

Mechanical Testing Facility

INTRODUCTION

MSSI houses a range of state of the art mechanical test equipment for static, fatigue and high speed testing, located in the basement of the Lonsdale building. This equipment includes screw driven and hydraulic machines with load ranges from ± 100 N to ± 300 kN, a high speed tensile test machine, for speeds from 1 mm/s to 20 m/s at ± 50 kN, high speed cameras, video extensometry and digital image correlation equipment.

TECHNICAL SPECIFICATIONS

Zwick HA 300 Universal Loading Machine

The Zwick HA 300 Universal Loading Machine at MSSI is a state of the art facility for static and fatigue testing of engineering materials. The machine is rated for ± 300 kN static loading, and ± 250 kN fatigue loading and has a servo-hydraulic actuator under computer control via the 9640 dual (and independent) controller. Static ramps, constant amplitude dynamic wave forms, and block programs are available. Other options (e.g. spectra) can be added through additional software. State of the art software allows user-defined test sequences, real-time data visualisation, filtering of data and frequency analysis. The hydraulic grips have a digital indicator for precise alignment and allow testing of round and flat specimens. They are rated for dynamic operation, and can be offset for e.g. testing of single-lap joints. Additional equipment includes Epsilon Dynamic extensometers, with extension arms for variable gauge lengths, LVDTs for accurate stroke measurement, and a 32 channel 6 kHz data acquisition unit with half-bridge strain gauge excitation and conditioning.

Figure 1. Zwick HTM 5020 Hydraulic High-Speed Testing Machine, with the Photron SA1.1 High-Speed Camera System in-situ

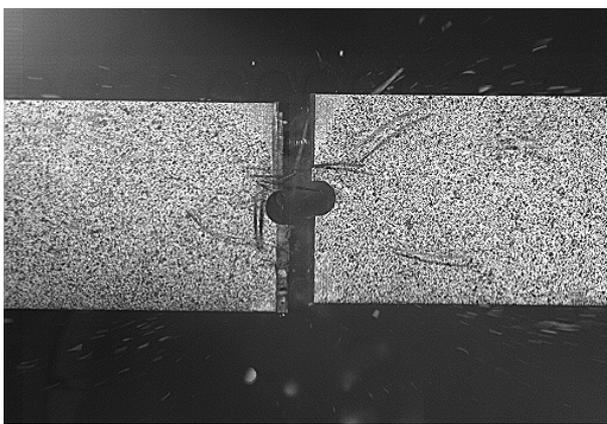
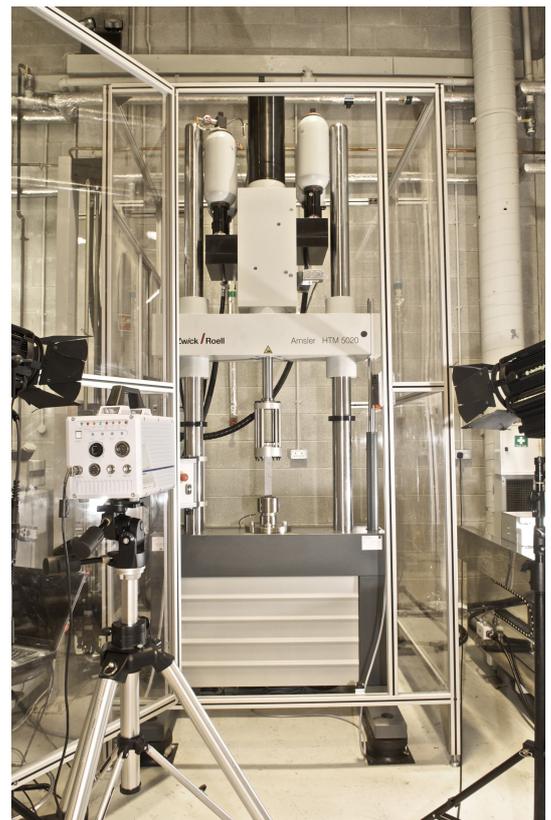


Figure 2. Open-hole tension of a CFRP coupon, speckled for DIC analysis. Tested at 5m/s, the image was taken using a Photron SA1.1 camera system



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Zwick 100kN Hydraulic Universal Straining Frame:

This machine has a $\pm 100\text{kN}$ load capacity and is used for static tensile/compression testing. The machine is also capable of low frequency cyclic testing. An auxiliary 10kN load-cell can be attached for lower load level testing. It also has a servo-hydraulic actuator under computer control via the 9640 dual controller. Static ramps, constant amplitude dynamic wave forms, and block programs are available. Other options (e.g. spectra) can be added through additional software. State of the art software allows user-defined test sequences, real-time data visualisation, filtering of data and frequency analysis. The hydraulic grips have a digital indicator for precise alignment and allow testing of round and flat specimens. They are rated for dynamic operation, and can be offset for e.g. testing of single-lap joints. The additional extensometry and data acquisition equipment of the Zwick HA300 machine can also be employed using this machine.

Tinius/Olsen Screw-Driven Straining Frame:

This machine is equipped with $\pm 25\text{kN}$ and $\pm 1\text{kN}$ load cells for static testing at relatively low load levels. A long travel extensometer (100SC) is attached to the machine for measuring a large range of specimen displacements. The 100SC extensometer has been designed as a dual purpose extensometer for determining E modulus and proof stress on relatively high modulus materials whilst also providing the facility for measuring high elongation up to specimen failure. The machine can be fitted with general-purpose wedge grips or specialised grips for testing low modulus plastics/elastomers.

Zwick 50kN Screw-Driven Straining Frame:

This machine has a $\pm 50\text{kN}$ load capacity and is used for static tensile/compression testing, with a working height of 2m. The machine can be fitted with wedge or bolt-tightened grips. An optical extensometer is attached to the machine for measuring a large range of specimen displacements.

Zwick HTM 5020 Hydraulic High-Speed Testing Machine

The Zwick HTM 5020 Hydraulic High-Speed Testing Machine is equipped with a $\pm 50\text{ kN}$ piezo-electric load-cell and is capable of testing materials at velocities within the range of 1mm/s to 20m/s. The HTM 5020 Lost Motion Adapter is used for tensile testing with a free piston accelerating up to testing speed with no interaction on the specimen together with the appropriate grips and inserts. A high-speed punch and specimen clamping system for high-speed impact/indentation testing of plastics (per ISO 6603-2: 1989) is also available. The machine has a data acquisition system capable of capturing data from load-cells, strain gauges etc at 10 MHz.. An external signal trigger module is also integrated to provide a trigger to the high-speed camera to capture the impact events.

Photron SA1.1 High-Speed Camera System

The Photron SA1.1 camera system (monochrome) is capable of capturing high-speed events at frame rates up to 675,000 frames per second. Maximum camera resolution is 1 megapixel. When used in conjunction with LAVision StrainMaster digital image correlation (DIC) software, test specimen displacements/strains can be determined.

