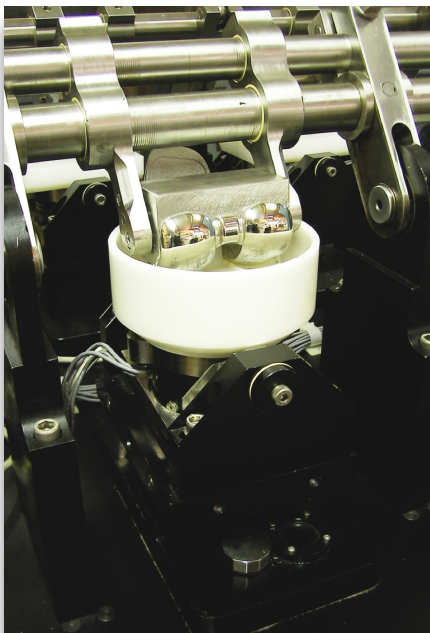


Knee Wear Simulator

Efficient and accurate ISO 14243 tests

The Shore Western Knee Wear Simulator was developed under direction of medical device manufacturers and orthopedic academics to simulate the complex kinematics and kinetics of the human knee in a physiological environment. Running in accordance with ISO 14243 axial load or displacement control, an array of knee complexities can be studied by researchers and



designers looking to extensively analyze the mechanical properties and materials tribology of their prosthetic hip designs.

A typical knee simulator has six stations oriented in two series of three. Each station has the ability to run independently, with three controlled degrees of freedom: axial load, anterior/posterior translation, and internal/external rotation (axial torsion). Flexion/extension is applied across a set of three stations. Axial loads can be up to 5kN (1.1kip) per station, and femoral motion can rotate in the horizontal plane up to 140° ($\pm 70^\circ$ flexion-extension). The simulator allows up to $\pm 25\text{mm}$ (1in) of Tibial translation (anterior/posterior) relative to Femoral load, which is programmable to 735N (165lbs), combined with allowable internal/external rotation totaling $\pm 10^\circ$ for programmable loads to 36Nm (320inlb) about the vertical axis. The medial/lateral and Varus/Vulgus are both passive planes of motion with $\pm 5\text{mm}$ ($\pm 0.2\text{in}$) of translation and $\pm 10^\circ$ of Tibial rotation respectively. The medial/lateral pivot point is adjustable with $\pm 10\text{mm}$ ($\pm 0.4\text{in}$) of translation.

Each knee joint is immersed in liquid (water, saline, or bovine/alpha calf serum), within an individual test chamber, making collection of spent serum for wear debris analysis straightforward, without risk of cross contamination between stations.

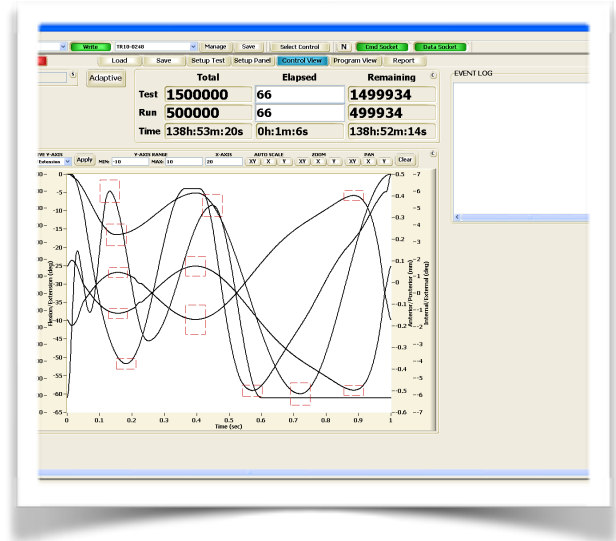
Individual peristaltic pumps are available for each channel with level and temperature interlocks in each serum storage reservoir; lubricant temperature can be set and maintained via the heater/chiller unit. The test chambers are enclosed within polycarbonate swivel doors, maintaining a clean and safe test environment. Available loaded-soak stations (without knee kinematics) can accept three daisy-chained specimens on each load channel for a total of six. Each station includes independent control with load feedback.

Shore Western can also supply our industry acclaimed Whisperpak® hydraulic pump to complement the system. These pumps provide clean, full flow, conditioned oil at 210bar (3000psi) with less than 70dB of noise.

Control System

The Knee Wear control system is based on the Shore Western SC6000 platform, running in a Windows® 7 environment.

Depending on the ISO specification required, the system can run in either displacement or mixed mode load control. Our proprietary Real Time Active Control (RTAC) algorithm is able to learn the system behavior and adapt to control the non-linear response, matching the user-entered desired load or displacement waveform. The robustness of the control system allows you to apply an array of virtual spring model constraints to simulate soft tissue and tendon reaction forces on the knee. Error boxes can be entered for the turning points. Should the response signal fall outside these limits, the system can be stopped, allowing early detection of damage to the specimen.



Features

- Three separate actuator axes per station, plus two per set of three, giving 20 channels of independent servohydraulic control.
- Axial load (Fz) capacity of up to 5000N (1100lbs) per station with independent programmability
- Axial torque capacity of up to 36Nm (320inlb) per station, with $\pm 10^\circ$ of rotation with independent programmability
- Flexion rotation of $\pm 70^\circ$ total range of motion (ROM) with 51Nm (451inlb) of torque per station (common program across three stations)
- Anterior/Posterior translation of $\pm 25\text{mm}$ ($\pm 1\text{in}$) with up to 735N (165lb) of load per station with independent programmability
- Individual multi-axis load cells on each station to monitor Fx, Fy, Fz and Mx.
- Medial/Lateral and Varus/Valgus passive planes have $\pm 5\text{mm}$ ($\pm 0.2\text{in}$) of translation and $\pm 10^\circ$ of Tibial rotation respectively
- Adjustable medial pivot point offset of $\pm 10\text{mm}$ ($\pm 4\text{in}$)
- Up to 2Hz cycle speed
- 24/7 operation is possible with sophisticated specimen failure detection, and reliable uptime.

Options

- Individual peristaltic pump for each channel with a temperature interlock in each serum reservoir. Lubricant temperature can be set and maintained using a heater/chiller unit.
- Loaded soak stations (without knee kinematics). Each station accepts up to three daisy-chained specimens on each load channel for a total of six specimens. Each station includes independent control with load feedback.
- 5th Degree of Freedom for Medial/Lateral control
- Calibration fixtures. A single axis calibration cell is used to calibrate the Fz load to full scale.