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MODEL AB-2012 FPS WEAR TESTING SYSTEM



UESHIMA SEISAKUSHO CO., LTD.



FPS WEAR TESTING SYSTEM (MODEL AB-2012)

Outline

A Lambourn abrasion tester or conventional FPS tester, which is used for abrasion tests of high polymer material for such products like tire and belt, controls slip ratio or speed difference between test piece and road wheel while doing an abrasion test.

AB-2012 FPS Abrasion Tester can perform tests by controlling tangential force between the test piece and the road wheel in addition to the conventional control of slip ratio, aiming more correlation to the real tires. It was necessary to repeat tests with different conditions in order to evaluate abrasion vs friction energy, which is deemed to have more correlation to the real tire.

The FPS abrasion tester enables to reproduce conditions of real tire more precisely by directly controlling the friction force.

* FPS stands for Field Performance Simulation.

Test Item

- Slip ratio regulation test
- Friction force regulation test

Feature

- Friction force regulation tests which were not available with conventional abrasion testers
- Real-time measurement of test piece diameter for feed-back of the circumferential speed
- Control of abrasive wheel temperature without using a slip ring (RT+10°C to 80°C as standard)
- Simplified test piece transport system using the swing arm
- Improved test piece clamping system with a ratchet
- Use of the accurately controlled talc feeding system for adhesion preventing (Japan patent no. 4559617)
- High repeatability of test conditions with sandpaper used as abrasive
- Fully automatic tests of 56 (50-mm dia.) test pieces
- Two brushes clean the surface of the road wheel to keep the conditions constant
- Friction energy analysis available with the exclusive software

Application

- Abrasion tests of rubber materials for tire, etc.
ISO and JIS describes abrasion testers for rubber. However, difference of test piece shapes, abrasives and methods may give different results because of the different wear mode. An optimum tester must be selected for the final product of the material and its usage conditions. The FPS abrasion tester is specially designed to get material abrasion result best correlated to that of automobile tires.

Measurement Item

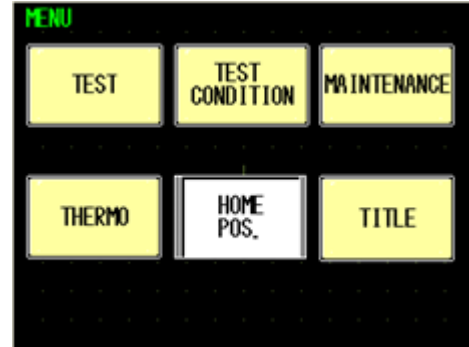
- Test piece velocity (m/min)
- Road wheel velocity (m/min)
- Slip ratio (%)
- Load (N)
- Friction force (N) or torque (N·m)
- Test piece diameter (mm)
- Test piece surface temperature (°C)
- Road surface temperature (°C) (optional)

Software(Touch Panel Screen)



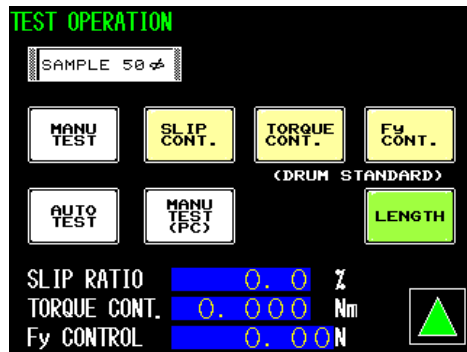
Initial screen at power-on

TITLE



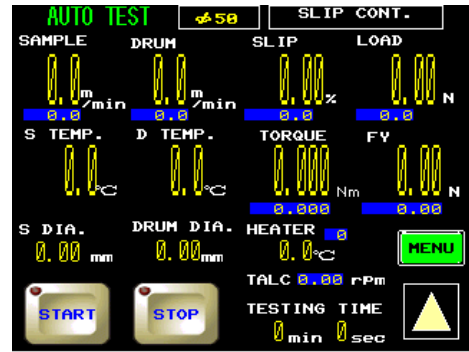
Select operation in the MENU.

MENU



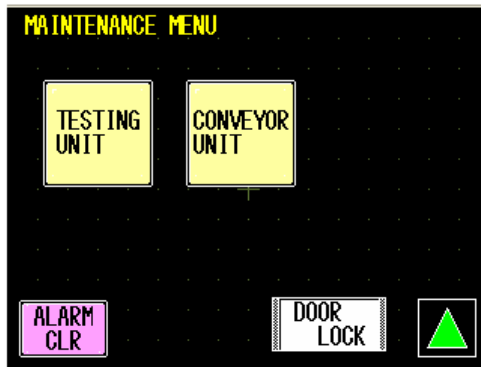
Select a test mode

TEST OPERATION



Displays measurement data.

AUTO TEST



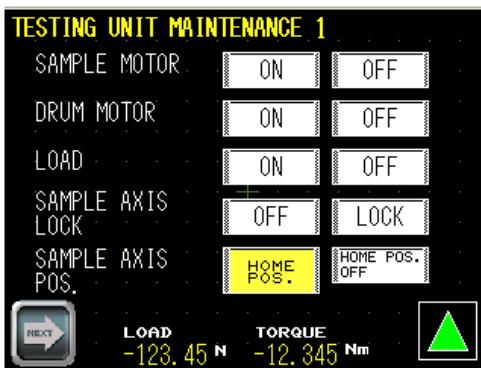
Operation of each part

MAINTENANCE MENU



Set up test conditions.

TEST CONDITION 1



Operation of testing unit

TESTING UNIT MAINTENANCE1



A Message will appear upon Alarm

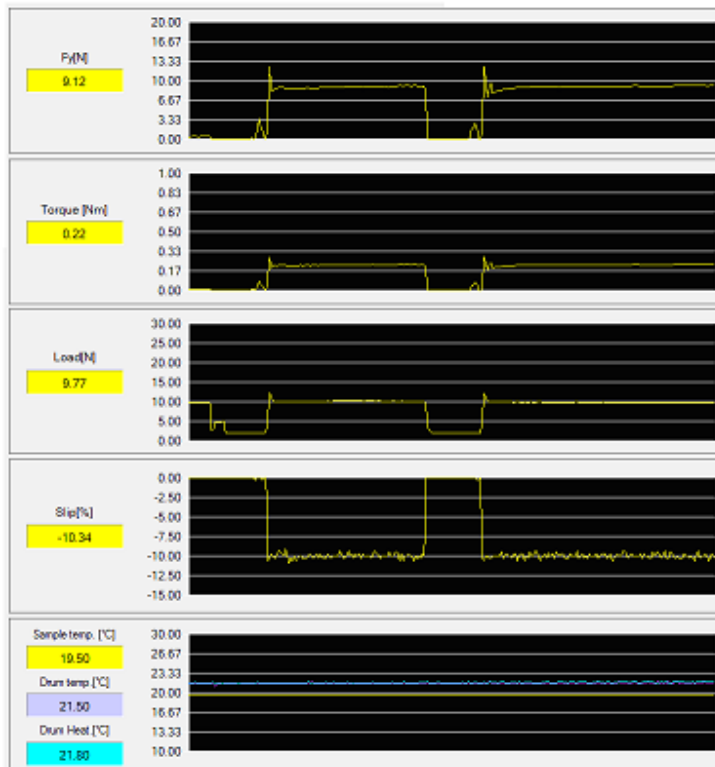
ALARM DISPLAY

Software (PC Screen)

Main Setup Screen

Result Screen

(Magnified)



Current Data Graph

It displays the current measurement data of "Fy", "Torque", "Load", "Slip", "Sample temp", "Drum temp" and "Drum Heat".

Tire Material Wear Test - How to Summarize the Results

From the Standard (ISO, JIS)

Wear volume(Per unit time)

$$V = \frac{\Delta m}{\rho \times t}$$

V : Wear volume [mm³/min]
 Δm : Wear mass [mg]
 ρ : Test piece density [g/cm³]
 t : Test time [min]

Volumeric wear rate(Per unit running)

$$V' = \frac{\Delta m}{\rho \times L}$$

V' : Volumeric wear rate [mm³/km]
 L : Wear dist. [km] $L=(vt \times t)/1000$
 vt : Test piece surface vel. [m/min]

Wear index

$$I = \frac{Vr}{Vt} \times 100 = \frac{V'r}{V't} \times 100$$

I : Wear index
 Vr : Wear volume of reference material [mm³/min]
 Vt : Wear volume of test piece [mm³/min]
 $V'r$: Volumeric wear rate of ref. material [mm³/km]
 $V't$: Volumeric wear rate of test piece [mm³/km]

Based on severity (Friction energy vs Wear volume per 1,000 km)

Friction energy

$$ew = \frac{(F_y - F_0) \cdot S \cdot L}{2\pi \cdot R_r \cdot D \cdot L}$$

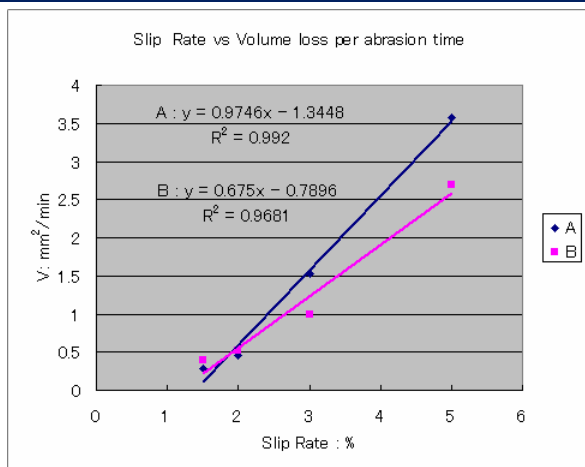
ew : Friction energy [J/m²·m]
 F_y : Tangential force [N]
 F_0 : Tangential force at zero slip ratio (free rolling) [N]
 S : Slip ratio
 L : Test distance (Vd × t)
 R_r : Test piece radius [m]

Wear volume per 1,000 km

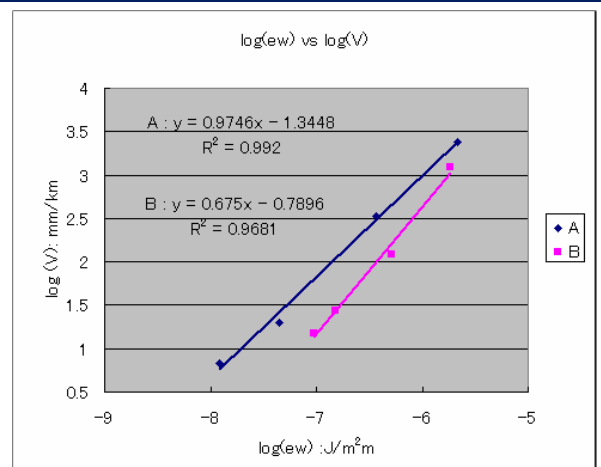
$$V = \frac{10^6(W_0 / \rho)}{(2\pi \times R_r \times D) / L}$$

V : Wear volume [cm³/1,000km]
 W_0 : Wear mass [g]
 R_r : Test piece radius [m]
 D : Test piece width [m]
 ρ : Density [g/cm³]
 L : Test distance [m] (Vd × t)
 Vd : Drum surface vel. [m/min]
 t : Test time [min]

An example: Comparison of different materials



Slip Ratio VS Wear Volume

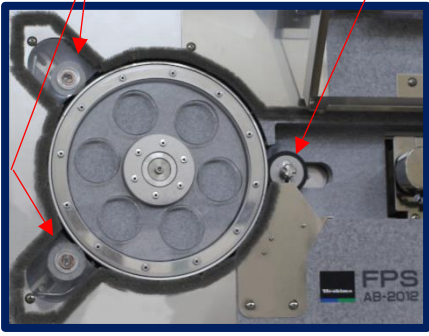


Wear Volume/1,000km VS Friction Energy

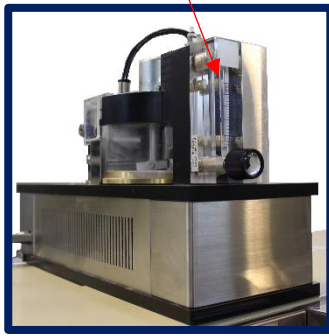
Details of Each Part

Cleaning Brush

Test Piece



Flow Meter



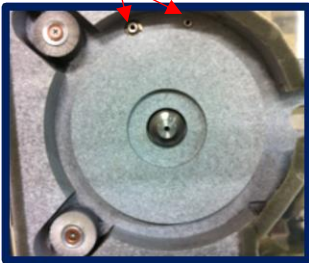
Talc Supply



Road Wheel

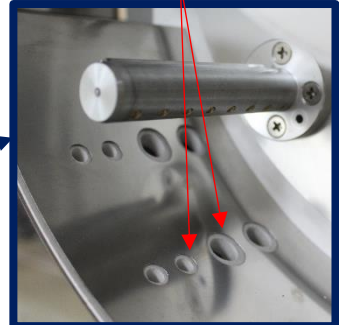
Talc Feeder

Air Port



Wheel Removed

Air Port

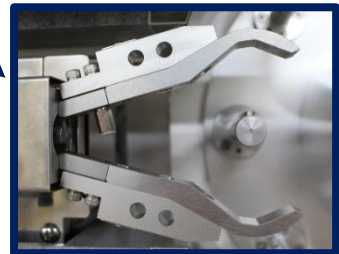


Turret Section

Ratchet of Test Shaft

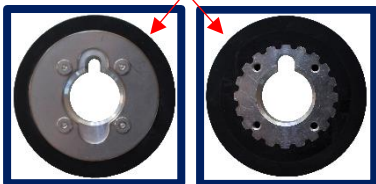


Test Shaft



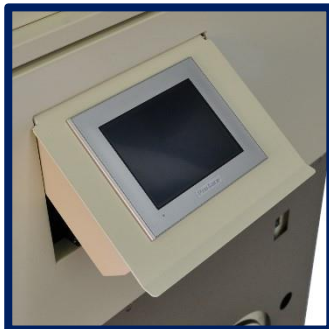
Hand

50mm x 10mm t

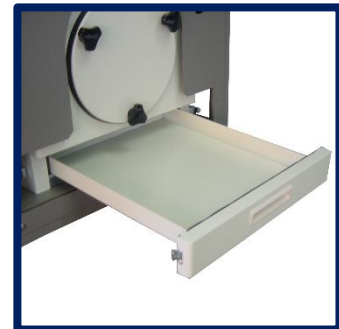


Test Piece Front

Test Piece Back

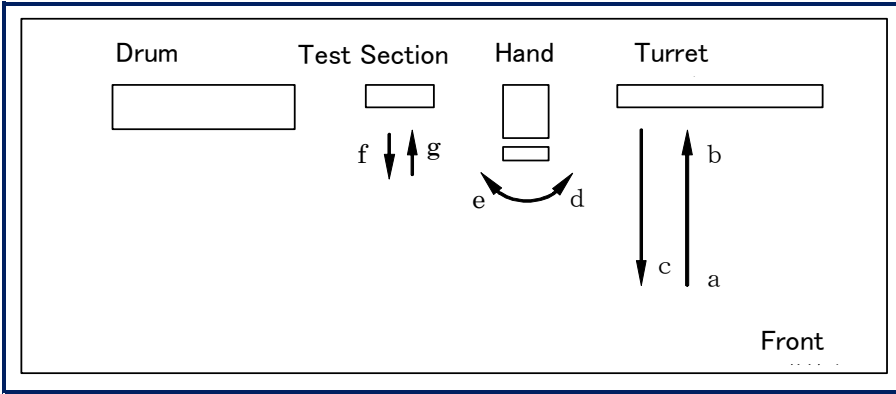


Touch Panel Screen

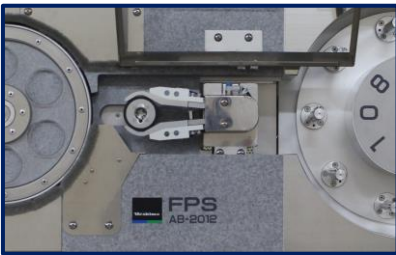


Tray

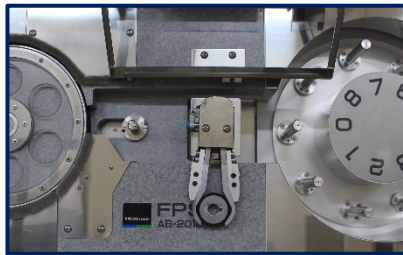
Transportation System



The hand picks up a test piece on the turret and set it in the test section as shown. After a test is complete, it will send back the test piece to the turret and pick up the next one for testing.



Test piece set (f, g)

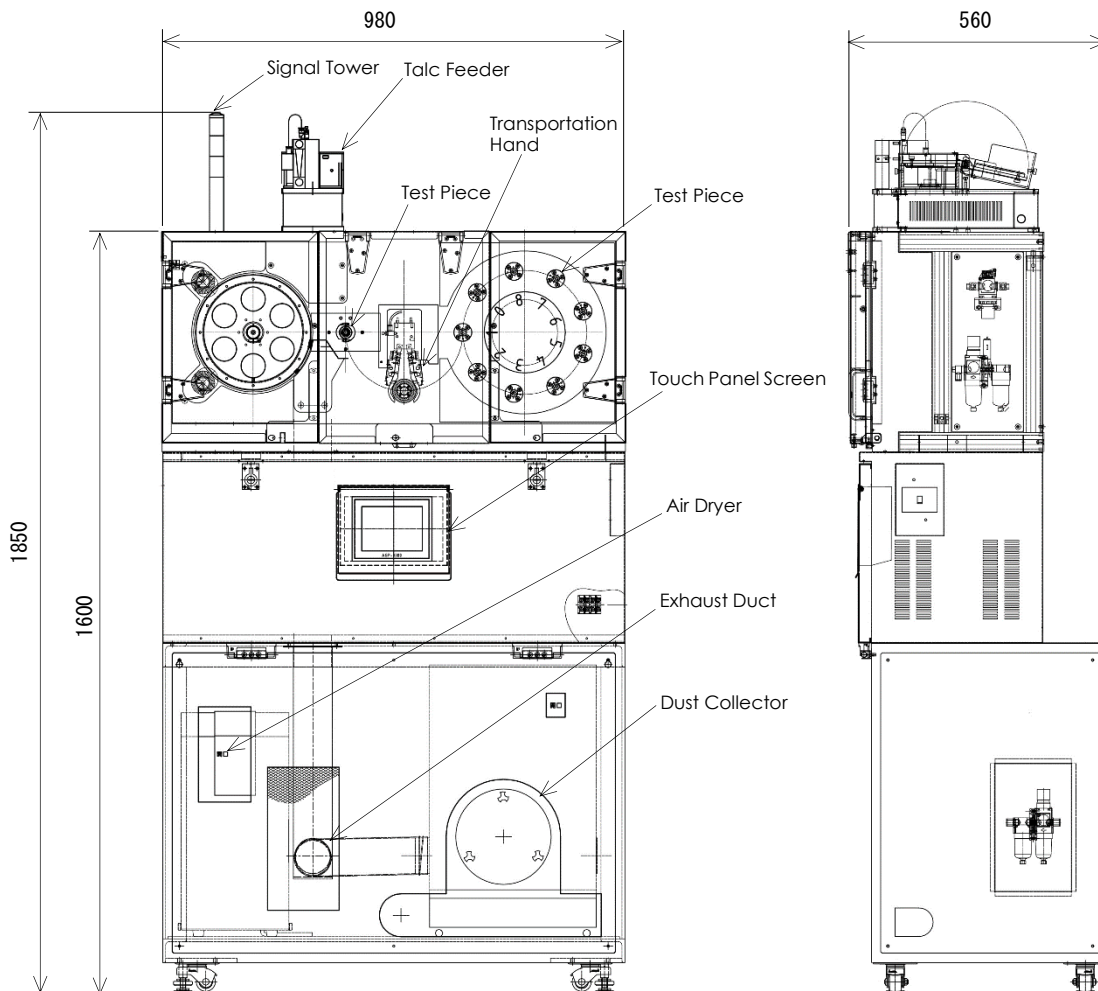


Swing (d, e)



Pickup (a-c)

Appearance



Specification

MODEL	AB-2012
Name	FPS Abrasion Tester
Test Piece Shape	50-mm dia. x 10-mm thick
Road Wheel	250-mm dia. x 30-mm thick (Abrasive: Sandpaper)
Load	10 to 80N (The settings can be changed as desired.) Air cylinder drive load cell feedback control
Test Shaft Torque	-3 to 3Nm (Setting range)
Slip Ratio Setting	±30%
Testing Velocity	Test piece: 10 to 210 m/min, Road Wheel: 10 to 150m/min
Automatic Testing	Automatic transportation and testing of test pieces stored on the turret
Continuous Operation	56 pcs max. for 50-mm dia. test pieces
Surface Temperature	Non-contact thermometers (0 to 250° C for test piece and road wheel)
Road surface temperature	RT+10°C to 80°C 10°C to RT (Option: using colders)
Dusting System	Talc feeder (0.1 to 0.8rpm)
Data Processing (PC)	Condition setting, start/stop control, data acquisition, graph plotting, etc.
Safety Device	Emergency stop switch, door interlock, overload protection
Utility	Electric Power: 3-phs 200VAC, 30A 50/60Hz Dry Air: Dry and clean air 0.5Mpa to 0.8Mpa , about 150L/min (Option: about 300L/min when using colders)
Usage Environment	According to JIS K 6250-2006
Dimensions & Weight	Approx. 980(W) × 560(D) × 1850(H)mm, 320kg (incl. dust collector and air dryer)
Accessories	Dust collector, air dryer, calibration tool, core metals, etc.

● The PC is basically to be provided by the customer. The following PC specifications are recommended.

OS: Windows 7 or later, CPU: Intel Core i3 or higher, MEMORY: 4 GB or more, STORAGE: 500 GB or more
OPTICAL DRIVE: DVD+/-RW, DISPLAY: 1280 X 1024 (1920 X 1080 will do, too.)
DATA COMMUNICATION: Wired LAN (1 port), RS232C (1 port), MOUSE: USB 2.0, KEYBOARD: USB 2.0

Option

- Electronic balance (with PC interface)
- Compact humidity conditioning case
- Sandpaper (#240, #120, #80)
- Talc
- Mold for test pieces (50-mm dia, 9 cavities)

UESHIMA SEISAKUSHO CO., LTD.

<Manufacturer>

Ueshima

UESHIMA SEISAKUSHO CO., LTD.

6-5-22, Yaho, Kunitachi-shi, Tokyo 186-0011, Japan



TEL. 81-42-572-1397 FAX. 81-42-573-1520

E-mail: sales@ueshima-seisakusho.com

<http://www.ueshima-seisakusho.com>

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