

Technical Product Sheet

BioRID II, 590-0000

The BioRID II was originally developed by Chalmers University in Gothenburg, Sweden and has been produced by First Technology Safety Systems. In fabrications the dummy, FTSS has solicited user feedback from academia and industry, incorporating subtle improvements that improve dummy usability on top of FTSS' high standards for calibration and production. FTSS 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 vertebrae: 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

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, six-axis upper neck load cell.

Neck-Cervical Vertebrae

The neck of the BioRID consists of seven 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 bumpers feature a locating

hole system that speeds replacement and realignment very quick. The C4 vertebra can accept a two-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 five-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 two-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 FTSS 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.

Lumbar Vertebrae and Pelvis

The lumbar vertebrae consists of five 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 five-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. FTSS has developed a modified upper leg to accommodate a DTS G5 unit for an iDummy version of the BioRID, which is also available.

Segment Weights

Part	Weight (lbs.)	Tol. (+/-)
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

Test Equipment

Part No.	Description
TE-590	BioRID Calibration Sled Assembly

Instrumentation

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

Anthropometric Dimensions

Dimensions Descriptions	Specs. (in)	Tol. (+/- in)
Total Sitting Height	34.80	0.20
Shoulder Pivot Height	20.20	0.30
Hip Pivot Height (ref.)	3.40	0.10
Hip Pivot from Back Line (ref.)	5.40	0.10
Shoulder Pivot from Back Line	3.50	0.20
Thigh Clearance	5.80	0.30
Back of Elbow to Wrist Pivot	11.70	0.30
Head Back from Back Line (ref.)	1.70	0.10
Shoulder to Elbow Length	13.30	0.30
Elbow Rest Height	7.90	0.40
Buttock to Knee Length	23.30	0.50
Popliteal Height	17.40	0.50
Knee Pivot Height	19.40	0.30
Buttock Popliteal Length	18.30	0.50
Foot Length	10.20	0.30
Foot Width	3.90	0.30
Shoulder Breadth	16.90	0.30
Hip Width at H-Point	14.30	0.30