

BioRiD-II



Technical Product Sheet

The BioRID-II was originally developed by Chalmers University in Gothenburg, Sweden and has been produced by Humanetics. In fabricating the dummy, Humanetics has solicited user feedback from academia and industry, incorporating subtle improvements that improve dummy usability on top of Humanetics' high standards for calibration and production. Humanetics also incorporated the latest recommendations from global users, as well as ensuring that components met the latest anthropomorphic shell data.

The BioRID-II was created to assess seat restraints in a rear impact scenario, after extensive testing on prior dummy models indicated a severe lack of biofidelity. The BioRID-II's distinguishing feature is its vertebral column, which consists of 24 separate vertebra: 5 lumbar, 12 thoracic, and 7 cervical. A combination of torsion washers, urethane bumpers, and muscle-simulating springs provide biofidelic performance. The vertebral column is installed inside a silicone jacket featuring pin linkages to the vertebra and a water filled bladder in the abdominal region.

Dummy Features

Head & Neck

The skull, cap and skins are Hybrid III hardware with modifications to accommodate the unique design of the BioRID-II. The skull features a modified keensert on the crown to accept the head leveling tool, while the skin is modified in the chin area to provide clearance for the cervical vertebra assembly. The rear of the skull and cap feature cutouts to accommodate the cable exit bundle. This feature is presently under review and may be altered depending on global consensus. The head accommodates standard measurement hardware including tri-axial accelerometer blocks, and the upper neck structural replacement can be exchanged for a low capacity, 6-axis upper neck load cell.

Neck-Cervical Vertebrae

The neck of the BioRID-II consists of 7 cervical vertebrae and an Occipital Condyle plate. The OC plate holds the cable adjustment hardware for the muscle substitute springs and the damper system, and protrudes into the modified skull. The vertebrae are made from Delrin and feature two urethane bumpers of varying durometer depending on location. The C4 vertebra can accept a 2-axis accelerometer block.

Thorax-Thoracic Vertebrae

There are twelve thoracic vertebrae from T1-T12. The T1 vertebra is in the traditional lower neck position, and is offered in a 5-axis load cell made of aluminum. Both the load cell and the structural replacement feature cable removal stops that eliminate the need to cut the cables when removing them. In addition to accommodating a 2-axis accelerometer block, they are also able to directly mount angular rate sensors to either side of the vertebra.

The remaining vertebrae from T2-T12 are of Delrin construction and feature urethane bumpers. The vertebrae are coupled together with stainless steel torsion pins, featuring a spline that locks into alternating sets of stainless steel torsion washers. The torsion washers are adjustable and set the vertebra into the appropriate position using the Humanetics spine set up tool, and in the dummy transfer torsion from the vertebra down the spinal column. They also provide holes for the jacket pins to attach, which protrude from each side of the dummy into the silicone flesh. The T4 torsion washer is slightly different to accommodate the mounting of the fluid filled damper, which controls the rate of head rotation. On the opposite side, two spring muscle substitutes are mounted in Delrin tubes which insert into the T4 vertebra and thread through the upper vertebra and the neck up to the OC plate. This system works together to form the core of the performance of the BioRID dummy.



Technical Specifications

Lumbar Vertebrae and Pelvis

The lumbar vertebrae consists of 5 vertebrae featuring larger urethane bumpers and the same torsion pin/washer arrangement as the thoracic vertebra. The column interfaces with the pelvis at the L5 location, which is also offered as a 5-axis load cell. The Sacrum-to-L5 Interface Plate mates the spine assembly to the modified Hybrid III pelvis, which features a lower cut iliac and larger leg openings.

Legs and Arms

The legs and arms of the dummy are standard Hybrid III 50th, with the option to include any of the sensors available for these appendages. Humanetics has developed a modified upper leg to accommodate a DTS G5 unit for an iDummy version of the BioRID-II, which is also available.

Simulation Models

Humanetics offers highly detailed and fully validated Finite Element (FE) Models of its dummies in the codes LS-DYNA, PAM-CRASH, ABAQUS and RADIOSS, along with FE modeling consultancy services.

Weight Specification

Body Segment	Mass (lb)	Tol. (lb +/-)
Head Assembly	10.0	0.1
Torso Assembly	93.5	1.0
Arm Assembly, Left	9.3	0.4
Arm Assembly, Right	9.3	0.4
Leg Assembly, Left	25.2	0.5
Leg Assembly, Right	25.2	0.5
Total Weight	172.50	3.0

Dimensions

Measurement	Dim. (in)	Tol. (in +/-)
Total Sitting Height	34.80	.20
Shoulder Pivot Height	20.20	.30
Hip-Point Height (ref.)	3.40	.10
Hip-Point from Backline (ref.)	5.40	.10
Shoulder Pivot from Backline	3.50	.20
Thigh Clearance	5.80	.30
Back of Elbow to Wrist Pivot	11.70	.30
Head Back from Backline (ref.)	1.70	.10
Shoulder to Elbow Length	13.30	.30
Elbow Rest Height	7.90	.40
Buttock to Knee	23.30	.50
Popliteal Height	17.40	.50
Knee Pivot Height	19.40	.30
Buttock Popliteal Length	18.30	.50
Foot Length	10.20	.30
Foot Width	3.90	.30
Shoulder Breadth	16.90	.30
Hip Width at H-Point	14.30	.30

Instrumentation

Location	Description	Channels
Head	Tri-axial Accel Pack 1 Accel to compute anglular acceleration 6-Axis Upper Neck Load Cell C4 Bi-axial Accel Pack	Ax, Ay, Az Az Fx, Fy, Fz, Mx, My, Mz Ax, Az
Neck	T1 Bi-axial Accel Pack T1 3-Axis Load Cell DTS Angular Rate Sensor (calibration) T8 Bi-axial Accel Pack	Ax, Az Fx, Fz, My AR Ax, Az
Thorax	L1 Bi-axial Accel Pack L5 6-Axis Load Cell	Ax, Az Fx, Fy, Fz, Mx, My, Mz
Pelvis	Tri-axial Accel Pack	Ax, Ay, Az