

REPORT NUMBER: 213-MGA-10-002

**SAFETY RESEARCH TESTING FOR
CHILD RESTRAINT SYSTEMS**

**Orbit Baby, Inc.
Infant Car Seat, Model ORB803000**

**PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105**



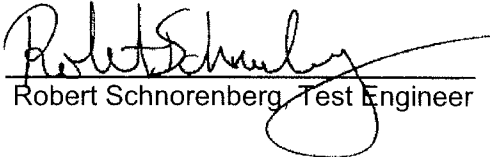
Report Date: October 5, 2009

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
1200 NEW JERSEY AVENUE, SE (NVS-220)
WASHINGTON, D.C. 20590**

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Safety Compliance Engineer
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<p>15. <i>Supplementary Notes</i></p>			
<p>16. <i>Abstract</i> Following receipt of information that in dynamic sled tests performed by Consumers Union (CU) there were two incidents of seat base separations of the Orbit Baby Infant Car Seat and Base (Orbit) (model ORB803000) child restraint system, NHTSA conducted tests. NHTSA's tests were dynamic sled tests on four Orbit child restraint systems that replicated the CU test configurations and installation methods. No seat base separations were observed in NHTSA tests.</p> <p>The test configurations and installation methods used by CU and replicated by NHTSA for tests of the Orbit system did not strictly follow FMVSS No. 213 test protocols. Nonetheless, NHTSA used FMVSS No. 213 as a frame of reference for test results. While this report refers to FMVSS No. 213, this is for reference only, and not an assessment of compliance with FMVSS No. 213. NHTSA's replication of the CU tests contained in this report was performed for research purposes only and is not to be used for any determination of compliance with FMVSS No. 213.</p>			
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SECTION 1

INTRODUCTION AND SUMMARY

Research testing was conducted by NHTSA in response to information provided by the Consumers Union (CU) regarding seat base separations of the Orbit Baby Infant Car Seat and Base observed during two dynamic sled tests. In one of the CU tests in which the separation was observed, the restraint base was installed on the test bench with the lower anchors; in the other CU test the restraint base was installed on the test bench with the lap and shoulder belt. The 12 month old CRABI dummy was used in the rear facing configuration for all tests.

The NHTSA research tests replicated the test configurations and installation methods used by CU. In some cases the test parameters used by CU deviated from certain FMVSS No. 213 test protocol.

1. The installation of a child restraint to the test bench with a lap and shoulder belt is not provided in FMVSS No. 213.
2. The Orbit restraint base is equipped with a device called “StrongArm” which, when engaged, provides additional tension between the base and the means to attach the base to the test bench (i.e., lower anchor webbing or belt). The use of the “StrongArm” is included in the instructions in Orbit’s owner’s manual. The “StrongArm” was not engaged for the CU tests and therefore NHTSA did not engage the “StrongArm” for this series of tests.

We also note that while NHTSA’s regulations govern the performance of tests, NHTSA also has recommended practices that contract test labs use. These do not limit or modify the regulations. NHTSA’s recommended practice for rear facing seats is to place the harness through the slot at or below the level of the dummy’s shoulder, which NHTSA believes is the middle slot for the Orbit restraint and 12 month old dummy. To replicate the CU test configurations, NHTSA’s tests were conducted with the restraint’s shoulder harness placed through the top slot on the seat back. Although this is not in agreement with NHTSA’s recommended practice, use of the top slot is permitted by FMVSS No. 213.

A summary of the test results is provided in this report. No seat base separations of the Orbit system were observed.

TEST DATA NO. 1
DYNAMIC IMPACT TEST CONDITIONS
(FMVSS 213, S6.1)

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09960F
Item Code	002-OORB803000-01-12CRB3FN
Date of Manufacture:	042009

Laboratory Ambient Conditions During Testing:

Temperature Degrees C (F)	21 (70)
Relative Humidity %	39

Test Configuration (I or II):	I
Nominal Velocity (km/h (mph)):	48 (+0, -3) (30 (+0, -2))
Type of Dummy Used:	12 month old
Serial Number:	082
Child Restraint System	
Installation Mode:	Rear-facing (1) (2) (3)
Adjustment Mode:	N/A
"Misuse" Mode:	N/A
Test Results	
Actual Velocity (km/h (mph)):	48.3 (30.0)
Integrated area of sled acceleration deviation below the lower severity boundary (m/s (ft/s)):	0.0

The acceleration-time history plot is presented on the following page. Pre and post test photographs are presented in Appendix B.

Remarks:

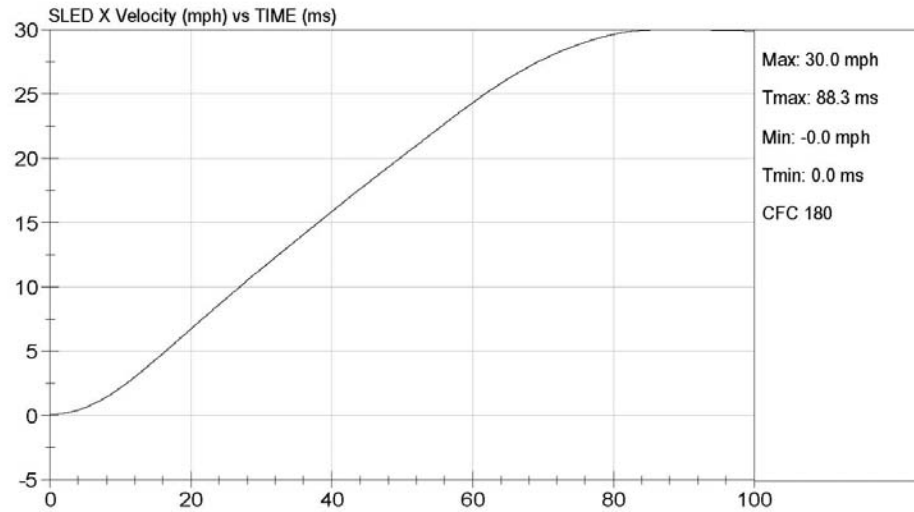
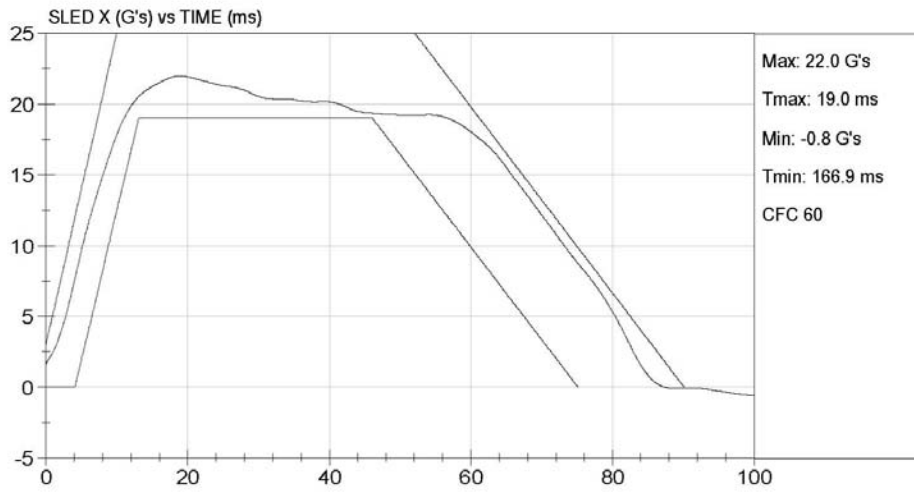
- (1) The belts were threaded through the top slots on the seat back.
- (2) The restraint was attached to the test bench with a lap and shoulder belt.
- (3) The base is equipped with a device called "StrongArm" which, when engaged, provides additional tension between the base and the means of attachment (i.e. LATCH webbing or lap and shoulder belt). The "StrongArm" device was not engaged during this test.

TEST DATA NO. 1...(continued)
DYNAMIC IMPACT TEST CONDITIONS
(FMVSS 213, S6.1)

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09960F
Item Code	002-OORB803000-01-12CRB3FN

	FMVSS 213 TEST 002-OORB803000-01-12CRB3FN	TEST DATE: 09/28/2009 TEST #: H09960
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TEST DATA NO. 1...(continued)
RESTRAINT SYSTEM INTEGRITY
(FMVSS 213, S5.1.1)

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09960F
Item Code	002-OORB803000-01-12CRB3FN

Test	Compliance Requirement	Test Result	Pass/Fail
Structural Integrity	No complete separation	None	Pass
	No partial separation with exposed edge radius < 6.35 mm (1/4 in)	None	Pass
	No partial separation With protrusions > 9.53 mm (3/8 in)	None	Pass
Adjustment Position	No change	No change	Pass
Back Surface/ Seating Surface Angle	Not < 45 degrees	> 45 degrees	Pass

Remarks:

TEST DATA NO. 1...(continued)

INJURY CRITERIA

(FMVSS 213, S5.1.2)

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09960F
Item Code	002-OORB803000-01-12CRB3FN

Test	Compliance Requirement	Test Result	Pass/Fail
Head Injury Criterion	≤ 1000	551	Pass
Chest Injury Criterion	Cumulative Duration Over 60 g ≤ 3 ms	3 msec clip = 43.1 Duration exceeded 60 g = 0.0	Pass

Remarks:

TEST DATA NO. 1...(continued)
OCCUPANT EXCURSION
(FMVSS 213, S5.1.3, S5.1.4, S5.2.1.1(c))

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09960F
Item Code	002-OORB803000-01-12CRB3FN

Forward-Facing Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Torso Retention (FMVSS 213, S5.1.3.1)	Retain within system	N/A	N/A
Head Excursion (FMVSS 213, S5.1.3.1)	≤ 81.3 cm (32 in)	N/A	N/A
Knee Target Excursion (FMVSS 213, S5.1.3.1)	≤ 91.5 cm (36 in)	N/A	N/A
Head – Torso Angle (FMVSS 213, S5.2.1.1(c))	Rearward change ≤ 45 degrees	N/A	N/A

Rear-Facing Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Torso Retention (FMVSS 213, S5.1.3.2)	Retain within system	Retained	Pass
Head Target Excursion (FMVSS 213, S5.1.3.2)	Not beyond restraint's top and forward edge	Below	Pass
Back Support Angle (FMVSS 213, S5.1.4)	≤ 70 degrees	62 degrees	Pass
Head – Torso Angle (FMVSS 213, S5.2.1.1(c))	Rearward change ≤ 45 degrees	< 45 degrees	Pass

Car Bed Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Head – Torso Retention (FMVSS 213, S5.1.3.3)	Retain within confines of system	N/A	N/A

Remarks:

TEST DATA NO. 2
DYNAMIC IMPACT TEST CONDITIONS
(FMVSS 213, S6.1)

Report No.:	213-MGA-10-002	Sled Test No.	H09960R
Test Date:	9/28/2009	Item Code	002-OORB803000-02-12CRBLFN
		Date of Manufacture:	042009

Laboratory Ambient Conditions During Testing:

Temperature Degrees C (F)	21 (70)
Relative Humidity %	39

Test Configuration (I or II):	I
Nominal Velocity (km/h (mph)):	48 (+0, -3) (30 (+0, -2))
Type of Dummy Used:	12 month old
Serial Number:	083
Child Restraint System	
Installation Mode:	Rear-facing (1) (2) (3)
Adjustment Mode:	N/A
"Misuse" Mode:	N/A
Test Results	
Actual Velocity (km/h (mph)):	48.3 (30.0)
Integrated area of sled acceleration deviation below the lower severity boundary (m/s (ft/s)):	0.0

The acceleration-time history plot is presented on the following page. Pre and post test photographs are presented in Appendix B.

Remarks:

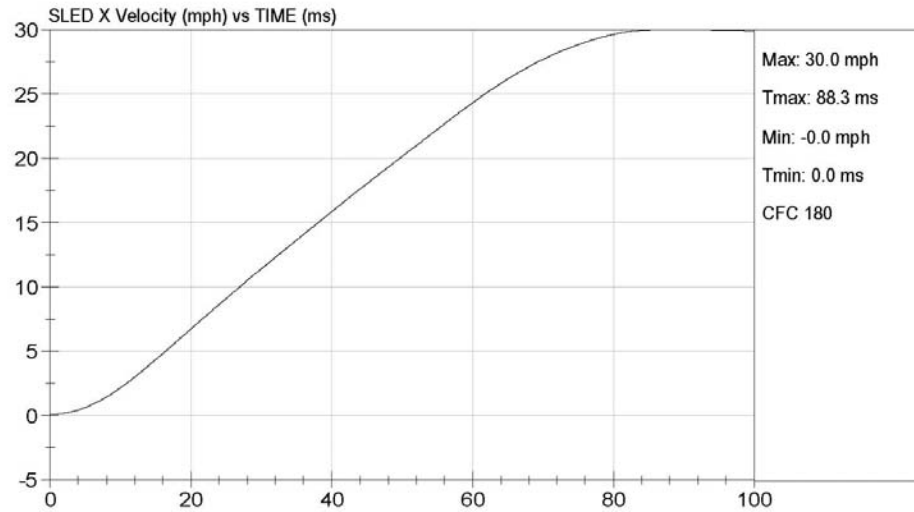
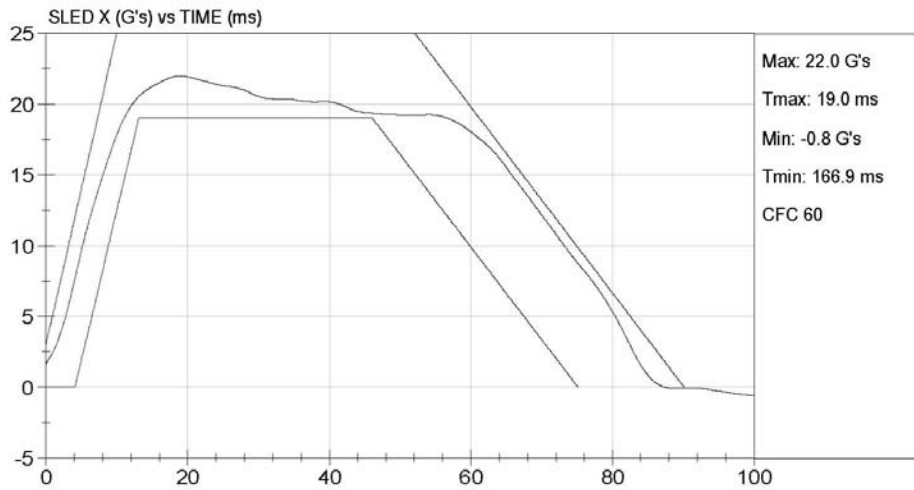
- (1) The belts were threaded through the top slots on the seat back.
- (2) The restraint was attached to the test bench with the child restraint anchorage system (LATCH).
- (3) The base is equipped with a device called "StrongArm" which, when engaged, provides additional tension between the base and the means of attachment (i.e. LATCH webbing or lap and shoulder belt). The "StrongArm" device was not engaged during this test.

TEST DATA NO. 2...(continued)
DYNAMIC IMPACT TEST CONDITIONS
(FMVSS 213, S6.1)

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09960R
Item Code	002-OORB803000-02-12CRBLFN

	FMVSS 213 TEST 002-OORB803000-02-12CRBLFN	TEST DATE: 09/28/2009 TEST #: H09960
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TEST DATA NO. 2...(continued)
RESTRAINT SYSTEM INTEGRITY
(FMVSS 213, S5.1.1)

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09960R
Item Code	002-OORB803000-02-12CRBLFN

Test	Compliance Requirement	Test Result	Pass/Fail
Structural Integrity	No complete separation	None	Pass
	No partial separation with exposed edge radius < 6.35 mm (1/4 in)	None	Pass
	No partial separation With protrusions > 9.53 mm (3/8 in)	None	Pass
Adjustment Position	No change	No change	Pass
Back Surface/ Seating Surface Angle	Not < 45 degrees	> 45 degrees	Pass

Remarks:

TEST DATA NO. 2...(continued)

INJURY CRITERIA

(FMVSS 213, S5.1.2)

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09960R
Item Code	002-OORB803000-02-12CRBLFN

Test	Compliance Requirement	Test Result	Pass/Fail
Head Injury Criterion	≤ 1000	546	Pass
Chest Injury Criterion	Cumulative Duration Over 60 g ≤ 3 ms	3 msec clip = 46.3 Duration exceeded 60 g = 0.0	Pass

Remarks:

TEST DATA NO. 2...(continued)
OCCUPANT EXCURSION
(FMVSS 213, S5.1.3, S5.1.4, S5.2.1.1(c))

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09960R
Item Code	002-OORB803000-02-12CRBLFN

Forward-Facing Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Torso Retention (FMVSS 213, S5.1.3.1)	Retain within system	N/A	N/A
Head Excursion (FMVSS 213, S5.1.3.1)	≤ 81.3 cm (32 in)	N/A	N/A
Knee Target Excursion (FMVSS 213, S5.1.3.1)	≤ 91.5 cm (36 in)	N/A	N/A
Head – Torso Angle (FMVSS 213, S5.2.1.1(c))	Rearward change ≤ 45 degrees	N/A	N/A

Rear-Facing Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Torso Retention (FMVSS 213, S5.1.3.2)	Retain within system	Retained	Pass
Head Target Excursion (FMVSS 213, S5.1.3.2)	Not beyond restraint's top and forward edge	Below	Pass
Back Support Angle (FMVSS 213, S5.1.4)	≤ 70 degrees	62 degrees	Pass
Head – Torso Angle (FMVSS 213, S5.2.1.1(c))	Rearward change ≤ 45 degrees	< 45 degrees	Pass

Car Bed Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Head – Torso Retention (FMVSS 213, S5.1.3.3)	Retain within confines of system	N/A	N/A

Remarks:

TEST DATA NO. 3
DYNAMIC IMPACT TEST CONDITIONS
(FMVSS 213, S6.1)

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09961F
Item Code	002-OORB803000-03-12CRB3FN
Date of Manufacture:	042009

Laboratory Ambient Conditions During Testing:

Temperature Degrees C (F)	21 (70)
Relative Humidity %	39

Test Configuration (I or II):	I
Nominal Velocity (km/h (mph)):	48 (+0, -3) (30 (+0, -2))
Type of Dummy Used:	12 month old
Serial Number:	082
Child Restraint System	
Installation Mode:	Rear-facing (1) (2) (3)
Adjustment Mode:	N/A
"Misuse" Mode:	N/A
Test Results	
Actual Velocity (km/h (mph)):	48.3 (30.0)
Integrated area of sled acceleration deviation below the lower severity boundary (m/s (ft/s)):	0.0

The acceleration-time history plot is presented on the following page. Pre and post test photographs are presented in Appendix B.

Remarks:

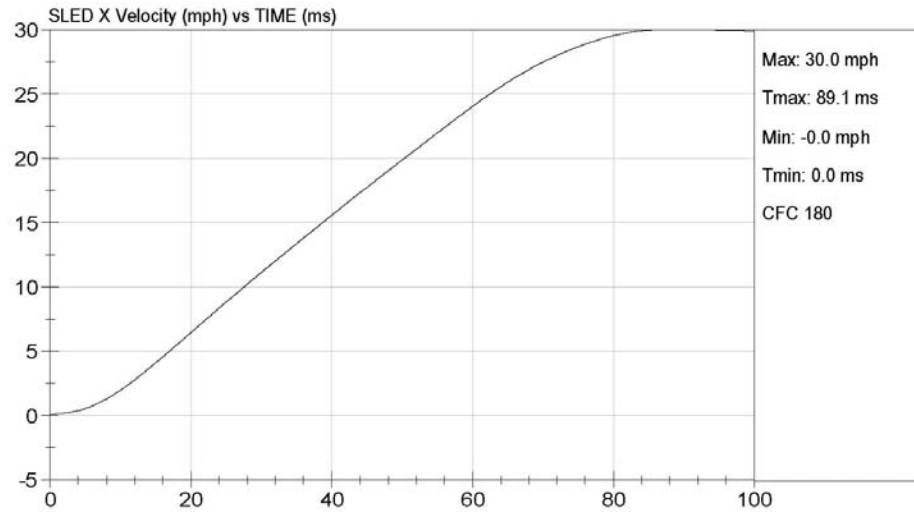
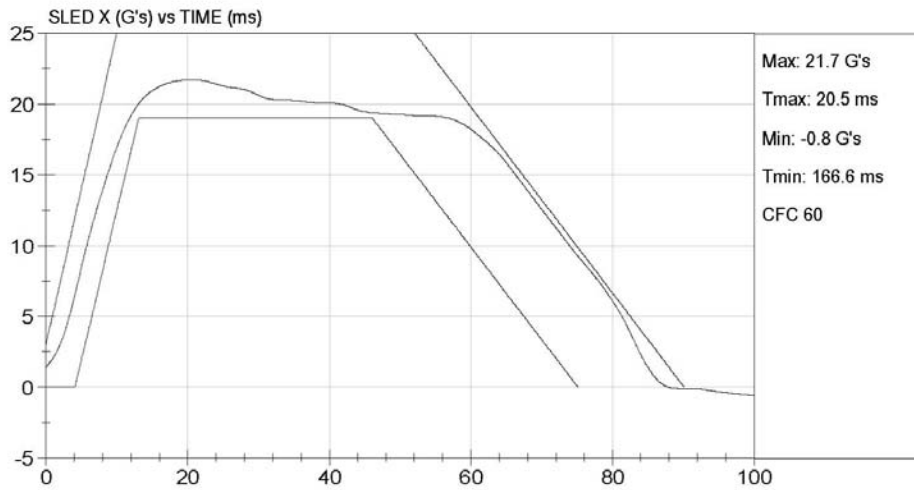
- (1) The belts were threaded through the top slots on the seat back.
- (2) The restraint was attached to the test bench with a lap and shoulder belt.
- (3) The base is equipped with a device called "StrongArm" which, when engaged, provides additional tension between the base and the means of attachment (i.e. LATCH webbing or lap and shoulder belt). The "StrongArm" device was not engaged during this test.

TEST DATA NO. 3...(continued)
DYNAMIC IMPACT TEST CONDITIONS
(FMVSS 213, S6.1)

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09961F
Item Code	002-OORB803000-03-12CRB3FN

	FMVSS 213 TEST 002-OORB803000-03-12CRB3FN	TEST DATE: 09/28/2009 TEST #: H09961
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TEST DATA NO. 3...(continued)
RESTRAINT SYSTEM INTEGRITY
(FMVSS 213, S5.1.1)

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09961F
Item Code	002-OORB803000-03-12CRB3FN

Test	Compliance Requirement	Test Result	Pass/Fail
Structural Integrity	No complete separation	None	Pass
	No partial separation with exposed edge radius < 6.35 mm (1/4 in)	None	Pass
	No partial separation With protrusions > 9.53 mm (3/8 in)	None	Pass
Adjustment Position	No change	No change	Pass
Back Surface/ Seating Surface Angle	Not < 45 degrees	> 45 degrees	Pass

Remarks:

TEST DATA NO. 3...(continued)

INJURY CRITERIA

(FMVSS 213, S5.1.2)

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09961F
Item Code	002-OORB803000-03-12CRB3FN

Test	Compliance Requirement	Test Result	Pass/Fail
Head Injury Criterion	≤ 1000	540	Pass
Chest Injury Criterion	Cumulative Duration Over 60 g ≤ 3 ms	3 msec clip = 45.7 Duration exceeded 60 g = 0.0	Pass

Remarks:

TEST DATA NO. 3...(continued)
OCCUPANT EXCURSION
(FMVSS 213, S5.1.3, S5.1.4, S5.2.1.1(c))

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09961F
Item Code	002-OORB803000-03-12CRB3FN

Forward-Facing Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Torso Retention (FMVSS 213, S5.1.3.1)	Retain within system	N/A	N/A
Head Excursion (FMVSS 213, S5.1.3.1)	≤ 81.3 cm (32 in)	N/A	N/A
Knee Target Excursion (FMVSS 213, S5.1.3.1)	≤ 91.5 cm (36 in)	N/A	N/A
Head – Torso Angle (FMVSS 213, S5.2.1.1(c))	Rearward change ≤ 45 degrees	N/A	N/A

Rear-Facing Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Torso Retention (FMVSS 213, S5.1.3.2)	Retain within system	Retained	Pass
Head Target Excursion (FMVSS 213, S5.1.3.2)	Not beyond restraint's top and forward edge	Below	Pass
Back Support Angle (FMVSS 213, S5.1.4)	≤ 70 degrees	61 degrees	Pass
Head – Torso Angle (FMVSS 213, S5.2.1.1(c))	Rearward change ≤ 45 degrees	< 45 degrees	Pass

Car Bed Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Head – Torso Retention (FMVSS 213, S5.1.3.3)	Retain within confines of system	N/A	N/A

Remarks:

TEST DATA NO. 4
DYNAMIC IMPACT TEST CONDITIONS
(FMVSS 213, S6.1)

Report No.:	213-MGA-10-002	Sled Test No.	H09961R
Test Date:	9/28/2009	Item Code	002-OORB803000-04-12CRBLFN
		Date of Manufacture:	042009

Laboratory Ambient Conditions During Testing:

Temperature Degrees C (F)	21 (70)
Relative Humidity %	39

Test Configuration (I or II):	I
Nominal Velocity (km/h (mph)):	48 (+0, -3) (30 (+0, -2))
Type of Dummy Used:	12 month old
Serial Number:	083
Child Restraint System	
Installation Mode:	Rear-facing (1) (2) (3)
Adjustment Mode:	N/A
"Misuse" Mode:	N/A
Test Results	
Actual Velocity (km/h (mph)):	48.3 (30.0)
Integrated area of sled acceleration deviation below the lower severity boundary (m/s (ft/s)):	0.0

The acceleration-time history plot is presented on the following page. Pre and post test photographs are presented in Appendix B.

Remarks:

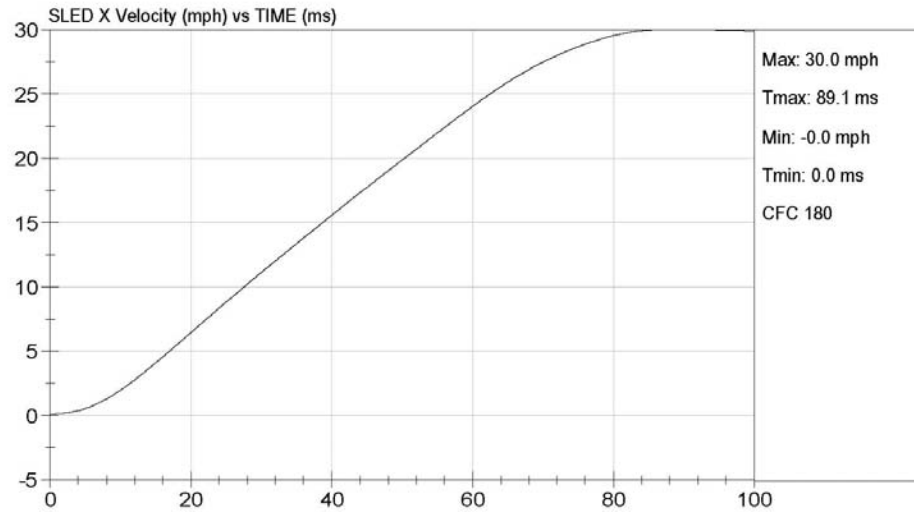
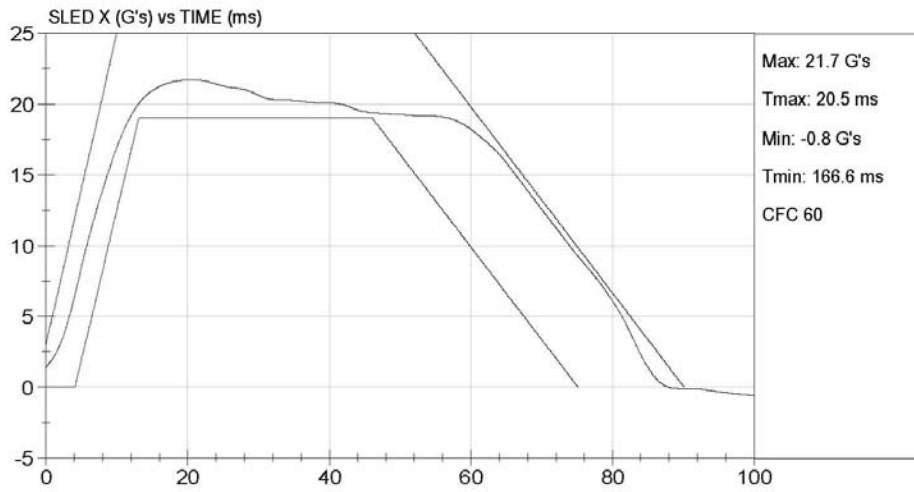
- (1) The belts were threaded through the top slots on the seat back.
- (2) The restraint was attached to the test bench with the child restraint anchorage system (LATCH).
- (3) The base is equipped with a device called "StrongArm" which, when engaged, provides additional tension between the base and the means of attachment (i.e. LATCH webbing or lap and shoulder belt). The "StrongArm" device was not engaged during this test.

TEST DATA NO. 4...(continued)
DYNAMIC IMPACT TEST CONDITIONS
(FMVSS 213, S6.1)

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09961R
Item Code	002-OORB803000-04-12CRBLFN

	FMVSS 213 TEST 002-OORB803000-04-12CRBLFN	TEST DATE: 09/28/2009 TEST #: H09961
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TEST DATA NO. 4...(continued)
RESTRAINT SYSTEM INTEGRITY
(FMVSS 213, S5.1.1)

Report No.:	213-MGA-10-002
Test Date:	9/28/2009

Sled Test No.	H09961R
Item Code	002-OORB803000-04-12CRBLFN

Test	Compliance Requirement	Test Result	Pass/Fail
Structural Integrity	No complete separation	None	Pass
	No partial separation with exposed edge radius < 6.35 mm (1/4 in)	None	Pass
	No partial separation With protrusions > 9.53 mm (3/8 in)	None	Pass
Adjustment Position	No change	No change	Pass
Back Surface/ Seating Surface Angle	Not < 45 degrees	> 45 degrees	Pass

Remarks:

TEST DATA NO. 4...(continued)

INJURY CRITERIA

(FMVSS 213, S5.1.2)

Report No.:	213-MGA-10-002	Sled Test No.	H09961R
Test Date:	9/28/2009	Item Code	002-OORB803000-04-12CRBLFN

Test	Compliance Requirement	Test Result	Pass/Fail
Head Injury Criterion	≤ 1000	535	Pass
Chest Injury Criterion	Cumulative Duration Over 60 g ≤ 3 ms	3 msec clip = 45.4 Duration exceeded 60 g = 0.0	Pass

Remarks:

TEST DATA NO. 4...(continued)
OCCUPANT EXCURSION
(FMVSS 213, S5.1.3, S5.1.4, S5.2.1.1(c))

Report No.:	213-MGA-10-002	Sled Test No.	H09961R
Test Date:	9/28/2009	Item Code	002-OORB803000-04-12CRBLFN

Forward-Facing Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Torso Retention (FMVSS 213, S5.1.3.1)	Retain within system	N/A	N/A
Head Excursion (FMVSS 213, S5.1.3.1)	≤ 81.3 cm (32 in)	N/A	N/A
Knee Target Excursion (FMVSS 213, S5.1.3.1)	≤ 91.5 cm (36 in)	N/A	N/A
Head – Torso Angle (FMVSS 213, S5.2.1.1(c))	Rearward change ≤ 45 degrees	N/A	N/A

Rear-Facing Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Torso Retention (FMVSS 213, S5.1.3.2)	Retain within system	Retained	Pass
Head Target Excursion (FMVSS 213, S5.1.3.2)	Not beyond restraint's top and forward edge	Below	Pass
Back Support Angle (FMVSS 213, S5.1.4)	≤ 70 degrees	62 degrees	Pass
Head – Torso Angle (FMVSS 213, S5.2.1.1(c))	Rearward change ≤ 45 degrees	< 45 degrees	Pass

Car Bed Restraints

Test	Compliance Requirement	Test Result	Pass/Fail
Head – Torso Retention (FMVSS 213, S5.1.3.3)	Retain within confines of system	N/A	N/A

Remarks:

APPENDIX A
TEST CONFIGURATION CODES

The following table explains the code used to describe the test configurations in this report. For example, the test configuration code 12CFNLFU indicates that the child restraint sled test was conducted using a 12-month old CRABI dummy, installed in the forward facing direction with no optional base, the latch system, no tether, and in the upright position.

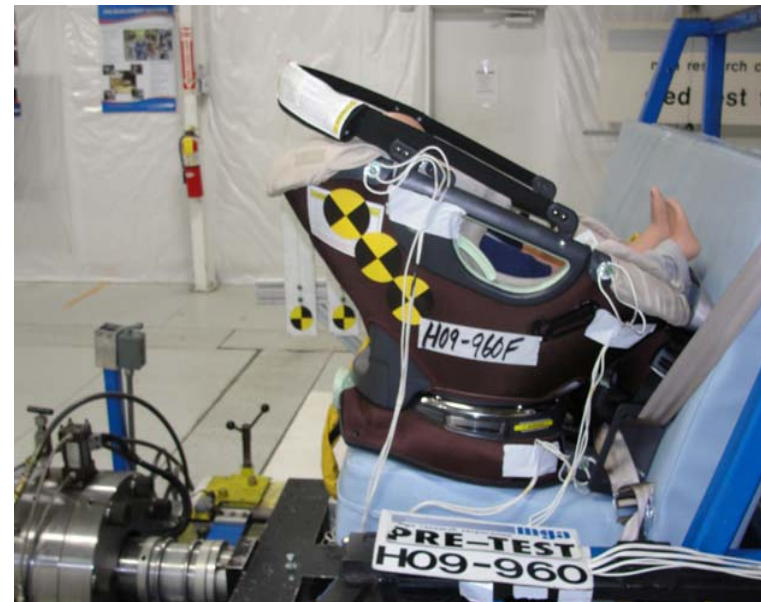
Dummy Description	NIN – Newborn Infant
	3H3 – 3 YO, Hybrid III
	12C -12 MO, CRABI
	6H2 – 6YO Hybrid II
	6H3 – 6YO, Hybrid III
	6W3 – 6 YO, Weighted Hybrid III
Installed Direction	R – Rear Facing
	F – Forward Facing
	S - Sideways
Base Usage	B – Optional base used with infant CRS
	N – All other configurations
Attachment Method	L – LATCH
	2 – Two-point belt
	3 – Three point belt
Tether Usage	T – Tether
	F – Tether Free
Back Angle	U – Upright
	R – Reclined
	N – Not Applicable

APPENDIX B
PHOTOGRAPHS

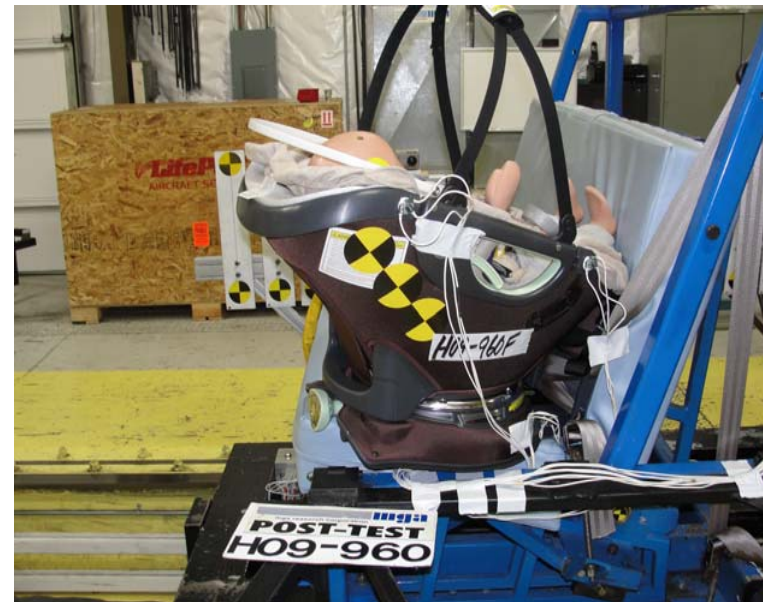
SLED BUCK – STANDARD BENCH SEAT
Report No.: 213-MGA-10-002



B-1



B-2



B-3



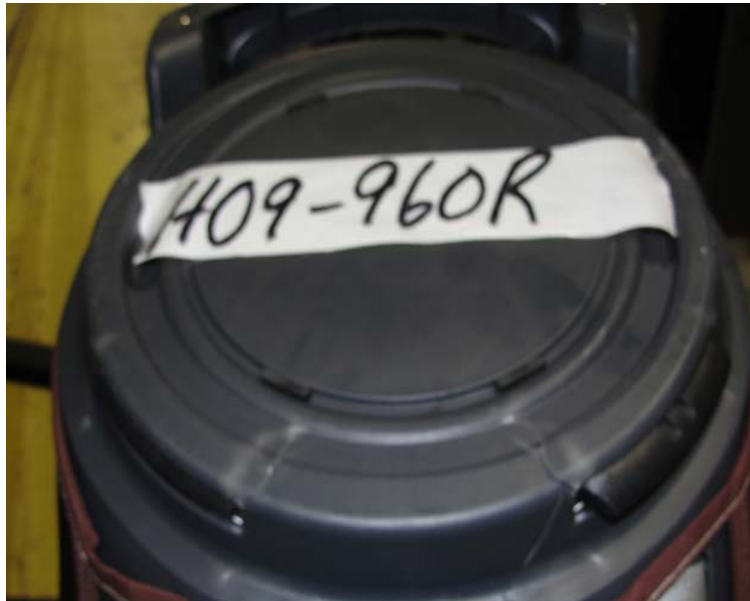
B-4



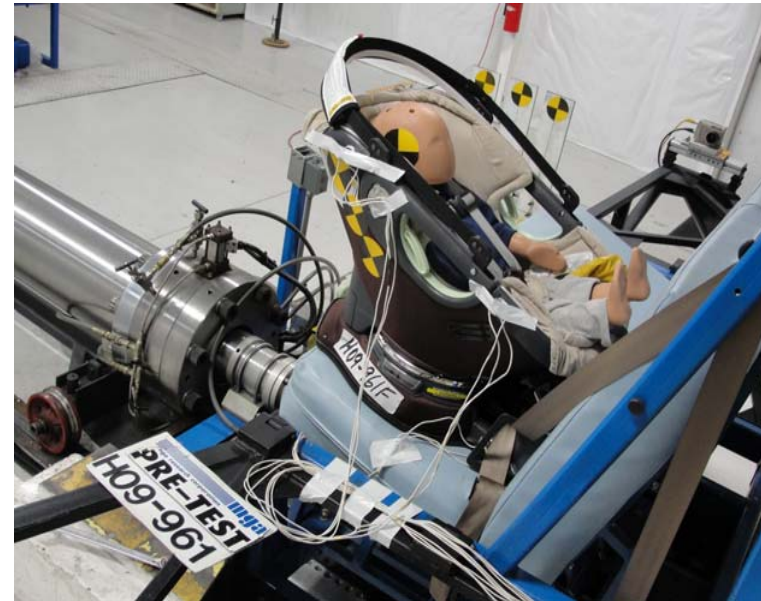
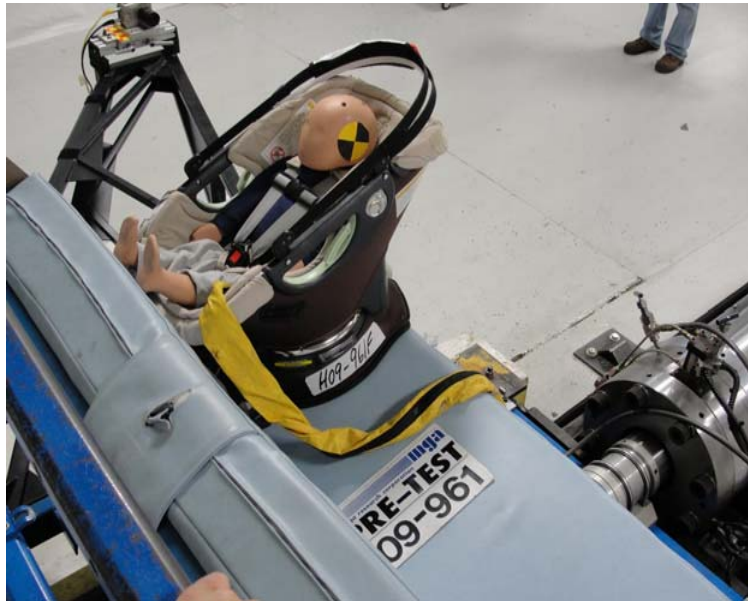
B-5



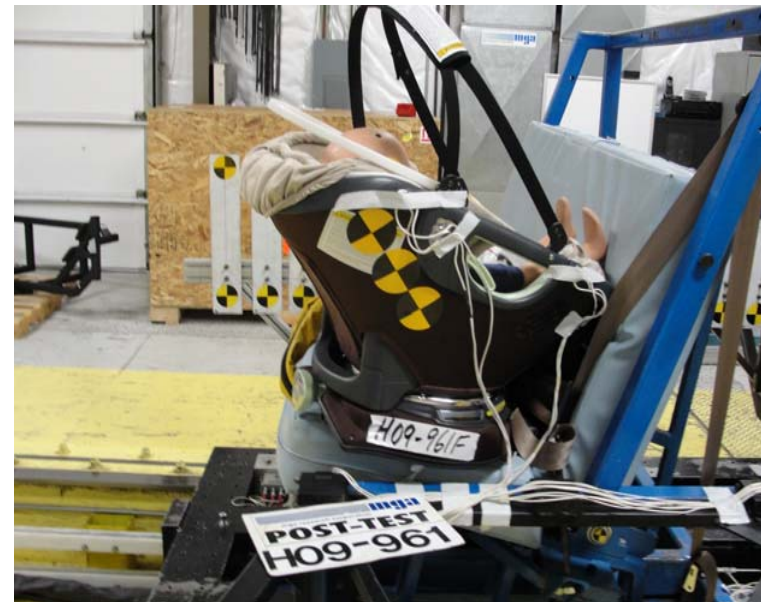
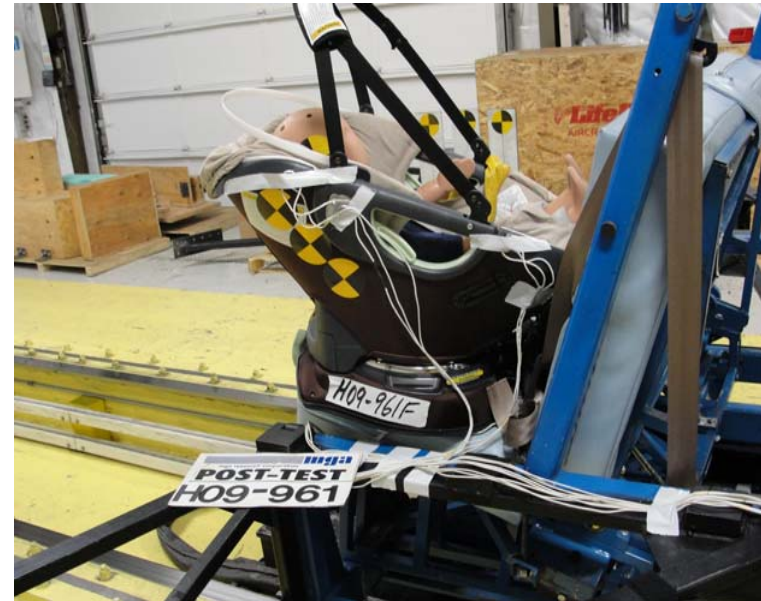
B-6



B-7



B-8



B-9



B-10

Item Code: 002-OORB803000-03-12CRB3FN

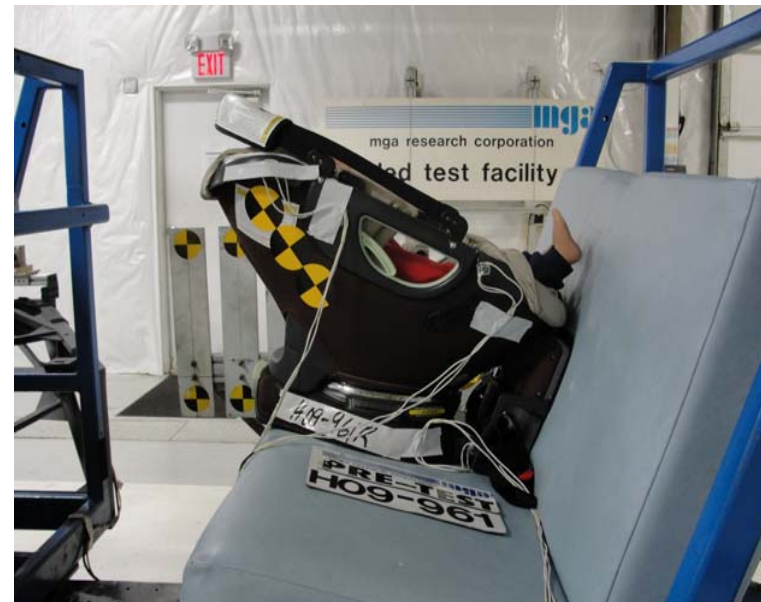
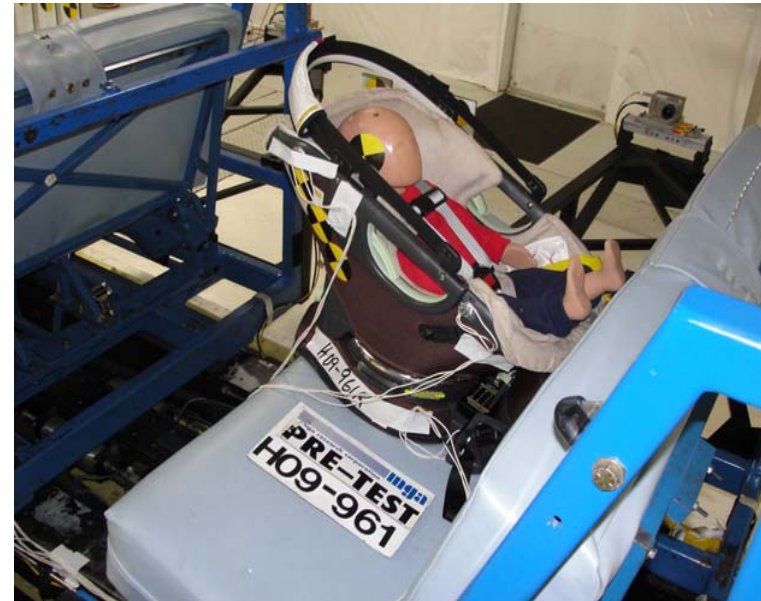
Report No.: 213-MGA-10-002

Sled Test: H09961F

Post-Test



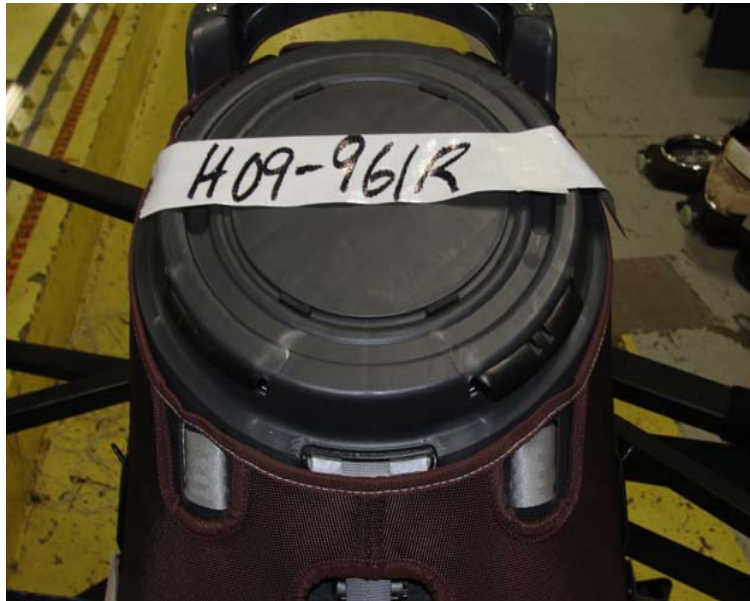
B-11



B-12



B-13



B-14

Item Code: 002-OORB803000-04-12CRBLFN

Report No.: 213-MGA-10-002

Sled Test: H09961R

Post-Test

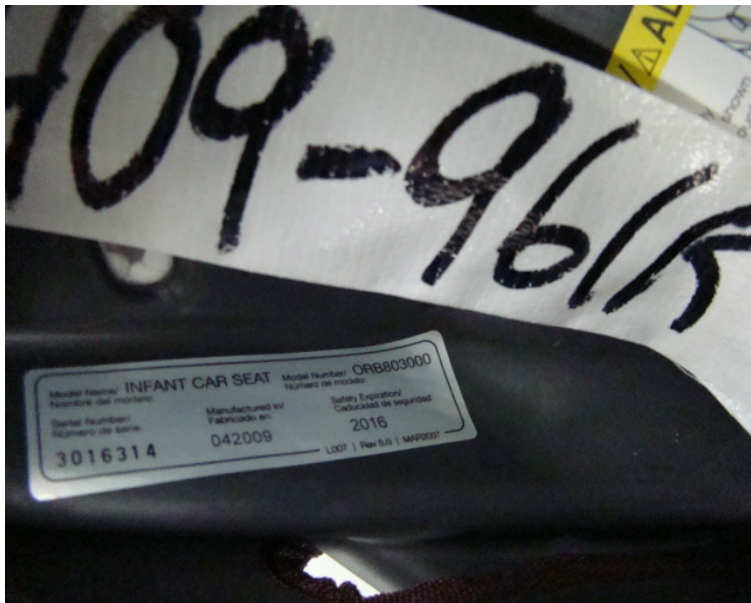


B-15

LABELS

Item Code: 001-RB803000-01-12CRB3FN
 Item Code: 001-RB803000-03-12CRB3FN

Item Code: 001-RB803000-02-12CRBLFN
 Item Code: 001-RB803000-04-12CRBLFN



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