

Hip Wear Simulator



The Shore Western Hip simulator was developed through direction from medical device manufacturers and orthopaedic academics to simulate the complex kinematics and kinetics of the human hip in a physiological environment. Running in accordance with ISO 14242-3 under axial load control an array of hip complexities can be studied allowing researchers and designers to extensively analyze their prosthetic-hip design optimizing components mechanical properties and materials tribological performance.

Typical hip simulator has four stations orientated in three channels per station. Each channel has the capacity of running individual load profile conditions under closed-loop independently of the next running up to 1.5Hz. Axial loads can be configured up to 4500N (1000lbs) on each channel combined with axial torque data acquisition. Flexion/Extension and Adduction/Abduction translations are governed by a 23° bi-axial rocking motion common to all channels.

Acetabular cup orientation can be studied either anatomically correct or inverted (cup on bottom) and compliant using components with bearing diameter up to 66mm with a maximum test chamber volume of 1000ml (implementing water, saline or bovine/alpha calf serum), allowing the researcher greater flexibility in their study matrix. Metallic

surfaces within the test chamber prone to contact with testing lubricant are thin film plastic coated to prevent metal ion interaction between test chamber and bearing components and its debris, making collection of spent serum for wear debris or metal ion analysis straightforward without risk of cross-contamination between test chambers. Available individual peristaltic pump for each channel with level and temperature interlocks in each serum storage reservoir safe-guard continuous 24/7 operation; lubricant temperature can be set and maintained via heater/chiller unit. Each station of test chambers is enclosed within ergonomic Lexan hoods maintaining a clean test environment and maintaining user safety. Available loaded-soak stations (loaded-soak stations do not translate hip kinematics) can accept [three] or six daisy-chained specimens on each load channel for a total of twelve specimens. Each channel includes independent control with closed-loop axial load feedback.

Shore Western Hip Simulators can be optimized to accommodate ISO 14242-1, allowing independent closed-loop angular displacement of Flexion/Extension, Adduction/Abduction and Internal/External rotations.

SPECIFICATIONS

Twelve channel hip simulator, orientated in 3 channels of 4 stations.

- **Twelve Axes** – Twelve station hip simulator orientated in four (4) stations of three (3) channels; each channel individually controlled.
- **Actuator Axes** – Twelve separate actuator axes controlled servo hydraulically combined with a common DC motor for each channels rotation.
- **Axial load – Axial load (Fz)** up to 4500N (1000lbs) per channel. Each channel can be under separate control; every channel can run a different load profile independently or disconnected or alternatively can be adjusted manually to match command.
- **Individual load cells** – Individual bi-axial load cells on each channel monitor Fx and Mx.
- **Bi-axial rocking motion** – Flexion/Extension and Adduction/Abduction are run common to 23° bi-axial rocking motion.
- **Anatomical or Inverted** – Anatomically correct or inverted cup orientation can both be put into practice allowing researchers greater study flexibility
- **Speed** - Up to 1.5Hz cycle speed, computer adjusted.
- **Large Diameter Components** – compliant for testing large diameter components up to 66mm in bearing diameter.
- **Large Volume** – serum test chamber can accommodate up to 1000ml of testing lubricant
- **Access** – Separate ergonomic Lexan hoods cover each station from external environment
- **Compact Footprint** – Approx. footprint 1790mm (70.5") [1994mm (78.5")] long X 533mm (21") wide X 1473mm (58") [1555mm (61.25")] high.
- **24/7** – Continuous 24 hour operation seven days a week with load/rotation safety shutdown or fluid level shutdown.
- **Independent Control** – Each actuator on each series can be independently controlled under manual mode outside its normal automatic operation

[] – modular loaded-soak option

CONTROL SYSTEM

The Hip Wear Simulator controller system is based on Shore Western's new SC6000 platform running under a Windows XP environment. Depending on the ISO specification simulated the controller functions both in displacement and load control using Shore Western's Mixed Input-

Real Time Adaptive Control (MI-RTAC) algorithm. The MI-RTAC algorithm compensates for cumbersome servo-hydraulic tuning while monitoring and correcting via a point-by-point basis amplitude and phase of the control waveform(s). The controller monitors user definable peak and valley error detects combined with rotation or gait synchronization across all channels to the control waveform.

OPTIONS

- **Individual peristaltic pump** for each channel with level and temperature interlock in each serum test chamber - lubricant temperature can be set and is maintained via heater/chiller unit.
- **Loaded-Soak Stations** (Loaded-Soak Stations do not translate hip kinematics). Two options are available; modular loaded-soak which is placed on one end of the hip simulator, accepting three daisy-chained specimens on each load channel for a total of twelve specimens or an individual soak load frame with each station accepting up to six daisy-chained specimens on each load channel for a total of twelve specimens. Each station includes independent control with load feedback. Cyclic loads are synchronized simultaneously with each wear test station and can be discretely isolated and adjusted. The individual loaded-soak frame can accommodate both knee and hip components giving bi-functionality over the modular option.
- **Calibration fixtures** to calibrate the multi-axis load cell. A single axis calibration cell is used to calibrate the Fz load to full scale.



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