

# **COMPLIANCE TESTING FOR FMVSS No. 218 MOTORCYCLE HELMETS**

Jiangmen Pengcheng Helmets Ltd (MHR) Tuzo

Model – MX442

Size – S (56 cm)

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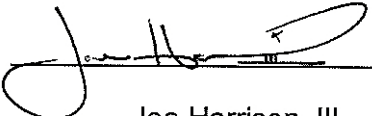
**Jiangmen Pengcheng Helmets Ltd.**

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Date: 2 March 2010

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## 1. PURPOSE OF COMPLIANCE TEST

The purpose of the test was to determine if the MX442 production helmets supplied by Jiangmen Pengcheng Helmets Ltd (MHR) satisfy the requirements of Federal Motor Vehicle Safety Standard Number 218 - Motorcycle Helmets (FMVSS No. 218). This specification is a performance standard, and is not intended to restrict design.

## 2. HELMET DATA

Helmet data given is based on information provided with the helmets, information provided by the manufacturer/distributor, and measured data.

Helmet Brand Name: Tuzo

Helmet Model Designation: MX442

Helmet Manufacturer: Jiangmen Pengcheng Helmets Ltd (MHR)

Month and Year of Manufacture: 02/2010

Helmet Size Designation: S (56 cm)

Coverage: Complete

Helmet Position Index (HPI) (mm): 45.0 mm

Shell Material: Fiberglass

Liner Material: EPS

Type of Retention System: D-Ring

Helmet	A Ambient	B Low Temp	C High Temp	D Water Immersed	E Spare
Shell Color/Pattern	Silver	Silver	Silver	Silver	Silver
Weight (grams)	1271	1218	1247	1278	1304
Month & Year of Manufacture	02/2010	02/2010	02/2010	02/2010	02/2010

### Comments:

- The HPI is based on information supplied by the manufacturer.
- Weight is with all auxiliary equipment removed including face shield and support hardware - ready for testing.
- Photographs of the helmets are given in Photographs (Section 19).

### 3. SUMMARY OF TEST RESULTS

TEST	HELMET	A	B	C	D
IMPACT (S5.1, S7.1)		PASS	PASS	PASS	PASS
PENETRATION (S5.2, S7.2)		PASS	PASS	PASS	PASS
RETENTION (S5.3, S7.3)		PASS	PASS	PASS	PASS
CONFIGURATION (S5.4)		PASS	NA	NA	NA
PERIPHERAL VISION/BROW OPENING (S5.4)		PASS	NA	NA	NA
PROJECTIONS (S5.5)		PASS	NA	NA	NA
LABELING (S5.6)		PASS	NA	NA	NA

Comments:

- The helmet passed all testing. This helmet satisfies the requirements of FMVSS No. 218.

#### 4. SELECTION OF APPROPRIATE HEADFORM (S6.1)

Selection of the headform used during testing was based on the helmet size designation, as identified in the following table. If the size range is not specified by hat size, the selection is based on best fit of the helmet on the headform. 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. When multiple headforms are appropriate, the selection shall be based on best fit and discussion with the supplier of the helmets.

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

Comments:

- A medium headform was used based on information provided by the manufacturer. The total weight of the drop assembly was 4.98 kg. The helmet was a good fit on the headform.

#### 5. REFERENCE MARKING (S6.2) AND HELMET POSITIONING (S6.3)

The test line was drawn on the helmet, as identified by Figure 2 in FMVSS No. 218, following the procedures of S6.2 of FMVSS No. 218. The centers of impact sites were selected at points on the helmet on or above the test line. Before each test, the helmet was fixed on the test headform in the position that conformed to the helmet position index, in accordance with the requirements of S6.3 of FMVSS No. 218.

Comments:

- None.

#### 6. CONFIGURATION (S5.4)

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

Comments:

- This helmet satisfies the configuration requirements of S5.4 of FMVSS No. 218. See helmet photographs in Photographs (Section 19).

## 7. PERIPHERAL VISION AND BROW OPENING (S5.4)

The peripheral vision shall be at least 105° 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 is within the angles of peripheral vision. The peripheral vision and brow opening were measured with the helmet positioned on the headform in accordance with S6.2.1 and S6.2.2 of FMVSS No. 218.

	REQUIREMENTS	TEST RESULTS
Peripheral Vision	> 105°	> 105°
Brow Opening	> 2.54 cm	> 2.54 cm

### Comments:

- This helmet satisfies the peripheral vision and brow opening requirements of S5.4 of FMVSS No. 218.

## 8. 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 5 mm (0.20 inches).

Projection Type	REQUIREMENTS		TEST RESULTS	
	Availability	Height (mm)	Availability	Height (mm)
Internal Rigid	None	0.00	None	N/A
External Rigid	Operational	< 5 mm	None	N/A

### Comments:

- This helmet satisfies all the projection requirements of S5.5 of FMVSS No. 218.



## 9. 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.	PASS	
(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:

- This helmet satisfies all the labeling requirements of S5.6 of FMVSS No. 218. See labeling photographs (Section 19). The DOT symbol is 1.0 cm in height. The specified height is greater than 1.0 cm. It is 2.5 cm above the rear of the helmet based on the edge of the black molding. The specified height is between 2.9 and 3.5 cm.

## 10. CONDITIONING FOR TESTING (S6.4)

The helmets were conditioned for 12 to 24 hours in the specified environmental condition shown below, prior to testing. One helmet was conditioned in each environment. Each test was begun within two minutes after removal of the helmet from conditioning. The maximum time during which the helmets were out of the conditioning environment was less than four minutes. Records of the conditioning are given in Conditioning Environments (Section 16).

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

Comments:

- None.

## 11. IMPACT TESTING (S5.1 & S7.1)

The helmets were subjected to the impact attenuation test in accordance with S7.1 of FMVSS No. 218. The construction materials and resonant frequencies of the headforms satisfy the requirements of S7.1.5 of FMVSS No. 218. The testing was performed using a monorail drop test system, as required by S7.1.6 of FMVSS No. 218. The drop assembly satisfies the requirements of S7.1.7, S7.1.8, and S7.1.12 of FMVSS No. 218. The response accelerometer and instrumentation satisfy the requirements of S7.1.9 of FMVSS No. 218. The anvils and mounting satisfy the requirements of S7.1.10 and S7.1.11 of FMVSS No. 218.

The Impact Attenuation Instrument System was checked before and after testing by dropping the bare headform, for impact on the top, onto a MEP pad. The pre-test drop height was set to achieve a nominal peak acceleration of 400 g's  $\pm$  10 g's. Post-test drops were made from the same drop height. Three drops were made for the pre-test and post-test conditions, and the peak deceleration averaged. Summary data is provided in the following table and time histories for the system check impacts are given in Impact Time Histories (Section 17). The difference between pre-test average and the post-test average shall not exceed 40 g's.

MHR, Tuzo MX 422, S (56cm)  
Impact Testing

Anvil	Impact Velocity
Hemispherical	5.07 to 5.33 m/sec
Flat	5.85 to 6.15 m/sec

Temperature C	Relative Humidity %
23	50

Headform Size = Medium  
Impact Position on Crown

Drop Assembly Weight = 4.98 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	98	4.28	399	2.0	1.7
	2A	98	4.27	399	2.0	1.7
	3A	98	4.27	400	2.0	1.7
Pre Test Average				---	---	---
Post Test	1B	98	4.28	398	2.0	1.7
	2B	98	4.28	399	2.0	1.7
	3B	98	4.28	400	2.0	1.7
Post Test Average				---	---	---
Difference Between Pre Test and Post Test Averages				0	Difference Not to Exceed 40 g's	

Each helmet (A, B, C, and D) was impacted at four sites with the center of impact points on or above the test line, and at least one-fifth of the maximum circumference of the helmet from any prior impact center. Two impacts on each helmet were with the hemispherical anvil and two were with the flat anvil. Acceptable velocities were: (a) Flat Anvil – 5.85 to 6.15 m/sec (19.19 to 20.18 ft/sec) and (b) Hemispherical Anvil – 5.07 to 5.33 m/sec (16.64 to 17.49 ft/sec). Summary data is provided in the following table and time histories for the impacts are given in Impact Time Histories (Section 17). Given on these plots are the conditioning environment, impact location, anvil type, peak acceleration, dwells at 150 g's and 200 g's, and impact velocity.

### Comments:

- This helmet satisfies the impact attenuation testing of S5.1 of FMVSS No. 218.

MHR, Tuzo MX 422, S (56cm)  
Impact Testing

Helmet Designation	Helmet Condition	Helmet Type	Impact Location (+/- 45 degrees)							
		Partial/Full	Forehead		Left Side		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	115	109	94	107	166	173	139	159
		ms @ 150 g	0.0	0.0	0.0	0.0	1.8	2.3	0.0	0.8
		ms @ 200 g	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Velocity m/sec	5.20	5.28	5.28	5.27	5.93	5.94	5.93	5.94
B	Low Temperature	Anvil	Hemi		Hemi		Flat		Flat	
		Test Record No.	5	6	13	14	21	22	29	30
		Peak g	101	98	95	99	171	172	155	162
		ms @ 150 g	0.0	0.0	0.0	0.0	1.8	1.8	0.4	1.4
		ms @ 200 g	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Velocity m/sec	5.27	5.27	5.28	5.28	5.93	5.94	5.94	6.04
C	High Temperature	Anvil	Hemi		Hemi		Flat		Flat	
		Test Record No.	7	8	15	16	23	24	31	32
		Peak g	112	105	91	93	161	177	139	151
		ms @ 150 g	0.0	0.0	0.0	0.0	1.0	2.1	0.0	0.0
		ms @ 200 g	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Velocity m/sec	5.19	5.20	5.20	5.28	5.94	5.93	5.94	5.94
D	Water Immersed	Anvil	Hemi		Hemi		Flat		Flat	
		Test Record No.	9	10	17	18	25	26	33	34
		Peak g	100	105	91	92	155	162	130	142
		ms @ 150 g	0.0	0.0	0.0	0.0	0.4	1.3	0.0	0.0
		ms @ 200 g	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Velocity m/sec	5.28	5.27	5.28	5.20	5.93	5.93	5.93	5.93

## 12. PENETRATION (S5.2 & S7.2)

One sample of each of the helmets was subjected to the penetration test in accordance with S7.2 of FMVSS No. 218. The penetration striker satisfies the requirements of S7.2.6 and S7.2.7 of FMVSS No. 218. The height of the free fall drop was a normal 300 cm (116.9 to 118.1 inches), as measured from the striker point to the impact point on the outer surface of the test helmet. Two penetration blows were 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.

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 satisfies the penetration requirements of S5.2 of FMVSS No. 218.

### 13. RETENTION SYSTEM TESTING (S5.3 & S7.3)

The helmets were subjected to the retention system testing in accordance with the procedures given in S7.3 of FMVSS No. 218. The helmet was placed on the headform, which was mounted on a stationary support. Load was applied to the retention system through a simulated jaw structure that satisfies the requirements of S7.3.2. The elongation of the retention system was measured between the extremity of the adjustable portion of the retention system and the apex of the helmet. Elongation was defined as the difference between the position with an initial 22.7 kg (50-lb.) load and the final position with a 136 kg (300-lb.) load. The acceptance criteria were 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	1.57	2.75	1.18
B	Low Temperature	1.38	2.54	1.16
C	High Temperature	1.43	2.68	1.25
D	Water Immersed	1.38	2.63	1.25

Time histories for the retention system testing are given in Retention Time Histories (Section 18). Given on these plots are the conditioning environment, load, and elongation.

Comments:

- This helmet satisfies all the retention requirements of S5.3 of FMVSS No. 218.

#### **14. TEST FAILURE DETAILS**

Comments:

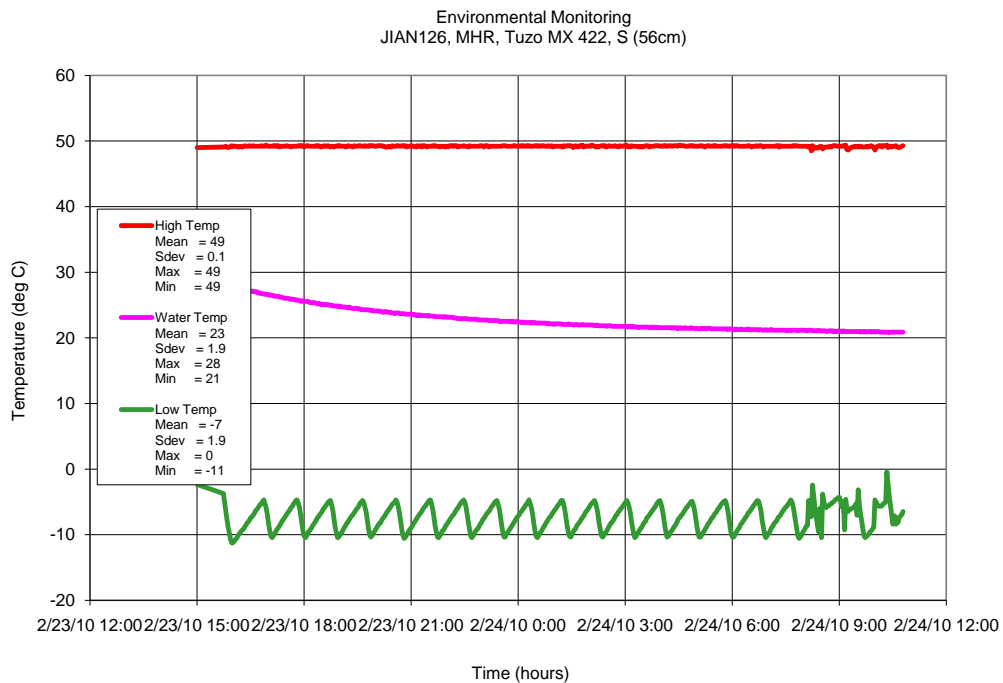
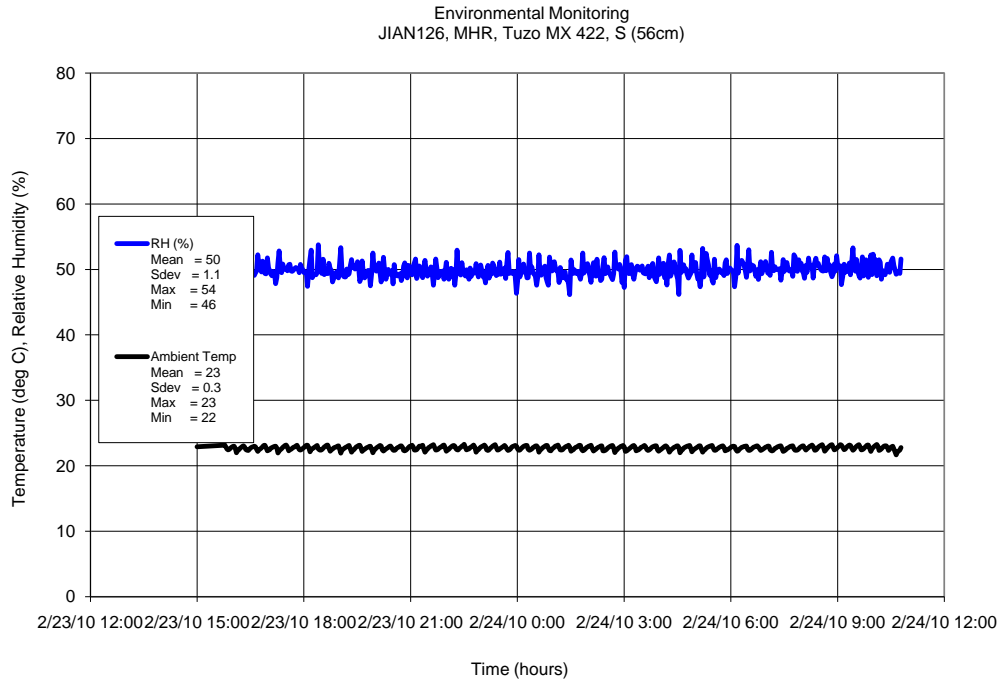
- The helmet passed all testing. This helmet satisfies the requirements of FMVSS No. 218.

#### **15. INTERPRETATION OF DEVIATIONS FROM FMVSS NO. 218**

Comments:

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

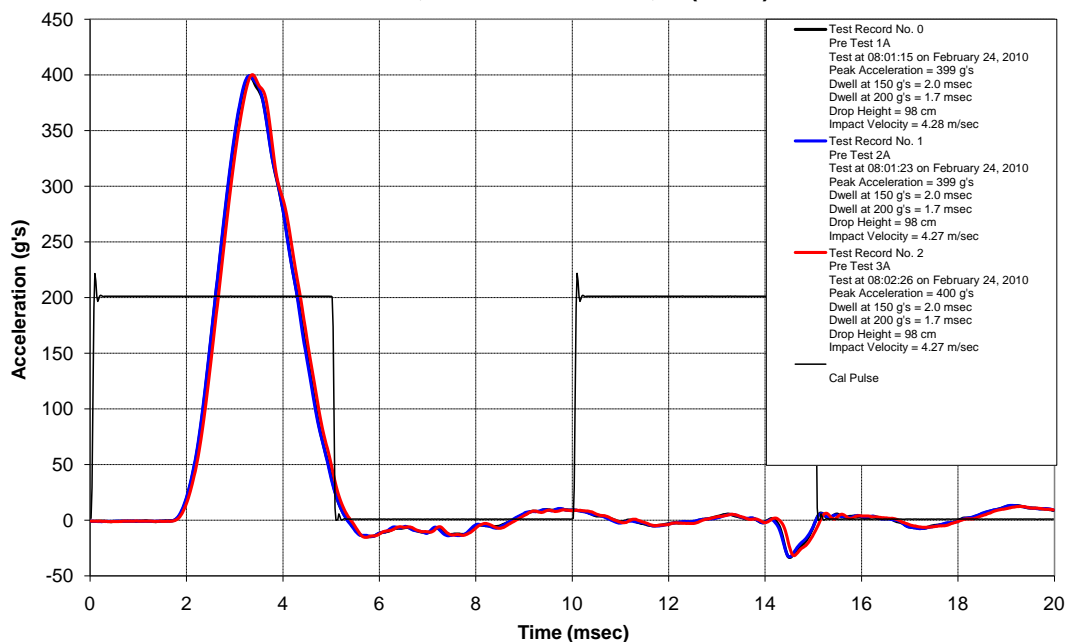
## 16. CONDITIONING ENVIRONMENTS



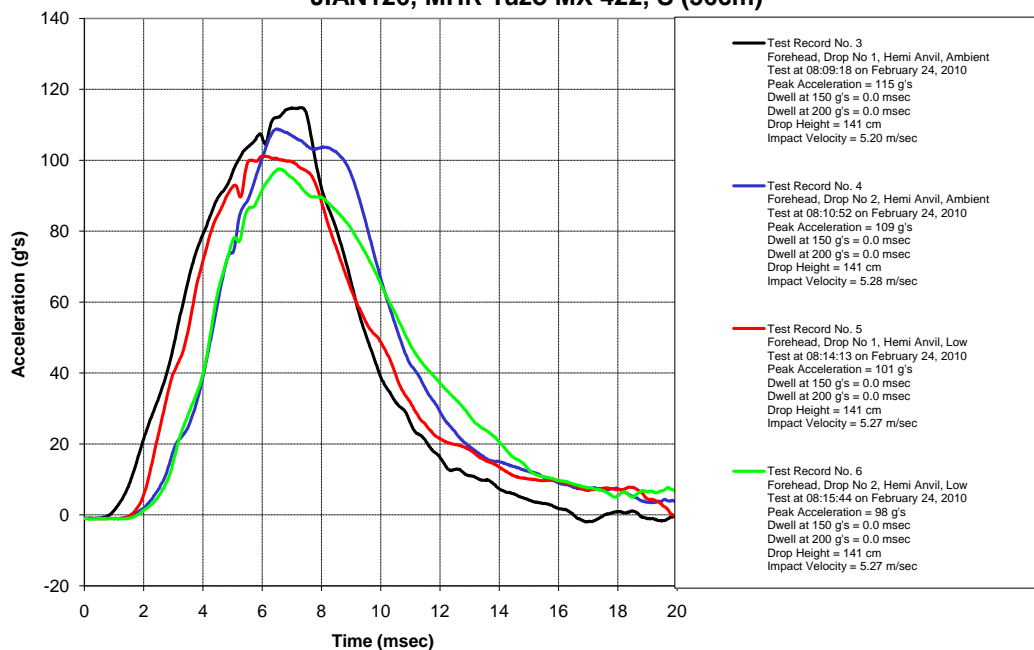


## 17. IMPACT TIME HISTORIES

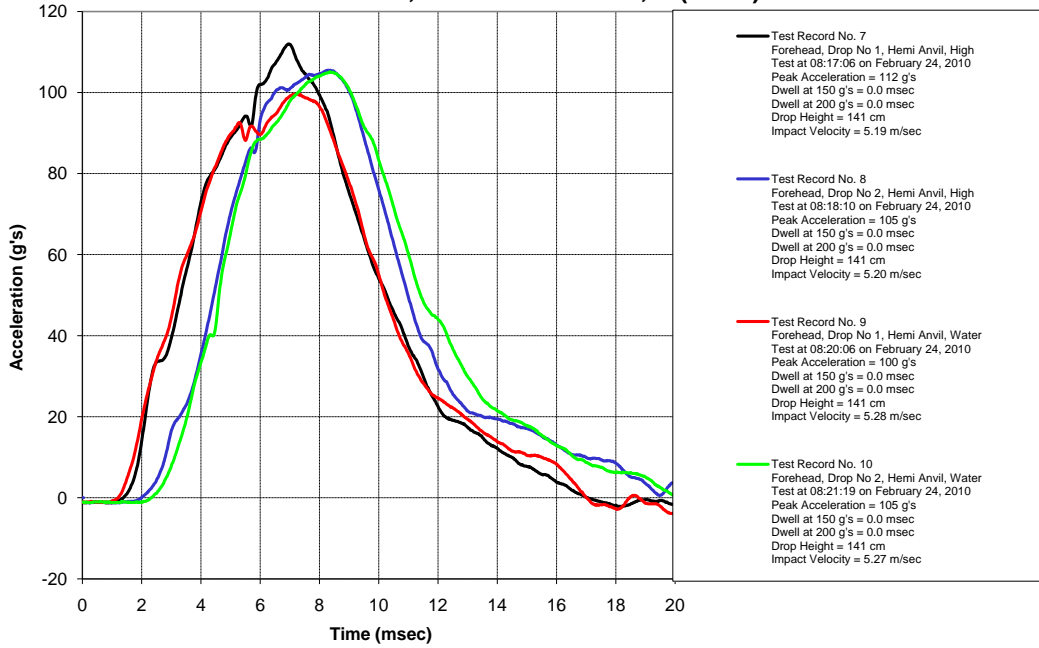
**Impact Testing  
JIAN126, MHR Tuzo MX 422, S (56cm)**



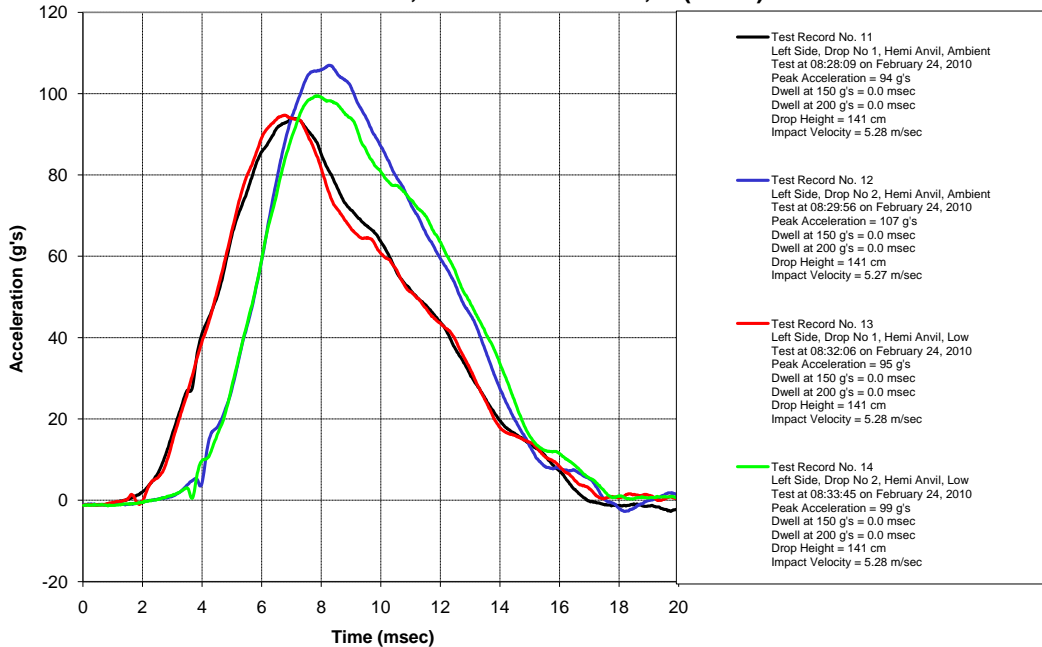
**Impact Testing  
JIAN126, MHR Tuzo MX 422, S (56cm)**



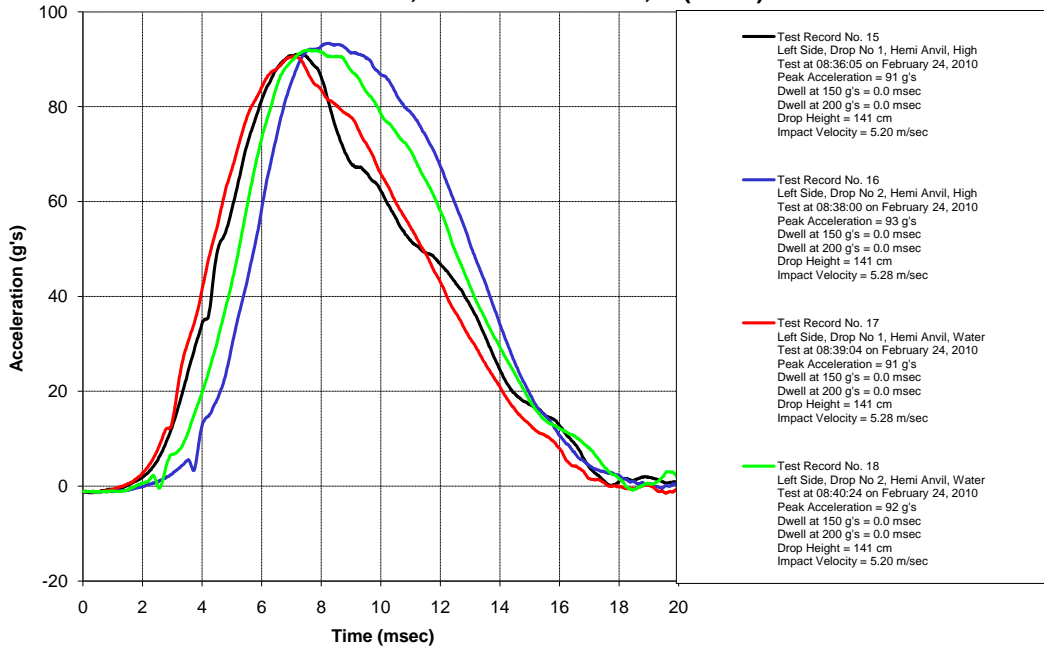
### Impact Testing JIAN126, MHR Tuzo MX 422, S (56cm)



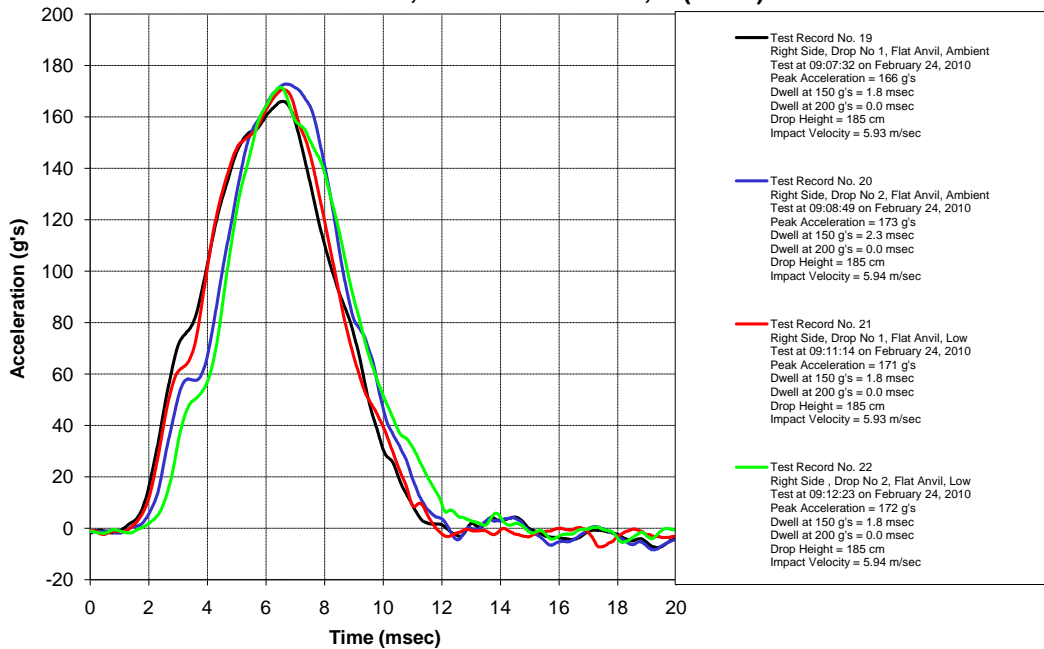
### Impact Testing JIAN126, MHR Tuzo MX 422, S (56cm)



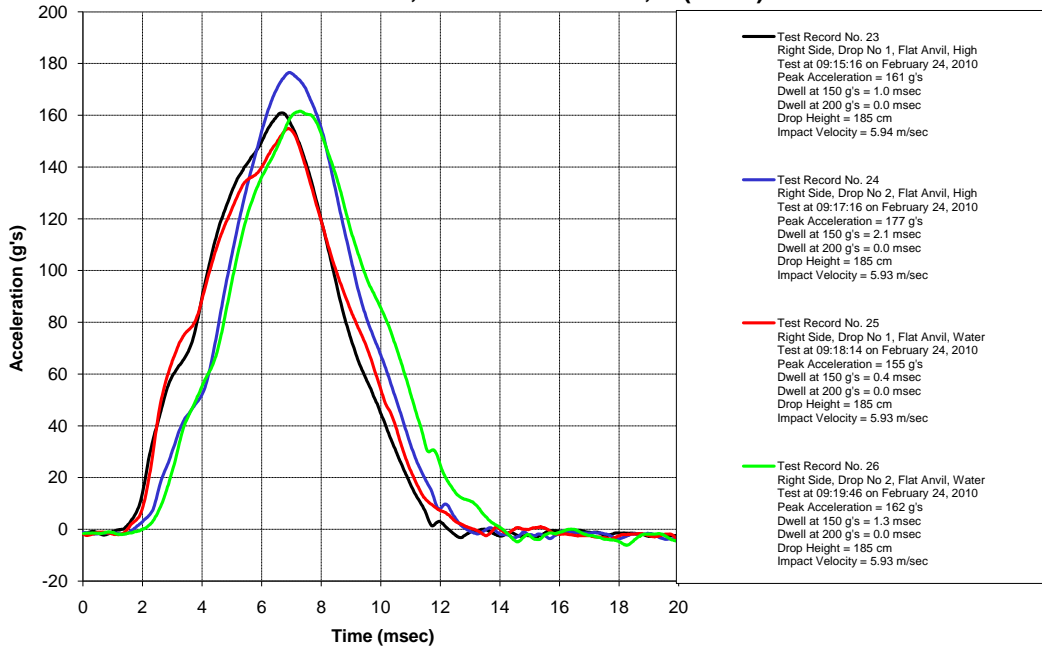
### Impact Testing JIAN126, MHR Tuzo MX 422, S (56cm)



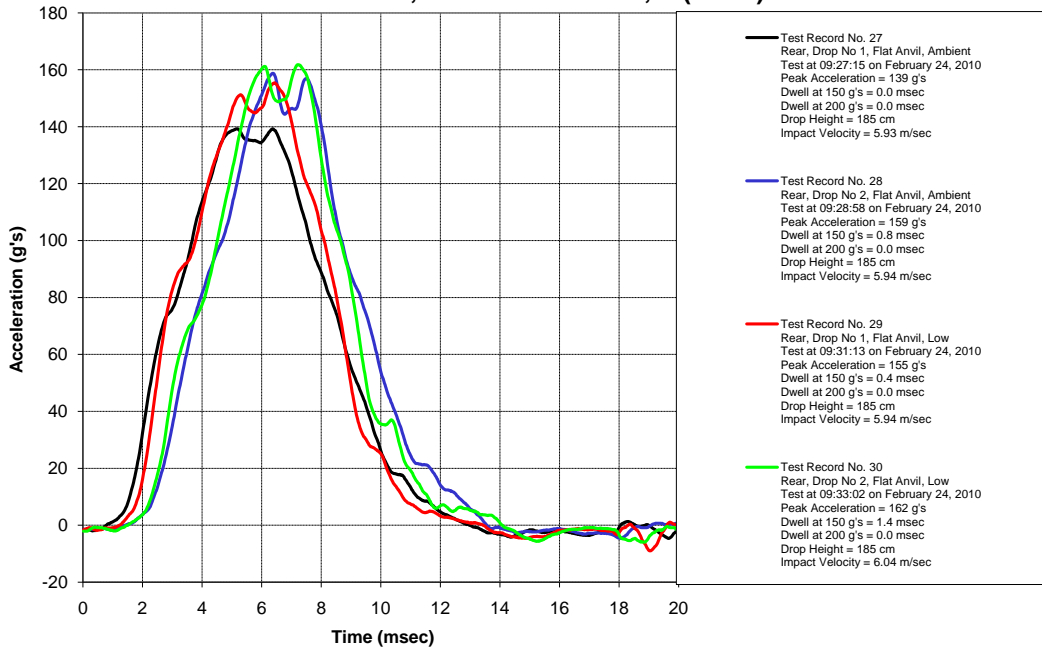
### Impact Testing JIAN126, MHR Tuzo MX 422, S (56cm)



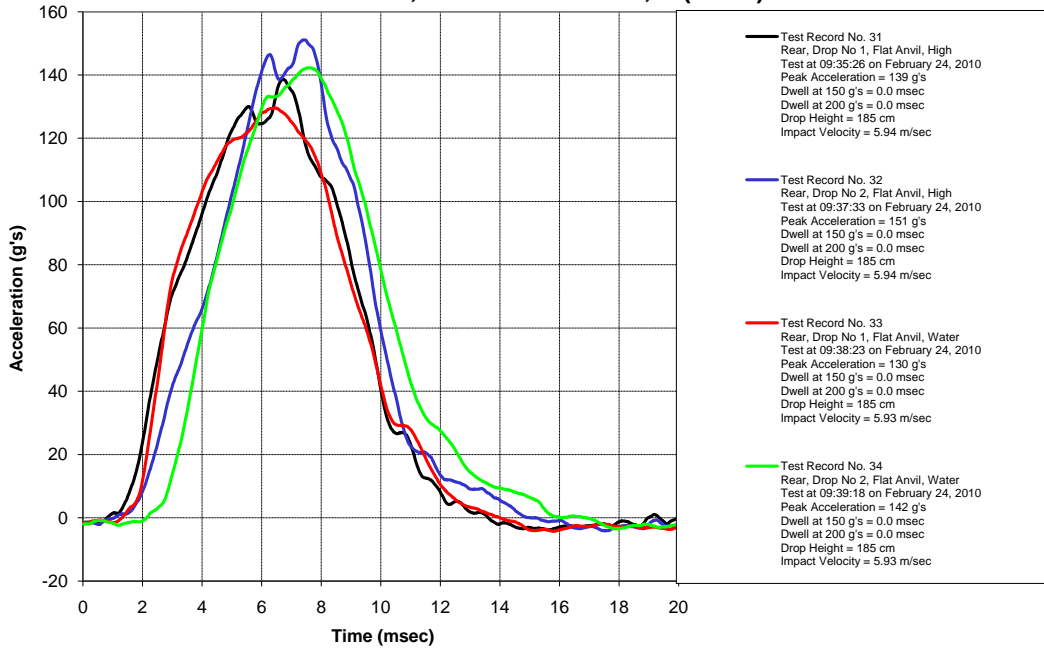
### Impact Testing JIAN126, MHR Tuzo MX 422, S (56cm)



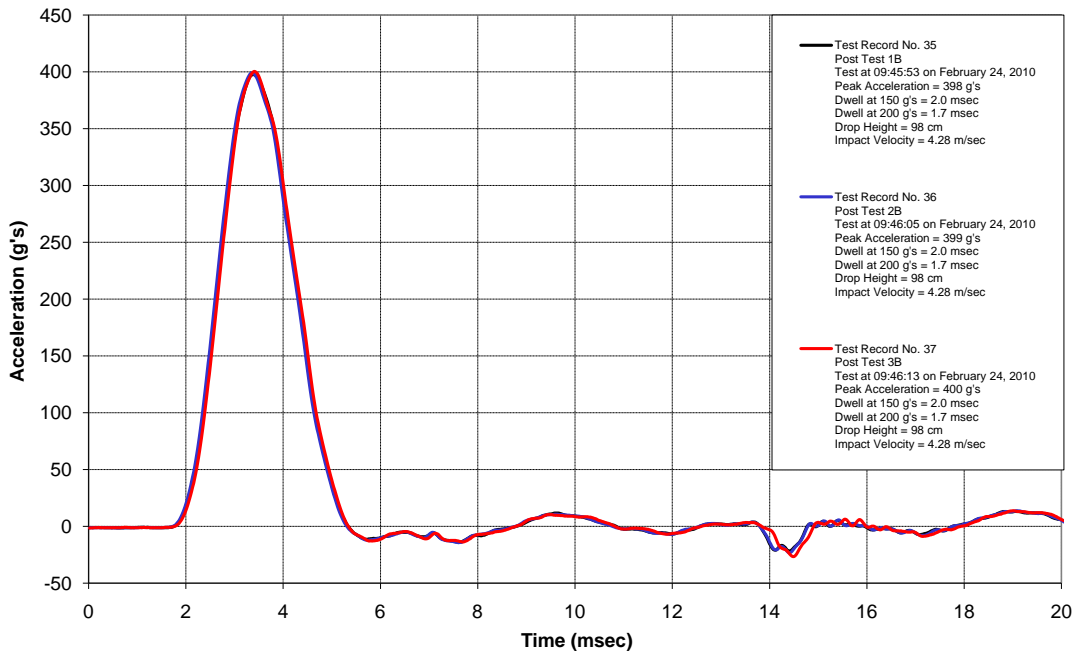
### Impact Testing JIAN126, MHR Tuzo MX 422, S (56cm)



**Impact Testing  
JIAN126, MHR Tuzo MX 422, S (56cm)**

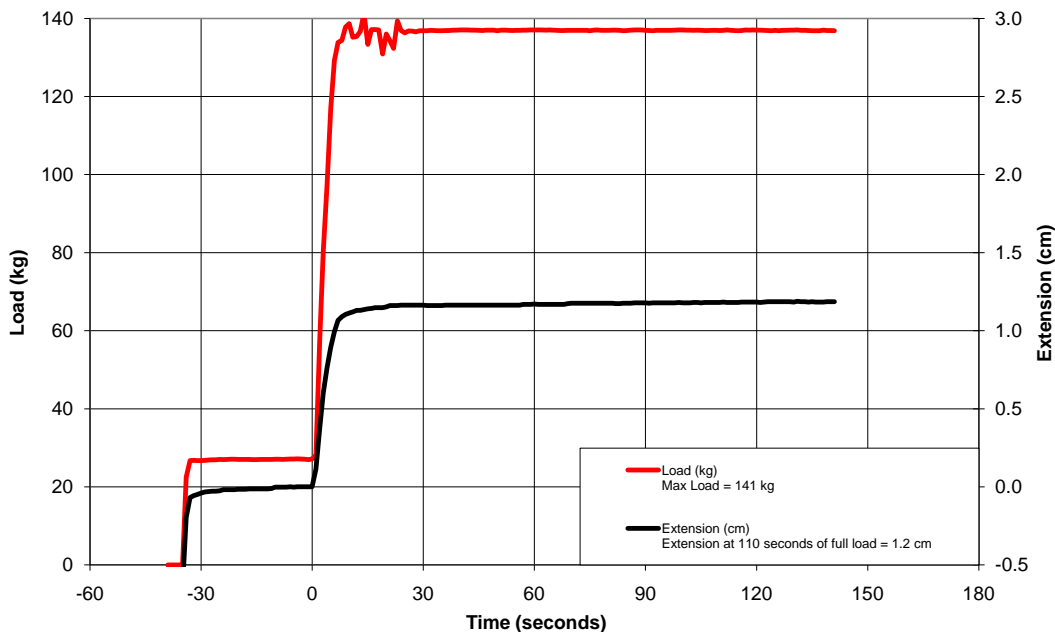


**Impact Testing  
JIAN126, MHR Tuzo MX 422, S (56cm)**

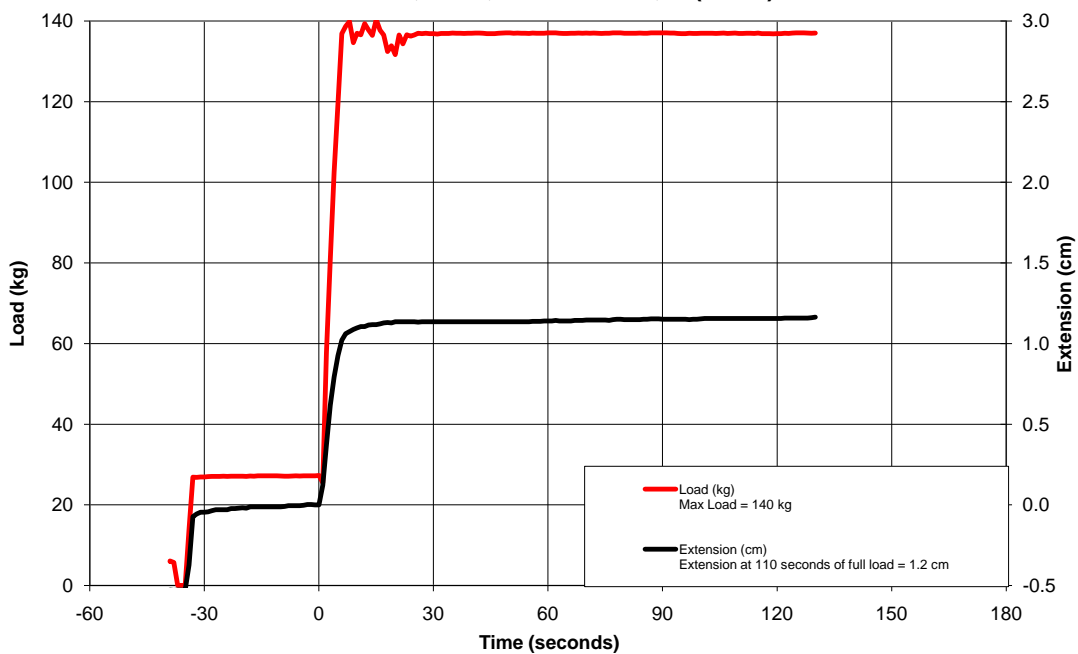


## 18. RETENTION TIME HISTORIES

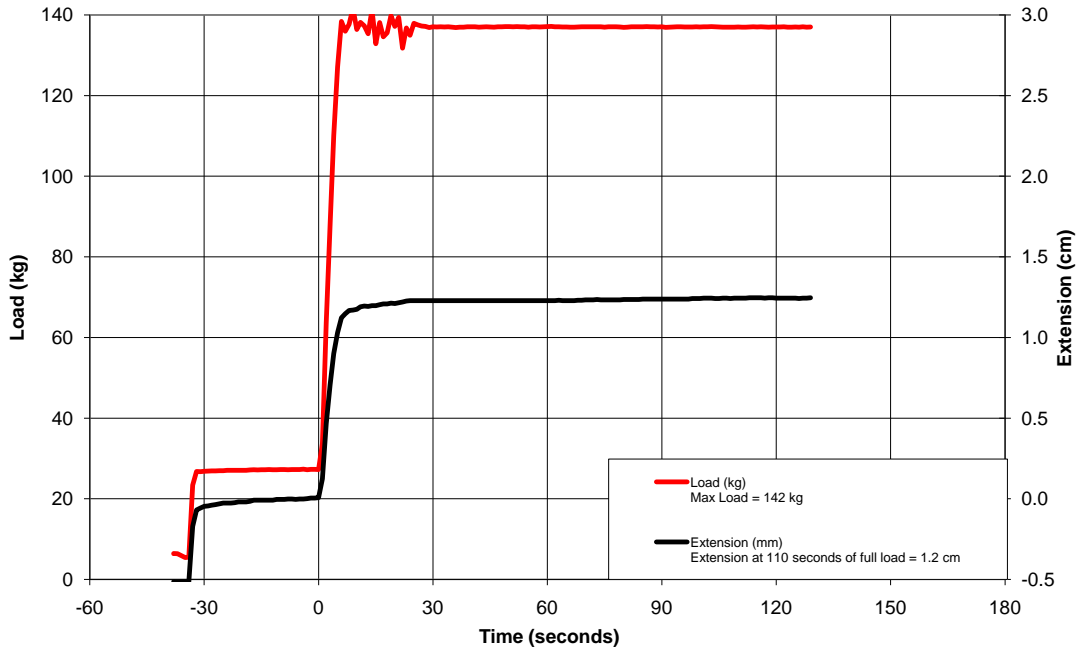
Ambient Temperature Retention Testing 02/24/10  
JIAN126, MHR, Tuzo MX 422, S (56cm)



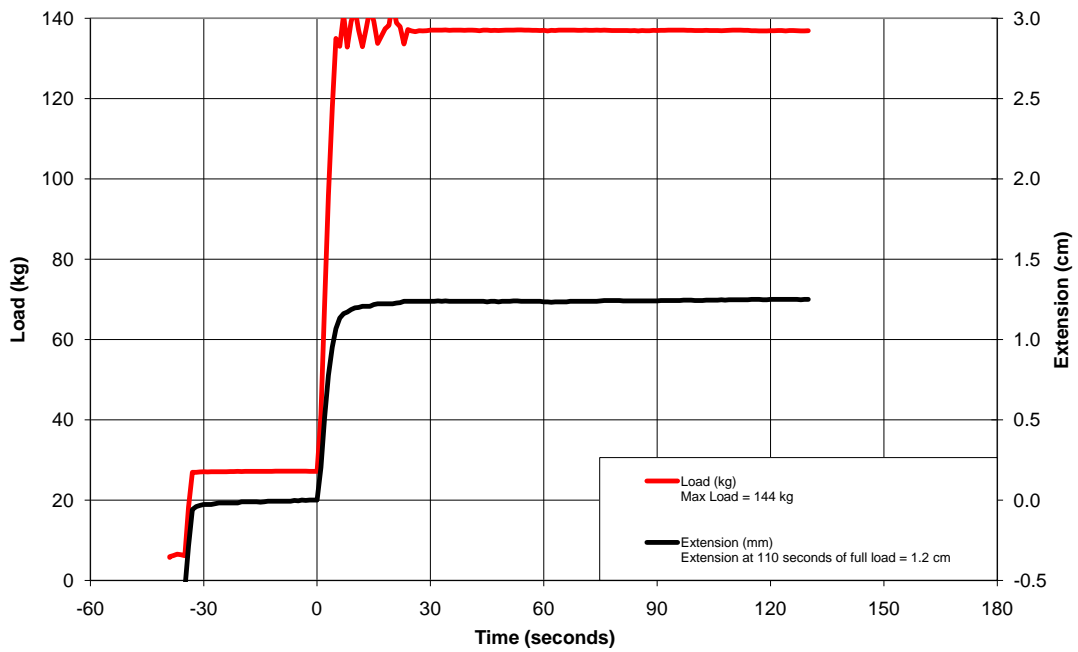
Low Temperature Retention Testing 02/24/10  
JIAN126, MHR, Tuzo MX 422, S (56cm)



High Temperature Retention Testing 02/24/10  
JIAN126, MHR, Tuzo MX 422, S (56cm)



Water Immersed Retention Testing 02/24/10  
JIAN126, MHR, Tuzo MX 422, S (56cm)



**19. PHOTOGRAPHS**



**Photograph 1. Front View Jiangmen Pengcheng Helmets Ltd (MHR), MX442, S (56 cm)**



**Photograph 2. Side View Jiangmen Pengcheng Helmets Ltd (MHR), MX442, S (56 cm)**





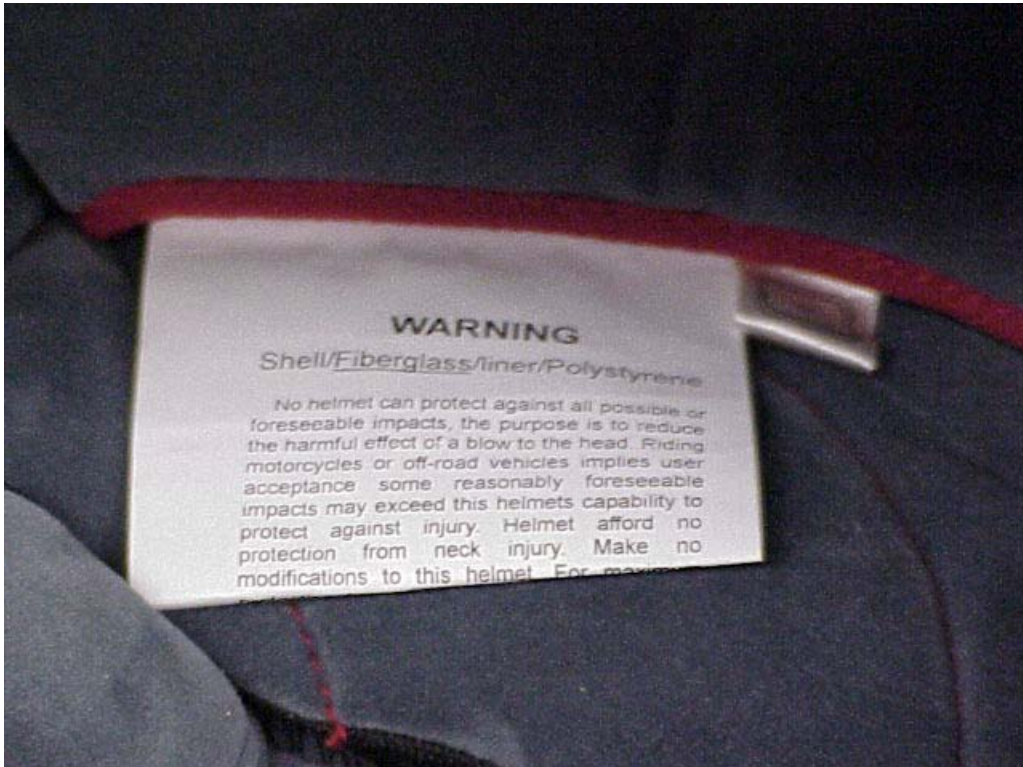
**Photograph 3. Rear View Jiangmen Pengcheng Helmets Ltd (MHR), MX442, S (56 cm)**



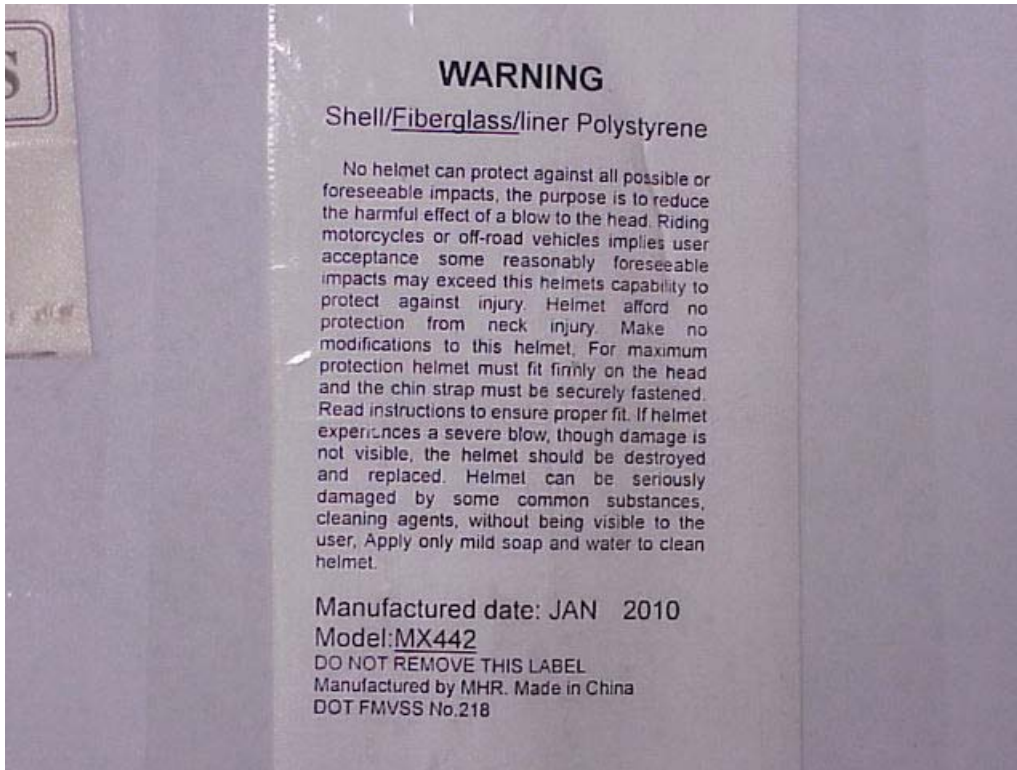
**Photograph 4. Top View Jiangmen Pengcheng Helmets Ltd (MHR), MX442, S (56 cm)**



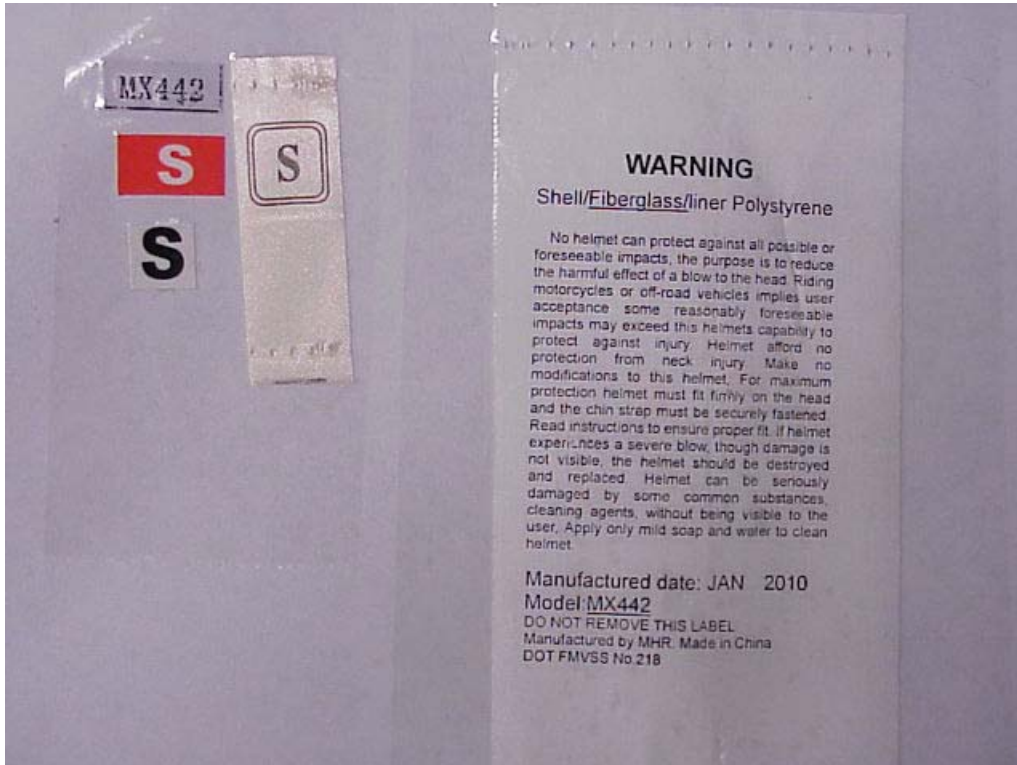
Photograph 5. Interior View Jiangmen Pengcheng Helmets Ltd (MHR), MX442, S (56 cm)



Photograph 6. Labeling 1 Jiangmen Pengcheng Helmets Ltd (MHR), MX442, S (56 cm)



Photograph 7. Labeling 2 Jiangmen Pengcheng Helmets Ltd (MHR), MX442, S (56 cm)



Photograph 8. Labeling 3 Jiangmen Pengcheng Helmets Ltd (MHR), MX442, S (56 cm)

## 20. TEST 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	Data Acquisition Card	National Instruments PCIMIO-16E-4	None	System Software Validation Procedure	NA	NA
	Data Acquisition Software	National Instruments / Labview for Windows	Ver 6			
	Data Acquisition Computer	Dell Computer Optiplex GX280	BVRV261			
2	Humidity and Temperature Transmitter	Omega / HX41	0599-6004	Manufacturer's Specification and System Software Verification Procedure	07/14/09	07/14/10
	Isolated Voltage Output	Omega / OM5-II-4-20	9213-15 9149-08			
3	Thermocouple Wire and Thermocouple Input Module	Omega / OM5-LTC-J2-C	21266 21261 21253	System Software Verification Procedure	06/27/09	06/27/10
4	Optical Velocity Transducer	Biokinetic and Associates Velocity Gate / 048-004-9411	9505-007	System Software Verification Procedure	06/27/09	06/27/10
5	Test Accelerometer	Endevco / 2262-1000	NL05	System Software Verification Procedure	06/27/09	06/27/10
	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	System Software Verification Procedure	06/27/09	06/27/10
	Strain Gage Conditioner	Measurement Group Inc. / 2120A	102130			
	Strain Gage Power Supply	Measurements Group Inc. / 2110A	102034			
	Isolated Voltage Output	Intelligent Measurement / PCI-5B41-02	None			
7	Potentiometer	Humphrey / RP14-0601-1	87	System Software Verification Procedure	06/27/09	06/27/10
	Isolated Voltage Output	Intelligent Measurement / PCI-5B41-02	None			
8	Scale	Ohaus Scale Corp / EB-15	8029436776	Manufacturer's Specification	01/13/10	01/13/11
9	Function Generator	Agilent / 33220A	MY44029640	Manufacturer's Specification	02/13/09	02/13/10

**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
		CADEX	Large	4914	+0.31 inches	2/08
2	ISO Impact Headforms		A, E, J, M, and O			
3	ISO Full Headforms		A, E, J, M, and O			
4	Drop Assembly	SwRI	Small, Medium, and Large	None	TP-218-06	6/89
5	Modular Elastomeric Programmer (MEP)	MTS Systems Corp.	None	None	N/A	N/A
6	Spherical Impactor with MEP					
7	Static Retention Test System	SwRI				
8	Chin Strap Fixture	SwRI	1	1	TP-218-06	1/80
9	Static Weights (Steel)	SwRI	1	1	±0.1 lbs.	2/94
10	Hydraulic Cylinder	Enerpac	RD46	1	N/A	N/A
11	Hydraulic Pump	Enerpac	P-18	CC 4511	N/A	N/A
12	Dynamic Retention Test System					
13	Chin Strap Fixture	SwRI	1	1	TP-218-06	1/80
14	Dynamic Weights (Steel)				±0.1 lbs.	
15	Roll-off Test System					
16	Penetration Striker	SwRI	1	1	TP-218-06	1/80
17	Environmental Conditioner	EDPAC	Mini Tech 90	None	N/A	N/A
18	Oven with Digitronic Control	Despatch Industries Inc.	LDB1-69	128710	N/A	N/A
19	Freezer with Omega Temperature Controller	Sears	9105010 CN100TC	S10204102 6 4011302	N/A	N/A
20	Peripheral Vision Template	SwRI	1	1	±15 min	1/80