ASTM F2912/GSA TS01/ISO 16933 TEST REPORT

Rendered to:

3M Company - St. Paul, Minnesota

PRODUCT TYPE:
Fragment Retention Film on 1/4" Monolithic Glass Unit
and
Fragment Retention Film on 1" Insulating Glass Unit

SERIES/MODEL:
3M™ Scotchshield™ Ultra S600 Safety and Security Window Film
3M™ Scotchshield™ Ultra S800 Safety and Security Window Film
3M™ Impact Protection Profile Film Attachment System

This report contains in its entirety:

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Drawings:	5 pages

Texas Firm F-11869

Digitally Signed by: John H. Waskow

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Report No.: E1298.01-801-12
Test Completion Date: 10/13/14
Report Date: 01/05/15
Test Record Retention Date: 10/13/18

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Southlake, TX 76092

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Summary of Results – Test 1

Specimen No.	Glass Type	Film Type	Film Attachment Type	Average Peak Reflected Pressure	Average Positive Phase Impulse	Average Positive Phase Duration	GSA Performance Condition	ASTM Hazard Rating	ISO Hazard Rating
1	1/4" Annealed	Ultra 600	Daylite	4.744 psi	28.38 psi*msec	10.99 msec	4	Low Hazard	Low Hazard
2		Ultra 800	Daylite				3B	Low Hazard	Low Hazard
3	1/4" Tempered	Ultra 600	Daylite				3B	Low Hazard	Low Hazard
4		Ultra 800	Daylite				3B	Low Hazard	Low Hazard
5	1/4" Annealed	Ultra 600	Daylite				3B	Very Low Hazard	Very Low Hazard
6		Ultra 800	Daylite				5	Low Hazard	Low Hazard
7	1/4" Tempered	Ultra 600	Daylite				3B	Very Low Hazard	Very Low Hazard
8		Ultra 800	Daylite				3B	Low Hazard	Low Hazard

Summary of Results – Test 2

Specimen No.	Glass Type	Film Type	Film Attachment Type	Average Peak Reflected Pressure	Average Positive Phase Impulse	Average Positive Phase Duration	GSA Performance Condition	ASTM Hazard Rating	ISO Hazard Rating
9	1/4" Annealed	Ultra 800	Daylite	10.97 psi	42.48 psi*msec	9.83 msec	5	High Hazard	High Hazard
10		Ultra 600	IPP BP700[1]				5	High Hazard	High Hazard
11	1/4" Tempered	Ultra 800	IPP BP700[1]				3B	Very Low Hazard	Very Low Hazard
12		Ultra 600	Daylite				3B	Low Hazard	Low Hazard
13	1/4" Annealed	Ultra 600	Daylite	5.19 psi	28.63 psi*msec	12.87 msec	3B	Very Low Hazard	Very Low Hazard
14	1/4" Tempered	Ultra 600	Daylite				3B	Very Low Hazard	Very Low Hazard
15		Ultra 800	Daylite				3B	Very Low Hazard	Very Low Hazard
16	1/4" Annealed	Ultra 800	Daylite				3B	Very Low Hazard	Very Low Hazard

[1] IPP = 3M™ Impact Protection Profile

Summary of Results – Test 3

Specimen No.	Glass Type	Film Type	Film Attachment Type	Average Peak Reflected Pressure	Average Positive Phase Impulse	Average Positive Phase Duration	GSA Performance Condition	ASTM Hazard Rating	ISO Hazard Rating
17	1" IGU Annealed	Ultra 600	Daylite	5.086 psi	28.85 psi*msec	12.51 msec	3B	Low Hazard	Low Hazard
18	1” IGU Tempered	Ultra 600	IPP BP950[1]				1	No Break	No Break
19		Ultra 800	Daylite				1	No Break	No Break
20	1" IGU Annealed	Ultra 800	Daylite				3B	Low Hazard	Low Hazard
21	1" IGU Annealed	Ultra 600	Daylite	10.64 psi	42.15 psi*msec	9.44 msec	3B	Low Hazard	Low Hazard
22	1” IGU Tempered	Ultra 600	Daylite				1	No Break	No Break
23		Ultra 800	Daylite				1	No Break	No Break
24	1” IGU Annealed	Ultra 800	Daylite				3B	Low Hazard	Low Hazard

[1] IPP = 3M™ Impact Protection Profile

Summary of Results – Test 4

Specimen No.	Glass Type	Film Type	Film Attachment Type	Average Peak Reflected Pressure	Average Positive Phase Impulse	Average Positive Phase Duration	GSA Performance Condition	ASTM Hazard Rating	ISO Hazard Rating
25	1" IGU Tempered	Ultra 600	Daylite	11.93 psi	65.36 psi*msec	10.44 msec	3B	Low Hazard	Low Hazard
26		Ultra 600	IPP BP950[1]				5	High Hazard	High Hazard
27		Ultra 800	IPP BP950[1]				5	High Hazard	High Hazard
28		Ultra 800	Daylite				1	No Break	No Break

[1] IPP = 3M™ Impact Protection Profile

Reference must be made to Report No. E1298.01-801-12, dated 01/05/14 for complete test specimen description and detailed test results.

1.0 Report Issued To: 3M Renewable Energy Division
3M Center, Building 235, E-330-3D-02
St. Paul, Minnesota 55144

2.0 Test Laboratory: Architectural Testing, Inc.
1098 US Highway 380
Tahoka, Texas 79373
817.410.7202

3.0 Project Summary:

3.1 Product Type: Fragment Retention Film on 1/4" Monolithic Glass Units and 1" Insulating Glass Units

3.2 Series /Model: 3M™ Scotchshield™ Ultra S600 and Ultra S800 Safety and Security Window Film with 3M™ Impact Protection Profile Film Attachment System

3.3 Compliance Statement: Results obtained are tested values and were secured by using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimens tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

3.4 Test Dates: 10/13/2014 - 10/17/2014

3.5 Test Facility: Architectural Testing's blast reaction chamber construction consists of wide flange steel beams, steel tubes, and steel skin that enclose the chamber. Architectural Testing also placed four (4) feet wide wing walls on the blast reaction chamber's top and sides to reduce clearing effects on the reflecting surface. The overall dimensions of the blast reaction chamber are twenty-eight (28) feet wide, sixteen (16) feet tall, and ten (10) feet deep. The blast reaction chamber encloses a volume that houses witness panels and structural members. The sealed surfaces of the blast reaction chamber prevent air blast pressure from wrapping around the test specimens so that the blast pressure loads only one side of the test specimens. Photographs of the arena arrangement are provided in Appendix A.

3.6 Test Sample Source: The test specimens were provided by the client. Representative samples of the test specimens will be retained by Architectural Testing for a minimum of four years from the test completion date.

3.7 Drawing Reference: The test specimen drawings have been reviewed by Architectural Testing and are representative of the test specimens reported herein. Test specimen construction was verified by Architectural Testing per the drawings located in Appendix D. Any deviations are documented herein or on the drawings.

3.8 Data Acquisition: In accordance with ASTM F 1642, GSA TS01, and ISO 16933, reflective pressure transducers are utilized to record data at a 100 kHz sample rate. Reflective pressure transducers are located on the reaction chamber at the horizontal and vertical midpoints or on a representative structure. A pressure transducer is also located in the witness area, to the interior of the reaction chamber face. One free field pressure transducer was placed each at of the corresponding standoffs for each blast. A sketch of the reaction chamber and corresponding reflective pressure sensor locations are provided in Appendix A.

3.9 Explosive Charge:

Test Number	Charge Weight	Explosive
1	150 lbs.	Ammonium Nitrate Fuel Oil (ANFO)
2	300 lbs.	
3	600 lbs.	
4	700 lbs.	

3.10 List of Official Observers:

Name	Company
Daniel Simmons, E.I.T.	Architectural Testing, Inc.
Bart Masters	Architectural Testing, Inc.
Clint Barnett	Architectural Testing, Inc.
Chris Longoria	Architectural Testing, Inc.
Paul Neumann	3M Company

4.0 Test Specifications:

ASTM F1642, *Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings*

ASTM F2912, *Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings*

GSA-TS01-2003, *US General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings*

ISO 16933, *Glass in building – Explosion-resistant security glazing – Test and Classification for arena air-blast loading*

5.0 Test Specimen Description: The following descriptions apply to all specimens.

5.1 1/4" Monolithic Glass Units

5.1.1 Product Sizes:

Measured Dimensions	Width (inches)	Height (inches)
Overall size	48	66
Fixed Day Lite Opening	44-1/2	62-1/2

5.1.2 Frame Construction:

Frame Member	Material	Description
45-010	6063-T5 Aluminum	Head and Jamb
45-018	6063-T5 Aluminum	Sill
45-026	6063-T5 Aluminum	Glass Stop
45-101	6063-T5 Aluminum	Shear Block

	Joinery Type	Detail
All corners	Square Cut and Butted	A shear block was mechanically fastened to the jambs using one (1) #10 x 5/8" FH screw. The head/sill is the slid over the shear block and mechanically fastened with four (4) #10 x 2 PH TEK 3 screws. .
Glass Stop	Snap Fit	The glass stop is snap fit into the sill.

5.0 Test Specimen Description: (Continued)

5.2 1" Insulating Glass Units

5.2.1 **Product Sizes**:

Measured Dimensions	Width (inches)	Height (inches)
Overall size	48	66
Fixed Day Lite Opening	43	61

5.2.2 **Frame Construction**:

Frame Member	Material	Description
WW-401	6063-T5 Aluminum	Head
WW-402	6063-T5 Aluminum	Jamb/Sill
WW-162	6063-T5 Aluminum	Pressure Plate
WW-110	6063-T5 Aluminum	Face Cap
WW-181-01	6063-T5 Aluminum	Shear Block

	Joinery Type	Detail
All corners	Square Cut and Butted	A shear block was mechanically fastened to the jambs using two (2) #14 x 1-1/2" HH screw. The head/sill is the slid over the shear block and mechanically fastened with two (2) #10 x 1 PPH screws. .
Glass Stop	Snap Fit	The glass stop is snap fit into the sill.
Pressure Plate	Mechanical	The pressure plate was attached to the frame head/sill/jamb using #12-14 x 1-1/2" HWH screws at 9" O.C.

5.0 Test Specimen Description: (Continued)

5.3 Glazing:

Glass Type	Specimens	Interior Lite	Spacer	Exterior Lite	Film Type	Glazing Bite
1/4" Monolithic	1,5,10*,13	N/A	N/A	1/4"AN	Ultra S600	7/16"
	3,7,12,14			1/4" FT		
	2,6,9,16			1/4" AN	Ultra S800	
	4,8,11*,15			1/4" FT		
1" IGU	17,21	1/4"AN	1/2"	1/4"AN	Ultra 600	1-1/16"
	18**,22,25,26**	1/4"FT		1/4"FT		
	20,24	1/4"AN		1/4"AN	Ultra 800	
	19,23,27**,28	1/4"FT		1/4"FT		

*3M™ Impact Protection Profile BP700
**3M™ Impact Protection Profile BP950

5.4 Film:

Film Type	Thickness
3M™ Scotchshield™ Ultra S600 Safety and Security Window Film	6 mil
3M™ Scotchshield™ Ultra S800 Safety and Security Window Film	8 mil

5.5 Glazing Method: All specimens utilized a micro-layered safety and security film adhered to the interior surface of the glass. The glass was channel glazed and secured at the exterior sill using extruded aluminum glazing stops or pressure plate. The glass was set against a kerf-mounted rubber gasket. On select specimens,(noted above with * or **) the filmed glass was adhesively anchored to the interior side of the frame using 3M™ Impact Protection Profile (IPP), a flexible-mechanical rubber gasket type film attachment system

5.6 Hardware: No hardware was utilized.

5.7 Reinforcement: No reinforcement was utilized.

6.0 Installation: The specimens were placed directly into the arena chamber test frame.

7.0 Pressure Results:

Test #1			
Transducer Number	**Peak Positive Pressure (psi)**	**Peak Positive Phase Duration (msec)**	**Peak Positive Phase Impulse (psi*msec)**
RPT 1	4.695	10.2	28.06
RPT 2	4.552	9.85	28.14
RPT 3	4.929	*Insufficient Data	*Insufficient Data
RPT 4	4.908	11.83	29.28
RPT 5	4.636	12.06	28.03
IPT 1	0.354	N/A	N/A
IPT 2	0.548	N/A	N/A
FFT 1	2.344	11.99	11.42

Test #2			
4 psi Chamber			
Transducer Number	**Peak Positive Pressure (psi)**	**Peak Positive Phase Duration (msec)**	**Peak Positive Phase Impulse (psi*msec)**
RPT 1	5.283	*Insufficient Data	*Insufficient Data
RPT 2	5.070	13.69	28.32
RPT 3	5.183	10.37	28.80
RPT 4	5.477	12.62	29.26
RPT 5	4.982	12.32	28.12
IPT 1	0.170	N/A	N/A
FFT 1	2.407	15.63	13.30
7 psi Chamber			
Transducer Number	**Peak Positive Pressure (psi)**	**Peak Positive Phase Duration (msec)**	**Peak Positive Phase Impulse (psi*msec)**
RPT 1	10.72	10.48	42.92
RPT 2	11.46	9.14	42.70
RPT 3	10.73	9.87	41.82
IPT 1	0.016	N/A	N/A
FFT 1	*Insufficient Data	*Insufficient Data	*Insufficient Data

7.0 Pressure Results: (Continued)

Test #3			
4 psi Chamber			
Transducer Number	**Peak Positive Pressure (psi)**	**Peak Positive Phase Duration (msec)**	**Peak Positive Phase Impulse (psi*msec)**
RPT 1	5.108	*Insufficient Data	*Insufficient Data
RPT 2	5.067	14.06	28.61
RPT 3	4.935	10.96	29.1
IPT 1	0.357	N/A	N/A
FFT 1	2.074	17.73	13.1
7 psi Chamber			
Transducer Number	**Peak Positive Pressure (psi)**	**Peak Positive Phase Duration (msec)**	**Peak Positive Phase Impulse (psi*msec)**
RPT 1	*Insufficient Data	*Insufficient Data	*Insufficient Data
RPT 2	10.97	9.44	42.13
RPT 3	10.31	9.44	42.18
IPT 1	0.344	N/A	N/A
FFT 1	4.389	*Insufficient Data	*Insufficient Data

Test #4			
Transducer Number	**Peak Positive Pressure (psi)**	**Peak Positive Phase Duration (msec)**	**Peak Positive Phase Impulse (psi*msec)**
RPT 1	11.69	*Insufficient Data	*Insufficient Data
RPT 2	11.8	10.24	64.91
RPT 3	12.3	10.64	65.81
IPT 1	0.124	N/A	N/A
FFT 1	4.583	18.56	31.16

Pressure transducer locations are presented in Appendix A.
Pressure time plots are presented in Appendix B

8.0 Test Results: The results are tabulated as follows.

Test Specimen #1:

Description	Results
Ambient Temperature	65°F
Glazing Temperature	62°F
ASTM Hazard Rating	**Low Hazard**
GSA Performance Condition	**4**
ISO Classification Code	**EXV45(E)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension greater than 10"were located beyond 39-3/8" from the interior face of the specimen on the witness chamber floor. One (1) fragment indent was located at a height of 21" in the vertical witness panel.

Test Specimen #2:

Description	Results
Ambient Temperature	65°F
Glazing Temperature	63°F
ASTM Hazard Rating	**Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV45(E)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension greater than 10"were located beyond 39-3/8" from the interior face of the specimen on the witness chamber floor.

8.0 Test Results: (Continued)

Test Specimen #3:

Description	Results
Ambient Temperature	65°F
Glazing Temperature	62°F
ASTM Hazard Rating	**Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV45(E)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension greater than 10"were located beyond 39-3/8" from the interior face of the specimen in the witness chamber floor. One (1) sliver perforation was located in the vertical witness panel. The interior snap cover fell 43" to the interior.

Test Specimen #4:

Description	Results
Ambient Temperature	65°F
Glazing Temperature	62°F
ASTM Hazard Rating	**Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV45(D)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension greater than 10"were located beyond 39-3/8" from the interior face of the specimen on the witness chamber floor. Three (3) sliver perforations were located in the vertical witness panel.

8.0 Test Results: (Continued)

Test Specimen #5:

Description	Results
Ambient Temperature	65°F
Glazing Temperature	59°F
ASTM Hazard Rating	**Very Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV45(D)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension less than 10”were located beyond 39-3/8” from the interior face of the specimen in the witness chamber floor.

Test Specimen #6:

Description	Results
Ambient Temperature	65°F
Glazing Temperature	60°F
ASTM Hazard Rating	**Low Hazard**
GSA Performance Condition	**5**
ISO Classification Code	**EXV45(E)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension greater than 10”were located beyond 39-3/8” from the interior face of the specimen in the witness chamber floor. One (1) fragment indent was located above 24" in the vertical witness panel.

8.0 Test Results: (Continued)

Test Specimen #7:

Description	Results
Ambient Temperature	65°F
Glazing Temperature	58°F
ASTM Hazard Rating	**Very Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV45(D)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension less than 10”were located beyond 39-3/8” from the interior face of the specimen in the witness chamber floor.

Test Specimen #8:

Description	Results
Ambient Temperature	65°F
Glazing Temperature	59°F
ASTM Hazard Rating	**Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV45(E)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension greater than 10”were located beyond 39-3/8” from the interior face of the specimen on the witness chamber floor. Two (2) sliver perforations were located in the vertical witness panel. The interior snap cover fell 49” to the interior.

8.**0 Test Results**: (Continued)

Test Specimen #9:

Description	Results
Ambient Temperature	64°F
Glazing Temperature	59°F
ASTM Hazard Rating	**High Hazard**
GSA Performance Condition	**5**
ISO Classification Code	**EXV45(F)**

Glazing Response	
Lite	Released to interior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension greater than 10”were located beyond 39-3/8” from the interior face of the specimen in the witness chamber floor. The lite impacted the vertical witness panel above 24”.

Test Specimen #10:

Description	Results
Ambient Temperature	64°F
Glazing Temperature	60°F
ASTM Hazard Rating	**High Hazard**
GSA Performance Condition	**5**
ISO Classification Code	**EXV45(F)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension greater than 10”were located beyond 39-3/8” from the interior face of the specimen in the witness chamber floor. Two (2) sliver perforations and one (1) fragment indent above 24" were located in the vertical witness panel.

8.**0 Test Results**: (Continued)

Test Specimen #11:

Description	Results
Ambient Temperature	64°F
Glazing Temperature	60°F
ASTM Hazard Rating	**Very Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV45(D)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension less than 10”were located beyond 39-3/8” from the interior face of the specimen on the witness chamber floor. Two (2) sliver perforations were located in the vertical witness panel.

Test Specimen #12:

Description	Results
Ambient Temperature	64°F
Glazing Temperature	59°F
ASTM Hazard Rating	**Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV45(E)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension greater than 10”were located beyond 39-3/8” from the interior face of the specimen on the witness chamber floor. Five (5) sliver perforations were located in the vertical witness panel.

8.**0 Test Results**: (Continued)

Test Specimen #13:

Description	Results
Ambient Temperature	64°F
Glazing Temperature	64°F
ASTM Hazard Rating	**Very Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV33(D)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension less than 10”were located beyond 39-3/8” from the interior face of the specimen on the witness chamber floor. One (1) sliver perforation was located in the vertical witness panel.

Test Specimen #14:

Description	Results
Ambient Temperature	64°F
Glazing Temperature	60°F
ASTM Hazard Rating	**Very Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV33(D)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension less than 10”were located beyond 39-3/8” from the interior face of the specimen on the witness chamber floor. One (1) sliver perforation was located in the vertical witness panel.

8.**0 Test Results**: (Continued)

Test Specimen #15:

Description	Results
Ambient Temperature	64°F
Glazing Temperature	61°F
ASTM Hazard Rating	**Very Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV33(D)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension less than 10”were located beyond 39-3/8” from the interior face of the specimen on the witness chamber floor. One (1) sliver perforation was located in the vertical witness panel.

Test Specimen #16:

Description	Results
Ambient Temperature	64°F
Glazing Temperature	59°F
ASTM Hazard Rating	**Very Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV33(D)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension less than 10”were located beyond 39-3/8” from the interior face of the specimen on the witness chamber floor.

8.**0 Test Results**: (Continued)

Test Specimen #17:

Description	Results
Ambient Temperature	90°F
Glazing Temperature	86°F
ASTM Hazard Rating	**Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV45(E)**

Glazing Response	
Lite	Released to interior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension greater than 10”were located beyond 39-3/8” from the interior face of the specimen in the witness chamber floor. The lite fell 42" to the interior of the witness chamber. Eight (8) sliver perforations were located in the vertical witness panel.

Test Specimen #18:

Description	Results
Ambient Temperature	90°F
Glazing Temperature	84°F
ASTM Hazard Rating	**No Break**
GSA Performance Condition	**1**
ISO Classification Code	**EXV45(A)**

Glazing Response	
Lite	Unbroken
Glazing Pullout	None
Glazing Tearing	None

Witness Chamber Results
No debris was observed.

8.**0 Test Results**: (Continued)

Test Specimen #19:

Description	Results
Ambient Temperature	90°F
Glazing Temperature	88°F
ASTM Hazard Rating	**No Break**
GSA Performance Condition	**1**
ISO Classification Code	**EXV45(A)**

Glazing Response	
Lite	Unbroken
Glazing Pullout	None
Glazing Tearing	None

Witness Chamber Results
No debris was observed.

Test Specimen #20:

Description	Results
Ambient Temperature	90°F
Glazing Temperature	89°F
ASTM Hazard Rating	**Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV45(E)**

Glazing Response	
Lite	Released to interior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension greater than 10”were located beyond 39-3/8” from the interior face of the specimen in the witness chamber floor. The lite fell 52" to the interior of the witness chamber. Four (4) sliver perforations were located in the vertical witness panel.

8.**0 Test Results**: (Continued)

Test Specimen #21:

Description	Results
Ambient Temperature	90°F
Glazing Temperature	88°F
ASTM Hazard Rating	**Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV33(E)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension greater than 10"were located beyond 39-3/8" from the interior face of the specimen in the witness chamber floor. One (1) sliver perforation was located in the vertical witness panel.

Test Specimen #22:

Description	Results
Ambient Temperature	90°F
Glazing Temperature	89°F
ASTM Hazard Rating	**No Break**
GSA Performance Condition	**1**
ISO Classification Code	**EXV33(A)**

Glazing Response	
Lite	Unbroken
Glazing Pullout	None
Glazing Tearing	None

Witness Chamber Results
No debris was observed.

8.**0 Test Results**: (Continued)

Test Specimen #23:

Description	Results
Ambient Temperature	90°F
Glazing Temperature	89°F
ASTM Hazard Rating	**No Break**
GSA Performance Condition	**1**
ISO Classification Code	**EXV33(A)**

Glazing Response	
Lite	Unbroken
Glazing Pullout	None
Glazing Tearing	None

Witness Chamber Results
No debris was observed.

Test Specimen #24:

Description	Results
Ambient Temperature	90°F
Glazing Temperature	88°F
ASTM Hazard Rating	**Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV33(E)**

Glazing Response	
Exterior Lite	Fractured
Glazing Pullout	Greater than 50% of the lite site perimeter pulled out from the surrounding frame.
Glazing Tearing	None

Witness Chamber Results
Fragments with a sum total united dimension greater than 10”were located beyond 39-3/8” from the interior face of the specimen in the witness chamber floor.

8.**0 Test Results**: (Continued)

Test Specimen #25:

Description	Results
Ambient Temperature	76°F
Glazing Temperature	77°F
ASTM Hazard Rating	**Low Hazard**
GSA Performance Condition	**3B**
ISO Classification Code	**EXV25(E)**

Glazing Response	
Lite	Ejected to exterior.
Glazing Pullout	None
Glazing Tearing	Complete perimeter.

Witness Chamber Results
Fragments with a sum total united dimension greater than 10”were located beyond 39-3/8” from the interior face of the specimen in the witness chamber floor. Fifteen (15) total sliver perforations were located in the vertical witness panel, four (4) above 20".

Test Specimen #26:

Description	Results
Ambient Temperature	76°F
Glazing Temperature	76°F
ASTM Hazard Rating	**High Hazard**
GSA Performance Condition	**5**
ISO Classification Code	**EXV25(F)**

Glazing Response	
Lite	Fractured
Glazing Pullout	Greater than 50% of the lite site perimeter pulled out from the surrounding frame.
Glazing Tearing	None

Witness Chamber Results
Fragments with a sum total united dimension greater than 10”were located beyond 39-3/8” from the interior face of the specimen in the witness chamber floor. Greater than ten (10) sliver perforations above 20" were located in the vertical witness panel.

8.**0 Test Results**: (Continued)

Test Specimen #27:

Description	Results
Ambient Temperature	76°F
Glazing Temperature	76°F
ASTM Hazard Rating	**High Hazard**
GSA Performance Condition	**5**
ISO Classification Code	**EXV25(F)**

Glazing Response	
Lite	Fractured
Glazing Pullout	Greater than 50% of the lite site perimeter pulled out from the surrounding frame.
Glazing Tearing	None

Witness Chamber Results
Fragments with a sum total united dimension greater than 10”were located beyond 39-3/8” from the interior face of the specimen in the witness chamber floor. Greater than ten (10) sliver perforations above 20" were located in the vertical witness panel.

Test Specimen #28:

Description	Results
Ambient Temperature	76°F
Glazing Temperature	75°F
ASTM Hazard Rating	**No Break**
GSA Performance Condition	**1**
ISO Classification Code	**EXV25(A)**

Glazing Response	
Lite	Unbroken
Glazing Pullout	None
Glazing Tearing	None

Witness Chamber Results
No debris was observed.

Architectural Testing will service this report for the entire test record retention period. Test records that are retained such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Architectural Testing, Inc. for the entire test record retention period.

Results obtained are tested values and were secured using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimens tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.:

Digitally Signed by: Daniel Simmons

Daniel B Simmons, E.I.T.
Project Manager

Digitally Signed by: John H. Waskow

John H. Waskow, P.E.
Director – Regional Operations

DS:jw/hd

Attachments (pages): This report is complete only when all attachments listed are included.
- Appendix A: Test Facility (11)
- Appendix B: Pressure Time Plots (37)
- Appendix C: Photographs (63)
- Appendix D: Drawings (5)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	01/05/14	N/A	Original report issue

APPENDIX A

Test Facility

Photo No 1
Test #1 Setup and Specimen Label

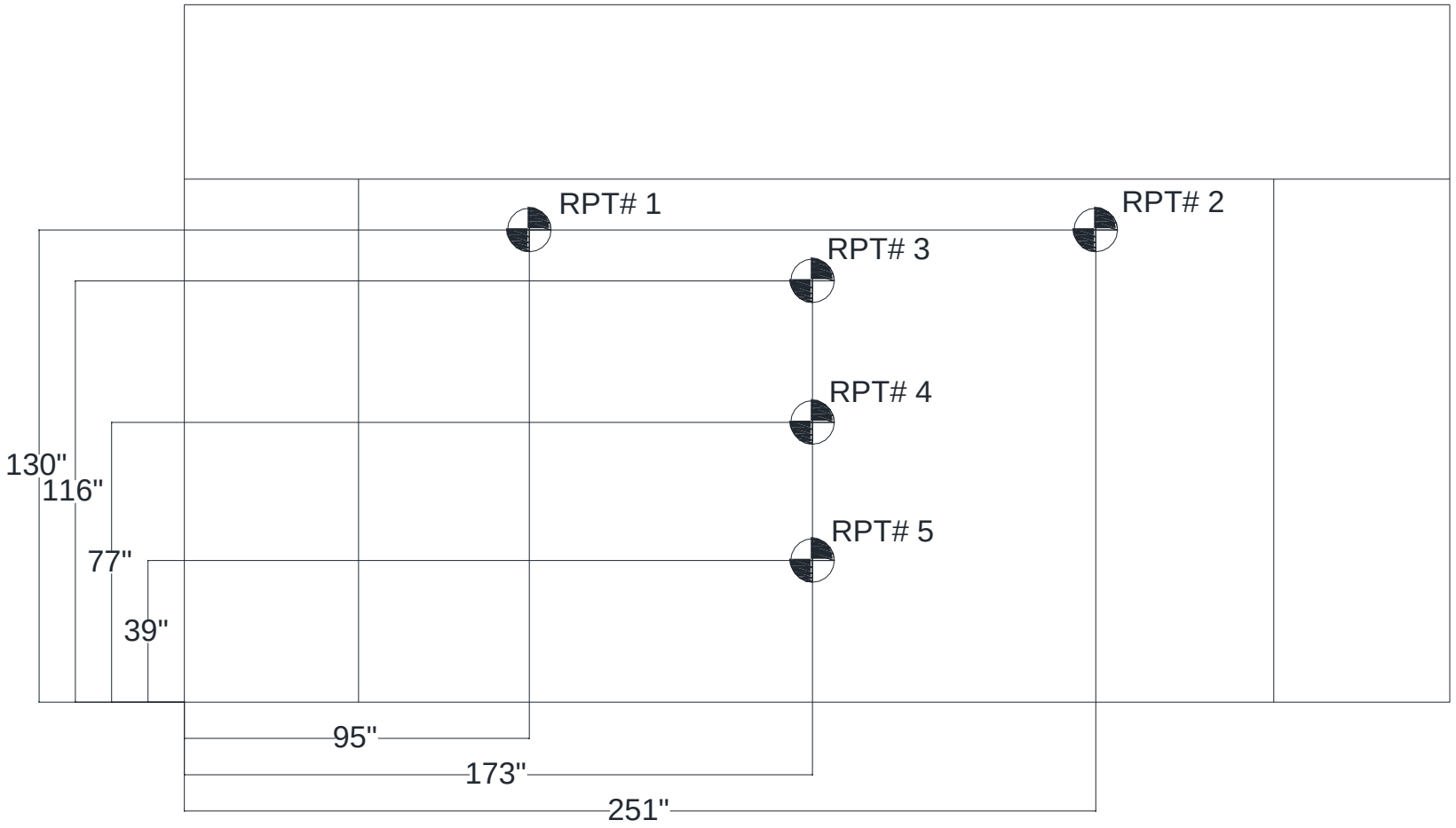


Photo No 2
Test #1 Transducer Location

Photo No 3
Test #2 Setup and Specimen Label

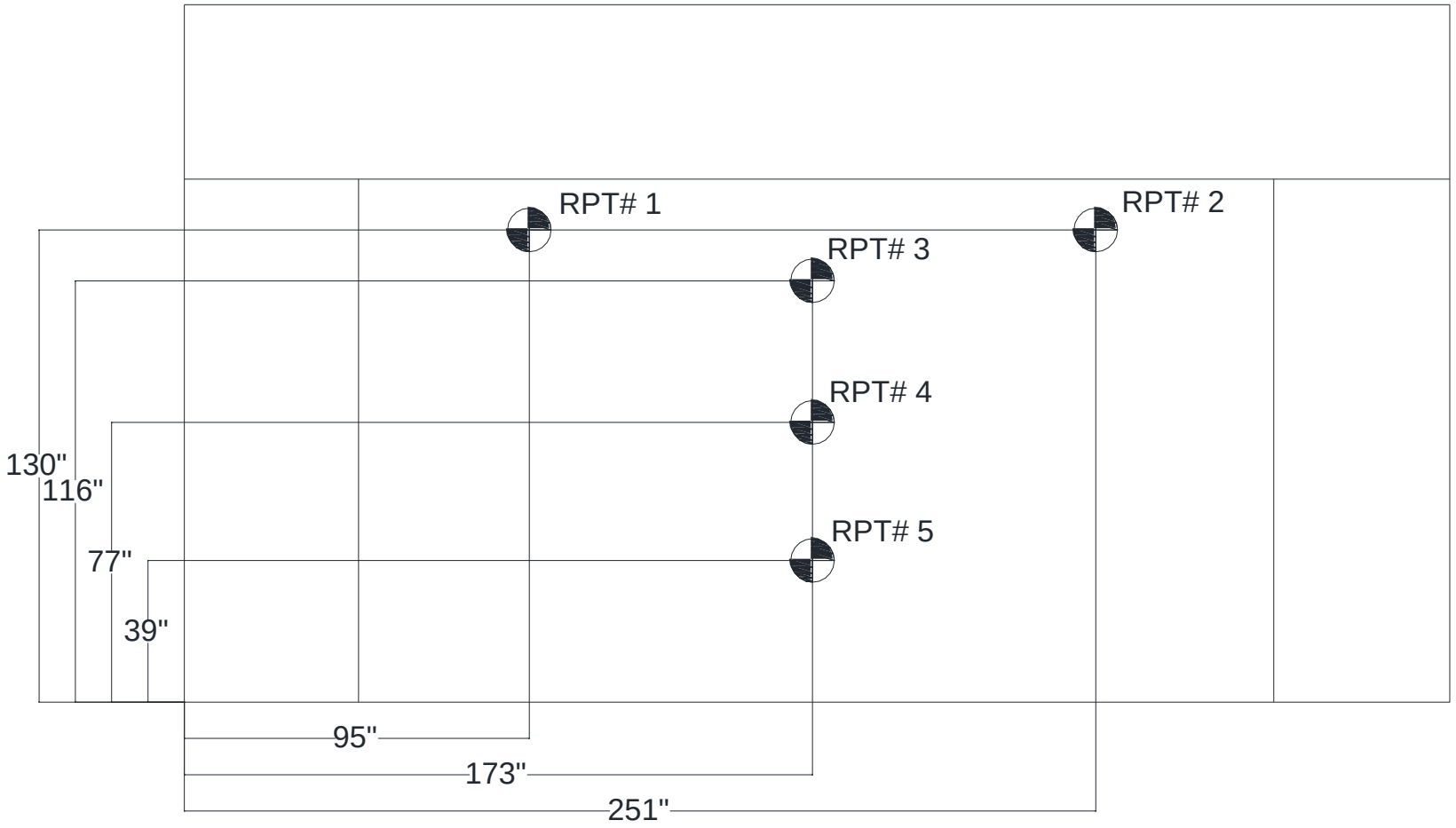


Photo No 4
Test #2 Transducer Location – 4psi Chamber

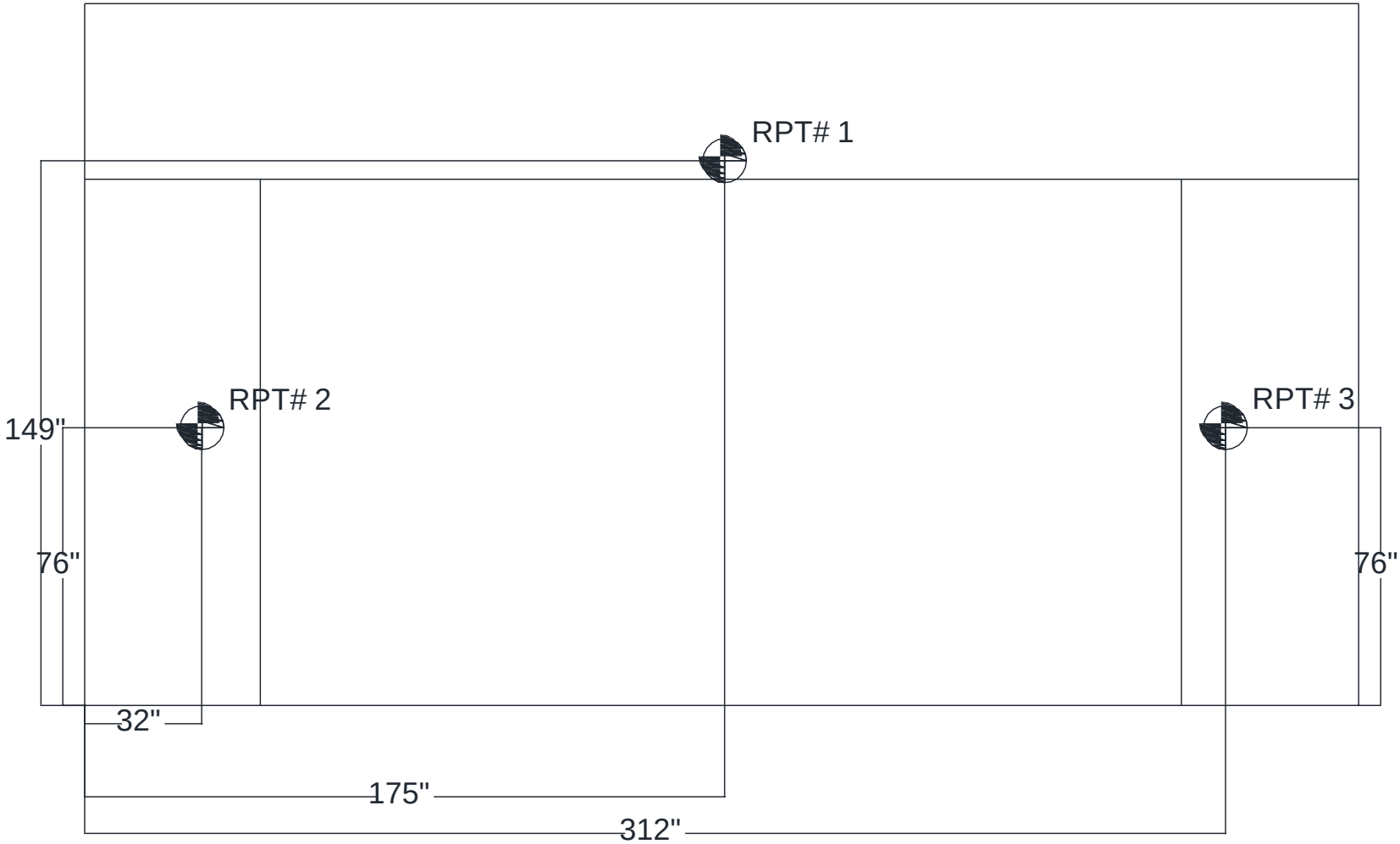


Photo No 5
Test #2 Transducer Location – 7psi Chamber

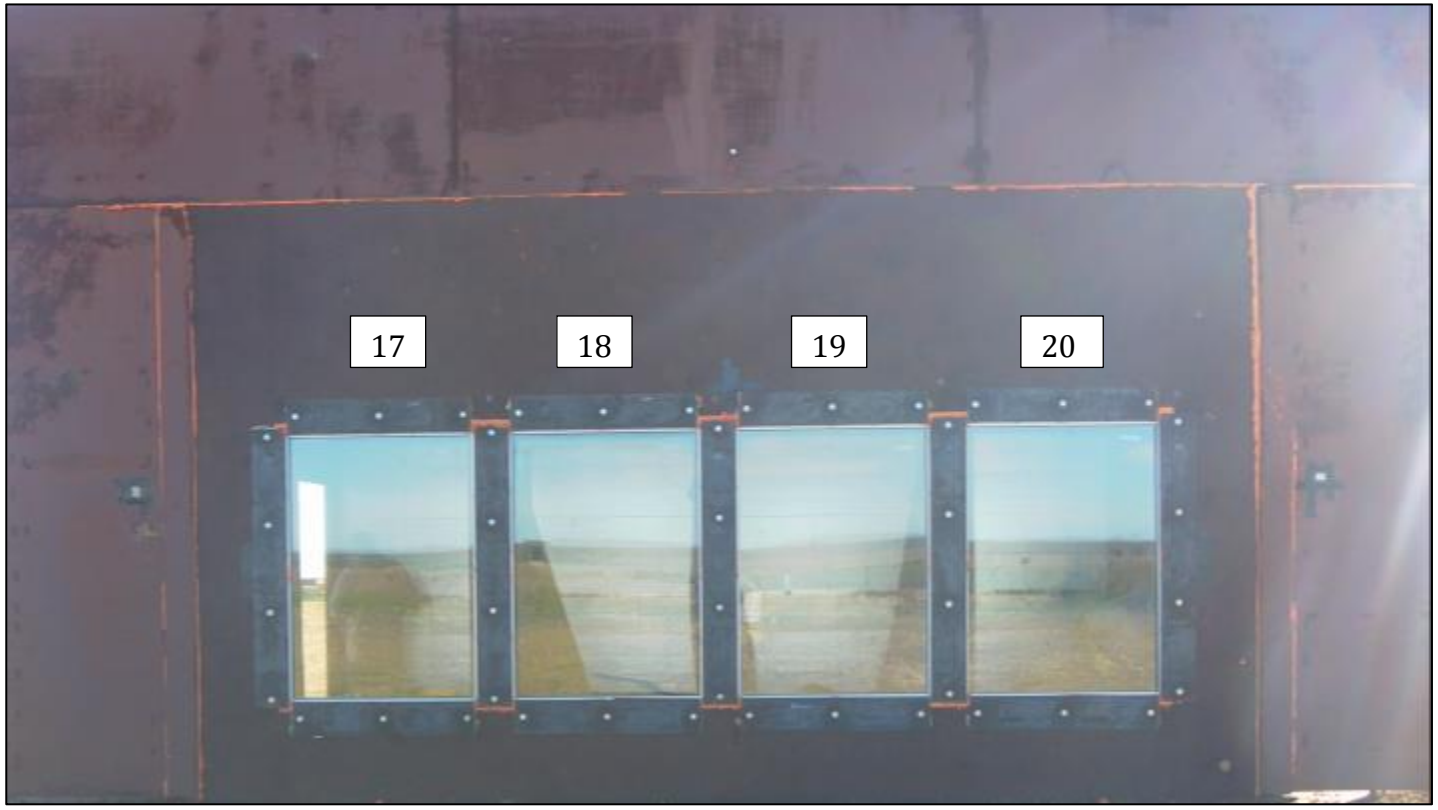


Photo No 6
Test #3 Setup and Specimen Label – 7 psi Chamber

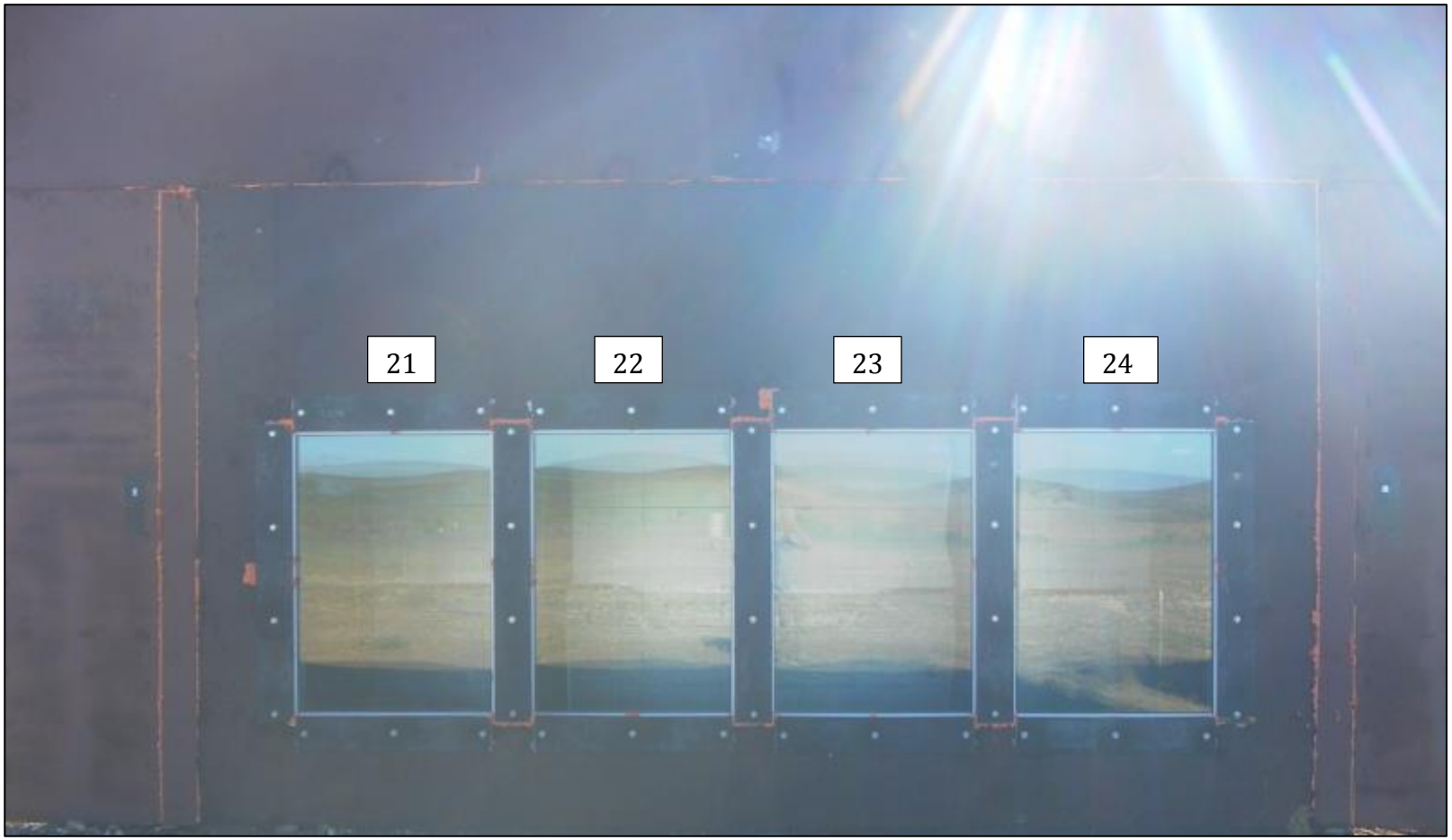


Photo No 7
Test #3 Setup and Specimen Label – 4 psi Chamber

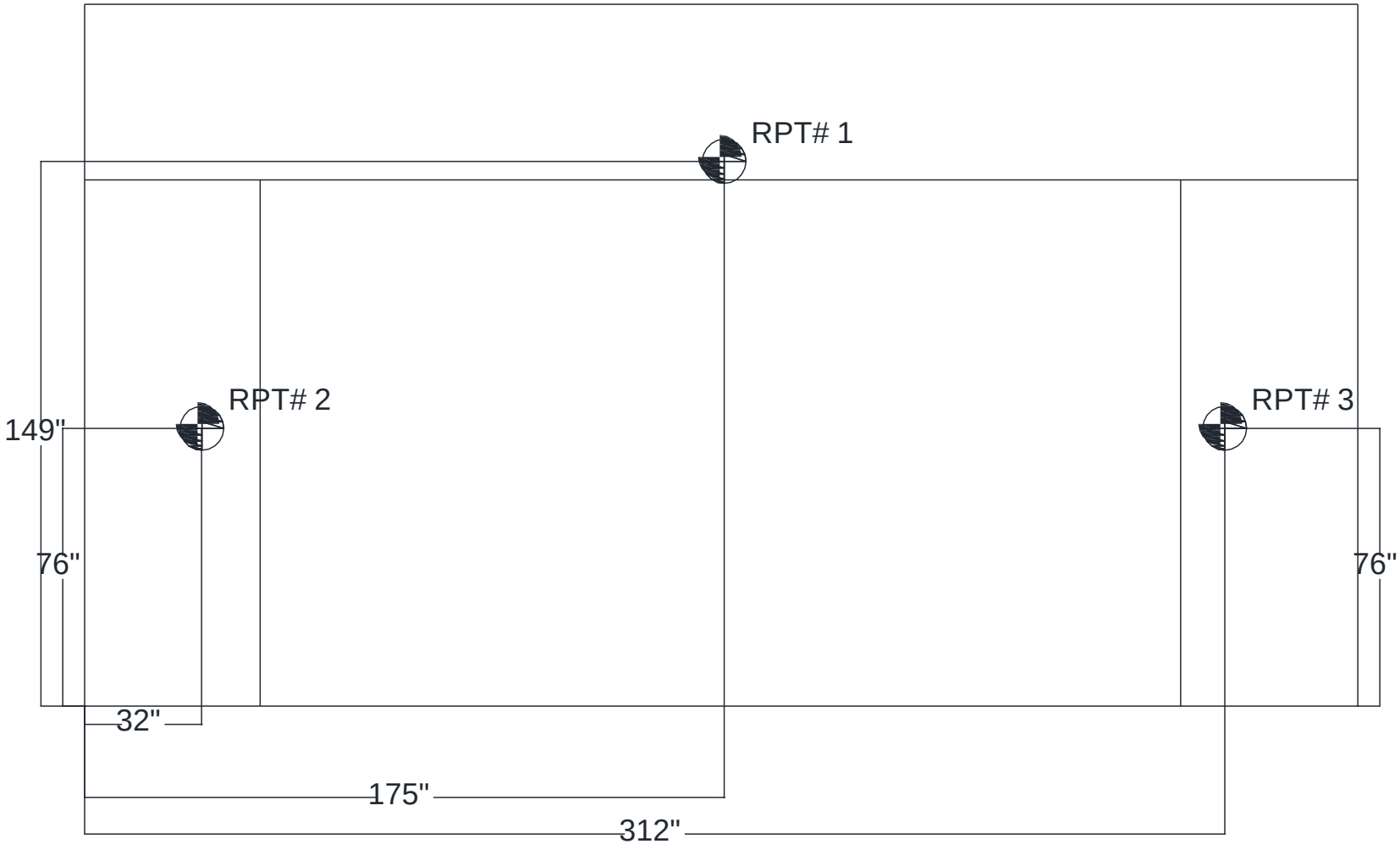


Photo No 8
Test #3 Transducer Location – 4psi Chamber

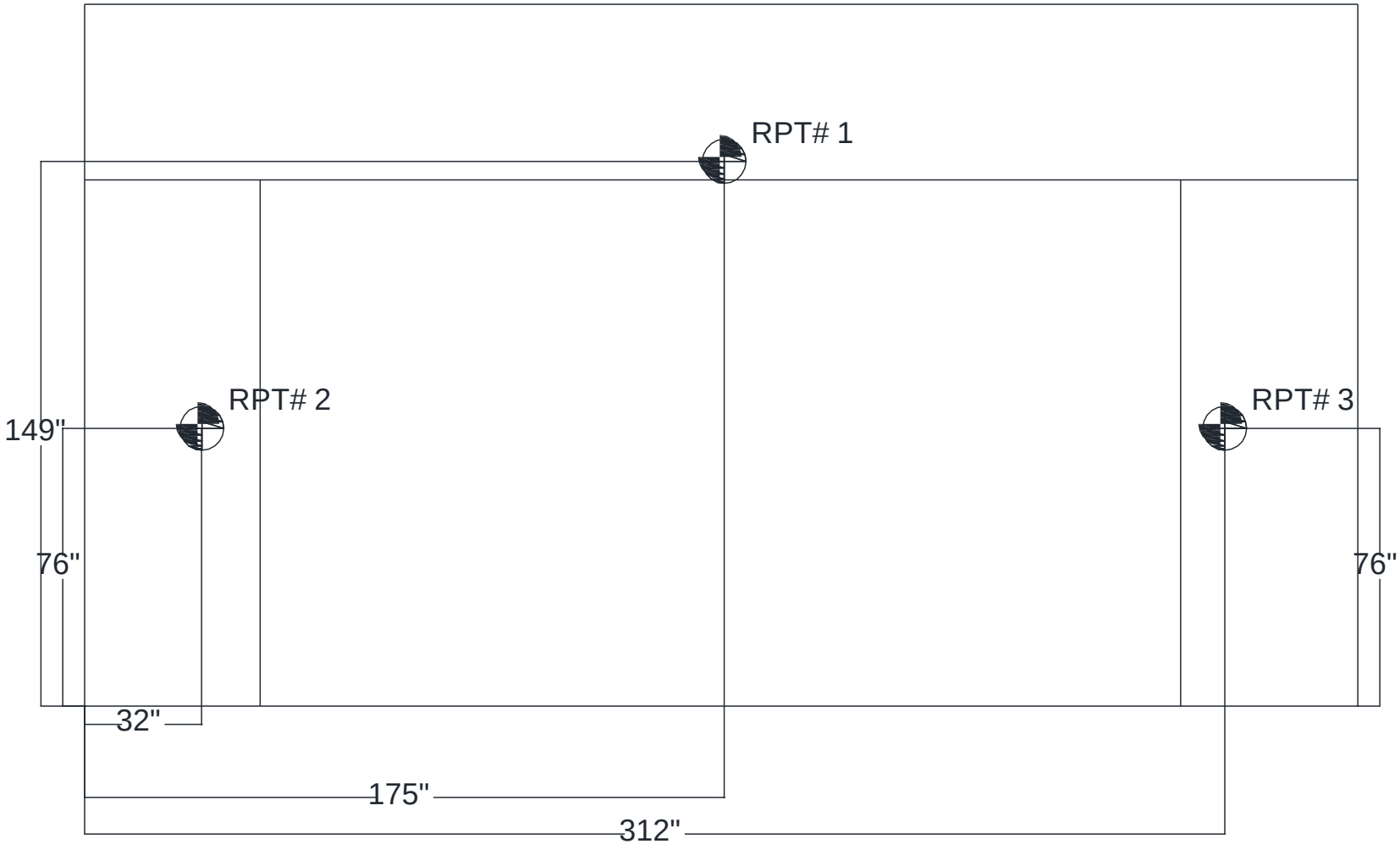


Photo No 9
Test #3 Transducer Location – 7psi Chamber

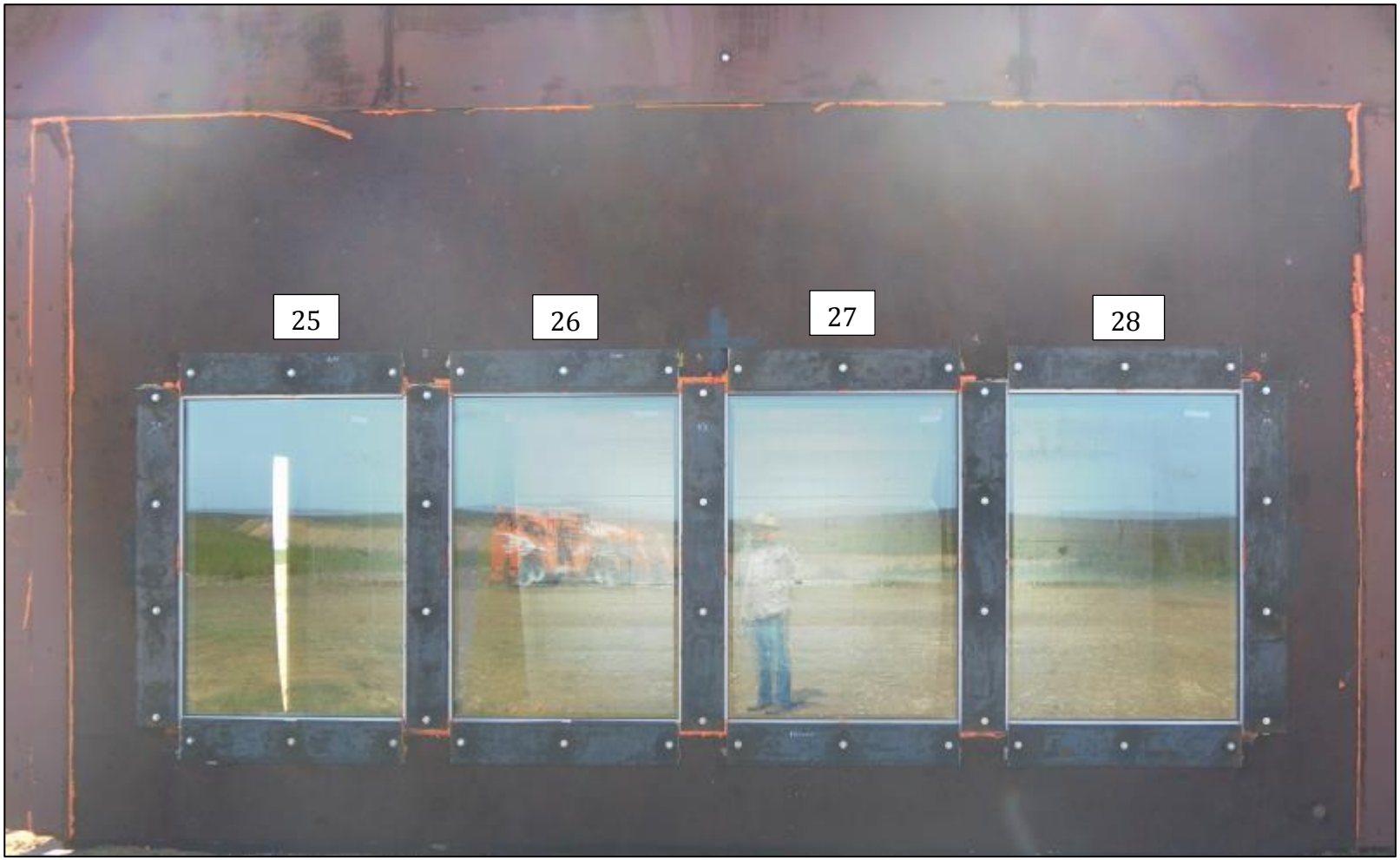


Photo No 10
Test #4 Setup and Specimen Label

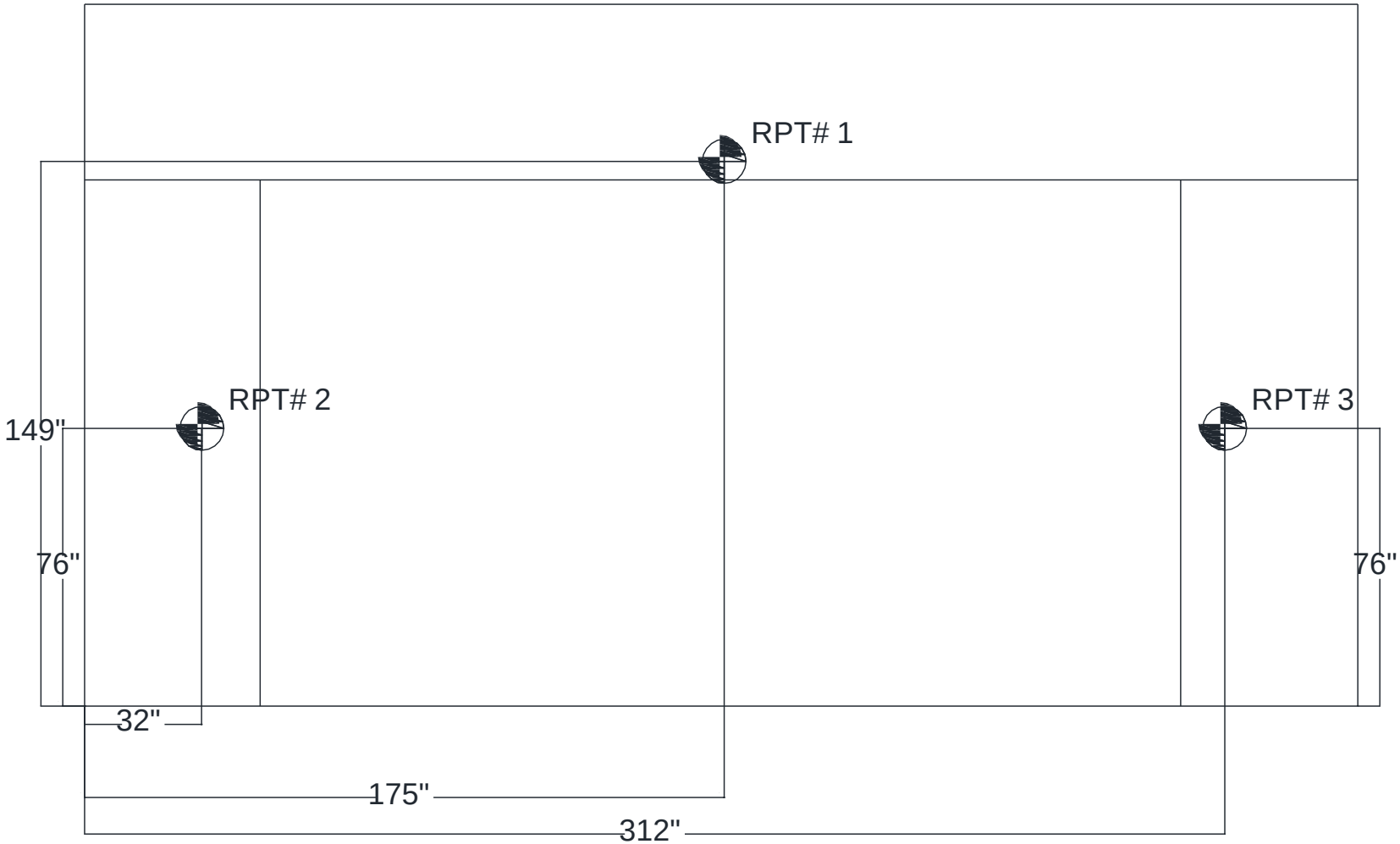
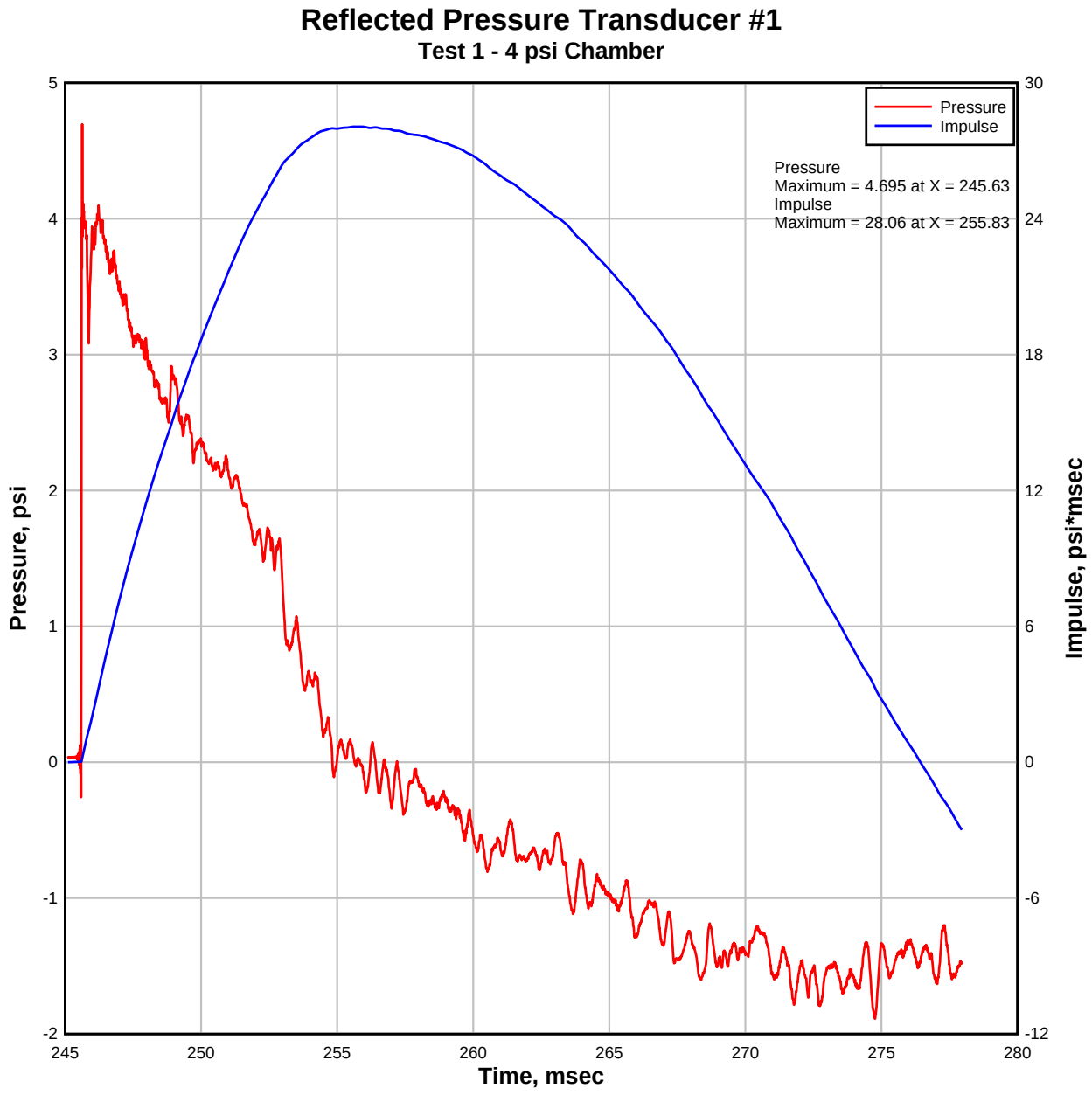


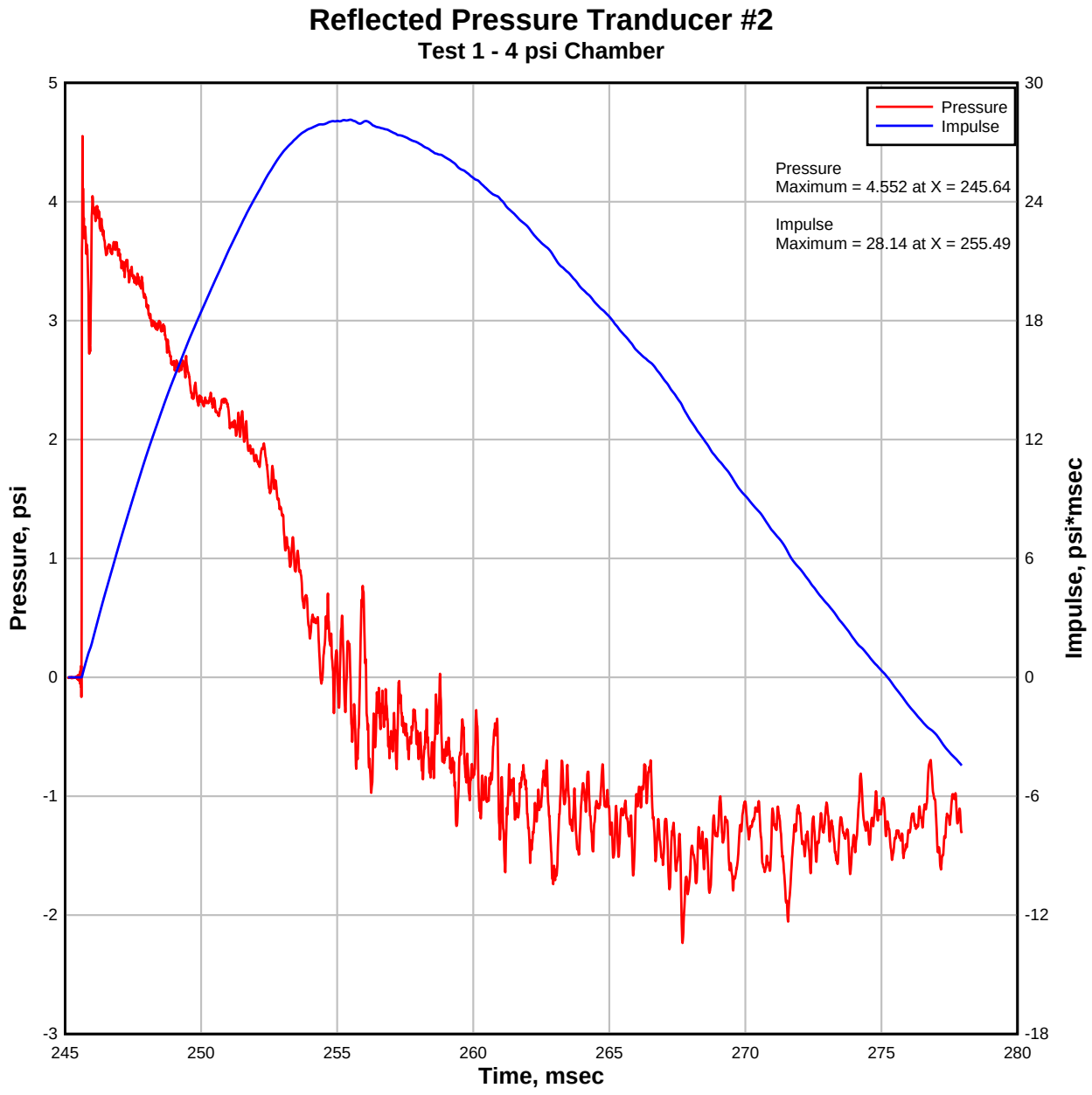
Photo No 11
Test #4 Transducer Location

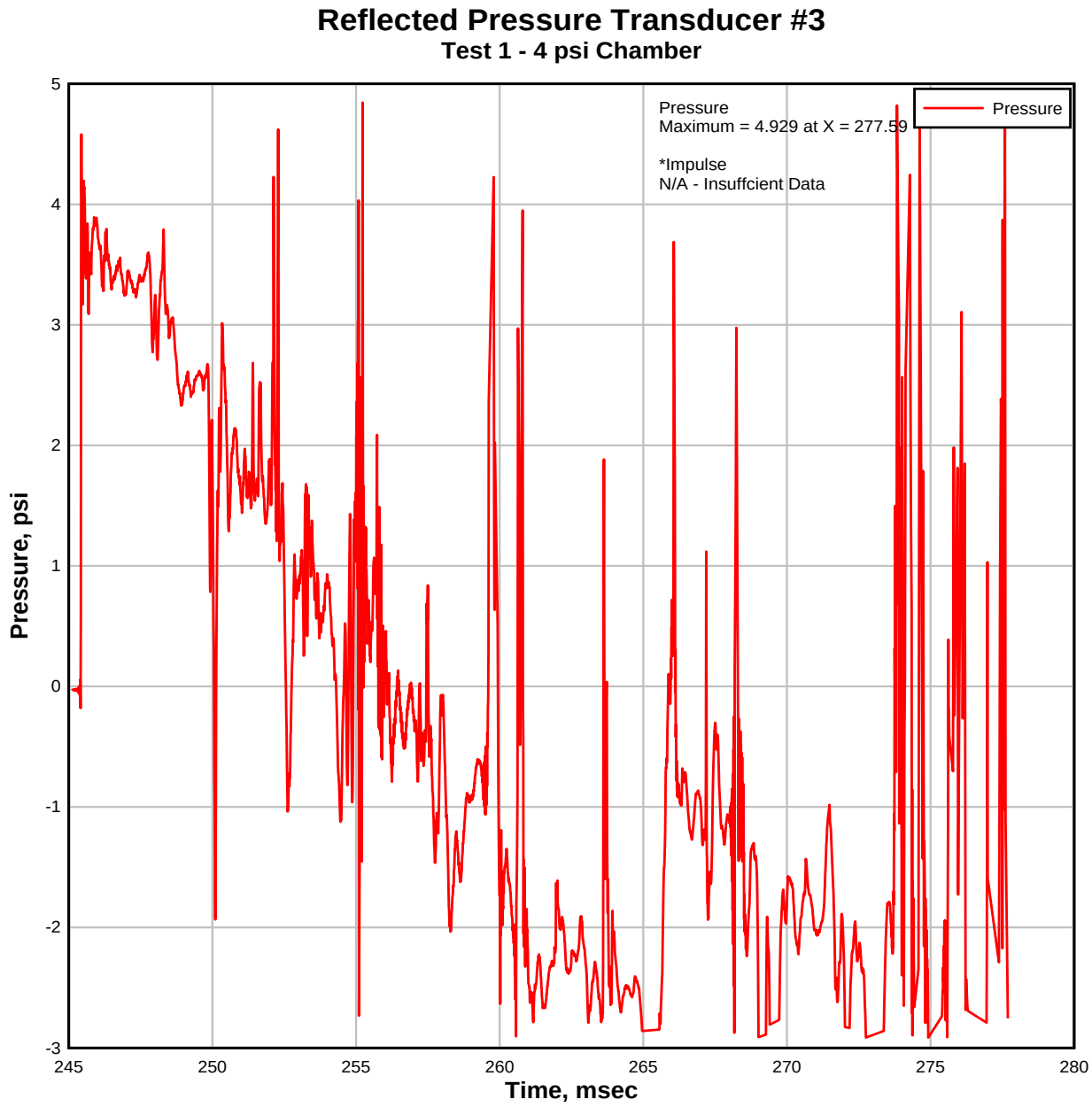
APPENDIX B

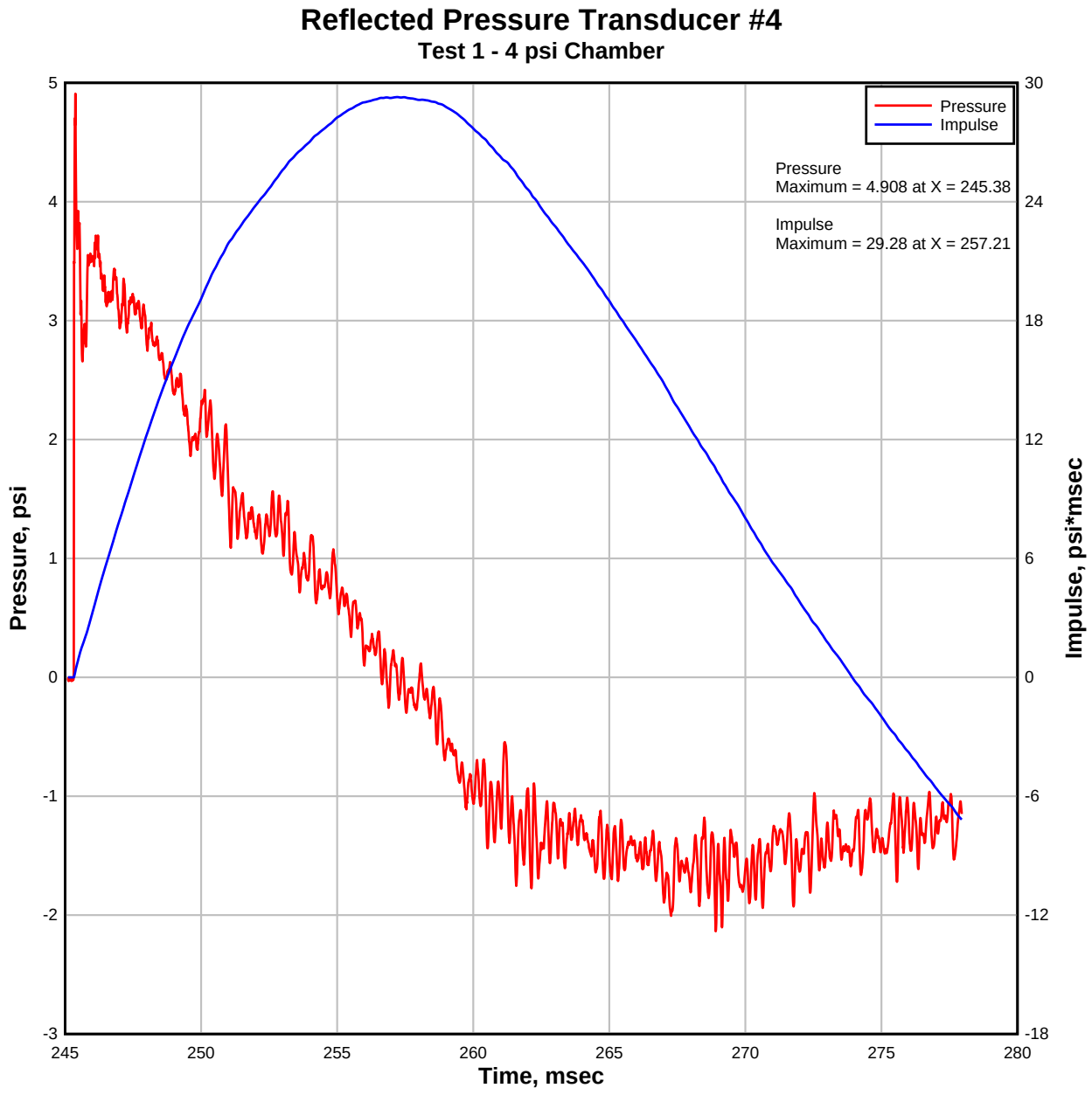
Pressure Time Histories

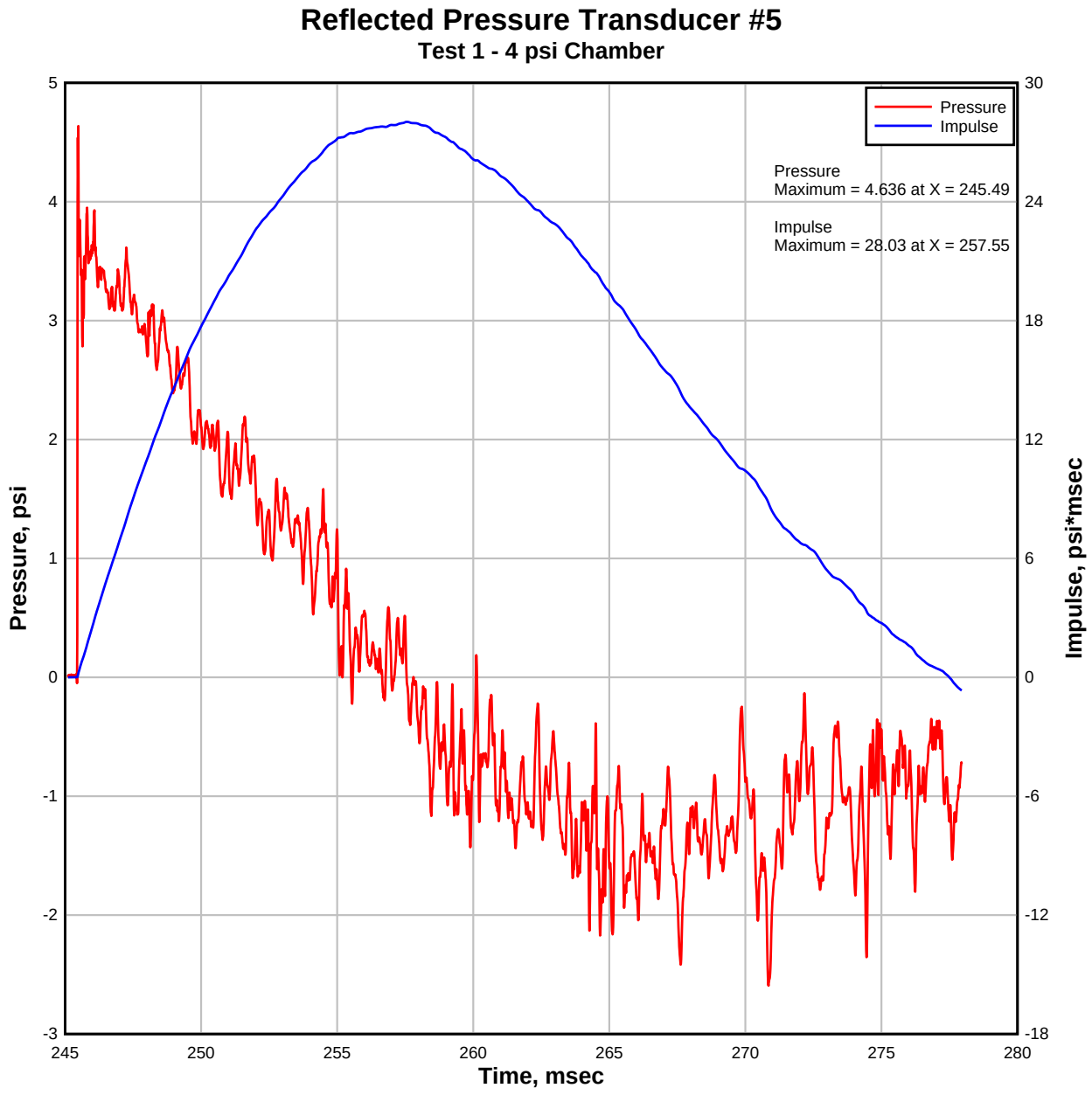
Test #1

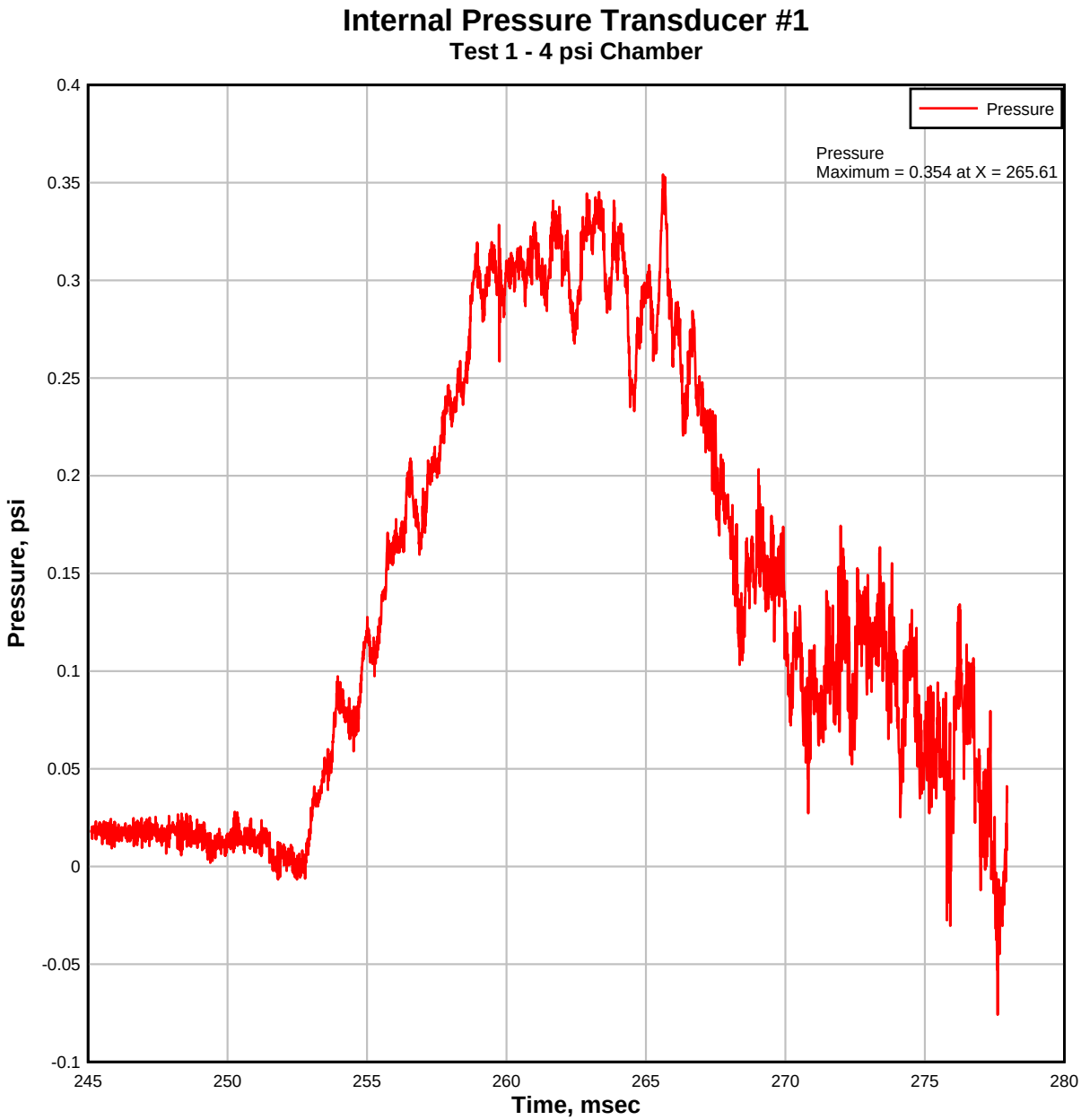

Reflected Pressure Transducer #1
Test 1 - 4 psi Chamber
Pressure
Impulse
Pressure
Maximum = 4.695 at X = 245.63
Impulse
Maximum = 28.06 at X = 255.83
Pressure, psi
Impulse, psi*msec
Time, msec
5
4
3
2
1
0
-1
-2
30
24
18
12
6
0
-6
-12
245
250
255
260
265
270
275
280

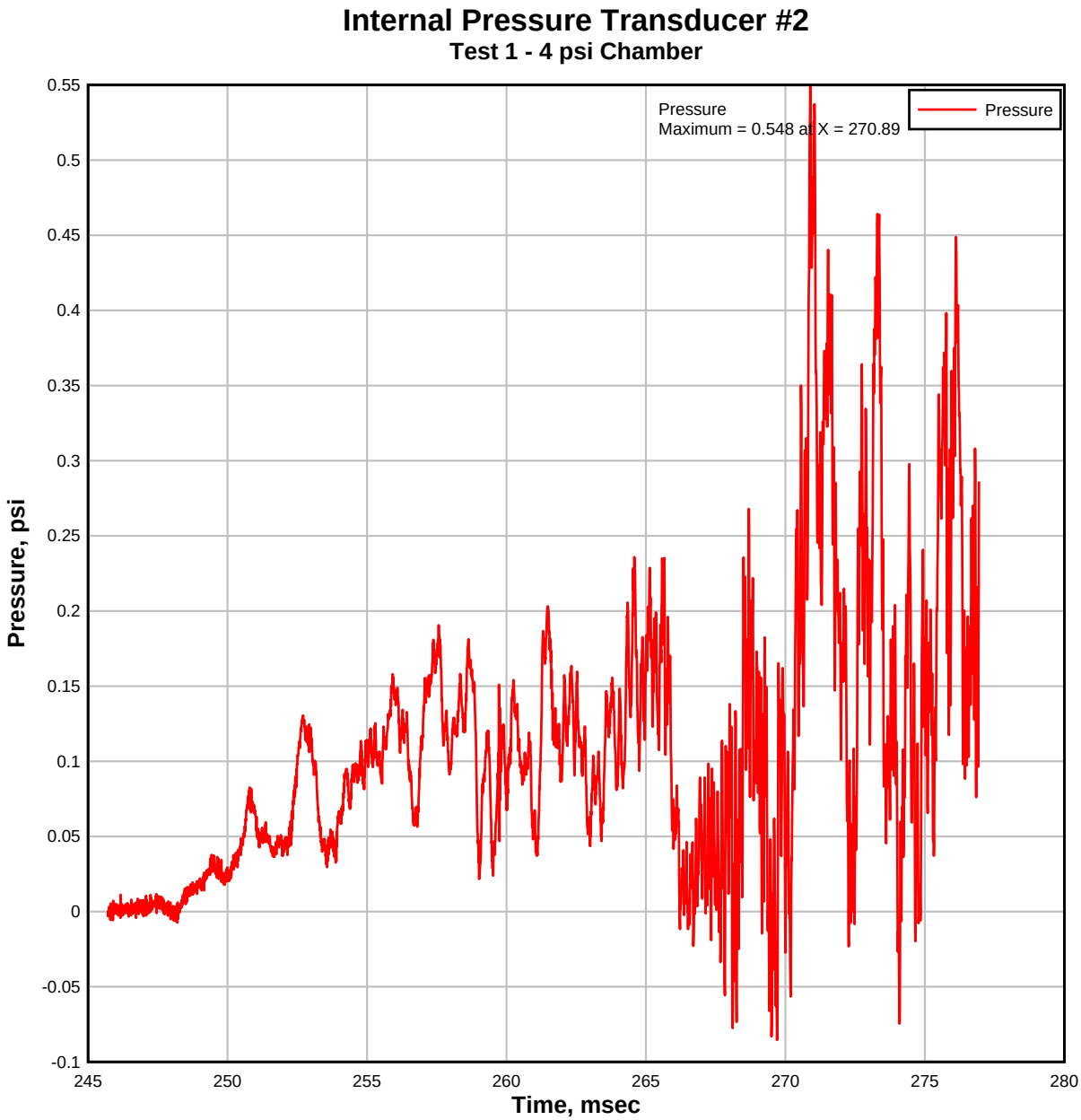

Reflected Pressure Tranducer #2
Test 1 - 4 psi Chamber
Pressure
Impulse
Pressure
Maximum = 4.552 at X = 245.64
Impulse
Maximum = 28.14 at X = 255.49
Pressure, psi
Impulse, psi*msec
Time, msec
5
4
3
2
1
0
-1
-2
-3
30
24
18
12
6
0
-6
-12
-18
245
250
255
260
265
270
275
280

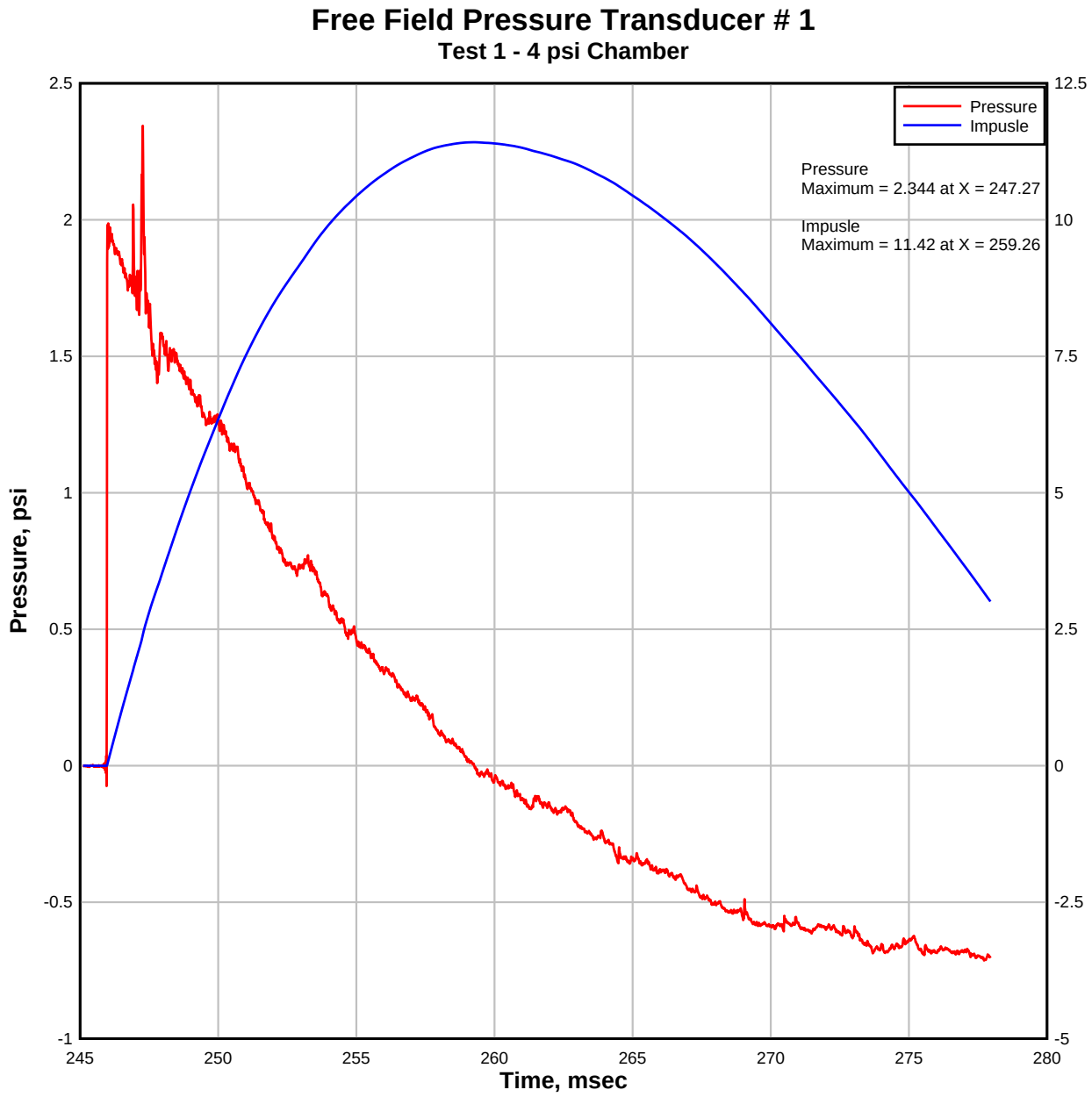

Reflected Pressure Transducer #3
Test 1 - 4 psi Chamber
Pressure
Maximum = 4.929 at X = 277.59
*Impulse
N/A - Insuffcient Data
Pressure
Pressure, psi
Time, msec
5
4
3
2
1
0
-1
-2
-3
245
250
255
260
265
270
275
280


Reflected Pressure Transducer #4
Test 1 - 4 psi Chamber
Pressure
Impulse
Pressure
Maximum = 4.908 at X = 245.38
Impulse
Maximum = 29.28 at X = 257.21
Pressure, psi
Impulse, psi*msec
Time, msec
5
4
3
2
1
0
-1
-2
-3
30
24
18
12
6
0
-6
-12
-18
245
250
255
260
265
270
275
280

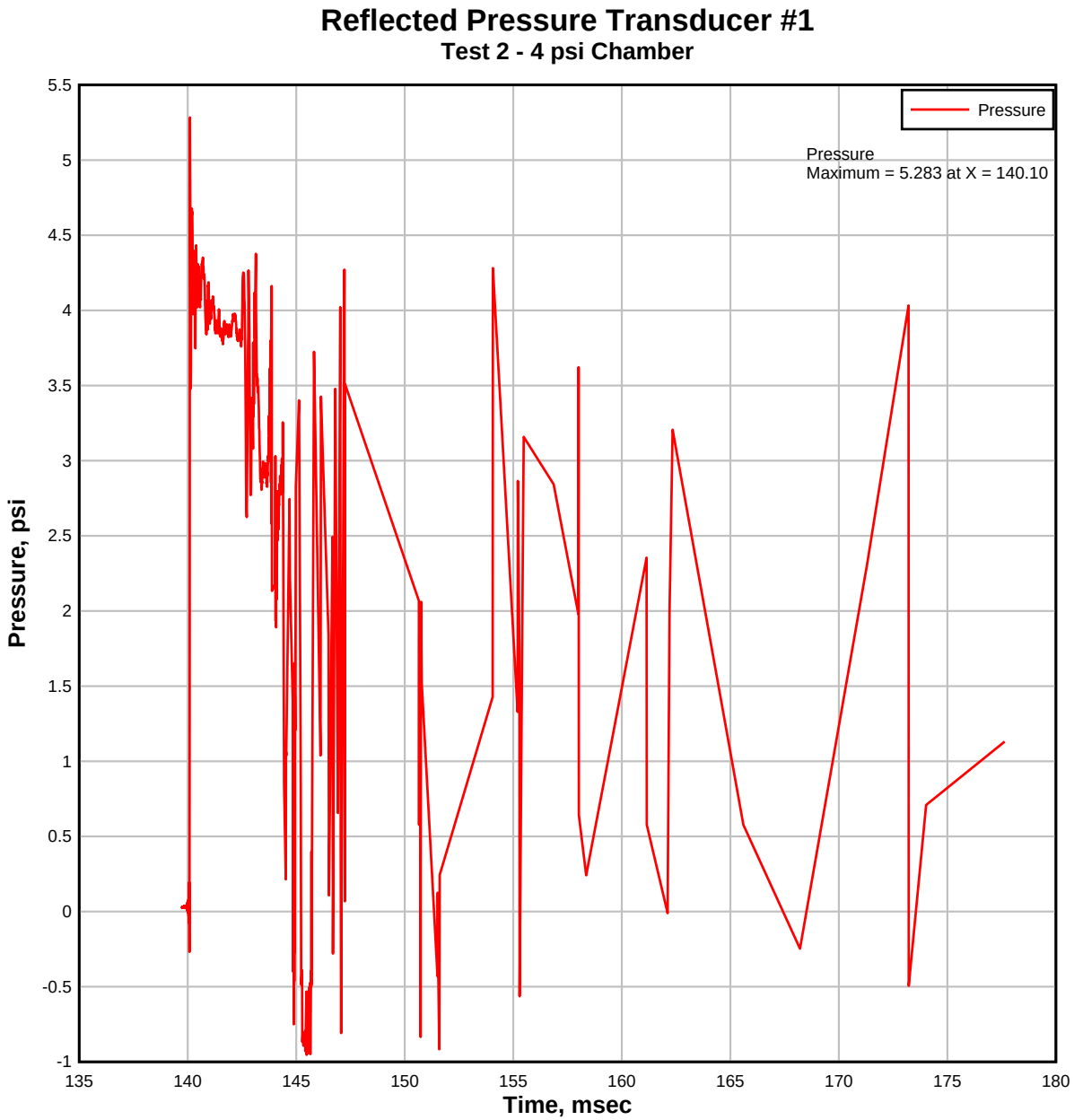

Reflected Pressure Transducer #5
Test 1 - 4 psi Chamber
Pressure
Impulse
Pressure
Maximum = 4.636 at X = 245.49
Impulse
Maximum = 28.03 at X = 257.55
Pressure, psi
Impulse, psi*msec
Time, msec
5
4
3
2
1
0
-1
-2
-3
30
24
18
12
6
0
-6
-12
-18
245
250
255
260
265
270
275
280

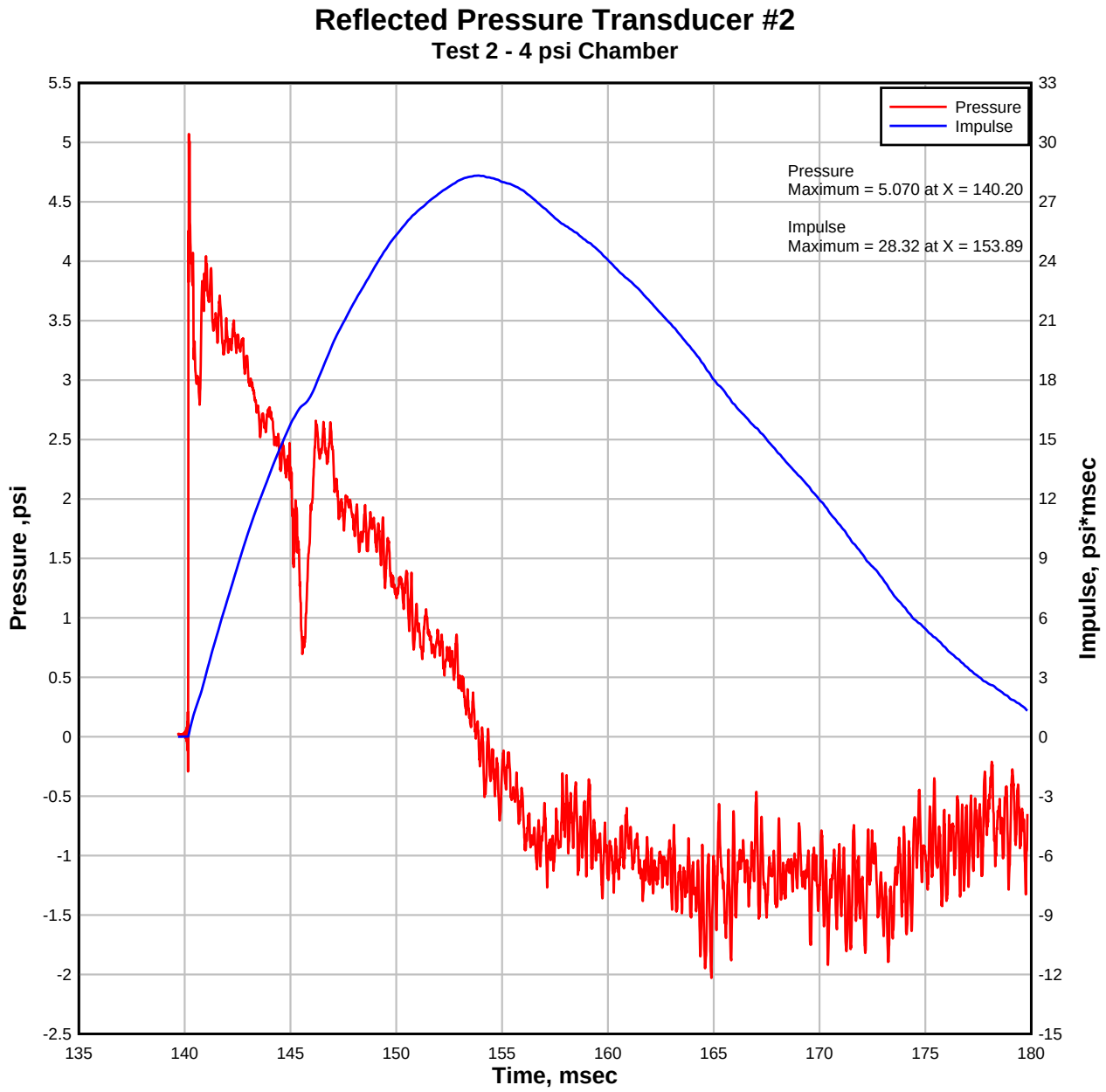

Internal Pressure Transducer #1
Test 1 - 4 psi Chamber
Pressure
Pressure
Maximum = 0.354 at X = 265.61
Pressure, psi
Time, msec
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
245
250
255
260
265
270
275
280

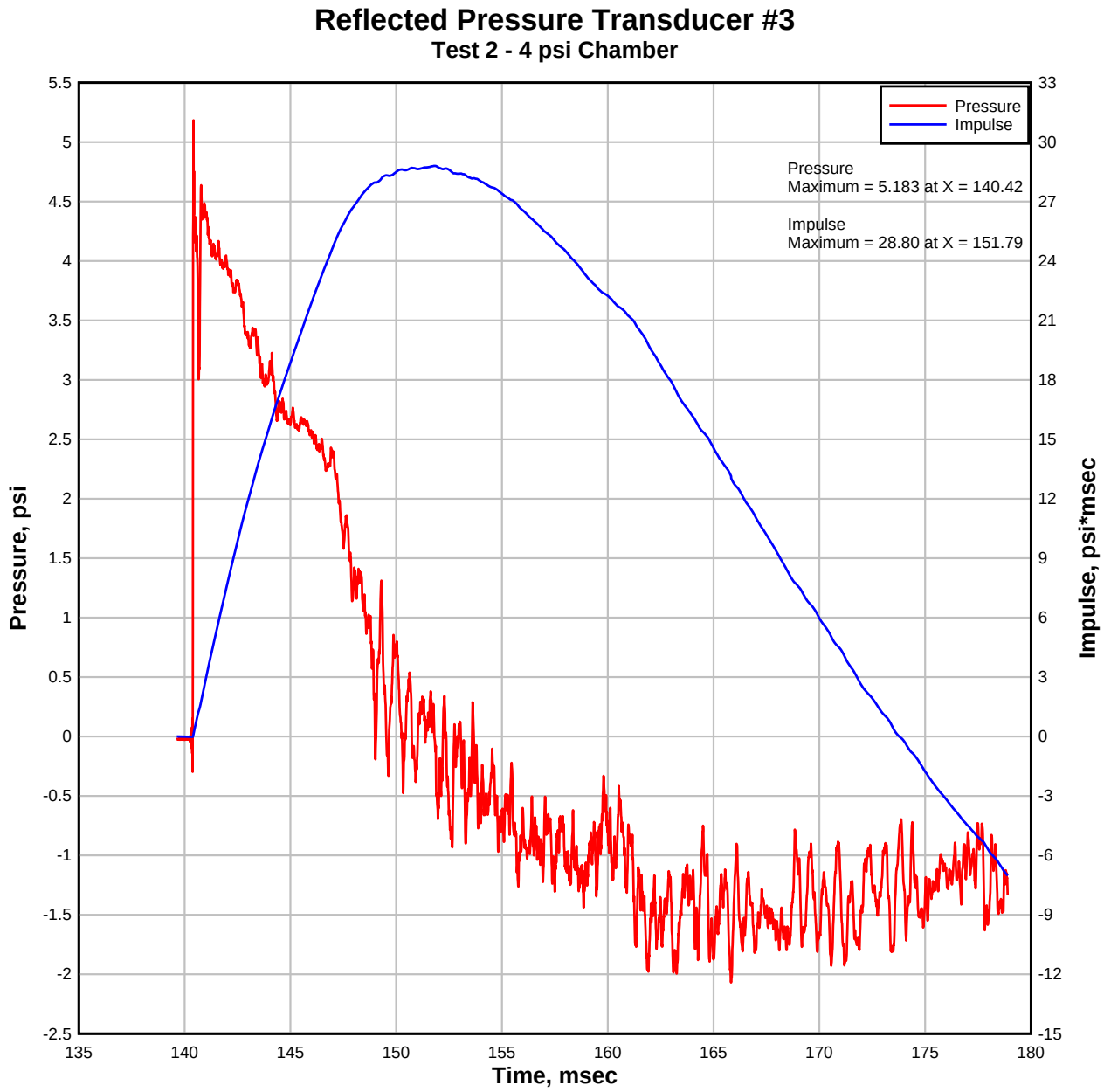

Internal Pressure Transducer #2
Test 1 - 4 psi Chamber
Pressure
Maximum = 0.548 at X = 270.89
Pressure
Pressure, psi
Time, msec
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
245
250
255
260
265
270
275
280

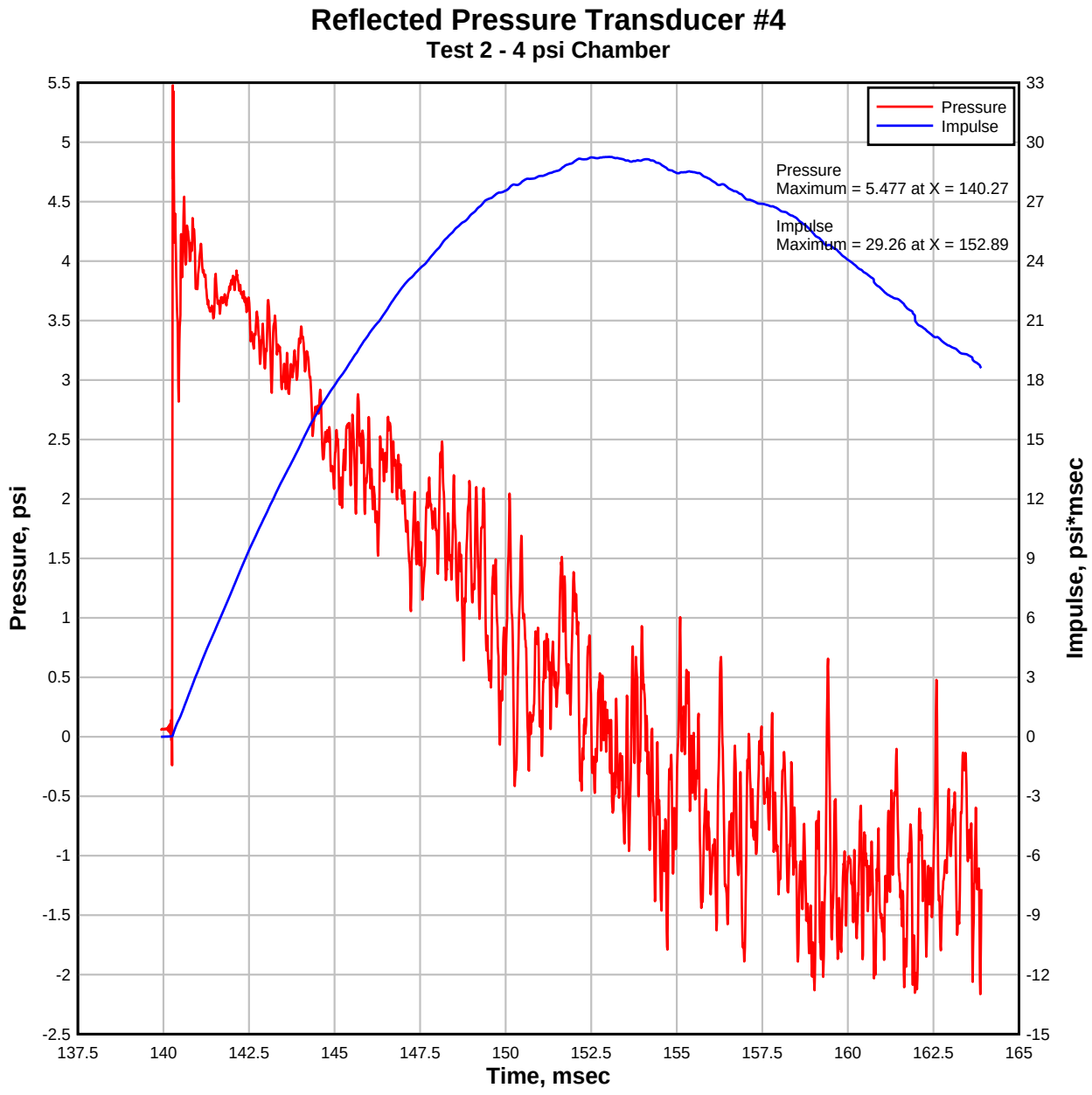

Free Field Pressure Transducer # 1
Test 1 - 4 psi Chamber
Pressure
Impusle
Pressure
Maximum = 2.344 at X = 247.27
Impusle
Maximum = 11.42 at X = 259.26
Pressure, psi
Time, msec
2.5
2
1.5
1
0.5
0
-0.5
-1
12.5
10
7.5
5
2.5
0
-2.5
-5
245
250
255
260
265
270
275
280

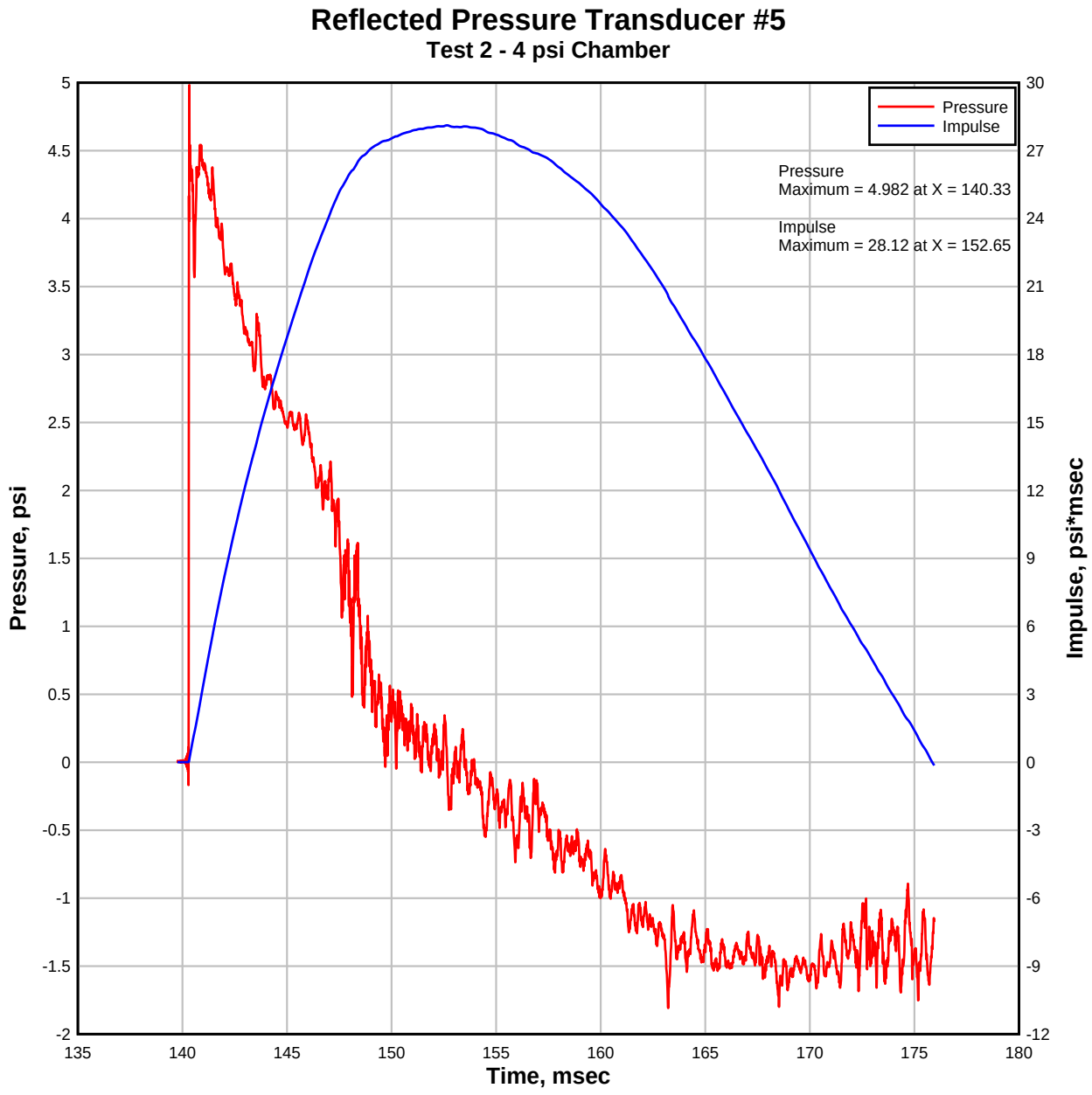
Test #2

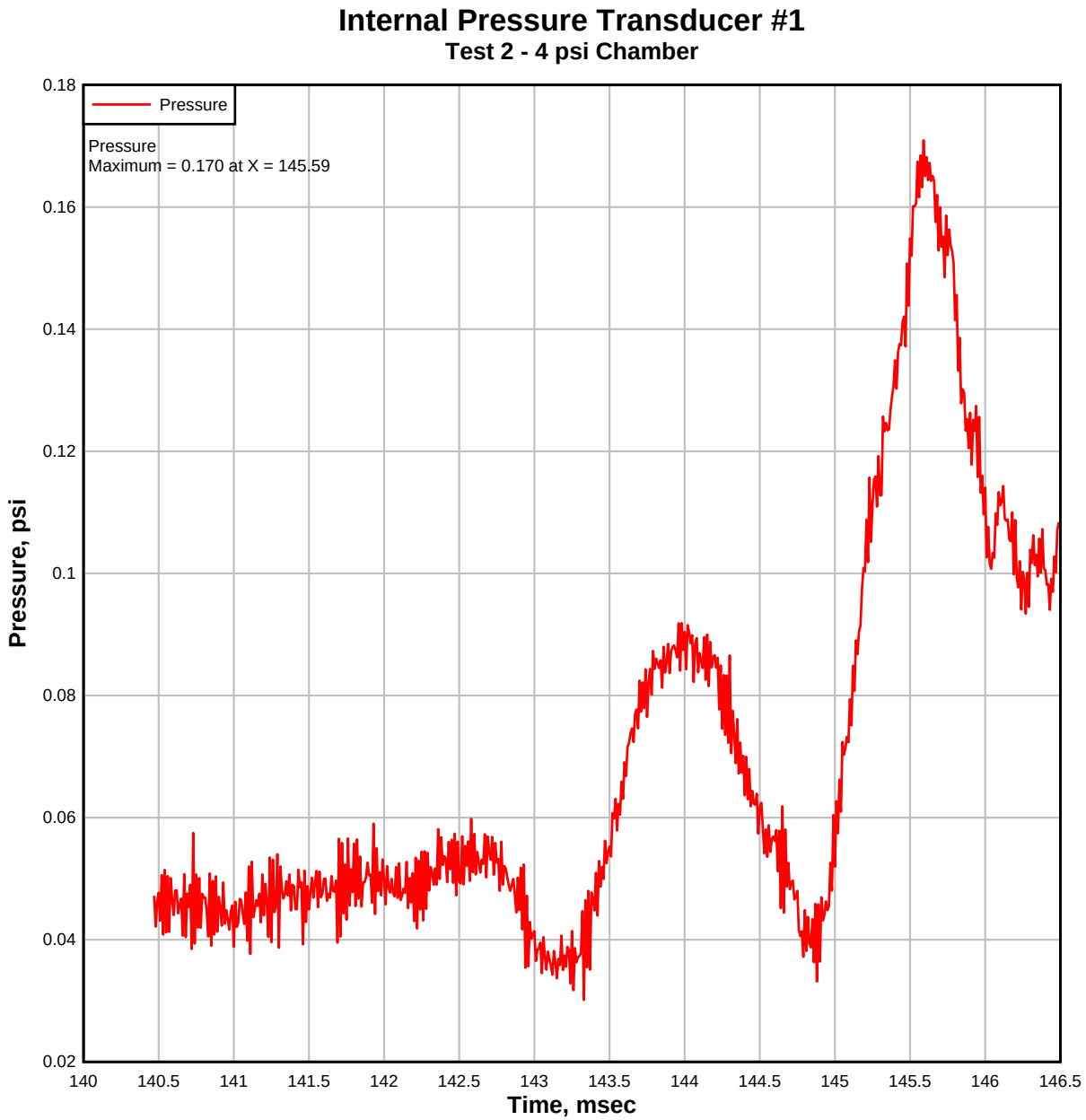

Reflected Pressure Transducer #1
Test 2 - 4 psi Chamber
Pressure
Pressure
Maximum = 5.283 at X = 140.10
Pressure, psi
Time, msec
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
135
140
145
150
155
160
165
170
175
180

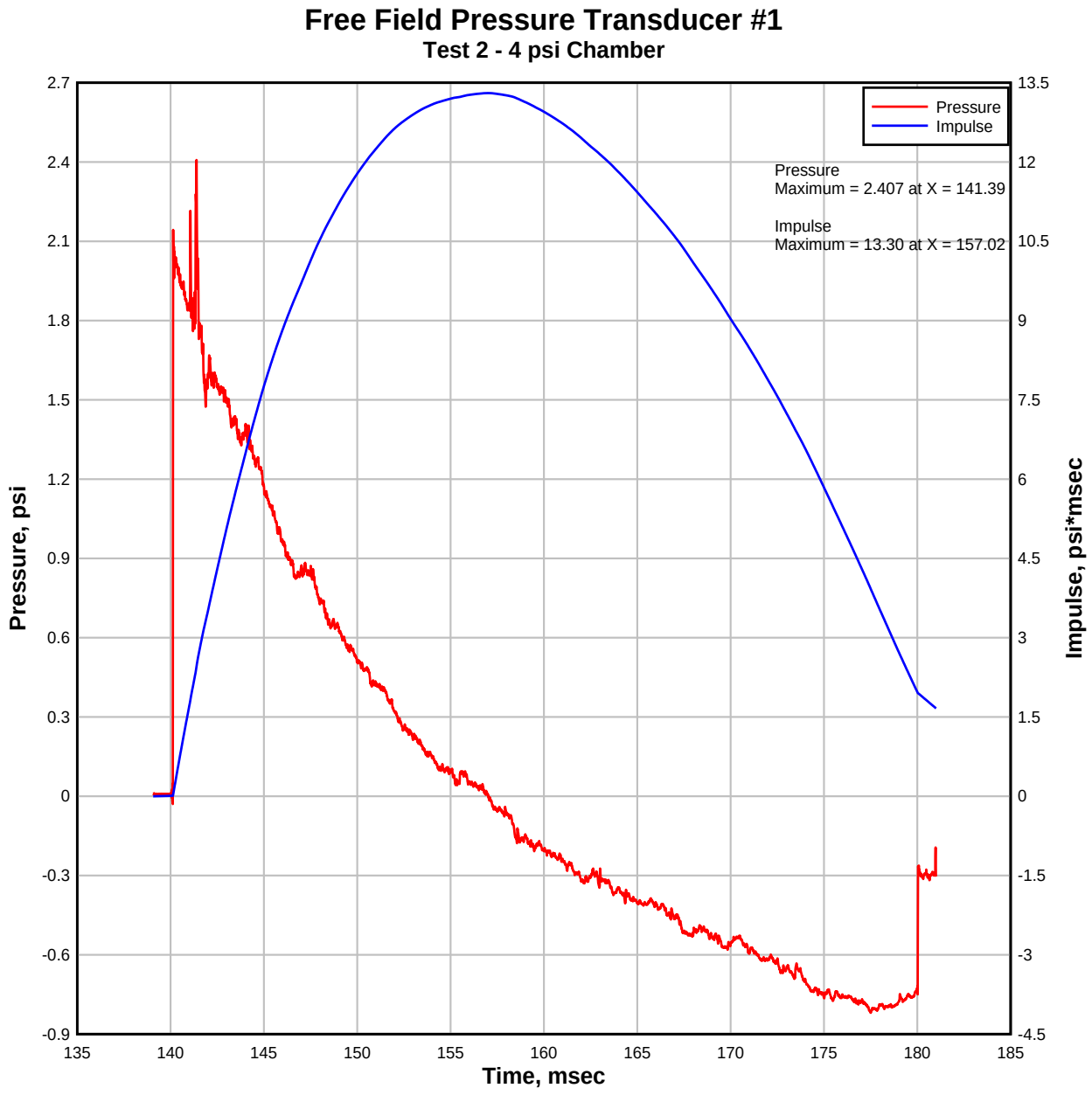

Reflected Pressure Transducer #2
Test 2 - 4 psi Chamber
Pressure
Impulse
Pressure
Maximum = 5.070 at X = 140.20
Impulse
Maximum = 28.32 at X = 153.89
Pressure ,psi
Impulse, psi*msec
Time, msec
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
33
30
27
24
21
18
15
12
9
6
3
0
-3
-6
-9
-12
-15
135
140
145
150
155
160
165
170
175
180

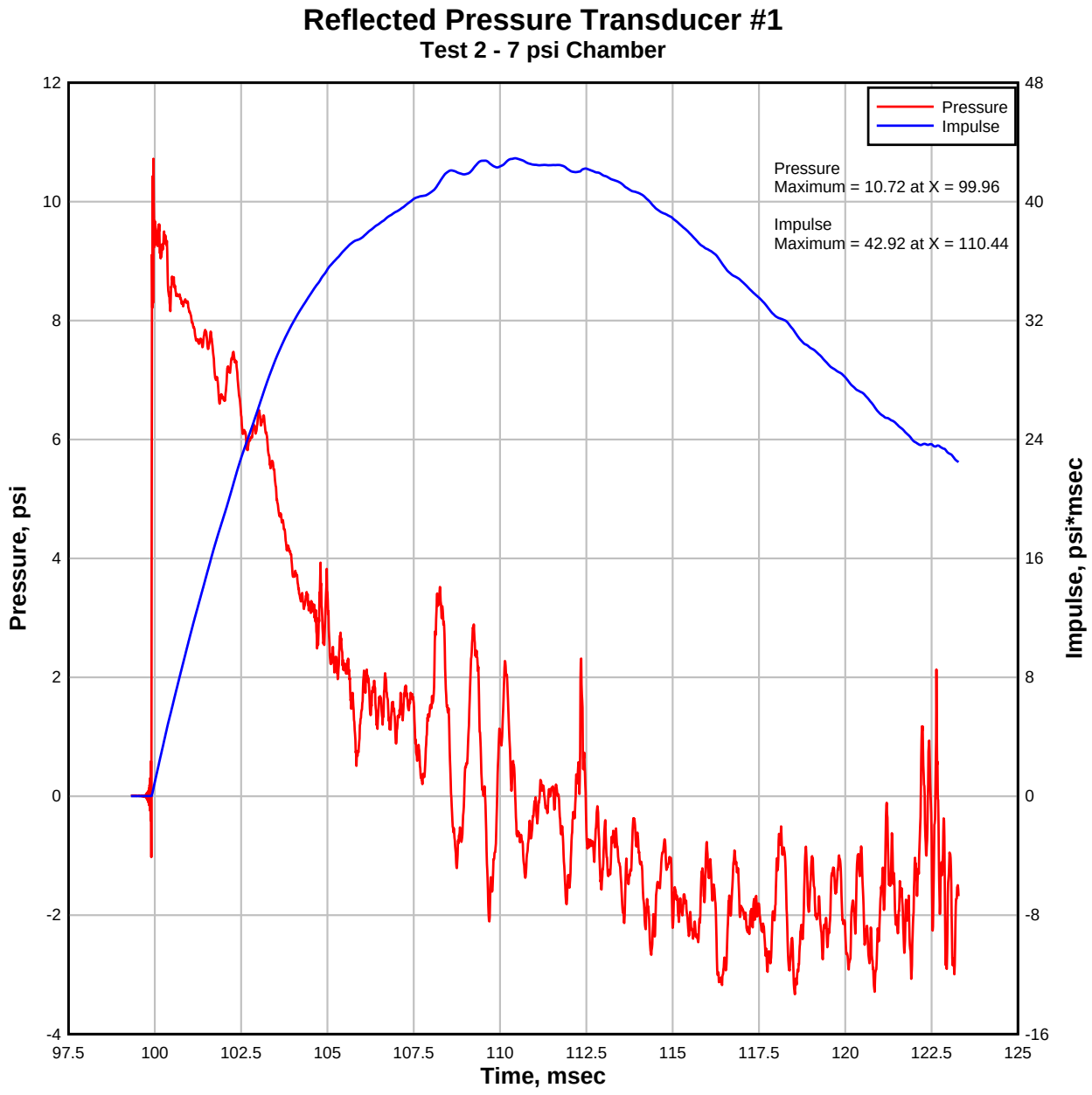

Reflected Pressure Transducer #3
Test 2 - 4 psi Chamber
Pressure
Impulse
Pressure
Maximum = 5.183 at X = 140.42
Impulse
Maximum = 28.80 at X = 151.79
Pressure, psi
Impulse, psi*msec
Time, msec
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
33
30
27
24
21
18
15
12
9
6
3
0
-3
-6
-9
-12
-15
135
140
145
150
155
160
165
170
175
180

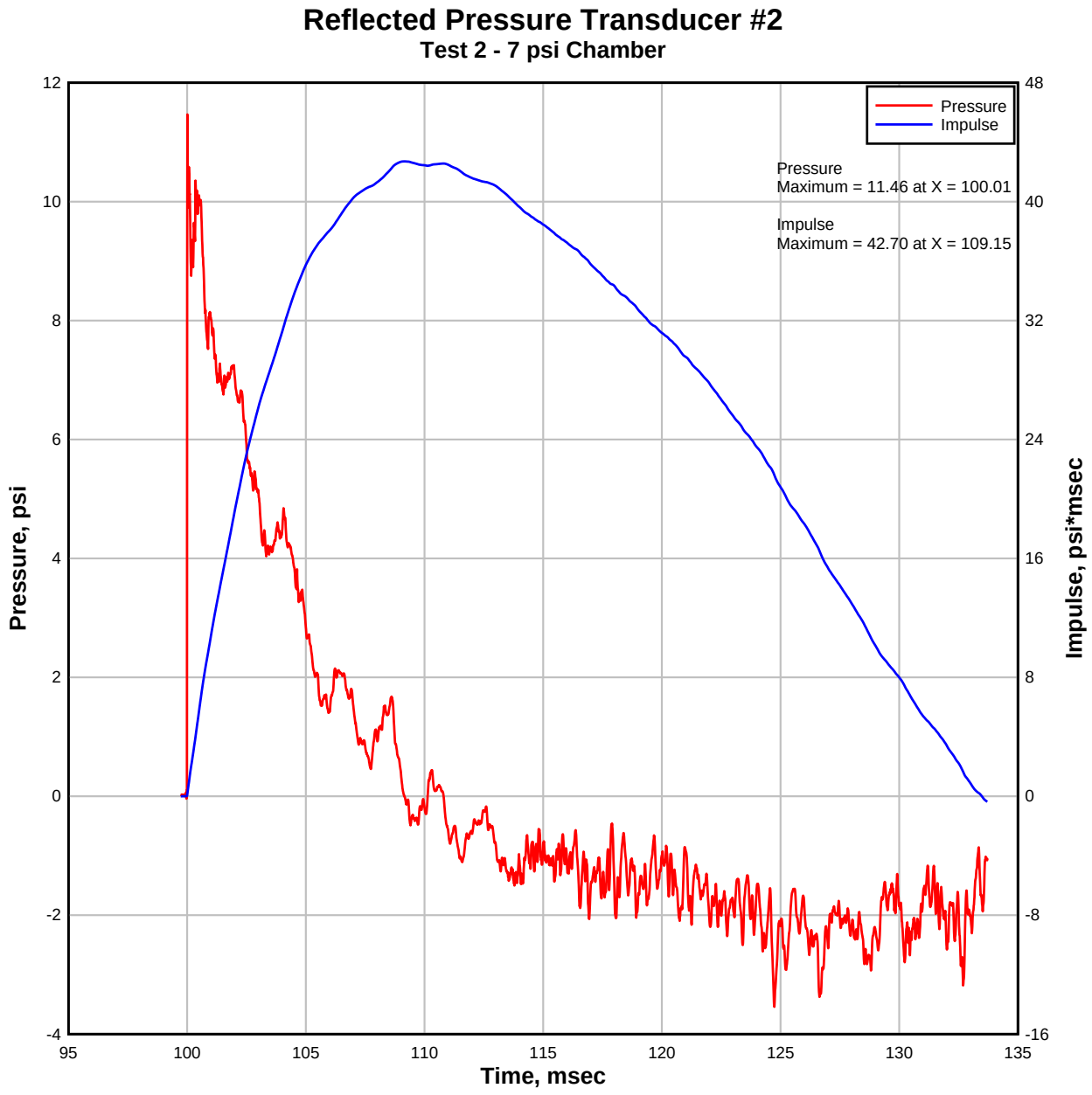

Reflected Pressure Transducer #4
Test 2 - 4 psi Chamber
Pressure
Impulse
Pressure
Maximum = 5.477 at X = 140.27
Impulse
Maximum = 29.26 at X = 152.89
Pressure, psi
Impulse, psi*msec
Time, msec
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
33
30
27
24
21
18
15
12
9
6
3
0
-3
-6
-9
-12
-15
137.5
140
142.5
145
147.5
150
152.5
155
157.5
160
162.5
165

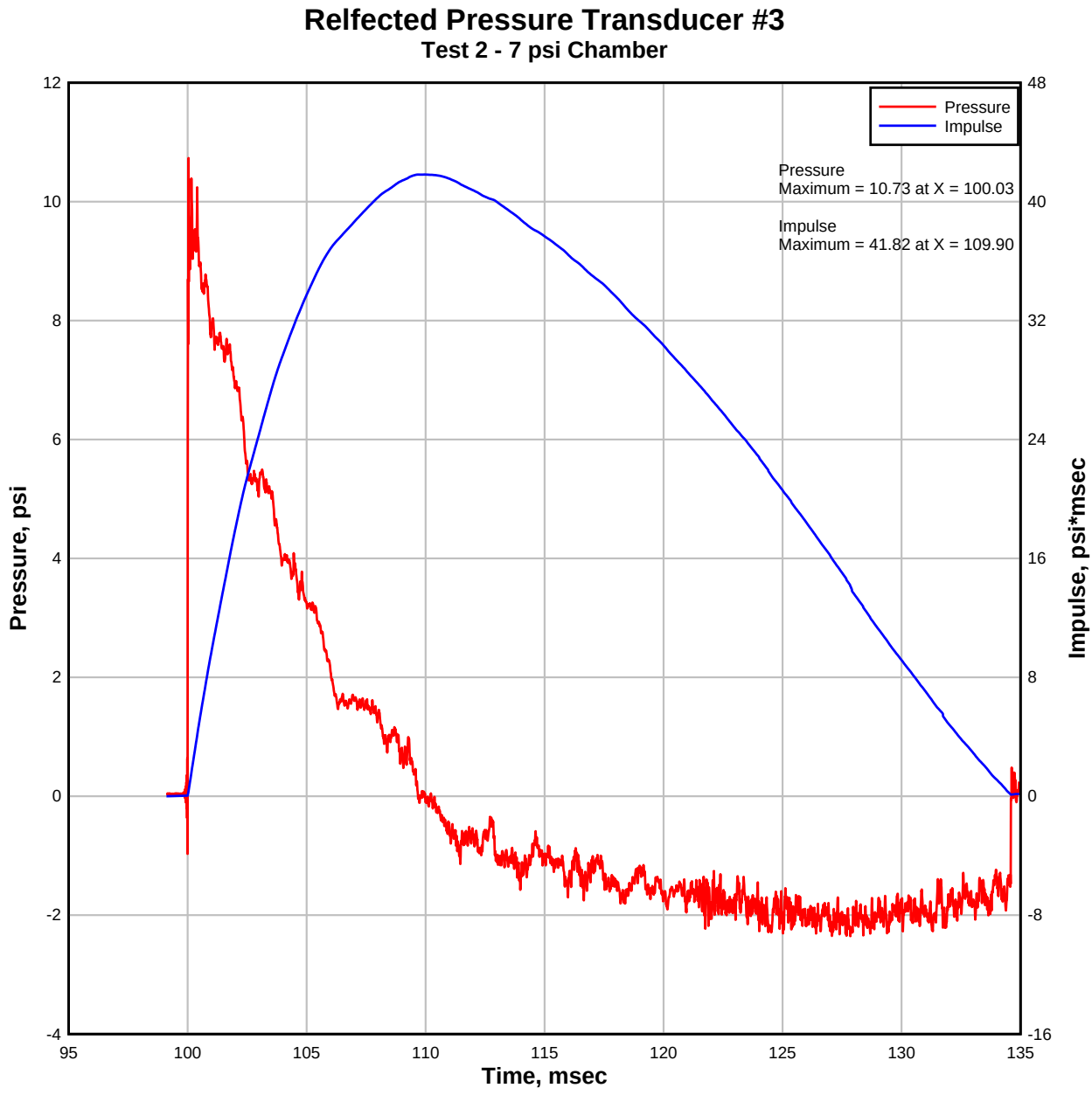

Reflected Pressure Transducer #5
Test 2 - 4 psi Chamber
Pressure
Impulse
Pressure
Maximum = 4.982 at X = 140.33
Impulse
Maximum = 28.12 at X = 152.65
Pressure, psi
Impulse, psi*msec
Time, msec
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
30
27
24
21
18
15
12
9
6
3
0
-3
-6
-9
-12
135
140
145
150
155
160
165
170
175
180

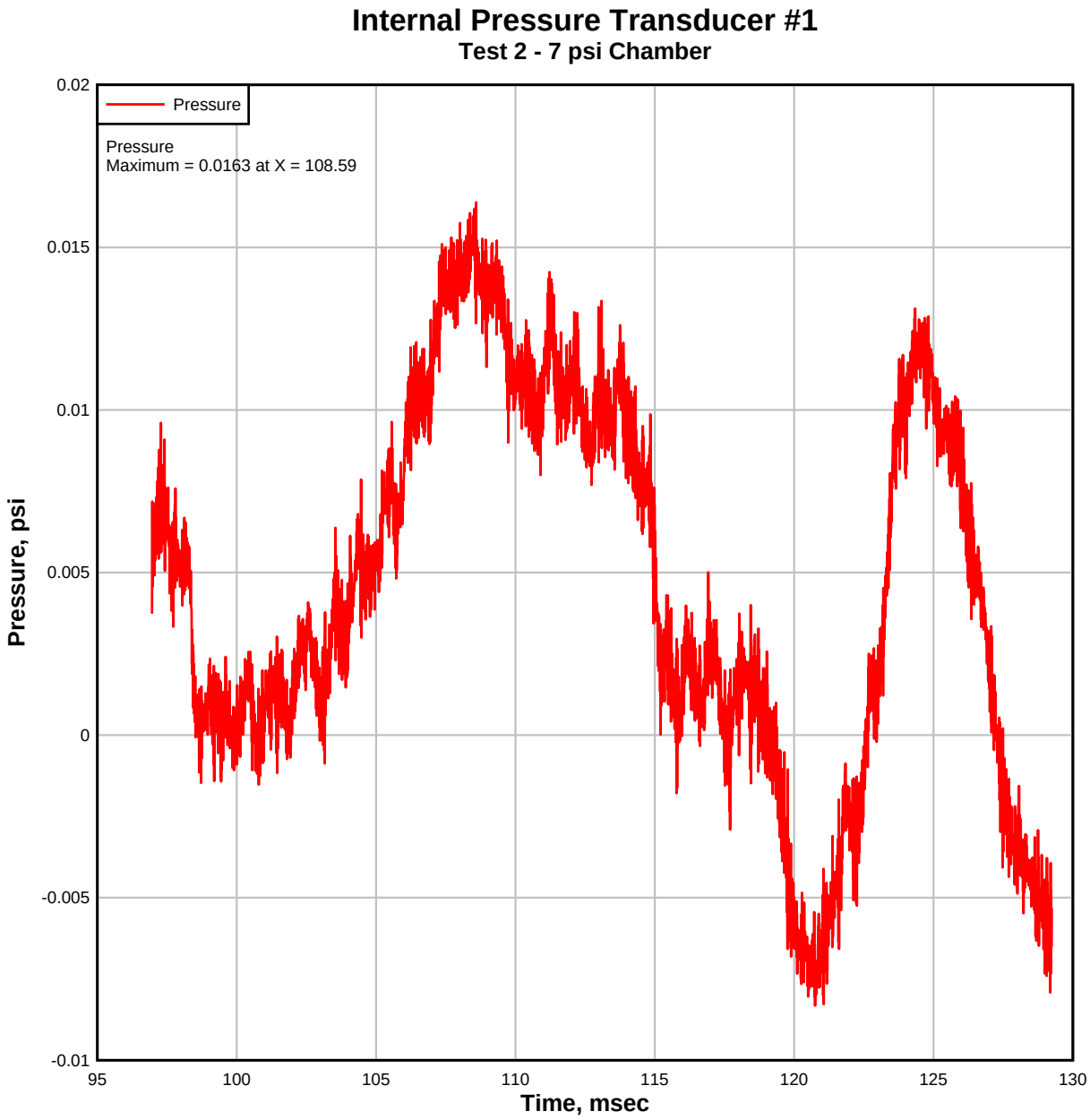

Internal Pressure Transducer #1
Test 2 - 4 psi Chamber
Pressure
Pressure
Maximum = 0.170 at X = 145.59
Pressure, psi
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
140
140.5
141
141.5
142
142.5
143
143.5
144
144.5
145
145.5
146
146.5
Time, msec


Free Field Pressure Transducer #1
Test 2 - 4 psi Chamber
Pressure
Impulse
Pressure
Maximum = 2.407 at X = 141.39
Impulse
Maximum = 13.30 at X = 157.02
Pressure, psi
Impulse, psi*msec
Time, msec
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0
-0.3
-0.6
-0.9
13.5
12
10.5
9
7.5
6
4.5
3
1.5
0
-1.5
-3
-4.5
135
140
145
150
155
160
165
170
175
180
185

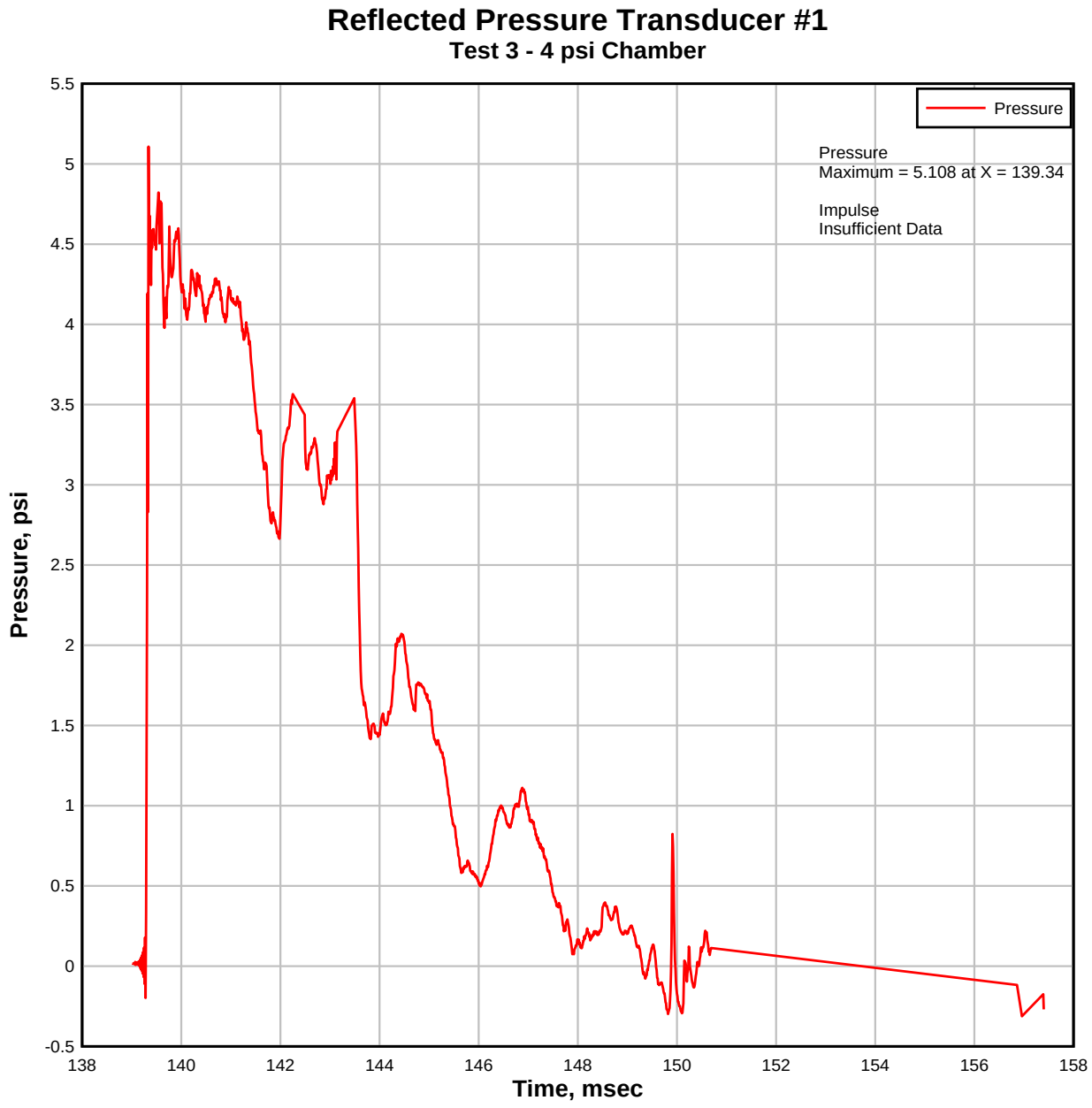

Reflected Pressure Transducer #1
Test 2 - 7 psi Chamber
Pressure
Impulse
Pressure
Maximum = 10.72 at X = 99.96
Impulse
Maximum = 42.92 at X = 110.44
Pressure, psi
Impulse, psi*msec
Time, msec
12
10
8
6
4
2
0
-2
-4
48
40
32
24
16
8
0
-8
-16
97.5
100
102.5
105
107.5
110
112.5
115
117.5
120
122.5
125

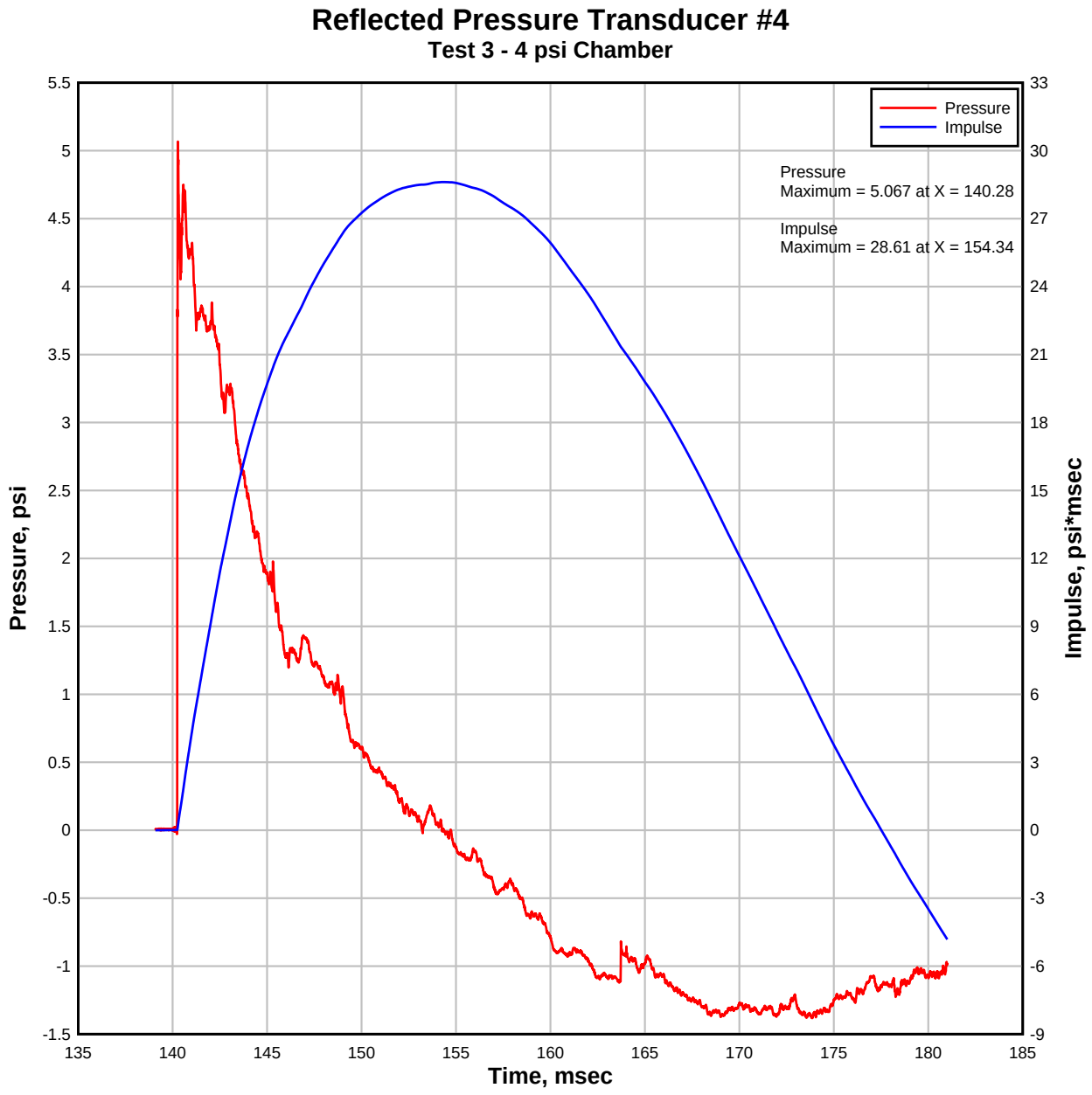

Reflected Pressure Transducer #2
Test 2 - 7 psi Chamber
Pressure
Impulse
Pressure
Maximum = 11.46 at X = 100.01
Impulse
Maximum = 42.70 at X = 109.15
Pressure, psi
Impulse, psi*msec
Time, msec
12
10
8
6
4
2
0
-2
-4
48
40
32
24
16
8
0
-8
-16
95
100
105
110
115
120
125
130
135

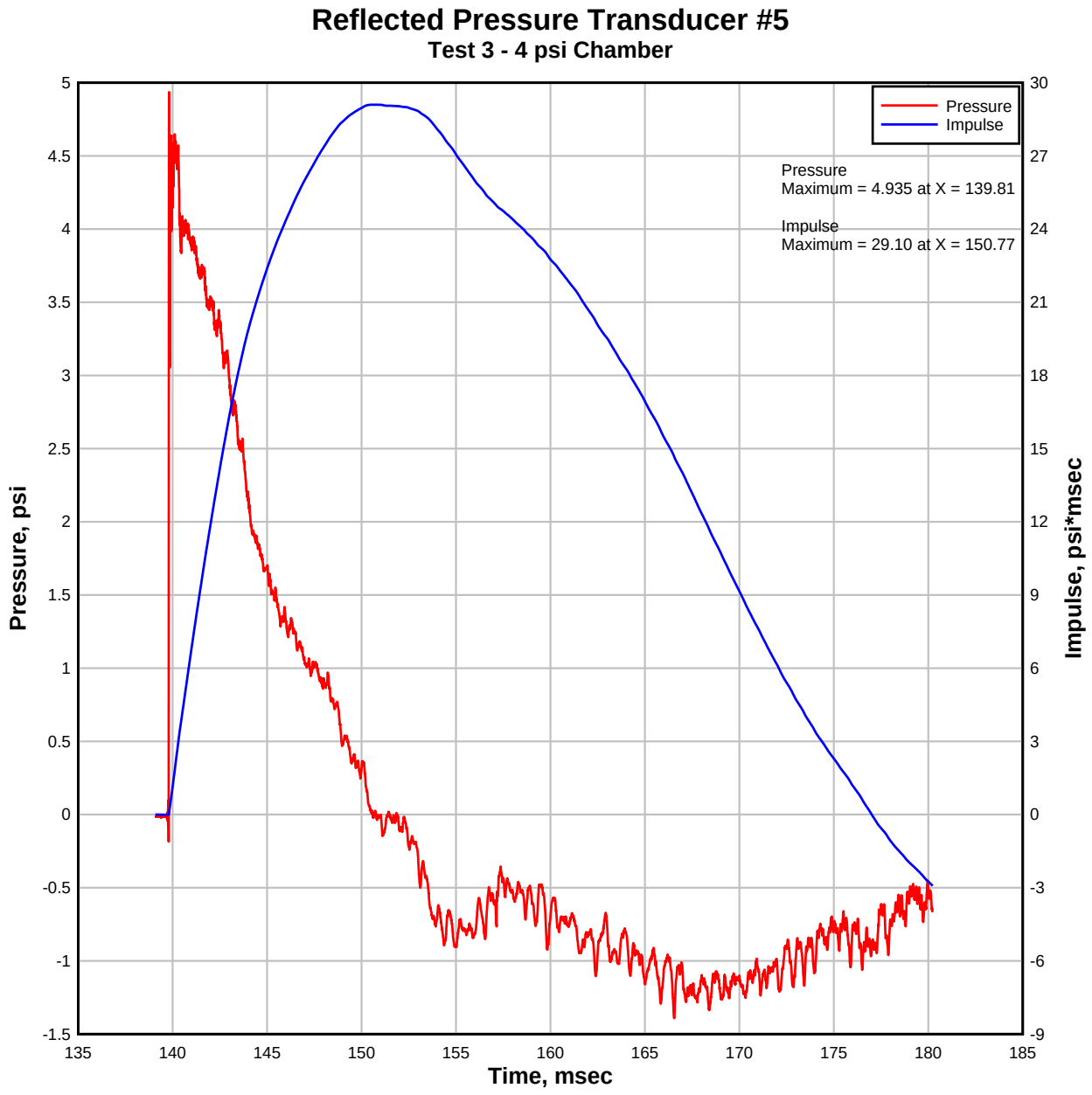

Relfected Pressure Transducer #3
Test 2 - 7 psi Chamber
Pressure
Impulse
Pressure
Maximum = 10.73 at X = 100.03
Impulse
Maximum = 41.82 at X = 109.90
Pressure, psi
Impulse, psi*msec
Time, msec
12
10
8
6
4
2
0
-2
-4
48
40
32
24
16
8
0
-8
-16
95
100
105
110
115
120
125
130
135

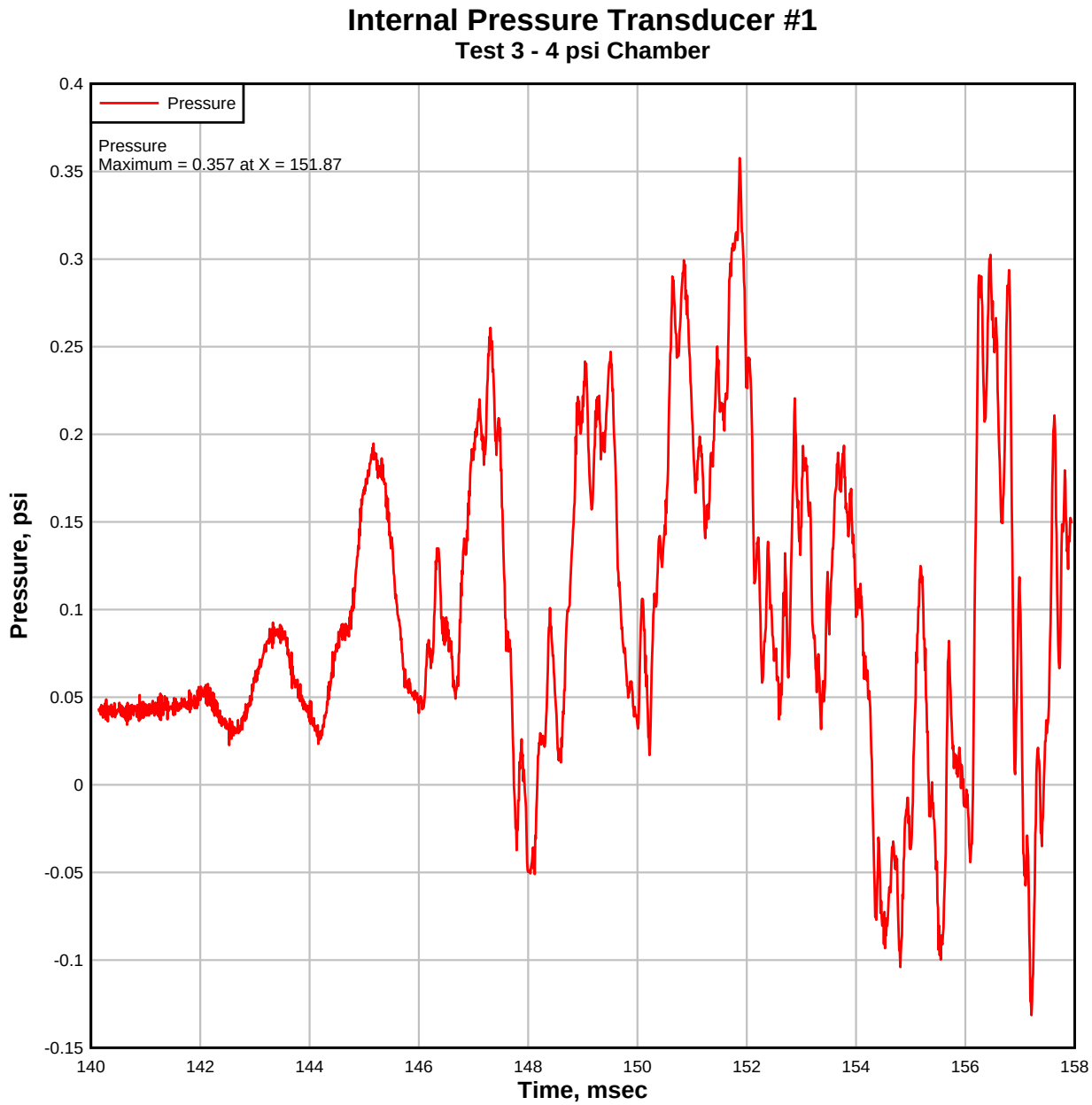

Internal Pressure Transducer #1
Test 2 - 7 psi Chamber
Pressure
Pressure
Maximum = 0.0163 at X = 108.59
0.02
0.015
0.01
0.005
0
-0.005
-0.01
Pressure, psi
95
100
105
110
115
120
125
130
Time, msec

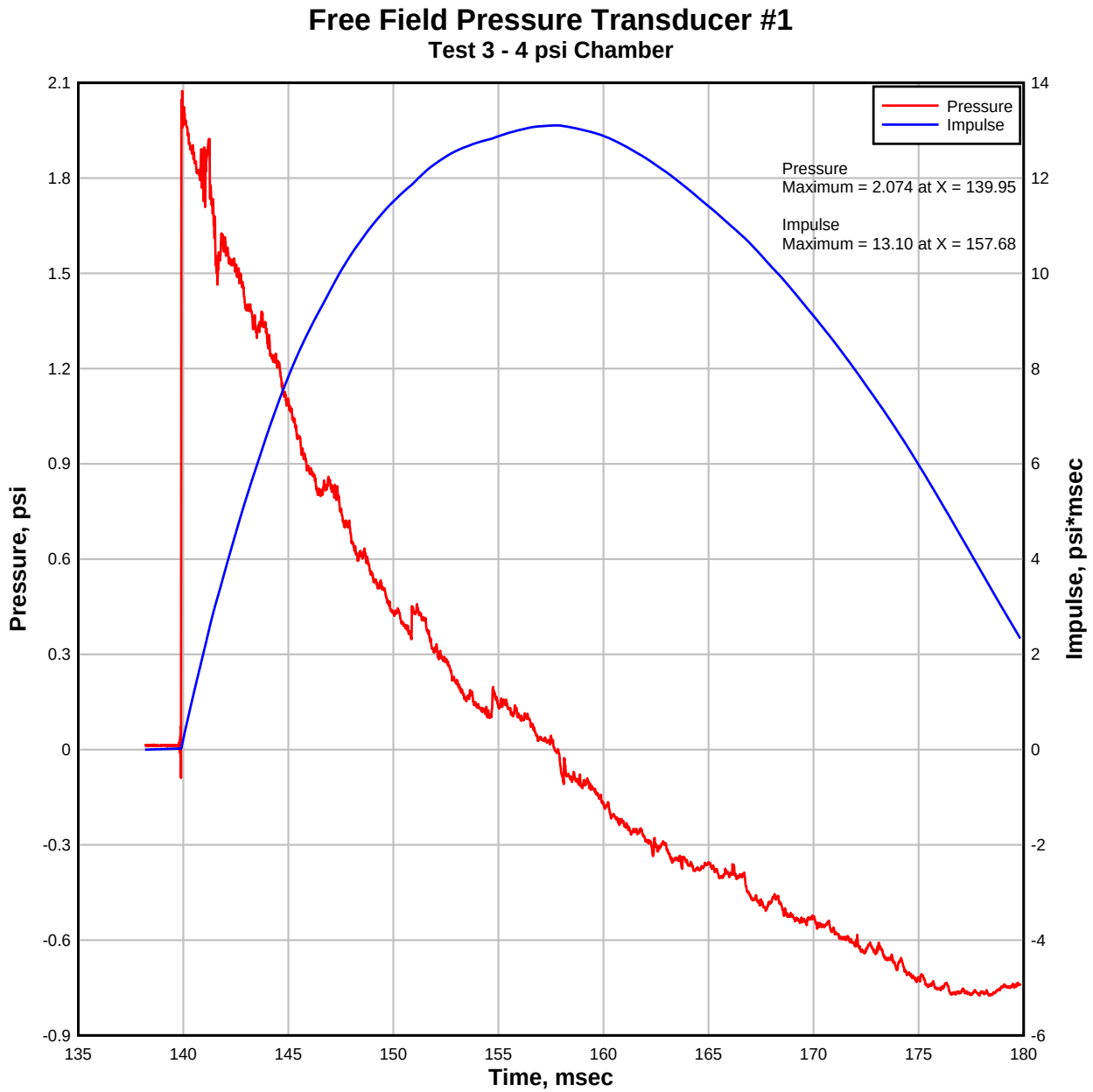
Test #3

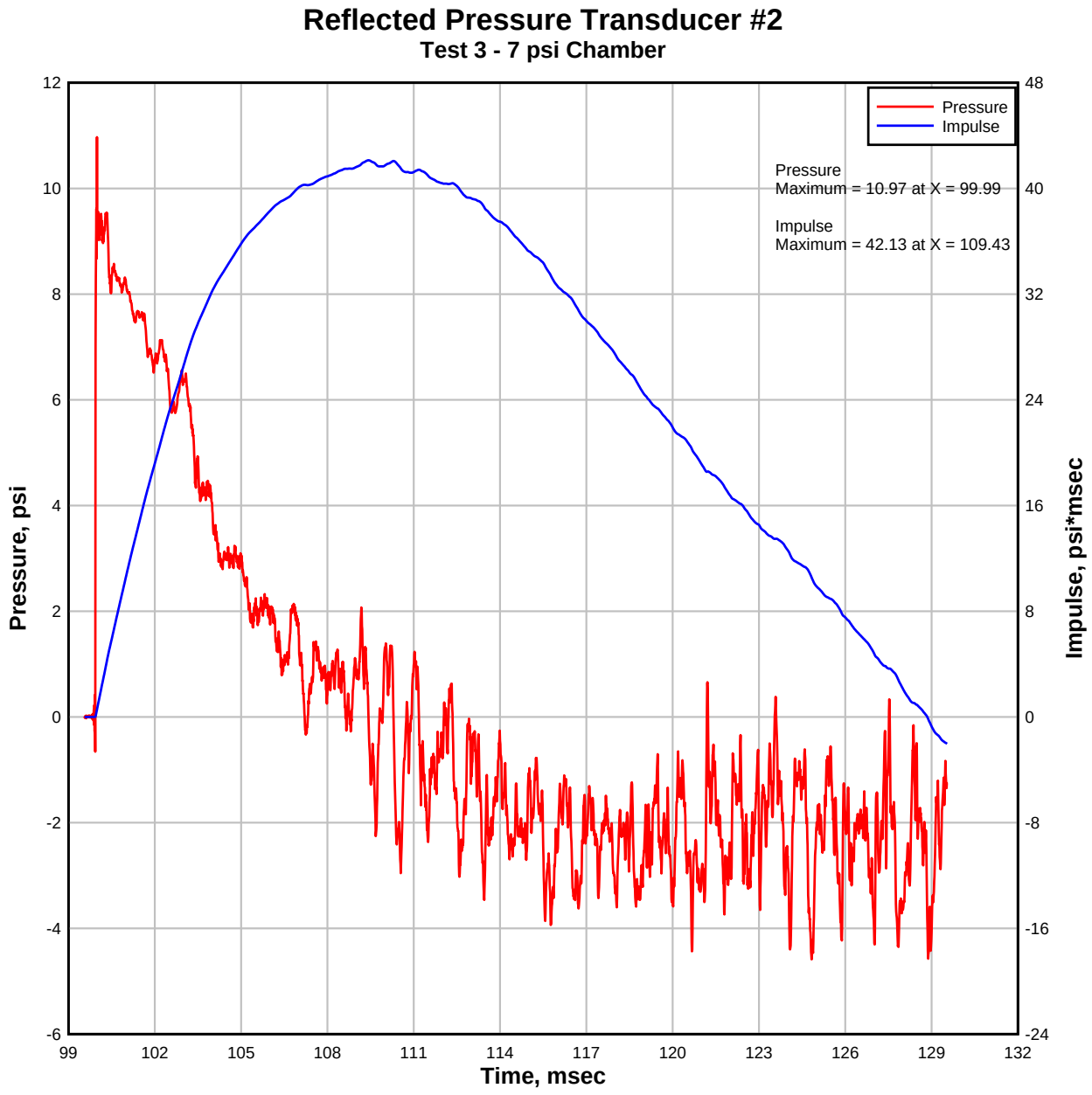

Reflected Pressure Transducer #1
Test 3 - 4 psi Chamber
Pressure
Pressure
Maximum = 5.108 at X = 139.34
Impulse
Insufficient Data
Pressure, psi
Time, msec
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
138
140
142
144
146
148
150
152
154
156
158

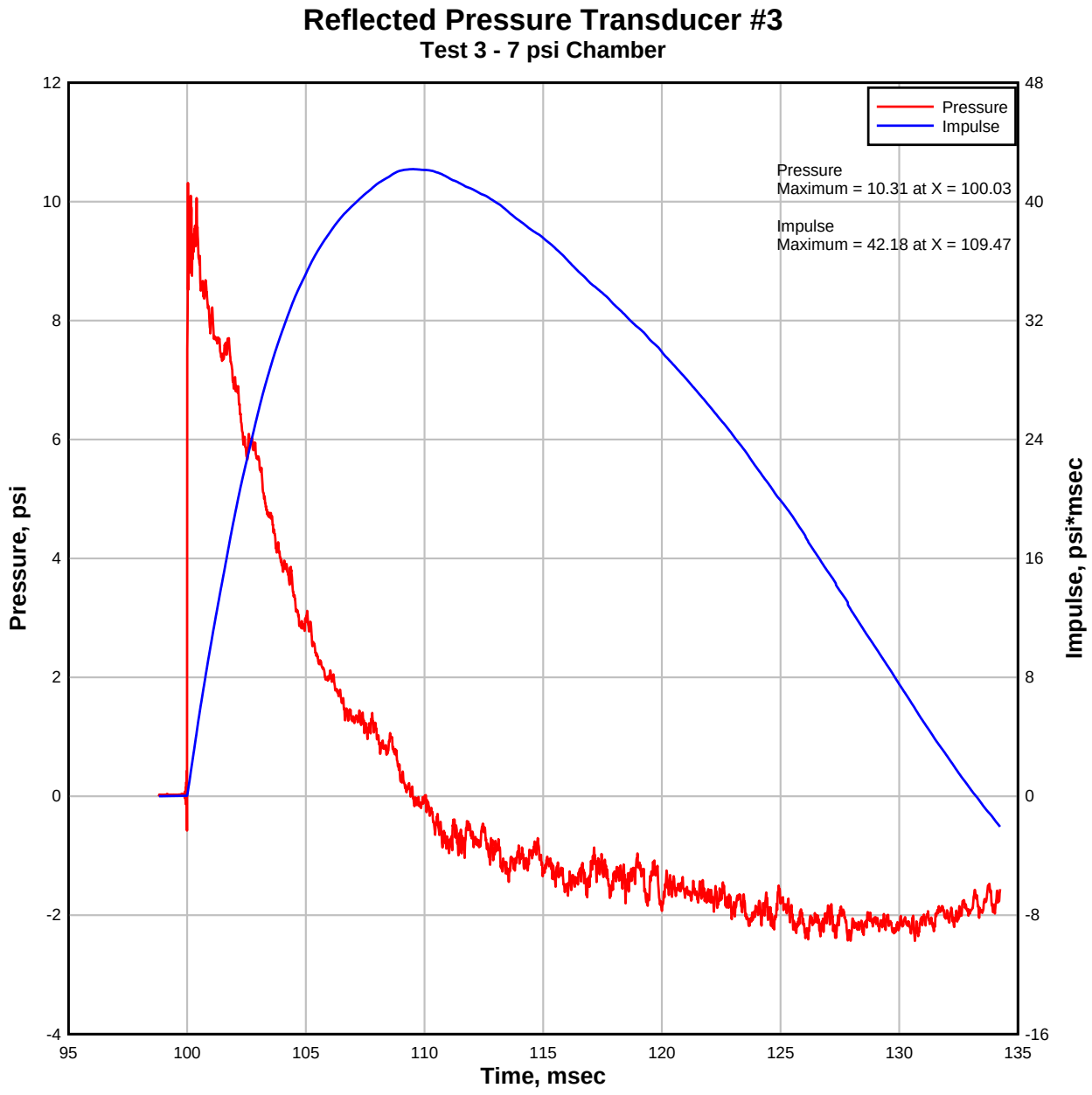

Reflected Pressure Transducer #4
Test 3 - 4 psi Chamber
Pressure
Impulse
Pressure
Maximum = 5.067 at X = 140.28
Impulse
Maximum = 28.61 at X = 154.34
Pressure, psi
Impulse, psi*msec
Time, msec
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
33
30
27
24
21
18
15
12
9
6
3
0
-3
-6
-9
135
140
145
150
155
160
165
170
175
180
185

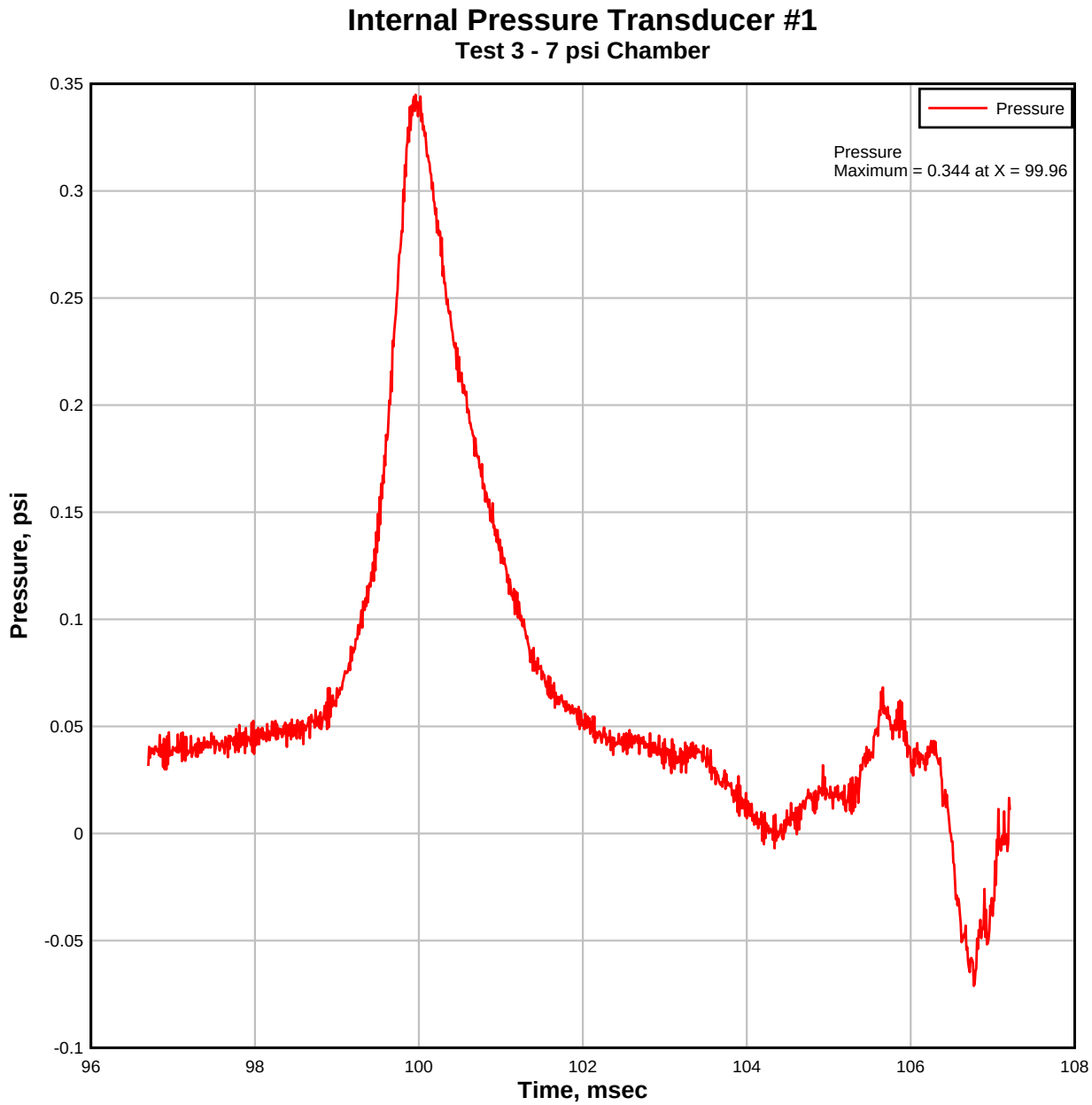

Reflected Pressure Transducer #5
Test 3 - 4 psi Chamber
Pressure
Impulse
Pressure
Maximum = 4.935 at X = 139.81
Impulse
Maximum = 29.10 at X = 150.77
Pressure, psi
Impulse, psi*msec
Time, msec
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
30
27
24
21
18
15
12
9
6
3
0
-3
-6
-9
135
140
145
150
155
160
165
170
175
180
185

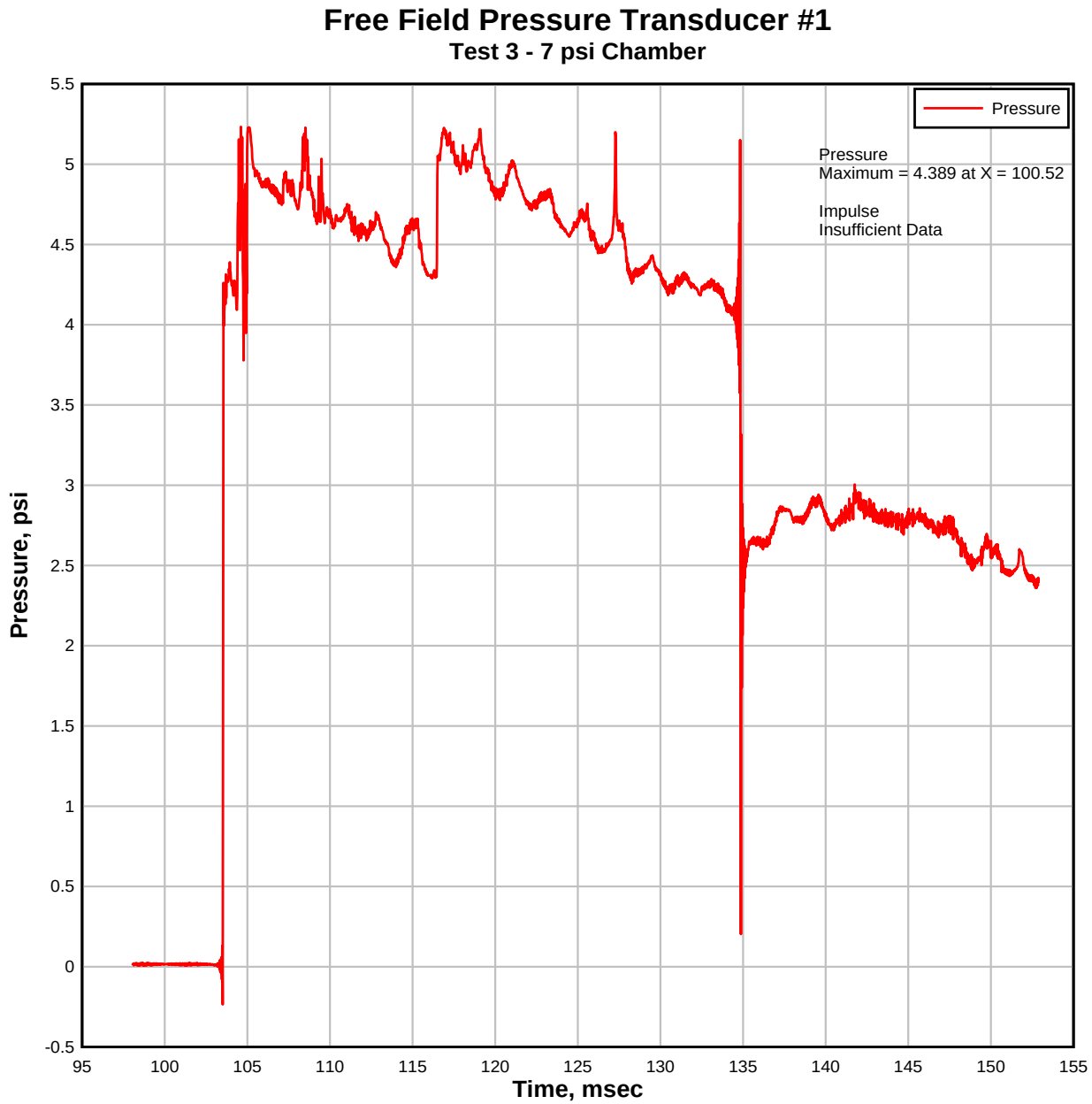

Internal Pressure Transducer #1
Test 3 - 4 psi Chamber
Pressure
Pressure
Maximum = 0.357 at X = 151.87
Pressure, psi
Time, msec
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
140
142
144
146
148
150
152
154
156
158


Free Field Pressure Transducer #1
Test 3 - 4 psi Chamber
Pressure
Impulse
Pressure
Maximum = 2.074 at X = 139.95
Impulse
Maximum = 13.10 at X = 157.68
Pressure, psi
Impulse, psi*msec
Time, msec
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0
-0.3
-0.6
-0.9
14
12
10
8
6
4
2
0
-2
-4
-6
135
140
145
150
155
160
165
170
175
180

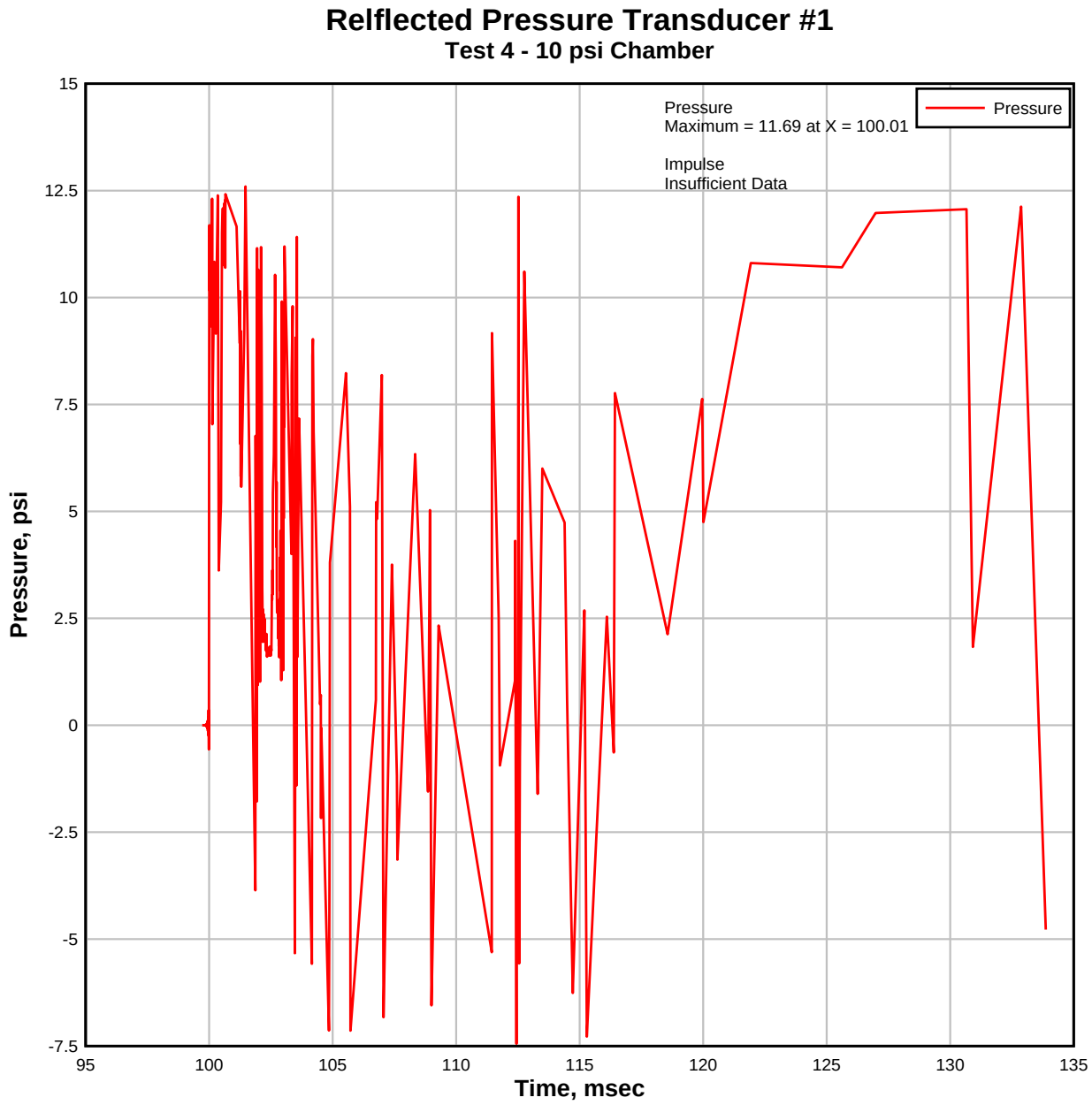

Reflected Pressure Transducer #2
Test 3 - 7 psi Chamber
Pressure
Impulse
Pressure
Maximum = 10.97 at X = 99.99
Impulse
Maximum = 42.13 at X = 109.43
Pressure, psi
Impulse, psi*msec
Time, msec
12
10
8
6
4
2
0
-2
-4
-6
48
40
32
24
16
8
0
-8
-16
-24
99
102
105
108
111
114
117
120
123
126
129
132

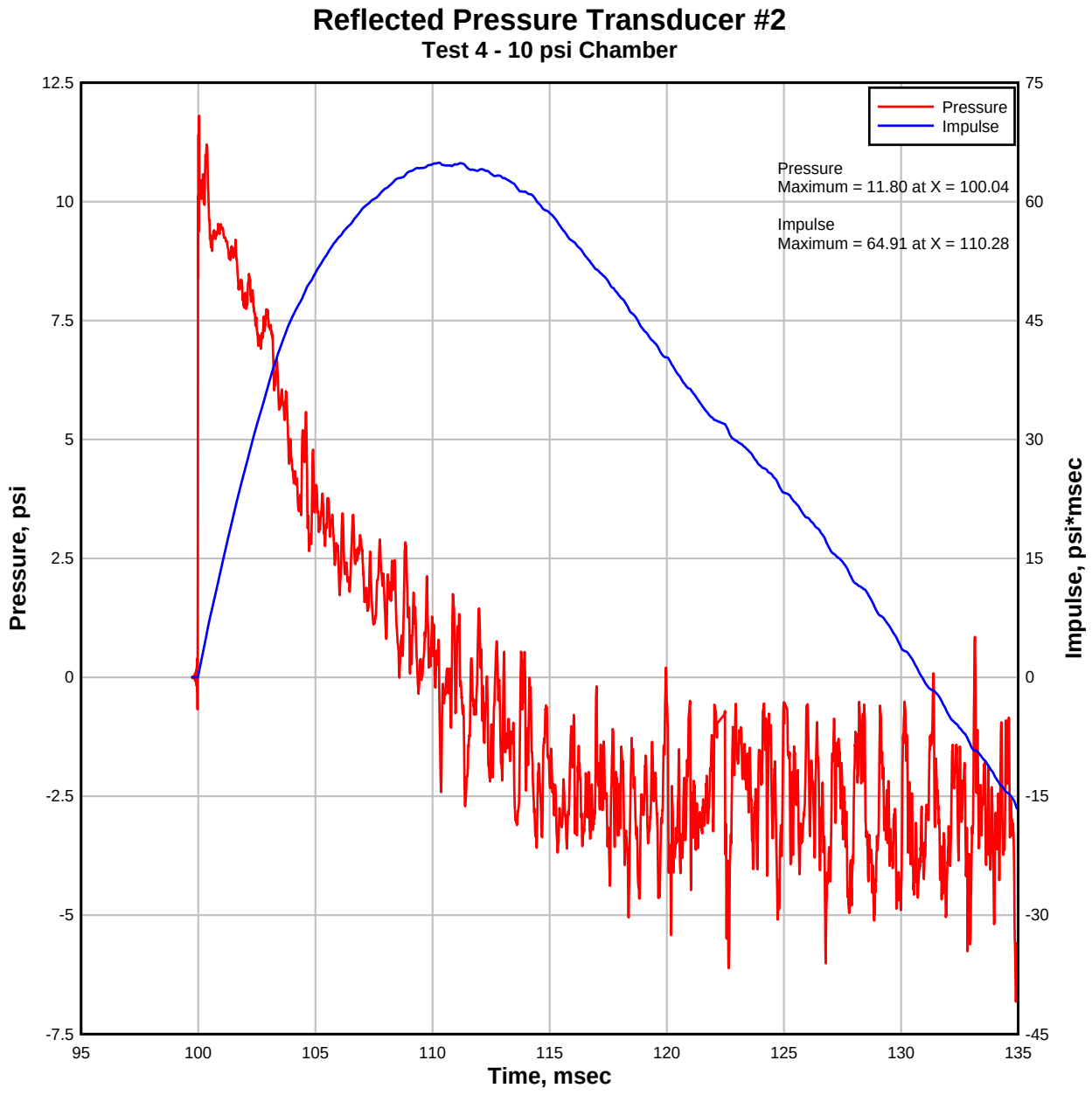

Reflected Pressure Transducer #3
Test 3 - 7 psi Chamber
Pressure
Impulse
Pressure
Maximum = 10.31 at X = 100.03
Impulse
Maximum = 42.18 at X = 109.47
Pressure, psi
Impulse, psi*msec
Time, msec
12
10
8
6
4
2
0
-2
-4
48
40
32
24
16
8
0
-8
-16
95
100
105
110
115
120
125
130
135

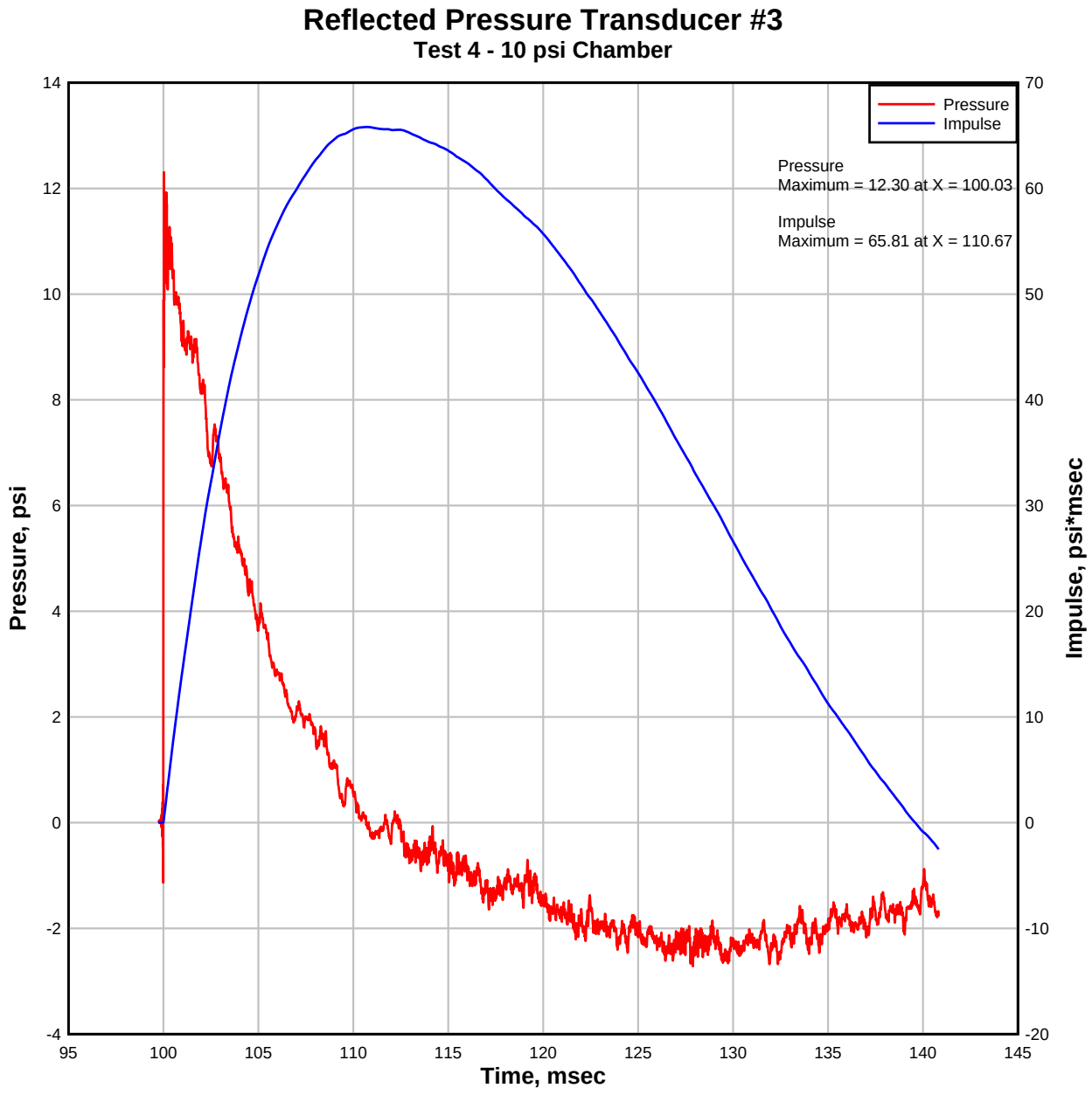

Internal Pressure Transducer #1
Test 3 - 7 psi Chamber
Pressure
Pressure
Maximum = 0.344 at X = 99.96
Pressure, psi
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
96
98
100
102
104
106
108
Time, msec

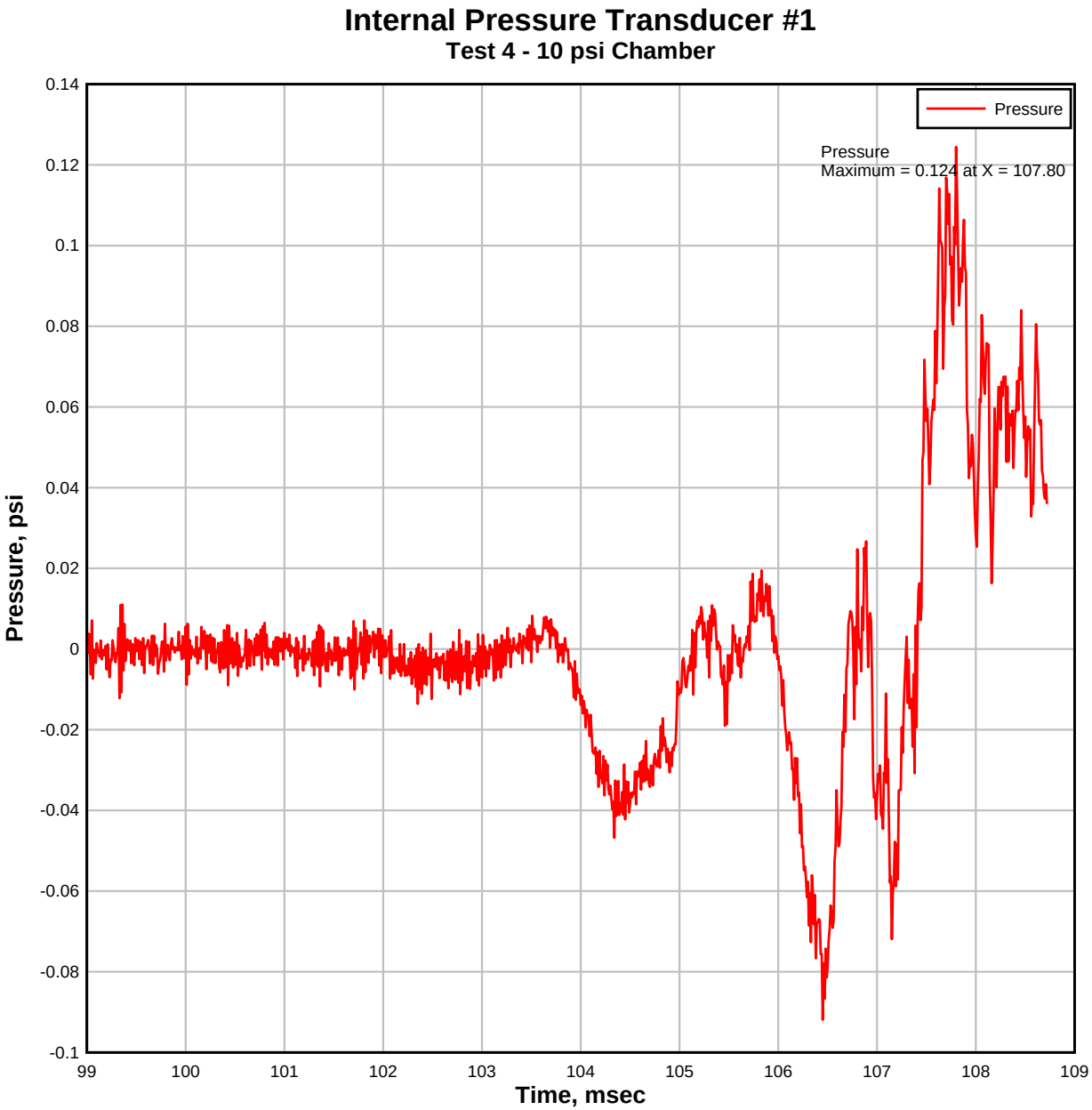

Free Field Pressure Transducer #1
Test 3 - 7 psi Chamber
Pressure
Pressure
Maximum = 4.389 at X = 100.52
Impulse
Insufficient Data
Pressure, psi
Time, msec
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
95
100
105
110
115
120
125
130
135
140
145
150
155

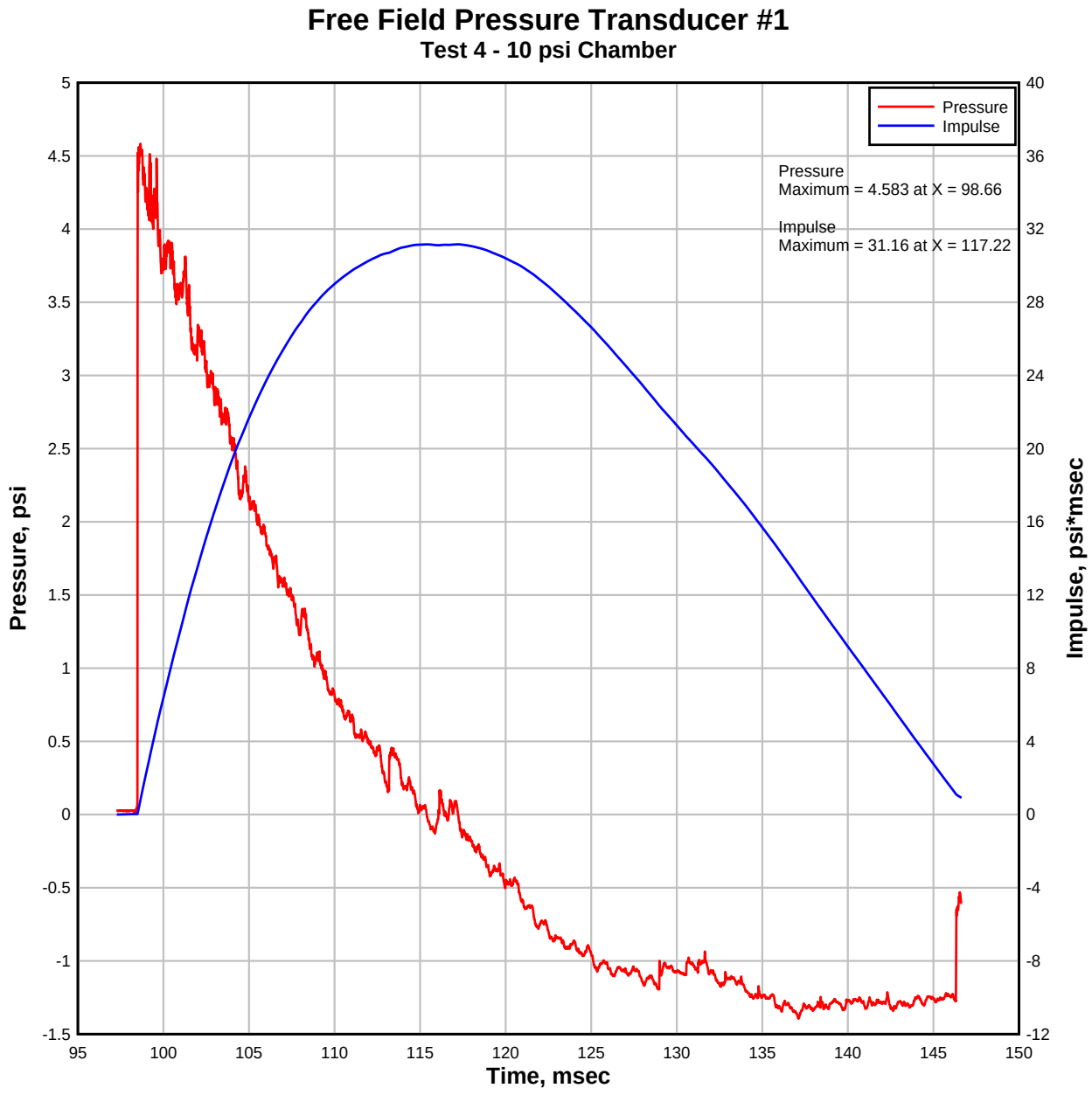
Test #4


Relflected Pressure Transducer #1
Test 4 - 10 psi Chamber
Pressure
Maximum = 11.69 at X = 100.01
Impulse
Insufficient Data
Pressure
Pressure, psi
Time, msec
15
12.5
10
7.5
5
2.5
0
-2.5
-5
-7.5
95
100
105
110
115
120
125
130
135


Reflected Pressure Transducer #2
Test 4 - 10 psi Chamber
Pressure
Impulse
Pressure
Maximum = 11.80 at X = 100.04
Impulse
Maximum = 64.91 at X = 110.28
Pressure, psi
Impulse, psi*msec
Time, msec
12.5
10
7.5
5
2.5
0
-2.5
-5
-7.5
75
60
45
30
15
0
-15
-30
-45
95
100
105
110
115
120
125
130
135


Reflected Pressure Transducer #3
Test 4 - 10 psi Chamber
Pressure
Impulse
Pressure
Maximum = 12.30 at X = 100.03
Impulse
Maximum = 65.81 at X = 110.67
Pressure, psi
Impulse, psi*msec
Time, msec
14
12
10
8
6
4
2
0
-2
-4
70
60
50
40
30
20
10
0
-10
-20
95
100
105
110
115
120
125
130
135
140
145


Internal Pressure Transducer #1
Test 4 - 10 psi Chamber
Pressure
Pressure
Maximum = 0.124 at X = 107.80
Pressure, psi
Time, msec
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
99
100
101
102
103
104
105
106
107
108
109


Free Field Pressure Transducer #1
Test 4 - 10 psi Chamber
Pressure
Impulse
Pressure
Maximum = 4.583 at X = 98.66
Impulse
Maximum = 31.16 at X = 117.22
Pressure, psi
Impulse, psi*msec
Time, msec
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
40
36
32
28
24
20
16
12
8
4
0
-4
-8
-12
95
100
105
110
115
120
125
130
135
140
145
150

APPENDIX C

Photographs

Photo No 1
Pre-test, Exterior
Specimen 1

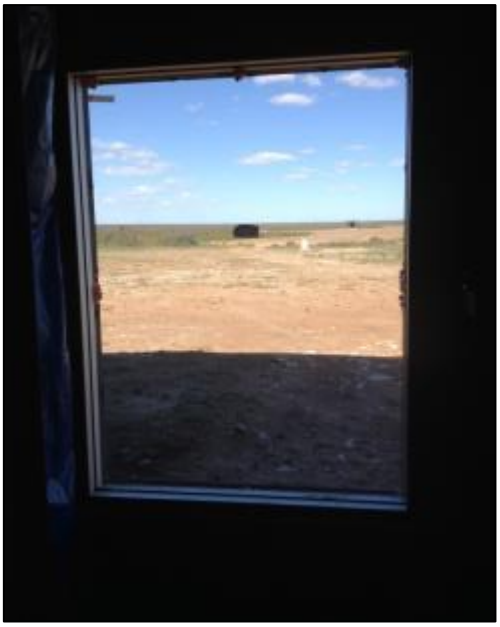


Photo No 2
Pre-test, Interior
Specimen 1

Photo No 3
Post-test, Exterior
Specimen 1

Photo No 4
Post-test, Exterior
Specimen 1

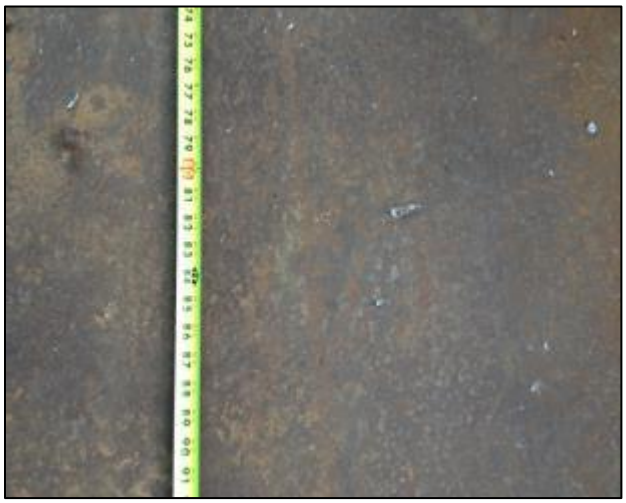


Photo No 5
Post-test, Fragments
Specimen 1

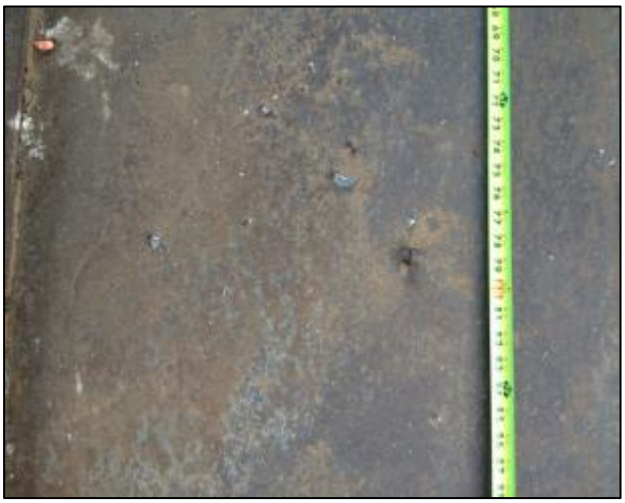


Photo No 6
Post-test, Fragments
Specimen 1

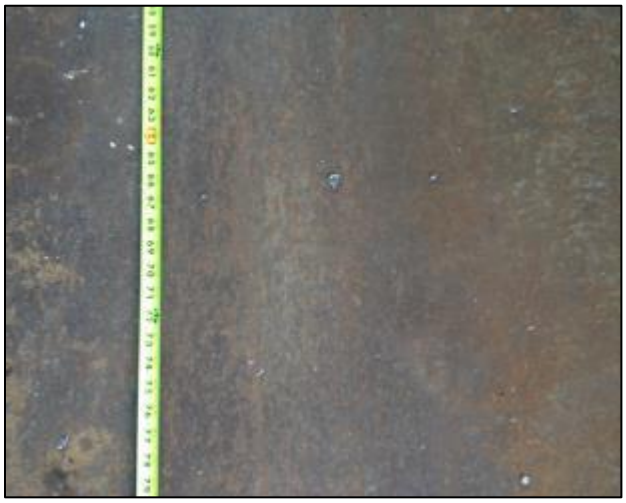


Photo No 7
Post-test, Fragments
Specimen 1

Photo No 8
Post-test, Fragments
Specimen 1

Photo No 9
Post-test, Fragments
Specimen 1

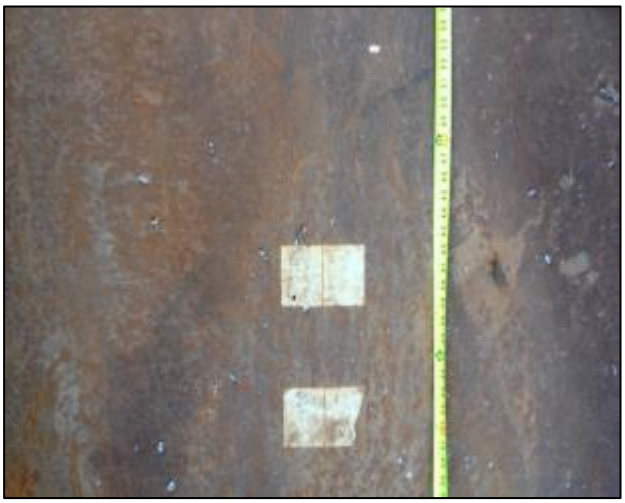


Photo No 10
Post-test, Fragments
Specimen 1

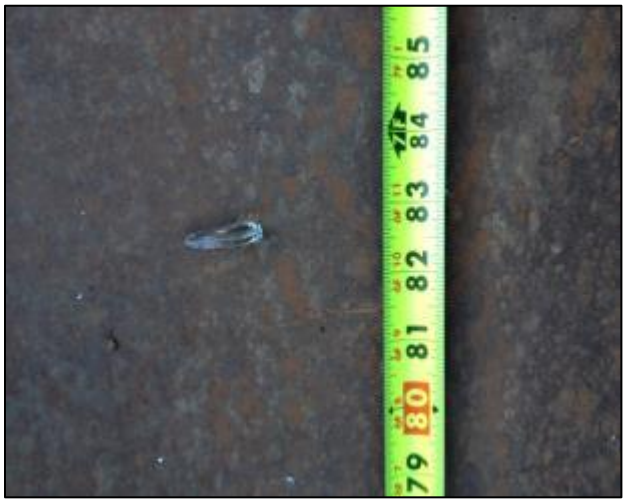


Photo No 11
Post-test, Fragments
Specimen 1

Photo No 12
Post-test, Fragments
Specimen 1

Photo No 13
Post-test, Fragments
Specimen 1

Photo No 14
Pre-test, Exterior
Specimen 2

Photo No 15
Pre-test, Interior
Specimen 2

Photo No 16
Post-test, Exterior
Specimen 2

Photo No 17
Post-test, Fragments
Specimen 2

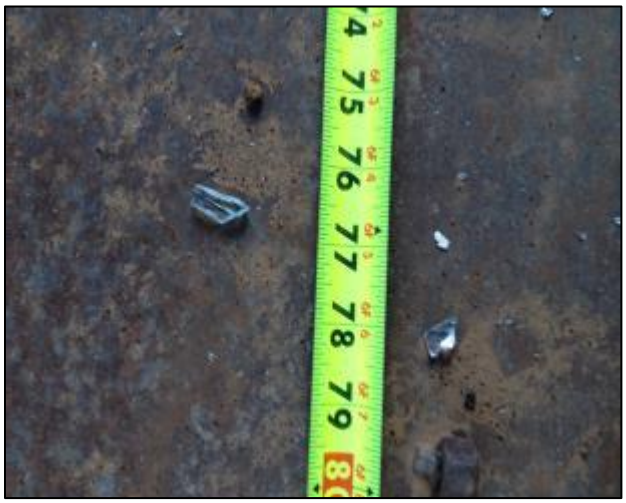


Photo No 18
Post-test, Fragments
Specimen 2

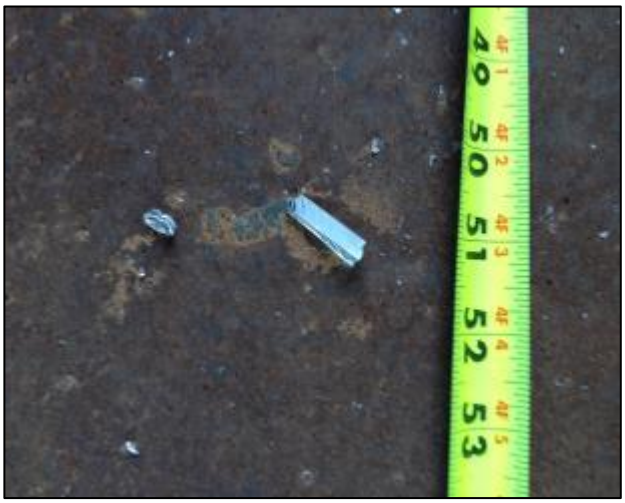


Photo No 19
Post-test, Fragments
Specimen 2

Photo No 20
Post-test, Fragments
Specimen 2

Photo No 21
Post-test, Fragments
Specimen 2

Photo No 22
Post-test, Fragments
Specimen 2

Photo No 23
Post-test, Fragments
Specimen 2

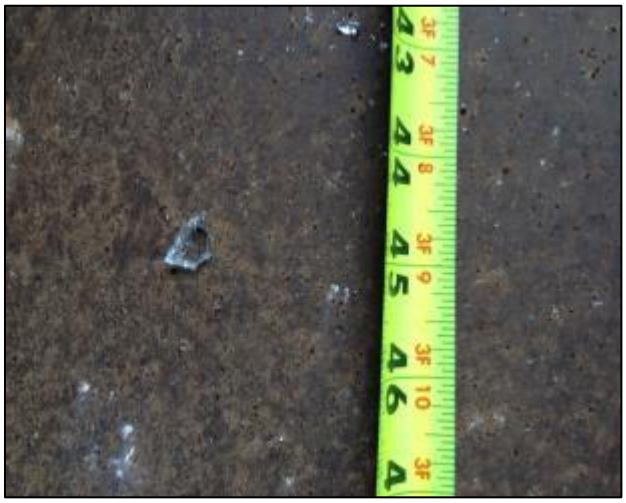


Photo No 24
Post-test, Fragments
Specimen 2

Photo No 25
Pre-test, Exterior
Specimen 3

Photo No 26
Pre-test, Interior
Specimen 3

Photo No 27
Post-test, Exterior
Specimen 3

Photo No 28
Post-test, Snap Cover
Specimen 3

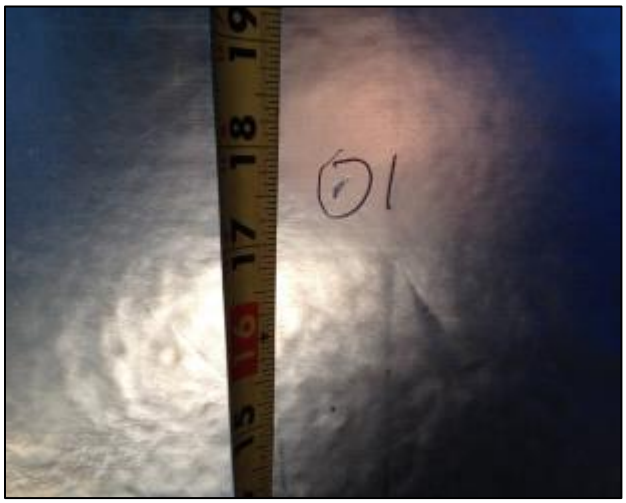


Photo No 29
Post-test, Sliver Perforation
Specimen 3

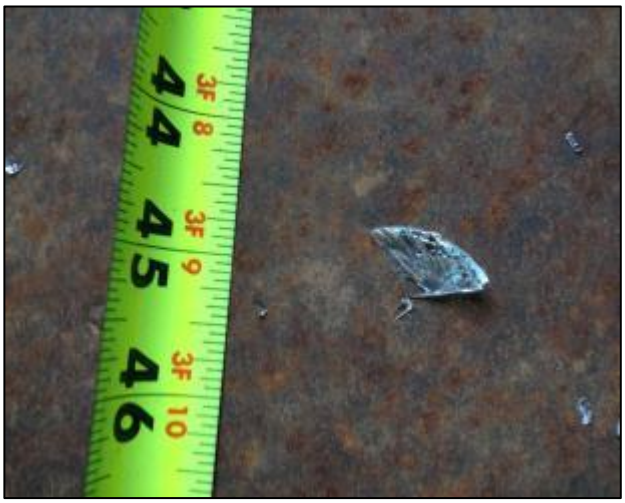


Photo No 30
Post-test, Fragments
Specimen 3

Photo No 31
Post-test, Fragments
Specimen 3

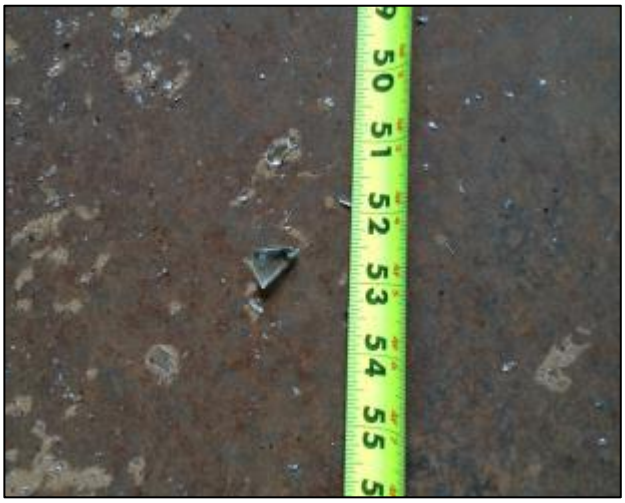


Photo No 32
Post-test, Fragments
Specimen 3

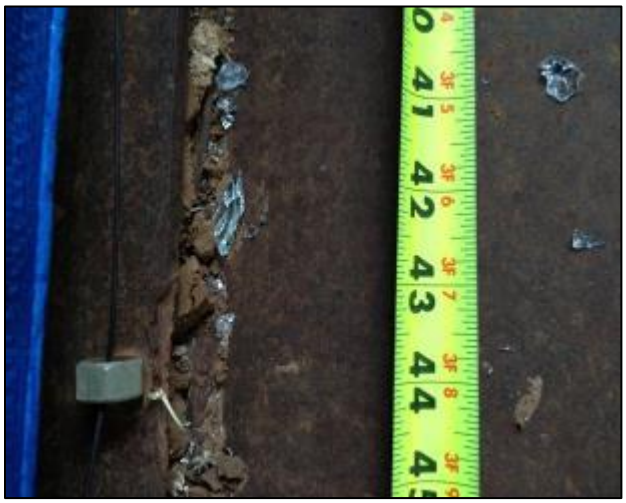


Photo No 33
Post-test, Fragments
Specimen 3

Photo No 34
Post-test, Fragments
Specimen 3

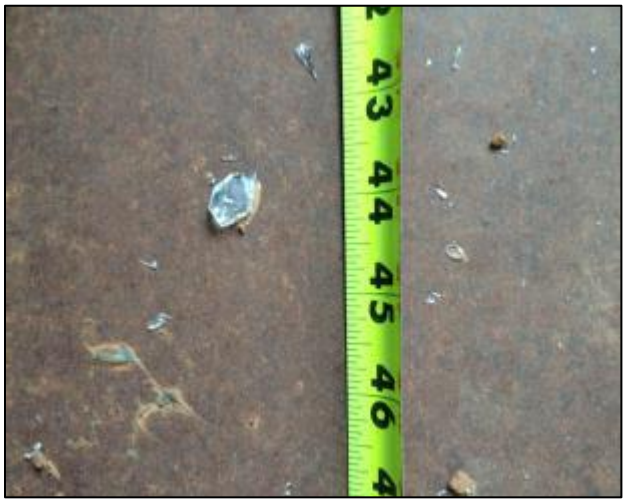


Photo No 35
Post-test, Fragments
Specimen 3

Photo No 36
Post-test, Fragments
Specimen 3

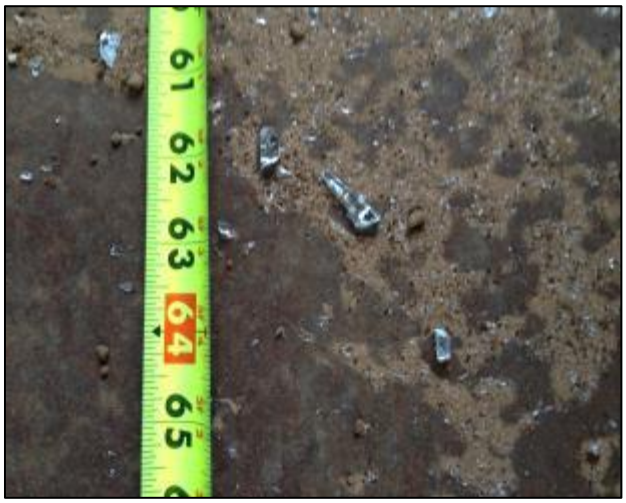


Photo No 37
Post-test, Fragments
Specimen 3

Photo No 38
Pre-test, Exterior
Specimen 4

Photo No 39
Pre-test, Interior
Specimen 4

Photo No 40
Post-test, Exterior
Specimen 4

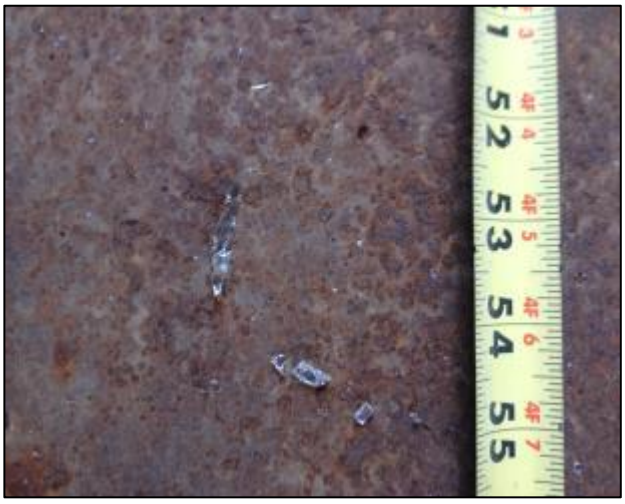


Photo No 41
Post-test, Fragments
Specimen 4

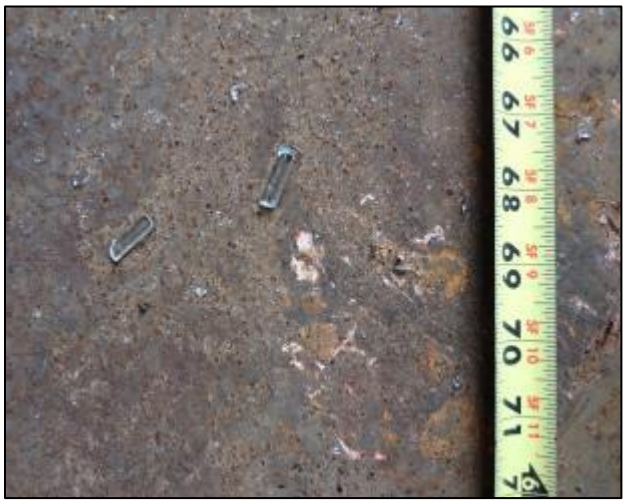


Photo No 42
Post-test, Fragments
Specimen 4

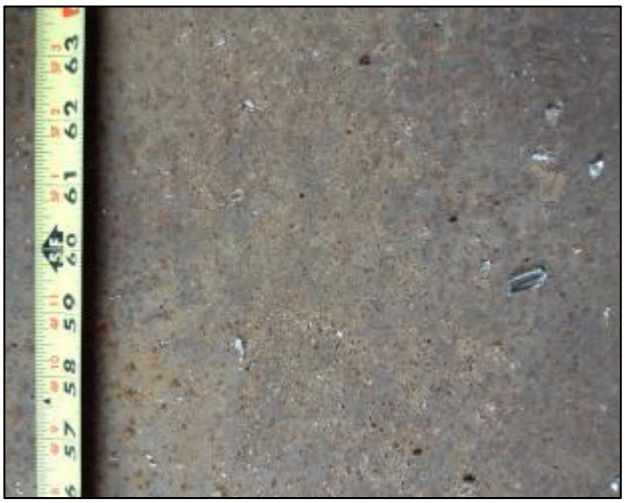


Photo No 43
Post-test, Fragments
Specimen 4

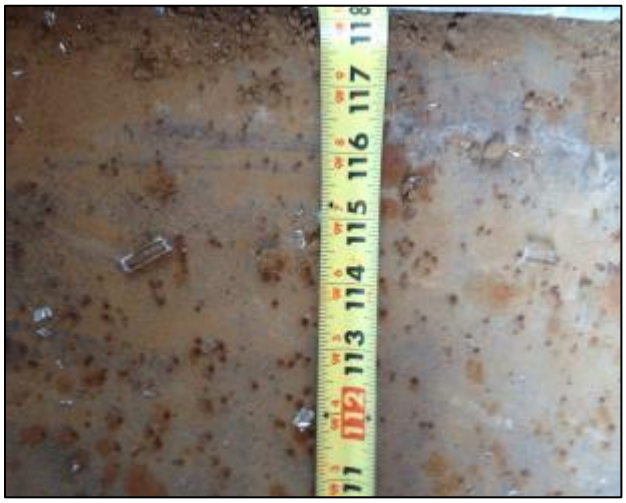


Photo No 44
Post-test, Fragments
Specimen 4

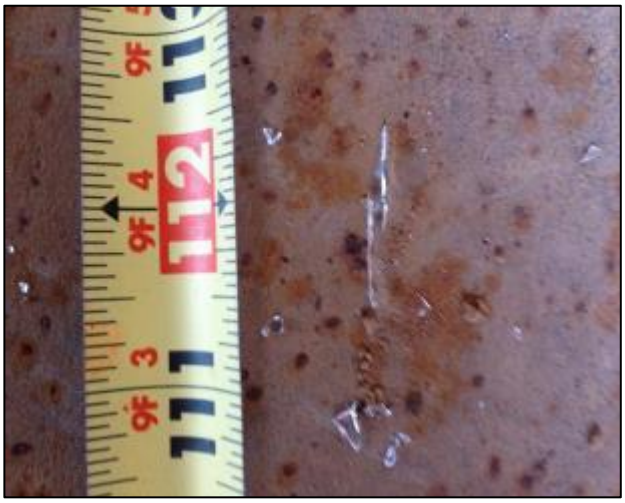


Photo No 45
Post-test, Fragments
Specimen 4

Photo No 46
Post-test, Sliver Perforation
Specimen 4

Photo No 47
Post-test, Sliver Perforation
Specimen 4

Photo No 48
Post-test, Sliver Perforation
Specimen 4

Photo No 49
Pre-test, Exterior
Specimen 5

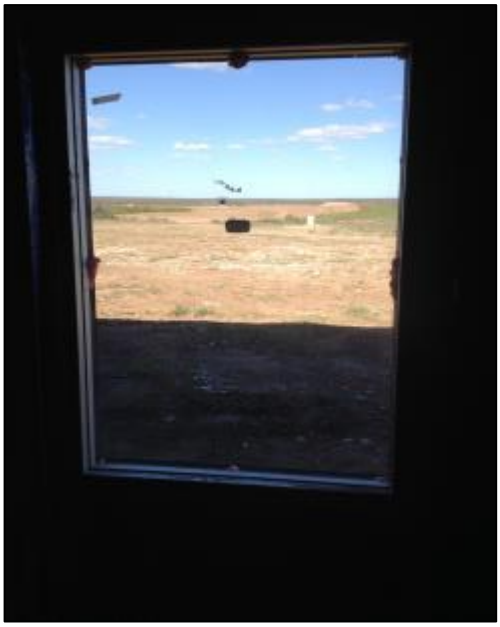


Photo No 50
Pre-test, Interior
Specimen 5

Photo No 51
Post-test, Fragments
Specimen 5

Photo No 52
Post-test, Fragments
Specimen 5

Photo No 53
Post-test, Fragments
Specimen 5

Photo No 54
Post-test, Fragments
Specimen 5

Photo No 55
Post-test, Fragments
Specimen 5

Photo No 56
Post-test, Fragments
Specimen 5

Photo No 57
Pre-test, Exterior
Specimen 6

Photo No 58
Pre-test, Interior
Specimen 6

Photo No 59
Post-test, Fragments
Specimen 6

Photo No 60
Post-test, Fragments
Specimen 6

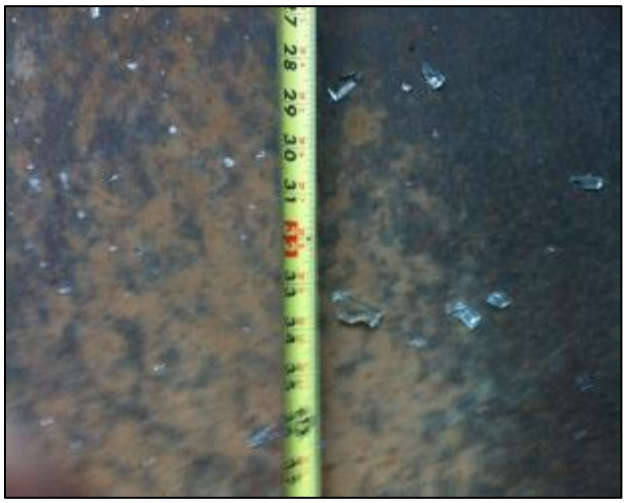


Photo No 61
Post-test, Fragments
Specimen 6

Photo No 62
Pre-test, Exterior
Specimen 7

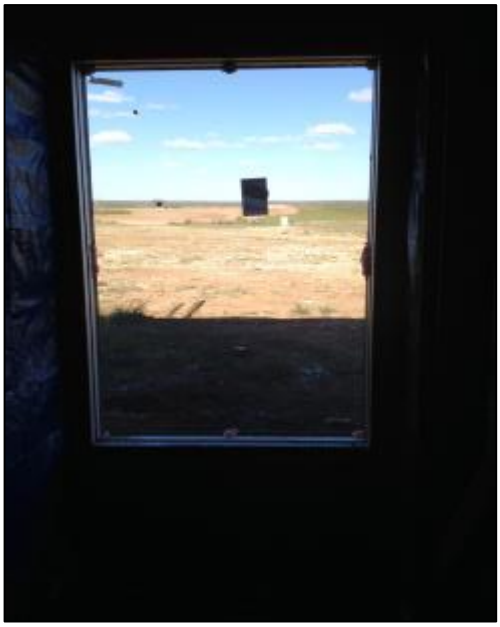


Photo No 63
Pre-test, Interior
Specimen 7

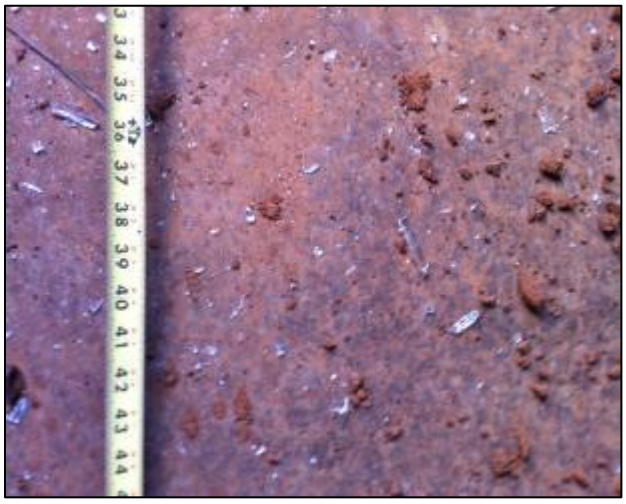


Photo No 64
Post-test, Fragments
Specimen 7

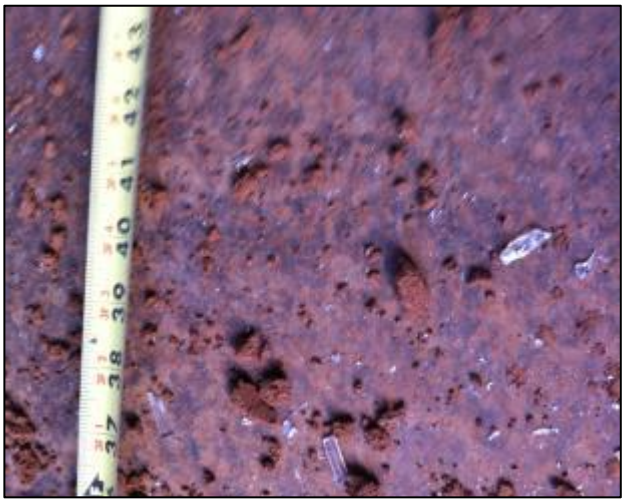


Photo No 65
Post-test, Fragments
Specimen 7

Photo No 66
Pre-test, Exterior
Specimen 8

Photo No 67
Pre-test, Interior
Specimen 8

Photo No 68
Post-test, Exterior
Specimen 8

Photo No 69
Post-test, Snap Cover
Specimen 8

Photo No 70
Post-test, Sliver Perforation
Specimen 8

Photo No 71
Post-test, Sliver Perforation
Specimen 8

Photo No 72
Post-test, Exterior
Specimen 9

Photo No 73
Post-test, Glazing
Specimen 9

Photo No 74
Post-test, Witness Panel
Specimen 9

Photo No 75
Post-test, Exterior
Specimen 10

Photo No 76
Post-test, Fragments
Specimen 10

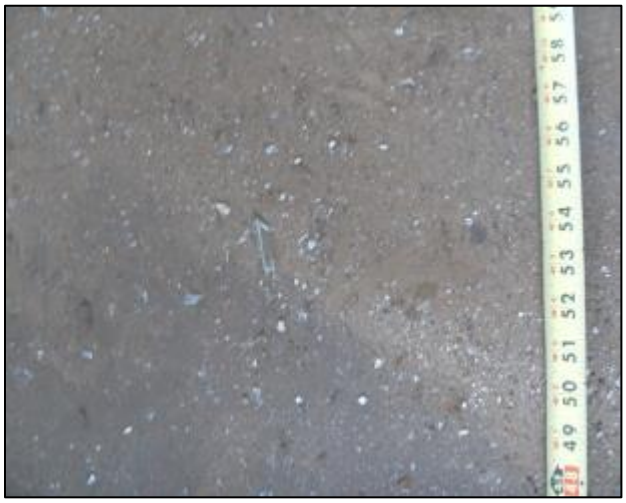


Photo No 77
Post-test, Fragments
Specimen 10

Photo No 78
Post-test, Fragments
Specimen 10

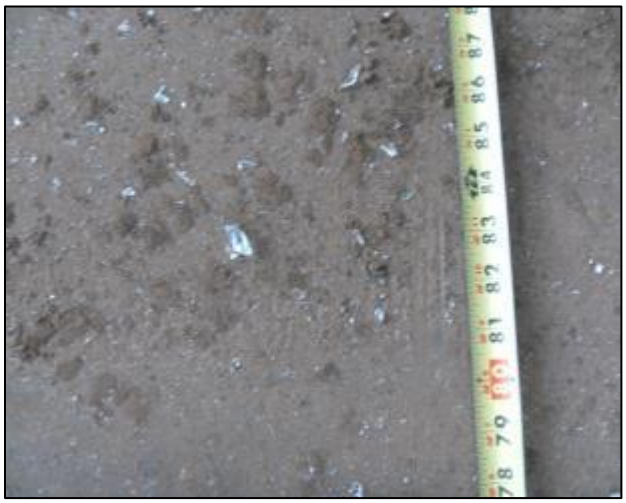


Photo No 79
Post-test, Fragments
Specimen 10

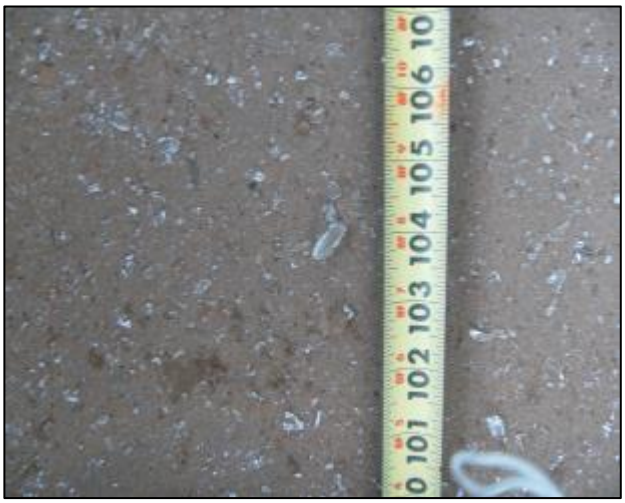


Photo No 80
Post-test, Fragments
Specimen 10

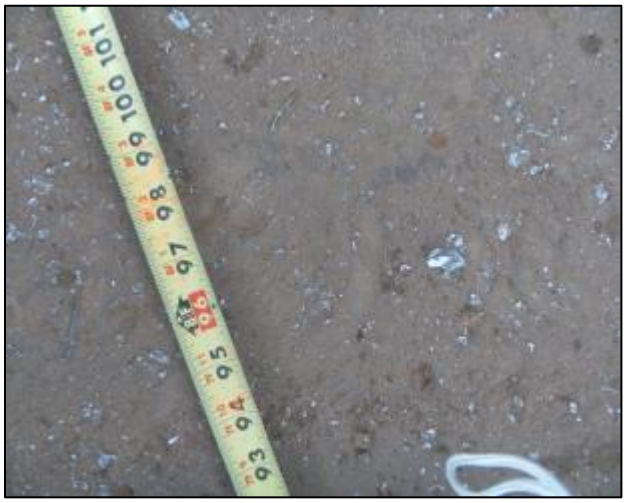


Photo No 81
Post-test, Fragments
Specimen 10

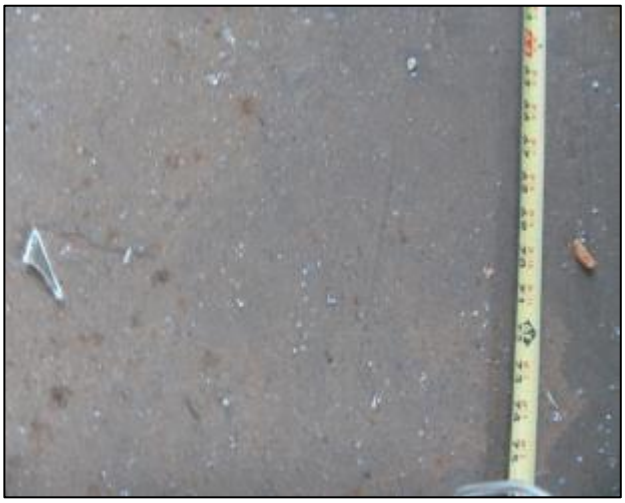


Photo No 82
Post-test, Fragments
Specimen 10

Photo No 83
Post-test, Fragments
Specimen 10

Photo No 84
Post-test, Fragments
Specimen 10

Photo No 85

Post-test, Fragments
Specimen 10

Photo No 86
Post-test, Sliver Perforation and Fragment Indent
Specimen 10

Photo No 87
Post-test, Exterior
Specimen 11

Photo No 88
Post-test, Fragments
Specimen 11

Photo No 89
Post-test, Fragments
Specimen 11

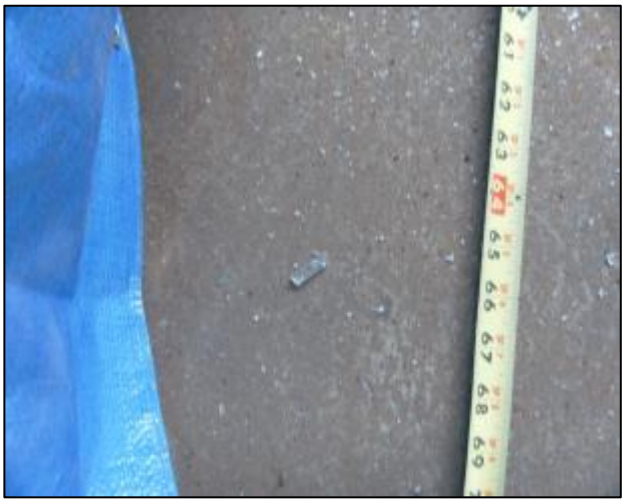


Photo No 90
Post-test, Fragments
Specimen 11

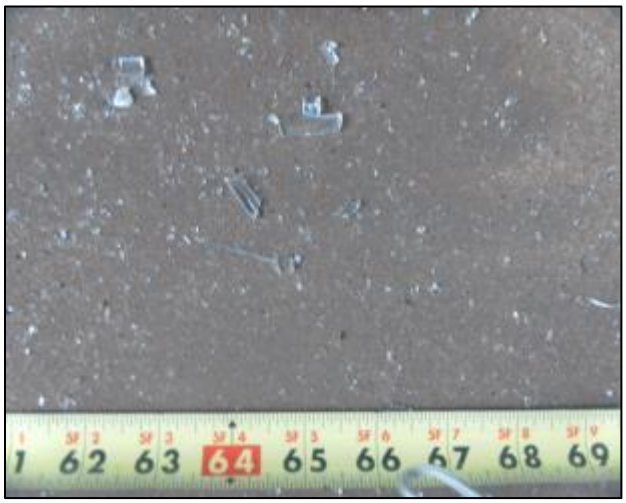


Photo No 91
Post-test, Fragments
Specimen 11

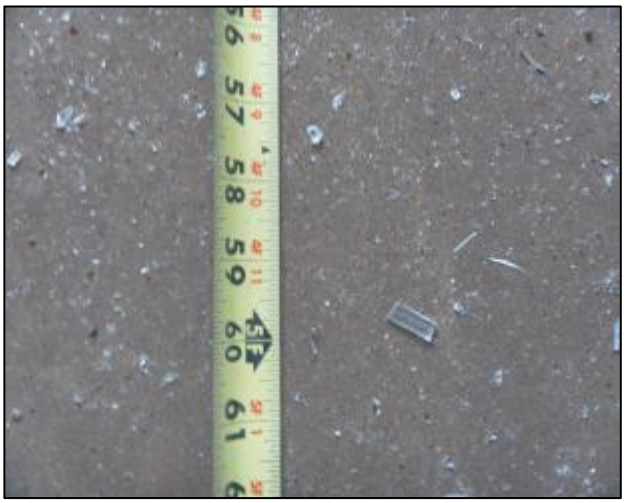


Photo No 92
Post-test, Fragments
Specimen 11

Photo No 93
Post-test, Fragments
Specimen 11

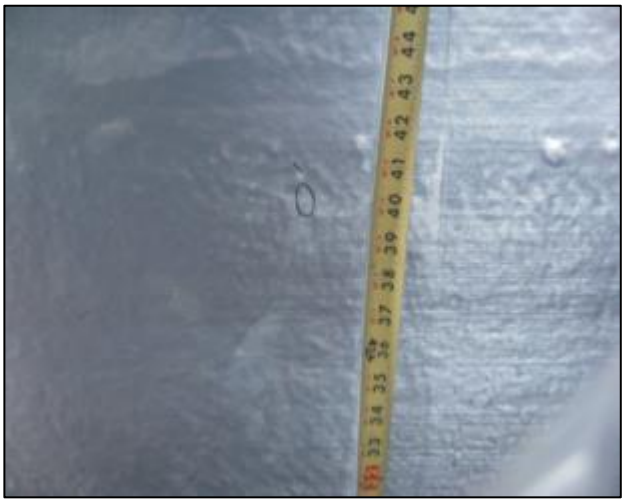


Photo No 94
Post-test, Sliver Perforation
Specimen 11

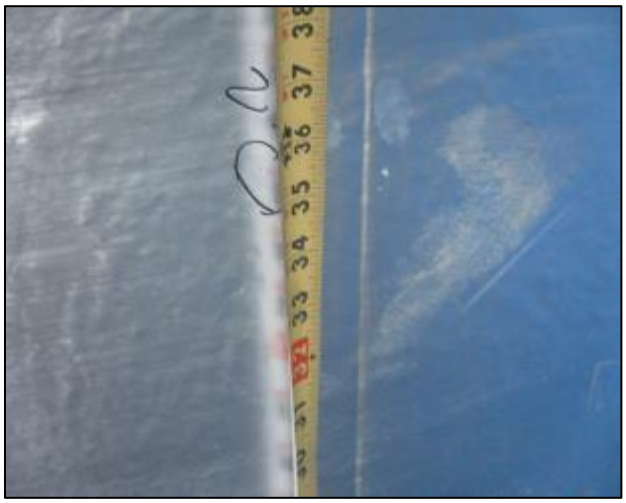


Photo No 95
Post-test, Sliver Perforation
Specimen 11

Photo No 96
Post-test, Exterior
Specimen 12

Photo No 97
Post-test, Glazing
Specimen 12

Photo No 98
Post-test, Glazing
Specimen 12

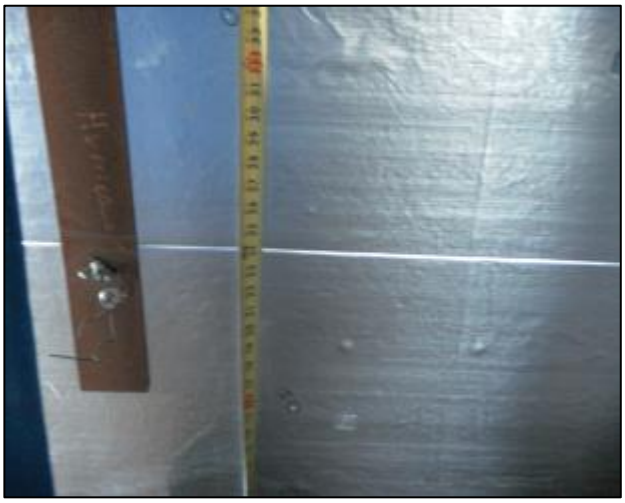


Photo No 99
Post-test, Sliver Perforation
Specimen 12

Photo No 100
Post-test, Sliver Perforation
Specimen 12

Photo No 101
Post-test, Exterior
Specimen 13

Photo No 102
Post-test, Fragments
Specimen 113

Photo No 103
Post-test, Fragments
Specimen 13

Photo No 104
Post-test, Fragments
Specimen 13

Photo No 105
Post-test, Fragments
Specimen 13

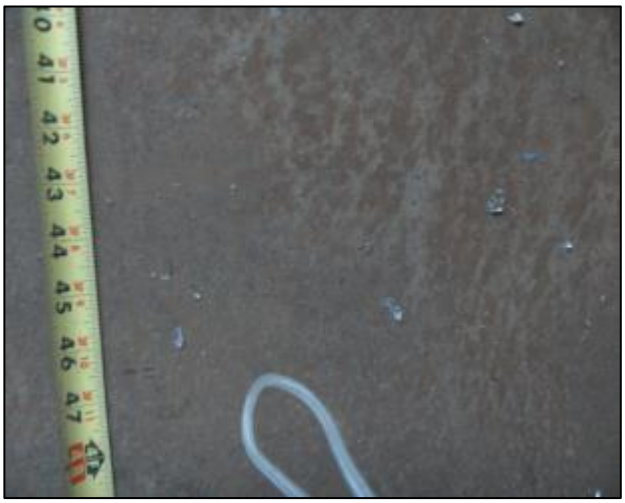


Photo No 106
Post-test, Fragments
Specimen 13

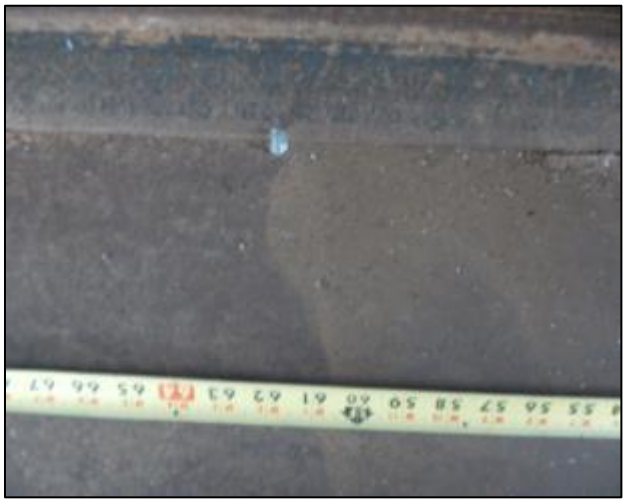


Photo No 107
Post-test, Fragments
Specimen 13

Photo No 108
Post-test, Exterior
Specimen 14

Photo No 109
Post-test, Fragments
Specimen 14

Photo No 110
Post-test, Fragments
Specimen 14

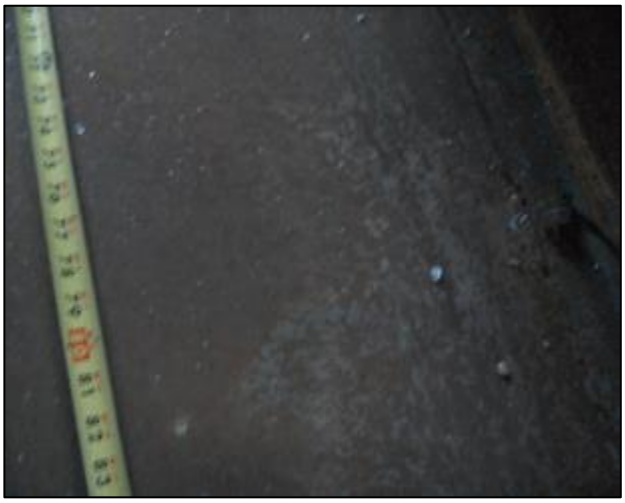


Photo No 111
Post-test, Fragments
Specimen 14

Photo No 112
Post-test, Sliver Perforation
Specimen 14

Photo No 113
Post-test, Exterior
Specimen 15

Photo No 114
Post-test, Fragments
Specimen 15

Photo No 115
Post-test, Fragments
Specimen 15

Photo No 116
Post-test, Fragments
Specimen 15

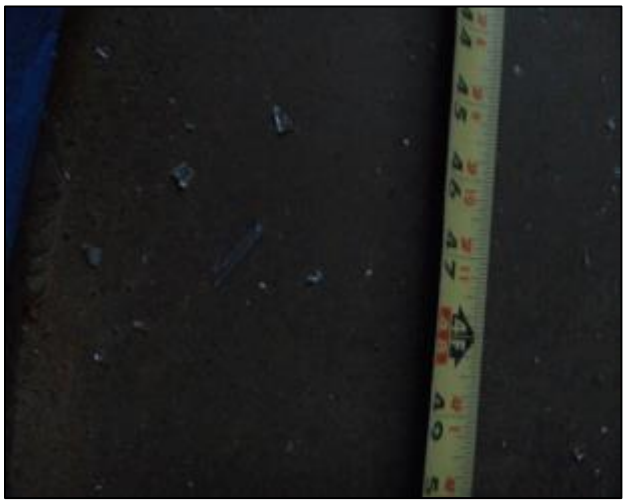


Photo No 117
Post-test, Fragments
Specimen 15

Photo No 118
Post-test, Fragments
Specimen 15

Photo No 119
Post-test, Sliver Perforation
Specimen 15

Photo No 120
Post-test, Exterior
Specimen 16

Photo No 121
Post-test, Fragments
Specimen 16

Photo No 122
Post-test, Fragments
Specimen 16

Photo No 123
Post-test, Fragments
Specimen 16

Photo No 124
Pre-test, Exterior
Specimen 17

Photo No 125
Pre-test, Interior
Specimen 17

Photo No 126
Post-test, Exterior
Specimen 17

Photo No 127
Post-test, Glazing
Specimen 17

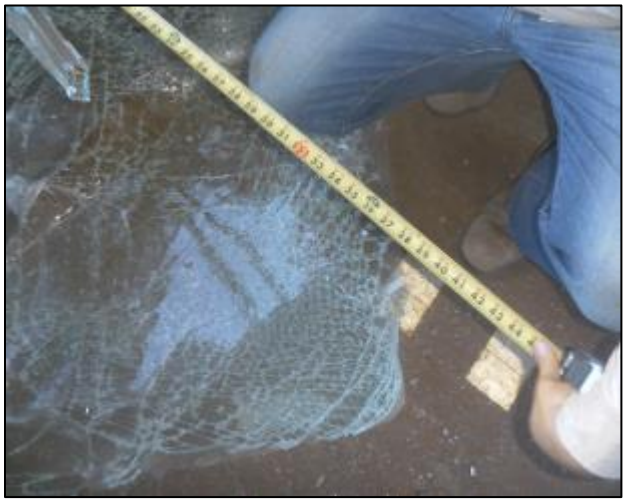


Photo No 128
Post-test, Glazing
Specimen 17

Photo No 129
Post-test, Fragments
Specimen 17

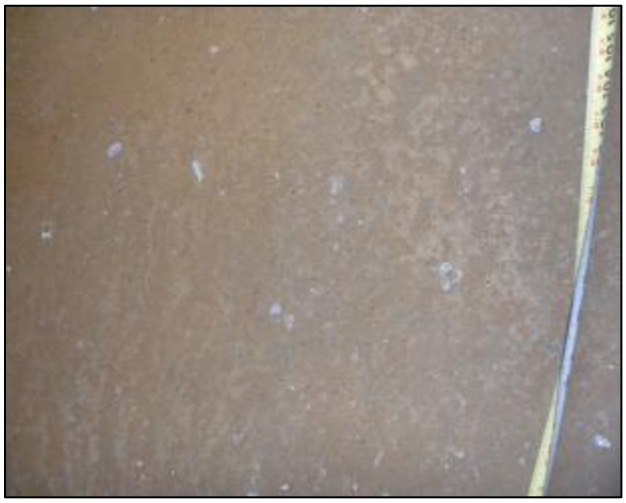


Photo No 130
Post-test, Fragments
Specimen 17

Photo No 131
Post-test, Fragments
Specimen 17

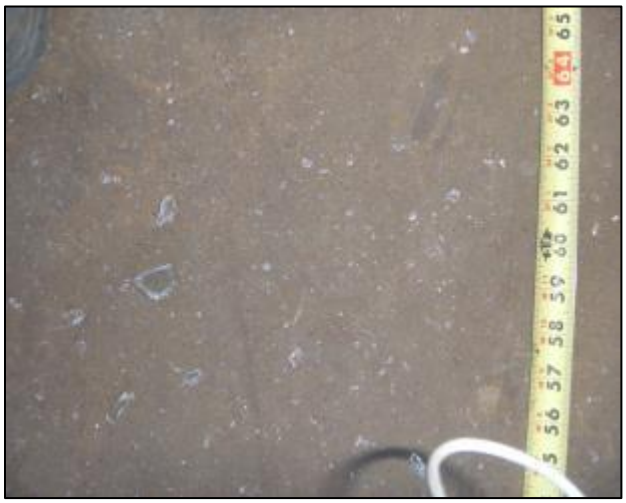


Photo No 132
Post-test, Fragments
Specimen 17

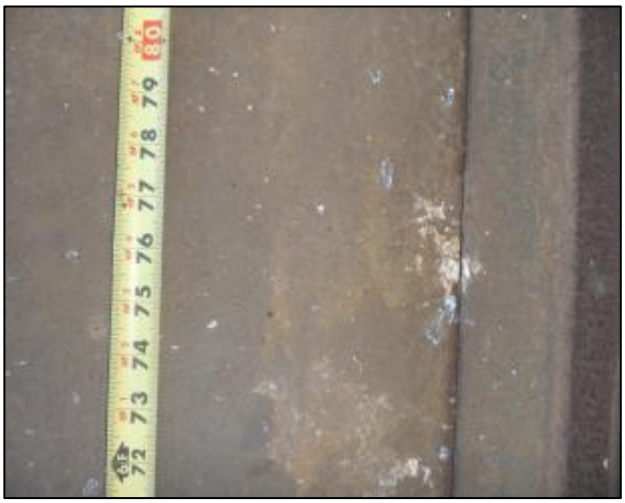


Photo No 133
Post-test, Fragments
Specimen 17

Photo No 134
Post-test, Fragments
Specimen 17

Photo No 135
Post-test, Fragments
Specimen 17

Photo No 136
Post-test, Fragments
Specimen 17

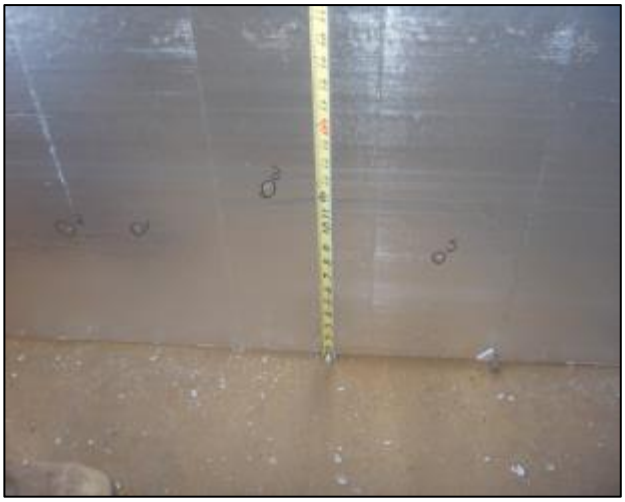


Photo No 137
Post-test, Sliver Perforations
Specimen 17

Photo No 138
Pre-test, Exterior
Specimen 18

Photo No 139
Pre-test, Interior
Specimen 18

Photo No 140
Post-test, Exterior
Specimen 18

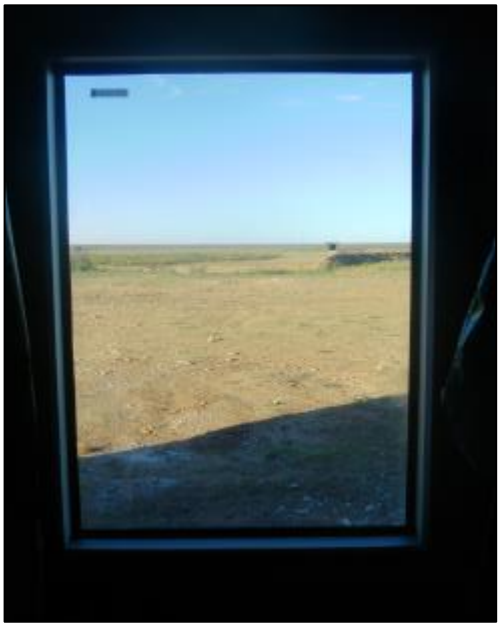


Photo No 141
Post-test, Interior
Specimen 18

Photo No 142
Pre-test, Exterior
Specimen 19

Photo No 143
Pre-test, Interior
Specimen 19

Photo No 144
Post-test, Exterior
Specimen 19

Photo No 145
Post-test, Interior
Specimen 19

Photo No 146
Pre-test, Exterior
Specimen 20

Photo No 147
Pre-test, Interior
Specimen 20

Photo No 148
Post-test, Exterior
Specimen 20

Photo No 149
Post-test, Glazing
Specimen 20

Photo No 150
Post-test, Glazing
Specimen 20

Photo No 151
Post-test, Sliver Perforation
Specimen 20

Photo No 152
Post-test, Sliver Perforation
Specimen 20

Photo No 153
Pre-test, Exterior
Specimen 21

Photo No 154
Pre-test, Interior
Specimen 21

Photo No 155
Post-test, Exterior
Specimen 21

Photo No 156
Post-test, Fragments
Specimen 21

Photo No 157
Post-test, Fragments
Specimen 21

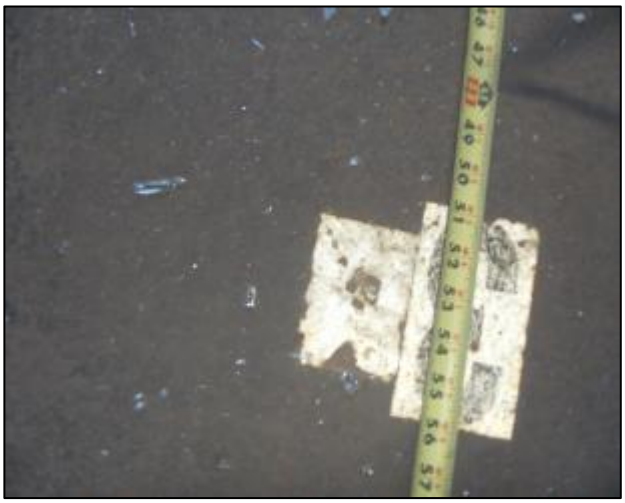


Photo No 158
Post-test, Fragments
Specimen 21

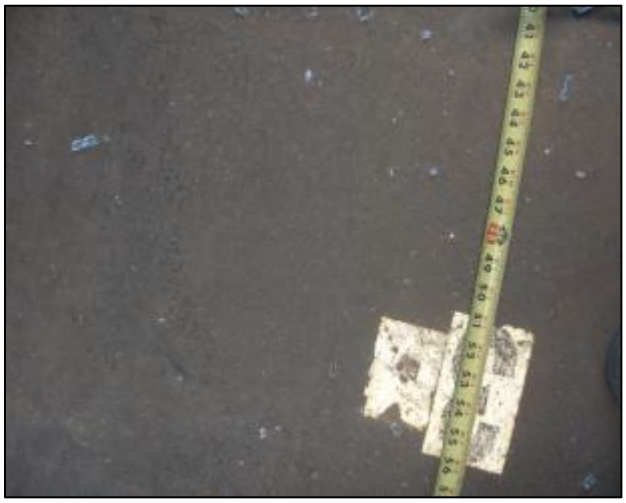


Photo No 159
Post-test, Fragments
Specimen 21

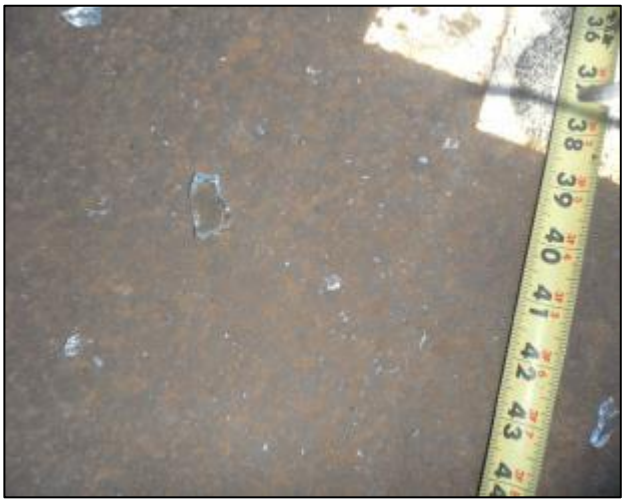


Photo No 160
Post-test, Fragments
Specimen 21

Photo No 161
Post-test, Fragments
Specimen 21

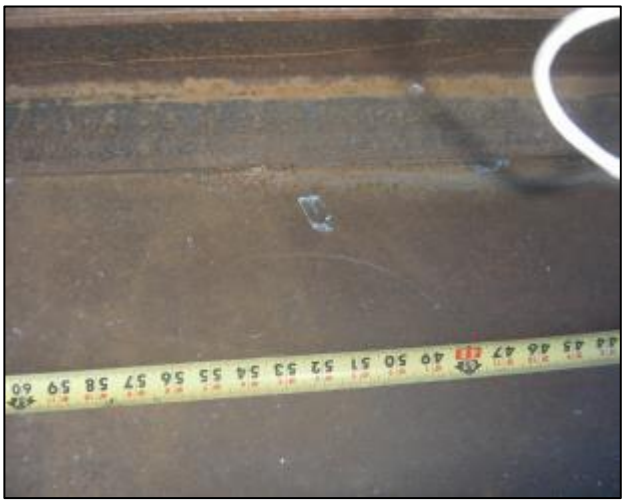


Photo No 162
Post-test, Fragments
Specimen 21

Photo No 163
Post-test, Sliver Penetrations
Specimen 21

Photo No 164
Pre-test, Exterior
Specimen 22

Photo No 165
Pre-test, Interior
Specimen 22

Photo No 166
Post-test, Exterior
Specimen 22

Photo No 167
Post-test, Interior
Specimen 22

Photo No 168
Pre-test, Exterior
Specimen 23

Photo No 169
Pre-test, Interior
Specimen 23

Photo No 170
Post-test, Exterior
Specimen 23

Photo No 171
Post-test, Interior
Specimen 23

Photo No 172
Pre-test, Exterior
Specimen 24

Photo No 173
Pre-test, Interior
Specimen 24

Photo No 174
Post-test, Exterior
Specimen 24

Photo No 175
Post-test, Interior
Specimen 24

Photo No 176
Post-test, Glazing Tears
Specimen 24

Photo No 177
Post-test, Glazing Tears
Specimen 24

Photo No 178
Post-test, Glazing Tears
Specimen 24

Photo No 179
Post-test, Glazing Tears
Specimen 24

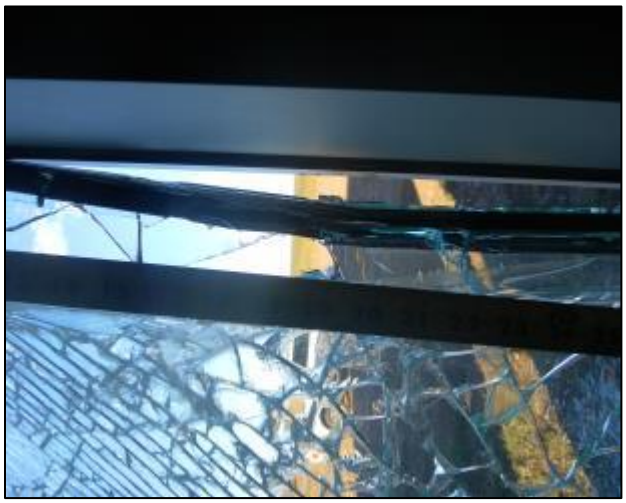


Photo No 180
Post-test, Glazing Tears
Specimen 24

Photo No 181
Post-test, Glazing Tears
Specimen 24

Photo No 182
Post-test, Glazing Tears
Specimen 24

Photo No 183
Post-test, Glazing Tears
Specimen 24

Photo No 184
Post-test, Fragments
Specimen 24

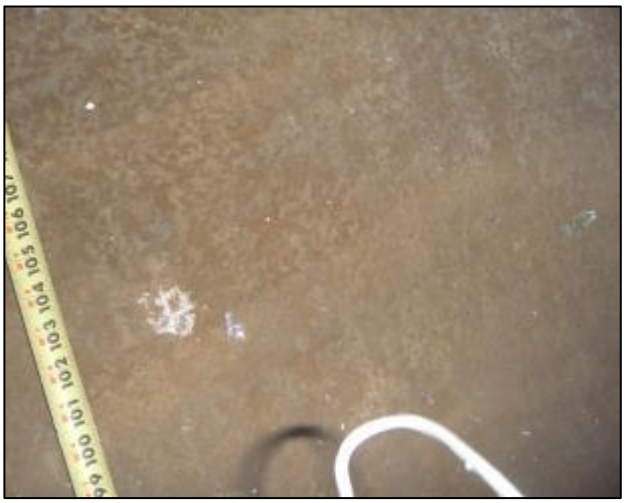


Photo No 185
Post-test, Fragments
Specimen 24

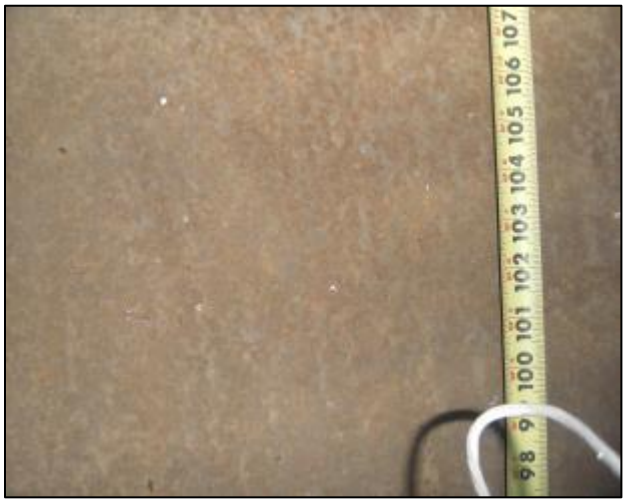


Photo No 186
Post-test, Fragments
Specimen 24

Photo No 187
Post-test, Fragments
Specimen 24

Photo No 188
Post-test, Fragments
Specimen 24

Photo No 189
Post-test, Fragments
Specimen 24

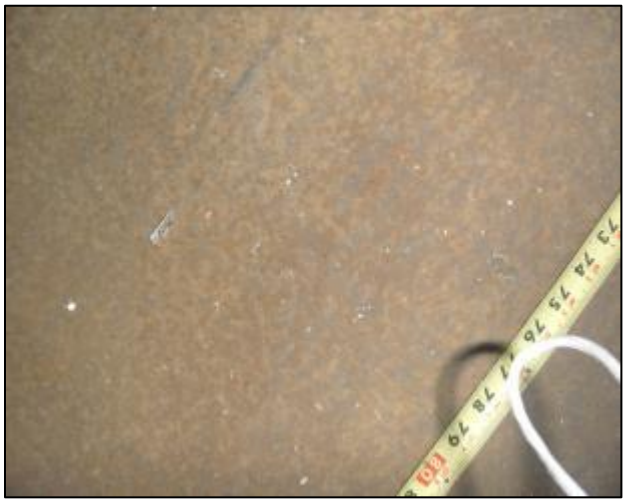


Photo No 190
Post-test, Fragments
Specimen 24

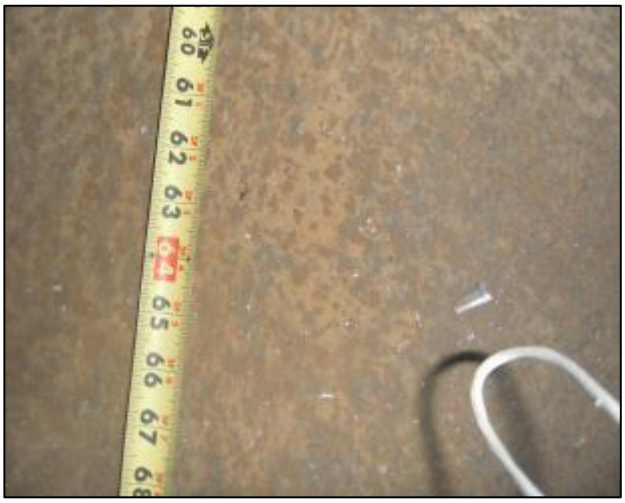


Photo No 191
Post-test, Fragments
Specimen 24

Photo No 192
Post-test, Fragments
Specimen 24

Photo No 193
Post-test, Fragments
Specimen 24

Photo No 194
Post-test, Fragments
Specimen 24

Photo No 195
Pre-test, Exterior
Specimen 25

Photo No 196
Pre-test, Interior
Specimen 25

Photo No 197
Post-test, Exterior
Specimen 25

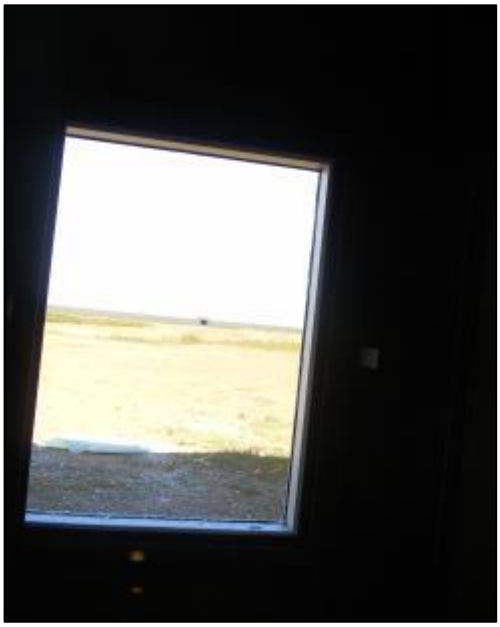


Photo No 198
Post-test, Interior
Specimen 25

Photo No 199
Post-test, Fragments
Specimen 25

Photo No 200
Pre-test, Exterior
Specimen 26

Photo No 201
Pre-test, Interior
Specimen 26

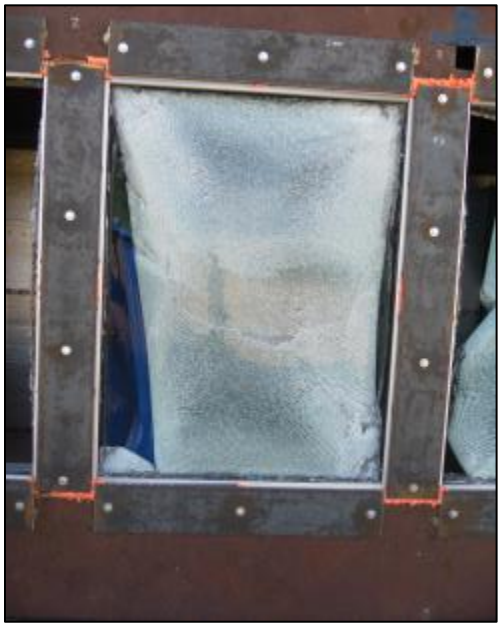


Photo No 202
Post-test, Exterior
Specimen 26

Photo No 203
Post-test, Interior
Specimen 26

Photo No 204
Post-test, Fragments
Specimen 26

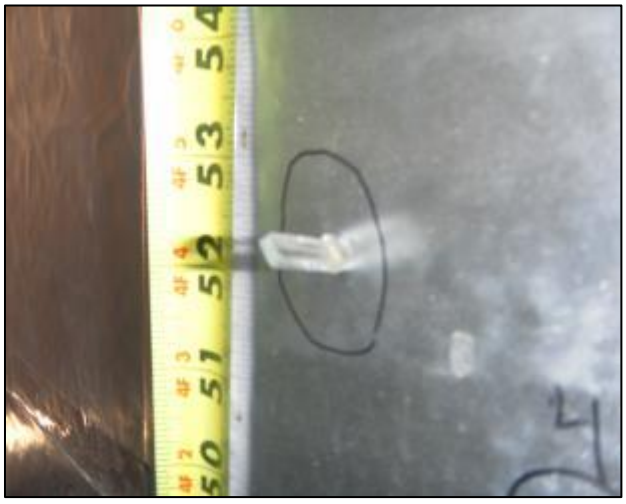


Photo No 205
Post-test, Fragment Indent
Specimen 26

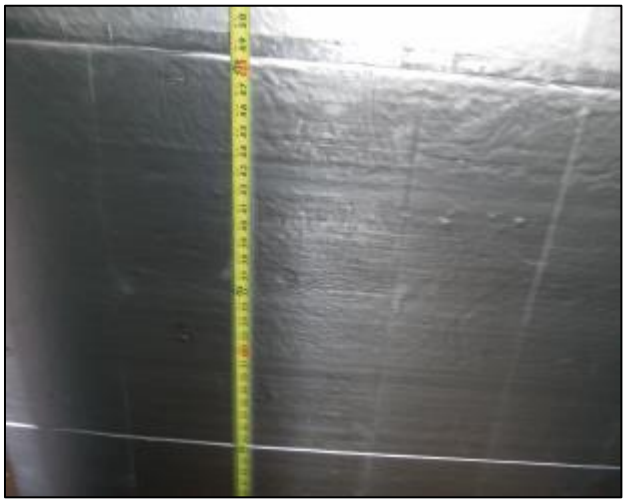


Photo No 206
Post-test, Sliver Perforation
Specimen 26

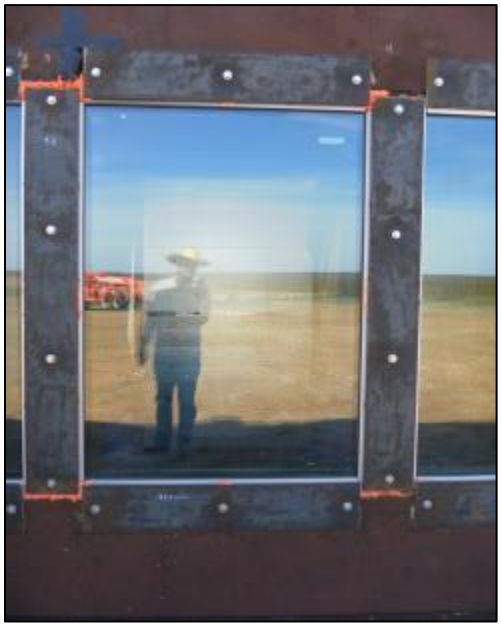


Photo No 207
Pre-test, Exterior
Specimen 27

Photo No 208
Pre-test, Interior
Specimen 27

Photo No 209
Post-test, Exterior
Specimen 27

Photo No 210
Post-test, Interior
Specimen 27

Photo No 211
Post-test, Fragments
Specimen 27

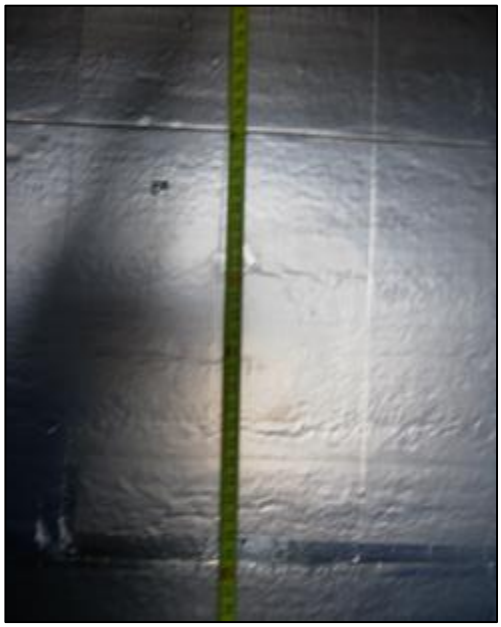


Photo No 212
Post-test, Sliver Perforation
Specimen 27

Photo No 213
Pre-test, Exterior
Specimen 28

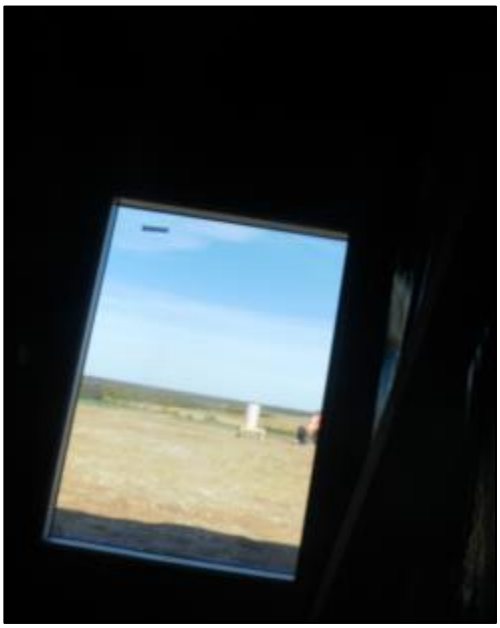


Photo No 214
Pre-test, Interior
Specimen 28

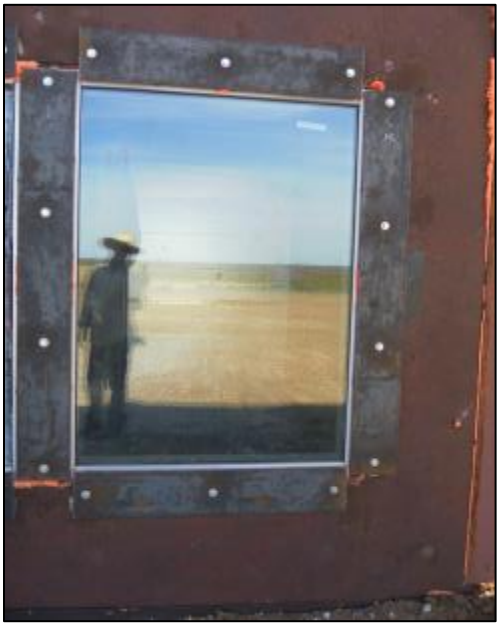
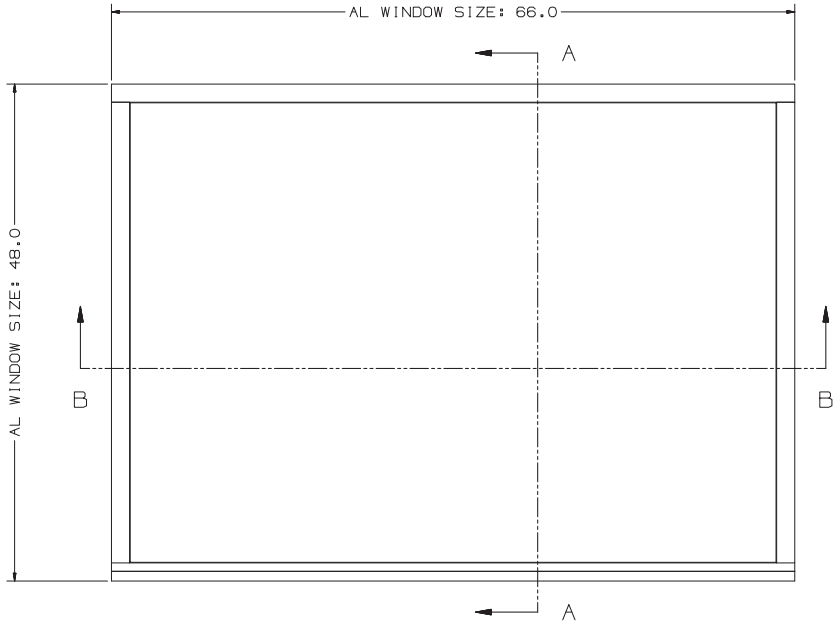


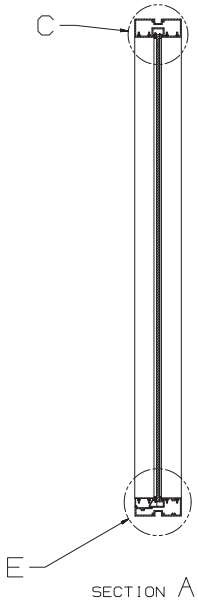
Photo No 215
Post-test, Exterior
Specimen 28

Photo No 216
Post-test, Interior
Specimen 28

APPENDIX D

Drawings





SECTION A - A

Architectural Testing, Inc

Test sample complies with details shown herein. Any deviations are noted in the test report or drawings.

Report #: E1298.01-801-12

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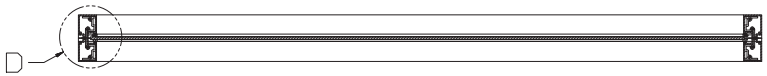


SECTION B - B

REV.	ECO	ISSUE DATE AND DESCRIPTION	DRFT	CHKD
1		SEP 09,2014		

DRFT AVL DATE SEP 09,2014 MFR DATE
CHKD DATE APPVL DATE

DESIGN REFERENCE | NEXT ASSEMBLY | ACCESS CODES | DIVISION | DIVISION CODE

DO NOT SCALE DRAWING | SCALE 1/6

THIRD ANGLE PROJECTION

INTERPRET PER ASME Y14.5 - 2009

MAX SURFACE ROUGHNESS 125 ☐ ALL SURFACES ☒ MARKED ONLY

TOLERANCES EXCEPT AS NOTED

INCHES
.0 ± .1
.00 ± .02
.000 ± .005
.0000 ± .0002

MILLIMETERS
0 ±
.0 ±
.00 ±
.000 ±

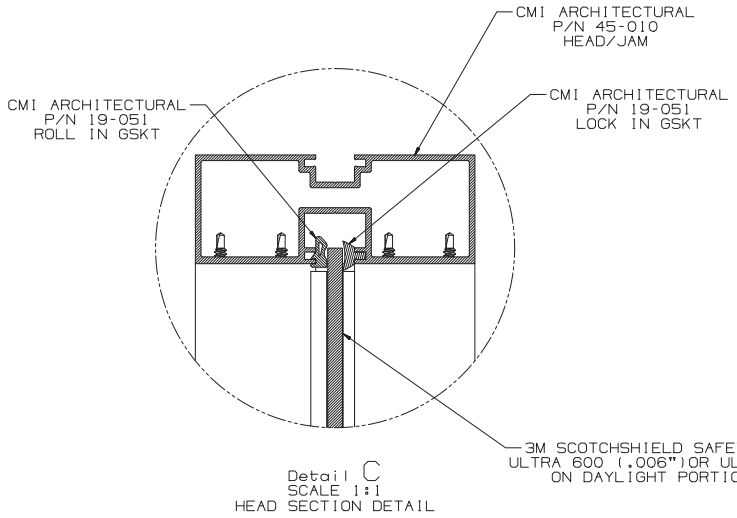
ANGLES ±1°

3M Center St. Paul, MN 55144

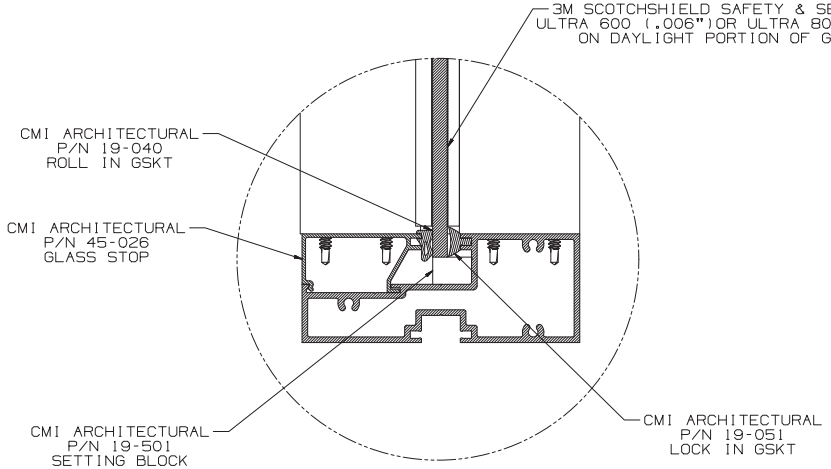
TITLE
SINGLE PANE WINDOW
TEST FIXTURE WITH 3M
ULTRA SAFETY FILM
AND NO FILM ATTACHMENT

CAGE NUMBER | SIZE D | DRAWING NO. ASSY_WINDOW_48X66_UNV_NFA | REV. 1

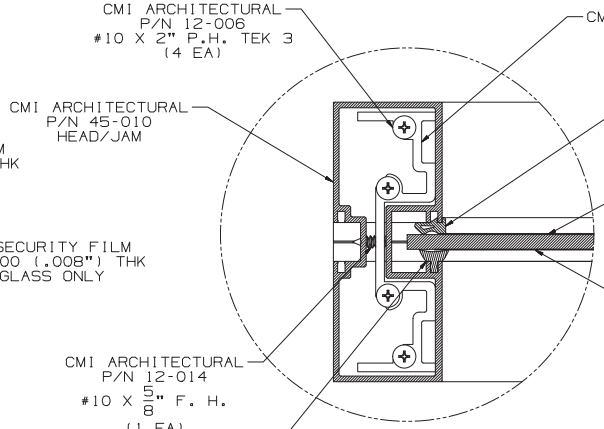
MODEL | PART LISTS ☐ YES ☒ NO | SHT 1 OF 2



Detail C
SCALE 1:1
HEAD SECTION DETAIL



Detail E
SCALE 1:1
SILL SECTION DETAIL



Detail D
SCALE 1:1
JAMB SECTION DETAIL

Architectural Testing, Inc

Test sample complies with details shown herein. Any deviations are noted in the test report or drawings.

Report #: E1298.01-801-12

Date: 01/05/15 By: DS

REV	ECO	ISSUE DATE AND DESCRIPTION	DRFT	CHKD
1		SEP 09,2014		

DESIGN REFERENCE | NEXT ASSEMBLY | ACCESS CODES | DIVISION | DIVISION CODE

DRFT AVL DATE SEP 09,2014 MFR DATE
CHKD DATE APPVL DATE

DO NOT SCALE DRAWING | SCALE 1/6

TOLERANCES EXCEPT AS NOTED
INCHES
.0 ± .1
.00 ± .02
.000 ± .005
.0000 ± .0002
MILLIMETERS
0 ±
.0 ±
.00 ±
.000 ±
ANGLES ±1°

THIRD ANGLE PROJECTION

INTERPRET PER ASME Y14.5 - 2009

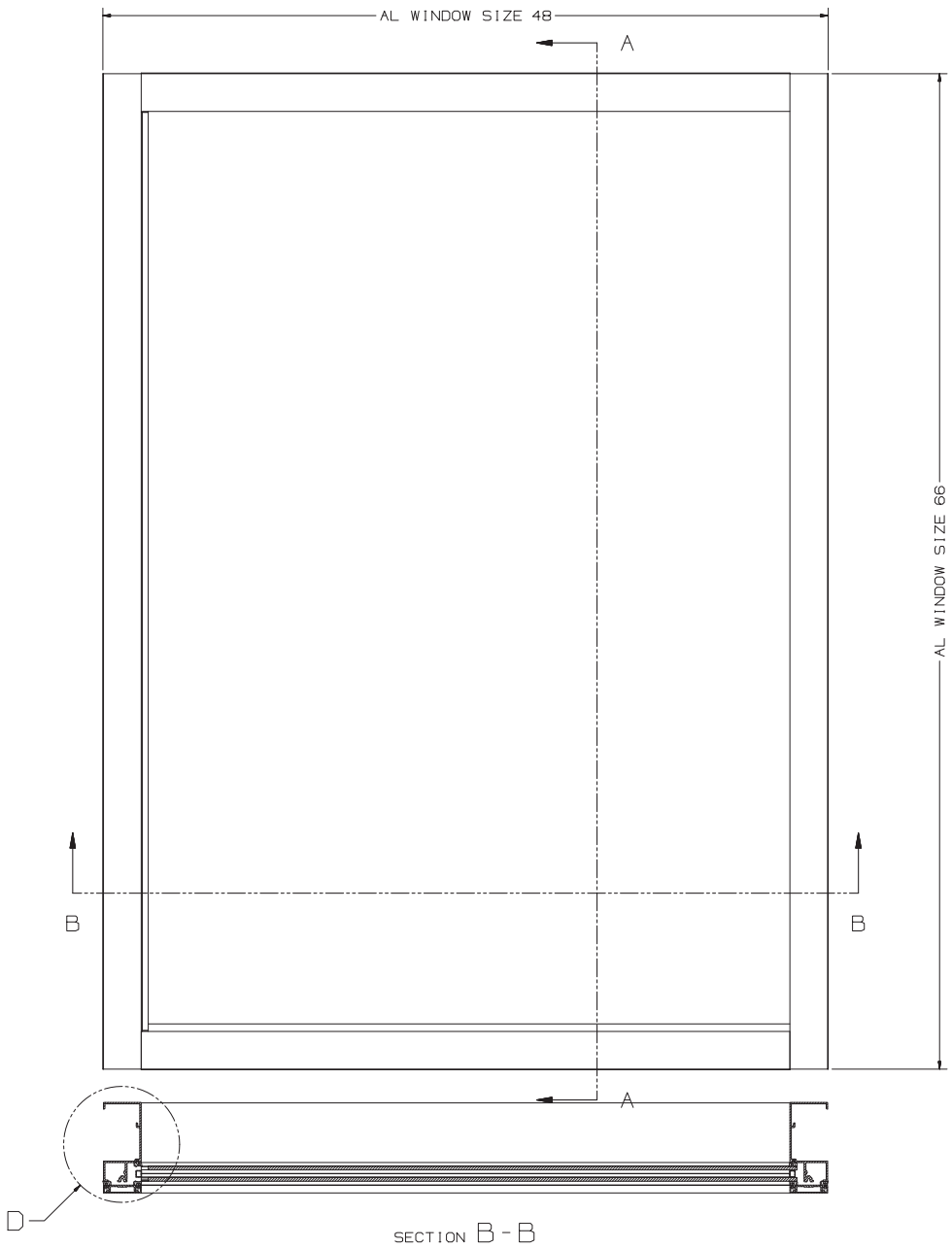
MAX SURFACE ROUGHNESS 125 ☐ ALL SURFACES ☒ MARKED ONLY

3M Center St. Paul, MN 55144

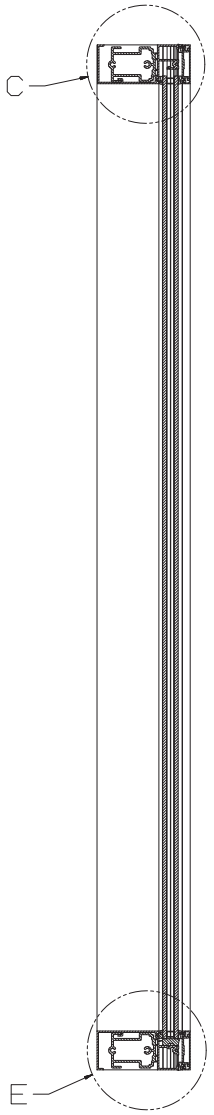
TITLE
SINGLE PANE WINDOW
TEST FIXTURE WITH 3M
ULTRA SAFETY FILM
AND NO FILM ATTACHMENT

CAGE NUMBER | SIZE D | DRAWING NO. ASSY_WINDOW_48X66_UNV_NFA | REV. 1

MODEL | DRFT LISTS ☐ YES ☒ NO | SHT 2 OF 2



SECTION B - B



SECTION A - A

Architectural Testing, Inc

Test sample complies with details shown herein. Any deviations are noted in the test report or drawings.

Report #: E1298.01-801-12

Date: 01/05/15 By: DS

REV.	ECO	ISSUE DATE AND DESCRIPTION	DRFT	CHKD
1		SEP 16,2014		

DESIGN REFERENCE | NEXT ASSEMBLY | ACCESS CODES | DIVISION | DIVISION CODE

DRFT AVL SEP 16,2014 MFR DATE

CHKD DATE APPVL DATE

DO NOT SCALE DRAWING | SCALE 1/4

THIRD ANGLE PROJECTION

INTERPRET PER ASME Y14.5 - 2009

MAX SURFACE ROUGHNESS 125 ☐ ALL SURFACES ☒ MARKED ONLY

TOLERANCES EXCEPT AS NOTED

INCHES
.0 ± .1
.00 ± .02
.000 ± .005
.0000 ± .0002

MILLIMETERS
0 ±
.0 ±
.00 ±
.000 ±

ANGLES ±1°

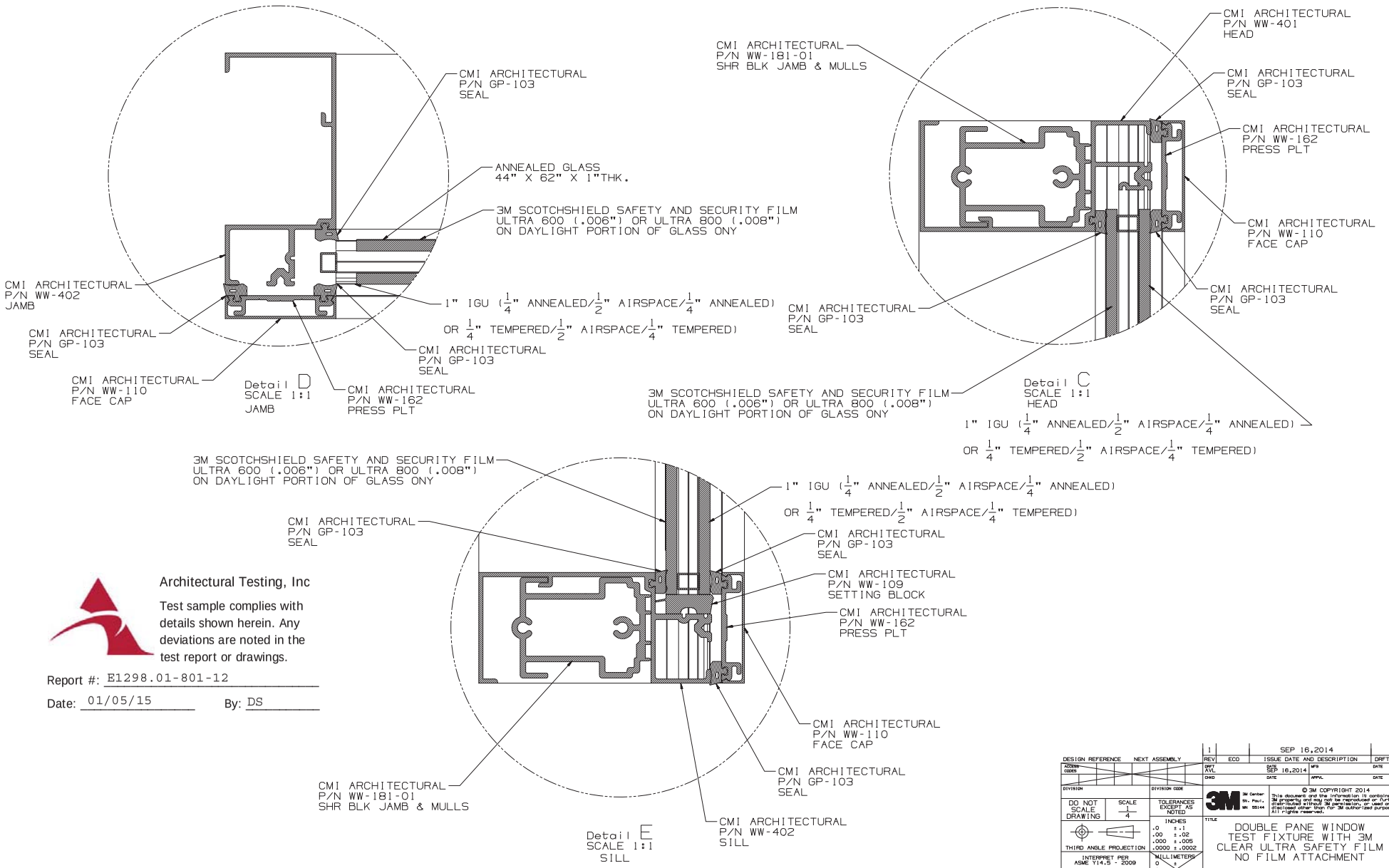
3M Center St. Paul, MN 55144

TITLE
DOUBLE PANE WINDOW
TEST FIXTURE WITH 3M
CLEAR ULTRA SAFETY FILM
NO FILM ATTACHMENT

CASE NUMBER | SIZE D | DRAWING NO. ASSY-DOUBLE-39.4X47.3_ULTRA-NF | REV. A 1

MODEL | DFT LISTS ☐ YES ☒ NO | SHT 1 OF 2

ASSY-DOUBLE-39 A 1



Architectural Testing, Inc

Test sample complies with details shown herein. Any deviations are noted in the test report or drawings.

Report #: E1298.01-801-12

Date: 01/05/15 By: DS

REV	ECO	ISSUE DATE AND DESCRIPTION	DRFT	CHKD
1		SEP 16,2014		

DESIGN REFERENCE | NEXT ASSEMBLY | ACCESS CODES | DIVISION | DIVISION CODE

DRFT AVL SEP 16,2014 MFR DATE

CHKD DATE APPVL DATE

DO NOT SCALE DRAWING | SCALE 1/4 | THIRD ANGLE PROJECTION | INTERPRET PER ASME Y14.5 - 2009 | MAX SURFACE ROUGHNESS 125 ☐ ALL SURFACES ☒ MARKED ONLY

TOLERANCES EXCEPT AS NOTED
INCHES: .0 ±.1; .00 ±.02; .000 ±.005; .0000 ±.0002
MILLIMETERS: .0 ±; .00 ±; .000 ±
ANGLES ±1°

TITLE: DOUBLE PANE WINDOW TEST FIXTURE WITH 3M CLEAR ULTRA SAFETY FILM NO FILM ATTACHMENT

CAGE NUMBER | SIZE D | DRAWING NO. ASSY-DOUBLE-394X47.3_ULTRA-NFA | REV. 1

MODEL | DFT LISTS ☐ YES ☒ NO | SHT 2 OF 2

ASSY-DOUBLE-39 4X47.3_ULTRA-NFA 1

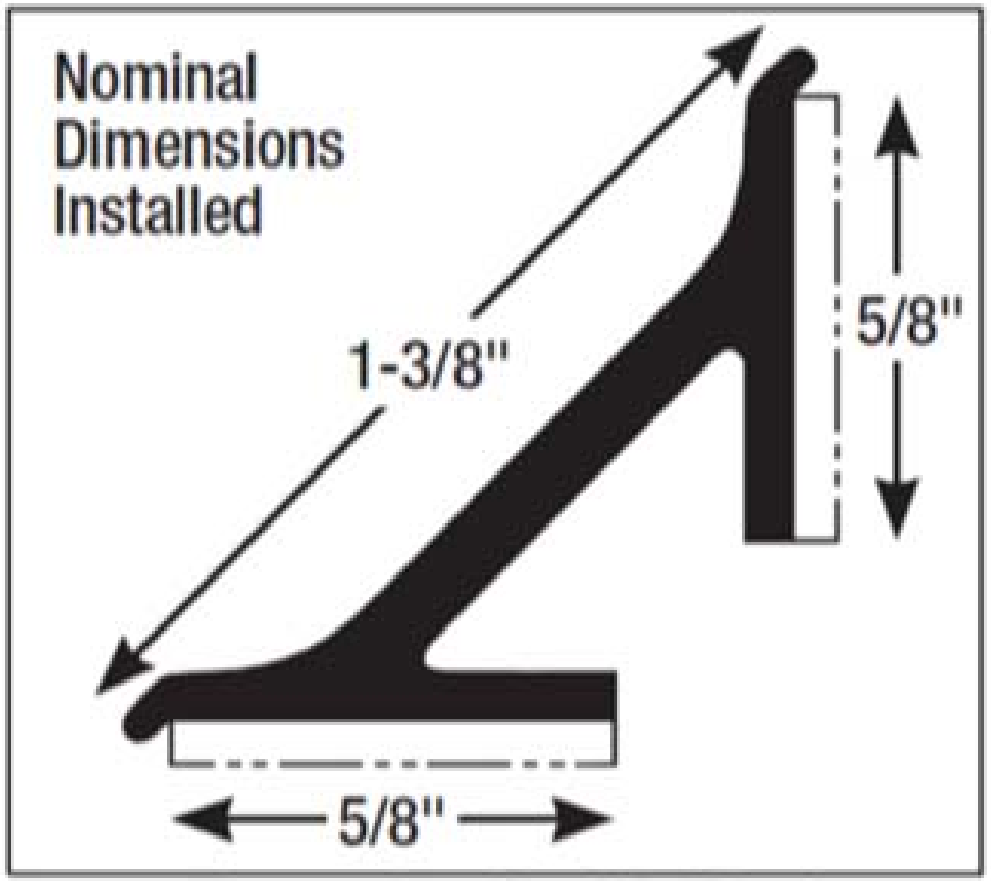
3M™ Impact Protection Profile

Architectural Testing, Inc

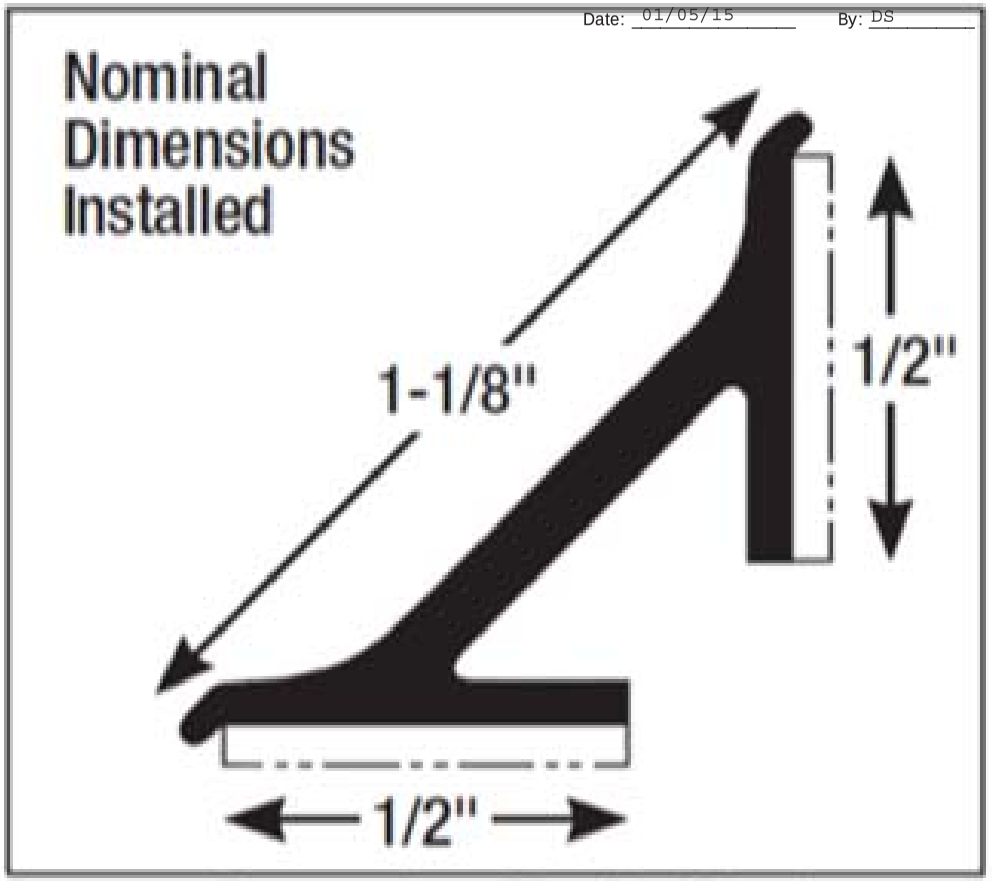
Test sample complies with details shown herein. Any deviations are noted in the test report or drawings.

Report #: E1298.01-801-12

Date: 01/05/15 By: DS



Impact Protection Profile Black
BP950 (1-7/16" Flat)



Impact Protection Profile Black
BP700 (1-1/8" Flat)