion conditions for various materials.

Related standards and test specifications that can be measured using this system are:

- ASTM G65 – Measuring Abrasion Using the Dry Sand Rubber Wheel Apparatus
- ASTM G105 – Conducting Wet Sand Rubber Wheel Abrasion Tests

**Control Parameters**
- Rotation Speed: max. 3,000 rpm (m/sec)
- Base Rotation Speed: max. 2,000 rpm
- Sand/Water Rate: cm³/cm³
- Impingement Angle Control
- Test Duration (hr/min/sec)

**Software**
- System Control
- Data Record
- Data Save
- Graphic Display

**Test Modes**
- ASTM G65, G105

**Specifications**

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Loading Control</td>
<td>- Max. 500 N</td>
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<tr>
<td></td>
<td>- Compression type Load Cell</td>
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<tr>
<td>Wet Chamber</td>
<td>- Sand/Water Mixing Wing</td>
</tr>
<tr>
<td></td>
<td>- View Port</td>
</tr>
<tr>
<td>Steel Disc</td>
<td>AISI 1020</td>
</tr>
<tr>
<td>Chlorobutyl Rubber Molded</td>
<td>dia. 228.6 mm X12.7 mm</td>
</tr>
<tr>
<td>Neoprene Rubber Molded</td>
<td>dia. 178 mm x 12.7 mm</td>
</tr>
<tr>
<td>Metal Wheel</td>
<td>- Wheel driving system: dia. 65mm</td>
</tr>
<tr>
<td></td>
<td>- Wheel driving system: thickness. 12.7 mm</td>
</tr>
<tr>
<td>Sand Feeding System &amp; Sand Hopper</td>
<td>Max. 400 rpm</td>
</tr>
<tr>
<td>Fabricated Sand Nozzle</td>
<td>300-400 g/min</td>
</tr>
<tr>
<td>Sample Holding Jig</td>
<td>Holding sample size: 25 mm x 76 mm x 12.7 mm</td>
</tr>
<tr>
<td></td>
<td>- Enclosure frame and waste sand chamber</td>
</tr>
<tr>
<td>Water Jet Nozzle Gun</td>
<td>Flexible Plastic Nozzle</td>
</tr>
<tr>
<td>System Controller</td>
<td></td>
</tr>
</tbody>
</table>
General Information

In the ultra-precision industry of metallic materials and semi-conductors, surface treatment technology is an essential component of protecting and strengthening the surface layer. The performance of thin film coating is largely influenced by the properties of the thin film layer and its adhesiveness to the base material.

The AST210 System using sound wave technology, measures the coating layer's adhesiveness to the base metal as well as the surface frictional force of the thin film.

Control Parameters
- Frequency Module
- Load
- Test Duration
- Temperature

Recorded Parameters
- Load (N)
- Friction Force (N)
- Friction Coefficient (μ)
- Sliding Distance (m/sec)
- Test Duration
- Temperature (°)
- Electrical Contact Resistance

Load Measurement System
- Transducer: Precision Load Cell (Dual Sensor)
- Amplifier: Precision Strain Gauge Module

Acoustic Emission
- Measurement System
- AE Detector: 200 kHz
- AE Preamplifier
- Octave Bandwidth Filter: 200 kHz
- Amplification: 40 dB
- AE amplifier
  - Large Bandwidth Amplifier: 50 – 400 kHz
  - Amplification: 0 – 20 dB
  - AE Signal Converter

Specifications

<table>
<thead>
<tr>
<th>Multi-Function Tests</th>
<th>- Peel off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply</td>
<td>AC 220 V, 50/60 Hz</td>
</tr>
<tr>
<td>Translational Table Speed</td>
<td>Range: 2 &lt; dy/dt &lt; 35 mm/min</td>
</tr>
<tr>
<td></td>
<td>Calibrated value: 10±0.1 mm/minAISI 1020</td>
</tr>
<tr>
<td>Loading Rate</td>
<td>Range: 20 &lt; dz/dt &lt; 400 N/min</td>
</tr>
<tr>
<td></td>
<td>Calibrated value: 100±1 N/min</td>
</tr>
<tr>
<td>Normal Force</td>
<td>Range: 1 to 200 N (adjustable)</td>
</tr>
<tr>
<td>Multi-Axis Testing</td>
<td>- X, Y, and Z</td>
</tr>
<tr>
<td></td>
<td>- Up to 4 axis</td>
</tr>
<tr>
<td></td>
<td>- X is manual (max. displacement range 120 mm)</td>
</tr>
<tr>
<td></td>
<td>- Y is motorized (max. displacement range 75 mm)</td>
</tr>
<tr>
<td></td>
<td>- X is in the direction of the scratch</td>
</tr>
<tr>
<td></td>
<td>- Y is perpendicular to the direction of the scratch</td>
</tr>
<tr>
<td>Standard Sample Holder</td>
<td>W 49 mm × D 35 mm</td>
</tr>
<tr>
<td>Dimensions</td>
<td>W 480 × D 530 × H 550 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>≈ 70 kg</td>
</tr>
</tbody>
</table>
Scratch Test System – SCRT800

General Information
The importance of surface treatment technology is on the rise. Surface treatment technology is used to protect and reinforce the surface layer in ultra-precision industries such as metals and semi-conductors. Performance of the thin film coating is determined primarily by the property and adhesive strength of the film to the substrate.

The SCRT800 system measures the adhesive strength between the coating layer and the substrate. It measures the adhesive strength through friction force for thin film surface and the change of acoustic emission.

Control Parameters
- Frequency Module
- Load
- Test Duration
- Temperature

Recorded Parameters
- Load (N)
- Friction Force (N)
- Friction Coefficient (μ)
- Sliding Distance (m/sec)
- Test Duration
- Temperature (°)
- Electrical Contact Resistance

Load Measurement System
- Transducer: Precision Load Cell (Dual Sensor)
- Amplifier: Precision Strain Gauge Module

Acoustic Emission
- AE Detector: 200 kHz
- AE Preamplifier
- Octave Bandwidth Filter: 200 kHz
- Amplification: 40 dB
- AE amplifier
  - Large Bandwidth Amplifier: 50 – 400 kHz
  - Amplification: 0 – 20 dB
  - AE Signal Converter

Specifications

<table>
<thead>
<tr>
<th>Power Supply</th>
<th>AC 220 V, 50 – 60 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Translational Table Speed</td>
<td>- Range: 2 &lt; dy/dt &lt; 35 mm/min</td>
</tr>
<tr>
<td></td>
<td>- Calibrated value: 10 ± 0.1 mm/min</td>
</tr>
<tr>
<td>Loading Rate</td>
<td>- Range: 20 &lt; dz/dt &lt; 400 N/min</td>
</tr>
<tr>
<td></td>
<td>- Calibrated value: 100 ± 1 N/min</td>
</tr>
<tr>
<td>Normal Force</td>
<td>Range: 1 to 200 N</td>
</tr>
<tr>
<td>Positioning of the Sample</td>
<td>- In the direction of the scratch</td>
</tr>
<tr>
<td></td>
<td>Y: motorized (maximum displacement range: 75 mm)</td>
</tr>
<tr>
<td></td>
<td>- Perpendicular to the direction of the scratch</td>
</tr>
<tr>
<td></td>
<td>X: manual (maximum displacement range: 120 mm)</td>
</tr>
<tr>
<td>Standard Sample Holder</td>
<td>W 49 mm×D 35 mm</td>
</tr>
<tr>
<td>Dimensions</td>
<td>W 420×D 530×H 550 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>≈ 70 kg</td>
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</tbody>
</table>
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