

# HIGH STRAIN RATE VHS SYSTEM

High Speed Testing up to 25 m/s

Many materials exhibit different behaviors under various strain rates, meaning 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 when investigating material failure mechanisms and optimizing component design for weight.

High strain rate testing machines have helped industries to predict material behavior, which in turn helps the design of components that are exposed to high strain rates during their life-cycle. Whether the landing gear on aircraft, the crash impact structure of a road vehicle or even the cord strings on a parachute, all of these examples involve components that are subjected to high strain rate impact. These components and products are required to meet stringent safety and industry standards to be released for sale. Therefore, a high strain rate testing machine with reliable operation and accurate data acquisition is essential for designing safe and functional products and verifying the validity of computer simulation models, for example, 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 assessment 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 behavior: ASTM D3763, ISO 6603-2
- Peel test: ISO 11343

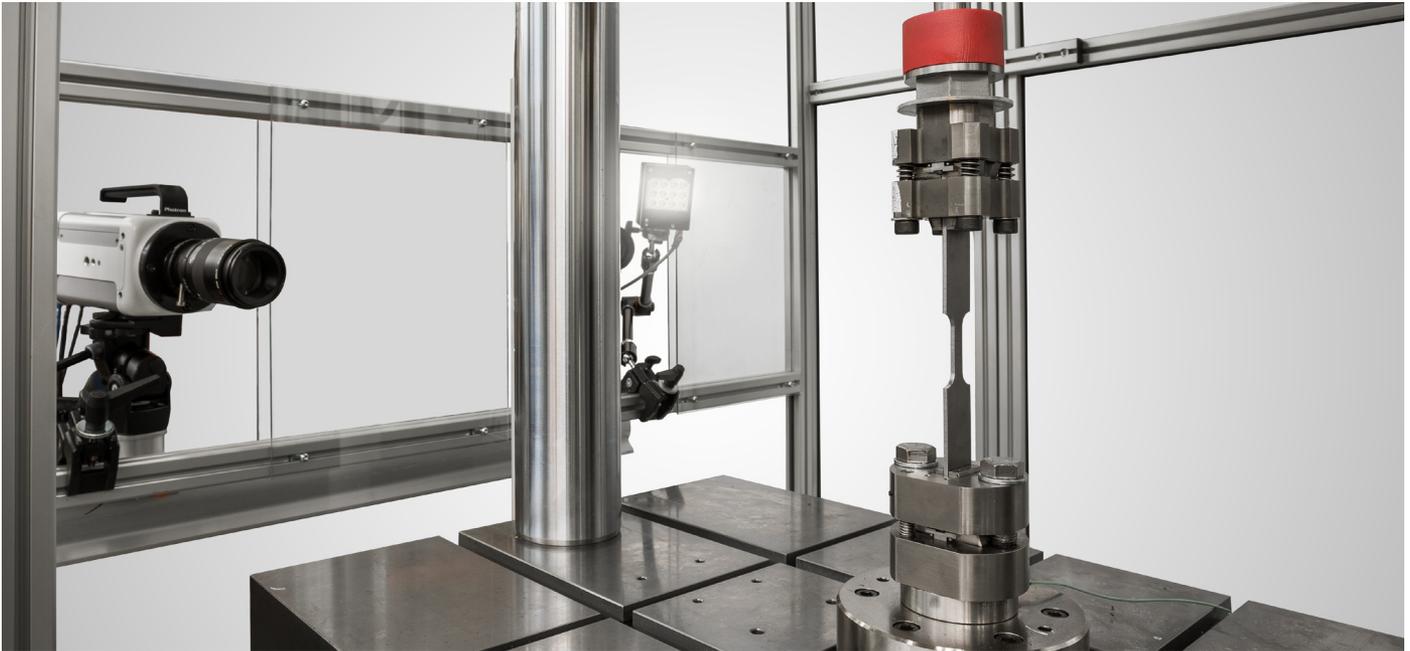


*The difference is measurable®*

## 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 market. From composites and metals, including high strength alloys, to more compliant polymer materials, there is a configuration of VHS system 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 phase of the test. 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 your specimen. Our standard VHS machines can operate from less than 1 mm/s up to 20 m/s, allowing great flexibility in designing the test and a 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.



## BENEFITS

- Integrated solution allows quasi-static tests all the way up to 1000/s high strain rate tests to be conducted on one VHS machine
  - Stable transition and operation of actuator between closed loop control at speeds below 1 m/s and open loop control for speeds above 1 m/s
  - High stiffness load frames help to reduce ringing and noise measured by the system transducers, improving the quality of your test data
  - Standard 300 mm total stroke allows sufficient length to accelerate and decelerate the piston, so the piston can deliver the target strain rate to the specimen gauge length for most composite and metallic materials. We also offer a 600 mm stroke system for high strain rate testing of more compliant polymer materials
  - Multiple hydraulic accumulators and high flow servovalves configured for each actuator size ensure sufficient performance to minimize velocity drop-off during specimen loading in open loop control
  - Lightweight actuator piston design and high-pressure hydraulics:
    - Reduce acceleration distance needed to reach testing speed
    - Maximize oil column stiffness – reducing resonance effects on test data
  - Electronically interlocked protective enclosure ensures access to test area is restricted during the test, creating a safe laboratory environment
  - Digital Image Correlation (DIC) contactless strain measurement systems can be fully integrated, with 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 extensometers or strain gauges cannot operate, offering more possibilities in the tests compatible with Instron VHS
  - Integration with temperature chambers expands testing capabilities of VHS to both low and high temperature conditions
- 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
  - Compression fixture

## CONTROLLER AND SOFTWARE

Instron VHS testing systems are supplied with a VHS8800MT controller package and Instron HighRate software to provide high quality control, data acquisition and calibration features. The controller is suitable for a wide range of applications and complex velocity profiles, and the latest Bluehill VHS Analysis software provides statistical analysis and powerful tools for quick post-processing. Optional DIC systems allow for non-contacting strain measurement and can be fully integrated with the VHS system, offering complete testing capability.

For more information, see the Bluehill® VHS Analysis brochure.

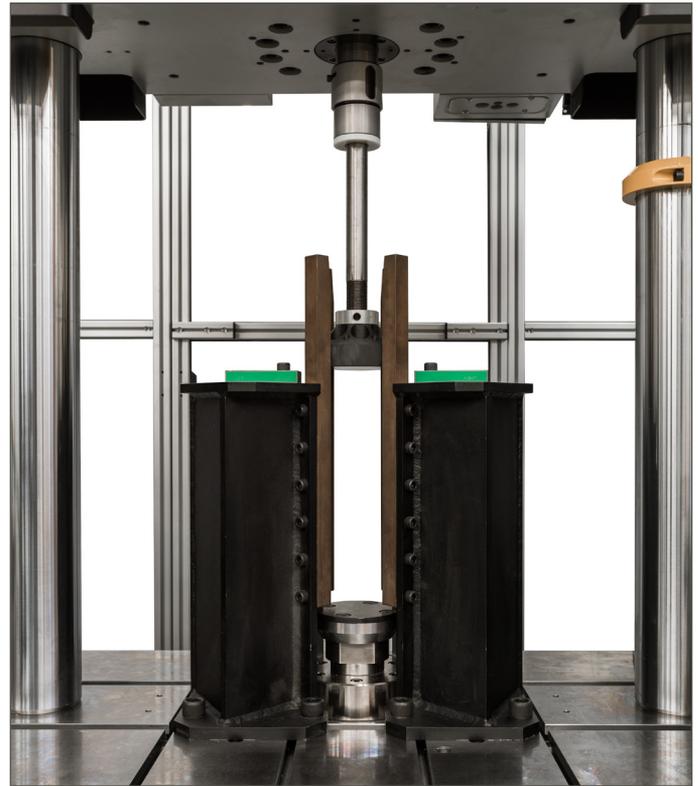
## SAFETY FIRST

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



Cord Grip



Compression Fixture

## DATA PROCESSING, SOFTWARE AND CAMERA INTEGRATION

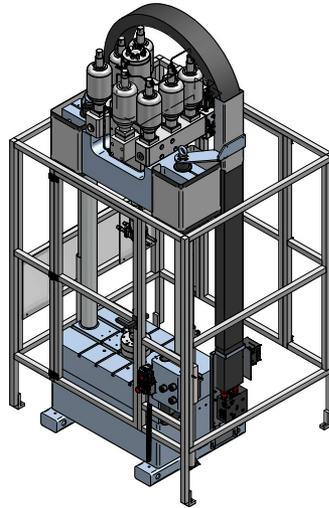
Depending on the specimen, tests can last as little as 3–10 ms. Instron HighRate package compensates by providing a data acquisition sampling rate up to 60 MHz, advanced profiling capability, high-speed data acquisition and analysis capabilities, plus piezoelectric transducer conditioner with a bandwidth up to 200 kHz.

- Actuator velocity calibration for open loop control testing
- Transducer and data acquisition setup including test method creation
- Third party high speed DIC camera data integration and post processing

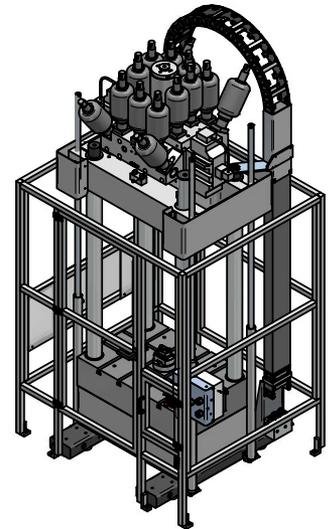
## RESEARCH A VARIETY OF MATERIAL PROPERTIES

Instron also offers a wide variety of test specific 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 includes slack rods and fast jaw grips
- Compression fixture with side load protection
- Puncture probes with suitable force-pin transducers



Instron VHS 65/80 - 20



Instron VHS 160/100 - 20

**FRAME SPECIFICATIONS**

	VHS 35/50 - 20	VHS 40/50 - 20	VHS 65/80 - 20 (25)	VHS 160/100 - 20
<b>Daylight Opening</b> (Maximum Between Table and Crosshead)	1975 mm (78 in)	1515 mm (60 in)	1400 mm (55 in)	1500 mm (59 in)
<b>Stall Force<sub>1</sub></b> (Static Load Capacity)	±35 kN (±7.9 kip)	±40 kN (±9 kip)	±65 kN (±15 kip)	±160 kN (±36 kip)
<b>Maximum Impact Load<sub>1</sub></b> (Including Inertia Force of Piston Rod)	±50 kN (±11 kip)	±50 kN (±11 kip)	±80 kN (±18 kip)	±100 kN (±22 kip)
<b>Maximum Velocity</b>	20 m/s	20 m/s	20 m/s (Optional 25)	20 m/s
<b>Nominal Actuator Stroke</b> (Includes 50mm buffer zones on each end)	600 mm (24 in)	300 mm (12 in)	300 mm (12 in)	300 mm (12 in)
<b>Configuration</b>	2-Column High-Stiffness Load Frame with Actuator in Upper Crosshead			4-Column High-Stiffness Load Frame with Actuator in Upper Crosshead
<b>Lift and Locks</b>	Hydraulically-Powered Lifts and Locks			
<b>Load Measurement System</b>	Piezoelectric load washer and patented <sub>2</sub> Dynacell™ fatigue-rated load cell supplied for calibration of piezoelectric load washer			
<b>Operating Pressure</b>	280 bar (4000 psi)			
<b>Frame Weight</b> (Approximate Guidance Only)	2500 kg (5512 lb)	2500 kg (5512 lb)	2900 kg (6390 lb)	5300 kg (11700 lb)
<b>Dimensions</b> (with enclosure)	1660 x 1420 x 4150 mm <sub>3</sub> (65 x 56 x 163 in <sub>3</sub> )*	1660 x 1420 x 3350 mm <sub>3</sub> (65 x 56 x 132 in <sub>3</sub> )*	1660 x 1420 x 3350 mm <sub>3</sub> (65 x 56 x 132 in <sub>3</sub> )*	1660 x 1420 x 3550 mm <sub>3</sub> (65 x 56 x 140 in <sub>3</sub> )*

\*Dimensions are correct for the enclosure when supplied without environmental chamber.

1) Note that static and dynamic performance of the actuator is subject to change 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

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