

HIGH STRAIN RATE VHS SYSTEM

High Speed Testing up to 25 m/s

Many materials exhibit different behaviours under various strain rates, i.e. they have strain rate dependent properties. Characterizing these dynamic properties across a wide range of velocities becomes very important in applications where components are exposed to high strain rates, especially on investigating material failure and also identifying the most optimal design for weight.

High strain rate testing machines have helped industries to predict material behaviour, which in turn helps the design of many components that are exposed to high strain rates during its life cycle. Whether it is in the landing gear on aircraft, the crash impact of a road vehicle or even the cord strings when a parachute is opened, all of these examples involve one or more components of a product that are subjected to high strain rate impact. These components require safety and industry standards to be met in order to compete in the industry. Therefore, a high strain rate testing machine with reliable operations and accurate data acquisition is essential in designing safe and functional products and verifying the validity of the computer simulation tools, e.g. car crash simulation.

HIGH STRAIN RATE APPLICATIONS AND RESEARCH AREAS INCLUDE:

- Characterization of metals, composites and polymers from quasi-static up to strain rates of 1000/s (specimen dependent)
- Cumulative damage of aerospace components under high strain rate impact
- Crash impact of automotive vehicles
- Tensile impact on parachute cords and seatbelts
- Weight reduction of components

INSTRON VHS MACHINES COMPLY WITH FOLLOWING TEST STANDARDS

- High strain rate tensile: ISO 26203-2, ISO 18872
- SAE International J2749
- Puncture impact behaviour: ASTM D3763, ISO 6603-2
- Peel test: ISO 11343

WHY CHOOSE INSTRON?

Instron has provided high strain rate testing machines for 20 years and has helped to advance relevant material research in high strain rate and development of new metals, plastics and composites. Instron continues to innovate and expand our dedicated range of high strain rate machines to accommodate wider range of materials, applications and more complex velocity profiles, offering more advanced data acquisition and processing techniques to ensure the data integrity of test results. Our accumulated experience in high strain rate testing will give you the edge in obtaining accurate and reliable data of materials across a wide range of strain rates, aiding you with our reliable machines in research, product design and complying with various test standards.



INSTRON VHS

Instron provides a range of high strain rate VHS machines that are capable of performing tests from quasi-static to high strain rates of up to 1000/s, offering unparalleled coverage in the materials and strain rates. From composites and metals including high strength alloys to more compliant polymer materials, there is a configuration of VHS systems that is right for your material and application. With our specially designed accessories, your specimen will be tested when the target speed is reached and not during the acceleration process. Our carefully chosen stroke options will ensure that there is enough workable stroke to allow for the acceleration and deceleration of the piston, leaving enough stroke for the testing of specimen. Our standard VHS machines go from less than 1 mm/s up to 20 m/s, allowing great flexibility in designing the test and specimen that will suit most applications. There is also an option to configure the VHS 65/80 actuator up to a market leading 25 m/s for applications where even higher strain rates are needed to perform the desired tests.



BENEFITS

- Integrated solution that allows quasi-static tests all the way up to 1000/s high strain rate testing to be conducted on our VHS machine
- Stable transition and operations of actuator between closed loop control at speeds below 1 m/s and open loop control for speeds above 1 m/s
- Our frames are designed to have a high enough stiffness to maximize use of actuator speed and minimize the time for specimen to reach steady state when loading during tests
- Our 300 mm stroke allows sufficient length to accelerate and decelerate the piston, so the piston can deliver target strain rate in specimen gauge length for most composite and metallic materials. We also offer 600 mm stroke system for more compliant polymer materials for the added coverage of different materials that can be tested at high strain rate
- Choosing the right fixture for the material and specimen size is important. Instron has a range of fixtures, including the following:
 - Lost motion grips
 - Fast jaw grips
 - Puncture probes for specimen to ISO 6603-2 or ASTM D3763
- Multiple hydraulic accumulators, large flow servovalve system and actuator size on the VHS ensure a large enough output to minimize a drop in speed while loading the specimen under open loop control
- Lightweight actuator design
 - Short acceleration path needed to reach testing speed
 - Much higher oil column stiffness – reduces resonance effects on test data
- Electronically interlocked protective enclosure that will ensure access to test area is restricted during test, creating a safe laboratory environment
- DIC contactless strain measurement systems can be fully integrated and automatic resampling of DIC data to align with machine data. The addition of DIC enables measurement of strain at high strain rates or high temperatures where strain gauges cannot operate, offering more possibilities in the tests compatible with Instron VHS
- Integration with high temperature chambers expand testing capabilities of VHS under conditions other than ambient

OUR RANGE

The **VHS 35/50-20** has a stall force of 35 kN (7.9 kip) and maximum load impact of 50 kN (11 kip) at a maximum velocity of 20 m/s, and a nominal actuator stroke of 600 mm (24 in). Its long stroke characteristic allows more compliant specimens to be tested, which is popular among companies that want to test polymers, such as seatbelt material and parachute cords.

The **VHS 40/50-20** has a stall force of 40 kN (9 kip) and a maximum load impact of 50 kN (11 kip) with a maximum velocity of 20 m/s and a nominal actuator stroke of 300 mm (12 in), its static and dynamic capacities are typically used for testing plastics, composites and lower force metal without the requirement for the long stroke option.

The **VHS 65/80-20** is rated at 65 kN (15 kip) statically and 80 kN (18 kip) dynamically with a maximum velocity of 20 m/s, and is the most versatile machine. With a 300 mm (12 in) nominal actuator stroke, the machine sits comfortably in between polymer, composites and metal testing, allowing a good coverage in most material types. There is also a configuration option for VHS 65/80 of test speeds at either 20 m/s or 25 m/s, allowing even higher strain rates to be tested.

The **VHS 160/100-20** is rated at 160 kN (36 kip) statically and 100 kN (22 kip) dynamically with a maximum velocity of 20 m/s. With a 300 mm (12 in) nominal actuator stroke, it is typically used to test composites, metals and high strength alloys, and component testing is also available utilizing the T-slot table to configure the test space according to testing requirement.

CONTROLLER AND SOFTWARE

Instron VHS testing system is supplied with a custom-made VHS8800MT controller package with Instron HighRate Software to provide a fully integrated experience and unique profiling capability. The VHS8800 controller is suitable for a wide range of applications and complex velocity profiles, offering high rate data acquisition, and the software provides statistical analysis and powerful tools for quick post-processing modelling. Optional DIC systems provide an extra layer of data and can be fully integrated with the VHS testing system, offering a complete testing capability.

SAFETY FIRST

Instron VHS machines are capable of moving at speeds up to 25 m/s and do so by controlled high volume, high pressure hydraulic oil flow. With this in mind, we make operator safety our absolute priority in the design of these systems.

- Interlocked Safety Enclosure which restricts access to the test area during test
- Dual Hydraulic Circuitry on all safety critical components compliant with the relevant EU machinery directive
- Full System CE Certification for EU shipments

DATA PROCESSING, SOFTWARE AND CAMERA INTEGRATION

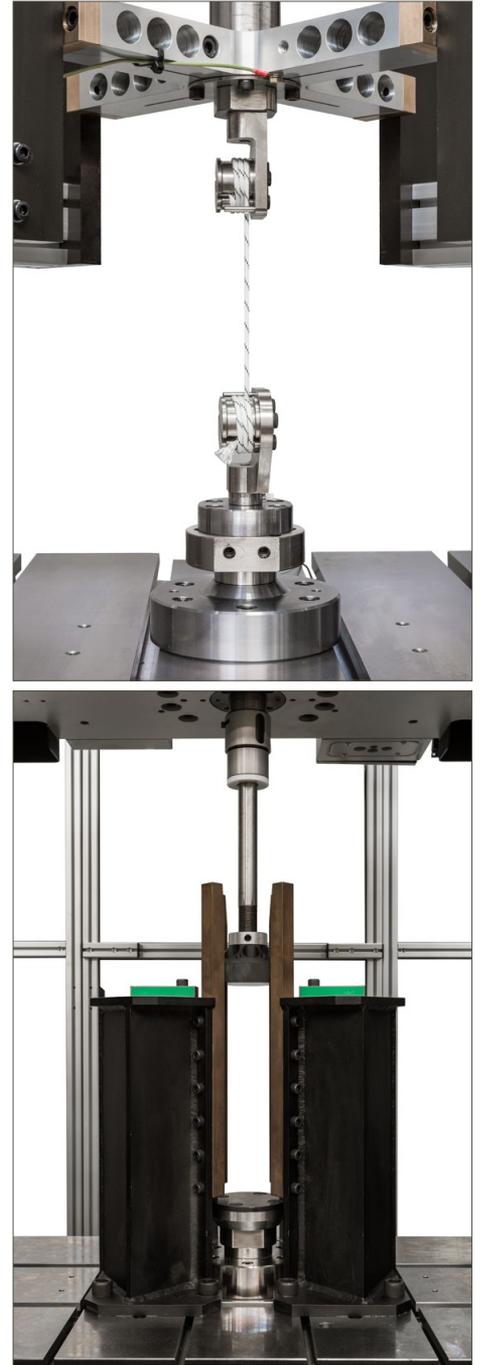
Tests can last as little as 3–10 ms (specimen dependent). Instron HiRate package accommodates by providing a data acquisition sampling rate up to 60 MHz, advanced profiling capability, high-speed data acquisition and analysis capabilities with strain gauge transducer conditioner that has a bandwidth up to 200 kHz.

- Rapid Statistical Analysis of Multiple Results Files to reduce post processing time
- Polynomial Curve Fitting to facilitate theoretical modelling and simulation
- Third Party High Speed DIC Camera Data Integration & Post Processing

RESEARCH A VARIETY OF MATERIAL PROPERTIES

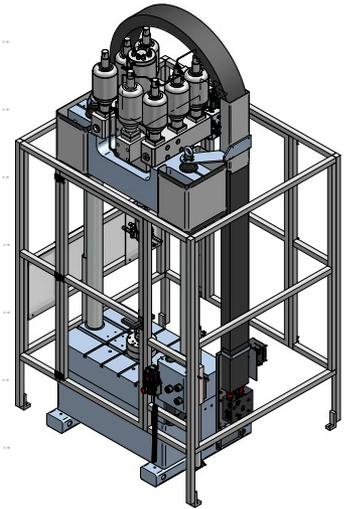
Instron also offers a wide variety of test dependent accessories to support different test types and service conditions. We can also include an additional temperature environmental chamber for testing from sub-ambient up to 250 °C or an induction heating system up to 1000 °C.

- Tensile gripping include slack rods and fast jaw grips
- Compression fixture with side load protection
- Puncture Probes with suitable force-pin transducers



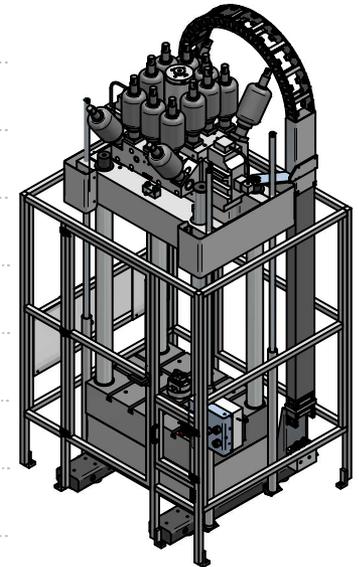
Above: Cord Grip. Below: Compression Fixture.

FRAME SPECIFICATIONS	VHS 35/50 - 20	VHS 40/50 - 20	VHS 65/80 - 20 (25)
Daylight Opening (Maximum Between Table and Crosshead)	1975 mm (78 in)	1515 mm (60 in)	1400 mm (55 in)
Stall Force₁ (Static Load Capacity)	±35 kN (±7.9 kip)	±40 kN (±9 kip)	±65 kN (±15 kip)
Maximum Impact Load₁ (Including Inertia Force of Piston Rod)	±50 kN (±11 kip)	±50 kN (±11 kip)	±80 kN (±18 kip)
Maximum Velocity	20 m/s	20 m/s	20 m/s (Optional 25)
Nominal Actuator Stroke (Includes 50mm buffer zones on each end)	600 mm (24 in)	300 mm (12 in)	300 mm (12 in)
Configuration	2-Column High-Stiffness Load Frame with Actuator in Upper Crosshead		
Lift and Locks	Hydraulically-Powered Lifts and Locks		
Load Measurement System	Piezoelectric load washer and patented ₂ Dynacell™ fatigue-rated load cell supplied for calibration of piezoelectric load washer		
Operating Pressure	280 bar (4000 psi)		
Frame Weight (Approximate Guidance Only)	2500 kg (5512 lb)		
Dimensions (with enclosure)	1660 x 1420 x 3350 mm ₃ (65 x 56 x 132 in ₃)		



Instron VHS 65/80 - 20

FRAME SPECIFICATIONS	VHS 65/80 - 20 (25)	VHS 160/100 - 20
Daylight Opening (Maximum Between Table and Crosshead)	1515 mm (60 in)	1515 mm (60 in)
Stall Force₁ (Static Load Capacity)	±65 kN (±15 kip)	±160 kN (±36 kip)
Maximum Impact Load₁ (Including Inertia Force of Piston Rod)	±80 kN (±18 kip)	±100 kN (±22 kip)
Maximum Velocity	20 m/s (Optional 25)	20 m/s
Nominal Actuator Stroke (Includes 50mm buffer zones on each end)	300 mm (12 in)	
Configuration	4-Column High-Stiffness Load Frame with Actuator in Upper Crosshead	
Lift and Locks	Hydraulically-Powered Lifts and Locks	
Load Measurement System	Piezoelectric load washer and patented ₂ Dynacell™ fatigue-rated load cell supplied for calibration of piezoelectric load washer	
Operating Pressure	280 bar (4000 psi)	
Frame Weight (Approximate Guidance Only)	5300 kg (11700 lb)	
Dimensions (with enclosure)	1660 x 1420 x 3550 mm ₃ (65 x 56 x 140 in ₃)	



Instron VHS 160/100 - 20

1) Note that static and dynamic performance of the actuator is subjected to vary with specimen type and velocity, please consult Instron for further details.

2) US Patent Number 6508132

3) Width x Depth x Maximum Height with crosshead raised to highest position, note that dimensions are subject to change without notice

