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Evaluation of Aerospace 2-Point Lap Belts Under Dynamic Test Conditions

November 2015

Final Report

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16. Abstract

To determine how differences in elongation properties affect seat dynamic response, the Federal Aviation Administration conducted a test program using a rigid seat setup in different configurations with different webbing materials. The selected seating configurations represented seats commonly in use. New and newly repaired belts were acquired for this study. The belts were then subjected to dynamic impact tests using a rigid seat and the sled test pulse from Title 14 Code of Federal Regulations 25.562. No structural failures occurred and, in general, the rewebbed belts performed similarly, but not identically, to the original belts.

As part of this test program, a second phase was conducted to investigate the effects of belt stiffness. Original belt webbing material and several replacement webbing material candidates were statically tested to determine their elongation properties. These belts were then subjected to the same test setup as in Phase 1, with the only difference being that only one seating configuration was tested. No structural failures occurred. A trend was noted that higher belt stiffness resulted in less occupant excursion and higher belt loads.

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LIST OF ACRONYMS

AD	Airworthiness Directive
AS	Aerospace Standard
ATD	Anthropomorphic test device
CFR	Code of Federal Regulations
EASA	European Aviation Safety Agency
FAA	Federal Aviation Administration
OEM	Original equipment manufacturer
SBA	Seat belt anchor
SRP	Seat reference point
TSO	Technical Standard Order

EXECUTIVE SUMMARY

To determine how differences in elongation properties affect seat dynamic response, the Federal Aviation Administration conducted a test program using a rigid seat setup in different configurations with different webbing materials. The selected seating configurations represented seats commonly in use. Both new and newly repaired belts were acquired for this study. These belts were then subjected to dynamic impact tests using a rigid seat and the sled test pulse from Title 14 Code of Federal Regulations 25.562. No structural failures occurred and, in general, the rewebbed belts performed similarly, but not identically, to the original belts.

As part of this test program, a second phase was conducted to investigate the effects of belt stiffness. Original belt webbing material and several replacement webbing material candidates were statically tested to determine their elongation properties. These belts were then subjected to the same test setup as in Phase 1; however, unlike Phase 1, only one seating configuration was tested. No structural failures occurred. A trend was noted that higher belt stiffness resulted in less occupant excursion and higher belt loads.

1. INTRODUCTION

In 2012, the European Aviation Safety Agency (EASA) issued a notification of a proposal to issue an Airworthiness Directive (AD) for specific safety belts and torso restraint systems [1]. This was subsequently issued as EASA AD 2013-020 and specifically identified a concern with the material type being used interchangeably between belts [2]. The differences noted were from different elongation properties. Technical Standard Orders (TSOs) C22g [3] and C114 [4] reference SAE Aerospace Standard (AS) 8043 [5], which states that when subjected to a static pull of 2500 lb, the elongation in the restraint system shall be less than 20%.

A TSO tag on a seat belt does not approve it to be installed on any aircraft as a replacement part. The seat belt is approved only as part of the original seat certification. Seat belt elongation properties vary based upon the design, material, and lot. For seats certified to Title 14 Code of Federal Regulations (CFR) 25.562 [6] and TSO C127a [7], the restraint system is part of the seat certification and cannot be used interchangeably with another seat system. Seat belt repairs should be completed with webbing and stitching material that is equivalent in stiffness and strength to ensure similarity to the original certification. Differences in stiffness properties may lead to differences in structural loading of the seat and possible injury.

To determine how differences in elongation properties affect seat dynamic response, the Federal Aviation Administration (FAA) conducted a test program using a rigid seat setup in different configurations with different webbing materials.

2. METHODS

The FAA issued FAA Policy ANM-115-05-10 [8] as guidance material for replacing seat belts for dynamically certified seats. This policy outlines a dynamic testing methodology to determine if two seat belts are equivalent. It describes the setup for a rigid seat test that uses representative seat geometry, including the seat reference point (SRP) and anchor point locations. The rigid seat and occupant are attached to the impact sled at no yaw and subjected to the 14 CFR 25.562 horizontal impact condition (16 G, 44 ft/sec). The evaluation metrics, which include anchor point load and head path, are computed for comparison purposes. For determining equivalence, the anchor loads should be within ± 6% and the head path within ± 1″. One of the policy requirements is that a single test will be used with both belts tested simultaneously on two identical seats. Testing in this manner ensures that the same pulse is applied to each seat; however, differences in anthropomorphic test device (ATD) construction could have an effect on the results.

For this project, the intent of the policy was followed by using a single ATD and seat on each test. To account for slight variations in the sled pulse, the belt load and head excursion data were linearly scaled to 16 G by multiplying by the factor (16/actual peak G). This was considered acceptable because the actual variations were less [9] than the 10% permitted by AC 25-562-1B [10] for scaling shoulder belt tension. This method is a slight modification, but follows the intent of the policy. This approach was necessary for the purposes of this project but does not constitute a revision to the published policy. All values discussed in this report will be based on the scaled data unless otherwise noted. It should be noted that scaling did not change the conclusions of this study.

Testing was conducted over two separate phases. Phase 1 consisted of testing with a range of seat geometries and two types of webbing. The purpose of Phase 1 was to evaluate the performance of seat belt repairs with a webbing material that differs from the original equipment manufacturer (OEM) material and may not meet all the requirements of SAE AS 8043 when installed in a variety of possible seat configurations. Phase 2 consisted of testing with a single seat geometry and webbing materials that vary in stiffness and strength. The purpose of Phase 2 was to evaluate the effect of webbing stiffness differences on the response.

A rigid seat fixture that could be configured to represent the geometry of an aircraft seat was provided by the test lab (see figure 1). The seat was rigid with an 18" seat width, 5 degrees from horizontal pan angle, and a 13 degrees from vertical seat back angle. The seat belt anchor (SBA) points could be modified to achieve the required SRP to anchor point geometries for each test configuration. A 1″ thick, cloth-covered Confor CF47 (very firm) cushion was placed on the seat and was clamped down to prevent sliding. Each lap belt anchor, seat back, and bottom support surface was attached to a tri-axial load cell. Webbing tension was directly measured using a tensiometer installed on the left side belt segment. The actual belt angle in the XZ plane was determined for each test based on the measured location of the belt anchor points and the belt midpoint at occupant centerline. Five specific seat geometries that were considered representative of typical seat installations were selected for this investigation (see figure 2 and table 1):

- Configurations 1 and 3 were selected because they were considered common geometries.

- Configuration 2 was selected because it was a possible design with the most forward anchor point likely in service.

- Configuration 4 was selected because it was a possible design with the anchor point located such that the belt angle was between the others chosen.

- Configuration 5 was a modification of configuration 4 in which the anchor points were moved to force the buckle to be offset greater than 1.5" from the centerline of the ATD. This was done to investigate the effect of buckle offset which may lead to increased loading and possible failure of the belt.



Figure 1. NIAR rigid seat test setup

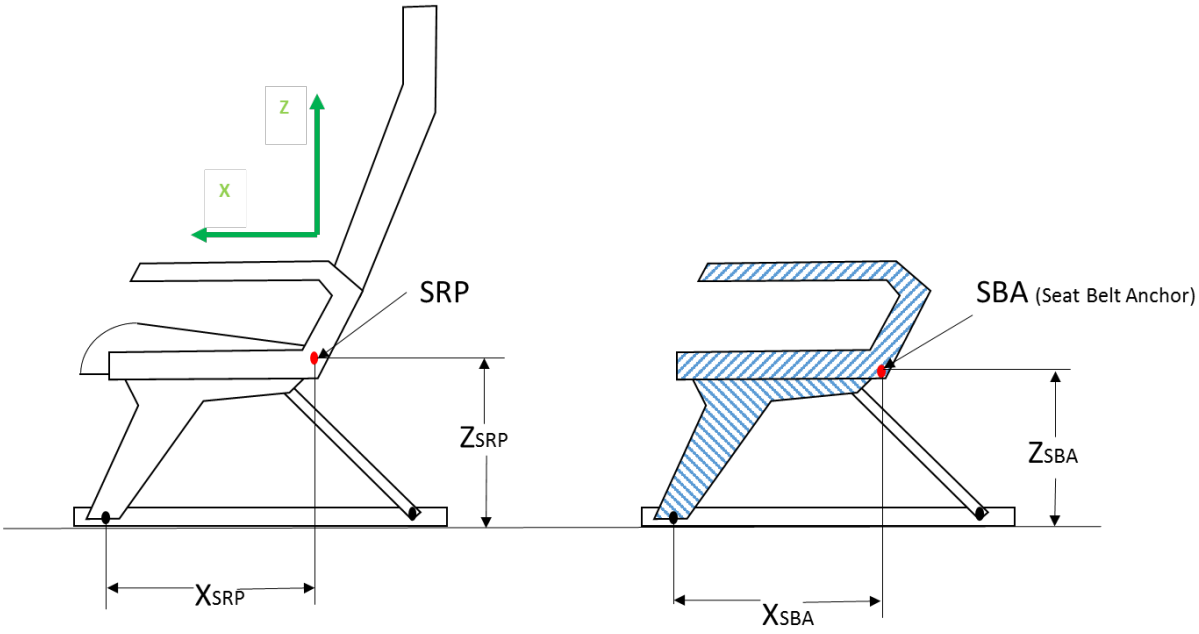


Figure 2. Seat diagram showing SRP and anchor point geometry

Table 1. Test geometry measurements

		Distance from SRP to SBA (in)		Seat	Nominal* Belt Angle in XZ plane
	Comment	dx (in)	dz (in)	width (in)	WRT horz (degrees)
Configuration 1		0.5	-2.65	18	46.2
Configuration 2		5.0	-2.8	18	64.1
Configuration 3		2.5	-0.4	18	45.6
Configuration 4		3.0	-2.5	18	54.6
Configuration 5	Buckle Offset	-----	-------	18	64.1

* = Nominal Belt Angle calculated per AS8049B [11] paragraph 3.2.15

2.1 PHASE 1 TESTING

Phase 1 testing consisted of a direct comparison of OEM belts with repaired belts installed on five possible seat configurations. The belts were repaired by cutting off the OEM belt material and re-webbing them with Bally Ribbon 4035 webbing. The hardware and connectors, such as the load bar, latch, and anchor fittings, were new for each test. All five seat configurations were tested twice: once with the OEM belt, and once with the repaired belt. The OEM material had a measured elongation of 18.0% at 2500 lb, whereas the Bally Ribbon material had a measured elongation of 23.1% at 2500 lb.

2.2 PHASE 2 TESTING

Phase 2 testing consisted of comparing the OEM belt to several belts repaired with different material. Only seat configuration 4 was used for this phase. The belts were repaired by cutting off the OEM belt material and re-webbing them with five different webbing materials referred to as Repaired #1–5. The materials selected for the repairs had different elongation and strength properties.

The belt materials selected and their manufacturer's specifications were:

Repaired #1
Webbing: Specification 50005, Polyester, Black PO2009
Thread: Tex 210, Specification A-A-59826 TPII CLA 3 BT207N3
Stitch pattern: Mitsubishi PLK-E2008H – X Box
Elongation at 2500 lb: 6.9%
Breaking Strength (lb): 7051

Repaired #2
Webbing: BRM Pattern 5038-1 15/16", Nylon Khaki PO 2006
Thread: Tex 210, Specification A-A-59826 TPII CLA 3 BT207N3
Stitch pattern: Mitsubishi PLK-E2008H – X Box
Elongation at 2500 lb: 19.3%
Breaking Strength (lb): 7173

Repaired #3
Webbing: Specification 10-2167 (46554), Nylon, Cruiser Gray PO1819
Thread: Tex 210, Specification A-A-59826 TPII CLA 3 BT207N3
Stitch pattern: Mitsubishi PLK-E2008H – X Box
Elongation at 2500 lb: 15%
Breaking Strength (lb): 6142

Repaired #4
Webbing: Pattern 9-18675, Polyester, Medium Dark Pewter PO 1651
Thread: Tex 210, Specification A-A-59826 TPII CLA 3 BT207N3
Stitch pattern: Singer Cam Machine 1 – X Box
Elongation at 2500 lb: 8.3%
Breaking Strength (lb): 6646

Repaired #5
Webbing: BRM Pattern 5096 1 15/16", Polyester, Black PO Sample
Thread: Tex 210, Specification A-A-59826 TPII CLA 3 BT207N3
Stitch pattern: Singer Cam Machine 1 – X Box
Elongation at 2500 lb: 13.52%
Breaking Strength (lb): 6545

2.3 ELONGATION TESTING

Belt material data were missing for two of the tested configurations, including the OEM and repaired belts from Phase 1. Also, there is some expected variability between the specified properties and the actual delivered properties. To have a set of data that could be used to compare the webbing materials, a test series was conducted to gather these additional data. The test procedure was similar to that in SAE AS8043 [5], with the primary difference being the use of a set of compression grips. Three samples were tested for each of the seven webbing types to conduct summary statistics. Details on these tests are contained in appendices A and B. All

elongation values cited in this report reflect these test results rather than the manufacturer's specifications.

3. RESULTS

The data were successfully collected for all tests. For detailed results from Phase 1, see FAA report DOT/FAA/TC-14/5 [12]. Results from Phase 2 are contained in appendix C. No structural failures occurred in any of the belts for all testing.

3.1 PHASE 1 RESULTS

Both the highest and lowest belt loading conditions for the OEM and repaired belts occurred on the same configuration. Configuration 1 (Test 1 and Test 2) was repeated (Test 11 and Test 12). During the first test, the legs did not slide up off the floor and it was determined that this condition was not repeatable. To ensure consistency in the rest of the tests, the carpet was removed from the floor and the initial position of the ATD knees was slightly modified by increasing the angle of the lower leg to ensure a position that would not prevent leg flail. For all configurations, the belt loads for the repaired belt were lower, the head path was larger, and the anchor loads were lower than the OEM belt. If Tests 1 and 2 are disregarded, the belt loads for the OEM belts ranged from 1969–2306 lb and the head displacement ranged from 32.1″–37.7″, whereas the belt loads for the repaired belts ranged from 1742–2119 lb, and the head displacement ranged from 34.3″–38.5″ (see table 2).

Table 2. Phase 1 original and scaled test result summary

					Scaled Data				Original Data				
Configuration	Belt Description	Measured Elongation (Percentage at 2500 lb)	Test #	Belt Angle WRT Horz	Belt Load (lb)	Head Displacement (in)	Anchor Load LHS (lb)	Anchor Load RHS (lb)	Belt Load (lb)	Head Displacement (in)	Anchor Load LHS (lb)	Anchor Load RHS (lb)	Pulse (g)
Configuration 1	OEM	18.0	Test 1	57.5	1731	32.0	1738	1909	1755	32.4	1762	1936	-16.22
Configuration 1	Repaired	23.1	Test 2	56.3	1553	32.2	1548	1615	1570	32.5	1564	1632	-16.17
Difference		5.1			-11.4%	0.2	-12.3%	-18.2%	-11.8%	0.1	-12.6%	-18.6%	-0.3%
Configuration 2	OEM	18.0	Test 3	73.8	1969	37.7	1976	2145	1979	37.9	1986	2157	-16.09
Configuration 2	Repaired	23.1	Test 4	73.9	1914	38.5	1879	2077	1922	38.7	1887	2086	-16.07
Difference		5.1			-2.9%	0.9	-5.2%	-3.3%	-3.0%	0.8	-5.3%	-3.4%	-0.1%
Configuration 4	OEM	18.0	Test 5	64.3	2016	35.5	2044	2239	2029	35.7	2057	2253	-16.10
Configuration 4	Repaired	23.1	Test 6	63.2	1830	36.3	1838	2064	1836	36.4	1844	2071	-16.05
Difference		5.1			-10.1%	0.8	-11.2%	-8.4%	-10.5%	0.7	-11.6%	-8.8%	-0.4%

Table 2. Phase 1 original and scaled test result summary (continued)

					Scaled Data				Original Data				
Configuration	Belt Description	Measured Elongation (Percentage at 2500 lb)	Test #	Belt Angle WRT Horz	Belt Load (lb)	Head Displacement (in)	Anchor Load LHS (lb)	Anchor Load RHS (lb)	Belt Load (lb)	Head Displacement (in)	Anchor Load LHS (lb)	Anchor Load RHS (lb)	Pulse (g)
Configuration 5	OEM	18.0	Test 7	64.9	2037	35.8	1989	2000	2051	36.1	2004	2014	-16.12
Configuration 5	Repaired	23.1	Test 8	65.3	1742	36.6	1772	1813	1755	36.9	1784	1826	-16.11
Difference		5.1			-16.9%	0.8	-12.3%	-10.3%	-16.9%	0.8	-12.3%	-10.3%	0.0%
Configuration 3	OEM	18.0	Test 9	57.8	2306	32.1	2327	2260	2344	32.6	2365	2297	-16.26
Configuration 3	Repaired	23.1	Test 10	57.5	2119	34.3	2195	2130	2130	34.5	2206	2140	-16.08
Difference		5.1			-8.8%	2.2	-6.0%	-6.1%	-10.0%	1.8	-7.2%	-7.3%	-1.1%
Configuration 1 (re-test)	OEM	18.0	Test 11	57.4	1981	33.7	1979	2408	2006	34.1	2004	2439	-16.20
Configuration 1 (re-test)	Repaired	23.1	Test 12	57.0	1819	35.0	1848	2200	1831	35.2	1860	2214	-16.10
Difference		5.1			-8.9%	1.3	-7.1%	-9.4%	-9.6%	1.1	-7.8%	-10.1%	-0.6%

The head excursion was linearly related to measured seat belt angle for both the OEM and Repaired belts (see figure 3). This is an expected result because a more horizontal belt would more directly act to reduce pelvis forward translation, and therefore head displacement, than a belt that is more vertical.

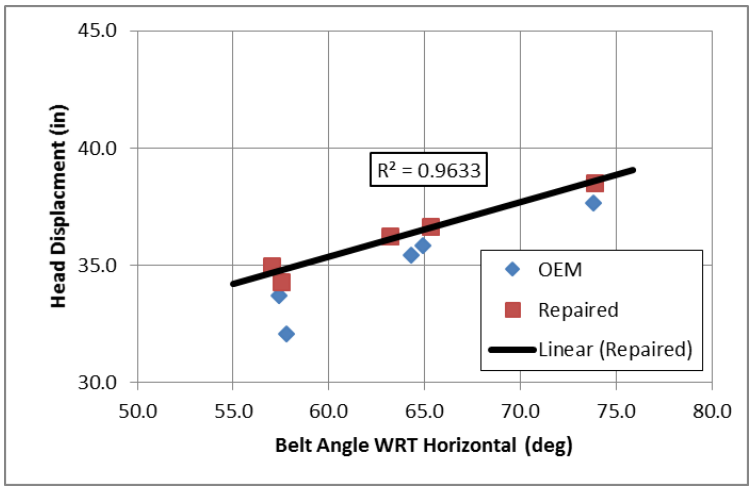


Figure 3. Head displacement versus belt angle

3.2 PHASE 2 RESULTS

The belt loads ranged from 1994–2851 lb (see table 3). The head displacement ranged from 34.5″–36.4″. The anchor loads ranged from 1870–2832 lb.

Table 3. Phase 2 original and scaled test result summary

		Scaled Data				Original Data				
Description	Measured Elongation (% at 2500 lb)	Belt Load (lb)	Head Displacement (in)	Anchor Load LHS (lb)	Anchor Load RHS (lb)	Belt Load (lb)	Head Displacement (in)	Anchor Load LHS (lb)	Anchor Load RHS (lb)	Pulse (g)
OEM	18.0	2110	36.4	1903	2184	2162	37.3	1949	2237	-16.39
Repaired #1	6.8	2851	34.7	2569	2832	2905	35.4	2617	2885	-16.30
Repaired #2	19.3	2181	36.2	1991	2158	2231	37.0	2037	2208	-16.37
Repaired #3	18.1	2380	35.8	2150	2322	2432	36.6	2197	2373	-16.35
Repaired #4	8.0	2600	34.5	2328	2776	2660	35.3	2382	2840	-16.37
Repaired #5	14.3	1994	34.6	1870	2365	2038	35.4	1911	2417	-16.35
Difference between OEM and										
Repaired #1	6.8	35.1%	-1.7	35.0%	29.7%	34.4%	-2.0	34.3%	29.0%	0.5%
Repaired #2	19.3	3.3%	-0.2	4.6%	-1.2%	3.2%	-0.3	4.5%	-1.3%	0.1%
Repaired #3	18.1	12.8%	-0.6	13.0%	6.3%	12.5%	-0.7	12.7%	6.1%	0.2%
Repaired #4	8.0	23.2%	-1.9	22.4%	27.1%	23.1%	-2.0	22.2%	26.9%	0.1%
Repaired #5	14.3	-5.5%	-1.8	-1.7%	8.3%	-5.7%	-1.9	-2.0%	8.0%	0.2%

The head displacement was greatest for the OEM belt with all repaired belts showing a lower head path. There was a trend of lower head displacement paths with the higher belt loads (see figure 4).

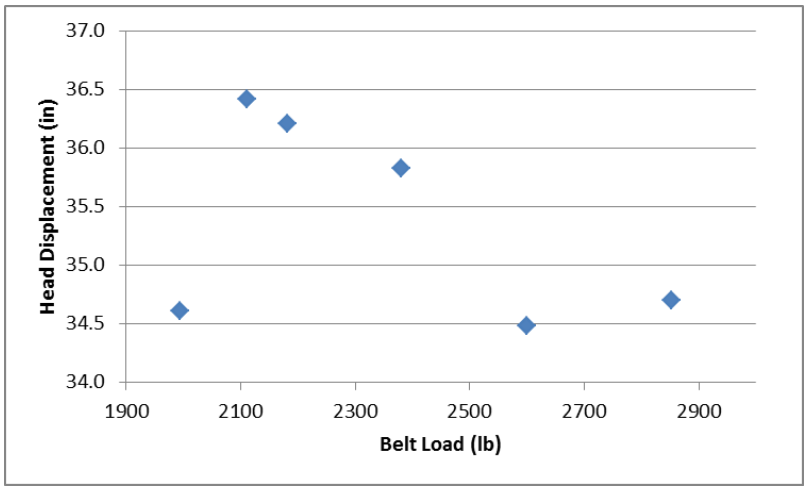


Figure 4. Head displacement versus belt loads for Phase 2

There was a general trend of higher anchor loads with higher belt loads; the right side loads were higher than the left side loads (see figure 5). In an ideal situation, the anchor loads and belt loads

would have been identical; however, the effects of friction and testing asymmetry are present, therefore the difference observed.

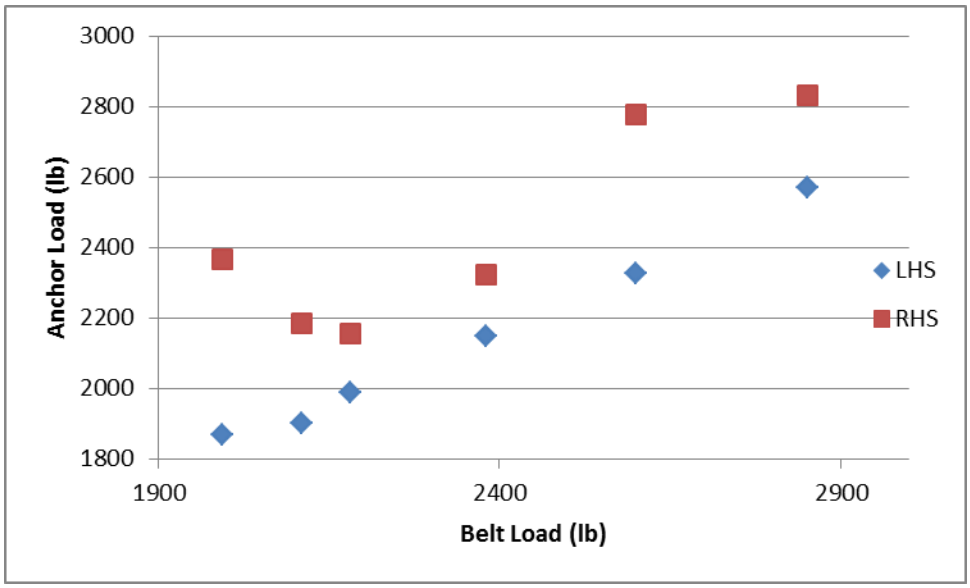


Figure 5. Anchor loads versus belt loads for Phase 2

With the exception of one test, the output data follows a trend of shorter head displacement corresponding to higher belt loads (see figure 3). The one test that does not follow this pattern is Repaired #5. It had the overall lowest belt loads and was nearly the lowest head path. On closer examination of this test, it was noted that the left foot and leg moved earlier and out of phase with the right side (figures 6A and 6C). This out of phase movement caused the left foot to hit the ATD's head, thereby shortening the head path. This difference in movement is apparent when compared to other test results (figures 6B and 6D). Only Test 1 is shown for comparison, but the other test results were similar to Test 1. It was only Test 6 that showed this asymmetry. The cause is not exactly known, but it is surmised that the effect was due to a slight change in the setup. Another possibility is that the belt became caught on the right side, forcing the ATD to move differently; this would also explain the difference in the anchor loads. As such, it was determined that the data from Test 6 (Repaired #5) should not be included in any analysis.

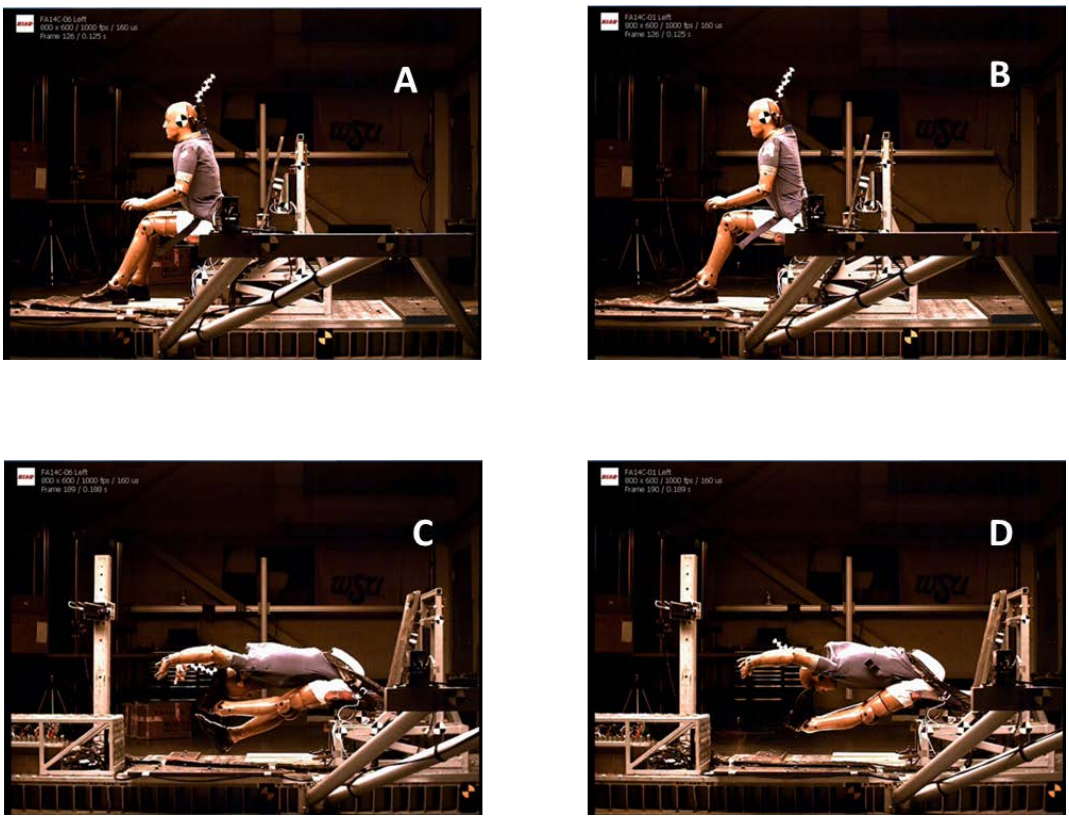


Figure 6. Kinematic comparison of Test 6 and Test 1: (A) initial motion of Test 6, (B) initial motion of Test 1, (C) foot head contact of Test 6, and (D) foot head contact of Test 1

Removing that one data point shows a clearer trend in the data. A linear regression was conducted on this reduced data set for the head displacment versus belt load (see figure 7). This linear regression resulted in a correlation coefficient of 0.85 for the scaled data and 0.90 for the original data.

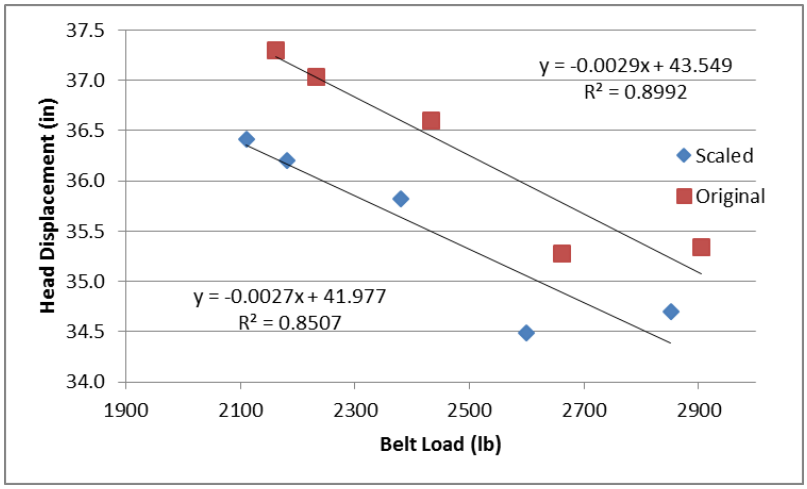


Figure 7. Head path versus belt loads for Phase 2 reduced data, scaled and original

If Test 6 is disregarded, the belt loads ranged from 2110–2851 lb. The head displacement ranged from 34.5″–36.4″. The total head path was greatest for the OEM belt with all repaired belts showing a lower head path.

As in Phase 1, the belt anchor loads on each side were measured in addition to a direct mesaurment of belt tension using a webbing transducer on the left belt segment. The anchor loads had a trend of higher loads on the right side than the left side. In an ideal situation, the anchor loads and belt loads would have been identical; however, the effects of friction and testing asymmetry are present, therefore the difference observed. A linear regression of the anchor loads versus belt loads (see figure 8) resulted in correlation coefficients of 0.92 and 0.99 for the left and right side anchor loads for the scaled data, respectively, and 0.91 and 0.99 left and right side anchor loads for the original data, respectively. The regressions on these data help demonstrate the small effect of scaling on the original data. For both sides of the anchor points, the slope was close to 1 with these high correlations demonstrating the tight coupling of the belt loads and anchor point restraint loads. For this reason, the directly measured belt load values are used for comparison purposes in this report.

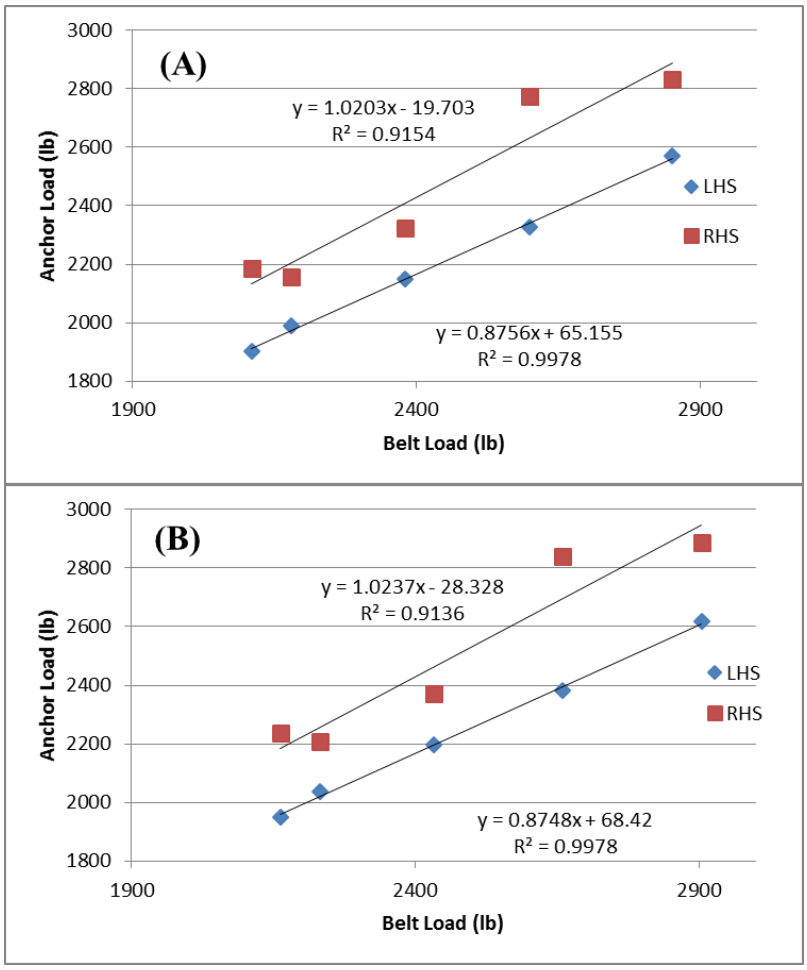


Figure 8. Anchor loads versus belt loads for Phase 2 reduced data: (A) scaled data and (B) original data

3.3 COMPARISON OF PHASE 1 AND PHASE 2 RESULTS

Phase 1 and Phase 2 had different goals and slightly different belt webbing; however, they did have one configuration and test in common. Phase 1 Test 5 was Configuration 4 with a new OEM belt. Phase 2 Test 1 was also Configuration 4 with a new OEM belt. Comparing these two tests (see table 4), the head displacement for the Phase 2 test was approximately 0.9″ longer, and the belt load was approximately 5% higher. The only difference between the two tests is that different ATDs were used for each phase of testing. Physical differences between the ATDs are the most likely cause of the differing results.

Table 4. Phase 1 and Phase 2 common test comparison

Phase	Test #	Belt Load (lb)	Head Displacement (in)	Anchor Load LHS (lb)	Anchor Load RHS (lb)
Phase 1	Test 5	2016	35.5	2044	2239
Phase 2	Test 1	2110	36.4	1903	2184
Comparison		-5%	1.0	6.9%	2.4%

3.4 ELONGATION TEST RESULTS

All tests with the belt materials were successfully completed (see table 5). Because no structural failures occurred in any of the Phase 1 and Phase 2 dynamic tests, only the elongation data are presented. Manufacturer supplied data were available for the belts tested in Phase 2. The measured and manufacturer supplied data were very close for all belts except Repaired #3, which was still nearly within the ±3% tolerance on the manufacturer supplied data (see table 6). All belts had significantly different elongation properties from the new belt except for Phase 2 Repaired #3.

Table 5. Belt elongation tests

Elongation Limit for Seat Belt Webbing Testing					Elongation Limit Statistics		
Sample	Unstretched Gage Length (in)	Gage Length at 50 lb (in)	Gage Length at 2500 lb (in)	Elongation Limit at 2500 lb (%)	X Bar	s	t.test
Repaired	9.98	10.01	12.34	23.3			
Repaired	10.00	10.03	12.35	23.1			
Repaired	9.98	10.01	12.31	23.0	23.1%	1.57E-03	2.35E-05
OEM	10.00	10.02	11.81	18.0			
OEM	10.02	10.04	11.81	17.7			
OEM	10.00	10.02	11.84	18.2	18.0%	2.64E-03	
Repaired # 1	9.99	10.00	10.67	6.8			
Repaired # 1	9.98	9.99	10.67	6.8			
Repaired # 1	10.02	10.03	10.71	6.8	6.8%	1.30E-04	8.94E-05
Repaired # 2	9.99	10.01	11.96	19.4			
Repaired # 2	10.03	10.05	11.97	19.1			
Repaired # 2	10.01	10.03	11.98	19.4	19.3%	1.91E-03	1.39E-03
Repaired # 3	10.00	10.02	11.82	18.0			
Repaired # 3	9.99	10.01	11.82	18.1			
Repaired # 3	9.99	10.01	11.84	18.3	18.1%	1.40E-03	2.41E-01
Repaired # 4	10.00	10.01	10.81	8.0			
Repaired # 4	10.00	10.01	10.80	7.9			
Repaired # 4	10.00	10.01	10.80	7.9	8.0%	5.46E-04	6.64E-05
Repaired # 5	10.00	10.01	11.46	14.4			
Repaired # 5	10.00	10.01	11.44	14.3			
Repaired # 5	10.00	10.01	11.44	14.3	14.3%	9.66E-04	2.80E-04

X Bar = Average; s = Standard Deviation; t.test = tail unequal variance comparison to OEM
X Bar = Average, s=Standard Deviation, t.test=1 tail unequal variance comparison to OEM

Table 6. Comparison of manufacturer elongation data to measured data

Sample	Measured	Reported
Repaired # 1	6.8%	6.9%
Repaired # 2	19.3%	19.3%
Repaired # 3	18.1%	15.0%
Repaired # 4	8.0%	8.3%
Repaired # 5	14.3%	13.5%

Using just the valid Phase 2 reduced data, a trend is noted between the belt stiffness and the belt loads in a dynamic test (see figure 9). The expected trend for increased static belt elongation to result in more head displacement is shown in figure 10. Figure 10 also shows a general relationship between stiffness and material type (nylon and polyester) for this group of webbing materials.

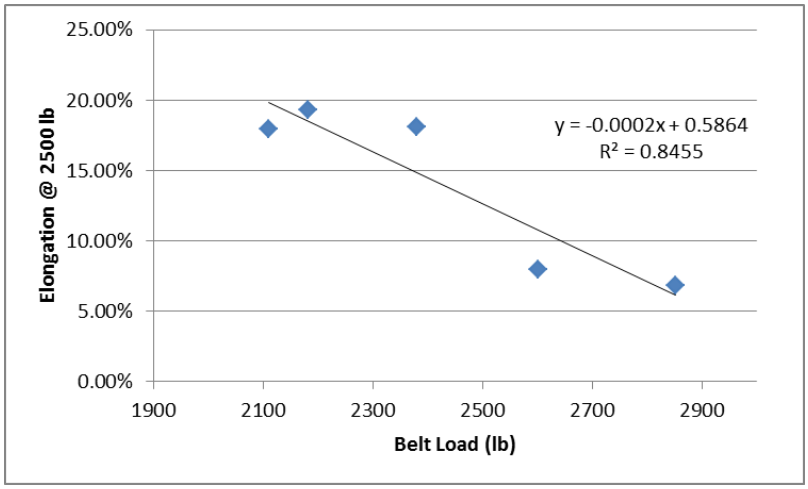


Figure 9. Relationship between static belt stiffness and dynamic belt load

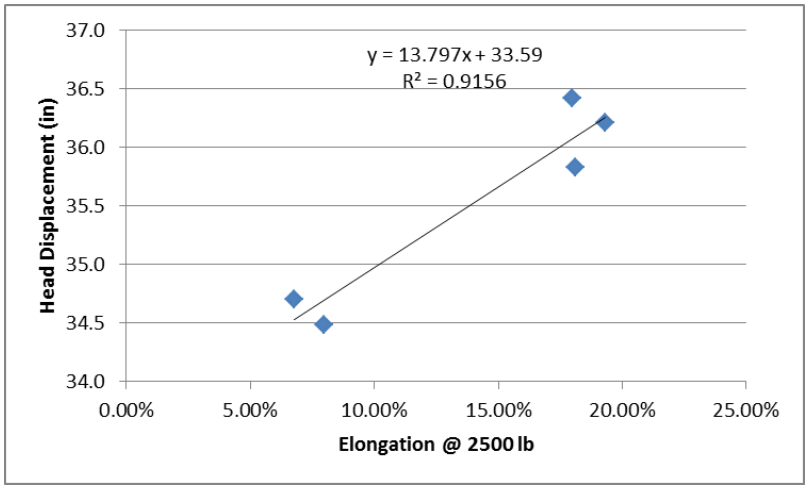


Figure 10. Head displacement versus static elongation

4. DISCUSSION

There were no structural failures of any of the new or repaired belts. The load differences ranged from 16.9% lower than the OEM to 35.1% higher. The excursion differences ranged from 2.2″ greater than the OEM to 1.9″ less. The effect of these differences on occupant safety can be investigated separately.

Higher belt loads can induce structural issues if the seat's factor of safety is not high enough to accommodate the additional loading. Lower anchor loads are not likely to induce additional

structural issues unless the load is transferred elsewhere into the system leading to a failure of those components. During these tests, the seat pan was initially loaded in the forward direction as the occupant slid forward. As the occupant's torso and legs flailed forward, the pelvis tended to lift off the seat pan and rotate forward about the belt contact point, forcing the bottom of the thighs against the front edge of the seat pan. This created a significant aft-ward and downward force on the front edge during all tests. The effect of belt changes on seat pan loading was not being investigated in this study; however, some observations were made. The seat pan had a thin metal rounded strip over the front edge to prevent a large stress concentration from cutting into the ATD's legs. During the first tests, the original piece was severely damaged and was replaced with a more robust one for the later tests. The damage demonstrated loading to the front edge of the seat pan by the ATD. In examining the valid seat pan force data from Phase 2 (see figure 11), there is no clear correlation between belt load and resultant XZ seat pan load. If one anomalous data point is removed, then a correlation of approximately 0.82 could be achieved for the resultant seat pan load. This trend points to a lower seat pan load corresponding to the lower belt loads. This means that lower belt loads should not create structural issues to the seat pan.

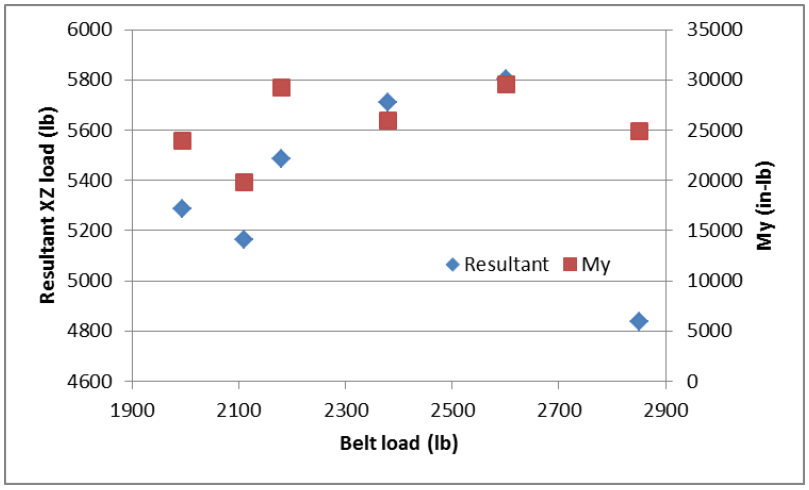


Figure 11. Seat pan loads versus belt loads for Phase 2

These tests used data from a single ATD, eliminating any ATD variability. In vertical testing, it was noted that a test variability of 5% or more was not uncommon [13]. This variability is due to manufacturing tolerances and can be difficult to fully quantify because it is part of an overall testing variability. The Phase 1 and Phase 2 tests each used a single ATD. The one common configuration between phase 1 and Phase 2 testing demonstrated some of this variability (see table 4) because the ATDs used in Phase 1 and Phase 2 were different.

Differences in head excursion can affect safety if that difference changes the way the occupant interacts with objects within striking distance. Seats installed behind rigid walls are often placed so that a majority of occupants would not contact the wall with their head during a forward impact. Additional excursion would increase the risk of striking the wall, whereas less excursion could reduce the risk. For seats in multiple rows, head impact protection is usually provided by means of energy absorbing features built into the seat back in the areas most likely to be struck by the occupant in the seat behind. If a longer or shorter head path causes an occupant to strike

the seat back outside the expected area, then the effect on safety would be unknown since that area's energy absorption capability would be different.

A previous study that compared anchor loads for different belt types demonstrated a slightly different trend than observed here [14]. A comparison between nylon and polyester belts showed that the lower elongation polyester had a shorter head path (as found in the current study) but had lower belt loads (which is the opposite trend noted in the current study). A couple of differences between the studies that likely affected the outcome are that the previous study used actual deformable seats and the occupant's legs were prevented from flailing forward by toe stops that emulated installation behind an interior wall. The thicker seat cushion, deformable seat pan, and flexible seat frame of the actual seat provide some energy absorption, which could alter the phasing and magnitude of the belt loads and occupant kinematics. Restricting the flail of the legs in the actual seat tests changes the entire manner in which the occupant loads the seat pan and the restraint system when compared to a test with unrestricted flail. These major differences in the studies must be considered when directly comparing results. The differences observed, however, illustrate that while data gathered from rigid seat tests as used in the current study are useful for parametric comparisons, the magnitude of parameters such as belt tension and head displacement may not correspond to actual seat and aircraft installation test results.

5. CONCLUSION

To determine how differences in elongation properties affect seat dynamic response, the Federal Aviation Administration conducted a test program using a rigid seat setup in different configurations with different webbing materials. The selected seating configurations represented seats commonly in use. New and newly repaired belts were acquired for the study. The belts were then subjected to dynamic impact tests using a rigid seat and the sled test pulse from Title 14 Code of Federal Regulations 25.562. No structural failures occurred and, in general, the rewebbed belts performed similarly, but not identical, to the original belts.

As part of this test program, a second phase was conducted to investigate the effects of belt stiffness. Original belt webbing material and several candidate replacement webbing materials were statically tested to determine their elongation properties. The belts were then subjected to the same test setup as in Phase 1, with the only difference being that only one seating configuration was tested. No structural failures occurred. A trend was noted that higher belt stiffness resulted in less occupant excursion and higher belt loads.

There were no structural failures, but some differences in head path and anchor loads between the new and the repaired belts were noted.

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4. "Torso Restraint Systems," FAA TSO-C114, March, 27 1987.

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FAA Seatbelt Webbing

Elongation Test Results

8/1/2014

Prepared by:

Computational Mechanics Department

National Institute for Aviation Research
1845 Fairmont • Wichita, Kansas 67260-0093
800.642.7078 • http://www.niar.wichita.edu/

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APPENDIX B SPECIMEN PICTURES B.1

1 SCOPE

The report covers the results of the seat belt webbing elongation tests conducted on May 15th, 2014. Seat belt webbing specimens were fabricated from 7 different webbing types that were provided by the FAA. Tests were conducted at room temperature conditions and ambient relative humidity (RTA). The purpose of the tests was to define the elongation limit of the webbings, and was not intended to provide breaking strength data. However, the tests were conducted to final rupture for comparison purposes with other test procedures (i.e. AS8043).

2 TEST MATRIX

The following test matrix on Table 2.1 outlines the different specimens tested. All specimens were successfully tested.

Table 2.1 Test Matrix

TEST MATRIX				
Test #	Webbing Source	Specimen	Stroke Rate (in/min)	Instrument
1	Repair Station	BR-NIAR-A-01	3	Load Cell
2	Repair Station	BR-NIAR-A-02	3	Load Cell
3	Repair Station	BR-NIAR-A-03	3	Load Cell
4	AmSafe	AM-NIAR-B-01	3	Load Cell
5	AmSafe	AM-NIAR-B-02	3	Load Cell
6	AmSafe	AM-NIAR-B-03	3	Load Cell
7	Sample Belt 1	SB1-NIAR-C-01	3	Load Cell
8	Sample Belt 1	SB1-NIAR-C-02	3	Load Cell
9	Sample Belt 1	SB1-NIAR-C-03	3	Load Cell
10	Sample Belt 2	SB2-NIAR-D-01	3	Load Cell
11	Sample Belt 2	SB2-NIAR-D-02	3	Load Cell
12	Sample Belt 2	SB2-NIAR-D-03	3	Load Cell
13	Sample Belt 3	SB3-NIAR-E-01	3	Load Cell
14	Sample Belt 3	SB3-NIAR-E-02	3	Load Cell
15	Sample Belt 3	SB3-NIAR-E-03	3	Load Cell
16	Sample Belt 4	SB4-NIAR-F-01	3	Load Cell
17	Sample Belt 4	SB4-NIAR-F-02	3	Load Cell
18	Sample Belt 4	SB4-NIAR-F-03	3	Load Cell
19	Sample Belt 5	SB5-NIAR-G-01	3	Load Cell
20	Sample Belt 5	SB5-NIAR-G-02	3	Load Cell
21	Sample Belt 5	SB5-NIAR-G-03	3	Load Cell

3 SPECIMEN FABRICATION AND PREPARATION

The test specimens were each taken from an unmodified roll of seat belt webbing. Test specimen width was kept as the original width of the roll.

3.1 GEOMETRY

Each test specimen was cut to the nominal dimensions indicated in Table 3.1. Test specimen width and thickness were defined by the each of the seat belt configurations tested. Figure 3.1 shows the specimen nominal dimensions along with the inclusion of tabs.

Table 3.1 Test specimen nominal dimensions

Total Length [in]	14
Gage Length [in]	10
Width [in]	To be defined per belt configuration
Thickness [in]	To be defined per belt configuration

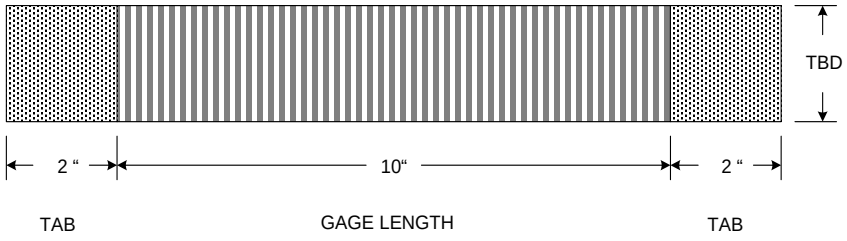


Figure 3.1 Test specimen with tabs

3.2 SPECIMEN DIMENSIONING

Test specimens were dimensioned prior to testing and after testing. Measurements are summarized according to Table 3.2 and Table 3.3. Test specimens were tested until rupture, so the post-test measurements for total length and gage length are approximate totals that were obtained by adding the lengths of the ruptured pieces.

Table 3.2 Test specimen dimensions – Pre-Test

PRE-TEST MEASUREMENTS										
	Length (in)		Thickness (in)				Width (in)			
Specimen	Total	**Gage**	t_1	t_2	t_3	$\mathbf{t_{AVG}}$	w_1	w_2	w_3	$\mathbf{w_{AVG}}$
BR-NIAR-A-01	14	**9.98**	0.068	0.066	0.0655	**0.0665**	2.022	2.013	2.012	**2.0157**
BR-NIAR-A-02	14.04	**10**	0.0665	0.0675	0.066	**0.0667**	2.012	2.0135	2.0065	**2.0107**
BR-NIAR-A-03	14.08	**9.98**	0.0645	0.064	0.065	**0.0645**	2.009	2.0115	2.0035	**2.0080**
AM-NIAR-B-01	14.03	**10**	0.0555	0.0575	0.0565	**0.0565**	1.9205	1.9305	1.922	**1.9243**
AM-NIAR-B-02	14.03	**10.02**	0.0565	0.0575	0.056	**0.0567**	1.9325	1.924	1.924	**1.9268**
AM-NIAR-B-03	14.07	**10**	0.0575	0.058	0.0585	**0.0580**	1.92	1.9215	1.9215	**1.9210**
SB1-NIAR-C-01	14.06	**9.99**	0.0475	0.048	0.048	**0.0478**	2.004	2.01	2.007	**2.0070**
SB1-NIAR-C-02	14.02	**9.98**	0.0475	0.0475	0.047	**0.0473**	2.007	2.0085	2.003	**2.0062**
SB1-NIAR-C-03	14.04	**10.02**	0.0475	0.0475	0.047	**0.0473**	2.0065	2.0065	2.003	**2.0053**
SB2-NIAR-D-01	14.05	**9.99**	0.059	0.058	0.058	**0.0583**	1.884	1.883	1.886	**1.8843**
SB2-NIAR-D-02	14.06	**10.03**	0.057	0.057	0.0565	**0.0568**	1.887	1.877	1.8855	**1.8832**
SB2-NIAR-D-03	14.05	**10.01**	0.0585	0.057	0.057	**0.0575**	1.8755	1.8825	1.8845	**1.8808**
SB3-NIAR-E-01	14.04	**10**	0.0605	0.061	0.0605	**0.0607**	1.982	1.9885	1.982	**1.9842**
SB3-NIAR-E-02	14.04	**9.99**	0.061	0.0605	0.0605	**0.0607**	1.9825	1.9775	1.977	**1.9790**
SB3-NIAR-E-03	14.05	**9.99**	0.061	0.061	0.0605	**0.0608**	1.9775	1.9775	1.981	**1.9787**
SB4-NIAR-F-01	14.03	**10**	0.049	0.049	0.0485	**0.0488**	1.8405	1.844	1.8415	**1.8420**
SB4-NIAR-F-02	14.01	**10**	0.049	0.0485	0.0485	**0.0487**	1.8465	1.843	1.839	**1.8428**
SB4-NIAR-F-03	14.02	**10**	0.049	0.0495	0.0485	**0.0490**	1.839	1.848	1.838	**1.8417**
SB5-NIAR-G-01	14.04	**10**	0.054	0.0535	0.053	**0.0535**	1.9065	1.9045	1.91	**1.9070**
SB5-NIAR-G-02	14.04	**10**	0.053	0.053	0.053	**0.0530**	1.9155	1.9075	1.9085	**1.9105**
SB5-NIAR-G-03	14.05	**10**	0.0535	0.0535	0.0535	**0.0535**	1.9135	1.9065	1.907	**1.9090**

Table 3.3 Test specimen dimensions – Post-Test

POST-TEST MEASUREMENTS										
	Length (in)		Thickness (in)				Width (in)			
Specimen	Total	**Gage**	t_1	t_2	t_3	**t_{AVG}**	w_1	w_2	w_3	**w_{AVG}**
BR-NIAR-A-01	13.661	**9.6335**	0.0745	0.0785	0.073	**0.0753**	2.002	2.0215	2.011	**2.0115**
BR-NIAR-A-02	13.6895	**9.6585**	0.077	0.0805	0.0775	**0.0783**	2.001	2.0165	2.0055	**2.0077**
BR-NIAR-A-03	13.901	**9.7995**	0.077	0.074	0.0735	**0.0748**	2.0035	2.01	2.014	**2.0092**
AM-NIAR-B-01	13.64	**9.6145**	0.065	0.065	0.0655	**0.0652**	1.9235	1.927	1.937	**1.9292**
AM-NIAR-B-02	13.701	**9.684**	0.0645	0.0665	0.0675	**0.0662**	1.919	1.1985	1.9365	**1.6847**
AM-NIAR-B-03	13.9515	**9.9385**	0.064	0.0625	0.0635	**0.0633**	1.928	1.9205	1.915	**1.9212**
SB1-NIAR-C-01	13.1585	**9.1735**	0.0595	0.0695	0.0665	**0.0652**	1.996	2.0005	1.989	**1.9952**
SB1-NIAR-C-02	13.2355	**9.209**	0.062	0.058	0.0655	**0.0618**	2.000	2.0065	2.0035	**2.0033**
SB1-NIAR-C-03	13.3185	**9.2925**	0.0615	0.0615	0.064	**0.0623**	2.0005	2.002	2.016	**2.0062**
SB2-NIAR-D-01	13.719	**9.68**	0.0655	0.063	0.0665	**0.0650**	1.8765	1.89	1.8815	**1.8827**
SB2-NIAR-D-02	13.7895	**9.702**	0.065	0.064	0.0665	**0.0652**	1.8895	1.8895	1.885	**1.8880**
SB2-NIAR-D-03	13.879	**9.8605**	0.064	0.064	0.0685	**0.0655**	1.8855	1.8925	1.871	**1.8830**
SB3-NIAR-E-01	13.845	**9.7985**	0.067	0.71	0.073	**0.2833**	1.993	1.993	1.9825	**1.9895**
SB3-NIAR-E-02	13.7515	**9.6635**	0.0695	0.0665	0.0705	**0.0688**	1.9675	1.9955	1.968	**1.9770**
SB3-NIAR-E-03	13.793	**9.713**	0.072	0.0715	0.079	**0.0742**	1.9685	1.9865	1.9855	**1.9802**
SB4-NIAR-F-01	13.4155	**9.429**	0.0585	0.057	0.057	**0.0575**	1.8405	1.839	1.8445	**1.8413**
SB4-NIAR-F-02	13.4945	**9.4775**	0.057	0.0615	0.065	**0.0612**	1.846	1.8435	1.8595	**1.8497**
SB4-NIAR-F-03	13.09	**9.0675**	0.061	0.0665	0.0715	**0.0663**	1.8415	1.8485	1.8465	**1.8455**
SB5-NIAR-G-01	13.922	**9.9065**	0.0675	0.0665	0.0665	**0.0668**	1.9095	1.91	1.903	**1.9075**
SB5-NIAR-G-02	14.105	**10.0965**	0.058	0.058	0.064	**0.0600**	1.903	1.9065	1.9075	**1.9057**
SB5-NIAR-G-03	13.57	**9.5365**	0.0655	0.0655	0.0695	**0.0668**	1.885	1.8875	1.9055	**1.8927**

4 APPARATUS

The testing apparatus used was in conformance with standard calibration practices exposed in ASTM E4 Force Verification of Testing Machines [1] and ASTM E2309 Verification and Classification of Extensometer System [2]. The calibration practices satisfy minimum requirements for test machine, force indicator, grips, and system alignment.

4.1 TESTING MACHINE

The testing machine requirements state that the testing machine should have a stationary head (cross-head) and a movable head (actuator). The drive mechanism should be capable of imparting the actuator a controlled rate of motion with respect to the cross-head. Standard servo-hydraulic systems are commonly used, see Figure 4.1. Actuator velocity should be regulated as specified in Section 5.
SAE AS8043B [3] requires a minimum breaking strength of 5000 lbf for lap belt webbings. Therefore the testing machine with at least an 11 kip load cell should be used.
The force sensing device (load cell) should be capable of indicating the total force being applied to the test specimens. A piezoresistive load cell common to quasi-static testing can be used. The device should be free from inertia lag at the specified rate of testing. Force should be indicated with accuracy over the force range of interest of within ± 1 % of the indicated value.



Figure 4.1 Test set-up

An actuator extension indicator suitable of showing the amount of change in the separation of the grips shall be used. Displacement transducers coaxially mounted in the hollow piston rod of the type LVDT

(linear variable differential transformer) are commonly used. The mechanism should be free of inertial lag at the specified test velocity. Actuator displacement should be indicated with accuracy of ± 10 % of the indicated value.
The test apparatus used was a MTS 810 Testing System Load Frame with a 55 kip load cell. Hydraulic self-aligning grips were used to grip the specimen, and were at a gripping pressure of 3,000 psi.



Figure 4.2 Test specimen gripping

5 TEST PARAMETERS AND RESULTS

Table 5.1 summarizes the required test parameters that were used in performing the test. Testing was conducted at an ambient room temperature of 78.4 degrees Fahrenheit and 55.5% relative humidity.

Table 5.1 Test parameters

Grip Pressure [psi]	3,000
Pre-load [lbf]	10-20
Speed of Testing [in/min]	3
Sampling Rate [Hz]	10 - 20
Maximum Load [lbf]	Breaking Strength (≈ 5000 lbf)

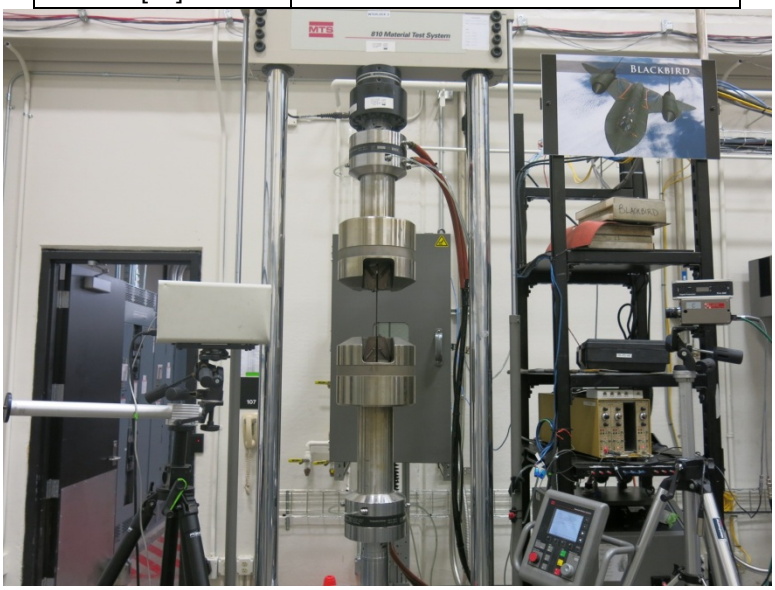


Figure 5.1 Webbing Testing Setup

5.1 LOAD CELL ELONGATION LIMIT RESULTS

One of the important values obtained from the test is the percent elongation of each of the specimens. For the purpose of this test, the percent elongation is the relative change in gage length with respect to the gage length at a load of 50 lb. It is calculated as the relative separation of the grips and measured by the testing machine and is expressed as a percent. The static elongation limit is calculated as the

relative separation between grips obtained at 2500 lbf load. It is expressed as a percentage of the initial gage length of the test specimen. The results from the test are listed in Table 5.2.

Table 5.2 Static Elongation Limit Results

ELONGATION LIMIT FOR SEATBELT WEBBING TESTING						
Sample	Unstretched Gage Length (in)	Actuator Travel at 50 lb (in)	Gage Length at 50 lb (in)	Actuator Travel at 2500 lb (in)	Gage Length at 2500 lb (in)	Elongation Limit at 2500 lb (%)
BR-NIAR-A-01	9.98	0.027329	10.00732	2.360561	12.340561	23.32%
BR-NIAR-A-02	10	0.028038	10.02803	2.345176	12.345176	23.11%
BR-NIAR-A-03	9.98	0.028912	10.00891	2.331828	12.311828	23.01%
AM-NIAR-B-01	10	0.015514	10.01551	1.814771	11.814771	17.96%
AM-NIAR-B-02	10.02	0.015671	10.03567	1.792055	11.812055	17.70%
AM-NIAR-B-03	10	0.018498	10.01849	1.844655	11.844655	18.23%
SB1-NIAR-C-01	9.99	0.00801	9.99801	0.684422	10.674422	6.77%
SB1-NIAR-C-02	9.98	0.007717	9.987717	0.685886	10.665886	6.79%
SB1-NIAR-C-03	10.02	0.008026	10.02802	0.686935	10.706935	6.77%
SB2-NIAR-D-01	9.99	0.023594	10.01359	1.967308	11.957308	19.41%
SB2-NIAR-D-02	10.03	0.021085	10.05108	1.940712	11.970712	19.10%
SB2-NIAR-D-03	10.01	0.023466	10.03346	1.974427	11.984427	19.44%
SB3-NIAR-E-01	10	0.020136	10.02013	1.821761	11.821761	17.98%
SB3-NIAR-E-02	9.99	0.021501	10.01150	1.830745	11.820745	18.07%
SB3-NIAR-E-03	9.99	0.020474	10.01047	1.847843	11.837843	18.25%
SB4-NIAR-F-01	10	0.01078	10.01078	0.813681	10.813681	8.02%
SB4-NIAR-F-02	10	0.007232	10.00723	0.80248	10.80248	7.95%
SB4-NIAR-F-03	10	0.008447	10.00844	0.800482	10.800482	7.91%
SB5-NIAR-G-01	10	0.011393	10.01139	1.456258	11.456258	14.43%
SB5-NIAR-G-02	10	0.011696	10.01169	1.439476	11.439476	14.26%
SB5-NIAR-G-03	10	0.010219	10.01021	1.438558	11.438558	14.27%

As can be seen from the data, each of the three specimens from the different webbings all provided similar static elongation limit results. The statistics for each sample, including average elongation limit and standard deviation are listed in Table 5.3. The arithmetic mean of the three samples is defined as X Bar and the standard deviation as s. The final value, CV, the coefficient of variation, is defined as the average divided by the standard deviation.

Table 5.3 Static Elongation Statistics

STATIC ELONGATION STATISTICS			
Sample	X Bar	s	CV
BR-NIAR-A	23.14%	0.16%	0.6766%
AM-NIAR-B	17.96%	0.26%	1.4672%
SB1-NIAR-C	6.78%	0.01%	0.1926%
SB2-NIAR-D	19.32%	0.19%	0.9870%
SB3-NIAR-E	18.10%	0.14%	0.7721%
SB4-NIAR-F	7.96%	0.05%	0.6862%
SB5-NIAR-G	14.32%	0.10%	0.6748%

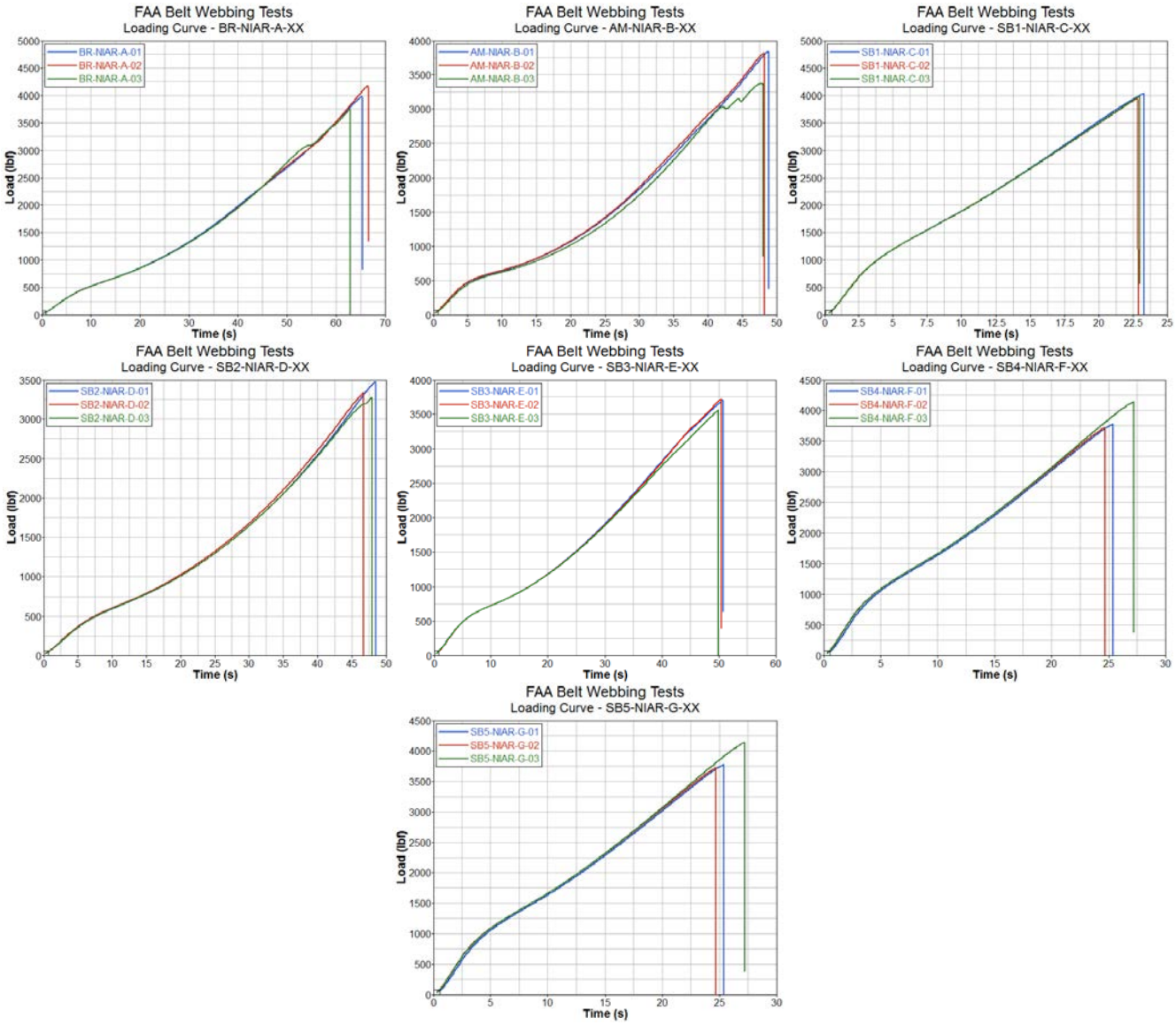


Figure 5.2 Load displacement curves from the actuator readings

As is evidenced by some of the loading stagnations, some slippage occurred in some of the specimens while testing, specifically tests BR-NIAR-A-03, AM-NIAR-B-03, and SB2-NIAR-D-03. However, the data from the graphs show that the slippage occurred after the load of 2500 lbf, which is the critical value that is used to determine the elongation limit of each specimen.

The failure values for each of the specimens were also analyzed. The failure load and strain value at failure for each specimen are listed below in Table 5.4. Statistics for failure load and failure strain can be found in Table 5.5 and Table 5.6, respectively. Every specimen failed before reaching 5000 lbf,

which was the expected loading. The position of the failure of each specimen also occurred near the grip tabs every time, indicating that the wedge grips used on the specimens created a stress concentration. This concentration is likely the cause of the premature failures.

Table 5.4 Specimen Failure Values

SPECIMEN FAILURE VALUES					
Sample	Unstretched Gage Length (in)	Actuator Travel at Failure (in)	Gage Length at Failure (in)	Strain at Failure (in/in)	Failure Load (lbf)
BR-NIAR-A-01	9.98	3.2540	13.2340	0.3261	3987.81
BR-NIAR-A-02	10	3.3065	13.3065	0.3307	4173.93
BR-NIAR-A-03	9.98	3.1314	13.1114	0.3138	3748.88
AM-NIAR-B-01	10	2.4263	12.4263	0.2426	3839.62
AM-NIAR-B-02	10.02	2.3940	12.4140	0.2389	3819.67
AM-NIAR-B-03	10	2.3764	12.3764	0.2376	3367.63
SB1-NIAR-C-01	9.99	1.1487	11.1387	0.1150	4029.91
SB1-NIAR-C-02	9.98	1.1128	11.0928	0.1115	3939.81
SB1-NIAR-C-03	10.02	1.1337	11.1537	0.1131	3968.14
SB2-NIAR-D-01	9.99	2.4113	12.4013	0.2414	3479.47
SB2-NIAR-D-02	10.03	2.3239	12.3539	0.2317	3337.66
SB2-NIAR-D-03	10.01	2.3837	12.3937	0.2381	3273.3
SB3-NIAR-E-01	10	2.5263	12.5263	0.2526	3708.94
SB3-NIAR-E-02	9.99	2.5087	12.4987	0.2511	3719.59
SB3-NIAR-E-03	9.99	2.4839	12.4739	0.2486	3553.24
SB4-NIAR-F-01	10	1.2537	11.2537	0.1254	3767.43
SB4-NIAR-F-02	10	1.2213	11.2213	0.1221	3715.21
SB4-NIAR-F-03	10	1.3486	11.3486	0.1349	4138.09
SB5-NIAR-G-01	10	2.2440	12.2440	0.2244	4081.65
SB5-NIAR-G-02	10	2.1264	12.1264	0.2126	3856.55
SB5-NIAR-G-03	10	2.2211	12.2211	0.2221	4133.17

Table 5.5 Specimen Failure Load Statistics

FAILURE LOAD STATISTICS			
Sample	X Bar (lbf)	s (lbf)	CV
BR-NIAR-A	3970.21	213.07	5.3668%
AM-NIAR-B	3675.64	266.93	7.2622%
SB1-NIAR-C	3979.29	46.07	1.1578%
SB2-NIAR-D	3363.48	105.48	3.1361%
SB3-NIAR-E	3660.59	93.12	2.5439%
SB4-NIAR-F	3873.58	230.56	5.9521%
SB5-NIAR-G	4023.79	147.11	3.6559%

Table 5.6 Specimen Failure Strain Statistics

FAILURE STRAIN STATISTICS			
Sample	X Bar (in/in)	s (in/in)	CV
BR-NIAR-A	0.323	0.009	2.698%
AM-NIAR-B	0.240	0.003	1.080%
SB1-NIAR-C	0.113	0.002	1.535%
SB2-NIAR-D	0.237	0.005	2.078%
SB3-NIAR-E	0.251	0.002	0.802%
SB4-NIAR-F	0.127	0.007	5.194%
SB5-NIAR-G	0.220	0.006	2.838%

6 CALCULATION

The test method is designed to obtain the static elongation limit of seat belt webbing over a predefined loading/unloading profile. At the same time static elongation graphs should be generated.

6.1 PERCENT ELONGATION

For the purpose of this test, the percent elongation is the relative change in gage length with respect to the gage length at a load of 50 lb. It is calculated as the relative separation of the grips and measured by the testing machine described in Section 4.1. It should be expressed as a percent.

6.2 ELONGATION LIMIT

The static elongation limit is calculated as the relative separation between grips obtained at 2500 lbf load. It shall be expressed as a percentage of the initial gage length of the test specimen.

6.3 STATIC ELONGATION GRAPH

The static elongation graph describes the seat belt webbing relative elongation with the applied force. It shall be generated including the loading portion and the unloading portion of the predefined profile.

6.4 STATISTICS

Test results shall include calculated statistics within the minimum test sample of three (3) specimens. Result should include the arithmetic mean of test sample $\bar{x}$,

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \tag{1}$$

the estimated standard deviation s ,

$$s = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2} \tag{2}$$

and the coefficient of variation CV defined as the residual variability in the data as a percentage of the mean $\bar{x}$ [4],

$$CV = \frac{s}{\bar{x}} \cdot 100 \tag{3}$$

7 REFERENCES

1) ASTM Standard E4-03, "Standard Practices for Force Verification of Testing Machines," ASTM International, 2003.
2) ASTM Standard E83-02, "Standard Practices for Verification and Classification of Extensometer System," *ASTM International*, 2003.
3) SAE Aerospace Standard 8043B, "Restraint Systems for Civil Aircraft," *SAE International*, 2008.
4) Montgomery, D. C., "Design and Analysis of Experiments," *Wiley*, 5th Ed., 2000.

APPENDIX B—ELONGATION SPECIMEN PICTURES



Figure B.1 BR-NIAR-A Pre-test Specimens



Figure B.2 AM-NIAR-B Pre-test Specimens



Figure B.3 SB1-NIAR-C Pre-test Specimens



Figure B.4 SB2-NIAR-D Pre-test Specimens



Figure B.5 SB3-NIAR-E Pre-test Specimens



Figure B.6 SB4-NIAR-F Pre-test Specimens



Figure B.7 SB5-NIAR-G Pre-test Specimens



Figure B.8 BR-NIAR-A Post-test Specimens



Figure B.9 AM-NIAR-B Post-test Specimens



Figure B.10 SB1-NIAR-C Post-test Specimens

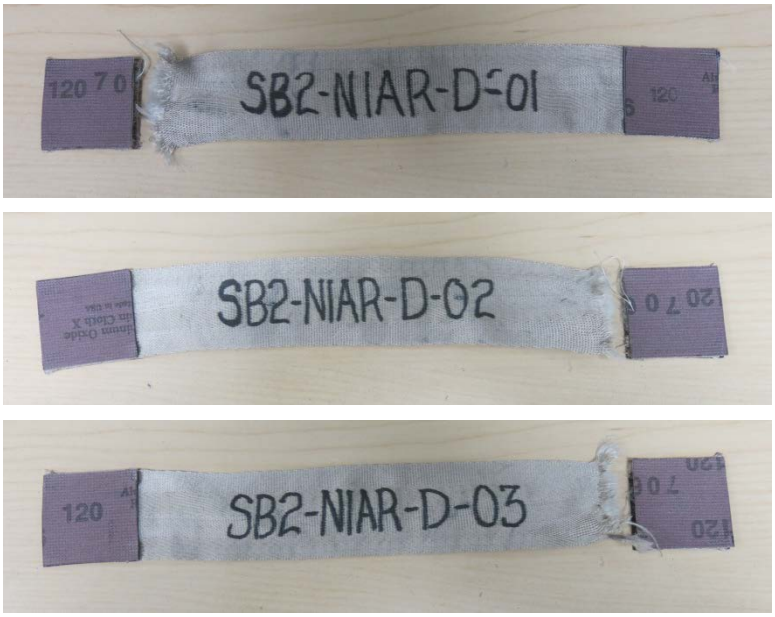


Figure B.11 SB2-NIAR-D-03 Post-test Specimens



Figure B.12 SB3-NIAR-E Post-test Specimens



Figure B.13 SB4-NIAR-F-03 Post-test Specimens



Figure B.14 SB5-NIAR-G-05 Post-test Specimens

APPENDIX C—PHASE 2 RESULTS

WICHITA STATE UNIVERSITY
NATIONAL INSTITUTE FOR AVIATION RESEARCH
Crash Dynamics Lab

Report No. CDL-FA14C-01-01

Requested by:

FAA

Final Test Report FA14C-01

05/05/2014

Revision	Change	Date	Revised By
New		05/05/2014	Rob Huculak

Prepared and Reviewed by:

Rob Huculak
Laboratory Manager

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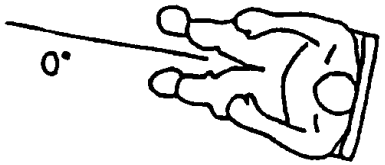
This test report is in accordance with ISO/IEC 17025:2005 requirements and all equipment standards used are traceable to the National Institute of Standards and Technology.
The information in this report relates only to the article under test and cannot be reproduced, except in full, without the written approval of the National Institute for Aviation Research.

Test Summary

The dynamic test (FA14C-01) was performed for FAA in accordance with 14 CFR 25.562 Test 2 on 05/05/2014.

Pulse Parameters	Required	Result	Pass/Fail
Minimum Peak Acceleration (g)	16	16.39	PASS
Minimum Velocity Change (ft/sec)	44	45.67	PASS
Maximum Rise Time (msec)	90	86.9	PASS
Minimum Velocity Change During Rise Time (ft/sec)	22	23.31	PASS
2g Offset	--	--	PASS

Test Orientation



ATD: H2 699 **Position: Config 4 - New Belt (#6)**

0 deg

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National Institute for Aviation Research
1845 N. Fairmount St.
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Tel: (316) 978-5239
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Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

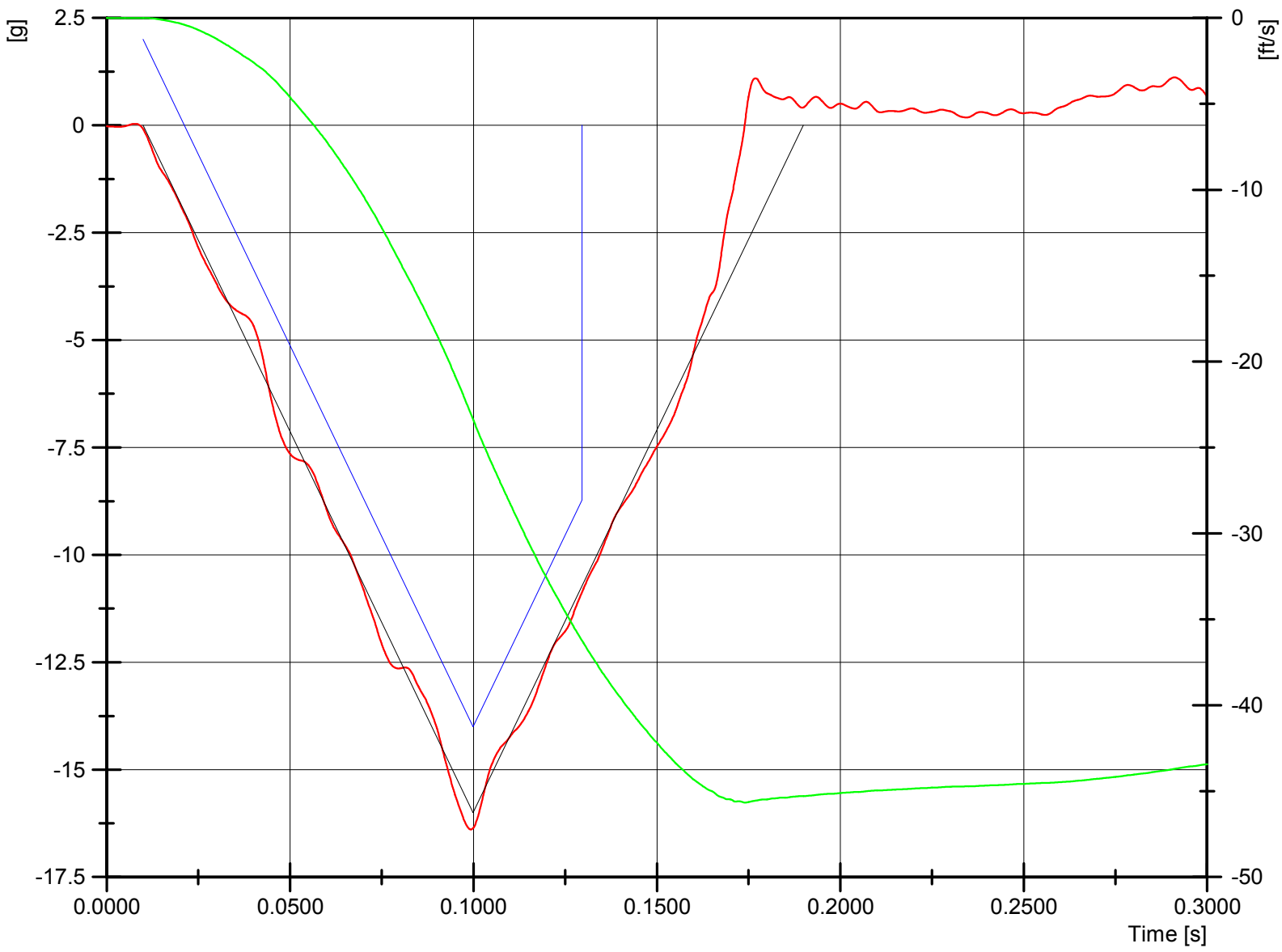
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Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

Temperature	Relative Humidity
74.6°F	29.5%



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Fax: (316) 978-3175
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14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
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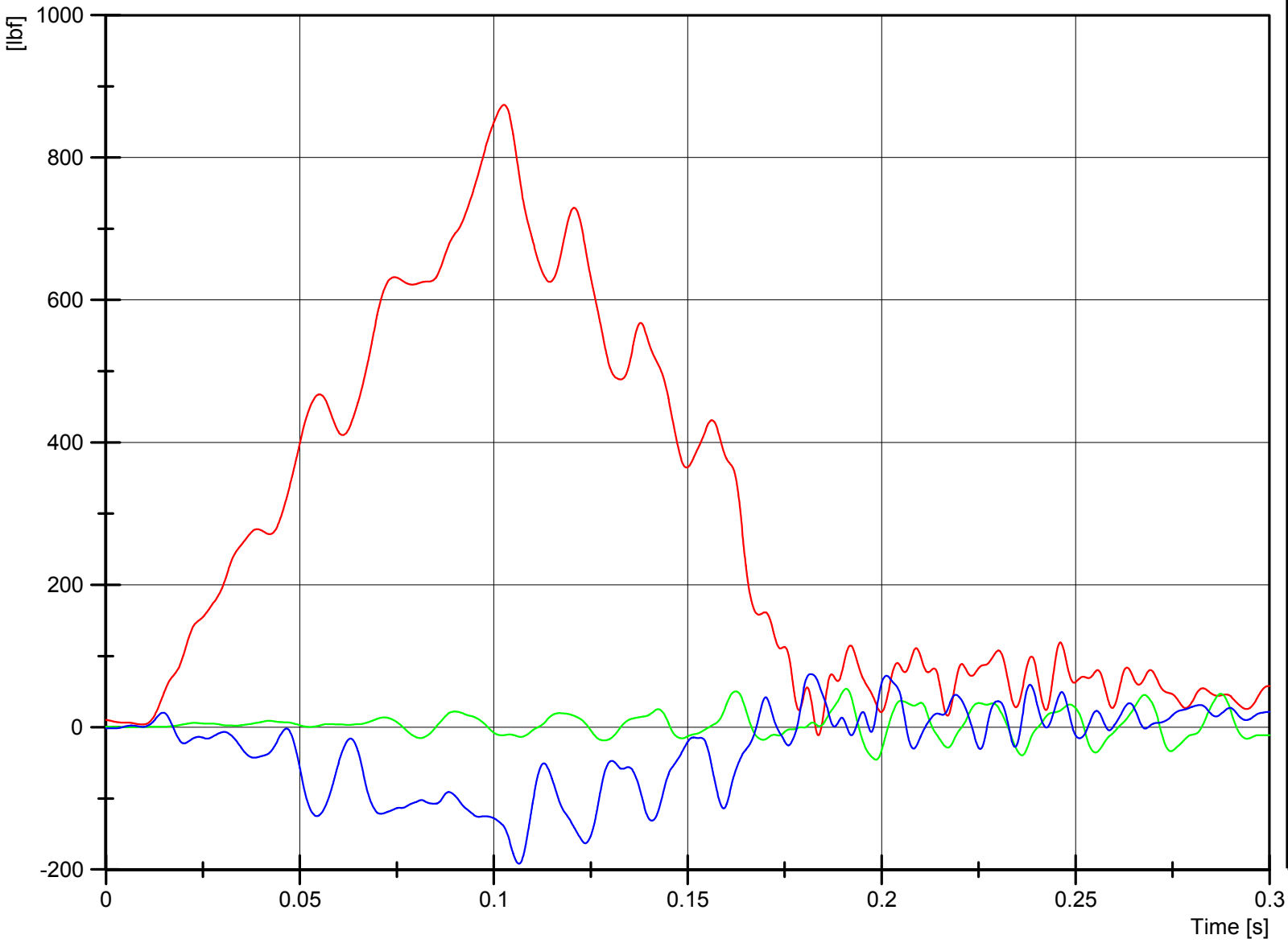
Comments:

Sled Acceleration — Sled Velocity — Ideal Pulse — Upper Limit

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Minimum: -16.39 g Time: 0.0993 sec.
CFC: 60
Sensor Type: ENDEVCO 7290A-100
S/N: 29924
Sensitivity: 0.01912 V/EU
Cal. Due: 01/07/2015
Full Scale: 100 g
DAS Channel: 50
Ref. No.: 1
Polarity: R

Minimum: -45.67 ft/s Time: 0.1741 sec.

Pulse Requirement		Actual
Minimum Required Peak Acceleration:	16 g	16.39 g
Minimum Overall Velocity Change:	44 ft/s	45.67 ft/s
Maximum Rise Time:	90 msec	86.9 msec
Minimum Velocity Change Before Greq:	22 ft/s	23.31 ft/s



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Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

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Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

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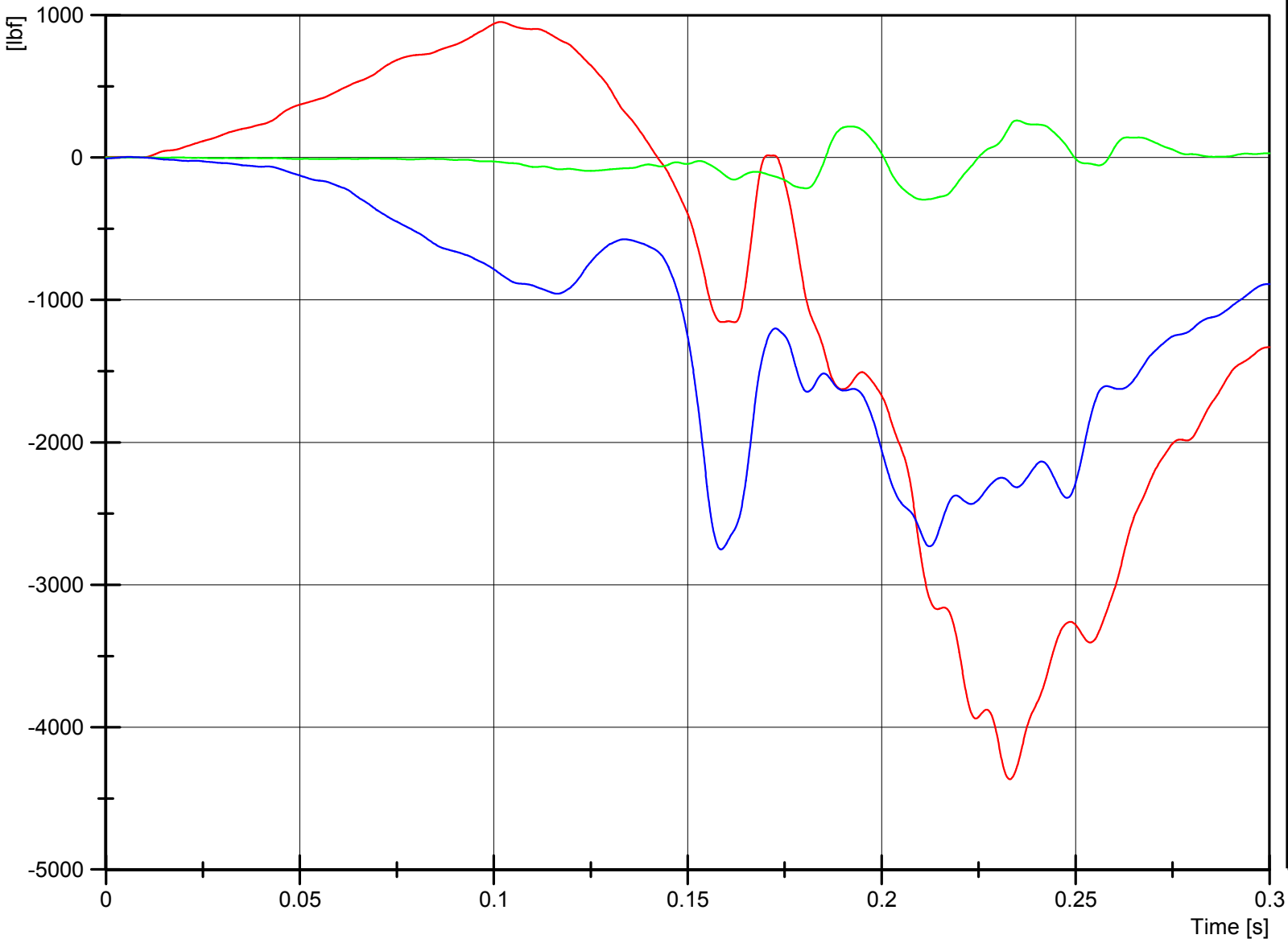
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Minimum: -11.19 lbf Time: 0.1839 sec.
CFC: 60
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S/N: STLC083FZ
Sensitivity: 1.187E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 12
Ref. No.: 15
Polarity: N

Rigid Seat Seat Back Fy

Maximum: 53.9994 lbf Time: 0.1911 sec.
Minimum: -45.78 lbf Time: 0.1987 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FY
Sensitivity: 2.769E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 11
Ref. No.: 14
Polarity: N

Rigid Seat Seat Back Fz

Maximum: 74.5724 lbf Time: 0.1067 sec.
Minimum: -191.76 lbf Time: 0.1819 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FX
Sensitivity: 2.765E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 10
Ref. No.: 13
Polarity: R



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Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

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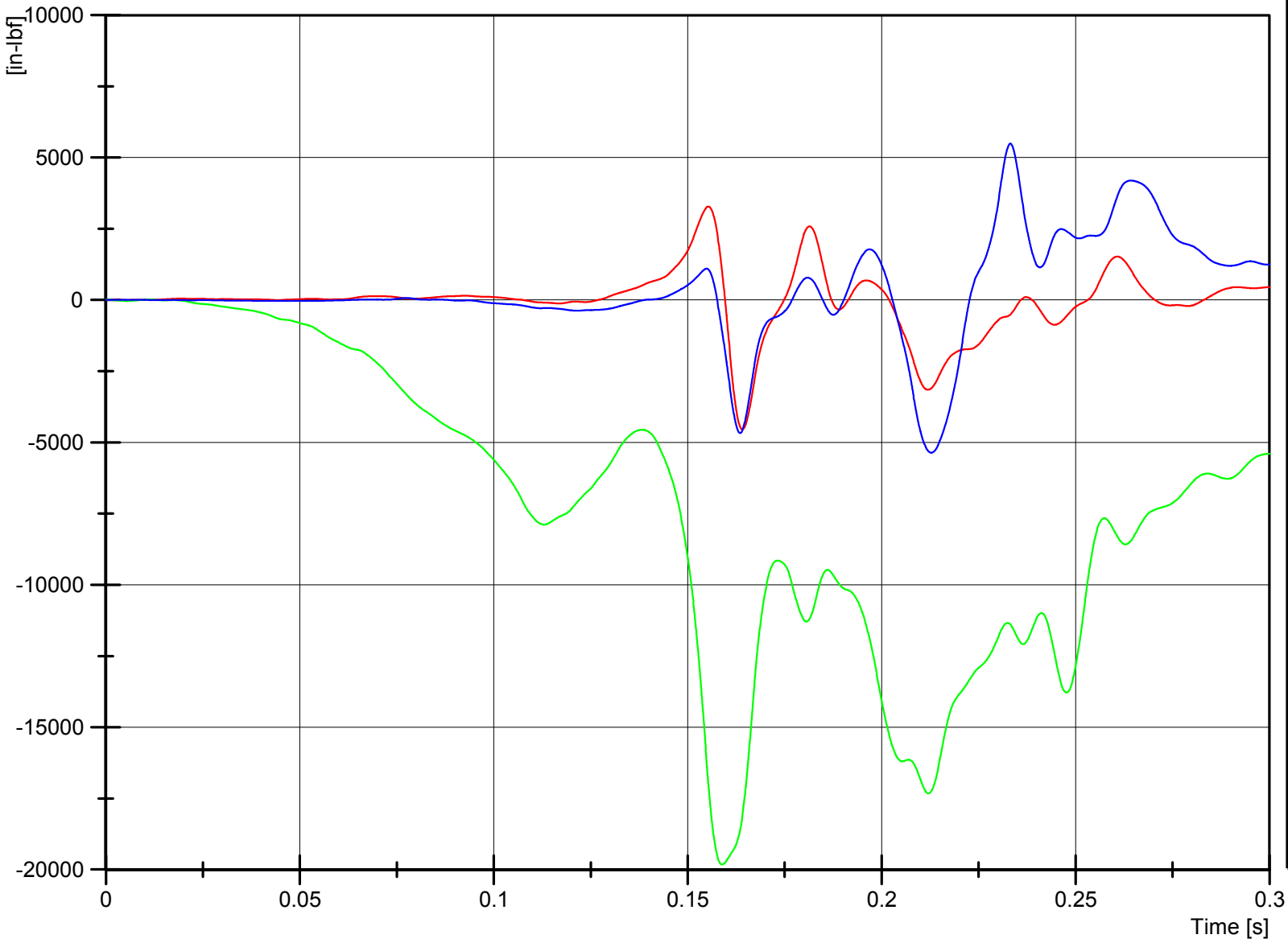
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Full Scale: 10000 lbf
DAS Channel: 13
Ref. No.: 10
Polarity: N

Rigid Seat Seat Pan Fy

Maximum: 261.39 lbf Time: 0.235 sec.
Minimum: -296.30 lbf Time: 0.211 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FY
Sensitivity: 2.846E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 14
Ref. No.: 11
Polarity: N

Rigid Seat Seat Pan Fz

Maximum: 3.4922 lbf Time: 0.1588 sec.
Minimum: -2.75E+03 lbf Time: 0.0063 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FZ
Sensitivity: 1.205E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 15
Ref. No.: 12
Polarity: N



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National Institute for Aviation Research
1845 N. Fairmount St.
Wichita, Kansas 67260-0093
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Fax: (316) 978-3175
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Version: New

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Customer: FAA

Test: FA14C-01

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

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Pretrigger Samples: 40960
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Rev.: Impax-SD 6.02 Rev A12t
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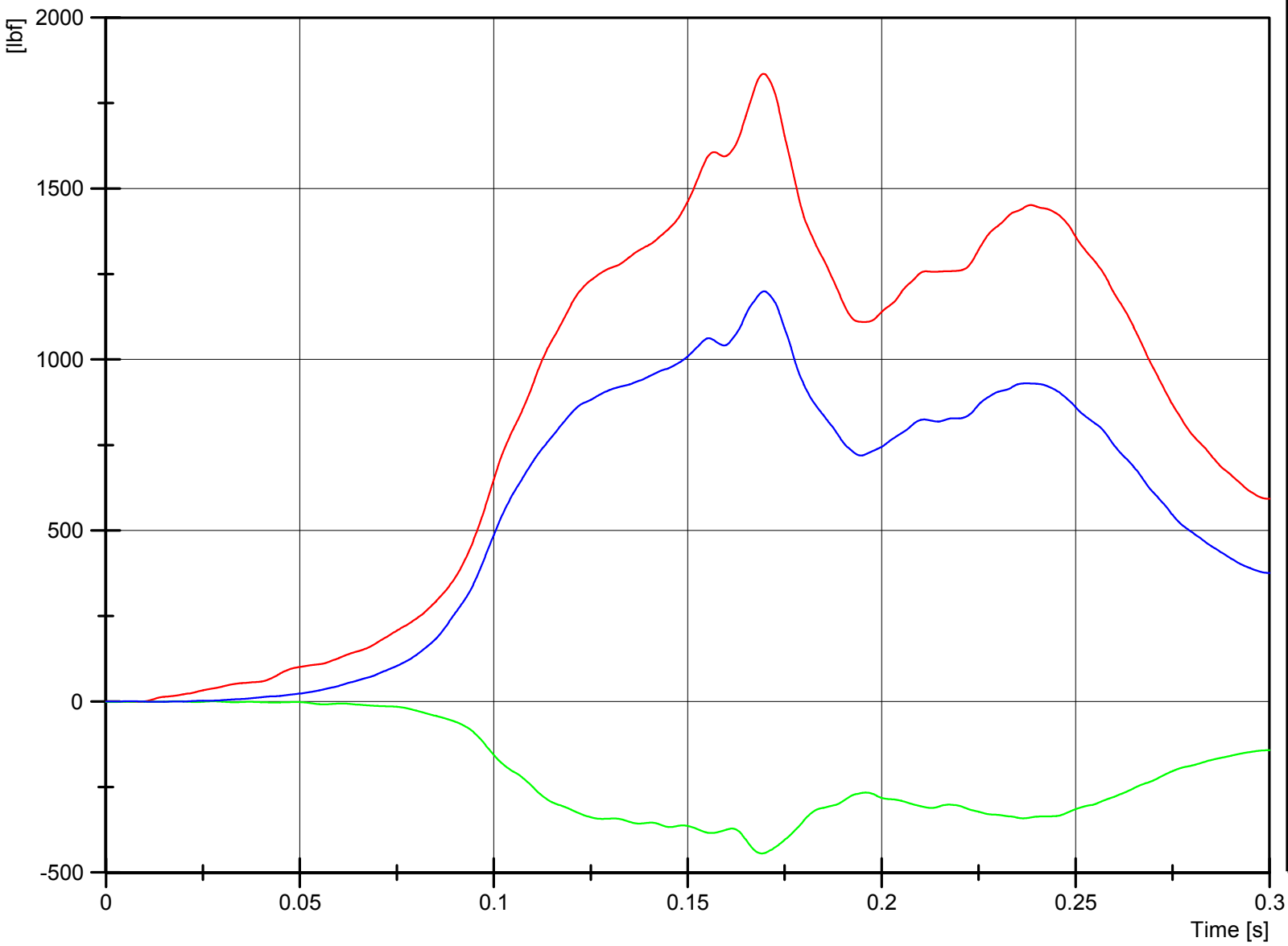
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Sensitivity: 7.104E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 25000 in-lbf
DAS Channel: 16
Ref. No.: 7
Polarity: N

Rigid Seat Seat Pan My

Maximum: 21.3479 in-lbf Time: 0 sec.
Minimum: -1.98E+04 in-lbf Time: 0.1591 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MY
Sensitivity: 7.112E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 25000 in-lbf
DAS Channel: 17
Ref. No.: 8
Polarity: N

Rigid Seat Seat Pan Mz

Maximum: 5488.45 in-lbf Time: 0.2334 sec.
Minimum: -5.36E+03 in-lbf Time: 0.213 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MZ
Sensitivity: 9.38E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 20000 in-lbf
DAS Channel: 18
Ref. No.: 9
Polarity: R



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Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: H2 718

Position: Config 1 - New Belt

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

Rigid Seat Right Lap Fx

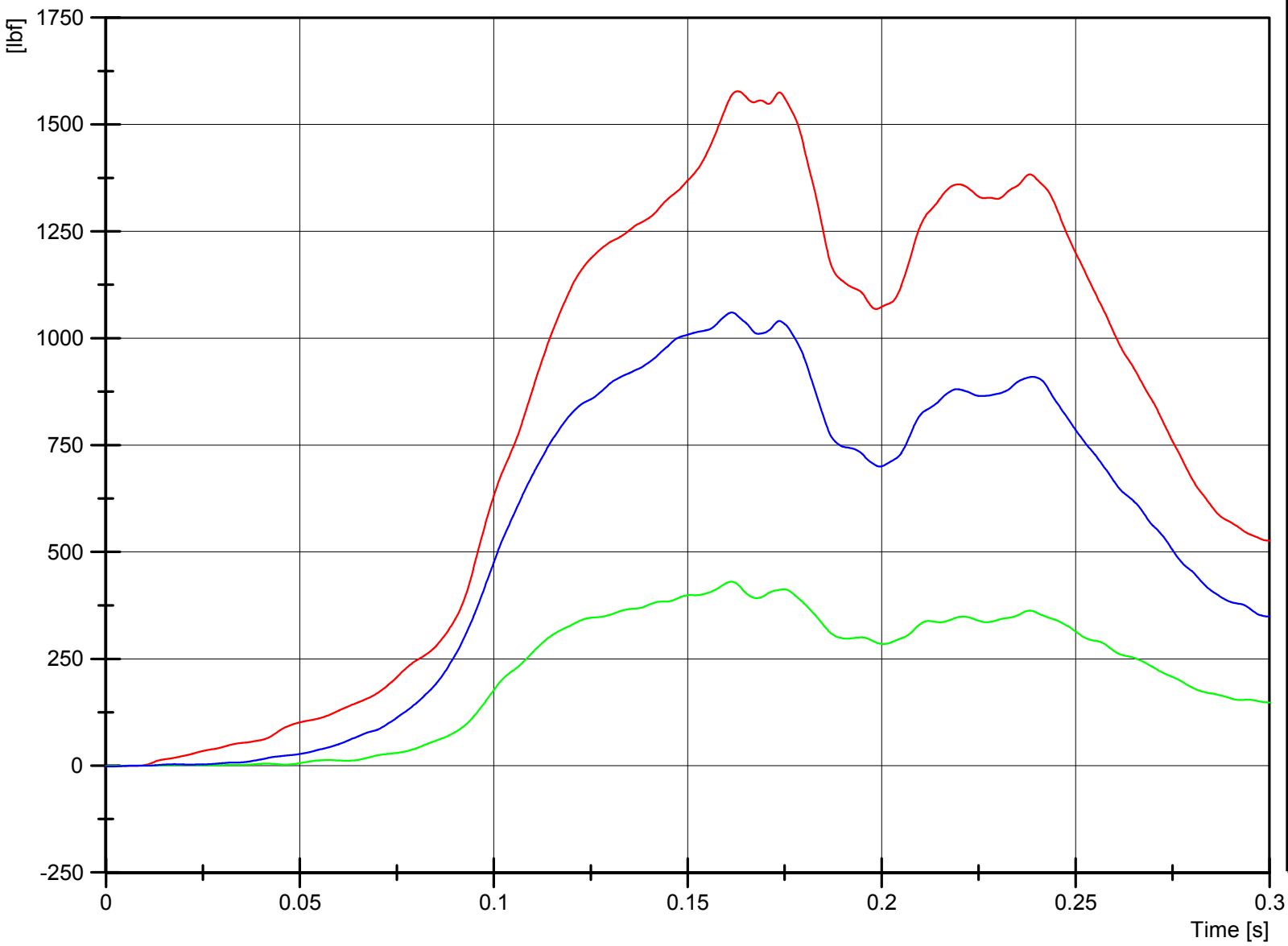
Maximum: 1835.58 lbf Time: 0.1697 sec.
Minimum: -0.4261 lbf Time: 0.0084 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FX
Sensitivity: 2.6022E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 19
Ref. No.: 74
Polarity: N

Rigid Seat Right Lap Fy

Maximum: 1.1969 lbf Time: 0.0188 sec.
Minimum: -444.15 lbf Time: 0.1693 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FY
Sensitivity: 2.5935E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 20
Ref. No.: 75
Polarity: N

Rigid Seat Right Lap Fz

Maximum: 1199.18 lbf Time: 0.0146 sec.
Minimum: -0.4701 lbf Time: 0.1699 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FZ
Sensitivity: 1.088E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 21
Ref. No.: 76
Polarity: N



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Fax: (316) 978-3175
www.niar.wichita.edu

Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: H2 718

Position: Config 1 - New Belt

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

Rigid Seat Left Lap Fx

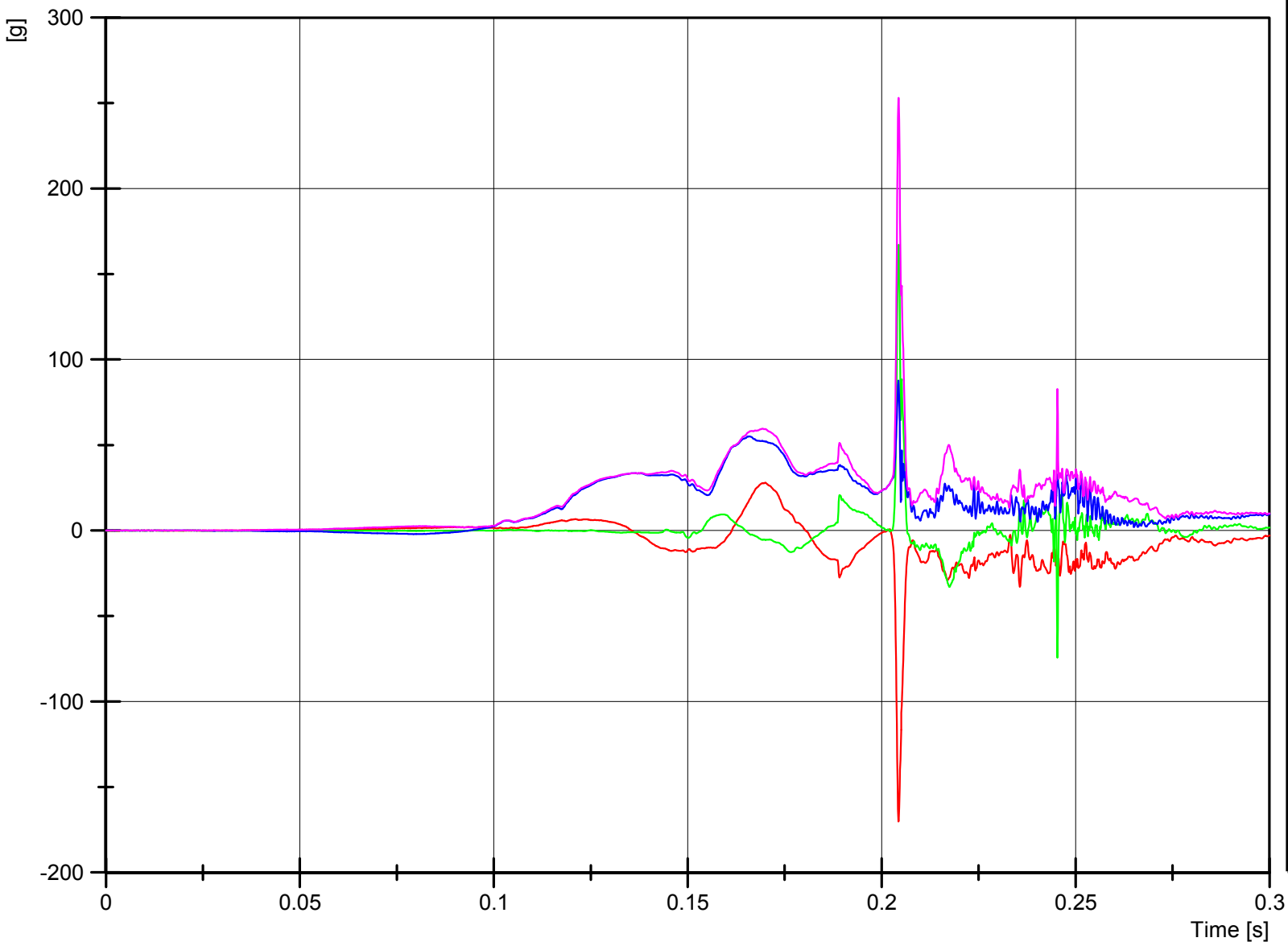
Maximum: 1577.46 lbf Time: 0.1631 sec.
Minimum: -1.4958 lbf Time: 0.0017 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FX
Sensitivity: 2.608E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 22
Ref. No.: 77
Polarity: N

Rigid Seat Left Lap Fy

Maximum: 430.095 lbf Time: 0.1615 sec.
Minimum: -0.8465 lbf Time: 0 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FY
Sensitivity: 2.606E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 23
Ref. No.: 78
Polarity: N

Rigid Seat Left Lap Fz

Maximum: 1060.56 lbf Time: 0.0009 sec.
Minimum: -1.8556 lbf Time: 0.1615 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FZ
Sensitivity: 1.087E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 24
Ref. No.: 79
Polarity: R



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Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: H2 699

Position: Config 4 - New Belt (#6)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

Head Ax H2 699

Maximum: 27.93 g Time: 0.1702 sec.
Minimum: -170.20 g Time: 0.2045 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P45436
Sensitivity: 1.823E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 25
Ref. No.: 22
Polarity: R

Head Ay H2 699

Maximum: 167.30 g Time: 0.2046 sec.
Minimum: -74.26 g Time: 0.2455 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P47924
Sensitivity: 1.863E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 26
Ref. No.: 23
Polarity: R

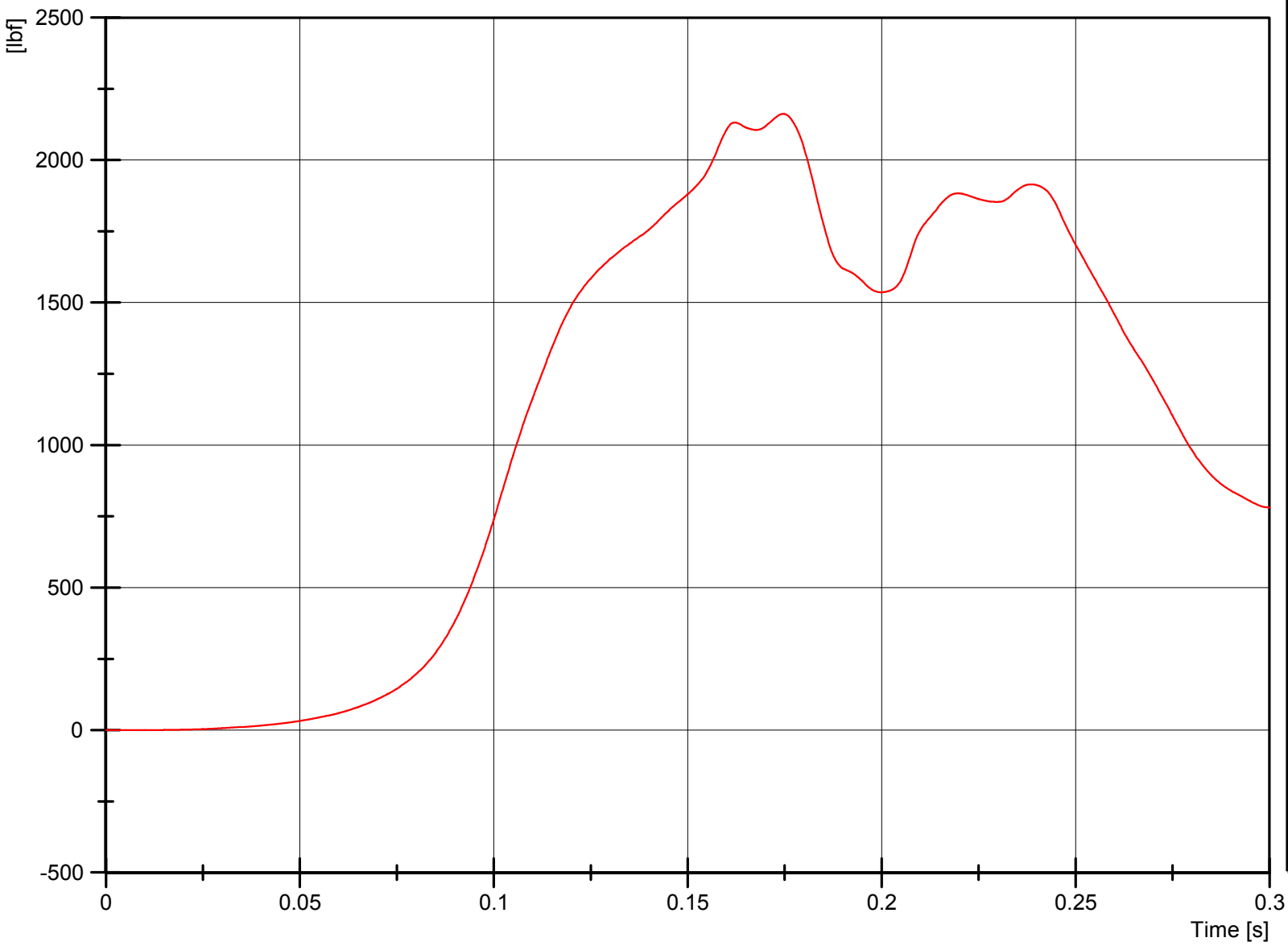
Head Az H2 699

Maximum: 87.6416 g Time: 0.2045 sec.
Minimum: -2.0828 g Time: 0.0796 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P48250
Sensitivity: 1.827E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 27
Ref. No.: 24
Polarity: R

Head Resultant H2 699

Maximum: 253.14 g Time: 0.02044 sec.

HIC: 974.2
T1: 120.2 msec.
T2: 257.2 msec.



Lap Belt Force H2 699

Maximum: 2161.89 lbf
Minimum: -0.2523 lbf
CFC: 60
Sensor Type: Denton 3255
S/N: SBLC259
Sensitivity: 6.0647E-07 V/EU
Cal. Due: 10/17/2014
Full Scale: 3000 lbf
DAS Channel: 31
Ref. No.: 17
Polarity: N

Time: 0.1748 sec.
Time: 0 sec.

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Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: H2 699

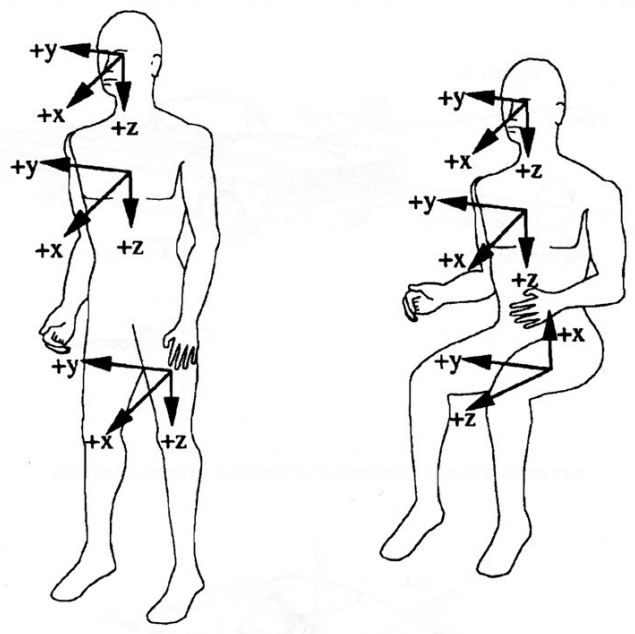
Position: Config 4 - New Belt (#6)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

J211/1 Sign Conventions



Upper Neck Load Cell:
+FX Head rearward, chest forward
+FY Head leftward, chest rightward
+FZ Head upward, chest downward
+MX Left ear toward left shoulder
+MY Chin toward sternum
+MZ Chin toward left shoulder

Lumbar Load Cell:
+FX Chest rearward, pelvis forward
+FY Chest leftward, pelvis rightward
+FZ Chest upward, pelvis downward
+MX Left shoulder toward left hip
+MY Sternum toward front of legs
+MZ Right shoulder forward, left shoulder rearward

Femur Load Cells:
+FZ Tension

Chest Displacement:
-DX Compression

Rib Dispacement:
-DY Compression

Belt Load Cells:
+FX Tension

Floor Load Cells:
+FX Test article forward
+FY Test article right
+FZ Test article up

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Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

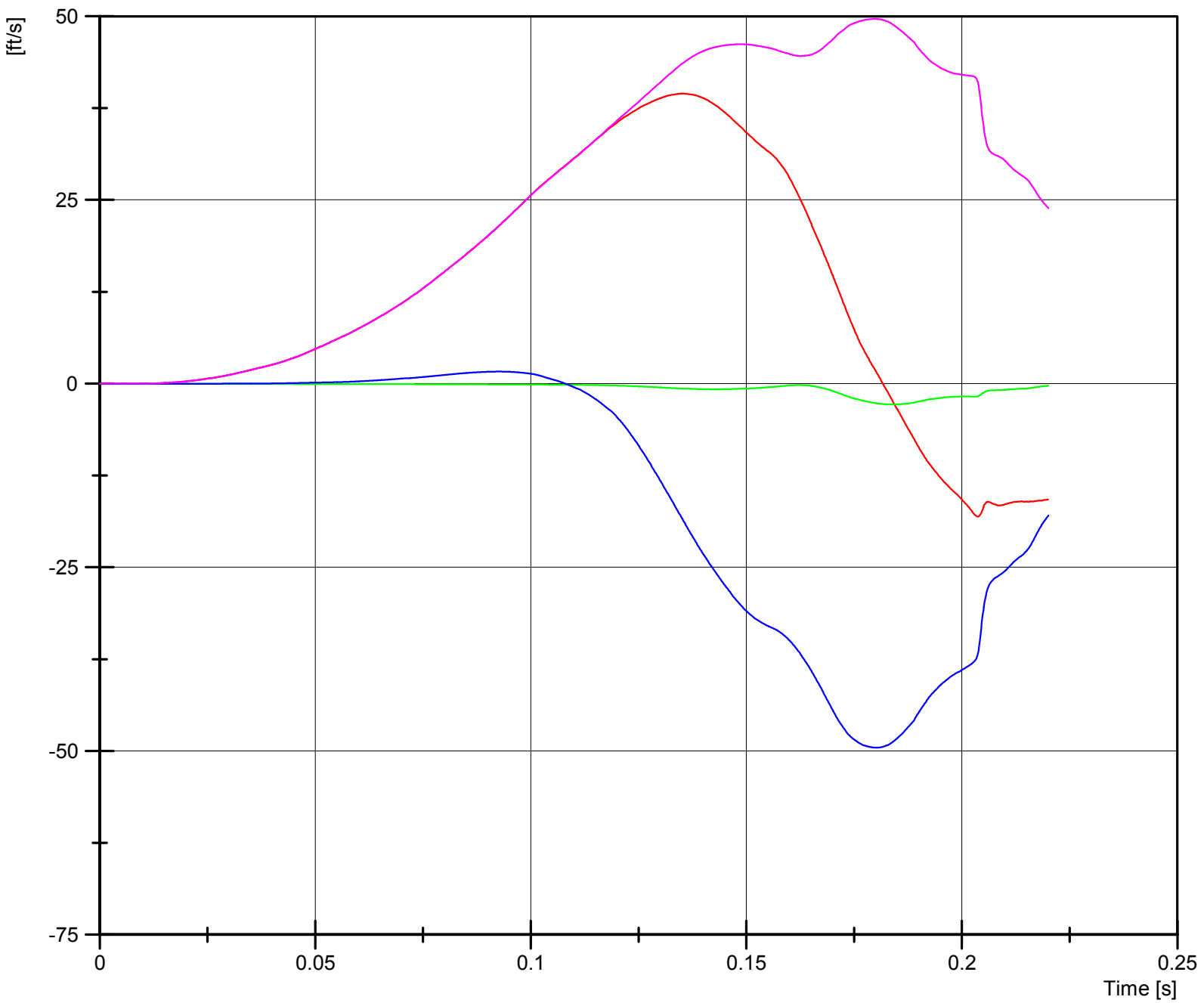
Test: FA14C-01

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

Comments:



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Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: H2 699

Position: Config 4 - New Belt (#6)

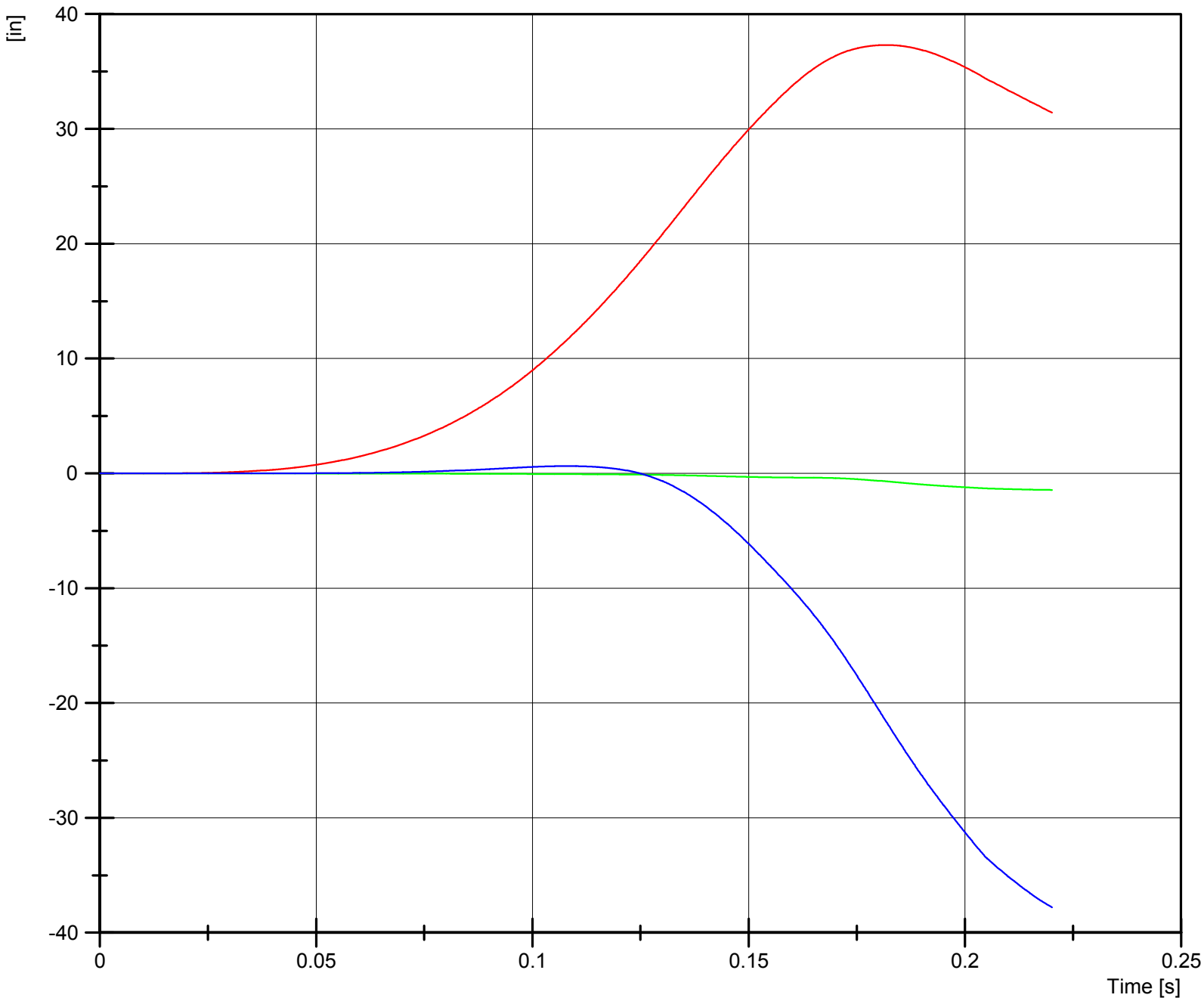
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

Comments:

Global Head Vx H2 699		Global Head Vy H2 699		Global Head Vz H2 699		Global Head Velocity Resultant H2 699	
Maximum: 39.49 ft/s	Time: 0.1351 sec.	Maximum: 0 ft/s	Time: 0.0001 sec.	Maximum: 1.64 ft/s	Time: 0.0926 sec.	Maximum: 49.65 ft/s	Time: 0.1798 sec.
Minimum: -18.11 ft/s	Time: 0.2037 sec.	Minimum: -2.82 ft/s	Time: 0.1839 sec.	Minimum: -49.54 ft/s	Time: 0.1801 sec.	Minimum: 0 ft/s	Time: 0.0001 sec.



Global Head Dx H2 699 | Global Head Dy H2 699 | Global Head Dz H2 699

Maximum: 37.30 in	Time: 0.1818 sec.	Maximum: 0.00 in	Time: 0.0001 sec.	Maximum: 0.64 in	Time: 0.108 sec.
Minimum: -0.00 in	Time: 0.0043 sec.	Minimum: -1.43 in	Time: 0.2201 sec.	Minimum: -37.78 in	Time: 0.2201 sec.

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Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: H2 699

Position: Config 4 - New Belt (#6)

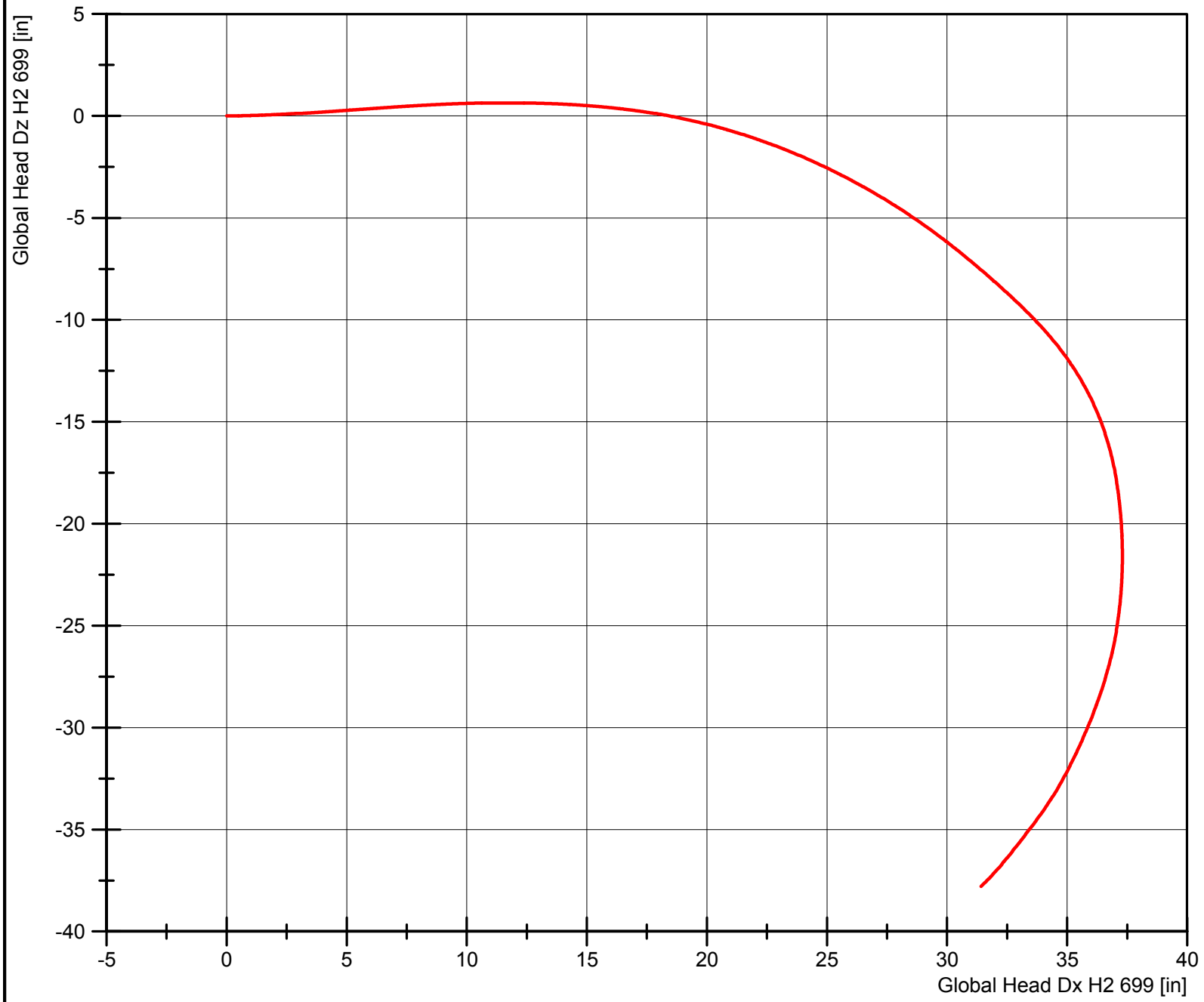
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

Comments:

Displacement values are calculated from Head Accelerations and Angular Velocities.
This method cannot be used to substitute photometric analysis.



Global Head Displacement XZ

X Maximum: 37.30 in **Time: 0.1818 sec.**

Z Value at X Maximum: -21.61 in

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Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: H2 699

Position: Config 4 - New Belt (#6)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

Comments:

Displacement values are calculated from Head Accelerations and Angular Velocities.
This method cannot be used to substitute photometric analysis.

Pre-test Photos











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Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: N/A

Position: N/A

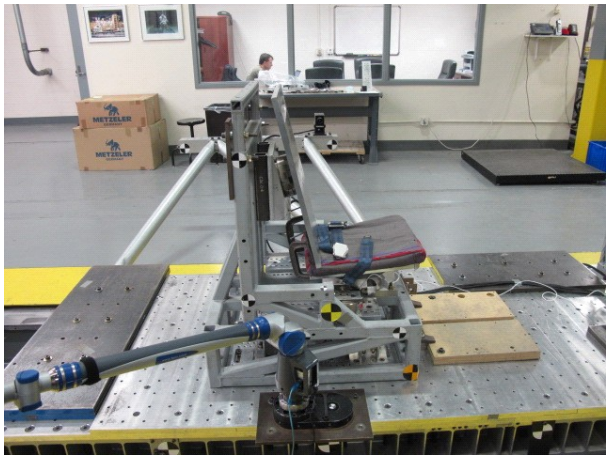
Test Description:
14 CFR 25.562 Test 2

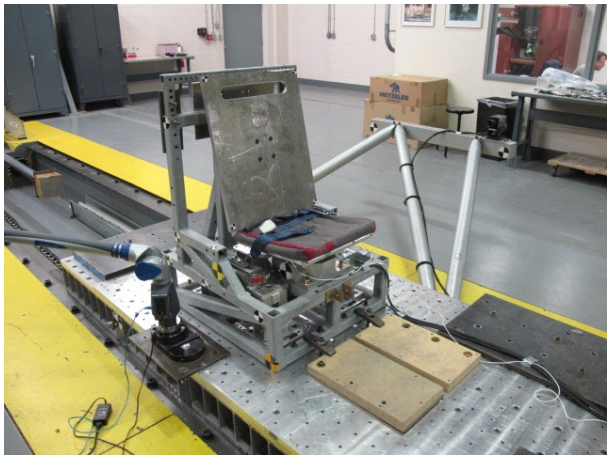
Pulse Name:
16g-04

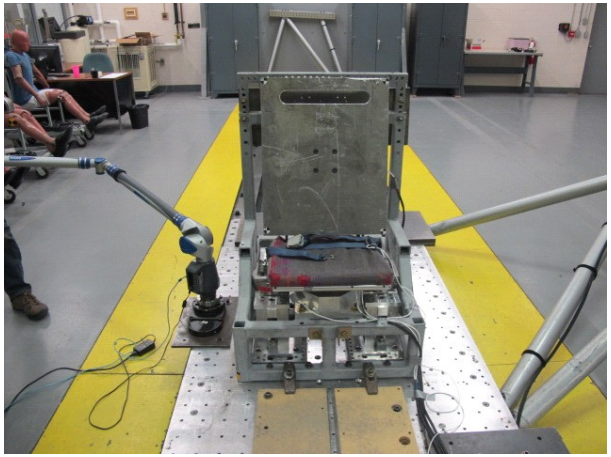
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Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

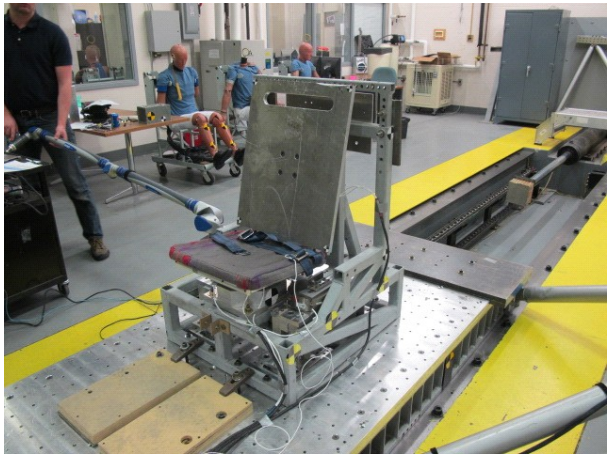
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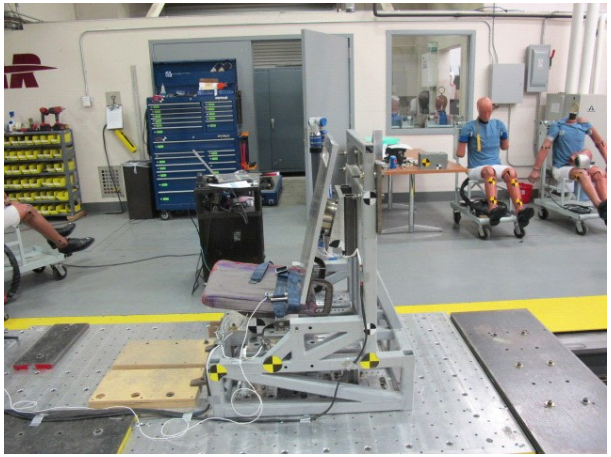
Pre-test Photos

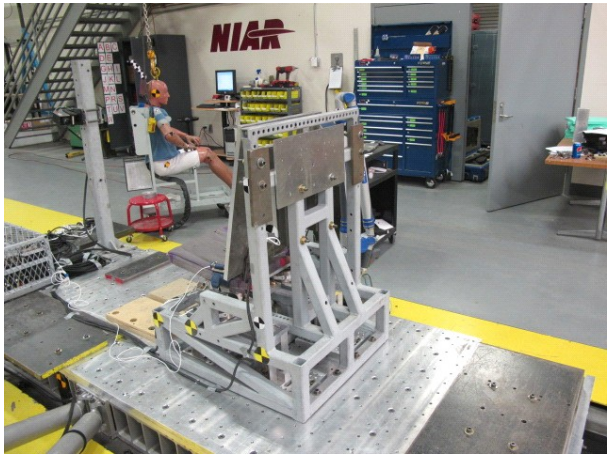












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Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: N/A

Position: N/A

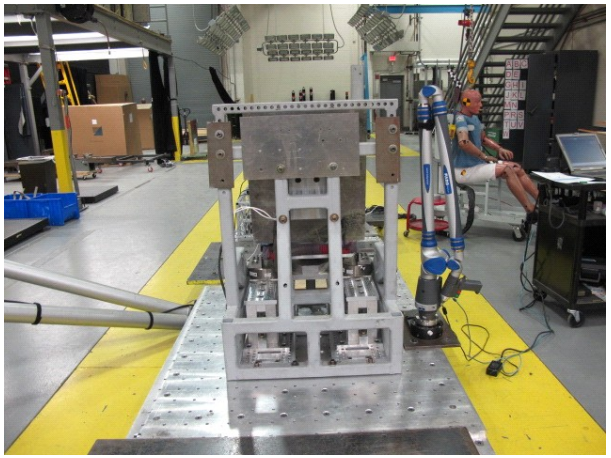
Test Description:
14 CFR 25.562 Test 2

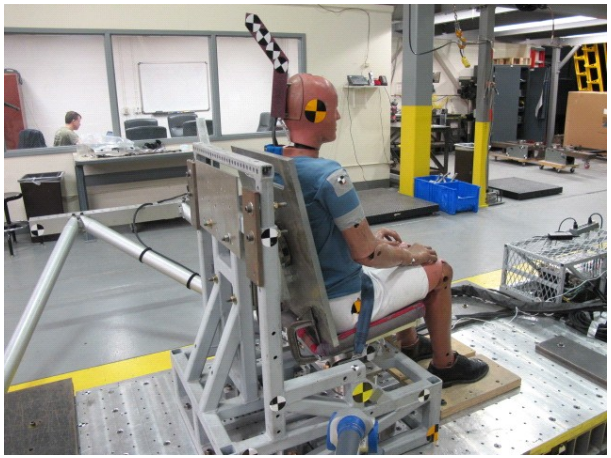
Pulse Name:
16g-04

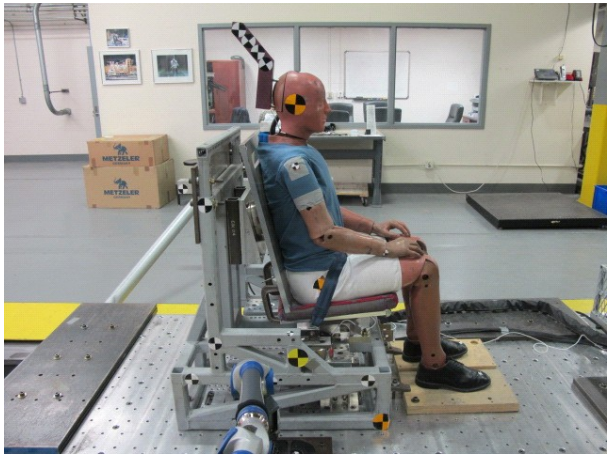
Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

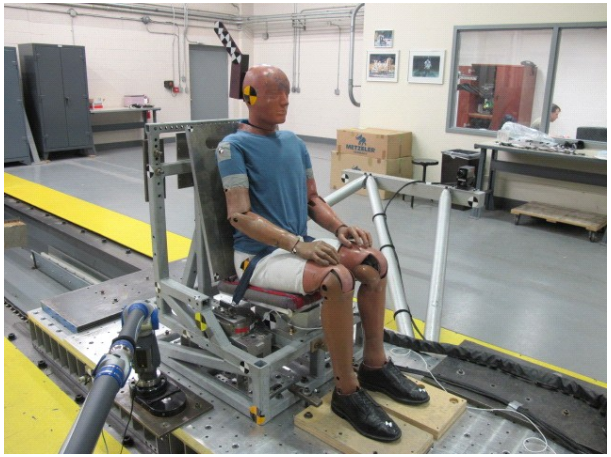
Comments:

Pre-test Photos

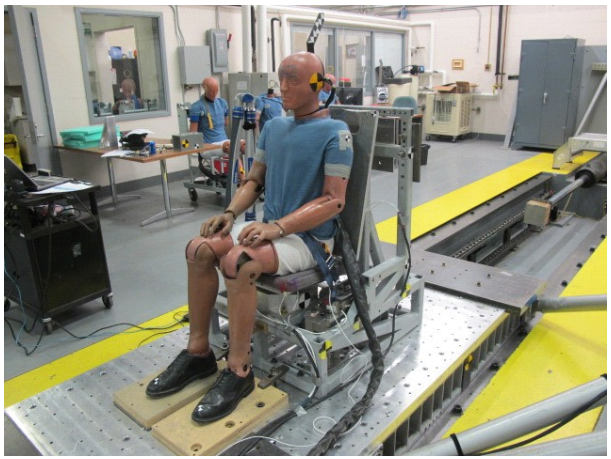












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Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: N/A

Position: N/A

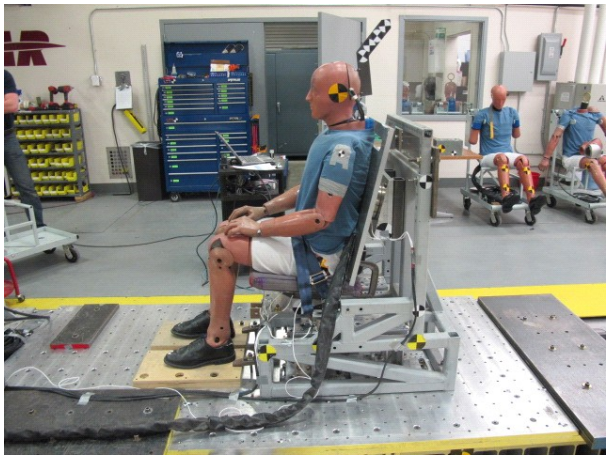
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

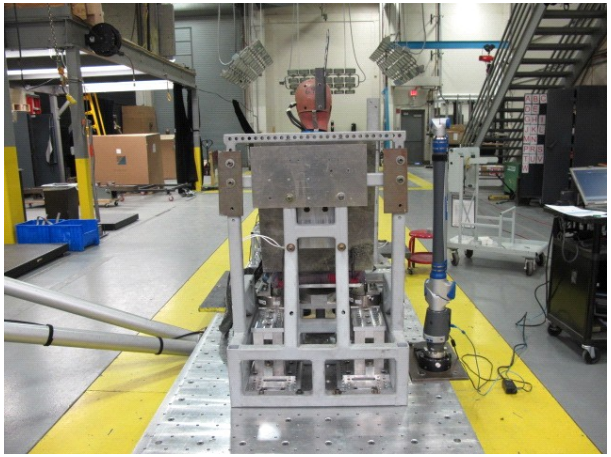
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Total Samples: 81920
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Test Date/Time: 05/05/2014 12:40

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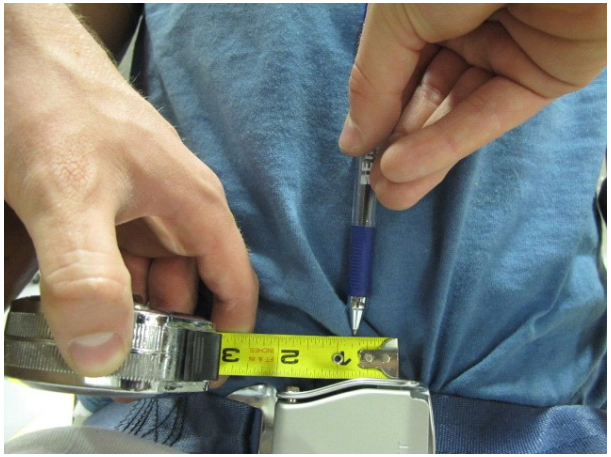
Pre-test Photos

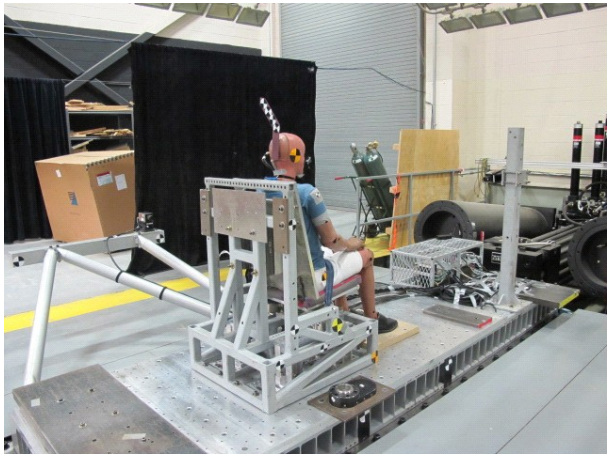












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Report Date: 05/05/2014

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Test: FA14C-01

Dummy: N/A

Position: N/A

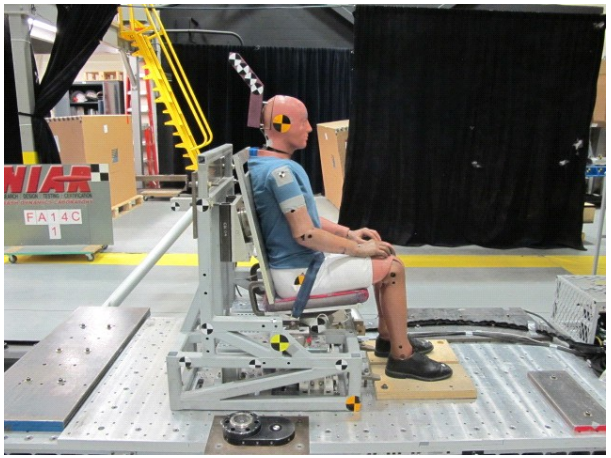
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

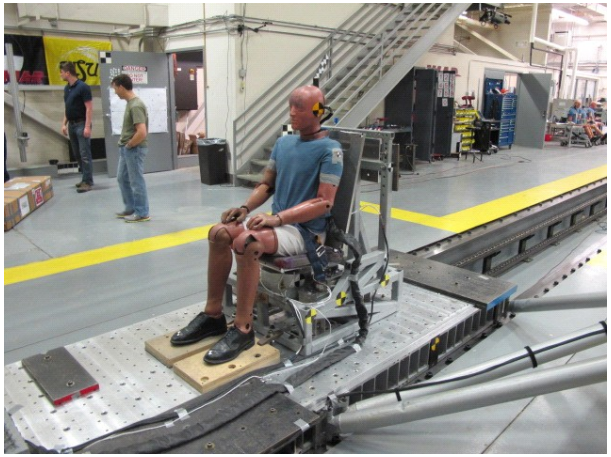
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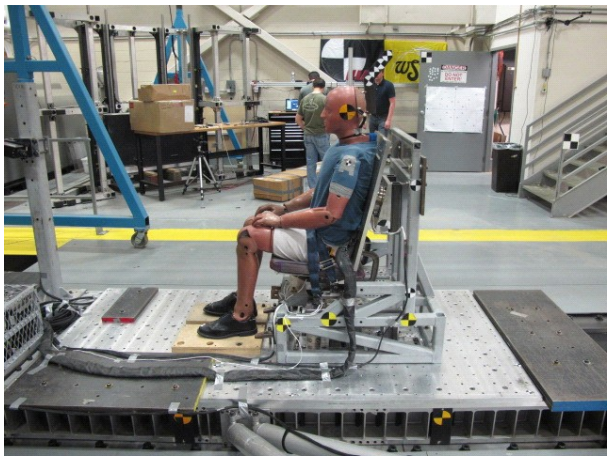
Pre-test Photos

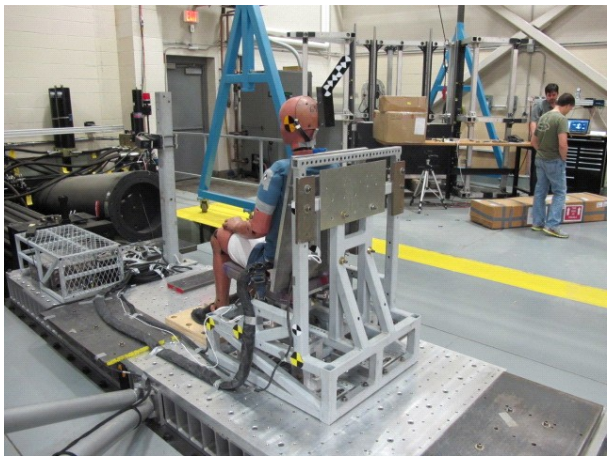












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Test: FA14C-01

Dummy: N/A

Position: N/A

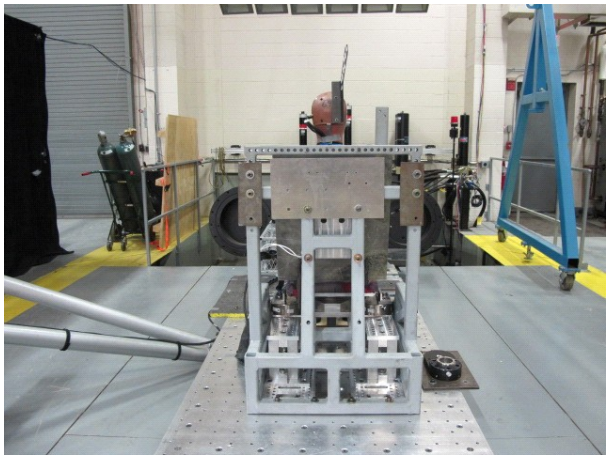
Test Description:
14 CFR 25.562 Test 2

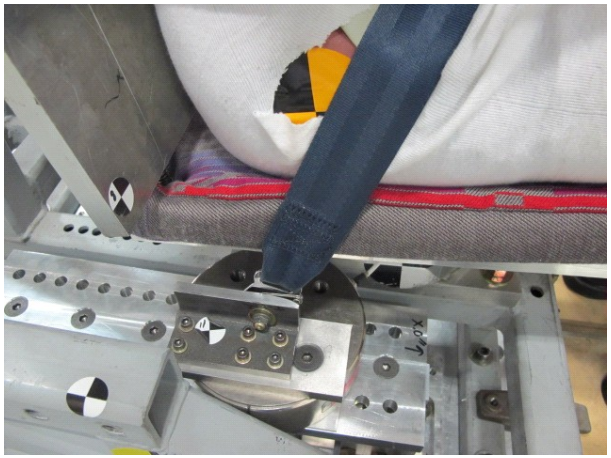
Pulse Name:
16g-04

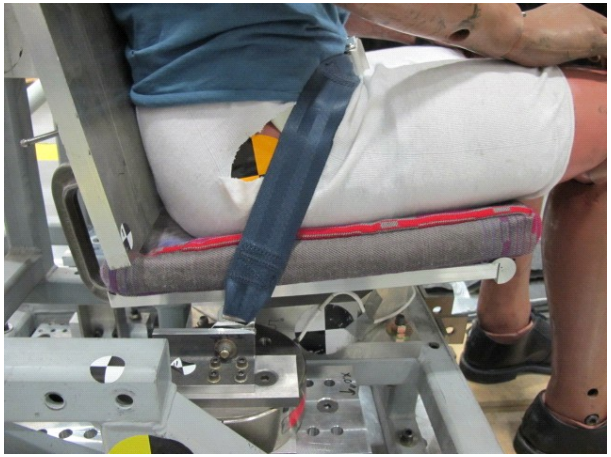
Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

Comments:

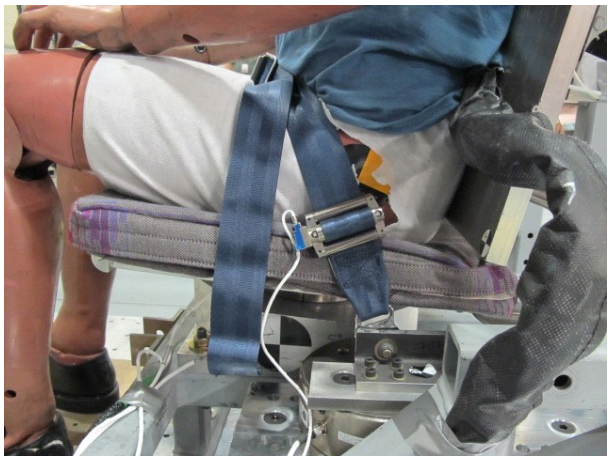
Pre-test Photos

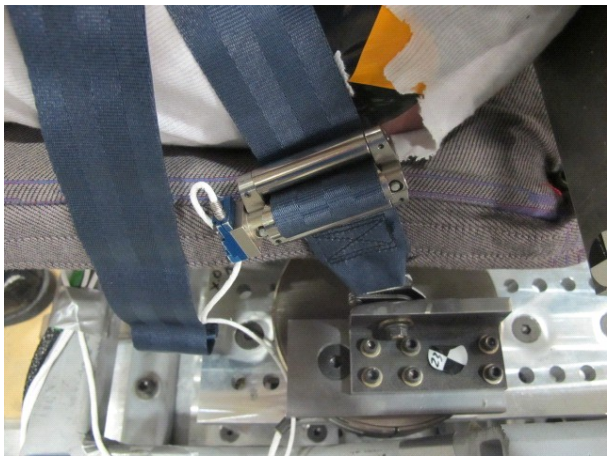












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Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

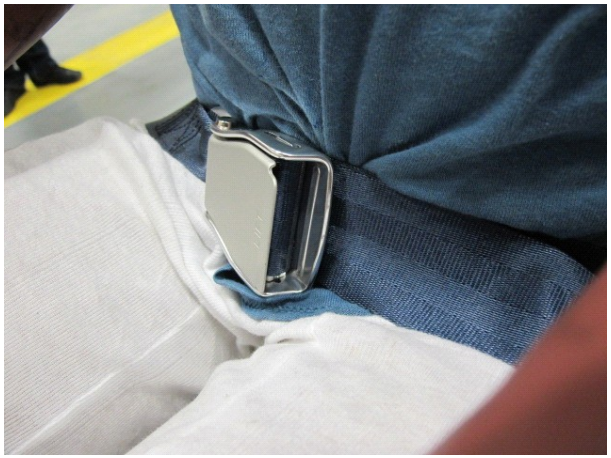
Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

Comments:

Pre-test Photos





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Dummy: N/A

Position: N/A

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14 CFR 25.562 Test 2

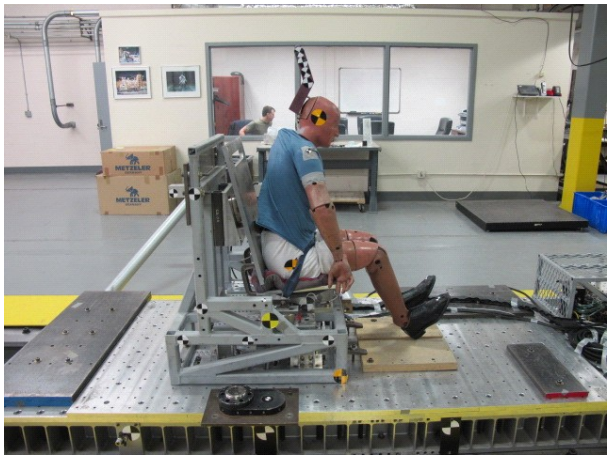
Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

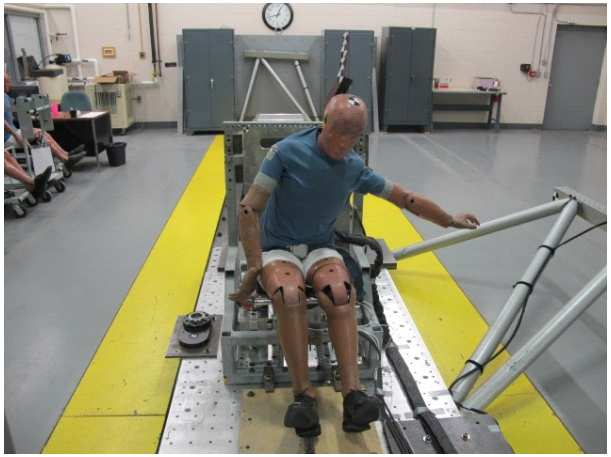
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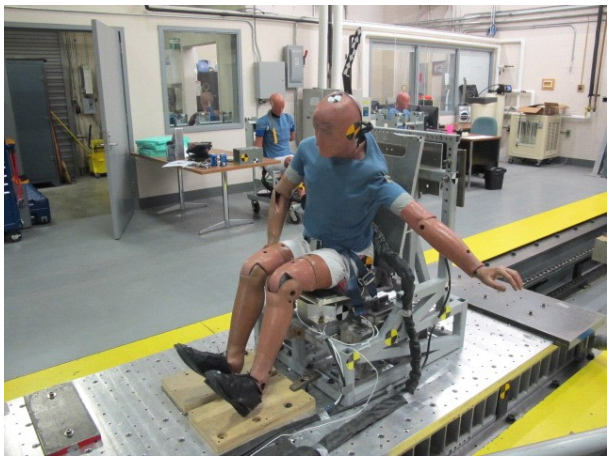
Post-test Photos

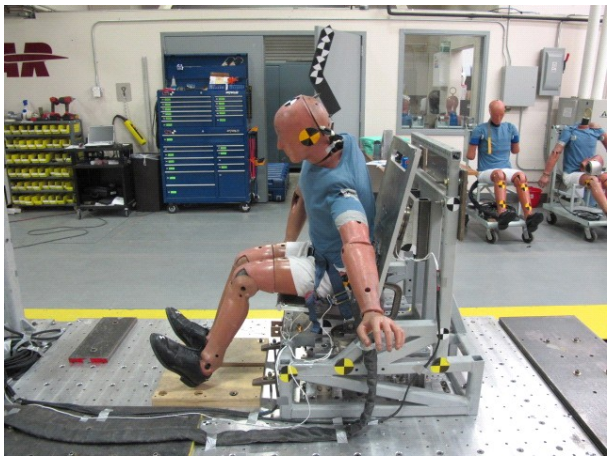












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Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

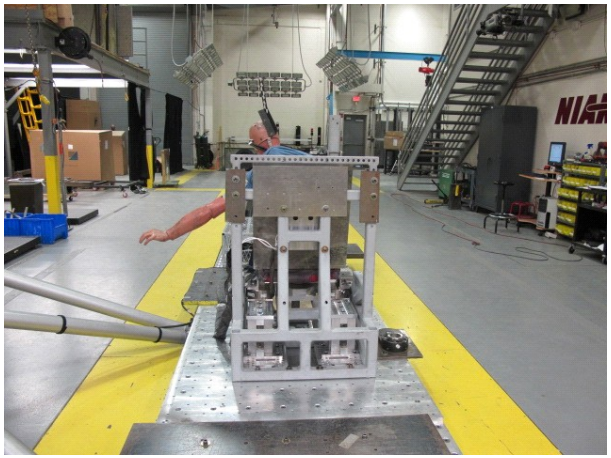
Pulse Name:
16g-04

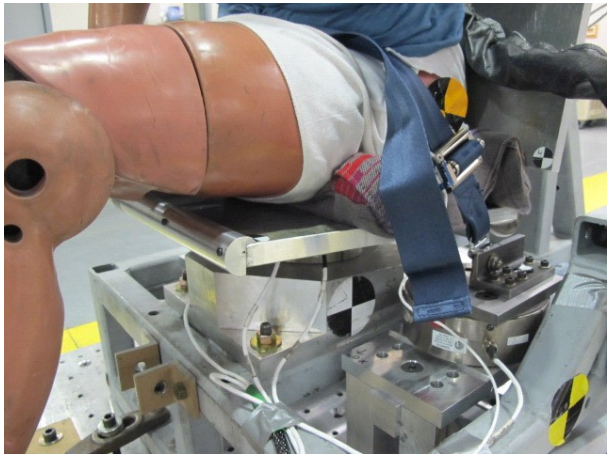
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Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

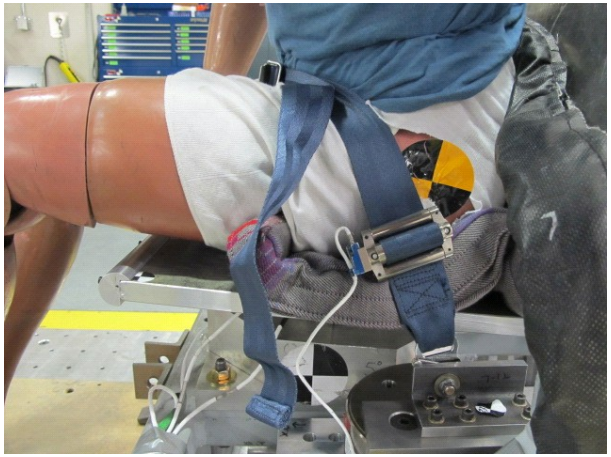
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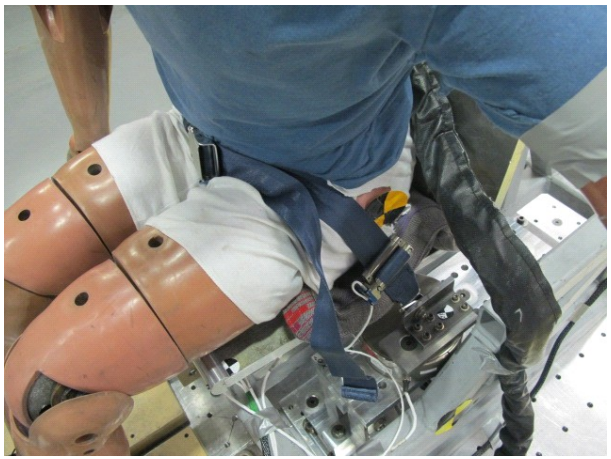
Post-test Photos

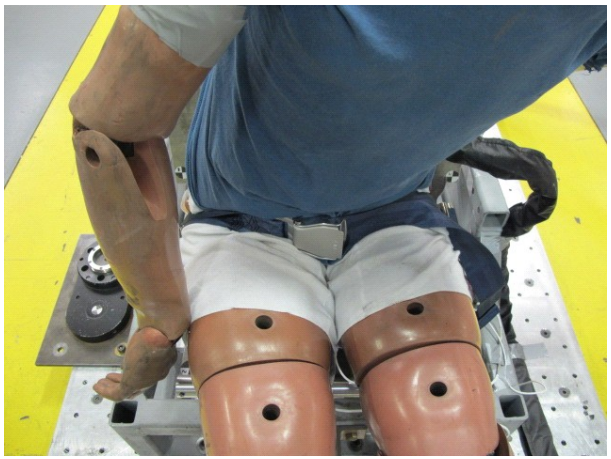












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Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

Comments:

Post-test Photos

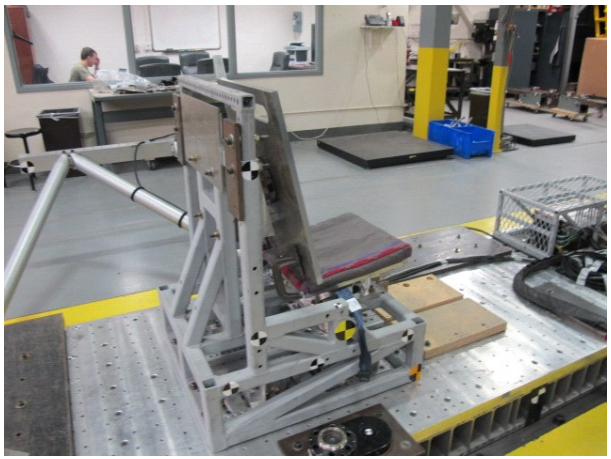












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Customer: FAA

Test: FA14C-01

Dummy: N/A

Position: N/A

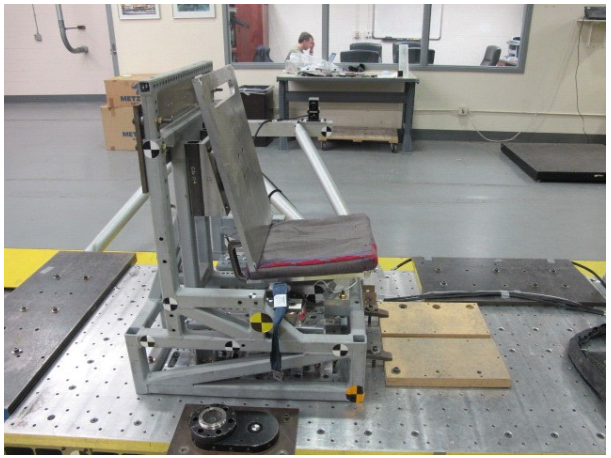
Test Description:
14 CFR 25.562 Test 2

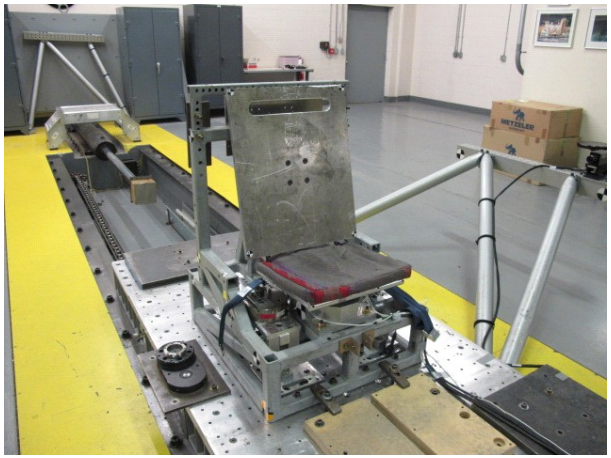
Pulse Name:
16g-04

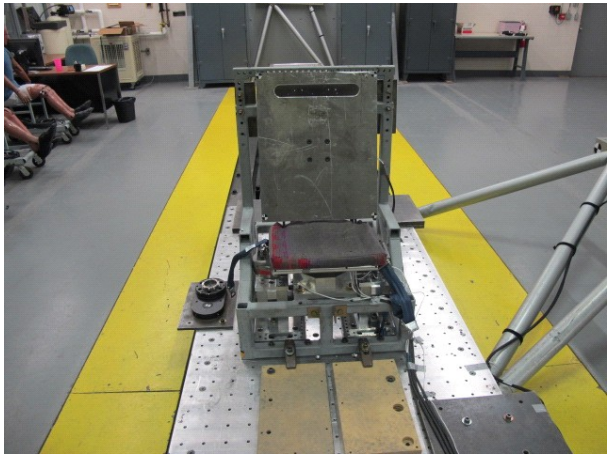
Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

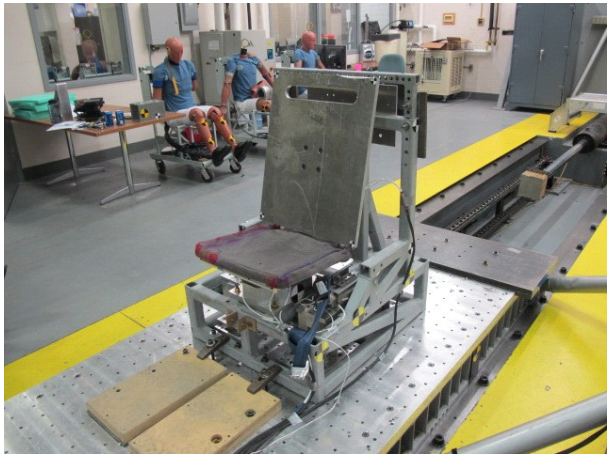
Comments:

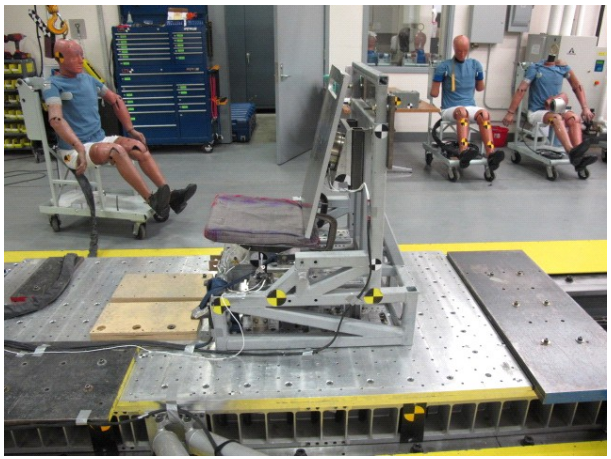
Post-test Photos

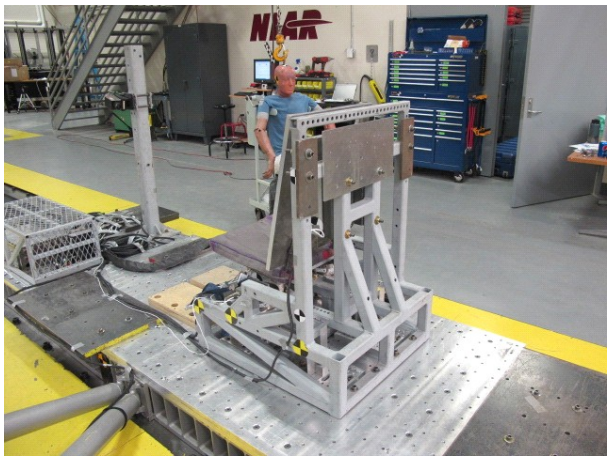












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Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: N/A

Position: N/A

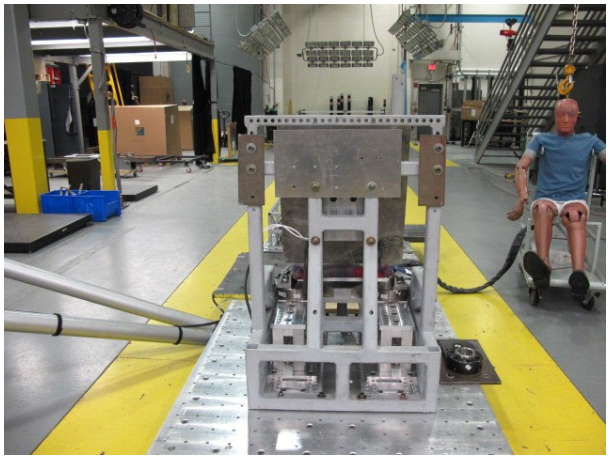
Test Description:
14 CFR 25.562 Test 2

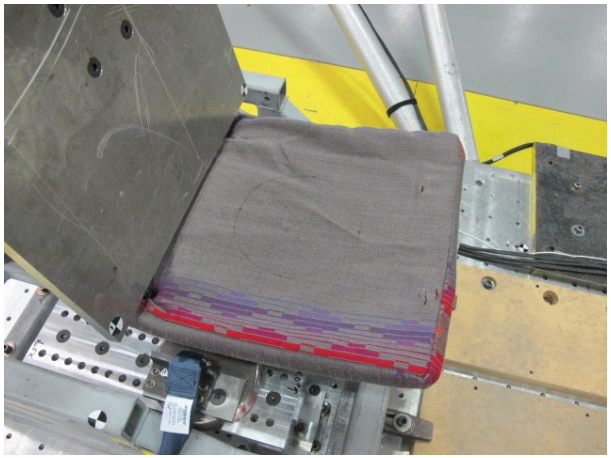
Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

Comments:

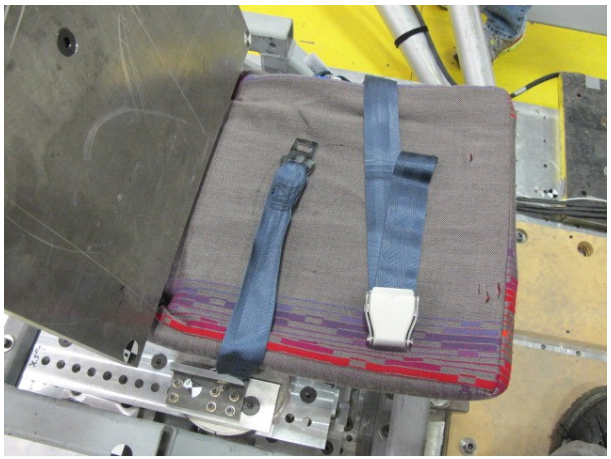
Post-test Photos

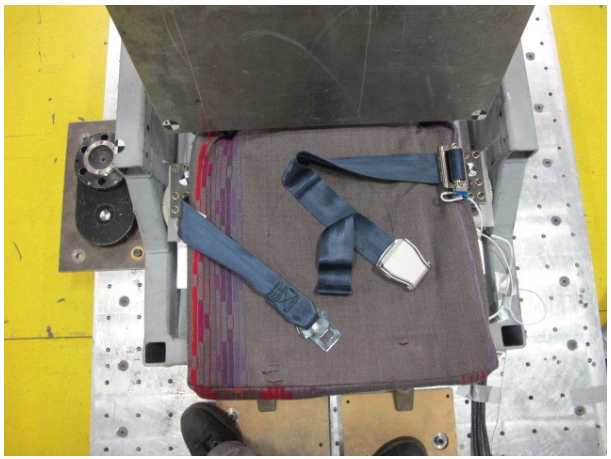












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Doc. No.: CDL-FA14C-01-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-01

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 12:40

Comments:

WICHITA STATE UNIVERSITY
NATIONAL INSTITUTE FOR AVIATION RESEARCH
Crash Dynamics Lab

Report No. CDL-FA14C-02-01

Requested by:

FAA

Final Test Report FA14C-02

05/05/2014

Revision	Change	Date	Revised By
New		05/05/2014	Rob Huculak

Prepared and Reviewed by:

Rob Huculak
Laboratory Manager

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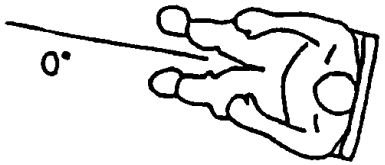
This test report is in accordance with ISO/IEC 17025:2005 requirements and all equipment standards used are traceable to the National Institute of Standards and Technology.
The information in this report relates only to the article under test and cannot be reproduced, except in full, without the written approval of the National Institute for Aviation Research.

Test Summary

The dynamic test (FA14C-02) was performed for FAA in accordance with 14 CFR 25.562 Test 2 on 05/05/2014.

Pulse Parameters	Required	Result	Pass/Fail
Minimum Peak Acceleration (g)	16	16.37	PASS
Minimum Velocity Change (ft/sec)	44	45.49	PASS
Maximum Rise Time (msec)	90	86.3	PASS
Minimum Velocity Change During Rise Time (ft/sec)	22	23.56	PASS
2g Offset	--	--	PASS

Test Orientation



ATD: H2 699 **Position: Config 4 - Repaired Belt (#2)**

0 deg

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Doc. No.: CDL-FA14C-02-01

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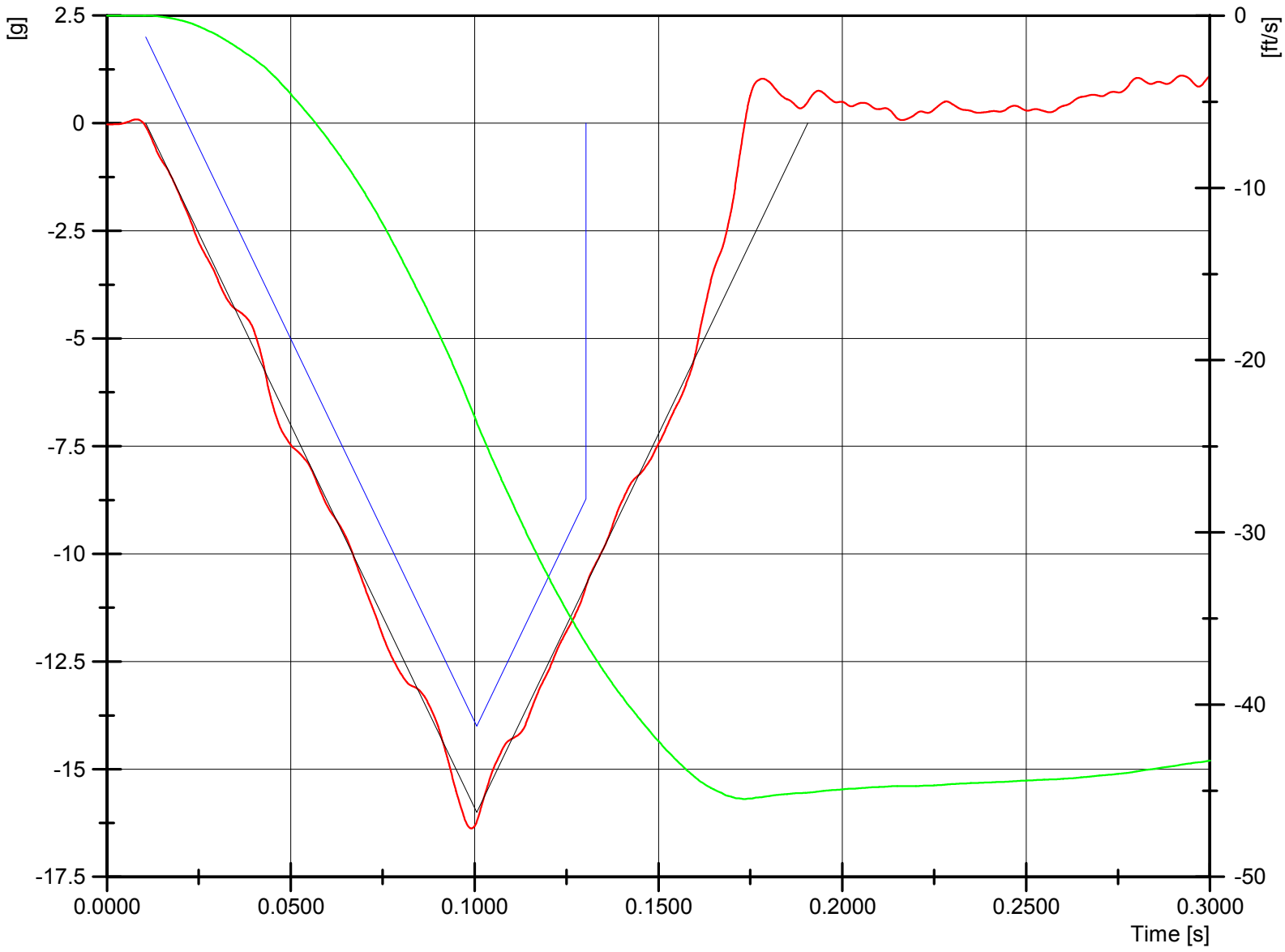
Test: FA14C-02

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Temperature	Relative Humidity
74.1°F	30.6%



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Pulse Name:
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Pretrigger Samples: 40960
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Test Date/Time: 05/05/2014 14:41

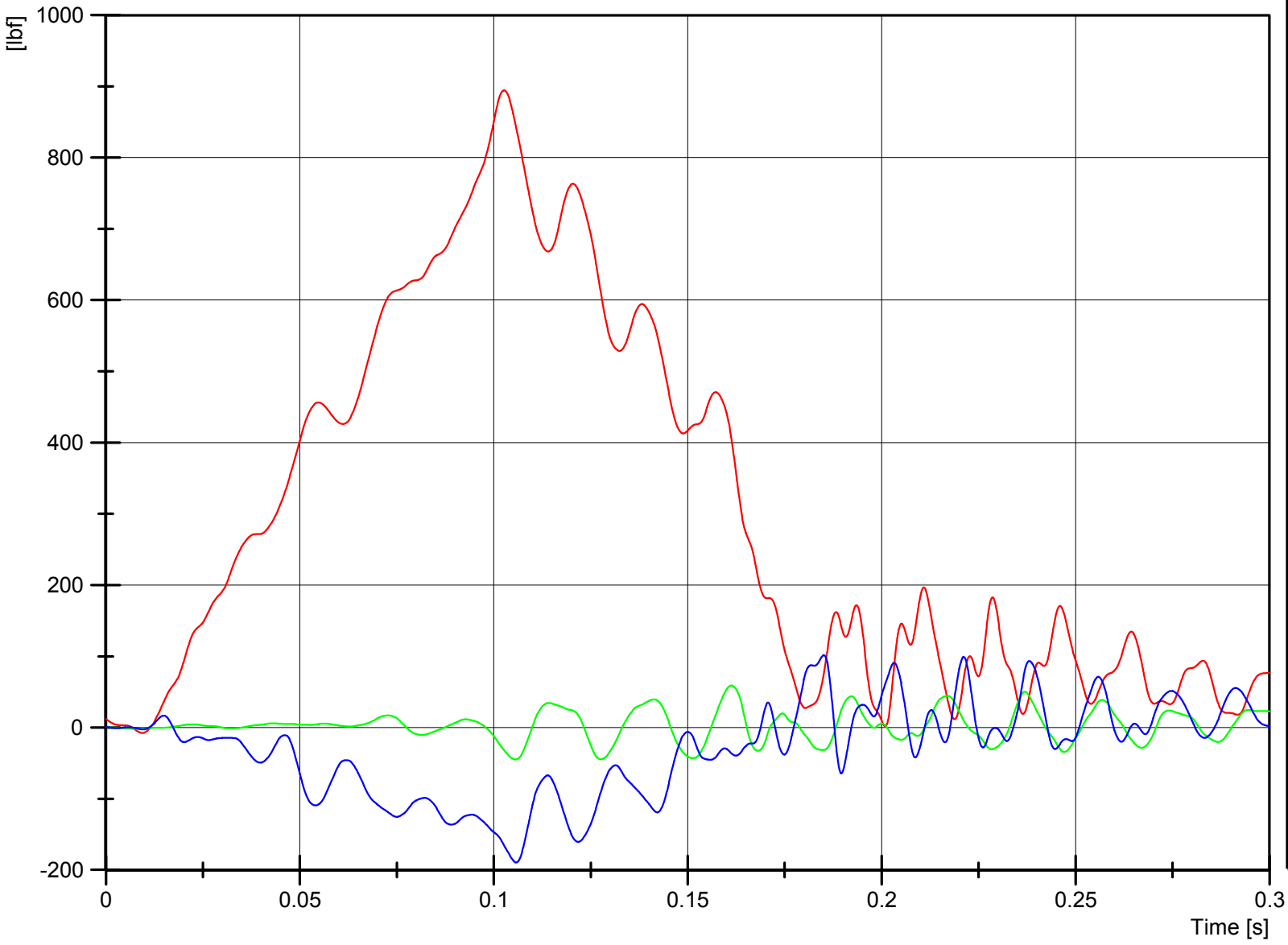
Comments:

Sled Acceleration | Sled Velocity | Ideal Pulse | Upper Limit

Maximum: 1.11 g Time: 0.3 sec.
Minimum: -16.37 g Time: 0.0991 sec.
CFC: 60
Sensor Type: ENDEVCO 7290A-100
S/N: 29924
Sensitivity: 0.01912 V/EU
Cal. Due: 01/07/2015
Full Scale: 100 g
DAS Channel: 50
Ref. No.: 1
Polarity: R

Minimum: -45.49 ft/s Time: 0.1733 sec.

Pulse Requirement		Actual
Minimum Required Peak Acceleration:	16 g	16.37 g
Minimum Overall Velocity Change:	44 ft/s	45.49 ft/s
Maximum Rise Time:	90 msec	86.3 msec
Minimum Velocity Change Before Greq:	22 ft/s	23.56 ft/s



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Version: New

Report Date: 05/05/2014

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Test: FA14C-02

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Comments:

Rigid Seat Seat Back Fx

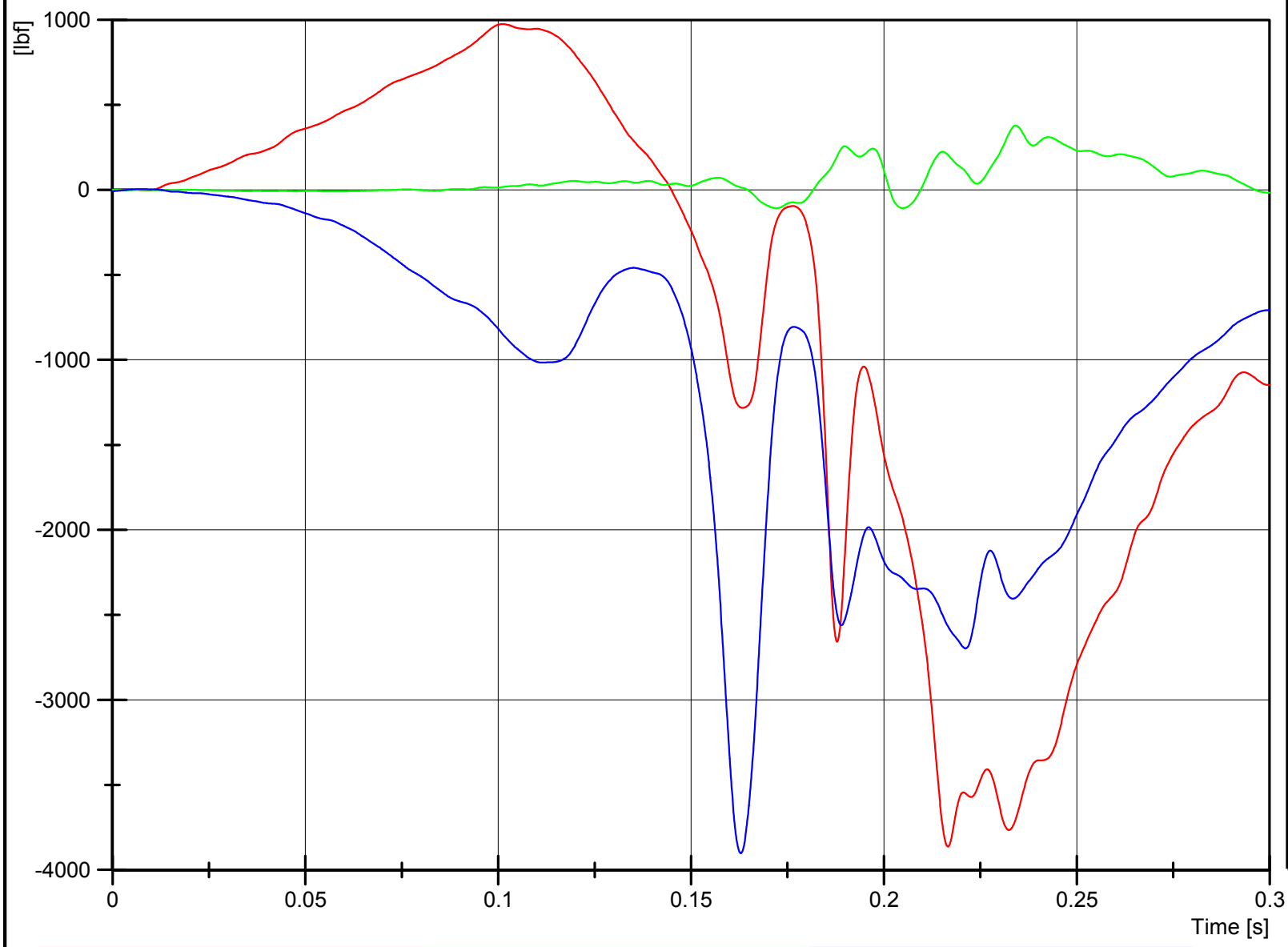
Maximum: 894.42 lbf Time: 0.1029 sec.
Minimum: -7.6551 lbf Time: 0.0096 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FZ
Sensitivity: 1.187E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 12
Ref. No.: 15
Polarity: N

Rigid Seat Seat Back Fy

Maximum: 58.9732 lbf Time: 0.1615 sec.
Minimum: -44.91 lbf Time: 0.1058 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FY
Sensitivity: 2.769E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 11
Ref. No.: 14
Polarity: N

Rigid Seat Seat Back Fz

Maximum: 101.639 lbf Time: 0.1853 sec.
Minimum: -189.65 lbf Time: 0.106 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FX
Sensitivity: 2.765E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 10
Ref. No.: 13
Polarity: R



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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Comments:

Rigid Seat Seat Pan Fx

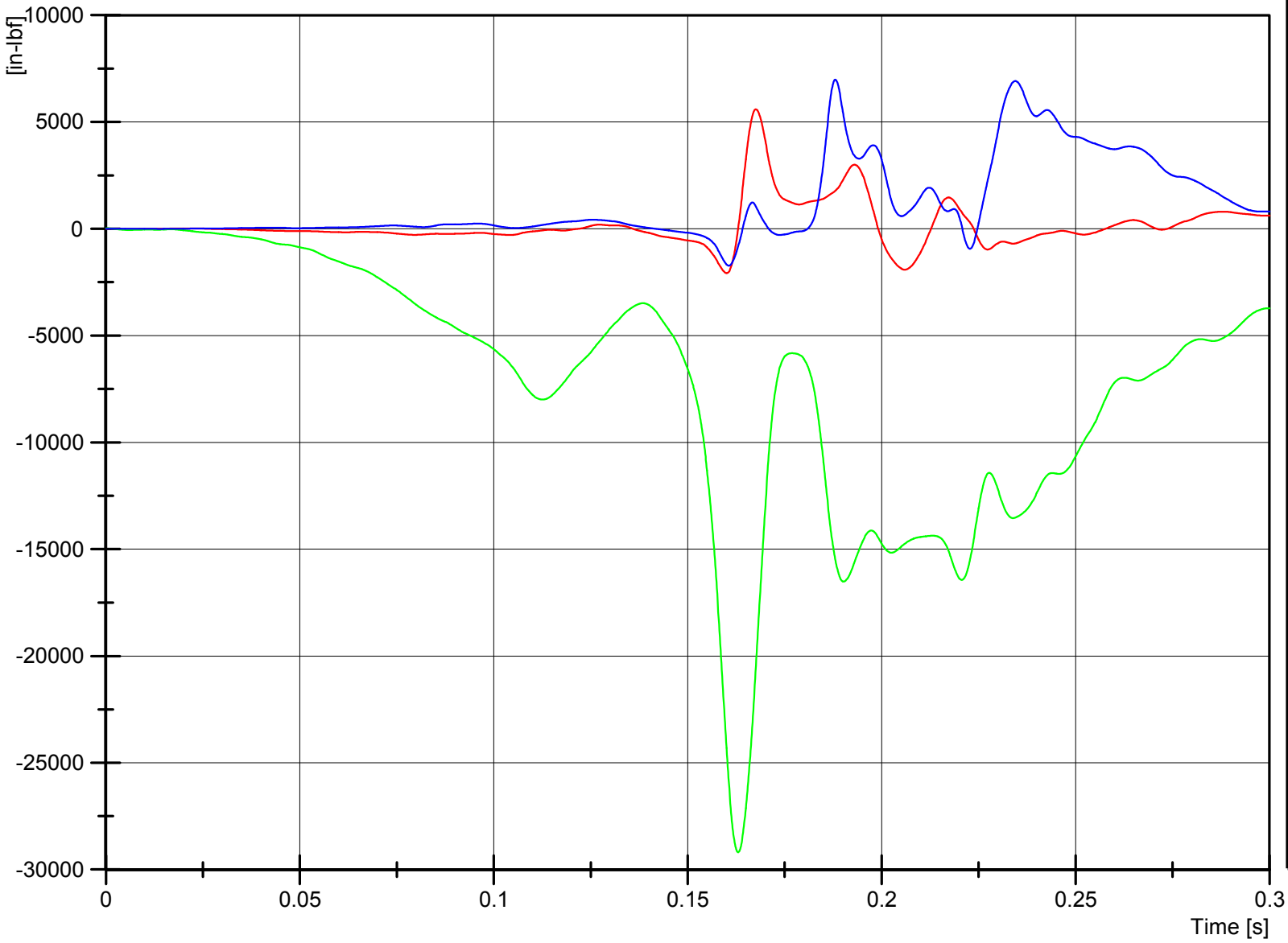
Maximum: 976.04 lbf Time: 0.1014 sec.
Minimum: -3.86E+03 lbf Time: 0.2168 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FX
Sensitivity: 2.848E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 13
Ref. No.: 10
Polarity: N

Rigid Seat Seat Pan Fy

Maximum: 377.57 lbf Time: 0.2344 sec.
Minimum: -107.60 lbf Time: 0.1723 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FY
Sensitivity: 2.846E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 14
Ref. No.: 11
Polarity: N

Rigid Seat Seat Pan Fz

Maximum: 5.436 lbf Time: 0.0076 sec.
Minimum: -3.90E+03 lbf Time: 0.1631 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FZ
Sensitivity: 1.205E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 15
Ref. No.: 12
Polarity: N



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Crash Dynamics Lab

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Fax: (316) 978-3175
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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Comments:

Rigid Seat Seat Pan Mx

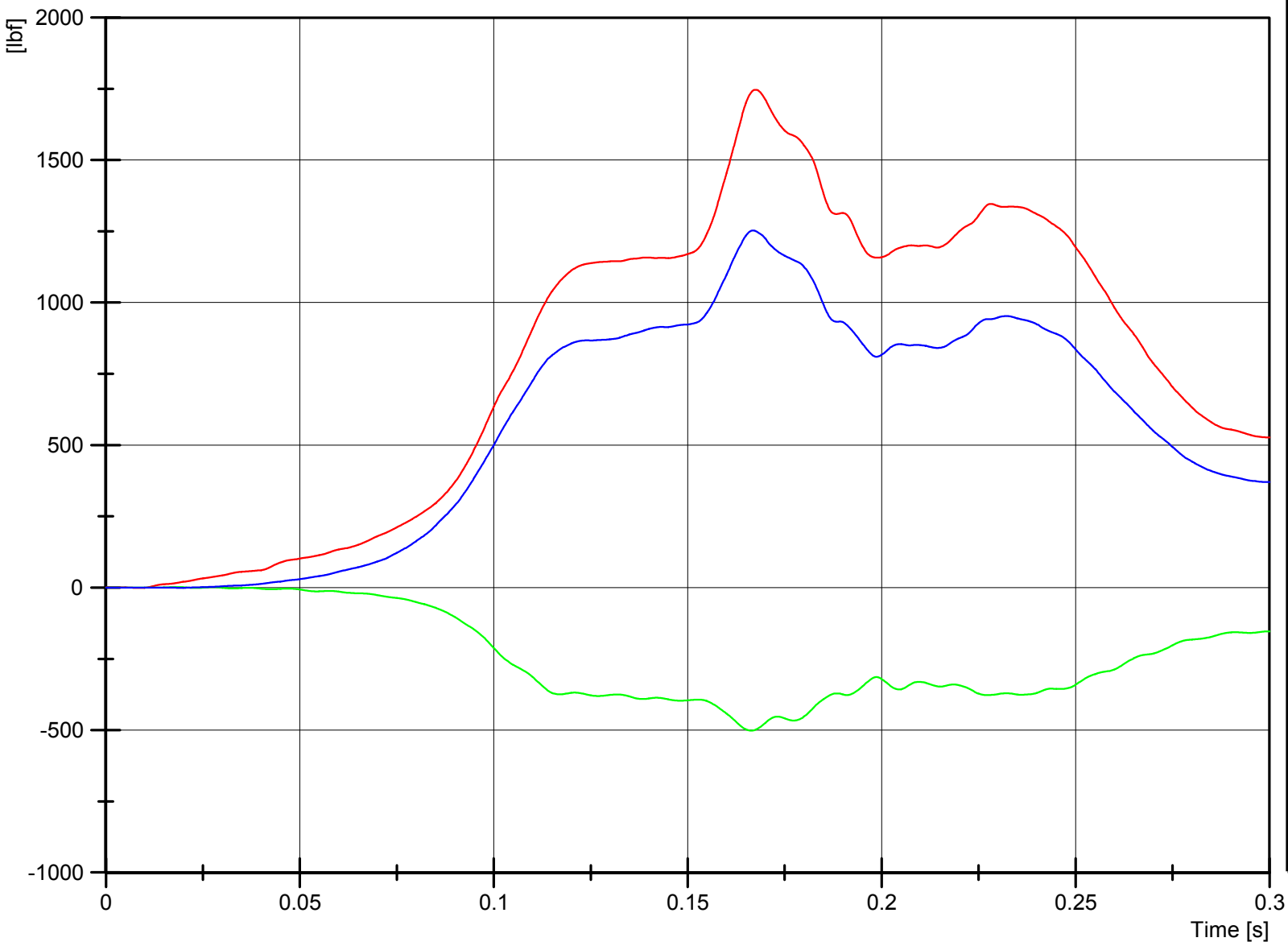
Maximum: 5597.40 in-lbf Time: 0.1678 sec.
Minimum: -2.08E+03 in-lbf Time: 0.1602 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MX
Sensitivity: 7.104E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 25000 in-lbf
DAS Channel: 16
Ref. No.: 7
Polarity: N

Rigid Seat Seat Pan My

Maximum: 29.0357 in-lbf Time: 0 sec.
Minimum: -2.92E+04 in-lbf Time: 0.1632 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MY
Sensitivity: 7.112E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 25000 in-lbf
DAS Channel: 17
Ref. No.: 8
Polarity: N

Rigid Seat Seat Pan Mz

Maximum: 6983.14 in-lbf Time: 0.1882 sec.
Minimum: -1.72E+03 in-lbf Time: 0.1608 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MZ
Sensitivity: 9.38E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 20000 in-lbf
DAS Channel: 18
Ref. No.: 9
Polarity: R



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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: H2 718

Position: Config 4 - Repaired Belt (#2)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Rigid Seat Right Lap Fx

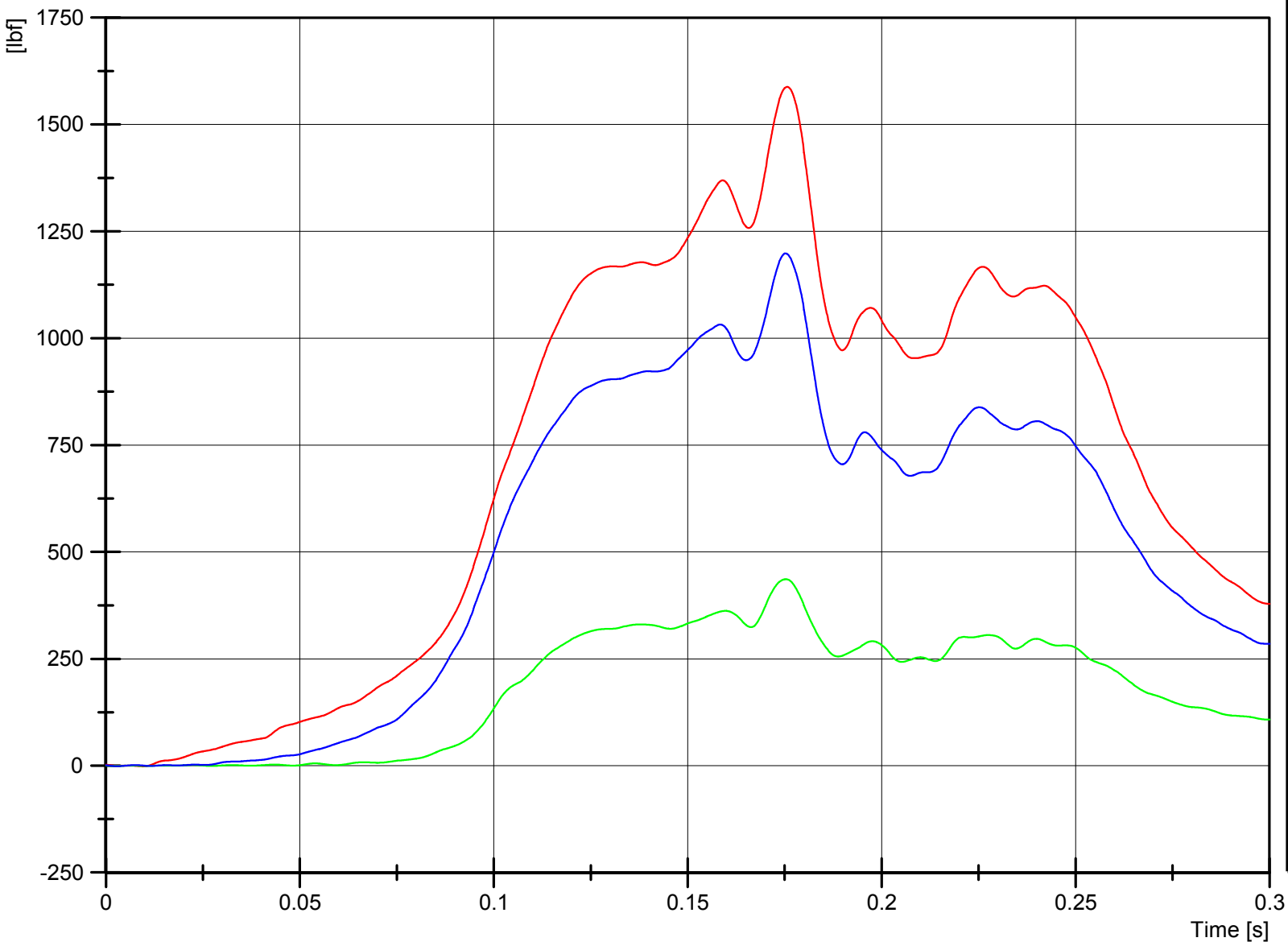
Maximum: 1747.19 lbf Time: 0.1677 sec.
Minimum: -1.4684 lbf Time: 0.009 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FX
Sensitivity: 2.6022E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 19
Ref. No.: 74
Polarity: N

Rigid Seat Right Lap Fy

Maximum: 1.8955 lbf Time: 0.0185 sec.
Minimum: -501.99 lbf Time: 0.1666 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FY
Sensitivity: 2.5935E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 20
Ref. No.: 75
Polarity: N

Rigid Seat Right Lap Fz

Maximum: 1253.10 lbf Time: 0.167 sec.
Minimum: -0.86 lbf Time: 0.0197 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FZ
Sensitivity: 1.088E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 21
Ref. No.: 76
Polarity: N



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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: H2 718

Position: Config 4 - Repaired Belt (#2)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Rigid Seat Left Lap Fx

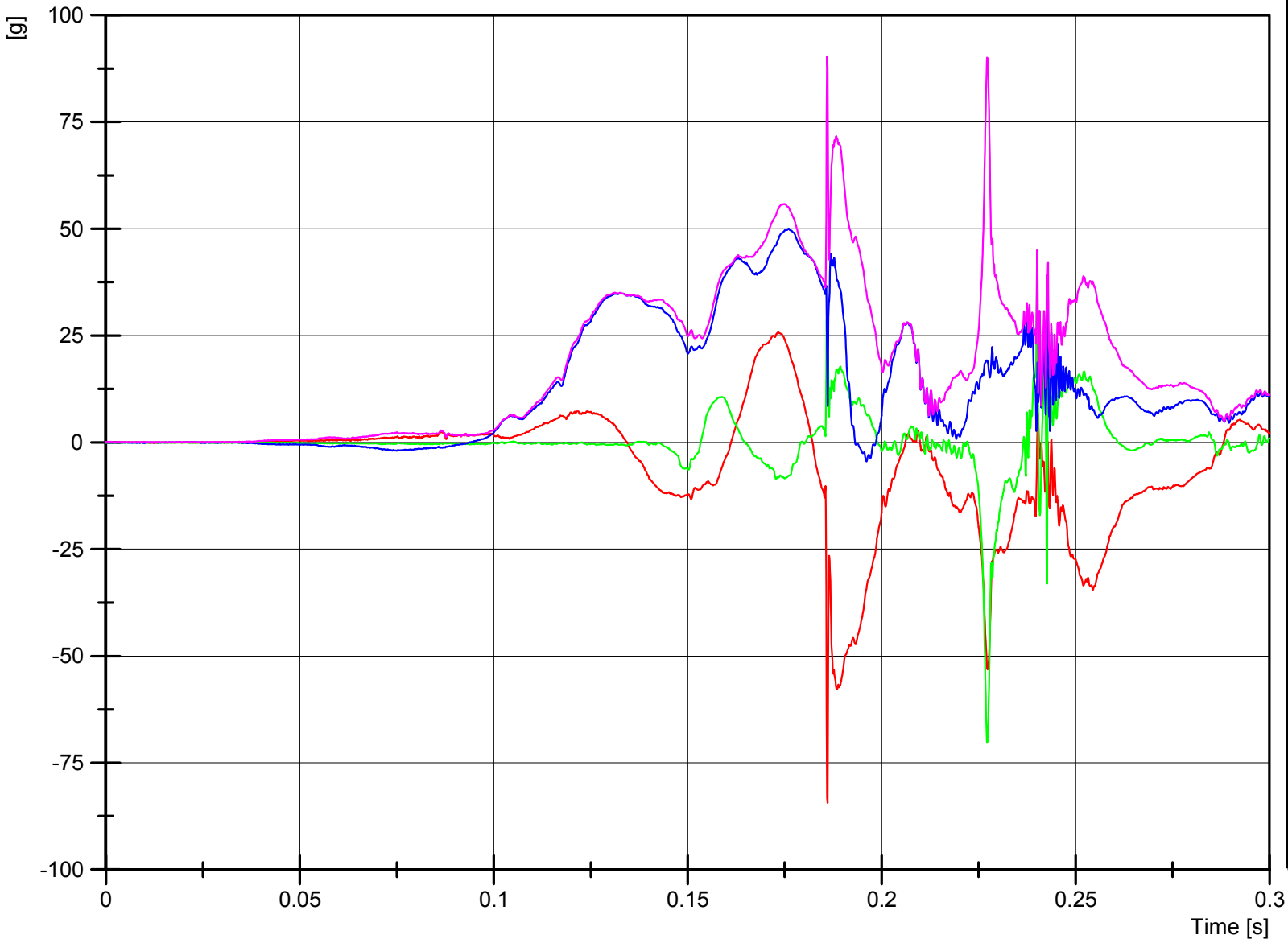
Maximum: 1588.08 lbf Time: 0.1758 sec.
Minimum: -1.4332 lbf Time: 0.0098 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FX
Sensitivity: 2.608E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 22
Ref. No.: 77
Polarity: N

Rigid Seat Left Lap Fy

Maximum: 436.38 lbf Time: 0.1755 sec.
Minimum: -0.7275 lbf Time: 0.0275 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FY
Sensitivity: 2.606E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 23
Ref. No.: 78
Polarity: N

Rigid Seat Left Lap Fz

Maximum: 1198.56 lbf Time: 0.1754 sec.
Minimum: -1.1726 lbf Time: 0.0031 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FZ
Sensitivity: 1.087E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 24
Ref. No.: 79
Polarity: N



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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: H2 699

Position: Config 4 - Repaired Belt (#2)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Head Ax H2 699

Maximum: 25.8333 g Time: 0.1735 sec.
Minimum: -84.44 g Time: 0.1862 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P45436
Sensitivity: 1.823E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 25
Ref. No.: 22
Polarity: R

Head Ay H2 699

Maximum: 42.7089 g Time: 0.2403 sec.
Minimum: -70.33 g Time: 0.2274 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P47924
Sensitivity: 1.863E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 26
Ref. No.: 23
Polarity: R

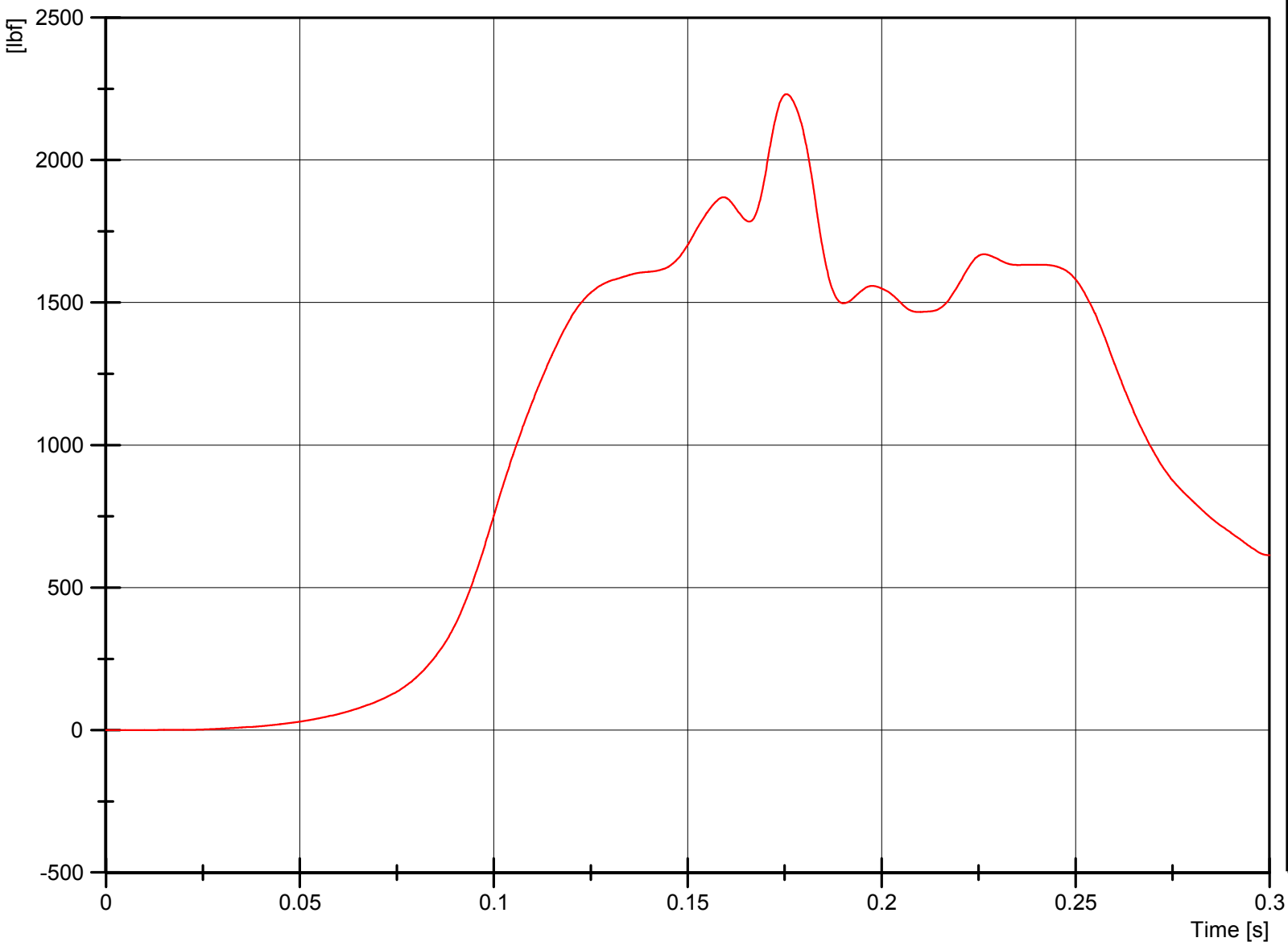
Head Az H2 699

Maximum: 50.075 g Time: 0.1762 sec.
Minimum: -4.4903 g Time: 0.1963 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P48250
Sensitivity: 1.827E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 27
Ref. No.: 24
Polarity: R

Head Resultant H2 699

Maximum: 90.35 g Time: 0.1859 sec.

HIC: 911
T1: 119.3 msec.
T2: 261.2 msec.



Lap Belt Force H2 699

Maximum: 2231.27 lbf Time: 0.1757 sec.
Minimum: -0.2345 lbf Time: 0.0045 sec.
CFC: 60
Sensor Type: Denton 3255
S/N: SBLC259
Sensitivity: 6.0647E-07 V/EU
Cal. Due: 10/17/2014
Full Scale: 3000 lbf
DAS Channel: 31
Ref. No.: 17
Polarity: N

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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: H2 699

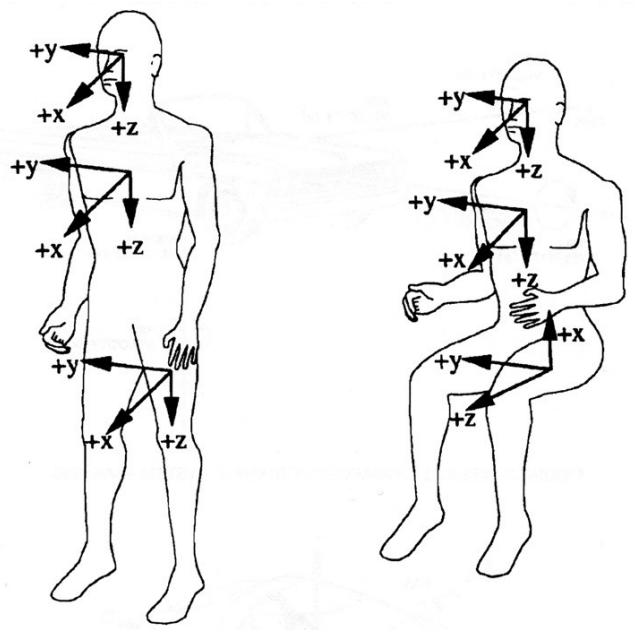
Position: Config 4 - Repaired Belt (#2)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

J211/1 Sign Conventions



Upper Neck Load Cell:
+FX Head rearward, chest forward
+FY Head leftward, chest rightward
+FZ Head upward, chest downward
+MX Left ear toward left shoulder
+MY Chin toward sternum
+MZ Chin toward left shoulder

Lumbar Load Cell:
+FX Chest rearward, pelvis forward
+FY Chest leftward, pelvis rightward
+FZ Chest upward, pelvis downward
+MX Left shoulder toward left hip
+MY Sternum toward front of legs
+MZ Right shoulder forward, left shoulder rearward

Femur Load Cells:
+FZ Tension

Chest Displacement:
-DX Compression

Rib Dispacement:
-DY Compression

Belt Load Cells:
+FX Tension

Floor Load Cells:
+FX Test article forward
+FY Test article right
+FZ Test article up

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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

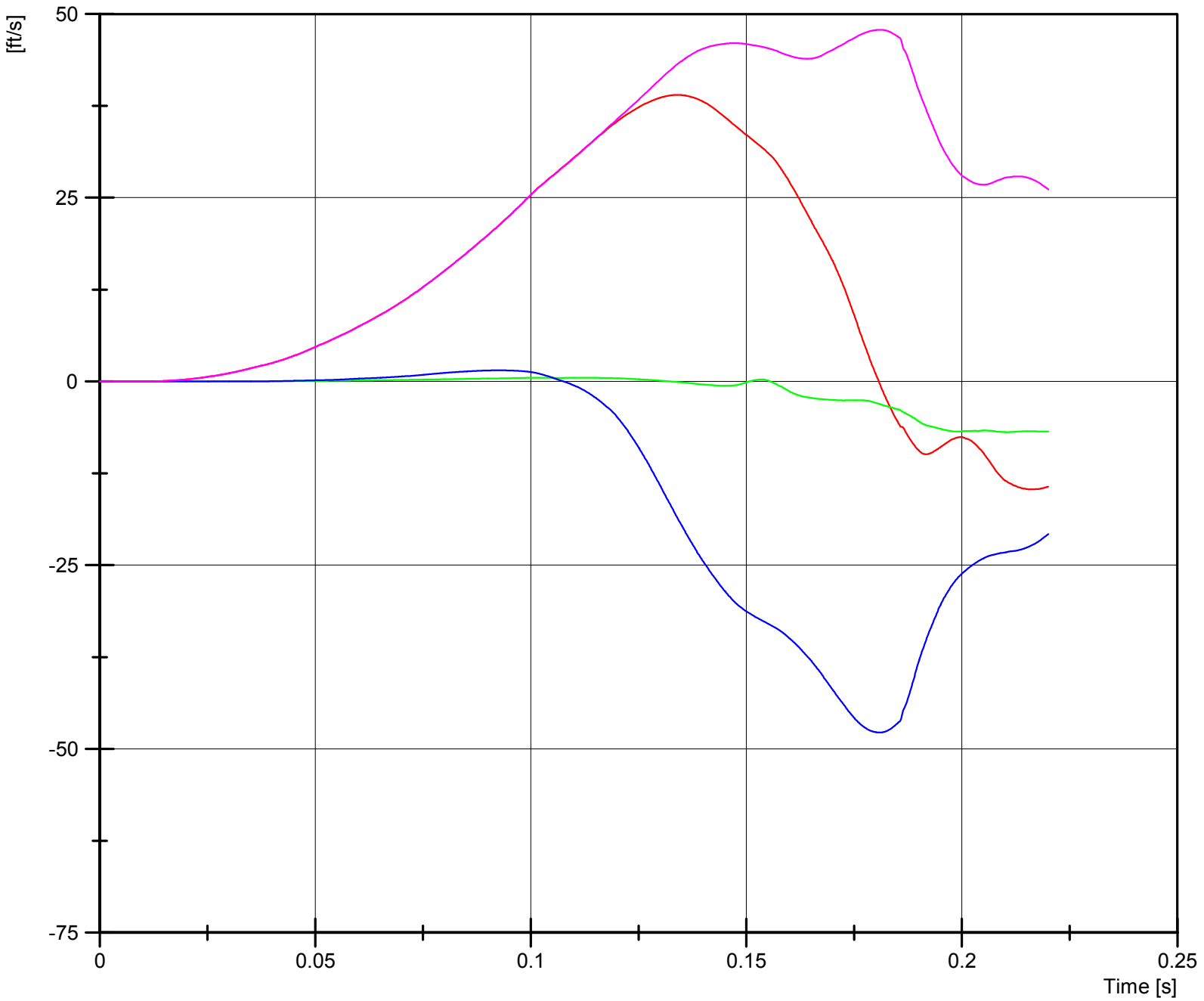
Test: FA14C-02

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Comments:



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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: H2 699

Position: Config 4 - Repaired Belt (#2)

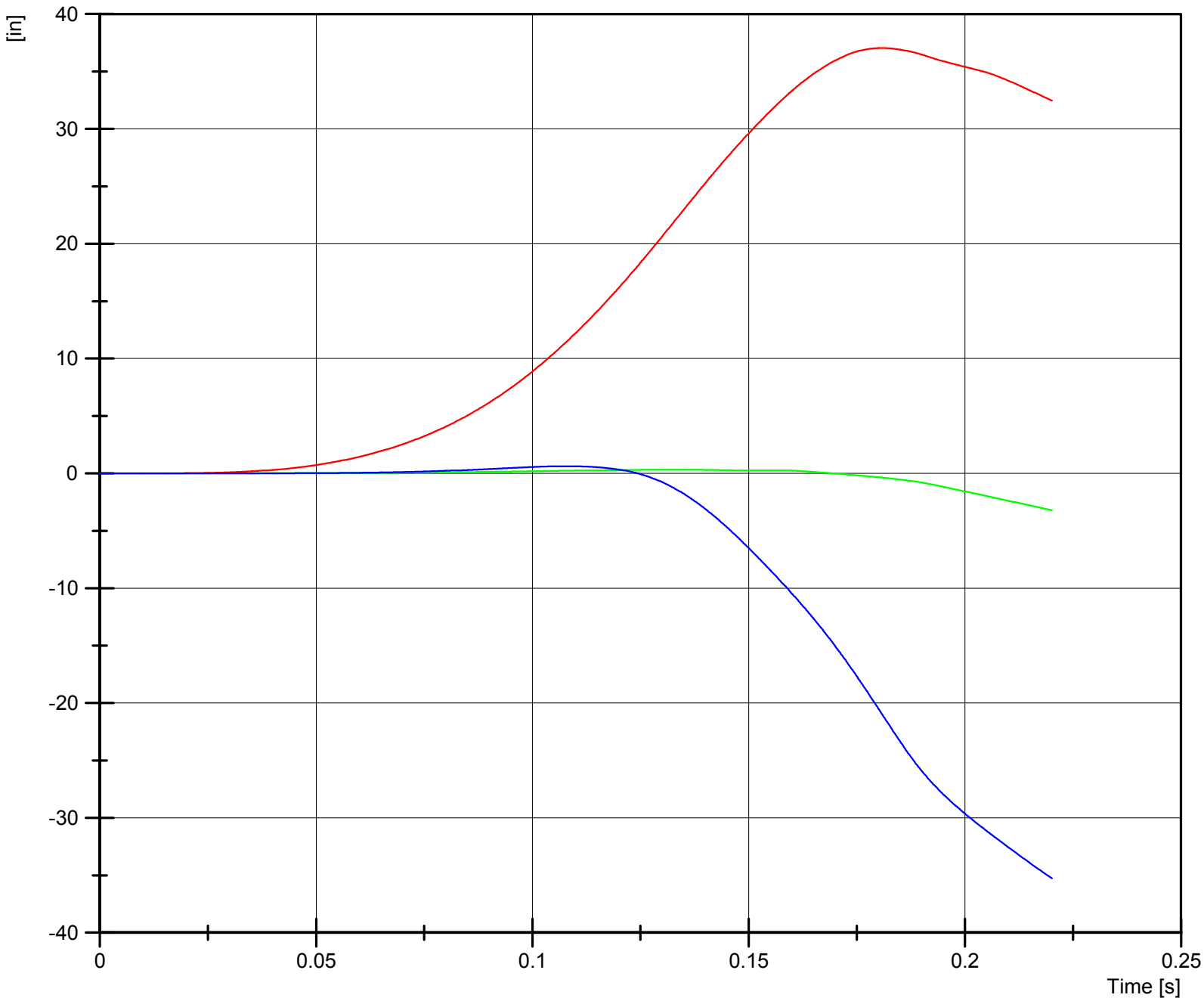
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Comments:

Global Head Vx H2 699		Global Head Vy H2 699		Global Head Vz H2 699		Global Head Velocity Resultant H2 699	
Maximum: 38.98 ft/s	Time: 0.1341 sec.	Maximum: 0.493 ft/s	Time: 0.1018 sec.	Maximum: 1.52 ft/s	Time: 0.0927 sec.	Maximum: 47.84 ft/s	Time: 0.1811 sec.
Minimum: -14.67 ft/s	Time: 0.2163 sec.	Minimum: -6.91 ft/s	Time: 0.2107 sec.	Minimum: -47.74 ft/s	Time: 0.1809 sec.	Minimum: 0 ft/s	Time: 0.0001 sec.



Global Head Dx H2 699 | Global Head Dy H2 699 | Global Head Dz H2 699

Maximum: 37.04 in	Time: 0.1808 sec.	Maximum: 0.33 in	Time: 0.1326 sec.	Maximum: 0.63 in	Time: 0.1077 sec.
Minimum: 0.00 in	Time: 0.0001 sec.	Minimum: -3.20 in	Time: 0.2201 sec.	Minimum: -35.25 in	Time: 0.2201 sec.

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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: H2 699

Position: Config 4 - Repaired Belt (#2)

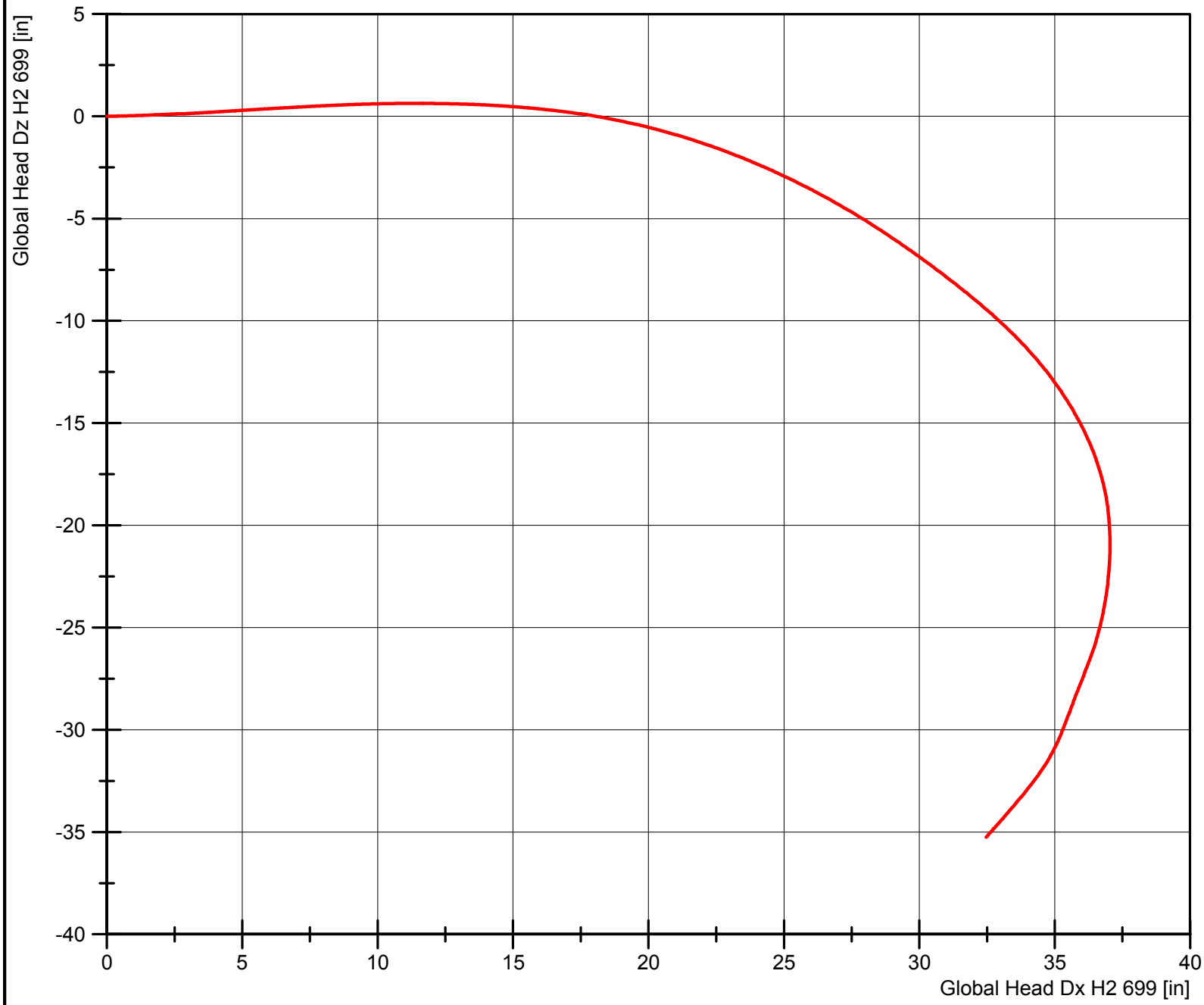
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Comments:

Displacement values are calculated from Head Accelerations and Angular Velocities.
This method cannot be used to substitute photometric analysis.



Global Head Displacement XZ

X Maximum: 37.04 in **Time: 0.1808 sec.**

Z Value at X Maximum: -20.94 in

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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: H2 699

Position: Config 4 - Repaired Belt (#2)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Comments:

Displacement values are calculated from Head Accelerations and Angular Velocities.
This method cannot be used to substitute photometric analysis.

Pre-test Photos



NA

NA

NA

NA



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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: N/A

Position: N/A

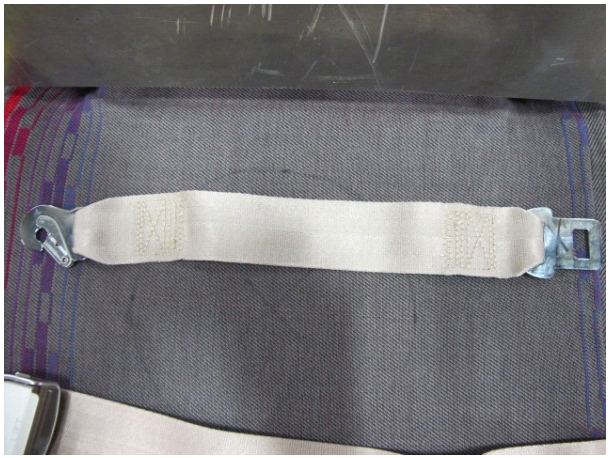
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14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
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Rev.: Impax-SD 6.02 Rev A12t
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Comments:

Pre-test Photos













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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: N/A

Position: N/A

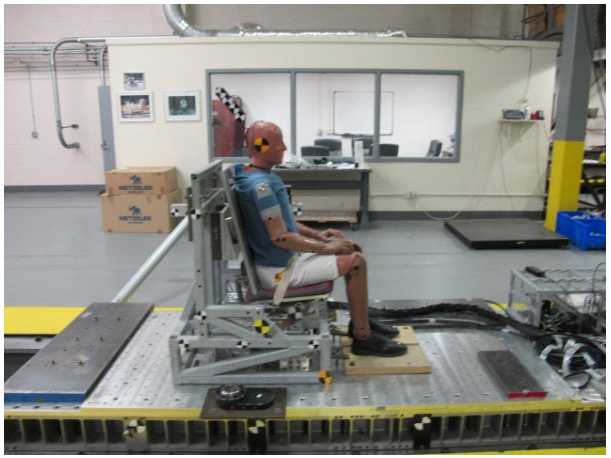
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14 CFR 25.562 Test 2

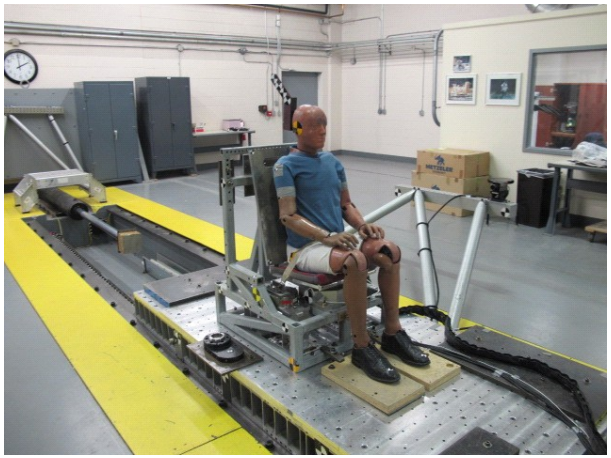
Pulse Name:
16g-04

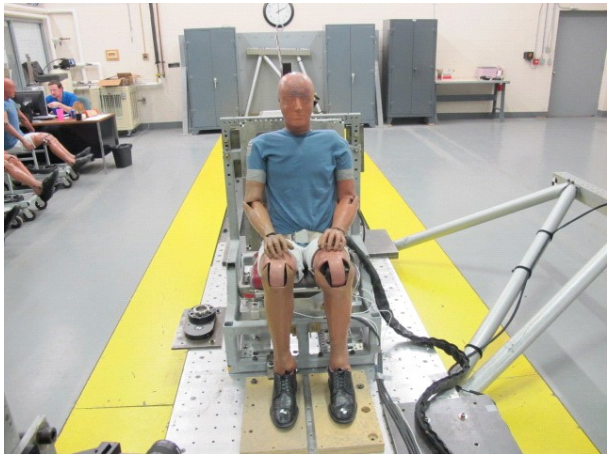
Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

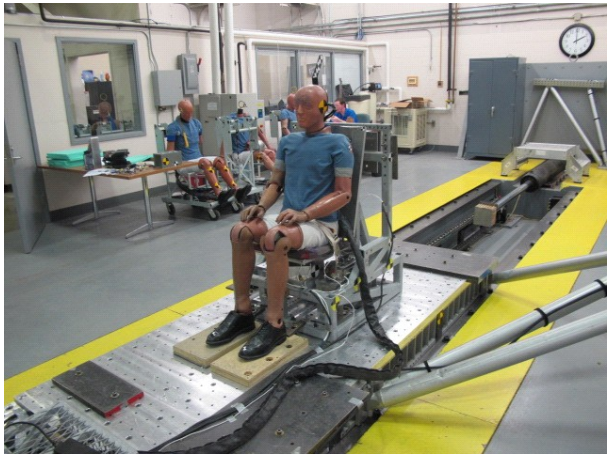
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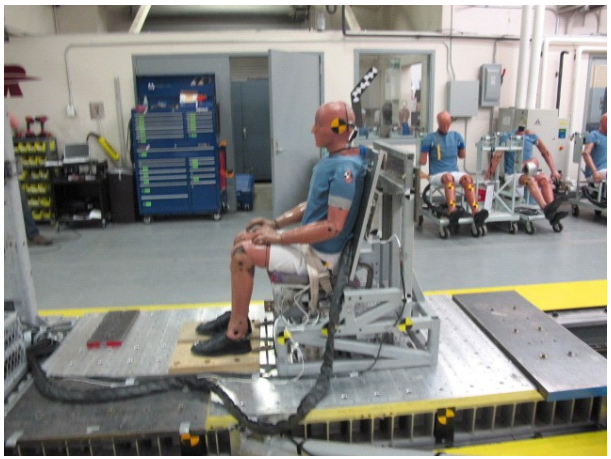
Pre-test Photos













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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: N/A

Position: N/A

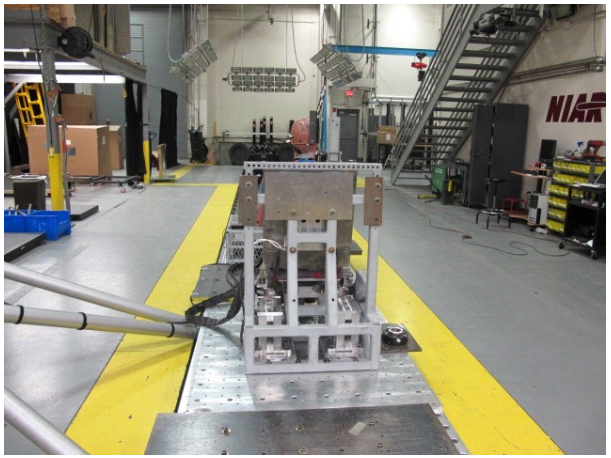
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

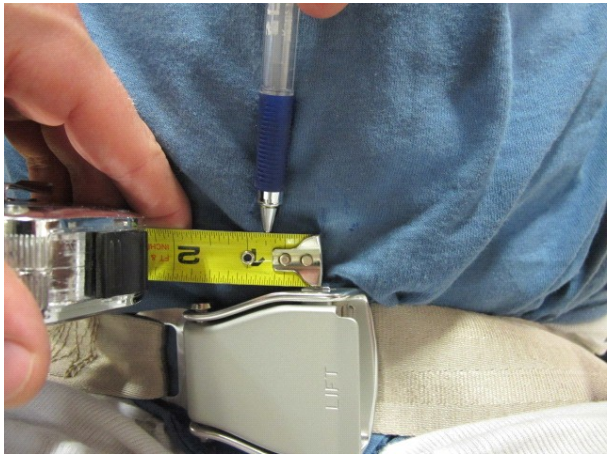
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Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

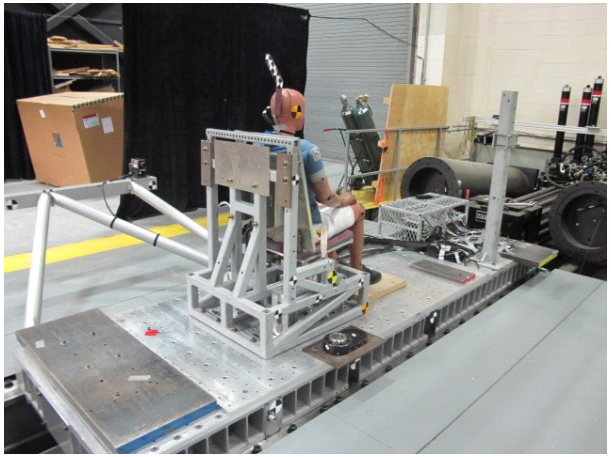
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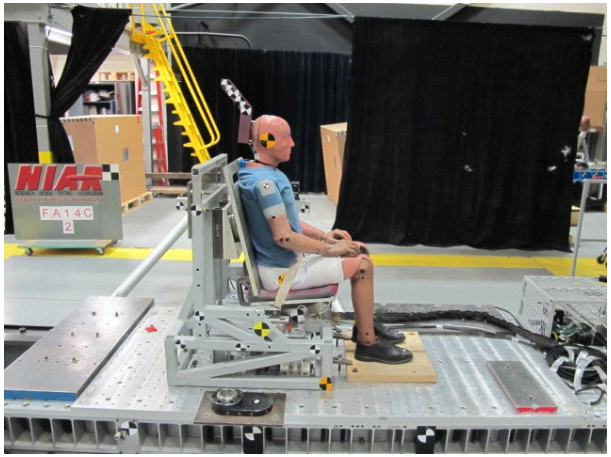
Pre-test Photos













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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: N/A

Position: N/A

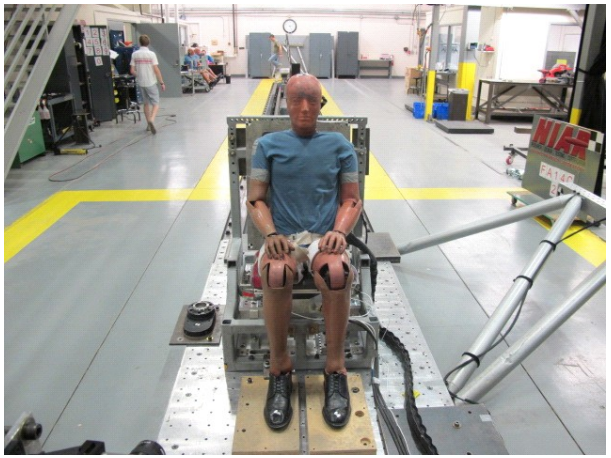
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14 CFR 25.562 Test 2

Pulse Name:
16g-04

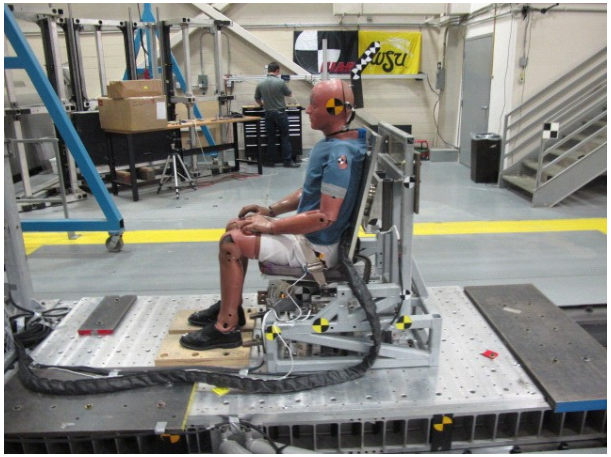
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Total Samples: 81920
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Test Date/Time: 05/05/2014 14:41

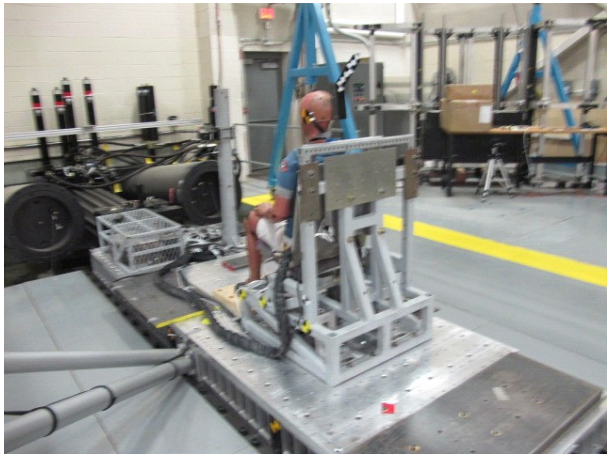
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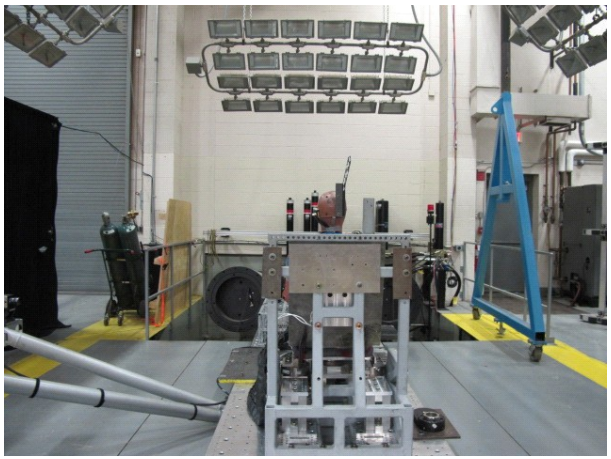
Pre-test Photos

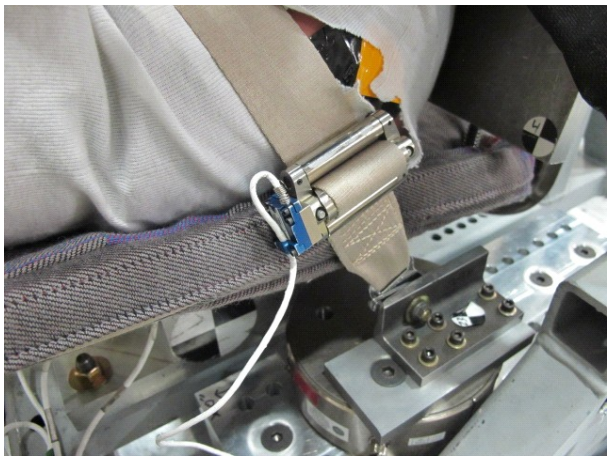












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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

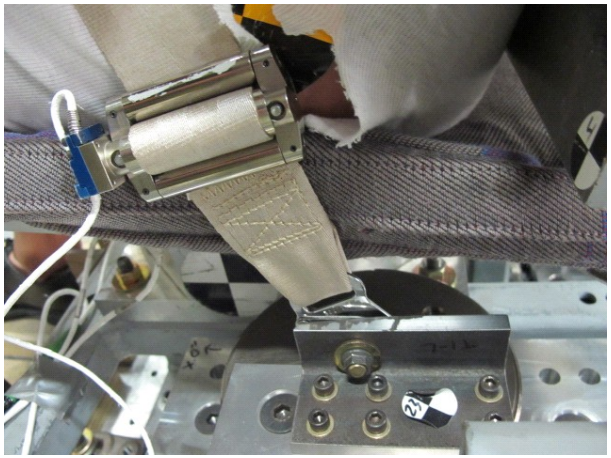
Pulse Name:
16g-04

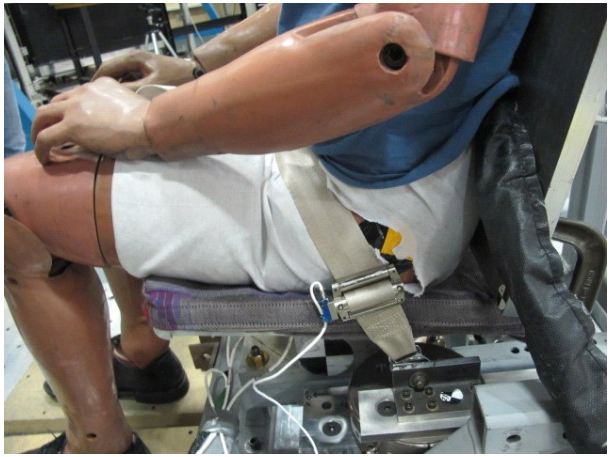
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Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

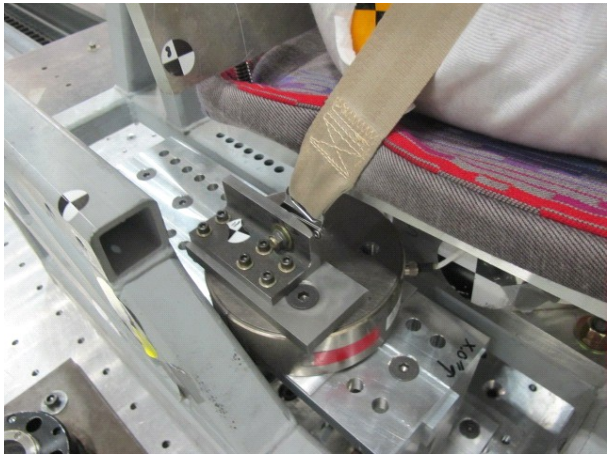
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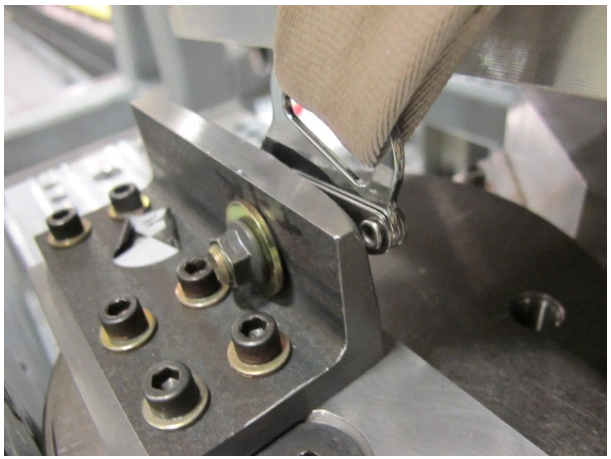
Pre-test Photos

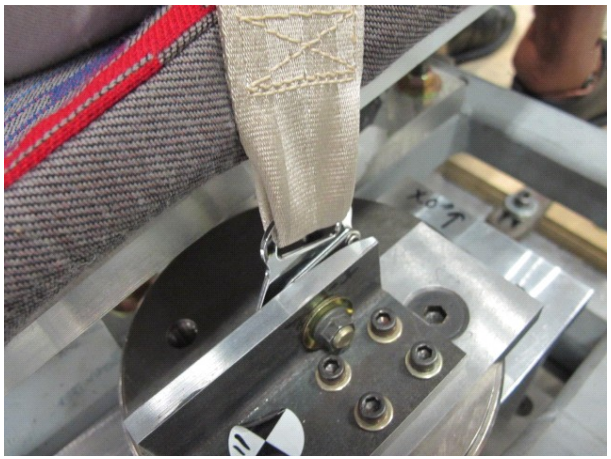












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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

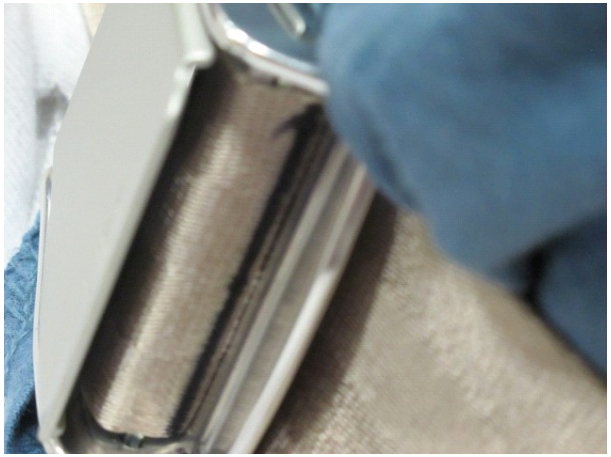
Comments:

Pre-test Photos









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Version: New

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Customer: FAA

Test: FA14C-02

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

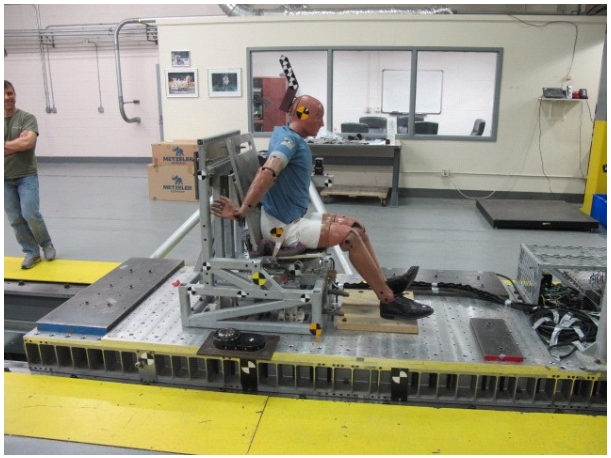
Pulse Name:
16g-04

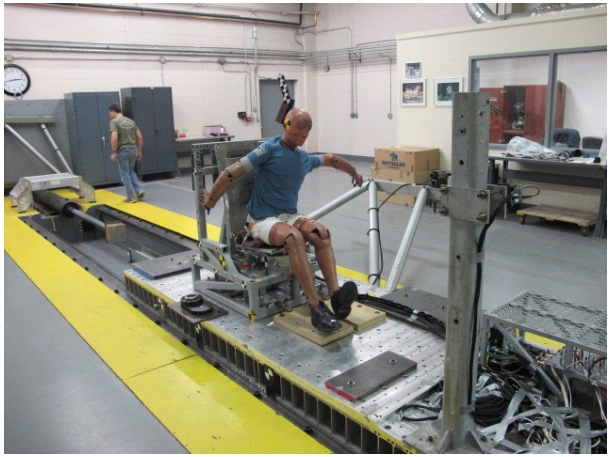
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Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

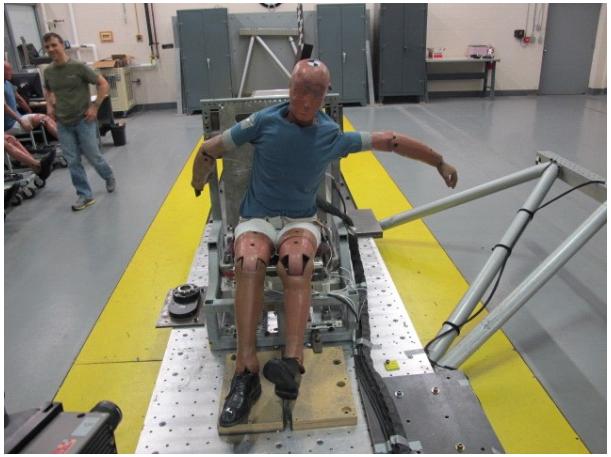
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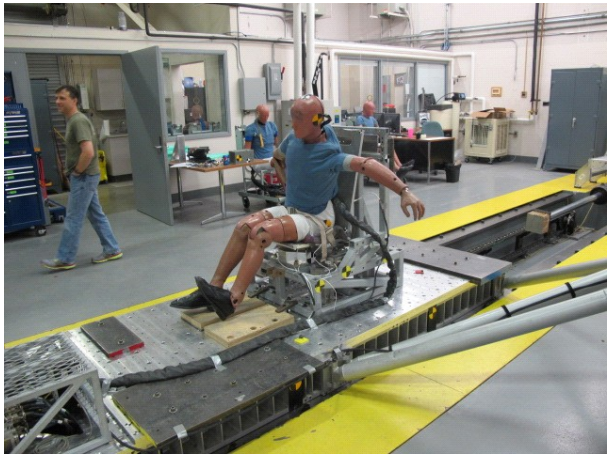
Post-test Photos

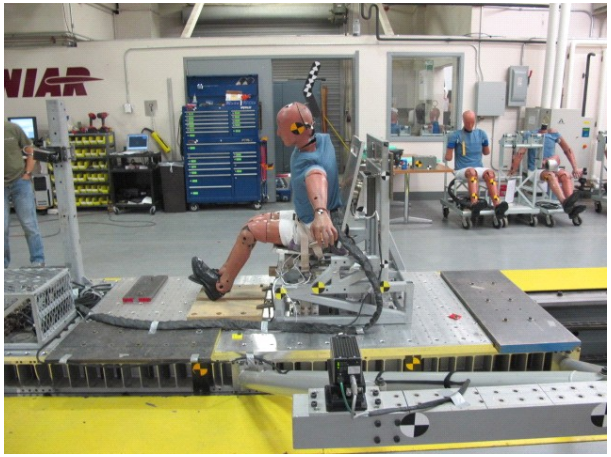












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Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

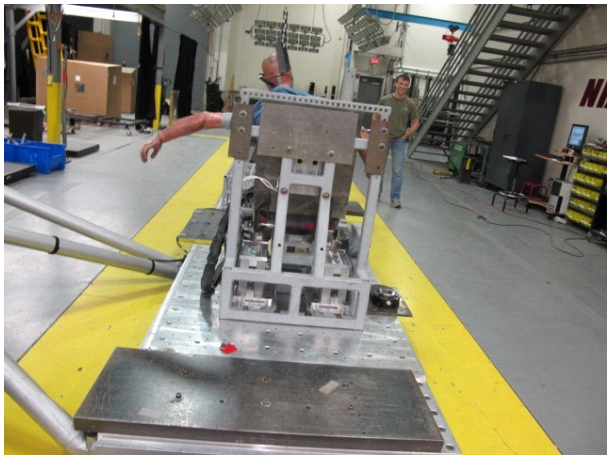
Pulse Name:
16g-04

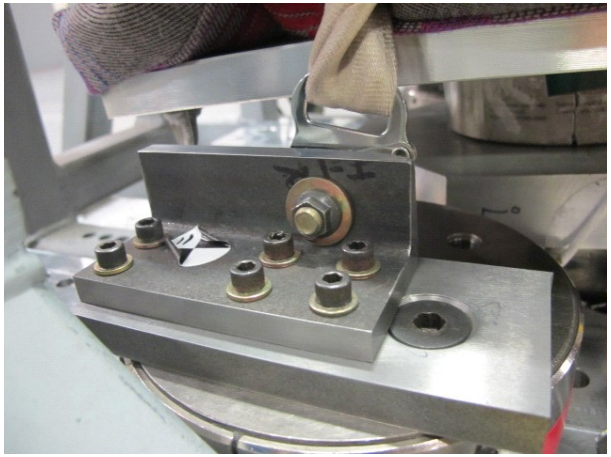
Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

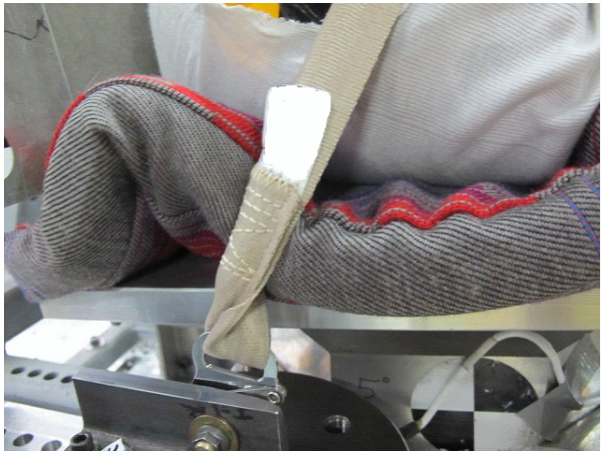
Comments:

Post-test Photos













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Customer: FAA

Test: FA14C-02

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

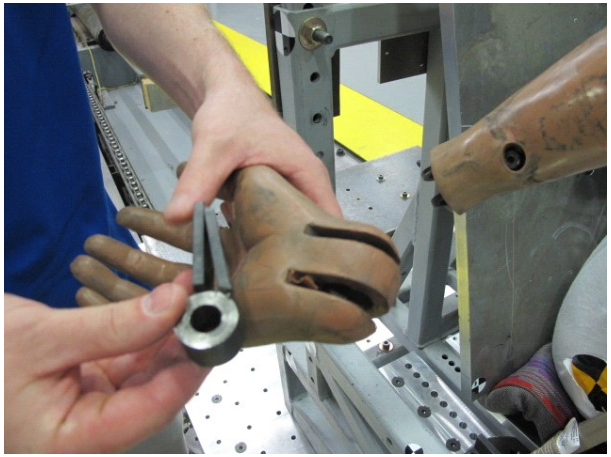
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Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Comments:

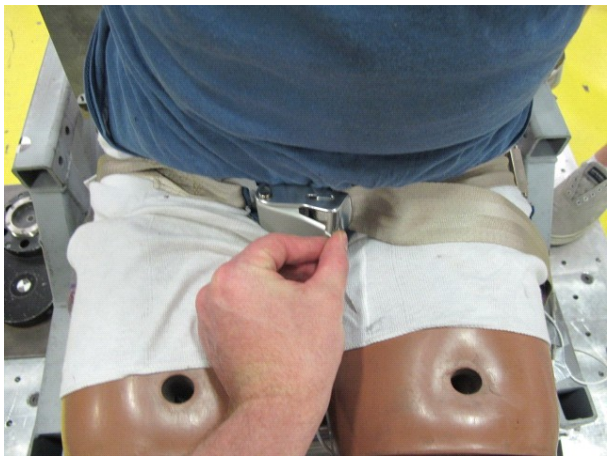
Post-test Photos

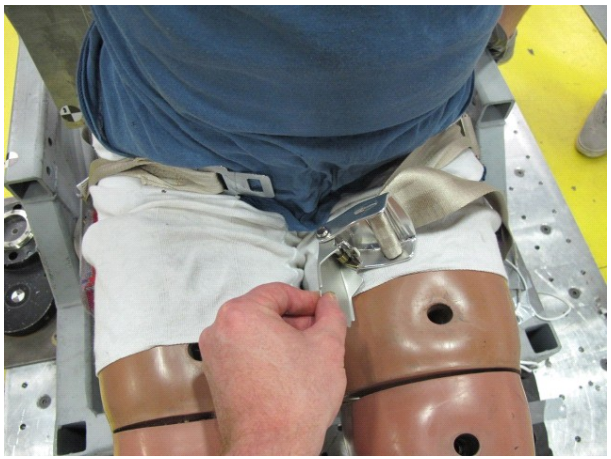












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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

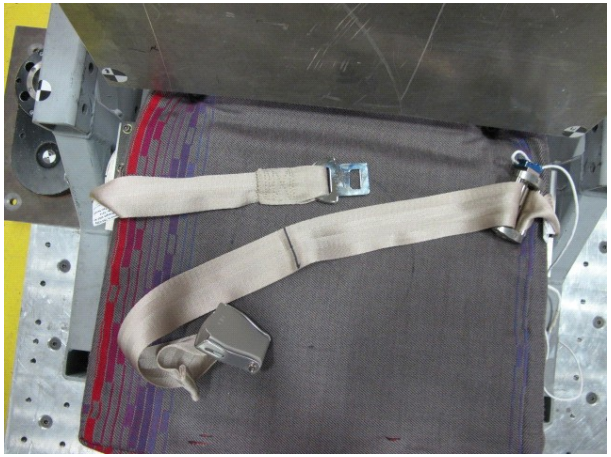
Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Comments:

Post-test Photos









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Doc. No.: CDL-FA14C-02-01

Version: New

Report Date: 05/05/2014

Customer: FAA

Test: FA14C-02

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 14:41

Comments:

WICHITA STATE UNIVERSITY
NATIONAL INSTITUTE FOR AVIATION RESEARCH
Crash Dynamics Lab

Report No. CDL-FA14C-03-01

Requested by:

FAA

Final Test Report FA14C-03

05/06/2014

Revision	Change	Date	Revised By
New		05/06/2014	Rob Huculak

Prepared and Reviewed by:

Rob Huculak
Laboratory Manager

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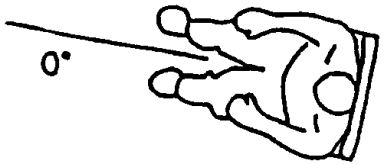
This test report is in accordance with ISO/IEC 17025:2005 requirements and all equipment standards used are traceable to the National Institute of Standards and Technology.
The information in this report relates only to the article under test and cannot be reproduced, except in full, without the written approval of the National Institute for Aviation Research.

Test Summary

The dynamic test (FA14C-03) was performed for FAA in accordance with 14 CFR 25.562 Test 2 on 05/06/2014.

Pulse Parameters	Required	Result	Pass/Fail
Minimum Peak Acceleration (g)	16	16.3	PASS
Minimum Velocity Change (ft/sec)	44	45.66	PASS
Maximum Rise Time (msec)	90	87.8	PASS
Minimum Velocity Change During Rise Time (ft/sec)	22	22.97	PASS
2g Offset	--	--	PASS

Test Orientation



ATD: H2 699 **Position: Config 4 - Repaired Belt (#1)**

0 deg

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Doc. No.: CDL-FA14C-03-01

Version: New

Report Date: 05/06/2014

Customer: FAA

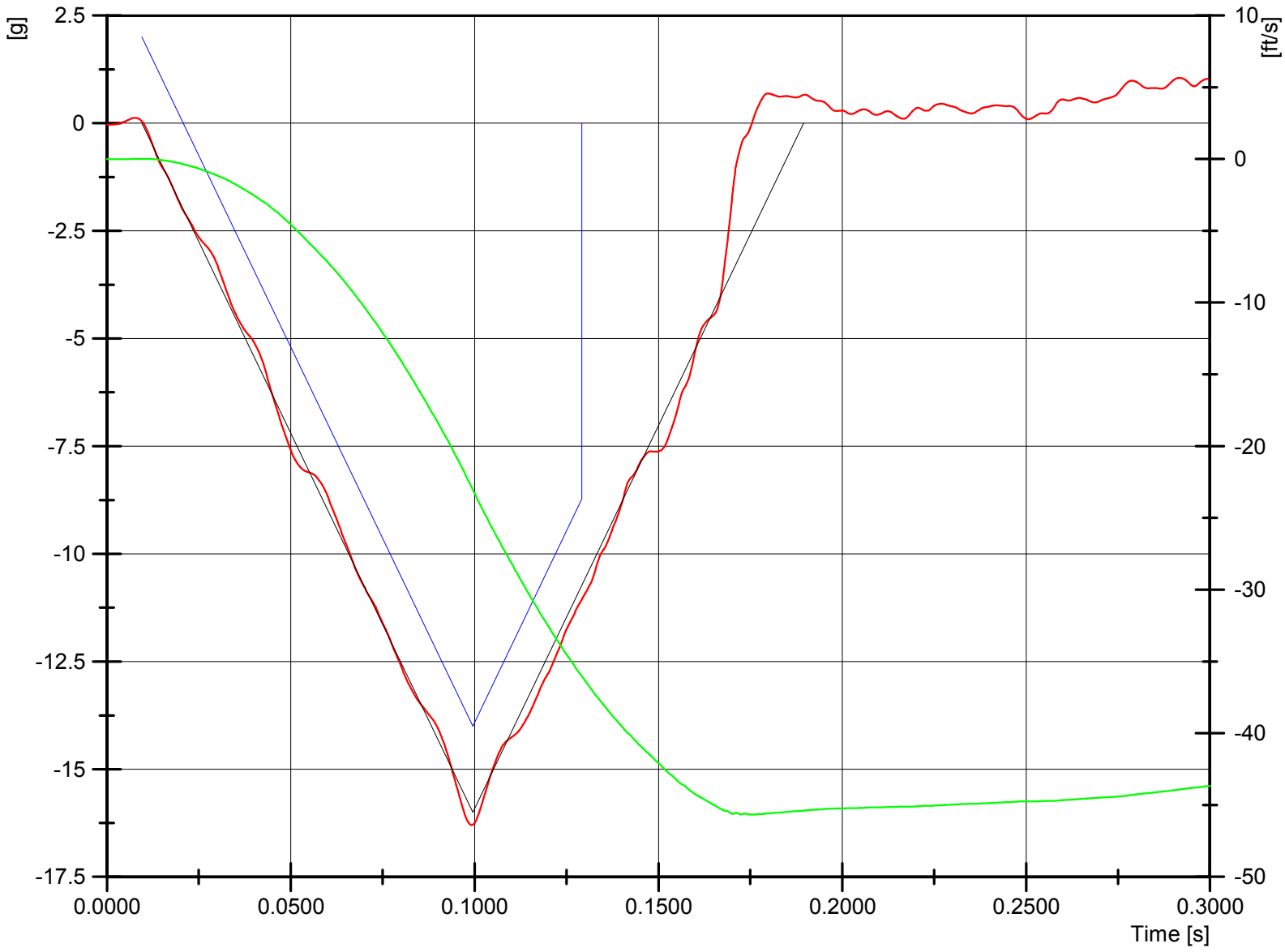
Test: FA14C-03

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Temperature	Relative Humidity
74.6°F	31.3%



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Doc. No.: CDL-FA14C-03-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-03

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

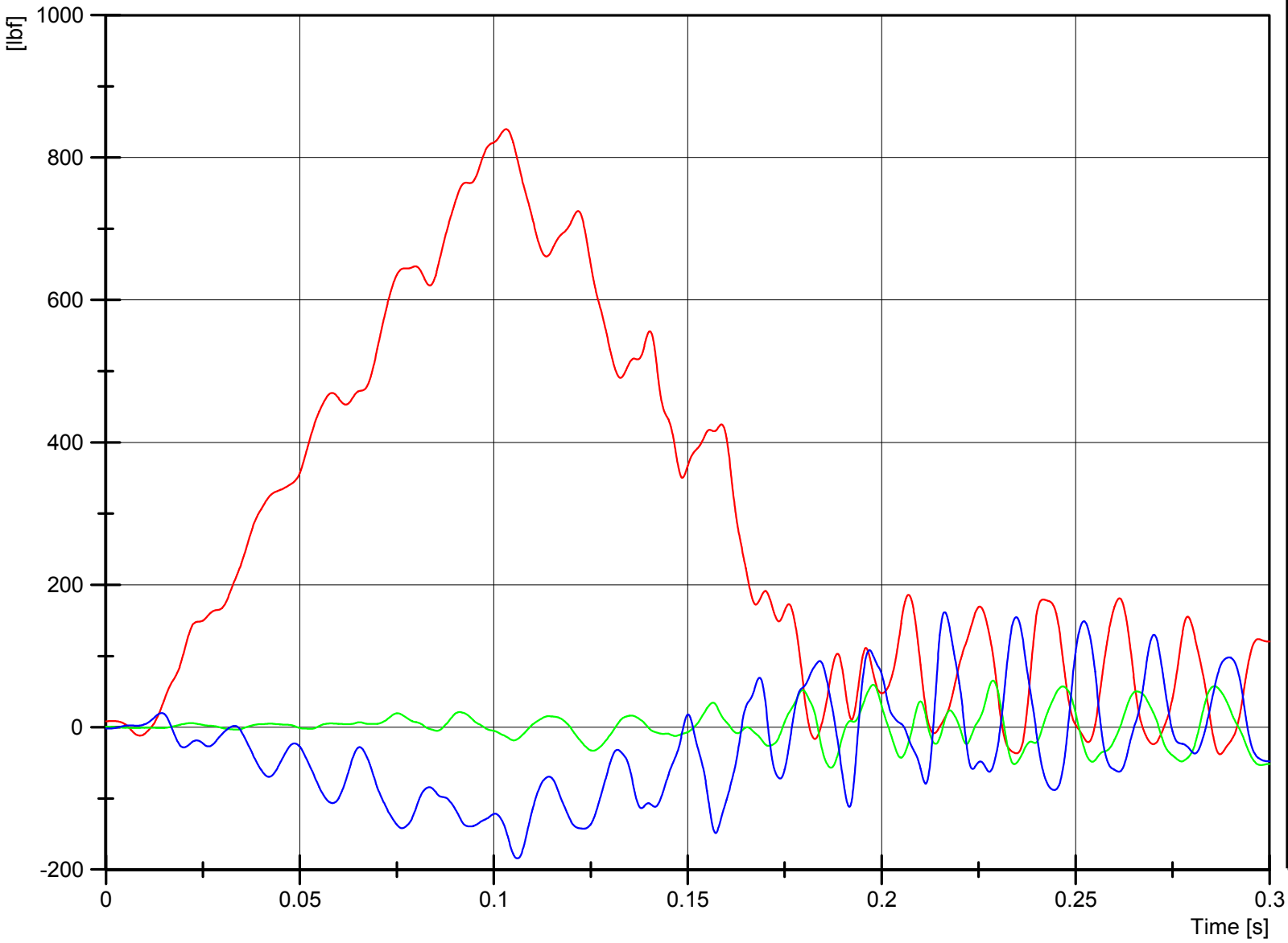
Comments:

Sled Acceleration | Sled Velocity | Ideal Pulse | Upper Limit

Maximum: 1.05 g Time: 0.2917 sec.
Minimum: -16.30 g Time: 0.0992 sec.
CFC: 60
Sensor Type: ENDEVCO 7290A-100
S/N: 29924
Sensitivity: 0.01912 V/EU
Cal. Due: 01/07/2015
Full Scale: 100 g
DAS Channel: 50
Ref. No.: 1
Polarity: R

Minimum: -45.66 ft/s Time: 0.176 sec.

Pulse Requirement		Actual
Minimum Required Peak Acceleration:	16 g	16.3 g
Minimum Overall Velocity Change:	44 ft/s	45.66 ft/s
Maximum Rise Time:	90 msec	87.8 msec
Minimum Velocity Change Before Greq:	22 ft/s	22.97 ft/s



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Doc. No.: CDL-FA14C-03-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-03

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Comments:

Rigid Seat Seat Back Fx

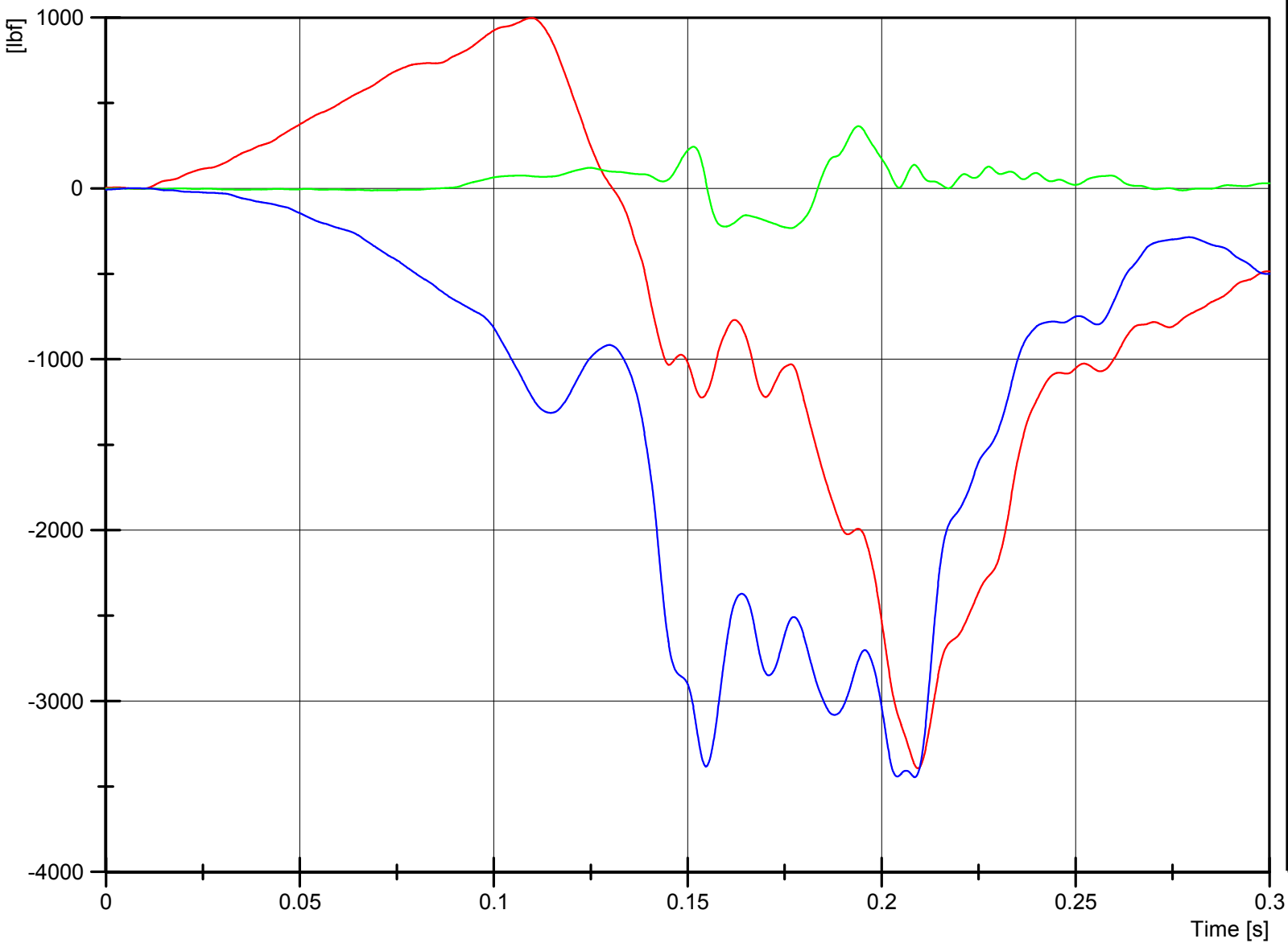
Maximum: 839.98 lbf Time: 0.1034 sec.
Minimum: -37.97 lbf Time: 0.2874 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FZ
Sensitivity: 1.187E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 12
Ref. No.: 15
Polarity: N

Rigid Seat Seat Back Fy

Maximum: 65.3116 lbf Time: 0.2289 sec.
Minimum: -56.76 lbf Time: 0.1871 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FY
Sensitivity: 2.769E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 11
Ref. No.: 14
Polarity: N

Rigid Seat Seat Back Fz

Maximum: 161.58 lbf Time: 0.2164 sec.
Minimum: -184.36 lbf Time: 0.1063 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FX
Sensitivity: 2.765E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 10
Ref. No.: 13
Polarity: R



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Doc. No.: CDL-FA14C-03-01

Version: New

Report Date: 05/06/2014

Customer: FAA

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Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Comments:

Rigid Seat Seat Pan Fx

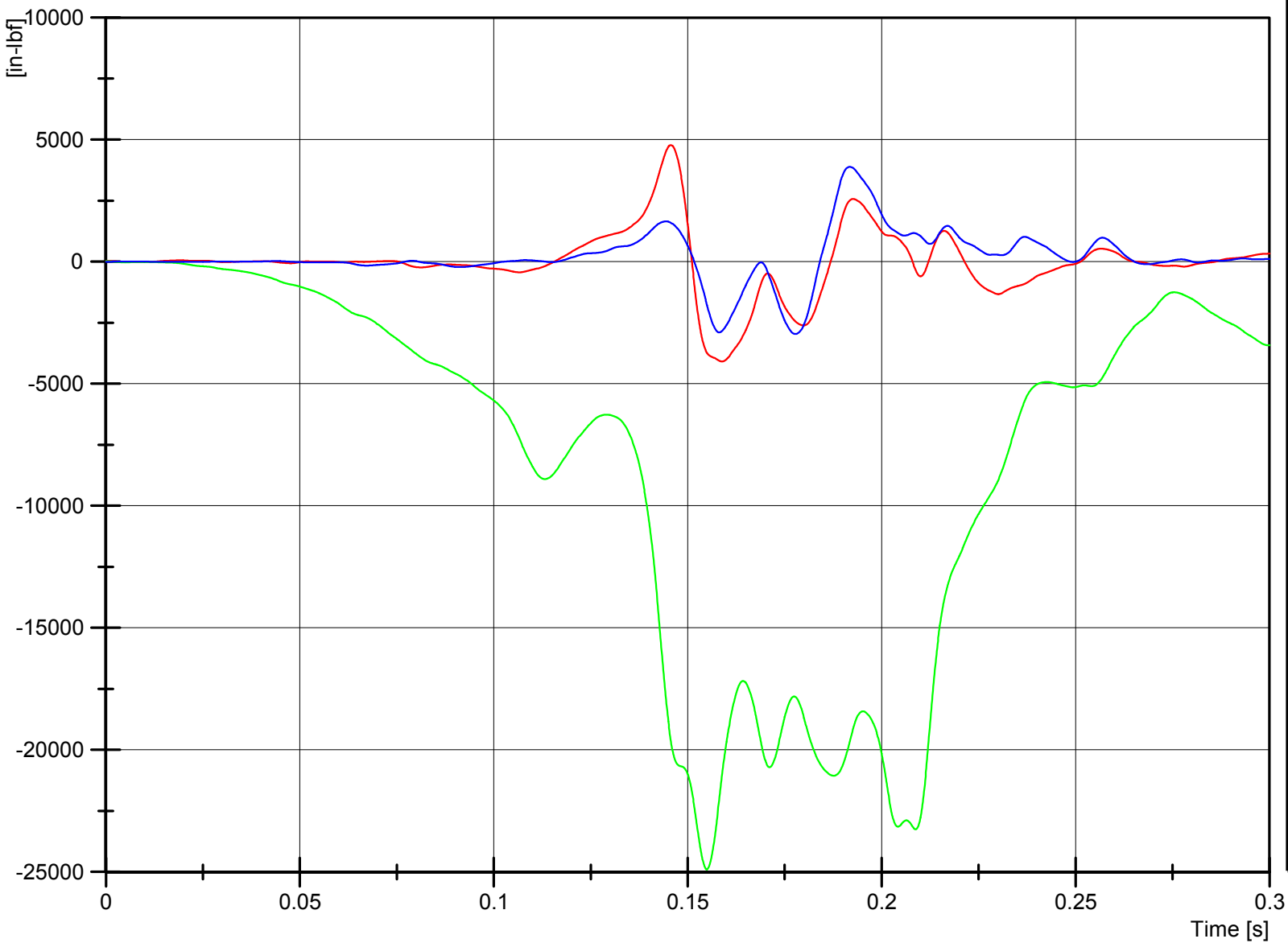
Maximum: 998.01 lbf Time: 0.11 sec.
Minimum: -3.39E+03 lbf Time: 0.2095 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FX
Sensitivity: 2.848E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 13
Ref. No.: 10
Polarity: N

Rigid Seat Seat Pan Fy

Maximum: 364.01 lbf Time: 0.1942 sec.
Minimum: -232.42 lbf Time: 0.1768 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FY
Sensitivity: 2.846E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 14
Ref. No.: 11
Polarity: N

Rigid Seat Seat Pan Fz

Maximum: 2.3278 lbf Time: 0.0072 sec.
Minimum: -3.45E+03 lbf Time: 0.2088 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FZ
Sensitivity: 1.205E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 15
Ref. No.: 12
Polarity: N



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Doc. No.: CDL-FA14C-03-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-03

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Comments:

Rigid Seat Seat Pan Mx

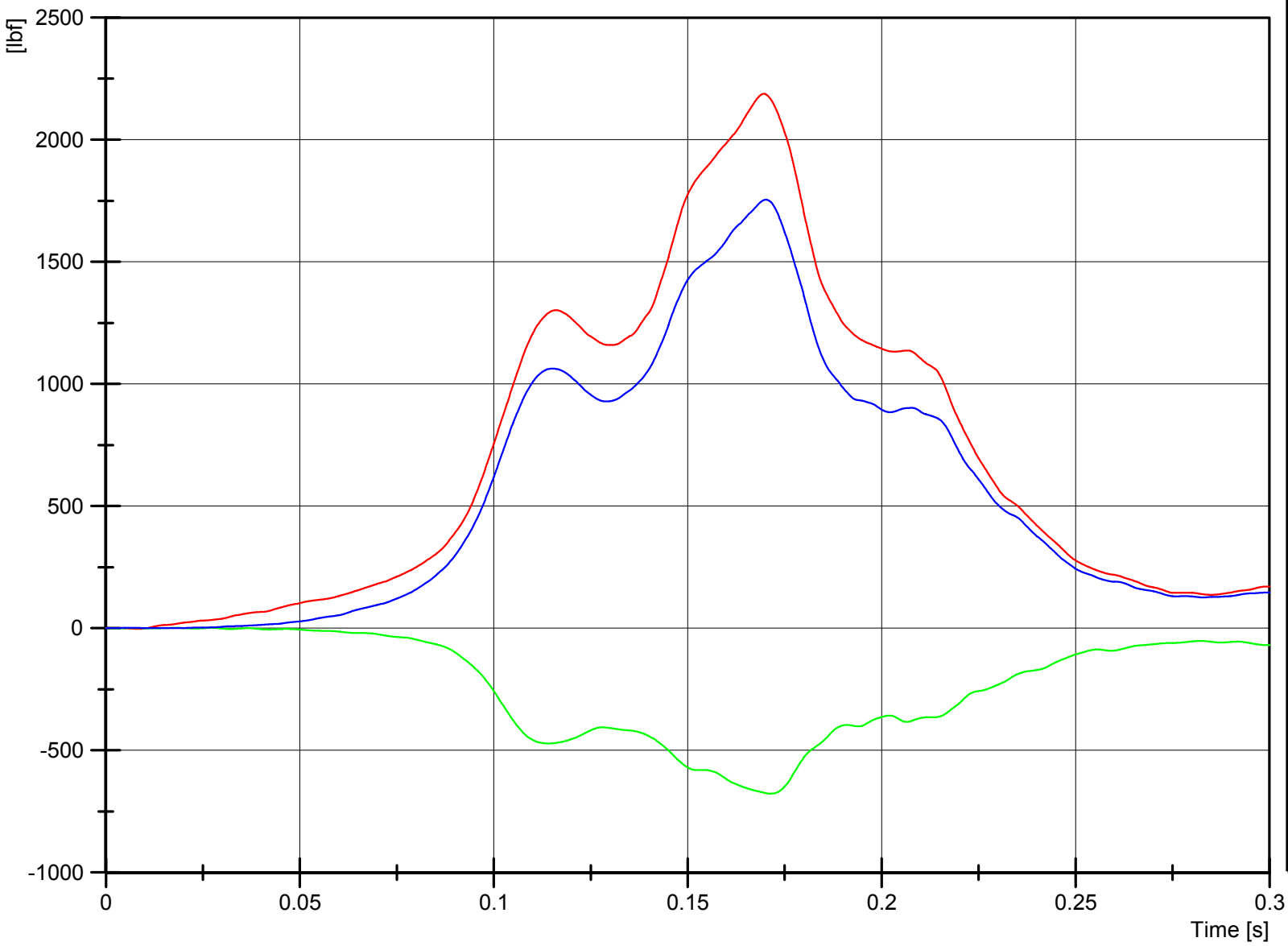
Maximum: 4782.96 in-lbf Time: 0.1458 sec.
Minimum: -4.09E+03 in-lbf Time: 0.1591 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MX
Sensitivity: 7.104E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 25000 in-lbf
DAS Channel: 16
Ref. No.: 7
Polarity: N

Rigid Seat Seat Pan My

Maximum: 21.6843 in-lbf Time: 0 sec.
Minimum: -2.49E+04 in-lbf Time: 0.1551 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MY
Sensitivity: 7.112E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 25000 in-lbf
DAS Channel: 17
Ref. No.: 8
Polarity: N

Rigid Seat Seat Pan Mz

Maximum: 3889.64 in-lbf Time: 0.192 sec.
Minimum: -2.96E+03 in-lbf Time: 0.178 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MZ
Sensitivity: 9.38E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 20000 in-lbf
DAS Channel: 18
Ref. No.: 9
Polarity: R



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Doc. No.: CDL-FA14C-03-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-03

Dummy: H2 718

Position: Config 4 - Repaired Belt (#1)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Rigid Seat Right Lap Fx

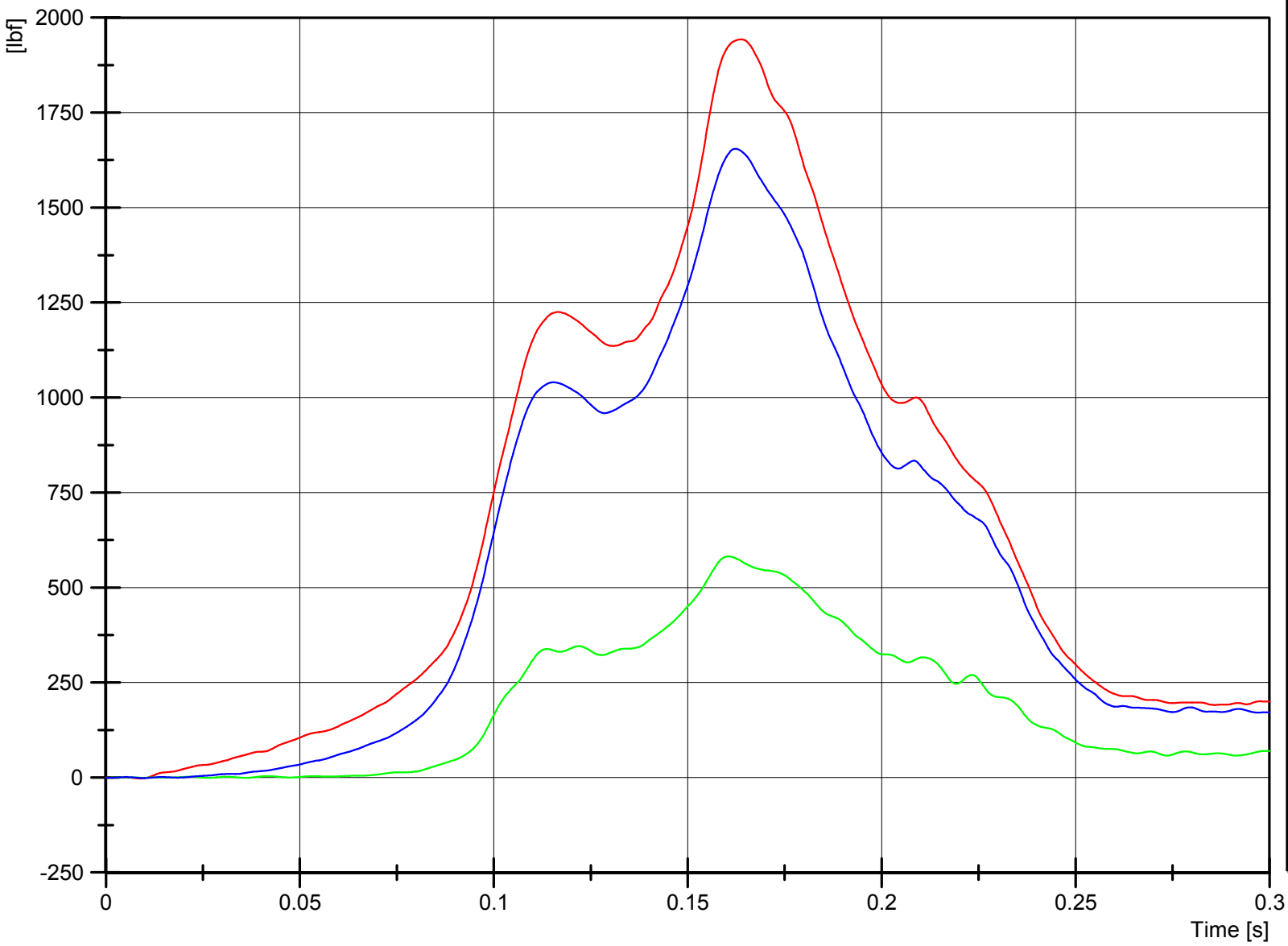
Maximum: 2187.96 lbf Time: 0.1698 sec.
Minimum: -2.4518 lbf Time: 0.0085 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FX
Sensitivity: 2.6022E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 19
Ref. No.: 74
Polarity: N

Rigid Seat Right Lap Fy

Maximum: 1.5441 lbf Time: 0.0274 sec.
Minimum: -676.41 lbf Time: 0.1715 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FY
Sensitivity: 2.5935E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 20
Ref. No.: 75
Polarity: N

Rigid Seat Right Lap Fz

Maximum: 1754.78 lbf Time: 0.1704 sec.
Minimum: -0.0178 lbf Time: 0 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FZ
Sensitivity: 1.088E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 21
Ref. No.: 76
Polarity: N



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Doc. No.: CDL-FA14C-03-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-03

Dummy: H2 718

Position: Config 4 - Repaired Belt (#1)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Rigid Seat Left Lap Fx

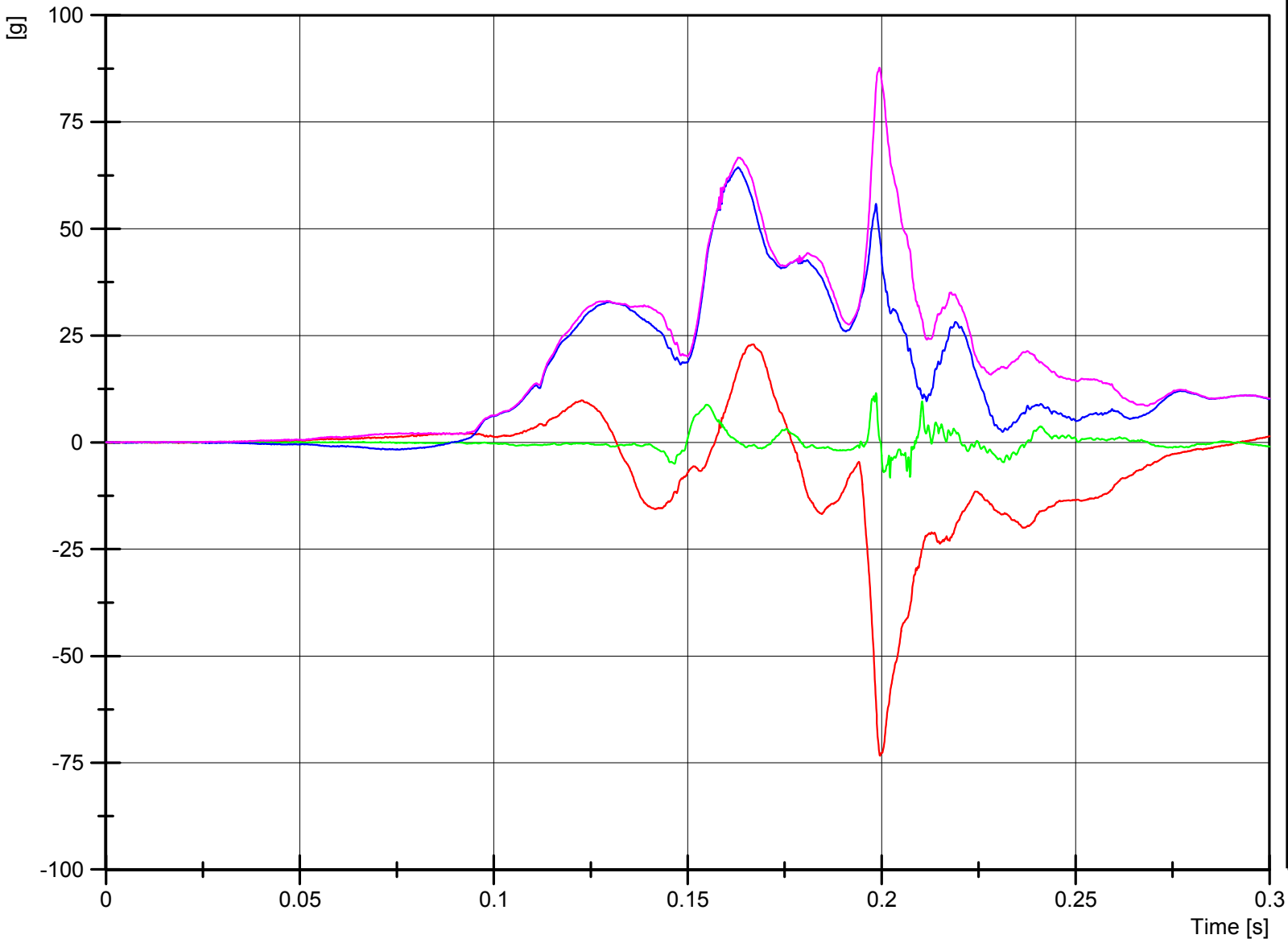
Maximum: 1942.57 lbf Time: 0.164 sec.
Minimum: -2.3297 lbf Time: 0.0092 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FX
Sensitivity: 2.608E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 22
Ref. No.: 77
Polarity: N

Rigid Seat Left Lap Fy

Maximum: 582.36 lbf Time: 0.1607 sec.
Minimum: -0.7727 lbf Time: 0.0362 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FY
Sensitivity: 2.606E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 23
Ref. No.: 78
Polarity: N

Rigid Seat Left Lap Fz

Maximum: 1654.63 lbf Time: 0.1625 sec.
Minimum: -1.2049 lbf Time: 0.0101 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FZ
Sensitivity: 1.087E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 24
Ref. No.: 79
Polarity: N



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Doc. No.: CDL-FA14C-03-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-03

Dummy: H2 699

Position: Config 4 - Repaired Belt (#1)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Head Ax H2 699

Maximum: 22.9875 g Time: 0.1671 sec.
Minimum: -73.37 g Time: 0.1998 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P45436
Sensitivity: 1.823E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 25
Ref. No.: 22
Polarity: R

Head Ay H2 699

Maximum: 11.5274 g Time: 0.1987 sec.
Minimum: -8.2313 g Time: 0.2024 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P47924
Sensitivity: 1.863E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 26
Ref. No.: 23
Polarity: R

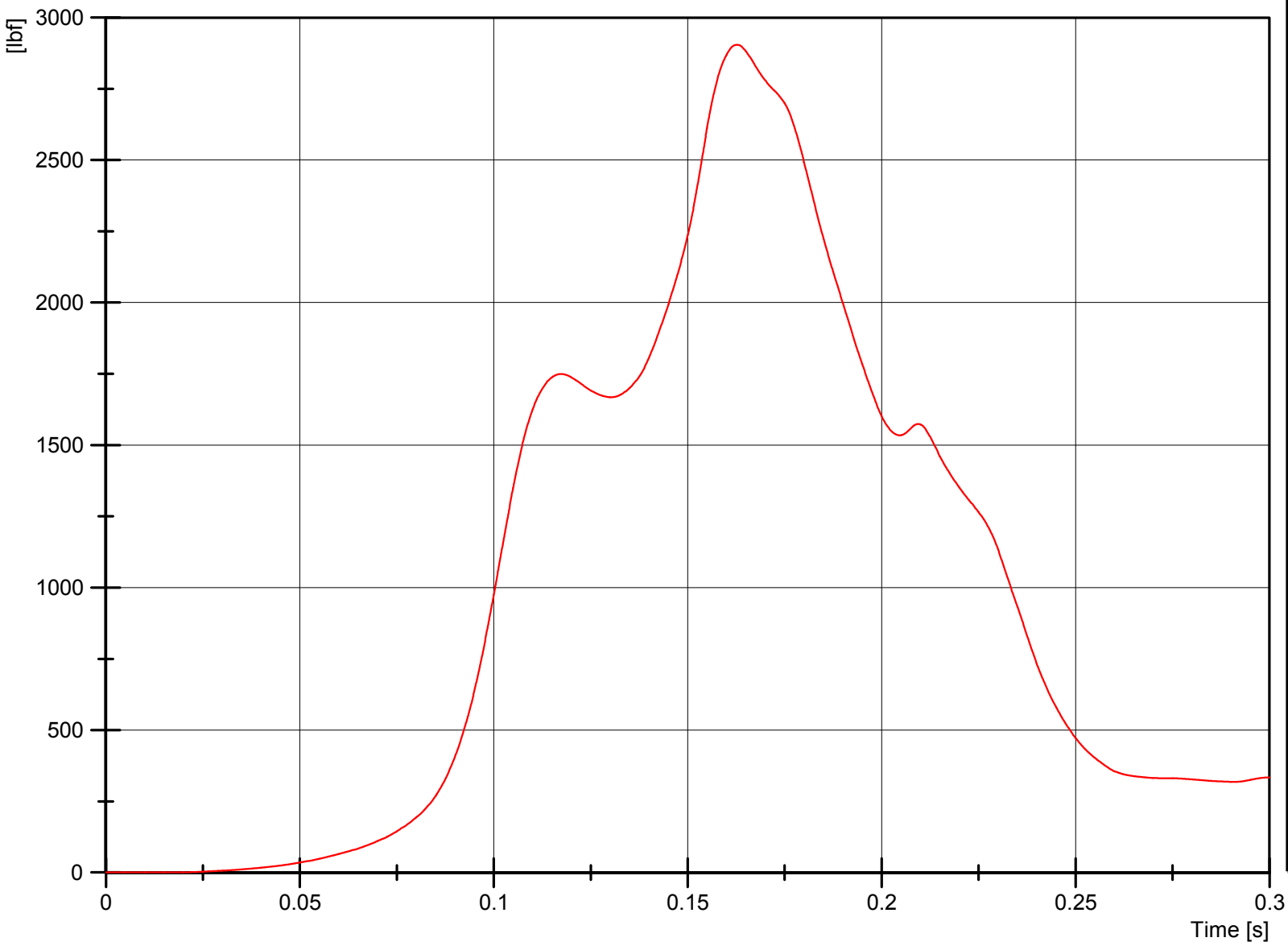
Head Az H2 699

Maximum: 64.4107 g Time: 0.1632 sec.
Minimum: -1.7349 g Time: 0.0757 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P48250
Sensitivity: 1.827E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 27
Ref. No.: 24
Polarity: R

Head Resultant H2 699

Maximum: 87.71 g Time: 0.1994 sec.

HIC: 1065.6
T1: 117.1 msec.
T2: 223.2 msec.



Lap Belt Force H2 699

Maximum: 2904.89 lbf
Minimum: 0.1365 lbf
CFC: 60
Sensor Type: Denton 3255
S/N: SBLC259
Sensitivity: 6.0647E-07 V/EU
Cal. Due: 10/17/2014
Full Scale: 3000 lbf
DAS Channel: 31
Ref. No.: 17
Polarity: N

Time: 0.1629 sec.
Time: 0 sec.

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Doc. No.: CDL-FA14C-03-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-03

Dummy: H2 699

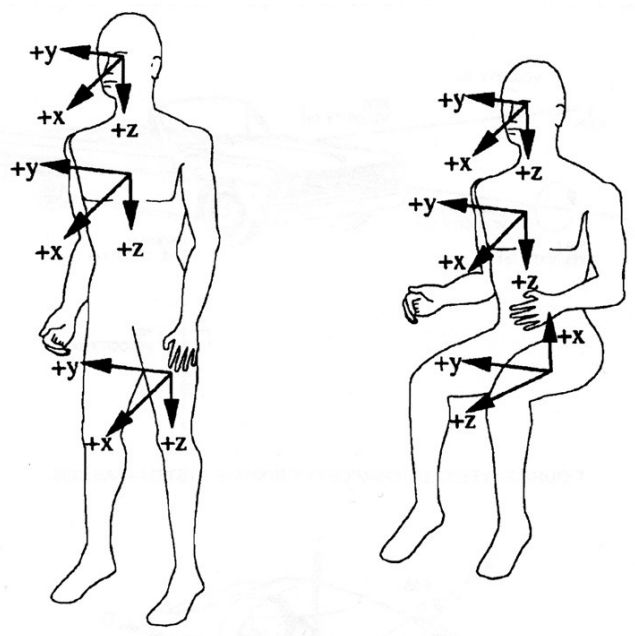
Position: Config 4 - Repaired Belt (#1)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

J211/1 Sign Conventions



Upper Neck Load Cell:
+FX Head rearward, chest forward
+FY Head leftward, chest rightward
+FZ Head upward, chest downward
+MX Left ear toward left shoulder
+MY Chin toward sternum
+MZ Chin toward left shoulder

Lumbar Load Cell:
+FX Chest rearward, pelvis forward
+FY Chest leftward, pelvis rightward
+FZ Chest upward, pelvis downward
+MX Left shoulder toward left hip
+MY Sternum toward front of legs
+MZ Right shoulder forward, left shoulder rearward

Femur Load Cells:
+FZ Tension

Chest Displacement:
-DX Compression

Rib Dispacement:
-DY Compression

Belt Load Cells:
+FX Tension

Floor Load Cells:
+FX Test article forward
+FY Test article right
+FZ Test article up

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National Institute for Aviation Research
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Wichita, Kansas 67260-0093
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Doc. No.: CDL-FA14C-03-01

Version: New

Report Date: 05/06/2014

Customer: FAA

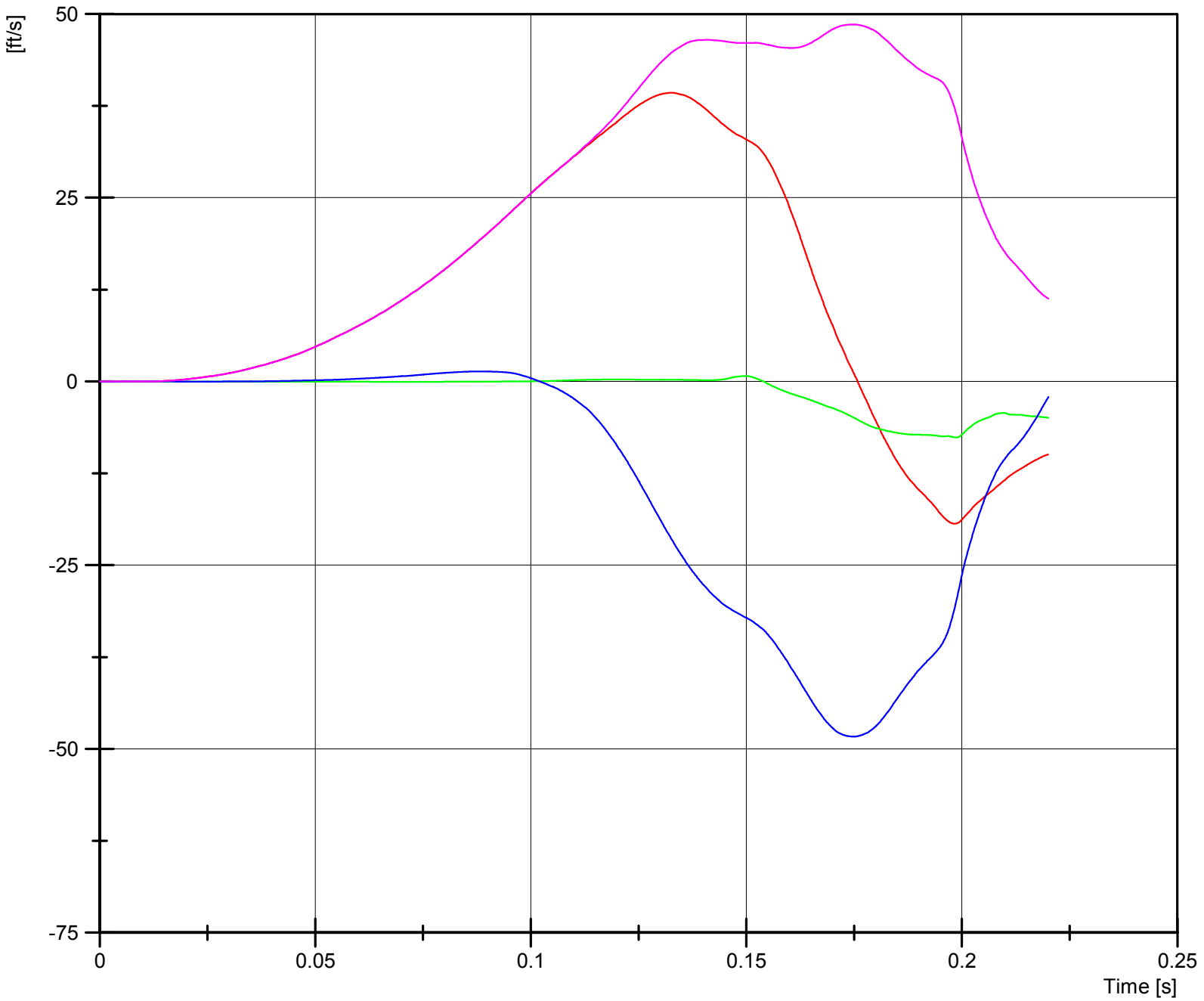
Test: FA14C-03

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Comments:



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Report Date: 05/06/2014

Customer: FAA

Test: FA14C-03

Dummy: H2 699

Position: Config 4 - Repaired Belt (#

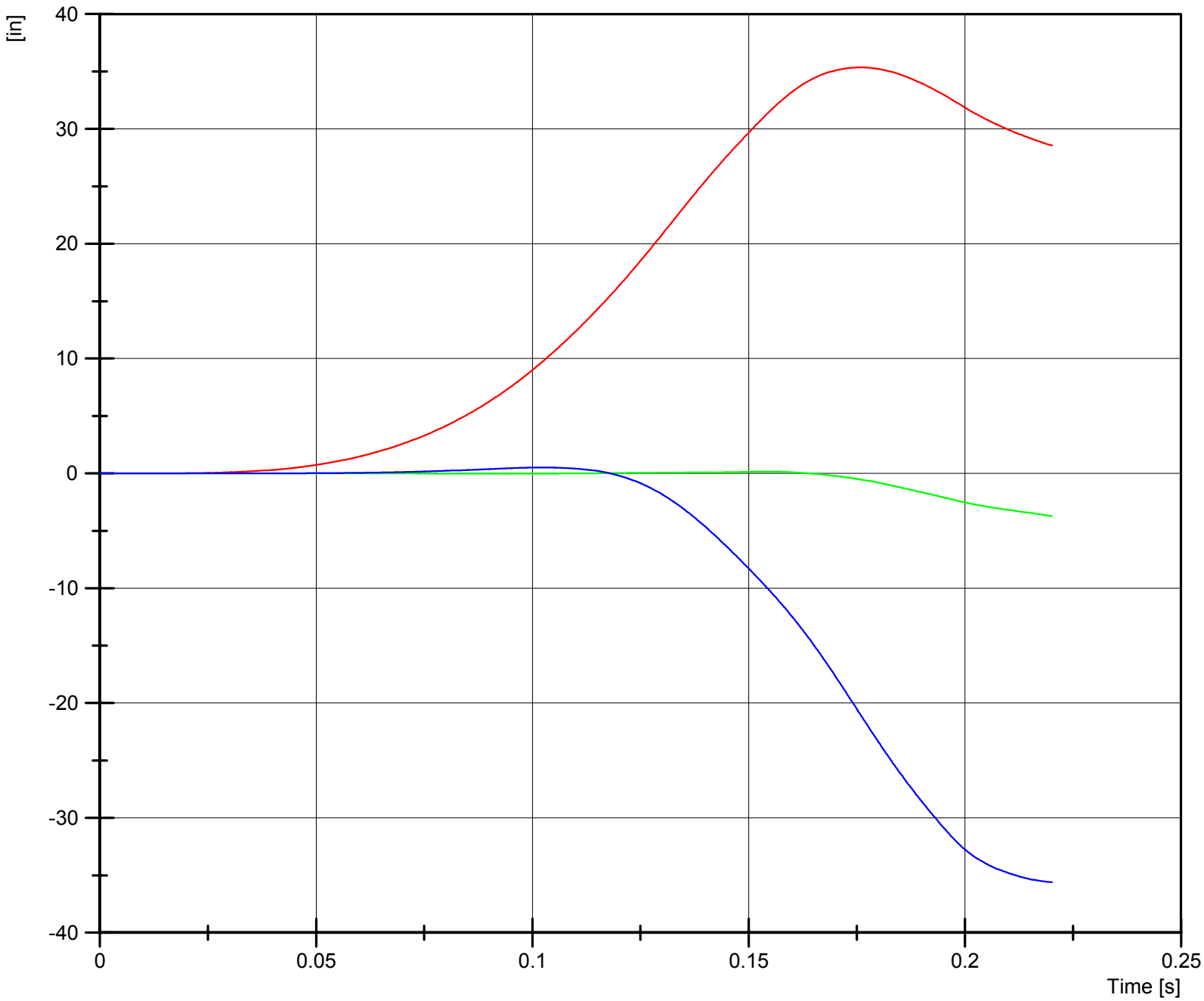
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Comments:

Global Head Vx H2 699		Global Head Vy H2 699		Global Head Vz H2 699		Global Head Velocity Resultant H2 699	
Maximum: 39.27 ft/s	Time: 0.1327 sec.	Maximum: 0.744 ft/s	Time: 0.1497 sec.	Maximum: 1.38 ft/s	Time: 0.0885 sec.	Maximum: 48.58 ft/s	Time: 0.1748 sec.
Minimum: -19.36 ft/s	Time: 0.1983 sec.	Minimum: -7.60 ft/s	Time: 0.1988 sec.	Minimum: -48.31 ft/s	Time: 0.1748 sec.	Minimum: 0 ft/s	Time: 0.0001 sec.



Global Head Dx H2 699 | Global Head Dy H2 699 | Global Head Dz H2 699

Maximum: 35.35 in	Time: 0.1759 sec.	Maximum: 0.15 in	Time: 0.154 sec.	Maximum: 0.52 in	Time: 0.1021 sec.
Minimum: -0.00 in	Time: 0.0121 sec.	Minimum: -3.73 in	Time: 0.2201 sec.	Minimum: -35.60 in	Time: 0.2201 sec.

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Doc. No.: CDL-FA14C-03-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-03

Dummy: H2 699

Position: Config 4 - Repaired Belt (#

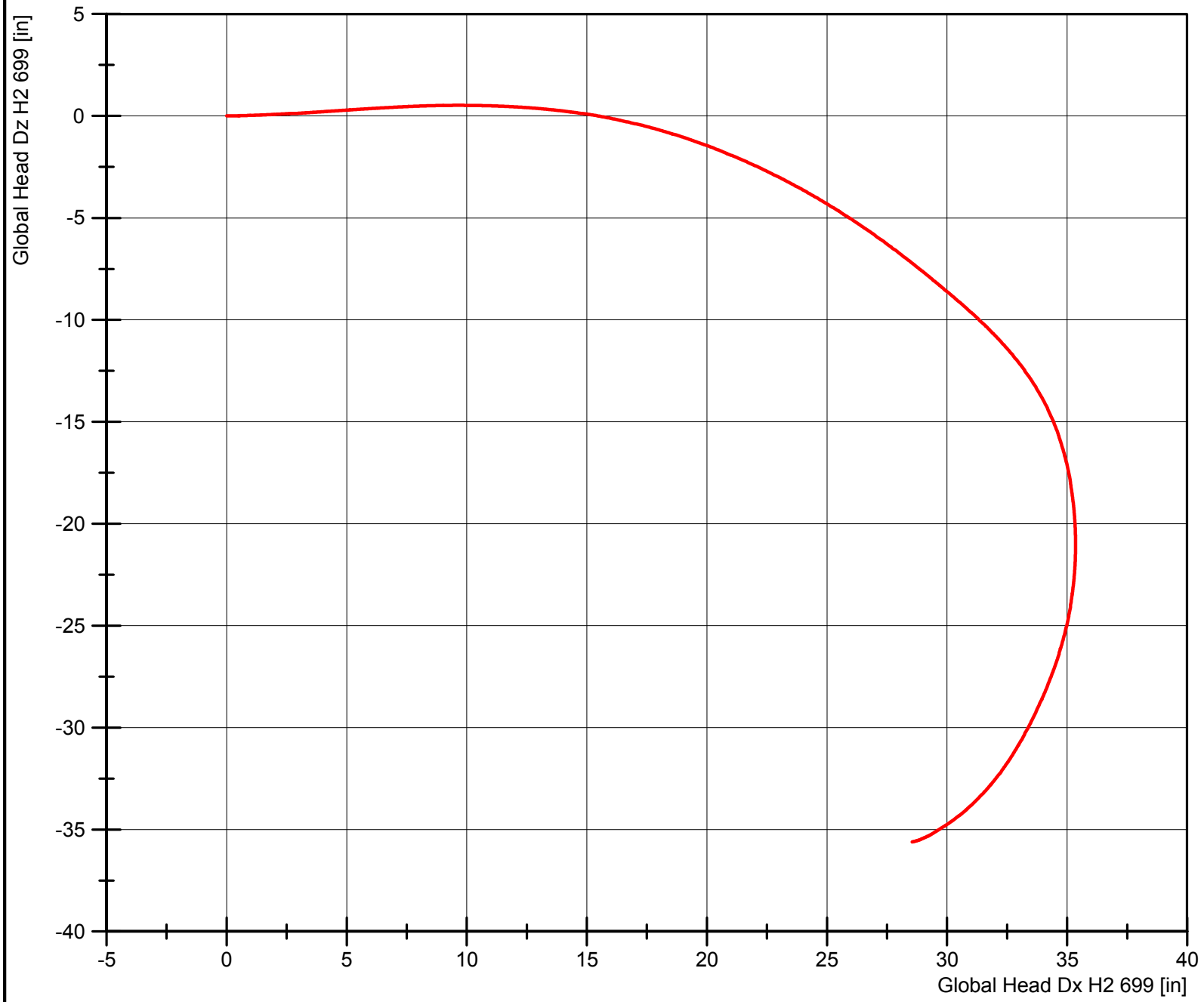
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Comments:

Displacement values are calculated from Head Accelerations and Angular Velocities.
This method cannot be used to substitute photometric analysis.



Global Head Displacement XZ

X Maximum: 35.35 in **Time: 0.1759 sec.**

Z Value at X Maximum: -21.03 in

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Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-03

Dummy: H2 699

Position: Config 4 - Repaired Belt (#

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Comments:

Displacement values are calculated from Head Accelerations and Angular Velocities.
This method cannot be used to substitute photometric analysis.

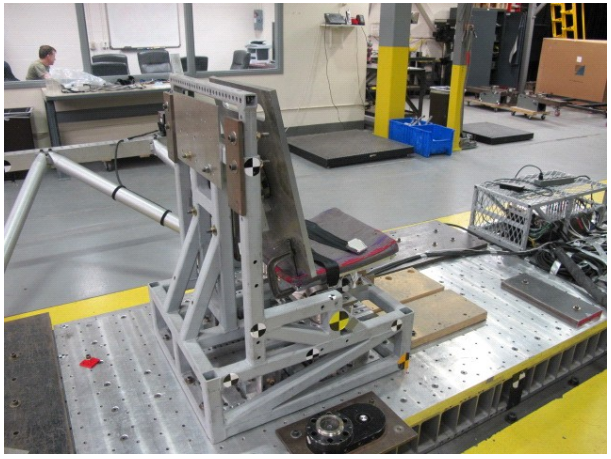
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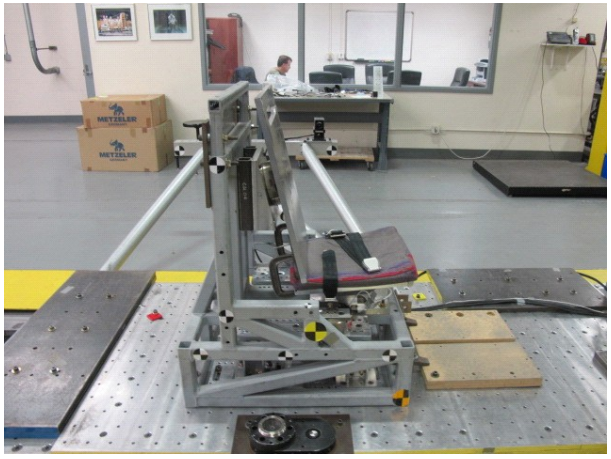


NA

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Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-03

Dummy: N/A

Position: N/A

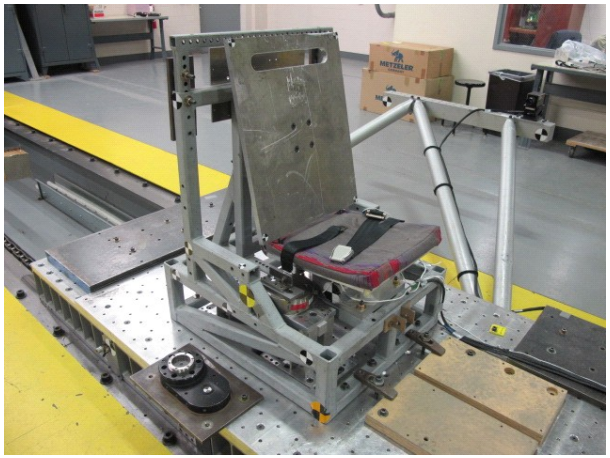
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14 CFR 25.562 Test 2

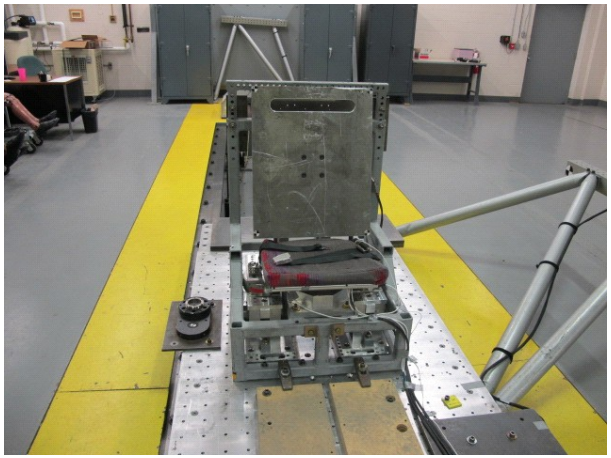
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16g-04

Rate: 10000
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Total Samples: 81920
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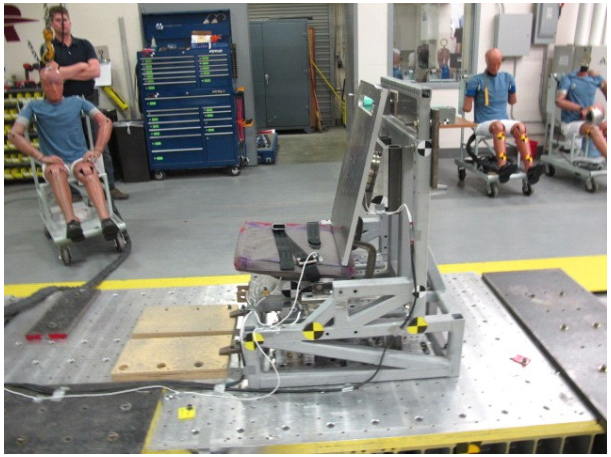
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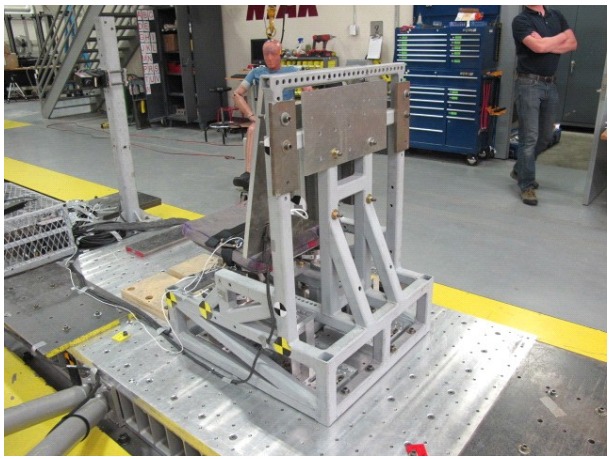
Pre-test Photos

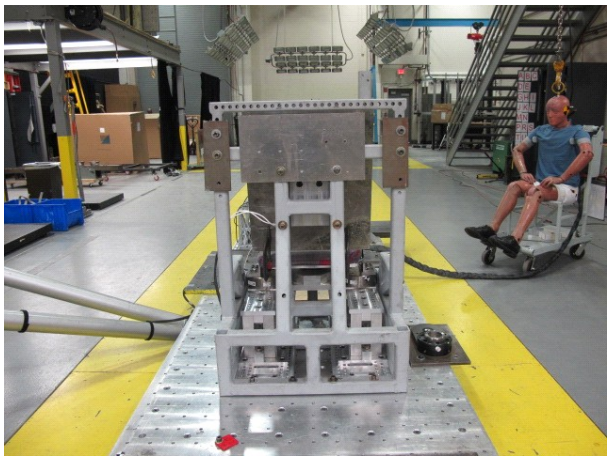












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Dummy: N/A

Position: N/A

Test Description:
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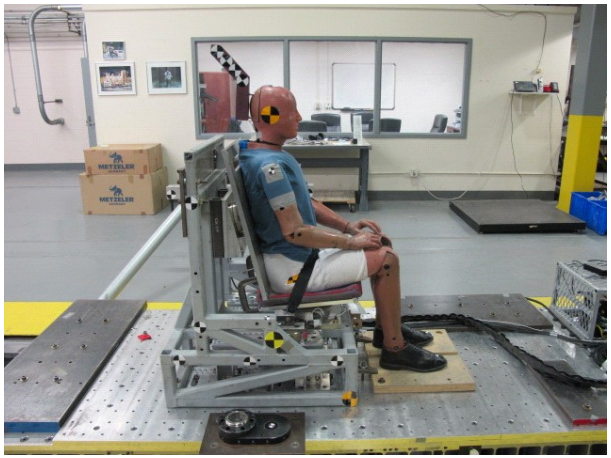
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16g-04

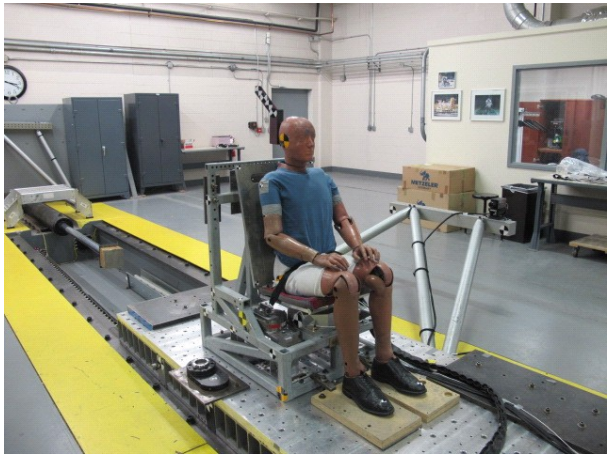
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Pretrigger Samples: 40960
Total Samples: 81920
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Test Date/Time: 05/05/2014 15:57

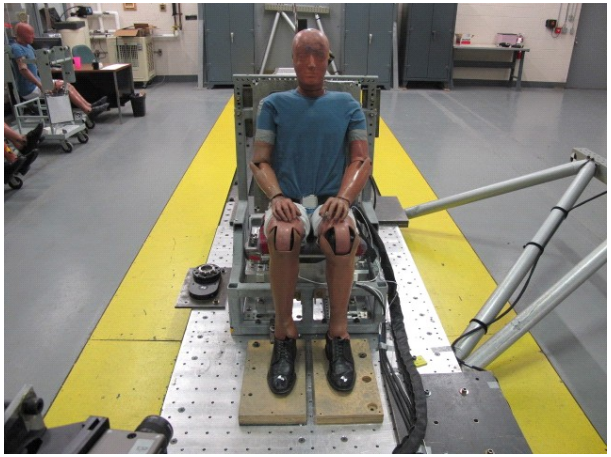
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Pre-test Photos

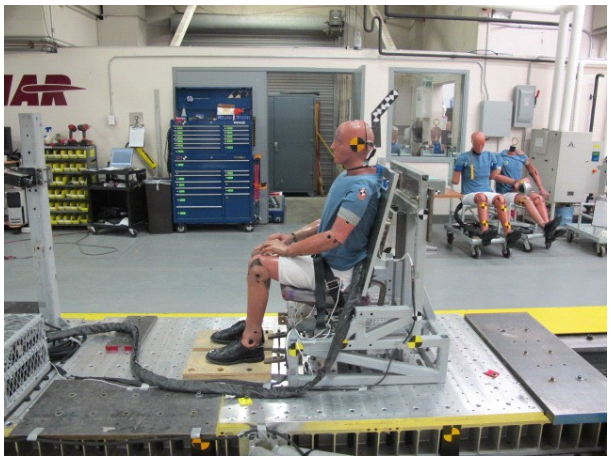












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Dummy: N/A

Position: N/A

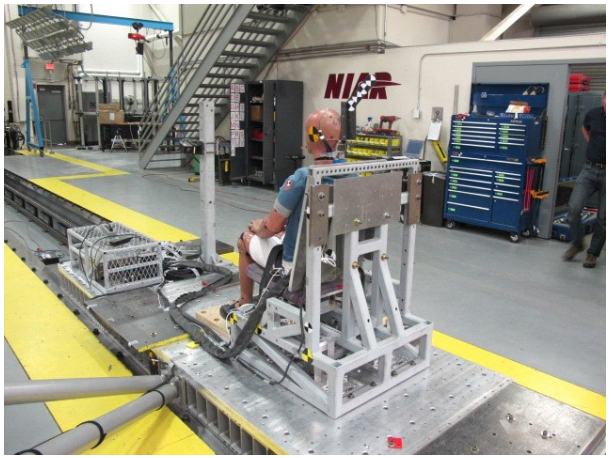
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

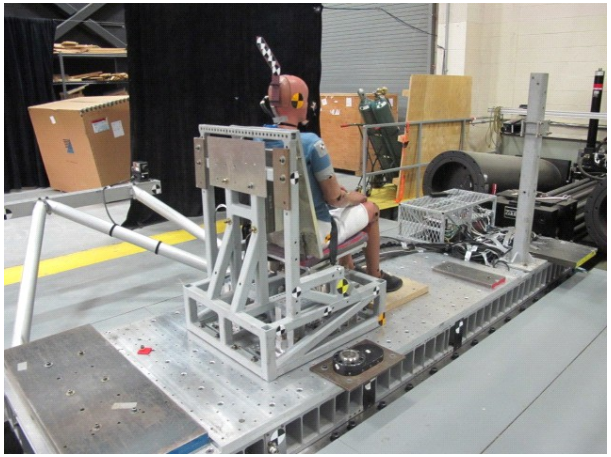
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Pretrigger Samples: 40960
Total Samples: 81920
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Test Date/Time: 05/05/2014 15:57

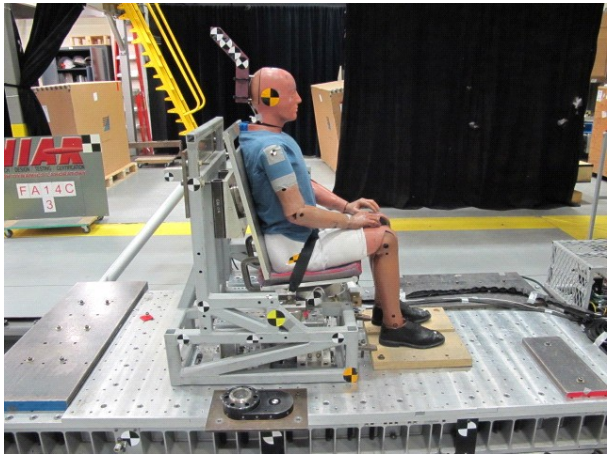
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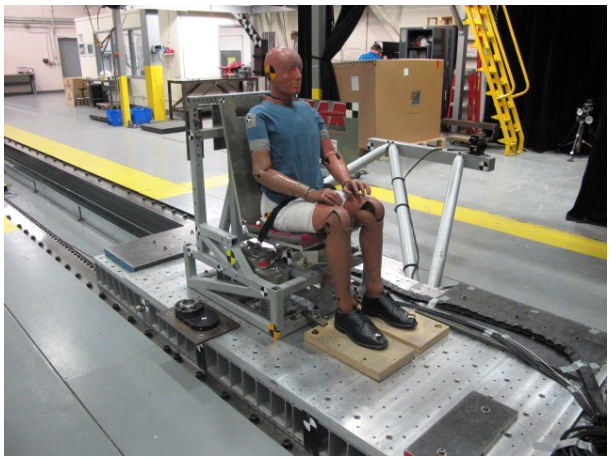
Pre-test Photos

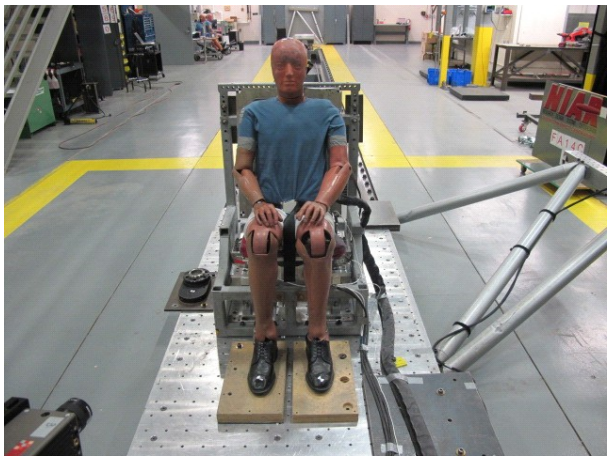












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Doc. No.: CDL-FA14C-03-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-03

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

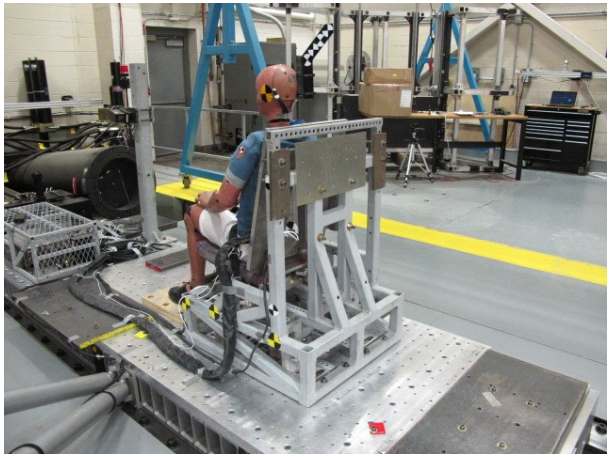
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Total Samples: 81920
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Test Date/Time: 05/05/2014 15:57

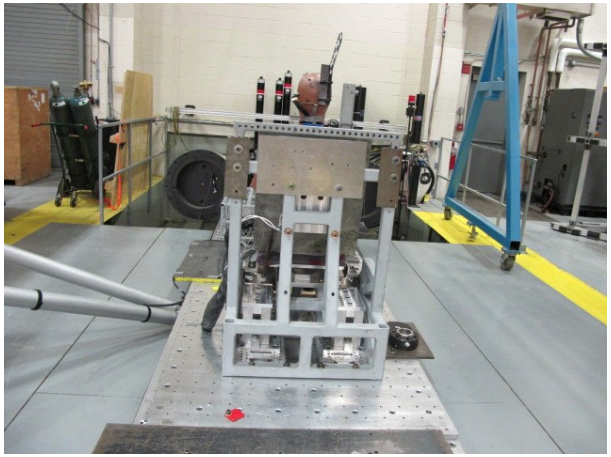
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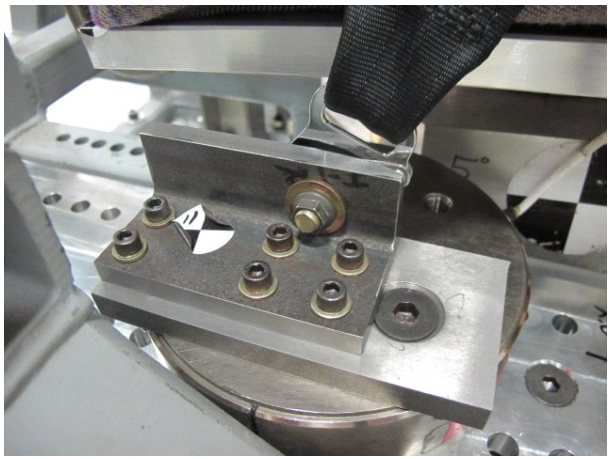
Pre-test Photos

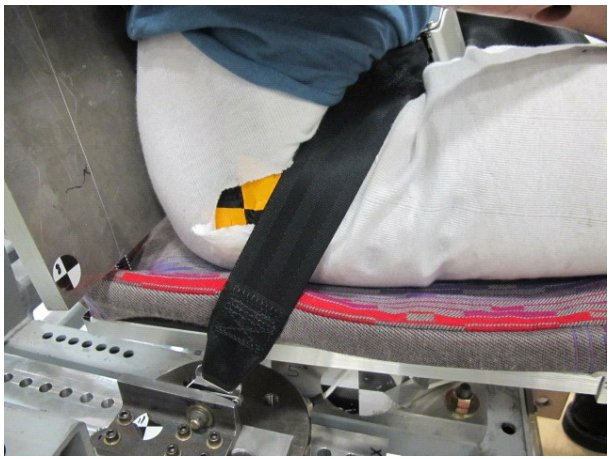












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www.niar.wichita.edu

Doc. No.: CDL-FA14C-03-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-03

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

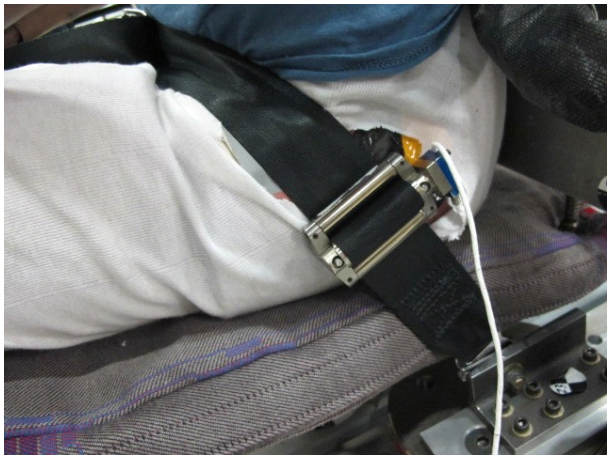
Pulse Name:
16g-04

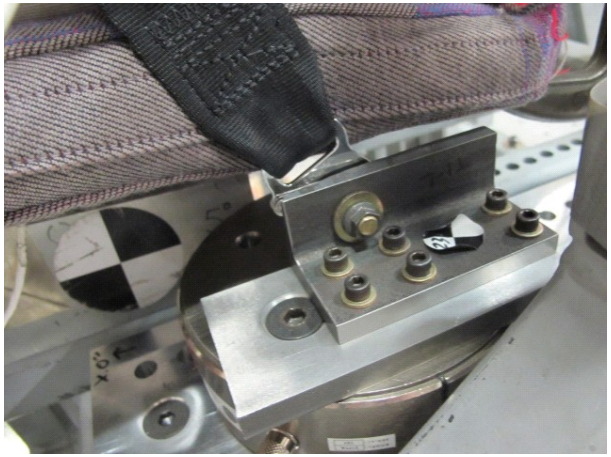
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Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Comments:

Pre-test Photos

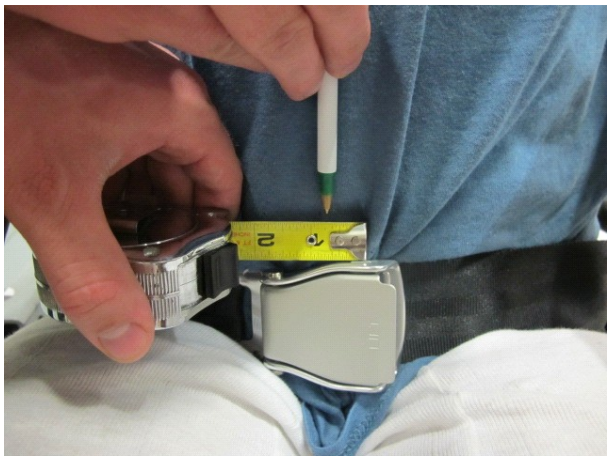












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Dummy: N/A

Position: N/A

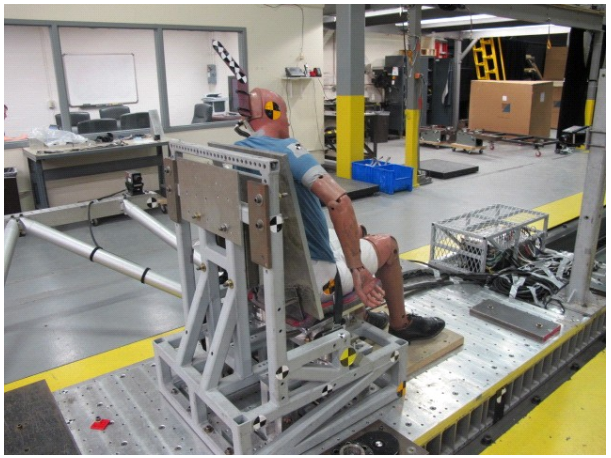
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

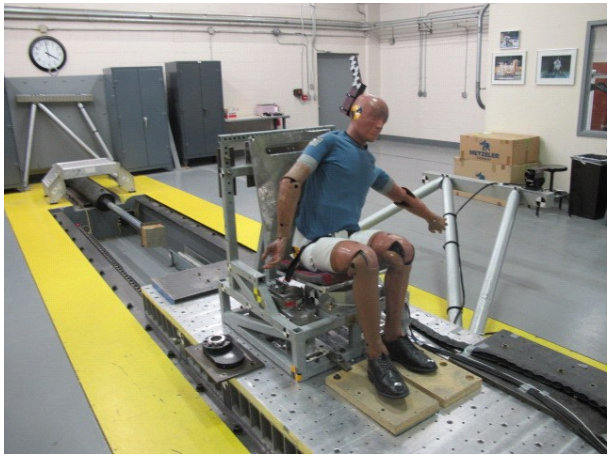
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Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

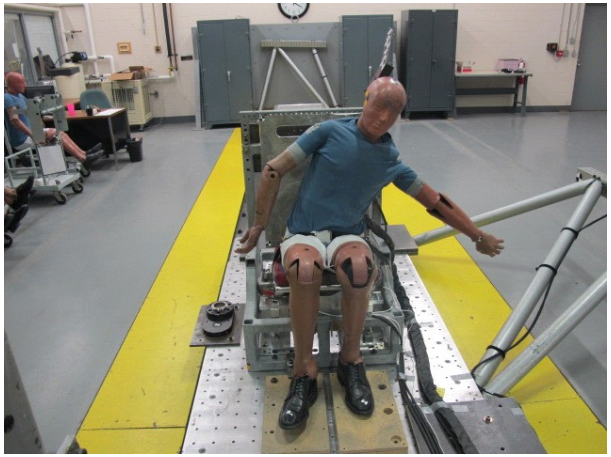
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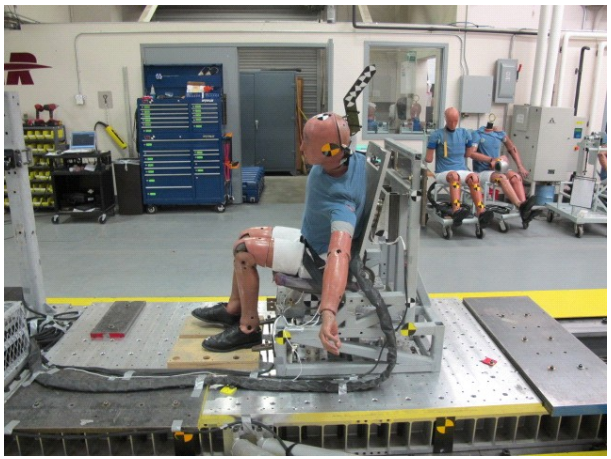
Post-test Photos

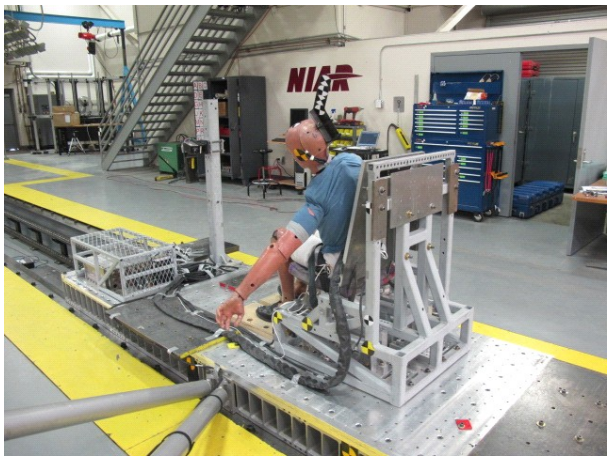












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Customer: FAA

Test: FA14C-03

Dummy: N/A

Position: N/A

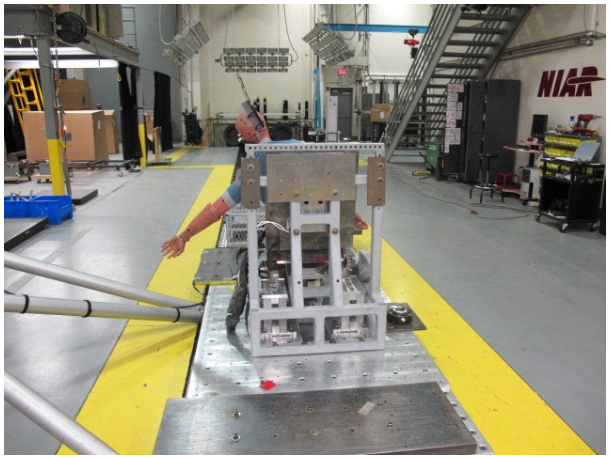
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Comments:

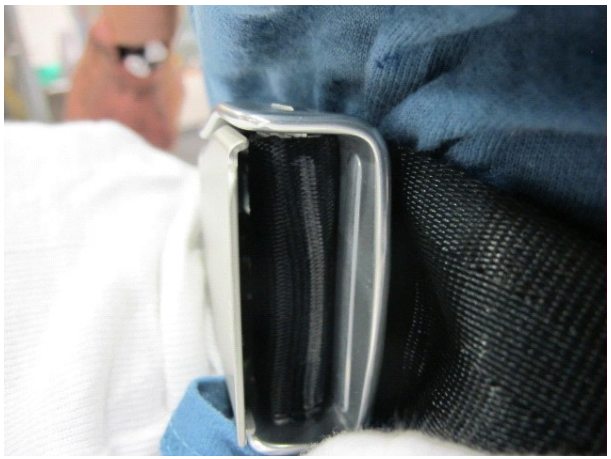
Post-test Photos

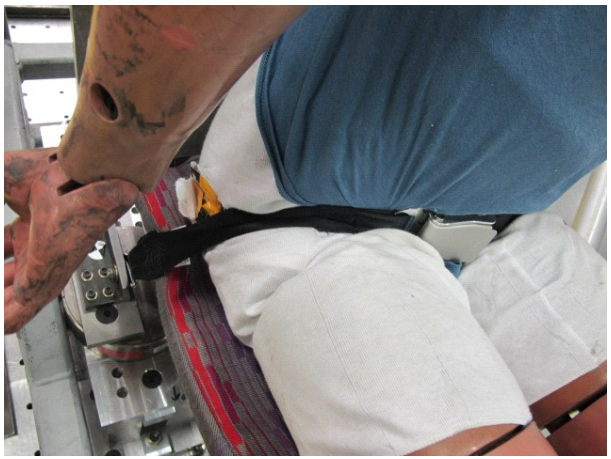












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Dummy: N/A

Position: N/A

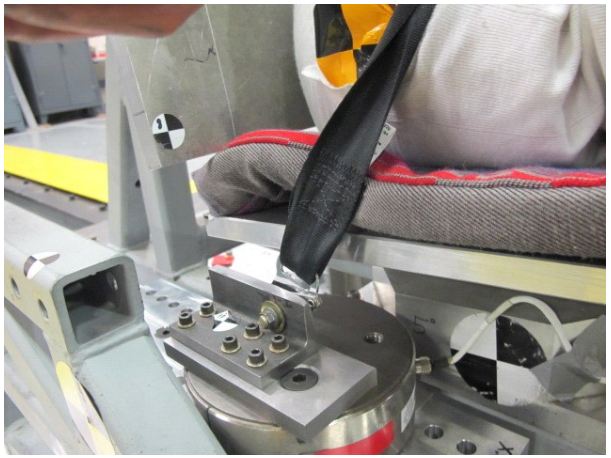
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14 CFR 25.562 Test 2

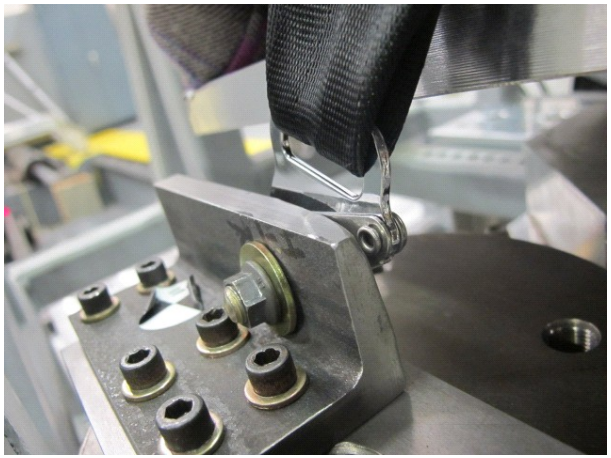
Pulse Name:
16g-04

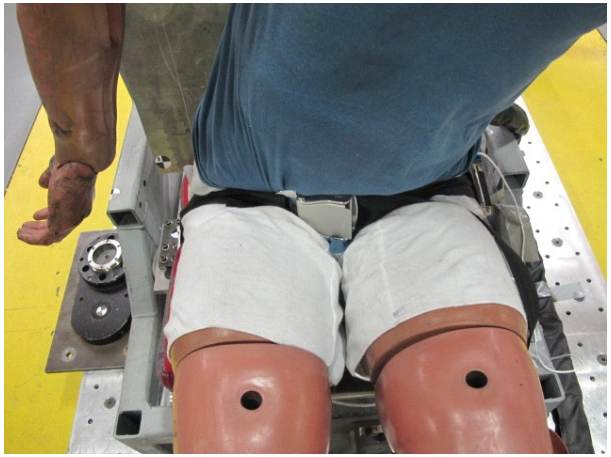
Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/05/2014 15:57

Comments:

Post-test Photos

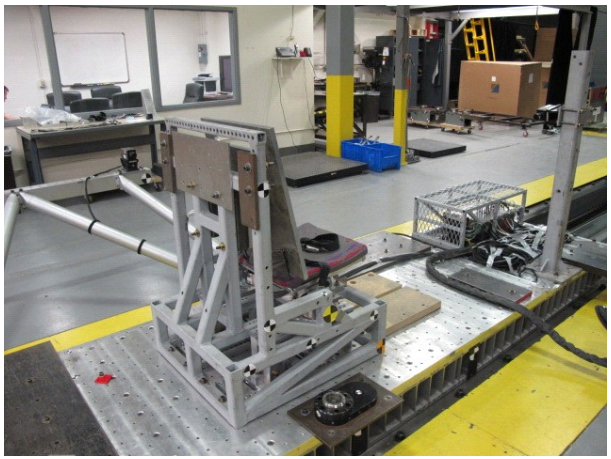












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Dummy: N/A

Position: N/A

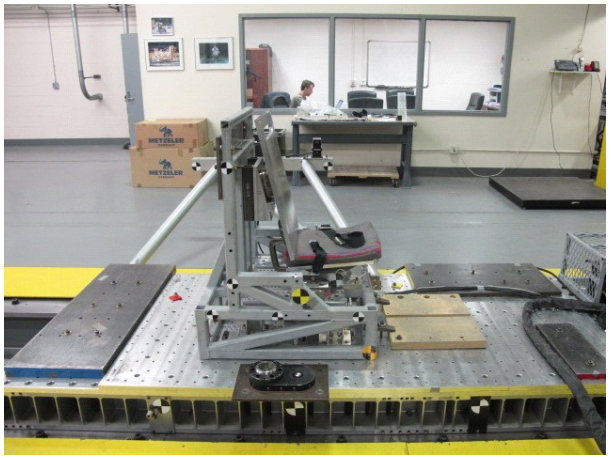
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14 CFR 25.562 Test 2

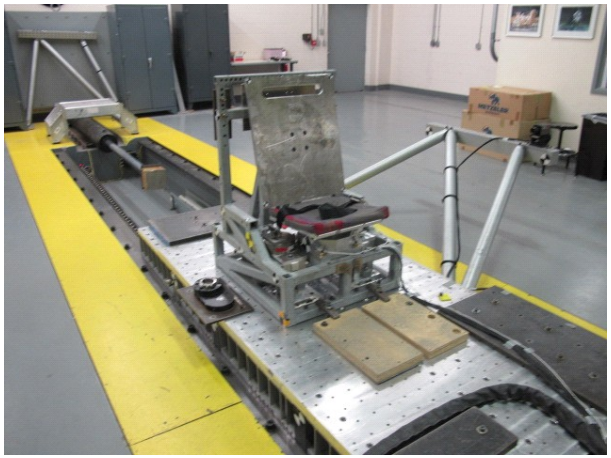
Pulse Name:
16g-04

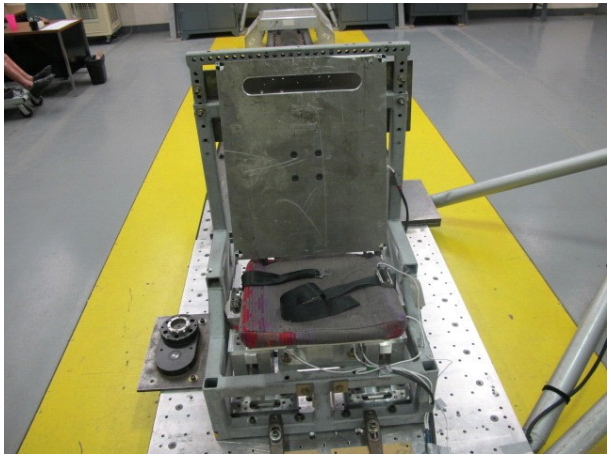
Rate: 10000
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Comments:

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Dummy: N/A

Position: N/A

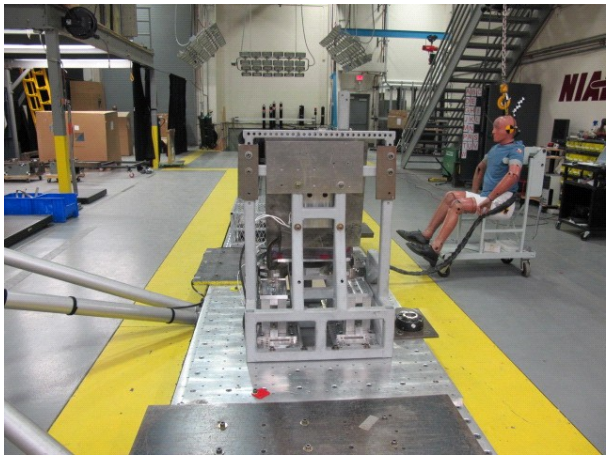
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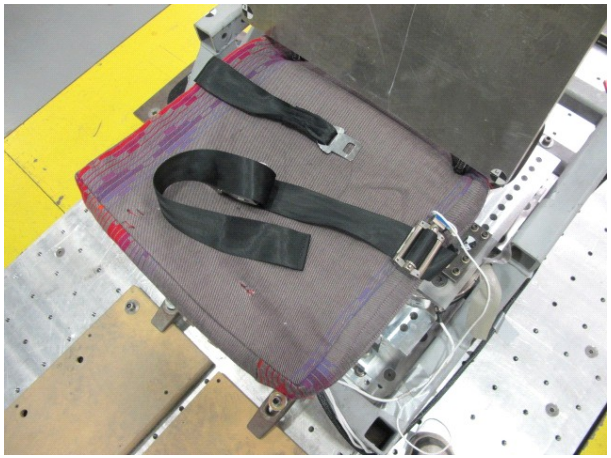
Pulse Name:
16g-04

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Test Date/Time: 05/05/2014 15:57

Comments:

WICHITA STATE UNIVERSITY
NATIONAL INSTITUTE FOR AVIATION RESEARCH
Crash Dynamics Lab

Report No. CDL-FA14C-04-01

Requested by:

FAA

Final Test Report FA14C-04

05/06/2014

Revision	Change	Date	Revised By
New		05/06/2014	Rob Huculak

Prepared and Reviewed by:

Rob Huculak
Laboratory Manager

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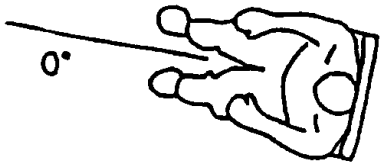
This test report is in accordance with ISO/IEC 17025:2005 requirements and all equipment standards used are traceable to the National Institute of Standards and Technology.
The information in this report relates only to the article under test and cannot be reproduced, except in full, without the written approval of the National Institute for Aviation Research.

Test Summary

The dynamic test (FA14C-04) was performed for FAA in accordance with 14 CFR 25.562 Test 2 on 05/06/2014.

Pulse Parameters	Required	Result	Pass/Fail
Minimum Peak Acceleration (g)	16	16.35	PASS
Minimum Velocity Change (ft/sec)	44	45.16	PASS
Maximum Rise Time (msec)	90	86.9	PASS
Minimum Velocity Change During Rise Time (ft/sec)	22	23.22	PASS
2g Offset	--	--	PASS

Test Orientation



ATD: H2 699 **Position: Config 4 - Repaired Belt (#3)**

0 deg

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Doc. No.: CDL-FA14C-04-01

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Customer: FAA

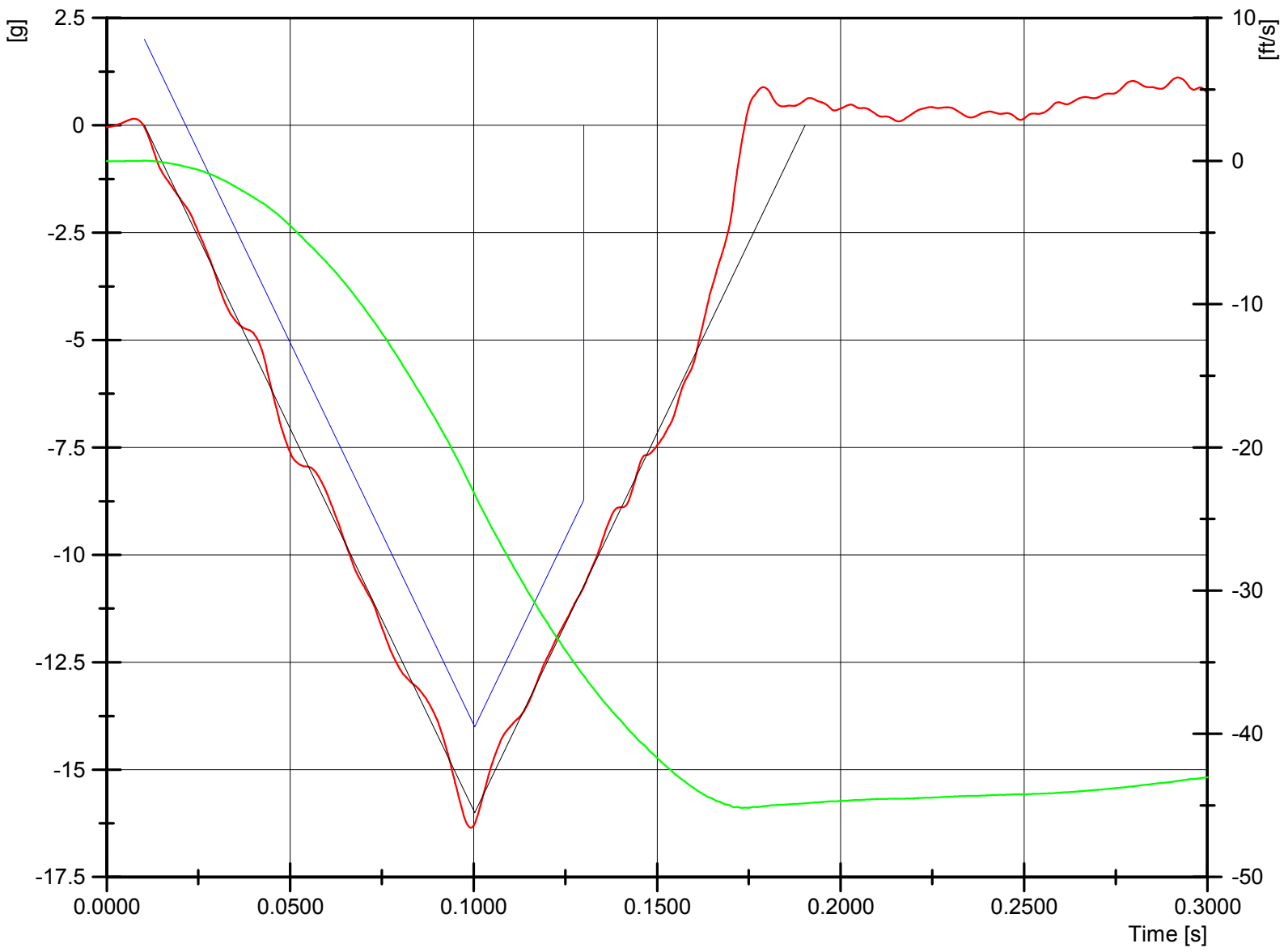
Test: FA14C-04

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Temperature	Relative Humidity
76.4°F	42.0%



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Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
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Test Date/Time: 05/06/2014 09:39

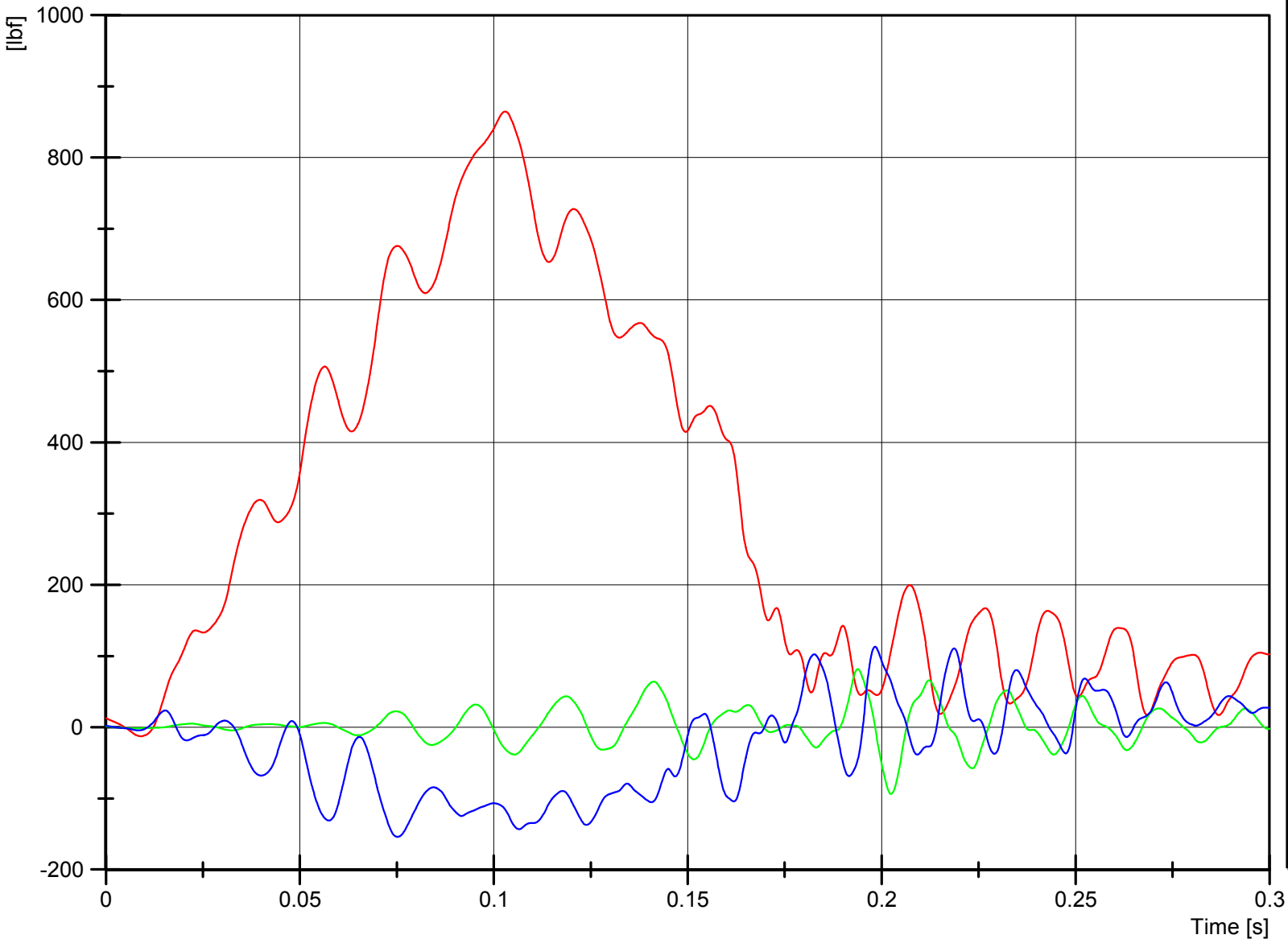
Comments:

Sled Acceleration — Sled Velocity — Ideal Pulse — Upper Limit

Maximum: 1.12 g Time: 0.2919 sec.
Minimum: -16.35 g Time: 0.0993 sec.
CFC: 60
Sensor Type: ENDEVCO 7290A-100
S/N: 29924
Sensitivity: 0.01912 V/EU
Cal. Due: 01/07/2015
Full Scale: 100 g
DAS Channel: 50
Ref. No.: 1
Polarity: R

Minimum: -45.16 ft/s Time: 0.1731 sec.

Pulse Requirement		Actual
Minimum Required Peak Acceleration:	16 g	16.35 g
Minimum Overall Velocity Change:	44 ft/s	45.16 ft/s
Maximum Rise Time:	90 msec	86.9 msec
Minimum Velocity Change Before Greq:	22 ft/s	23.22 ft/s



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Doc. No.: CDL-FA14C-04-01

Version: New

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Test: FA14C-04

Test Description:
14 CFR 25.562 Test 2

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16g-04

Rate: 10000
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Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Comments:

Rigid Seat Seat Back Fx

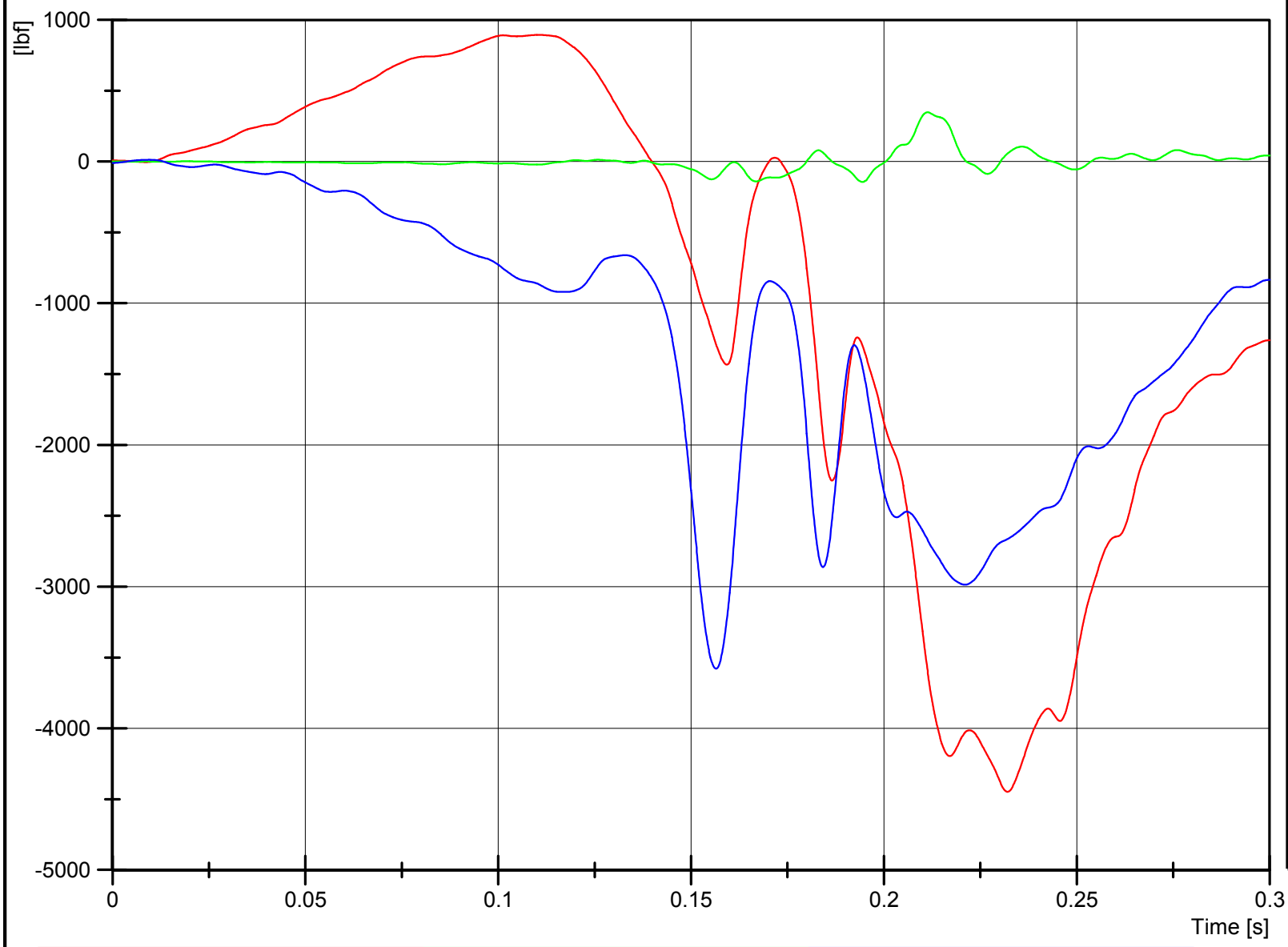
Maximum: 864.61 lbf Time: 0.1031 sec.
Minimum: -12.88 lbf Time: 0.0092 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FZ
Sensitivity: 1.187E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 12
Ref. No.: 15
Polarity: N

Rigid Seat Seat Back Fy

Maximum: 81.4004 lbf Time: 0.194 sec.
Minimum: -93.95 lbf Time: 0.2026 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FY
Sensitivity: 2.769E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 11
Ref. No.: 14
Polarity: N

Rigid Seat Seat Back Fz

Maximum: 112.90 lbf Time: 0.1985 sec.
Minimum: -154.13 lbf Time: 0.0754 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FX
Sensitivity: 2.765E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 10
Ref. No.: 13
Polarity: R



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Test Description:
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Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Comments:

Rigid Seat Seat Pan Fx

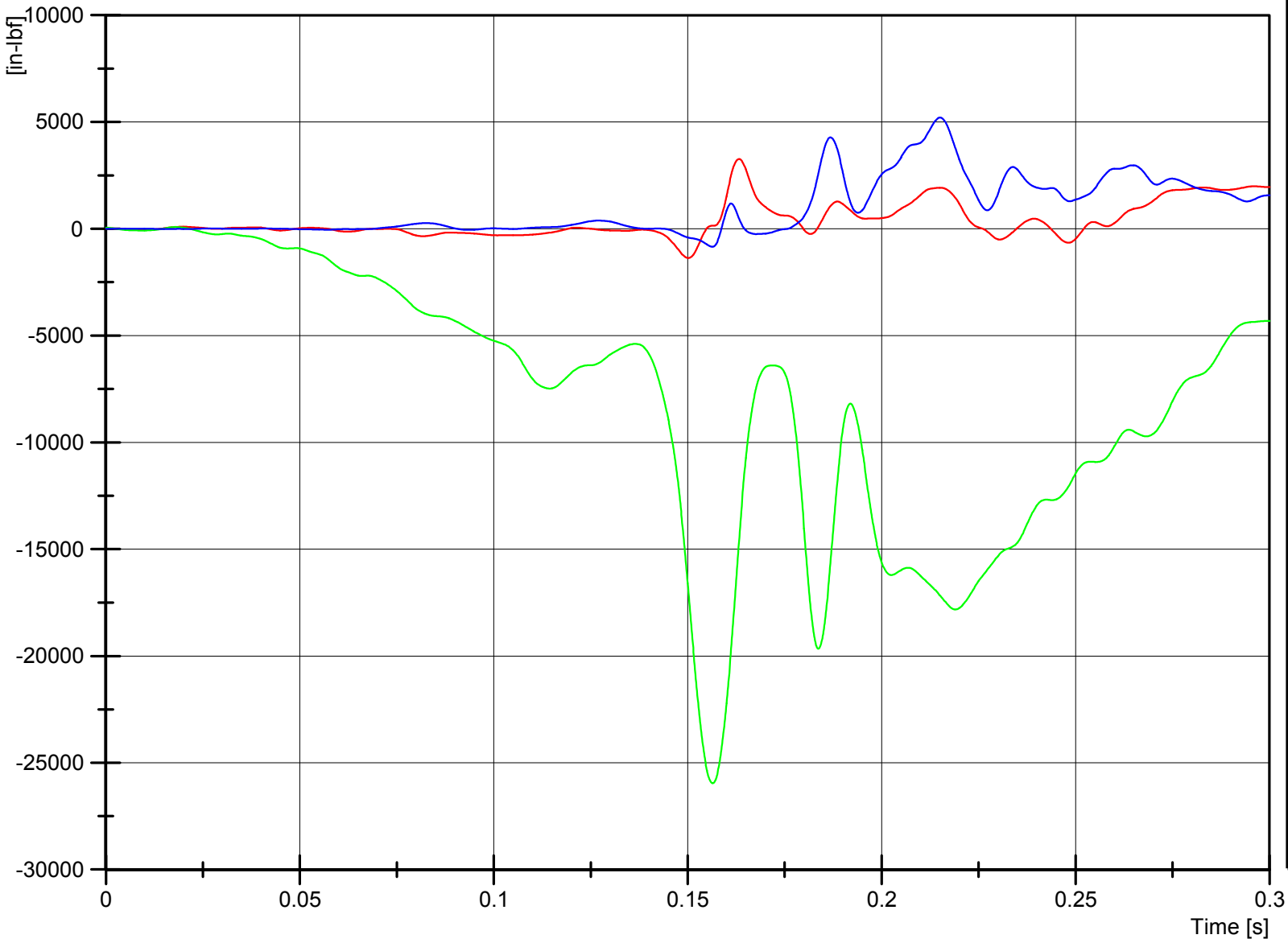
Maximum: 895.13 lbf Time: 0.1107 sec.
Minimum: -4.45E+03 lbf Time: 0.2322 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FX
Sensitivity: 2.848E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 13
Ref. No.: 10
Polarity: N

Rigid Seat Seat Pan Fy

Maximum: 349.15 lbf Time: 0.2115 sec.
Minimum: -144.48 lbf Time: 0.1946 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FY
Sensitivity: 2.846E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 14
Ref. No.: 11
Polarity: N

Rigid Seat Seat Pan Fz

Maximum: 12.0893 lbf Time: 0.0096 sec.
Minimum: -3.58E+03 lbf Time: 0.1567 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FZ
Sensitivity: 1.205E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 15
Ref. No.: 12
Polarity: N



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Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Comments:

Rigid Seat Seat Pan Mx

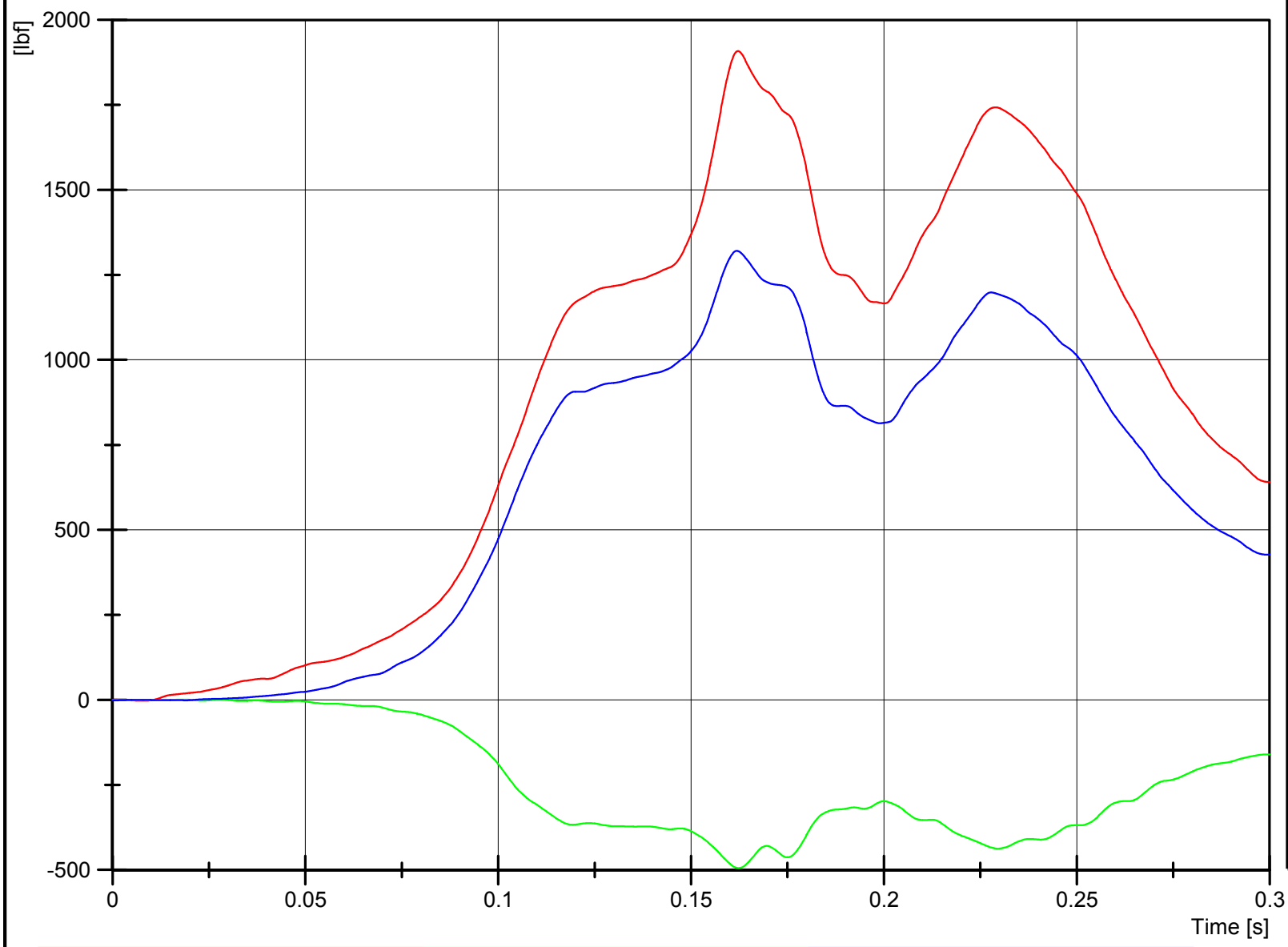
Maximum: 3262.71 in-lbf Time: 0.1634 sec.
Minimum: -1.37E+03 in-lbf Time: 0.1504 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MX
Sensitivity: 7.104E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 25000 in-lbf
DAS Channel: 16
Ref. No.: 7
Polarity: N

Rigid Seat Seat Pan My

Maximum: 80.3088 in-lbf Time: 0.018 sec.
Minimum: -2.60E+04 in-lbf Time: 0.1566 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MY
Sensitivity: 7.112E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 25000 in-lbf
DAS Channel: 17
Ref. No.: 8
Polarity: N

Rigid Seat Seat Pan Mz

Maximum: 5210.44 in-lbf Time: 0.2153 sec.
Minimum: -843.26 in-lbf Time: 0.1565 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MZ
Sensitivity: 9.38E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 20000 in-lbf
DAS Channel: 18
Ref. No.: 9
Polarity: R



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National Institute for Aviation Research
1845 N. Fairmount St.
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Tel: (316) 978-5239
Fax: (316) 978-3175
www.niar.wichita.edu

Doc. No.: CDL-FA14C-04-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-04

Dummy: H2 718

Position: Config 4 - Repaired Belt (#3)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Rigid Seat Right Lap Fx

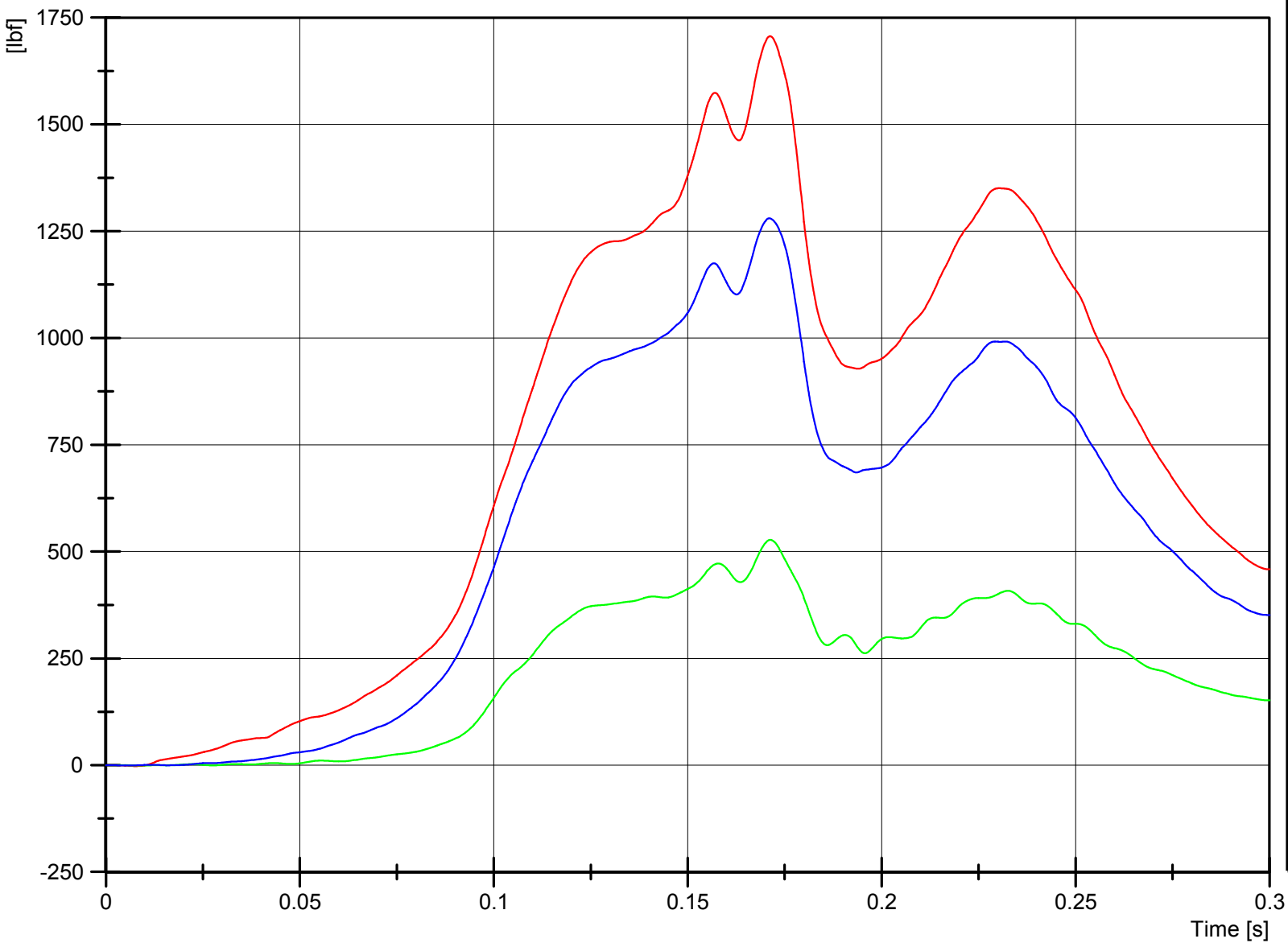
Maximum: 1908.14 lbf Time: 0.1624 sec.
Minimum: -2.2011 lbf Time: 0.008 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FX
Sensitivity: 2.6022E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 19
Ref. No.: 74
Polarity: N

Rigid Seat Right Lap Fy

Maximum: 1.4036 lbf Time: 0.0282 sec.
Minimum: -494.16 lbf Time: 0.1625 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FY
Sensitivity: 2.5935E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 20
Ref. No.: 75
Polarity: N

Rigid Seat Right Lap Fz

Maximum: 1320.55 lbf Time: 0.1621 sec.
Minimum: -1.3462 lbf Time: 0 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FZ
Sensitivity: 1.088E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 21
Ref. No.: 76
Polarity: N



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Doc. No.: CDL-FA14C-04-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-04

Dummy: H2 718

Position: Config 4 - Repaired Belt (#3)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Rigid Seat Left Lap Fx

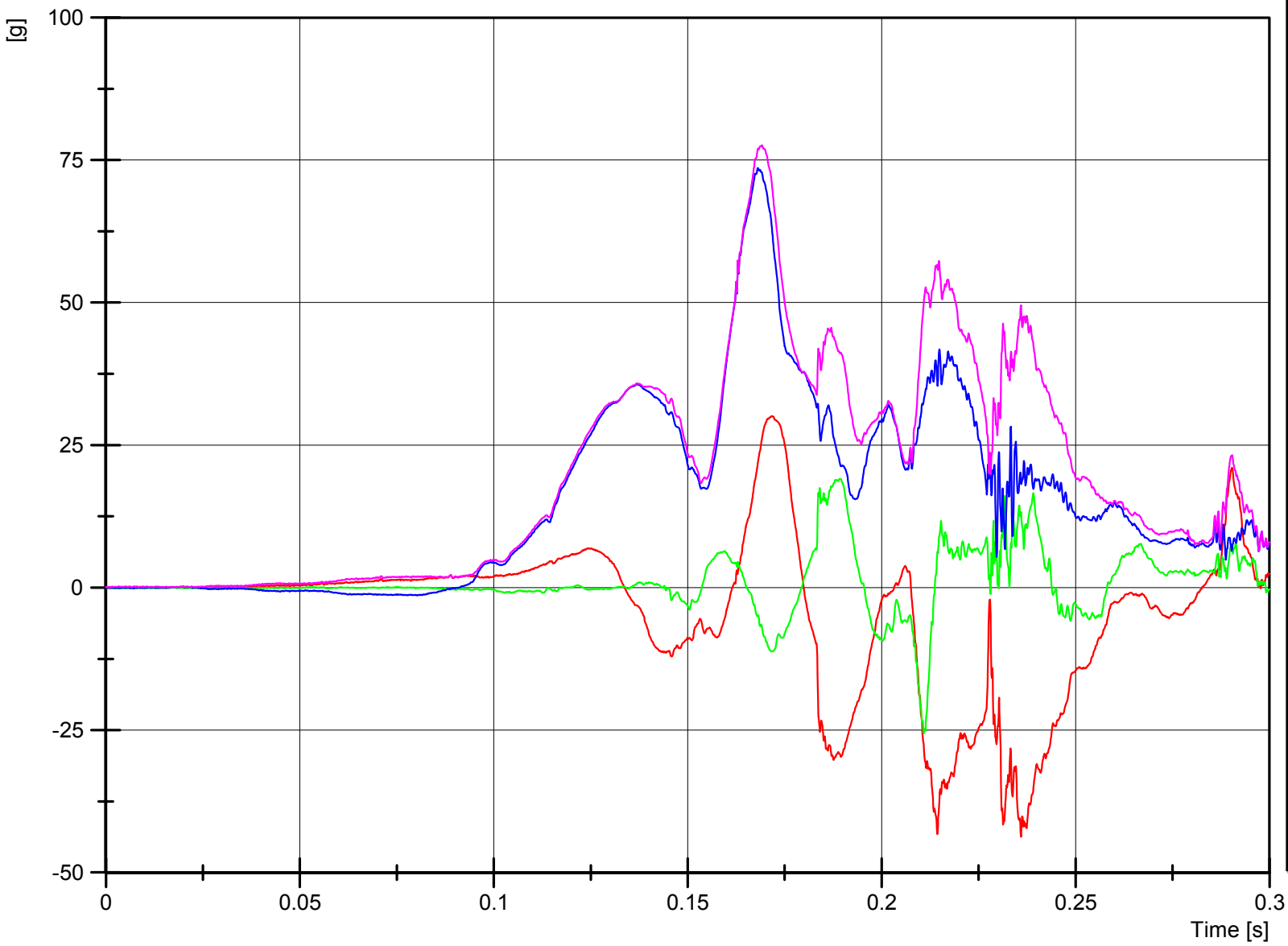
Maximum: 1706.17 lbf Time: 0.1715 sec.
Minimum: -2.0522 lbf Time: 0.0079 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FX
Sensitivity: 2.608E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 22
Ref. No.: 77
Polarity: N

Rigid Seat Left Lap Fy

Maximum: 527.35 lbf Time: 0.1715 sec.
Minimum: -0.4591 lbf Time: 0.0085 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FY
Sensitivity: 2.606E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 23
Ref. No.: 78
Polarity: N

Rigid Seat Left Lap Fz

Maximum: 1280.07 lbf Time: 0.1713 sec.
Minimum: -0.4136 lbf Time: 0.0068 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FZ
Sensitivity: 1.087E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 24
Ref. No.: 79
Polarity: N



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Crash Dynamics Lab

National Institute for Aviation Research
1845 N. Fairmount St.
Wichita, Kansas 67260-0093
Tel: (316) 978-5239
Fax: (316) 978-3175
www.niar.wichita.edu

Doc. No.: CDL-FA14C-04-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-04

Dummy: H2 699

Position: Config 4 - Repaired Belt (#3)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Head Ax H2 699

Maximum: 30.0965 g Time: 0.1719 sec.
Minimum: -43.71 g Time: 0.2361 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P45436
Sensitivity: 1.823E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 25
Ref. No.: 22
Polarity: R

Head Ay H2 699

Maximum: 19.0975 g Time: 0.1893 sec.
Minimum: -25.57 g Time: 0.211 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P47924
Sensitivity: 1.863E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 26
Ref. No.: 23
Polarity: R

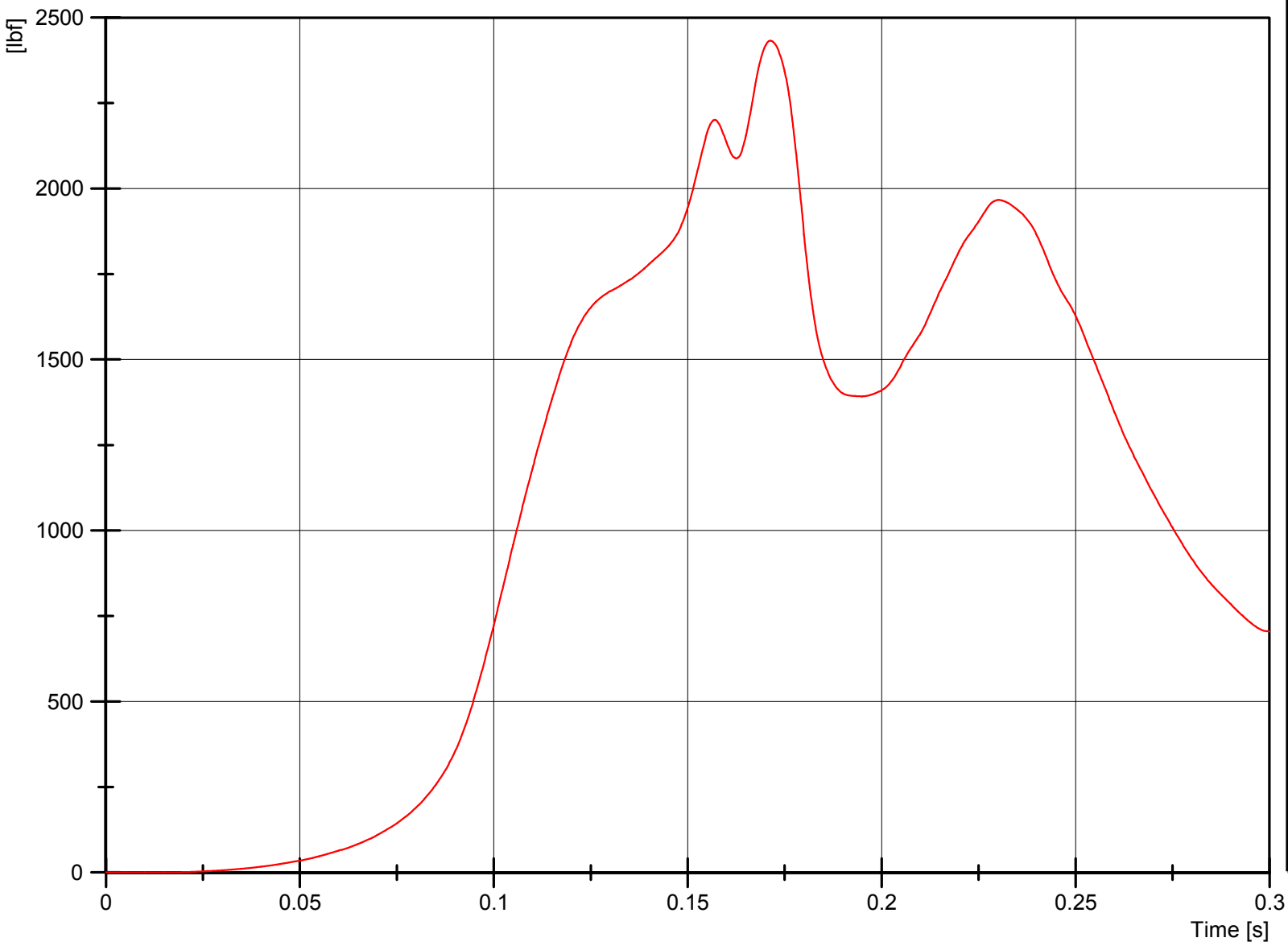
Head Az H2 699

Maximum: 73.6483 g Time: 0.1683 sec.
Minimum: -1.3678 g Time: 0.078 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P48250
Sensitivity: 1.827E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 27
Ref. No.: 24
Polarity: R

Head Resultant H2 699

Maximum: 77.64 g Time: 0.1691 sec.

HIC: 1152.2
T1: 121.2 msec.
T2: 248.4 msec.



Lap Belt Force H2 699

Maximum: 2432.43 lbf
Minimum: 0.0535 lbf
CFC: 60
Sensor Type: Denton 3255
S/N: SBLC259
Sensitivity: 6.0647E-07 V/EU
Cal. Due: 10/17/2014
Full Scale: 3000 lbf
DAS Channel: 31
Ref. No.: 17
Polarity: N

Time: 0.1715 sec.
Time: 0 sec.

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Doc. No.: CDL-FA14C-04-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-04

Dummy: H2 699

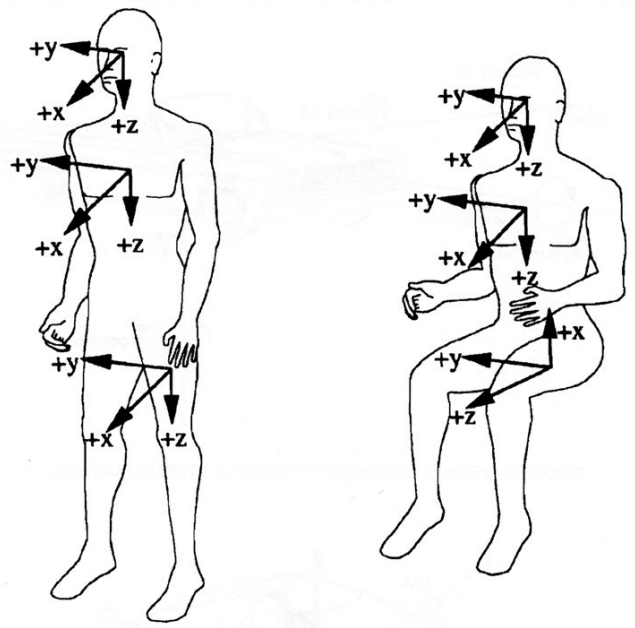
Position: Config 4 - Repaired Belt (#3)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

J211/1 Sign Conventions



Upper Neck Load Cell:
+FX Head rearward, chest forward
+FY Head leftward, chest rightward
+FZ Head upward, chest downward
+MX Left ear toward left shoulder
+MY Chin toward sternum
+MZ Chin toward left shoulder

Lumbar Load Cell:
+FX Chest rearward, pelvis forward
+FY Chest leftward, pelvis rightward
+FZ Chest upward, pelvis downward
+MX Left shoulder toward left hip
+MY Sternum toward front of legs
+MZ Right shoulder forward, left shoulder rearward

Femur Load Cells:
+FZ Tension

Chest Displacement:
-DX Compression

Rib Dispacement:
-DY Compression

Belt Load Cells:
+FX Tension

Floor Load Cells:
+FX Test article forward
+FY Test article right
+FZ Test article up

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National Institute for Aviation Research
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Doc. No.: CDL-FA14C-04-01

Version: New

Report Date: 05/06/2014

Customer: FAA

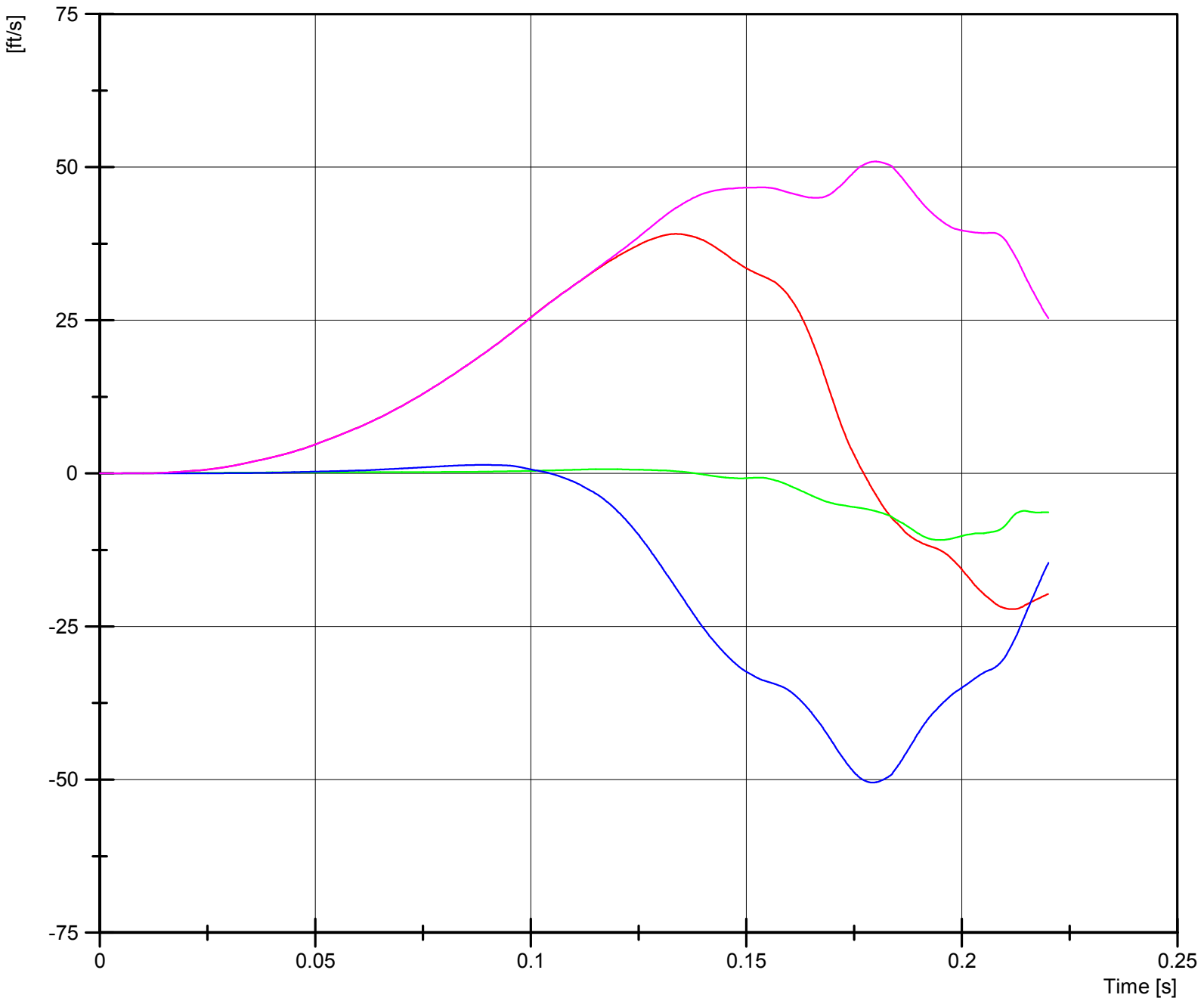
Test: FA14C-04

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Comments:



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Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-04

Dummy: H2 699

Position: Config 4 - Repaired Belt (#

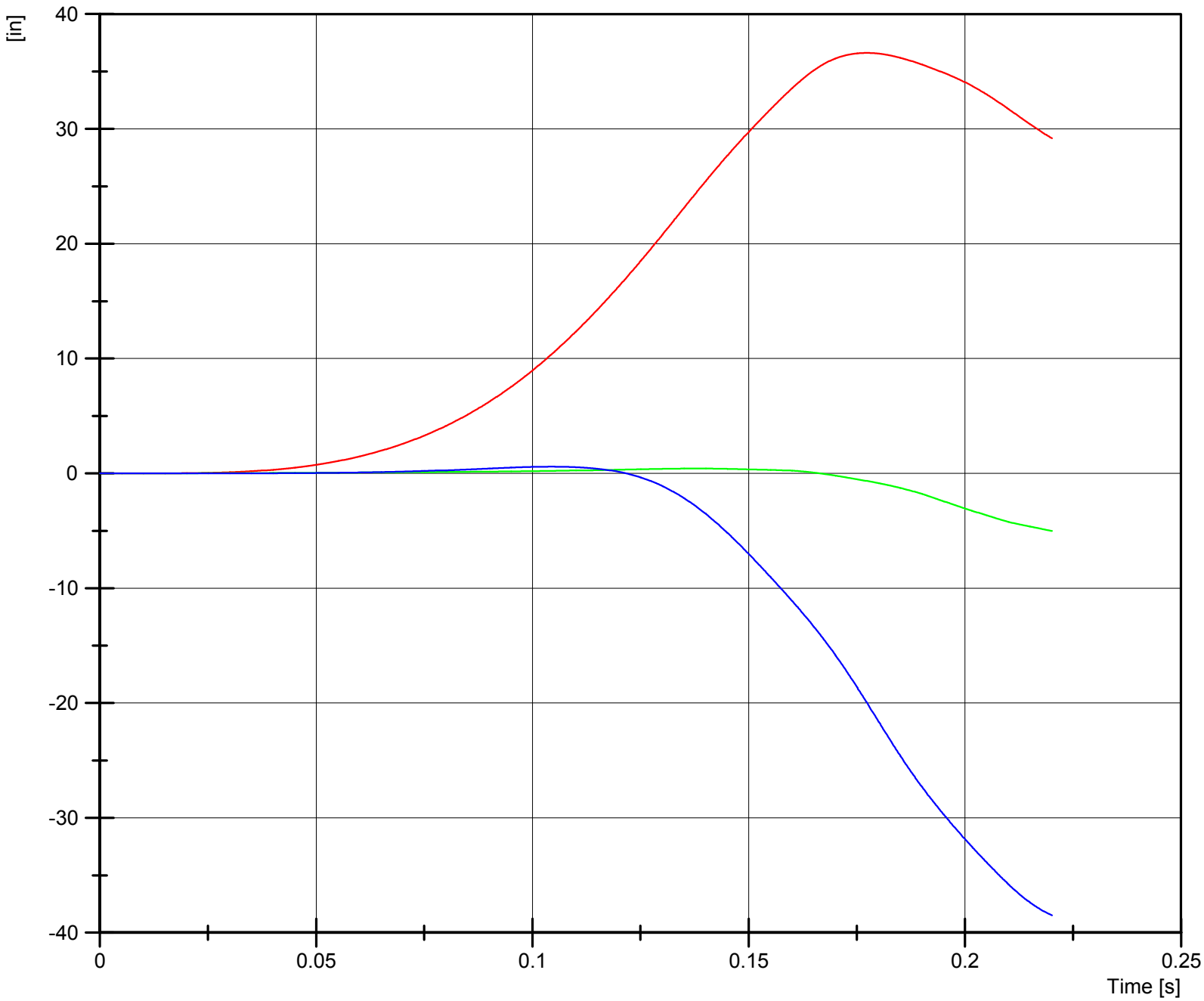
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Comments:

Global Head Vx H2 699		Global Head Vy H2 699		Global Head Vz H2 699		Global Head Velocity Resultant H2 699	
Maximum: 39.09 ft/s	Time: 0.1337 sec.	Maximum: 0.709 ft/s	Time: 0.1171 sec.	Maximum: 1.38 ft/s	Time: 0.0889 sec.	Maximum: 50.91 ft/s	Time: 0.1799 sec.
Minimum: -22.17 ft/s	Time: 0.2119 sec.	Minimum: -10.86 ft/s	Time: 0.1946 sec.	Minimum: -50.47 ft/s	Time: 0.1793 sec.	Minimum: 0 ft/s	Time: 0.0001 sec.



Global Head Dx H2 699 | Global Head Dy H2 699 | Global Head Dz H2 699

Maximum: 36.61 in	Time: 0.1773 sec.	Maximum: 0.43 in	Time: 0.1381 sec.	Maximum: 0.59 in	Time: 0.1044 sec.
Minimum: 0.00 in	Time: 0.0001 sec.	Minimum: -5.01 in	Time: 0.2201 sec.	Minimum: -38.48 in	Time: 0.2201 sec.

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Doc. No.: CDL-FA14C-04-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-04

Dummy: H2 699

Position: Config 4 - Repaired Belt (#

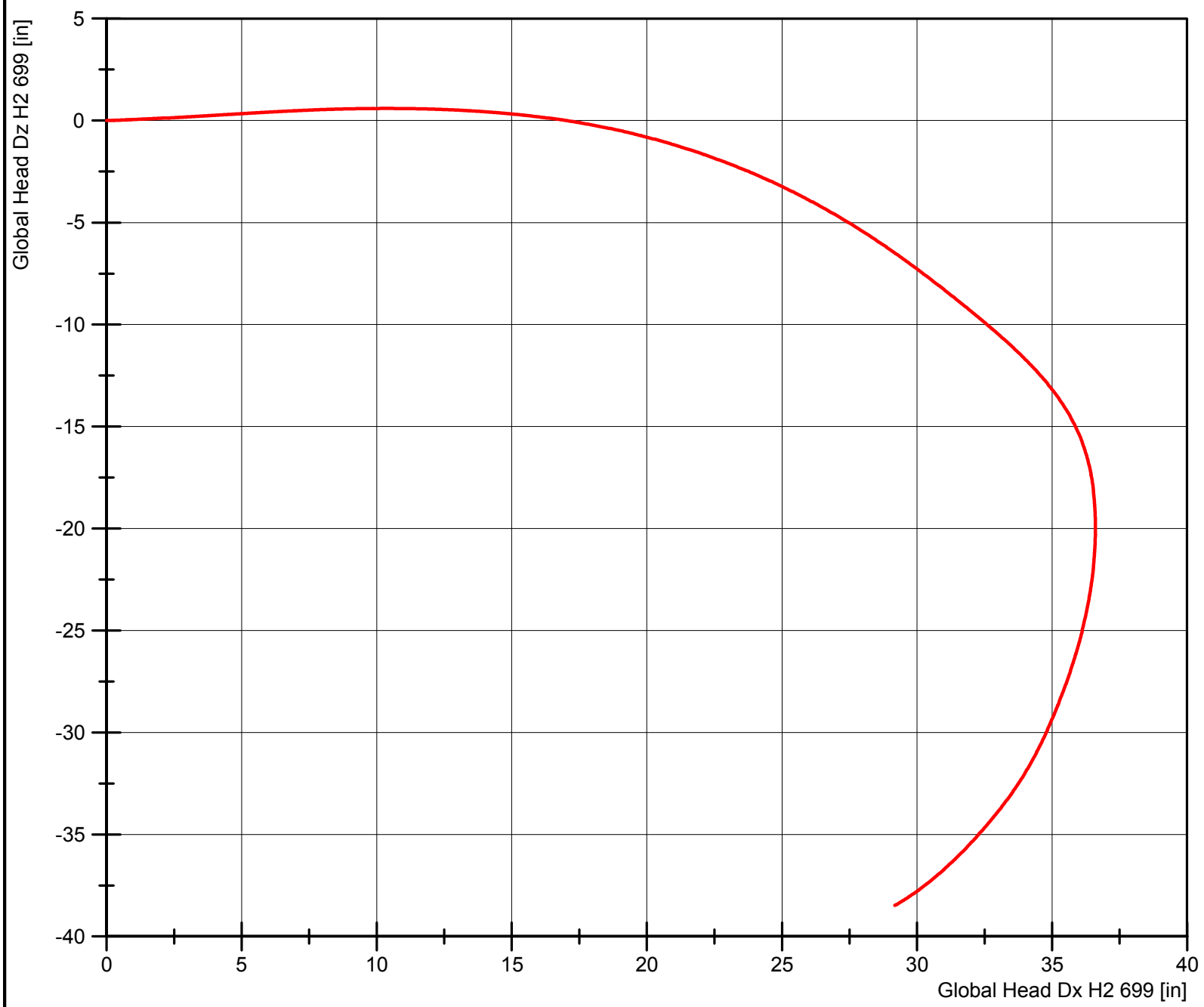
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Comments:

Displacement values are calculated from Head Accelerations and Angular Velocities.
This method cannot be used to substitute photometric analysis.



Global Head Displacement XZ

X Maximum: 36.61 in **Time: 0.1773 sec.**

Z Value at X Maximum: -19.94 in

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Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-04

Dummy: H2 699

Position: Config 4 - Repaired Belt (#

Test Description:
14 CFR 25.562 Test 2

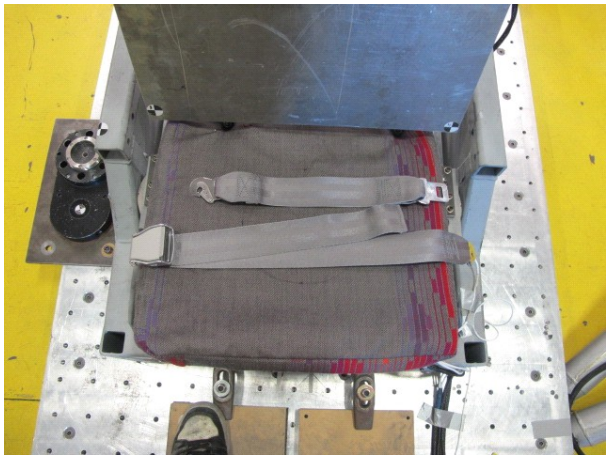
Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Comments:

Displacement values are calculated from Head Accelerations and Angular Velocities.
This method cannot be used to substitute photometric analysis.

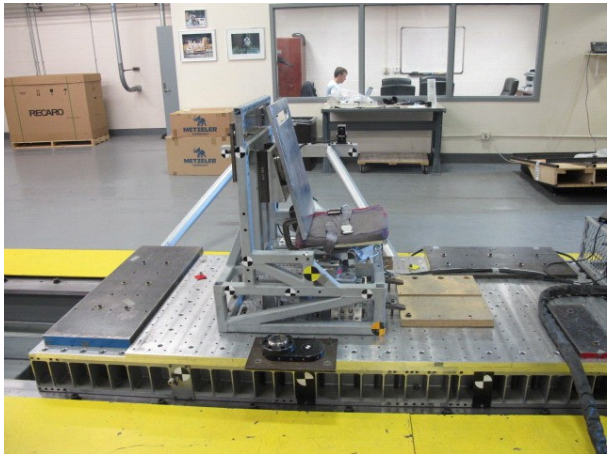
Pre-test Photos

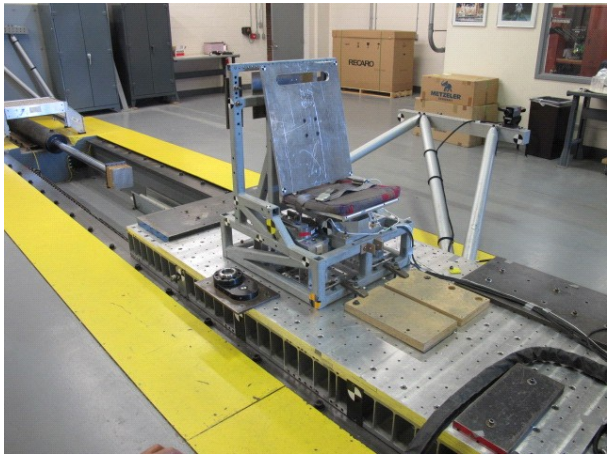


NA

NA







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Report Date: 05/06/2014

Customer: FAA

Test: FA14C-04

Dummy: N/A

Position: N/A

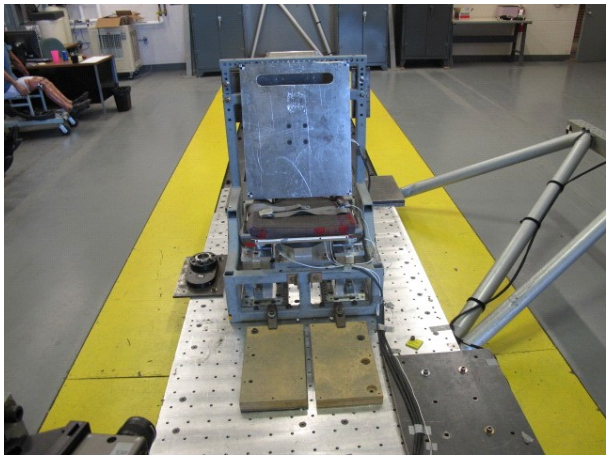
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14 CFR 25.562 Test 2

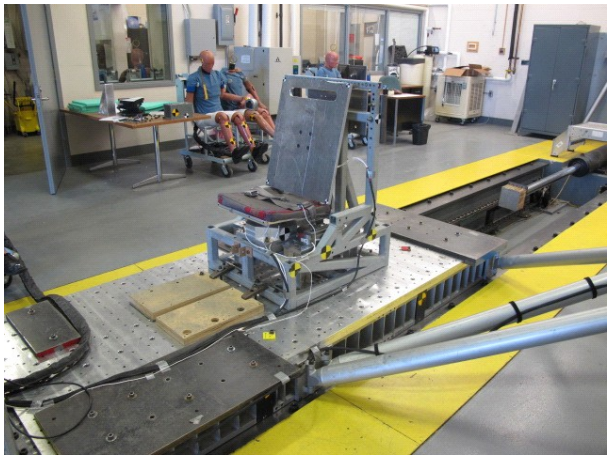
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16g-04

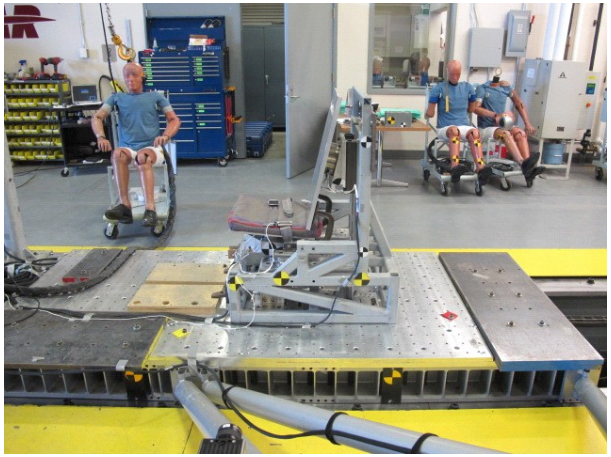
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Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

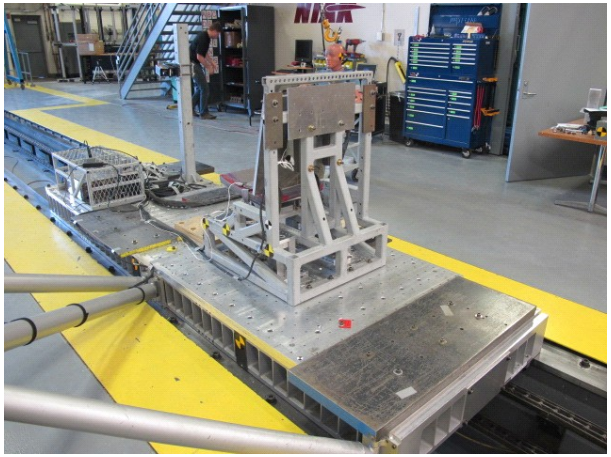
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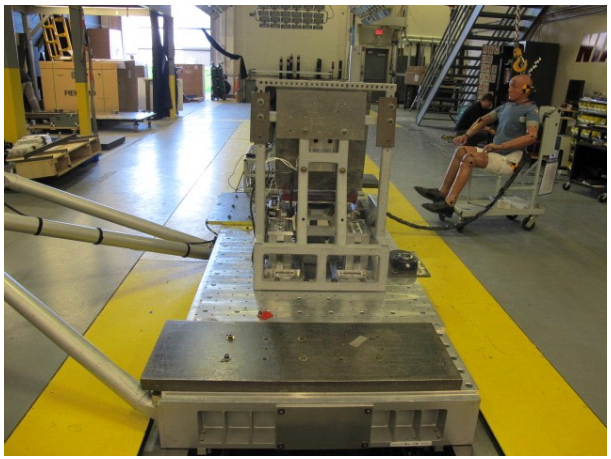
Pre-test Photos













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Report Date: 05/06/2014

Customer: FAA

Test: FA14C-04

Dummy: N/A

Position: N/A

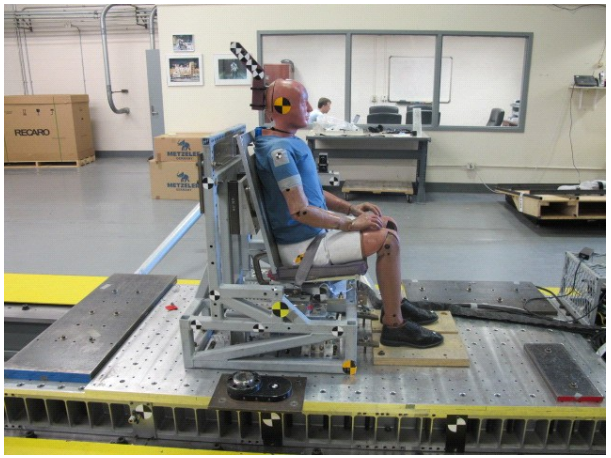
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

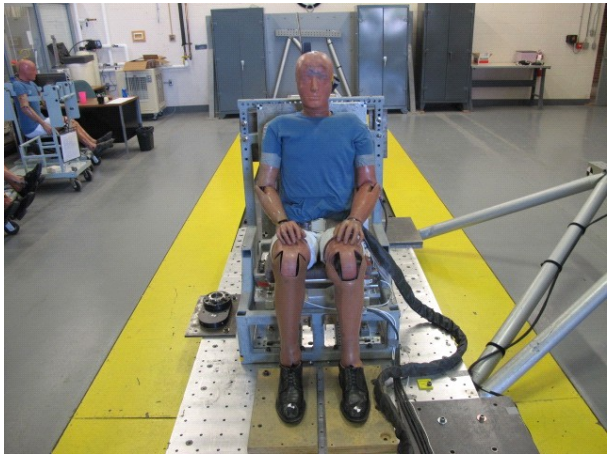
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Test Date/Time: 05/06/2014 09:39

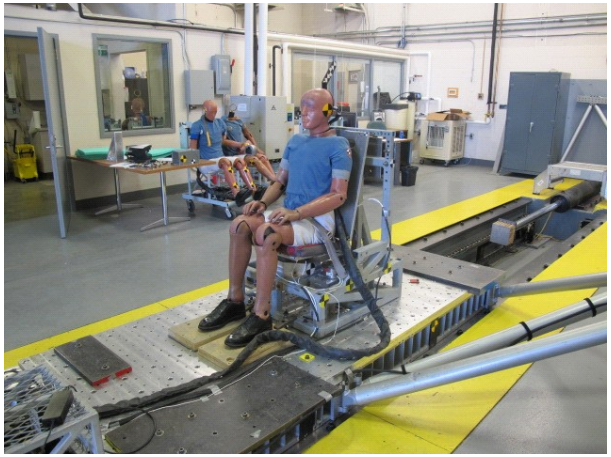
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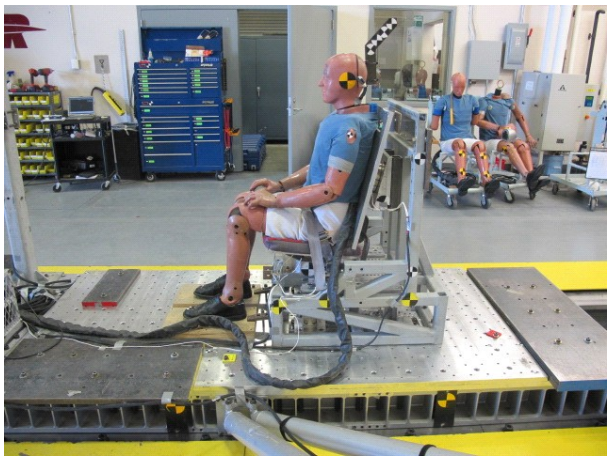
Pre-test Photos













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Dummy: N/A

Position: N/A

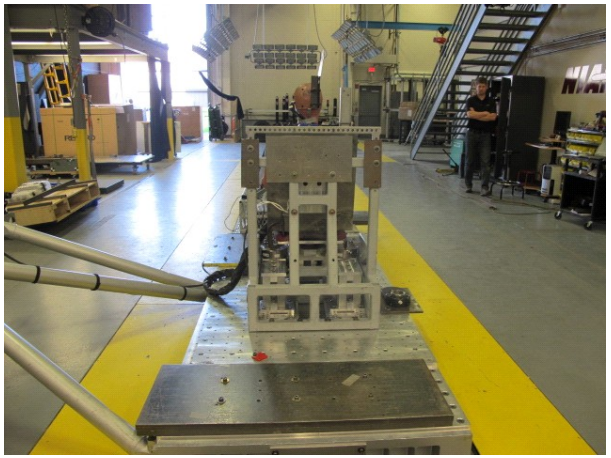
Test Description:
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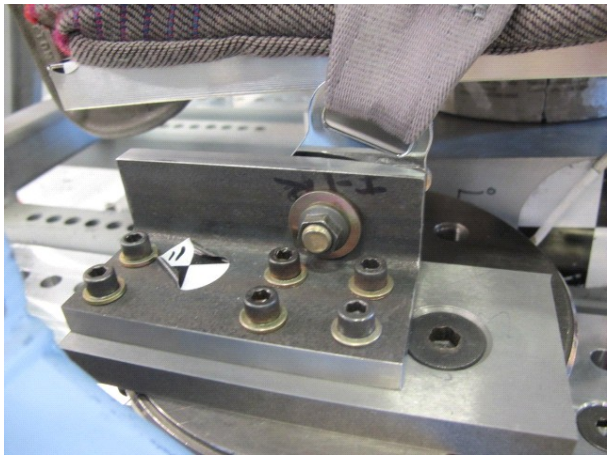
Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Comments:

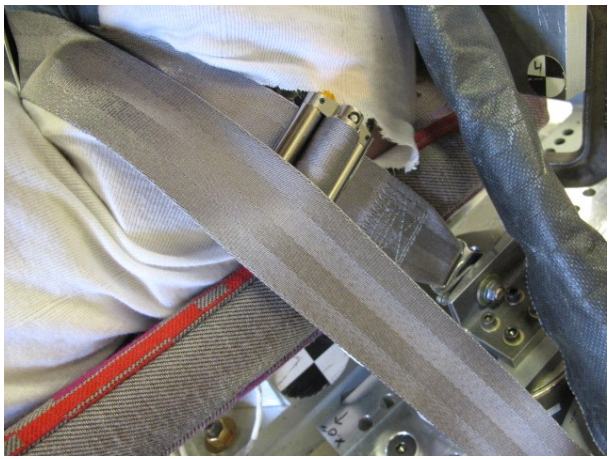
Pre-test Photos

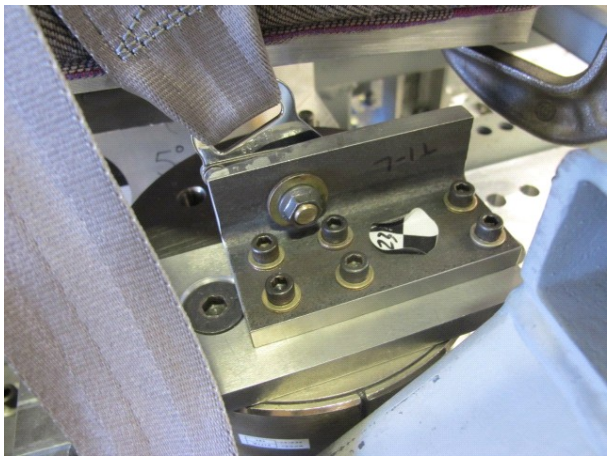












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Dummy: N/A

Position: N/A

Test Description:
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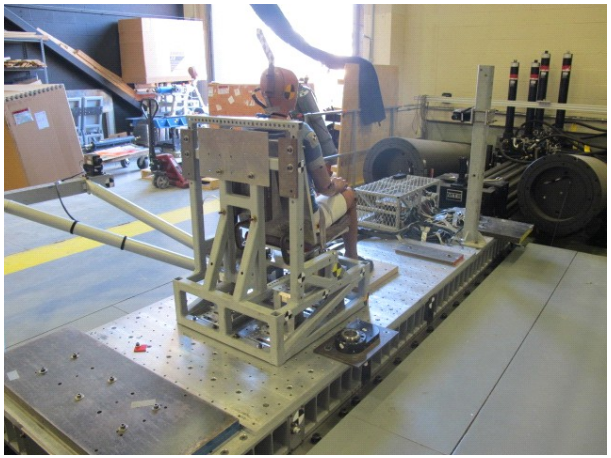
Pulse Name:
16g-04

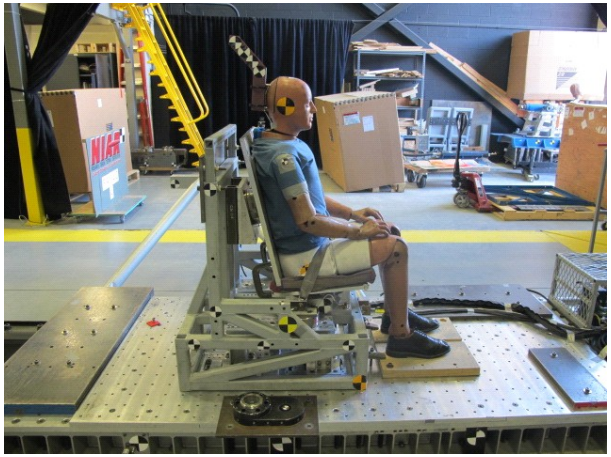
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Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

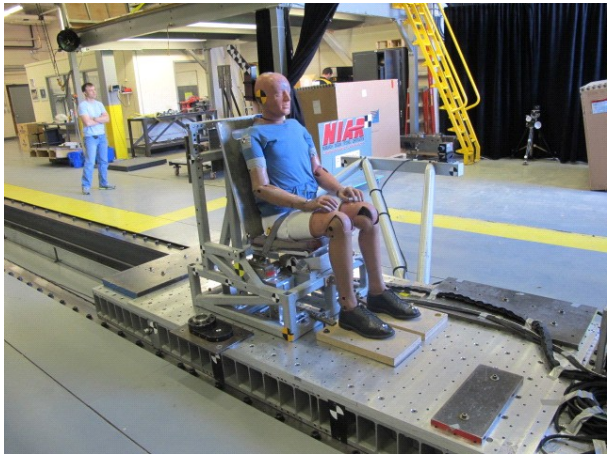
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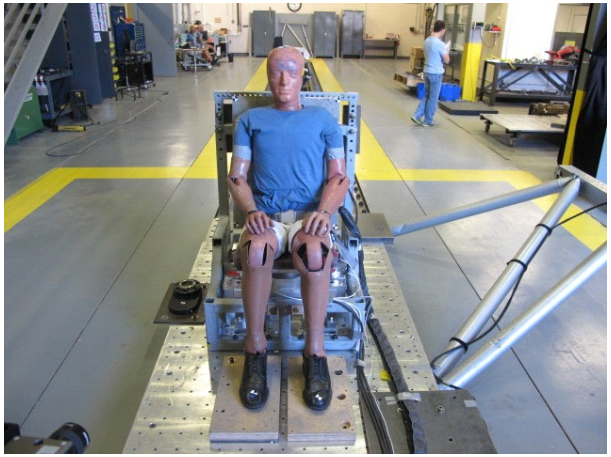
Pre-test Photos













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Doc. No.: CDL-FA14C-04-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-04

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

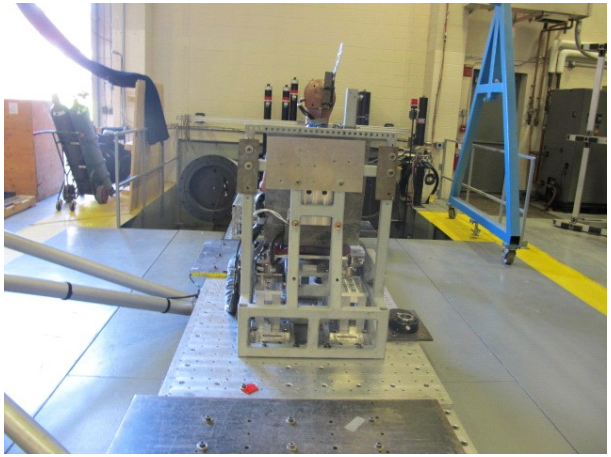
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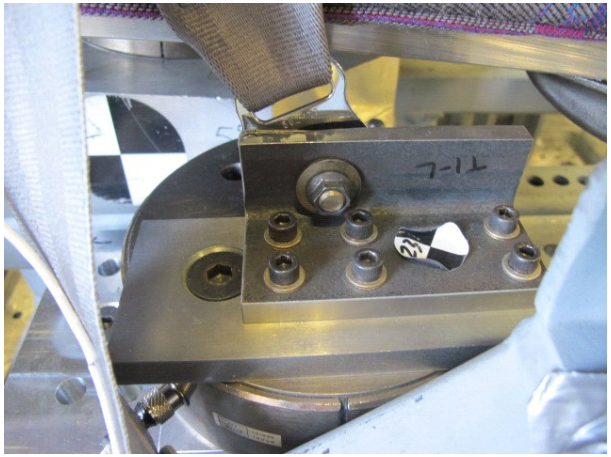
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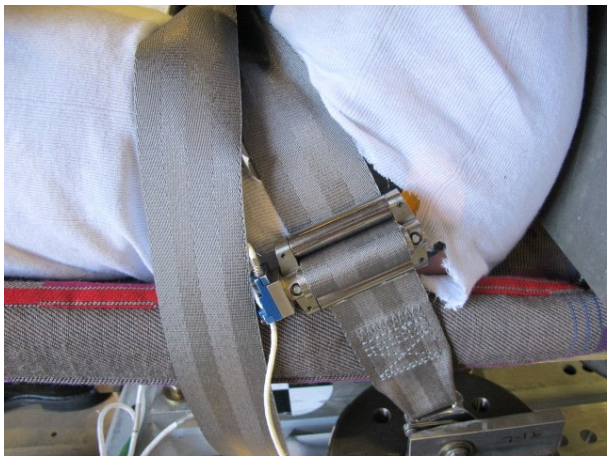
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Dummy: N/A

Position: N/A

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14 CFR 25.562 Test 2

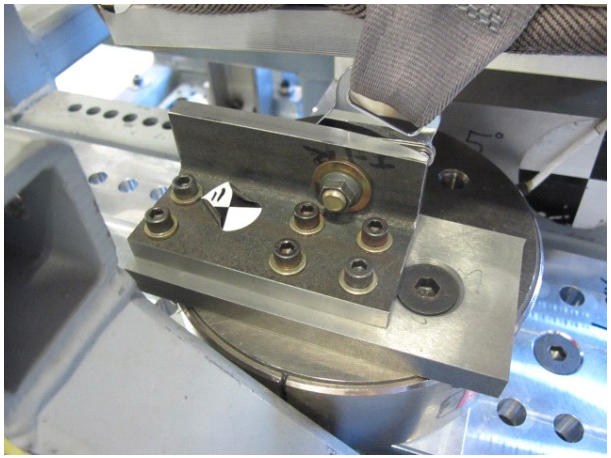
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16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

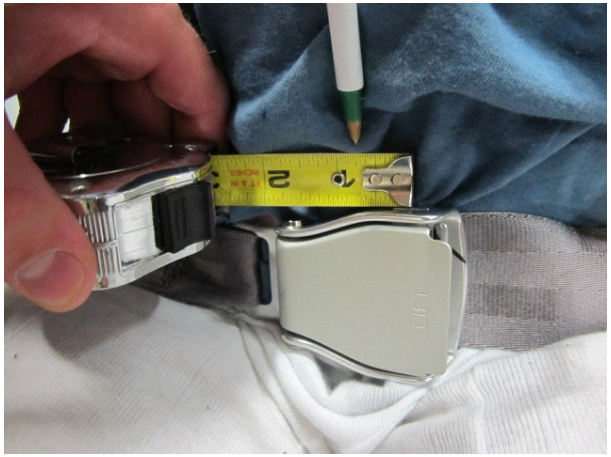
Comments:

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Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

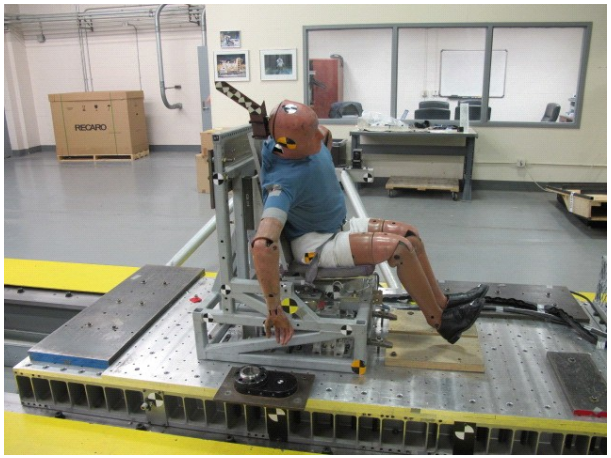
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16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

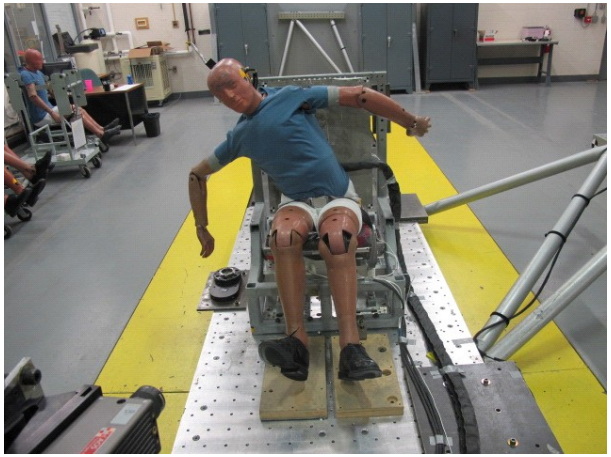
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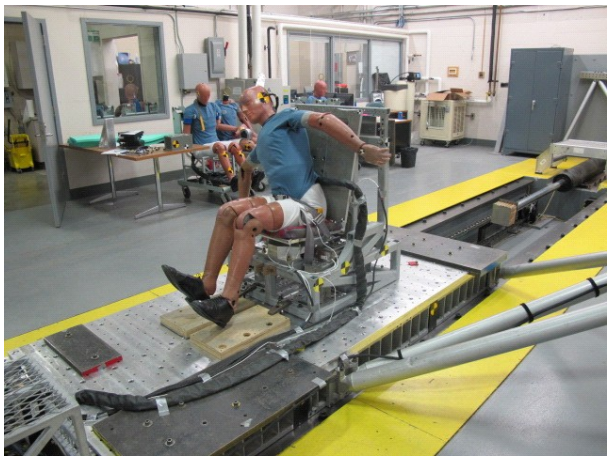
Post-test Photos

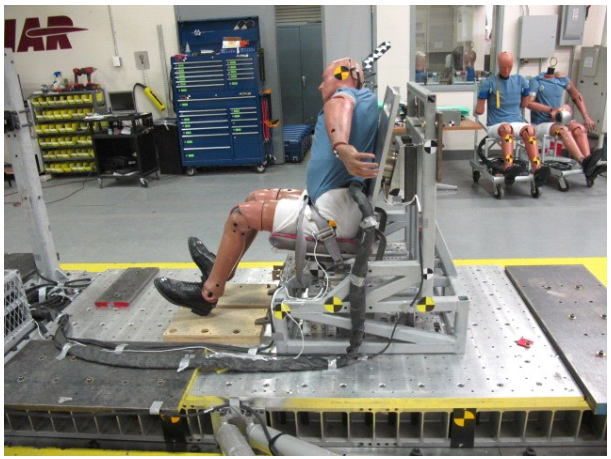












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Dummy: N/A

Position: N/A

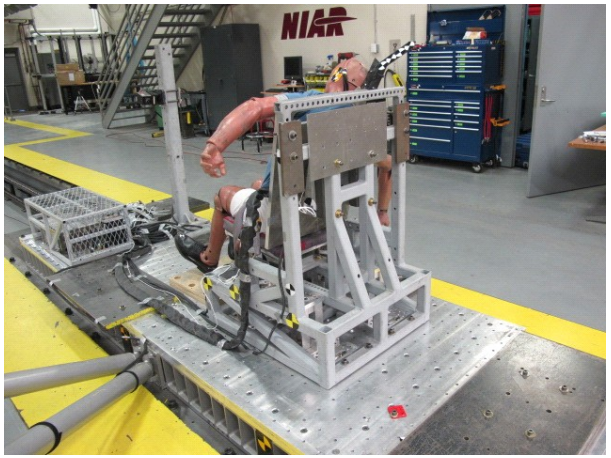
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14 CFR 25.562 Test 2

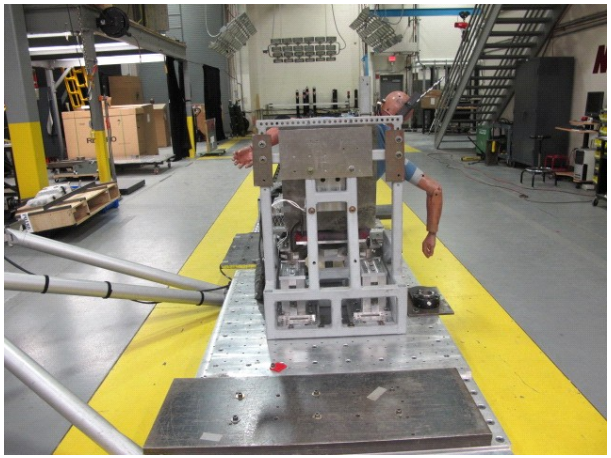
Pulse Name:
16g-04

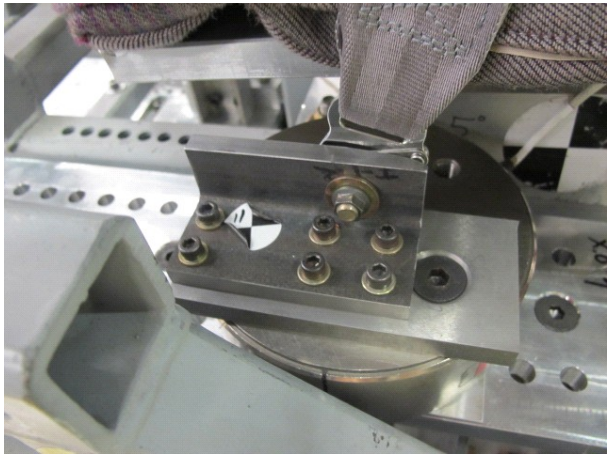
Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Comments:

Post-test Photos













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Customer: FAA

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Position: N/A

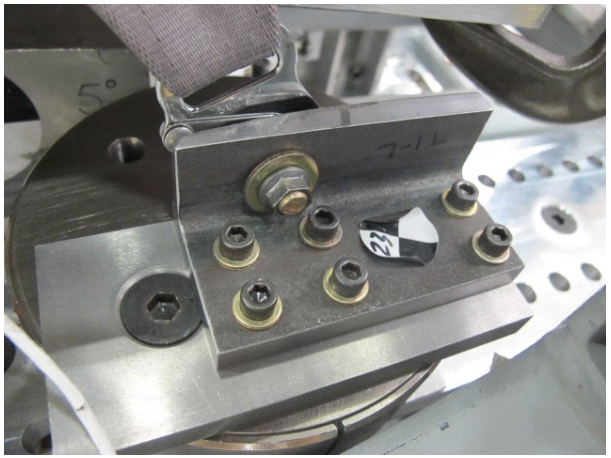
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14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
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Rev.: Impax-SD 6.02 Rev A12t
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Comments:

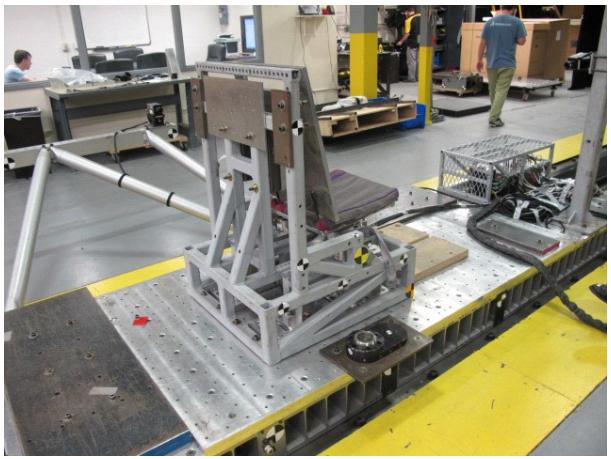
Post-test Photos

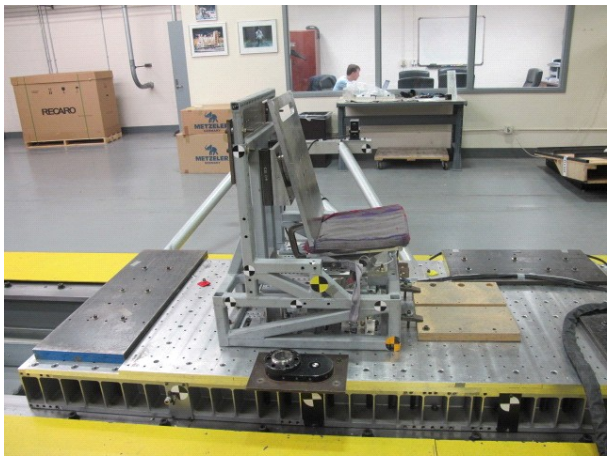












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Customer: FAA

Test: FA14C-04

Dummy: N/A

Position: N/A

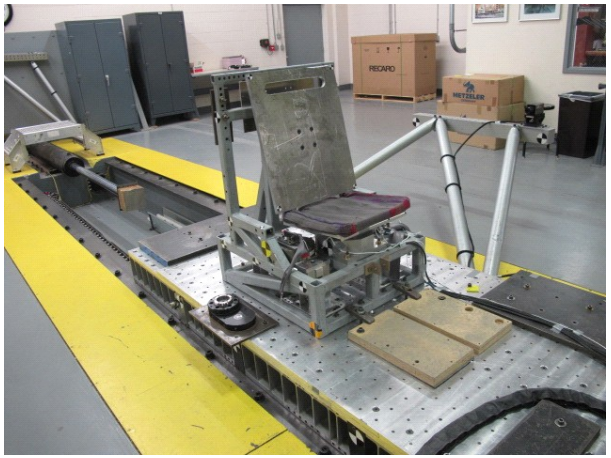
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14 CFR 25.562 Test 2

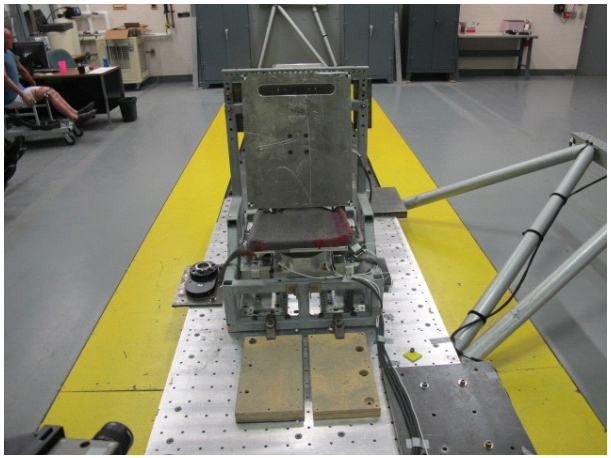
Pulse Name:
16g-04

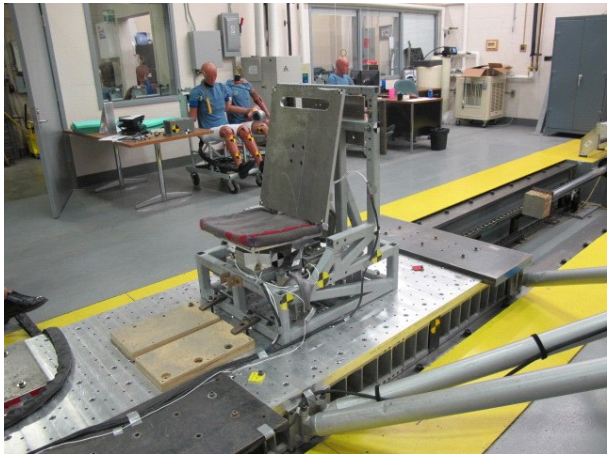
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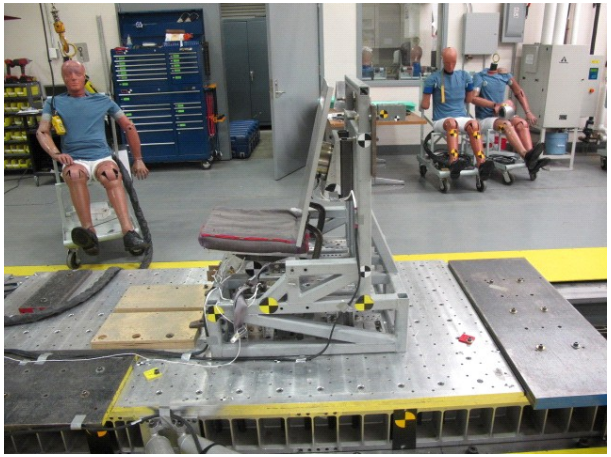
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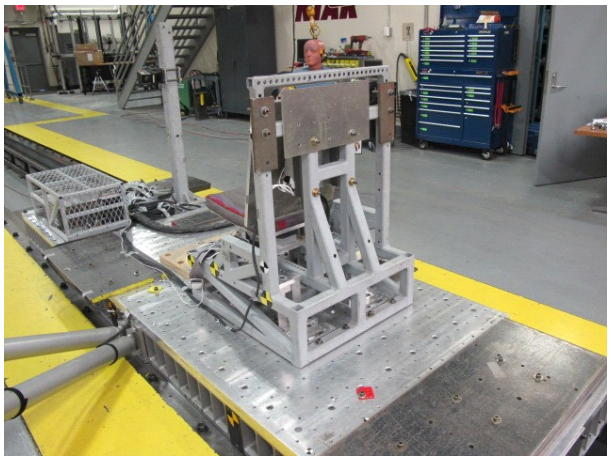
Post-test Photos

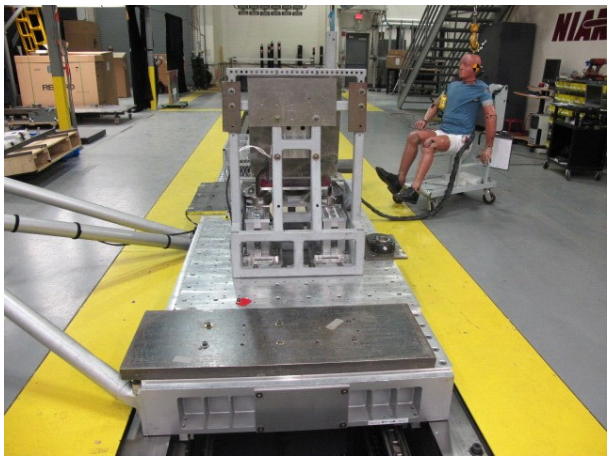












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Doc. No.: CDL-FA14C-04-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-04

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 09:39

Comments:

Post-test Photos







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Comments:

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Crash Dynamics Lab

Report No. CDL-FA14C-05-01

Requested by:

FAA

Final Test Report FA14C-05

05/06/2014

Revision	Change	Date	Revised By
New		05/06/2014	Rob Huculak

Prepared and Reviewed by:

Rob Huculak
Laboratory Manager

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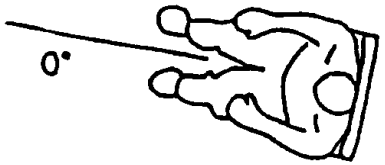
This test report is in accordance with ISO/IEC 17025:2005 requirements and all equipment standards used are traceable to the National Institute of Standards and Technology.
The information in this report relates only to the article under test and cannot be reproduced, except in full, without the written approval of the National Institute for Aviation Research.

Test Summary

The dynamic test (FA14C-05) was performed for FAA in accordance with 14 CFR 25.562 Test 2 on 05/06/2014.

Pulse Parameters	Required	Result	Pass/Fail
Minimum Peak Acceleration (g)	16	16.37	PASS
Minimum Velocity Change (ft/sec)	44	45.39	PASS
Maximum Rise Time (msec)	90	88.4	PASS
Minimum Velocity Change During Rise Time (ft/sec)	22	22.63	PASS
2g Offset	--	--	PASS

Test Orientation



ATD: H2 699 **Position: Config 4 - Repaired Belt (#4)**

0 deg

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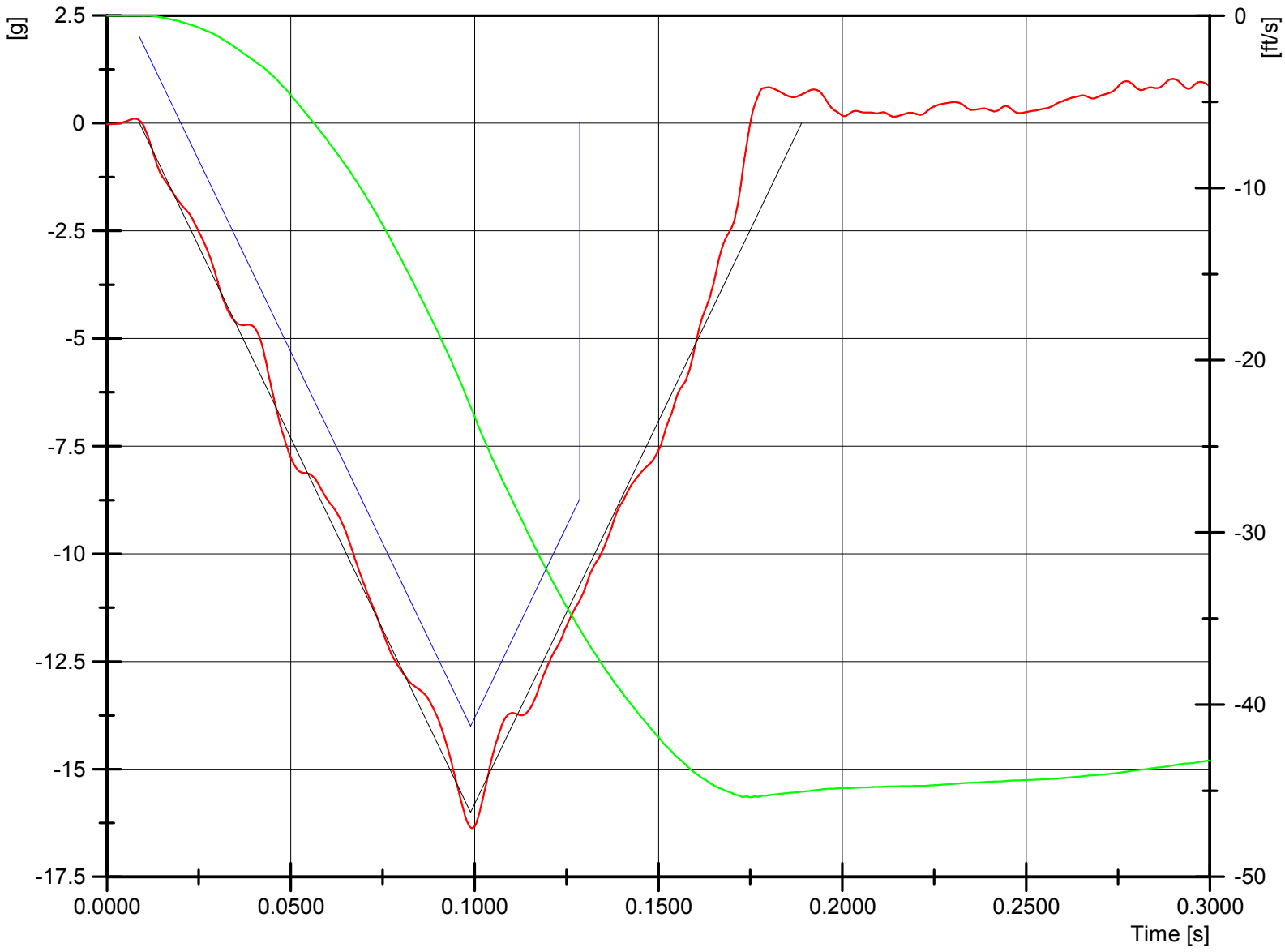
Test: FA14C-05

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

Temperature	Relative Humidity
72.6°F	37.9%



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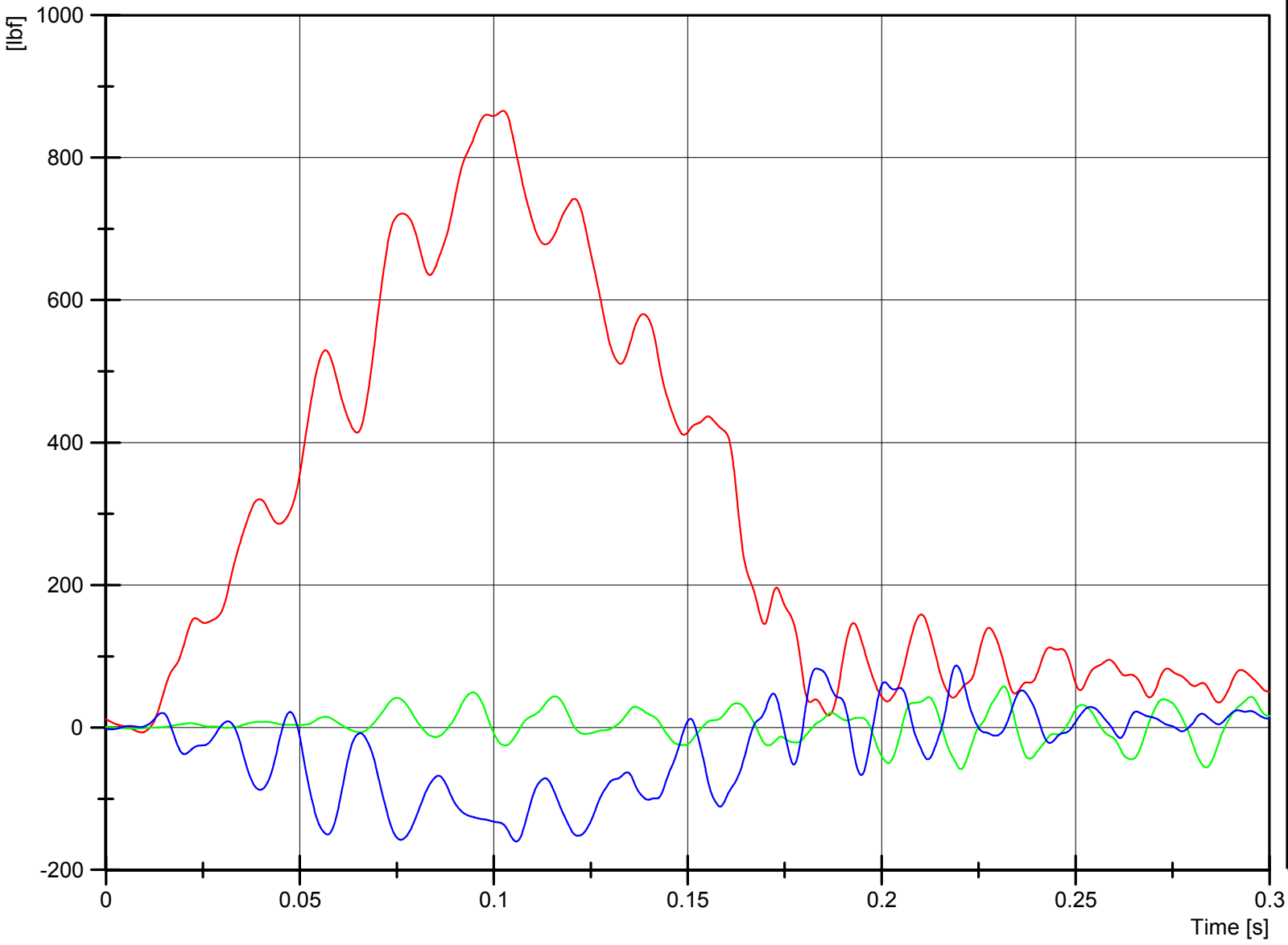
Comments:

Sled Acceleration | Sled Velocity | Ideal Pulse | Upper Limit

Maximum: 1.03 g Time: 0.2898 sec.
Minimum: -16.37 g Time: 0.0994 sec.
CFC: 60
Sensor Type: ENDEVCO 7290A-100
S/N: 29924
Sensitivity: 0.01912 V/EU
Cal. Due: 01/07/2015
Full Scale: 100 g
DAS Channel: 50
Ref. No.: 1
Polarity: R

Minimum: -45.39 ft/s Time: 0.175 sec.

Pulse Requirement		Actual
Minimum Required Peak Acceleration:	16 g	16.37 g
Minimum Overall Velocity Change:	44 ft/s	45.39 ft/s
Maximum Rise Time:	90 msec	88.4 msec
Minimum Velocity Change Before Greq:	22 ft/s	22.63 ft/s



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Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

Comments:

Rigid Seat Seat Back Fx

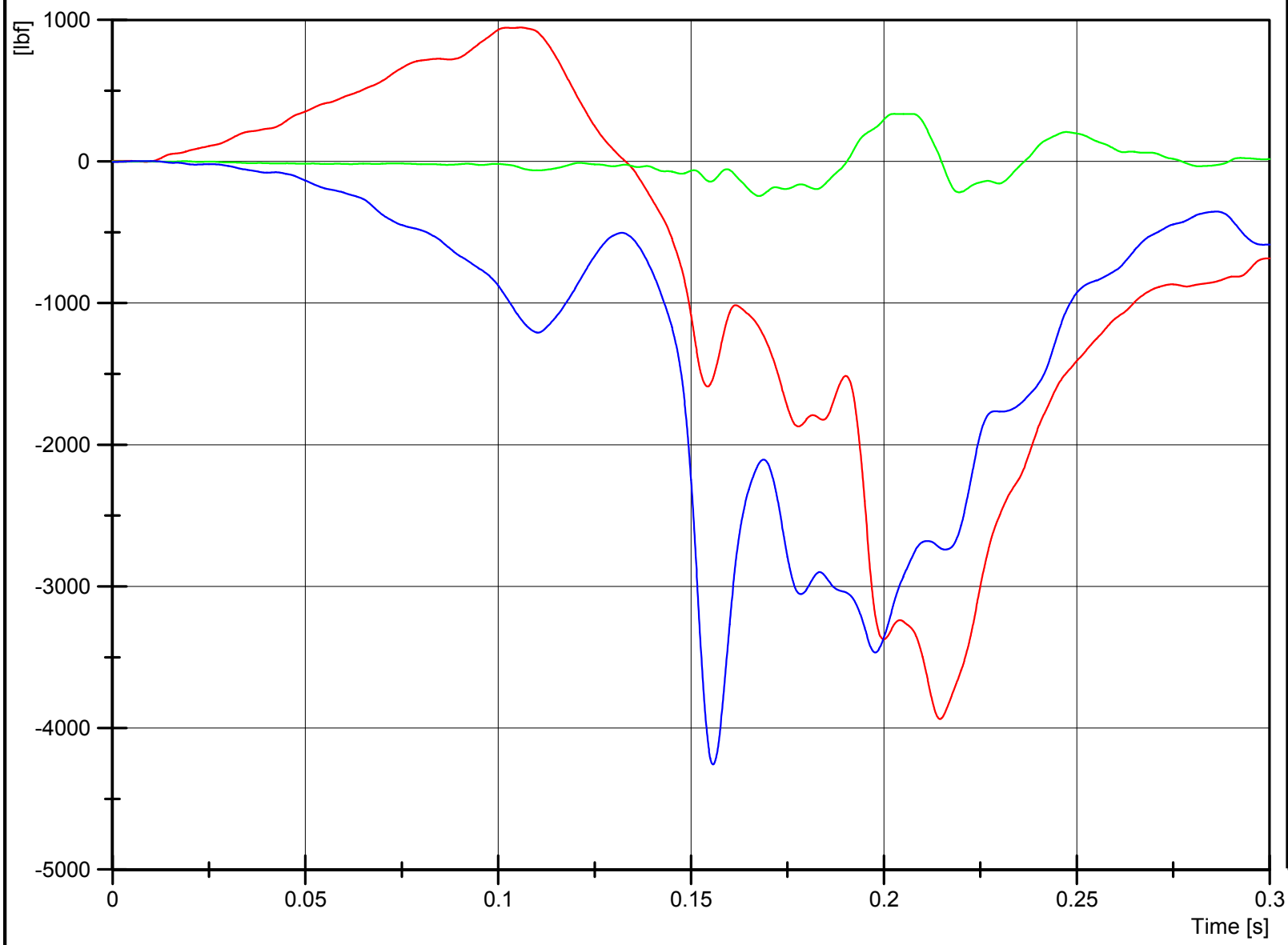
Maximum: 865.51 lbf Time: 0.1026 sec.
Minimum: -6.7406 lbf Time: 0.0095 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FZ
Sensitivity: 1.187E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 12
Ref. No.: 15
Polarity: N

Rigid Seat Seat Back Fy

Maximum: 57.804 lbf Time: 0.2317 sec.
Minimum: -58.21 lbf Time: 0.2206 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FY
Sensitivity: 2.769E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 11
Ref. No.: 14
Polarity: N

Rigid Seat Seat Back Fz

Maximum: 87.0592 lbf Time: 0.2195 sec.
Minimum: -160.06 lbf Time: 0.106 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FX
Sensitivity: 2.765E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 10
Ref. No.: 13
Polarity: R



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Rev.: Impax-SD 6.02 Rev A12t
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Comments:

Rigid Seat Seat Pan Fx

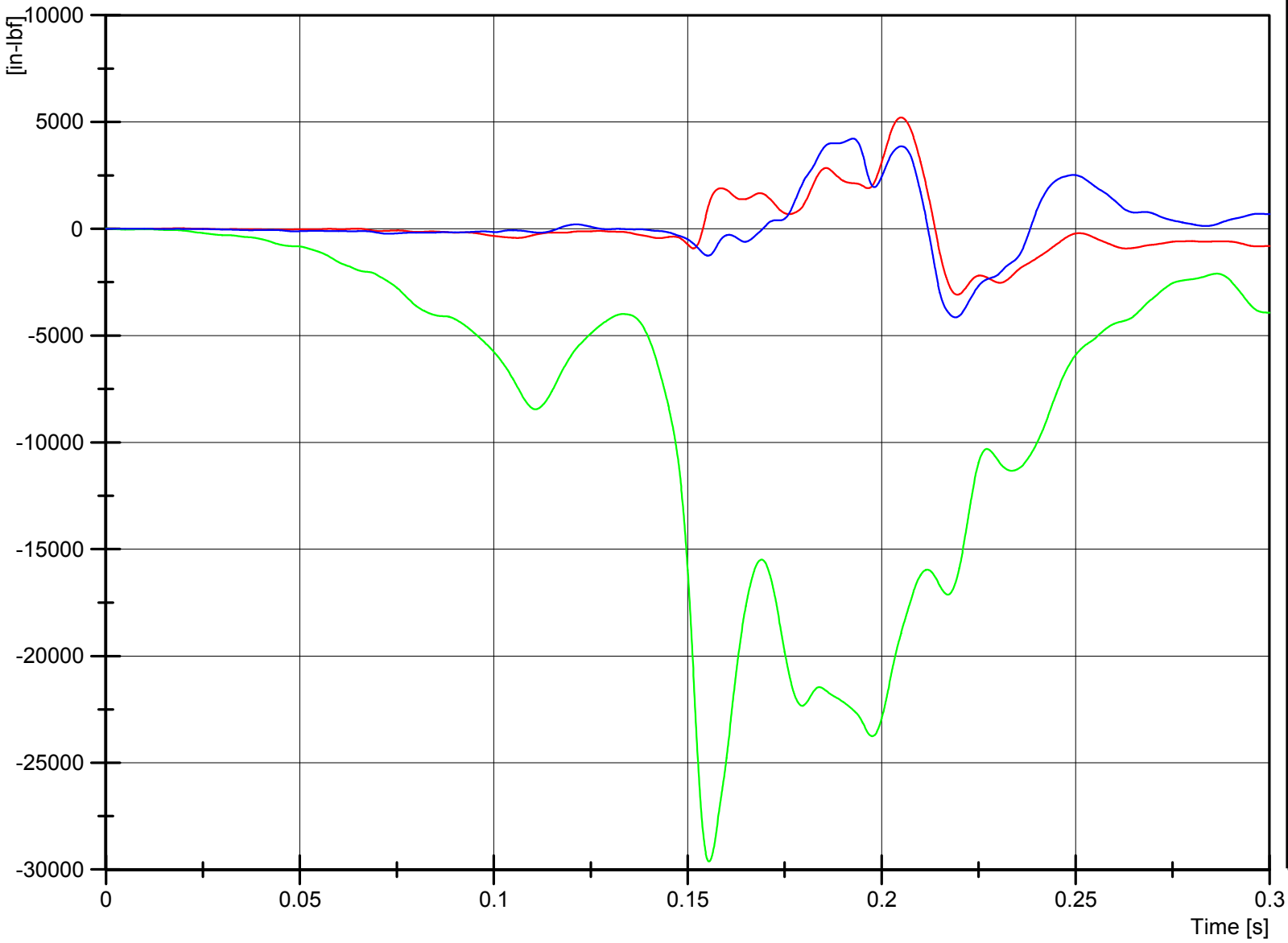
Maximum: 945.69 lbf Time: 0.106 sec.
Minimum: -3.94E+03 lbf Time: 0.2147 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FX
Sensitivity: 2.848E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 13
Ref. No.: 10
Polarity: N

Rigid Seat Seat Pan Fy

Maximum: 337.34 lbf Time: 0.2029 sec.
Minimum: -244.04 lbf Time: 0.1678 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FY
Sensitivity: 2.846E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 14
Ref. No.: 11
Polarity: N

Rigid Seat Seat Pan Fz

Maximum: 2.613 lbf Time: 0.0071 sec.
Minimum: -4.26E+03 lbf Time: 0.1559 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FZ
Sensitivity: 1.205E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 15
Ref. No.: 12
Polarity: N



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1845 N. Fairmount St.
Wichita, Kansas 67260-0093
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Fax: (316) 978-3175
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Doc. No.: CDL-FA14C-05-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-05

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

Comments:

Rigid Seat Seat Pan Mx

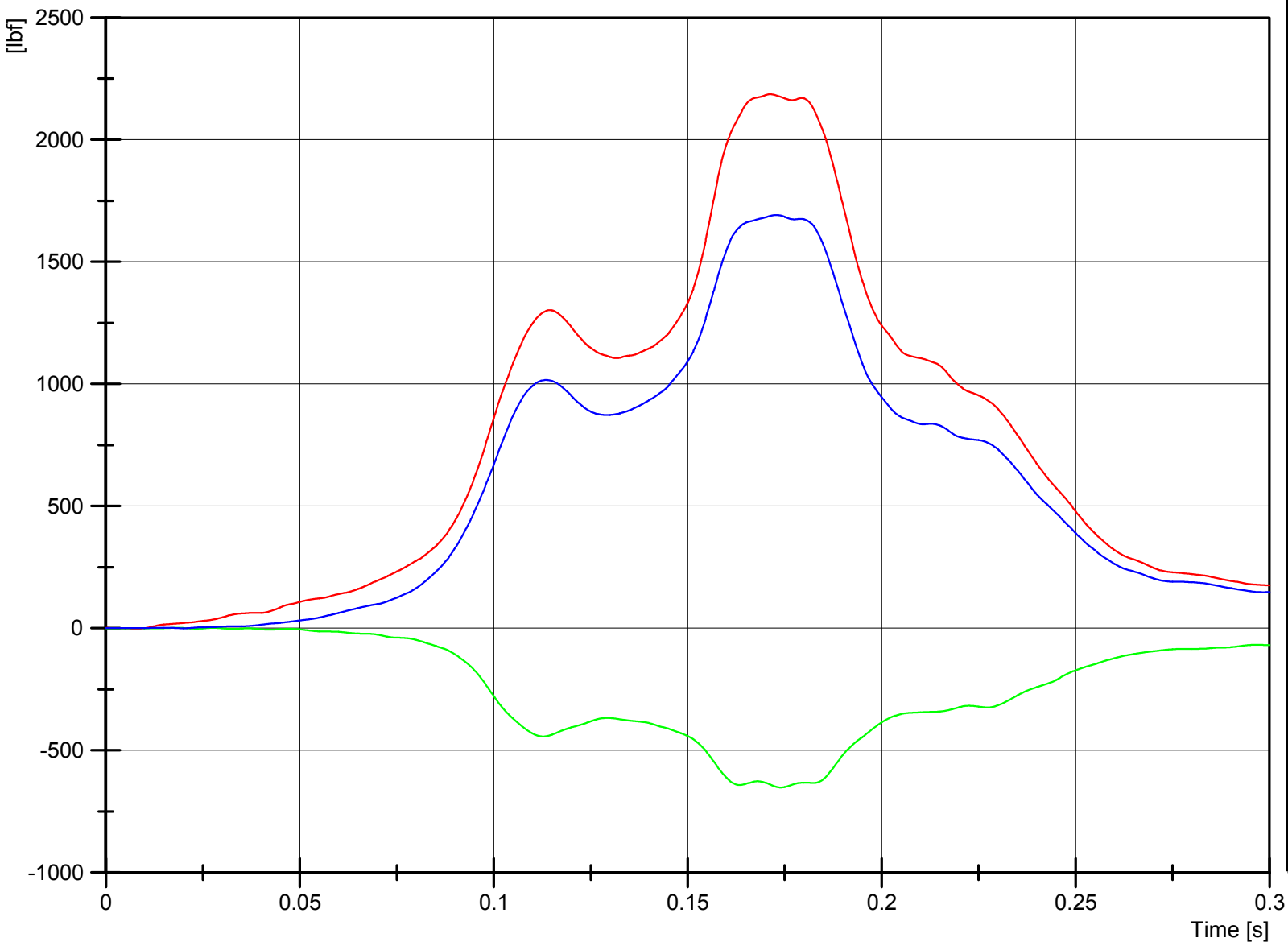
Maximum: 5216.35 in-lbf Time: 0.2052 sec.
Minimum: -3.09E+03 in-lbf Time: 0.2197 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MX
Sensitivity: 7.104E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 25000 in-lbf
DAS Channel: 16
Ref. No.: 7
Polarity: N

Rigid Seat Seat Pan My

Maximum: 21.5295 in-lbf Time: 0 sec.
Minimum: -2.96E+04 in-lbf Time: 0.1557 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MY
Sensitivity: 7.112E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 25000 in-lbf
DAS Channel: 17
Ref. No.: 8
Polarity: N

Rigid Seat Seat Pan Mz

Maximum: 4223.52 in-lbf Time: 0.1928 sec.
Minimum: -4.14E+03 in-lbf Time: 0.2192 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MZ
Sensitivity: 9.38E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 20000 in-lbf
DAS Channel: 18
Ref. No.: 9
Polarity: R



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Doc. No.: CDL-FA14C-05-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-05

Dummy: H2 718

Position: Config 4 - Repaired Belt (#4)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

Rigid Seat Right Lap Fx

Maximum: 2186.01 lbf
Minimum: -1.5011 lbf
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FX
Sensitivity: 2.6022E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 19
Ref. No.: 74
Polarity: N

Time: 0.1715 sec.
Time: 0.008 sec.

Rigid Seat Right Lap Fy

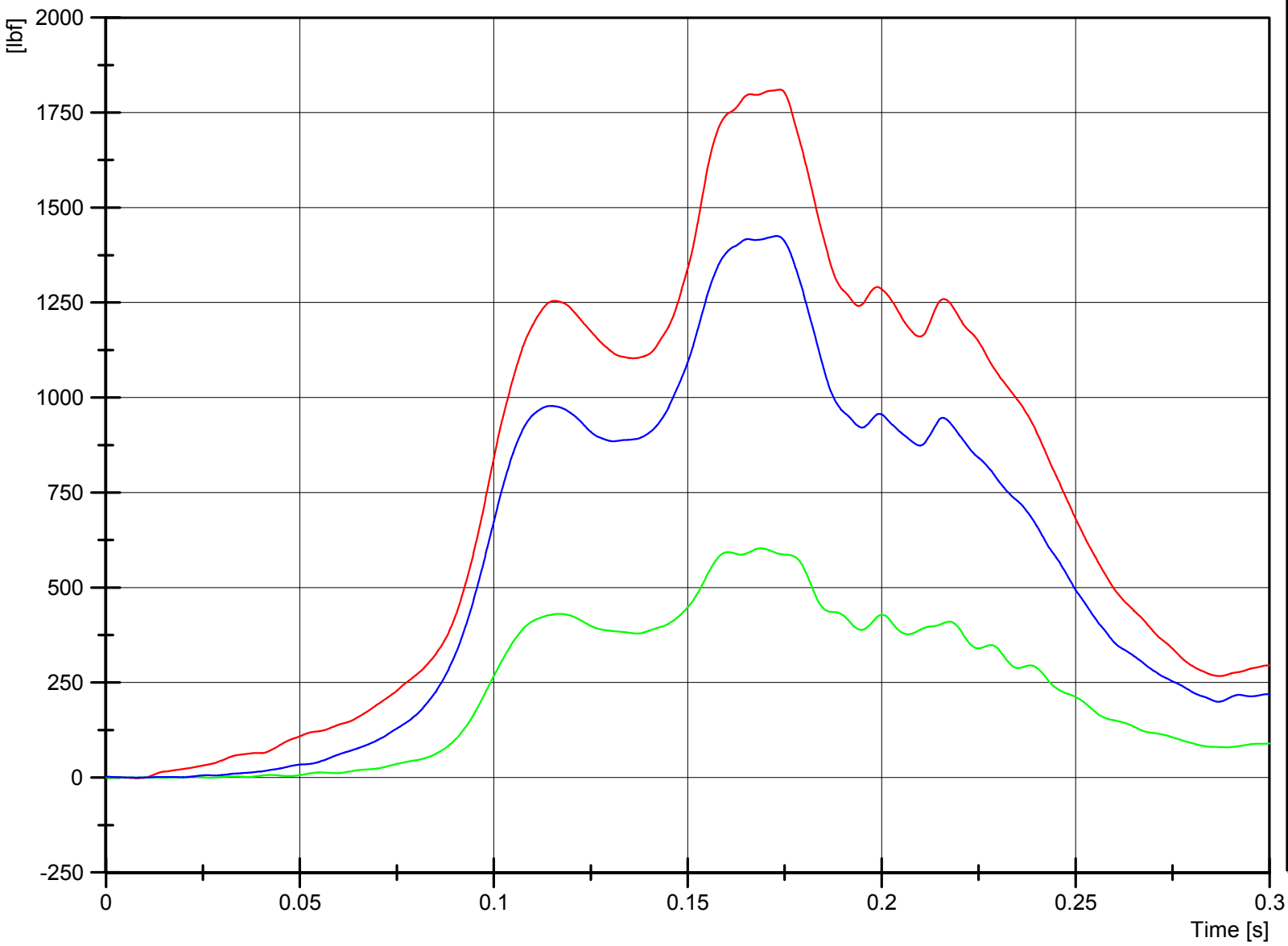
Maximum: 1.7923 lbf
Minimum: -651.79 lbf
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FY
Sensitivity: 2.5935E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 20
Ref. No.: 75
Polarity: N

Time: 0.0186 sec.
Time: 0.1742 sec.

Rigid Seat Right Lap Fz

Maximum: 1691.30 lbf
Minimum: -0.4454 lbf
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FZ
Sensitivity: 1.088E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 21
Ref. No.: 76
Polarity: N

Time: 0.1729 sec.
Time: 0.0202 sec.



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Doc. No.: CDL-FA14C-05-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-05

Dummy: H2 718

Position: Config 4 - Repaired Belt (#4)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

Rigid Seat Left Lap Fx

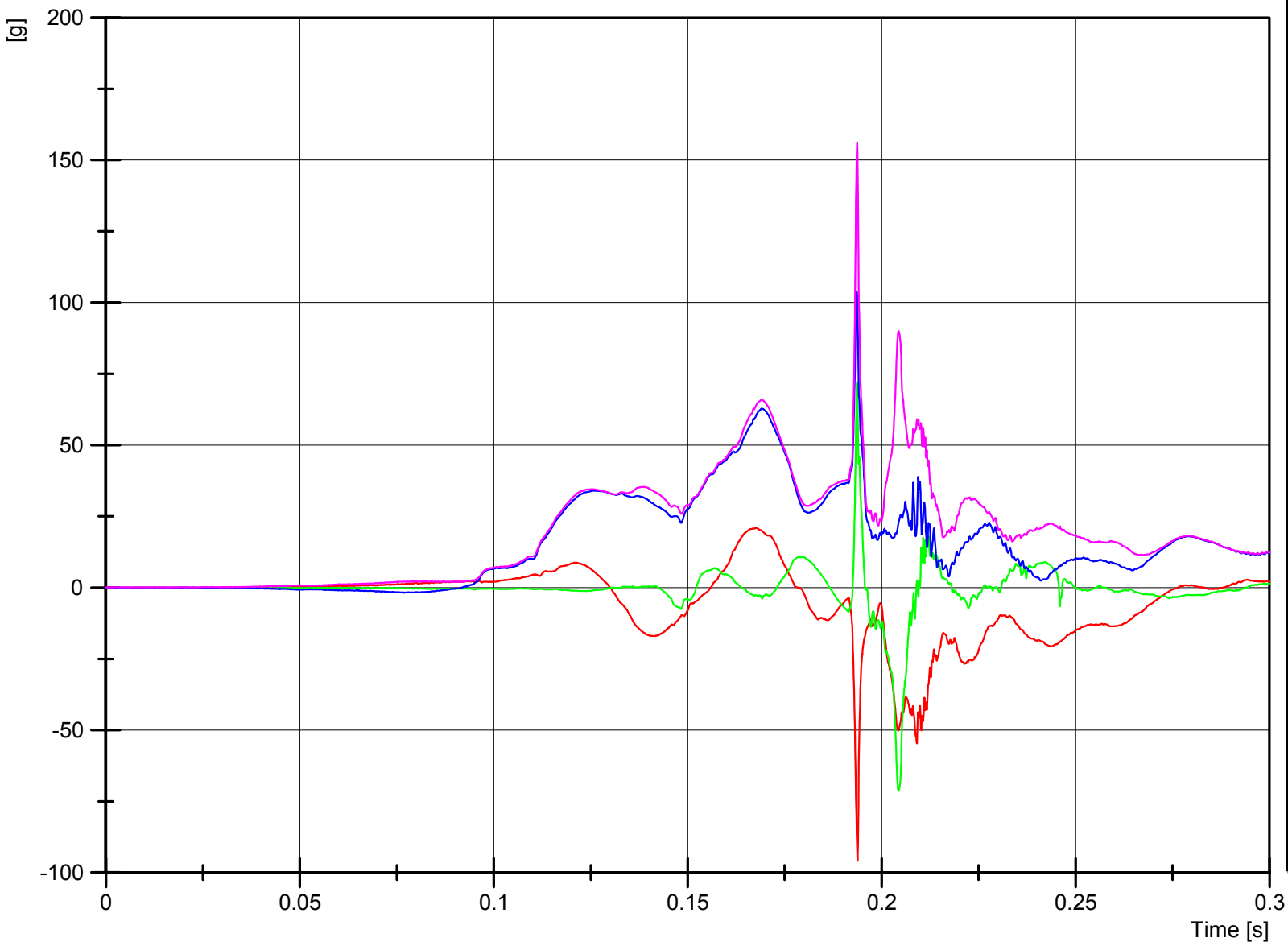
Maximum: 1810.78 lbf Time: 0.174 sec.
Minimum: -1.586 lbf Time: 0.0083 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FX
Sensitivity: 2.608E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 22
Ref. No.: 77
Polarity: N

Rigid Seat Left Lap Fy

Maximum: 603.00 lbf Time: 0.169 sec.
Minimum: -0.2651 lbf Time: 0.0274 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FY
Sensitivity: 2.606E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 23
Ref. No.: 78
Polarity: N

Rigid Seat Left Lap Fz

Maximum: 1424.86 lbf Time: 0.1731 sec.
Minimum: -0.1615 lbf Time: 0.008 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FZ
Sensitivity: 1.087E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 24
Ref. No.: 79
Polarity: N



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Doc. No.: CDL-FA14C-05-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-05

Dummy: H2 699

Position: Config 4 - Repaired Belt (#4)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

Head Ax H2 699

Maximum: 20.8354 g Time: 0.1678 sec.
Minimum: -95.872 g Time: 0.194 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P45436
Sensitivity: 1.823E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 25
Ref. No.: 22
Polarity: R

Head Ay H2 699

Maximum: 72.1593 g Time: 0.1939 sec.
Minimum: -71.31 g Time: 0.2046 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P47924
Sensitivity: 1.863E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 26
Ref. No.: 23
Polarity: R

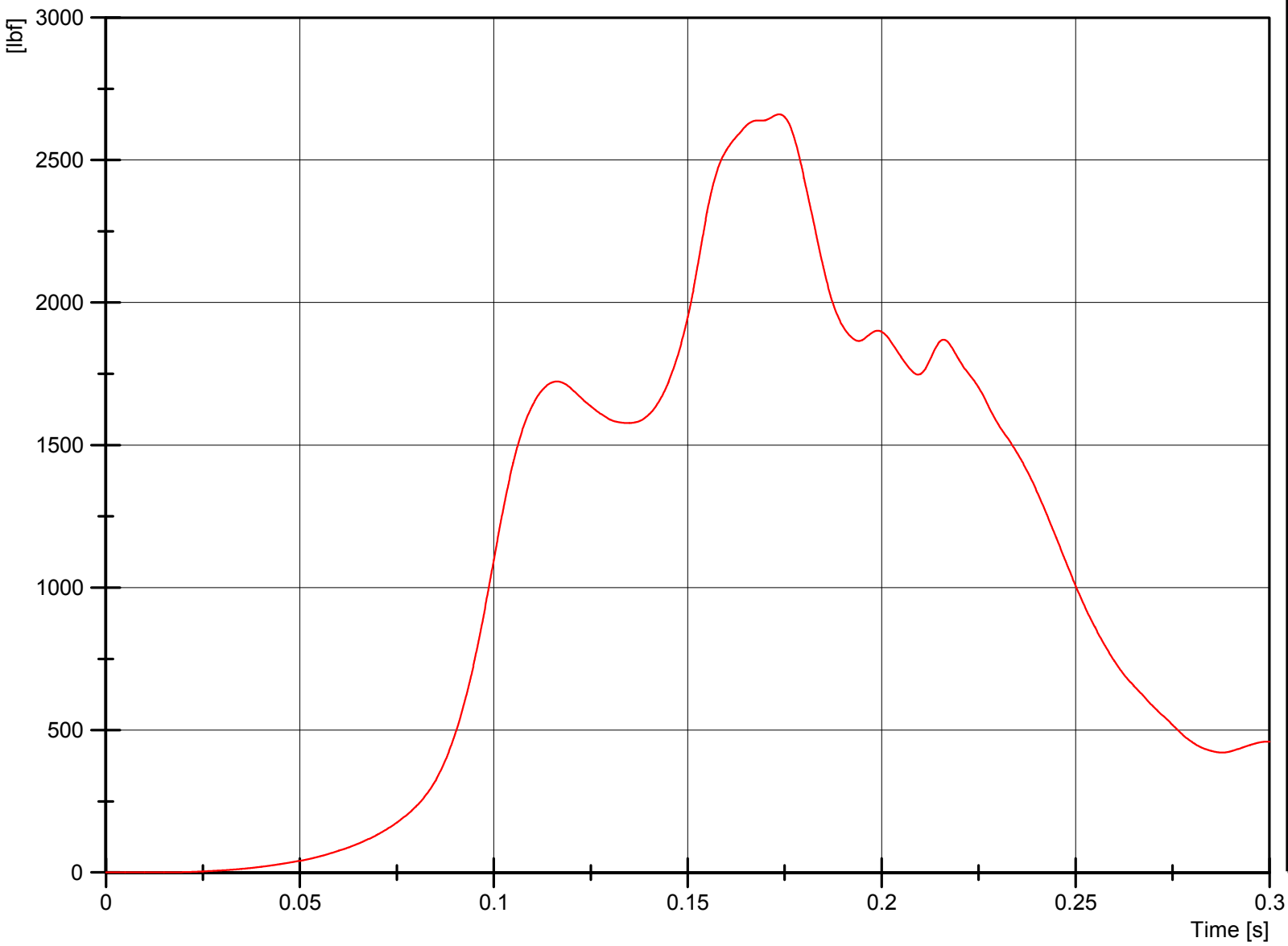
Head Az H2 699

Maximum: 103.81 g Time: 0.1938 sec.
Minimum: -1.7704 g Time: 0.077 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P48250
Sensitivity: 1.827E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 27
Ref. No.: 24
Polarity: R

Head Resultant H2 699

Maximum: 156.28 g Time: 0.1937 sec.

HIC: 1093.4
T1: 115.7 msec.
T2: 229.5 msec.



Lap Belt Force H2 699

Maximum: 2660.46 lbf Time: 0.1738 sec.
Minimum: 0.0961 lbf Time: 0.0051 sec.
CFC: 60
Sensor Type: Denton 3255
S/N: SBLC259
Sensitivity: 6.0647E-07 V/EU
Cal. Due: 10/17/2014
Full Scale: 3000 lbf
DAS Channel: 31
Ref. No.: 17
Polarity: N

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Doc. No.: CDL-FA14C-05-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-05

Dummy: H2 699

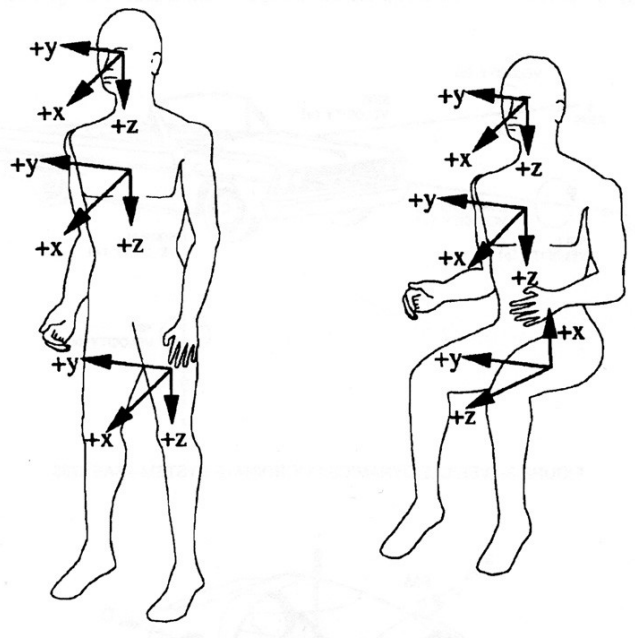
Position: Config 4 - Repaired Belt (#4)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

J211/1 Sign Conventions



Upper Neck Load Cell:
+FX Head rearward, chest forward
+FY Head leftward, chest rightward
+FZ Head upward, chest downward
+MX Left ear toward left shoulder
+MY Chin toward sternum
+MZ Chin toward left shoulder

Lumbar Load Cell:
+FX Chest rearward, pelvis forward
+FY Chest leftward, pelvis rightward
+FZ Chest upward, pelvis downward
+MX Left shoulder toward left hip
+MY Sternum toward front of legs
+MZ Right shoulder forward, left shoulder rearward

Femur Load Cells:
+FZ Tension

Chest Displacement:
-DX Compression

Rib Dispacement:
-DY Compression

Belt Load Cells:
+FX Tension

Floor Load Cells:
+FX Test article forward
+FY Test article right
+FZ Test article up

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Doc. No.: CDL-FA14C-05-01

Version: New

Report Date: 05/06/2014

Customer: FAA

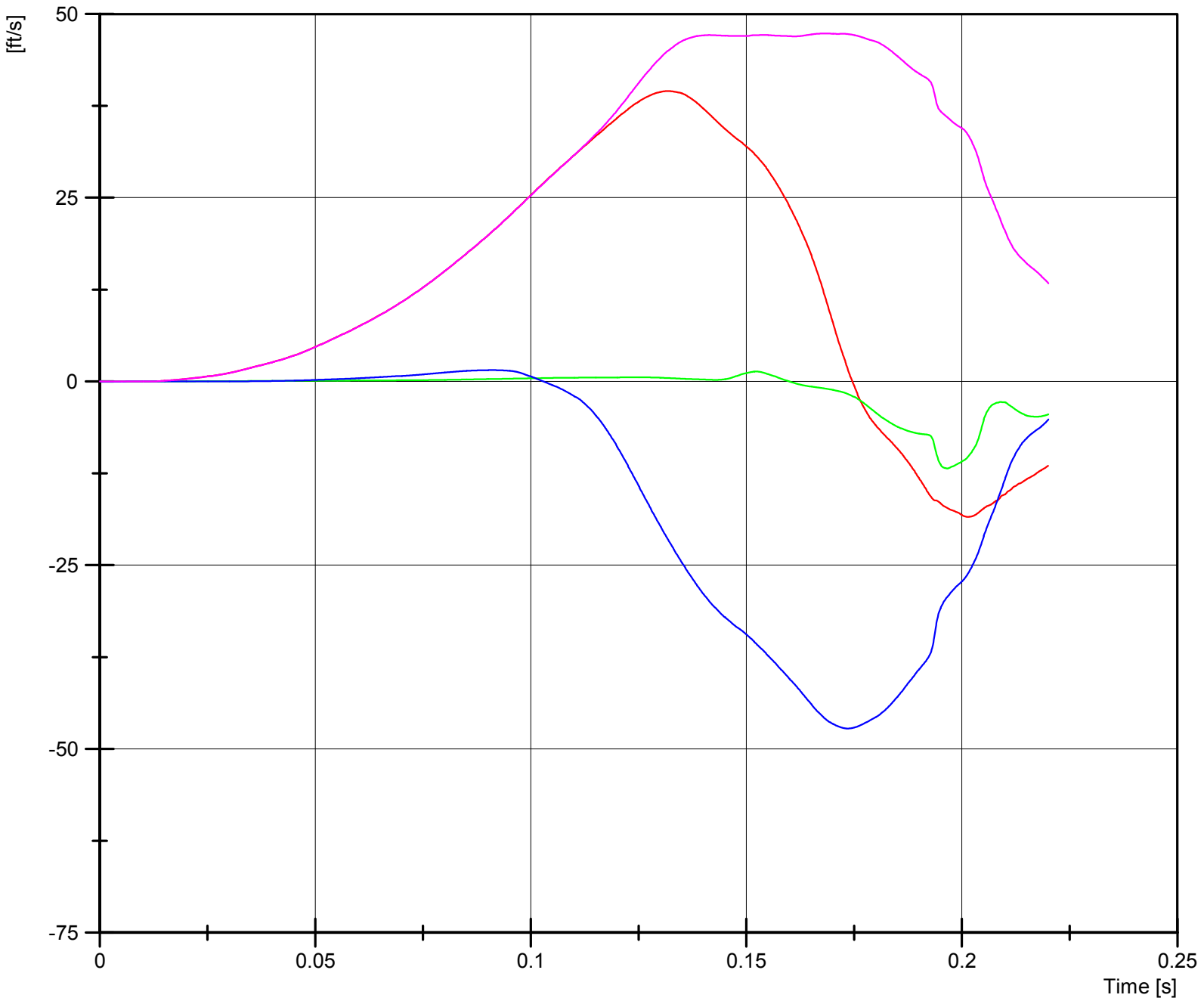
Test: FA14C-05

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

Comments:



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Doc. No.: CDL-FA14C-05-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-05

Dummy: H2 699

Position: Config 4 - Repaired Belt (#

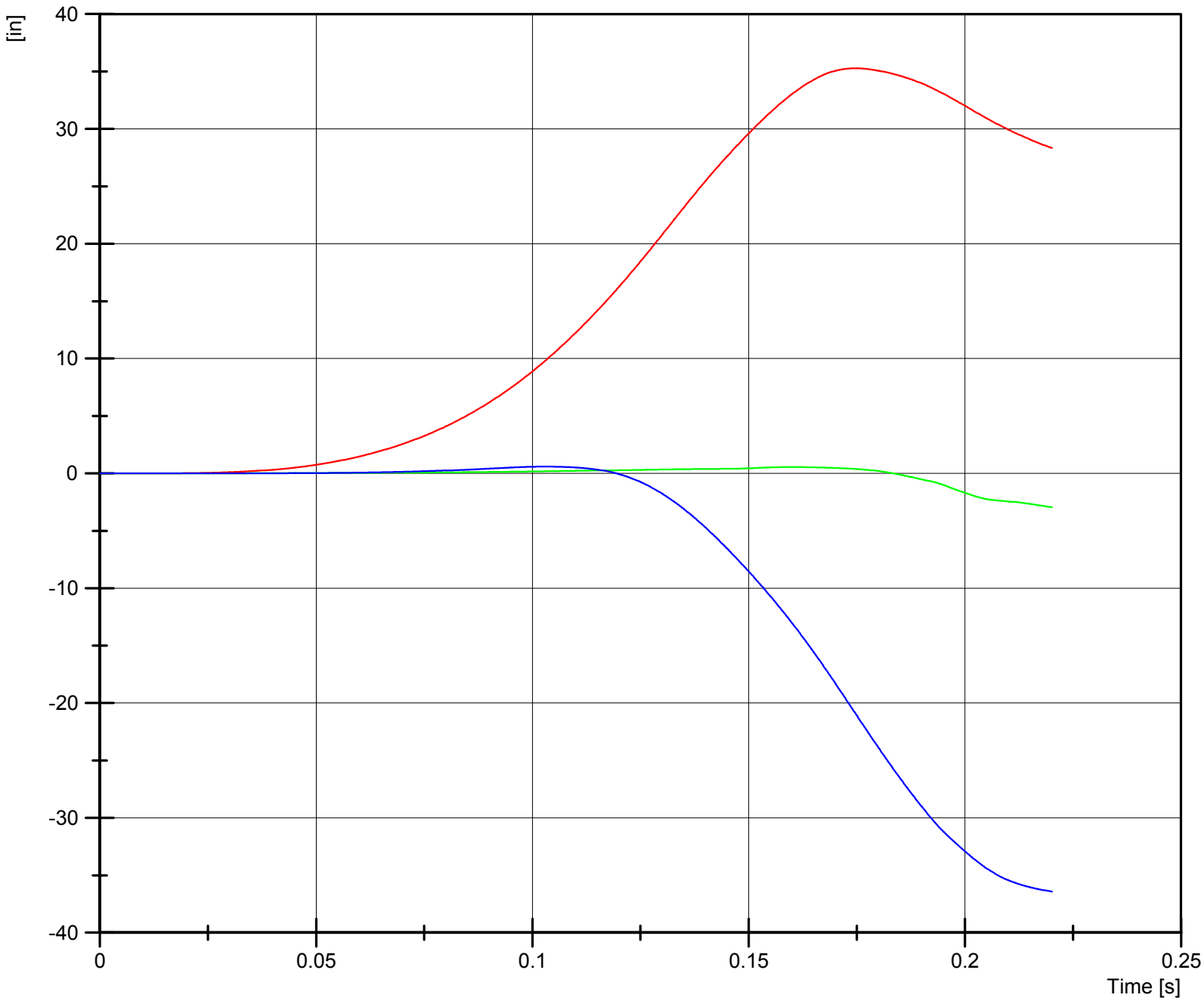
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

Comments:

Global Head Vx H2 699		Global Head Vy H2 699		Global Head Vz H2 699		Global Head Velocity Resultant H2 699	
Maximum: 39.53 ft/s	Time: 0.1317 sec.	Maximum: 1.37 ft/s	Time: 0.1523 sec.	Maximum: 1.55 ft/s	Time: 0.0911 sec.	Maximum: 47.35 ft/s	Time: 0.1683 sec.
Minimum: -18.42 ft/s	Time: 0.2013 sec.	Minimum: -11.82 ft/s	Time: 0.1966 sec.	Minimum: -47.21 ft/s	Time: 0.1735 sec.	Minimum: 0 ft/s	Time: 0.0001 sec.



Global Head Dx H2 699 | Global Head Dy H2 699 | Global Head Dz H2 699

Maximum: 35.28 in	Time: 0.1747 sec.	Maximum: 0.55 in	Time: 0.16 sec.	Maximum: 0.59 in	Time: 0.103 sec.
Minimum: -0.00 in	Time: 0.012 sec.	Minimum: -2.95 in	Time: 0.2201 sec.	Minimum: -36.42 in	Time: 0.2201 sec.

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Doc. No.: CDL-FA14C-05-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-05

Dummy: H2 699

Position: Config 4 - Repaired Belt (#

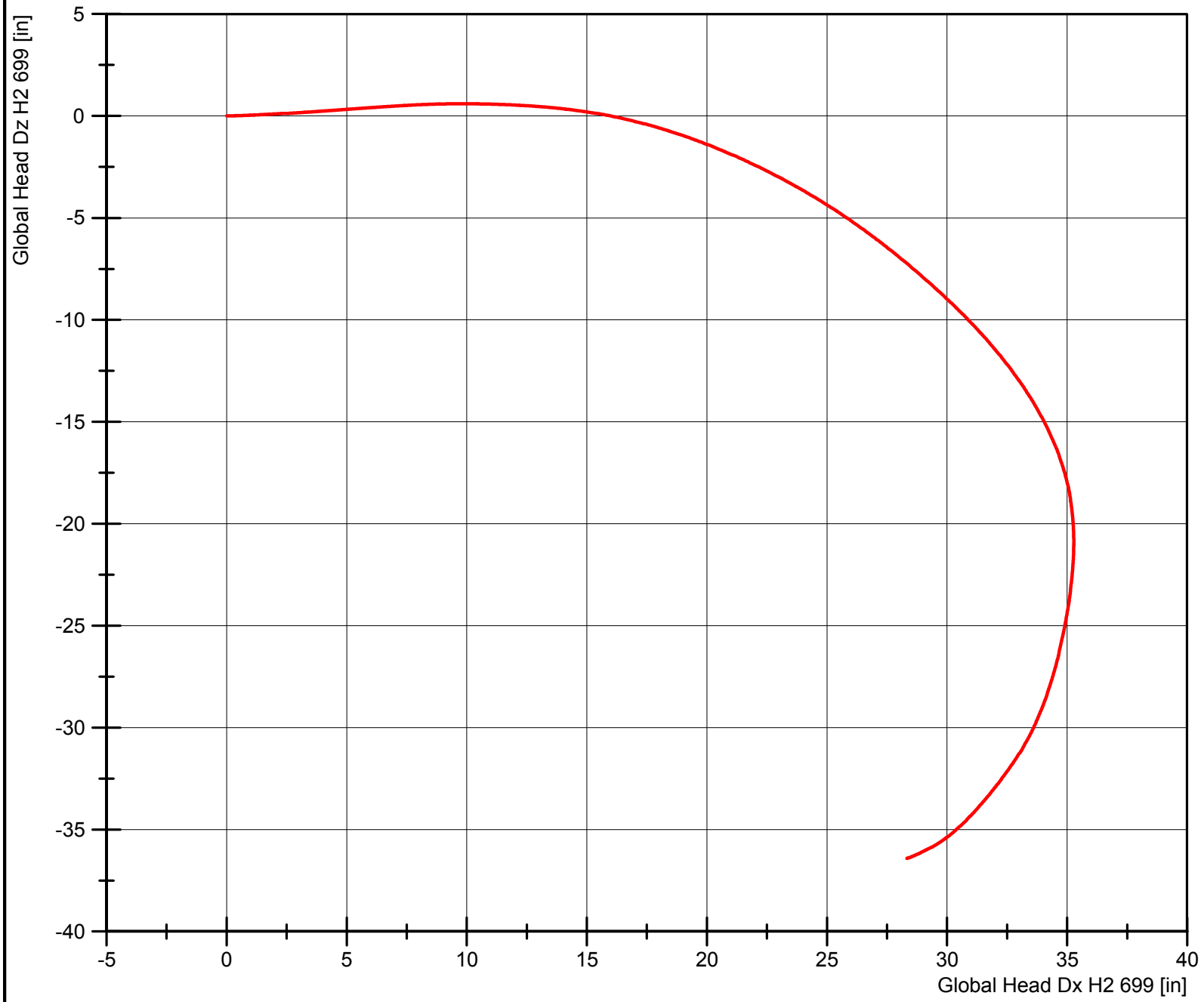
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

Comments:

Displacement values are calculated from Head Accelerations and Angular Velocities.
This method cannot be used to substitute photometric analysis.



Global Head Displacement XZ

X Maximum: 35.28 in **Time: 0.1747 sec.**

Z Value at X Maximum: -20.91 in

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Doc. No.: CDL-FA14C-05-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-05

Dummy: H2 699

Position: Config 4 - Repaired Belt (#

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

Comments:

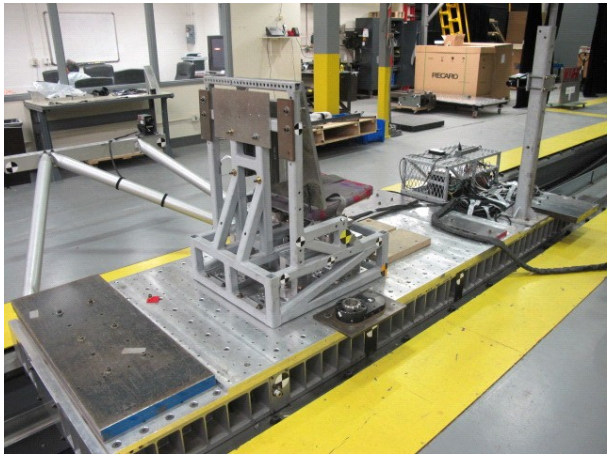
Displacement values are calculated from Head Accelerations and Angular Velocities.
This method cannot be used to substitute photometric analysis.

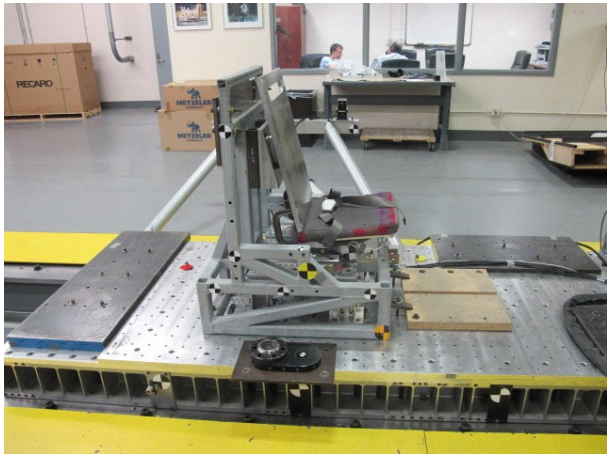
Pre-test Photos



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Doc. No.: CDL-FA14C-05-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-05

Dummy: N/A

Position: N/A

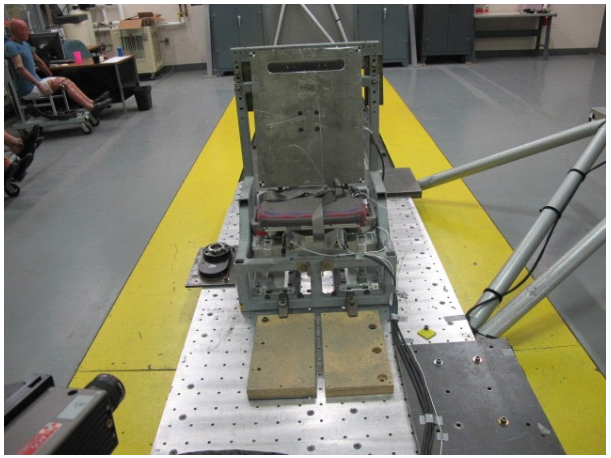
Test Description:
14 CFR 25.562 Test 2

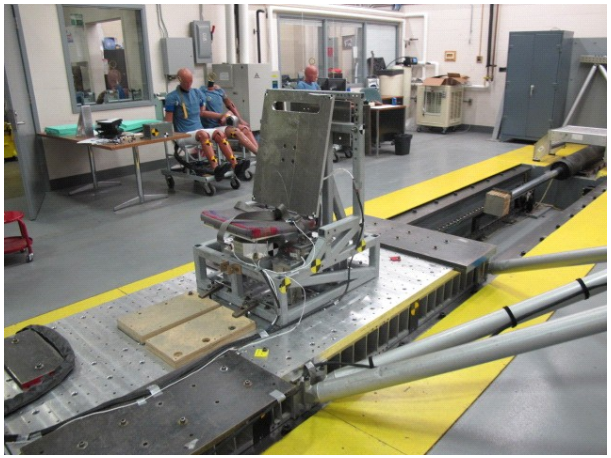
Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

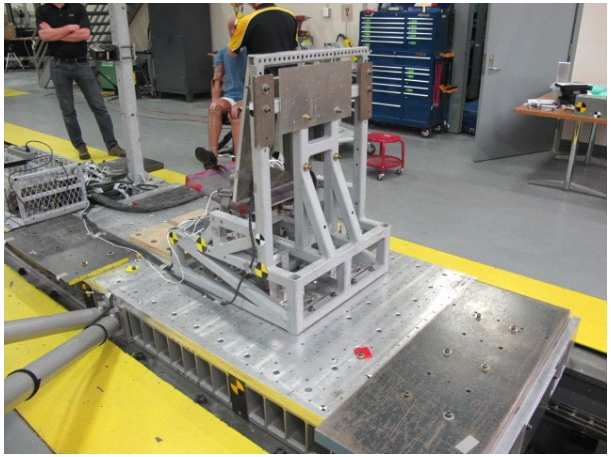
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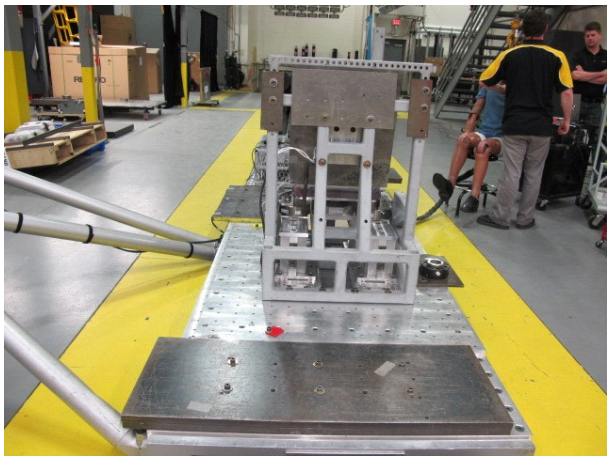
Pre-test Photos













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Doc. No.: CDL-FA14C-05-01

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Report Date: 05/06/2014

Customer: FAA

Test: FA14C-05

Dummy: N/A

Position: N/A

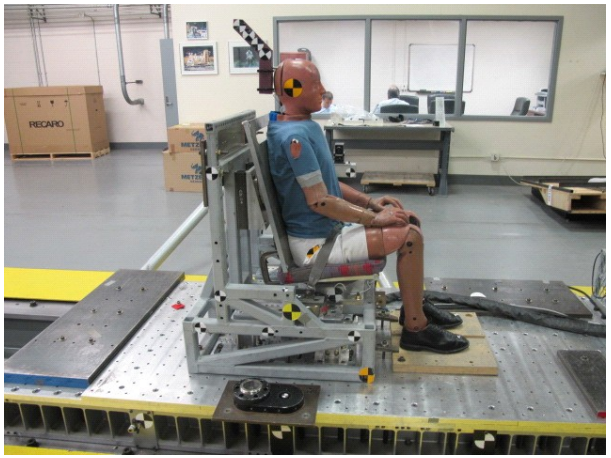
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14 CFR 25.562 Test 2

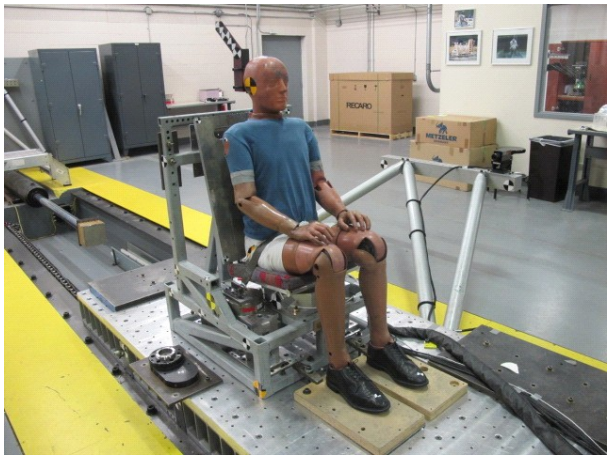
Pulse Name:
16g-04

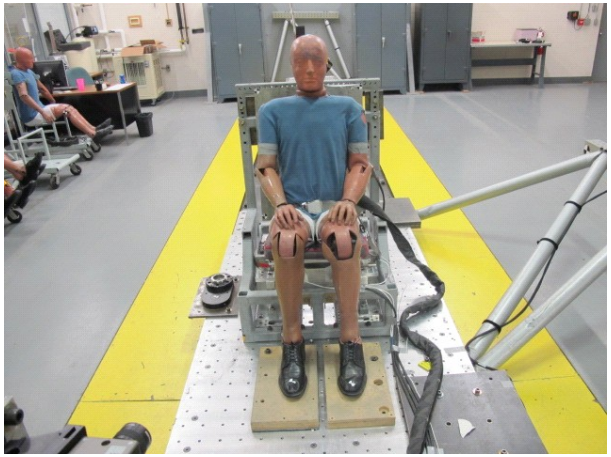
Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

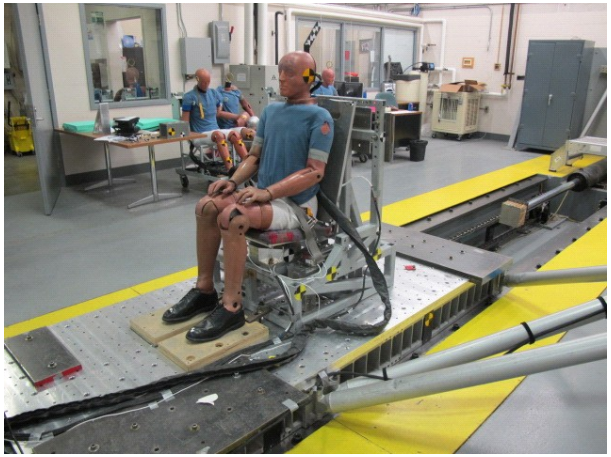
Comments:

Pre-test Photos













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Doc. No.: CDL-FA14C-05-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-05

Dummy: N/A

Position: N/A

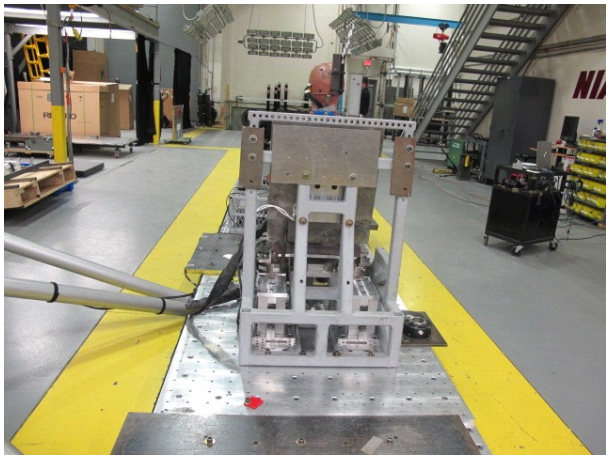
Test Description:
14 CFR 25.562 Test 2

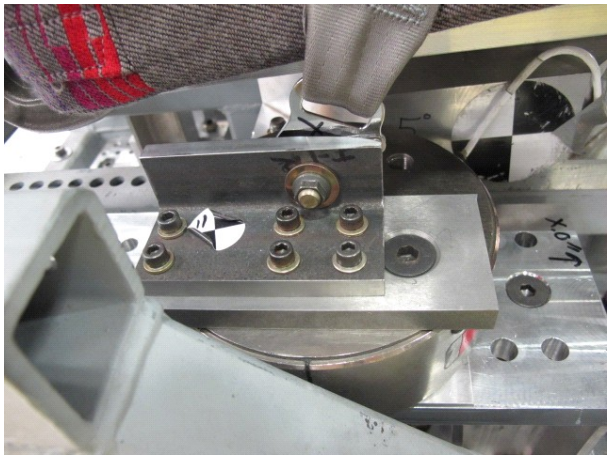
Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

Comments:

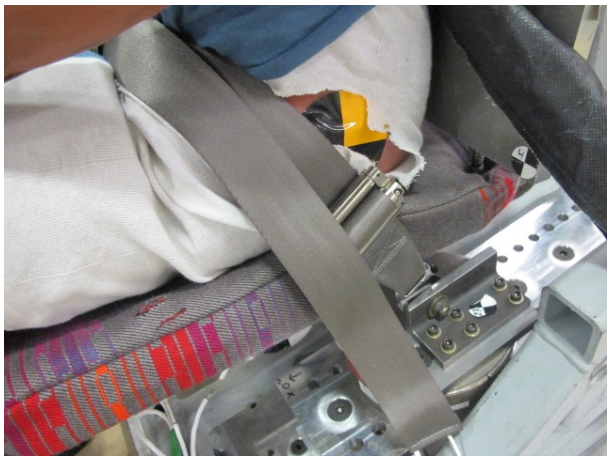
Pre-test Photos

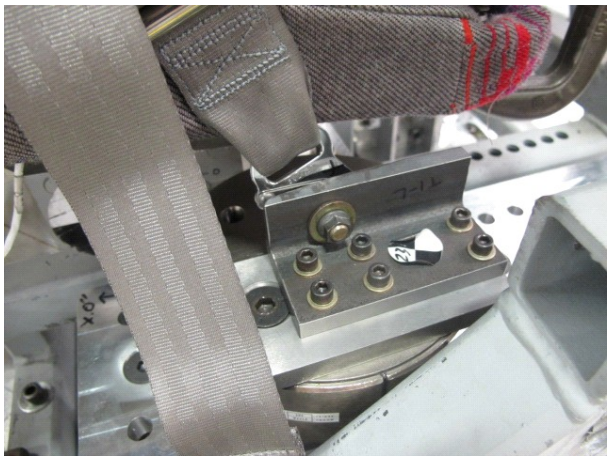












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Doc. No.: CDL-FA14C-05-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-05

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

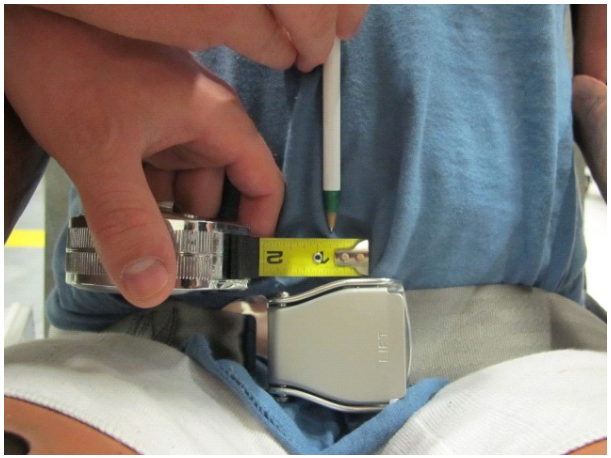
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16g-04

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Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

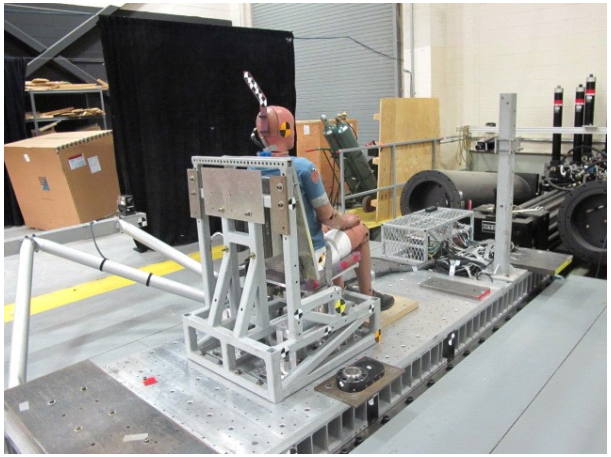
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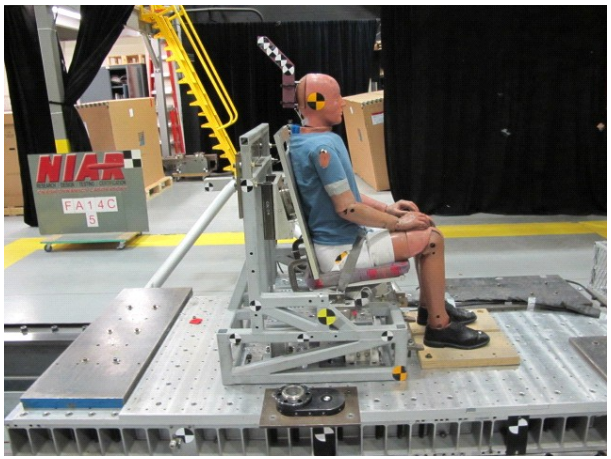
Pre-test Photos

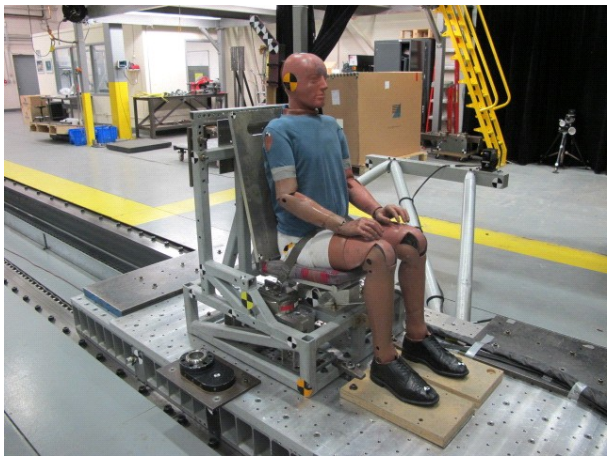












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Test Description:
14 CFR 25.562 Test 2

Pulse Name:
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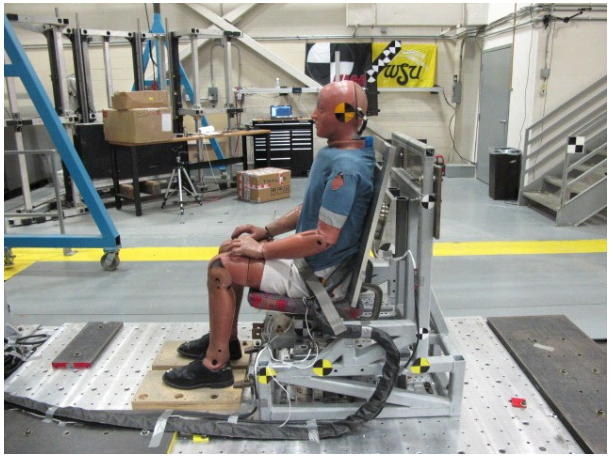
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Test Date/Time: 05/06/2014 11:15

Comments:

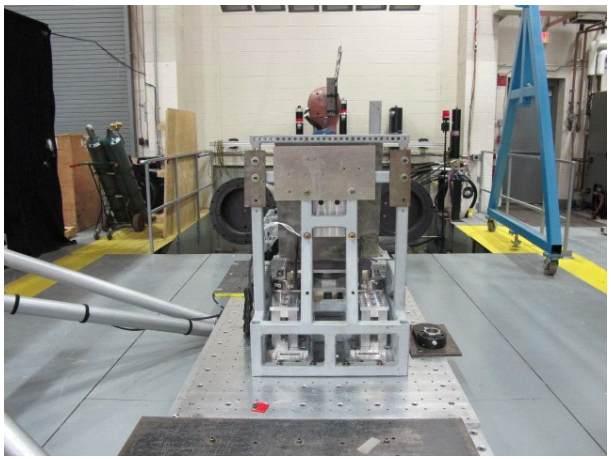
Pre-test Photos













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Dummy: N/A

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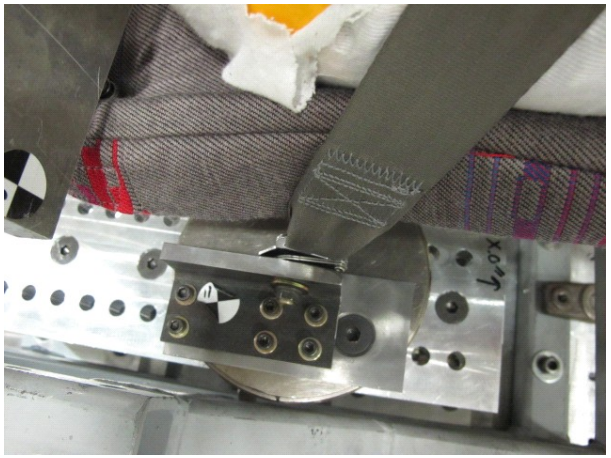
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Pulse Name:
16g-04

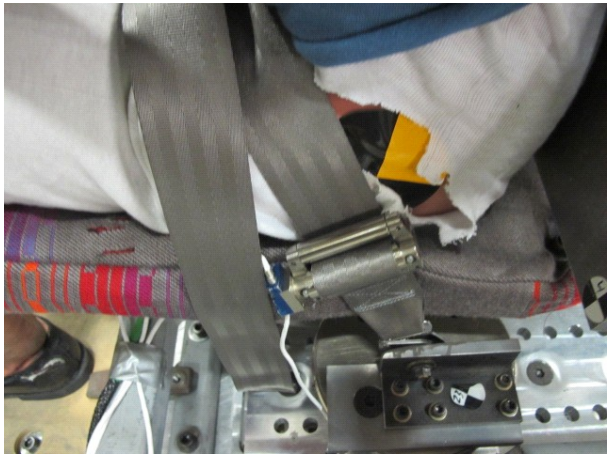
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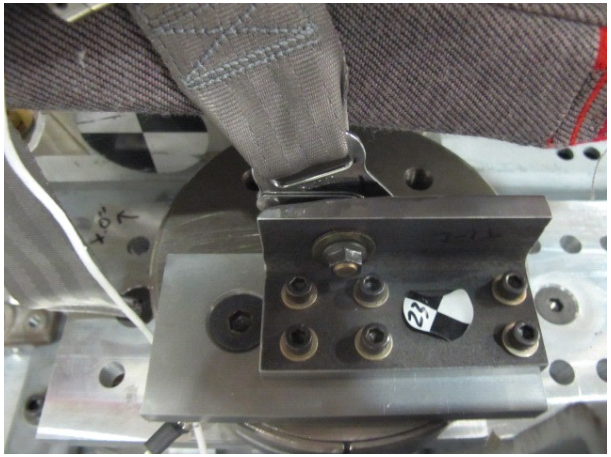
Comments:

Pre-test Photos









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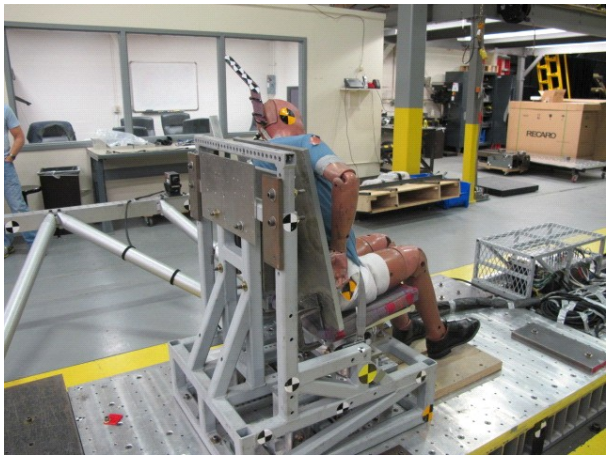
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14 CFR 25.562 Test 2

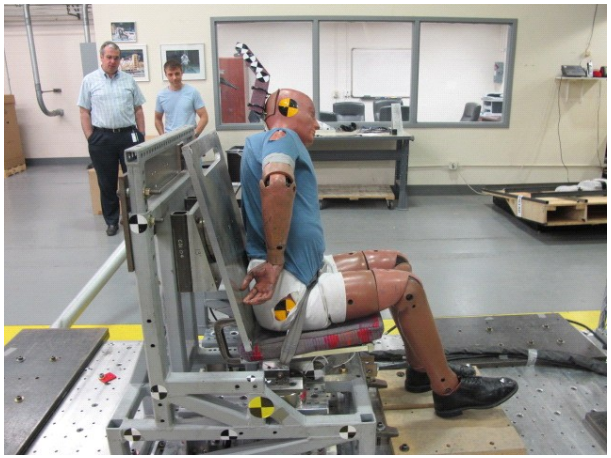
Pulse Name:
16g-04

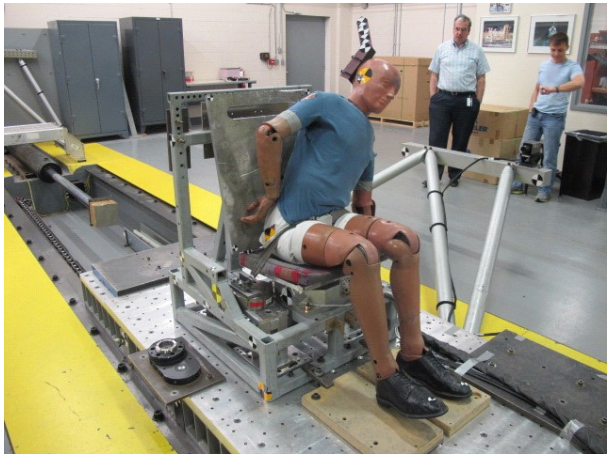
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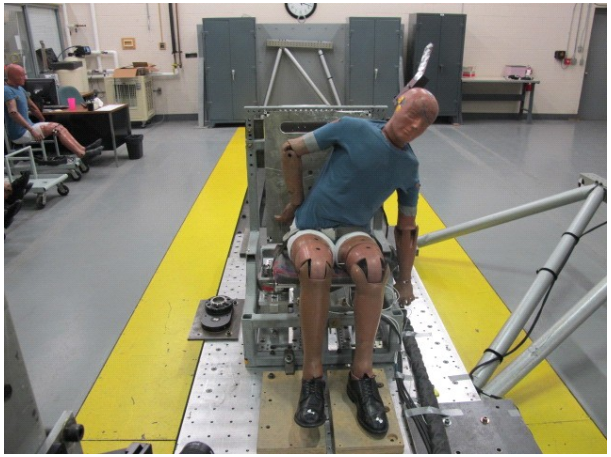
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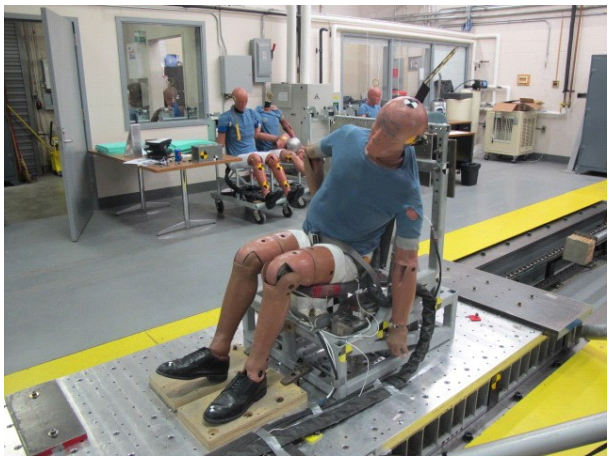
Post-test Photos

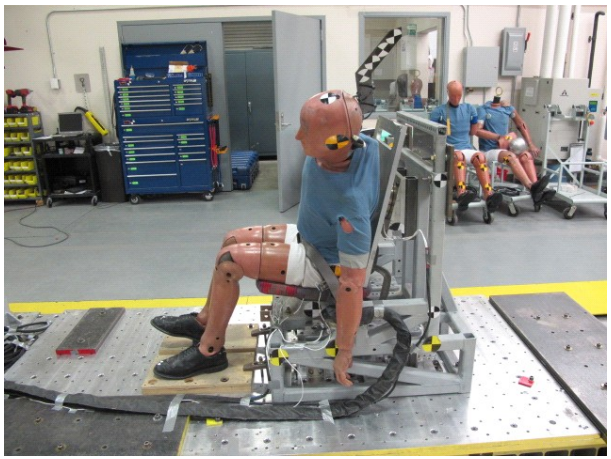












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Customer: FAA

Test: FA14C-05

Dummy: N/A

Position: N/A

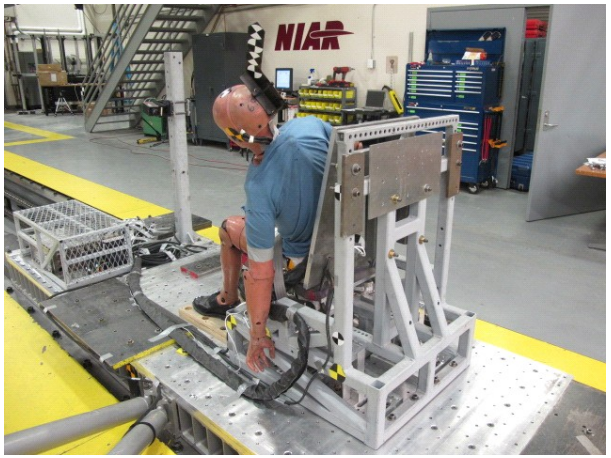
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14 CFR 25.562 Test 2

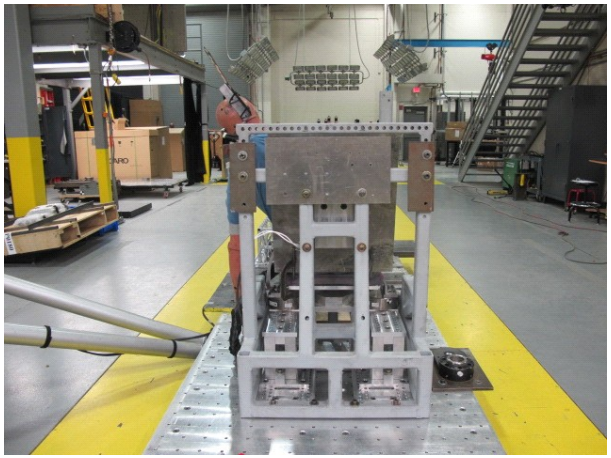
Pulse Name:
16g-04

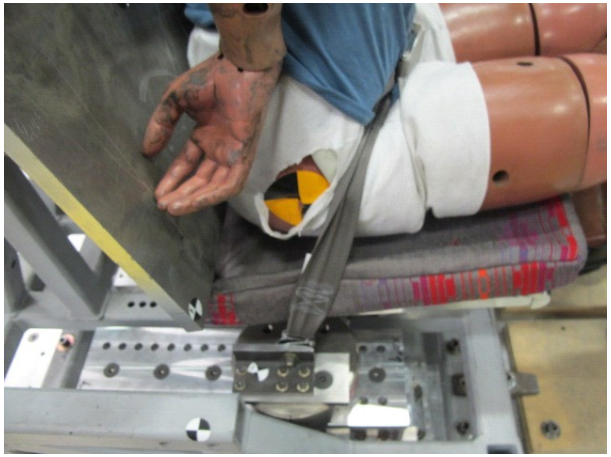
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Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

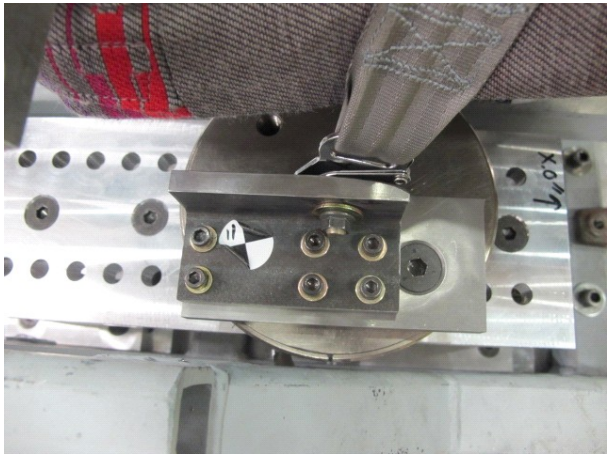
Comments:

Post-test Photos













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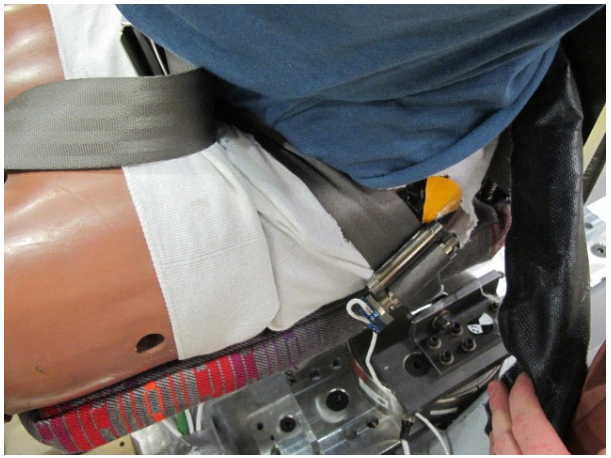
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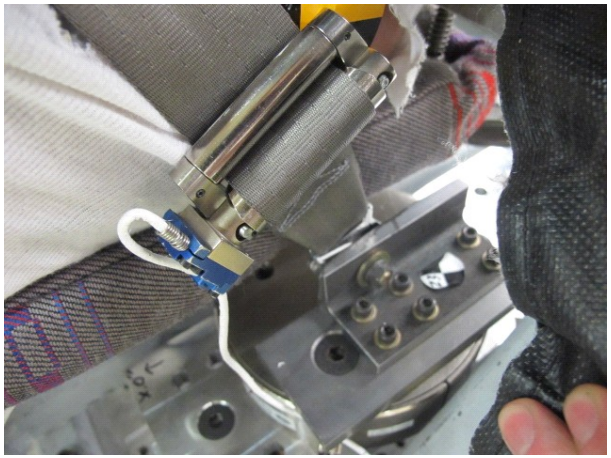
Pulse Name:
16g-04

Rate: 10000
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Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

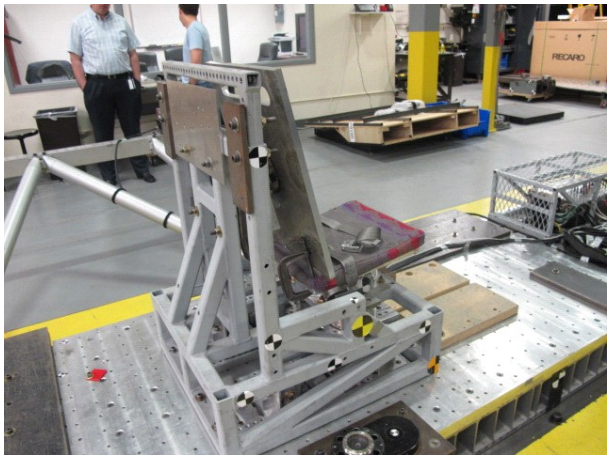
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16g-04

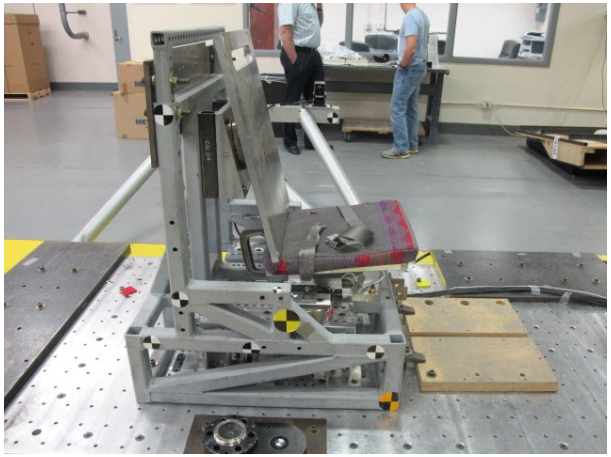
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Pretrigger Samples: 40960
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Rev.: Impax-SD 6.02 Rev A12t
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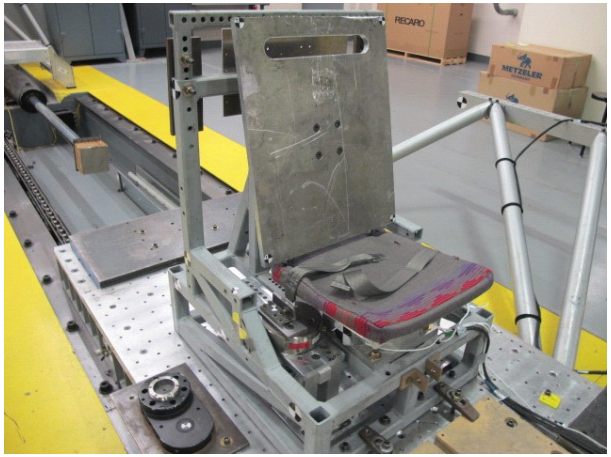
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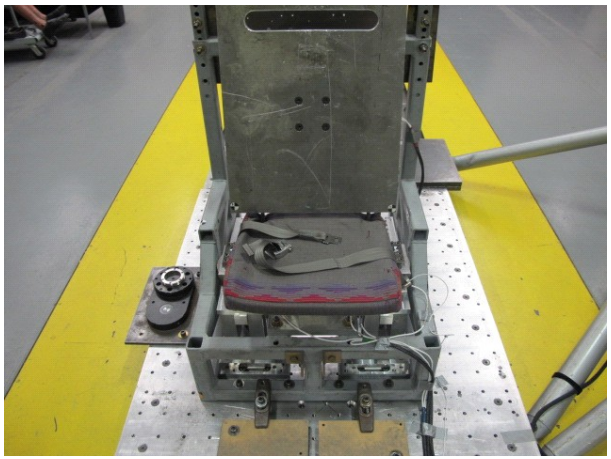
Post-test Photos

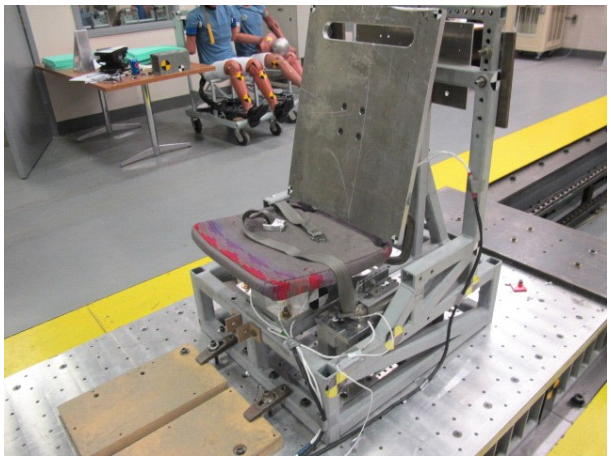












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Report Date: 05/06/2014

Customer: FAA

Test: FA14C-05

Dummy: N/A

Position: N/A

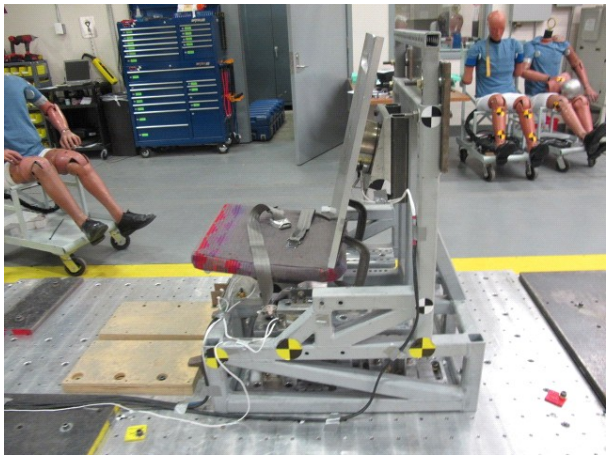
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14 CFR 25.562 Test 2

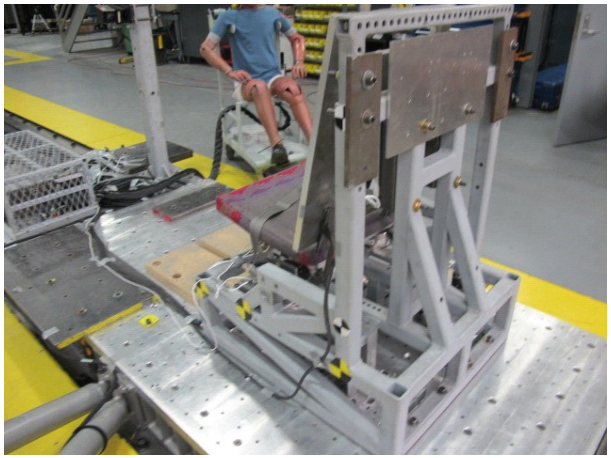
Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 11:15

Comments:

Post-test Photos





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Dummy: N/A

Position: N/A

Test Description:
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Pulse Name:
16g-04

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Comments:

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Report No. CDL-FA14C-06-01

Requested by:

FAA

Final Test Report FA14C-06

05/06/2014

Revision	Change	Date	Revised By
New		05/06/2014	Rob Huculak

Prepared and Reviewed by:

Rob Huculak
Laboratory Manager

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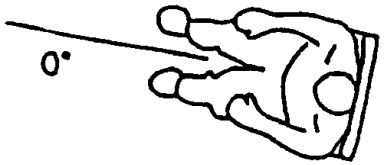
This test report is in accordance with ISO/IEC 17025:2005 requirements and all equipment standards used are traceable to the National Institute of Standards and Technology.
The information in this report relates only to the article under test and cannot be reproduced, except in full, without the written approval of the National Institute for Aviation Research.

Test Summary

The dynamic test (FA14C-06) was performed for FAA in accordance with 14 CFR 25.562 Test 2 on 05/06/2014.

Pulse Parameters	Required	Result	Pass/Fail
Minimum Peak Acceleration (g)	16	16.35	PASS
Minimum Velocity Change (ft/sec)	44	45.58	PASS
Maximum Rise Time (msec)	90	87.8	PASS
Minimum Velocity Change During Rise Time (ft/sec)	22	23.04	PASS
2g Offset	--	--	PASS

Test Orientation



ATD: H2 699 **Position: Config 4 - Repaired Belt (#5)**

0 deg

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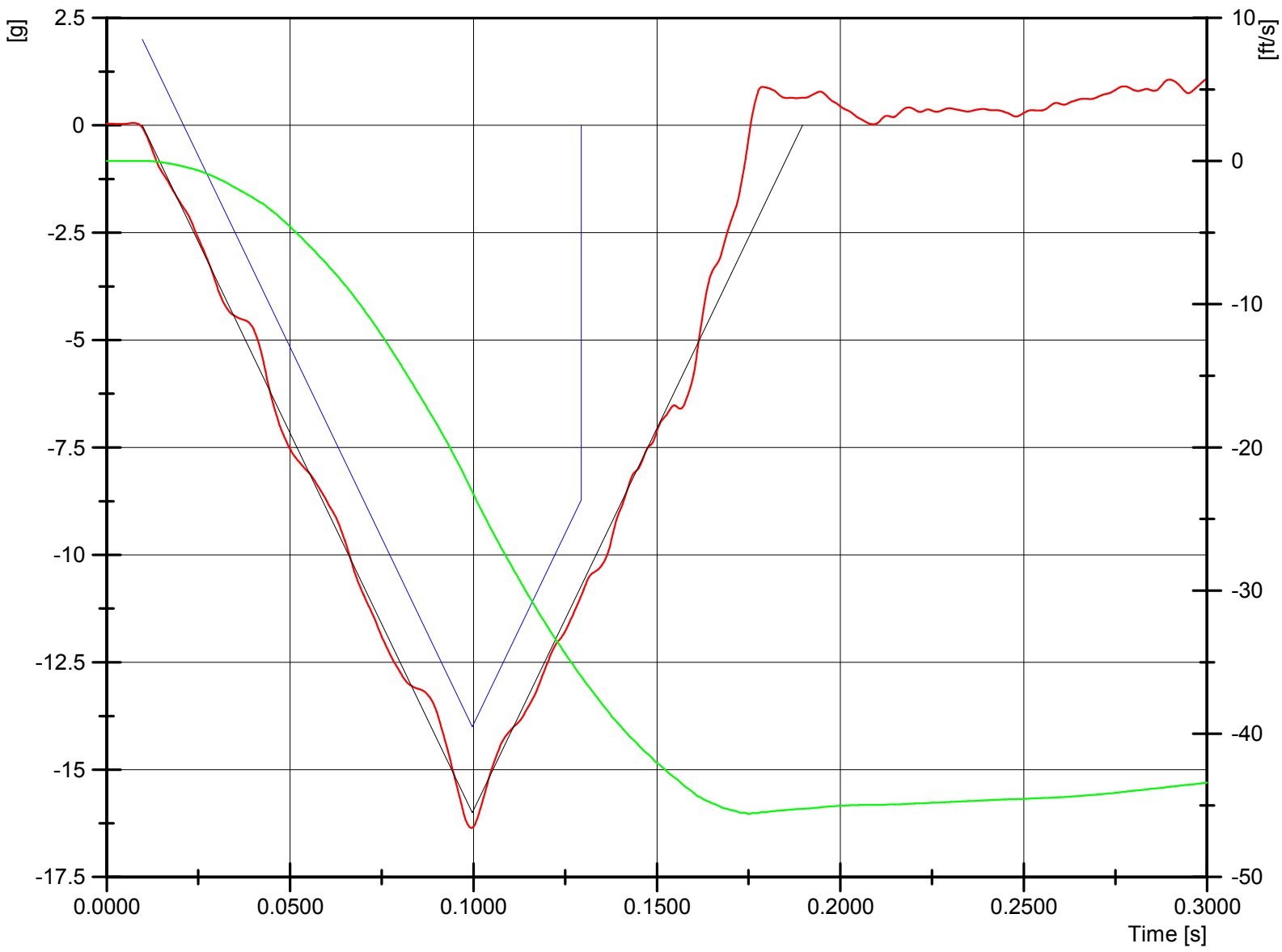
Test: FA14C-06

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

Temperature	Relative Humidity
71.0°F	37.7%



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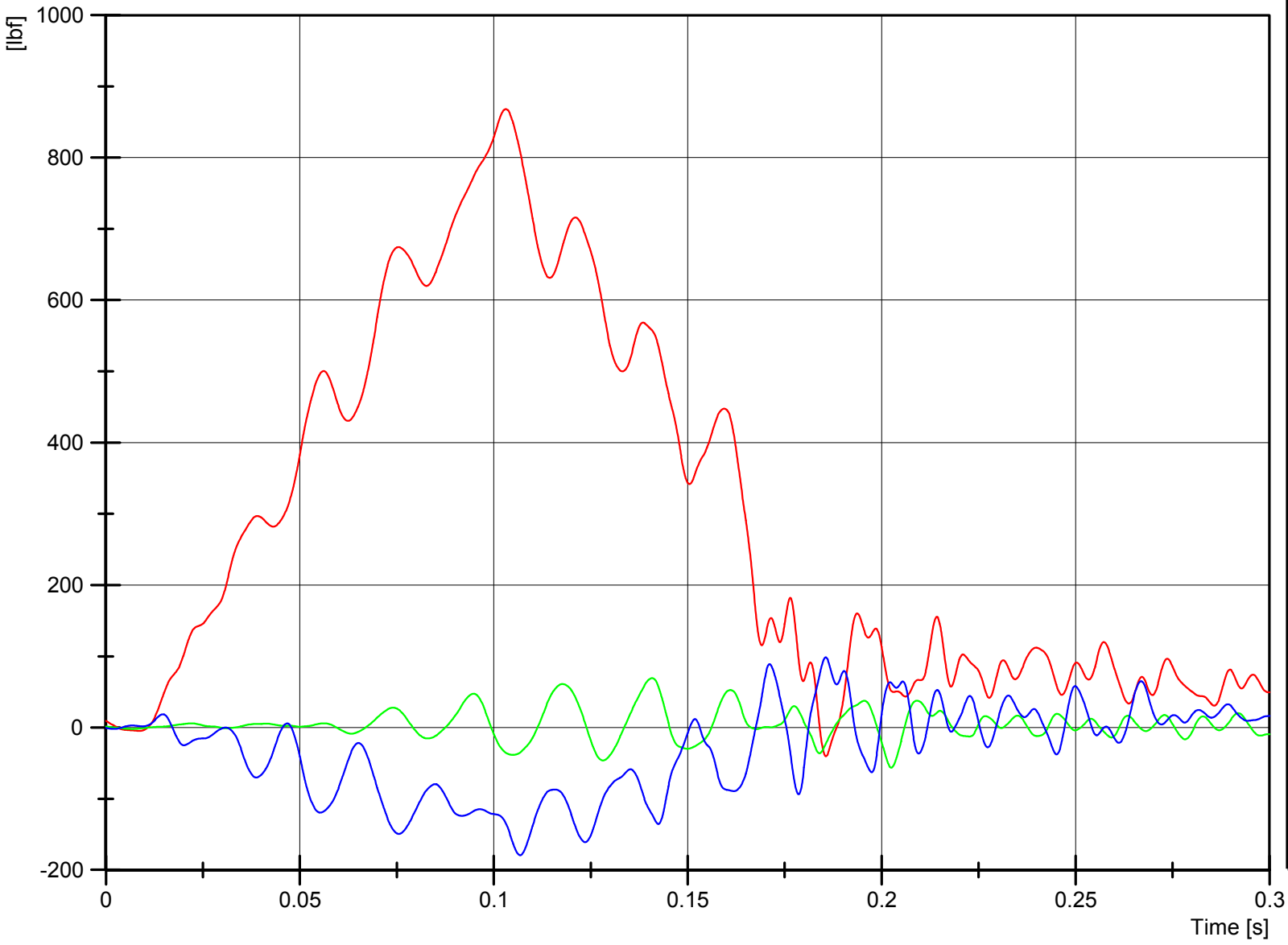
Comments:

Sled Acceleration | Sled Velocity | Ideal Pulse | Upper Limit

Maximum: 1.09 g Time: 0.3 sec.
Minimum: -16.35 g Time: 0.0994 sec.
CFC: 60
Sensor Type: ENDEVCO 7290A-100
S/N: 29924
Sensitivity: 0.01912 V/EU
Cal. Due: 01/07/2015
Full Scale: 100 g
DAS Channel: 50
Ref. No.: 1
Polarity: R

Minimum: -45.58 ft/s Time: 0.1751 sec.

Pulse Requirement		Actual
Minimum Required Peak Acceleration:	16 g	16.35 g
Minimum Overall Velocity Change:	44 ft/s	45.58 ft/s
Maximum Rise Time:	90 msec	87.8 msec
Minimum Velocity Change Before Greq:	22 ft/s	23.04 ft/s



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16g-04

Rate: 10000
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Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

Comments:

Rigid Seat Seat Back Fx

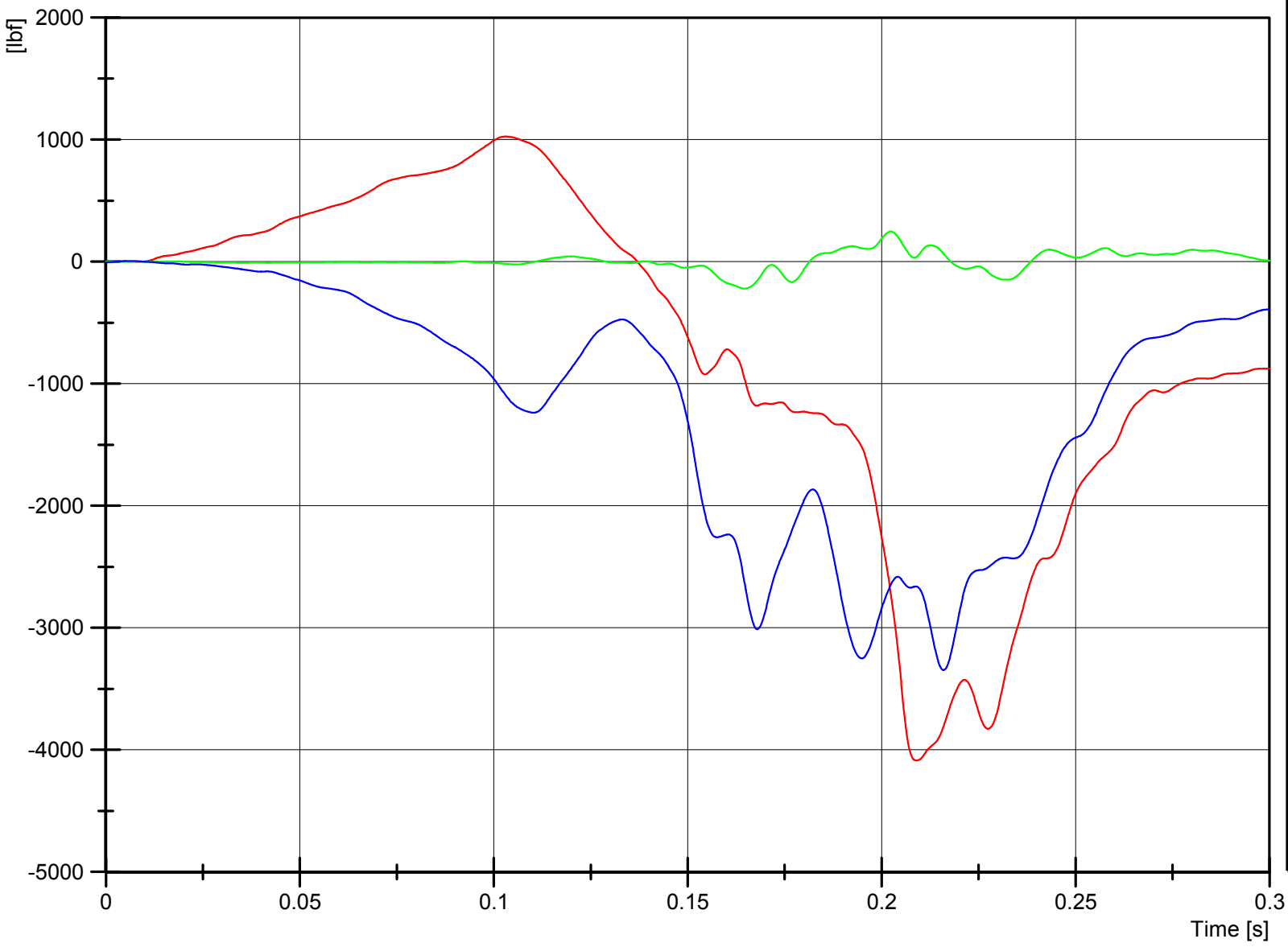
Maximum: 868.293 lbf Time: 0.1033 sec.
Minimum: -40.29 lbf Time: 0.1858 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FZ
Sensitivity: 1.187E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 12
Ref. No.: 15
Polarity: N

Rigid Seat Seat Back Fy

Maximum: 69.4733 lbf Time: 0.141 sec.
Minimum: -56.32 lbf Time: 0.2027 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FY
Sensitivity: 2.769E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 11
Ref. No.: 14
Polarity: N

Rigid Seat Seat Back Fz

Maximum: 98.3297 lbf Time: 0.1858 sec.
Minimum: -179.22 lbf Time: 0.107 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC083FX
Sensitivity: 2.765E-07 V/EU
Cal. Due: 02/20/2015
Full Scale: 10000 lbf
DAS Channel: 10
Ref. No.: 13
Polarity: R



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National Institute for Aviation Research
1845 N. Fairmount St.
Wichita, Kansas 67260-0093
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www.niar.wichita.edu

Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

Comments:

Rigid Seat Seat Pan Fx

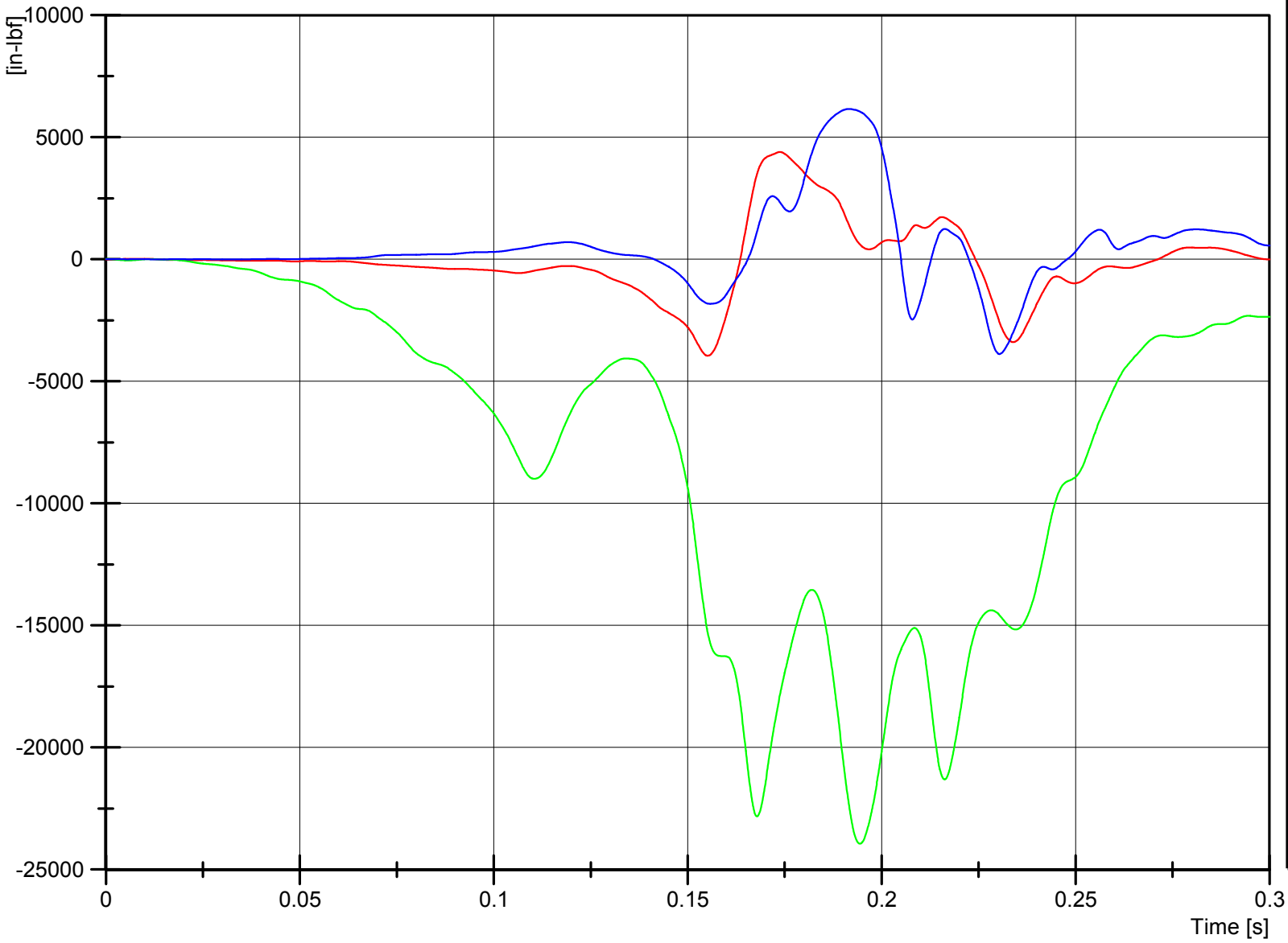
Maximum: 1024.98 lbf Time: 0.1033 sec.
Minimum: -4.09E+03 lbf Time: 0.2092 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FX
Sensitivity: 2.848E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 13
Ref. No.: 10
Polarity: N

Rigid Seat Seat Pan Fy

Maximum: 248.30 lbf Time: 0.2025 sec.
Minimum: -220.14 lbf Time: 0.1649 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FY
Sensitivity: 2.846E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 14
Ref. No.: 11
Polarity: N

Rigid Seat Seat Pan Fz

Maximum: 5.5529 lbf Time: 0.0066 sec.
Minimum: -3.35E+03 lbf Time: 0.2161 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082FZ
Sensitivity: 1.205E-07 V/EU
Cal. Due: 03/12/2015
Full Scale: 10000 lbf
DAS Channel: 15
Ref. No.: 12
Polarity: N



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Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

Comments:

Rigid Seat Seat Pan Mx

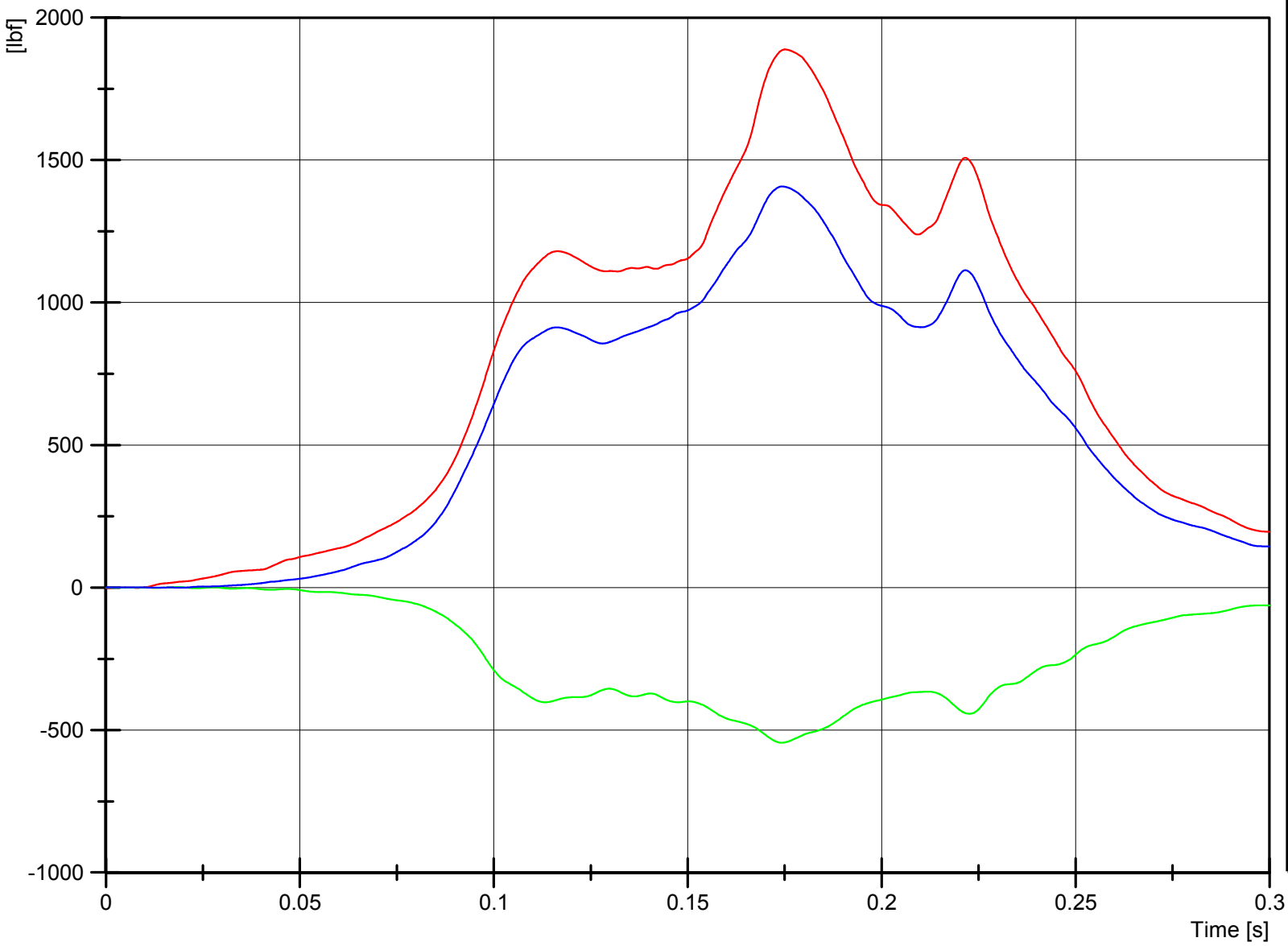
Maximum: 4399.30 in-lbf Time: 0.174 sec.
Minimum: -3.95E+03 in-lbf Time: 0.1554 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MX
Sensitivity: 7.104E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 25000 in-lbf
DAS Channel: 16
Ref. No.: 7
Polarity: N

Rigid Seat Seat Pan My

Maximum: 16.3162 in-lbf Time: 0 sec.
Minimum: -2.39E+04 in-lbf Time: 0.1946 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MY
Sensitivity: 7.112E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 25000 in-lbf
DAS Channel: 17
Ref. No.: 8
Polarity: N

Rigid Seat Seat Pan Mz

Maximum: 6164.83 in-lbf Time: 0.1917 sec.
Minimum: -3.88E+03 in-lbf Time: 0.2306 sec.
CFC: 60
Sensor Type: Denton 2513
S/N: STLC082MZ
Sensitivity: 9.38E-08 V/EU
Cal. Due: 03/12/2015
Full Scale: 20000 in-lbf
DAS Channel: 18
Ref. No.: 9
Polarity: R



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Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Dummy: H2 718

Position: Config 4 - Repaired Belt (#5)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

Rigid Seat Right Lap Fx

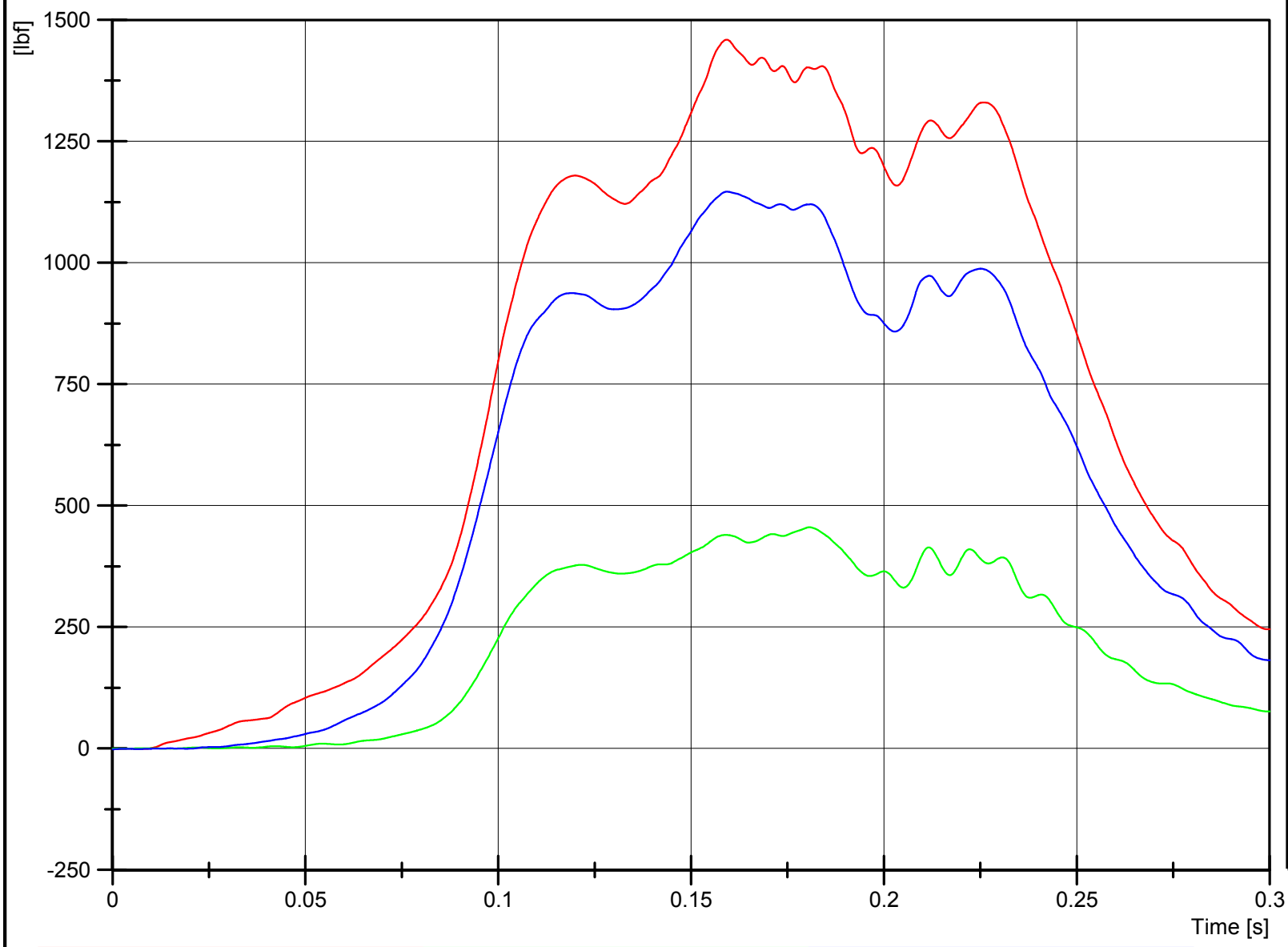
Maximum: 1887.97 lbf Time: 0.1753 sec.
Minimum: -1.735 lbf Time: 0 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FX
Sensitivity: 2.6022E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 19
Ref. No.: 74
Polarity: N

Rigid Seat Right Lap Fy

Maximum: 1.6692 lbf Time: 0.0186 sec.
Minimum: -544.41 lbf Time: 0.1744 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FY
Sensitivity: 2.5935E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 20
Ref. No.: 75
Polarity: N

Rigid Seat Right Lap Fz

Maximum: 1407.74 lbf Time: 0.1746 sec.
Minimum: -0.409 lbf Time: 0.0196 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC122FZ
Sensitivity: 1.088E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 21
Ref. No.: 76
Polarity: N



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Fax: (316) 978-3175
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Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Dummy: H2 718

Position: Config 4 - Repaired Belt (#5)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

Rigid Seat Left Lap Fx

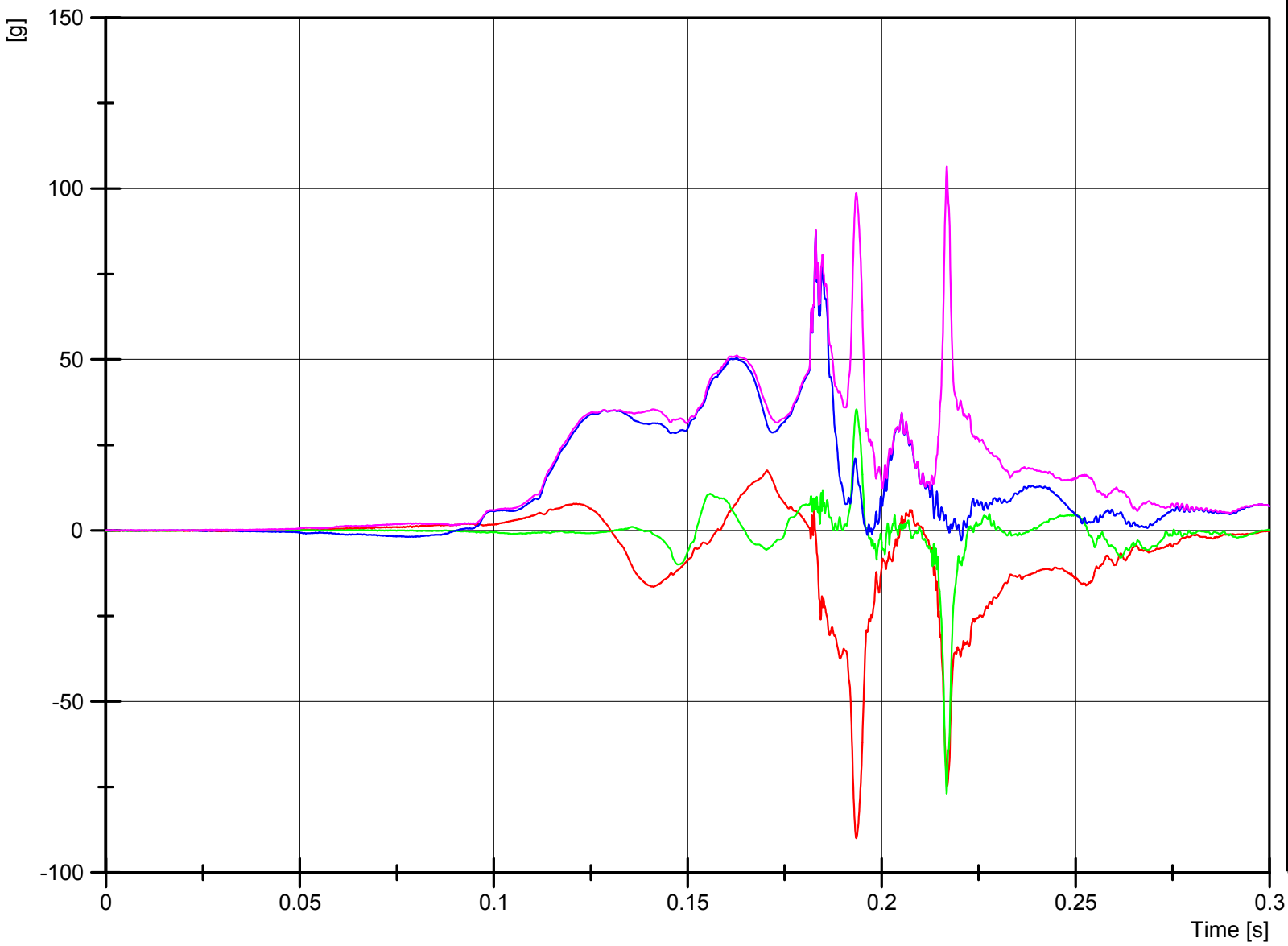
Maximum: 1459.20 lbf Time: 0.1595 sec.
Minimum: -1.5445 lbf Time: 0 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FX
Sensitivity: 2.608E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 22
Ref. No.: 77
Polarity: N

Rigid Seat Left Lap Fy

Maximum: 455.39 lbf Time: 0.1809 sec.
Minimum: -0.348 lbf Time: 0.0025 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FY
Sensitivity: 2.606E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 23
Ref. No.: 78
Polarity: N

Rigid Seat Left Lap Fz

Maximum: 1146.11 lbf Time: 0.1595 sec.
Minimum: -1.8904 lbf Time: 0 sec.
CFC: 60
Sensor Type: Denton 2177A
S/N: STLC121FZ
Sensitivity: 1.087E-07 V/EU
Cal. Due: 11/25/2014
Full Scale: 10000 lbf
DAS Channel: 24
Ref. No.: 79
Polarity: N



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Fax: (316) 978-3175
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Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Dummy: H2 699

Position: Config 4 - Repaired Belt (#5)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

Head Ax H2 699

Maximum: 17.5984 g Time: 0.1707 sec.
Minimum: -89.96 g Time: 0.1937 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P45436
Sensitivity: 1.823E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 25
Ref. No.: 22
Polarity: R

Head Ay H2 699

Maximum: 35.4601 g Time: 0.1937 sec.
Minimum: -76.92 g Time: 0.2169 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P47924
Sensitivity: 1.863E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 26
Ref. No.: 23
Polarity: R

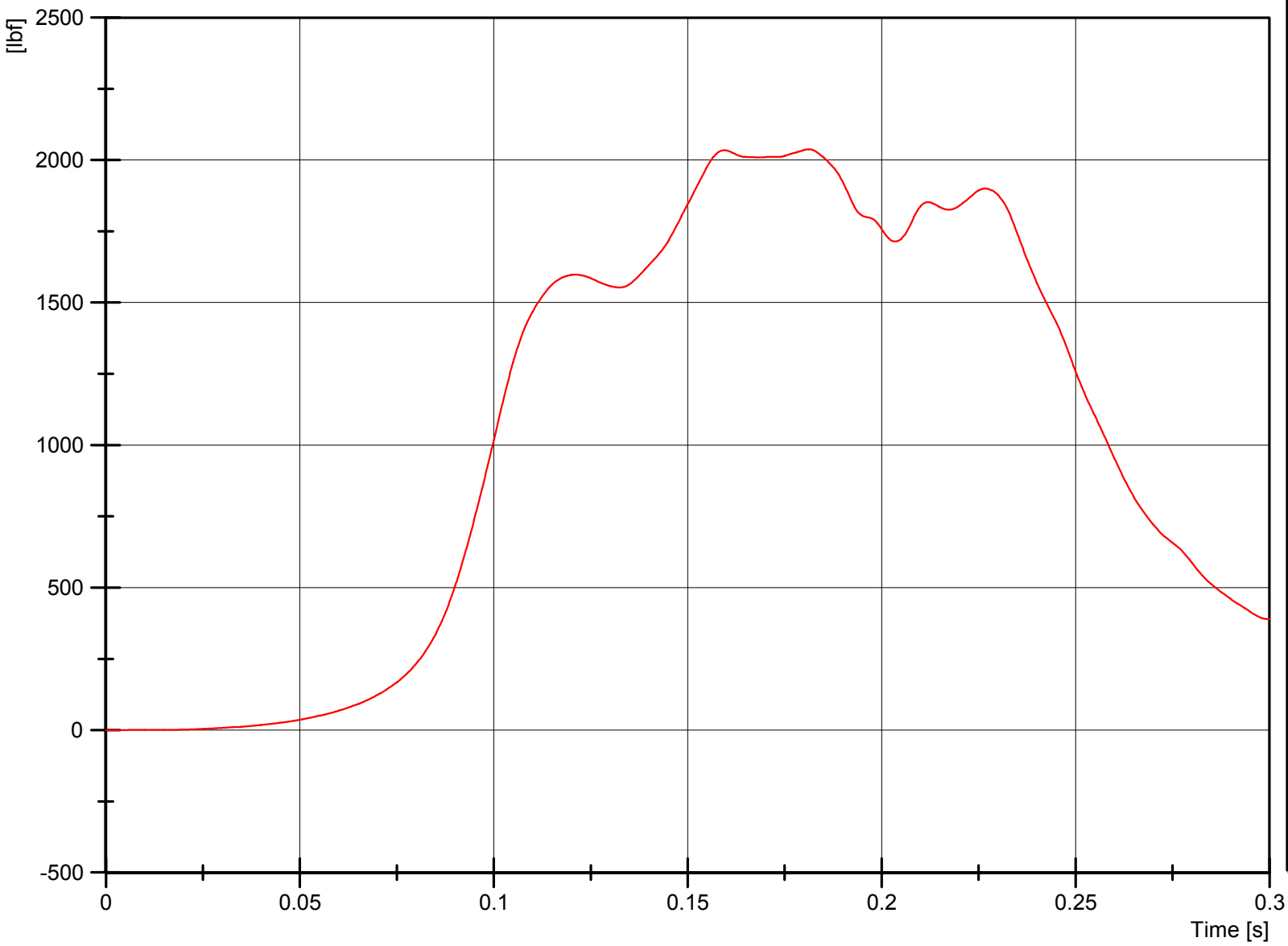
Head Az H2 699

Maximum: 87.6891 g Time: 0.1832 sec.
Minimum: -2.9339 g Time: 0.2207 sec.
CFC: 1000
Sensor Type: Endevco 7264C
S/N: P48250
Sensitivity: 1.827E-05 V/EU
Cal. Due: 01/03/2015
Full Scale: 2000 g
DAS Channel: 27
Ref. No.: 24
Polarity: R

Head Resultant H2 699

Maximum: 106.59 g Time: 0.2168 sec.

HIC: 1002.2
T1: 116.8 msec.
T2: 227.8 msec.



Lap Belt Force H2 699

Maximum: 2037.87 lbf
Minimum: -0.1936 lbf
CFC: 60
Sensor Type: Denton 3255
S/N: SBLC259
Sensitivity: 6.0647E-07 V/EU
Cal. Due: 10/17/2014
Full Scale: 3000 lbf
DAS Channel: 31
Ref. No.: 17
Polarity: N

Time: 0.1814 sec.
Time: 0 sec.

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Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Dummy: H2 699

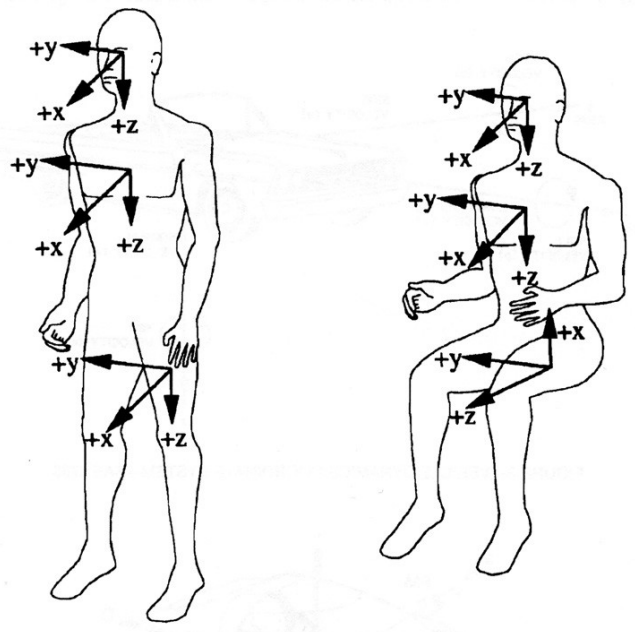
Position: Config 4 - Repaired Belt (#5)

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

J211/1 Sign Conventions



Upper Neck Load Cell:
+FX Head rearward, chest forward
+FY Head leftward, chest rightward
+FZ Head upward, chest downward
+MX Left ear toward left shoulder
+MY Chin toward sternum
+MZ Chin toward left shoulder

Lumbar Load Cell:
+FX Chest rearward, pelvis forward
+FY Chest leftward, pelvis rightward
+FZ Chest upward, pelvis downward
+MX Left shoulder toward left hip
+MY Sternum toward front of legs
+MZ Right shoulder forward, left shoulder rearward

Femur Load Cells:
+FZ Tension

Chest Displacement:
-DX Compression

Rib Dispacement:
-DY Compression

Belt Load Cells:
+FX Tension

Floor Load Cells:
+FX Test article forward
+FY Test article right
+FZ Test article up

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Crash Dynamics Lab
National Institute for Aviation Research
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Wichita, Kansas 67260-0093
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www.niar.wichita.edu

Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

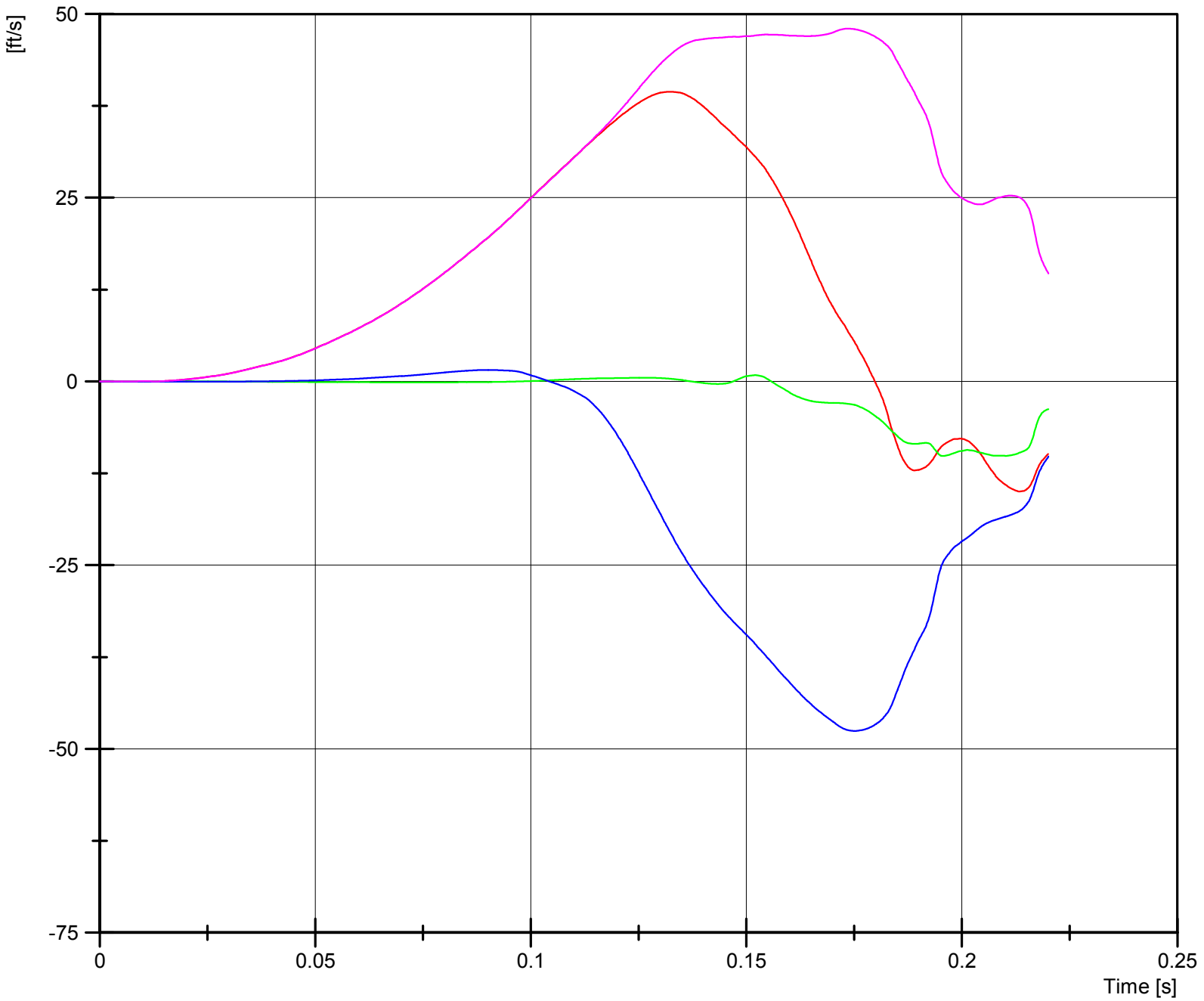
Test: FA14C-06

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

Comments:



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Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Dummy: H2 699

Position: Config 4 - Repaired Belt (#

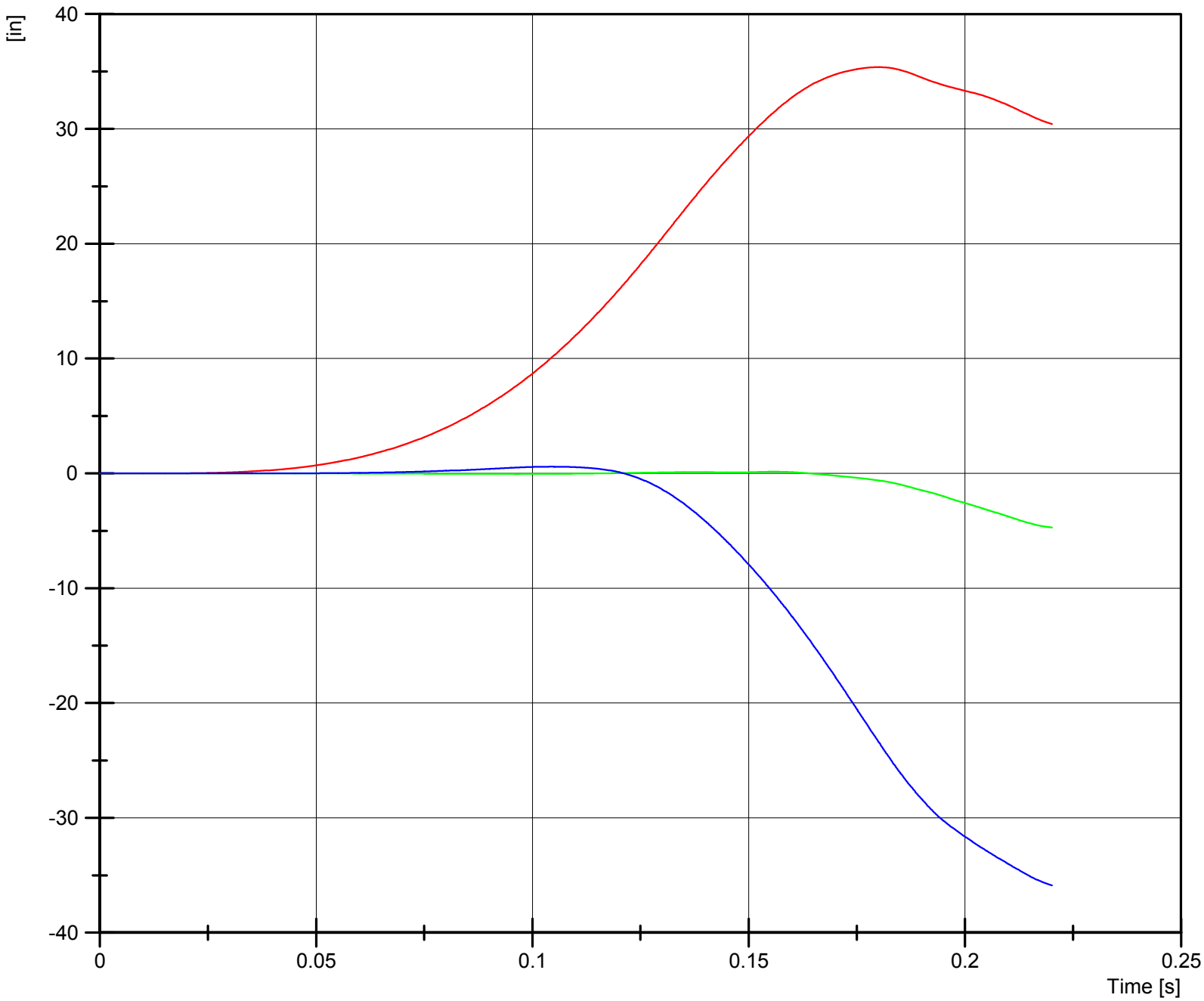
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

Comments:

Global Head Vx H2 699		Global Head Vy H2 699		Global Head Vz H2 699		Global Head Velocity Resultant H2 699	
Maximum: 39.43 ft/s	Time: 0.1324 sec.	Maximum: 0.875 ft/s	Time: 0.152 sec.	Maximum: 1.58 ft/s	Time: 0.0898 sec.	Maximum: 48.02 ft/s	Time: 0.1735 sec.
Minimum: -14.97 ft/s	Time: 0.2133 sec.	Minimum: -10.13 ft/s	Time: 0.1956 sec.	Minimum: -47.53 ft/s	Time: 0.1752 sec.	Minimum: 0 ft/s	Time: 0.0001 sec.



Global Head Dx H2 699 | Global Head Dy H2 699 | Global Head Dz H2 699

Maximum: 35.37 in	Time: 0.1799 sec.	Maximum: 0.14 in	Time: 0.1558 sec.	Maximum: 0.59 in	Time: 0.1044 sec.
Minimum: -0.00 in	Time: 0.0133 sec.	Minimum: -4.71 in	Time: 0.2201 sec.	Minimum: -35.88 in	Time: 0.2201 sec.

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Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Dummy: H2 699

Position: Config 4 - Repaired Belt (#

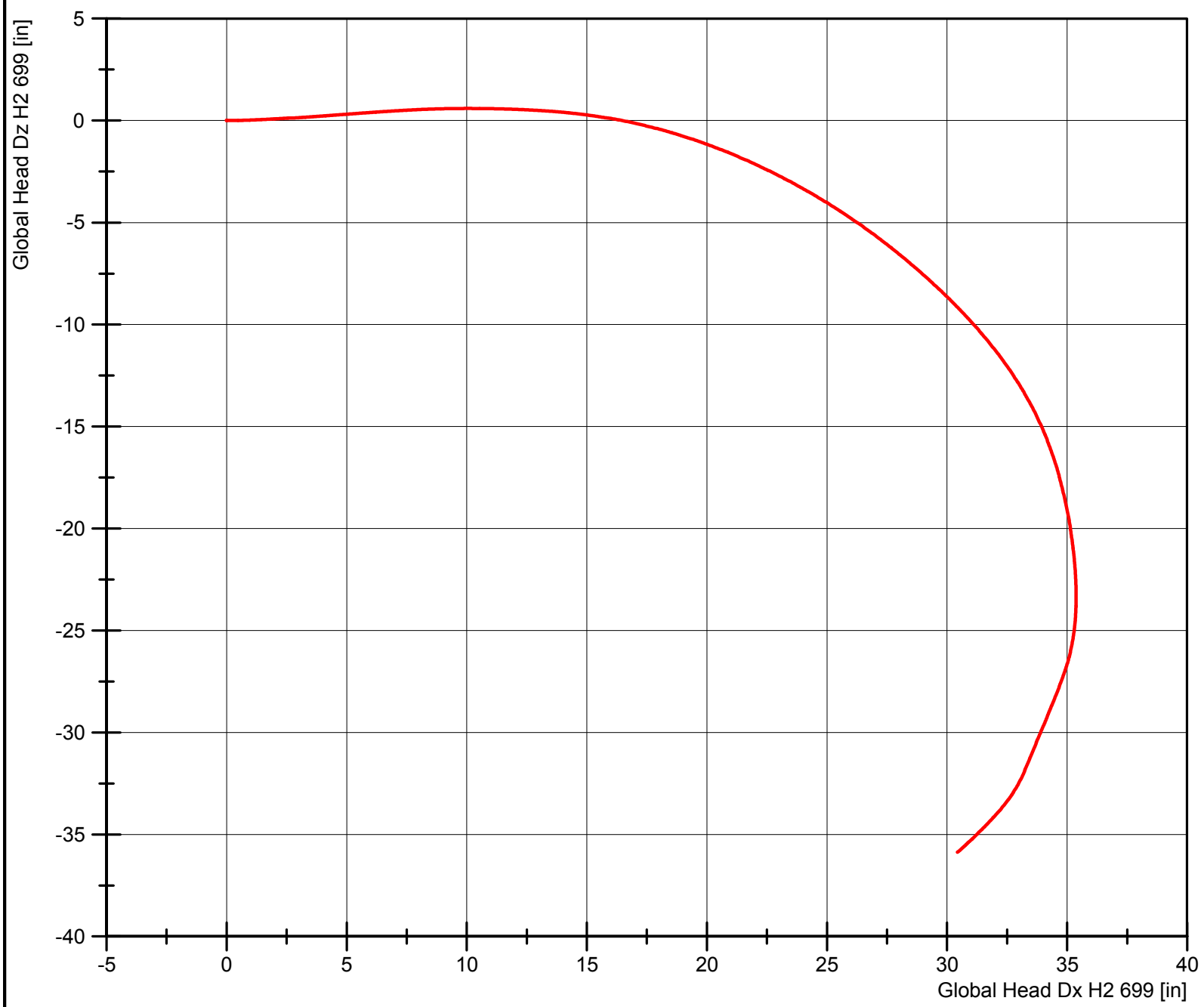
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

Comments:

Displacement values are calculated from Head Accelerations and Angular Velocities.
This method cannot be used to substitute photometric analysis.



Global Head Displacement XZ

X Maximum: 35.37 in **Time: 0.1799 sec.**

Z Value at X Maximum: -23.30 in

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Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Dummy: H2 699

Position: Config 4 - Repaired Belt (#

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

Comments:

Displacement values are calculated from Head Accelerations and Angular Velocities.
This method cannot be used to substitute photometric analysis.

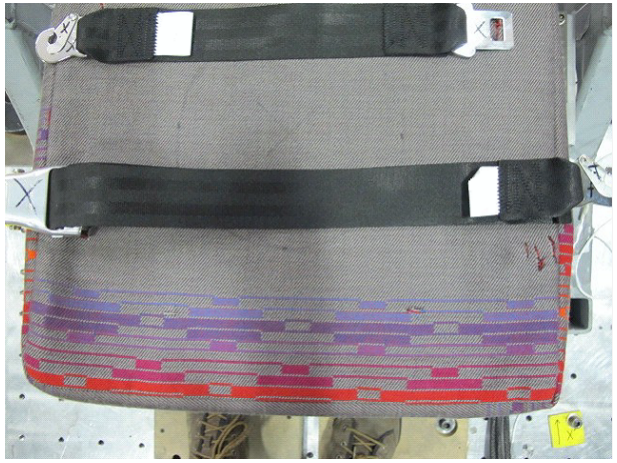
Pre-test Photos





NA

NA



NA

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Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

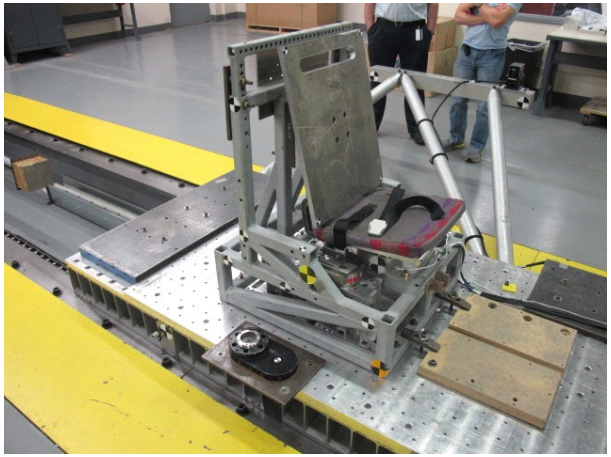
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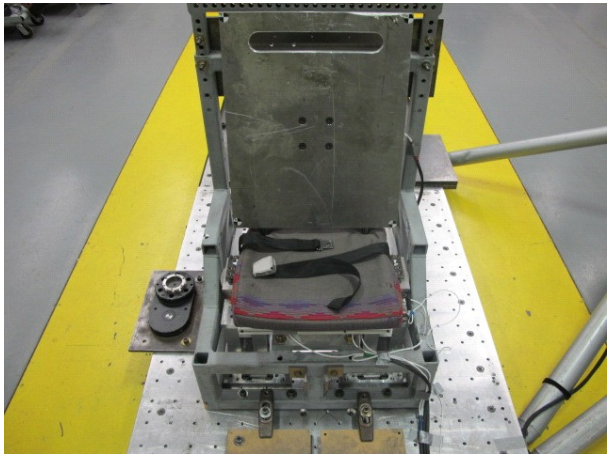
Pre-test Photos











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Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Dummy: N/A

Position: N/A

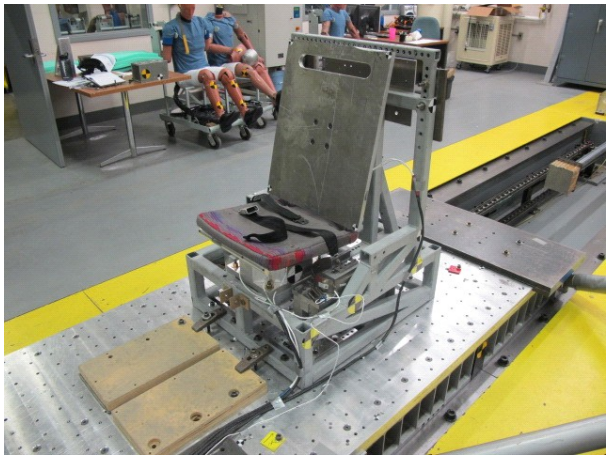
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

Comments:

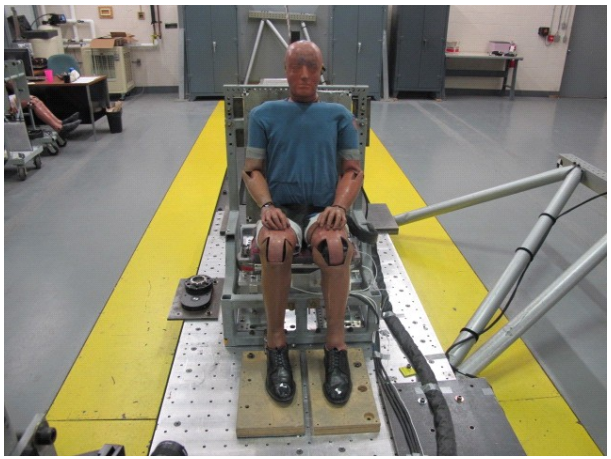
Pre-test Photos













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Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Dummy: N/A

Position: N/A

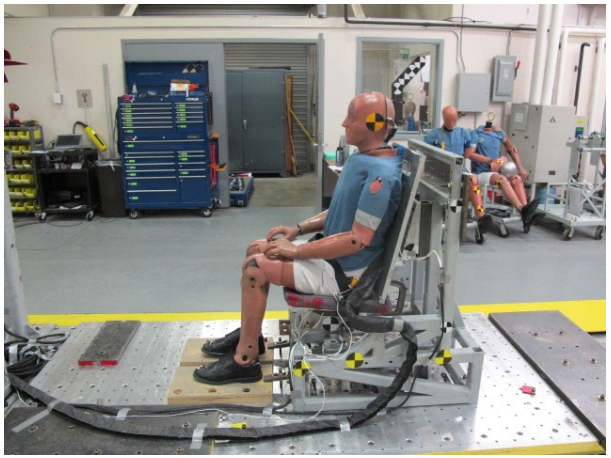
Test Description:
14 CFR 25.562 Test 2

Pulse Name:
16g-04

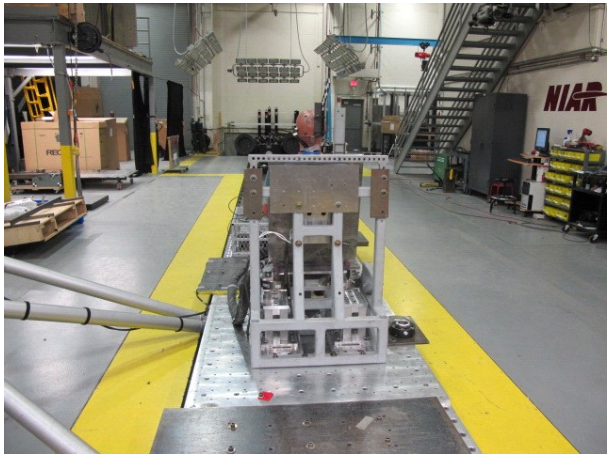
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Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

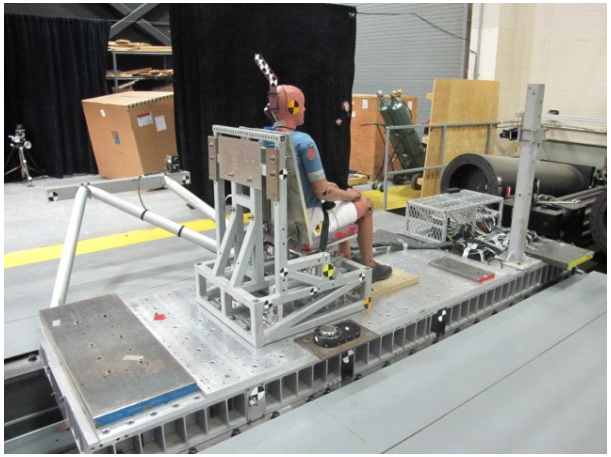
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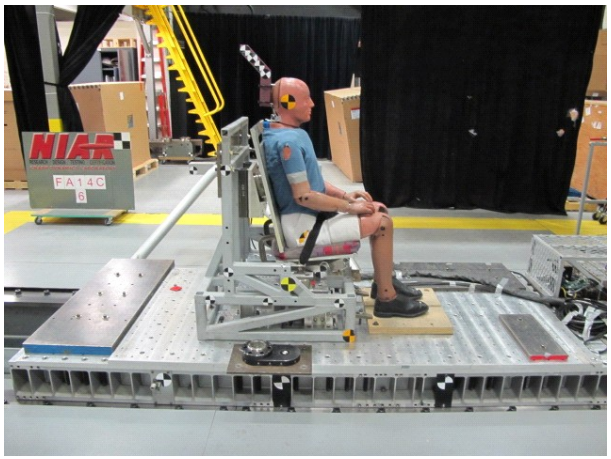
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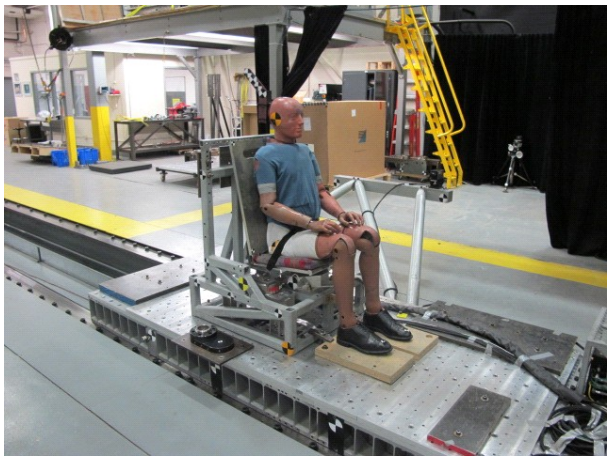












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Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Dummy: N/A

Position: N/A

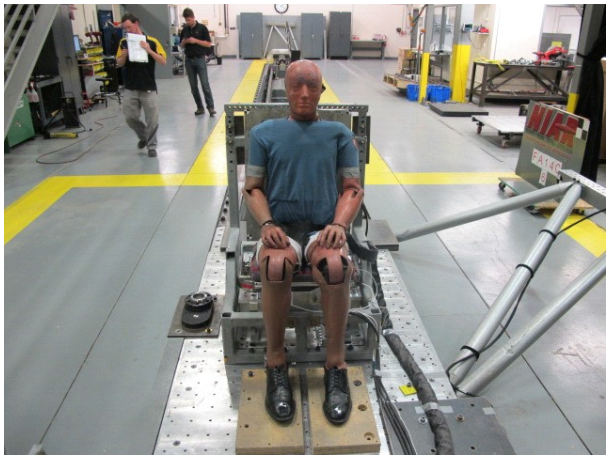
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14 CFR 25.562 Test 2

Pulse Name:
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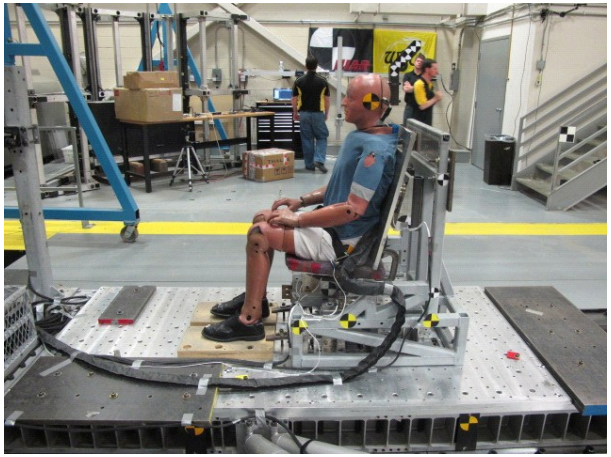
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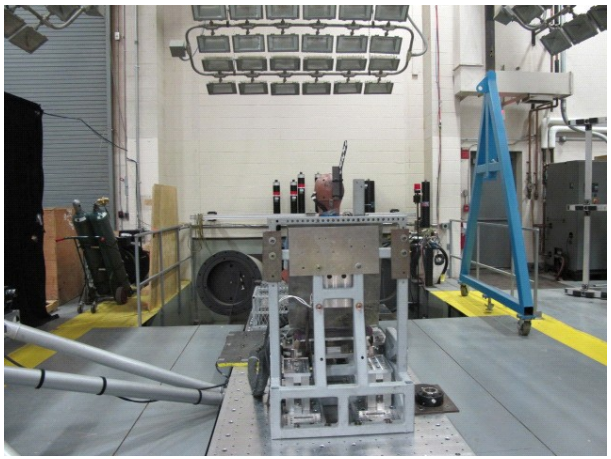
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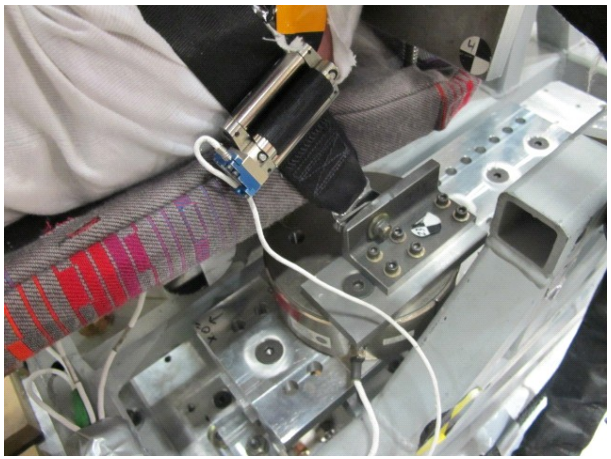












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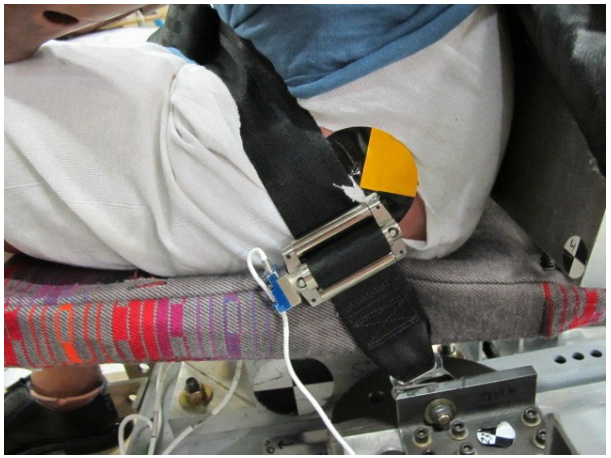
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14 CFR 25.562 Test 2

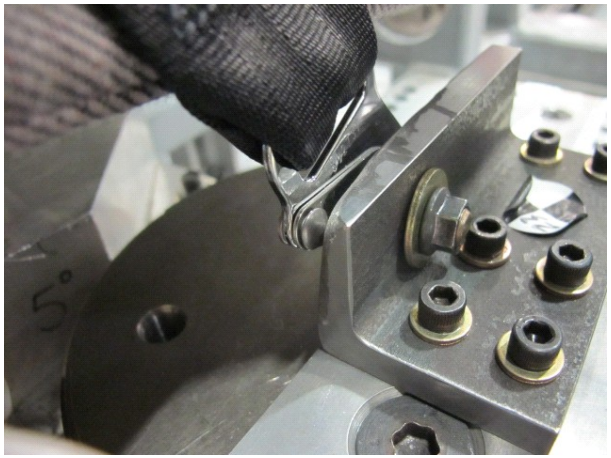
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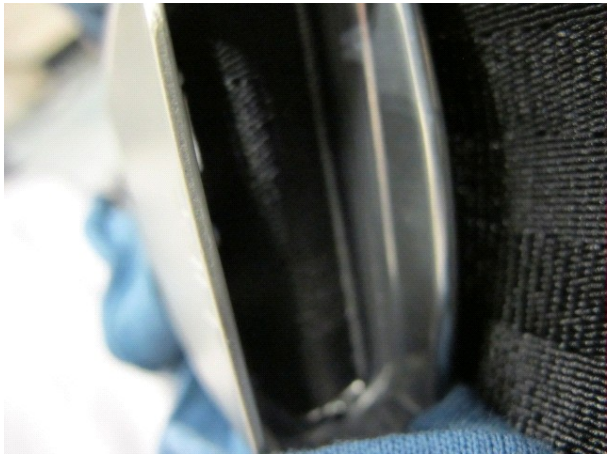
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Pre-test Photos

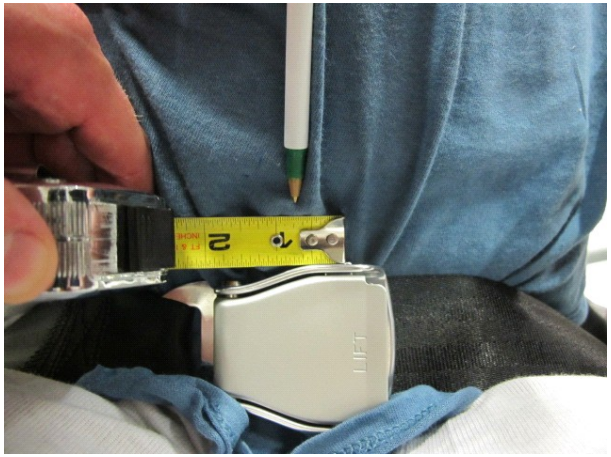












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Position: N/A

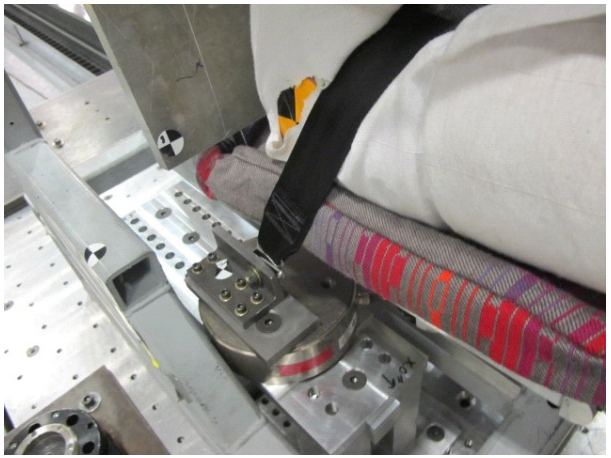
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14 CFR 25.562 Test 2

Pulse Name:
16g-04

Rate: 10000
Pretrigger Samples: 40960
Total Samples: 81920
Rev.: Impax-SD 6.02 Rev A12t
Test Date/Time: 05/06/2014 13:31

Comments:

Pre-test Photos









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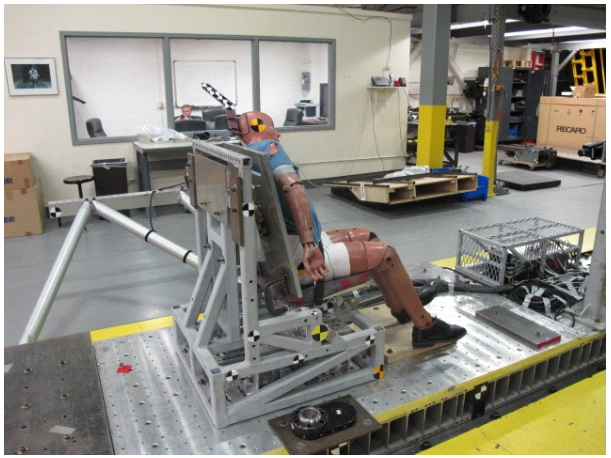
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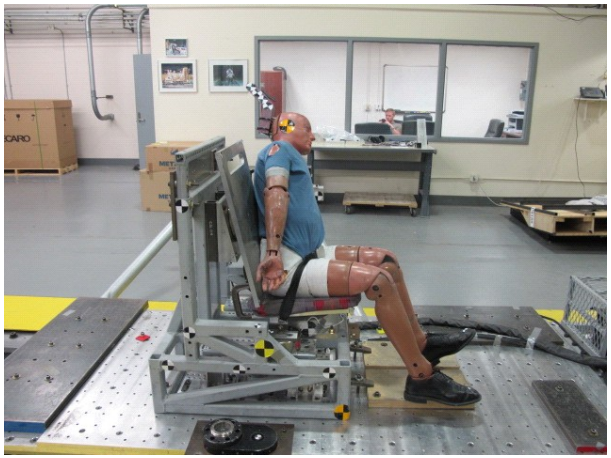
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16g-04

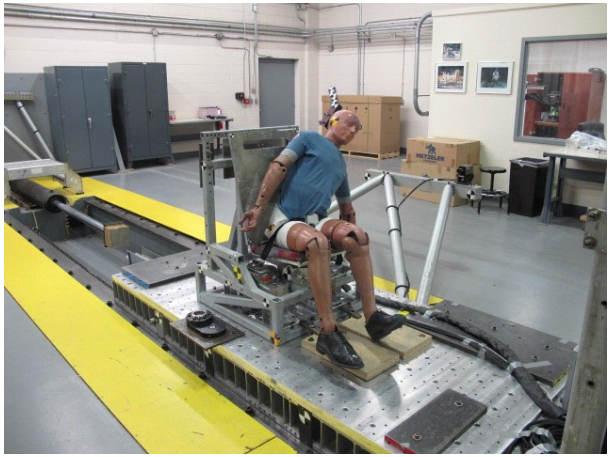
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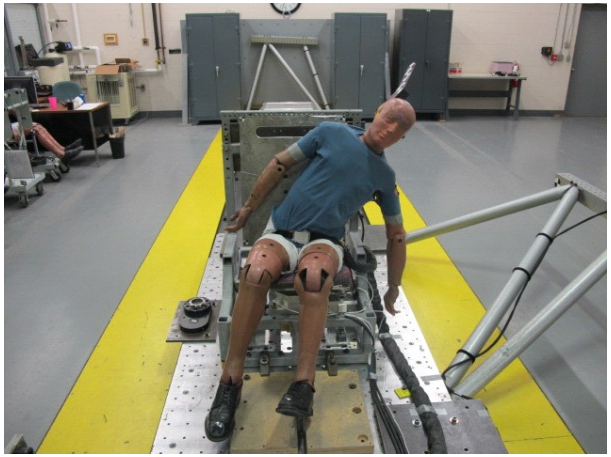
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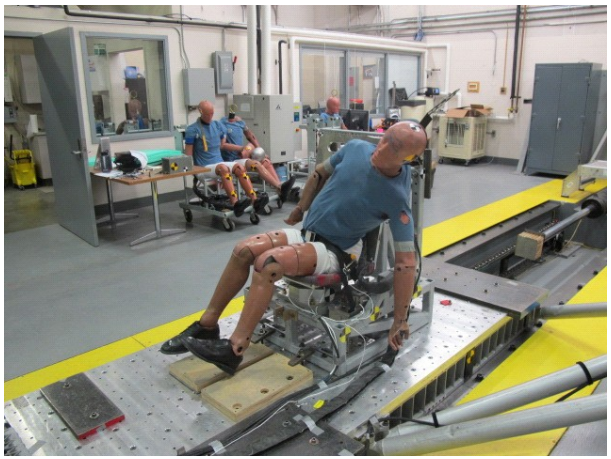
Post-test Photos

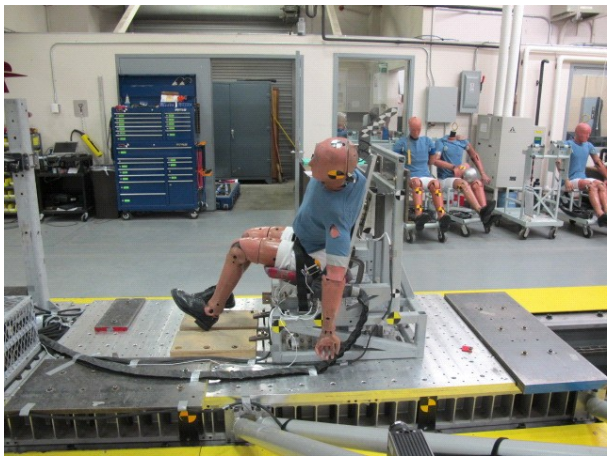












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Doc. No.: CDL-FA14C-06-01

Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Dummy: N/A

Position: N/A

Test Description:
14 CFR 25.562 Test 2

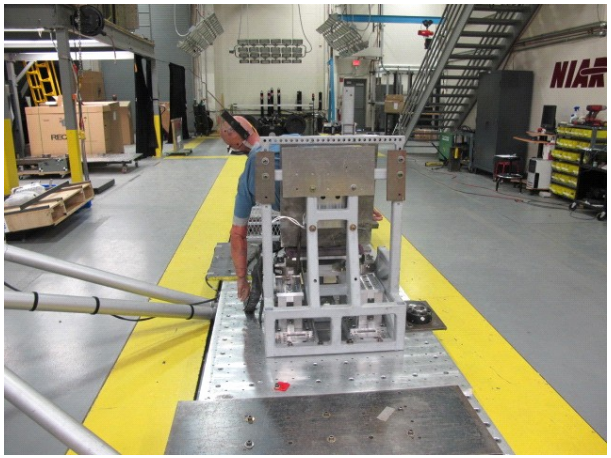
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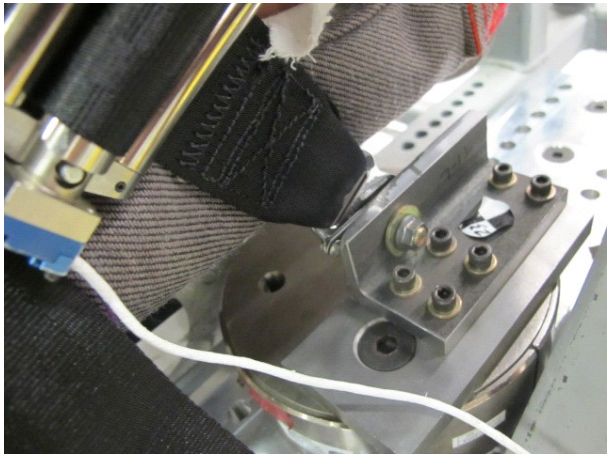
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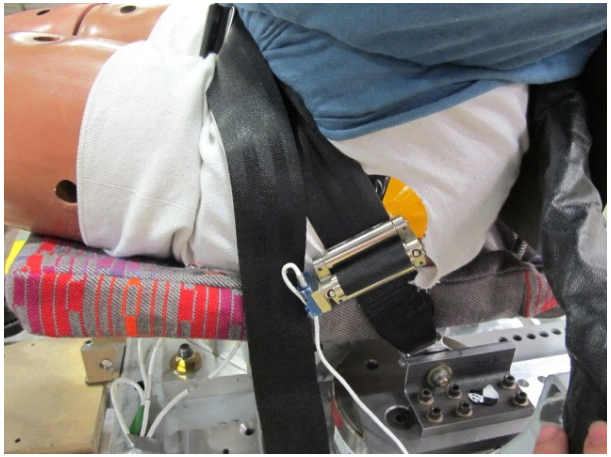
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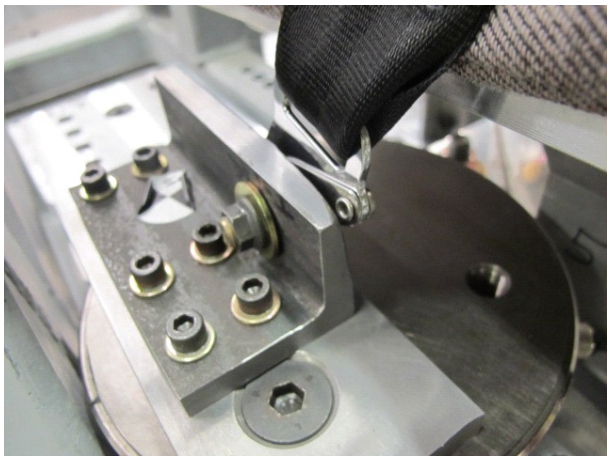
Post-test Photos













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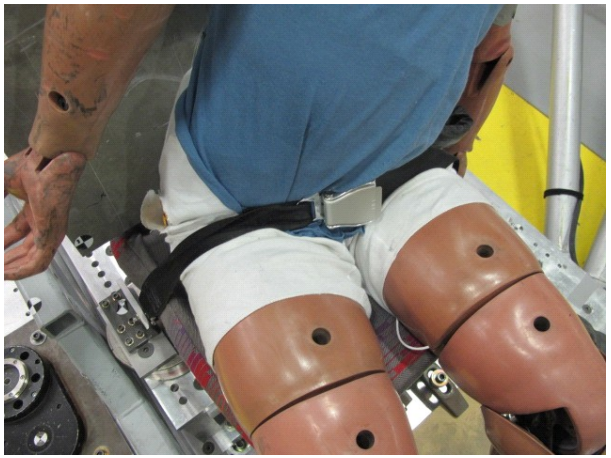
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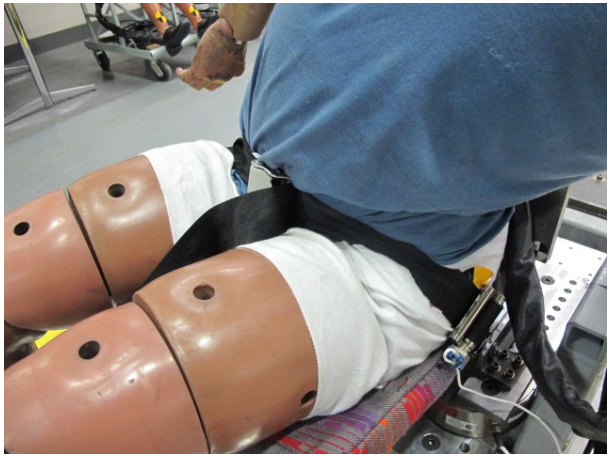
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Post-test Photos

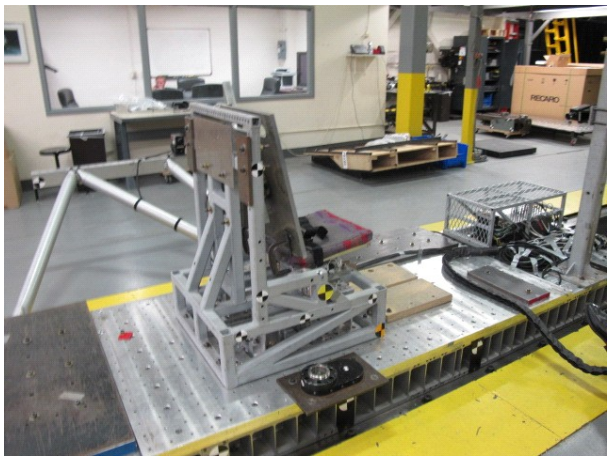












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Version: New

Report Date: 05/06/2014

Customer: FAA

Test: FA14C-06

Dummy: N/A

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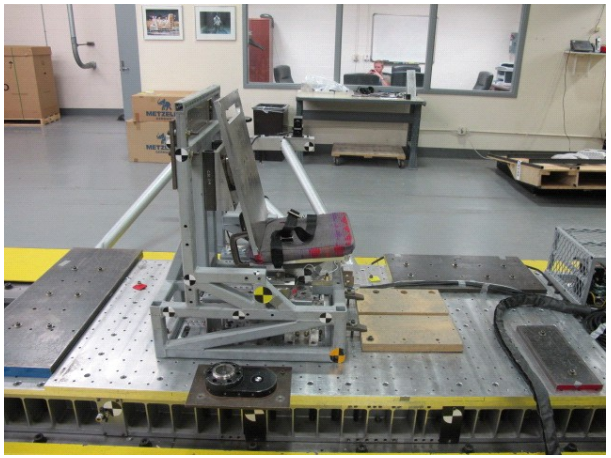
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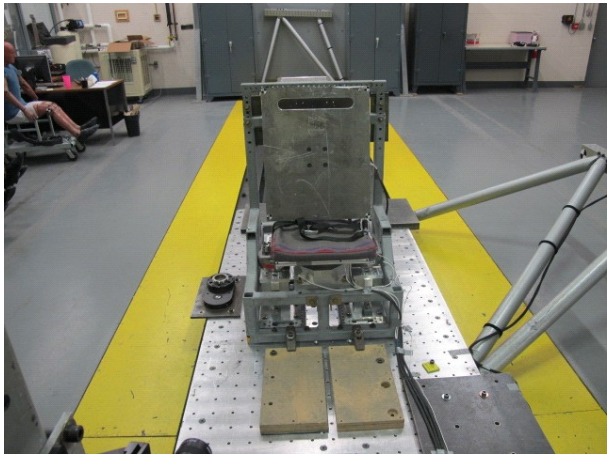
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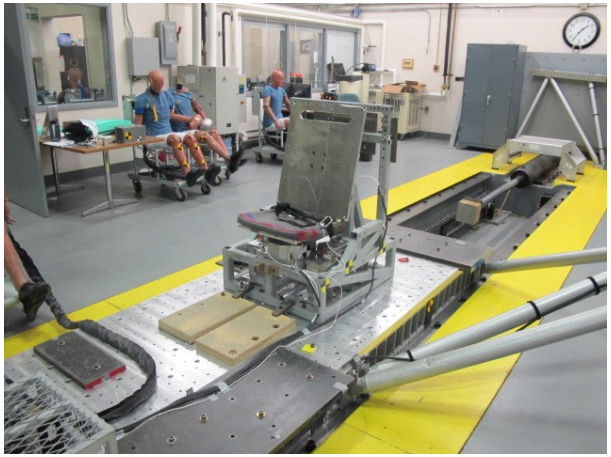
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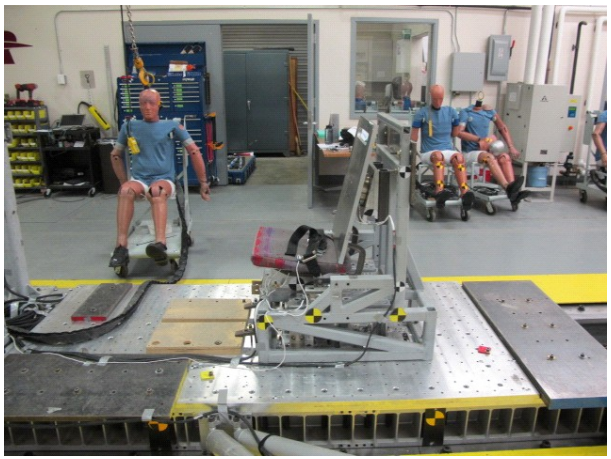
Post-test Photos

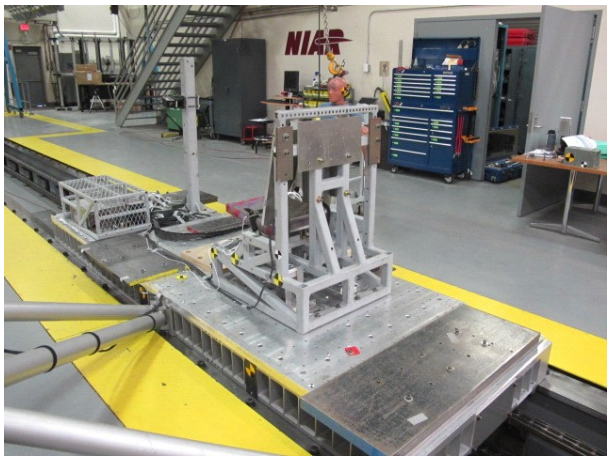












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