

**Vehicle Research and Test Center  
Eval of ATD THOR50M Shoulder Evaluation  
THOR-50M**

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**Summary Report**

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**Prepared For  
Vehicle Research and Test Center  
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**SECTION 1**  
**PURPOSE AND SUMMARY FOR THOR-50M**

The purpose of the testing is: (1) Evaluate THOR Shoulder design in Frontal Impacts (2) Evaluate THOR Shoulder design in 20°Oblique Impacts

**SUMMARY**

A THOR-50M (serial number 016) was secured in the left front occupant position (position 1 or P1). The THOR-50M was instrumented with head, spine (upper, middle and lower), and pelvis triaxial accelerometers, upper/lower neck, thoracic spine, ASIS, tibia and Femur force and moment load cells; acetabulum force load cells, knee displacement potentiometers and thorax and abdomen IRTRACC voltages. During this test series the dummy was restrained with a 3-point seatbelt and airbags.

Section 2 contains the driver's side 20° buck views of the dummy. Section 3 contains the driver's side 0° buck views of the dummy. Section 4 contains the dummy certification information.

**SECTION 2**  
**DRIVER SIDE 20° BUCK TEST SUMMARY**

**TEST DUMMY INFORMATION**

Description	Position # 1
ATD Type/Serial No.	THOR-50M/016
Restraint System	3-Point Seatbelt
Shoulder	Original (SD3) or Alternate (NHTSA)

**CAMERA POSITIONING FARO MEASUREMENTS**

Description	Units	X	Y	Z
Origin	mm	0.00	0.00	0.00
N3 Driver Shoulder	mm	-681.05	-452.28	-533.20
N1 Center	mm	-677.39	-721.72	-531.83

## DUMMY POSITIONING

THOR50M 016 – Original (SD3) – 20° Degrees

TRC Test Number: S201013-1

VRTC Test Number: FRT\_ALTSHLD\_01



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin-post	mm	-0.005	0.063	-0.082
SO	mm	447.647	404.633	-177.374
TS	mm	534.021	401.195	-339.996
BS	mm	396.944	404.091	-25.314
RHDCG	mm	-40.351	482.331	-483.331
Right EAM	mm	-30.379	476.197	-455.358
LHDCG	mm	-36.226	328.274	-480.572
Left EAM	mm	-29.342	333.234	-456.755
NS	mm	58.488	408.863	-493.916
Right IOF	mm	55.514	439.373	-455.930
Left IOF	mm	55.425	376.132	-456.361
TN	mm	58.469	408.647	-457.707
TC	mm	52.662	409.299	-357.513
C1	mm	85.657	409.720	-233.054
C2	mm	114.890	405.687	-177.721
C3	mm	204.471	405.501	-23.652
SHT1	mm	-62.092	212.510	-258.180
SHT2	mm	18.134	216.629	-244.335
E1	mm	185.362	138.300	-15.608
P1	mm	103.256	135.397	141.928
H-Point	mm	178.187	175.733	169.806
OK	mm	582.196	231.273	44.810
IK	mm	586.719	488.903	64.698

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

OA	mm	850.130	210.987	368.138
IA	mm	867.488	541.706	370.891
OH	mm	895.238	231.108	502.851
IH	mm	879.763	559.772	501.143
OP	mm	-236.547	312.791	-337.232
Shoulder Belt Top	mm	82.736	408.703	-241.649
Shoulder Belt Bottom	mm	128.308	408.827	-174.185
Lap Belt Top	mm	232.796	408.175	18.854
Lap Belt Bottom	mm	253.859	408.136	59.713
HW	mm	760.428	409.695	-493.679
Seat Point	mm	313.847	171.342	306.728

**DUMMY INJURY**

HIC (36 ms)	N/A
HIC (15 ms)	N/A
BrlC	067
NIJ Max	0.43
Chest Deflection (mm)	43.7
Abdomen Deflection (mm)	45.3
Acetabulum Force (N)	4421.9
Femur Force (N)	-4796.1

## DUMMY POSITIONING

THOR50M 016 – Original (SD3) – 20° Degrees

TRC Test Number: S201022-1

VRTC Test Number: FRT\_ALTSHLD\_02



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin-post	mm	-0.023	0.164	0.195
SO	mm	448.658	408.119	-179.724
TS	mm	532.388	409.689	-345.442
BS	mm	396.847	409.216	-28.553
RHDCG	mm	-32.980	486.700	-483.044
Right EAM	mm	-23.670	481.088	-454.520
LHDCG	mm	-28.382	332.438	-481.275
Left EAM	mm	-20.889	338.192	-457.672
NS	mm	65.255	413.593	-494.509
Right IOF	mm	60.933	444.935	-456.188
Left IOF	mm	60.303	381.016	-456.889
TN	mm	61.046	413.768	-457.341
TC	mm	58.525	412.803	-357.212
C1	mm	89.200	410.442	-229.595
C2	mm	115.741	411.580	-178.235
C3	mm	206.483	411.858	-27.121
SHT1	mm	-52.794	213.503	-258.061
SHT2	mm	26.186	215.247	-240.602
E1	mm	193.085	146.934	-13.048
P1	mm	107.331	137.695	145.408
H-Point	mm	182.282	177.211	172.192
OK	mm	586.029	230.699	49.028
IK	mm	592.668	486.924	64.166

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

OA	mm	849.360	217.043	375.816
IA	mm	867.899	540.918	373.027
OH	mm	886.128	234.174	510.635
IH	mm	881.345	565.081	506.520
OP	mm	-225.910	316.238	-339.864
Shoulder Belt Top	mm	80.589	410.303	-241.007
Shoulder Belt Bottom	mm	119.727	410.852	-169.781
Lap Belt Top	mm	233.969	411.880	18.374
Lap Belt Bottom	mm	256.440	411.202	57.112
HW	mm	758.950	412.324	-493.032
Seat Point	mm	313.926	173.636	306.830

**DUMMY INJURY**

HIC (36 ms)	371
HIC (15 ms)	195
BrIC	0.98
NIJ Max	0.46
Chest Deflection (mm)	47.8
Abdomen Deflection (mm)	49.2
Acetabulum Force (N)	6614.1
Femur Force (N)	-7174.4

**SECTION 3**  
**DRIVER SIDE 0° BUCK TEST SUMMARY**

Description	Position # 1
ATD Type/Serial No.	THOR-50M/016
Restraint System	3-Point Seatbelt
Shoulder	Original (SD3) or Alternate (NHTSA)

**CAMERA POSITIONING FARO MEASUREMENTS**

Description	Units	X	Y	Z
Origin	mm	0.00	0.00	0.00
N3 Driver Shoulder	mm	-681.05	-452.28	-533.20
N1 Center	mm	-677.39	-721.72	-531.83

## DUMMY POSITIONING

THOR50M 016 – Alternate (NHTSA) – 0° Degrees

TRC Test Number: S201123-1

VRTC Test Number: FRT\_ALTSHLD\_07



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin-post	mm	0.429	0.110	-0.033
SO	mm	447.398	410.684	-181.725
TS	mm	530.989	408.631	-346.503
BS	mm	397.101	412.057	-29.849
RHDCG	mm	-34.270	485.920	-480.708
Right EAM	mm	-25.184	481.084	-452.421
LHDCG	mm	-31.815	331.419	-477.124
Left EAM	mm	-23.396	336.362	-453.425
NS	mm	62.618	411.573	-493.782
Right IOF	mm	60.623	443.090	-455.497
Left IOF	mm	60.416	377.781	-455.450
TN	mm	64.132	410.519	-456.848
TC	mm	60.750	412.649	-356.960
C1	mm	91.566	409.690	-231.661
C2	mm	122.057	412.299	-182.633
C3	mm	209.098	412.335	-26.379
SHT1	mm	-45.739	207.638	-253.937
SHT2	mm	32.989	207.510	-244.943
E1	mm	182.749	149.987	-10.067
P1	mm	102.021	135.053	147.774
H-Point	mm	177.927	171.927	175.036
OK	mm	584.695	225.932	43.288
IK	mm	594.431	485.456	56.698

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

OA	mm	846.711	214.234	372.143
IA	mm	859.442	544.980	377.606
OH	mm	876.591	235.517	508.374
IH	mm	867.046	586.138	506.415
OP	mm	-233.766	323.227	-333.946
Shoulder Belt Top	mm	85.212	411.559	-241.728
Shoulder Belt Bottom	mm	122.193	411.242	-171.894
Lap Belt Top	mm	237.187	411.199	19.563
Lap Belt Bottom	mm	263.264	411.312	58.350
HW	mm	768.144	410.784	-490.758
Seat Point	mm	315.077	174.935	304.279

**DUMMY INJURY**

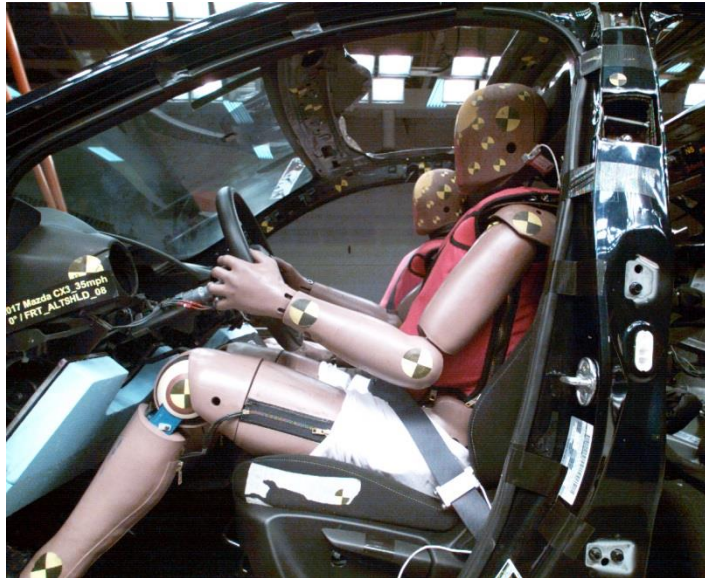
HIC (36 ms)	502
HIC (15 ms)	284
BrIC	0.93
NIJ Max	0.45
Chest Deflection (mm)	33.4
Abdomen Deflection (mm)	44.4
Acetabulum Force (N)	2434.0
Femur Force (N)	-6993.7

## DUMMY POSITIONING

THOR50M 016 – Alternate (NHTSA) – 0° Degrees

TRC Test Number: S201201-1

VRTC Test Number: FRT\_ALTSHLD\_08



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin-post	mm	0.591	0.335	-0.047
SO	mm	450.444	411.017	-181.244
TS	mm	535.818	410.508	-347.216
BS	mm	400.280	414.206	-30.851
RHDCG	mm	-42.198	479.911	-479.634
Right EAM	mm	-31.237	474.974	-452.497
LHDCG	mm	-30.376	326.632	-477.373
Left EAM	mm	-22.035	331.752	-454.224
NS	mm	59.301	411.057	-493.485
Right IOF	mm	55.745	442.119	-455.712
Left IOF	mm	59.104	378.548	-455.331
TN	mm	60.525	410.214	-456.242
TC	mm	57.087	411.595	-356.442
C1	mm	83.282	415.033	-229.667
C2	mm	115.186	413.968	-180.388
C3	mm	200.772	413.561	-31.830
SHT1	mm	-42.774	201.397	-255.185
SHT2	mm	37.135	207.461	-244.645
E1	mm	185.797	146.787	-11.658
P1	mm	110.041	136.024	147.668
H-Point	mm	184.006	177.580	175.927
OK	mm	579.965	216.270	49.519
IK	mm	587.825	487.601	57.225

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

OA	mm	842.372	211.718	378.734
IA	mm	851.626	539.844	376.872
OH	mm	867.718	243.839	510.971
IH	mm	863.612	579.030	502.754
OP	mm	-234.544	324.792	-330.157
Shoulder Belt Top	mm	77.236	412.743	-237.493
Shoulder Belt Bottom	mm	116.566	412.756	-167.537
Lap Belt Top	mm	231.422	410.030	26.162
Lap Belt Bottom	mm	254.403	411.234	66.402
HW	mm	764.963	411.182	-491.290
Seat Point	mm	314.459	175.818	306.078

**DUMMY INJURY**

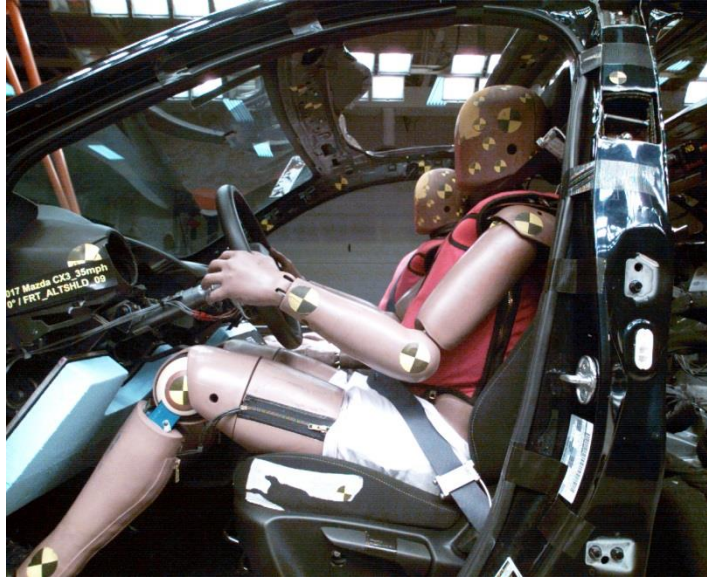
HIC (36 ms)	437
HIC (15 ms)	230
BrlC	0.84
NIJ Max	0.39
Chest Deflection (mm)	44.1
Abdomen Deflection (mm)	45.5
Acetabulum Force (N)	2819.6
Femur Force (N)	-6647.5

## DUMMY POSITIONING

THOR50M 016 – Alternate (NHTSA) – 0° Degrees

TRC Test Number: S201203-1

VRTC Test Number: FRT\_ALTSHLD\_09



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin-post	mm	0.491	0.323	-0.089
SO	mm	451.620	412.970	-182.379
TS	mm	535.283	410.486	-344.860
BS	mm	400.474	413.566	-31.718
RHDCG	mm	-41.357	485.101	-477.944
Right EAM	mm	-31.508	481.701	-451.733
LHDCG	mm	-37.671	330.736	-474.127
Left EAM	mm	-28.674	335.558	-450.721
NS	mm	55.748	412.131	-491.495
Right IOF	mm	54.175	441.924	-452.800
Left IOF	mm	54.329	378.290	-452.915
TN	mm	57.458	411.099	-454.334
TC	mm	55.448	412.443	-354.602
C1	mm	82.092	411.015	-231.982
C2	mm	112.687	416.122	-185.442
C3	mm	201.531	413.611	-33.166
SHT1	mm	-48.961	210.409	-251.996
SHT2	mm	28.534	207.859	-239.490
E1	mm	184.725	146.272	-14.800
P1	mm	108.069	133.725	147.763
H-Point	mm	182.740	173.893	175.059
OK	mm	582.806	219.136	47.235
IK	mm	590.000	485.593	57.480

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

OA	mm	849.740	214.364	371.399
IA	mm	854.160	539.806	376.203
OH	mm	869.112	228.483	507.553
IH	mm	858.155	580.533	507.550
OP	mm	-234.738	323.055	-330.777
Shoulder Belt Top	mm	71.330	413.327	-242.102
Shoulder Belt Bottom	mm	113.781	414.047	-175.279
Lap Belt Top	mm	233.233	411.985	22.158
Lap Belt Bottom	mm	255.889	410.536	61.908
HW	mm	770.028	414.407	-489.969
Seat Point	mm	313.863	174.749	305.811

**DUMMY INJURY**

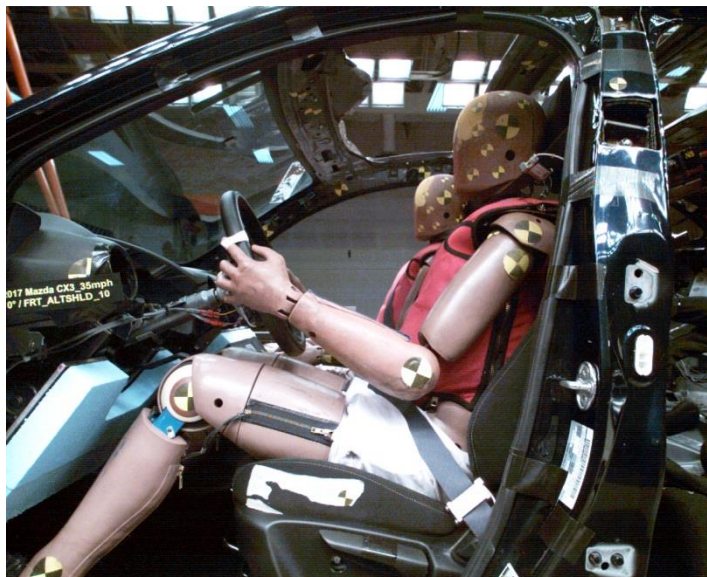
HIC (36 ms)	477
HIC (15 ms)	248
BrlC	0.85
NIJ Max	0.46
Chest Deflection (mm)	46.4
Abdomen Deflection (mm)	45.2
Acetabulum Force (N)	2844.6
Femur Force (N)	-6777.2

## DUMMY POSITIONING

THOR50M 016 – Original (SD3) – 0° Degrees

TRC Test Number: S201208-1

VRTC Test Number: FRT\_ALTSHLD\_10



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin-post	mm	0.451	0.302	-0.093
SO	mm	443.128	410.035	-180.143
TS	mm	524.575	412.220	-344.297
BS	mm	394.525	415.463	-29.811
RHDCG	mm	-38.032	490.274	-481.070
Right EAM	mm	-27.828	486.970	-453.532
LHDCG	mm	-33.241	336.027	-474.583
Left EAM	mm	-25.166	340.606	-450.890
NS	mm	59.226	418.355	-491.974
Right IOF	mm	57.178	449.729	-453.980
Left IOF	mm	58.370	385.518	-453.192
TN	mm	60.859	417.455	-455.008
TC	mm	57.607	419.015	-355.161
C1	mm	85.686	415.512	-228.115
C2	mm	118.050	414.018	-182.558
C3	mm	200.316	416.775	-27.995
SHT1	mm	-45.447	215.157	-250.638
SHT2	mm	32.295	215.599	-234.654
E1	mm	182.934	152.349	-1.754
P1	mm	102.387	143.835	153.983
H-Point	mm	177.316	174.404	181.239
OK	mm	580.018	233.458	48.590
IK	mm	591.660	486.762	62.436

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

OA	mm	844.830	210.420	376.060
IA	mm	865.243	537.111	373.847
OH	mm	867.680	237.695	511.168
IH	mm	872.939	586.620	507.007
OP	mm	-236.629	327.138	-330.234
Shoulder Belt Top	mm	75.168	413.193	-244.963
Shoulder Belt Bottom	mm	114.839	414.702	-173.044
Lap Belt Top	mm	229.068	415.447	23.020
Lap Belt Bottom	mm	255.788	414.796	62.258
HW	mm	765.512	420.982	-492.753
Seat Point	mm	313.948	175.535	306.242

**DUMMY INJURY**

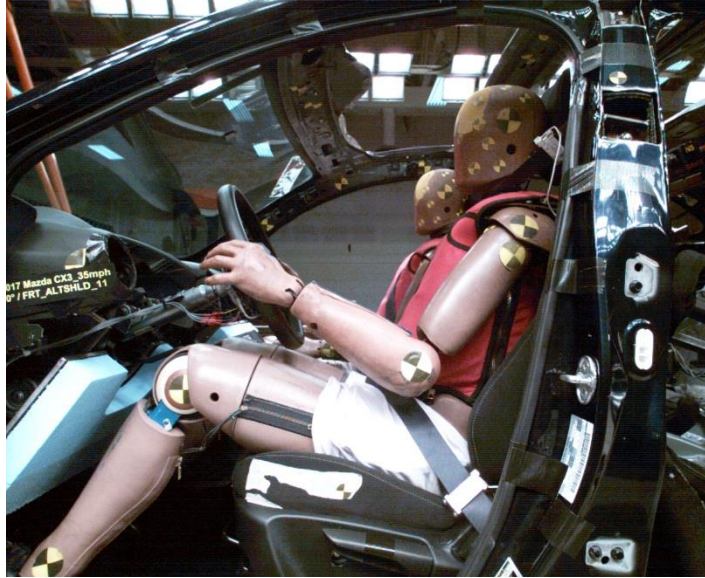
HIC (36 ms)	509
HIC (15 ms)	374
BrlC	0.73
NIJ Max	0.47
Chest Deflection (mm)	48.7
Abdomen Deflection (mm)	46.9
Acetabulum Force (N)	2152.8
Femur Force (N)	-5394.6

## DUMMY POSITIONING

THOR50M 016 – Original (SD3) – 0° Degrees

TRC Test Number: S201209-1

VRTC Test Number: FRT\_ALTSHLD\_11



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin-post	mm	0.639	0.357	-0.115
SO	mm	447.341	409.691	-181.846
TS	mm	531.926	412.113	-344.603
BS	mm	395.688	412.023	-29.360
RHDCG	mm	-39.634	488.008	-479.044
Right EAM	mm	-30.074	482.912	-450.631
LHDCG	mm	-35.706	334.592	-475.028
Left EAM	mm	-27.376	340.130	-451.782
NS	mm	57.820	415.992	-492.405
Right IOF	mm	55.310	447.638	-454.203
Left IOF	mm	56.698	383.366	-454.120
TN	mm	59.750	415.499	-455.409
TC	mm	56.842	416.446	-355.109
C1	mm	82.675	412.280	-233.830
C2	mm	112.041	408.747	-185.620
C3	mm	205.824	412.102	-27.794
SHT1	mm	-41.244	213.450	-250.176
SHT2	mm	38.201	219.077	-233.219
E1	mm	183.401	142.879	-0.686
P1	mm	106.944	142.703	149.309
H-Point	mm	182.799	172.309	176.464
OK	mm	583.618	220.466	44.764
IK	mm	594.622	490.911	52.774

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

OA	mm	845.000	220.248	374.309
IA	mm	852.809	545.279	374.842
OH	mm	869.682	227.964	510.389
IH	mm	859.427	593.505	504.501
OP	mm	-235.433	324.673	-329.917
Shoulder Belt Top	mm	71.905	413.676	-244.845
Shoulder Belt Bottom	mm	114.611	416.125	-176.930
Lap Belt Top	mm	238.478	414.915	21.665
Lap Belt Bottom	mm	259.525	415.703	63.401
HW	mm	764.771	414.217	-492.918
Seat Point	mm	314.078	175.525	305.200

**DUMMY INJURY**

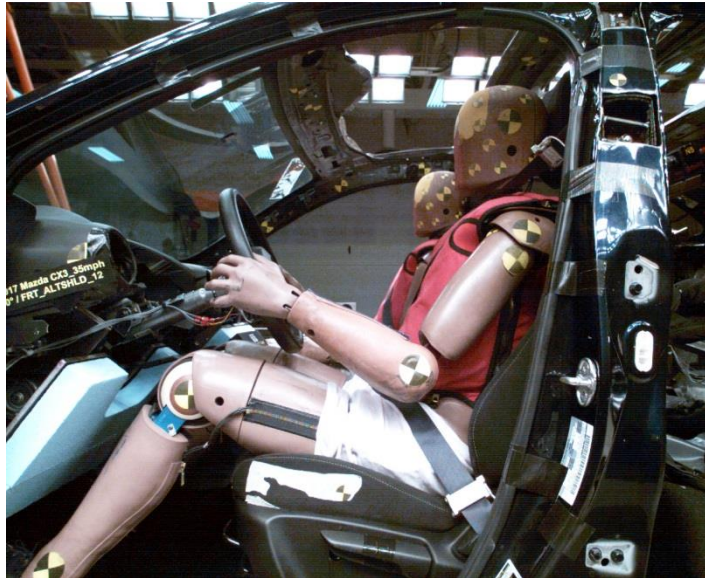
HIC (36 ms)	444
HIC (15 ms)	204
BrlC	0.88
NIJ Max	0.43
Chest Deflection (mm)	49.0
Abdomen Deflection (mm)	47.6
Acetabulum Force (N)	2680.8
Femur Force (N)	-6475.8

## DUMMY POSITIONING

THOR50M 016 – Original (SD3) – 0° Degrees

TRC Test Number: S201210-1

VRTC Test Number: FRT\_ALTSHLD\_12



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin-post	mm	0.550	0.364	-0.109
SO	mm	447.775	413.496	-177.903
TS	mm	530.782	415.435	-342.907
BS	mm	399.812	412.713	-28.977
RHDCG	mm	-37.339	482.758	-478.683
Right EAM	mm	-27.972	477.984	-452.051
LHDCG	mm	-35.718	329.433	-474.523
Left EAM	mm	-27.713	335.073	-451.319
NS	mm	58.425	409.549	-492.441
Right IOF	mm	56.465	440.357	-453.517
Left IOF	mm	56.444	376.532	-453.562
TN	mm	59.728	408.403	-454.667
TC	mm	56.917	410.760	-355.260
C1	mm	83.768	408.489	-231.706
C2	mm	118.977	413.781	-179.651
C3	mm	197.873	412.168	-26.480
SHT1	mm	-43.952	209.394	-245.741
SHT2	mm	33.461	214.360	-231.697
E1	mm	184.605	142.081	-0.335
P1	mm	98.756	144.987	151.920
H-Point	mm	174.273	177.338	179.160
OK	mm	576.181	225.997	51.020
IK	mm	585.624	492.396	53.032

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

OA	mm	840.389	215.826	379.141
IA	mm	854.251	539.601	370.446
OH	mm	868.534	239.451	510.138
IH	mm	875.911	583.883	505.393
OP	mm	-238.613	324.615	-329.155
Shoulder Belt Top	mm	71.479	411.388	-245.535
Shoulder Belt Bottom	mm	112.998	411.474	-171.991
Lap Belt Top	mm	229.068	411.452	21.829
Lap Belt Bottom	mm	248.856	411.515	60.016
HW	mm	766.008	408.026	-491.483
Seat Point	mm	312.890	175.605	305.305

**DUMMY INJURY**

HIC (36 ms)	432
HIC (15 ms)	216
BrlC	0.79
NIJ Max	0.52
Chest Deflection (mm)	47.9
Abdomen Deflection (mm)	48.9
Acetabulum Force (N)	3367.6
Femur Force (N)	-13056.2

## SECTION 4

### DUMMY CALIBRATION DATA