

**Research FMVSS 208
Flat Frontal Barrier Test
Belted at 35 mph**

**FCA US LLC
2020 Ram 2500 Crew Cab Long Bed**

**PREPARED BY:
Transportation Research Center Inc.
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Report Date: April 7, 2025

FINAL REPORT

**Prepared For:
Vehicle Research and Test Center
P.O. Box 37
East Liberty, OH 43319**

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.																																																	
4. Title and Subtitle Final Report of Frontal Rigid Barrier Impact Testing of a 2020 Ram 2500 Crew Cab Long Bed		5. Report Date April 7, 2025																																																	
		6. Performing Organization Code TRC Inc.																																																	
7. Author(s) John Shultz, Project Manager		8. Performing Organization Report No. 250325																																																	
9. Performing Organization Name and Address Transportation Research Center Inc. 10820 State Route 347 East Liberty, OH 43319-0367		10. Work Unit No.																																																	
		11. Contract or Grant No. 693JJ923D000057																																																	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Vehicle Research and Test Center (NSR-130) 10820 State Route 347 East Liberty, OH 43319		13. Type of Report and Period Covered Final Report April 16, 2025																																																	
		14. Sponsoring Agency Code NSR-130																																																	
15. Supplemental Notes																																																			
16. Abstract A 56.32 km/h (35 mph), frontal rigid barrier impact test was conducted on a 2020 Ram 2500 Crew Cab Long Bed based on the specifications of the Office of Crashworthiness Standards Laboratory Procedure for NCAP Full Frontal Rigid Barrier Impact Testing (May 2018) and FMVSS 208 (September 2012) test procedures. This test was conducted to obtain data related to FMVSS Nos. 208, 212, 219 (partial), performance. The test was conducted at the Transportation Research Center Inc. in East Liberty, Ohio on March 25, 2025. The impact velocity was 56.14 km/h, and the ambient temperature at the barrier face at the time of impact was 20.5° C. The target vehicle post-test maximum crush was 617 millimeters at Crush zone 2 at left side. The test vehicle's performance is as follows: <table border="1"> <thead> <tr> <th>Measurement Description</th><th>Units</th><th>Driver THOR-50M</th><th>Passenger</th></tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC15)</td><td>N/A</td><td>358</td><td></td></tr> <tr> <td>Brain Injury Criteria (BrIC)</td><td>N/A</td><td>1.02</td><td></td></tr> <tr> <td>Abdomen Deflection</td><td>mm</td><td>48.24</td><td></td></tr> <tr> <td>Peak Resultant Acetabulum Force</td><td>N</td><td>2172.11</td><td></td></tr> <tr> <td>Peak Chest Deflection</td><td>mm</td><td>62.52</td><td></td></tr> <tr> <td>Neck Injury Criteria (Nij)</td><td>N/A</td><td>0.61</td><td></td></tr> <tr> <td>Peak Neck Tension</td><td>N</td><td>1938.39</td><td></td></tr> <tr> <td>Peak Neck Compression</td><td>mm</td><td>-223.66</td><td></td></tr> <tr> <td>Peak Upper Tibia Index</td><td>N</td><td></td><td></td></tr> <tr> <td>Left Femur Force</td><td>N</td><td>-3517.95</td><td></td></tr> <tr> <td>Right Femur Force</td><td>N</td><td>-3495.30</td><td></td></tr> </tbody> </table>				Measurement Description	Units	Driver THOR-50M	Passenger	Head Injury Criteria (HIC15)	N/A	358		Brain Injury Criteria (BrIC)	N/A	1.02		Abdomen Deflection	mm	48.24		Peak Resultant Acetabulum Force	N	2172.11		Peak Chest Deflection	mm	62.52		Neck Injury Criteria (Nij)	N/A	0.61		Peak Neck Tension	N	1938.39		Peak Neck Compression	mm	-223.66		Peak Upper Tibia Index	N			Left Femur Force	N	-3517.95		Right Femur Force	N	-3495.30	
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19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. Number of Pages 294	22. Price																																																

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SECTION 1 PURPOSE AND SUMMARY OF THE TEST

PURPOSE

This 56.32 km/h frontal barrier impact test is part of the frontal research crash test program. It was conducted for the National Highway Traffic Safety Administration's (NHTSA) under 693JJ923D000057 by Transportation Research Center Inc. The purpose of this test was to evaluate the repeatability, reproducibility and durability of the THOR 50th percentile ATD and evaluate the high-res load cell barrier wall extensions.

The test was conducted using NHTSA's Procedure for NCAP Full Frontal Rigid Barrier Impact Testing (dated May 2018.) and NHTSA's FMVSS No.208, dated September 2012 as a guidelines. THOR-50M ATD was used in the driver's position instead of the Hybrid III 50. No passenger ATD was used in this test.

SUMMARY

A high-res load cell barrier; provided by NHTSA; consisting of 176 load cells that can collect force and moment was impacted by a 2020 Ram 2500 Crew Cab Long Bed at a velocity of 56.14 km/h. This test only collected 176 channels of force data in the X-direction. The test was performed at Transportation Research Center, Inc. on March 25, 2025. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time and 14 high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.

One THOR-50M anthropomorphic test device (ATD) was placed in the driver seating position. The ATD was seated per a draft THOR-50M seating procedure Appendix E. The driver SN: EG2595 (IDDAS) was equipped with IR-TRACCs and HIS 4-position spine. The driver was fully instrumented with head, chest, spine and pelvis tri-axial accelerometers, upper neck transducers, and femur load cells.

The driver (position 1) ATD (Serial No. EG2595) was qualified prior to the test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 284 channels of data were recorded at 20,000 samples per second and processed as specified in SAE J211/1MAR 95. Appendix B contains the vehicle and dummy response data traces.

There was 100.0 percent windshield retention and no intrusion into the protected zone of the windshield during the event.

The maximum static crush of the vehicle was 617 mm and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

The driver's visible contact points were as follows: front airbag, head restraint and knee bolster.

The occupant data is summarized below:

Measurement Description	Units	Driver	Passenger
Head Injury Criteria (HIC ₁₅)	N/A	358	
Brain Injury Criterion (BrIC)	N/A	1.02	
Neck Injury Criteria (NIJ)	N/A	0.61	
Neck Tension	N	1938.39	
Neck Compression	N	-223.66	
Upper Left Resultant Chest Deflection	mm	39.57	
Upper Right Resultant Chest Deflection	mm	62.52	
Lower Left Resultant Chest Deflection	mm	10.02	
Lower Right Resultant Chest Deflection	mm	41.07	
Maximum Chest Deflection	mm	62.52	
T6 Chest Resultant Acceleration, 3ms Clip	g	39.94	
Left Abdomen Deflection	mm	48.24	
Right Abdomen Deflection	mm	47.85	
Maximum Abdomen Deflection	mm	48.24	
Left Acetabulum Force	N	2011.07	
Right Acetabulum Force	N	2172.11	
Left Femur Force	N	-3517.95	
Right Femur Force	N	-3495.30	

DATA ACQUISITION EXPLANATIONS

None

TABLE 1 THOR-50M INSTRUMENTATION DATA
Driver Dummy Serial Number: EG2595

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
Head Acceleration (g)	X	59.27	69.30	-20.52	290.60
	Y	5.08	191.75	-29.48	90.25
	Z	34.57	74.70	-4.60	167.65
	R	66.75	69.30		
Head Angular Rate (deg/sec)	X	600.00	107.40	-394.99	168.40
	Y	1767.82	71.65	-1340.40	250.15
	Z	2086.74	78.55	-1632.94	136.60
Driver Front Neck Spring Load Cell (N)	Z	180.38	112.50	-20.88	72.85
Driver Rear Neck Spring Load Cell (N)	Z	552.40	165.35	-29.62	114.85
Driver Occipital Condyle Rotary Potentiometer (deg)	Y	46.12	202.15	14.82	84.90
Upper Neck Force (N)	X	360.48	96.80	-785.67	185.30
	Y	254.21	77.50	-173.84	105.10
	Z	1938.39	71.60	-223.27	158.55
Upper Neck Moment (Nm)	X	26.03	179.90	-29.18	78.55
	Y	17.62	165.35	-11.10	97.85
	Z	45.14	93.90	-15.31	159.75
Left Upper Thorax IR-TRACC (V)		0.10	75.65	0.04	270.55
Left Upper Thorax Rotary Potentiometer (deg)	Y	18.16	169.00	0.77	67.05
	Z	21.10	73.60	10.93	300.00
Right Upper Thorax IR-TRACC (V)		0.25	79.55	0.04	270.55
Right Upper Thorax Rotary Potentiometer(deg)	Y	34.24	138.55	11.30	75.10
	Z	-8.39	122.85	-14.85	38.25
T6 Acceleration (g)	X	5.99	172.85	-39.63	77.65
	Y	4.60	112.10	-8.32	73.15
	Z	7.35	78.25	-7.24	50.30
	R	40.73	77.70		
T6 Angular Rate (deg/sec)	X	182.87	97.20	-290.34	50.40
	Y	399.02	150.80	-722.96	67.70
	Z	287.08	102.05	-236.56	136.20
Thoracic Spine Force (N)	X	394.44	173.80	-717.31	87.05
	Y	94.27	151.05	-724.55	81.45
	Z	1353.31	67.60	-835.87	99.40
Thoracic Spine Moment (Nm)	X	33.72	104.05	-26.92	247.90
	Y	111.80	137.35	-35.09	45.50

TABLE 1 THOR-50M INSTRUMENTATION DATA (CONT'D)**Driver Dummy Serial Number: EG2595**

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
Left Lower Thorax IR-TRACC (V)		0.08	68.65	0.06	300.00
Left Lower Thorax Rotary Potentiometer (deg)	Y	-2.10	300.00	-6.11	221.80
	Z	7.59	101.65	3.31	268.25
Right Lower Thorax IR-TRACC (V)		0.18	80.20	0.06	299.60
Right Lower Thorax Rotary Potentiometer (deg)	Y	-5.07	-24.40	-11.89	100.95
	Z	-0.05	107.95	-5.58	204.90
Left Abdominal IR-TRACC (V)		0.13	63.80	0.06	24.10
Left Abdominal Rotary Potentiometer (deg)	Y	6.66	31.15	-0.37	167.60
	Z	2.63	23.10	-2.68	73.05
Right Abdominal IR-TRACC (V)		0.15	78.55	0.07	-32.60
Right Abdominal Rotary Potentiometer (deg)	Y	6.49	31.55	-0.27	182.60
	Z	-0.23	26.20	-7.08	73.10
Left A.S.I.S. Load Cell Force (N)	X	44.21	44.55	-661.51	68.25
Left A.S.I.S. Load Cell Moment (Nm)	Y	1.40	30.05	-6.53	71.75
Right A.S.I.S. Load Cell Force (N)	X	54.26	196.70	-904.14	75.45
Right A.S.I.S. Load Cell Moment (Nm)	Y	3.20	49.10	-2.02	87.35
Left Acetabulum Force (N)	X	1916.37	51.80	-432.43	30.05
	Y	174.04	103.00	-587.67	70.30
	Z	240.15	51.70	-1160.63	79.20
	R	2011.07	51.80		
Right Acetabulum Force (N)	X	628.80	28.55	-2087.45	53.05
	Y	656.19	54.15	-209.28	45.95
	Z	1290.69	38.60	-397.55	46.20
	R	2172.11	53.10		
Pelvis Accelerometer (g)	X	45.49	52.15	-3.22	132.25
	Y	20.29	71.00	-14.56	37.05
	Z	9.16	109.90	-10.71	26.05
	R	45.50	52.15		
Pelvis Angular Rate (deg/sec)	X	177.70	60.70	-253.04	48.35
	Y	633.10	73.30	-515.57	123.15
	Z	529.28	56.80	-219.14	84.00
Left Femur Force (N)	X	615.95	39.60	-183.21	179.70
	Y	176.64	87.40	-193.74	64.25
	Z	400.64	34.15	-3517.95	50.70
Left Femur Moment (Nm)	X	14.17	69.60	-49.38	90.10
	Y	70.95	39.80	-105.25	51.20
	Z	29.50	83.45	-14.95	240.25

TABLE 1 THOR-50M INSTRUMENTATION DATA (CONT'D)
Driver Dummy Serial Number: EG2595

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
Left Knee Slider Potentiometer (mm)	X	1.74	36.10	-4.96	48.00
Right Femur Force (N)	X	1474.33	39.40	-531.10	47.30
	Y	209.41	89.65	-405.32	38.15
	Z	374.71	29.35	-3495.30	51.85
Right Femur Moment (Nm)	X	62.76	54.80	-46.75	89.15
	Y	173.86	37.80	-114.92	46.20
	Z	13.14	89.75	-48.64	39.90
Right Knee Slider Potentiometer (mm)	X	1.82	34.15	-12.54	70.15

Positive Direction

Longitudinal Forward
Lateral Rightward
Vertical Downward

Negative Direction

Longitudinal Rearward
Lateral Leftward
Vertical Upward

SECTION 2 OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1 - GENERAL TEST AND VEHICLE PARAMETER DATATest Vehicle: 2020 Ram 2500 Crew Cab Long BedTest Program: THOR-50 Durability EvaluationTest Date: 3/25/2025**TEST VEHICLE INFORMATION**

NHTSA No.	
Model Year	2020
Make	Ram
Model	Ram 2500
Body Style	Truck
VIN	3C6UR5JL8LG116633
Body Color	White
Odometer Reading (km/mi)	70,290
Engine Displacement (L)	6.7
Type/No. Cylinders	Straight/6
Engine Placement	Inline
Transmission Type	Automatic
Transmission Speeds	10
Overdrive	Yes
Final Drive	4WD
Roof Rack	No
Sunroof/T-Top	No
Running Boards	Yes
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADLs)	Yes

TEST VEHICLE OPTIONS

Traction Control System (TCS)	Yes
Power Steering	Yes
Power Window Auto-Reverse	Yes
Driver Frontal Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	No
Front Pass. Frontal Airbag	Yes
Front Pass. Curtain Airbag	Yes
Front Pass. Head/Torso Airbag	No
Front Pass. Torso Airbag	No
Front Pass. Torso/Pelvis Airbag	Yes
Front Pass. Pelvis Airbag	No
Front Pass. Knee Airbag	No
Driver Pretensioner	Yes
Driver Load Limiter	Yes
Front Pass. Pretensioner	Yes
Front Pass. Load Limiter	Yes
Other:	No

Does owner's manual provide instructions to turn off automatic door locks?

No

DATA FROM CERTIFICATION LABEL

Manufactured by	FCA US LLC	GVWR (kg)	4536 (10000 LB)
Date of Manufacture	12/19	GAWR Front (kg)	2722 (6000 LB)
		GAWR Rear (kg)	2740 (6040 LB)

VEHICLE SEATING AND WEIGHT CAPACITY

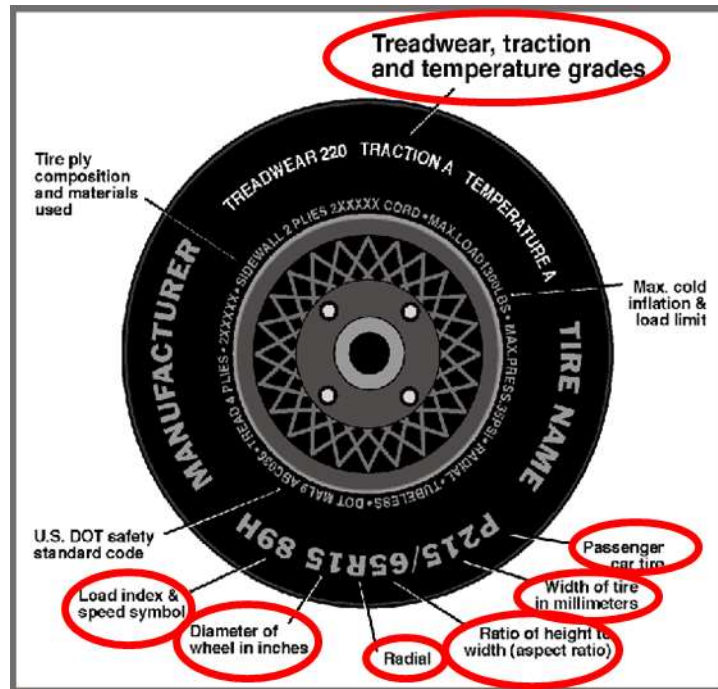
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bench	Bench	N/A	
Number of Occupants	3	3	N/A	6
Capacity Wt. (VCW) (kg)				962.0
Cargo Wt. (RCLW) (kg)				554.0

DATA SHEET NO. 1 - GENERAL TEST AND VEHICLE PARAMETER DATA (CONT'D)

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	550	550
Cold / Test Pressure (kPa)	415	415
Recommended Tire Size	LT275/70R18	LT275/70R18
Tire Size on Vehicle	LT275/70R18	LT275/70R18
Tire Manufacturer	Bridgestone	Bridgestone
Tire Model	Dueller	Dueller
Treadwear	N/A	N/A
Traction Grade	N/A	N/A
Temperature Grade	N/A	N/A
Tire Plies Sidewall	2	2
Tire Plies Body	5	5
Load Index/Speed Symbol	122R	122R
Tire Material	Polyester, Steel, Nylon	Polyester, Steel, Nylon
DOT Safety Code Right	17X 15RHD1 0923	17X 15RHD1 3223
DOT Safety Code Left	17X 15RHD1 0223	17X 15RHD1 3223

DATA SHEET NO. 1 - GENERAL TEST AND VEHICLE PARAMETER DATA (CONT'D)Test Vehicle: 2020 Ram 2500 Crew Cab Long BedTest Program: THOR-50 Durability EvaluationTest Date: 3/25/2025**TEST VEHICLE WEIGHTS**

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	954.6	691.2		1109.0	742.0	
Right	kg	1021.4	667.4		1158.0	631.5	
Ratio	%	59.3	40.7		62.3	37.3	
Totals	kg	1976.0	1358.6	3334.6	2267.0	1373.5	3640.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	3334.6
Weight of 1 THOR-50 ATD (98.0 kg)	kg	98.0
Rated Cargo/Luggage Weight (RCLW) ¹	kg	136.0
Vehicle Target Weight (TVTW)	kg	3568.6

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front)
As Delivered	mm	1023	1022	1094	1092	1754
As Tested	mm	1015	1019	1087	1087	1624
Post Test	mm	1029	1038	1168	1140	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Test Vehicle Wheel Base	mm	4305
Total Vehicle Length at Left Side	mm	6468
Total Vehicle Length at Centerline	mm	6612
Total Vehicle Length at Right Side	mm	6463
Weight of Ballast in Cargo Area	kg	0.0
Weight of Vehicle Components Removed	kg	0.0
Amount of Stoddard Solvent in Fuel Tank	liters	115.1

LIST OF COMPONENTS REMOVED TO MEET TEST WEIGHT:None¹ Rated cargo and luggage weight limited to 136.0 kg or 300.0 lbs

DATA SHEET NO. 1 - GENERAL TEST AND VEHICLE PARAMETER DATA (CONT'D)Test Vehicle: 2020 Ram 2500 Crew Cab Long BedTest Program: THOR-50 Durability EvaluationTest Date: 3/25/2025**TARGET VEHICLE STRUCTURAL MEASUREMENT**

	Elements	Descriptions	Pre-Test (mm)
1	Total Length	Total length of the vehicle bumper to bumper	6612
2	Total Width	Widest part of the vehicle excluding mirrors	2010
3	Bumper Top Height	Height from ground	760
4	Bumper Bottom Height	Height from ground	500
5	Longitudinal Member Top Height	Bumper beam top to ground	780
6	Distance Between Longitudinal Members	Distance between bumper beam mounts	750
7	Longitudinal Member Width	Bumper beam width	80
8	Engine Top Height	Top of engine to ground	1330
9	Engine Bottom Height	Bottom of engine to ground	590
10	Engine and Gearbox Width	Engine width	2000
11	Front Bumper-Engine Distance	Front of front bumper to leading edge of engine	620
12	Front Shock Absorber Fixing Height	Shock mount (Under hood) to ground	895
13	Bonnet Leading Edge Height	Height of the leading edge of hood to ground	1342
14	Front Shock Absorber Fixing Width	Width between shock mounts	940
15	Front Bumper – Front Axle Distance	leading edge of bumper to front axle	1022
16	Front Axle – A-Pillar Distance	Front axle to A pillar	656
17	A-Pillar – B-Pillar Distance	Distance between A and B pillars	1095
18	B-Pillar – Rear Axle Distance	B Pillar to rear axle	2540
19	B-Pillar – C-Pillar Distance	Distance between B and C pillars	918
20	Roof Sill Bottom Height	Bottom of roof Sill to ground (door frame top)	1845
21	Roof Sill Top Height	Top of roof Sill to ground (edge of the roof where it rolls into roof)	1960
22	Floor Sill Bottom Height	Sill bottom to ground	535
23	Floor Sill Top Height	Sill top to ground	688

DATA SHEET NO. 2 - SEAT ADJUSTMENT, FUEL SYSTEM AND STEERING WHEEL DATA

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

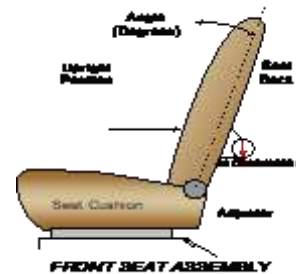
Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025

NORMAL DESIGN RIDING POSITION

Measure at the head rest post

	Degree
Driver Seat back angle:	6.2
Passenger Seat back angle:	6.2



SEAT FORE/AFT POSITIONS

Mid per the Thor 50th Seating procedure

	Total Fore/Aft Travel	Placed in Position No.
Driver Seat	230	Mid
Passenger Seat	230	Mid

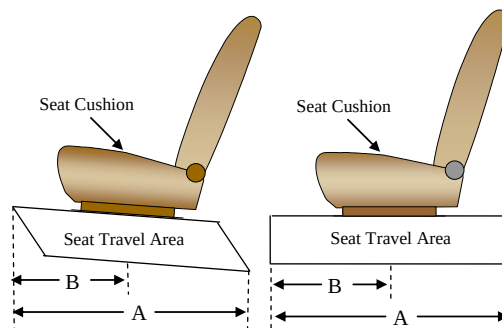
SEAT BELT UPPER ANCHORAGE

Describe the method of positioning seat belt upper anchorages.

Driver: Uppermost, Positioned according to Form 1

Passenger: Uppermost, Positioned according to Form 1

	Total No. of Positions	Placed in Position No.
Driver Seat	5	0
Passenger Seat	5	0



DATA SHEET NO. 2 - SEAT ADJUSTMENT, FUEL SYSTEM AND STEERING WHEEL DATA (CONT'D)

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

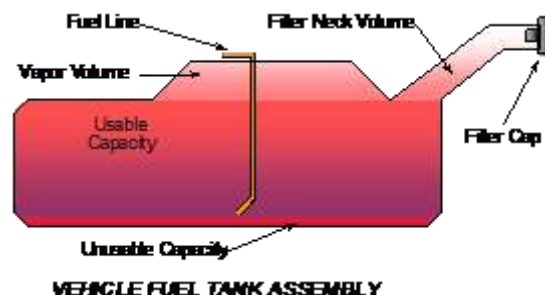
Test Date: 3/25/2025

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	121.1
Usable Capacity of "Optional Tank"	N/A
92%-94% of Usable Capacity	112.7
Actual Amount of Solvent Used	115.1
1/3 of Usable Capacity	40.4

Describe the fuel system - what type of fuel pump, details about how it operates, etc.

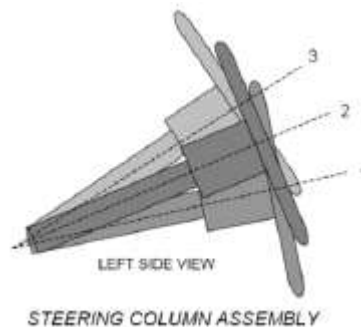
Electric fuel pump operates when the
Ignition key in and turned to the run position



STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. Describe how this measurement was taken.

The steering wheel was adjusted to the midpoint of tilt angle range and the midpoint of the telescoping travel (if applicable)



STEERING COLUMN POSITIONS

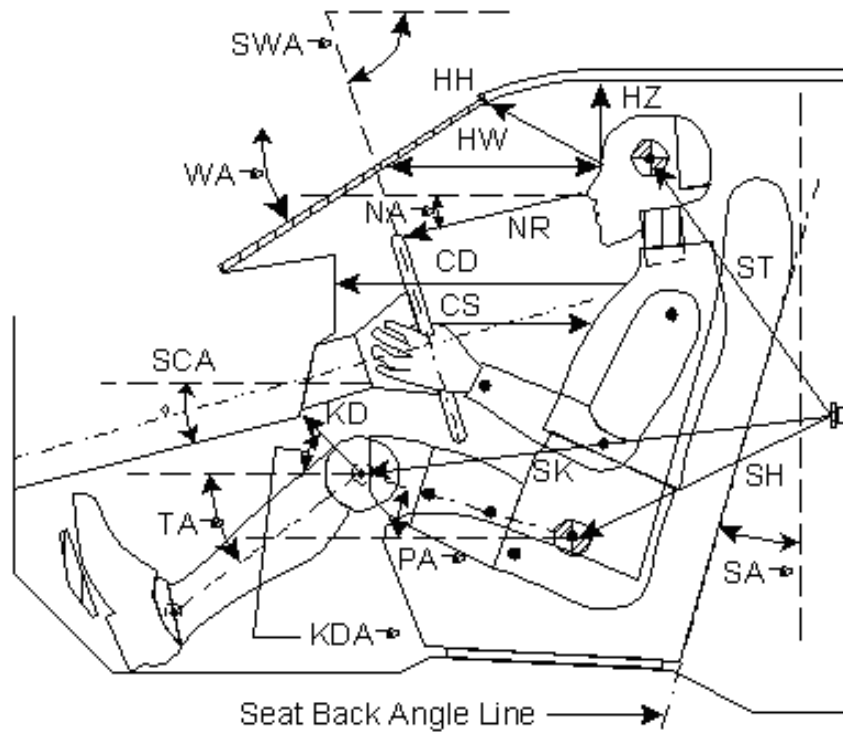
	Degrees	Fore/Aft Position (mm)
Lowermost Position No. 1	15.6	N/A
Geometric Center Position No. 2	24.1	N/A
Uppermost Position No. 3	32.6	N/A
Telescoping Steering Wheel Travel		N/A
Test Position	24.1	N/A

DATA SHEET NO. 3 - DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025



Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		34.1		
SWA°	Steering Wheel Angle		30.0		
SCA°	Steering Column Angle		30.0		
SA°	Seat Back Angle (on head rest post)		6.2		
HZ	Head to Roof (Z)	232			
HH	Head to Header	538			
HW	Head to Windshield	755			
NR	Nose to Rim	534			
CD	Chest to Dash	1025			
CS	Chest to Steering Hub	379			
RA	Rim to Abdomen	205			
KDL	Left Knee to Dash	141	34.5		
KDR	Right Knee to Dash	129	30.8		
PA°	Pelvic Angle		32		
TA°	Tibia Angle		4.4		
SK	Striker to Knee	607	6.6		
ST	Striker to Head	664	83.3		
SH	Striker to H-Point	193	12.1		

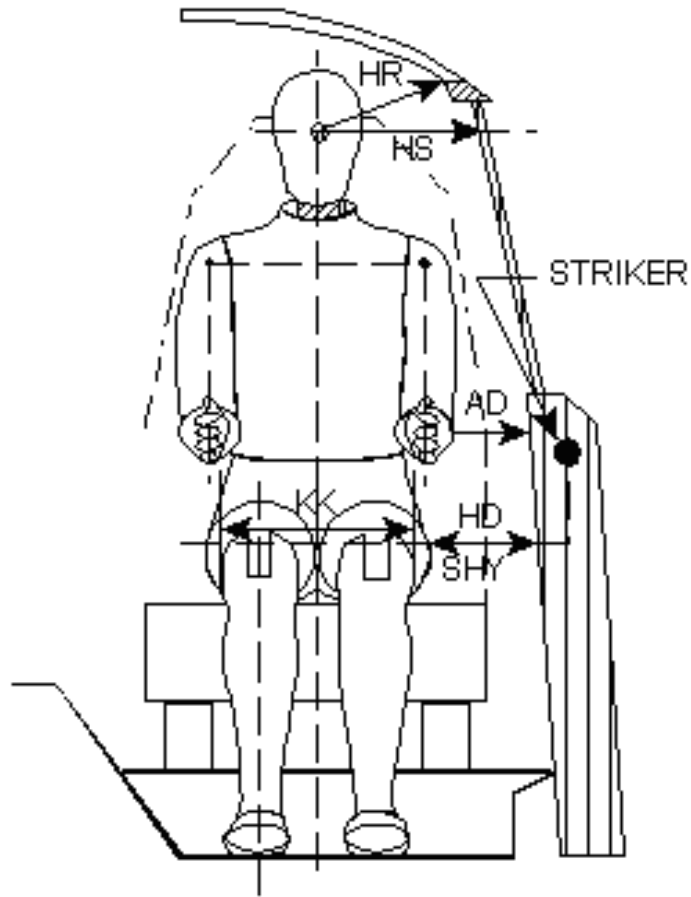
Measurements taken with CMM

DATA SHEET NO. 4 - DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025



Code	Description	Axis	Units	Driver		Passenger	
AD	Arm to Door		mm	141			
HD	H-Point to Door		mm	99			
HR	Head to Side Header		mm	214			
HS	Head to Side Window		mm	339			
KK	Knee to Knee		mm	254			
SHY	Striker to H-Point (Y Direction)		mm	41			
HLHL	Heel to Heel		mm	306			
Tilt Sensor	Head	X, Y	Deg	0.0	3.9		
	Upper Thorax	X, Y	Deg	-0.2	-0.3		
	Mid Thorax	X, Y	Deg	-0.4	21.1		
	Lower Thorax	X, Y	Deg	0.0	31.0		
	Pelvis	X, Y	Deg	0.5	32.0		

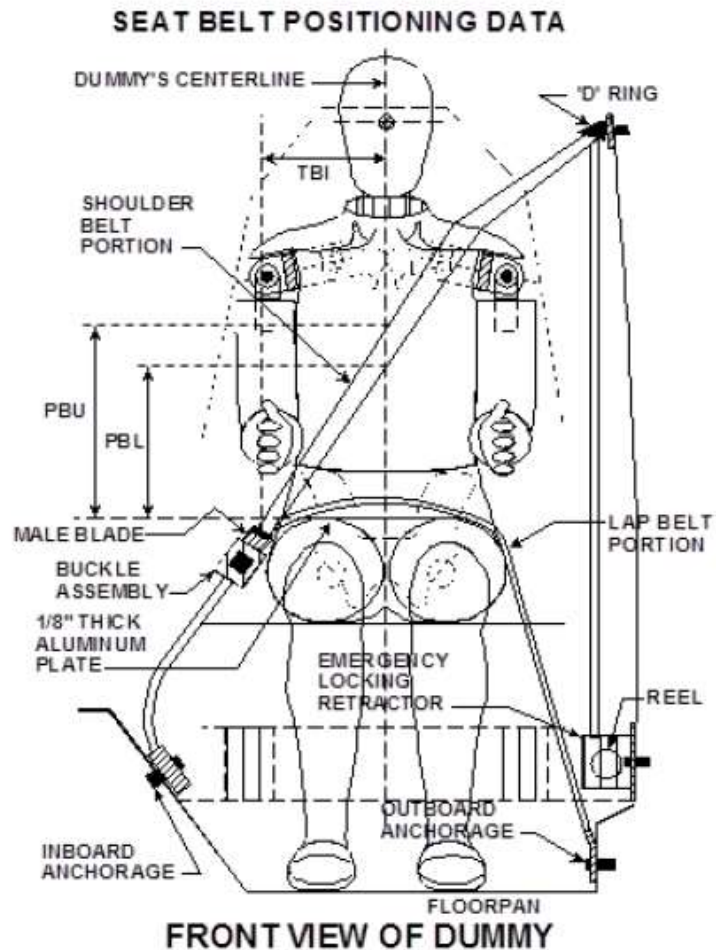
Measurements taken with CMM

DATA SHEET NO. 5 - SEAT BELT POSITIONING DATA

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU – Top surface of reference to belt upper edge	mm	300	
PBL – Top surface of reference to belt lower edge	mm	221	

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	855	
Lap belt length as measured on ATD	mm	685	
Remainder of belt on reel	mm	1310	
Total belt length for continuous webbing systems	mm	2850	

TABLE 2 SEATING TABLE

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025

Driver THOR 50M Seating Worksheet

Vehicle	2020 Ram 2500 Crew Cab Long Bed		Technician	Jeremy	
VIN #			Position	Driver	
ATD	EG2595		Date	3/25/2025	
Test #	250325				

SCRL Angle	Max _____	THOR Tilt Sensors	X	Y	20.5-23.9 CELSI
	Min - _____	Head	0	3.9	TEMP
	Difference _____ 0	T1	record for ref	0.3	0.3
	/2 _____ 0	T6	record for ref	-0.4	21.1
	Min + _____ 0	T12	record for ref	0.2	31
	Mid Angle _____ 0	Pelvis	0°±1°/33°±2.5°	0.5	32

Seat Back Angle	W/Level ° _____ 6.2	HEAD REST POST ANGLE	6.2	REST POST ANGLE	6.2
Seat Pan Angle	W/Level ° _____	head rest post adjusted one detent			
		Seat Fore/Aft Mid Position	one detent rearward	Seat Fore/Aft Set Position	Mid
		CENTER OF KNEE TO KNEE		mm rearward of mid position	

Pelvis Angle	THOR 33° +/-2.5°	Manual		Tilt Sensor	32
		Inclinometer			

FARO Measurements On Vehicle Before Seating and Instrumentation								
Measurements From Striker								
Name	Meas X	Meas Y	Meas Z	X-DISTANCE	Y-DISTANCE	Z-DISTANCE	3D Distance	Deg
SBU -	-30.882	-0.573	-18.478					
SBL -	-28.621	-2.172	21.528					
STRIKER (Center) -	0.000	0.000	0.000					
FOSB								
FISB								
ROSB								
RISB								
S0	515.934	415.551	-365.530					
TS -	600.369	415.514	-534.327					
BS -	439.269	415.458	-201.123					
SC1-	734.541	300.479	-249.818					
CLAP (Bottom center of accel pedal)	990.246	594.440	248.540					
Floor Pan Point	959.124	594.122	332.438					
Brake Pedal - Center (from J.S. E.15)	976.387	418.287	148.256					
Left Lower IP(from J.S. E.15)	735.441	265.391	-118.118					
Right Lower IP(from J.S. E.15)	717.703	565.003	-118.681					
Upper IP(from J.S. E.15)	841.424	265.260	33.151					
Parking Brake(from J.S. E.15)	875.147	149.644	63.510					
Footrest(from J.S. E.15)	1264.540	418.052	148.987					
TP Outboard(from J.S. E.15)	1222.958	265.496	149.116					
TP Center(from J.S. E.15)	1265.101	416.777	149.097					
TP Inboard(from J.S. E.15)	1175.192	568.292	149.344					
PEDAL REFERENCE POINT (PRP)	1025.188	593.444	185.223					
RHP - (Right Heel Point)	912.944	593.452	341.471					
LHP - (Left Heel Point)	914.859	264.569	359.359					
Gas Pedal Right Upper	1068.413	635.908	138.641					
Gas Pedal Right Lower	990.257	600.703	247.748					
Gas Pedal Left Upper	1073.060	565.480	137.962					
Gas Pedal Left Lower	991.555	569.857	249.155					
Brake Pedal Right Upper	1003.858	473.161	133.387					
Brake Pedal Right Lower	965.236	461.151	182.105					
Brake Pedal Left Upper	1002.868	359.932	133.383					
Brake Pedal Left Lower	965.527	371.183	178.899					
Seat Centerline Point								
SCR-P: Full Forward (Per Seating Procedure)	340.363	149.873	68.711					
SCR-P: Full Rearward (Per Seating Procedure)	111.249	148.404	85.787					
SCR-P: Mid Track (Per Seating Procedure)	482.921	154.747	65.980					
SAE J826 Manikin H-POINT - (Seating Procedure)								
DR PROJECTED THOR H-POINT AT MID-POSITION - (Seating Procedure)								
DRIVER STP 15.27 MID-POSITION - (Seating Procedure)								

NOTES:

TABLE 2 SEATING TABLE (CONT'D)

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025

FARO Measurements Taken Once Seating is Complete								
Name	Measurements From Striker							
	Meas X	Meas Y	Meas Z	X-DISTANCE	Y-DISTANCE	Z-DISTANCE	3D Distance	Deg
DRIVER STP STEP 18.6 TRIAL 1 -								
DR PROJECTED THOR H-POINT STEP 18.6.2 TRIAL 1 -								
DRIVER STP STEP 18.6 TRIAL 2 -								
DR PROJECTED THOR H-POINT STEP 18.6.2 TRIAL 2 -								
DRIVER STP STEP 18.6 TRIAL 3 -								
DR PROJECTED THOR H-POINT STEP 18.6.2 TRIAL 3 -								
RHCG	-13.637	498.737	-691.409					
LHCG	-11.175	342.539	-691.755					
RIGHT EAM	-6.374	494.403	-663.442					
LEFT EAM	-6.033	346.972	-662.794					
NS	81.848	422.744	-697.820					
RIGHT IOF	76.783	452.583	-659.517					
LEFT IOF	77.898	388.745	-659.304					
TN	80.644	420.844	-658.715					
TC	66.709	418.139	-555.200					
C1	105.511	411.561	-438.295					
C2	136.774	415.988	-365.018					
C3	234.385	416.110	-200.615					
SHIT R	-39.364	619.923	-463.779					
SHIT L	-17.127	222.186	-463.420					
E1	226.526	183.240	-240.641					
LEFT WRIST	454.152	218.159	-345.817					
RIGHT WRIST	444.297	612.483	-337.053					
P1	115.173	150.913	-72.032					
H-POINT	188.684	190.493	-40.459					
H-POINT (2)	192.736	221.789	-20.940					
OK	602.656	222.719	-69.520					
IK	608.748	476.083	-80.282					
OA	905.870	236.208	216.805					
IA	899.027	519.542	217.691					
OH	893.753	262.756	352.707					
IH	920.419	567.855	355.146					
OUTBOARD TOE	1087.333	263.741	162.516					
INBOARD TOE	1060.858	539.274	124.139					
OP	-209.775	356.175	-505.472					
TOP CENTER SHOULDER BELT	107.430	422.320	-434.861					
BOTTOM CENTER SHOULDER BELT	142.297	422.281	-355.684					
TOP CENTER LAP BELT	245.866	422.740	-178.469					
BOTTOM CENTER LAP BELT	265.506	423.249	-135.323					
CENTER OF BELT AT D-RING	-111.885	186.127	-646.379					
DRIVER SCRIP - FINAL TEST POSITION	220.768	151.388	75.683					
Measurements to be taken once Dummy is seated and measured								
Name	Meas X	Meas Y	Meas Z	X-DISTANCE	Y-DISTANCE	Z-DISTANCE	3D Distance	Deg
R	81.337	423.908	-930.237					
H	602.289	422.434	-832.621					
W1	837.044	423.057	-698.735					
W1 OUTSIDE	855.345	423.253	-697.476					
W2 OUTSIDE	1183.983	422.631	-476.803					
D1	740.486	412.224	-496.091					
D2	718.979	223.116	-149.347					
D3	719.894	476.076	-146.517					
HRP	82.405	254.916	-830.469					
HSP	81.238	83.950	-697.011					
ADP	227.517	42.443	-239.770					
HDP	190.265	91.699	-39.960					
Measurements calculated using points collected from the FARO arm								
Name	Meas X	Meas Y	Meas Z	X-DISTANCE	Y-DISTANCE	Z-DISTANCE	3D Distance	Deg
HZ						232		
HH							538	
HW				755				
NR							534	
CD							1025	
CS				379				
CBS				479				
IKD							129	
OKD							141	
HR							214	
HS					339			
AD					141			
HD					99			
HLHL							306	
KK							254	
SH							271	
HRA - (Inclinometer measurement deg)								#REF!
H-POINT TOOL ANGLE								23.2
TORSO ANGLE								17.1
WINDSHIELD ANGLE								56.1
Distance A (From Point 1 to 7)				Missing Point 1				
Distance B (from Point 4 to 8)				Missing Point 4				
Wheelbase (From center of front tire to rear tire) Driver Side				Missing Front Wheel				

NOTES:

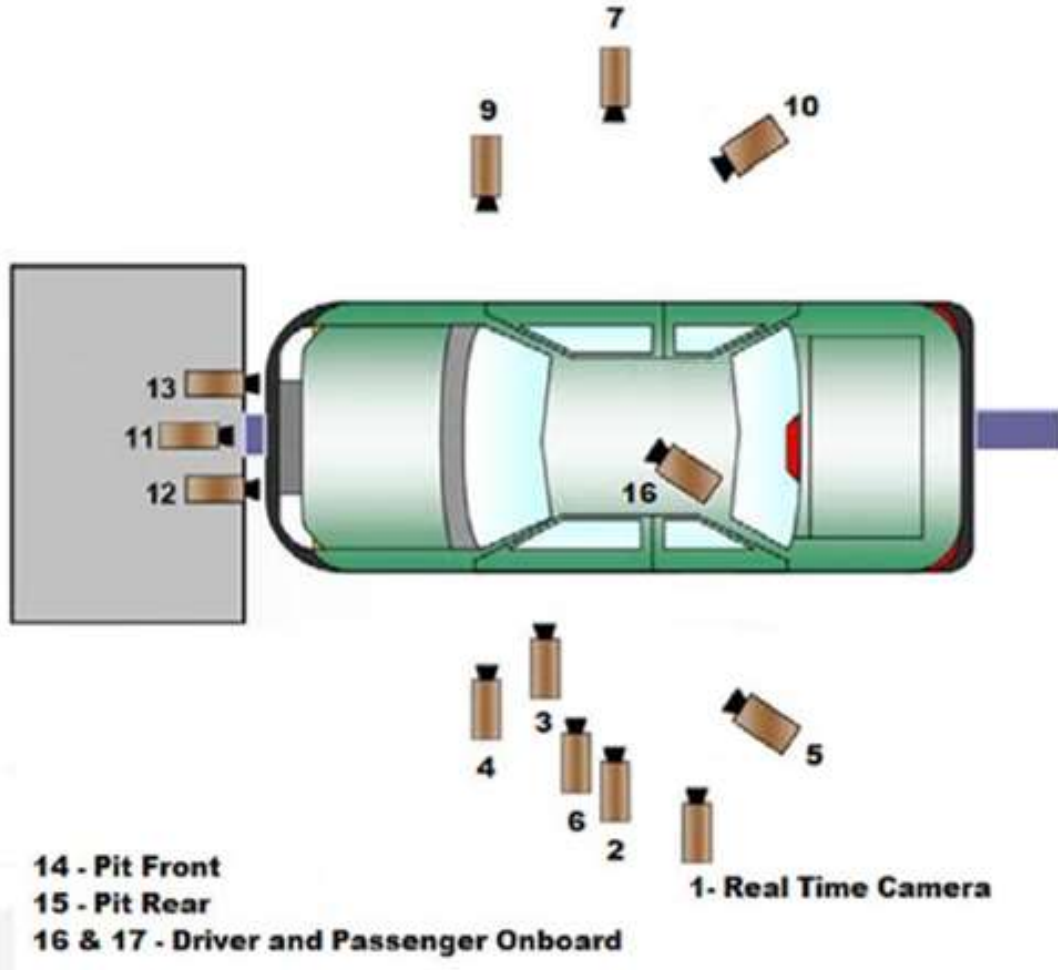
DATA SHEET NO. 6 - HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET NO. 6 - HIGH SPEED CAMERA LOCATIONS AND DATA (CONT'D)Test Vehicle: 2020 Ram 2500 Crew Cab Long BedTest Program: THOR-50 Durability EvaluationTest Date: 3/25/2025**CAMERA LOCATIONS**

No.	Camera View	Location (mm)			Lens (mm)	Frame Speed (fps)
		X	Y	Z		
1	Real-Time Left Overall					30
2	Left Overall	2185	5066	-1846	8.5	1000
3	Driver Close-Up	2295	5086	-1869	50	1000
4	Left Front Half	1426	5125	-1559	25	1000
5	Left Angle	3742	1872	-2074	20	1000
6	Steering Column	2295	4846	-1859	50	1000
7	Right Overall	2187	-4544	-1923	8.5	1000
9	Right Front Half	2201	-4533	-1852	50	1000
10	Right Angle	1579	-5032	-1931	25	1000
11	Windshield	3440	-1880	-6130	20	1000
12	Driver Windshield	0	0	-6130	20	1000
13	Passenger Windshield	0	643	-6130	25	1000
14	Pit Front	0	-500	3040	25	1000
15	Pit Rear	-975	0	3040	20	1000
16	Onboard Driver				8.5	1000

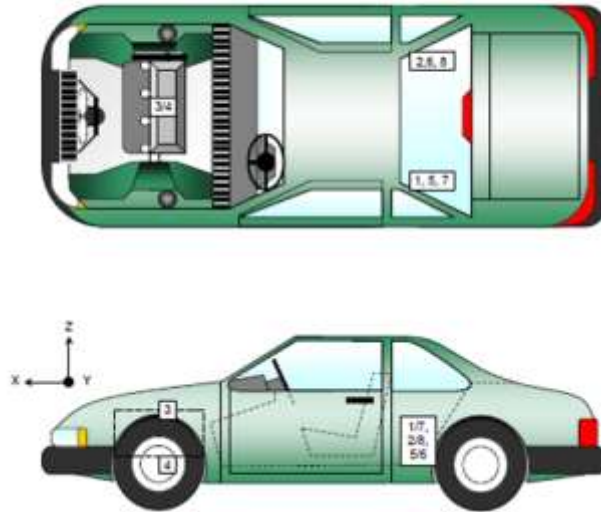
Reference Points: +X – forward of impact plane
+Y – right of monorail center
+Z – into ground

DATA SHEET NO. 7 - VEHICLE ACCELEROMETER DATA

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

Location		Coordinates (mm)			Positive Direction		Negative Direction	
		X	Y	Z	Max	Time (ms)	Max	Time (ms)
1	Left Rear Seat Cross Member	3428	402	148				
	Longitudinal (g)				2.79	122.85	-43.28	68.05
	Vertical (g)				38.89	69.05	-23.27	92.95
2	Right Rear Seat Cross Member	3431	-385	147				
	Longitudinal (g)				4.22	123.05	-42.14	67.80
	Vertical (g)				18.26	67.90	-20.71	91.90
3	Engine Top	5893	47	-302				
	Longitudinal (g)				25.24	48.65	-125.14	33.55
4	Bottom of Engine	5344	-41	685				
	Longitudinal (g)				52.05	47.05	-112.80	34.10
5	Left Rear Seat Cross Member - Redundant	3430	431	151				
	Longitudinal (g)				2.77	134.15	-41.71	68.00
6	Right Rear Seat Cross Member Redundant	3431	-415	151				
	Longitudinal (g)				4.75	123.05	-41.14	67.75

Reference point:

X – Rear Surface of Vehicle (+ forward)

Y – Vehicle Centerline (+ to right)

Z – Ground Plane (+ down)

DATA SHEET NO. 8 - PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

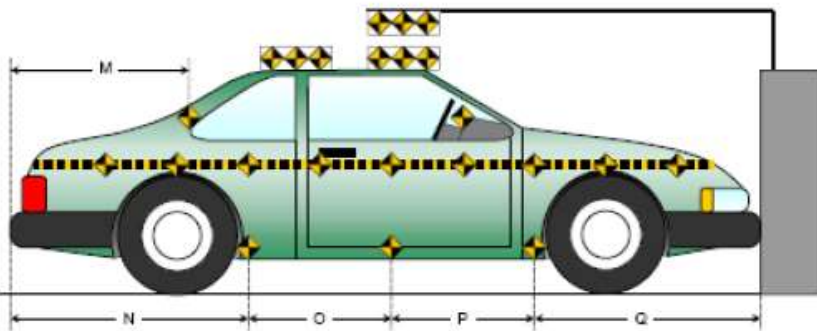
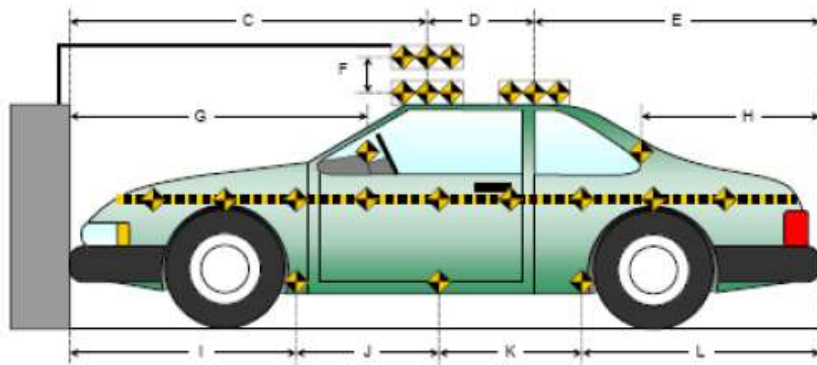
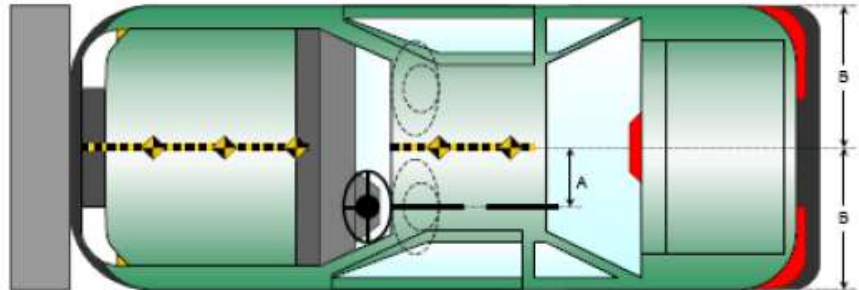
Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025

Item	Value
A	448
B	1005
C	2396
D	600
E	3550
F	200
G	1901
H	2892
I	1600
J	1321
K	1820
L	1871
M	2884
N	1853
O	1830
P	1310
Q	1619

All units in millimeters



DATA SHEET NO. 9 - TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025

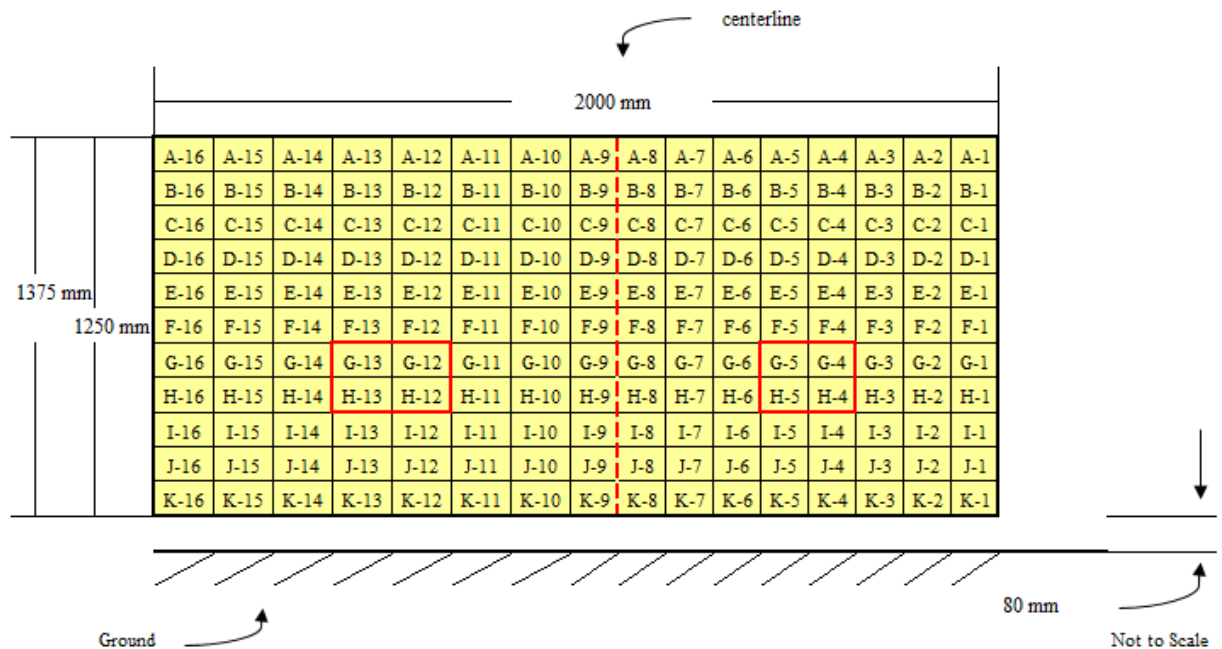
INSTRUMENTATION

Instrumentation	Number of Channels Collected
Driver Dummy	98
Passenger Dummy	N/A
Vehicle Structure	10
High-Res Load Cell Barrier	176
Total	284

CAMERA COVERAGE

Type of Camera	Number Used in this Test
High-Speed Vehicle Onboard	1
High-Speed Offboard	14
Real-Time Vehicle Offboard	1
Total	15

LOAD CELL LOCATIONS ON FIXED BARRIER



*G4, 5 & H4, 5 as well as G12, 13 & H12, 13 were combined with one large block

DATA SHEET NO. 10 - POST-TEST OBSERVATIONS

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	THOR-50M/EG2595	
Head Contact	Frontal AB, HR	
Upper Torso Contact	Seat Belt, AB	
Lower Torso Contact	Seat Belt	
Left Knee Contact	Knee Bolster	
Right Knee Contact	Knee Bolster	

DOOR OPENING, TRUNK OPENING, AND SEAT TRACK INFORMATION

Description	Driver	Passenger	Other
Locked/Unlocked Doors**	Unlocked	Unlocked	
Front Door Opening**	No	No	
Rear Door Opening**	No	No	
Trunk/Hatch/Tailgate Opening**			No
Seat Track Shift (mm) **	No	No	
Seat Back Movement from Initial Position**	No	No	

**NOTE: Indicate "No", "N/A", or "Yes", and if "Yes", describe

POST- OTHER VEHICLE POST-TEST OBSERVATIONS

Critical Areas of Performance	Observations
Windshield Damage	Cracked
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1204
Center	mm	1100
Right Side	mm	1210
Average	mm	1171

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

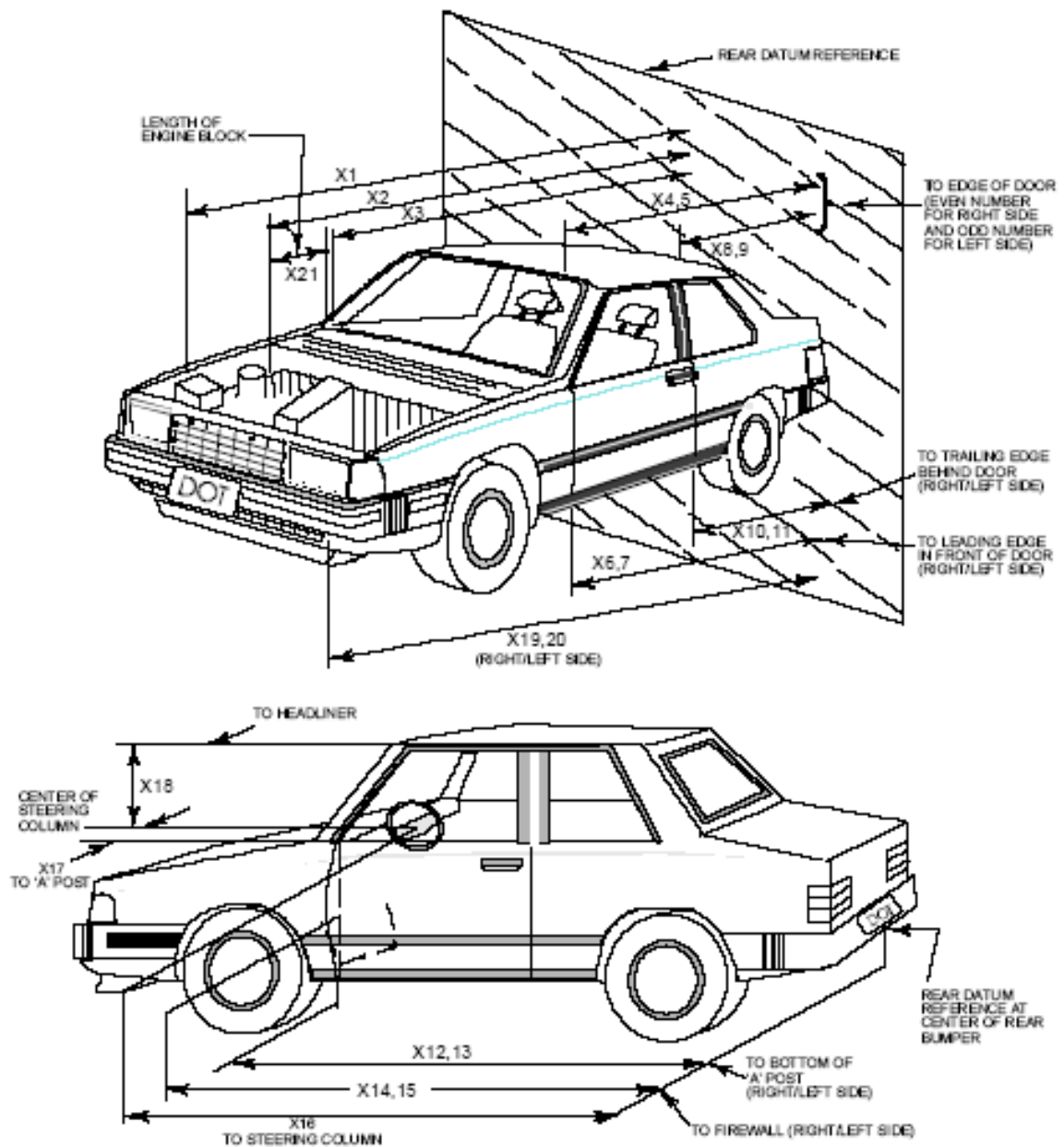
Restraint Type	Driver (Occupant 1)		Passenger (Occupant 2)	
	Installed	Deployed	Installed	Deployed
Front Airbag	Yes	Yes	Yes	Yes
Torso/Pelvis Side Airbag	Yes	No	Yes	No
Curtain Side Airbag	Yes	No	Yes	No
Knee Airbag	No	N/A	No	N/A
Seat Belt Pretensioner	Yes	Yes	Yes	No
Seat Belt Load Limiter	Yes	Yes	Yes	No
Seat Belt Buckle Pretensioner	No	N/A	No	N/A
Other	No	N/A	No	N/A

DATA SHEET NO. 11 - VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025



DATA SHEET NO. 11 - VEHICLE PROFILE MEASUREMENTS (CONT'D)Test Vehicle: 2020 Ram 2500 Crew Cab Long BedTest Program: THOR-50 Durability EvaluationTest Date: 3/25/2025

No.	Measurement Description	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	6612	6020	-592
2	Rear Surface of Vehicle (RSOV) to Front of Engine	5992	5713	-279
3	RSOV to Firewall	5476	5286	-190
4	RSOV to Upper Leading Edge of Right Door	5004	4983	-21
5	RSOV to Upper Leading Edge of Left Door	5012	5010	-2
6	RSOV to Lower Leading Edge of Right Door	4955	4944	-11
7	RSOV to Lower Leading Edge of Left Door	4962	4968	6
8	RSOV to Upper Trailing Edge of Right Door	3924	3902	-22
9	RSOV to Upper Trailing Edge of Left Door	3929	3930	1
10	RSOV to Lower Trailing Edge of Right Door	3924	3916	-8
11	RSOV to Lower Trailing Edge of Left Door	3931	3936	5
12	RSOV to Bottom of "A" Post-of Right Side	4934	4901	-33
13	RSOV to Bottom of "A" Post-of Left Side	4940	4933	-7
14	RSOV to Firewall, Right Side	5433	5307	-126
15	RSOV to Firewall, Left Side	5398	5308	-90
16	RSOV to Steering Column	4515	4460	-55
17	Center of Steering Column to "A" Post	300	226	-74
18	Center of Steering Column to Headliner	460	370	-90
19	RSOV to Right Side of Front Bumper	6463	5987	-476
20	RSOV to Left Side of Front Bumper	6468	6008	-460
21	Length of Engine Block	650	648	-2
RD	RSOV to Right Side of Dash Panel	4752	4685	-67
CD	RSOV to Center of Dash Panel	4690	4660	-30
LD	RSOV to Left Side of Dash Panel	4755	4749	-6

All Dimensions in mm

DATA SHEET NO. 12 - ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025

VEHICLE INFORMATION

VIN: 3C6UR5JL8LG116633
Vehicle Size Category: Truck

Wheelbase: 4305
Test Weight (kg): 3640.5

ACCELEROMETER DATA

Accelerometer Locations: As listed on Page 15 of this report.

Cal. Procedure/Interval: TRC procedure / 6-month interval

Integration Algorithm: Trapezoidal

Linearity: > 99%

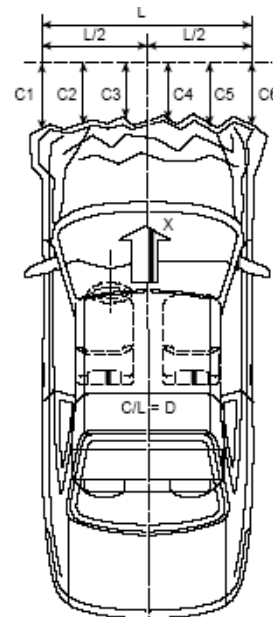
Impact Velocity (km/h): 56.14

Velocity Change (km/h): 62.96

Time of Separation (ms): 168

CRUSH PROFILE

Collision Deformation Classification: 12FDEW2
Midpoint of Damage: Centerline
Damage Region Length (mm): 1626
Impact Mode: Frontal



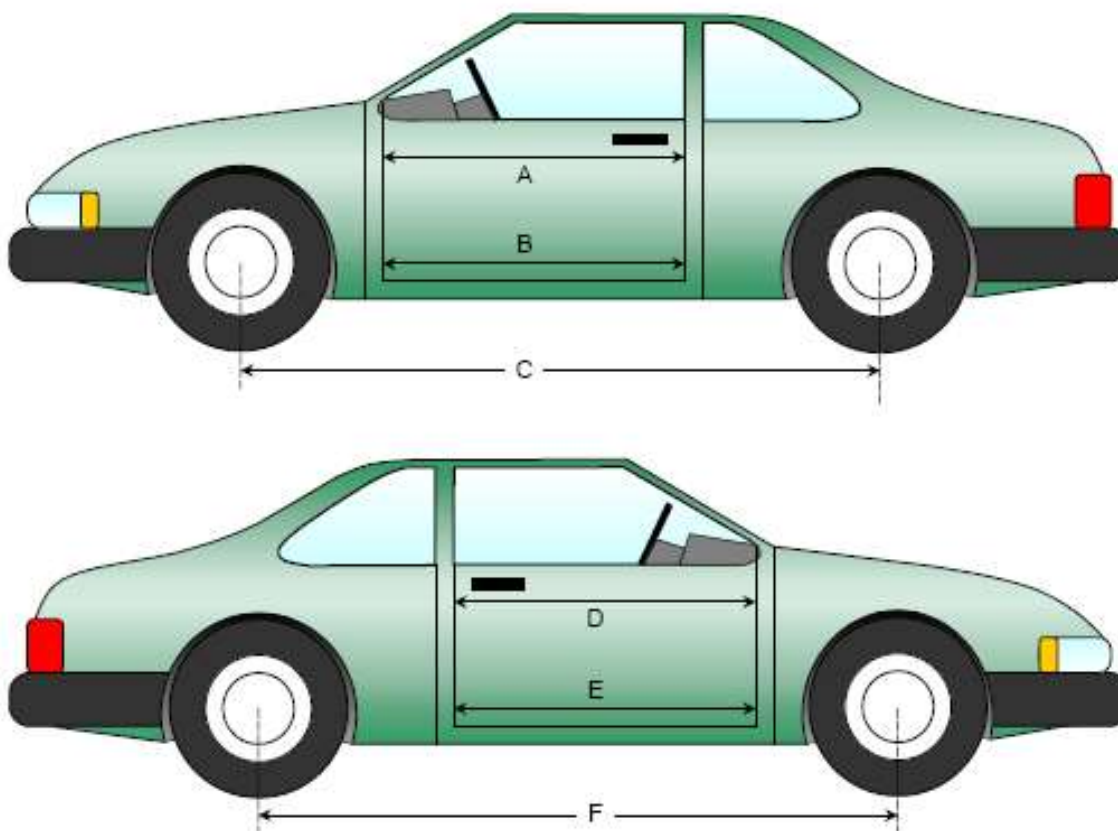
No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	153	613	460
C2	Crush zone 2 at left side	mm	1	618	617
C3	Crush zone 3 at left side	mm	11	578	567
C4	Crush zone 4 at right side	mm	13	596	583
C5	Crush zone 5 at right side	mm	0	616	616
C6	Crush zone 6 at right side	mm	158	634	476
L	C1 to C6	mm	1626	1608	-18

DATA SHEET NO. 13 - VEHICLE INTRUSION MEASUREMENTSTest Vehicle: 2020 Ram 2500 Crew Cab Long BedTest Program: THOR-50 Durability EvaluationTest Date: 3/25/2025**DOOR OPENING WIDTH**

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	967	963	-4
B	Left Side Lower	mm	942	938	-4
D	Right Side Upper	mm	967	962	-5
E	Right Side Lower	mm	942	938	-4

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	4305	4248	-57
F	Right Side Wheelbase	mm	4305	4250	-55



DATA SHEET NO. 13 VEHICLE INTRUSION MEASUREMENTS (CONT'D)

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

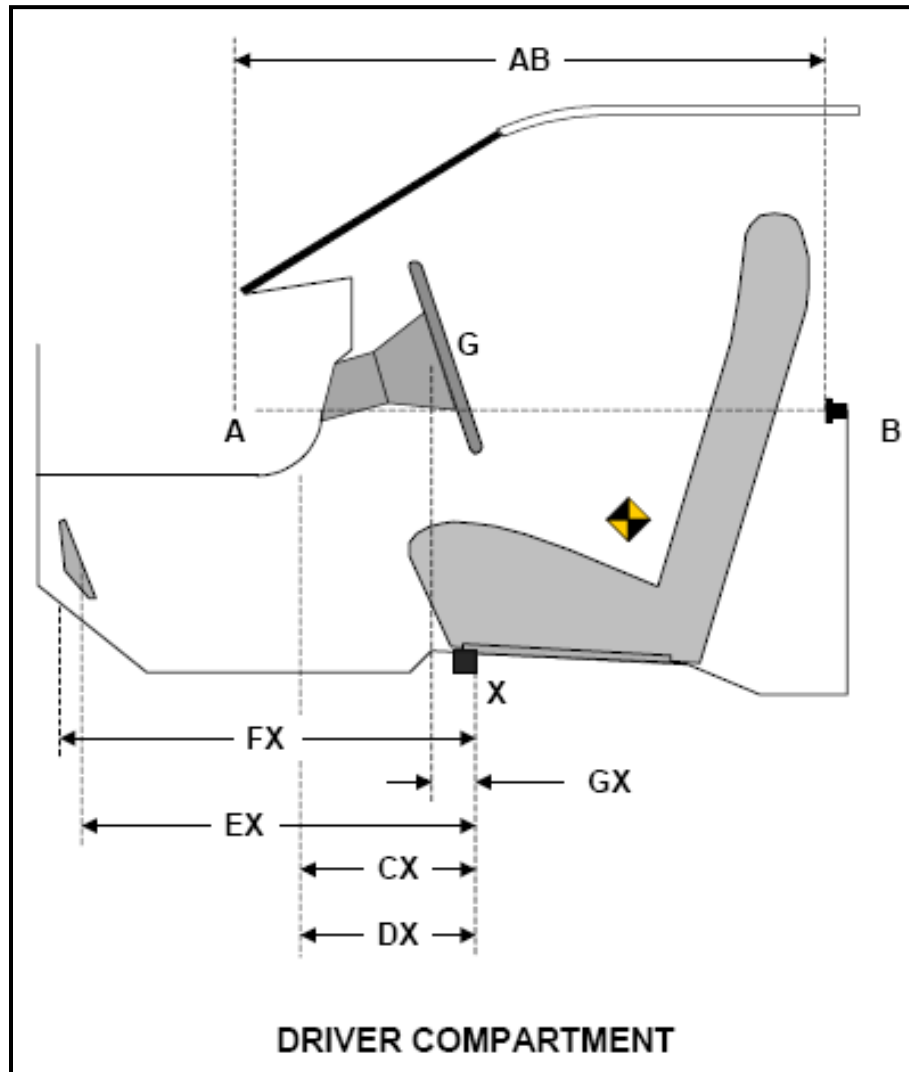
Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	800	805	5
CX	Left Knee Bolster to X	mm	242	207	-35
DX	Right Knee Bolster to X	mm	202	159	-43
EX	Brake Pedal to X	mm	506	365	-141
FX	Foot Rest to X	mm	532	488	-44
GX	Center of Steering Column Wheel Hub to X	mm	62	25	-37

X = Front of Seat Track (Stationary)



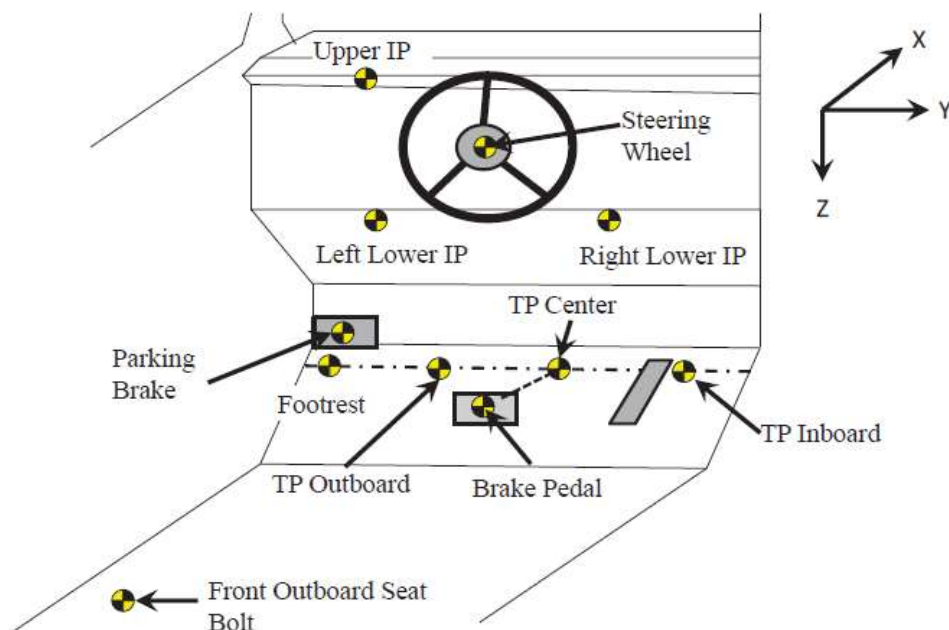
DATA SHEET NO. 13 VEHICLE INTRUSION MEASUREMENTS (CONT'D)

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025

DRIVER FLOOR PAN MEASUREMENTS



Intrusion Location	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
Steering Wheel	4,524	-483	-724	4,426	-532	-912	-98	-49	-188
Left Lower IP	4,743	-633	-477	4,739	-622	-637	-4	11	-160
Right Lower IP	4,725	-333	-477	4,641	-338	-653	-84	-5	-176
Upper IP	4,849	-633	-326	4,562	-332	-711	-287	301	-385
Parking Brake Pedal Point	4,883	-749	-295	4,838	-719	-404	-45	30	-109
TP Footrest	5,272	-480	-210	4,969	-664	-161	-303	-184	49
TP Outboard	5,231	-633	-210	5,068	-585	-424	-163	48	-214
TP Center	5,273	-482	-210	4,982	-467	-463	-291	15	-253
TP Inboard	5,183	-330	-209	4,936	-309	-411	-247	21	-202

Reference point:

+X – From the rear of the vehicle to the front of the vehicle

+Y – From the left side of the vehicle to the right side of the vehicle

+Z – From the top of the vehicle to the bottom of the vehicle

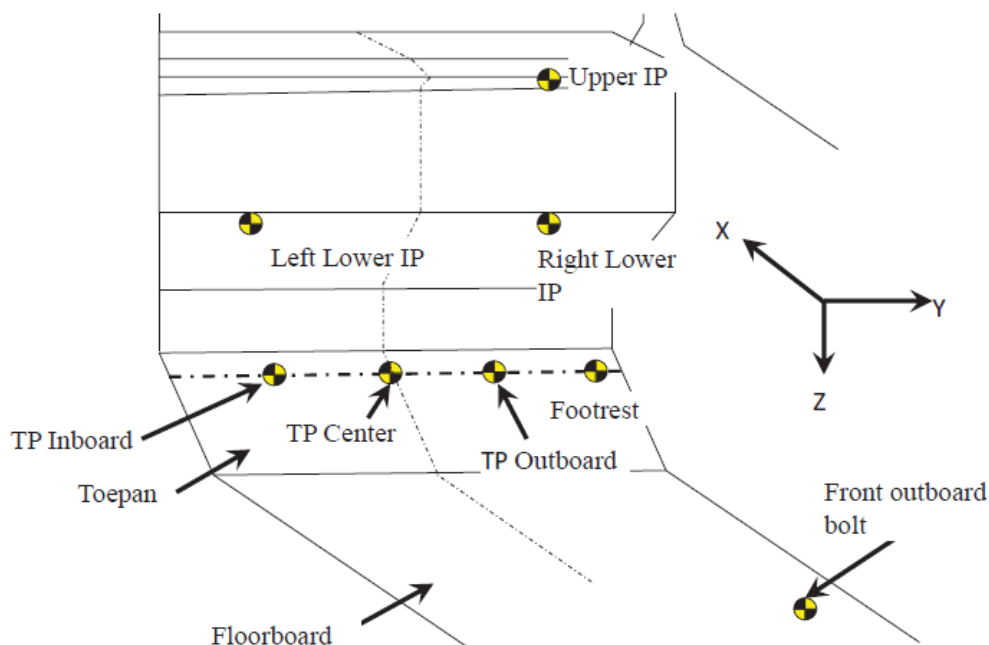
DATA SHEET NO. 13 VEHICLE INTRUSION MEASUREMENTS (CONT'D)

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025

PASSENGER FLOOR PAN MEASUREMENTS



Intrusion Location	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
Left Lower IP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Right Lower IP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Upper IP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TP Footrest	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TP Outboard	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TP Center	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TP Inboard	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Reference point:

- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

¹ Vehicle does not have passenger foot rest

DATA SHEET NO. 13 VEHICLE INTRUSION MEASUREMENTS (CONT'D)

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

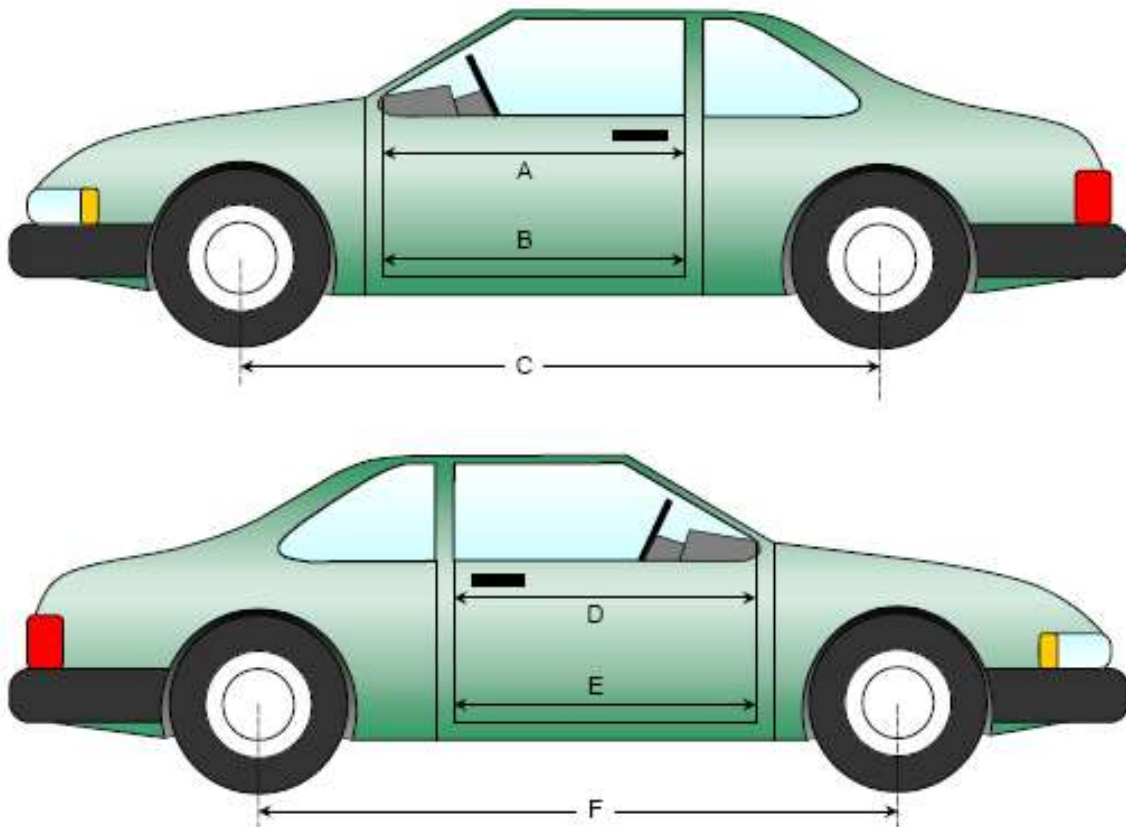
Test Date: 3/25/2025

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	967	963	-4
B	Left Side Lower	mm	942	938	-4
D	Right Side Upper	mm	967	962	-5
E	Right Side Lower	mm	942	938	-4

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	4305	4248	-57
F	Right Side Wheelbase	mm	4305	4250	-55



DATA SHEET NO. 13 VEHICLE INTRUSION MEASUREMENTS (CONT'D)

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

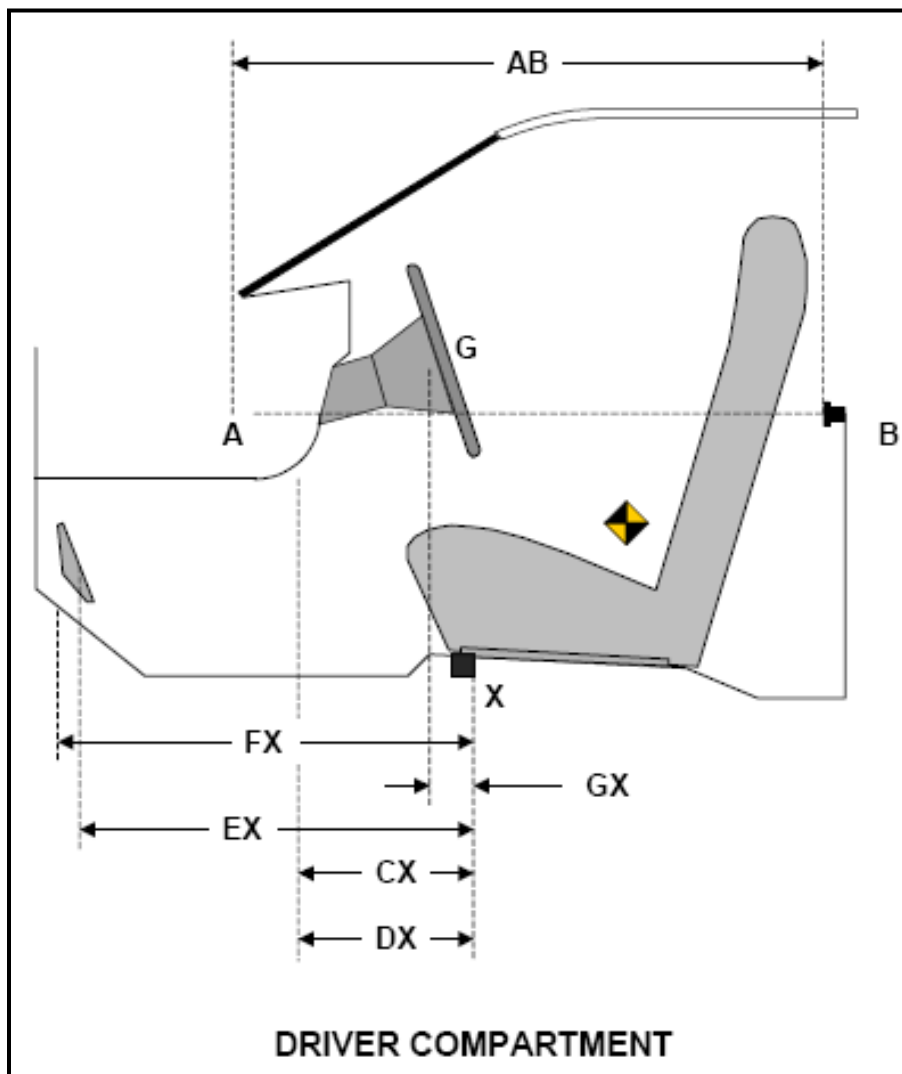
Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	800	805	5
CX	Left Knee Bolster to X	mm	242	207	-35
DX	Right Knee Bolster to X	mm	202	159	-43
EX	Brake Pedal to X	mm	506	365	-141
FX	Foot Rest to X	mm	532	488	-44
GX	Center of Steering Column Wheel Hub to X	mm	62	25	-37

X = Front of Seat Track (Stationary)



**DATA SHEET NO. 14 - SUMMARY OF INDICANT FMVSS 212 AND FMVSS 219
(PARTIAL) DATA**

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025

Please provide windshield mounting details.

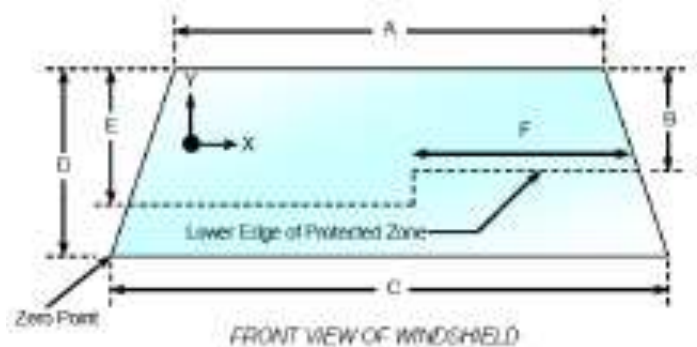
The standard requires that the post-test retention measurement be a minimum of 75% of the pre-test total periphery measurement for vehicle not equipped with occupant passive restraint and 50% for each side of the windshield for vehicle which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 20.5°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% Retention
Left Side	2277.5	2277.5	100.0
Right Side	2277.5	2277.5	100.0
Total	4555	4555	100.0

Item	Units	Value
A	mm	1390
B	mm	423
C	mm	1565
D	mm	800
E	mm	492
F	mm	220



AREAS OF PROTECTED ZONE FAILURES

A. Provide coordinates of the area that the protected zone was penetrated more than .25 inches by a vehicle component other than one that is normally in contact with the windshield.

X	Y
N/A	N/A
N/A	N/A
N/A	N/A
N/A	N/A

B. The inner surface of the windshield was penetrated by the hood support beneath the protected zone.

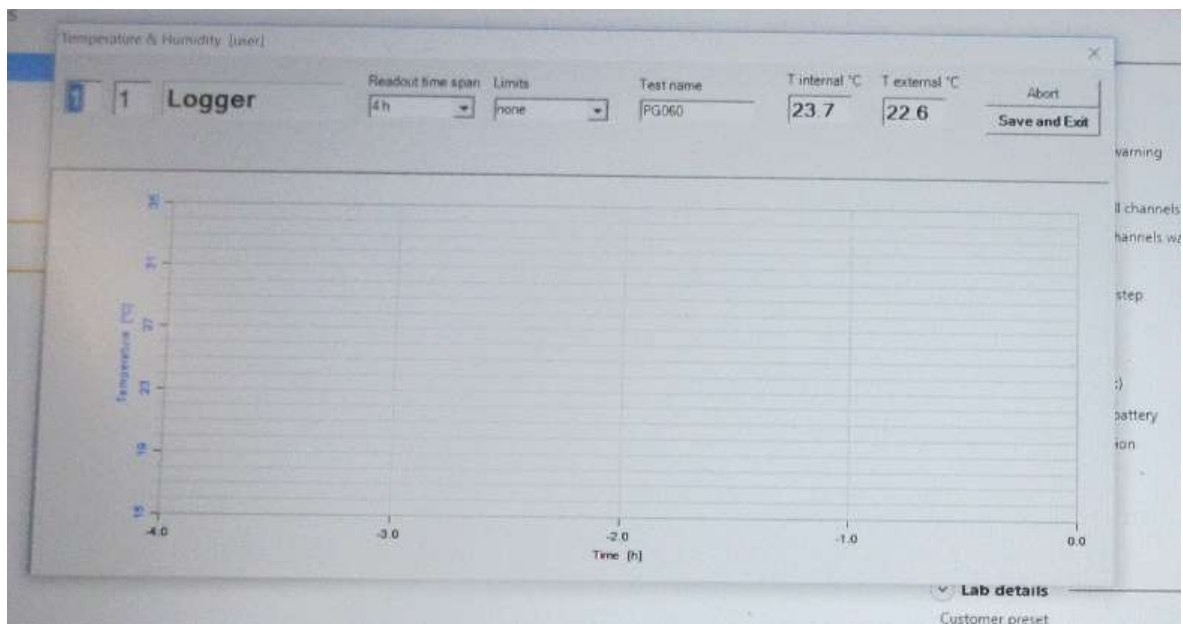
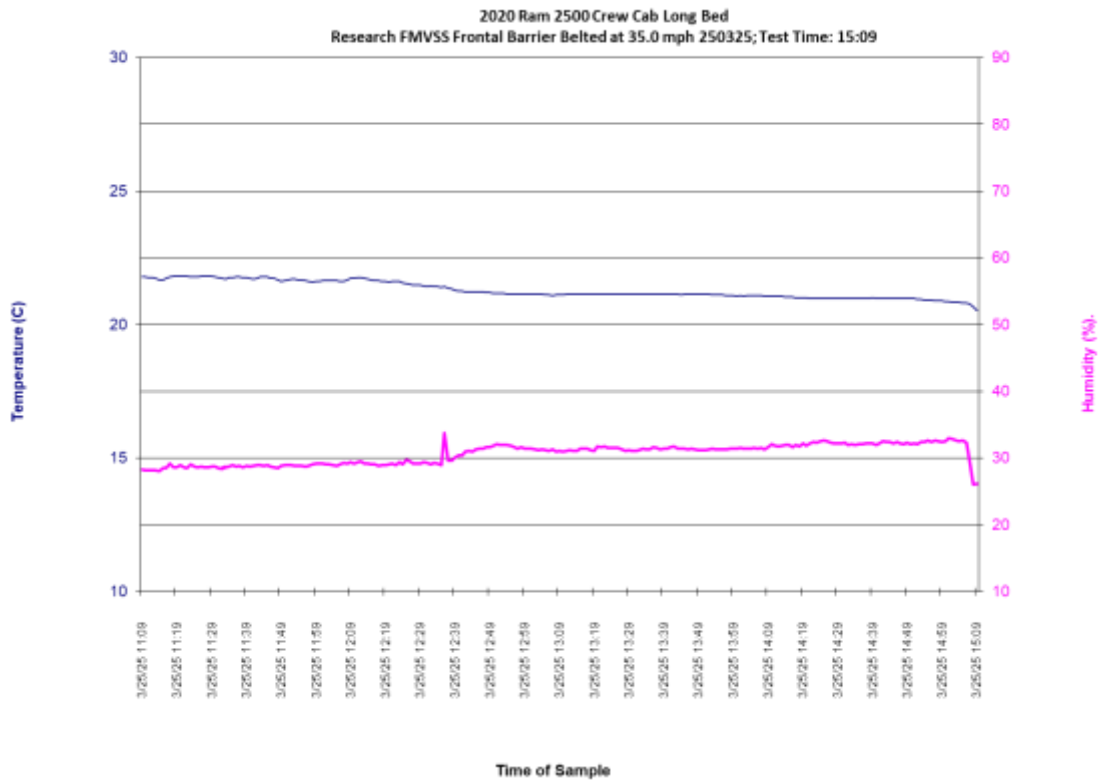
X	Y
N/A	N/A
N/A	N/A
N/A	N/A
N/A	N/A

DATA SHEET NO. 15 - DUMMY/VEHICLE TEMPERATURE STABILIZATION

Test Vehicle: 2020 Ram 2500 Crew Cab Long Bed

Test Program: THOR-50 Durability Evaluation

Test Date: 3/25/2025



** The internal temperature sensor in the ATD did not record throughout the event. However, the temperature was closely monitored pre-test and were within specifications.

APPENDIX A
PHOTOGRAPHS

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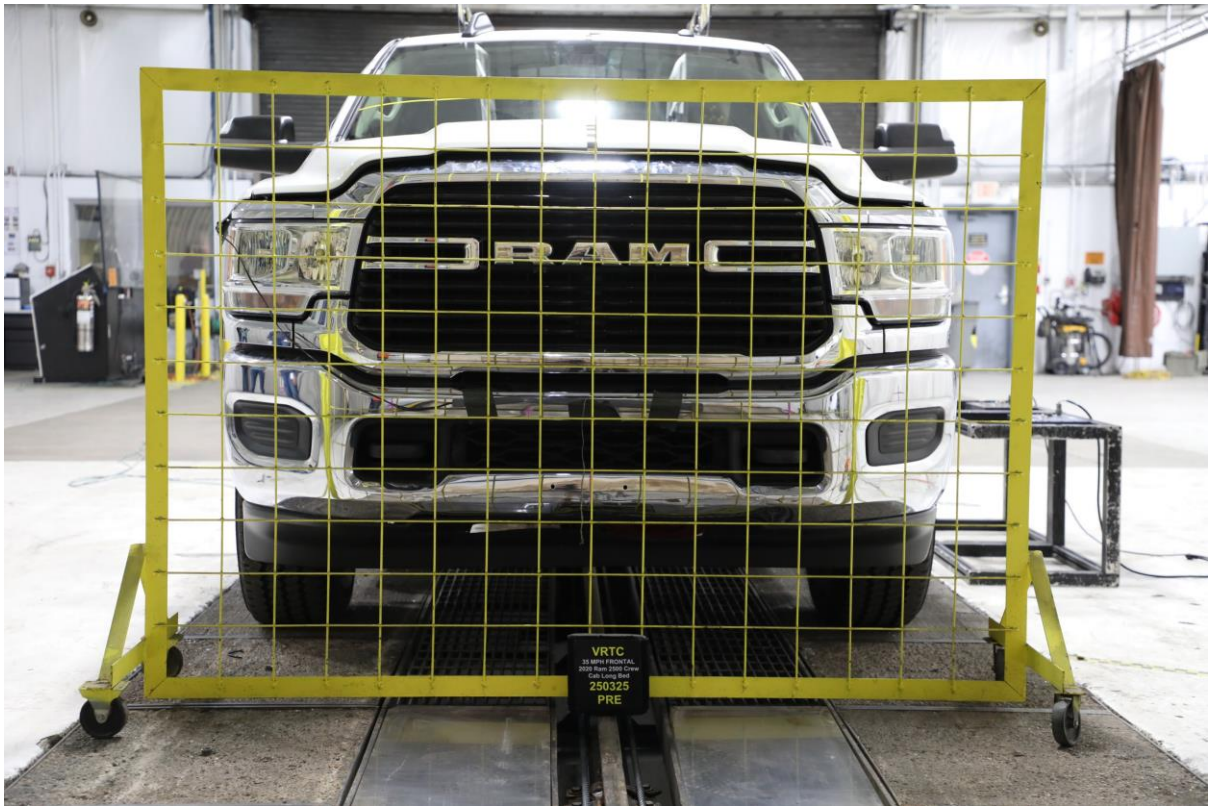
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3	Post-Test Load Cell Wall	A-6
4	Manufacturer's Label	A-7
5	Tire Placard	A-7
6	2020 Ram 2500 Crew Cab Long Bed Frontal As Delivered	A-8
7	Left Rear 3-4 View, as Received	A-8
8	Pre-Test Front View of Test Vehicle	A-9
9	Post-Test Front View of Test Vehicle	A-9
10	Pre-Test Left View of Test Vehicle	A-10
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001 Load Cell Location



002 Pre-Test Load Cell Wall

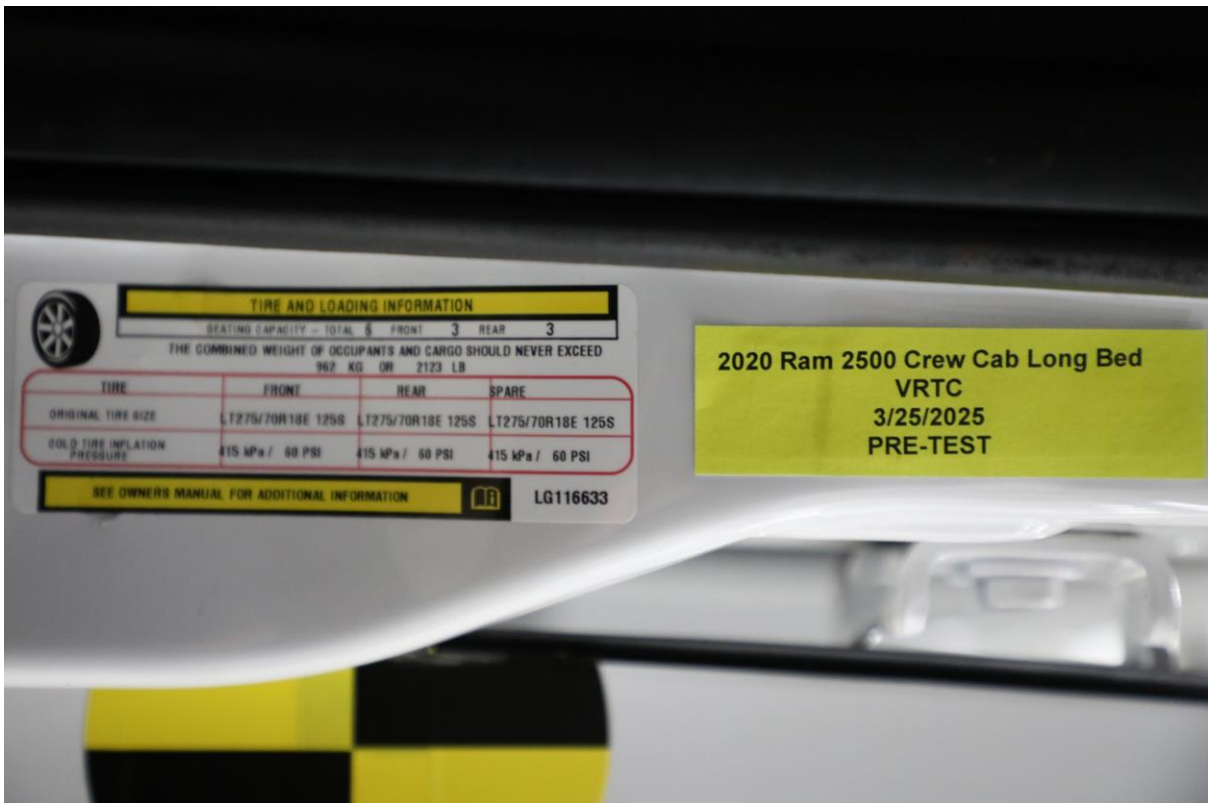


003 Pre-Test Load Cell Wall

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004 Manufacturer's Label



005 Tire Placard



006 2020 Ram 2500 Crew Cab Long Bed Frontal As Delivered



007 Left Rear 3-4 View, as Received



008 Pre-Test Front View of Test Vehicle



009 Post-Test Front View of Test Vehicle



010 Pre-Test Left View of Test Vehicle



011 Post-Test Left View of Test Vehicle



012 Pre-Test Right View of Test Vehicle



013 Post-Test Right View of Test Vehicle



014 Pre-Test Right Front 3-4 View



015 Post-Test Right Front 3-4 View



016 Pre-Test Left Rear 3-4 View



017 Post-Test Left Rear 3-4 View



018 Pre-Test Windshield View



019 Post-Test Windshield View



020 Pre-Test Engine Compartment View



021 Post-Test Engine Compartment View



022 Pre-Test Fuel Filler Cap View



023 Post-Test Fuel Filler Cap View

PHOTO NOT APPLICABLE

024 Pre-Test Front Underbody View

PHOTO NOT APPLICABLE

025 Post-Test Front Underbody View

PHOTO NOT APPLICABLE

025a Pre-Test Mid Front Underbody View

PHOTO NOT APPLICABLE

025b Post-Test Mid Front Underbody View

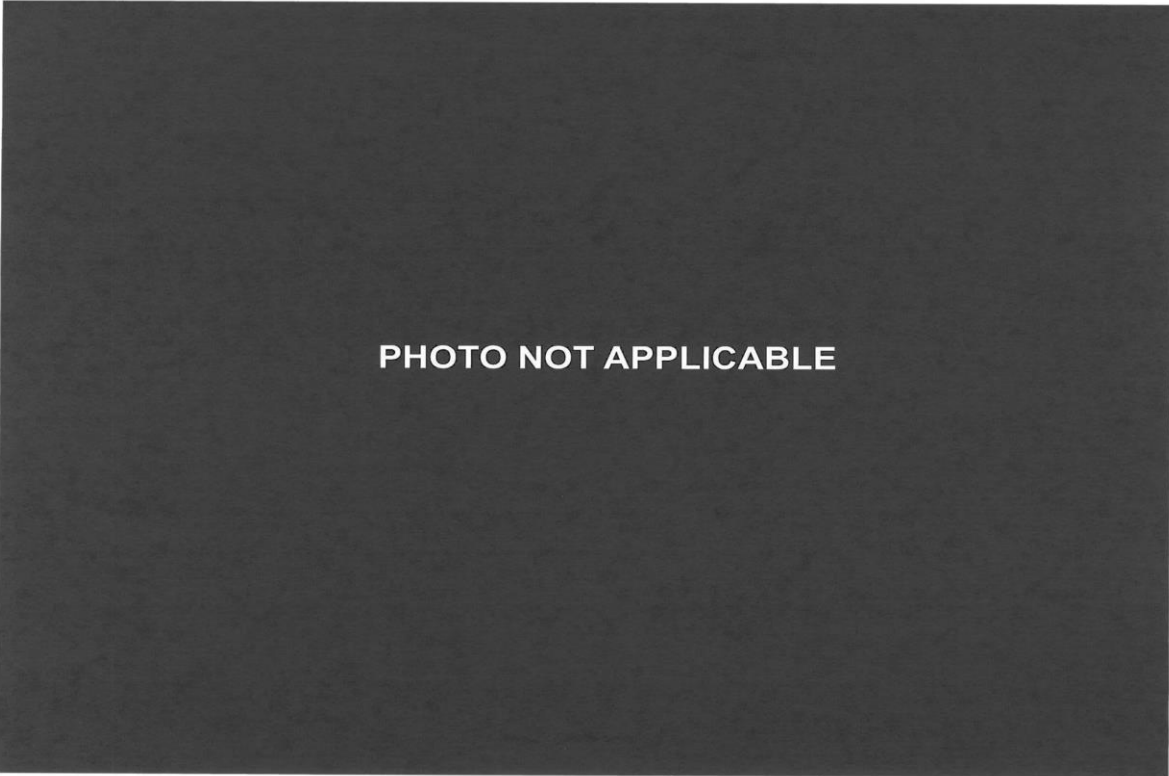


PHOTO NOT APPLICABLE

025c Pre-Test Mid Rear Underbody View

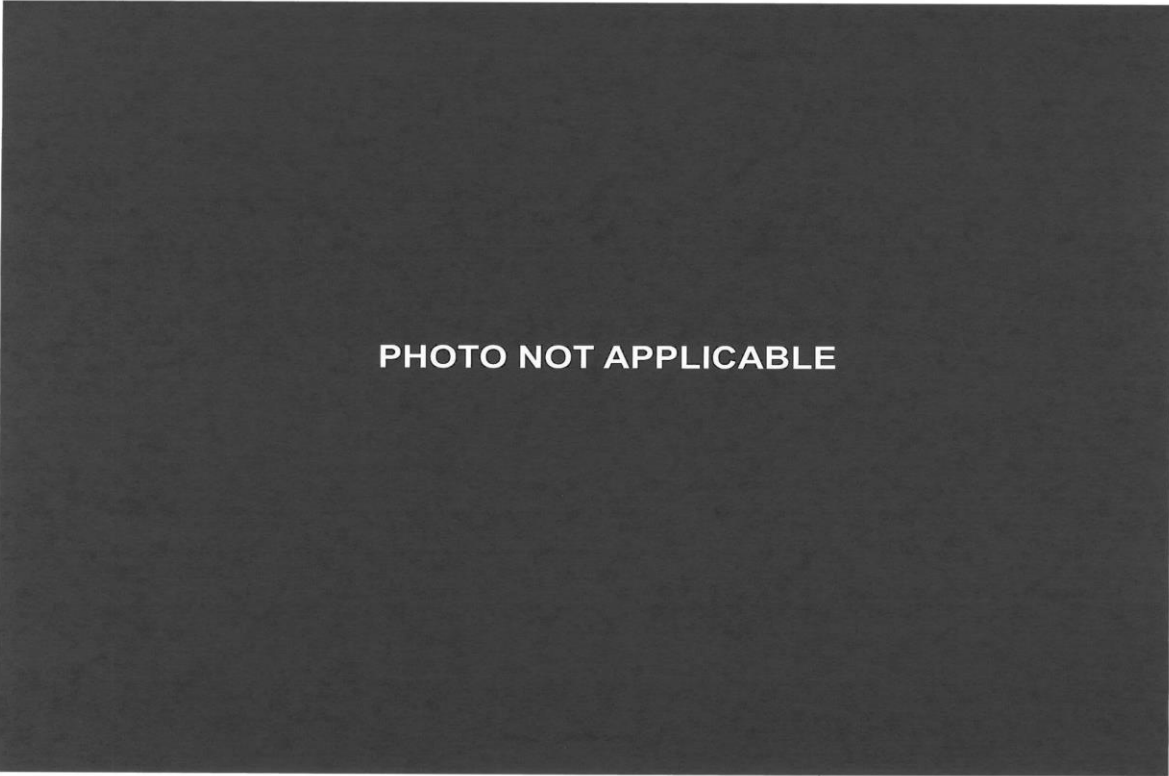


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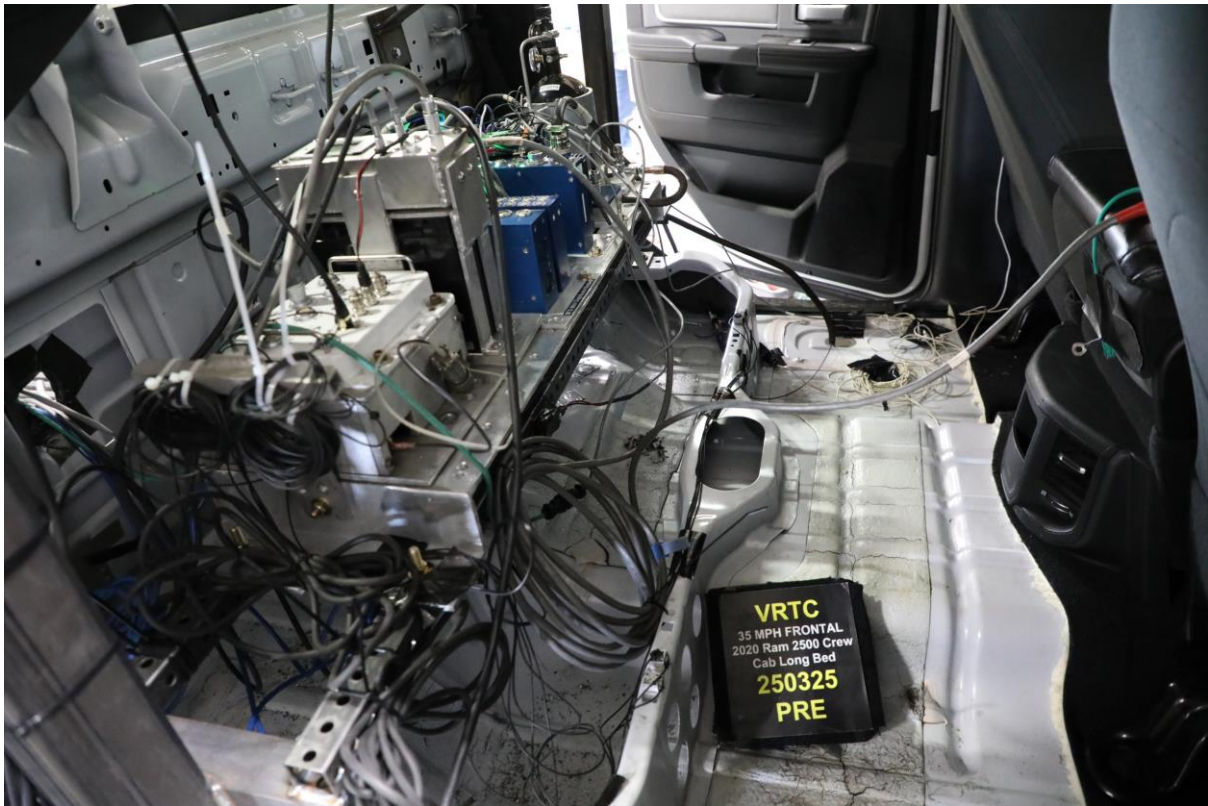
025d Post-Test Mid Rear Underbody View

PHOTO NOT APPLICABLE

026 Pre-Test Rear Underbody View

PHOTO NOT APPLICABLE

027 Post-Test Rear Underbody View



028 Pre-Test Dummy Cable Routing



029 Post-Test Dummy Cable Routing



030 Pre-Test Driver Dummy Front View



031 Post-Test Driver Dummy Front View



032 Pre-Test Driver Dummy Window View



033 Post-Test Driver Dummy Window View



034 Pre-Test Driver Dummy and Vehicle Interior View



035 Post-Test Driver Dummy and Vehicle Interior View



036 Pre-Test Driver's Seat Fore-Aft Markings



037 Post-Test Driver's Seat Fore-Aft Markings



038 Pre-Test View of Belt Anchorage for Driver Dummy



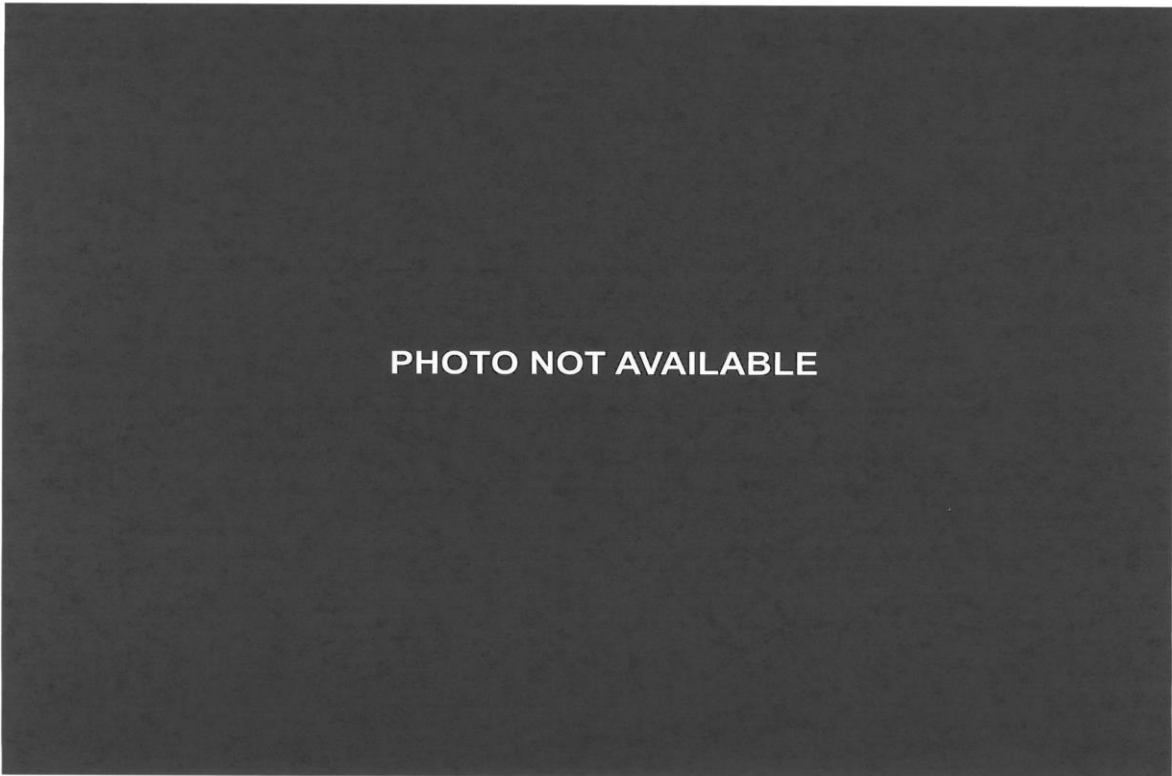
039 Post-Test View of Belt Anchorage for Driver Dummy



040 Pre-Test Driver Dummy Feet



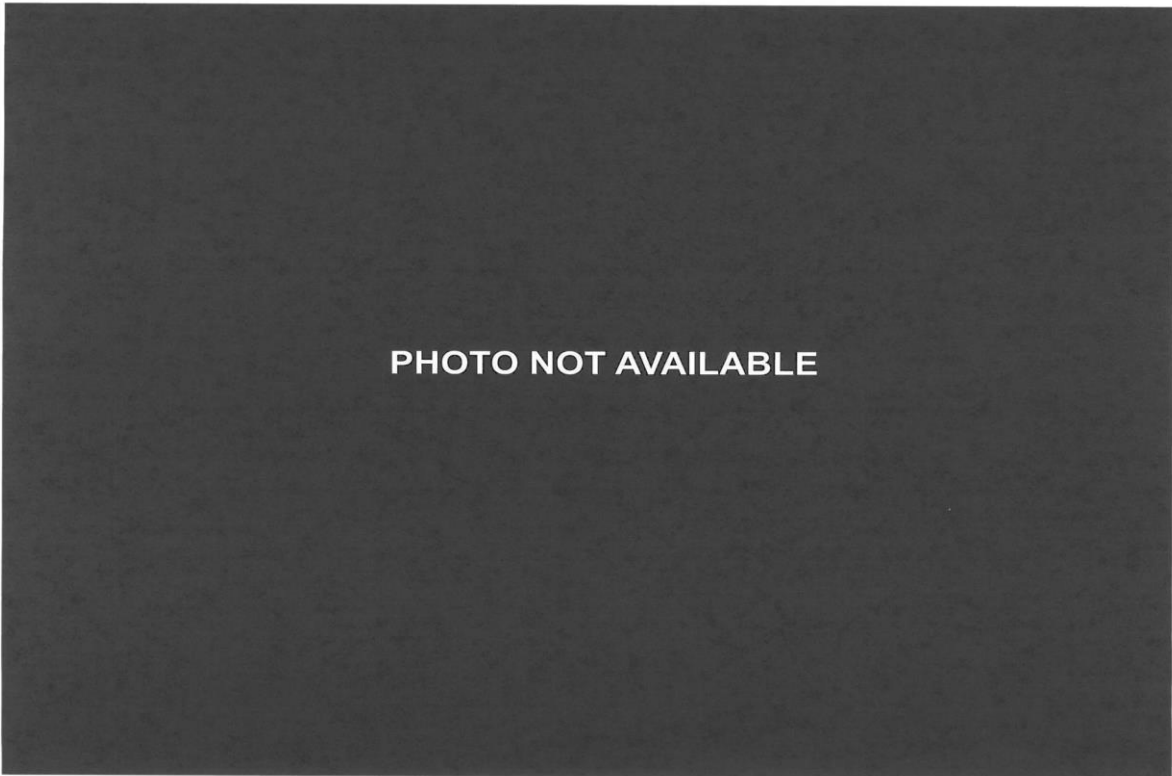
041 Post-Test Driver Dummy Feet



042 Pre-Test Driver's Side Knee Bolster



043 Post-Test Driver's Side Knee Bolster



044 Pre-Test Driver's Side Floorpan



045 Post-Test Driver's Side Floorpan



046 Post-Test Driver Dummy Face



047 Post-Test Driver Dummy Contact with Airbag



048 Post-Test Driver Dummy Contact with Headrest

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049 Pre-Test View of the Steering Wheel



050 Post-Test View of the Steering Wheel

PHOTO NOT APPLICABLE

051 Pre-Test Passenger Dummy Front View

PHOTO NOT APPLICABLE

052 Post-Test Passenger Dummy Front View

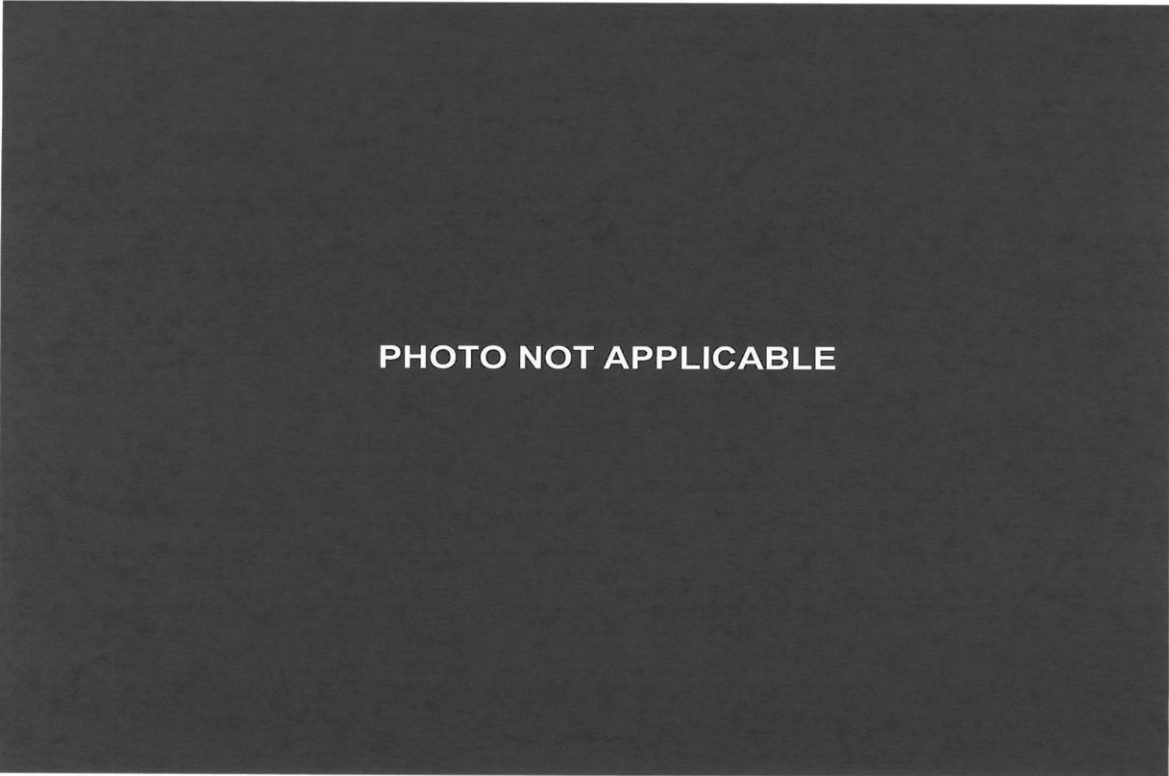


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053 Pre-Test Passenger Dummy Window View

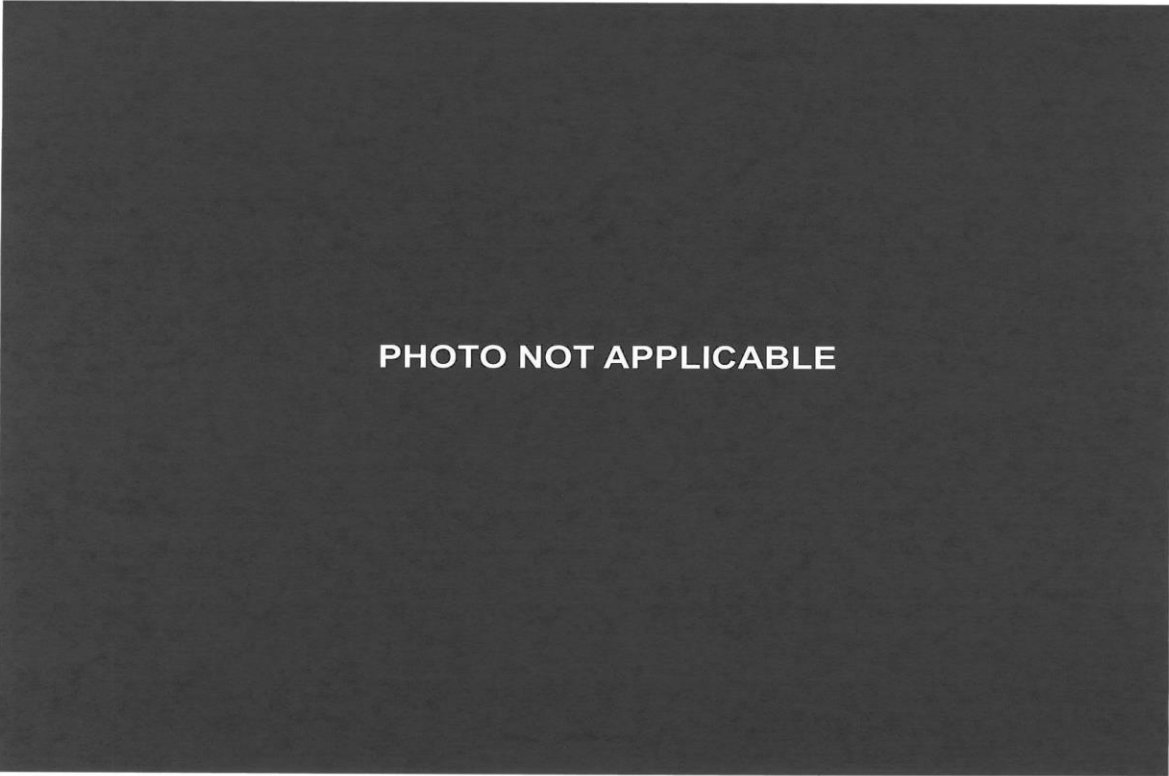


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054 Post-Test Passenger Dummy Window View

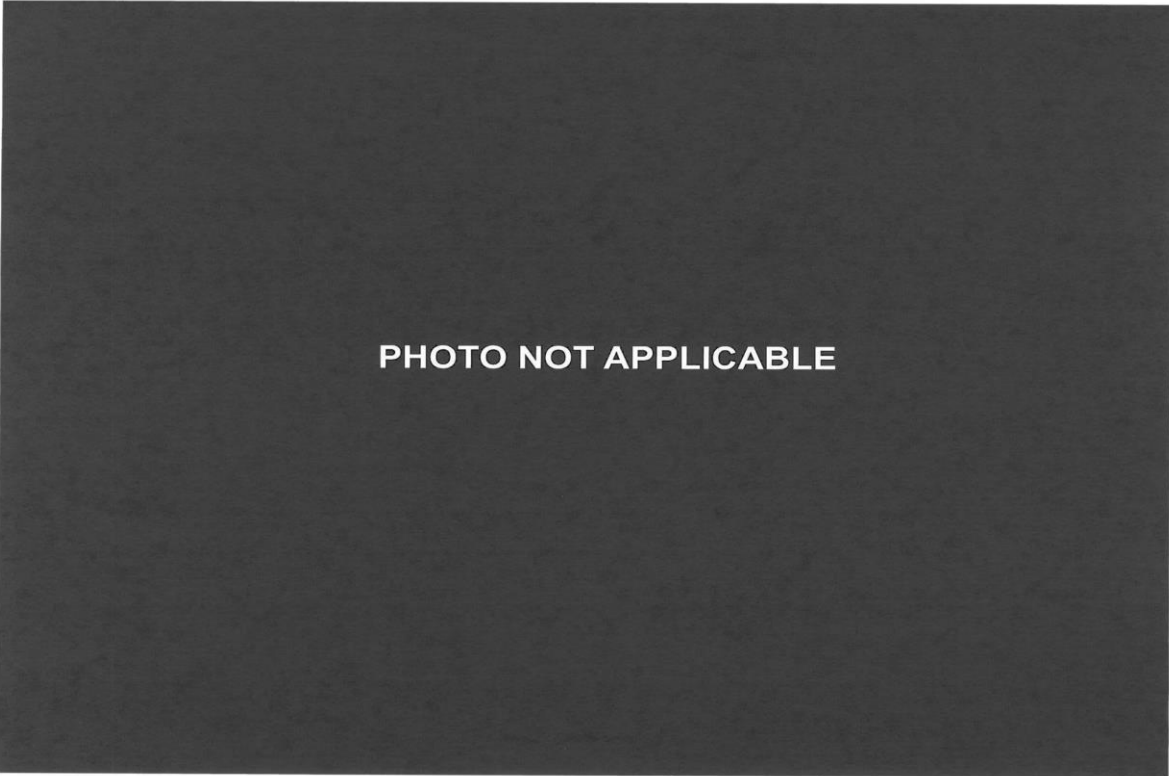


PHOTO NOT APPLICABLE

055 Pre-Test Passenger Dummy and Vehicle Interior View

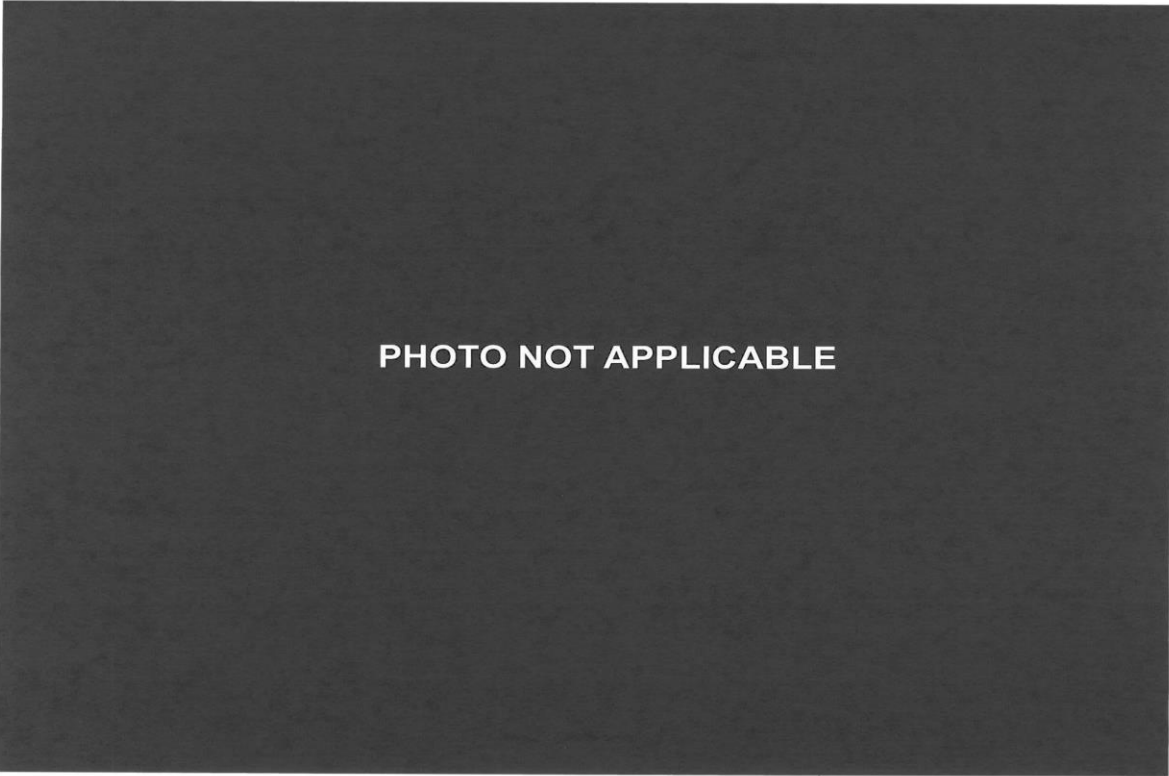


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056 Post-Test Passenger Dummy and Vehicle Interior View

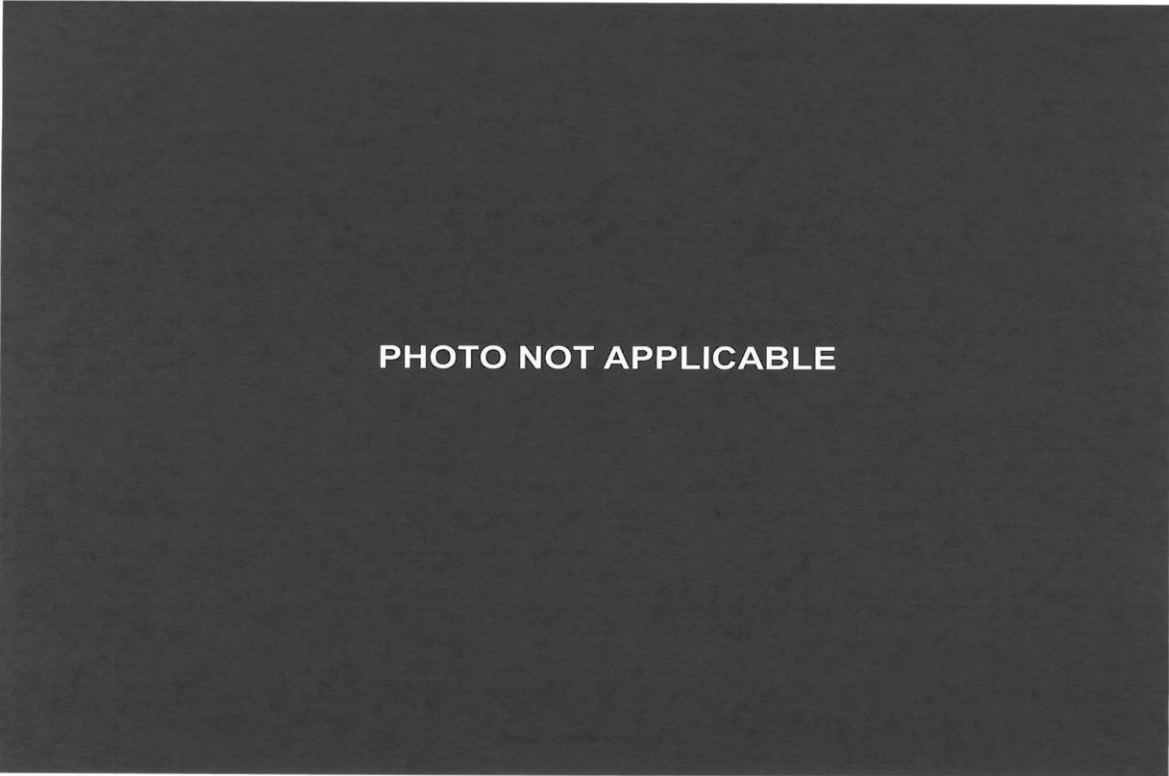


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057 Pre-Test Passenger's Seat Fore-Aft Markings

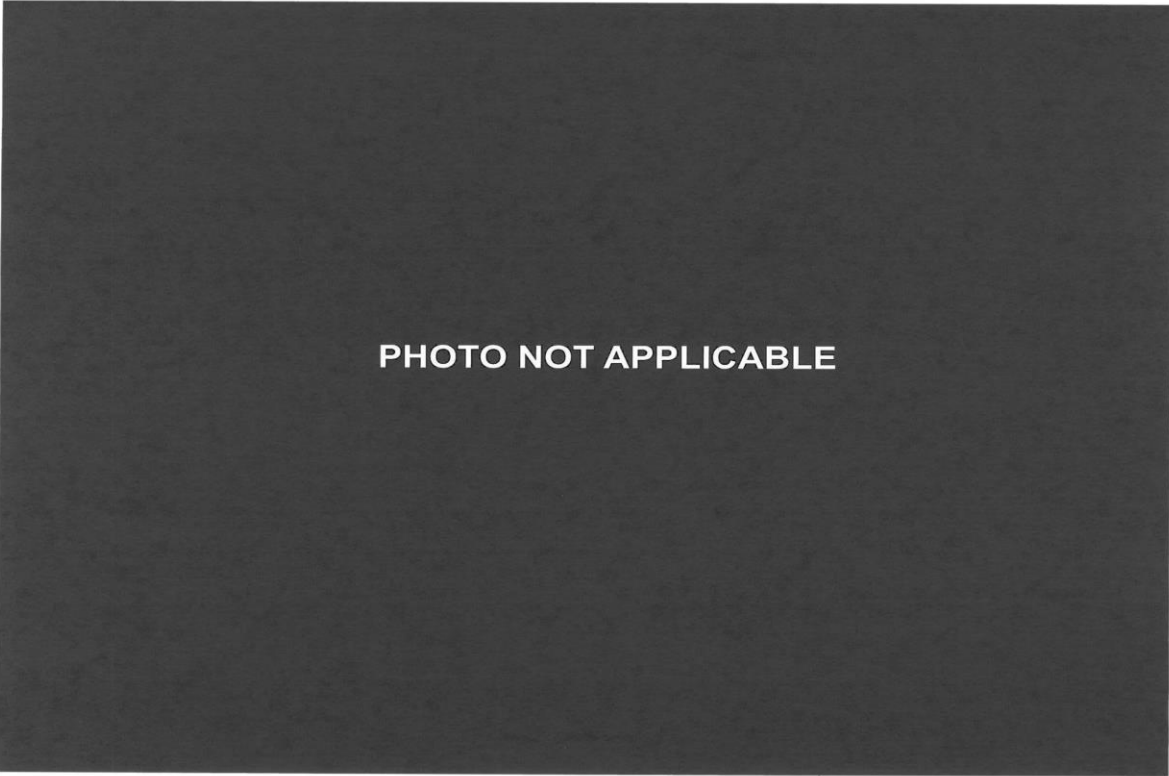


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058 Post-Test Passenger's Seat Fore-Aft Markings

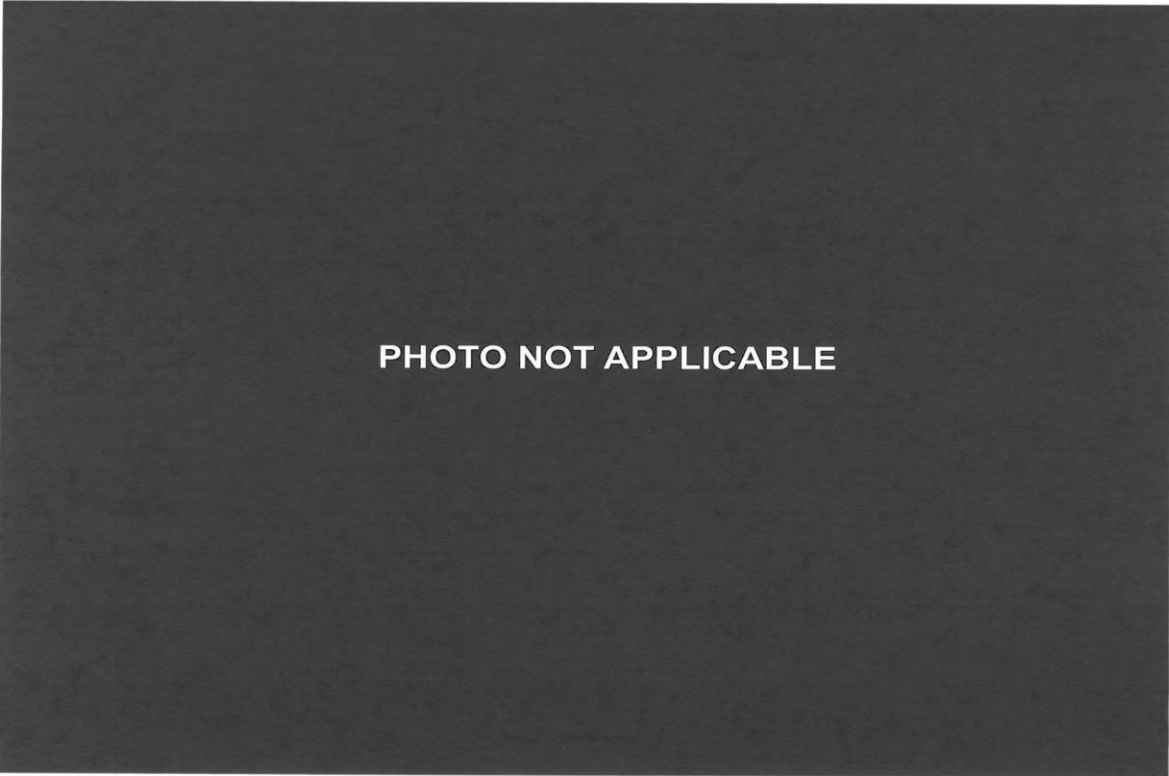


PHOTO NOT APPLICABLE

059 Pre-Test View of Belt Anchorage for Passenger Dummy

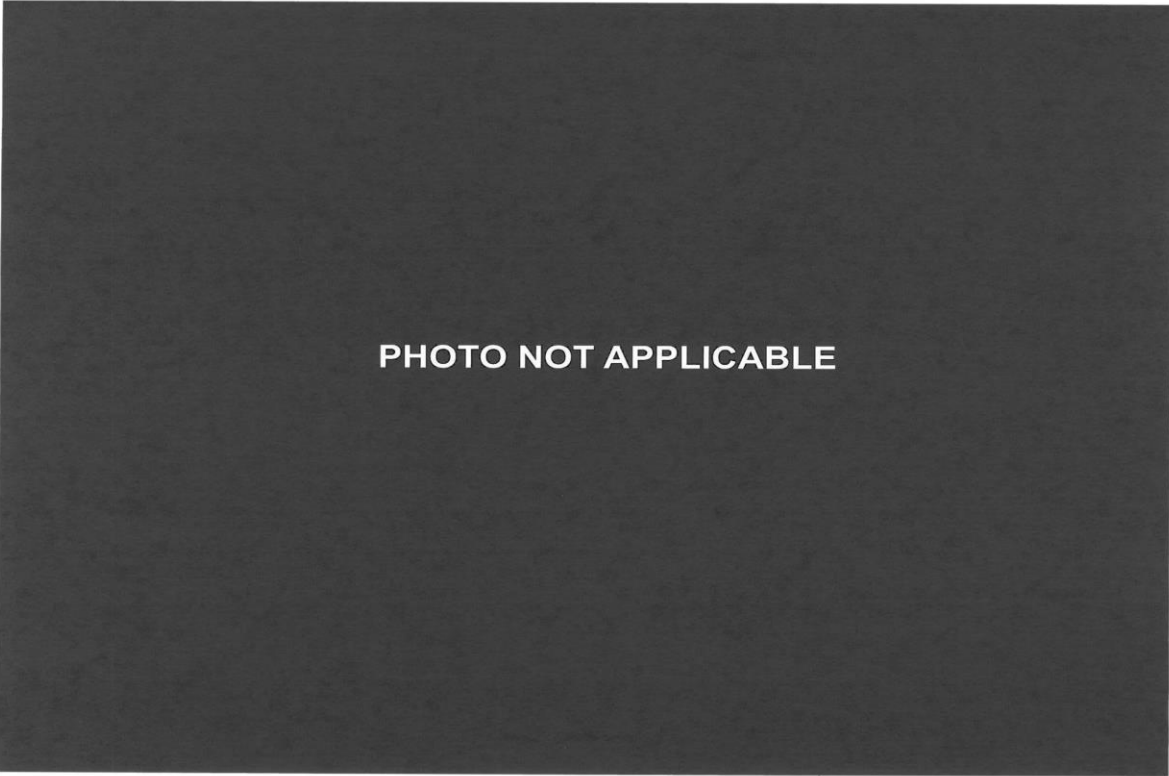


PHOTO NOT APPLICABLE

060 Post-Test View of Belt Anchorage for Passenger Dummy

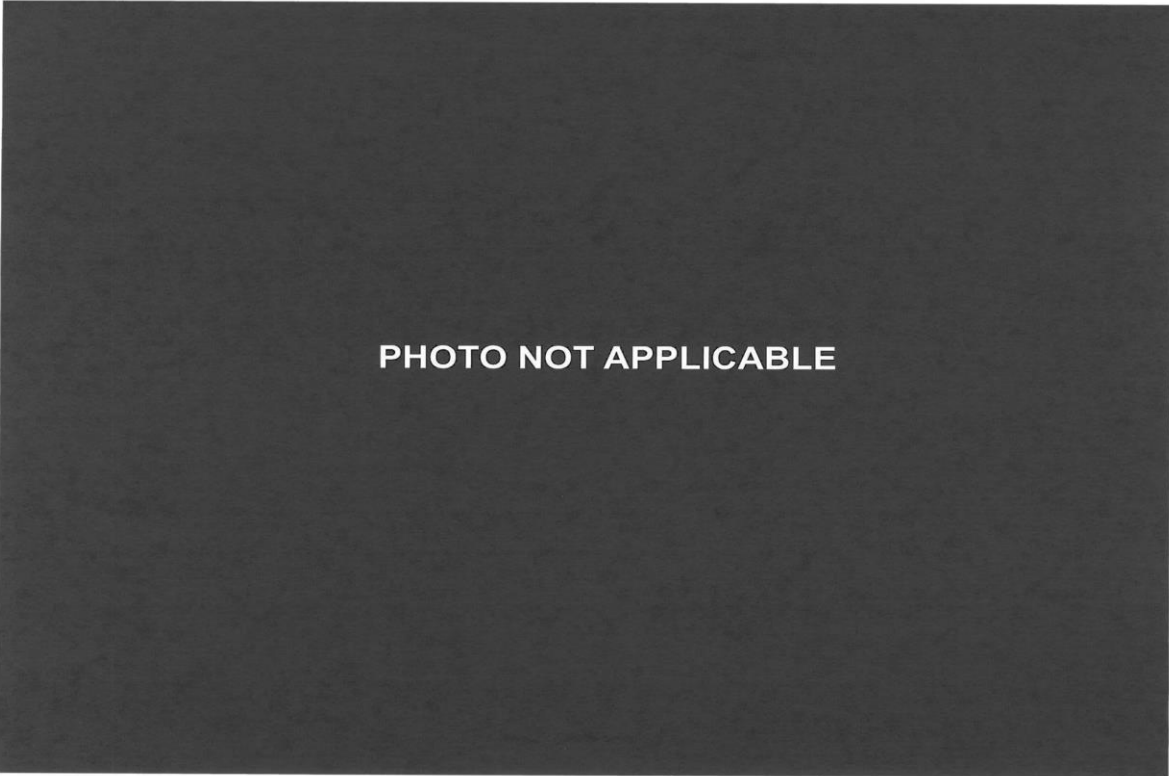


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061 Pre-Test Passenger Dummy Feet

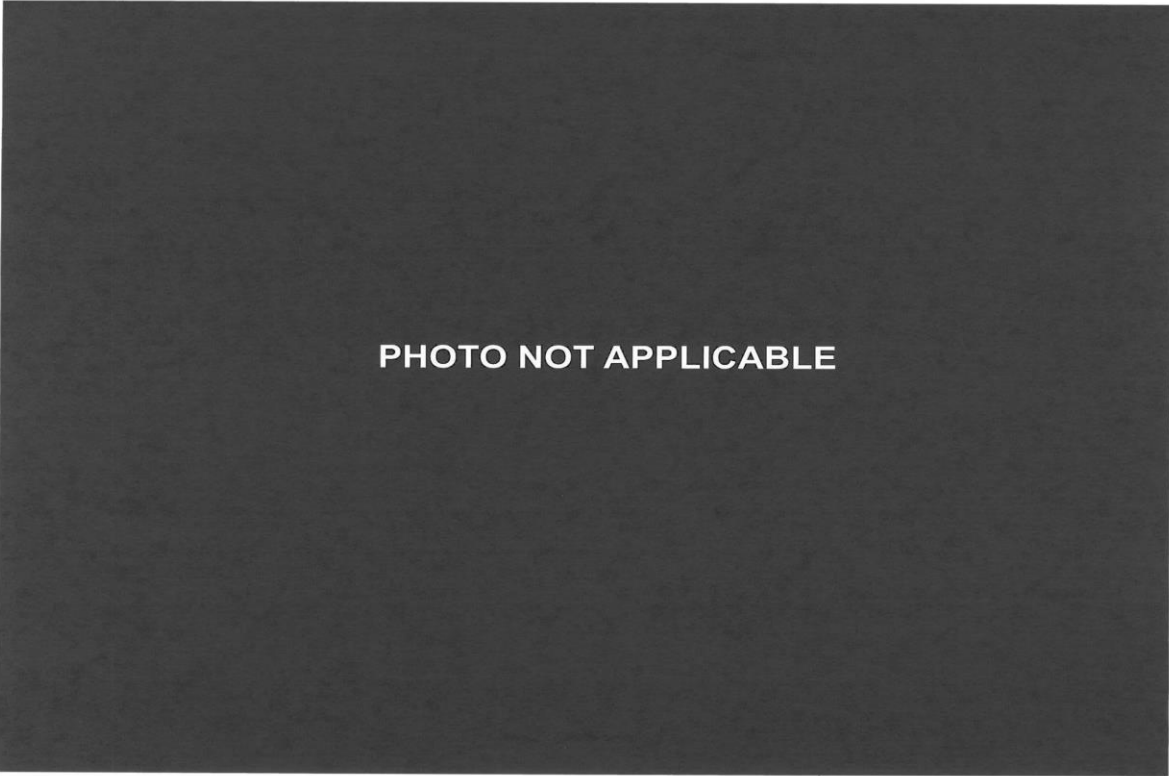


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062 Post-Test Passenger Dummy Feet

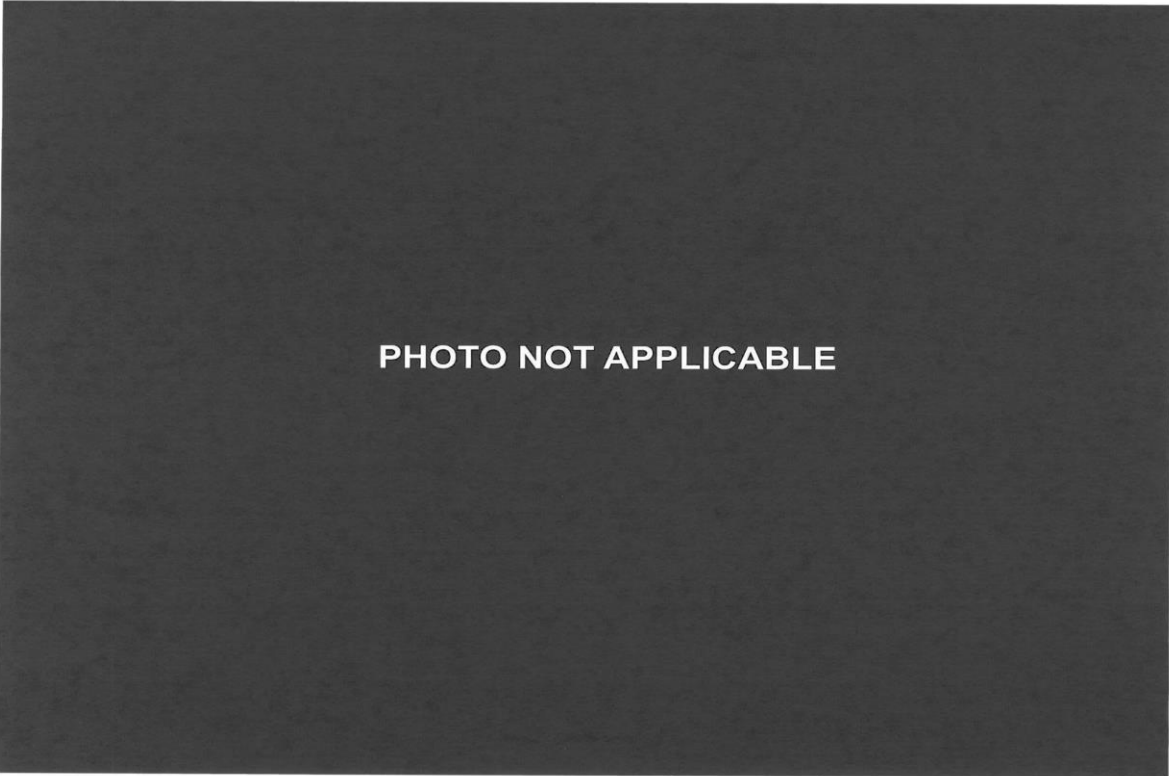


PHOTO NOT APPLICABLE

063 Pre-Test Passenger's Side Knee Bolster

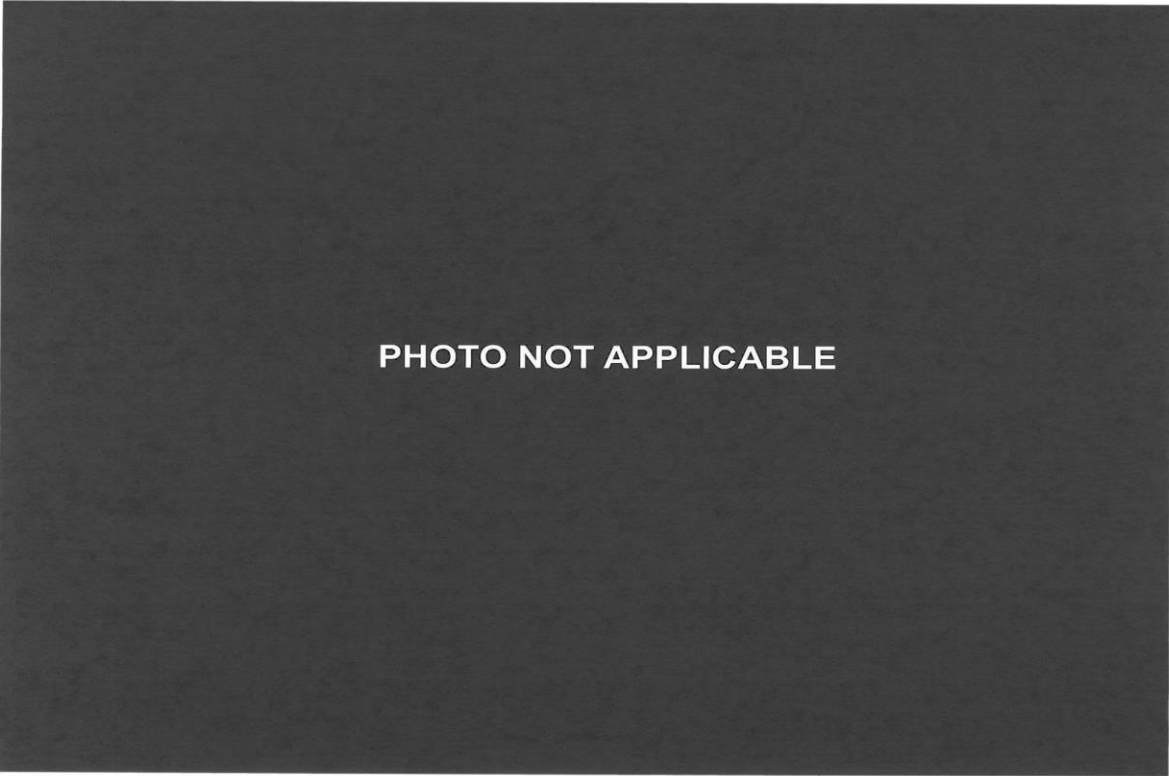


PHOTO NOT APPLICABLE

064 Post-Test Passenger's Side Knee Bolster

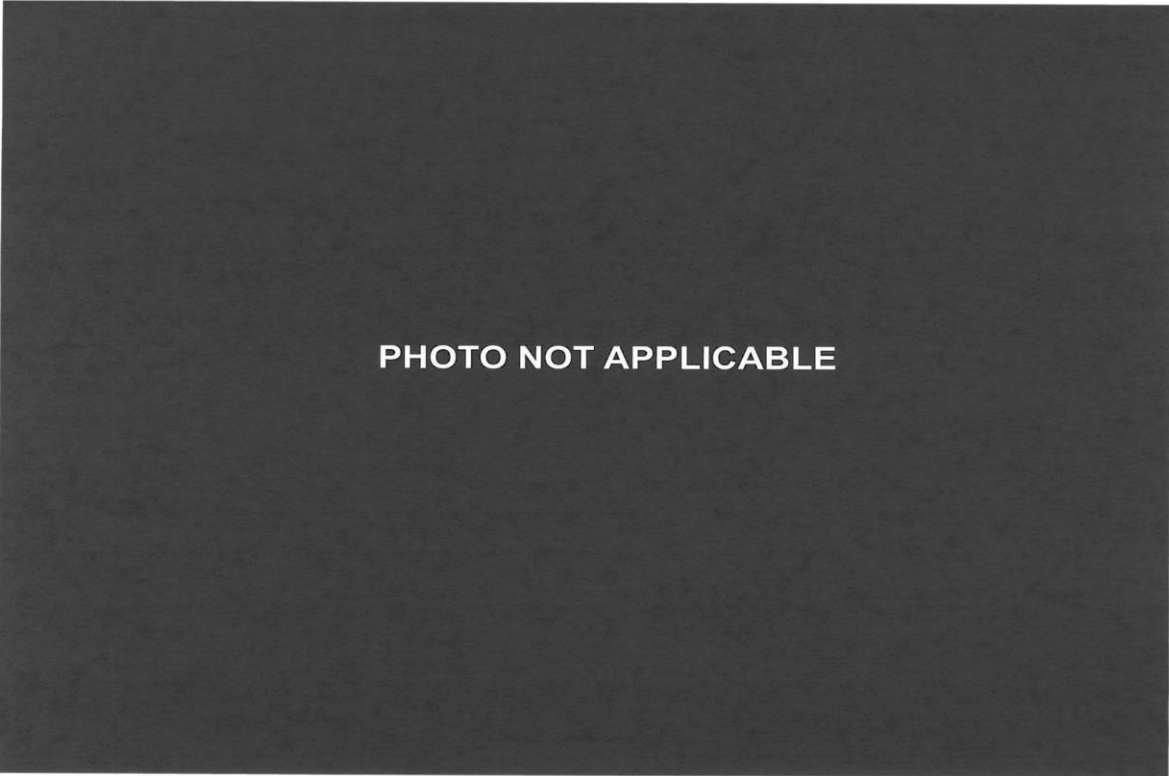


PHOTO NOT APPLICABLE

065 Pre-Test Passenger's Side Floorpan

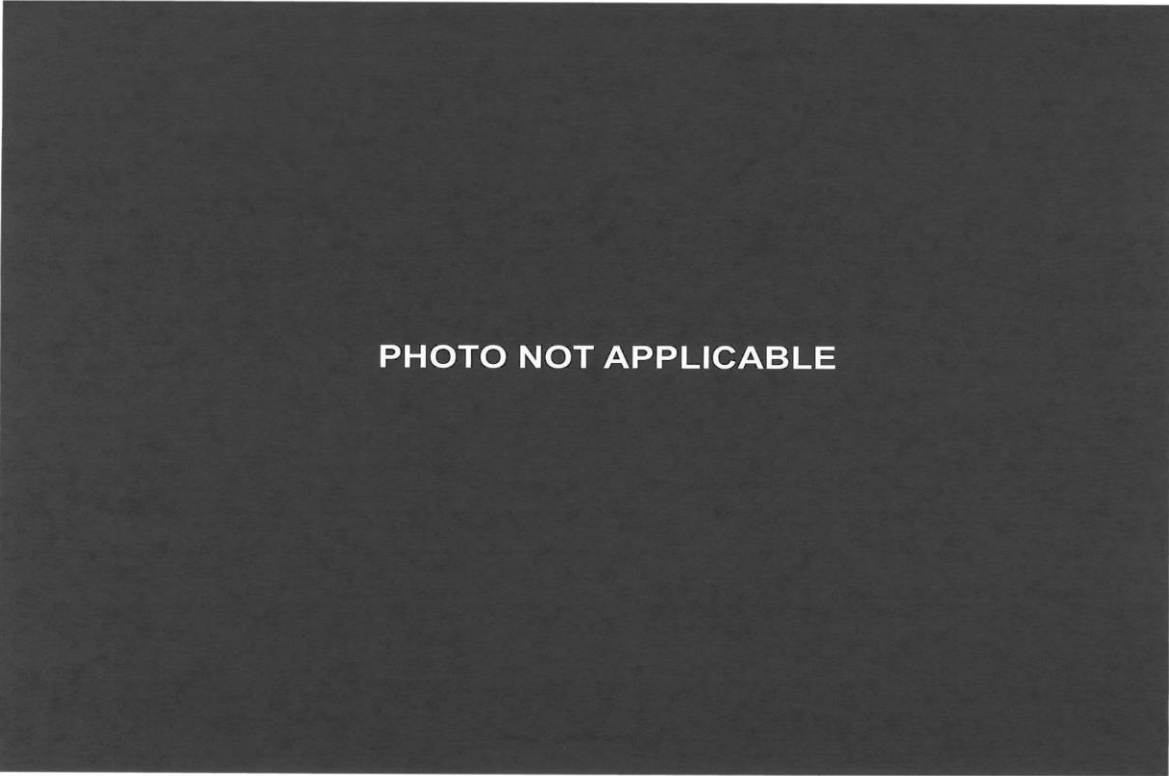


PHOTO NOT APPLICABLE

066 Post-Test Passenger's Side Floorpan

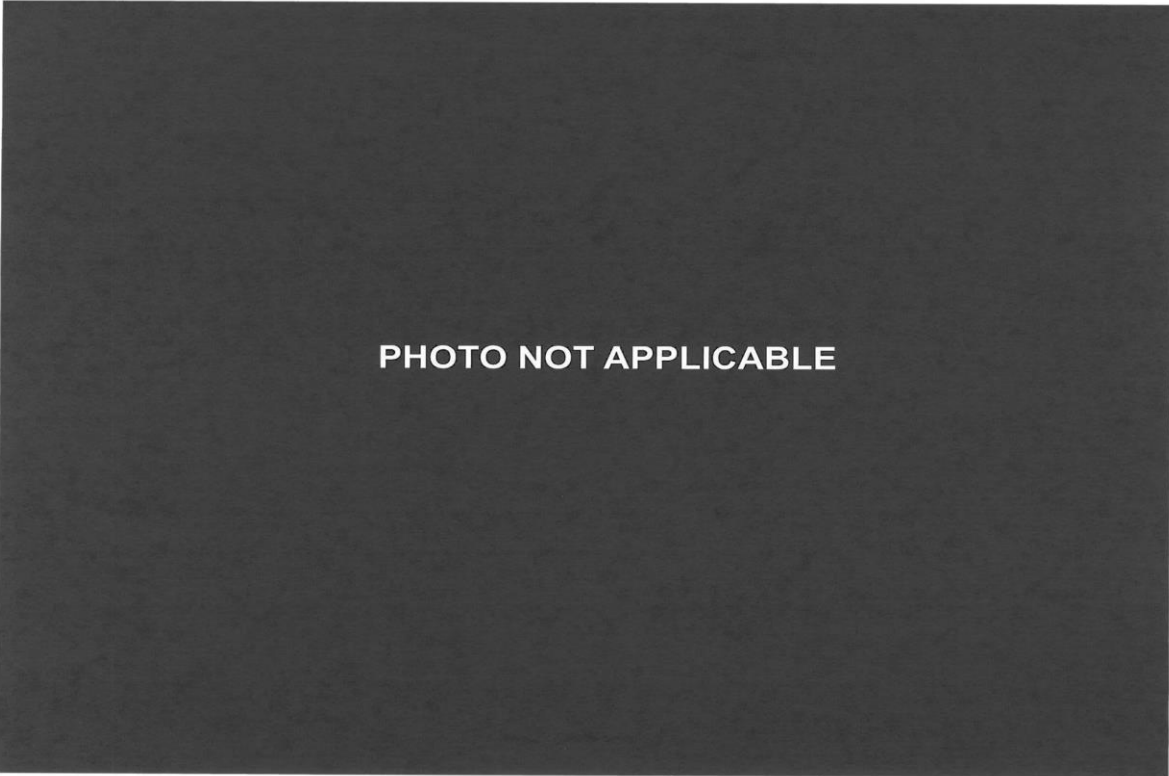


PHOTO NOT APPLICABLE

067 Post-Test Passenger Dummy Face

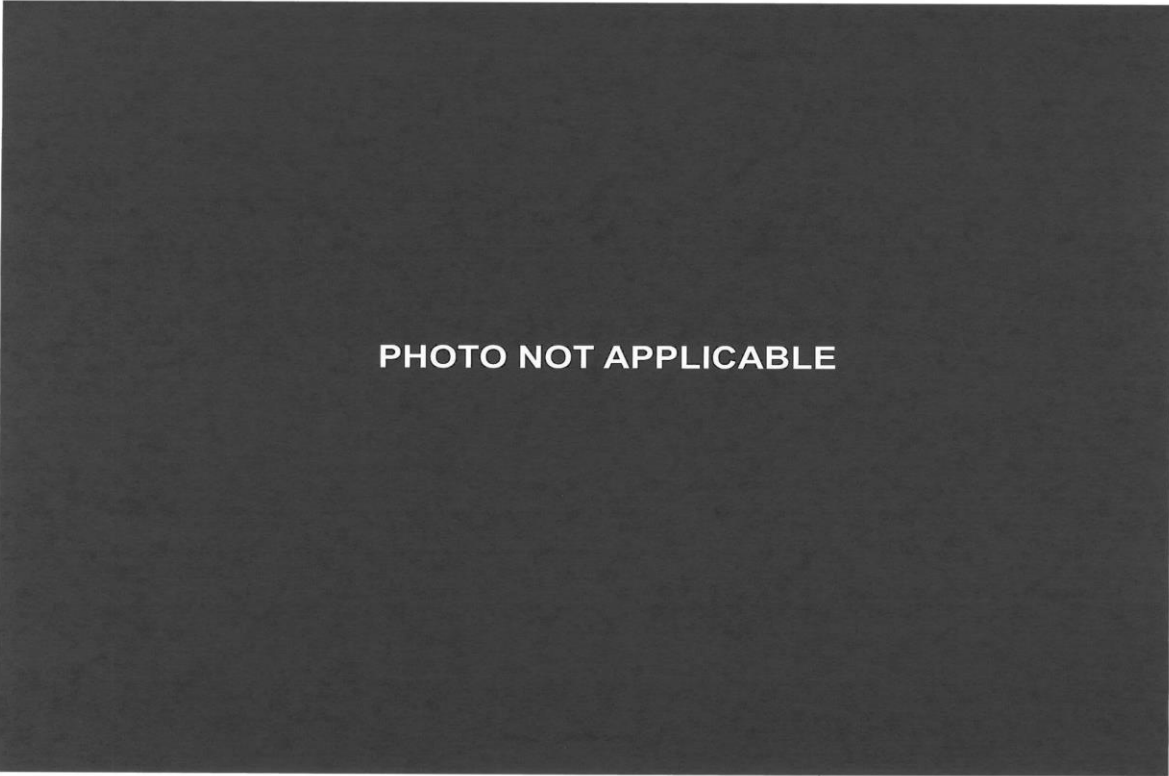


PHOTO NOT APPLICABLE

068 Post-Test Passenger Dummy Contact with Airbag

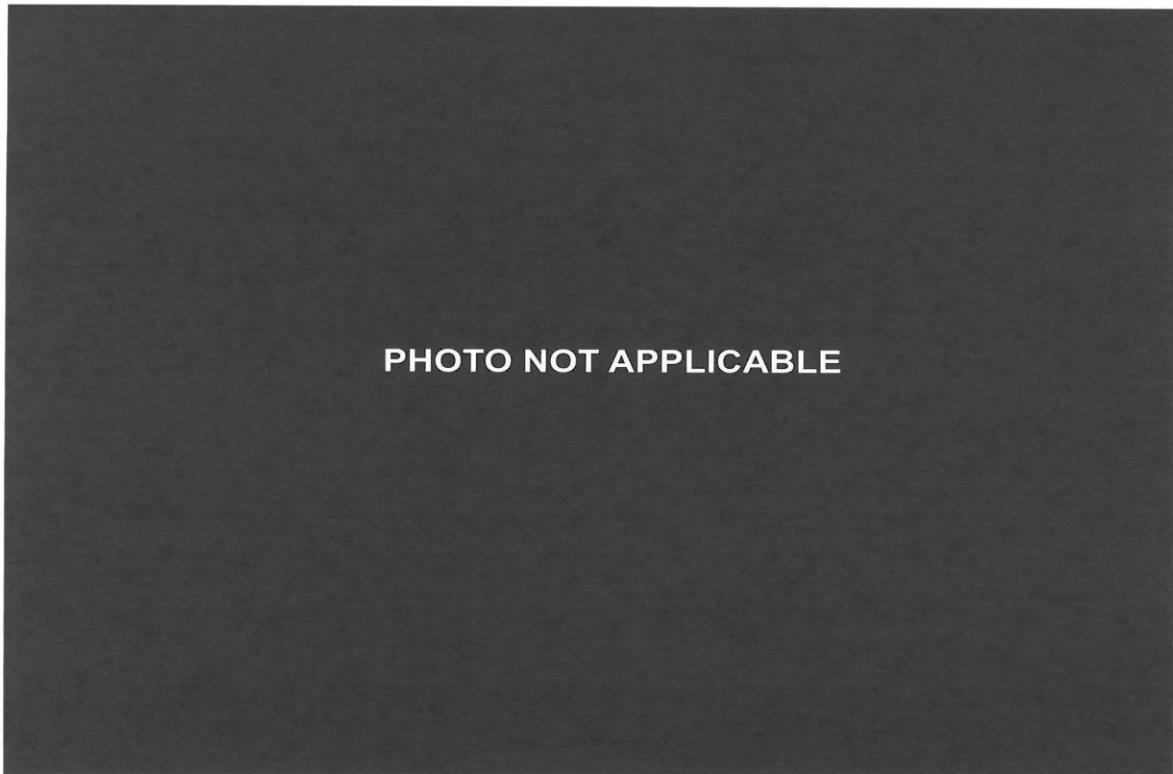
PHOTO NOT APPLICABLE

069 Post-Test Passenger Dummy Contact with Headrest

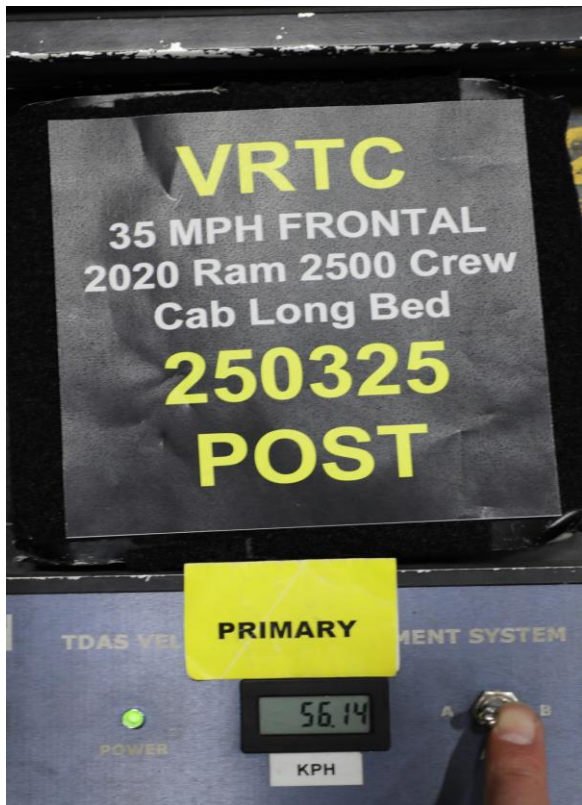
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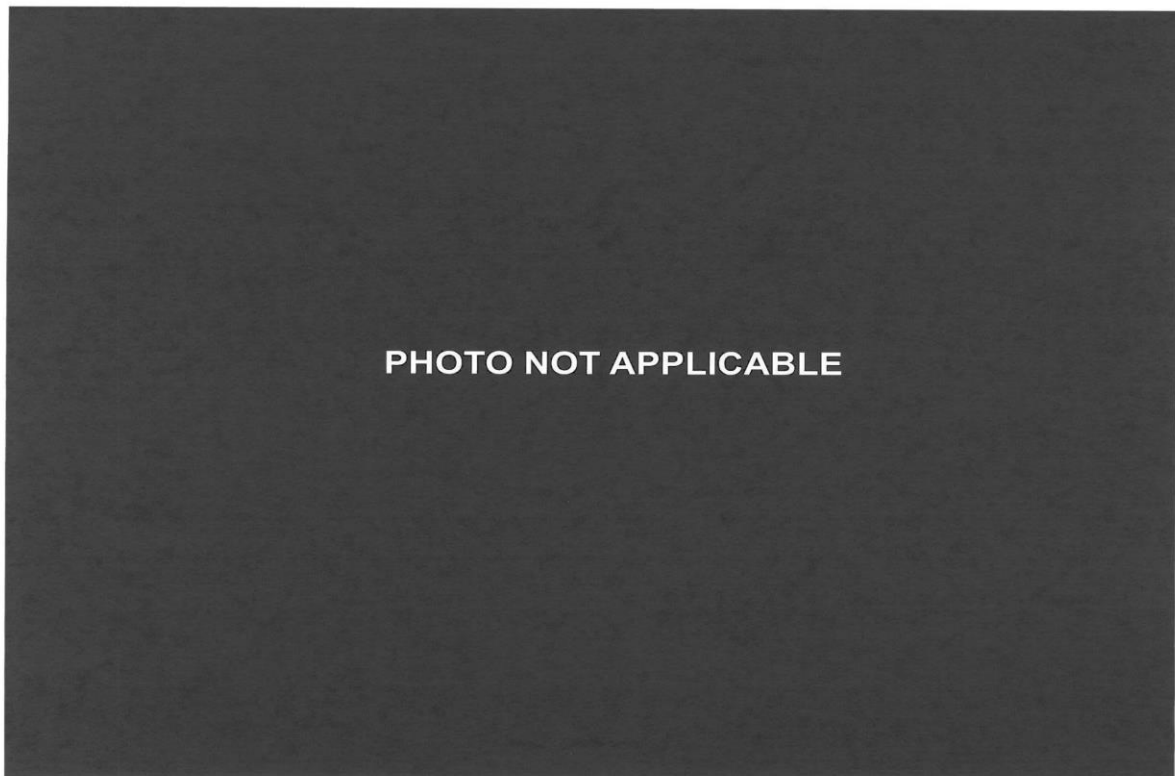
070 Photograph of Ballast Installed in Vehicle



071 Post-Test Stoddard Spillage Location View



072 Post-Test Speed Trap Read out



073 Vehicle at 0° on Static Rollover Device

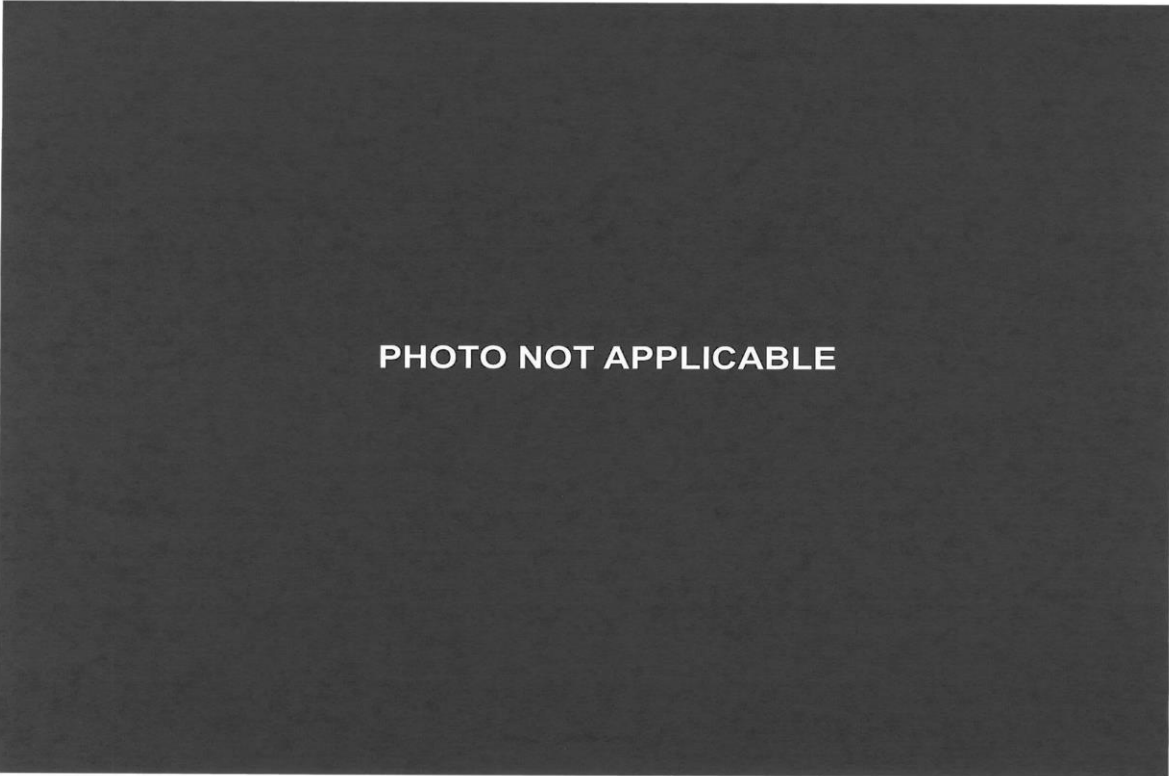


PHOTO NOT APPLICABLE

074 Vehicle at 90° on Static Rollover Device

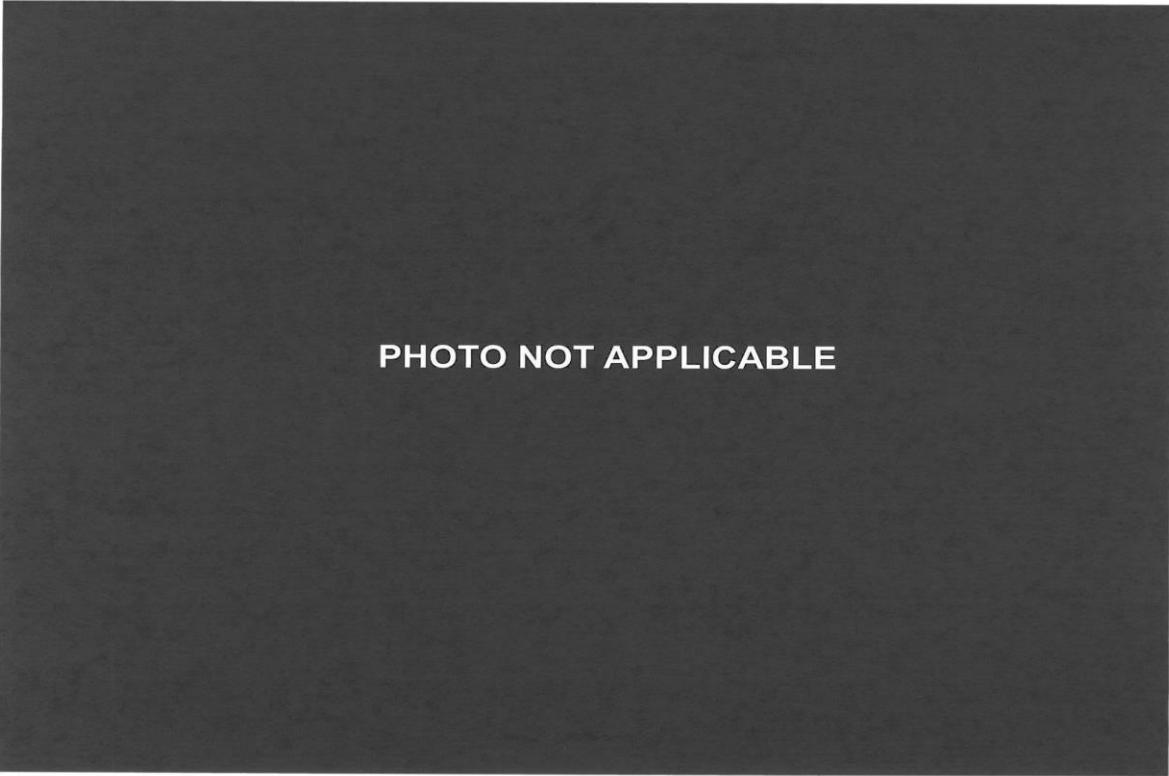


PHOTO NOT APPLICABLE

075 Vehicle at 180° on Static Rollover Device

PHOTO NOT APPLICABLE

076 Vehicle at 270° on Static Rollover Device

PHOTO NOT APPLICABLE

077 Vehicle at 360° on Static Rollover Device

PHOTO NOT AVAILABLE

078 2020 Ram 2500 Crew Cab Long Bed Frontal Impact Event

PHOTO NOT AVAILABLE

079 Monroney Label Photograph

APPENDIX B
VEHICLE AND DUMMY RESPONSE DATA PLOTS

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4	Driver Head Accelerometer Resultant	B-9
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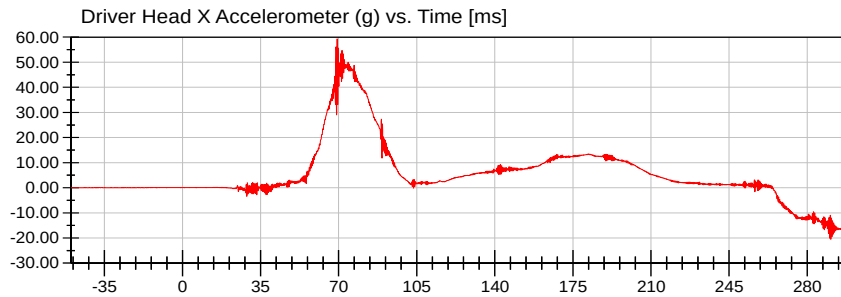
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VRTC

Test Lab: CTF

Test Number: 250325 ()

Test Date: 03/25/2025



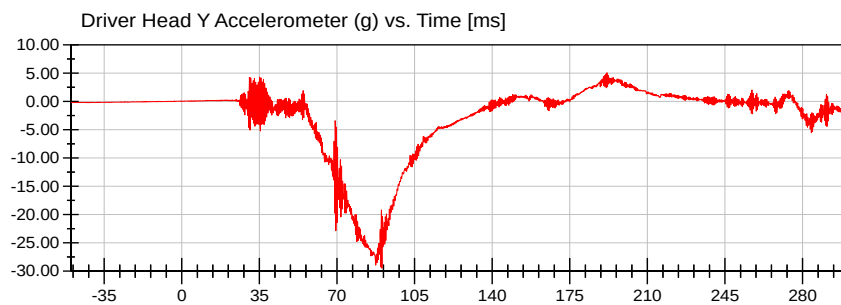
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59.27 g at 69.30 ms

<Min>

-20.52 g at 290.60 ms

CFC_1000



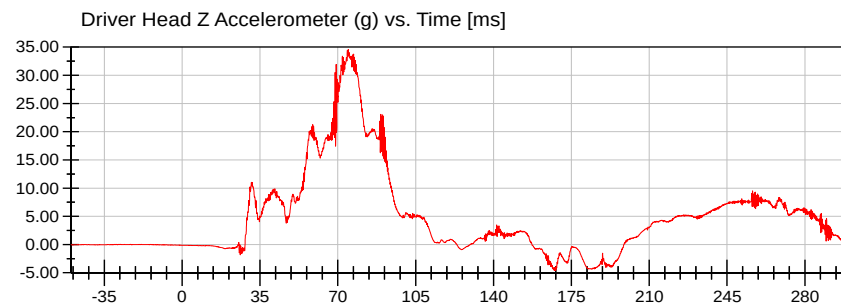
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5.08 g at 191.75 ms

<Min>

-29.48 g at 90.25 ms

CFC_1000



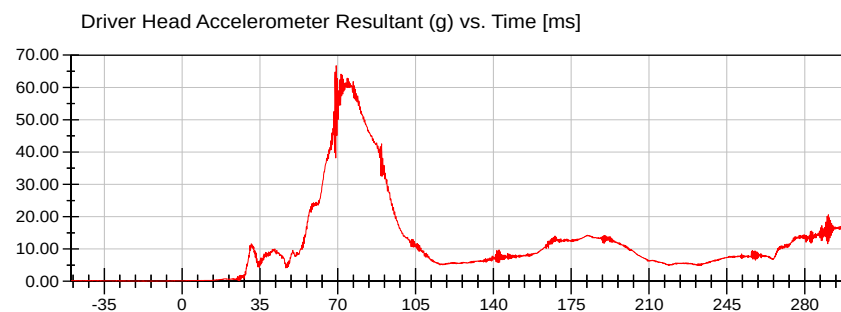
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34.57 g at 74.70 ms

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-4.60 g at 167.65 ms

CFC_1000



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66.75 g at 69.30 ms

<Min>

0.04 g at -16.85 ms

CFC_1000

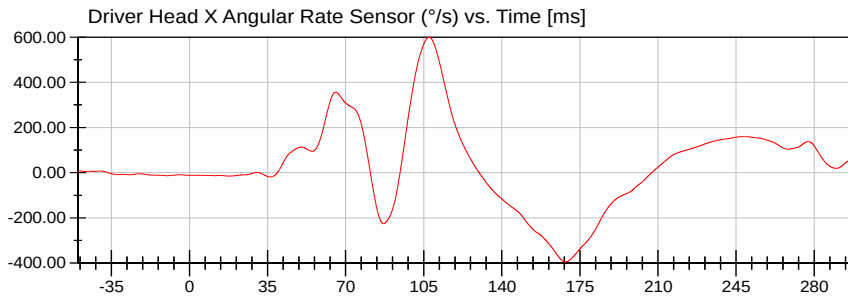


VRTC

Test Lab: CTF

Test Number: 250325 ()

Test Date: 03/25/2025



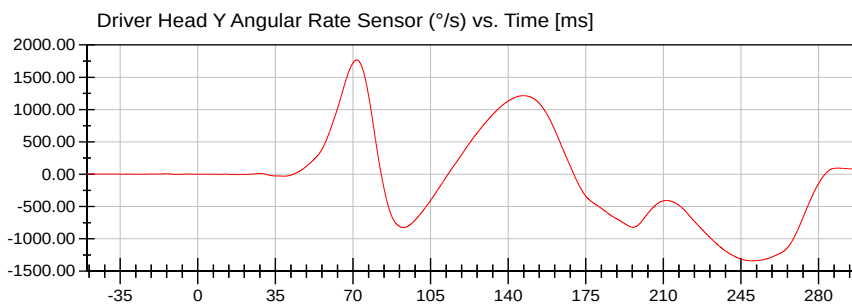
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600.00 °/s at 107.40 ms

<Min>

-394.99 °/s at 168.40 ms

CFC_60



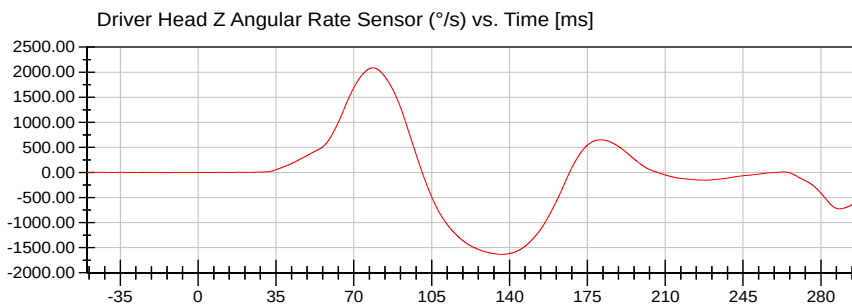
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1,767.82 °/s at 71.65 ms

<Min>

-1,340.40 °/s at 250.15 ms

CFC_60



<Max>

2,086.74 °/s at 78.55 ms

<Min>

-1,632.94 °/s at 136.60 ms

CFC_60

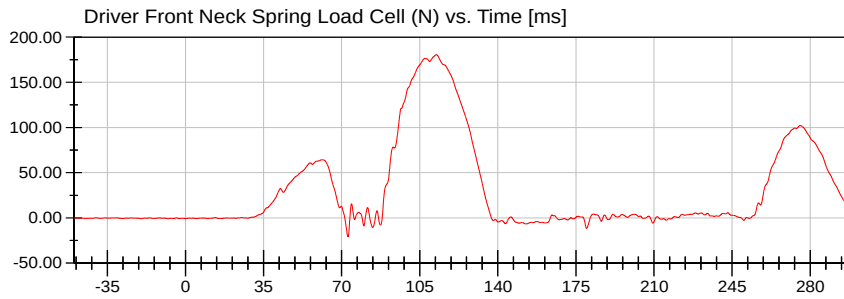


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



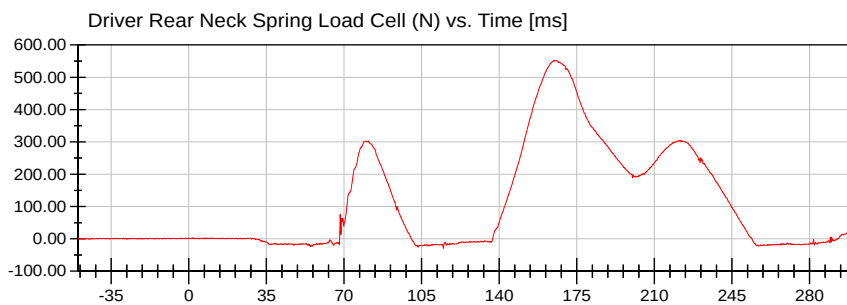
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180.38 N at 112.50 ms

<Min>

-20.88 N at 72.85 ms

CFC_180



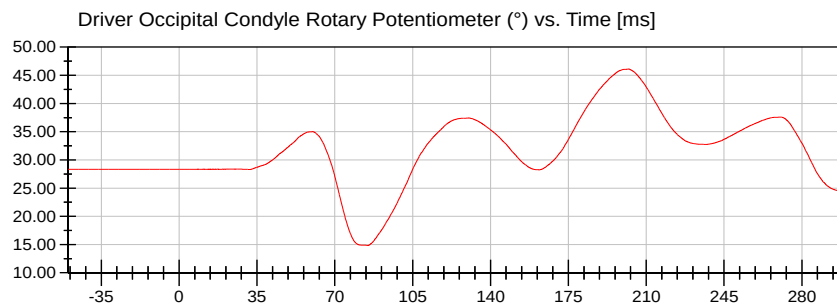
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552.40 N at 165.35 ms

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-29.62 N at 114.85 ms

CFC_1000



<Max>

46.12 ° at 202.15 ms

<Min>

14.82 ° at 84.90 ms

CFC_1000

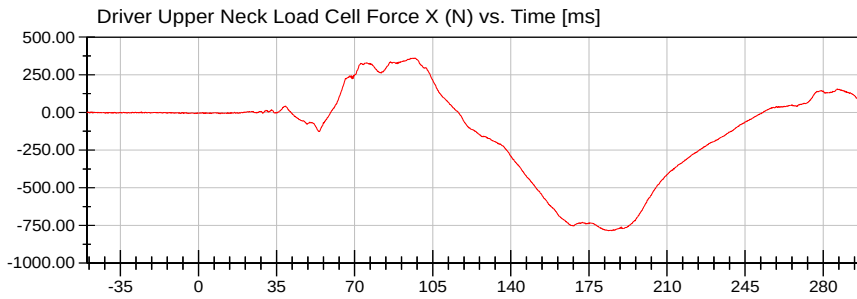


VRTC

Test Lab: CTF

Test Number: 250325 ()

Test Date: 03/25/2025



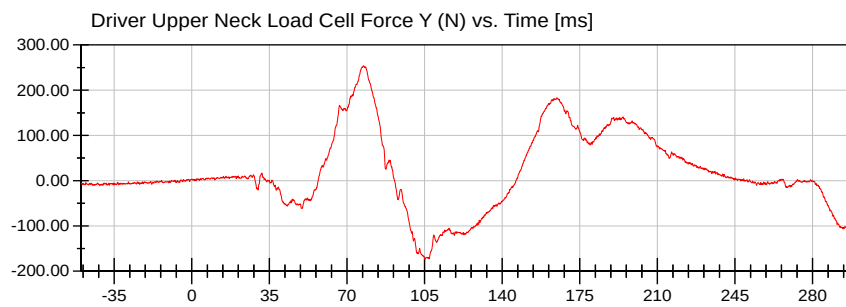
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360.48 N at 96.80 ms

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-785.67 N at 185.30 ms

CFC_1000



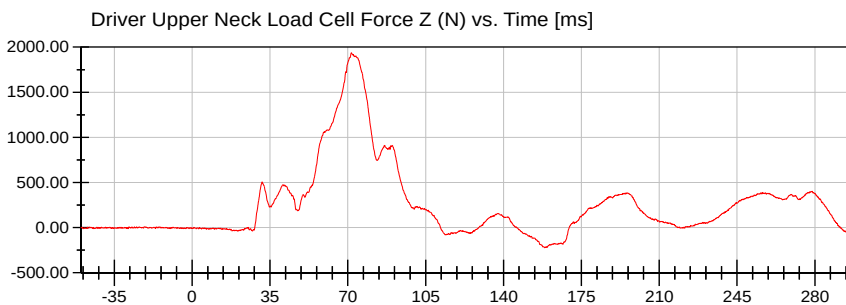
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254.21 N at 77.50 ms

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-173.84 N at 105.10 ms

CFC_1000



<Max>

1,938.39 N at 71.60 ms

<Min>

-223.26 N at 158.55 ms

CFC_1000

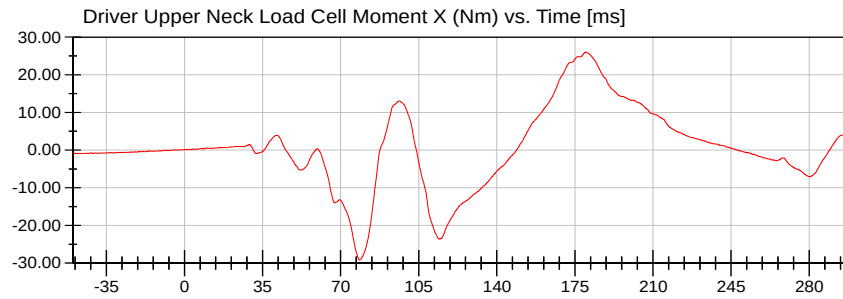


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



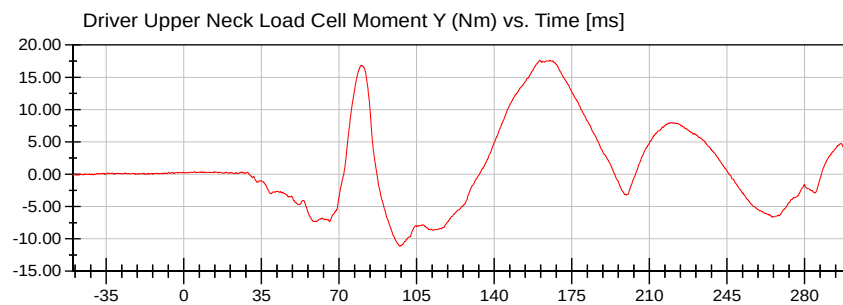
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26.03 Nm at 179.90 ms

<Min>

-29.18 Nm at 78.55 ms

CFC_600



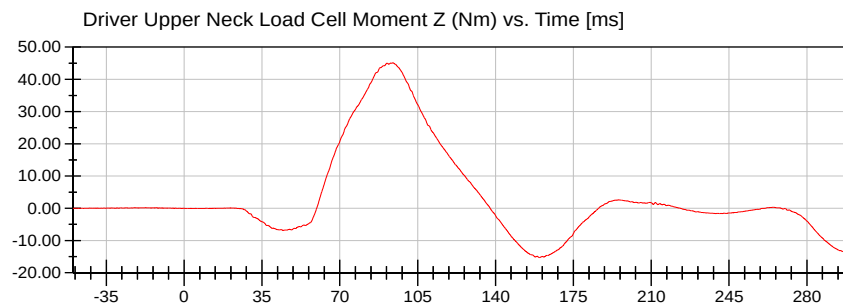
<Max>

17.62 Nm at 165.35 ms

<Min>

-11.10 Nm at 97.85 ms

CFC_600



<Max>

45.14 Nm at 93.90 ms

<Min>

-15.31 Nm at 159.75 ms

CFC_600

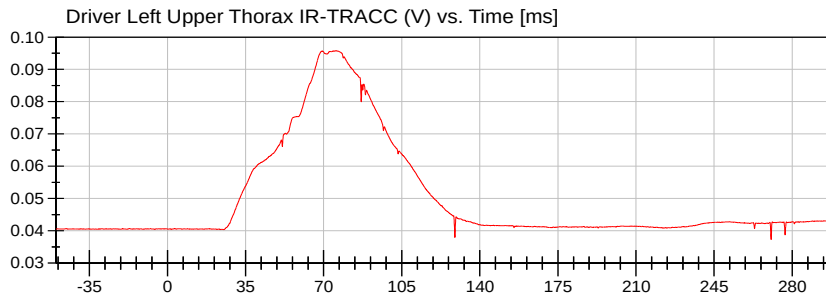


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



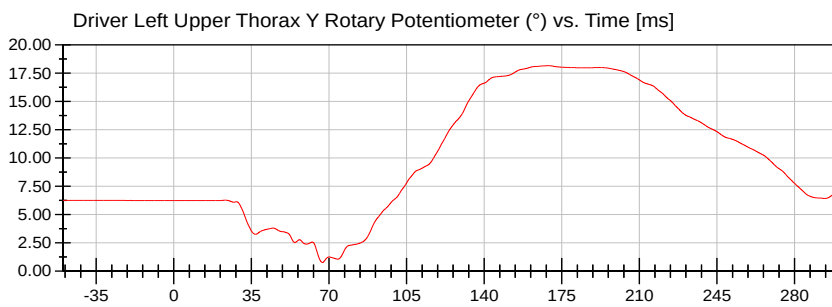
<Max>

0.10 V at 75.65 ms

<Min>

0.04 V at 270.55 ms

CFC_600



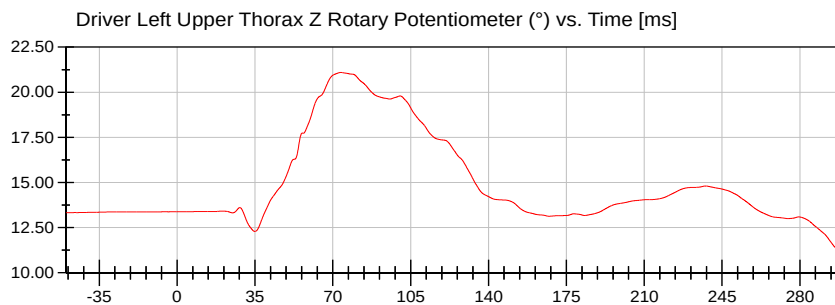
<Max>

18.16 ° at 169.00 ms

<Min>

0.77 ° at 67.05 ms

CFC_180



<Max>

21.10 ° at 73.60 ms

<Min>

10.93 ° at 300.00 ms

CFC_180

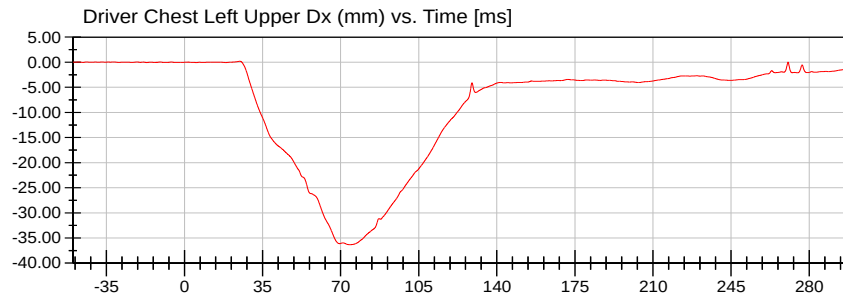


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



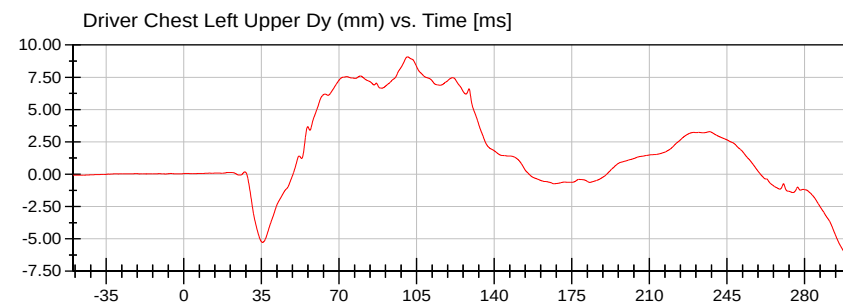
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0.18 mm at 24.80 ms

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-36.33 mm at 74.20 ms

CFC_1000



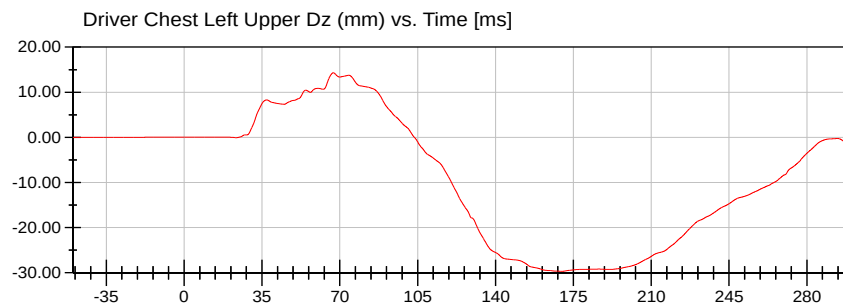
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9.08 mm at 100.90 ms

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-6.60 mm at 300.00 ms

CFC_1000



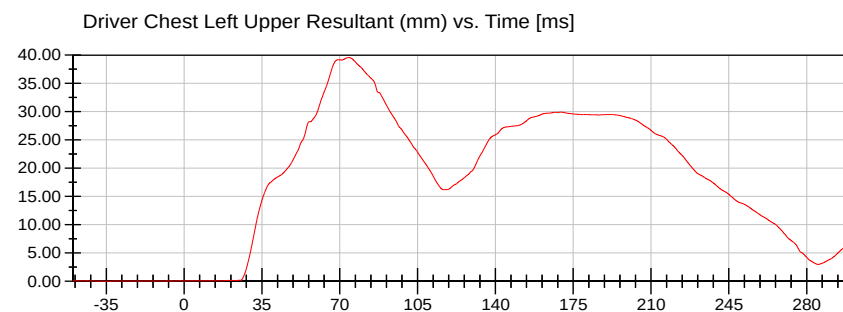
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14.32 mm at 67.05 ms

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-29.68 mm at 169.90 ms

CFC_1000



<Max>

39.57 mm at 74.05 ms

<Min>

0.01 mm at -33.20 ms

CFC_1000



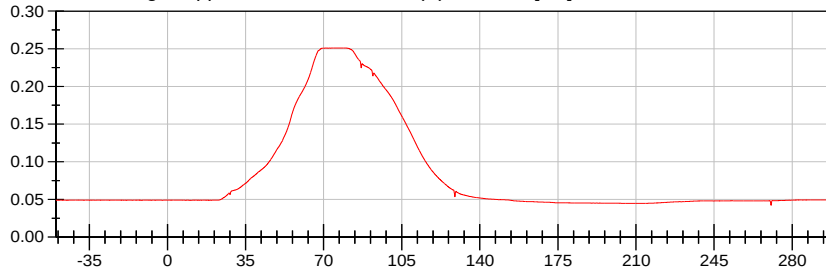
VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()

Driver Right Upper Thorax IR-TRACC (V) vs. Time [ms]



<Max>

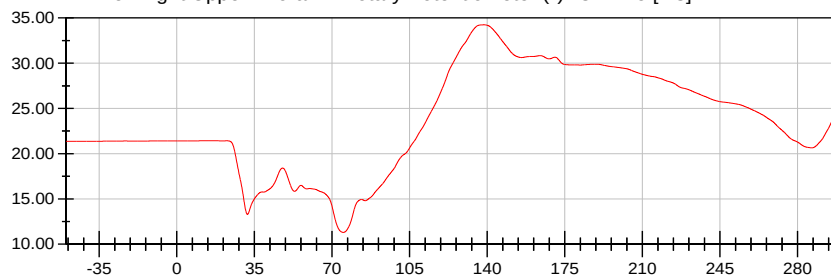
0.25 V at 79.55 ms

<Min>

0.04 V at 270.55 ms

CFC_600

Driver Right Upper Thorax Y Rotary Potentiometer (°) vs. Time [ms]



<Max>

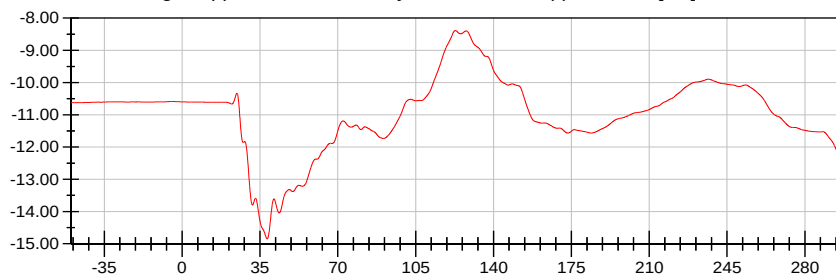
34.24 ° at 138.55 ms

<Min>

11.30 ° at 75.10 ms

CFC_180

Driver Right Upper Thorax Z Rotary Potentiometer (°) vs. Time [ms]



<Max>

-8.39 ° at 122.85 ms

<Min>

-14.85 ° at 38.25 ms

CFC_180

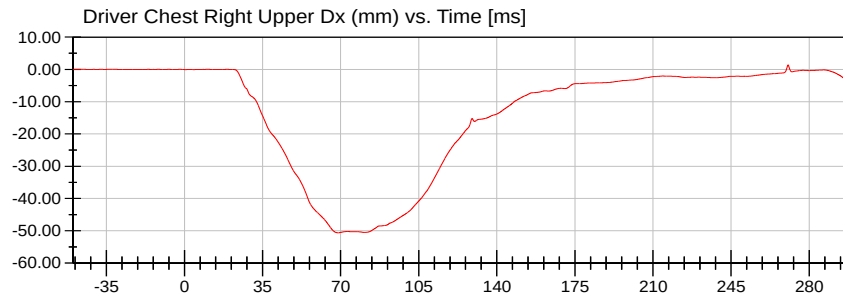


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



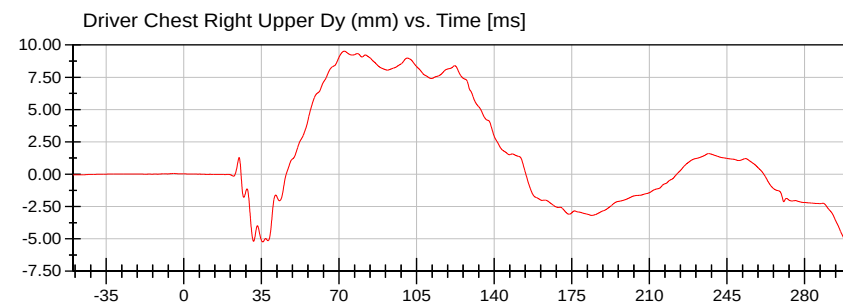
<Max>

1.39 mm at 270.55 ms

<Min>

-50.63 mm at 68.85 ms

CFC_1000



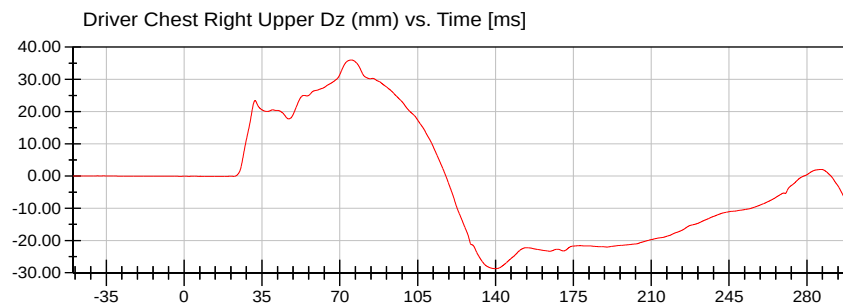
<Max>

9.52 mm at 72.40 ms

<Min>

-5.92 mm at 300.00 ms

CFC_1000



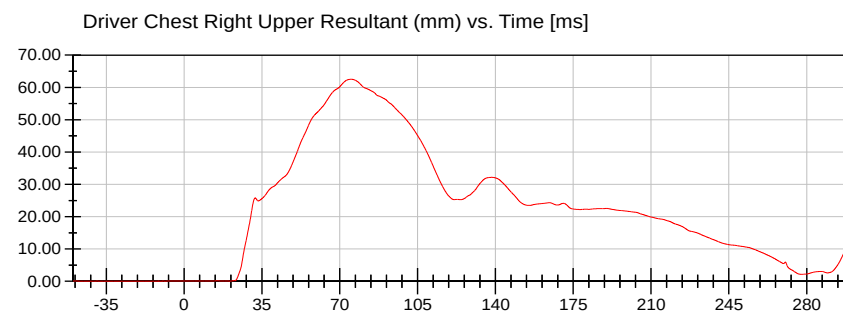
<Max>

36.01 mm at 75.25 ms

<Min>

-28.71 mm at 139.75 ms

CFC_1000



<Max>

62.52 mm at 75.25 ms

<Min>

0.02 mm at -30.65 ms

CFC_1000

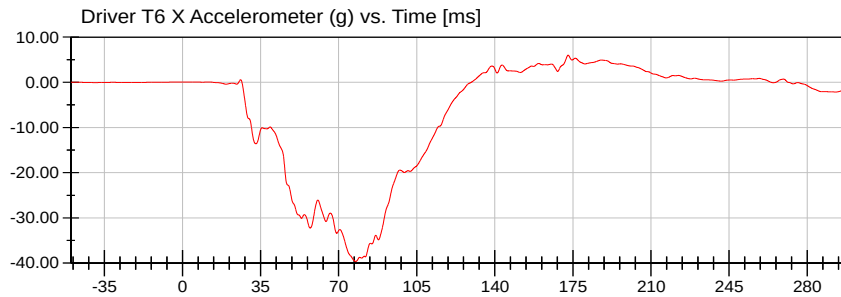


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



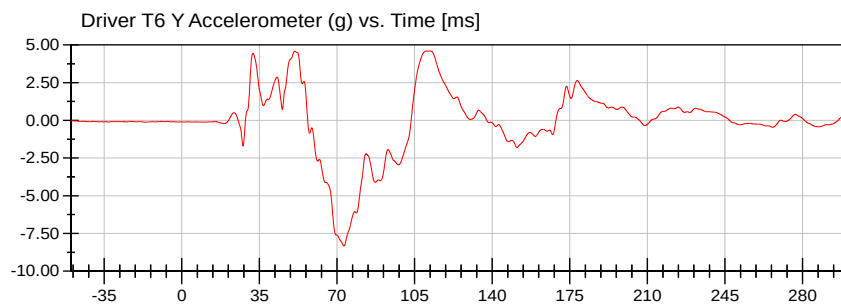
<Max>

5.99 g at 172.85 ms

<Min>

-39.63 g at 77.65 ms

CFC_180



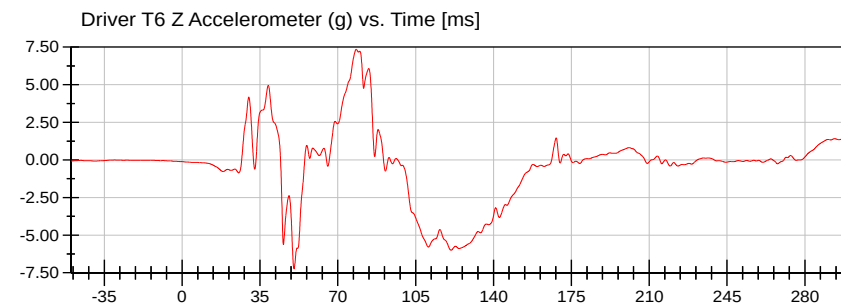
<Max>

4.60 g at 112.10 ms

<Min>

-8.32 g at 73.15 ms

CFC_180



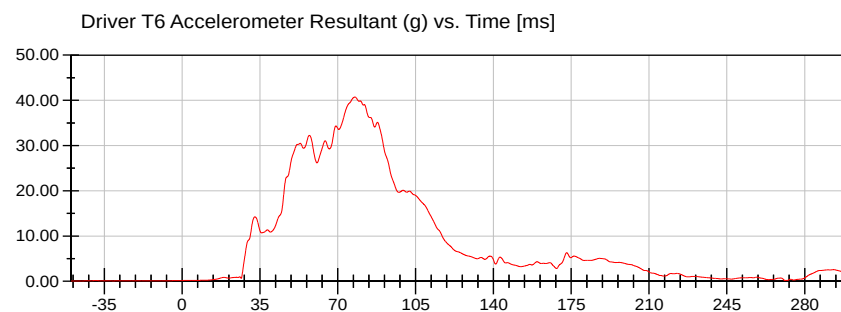
<Max>

7.35 g at 78.25 ms

<Min>

-7.24 g at 50.30 ms

CFC_180



<Max>

40.73 g at 77.70 ms

<Min>

0.06 g at -47.00 ms

CFC_180

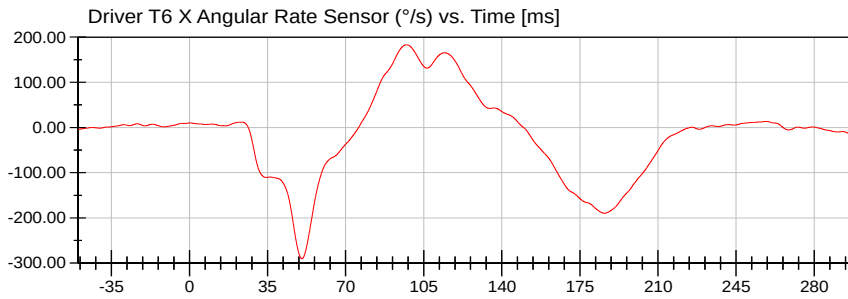


VRTC

Test Lab: CTF

Test Number: 250325 ()

Test Date: 03/25/2025



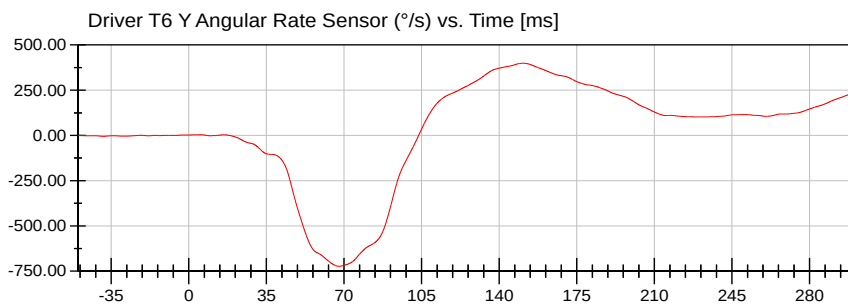
<Max>

182.87 °/s at 97.20 ms

<Min>

-290.34 °/s at 50.40 ms

CFC_60



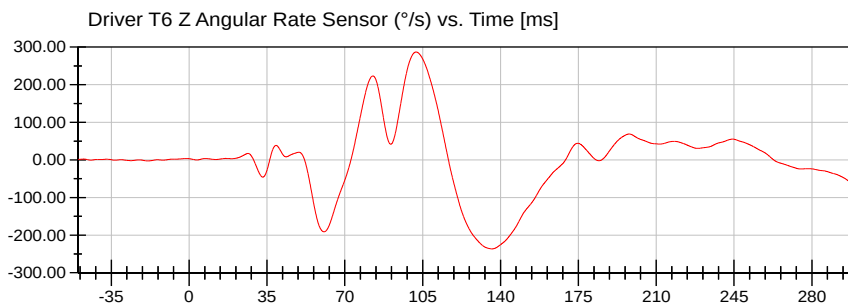
<Max>

399.02 °/s at 150.80 ms

<Min>

-722.96 °/s at 67.70 ms

CFC_60



<Max>

287.08 °/s at 102.05 ms

<Min>

-236.56 °/s at 136.20 ms

CFC_60

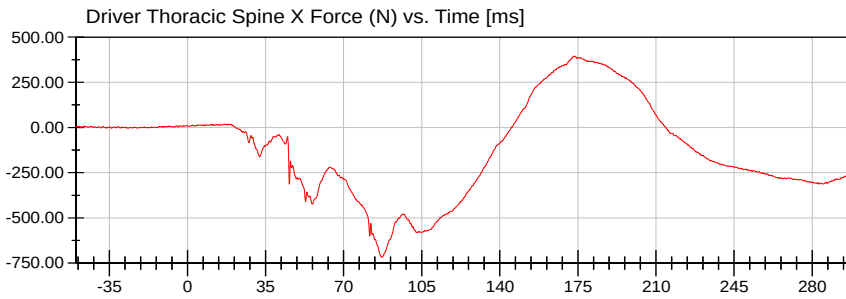


VRTC

Test Lab: CTF

Test Number: 250325 ()

Test Date: 03/25/2025



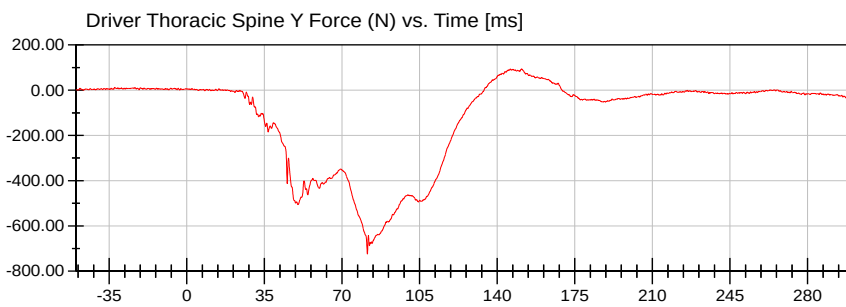
<Max>

394.44 N at 173.80 ms

<Min>

-717.31 N at 87.05 ms

CFC_600



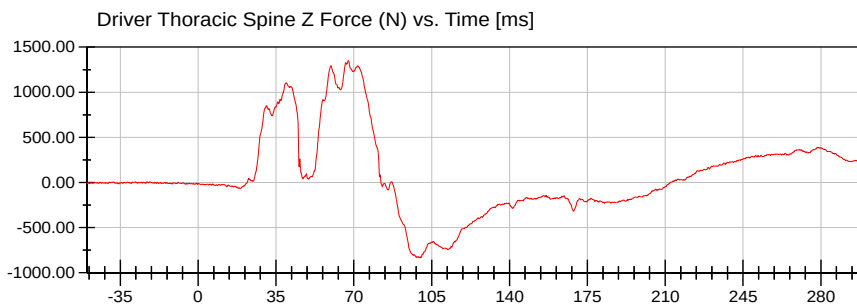
<Max>

94.27 N at 151.05 ms

<Min>

-724.55 N at 81.45 ms

CFC_600



<Max>

1,353.30 N at 67.60 ms

<Min>

-835.87 N at 99.40 ms

CFC_600

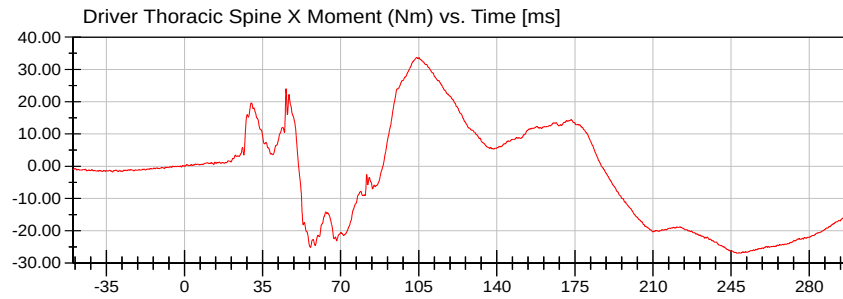


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



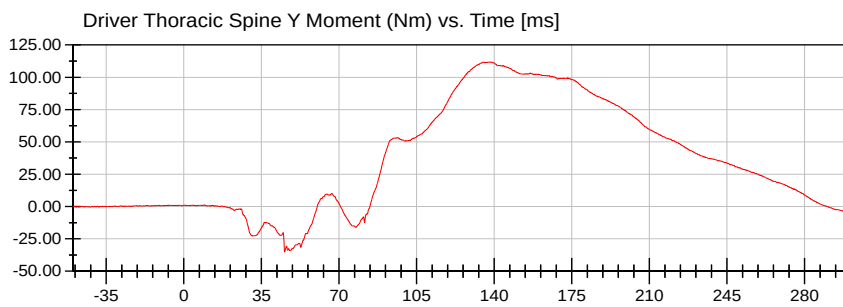
<Max>

33.72 Nm at 104.05 ms

<Min>

-26.92 Nm at 247.90 ms

CFC_600



<Max>

111.80 Nm at 137.35 ms

<Min>

-35.09 Nm at 45.50 ms

CFC_600

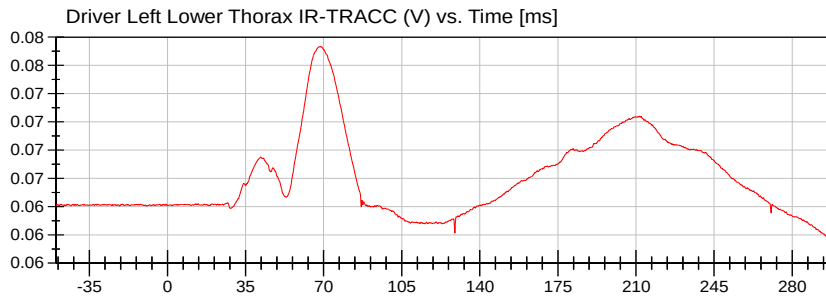


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



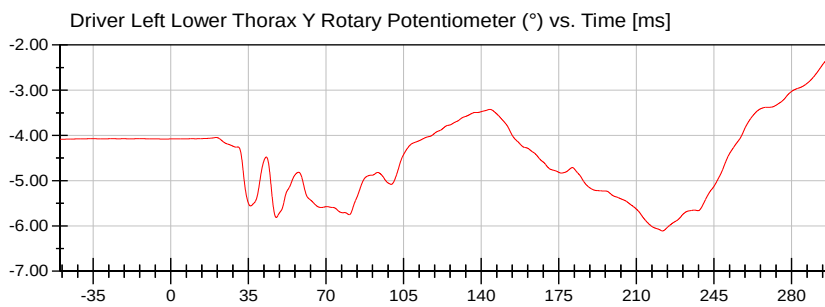
<Max>

0.08 V at 68.65 ms

<Min>

0.06 V at 300.00 ms

CFC_600



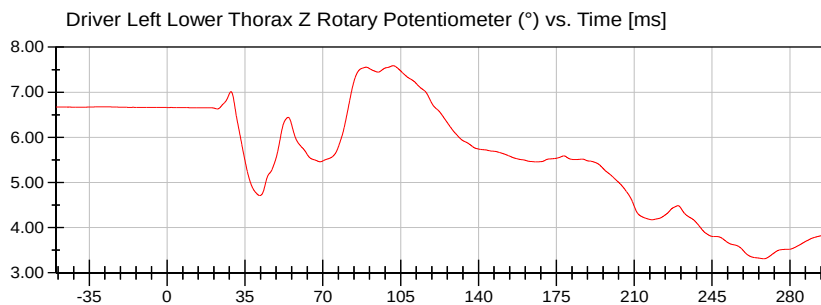
<Max>

-2.10 ° at 300.00 ms

<Min>

-6.11 ° at 221.80 ms

CFC_180



<Max>

7.59 ° at 101.65 ms

<Min>

3.31 ° at 268.25 ms

CFC_180

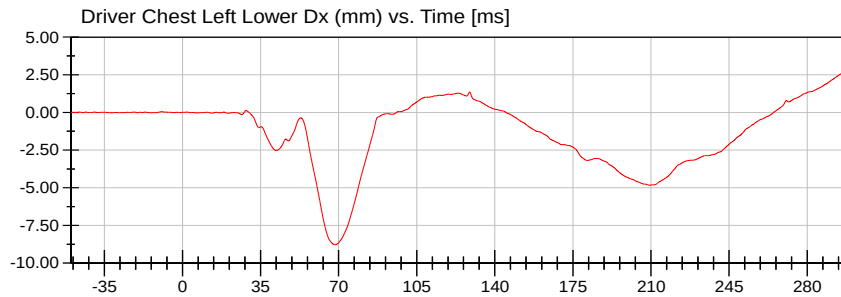


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



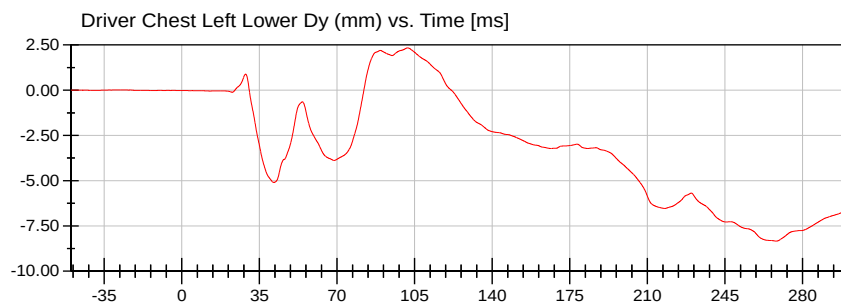
<Max>

2.77 mm at 300.00 ms

<Min>

-8.78 mm at 68.35 ms

CFC_1000



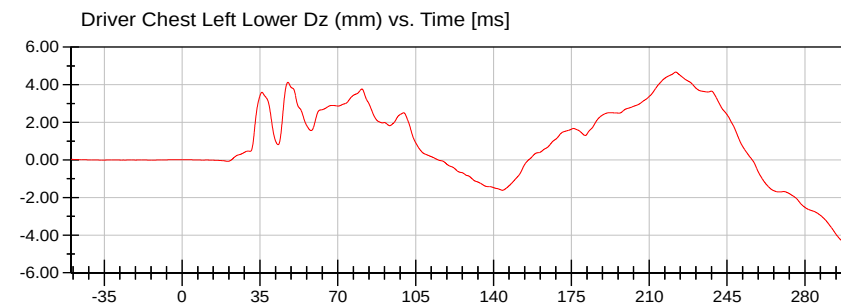
<Max>

2.34 mm at 101.85 ms

<Min>

-8.34 mm at 268.10 ms

CFC_1000



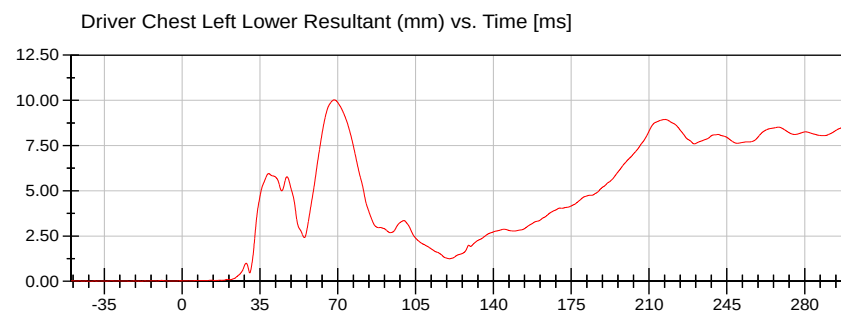
<Max>

4.67 mm at 221.95 ms

<Min>

-4.78 mm at 300.00 ms

CFC_1000



<Max>

10.02 mm at 68.45 ms

<Min>

0.00 mm at -42.40 ms

CFC_1000

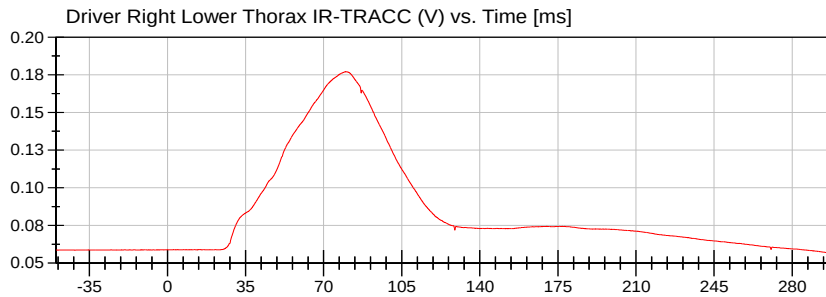


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



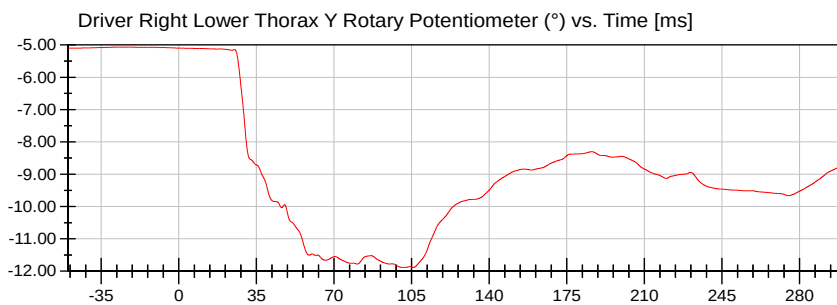
<Max>

0.18 V at 80.20 ms

<Min>

0.06 V at 299.60 ms

CFC_600



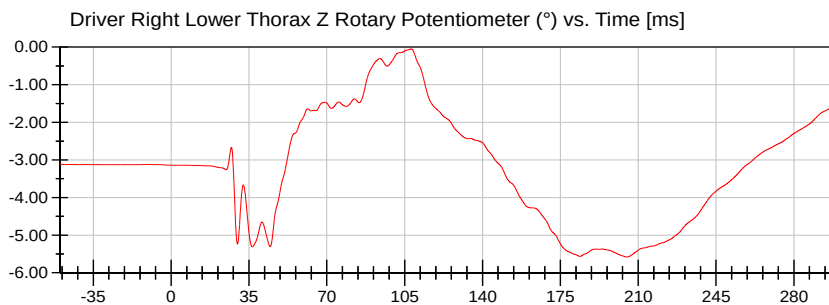
<Max>

-5.07 ° at -24.40 ms

<Min>

-11.88 ° at 100.95 ms

CFC_180



<Max>

-0.05 ° at 107.95 ms

<Min>

-5.58 ° at 204.90 ms

CFC_180

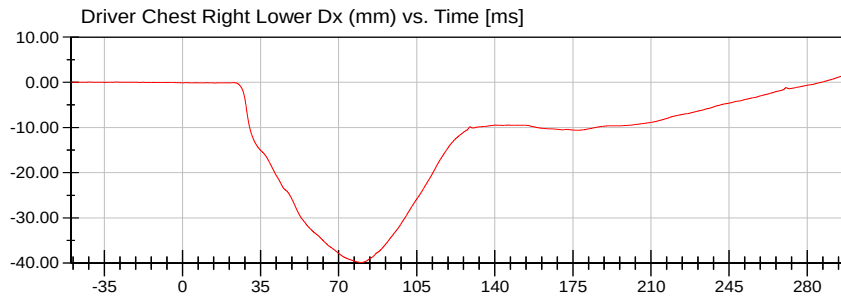


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



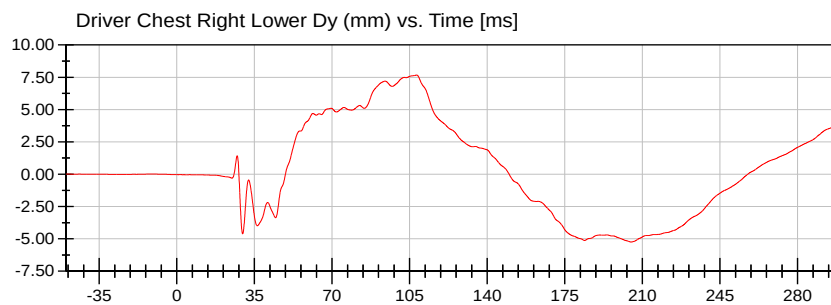
<Max>

1.99 mm at 300.00 ms

<Min>

-39.86 mm at 80.10 ms

CFC_1000



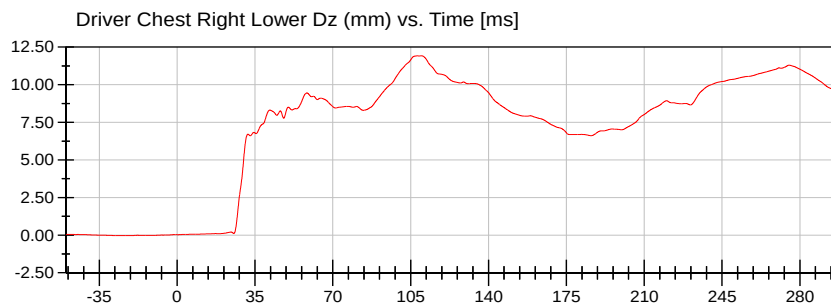
<Max>

7.68 mm at 108.15 ms

<Min>

-5.24 mm at 204.90 ms

CFC_1000



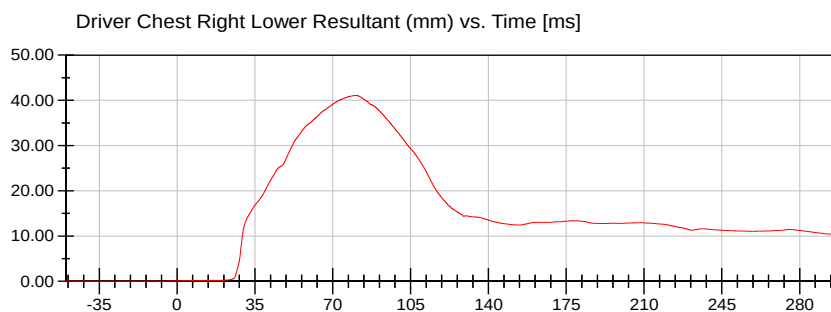
<Max>

11.92 mm at 109.80 ms

<Min>

-0.03 mm at -24.45 ms

CFC_1000



<Max>

41.07 mm at 80.35 ms

<Min>

0.00 mm at -34.05 ms

CFC_1000

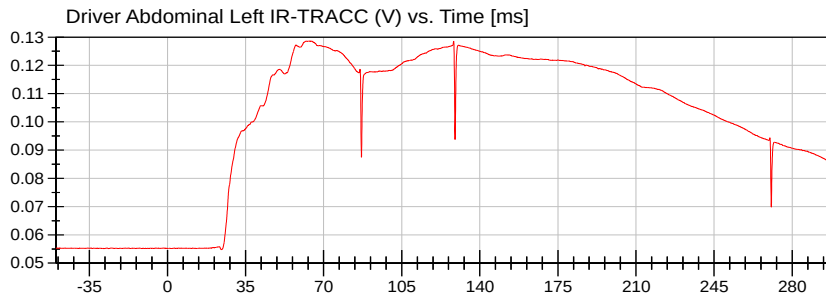


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



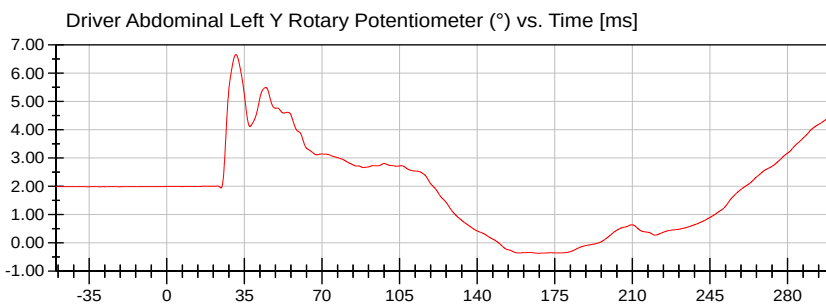
<Max>

0.13 V at 63.80 ms

<Min>

0.05 V at 24.10 ms

CFC_600



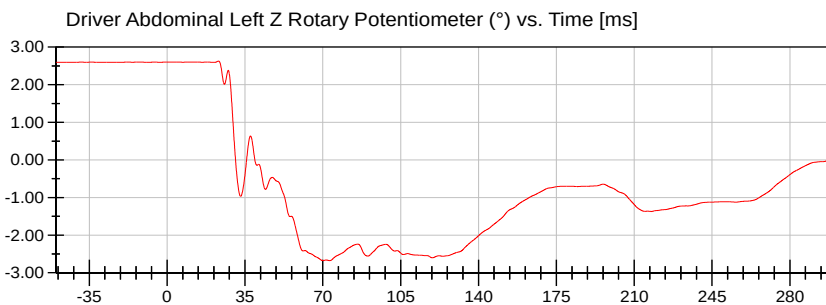
<Max>

6.66 ° at 31.15 ms

<Min>

-0.37 ° at 167.60 ms

CFC_180



<Max>

2.63 ° at 23.10 ms

<Min>

-2.68 ° at 73.05 ms

CFC_180

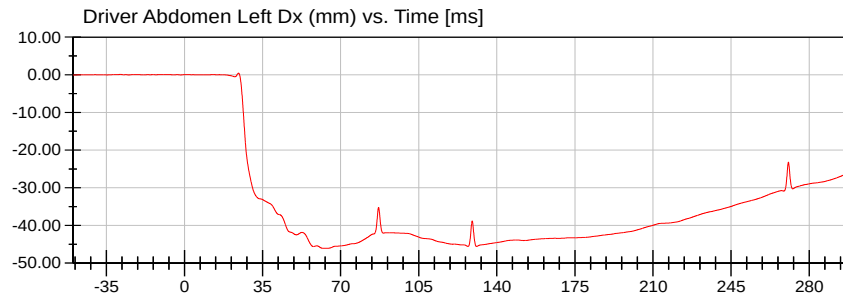


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



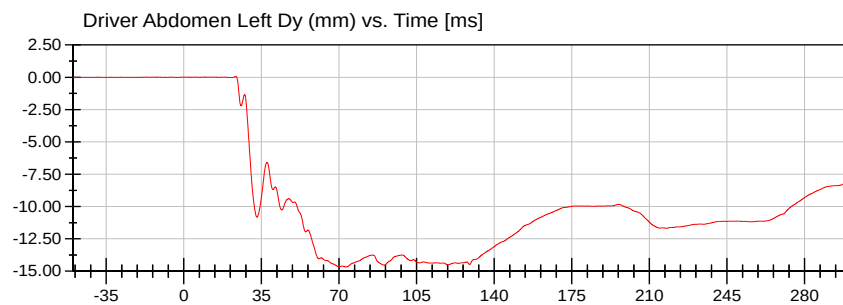
<Max>

0.43 mm at 24.20 ms

<Min>

-46.09 mm at 62.45 ms

CFC_1000



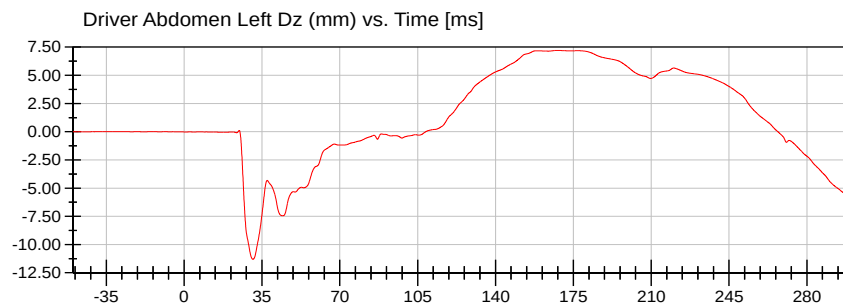
<Max>

0.07 mm at 23.45 ms

<Min>

-14.68 mm at 73.05 ms

CFC_1000



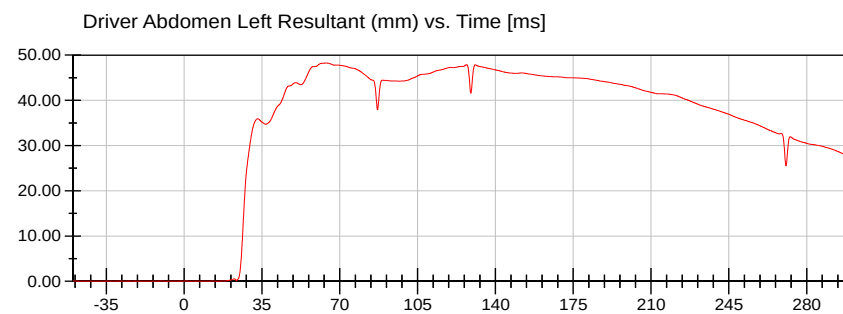
<Max>

7.20 mm at 167.30 ms

<Min>

-11.30 mm at 30.95 ms

CFC_1000



<Max>

48.24 mm at 63.85 ms

<Min>

0.00 mm at -15.05 ms

CFC_1000



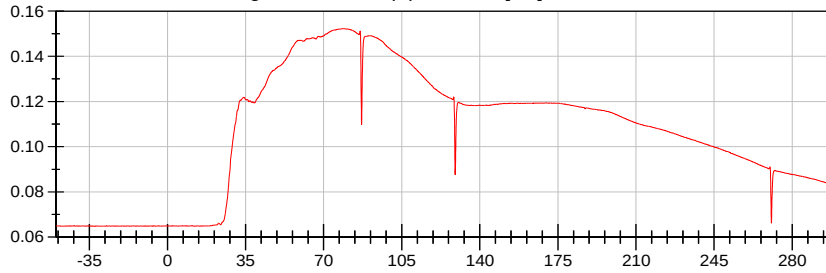
VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()

Driver Abdominal Right IR-TRACC (V) vs. Time [ms]



<Max>

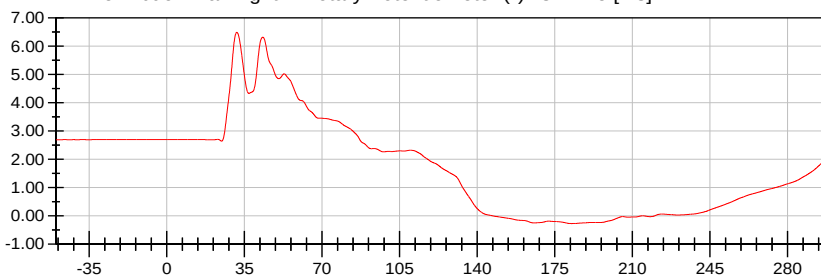
0.15 V at 78.55 ms

<Min>

0.06 V at -32.60 ms

CFC_600

Driver Abdominal Right Y Rotary Potentiometer (°) vs. Time [ms]



<Max>

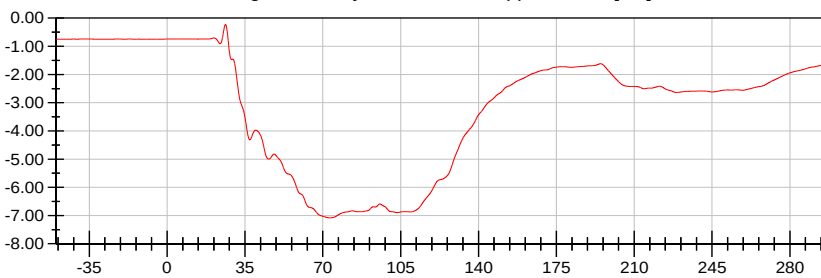
6.49 ° at 31.55 ms

<Min>

-0.27 ° at 182.60 ms

CFC_180

Driver Abdominal Right Z Rotary Potentiometer (°) vs. Time [ms]



<Max>

-0.23 ° at 26.20 ms

<Min>

-7.08 ° at 73.10 ms

CFC_180

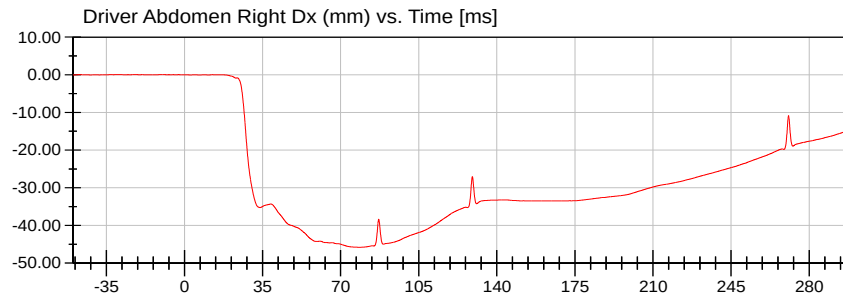


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



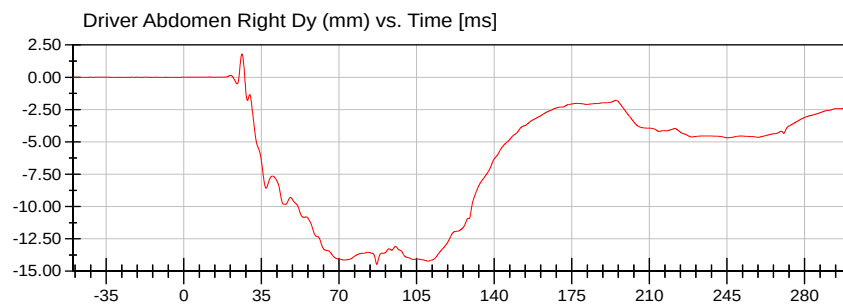
<Max>

0.05 mm at -28.90 ms

<Min>

-45.81 mm at 78.55 ms

CFC_1000



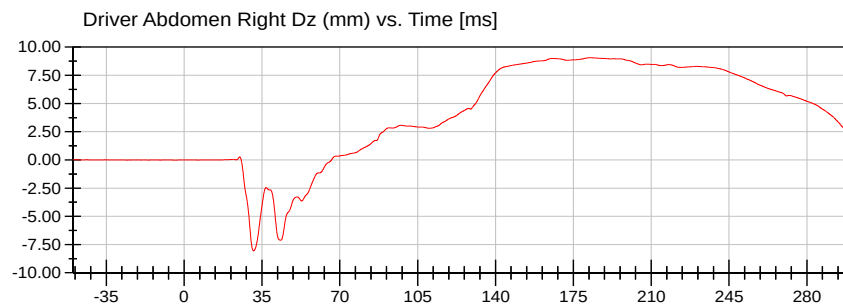
<Max>

1.80 mm at 26.25 ms

<Min>

-14.48 mm at 87.05 ms

CFC_1000



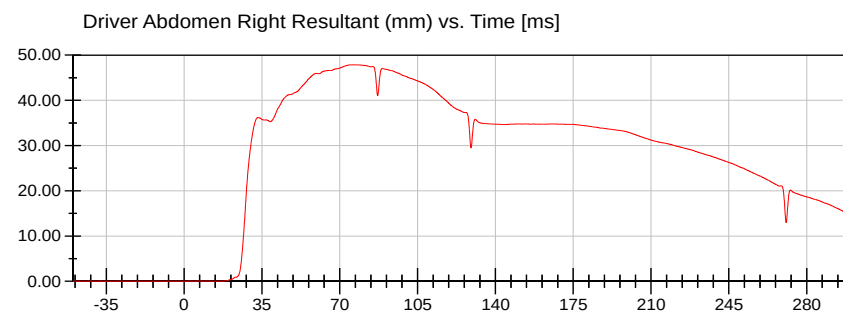
<Max>

9.05 mm at 182.55 ms

<Min>

-8.06 mm at 31.20 ms

CFC_1000



<Max>

47.85 mm at 76.05 ms

<Min>

0.00 mm at -7.40 ms

CFC_1000

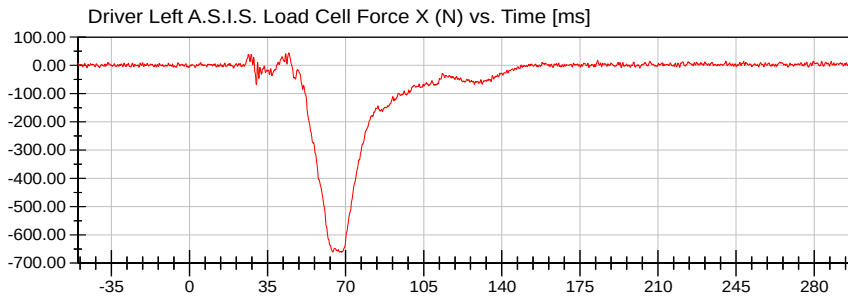


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



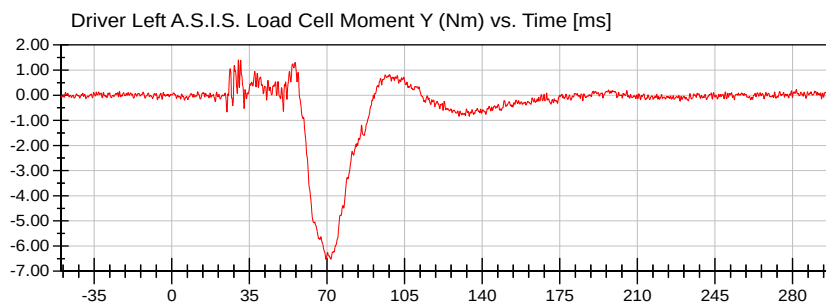
<Max>

44.21 N at 44.55 ms

<Min>

-661.51 N at 68.25 ms

CFC_600



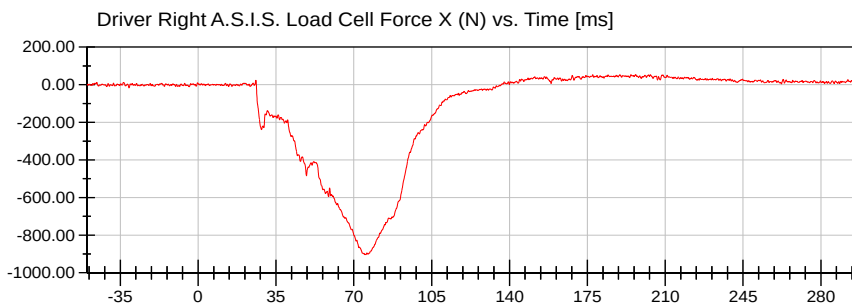
<Max>

1.40 Nm at 30.05 ms

<Min>

-6.52 Nm at 71.75 ms

CFC_600



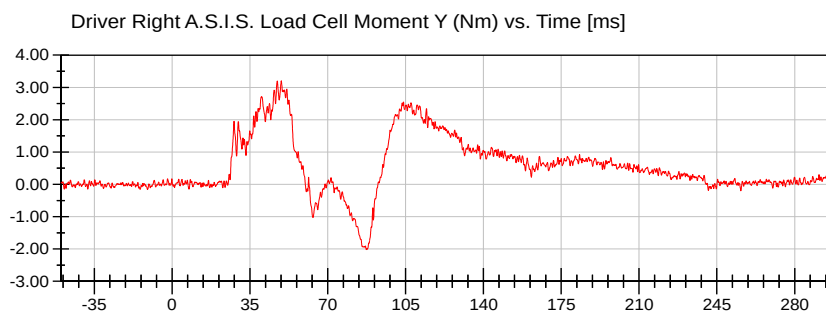
<Max>

54.26 N at 196.70 ms

<Min>

-904.14 N at 75.45 ms

CFC_600



<Max>

3.20 Nm at 49.10 ms

<Min>

-2.02 Nm at 87.35 ms

CFC_600

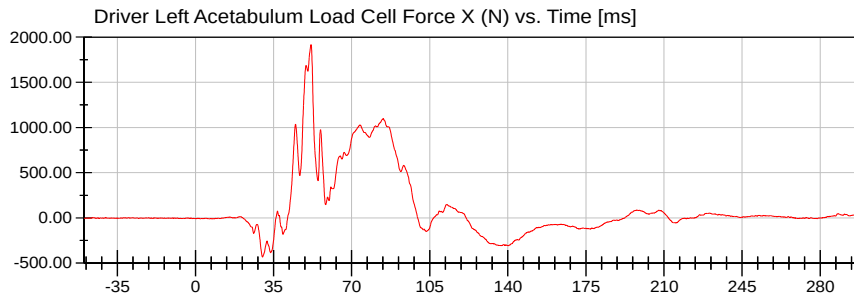


VRTC

Test Lab: CTF

Test Number: 250325 ()

Test Date: 03/25/2025



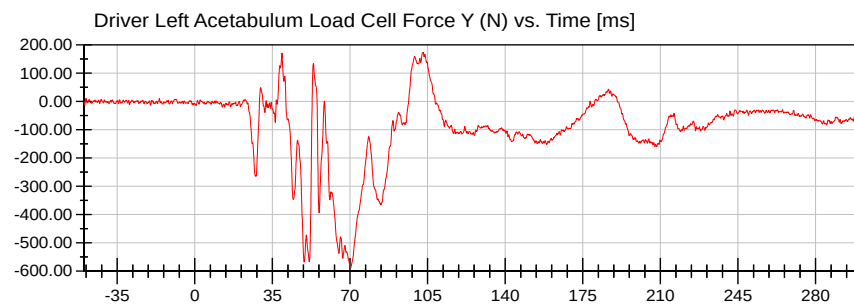
<Max>

1,916.37 N at 51.80 ms

<Min>

-432.43 N at 30.05 ms

CFC_600



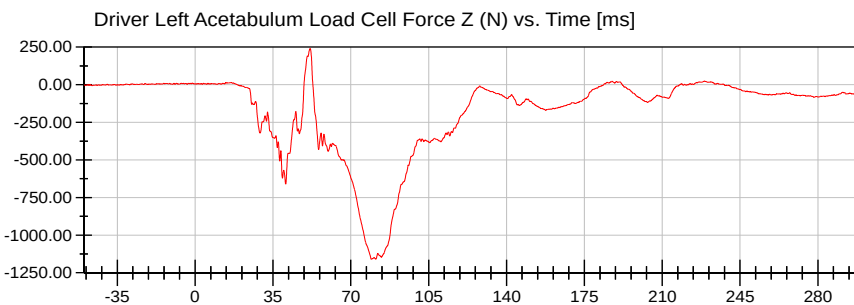
<Max>

174.04 N at 103.00 ms

<Min>

-587.67 N at 70.30 ms

CFC_600



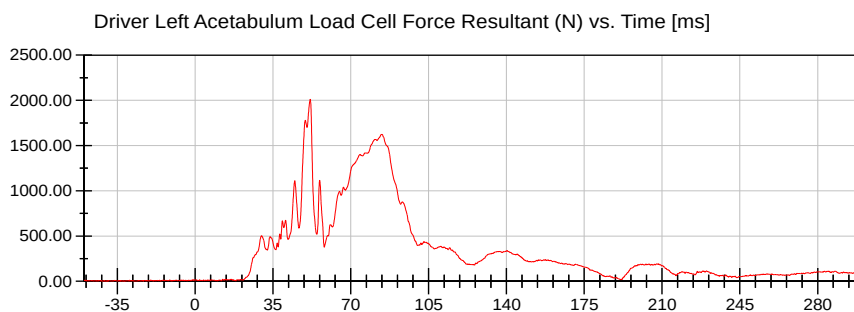
<Max>

240.14 N at 51.70 ms

<Min>

-1,160.63 N at 79.20 ms

CFC_600



<Max>

2,011.07 N at 51.80 ms

<Min>

0.54 N at -41.55 ms

CFC_600

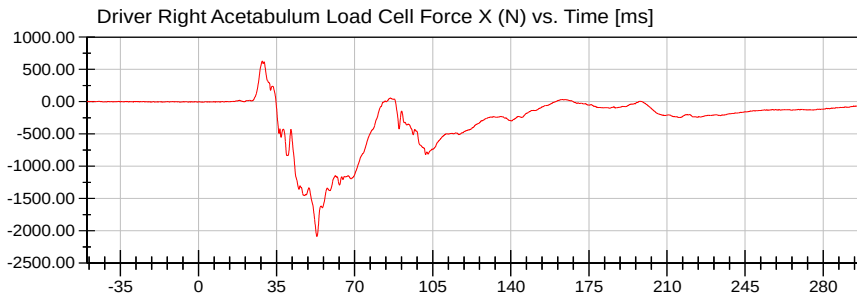


VRTC

Test Lab: CTF

Test Number: 250325 ()

Test Date: 03/25/2025



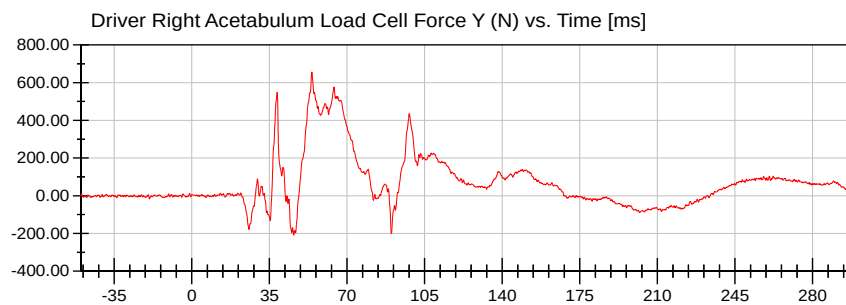
<Max>

628.80 N at 28.55 ms

<Min>

-2,087.45 N at 53.05 ms

CFC_600



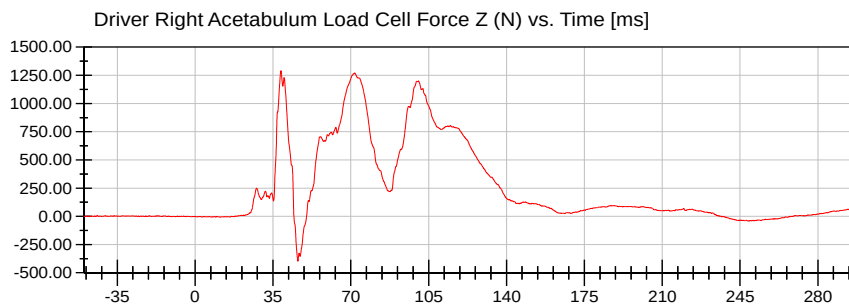
<Max>

656.18 N at 54.15 ms

<Min>

-209.28 N at 45.95 ms

CFC_600



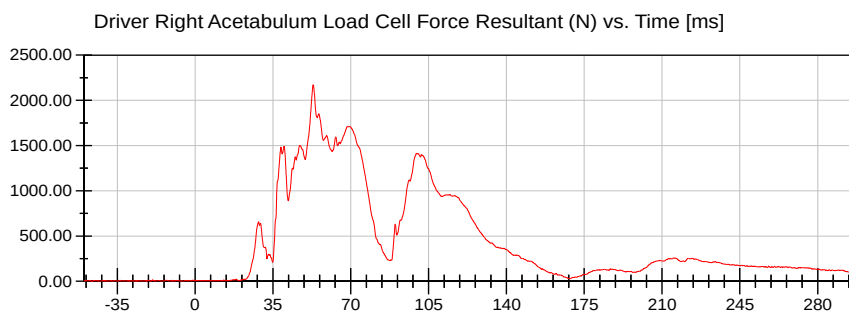
<Max>

1,290.69 N at 38.60 ms

<Min>

-397.55 N at 46.20 ms

CFC_600



<Max>

2,172.11 N at 53.10 ms

<Min>

0.49 N at -26.85 ms

CFC_600

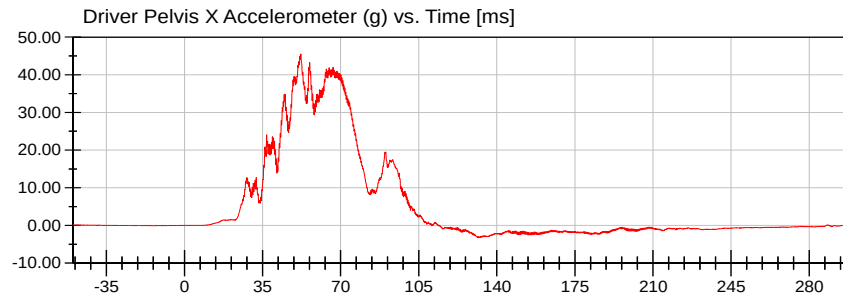


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



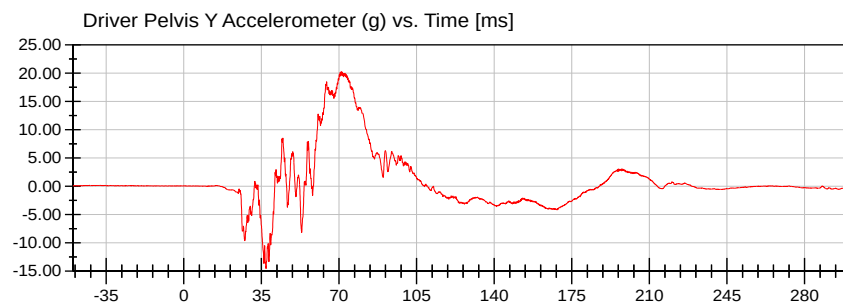
<Max>

45.49 g at 52.15 ms

<Min>

-3.22 g at 132.25 ms

CFC_1000



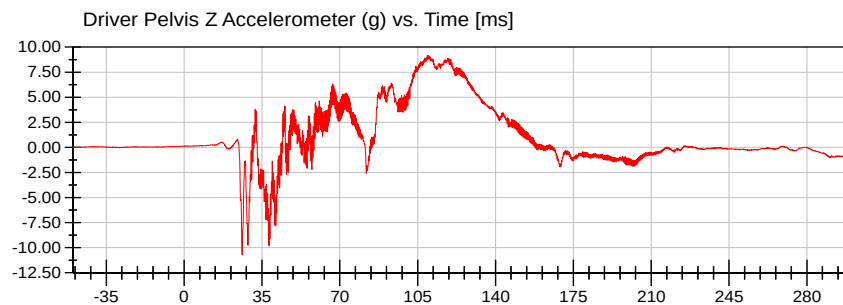
<Max>

20.29 g at 71.00 ms

<Min>

-14.56 g at 37.05 ms

CFC_1000



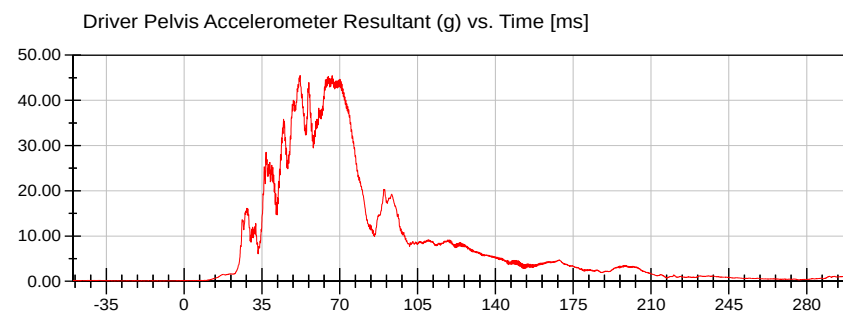
<Max>

9.16 g at 109.90 ms

<Min>

-10.71 g at 26.05 ms

CFC_1000



<Max>

45.50 g at 52.15 ms

<Min>

0.06 g at -17.95 ms

CFC_1000

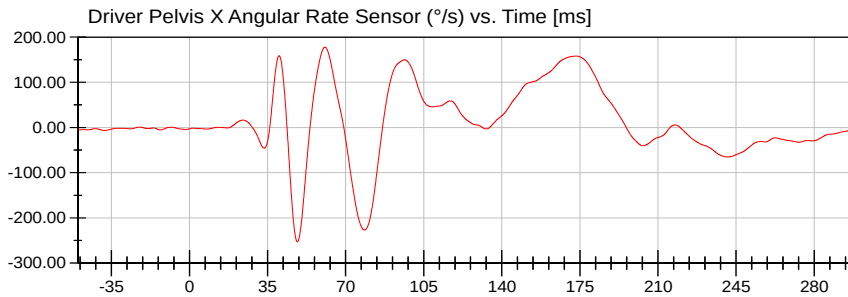


VRTC

Test Lab: CTF

Test Number: 250325 ()

Test Date: 03/25/2025



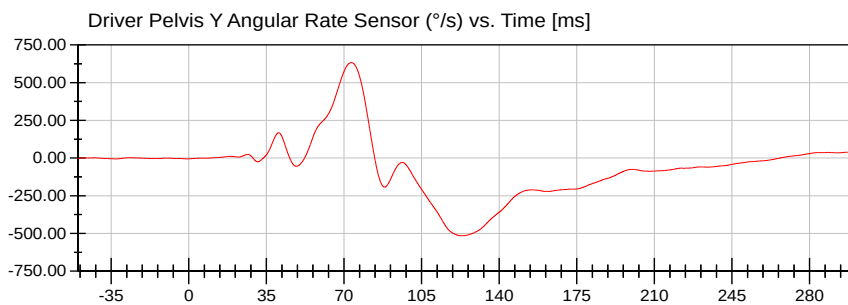
<Max>

177.70 °/s at 60.70 ms

<Min>

-253.04 °/s at 48.35 ms

CFC_60



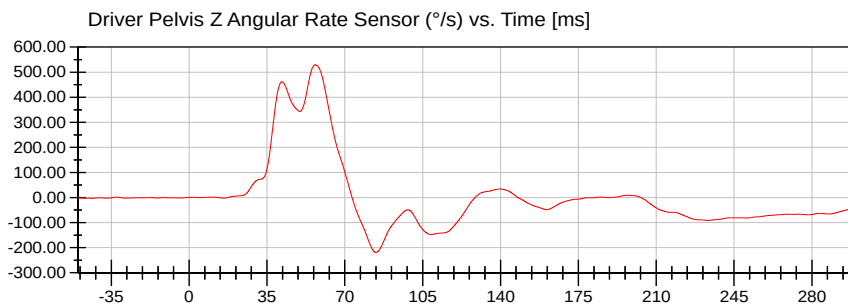
<Max>

633.10 °/s at 73.30 ms

<Min>

-515.57 °/s at 123.15 ms

CFC_60



<Max>

529.28 °/s at 56.80 ms

<Min>

-219.14 °/s at 84.00 ms

CFC_60



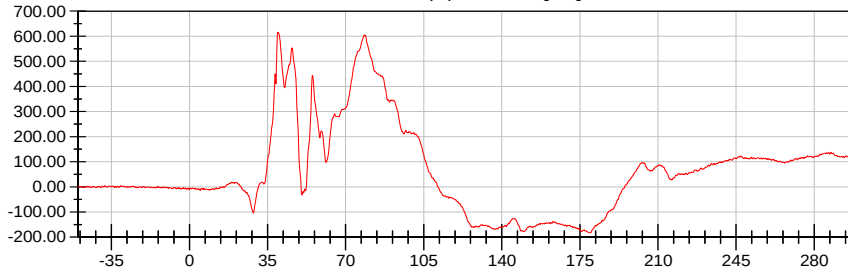
VRTC

Test Lab: CTF

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Driver Left Femur Load Cell Force X (N) vs. Time [ms]



<Max>

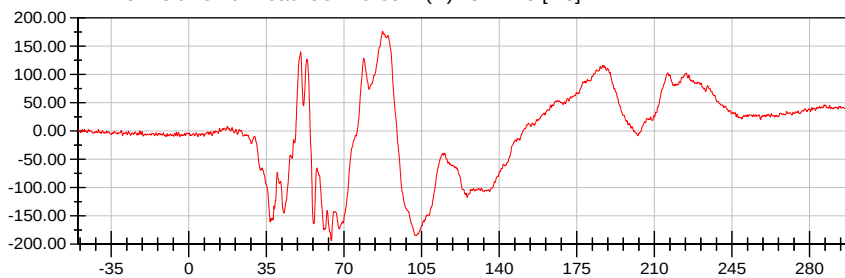
615.95 N at 39.60 ms

<Min>

-183.21 N at 179.70 ms

CFC_600

Driver Left Femur Load Cell Force Y (N) vs. Time [ms]



<Max>

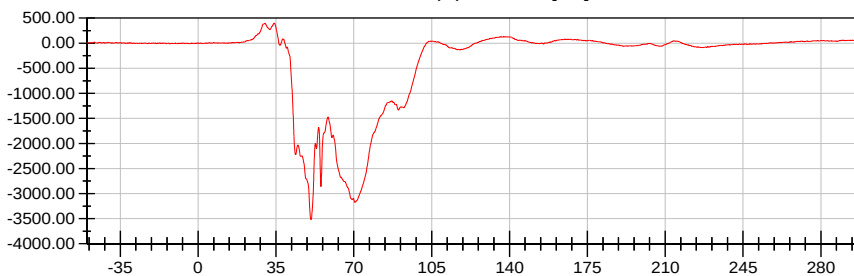
176.64 N at 87.40 ms

<Min>

-193.74 N at 64.25 ms

CFC_600

Driver Left Femur Load Cell Force Z (N) vs. Time [ms]



<Max>

400.64 N at 34.15 ms

<Min>

-3,517.95 N at 50.70 ms

CFC_600

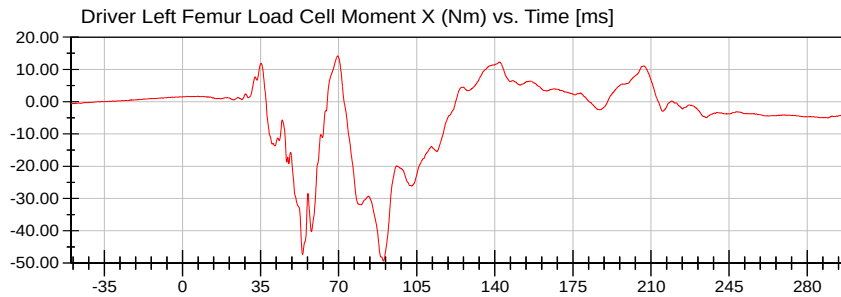


VRTC

Test Lab: CTF

Test Number: 250325 ()

Test Date: 03/25/2025



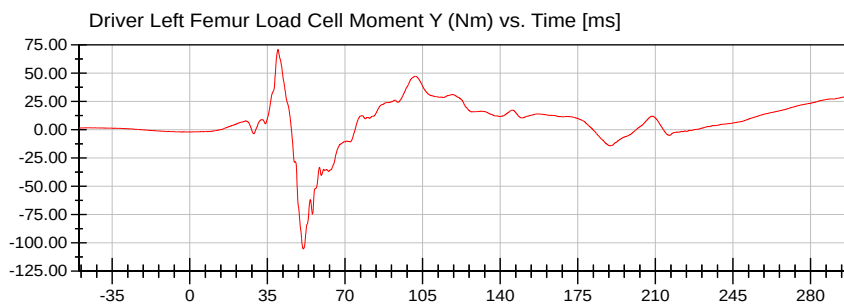
<Max>

14.17 Nm at 69.60 ms

<Min>

-49.38 Nm at 90.10 ms

CFC_600



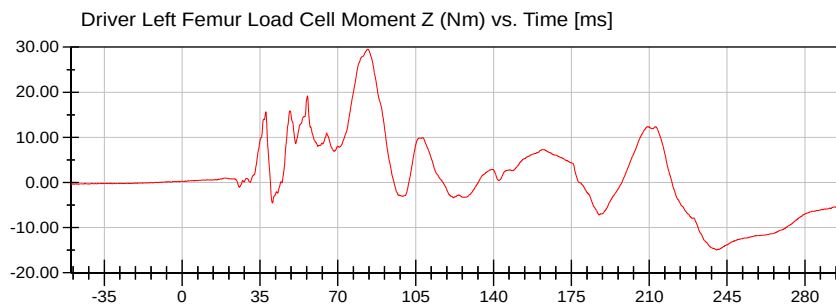
<Max>

70.95 Nm at 39.80 ms

<Min>

-105.25 Nm at 51.20 ms

CFC_600



<Max>

29.50 Nm at 83.45 ms

<Min>

-14.95 Nm at 240.25 ms

CFC_600

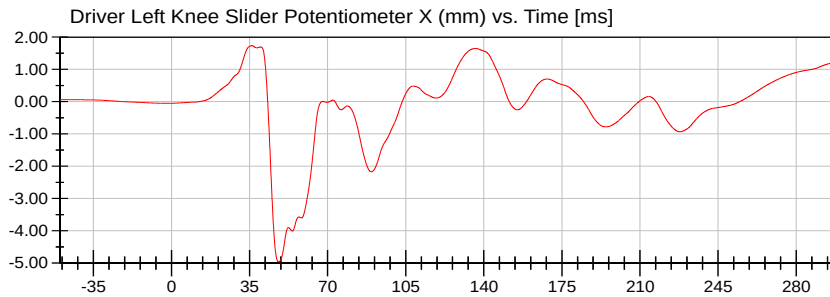


VRTC

Test Date: 03/25/2025

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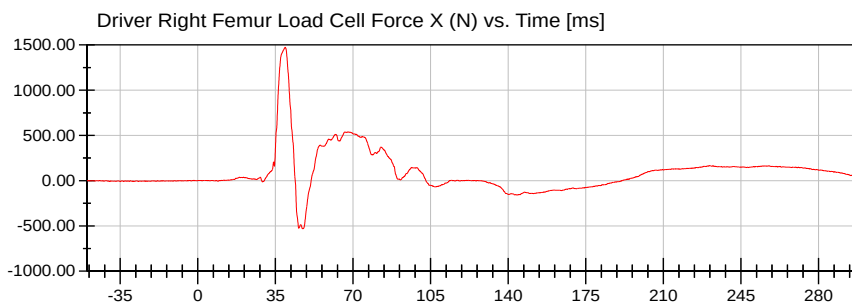
<Max>

1.74 mm at 36.10 ms

<Min>

-4.96 mm at 48.00 ms

CFC_180



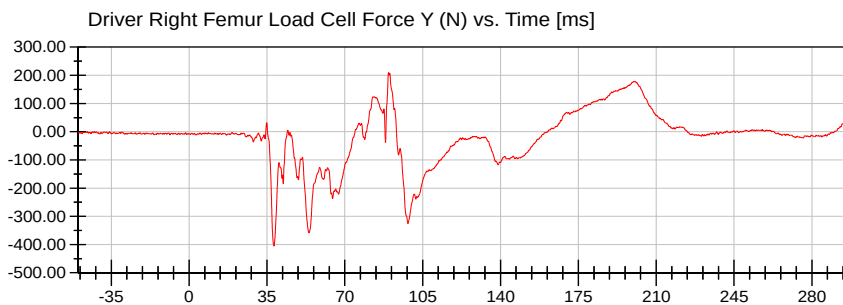
<Max>

1,474.33 N at 39.40 ms

<Min>

-531.10 N at 47.30 ms

CFC_600



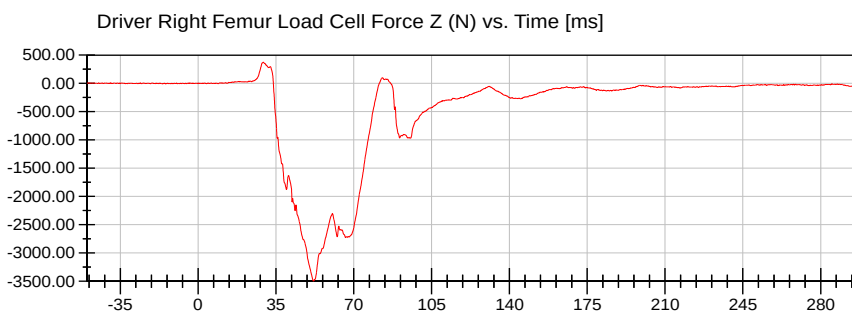
<Max>

209.41 N at 89.65 ms

<Min>

-405.32 N at 38.15 ms

CFC_600



<Max>

374.71 N at 29.35 ms

<Min>

-3,495.30 N at 51.85 ms

CFC_600

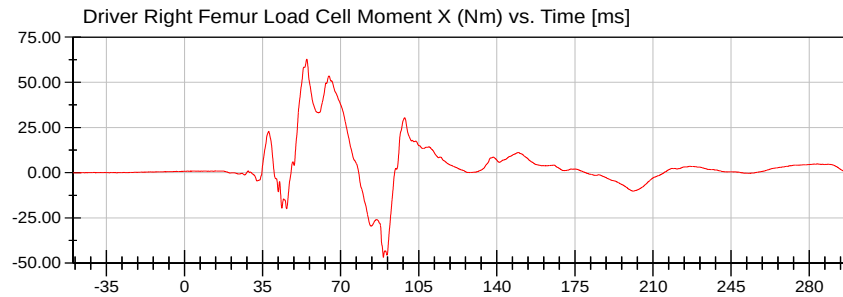


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



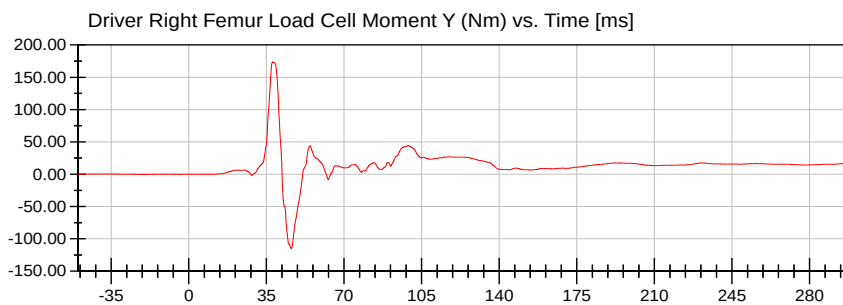
<Max>

62.76 Nm at 54.80 ms

<Min>

-46.75 Nm at 89.15 ms

CFC_600



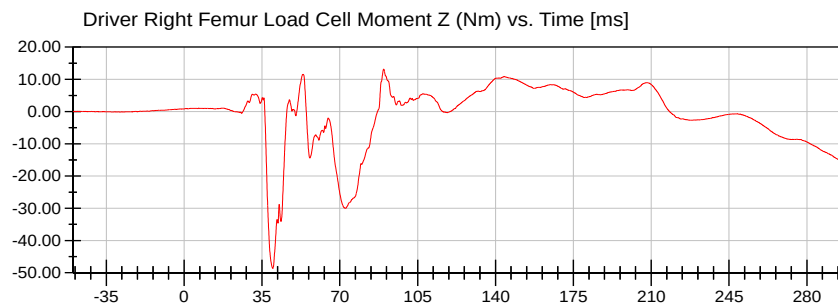
<Max>

173.86 Nm at 37.80 ms

<Min>

-114.92 Nm at 46.20 ms

CFC_600



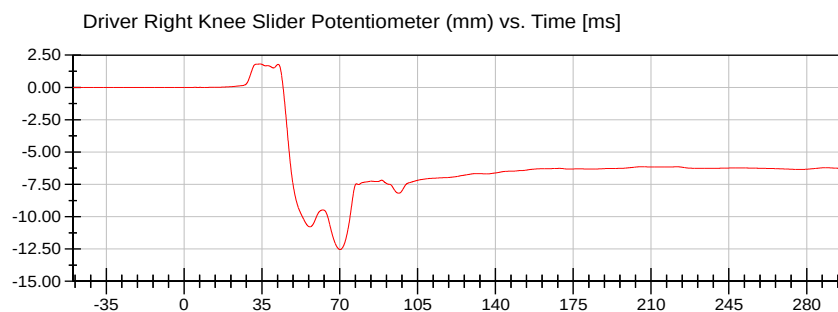
<Max>

13.14 Nm at 89.75 ms

<Min>

-48.64 Nm at 39.90 ms

CFC_600



<Max>

1.81 mm at 34.15 ms

<Min>

-12.54 mm at 70.15 ms

CFC_180

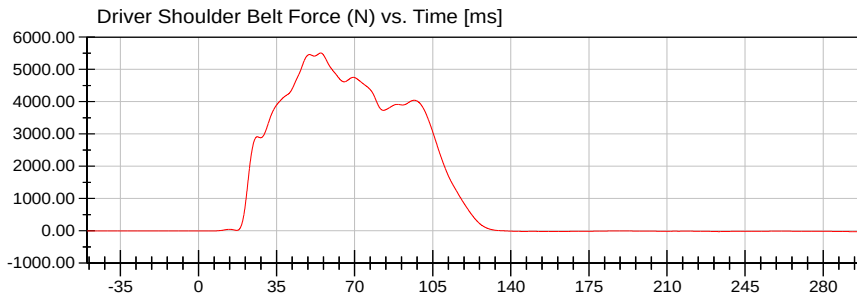


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



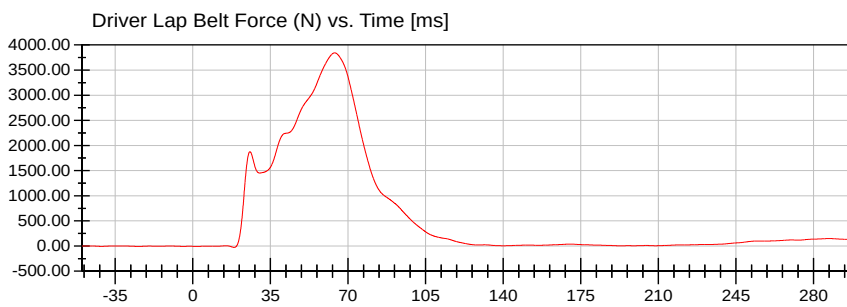
<Max>

5,506.97 N at 54.75 ms

<Min>

-24.95 N at 295.10 ms

CFC_60



<Max>

3,842.67 N at 64.00 ms

<Min>

-28.10 N at 18.65 ms

CFC_60

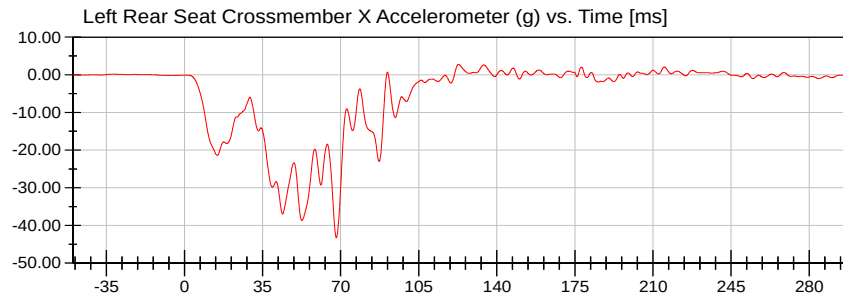


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



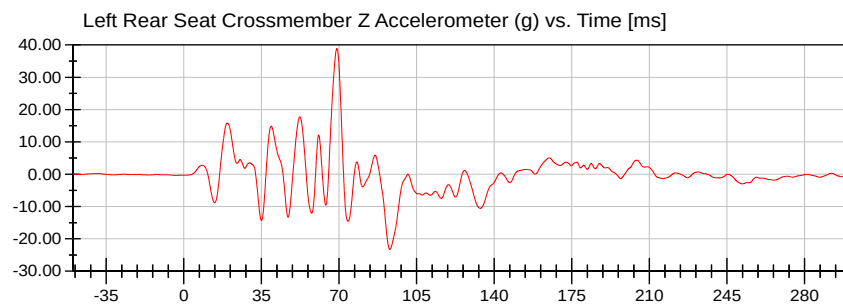
<Max>

2.79 g at 122.85 ms

<Min>

-43.28 g at 68.05 ms

CFC_60



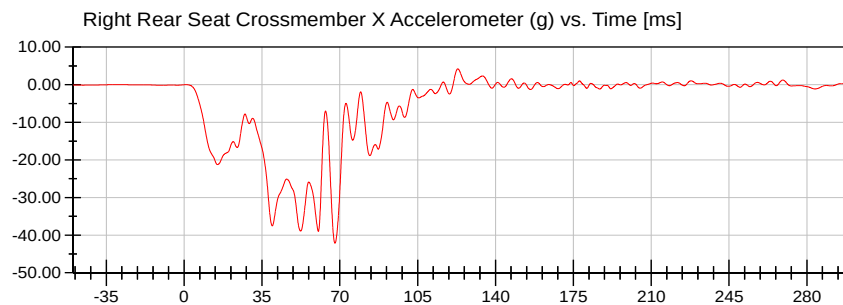
<Max>

38.89 g at 69.05 ms

<Min>

-23.27 g at 92.95 ms

CFC_60



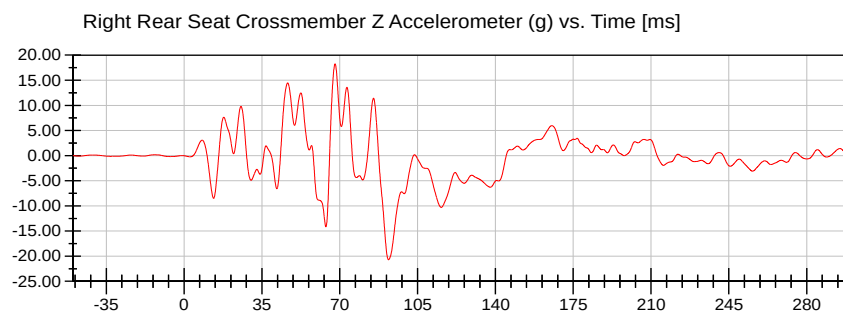
<Max>

4.22 g at 123.05 ms

<Min>

-42.14 g at 67.80 ms

CFC_60



<Max>

18.26 g at 67.90 ms

<Min>

-20.71 g at 91.90 ms

CFC_60

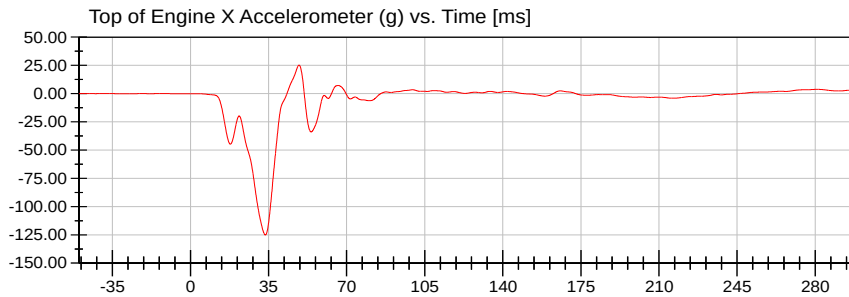


VRTC

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Test Lab: CTF

Test Number: 250325 ()



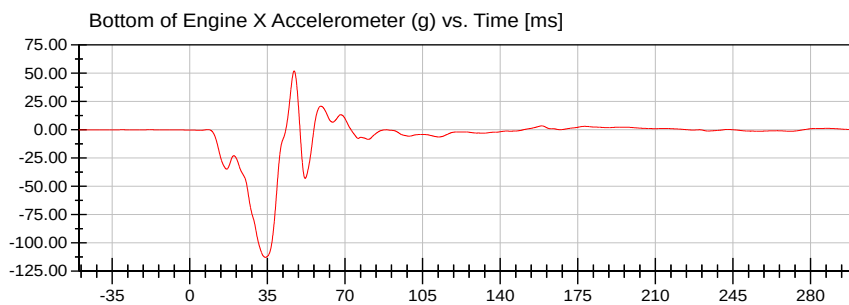
<Max>

25.24 g at 48.65 ms

<Min>

-125.14 g at 33.55 ms

CFC_60



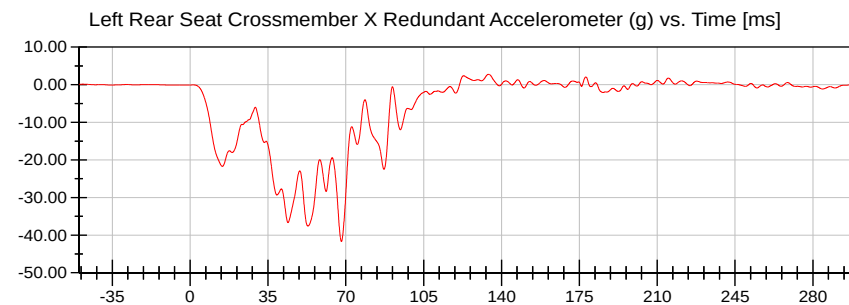
<Max>

52.05 g at 47.05 ms

<Min>

-112.80 g at 34.10 ms

CFC_60



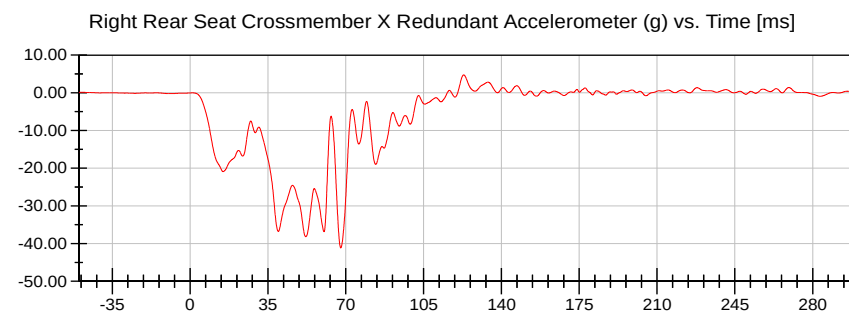
<Max>

2.77 g at 134.15 ms

<Min>

-41.70 g at 68.00 ms

CFC_60



<Max>

4.75 g at 123.05 ms

<Min>

-41.14 g at 67.75 ms

CFC_60

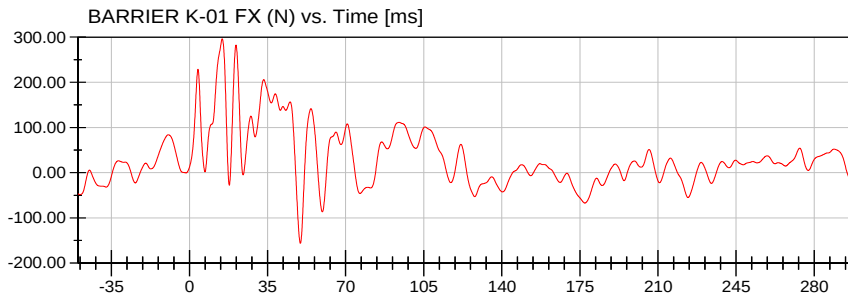


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



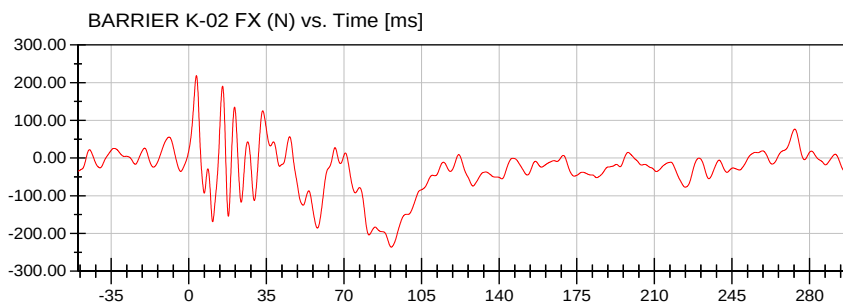
<Max>

296.08 N at 14.65 ms

<Min>

-156.24 N at 49.70 ms

CFC_60



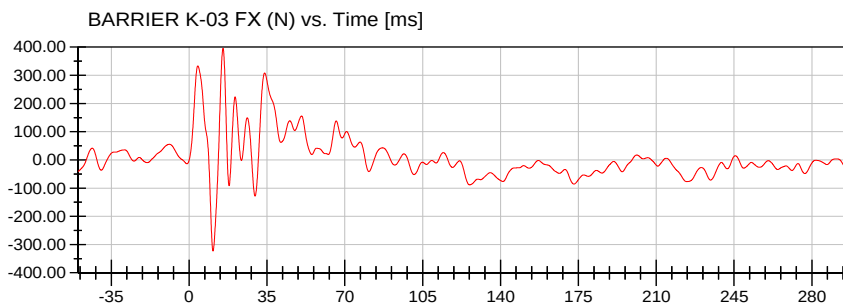
<Max>

218.69 N at 3.40 ms

<Min>

-236.24 N at 91.35 ms

CFC_60



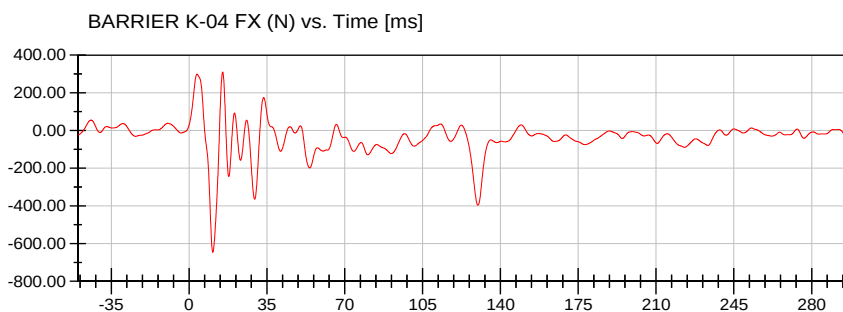
<Max>

395.92 N at 15.25 ms

<Min>

-323.02 N at 10.75 ms

CFC_60



<Max>

309.91 N at 15.10 ms

<Min>

-646.74 N at 10.65 ms

CFC_60

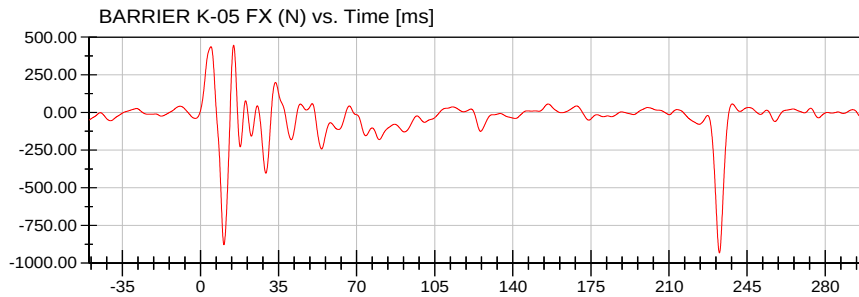


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



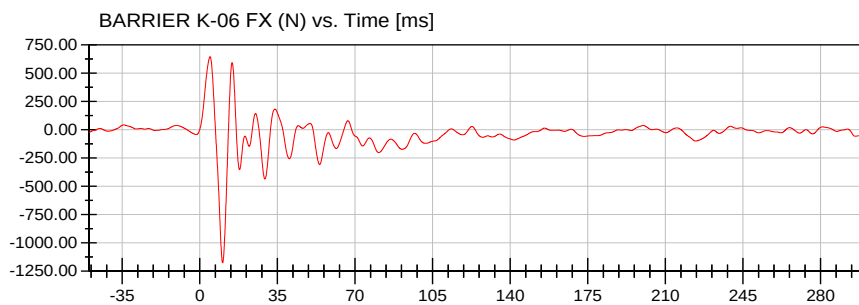
<Max>

446.46 N at 14.85 ms

<Min>

-932.48 N at 232.60 ms

CFC_60



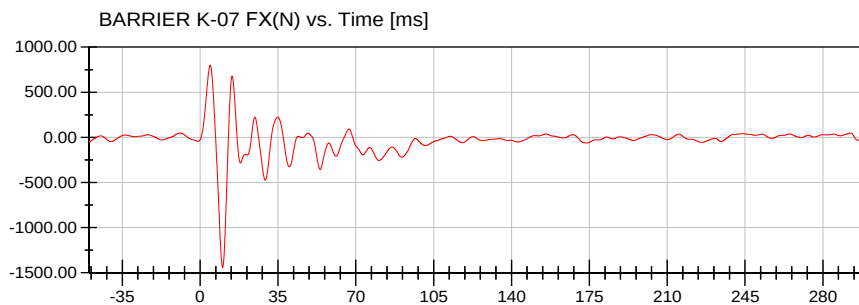
<Max>

646.13 N at 4.60 ms

<Min>

-1,176.66 N at 10.30 ms

CFC_60



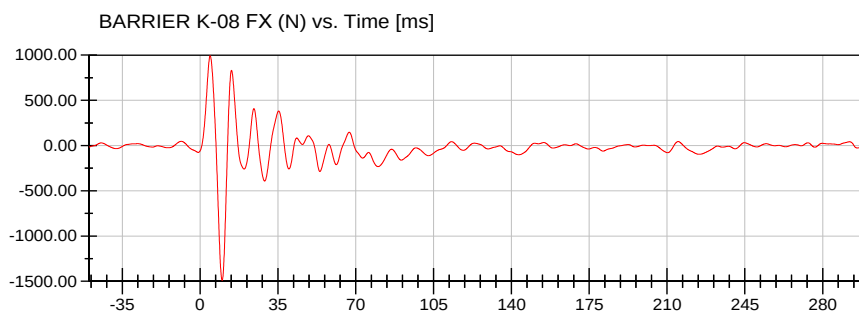
<Max>

799.40 N at 4.50 ms

<Min>

-1,442.78 N at 10.10 ms

CFC_60



<Max>

993.11 N at 4.50 ms

<Min>

-1,490.65 N at 9.90 ms

CFC_60

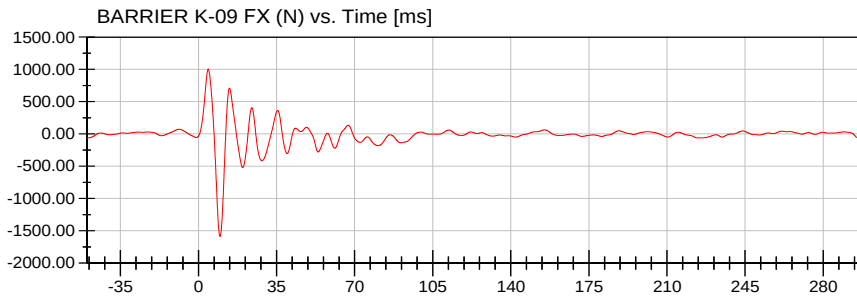


VRTC

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Test Lab: CTF

Test Number: 250325 ()



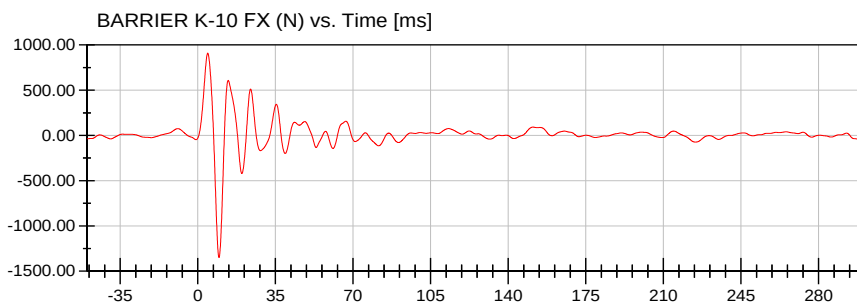
<Max>

1,003.64 N at 4.35 ms

<Min>

-1,587.24 N at 9.65 ms

CFC_60



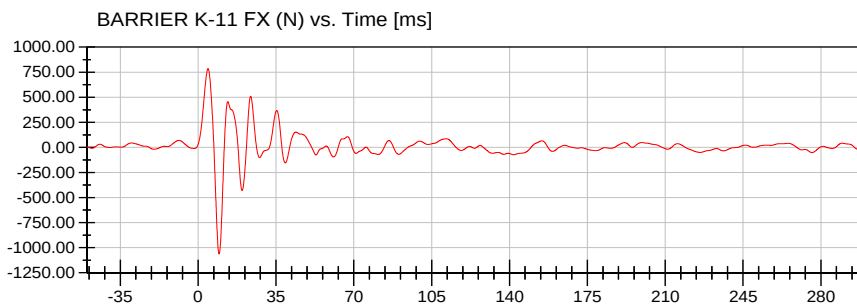
<Max>

909.56 N at 4.50 ms

<Min>

-1,348.88 N at 9.55 ms

CFC_60



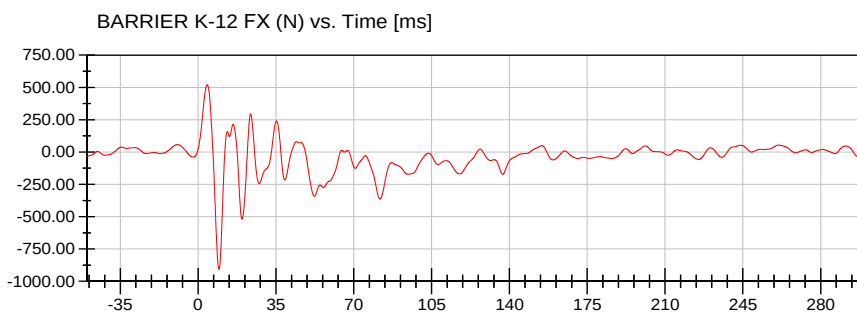
<Max>

785.64 N at 4.45 ms

<Min>

-1,063.26 N at 9.45 ms

CFC_60



<Max>

519.89 N at 4.10 ms

<Min>

-908.06 N at 9.40 ms

CFC_60

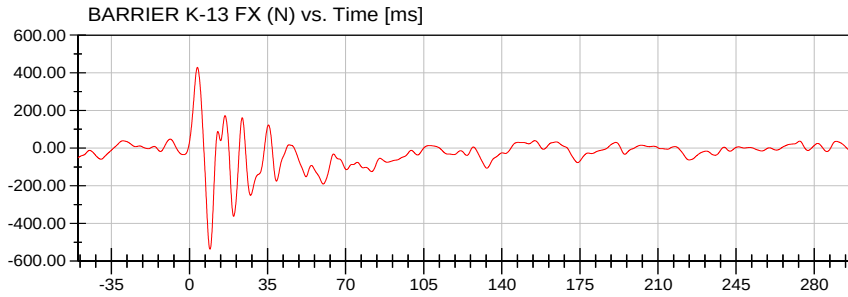


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



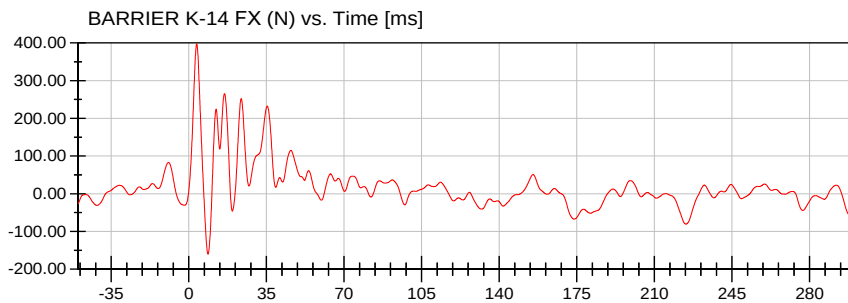
<Max>

428.68 N at 3.55 ms

<Min>

-536.73 N at 9.20 ms

CFC_60



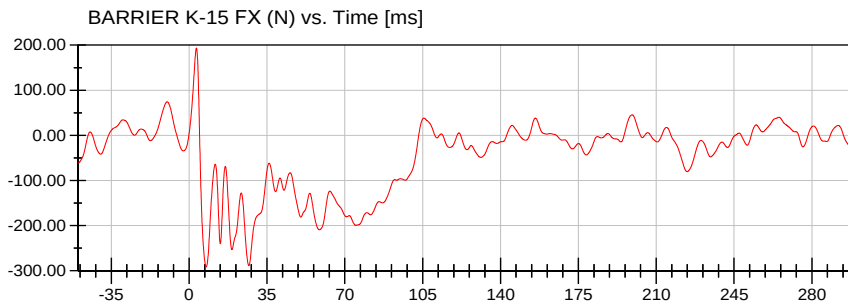
<Max>

397.57 N at 3.55 ms

<Min>

-160.29 N at 8.65 ms

CFC_60



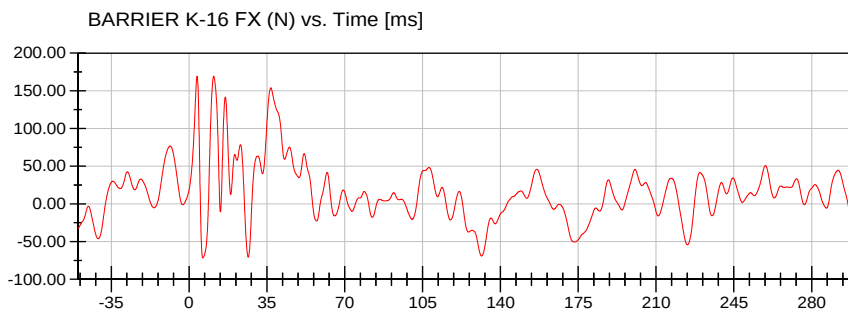
<Max>

193.64 N at 3.25 ms

<Min>

-291.69 N at 7.65 ms

CFC_60



<Max>

169.46 N at 11.05 ms

<Min>

-71.82 N at 6.15 ms

CFC_60

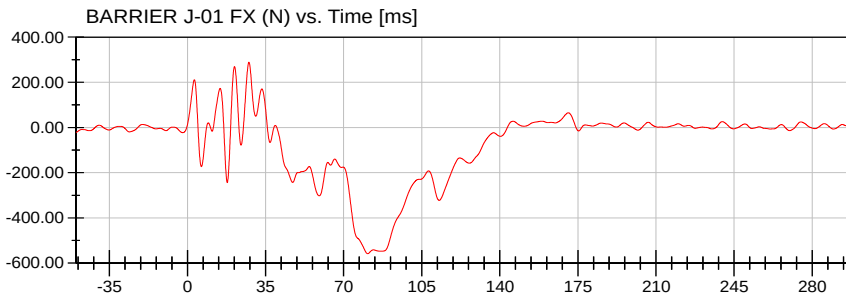


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



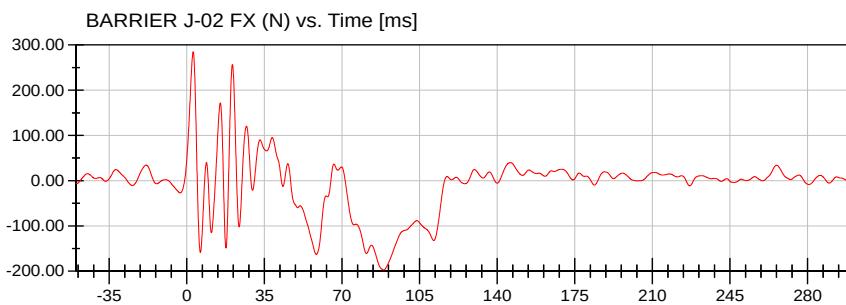
<Max>

288.89 N at 27.55 ms

<Min>

-558.49 N at 80.75 ms

CFC_60



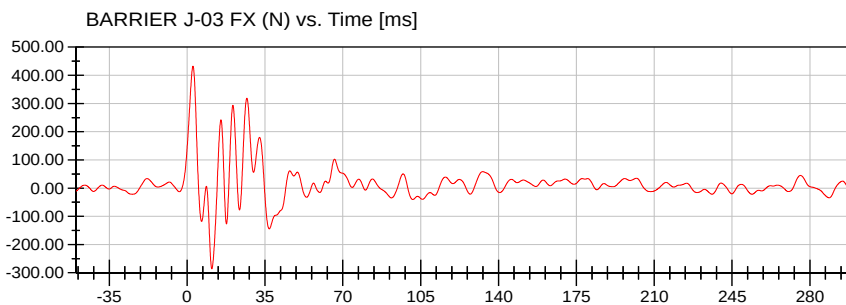
<Max>

284.83 N at 2.85 ms

<Min>

-197.28 N at 88.75 ms

CFC_60



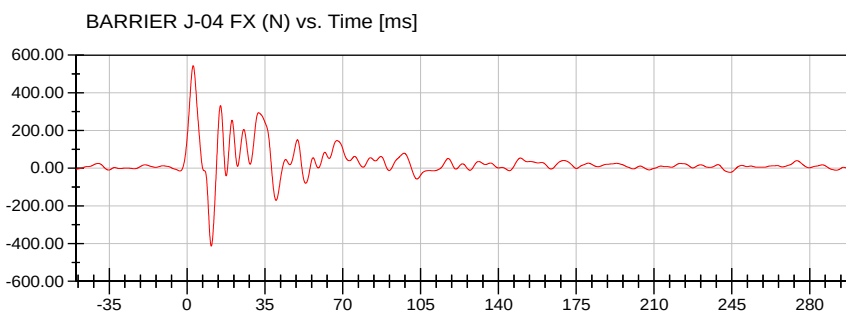
<Max>

432.48 N at 2.60 ms

<Min>

-286.15 N at 11.10 ms

CFC_60



<Max>

543.74 N at 2.70 ms

<Min>

-413.37 N at 10.85 ms

CFC_60

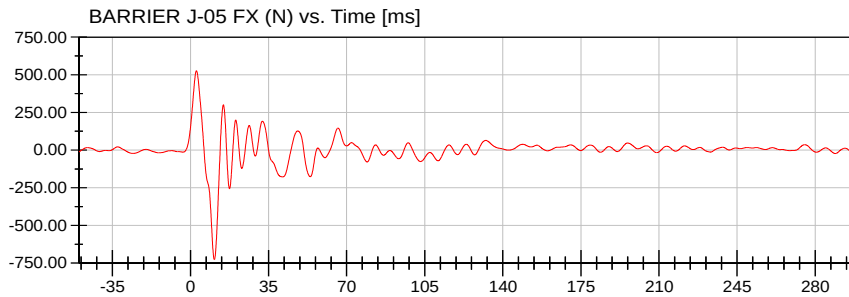


VRTC

Test Date: 03/25/2025

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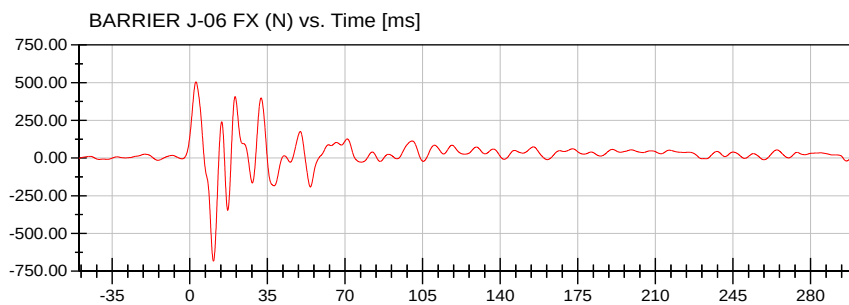
<Max>

526.79 N at 2.65 ms

<Min>

-727.05 N at 10.70 ms

CFC_60



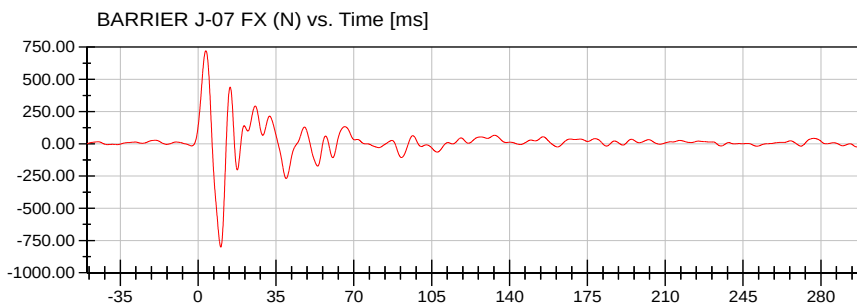
<Max>

505.40 N at 2.75 ms

<Min>

-684.09 N at 10.65 ms

CFC_60



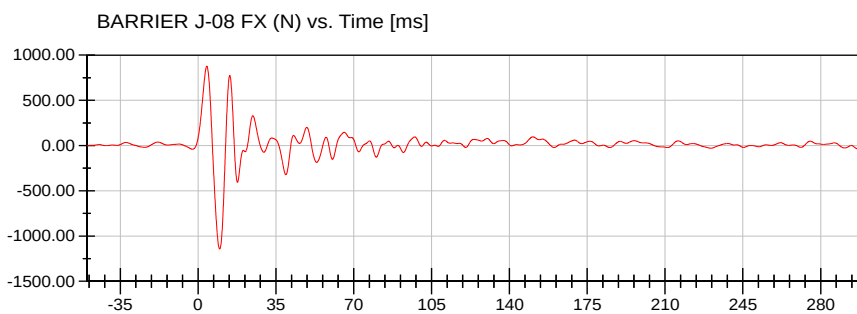
<Max>

721.74 N at 3.45 ms

<Min>

-800.64 N at 10.20 ms

CFC_60



<Max>

877.73 N at 3.90 ms

<Min>

-1,142.80 N at 9.70 ms

CFC_60

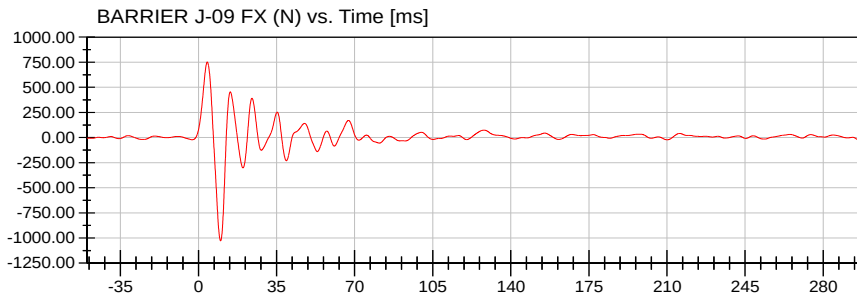


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



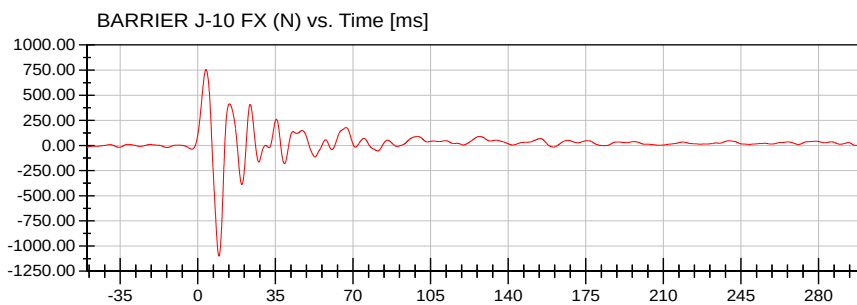
<Max>

752.58 N at 3.90 ms

<Min>

-1,028.83 N at 9.90 ms

CFC_60



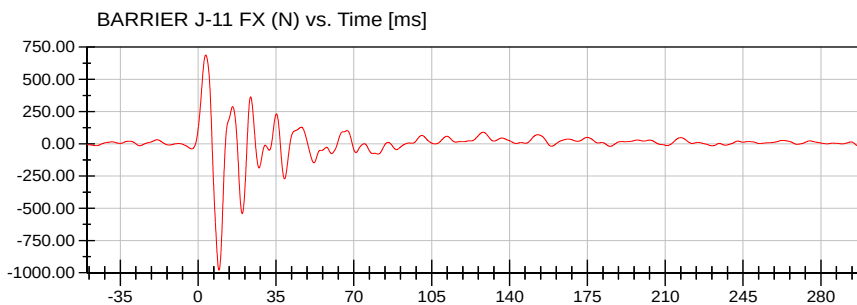
<Max>

755.43 N at 3.70 ms

<Min>

-1,099.96 N at 9.55 ms

CFC_60



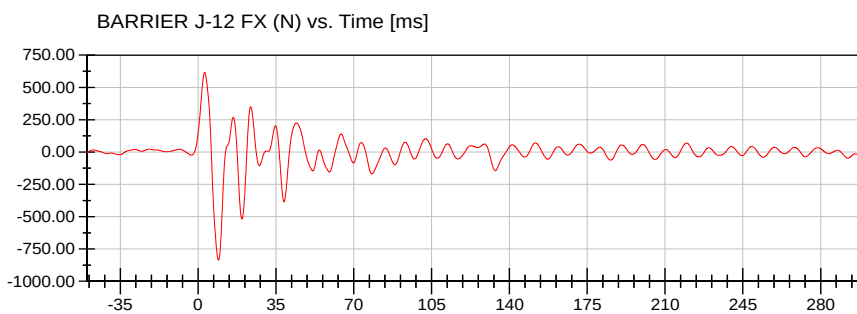
<Max>

688.80 N at 3.40 ms

<Min>

-979.86 N at 9.40 ms

CFC_60



<Max>

616.02 N at 2.90 ms

<Min>

-837.25 N at 9.15 ms

CFC_60

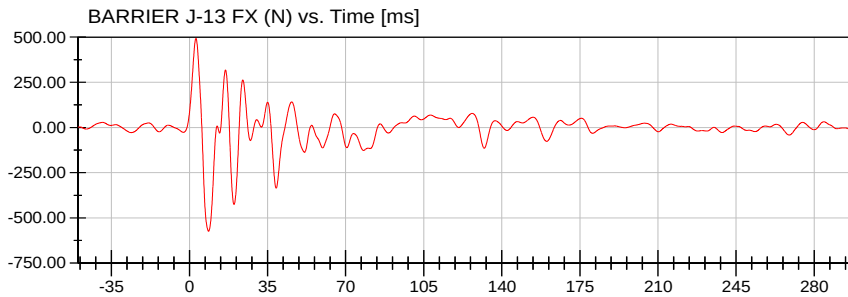


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



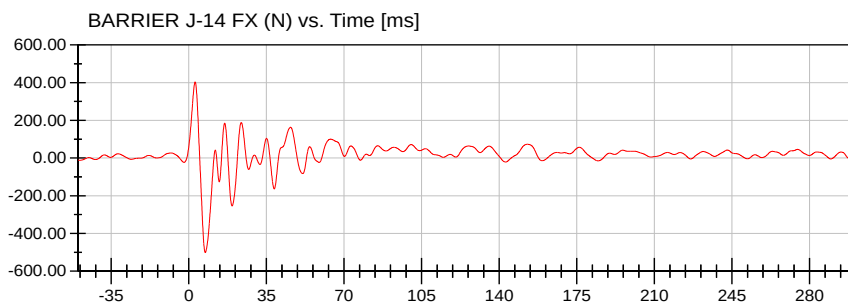
<Max>

492.97 N at 2.90 ms

<Min>

-573.96 N at 8.55 ms

CFC_60



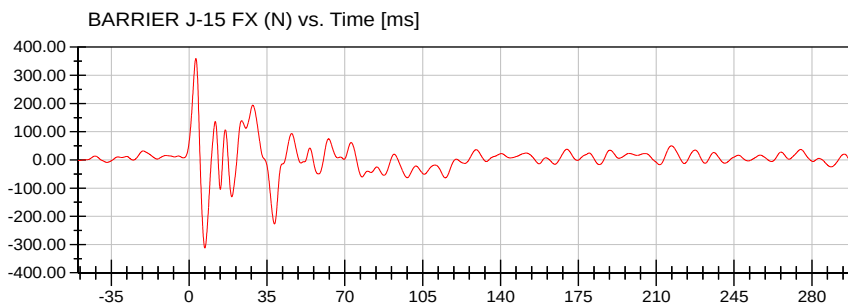
<Max>

403.62 N at 2.85 ms

<Min>

-501.17 N at 7.40 ms

CFC_60



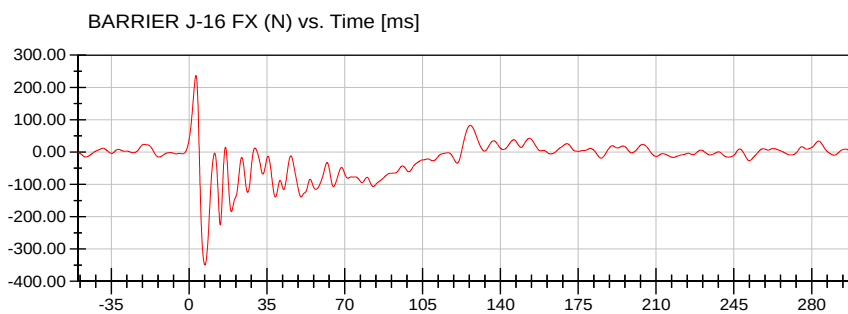
<Max>

359.77 N at 3.00 ms

<Min>

-312.45 N at 7.10 ms

CFC_60



<Max>

236.79 N at 3.05 ms

<Min>

-349.16 N at 7.10 ms

CFC_60

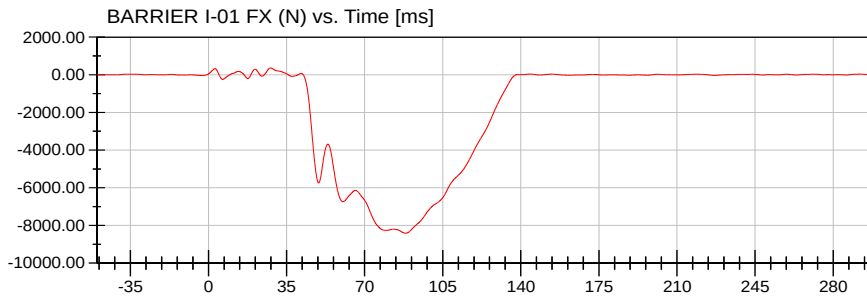


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



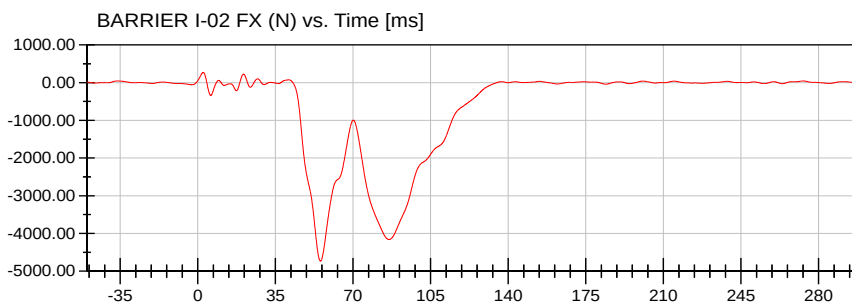
<Max>

362.71 N at 27.80 ms

<Min>

-8,414.30 N at 88.35 ms

CFC_60



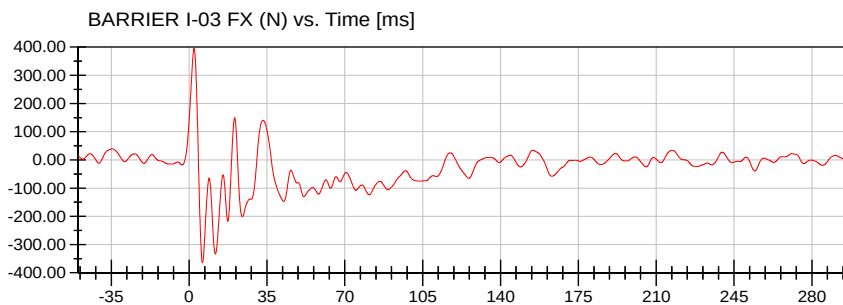
<Max>

270.45 N at 2.45 ms

<Min>

-4,732.37 N at 55.35 ms

CFC_60



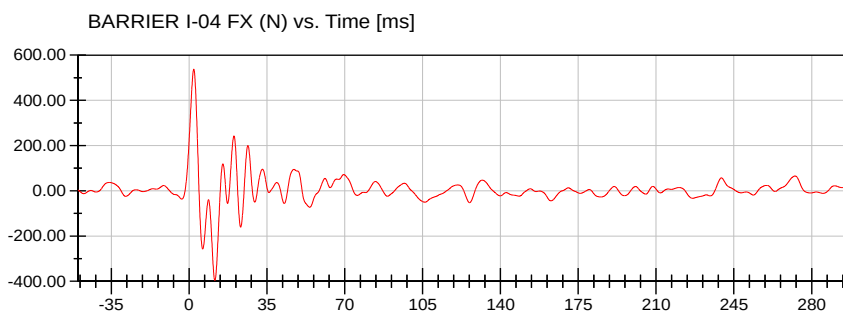
<Max>

395.47 N at 2.25 ms

<Min>

-364.80 N at 6.00 ms

CFC_60



<Max>

537.56 N at 2.10 ms

<Min>

-396.11 N at 11.55 ms

CFC_60

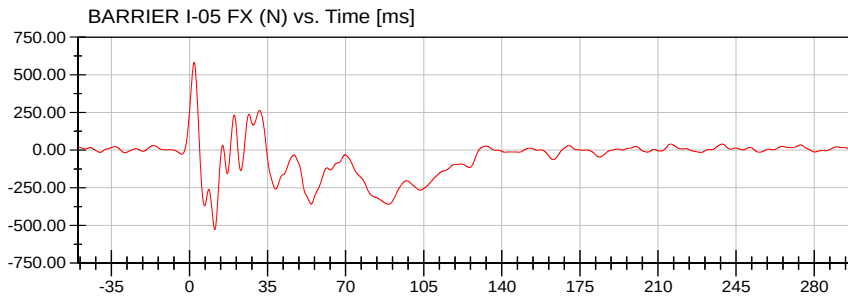


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



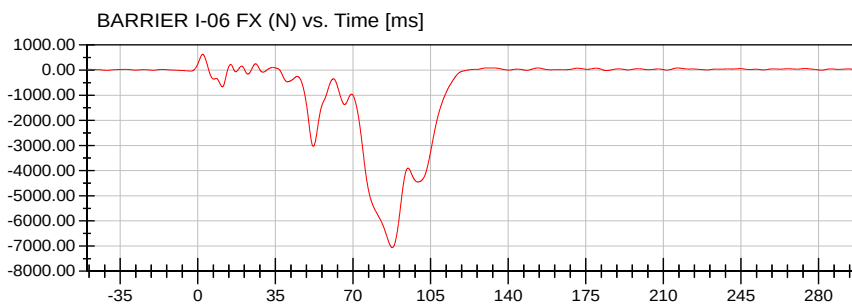
<Max>

581.89 N at 2.05 ms

<Min>

-528.70 N at 11.35 ms

CFC_60



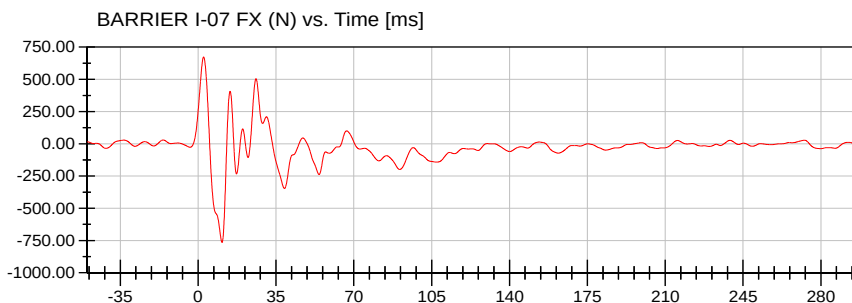
<Max>

629.89 N at 2.20 ms

<Min>

-7,062.51 N at 87.70 ms

CFC_60



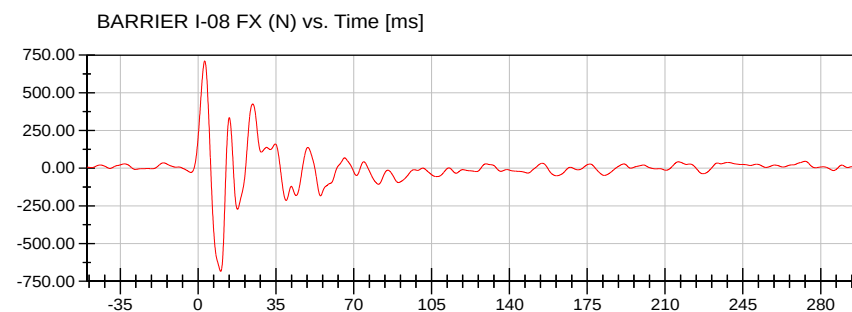
<Max>

673.90 N at 2.45 ms

<Min>

-765.37 N at 10.75 ms

CFC_60



<Max>

711.10 N at 2.95 ms

<Min>

-683.90 N at 10.15 ms

CFC_60



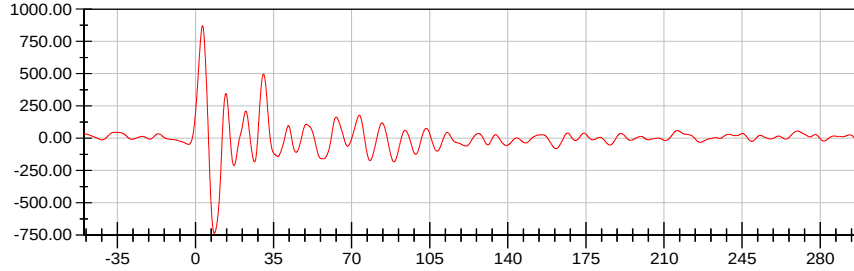
VRTC

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BARRIER I-09 FX (N) vs. Time [ms]



<Max>

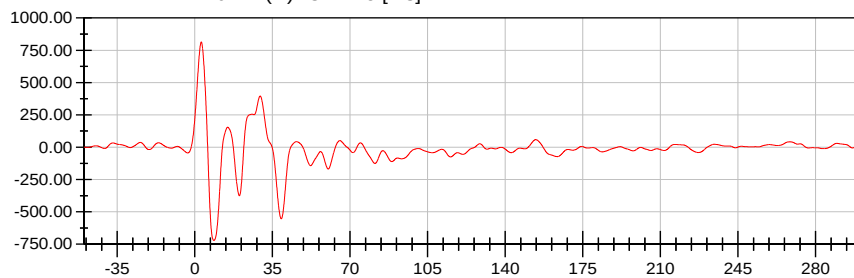
871.26 N at 3.15 ms

<Min>

-737.08 N at 8.40 ms

CFC_60

BARRIER I-10 FX (N) vs. Time [ms]



<Max>

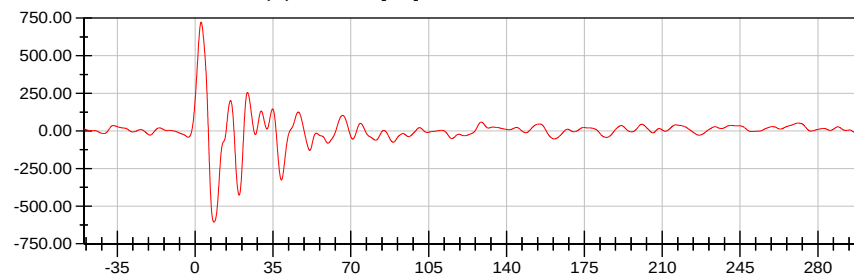
814.22 N at 2.90 ms

<Min>

-721.15 N at 8.60 ms

CFC_60

BARRIER I-11 FX (N) vs. Time [ms]



<Max>

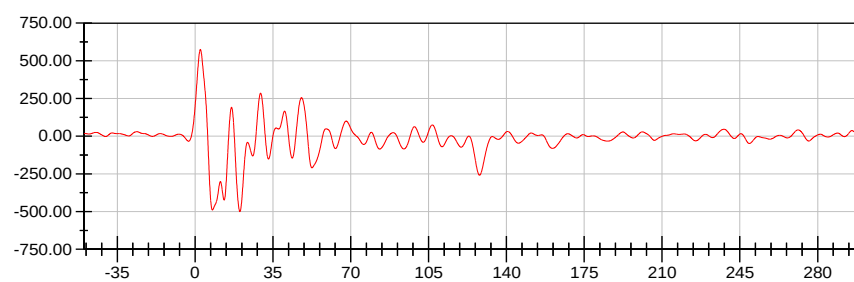
723.82 N at 2.70 ms

<Min>

-605.38 N at 8.50 ms

CFC_60

BARRIER I-12 FX (N) vs. Time [ms]



<Max>

575.17 N at 2.35 ms

<Min>

-500.10 N at 20.15 ms

CFC_60

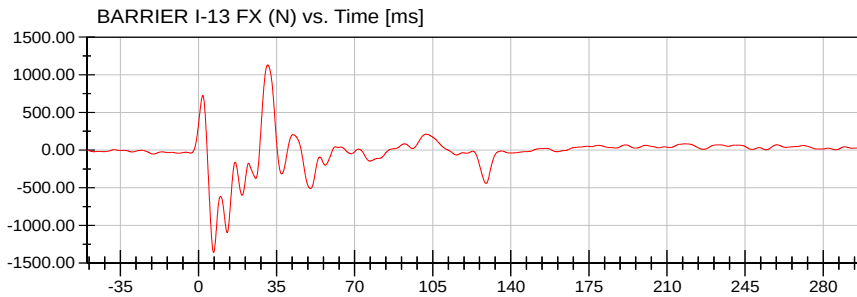


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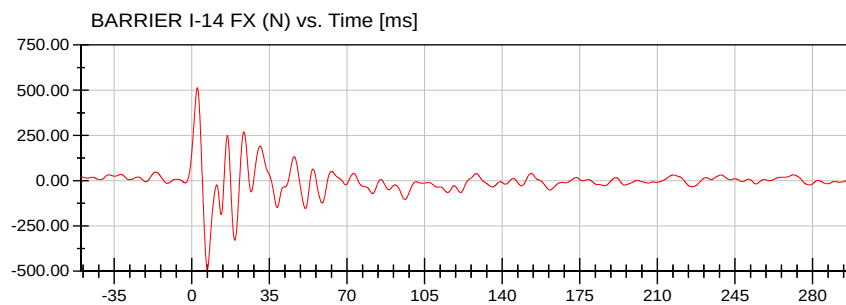
<Max>

1,130.35 N at 31.00 ms

<Min>

-1,358.13 N at 6.75 ms

CFC_60



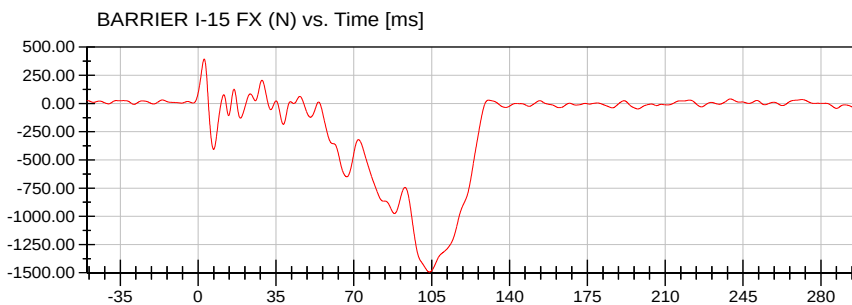
<Max>

513.70 N at 2.50 ms

<Min>

-486.93 N at 7.00 ms

CFC_60



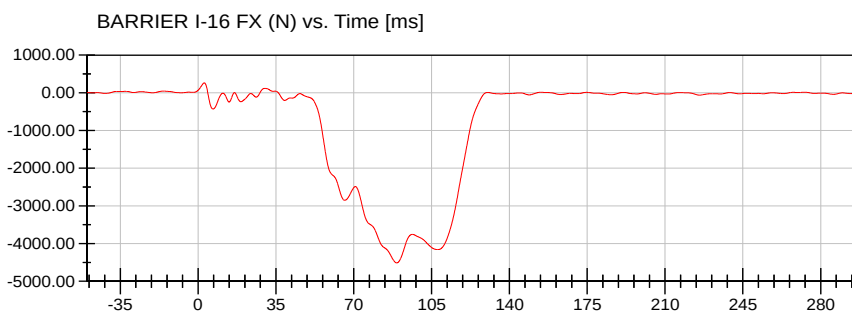
<Max>

394.33 N at 2.70 ms

<Min>

-1,493.44 N at 104.00 ms

CFC_60



<Max>

262.80 N at 2.75 ms

<Min>

-4,511.68 N at 89.30 ms

CFC_60

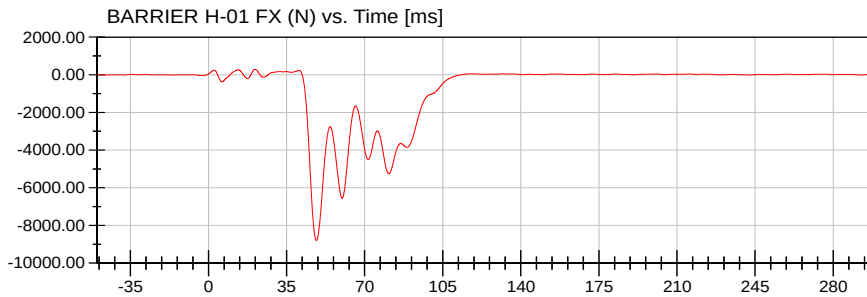


VRTC

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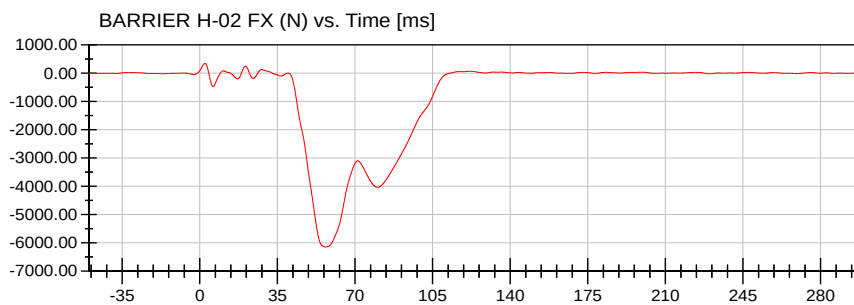
<Max>

285.82 N at 20.90 ms

<Min>

-8,804.15 N at 48.35 ms

CFC_60



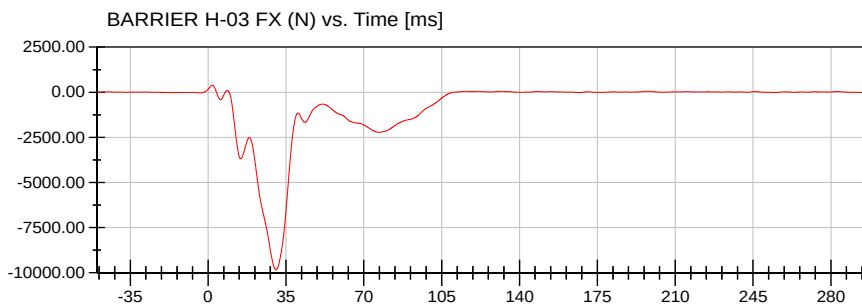
<Max>

347.74 N at 2.35 ms

<Min>

-6,143.75 N at 56.85 ms

CFC_60



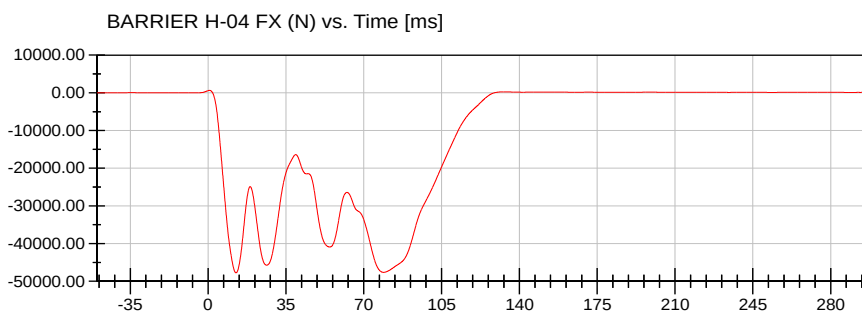
<Max>

383.77 N at 1.90 ms

<Min>

-9,843.24 N at 30.50 ms

CFC_60



<Max>

643.98 N at 0.60 ms

<Min>

-47,761.68 N at 12.55 ms

CFC_60

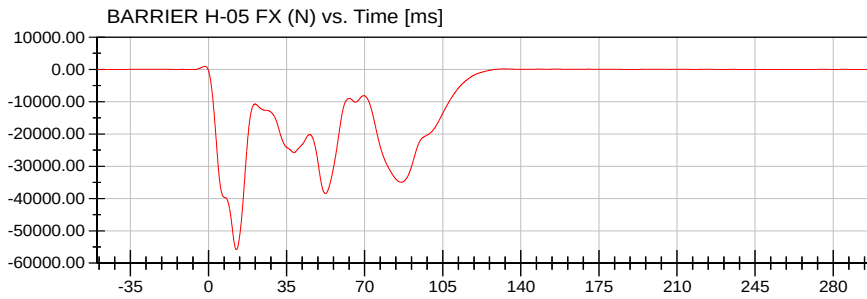


VRTC

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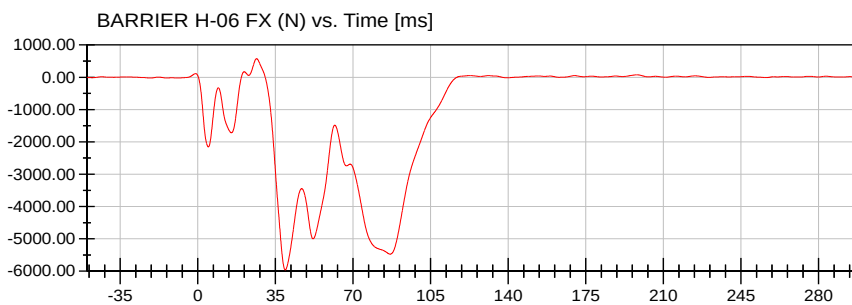
<Max>

949.49 N at -1.65 ms

<Min>

-55,827.12 N at 12.50 ms

CFC_60



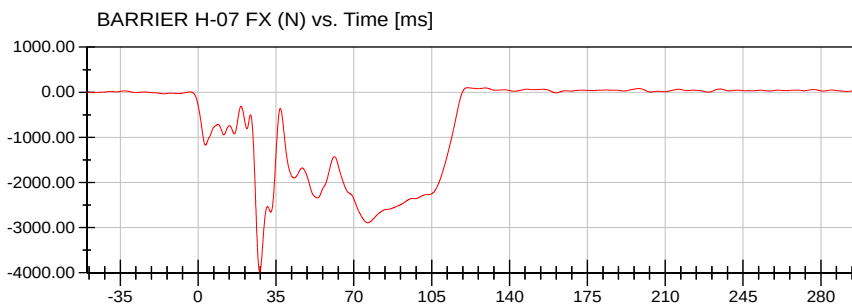
<Max>

575.59 N at 26.50 ms

<Min>

-5,962.47 N at 39.45 ms

CFC_60



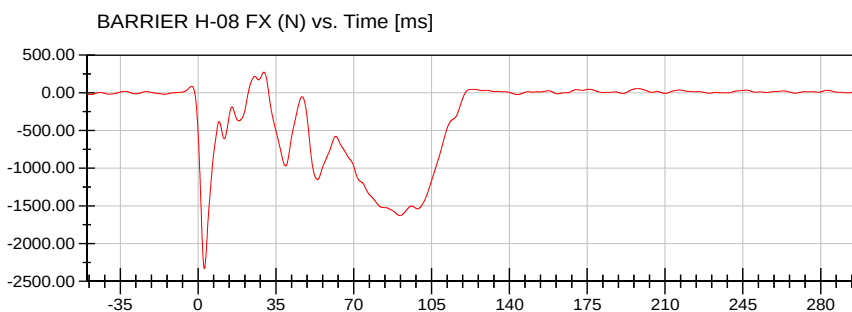
<Max>

102.57 N at 121.15 ms

<Min>

-3,988.69 N at 27.70 ms

CFC_60



<Max>

273.38 N at 29.60 ms

<Min>

-2,332.12 N at 2.80 ms

CFC_60

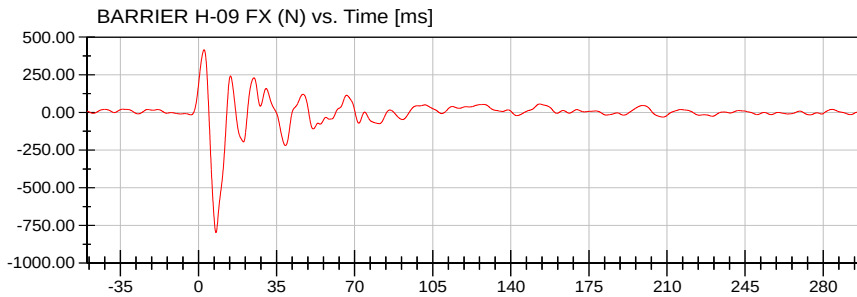


VRTC

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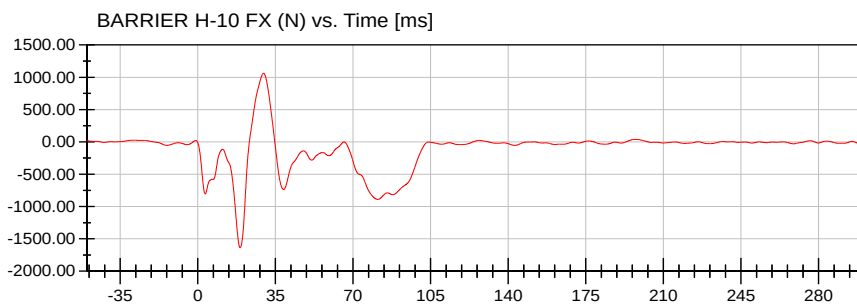
<Max>

416.22 N at 2.50 ms

<Min>

-797.92 N at 7.80 ms

CFC_60



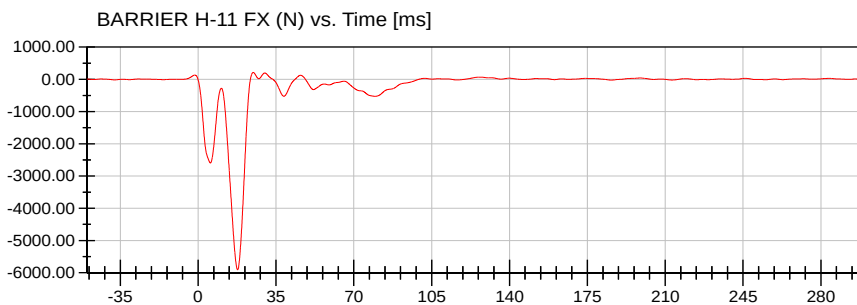
<Max>

1,061.32 N at 29.70 ms

<Min>

-1,637.39 N at 19.10 ms

CFC_60



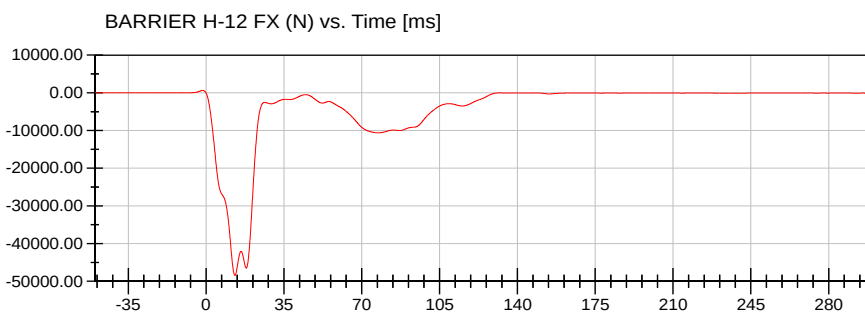
<Max>

213.23 N at 24.80 ms

<Min>

-5,910.04 N at 17.75 ms

CFC_60



<Max>

619.68 N at -1.50 ms

<Min>

-48,445.02 N at 12.95 ms

CFC_60

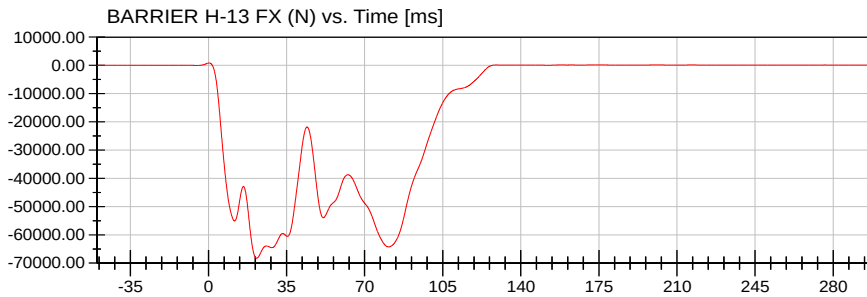


VRTC

Test Lab: CTF

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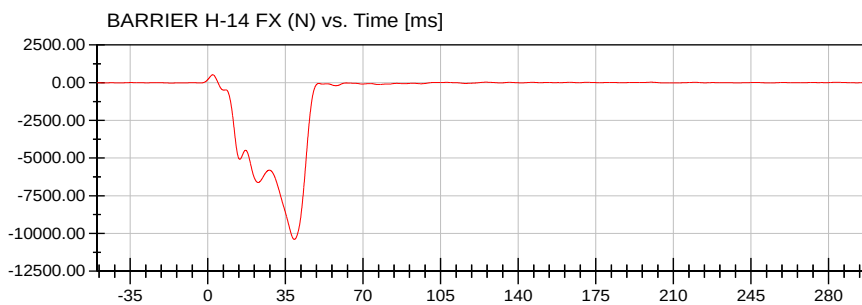
<Max>

829.34 N at 0.30 ms

<Min>

-68,257.58 N at 21.60 ms

CFC_60



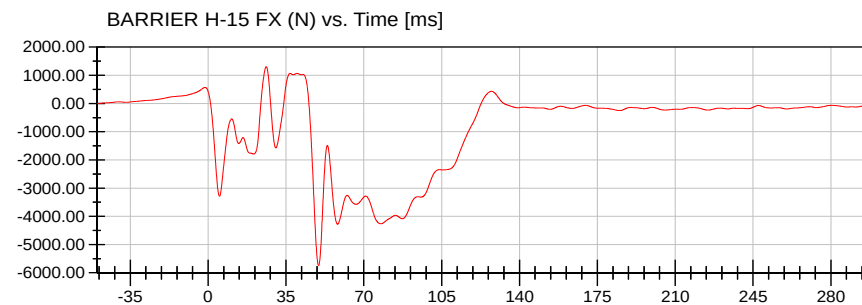
<Max>

524.45 N at 2.25 ms

<Min>

-10,395.36 N at 39.05 ms

CFC_60



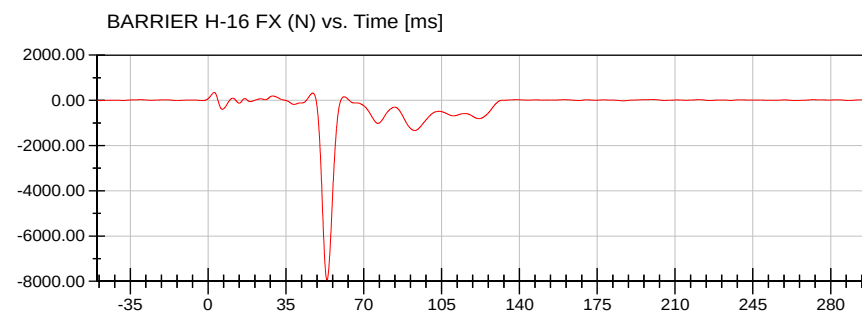
<Max>

1,307.35 N at 26.10 ms

<Min>

-5,748.28 N at 49.65 ms

CFC_60



<Max>

346.01 N at 2.75 ms

<Min>

-7,942.99 N at 53.45 ms

CFC_60

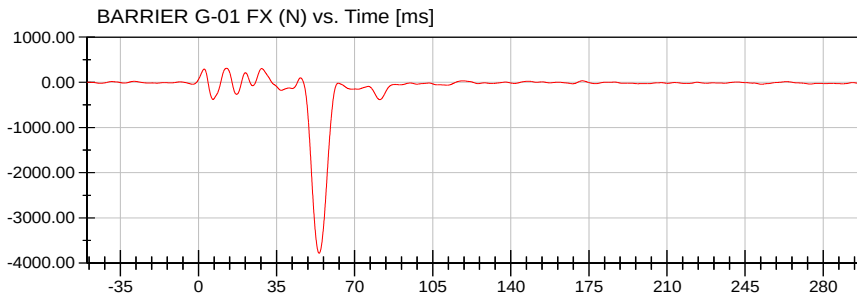


VRTC

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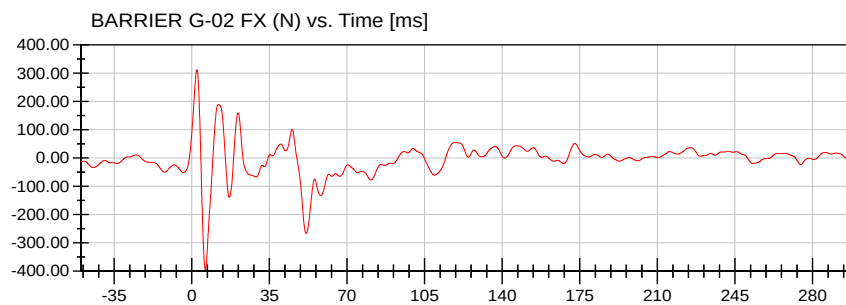
<Max>

309.69 N at 12.50 ms

<Min>

-3,782.98 N at 54.05 ms

CFC_60



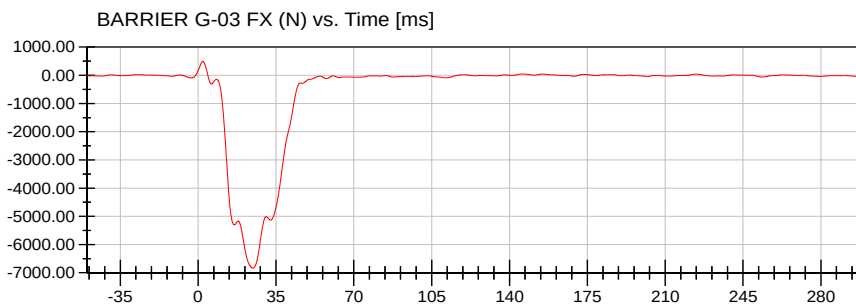
<Max>

312.58 N at 2.30 ms

<Min>

-394.75 N at 6.10 ms

CFC_60



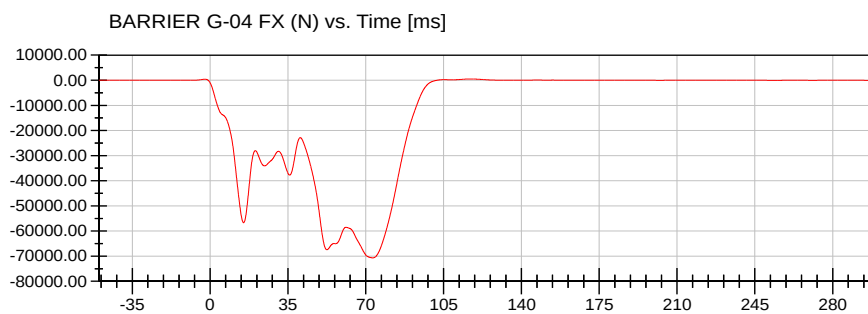
<Max>

494.73 N at 2.10 ms

<Min>

-6,835.25 N at 24.70 ms

CFC_60



<Max>

489.04 N at 117.00 ms

<Min>

-70,675.70 N at 73.10 ms

CFC_60

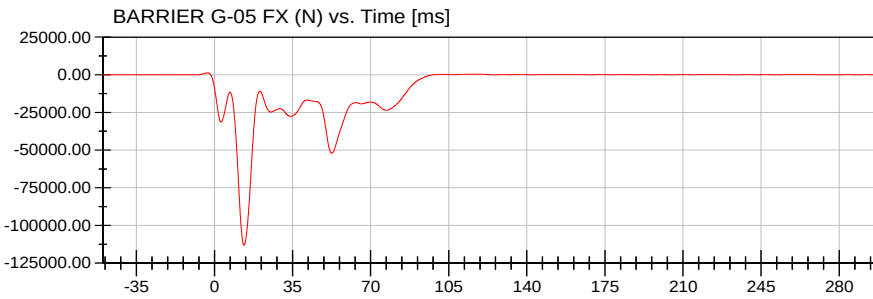


VRTC

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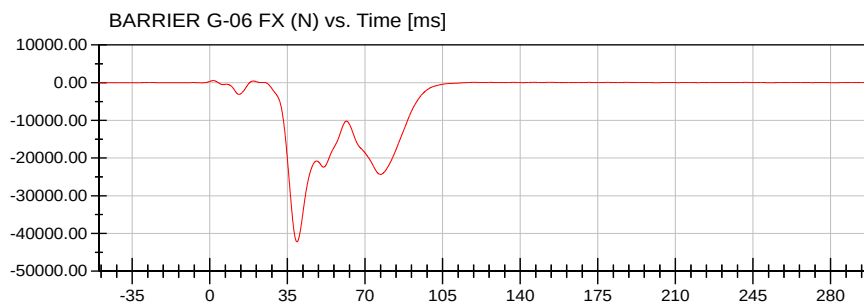
<Max>

1,284.35 N at -3.15 ms

<Min>

-113,138.15 N at 13.25 ms

CFC_60



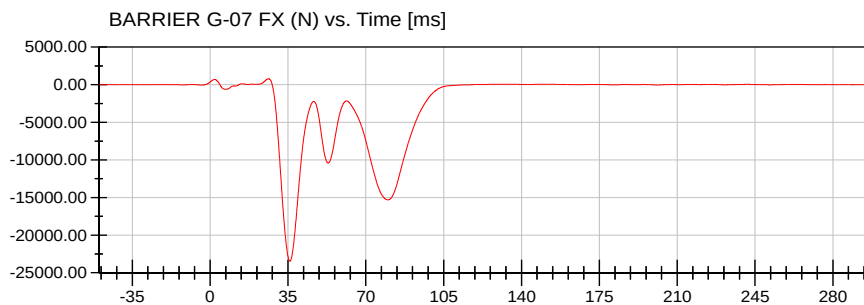
<Max>

547.68 N at 1.60 ms

<Min>

-42,206.17 N at 39.35 ms

CFC_60



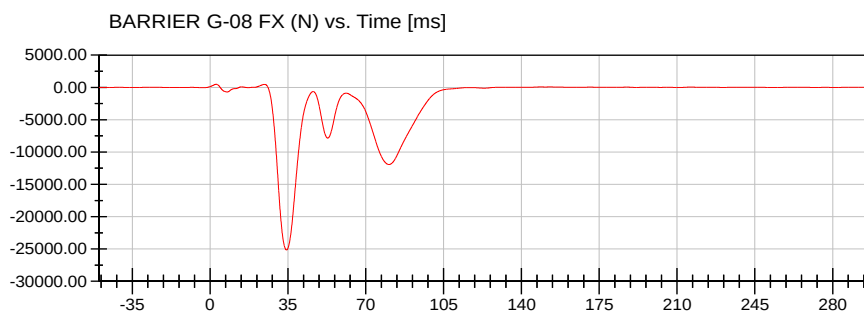
<Max>

794.94 N at 26.20 ms

<Min>

-23,459.56 N at 35.85 ms

CFC_60



<Max>

491.47 N at 2.70 ms

<Min>

-25,146.81 N at 34.35 ms

CFC_60

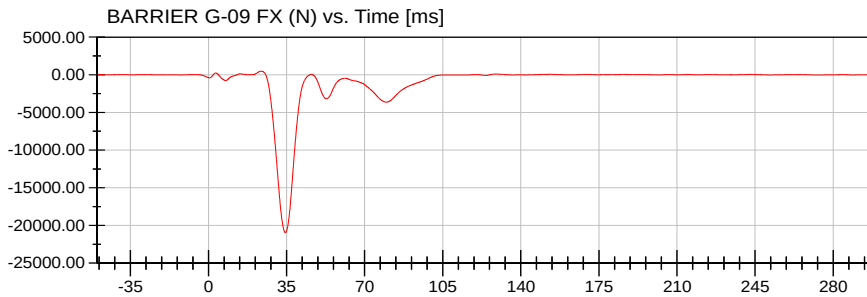


VRTC

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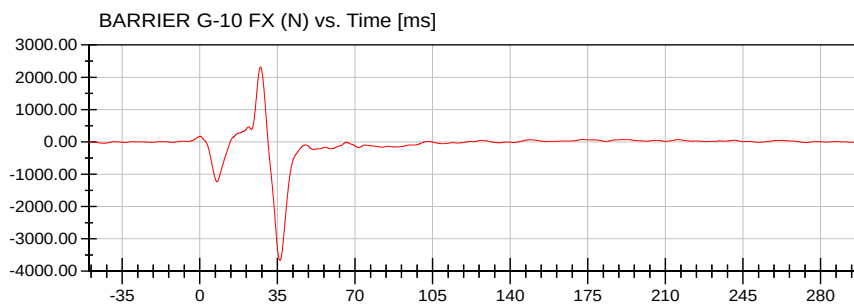
<Max>

469.64 N at 23.65 ms

<Min>

-20,951.70 N at 34.45 ms

CFC_60



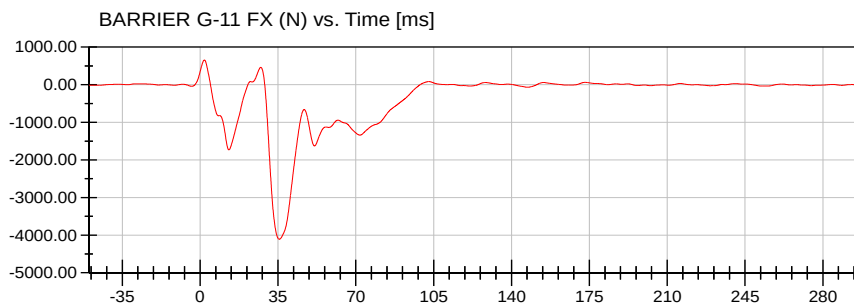
<Max>

2,314.94 N at 27.35 ms

<Min>

-3,668.51 N at 36.15 ms

CFC_60



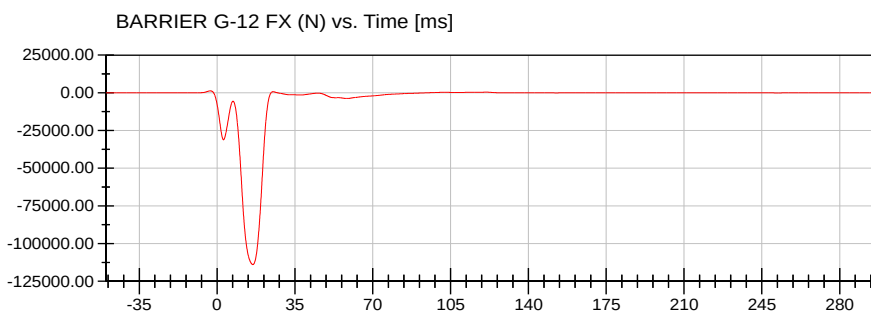
<Max>

658.33 N at 1.90 ms

<Min>

-4,106.41 N at 35.60 ms

CFC_60



<Max>

1,314.32 N at -3.00 ms

<Min>

-113,903.15 N at 16.05 ms

CFC_60

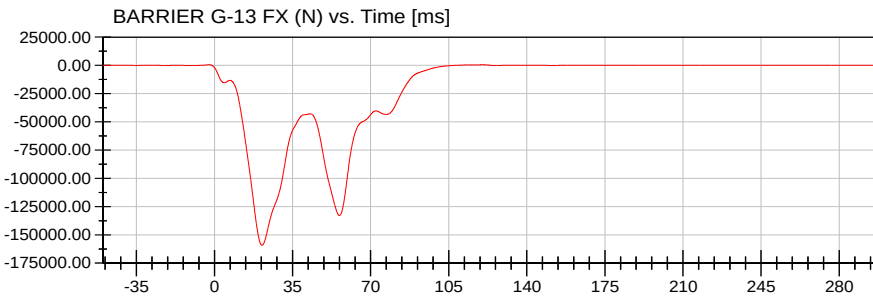
TRC

VRTC

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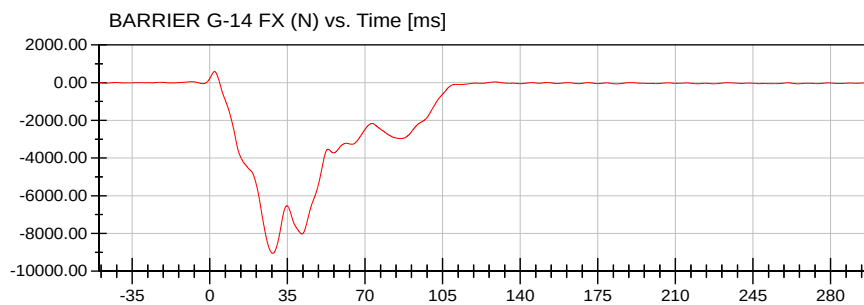
<Max>

534.83 N at -2.55 ms

<Min>

-159,173.29 N at 21.30 ms

CFC_60



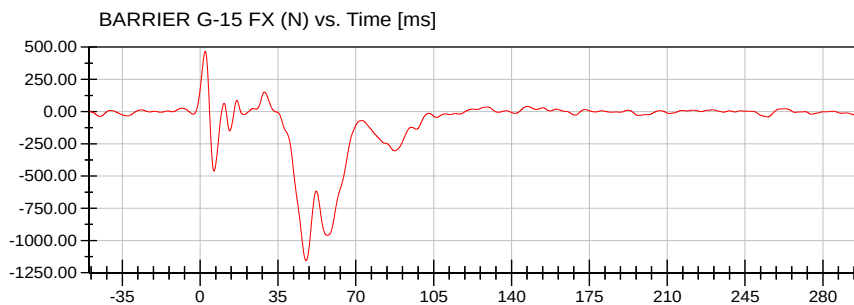
<Max>

591.60 N at 2.15 ms

<Min>

-9,053.15 N at 28.40 ms

CFC_60



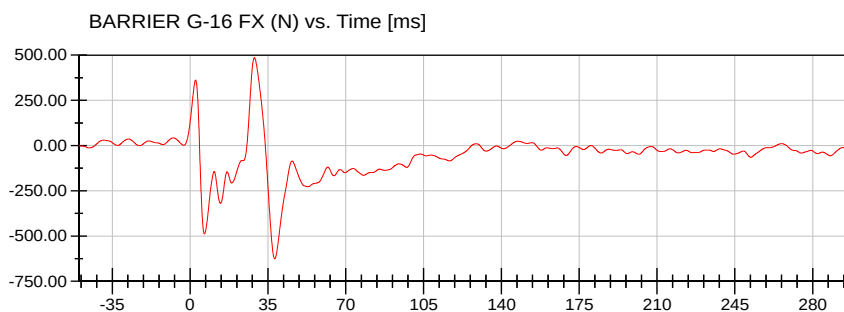
<Max>

466.64 N at 2.30 ms

<Min>

-1,155.89 N at 47.60 ms

CFC_60



<Max>

485.74 N at 28.90 ms

<Min>

-626.19 N at 38.05 ms

CFC_60



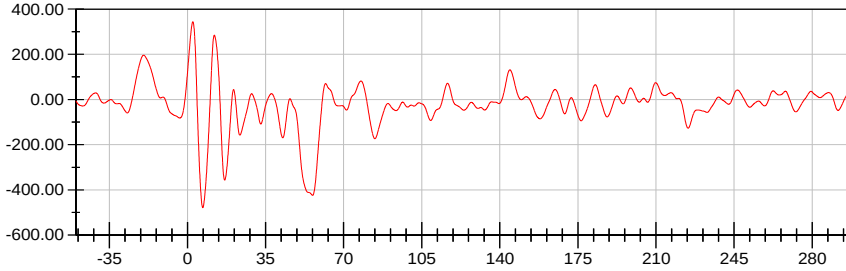
VRTC

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BARRIER F-01 FX (N) vs. Time [ms]



<Max>

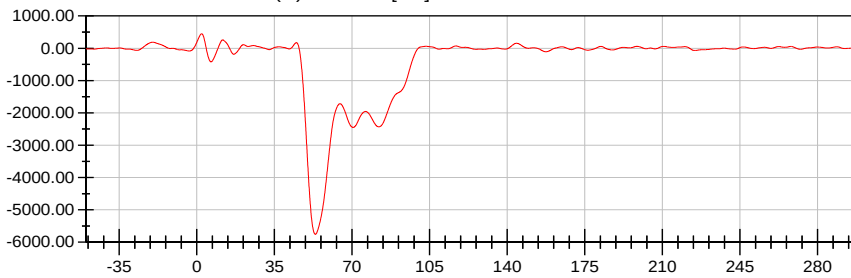
344.17 N at 2.40 ms

<Min>

-478.74 N at 6.85 ms

CFC_60

BARRIER F-02 FX (N) vs. Time [ms]



<Max>

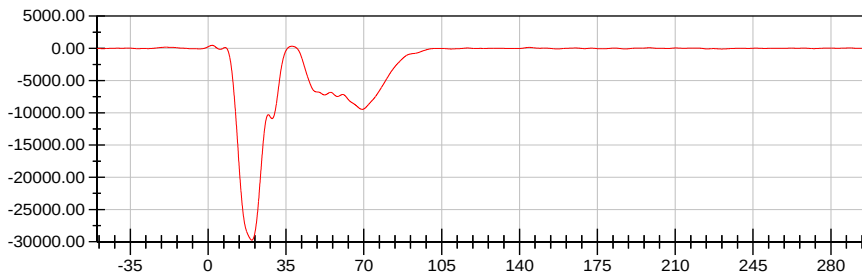
450.11 N at 2.20 ms

<Min>

-5,758.05 N at 53.45 ms

CFC_60

BARRIER F-03 FX (N) vs. Time [ms]



<Max>

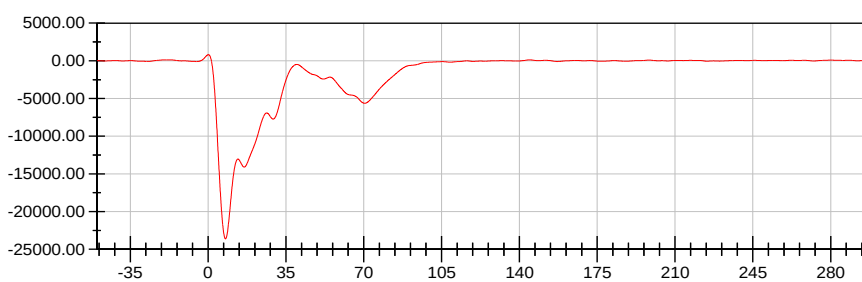
468.92 N at 1.85 ms

<Min>

-29,752.04 N at 19.65 ms

CFC_60

BARRIER F-04 FX (N) vs. Time [ms]



<Max>

813.16 N at 0.10 ms

<Min>

-23,608.78 N at 7.80 ms

CFC_60

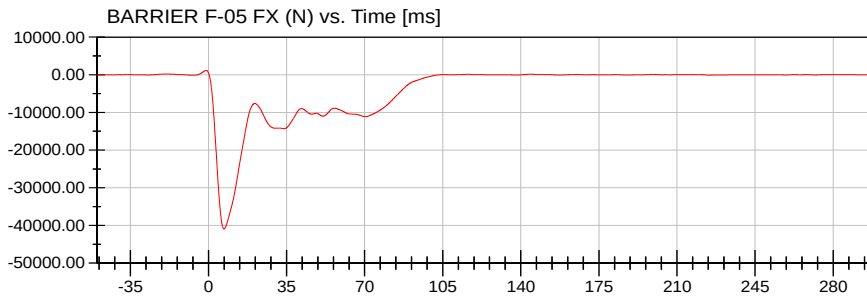


VRTC

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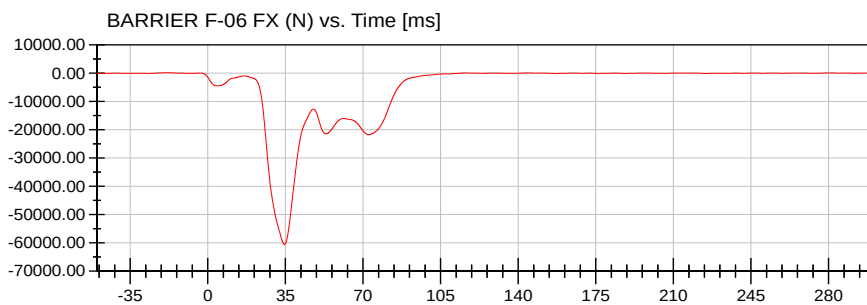
<Max>

1,168.85 N at -1.10 ms

<Min>

-40,954.49 N at 6.95 ms

CFC_60



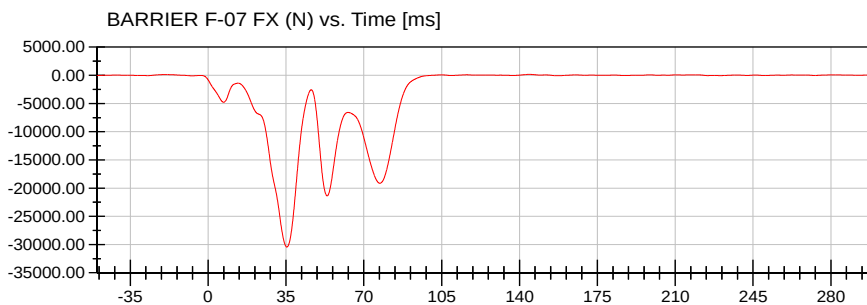
<Max>

160.72 N at -18.65 ms

<Min>

-60,582.17 N at 34.60 ms

CFC_60



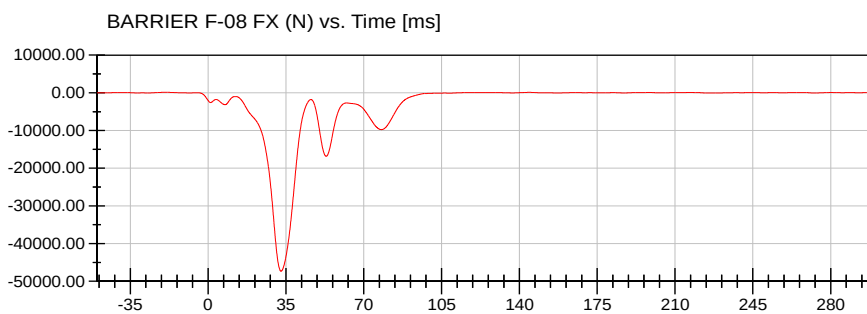
<Max>

173.02 N at 144.35 ms

<Min>

-30,432.71 N at 35.40 ms

CFC_60



<Max>

155.16 N at -19.35 ms

<Min>

-47,315.13 N at 32.80 ms

CFC_60

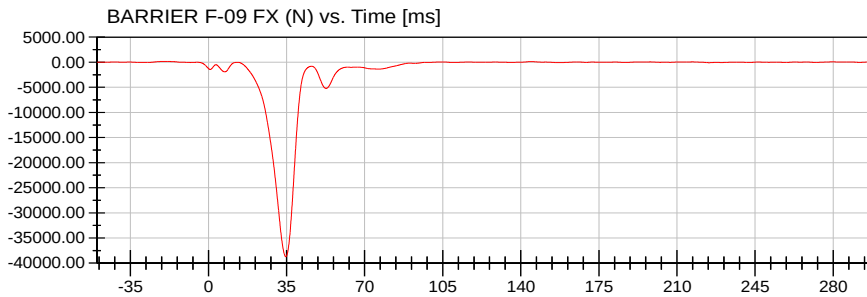


VRTC

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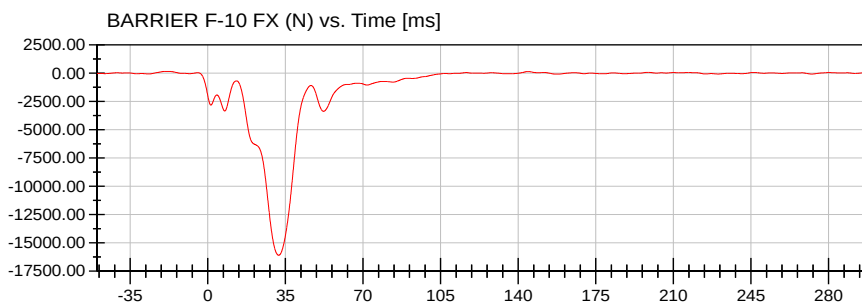
<Max>

155.35 N at -19.90 ms

<Min>

-38,725.51 N at 34.65 ms

CFC_60



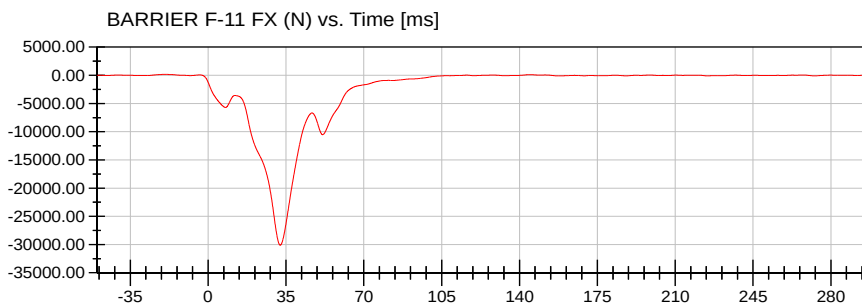
<Max>

165.50 N at -18.25 ms

<Min>

-16,098.60 N at 32.00 ms

CFC_60



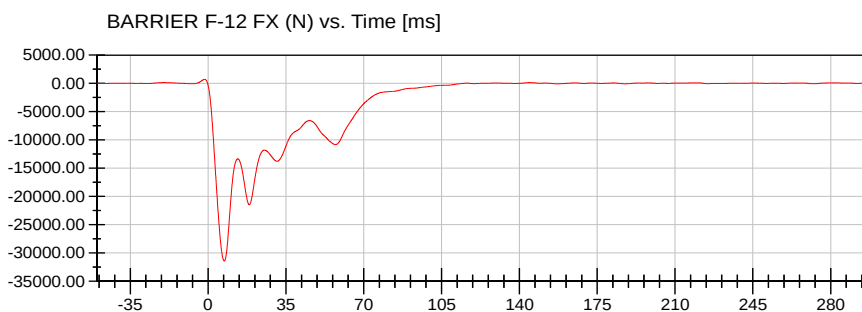
<Max>

172.83 N at -19.60 ms

<Min>

-30,124.74 N at 32.40 ms

CFC_60



<Max>

710.32 N at -1.60 ms

<Min>

-31,406.91 N at 7.25 ms

CFC_60

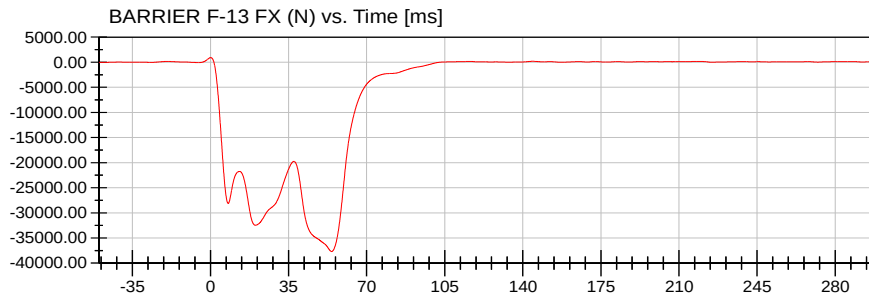


VRTC

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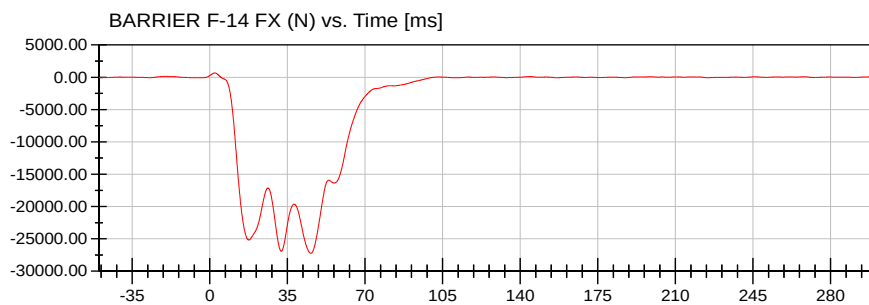
<Max>

923.71 N at 0.10 ms

<Min>

-37,692.46 N at 54.25 ms

CFC_60



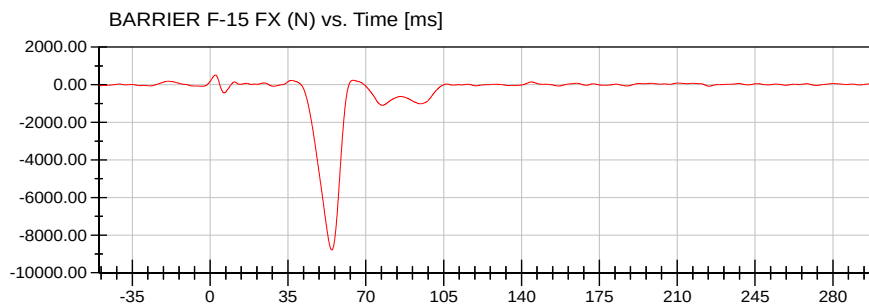
<Max>

671.71 N at 2.25 ms

<Min>

-27,241.92 N at 45.55 ms

CFC_60



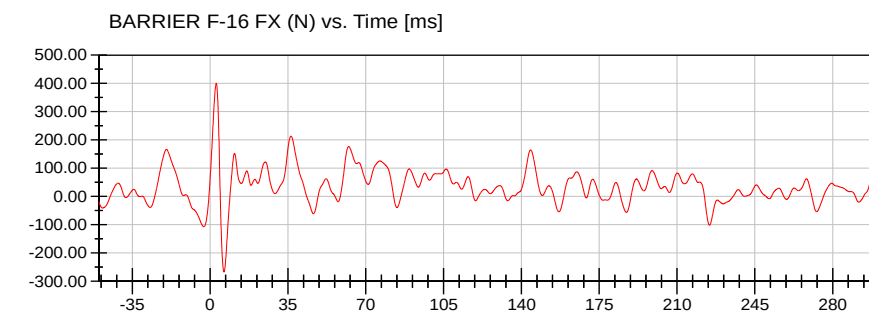
<Max>

516.00 N at 2.35 ms

<Min>

-8,790.56 N at 54.70 ms

CFC_60



<Max>

400.16 N at 2.75 ms

<Min>

-267.18 N at 6.25 ms

CFC_60

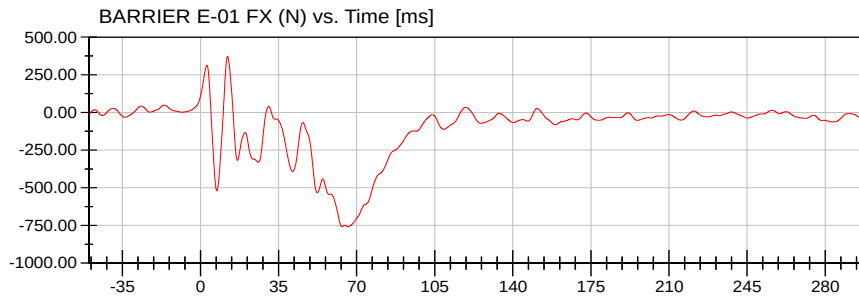


VRTC

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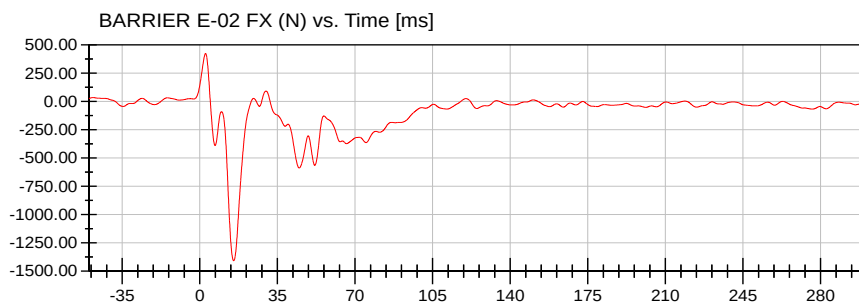
<Max>

372.37 N at 12.10 ms

<Min>

-758.77 N at 63.40 ms

CFC_60



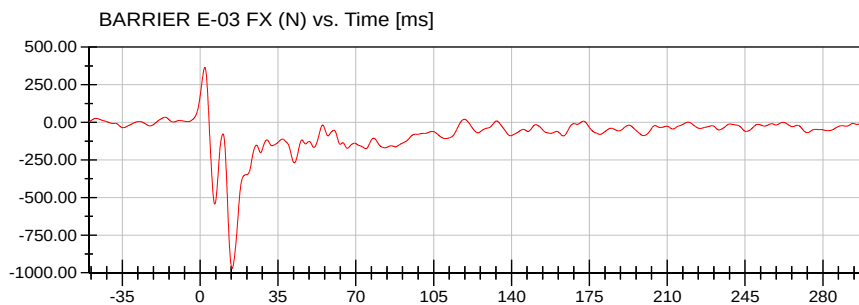
<Max>

425.02 N at 2.60 ms

<Min>

-1,407.92 N at 15.30 ms

CFC_60



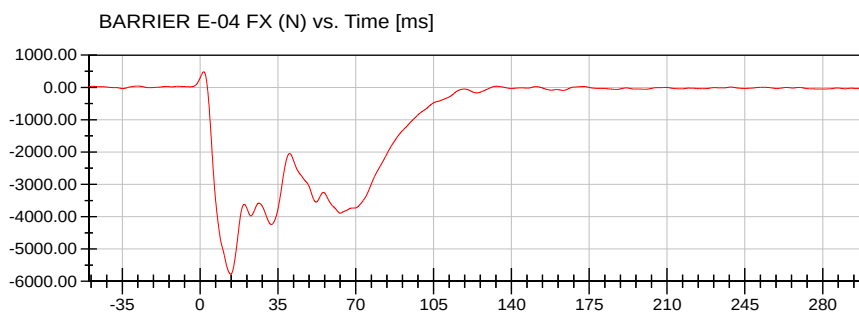
<Max>

365.48 N at 2.10 ms

<Min>

-971.24 N at 14.40 ms

CFC_60



<Max>

483.82 N at 1.65 ms

<Min>

-5,782.04 N at 13.75 ms

CFC_60

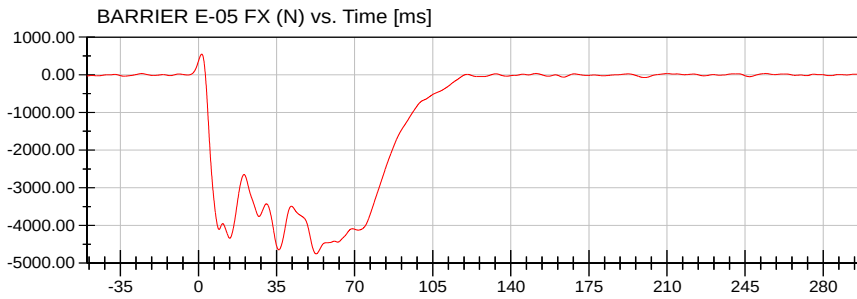


VRTC

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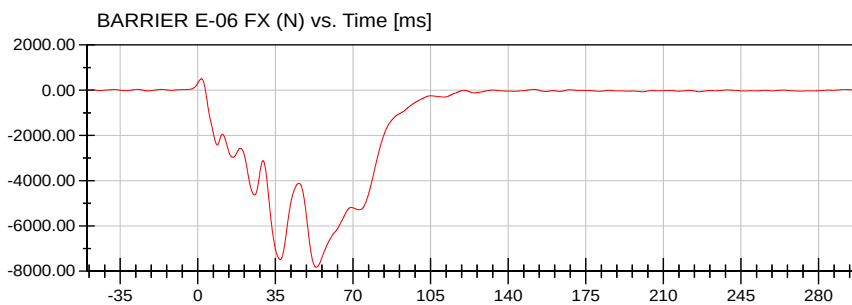
<Max>

547.78 N at 1.45 ms

<Min>

-4,756.27 N at 52.75 ms

CFC_60



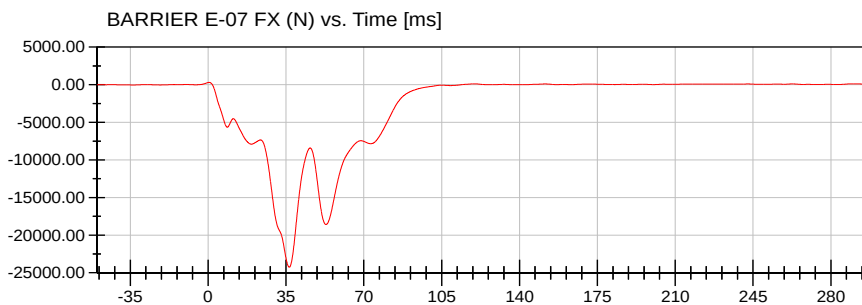
<Max>

505.16 N at 1.65 ms

<Min>

-7,828.41 N at 53.45 ms

CFC_60



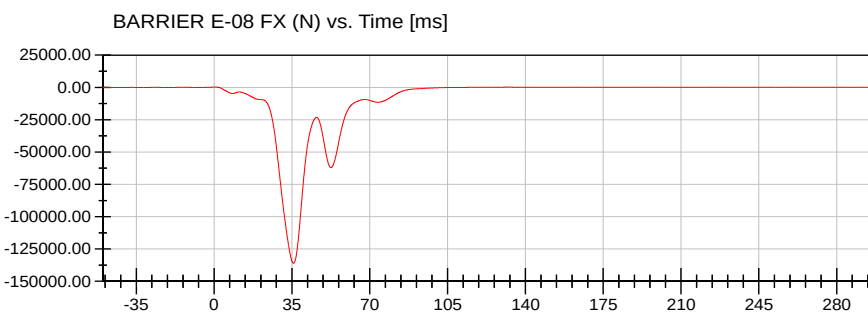
<Max>

303.28 N at 0.45 ms

<Min>

-24,262.40 N at 36.45 ms

CFC_60



<Max>

278.26 N at 0.55 ms

<Min>

-136,061.82 N at 35.70 ms

CFC_60

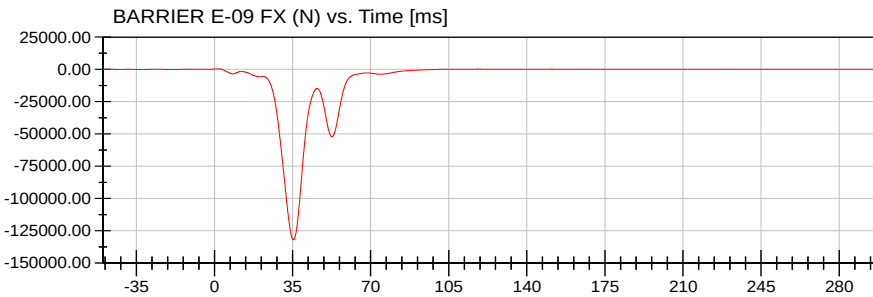


VRTC

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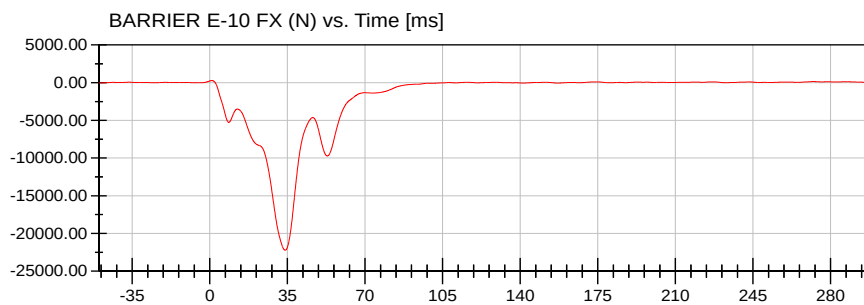
<Max>

399.15 N at 1.40 ms

<Min>

-131,951.07 N at 35.35 ms

CFC_60



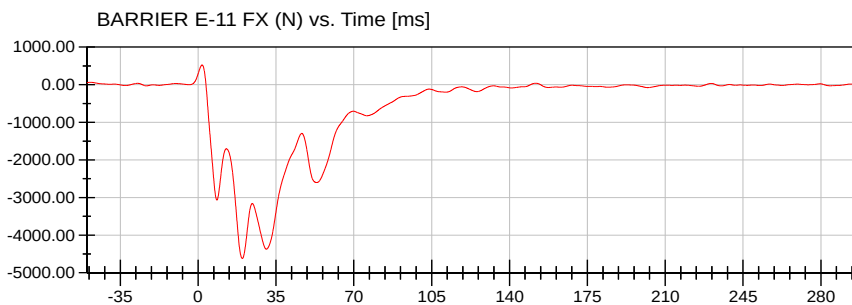
<Max>

274.02 N at 0.90 ms

<Min>

-22,216.60 N at 34.00 ms

CFC_60



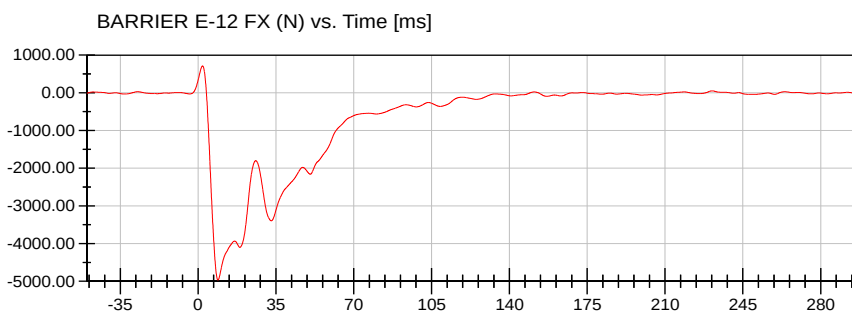
<Max>

526.18 N at 1.75 ms

<Min>

-4,621.17 N at 19.90 ms

CFC_60



<Max>

713.60 N at 2.00 ms

<Min>

-4,967.73 N at 8.90 ms

CFC_60

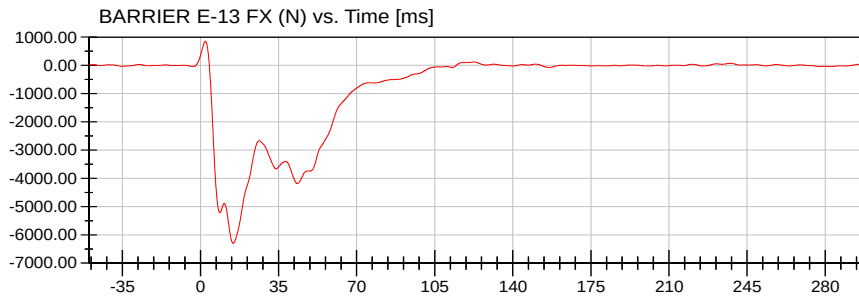


VRTC

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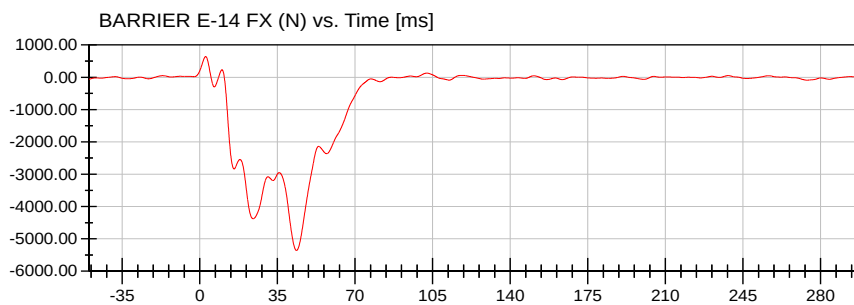
<Max>

852.58 N at 2.20 ms

<Min>

-6,297.22 N at 14.65 ms

CFC_60



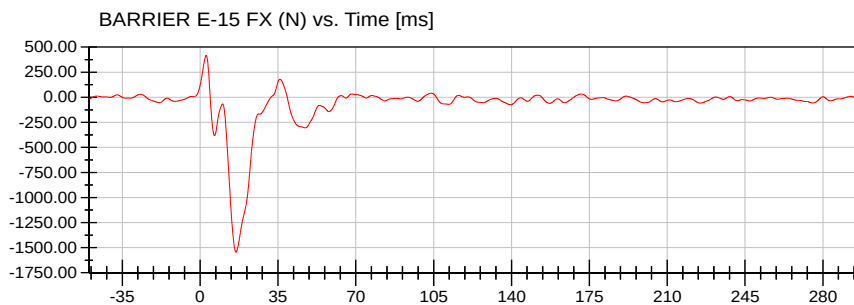
<Max>

641.08 N at 2.60 ms

<Min>

-5,359.50 N at 43.60 ms

CFC_60



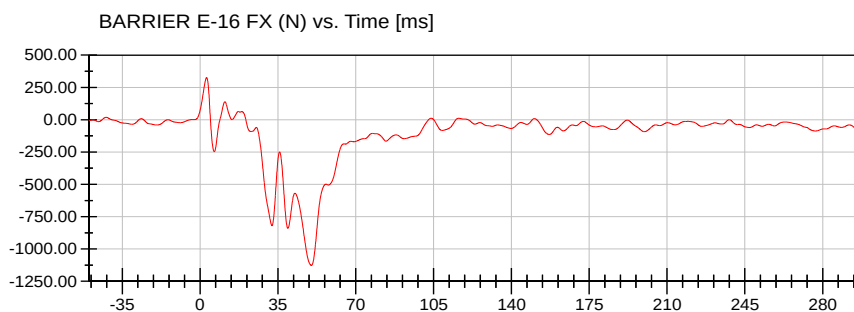
<Max>

416.18 N at 2.70 ms

<Min>

-1,544.52 N at 16.10 ms

CFC_60



<Max>

326.46 N at 2.90 ms

<Min>

-1,127.06 N at 50.00 ms

CFC_60

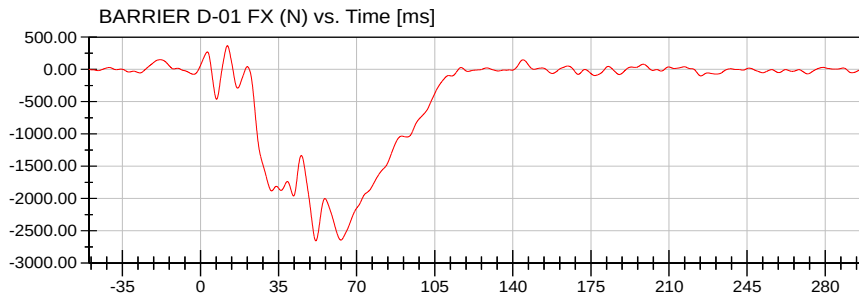


VRTC

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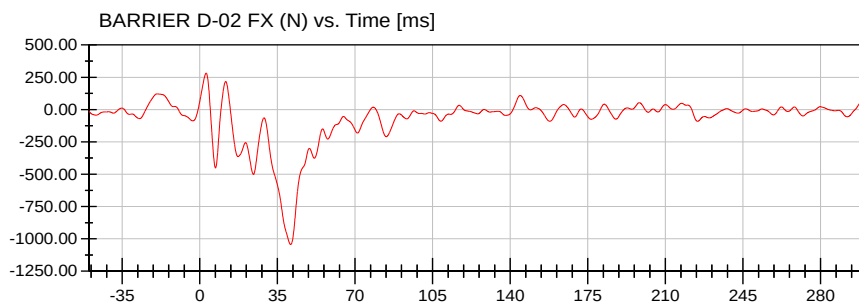
<Max>

367.07 N at 12.05 ms

<Min>

-2,656.02 N at 51.70 ms

CFC_60



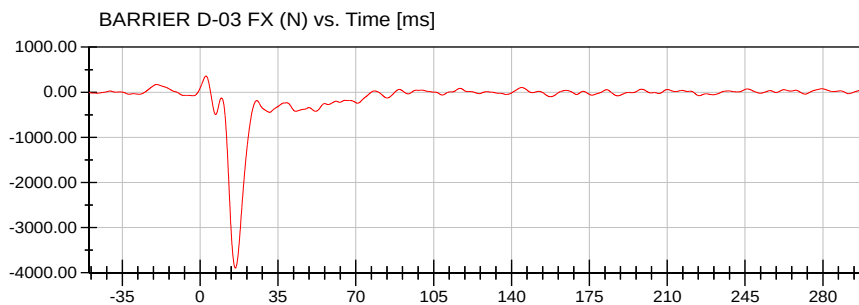
<Max>

281.95 N at 2.85 ms

<Min>

-1,043.20 N at 40.95 ms

CFC_60



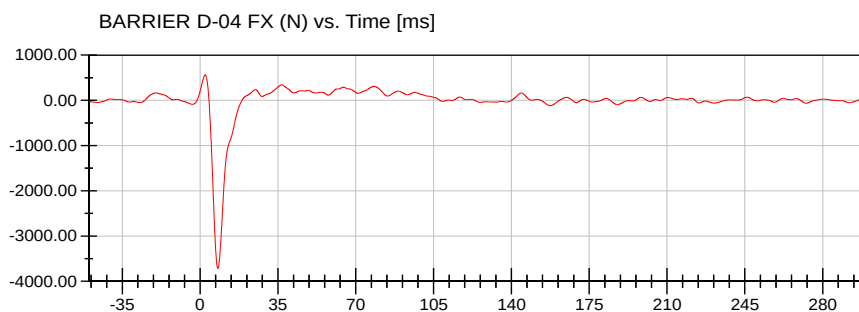
<Max>

359.94 N at 2.60 ms

<Min>

-3,898.07 N at 15.85 ms

CFC_60



<Max>

562.91 N at 2.25 ms

<Min>

-3,717.55 N at 7.95 ms

CFC_60

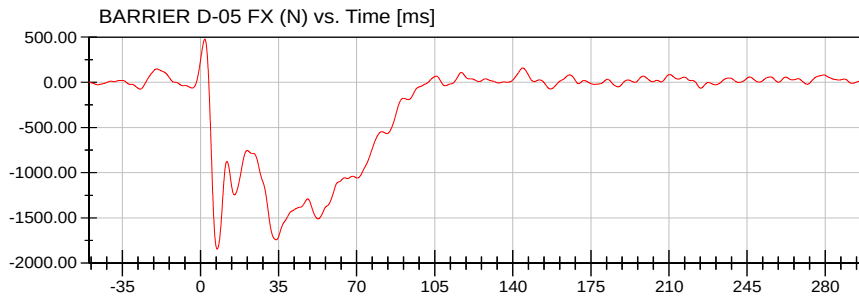


VRTC

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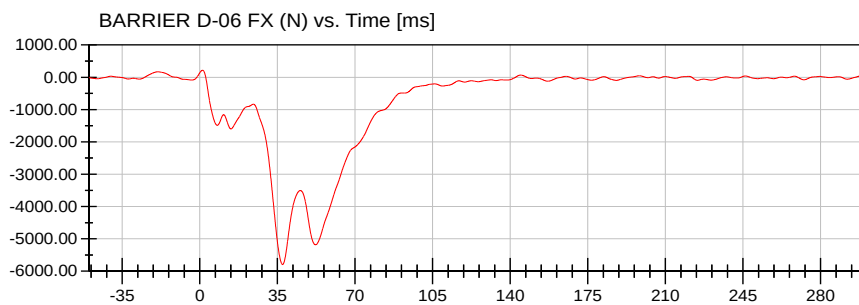
<Max>

477.35 N at 1.95 ms

<Min>

-1,844.61 N at 7.45 ms

CFC_60



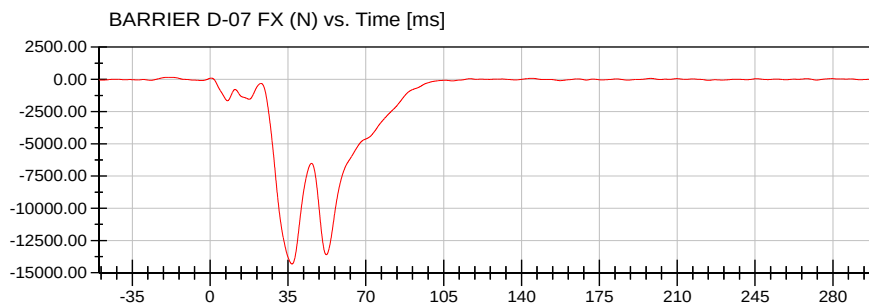
<Max>

218.50 N at 1.20 ms

<Min>

-5,794.82 N at 37.35 ms

CFC_60



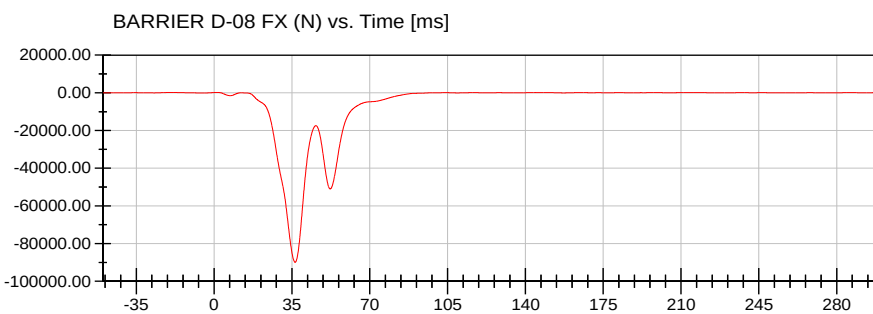
<Max>

156.05 N at -19.20 ms

<Min>

-14,324.39 N at 36.80 ms

CFC_60



<Max>

198.98 N at 1.25 ms

<Min>

-89,918.72 N at 36.40 ms

CFC_60

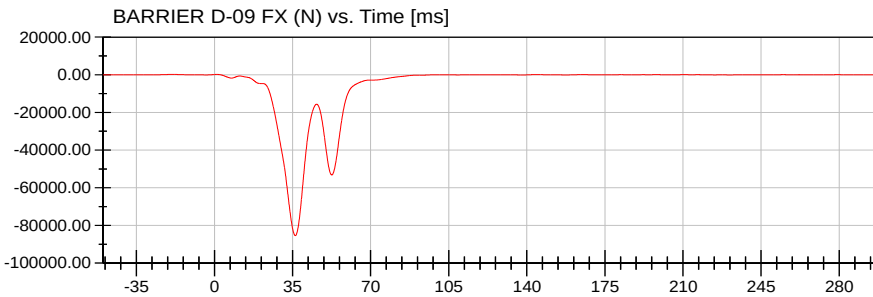


VRTC

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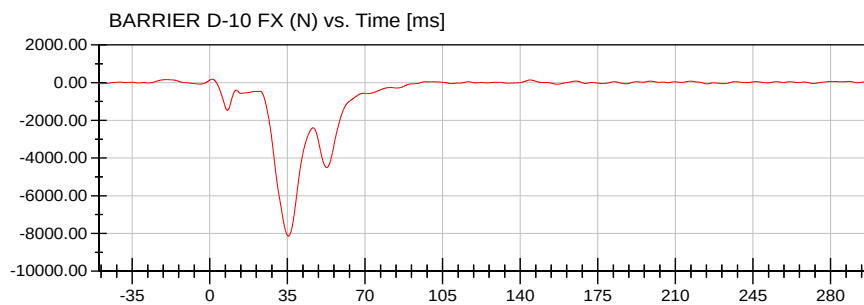
<Max>

149.17 N at 1.05 ms

<Min>

-85,402.63 N at 36.20 ms

CFC_60



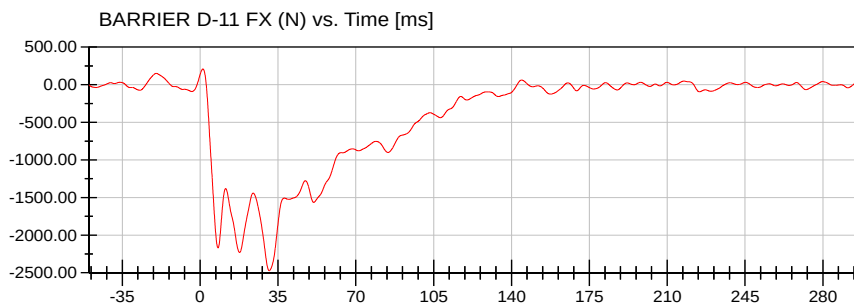
<Max>

181.04 N at 1.15 ms

<Min>

-8,136.82 N at 35.45 ms

CFC_60



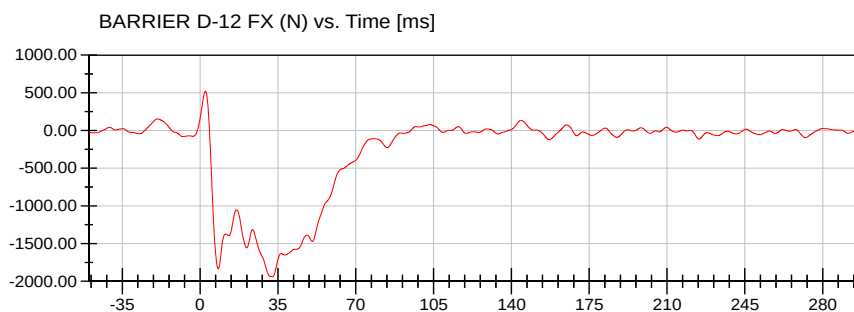
<Max>

209.27 N at 1.25 ms

<Min>

-2,472.70 N at 31.05 ms

CFC_60



<Max>

521.94 N at 2.40 ms

<Min>

-1,938.17 N at 32.40 ms

CFC_60

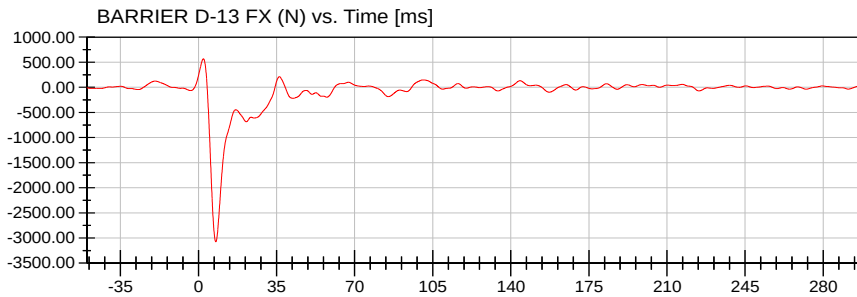


VRTC

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Test Lab: CTF

Test Number: 250325 ()



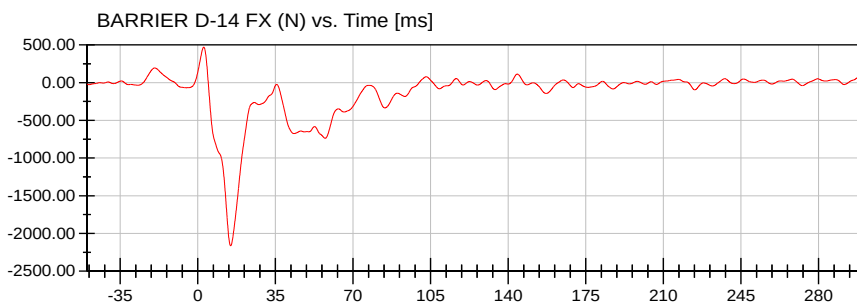
<Max>

568.57 N at 2.20 ms

<Min>

-3,076.92 N at 7.75 ms

CFC_60



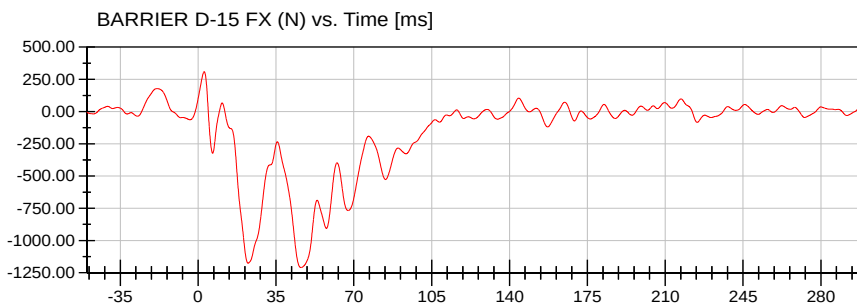
<Max>

471.79 N at 2.65 ms

<Min>

-2,163.55 N at 14.85 ms

CFC_60



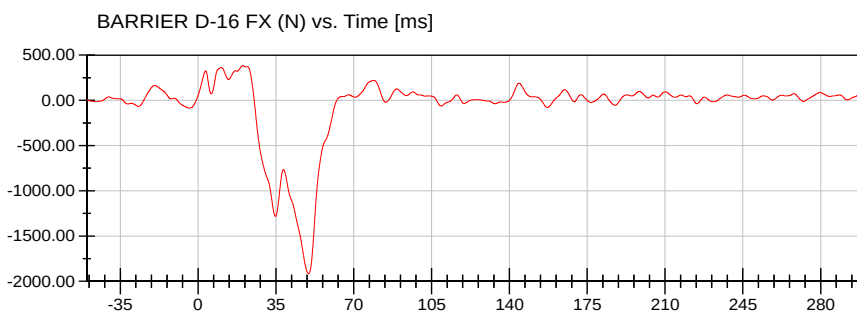
<Max>

309.51 N at 2.70 ms

<Min>

-1,209.52 N at 46.20 ms

CFC_60



<Max>

383.51 N at 20.10 ms

<Min>

-1,917.19 N at 49.70 ms

CFC_60

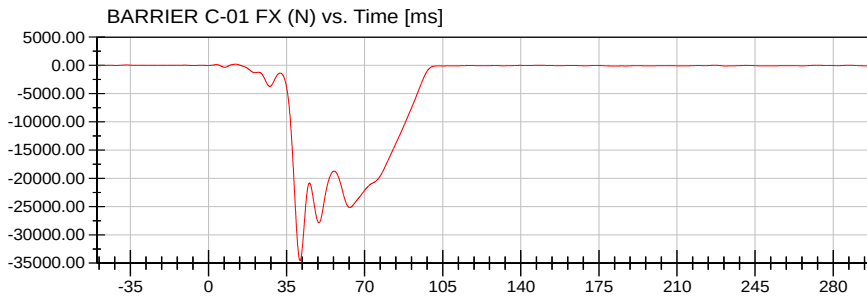


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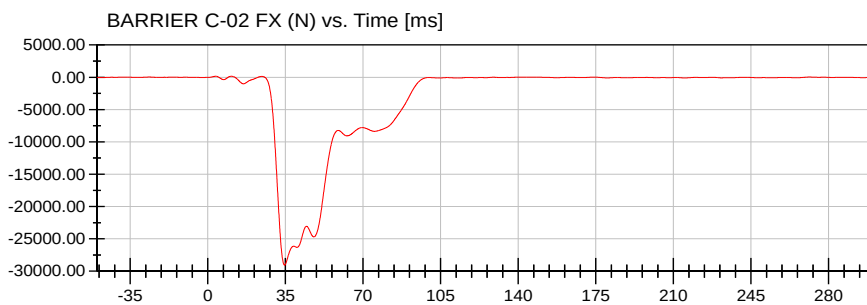
<Max>

212.84 N at 12.20 ms

<Min>

-34,579.31 N at 41.05 ms

CFC_60



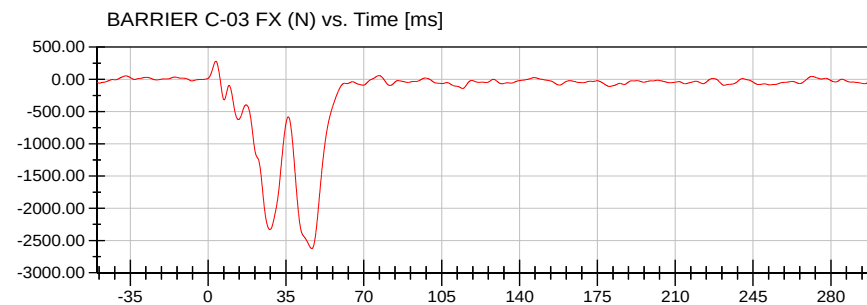
<Max>

162.23 N at 3.55 ms

<Min>

-29,065.16 N at 34.60 ms

CFC_60



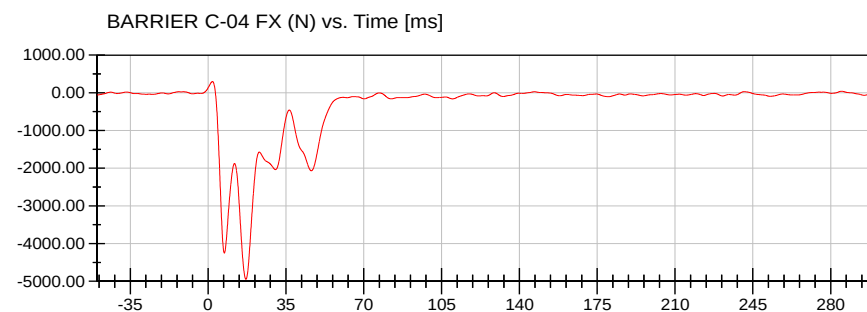
<Max>

280.89 N at 3.45 ms

<Min>

-2,625.83 N at 46.60 ms

CFC_60



<Max>

296.81 N at 1.95 ms

<Min>

-4,946.73 N at 17.00 ms

CFC_60

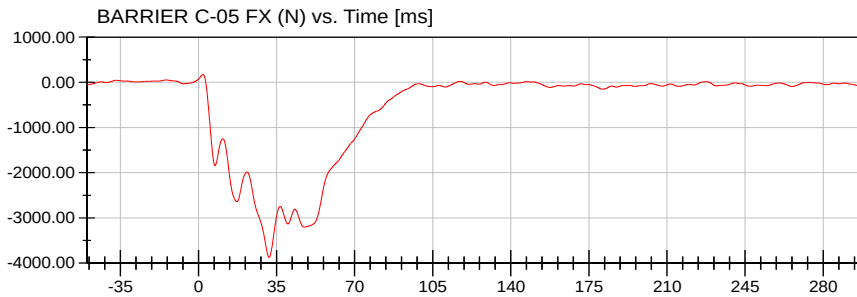


VRTC

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Test Number: 250325 ()



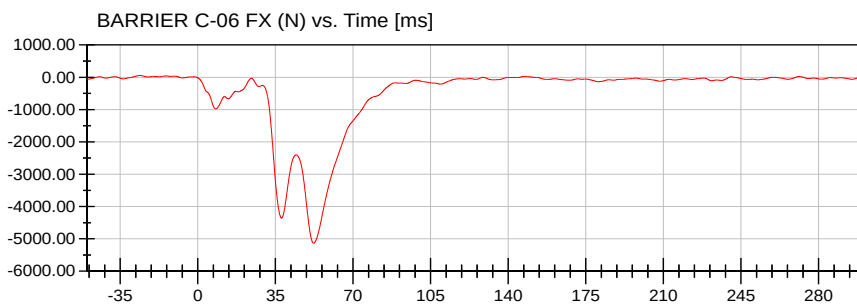
<Max>

169.75 N at 1.95 ms

<Min>

-3,874.42 N at 31.65 ms

CFC_60



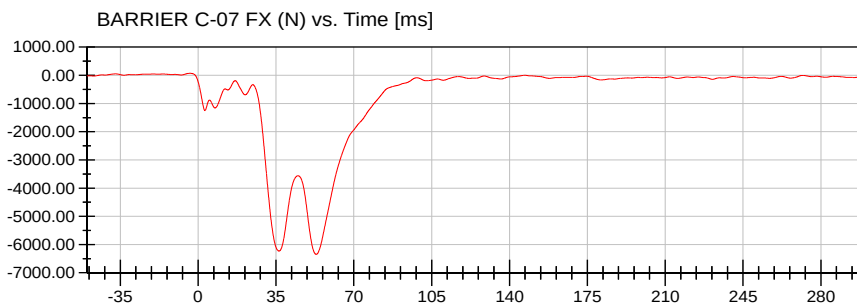
<Max>

55.37 N at -26.15 ms

<Min>

-5,136.07 N at 52.25 ms

CFC_60



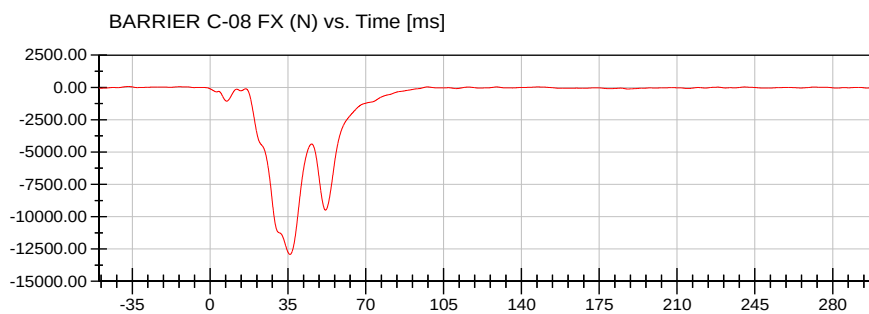
<Max>

72.80 N at -3.60 ms

<Min>

-6,347.84 N at 53.05 ms

CFC_60



<Max>

66.80 N at -36.80 ms

<Min>

-12,921.35 N at 35.90 ms

CFC_60

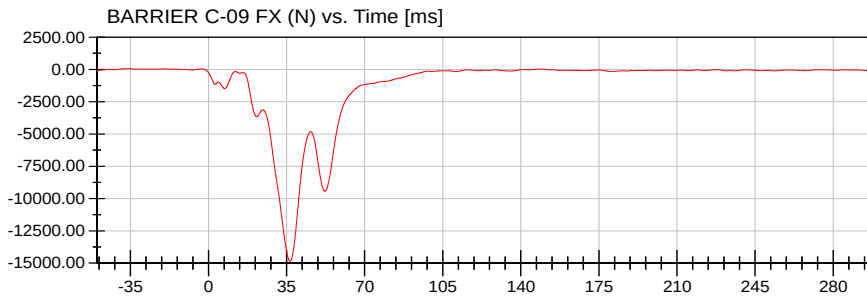


VRTC

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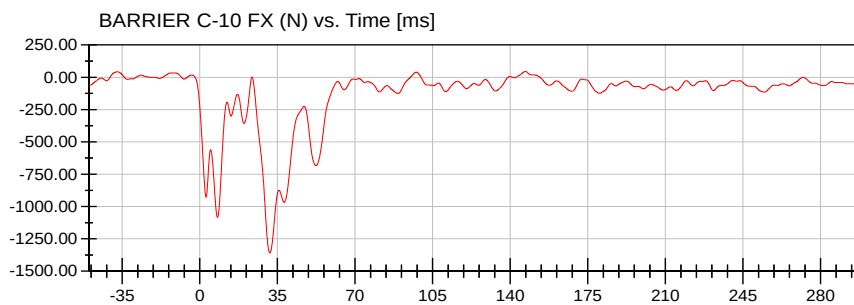
<Max>

58.34 N at -36.55 ms

<Min>

-14,857.96 N at 36.55 ms

CFC_60



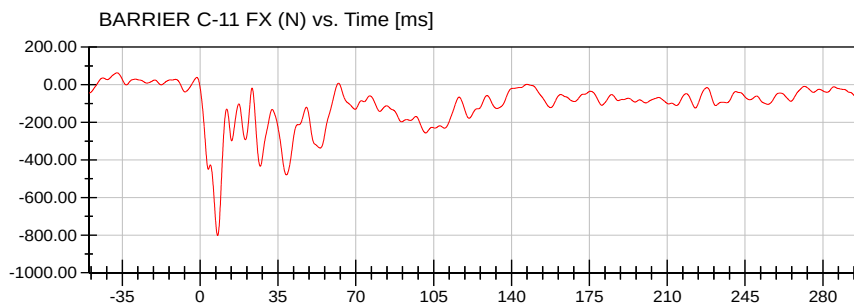
<Max>

45.87 N at 146.80 ms

<Min>

-1,358.15 N at 31.60 ms

CFC_60



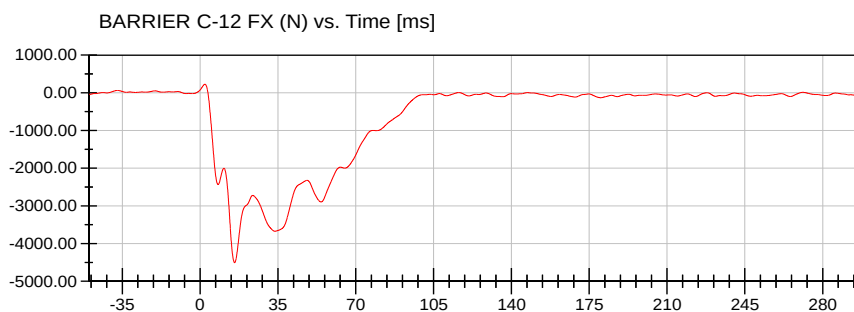
<Max>

63.47 N at -37.35 ms

<Min>

-802.05 N at 7.85 ms

CFC_60



<Max>

228.13 N at 2.15 ms

<Min>

-4,505.96 N at 15.50 ms

CFC_60

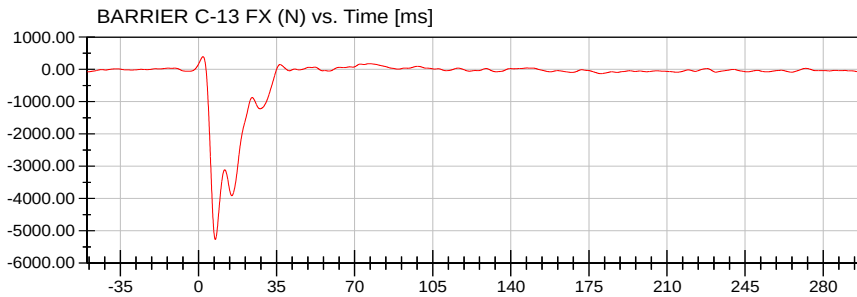


VRTC

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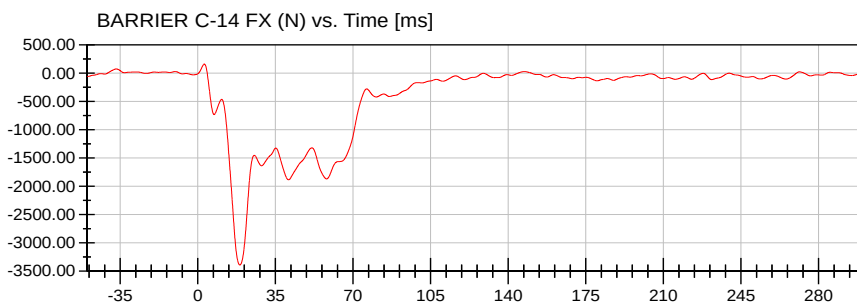
<Max>

394.45 N at 2.00 ms

<Min>

-5,269.04 N at 7.55 ms

CFC_60



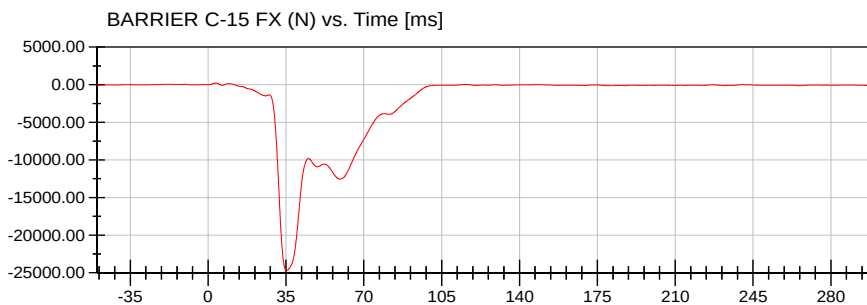
<Max>

162.99 N at 2.90 ms

<Min>

-3,390.15 N at 19.00 ms

CFC_60



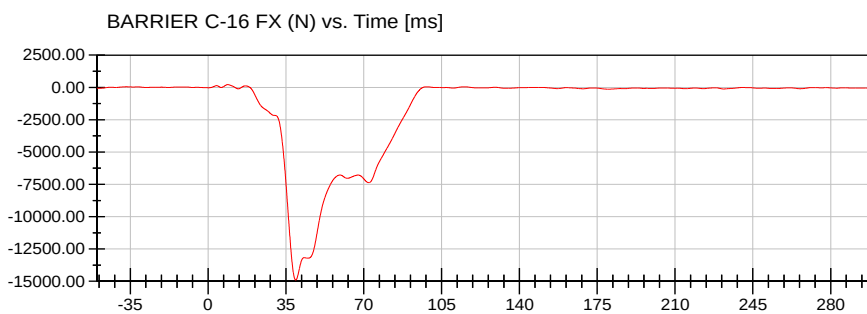
<Max>

214.91 N at 3.55 ms

<Min>

-24,717.01 N at 35.25 ms

CFC_60



<Max>

219.33 N at 8.80 ms

<Min>

-14,905.04 N at 39.40 ms

CFC_60

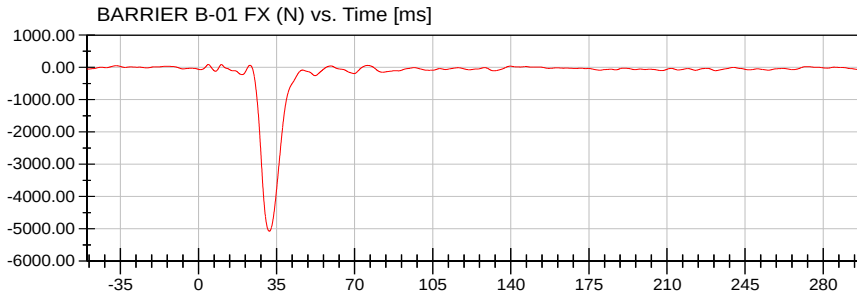


VRTC

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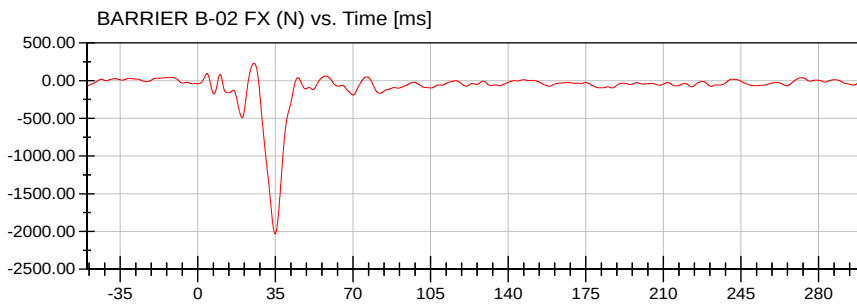
<Max>

88.30 N at 4.45 ms

<Min>

-5,076.92 N at 31.75 ms

CFC_60



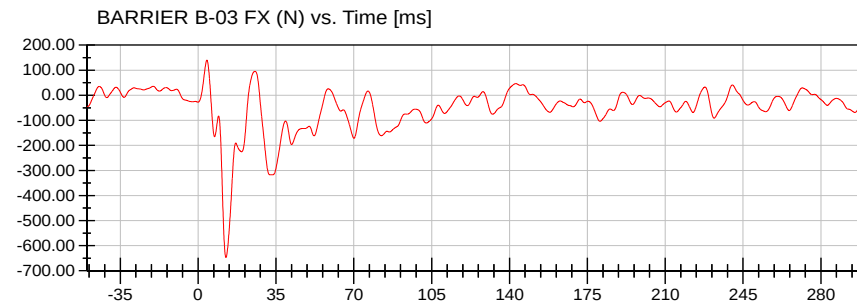
<Max>

230.09 N at 25.30 ms

<Min>

-2,032.96 N at 34.90 ms

CFC_60



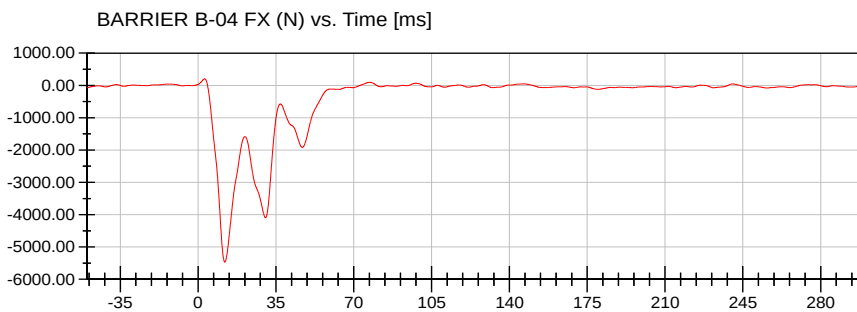
<Max>

139.84 N at 3.95 ms

<Min>

-647.28 N at 12.50 ms

CFC_60



<Max>

202.21 N at 2.90 ms

<Min>

-5,469.32 N at 12.00 ms

CFC_60

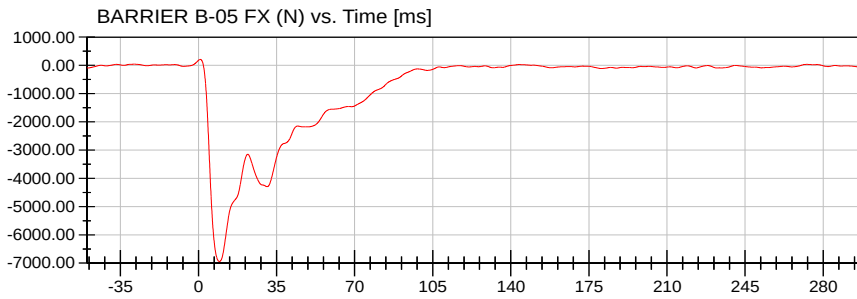


VRTC

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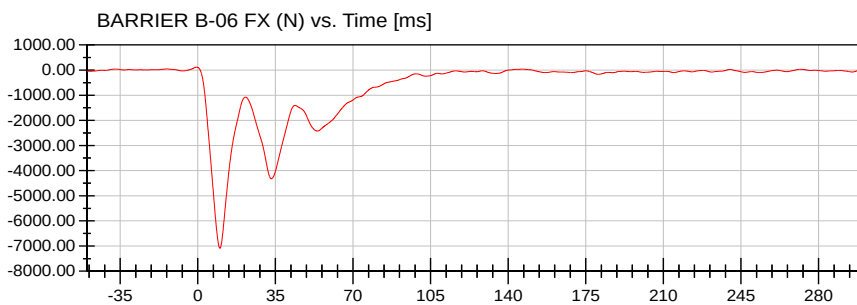
<Max>

209.41 N at 0.85 ms

<Min>

-6,943.73 N at 9.40 ms

CFC_60



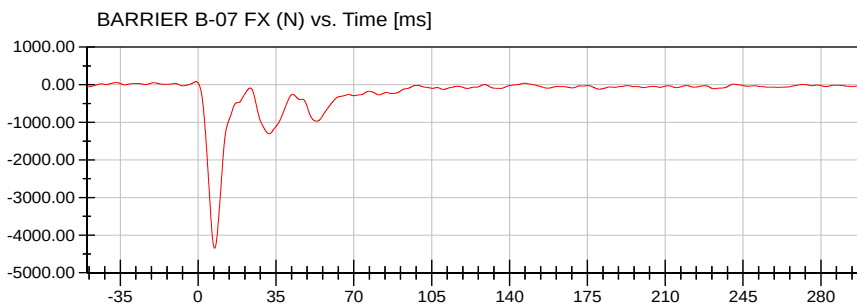
<Max>

117.03 N at -0.45 ms

<Min>

-7,088.21 N at 10.00 ms

CFC_60



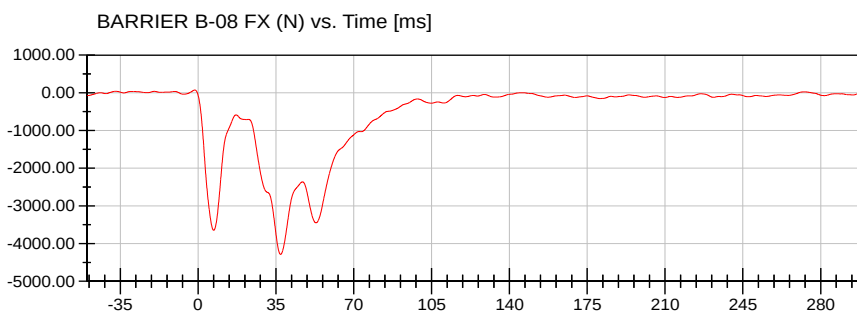
<Max>

80.72 N at -0.95 ms

<Min>

-4,347.02 N at 7.40 ms

CFC_60



<Max>

73.58 N at -1.50 ms

<Min>

-4,286.81 N at 37.10 ms

CFC_60

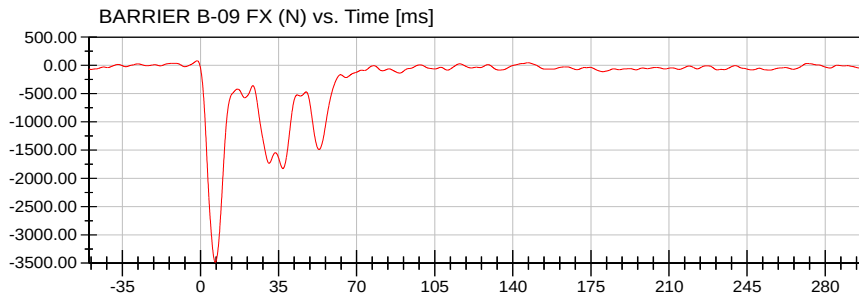


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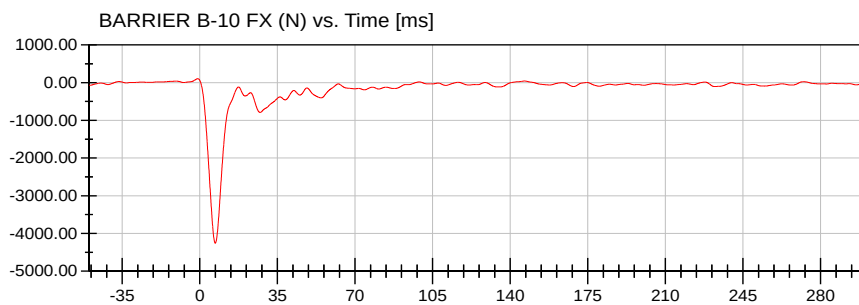
<Max>

80.18 N at -1.50 ms

<Min>

-3,483.37 N at 6.65 ms

CFC_60



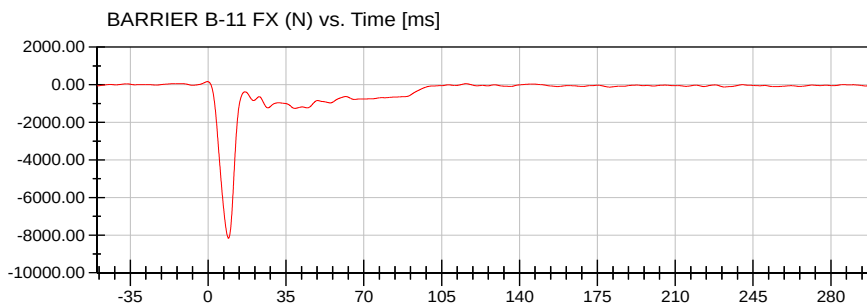
<Max>

105.52 N at -0.95 ms

<Min>

-4,255.73 N at 6.95 ms

CFC_60



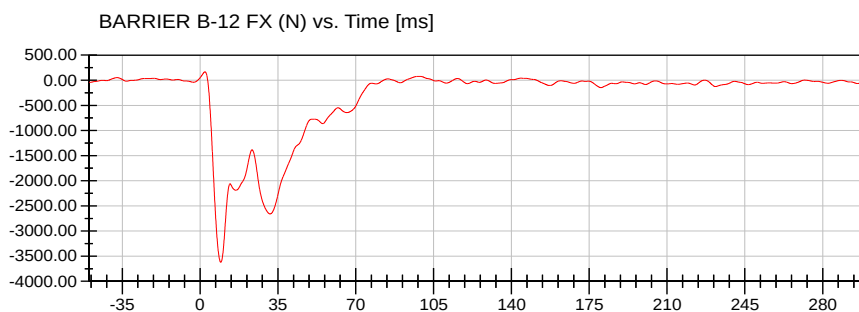
<Max>

163.28 N at -0.30 ms

<Min>

-8,165.59 N at 9.15 ms

CFC_60



<Max>

167.39 N at 2.15 ms

<Min>

-3,620.96 N at 9.30 ms

CFC_60

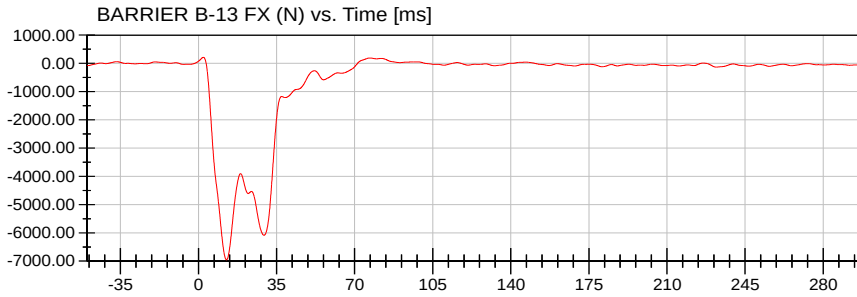


VRTC

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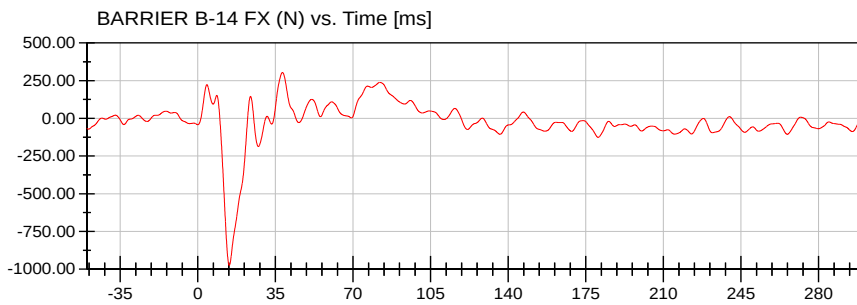
<Max>

212.44 N at 2.20 ms

<Min>

-6,954.61 N at 12.55 ms

CFC_60



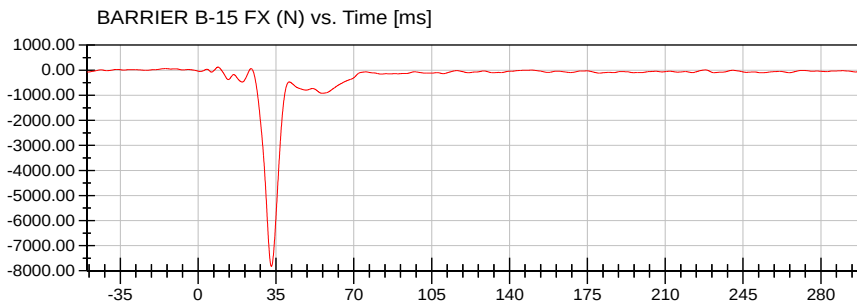
<Max>

304.09 N at 38.20 ms

<Min>

-974.88 N at 14.20 ms

CFC_60



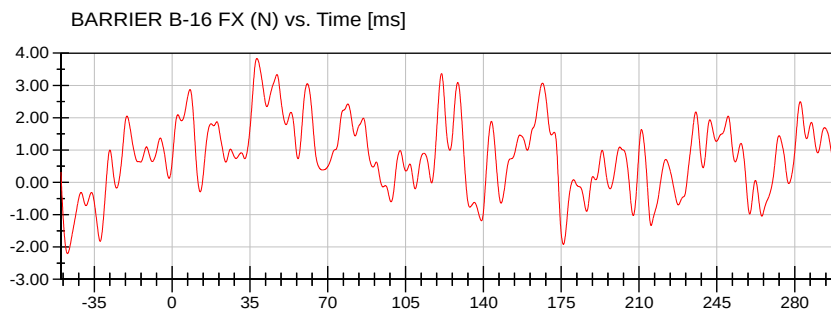
<Max>

123.99 N at 8.90 ms

<Min>

-7,827.40 N at 32.95 ms

CFC_60



<Max>

3.83 N at 38.15 ms

<Min>

-2.20 N at -47.05 ms

CFC_60

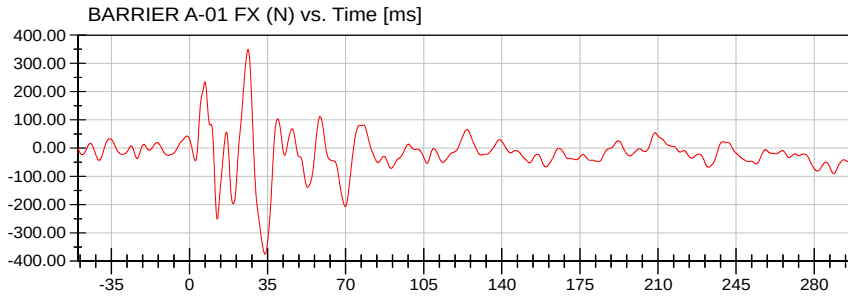


VRTC

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Test Lab: CTF

Test Number: 250325 ()



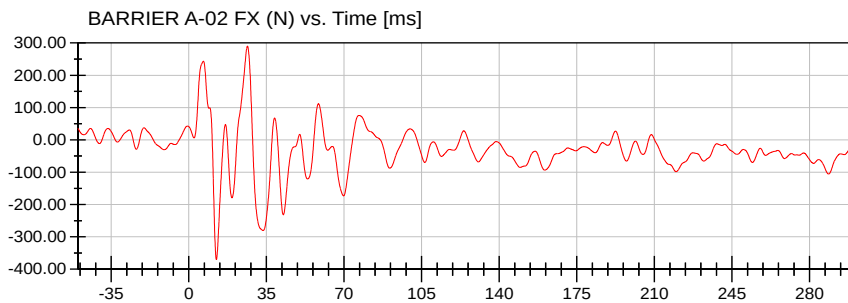
<Max>

348.84 N at 26.20 ms

<Min>

-375.47 N at 33.85 ms

CFC_60



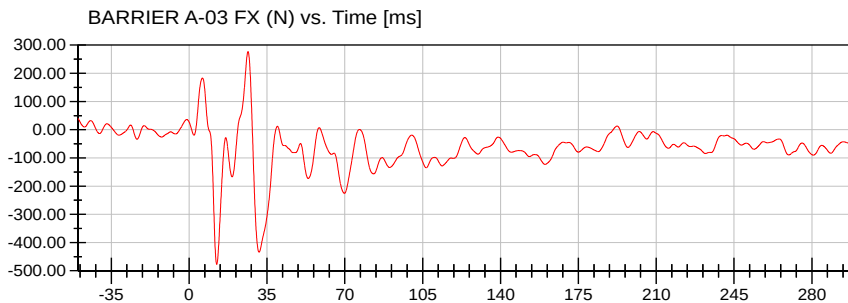
<Max>

290.29 N at 26.45 ms

<Min>

-370.42 N at 12.45 ms

CFC_60



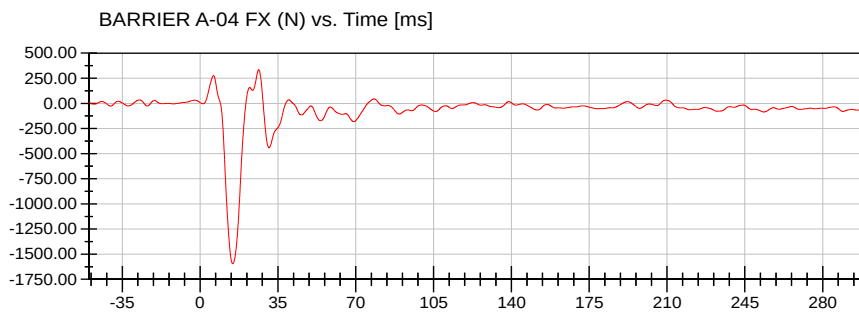
<Max>

277.13 N at 26.45 ms

<Min>

-477.13 N at 12.40 ms

CFC_60



<Max>

335.06 N at 26.35 ms

<Min>

-1,595.11 N at 14.65 ms

CFC_60

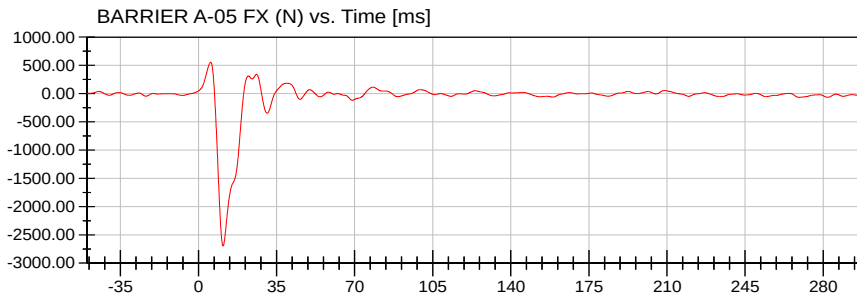


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



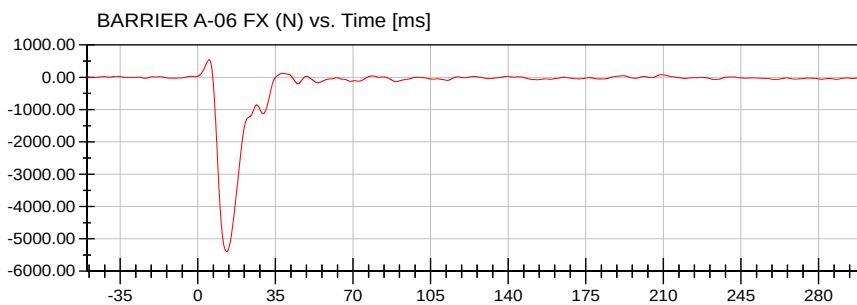
<Max>

554.54 N at 5.45 ms

<Min>

-2,696.21 N at 11.00 ms

CFC_60



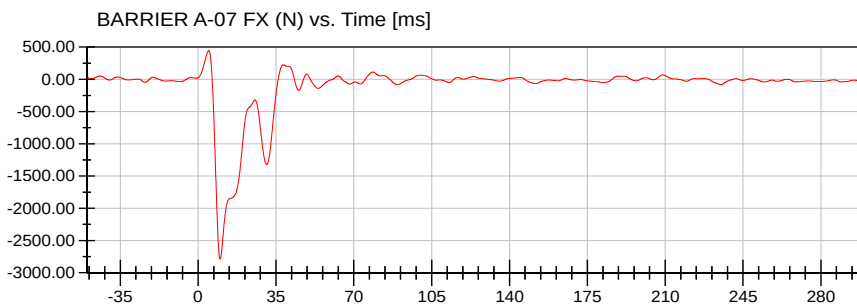
<Max>

540.81 N at 5.15 ms

<Min>

-5,390.52 N at 13.05 ms

CFC_60



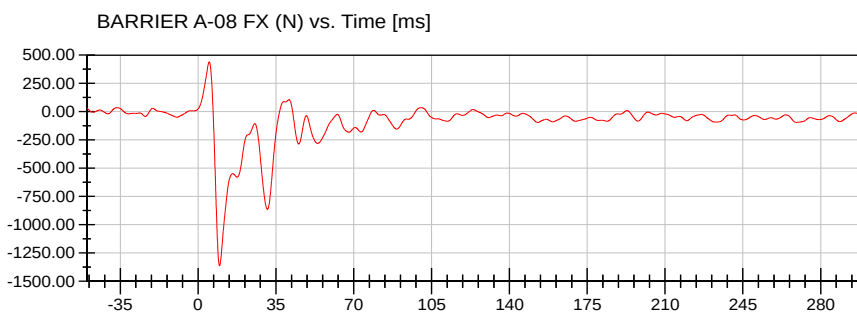
<Max>

447.16 N at 4.75 ms

<Min>

-2,786.78 N at 9.90 ms

CFC_60



<Max>

440.21 N at 5.00 ms

<Min>

-1,362.11 N at 9.65 ms

CFC_60

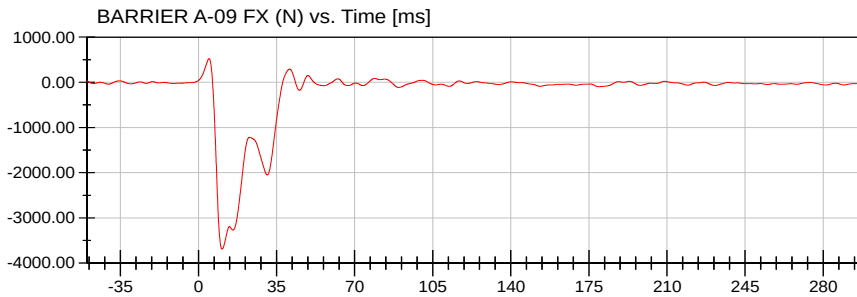


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



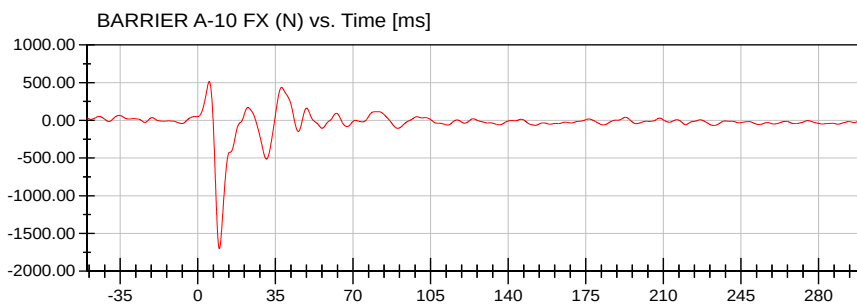
<Max>

525.80 N at 4.75 ms

<Min>

-3,690.66 N at 10.60 ms

CFC_60



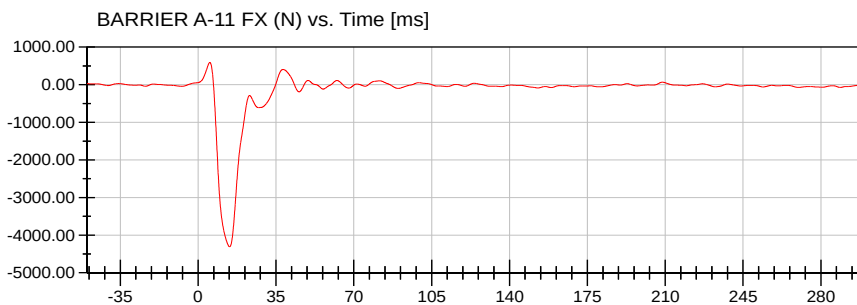
<Max>

515.32 N at 5.15 ms

<Min>

-1,701.74 N at 9.75 ms

CFC_60



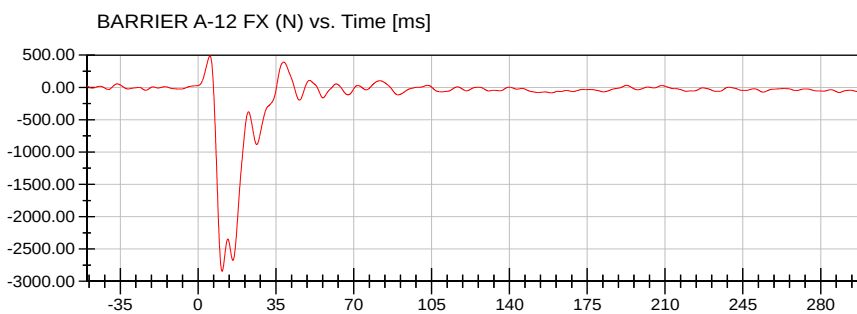
<Max>

592.38 N at 5.25 ms

<Min>

-4,308.59 N at 14.15 ms

CFC_60



<Max>

487.80 N at 5.35 ms

<Min>

-2,844.84 N at 10.80 ms

CFC_60

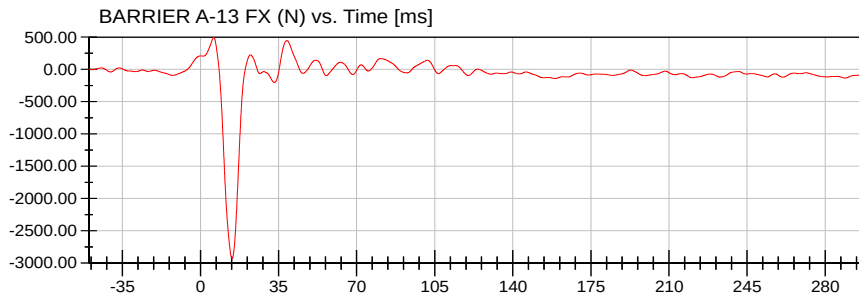


VRTC

Test Date: 03/25/2025

Test Lab: CTF

Test Number: 250325 ()



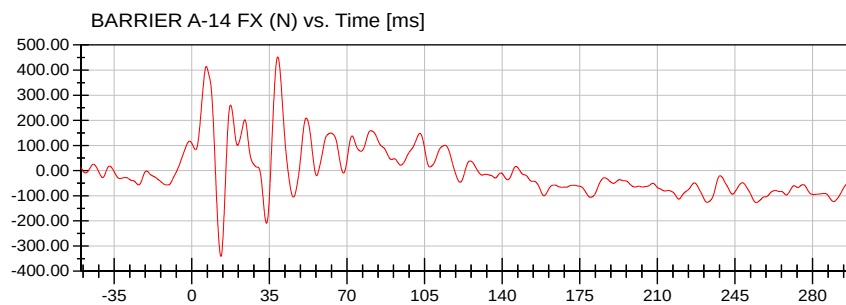
<Max>

496.01 N at 5.95 ms

<Min>

-2,930.17 N at 14.15 ms

CFC_60



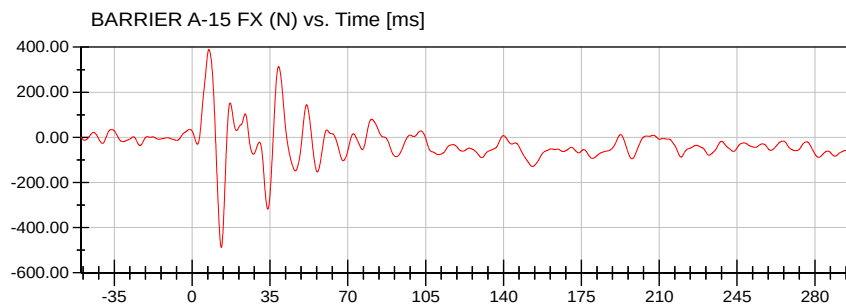
<Max>

452.58 N at 38.75 ms

<Min>

-341.45 N at 13.15 ms

CFC_60



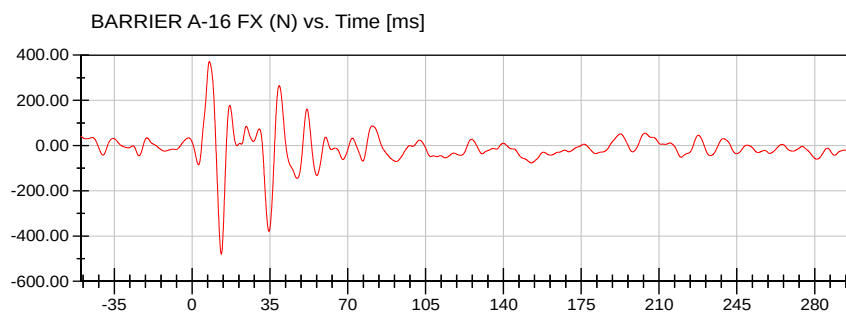
<Max>

389.37 N at 7.50 ms

<Min>

-487.82 N at 13.10 ms

CFC_60



<Max>

372.07 N at 7.75 ms

<Min>

-480.35 N at 13.10 ms

CFC_60



APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION

THOR-50M Upper Thorax Qualification

Test Results Summary

Dummy Serial Number: EG2595

Tested Components

Rib 1 Serial Number:
Rib 2 Serial Number:
Rib 3 Serial Number:
Rib 4 Serial Number:

Rib 5 Serial Number:
Rib 6 Serial Number:
Rib 7 Serial Number:

Test ID: 250213-9
Test Date: 2/13/2025
Test Time: 10:28 AM

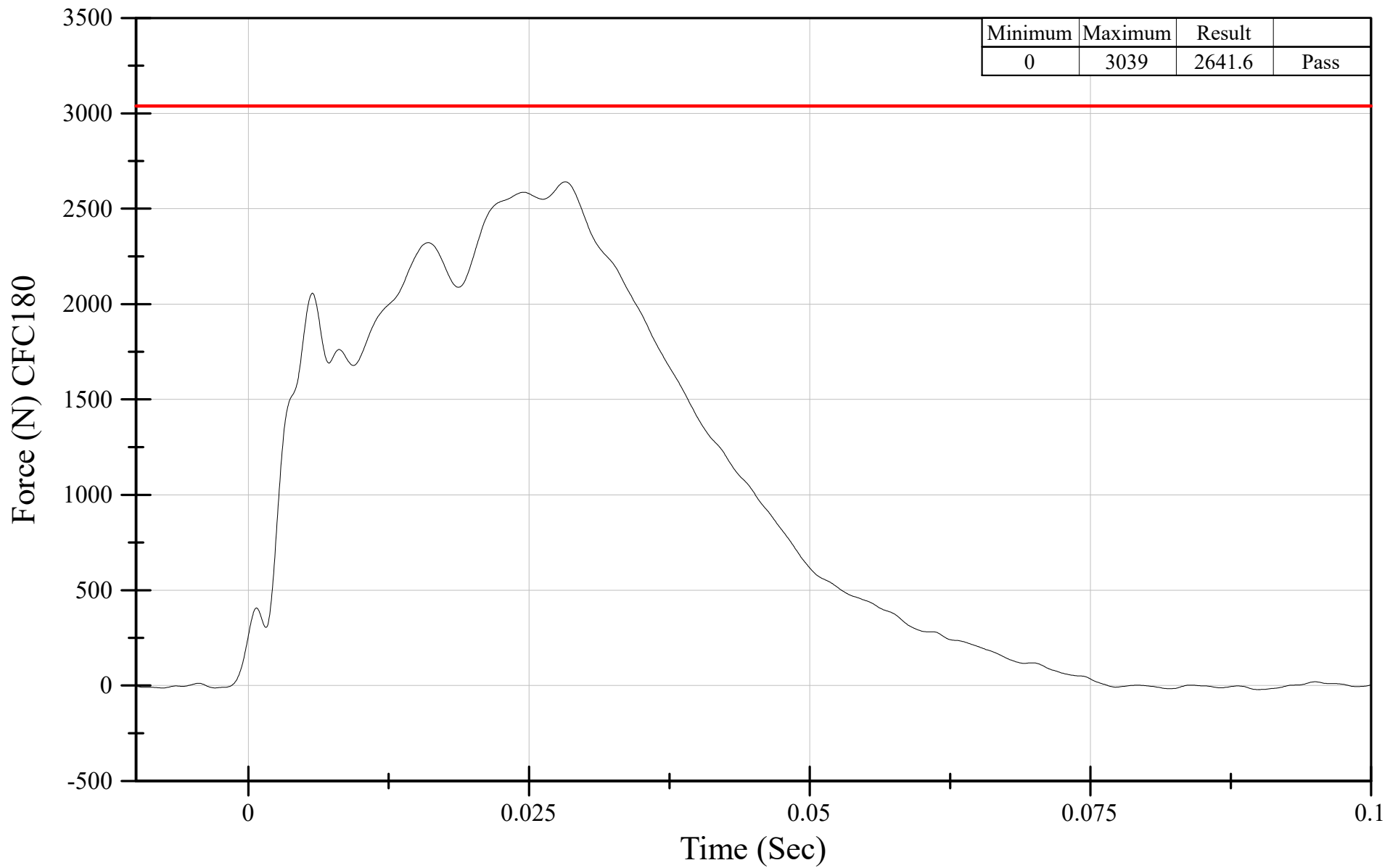
Test Results

<u>Test Parameter</u>	<u>Specification Range*</u>	<u>Result</u>	<u>Pass/Fail</u>
Test Temperature (°C)	20.6 - 22.2	21.7	Pass
Test Humidity (%)	10 - 70	52	Pass
Test Velocity (m/s)	4.25 - 4.35	4.305	Pass
Peak Probe Force (N)	less than 3039	2641.6	Pass
Peak Upper Left Resultant Deflection (mm)	48.3 - 59.0	52.79	Pass
Peak Upper Right Resultant Deflection (mm)	48.3 - 59.0	52.40	Pass
Difference Between Peak Left & Right Resultant Deflections (mm)	less than 5.0	0.4	Pass
Force at Left Peak Resultant Deflection (N)	2409 - 2944	2555.4	Pass
Force at Right Peak Resultant Deflection (N)	2409 - 2944	2579.2	Pass

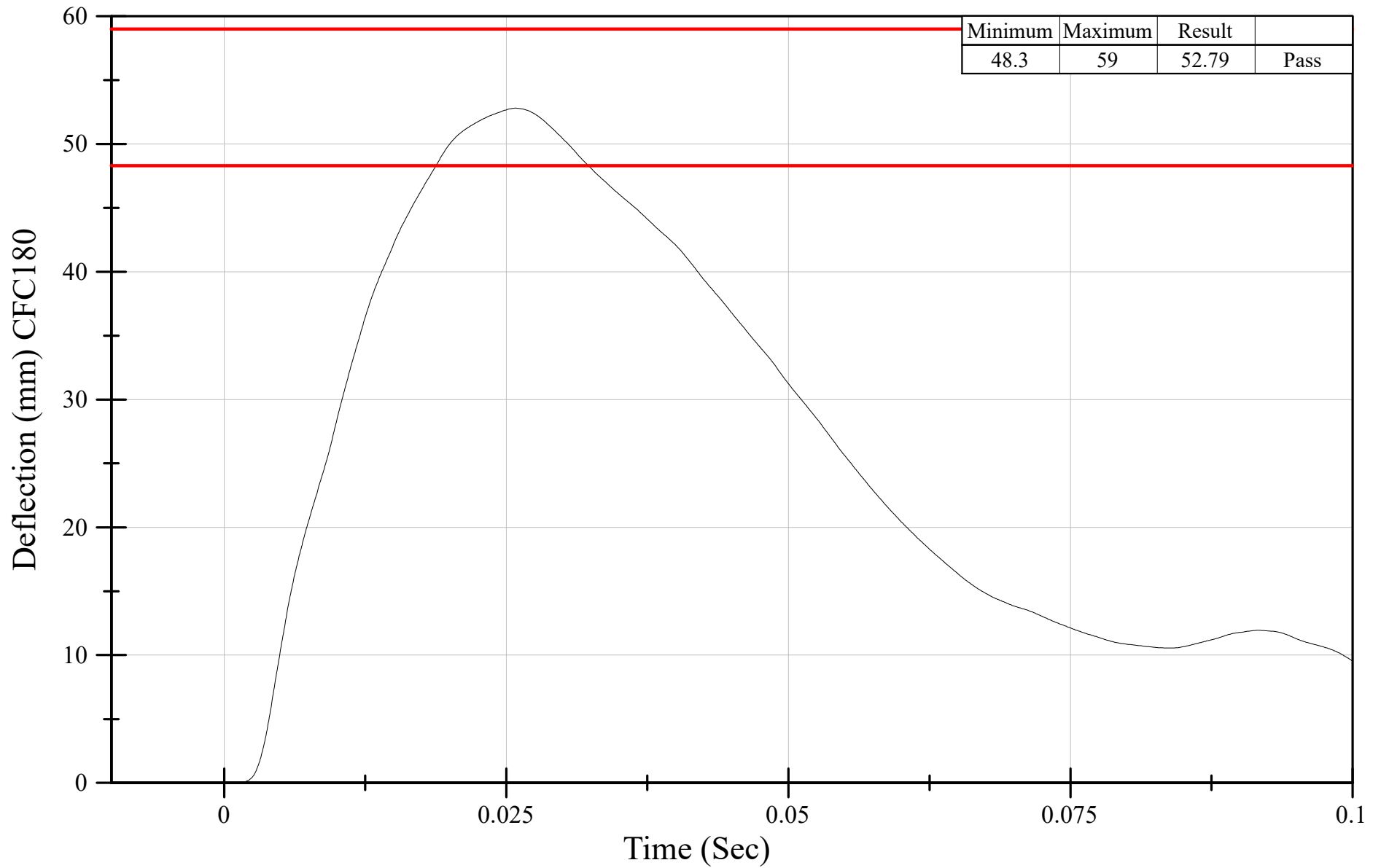
THOR-50M Upper Thorax Qualification

Probe Force

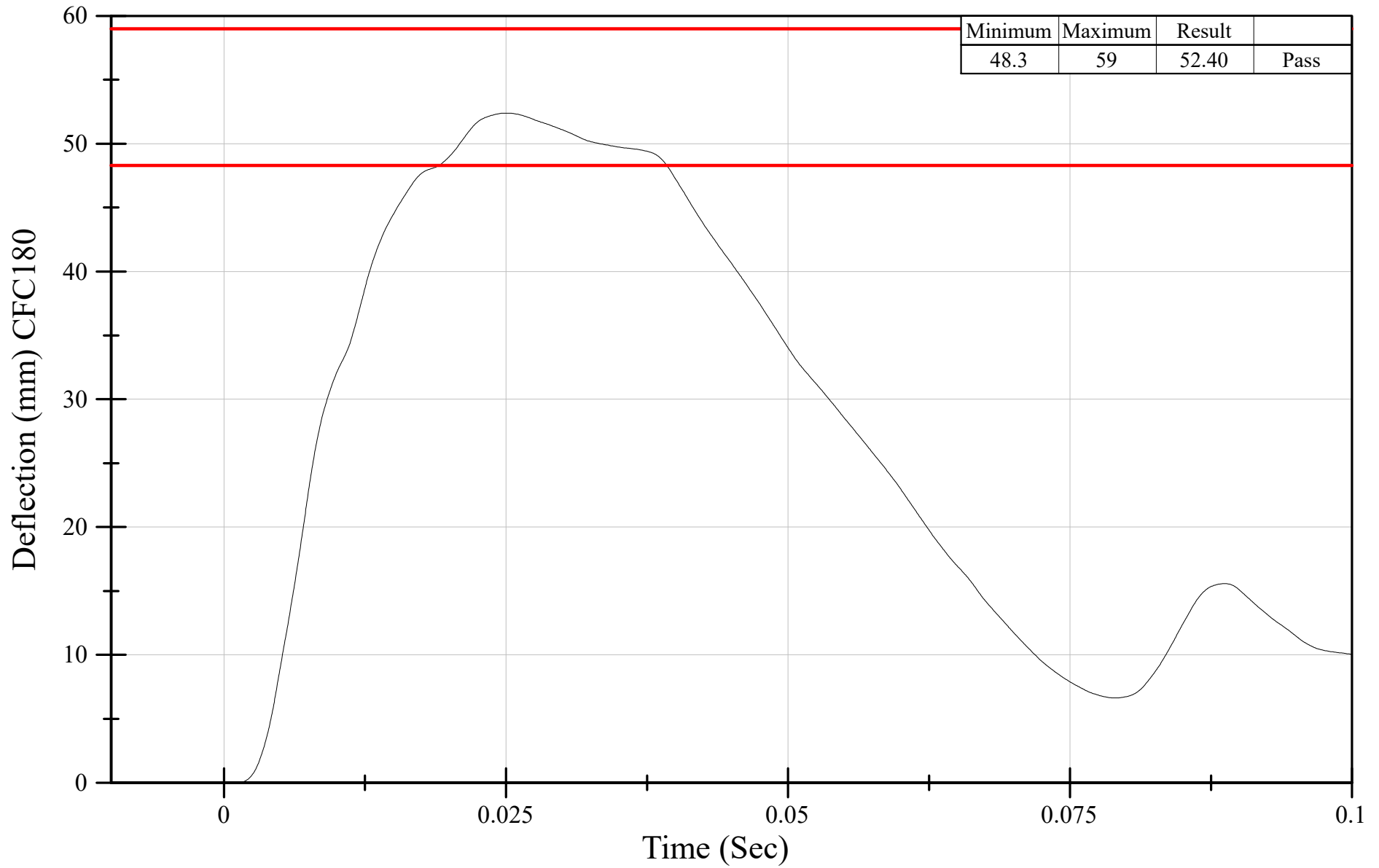
Serial Number: EG2595



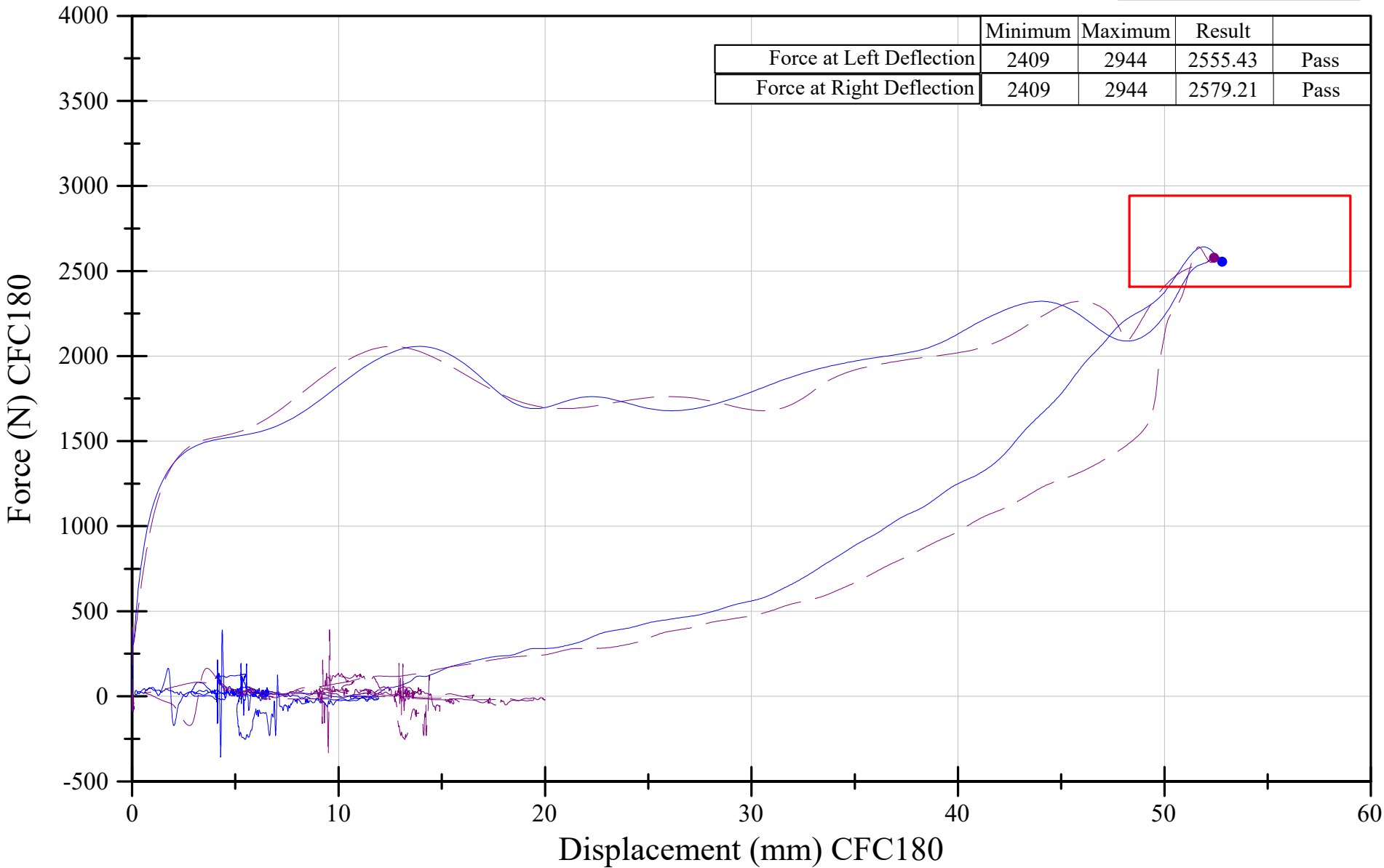
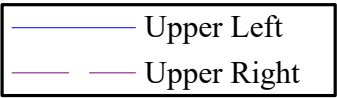
THOR-50M Upper Thorax Qualification
Left Resultant Deflection
Serial Number: EG2595



THOR-50M Upper Thorax Qualification
Right Resultant Deflection
Serial Number: EG2595



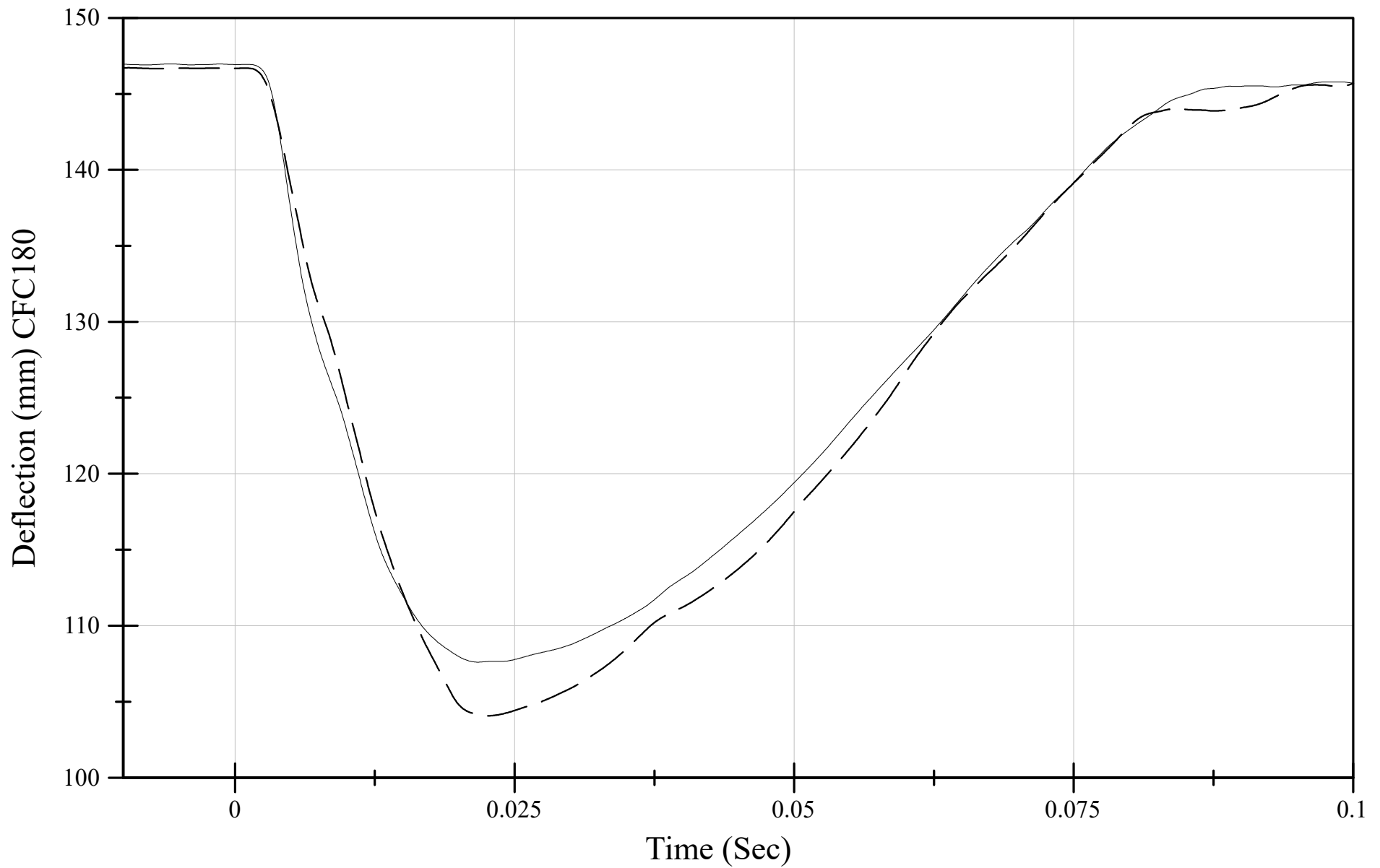
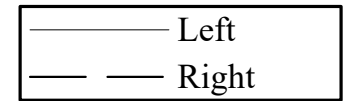
THOR-50M Upper Thorax Qualification
Probe Force vs Resultant Deflection
Serial Number: EG2595



THOR-50M Upper Thorax Qualification

X-Deflection

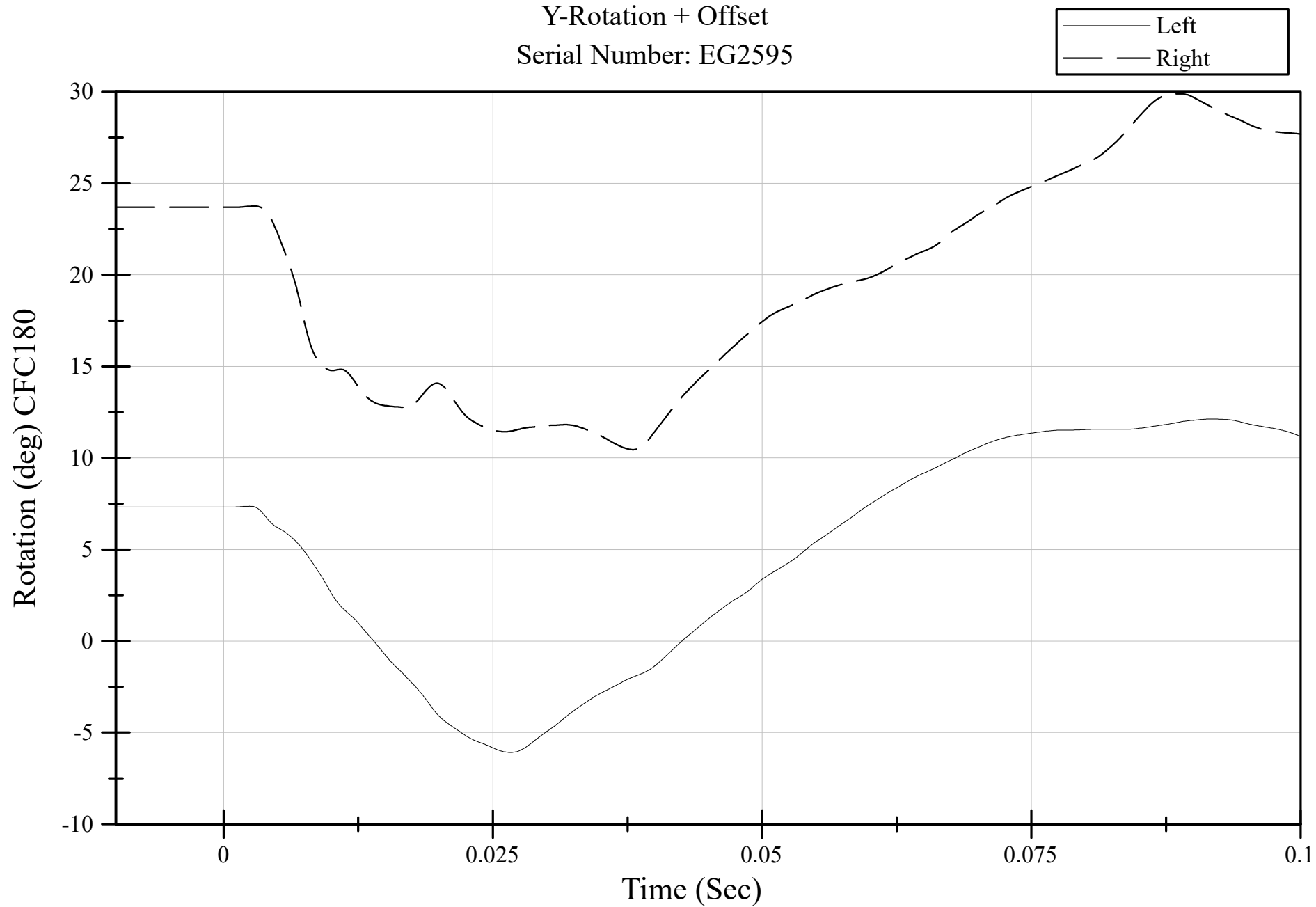
Serial Number: EG2595



THOR-50M Upper Thorax Qualification

Y-Rotation + Offset

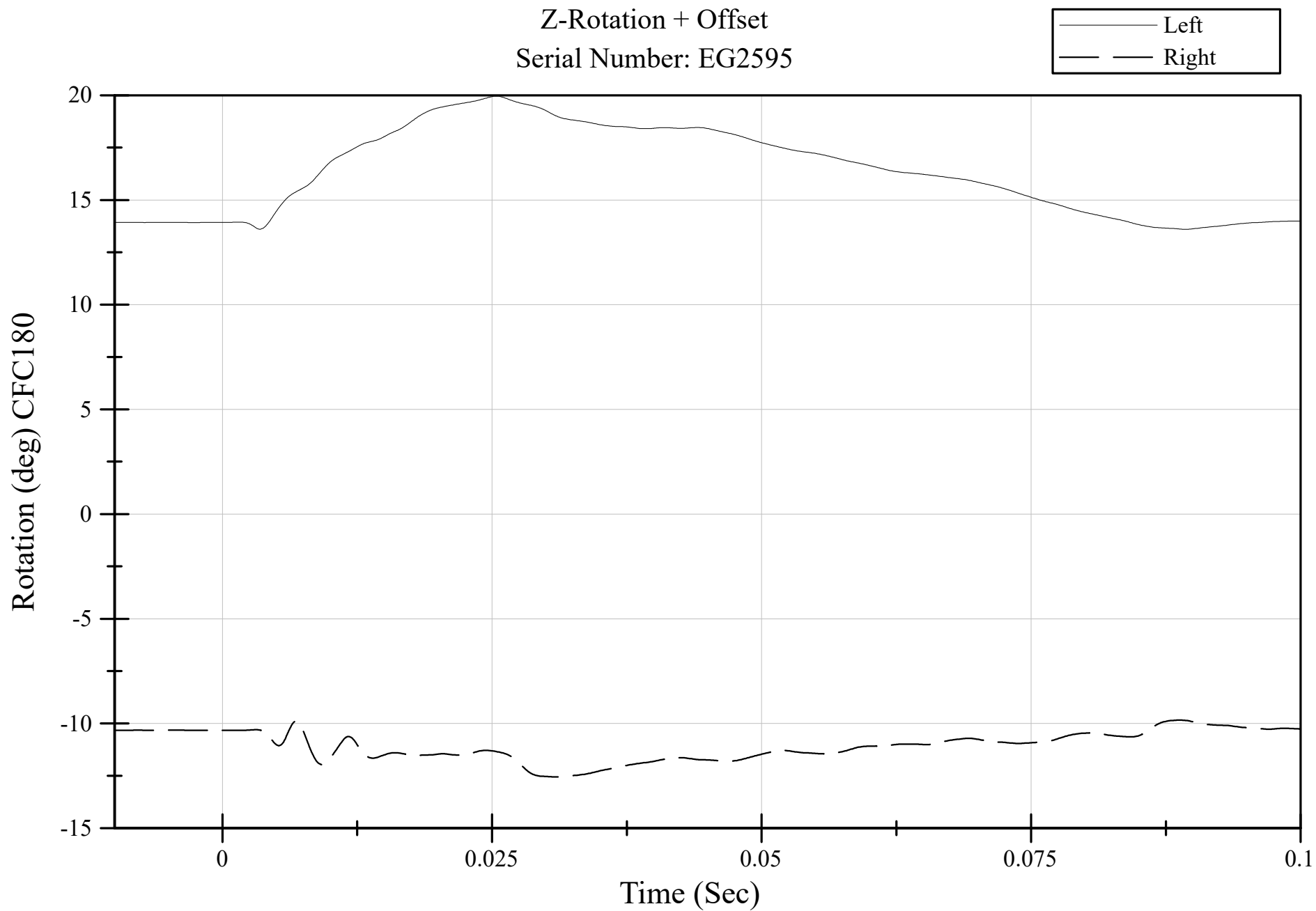
Serial Number: EG2595



THOR-50M Upper Thorax Qualification

Z-Rotation + Offset

Serial Number: EG2595



THOR-50M Left Lower Thorax Qualification

Test Results Summary

Dummy Serial Number: EG2595

Tested Components

Rib 1 Serial Number:

Rib 2 Serial Number:

Rib 3 Serial Number:

Rib 4 Serial Number:

Rib 5 Serial Number:

Rib 6 Serial Number:

Rib 7 Serial Number:

Test ID: 250213-12

Test Date: 2/13/2025

Test Time: 12:47 PM

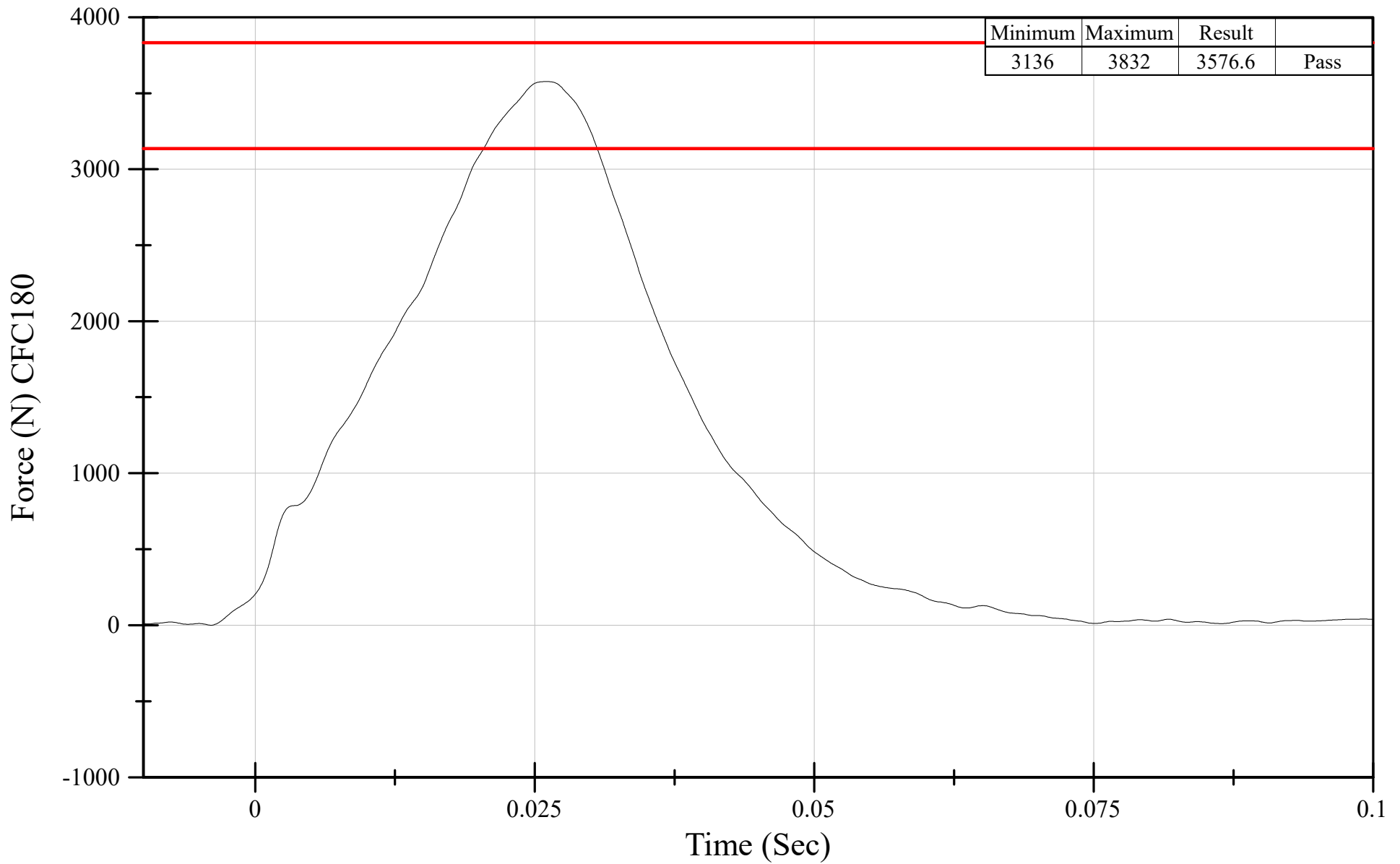
Test Results

<u>Test Parameter</u>	<u>Specification Range*</u>	<u>Result</u>	<u>Pass/Fail</u>
Test Temperature (°C)	20.6 - 22.2	21.4	Pass
Test Humidity (%)	10 - 70	50	Pass
Test Velocity (m/s)	4.25 - 4.35	4.295	Pass
Peak Probe Force (N)	3136 - 3832	3576.6	Pass
Left Resultant Deflection at Peak Force (mm)	45.8 - 56.0	50.52	Pass

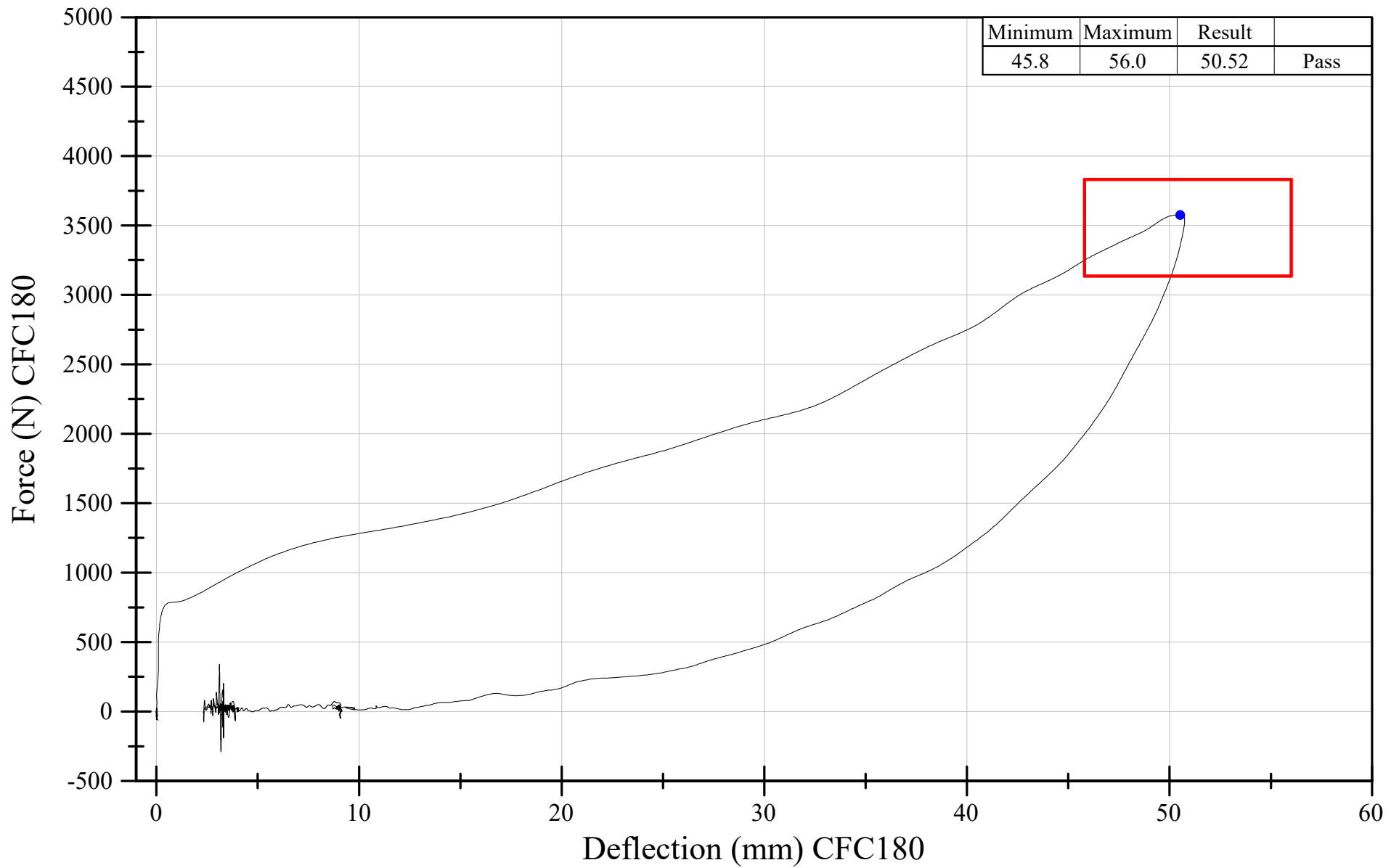
THOR-50M Left Lower Thorax Qualification

Probe Force

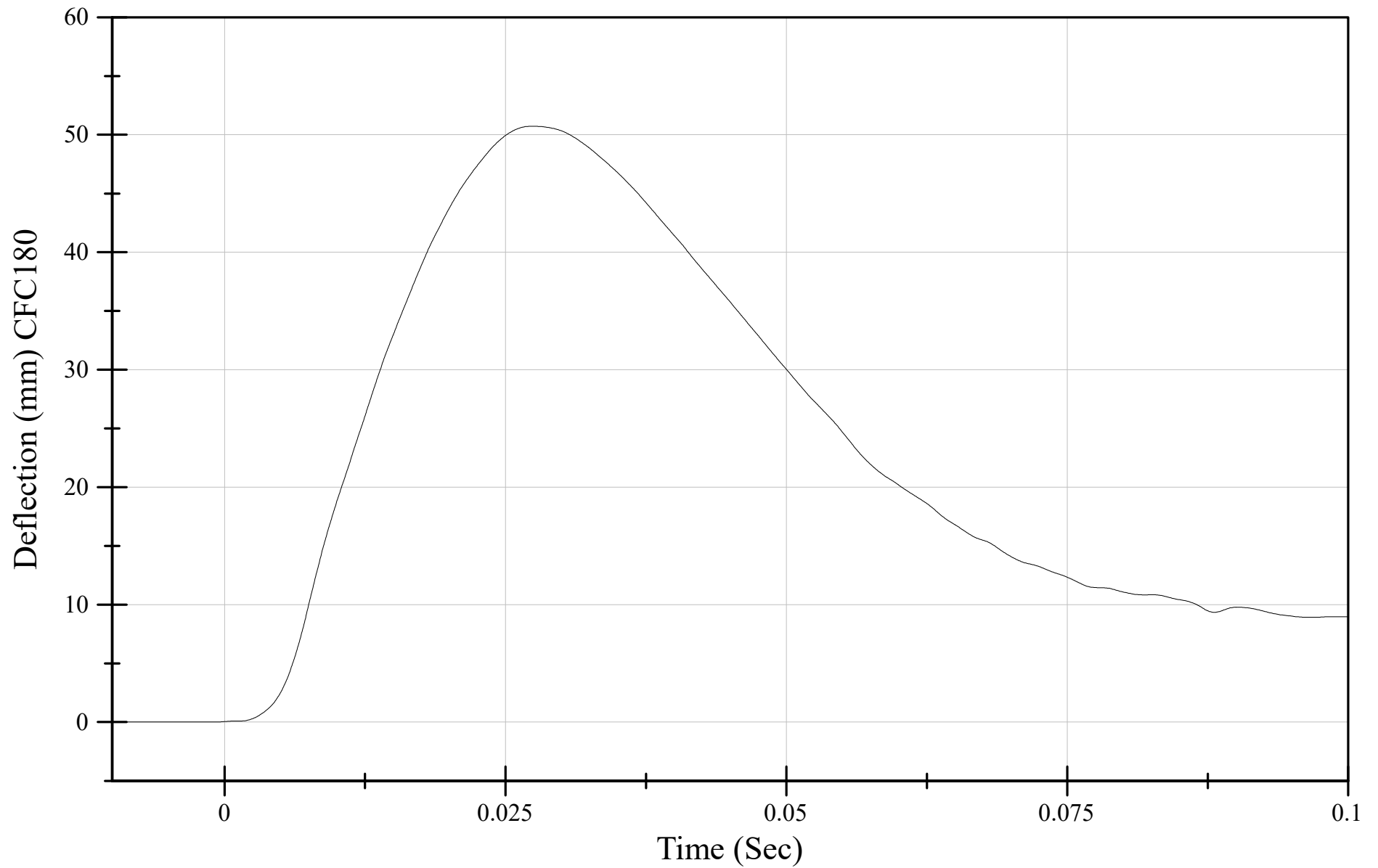
Serial Number: EG2595



THOR-50M Left Lower Thorax Qualification
Left Resultant Deflection at Peak Force
Serial Number: EG2595



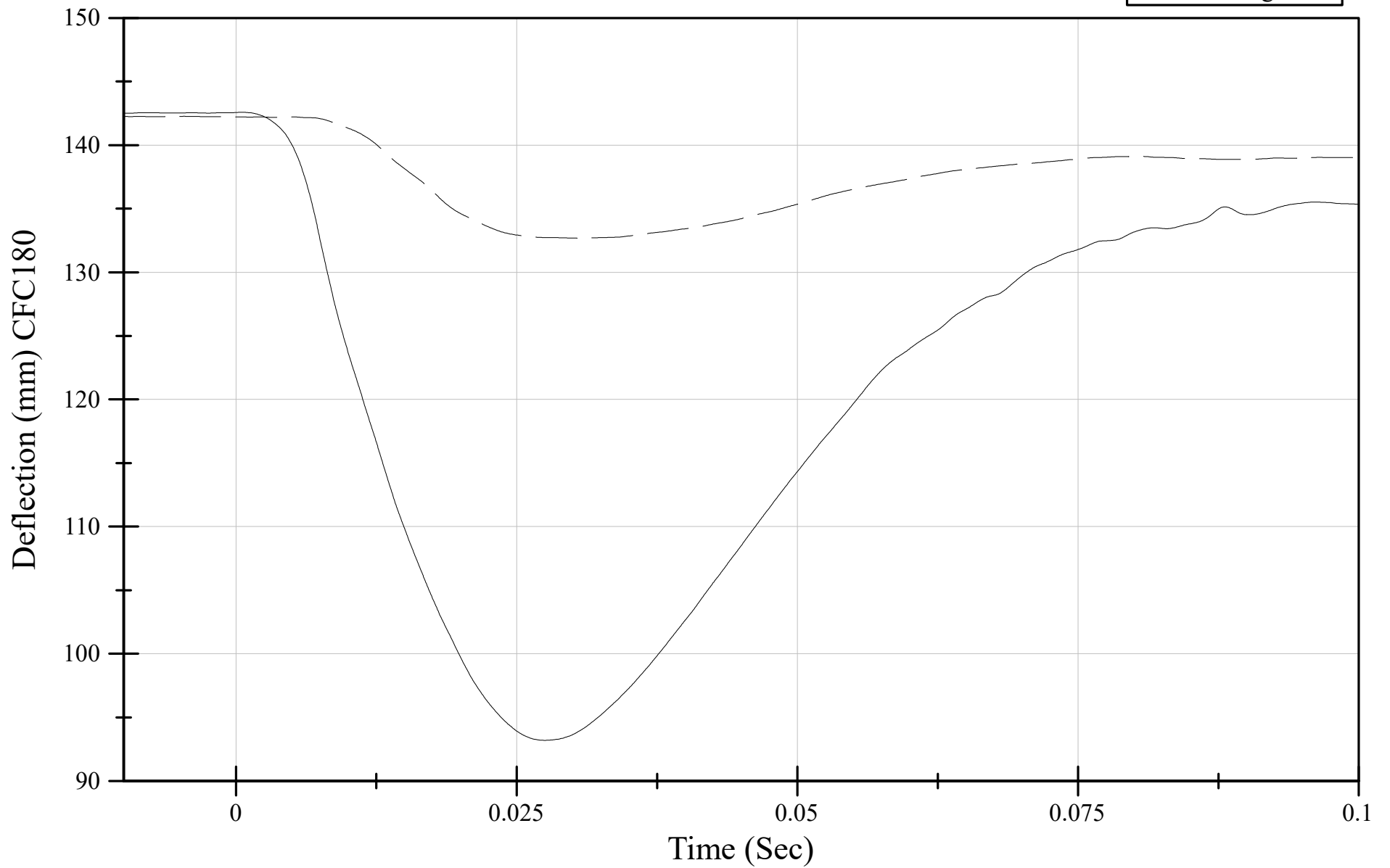
THOR-50M Left Lower Thorax Qualification
Left Resultant Deflection
Serial Number: EG2595



THOR-50M Left Lower Thorax Qualification

X-Deflection

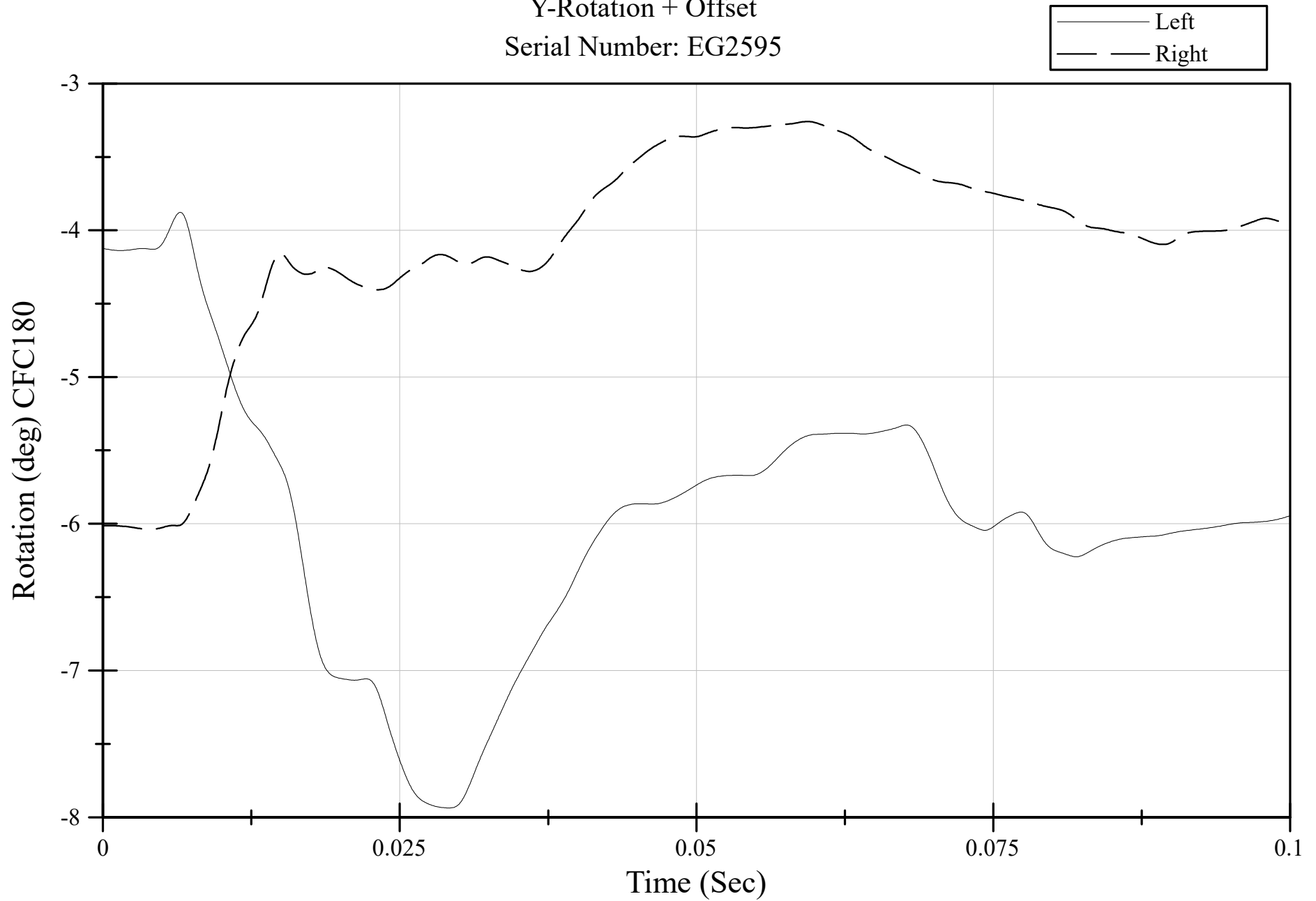
Serial Number: EG2595



THOR-50M Left Lower Thorax Qualification

Y-Rotation + Offset

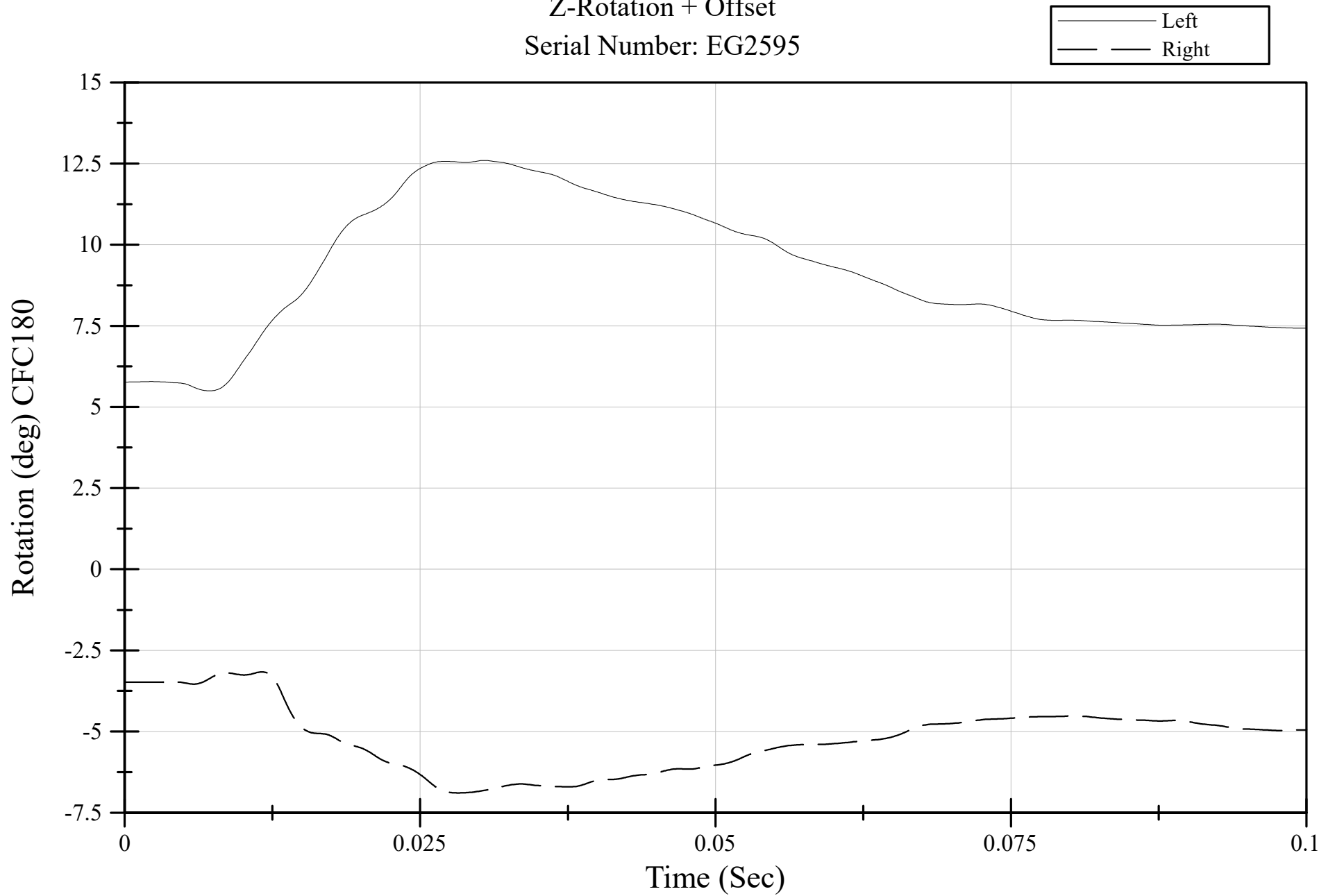
Serial Number: EG2595



THOR-50M Left Lower Thorax Qualification

Z-Rotation + Offset

Serial Number: EG2595



THOR-50M Right Lower Thorax Qualification

Test Results Summary

Dummy Serial Number: EG2595

Tested Components

Rib 1 Serial Number:

Rib 5 Serial Number:

Rib 2 Serial Number:

Rib 6 Serial Number:

Rib 3 Serial Number:

Rib 7 Serial Number:

Rib 4 Serial Number:

Test ID: 250213-14

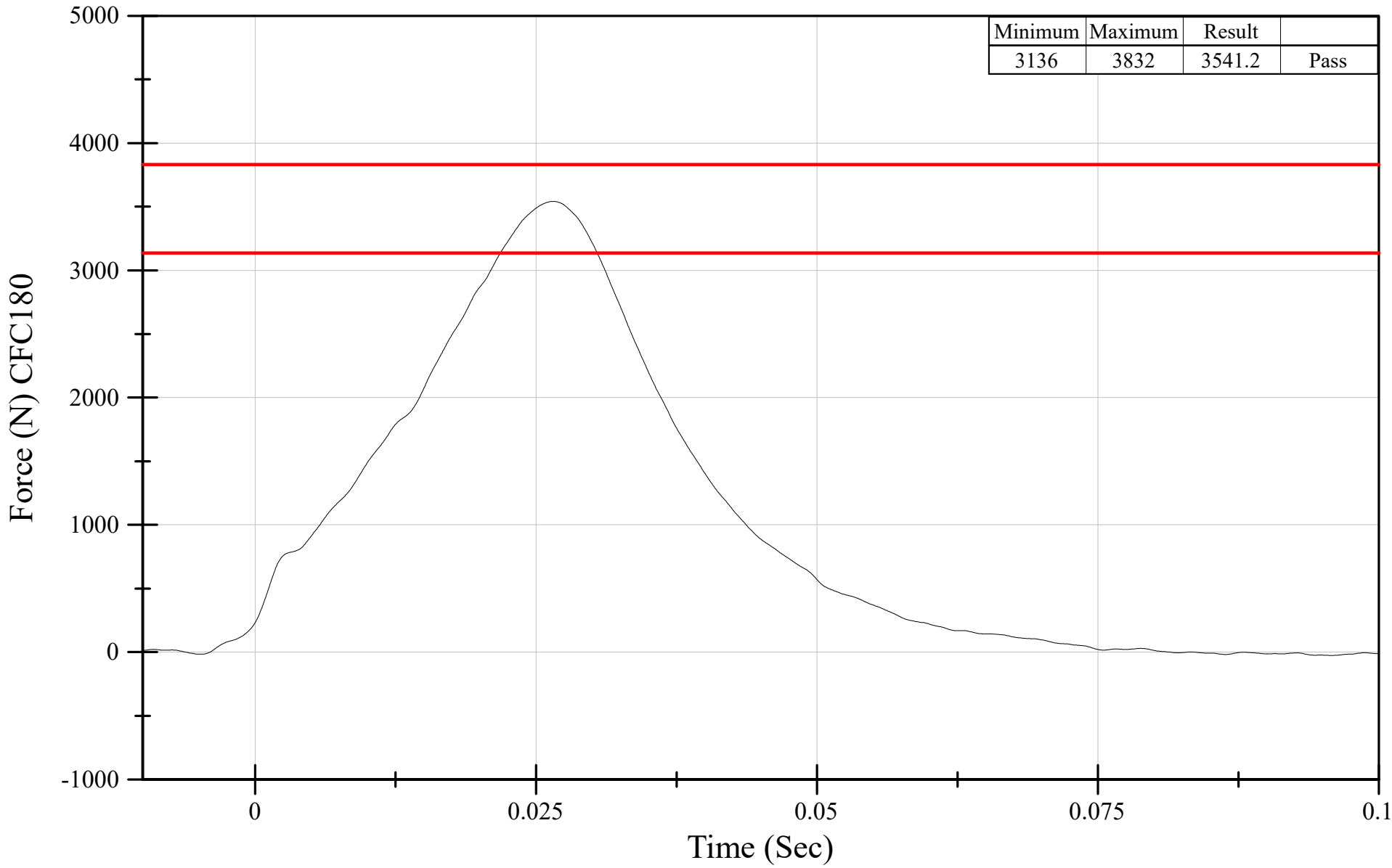
Test Date: 2/13/2025

Test Time: 2:06 PM

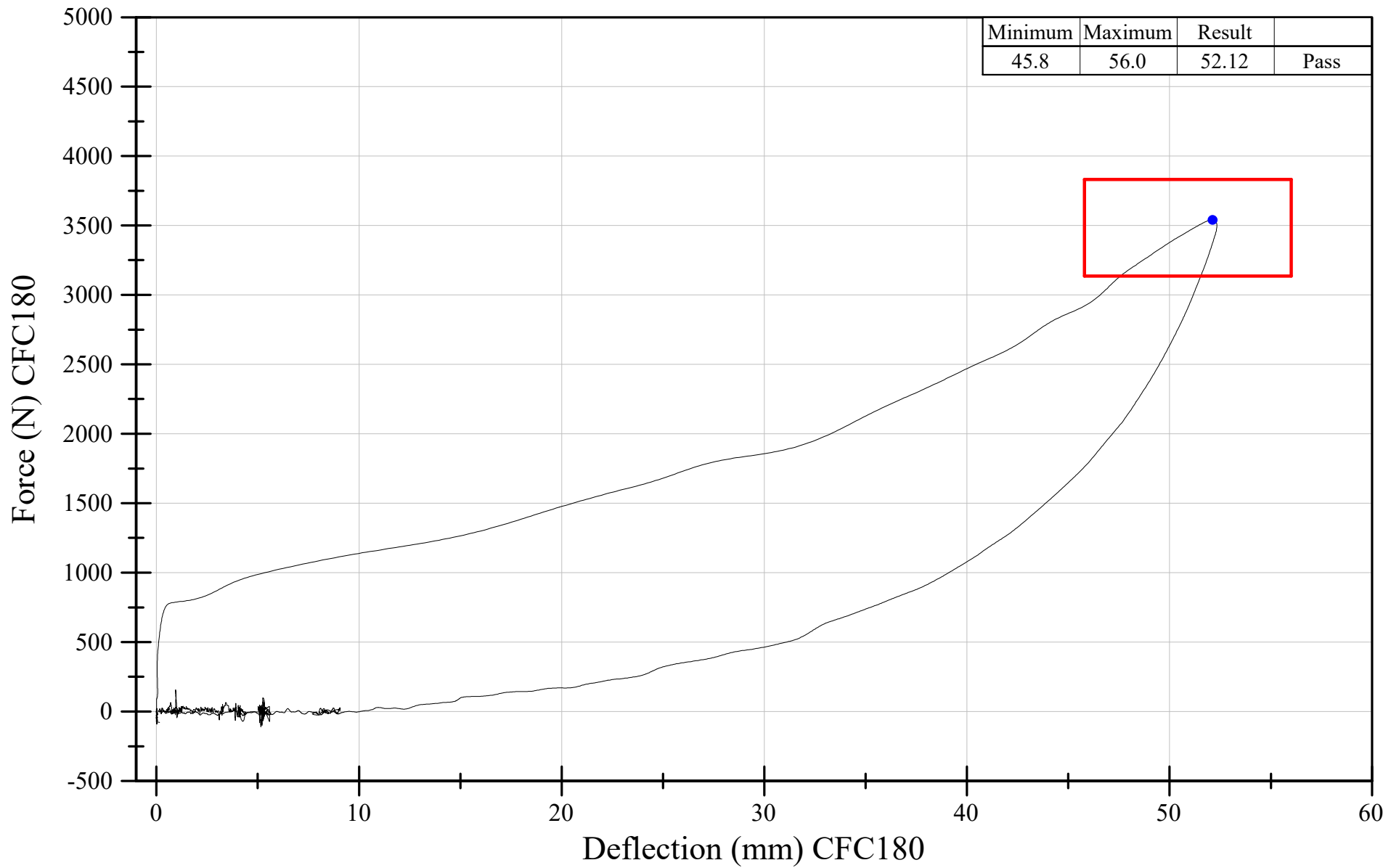
Test Results

<u>Test Parameter</u>	<u>Specification Range*</u>	<u>Result</u>	<u>Pass/Fail</u>
Test Temperature (°C)	20.6 - 22.2	21.3	Pass
Test Humidity (%)	10 - 70	51	Pass
Test Velocity (m/s)	4.25 - 4.35	4.305	Pass
Peak Probe Force (N)	3136 - 3832	3541.2	Pass
Right Resultant Deflection at Peak Force (mm)	45.8 - 56.0	52.12	Pass

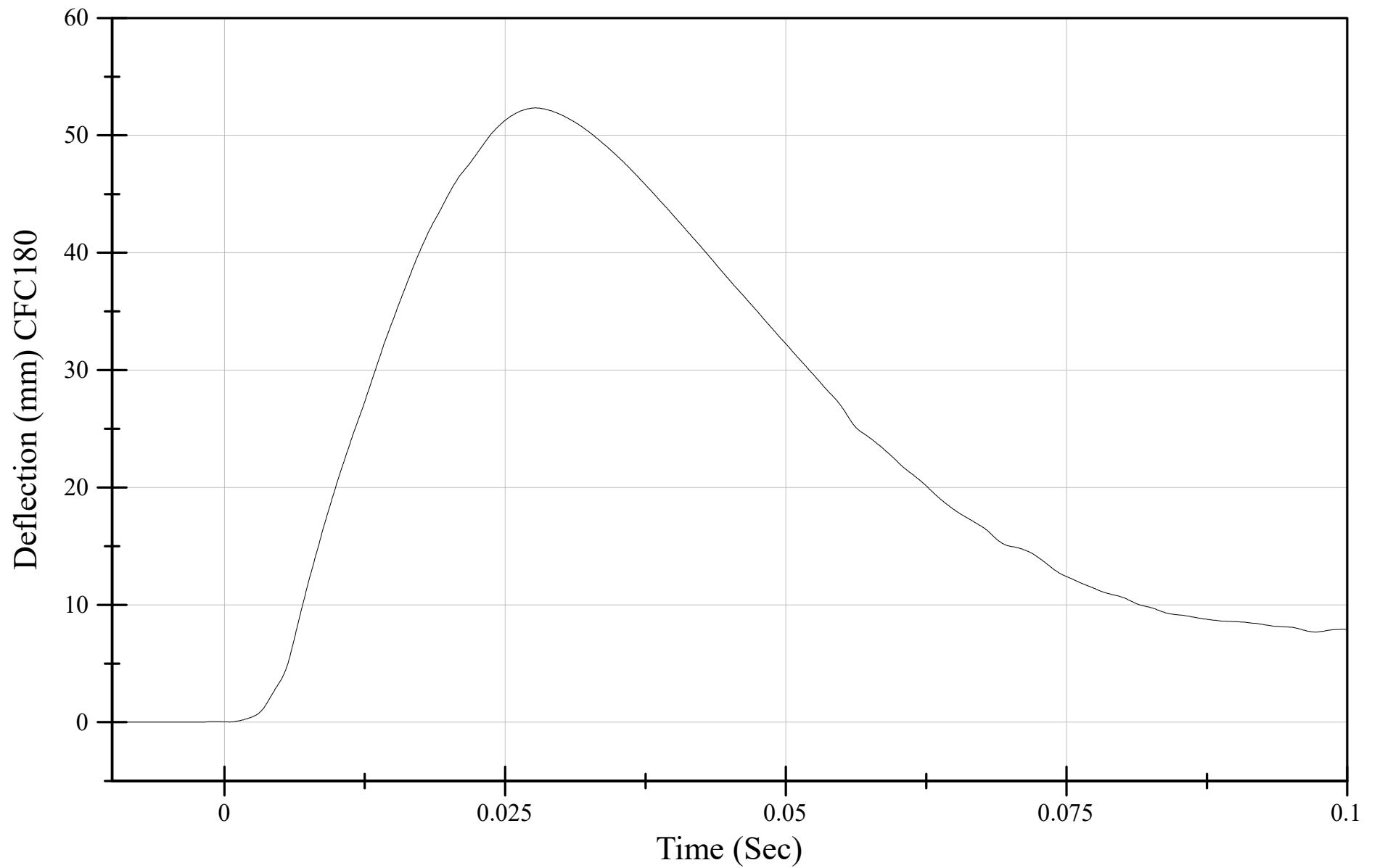
THOR-50M Right Lower Thorax Qualification
Probe Force
Serial Number: EG2595



THOR-50M Right Lower Thorax Qualification
Right Resultant Deflection at Peak Force
Serial Number: EG2595



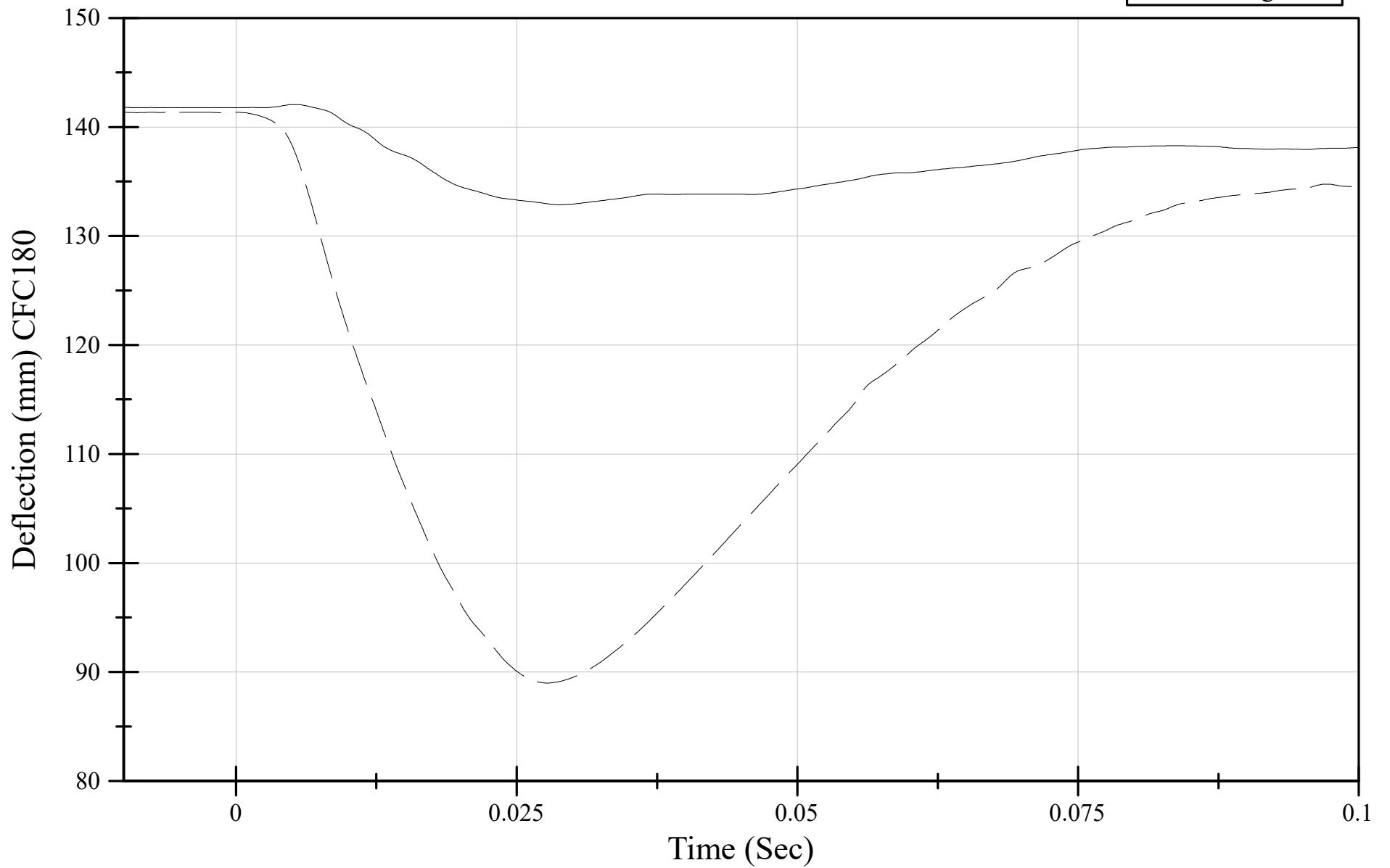
THOR-50M Right Lower Thorax Qualification
Right Resultant Deflection
Serial Number: EG2595



THOR-50M Right Lower Thorax Qualification

X-Deflection

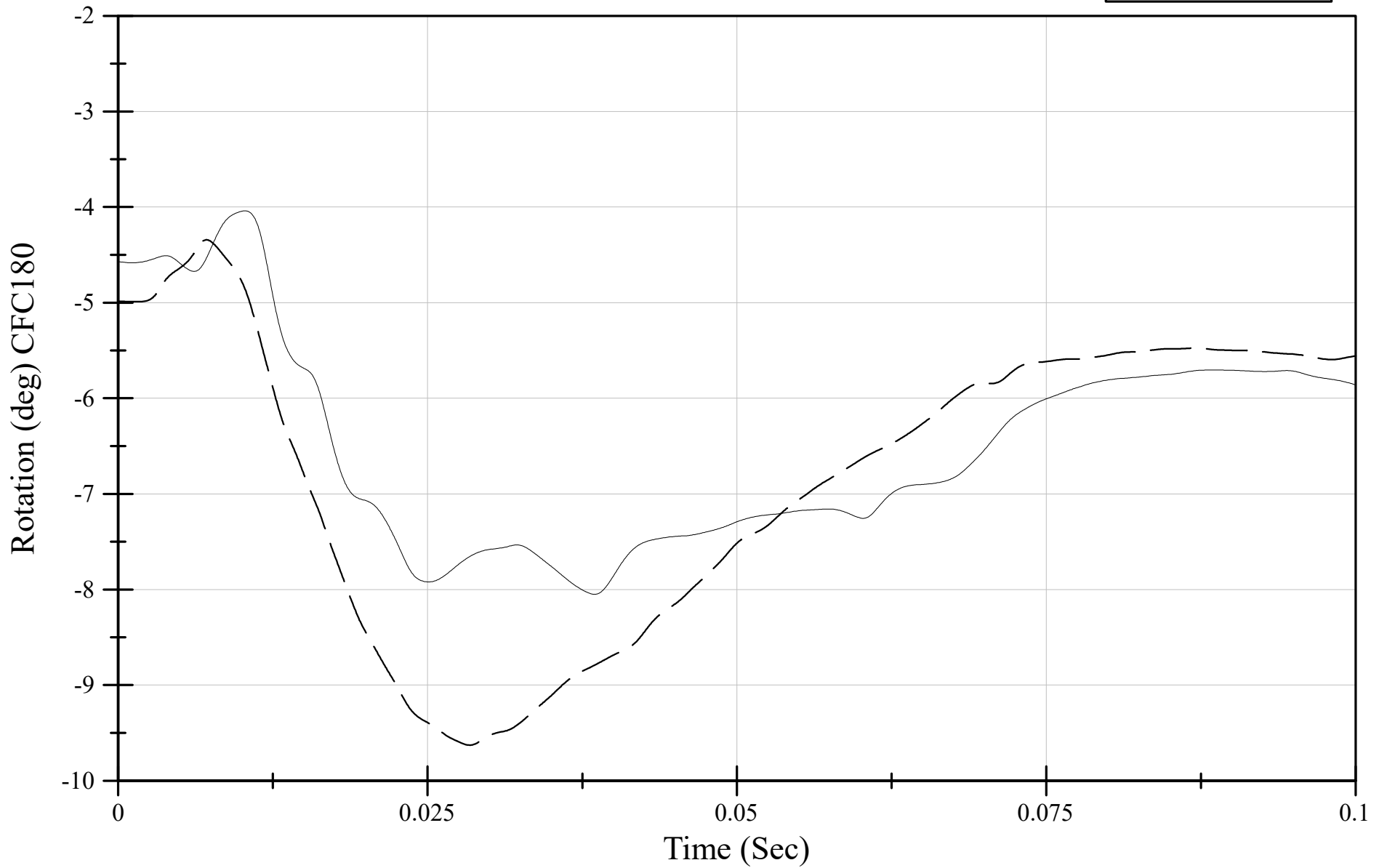
Serial Number: EG2595



THOR-50M Right Lower Thorax Qualification

Y-Rotation + Offset

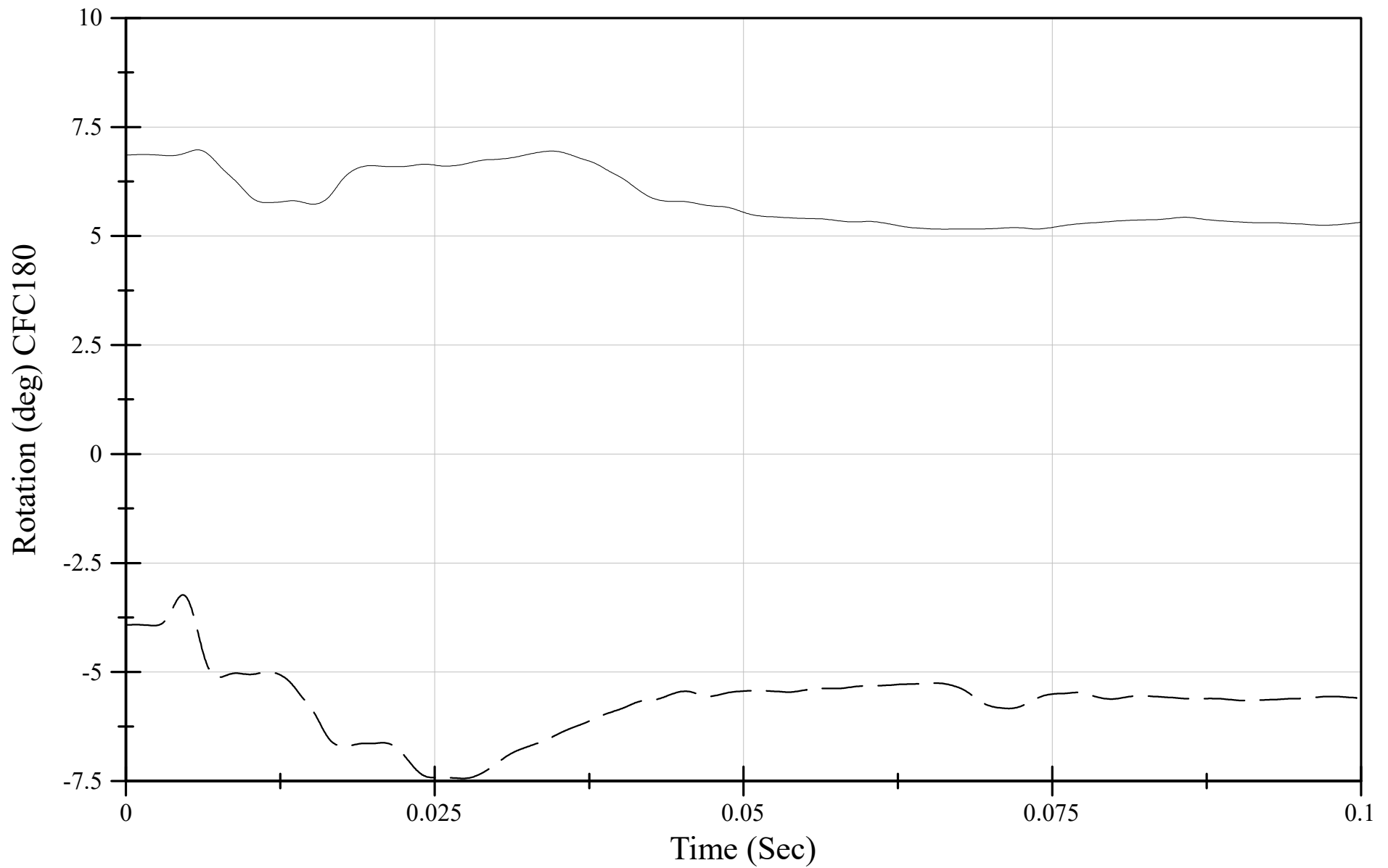
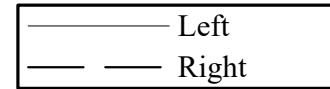
Serial Number: EG2595



THOR-50M Right Lower Thorax Qualification

Z-Rotation + Offset

Serial Number: EG2595



THOR-50M Face Disk Qualification

Test Results Summary

Dummy Serial Number: EG2595

Tested Components

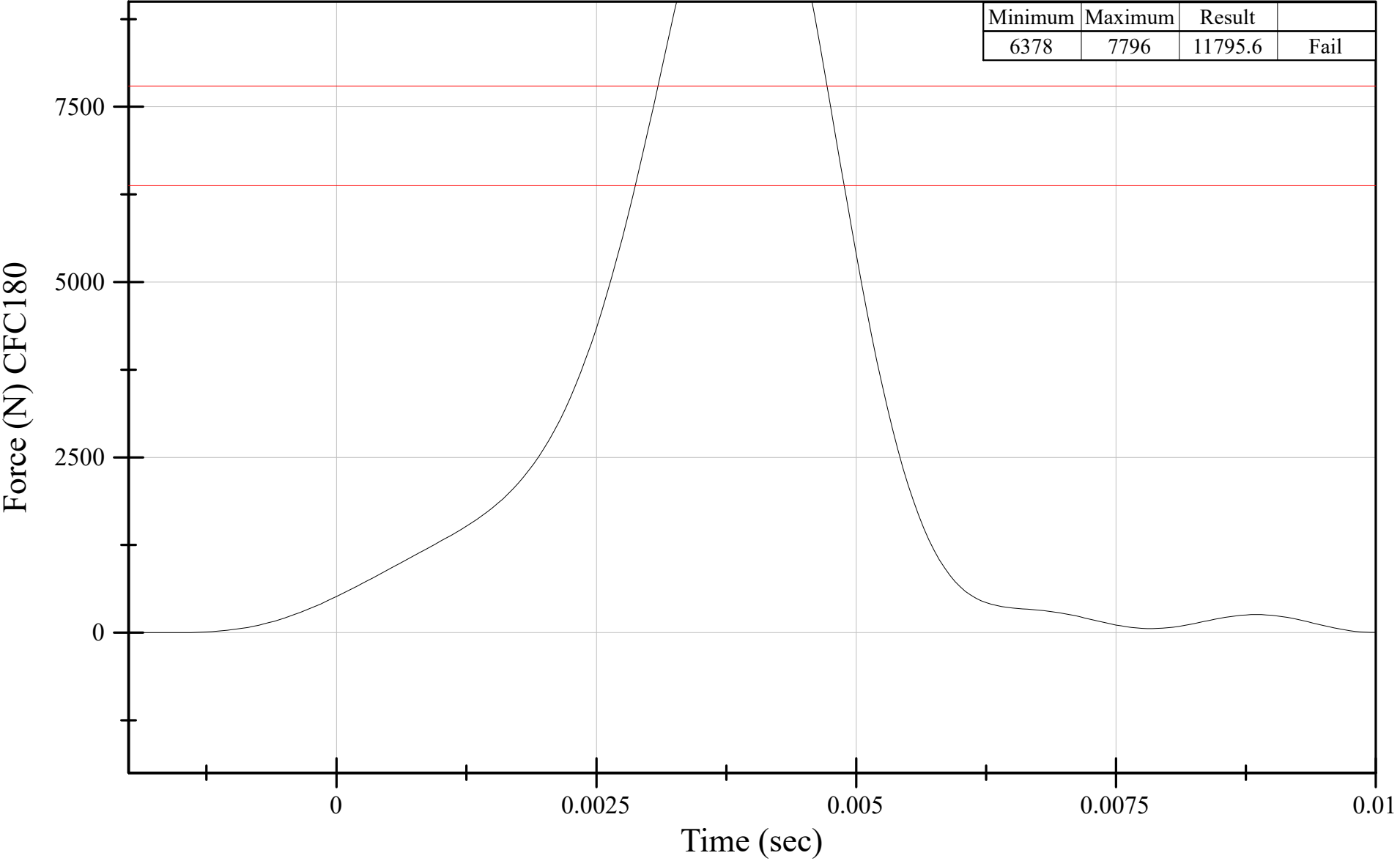
Head Skin:
Face Insert:

Test ID: 250402-17
Test Date: 4/2/2025
Test Time: 4:03 PM

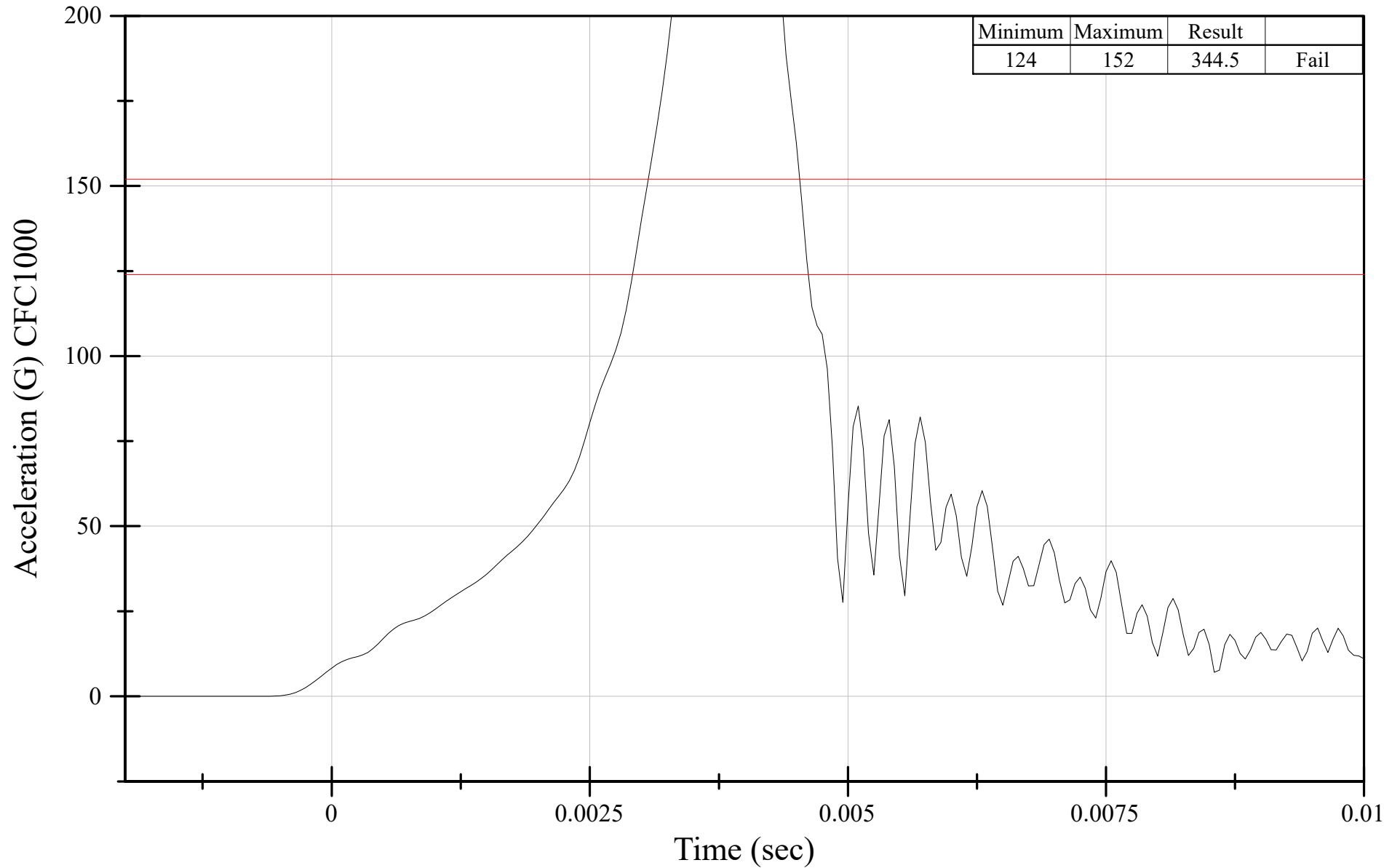
Test Results

<u>Test Parameter</u>	<u>Specification Range*</u>	<u>Result</u>	<u>Pass/Fail</u>
Test Temperature (°C)	20.6 - 22.2	21.6	Pass
Test Humidity (%)	10 - 70	54	Pass
Test Velocity (m/s)	6.68 - 6.78	6.739	Pass
Peak Probe Force (N)	6378 - 7796	11795.6	Fail
Peak Head CG Resultant Acceleration (g)	124 - 152	344.5	Fail

THOR-50M Face Disk Qualification
Probe Force
Serial Number: EG2595



THOR-50M Face Disk Qualification
Head CG Resultant Acceleration
Serial Number: EG2595



THOR-50M Head Impact Qualification

Test Results Summary

Dummy Serial Number: EG2595

Tested Components

Head Skin:

Test ID: 250331-7

Test Date: 3/31/2025

Test Time: 2:07 PM

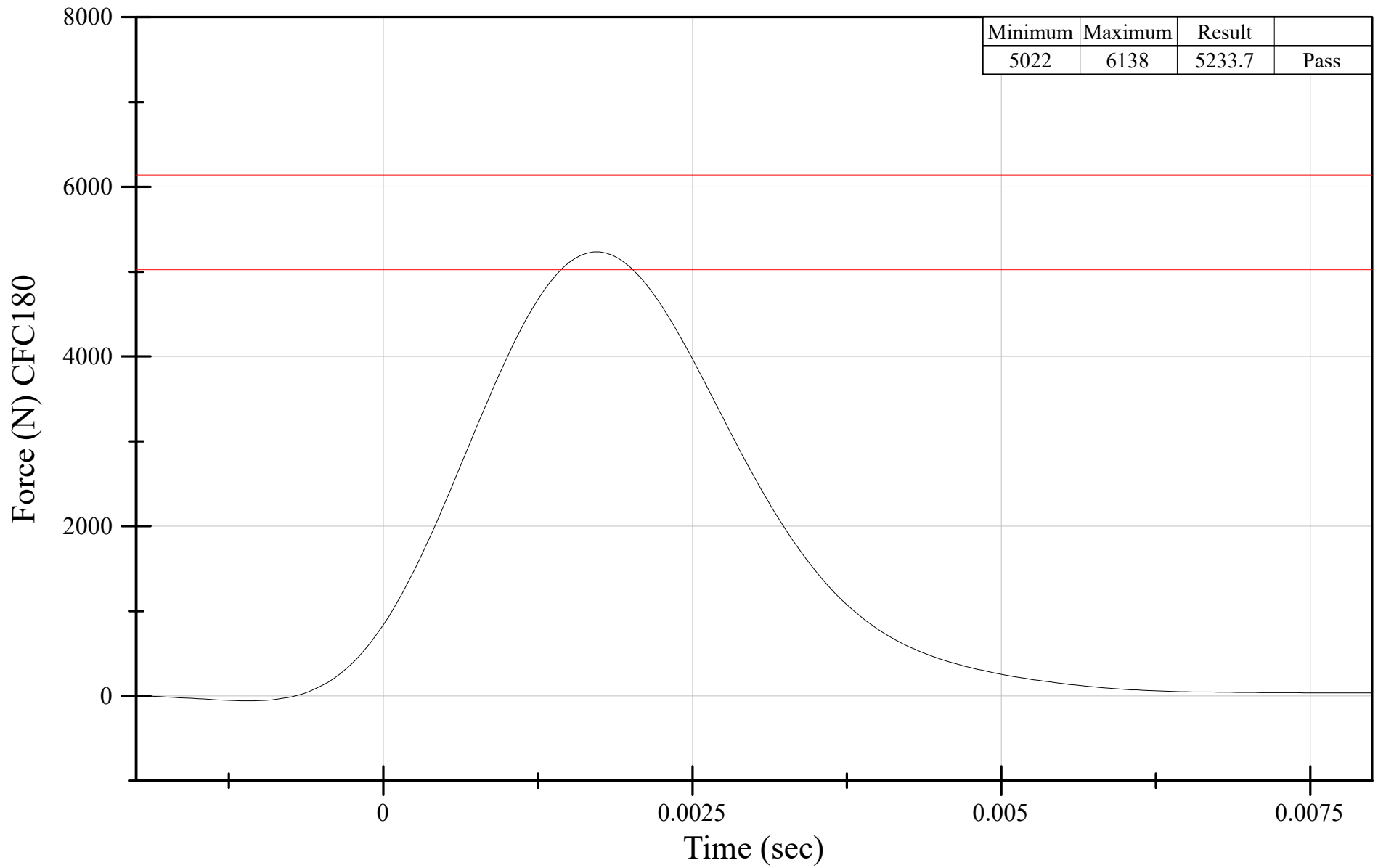
Test Results

<u>Test Parameter</u>	<u>Specification Range*</u>	<u>Result</u>	<u>Pass/Fail</u>
Test Temperature (°C)	20.6 - 22.2	21.8	Pass
Test Humidity (%)	10 - 70	49	Pass
Test Velocity (m/s)	1.95 - 2.05	1.912	Fail
Peak Probe Force (N)	5022 - 6138	5233.7	Pass
Peak Head CG Resultant Acceleration (g)	105.3 - 128.7	114.30	Pass

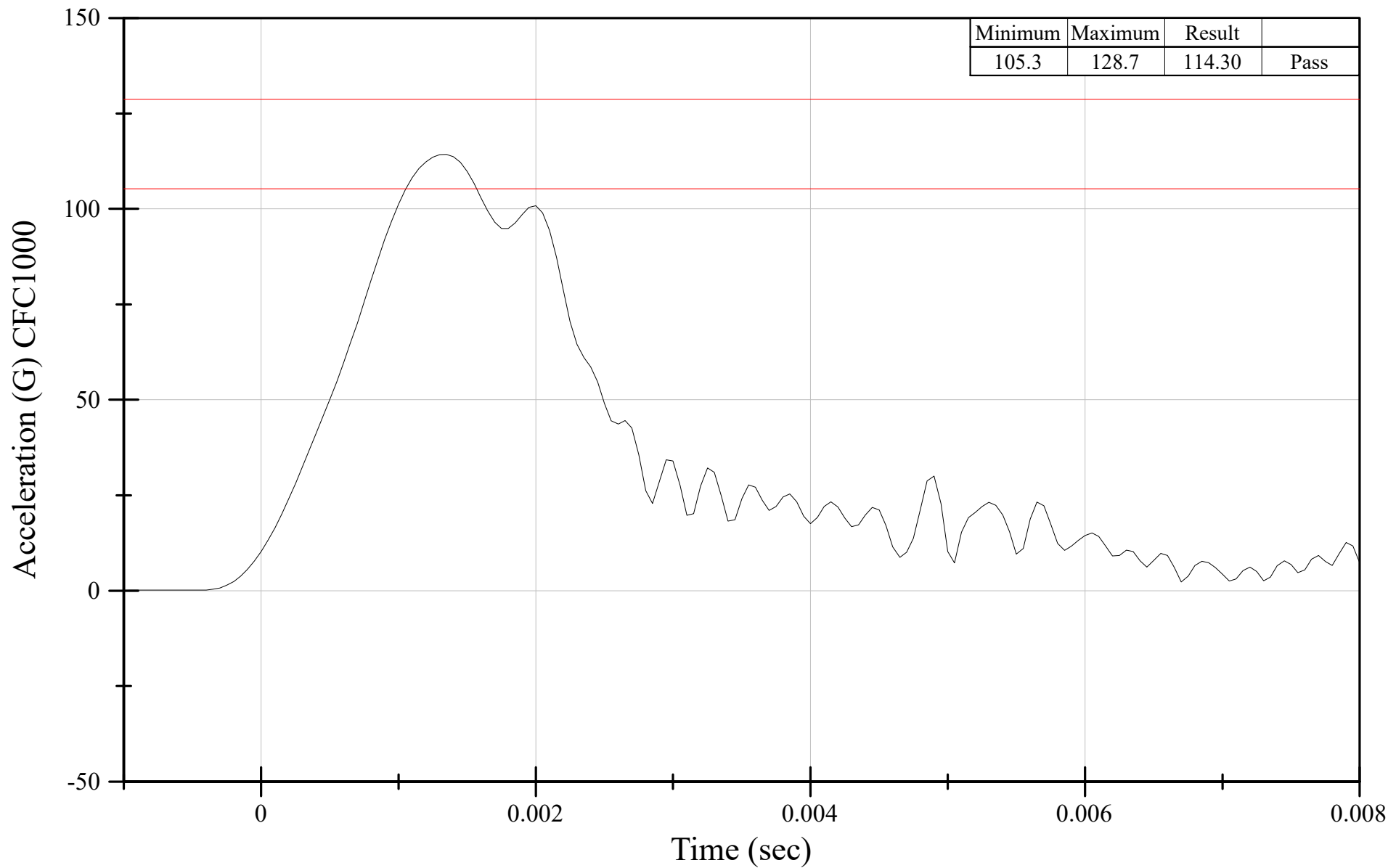
THOR-50M Head Impact Qualification

Probe Force

Serial Number: EG2595



THOR-50M Head Impact Qualification
Head CG Resultant Acceleration
Serial Number: EG2595



THOR-50M Upper Thorax Qualification

Test Results Summary

Dummy Serial Number: EG2595

Tested Components

Rib 1 Serial Number:
Rib 2 Serial Number:
Rib 3 Serial Number:
Rib 4 Serial Number:

Rib 5 Serial Number:
Rib 6 Serial Number:
Rib 7 Serial Number:

Test ID: 250331-1
Test Date: 3/31/2025
Test Time: 7:14 AM

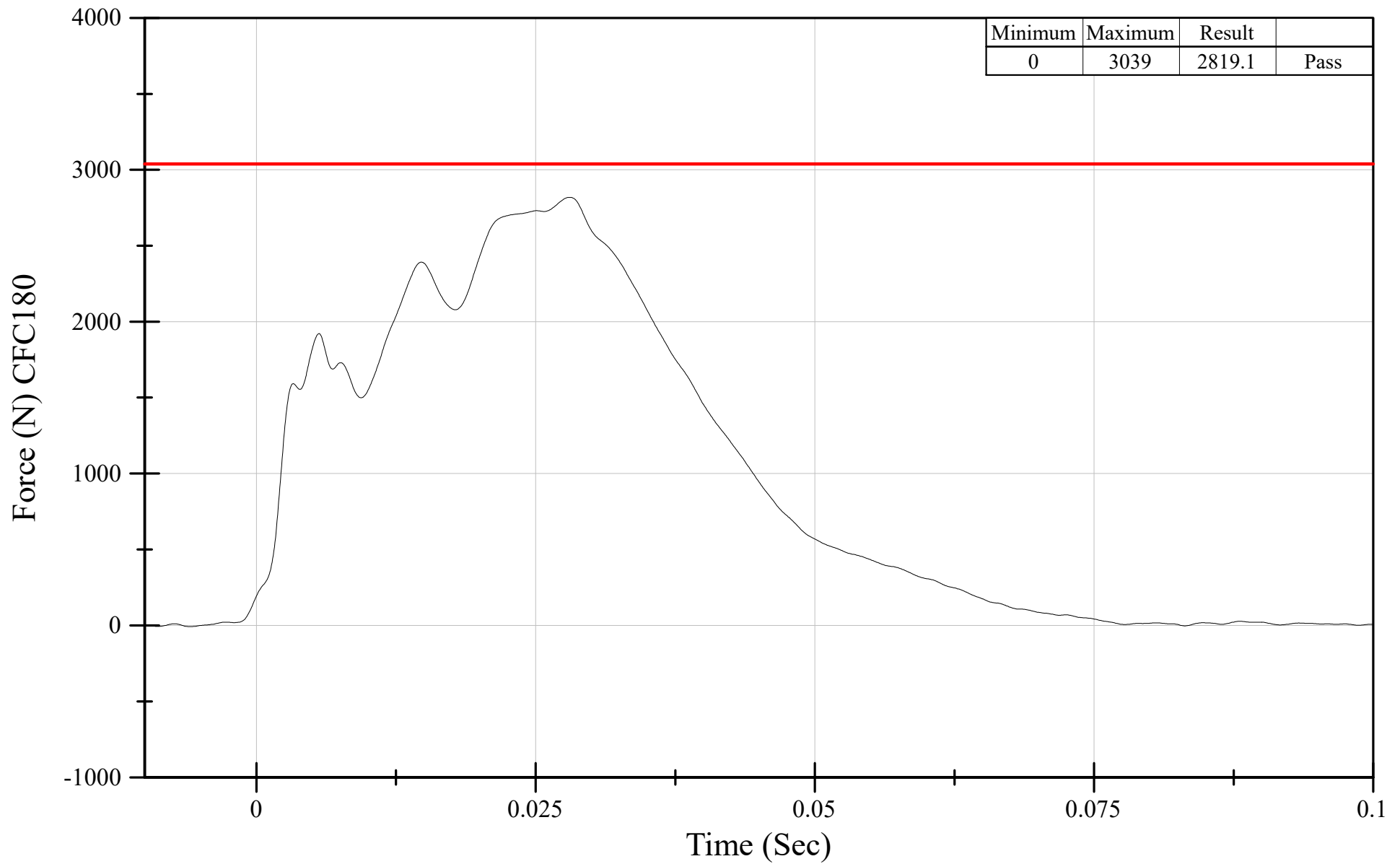
Test Results

<u>Test Parameter</u>	<u>Specification Range*</u>	<u>Result</u>	<u>Pass/Fail</u>
Test Temperature (°C)	20.6 - 22.2	21.4	Pass
Test Humidity (%)	10 - 70	53	Pass
Test Velocity (m/s)	4.25 - 4.35	4.293	Pass
Peak Probe Force (N)	less than 3039	2819.1	Pass
Peak Upper Left Resultant Deflection (mm)	48.3 - 59.0	53.78	Pass
Peak Upper Right Resultant Deflection (mm)	48.3 - 59.0	53.63	Pass
Difference Between Peak Left & Right Resultant Deflections (mm)	less than 5.0	0.15	Pass
Force at Left Peak Resultant Deflection (N)	2409 - 2944	2727.5	Pass
Force at Right Peak Resultant Deflection (N)	2409 - 2944	2729.5	Pass

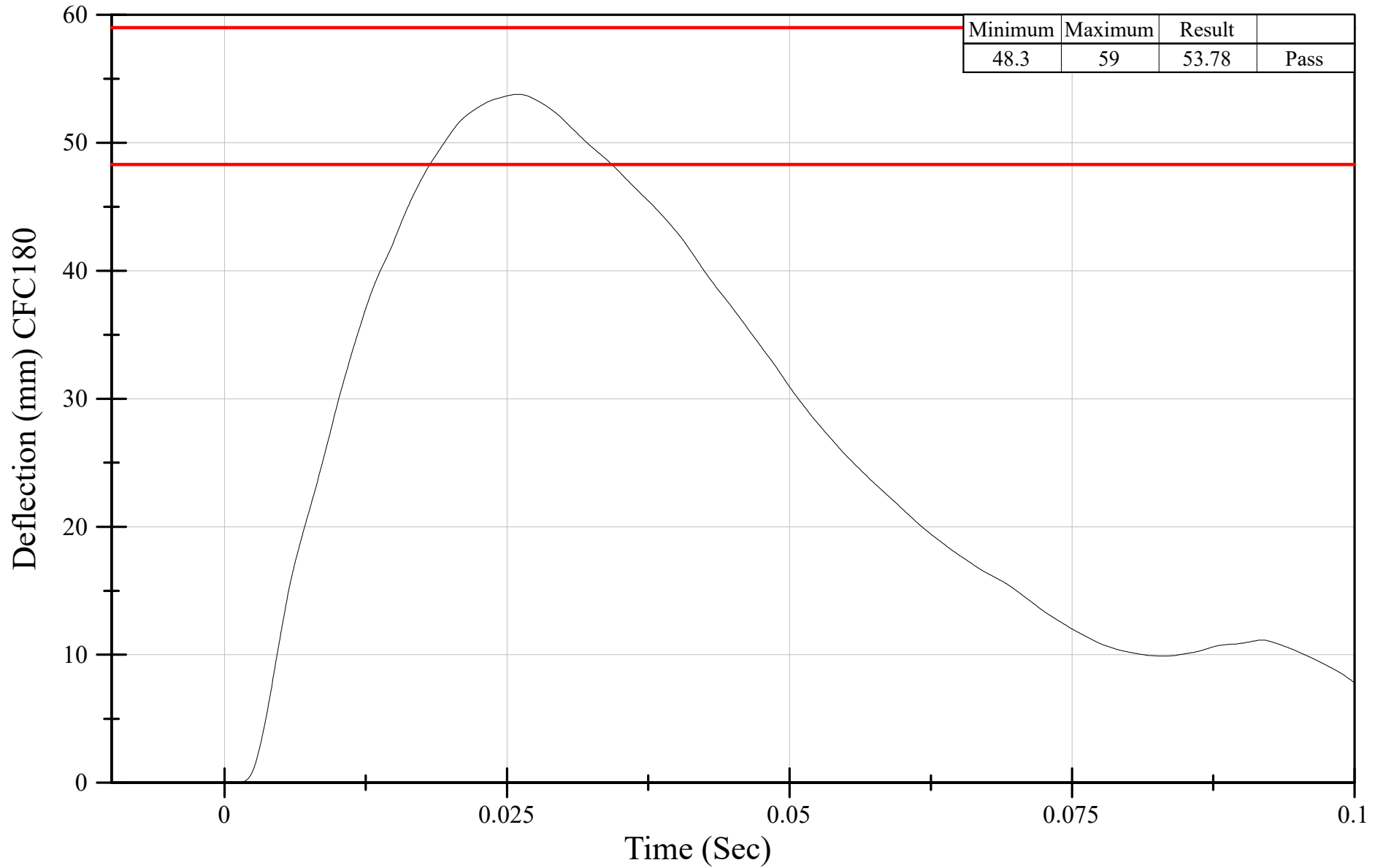
THOR-50M Upper Thorax Qualification

Probe Force

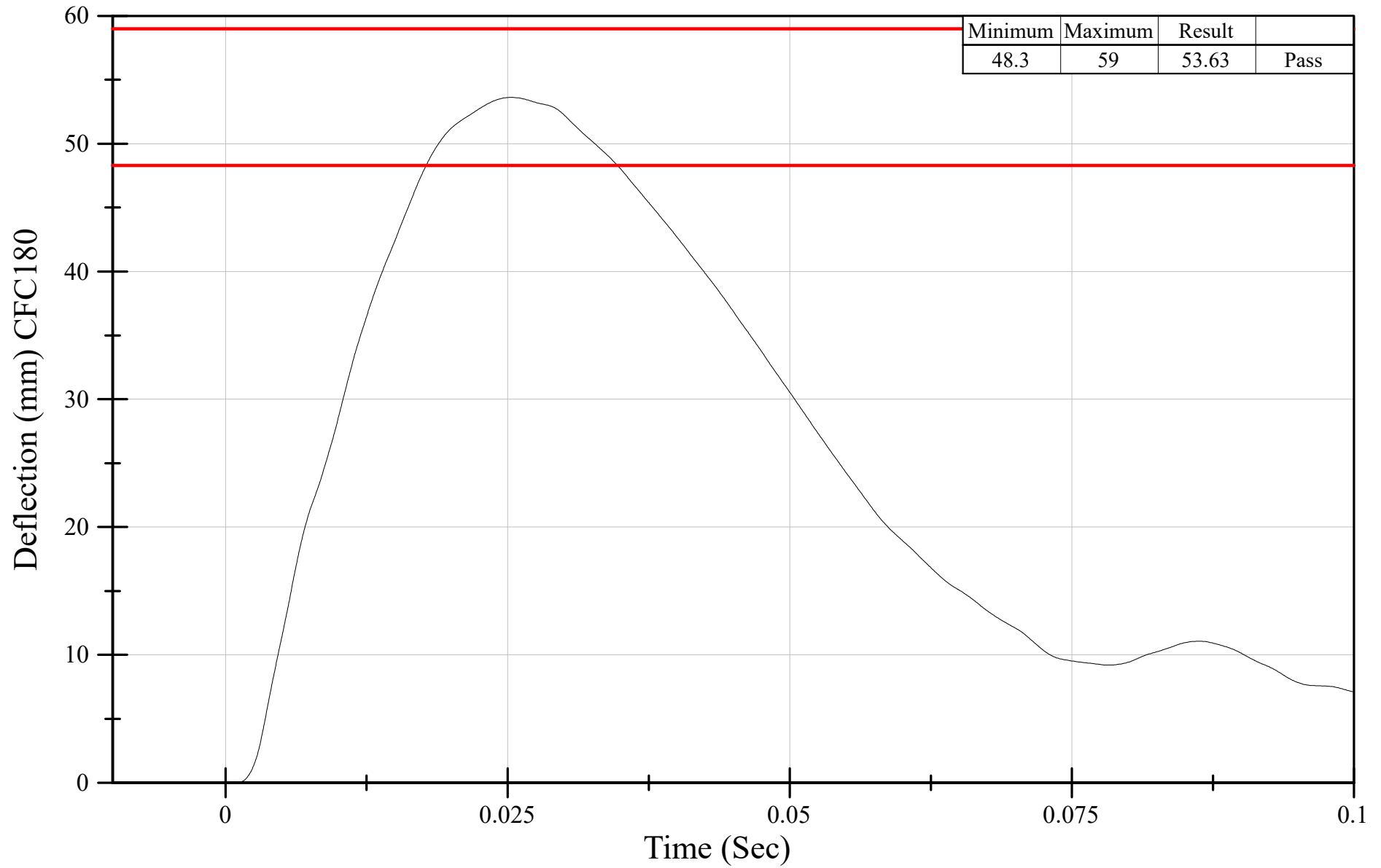
Serial Number: EG2595



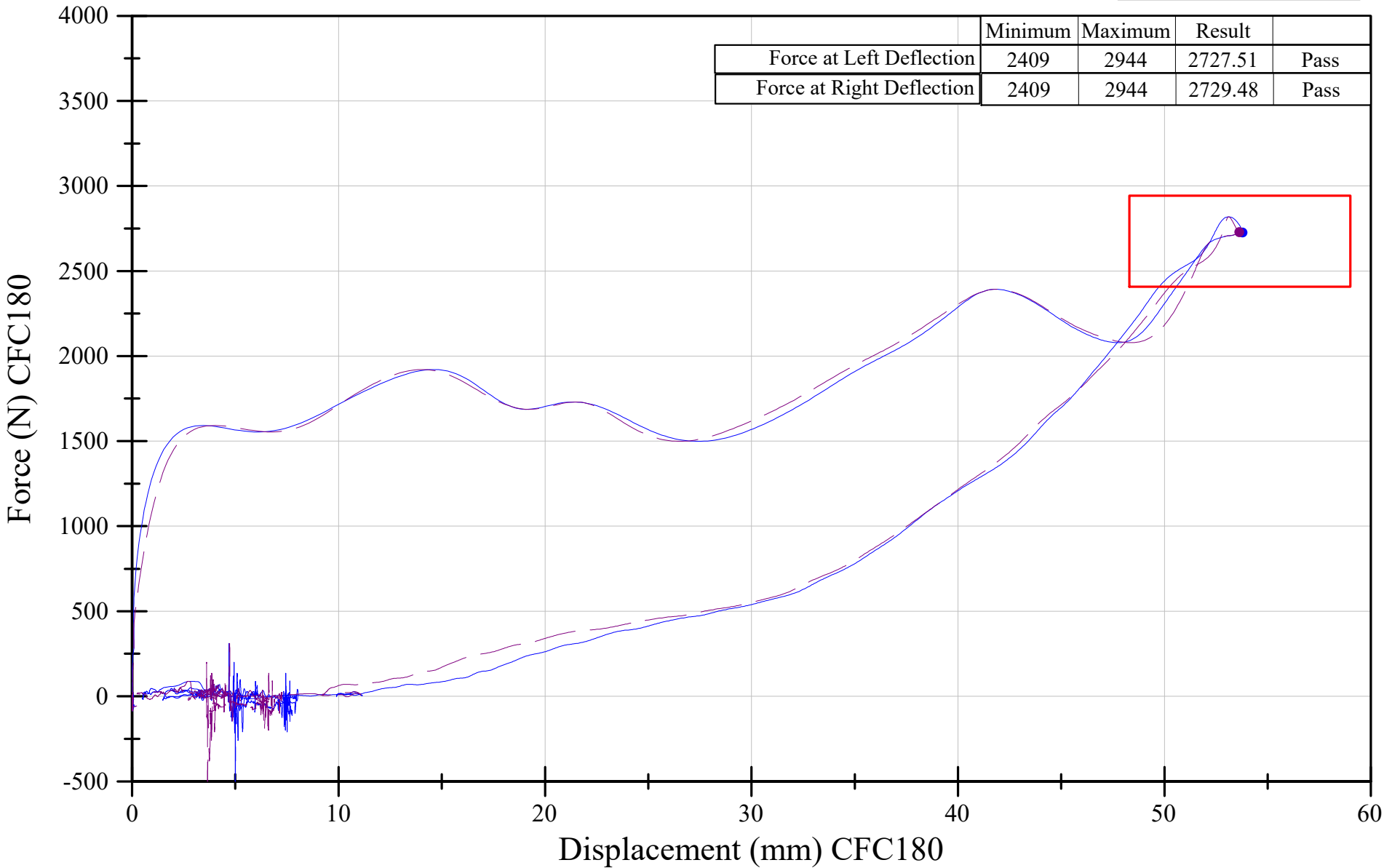
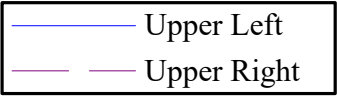
THOR-50M Upper Thorax Qualification
Left Resultant Deflection
Serial Number: EG2595



THOR-50M Upper Thorax Qualification
Right Resultant Deflection
Serial Number: EG2595



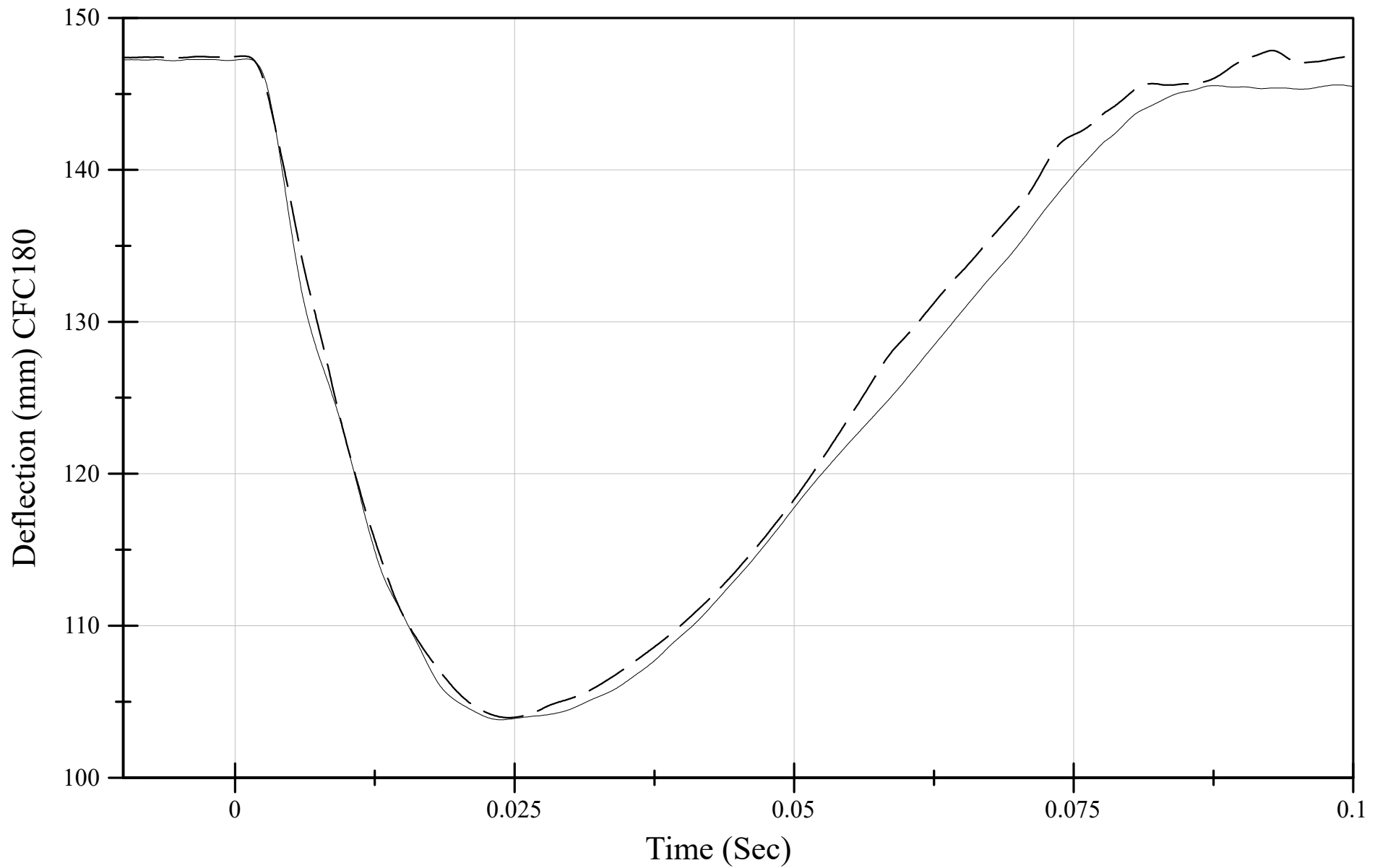
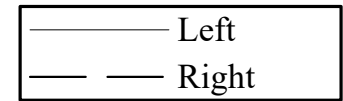
THOR-50M Upper Thorax Qualification
Probe Force vs Resultant Deflection
Serial Number: EG2595



THOR-50M Upper Thorax Qualification

X-Deflection

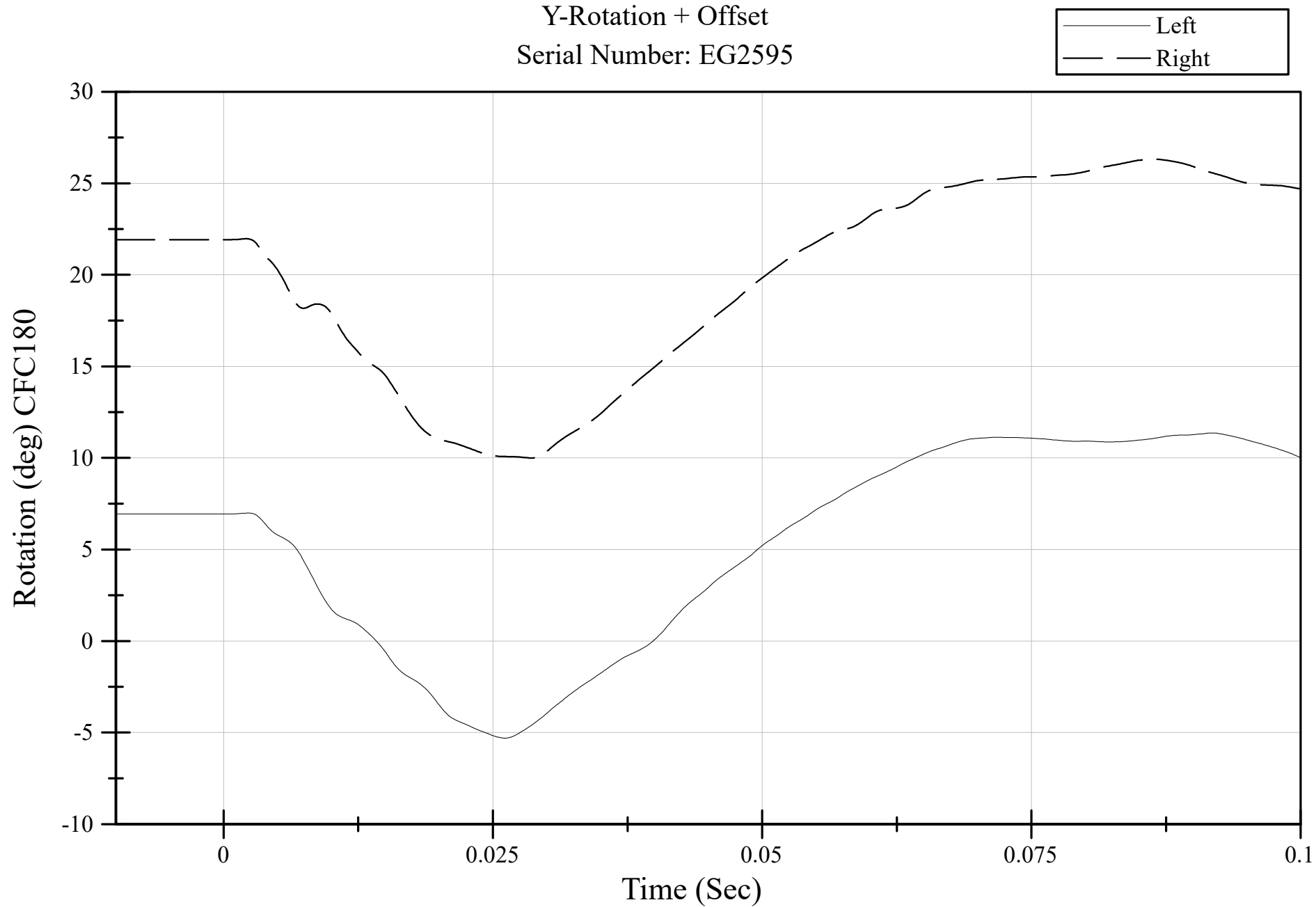
Serial Number: EG2595



THOR-50M Upper Thorax Qualification

Y-Rotation + Offset

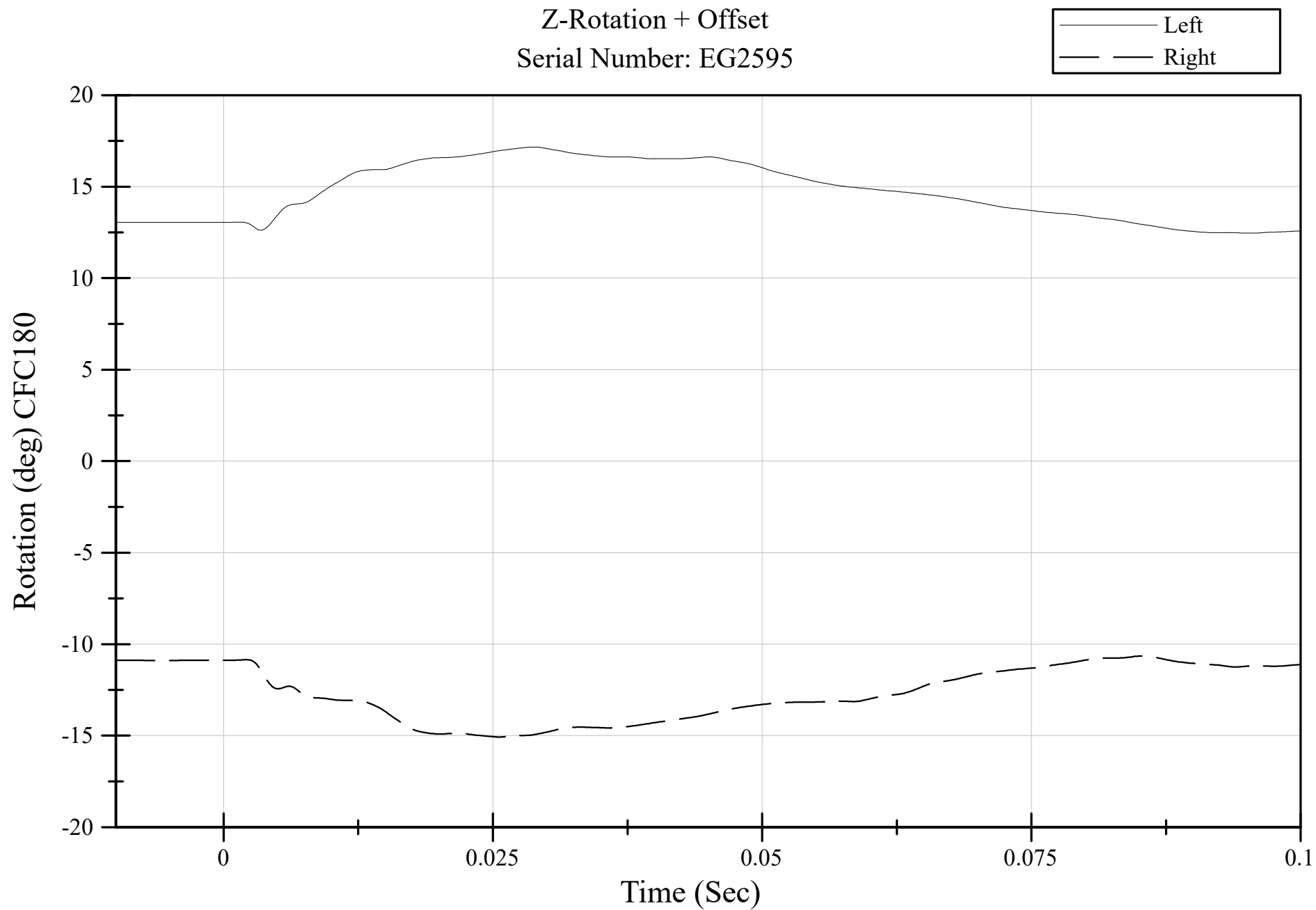
Serial Number: EG2595



THOR-50M Upper Thorax Qualification

Z-Rotation + Offset

Serial Number: EG2595



THOR-50M Left Lower Thorax Qualification

Test Results Summary

Dummy Serial Number: EG2595

Tested Components

Rib 1 Serial Number:

Rib 2 Serial Number:

Rib 3 Serial Number:

Rib 4 Serial Number:

Rib 5 Serial Number:

Rib 6 Serial Number:

Rib 7 Serial Number:

Test ID: 250331-2

Test Date: 3/31/2025

Test Time: 10:46 AM

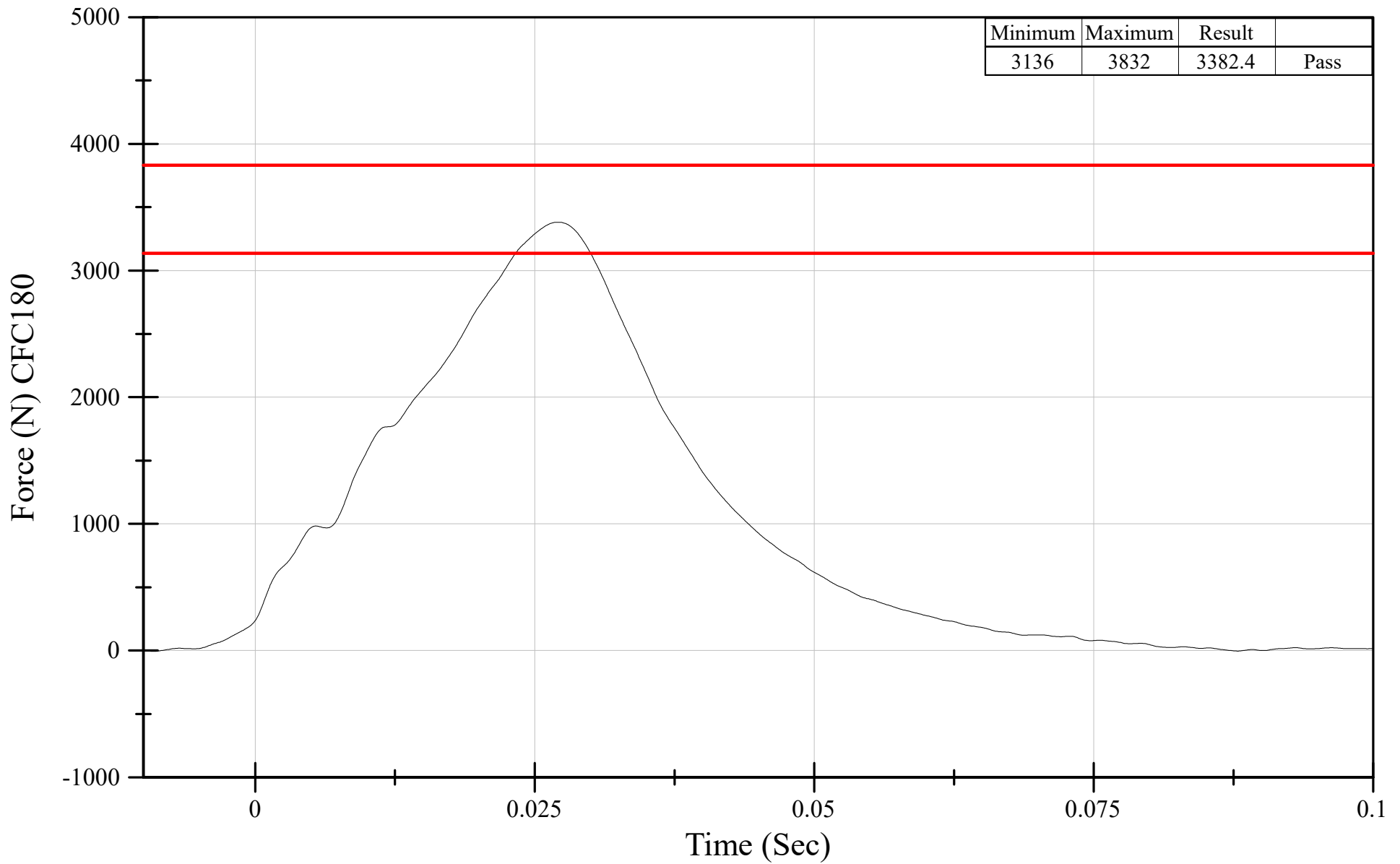
Test Results

<u>Test Parameter</u>	<u>Specification Range*</u>	<u>Result</u>	<u>Pass/Fail</u>
Test Temperature (°C)	20.6 - 22.2	21.6	Pass
Test Humidity (%)	10 - 70	50	Pass
Test Velocity (m/s)	4.25 - 4.35	4.295	Pass
Peak Probe Force (N)	3136 - 3832	3382.4	Pass
Left Resultant Deflection at Peak Force (mm)	45.8 - 56.0	61.60	Fail

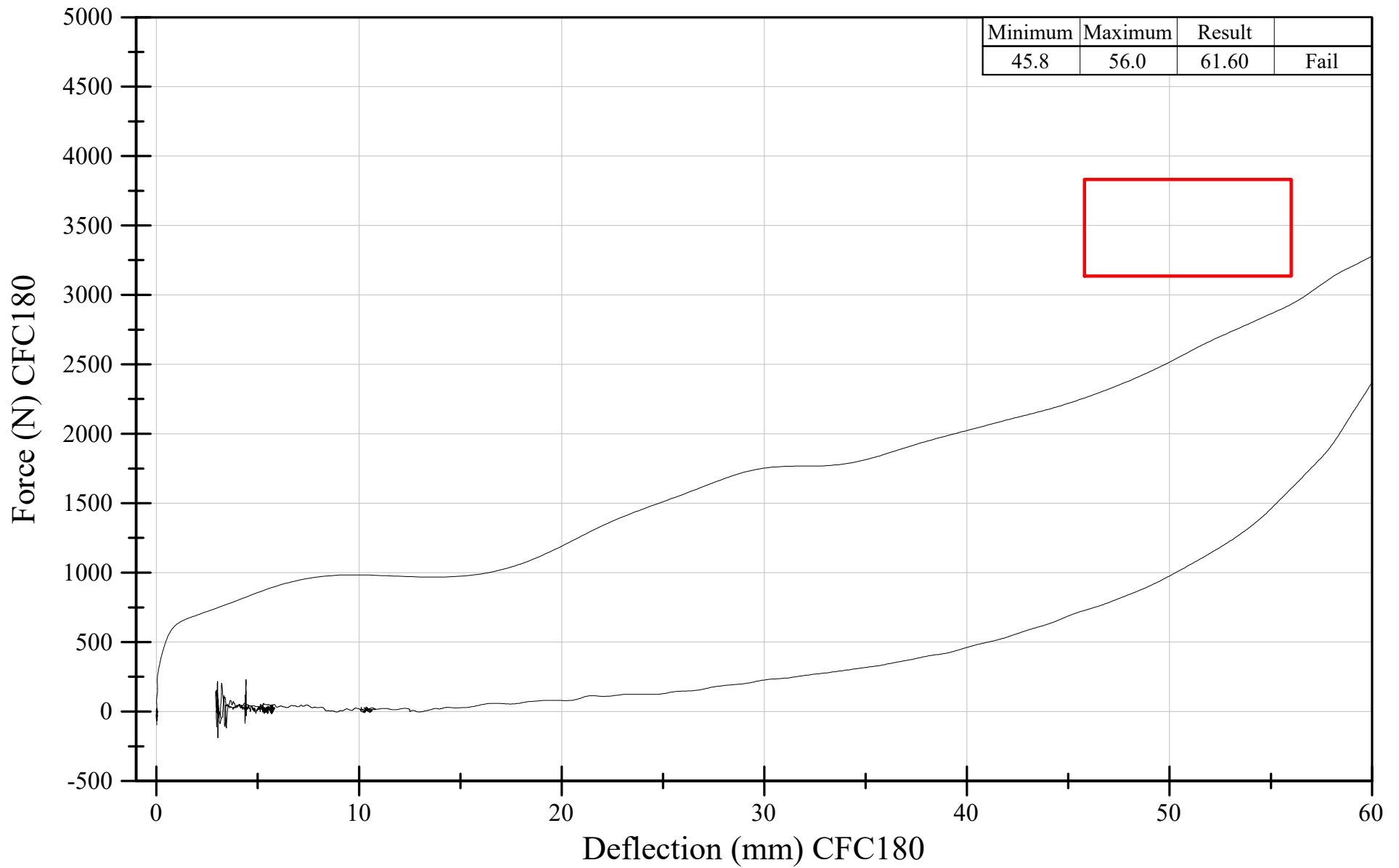
THOR-50M Left Lower Thorax Qualification

Probe Force

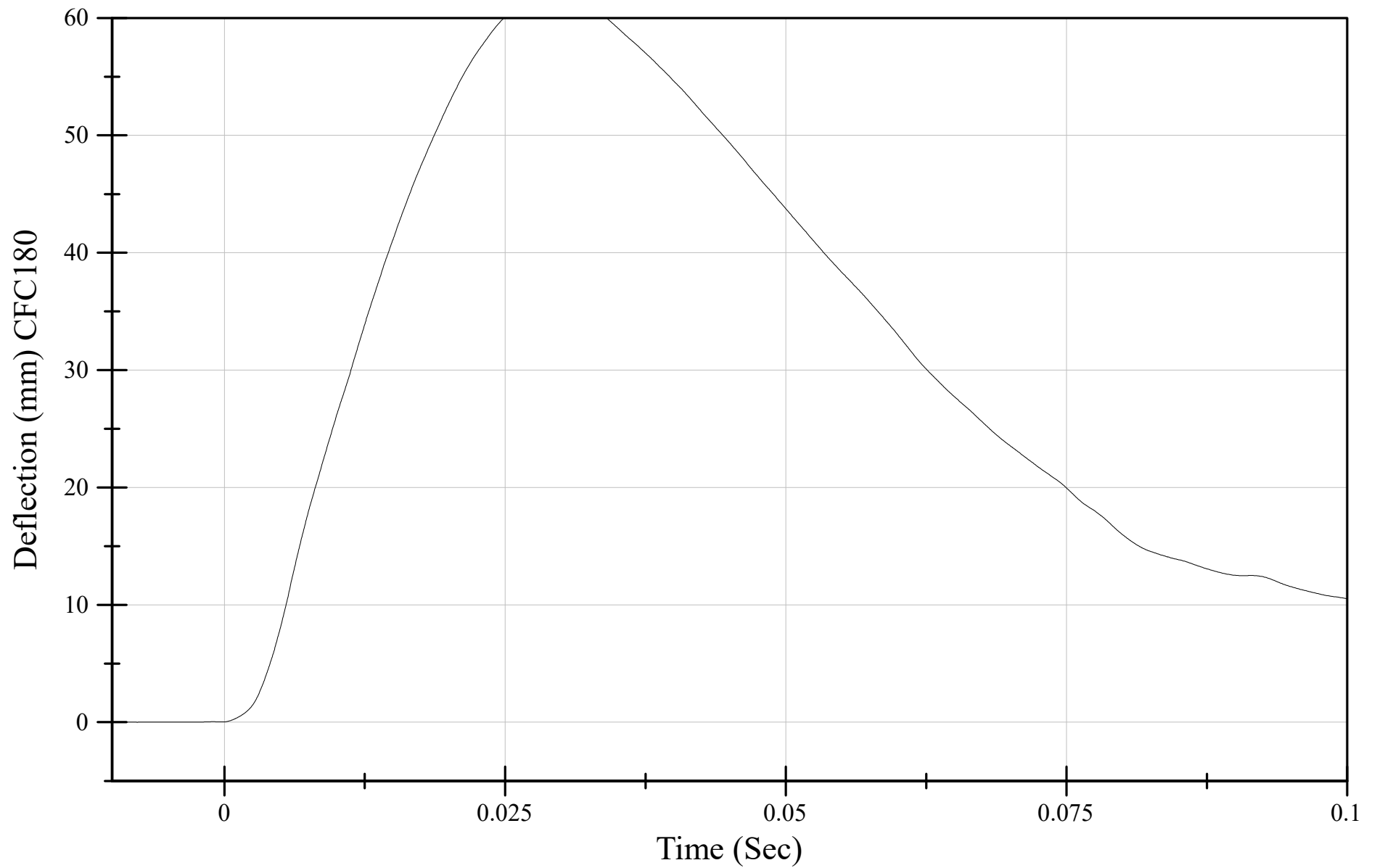
Serial Number: EG2595



THOR-50M Left Lower Thorax Qualification
Left Resultant Deflection at Peak Force
Serial Number: EG2595



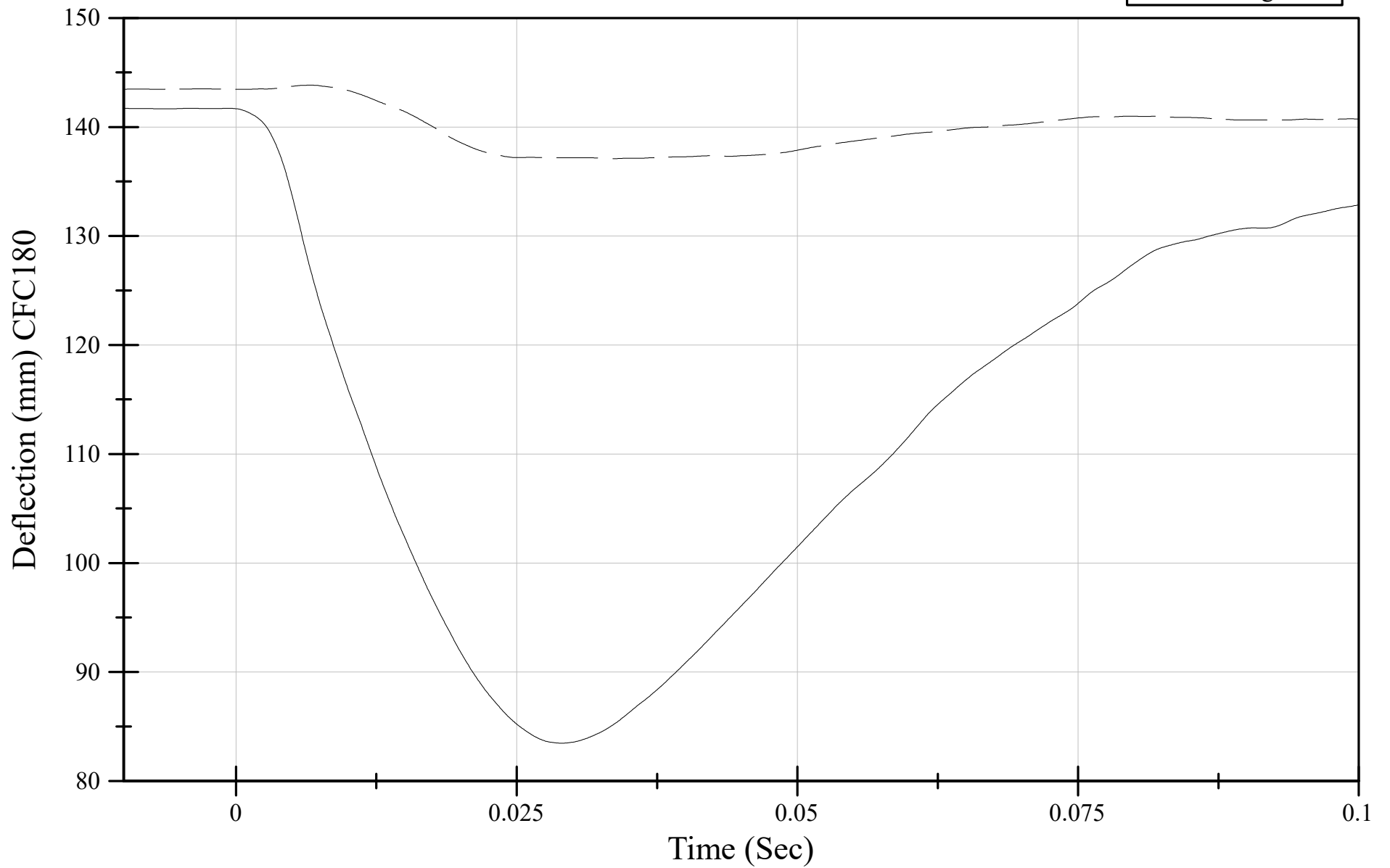
THOR-50M Left Lower Thorax Qualification
Left Resultant Deflection
Serial Number: EG2595



THOR-50M Left Lower Thorax Qualification

X-Deflection

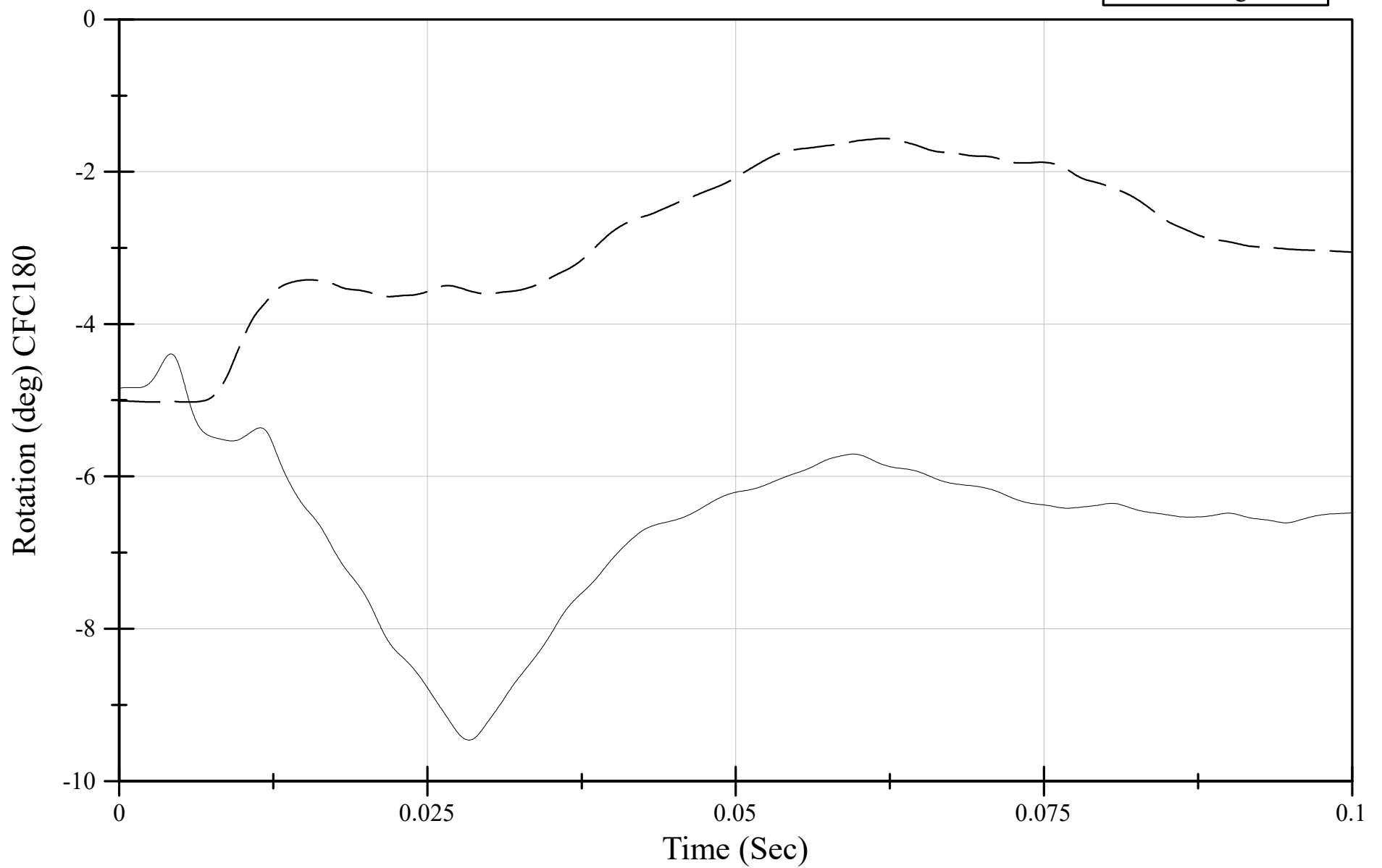
Serial Number: EG2595



THOR-50M Left Lower Thorax Qualification

Y-Rotation + Offset

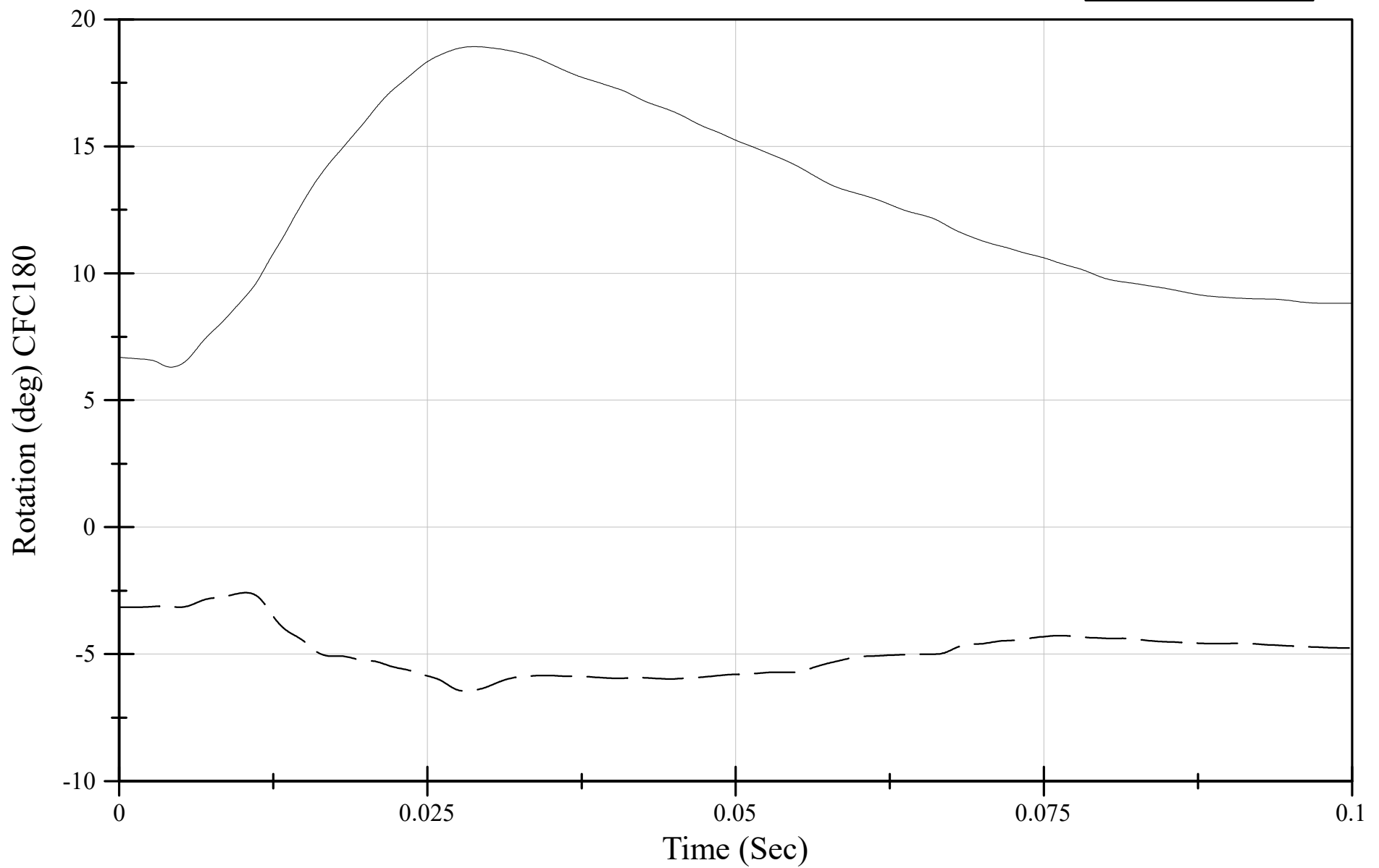
Serial Number: EG2595



THOR-50M Left Lower Thorax Qualification

Z-Rotation + Offset

Serial Number: EG2595



THOR-50M Right Lower Thorax Qualification

Test Results Summary

Dummy Serial Number: EG2595

Tested Components

Rib 1 Serial Number:

Rib 5 Serial Number:

Rib 2 Serial Number:

Rib 6 Serial Number:

Rib 3 Serial Number:

Rib 7 Serial Number:

Rib 4 Serial Number:

Test ID: 250331-4

Test Date: 3/31/2025

Test Time: 1:06 PM

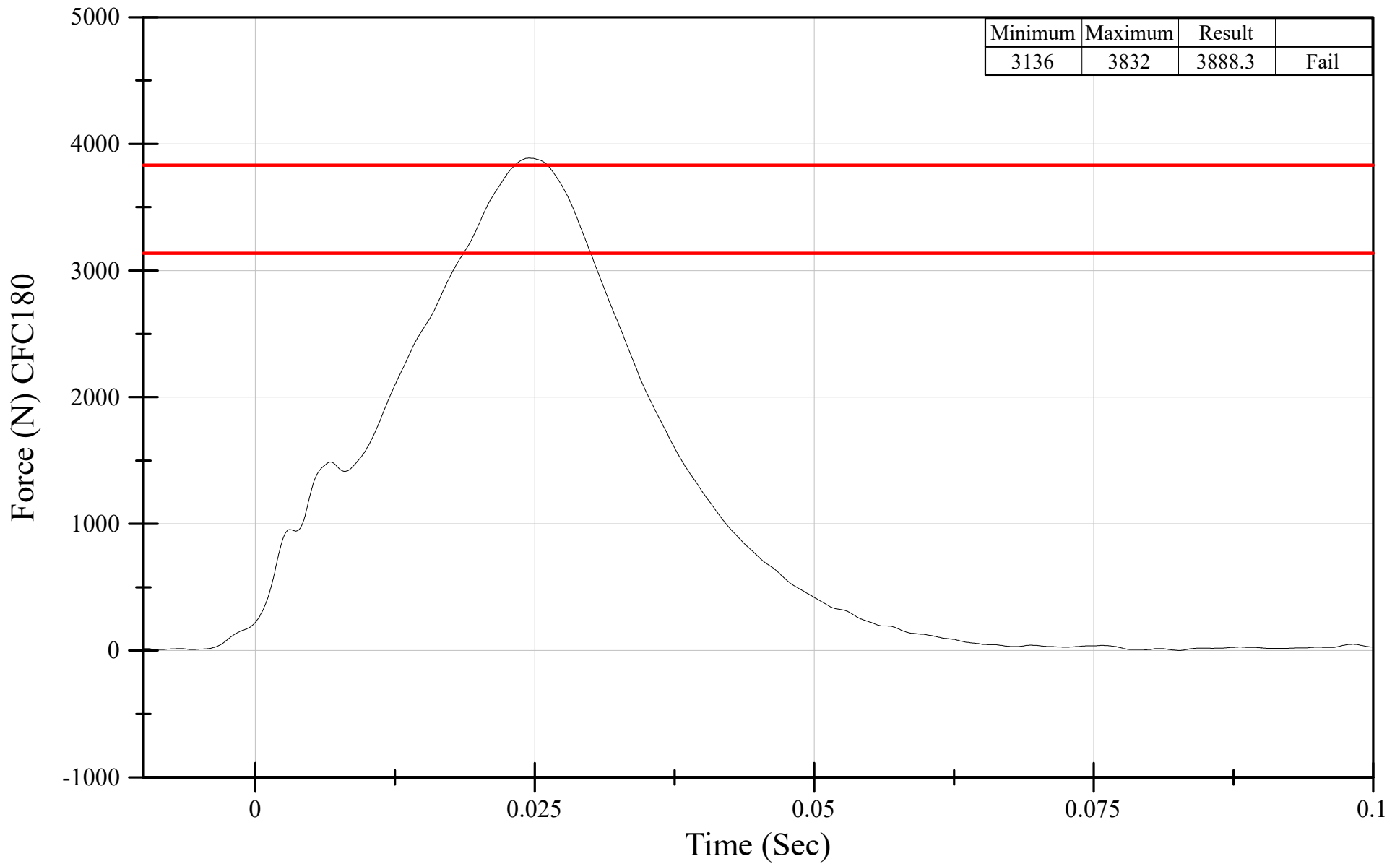
Test Results

<u>Test Parameter</u>	<u>Specification Range*</u>	<u>Result</u>	<u>Pass/Fail</u>
Test Temperature (°C)	20.6 - 22.2	21.6	Pass
Test Humidity (%)	10 - 70	48	Pass
Test Velocity (m/s)	4.25 - 4.35	4.297	Pass
Peak Probe Force (N)	3136 - 3832	3888.3	Fail
Right Resultant Deflection at Peak Force (mm)	45.8 - 56.0	43.75	Fail

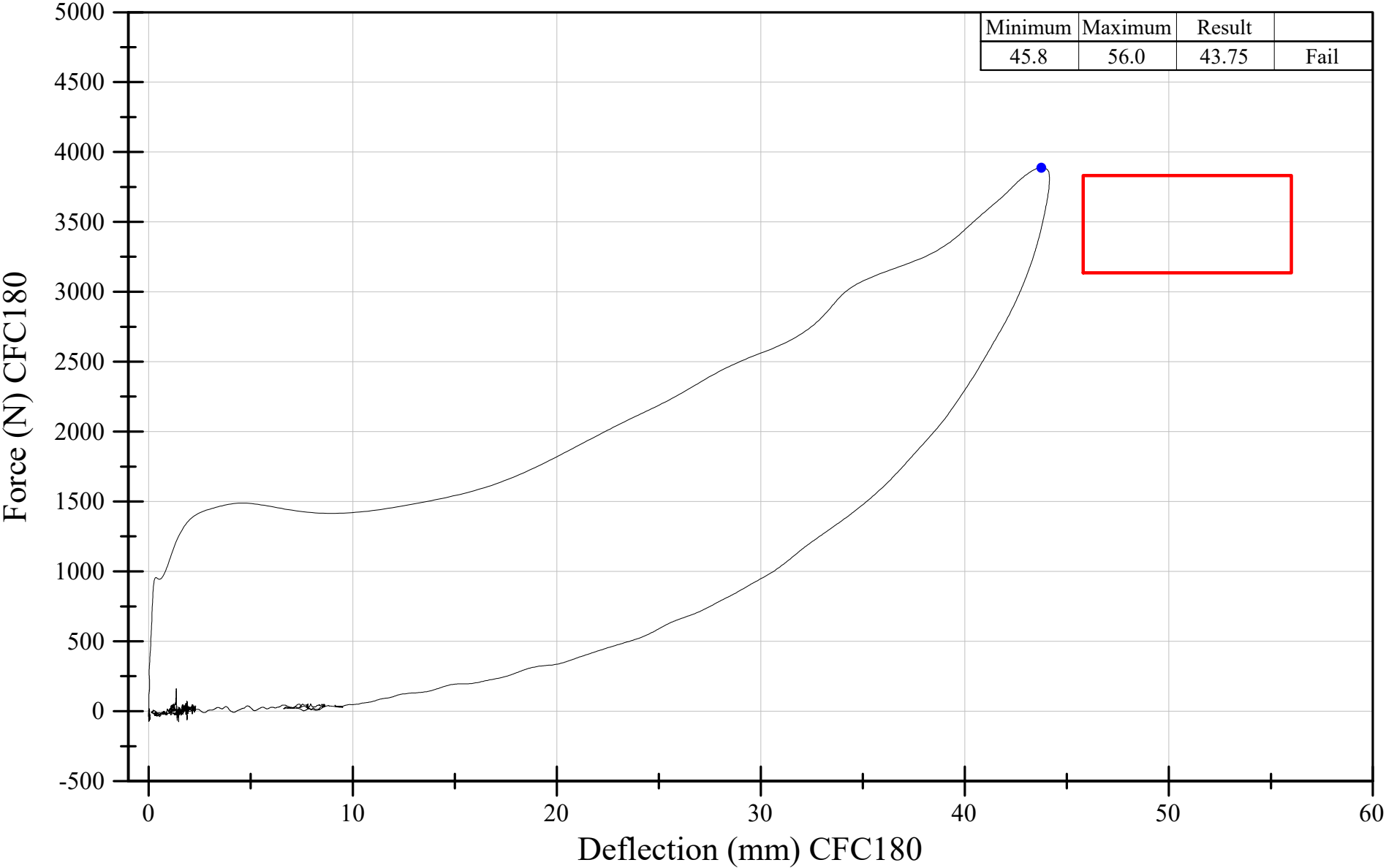
THOR-50M Right Lower Thorax Qualification

Probe Force

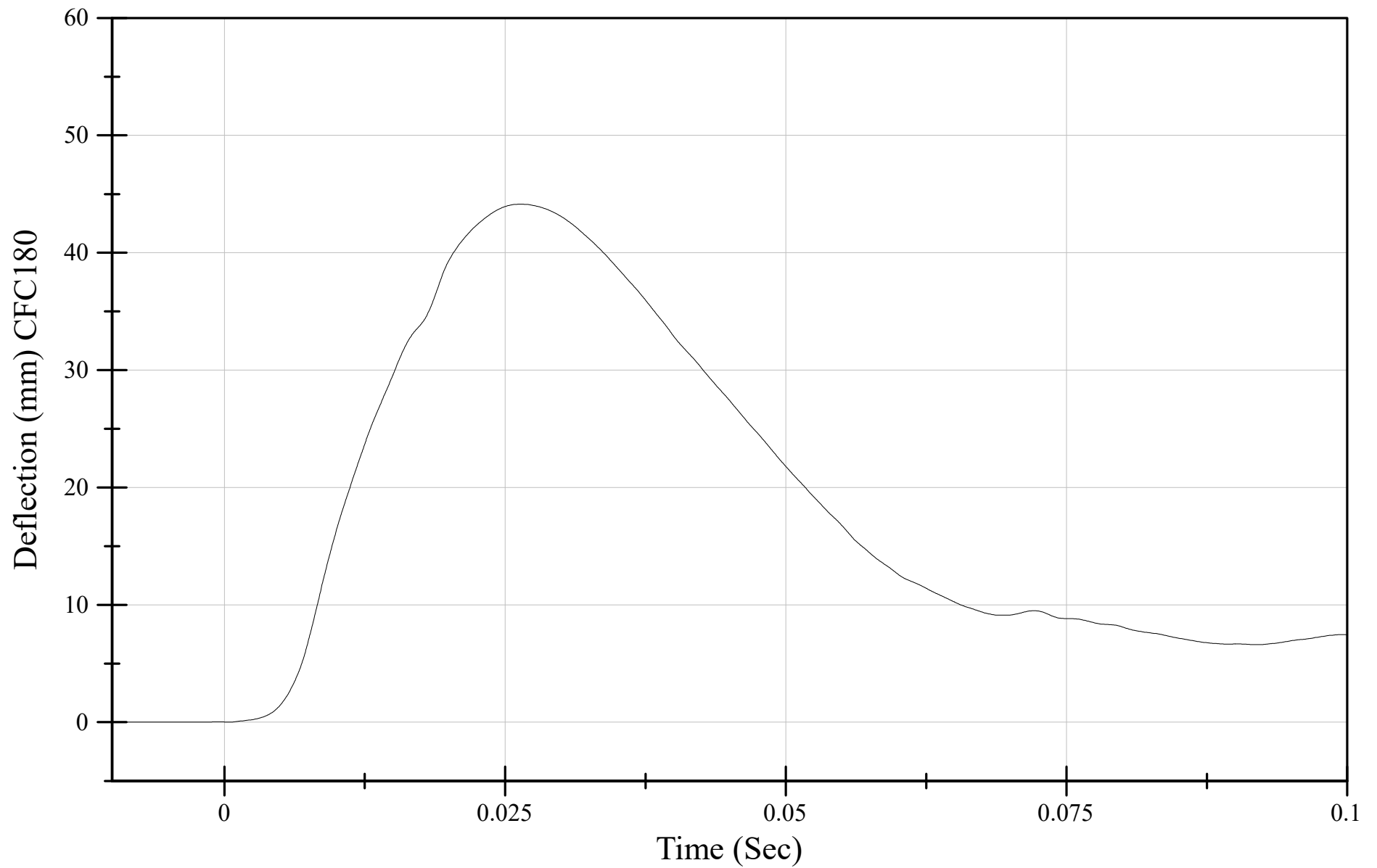
Serial Number: EG2595



THOR-50M Right Lower Thorax Qualification
Right Resultant Deflection at Peak Force
Serial Number: EG2595



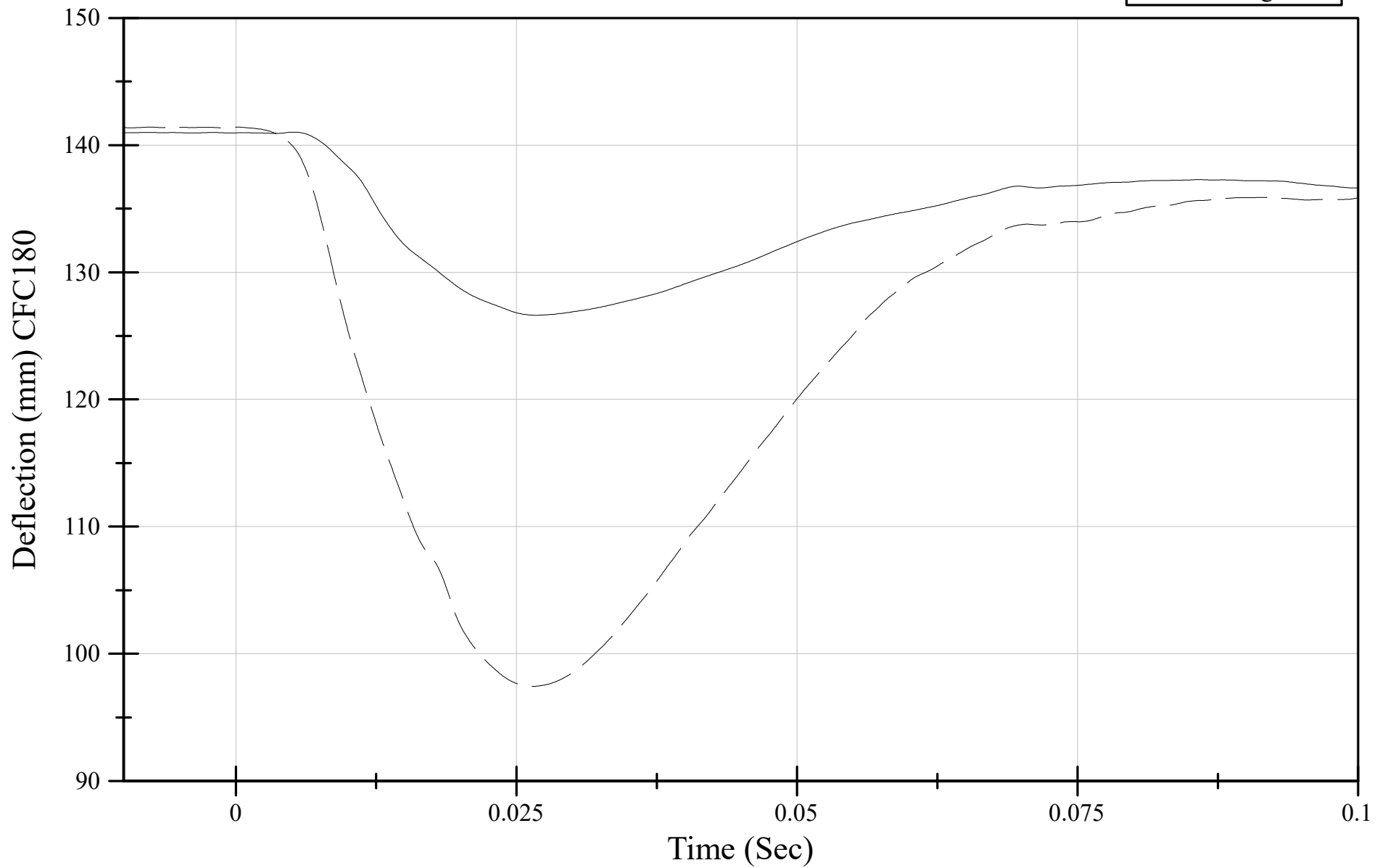
THOR-50M Right Lower Thorax Qualification
Right Resultant Deflection
Serial Number: EG2595



THOR-50M Right Lower Thorax Qualification

X-Deflection

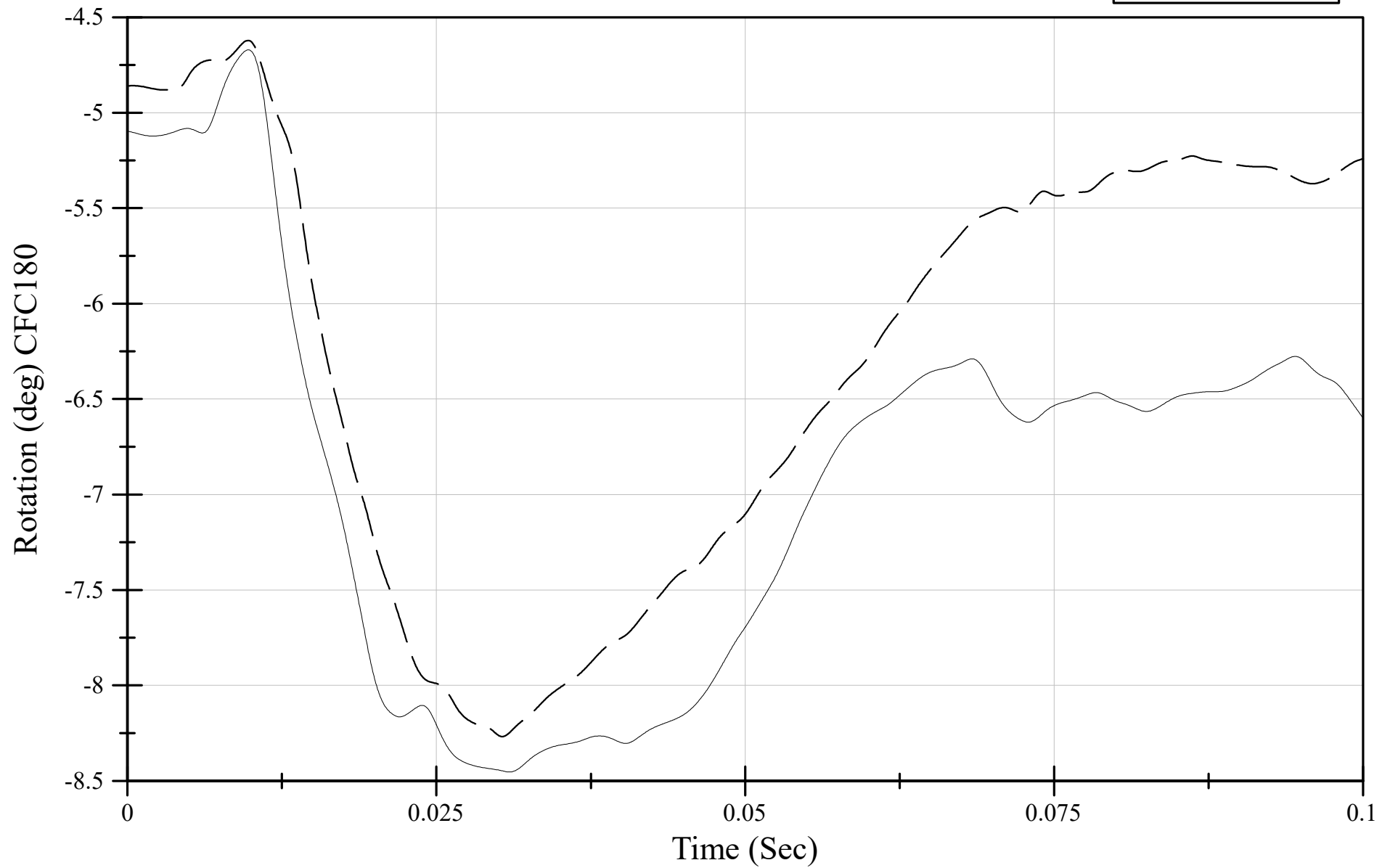
Serial Number: EG2595



THOR-50M Right Lower Thorax Qualification

Y-Rotation + Offset

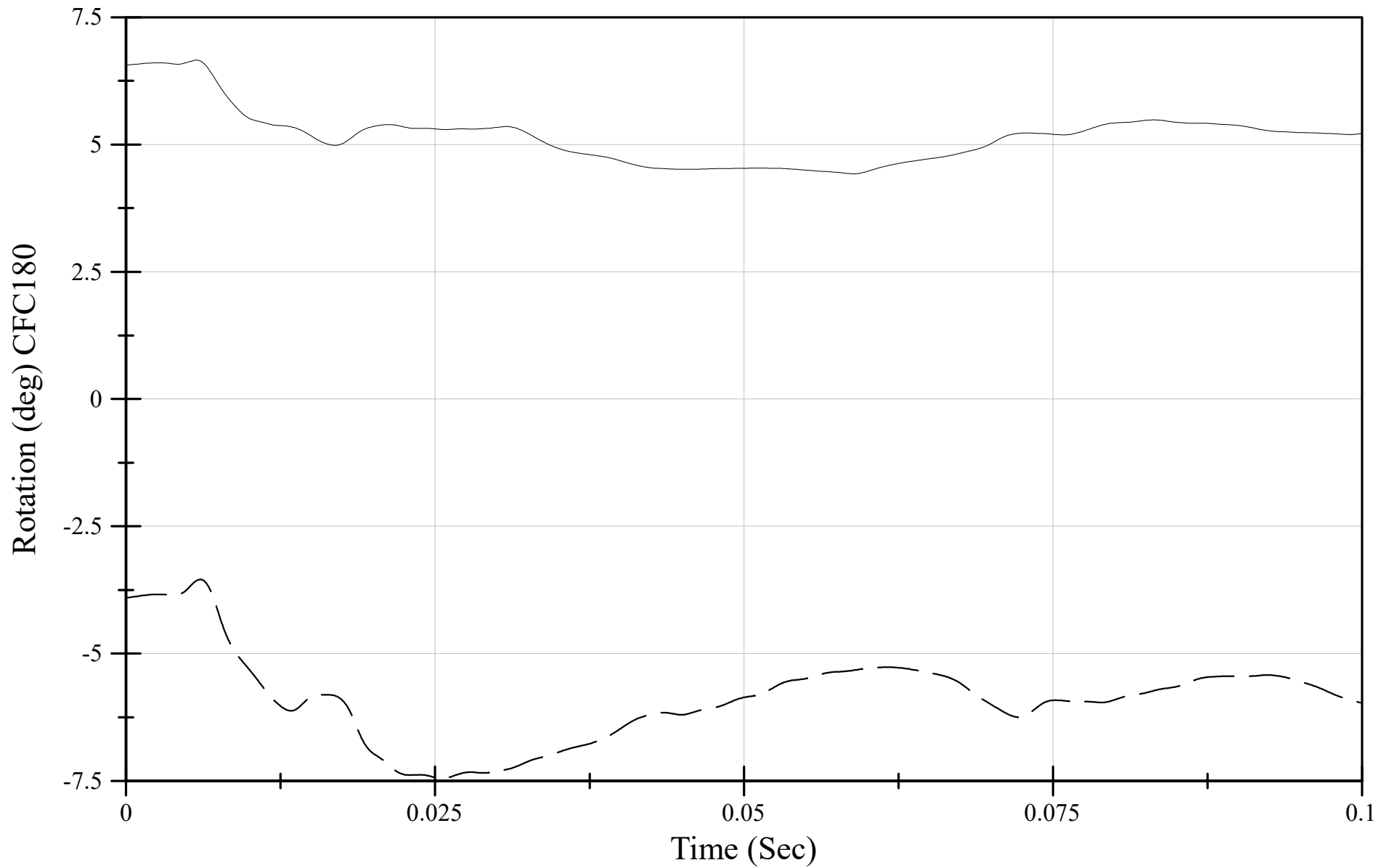
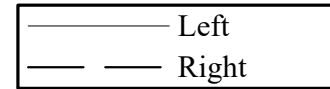
Serial Number: EG2595



THOR-50M Right Lower Thorax Qualification

Z-Rotation + Offset

Serial Number: EG2595



THOR-50M Lower Abdomen Qualification

Test Results Summary

Dummy Serial Number: EG2595

Tested Components

Front Lower Abdomen Foam:

Rear Lower Abdomen Foam:

Lower Abdomen Bag:

Test ID: 250331-5

Test Date: 3/31/2025

Test Time: 1:36 PM

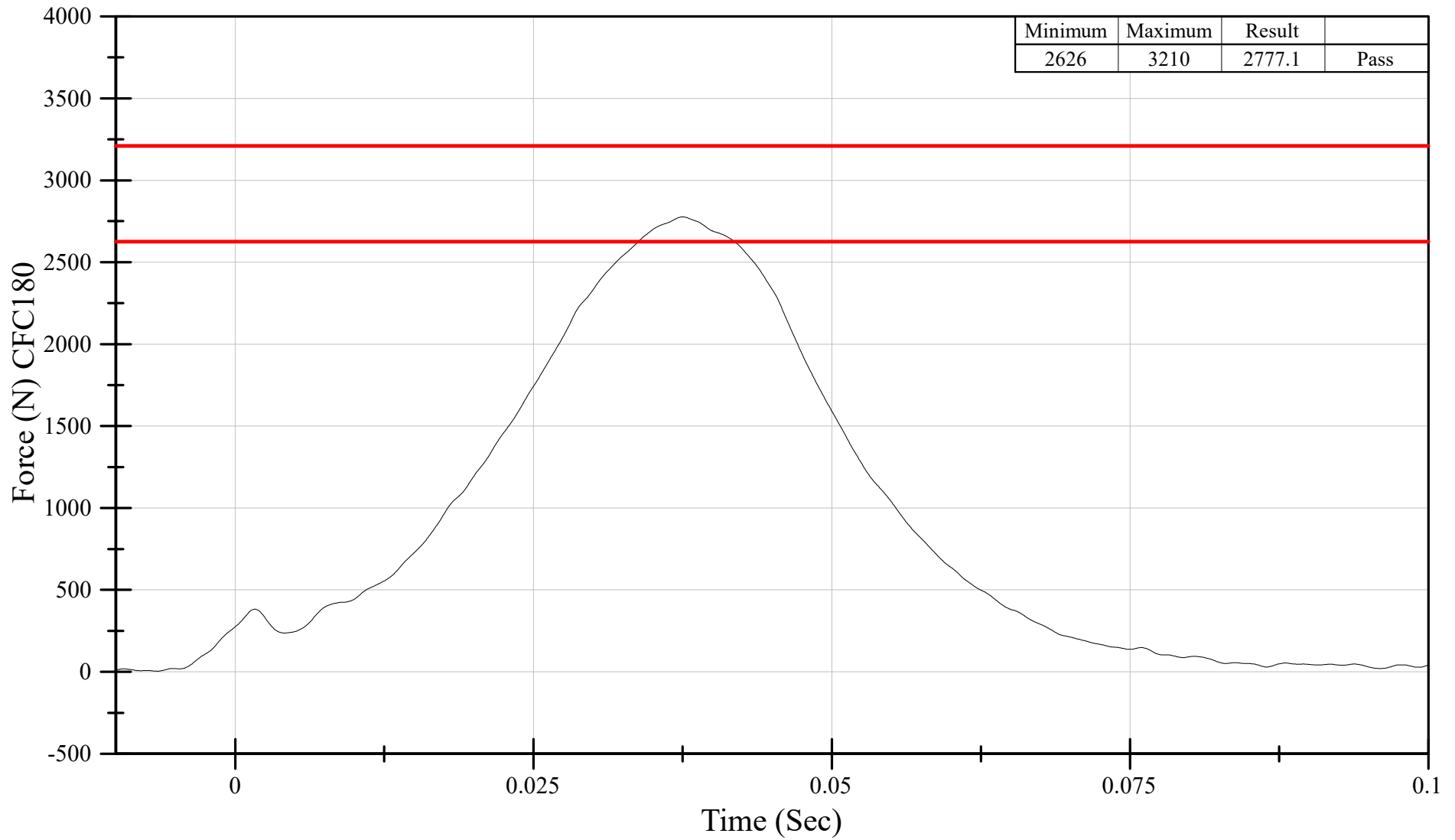
Test Results

<u>Test Parameter</u>	<u>Specification Range*</u>	<u>Result</u>	<u>Pass/Fail</u>
Test Temperature (°C)	20.6 - 22.2	21.6	Pass
Test Humidity (%)	10 - 70	48	Pass
Test Velocity (m/s)	3.25 - 3.35	3.257	Pass
Peak Probe Force (N)	2626 - 3210	2777.1	Pass
Lower Left Abdomen X-axis Deflection at Time of Peak Force (mm)	-91.3 - (-74.7)	-86.60	Pass
Lower Right Abdomen X-axis Deflection at Time of Peak Force (mm)	-91.3 - (-74.7)	-83.76	Pass
Difference Between Peak Left & Right X-axis Deflections (mm)	less than 8.0	2.99	Pass

THOR-50M Lower Abdomen Qualification

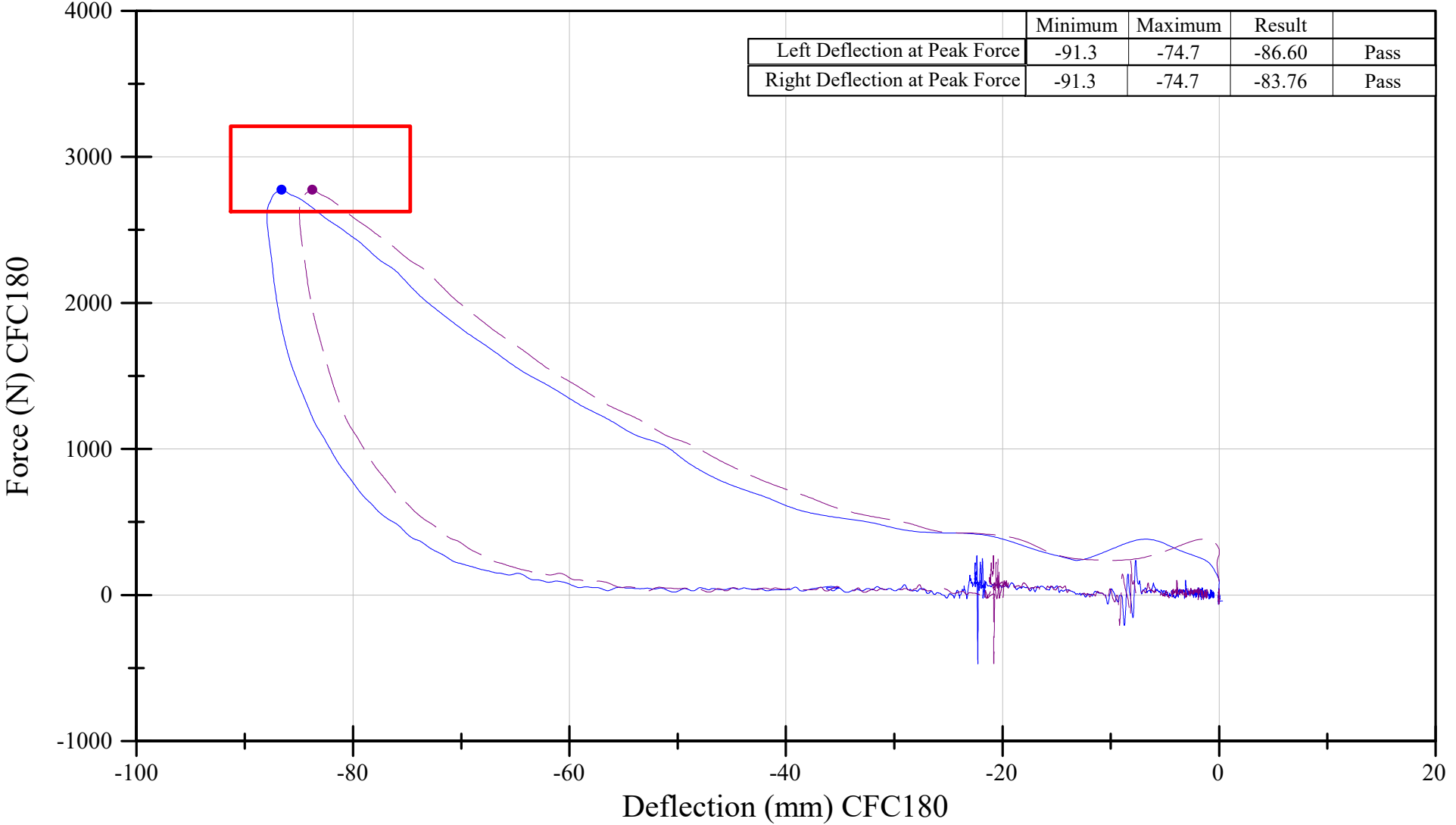
Probe Force

Serial Number: EG2595



THOR-50M Lower Abdomen Qualification
Deflection at Time of Peak Force
Serial Number: EG2595

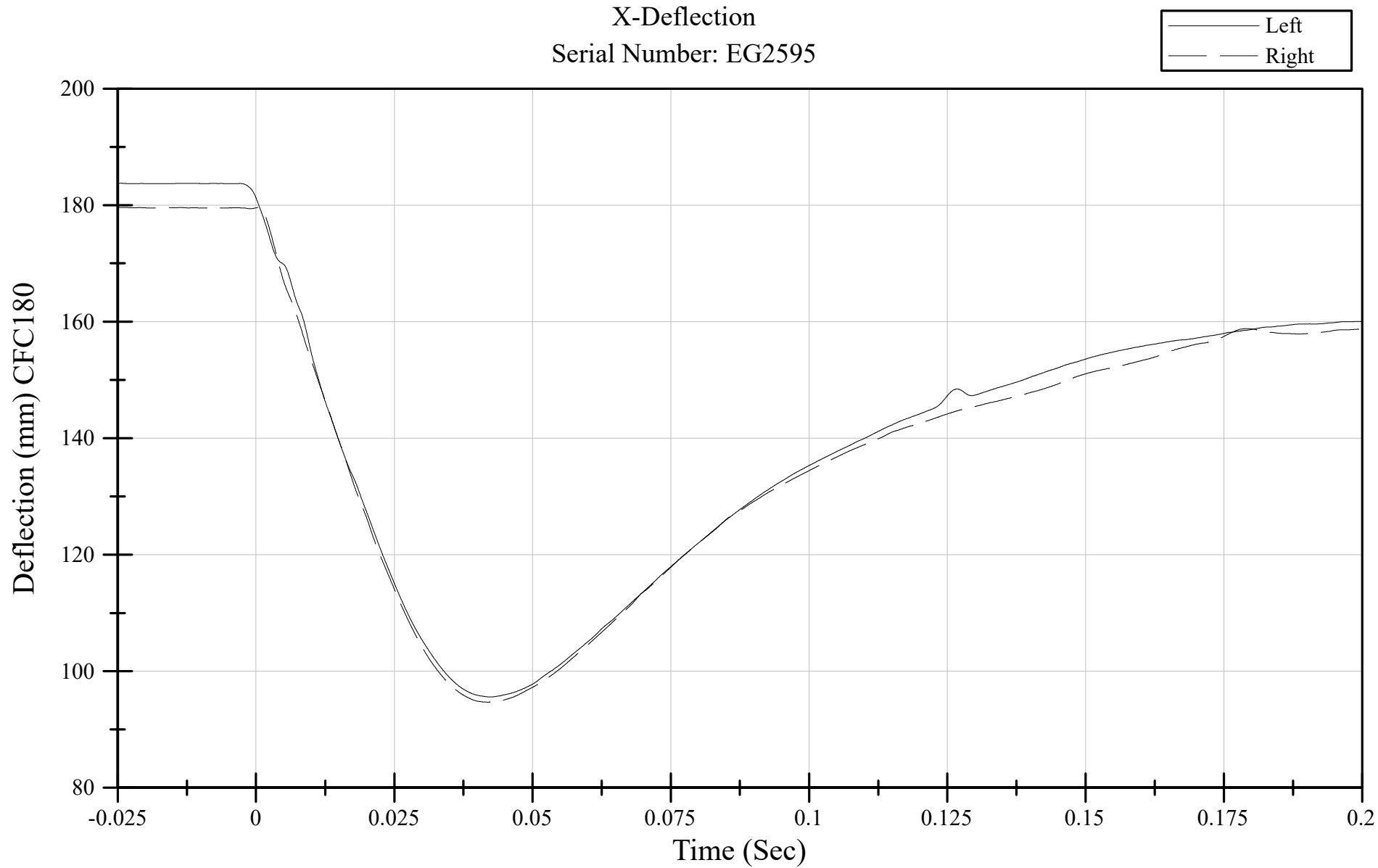
Left
Right



THOR-50M Lower Abdomen Qualification

X-Deflection

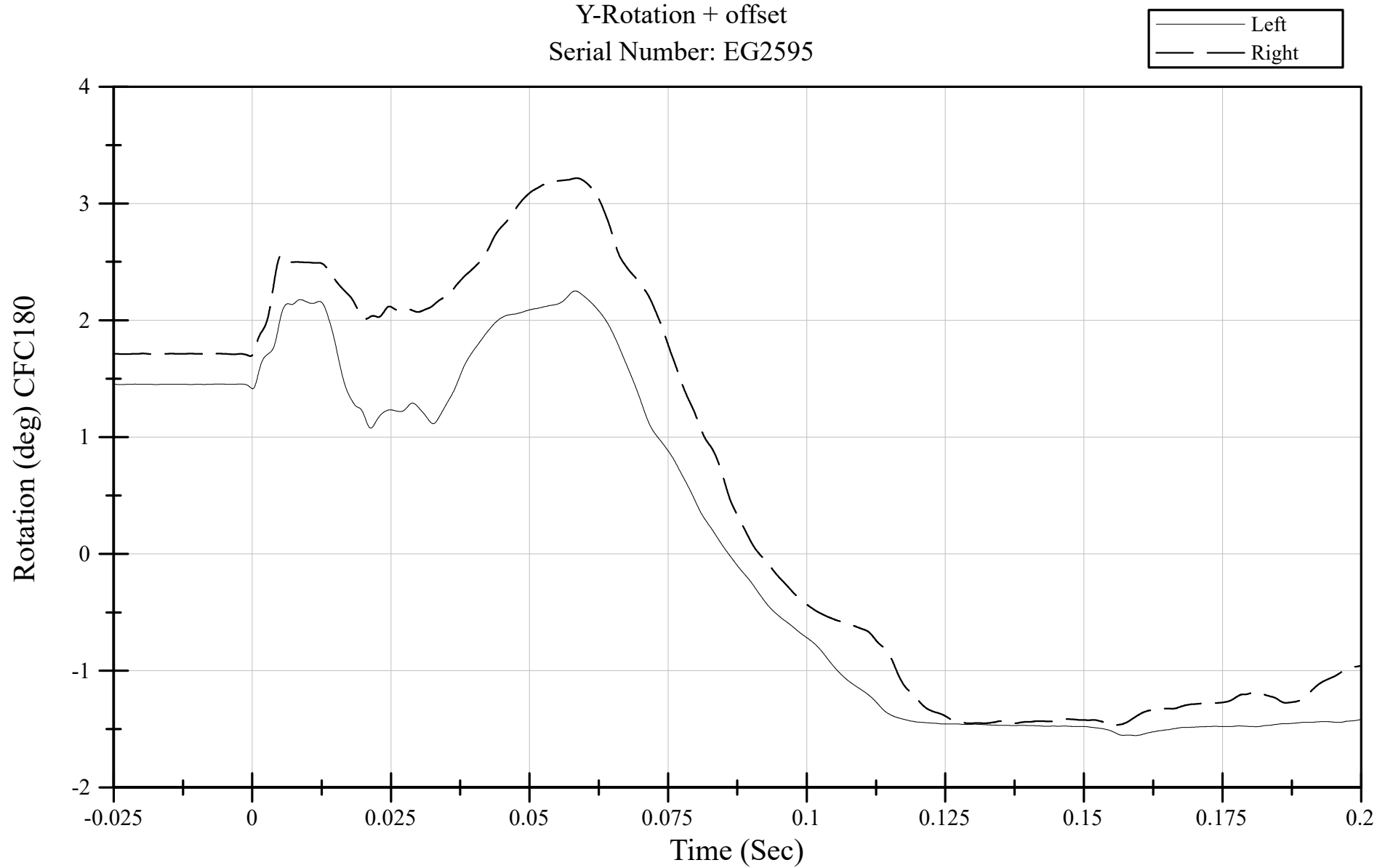
Serial Number: EG2595



THOR-50M Lower Abdomen Qualification

Y-Rotation + offset

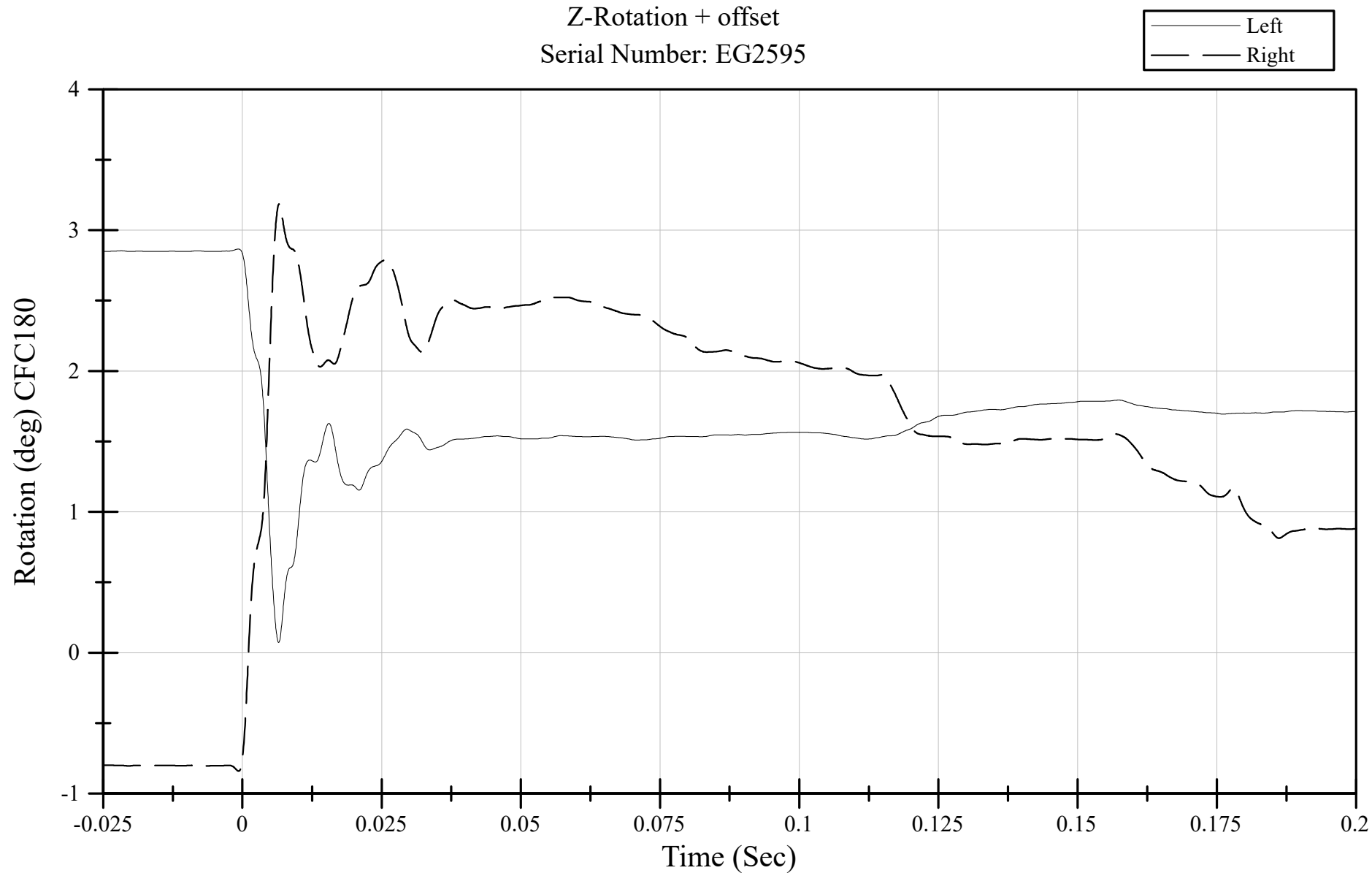
Serial Number: EG2595



THOR-50M Lower Abdomen Qualification

Z-Rotation + offset

Serial Number: EG2595



THOR-50M Left Upper Leg Qualification

Test Results Summary

Dummy Serial Number: EG2595

Tested Components

Compression Element:

Left Thigh Flesh:

Test ID: 250407-7

Test Date: 4/7/2025

Test Time: 3:11 PM

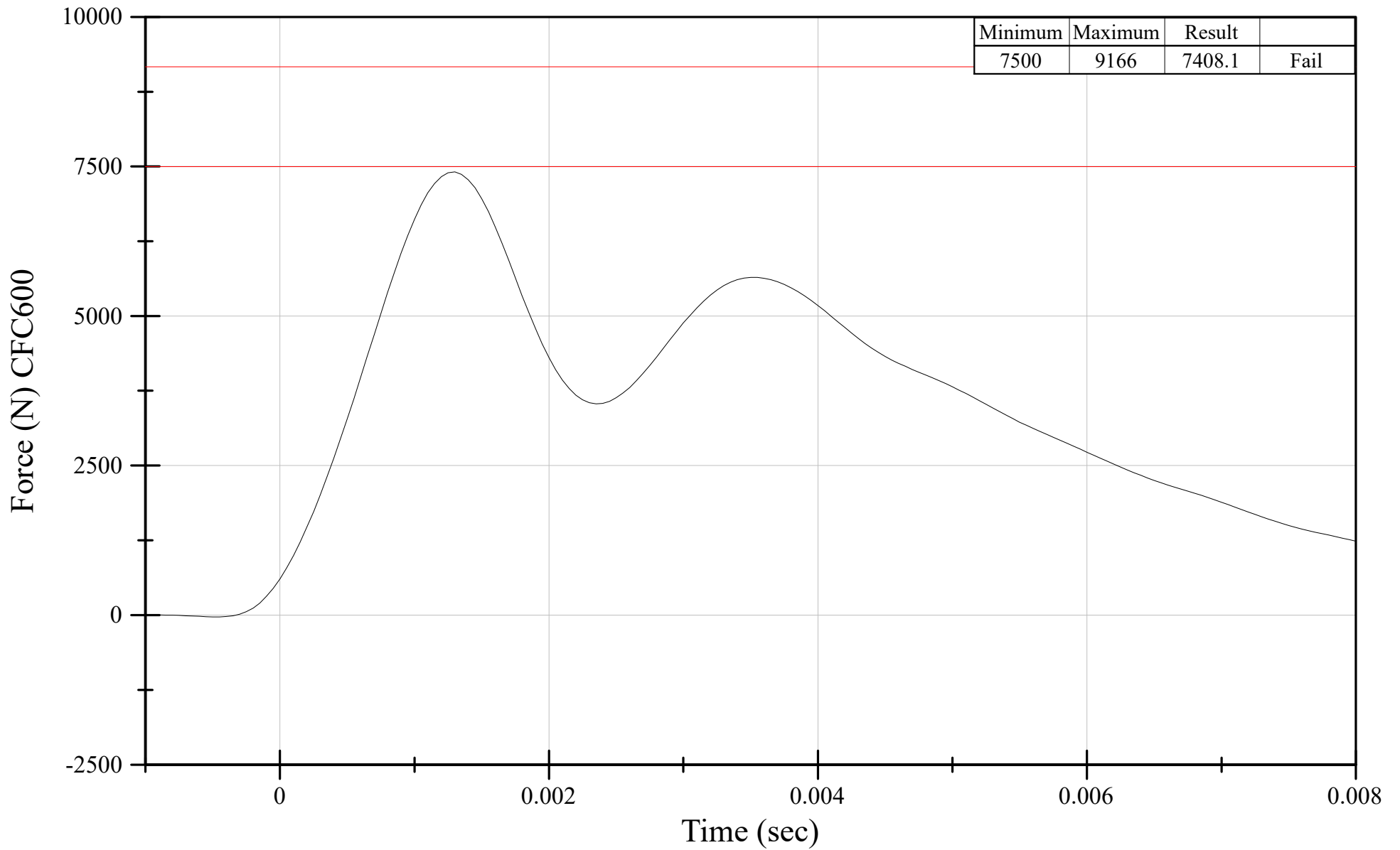
Test Results

<u>Test Parameter</u>	<u>Specification Range*</u>	<u>Result</u>	<u>Pass/Fail</u>
Test Temperature (°C)	20.6 - 22.2	21.6	Pass
Test Humidity (%)	10 - 70	48	Pass
Test Velocity (m/s)	3.25 - 3.35	3.333	Pass
Peak Probe Force (N)	7500 - 9166	7408.1	Fail
Peak Femur Force (N)	-5412 - (-4428)	-4606.3	Pass
Peak Resultant Acetabulum Force (N)	2464 - 3012	2812.6	Pass

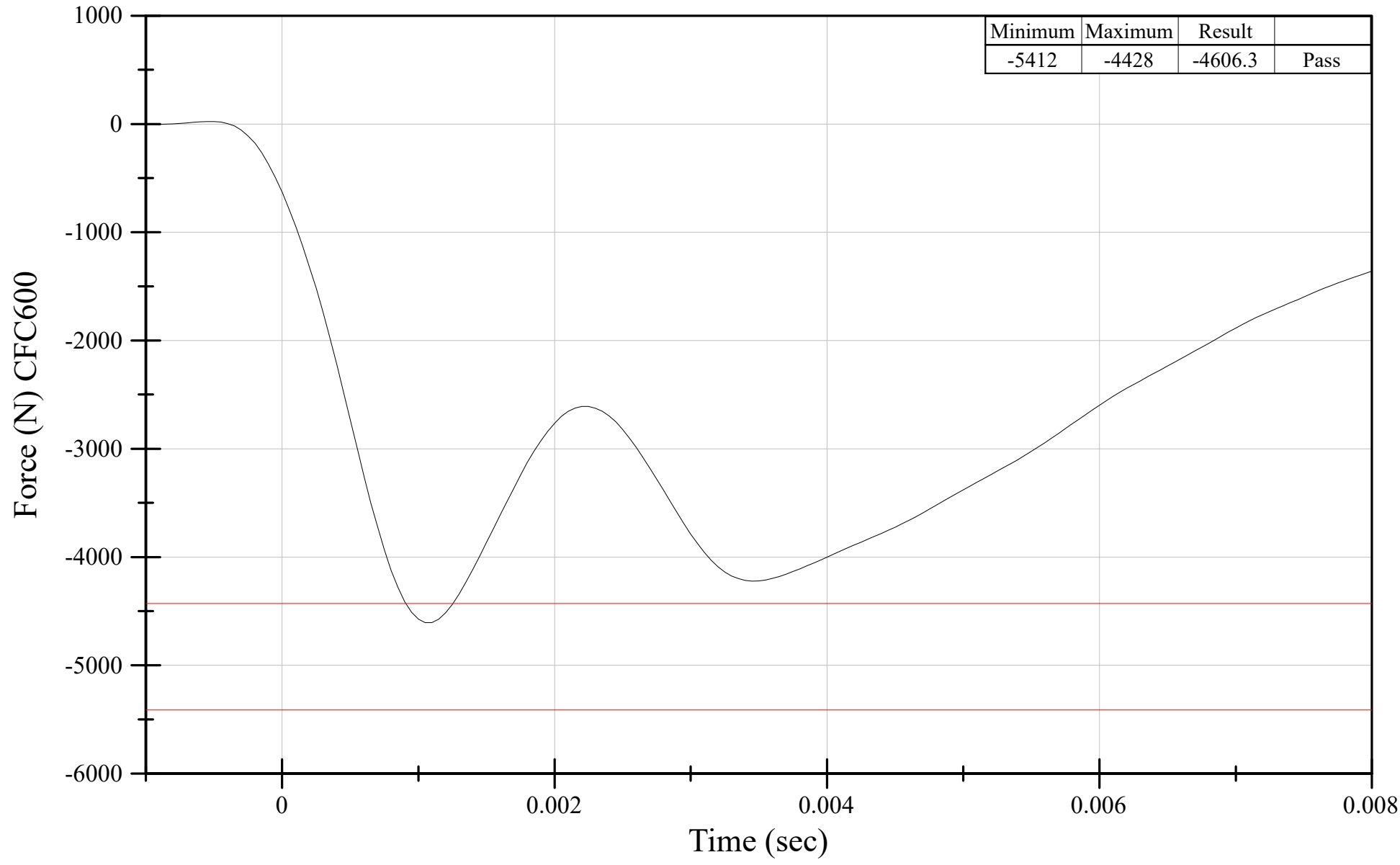
THOR-50M Left Upper Leg Qualification

Probe Force

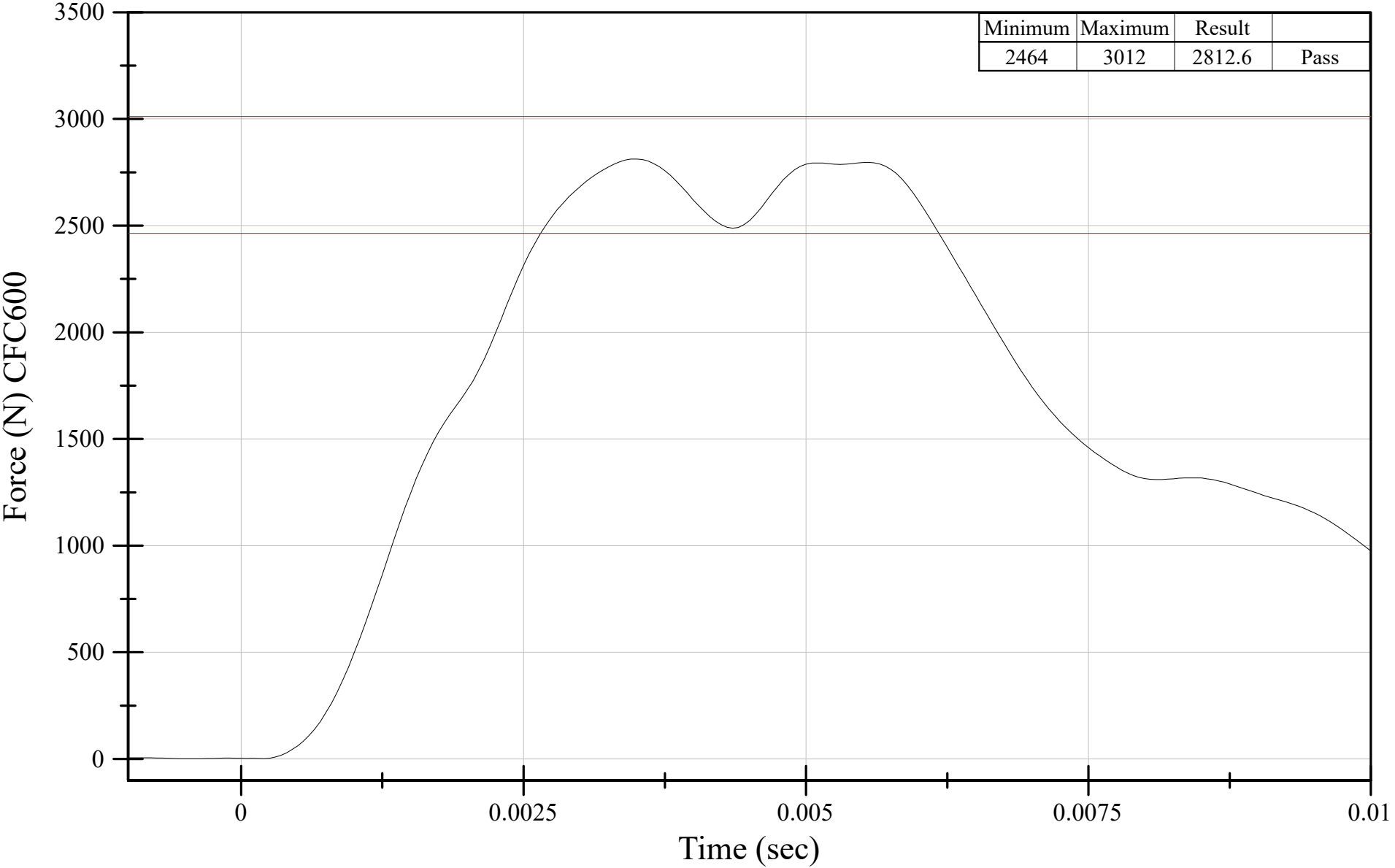
Serial Number: EG2595



THOR-50M Left Upper Leg Qualification
Femur Z-Force
Serial Number: EG2595



THOR-50M Left Upper Leg Qualification
Peak Acetabulum Resultant Force
Serial Number: EG2595



THOR-50M Right Upper Leg Qualification

Test Results Summary

Dummy Serial Number: EG2595

Tested Components

Compression Element:
Right Thigh Flesh:

Test ID: 250407-6

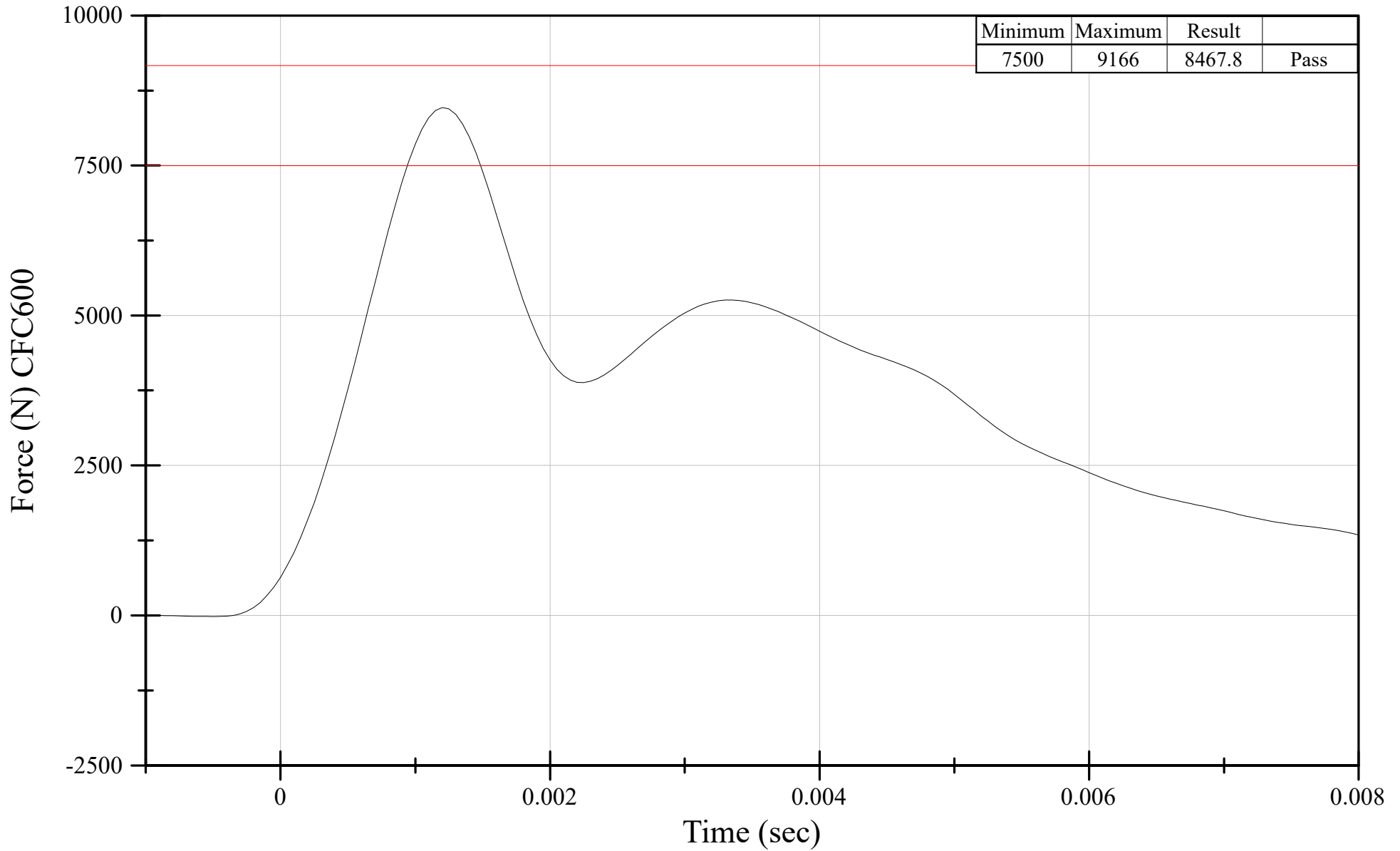
Test Date: 4/7/2025

Test Time: 2:34 PM

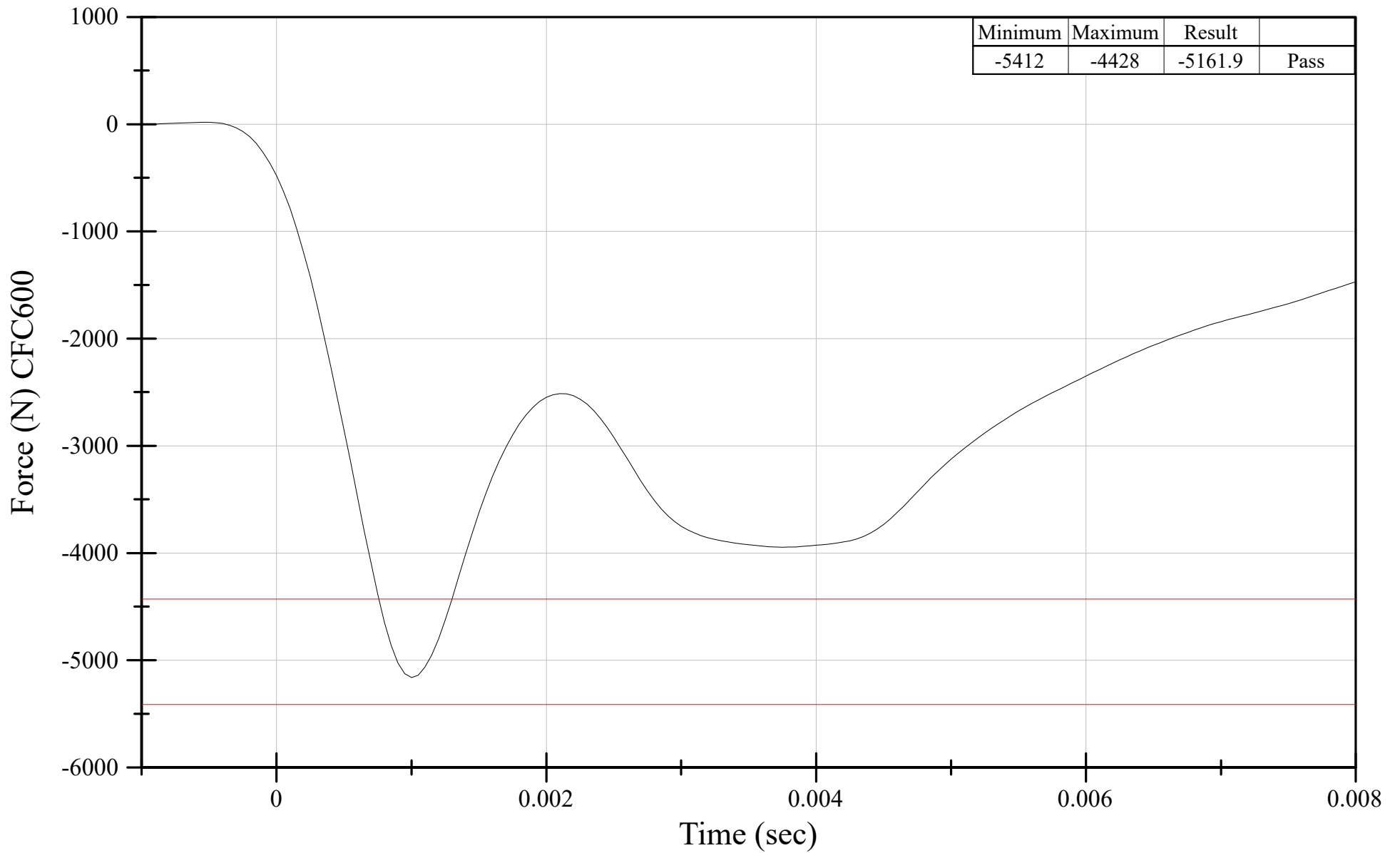
Test Results

<u>Test Parameter</u>	<u>Specification Range*</u>	<u>Result</u>	<u>Pass/Fail</u>
Test Temperature (°C)	20.6 - 22.2	21.4	Pass
Test Humidity (%)	10 - 70	49	Pass
Test Velocity (m/s)	3.25 - 3.35	3.336	Pass
Peak Probe Force (N)	7500 - 9166	8467.8	Pass
Peak Femur Force (N)	-5412 - (-4428)	-5161.9	Pass
Peak Resultant Acetabulum Force (N)	2464 - 3012	2901.6	Pass

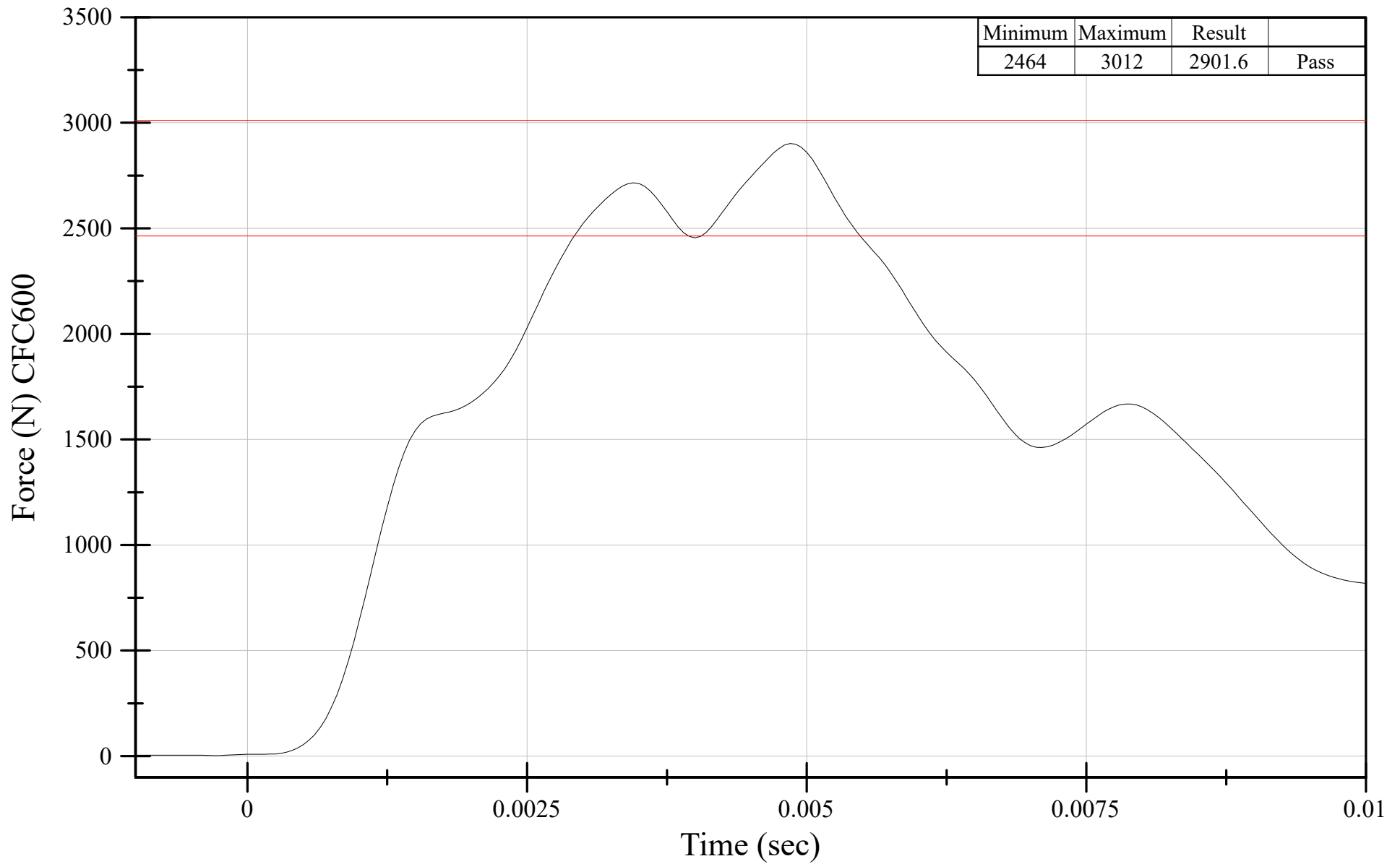
THOR-50M Right Upper Leg Qualification
Probe Force
Serial Number: EG2595



THOR-50M Right Upper Leg Qualification
Femur Z-Force
Serial Number: EG2595



THOR-50M Right Upper Leg Qualification
Peak Acetabulum Resultant Force
Serial Number: EG2595



APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

TABLE 1 – DRIVER DUMMY INSTRUMENTATION

Instrumentation			Axis/Location	THOR-50M S/N EG2595		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers			X	A20123-AC1	DTS	27-Feb-2024
			Y	A20123-AC2	DTS	27-Feb-2024
			Z	A20123-AC3	DTS	27-Feb-2024
Head Angular Rate Sensors			X	A20123-AV1	DTS	27-Feb-2024
			Y	A20123-AV2	DTS	27-Feb-2024
			Z	A20123-AV3	DTS	27-Feb-2024
Neck Spring Load Cells			Z	DI7619	HUMANETICS	19-Aug-2024
			Z	DI7618	HUMANETICS	19-Aug-2024
Neck OC Potentiometer			Y	54	SFERNICE	07-Aug-2024
Neck Load Cells		Upper	FX, FY, FZ, MX, MY, MZ	DS9758	HUMANETICS	29-Jul-2024
Thorax IR-TRACCs	Left	Upper	N/A	DI4718	HUMANETICS	7-Aug-2024
	Right		N/A	DJ2613	HUMANETICS	12-Aug-2024
	Left	Lower	N/A	DS6353	HUMANETICS	14-Aug-2024
	Right		N/A	DS6354	HUMANETICS	12-Aug-2024
Thorax Rotary Potentiometers	Left	Upper	Y	DI2383	SFERNICE	7-Aug-2024
			Z	DI2382	SFERNICE	7-Aug-2024
	Right	Upper	Y	DI7752	SFERNICE	7-Aug-2024
			Z	DI7753	SFERNICE	7-Aug-2024
	Left	Lower	Y	68	SFERNICE	13-Aug-2024
			Z	DS4092	SFERNICE	7-Aug-2024
	Right	Lower	Y	DM4776	SFERNICE	7-Aug-2024
			Z	DM4777	SFERNICE	7-Aug-2024
T6 Accelerometers			X	A20124-AC1	DTS	27-Feb-2024
			Y	A20124-AC3	DTS	27-Feb-2024
			Z	A20124-AC2	DTS	27-Feb-2024
T6 Angular Rate Sensors			X	A20124-AV1	DTS	27-Feb-2024
			Y	A20124-AV3	DTS	27-Feb-2024
			Z	A20124-AV2	DTS	27-Feb-2024
Thoracic Spine Load Cells			FX, FY, FZ, MX, MY, MZ	ED3057T	HUMANETICS	29-Jul-2024
Abdominal IR-TRACCs		Left	N/A	EA3851	HUMANETICS	8-Aug-2024
		Right	N/A	EC4123	HUMANETICS	4-Sep-2024
Abdominal Rotary Potentiometers		Left	Y	DJ5443	SFERNICE	7-Aug-2024
			Z	DJ5444	SFERNICE	7-Aug-2024
		Right	Y	DJ5445	SFERNICE	7-Aug-2024
			Z	DJ5446	SFERNICE	7-Aug-2024

TABLE 1 – DRIVER DUMMY INSTRUMENTATION (CONT'D)

Instrumentation		Axis/Location	THOR-50M S/N EG2595		
			Serial Number	Manufacturer	Calibration Date
A.S.I.S. Load Cells	Left	FX, MY	DP5091	Humanetics	30-Jul-2024
	Right	FX, MY	DP5092	Humanetics	30-Jul-2024
Acetabulum Load Cells	Left	FX, FY, FZ	DP1100	Humanetics	30-Jul-2024
	Right	FX, FY, FZ	DL9552	Humanetics	30-Jul-2024
Pelvis Accelerometers		X	A20125-AC2	DTS	27-Feb-2024
		Y	A20125-AC1	DTS	27-Feb-2024
		Z	A20125-AC3	DTS	27-Feb-2024
Pelvis Angular Rate Sensors		X	A20125-AV2	DTS	27-Feb-2024
		Y	A20125-AV1	DTS	27-Feb-2024
		Z	A20125-AV3	DTS	27-Feb-2024
Femur Load Cells	Left	FX, FY, FZ, MX, MY, MZ	EF6258	Humanetics	29-Jul-2024
	Right	FX, FY, FZ, MX, MY, MZ	EF6262	Humanetics	30-Jul-2024
Knee Slider Potentiometers	Left	FX	18084185	Firstmark	8-Aug-2024
	Right	FX	18105187	Firstmark	8-Aug-2024
Seat Belt Load Cells	Shoulder	N/A	N100E8	Measurement Spec.	13-Jan-2025
	Lap	N/A	T1210A	Measurement Spec.	13-Jan-2025

TABLE 2 – VEHICLE INSTRUMENTATION (CONT'D)

Instrumentation		Axis	Serial Number	Manufacturer	Calibration Date
Seat Crossmember Accelerometers	Left Rear	X	A377544	Measurement Spec.	3-Mar-2025
		Z	A377526	Measurement Spec.	3-Mar-2025
	Right Rear	X	A379051	Measurement Spec.	3-Mar-2025
		Z	A379063	Measurement Spec.	3-Mar-2025
Seat Crossmember Redundant Accelerometers	Left Rear	X	A377524	Measurement Spec.	3-Mar-2025
	Right Rear	X	A379040	Measurement Spec.	27-Feb-2025

APPENDIX E
SEATING PROCEDURE

Appendix E

THOR 50TH PERCENTILE MALE DUMMY SEATING & POSITIONING PROCEDURES: DRIVER POSITION

Seating and Positioning Procedures for the THOR 50th Percentile Male Dummy (THOR-50M) – Driver Position

1 Determine the seat type

Visually inspect the seats to determine type (i.e., bucket or bench).

___Bench

___Bucket

2 Position lumbar supports

Position the seat's adjustable lumbar supports to the lowest, retracted, or deflated adjustment positions.

___N/A No lumbar adjustment

3 Position additional supports

Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position.

___N/A No additional support adjustment

4 Position leg supports

Position an adjustable leg support system in its rearmost position.

___N/A No adjustable leg support system

5 Mark the centerline of the seat using a vehicle longitudinal, vertical (XZ) plane (complete ONLY the one that is applicable to seat being marked)

5.1 Bucket Seat: For future reference, locate and mark the line on the seat cushion that is the intersection of the XZ plane which passes through the centerline of the seat and the seat cushion upper surface.

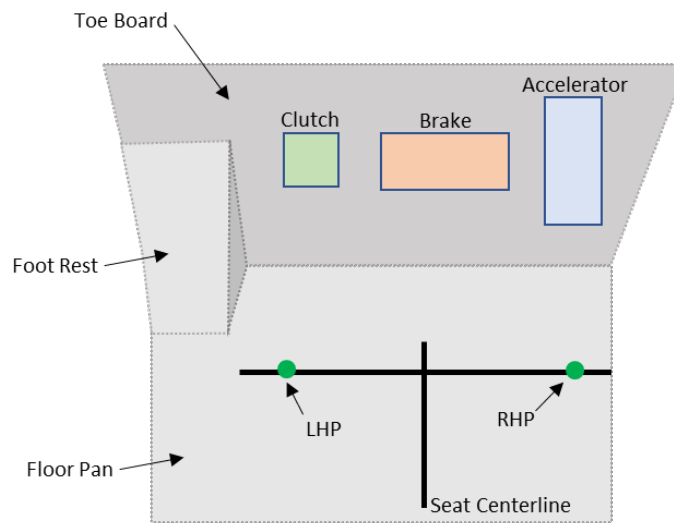
5.2 Bench Seat: For future reference, locate and mark the line on the seat cushion that is the intersection of the XZ plane which passes through the centerline of the steering wheel and the seat cushion upper surface.

6 Determine the type of accelerator pedal in the vehicle in order to mark the Right Heel Point (RHP). It is suggested to do the measurements using a Coordinate-Measuring Machine (CMM).

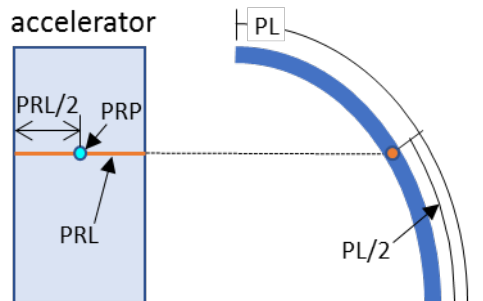
6.1 Is it a suspended accelerator pedal? If so, use the procedures detailed in step 7, and then go to step 9.

6.2 Is it a floor-mounted accelerator pedal? If so, skip step 7 and use the procedures detailed in step 8, and then go to step 9.

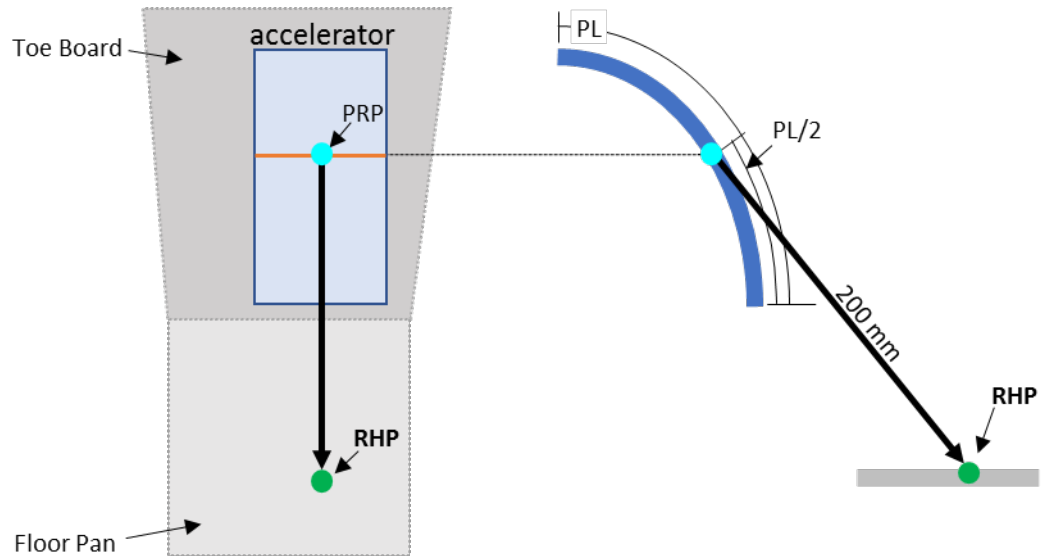
- 7 **Locate and mark the Heel Points (RHP and LHP) on the floor pan with a suspended accelerator pedal.** (For a floor-mounted pedal, proceed to step 8.)



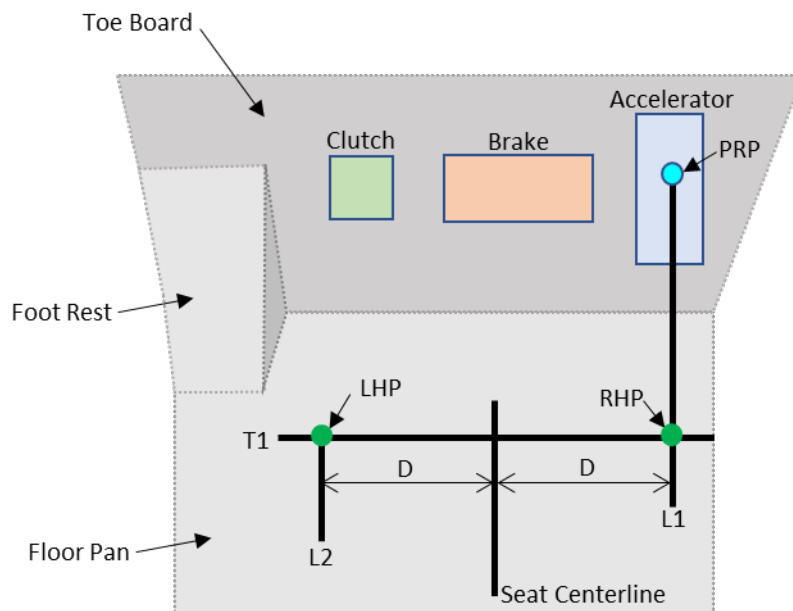
- 7.1 Place adjustable pedals in the full forward position (towards the front of the vehicle).
___N/A the pedals are not adjustable.
- 7.2 Using the diagram and steps below, locate the Pedal Reference Point (PRP) on the accelerator pedal (using a measurement device such as a flexible tape measure, CMM, and/or calipers).



- 7.2.1 Measure the accelerator pedal length (PL) along the surface of the pedal from the top edge to the bottom edge. Establish the pedal reference line (PRL) by marking a line in the y-direction on the pedal surface at the midpoint of the PL.
- 7.2.2 Measure the accelerator pedal width along the PRL. Establish the pedal reference point (PRP) by marking the midpoint of the PRL.
- 7.3 Using a measurement device (CMM, 200 mm bar, calipers), locate a point on the floor pan that is 200 mm from PRP and is in the vehicle's longitudinal, vertical (XZ) plane which passes through PRP. This is the right heel point (RHP).



- 7.4 Mark a line on the pedal and the floor pan that passes through PRP and RHP. This line shall be referred to as L1 and should be in the same vehicle XZ plane as PRP and RHP.
- 7.5 Translate and mark the seat centerline on the floor pan. The lines on the seat and floor pan should be in the same vehicle XZ plane.
- 7.6 Measure the distance in the y-direction (D) from the seat centerline to L1. Record the value:_____.



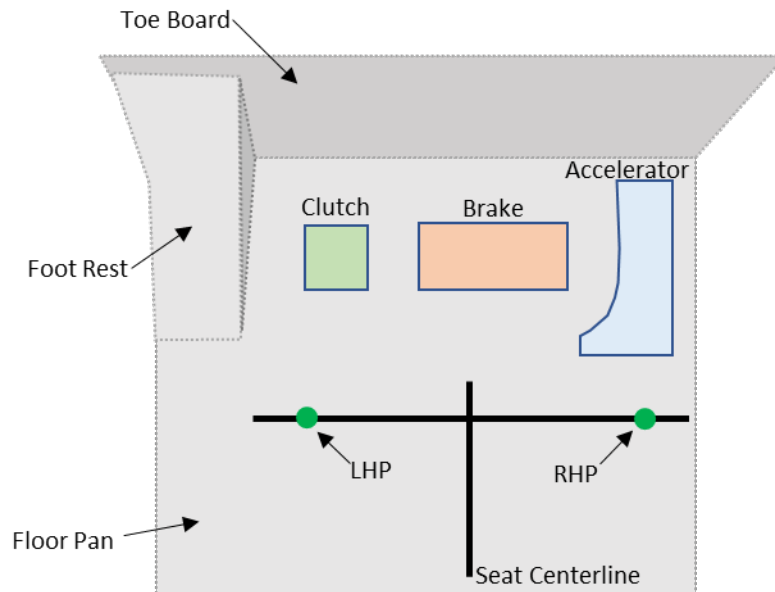
- 7.6.1 Measure and mark a point on the floor pan to the left of the seat centerline that is the same distance from the seat centerline as RHP and in the same vehicle lateral, vertical (YZ) plane, and label that the left heel point (LHP).

7.6.2 Construct a line on the floor pan through RHP and LHP; call it T1.

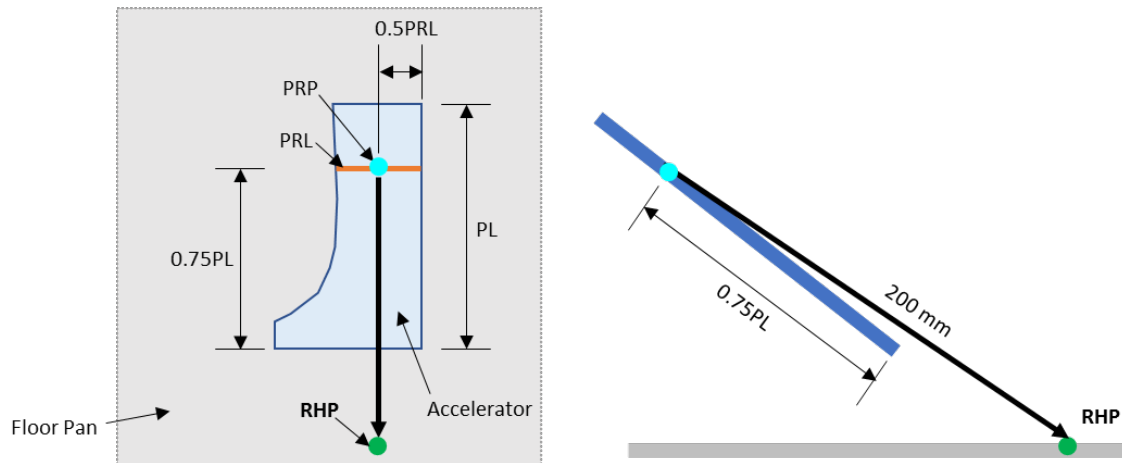
7.6.3 Construct a line on the floor pan that is in a vehicle XZ plane and that passes through LHP. This line shall be referred to as L2.

7.7 Mark two lines on the floor pan parallel to line T1; the first 10 mm forward and the second 10 mm rearward of T1. This zone between these two lines will be used for placement of both the left and right heels and will be referred to as the heel point zone.

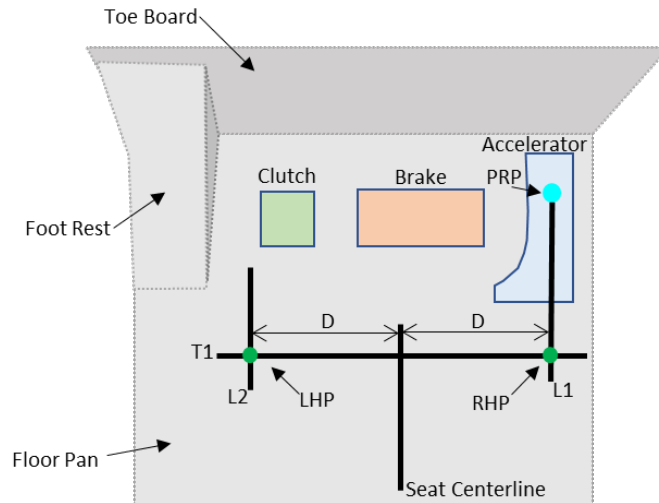
8 Locate and mark the Heel Points (RHP and LHP) on the floor pan with a floor-mounted accelerator pedal. (Use step 7 for a suspended pedal.)



8.1 Using the diagram below, locate the Pedal Reference Point (PRP) and the Right Heel Point (RHP) using a measurement device such as a tape measure, CMM, 200 mm bar, and/or calipers. Use the active part of the pedal, which is defined as the moveable part of the floor-mounted pedal.



- 8.1.1 Determine the overall pedal length (PL) on the active pedal, as measured along the surface of the moveable pedal. Record the length:_____. Calculate 75% of this length (0.75PL). Establish the pedal reference line (PRL) by marking a line in the y-direction on the pedal surface at 0.75PL from the bottom edge of the pedal.
- 8.1.2 Measure the length of the PRL in the y-direction and mark the center point of the PRL. This is the PRP.
- 8.1.3 Using a measurement device (CMM, 200mm bar, calipers), locate a point on the floor pan that is 200 mm from PRP and in the vehicle's longitudinal, vertical (XZ) plane which passes through PRP. This is the right heel point (RHP).
- 8.2 Mark a line on the pedal and the floor pan that passes through PRP and RHP. This line shall be referred to as L1 and should be in the same vehicle XZ plane as PRP and RHP.
- 8.3 Translate and mark the seat centerline on the floor pan. The lines on the seat and floor pan should be in the same vehicle XZ plane.
- 8.4 Measure the distance in the y-direction (D) from the seat centerline to L1. Record the value:_____.



8.4.1 Measure and mark a point on the floor pan to the left of the seat centerline that is the same distance from the seat centerline as RHP and in the same vehicle lateral, vertical (YZ) plane, and label that the left heel point (LHP).

8.4.2 Construct a line on the floor pan through RHP and LHP; call it T1.

8.4.3 Construct a line on the floor pan that is in a vehicle XZ plane and that passes through LHP. This line shall be referred to as L2.

8.6 Mark two lines on the floor pan parallel to line T1; the first 10 mm forward and the second 10 mm rearward of T1. This zone between these two lines will be used for placement of both the left and right heels and will be referred to as the heel point zone.

9 Mark the range of seat travel

Prior to marking the seat for fore/aft travel, move the seat through its full range of motion using all available controls. Separately, operate each control to determine whether it moves the seat and/or seat cushion primarily in the fore-aft or up-down directions.

9.1 Mark a point (seat cushion reference point - SCRP) on the side of the seat cushion that is between 150 mm and 250 mm from the front edge of the seat cushion. For seat cushions that move up and down independently from the seat housing, mark the point on the side of the cushion in an area that will not be obscured by the seat housing when the seat cushion is at its lowest height position.

9.2 Draw a horizontal line (seat cushion reference line - SCRL) through the SCRP.

- 9.3 Using only the controls that primarily move the seat in the fore-aft direction, move the SCRP to the lowest rearmost position.
- 9.4 If the seat cushion adjusts fore-aft, independent of the seat back, using only the controls that primarily move the seat cushion in the fore-aft direction, move the SCRP to the rearmost position.

___ N/A No independent fore-aft seat cushion adjustment

- 9.5 Using any part of any control, other than the parts just used for fore-aft positioning, determine the range of angles of the SCRL and set the SCRL at mid-angle. Record the maximum, minimum, and mid-angles in the table below.

SCRL (deg)	Max	Min	Mid
Driver			

- 9.6 If the seat and/or seat cushion height is adjustable, using any part of any control other than the parts which primarily move the seat or seat cushion fore-aft, put the SCRP in its lowest position with the SCRL angle at the mid-angle found in 9.5.

___ N/A No seat height adjustment

- 9.7 Using only the controls that primarily move the seat in the fore-aft direction, verify the seat is in the rearmost position.
- 9.8 Using only the controls that primarily move the seat in the fore-aft direction, mark the fore-aft seat positions. Mark each position so that there is a visual indication when the seat is at a particular position.

For manual seats, move the seat forward one detent at a time and mark each detent.

For power seats, mark only the rearmost, middle, and foremost positions. Label three of the positions with the following: F for foremost, M for mid-track (if there is no mid-track, label the closest adjustment position to the rear of mid-track), and R for rearmost.

Measure the SCRP fore-aft location for each seat position on the table below.

	SCRL Mid-Angle (deg)							SCRP Height (mm) Spacing measurement between detents (if applicable)
		Rearmost		Mid-track		Foremost		
		X	Z	X	Z	X	Z	X
Driver								

9.8.1 While at mid-track, also mark a position that is 25 mm rearward of mid-track.

10 Position the head restraint

- 10.1 Using any adjustment of the head restraint, position it to its highest setting.
- 10.2 Using any adjustment of the head restraint, position it to the full rearward setting. If it rotates, rotate it such that the head restraint extends as far rearward as possible.

___N/A The test vehicle is equipped with automatically adjusting head restraints or there is no head restraint adjustment.

11 Set the seat for a test dummy

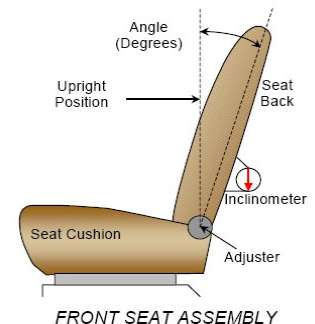
Using the reference marks on the seat, set the seat in the mid-track, lowest height, and mid seat cushion angle positions as follows:

- 11.1 If the seat or seat cushion height is adjustable, using other than the controls that primarily move the seat or seat cushion fore and aft, set the height of the SCRP to the minimum height, with the SCRL set as closely as possible to the mid-angle determined in previous steps.
- 11.2 Using the control that primarily moves the seat fore and aft, move the SCRP to the mid-track position.
- 11.3 Set the seat back angle at the manufacturer's nominal design riding position for a 50th percentile male adult occupant.

If the position is not specified, set the seat back in the position that produces a torso (back) angle of 25° from vertical when measured with the SAE J826 H-point machine. For seat backs with discrete positions, if a torso (back) angle of 25° from vertical cannot be achieved, set the seat back in the detent that yields a torso (back) angle as close as possible to 25° from vertical. Describe the method used to achieve the nominal design riding position and record the seat back angle.

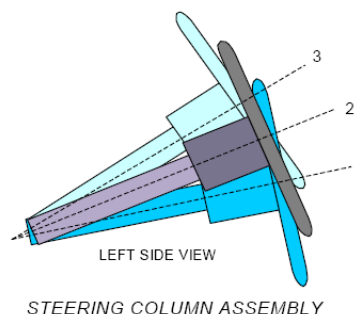
Seat Back Angle ___°

___N/A The seat back does not adjust.



12 Set the steering wheel to the mid-position

Use the markings to position the steering wheel hub at the geometric center of full range of driving positions including any telescoping positions. For steering columns with discrete positions and no detent at the mid-angle, position the column in the next lowest detent from the mid-angle.



Complete the following table:

	Degrees	Fore/Aft Position (mm)
Lowermost - Position 1		
Geometric Center – Position 2		
Uppermost – Position 3		
Telescoping Steering Wheel Travel		
Test Position		

__N/A The steering wheel does not adjust.

13 Set adjustable seat belt upper anchorages

Use the markings to position an adjustable seat belt upper anchorage at the manufacturer's nominal design position for a 50th percentile male adult occupant or highest position if not provided. Fill in the following table:

Seat	Total # of Positions	Placed in Position #
Driver		

__N/A The seat belt upper anchorage does not adjust.

14 Retract the armrest

Retract any folding armrest

___N/A No armrest or armrest is fixed, not retractable.

15 Determine the H-point location with the H-Point machine;

Position the three-dimensional H-point manikin (i.e., H-point machine) specified in Society of Automotive Engineers (SAE) Surface Vehicle Standard J826, revised July 1995, Devices for Use in Defining and Measuring Vehicle Seating Accommodation in the seat as follows:

- 15.1 Place a 910 mm² piece of muslin cotton cloth over the seat area (the muslin cloth shall be comparable to 48 threads/in² and density of 2.85 lb/yd). Tuck the muslin cloth a sufficient amount to prevent hammocking of the material.
- 15.2 Place the seat and back assembly of the H-Point machine such that its plane of symmetry is coincident with the centerline marking on the seat.
- 15.3 Install the lower leg and foot segments.
- 15.4 Set the length of the lower leg segments at 414 mm (16.3 in) and the length of the thigh bar at 401 mm (15.8 in).
- 15.5 Leg and foot placement
 - 15.5.1 Insert the pin so that the right foot angle is not less than 87°.
 - 15.5.2 Place the right foot on the un-depressed accelerator pedal with the sole of the foot on the pedal and the heel as far forward as allowable. Do not place the heel on the toe board.
 - 15.5.3 Adjust the left leg to be the same distance from H-point machine centerline as the right leg.
 - 15.5.4 With the T-bar level, place the left foot on the toe board with the rearmost point of the heel resting on the floor pan as close as possible to the point of intersection of the planes described by the toe board and the floor pan and not on the wheel well projection. If the foot cannot be positioned on the toe board, set it on the floor pan.
 - ___Foot on toe board
 - ___Foot on floor pan
- 15.6 Apply the lower leg weights.
- 15.7 Apply the thigh weights.
- 15.8 Tilt the back pan forward against the forward stop and draw the H-point machine

away from the seatback using the T-bar.

15.9 Re-positioning the H-point machine.

15.9.1 Allow the H-point machine to slide rearward until a forward horizontal restraining load on the T-bar is no longer required due to the seat pan contacting the seat back.

___The seat pan does not slide rearward. Go to step 15.9.2.

15.9.2 Slide the H-point machine rearward by a horizontal rearward load applied at the T-bar until the seat pan contacts the seat back.

15.10 Apply a 10 kg load at the intersection of the hip angle quadrant and the T-bar housing along a line from the above intersection to a point just above the thigh bar housing.

15.11 Again apply a 10 kg load at the intersection of the hip angle quadrant and the T-bar housing along a line from the above intersection to a point just above the thigh bar housing.

15.12 Carefully return the back pan to the seat back.

15.13 Install the right and left buttock weights.

15.14 Install the eight torso weights, alternating the installation between right and left.

15.15 Tilt the back pan forward until the stop is contacted.

15.16 Rock the H-point machine from side to side over a 10° arc (5° to each side of the vertical centerline) for three complete cycles. Restrain the T-bar during rocking so that the seat pan does not change position. Minimize any inadvertent exterior loads applied in a vertical or fore-aft direction. The feet are free to move during this rocking motion.

15.17 Without applying a forward or lateral load, lift the right foot off the floor the minimum amount necessary until no additional forward foot movement is obtained.

15.18 Lower the right foot until the heel is in contact with the floor pan and the ball of the foot is in contact with the floor, toe board, or undepressed accelerator pedal.

15.19 Without applying a forward or lateral load, lift the left foot off the floor the minimum amount necessary until no additional forward foot movement is obtained.

15.20 Lower the left foot until the heel is in contact with the floor pan and the ball of the foot is in contact with the floor or toe board.

15.21 Is the seat pan level?

___Yes. Go to step 15.23.

___No. Go to step 15.22.

- 15.22 Apply a sufficient lateral load to the top of the seatback pan to level the H-point machine seat pan on the seat.
- 15.23 Holding the T-bar to prevent the H-point machine from sliding forward on the seat cushion, return the seatback pan to the seatback.
- 15.24 Holding the T-bar to prevent the H-point machine from sliding forward on the seat cushion, apply a rearward force perpendicular to the back angle bar just above the torso weights until either 66 N (15 lb) of force is reached or the hip angle is increased by 3°, whichever occurs first. Minimize the exterior downward or side forces applied to the H-point machine. Release the force. Repeat this step until the resulting hip angle is identical. Complete as many force applications as necessary and record the results in the following table:

Force App.	Hip Angle
1	
2	
3	
4	
5	

- 15.25 Is the H-point machine level?
___Yes. Go to step 15.26.
___No. Go back to step 15.15 and repeat steps to re-level H-point machine.

- 15.26 Record the H-point location in the table below:

H-point Machine H-point Location and Torso Angle	
Torso Angle	°
X (positive (+) forward of striker)	(mm)
Z (positive (+) below striker)	(mm)

Reference: X-axis is positive forward of striker
Y-axis is positive right of striker
Z-axis is positive below striker



- 15.27 Create a Seat Tracking Point (STP): Place a target point 20 mm forward of the H-point machine H-point on a rigid part of the seat and record its location in the table below. This reference point will be used to locate the dummy H-point relative to the seat if the seat cannot be set to the mid-track position.

Seat Tracking Point (STP) Location at Mid-track	
X (positive (+) forward of striker)	(mm)
Z (positive (+) below striker)	(mm)

- 15.28 Remove the H-point machine.

16 Calculate the THOR-50M H-point target at seat mid-track

- 16.1 The THOR-50M H-point is offset 20 mm forward and 20 mm above the H-point machine H-point as determined in the table below:

THOR-50M Target H-point at Mid-track		
H-point machine H-point (from step 15.26) +/- 20 mm = THOR-50M H-point at mid-track		
X (positive (+) forward of striker)	() + 20 mm	mm
Z (positive (+) below striker)	() - 20 mm	mm

If steps 1-16 were completed prior to seating, verify that measurements have been recorded prior to placing dummy in seat.

17 Once the H-point has been determined and the following things are verified, position a THOR-50M in the driver seat of the test vehicle.

- 17.1 Follow the procedures in the THOR-50M Qualification Manual for setting the

joint torques. Also, make sure the neck is placed in the neutral position setting and the spine box is placed in the slouched position before placing the dummy in the vehicle.

- 17.2 Verify the head and pelvis tilt sensors installed in the dummy are reading correctly about the X and Y axes.
- 17.3 Record the lumbar spine pitch change joint and neck pitch change joint settings below:

Lumbar spine pitch change joint: _____

Neck pitch change joint: _____

- 17.4 Verify the seat back and base angles, the steering wheel location, and the seat belt height adjustment are in the correct locations.

18 Positioning the test dummy in the seat

- 18.1 Move the seat to the full rearward position and place the test dummy in the seat with the thighs resting on the seat cushion.
- 18.2 Position the test dummy in the seat such that its plane of symmetry (i.e., mid-sagittal plane) is coincident with the centerline marking on the seat cushion, seat back, and head restraint and its H-point is approximately above the STP.
- 18.3 Bend the upper torso forward and then lay it back against the seat back. Push the shoulders of the dummy fully rearward. Using the installed tilt sensors, position the dummy so that it sits squarely and level in both the X- and Y-axes in the seat.
- 18.4 To the extent practicable keep the left and right thighs and legs in vertical planes and align the centerline of the right foot with the centerline of the accelerator pedal. Initially set the feet perpendicular to the legs and then place the right foot as far forward as possible in the direction of the pedal centerline.

18.4.1 Does this vehicle have a footrest?

___Yes. Starting with the left foot and leg inboard of the footrest, rotate the leg about the hip the minimal amount needed to maximize coverage of the sole of the shoe over the footrest (when viewed longitudinally), while keeping the centerline of the foot in a vertical plane and the leg as vertical as practicable. Ignore the LHP.

___No. Adjust the left leg so the knees are an equal distance from the seat centerline, as measured from the centerline of the knee, while keeping the leg as vertical as practical. Align the foot with the LHP (± 10 mm).

- 18.5 Lift the feet and slide the seat forward to 25 mm rearward of mid-track or the detent closest to this position that is not greater than 25 mm rearward of mid-

track. Adjust the feet if necessary. If there is knee/leg contact with the steering wheel, steering column, or instrument panel, adjust the knee/leg making contact inboard or outboard the minimal amount required to create clearance (not more than 10 mm).

Is there still interference between the dummy's knees/legs and the knee bolster/instrument panel?

___No. Go to step 18.6.

___Yes. Lift the feet and slide the seat to 50 mm rearward of mid-track or the detent closest to this position that is not greater than 50 mm rearward of mid-track. If there is still interference (within 5 mm), continue to move the seat rearward in 25 mm increments until there is no longer interference.

- 18.6 Verify the SCRP position, then measure location of the STP and record it under Trial 1 in the table below (subsequent trials may be needed, depending on the outcome of step 18.13):

Seat Tracking Point Location Trial 1	
X (positive (+) forward of striker)	(mm)
Z (positive (+) below striker)	(mm)
Seat Tracking Point Location Trial 2 (if applicable)	
X (positive (+) forward of striker)	(mm)
Z (positive (+) below striker)	(mm)
Seat Tracking Point Location Trial 3 (if applicable)	
X (positive (+) forward of striker)	(mm)
Z (positive (+) below striker)	(mm)

18.6.1 Calculate and record the Seat Tracking Point Difference (STPD)

STPD = Location of STP from step 18.6 – location of STP from step 15.27

Record in table below:

Trial 1			
	Results from 18.6 - Results from 15.27 = STPD		
X (positive (+) forward of striker)	()	-	() mm
Z (positive (+) below striker)	()	-	() mm

Trial 2 (if applicable)			
	Results from 18.6 - Results from 15.27 = STPD		
X (positive (+) forward of striker)	()	-	() mm
Z (positive (+) below striker)	()	-	() mm

Trial 3 (if applicable)			
	Results from 18.6 - Results from 15.27 = STPD		
X (positive (+) forward of striker)	()	-	() mm
Z (positive (+) below striker)	()	-	() mm

18.6.2 Calculate and record the THOR-50M target H-point for each seat position as the seat is moved forward (per step 18.5), following the corresponding steps.

X: THOR-50M Target H-point for 18.6.2 = (THOR-50M Target H-point from 16.1) + (STPD from 18.6.1)

Z: THOR-50M Target H-point for 18.6.2 = (THOR-50M Target H-point from 16.1) + (STPD from 18.6.1)

Trial 1			
	Results from 16.1 - Results from 18.6.1 = Current Target H-point		
X (positive (+) forward of striker)	()	+	() mm
Z (positive (+) below striker)	()	+	() mm

Trial 2 (if applicable)			
	Results from 16.1 - Results from 18.6.1 = Current Target H-point		
X (positive (+) forward of striker)	()		() mm
Z (positive (+) below striker)	()	+	() mm

Trial 3(if applicable)			
	Results from 16.1 - Results from 18.6.1 = Current Target H-point		
X (positive (+) forward of striker)	()	+	() mm
Z (positive (+) below striker)	()	+	() mm

- 18.7 Confirm, using the tilt sensors, that the dummy is positioned such that a horizontal, lateral line passing through the dummy's hip pivot center is perpendicular to the center XZ plane of the seat – adjust the dummy if necessary.
- 18.8 Verify/Measure the pelvis angles using the tilt angle sensors installed in the test dummy. Verify that the pelvis angles are $0^{\circ} \pm 1^{\circ}$ (about the X-axis) and $33^{\circ} \pm 2.5^{\circ}$ (about the Y-axis).
- 18.9 Confirm that the H-point is within ± 10 mm of the target location in the horizontal (X) and the vertical (Z) directions – adjust the dummy if necessary.

18.10 Are the pelvis angles within specification (described in step 18.8)?

___ Yes. Go to step 18.11.

___ No. Go back to step 18.7 and repeat steps to re-adjust pelvis angles while maintaining the H-point position within specification.

18.11 Verify/Measure the head angles using the tilt angle sensors installed in the test dummy. Verify that the head angles are $0^\circ \pm 1^\circ$ (about the X axis) and $0^\circ \pm 1^\circ$ (about the Y-axis).

18.11.1 Are the head angles within specification?

___ Yes. Go to step 18.12 (foot placement).

___ No and head is not touching head rest. Go back to step 18.7; adjust the pelvis while maintaining the H-point target position within specification.

___ No and head is not touching head rest, but the pelvis has already been re-adjusted. Go to step 18.11.2.

___ No and head is touching head rest. Go to step 18.11.2.

___ No and seat back has been adjusted already.

Record final head angles X: _____°
Y: _____°

18.11.2 Has seatback angle been adjusted?

___ No. Adjust seatback a maximum of 1 detent for manual seats and not more than 2° from the manufacturer's recommended angle found in step 11.3, to bring the head angles within/or as close as possible to specification. Return to step 18.7.

Record original seatback angle before adjustment: _____°
Record the new seatback angle: _____°

___ Yes. Make no further adjustment.

Record final head angles X: _____°
Y: _____°

Go to step 18.12.

18.12 Foot Placement

18.12.1 Right Foot Placement

Without inducing pelvis or torso movement, position the right foot in contact with the accelerator pedal such that the midline of the foot is in the same vertical plane as L1 (longitudinal line parallel with vehicle centerline

which passes through PRP) and the heel is resting on RHP or within the heel point zone (as determined in step 7).

To the extent practicable, keep the right thigh and the leg in a vertical plane. Rotate the toe towards the shin of the dummy to minimize the compression of the accelerator pedal while maintaining contact with the pedal.

The heel shall remain as close as practicable to RHP but always within the heel point zone ($RHP \pm 10$ mm fore-aft).

18.12.2 Left Foot Placement – Does the vehicle have a footrest?

☐ Yes. The LHP created in step 7 is not used. Place the foot on the footrest. Go to steps 18.12.3 and 18.12.4.

☐ No. Go to step 18.12.5.

18.12.3 Place the heel on the floor pan at the intersection of the foot rest and the floor pan. To the extent practicable, keep the left thigh and leg in a vertical plane, rotate the leg about the hip the minimal amount needed to maximize contact with the sole of the shoe and the footrest while keeping the midline of the foot in a vertical plane.

If the foot sole of the foot cannot rest on the footrest due to the footrest angle, rotate the ankle as far forward as possible, while maintaining the heel location at the intersection of the floor pan and the footrest.

18.12.4 When the foot is placed on the footrest, does the footrest elevate the left heel more than 20 mm above (vertical axis) the right heel?

☐ No. Go to step 18.13.

☐ Yes. Position the foot off the footrest using step 18.12.5.

18.12.5 If there is not a footrest or the foot cannot be placed due to Step 18.12.4;

To the extent practicable keep the left thigh and the leg in a vertical plane throughout the procedure. With the midline of the foot in the same vertical plane as L2, place the heel on LHP or as close as possible within the heel point zone. If the left heel cannot be placed within the heel point zone, place the heel as near to LHP as practicable while keeping the midline of the foot in the same vertical plane as L2. Rotate the foot towards the toe board (plantar flexion) to the maximum extent practicable while maintaining the heel position. Check which of the following that applies (ONLY check one):

☐ The left foot reaches the toe board without adjusting the foot or leg. Record final knee spacing below and go to step 18.13.

___The foot does not reach the toe board and does not contact the brake or clutch pedal with foot rotated forward as far as possible (plantar flexion). Record final knee spacing below and go to step 18.13.

___The left foot contacts the brake or clutch pedal.

___Rotate the foot about the leg (abduction) the minimal amount needed to avoid pedal contact. If the heel is not in the heel point zone, move the heel forward to the middle of the heel point zone and LHP to the extent practicable. Rotate the foot towards the toe board (plantar flexion) to the maximum extent practicable while maintaining the heel position. If the foot still contacts the brake or clutch pedal, continue to the next step; otherwise, record final knee spacing below and go to step 18.13.

___Rotate the leg outboard about the hip the minimum distance necessary to avoid pedal contact. If the heel is not in the heel point zone, move the heel forward to the middle of the heel point zone to the extent practicable. Rotate the foot towards the toe board (plantar flexion) to the maximum extent practicable while maintain the heel position. Record final knee spacing below and go to step 18.13.

Final Knee Spacing: _____mm

18.13 Verify that the head and pelvis angles and the H-point location are within the specifications (steps 18.8, 18.9, and 18.11). For a seat that is not in mid-track, if the dummy leg/knee to knee bolster/instrument panel clearance is greater than 5 mm, the seat should be moved forward. If there is leg/knee contact with the steering wheel, steering column, knee bolster, or instrument panel, adjust the leg/knee making contact inboard or outboard the minimal amount required to create clearance (not to exceed 10 mm).

___Seat is already at mid-track and dummy is within specified head/pelvis angles and H-point location. Go to step 18.14.

___Dummy leg/knee to knee bolster/instrument panel clearance is greater than 5 mm. Adjust the seat forward, without going forward of mid-track, until a clearance of 5 mm or less is achieved.

Record seat position: _____mm rearward of mid-track.

Return to step 18.6 and repeat the steps to go through the trials.

___Dummy leg/knee to knee bolster/instrument panel clearance is not greater than 5 mm. No adjustments required.

Record seat position: _____mm rearward of mid-track.

Go to step 18.14.

18.14 Arm and belt placement. Verify the shoulders of the dummy are rotated fully rearward.

18.14.1 Place the right upper arm adjacent to the torso with the centerline as close to a vertical plane as possible.

Is the seat belt used for this test?

___Yes. Go to step 18.14.2.

___No. Go to step 18.14.8.

18.14.2 Fasten the seat belt around the dummy.

18.14.3 Remove all slack from the lap belt portion.

18.14.4 Pull the upper torso webbing out of the retractor and allow it to retract; repeat this four times.

18.14.5 Apply a 2 to 4-pound tension load to the lap belt.
___pounds of load applied

18.14.6 Is the belt system equipped with a tension-relieving device?

___Yes. Go to step 18.14.7.

___No. Go to step 18.14.8

18.14.7 Introduce the maximum amount of slack into the upper torso belt that is recommended by the vehicle manufacturer in the vehicle owner's manual.

18.14.8 Place the left upper arm adjacent to the torso with the centerline as close to a vertical plane as possible.

18.14.9 Place the right hand with the palm in contact with the steering wheel at the rim's horizontal centerline and with the thumb over the steering wheel.

18.14.10 Place the left hand with the palm in contact with the steering wheel at the rim's horizontal centerline and with the thumb over the steering wheel.

18.14.11 Tape the thumb of each hand to the steering wheel using masking tape with a width of 6 mm. The length of the tape shall only be enough to go around the thumb and steering wheel one time.

APPENDIX F
HIGH-RES BARRIER INSTRUMENTATION DATA

Appendix F High Res Barrier Instrumentation Data

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
BARRIER K-01	N	296.08	14.65	-156.24	49.70
BARRIER K-02	N	218.69	3.40	-236.24	91.35
BARRIER K-03	N	395.92	15.25	-323.02	10.75
BARRIER K-04	N	309.91	15.10	-646.74	10.65
BARRIER K-05	N	446.46	14.85	-932.48	232.60
BARRIER K-06	N	646.13	4.60	-1176.66	10.30
BARRIER K-07	N	799.40	4.50	-1442.78	10.10
BARRIER K-08	N	993.11	4.50	-1490.65	9.90
BARRIER K-09	N	1003.64	4.35	-1587.25	9.65
BARRIER K-10	N	909.56	4.50	-1348.88	9.55
BARRIER K-11	N	785.64	4.45	-1063.26	9.45
BARRIER K-12	N	519.89	4.10	-908.06	9.40
BARRIER K-13	N	428.68	3.55	-536.73	9.20
BARRIER K-14	N	397.57	3.55	-160.29	8.65
BARRIER K-15	N	193.64	3.25	-291.69	7.65
BARRIER K-16	N	169.46	11.05	-71.82	6.15
BARRIER J-01 FX	N	288.89	27.55	-558.49	80.75
BARRIER J-02 FX	N	284.83	2.85	-197.28	88.75
BARRIER J-03 FX	N	432.48	2.60	-286.15	11.10
BARRIER J-04 FX	N	543.74	2.70	-413.37	10.85
BARRIER J-05 FX	N	526.79	2.65	-727.05	10.70
BARRIER J-06 FX	N	505.40	2.75	-684.09	10.65
BARRIER J-07 FX	N	721.74	3.45	-800.64	10.20
BARRIER J-08 FX	N	877.73	3.90	-1142.80	9.70
BARRIER J-09 FX	N	752.58	3.90	-1028.83	9.90
BARRIER J-10 FX	N	755.43	3.70	-1099.96	9.55
BARRIER J-11 FX	N	688.80	3.40	-979.86	9.40
BARRIER J-12 FX	N	616.02	2.90	-837.25	9.15
BARRIER J-13 FX	N	492.97	2.90	-573.96	8.55
BARRIER J-14 FX	N	403.62	2.85	-501.17	7.40
BARRIER J-15 FX	N	359.77	3.00	-312.45	7.10
BARRIER J-16 FX	N	236.80	3.05	-349.16	7.10
BARRIER I-01 FX	N	362.71	27.80	-8414.30	88.35
BARRIER I-02 FX	N	270.45	2.45	-4732.37	55.35

Appendix F High Res Barrier Instrumentation Data; Continued

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
BARRIER I-03 FX	N	395.47	2.25	-364.80	6.00
BARRIER I-04 FX	N	537.56	2.10	-396.11	11.55
BARRIER I-05 FX	N	581.89	2.05	-528.70	11.35
BARRIER I-06 FX	N	629.89	2.20	-7062.51	87.70
BARRIER I-07 FX	N	673.90	2.45	-765.37	10.75
BARRIER I-08 FX	N	711.10	2.95	-683.90	10.15
BARRIER I-09 FX	N	871.26	3.15	-737.08	8.40
BARRIER I-10 FX	N	814.23	2.90	-721.15	8.60
BARRIER I-11 FX	N	723.82	2.70	-605.38	8.50
BARRIER I-12 FX	N	575.17	2.35	-500.10	20.15
BARRIER I-13 FX	N	1130.35	31.00	-1358.14	6.75
BARRIER I-14 FX	N	513.70	2.50	-486.93	7.00
BARRIER I-15 FX	N	394.33	2.70	-1493.44	104.00
BARRIER I-16 FX	N	262.81	2.75	-4511.68	89.30
BARRIER H-01 FX	N	285.82	20.90	-8804.15	48.35
BARRIER H-02 FX	N	347.74	2.35	-6143.75	56.85
BARRIER H-03 FX	N	383.77	1.90	-9843.24	30.50
BARRIER H-04 FX	N	643.98	0.60	-47761.69	12.55
BARRIER H-05 FX	N	949.49	-1.65	-55827.12	12.50
BARRIER H-06 FX	N	575.59	26.50	-5962.47	39.45
BARRIER H-07 FX	N	102.57	121.15	-3988.69	27.70
BARRIER H-08 FX	N	273.38	29.60	-2332.12	2.80
BARRIER H-09 FX	N	416.22	2.50	-797.93	7.80
BARRIER H-10 FX	N	1061.32	29.70	-1637.39	19.10
BARRIER H-11 FX	N	213.23	24.80	-5910.05	17.75
BARRIER H-12 FX	N	619.68	-1.50	-48445.02	12.95
BARRIER H-13 FX	N	829.34	0.30	-68257.58	21.60
BARRIER H-14 FX	N	524.45	2.25	-10395.36	39.05
BARRIER H-15 FX	N	1307.36	26.10	-5748.28	49.65
BARRIER H-16 FX	N	346.01	2.75	-7942.99	53.45
BARRIER G-01 FX	N	309.69	12.50	-3782.98	54.05
BARRIER G-02 FX	N	312.58	2.30	-394.75	6.10
BARRIER G-03 FX	N	494.73	2.10	-6835.26	24.70
BARRIER G-04 FX	N	489.04	117.00	-70675.70	73.10

Appendix F High Res Barrier Instrumentation Data; Continued

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
BARRIER G-05 FX	N	1284.35	-3.15	-113138.15	13.25
BARRIER G-06 FX	N	547.68	1.60	-42206.17	39.35
BARRIER G-07 FX	N	794.94	26.20	-23459.56	35.85
BARRIER G-08 FX	N	491.47	2.70	-25146.81	34.35
BARRIER G-09 FX	N	469.64	23.65	-20951.70	34.45
BARRIER G-10 FX	N	2314.94	27.35	-3668.52	36.15
BARRIER G-11 FX	N	658.33	1.90	-4106.41	35.60
BARRIER G-12 FX	N	1314.32	-3.00	-113903.15	16.05
BARRIER G-13 FX	N	534.83	-2.55	-159173.30	21.30
BARRIER G-14 FX	N	591.60	2.15	-9053.15	28.40
BARRIER G-15 FX	N	466.64	2.30	-1155.89	47.60
BARRIER G-16 FX	N	485.74	28.90	-626.19	38.05
BARRIER F-01 FX	N	344.17	2.40	-478.74	6.85
BARRIER F-02 FX	N	450.11	2.20	-5758.05	53.45
BARRIER F-03 FX	N	468.92	1.85	-29752.04	19.65
BARRIER F-04 FX	N	813.16	0.10	-23608.78	7.80
BARRIER F-05 FX	N	1168.85	-1.10	-40954.49	6.95
BARRIER F-06 FX	N	160.72	-18.65	-60582.17	34.60
BARRIER F-07 FX	N	173.02	144.35	-30432.71	35.40
BARRIER F-08 FX	N	155.16	-19.35	-47315.13	32.80
BARRIER F-09 FX	N	155.35	-19.90	-38725.51	34.65
BARRIER F-10 FX	N	165.50	-18.25	-16098.60	32.00
BARRIER F-11 FX	N	172.83	-19.60	-30124.74	32.40
BARRIER F-12 FX	N	710.32	-1.60	-31406.91	7.25
BARRIER F-13 FX	N	923.71	0.10	-37692.46	54.25
BARRIER F-14 FX	N	671.71	2.25	-27241.92	45.55
BARRIER F-15 FX	N	516.00	2.35	-8790.56	54.70
BARRIER F-16 FX	N	400.16	2.75	-267.18	6.25
BARRIER E-01 FX	N	372.37	12.10	-758.77	63.40
BARRIER E-02 FX	N	425.02	2.60	-1407.92	15.30
BARRIER E-03 FX	N	365.48	2.10	-971.24	14.40
BARRIER E-04 FX	N	483.82	1.65	-5782.04	13.75
BARRIER E-05 FX	N	547.78	1.45	-4756.27	52.75
BARRIER E-06 FX	N	505.16	1.65	-7828.41	53.45

Appendix F High Res Barrier Instrumentation Data; Continued

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
BARRIER E-07 FX	N	303.28	0.45	-24262.40	36.45
BARRIER E-08 FX	N	278.26	0.55	-136061.82	35.70
BARRIER E-09 FX	N	399.15	1.40	-131951.07	35.35
BARRIER E-10 FX	N	274.02	0.90	-22216.60	34.00
BARRIER E-11 FX	N	526.18	1.75	-4621.17	19.90
BARRIER E-12 FX	N	713.60	2.00	-4967.73	8.90
BARRIER E-13 FX	N	852.58	2.20	-6297.22	14.65
BARRIER E-14 FX	N	641.08	2.60	-5359.50	43.60
BARRIER E-15 FX	N	416.18	2.70	-1544.52	16.10
BARRIER E-16 FX	N	326.46	2.90	-1127.06	50.00
BARRIER D-01 FX	N	367.07	12.05	-2656.02	51.70
BARRIER D-02 FX	N	281.95	2.85	-1043.20	40.95
BARRIER D-03 FX	N	359.94	2.60	-3898.07	15.85
BARRIER D-04 FX	N	562.91	2.25	-3717.55	7.95
BARRIER D-05 FX	N	477.35	1.95	-1844.61	7.45
BARRIER D-06 FX	N	218.50	1.20	-5794.82	37.35
BARRIER D-07 FX	N	156.05	-19.20	-14324.39	36.80
BARRIER D-08 FX	N	198.98	1.25	-89918.72	36.40
BARRIER D-09 FX	N	149.17	1.05	-85402.63	36.20
BARRIER D-10 FX	N	181.04	1.15	-8136.82	35.45
BARRIER D-11 FX	N	209.27	1.25	-2472.70	31.05
BARRIER D-12 FX	N	521.94	2.40	-1938.17	32.40
BARRIER D-13 FX	N	568.57	2.20	-3076.92	7.75
BARRIER D-14 FX	N	471.79	2.65	-2163.56	14.85
BARRIER D-15 FX	N	309.52	2.70	-1209.52	46.20
BARRIER D-16 FX	N	383.51	20.10	-1917.19	49.70
BARRIER C-01 FX	N	212.84	12.20	-34579.31	41.05
BARRIER C-02 FX	N	162.23	3.55	-29065.16	34.60
BARRIER C-03 FX	N	280.89	3.45	-2625.83	46.60
BARRIER C-04 FX	N	296.81	1.95	-4946.73	17.00
BARRIER C-05 FX	N	169.75	1.95	-3874.42	31.65
BARRIER C-06 FX	N	55.37	-26.15	-5136.07	52.25
BARRIER C-07 FX	N	72.80	-3.60	-6347.84	53.05
BARRIER C-08 FX	N	66.80	-36.80	-12921.35	35.90

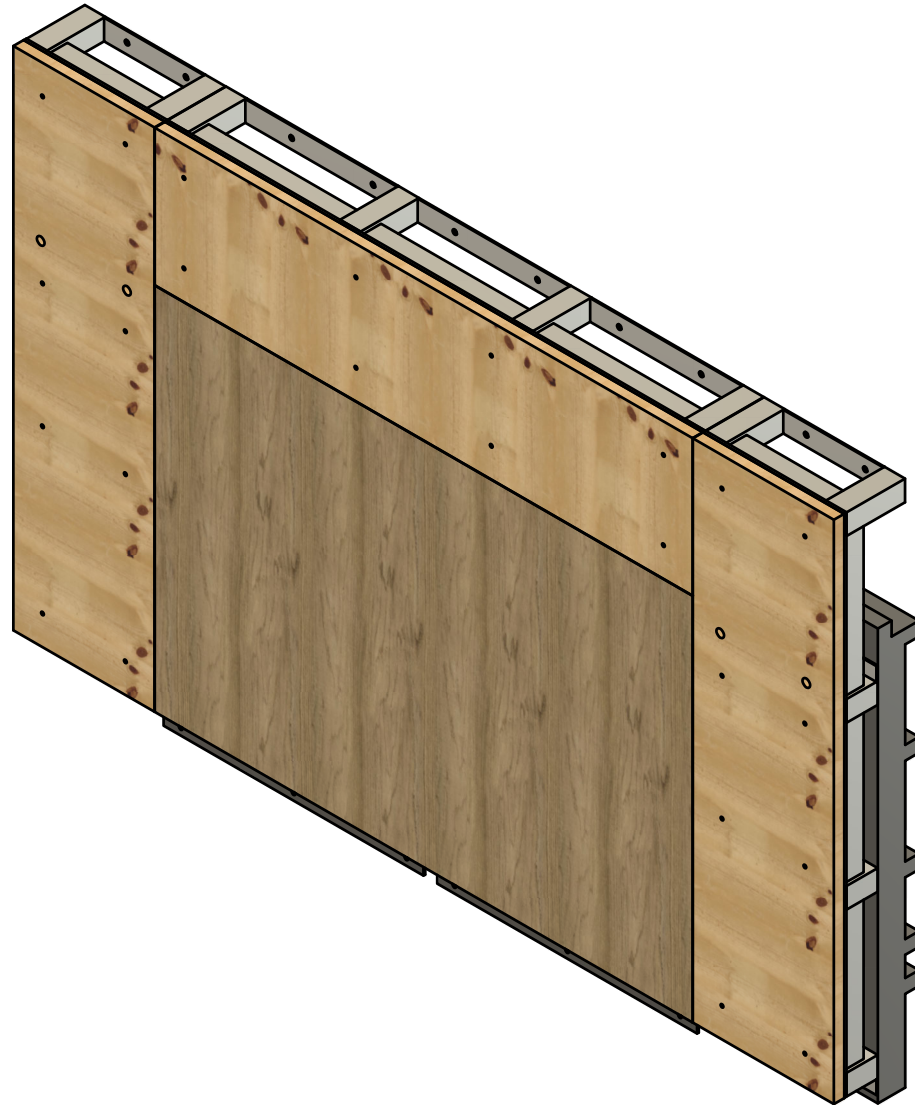
Appendix F High Res Barrier Instrumentation Data; Continued

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
BARRIER C-09 FX	N	58.34	-36.55	-14857.96	36.55
BARRIER C-10 FX	N	45.87	146.80	-1358.15	31.60
BARRIER C-11 FX	N	63.47	-37.35	-802.05	7.85
BARRIER C-12 FX	N	228.13	2.15	-4505.96	15.50
BARRIER C-13 FX	N	394.45	2.00	-5269.04	7.55
BARRIER C-14 FX	N	162.99	2.90	-3390.15	19.00
BARRIER C-15 FX	N	214.91	3.55	-24717.01	35.25
BARRIER C-16 FX	N	219.33	8.80	-14905.04	39.40
BARRIER B-01 FX	N	88.30	4.45	-5076.92	31.75
BARRIER B-02 FX	N	230.09	25.30	-2032.96	34.90
BARRIER B-03 FX	N	139.84	3.95	-647.28	12.50
BARRIER B-04 FX	N	202.21	2.90	-5469.32	12.00
BARRIER B-05 FX	N	209.41	0.85	-6943.73	9.40
BARRIER B-06 FX	N	117.04	-0.45	-7088.21	10.00
BARRIER B-07 FX	N	80.72	-0.95	-4347.02	7.40
BARRIER B-08 FX	N	73.58	-1.50	-4286.81	37.10
BARRIER B-09 FX	N	80.18	-1.50	-3483.37	6.65
BARRIER B-10 FX	N	105.52	-0.95	-4255.73	6.95
BARRIER B-11 FX	N	163.28	-0.30	-8165.59	9.15
BARRIER B-12 FX	N	167.39	2.15	-3620.96	9.30
BARRIER B-13 FX	N	212.44	2.20	-6954.61	12.55
BARRIER B-14 FX	N	304.09	38.20	-974.88	14.20
BARRIER B-15 FX	N	123.99	8.90	-7827.40	32.95
BARRIER B-16 FX	N	3.83	38.15	-2.20	-47.05
BARRIER A-01 FX	N	348.84	26.20	-375.47	33.85
BARRIER A-02 FX	N	290.29	26.45	-370.43	12.45
BARRIER A-03 FX	N	277.13	26.45	-477.13	12.40
BARRIER A-04 FX	N	335.06	26.35	-1595.11	14.65
BARRIER A-05 FX	N	554.54	5.45	-2696.21	11.00
BARRIER A-06 FX	N	540.81	5.15	-5390.52	13.05
BARRIER A-07 FX	N	447.16	4.75	-2786.78	9.90
BARRIER A-08 FX	N	440.21	5.00	-1362.11	9.65
BARRIER A-09 FX	N	525.80	4.75	-3690.66	10.60

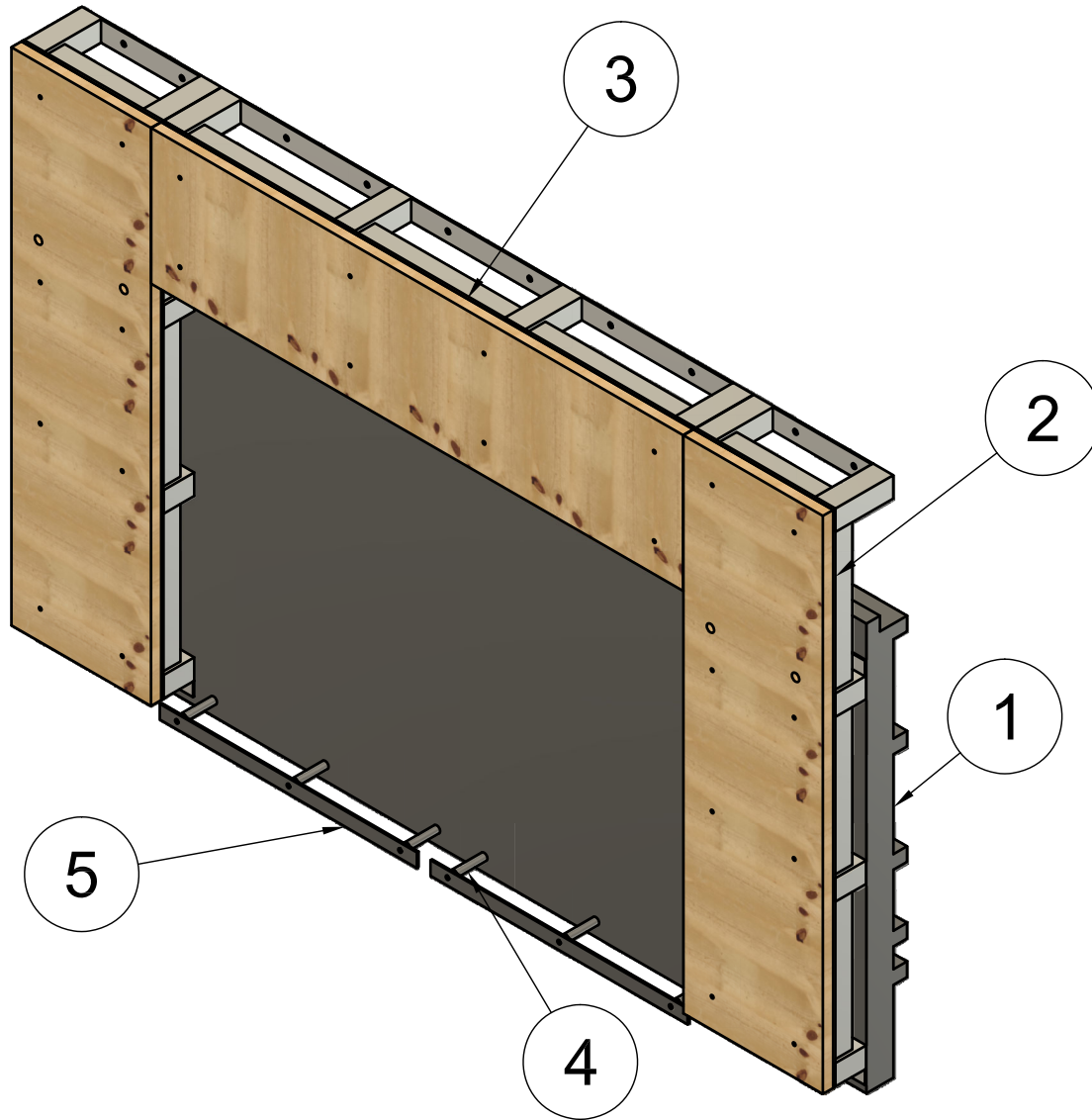
Appendix F High Res Barrier Instrumentation Data; Continued

Location		Positive Direction		Negative Direction	
		Max.	Time (ms)	Max.	Time (ms)
BARRIER A-10 FX	N	515.32	5.15	-1701.74	9.75
BARRIER A-11 FX	N	592.38	5.25	-4308.59	14.15
BARRIER A-12 FX	N	487.81	5.35	-2844.84	10.80
BARRIER A-13 FX	N	496.01	5.95	-2930.17	14.15
BARRIER A-14 FX	N	452.58	38.75	-341.45	13.15
BARRIER A-15 FX	N	389.37	7.50	-487.82	13.10
BARRIER A-16 FX	N	372.07	7.75	-480.35	13.10

APPENDIX G
HIGH-RES BARRIER EXTENSIONS
DRAWING PACKAGE



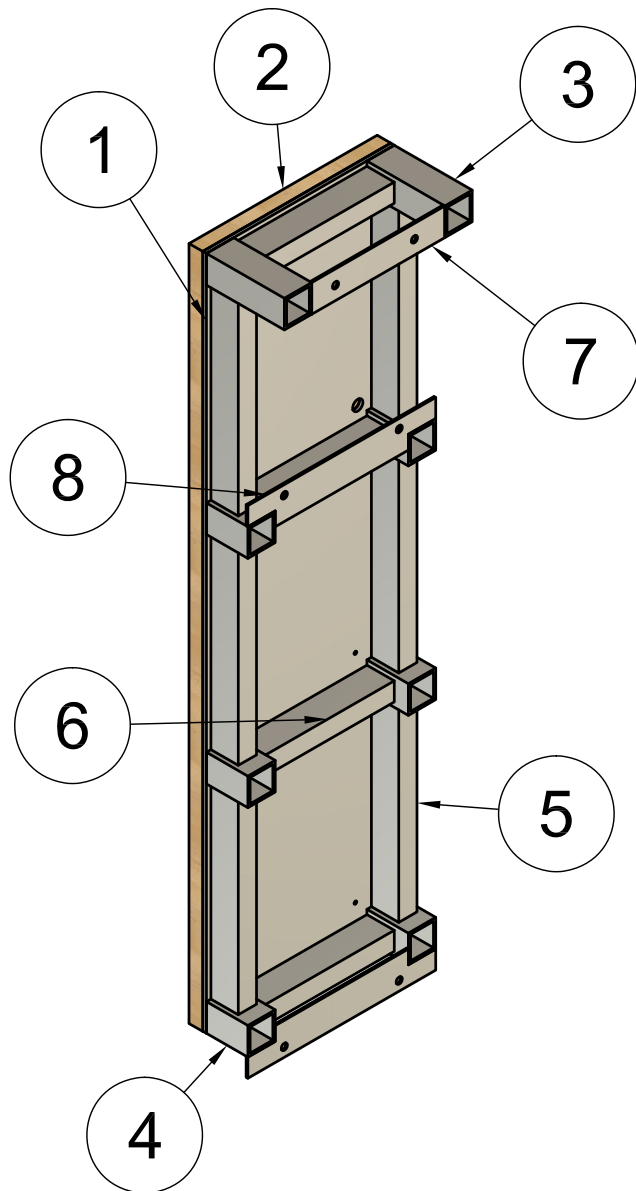
PROJECT				
Impact Lab				
TITLE				
Frontal Load Cell Barrier				
QTY	MATERIAL			UNITS
1	----			
SCALE	DRAWN		REV	SHEET
1:20	Franklin Xu		3/12/2025	A 1/2



PARTS LIST	
ITEM	PART NUMBER
1	BACKPLATE
2	SIDE PLATE
3	TOP PLATE
4	BOTTOM STANDOFF
5	BOTTOM SUPPORT BAR



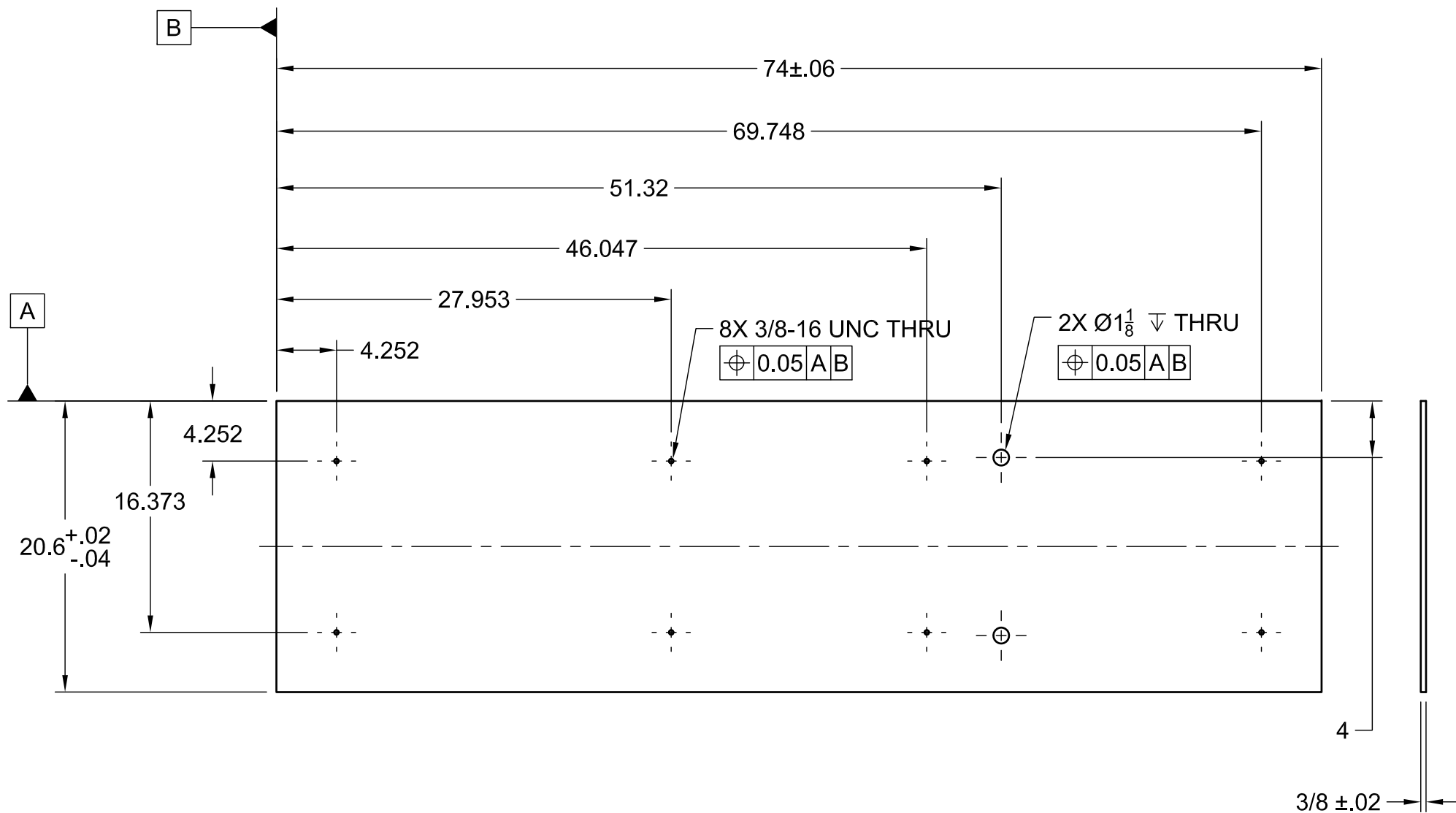
PROJECT Impact Lab				
TITLE Frontal Load Cell Barrier				
QTY 1	MATERIAL ----			UNITS
SCALE 1:20	DRAWN Franklin Xu	3/12/2025	REV A	SHEET 2/2



PARTS LIST		
ITEM	QTY	PART NUMBER
1	1	SIDE PLATE SURFACE
2	1	SIDE PLYWOOD SURFACE
3	2	LONG LEG
4	6	SHORT LEG
5	6	VERTICAL BEAM
6	4	HORIZONTAL BEAM
7	1	SIDE EXTENSION MOUNTING PLATE 1
8	1	SIDE EXTENSION MOUNTING PLATE 2



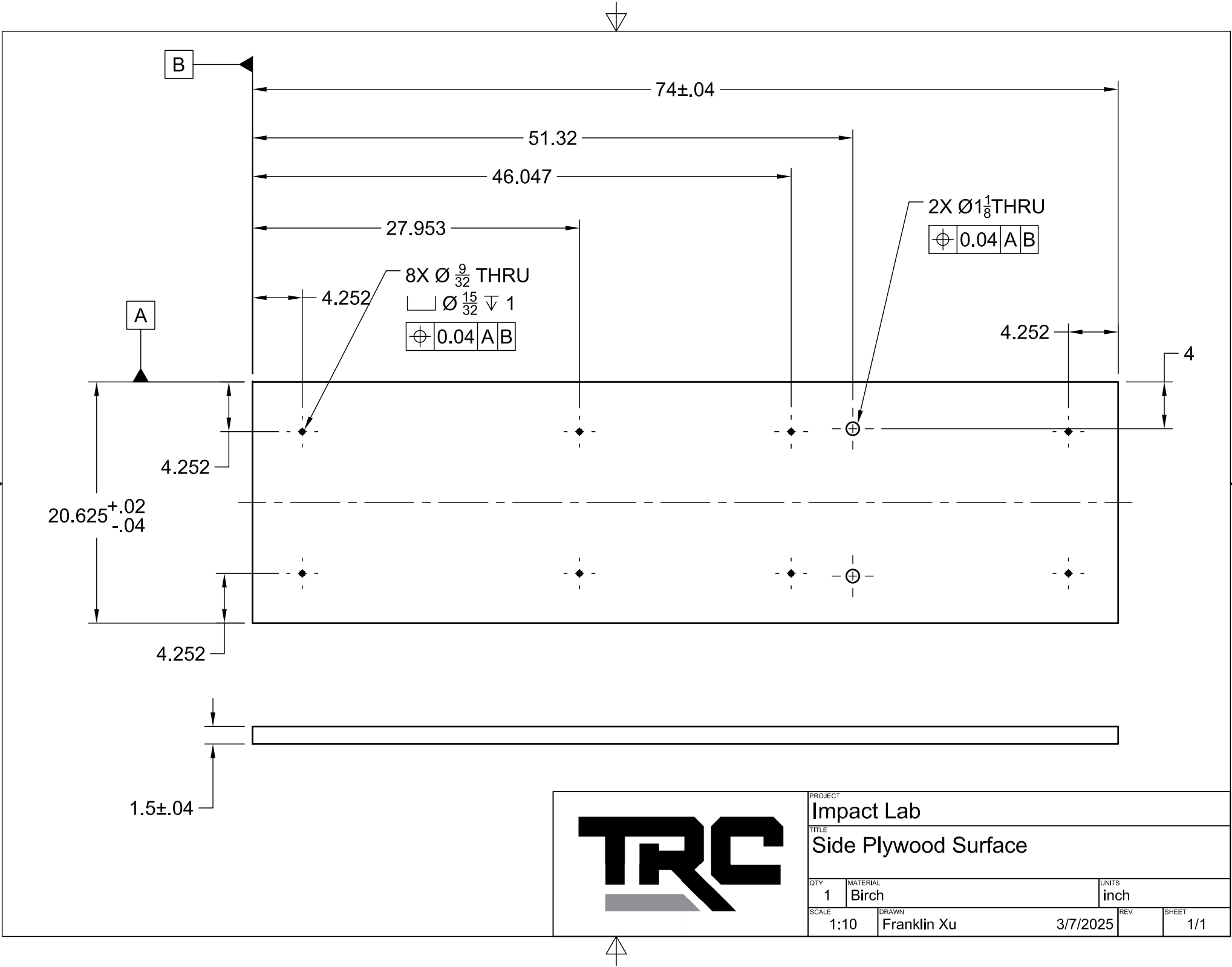
PROJECT			
Impact Lab			
TITLE			
Side Plate			
QTY	MATERIAL		UNITS
2	----		
SCALE	DRAWN	REV	SHEET
1:15	Josh Hendricks	4/3/2025	1/1



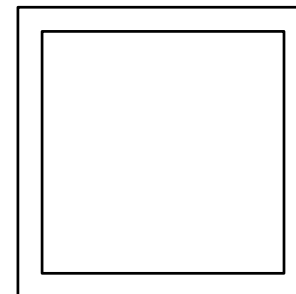
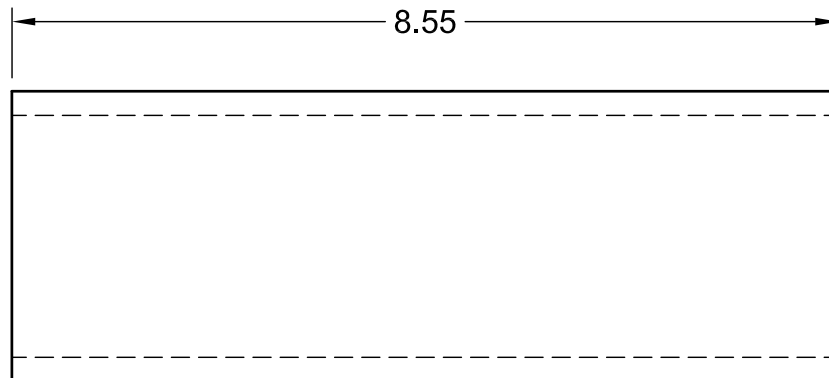
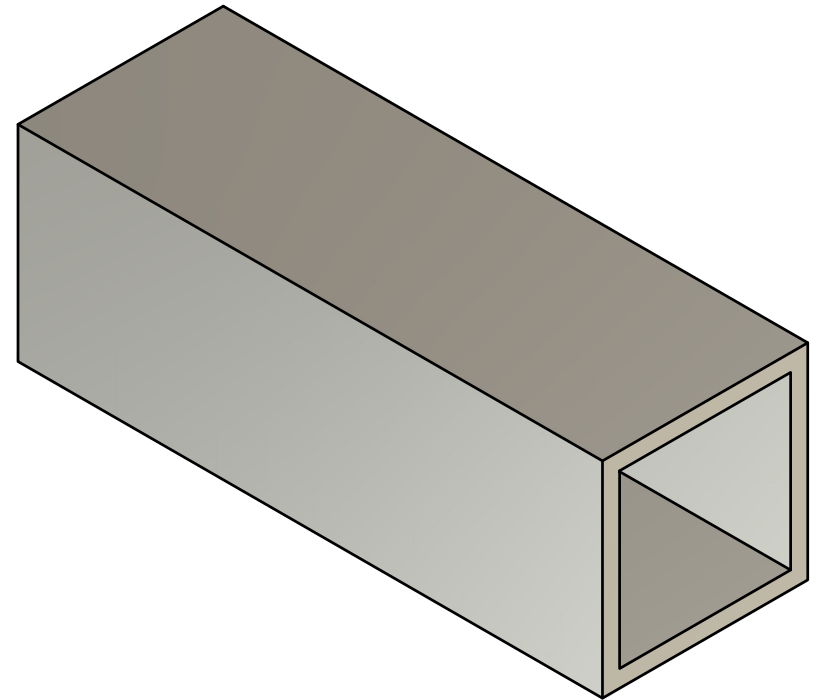
NOTE: USE 1/4"-20 STEEL INSERTS AT EACH 3/8"-16 THREADED HOLE. LINK TO ONE SUCH PART <https://www.mcmaster.com/90259A132/>



PROJECT			
Impact Lab			
TITLE			
Side Plate Surface			
QTY	MATERIAL		UNITS
1	Aluminum 6061		inch
SCALE	DRAWN	REV	SHEET
1:10	Franklin Xu	3/10/2025	1/1



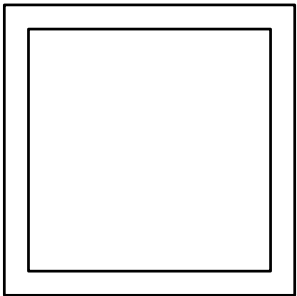
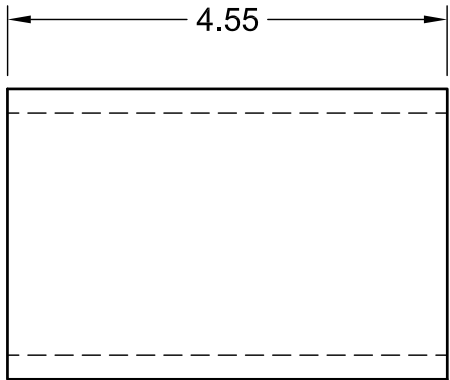
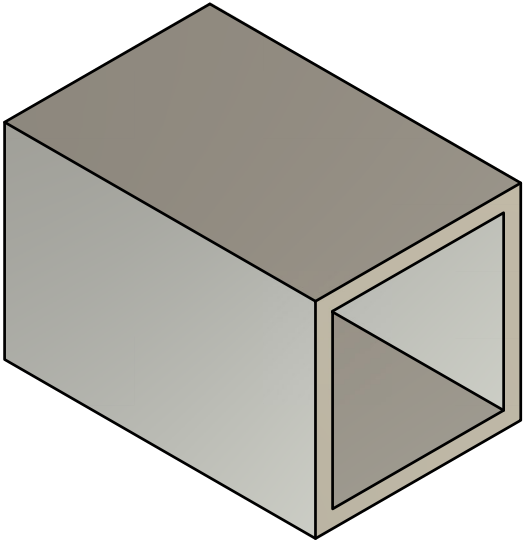
PROJECT			
Impact Lab			
TITLE			
Side Plywood Surface			
QTY	MATERIAL	UNITS	
1	Birch	inch	
SCALE	DRAWN	REV	SHEET
1:10	Franklin Xu	3/7/2025	1/1



Note: 3" x 3" x $\frac{1}{4}$ " Square Tubing



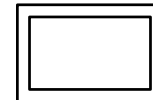
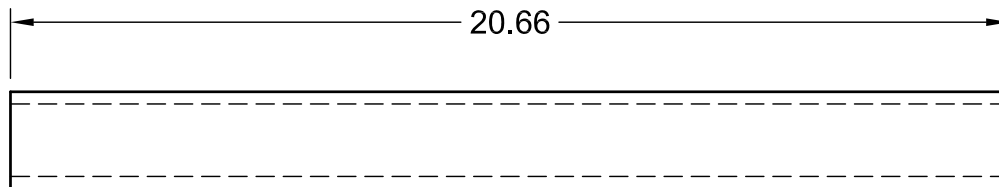
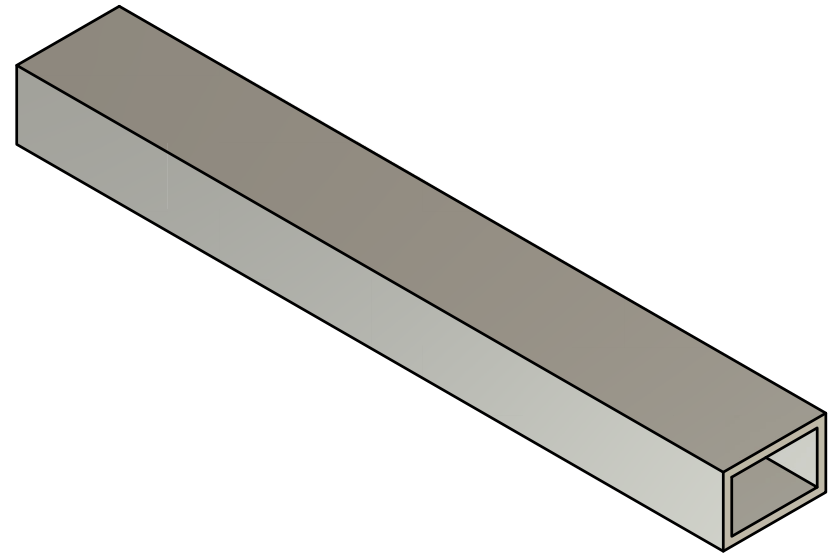
PROJECT				
Impact Lab				
TITLE				
Long Leg				
QTY	MATERIAL			UNITS
2	Aluminum 6061			inch
SCALE	DRAWN		REV	SHEET
1:2	Josh Hendricks		4/3/2025	1/1



Note: 3" x 3" x $\frac{1}{4}$ " Square Tubing



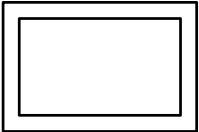
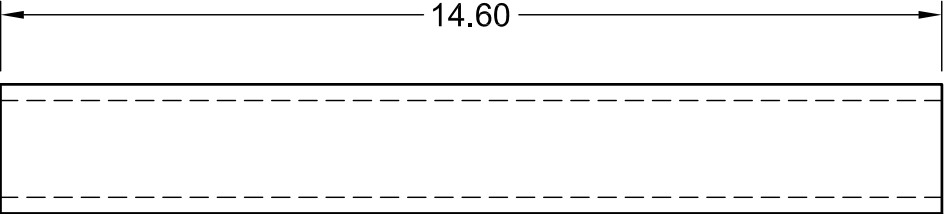
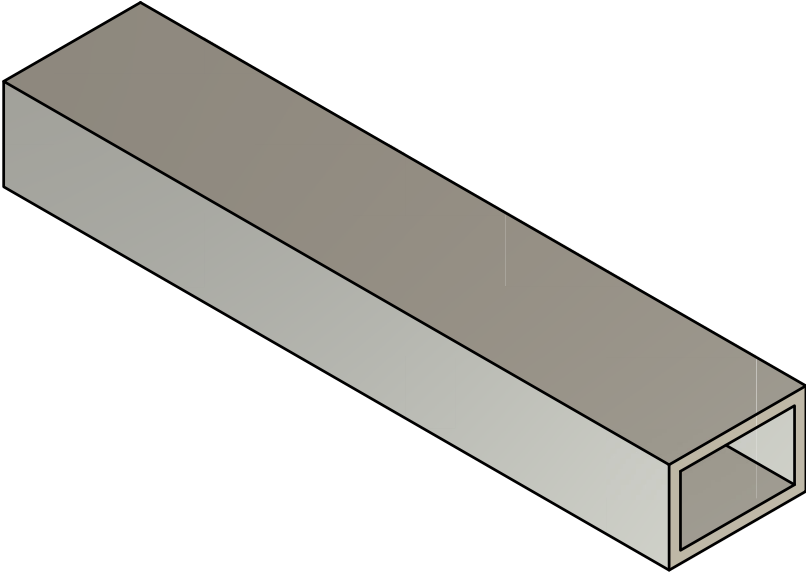
PROJECT					
Impact Lab					
TITLE					
Short Leg					
QTY	MATERIAL			UNITS	
6	Aluminum 6061			inch	
SCALE	DRAWN		REV	SHEET	
1:2	Josh Hendricks		4/3/2025	1/1	



Note: 2" x 3" x $\frac{1}{4}$ " Square Tubing

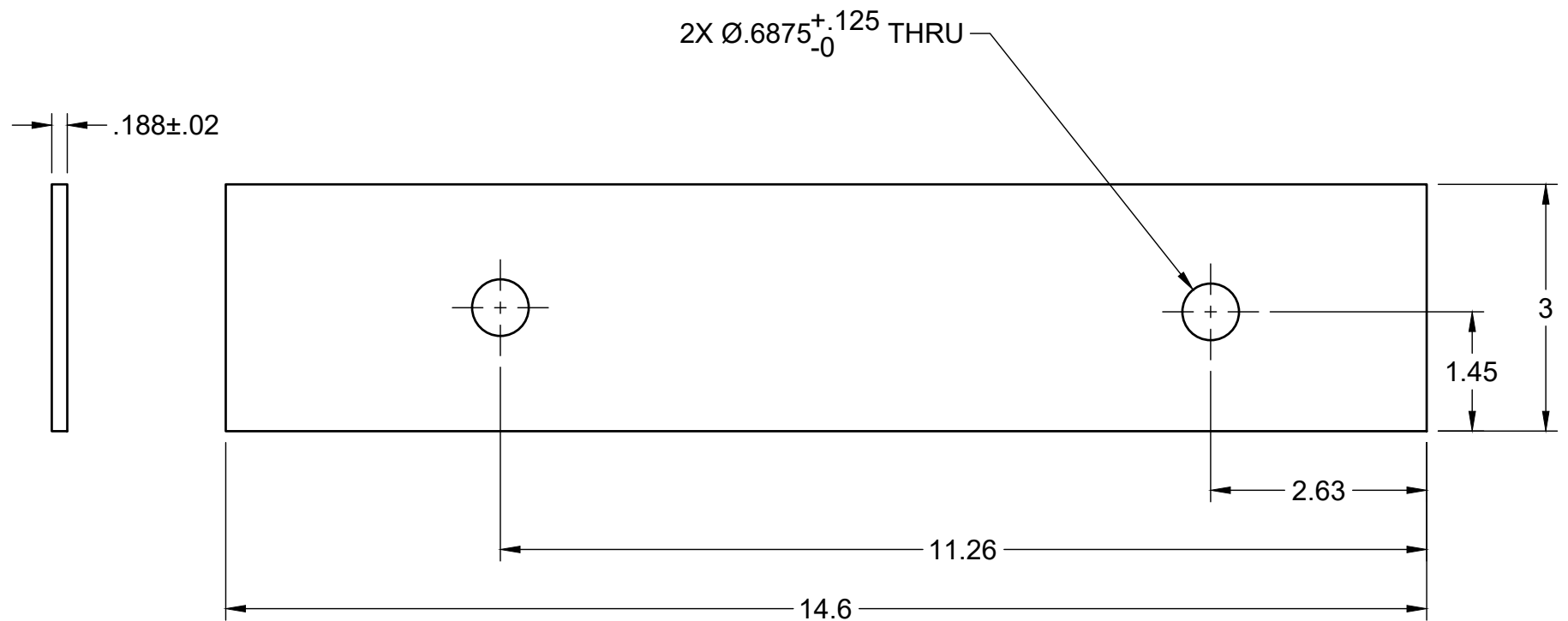


PROJECT					
Impact Lab					
TITLE					
Vertical Beam					
QTY	MATERIAL			UNITS	
6	Aluminum 6061			inch	
SCALE	DRAWN		REV		SHEET
1:4	Josh Hendricks		4/3/2025		1/1



Note: 2" x 3" x $\frac{1}{4}$ " Square Tubing

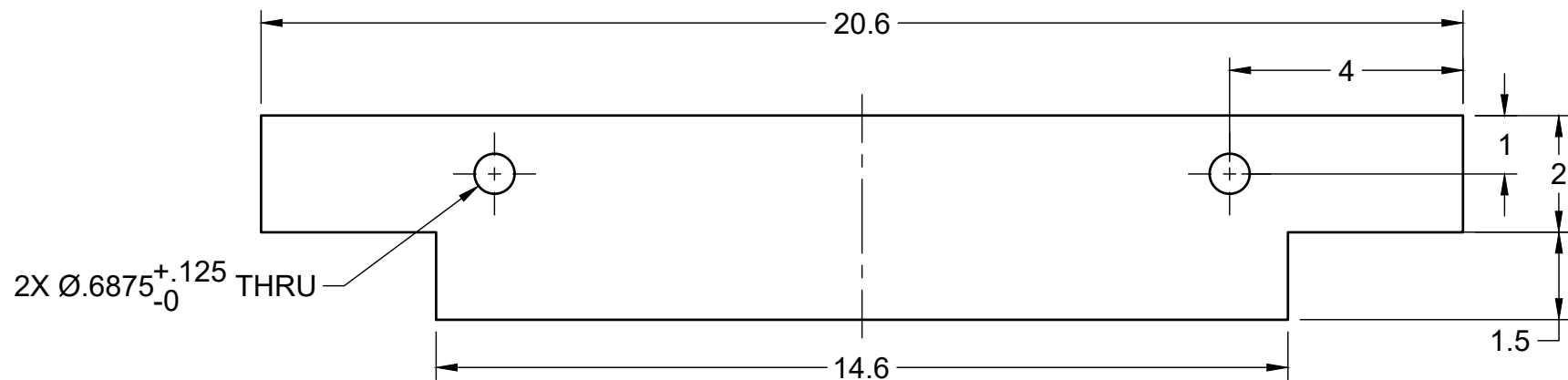
	PROJECT Impact Lab			
	TITLE Horizontal Beam			
	QTY 4	MATERIAL Aluminum 6061	UNITS inch	
SCALE 1:3		DRAWN Josh Hendricks	REV 4/3/2025	SHEET 1/1



NOTE: UNLESS OTHERWISE STATED, ALL TOLERANCES ±.01



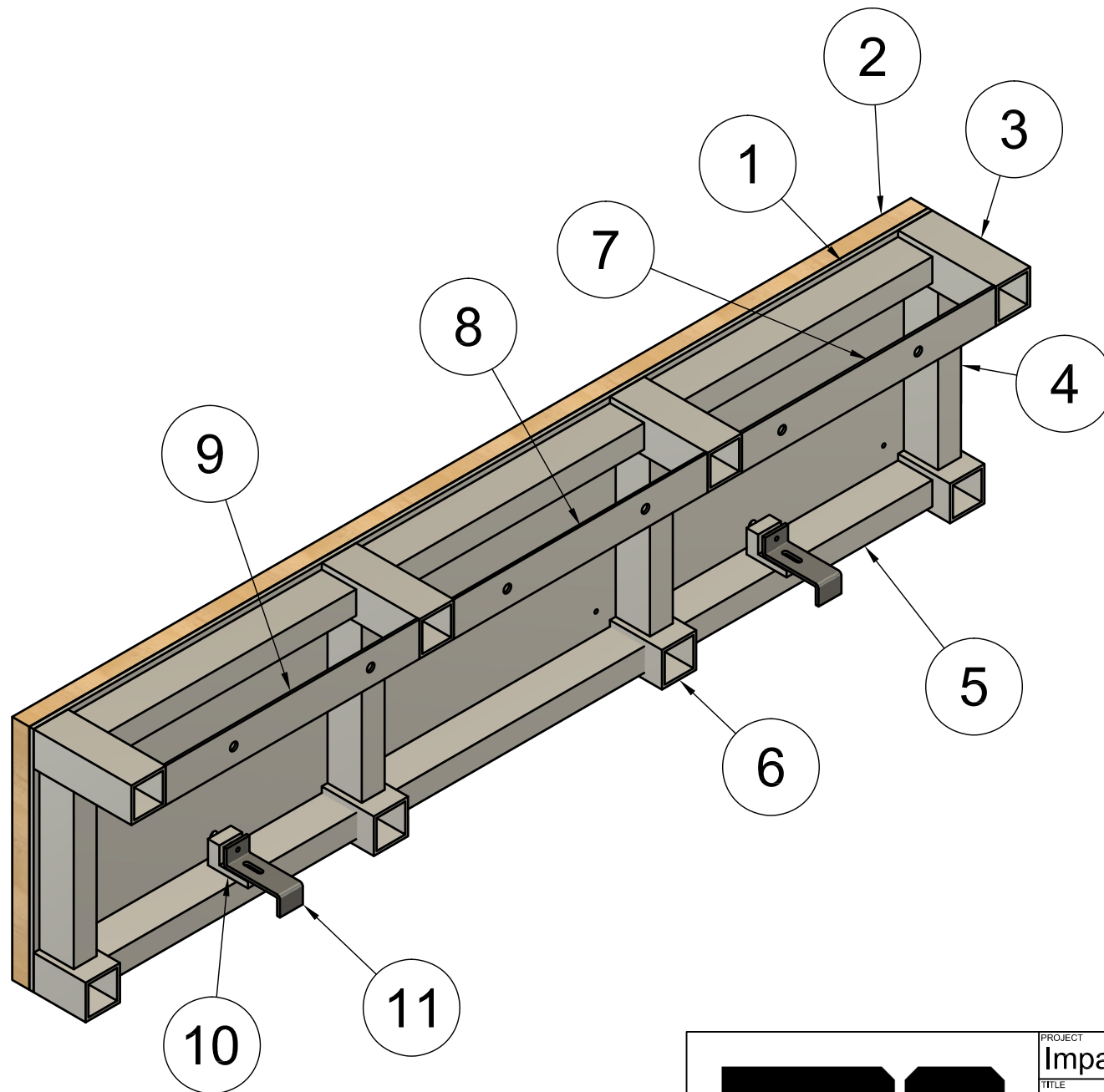
PROJECT				
Impact Lab				
TITLE				
Side Mounting Plate 1				
QTY	MATERIAL			UNITS
1	Aluminum 6061			inch
SCALE	DRAWN		REV	SHEET
1:2	Franklin Xu		3/13/2025	1/1



NOTE: UNLESS OTHERWISE STATED, ALL TOLERANCES ± 0.01



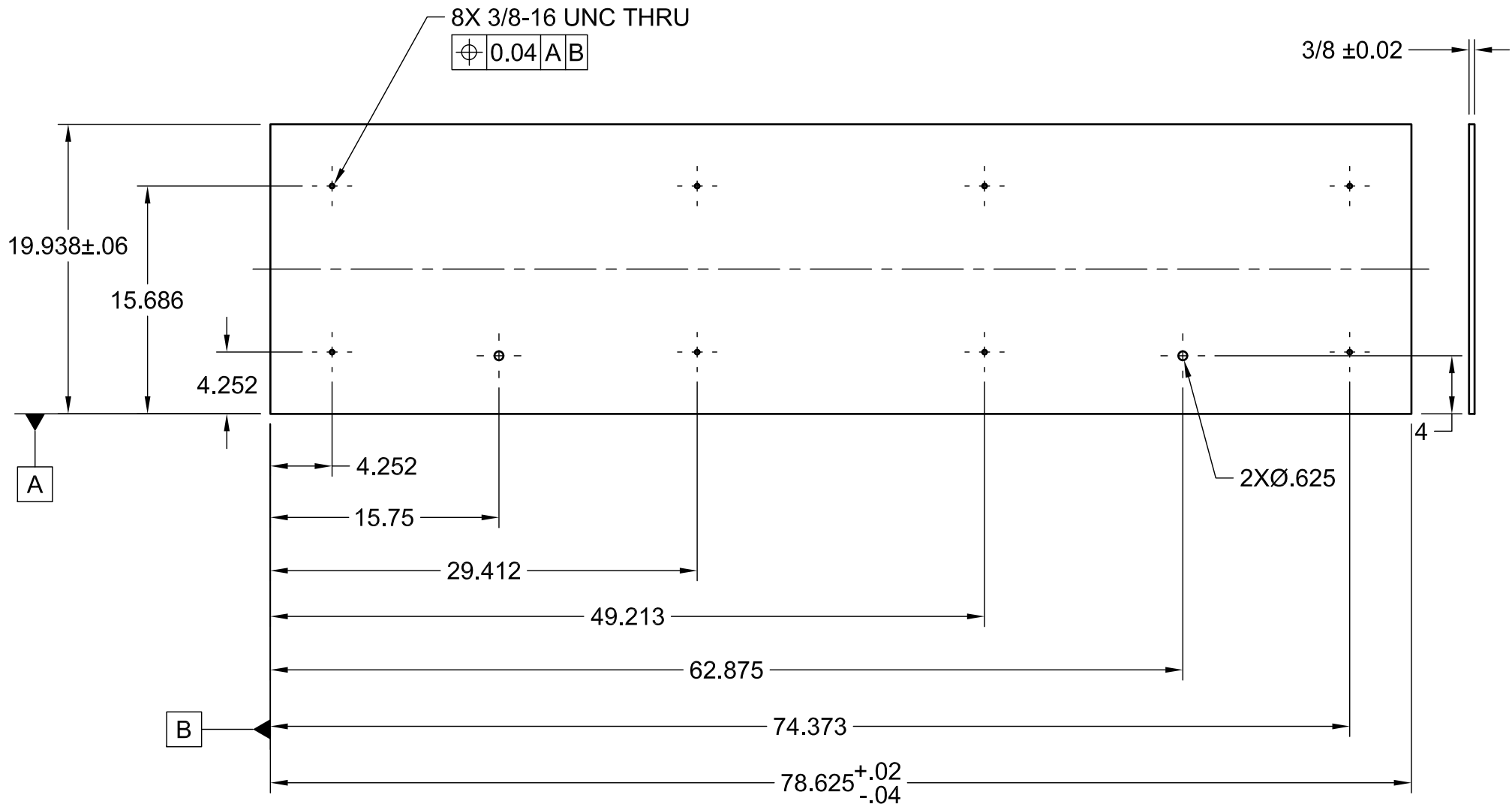
PROJECT			
Impact Lab			
TITLE			
Side Mounting Plate 2			
QTY	MATERIAL		UNITS
2	Aluminum		inch
SCALE	DRAWN		REV
1:3	Josh Hendricks		3/4/2025
			SHEET
			1/1



PARTS LIST		
ITEM	QTY	PART NUMBER
1	1	TOP PLATE SURFACE
2	1	TOP PLYWOOD SURFACE
3	4	LONG LEG
4	4	TOP PLATE BEAM 2
5	6	TOP PLATE BEAM 1
6	4	SHORT LEG
7	1	TOP EXTENSION MOUNTING PLATE 3
8	1	TOP EXTENSION MOUNTING PLATE 2
9	1	TOP EXTENSION MOUNTING PLATE 1
10	2	BARRIER CLAMP 2
11	2	BARRIER CLAMP 1



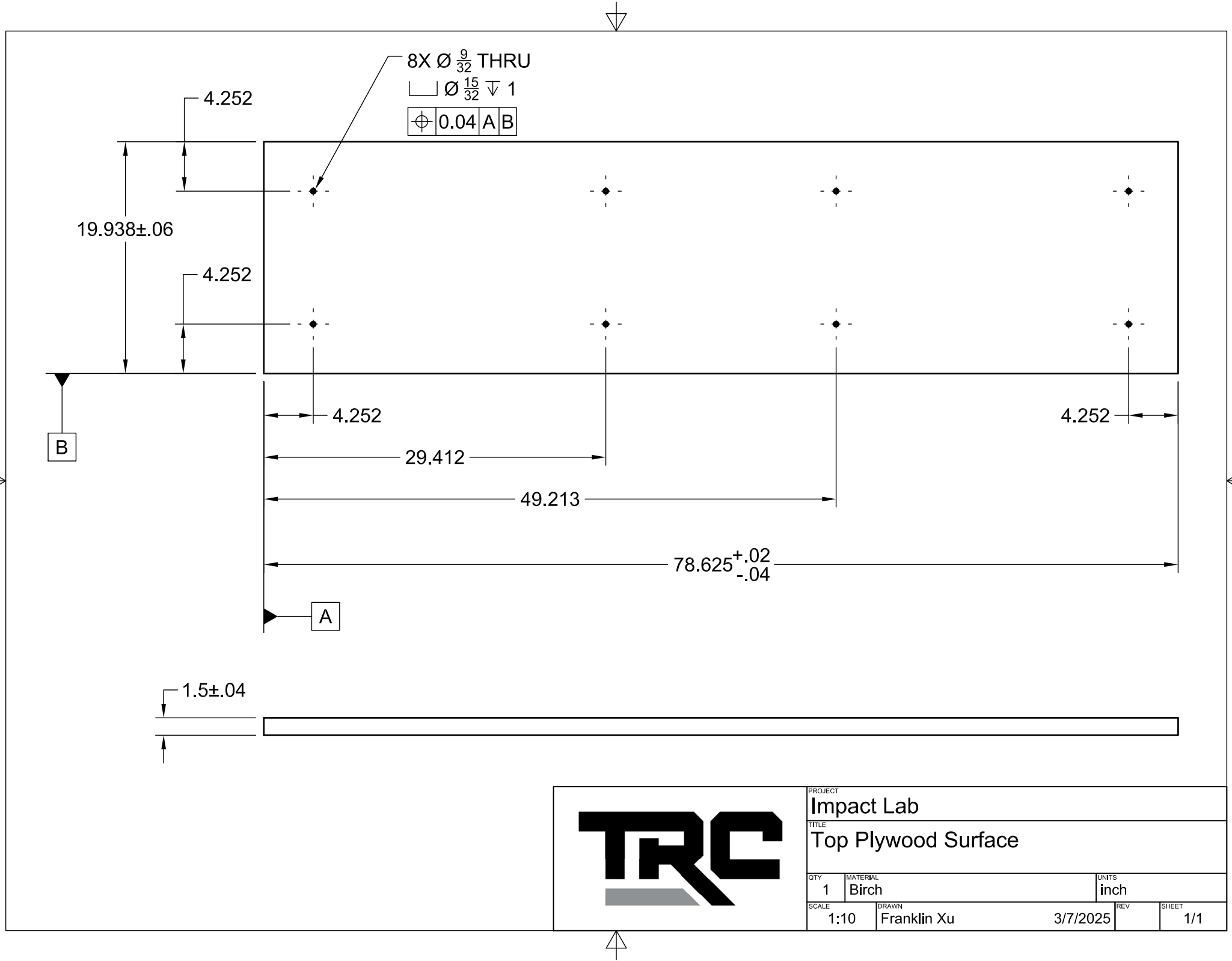
PROJECT			
Impact Lab			
TITLE			
Top Plate			
QTY	MATERIAL		UNITS
1	----		
SCALE	DRAWN	REV	SHEET
1:10	Josh Hendricks	4/3/2025	1/1



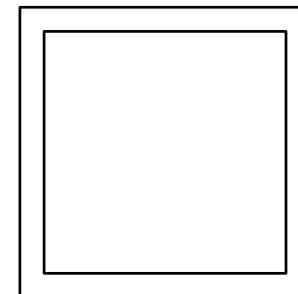
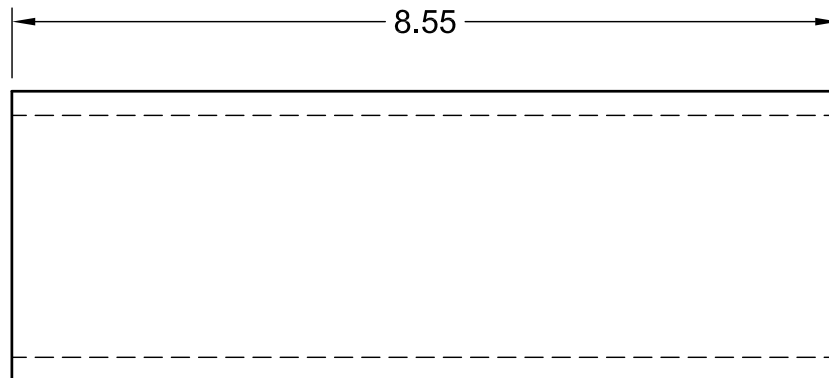
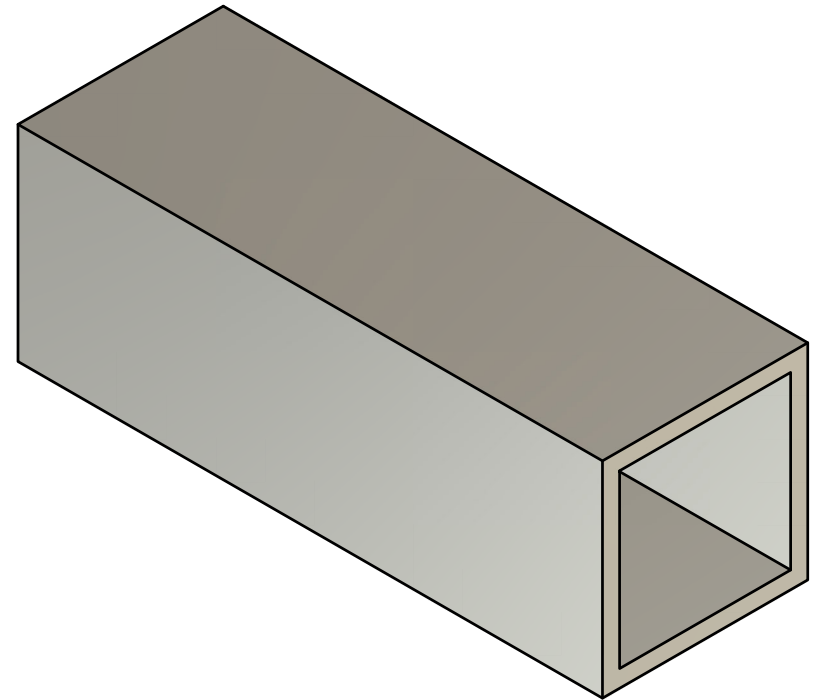
NOTE: USE 1/4"-20 STEEL INSERTS AT EACH 3/8"-16
THREADED HOLE. LINK TO ONE SUCH PART
<https://www.mcmaster.com/90259A132/>



PROJECT			
Impact Lab			
TITLE			
Top Plate Surface			
QTY	MATERIAL		UNITS
1	Aluminum 6061		inch
SCALE	DRAWN	REV	SHEET
1:10	Franklin Xu	3/10/2025	1/1



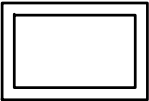
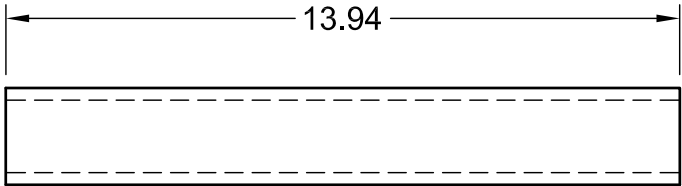
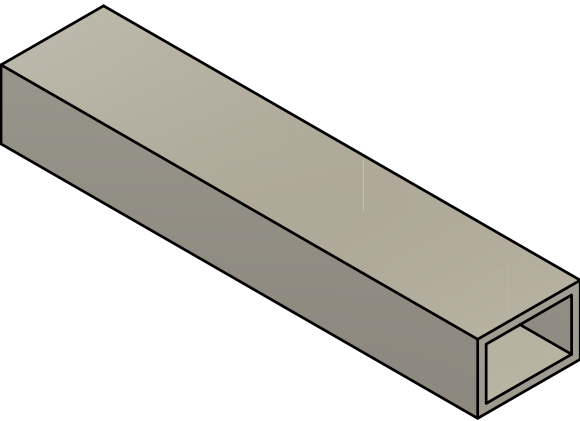
PROJECT			
Impact Lab			
TITLE			
Top Plywood Surface			
QTY	MATERIAL		UNITS
1	Birch		inch
SCALE	DRAWN		REV
1:10	Franklin Xu		3/7/2025
			SHEET
			1/1



Note: 3" x 3" x $\frac{1}{4}$ " Square Tubing



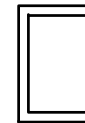
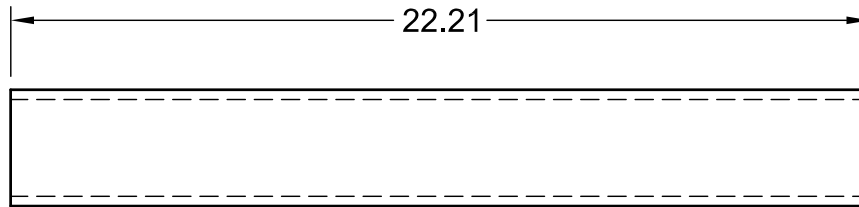
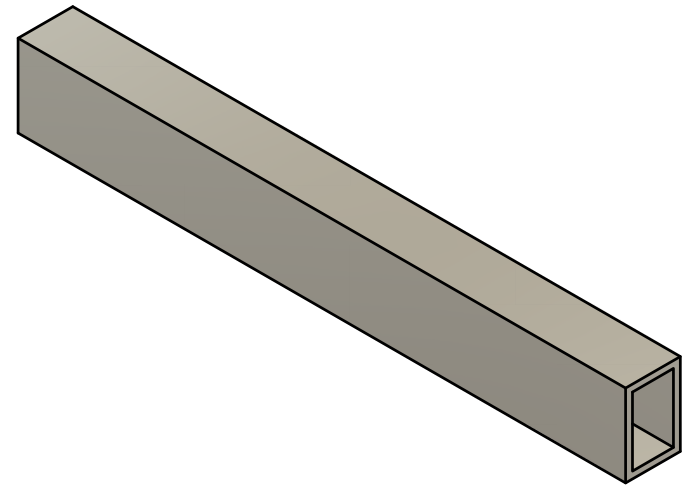
PROJECT				
Impact Lab				
TITLE				
Long Leg				
QTY	MATERIAL			UNITS
4	Aluminum 6061			inch
SCALE	DRAWN		REV	SHEET
1:2	Josh Hendricks		4/3/2025	1/1



Note: 2" x 3" x $\frac{1}{4}$ " Square Tubing



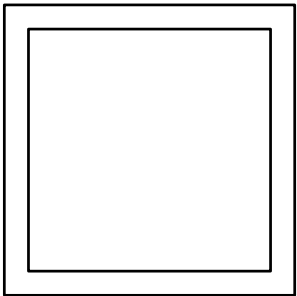
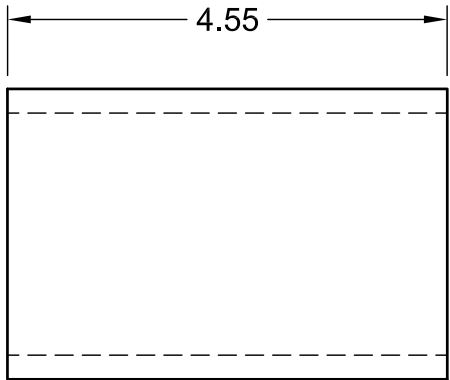
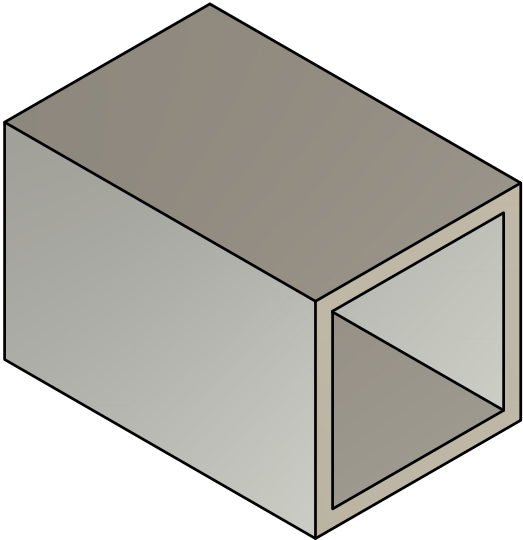
PROJECT				
Impact Lab				
TITLE				
Top Plate Beam 2				
QTY	MATERIAL			UNITS
4	Aluminum 6061			inch
SCALE	DRAWN		REV	SHEET
1:4	Josh Hendricks		4/3/2025	1/1



Note: 2" x 3" x $\frac{1}{4}$ " Square Tubing



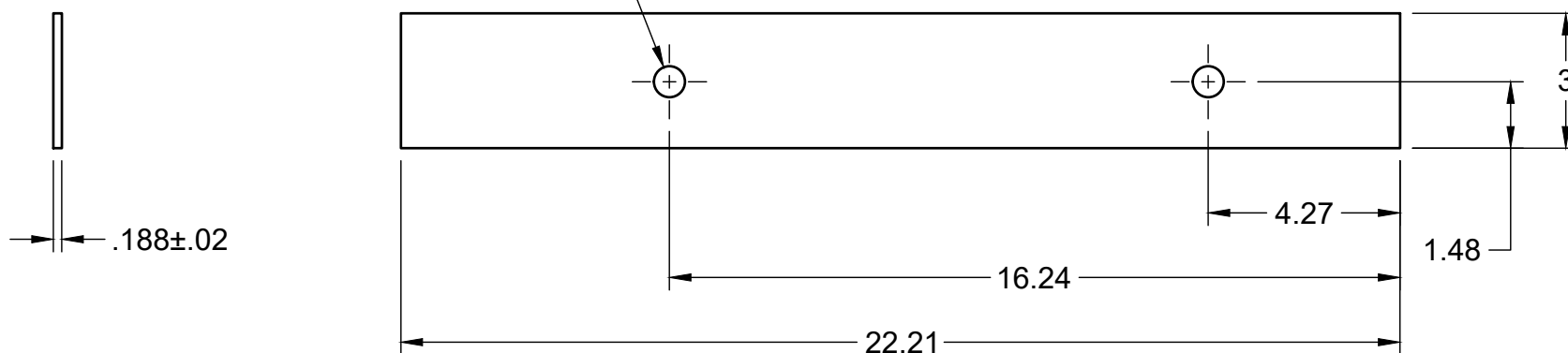
PROJECT					
Impact Lab					
TITLE					
Top Plate Beam 1					
QTY	MATERIAL			UNITS	
6	Aluminum 6061			inch	
SCALE	DRAWN		REV		SHEET
1:5	Josh Hendricks		4/3/2025		1/1



Note: 3" x 3" x $\frac{1}{4}$ " Square Tubing



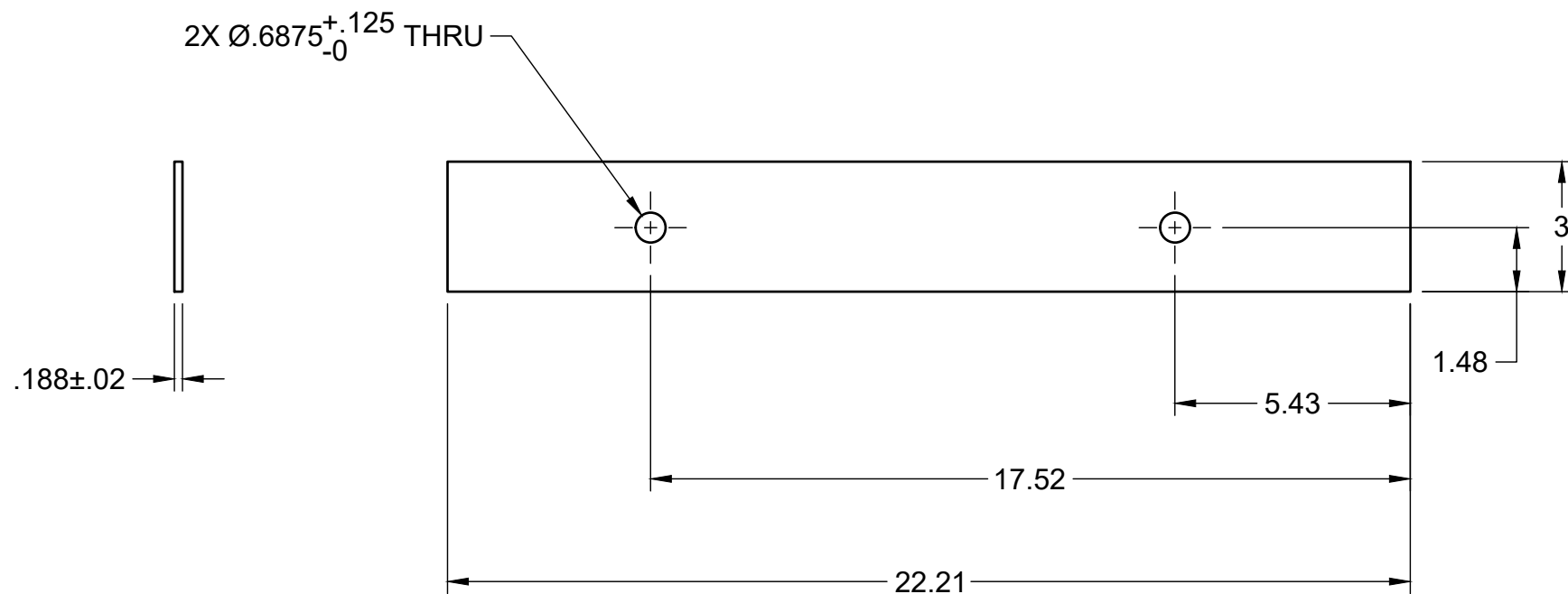
PROJECT					
Impact Lab					
TITLE					
Short Leg					
QTY	MATERIAL			UNITS	
4	Aluminum 6061			inch	
SCALE	DRAWN		REV	SHEET	
1:2	Josh Hendricks		4/3/2025	1/1	



NOTE: UNLESS OTHERWISE STATED, ALL TOLERANCES ±.01



PROJECT				
Impact Lab				
TITLE				
Top Extension Mounting Plate 1				
QTY	MATERIAL			UNITS
1	Aluminum 6061			in
SCALE	DRAWN		REV	SHEET
1:4	Franklin Xu		3/13/2025	1/1

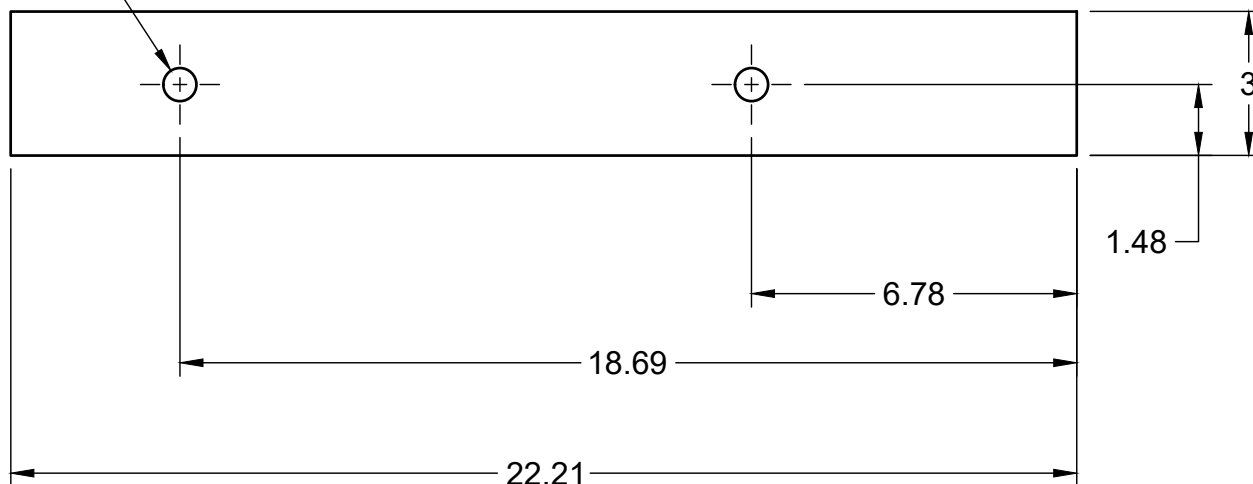
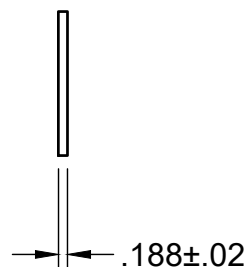


NOTE: UNLESS OTHERWISE STATED, ALL TOLERANCES ±.01



PROJECT				
Impact Lab				
TITLE				
Top Extension Mounting Plate 2				
QTY	MATERIAL			UNITS
1	Aluminum 6061			in
SCALE	DRAWN		REV	SHEET
1:4	Franklin Xu		3/13/2025	1/1

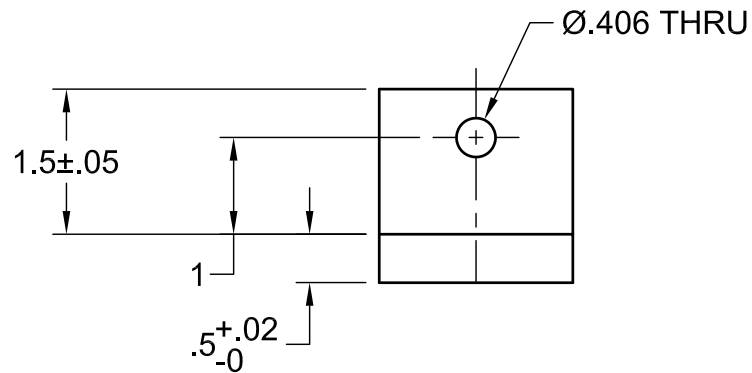
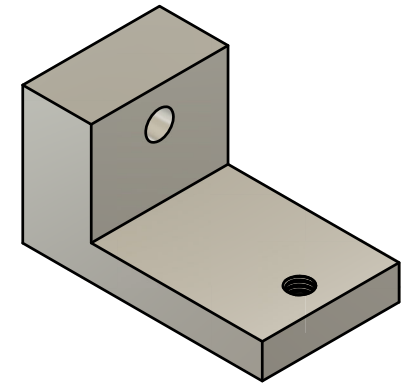
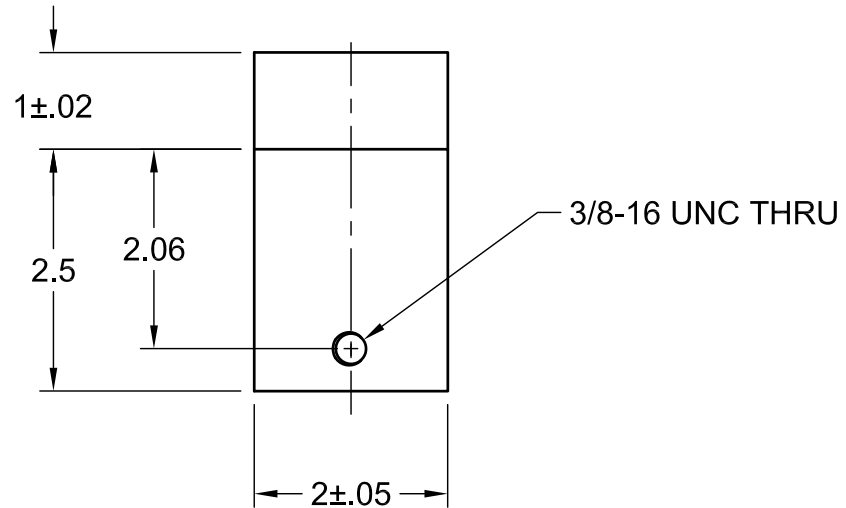
2X Ø.6875^{+.125}₋₀ THRU



NOTE: UNLESS OTHERWISE STATED, ALL TOLERANCES ±.01



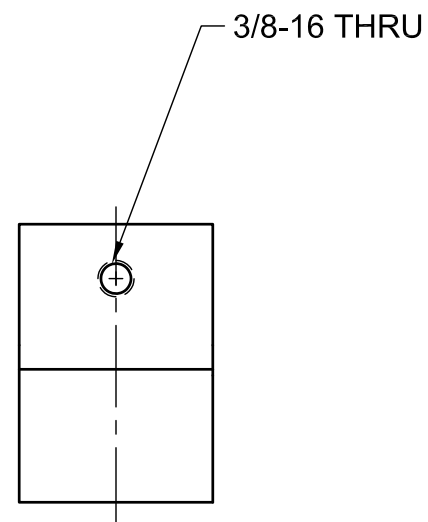
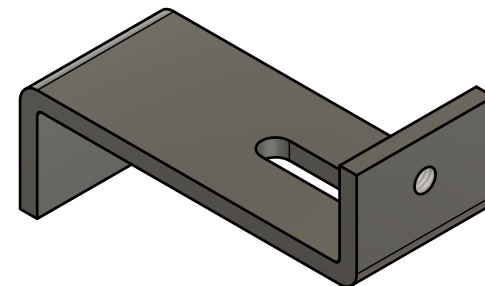
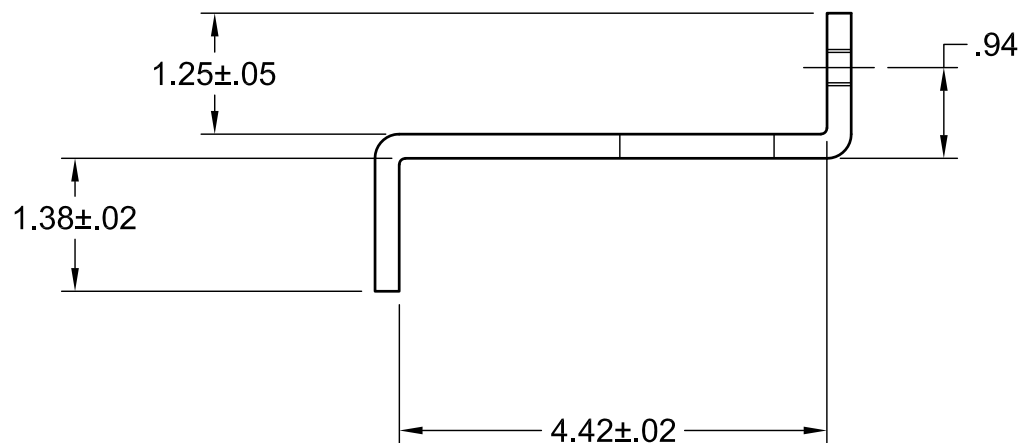
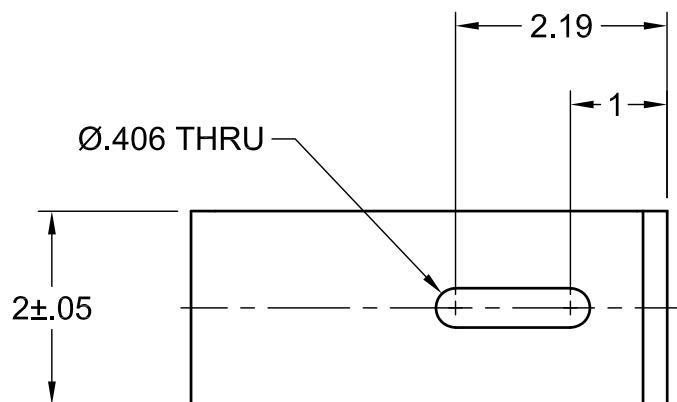
PROJECT		Impact Lab		
TITLE		Top Extension Mounting Plate 3		
QTY	MATERIAL	UNITS		
1	Aluminum 6061	in		
SCALE	DRAWN	REV	SHEET	
1:4	Franklin Xu	3/13/2025	1/1	



NOTE:
UNLESS OTHERWISE SPECIFIED, ALL TOLERANCES $\pm .01$



PROJECT			
Impact Lab			
TITLE			
Barrier Clamp 2			
QTY	MATERIAL	UNITS	
2	Aluminum	inch	
SCALE	DRAWN	REV	SHEET
1:2	Franklin Xu	3/14/2025	1/1

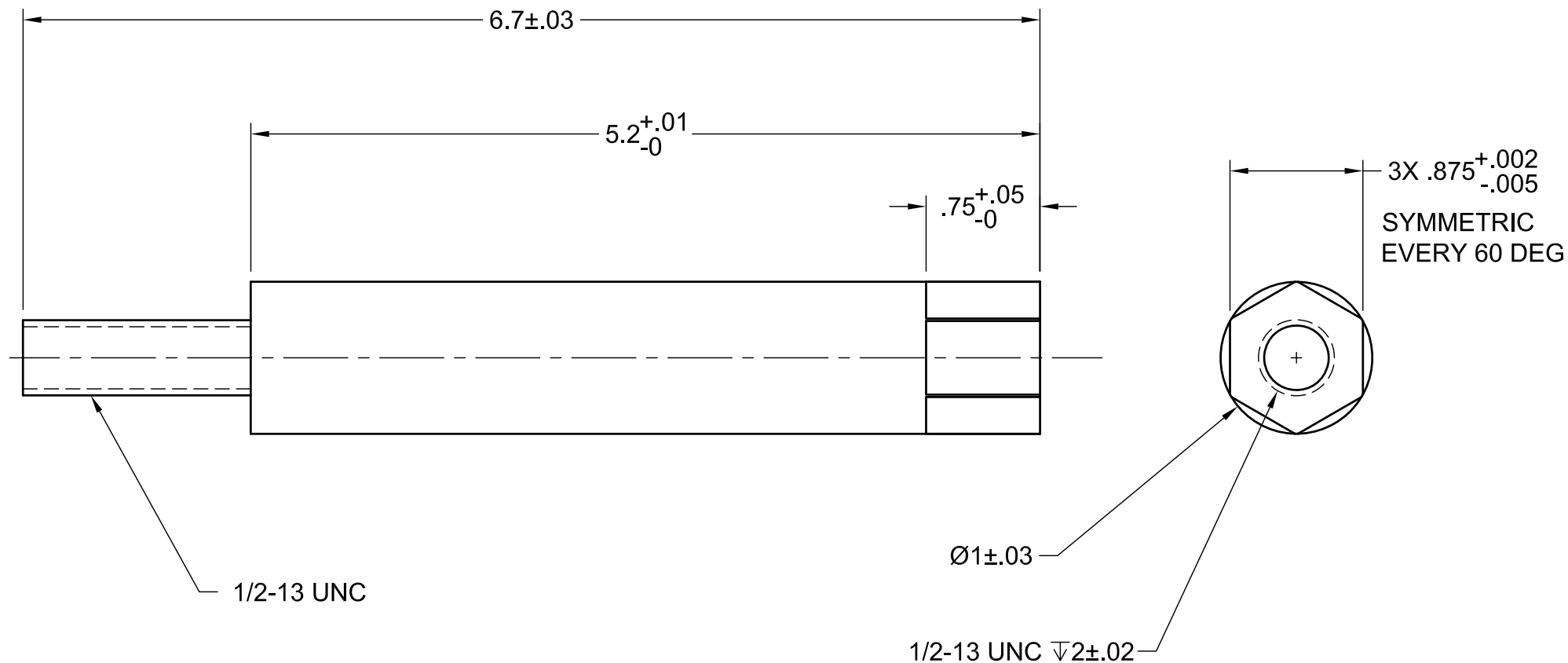


NOTE:
UNLESS OTHERWISE SPECIFIED, ALL TOLERANCES $\pm .01$



PROJECT				
Impact Lab				
TITLE				
Barrier Clamp 1				
QTY	MATERIAL			UNITS
2	1/4" Steel			inch
SCALE	DRAWN		REV	SHEET
1:2	Franklin Xu		3/14/2025	1/1

NOTE: UNLESS OTHERWISE STATED, ALL TOLERANCES ± 0.01



1/2-13 UNC

$\text{Ø}1 \pm 0.03$

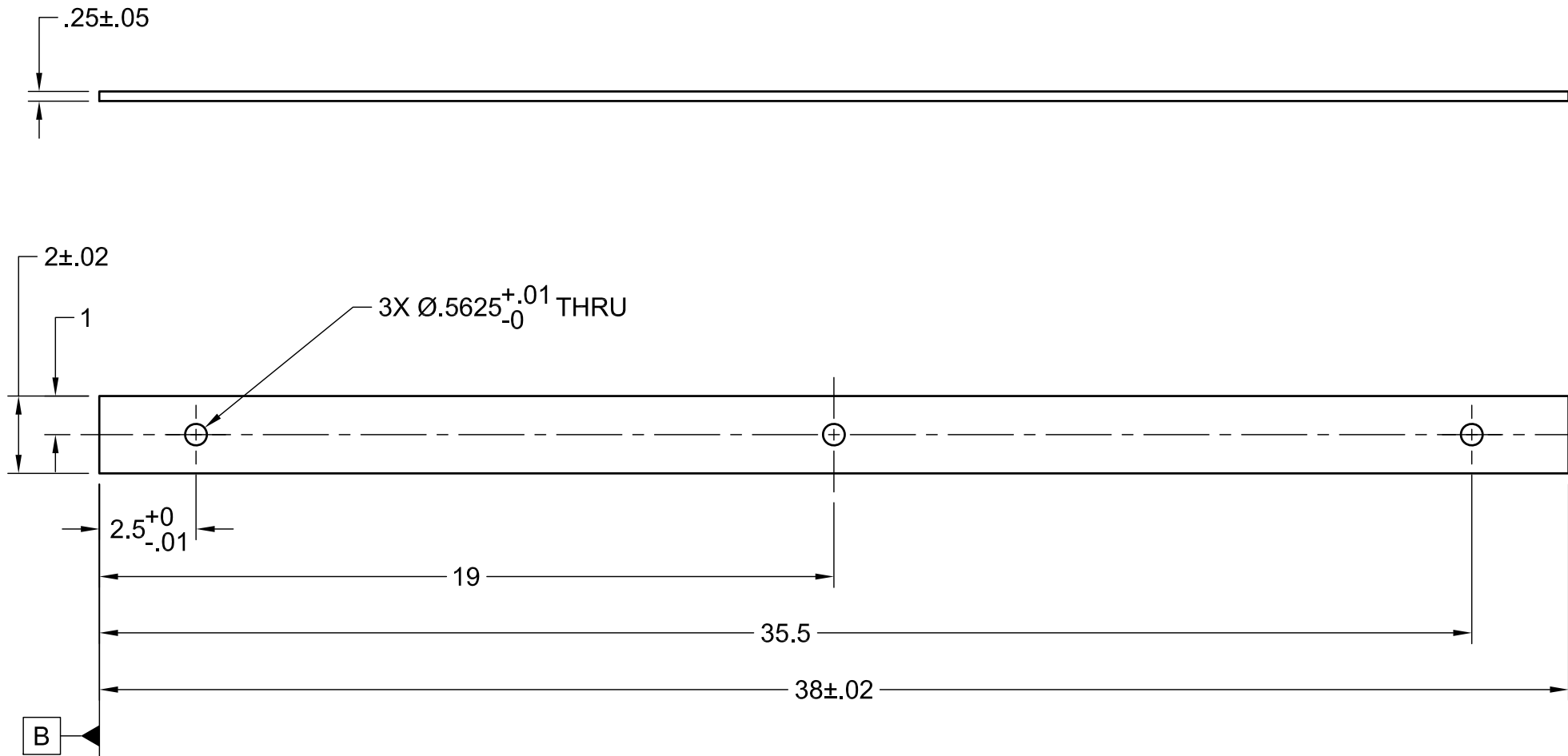
1/2-13 UNC $\nabla 2 \pm 0.02$

$3 \times .875^{+0.002}_{-0.005}$
SYMMETRIC
EVERY 60 DEG

SCALE 1:2



PROJECT			
Impact Lab			
TITLE			
Bottom Standoff			
QTY	MATERIAL	UNITS	
6	Steel	inch	
SCALE	DRAWN	REV	SHEET
1:1	Franklin Xu	3/17/2025	1/1



NOTE:
UNLESS OTHERWISE STATED, ALL TOLERANCES ± 0.01



PROJECT				
Impact Lab				
TITLE				
Bottom Support Bar				
QTY	MATERIAL			UNITS
2	1/4" Steel			inch
SCALE	DRAWN		REV	SHEET
1:4	Franklin Xu		3/17/2025	1/1