SAFETY COMPLIANCE TESTING FOR FMVSS No. 218 MOTORCYCLE HELMETS

Skid Lid, Model – U-69

Size – XL 61-62 cm

Prepared By

Southwest Research Institute®
6220 Culebra Road
San Antonio, Texas 78238-5166

SwRI Report No 18.10499.FTR.06-016

September 8, 2006

Final Report 218-SRI-06-016

Prepared For

U.S. Department of Transportation
National Highway Traffic Safety Administration
Office of Vehicle Safety Compliance
400 7th Street S.W.
Room 6111 (NVS-220)
Washington, DC 20590

Technician: Manuel Gonzalez
Manny R. Gonzalez

Project Manager: D J P
Daniel J. Pomerening

Approved By: Jenny L. Blankinship
Jenny L. Blankinship

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Accepted By: Claudia D Corell
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16. Abstract

Compliance tests were conducted on the Skid Lid Model U-69 motorcycle helmet in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-218-05.

Test failures identified were as follows:

S5.1 - The ambient, low temperature, and high temperature helmets failed the impact testing with peak accelerations in excess of 400g during the second impact onto the hemispherical anvil at the front and left side locations.

S5.6 – The DOT is not centered laterally at the rear of the helmet.

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Form DOT F 1700.7 (8-69)

TABLE OF CONTENTS

SECTION 1 PURPOSE OF COMPLIANCE TEST

1 PURPOSE OF COMPLIANCE TEST

This testing was conducted as part of the Department of Transportation, National Highway Traffic Safety Administration's Federal Motor Vehicle Safety Standard (FMVSS) No. 218, "Motorcycle Helmets"[1] Compliance Program. The purpose of the test was to determine if the production helmets supplied by the Office of Vehicle Safety Compliance satisfy the requirements of TP-218-05[2], as governed by the contract.

2 TEST PROCEDURE

The Southwest Research Institute Test Procedure for FMVSS No. 218[3] submitted to the Office of Vehicle Safety Compliance, National Highway Traffic Safety Administration, contains the specific procedures used to conduct this test. The Southwest Research Institute Test Procedure for FMVSS No. 218 as modified by project specific process travelers is in accordance with TP-218-05.

The test procedure shall not be in conflict with any portion of FMVSS No. 218 nor amendments in effect as noted in the applicable contract.

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[1] National Highway Traffic Safety Administration, Federal Motor Vehicle Safety Standard (FMVSS) No. 218, "Motorcycle Helmets", 49 CFR Chapter V Section 571.218, August 20, 1973 as last amended FR 12529 on April 15, 1988.

[2] National Highway Traffic Safety Administration, TP-218-05, Laboratory Test Procedure for FMVSS 218 Motorcycle Helmets, February 28, 2006.

[3] Southwest Research Institute, SwRI Test Procedure for Compliance Testing in Accordance with FMVSS No. 218 for Motorcycle Helmets, May 2006.

SECTION 2 COMPLIANCE TEST DATA SUMMARY

1 HELMET DATA

Helmet Brand Name:	Skid Lid
Helmet Model Designation:	U-69
Helmet Manufacturer:	Tong Ho Hsing Industrial Co. Ltd.
Helmet Size Designation:	XL 61-62 cm
Helmet Coverage:	Partial
Helmet Position Index (HPI) (cm):	6.00
Shell Material:	Polycarbonate
Liner Material:	Expanded Polystyrene
Buckle Description	D-Ring

Helmet	A Ambient	B Low Temp	C High Temp	D Water Immersed	E Spare
Shell Color/Pattern	Black	Black	White	White	Chrome
Weight (grams)	889	875	875	885	871
Month & Year of Manufacture	02/2006	12/2005	12/2005	04/2006	02/2006

Comments:

The HPI was supplied by NHTSA based on information obtained from the manufacturer.

The weight was with all auxiliary equipment removed ready for testing.

Photographs of the helmets are given in Appendix C (Photographs of Equipment).

The helmet data given was based on information provided with the helmets, information provided by NHTSA, and measured data.

2 SUMMARY OF TEST RESULTS

HELMET	A Ambient	B Low Temp	C High Temp	D Water Immersed
IMPACT (S5.1, S7.1)	FAIL	FAIL	FAIL	PASS
PENETRATION (S5.2, S7.2)	PASS	PASS	PASS	PASS
RETENTION (S5.3, S7.3)	PASS	PASS	PASS	PASS

CONFIGURATION (S5.4)	PASS
PERIPHERAL VISION/BROW OPENING (S5.4)	PASS
LABELING (S5.6)	FAIL

Comments: S5.1 Impact - The ambient, low temperature, and high temperature helmets failed the impact testing with peak accelerations in excess of 400g during the second impact onto the hemispherical anvil at the front and left side locations.

Ambient Helmet, Left Side Location, Hemispherical Anvil, Drop No. 2 – 432g
Low Temperature Helmet, Left Side Location, Hemispherical Anvil, Drop No. 2 – 402g
High Temperature Helmet, Left Side Location, Hemispherical Anvil, Drop No. 2 – 415g

Ambient Helmet, Front Location, Hemispherical Anvil, Drop No. 2 – 450g
Low Temperature Helmet, Front Location, Hemispherical Anvil, Drop No. 2 – 448g
High Temperature Helmet, Front Location, Hemispherical Anvil, Drop No. 2 – >450g

S5.6 Labeling – The DOT symbol is not centered laterally at the rear of the helmet.

3 SELECTION OF APPROPRIATE HEADFORM (S6.1)

Selection of the headform used during testing is based on the helmet size designation, marked on the helmet, as identified in the following table. If the size range is not specified on the helmet, consult with the COTR before beginning the test. As identified in FMVSS No. 218, if the helmet size designation falls into more than one of the size ranges, it shall be tested on each appropriate headform. Consult with the COTR before beginning the test.

HELMET SIZE DESIGNATION	HEADFORM SIZE	WEIGHT
≤ 6 3/4 ≤ European size 54	Small	3.5, +0.00, -0.063 kg 7.8, +0.00, -0.14 lbs
>6 3/4 but ≤ 7 1/2 >European Size 54 but ≤ European Size 60	Medium	5.0, +0.00, -0.090 kg 11.0, +0.00, -0.20 lbs
> 7 1/2 > European size 60	Large	6.1, +0.00, -0.108 kg 13.4, +0.00, -0.24 lbs

Comments: A large headform was used based on the discrete helmet size, XL 61-62 cm. The total weight of the drop assembly was 6.06 kg.

4 CONDITIONING FOR TESTING (S6.4)

The helmets shall be conditioned for not less than 12 hours in the specified environmental condition shown below, prior to testing.

IDENTIFICATION	CONDITIONS	HELMET
Ambient Conditions	21°C ± 6°C, 40% to 60% RH, Site Pressure 59°F to 81°F	A
Low Temperature	-10°C +8°C, -0°C 14°F to 28°F	B
High Temperature	50°C +0°C, -4°C 115°F to 122°F	C
Water Immersion	25°C ± 6°C 66°F to 88°F	D

The maximum time during which the helmet may be out of the conditioning environment shall not exceed 4 minutes. It must then be returned to the conditioning environment for a minimum of 3 minutes for each minute or portion of a minute in excess of 4 minutes out of the conditioning environment or 12 hours, whichever is less, prior to resumption of testing.

The first test shall be performed at a time greater than 2 minutes after removal from conditioning. The second test in a sequence shall be performed before the 4-minute limit.

The helmets were conditioned prior to testing. Records of the conditioning are given in Section 3.1 (Conditioning Environments).

Comments: None.

5 IMPACT TESTING (S5.1 & S7.1)

The helmets were subjected to the impact attenuation testing in accordance with the requirements of S5.1 and S7.1 of FMVSS No. 218.

Tong Ho Hsing Industrial Co. Ltd., Skid Lid U-69, XL 61-62 cm
Impact Testing

Anvil	Impact Velocity
Hemispherical	4.8 to 5.2 m/sec
Flat	5.6 to 6.0 m/sec

Temperature C	Relative Humidity %
21	53

Headform Size = Large
Impact Position on Crown

Drop Assembly Weight = 6.06 kg

System Check	Drop No	Drop Height (cm)	Vel (m/sec)	Peak Acceleration (g)	Dwell Time (msec)	
					at 150 g's	at 200 g's
Pre Test	1A	127	4.76	398	2.08	1.80
	2A	127	4.82	403	2.08	1.80
	3A	127	4.82	406	2.12	1.80
Pre Test Average		---	---	402	---	---
Post Test	1B	127	4.89	407	2.10	1.80
	2B	127	4.89	406	2.12	1.84
	3B	127	4.82	407	2.12	1.82
Post Test Average		---	---	407	---	---
Difference Between Pre Test and Post Test Averages				5	Difference Not to Exceed 40 g's	

Tong Ho Hsing Industrial Co. Ltd., Skid Lid U-69, XL 61-62 cm
Impact Testing

Helmet Designation	Helmet Condition	Helmet Type	Impact Location (+/- 45 degrees)							
		Partial/Full	Left Side		Front		Right Side		Rear	
		Complete	Left Front		Right Rear		Right Front		Left Rear	
		Impact No.	1	2	1	2	1	2	1	2
A	Ambient	Anvil	Hemi		Hemi		Flat		Flat	
		Test Record No.	3	4	11	12	19	20	27	28
		Peak g	121	432	138	450	189	299	175	218
		ms @ 150 g	0.00	1.42	0.00	1.34	2.58	2.40	2.50	2.78
		ms @ 200 g	0.00	1.10	0.00	1.02	0.00	1.74	0.00	1.36
		Velocity m/sec	5.04	5.04	5.03	4.96	5.73	5.74	5.72	5.74
B	Low Temperature	Anvil	Hemi		Hemi		Flat		Flat	
		Test Record No.	5	6	13	14	21	22	29	30
		Peak g	124	402	155	448	195	236	180	216
		ms @ 150 g	0.00	1.56	0.30	1.32	2.58	2.48	2.62	2.80
		ms @ 200 g	0.00	1.18	0.00	1.02	0.00	1.66	0.00	1.46
		Velocity m/sec	5.03	5.11	4.97	5.12	5.73	5.72	5.72	5.72
C	High Temperature	Anvil	Hemi		Hemi		Flat		Flat	
		Test Record No.	7	8	15	16	23	24	31	32
		Peak g	127	415	196	>450	184	352	163	205
		ms @ 150 g	0.00	1.28	0.96	1.18	2.34	2.22	1.88	2.66
		ms @ 200 g	0.00	1.02	0.00	0.98	0.00	1.74	0.00	0.40
		Velocity m/sec	5.04	5.04	5.04	4.96	5.63	5.72	5.63	5.72
D	Water Immersed	Anvil	Hemi		Hemi		Flat		Flat	
		Test Record No.	9	10	17	18	25	26	33	34
		Peak g	114	331	141	364	188	287	160	171
		ms @ 150 g	0.00	1.42	0.00	1.42	2.38	2.52	1.84	1.92
		ms @ 200 g	0.00	1.04	0.00	1.14	0.00	1.74	0.00	0.00
		Velocity m/sec	5.04	5.04	4.96	5.04	5.63	5.82	5.72	5.82

Comments: The helmet failed the impact testing with peak accelerations in excess of 400g for the following conditions:

Ambient Helmet, Left Side Location, Hemispherical Anvil, Drop No. 2 – 432g
Low Temperature Helmet, Left Side Location, Hemispherical Anvil, Drop No. 2 – 402g
High Temperature Helmet, Left Side Location, Hemispherical Anvil, Drop No. 2 – 415g

Ambient Helmet, Front Location, Hemispherical Anvil, Drop No. 2 – 450g
Low Temperature Helmet, Front Location, Hemispherical Anvil, Drop No. 2 – 448g
High Temperature Helmet, Front Location, Hemispherical Anvil, Drop No. 2 – >450g

6 PENETRATION (S5.2 & S7.2)

The helmets were subjected to the penetration test in accordance with the requirements of S5.2 and S7.2 of FMVSS No. 218.

Weight of Striker:	3, +0.000, -0.029 kg 6.625, +0.000, -0.065 lbs
Point of Striker:	Included angle of 60°, +1.0°, -0.0° Cone height of 3.8, +0.25, -0.00 cm (1.5, +0.1, -0.0 inches) Radius of 0.5, +0.08, -0.0 mm (0.019, +0.003, -0.000 inches) Minimum hardness of 60 Rockwell (Scale C)

The height of the free fall drop was 300, +0.00, -3.05 cm (118.1, +0.0, -1.2 inches) as measured from the striker point to the impact point on the outer surface of the test helmet. Two penetration blows are applied to each helmet at least 7.6 cm (3 inches) apart and at least 7.6 cm (3 inches) from the centers of any impacts applied during the impact attenuation test.

When tested, the test helmet shall be failed if the striker has made an indentation in the headform.

AMBIENT TEMPERATURE ºC	AMBIENT RELATIVE HUMIDITY %
21	54

TEST	HELMET	CONDITION	PASS	FAIL
1	A	Ambient	**PASS**	
2	A	Ambient	**PASS**	
3	B	Low Temperature	**PASS**	
4	B	Low Temperature	**PASS**	
5	C	High Temperature	**PASS**	
6	C	High Temperature	**PASS**	
7	D	Water Immersed	**PASS**	
8	D	Water Immersed	**PASS**	

Comments: This helmet passed the penetration testing. The free fall drop was 298.8 cm.

7 RETENTION SYSTEM TESTING (S5.3 & S7.3)

The helmets were subjected to the retention system testing in accordance with the requirements of S5.3 and S7.3 of FMVSS No. 218.

READING	APPLIED LOAD
INITIAL	22.7, +4.54, -0.0 kg 50, +10, -0 lbs.
FINAL	136, +0.0, -4.5 kg 300, +0.0, -10.0 lbs

AMBIENT TEMPERATURE ºC	AMBIENT RELATIVE HUMIDITY %
21	54

The acceptance criteria shall be that the retention system remained intact without elongating more than 2.54 cm (1 inch).

HELMET	CONDITIONS	INITIAL READING (cm)	FINAL READING (cm)	ELONGATION (cm)
A	Ambient	0.00	0.81	0.81
B	Low Temperature	0.00	0.94	0.94
C	High Temperature	0.00	0.91	0.91
D	Water Immersed	0.00	0.98	0.98

Time histories for the retention system testing are given in Section 3.3 Retention Time Histories. Given on these plots are the conditioning environment, load, and elongation.

Comments: This helmet passed the retention testing.

8 PERIPHERAL VISION AND BROW OPENING (S5.4)

The helmet shall provide a minimum peripheral vision of 105° to each side of the mid-sagittal plane through the basic plane. The brow opening shall be at least 2.54 cm (1 inch) above all points in the basic plane that are within the angles of peripheral vision.

	REQUIREMENTS	TEST RESULTS
PERIPHERAL VISION	> 105°	> 105 °
BROW OPENING	> 2.54 cm	> 2.54 cm

Comments: This helmet passed the peripheral vision and brow opening testing.

9 CONFIGURATION (S5.4)

The configuration of this helmet must be such that it has a protective surface of continuous contour at all points above the test line.

Comments: The helmet passed the configuration requirements.

10 PROJECTIONS (S5.5)

A helmet shall not have any internal rigid projections. External rigid projections shall be limited to those required for operation of essential accessories, and shall not protrude more than 5mm (0.20 inches).

PROJECTION	REQUIREMENT
INTERNAL RIGID	None
EXTERNAL RIGID	Operational, shall not protrude more than 5 mm (0.20 inches)

Test Results

PROJECTION	PRESENT	HEIGHT (mm)
INTERNAL	No	NA
EXTERNAL	Yes	7.6, 2.5

Comments: External projections include snap on the rear of the helmet (7.6 mm) that is located above the test line. The other external projections are rivets (2.5 mm) that are located above the test line.

11 LABELING (S5.6)

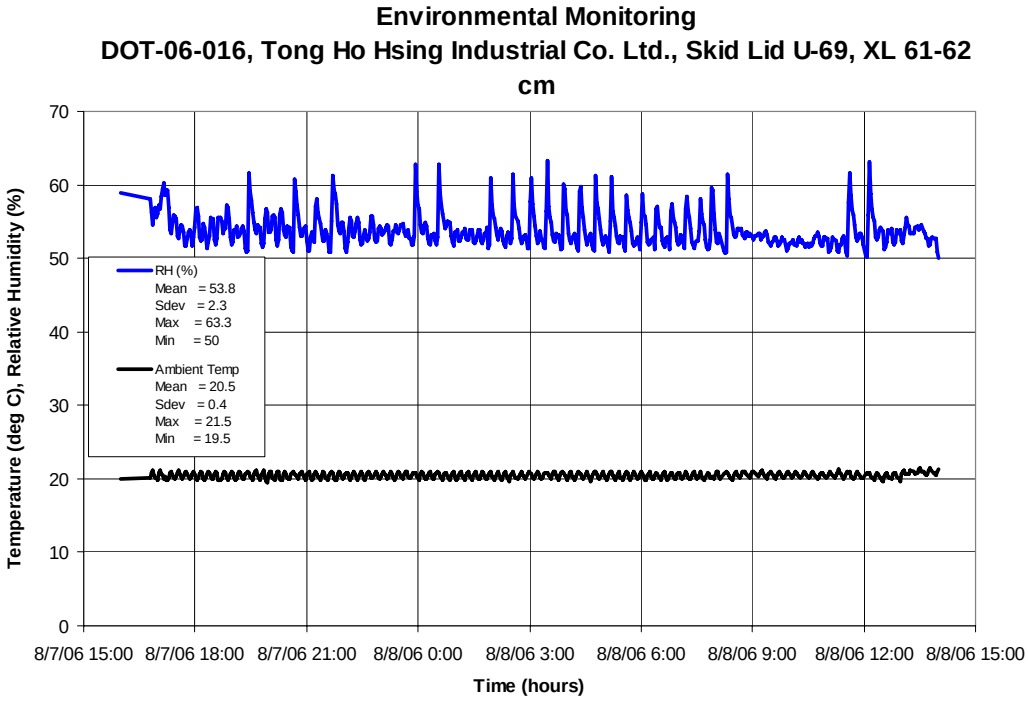
Each helmet shall be permanently and legibly labeled, in a manner such that the label(s) can be easily read without removing padding or any other permanent part. The following information shall be included:

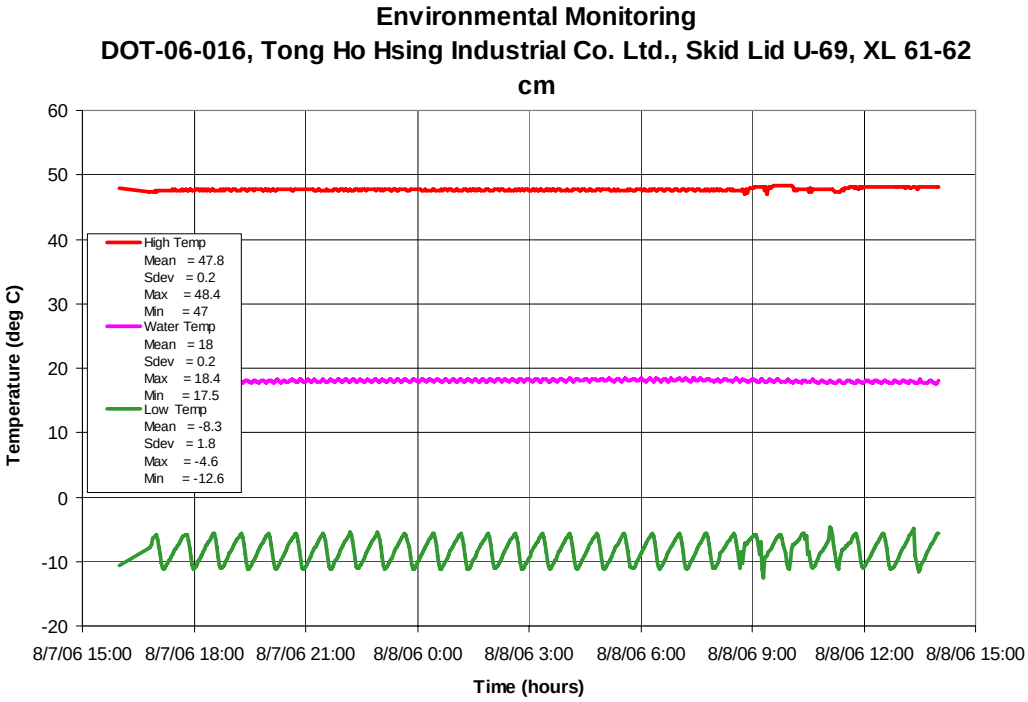
REQUIRED INFORMATION	PASS	FAIL
(1) Manufacturer's name or identification.	**PASS**	
(2) Precise model designation.	**PASS**	
(3) Size.	**PASS**	
(4) Month and year of manufacture.	**PASS**	
(5) The DOT symbol, constituting the manufacturer's certification that the helmet conforms to the applicable Federal Motor Vehicle Safety Standards. This symbol shall appear on the outer surface, in a color that contrasts with the background, in letters at least 1 cm (0.375 inch) high centered laterally with the horizontal centerline on the symbol located a minimum of 2.9 cm (1.125 inches) and a maximum of 3.5 cm (1.375 inches) from the bottom edge of the posterior portion of the helmet.		**FAIL**
(6) Instruction to the Purchaser as follows:		
Shell and liner constructed of (identify type(s) of materials)	**PASS**	
The helmet can be seriously damaged by some common substances without the damage being visible to the user.	**PASS**	
Apply only the following: (Recommended cleaning agents, paints, adhesives, etc. as appropriate).	**PASS**	
Make no modifications.	**PASS**	
Fasten helmet securely.	**PASS**	
If the helmet experiences a severe blow, return it to the manufacturer for inspection or destroy and replace it.	**PASS**	

Comments: The manufacturer's name was identified as Tong Ho Shing Industrial Co. Ltd. rather than Tong Ho Hsing Industrial Co. Ltd. The DOT symbol was located 4.2 cm above the rear edge of the helmet, specified between 2.9 and 3.5 cm. The DOT symbol is not centered laterally at the rear of the helmet.

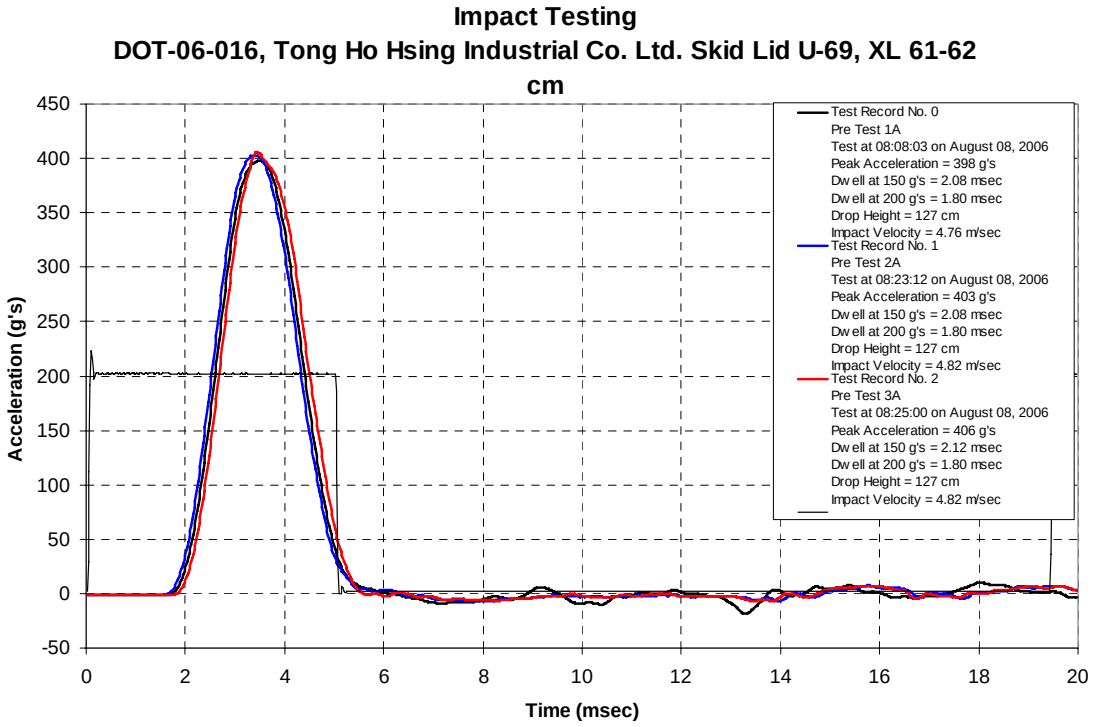
SECTION 3 TEST DATA

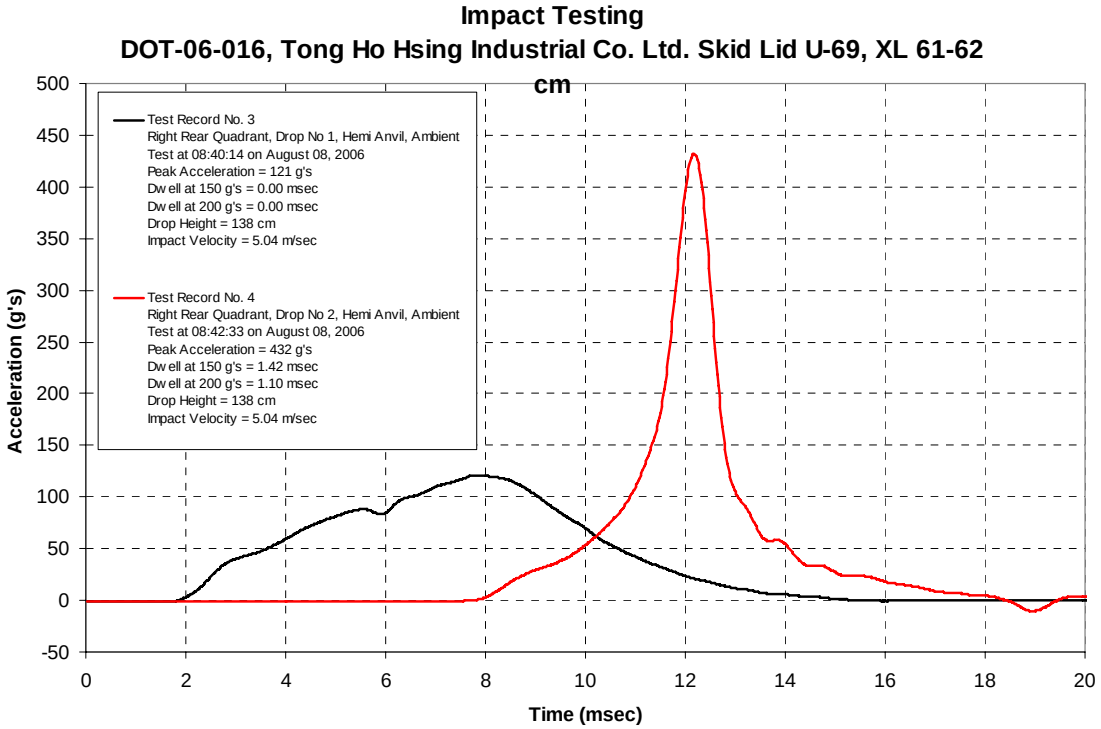
1 CONDITIONING ENVIRONMENTS

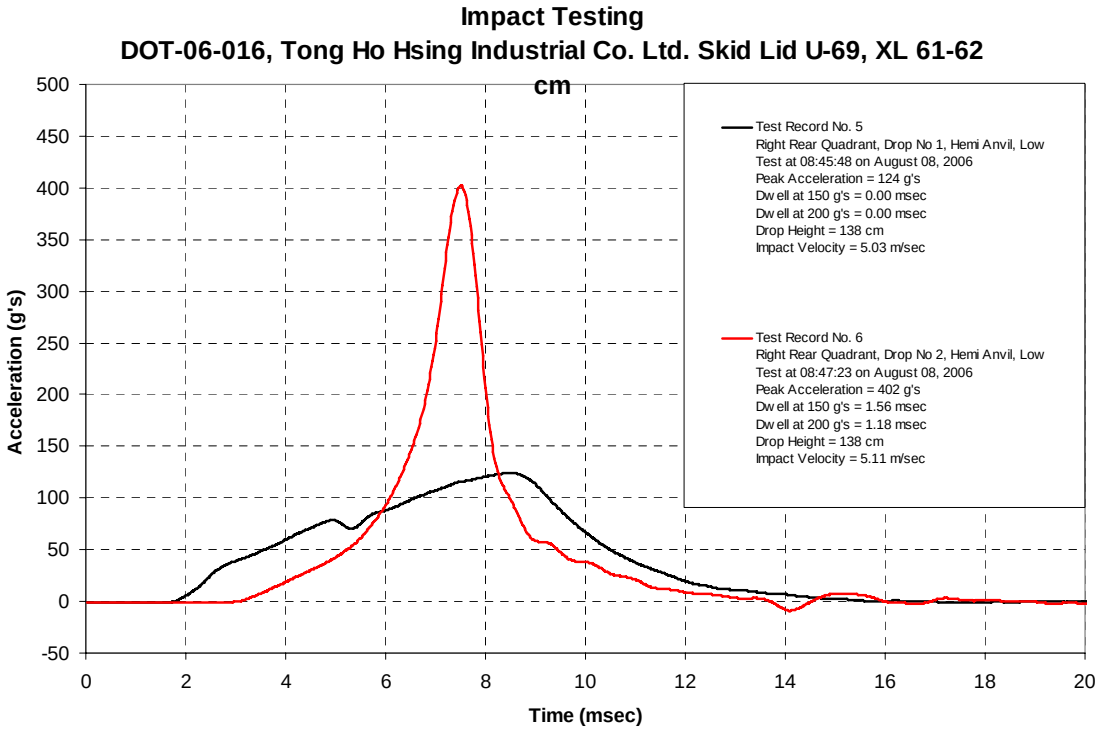


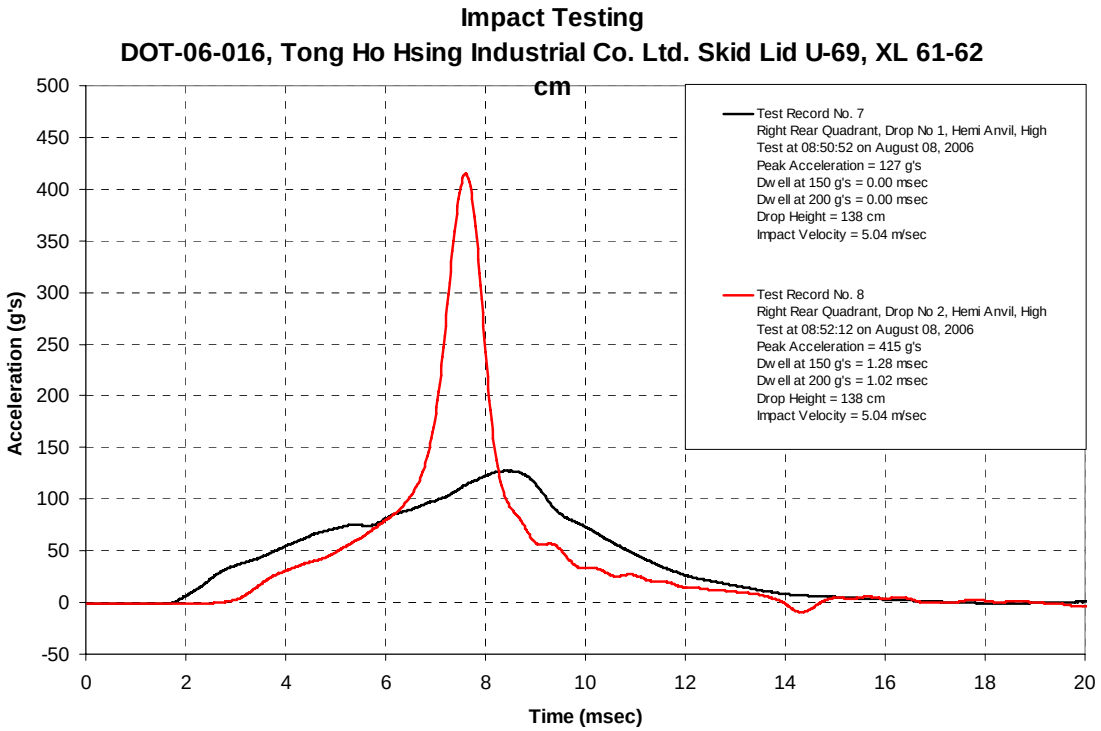


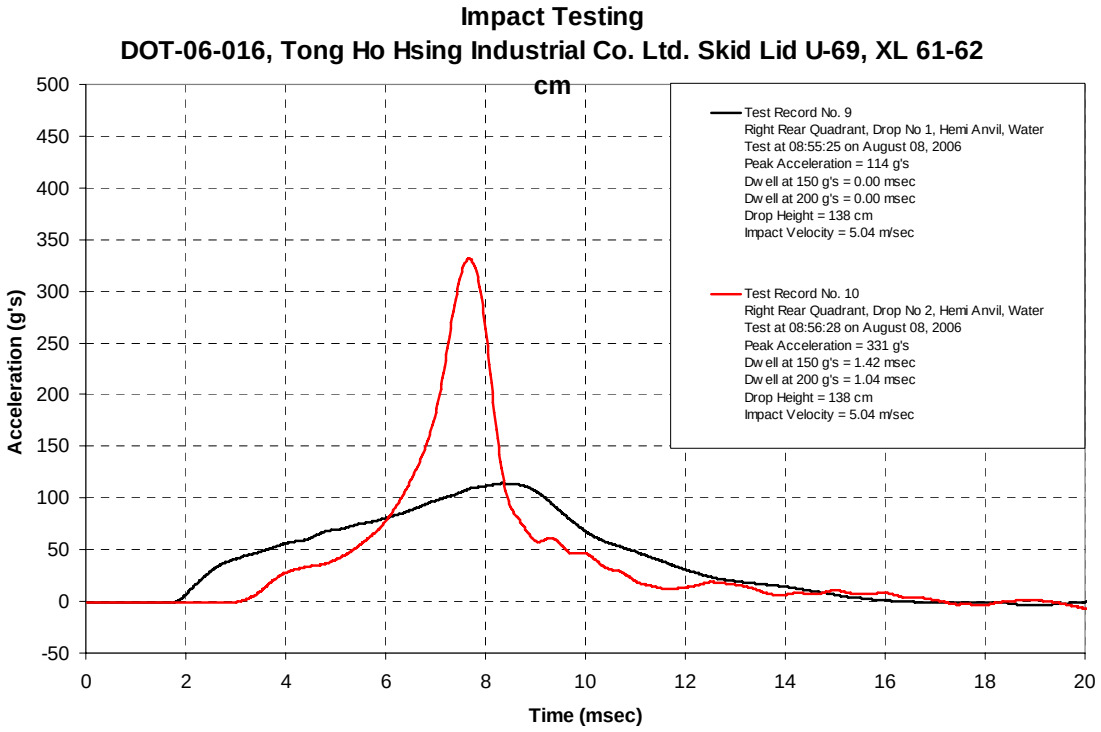
2 IMPACT TIME HISTORIES

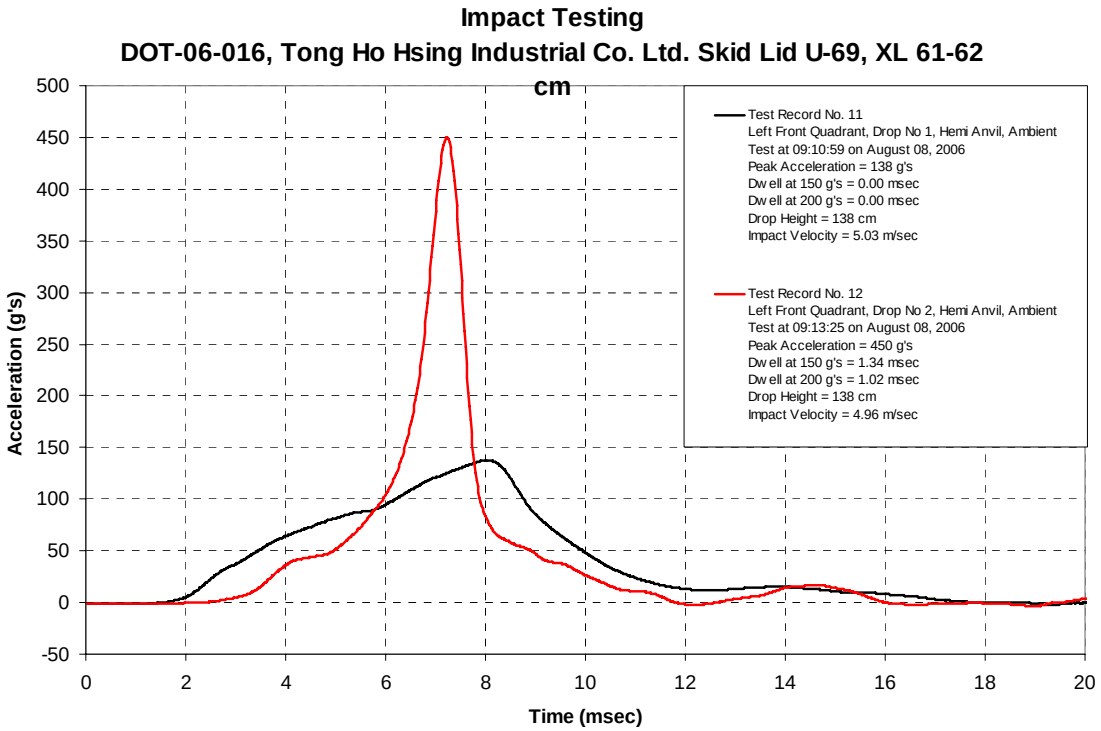


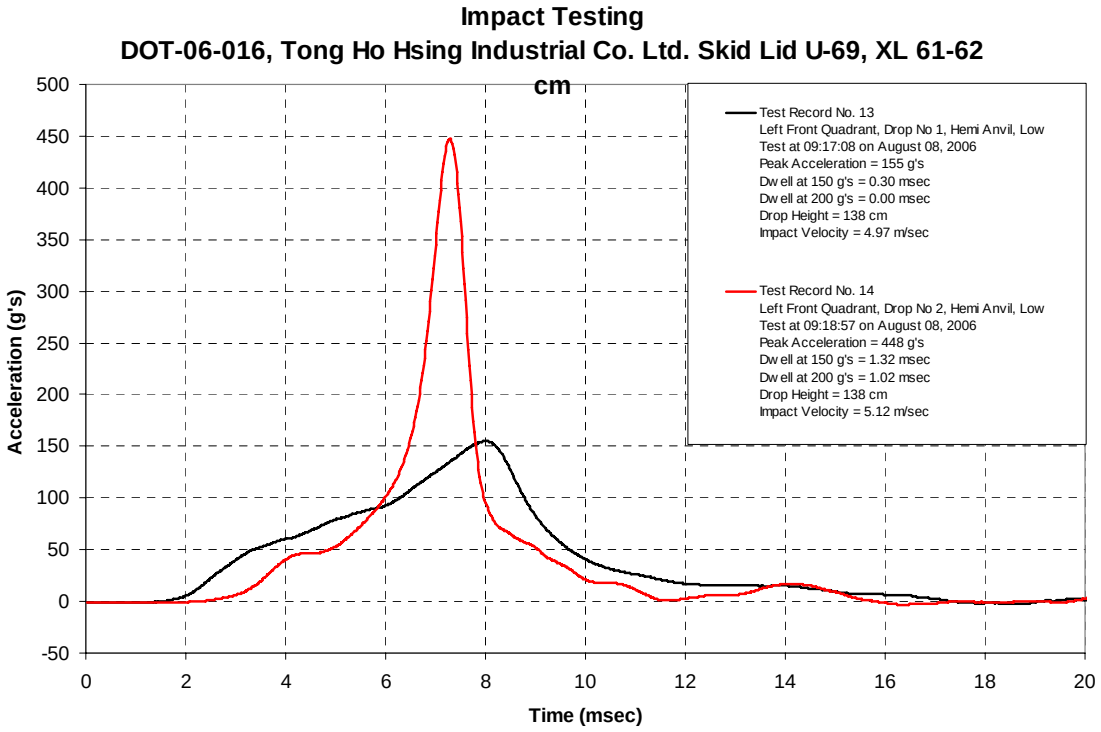


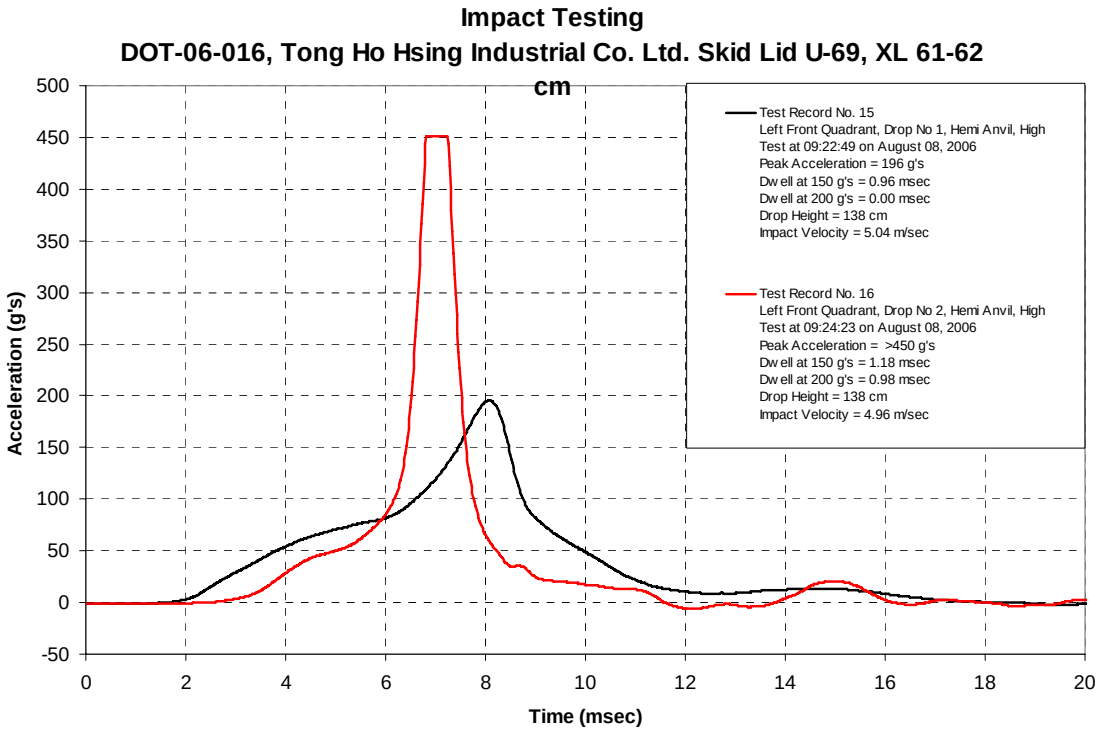

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Acceleration (g's)
Time (msec)
Test Record No. 5
Right Rear Quadrant, Drop No 1, Hemi Anvil, Low
Test at 08:45:48 on August 08, 2006
Peak Acceleration = 124 g's
Dwell at 150 g's = 0.00 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 138 cm
Impact Velocity = 5.03 m/sec
Test Record No. 6
Right Rear Quadrant, Drop No 2, Hemi Anvil, Low
Test at 08:47:23 on August 08, 2006
Peak Acceleration = 402 g's
Dwell at 150 g's = 1.56 msec
Dwell at 200 g's = 1.18 msec
Drop Height = 138 cm
Impact Velocity = 5.11 m/sec

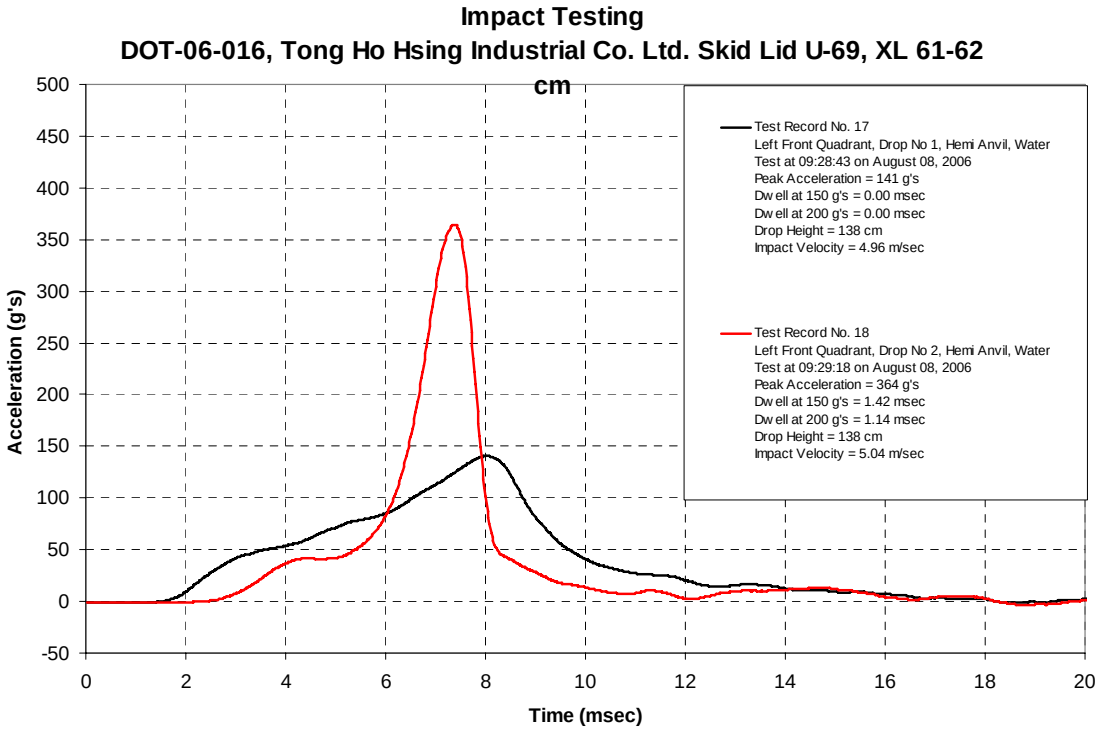

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Acceleration (g's)
Time (msec)
Test Record No. 7
Right Rear Quadrant, Drop No 1, Hemi Anvil, High
Test at 08:50:52 on August 08, 2006
Peak Acceleration = 127 g's
Dwell at 150 g's = 0.00 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 138 cm
Impact Velocity = 5.04 m/sec
Test Record No. 8
Right Rear Quadrant, Drop No 2, Hemi Anvil, High
Test at 08:52:12 on August 08, 2006
Peak Acceleration = 415 g's
Dwell at 150 g's = 1.28 msec
Dwell at 200 g's = 1.02 msec
Drop Height = 138 cm
Impact Velocity = 5.04 m/sec

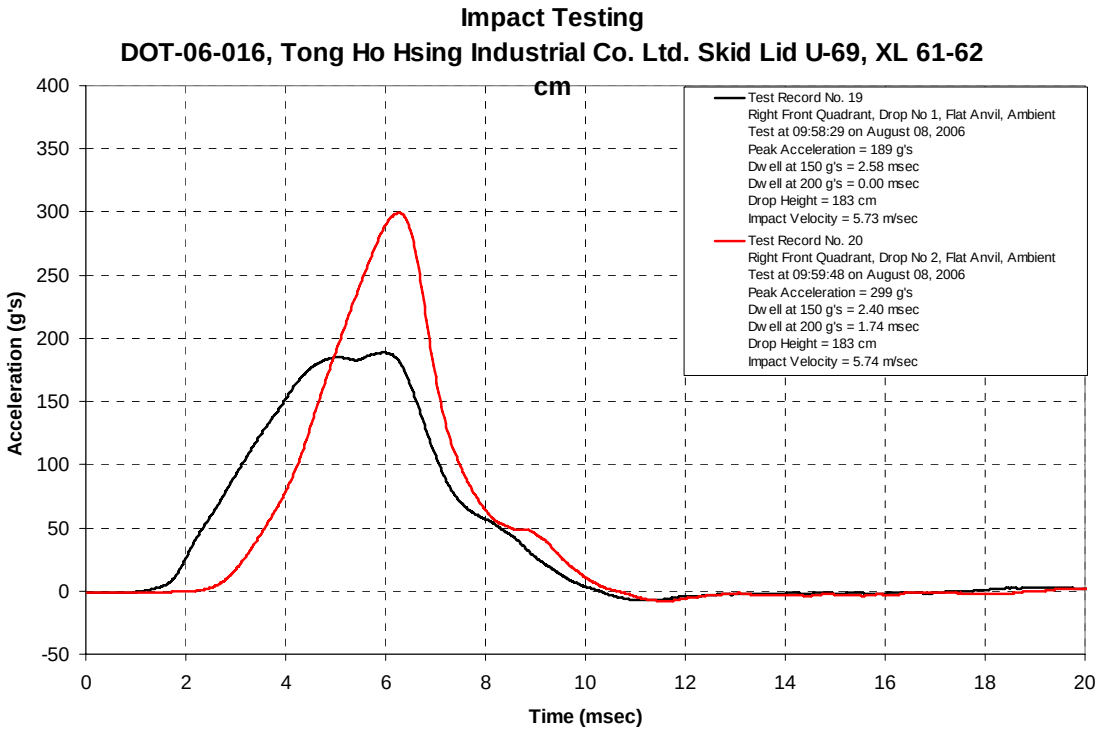

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Acceleration (g's)
Time (msec)
Test Record No. 9
Right Rear Quadrant, Drop No 1, Hemi Anvil, Water
Test at 08:55:25 on August 08, 2006
Peak Acceleration = 114 g's
Dwell at 150 g's = 0.00 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 138 cm
Impact Velocity = 5.04 m/sec
Test Record No. 10
Right Rear Quadrant, Drop No 2, Hemi Anvil, Water
Test at 08:56:28 on August 08, 2006
Peak Acceleration = 331 g's
Dwell at 150 g's = 1.42 msec
Dwell at 200 g's = 1.04 msec
Drop Height = 138 cm
Impact Velocity = 5.04 m/sec

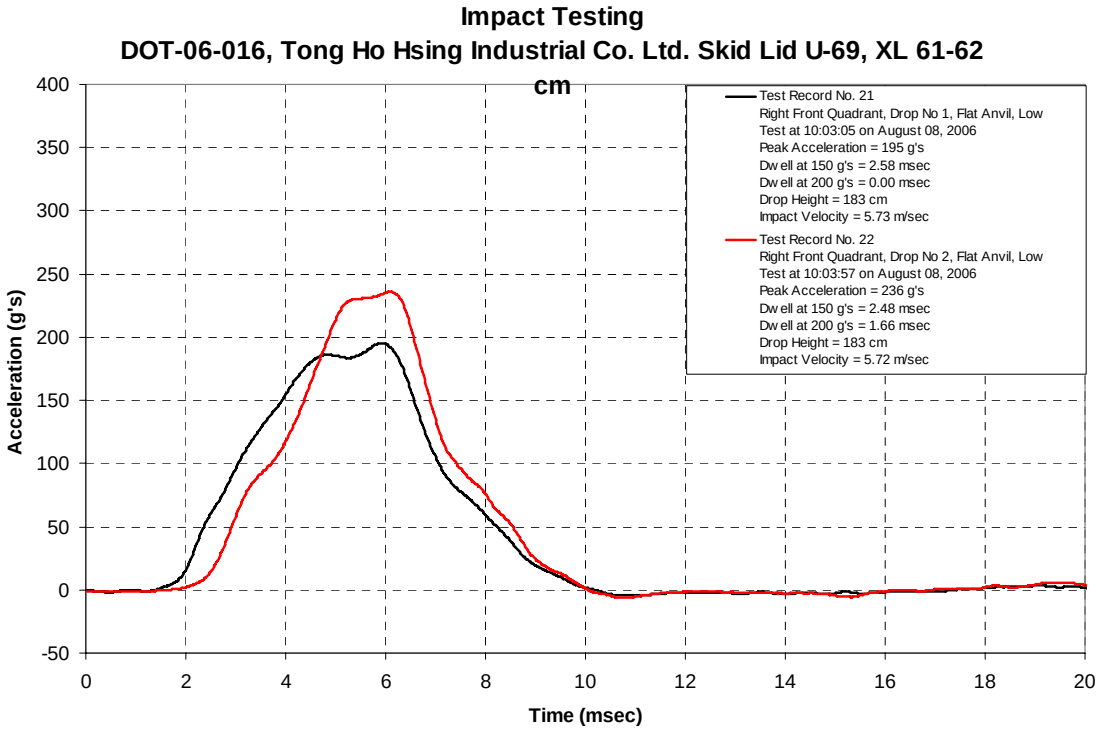

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Acceleration (g's)
Time (msec)
Test Record No. 11
Left Front Quadrant, Drop No 1, Hemi Anvil, Ambient
Test at 09:10:59 on August 08, 2006
Peak Acceleration = 138 g's
Dwell at 150 g's = 0.00 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 138 cm
Impact Velocity = 5.03 m/sec
Test Record No. 12
Left Front Quadrant, Drop No 2, Hemi Anvil, Ambient
Test at 09:13:25 on August 08, 2006
Peak Acceleration = 450 g's
Dwell at 150 g's = 1.34 msec
Dwell at 200 g's = 1.02 msec
Drop Height = 138 cm
Impact Velocity = 4.96 m/sec

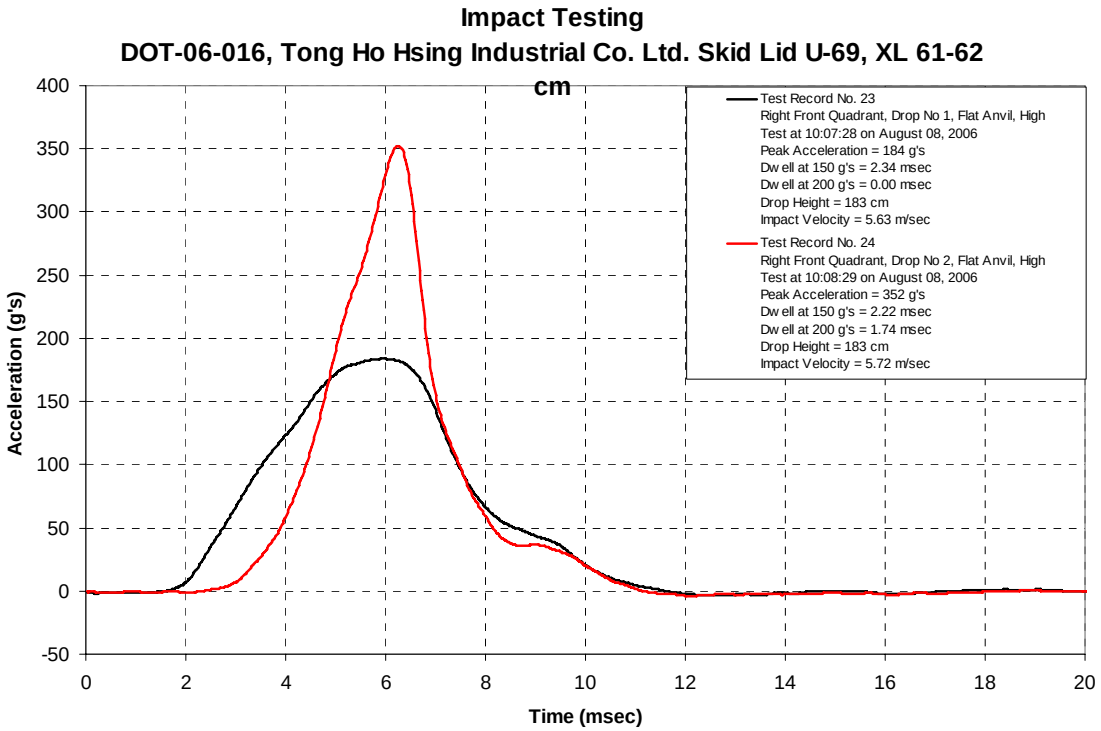

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Acceleration (g's)
Time (msec)
Test Record No. 13
Left Front Quadrant, Drop No 1, Hemi Anvil, Low
Test at 09:17:08 on August 08, 2006
Peak Acceleration = 155 g's
Dwell at 150 g's = 0.30 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 138 cm
Impact Velocity = 4.97 m/sec
Test Record No. 14
Left Front Quadrant, Drop No 2, Hemi Anvil, Low
Test at 09:18:57 on August 08, 2006
Peak Acceleration = 448 g's
Dwell at 150 g's = 1.32 msec
Dwell at 200 g's = 1.02 msec
Drop Height = 138 cm
Impact Velocity = 5.12 m/sec

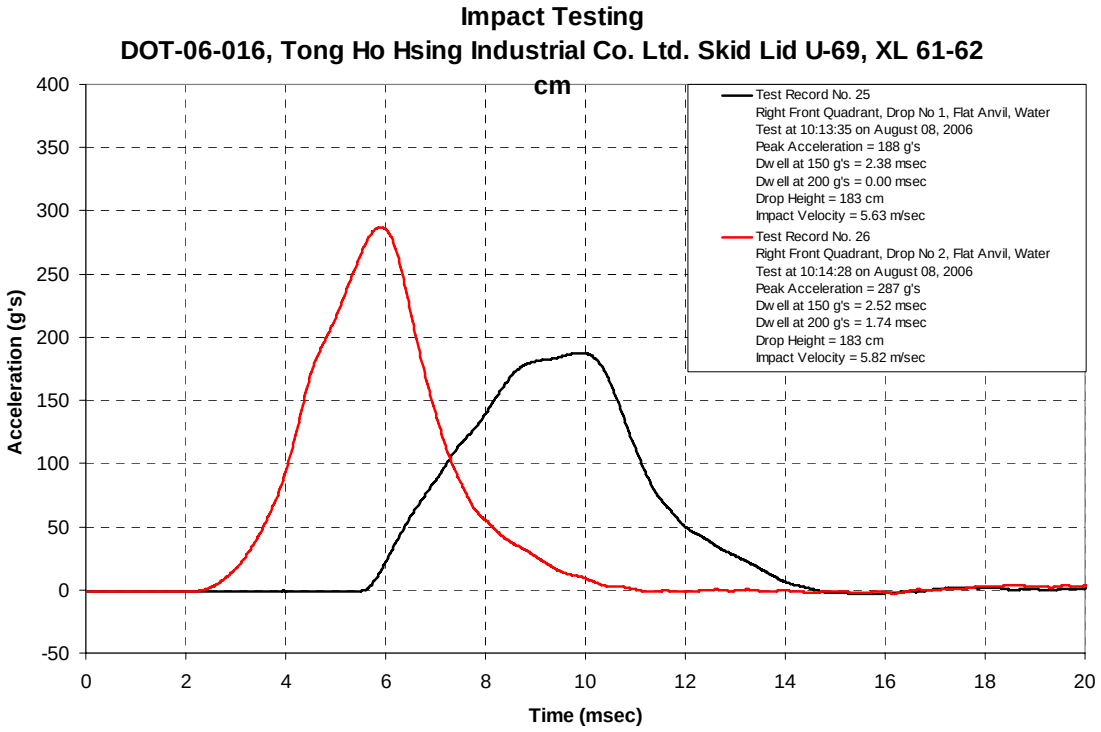

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Acceleration (g's)
Time (msec)
Test Record No. 15
Left Front Quadrant, Drop No 1, Hemi Anvil, High
Test at 09:22:49 on August 08, 2006
Peak Acceleration = 196 g's
Dwell at 150 g's = 0.96 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 138 cm
Impact Velocity = 5.04 m/sec
Test Record No. 16
Left Front Quadrant, Drop No 2, Hemi Anvil, High
Test at 09:24:23 on August 08, 2006
Peak Acceleration = >450 g's
Dwell at 150 g's = 1.18 msec
Dwell at 200 g's = 0.98 msec
Drop Height = 138 cm
Impact Velocity = 4.96 m/sec

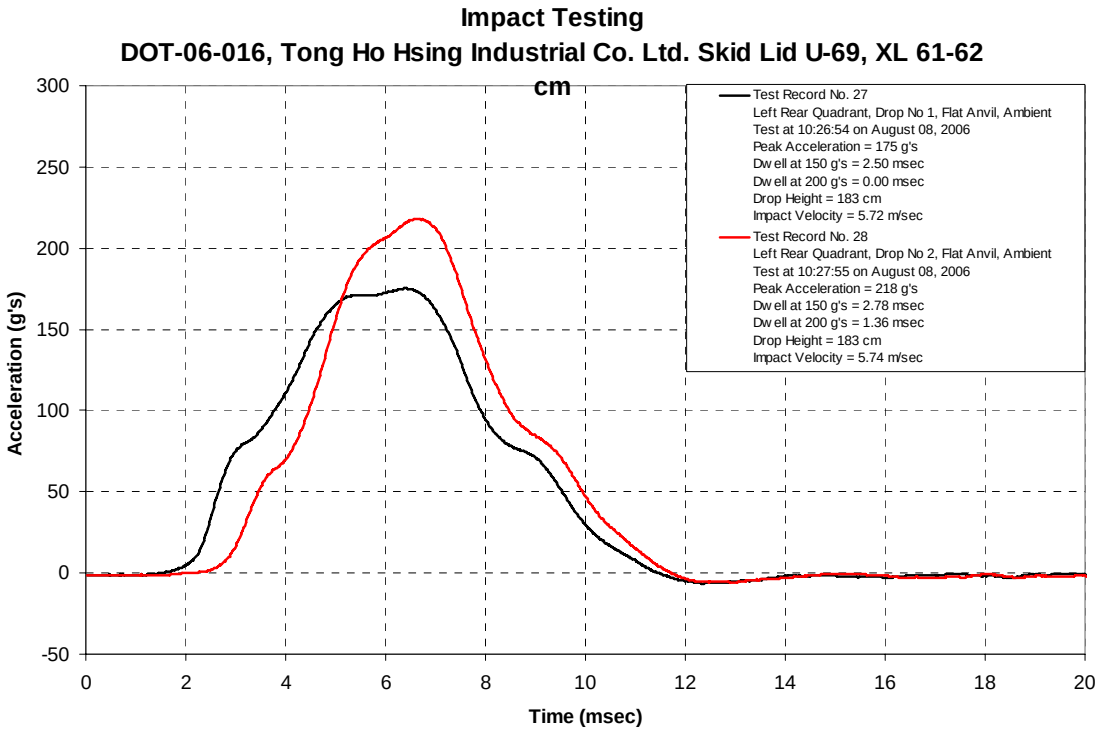

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Acceleration (g's)
Time (msec)
Test Record No. 17
Left Front Quadrant, Drop No 1, Hemi Anvil, Water
Test at 09:28:43 on August 08, 2006
Peak Acceleration = 141 g's
Dwell at 150 g's = 0.00 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 138 cm
Impact Velocity = 4.96 m/sec
Test Record No. 18
Left Front Quadrant, Drop No 2, Hemi Anvil, Water
Test at 09:29:18 on August 08, 2006
Peak Acceleration = 364 g's
Dwell at 150 g's = 1.42 msec
Dwell at 200 g's = 1.14 msec
Drop Height = 138 cm
Impact Velocity = 5.04 m/sec

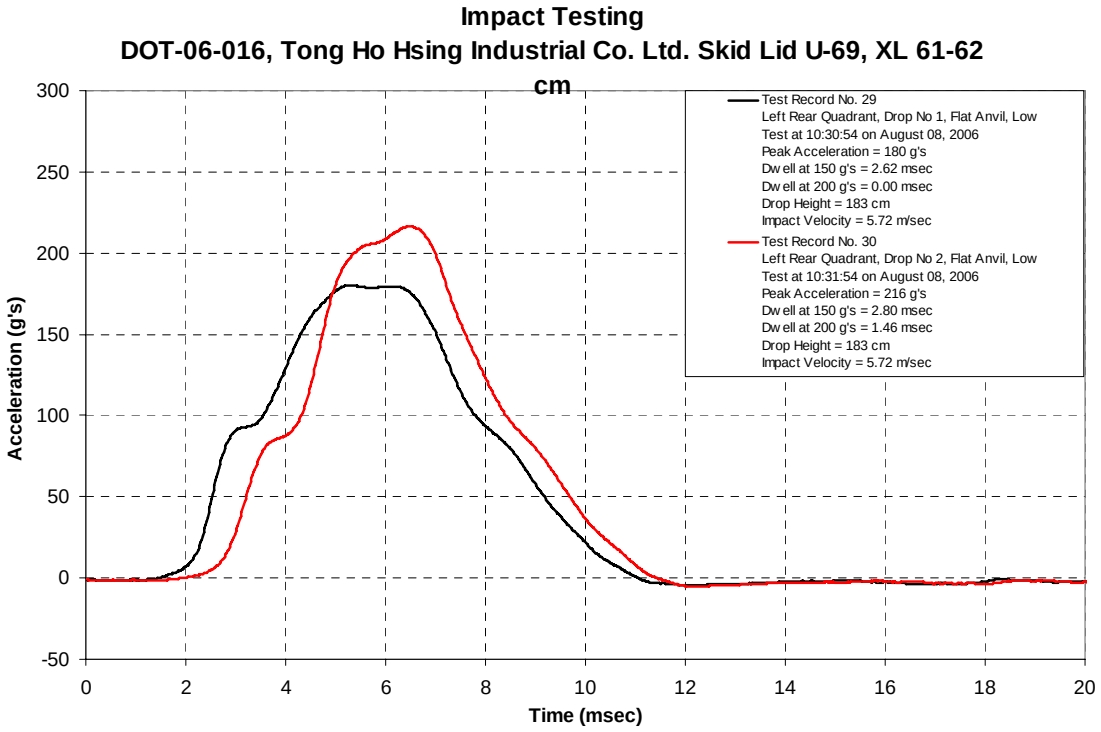

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Acceleration (g's)
Time (msec)
Test Record No. 19
Right Front Quadrant, Drop No 1, Flat Anvil, Ambient
Test at 09:58:29 on August 08, 2006
Peak Acceleration = 189 g's
Dwell at 150 g's = 2.58 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 183 cm
Impact Velocity = 5.73 m/sec
Test Record No. 20
Right Front Quadrant, Drop No 2, Flat Anvil, Ambient
Test at 09:59:48 on August 08, 2006
Peak Acceleration = 299 g's
Dwell at 150 g's = 2.40 msec
Dwell at 200 g's = 1.74 msec
Drop Height = 183 cm
Impact Velocity = 5.74 m/sec

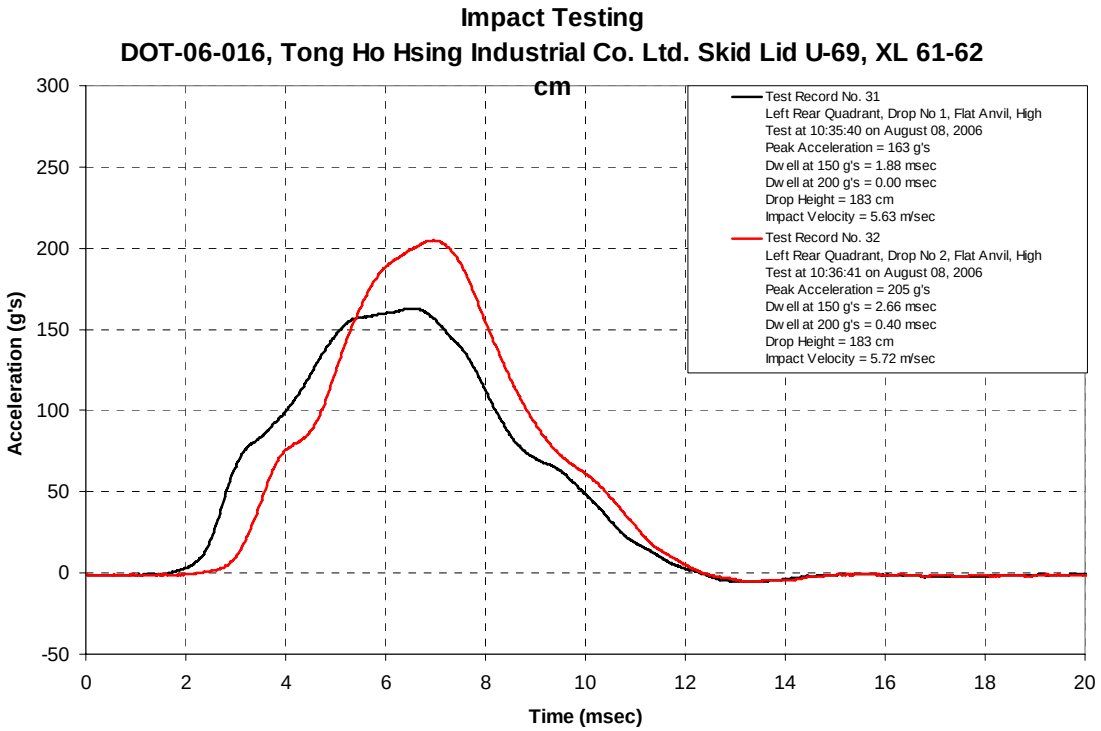

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Test Record No. 21
Right Front Quadrant, Drop No 1, Flat Anvil, Low
Test at 10:03:05 on August 08, 2006
Peak Acceleration = 195 g's
Dwell at 150 g's = 2.58 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 183 cm
Impact Velocity = 5.73 m/sec
Test Record No. 22
Right Front Quadrant, Drop No 2, Flat Anvil, Low
Test at 10:03:57 on August 08, 2006
Peak Acceleration = 236 g's
Dwell at 150 g's = 2.48 msec
Dwell at 200 g's = 1.66 msec
Drop Height = 183 cm
Impact Velocity = 5.72 m/sec
Acceleration (g's)
Time (msec)

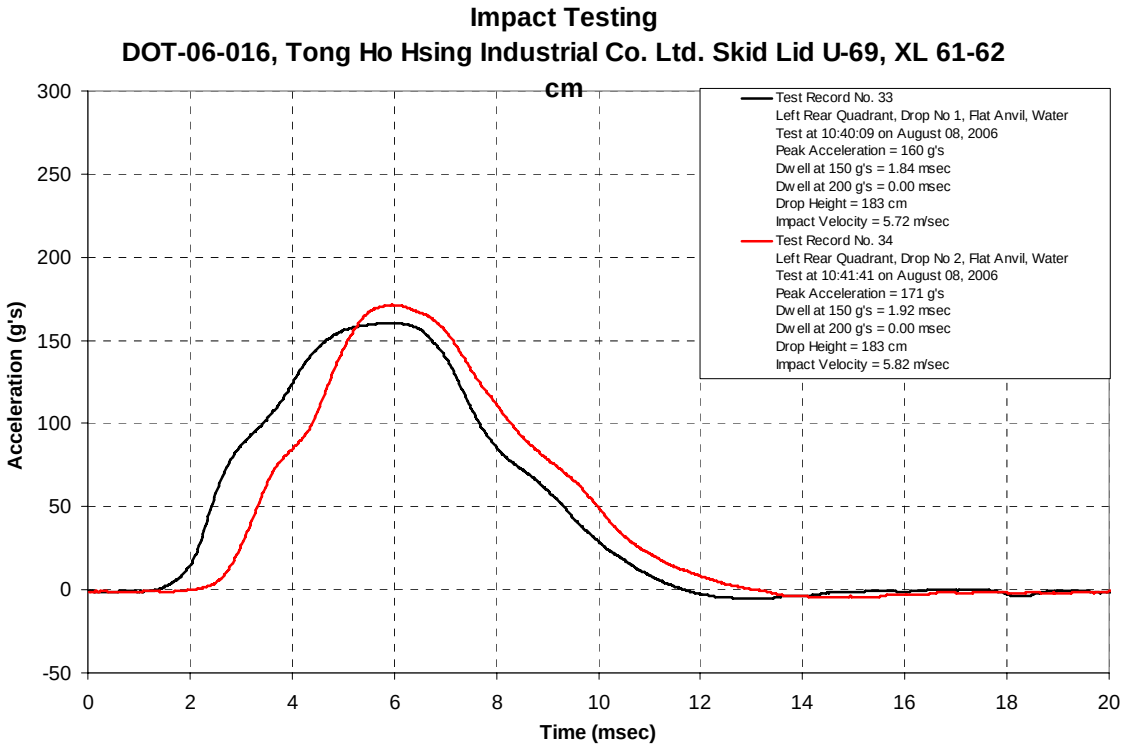

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Test Record No. 23
Right Front Quadrant, Drop No 1, Flat Anvil, High
Test at 10:07:28 on August 08, 2006
Peak Acceleration = 184 g's
Dwell at 150 g's = 2.34 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 183 cm
Impact Velocity = 5.63 m/sec
Test Record No. 24
Right Front Quadrant, Drop No 2, Flat Anvil, High
Test at 10:08:29 on August 08, 2006
Peak Acceleration = 352 g's
Dwell at 150 g's = 2.22 msec
Dwell at 200 g's = 1.74 msec
Drop Height = 183 cm
Impact Velocity = 5.72 m/sec
Acceleration (g's)
Time (msec)

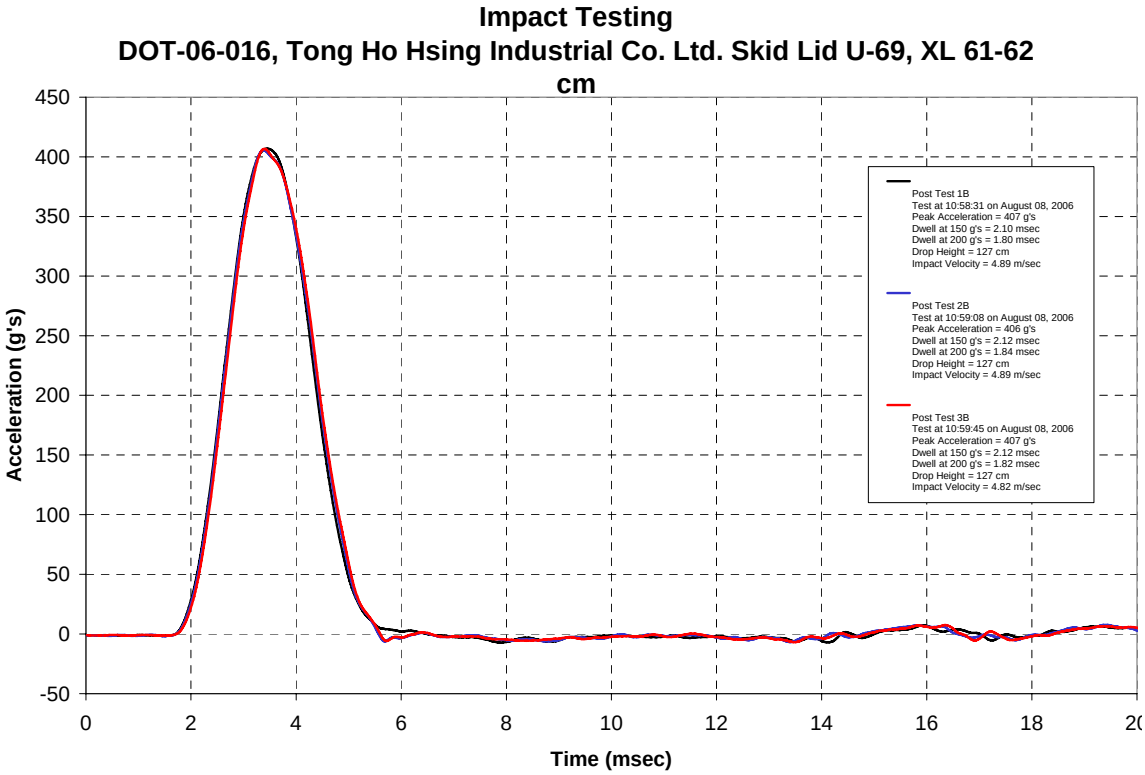

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Test Record No. 25
Right Front Quadrant, Drop No 1, Flat Anvil, Water
Test at 10:13:35 on August 08, 2006
Peak Acceleration = 188 g's
Dwell at 150 g's = 2.38 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 183 cm
Impact Velocity = 5.63 m/sec
Test Record No. 26
Right Front Quadrant, Drop No 2, Flat Anvil, Water
Test at 10:14:28 on August 08, 2006
Peak Acceleration = 287 g's
Dwell at 150 g's = 2.52 msec
Dwell at 200 g's = 1.74 msec
Drop Height = 183 cm
Impact Velocity = 5.82 m/sec
Acceleration (g's)
Time (msec)


Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Test Record No. 27
Left Rear Quadrant, Drop No 1, Flat Anvil, Ambient
Test at 10:26:54 on August 08, 2006
Peak Acceleration = 175 g's
Dwell at 150 g's = 2.50 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 183 cm
Impact Velocity = 5.72 m/sec
Test Record No. 28
Left Rear Quadrant, Drop No 2, Flat Anvil, Ambient
Test at 10:27:55 on August 08, 2006
Peak Acceleration = 218 g's
Dwell at 150 g's = 2.78 msec
Dwell at 200 g's = 1.36 msec
Drop Height = 183 cm
Impact Velocity = 5.74 m/sec
Acceleration (g's)
Time (msec)

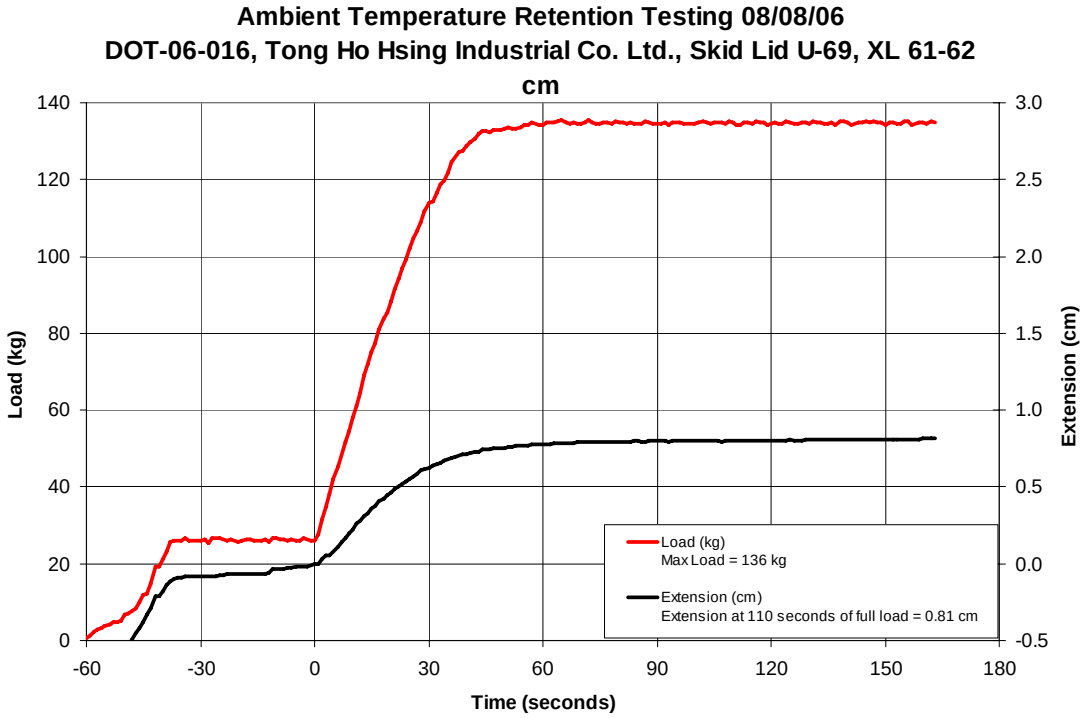

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Acceleration (g's)
Time (msec)
Test Record No. 29
Left Rear Quadrant, Drop No 1, Flat Anvil, Low
Test at 10:30:54 on August 08, 2006
Peak Acceleration = 180 g's
Dwell at 150 g's = 2.62 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 183 cm
Impact Velocity = 5.72 m/sec
Test Record No. 30
Left Rear Quadrant, Drop No 2, Flat Anvil, Low
Test at 10:31:54 on August 08, 2006
Peak Acceleration = 216 g's
Dwell at 150 g's = 2.80 msec
Dwell at 200 g's = 1.46 msec
Drop Height = 183 cm
Impact Velocity = 5.72 m/sec

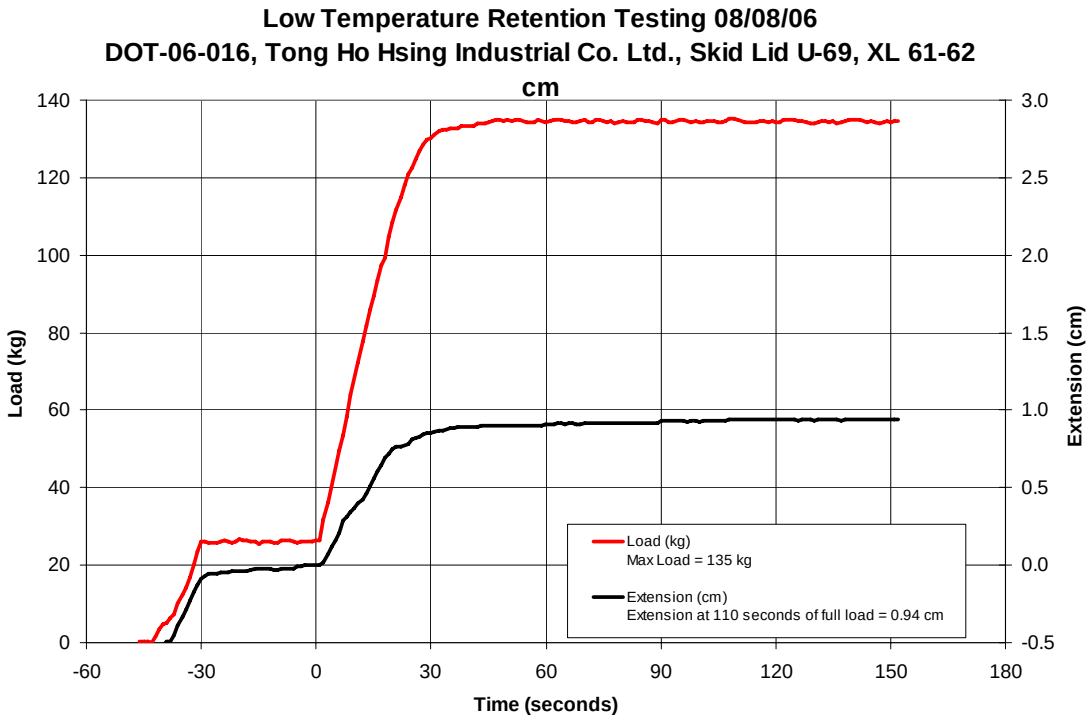

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Acceleration (g's)
Time (msec)
Test Record No. 31
Left Rear Quadrant, Drop No 1, Flat Anvil, High
Test at 10:35:40 on August 08, 2006
Peak Acceleration = 163 g's
Dwell at 150 g's = 1.88 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 183 cm
Impact Velocity = 5.63 m/sec
Test Record No. 32
Left Rear Quadrant, Drop No 2, Flat Anvil, High
Test at 10:36:41 on August 08, 2006
Peak Acceleration = 205 g's
Dwell at 150 g's = 2.66 msec
Dwell at 200 g's = 0.40 msec
Drop Height = 183 cm
Impact Velocity = 5.72 m/sec

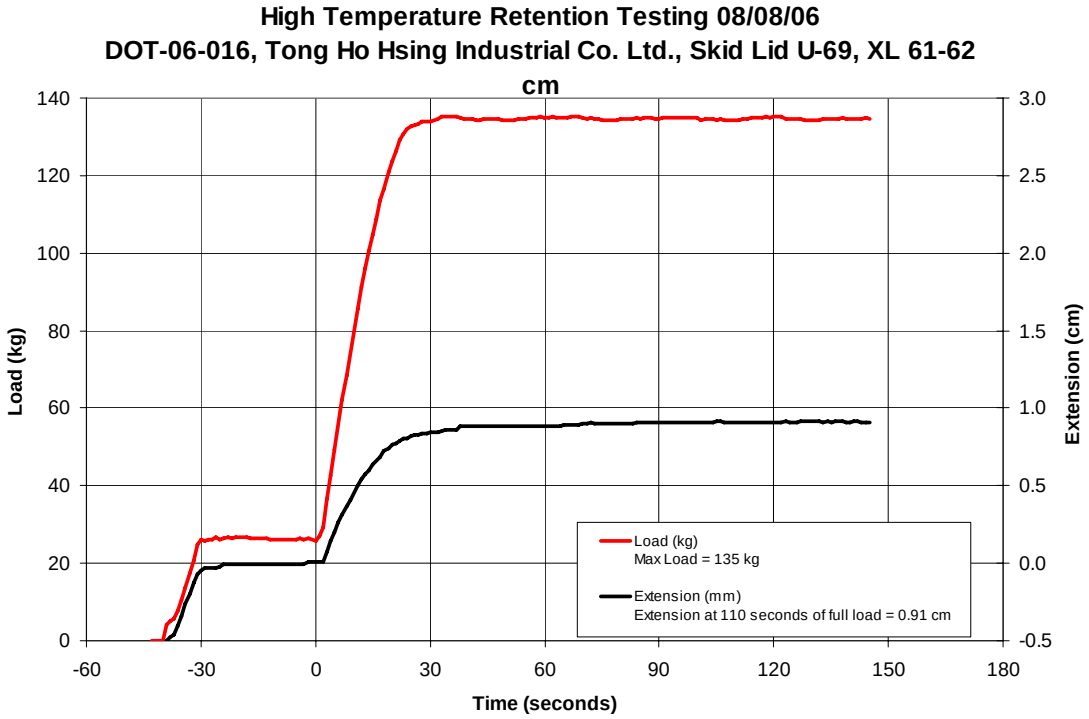

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Acceleration (g's)
Time (msec)
Test Record No. 33
Left Rear Quadrant, Drop No 1, Flat Anvil, Water
Test at 10:40:09 on August 08, 2006
Peak Acceleration = 160 g's
Dwell at 150 g's = 1.84 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 183 cm
Impact Velocity = 5.72 m/sec
Test Record No. 34
Left Rear Quadrant, Drop No 2, Flat Anvil, Water
Test at 10:41:41 on August 08, 2006
Peak Acceleration = 171 g's
Dwell at 150 g's = 1.92 msec
Dwell at 200 g's = 0.00 msec
Drop Height = 183 cm
Impact Velocity = 5.82 m/sec

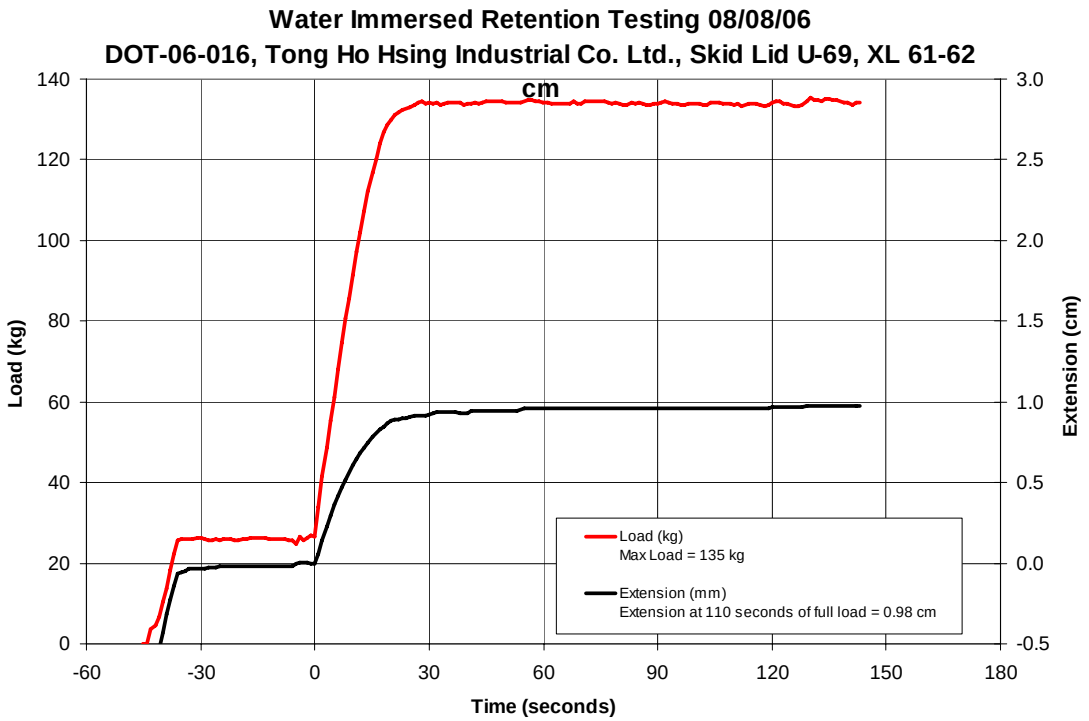

Impact Testing
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd. Skid Lid U-69, XL 61-62 cm
Acceleration (g's)
Time (msec)
Post Test 1B
Test at 10:58:31 on August 08, 2006
Peak Acceleration = 407 g's
Dwell at 150 g's = 2.10 msec
Dwell at 200 g's = 1.80 msec
Drop Height = 127 cm
Impact Velocity = 4.89 m/sec
Post Test 2B
Test at 10:59:08 on August 08, 2006
Peak Acceleration = 406 g's
Dwell at 150 g's = 2.12 msec
Dwell at 200 g's = 1.84 msec
Drop Height = 127 cm
Impact Velocity = 4.89 m/sec
Post Test 3B
Test at 10:59:45 on August 08, 2006
Peak Acceleration = 407 g's
Dwell at 150 g's = 2.12 msec
Dwell at 200 g's = 1.82 msec
Drop Height = 127 cm
Impact Velocity = 4.82 m/sec

3 RETENTION TIME HISTORIES






High Temperature Retention Testing 08/08/06
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd., Skid Lid U-69, XL 61-62 cm
Load (kg)
Extension (cm)
Time (seconds)
Load (kg)
Max Load = 135 kg
Extension (mm)
Extension at 110 seconds of full load = 0.91 cm


Water Immersed Retention Testing 08/08/06
DOT-06-016, Tong Ho Hsing Industrial Co. Ltd., Skid Lid U-69, XL 61-62 cm
Load (kg)
Extension (cm)
Time (seconds)
Load (kg)
Max Load = 135 kg
Extension (mm)
Extension at 110 seconds of full load = 0.98 cm

SECTION 4 TEST FAILURE DETAILS

The helmet failed the impact testing with peak accelerations in excess of 400g for the following conditions:

Ambient Helmet, Left Side Location, Hemispherical Anvil, Drop No. 2 – 432g
Low Temperature Helmet, Left Side Location, Hemispherical Anvil, Drop No. 2 – 402g
High Temperature Helmet, Left Side Location, Hemispherical Anvil, Drop No. 2 – 415g

Ambient Helmet, Front Location, Hemispherical Anvil, Drop No. 2 – 450g
Low Temperature Helmet, Front Location, Hemispherical Anvil, Drop No. 2 – 448g
High Temperature Helmet, Front Location, Hemispherical Anvil, Drop No. 2 – >450g

The peak accelerations were recorded at the time of testing and checked against the ASCII and Excel files and found to be consistent.

The helmet failed the labeling in that the DOT symbol is not centered on the helmet. A photograph is given.

APPENDIX A INTERPRETATIONS OR DEVIATIONS FROM FMVSS NO. 218

All testing was performed in accordance with the requirements of FMVSS NO. 218.

APPENDIX B EQUIPMENT LIST AND CALIBRATION INFORMATION

Table 1 - Instrumentation List for SwRI Protective Headgear Testing

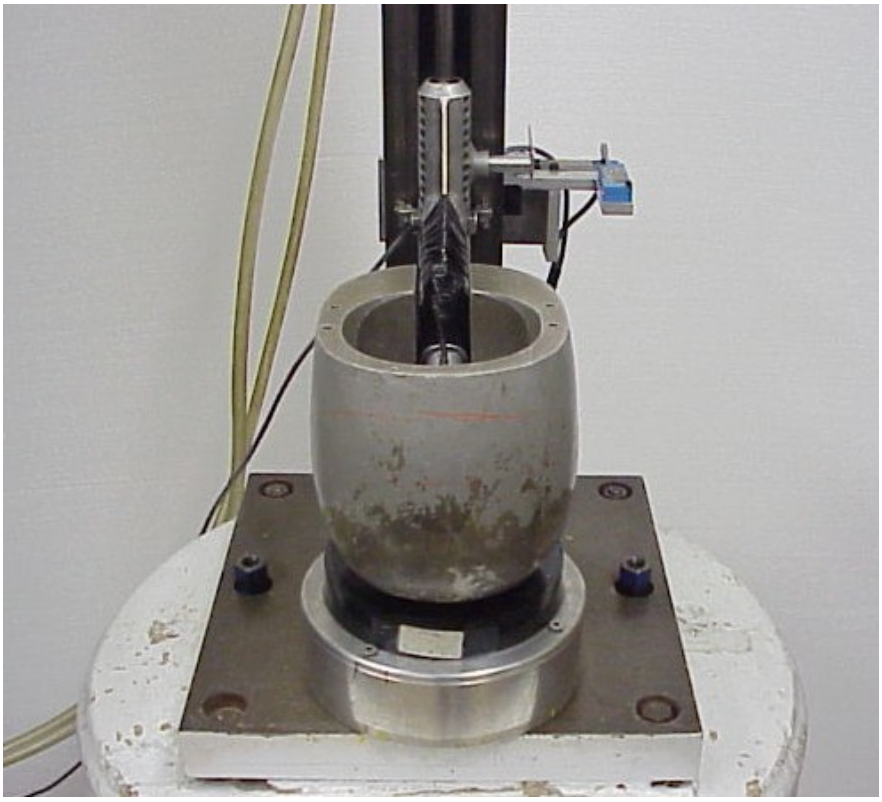
ITEM NO.	DESCRIPTION	MANUFACTURER AND MODEL	SERIAL NO	ACCURACY	DATE OF LAST CALIB.	DATE OF NEXT CALIB.
1	Humidity and Temperature Input Module	Omega / OM5-II-4-20	9213-150149-08	System Software Validation Procedure	11/02/00	NA
	Filter	Frequency Devices, Inc. / 5BAF-LPBU4 4 Pole Butterworth 1.75 KHz	None			
	Data Acquisition Card	National Instruments PCIMIO-16E-4	None			
	Data Acquisition Software	National Instruments / Labview for Windows	Ver 4.1			
	Data Acquisition Computer	Dell Computer Dim. XPS M166s	2170089			
2	Humidity and Temperature Transmitter	Omega / HX41	0599-6004	Manufacturer's Specification and System Software Validation Procedure	03/28/06	03/28/07
	Isolated Voltage Output	Burr Brown / PCI-5B41-02	None			
3	Thermocouple Wire and Thermocouple Input Module	Omega / OM5-LTC-J2-C	21266 21261 21253	Thermocouple Cal Procedure	07/04/06	07/04/07
4	Optical Velocity Transducer	SwRI / 1	1	Velocity Gate Cal Procedure	07/04/06	07/04/07
5	Test Accelerometer	Endevco / 2262-1000	NL05	Accelerometer Cal Procedure	07/04/06	07/04/07
	Strain Gage Conditioner	Measurement Group Inc. / 2120A	102130			
	Strain Gage Power Supply	Measurements Group Inc. / 2110A	102034			
	Filter	Frequency Devices, Inc. / 5BAF-LPBU4 4 Pole Butterworth 1.75 KHz	None			
6	Load Cell	Western / 51	830-7X	Load Cell Cal Procedure	07/04/06	07/04/07
	Strain Gage Conditioner	Measurement Group Inc. / 2120A	102130			
	Strain Gage Power Supply	Measurements Group Inc. / 2110A	102034			
	Isolated Voltage Output	Burr Brown / PCI-5B41-02	None			
7	Potentiometer	Humphrey / RP14-0601-1	87	Potentiometer Cal Procedure	07/04/06	07/04/07
	Isolated Voltage Output	Burr Brown / PCI-5B41-02	None			
8	Scale	Ohaus Scale Corp / 20 Kg / 45 lb	SwRI 5485	Manufacturer's Specification	03/17/06	10/17/06

Table 2 - Test Apparatus List for SwRI Protective Headgear Testing Requiring One Time Dimensions Checks or No Calibration

ITEM NO.	DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	ACCURACY	DATE OF DIMENSIONAL CHECK
1	DOT Headforms	Controlled Casting	Small, Medium, and Large	None	+0.31 inches	6/89
2	Monorail Drop Test System	SwRI	1	1	TP-218-04	1/80
3	Drop Assembly	SwRI	Small, Medium, and Large	None	TP-218-04	6/89
4	Modular Elastomeric Programmer (MEP)	U.S Testing	None	None	N/A	N/A
5	Penetration Test System	SwRI	1	1	TP-218-04	1/80
6	Penetration Striker	SwRI	1	1	TP-218-04	1/80
7	Retention Test System	SwRI	1	1	TP-218-04	1/80
8	Chin Strap Fixture	SwRI	1	1	TP-218-04	1/80
9	Static Weights (Steel)	SwRI	1	1	$\pm$0.1 lbs.	2/94
10	Hydraulic Cylinder	Enerpac	RD46	1	N/A	N/A
11	Hydraulic Pump	Delta Power Hydraulic Company	B2	NA	N/A	N/A
12	Environmental Conditioner	EDPAC	Mini Tech 90	None	N/A	N/A
13	Oven with Digitronic Control	Despatch Industries Inc.	LDB1-69	128710	N/A	N/A
14	Freezer with Omega Temperature Controller	Sears	9105010 CN100TC	S10204102 6 4011302	N/A	N/A
15	Peripheral Vision Template	SwRI	1	1	$\pm$15 min	1/80
16	HPI Indicator	SwRI	Small, Medium, Large	None	NA	NA
17	Test Line Marking System	SwRI	1	1	TP-218-04	1/80

APPENDIX C PHOTOGRAPHS

Test Equipment Photos



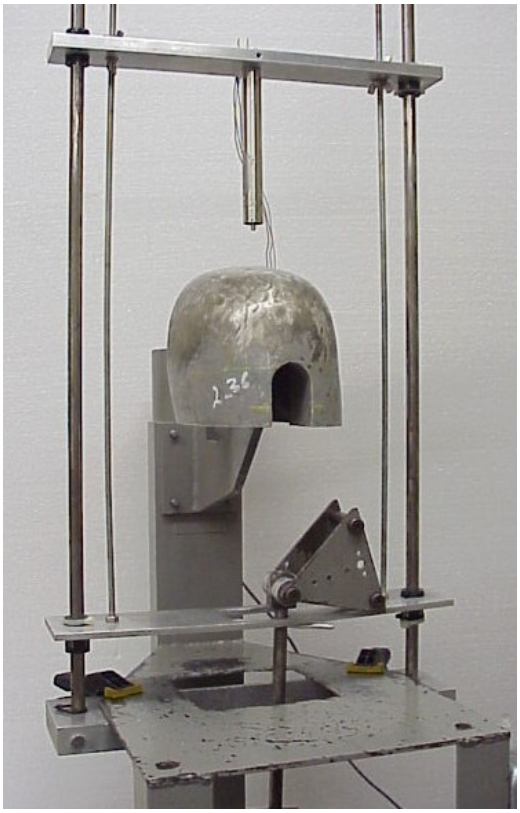
SwRI Helmet Test Equipment Photo 1. Monorail Impact Tester with MEP Pad, DOT Headform, SwRI Drop Assembly, and Velocity Gate

SwRI Helmet Test Equipment Photo 2. Flat Anvil Impact Configuration

SwRI Helmet Test Equipment Photo 3. Hemispherical Anvil Impact Configuration

SwRI Helmet Test Equipment Photo 4. Penetration Resistance Tester Configured for Crown Locations

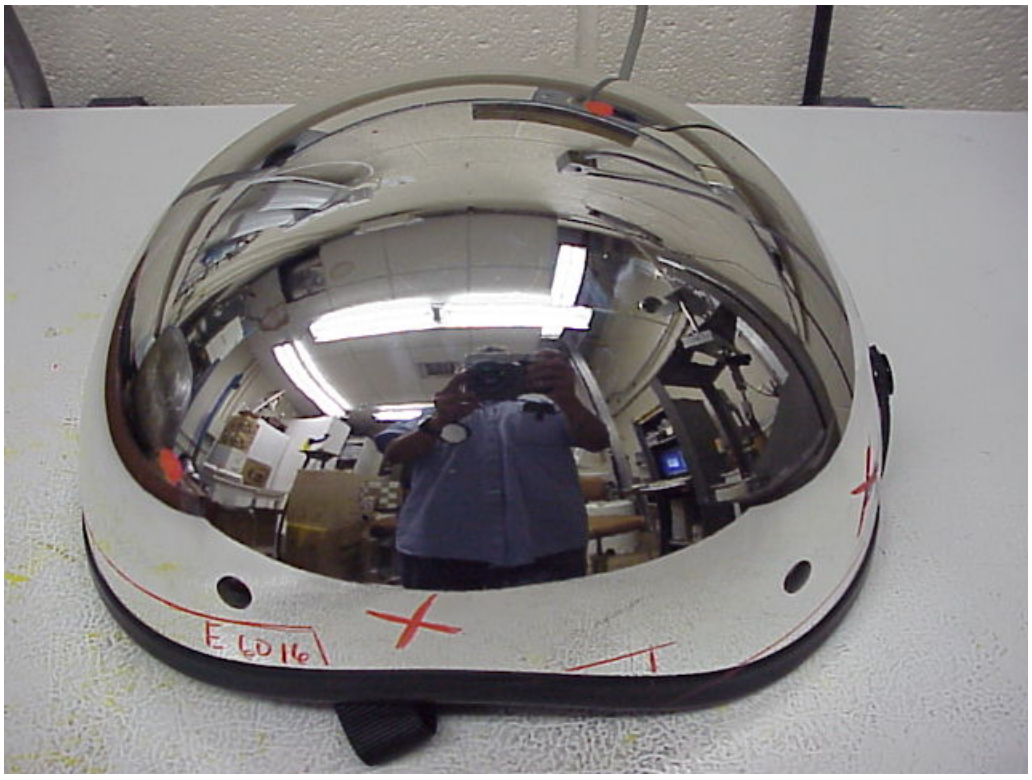
SwRI Helmet Test Equipment Photo 5. Penetration Resistance Tester Configured for Side, Front, and Rear Locations



SwRI Helmet Test Equipment Photo 6. Retention System Tester with Supported DOT Headform, Simulated Jaw, and Displacement Measuring System

Helmet Photographs

Helmet Photograph 1. Front View Skid Lid, U-69, XL 61-62 cm

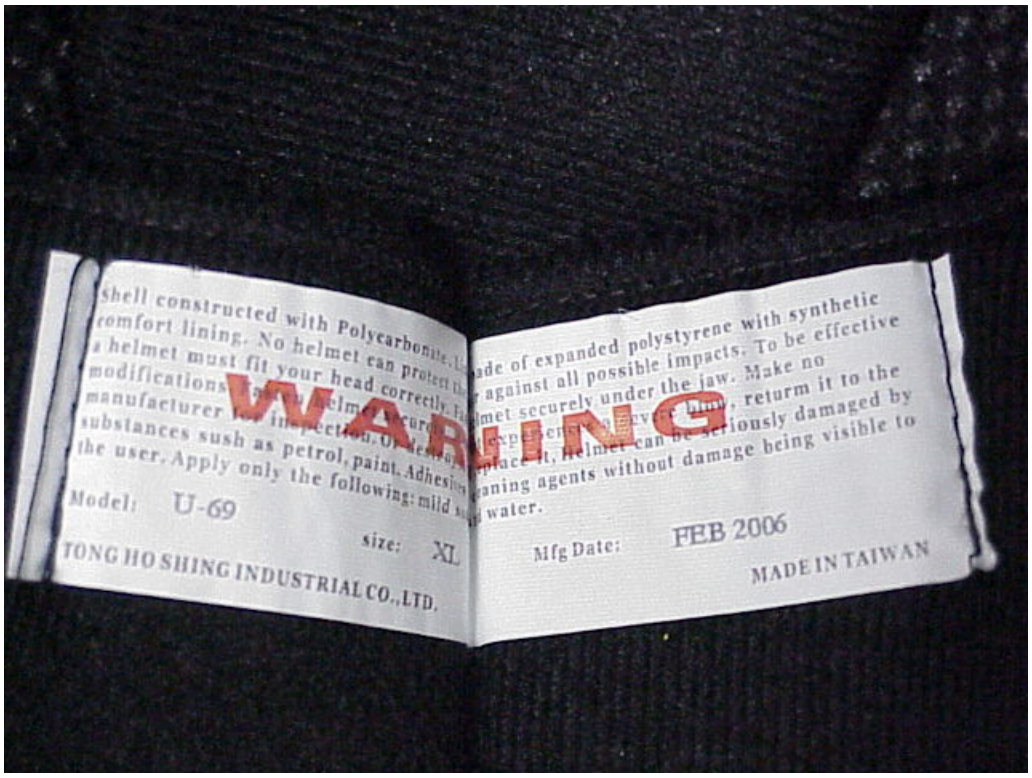


Helmet Photograph 2. Side View Skid Lid, U-69, XL 61-62 cm

Helmet Photograph 3. Rear View Skid Lid, U-69, XL 61-62 cm

Helmet Photograph 4. Top View Skid Lid, U-69, XL 61-62 cm

Helmet Photograph 5. Interior View Skid Lid, U-69, XL 61-62 cm



Helmet Photograph 6. Labeling Skid Lid, U-69, XL 61-62 cm

Helmet Photograph 7. Labeling Skid Lid, U-69, XL 61-62 cm