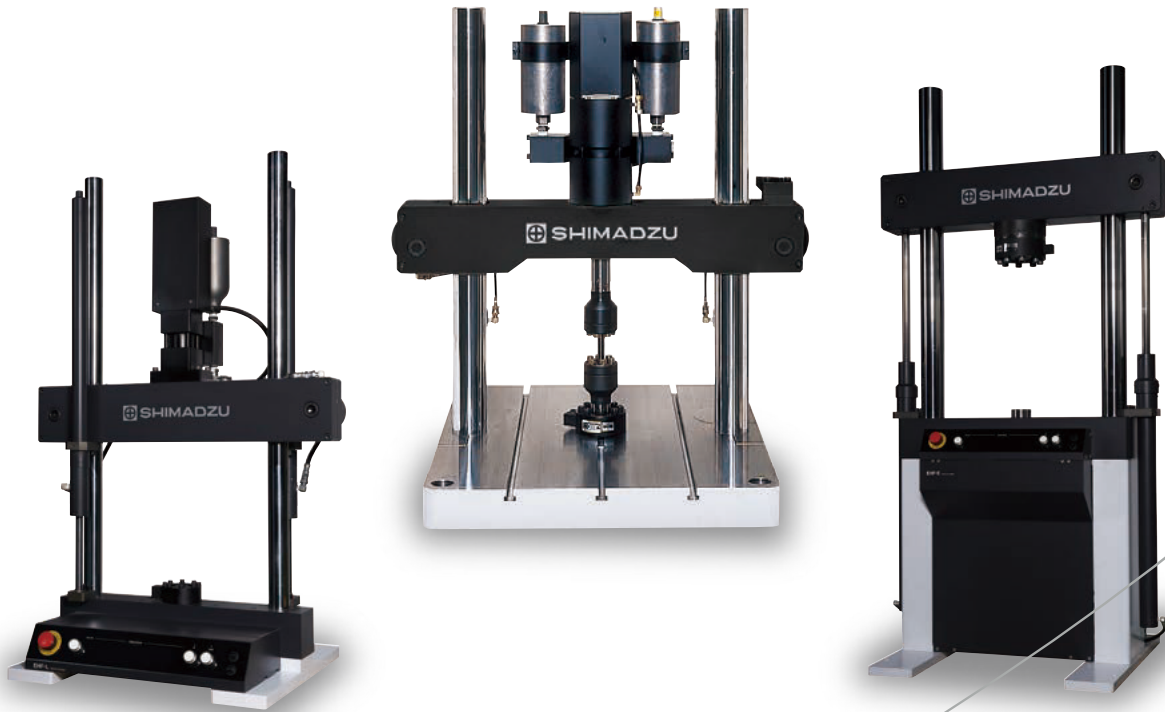


Dynamic and Fatigue Testing Systems



Your Partner for Dynamic and Fatigue Tests

The level and complexity of product reliability and safety requirements have been increasing in many industrial fields. Complying with such requirements requires performing a wide variety of tests and evaluations at each stage of production, from research and development of materials to evaluation of finished products.

Materials and parts can sometimes form cracks from repeated exposure to even small forces and, in the worst case, even completely fail. Therefore, for products that are exposed to repetitive loads, such as automobiles, mobile phones and other frequently handled items, and artificial bones and other biological materials or implants, it is essential that materials, parts, and finished products be evaluated by dynamic/fatigue testing and endurance/reliability testing. In addition, to more closely approximate actual usage conditions, an increasing number of tests used in research and development of various materials with special functional properties require more complicated and accurate control or measurement methods.

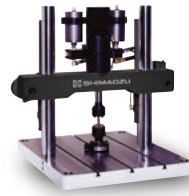
Therefore, Shimadzu offers a wide variety of testing machines that can be configured to satisfy increasingly sophisticated and diverse evaluation and testing requirements in a wide range of fields.



Dynamic and Fatigue Test Machines Servo Pulser Series Servopulser Series Dynamic and Fatigue Testing Machines | P.12 P.32 P.40

Servo-hydraulic actuators are able to apply a wide range of loads, from small to large test forces. Therefore, they are ideal for fatigue testing of materials and a wide range of other dynamic testing applications. Backed by Shimadzu's extensive experience-making actuators, frames, and controllers, these systems are capable of a wide variety of tests and evaluations.

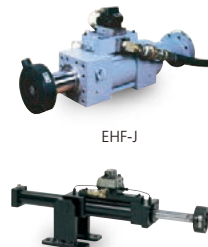
Hydraulic



EHF-U



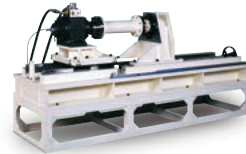
EHF-L



EHF-J



EHF-E



EHF-T



EHF-TQJ

Electric



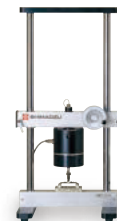
EMT-1kN



EMT-5kN



NJ-SERVO



MMT

Ultrasonic

Ultrasonic Fatigue Testing System

USF-2000A | P.64

Ultra efficient for gigacycle testing.
Also ideal for analyzing inclusions in metals.

Allows testing at 20 kHz ultrahigh cycle rates and significantly reduces the time required for fatigue testing.



Hydraulic

High-Speed Impact Testing Machine

HITS Series | P.66

Integrates various cutting-edge technologies for high-speed impact testing.

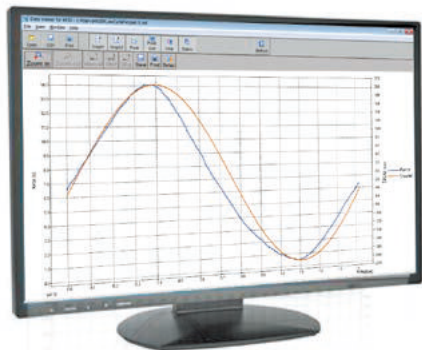
Allows evaluating high-speed deformation behavior with tensile and puncture impact tests at speeds up to 20 m/s (72 km/h).



High Accuracy and Reliability

Dynamic and fatigue testing machines are used to measure the behavior and response characteristics of materials, products, and structural members in response to varied loads. Extremely sophisticated testing control capabilities are required for controlling the waveform of the load input, from a basic sine wave to waveforms that simulate earthquakes or the loading behavior experienced in actual usage.

Shimadzu Servopulser dynamic and fatigue testing systems are based on Shimadzu's extensive dynamic testing and design technology expertise. They provide high-quality solutions for a wide variety of material testing and dynamic component evaluation applications.



- High-rigidity loading frame
- Low-friction actuator
- Controller with high waveform reproducibility and easy operability
- Software capable of diverse testing requirements and compliant with the testing standards

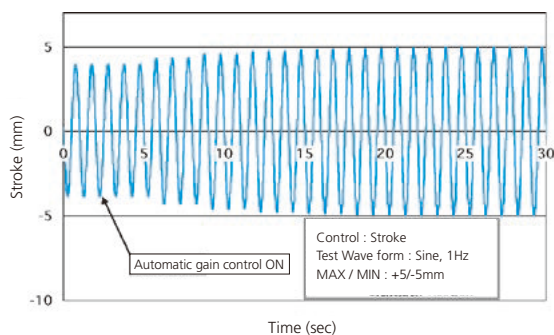


Designed for User-Friendly Operability

The Servo Controller 4830 for Servopulser series dynamic/fatigue testing machines features both an LCD touch panel and physical keys. This allows users to specify test settings and operate actuators easily and intuitively. An automatic gain control function ensures that input waveforms are reproduced accurately, which is especially important for fatigue testing. In addition to improving the efficiency of testing, it also provides assistance for users performing tests for the first time.

● Easy Operability and Broad Applicability

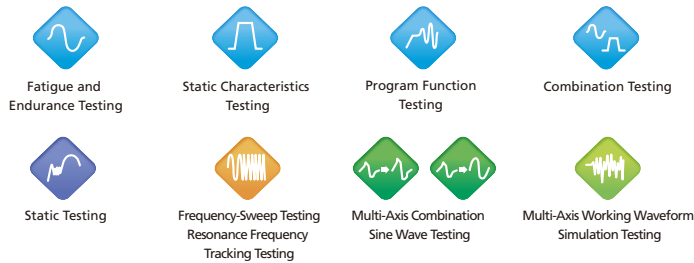
The LCD touch panel and jog dial allow users to specify test parameter settings or change parameters such as frequency, test force, or displacement at any time during tests. It also consolidates the various functions required for testing, such as real-time display of time graphs, X-Y graphs, and peak graphs, in a single location.



● Automatic Gain Control Function Ensures Waveforms are Reproduced Accurately

When configuring parameter settings for fatigue testing, or other tests that involve repetitive waveforms, tuning and optimizing control parameter settings can be very time-consuming. However, by entering approximate settings, the automatic gain control function can be used to correct the specified signal so that the peak measurement values are consistent with specified parameters. In cases where the settings must be changed frequently for testing a variety of materials or because the intended amplitude cannot be maintained due to fatigue degradation during the fatigue testing process, the automatic gain control function ensures that input waveforms are maintained accurately without having to reset control parameters.

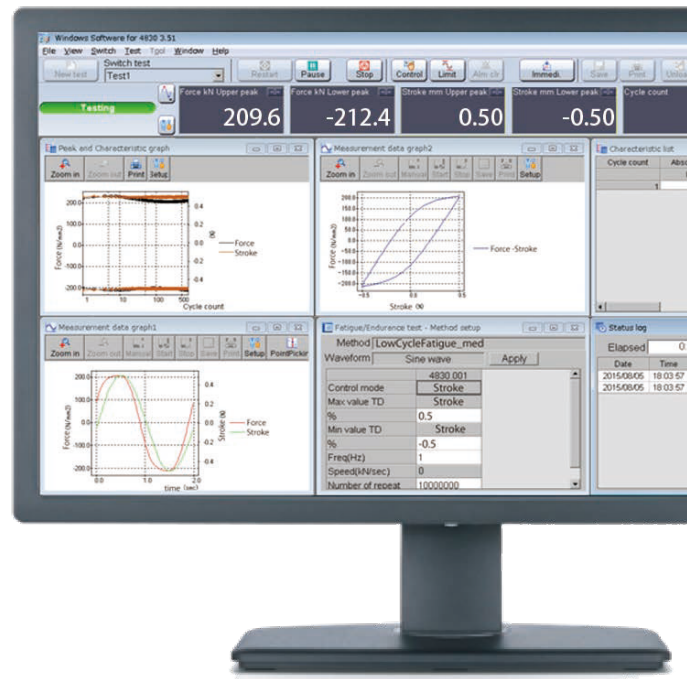
Easier, More Convenient, and More Sophisticated Testing



● Windows Software for 4830

Allows users to perform a variety of tests, such as material fatigue testing, programmed testing that combines various control waveforms, and static testing. Optional software is also available for performing more sophisticated tests, easily, such as multi-axis working waveform simulation tests, multi-axis combination sine wave tests, frequency-sweep tests, and resonance frequency tracking tests, in an easier manner.

See page 56.



Fracture Toughness Test

● GLUON 4830 Software for Fracture Toughness Testing Compliant with the Standards

Using Shimadzu's Servopulser with fracture toughness test software allows use of simple procedures to perform complicated tests that comply with the standards, such as crack propagation tests, KIC/CTOD tests, or JIC tests.

ASTM E647-13,
ISO 12108:2012

ASTM E399-12, ISO 12737-96
BS 7448-1:1991,
ASTM E1820-11

ASTM E1820-11,
ASTM E813-89
JIS Z 2284-98

Safety

Both hardware and software help ensure operator safety by positioning emergency stop buttons, crosshead adjustment buttons, and other important switches where they are easy to operate.

● Dual-Stage Crosshead Drive Mechanism

The crosshead vertical actuation system is equipped with various safety features, such as a two-stage operation for raising or lowering the crosshead and stoppers to prevent grips from falling off. A safety cover can also be installed to protect operators from flying debris.

● Anti-Spiking Mechanism for Hydraulic Power Supply Unit Startup

This mechanism prevents spiking during hydraulic power supply unit startup by setting control deviations to zero.

● Contact Load Function

This prevents applying excessive loads during manual actuator operations, such as when mounting or removing test samples.

● Various Software Alarms

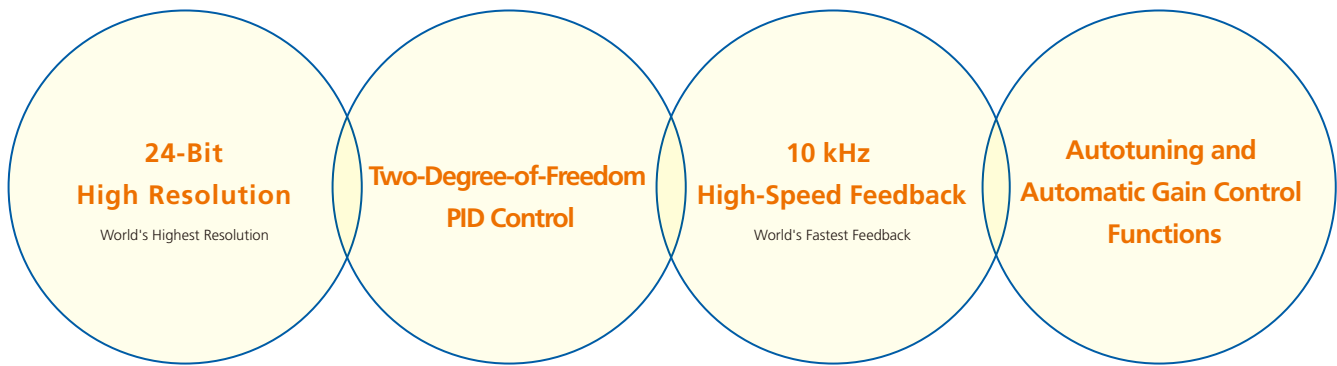
Numerous software and controller limit functions and post-limit actions ensure that even unattended operations are safe.



Stable Input Waveform

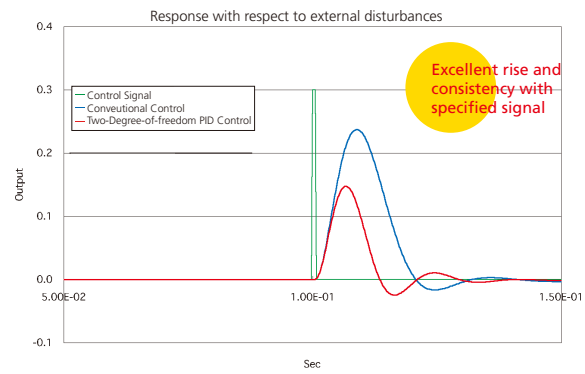
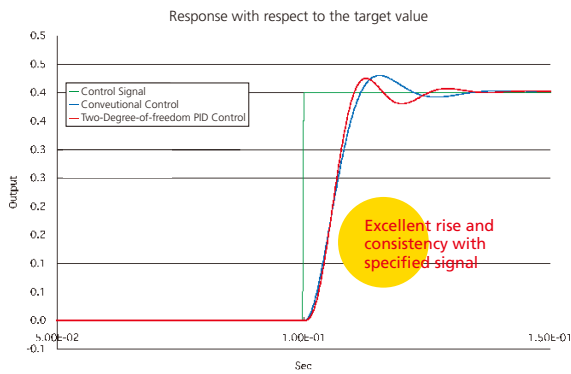
Due to the highly controlled response and accurate waveform reproducibility of Shimadzu dynamic and fatigue testing machines, they can apply loads to products based on highly precise input waveforms.

Providing such a stable input waveform ensures that material fatigue testing can be performed with high accuracy and high reproducibility. Therefore, even slight differences in product performance or endurance can be evaluated.



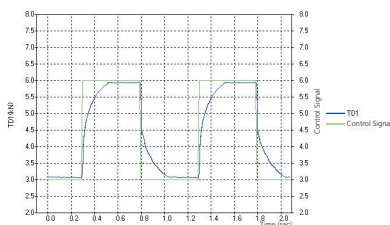
● Two-Degree-of-Freedom PID Control Minimizes Effects from External Disturbances

The control method (two-degree-of-freedom PID control) is able to optimize the target response for specified signals and the response to external noise. Optimizing the control parameters using the autotuning feature helps maximize the system performance. The 24-bit high-resolution measurement function and 10 kHz high-speed feedback ensure even sharp changes in test force or stroke can be controlled reliably.

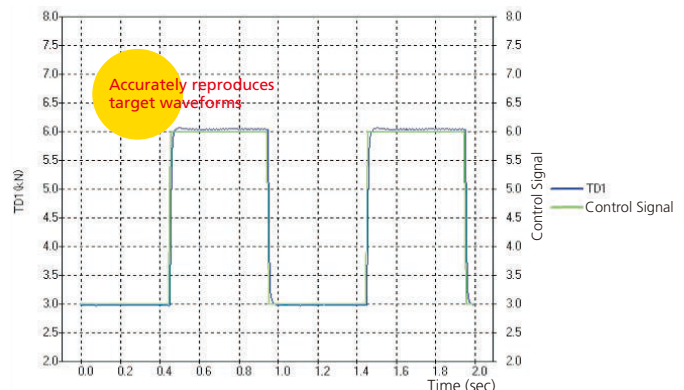


● Autotuning Function

The autotuning function accurately reproduces target waveforms by automatically determining optimal control parameters. Simply set up the sample in a similar state as for the intended testing and then specify the preload. Then the function automatically tunes the manually adjusted control parameters.



Automatically selects optimal control parameters

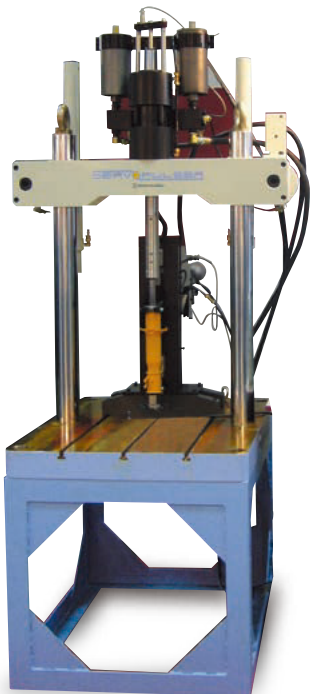
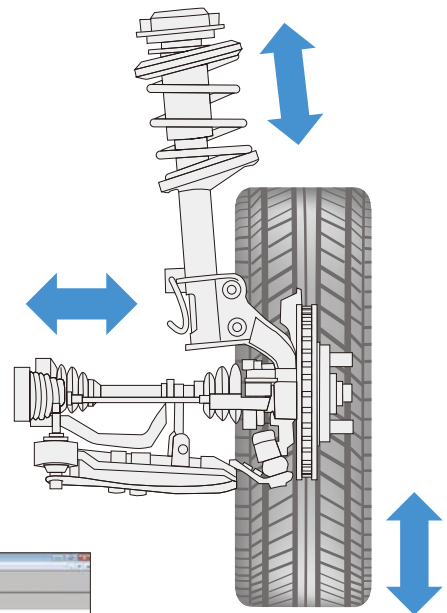


Measures Even Slight Differences in Performance

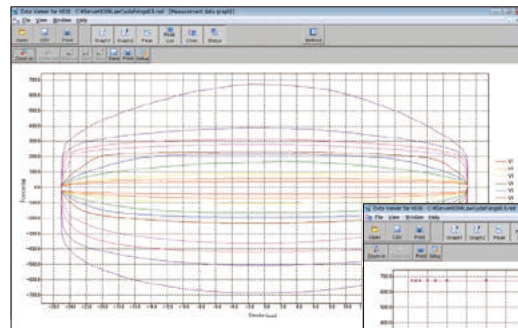
Dynamic testing machines apply a load waveform to a product and measure the corresponding response. The precise and reliable waveform input provided by Shimadzu dynamic testing machines and controllers allows identification of even slight differences in product performance and helps provide feedback for product design.

For example ...

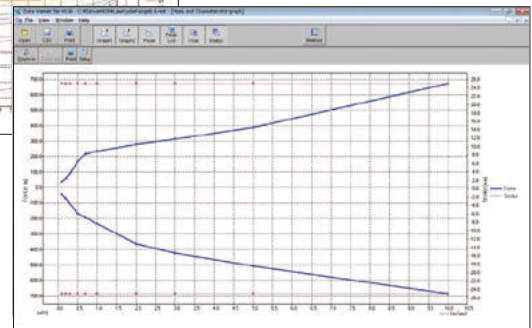
A variety of parts is used to achieve a comfortable ride in automobiles. To improve the performance of those parts, data from evaluating their characteristics is essential. Therefore, the damping force is measured as test frequency is varied. Shock absorber performance can be confirmed by measuring the relationship between velocity and damping force or the response to a Lissajous or other waveform. The input waveform is important for evaluating slight differences in performance.



Electric-Hydraulic Dynamic and Fatigue Testing System
EHF-U Series
Two-Axis Shock Absorber Testing System



Lissajous Waveform

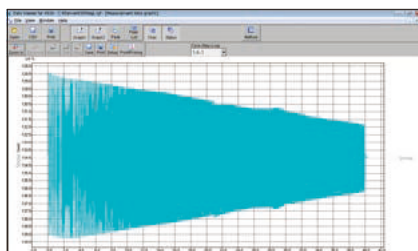


Velocity vs. Damping Force Waveform

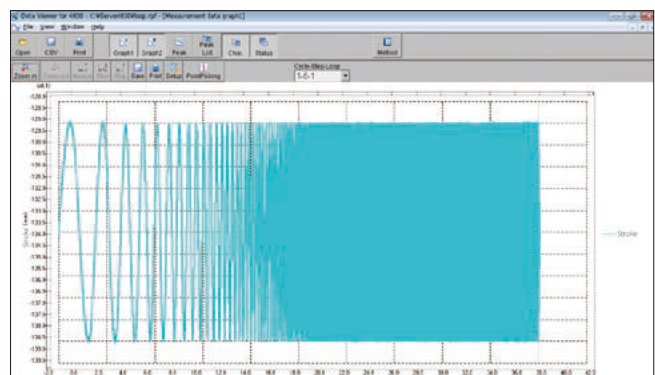
● Impressive Waveform Reproducibility

The 10 kHz high-speed feedback and 24-bit high resolution provides highly precise control waveforms for all measurement ranges.

Tests can be done with accurately controlled waveforms even in cases where the frequency of the input waveform varies, such for assemblies or finished products, or when the status of the item being tested changes from hour to hour.



Frequency-sweep
AGC function



Dedicated Shock Absorber Testing Software

If tests are affected by servo valve frequency characteristics or PID control settings are inadequate, then the amplitude can vary depending on the frequency, as shown above. However, the frequency-sweep AGC function corrects the amplitude to keep it constant at all frequency levels.

Evaluate Product Endurance in Any Manner Desired

Endurance testing requires a wide variety of testing inputs in order to evaluate the reliability of products or assemblies or to verify design specifications. Shimadzu's light-weight and compact hydraulic actuators can be installed on a wide variety of stands and used to generate test inputs that closely approximate the conditions under which samples are used. Therefore, they satisfy a wide variety of testing requirements, such as for actuator installation, loading mechanism design, multi-axis synchronized actuator testing, and multi-sample batch testing.

● Two-Degree-of-Freedom PID Control Minimizes Effects from External Disturbances

The control method (two-degree-of-freedom PID control) is able to optimize the target response for specified signals and the response to external noise. Optimizing the control parameters using the autotuning feature helps maximize the system performance. The 24-bit high-resolution measurement function and 10 kHz high-speed feedback ensure that even sharp changes in test force or stroke can be controlled reliably.

Light
Compact
Long Stroke



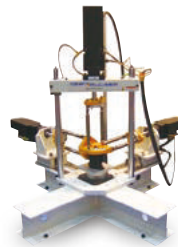
With a trunnion bracket



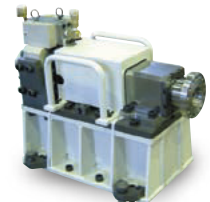
With vertical movement and left/right rotation mechanisms



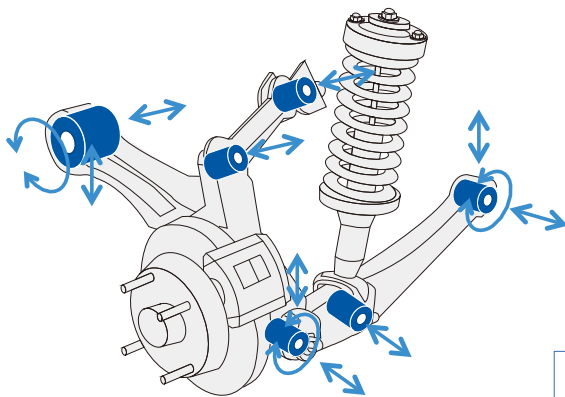
With vertical and left/right rotation mechanisms



XYZ 3-axis loading frame



Portable torsional actuator

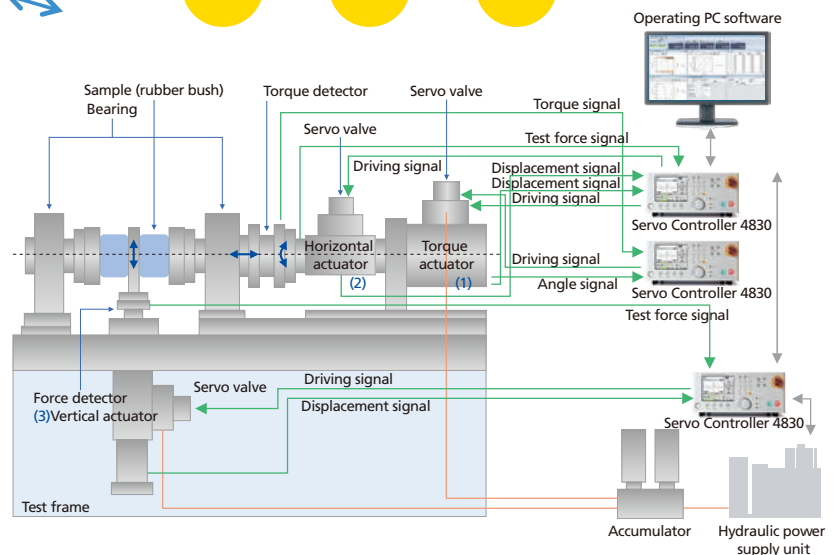


This allows users to perform 3-axis endurance tests with forces in axial and torsional directions to evaluate the endurance of rubber bushings, which are exposed to forces in various directions. The interference correction function permits tests using waveforms that are even closer to target waveforms.

Note: The interference correction function corrects for interference in other directions that result from dynamic loads. In various types of tests, it sends command signals for the opposite phase as the interference components and cancels out interference components, which achieves a waveform that more closely resembles the target waveform.

For example ...

The riding comfort of automobiles is directly related to reducing the amount of vibration and noise. Synchronizing multiple actuators using the Servo Controller 4830 allows accurately simulating the dynamic waveform experienced by parts and components during actual travel.



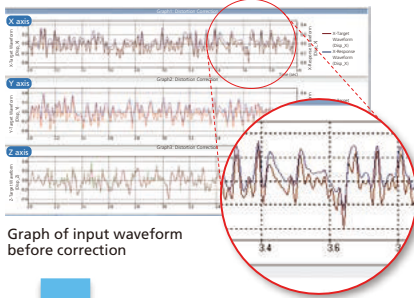
Accurately Reproduces Actual Operating Waveforms

The Servo Controller 4830 has a waveform correction function that helps accurately reproduce input waveforms. Used in combination with various additional software, it can be used to simulate actual operating waveforms determined by measuring the status of actual loads or simulate the most severe conditions by continuously applying loads at the resonant frequency. The Servo Controller 4830 optimizes actuator control based on various testing requirements to enable highly precise and accurate testing.

● Waveform Distortion Correction

This function makes it possible to correct the waveform based on the frequency characteristics of the loading mechanism (transfer function correction), which helps achieve the intended target waveform. Because it can correct for loading mechanism-specific periodic strain, it can cancel out unwanted strain components and accurately control loads according to the target waveform. Complicated actual loading profiles that were difficult to simulate can now be specified easily using this controller and software.

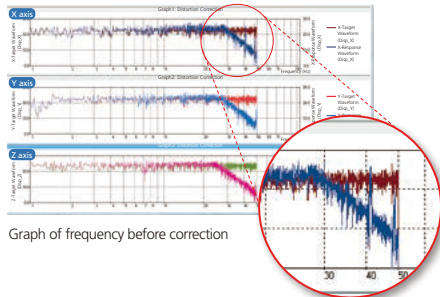
The response waveform is rounded and the high-frequency region waveform cannot be reproduced.



Graph of input waveform before correction

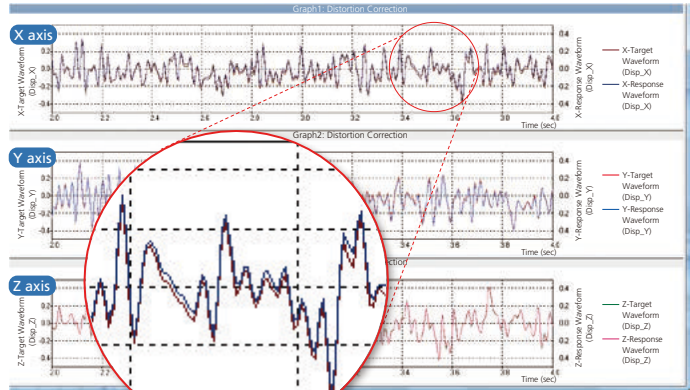


Response drops above 30 Hz.

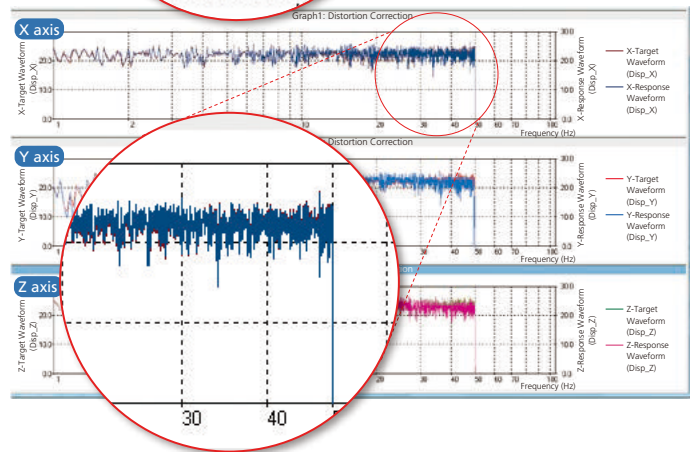


Graph of frequency before correction

Precisely matches the target waveform due to correction.



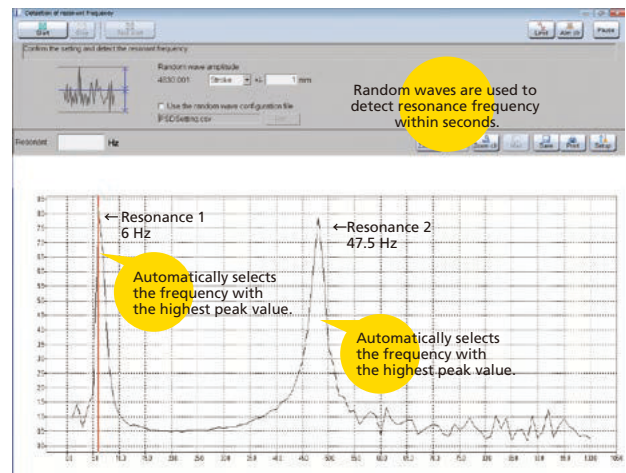
Accurately reproduces the 50 Hz maximum frequency of the target.



Guaranteeing Endurance

● Simulates the Most Severe Loading Conditions Using the Resonance Frequency Tracking Testing

To guarantee product endurance, the resonance frequency is input because it results in the highest load levels. The resonance frequency can be determined in only a few seconds. It can also be automatically tracked if it changes due to sample fatigue. This reduces the labor required to manually specify the resonance frequency and the stress on samples.



Random waves are used to detect resonance frequency within seconds.

Automatically selects the frequency with the highest peak value.

Automatically selects the frequency with the highest peak value.

Extensive Experience in a Wide Variety of Fields

From dynamic testing in automotive, aircraft, train, shipbuilding, healthcare, and construction fields to fatigue testing of materials, Shimadzu has developed various dynamic testing machines for all sorts of fields. Shimadzu's extensive dynamic testing experience is available for consulting with customers.



Multiple Jack System on the Railway Rail System Installed for East Japan Railway Company

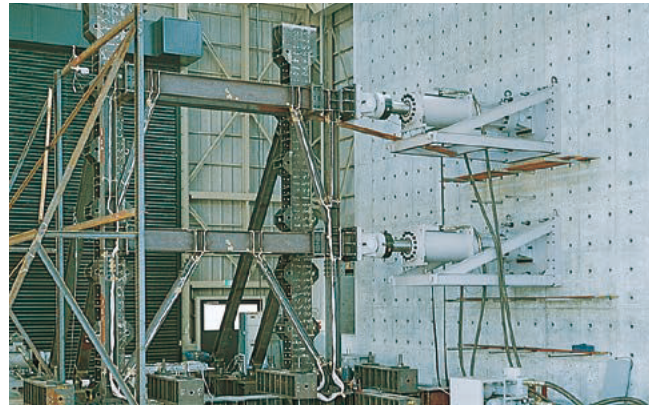
● Load Testing for Large-Scale Structural Members

The ground strength, bearing capacity of pilings, stability of basic structural members, etc. are evaluated by applying static and dynamic loads on large structural members using the Shimadzu Servopulser jack system to determine the relationship between test force and displacement. For load testing, actuator endurance and stable control technology are essential.

Shimadzu offers support for a wide range of evaluations, such as evaluating structural members made with new materials, evaluating the endurance of large-scale structural members, and inspecting old building structural members.

● Dynamic Evaluation of Automotive, Aircraft, Rail, Ship, and Various Other Transportation Equipment

Increasing the reliability of transportation equipment used to carry people and freight involves a variety of dynamic testing requirements, from various design verification work to evaluation of endurance. Shimadzu dynamic testing systems can be configured to meet unique customer requirements by combining various standard models or utilizing customized actuators and loading frames based on Shimadzu's extensive track record and experience.

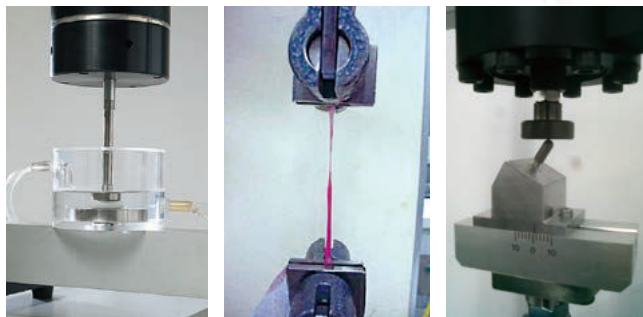


Loading Test System for Steel Structural Members



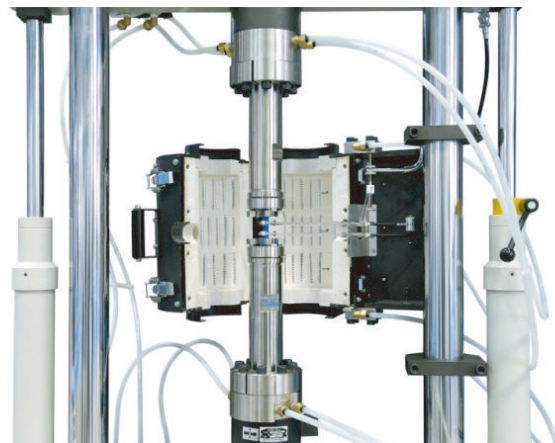
● Evaluating Implants and Biological Materials

Implants and other products in the biomedical industry must be subjected to various design verification testing and endurance evaluation before they can be released to the market. Shimadzu electromagnetic force and pneumatic Servopulser systems are ideal for clean environments and are capable of highly accurate testing at low load levels. Therefore, they are used to evaluate the endurance of knee, hip, and spinal implants or in human kinematic research.



● Dynamic and Fatigue Testing in Controlled Atmospheres

Servopulser systems can be fitted with an environmental control system that reproduces loads under high temperature or severe environmental conditions or under environmental conditions experienced during actual usage. This system accommodates a variety of testing requirements, such as testing at high temperatures, in a vacuum or gas atmosphere, or thermal fatigue testing.



Resistance Heat High-Temperature Testing System

Evaluating Strain Rate Dependence

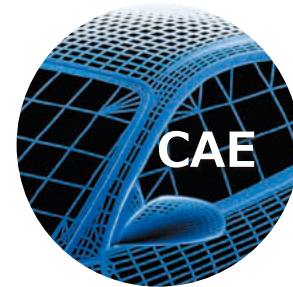
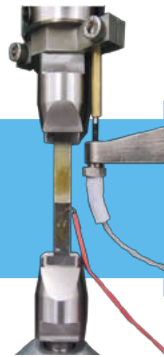
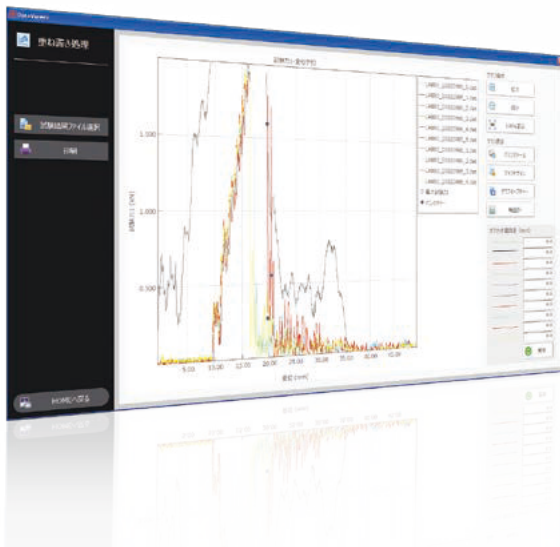
In order to accommodate increasingly sophisticated designs, computers are now being used in design simulation technologies. In particular, to ensure safety with respect to impacts or determine the behavior during impact fracture, material property parameters are measured at speeds experienced during actual operation or the simulated deformation rate. Using these parameters in calculations can contribute significantly to calculation results.

● High-Speed Impact Testing at Speeds Up to 20 m/sec

This high-speed impact testing system integrates several of Shimadzu's advanced technologies, such as actuators engineered for high-speed testing and shock-absorbing mechanisms that minimize the effects from impact testing, to realize a maximum impact speed of 20 m/sec (72 km/h).

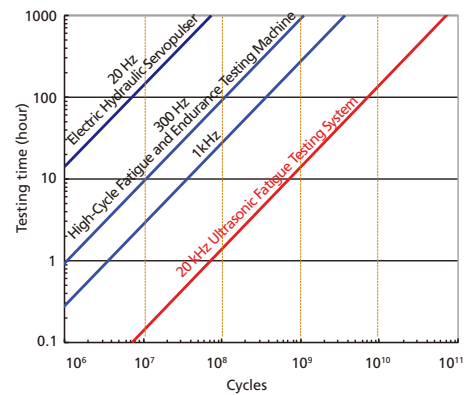


High-Speed Impact Testing System
Hydroshot HITS Series



For Reducing the Time Required for Fatigue Testing of Metal Materials and Gigacycle Fatigue Testing

Now that materials used in products are procured from around the world, it is especially important to evaluate the material properties when receiving materials. With cycle rates up to 20 kHz, the USF-2000 Ultrasonic Fatigue Testing System is able to accelerate fatigue life evaluations of metal materials. This means it can perform tests of 10^{10} cycles, which would normally take 3.2 years at 100 Hz, in only six days. This exceeds the gigacycle level to achieve ultrahigh efficiency.



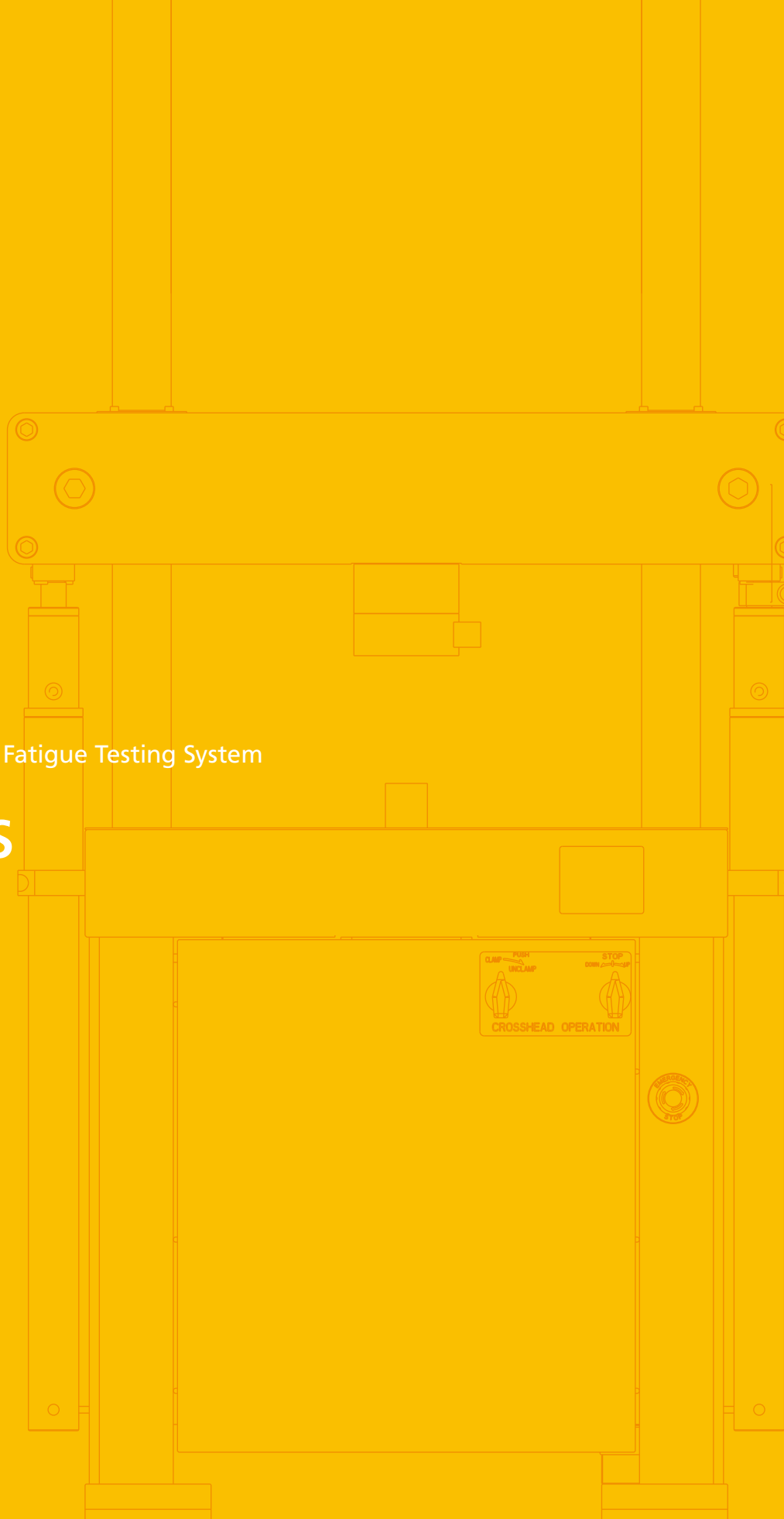
For example ...

Assume a 10^8 cycle test is performed at 20 Hz and 20 kHz.



Electric Hydraulic Dynamic and Fatigue Testing System

EHF Series



Electric-Hydraulic Dynamic and Fatigue Testing System

Servopulser series electric-hydraulic dynamic and fatigue testing systems feature servo-hydraulic actuators, which are able to accurately reproduce input waveforms. Therefore, they are highly accurate in applying loads ranging from low to high. From high-performance standard models to products customized to satisfy various unique testing requirements, these systems support a wide range of dynamic testing applications.

High Capacity and Compact

By controlling the flow rate of oil, compact hydraulic actuators can apply large forces at a wide range of testing speeds, from extremely slow to very fast. This means they can be used for a wide variety of testing applications.

High-Rigidity Frame

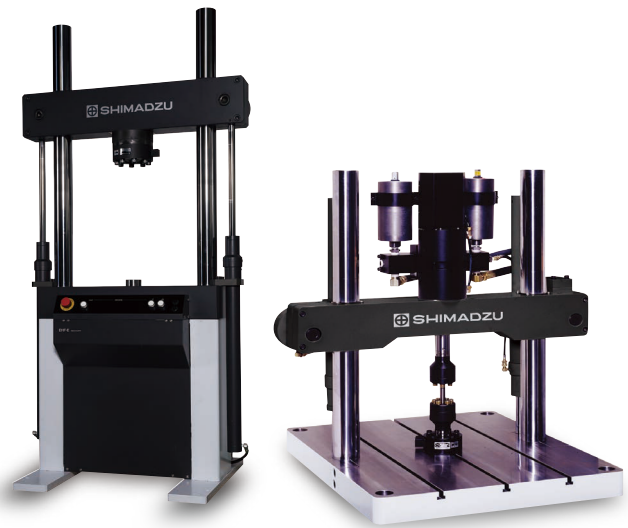
A very rigid loading frame is used to prevent buckling samples. This ensures high reliability for a variety of testing applications.

From Low to High Speeds From Low to High Loads

High-performance servo valves allow seamless and immediate change of the test force or speed.

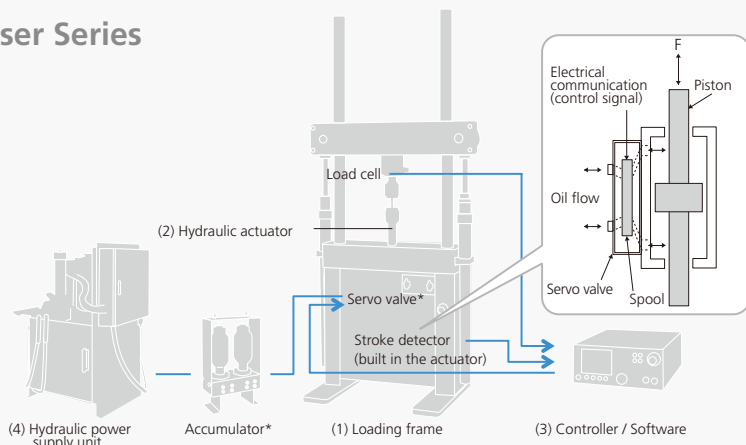
An Energy-Saving Operating Mode Is Also Available

By using the optional energy-conservation unit (ECU) (page 36), an energy-saving mode can be used to optimize the hydraulic power supply unit's power level based on the testing parameters and testing status. It reduces the hydraulic power supply unit's power level when tests are in standby mode.



Basic Configuration of Servopulser Series Electric-Hydraulic Systems

By selecting (1) a loading frame, (2) a hydraulic actuator, (3) a controller and software, and (4) a hydraulic power supply unit, Servopulser series electric-hydraulic systems are able to accommodate a wide variety of test force and testing speed requirements. The hydraulic drive actuator, which is electrically controlled via a servo valve, provides reciprocating motion capable of high test forces and a wide response range, from low to high frequency.



* Items marked with an asterisk are included based on the actuator and hydraulic power supply unit combination.

Electric-Hydraulic Dynamic and Fatigue Testing System

EHF-E Series



For Dynamic and Fatigue Testing of Various Materials and Small Parts

This series features an E-type frame with a bottom-mounted actuator, which can satisfy a wide variety of dynamic and fatigue testing requirements, from fatigue testing of materials to evaluating the performance of components.

Dynamic Capacity Rating of Actuators 50 kN / 100 kN / 200 kN

This series is capable of static, dynamic, and fatigue testing of a wide range of materials, from plastics to aluminum, composites, and steel.

High Rigidity and Large Testing Space

The large testing space supports material fatigue testing in a high-temperature or thermostatically controlled environment, thermal fatigue testing, fracture toughness evaluation, component performance and endurance testing, and so on. Accessories for respective tests are available. These include grips, compression plates, extensometers, and testing environmental control systems.

±0.5 % Test Force Accuracy

Test force accuracy is guaranteed to within ±0.5 % of the indicated value.

Bottom-Mounted Actuator

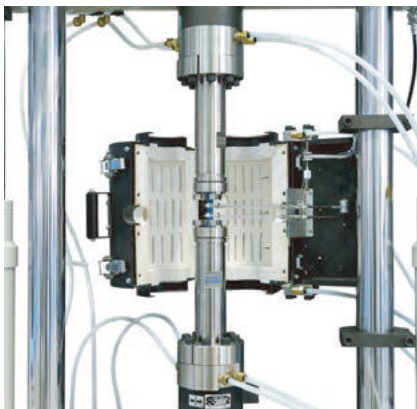
This supports a wide variety of tests, including component tensile, high/low cycle fatigue, failure, performance, and endurance tests.

Dual-Stage Crosshead Drive Mechanism

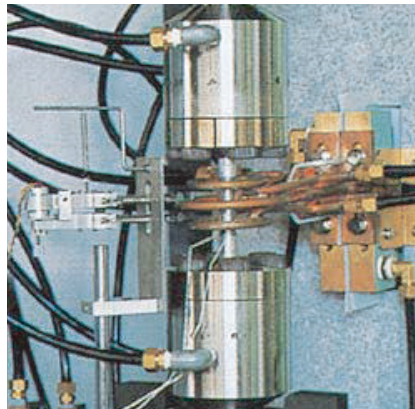
The hydraulic crosshead drive and hydraulic clamp can be operated more intuitively using handles.

This dual-stage configuration helps prevent operating errors and accidents.

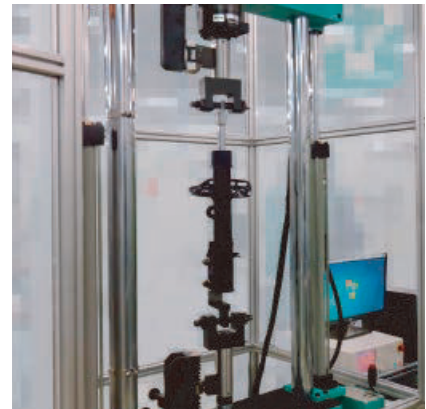
Automatically lifting/lowering hydraulic crosshead
High-accuracy column



Resistance Heat High-Temperature Testing System



High-Frequency Induction Heat High-Temperature Testing System

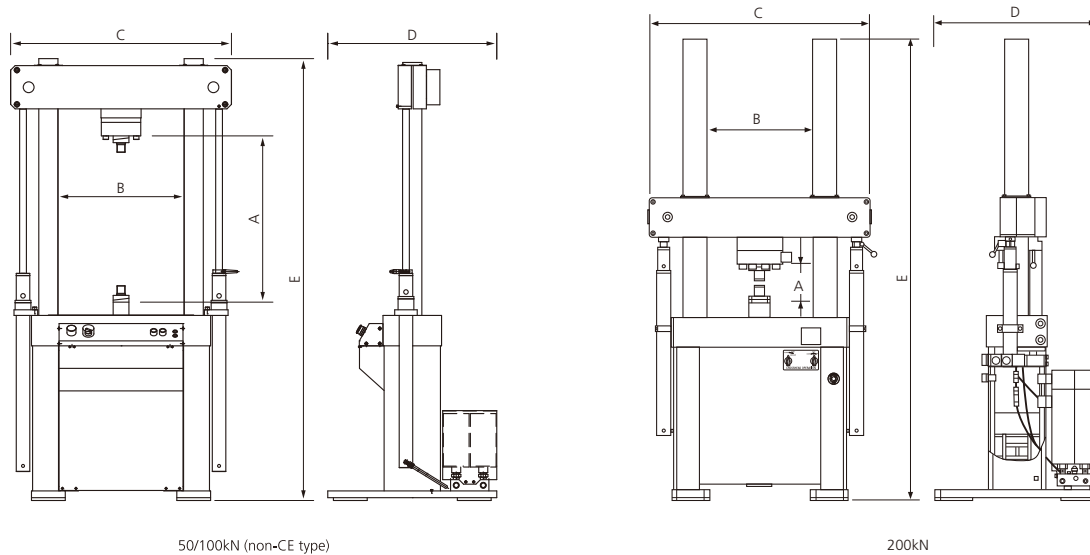


Component Test

Specifications

Model		EHF -EV051k1	EHF -EV051k2	EHF -EV101k1	EHF -EV101k2	EHF -EV200k1	EHF -EV200k2
Max. dynamic test force		±50kN		±100kN		±200kN	
Max. static test force		±60kN		±120kN		±240kN	
Actuator stroke		±25mm	±50mm	±25mm	±50mm	±25mm	±50mm
Cycle speed and amplitude		See amplitude characteristics charts.					
Controlled items		Test force and stroke (two can be added as options)					
Test force	Range	24-bit rangeless					
	Indication accuracy	Within 0.5 % of indicated value or ±0.02 % of maximum dynamic test force, whichever is greater					
Crosshead drive mechanism		Hydraulic drive (with hydraulic clamp)					
Applicable hydraulic power supply unit		QF-10B, QF-20B, QF-40B, QF-70B, QF-110, QF-140 AF-10B, AF-20B					
Power requirements		Varies depending on the hydraulic power supply unit (see pages 34 and 35).					

Testing Machine Main Unit Dimensions



50/100kN (non-CE type)

200kN

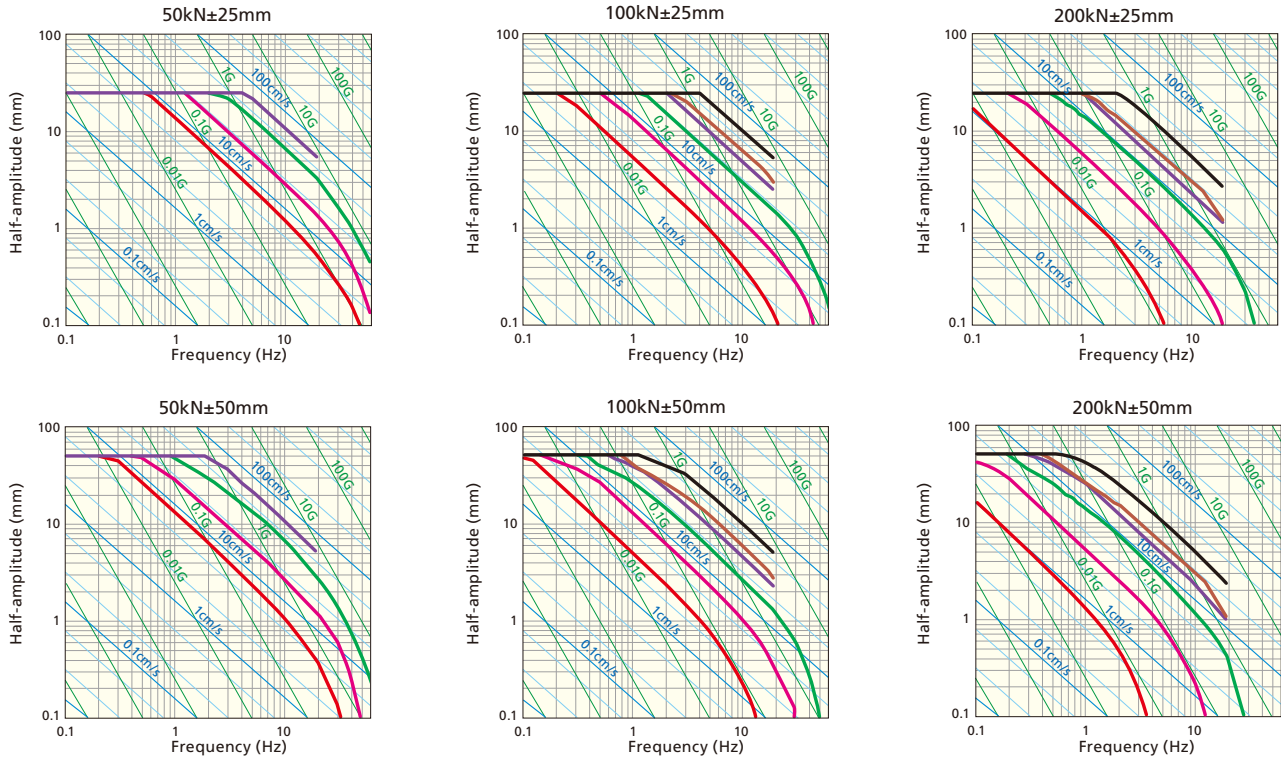
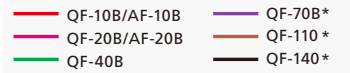
Capacity		50kN				100kN				200kN			
Actuator stroke		±25mm		±50mm		±25mm		±50mm		±25mm		±50mm	
Column length		Standard	Standard + 600	Standard	Standard + 600	Standard	Standard + 600	Standard	Standard + 600	Standard	Standard + 400	Standard	Standard + 400
Testing space (mm)	A	65 to 760	365 to 1360	40 to 735	340 to 1335	40 to 735	340 to 1335	15 to 710	315 to 1310	200 to 995	400 to 1395	175 to 970	375 to 1370
	B	560											
Main unit dimensions (mm)	C	980				980				1170			
	D	750				750				850			
	E	1965	2565	1965	2565	1965	2565	1965	2565	2405	2805	2405	2805
Weight (kg)*1/*2		840	900	850	910	880	940	890	950	1500	1580	1520	1600
Frame rigidity (mm/kN)*3		0.0012				0.0012				0.00065			

*1 Including actuator weight. Test jigs are not included.

*2 Weight may vary slightly depending on the type and number of servo valves.

*3 When the distance between the crosshead and the table is 500 mm

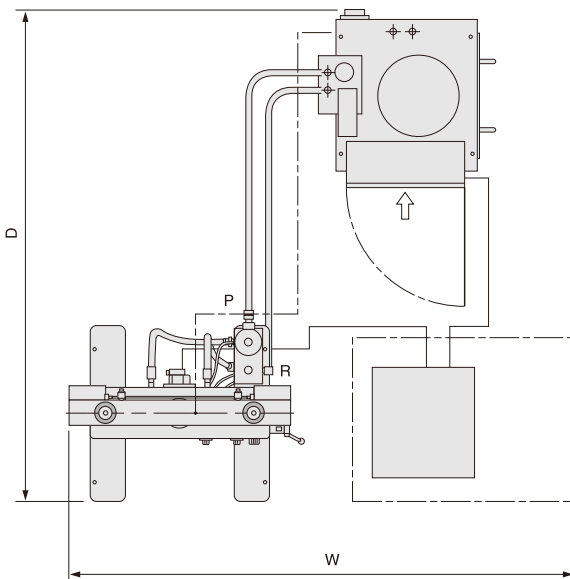
Amplitude Characteristics (60 Hz)



* It is not possible to use standard configurations of models QF-70B or higher for high-frequency regions due to the servo valve characteristics. However, these models may be used for testing at high frequencies if the servo valve is changed, for example. Contact Shimadzu for more information.

- The above characteristic curves indicate the relation between half-amplitude and cycle speed, given sine wave motion at the rated load level.
- The above indicates the amplitude characteristics given a 60 Hz power supply. Characteristics with a 50 Hz power supply will be about 5/6 of indicated values.
- The above characteristics do not include the frame or load cell characteristics. Compensate for the influence of these factors to determine actual amplitude characteristics.
- The indicated characteristics values were calculated based on typical characteristics of the servo valve being used, which may result in a difference of about 10 % on the frequency axis.
- There may be limitations on testing frequencies, depending on jig, sample, or other characteristics.

Standard Layout



Main Unit	Hydraulic Power Supply Unit	Space Required (W x D)
E50kN	QF-10B	2300×2100
	QF-20B	2300×2200
	QF-40B	2300×2600
	QF-70B	2300×2800
	AF-10B	2300×2200
	AF-20B	2300×2200
E100kN	QF-10B	2300×2100
	QF-20B	2300×2200
	QF-40B	2300×2600
	QF-70B	2300×2800
	AF-10B	2300×2200
	AF-20B	2300×2200
E200kN	QF-10B	2500×2100
	QF-20B	2500×2200
	QF-40B	2500×2600
	QF-70B	2500×2800
	AF-10B	2500×2200
	AF-20B	2500×2200

- At the installation site, provide about 500 mm of space on all four sides of the system, in addition to the space requirements indicated above, to allow access for operation and maintenance.
- The drawing above indicates the dedicated space requirements. The shape and orientation of the hydraulic power supply unit may vary depending on its capacity.
- For a more detailed standard layout drawing, contact Shimadzu.
- The standard system configuration does not include the table, computer, or printer.

EHF-U Series



For Full-Scale Fatigue and Endurance Testing of Structural Materials and Large Samples

By providing a T-slot surface plate at the bottom of a U-type loading frame with a top-mounted actuator, these systems allow installation of extra large components and parts. Due to the large testing space, dynamic testing and evaluation can be performed on a variety of samples, including full-size samples and structural members.

Rated Actuator Capacities of 50 kN, 100 kN, and 200 kN Support a Wide Range of Dynamic Testing

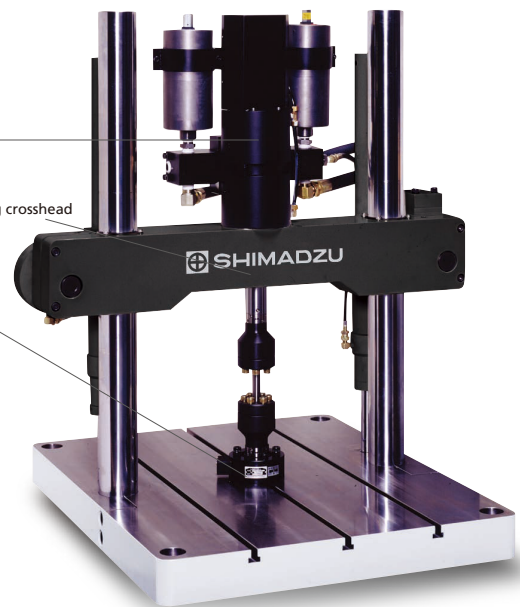
Top-Mounted Actuator

Supports dynamic and endurance testing of full-size samples, large components, and structural members.

Hydraulically lifting/lowering crosshead

±0.5 % test force accuracy

Test force accuracy is guaranteed to within ±0.5 % of the indicated value.



High Rigidity and Large Testing Space

A T-slot surface plate makes it easy to secure samples. The size of the surface plate and length of the columns can be customized based on the size of samples.

High-accuracy column



Crosshead drive handle

Crosshead Drive System with Operating Error Prevention Mechanism

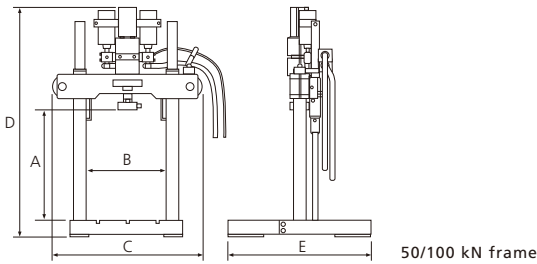
The hydraulic crosshead drive and hydraulic clamp can be operated intuitively using the handle.



Specifications

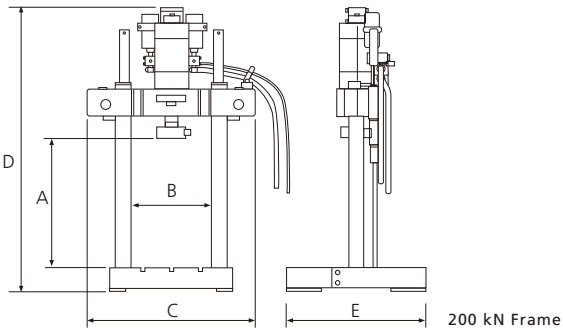
Model	EHF -UV050k1A	EHF -UV050k2A	EHF -UV100k1A	EHF -UV100k2A	EHF -UV200k1A	EHF -UV200k2A
Max. dynamic test force	±50kN		±100kN		±200kN	
Max. static test force	±60kN		±120kN		±240kN	
Piston stroke	±25mm	±50mm	±25mm	±50mm	±25mm	±50mm
Cycle speed and amplitude	See amplitude characteristics charts.					
Controlled items	Test force and stroke (two can be added as options)					
Test force	Range					
	24-bit rangeless					
Indication accuracy		Within 0.5 % of indicated value or ±0.02 % of maximum dynamic test force, whichever is greater				
Crosshead drive mechanism		Hydraulic drive (with hydraulic clamp)				
Applicable hydraulic power supply unit		QF-10B, QF-20B, QF-40B, QF-70B, QF-110, QF-140, AF-10B, AF-20B				
Power requirements		Varies depending on the hydraulic power supply unit (see pages 34 and 35).				

Testing Machine Main Unit Dimensions



	Capacity	50kN						100kN																	
	Actuator stroke	±25mm			±50mm			±25mm			±50mm														
	Column length	Standard		Standard + 400		Standard		Standard + 400		Standard		Standard + 400													
Testing space (mm)	A	180 to 785		380 to 1185		155 to 760		355 to 1160		180 to 735		380 to 1135		155 to 710		355 to 1110									
	B	560																							
Main unit dimensions (mm)	C	1046																							
	D	1610		2010		1710		2110		1655		2055		1755		2155									
	E	1000	1500	2000	1000	1500	2000	1000	1500	2000	1000	1500	2000	1000	1500	2000	1000	1500	2000						
Weight (kg)		970	1330	1630	1000	1360	1660	970	1330	1630	1000	1360	1660	1070	1460	1900	1100	1500	1940	1070	1460	1900	1100	1500	1940
Frame rigidity (mm/kN)*		0.0025												0.0019											

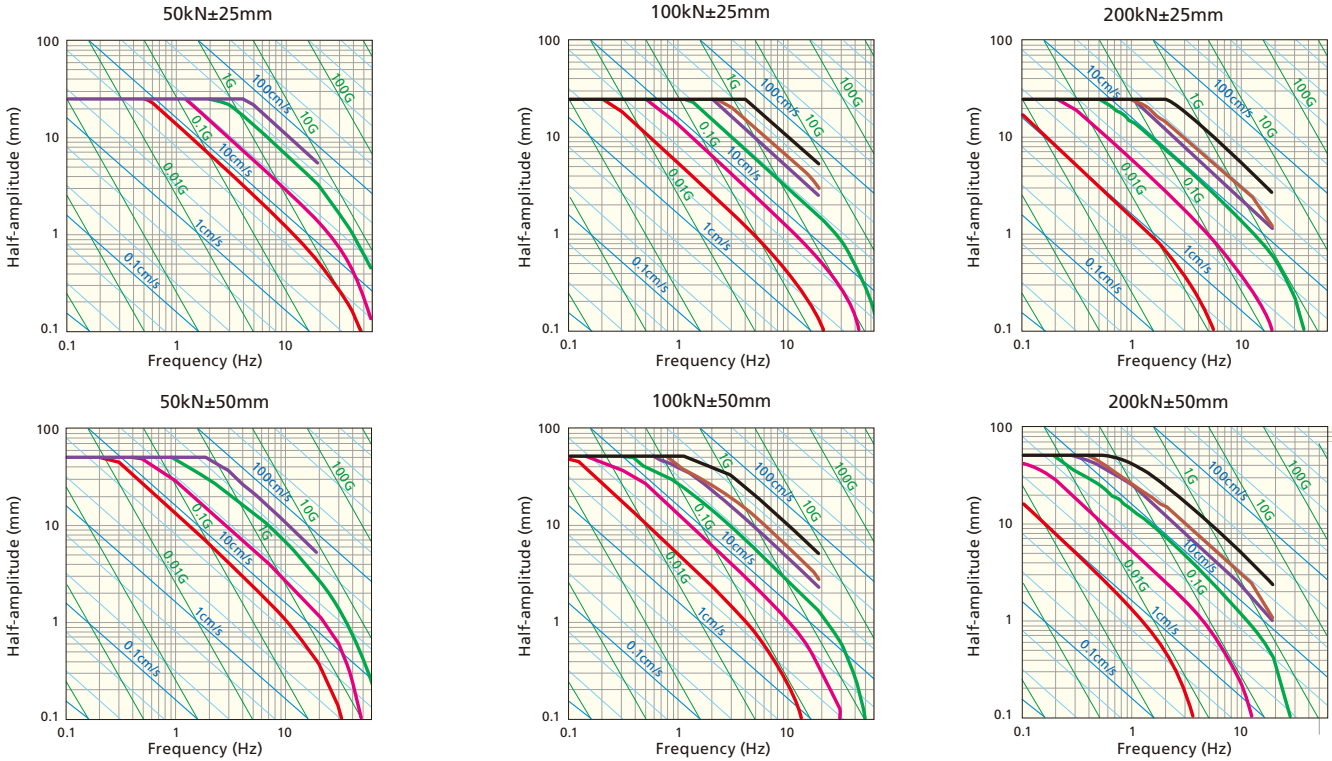
* Crosshead table clearance: 500 mm



	Capacity	200kN											
	Actuator stroke	±25mm						±50mm					
	Column length	Standard			Standard + 400			Standard			Standard + 400		
Testing space (mm)	A	200 to 950			400 to 1350			175 to 925			375 to 1325		
	B	560											
Main unit dimensions (mm)	C	1200											
	D	2255			2655			2305			2705		
	E	1000	1500	2000	1000	1500	2000	1000	1500	2000	1000	1500	2000
Weight (kg)		2020	2690	3430	2100	2770	3510	2050	2720	3460	2130	2800	3540
Frame rigidity (mm/kN)*		0.0009											

* Crosshead table clearance: 500 mm

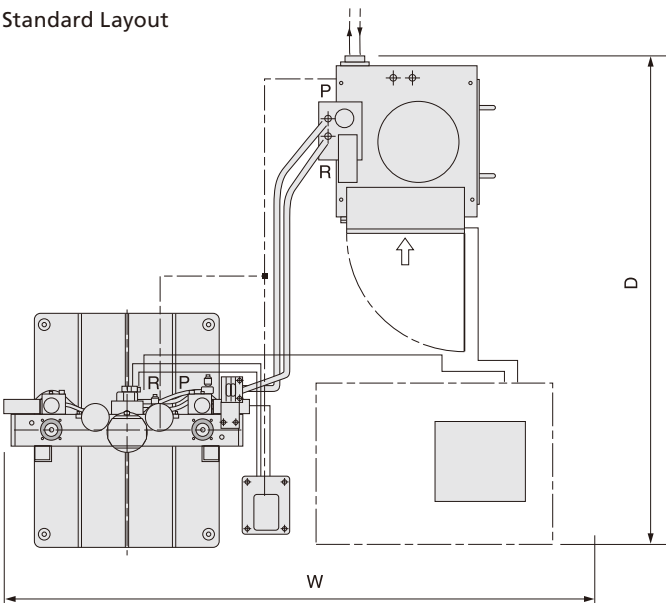
Amplitude Characteristics (60 Hz)



* It is not possible to use standard configurations of models QF-70B or higher for high-frequency regions, due to the servo valve characteristics. However, these models may be used for testing at high frequencies if the servo valve is changed, for example. Contact Shimadzu for more information.

- The above characteristic curves indicate the relation between half-amplitude and cycle speed, given sine wave motion at the rated load level.
- The above indicates the amplitude characteristics given a 60 Hz power supply. Characteristics with a 50 Hz power supply will be about 5/6 of indicated values.
- The above characteristics do not include the frame or load cell characteristics. Compensate for the influence of these factors to determine actual amplitude characteristics.
- The indicated characteristics values were calculated based on typical characteristics of the servo valve being used, which may result in a difference of about 10 % on the frequency axis.
- There may be limitations on testing frequencies, depending on jig, sample, or other characteristics.

Standard Layout



Main Unit	Hydraulic Power Supply Unit	Space Required (W x D)
U50kN	QF-10B	2500×2100
	QF-20B	2500×2200
	QF-40B	2500×2600
	QF-70B	2500×2800
	AF-10B	2500×2200
	AF-20B	2500×2200
U100kN	QF-10B	2500×2100
	QF-20B	2500×2200
	QF-40B	2500×2600
	QF-70B	2500×2800
	AF-10B	2500×2200
	AF-20B	2500×2200
U200kN	QF-10B	2600×2100
	QF-20B	2600×2200
	QF-40B	2600×2600
	QF-70B	2600×2800
	AF-10B	2600×2200
	AF-20B	2600×2200

- At the installation site, provide about 500 mm of space on all four sides of the system, in addition to the space requirements indicated above, to allow access for operation and maintenance.
- The drawing above indicates the dedicated space requirements. The shape and orientation of the hydraulic power supply unit may vary depending on its capacity.
- For a more detailed standard layout drawing, contact Shimadzu.
- The standard system configuration does not include the table, computer, or printer.

Tabletop Electric-Hydraulic Dynamic and Fatigue Testing System

EHF-L Series



For Fatigue and Endurance Testing of Various Materials and Small Parts

These compact tabletop models with a top-mounted actuator on an L-type loading frame can perform a wide range of fatigue and endurance tests, from fatigue testing materials to testing small components or parts.

With Dynamic Actuator Capacities of 5 kN, 10 kN, and 20 kN, the Compact Actuators Support a Wide Range of Tests

Top-Mounted Actuator

Capable of testing low-to-medium strength materials. From plastic to aluminum, even small component parts can be evaluated by installing an optional T-slot surface plate.

±0.5 % Test Force Accuracy

Test force accuracy is guaranteed to within ±0.5 % of the indicated value.

Dual-Stage Crosshead Drive Mechanism

The hydraulic crosshead drive and hydraulic clamp can be operated intuitively using handles. This dual-stage configuration helps prevent operating errors and accidents.

High Rigidity and Large Testing Space

A T-slot surface plate makes it easy to secure components.

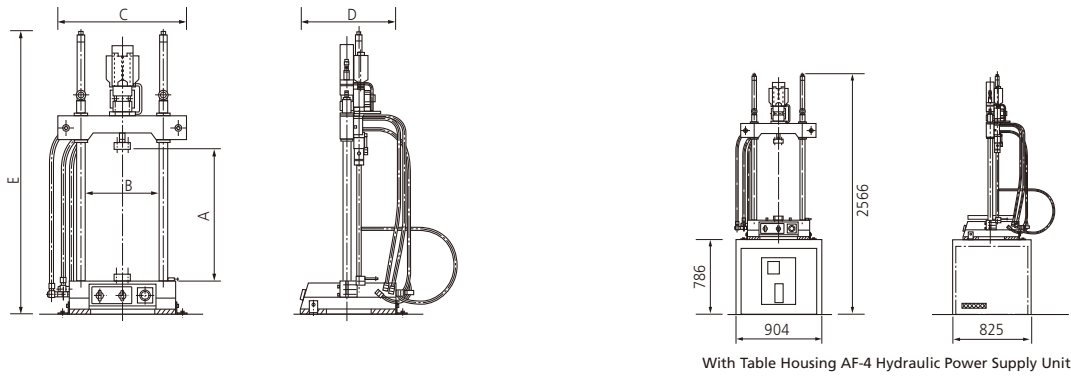
Compact Tabletop Testing Machine

A dedicated table for supporting the main testing machine (optional) and a table for enclosing the hydraulic power supply unit are available.



Optional Surface Plate Allows Full-Scale Testing

Specifications



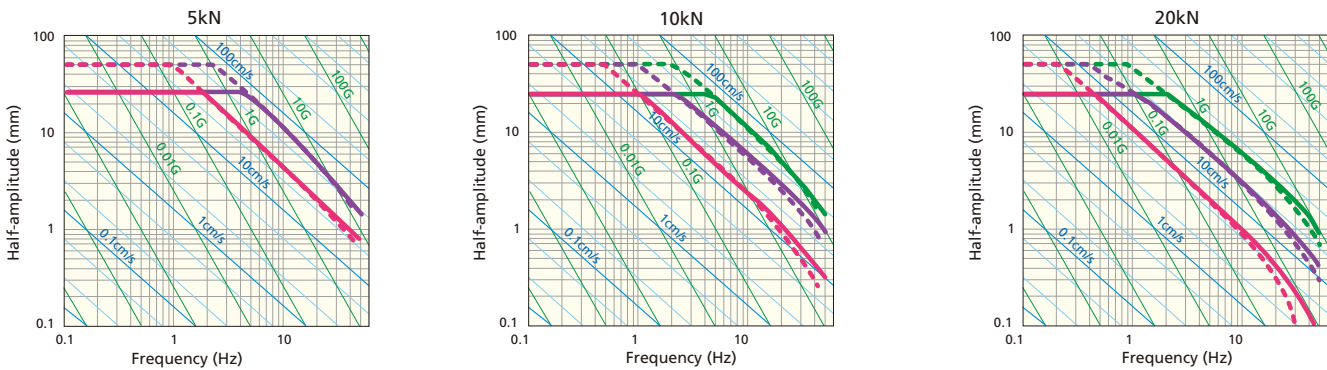
With Table Housing AF-4 Hydraulic Power Supply Unit

Model	EHF -LV005k1A	EHF -LV005k2A	EHF -LV010k1A	EHF -LV010k2A	EHF -LV020k1A	EHF -LV020k2A	
Max. dynamic test force	±5kN		±10kN		±20kN		
Max. static test force	±6kN		±12kN		±24kN		
Piston stroke	±25mm	±50mm	±25mm	±50mm	±25mm	±50mm	
Units with a maximum stroke of ±100 mm can also be made.							
Cycle speed and amplitude	See amplitude characteristics charts.						
Controlled items	Test force and stroke (two can be added as options)						
Test force	24-bit rangeless						
	Indication accuracy						
Within 0.5 % of indicated value or ±0.02 % of maximum dynamic test force, whichever is greater							
Crosshead drive mechanism	Hydraulic drive (with hydraulic clamp)						
Applicable hydraulic power supply unit	AF-4, AF-10B, AF-20B, QF-10B, QF-20B						
Power requirements							
Varies depending on the hydraulic power supply unit (see pages 34 and 35).							
Testing space (mm)	A	140 to 830	115 to 805	140 to 830	115 to 805	140 to 830	
	B						115 to 805
	C						460
Main unit dimensions (mm)	D						800
	E						600
		1760	1770	1760	1770	1760	1770
Weight (kg)	360	370	365	375	370	380	
Frame rigidity (mm/kN)	0.0033 (given a 500 mm crosshead-table clearance)						

Amplitude Characteristics (60 Hz)

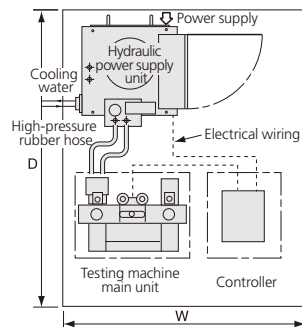


- The above characteristic curves indicate the relation between half-amplitude and cycle speed, given sine wave motion at the rated load level.
- The above indicates the amplitude characteristics given a 60 Hz power supply. Characteristics with a 50 Hz power supply will be about 5/6 of indicated values.
- The above characteristics do not include the frame or load cell characteristics. Compensate for the influence of these factors to determine actual amplitude characteristics.
- The indicated characteristics values were calculated based on typical characteristics of the servo valve being used, which may result in a difference of about 10 % on the frequency axis.
- There may be limitations on testing frequencies, depending on jig, sample, or other characteristics.



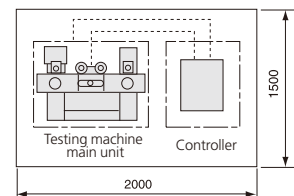
Standard Layout

- At the installation site, provide about 500 mm of space on all four sides of the system, in addition to the space requirements indicated above, to allow access for operation and maintenance.
- The drawing above indicates the dedicated space requirements. The shape and orientation of the hydraulic power supply unit may vary depending on its capacity.
- For a more detailed standard layout drawing, contact Shimadzu.
- The standard system configuration does not include the table, computer, or printer.



Main unit	Hydraulic power supply unit	Space required (W x D)
L5kN	QF-10B	2000×2200
L10kN	QF-20B	2000×2400
L20kN	AF-10B	2000×2400
	AF-20B	2000×2400

With Table Housing AF-4 Hydraulic Power Supply Unit



Optional Accessories and Systems

Servopulser series systems allow selection of the optimal combination of units based on testing objectives. In addition, an extensive selection of optional testing equipment, such as various testing jigs, detectors, and atmospheric control testing units, is available. For more details, refer to the separate optional accessories brochure.

Tensile and Compression Test Jigs

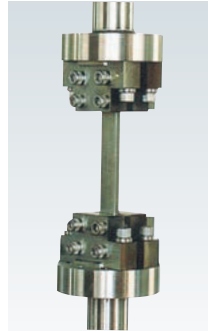


● Front-Opening Hydraulic Grip

Designed for full-amplitude tensile and compression fatigue testing, these grips offer superior ease-of-operation and ensure high-accuracy testing for a wide range of tests.

Maximum test force	±20 to 200 kN (multiple capacities available)
Operating temperature range	RT to +50 °C
Applicable sample	Rod / flat plate

Metals Plastics Composite materials

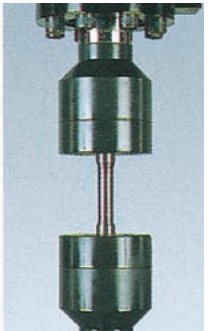


● Manual Non-Shift Plate Grip

These grips are designed for full-amplitude tensile and compression fatigue testing of flat plate materials and feature a simple and efficient construction.

Maximum test force	±5 to 100 kN (multiple capacities available)
Operating temperature range	RT to +50 °C -196 to +300 °C
Applicable sample	Flat plate

Metals Plastics Composite materials



● Split Flange Rod Grip

These grips allow samples to be secured easily and firmly. They are ideal for full-amplitude tensile and compression fatigue testing of round rod samples.

Maximum test force	±10 to 200 kN (multiple capacities available)
Operating temperature range	RT to +100 °C -196 to 300 °C
Applicable sample	Rod

Metals Plastics Composite materials



● Pin-Type Grip for Flat Samples + Dynamic Strain Gauge (for gauge length displacement)

These grips are designed for half-amplitude tensile fatigue testing.

Note: Supports only tensile testing.

Maximum test force	+6 kN/10 kN
Operating temperature range	-196 to +300 °C (±6 kN) -20 to +300 °C (±10 kN)
Applicable sample	Flat plate (max. 30 mm wide and 5 mm thick)

Metals Composite materials Lumber Plastics



● Non-Shift Wedge Grip for Static Testing

These grips can only be used for static testing. These high-capacity grips apply the self-tightening action of a wedge.

Note: Supports only tensile testing.

Maximum test force	±20 to 250 kN (multiple capacities available)
Operating temperature range	0 to +120 °C
Applicable sample	Rod / flat plate

Metals Composite materials Lumber Plastics



● Grips for CT Test Samples + Clip Gauge

These compact grips are designed specifically for tensile test samples and are compliant with ASTM E399 and E1820 standards. They can be used for tests performed to determine fracture toughness or crack propagation.

Note: Supports only tensile testing.

Maximum test force	±6 to 80 kN
Operating temperature range	RT to +100 °C -20 to 300 °C
Applicable sample	CT test sample

Metals Plastics Composite materials

Bolt Testing Jigs

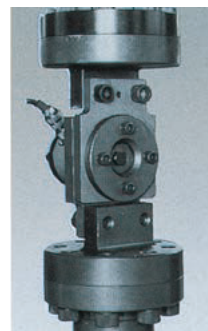


● Screw Tensile Test Jig

This jig is for tensile fatigue testing of various nuts and bolts. Various grips sizes are available depending on the bolt size.

Maximum test force	±100/250 kN
Operating temperature range	RT to +50 °C
Applicable sample	Nuts/bolts

Metals Plastics Composite materials



● Screw Looseness Test Device

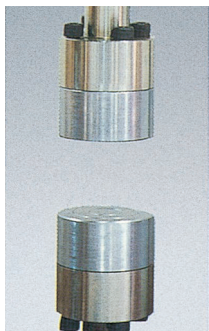
This device allows testing various parameters to determine the loosening process of bolts. It applies a vibrational displacement in the thread tightening direction and in the perpendicular direction and then measures the change in tightening force in relation to the number of vibrations.

Maximum test force	±20 kN
Operating temperature range	RT to +100 °C -20 to +300 °C
Applicable sample	CT test sample

Metals Plastics Composite materials

Compression and Bending Test Jigs

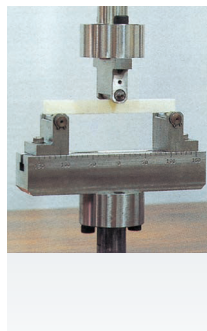
● Compression Plate



Compression plates are available with both the top and bottom fixed or with the top compression plate mounted on a spherical seat.

Maximum test force	20 to 500 kN (multiple capacities available)
Operating temperature range	RT to +250 °C
Applicable sample	60 to 220 mm dia.

- Metals
- Plastics
- Composite materials
- Rubber
- Rock
- Component

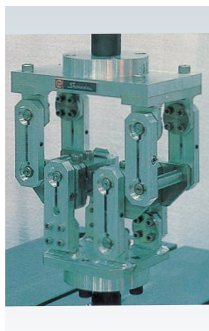


● 3-Point/4-Point Bending Test Jig (for partial half-amplitude fatigue testing)

Maximum test force	2kN
Max. dynamic bending moment	50 N/m
Operating temperature range	RT to +100 °C -196 to +300 °C
Jig dimensions	Lower span: 30 to 100 mm Upper span: 15 to 50 mm

- Metals
- Plastics
- Composite materials

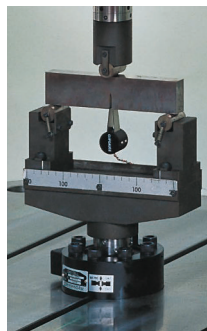
● Uniform Bending Test Jig (for full-amplitude fatigue testing)



This jig uses ball bearings at each support point to apply uniform bending loads.

Maximum test force	±2 to 10 kN
Max. dynamic bending moment	±20 to 250 N/m
Operating temperature range	RT to +50 °C -196 to +200 °C

- Metals
- Plastics
- Composite materials



● CTOD Bending Test Jig + Clip Gauge

This jig is for CTOD bending tests compliant with ASTM E339. It is used for fracture toughness testing.

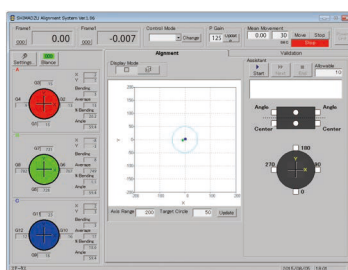
Maximum test force	50/100 kN
Max. dynamic bending moment	2/6 k N/m
Operating temperature range	RT to +100 °C -196 to +300 °C

- Metals
- Plastics
- Composite materials

Axis Adjustment System

Consisting of an axis adjustment unit, axis center sensor testing sample, strain amplifier unit, and dedicated axis adjustment software, this system allows adjusting the tilt between grips and adjusting the axis centers in the horizontal direction. It allows users to obtain highly reliable data by eliminating any bending stresses on samples.

- Metals
- Plastics
- Composite materials



Various Environmental Control Testing Systems

Various environmental control testing systems are required to simulate harsh environments or environments where materials are actually used, such as thermostatic, high-temperature, or extremely low-temperature environments. Therefore, an environmental control system can be added in the large testing space provided by the Servopulser series system.

See page 58.

- Metals



Compact Hydraulic Actuator

Force Simulator EHF-JF Series



For Testing the Endurance of Various Parts and Components



Lightweight and Easy to Install

The 20 kN \pm 100 mm model weighs only 25 kg. The aluminum body (20 kN model) makes it easy to transport or reinstall on a different testing system. This gives it the flexibility to be used for evaluating a variety of components, large structural members, or parts.



Compact

The small size of the actuator requires less space for attaching it to samples. Hydraulic lines are connected using quick couplers. This makes it easy to configure testing systems.

With Dynamic Actuator Capacities of 5 kN, 10 kN, 20 kN, 30 kN, and 50 kN, the Compact Actuators Support a Wide Range of Tests

Uses Low-Friction Dust Seals

Specialized seals are used to achieve high accuracy for small forces and minimize oil leakage.

Accommodates Various Types of Testing

Brackets for attaching various optional equipment can be mounted at the front, center, or tail. Load can be applied to samples from a variety of angles.



Long-Stroke Actuator

\pm 50 mm, \pm 100 mm, or \pm 150 mm. Long-stroke actuators can even simulate forces over long stroke distances.

\pm 0.5 % Test Force Accuracy

Test force accuracy is guaranteed to within \pm 0.5 % of the indicated value

Satisfies Requirements for a Diverse Range of Fields

It can be used to evaluate strength, verify or rationalize designs, or evaluate the safety and reliability of a variety of items via dynamic and fatigue testing, simulation testing, or actual dynamic waveform input testing.

- Automobiles
- Motorcycles
- Construction equipment



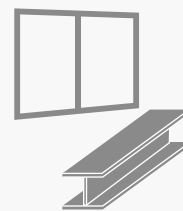
- Aircraft
- Ships
- Trains



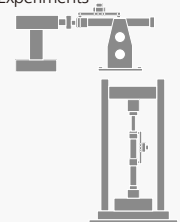
- Drinking water
- Light-gauge steel structures
- Prefabricated buildings
- Two-by-four method buildings



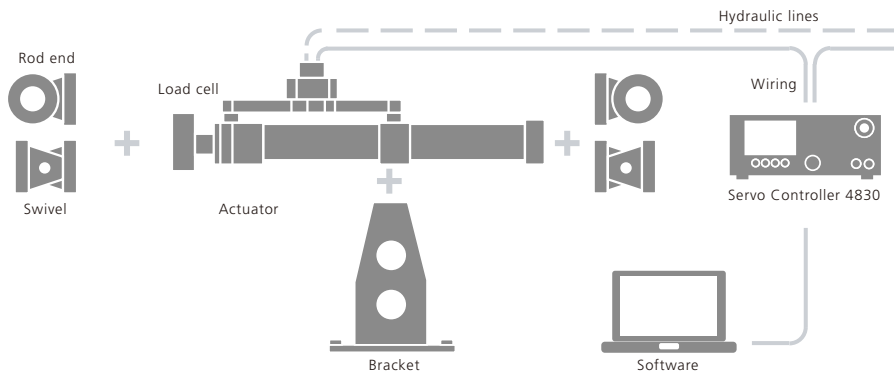
- Parts materials
- Pipes
- Shape steel
- New materials
- Chassis
- Aluminum materials



- Schools
- Research laboratories
- Industrial testing laboratories
- Training
- Experiments

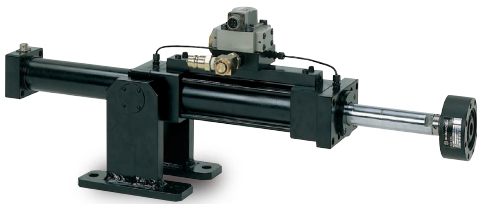


System Example



AF Series Portable Air-Cooled Hydraulic Power Supply Unit

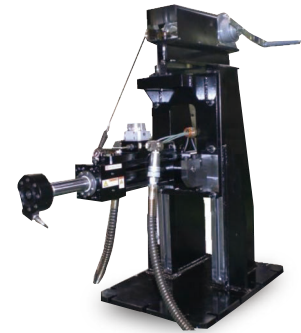
This air-cooled hydraulic power supply unit requires no cooling water. Also, all of the required hydraulic equipment is installed in a case mounted on caster wheels so that it can be relocated easily.



- With a trunnion bracket



- With vertical and left/right rotation mechanisms



- With vertical movement and vertical rotation mechanisms



● Bed Endurance Evaluation System

This system allows testing of bed mattresses or other large samples. By installing an EHF-J system on a reaction frame, loads can be repeatedly applied from perpendicular directions.

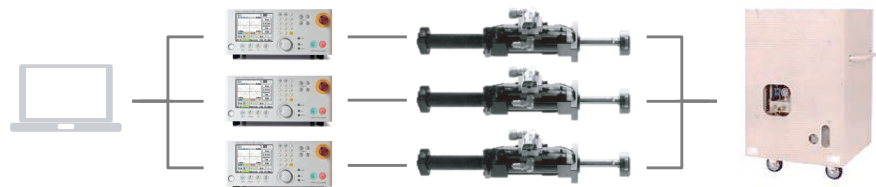
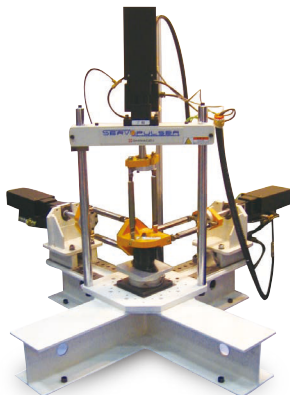
● Part Endurance Evaluation System

This system features a reaction frame with a hydraulically actuated crosshead installed on a large surface plate. The actuator can be adjusted to any angle or left/right position. Therefore, it can be used as a general-purpose system for testing the endurance of various parts and components.



● XYZ 3-Axis Engine Mount Testing System

This system is capable of applying synchronized loads in three directions, X, Y, and Z. It can also be used to accurately reproduce actual load profiles experienced by vehicles during travel.

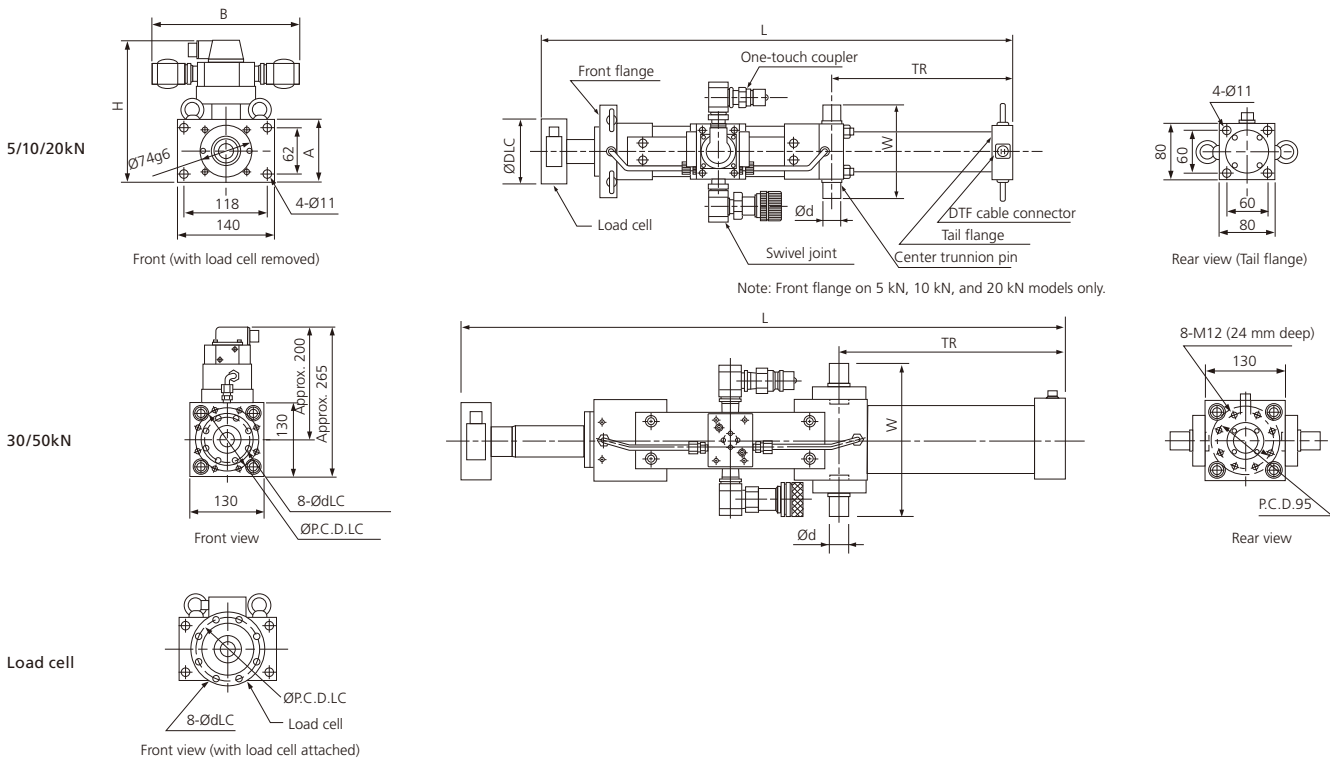


Specifications

Model	EHF -JF5kNV-XX-A10	EHF -JF10kNV-XX-A10	EHF -JF20kNV-XX-A10	EHF -JF30kNV-XX-A10	EHF -JF50kNV-XX-A10
Max. dynamic test force	±5kN	±10kN	±20kN	±30kN	±50kN
Max. static test force	Approx. ±7 kN	Approx. ±13 kN	Approx. ±27 kN	Approx. ±39 kN	Approx. ±63 kN
Load cell	SCL-5kN	SCL-10kN	SCL-20kN	SFL-30kN	SFL-50kN
Piston stroke	Select from ±50 mm, ±100 mm, or ±150 mm				
Cycle speed and amplitude	See amplitude characteristics charts.				
Controlled items	Test force and stroke (two can be added as options)				
Test force	Range	24-bit rangeless			
	Indication accuracy	Within ±0.5 % of indicated value or ±0.02 % of maximum dynamic test force, whichever is greater			
Applicable hydraulic power supply unit	AF-10B, AF-20B				
Hydraulic lines	1/2" hoses with couplers on both ends and protected with spiral wire guards				
Power requirements	Varies depending on the hydraulic power supply unit (see pages 34 and 35).				

Note: In actual model names, the "XX" is substituted with the actuator stroke value. Select from the table below.

Testing Machine Main Unit Dimensions

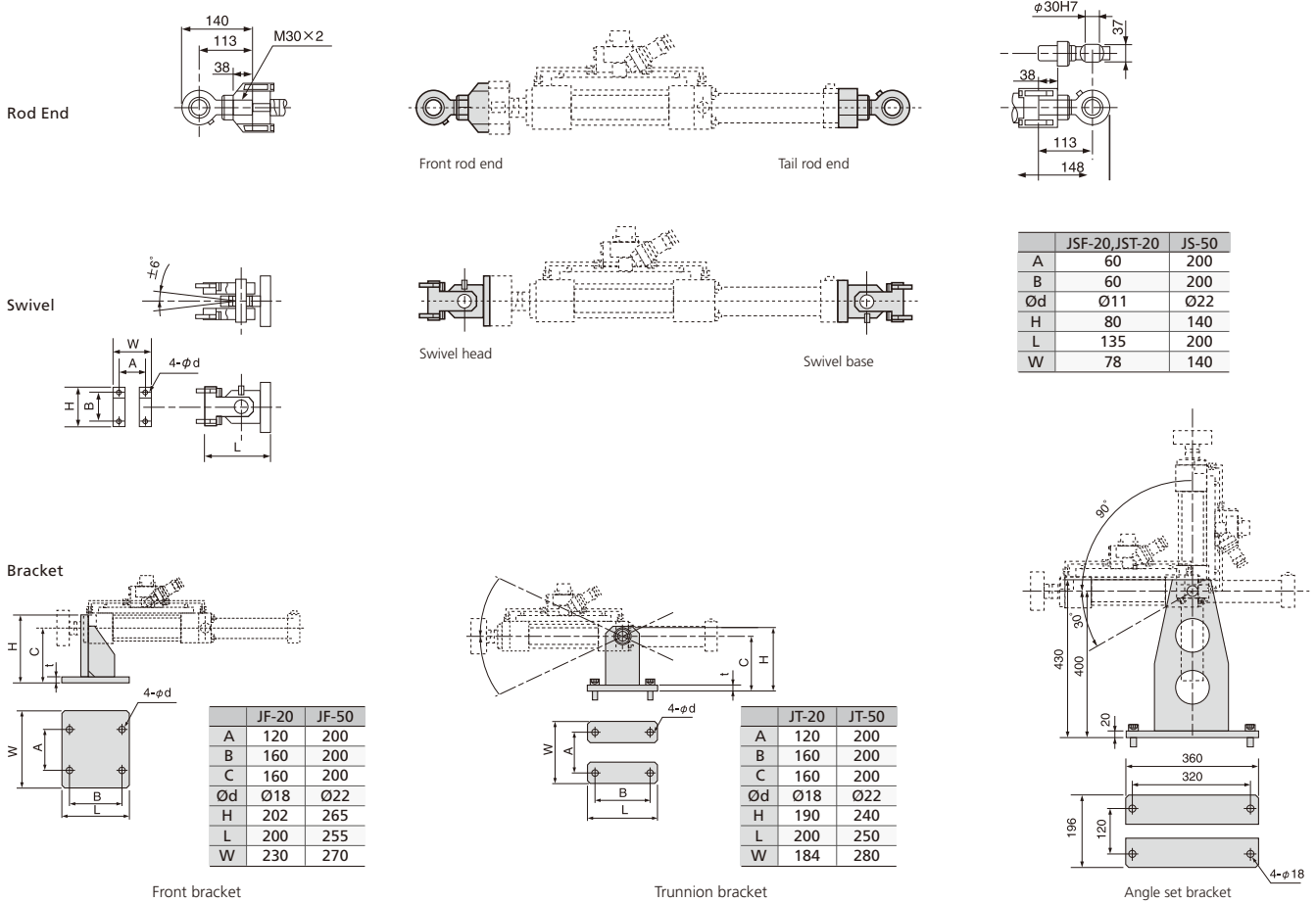


Capacity		5kN			10/20kN			30/50kN		
Actuator stroke		±50mm	±100mm	±150mm	±50mm	±100mm	±150mm	±50mm	±100mm	±150mm
Weight (kg)		17	20	26	21	25	28	74	84	94
Dimensions (mm)	L	565	815	1065	570	820	1070	715	965	1215
	W	140			140			245		
	Ød	25			25			30		
	TR	169	269	369	176	276	376	278	378	478
	ØDLC	100			100			125		
	ØP.C.D.L.C	85			85			110		
	ØdLC	9			9			13		
	B	210			210			—		
H	196			200			—			
A	80			84			—			

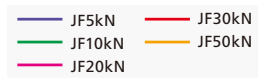
Optional Bracket

The optional brackets indicated below can be installed on the front flange, center trunnion, or tail flange. For details on where to install and dimensions, see the figure below.

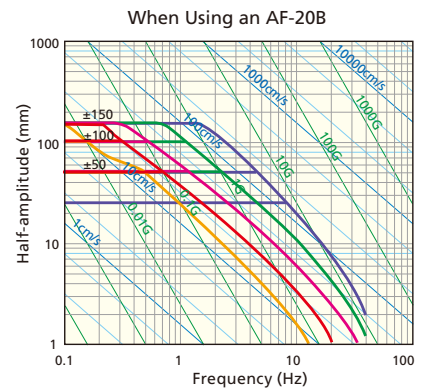
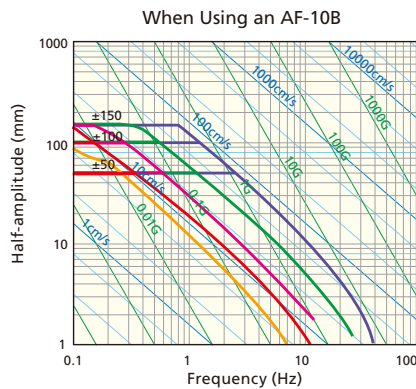
Optional bracket		Rod end			Swivel			Bracket		
		Set	Front	Tail	Set	Front	Tail	Front	Trunnion	Angle set
Model name	±5 to 20 kN	JRS-20	JRF-20	JRT-20	JSS-20	JSF-20	JST-20	JF-20	JT-20	JA-20
	30/50kN	-	-	-	If the base and head are used in combination, purchase two sets.	JS-50		JF-50	JT-50	-



Amplitude Characteristics (60 Hz)



- The above characteristic curves indicate the relation between half-amplitude and cycle speed, given sine wave motion at the rated load level.
- The above indicates the amplitude characteristics given a 60 Hz power supply. Characteristics with a 50 Hz power supply will be about 5/6 of indicated values.
- The above characteristics do not include the frame or load cell characteristics. Compensate for the influence of these factors to determine actual amplitude characteristics.
- The indicated characteristics values were calculated based on typical characteristics of the servo valve being used, which may result in a difference of about 10% on the frequency axis.
- There may be limitations on testing frequencies, depending on jig, sample, or other characteristics.



High-Capacity Hydraulic Actuator

EHF-J Series



For Full-Scale Testing and Evaluating Large Samples

Jack systems are used to test strength characteristics by attaching a jack to a test floor in a strong room, to a reaction wall, to a base plate (made of steel) or a testing frame, and then applying loads to samples in a specified mode. Two types of jack systems are available, either dynamic or static, based on the test objectives.

Low-Friction Actuator

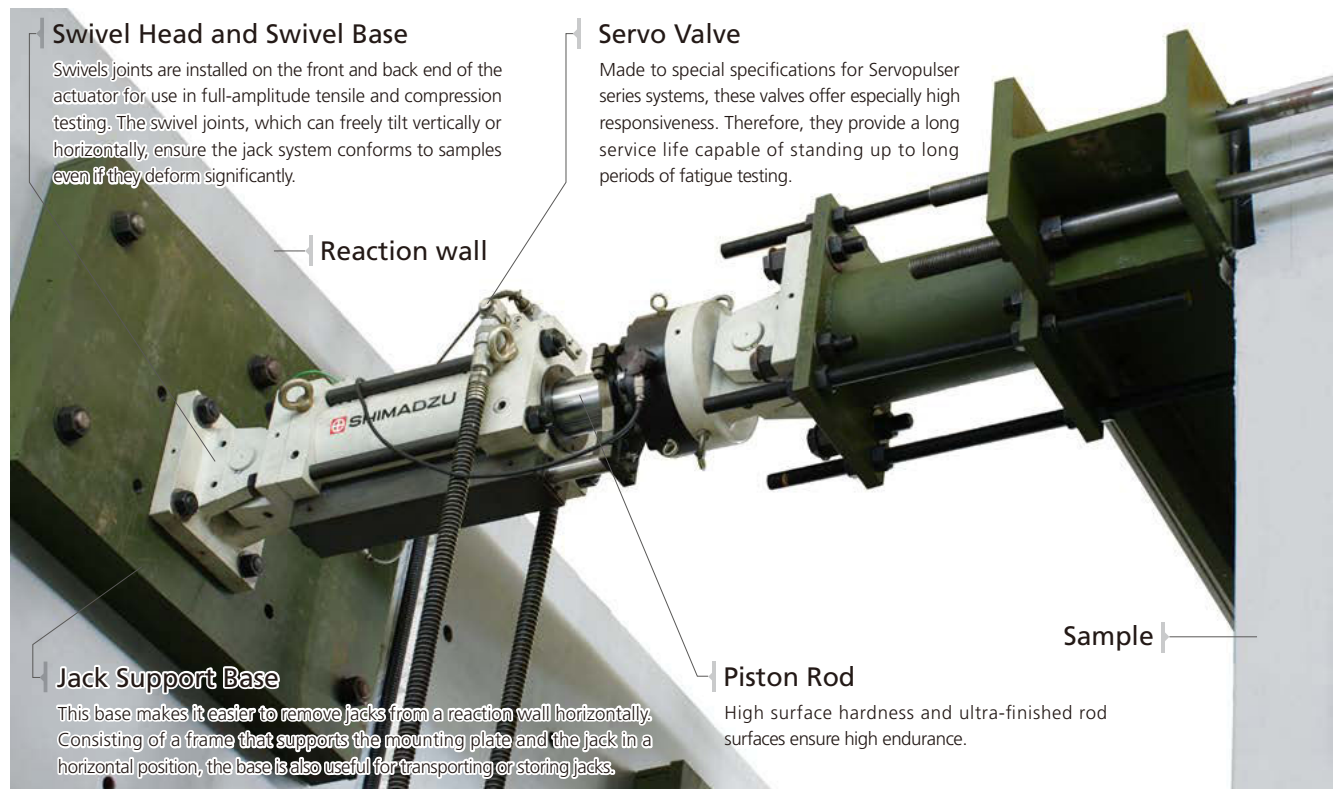
Dynamic testing jacks are designed with low friction to maximize endurance.

Supports Multi-Jack Systems

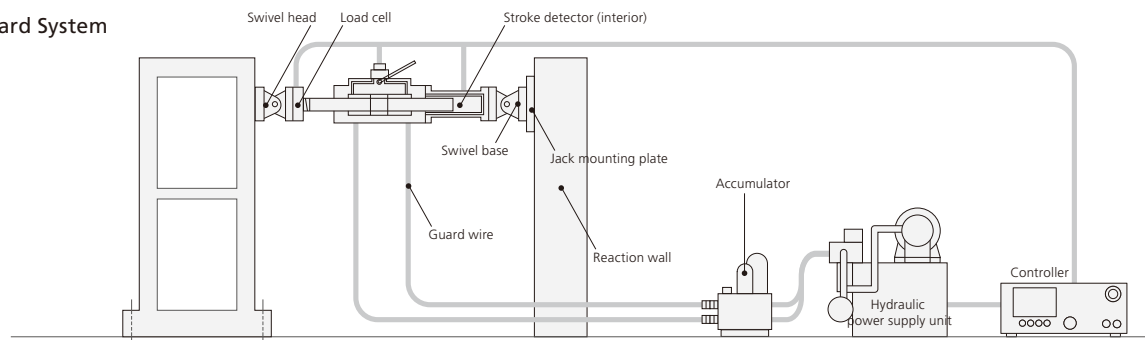
Customized multiple jack systems, to multiple jacks are linked and controlled to apply loads in any XYZ direction, are also available.

Jacks Can Also Be Installed on Cross Beam Type Testing Frames

By installing a cross beam type testing frame on a testing floor, jacks can be mounted and used as a testing machine for structural members.

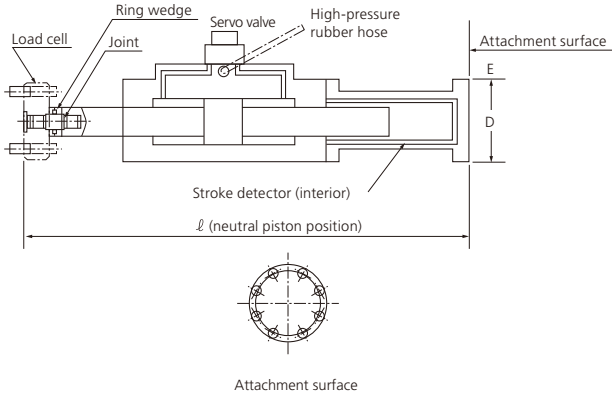


Example of Standard System

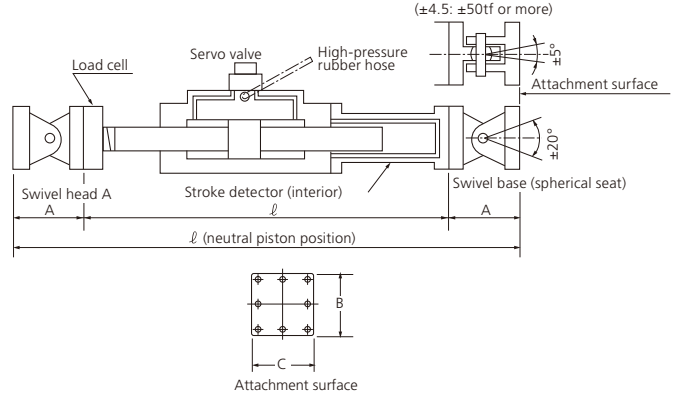


Dynamic Jack Specifications

Basic Dynamic Jack Model



Dynamic Jack with Swivel Head and Swivel Base



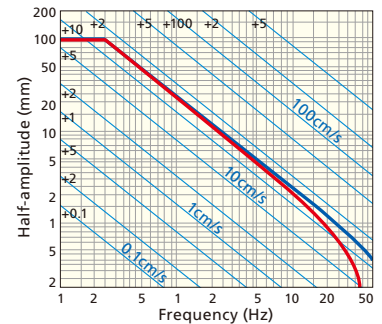
Capacity (kN)		Dynamic	±100	±200	±300	±500	±750	±1000
		Static	±150	±300	±450	±750	±1100	±1500
Actuator Stroke (mm)			±50/±100	±50/±100/±150	±50/±100	±50/±100	±50/±100	±100/±150/±200
Dimensions (mm)	Actuator	l	770/1020	935/1170/1400	1165/1395	1330/1580	1540/1790	1860/2110/2360
		L	1240/1490	1495/1730/1960	1885/2085	2230/2480	2540/2790	3040/3290/3540
	Swivel head and swivel base	A	235	280	345	450	500	590
		B	200	240	300	460	530	600
		C				320	440	450
	D	Ø 180	Ø 240	Ø 300	Ø 380	Ø 430	Ø 560	
Load cell			SFL-100kN	SFL-200kN	SFL-300kN	SFL-500kN	SFL-750kN	SFL-1000kN
Hydraulic power supply unit			QF-10B QF-20B QF-40B	QF-20B QF-40B QF-70B	QF-20B QF-40B QF-70B	QF-40B QF-70B QF-140B	QF-40B QF-70B QF-140B	QF-40B QF-70B QF-140B

- Notes:
- Lengths l and L are the distances to the neutral positions of the pistons.
 - The full stroke is 200 mm for a ±100 mm model.
 - Models with specifications other than indicated in this table can also be made.

Amplitude Characteristics (60 Hz)

Characteristic amplitude curves are determined by the hydraulic power supply unit capacity and servo valve properties. The chart on the right is only one example. The loading speed is expressed as the maximum value from one sine wave cycle ($\pi/2$ of the average value). The loading rate values are read on the diagonal axis.

— No load
— Rated load



Amplitude Curves for EHF-J, 200 kN, ±100 mm, and QF-70B Hydraulic Power Supply Unit

Max. Loading Speed Table

Maximum Loading Speed of Dynamic Jack System

The table on the right indicates the maximum loading speeds determined by the combination of the dynamic jack, hydraulic power supply unit, and servo valve used. It assumes that the system is equipped with an adequately large accumulator.

- For ramp wave or triangular wave loading waveforms or if the accumulator is ineffective, values are $2/\pi$ of the values indicated in the table.

Note: An accumulator sized proportional to the jack capacity and stroke is required.

Max. Loading Speed (cm/s)

Dynamic jack capacity (kN)	±100	±200	±300	±500	±750	±1000	
Hydraulic power supply	QF-10B	3.8	2.0	1.3	0.7	0.5	0.4
	QF-20B	8.0	4.1	2.7	1.6	1.1	0.8
	QF-40B	12.7	6.5	4.3	2.5	1.7	1.3
	QF-70B	28.4	14.6	9.7	5.6	3.8	3.0
	QF-140B	50	26	17.3	10.0	6.9	5.3
	QF-210B	85	43	29.0	16.9	11.6	9.0
	QF-330		73	48	28.1	19.3	15.0

Note: Indicated values are for regions with a 60 Hz power supply. For regions with 50 Hz power, values are 5/6 of the indicated values.

Various Test Jigs

For testing structural members, a test jig of appropriate size for the given samples is required. Shimadzu can fabricate various types of jigs based on customer requirements.

- Perpendicular loading unit
(jig applying pressures equivalent to its own weight)
- Horizontal loading frame
(supplemental reaction wall)
- Tensile test jig and hydraulic non-shift wedge grips
- Compression test jig
- Bending test jig
- Swivel Head and Swivel Base
- Jack Support Base

This base makes it easier to remove jacks from a reaction wall horizontally. Consisting of a frame that supports the mounting plate and the jack in a horizontal position, the base is also useful for transporting or storing jacks.



Jack Support Base



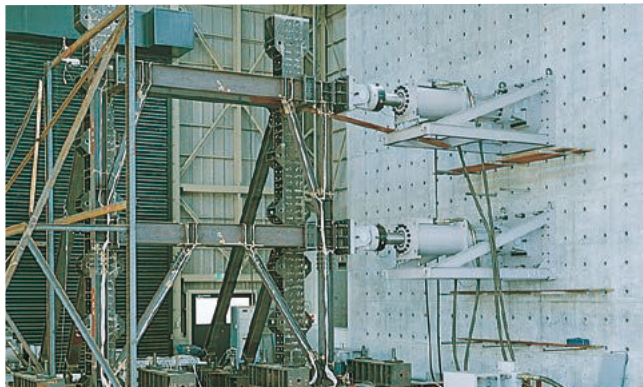
Tensile Test Jig



Bending Test Jig

Example of Large Jack Testing System

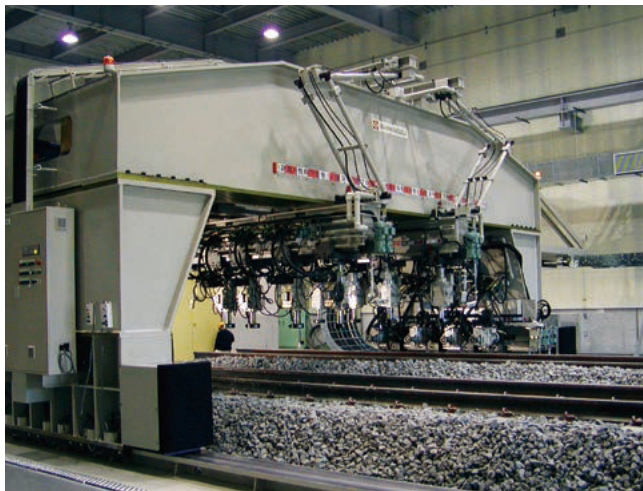
Loading Test for Steel Structural Members ±1000 kN



Loading Test for Wooden Structural Members Panel Shear Testing System



Multiple Jack System on a Railway Rail



System Installed for East Japan Railway Company

Compressive Fatigue Test of Steel Reinforced Concrete Manhole Covers ±1000 kN





±1000 kN Structural Member Testing Machine

The loading unit consists of a cross beam type frame (with friction clamps) built on a test floor in combination with dynamic jacks. The frame was constructed with friction clamps clamped to four columns.

Specifications	Model name
Capacity	Dynamic: ±1000 kN
	Static: ±1500 kN
Stroke	±100mm
Jig attachment spacing	Max. 5 m
Distance between columns	3.7m
Grips	Hydraulic



±10 MN Structural Member Testing Machine

This large structural member testing machine is capable of dynamic loads up to 8 MN (static loads up to 10 MN). The system is used to evaluate large full-scale CFRP aircraft materials and components by applying estimated loads experienced during takeoff and landing or during rocket launches.

Specifications	Model name
Capacity	Dynamic: ±8 MN
	Static: ±10 MN
Stroke	±150mm
Jig attachment spacing	1000 to 4000 mm
Distance between columns	3000mm×3000mm

Grips for Tensile Test



EHF-T Series



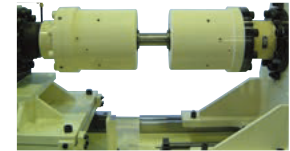
Stationary Torsional Dynamic and Fatigue Testing System with High Rigidity Frame and Large Testing Space

Large Testing Space

With a 1000 mm wide testing space, this system is perfect for evaluating the reliability and endurance of long parts, such as composite parts that combine multiple materials or structural materials. The testing space can be adjusted using a handle.

Supports a Wide Variety of Tests

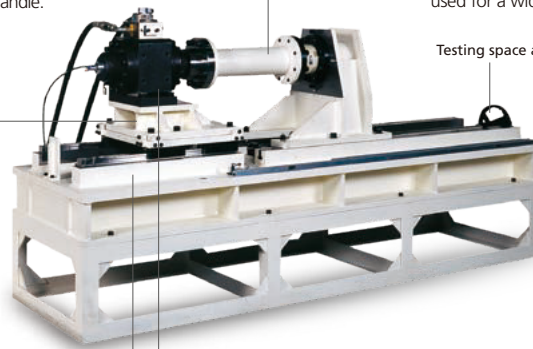
By using an extensive selection of optional products, such as grips and atmospheric control testing units, these systems can be used for a wide variety of applications.



Hydraulic collet-type rod grip



Testing space adjustment handle



Testing space adjustment handle

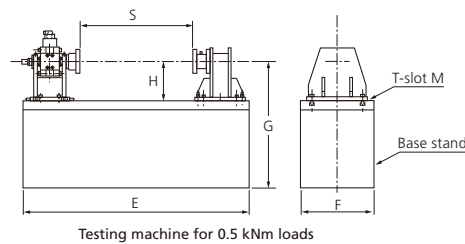
High-Rigidity Frame

A frame with high torsional rigidity allows the system to accurately control torque and rotation angle during measurements.

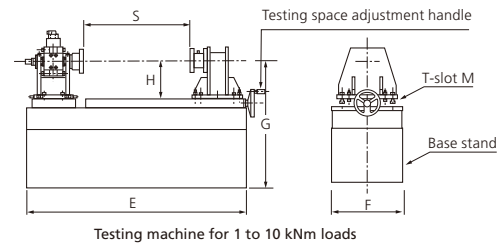
High-Performance Torque Actuator

Loads up to the actuator capacity of ± 0.5 to 10 kN can be applied. It can be used in combination with various other testing systems as well.

Specifications



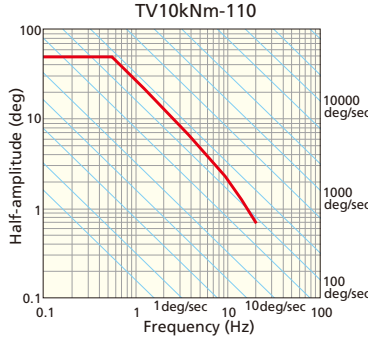
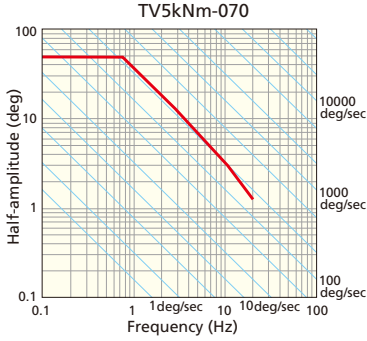
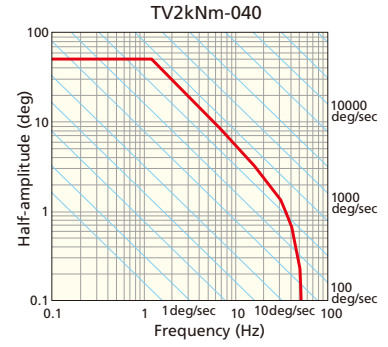
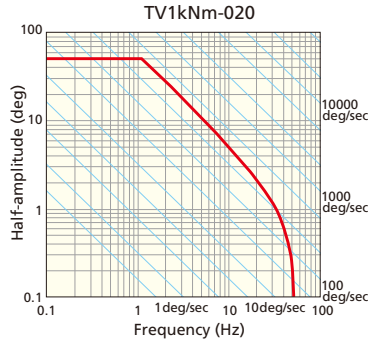
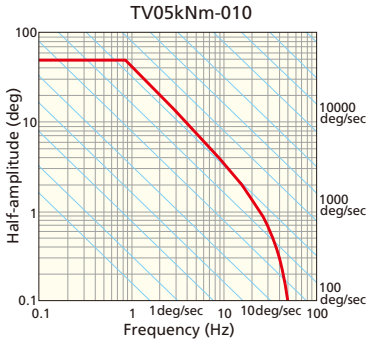
Testing machine for 0.5 kNm loads



Testing machine for 1 to 10 kNm loads

Model		EHF-TV05kNm-010	EHF-TV1kNm-020	EHF-TV2kNm-040	EHF-TV5kNm-070	EHF-TV10kNm-110
Maximum capacity	Dynamic / static	$\pm 0.5/\pm 0.75$ kN/m	$\pm 1/\pm 1.5$ kN/m	$\pm 2/\pm 3$ kN/m	$\pm 5/\pm 7.5$ kN/m	$\pm 10/\pm 15$ kN/m
Loading method		Electric-hydraulic servo (cross-looped system)				
Max. torsion angle		± 50 deg				
Cycle speed and amplitude (sine wave)		See amplitude characteristics charts.				
Control mode		Torque control and torsion angle control				
Static accuracy	Torque	Within ± 1 % of indicated value or within ± 0.05 % of dynamic rating, whichever is greater				
	Torsion angle	Within ± 1.5 % of indicated value or within ± 0.15 % of dynamic rating, whichever is greater				
Loading frame (testing space)	S: Flange spacing	0 to 1000 mm				0 to 1200 mm
	H: Height at center of torque	300 mm	300 mm	350 mm	400 mm	400 mm
	F×E: Table area (width × length)	600×1600 mm	760×1900 mm	650×2000 mm	800×2100 mm	1000×2500 mm
	G: Torque shaft height	900 mm	1100 mm	1150 mm	850 mm	850 mm
	M: T-slot size (nominal)	14 mm	22 mm	22 mm	22 mm	22 mm
Weight (including actuator)		About 830 kg	Approx. 950 kg	Approx. 1700 kg	Approx. 2600 kg	Approx. 3200 kg (excluding base stand)
Hydraulic power supply unit used	Model	QF-10B	QF-20B	QF-40B	QF-70B	QF-110B

Characteristic Amplitude Curves (60 Hz)



- The above characteristic curves indicate the relation between half-amplitude and cycle speed, given sine wave motion at the rated load level.
- The above characteristics do not include the frame or torque cell characteristics. Compensate for the influence of these factors to determine actual amplitude characteristics.
- The indicated characteristic values were calculated based on typical characteristics of the servo valve being used, which may result in a frequency band difference of about 10 %.
- The indicated characteristic values were calculated assuming a moment of inertia of zero for the jig and sample.
- The indicated characteristics are for regions with a 60 Hz power supply. Characteristics in regions with 50 Hz power will be about 5/6 of indicated values.

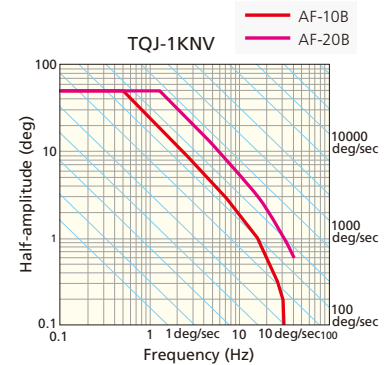
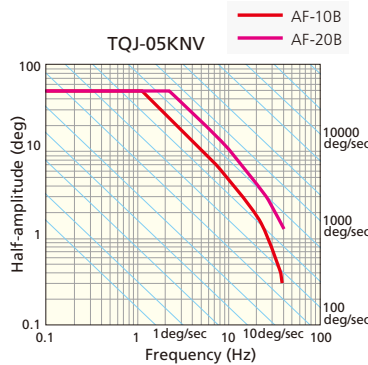
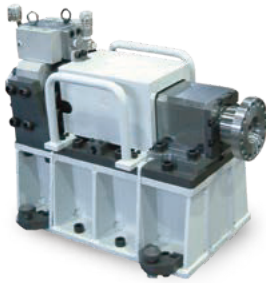
Portable Torsional Actuator

EHF-TQJ Series

For Testing the Torsional Endurance of Various Parts and Components

Freely Movable Testing Machine Based on Sample

In addition to a movable air-cooled hydraulic power supply unit, the torsional actuator can also be freely moved. Therefore, it offers broad applicability for evaluating the torsional endurance of products, components, and other full-size samples.



Note: Indicated values are for regions with a 60 Hz power supply. Characteristics in regions with 50 Hz power will be about 5/6 of indicated values.

Specifications

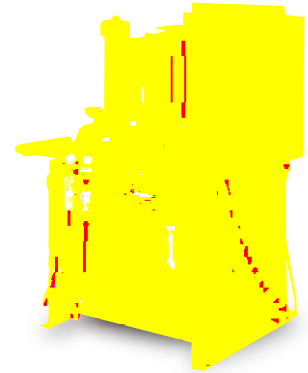
Model	TQJ-05kNV-A10	TQJ-05kNV-A20	TQJ-1kNV-A10	TQJ-1kNV-A20
Maximum capacity	Dynamic: 500 Nm Static: 750 Nm		Dynamic: 1 kNm Static: 1.5 kNm	
Product composition	Main movable testing machine unit (excluding torque actuator, torque cell, and servo valve), Servo Controller 4830*, air-cooled hydraulic power supply unit (with casters), hydraulic lines (5 m high-pressure rubber hose, routed above floor), wiring (routed above floor), and standard accessories			
Max. torsion angle	±50 deg			
Cycle speed and amplitude (sine wave)	See the amplitude characteristics curves.			
Control mode	Torque control and torsion angle control			
Static accuracy	Torque			
	Torsion angle			
Hydraulic power supply unit used	AF-10B	AF-20B	AF-10B	AF-20B
Weight	Approx. 140 kg	Approx. 160 kg	Approx. 140 kg	Approx. 160 kg

* A separate table is required for installation of the controller.

Water-Cooled Hydraulic Power Supply Unit

QF Series

These hydraulic power supply units are designed specifically for electric-hydraulic dynamic and fatigue testing systems. The system includes an oil pump, oil tank, filter, cooler, pressure regulator, and other equipment.

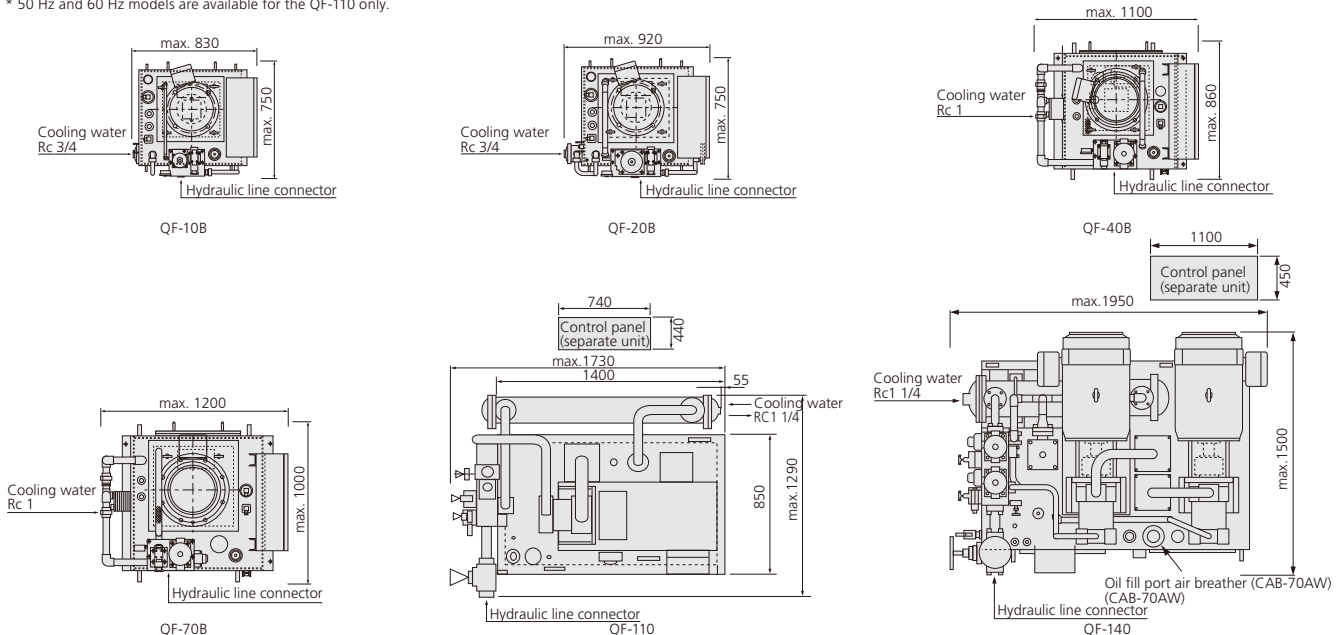


- The oil pump is a gear pump with minimal pulsing and low noise.
- The filter includes a 3-micron element that helps prevent wear in the servo valve and other equipment.
- Space savings have been achieved by orienting the pump and motor vertically (QF-10B to 70B, AF-4, and AF-10B to 20B).

Model		QF-10B	QF-20B	QF-40B	QF-70B	QF-110*	QF-140
Applicable testing system	E-type	○	○	○	○	○	○
	U-type	○	○	○	○	○	○
	L-type	○	○	○	○	○	○
	JF-type	○	○	○	○	○	○
	J-type	○	○	○	○	○	○
	T-type	○	○	○	○	○	○
Output (approx.)	50Hz	9L/min	19L/min	42L/min	68L/min	108L/min	138L/min
	60Hz	11L/min	24L/min	51L/min	81L/min	104L/min	162L/min
Oil pressure	Normal	21MPa					
Hydraulic oil		Mobil DTE 25					
Pump	Type	Fixed output gear pump					
	Number of units	1			2		
Motor	Capacity	5.5kw	11kw	22kw	37kw	45kw	37kwx2
Oil filter		3µm					
Tank capacity		90L	90L	190L	300L	500L	590L
Operating noise (at 21 MPa)		74dBA	76dBA	78dBA	80dBA	83dBA	85dBA
Power requirements	Single-phase 100 V	1.5kVA					
	Three-phase 200 V	8kVA	16kVA	32kVA	47kVA	57kVA	93kVA
Cooling water volume required		20L/min	20L/min	65L/min	80L/min	110L/min	150/180L/min(050Hz/60Hz)
Compatible cooling tower (tons of cooling)		2	3	5	10	20	20
Main unit dimensions (approx.)	Width (mm)	830mm	920mm	1100mm	1200mm	1730mm	1950mm
	Depth	750mm	750mm	860mm	1000mm	1290mm	1500mm
	Height	1235mm	1235mm	1400mm	1600mm	1370mm	1550mm
Weight	Including oil	Approx. 530 kg	Approx. 530 kg	Approx. 720 kg	Approx. 1040 kg	Approx. 1500 kg	Approx. 2200 kg
Recommended circuit breaker capacity (3-phase 200 V / 1-phase 100 V)		50A/15A	100A/15A	150A/15A	225A/15A	300A/15A	400A/15A

Notes

- The indicated operating noise values are provided for reference and are not guaranteed.
- The operating noise level may vary depending on the installation site conditions.
- * 50 Hz and 60 Hz models are available for the QF-110 only.



Air-Cooled Hydraulic Power Supply Unit

AF Series

These hydraulic power supply units are designed specifically for electric-hydraulic dynamic and fatigue testing systems. The system includes an oil pump, oil tank, filter, cooler, pressure regulator, and other equipment.

- The oil pump is a gear pump with minimal pulsing and low noise.
- Does not need any cooling water.



AF-4-type

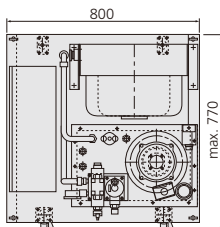
Model		AF-4	AF-10B	AF-20B
Applicable testing system	E-type		○	○
	U-type		○	○
	L-type	○	○	○
	JF-type		○	○
	J-type		○	○
	T-type		○	○
	TQJ-type		○	○
Output (approx.)	50Hz	3.7L/min	9L/min	19L/min
	60Hz	4.5L/min	11L/min	24L/min
Oil Pressure	Normal	21MPa		
Hydraulic oil		Mobil DTE 25		
Pump	Type	Fixed output gear pump		
	Number of units	1		
Motor	Capacity	2.2kw	5.5kw	11kw
Cooling fan		0.1kw	0.1kw	0.2kw
Oil filter		3μm		
Tank capacity		24L	90L	90L
Operating noise*		56dBA	71dBA	76dBA
Power Supply	Single-phase 100 V		1.5kVA	
	Three-phase 200 V	3.5kVA	8kVA	17kVA
Dimensions	Width (mm)	800mm	870mm	870mm
	Depth	770mm	900mm	900mm
	Height	700mm	1700mm	1700mm
	Weight	Including oil	Approx. 235 kg	Approx. 630 kg
Recommended circuit breaker capacity (3-phase 200 V / 1-phase 100 V)		20A/15A	50A/15A	100A/15A

* The AF-4 operating noise value indicates the level in front of the unit when it is installed in the dedicated base stand.

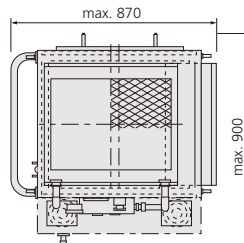
Note: The AF series is air-cooled. Keep the ambient temperature at the hydraulic power supply unit installation site at 25 °C or less.

* The indicated operating noise values are provided for reference and are not guaranteed.

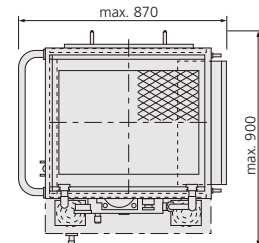
* The operating noise level may vary depending on the installation site conditions.



AF-4



AF-10B



AF-20B

Energy-Conservation Unit for
Servopulser Series Hydraulic Power Supply Units

ECU Series

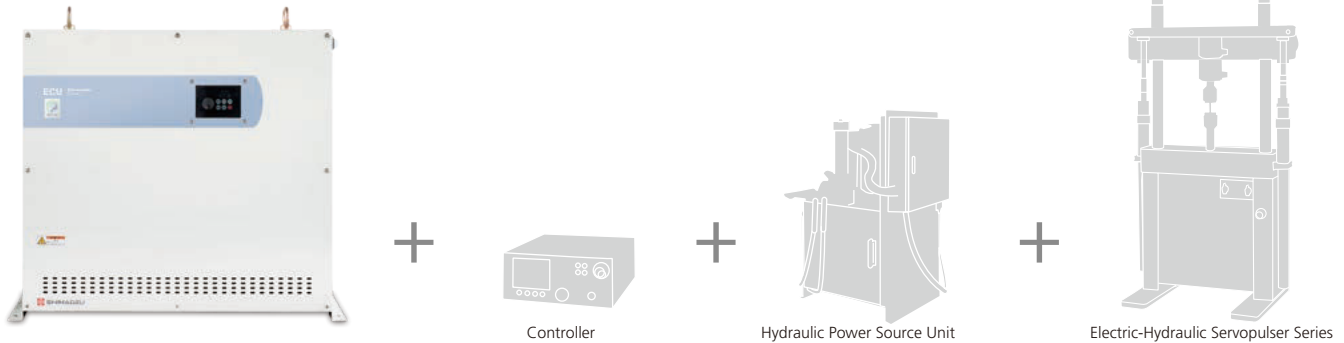
Helps Reduce Energy Consumption, CO2 Emissions,
and Running Costs by Up to 50 %



This product is certified as Shimadzu's Eco-Products Plus.

ECU1 Series: Up to 30% energy savings compared to previous models

ECU2 Series: Up to 50% energy savings compared to previous models



Up to 50 %
Lower Power
Consumption

Automatic
Energy-Saving
Operation

Remote
Operation



ECU Controller

Lower Running Costs

Using the ECU energy-conservation unit enables an energy-saving mode that can switch OFF the hydraulic power supply unit power depending on the testing parameters and testing status. It also reduces the hydraulic power supply unit's power level when tests are in standby mode.

Note: When using the ECU2 in a region with 60 Hz power supply (up to 30 % when using the ECU1).

Automatically Sets the Optimal Energy-Saving Mode

Used in combination with Microsoft Windows software, the ECU unit can automatically set the optimal energy-saving mode based on test parameters or testing status. This efficiently reduces operating power consumption while continuing to perform intended tests.

Operation with a Hand-Held Controller

The unit can be operated with a hand-held controller.

The hydraulic power supply unit's energy-saving settings (motor frequency and supply pressure settings) can be set from the Servo Controller 4830 or from Windows software for 4830.

Lower Hydraulic Power Supply Unit Operating Noise and Heat Generation

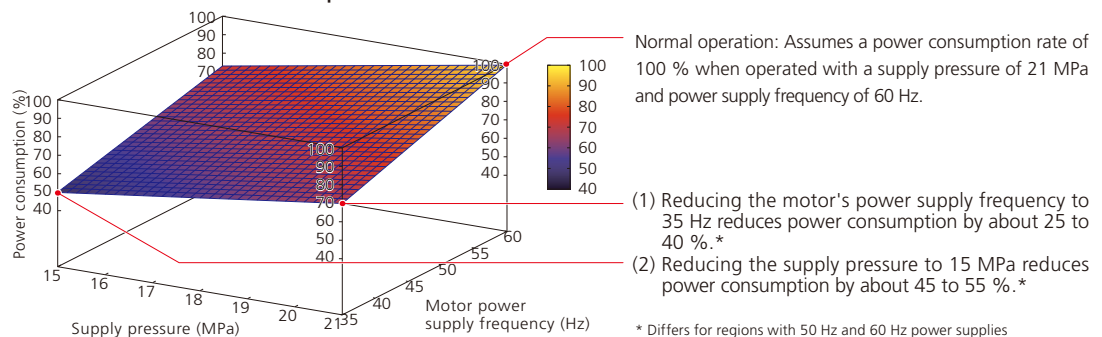
The energy-saving mode reduces the operating noise and heat generated from the hydraulic power supply unit. It also reduces heat generated from the oil, which helps extend the life of the oil.

ECU Units Can Be Retrofitted on Existing Hydraulic Power Supply Units (QF-A, QF-B, and AF Series)

Notes

- For systems using a controller model prior to the Servo Controller 4830, an ECU controller is required.
- Retrofitting an ECU unit on an existing system requires an on-site survey of the system in advance.
- It may not be possible to retrofit an ECU unit on existing hydraulic power supply units in poor site conditions.

Energy-Saving Mode Reduces Power Consumption

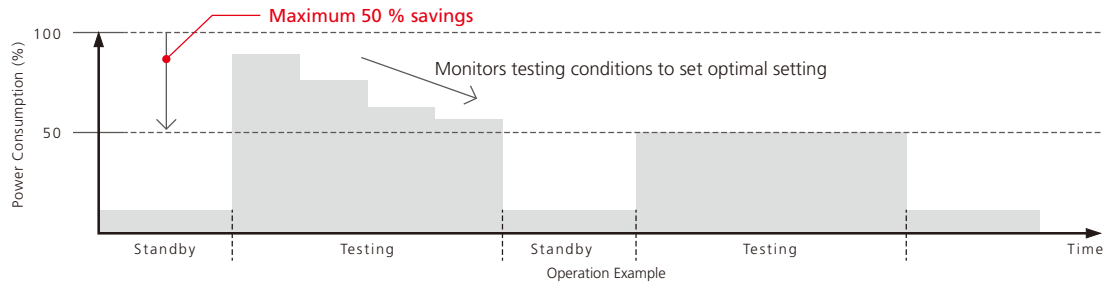


Energy-Saving Operation

Automatic Motor Power Supply Frequency and Supply Pressure Setting (with ECU2 and Windows software)

Automatically operates the system in energy-saving mode when the testing machine is in standby mode or depending on the test load status.

Note: Set manually via the Servo Controller 4830 if Windows software is not available.



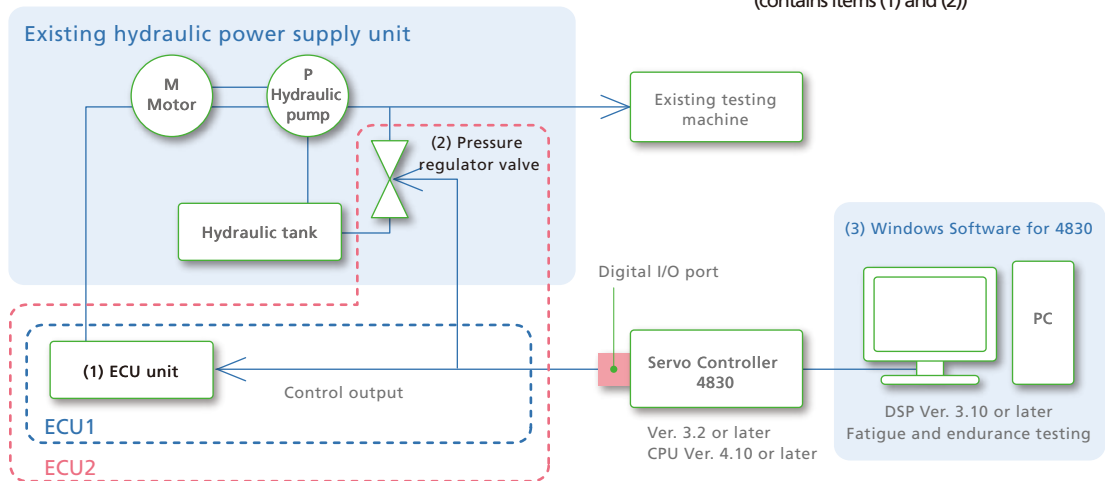
	Motor power supply frequency	Supply pressure
During standby	35Hz	7-9MPa
Just before testing	Automatically settings according to test conditions	
During testing	Periodically checks the displacement amplitude or test force to automatically set appropriate rpm or supply pressure.	

Note: If the function to automatically set the motor power supply frequency and supply pressure is used, the test conditions cannot be changed during testing.

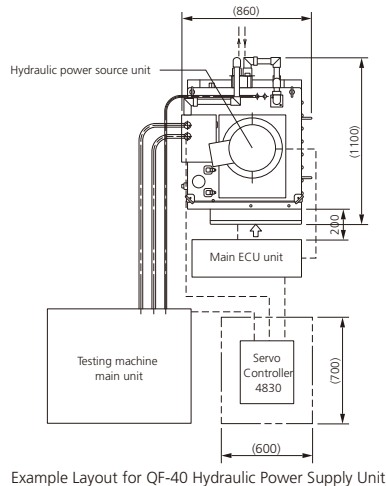
Configuration of Energy-Conservation Unit

ECU1 : Controls the motor's power supply frequency only (contains item (1))

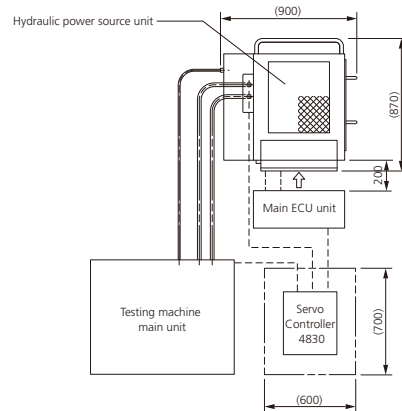
ECU2 : Controls both the motor's power supply frequency and supply pressure (contains items (1) and (2))



Layout Example



Example Layout for QF-40 Hydraulic Power Supply Unit



Example Layout for AF-20 Hydraulic Power Supply Unit

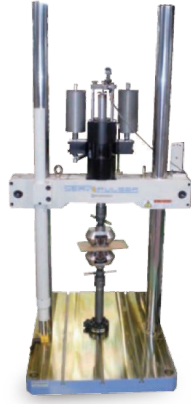
Units: mm

Customizing Electric-Hydraulic Dynamic and Fatigue Testing Systems

Servopulser series electric-hydraulic dynamic and fatigue testing systems can be customized to fit the needs of customers. Some special systems are featured on page 58.



300 Hz High-Cycle Fatigue Testing Machine



Long Sample Testing System



Multiple Load Testing Machine



Special Environmentally-Controlled Testing System

Examples of Customization

- Applying large loads..... 300 kN, 500 kN, and 1000 kN testing systems (E and U types)
- High-frequency testing..... 100 Hz and 300 Hz loading systems
- Large deformation levels 200 L, 300 L, and 500 L high flow rate hydraulic power supply units
- Large samples..... Testing machine frames with 1200 mm column height extension and 1000 mm width between columns
- Performing multiple tests simultaneously..... Four-sample loading systems
- Operating multiple testing machines using one hydraulic power supply unit Central hydraulic supply system
- Safety systems required Units added to meet safety requirements of each company
- Performing tests in specialized environments..... Combination of thermostatic chamber, humidity-controlled thermostatic chamber, or furnace

Installing Electric-Hydraulic Dynamic and Fatigue Testing Systems

Installation Site

- Foundation construction work is not necessary for concrete floors about 150 mm thick. Since vibration occurs from the testing machine during the test, install on the first floor without the underground space.
- If there is concern about floor vibration, such as there are any devices that hate vibration in the surroundings, please install it on an independent foundation. The level of the floor should be 3mm/1000mm or less.
- For QF-70B or larger hydraulic power supply units or sites particularly sensitive to floor vibration, install a reinforced foundation.
- Site with minimal temperature variations (+10 to +35 °C recommended) (For air-cooled hydraulic power supply units, keep the ambient temperature at the site 25 °C or lower.)
- Site with low humidity (10 to 75 %RH recommended)
- Site not exposed to direct air flow from heating or cooling systems
- Site not exposed to direct sunlight
- Site with low dust levels
- Site with no corrosive gas pollutants
- Site with low vibration levels (0.1 G or less recommended)
- For the AF series (air-cooled hydraulic power supply unit), keep ambient temperature of hydraulic power supply unit site at 25 °C or lower.

Note: For sites exposed to condensation, salt damage, or other such factors, countermeasures such as a dust-resistant enclosure should be considered.

Power Supply

- Provide a clean ground wire (type-D ground recommended).
- Avoid power supplies with large voltage fluctuations. If voltage fluctuations are unavoidable, use a constant-voltage power supply unit, noise filtering transformer, or other countermeasure.
- The customer is responsible for power supply installation work up to the power supply control panel terminals on the hydraulic power supply unit.
- Provide any additional power supply equipment required separately.
- There should be no high-capacity, noise-generating equipment on the same power supply line.

Cooling Water

- The customer is responsible for cooling water supply line installation work up to the cooling water line connectors on the hydraulic power supply unit.
- Provide any additional cooling water equipment required separately.
- Use clean water at a temperature of 32 °C or lower as cooling water.

Note: If the product is to be installed in a location where condensation or salt damage is possible, consider using a dustproof rack or other suitable product depending on the situation.

Hydraulic Piping

- The piping should be on the floor using a high-pressure rubber hose. If piping in the pit is necessary due to the location of the installation, we will make a separate estimate. Pit construction and its attached construction must be done by the customer.

EHF-E/U/L Series Electric-Hydraulic Dynamic and Fatigue Testing System Model Code

Electric-hydraulic Servopulser series systems can accommodate a wide variety of test force and testing speed requirements by selecting a combination of the following:

- Loading frame
- Actuator
- Controller and software
- Hydraulic power supply unit

EHF-E/U/L Series Electric-Hydraulic Dynamic and Fatigue Testing System Model Code

EHF - E V 0 1 0 K 1 A - 0 1 0 - 0

1 2 3 4 5 6 7

1 Select the loading frame.

Select the best-suited loading frame from the following three options.

<p>L L-Type Loading Frame</p> <p>Tabletop frame with top-mounted actuator</p> <p>Suitable for testing actual and prepared samples at test forces up to 20 kN. Application example: Bearing parts</p>	<p>E E-Type Loading Frame</p> <p>Standard frame with bottom-mounted actuator</p> <p>Suitable for testing small actual and prepared samples at test forces up to 200 kN. Application example: Standard shape samples</p>	<p>U U-Type Loading Frame</p> <p>Standard frame with top-mounted actuator</p> <p>Suitable for testing structural materials and large full-size samples at test forces up to 200 kN. Application example: Large parts</p>
---	--	---

2 Select the controller.



Servo Controller 4830

This controller is capable of generating an extensive selection of test waveforms and provides a measurement, control, and waveform display. Optional software allows testing with a combination of waveforms or a simulation of actual waveforms experienced during operation.

3 Select the actuator capacity. (Select a capacity that matches the loading frame capacity.)

Select one of the following maximum test force capacities. Note: For EHF-E series models with 10 to 100 kN capacity, the third digit is a "1."

0 0 5 : 5kN 0 1 0 : 10kN 0 2 0 : 20kN 0 5 0 : 50kN 1 0 0 : 100kN 2 0 0 : 200kN

4 Select the stroke length.

Select one of the following actuator stroke lengths (range of motion).

1 : ±25mm 2 : ±50mm

5 Select the hydraulic power supply unit's flow rate (testing range required).

Select a flow rate referring to the amplitude characteristic curves on pages 26 and 27.

0 1 0 : QF-10B 0 2 0 : QF-20B 0 4 0 : QF-40B 0 7 0 : QF-70B 1 1 E *) : QF-110(for 50Hz)
1 4 0 : QF-140 A 0 4 : AF-4 A 1 0 : AF-10B A 2 0 : AF-20B 1 1 W *) : QF-110(for 60Hz)

* Only for the QF-110, the model number differs depending on the frequency.

6 Select loading frame extensions.

Specify whether extended columns (E and U types) or an extended table length (U type) are required, based on the frame dimensions indicated on pages 14 and 15. (The L type is only available in the standard size.)

0 : Standard 1 : Columns extended 2 : Standard columns with table extended by 500 mm 3 : Columns extended and table extended by 500 mm
4 : Standard columns with table extended by +1000 mm 5 : Columns extended and table extended by +1000 mm

- When installing a thermostatic chamber in an E-type or U-type testing machine, select the frame extension type. The L type uses the standard type. E type 100 kN or less is extended by + 600 mm. The others is extended by + 400 mm.
- Extended table length (U type only): Standard, +500 mm, or +1000 mm (3 types) The table length (depth) can be changed to accommodate the size of samples being tested.

7 Select optional items.

Indicate whether or not any of the following customization options is required.

U : Includes base stand S : Special specifications (consult your Shimadzu representative separately)

Notes:

- Optional base stand (U50 kN and U100 kN only): Allows the system to be elevated about 700 mm higher than when the table is placed on the floor. This option is required when attaching a thermostatic chamber to a U-type loading frame.



Shimadzu Corporation

www.shimadzu.com/an/

For Research Use Only. Not for use in diagnostic procedures.

This publication may contain references to products that are not available in your country. Please contact us to check the availability of these products in your country.

Company names, products/service names and logos used in this publication are trademarks and trade names of Shimadzu Corporation, its subsidiaries or its affiliates, whether or not they are used with trademark symbol "TM" or "®".

Third-party trademarks and trade names may be used in this publication to refer to either the entities or their products/services, whether or not they are used with trademark symbol "TM" or "®".

Shimadzu disclaims any proprietary interest in trademarks and trade names other than its own.

The contents of this publication are provided to you "as is" without warranty of any kind, and are subject to change without notice. Shimadzu does not assume any responsibility or liability for any damage, whether direct or indirect, relating to the use of this publication.