SERVOSLED™
SERVO-ACCELERATOR SLED SYSTEMS

1.8MN ServoSled

Hyge Upgrade with Flush Rail
Seattle Safety ServoSled™ System
ServoSled™ servo-accelerator sled systems give full computer pulse control and high performance using a servo-hydraulic system 1/1000 the size of conventional servo-hydraulic sleds. This breakthrough is made possible by using the servo-hydraulics to modulate a friction brake rather than directly push the sled.

- Faster – The small single-stage servo-hydraulic system gives frequency response to 250 Hz, higher than any competitor.
- More Accurate – Faster servo-hydraulics reduce time delay. Less delay means real-time closed-loop control is possible for real-time pulse error correction.
- Easier to Use – Faster, more-linear servo-hydraulics and real-time correction allow the user to run a new pulse with good results on the first try.
- Simpler – The small hydraulic system makes for a more compact and serviceable system. Maintenance is greatly reduced.

System Schematic
**Integrated Zero-G and Side-Impact Capability**

Every ServoSled™ system can apply both positive and negative force to the sled. This is made possible by the unique location of the friction surfaces on the sled itself. Side impact testing requires no additional systems for positive/negative pulses. Also, frontal pulses may dip below zero without danger of losing ram contact.

The sled is dynamically analyzed using finite element analysis to produce an exceptionally stiff and lightweight structure. Sled guidance is by rollers for all loads, with the rail hardened and machined. A precision-threaded hole pattern provides optional payload connection using steel inserts for durability and maintainability. The sled brakes are mounted off-sled, applying friction to a sled-mounted blade, reducing sled weight and complexity, and improving reliability. Automated sled brake control is standard with the ServoSled™ system.

The rail is installed with the top surface level with the surrounding floor, providing a safe unimpeded walking surface. The grooves in the floor needed for guidance are narrow and unobtrusive. Overall installation is very clean, with minimal site impact and simplified civil work.

Camera outriggers, XYZ coordinate measuring devices, rapid sled payload changing system, and other fixturing options are available.

**Software and Control System**

The ServoSled™ system is fully computerized, with automated control of compressor, hydraulic power units, cylinder fill and bleed, and sled brake pressure. All system settings are calculated, set, and checked automatically.

Real-time control is run on an embedded Intel P4 processor running a real-time deterministic operating system. The processor achieves a 10-kHz loop update rate with real-time data collection, analysis, and calculation. The operating system isolates the control algorithm from delays, interrupts, and instability of a conventional operating system. The Windows interface runs on a separate computer communicating by TCP-IP.
Running a Test

Enter the Pulse – SAEJ211 filtering is user selectable to any filter class. We recommend CFC1000 for the entered waveform to allow various levels of filtering.

Calibrate System – Comprehensive self-check automatically tests and calibrates sensor and servo-valve response. The frequency response of the system is accurately predicted and graphed for each pulse and payload. This graph, right, gives an excellent pretest prediction of the response. At this time, filtering may be adjusted to vary frequency content. The graph shows frequency responses ample for CFC60 (predicted and target curves are nearly the same).

Enter Payload Weight – The control software uses a mathematical model of the system to predict a valve control signal for any pulse. Needed pressures are automatically calculated, and peak g and stroke are verified as within system capability.

Rerunning the calibration with the pulse filtered to CFC100 still shows excellent response. The ServoSled™ system can successfully run the dynamic pulse at greater than CFC60 response!

During the test, real-time closed-loop corrections are made to the valve control signal for excellent repeatability and fast tuning to a new pulse.

ServoSled™ System Capacities

<table>
<thead>
<tr>
<th></th>
<th>1.8 MN ServoSled™</th>
<th>3.0 MN ServoSled™</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Force</td>
<td>1800 kN (403,000 lb)</td>
<td>3000 kN (674,000 lb)</td>
</tr>
<tr>
<td>Available Stroke</td>
<td>1700 mm (67 in.)</td>
<td>1700 mm (67 in.)</td>
</tr>
<tr>
<td>Maximum Velocity</td>
<td>75 kph (47 mph)</td>
<td>80 kph (50 mph)</td>
</tr>
<tr>
<td>Peak Acceleration</td>
<td>90 g</td>
<td>110 g</td>
</tr>
<tr>
<td>Maximum Jerk</td>
<td>8 g/ms</td>
<td>20 g/ms</td>
</tr>
<tr>
<td>Maximum Payload</td>
<td>3000 kg (6600 lb)</td>
<td>4000 kg (8800 lb)</td>
</tr>
<tr>
<td>Sled Dimensions (L x W)</td>
<td>3.5 m x 1.5 m (138 in. x 59 in.)</td>
<td>4 m x 1.5 m (157.5 in. x 59 in.)</td>
</tr>
</tbody>
</table>

Upgrade Your Hyge/Bendix/MGA/Hodogaya System

ServoSled™ systems offer a simple upgrade path for existing pin-orifice accelerator systems. The conversion provides high frequency pulse capability, increased accuracy and repeatability, reduced tuning tests, and elimination of pin changing. The existing reaction block, rail, and air compressors can be used. Force increases are possible within reaction block limits.

System Integration

Seattle Safety is experienced in complete sled system integration, installation, and training. Data acquisition, airbag squib fire, transducers, photometric instrumentation, dummies, floodlights, custom fixturing, and triggering are all offered. Full integration of customer equipment to the sled control software is available.
ServoSled Pulse Examples - CFC 60 Filtering

ServoSled - 100Hz Pulse

ServoSled - Double Hump Pulse

ServoSled - Pulse Tuning

ServoSled - Pulse Repeatability

ServoSled - Late Onset Pulse

ServoSled - Rear Impact Pulse

1222 6th Avenue North
Kent, WA 98032 USA
www.seattlesafety.com

Tel: 253-395-4321
Fax: 253-981-0223
E-mail: info@seattlesafety.com
Ver. 5.04