Duratt®
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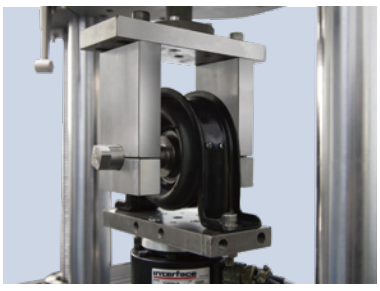
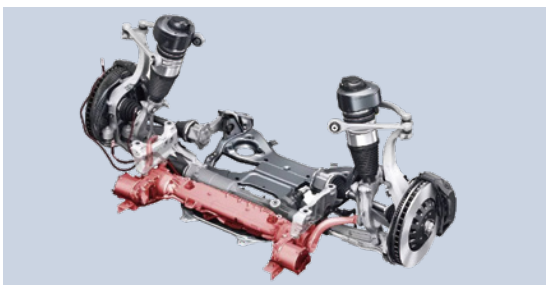
Automotive Components & Materials - Dynamic Mechanical Testing Solutions





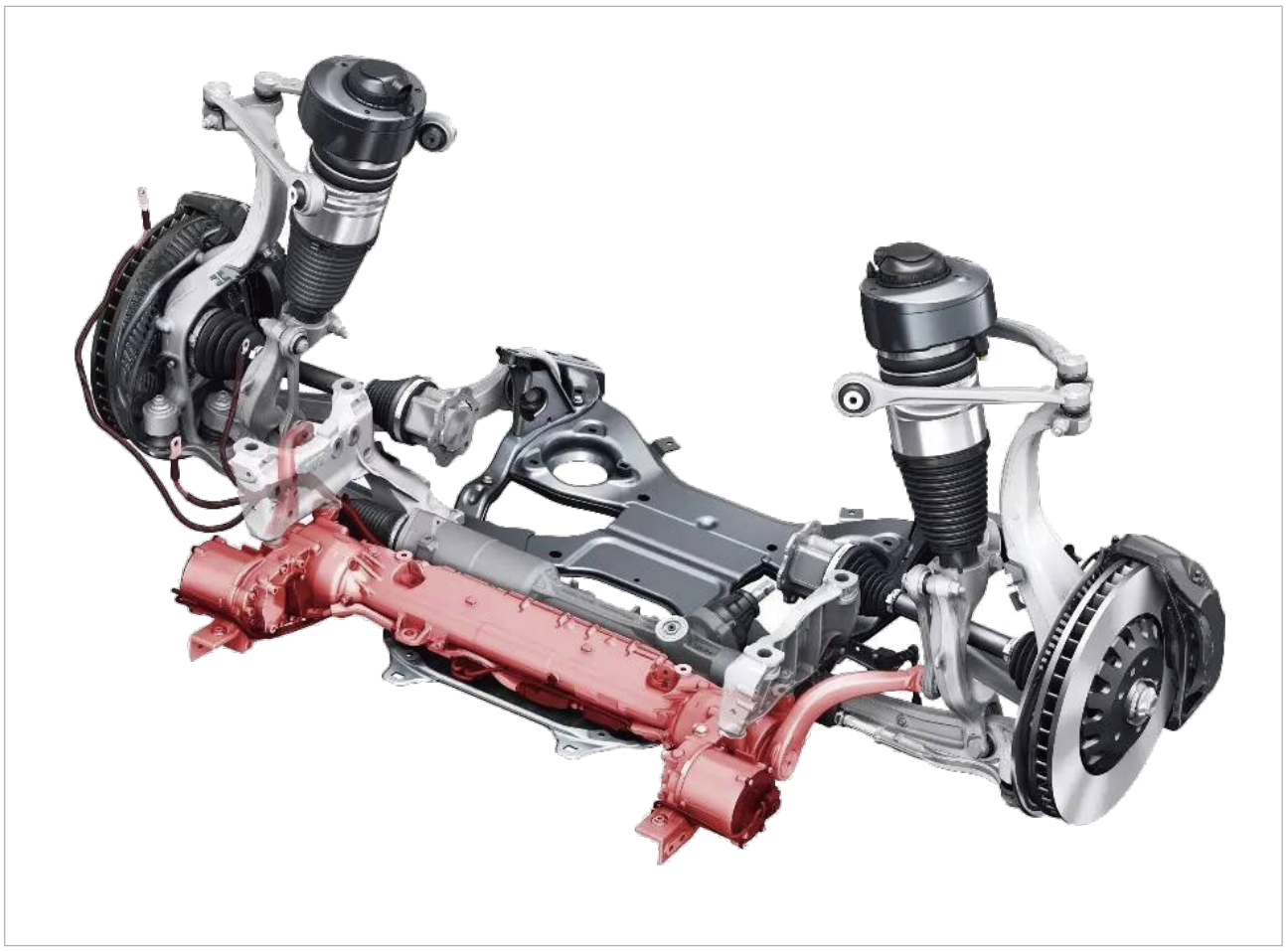
Shanghai Duratt Instrument Co., Ltd.

Duratt Instruments, based on our patented linear motor technology, has developed a dedicated dynamic mechanical testing platform for automotive componets. Compared with traditional drive methods, the Duratt series testing platforms offer a wider range of testing conditions, higher testing performance, a cleaner and quieter testing environment, lower energy consumption during use, and require almost no maintenance within the motor's service life, reducing daily operating costs and greatly enhancing the user experience.

Vehicle subsystems include the chassis, suspension, body, interior components, power system, battery, motor, electronic control, tires, etc., as well as numerous components. During the R & D process, a large number of dynamic performance tests are required, including fatigue tests, dynamic stiffness and other damping performance tests, and NVH (Noise, Vibration, Harshness) tests. Traditional testing methods, such as electro - hydraulic servo drive, cylinder loading, electric cylinder drive, and mechanical cam drive, have various defects and problems in terms of reliability and energy consumption. In the global environment of energy conservation and emission reduction, test engineers need an integrated dynamic testing system with high performance, high reliability, cleanliness, low noise, and multi - purpose features.

The high - response performance unique to Duratt electromagnetic - driven linear motors enables test systems for suspensions, shock absorbers, etc., to have a delay of milliseconds, meeting the closed - loop control requirements of HIL (Hardware - in - the - Loop) real - time tests. Combined with mature commercial simulation software and hardware modules, it can be used for road spectrum iterative loading, fatigue durability, dynamic and static stiffness, damping force, indicator diagram characteristics, HIL simulation, NVH, and other mechanical performance tests of components such as automotive passive/semi - active/active suspensions, shock absorbers, air springs (integrated shock - absorbing air springs), and shock absorber dampers.

Duratt standard dynamic testing platforms and customized multi - axis testing systems can provide specific solutions for fatigue durability tests of various automotive components, such as chassis parts, body parts, interior components, and power/ battery, motor, electronic control components, in different application scenarios. They can apply displacement - closed - loop program control, load - closed - loop program control, and complex multi - step tests to components. Available cases include battery cell terminals, seat durability and comfort tests, air - conditioning system components, touchscreens, door hinges, steering wheels, and brake boosters, meeting most existing testing standards and potential testing requirements with high performance, high reliability, and low energy consumption.



01 Road Simulator Testing System

The automotive suspension testing system conducts performance tests such as road spectrum loading, HIL, and NVH on the suspension system based on a dynamic testing platform with Duratt independent linear - motor - patented technology. The system can realistically restore the vibration effects generated by the road surface during normal vehicle driving with a high degree of fidelity, effectively simulating real - road - condition environments in a laboratory setting. This provides engineers with more convenient and efficient testing methods and verification means, meeting the performance testing requirements of various passive, semi - active, and active suspensions.

Test Products

Passive/Semi-Active/ Active Automotive Suspension.

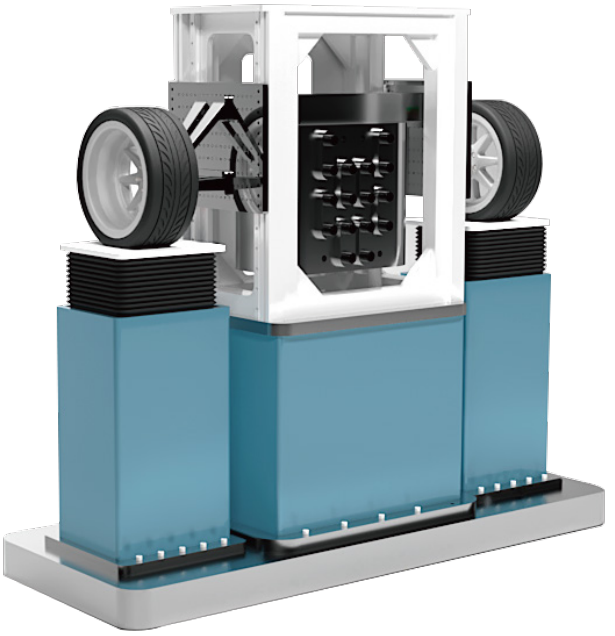
Testing Systems

Quarter Suspension Test Bench:ST-1
Half Suspension Test Bench:ST-2
Four-Post Suspension Test Bench:ST-4 .

Testing Content

Performance Testing、Fatigue and Durability Testing、Road Spectrum Iterative Loading Testing、Hardware-in-the-Loop (HIL) Simulation Testing、NVH (Noise, Vibration, and Harshness)、BSR (Buzz, Squeak, and Rattle)、EOL (End-of-Line) Testing、Air Spring Position Adjustment、and More.

ST-2



Half Suspension Test Bench

Specification

Maximum Dynamic Output

20kN-30kN

Preload Support Force

10kN-15kN

Maximum Speed

≥4m/s

Maximum Stroke

≥200mm(customizable)

Frequency Range

0.01-100HZ

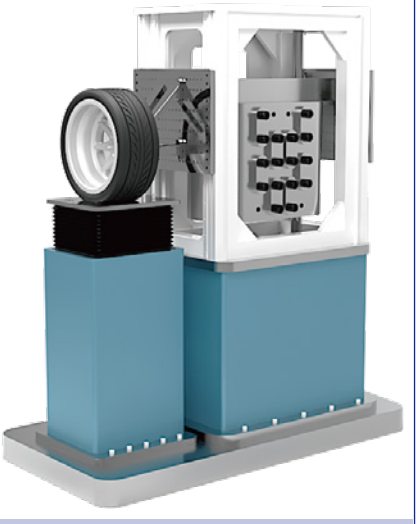
Time Lag

Millisecond-level delay

Features

- Self - patented linear motor drive technology
- Pneumatic pre - load support system for higher load capacity and peak thrust
- Road spectrum curve iteration software module
- Customizable loading curves including road spectrum,sine, triangular, square, combined and random waveforms
- Compatible with suspension systems of different tire sizes
- Multi - channel communication interface expansion on system platform for real - time HIL simulation communication of semi - active/full - active suspensions
- Adjustable sprung mass and optional real - time sprung mass loading module

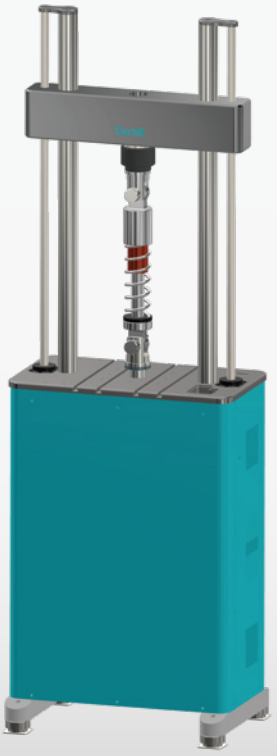
ST-1



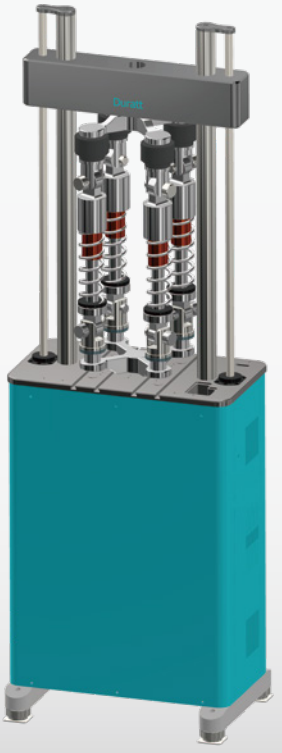
Quarter Suspension Test Bench

02 Shock Absorber Testing System

DT



Shock Absorber Dynamometer



Multi-Sample Shock Absorber Testing System

Test Products

Shock absorbers、air springs、and coil springs for passenger vehicles、all-terrain vehicles (ATVs)、racing cars、and motorcycles.

Test Systems

Shock absorber dynamometers:DT、fatigue and durability test systems:DT、multi-sample testing systems:DT、four-post HIL testing systems:DT.

Test Content

Performance parameter measurement (damping force, high-speed damping, friction、static/dynamic stiffness、active force、active force slope、response characteristics)、online production quality inspection、fatigue durability、road spectrum iterative loading、HIL simulation、NVH testing.

Equipment Features

Low Energy Consumption

Electric direct-drive system offers significant energy efficiency advantages.

Multiple Options

Optional pneumatic preload support expands load capacity options.

Outstanding Performance

Self-developed linear motor actuator delivers exceptional dynamic performance.

Infrared Temperature Monitoring

Optional pneumatic preload support expands load capacity options.

Stable Testing Performance

High-rigidity dual-column frame ensures superior testing stability, with electric crossbeam adjustment for easier damper installation and removal.

Maintenance-Free Minimalist Design

Simplified design with no complex mechanical or hydraulic systems ensures maintenance-free operation throughout its service life.

Multi-Channel Communication

The system platform provides multi-channel communication interfaces, supporting real-time HIL simulation for semi-active/fully active dampers.

Dedicated Testing Software Module

Independent damper performance testing software module allows quick setup of loading frequency, vibration amplitude, and other parameters, with real-time plotting of force-displacement (F-S) curves, force-velocity (F-v) characteristics, and dynamic/static stiffness curves.

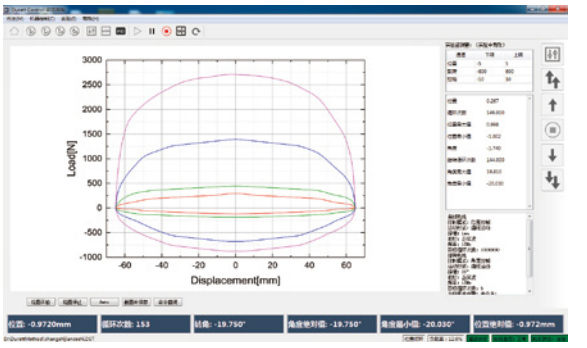
High-Responsiveness Performance

Leveraging the high responsiveness and low hysteresis (millisecond-level delay) of linear motor direct-drive control, it effectively addresses closed-loop control challenges in HIL testing.

Dynamometer Performance Parameters

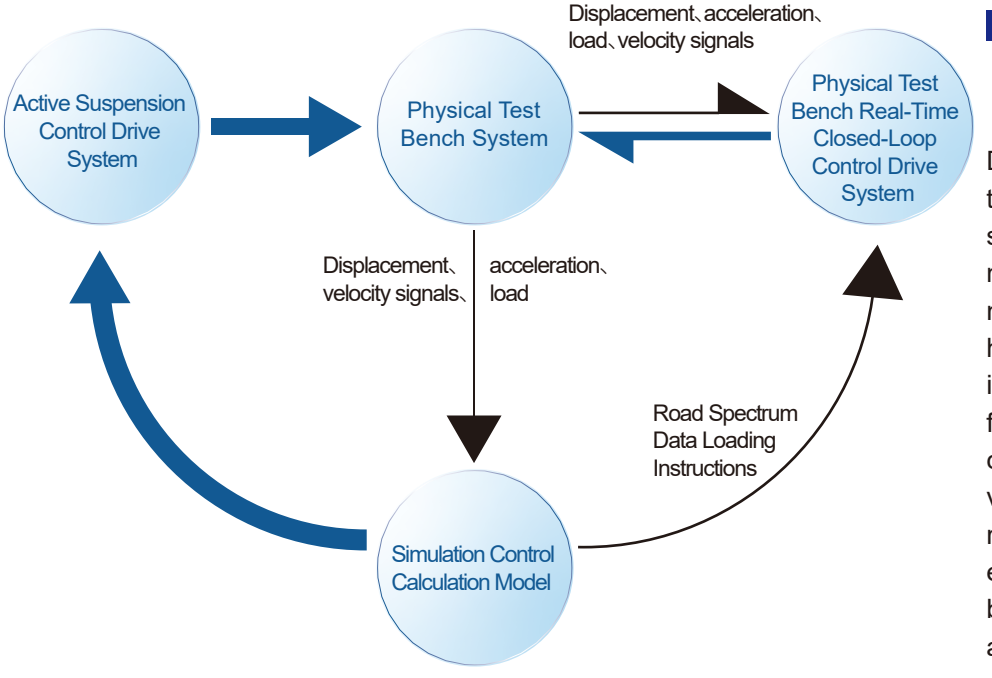
	20kN Actuator	30kN Actuator
Maximum Dynamic Force	20 kN	30 kN
Maximum Static Force	14 kN	21.5 kN
Maximum Speed	4 m/sec	4 m/sec
Stroke	200 mm	200 mm
Maximum Frequency	100 Hz	100 Hz
Displacement Sensor Resolution	50 nm	50 nm
Power Supply	380 V	380 V
	Varies with different configurations	
Pneumatic Preload Support (Optional)	10 kN	15 kN
Air Supply	7 bar	7 bar

Hardware-in-the-Loop Simulation Testing (HIL)



Shock Absorber Power Characteristics Graph

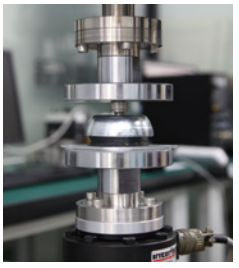
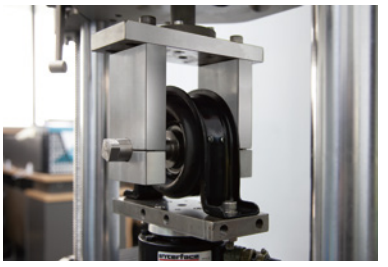
Four-Post HIL (Hardware-in-the-Loop) Shock Absorber Testing System

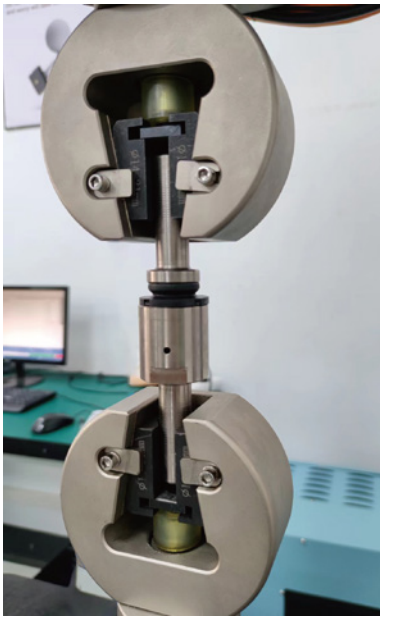


Hardware-in-the-Loop (HIL) Simulation

Durattest® professional dynamic testing software supports loading spectrum iteration and real-time mixed simulation. Combined with mature commercial simulation hardware and software modules, it integrates input and output feedback from the physical components under test into the virtual simulation. This enables real-time closed-loop data exchange and motion control between the virtual simulation and the physical test bench.

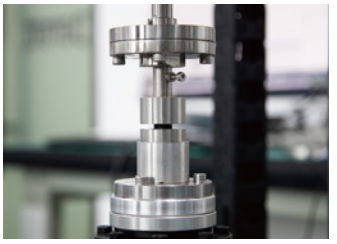
03 Rubber Elastomer Testing Solutions



It is essential to conduct relevant testing and evaluation on various rubber elastomer materials and their products.Rubber elastomers and other polymer materials are widely used in industries such as automotive, medical devices, shipbuilding, and aerospace. The dynamic and static mechanical properties, as well as the fatigue durability of products like tires, seals, suspension damping systems, and drive belts, directly impact the overall performance of vehicles, aircraft, and various equipment.

Testing Reference Standards：GB/T 13642、ISO1431-1、GB/T1688、ISO 6943、GB/T 13934、ISO132、GB/T41941、ISO27727、GB/T 41941、GB/T 13934、GB/T1687.3、ISO 4666-3、GB/T 1687.4、ISO 4666-4、GB/T9870、GB/T 33061、ISO 4664、ISO 6721、GB/T 15168.




Rubber Material Cylindrical Sample Testing

Sample

Rubber materials (cylindrical samples, dumbbell samples, etc.), rubber products: elastic bushings, engine mounts, top mounts, bridge bearings, air conditioning damping feet.

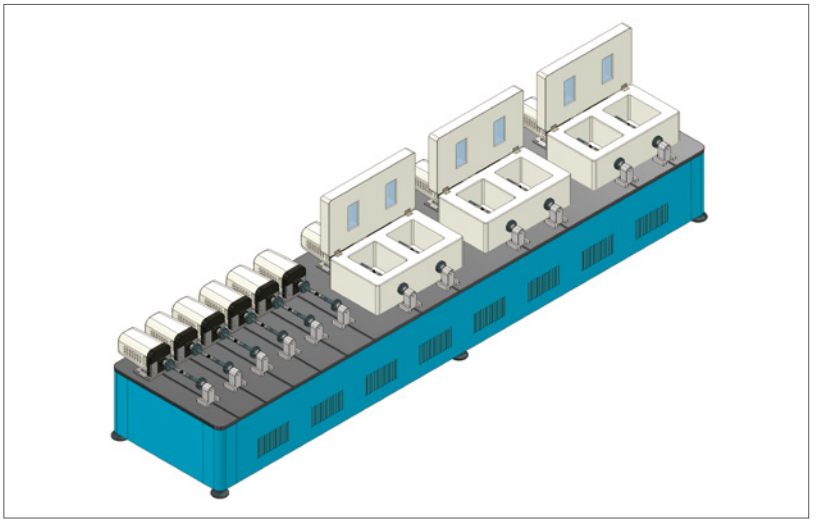
Machine

DMA (Dynamic Mechanical Analysis) systems, single-axis testing systems (D800, D2000, D4000, D8000, D15000), multi-axis testing systems, customized testing systems.

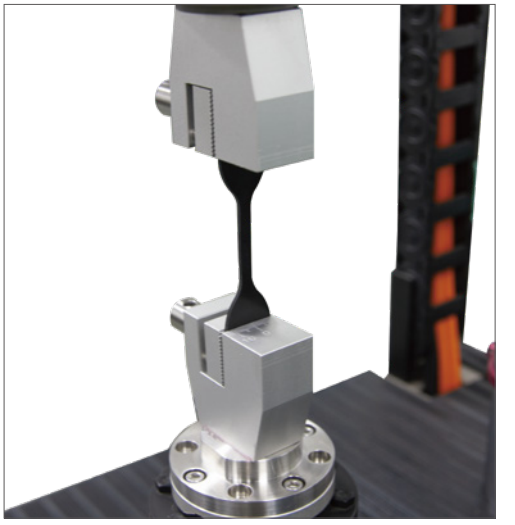
Result

Static and dynamic performance measurement: static stiffness, dynamic stiffness, fatigue life (road spectrum loading, extension fatigue, DeMattia flexing, etc.).Storage modulus, loss modulus, tan δ, temperature rise, crack propagation rate, creep, compression set, etc.

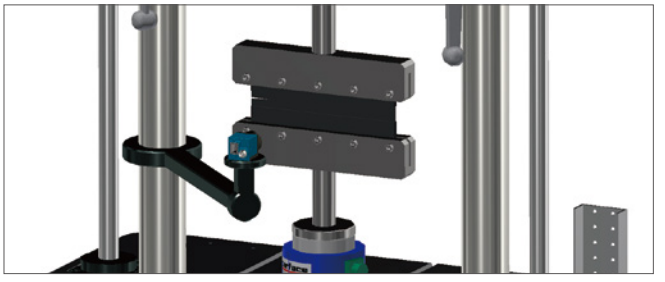
Elastomer Elasticity Testing System



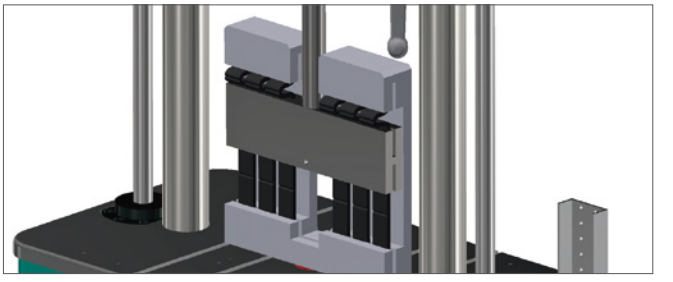
12-axis customized testing system



Rubber Material Dumbbell Sample Testing

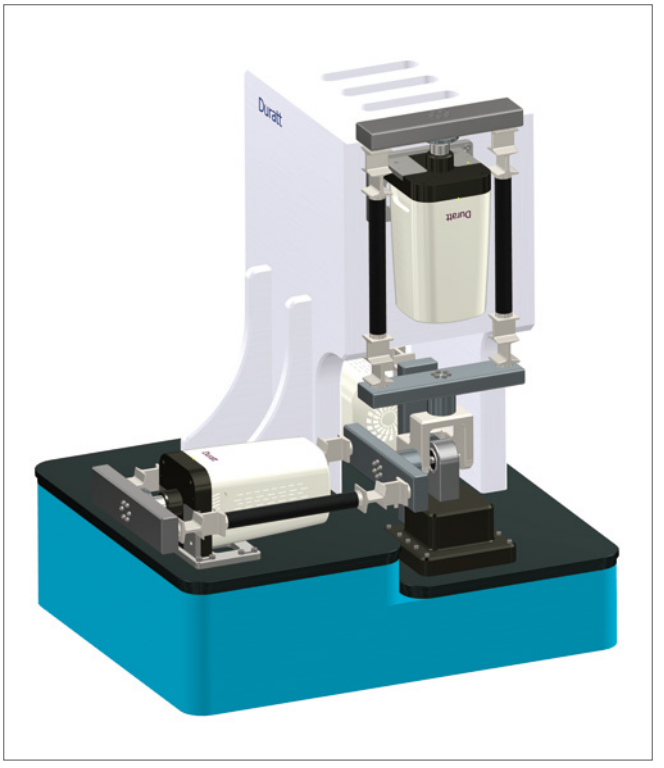


Fatigue crack growth rate test

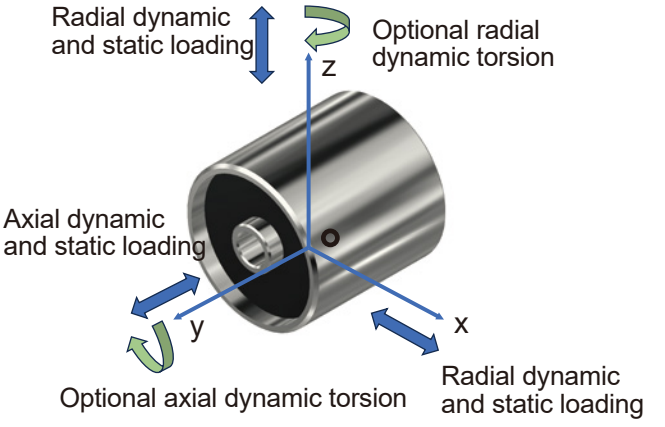


De Mattia Flex Test for Multiple Samples

Elastomeric Multi-Axis Testing System



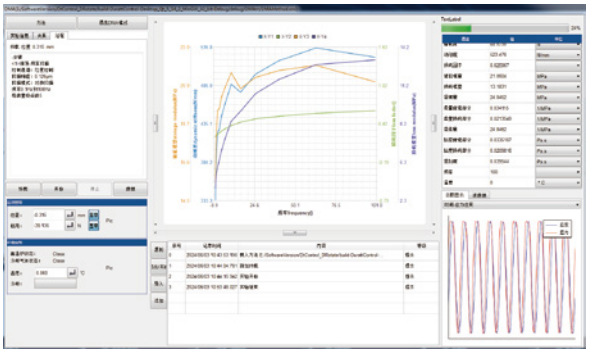
Rubber Bushing Triaxial Testing System



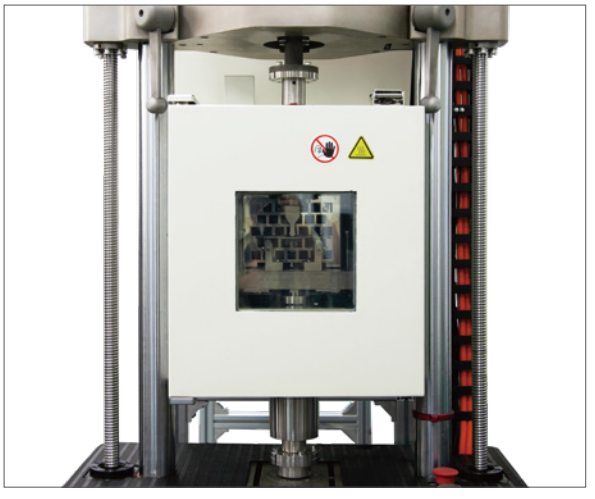
Rubber bushings, body or engine mounts, and other elastomeric vibration damping components used in automobiles are subjected to multi-axial loads under real-world operating conditions. Duratt offers a high-performance multi-axis durability testing system for these types of products. Customers can freely configure the system with options for two or three-axis linear and torsional loading, with a high-temperature environmental simulation system to more accurately replicate real automotive operating conditions. This system perfectly addresses the challenges of fatigue durability testing for bushings and mounts under combined axial, radial linear, and torsional loading.

DMA Equipment Features

- Clear Indicator Lights: Displays current testing status for easy monitoring.
- Motor Design: Ensures near-maintenance-free operation throughout its service life.
- High Force Capacity: Up to 800N, enabling DMA and fatigue testing for larger samples.
- High-Stiffness Dual-Column Frame: Ensures overall stability and testing accuracy.
- Wide Temperature Range: Environmental chamber (-150°C to 600°C) with forced convection for precise temperature control.
- Proprietary Linear Motor : Delivers exceptional dynamic performance and higher testing accuracy.
- Versatile Fixtures: Standard fixtures for tension, shear, and compression testing; optional high-temperature fixtures for tests above 500°C.



DMA Testing Interface



High and Low Temperature Environmental Chamber

DMA Specifications

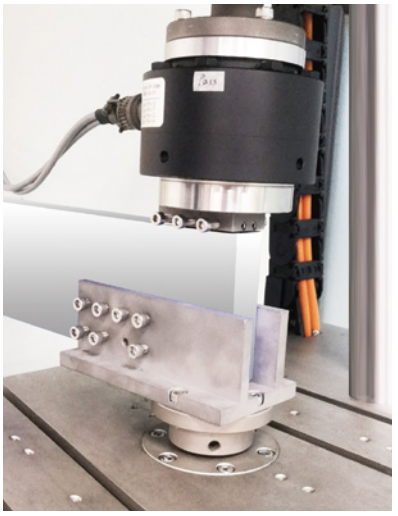
	DMA
Maximum Dynamic Force	800 N
Maximum Static Force	580 N
Minimum Force	0.22 N
Load Accuracy	±0.2%
Displacement Range	0.0005-12 mm
Displacement Resolution	50 nm
Minimum Frequency	0.00001 Hz
Maximum Frequency	100 Hz
Modulus Measurement Range	E3-3×E12 Pa
Loss Angle	0-90 °
Tanδ Resolution	0.000015

Environmental Chamber

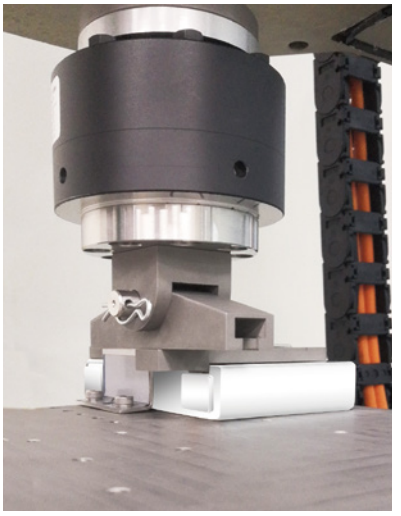
	Environmental Chamber
Maximum Temperature	600 ℃*
Minimum Temperature	-150 ℃
Heating Rate	0.1-10 ℃/min
Cooling Rate	0.1-10 ℃/min
Temperature Stability	± 0.1 ℃
Internal Dimensions	70 min high×60 Dia mm

*Note: The standard sample fixture is rated for a maximum test temperature of 500°C. For tests above 500°C, a special high-temperature fixture is required

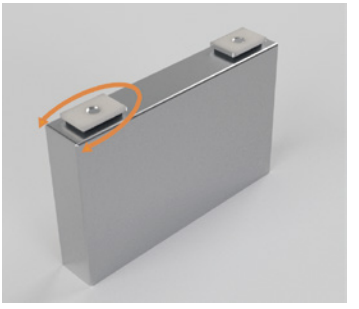
04 Fatigue Test of Other Automotive Components



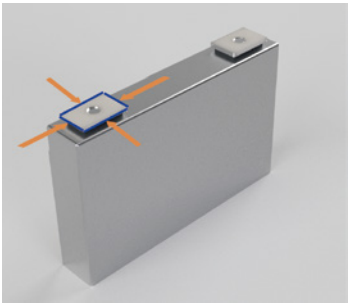
Terminal Torsion Testing



Terminal X-Direction Static Pressure Testing



Terminal Z-Axis Torsion



Terminal Long and Short EdgeStatic/Dynamic Tension/Compression

Battery Pack Cell Structural Mechanics Test

The structural mechanical performance test of lithium - ion batteries involves conducting static and dynamic mechanical tests on various structural components of lithium - batteries in accordance with specific experimental requirements, in order to detect and verify the structural mechanical performance of the battery model.

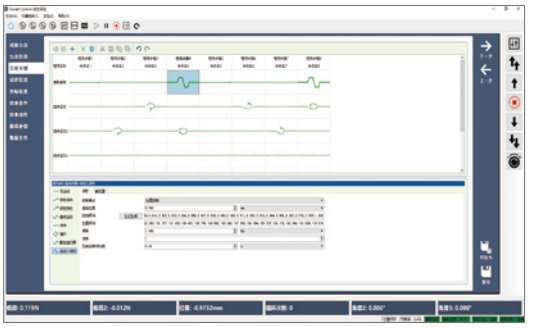
Applicable Models: D2000T, D4000T, D8000T

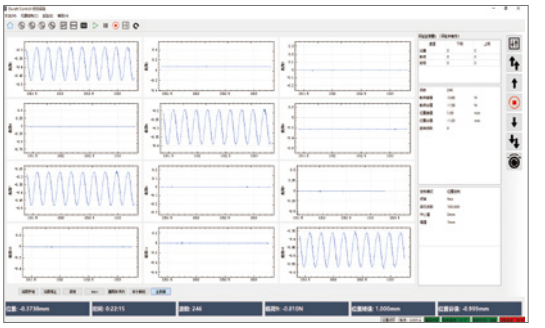
Fatigue Testing of Copper Plate Solder Joints in Automotive Motors

Simulating the vibration conditions of copper plate solder joints in automotive motor stators under real operating conditions to test the mechanical properties of the solder joint structure.

Applicable Models: D50, D800

Durattest® Test Software





Static / Dynamic Test Software

As standard Durattest® is with static and dynamic test software package.

For dynamic test, user can easily program multi-step test procedure in intuitive modular graphic interface.

Automatic PID Tunning

PID parameter self-tuning by stiffness automatic testing and calculation.

The end of test is user defined based on various test parameters. Test end actions ca also be defined. Data colletion type, quantity and time can be user defined as well.

Real-time Curve Display

High - precision sensors, combined with high - frequency data collectors (with a data collection capacity of over 10,000Hz), can display the data curves of each sensor and control channel in real - time. At the same time, key data is dynamically refreshed and directly displayed in the table. The display content of curves and data can be customized, providing testers with direct and accurate situational awareness.

Multi-axis Testing Systems

TT250 / TT500 Duratt® TT Series Benchtop All-electric Driven Dynamic Test Systems

	TT250	TT500
Maximum Dynamic Load	±250 N	±500 N
Maximum Continuous Load	±180 N	±350 N
Maximum Frequency	20 Hz	20 Hz
Stroke	22 mm	40 mm
Displacement Transducer Resolution	2 μm	2 μm
Load Cell Accuracy	± 0.2%	± 0.2%
Maximum Torque (optional)	± 6N·m	± 6N·m
Power Supply	220V\50Hz\12A	220V\50Hz\12A

Other linear actuators with higher load capacity up to 30KN can be offered optionally.

High-Performance All-electric Driven Dynamic Testing Systems, Standard Versions

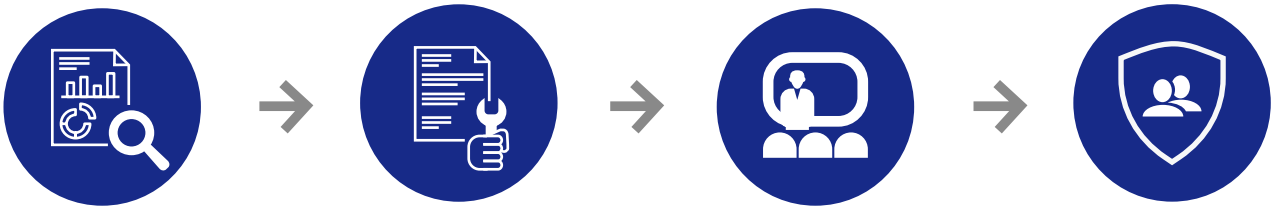
D50 D800 D2000 D4000 D8000 D20000

	D50	D800	D2000	D4000	D8000	D20000
Dynamic Load	±50 N	±800 N	±2000 N	±4200 N	±8200 N	±18000 N
Continuous Load	±35 N	±580 N	±1500 N	±3000 N	±6000 N	±12100 N
Maximum Frequency	20/100 Hz	100 Hz	100 Hz	100 Hz	100 Hz	100 Hz
Stroke	11 mm	41 mm	65 mm	65 mm	65 mm	80 mm
Maximum Speed	2 m/s	2 m/s	2 m/s	2 m/s	2 m/s	4 m/s
Test Space Vertical (without torsion)	170 mm	730 mm	730 mm	730 mm	860 mm	900 mm
Test Space Vertical (with torsion)	—	660 mm	660 mm	660 mm	790 mm	830 mm
Test Space Horizontal	225 mm	420 mm	420 mm	420 mm	450 mm	600 mm
Displacement Sensor Resolution	0.5 μm	0.05 μm	0.05 μm	0.05 μm	0.05 μm	0.05 μm
Load Cell Accuracy	± 0.2%	± 0.2%	± 0.2%	± 0.2%	± 0.2%	± 0.2%
Sampling Rate	10000 Hz	10000 Hz	10000 Hz	10000 Hz	10000 Hz	10000 Hz
Maximum Dynamic Torque (optional)	—	12 Nm	20 Nm	20 Nm	70 Nm	100 Nm
Maximum Torsion Speed (optional)	—	300 rpm	300 rpm	300 rpm	130 rpm	80 rpm
Environmental Temperature	5 – 30℃	5 – 30℃	5 – 30℃	5 – 30℃	5 – 30℃	5 – 30℃
Power Supply	220V\50Hz\3A	220V\50Hz\7A	220V\50Hz\26A	220V\50Hz\30A	220V\50Hz\37A	380V\50Hz\90A
Dimension (mm,W*H*D)	320*190*660	690*500*1400	800*600*1600	800*600*1800	900*700*2000	1070*720*2465
Weight	35 Kg	250 Kg	380 Kg	465 Kg	950 Kg	1050 Kg

Some References

Listed in no particular order

Service & Support



Presales Support → Installation → Training → Aftersales Service

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