

Process Plant Tent Responses to Vapor Cloud Explosions—Results of the American Petroleum Institute Tent Testing Program

API TECHNICAL REPORT 756-1
SEPTEMBER 2014



AMERICAN PETROLEUM INSTITUTE

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Downstream Segment

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Prepared for API by:
Raymond H. Bennett, P.E., Ph.D.
Martin Goodrich, P.E.
Brad Horn

Baker Engineering and Risk Consultants, Inc.
3330 Oakwell Court, Suite 100
San Antonio, TX 78218



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EXECUTIVE SUMMARY

The American Petroleum Institute (API) contracted with Baker Engineering and Risk Consultants, Inc. (BakerRisk) to perform vapor cloud explosion (VCE) tests to determine the response of tents to the potential explosion hazards that may be present at refineries, petrochemical and chemical operations, and natural gas and other onshore process facilities covered by OSHA 29 *CFR* 1910.119. The testing was conducted to provide data for use by the API committee developing API Recommended Practice (RP) 756, “Management of Hazards Associated with Location of Process Plant Tents”.

The tests were originally designed to serve multiple purposes:

- provide data on response of tents to a variety of blast loads ranging from 0.6 psi to 1.5 psi,
- identify the failure modes for different types of tents, and
- obtain data on tent response to support estimates on the vulnerability of tent occupants.

As the testing was performed, it became apparent that the tents being tested could withstand higher pressures than originally envisioned. The test program was therefore modified to accommodate the observed behavior. The development and modifications to the scope of the test program are discussed in the report. The following three series of tests were conducted.

- A Series – Three types of non-wind rated tents were tested with the long side of the tents facing the blast source.
- B Series – The same types of tents were rotated 90 degrees and retested at higher loads.
- C Series – Three types of engineered tents (designed for 90 mph 3 second wind gusts) were tested at two different pressures.

Subsequent to the completion of the API-funded tests, BakerRisk performed two additional tests to evaluate the DLG performance, as internal research. The response of the tents in these internal research tests, including the response of contents added to the tents, is discussed in this report.

The Explosion Research Cooperative (ERC) participants voted to release the data from a series of shock tube tests performed under their sponsorship that addressed the potential for the contents of a tent to become airborne. The data, in term of object mass and velocity, are provided in this report.

This report presents data only and does not provide any summary or conclusions on the acceptability of a tent siting approach.

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Process Plant Tent Responses To Vapor Cloud Explosions—Results Of The American Petroleum Institute Tent Testing Program

1 INTRODUCTION AND BACKGROUND

The American Petroleum Institute (API) contracted with Baker Engineering and Risk Consultants, Inc. (BakerRisk) to perform vapor cloud explosion (VCE) tests to determine the response of tents to the potential explosion hazards that may be present at refineries, petrochemical and chemical operations, natural gas and other onshore process facilities covered by OSHA 29 *CFR* 1910.119. The testing was conducted to provide data for use by the API committee developing API Recommended Practice (RP) 756, “Management of Hazards Associated with Location of Process Plant Tents”.

BakerRisk designed and constructed the Deflagration Load Generator (DLG) test rig used for these tests. The test rig measures 48 ft. long by 24 ft. deep by 12 ft. tall and has three rigid walls, a rigid roof and floor, and one open wall facing the structure being tested, as shown in Figure 1. The interior of the rig is fitted with congestion. The test rig is filled with a propane/air mixture and ignited, causing a VCE.



Figure 1. VCE Deflagration Load Generator Test Rig

The specific test environment is controlled through selection of fuel concentration, obstacle geometry, and the distance between the test article and the VCE test rig. The tests were deflagrations with moderate flame speeds such that the wave shape of the blast load would include a rise time to the peak pressure. This type of VCE is representative of typical accidental VCEs at industrial facilities.

The VCE deflagrations are set to vent outside the test rig, toward the test articles. The tents were placed at a sufficient range from the test rig such that three test articles could be tested simultaneously on each shot. The test rig was configured such that the blast loading on the tent could be changed by varying the fuel concentration rather than relocating the test articles.

The tests were originally designed to serve multiple purposes:

- Provide data on response of tents to a variety of blast loads ranging from 0.6 to 1.5 psi,
- Identify the failure modes for different types of tents, and
- Obtain data on tent response to support estimates on the vulnerability of tent occupants.

As the testing was performed it became apparent that the tents being tested could withstand higher pressures than originally envisioned. The test program was therefore modified to accommodate the observed behavior. The development and modifications to the scope of the test program are discussed in Section 2 of this report. The following three series of tests were conducted.

- A Series – Three types of non-wind rated tents were tested with the long side of the tents facing the blast source. The results of this series of tests are presented in Section 3.
- B Series – The same types of tents were rotated 90 degrees and retested at higher loads. The results of this series of tests are presented in Section 4.
- C Series – Three types of engineered tents (designed for 90 mph 3 second wind gusts) were tested at two different pressures. The results of this series of tests are presented in Section 5.

Subsequent to the completion of the API funded tests BakerRisk performed two additional tests to evaluate the DLG performance as internal research. The response of the tents in these internal research tests, including the response of contents added to the tents, is discussed in Section 6.

The Explosion Research Cooperative (ERC) participants voted to release the data from a series of shock tube tests performed under their sponsorship that addressed the potential for the contents of a tent to become airborne. The data, in term of object mass and velocity, are provided in Section 7.

This report presents data only and does not provide any summary or conclusions on the acceptability of a tent siting approach.

2 OVERVIEW AND DEVELOPMENT OF THE API TEST PROGRAM

2.1 Originally Planned Test Matrix

The test series as originally planned was to include a total of twelve VCE tests using three tents in each test. The twelve tests were divided into four test series. The test matrix as originally planned is shown in Table 1. Each test series was to be conducted with each of the three tents at a fixed distance from the DLG. The changes in blast loading were to be

accomplished by changing the fuel concentration in the DLG. Changing either the tent location or type of tent would constitute a new test series. The tent locations are shown in Figure 2.

Table 1. Originally Planned Test Matrix

Test Series	Test	Articles	Orientation	Incident Pressure (psi) (Front of Tents)	Impulse (psi-ms)
A Series	1	— Non wind-rated pole tent with sides.	Longitudinal	0.6	18
	2	— Non wind-rated pole tent without sides.		0.9	27
	3	— Non wind-rated frame tent with straight members.		1.5	45
B Series	4	— Same as Series A	End-on	0.6	18
	5			0.9	27
	6			1.5	45
C Series	7	— Non wind-rated frame tent with curved members.	Longitudinal	0.6	18
	8	— Aluminum framed tent with rigid framed connections designed for 90 mph winds.		0.9	27
	9	— Aluminum framed tent with slip over connectors.		1.5	45
D Series	10	— Same as Series C	End-On	0.6	18
	11			0.9	27
	12			1.5	45

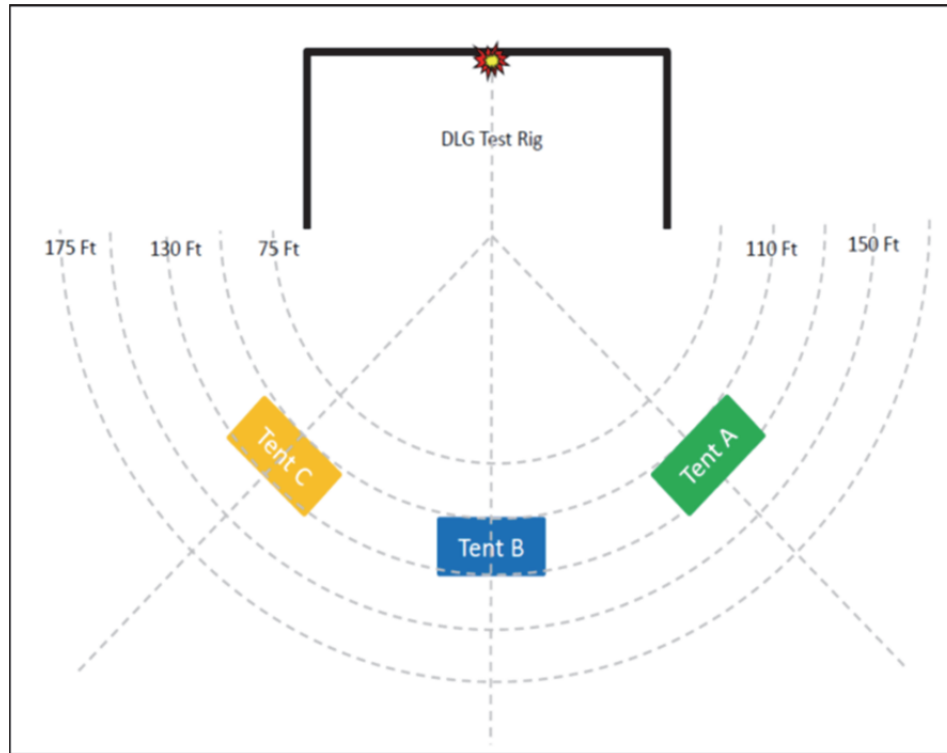


Figure 2. Typical Test Layout Showing Tent Locations

The test matrix was modified as the testing proceeded and all changes in the test matrix were coordinated with the API Tent Test Steering Committee. The primary reason for changing the test matrix was that the non-wind rated tents performed much better in Test Series A and B than was originally expected.

2.2 Final Test Matrix

The final test matrix as completed is shown in Table 2. The changes from the originally planned test series are as follows:

- the pressures and impulses for the Series A tests were reduced since the steering committee was not sure if the tents would survive the originally planned pressures;
- the pressures and impulses for the Series B tests were increased due to the performance of the tests in Series A;
- the tents tested in Series C were changed to more accurately reflect the types of tents used at industrial facilities based on an informal poll of the RP 756 committee members;
- the actual test pressure achieved in Test C01 was higher than planned, but since the tents performed well the decision was made by the committee to move the tents closer to the rig in order to obtain more information on potential failure modes;

- The actual test pressures achieved in Test C02 were somewhat lower than expected but still provided valuable information on the response of the tents.

Table 2. Final Test Matrix

Test Series	Articles (All Tests in Series)	Location on Test Bed	Orientation	Test Conditions		
				Test	Average Incident Pressure (psi)	Average Incident Impulse (psi-ms)
A Series	Non-wind rated pole tent with sides	A	Longitudinal	A01	< 0.1	N/A
	Non-wind rated frame tent with sides, straight members.	B		A02	0.2	12
	Non-wind rated pole tent without sides.	C		A03	0.9	18
B Series	Same as Series A	A	End-on	B01	0.4	11
		B		B06	0.7	17
		C		B08	1.4	16
C Series	Pole tent rated for 90 mph winds.	A	End-On	C01	4.7	43
	Aluminum framed tent with rigid framed connections designed for 90 mph winds.	B				
	Light cable stayed framed tent with slip over connectors rated for 90 mph winds.	C				
“D” Series	Same as Series C	A	Longitudinal	C02	3.3	43
		B				
		C				

2.3 Instrumentation and Camera Coverage

2.3.1 Instrumentation Locations

The pressure measurement system consisted of dynamic pressure gages connected to line-powered signal conditioners via microdots and BNC cables. The pressure sensors were amplified by various amounts based on the expected pressure at each gage location. Each pressure sensor was sampled by a PXI National Instruments system at 10,000 samples per second. Each pressure gage was mounted in a 1/2-inch thick steel plate and either mounted to a tent pole or placed in the ground.

Each tent was provided with pressure gages that recorded the pressures on the front of each tent surface. Keys to the gauge locations are shown in Figure 3 and Figure 4. Gauge 4 was moved from the interior of the tent to the front face between Gauges 3 and 5 for Tests C01 and C02.

2.3.2 Camera Coverage

High speed cameras (1000 fps) and high definition cameras (30 fps) were used to capture the response of each tent. Camera locations were varied to provide adequate viewing angles according to the tent locations and lighting conditions. The video files from the high speed cameras are provided to the API as part of the Data CD for the project.

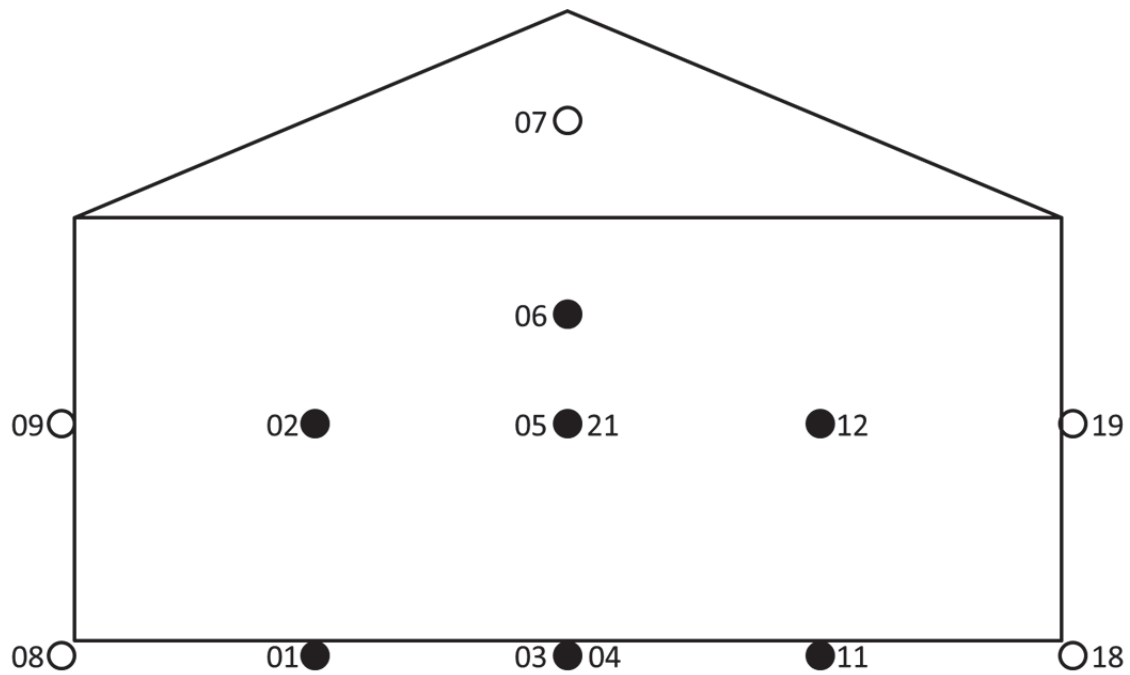


Figure 3. Pressure Gauge Layout – Front View of Tent – Facing Explosion

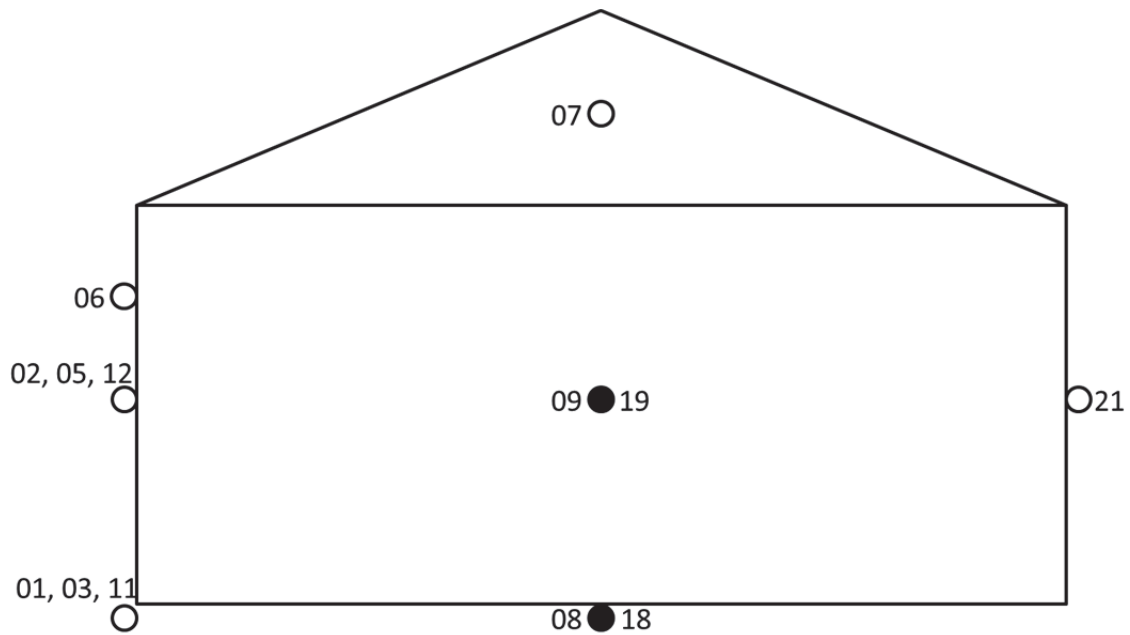


Figure 4. Pressure Gauge Layout – Side View of Tent

3 A SERIES TESTS

3.1 Tents Included

The three tents tested in the A series were all non-wind load rated tents. All tents had a 40 ft × 20 ft footprint and were large enough to be used for lunch tents or break tents for up to 100 people (based on event planning guidance of 8 sq. ft per person).

The pole tent with side walls is shown in Figure 5 and was placed on the test bed at Location A. The light framed tent with guy wires is shown in Figure 6; this tent was placed on the test bed at Location B. The pole tent without sides is shown in Figure 7; this tent was placed on the test bed at Location C. All tents were orientated with the long side facing the DLG rig. There vendor's information sheets for all three tents are provided in Annex A.

3.2 Test Bed Layout

The tents were placed on the test bed as shown in Figure 8 with the front face of each tent located 110 ft from the front of the DLG. The tents remained in these positions for all tests within this series.

3.3 Results of Test A02

3.3.1 Test Pressures

The peak pressures and associated impulses recorded during the test are summarized in Table 3. Data that was deemed suspect is marked with an asterisk (*). There was a significant variation in the pressures measured on the front of the pole tent with sides at test bed Location A. The full plots of the pressure data are provided in Annex B.

Test A02 resulted in the front wall loadings of between 0.14 and 0.16 psi (excluding the suspect data), and the average load from the test resulted in comparable loadings on each tent, with pressures measured on the interior of the tents at about 80% of the pressure measured on the ground at the sides of the tents. The typical pressure measured on the front of the tents (0.14 psi) is roughly equivalent to the stagnation pressure resulting from an 89 mph wind. The duration of the loading however; varying between 0.1 and 0.27 seconds, is much shorter than either sustained winds or wind gusts.

The data also indicates there was very little reflection of the incident pressure by the front wall of the tent.

A comparison of the internal pressure measured on the ground at the center of the tent footprint and ground pressures measured on either side of the tent for each tent are shown in Figure 9 and Figure 10. The internal pressure on the ground at the center of each tent tracks very closely with the pressure measured outside on the ground on either side of the tent.



Figure 5. Pole Tent with Sides



Figure 6. Light Framed Tent with Guy Wires



Figure 7. Pole Tent without Sides

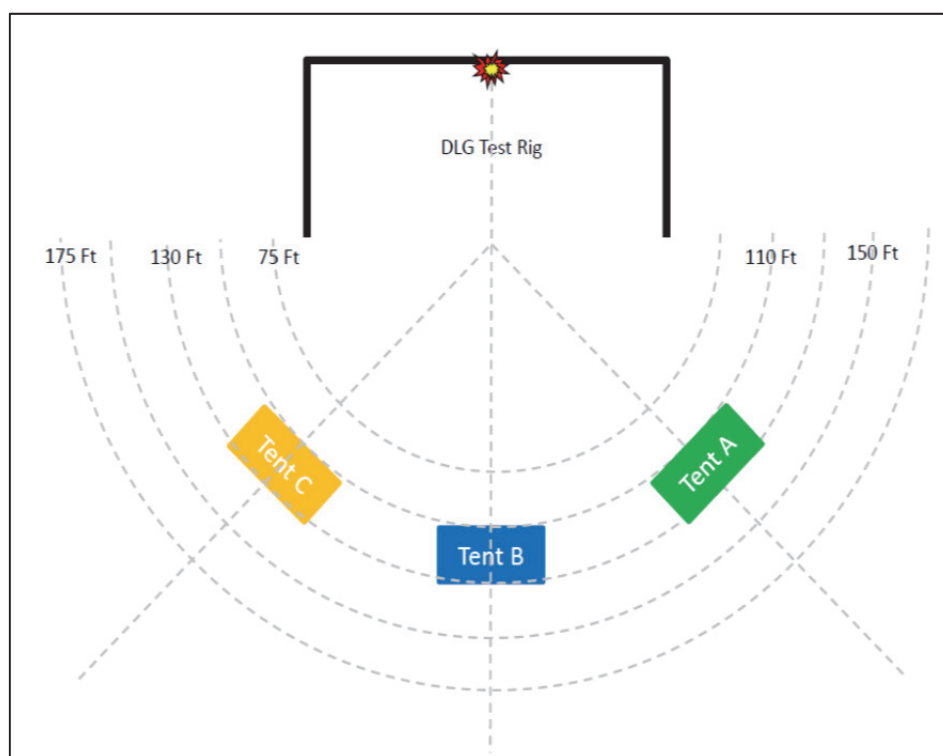


Figure 8. Layout of Tents for Test Series A

Table 3. Peak Pressures and Positive Phase Impulses Recorded for Test A02

Peak Pressures and Positive Phase Impulses – Test A02 2.7%Propane										
Location & Gauge No.		Pressure (psig)			Effective Duration (ms)			Impulse (psig-ms)		
		Tent A	Tent B	Tent C	Tent A	Tent B	Tent C	Tent A	Tent B	Tent C
Front Ground	1	0.14	0.15	0.15	171	213	173	12	16	13
	11	0.14	0.21	0.13	157	276	154	11	29	10
	3	0.10	0.12	0.13	100	100	185	5	6	12
Average Incident Load		0.13	0.16	0.14	143	197	171	9	17	12
Front Wall	5	0.61*	0.14	0.14	-	157	157	-	11	11
	6	0.10	0.14	0.13	160	157	169	8	11	11
	2	0.35	0.10	0.14	-	180	186	-	9	13
	12	0.01*	0.14	0.12	-	157	167	-	11	10
Average Front Wall Load		0.22	0.13	0.13	160	165	174	8	10	11
Average Reflection Factor		1.69	0.79	0.95	0.37	0.84	1.02	0.29	0.61	0.97
Side Ground	8	0.10	0.12	0.01*	160	150	800	8	9	4
	9	0.10	0.13	0.13	200	169	154	10	11	10
Side Wall	18	0.08	0.11	0.12	100	164	167	4	9	10
	19	0.09	0.14	0.11	178	157	182	8	11	10
Interior	4	0.10	0.08	0.09	180	200	178	9	8	8
Ratio of Interior to Side-On Load (%)		100	64	129	100	125	37	100	80	114
Front Roof	7	0.10	0.13	0.11	180	169	164	9	11	9
Back Roof	20	-	0.13	-	-	154	-	-	10	-
Back Wall	21	0.12	0.13	0.10	167	154	140	10	10	7

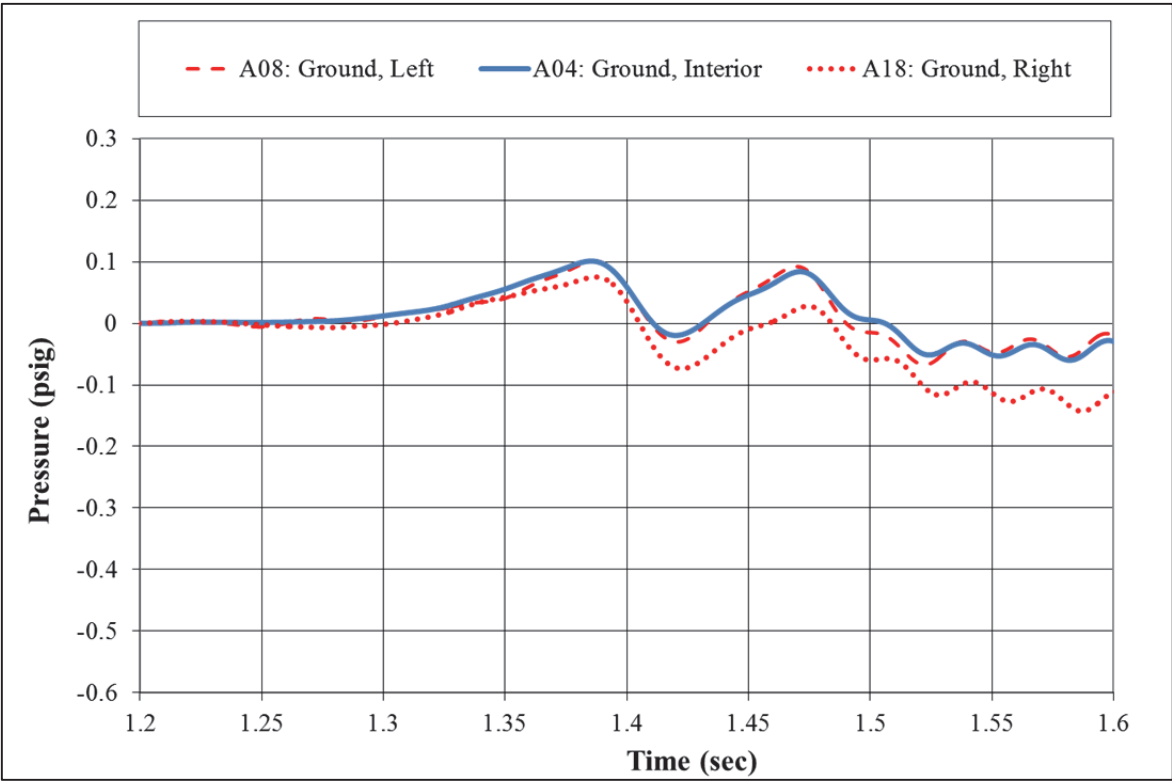


Figure 9. Internal vs. External Pressure, Non-Wind Rated Pole Tent with Sides, Test A02

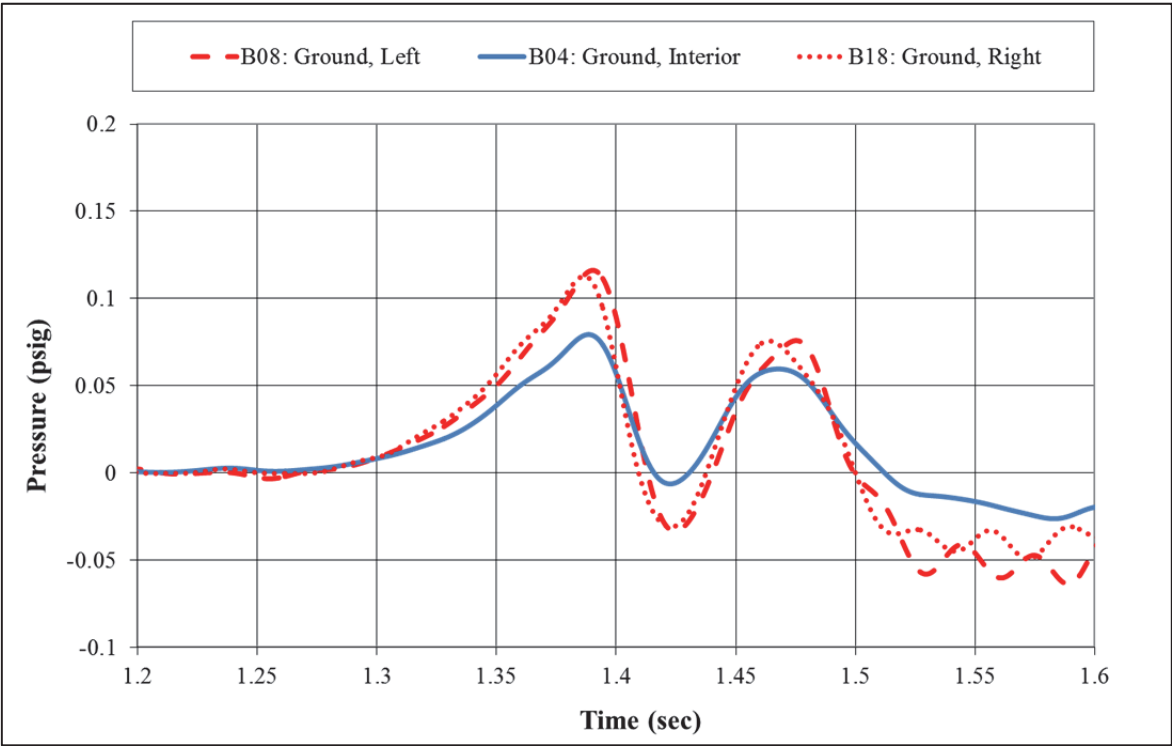


Figure 10. Internal vs. External Pressure, Non-Wind Rated Frame Tent, Test A02

3.3.2 Tent Response

There was no visible damage to the tents as a result of this test. The tents also displayed little motion during the test.

3.4 Results of Test A03

3.4.1 Test Pressures

The peak pressures and associated impulses recorded during the test are summarized in Table 4. The full plots of the pressure data are provided in Annex B. The test resulted in comparable loadings on each tent, and the pressures measured on the ground at the center of the tent footprint are somewhat reduced from the pressures measured on the ground at the sides of the tents. The left and right sides are selected for a viewer facing the front of the tent. A comparison of the internal pressure measured on the ground at the center of the tent footprint and ground pressures measure on either side of the tent for each tent are shown in Figure 11 and Figure 12.

3.4.2 Tent Response

The response of the tents to the blast loads was minimal. The pole tent with sides suffered some tearing of the connections of the sides to the top ropes, and minor movement of the side poles as shown in Figure 13 and Figure 14.

The light framed tent suffered one failed side panel and the bending of some frame components as shown in Figure 15 and Figure 16. Diagrams showing the frame deformations are provided in Figure 17 and Figure 18. Larger versions of these diagrams are provided in Annex B.

3.5 Summary and Findings Test Series A

The response of the tents tested in the A Series Tests would not have posed a hazard to potential occupants.

Table 4. Peak Pressures and Positive Phase Impulses Recorded for Test A03

Peak Pressures and Positive Phase Impulses - Test A03 3.0% Propane										
Location & Gauge No.		Pressure (psig)			Effective Duration (ms)			Impulse (psig-ms)		
		Tent A	Tent B	Tent C	Tent A	Tent B	Tent C	Tent A	Tent B	Tent C
Front Ground	1	0.83	0.91	0.93	41	37	43	17	17	20
	11	0.86	1.40	0.70	42	29	47	18	20	17
	3	0.92	1.01	1.09	36	37	33	17	19	18
Average Incident Load		0.87	1.11	0.91	40	34	41	17	19	18
Front Wall	5	-	1.11	0.87	-	36	45	-	20	19
	6	0.79	0.67	0.94	39	-	38	15	-	18
	2	-	0.59	0.80	-	37	43	-	11	17
	12	-	-	0.83	-	-	40	-	-	17
Average Front Wall Load		0.79	0.79	0.86	39	37	42	15	16	18
Average Reflection Factor		0.91	0.71	0.95	1	1	1	1	1	1
Side Ground	8	0.58	0.76	0.46	45	39	42	13	15	10
	9	0.58	0.83	0.80	46	35	39	13	15	16
Side Wall	18	0.83	1.07	0.59	37	34	45	15	18	13
	19	0.44	1.13	0.68	48	33	41	11	18	14
Interior	4	0.54	0.43	0.50	49	42	46	13	9	12
Ratio of Interior to Side-On Load (%)		93	54	79	108	114	114	100	60	92
Front Roof	7	0.44	0.93	0.74	50	37	46	11	17	17
Back Roof	20	-	0.87	-	-	51	-	-	22	-
Back Wall	21	0.67	0.79	0.53	42	43	43	14	17	12

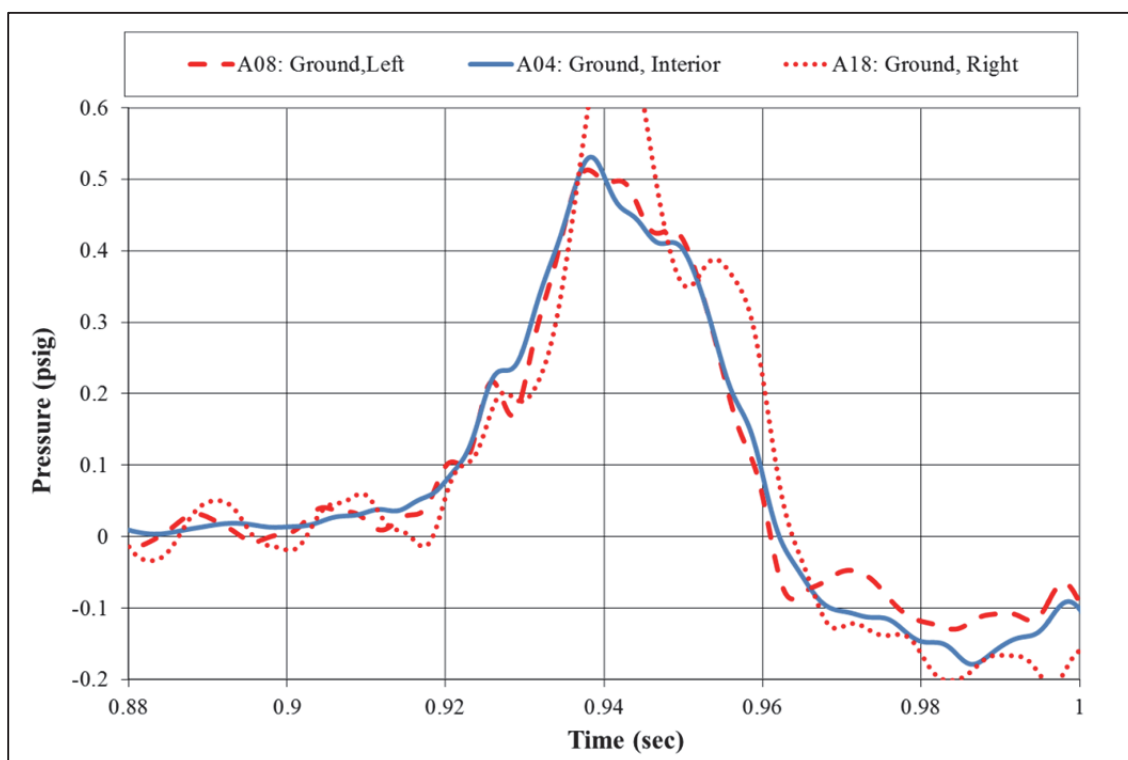


Figure 11. Internal vs. External Pressure, Non-Wind Rated Pole Tent with Sides, Test A03

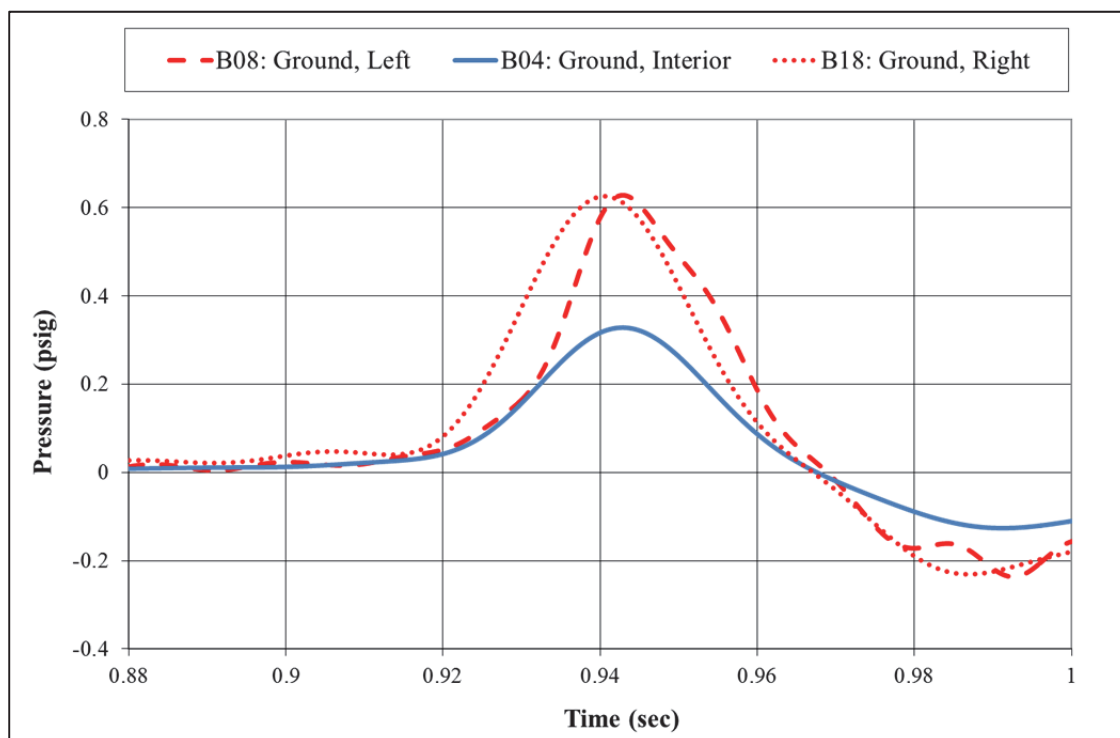


Figure 12. Internal vs. External Pressure, Non-Wind Rated Frame Tent, Test A03



Figure 13. Damage to Non-Wind Rated Pole Tent with Sides, Test A03



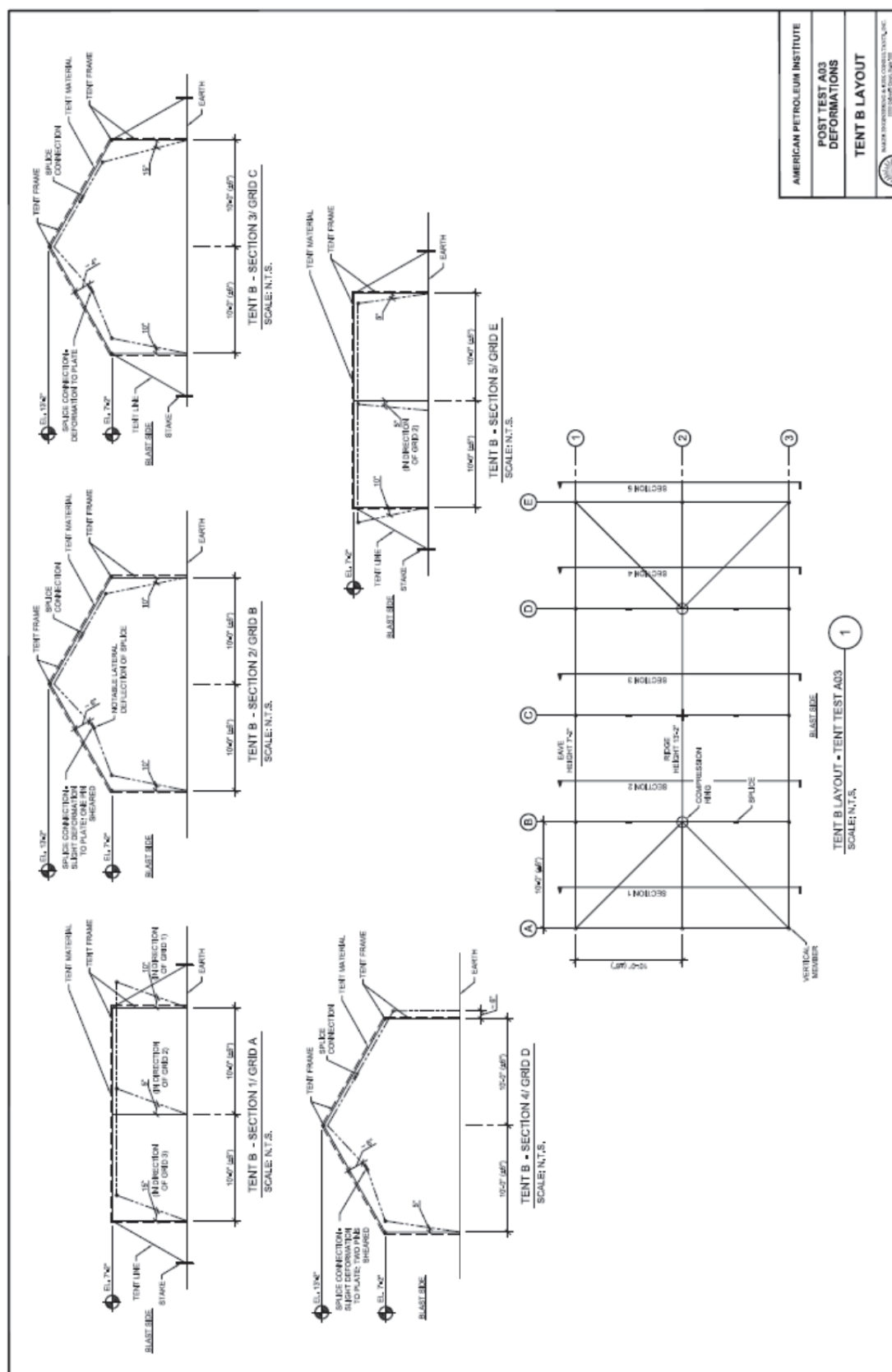
Figure 14. Rope to Wall Panel Connection, Non-Wind Rated Pole Tent w/ Sides, Test A03



Figure 15. Damage to Light Frame Tent, Test A03



Figure 16. Damage to Hinge of Roof Frame Member, Light Frame Tent, Test A03



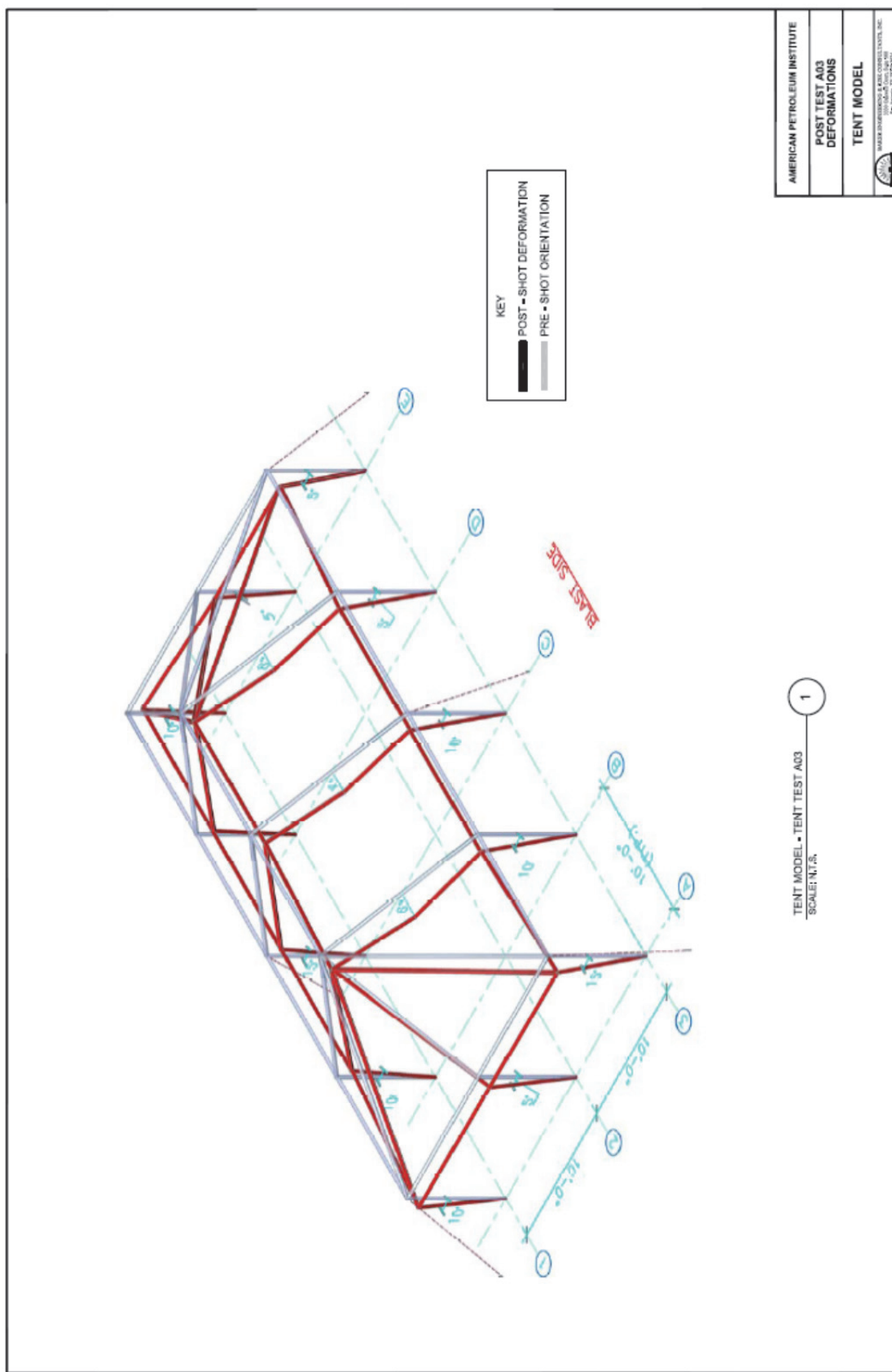


Figure 18. 3D Rendering of Deformed Light Frame Tent, Test A03

4 B SERIES TESTS

4.1 Tents Included

The tents tested in the series B tests were the same as those tested in the A Series tests. However, the tents were placed such that one end of the tent faced the DLG.

4.2 Test Bed Layout

The tents were located on the test bed as shown in Figure 19. The end of each tent was 110 ft from the front of the DLG. The tents remained in these positions for all of the tests within the test series.

4.3 Results of Test B01

4.3.1 Pressures Measured

The peak pressures and associated impulses recorded during the test are summarized in Table 5.

The full plots of the pressure data are provided in Annex C. The typical pressure measured on the end of the tents facing the DLG was 0.37 psi. The comparison of the internal pressure to the external pressure on the ground on each side for the pole tent with sides and the light frame tent is shown in Figure 20.

4.3.2 Tent Response

Post-test photos of the three tents are provided in Figure 21 through Figure 25. The deformations of all three tents are shown in Figure 26 through Figure 29. The tents only suffered minor damage during the test. The damage to the light frame tent was primarily due to permanent deformations of the vendor specific hinges on the long frame members. These hinges are used to allow the long members to be shipped as a single piece that can be unfolded to its full length when the tent is erected.

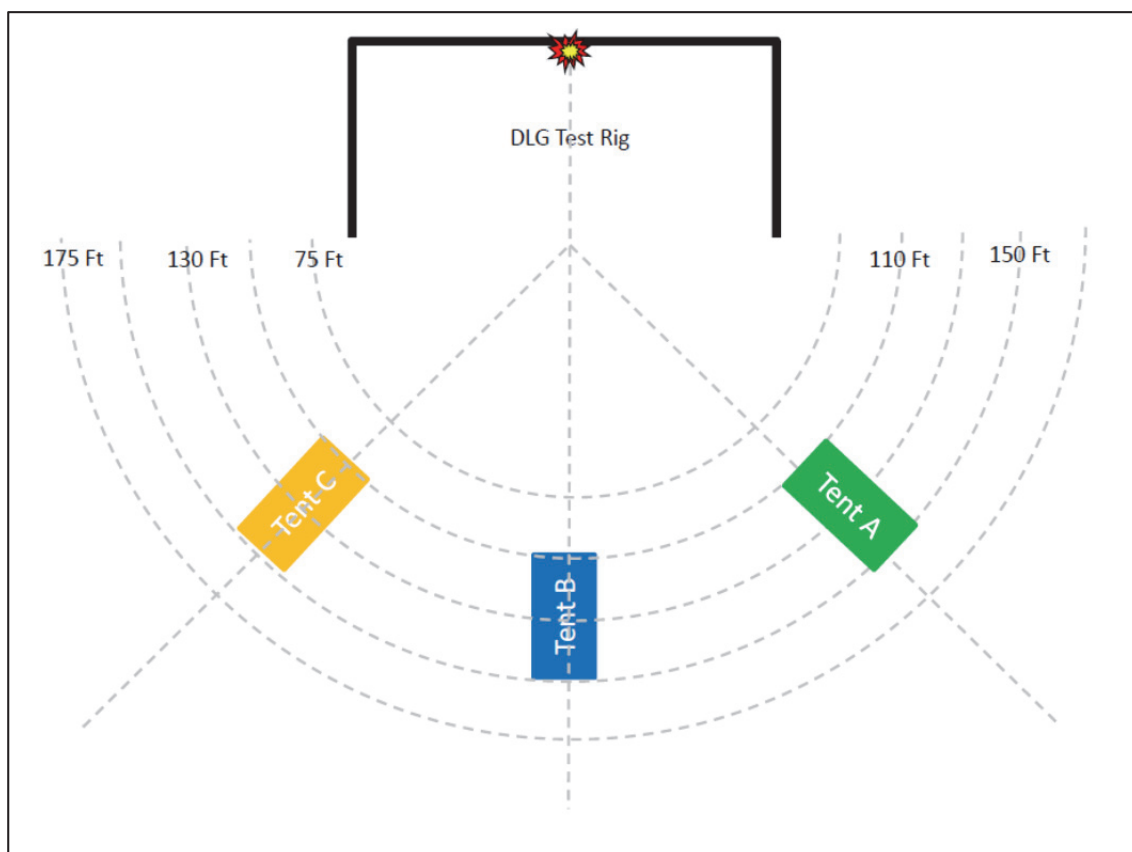


Figure 19. Layout of Tents for Test Series B

Table 5. Peak Pressures and Positive Phase Impulses Recorded for Test B01

Peak Pressures and Positive Phase Impulses Test B01 2.8% Propane										
Location & Gauge No.		Pressure (psig)			Effective Duration (ms)			Impulse (psig-ms)		
		Tent A	Tent B	Tent C	Tent A	Tent B	Tent C	Tent A	Tent B	Tent C
Front Ground	1	0.40	0.35	0.39	55	63	62	11	11	12
	11	0.33	0.40	0.36	67	60	61	11	12	11
	3	0.40	0.39	0.35	50	56	63	10	11	11
Average Incident Load		0.38	0.38	0.37	57	60	62	11	11	11
Front Wall	5	0.32	0.43	0.37	56	56	59	9	12	11
	6	0.31	0.42	0.37	52	62	59	8	13	11
	2	0.16	0.25	0.36	100	64	61	8	8	11
	12	0.37	0.36	0.28	54	67	71	10	12	10
Average Front Wall Load		0.28	0.34	0.34	69	64	64	9	11	11
Average Reflection Factor		0.74	0.90	0.92	1.20	1.07	1.03	0.81	0.97	0.94
Side Ground	8	0.30	0.27	0.18	53	67	67	8	9	6
	9	0.25	0.28	0.31	64	64	65	8	9	10
Side Wall	18	0.32	0.26	0.28	56	62	64	9	8	9
	19	0.18	0.36	0.19	56	56	74	5	10	7
Interior	4	0.40	0.16	-	70	75	-	14	6	-
Ratio of Interior to Side-On Load (%)		145	58	-	119	115	-	175	67	-
Front Roof	7	0.17	0.36	0.15	71	61	80	6	11	6
Back Roof	20	N/A	0.31	N/A	-	65	-	-	10	-
Back Wall	21	0.32	0.28	-	56	64	-	9	9	-

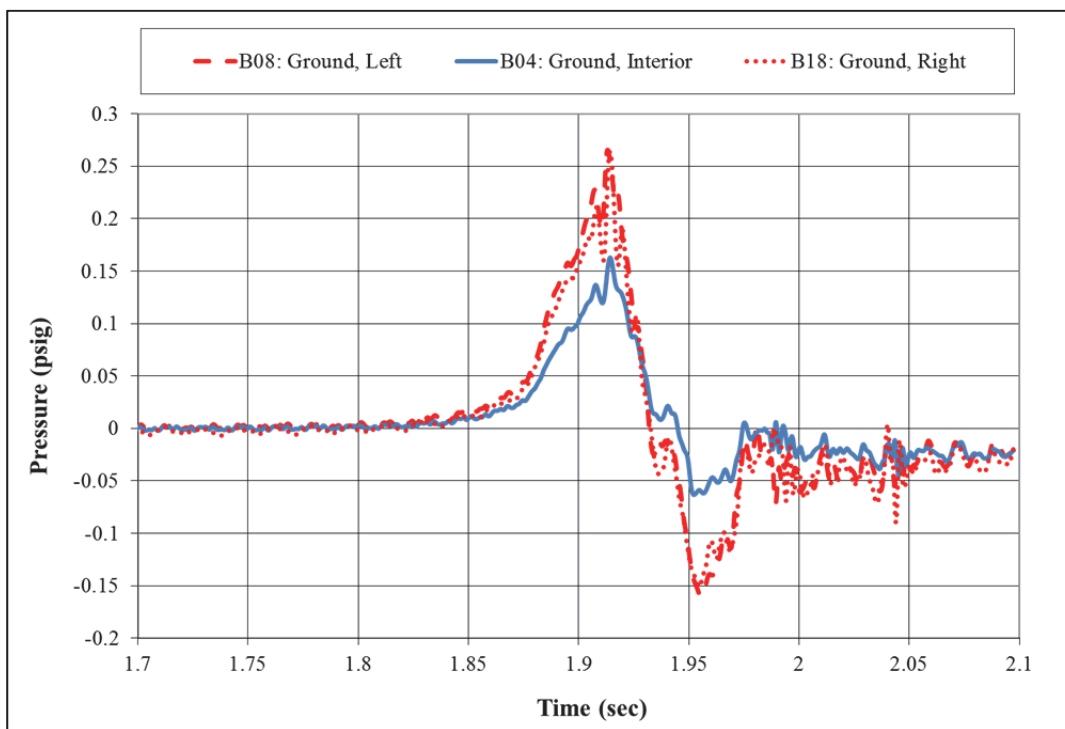


Figure 20. Comparison of Internal and External Pressure – Tent B, Test B01



Figure 21. Pole Tent with Sides Post Test B01



Figure 22. Interior of Pole Tent with Sides Test B01



Figure 23. Light Frame Tent Post Test B01



Figure 24. Interior of Light Frame Tent Post-Test B01



Figure 25. Pole Tent without Sides Post Test B01

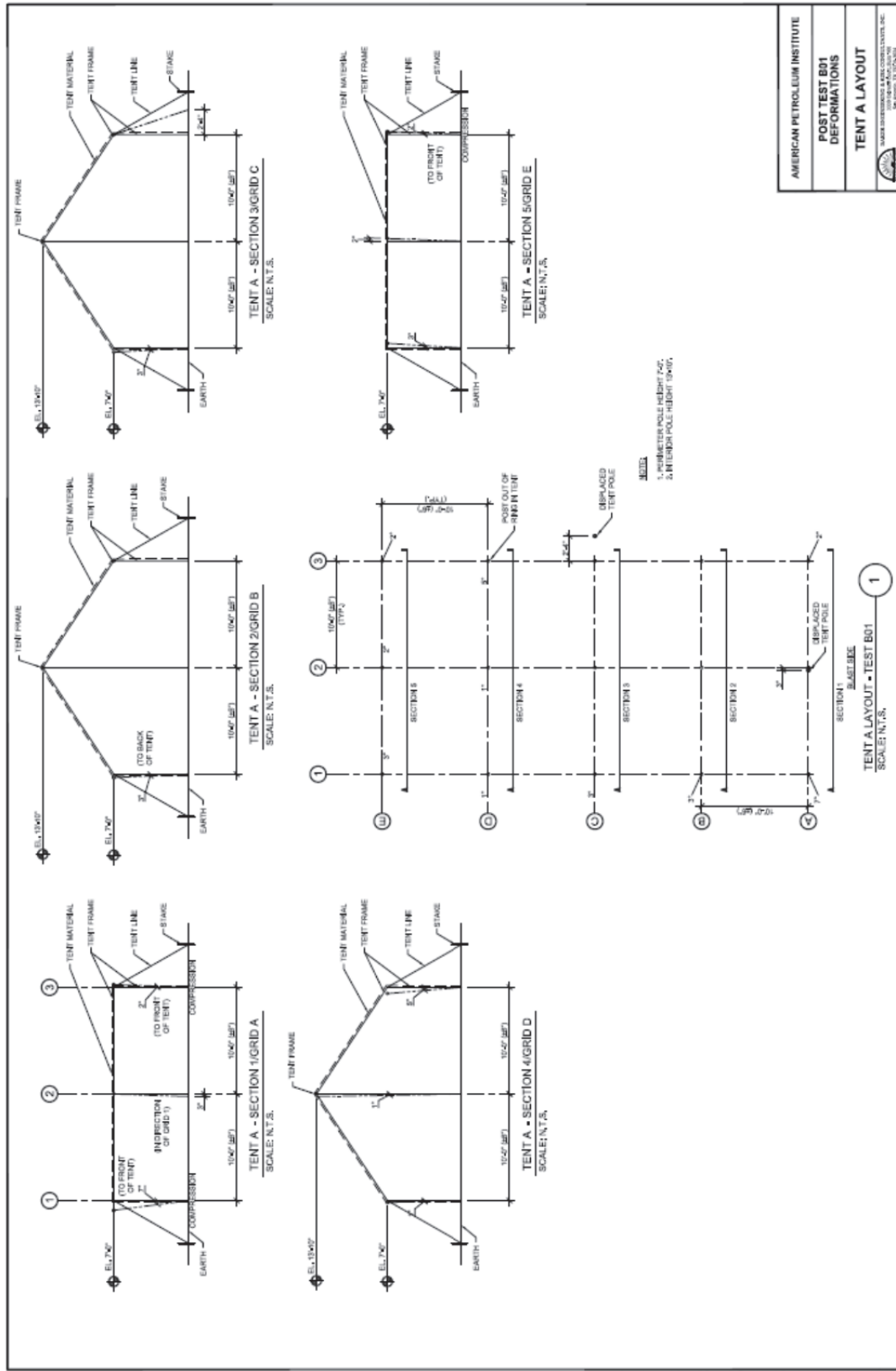
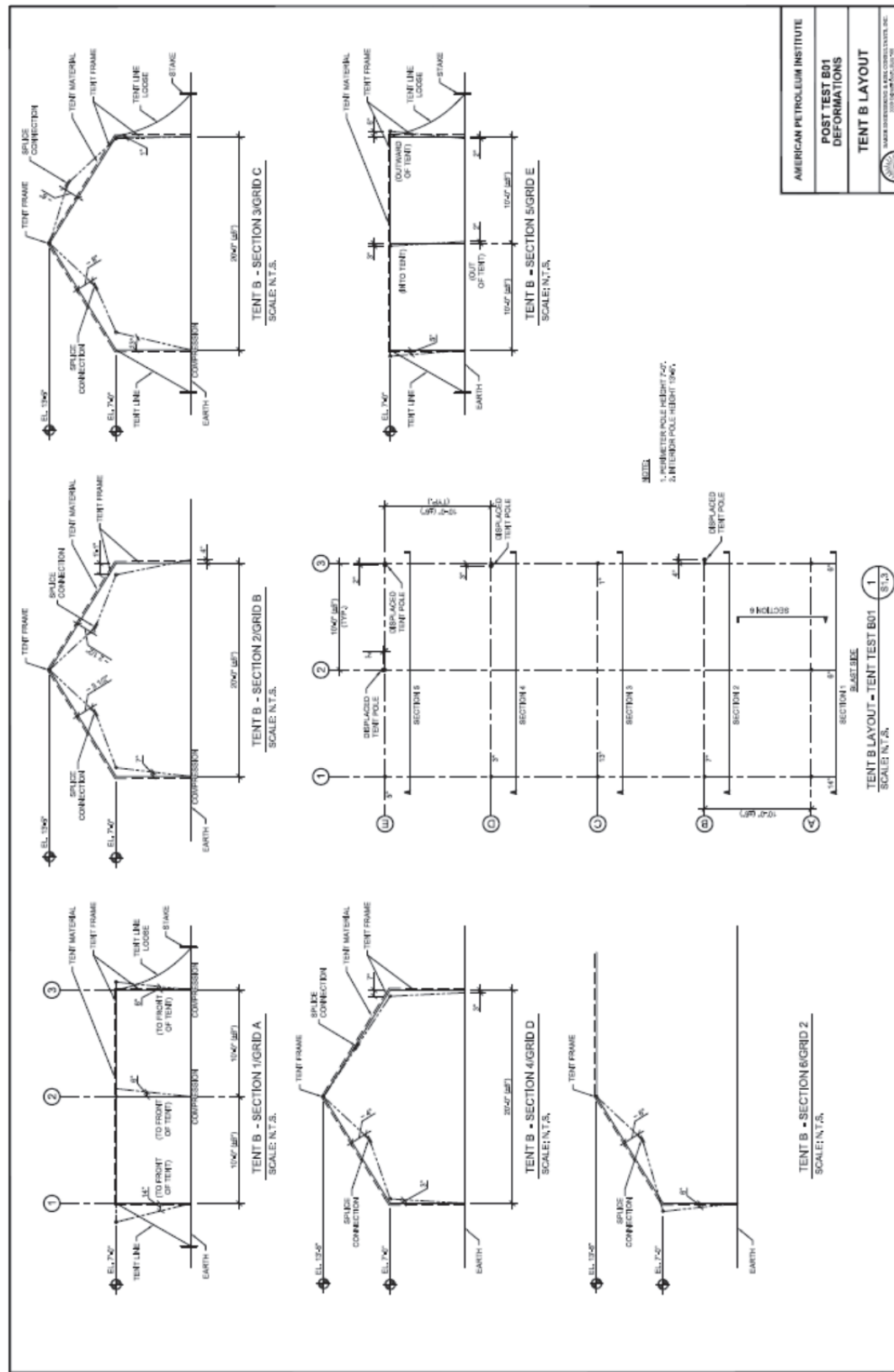


Figure 26. Deformations of Pole Tent with Sides Test B01



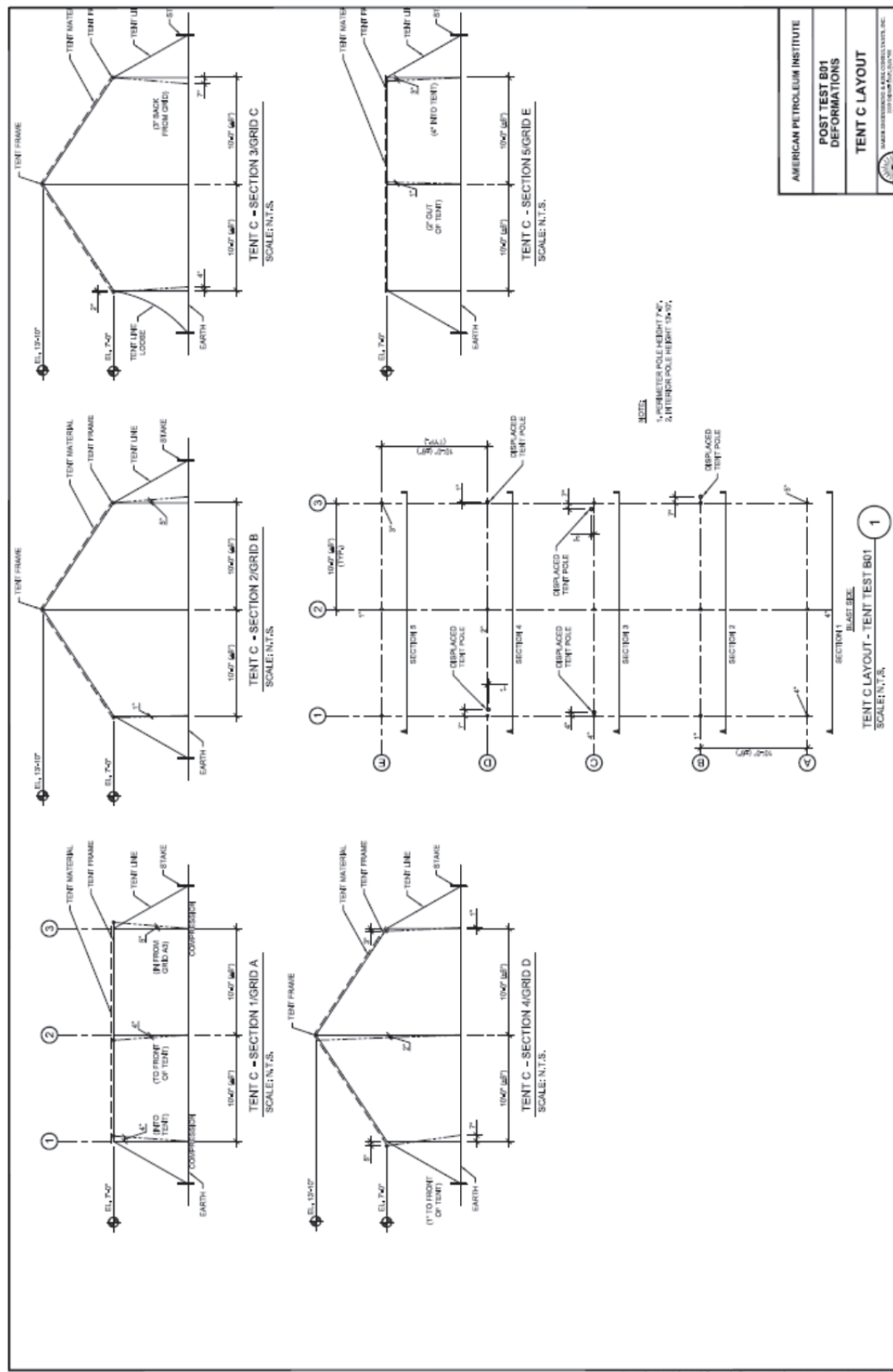
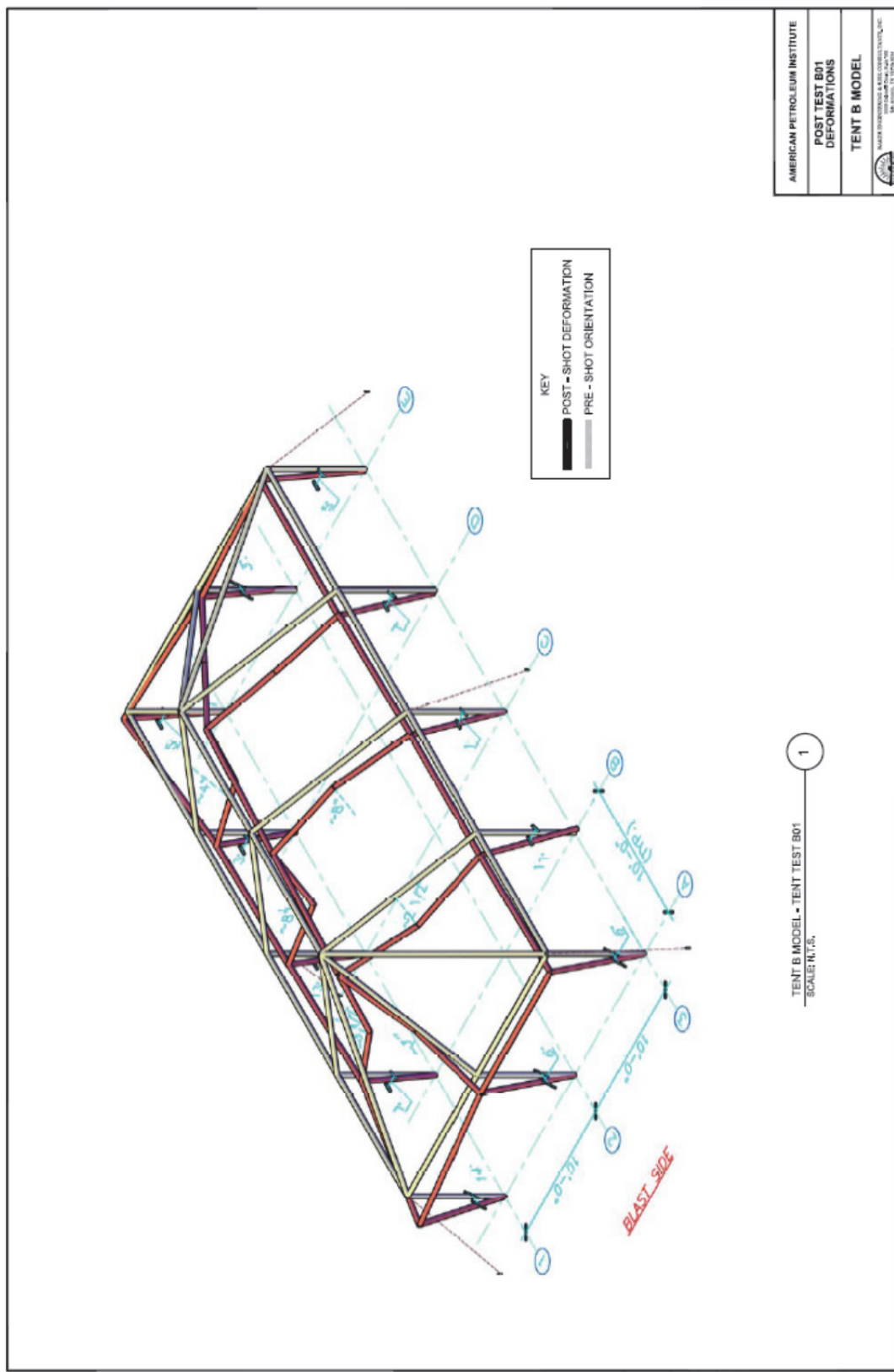


Figure 28. Deformations of Pole Tent without Sides Test B01



4.4 Results - Test B06

4.4.1 Pressures Measured

The peak pressures and associated impulses recorded during the test are summarized in Table 6. The full plots of the pressure data are provided in Annex C. The typical pressure measured on the end of the tents facing the DLG was approximately 0.65 psi. The comparison of the internal pressure to the external pressure on the ground on each side for the light framed tent and the pole tent without sides are shown in Figure 30 and Figure 31, respectively. The pressure gage at the center of the pole tent with no sides failed to register a signal.

4.4.2 Tent Response

Post-test photos of all three tents are provided in Figure 32 through Figure 38. The deformations of all tents are shown in Figure 39 through Figure 42. The deformations of the tents were relatively minor. However one of the proprietary connectors on the light framed tent was cracked (the connector at the top of the tent pole in Figure 37) and had to be repaired prior to the continuation of the test program.

Table 6. Peak Pressures and Positive Phase Impulses Recorded for Test B06

Peak Pressures and Positive Phase Impulses Test B06 3.1% Propane										
Location & Gauge No.		Pressure (psig)			Effective Duration (ms)			Impulse (psig-ms)		
		Tent A	Tent B	Tent C	Tent A	Tent B	Tent C	Tent A	Tent B	Tent C
Front Ground	1	0.63	0.65	0.74	48	49	49	15	16	18
	11	0.63	0.79	0.66	51	41	48	16	16	16
	3	0.50	0.72	0.67	52	44	51	13	16	17
Average Incident Load		0.59	0.72	0.69	50	45	49	15	16	17
Front Wall	5	-	0.79	0.81	-	56	42	-	22	17
	6	0.75	-	0.81	48	-	42	18	-	17
	2	0.33	0.51	0.65	55	67	46	9	17	15
	12	0.65	1.0	0.59	46	35	51	15	18	15
Average Front Wall Load		0.58	0.76	0.68	50	34	46	14	12	16
Average Reflection Factor		0.98	1.06	0.99	0.99	0.75	0.94	0.95	0.73	0.92
Side Ground	8	-	0.51	0.24	-	55	58	-	14	7
	9	0.37	0.50	0.56	54	52	46	10	13	13
Side Wall	18	0.48	0.63	0.51	54	-	47	13	-	12
	19	0.44	0.63	0.38	55	44	53	12	14	10
Interior	4	0.44	0.27	0.38	55	52	53	12	7	10
Ratio of Interior to Side-On Load (%)		-	53	-	-	97	-	-	52	-
Front Roof	7	0.28	0.70	-	57	49	-	8	17	-
Back Roof	20	-	0.56	-	-	50	-	-	14	-
Back Wall	21	0.45	0.51	-	53	47	-	12	12	-

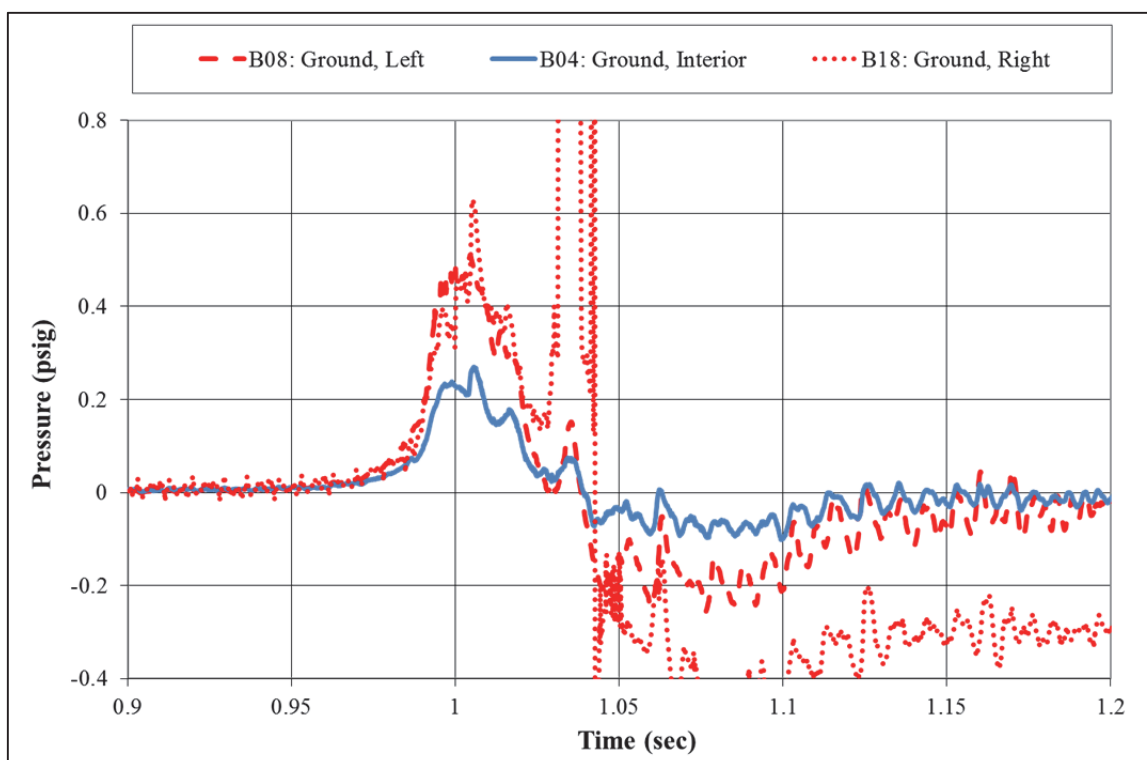


Figure 30. Comparison of Internal and External Pressure – Tent B, Test B06

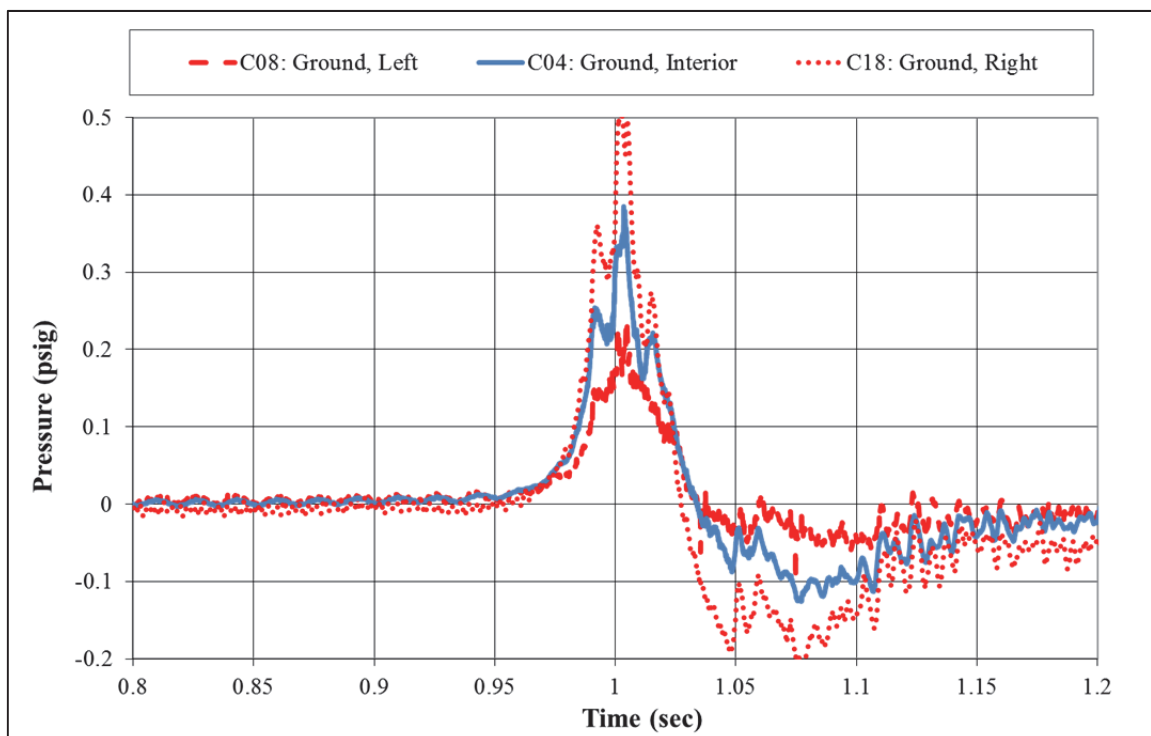


Figure 31. Comparison of Internal and External Pressure – Tent C, Test B06



Figure 32. Pole Tent with Sides Post Test B06



Figure 33. Interior of Pole Tent with Sides Post-Test B06



Figure 34. Rear of Light Frame Tent Post-Test B08



Figure 35. Exterior of Light Frame Tent Post-Test B06



Figure 36. Interior of Light Frame Tent Post-Test B06



Figure 37. Bent Frame on Light Frame Tent Post Test B06



Figure 38. Pole Tent without Sides Post-Test B06

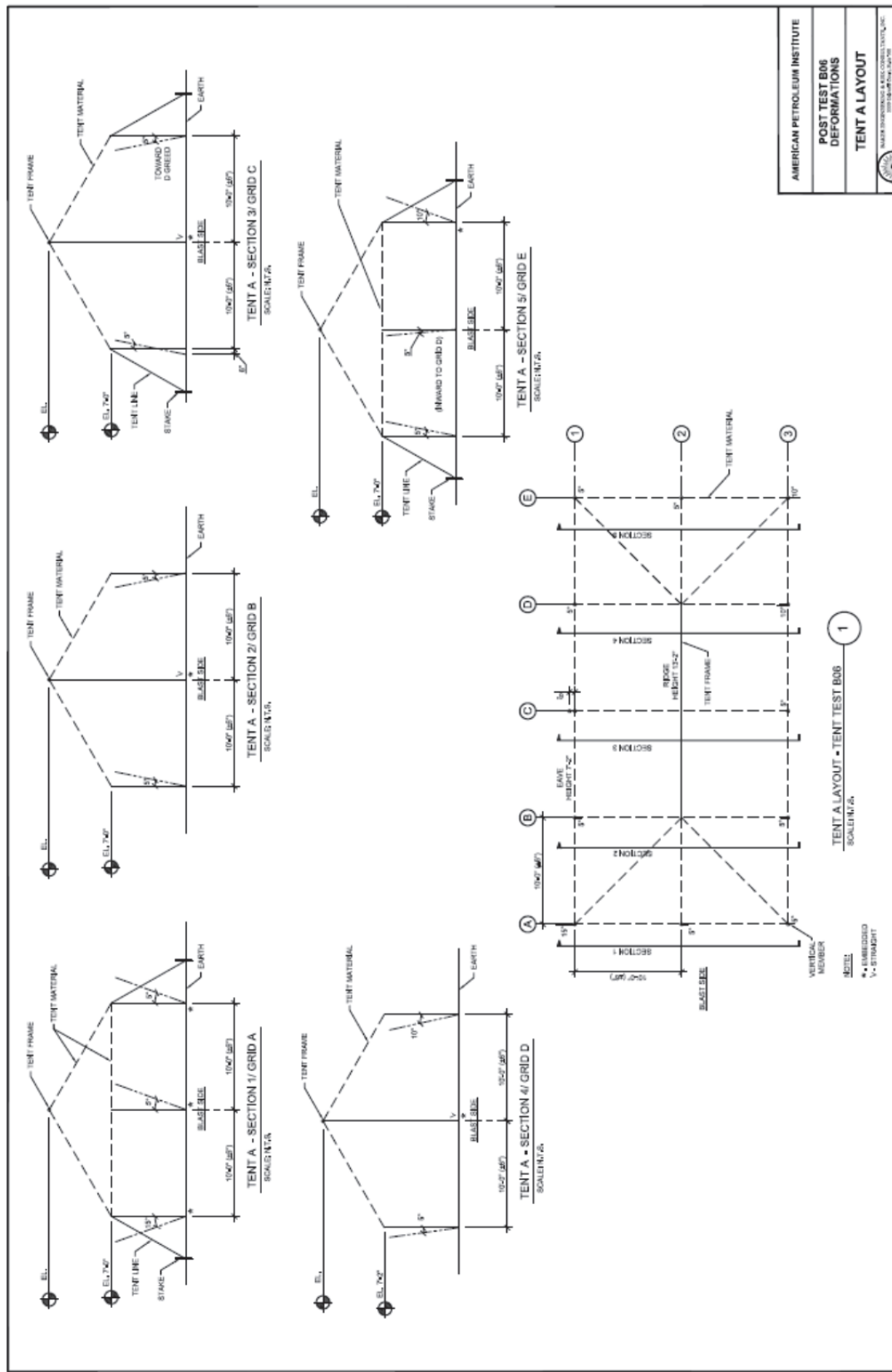


Figure 39. Deformations of Pole Tent with Sides Test B06

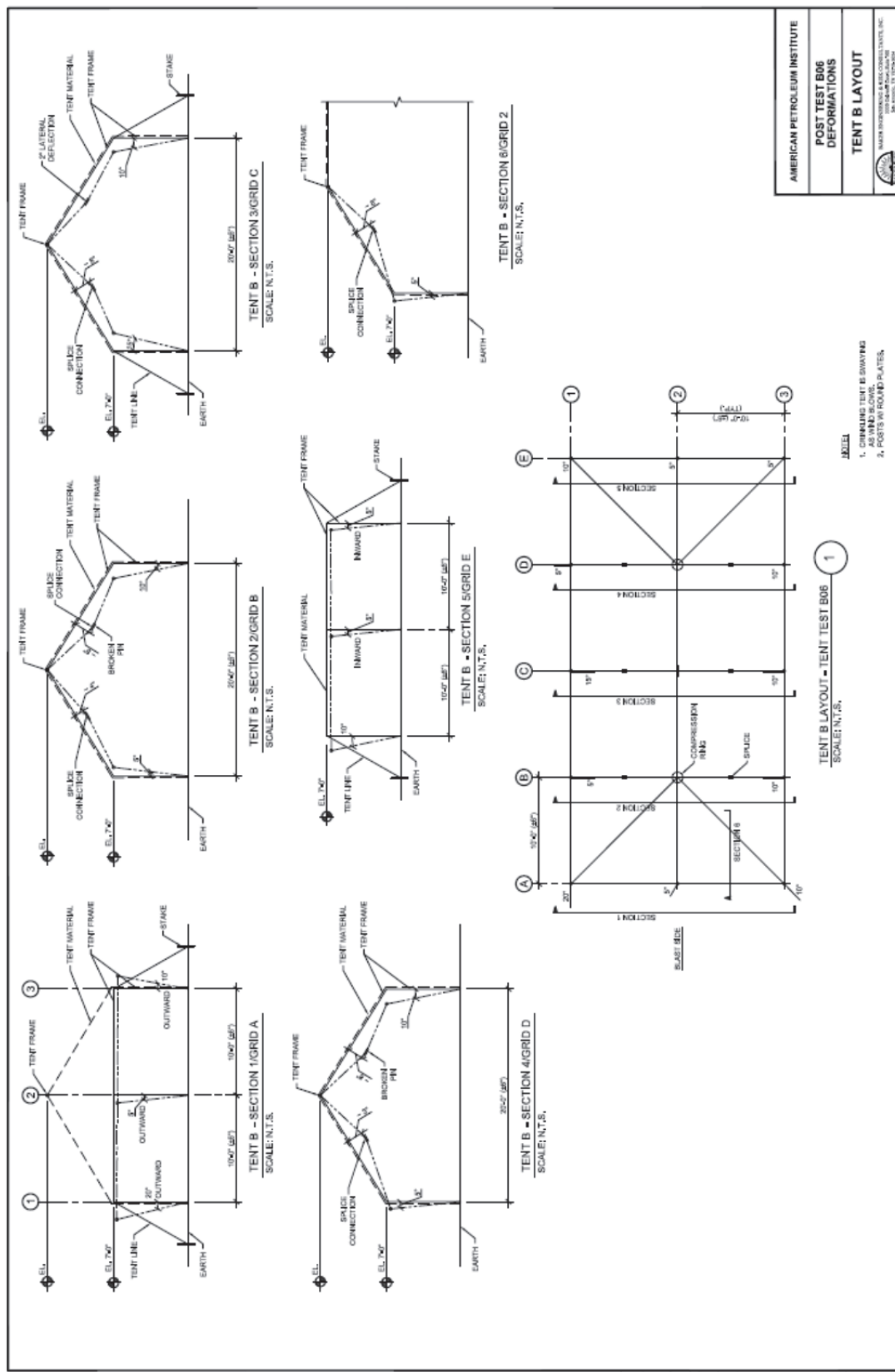


Figure 40. Deformations of Light Frame Tent Test B06

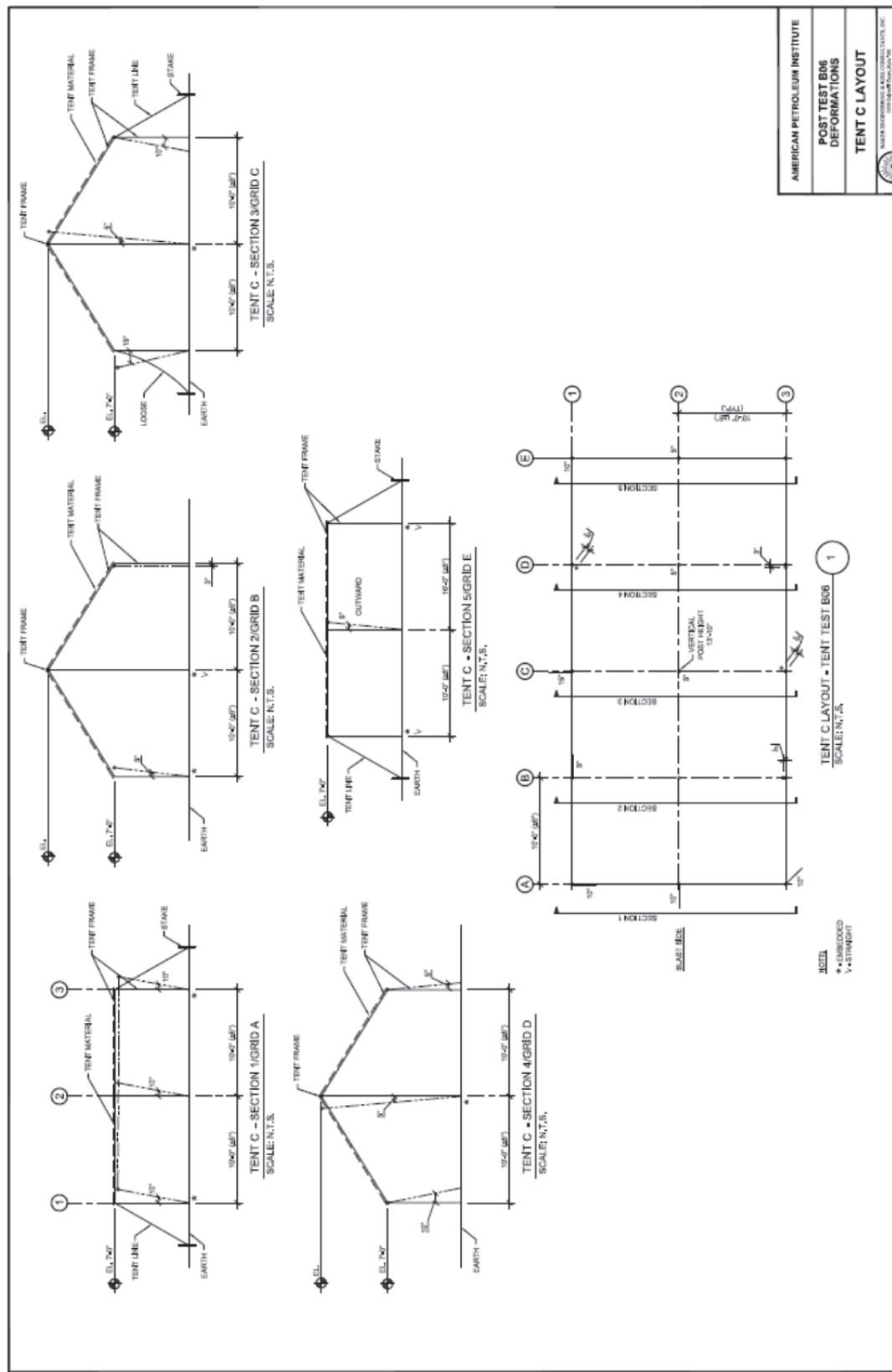


Figure 41. Deformations of Pole Tent without Sides Test B06

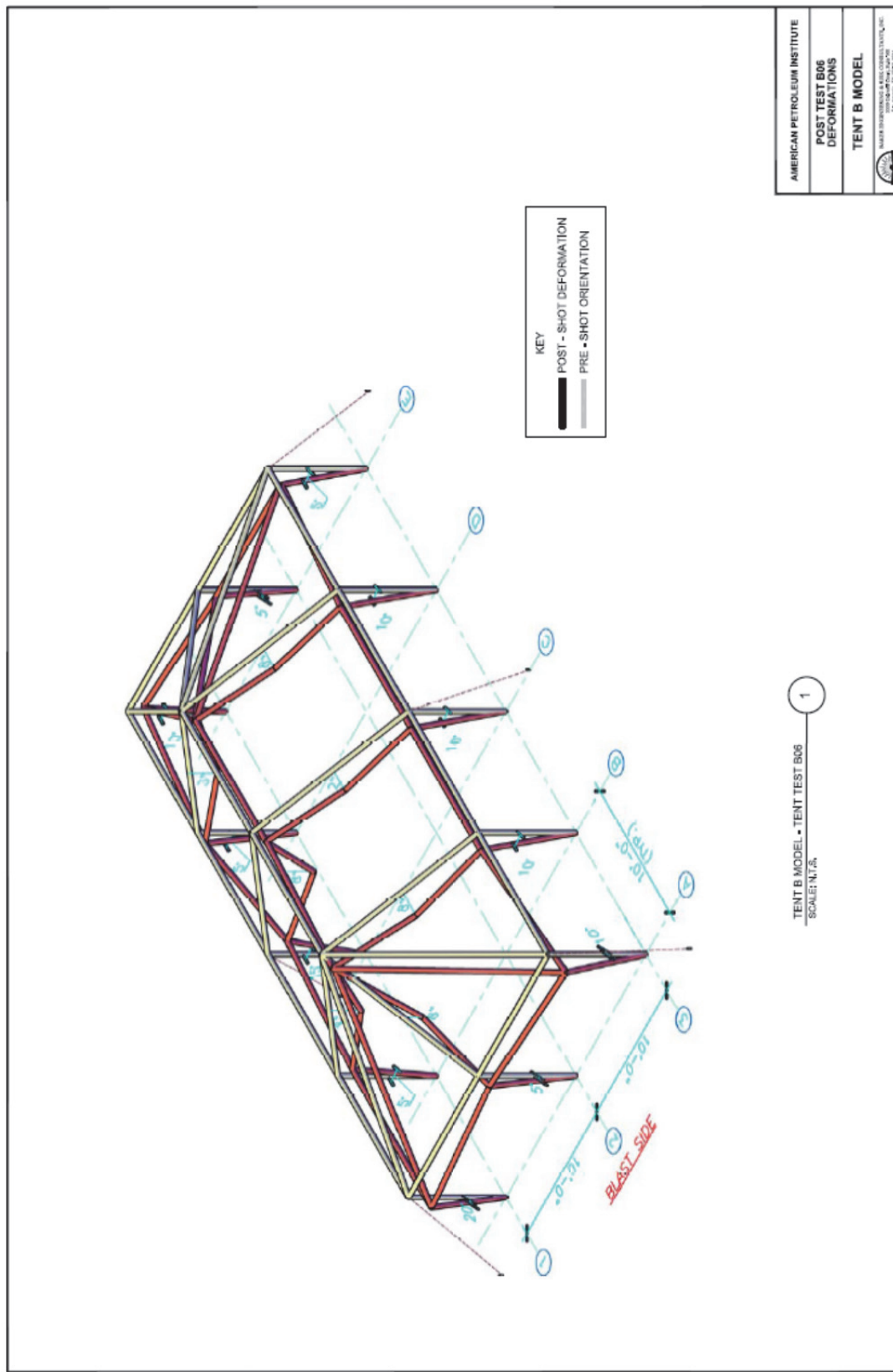


Figure 42. 3D Rendering of Light Frame Tent Deformations Test B06

4.5 Results Test B08

4.5.1 Pressure Measured

The peak pressures and associated impulses recorded during the test are summarized in Table 7. The full plots of the pressure data are provided in Annex C. The typical incident pressure measured on the end of the pole tent with walls and the light framed tent was 1.4 psi. The pressure measured at the front of the pole tent without sides was 0.8 psi. The comparison of the internal pressure to the external pressure on the ground on each side for the pole tent with sides and the light frame tent is shown in Figure 43. Note the gauge record for A18 in the figure shows a baseline shift.

4.5.2 Tent Response

Post-test photos of the three tents are shown in Figure 44 through Figure 48. The light framed tent and the pole tent with sides suffered similar damage in the form of torn panels and displaced poles and frame members. The tent without sides suffered no significant damage. The deformations of all three tents are shown in Figure 49 through Figure 52.

4.6 Summary and Findings from Test Series B

The damage suffered by the light frame and pole tent with sides was primarily due to the fabric tearing loose from the attachment points and the motion of the poles and framing members at their unrestrained braces. There was also minor damage to the light frame tent connectors, which were of a proprietary design. Since these connectors were starting to crack and deform the decision by the steering committee was to perform the rest of the testing with more robust tents that were engineered to withstand 90 mph wind loads. Since the pole tent without sides had not been damaged, this type of tent was eliminated from the rest of the test program.

Table 7. Peak Pressures and Positive Phase Impulses Recorded for Test B08

Peak Pressures and Positive Phase Impulses Test B08 3.7%Propane										
Location & Gauge No.		Pressure (psig)			Effective Duration (ms)			Impulse (psig-ms)		
		Tent A	Tent B	Tent C	Tent A	Tent B	Tent C	Tent A	Tent B	Tent C
Front Ground	1	1.4	1.4	1.0	30	34	35	21	24	17
	11	1.5	1.5	0.9	29	33	35	21	25	15
	3	1.1	1.4	0.8	17	34	39	9	23	16
Average Incident Load		1.31	1.44	0.88	25	33	36	17	24	16
Front Wall	5	2.3	2.0	0.5	17	24	50	19	24	13
	6	2.3	1.0	0.5	20		34	23	-	8
	2	2.2	1.3	1.1	16	34	28	17	23	15
	12	4.1	1.7	0.9	13	31	37	27	26	16
Average Front Wall Load		2.9	1.4	0.81	16	22	33	22	16	13
Average Reflection Factor		2.2	0.94	0.92	0.65	0.65	0.90	1.31	0.68	0.81
Side Ground	8	-	1.4	-	-	29	-	-	20	-
	9	.81	1.2	1.3	35	29	20	14	17	13
Side Wall	18	1.2	-	0.58	26	-	38	15	-	11
	19	1.1	-	0.42	2	-	-	1	-	-
Interior	4	1.2	0.64	0.43	29	28	42	17	9	9
Ratio of Interior to Side-On Load (%)		-	50	-	-	97	-	-	49	-
Front Roof	7	0.60	2.1	0.36	32	22	-	10	23	-
Back Roof	20	-	-	-	-	-	-	-	-	-
Back Wall	21	1.2	1.8	0.58	24	21	28	14	19	8

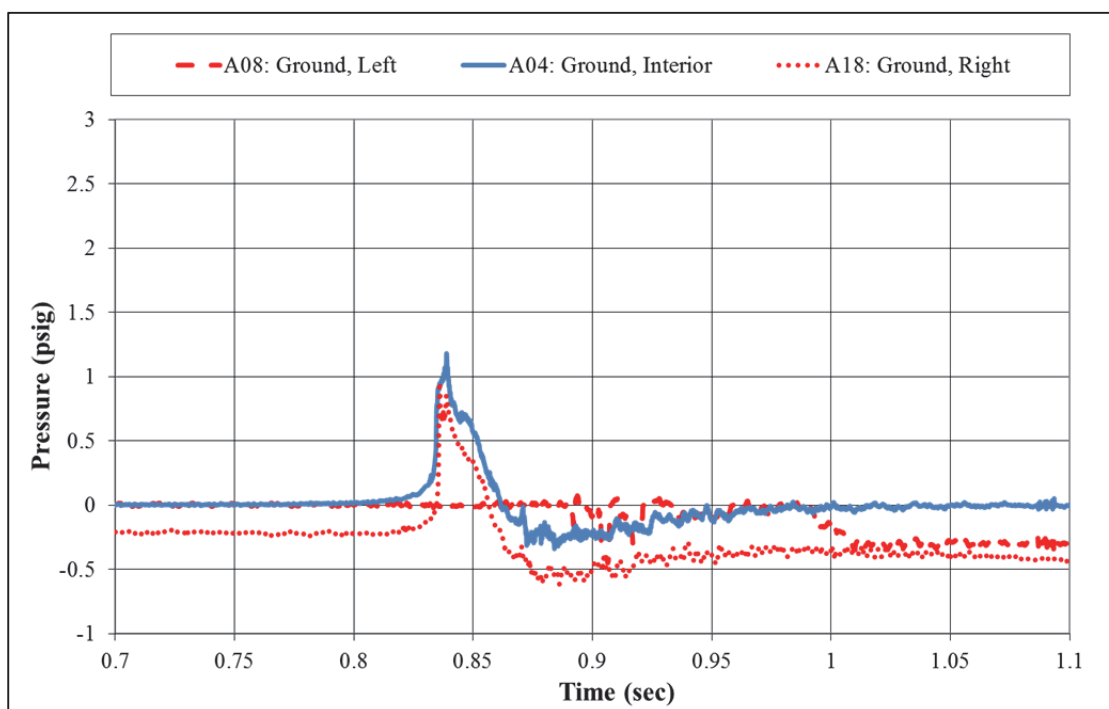


Figure 43. Comparison of Internal and External Pressure – Tent A, Test B08



Figure 44. Pole Tent with Sides Post-Test B08



Figure 45. Interior of Pole Tent with Sides Post-Test B08



Figure 46. Light Frame Tent Post-Test B08



Figure 47. Interior of Light Frame Tent Post-Test B08



Figure 48. Pole Tent without Sides Post-Test B08

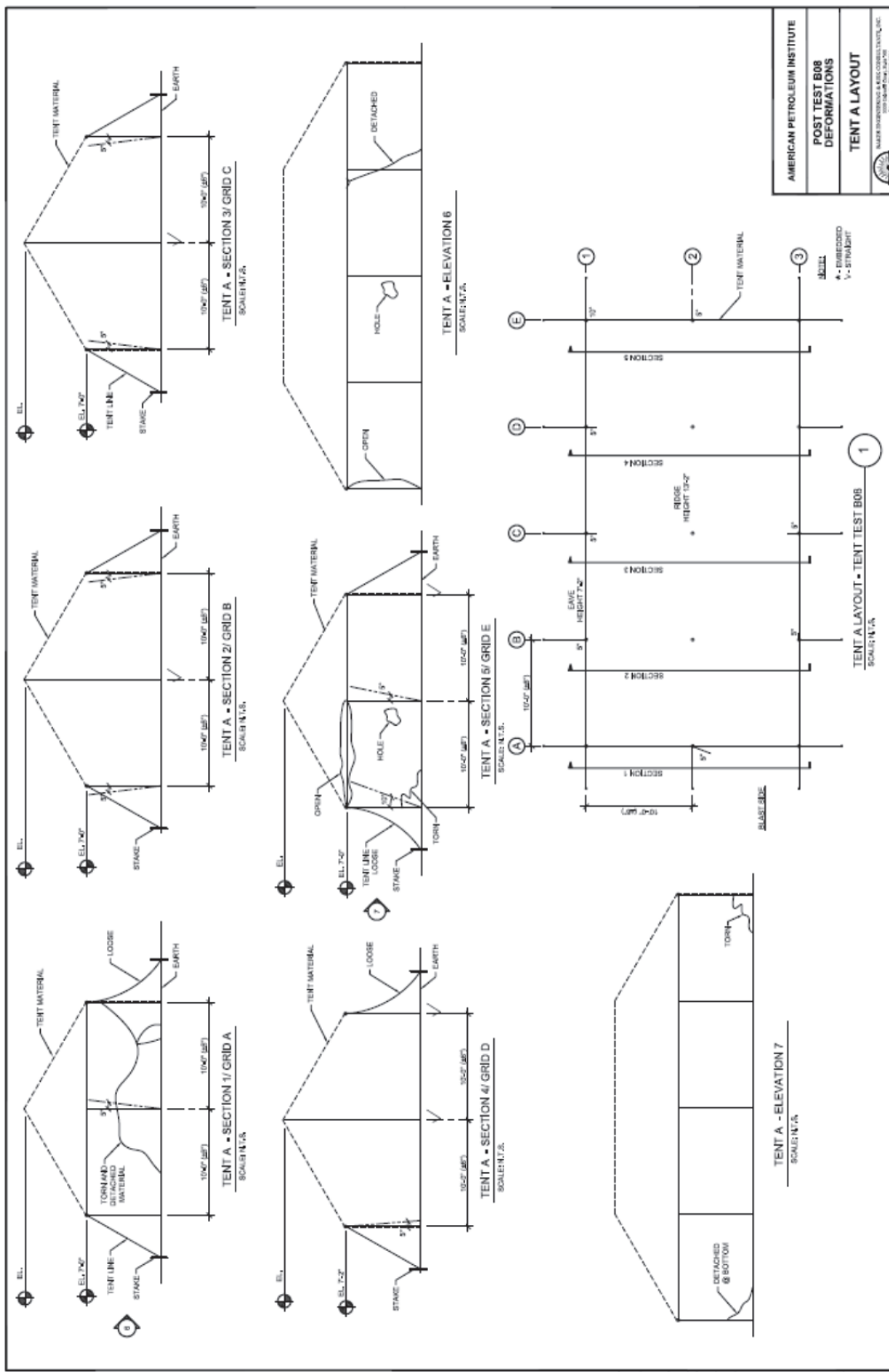
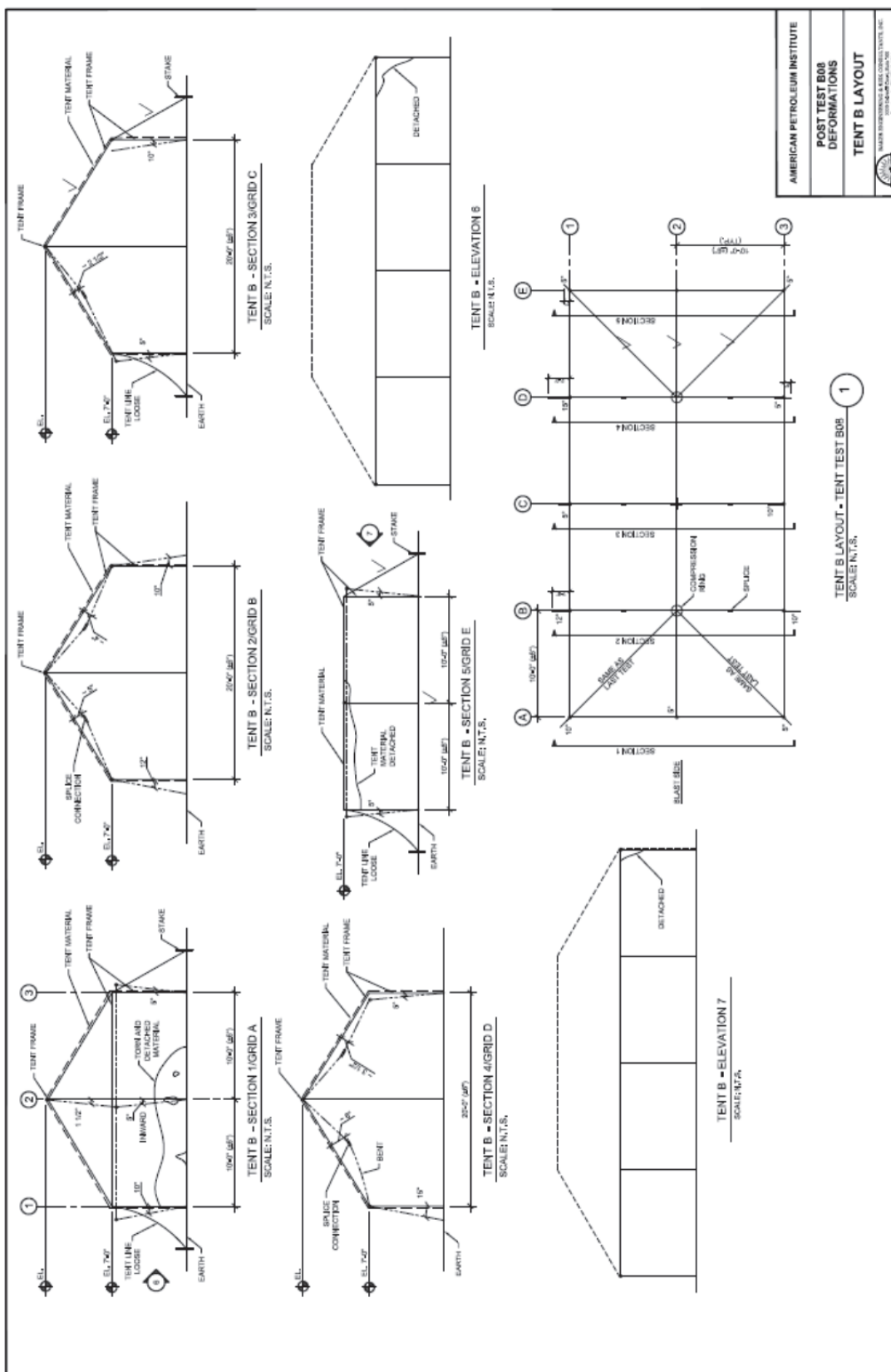


Figure 49. Deformations of Pole Tent Test B08



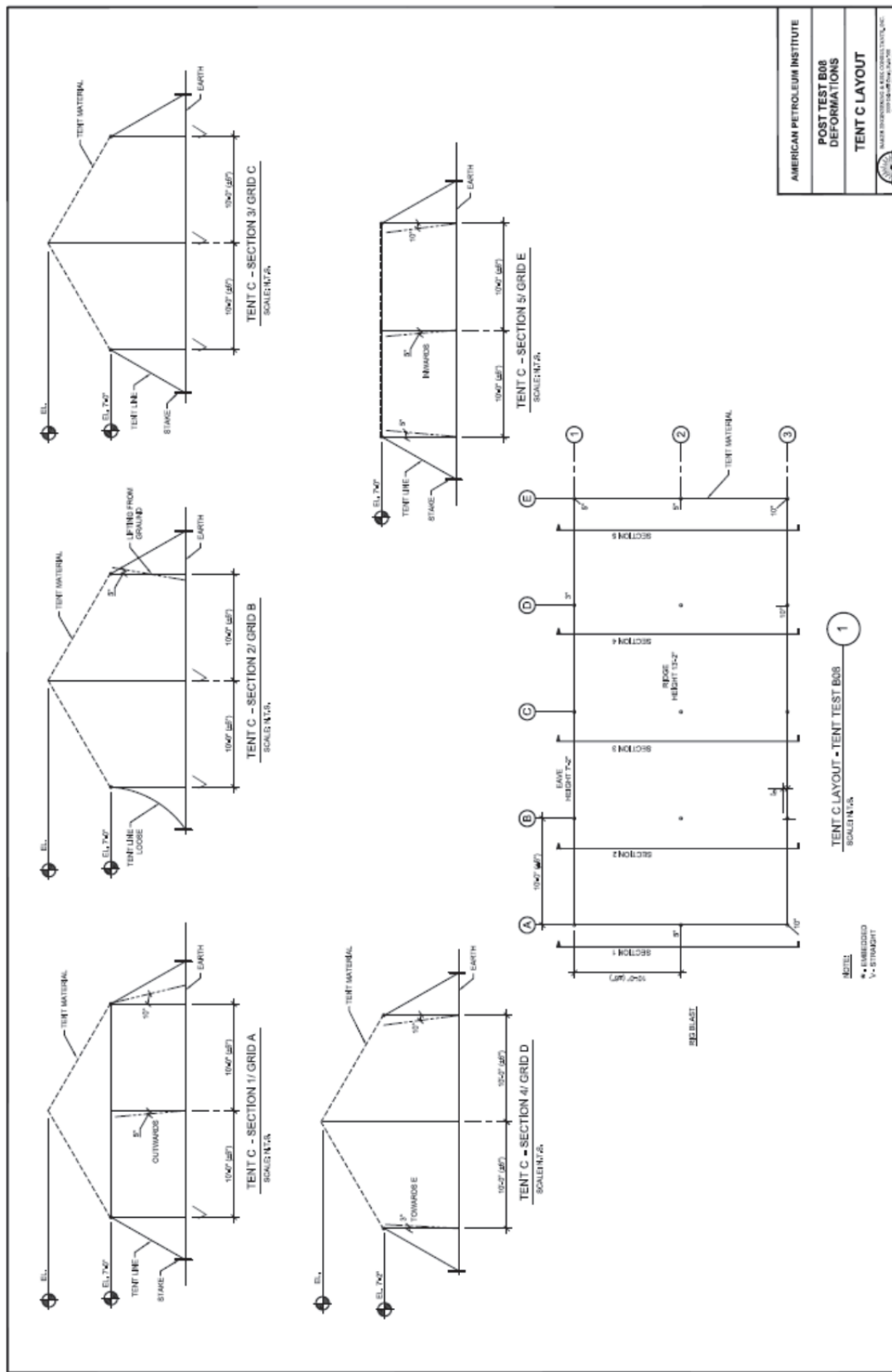
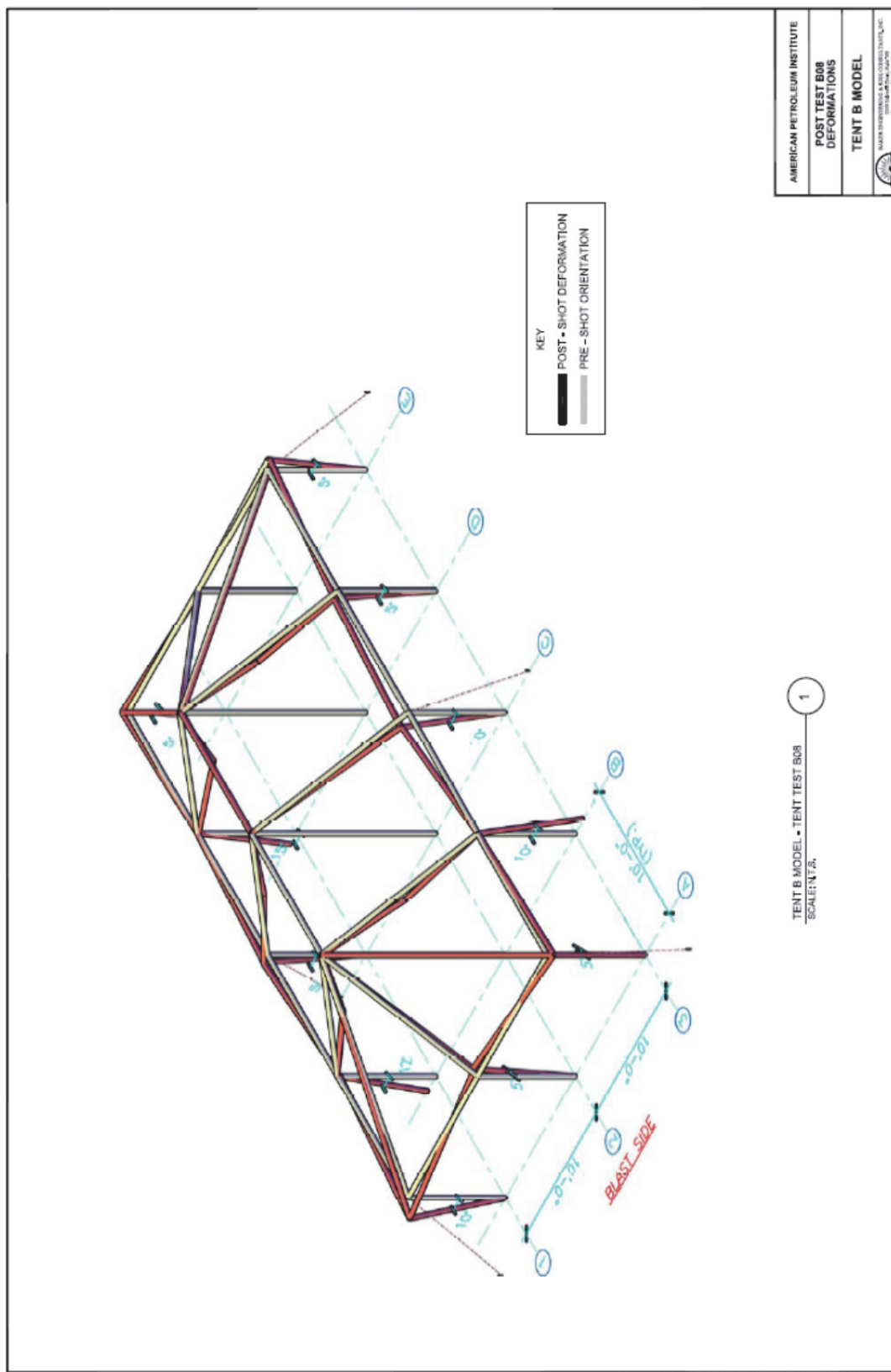


Figure 51. Deformations of Pole Tent without Sides Test B08



5 C SERIES TESTS

5.1 Tents Included

The three tents tested in the C series were all engineered to resist 90 mph 3 second wind gusts. The pole tent with side walls is shown in Figure 53 and Figure 54; this tent was placed on the test bed at location A. The tent had a 40 ft by 20 ft footprint. The moment framed tent is shown in Figure 55 and Figure 56. This tent relies on the moment frames and cross bracing rather than guy wires to provide for the lateral stability; this tent was placed on the test bed in Location B. The tent has 30 ft by 30 ft footprint. The light framed tent with guy wires is shown in Figure 57 and Figure 58; this tent was placed on the test bed at Location C. The pole tent and the light framed tent were provided by the same manufacturer that provided the tents used in Test Series A and B. All tents were orientated with the long side facing the DLG rig.

The vendor's information sheets for all three tents are provided in Annex A.



Figure 53. Exterior View of 90 mph Pole Tent – Test Bed Location A Pre-Test



Figure 54. Internal View of 90 mph Rated Pole Tent Pre-Test



Figure 55. External View of Moment Framed Tent Test Bed Location B Pre-Test



Figure 56. Internal View of Moment Framed Tent Showing Frames and Cross Bracing



Figure 57. External View of 90 mph Light Framed Tent Test Bed Location C Pre-Test



Figure 58. Internal View of Light Framed Tent

5.2 Test C01 Test Bed Layout

The tents were placed on the test bed as shown in Figure 59 for Test C01. The front face of each tent was 110 ft from the front of the DLG.

5.3 Results – Test C01

5.3.1 Pressures Measured

The peak pressures and associated impulses recorded during the test are summarized in Table 8. Data that was deemed suspect is marked with an asterisk (*). The full plots of the pressure data are provided in Annex D. The typical incident pressure measured on the end of the pole tent with walls and the light framed tent was 4 psi. The pressure measured at the front of the moment framed tent was 5 psi.

5.3.2 Tent Response

Post-test photos of the pole tent are shown in Figure 61 to Figure 64. The damage to the pole tent consisted of:

- Front and rear material ripped from the top attachment clips (Figure 61 and Figure 62);
- Perimeter poles at the front and rear were dislodged and on the ground (Figure 63);
- Perimeter poles at the two front corners were bent (Figure 61);
- Attachment pins at the tops of three other perimeter poles were sheared off (Figure 64).

The pole tent remained standing but the dislodgement of the poles and fabric pose a potential hazard to the tent occupants. The tent deformations are shown in Figure 65.

The moment frame tent suffered more damage than did the pole tent. The damage to the moment frame tent included:

- Front and rear tent material ripped from top attachment clips. (Figure 66)
- The vertical frame member at the front of the tent had a permanent deflection of approximately 12 inches. (Figure 66)
- Front and rear bottom curtain rods dislodged and one end was on the ground with permanent deflections ranging from 11 to 36 inches. (Figure 66)
- Rear vertical framing member was deformed. (Figure 67)
- Front and rear horizontal rectangular member sheared at connection to vertical member. (Figure 68, Figure 69, and Figure 70)
- Cable braces noticeably slackened.

The detached “curtain rods” entered the occupied space at or near head height and would have posed a potential hazard to occupants.

The deformations of the moment framed tent are shown in Figure 71.

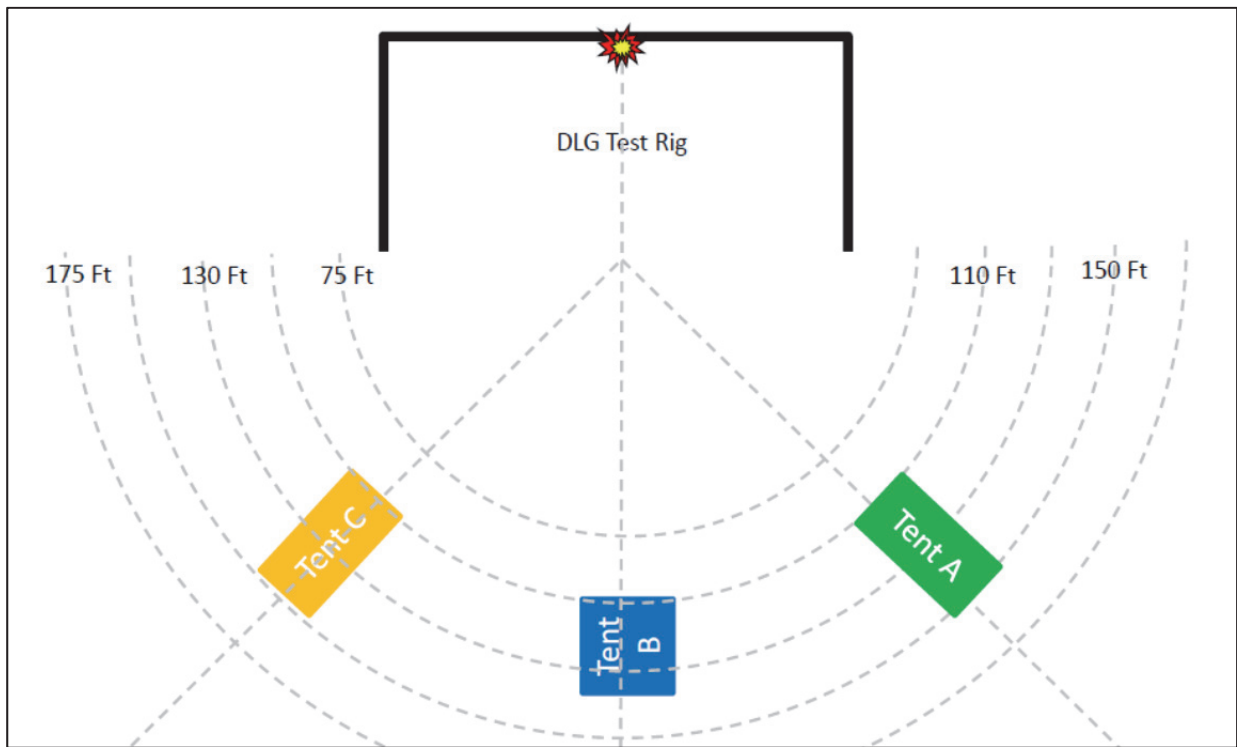


Figure 59. Layout of Tents for Test C01

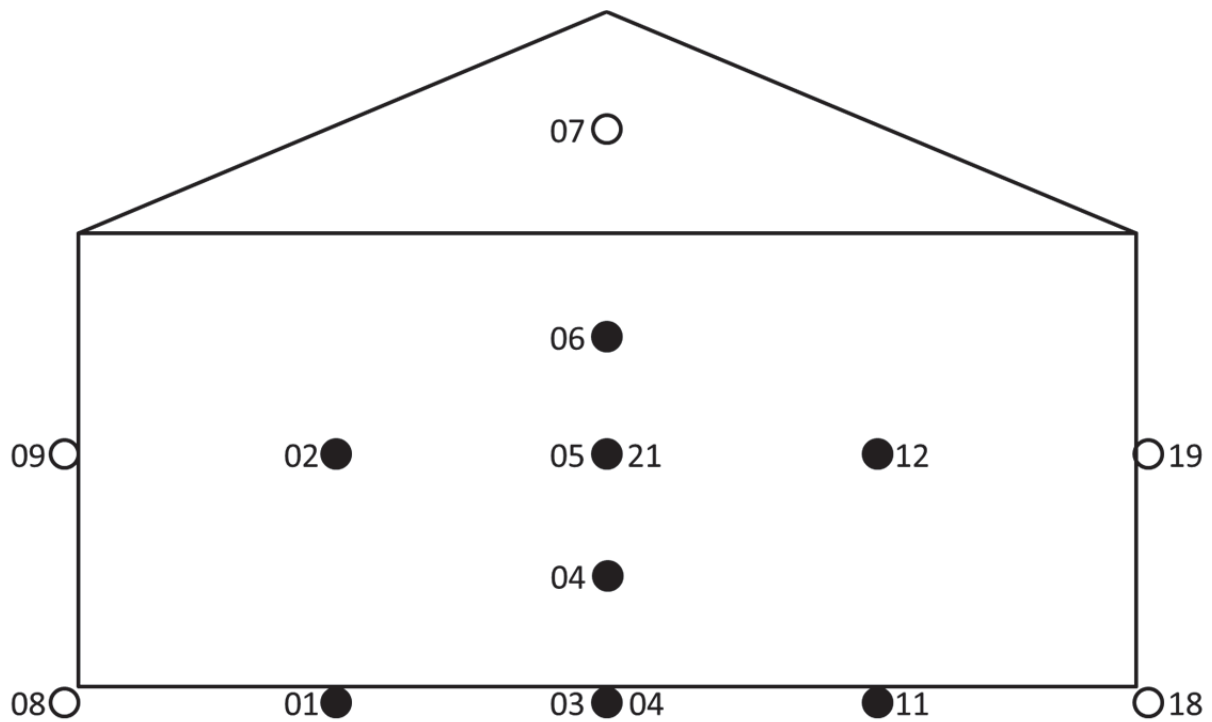


Figure 60. Pressure Gauge Layout – Test C01, C02 – Front View of Tent Facing Explosion

Table 8. Peak Pressures and Positive Phase Impulses Recorded for Test C01

Peak Pressures and Positive Phase Impulses Test C01 3.7% Propane										
Location & Gauge No.		Pressure (psig)			Effective Duration (ms)			Impulse (psig-ms)		
		Tent A	Tent B	Tent C	Tent A	Tent B	Tent C	Tent A	Tent B	Tent C
Front Ground	1	4.0	5.4	3.8	14	15	18	29	40	34
	11	4.0	5.3	4.7	16	16	13	31	42	31
	3	4.0	4.6	3.4	16	19	18	32	43	31
Average Incident Load		4.0	5.1	4.0	15	16	16	31	42	32
Front Wall	5	4.6	3.1	5.8	11	14	11	26	21	31
	6	4.2	4.0	3.8	16	8	14	34	16	27
	2	5.5	6.3	6.5	12	11	10	32	34	33
	12	5.1	6.7	3.3	11	9	5*	27	29	8
	4	5.9	4.7	5.0	10	17	12	28	41	30
Average Front Wall Load		5.0	5.7	4.5	13	9	10	31	26	23
Average Reflection Factor		1.3	1.1	1.1	0.83	0.56	0.60	1.0	0.63	0.71
Side Ground	8	1.0	5.9	-	35	11	-	18	31	-
	9	1.9	1.9	3.3	21	19	15	20	18	25
Side Wall	18	-	2.0	1.9	-	11	23	-	11	22
	19	2.1	2.6	2.9	20	17	14	21	22	20
Front Roof	7	2.2	-	3.3	27	-	3*	29	-	5*
Back Roof	20	-	2.9	1.6	-	20	27	-	29	22
Back Wall	21	2.7	1.4*	2.5	11	21	19	15	14	23



Figure 61. Front of Pole Tent – Test C01



Figure 62. Rear of Pole Tent Test C01



Figure 63. Damage to Connector at Top of Perimeter Pole



Figure 64. Example of Failed Connector at Top of Side Pole





Figure 66. Damage to Front of Framed Tent – Test C01



Figure 67. Damage to Rear of Framed Tent – Test C01



Figure 68. Damage to Framing Joint – Test C01



Figure 69. Failed Bolted Connection of Framed Tent – Test C01



Figure 70. Detail of Failed Horizontal Member – Test C01

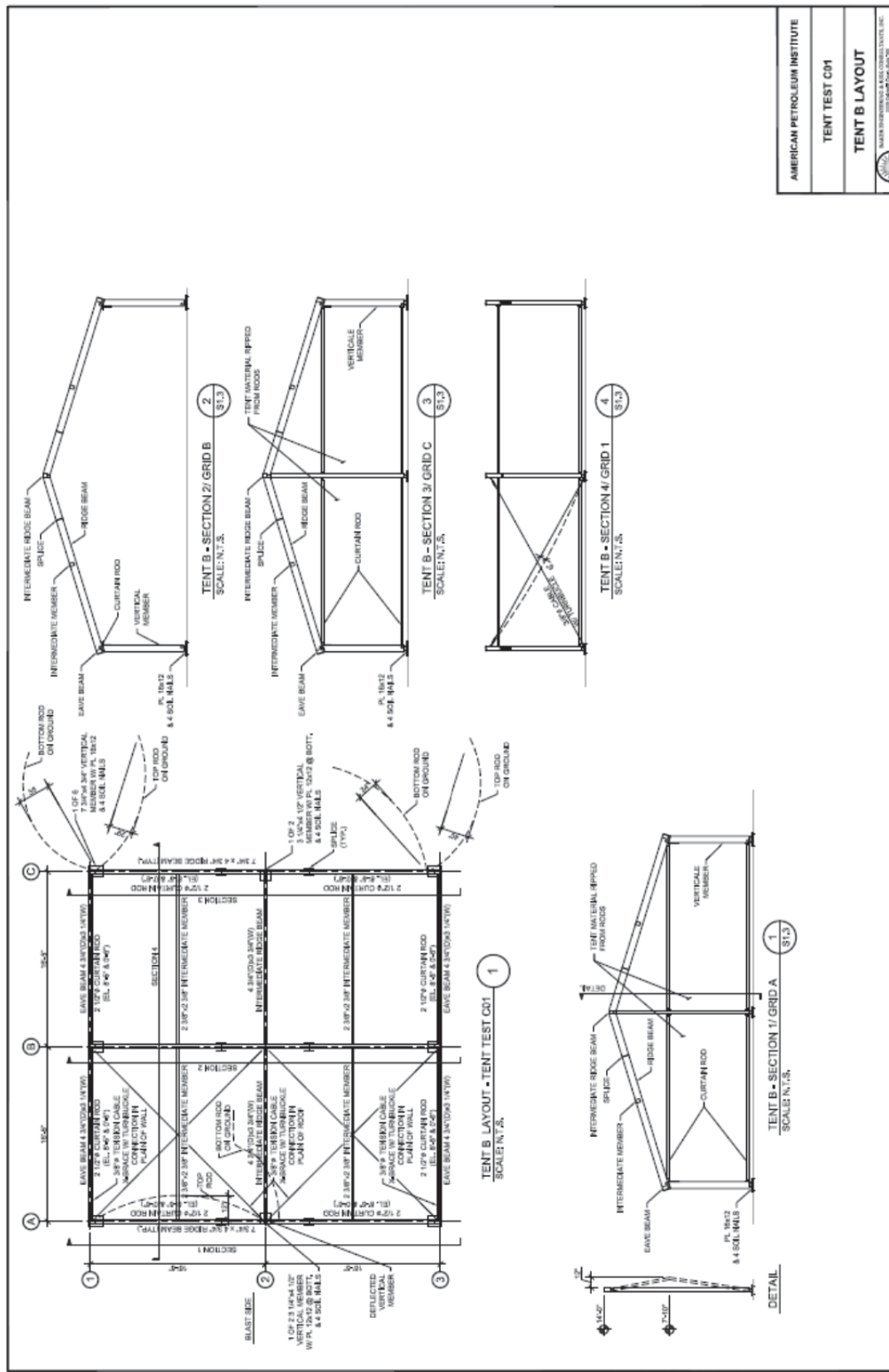


Figure 71. Deformations of Framed Tent – Test C01

The response of the light frame tent was similar to the pole tent but less severe than the moment framed tent. The damage to the light frame tent included:

- front and rear tent material ripped from top attachment clips,
- the vertical framing members at the front corners of the tent were displaced inward and slightly bent,
- rod knee braces at front poles were slightly bent.

All of the damage is visible in Figure 72. The deformations of the light frame tent are shown in Figure 73.



Figure 72. Damage to Front of Light Framed Tent – Test C01

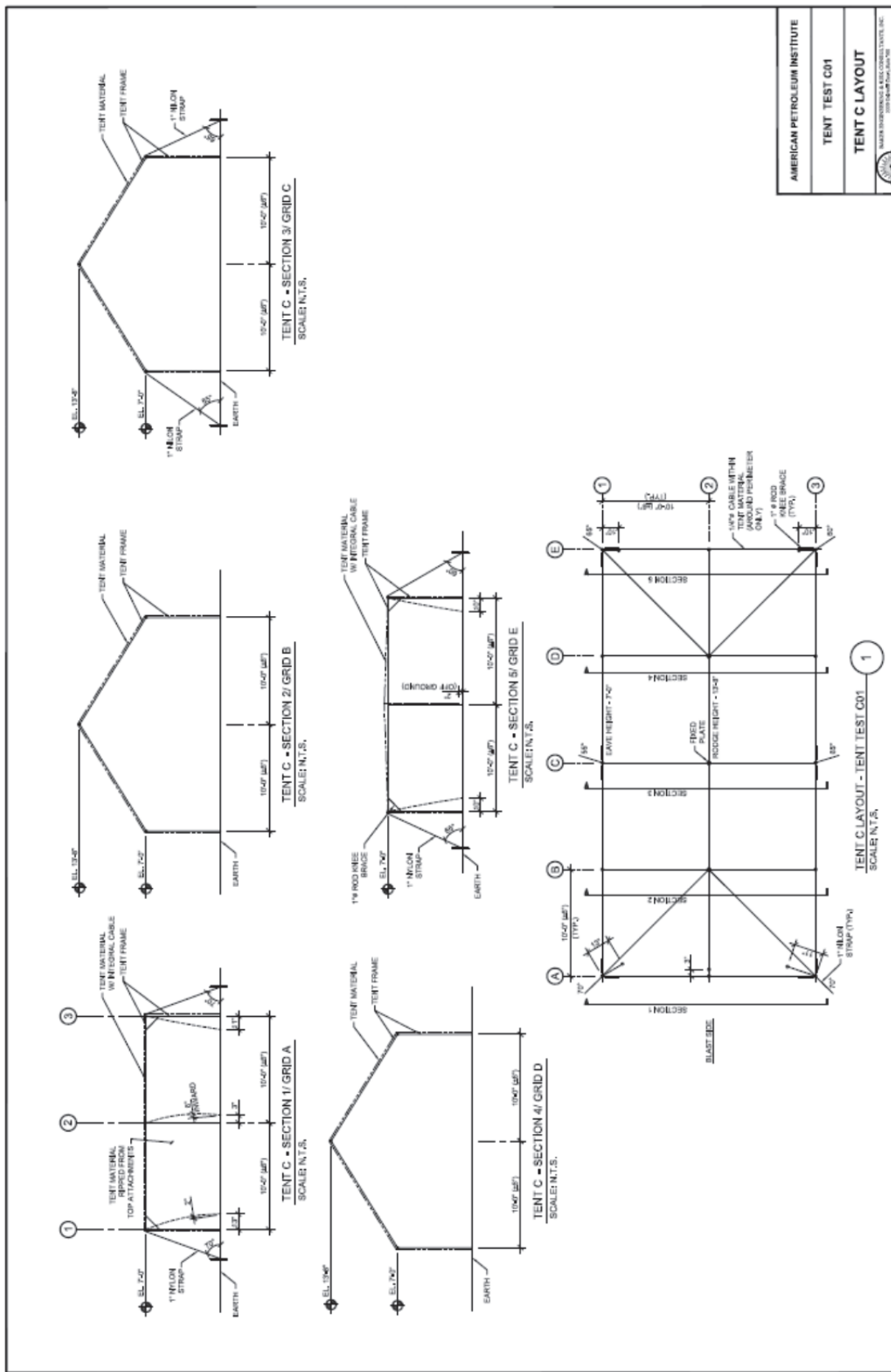


Figure 73. Deformations of Light Framed Tent – Test C01

5.4 Test C02 Test Bed Layout

The pole tent and the light framed tent were moved to 50 ft from the front of the DLG for Test C02. The tents were also rotated approximately 90 degrees. The moment framed tent was rotated 90 degrees and remained 110 ft from the front of the DLG. The tent positions for this test are shown in Figure 74.

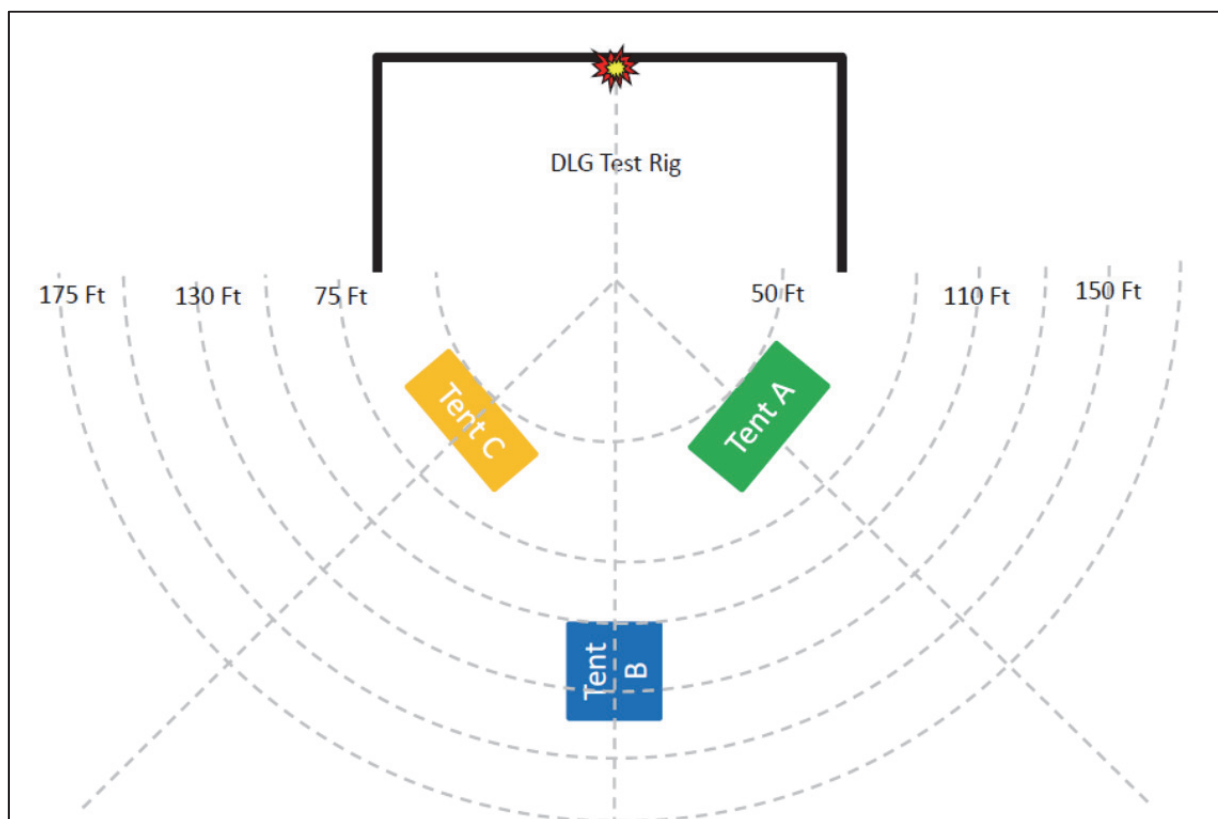


Figure 74. Layout of Tents for Test C2

5.5 Results of Test C2

5.5.1 Pressures Measured

The peak pressures and associated impulses recorded during the test are summarized in Table 9. The full plots of the pressure data are provided in Annex D. The typical incident pressure measured on the side of the pole tent was 3.5 psi. The pressure measured at the front of the moment framed tent was 2.4 psi. The pressure measured at the front of the moment framed tent was 3.1 psi.

Table 9. Peak Pressures and Positive Phase Impulses Recorded for Test C02

Peak Pressures and Positive Phase Impulses Test C02 4.3% Propane										
Location & Gauge No.		Pressure (psig)			Effective Duration (ms)			Impulse (psig-ms)		
		Tent A	Tent B	Tent C	Tent A	Tent B	Tent C	Tent A	Tent B	Tent C
Front Ground	1	3.1	2.4	3.3	23	19	32	35	23	53
	11	4.0	2.3	2.4	24	24	30	48	27	36
	3	3.5	2.4	3.5	25	20	25	43	24	44
Average Incident Load		3.5	2.4	3.1	24	21	29	42	25	44
Front Wall	5	3.3	-	2.6	13	-	33	22	-	42
	6	3.8	1.0	2.0	33	18	31	62	9	31
	2	3.0	2.8	3.0	-	14	39	-	19	58
	12	3.0	1.9	1.3	26	13	23	38	12	15
	4	2.7	3.2	2.5	30	16	33	41	25	41
Average Front Wall Load		3.3	1.9	2.1	20	15	31	33	13	35
Average Reflection Factor		0.93	0.80	0.68	0.82	0.71	1.07	0.79	0.54	0.78
Side Ground	8	1.5	1.3	2.6	38	28	41	28	18	52
	9	2.1	0.6	0.8	27	33	37	29	9	14
Side Wall	18	-	1.3	1.9	-	27	32	-	17	30
	19	2.6	0.9	1.8	26	28	32	34	12	28
Front Roof	7	3.0	1.4	4.6	32	29	21	47	20	49
Back Roof	20	-	1.2	1.9	-	-	39	-	-	37
Back Wall	21	1.9	1.5	1.9	27	-	-	26	-	-

5.5.2 Tent Responses

The damage to the pole tent included:

- front and rear tent material ripped from top attachment clips. (Figure 75);
- left side tent material ripped from top attachment clips; this was the side partially facing the DLG (Figure 75);
- multiple perimeter poles were dislodged
- the front poles were displaced inward at their bases and bent (Figure 76).

The deformations of the tent are shown in Figure 77.

The damage to the moment framed tent included:

- front tent material ripped from top attachment clips (Figure 78),
- front top left curtain rod member-connection fastener sheared (Figure 79),
- front top right curtain rod member- connection fastener sheared and the rod had a center deformation of 32 in.,
- rear top left curtain rod member-connection fastener sheared.

The deformations of the moment framed tent are shown in Figure 80.

The damage to the light framed tent included:

- front and rear tent material ripped from top attachment clips (Figure 81),
- the perimeter poles on the back side of the tent were dislodged and on the ground,
- the front corner points were displaced inward at their base (Figure 82),
- the roof members were significantly bent. (Figure 83 and Figure 84).

The deformations of the tent are shown in Figure 85.

5.6 Summary and Findings of the C Series Tests

The C Series tests indicated that the detachment of the fabric from the supporting structure is the most likely potential hazard to the tent occupants. The blast pressure and impulse at which this occurs is highly dependent on the details of the connection. The use of guy wires on the pole tent and the light frame tent provides the structure with significant redundancy as demonstrated by these structures as they remained standing even with the loss of some of the perimeter poles.



Figure 75. Damage to Pole Tent – Test C02



Figure 76. Bent Pole on Pole Tent – Test C02

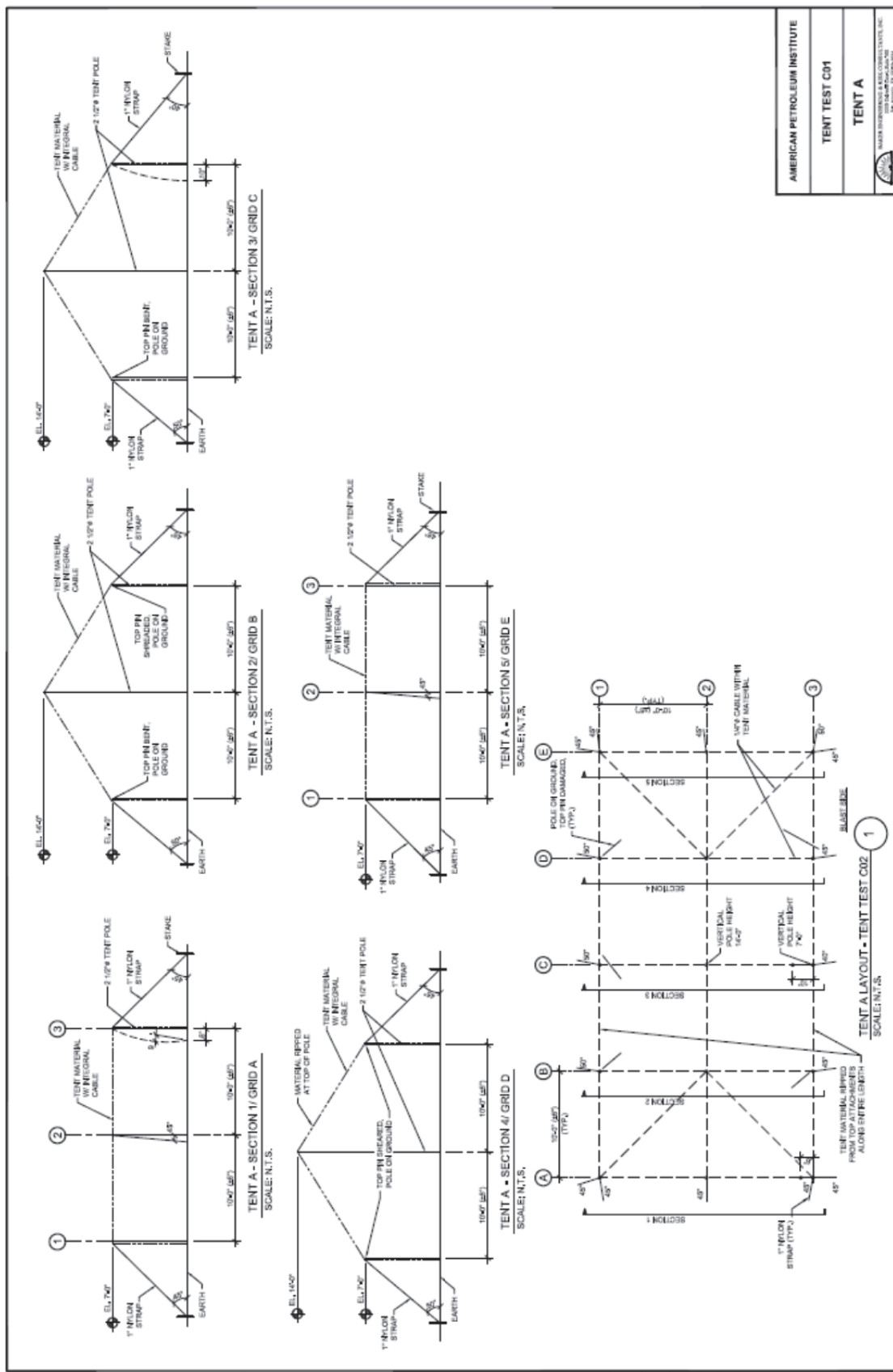


Figure 77. Deformations of Pole Tent – Test C02



Figure 78. Damage to Side of Framed Tent – Test C2



Figure 79. Damage to Rear of Framed Tent – Test C02

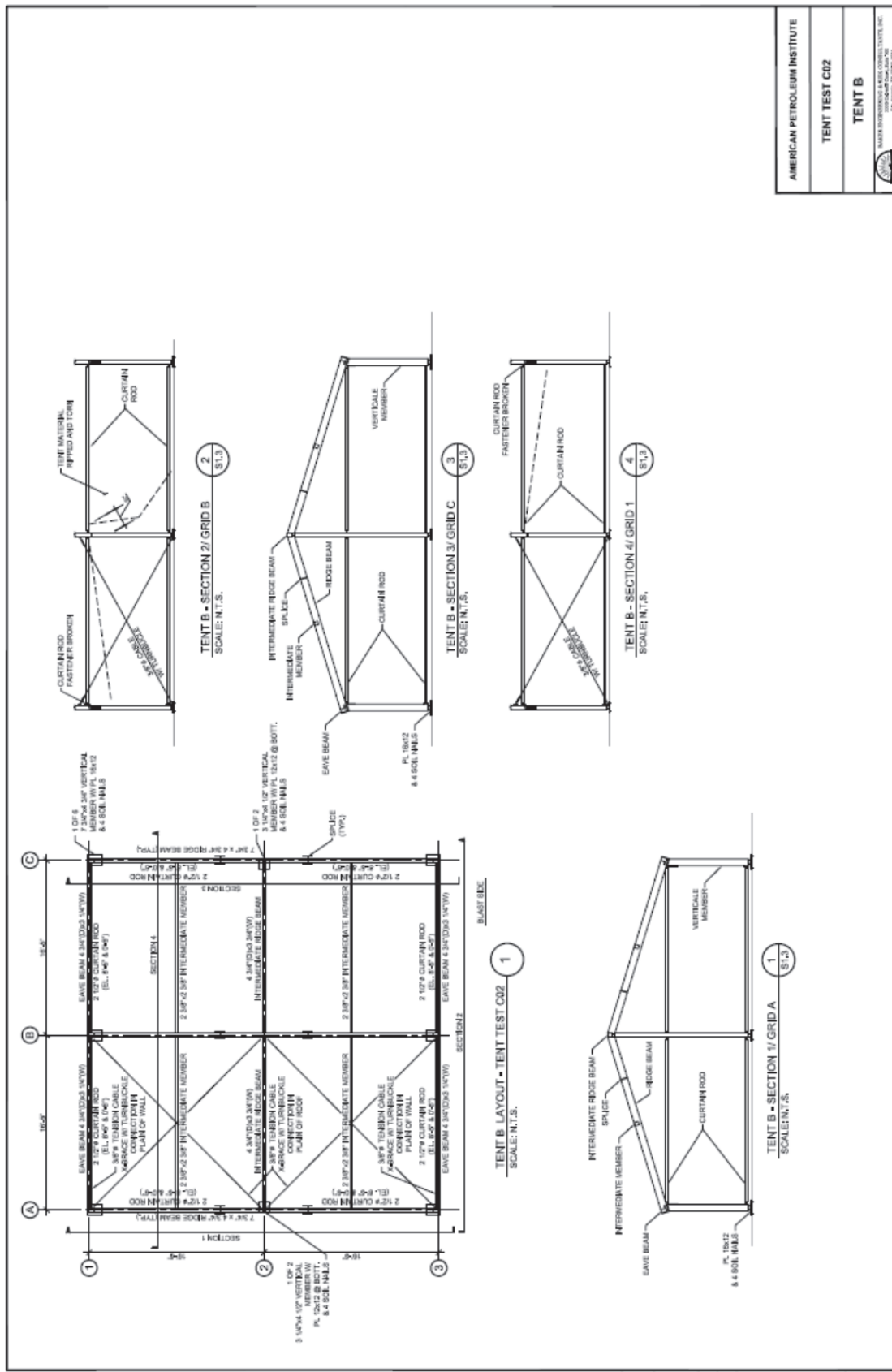


Figure 80. Deformations of Framed Tent – Test C02



Figure 81. Damage to Light Framed Tent – Test C02



Figure 82. Bending of Side Frame – Test C02

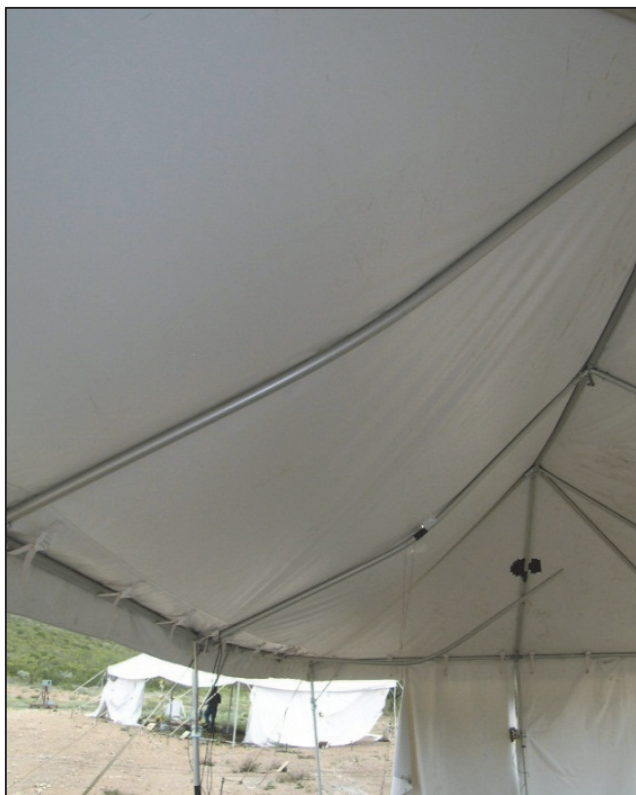
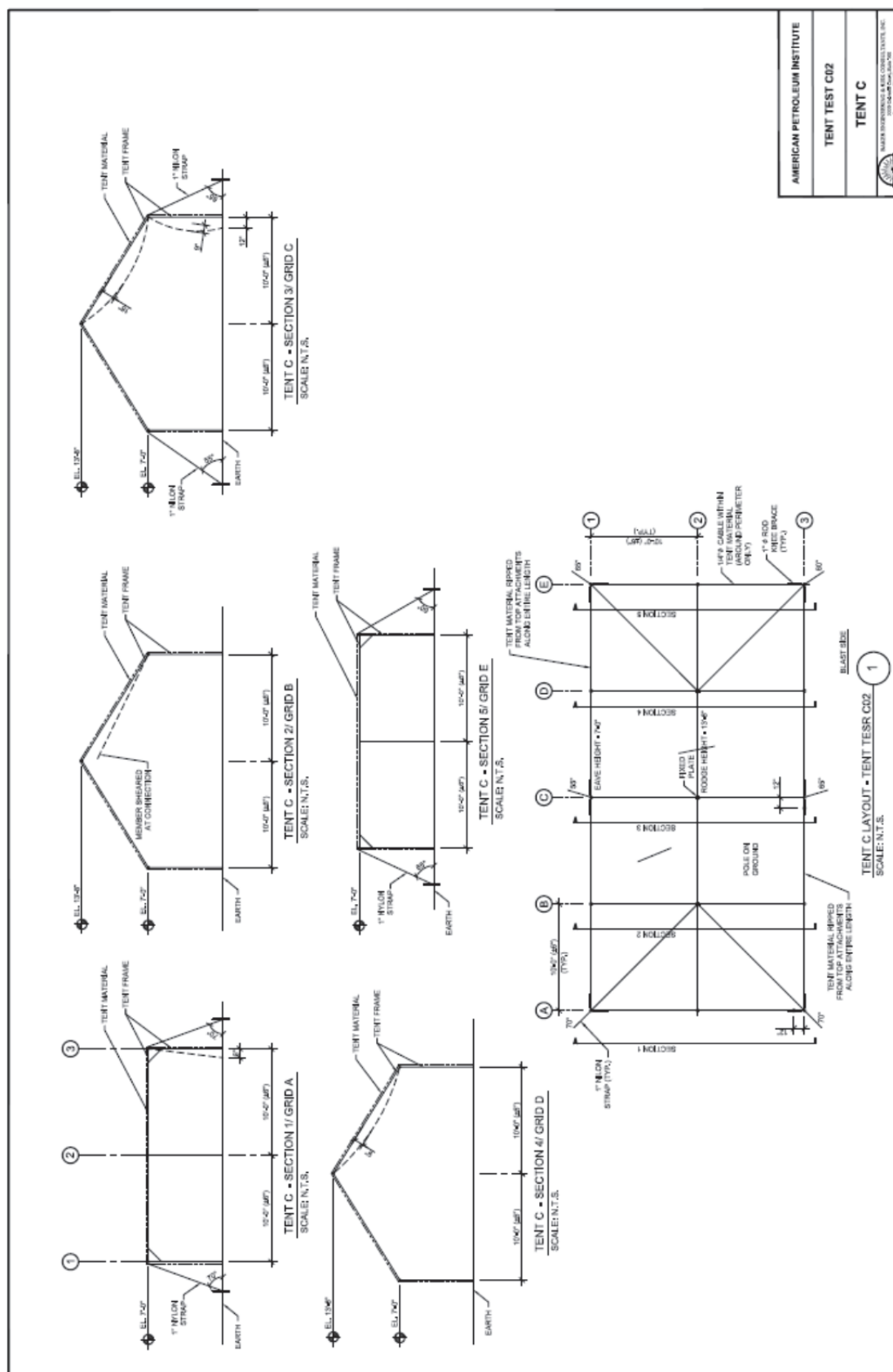


Figure 83. Bending of Roof Frames – Test C02



Figure 84. Failure of Roof Frame Connector – Test C02



6 FOLLOW-ON TESTS PERFORMED BY BAKERISK

For the tests conducted by BakerRisk, several items were placed in the pole tent described in Section 5. The contents are shown in Figure 86 and Figure 87. The contents included a heavy wood picnic table with a filled cooler on top and a lightweight table and folding chairs with a tool belt and computer monitor set on top of the table. A typical wheeled trash container and fan were included as well. The post-test condition of these items is shown in Figure 87 and Figure 88. The item displacement was due to being struck by the tent wall fabric and the collapsing side pole.

The pressure and impulse measured at the ground in front of the tent was 7.2 psi and 56 psi-ms.



Figure 86. Pre-Test Photo of Tent Contents



Figure 87. Close-up View of Materials on Table



Figure 88. Post Test View of Pole Tent and Contents



Figure 89. Damage to Pole Tent and Displacement of Table and Chairs

7 RESULTS OF EXPLOSION RESEARCH COOPERATIVE TEST ON TENT CONTENTS

7.1 Test Layouts

The Explosion Research Cooperative (ERC) sponsored a study¹ to determine the potential blast induced motions of contents commonly found in tents used at processing facilities. The ERC has made the results of eight of these tests available to the API in support of RP 756 development. The tests were conducted using the BakerRisk shock tube and represented a variety of common conditions. The various test layouts that mimicked common lunch tent arrangements are shown in Figure 90 through Figure 93. The items in the layout shown in Figure 94 represent a welding enclosure, and the layout of contents typically found in a warehouse is shown in Figure 95. Details on the layouts are provided below.

Layout A represents a typical lunch room or break room, and includes a lightweight plastic table with metal folding chairs. The table was oriented so that its long side was parallel to the tent fabric, and was positioned in close proximity to the fabric. A number of typical lunch room items were also positioned on the table: lunch boxes, plastic food containers, a hard hat, portable radio, and a tool belt with multiple pouches and containing some tools.

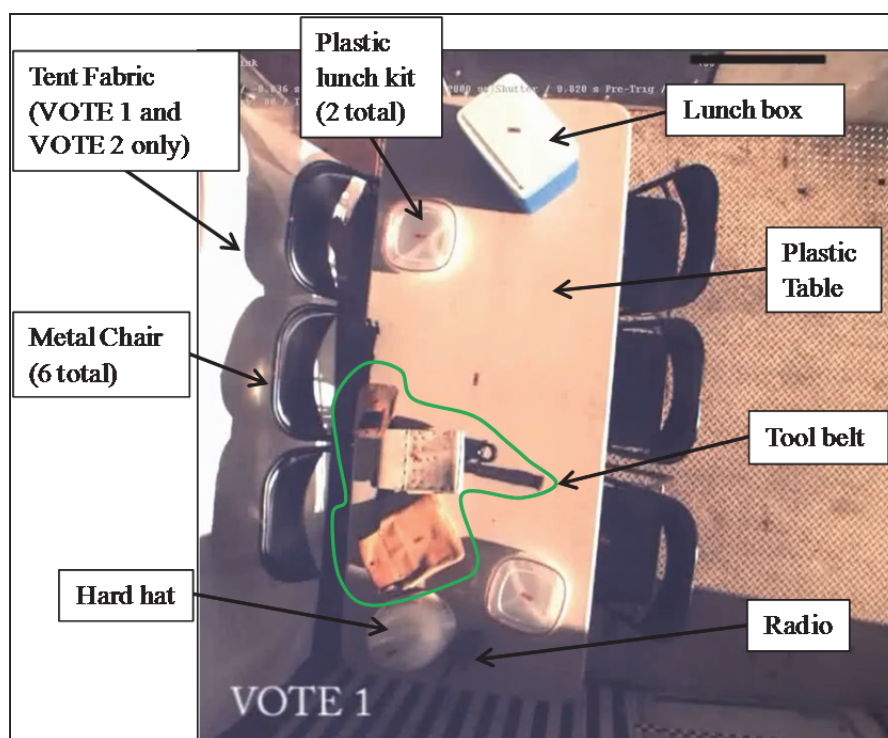


Figure 90. Test Layout A, Lunch Room with Plastic Table

¹ Explosion Research Cooperative, Lethality of Tent Contents Propelled by Blast Loading, BakerRisk Report No. 01-760-580-10, February 2011.

Layout A' (shown in Figure 91) was a variant on Layout A which represents the same lunch room, but with a much heavier wooden picnic table and wooden benches substituted. The items on the table remained the same.

Layout B represents another variant on the lunch room with the lightweight plastic table (Layout A), but the table has been rotated so that its long dimension is perpendicular to the fabric panel (Figure 92).

A different set of items was tested in Layout C, which still pertains to the lunch room but omits the table and chairs and instead includes items that are taller and more slender. In this layout (Figure 93), a free standing lighting unit, a large ventilation fan, and a plastic trash drum were provided. Again, all items were positioned in close proximity to the fabric.

Layout D (Figure 94) represents a welding enclosure. Included in this setup were a typical tool chest, consisting of unattached upper and lower cabinets and some simulated gas bottles. The bottles were represented by PVC pipe sections of approximately the same diameter as actual metal gas bottles, capped and filled with sand to attain the same approximate weight. Also included was a water cooler, which would be common to the lunch room/break tent as well. The water bottle was loosely placed above the cooler, and the bottle was filled with sand to obtain the approximate weight of a full 5-gallon bottle of water. While not visible in the photograph, a set of wooden pallets was stacked just outside the fabric panel, representing pallets that might typically be found outside welding enclosures.

Layout E (Figure 95) represents the warehouse application of tents. Included was a tall, free standing shelving unit holding a number of different boxed items. Also included was a microwave oven on a stand; this was more typical of the lunch room than the warehouse, but was included in this test out of convenience, since space was available in the test bed.

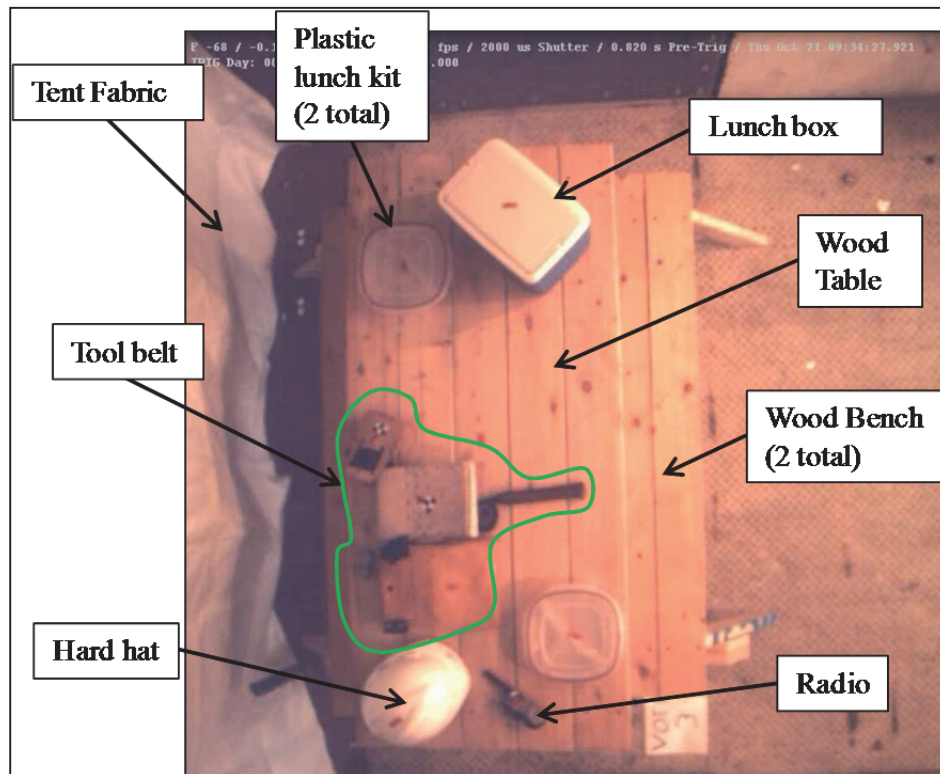


Figure 91. Test Layout A', Lunch Room with Wooden Table

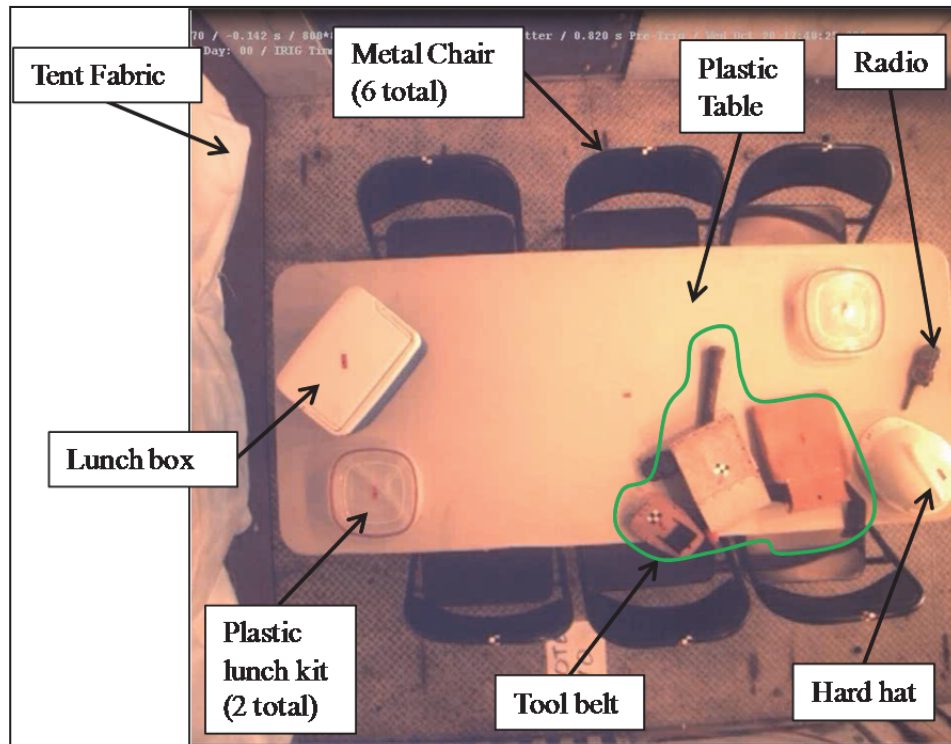


Figure 92. Test Layout B, Lunch Room with Plastic Table, Rotated

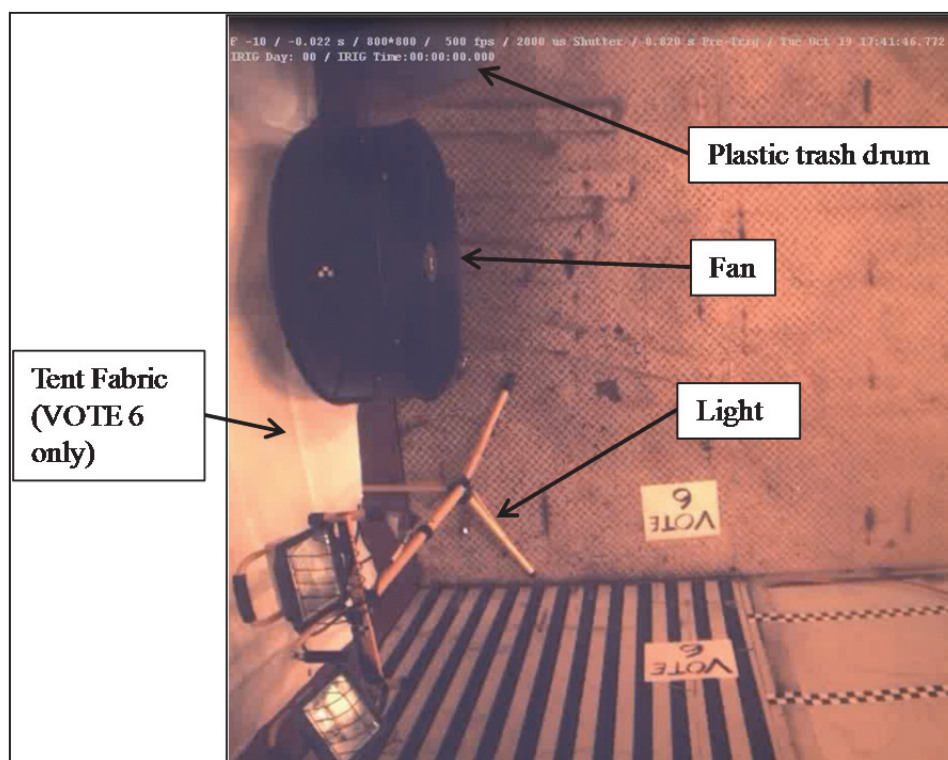


Figure 93. Test Layout C, Lunch Room with Tall Standing Objects

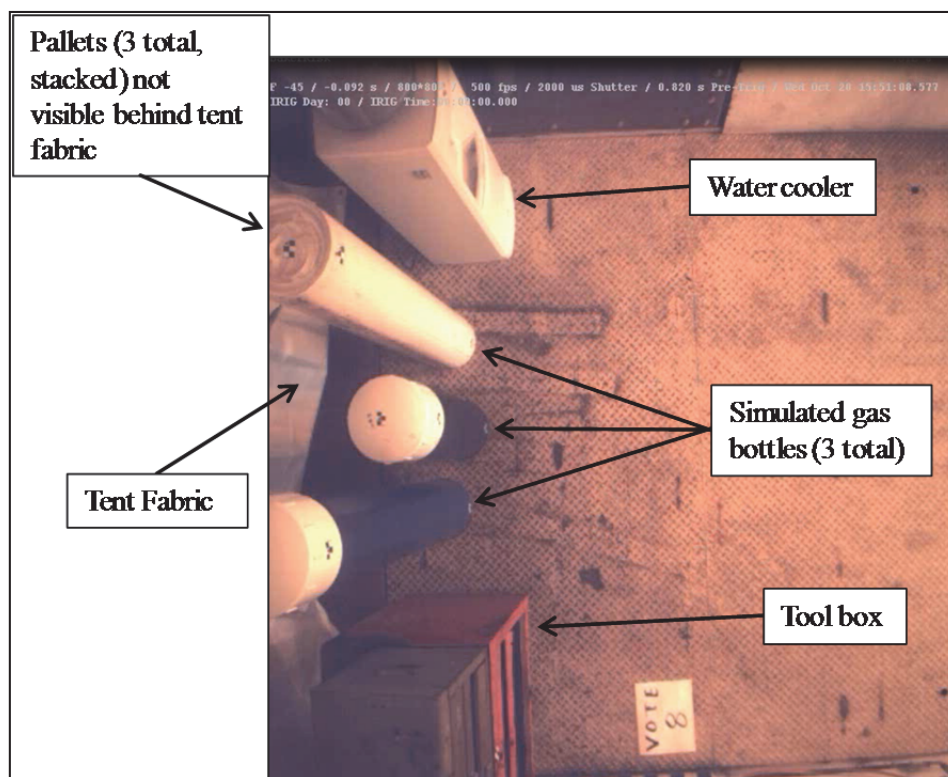


Figure 94. Test Layout D, Simulation of Welding Enclosure

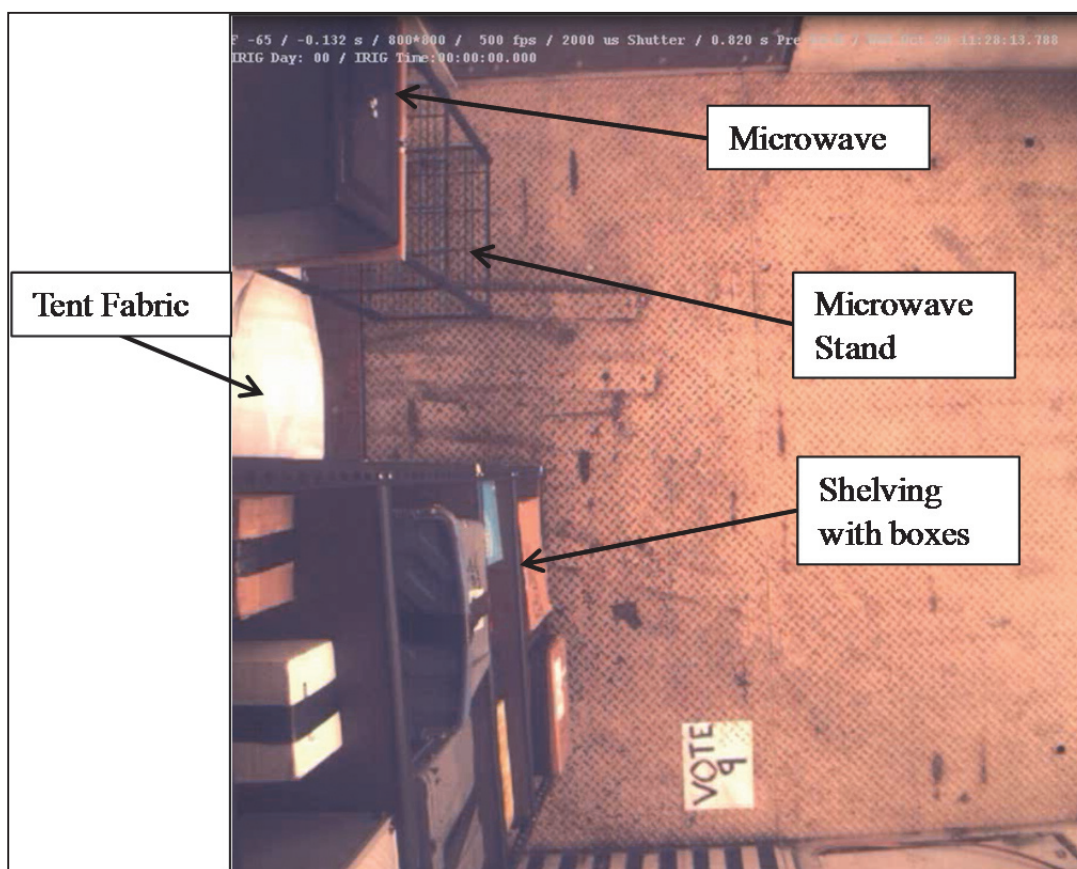


Figure 95. Test Layout E, Simulation of Warehouse

7.2 Results

The results for each test are shown in Table 10. The pressures listed are the pressures that struck the fabric upstream of the item layout. Pre- and Post-Test photos of each test are shown in Figure 96 through Figure 103.

Table 10. Summary of Mass and Velocity for Selected Items

Test Conditions				Object	Mass		Velocity	
Test No.	Layout	Pressure (psi)	Impulse (psi-ms)		lbm	kg	Ft/s	m/s
1	A	1	20	Table	35	16	12	3.6
				Chair	7.8	3.5	16	4.8
				Lunchbox	2.2	1.0	18	5.6
2	A	2.5	50	Table	36	16	16	4.8
				Chair	7.8	3.5	24	7.4
				Tool Belt	11	5.0	14	4.3
3	A'	2.9	55	Table	35	15.7	7.4	2.2
				Lunchbox	2.2	1.0	25	7.6
5	A – No Fabric	2.9	50	Lunchbox	2.2	1.0	3.1	0.9
				Hard Hat	0.8	0.4	12	3.6
6	C	1	20	Lamp	11	4.9	13	3.8
8	D	2.9	57	Water Cooler Bottle	40	18	18	5.6
9	E	1	20	Supply Box B	6	2.7	17	5.1
				Supply Box C	8.8	4.0	17	5.1
				Microwave	32	15	17	5.1
10	B	2.9	50	Chair 3	7.8	3.5	10	3.0
				Chair 4	7.8	3.5	12	3.6
				Lunchbox	2.2	1.0	5.9	1.8
				Tool Belt	11	5.0	13	3.8
				Table	35	16	13	4.1



Figure 96. Test 1, Pre- and Post-Test Photographs



Figure 97. Test 2, Pre- and Post-Test Photographs

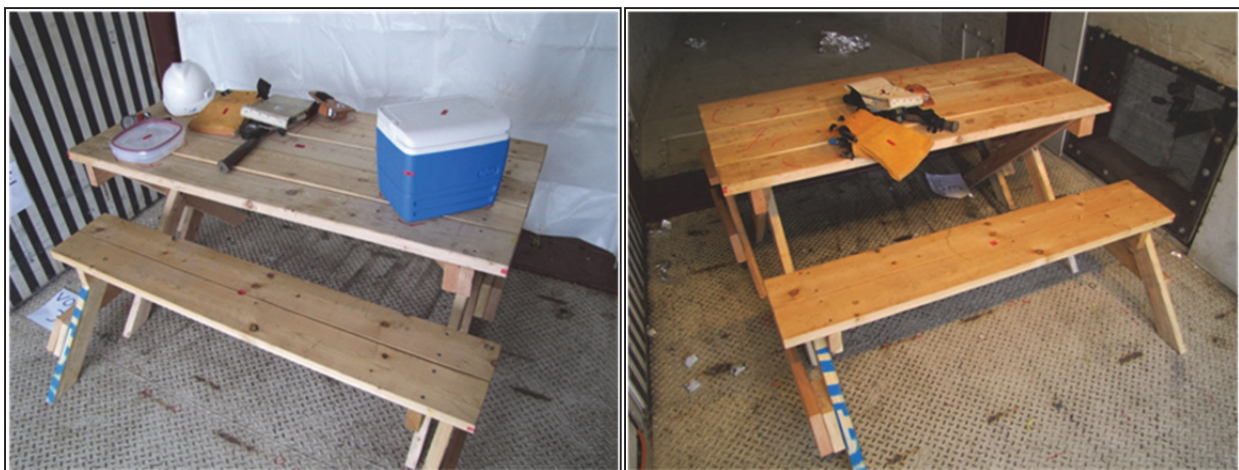


Figure 98. Test 3, Pre- and Post-Test Photographs



Figure 99. Test 5, Pre- and Post-Test Photographs



Figure 100. Test 6, Pre- and Post-Test Photographs



Figure 101. Test 8, Pre- and Post-Test Photographs



Figure 102. Test 9, Pre- and Post-Test Photographs



Figure 103. Test 10, Pre- and Post-Test Photographs

8 SUMMARY OF ALL API TEST DATA

The peak pressure and the positive phase impulse data from the A, B, and C Test Series are provided in Figure 104.

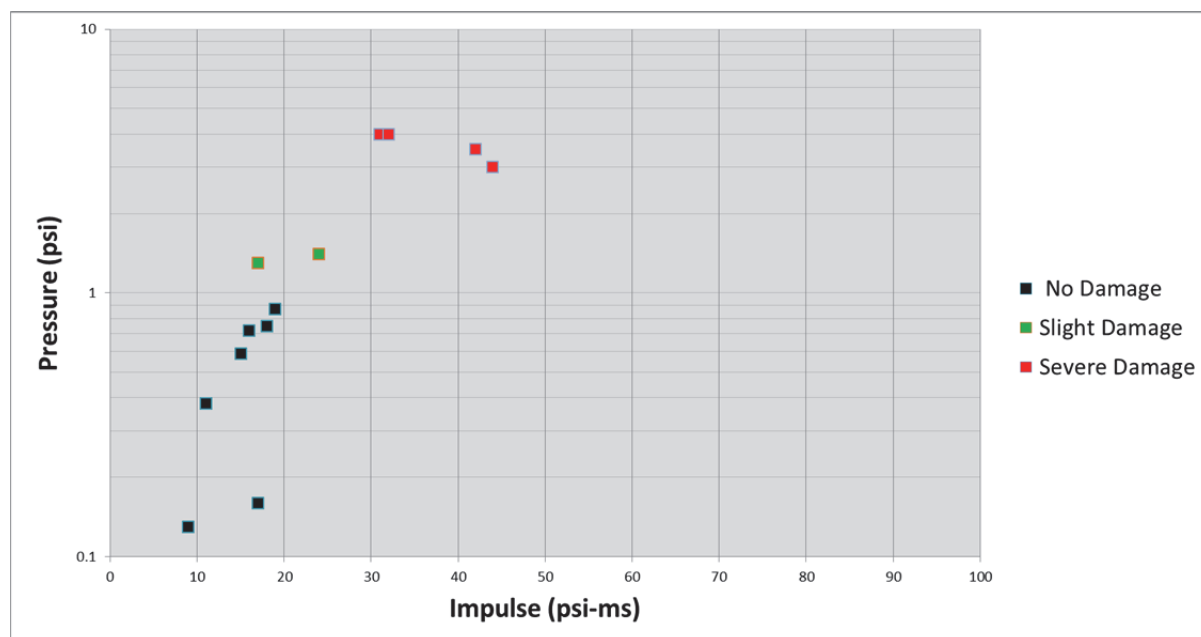


Figure 104. All API Test Data Shown in Pressure-Impulse Space

ANNEX A.

DESCRIPTIONS OF TENTS TESTED

A.1 INTRODUCTION

A total of six tent types were tested during the test program. The types of tents and the tent locations are shown in Table A-1. A short description of each test article is provided in the sections below. The information was taken from the vendor drawings and specifications where available. All photos were taken by testing personnel. The tents were acquired as a normal commercial transaction and believed to be representative of common manufacture.

Table A-1—Tent Types and Locations

Test Series	Articles (All Tests in Series)	Location on Test Bed	Tent Orientation Relative to Blast Source
Series A&B	Non-wind rated pole tent with sides	A	Longitudinal on Test Series A and End-On in Test Series B
	Non-wind rated frame tent with sides, straight members.	B	
	Non-wind rated pole tent without sides.	C	
Series C	Pole tent rated for 90 mph winds.	A	End-On
	Aluminum framed tent with rigid framed connections designed for 90 mph winds.	B	
	Light cable stayed framed tent with slip over connectors rated for 90 mph winds.	C	

A.2 NON-WIND RATED POLE TENT WITH SIDES

A.2.1 General Layout

The tent was 20-feet wide and 40-feet long. The tent ridge was 14 feet-high and the sidewalls were 7-feet high. The tent is shown in Figure A-1.



Figure A-1—Non-Wind Rated Pole Tent with Sides

A.2.2 Support Structure

The tent was supported around its perimeter by twelve poles, spaced 10-feet apart. The corner poles are each supported by two guy ropes, one normal to each tent side. The remaining eight perimeter poles were each supported by a single guy rope that was normal to the tent side. The three interior poles were set on grade and had no guy ropes. The

ropes were staked at a nominal 45-degree angle. The poles were 6061-T6, aluminum schedule 40 pipe. The guy ropes were 5/8 in. dia., 3-strand, twisted polypropylene rope w/ a minimum breaking strength of 5600 LB. The tent stakes were 1-inch diameter steel stakes driven 2-feet into the ground. A picture of the stakes prior to driving is shown in Figure A-2.



Figure A-2—Tent Stakes Prior to Driving (Fully driven stake in background.)

A.2.3 Fabric

The top of the tent consisted of a single piece of tent fabric secured to the vertical poles by means of a steel rod ($\frac{1}{2}$ -inch diameter, 6-inches long) embedded in the top of each pole that passed through a steel riveted eye sewn into the tent fabric. The walls of the tent consisted of fabric that was attached to a $\frac{1}{4}$ -inch nylon rope that formed a taut and continuous perimeter around the tops of the side poles. The connections are shown in Figure A-3. The wall fabric was not directly secured to the side poles along the pole length and was not secured at the bottom in any way. The tent fabric was heavy duty 14 oz./sq.yd. vinyl-laminated polyester, flame-retardant, 3-ply, 1000 denier, 9 x 9 weft-inserted weave. Fabric seams were RF-Welded, and sized to develop as least 90% of the tensile strength of the fabric joined. Webbing was 2-inch wide polyester w/5000 LB. min. breaking strength (max. elongation at break=12%), mildew-treated and UV-resistant.



Figure A-3—Detail of Fabric, Rope, and Pole Connections

A.3 NON-WIND RATED LIGHT FRAME TENTS

A.3.1 General Layout

The light frame tent was the same size as the non-wind rated pole tent discussed in Section A.2. The tent is shown in Figure A-4.



Figure A-4—Non-Wind Rated Light Frame Tent

A.3.2 Support Structure

The tent was supported by frames spaced at 10-feet on center along the longitudinal direction and by a subframe at the center of each gable end. The frames consisted of side poles, eaves struts, ridge struts, rafters, and hip rafters. All of these members were lengths of 6061-T6 aluminum schedule 80 pipe. Each rafter was spliced with a hinge in the middle to simplify erection by the manufacturer. A splice hinge is shown in Figure A-5. The members were connected with hubs as shown in Figure A-6, Figure A-7, and Figure A-8. The connection hubs were hot rolled steel type 1000 ASTM A513 schedule 10 pipes and secured with cotter pins. The poles at the four corners and the center of the long side were each secured with a guy rope oriented approximately 45 degrees normal to perimeter edge as shown in Figure A-9. The guy ropes were ½-in dia. 3-stranded twisted split film polypropylene rope with a minimum breaking strength of 3000 Lbs. The same stakes were used as for the pole tent discussed in Section A.2.



Figure A-5—Detail of Rafter Hinge (Cotter Pins still need to be installed.)



Figure A-6—Connection Hub at Center of Long Wall



Figure A-7—Connection Hub at Top of Gable End

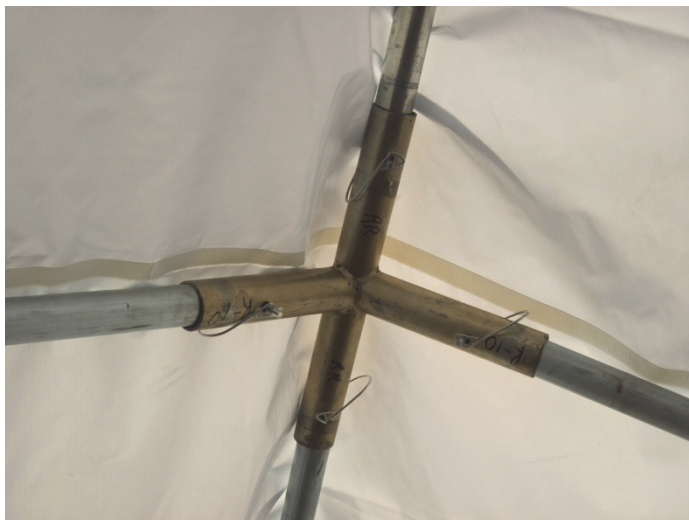


Figure A-8—Connection Between Ridge Struts and Rafters



Figure A-9—Guy Wire Locations at Corners and Middle of Long Side

A.3.3 Fabric

The tent roof fabric was secured to the eave struts by means of nylon straps as shown in Figure A-10. The tent wall panels were secured to a $\frac{1}{4}$ in. nylon rope with metal hardware clips in the same manner used on the pole tent. However, the nylon rope was secure to the frame by being run along the front (outside) of the eave struts and was passed behind the rafter at each raft to eave strut connection. This is shown as the red line in Figure A-10. The tent fabric was the same as used for the pole tent described in Section A.2.

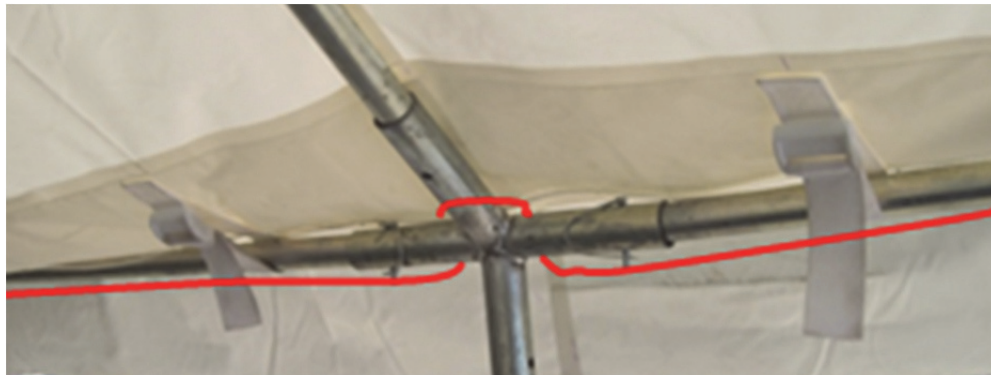


Figure A-10—Nylon Straps Used to Secure Top Fabric to Eave Struts (Red line indicates location of nylon rope use to hang wall sections.)

A.4 NON-WIND RATED POLE TENT WITHOUT SIDES

The layout and structure of the tent without sides was identical to the pole tent with sides. The only difference was that there were no side panels attached. A picture of the non-wind rated pole tent is shown in Figure A-11.



Figure A-11—Non-Wind Rated Pole Tent without Sides

A.5 WIND RATED POLE TENT WITH SIDES

A.5.1 General Layout

The tent had the same layout and dimensions as the non-wind rated pole tent described in Section A.2. The tent is shown in Figure A-12.



Figure A-12—Wind Rated Pole Tent with Sides

A.5.2 Support Structure

The support structure differed from the non-wind rated tent as follows:

- The top fabric seams included a $\frac{1}{4}$ in. dia. 7 x 19 aircraft cable with a minimum breaking strength of 2250 lbs. as shown in Figure A-13. The same cable was included in the roof panels at the eaves.
- The guy ropes were replaced with 1-inch wide nylon straps with a specified minimum breaking strength of 5600 lbs.



Figure A-13—Top of Interior Pole Showing Cables Embedded in Fabric

A.5.3 Fabric

The fabric used was the same as for the non-wind rated pole tents. However, in addition to the cables added to the top section, the means for attaching the sides was changed as well. The sides were attached to the perimeter rope by the use of plastic clips as shown in Figure A-14. This difference may be due to the wind rated tents being purchased after the non-wind rated tents and may reflect a cost saving substitution by the manufacturer rather than an actual design change.



Figure A-14—Plastic Clips Securing Side Panels to Perimeter Rope

A.6 WIND RATED RIGID FRAME TENT

A.6.1 General Layout

The rigid frame tent is shown in Figure A-15. The tent was 10 m (33 feet) square and supported in the longitudinal direction by three rigid moment frames. The lateral resistance along the length was provided by cable cross bracing. The frames and cross bracing can be seen in Figure A-16. The tent side walls were designed to be slid open and were supported on “curtain rods”. The failure of these rods dominated the response of the tent, and may not be representative of industrial applications.



Figure A-15—Rigid Frame Tent



Figure A-16—Interior of Rigid Frame Tent

A.6.2 Support Structure

The aluminum frames were spaced at 16.5-feet on center and had an eave height of 8.9 feet and a ridge height of 14.2 feet. The structural members were custom extrusions to facilitate a continuous tent fabric attachment. Tent roof fabric was continuously anchored to these members by means of interlocking pieces of the extrusions forming the members. The cable bracing was provided in one end bay and consisted of 0.375 inch cable with turnbuckles. The extrusion and end connection are shown in Figure A-17. The frame member outer dimensions are approximately 7.75-inches deep and 4.75-inches wide. The frames were mechanically spliced together in multiple locations as shown in Figure A-18. The frames were secured to base plates as shown in Figure A-19. There were no interior columns; however, the two end gables contained a wind column (4.5 inches deep x 3.25 inches wide). Both end frames were connected to the interior frame with a ridge beam (4.75 inches deep x 3.75 inches wide), an eave beam (3.75 inches deep x 3.25 inches wide), and an intermediate purlin (2.375 inches square). The connections were limited

strength shear connections as shown in Figure A-20. All of the extrusions and framing members were 6061-T6 aluminum.



Figure A-17—End of Framing Member Showing Extrusion Shape and Connection



Figure A-18—Frame Splice Develops Partial Moment Capacity



Figure A-19—Frame Base Plate Showing Cable Connection



Figure A-20—Connection of Purlin to Frame

A.6.3 Fabric

The tent wall fabric was hung from 2½ inch diameter pipes (curtain rods) at the eaves and was secured at the bottom to material similar to that used for scaffolding cross bracing as shown in Figure A-21. The fabric was a heavy duty 16-22 oz./sq.yd. Vinyl-laminated polyester, flame-retardant weave.



Figure A-21—Method Used for Securing the Bottom of the Wall Fabric

A.7 WIND RATED LIGHT FRAME TENT

A.7.1 General Layout

The tent is shown in Figure A-22, and the interior of the tent is shown in Figure A-23.



Figure A-22—Wind Rated Light Frame Tent



Figure A-23—Interior of Wind Rated Light Frame

A.7.2 Support Structure

The support structure differed from the non-wind rated frame tent discussed in Section A.3 as follows:

- The guy ropes were replaced with 1-inch wide nylon straps with a specified minimum breaking strength of 5600 lbs. This same change was made for the wind rated pole tent.
- The connections between the side poles and eave struts were braced as shown in Figure A-24 and Figure A-25 with ASTM A512 Steel Tubing.
- The hub connectors were more robust as shown in Figure A-26 and Figure A-27. The connection hubs were hot rolled steel type 1000 ASTM A513 schedule 10 pipes, welded to steel plates.



Figure A-24—Tubular Bracing at Corners



Figure A-25—Tubular Bracing at Sides

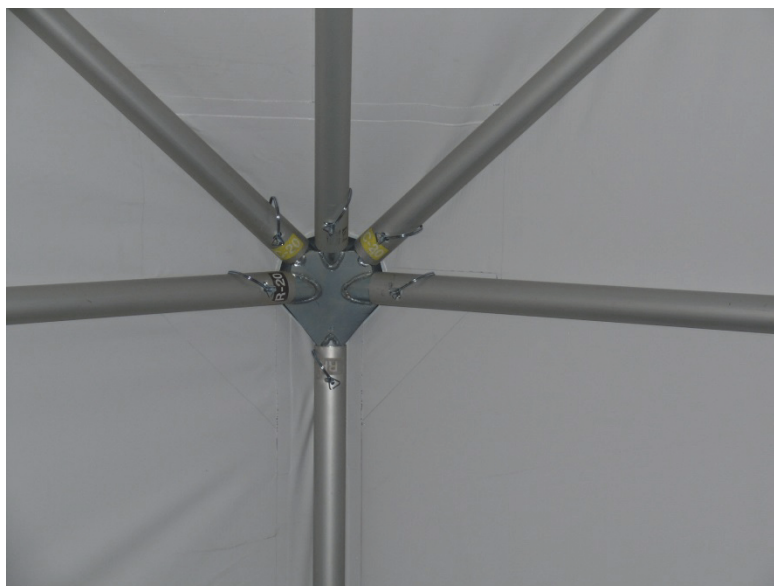


Figure A-26—End Hub Connector



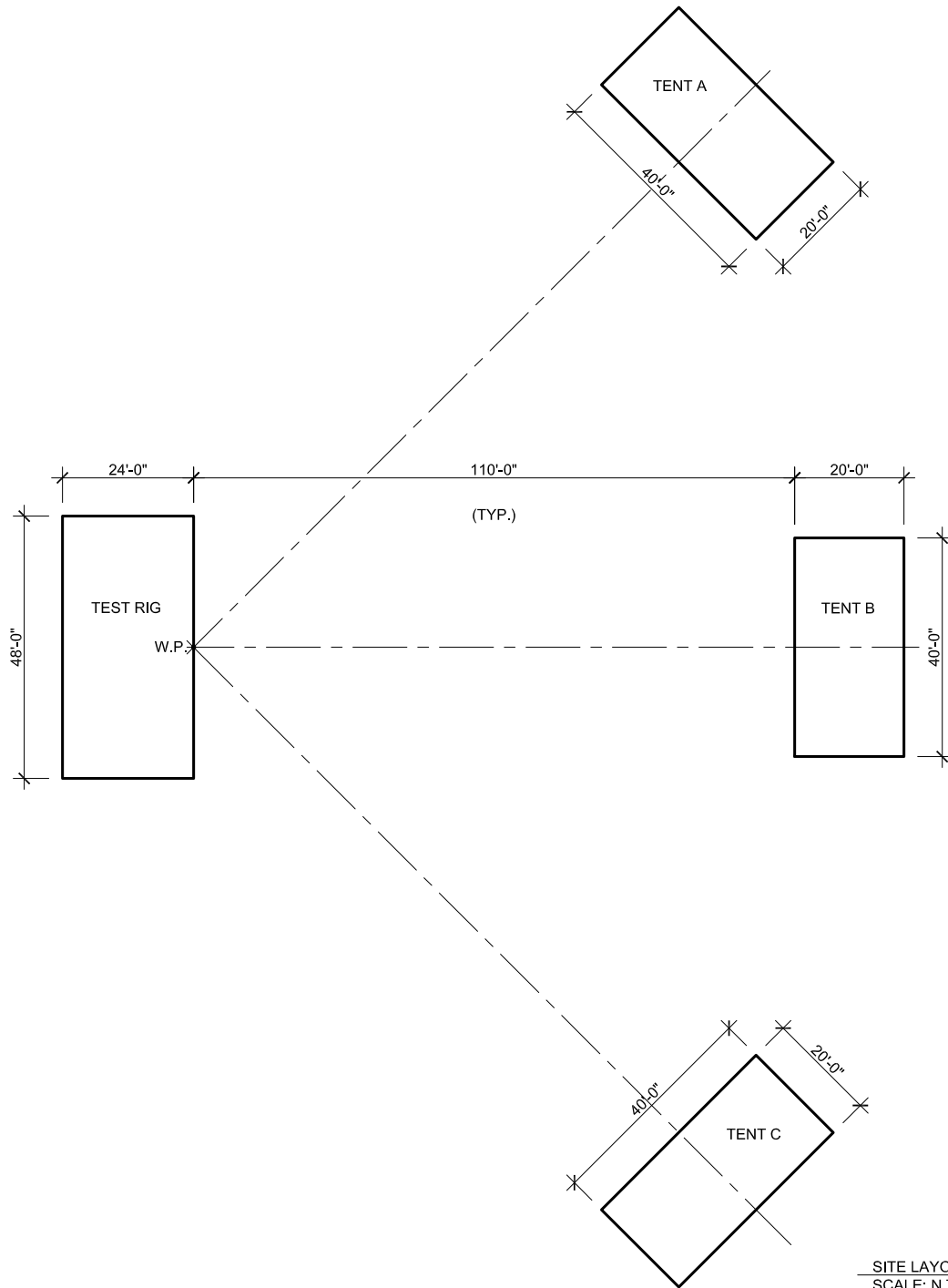
Figure A-27—Center Hub Connector

A.7.3 Fabric

Material Specifications: Tent fabric, Fabric seams, and webbing were same as for the wind rated pole tent described in Section A.5.


ANNEX B.

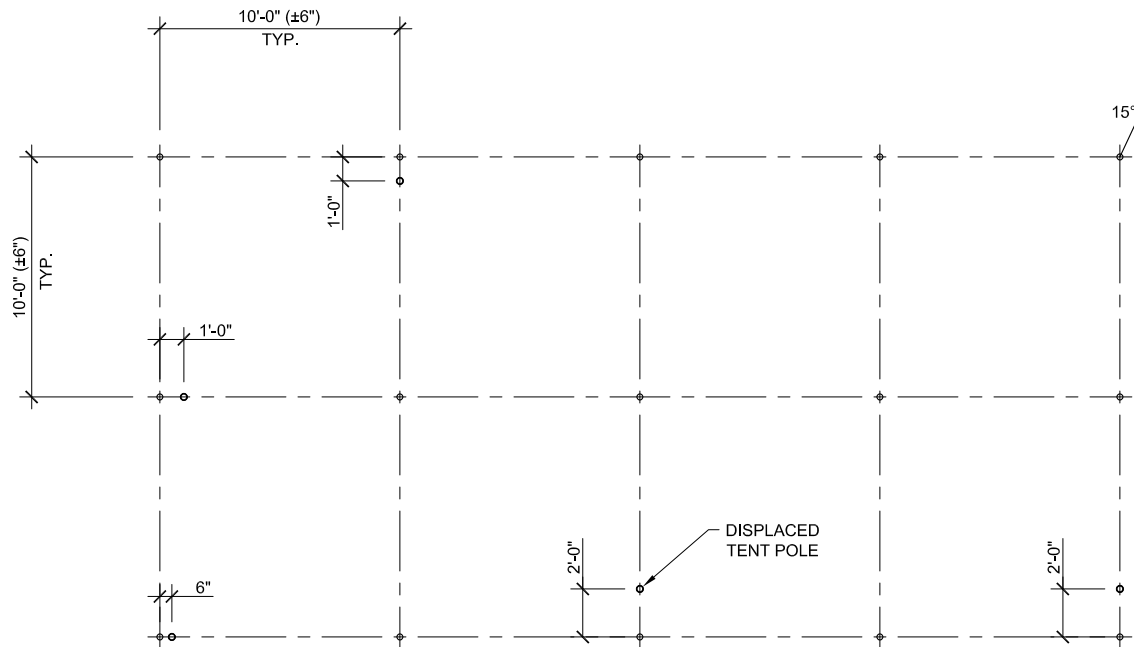
TEST SERIES A - FULL PLOTS OF PRESSURE DATA



SITE LAYOUT - A SERIES TEST
SCALE: N.T.S.

1

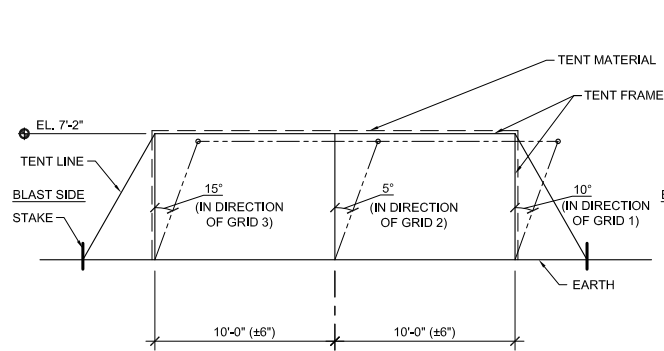
AMERICAN PETROLEUM INSTITUTE
A SERIES TEST
SITE LAYOUT
 BAKER ENGINEERING & RISK CONSULTANTS 3100 DRAWING COURT, SUITE 100 SAN ANTONIO, TX 78216-3024



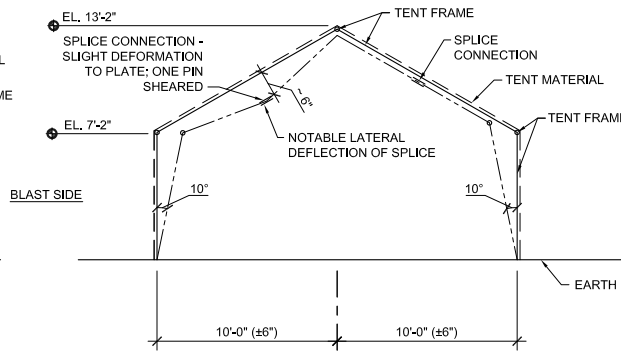
- NOTE:
1. PERIMETER POLE HEIGHT 7'-2".
 2. INTERIOR POLE HEIGHT 13'-2".

TENT A LAYOUT - TENT TEST A03
SCALE: N.T.S

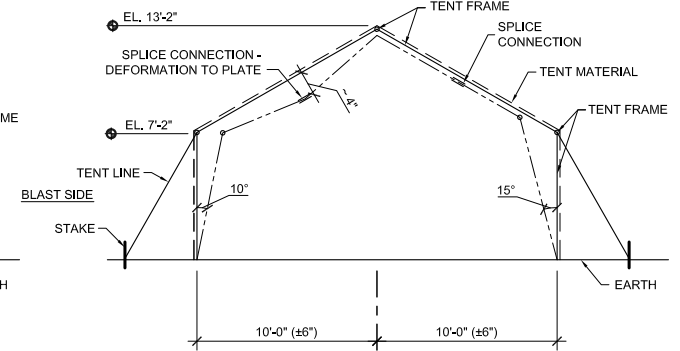
1



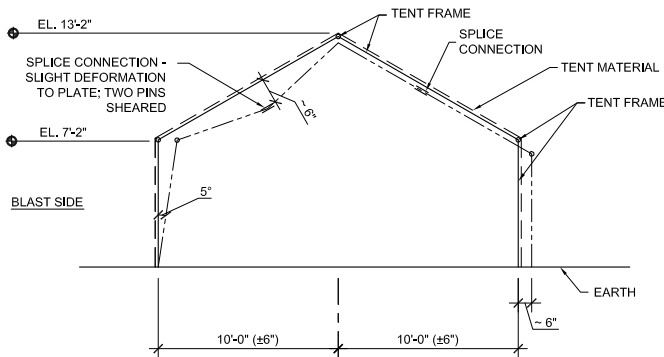
TENT B - SECTION 1/ GRID A
SCALE: N.T.S.



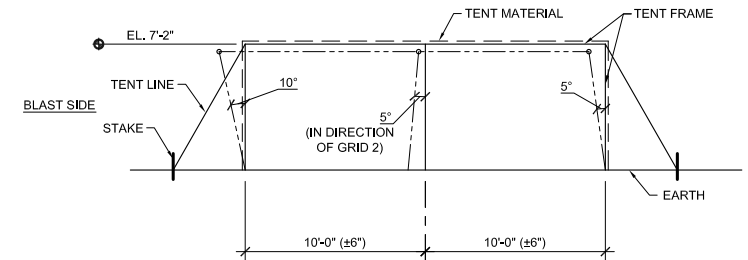
TENT B - SECTION 2/ GRID B
SCALE: N.T.S.



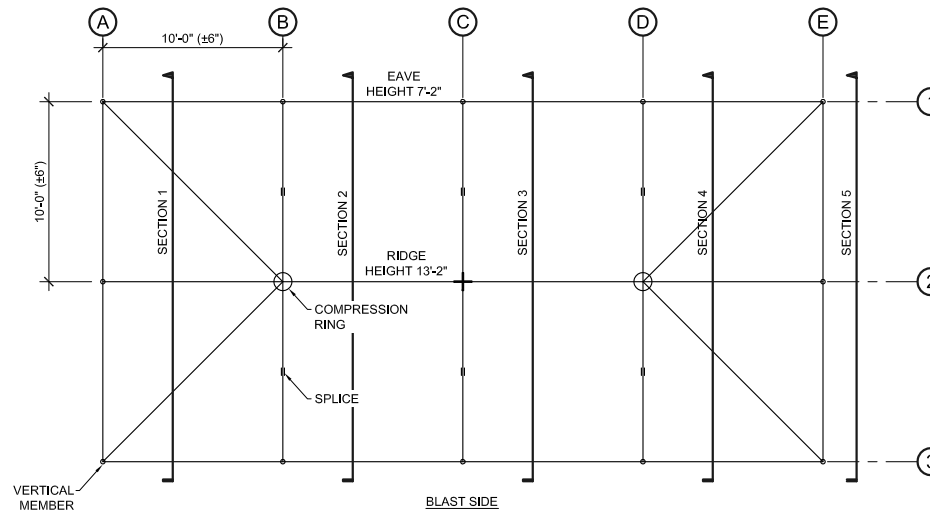
TENT B - SECTION 3/ GRID C
SCALE: N.T.S.



TENT B - SECTION 4/ GRID D
SCALE: N.T.S.



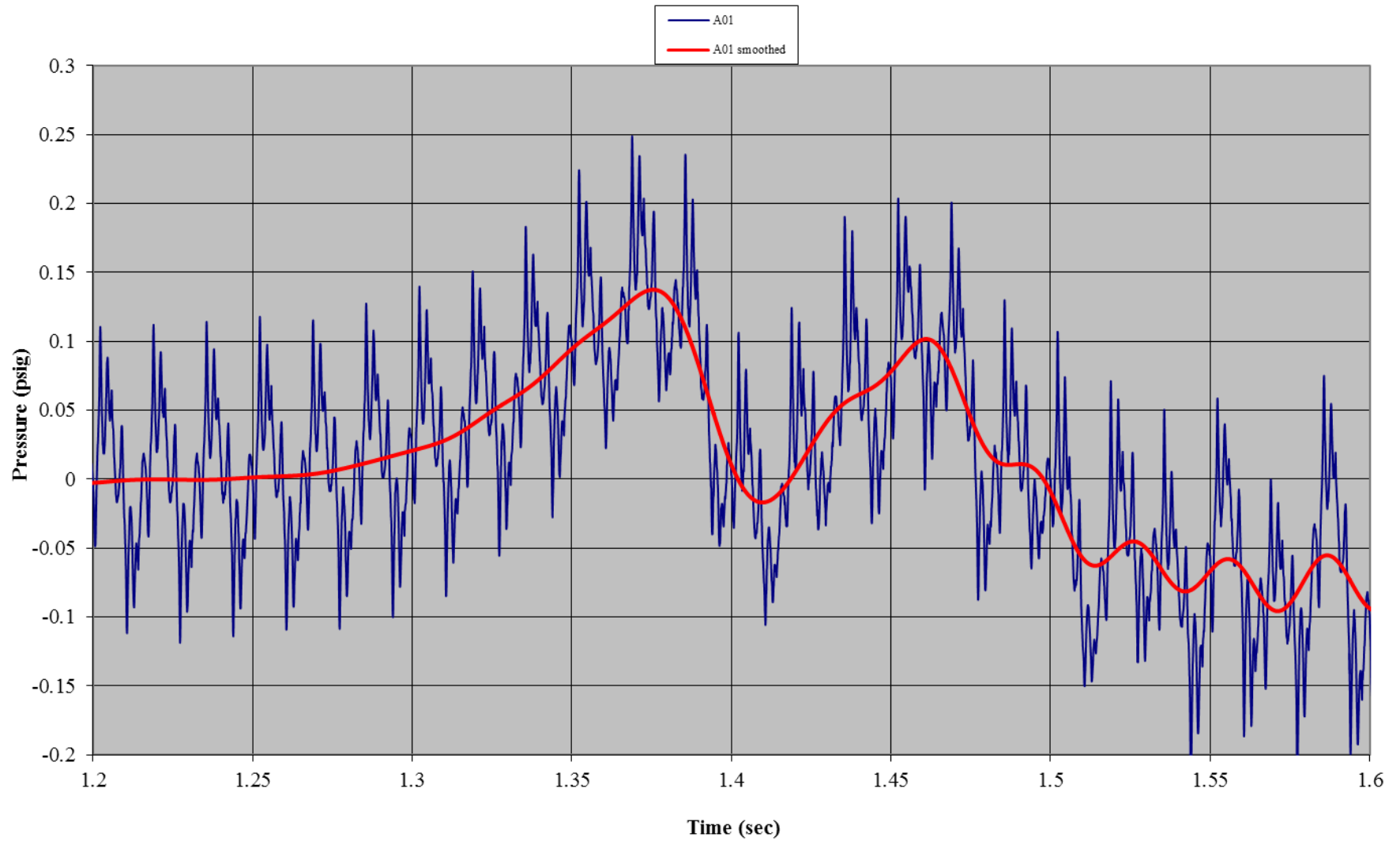
TENT B - SECTION 5/ GRID E
SCALE: N.T.S.



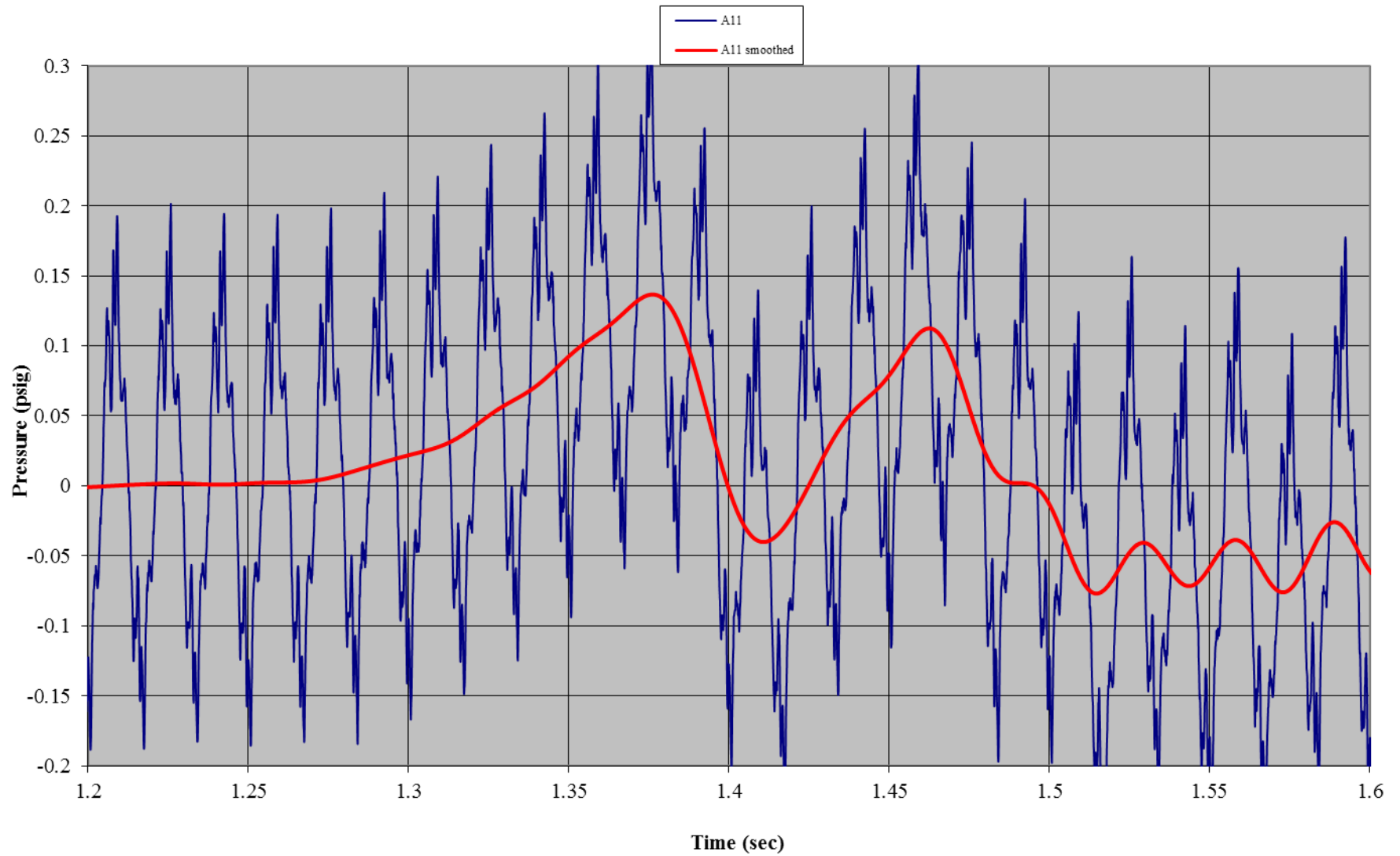
TENT B LAYOUT - TENT TEST A03
SCALE: N.T.S.

Test A02: Tent A

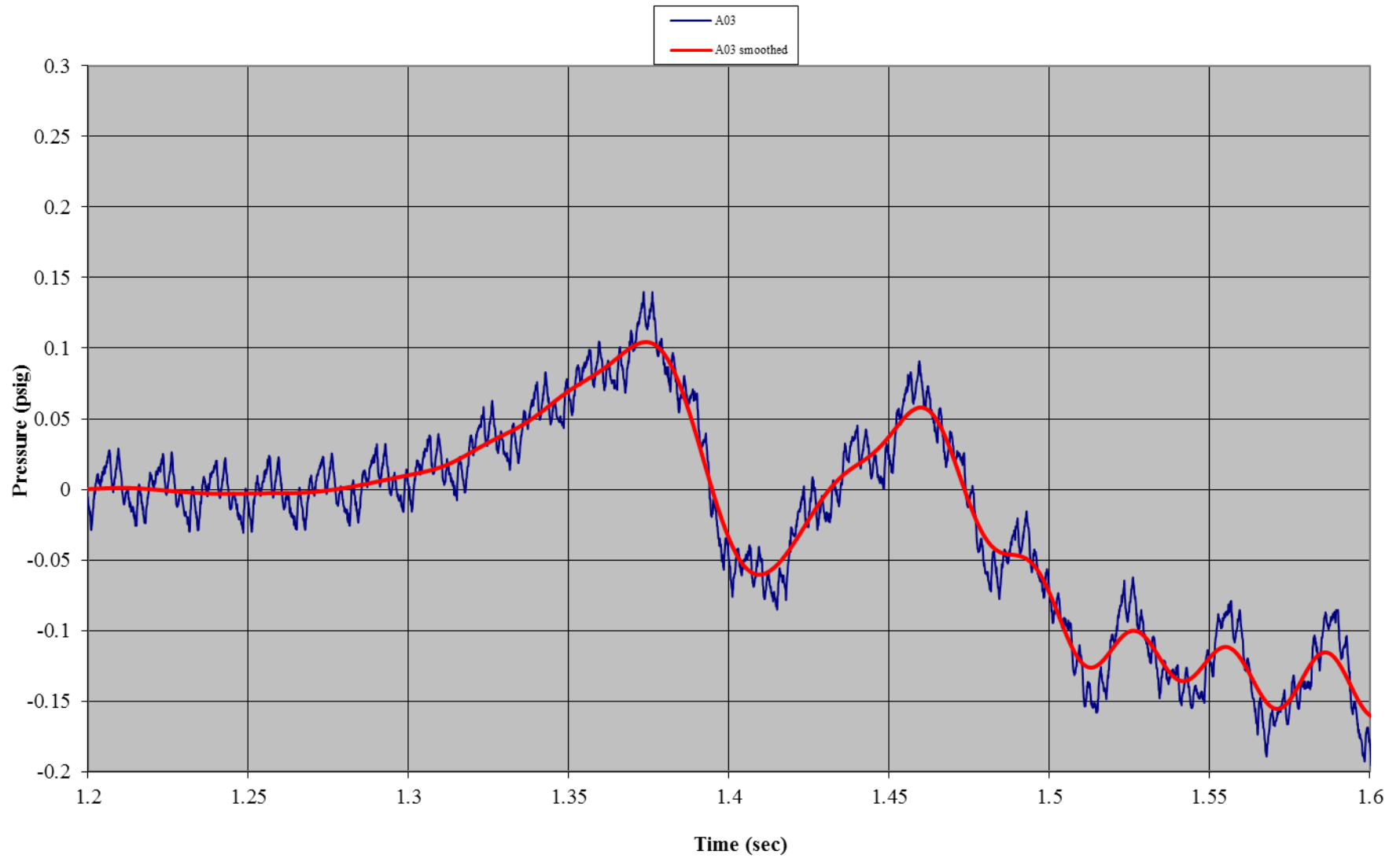
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 01: Front Wall, Left Bottom



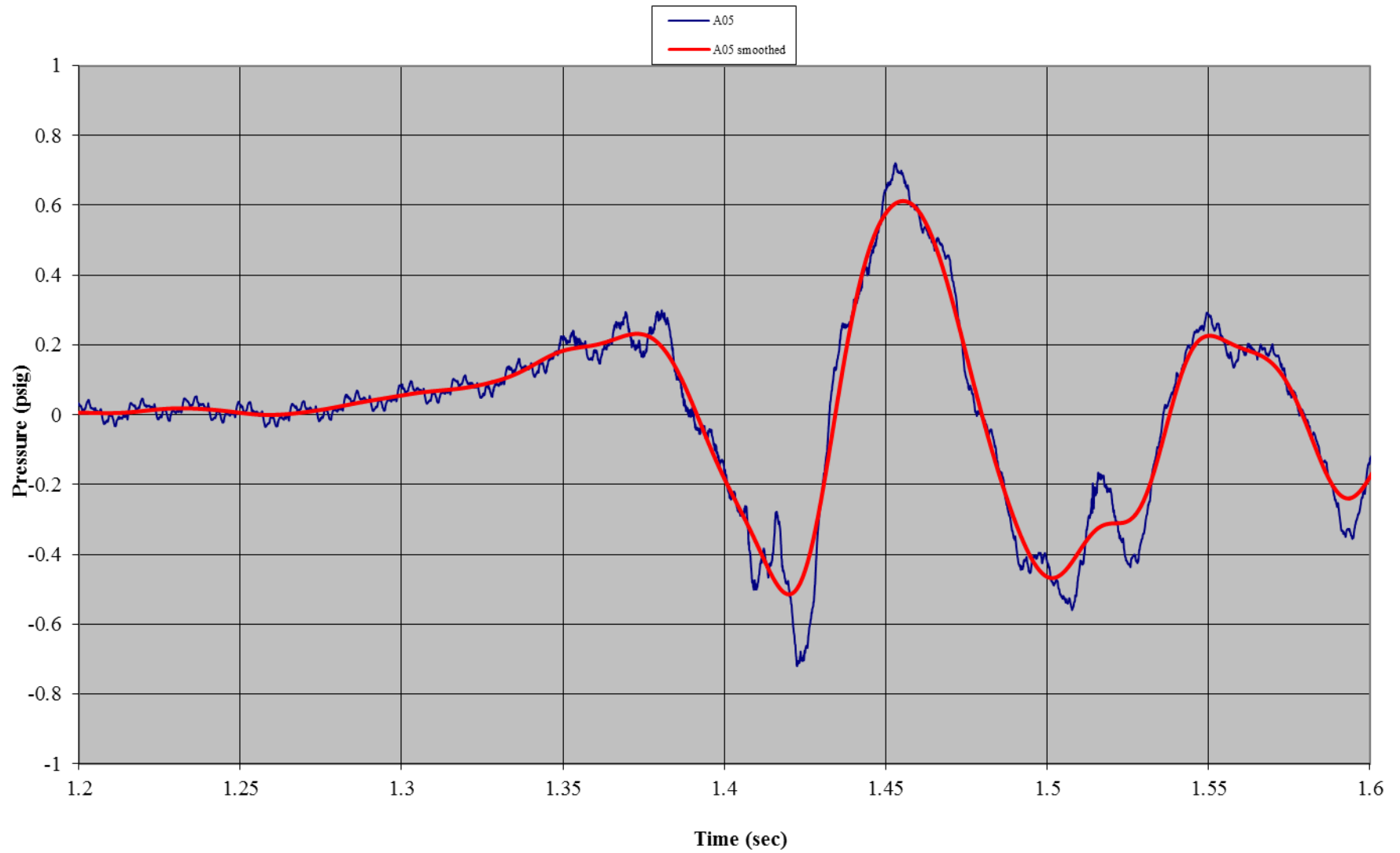
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 11: Front Wall, Right Bottom



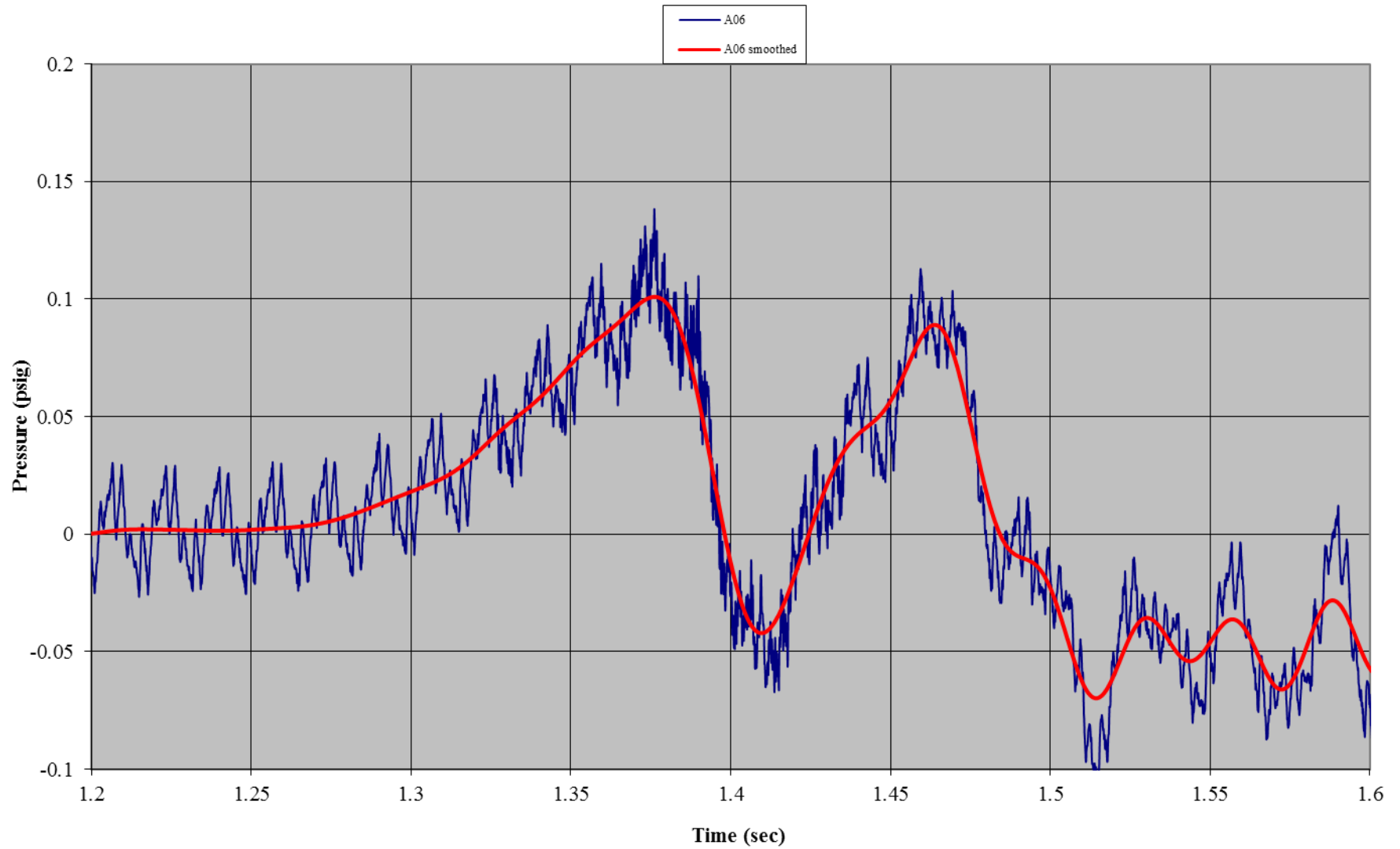
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 03: Front Wall, Center Bottom



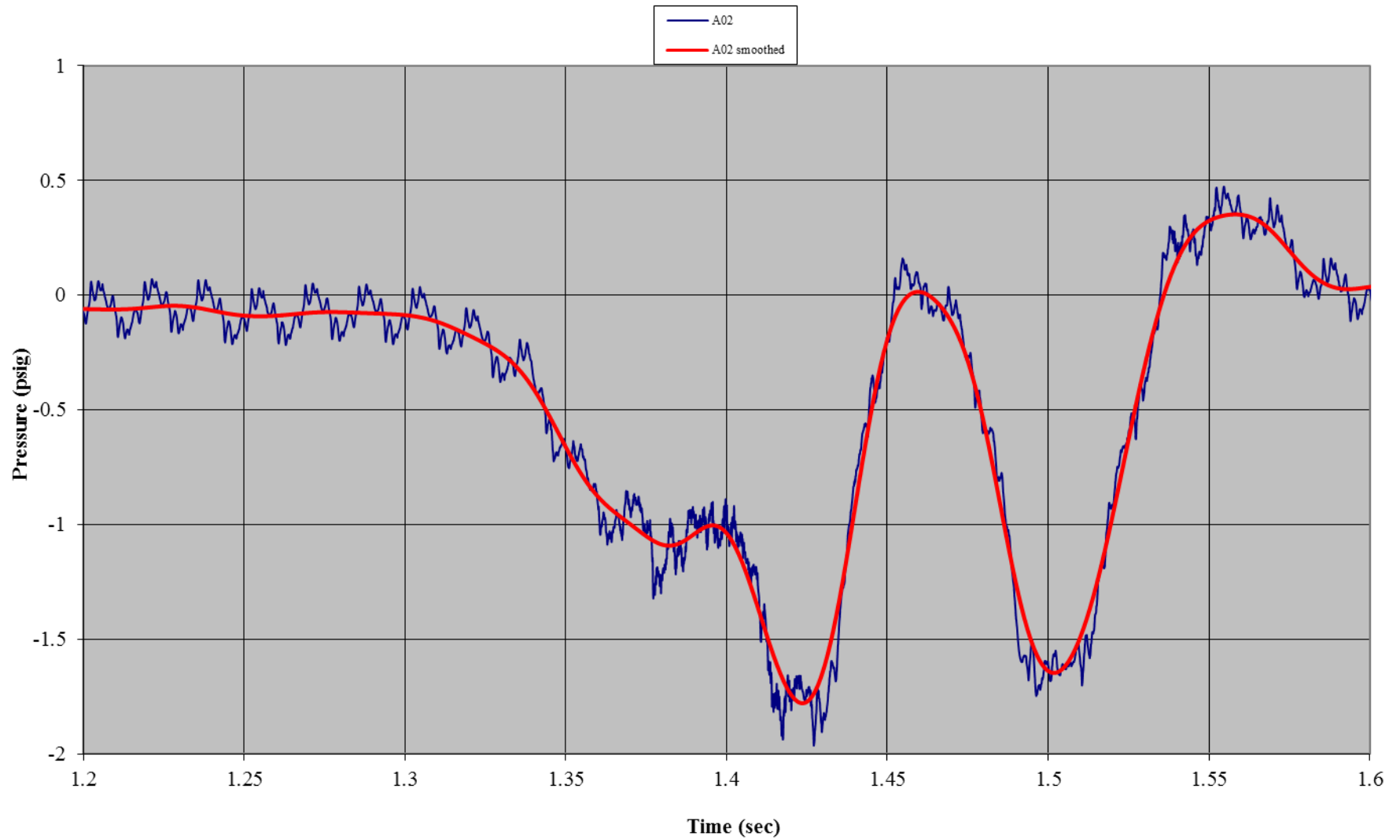
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



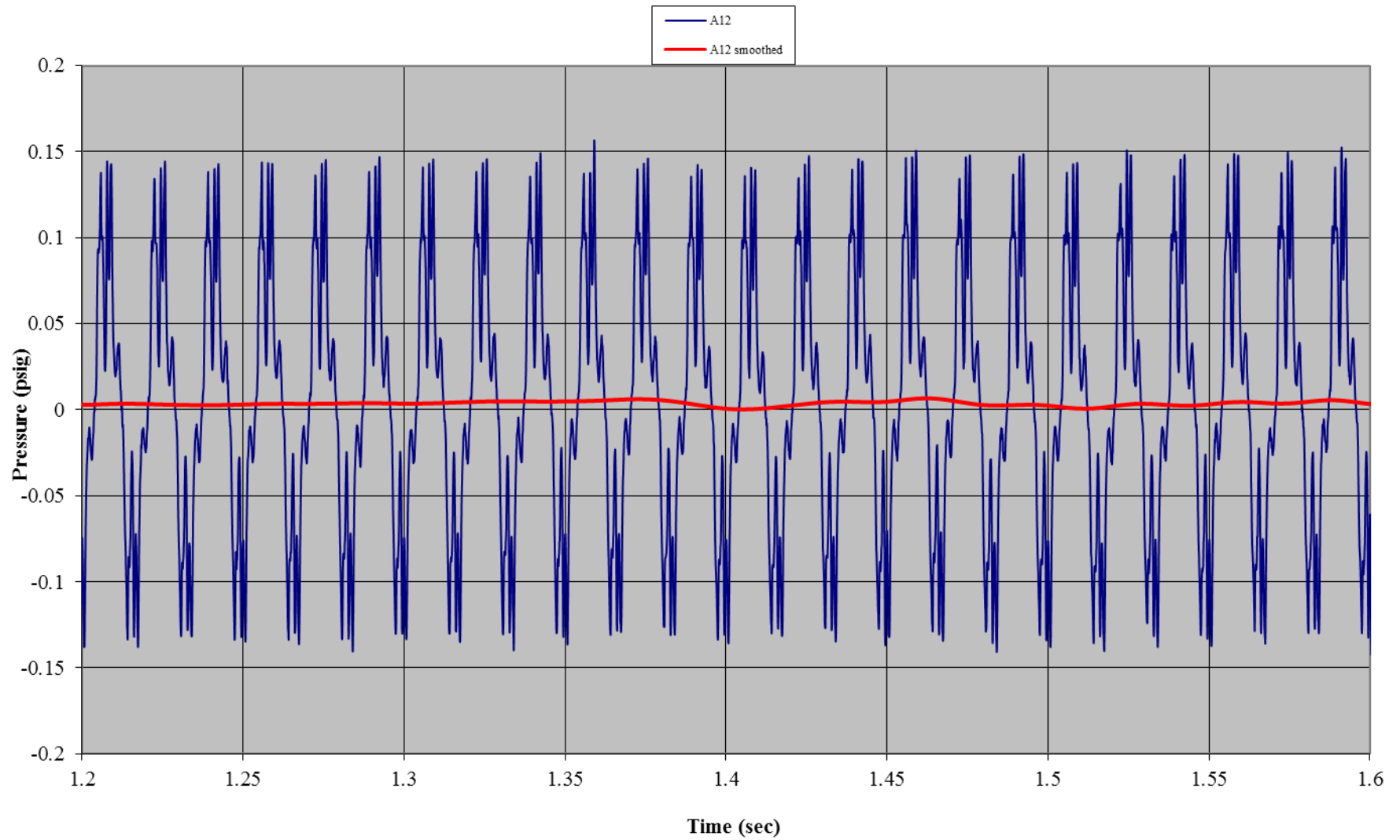
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 06: Front Wall, Center Top



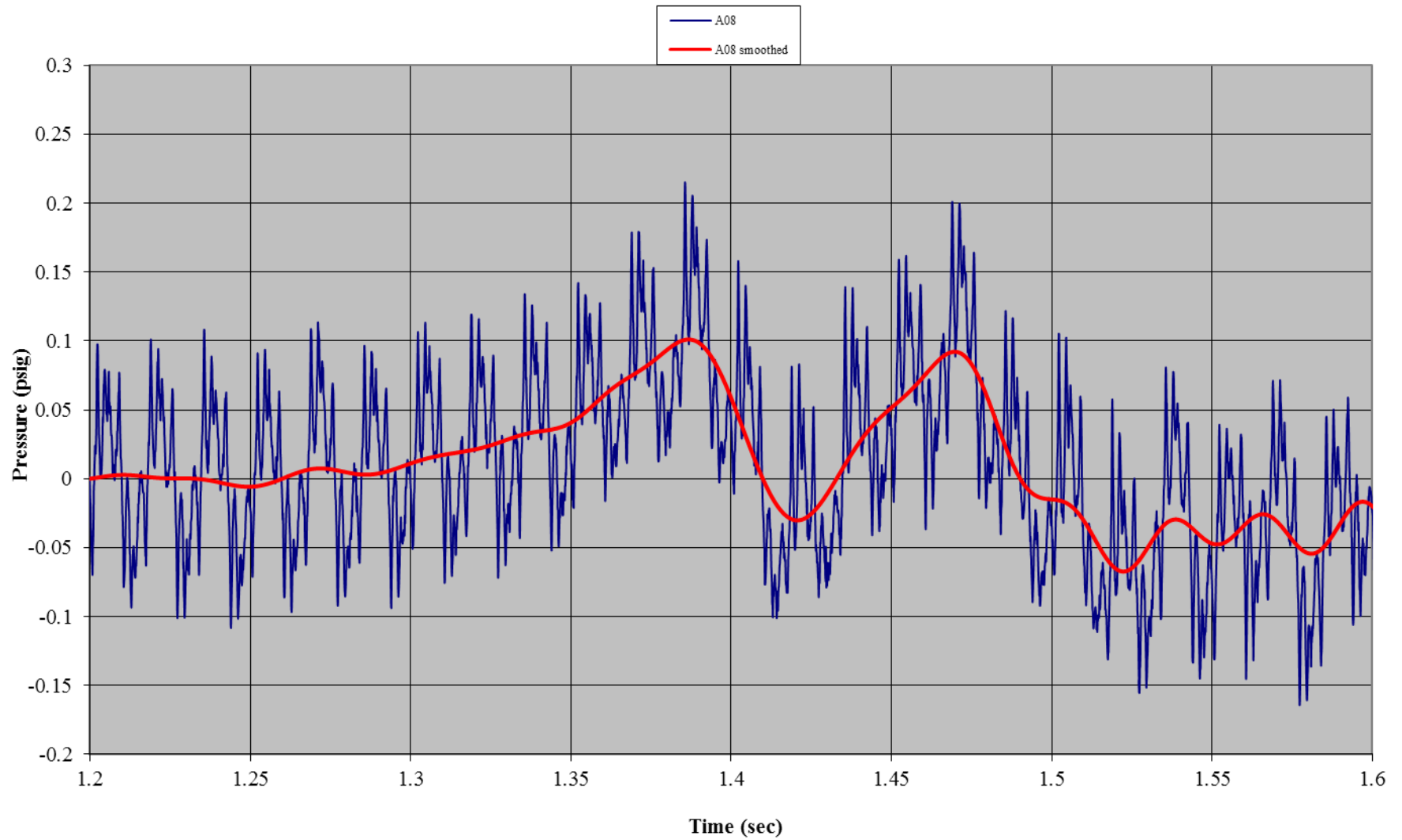
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



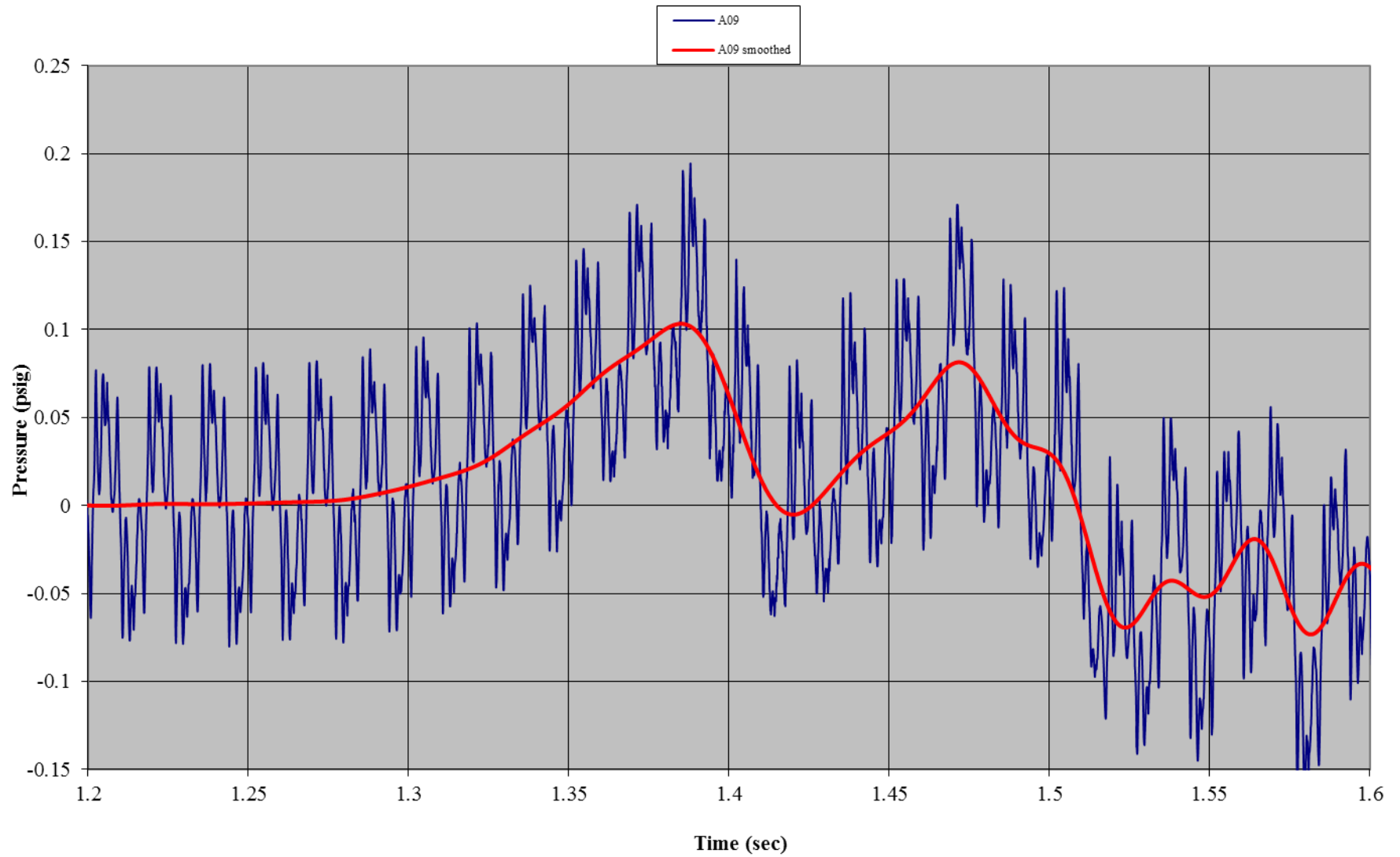
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



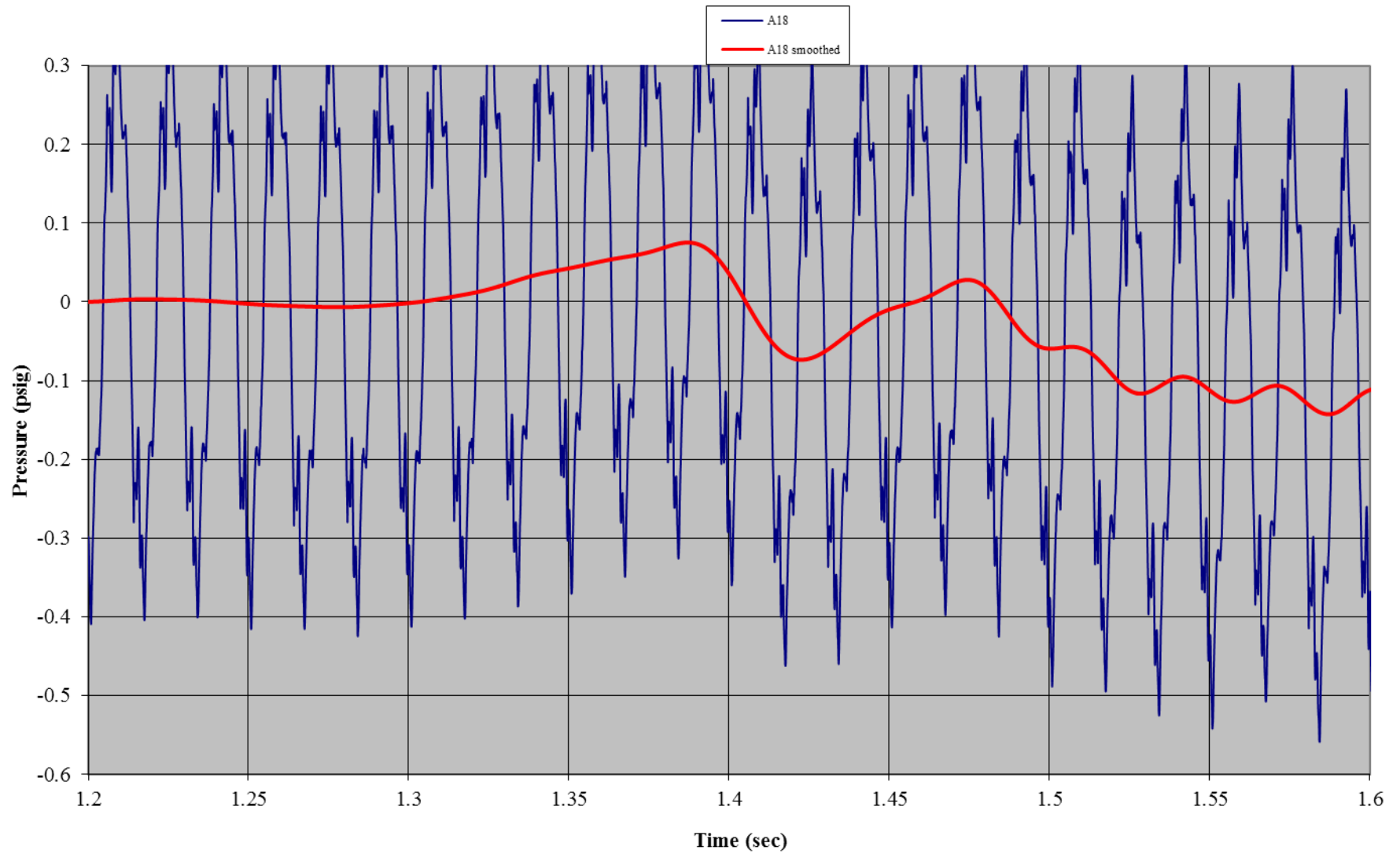
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 08: Left Side Wall, Bottom



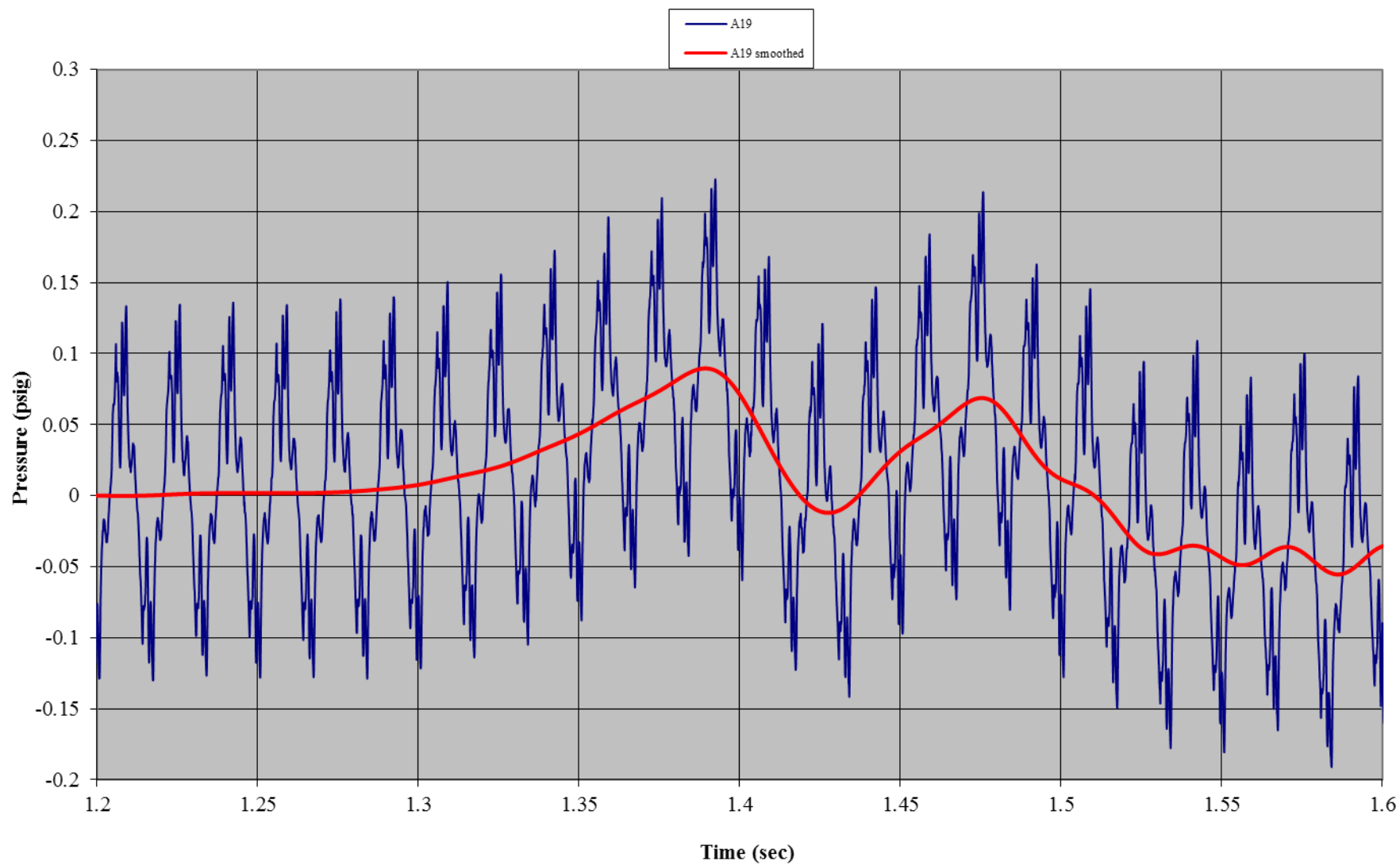
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



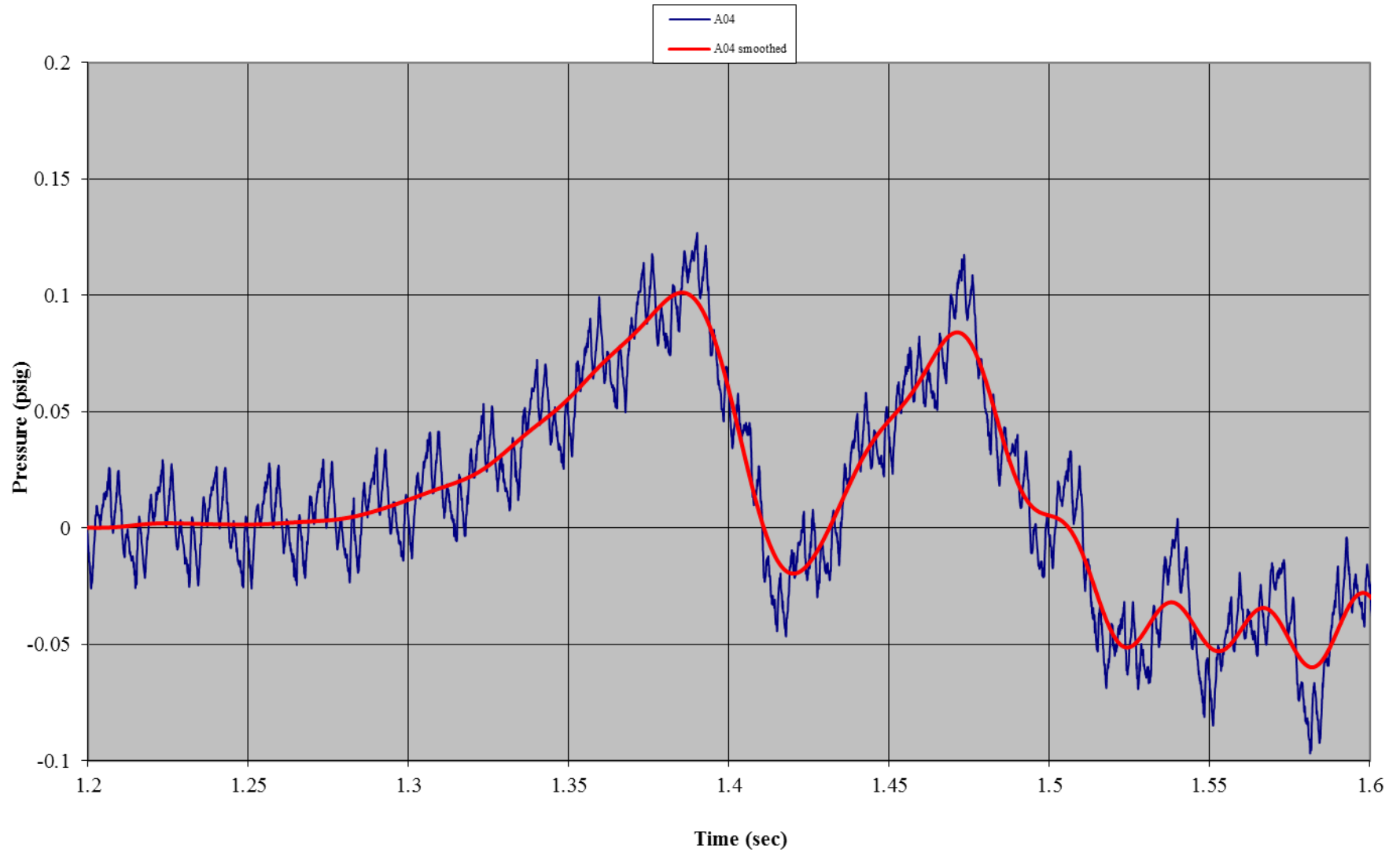
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 18: Right Side Wall, Bottom



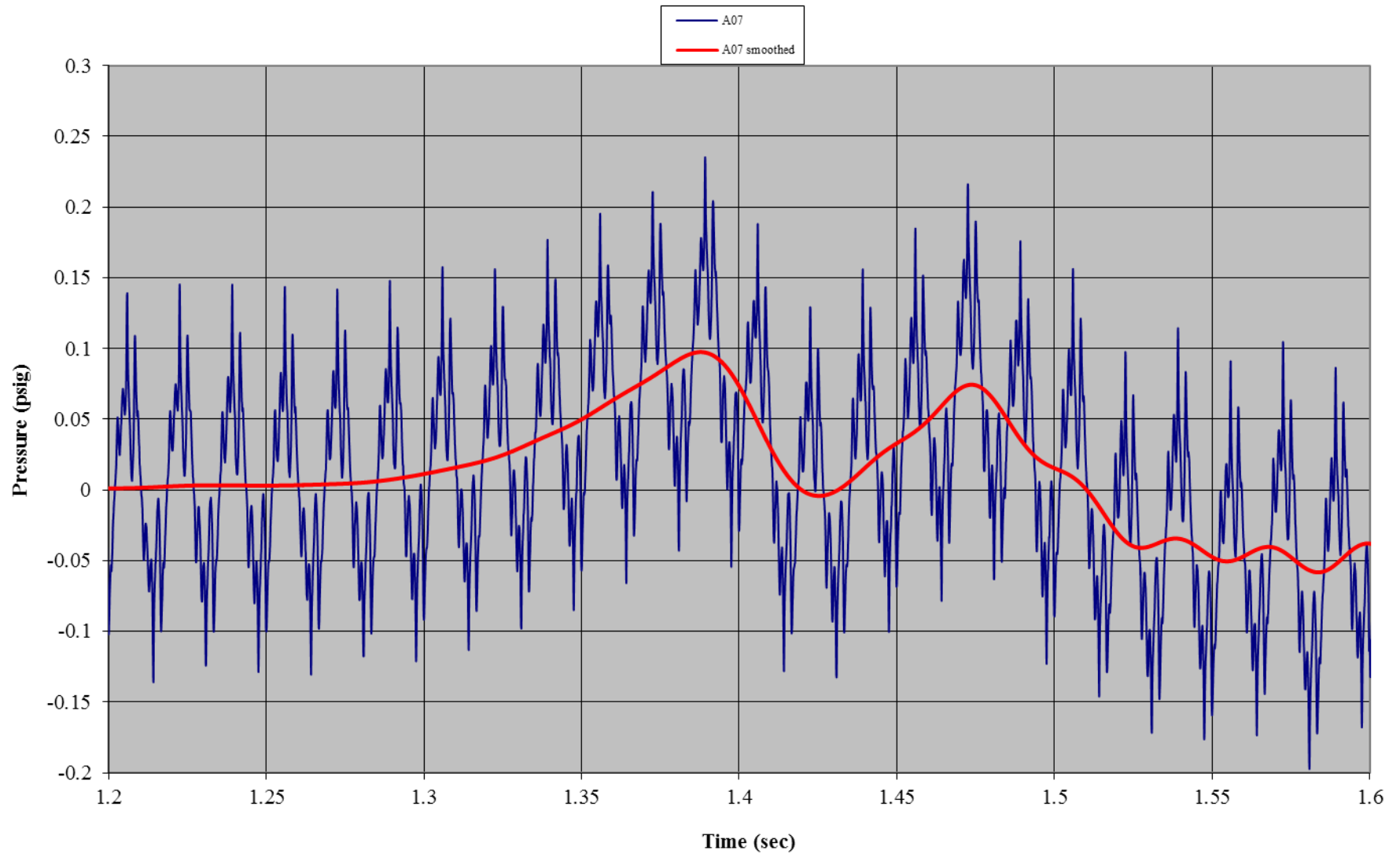
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



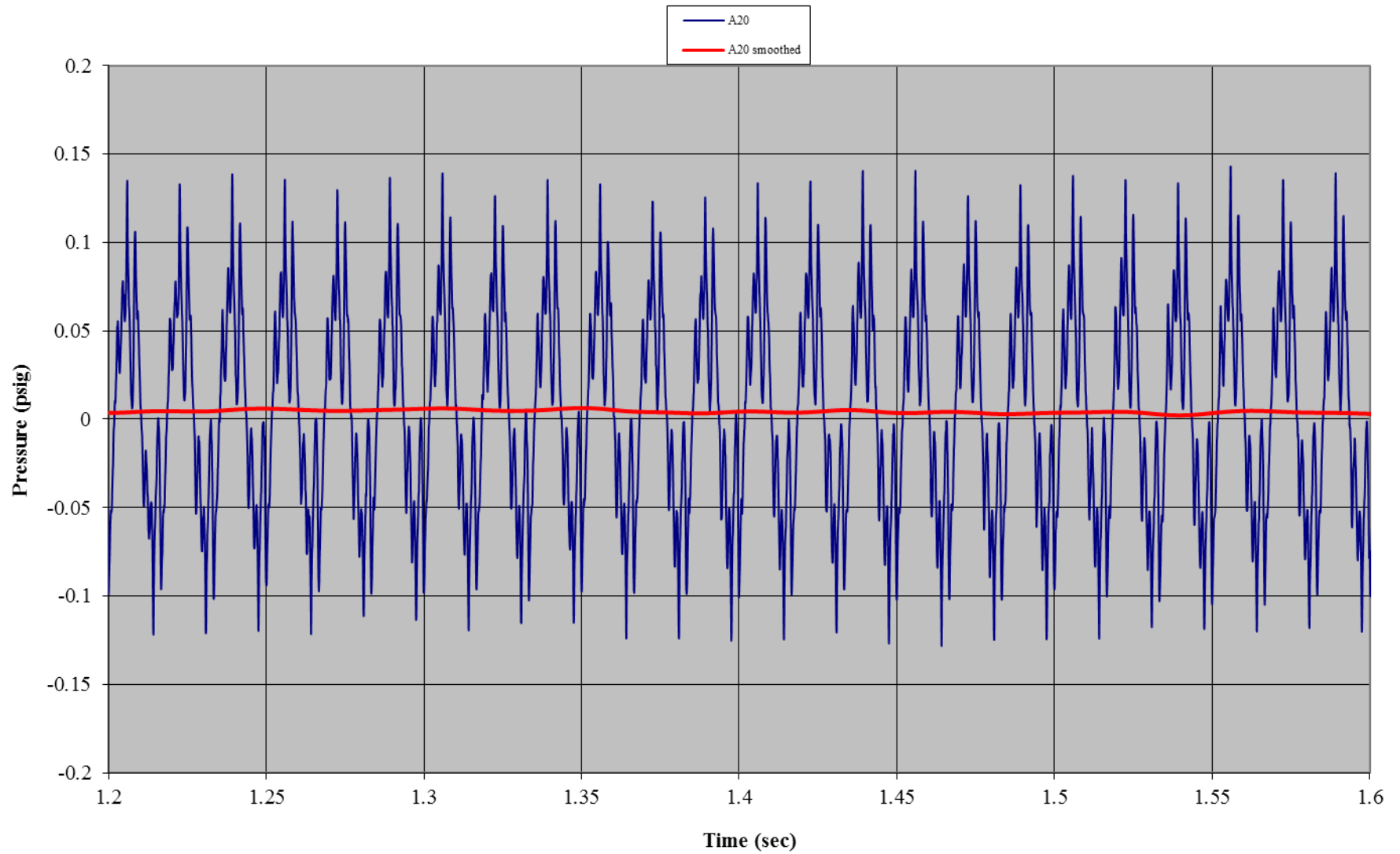
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 04: Interior, Ground



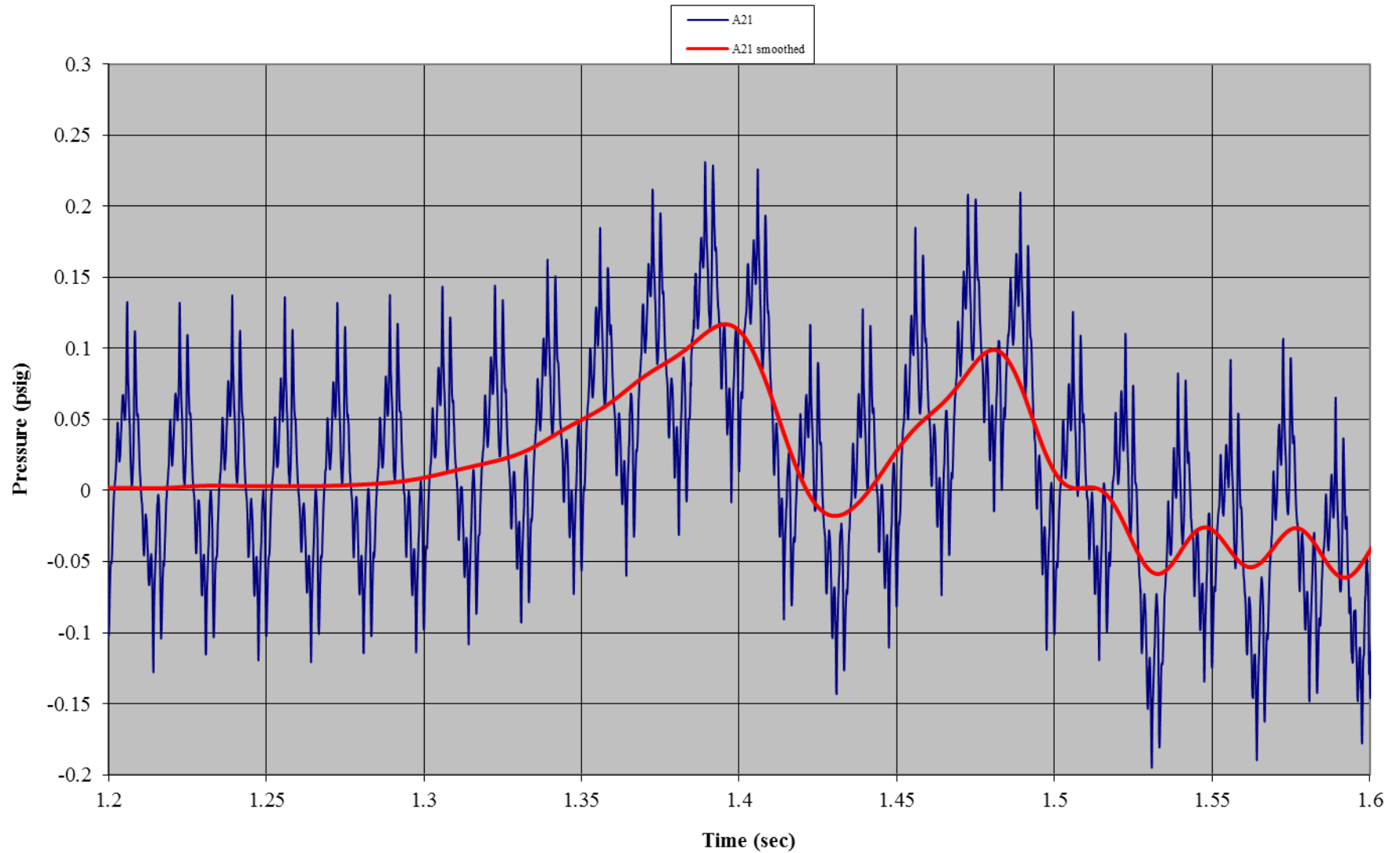
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 07: Roof, Front



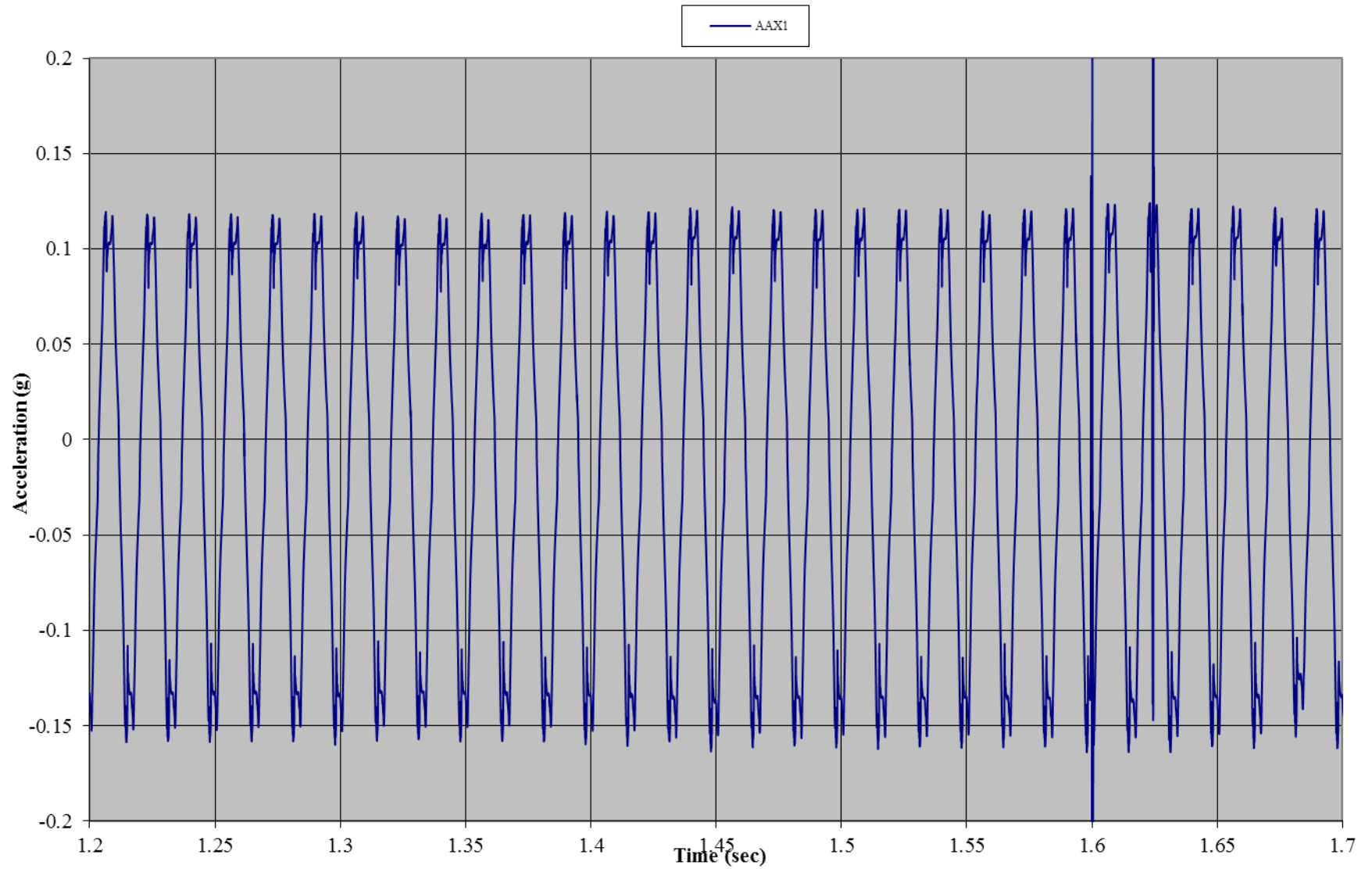
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 20: Roof, Back



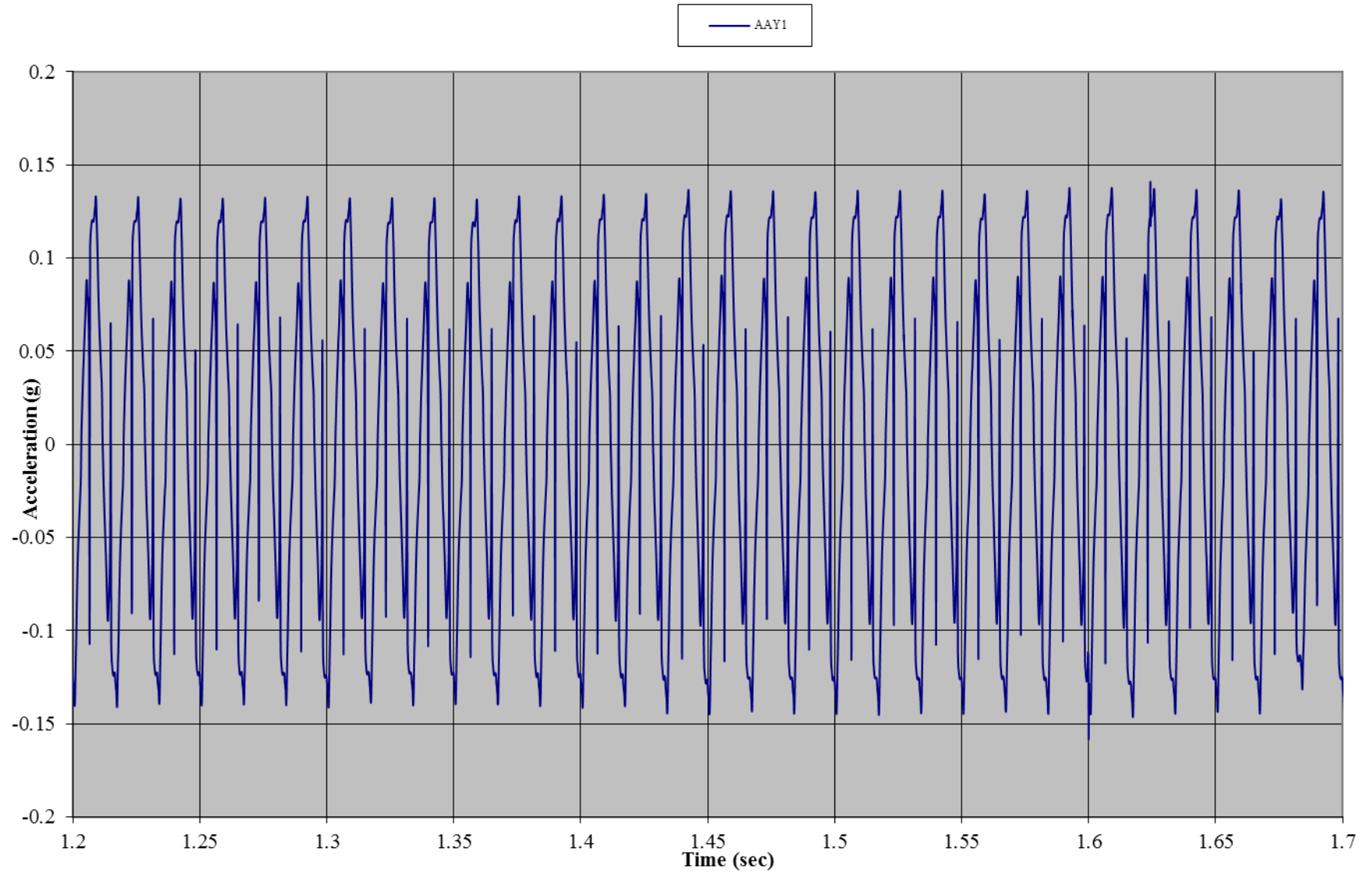
Test A02: Non-Wind Rated Pole Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



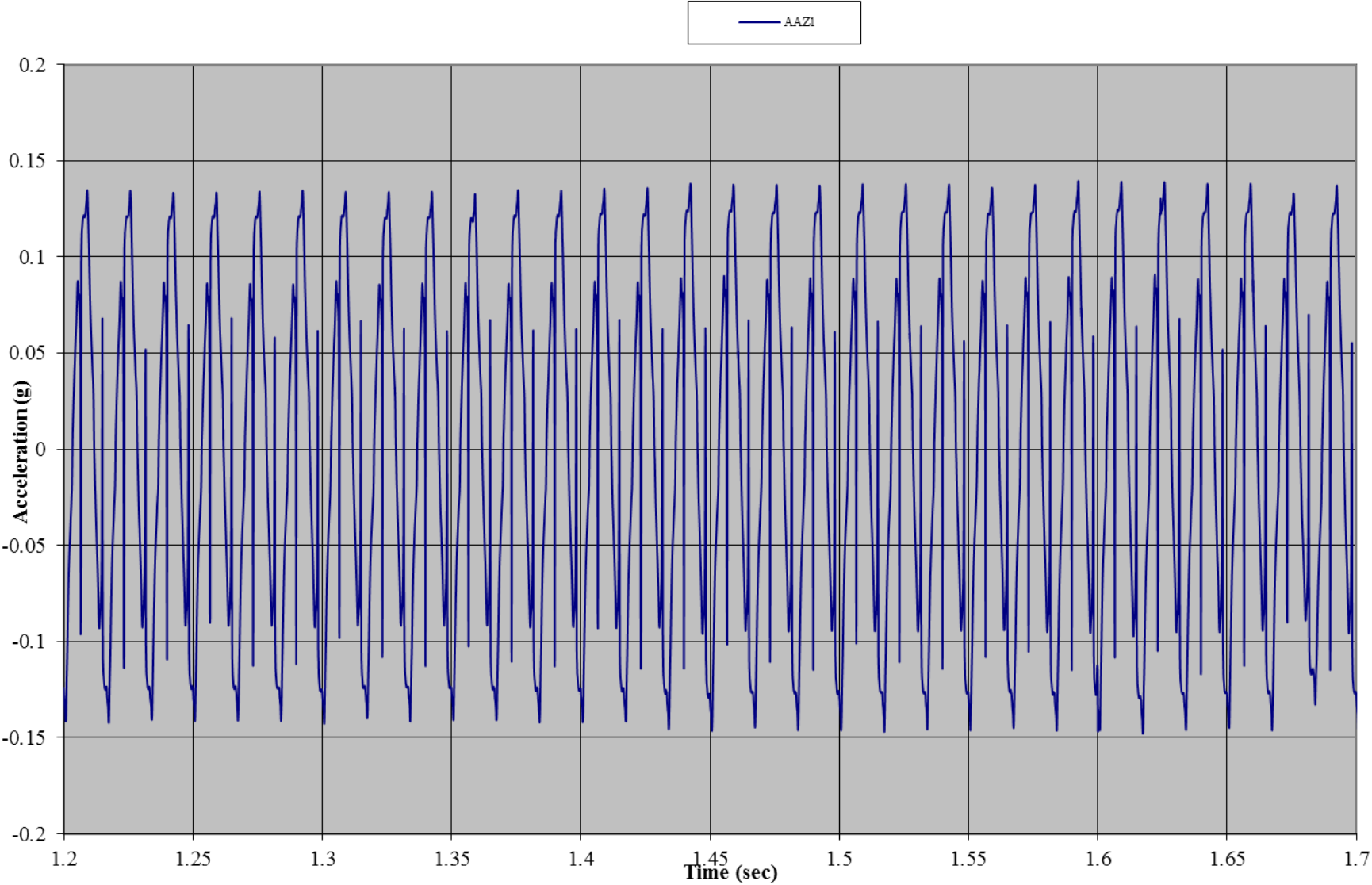
Test A02: Non-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (x-direction)



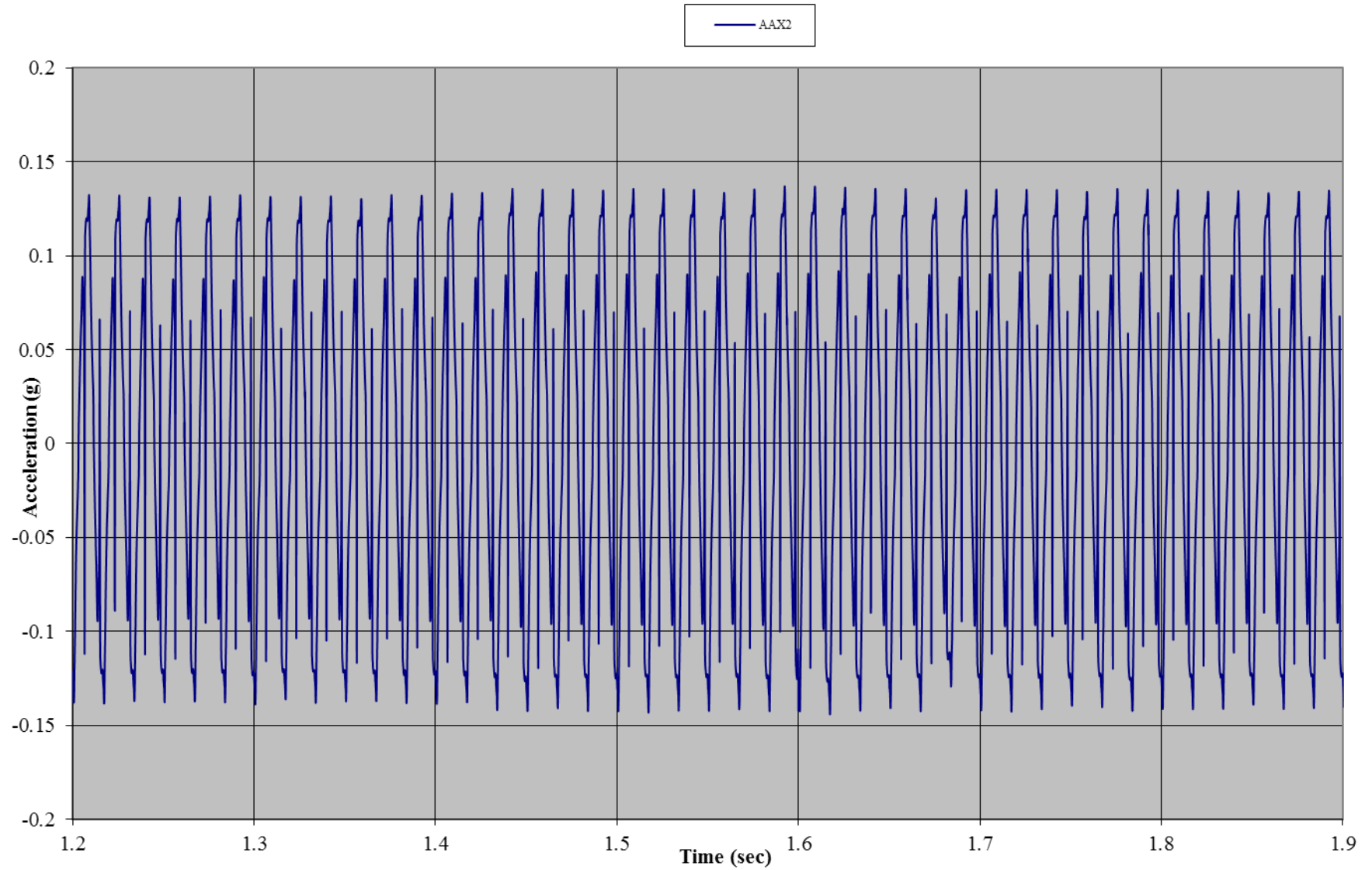
Test A02: Non-Wind Rated Pole Tent with Sides
Acceletometer 1: Front Wall (y-direction)



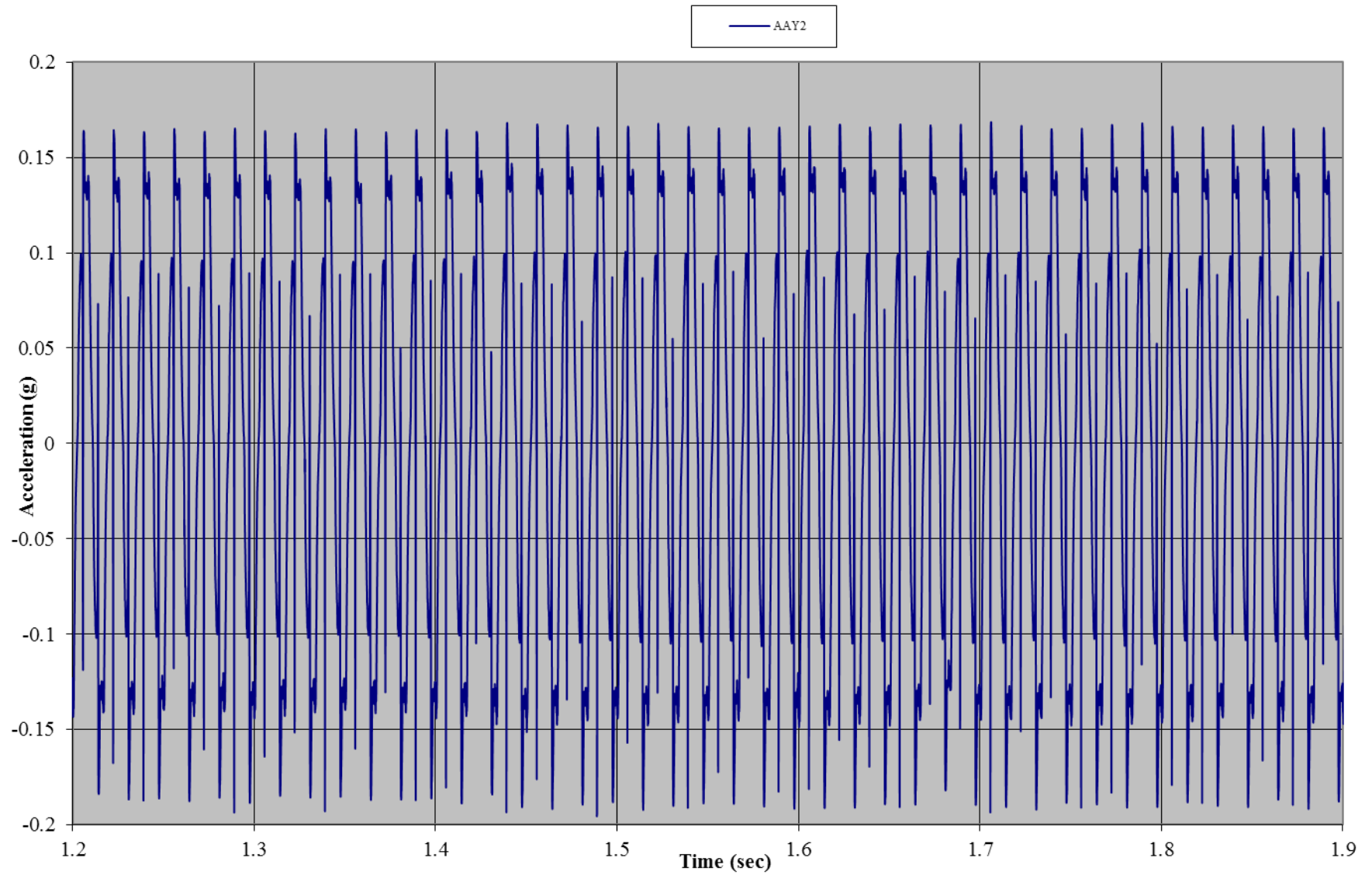
Test A02: Non-Wind Rated Pole Tent with Sides
Acceletometer 1: Front Wall (z-direction)



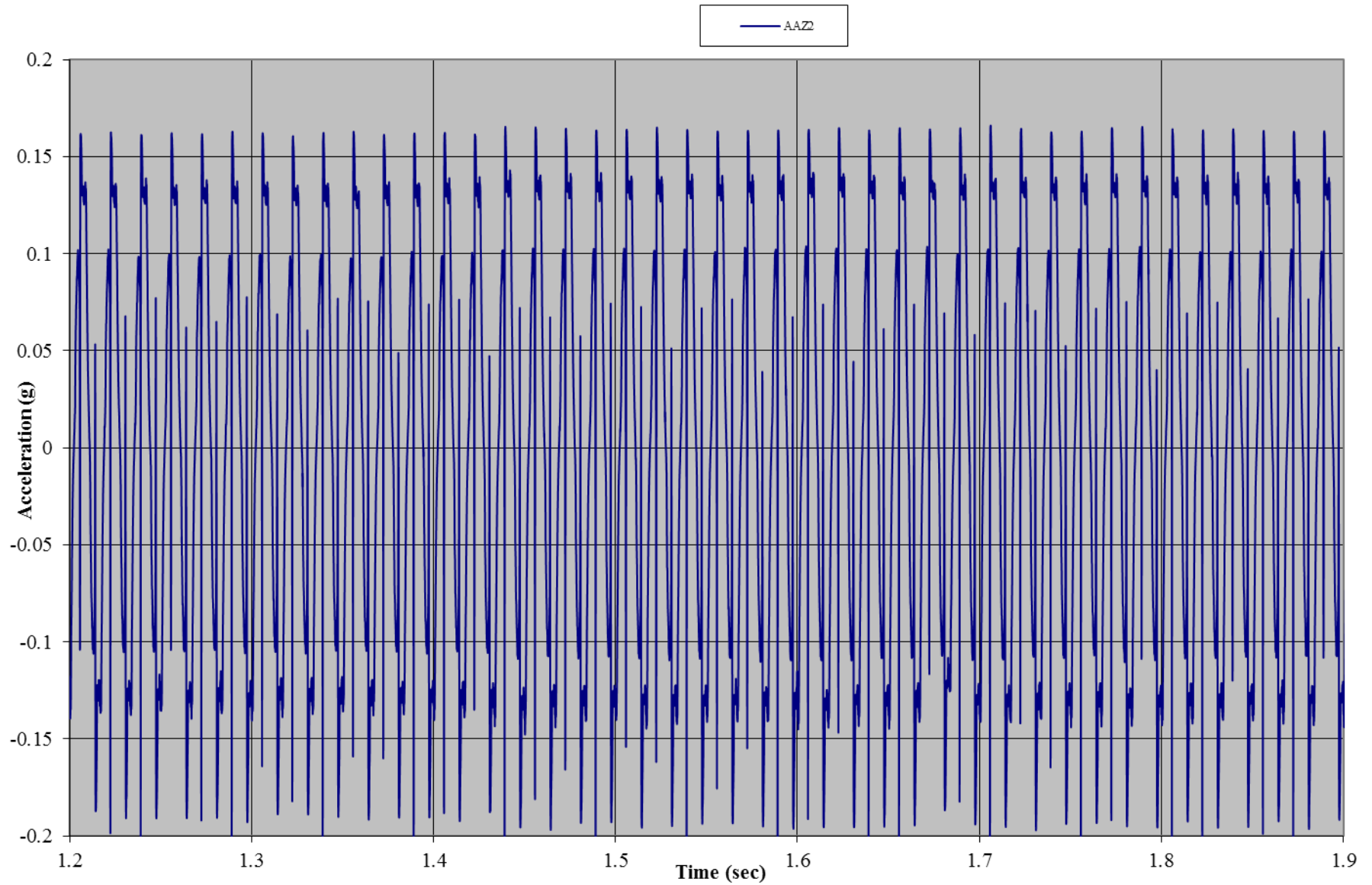
Test A02: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Front Wall (x-direction)



Test A02: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Front Wall (y-direction)

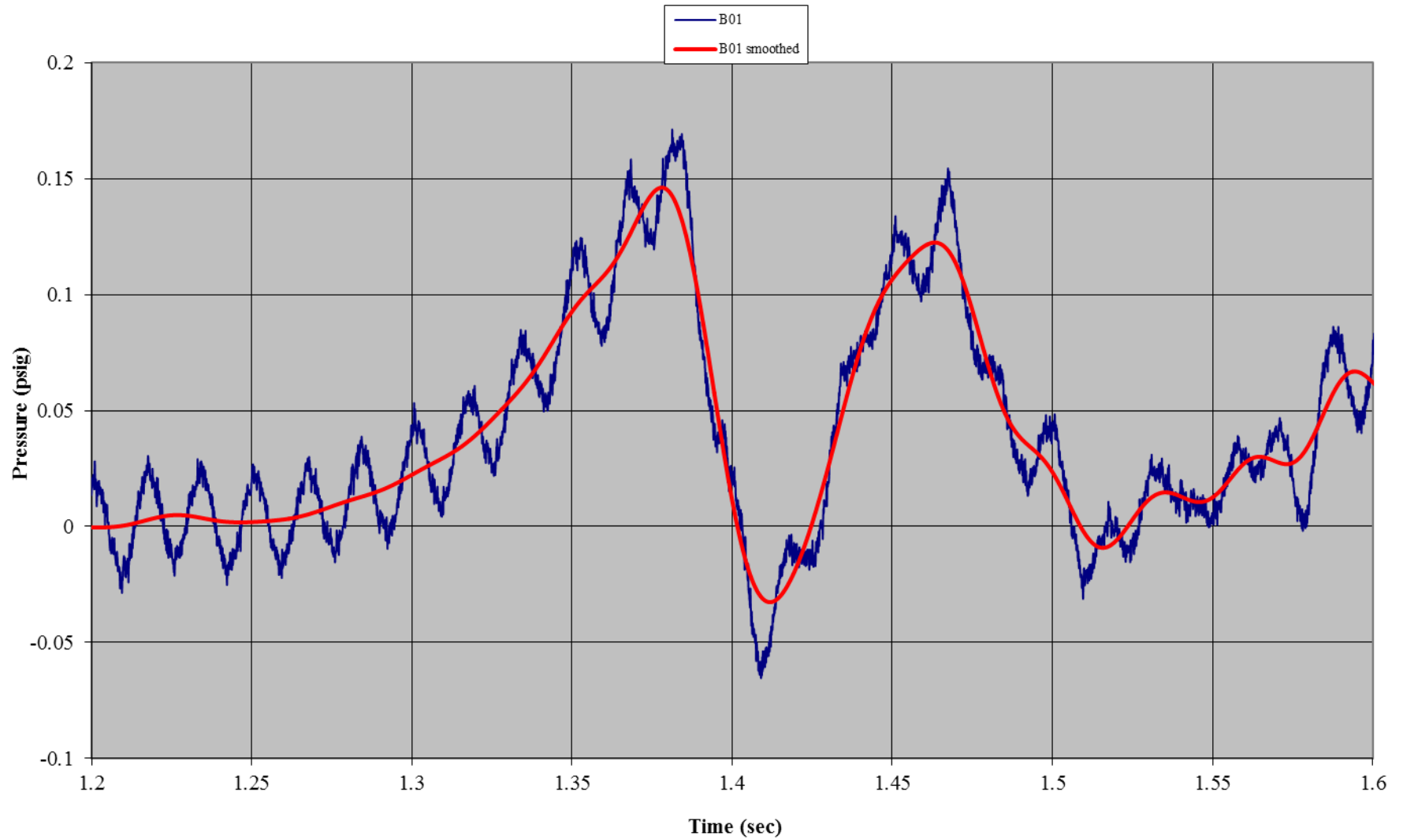


Test A02: Non-Wind Rated Pole Tent with Sides
Acceletometer 2: Front Wall (z-direction)

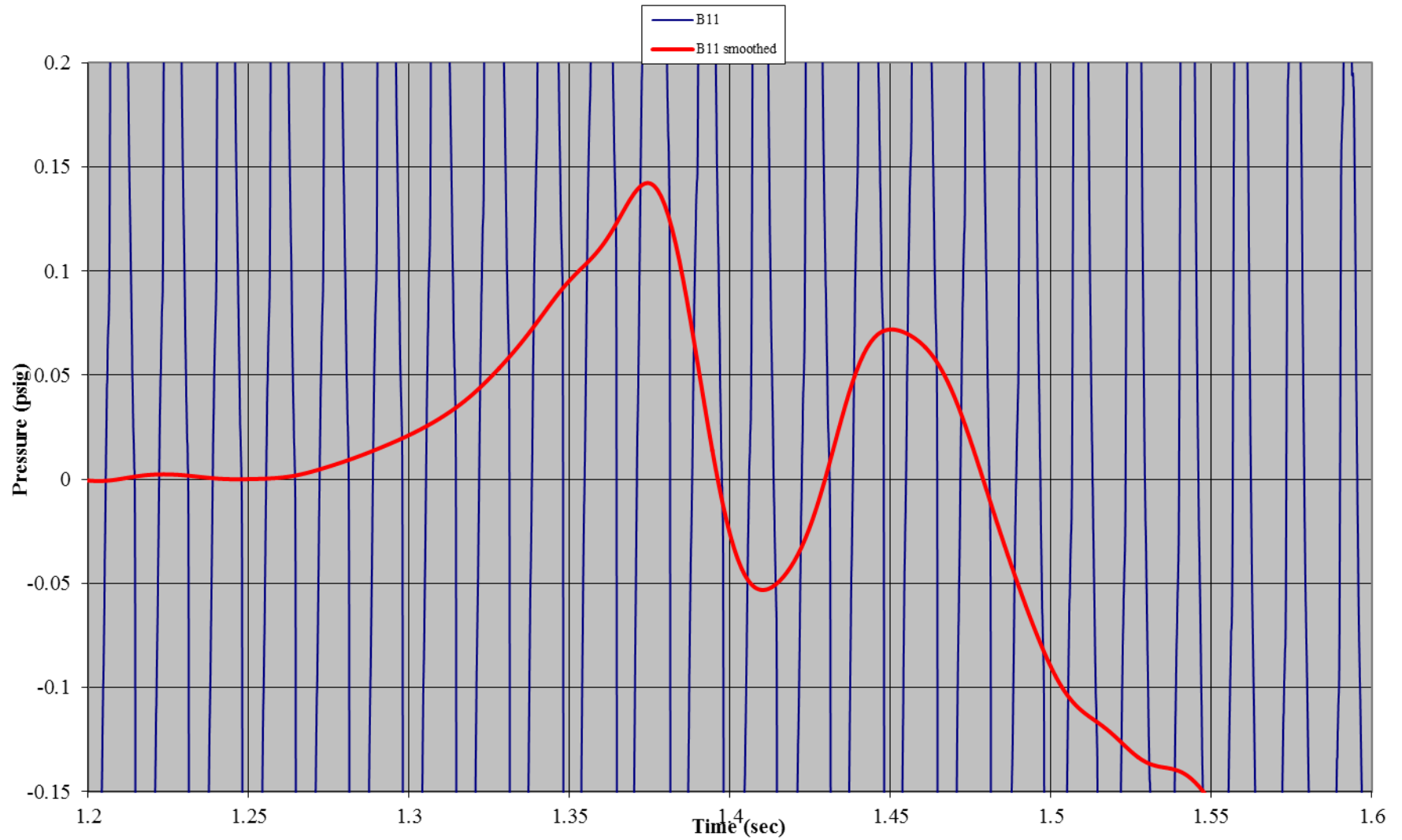


Test A02: Tent B

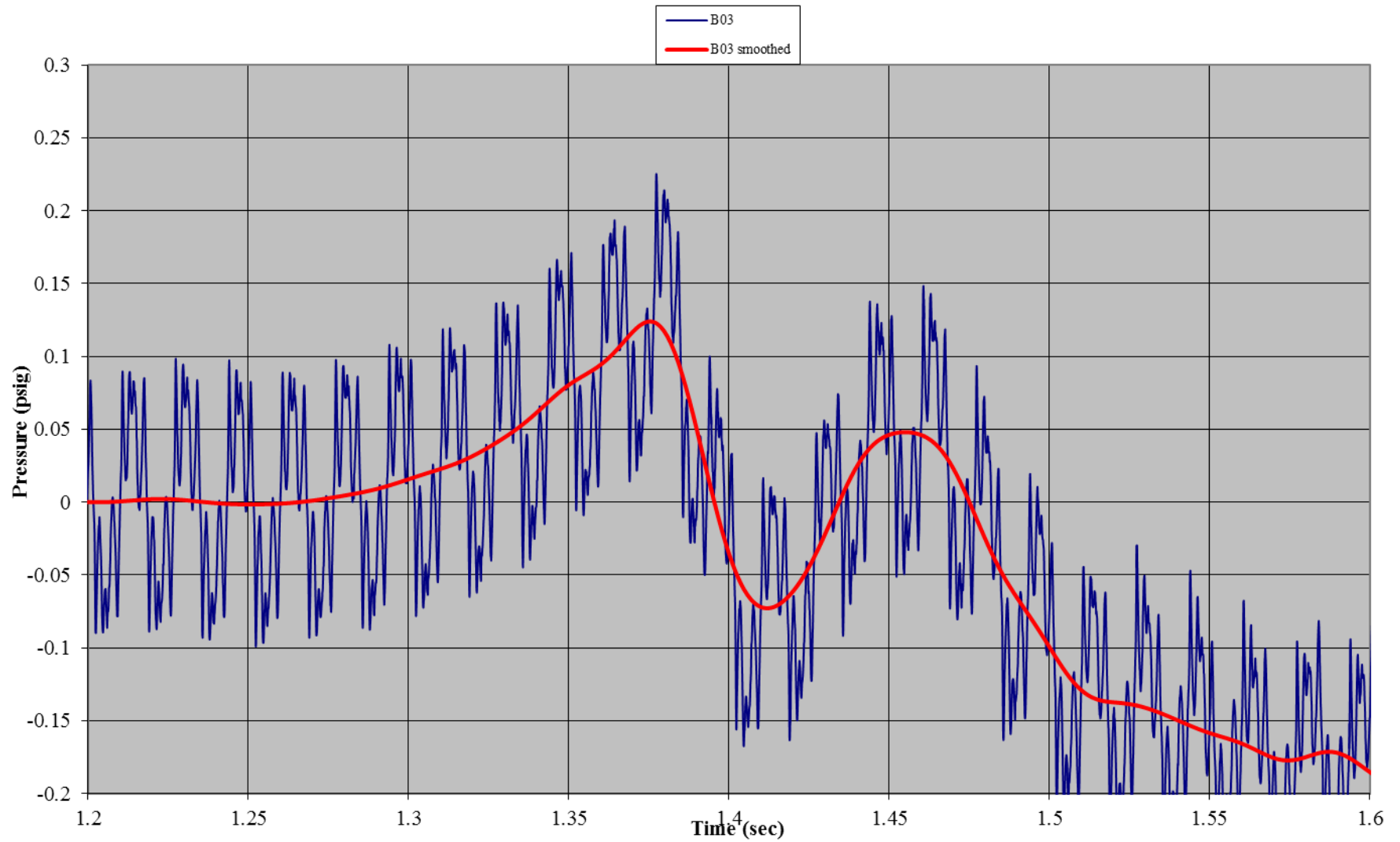
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 01: Front Wall, Left Bottom



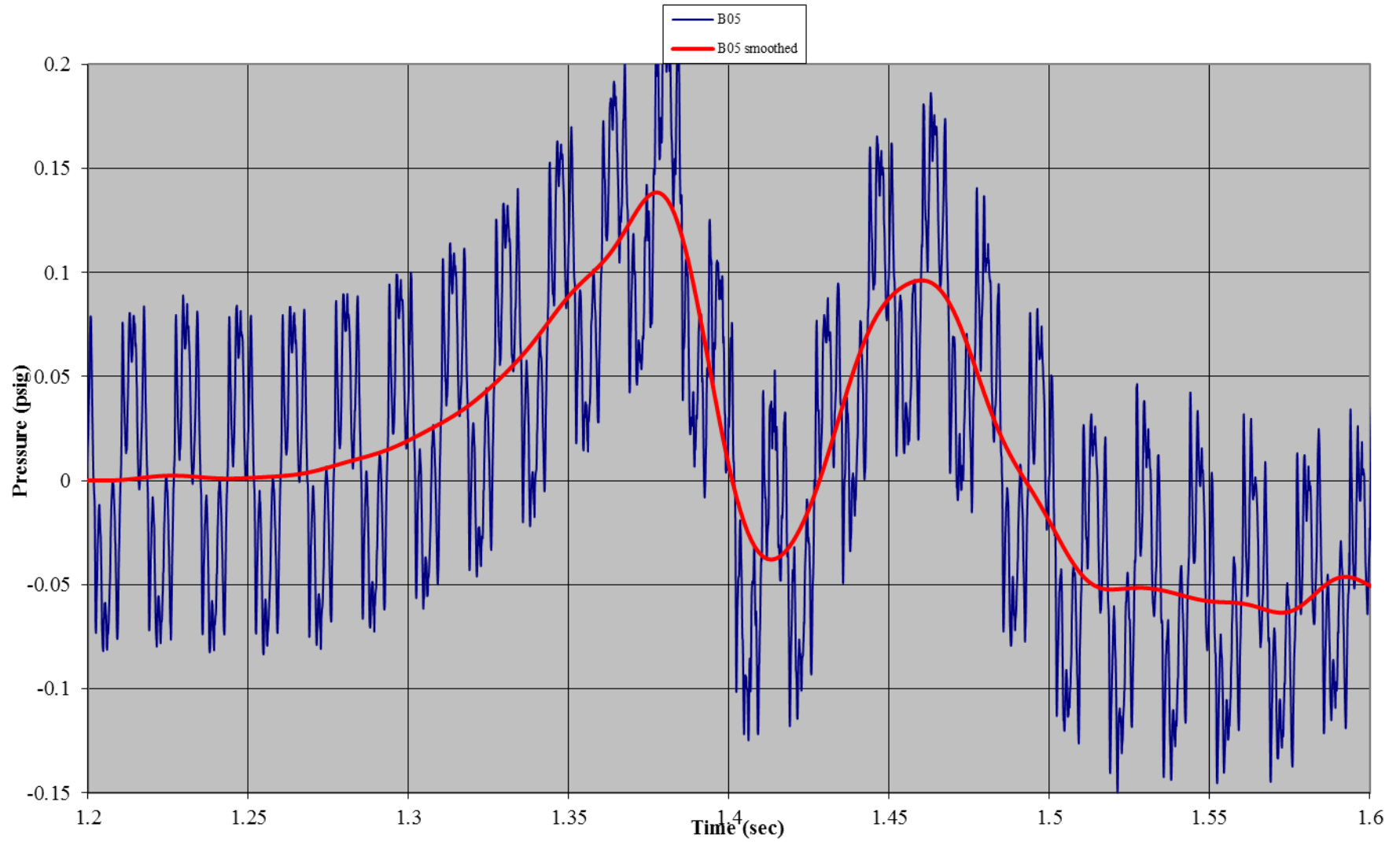
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 11: Front Wall, Right Bottom



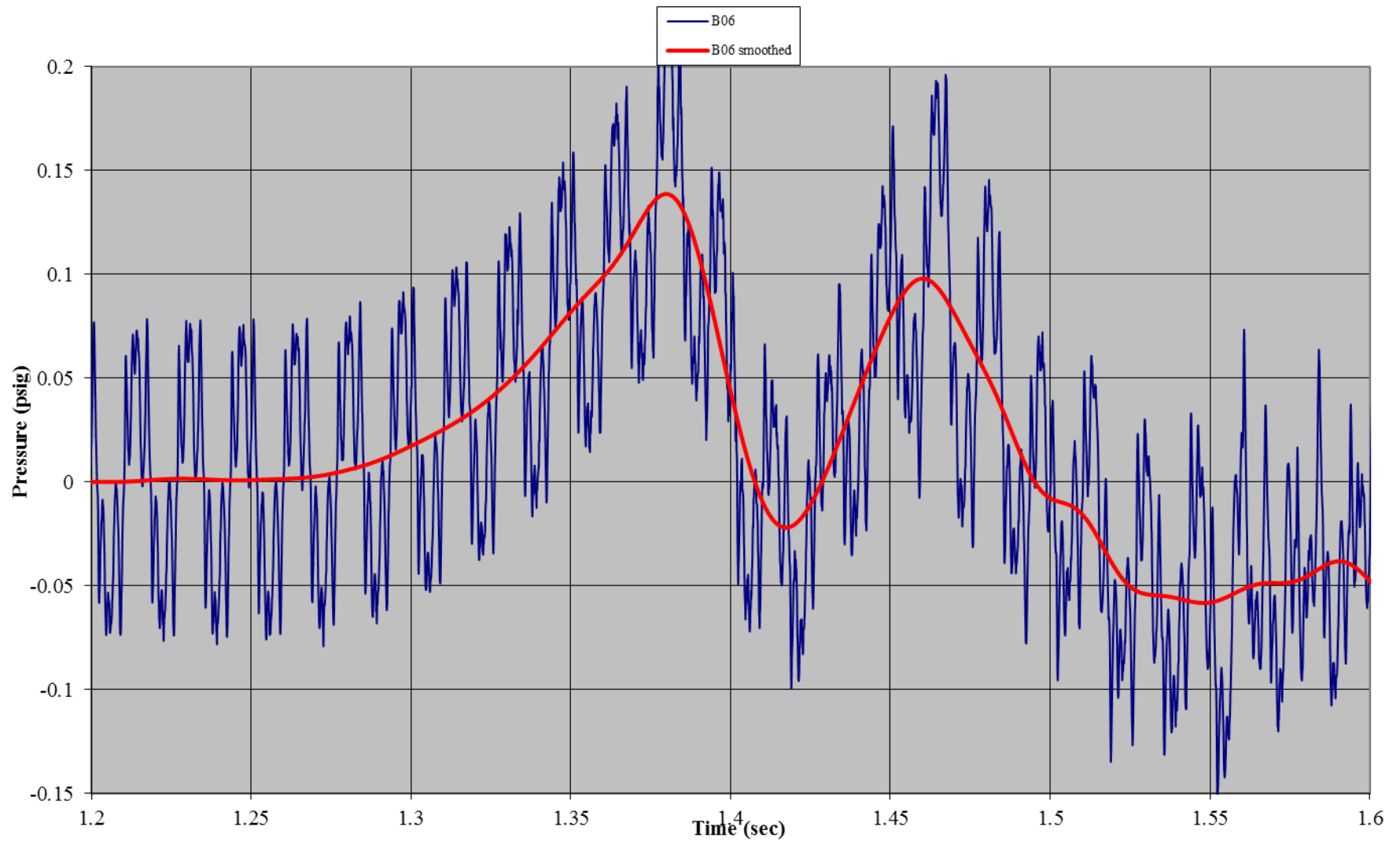
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 03: Front Wall, Center Bottom



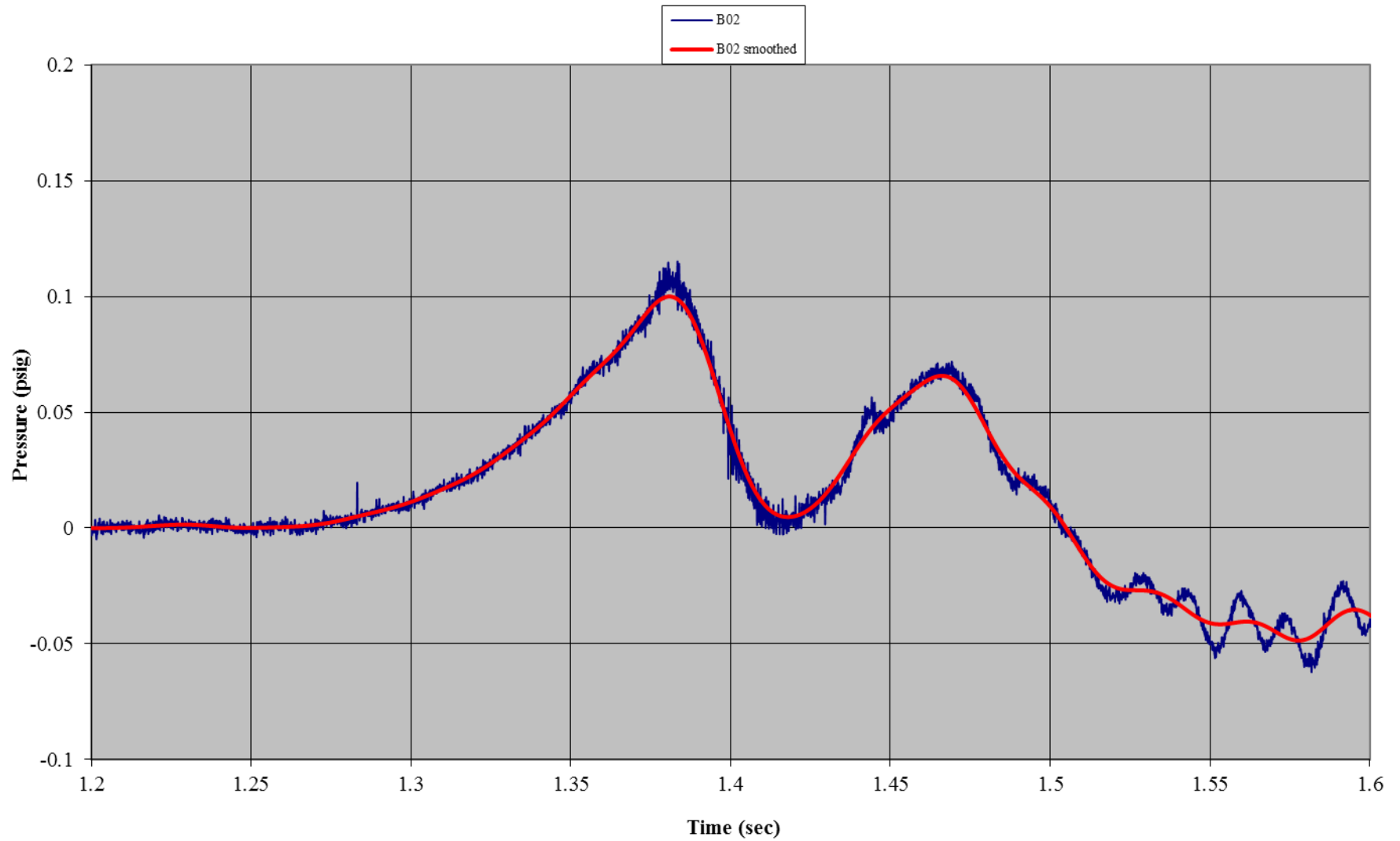
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



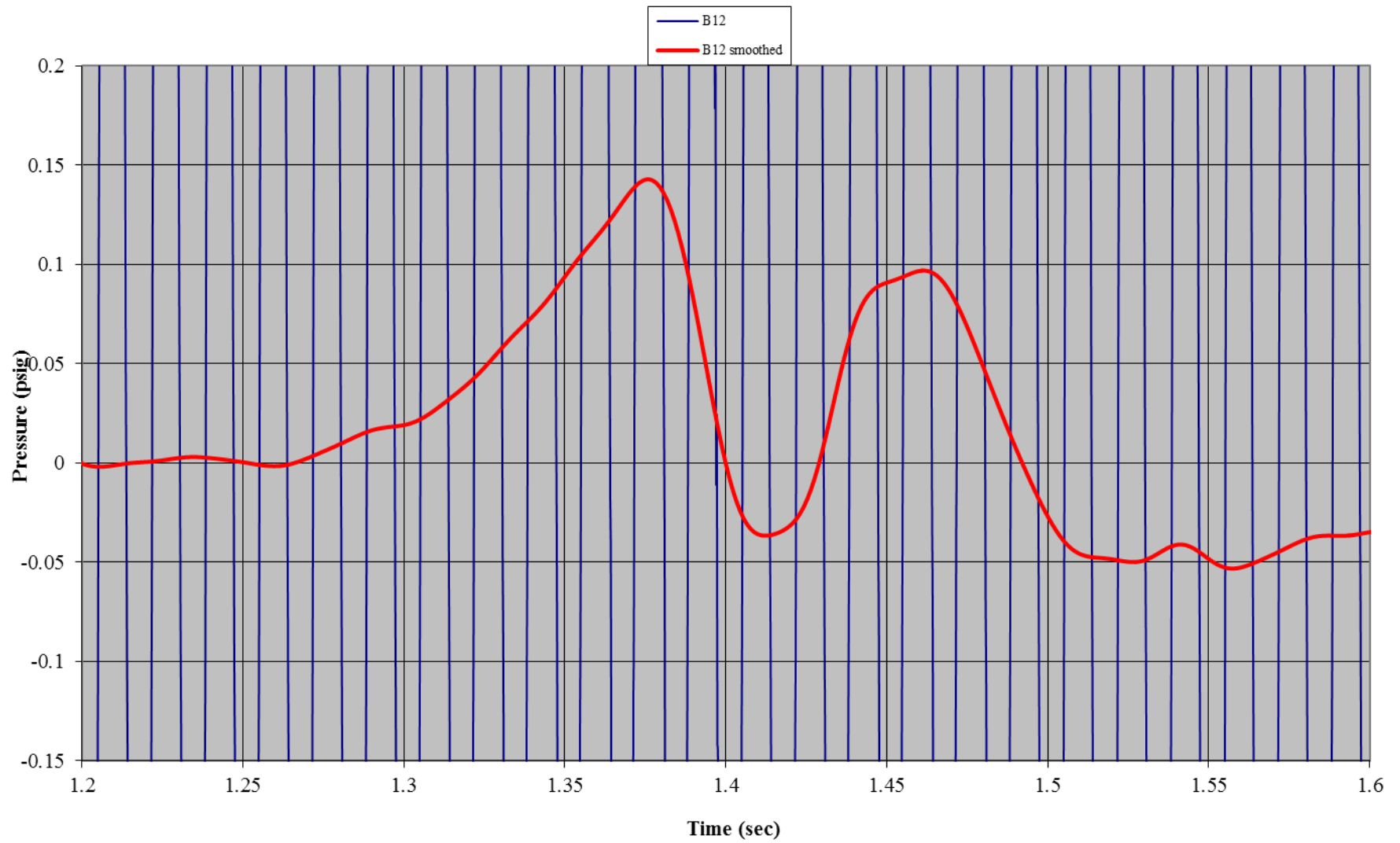
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 06: Front Wall, Center Top



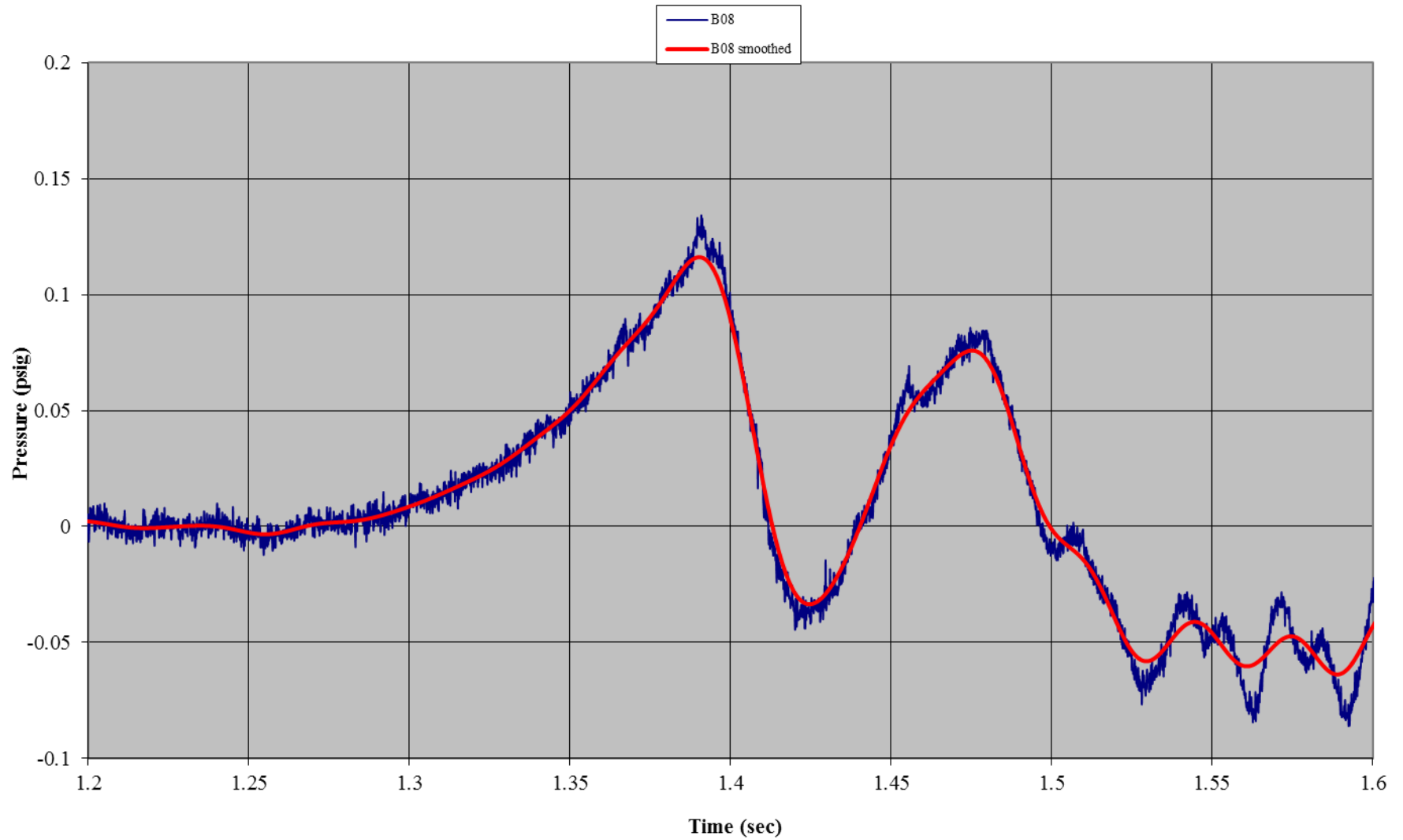
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



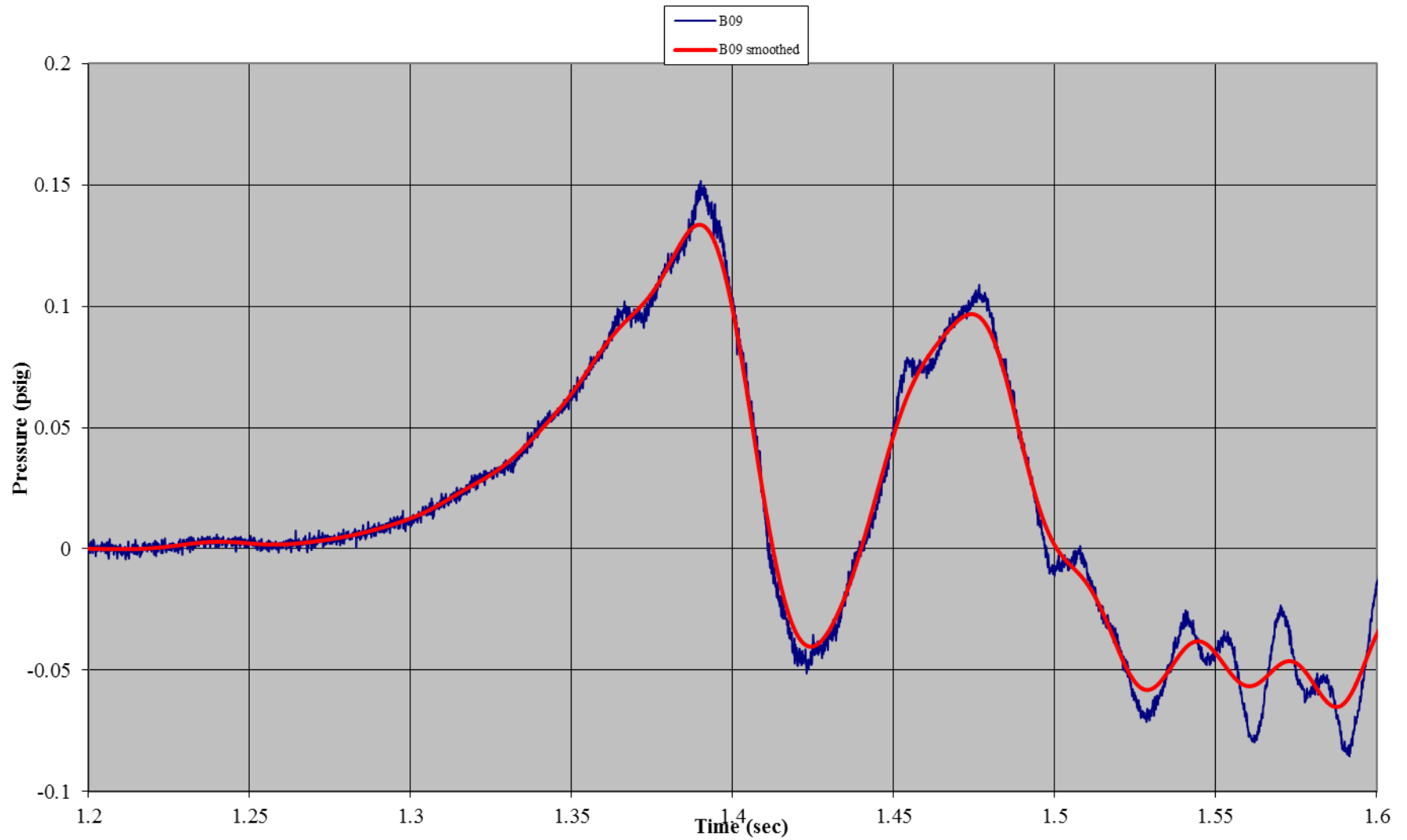
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



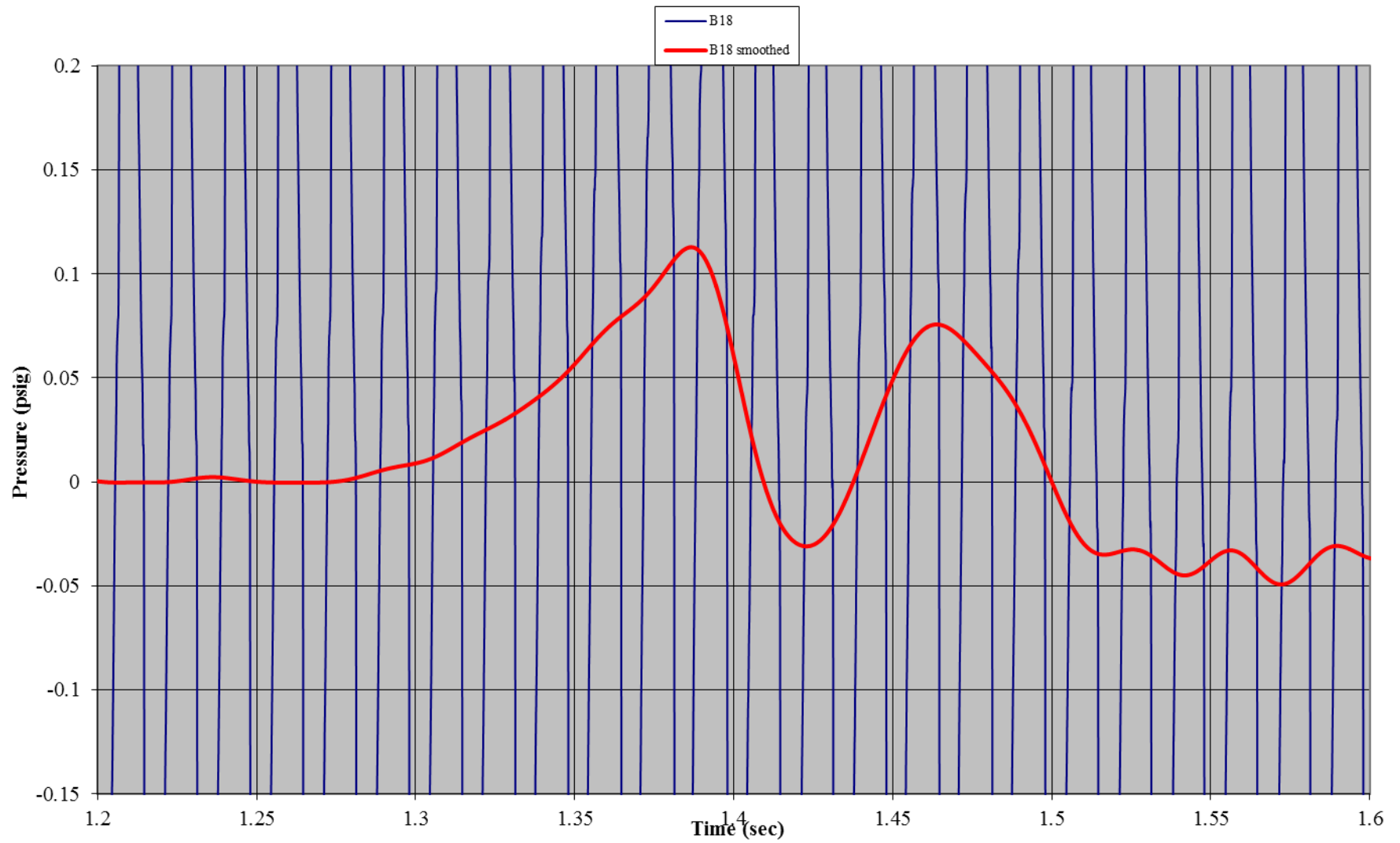
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 08: Left Side Wall, Bottom



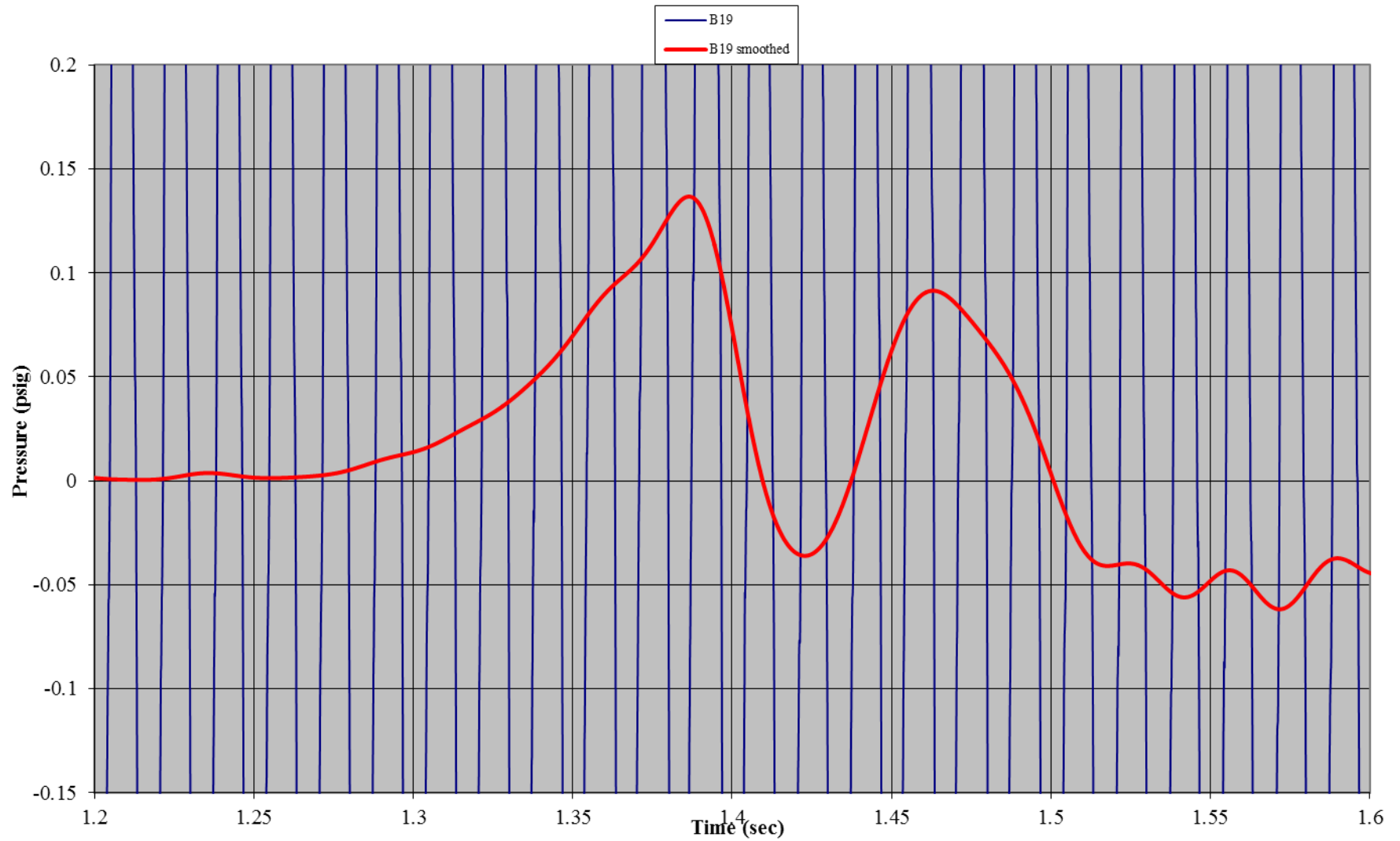
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



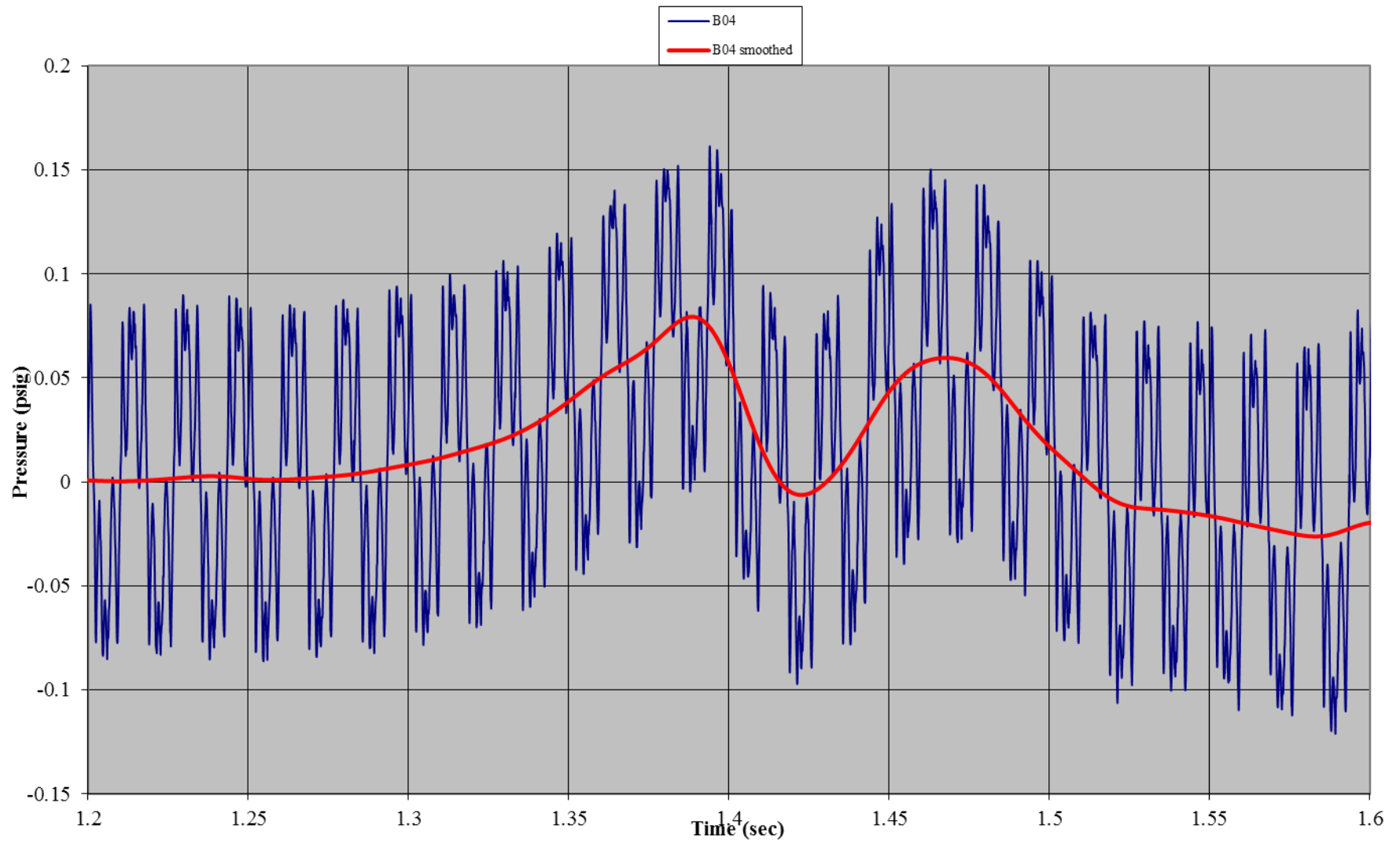
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 18: Right Side Wall, Bottom



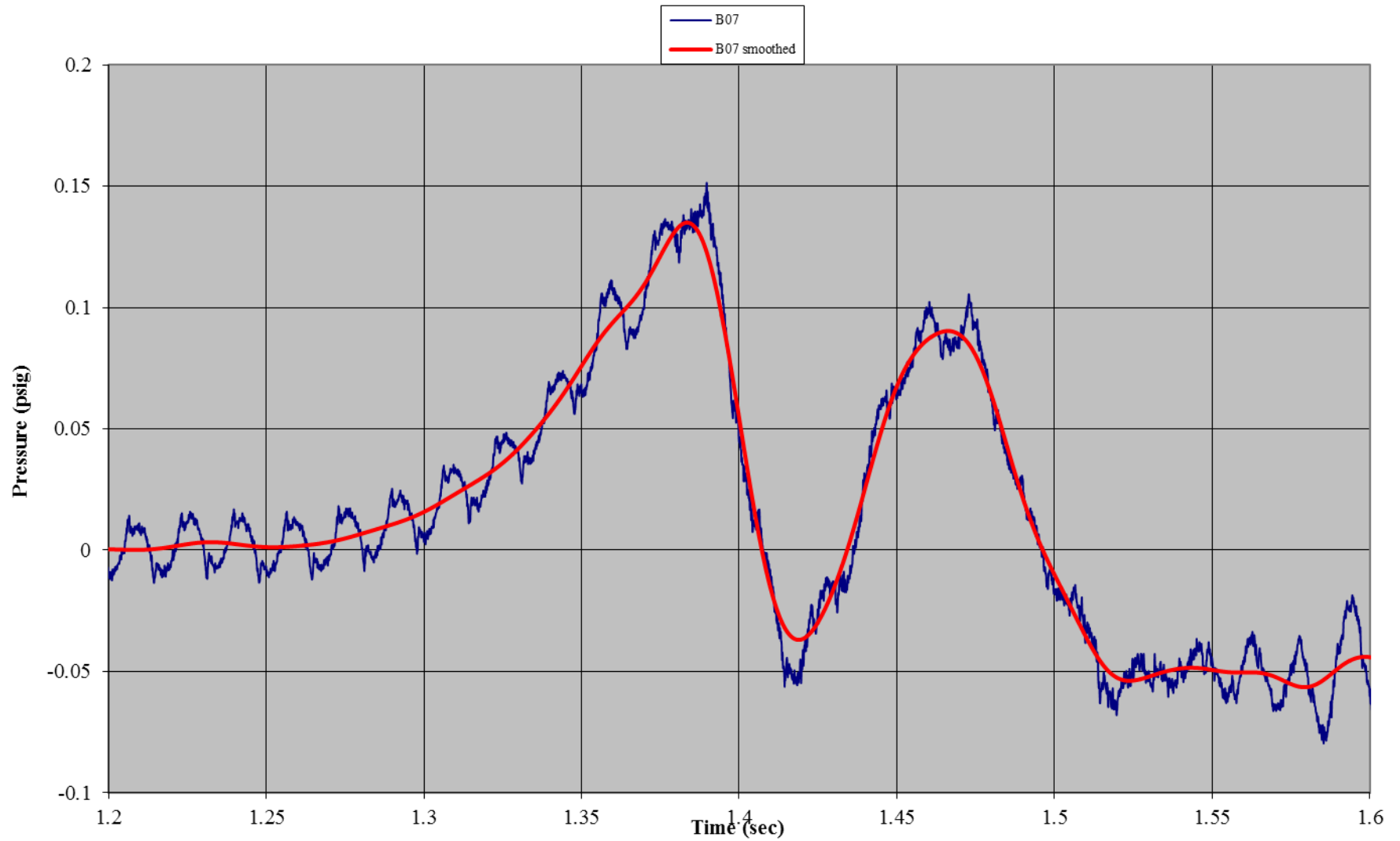
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



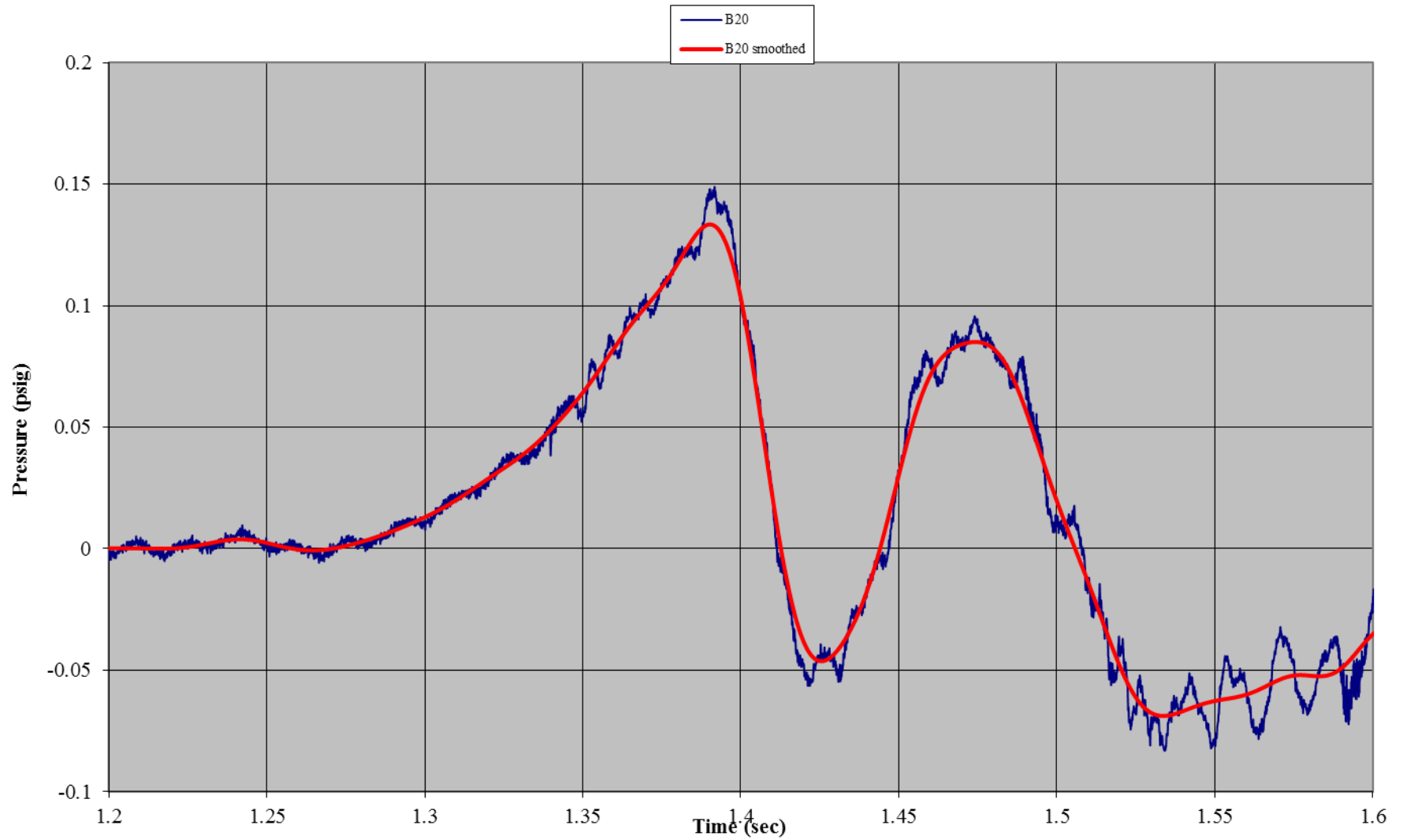
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 04: Interior, Ground



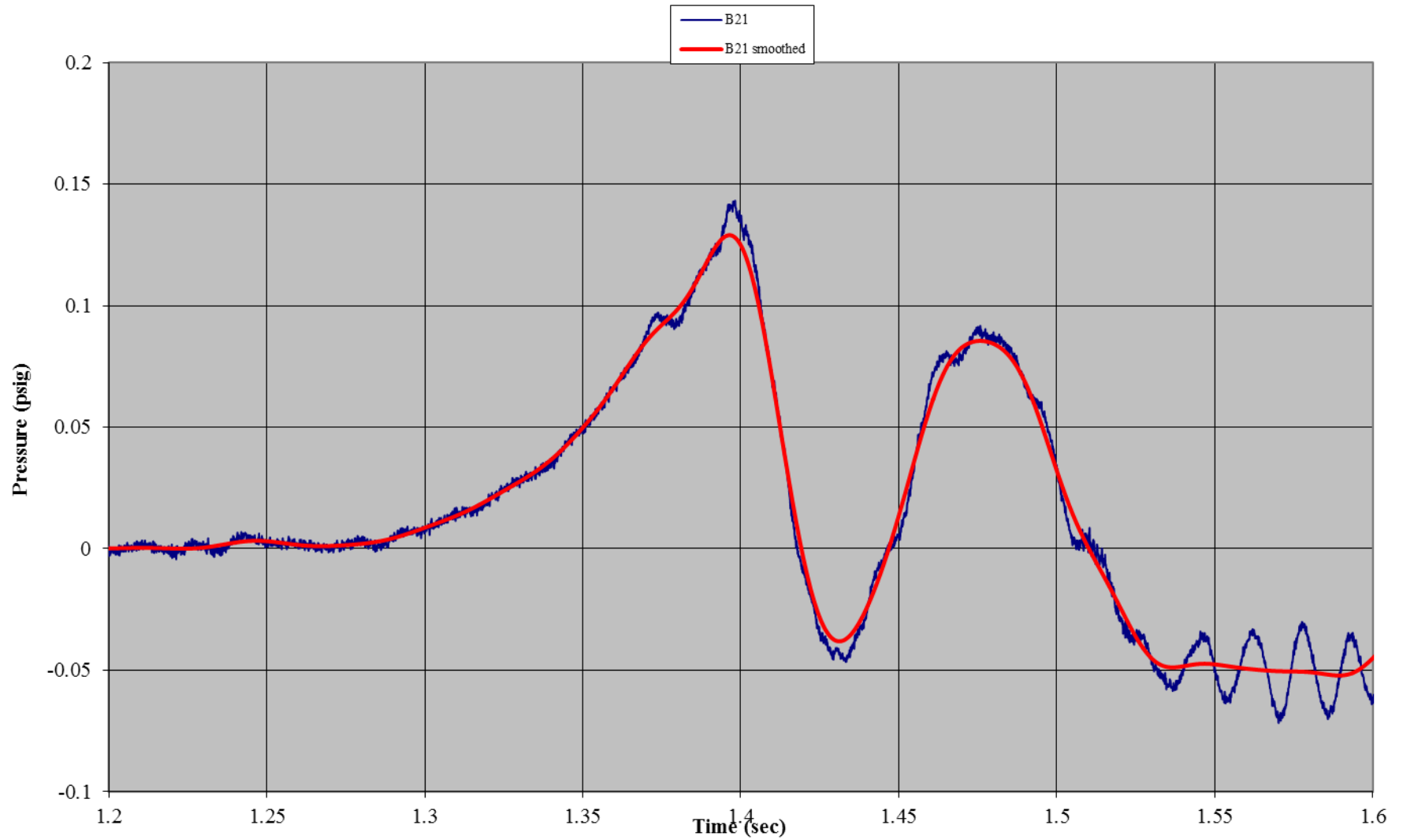
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 07: Front, Roof



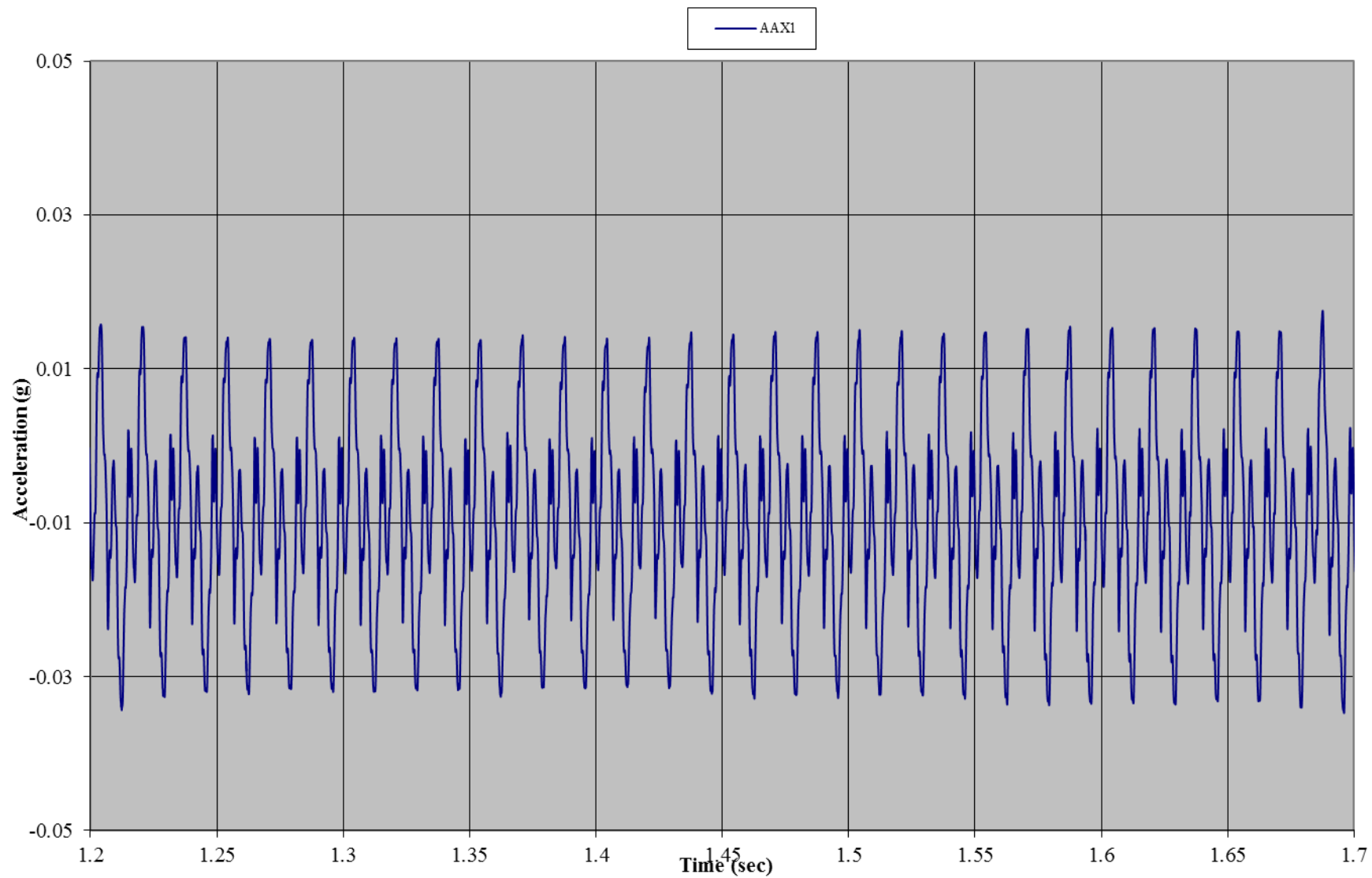
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 20: Roof, Back



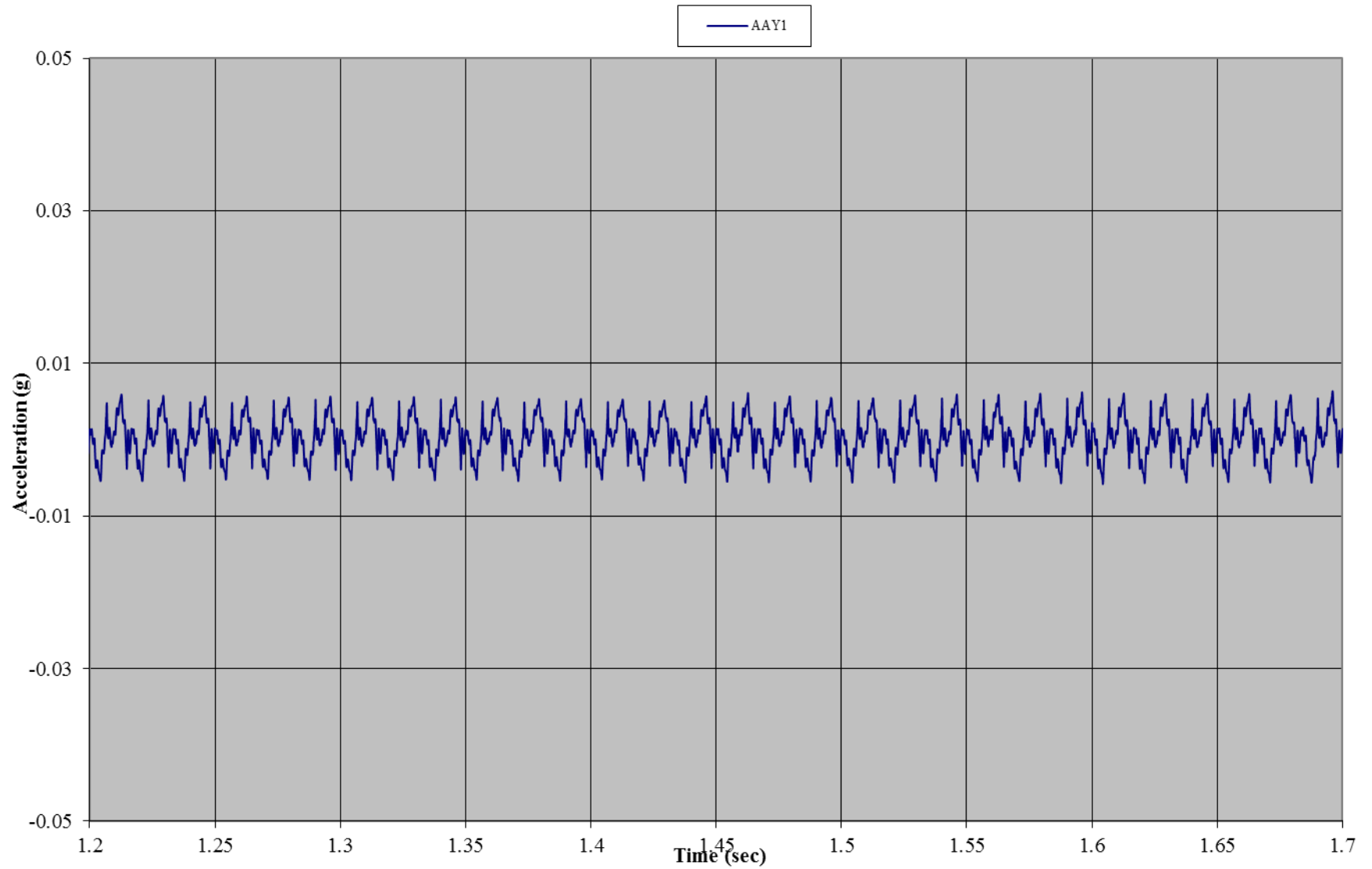
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



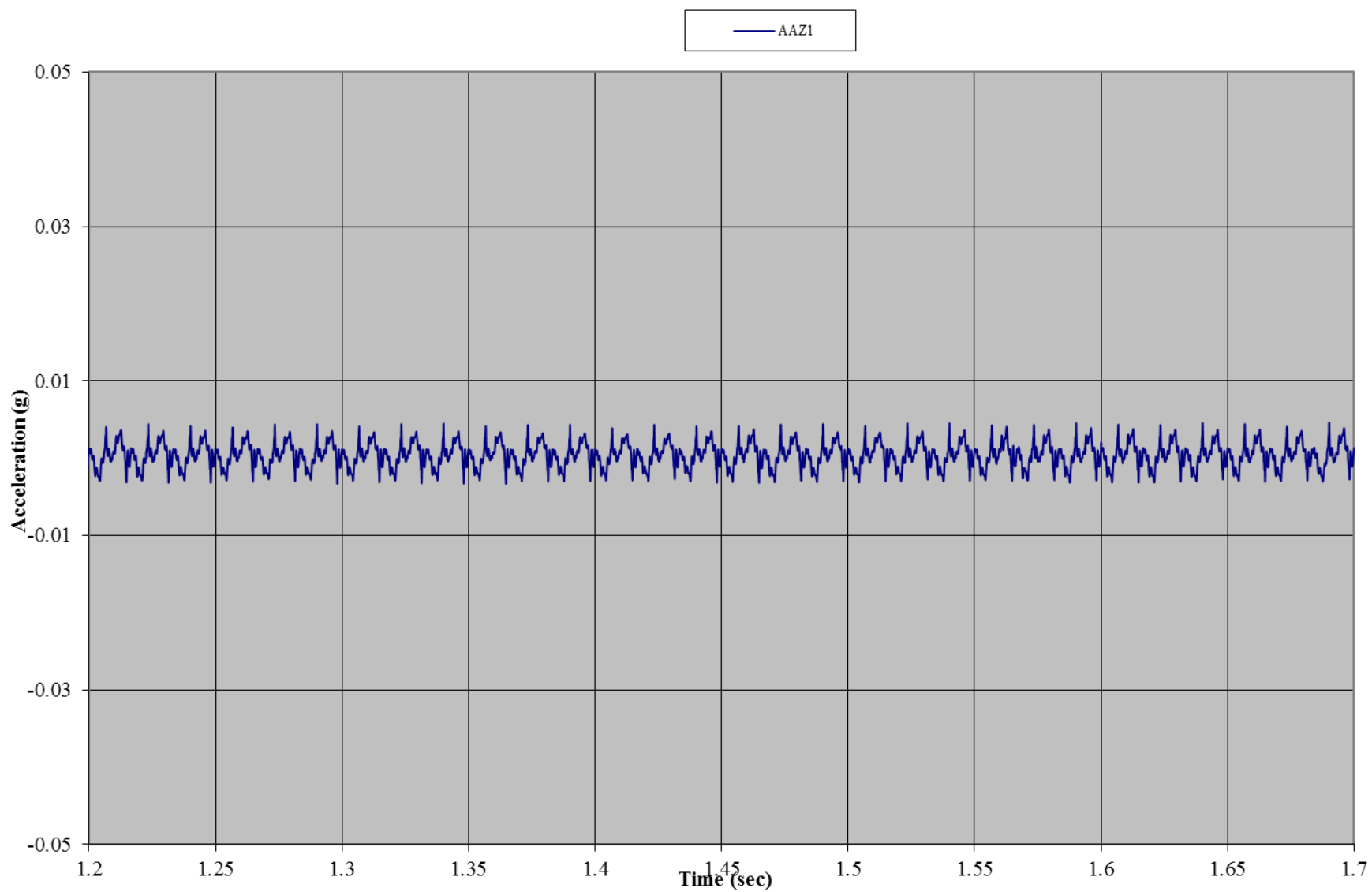
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (x-direction)



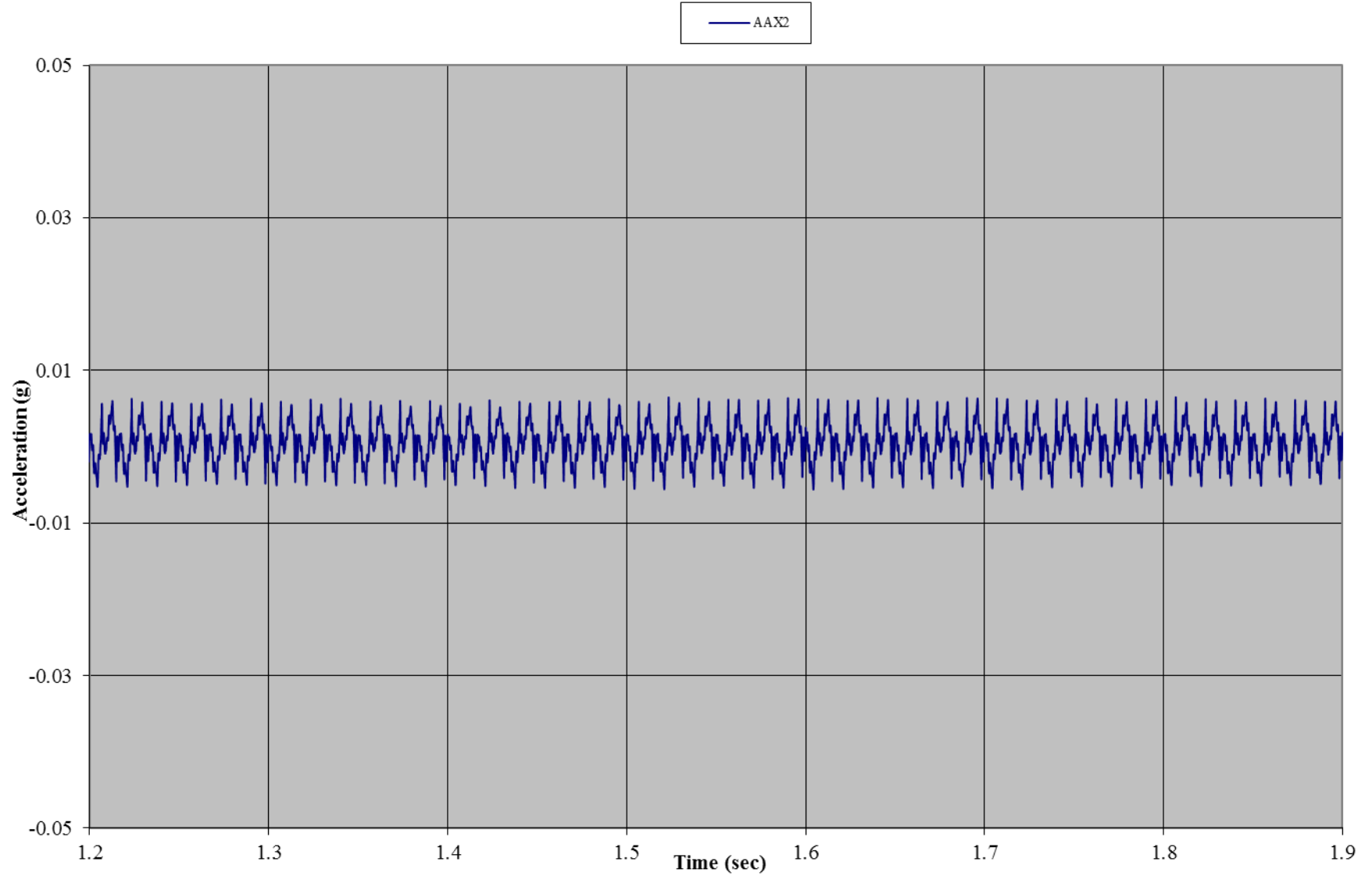
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (y-direction)



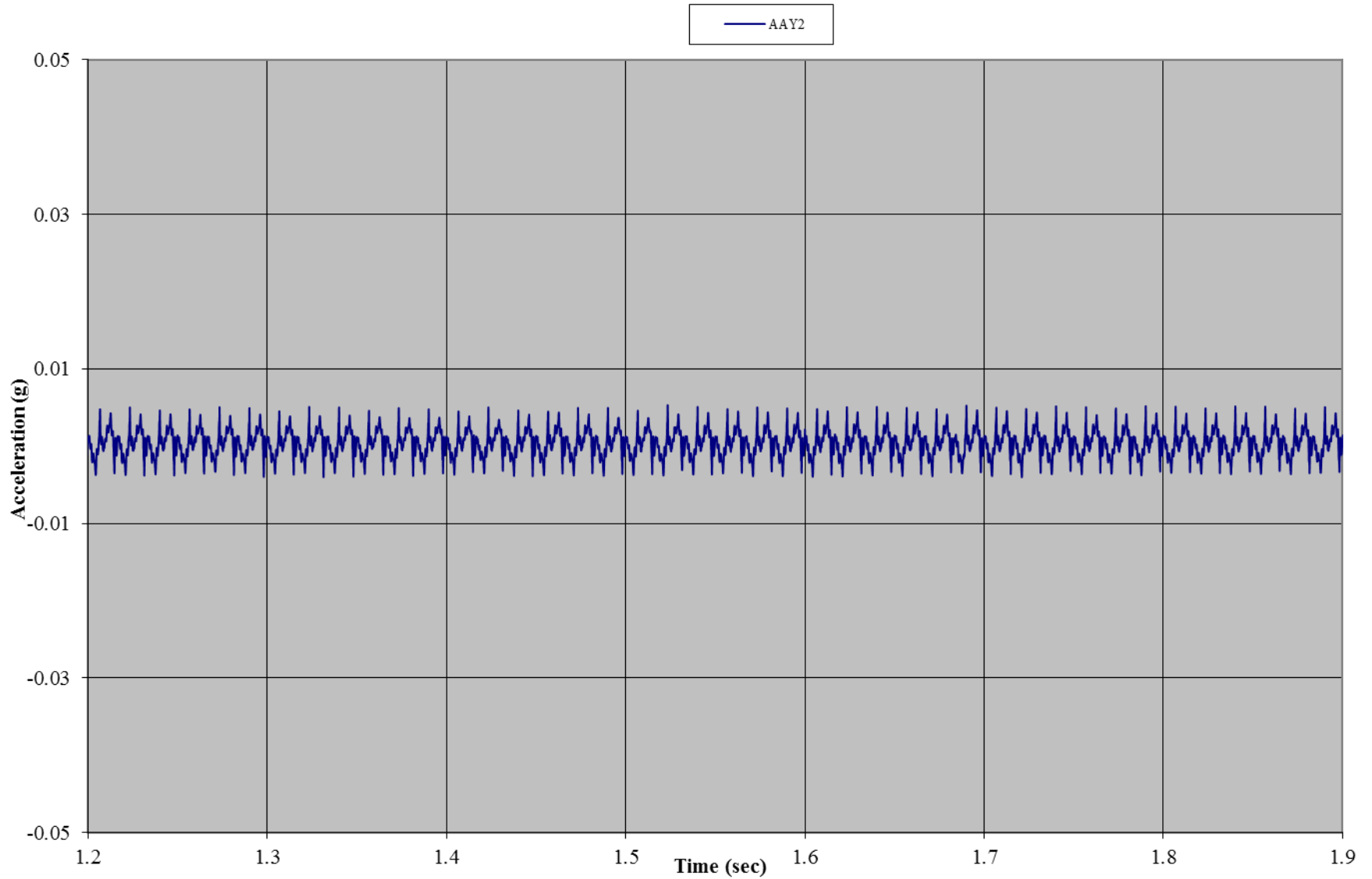
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (z-direction)



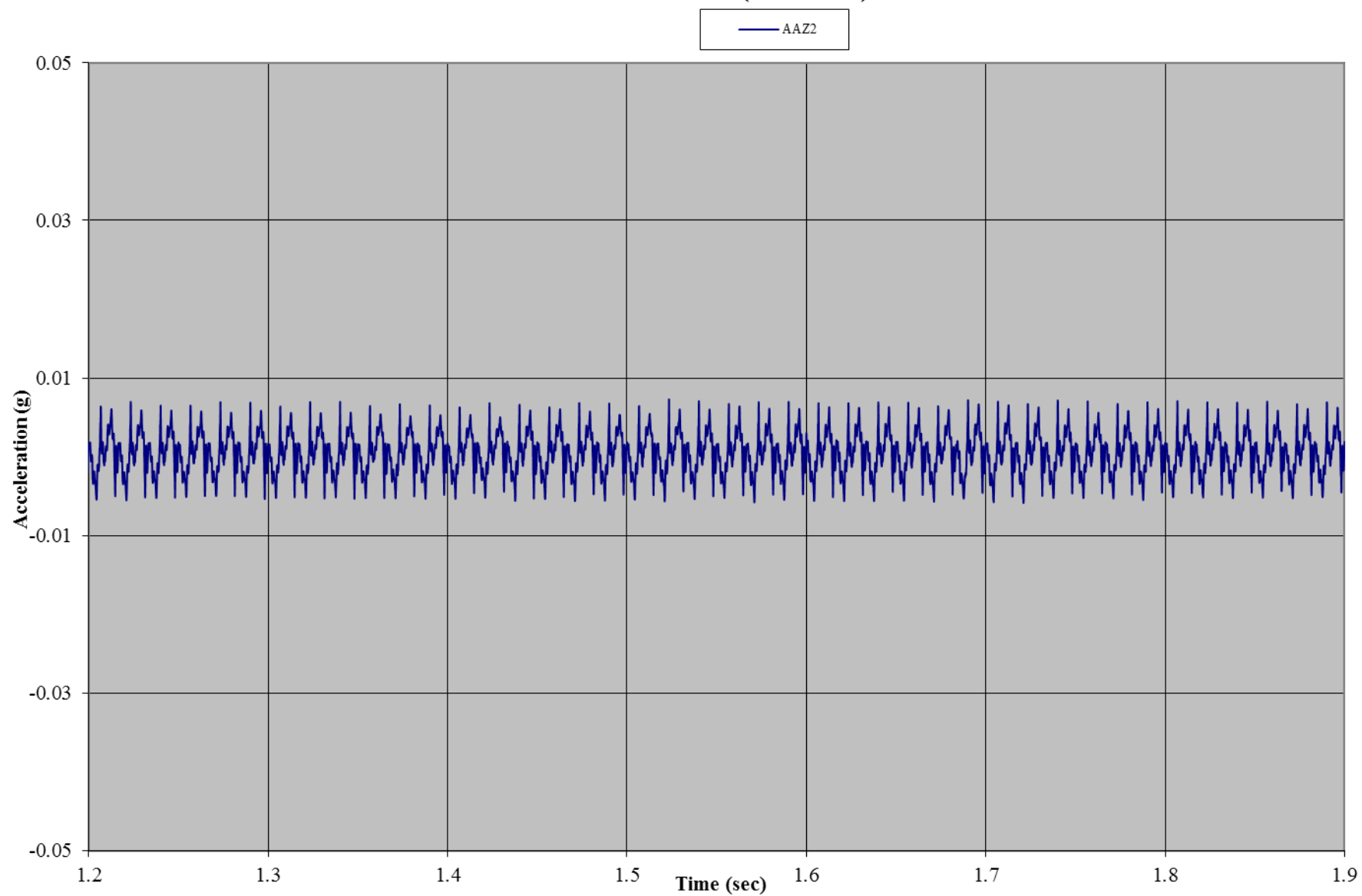
Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (x-direction)



Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (y-direction)

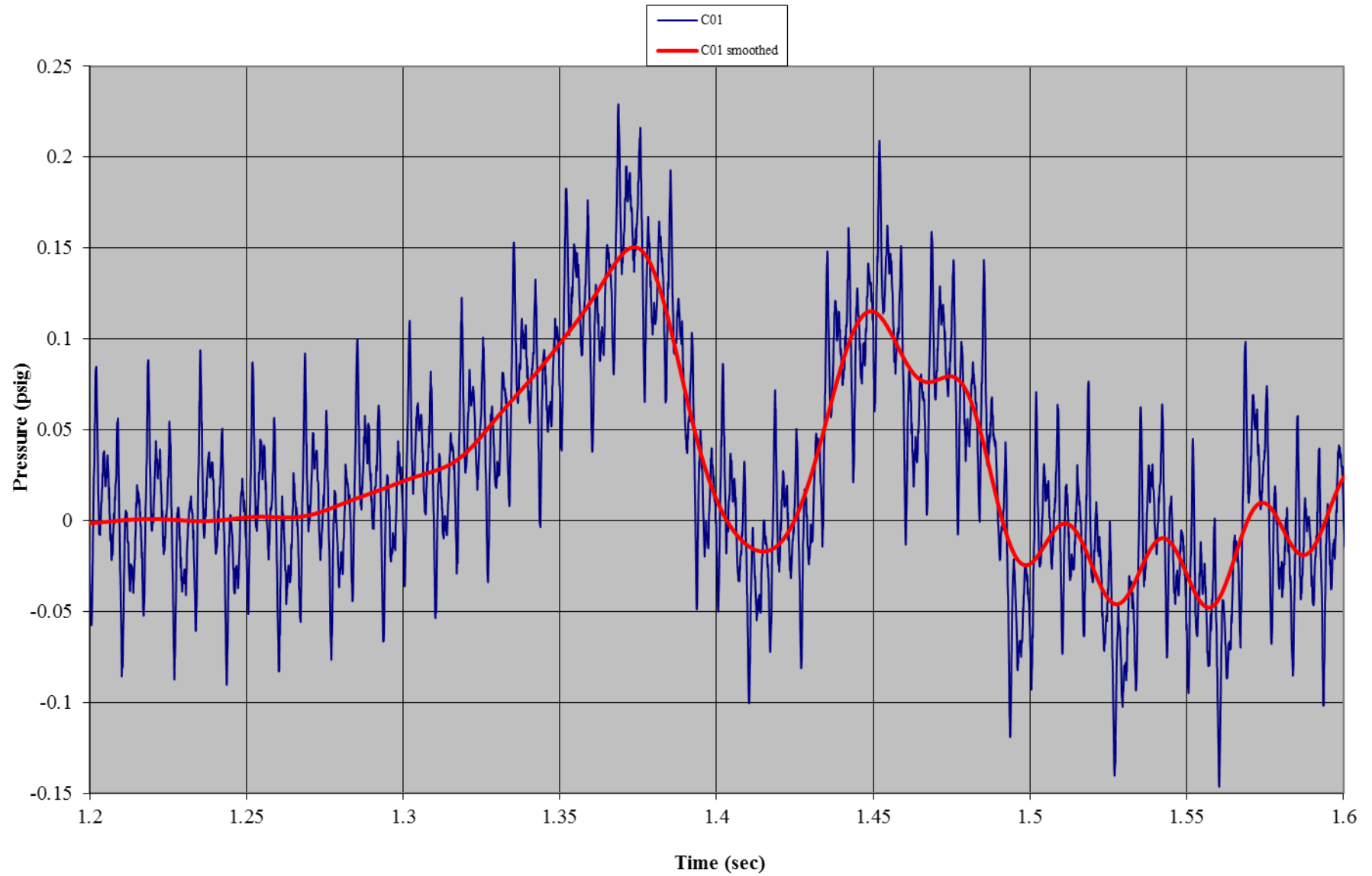


Test A02: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (z-direction)

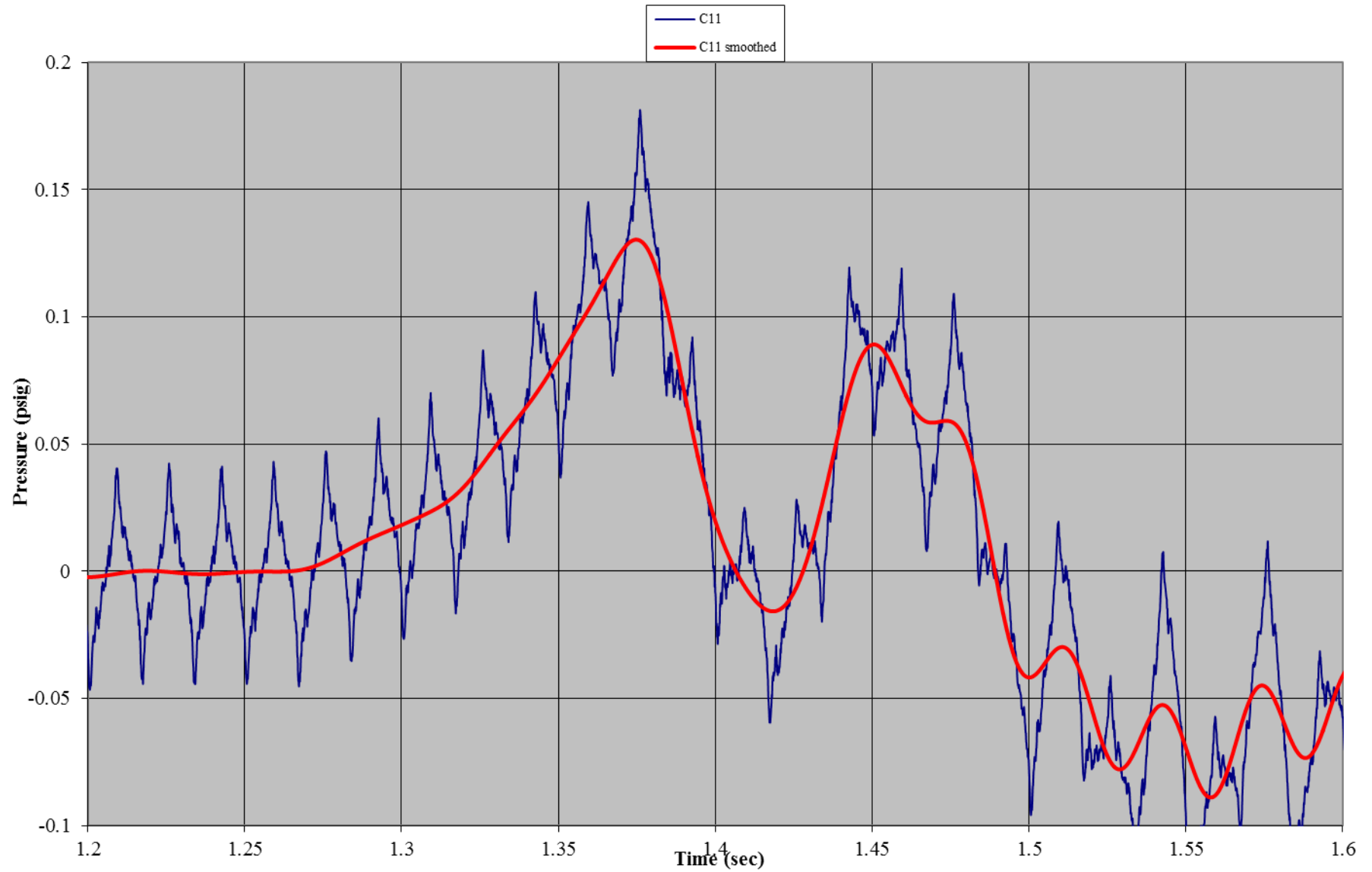


Test A02: Tent C

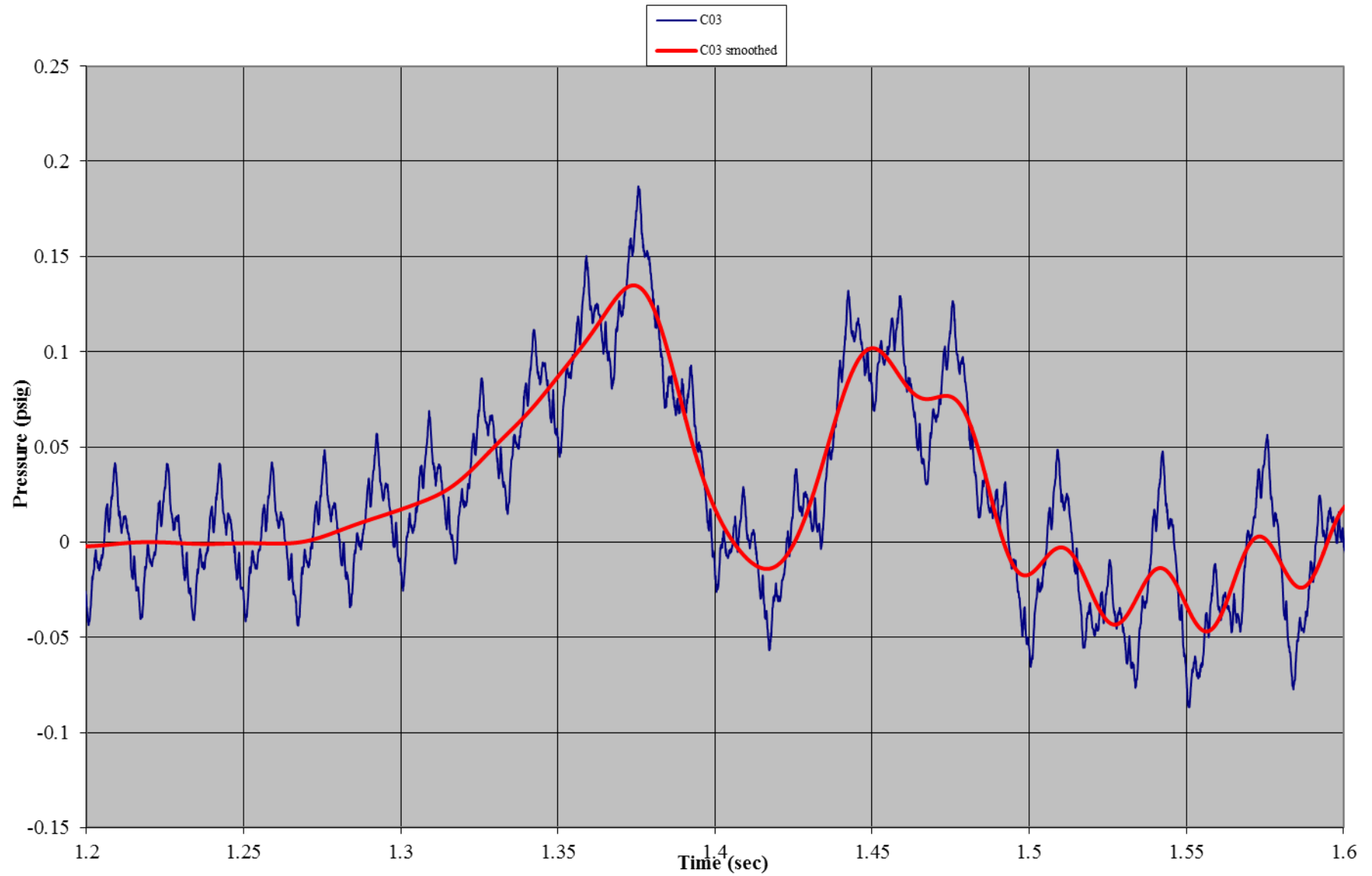
Test A02: Non-Wind Pole Rated Tent without Sides
Gauge 01: Front Wall, Left Bottom



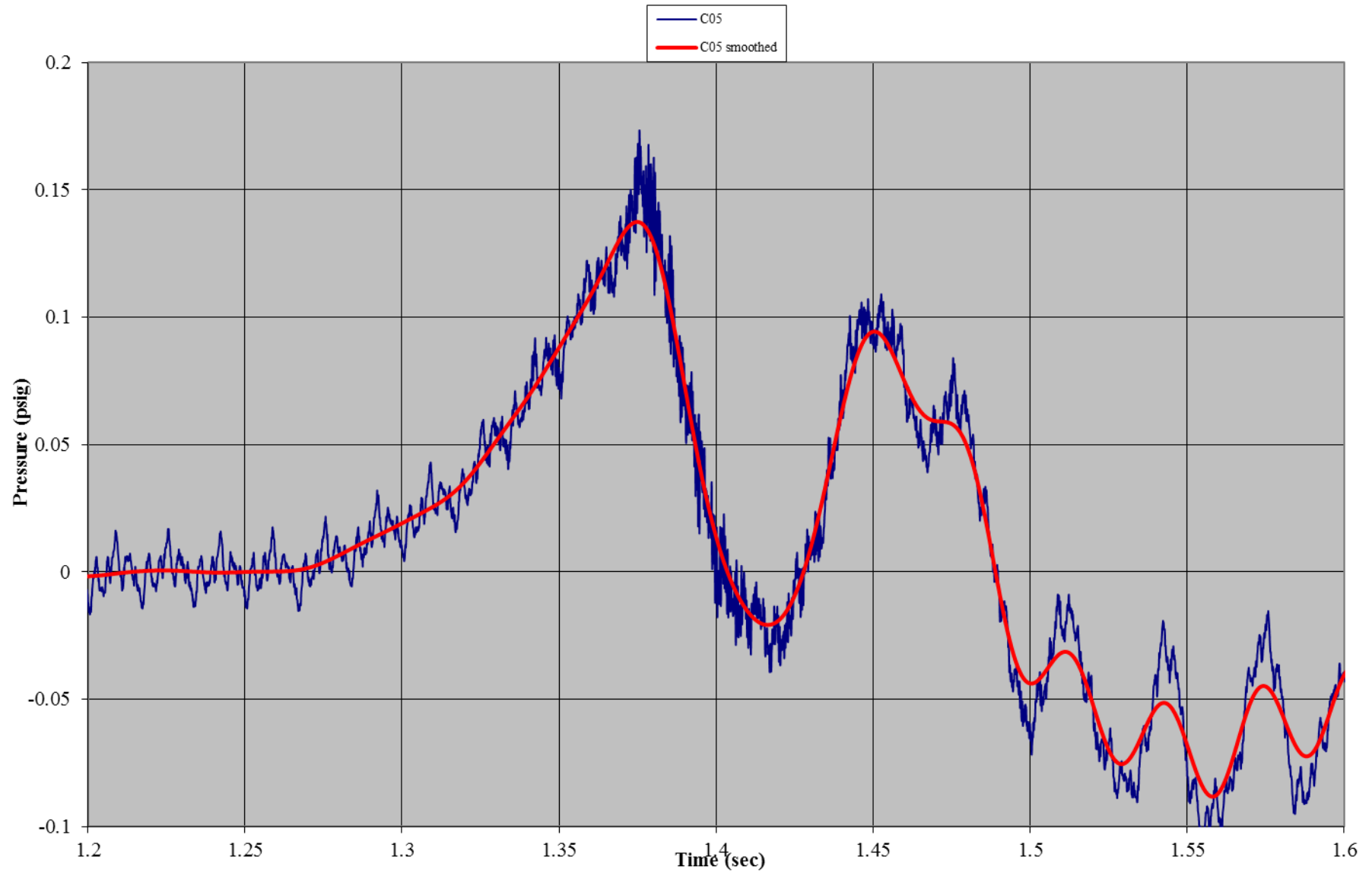
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 11: Front Wall, Right Bottom



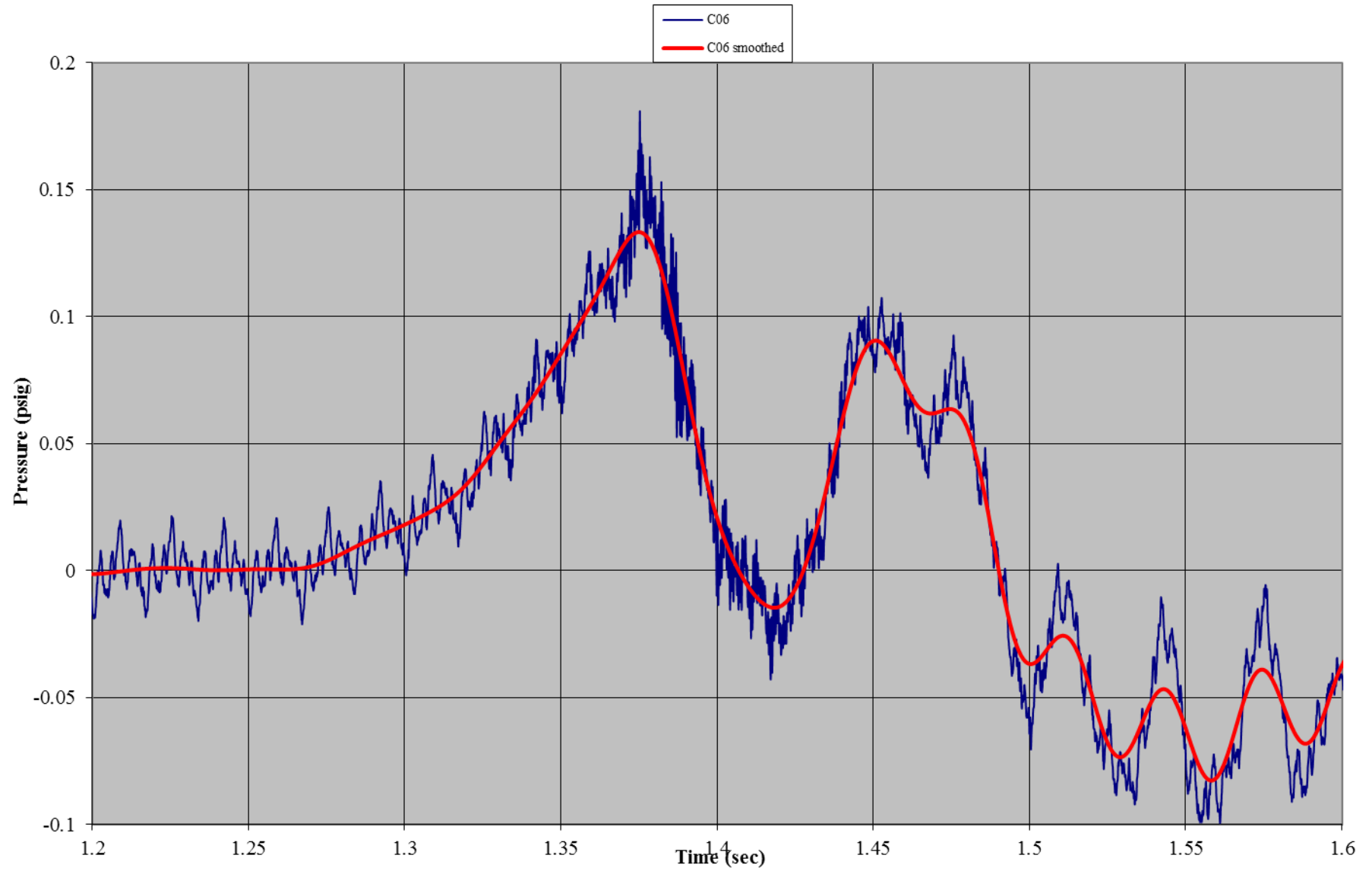
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 03: Front Wall, Center Bottom



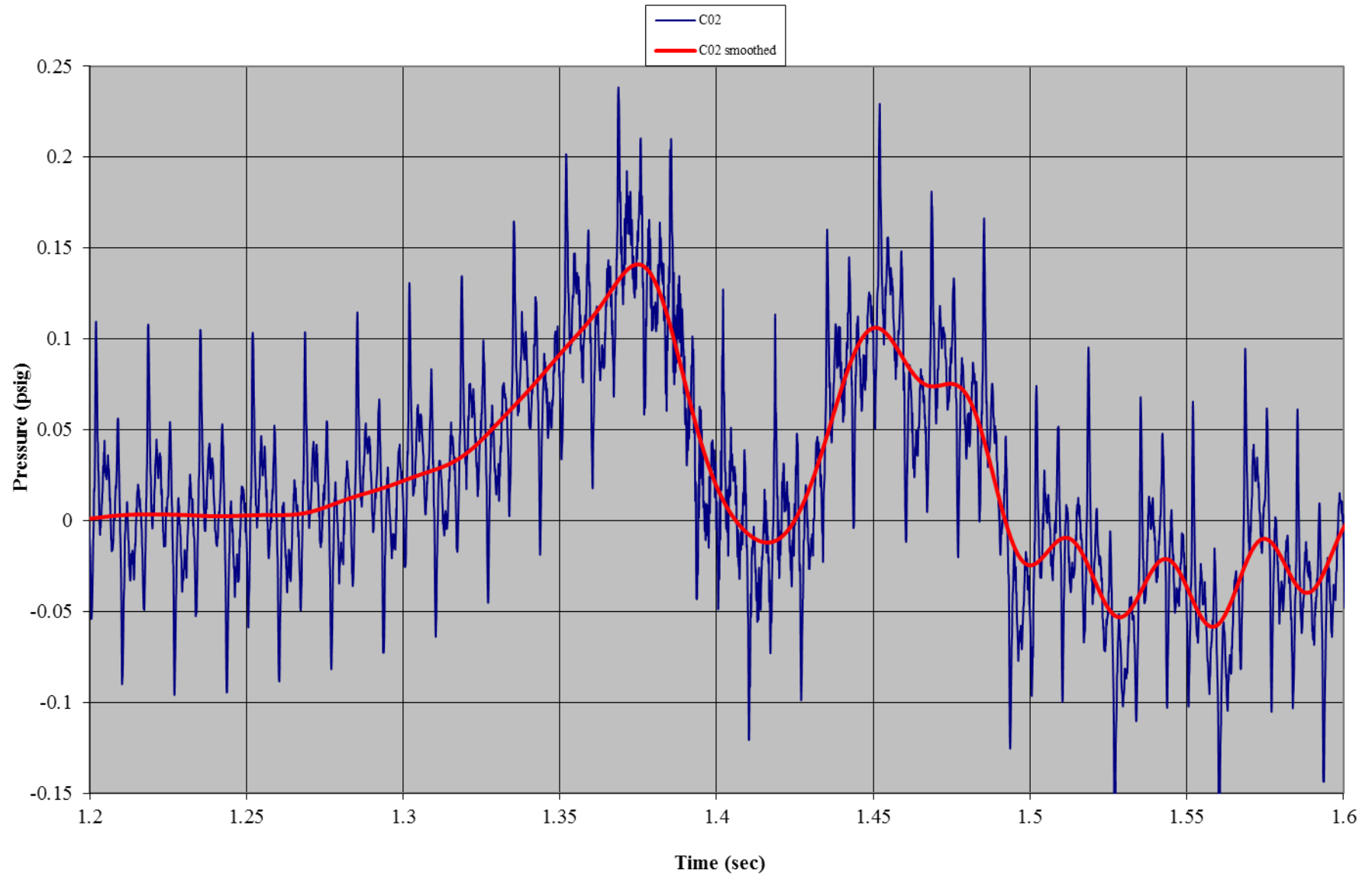
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 05: Front Wall, Center Mid-Height



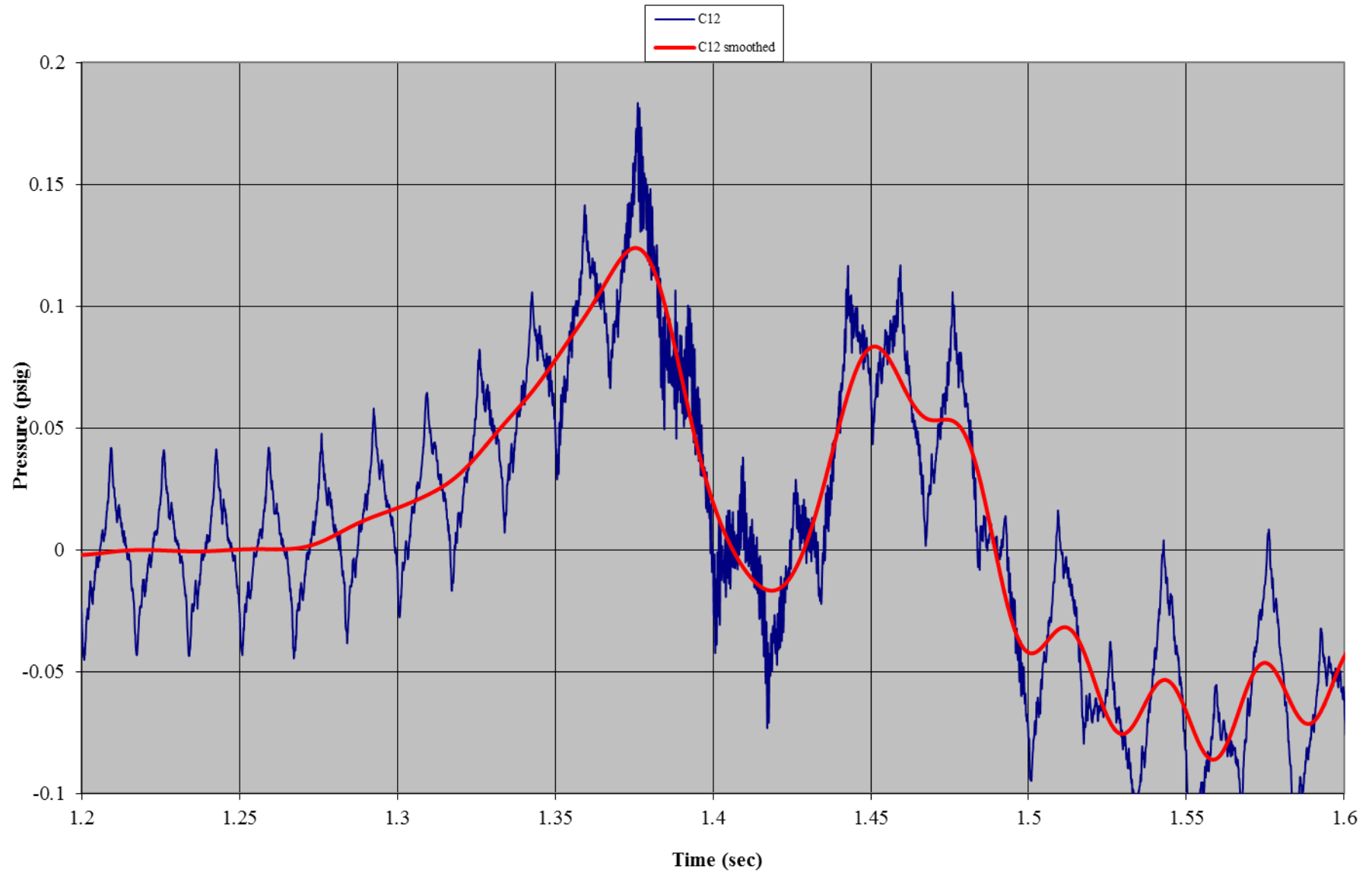
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 06: Front Wall, Center Top



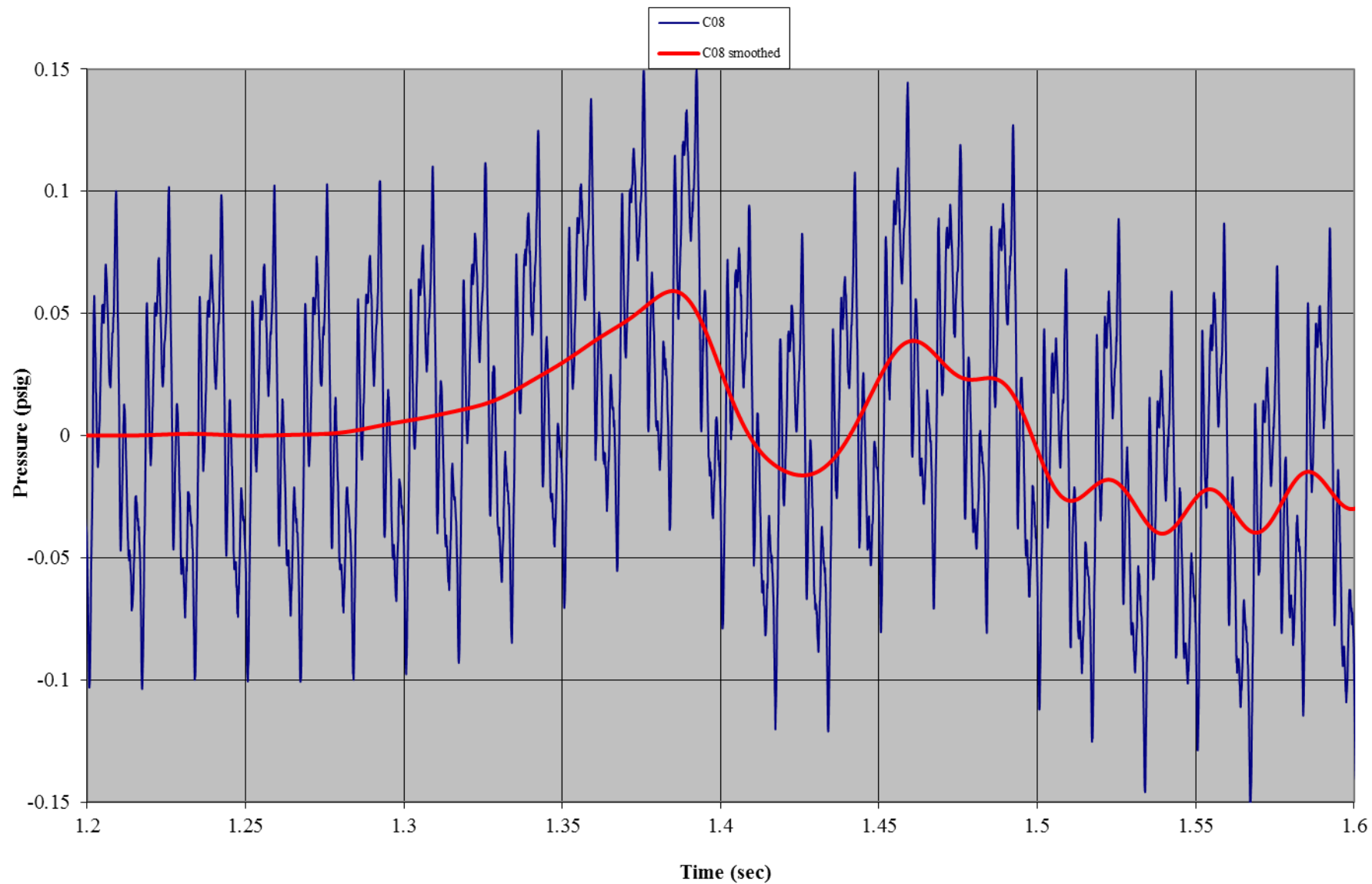
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 02: Front Wall, Left Mid-Height



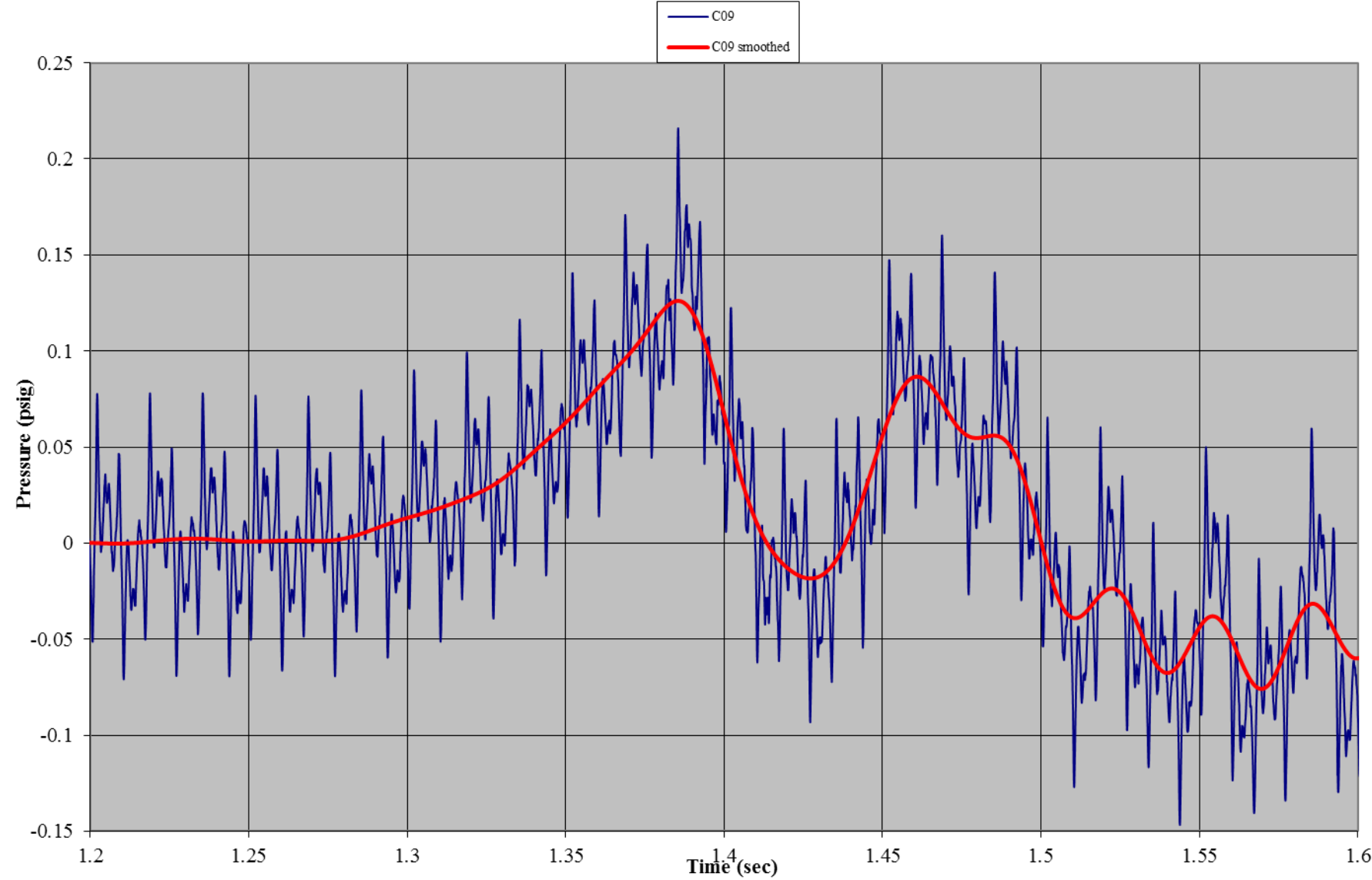
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 12: Front Wall, Right Mid-Height



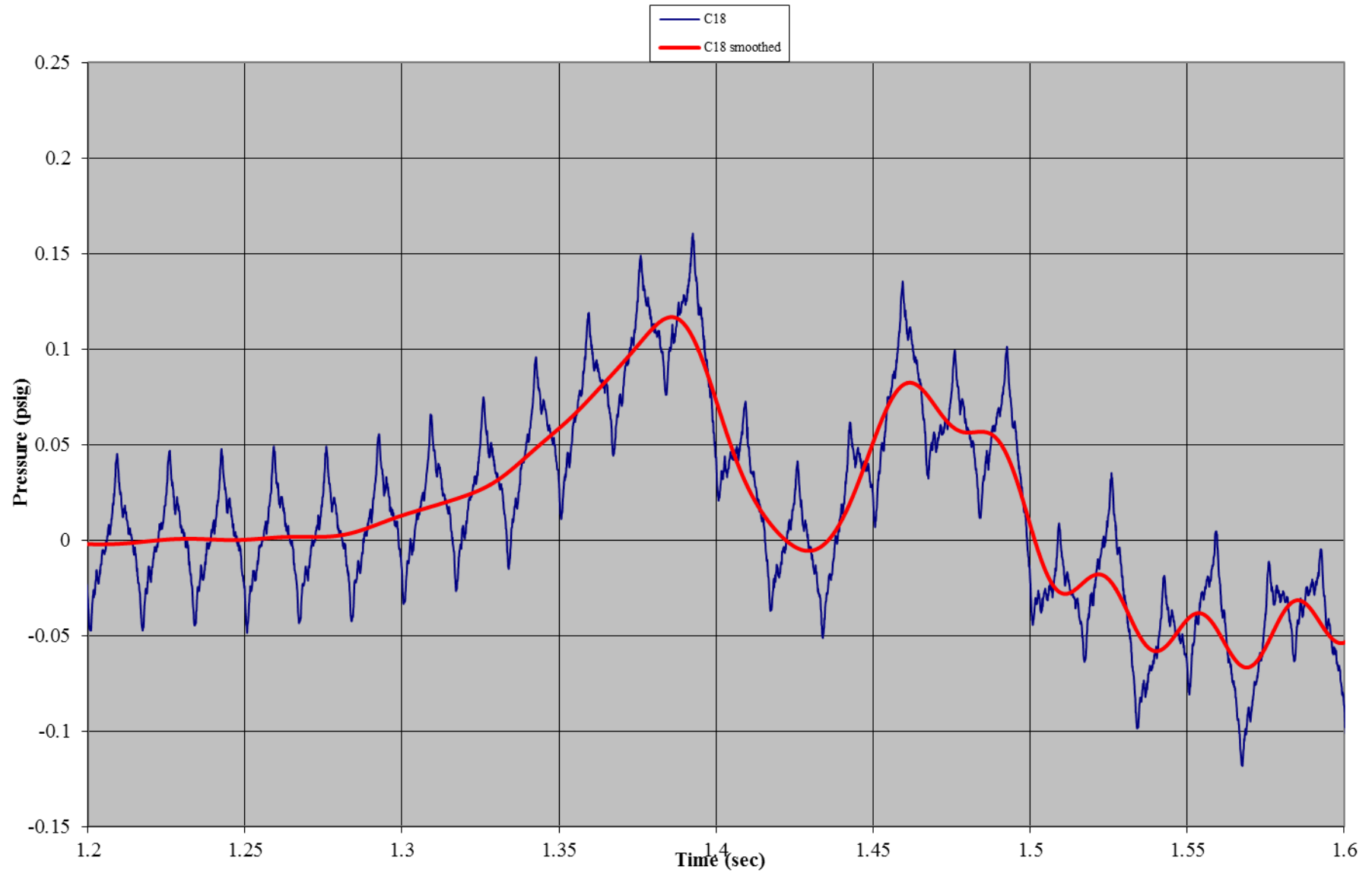
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 08: Left Side Wall, Bottom



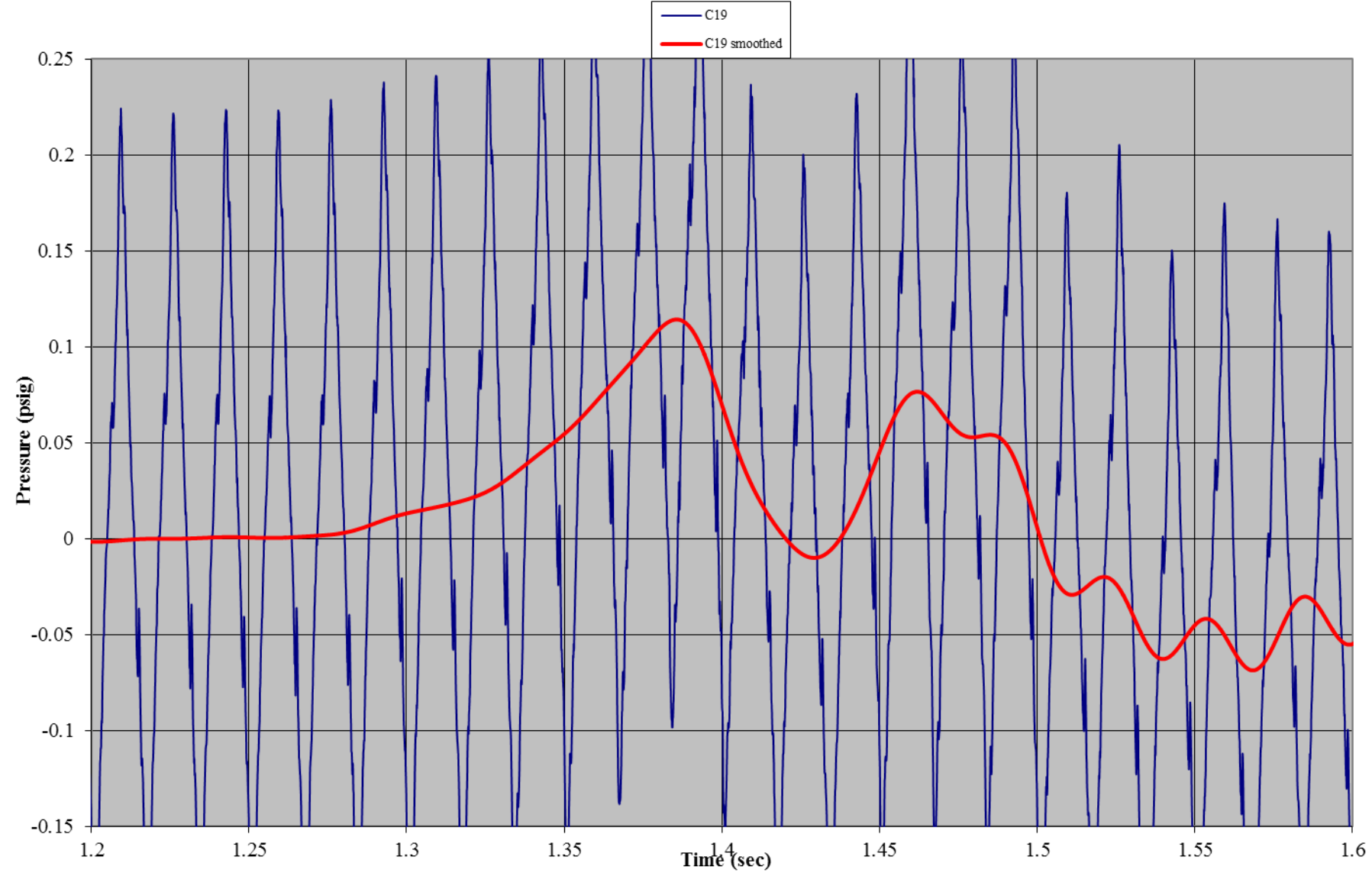
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 09: Left Side Wall, Mid-Height



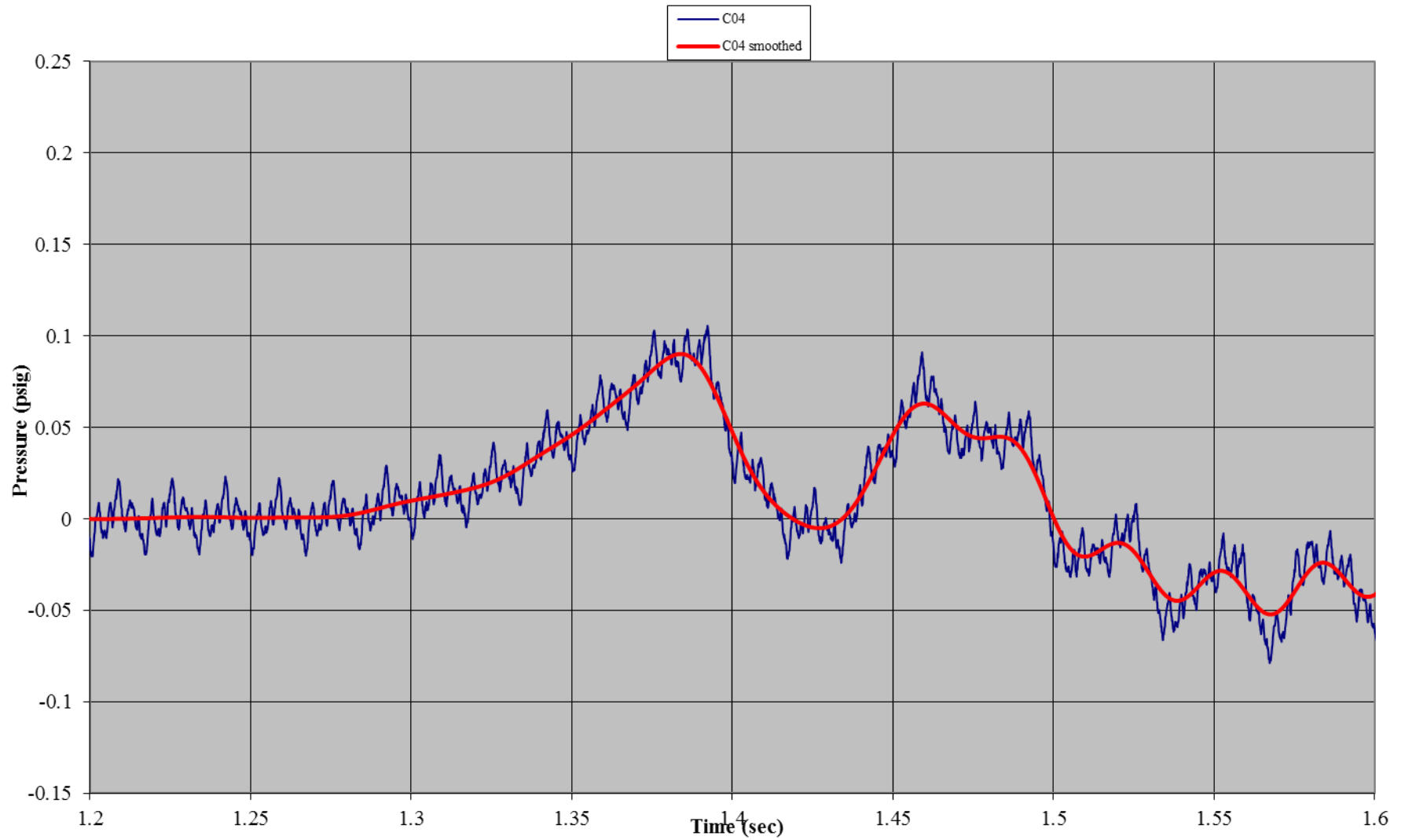
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 18: Right Side Wall, Bottom



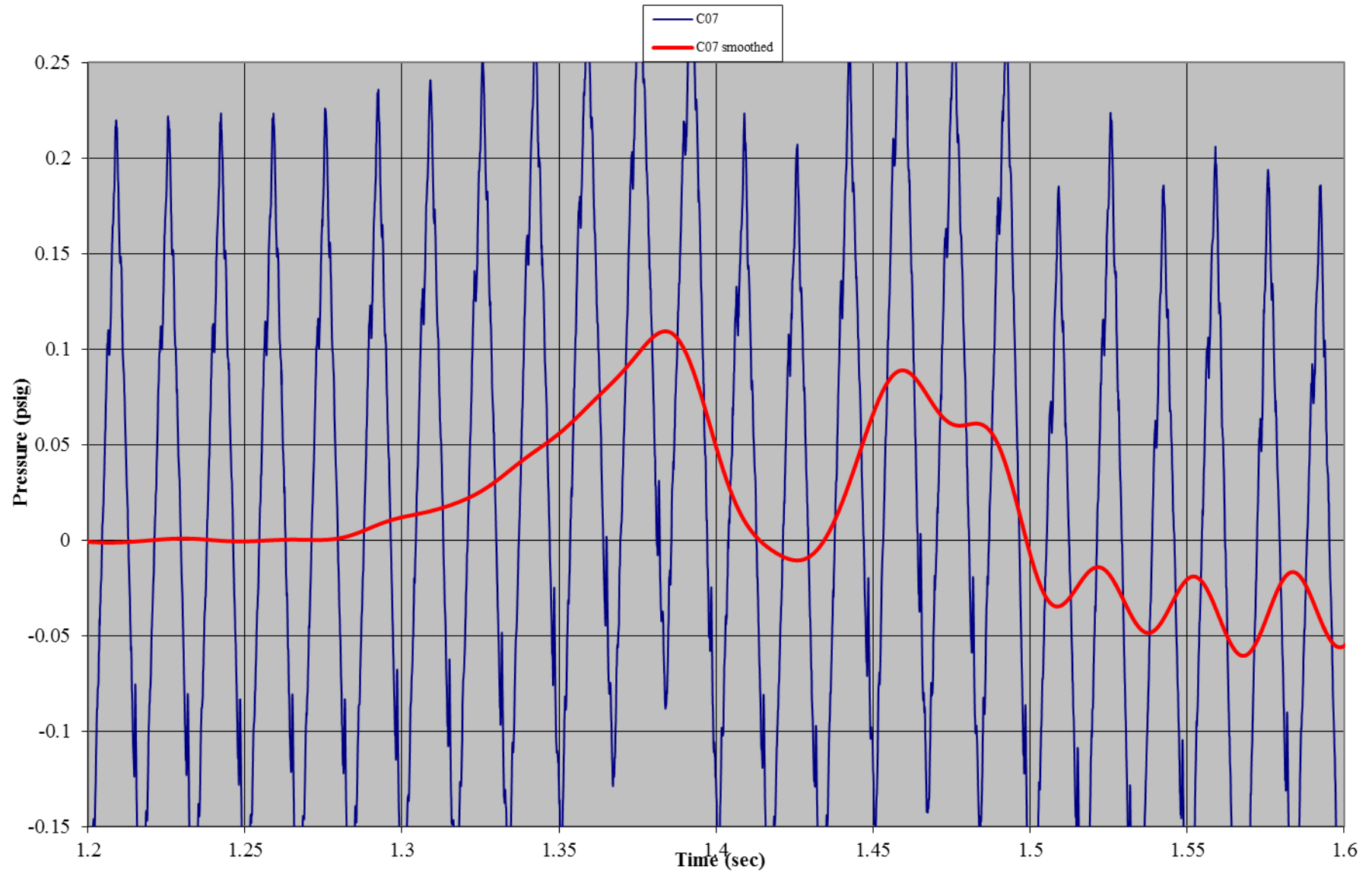
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 19: Right Side Wall, Mid-Height



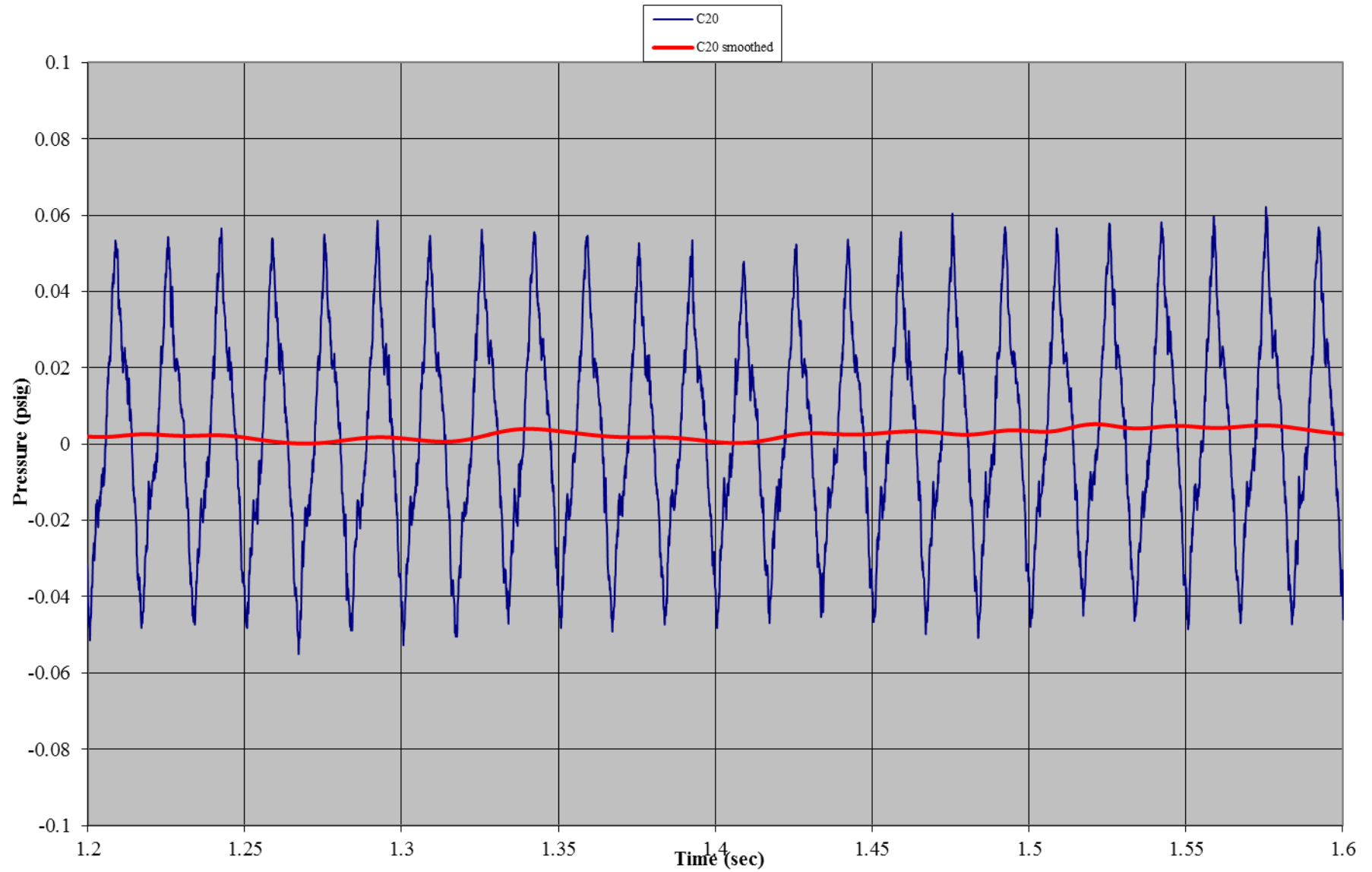
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 04: Interior, Ground



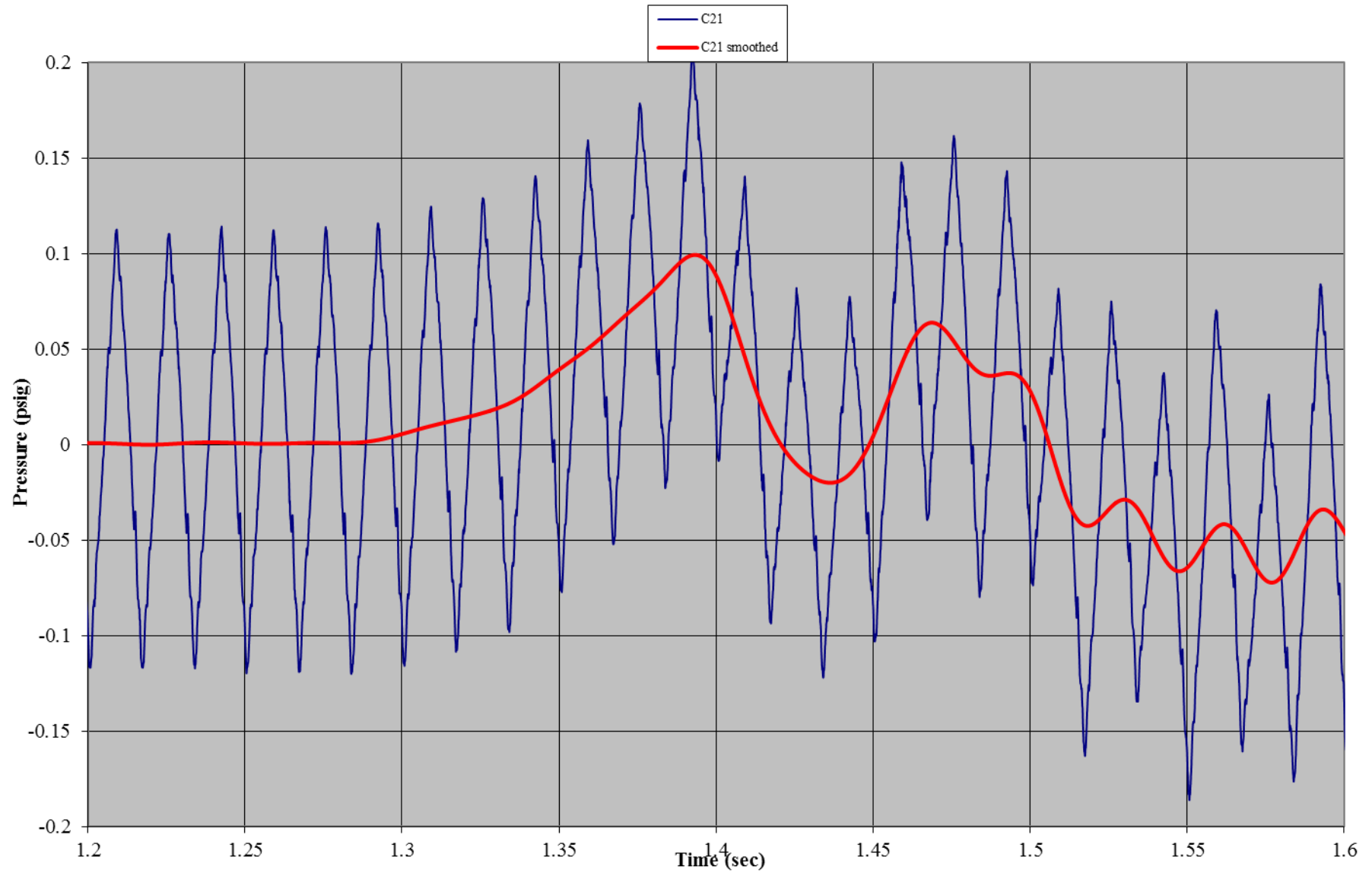
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 07: Roof, Front



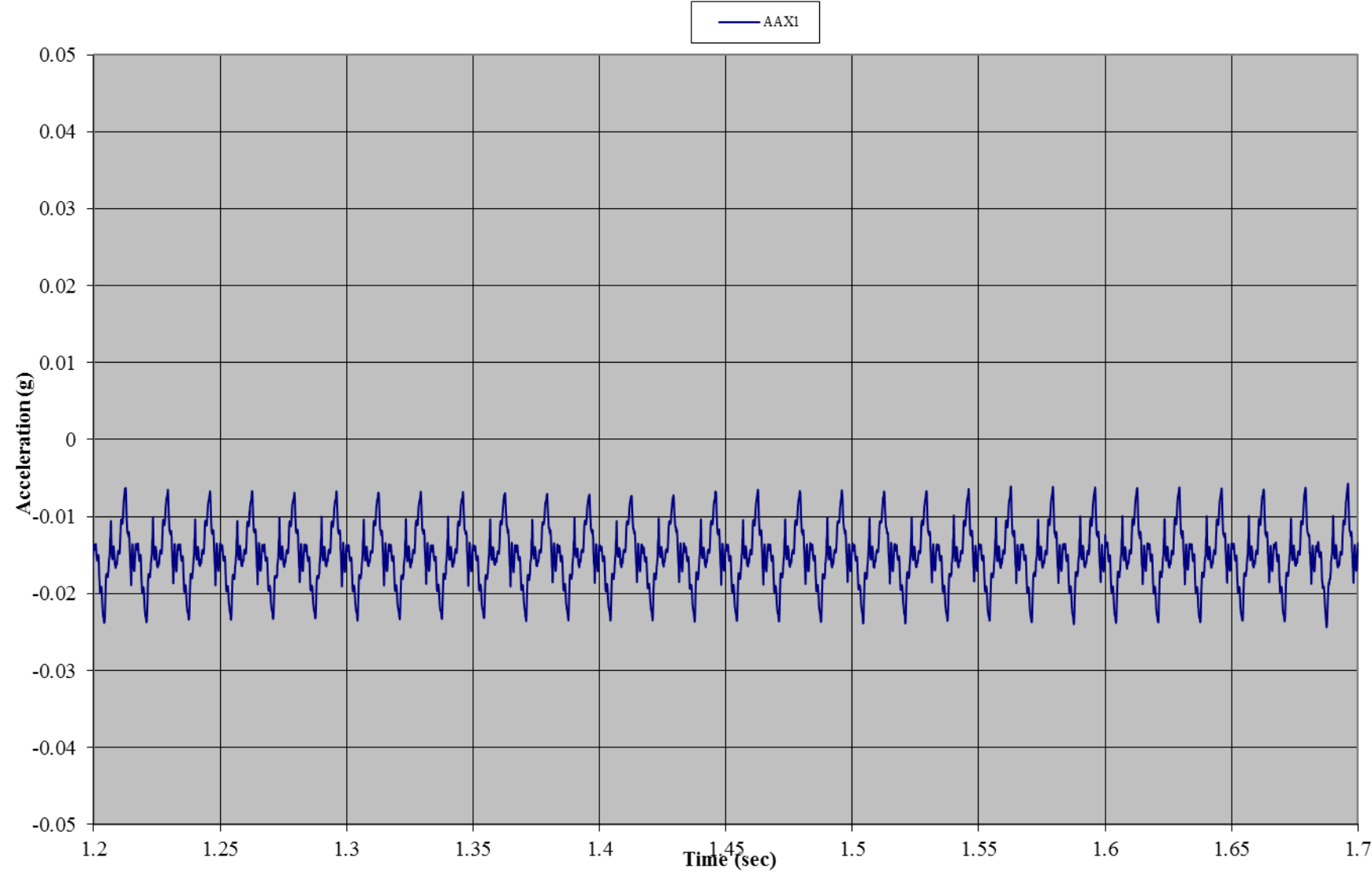
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 20: Roof, Back



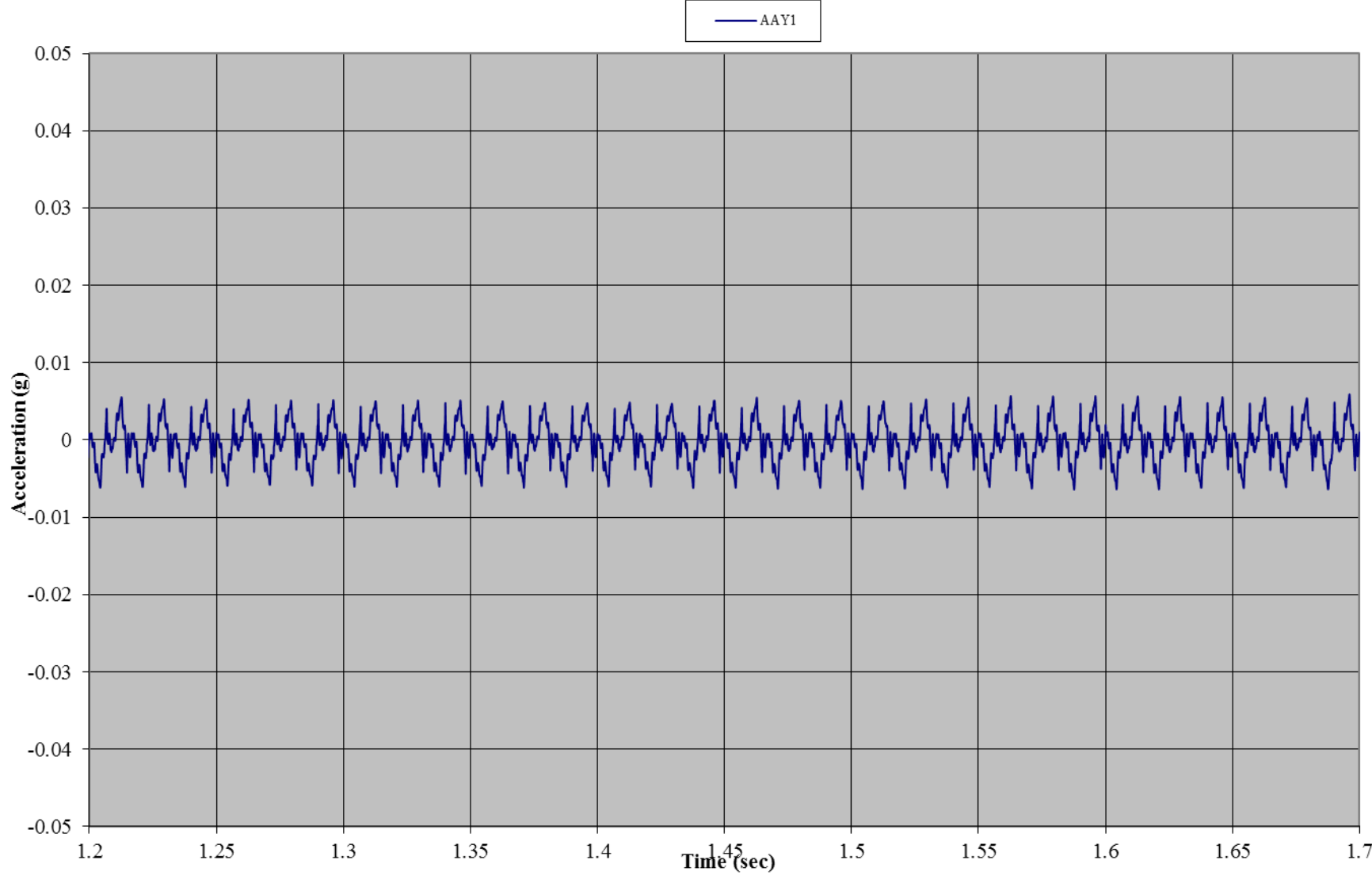
Test A02: Non-Wind Rated Pole Tent without Sides
Gauge 21: Back Wall, Cener Mid-Height



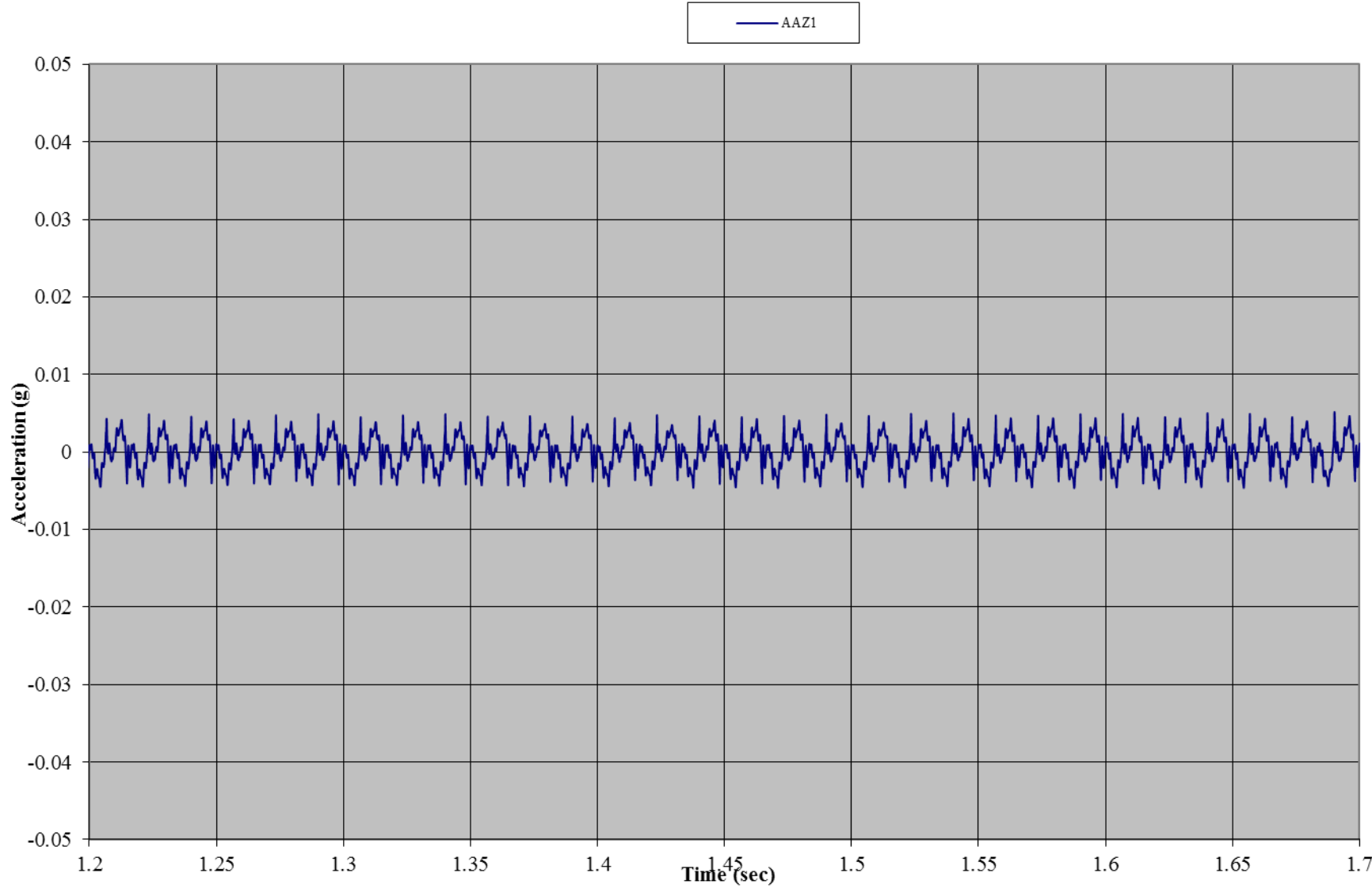
Test A02: Non-Wind Pole Rated Tent without Sides
Accelerometer 1: Front Wall (x-direction)



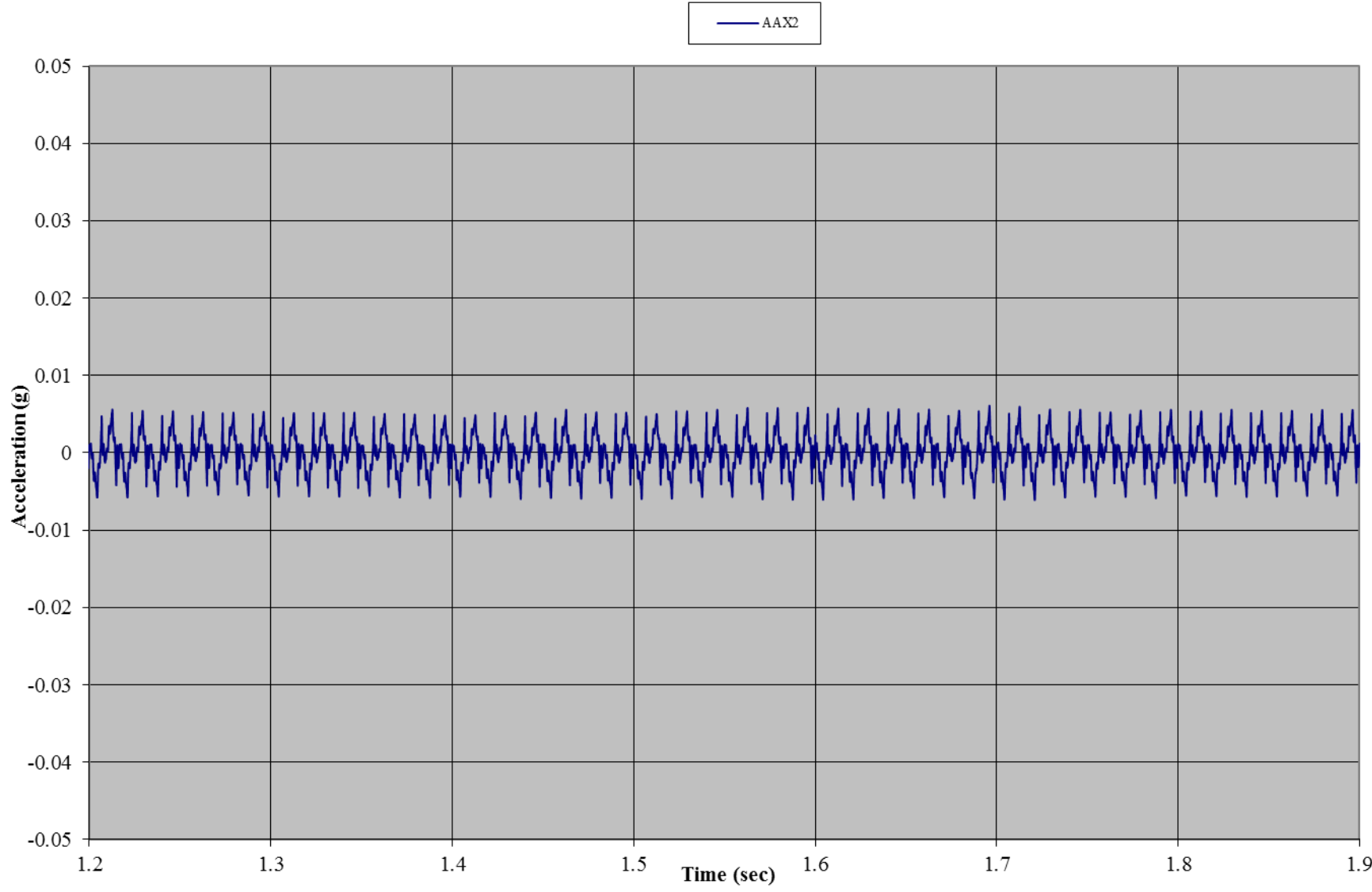
Test A02: Non-Wind Pole Rated Tent without Sides
Accelerometer 1: Front Wall (y-direction)



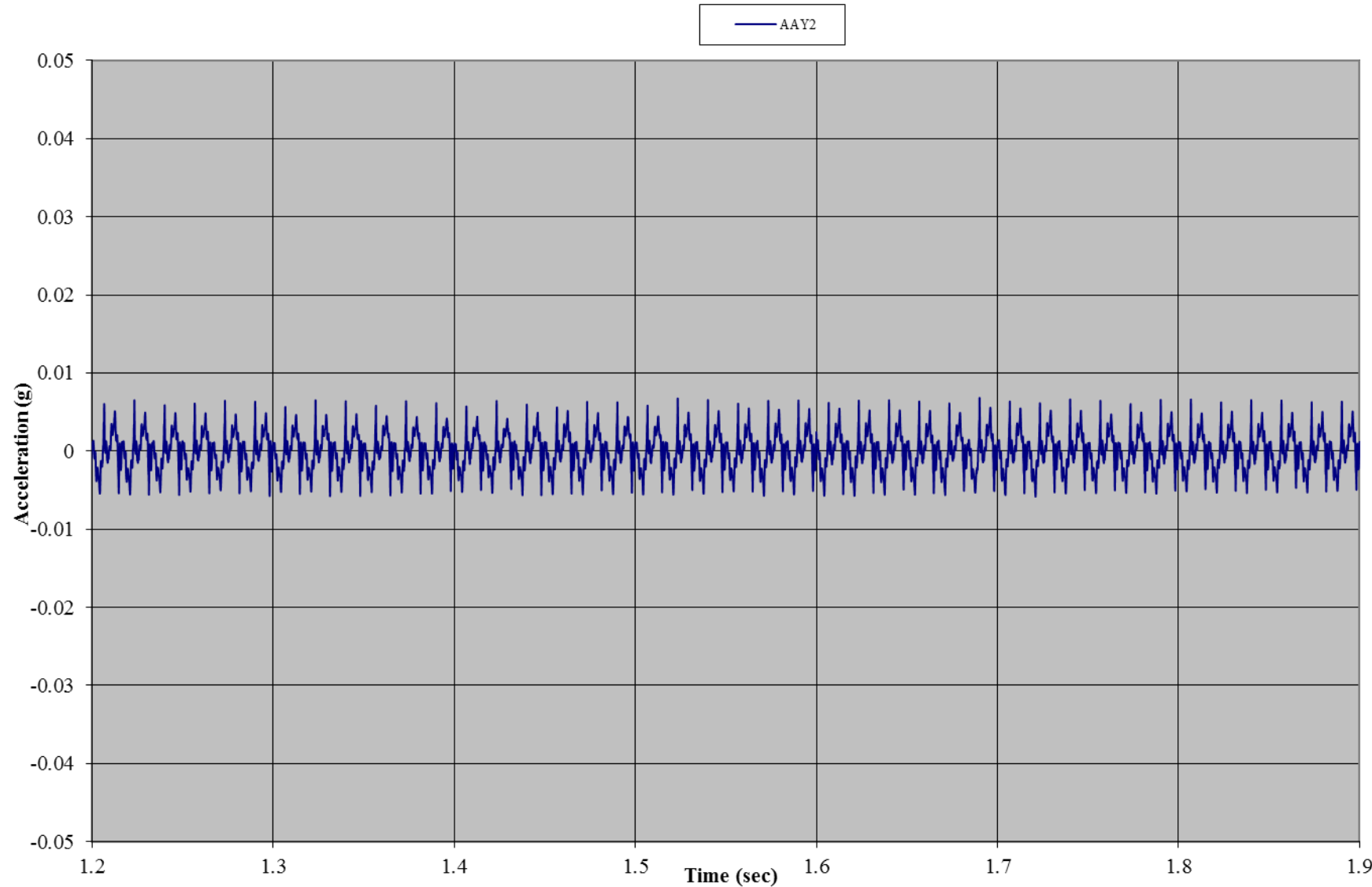
Test A02: Non-Wind Pole Rated Tent without Sides
Accelerometer 1: Front Wall (z-direction)



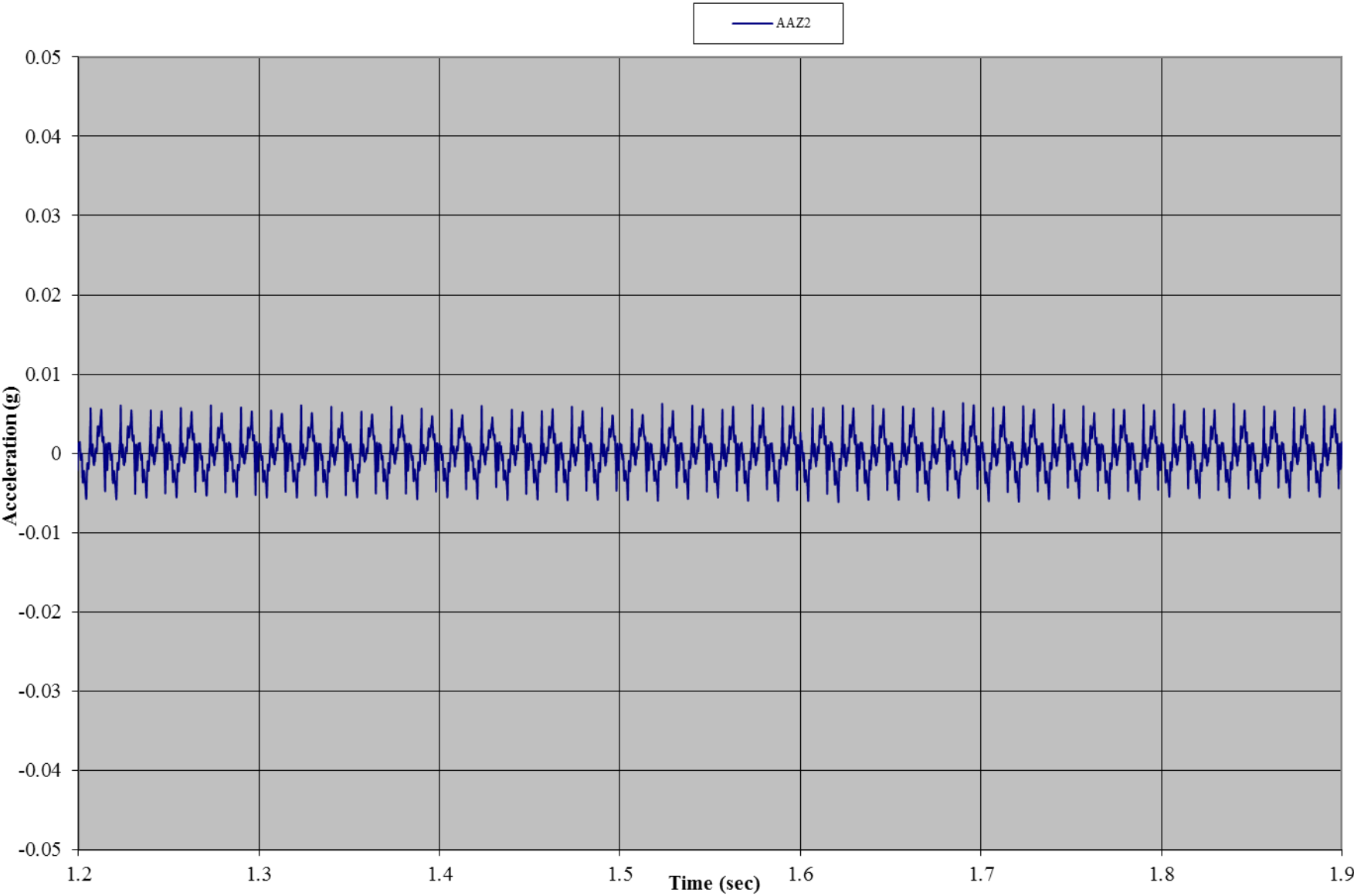
Test A02: Non-Wind Pole Rated Tent without Sides
Accelerometer 2: Roof (x-direction)



Test A02: Non-Wind Pole Rated Tent without Sides
Accelerometer 2: Roof (y-direction)

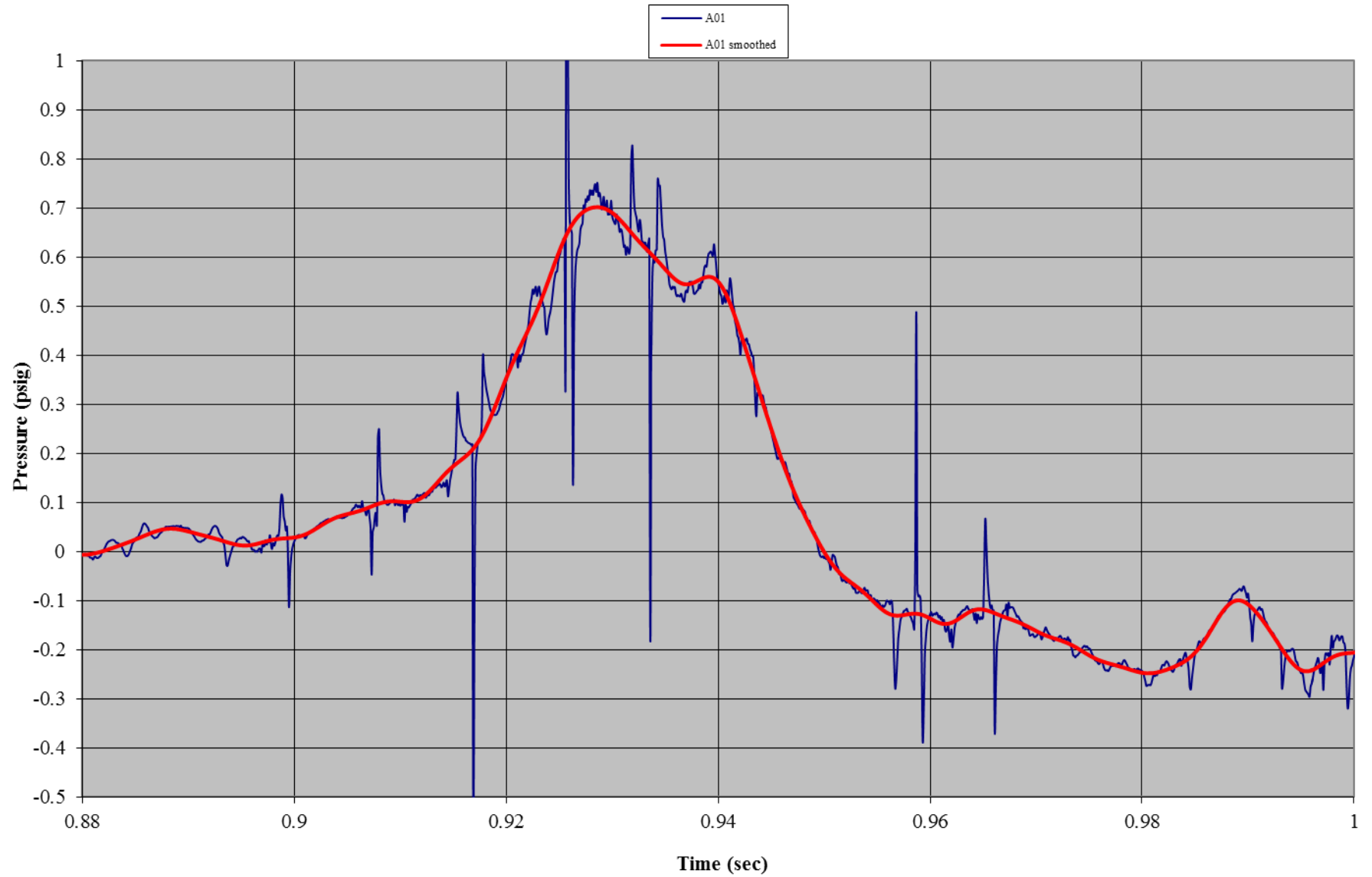


Test A02: Non-Wind Pole Rated Tent without Sides
Accelerometer 2: Roof (z-direction)

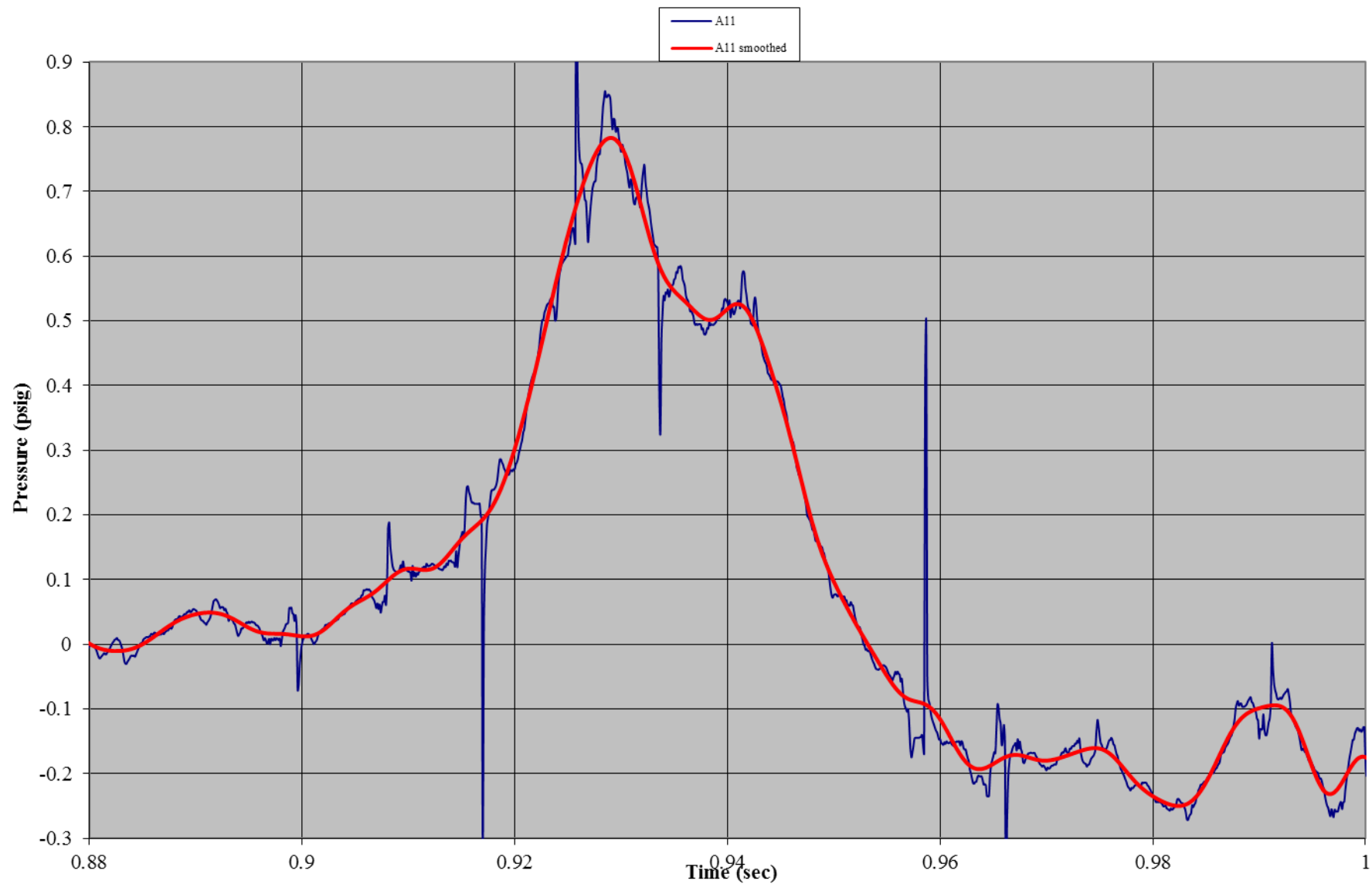


Test A03: Tent A

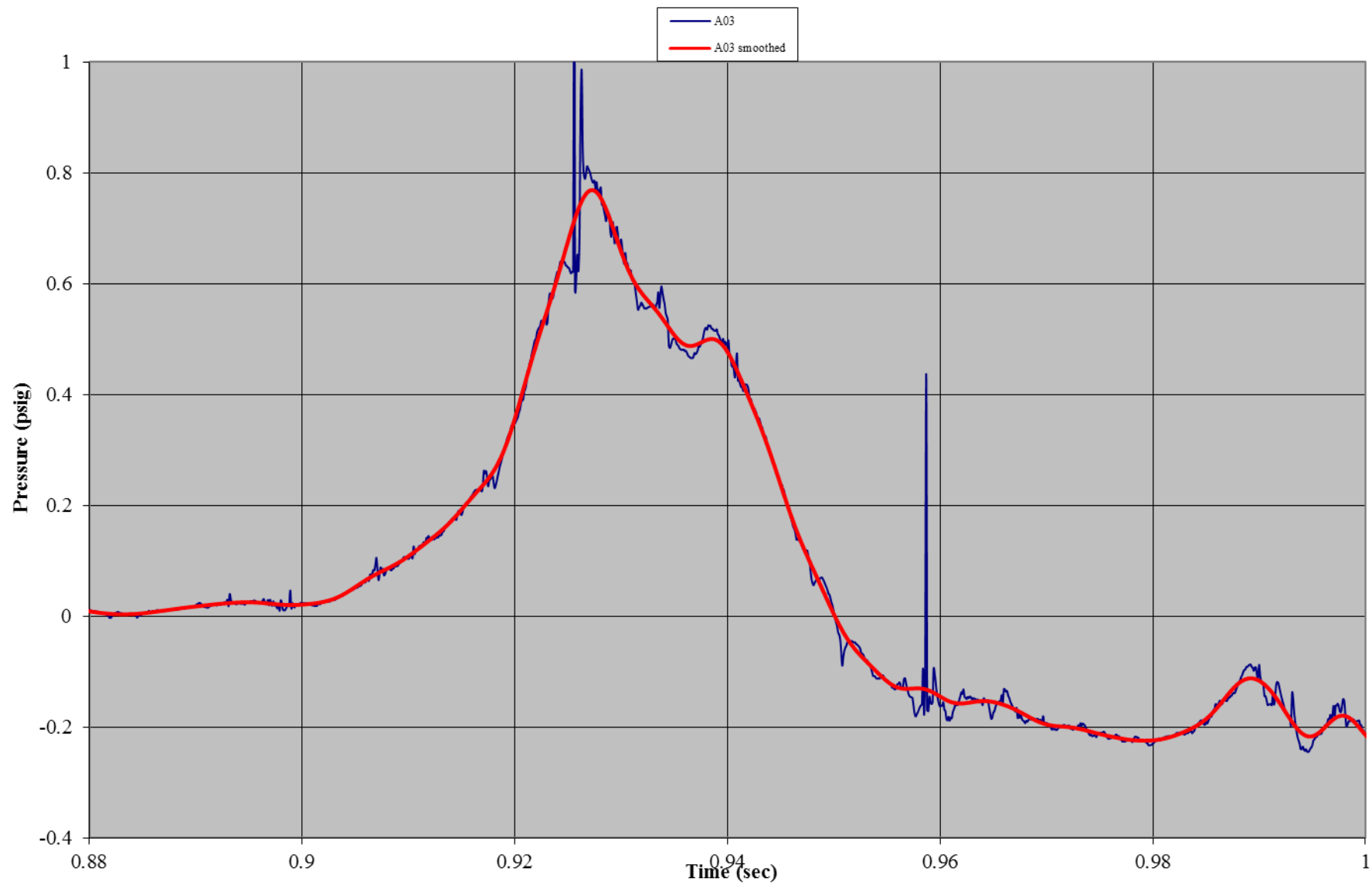
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 01: Front Wall, Left Bottom



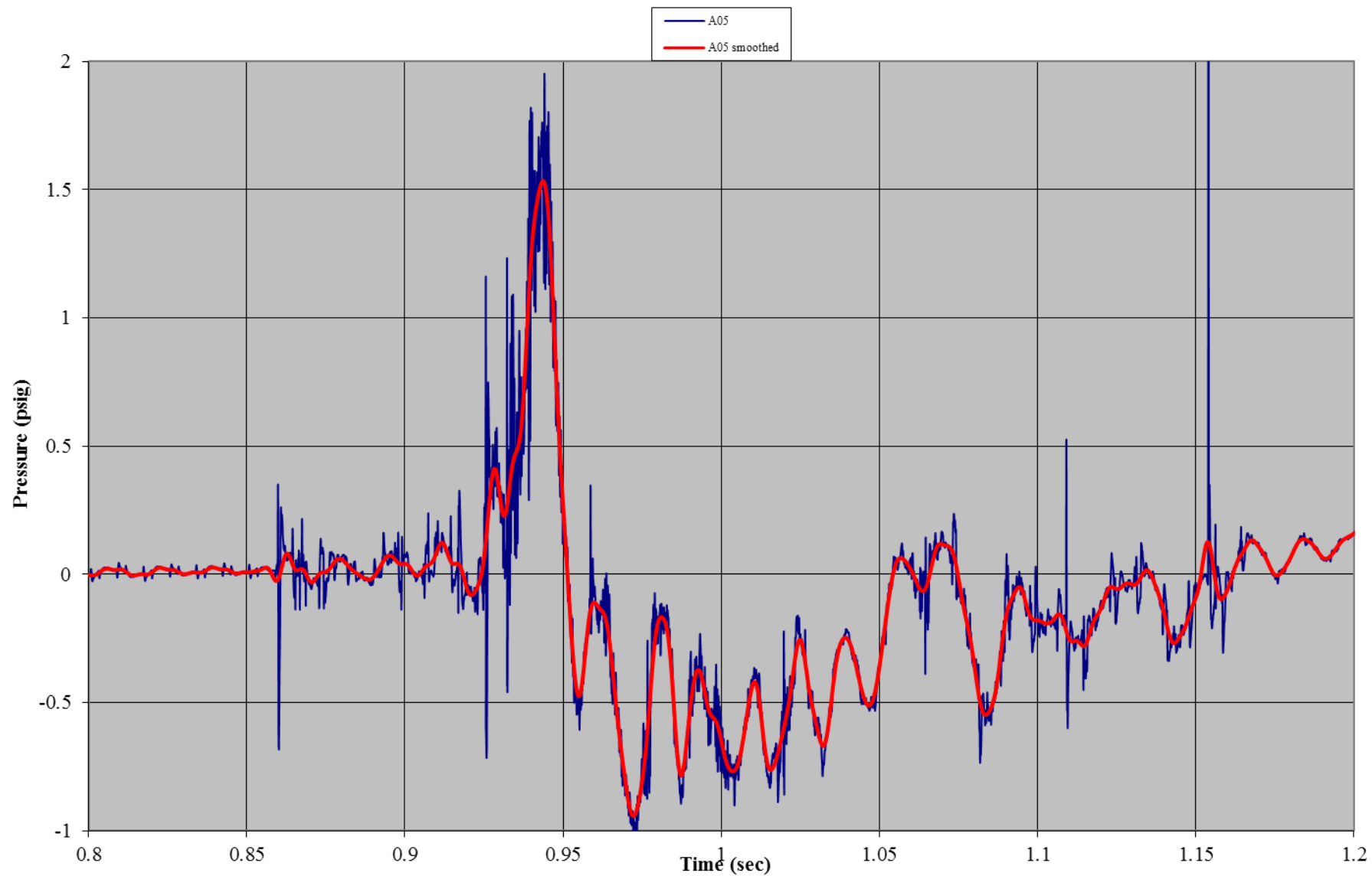
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 11: Front Wall, Right Bottom



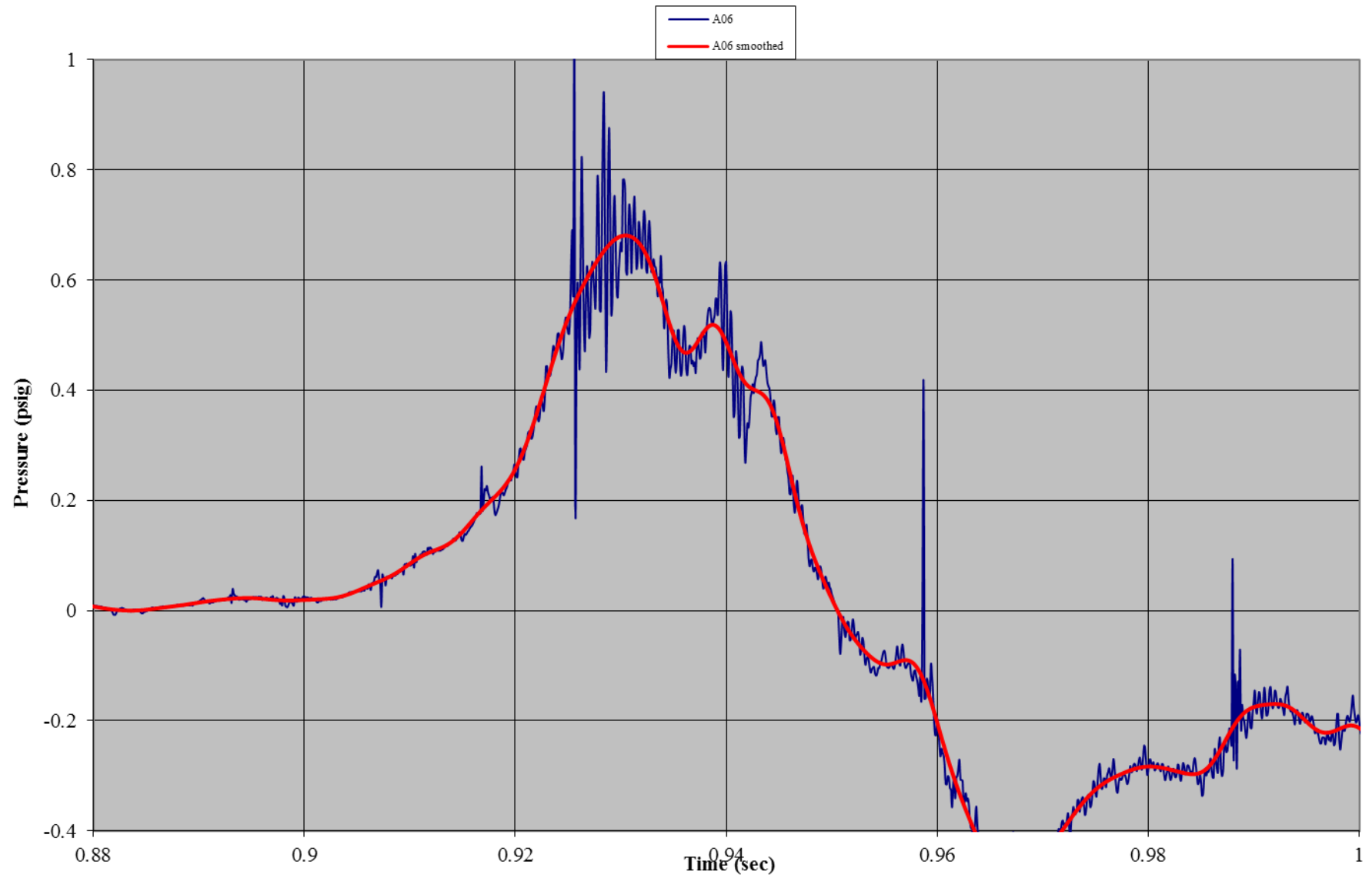
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 03: Front Wall, Center Bottom



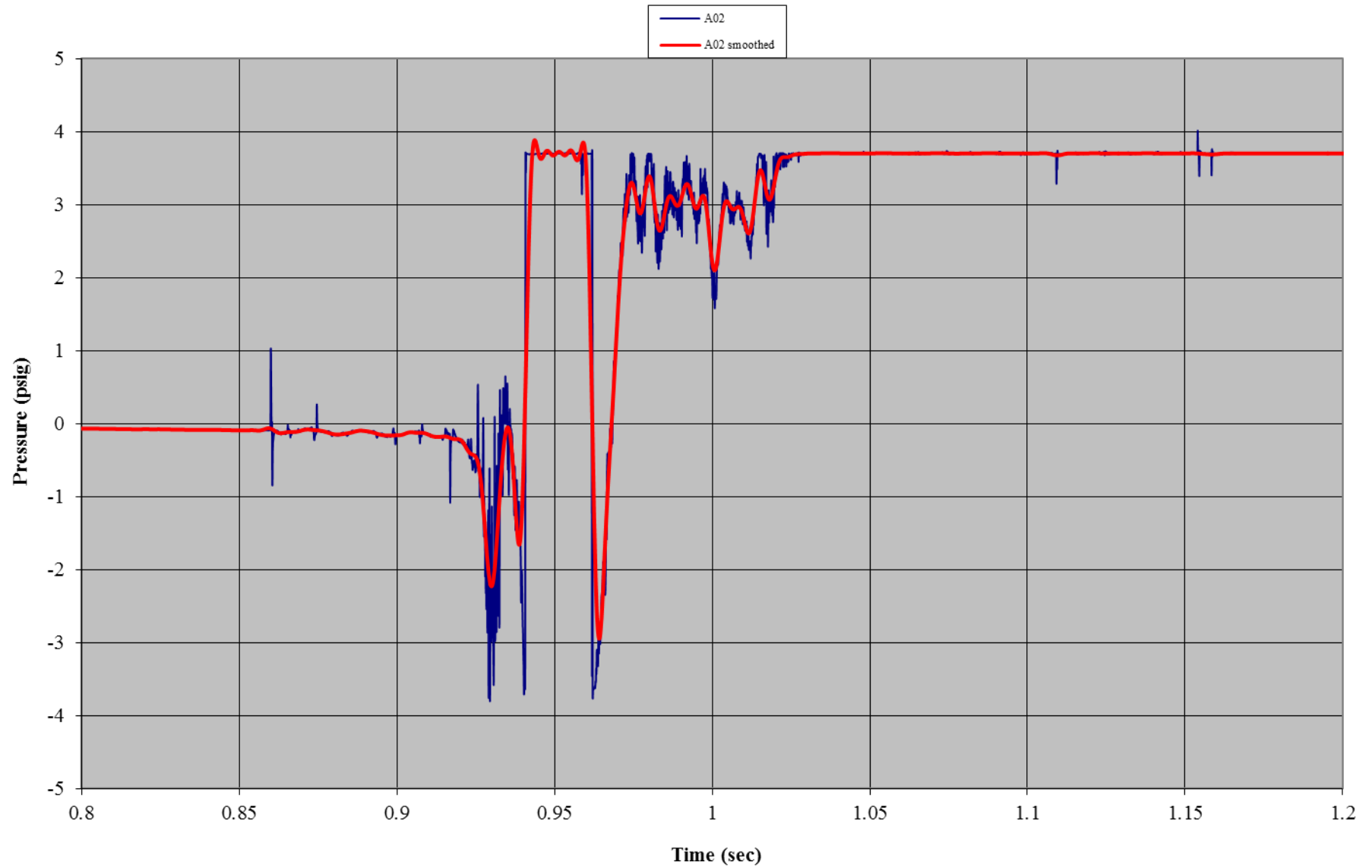
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



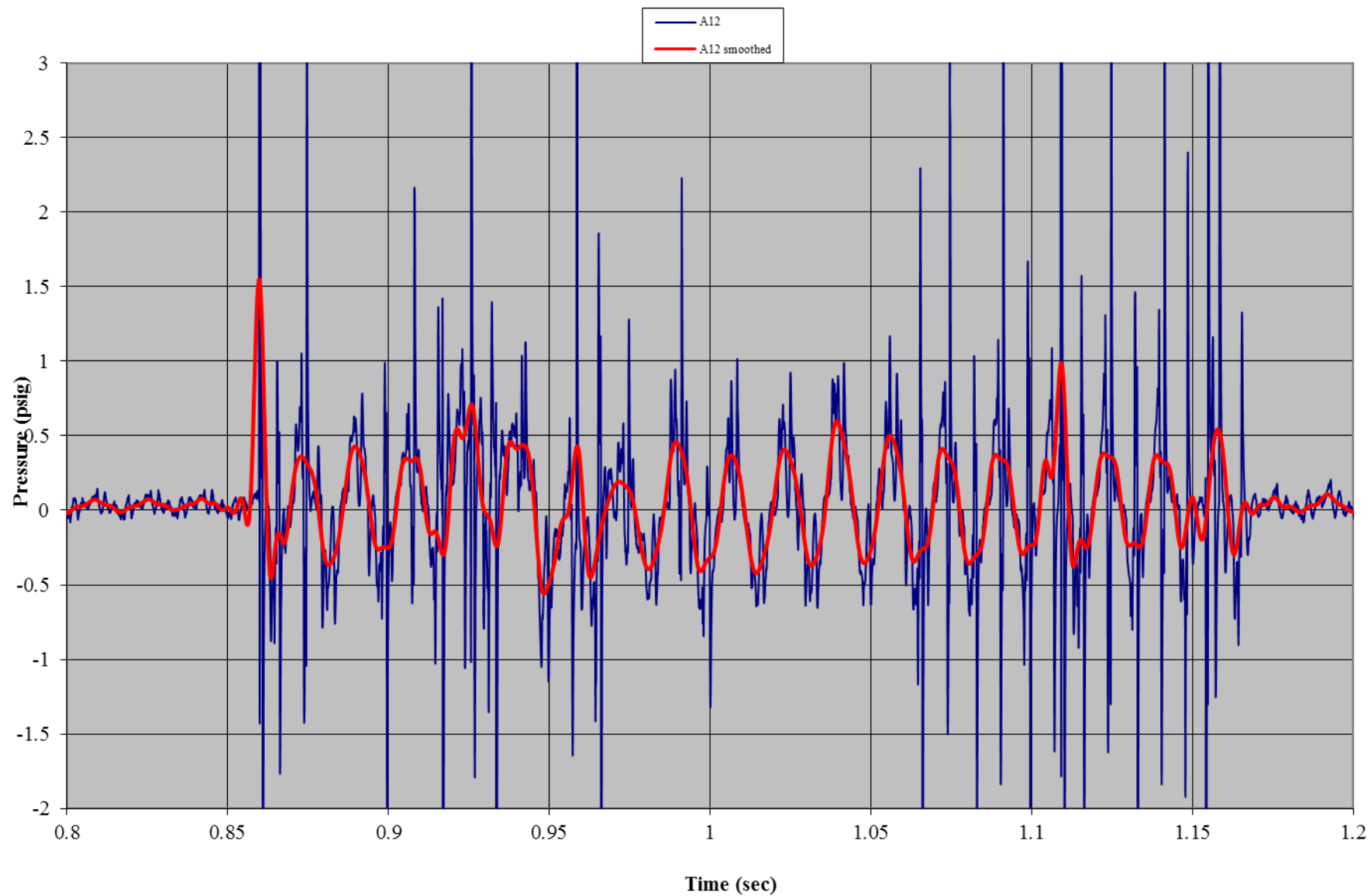
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 06: Front Wall, Center Top



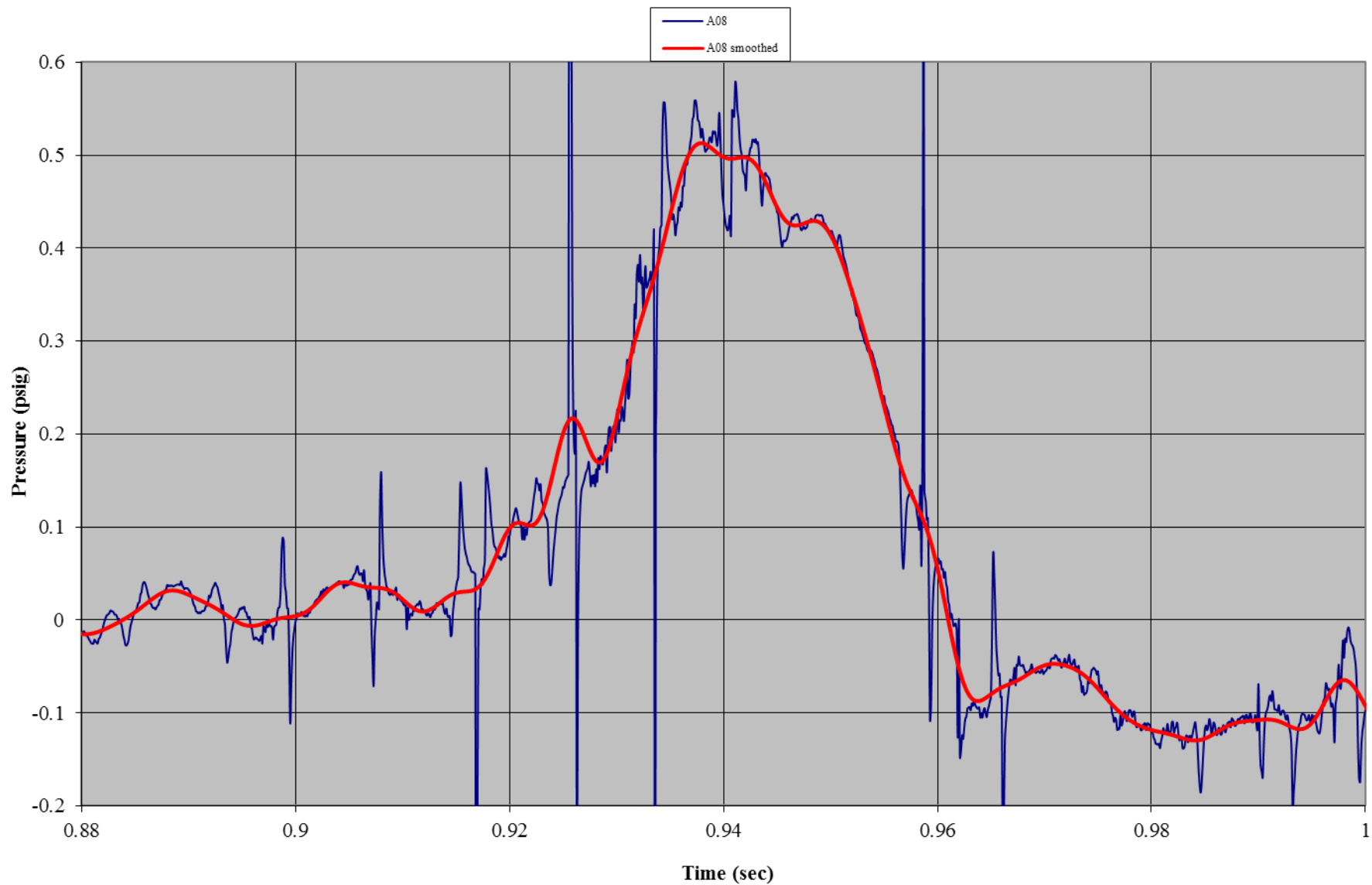
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



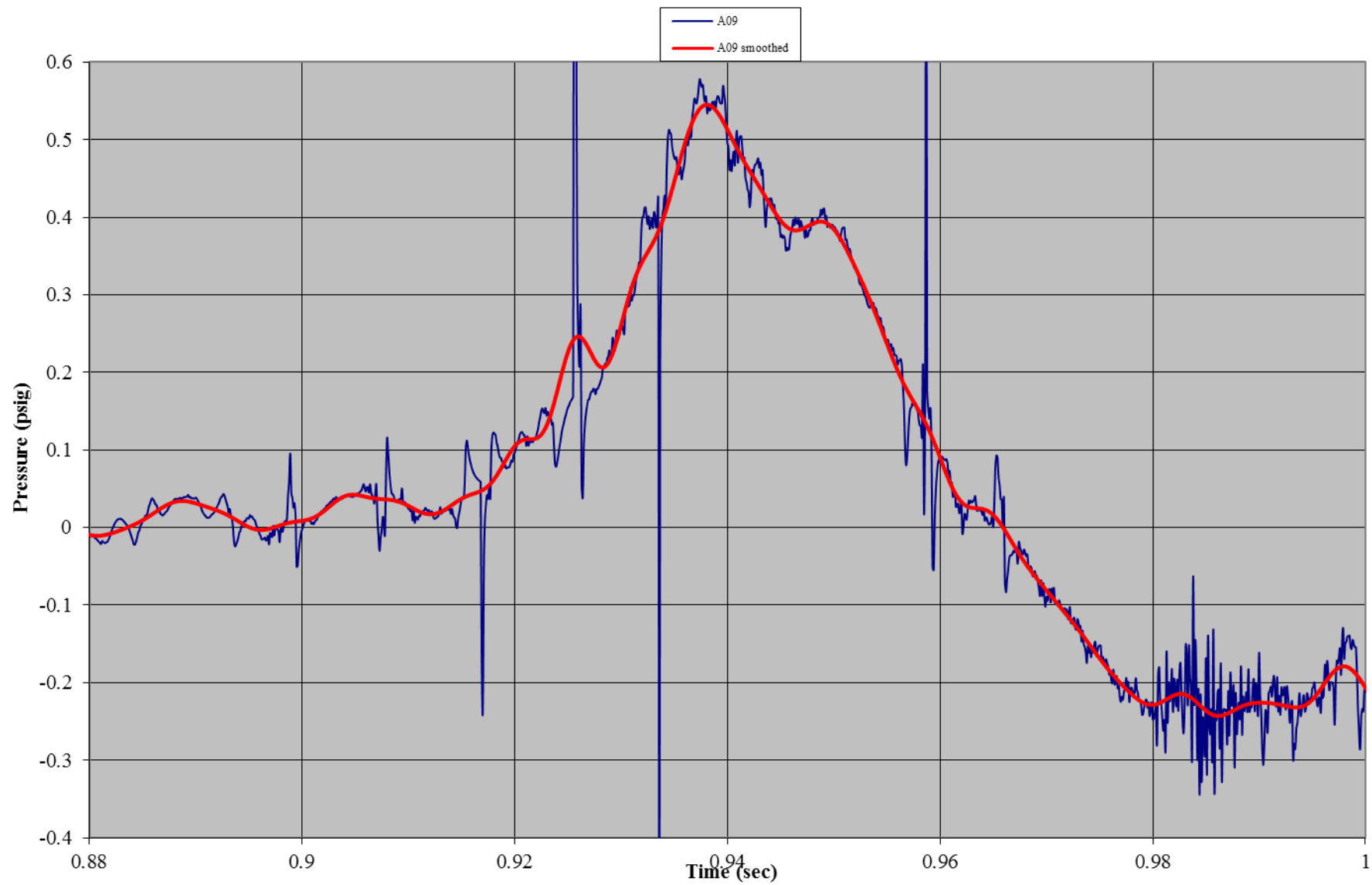
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



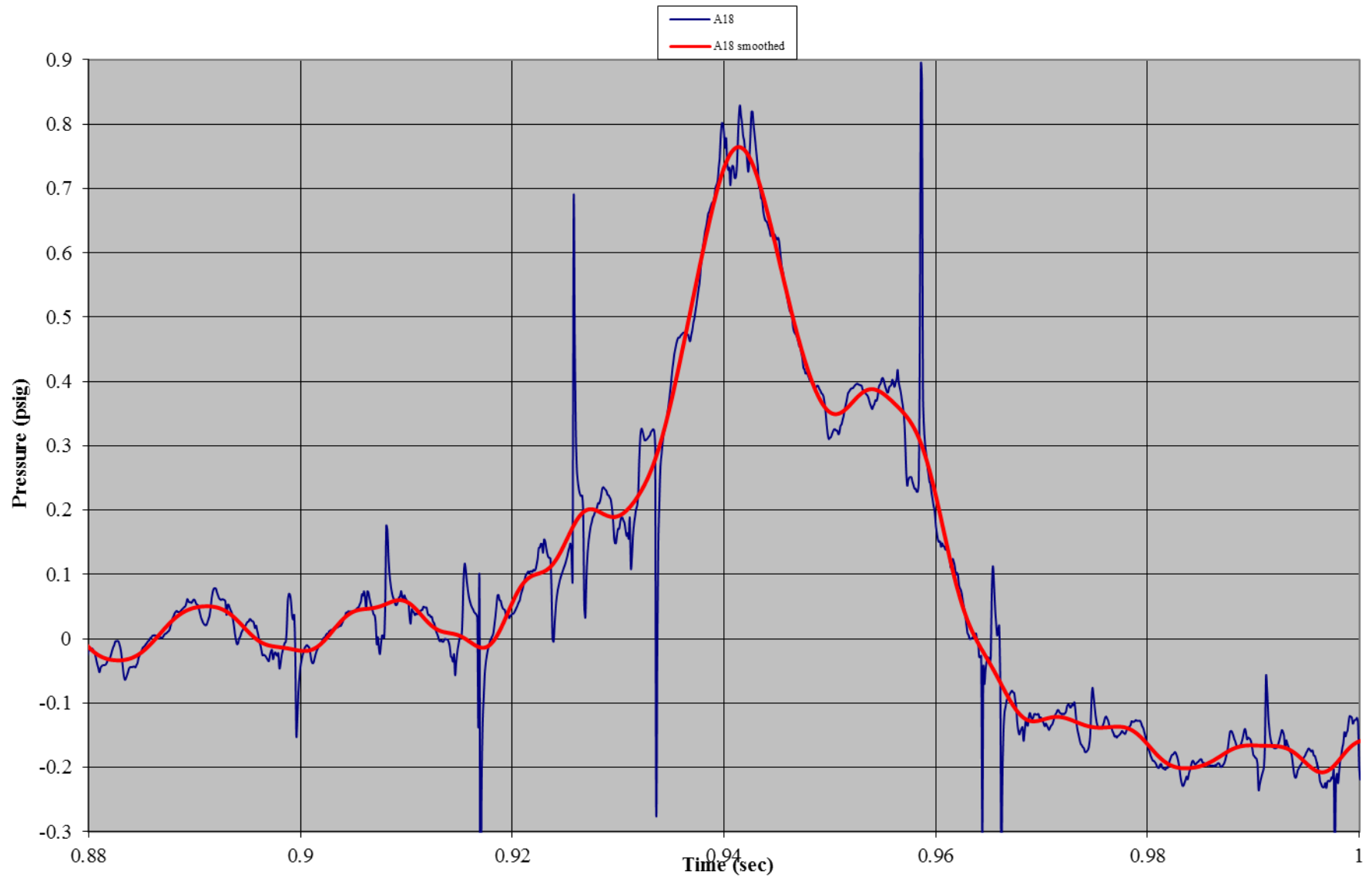
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 08: Left Side Wall, Bottom



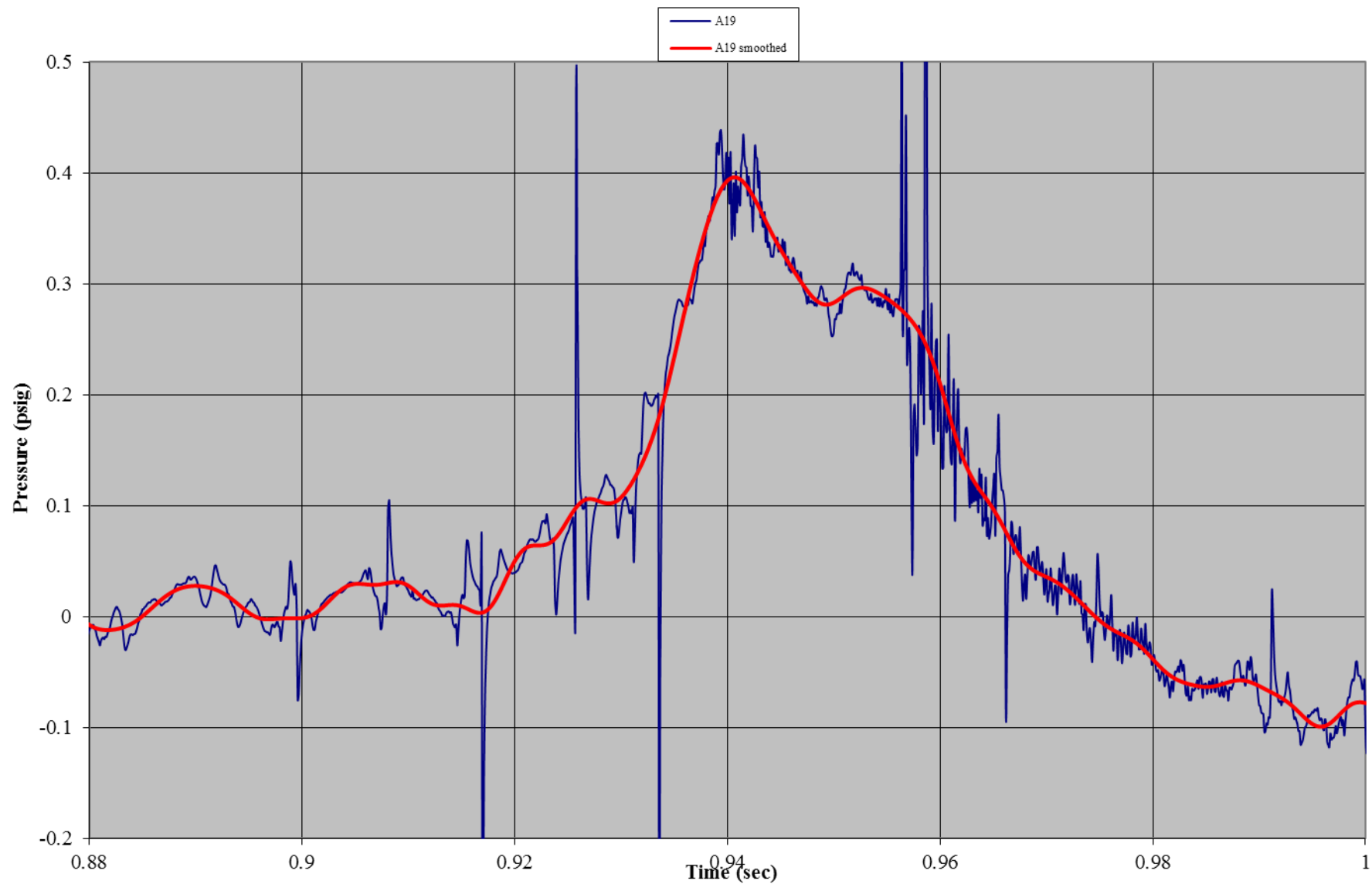
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



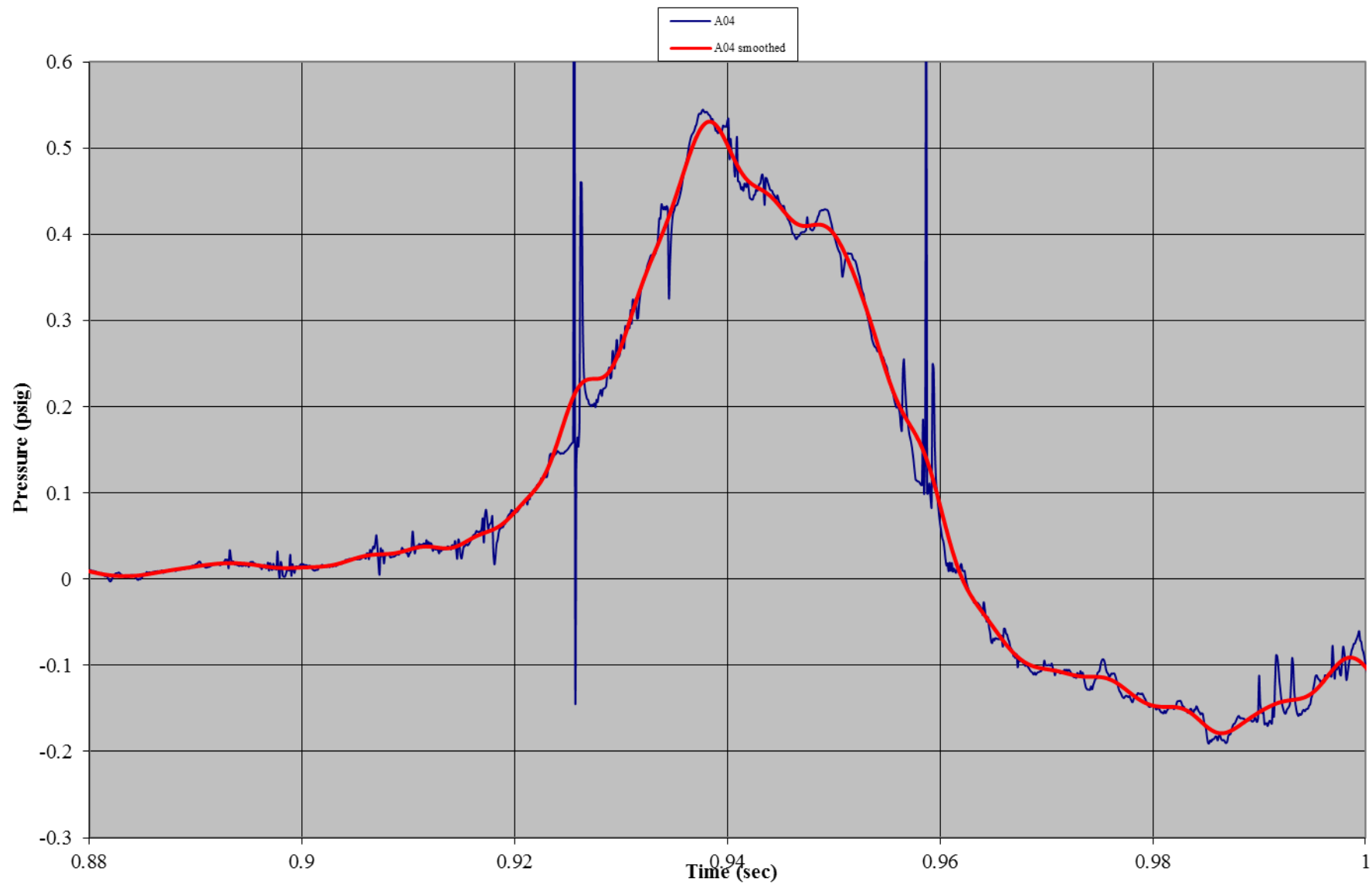
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 18: Right Side Wall, Bottom



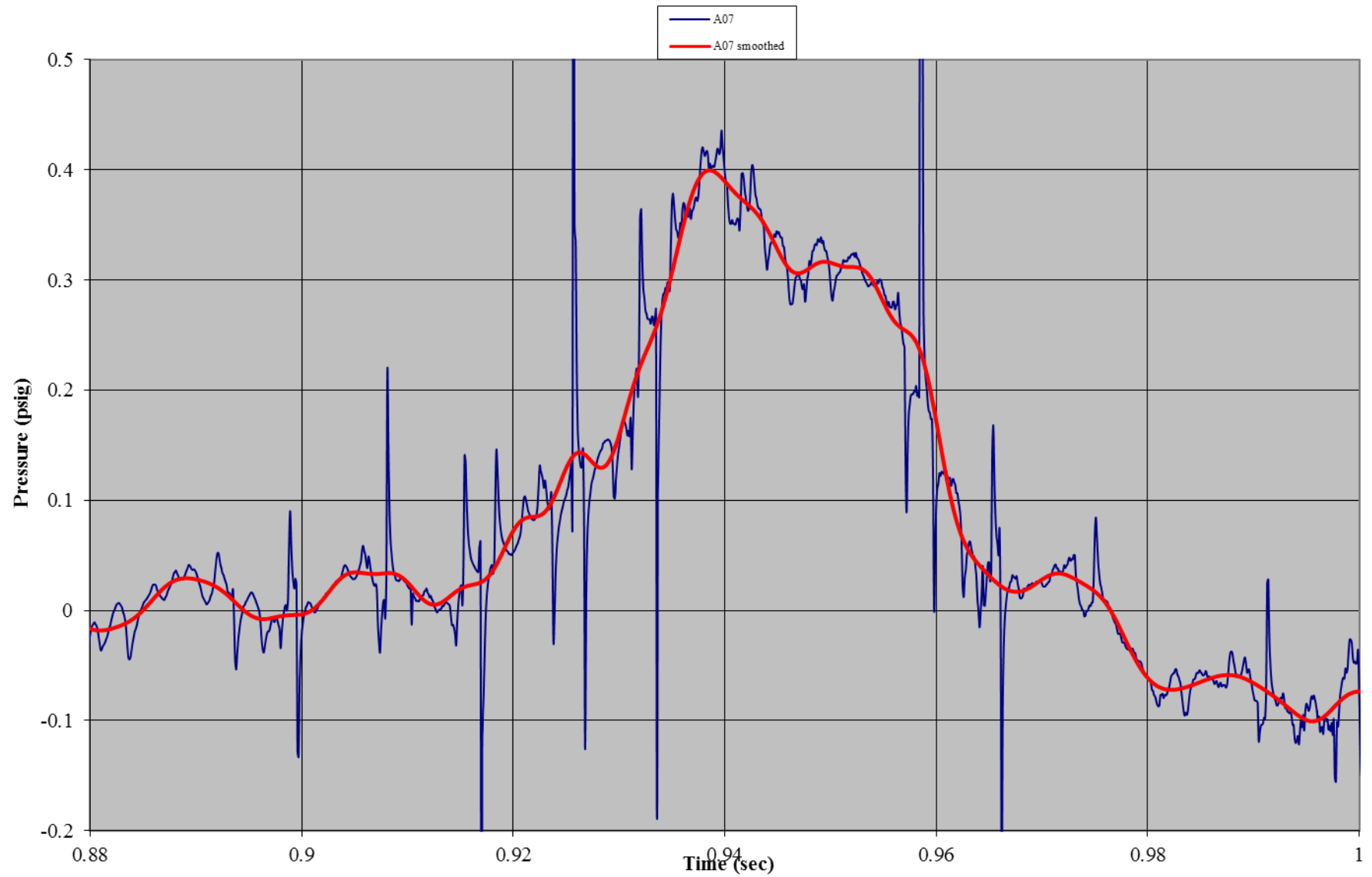
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



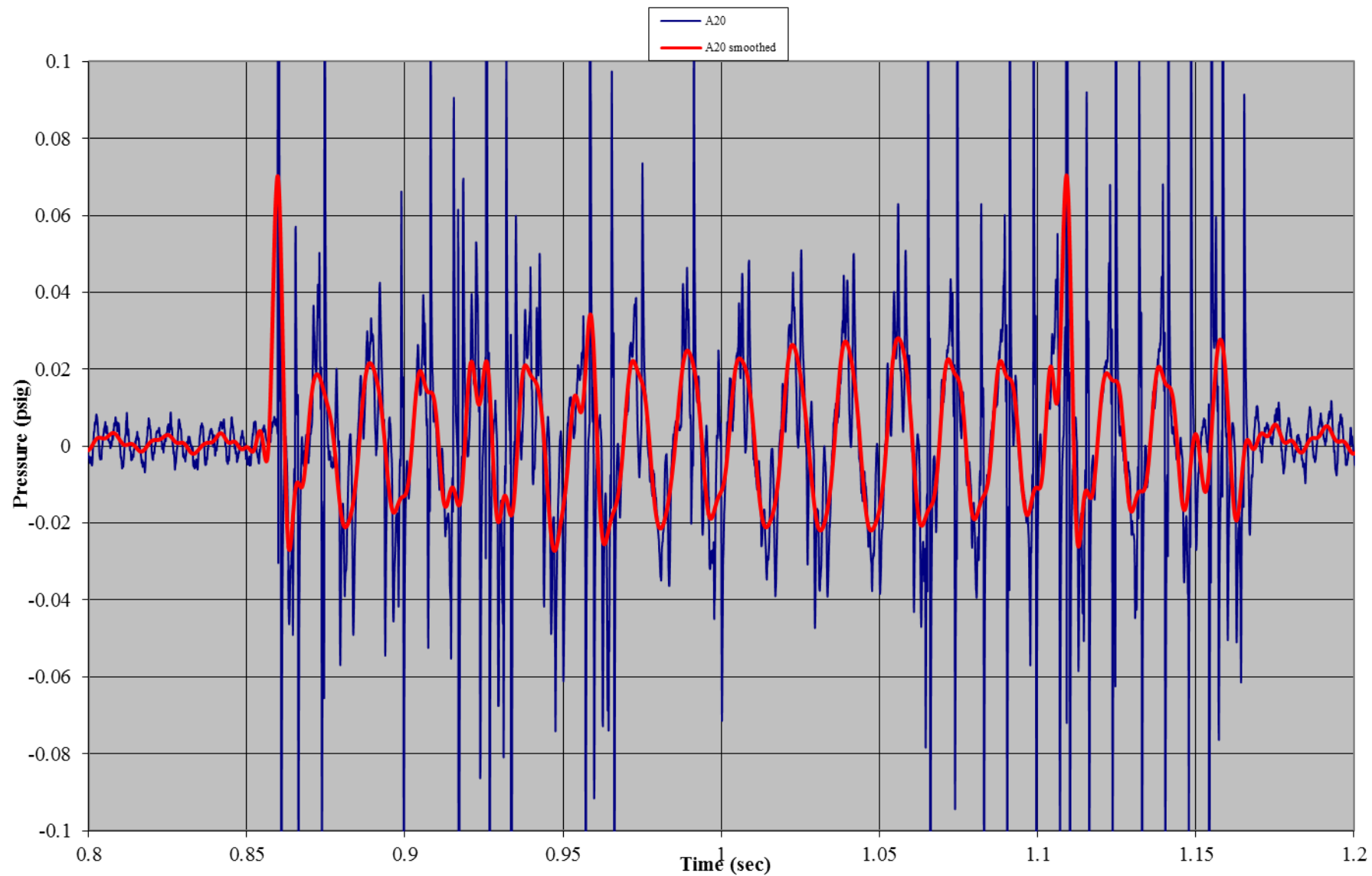
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 04: Interior, Ground



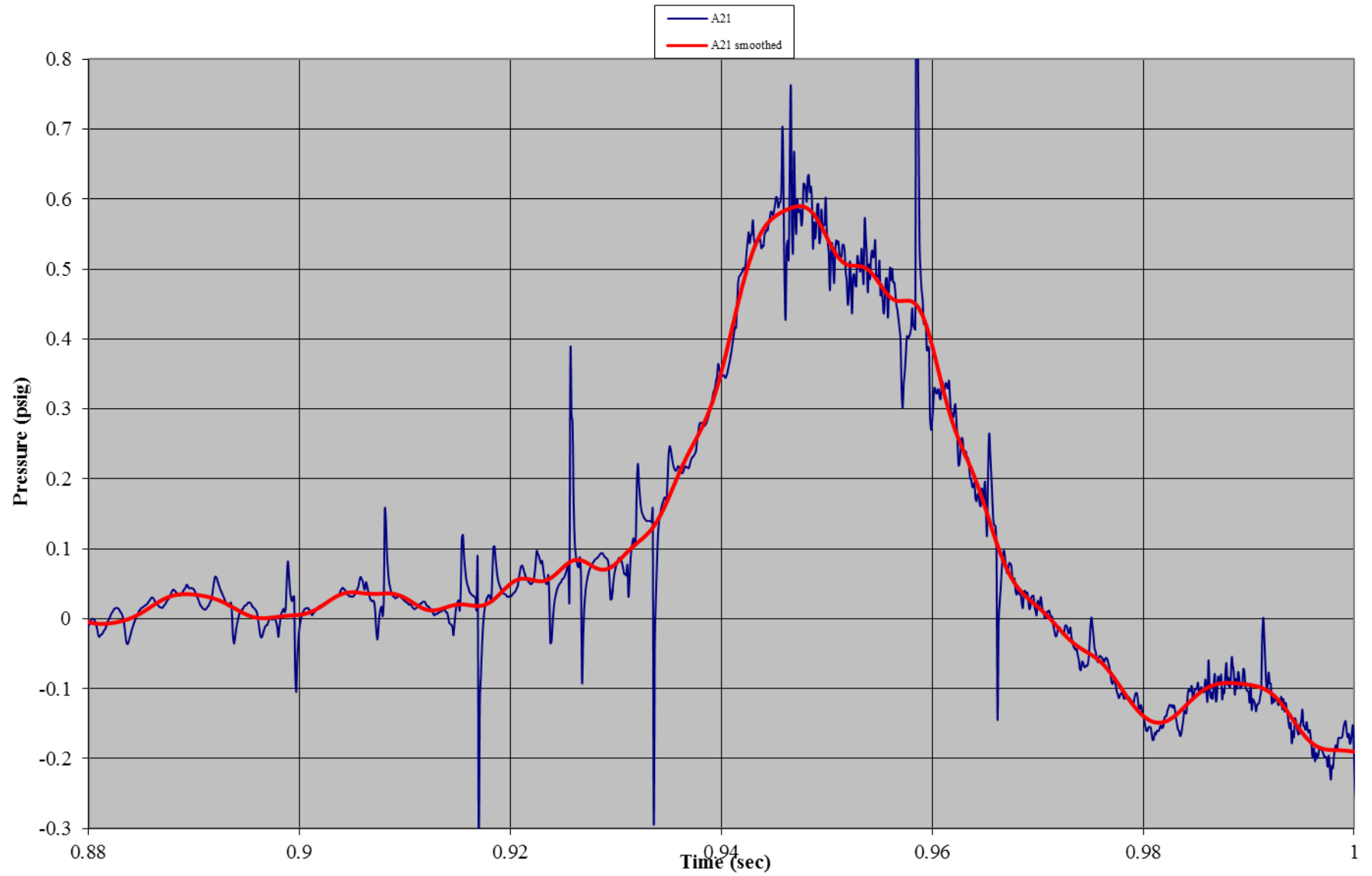
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 07: Roof, Front



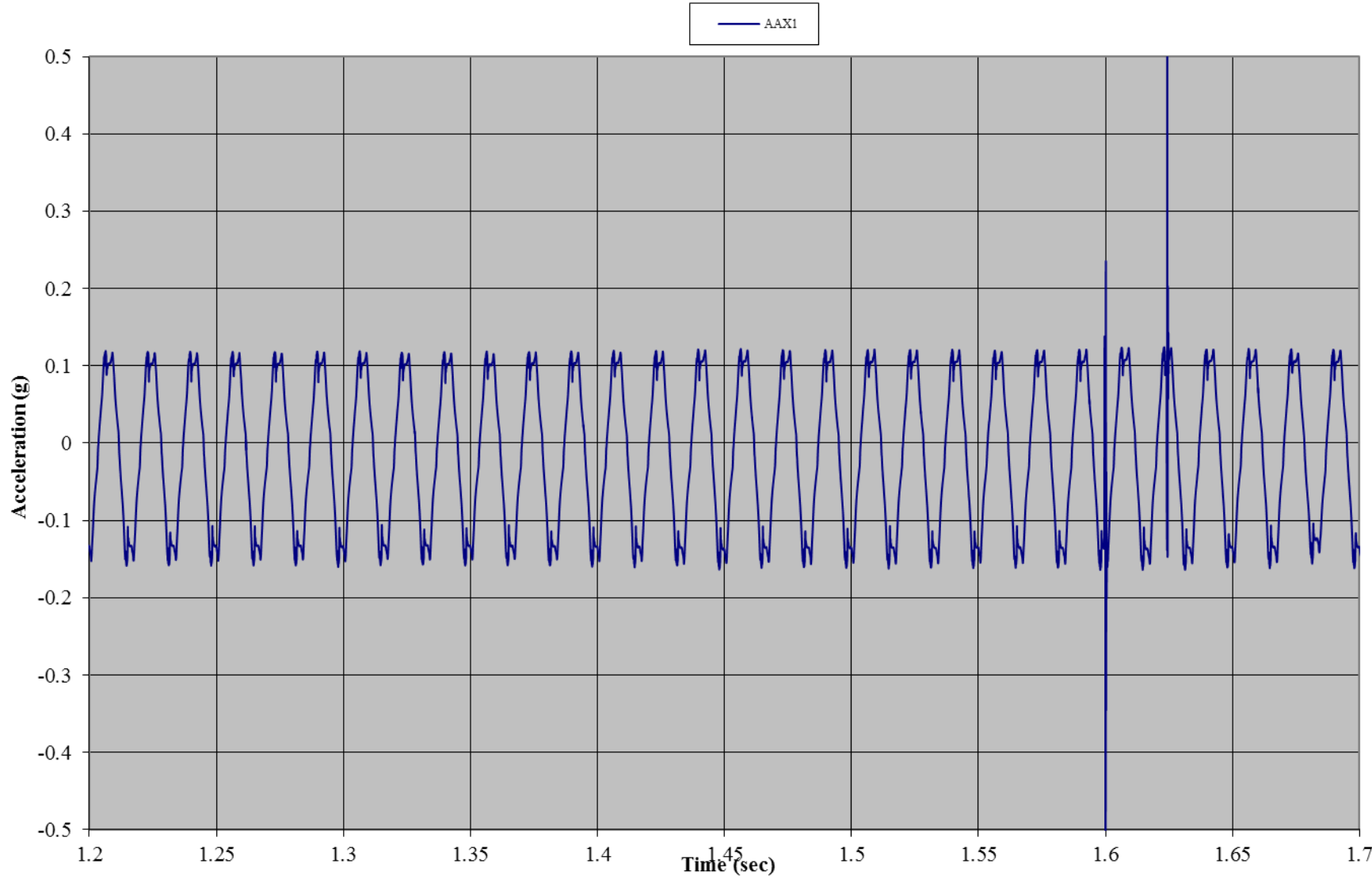
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 20: Roof, Back



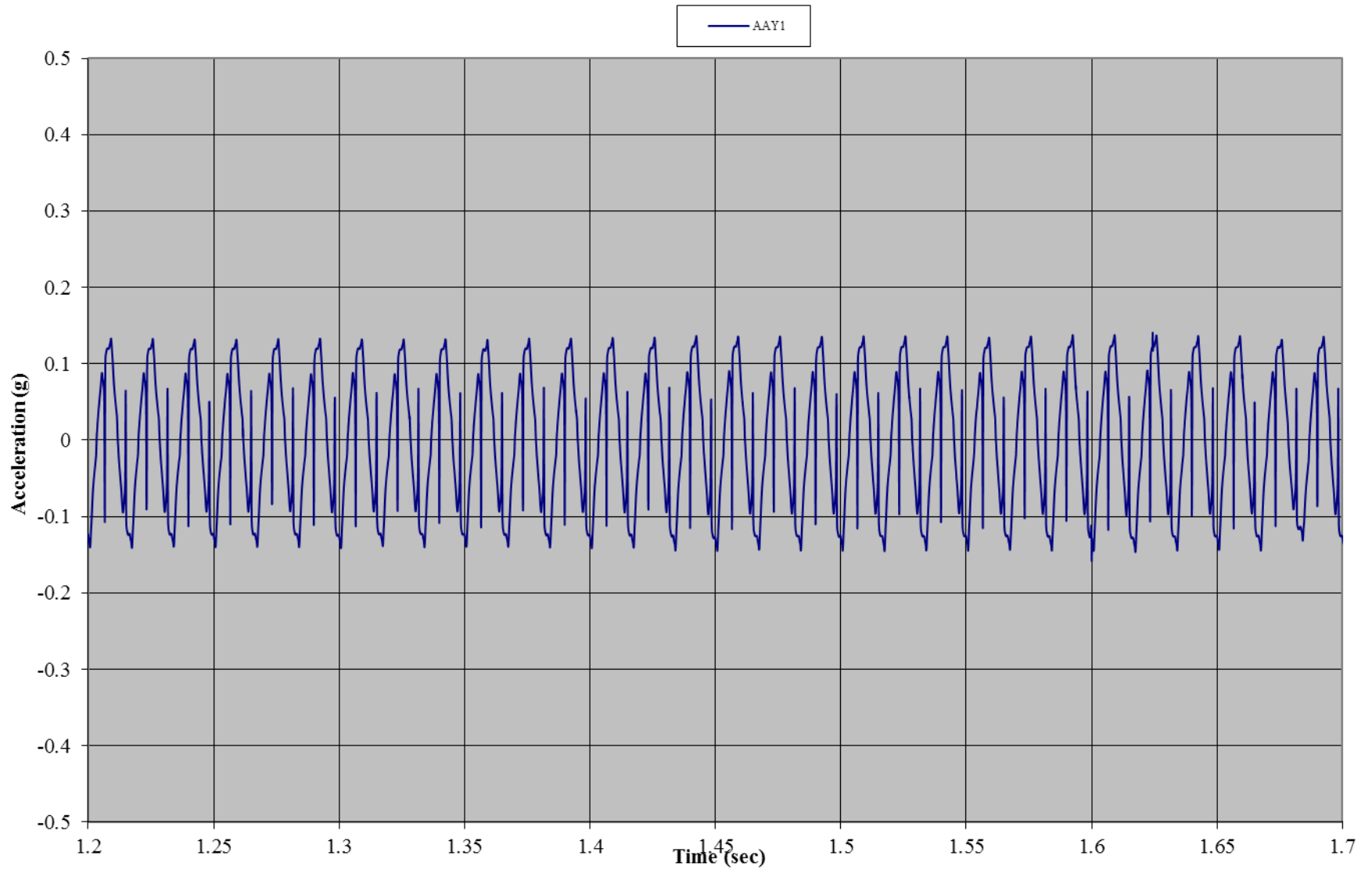
Test A03: Non-Wind Rated Pole Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



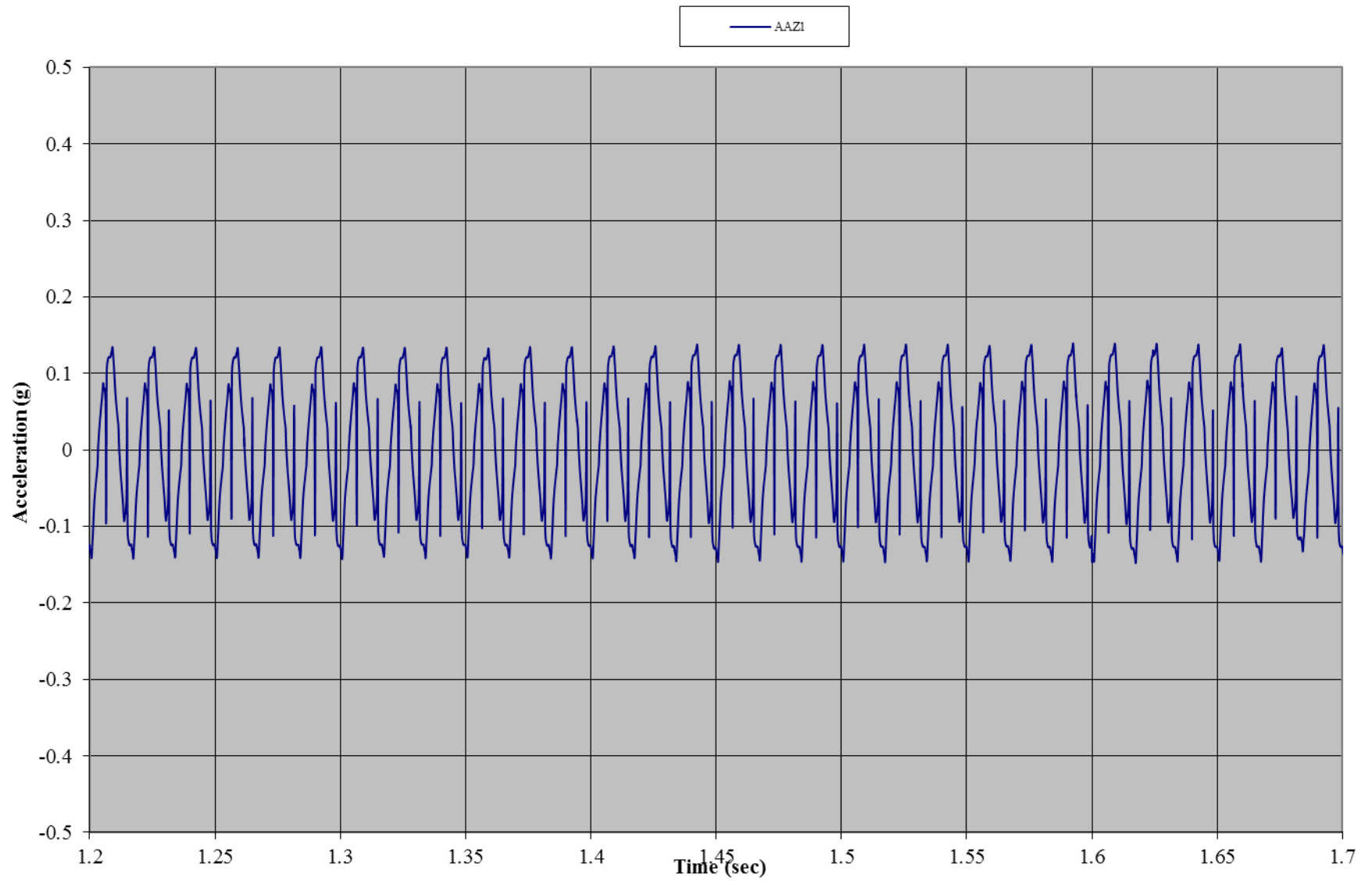
Test A03: Non-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (x-direction)



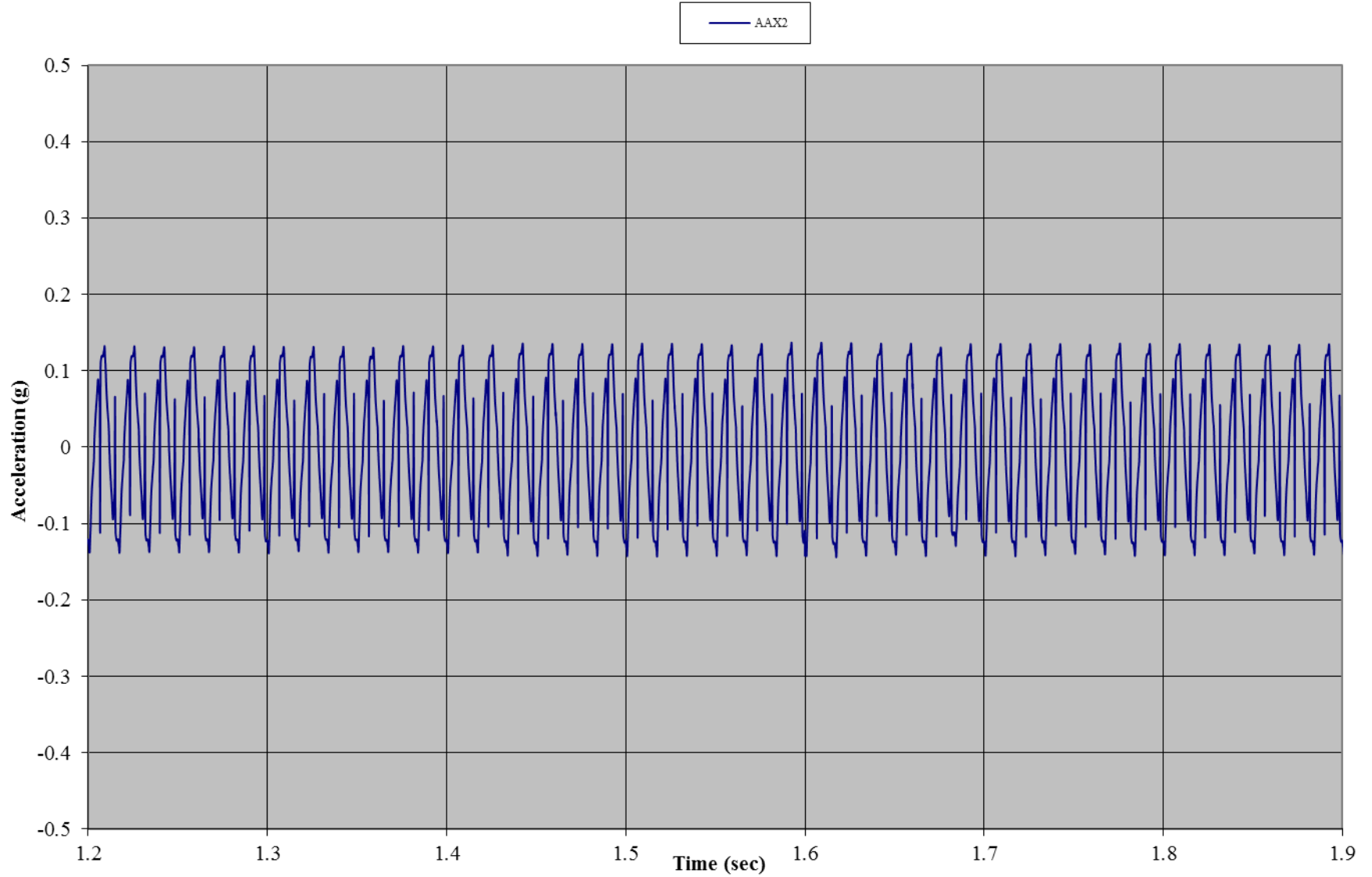
Test A03: Non-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (y-direction)



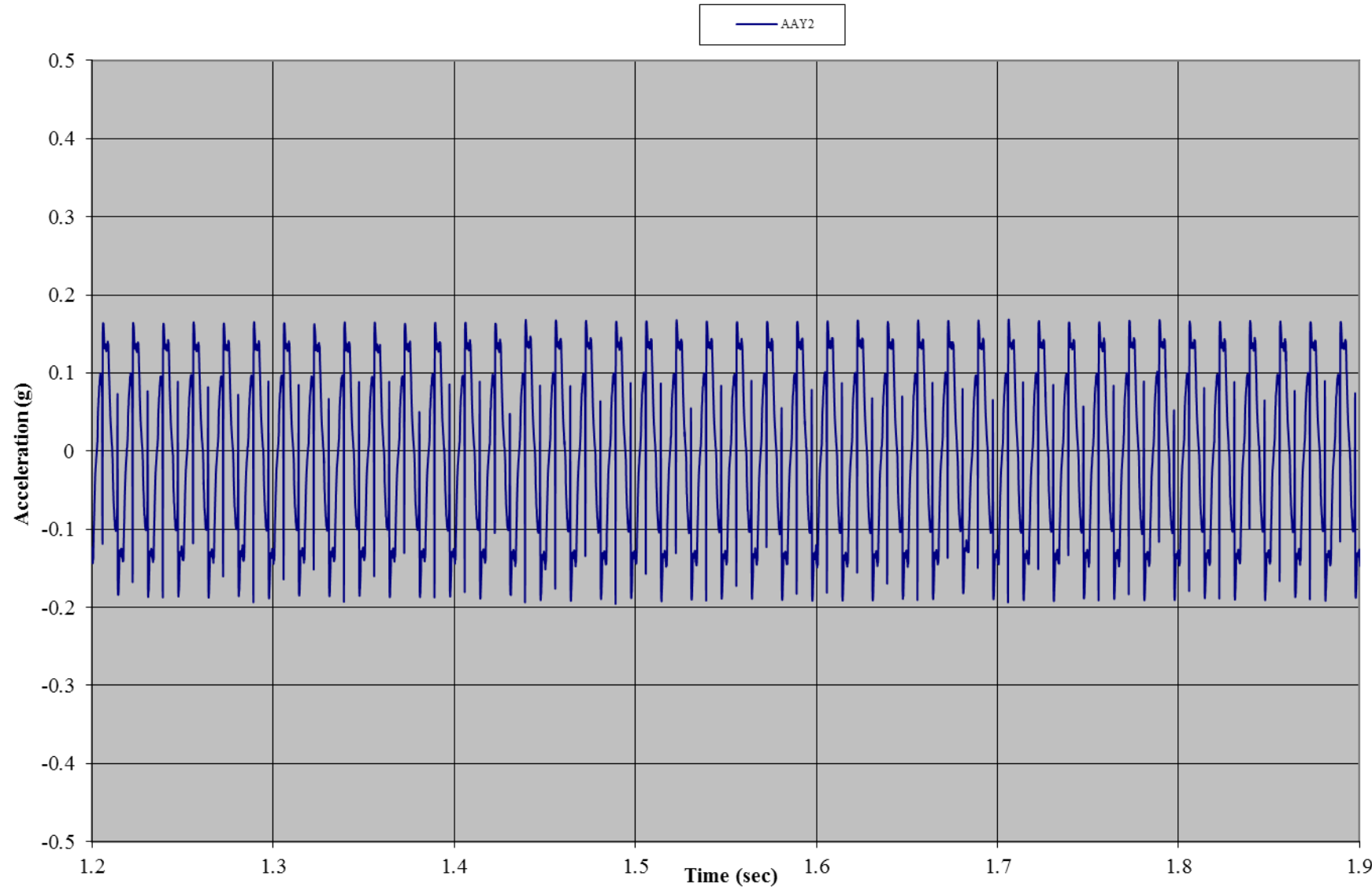
Test A03: Non-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (z-direction)



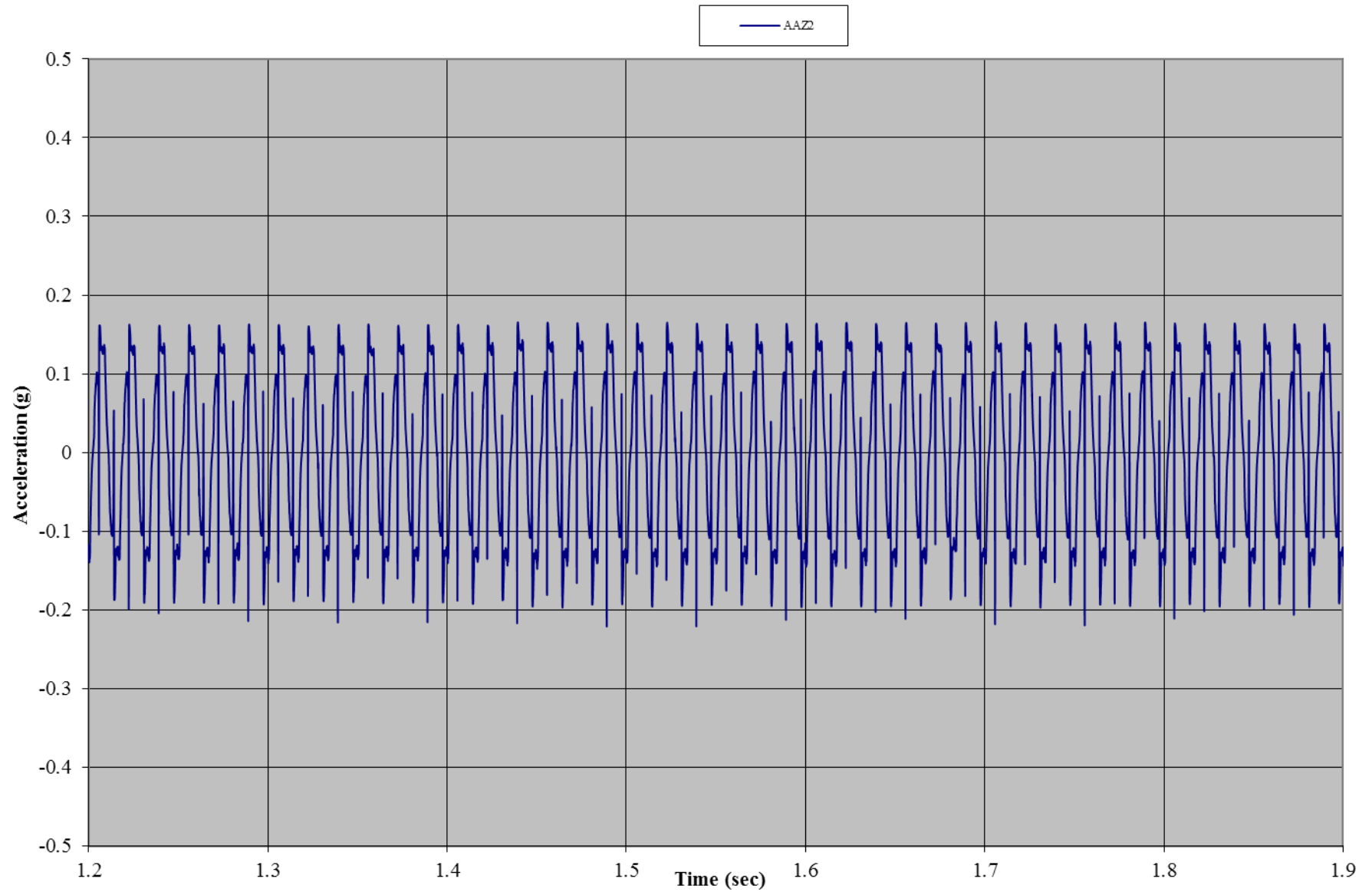
Test A03: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (x-direction)



Test A03: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (y-direction)

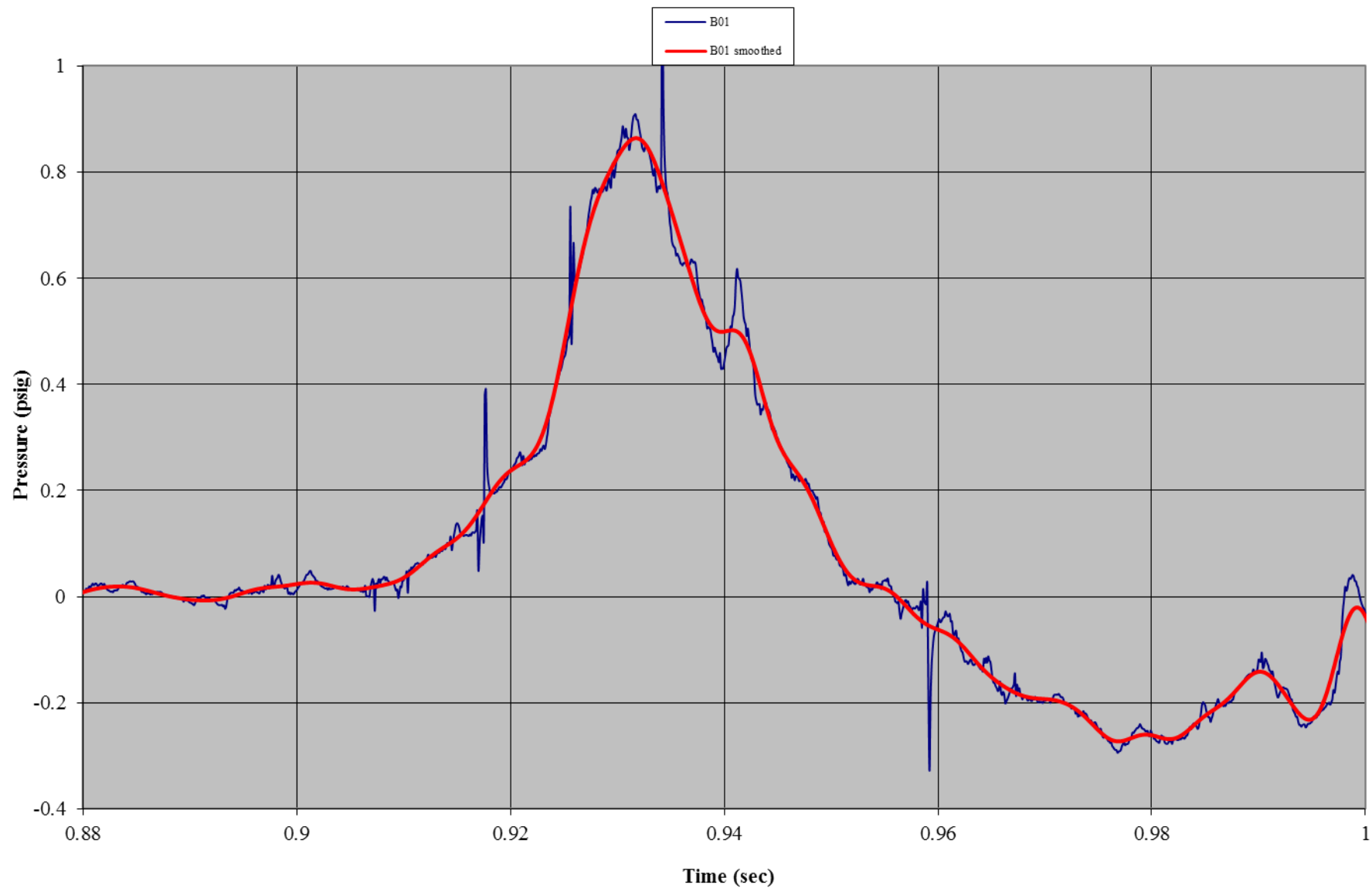


Test A03: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (z-direction)

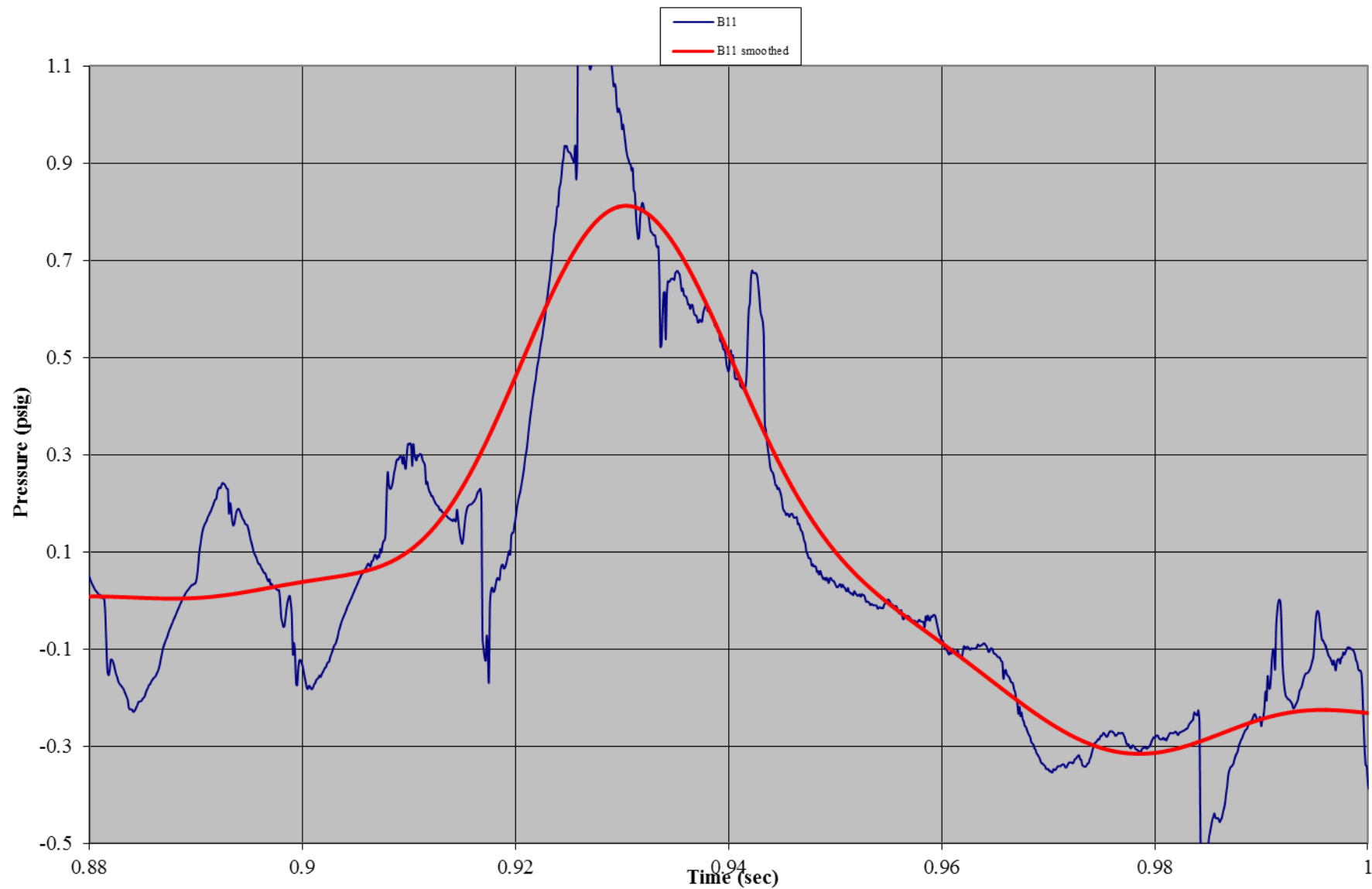


Test A03: Tent B

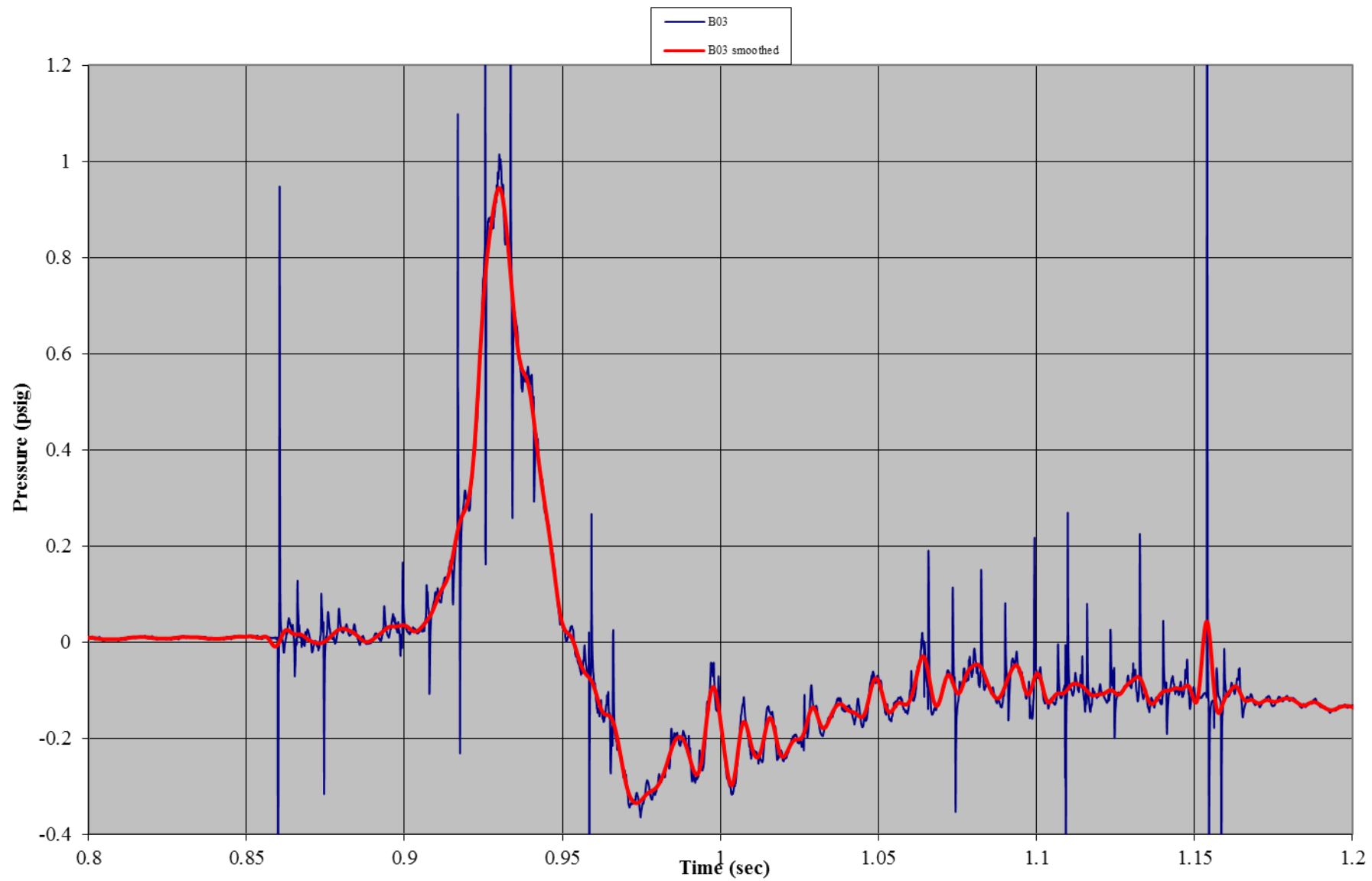
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 01: Front Wall, Left Bottom



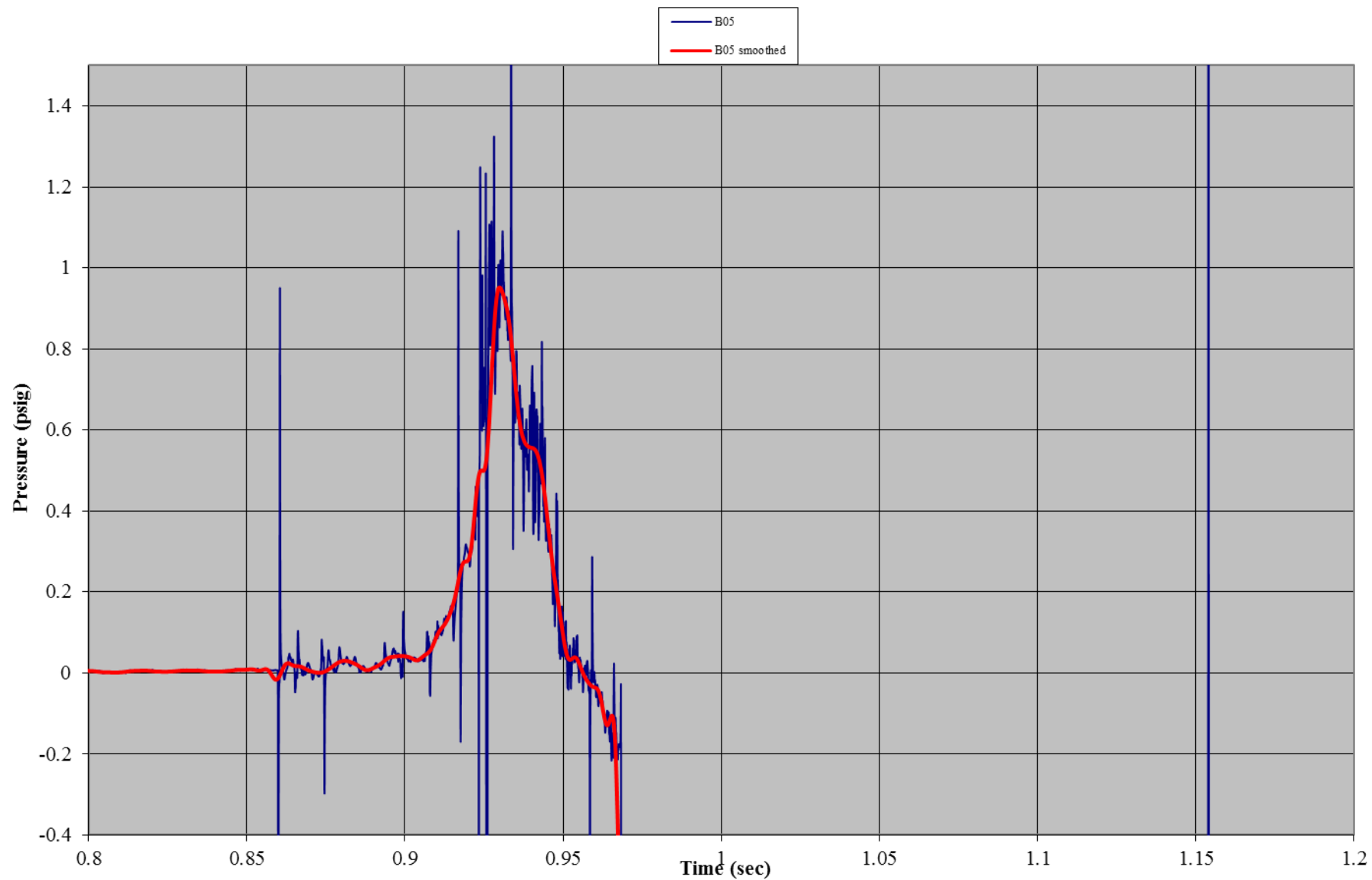
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 11: Front Wall, Right Bottom



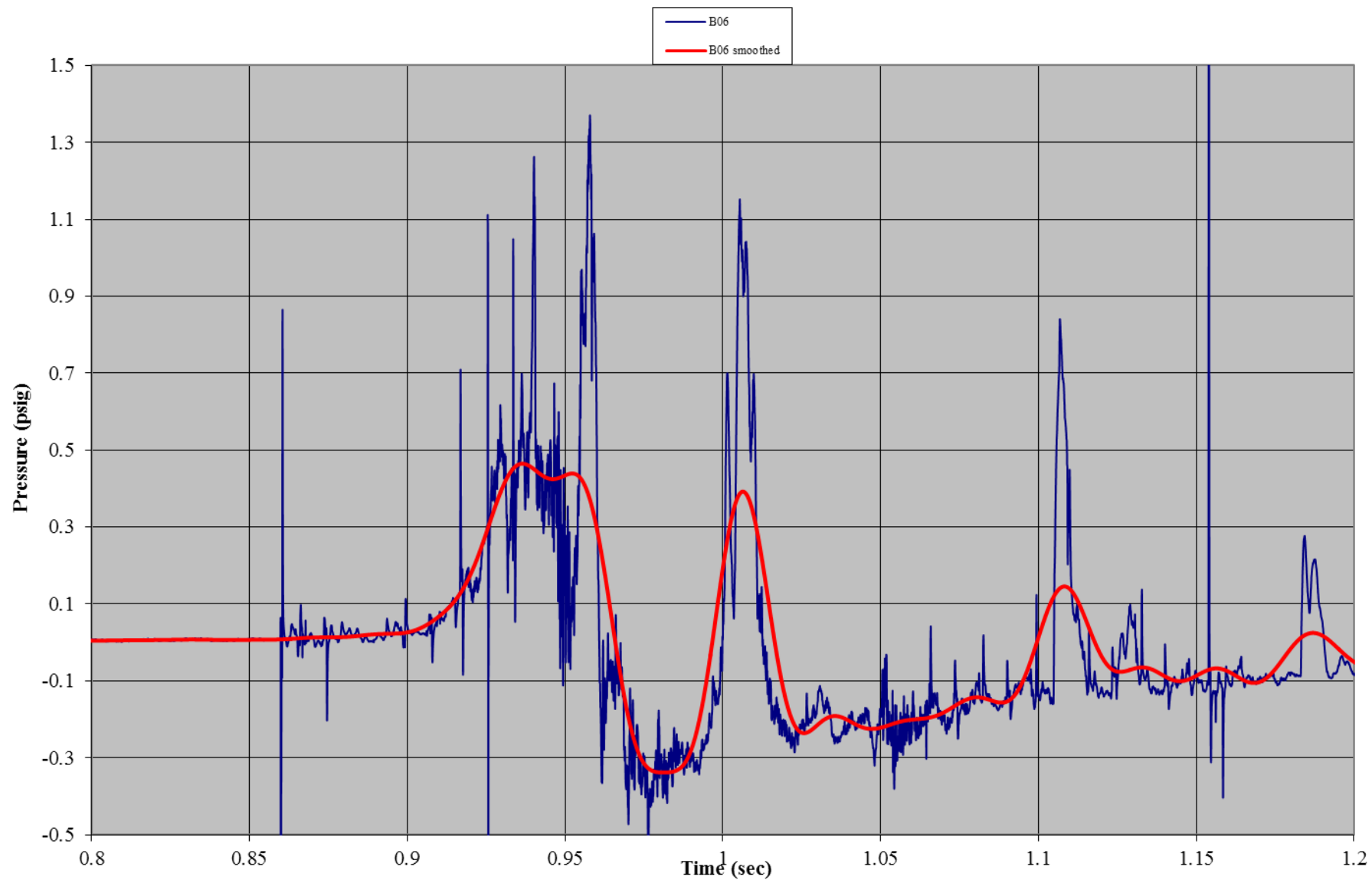
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 03: Front Wall, Center Bottom



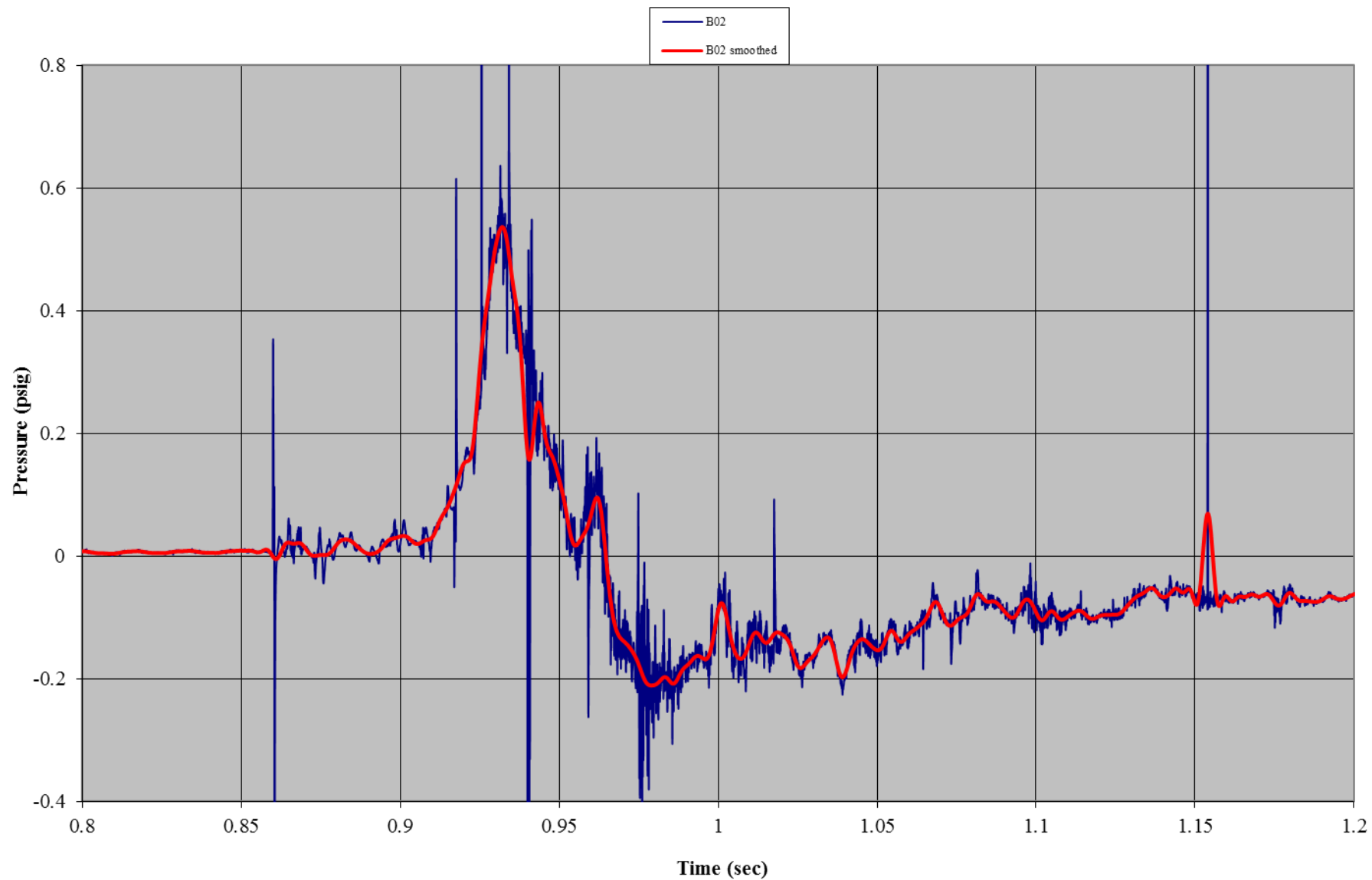
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



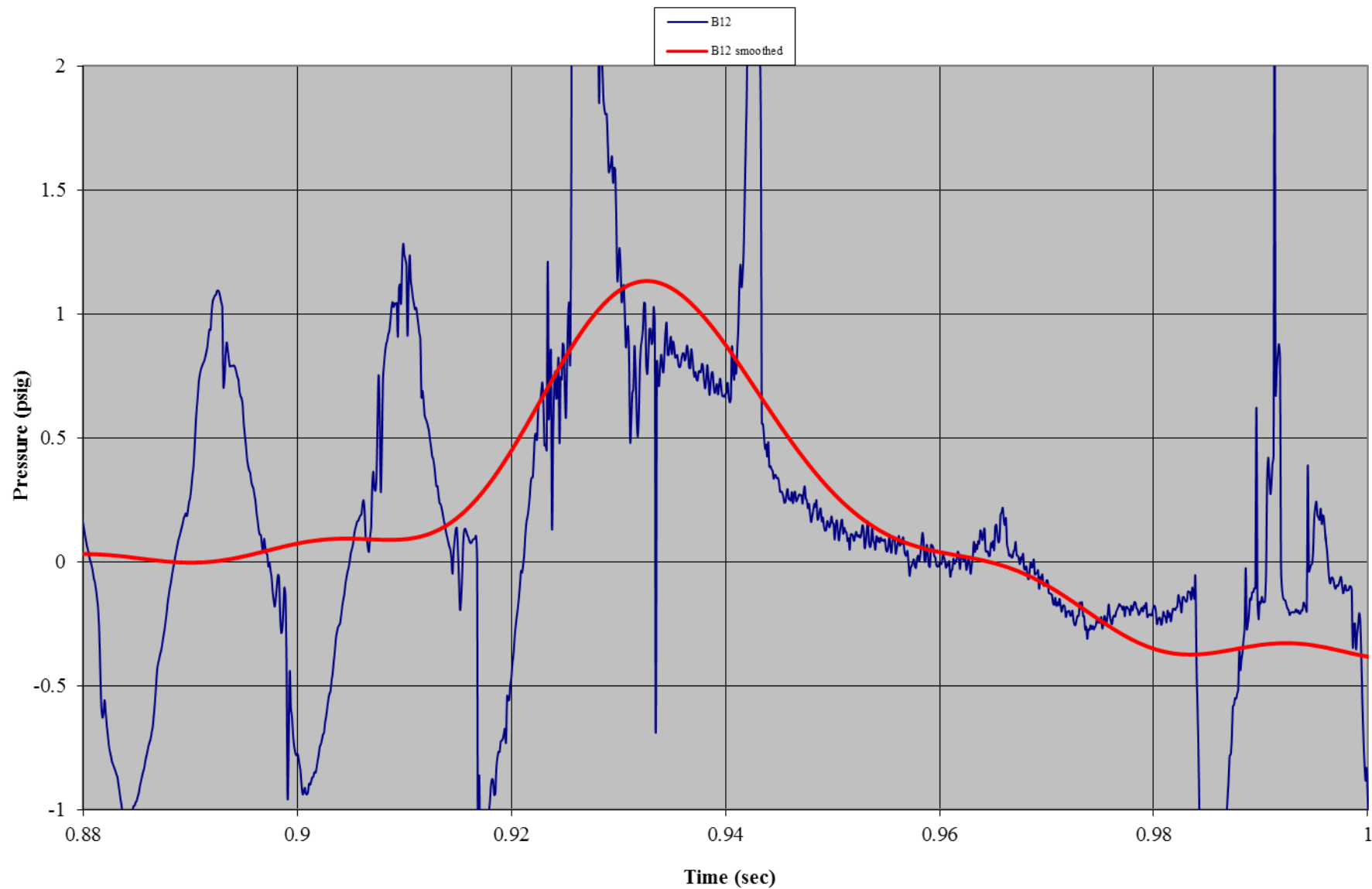
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 06: Front Wall, Center Top



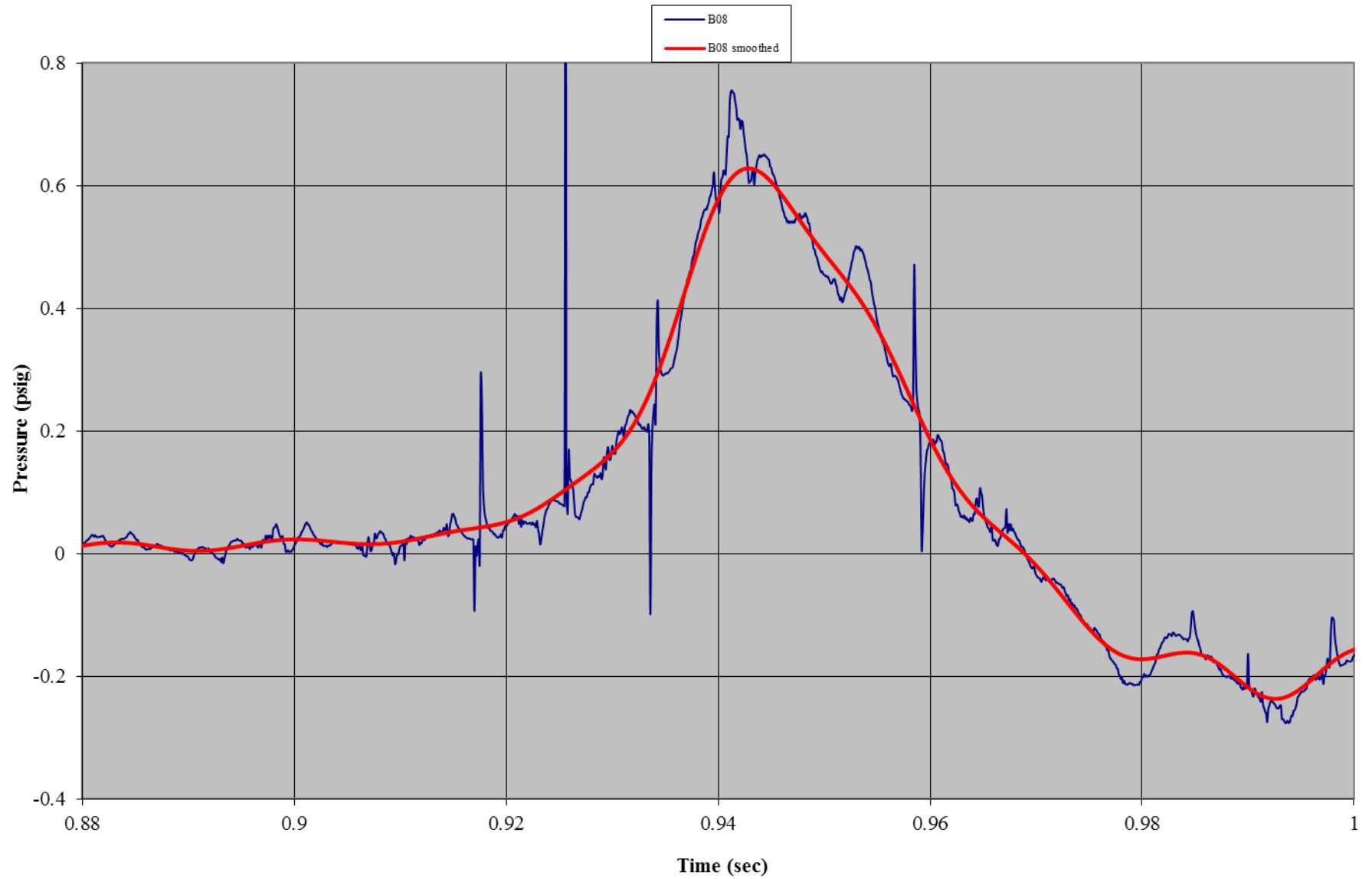
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



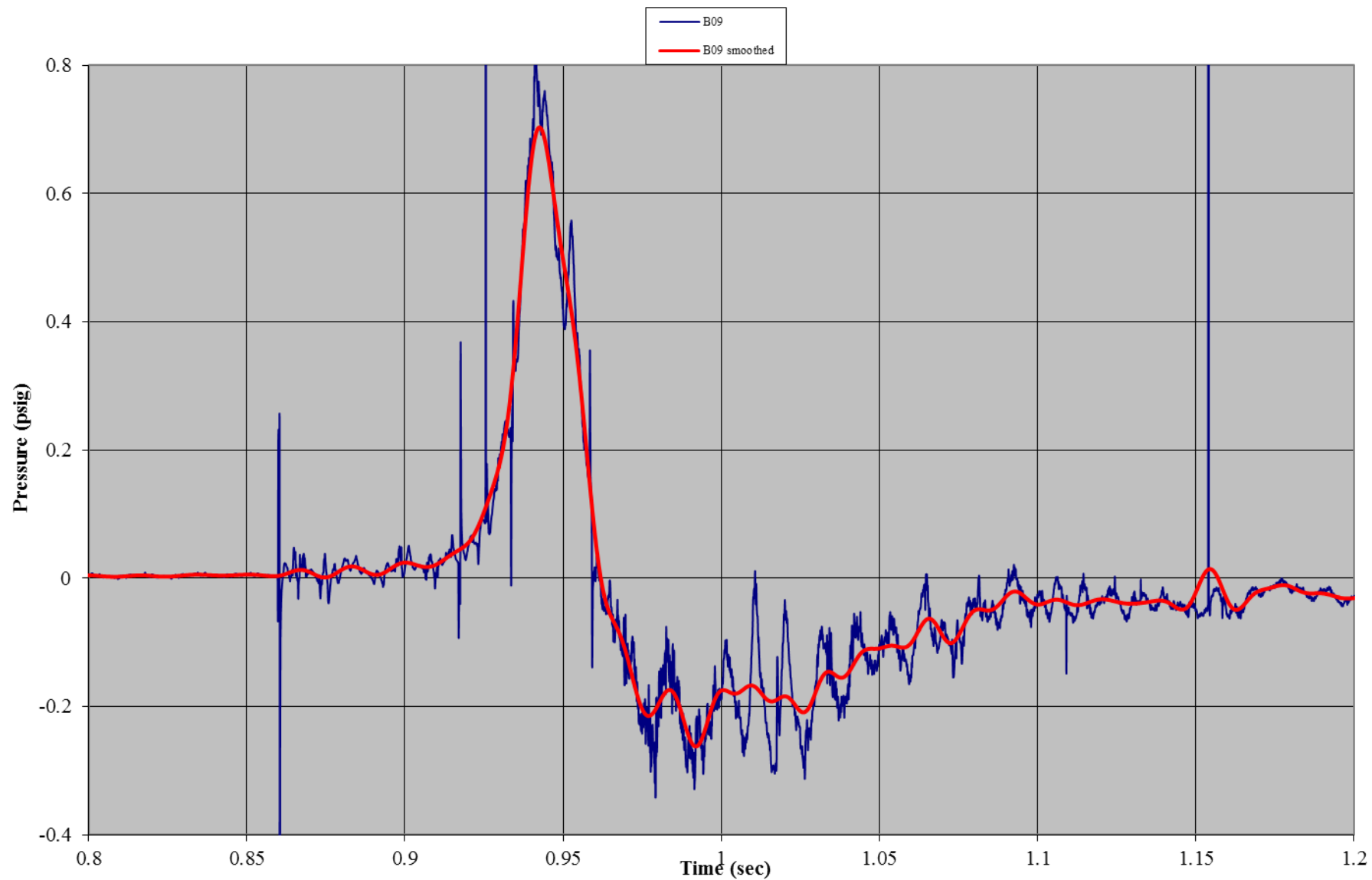
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



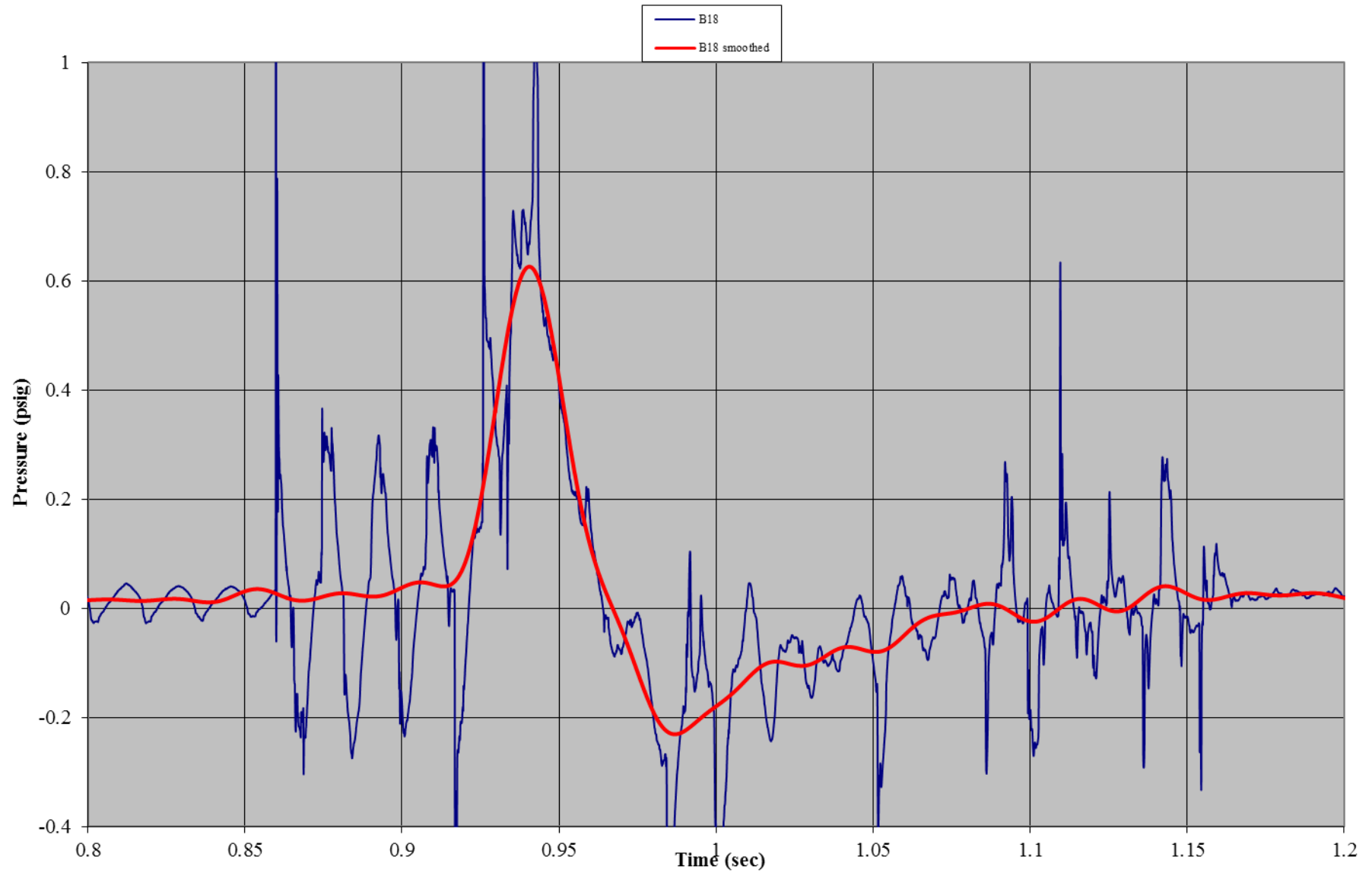
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 08: Left Side Wall, Bottom



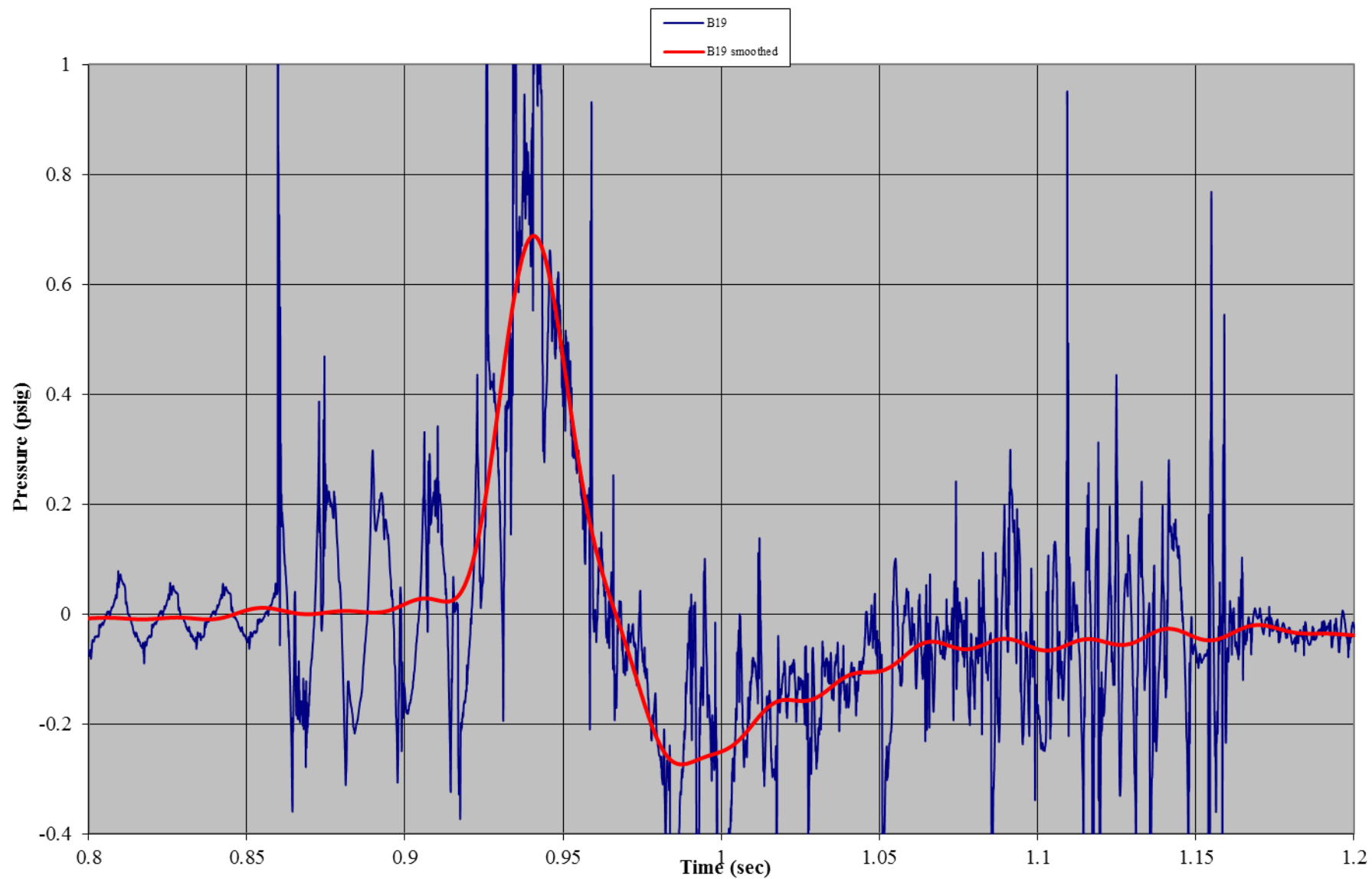
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 18: Right Side Wall, Bottom



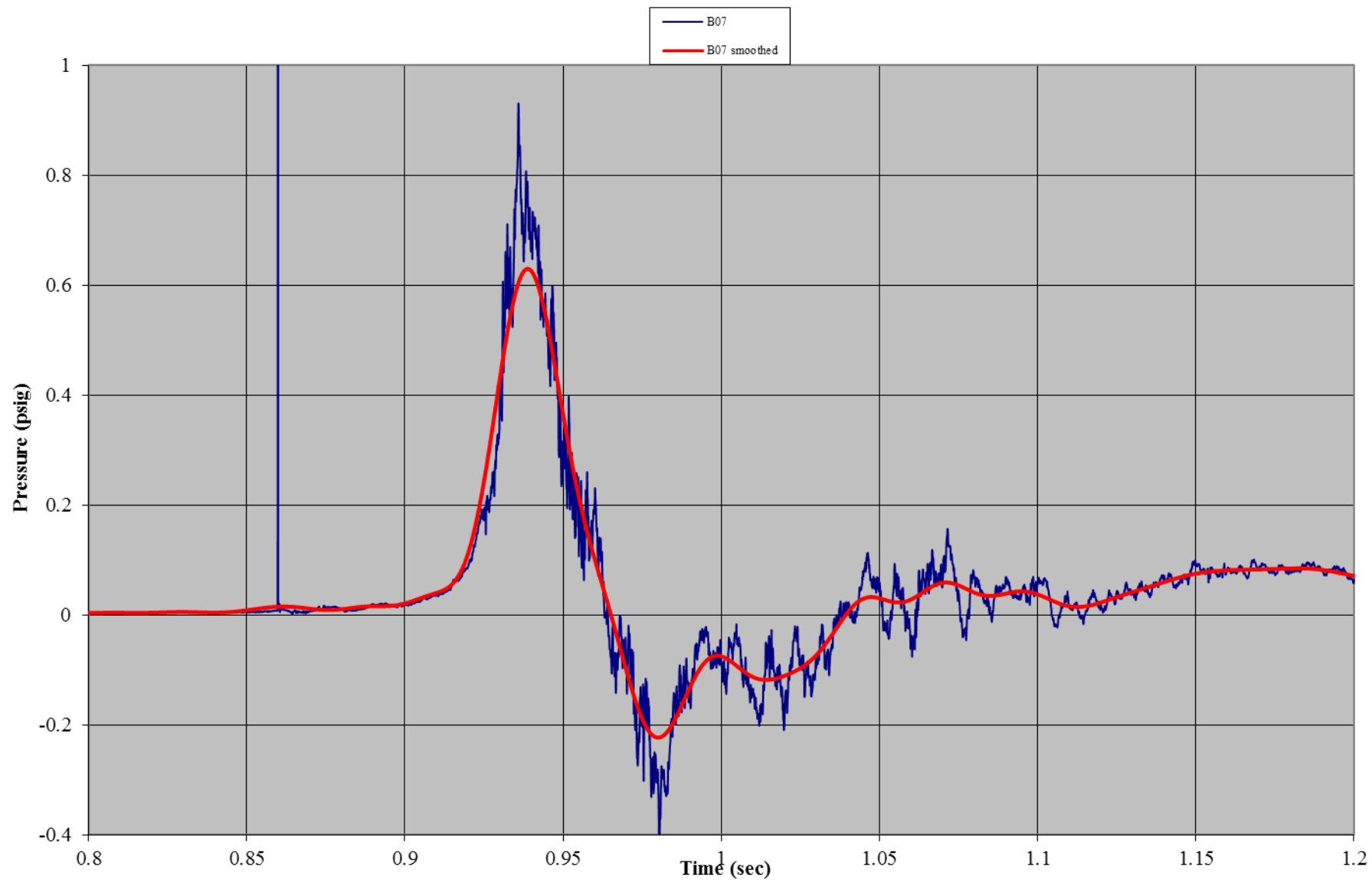
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



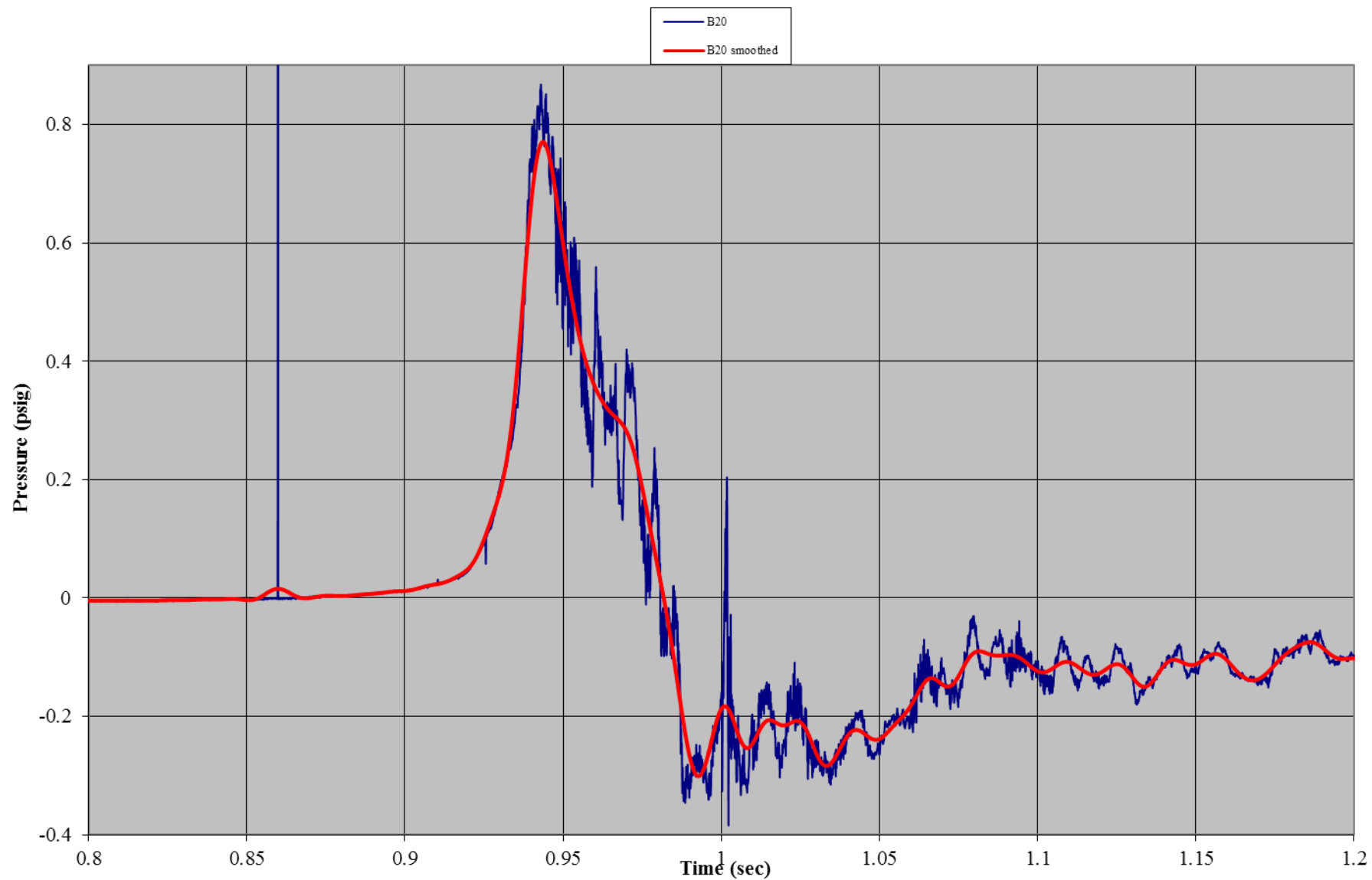
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 04: Interior, Ground



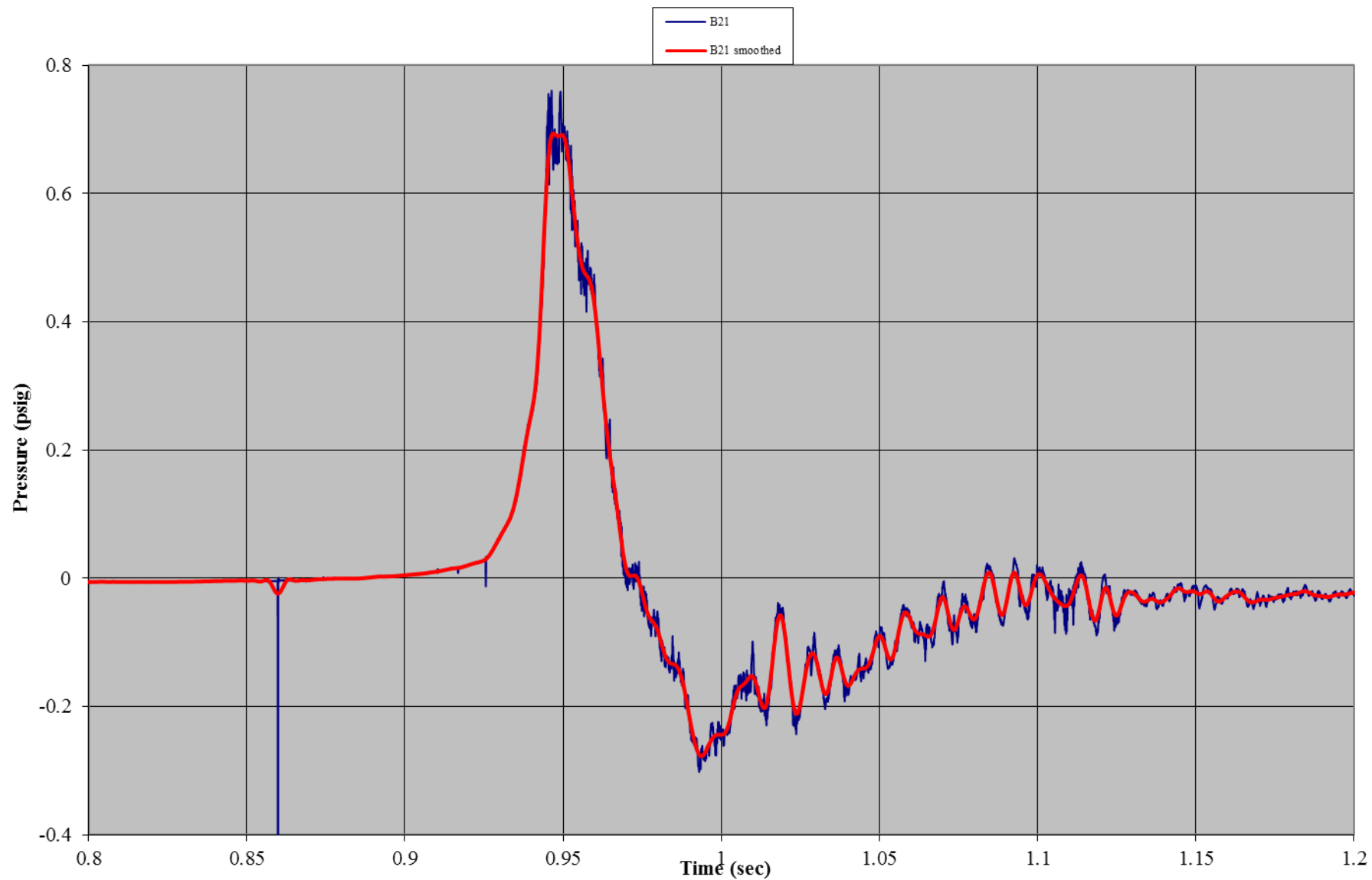
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 07: Roof, Front



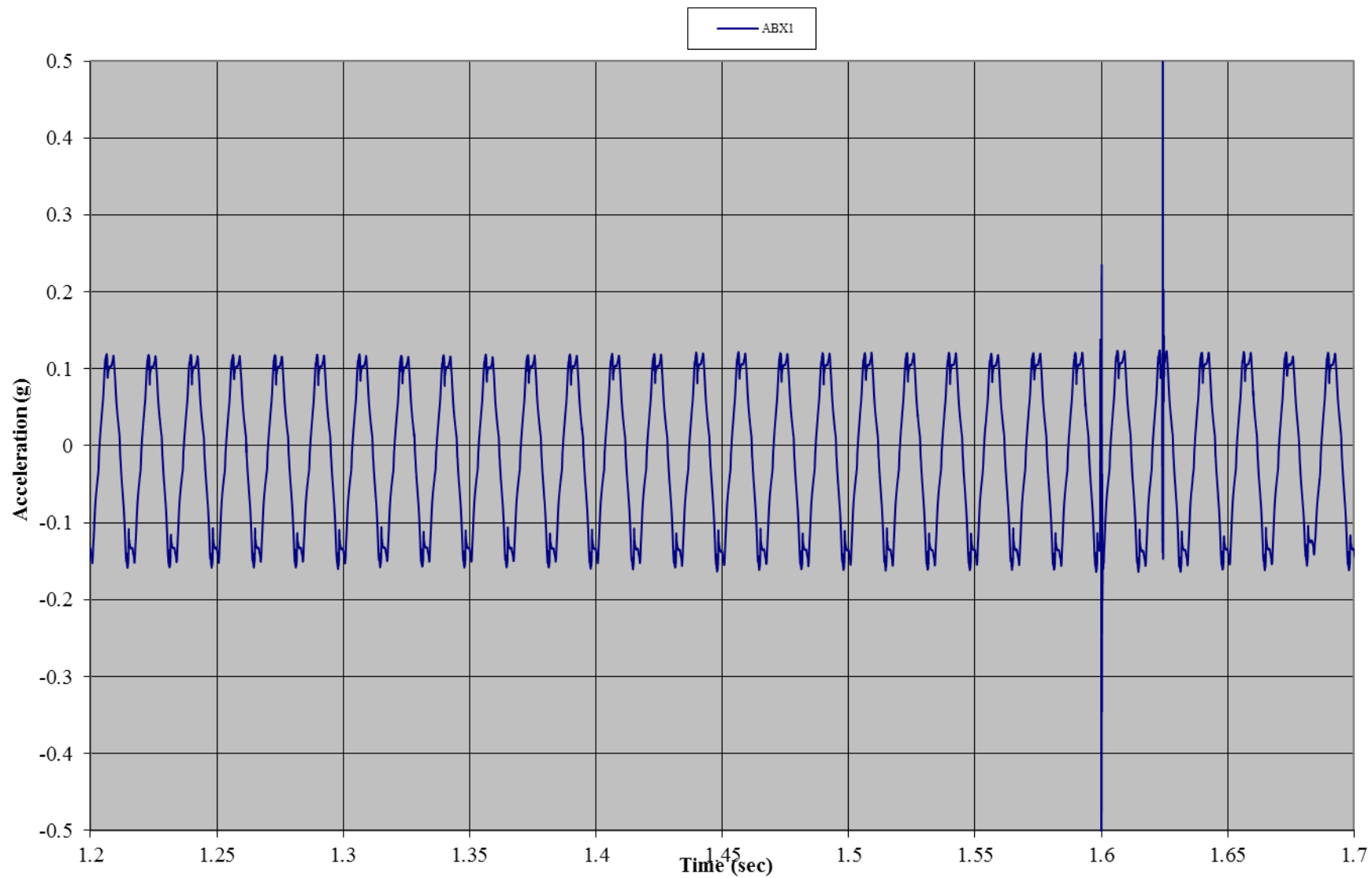
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 20: Roof, Back



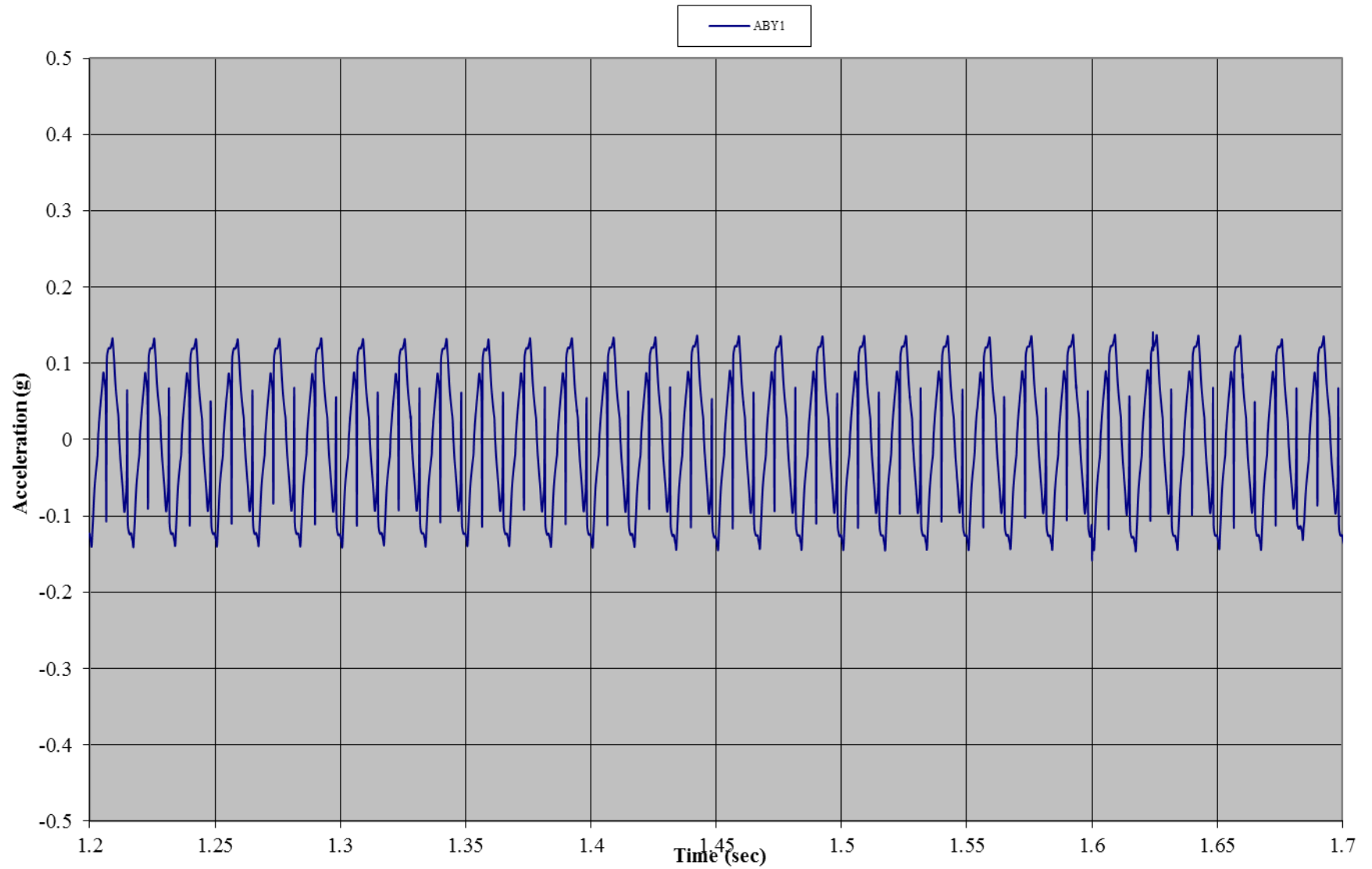
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



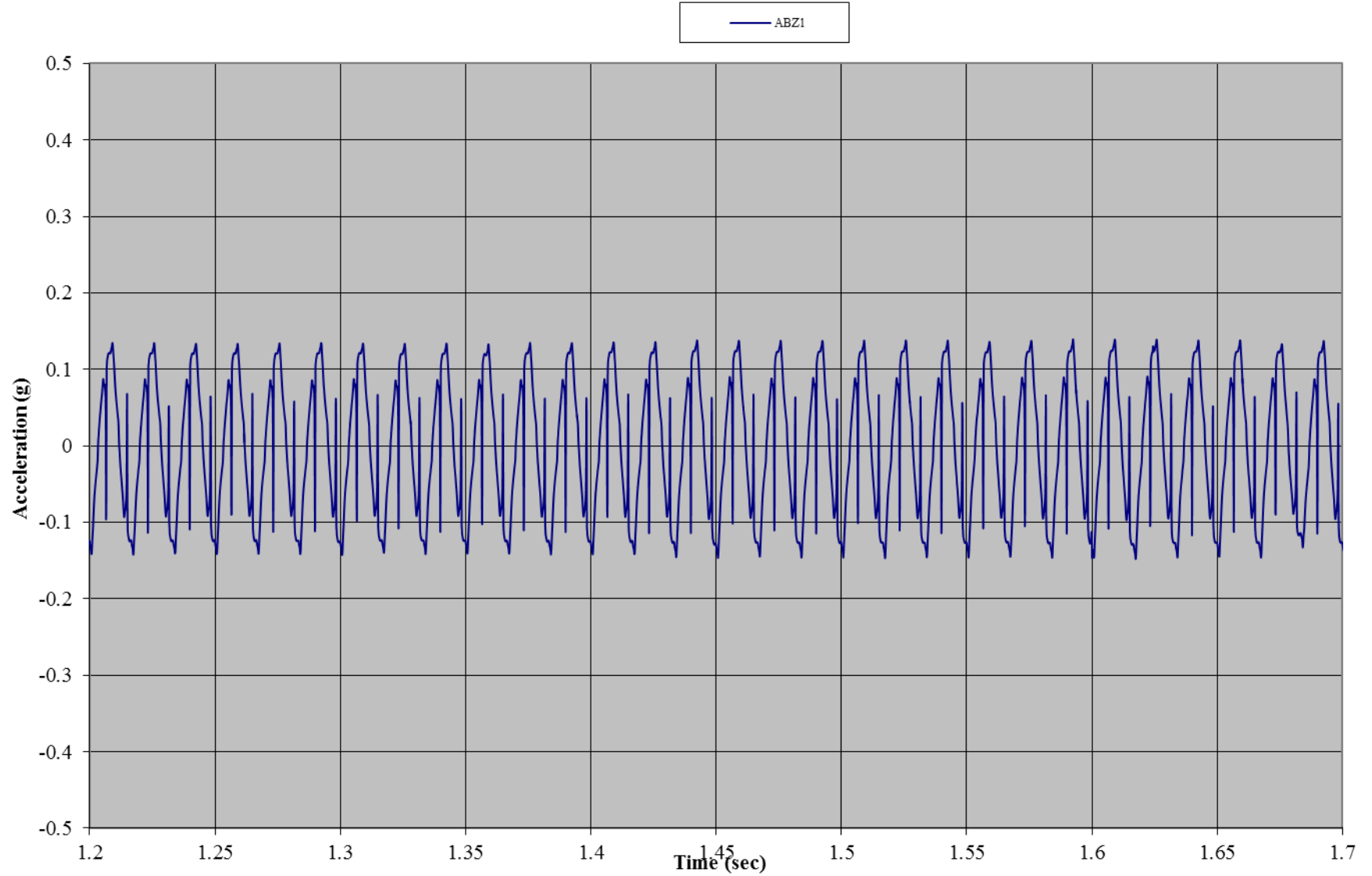
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Acceleromter 1: Front Wall (x-direction)



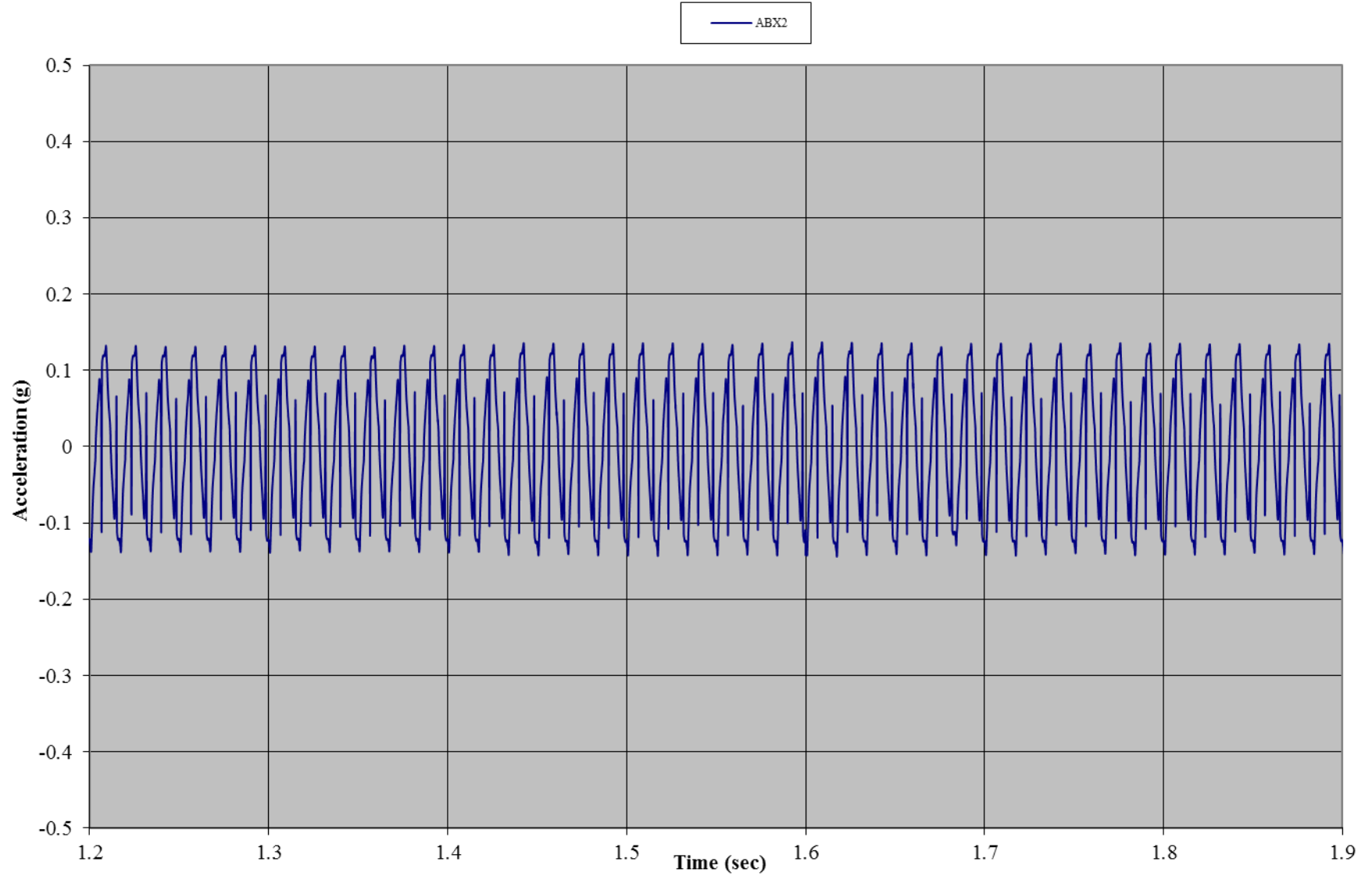
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Acceleromter 1: Front Wall (y-direction)



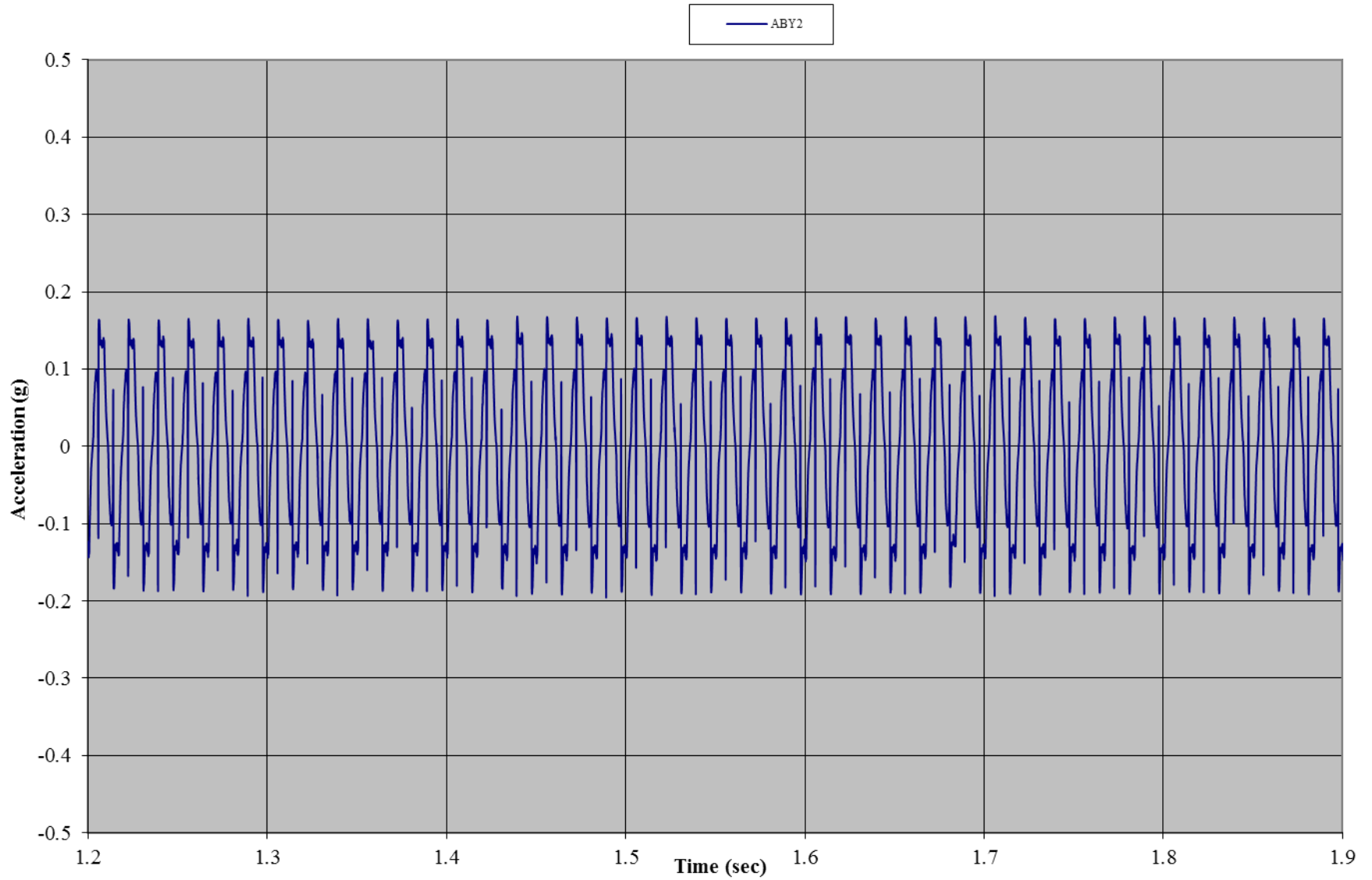
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (z-direction)



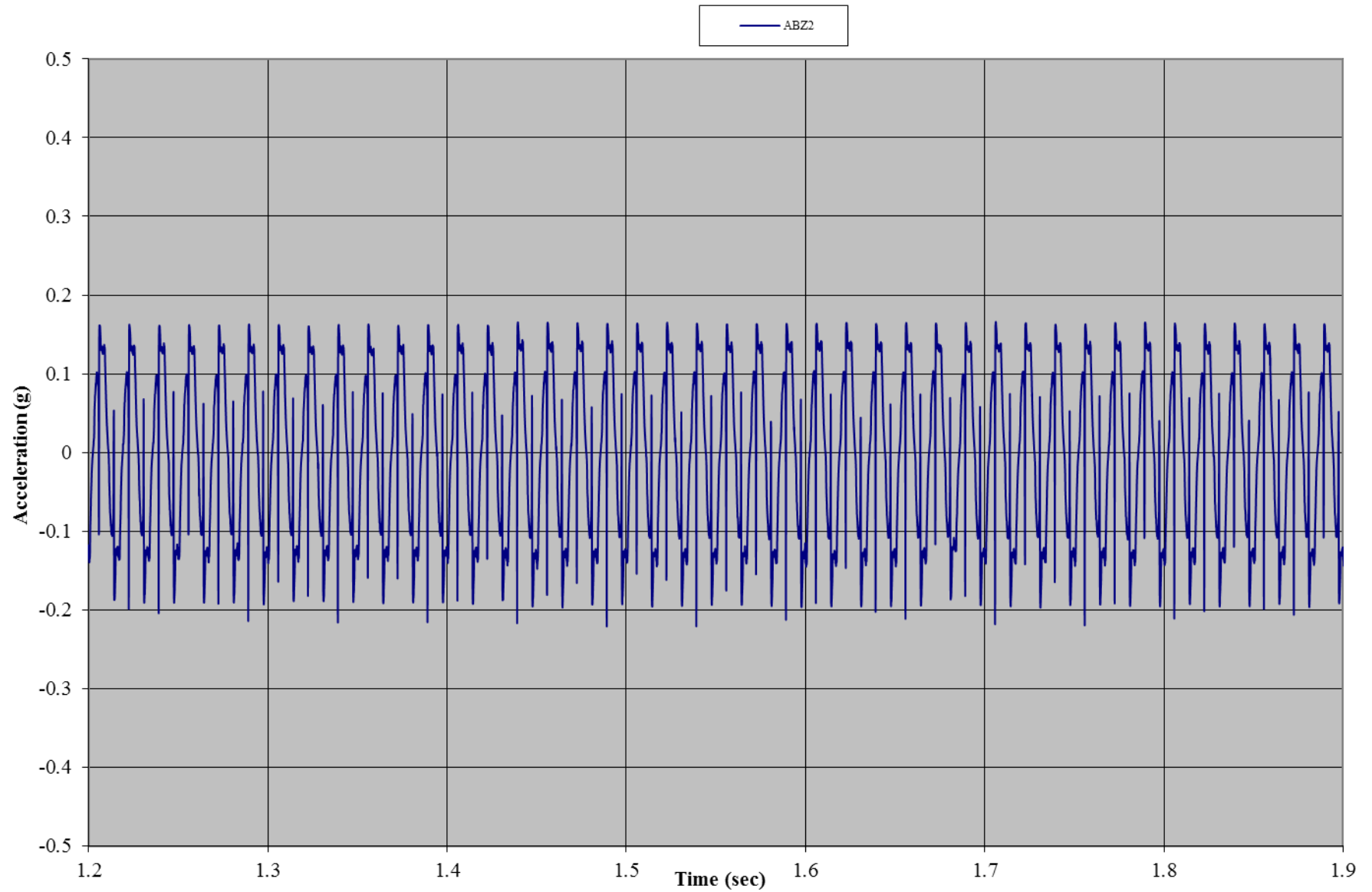
Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (x-direction)



Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Acceleromter 2: Roof (y-direction)

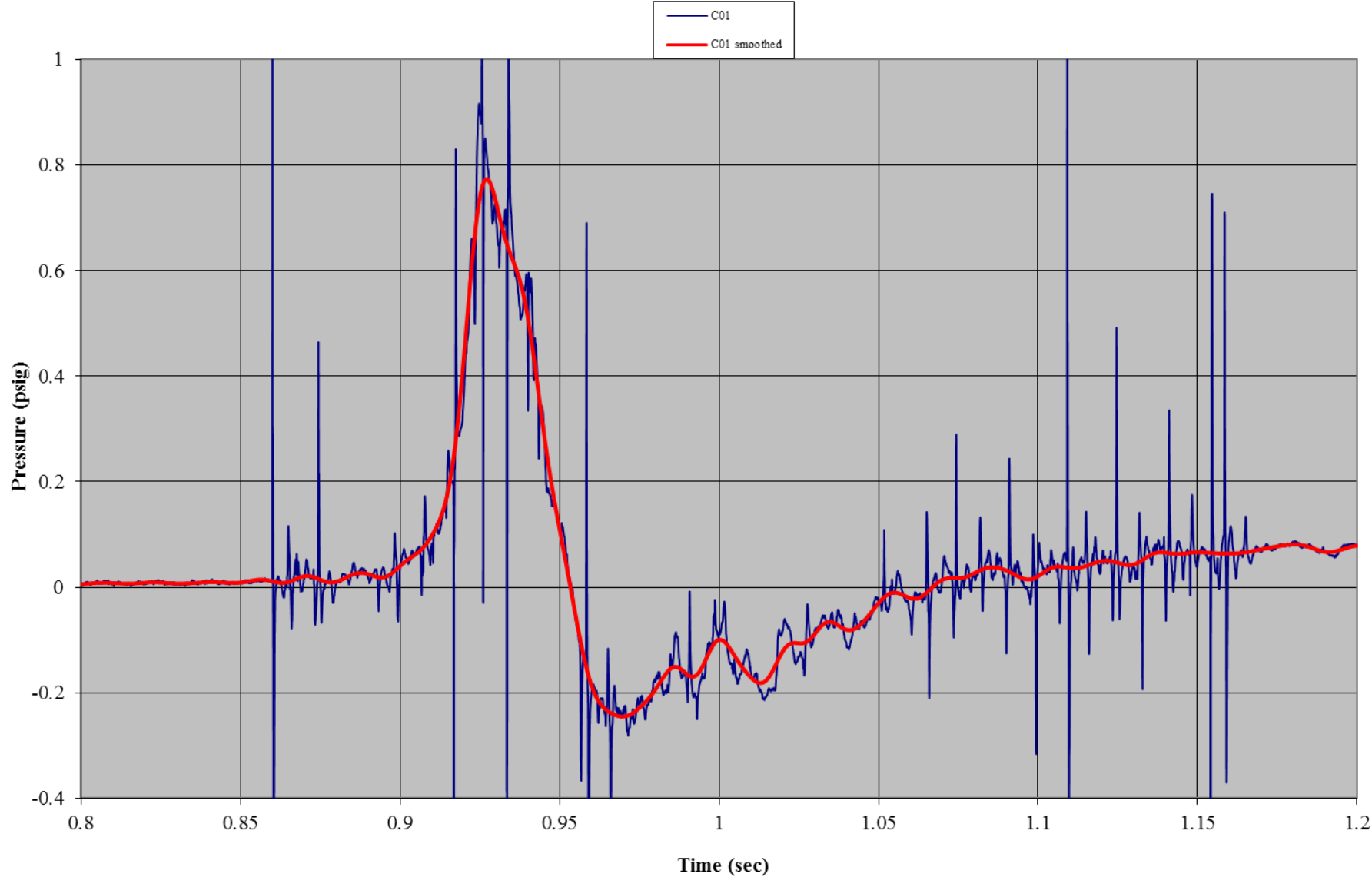


Test A03: Non-Wind Rated Flexible Frame Tent with Sides
Acceleromter 2: Roof (z-direction)

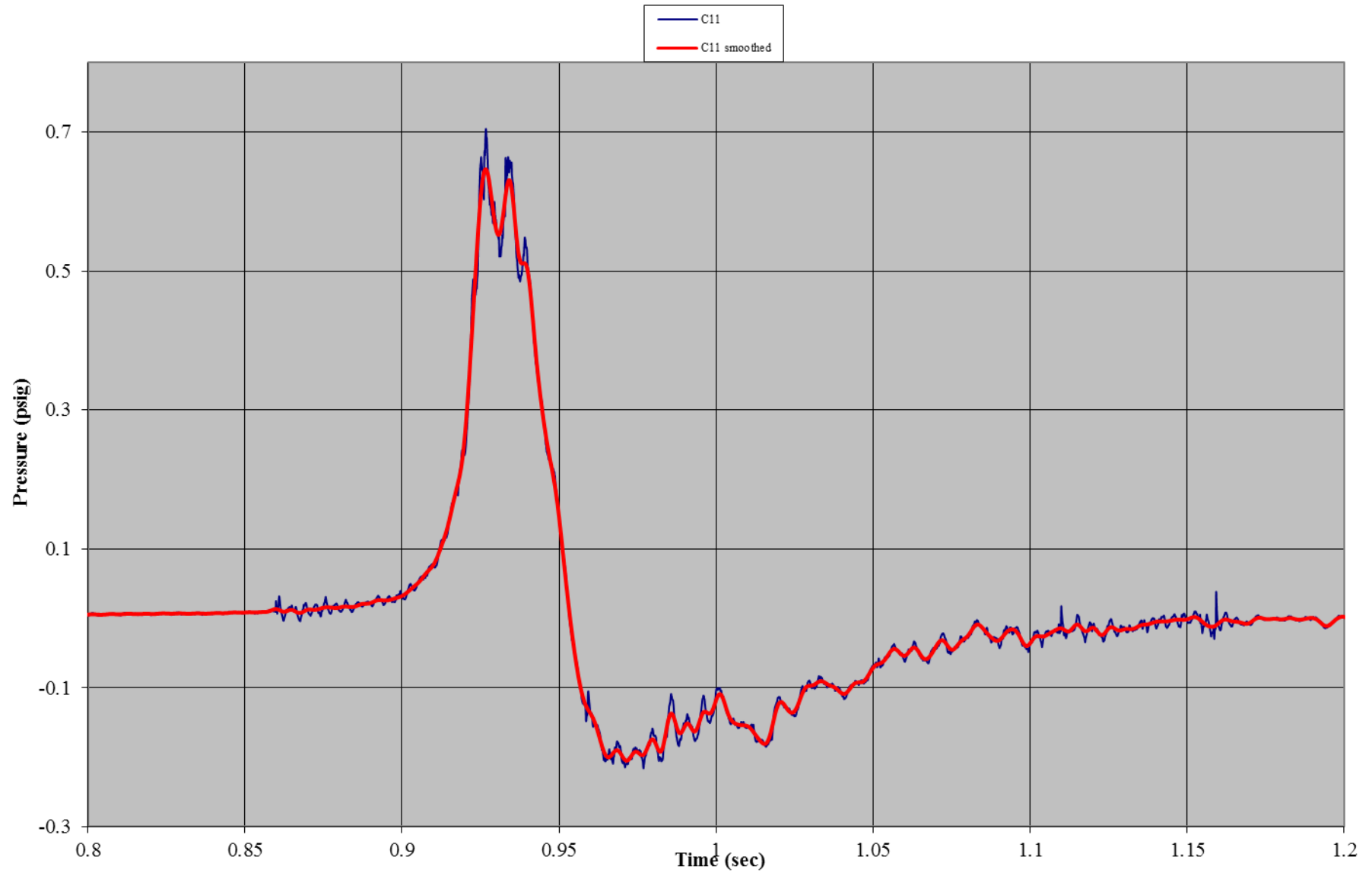


Test A03: Tent C

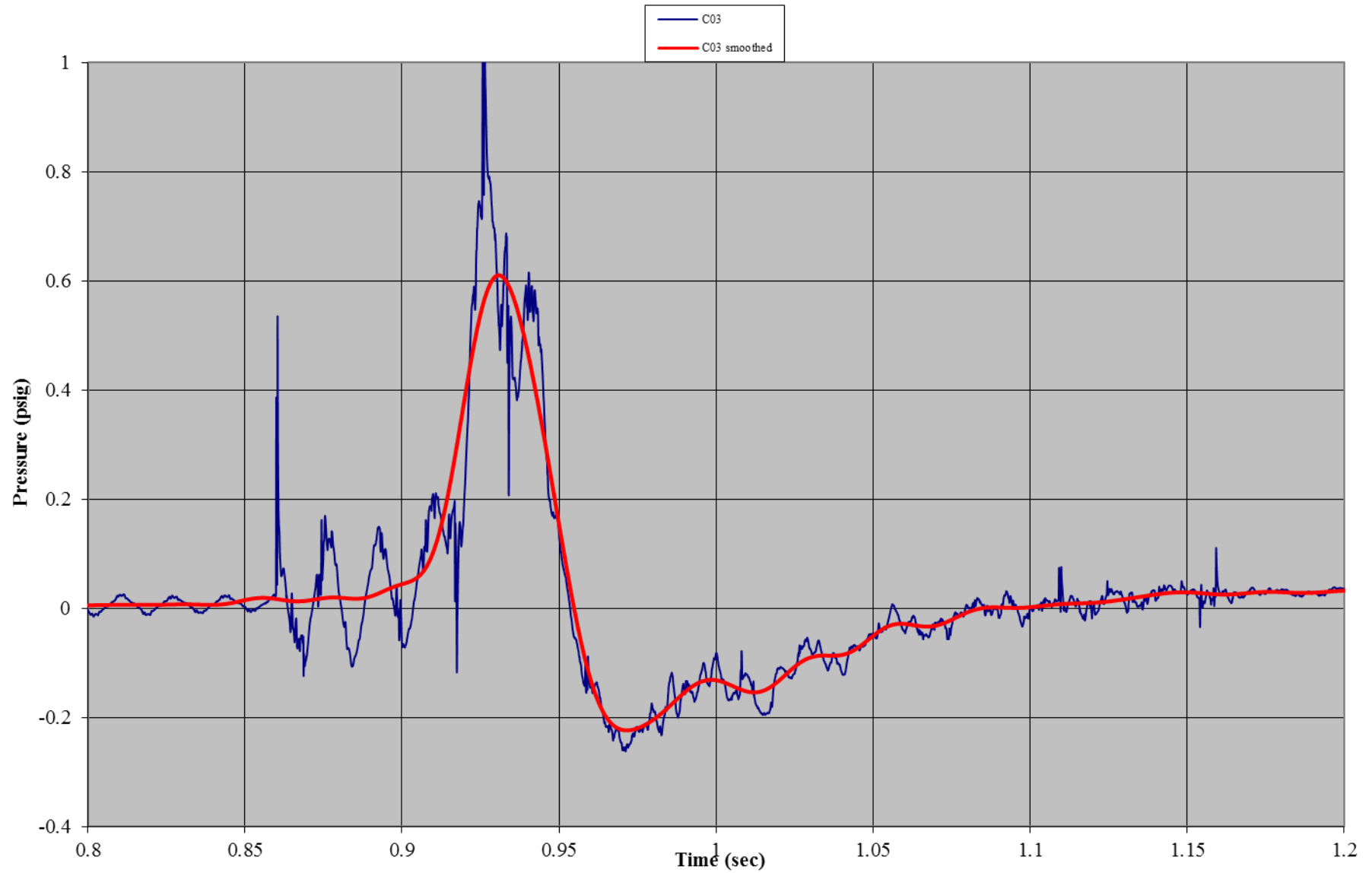
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 01: Front Wall, Left Bottom



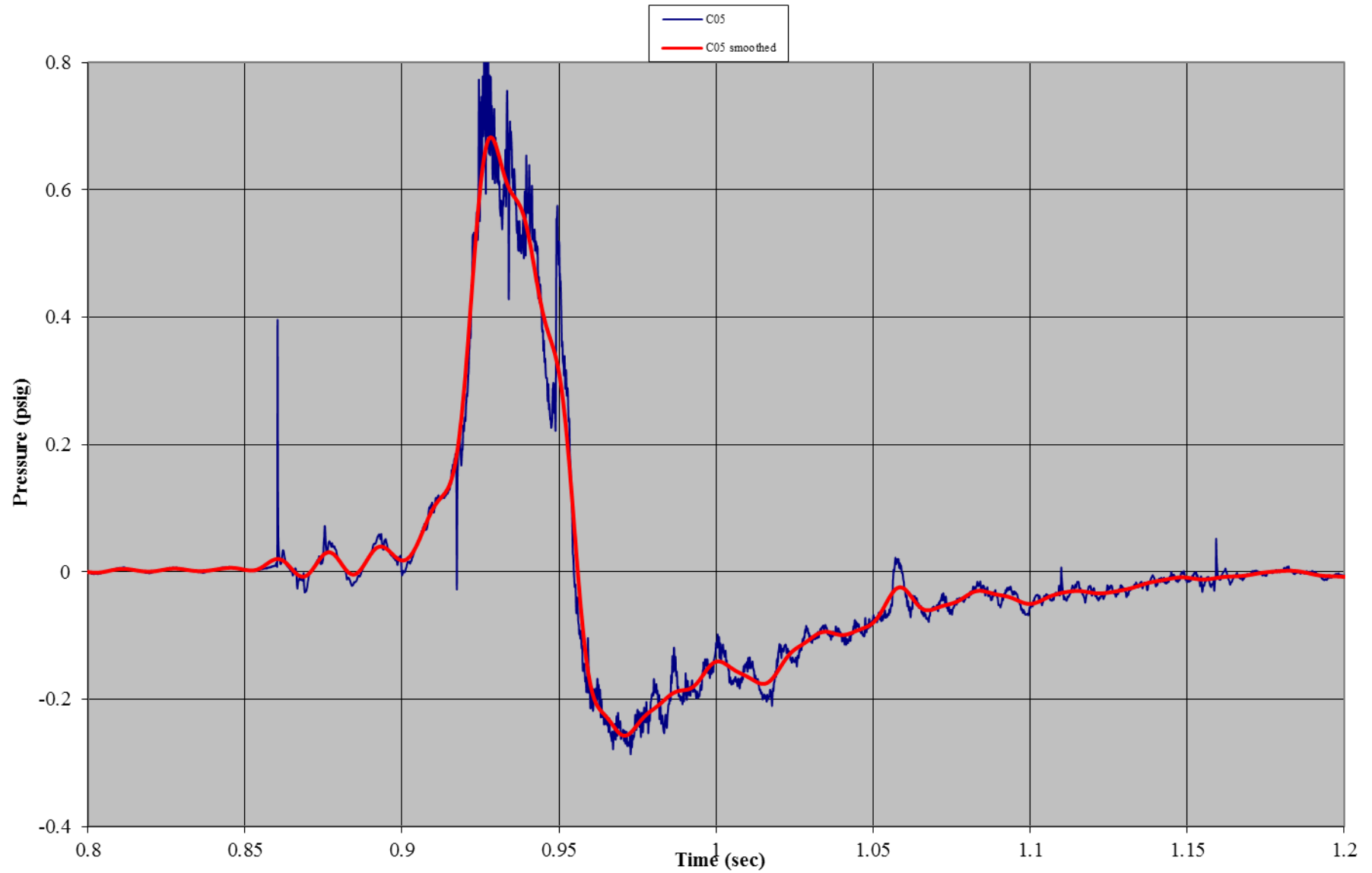
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 11: Front Wall, Right Bottom



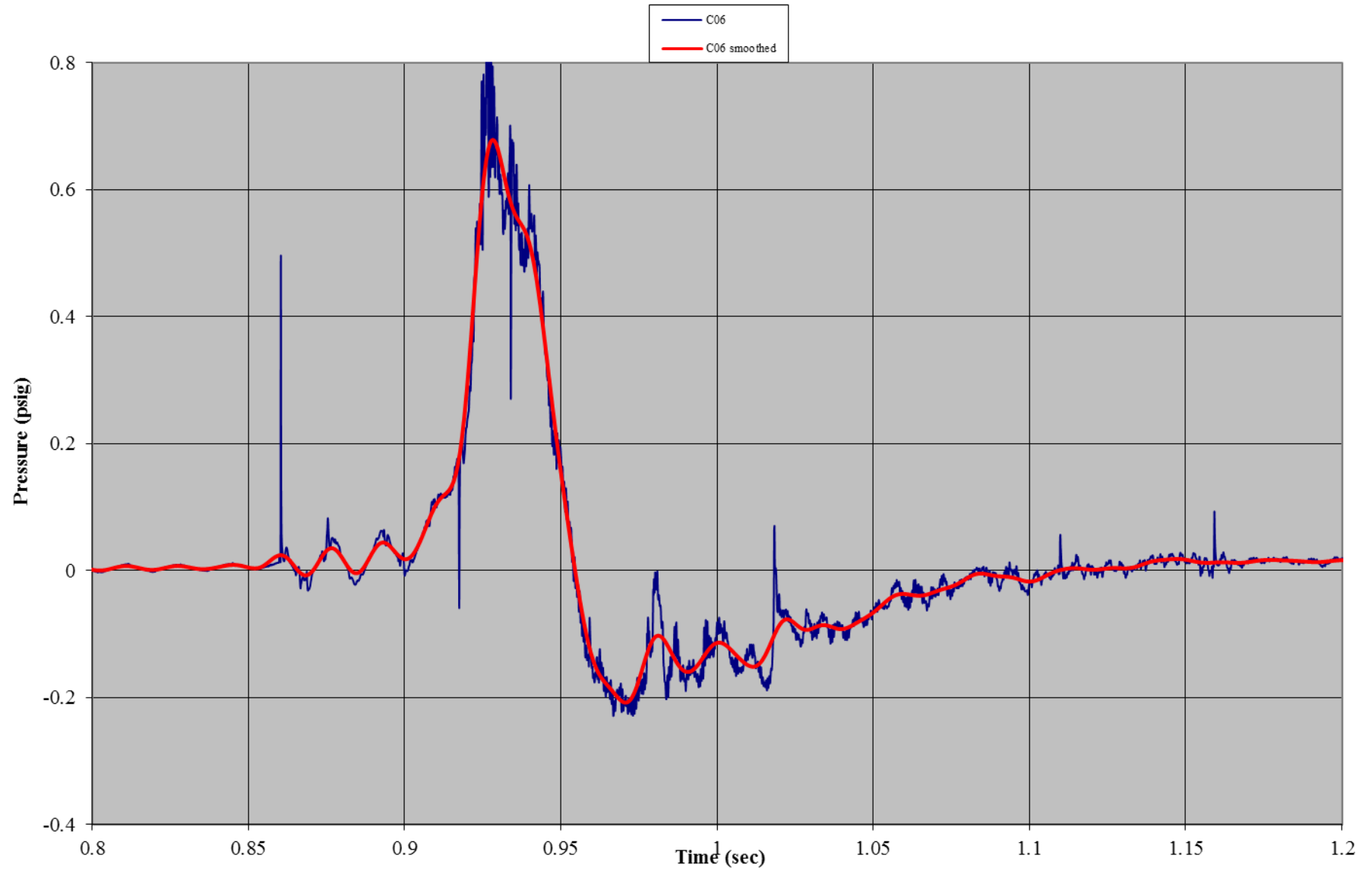
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 03: Front Wall, Center Bottom



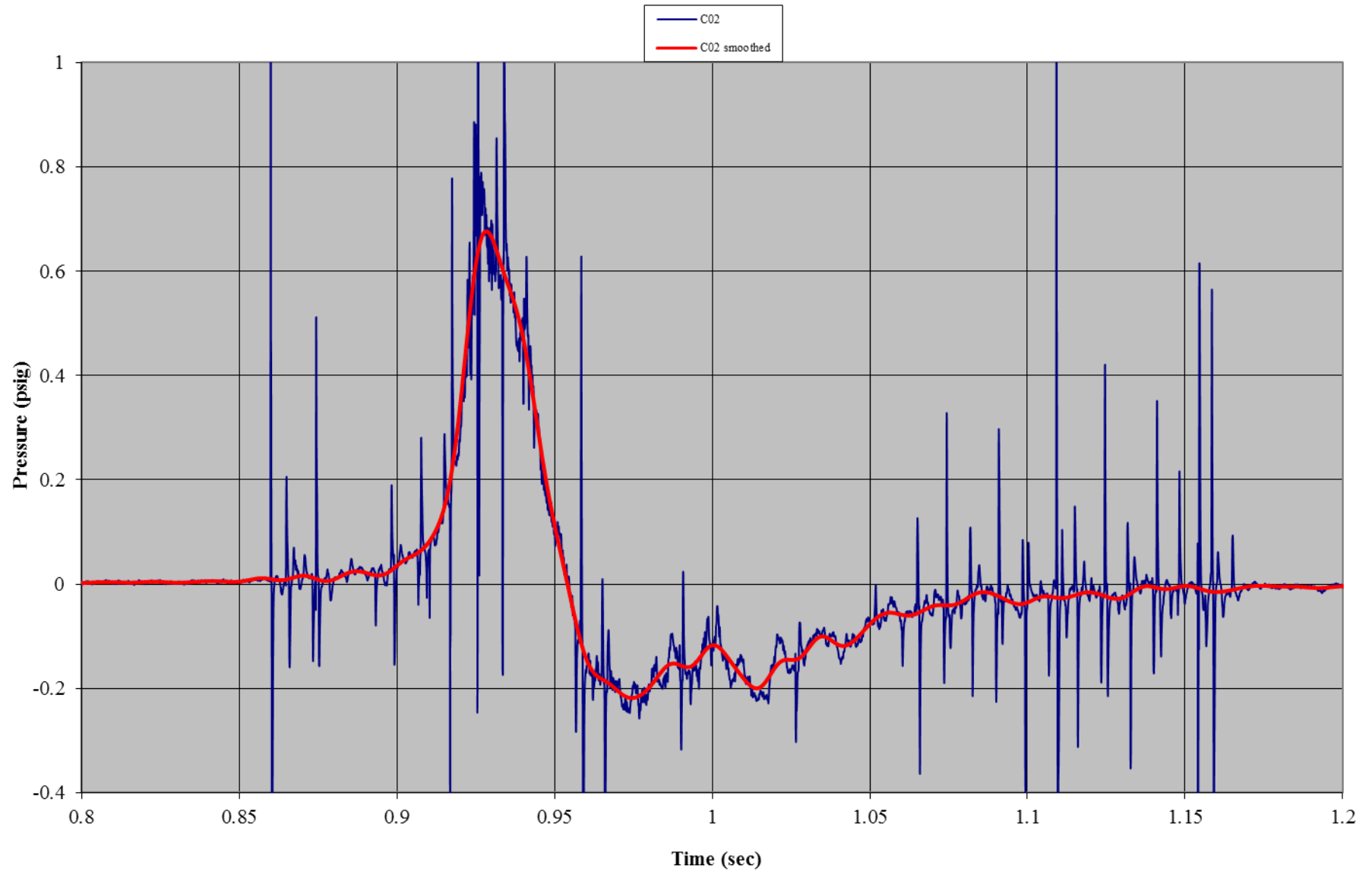
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 05: Front Wall, Center Mid-Height



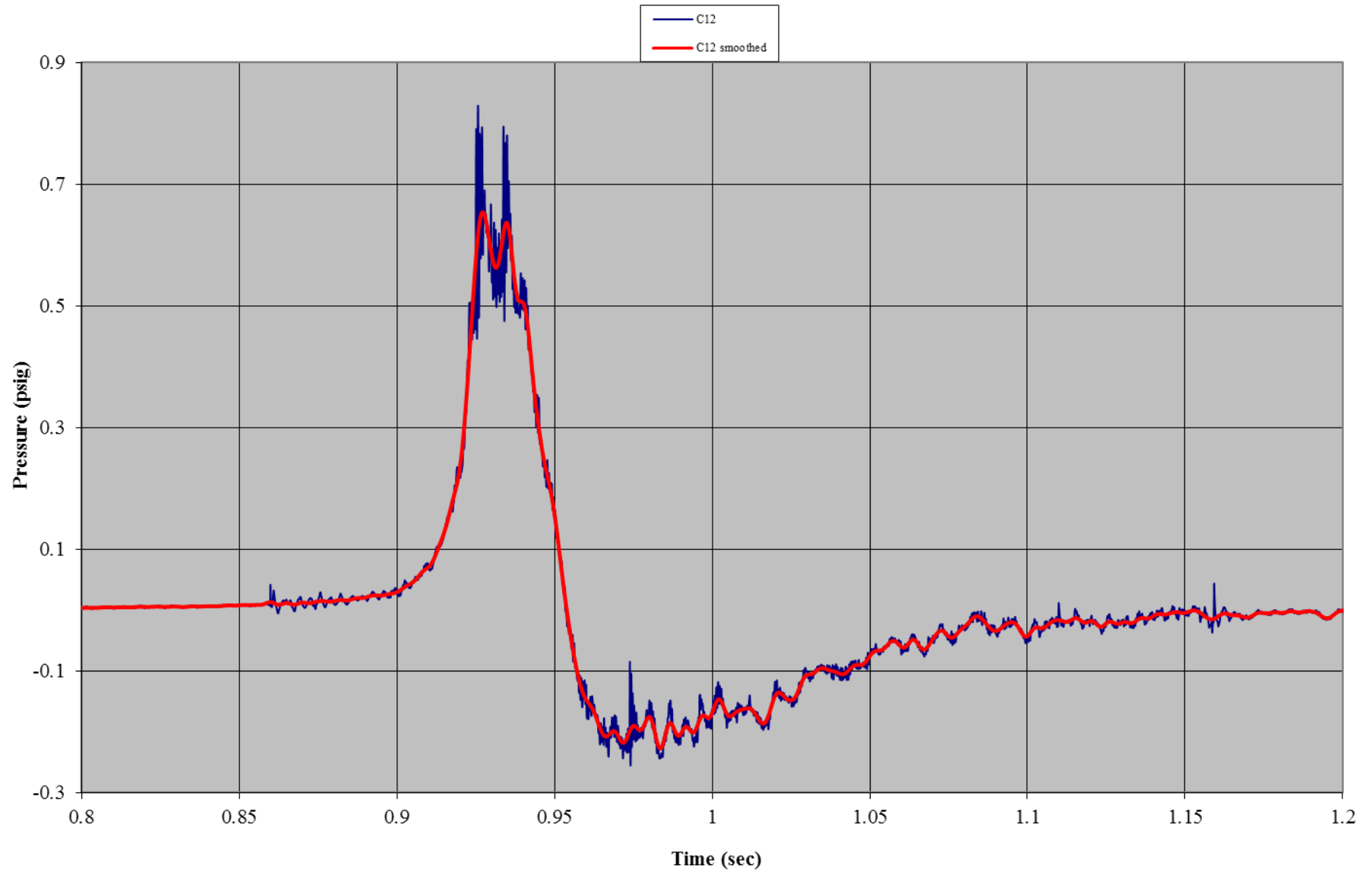
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 06: Front Wall, Center Top



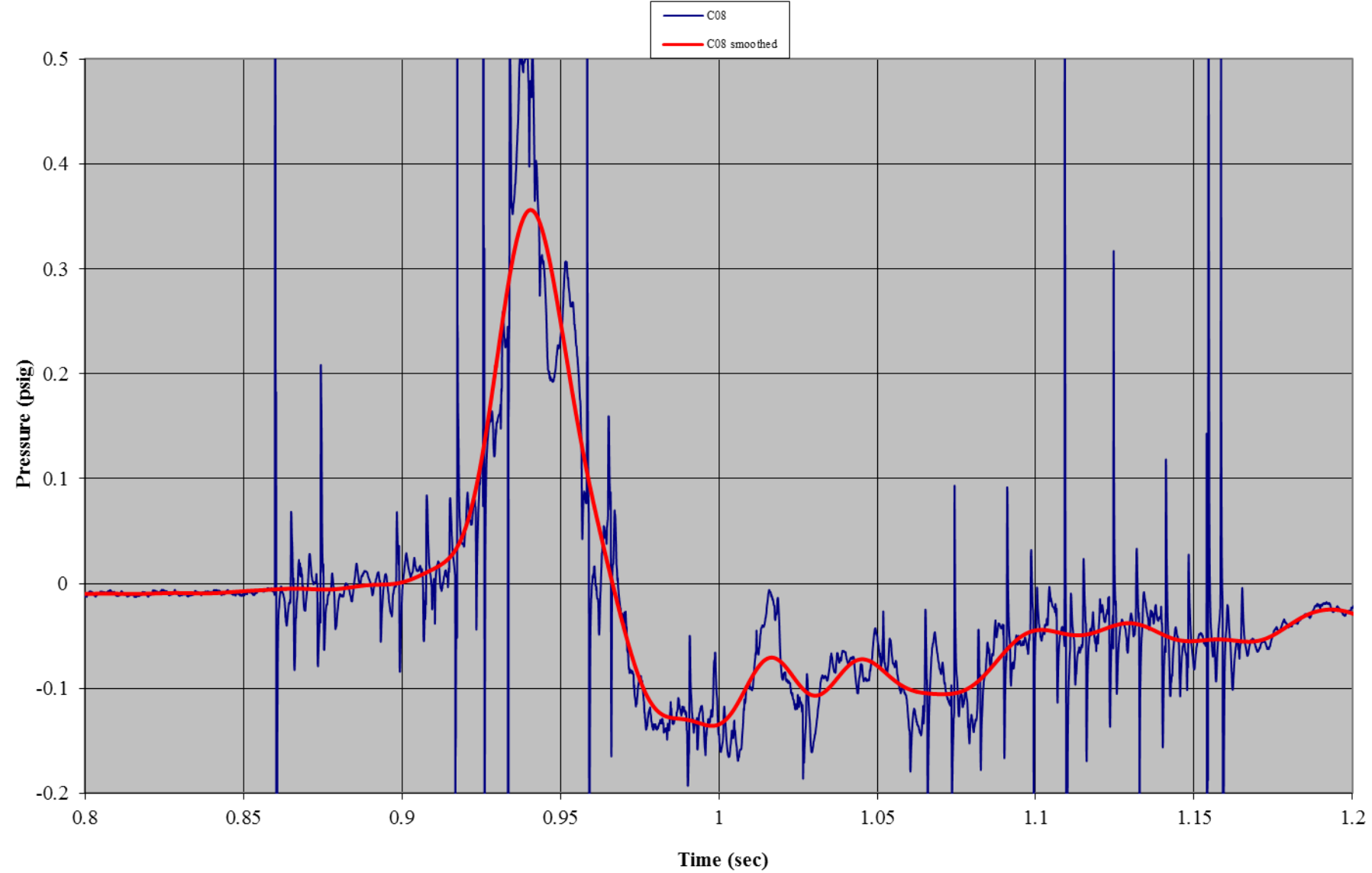
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 02: Front Wall, Left Mid-Height



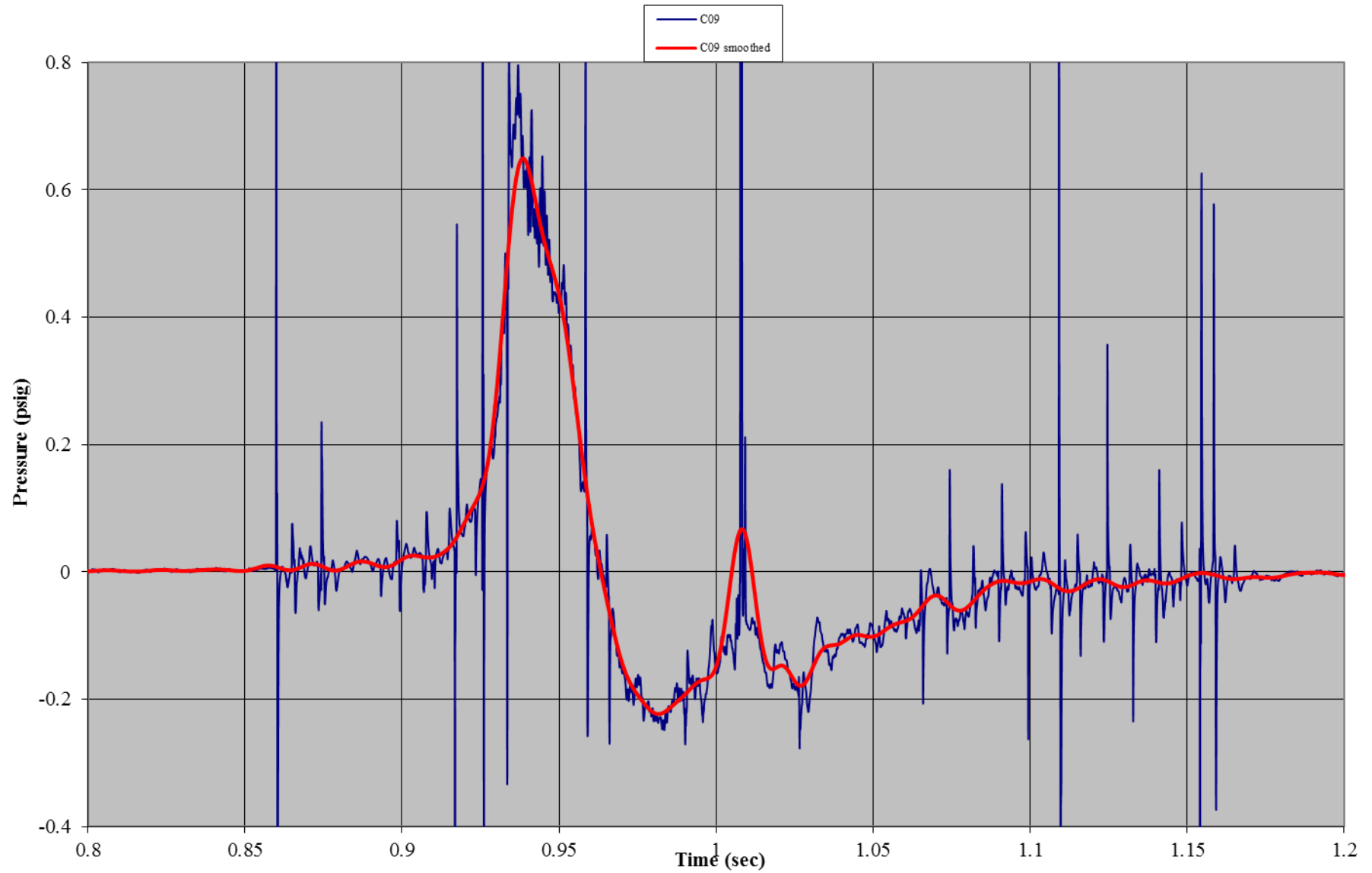
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 12: Front Wall, Right Mid-Height



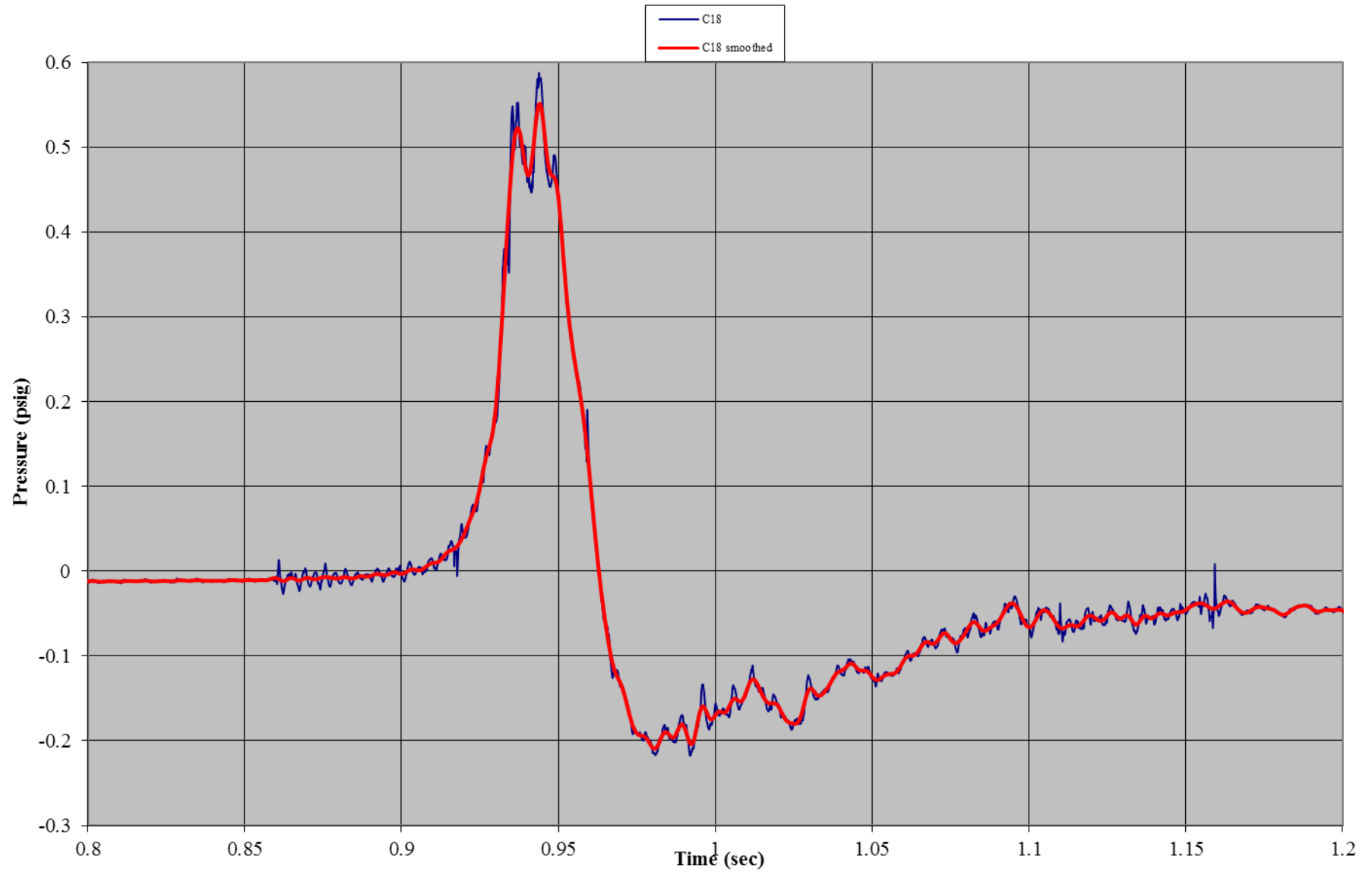
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 08: Left Side Wall, Bottom



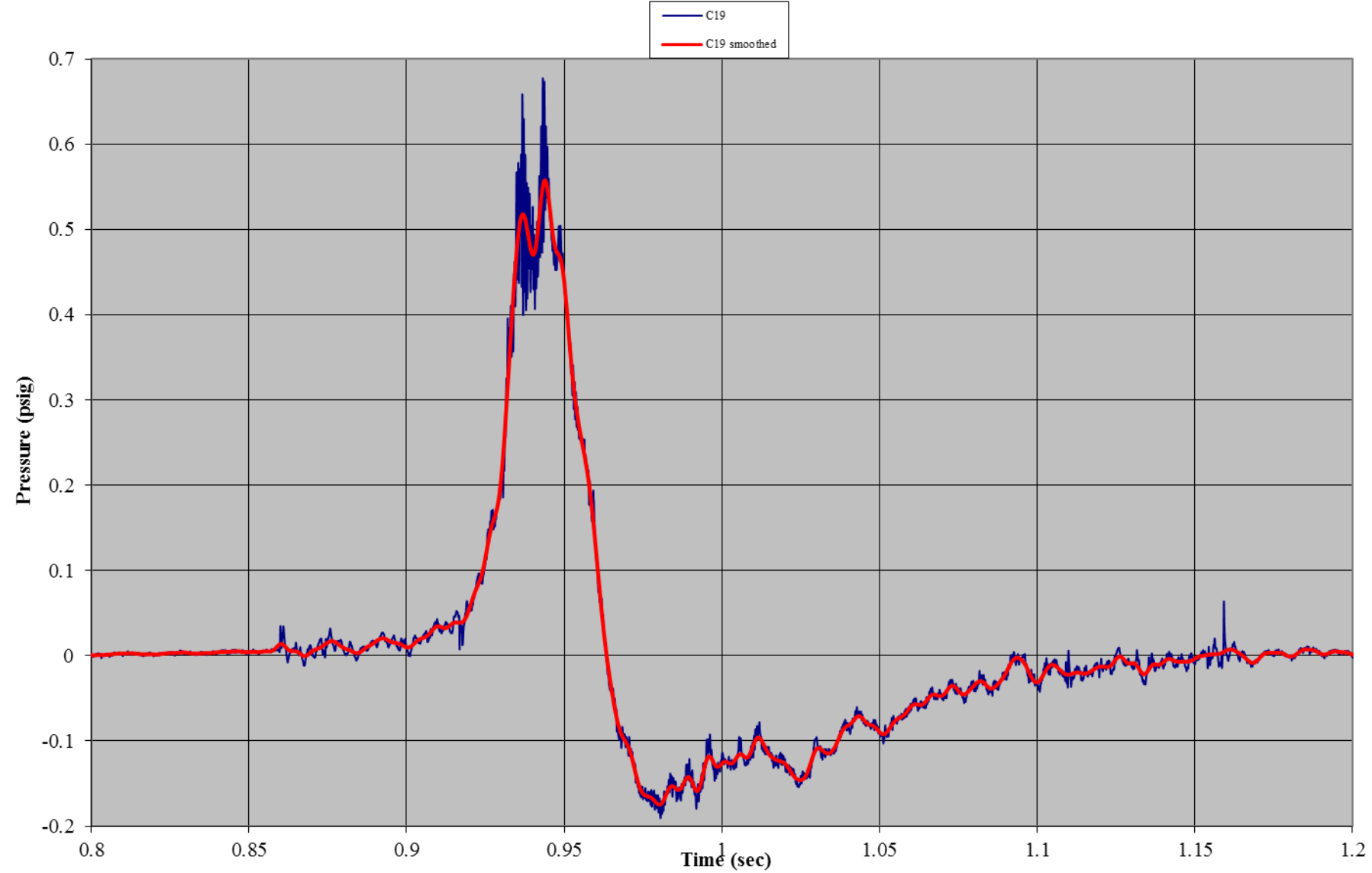
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 09: Left Side Wall, Mid-Height



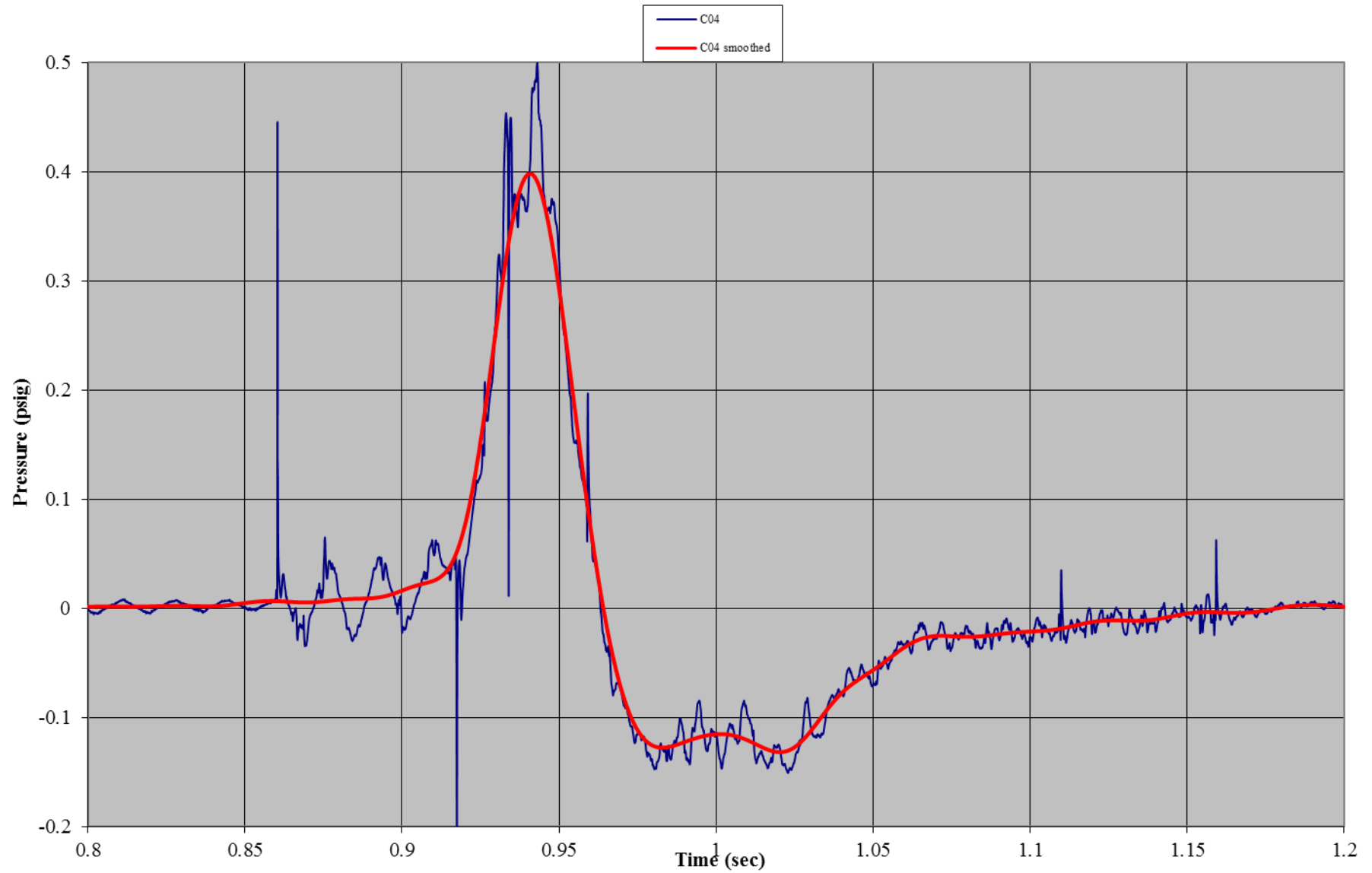
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 18: Right Side Wall, Bottom



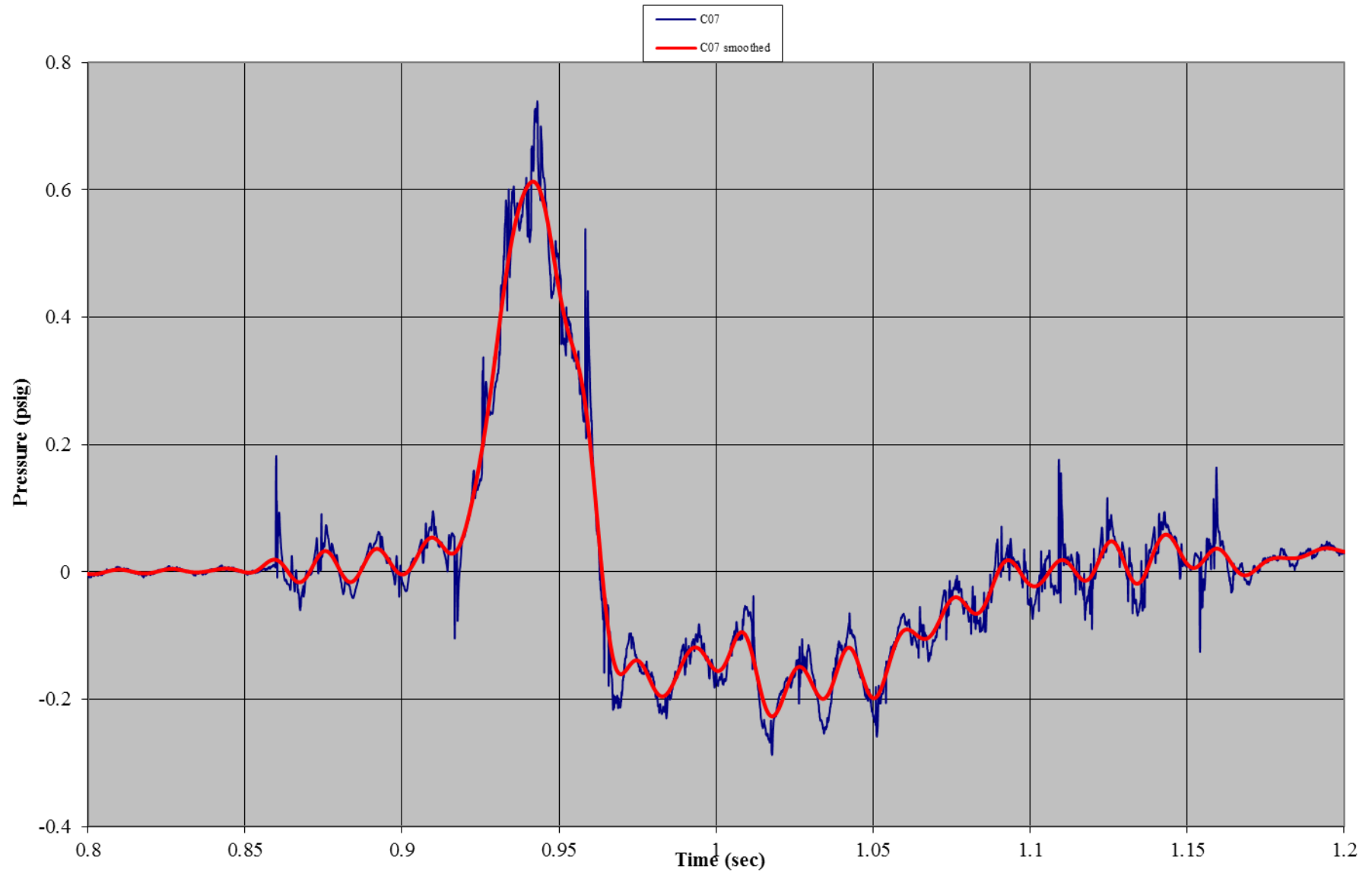
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 19: Right Side Wall, Mid-Height



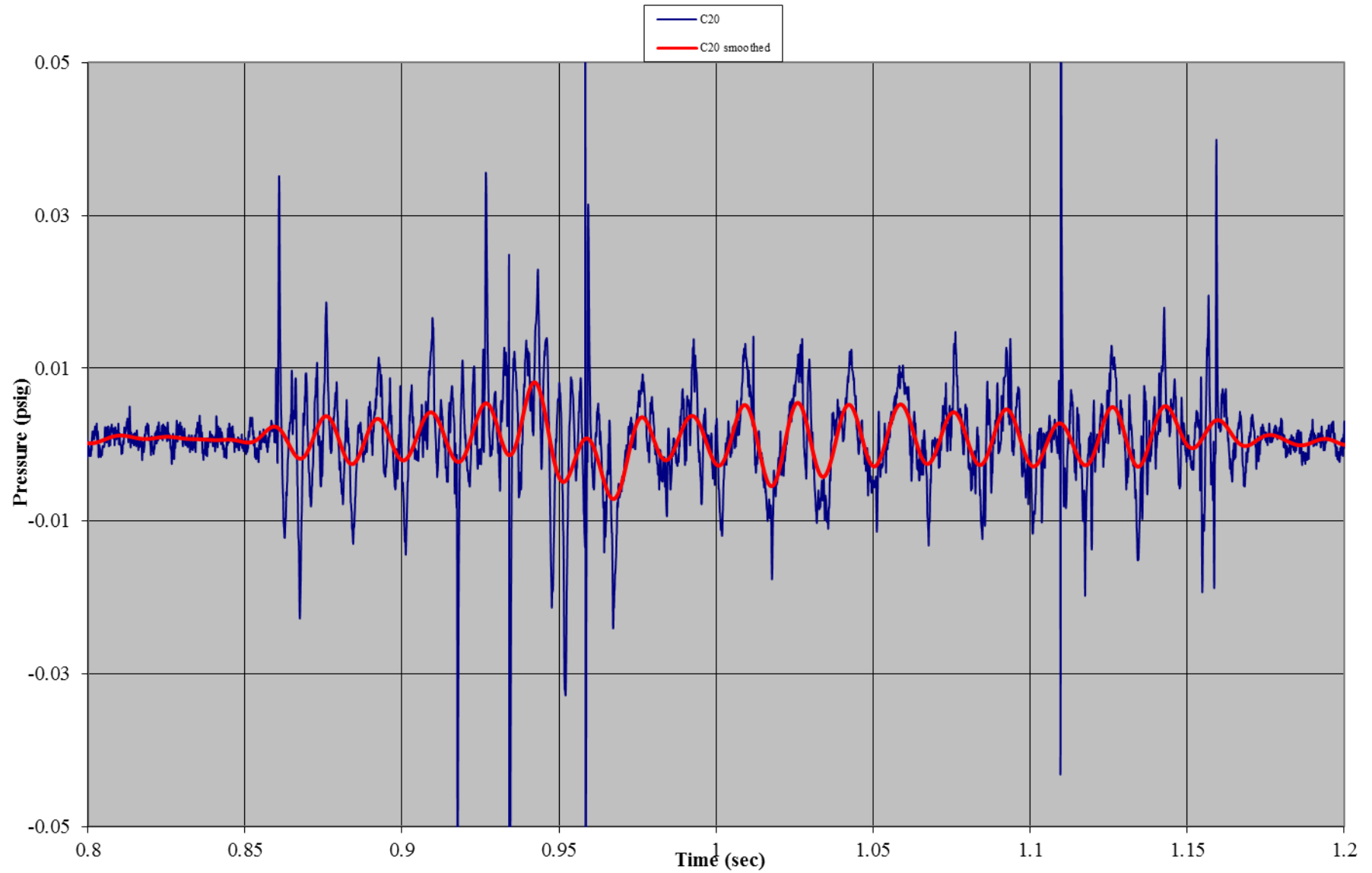
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 04: Interior, Ground



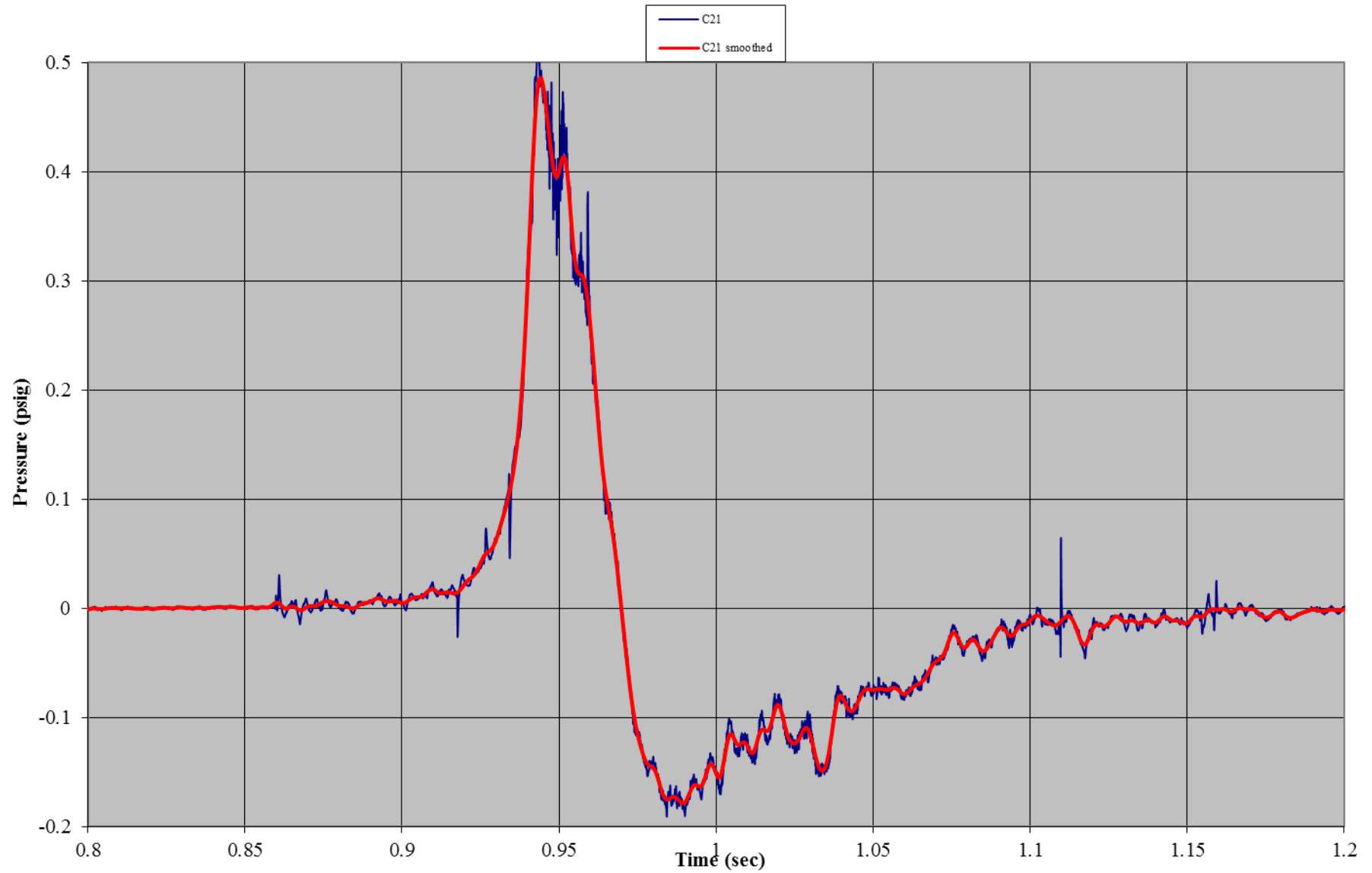
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 07: Roof, Front



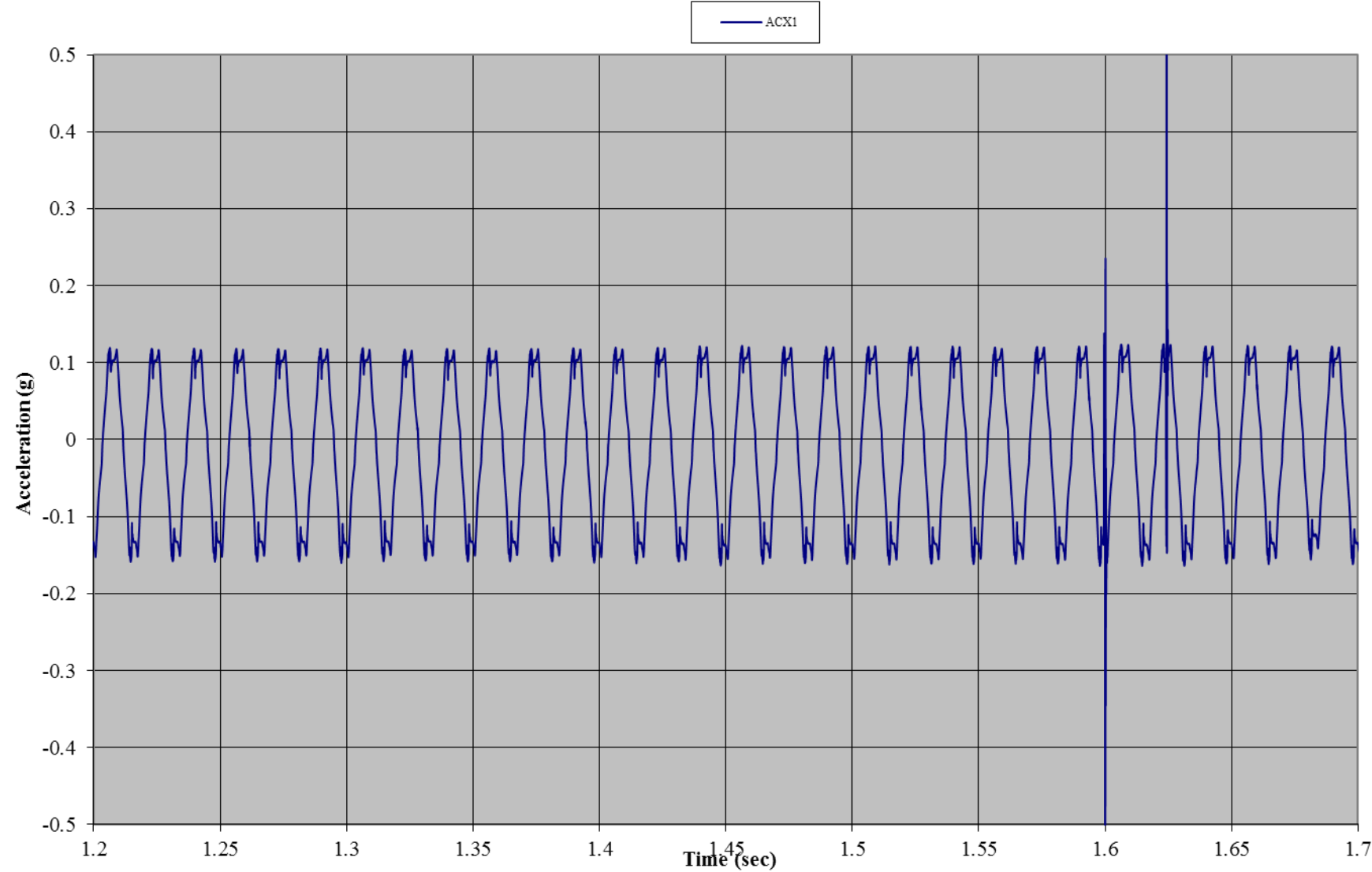
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 20: Roof, Back



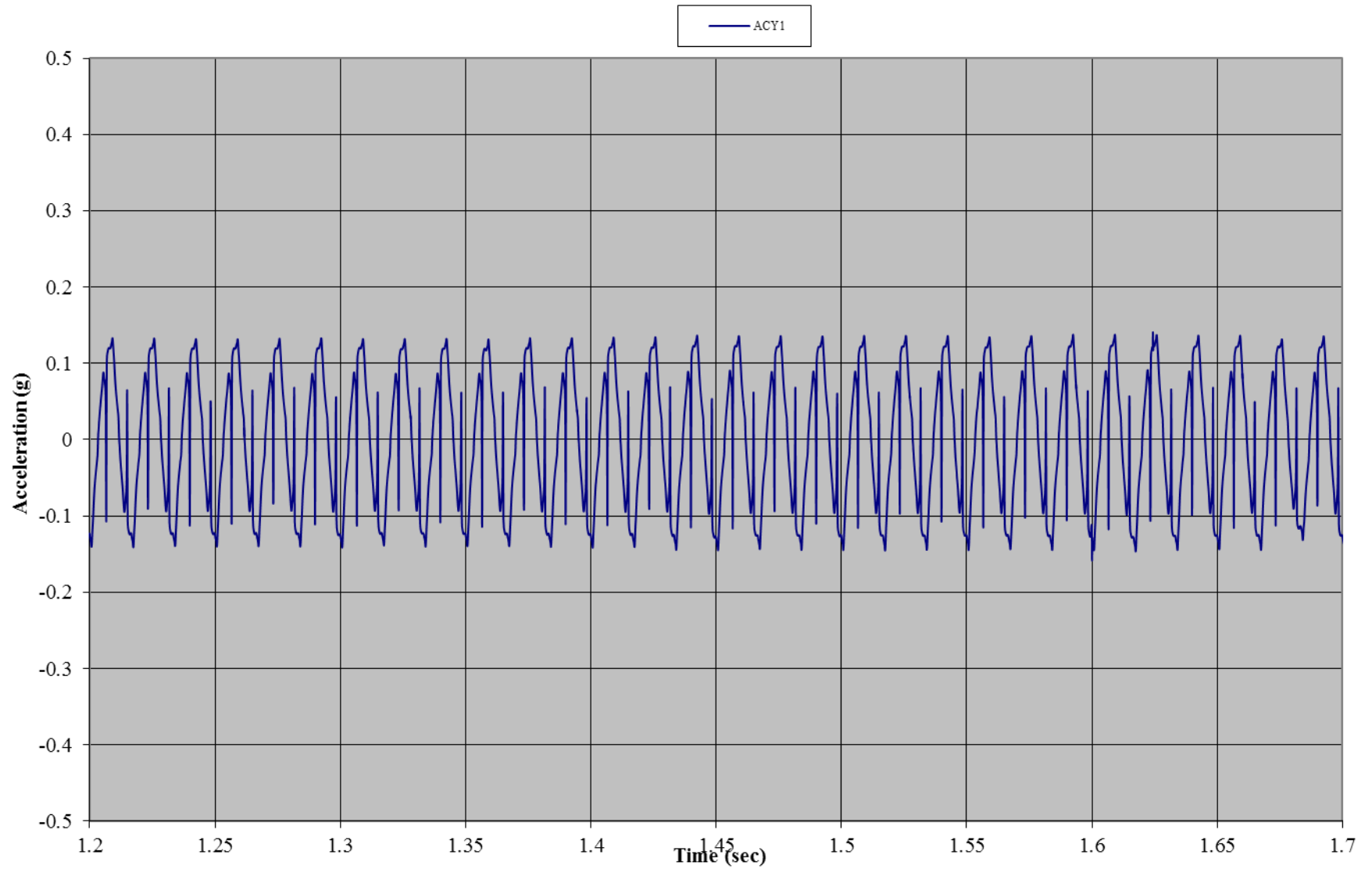
Test A03: Non-Wind Rated Pole Tent without Sides
Gauge 21: Back Wall, Center Mid-Height



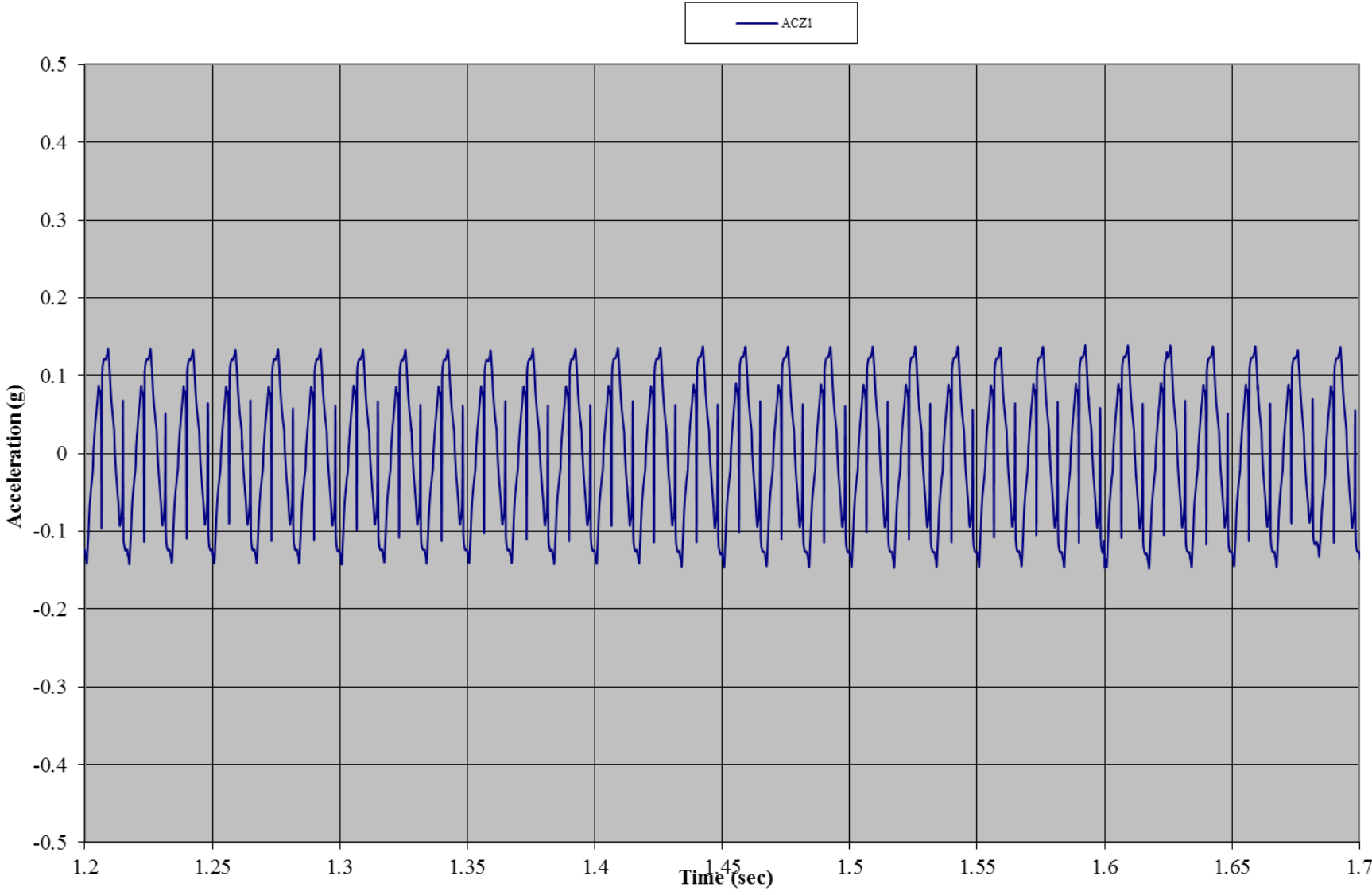
Test A03: Non-Wind Rated Pole Tent without Sides
Accelerometer 1: Front Wall (x-direction)



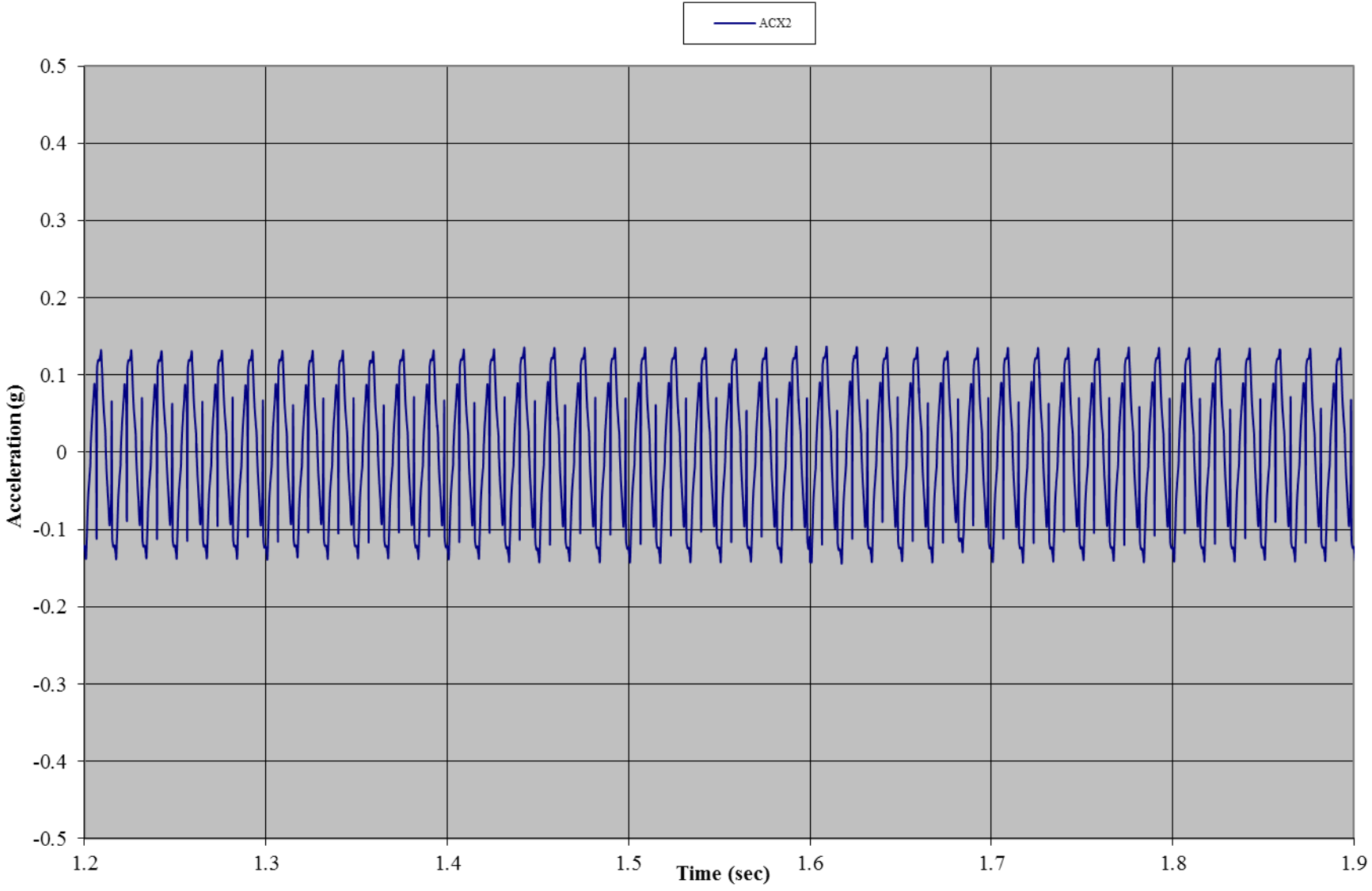
Test A03: Non-Wind Rated Pole Tent without Sides
Accelerometer 1: Front Wall (y-direction)



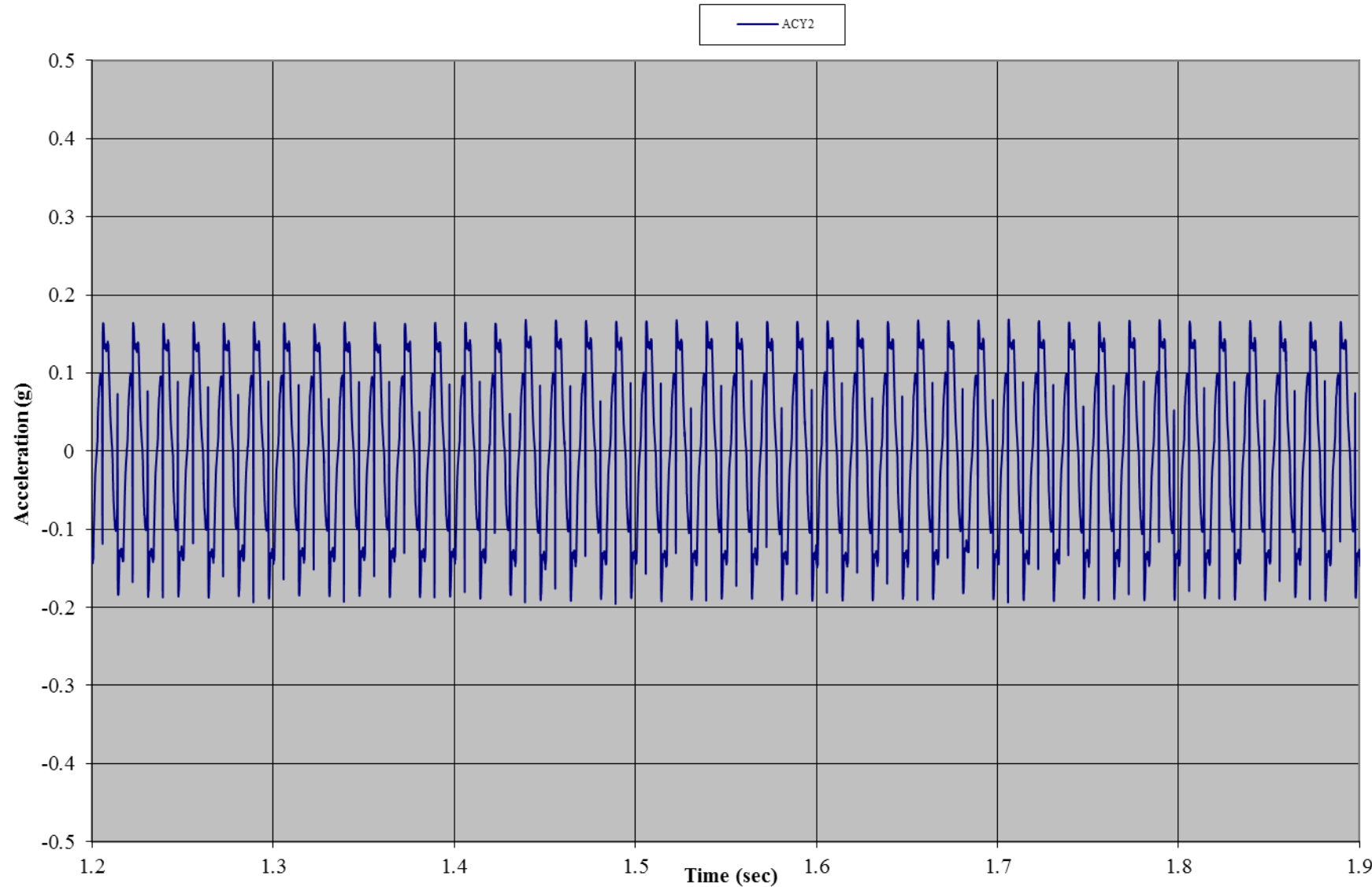
Test A03: Non-Wind Rated Pole Tent without Sides
Accelerometer 1: Front Wall (x-direction)



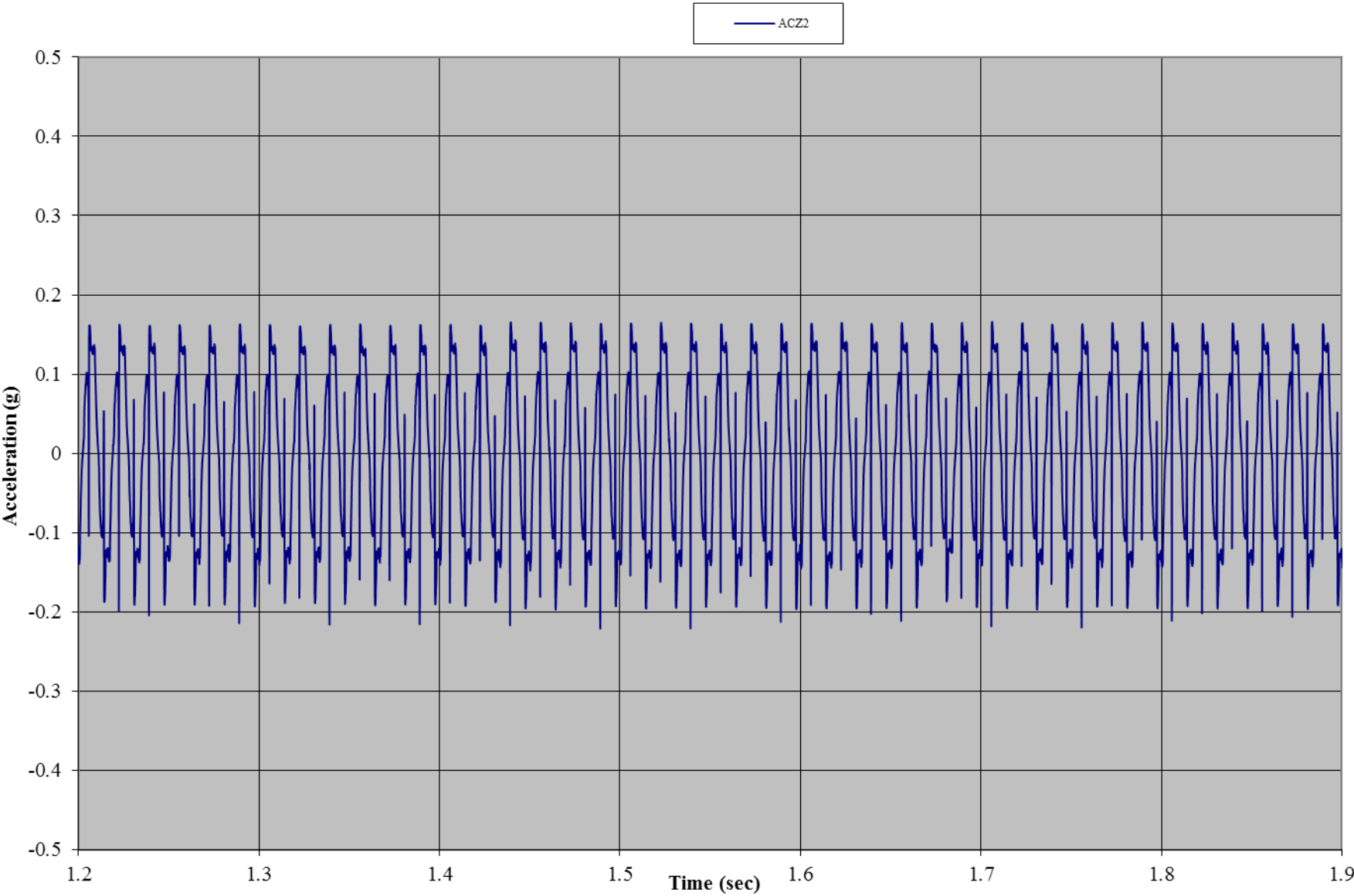
Test A03: Non-Wind Rated Pole Tent without Sides
Accelerometer 2: Roof (x-direction)



Test A03: Non-Wind Rated Pole Tent without Sides
Accelerometer 2: Roof (y-direction)

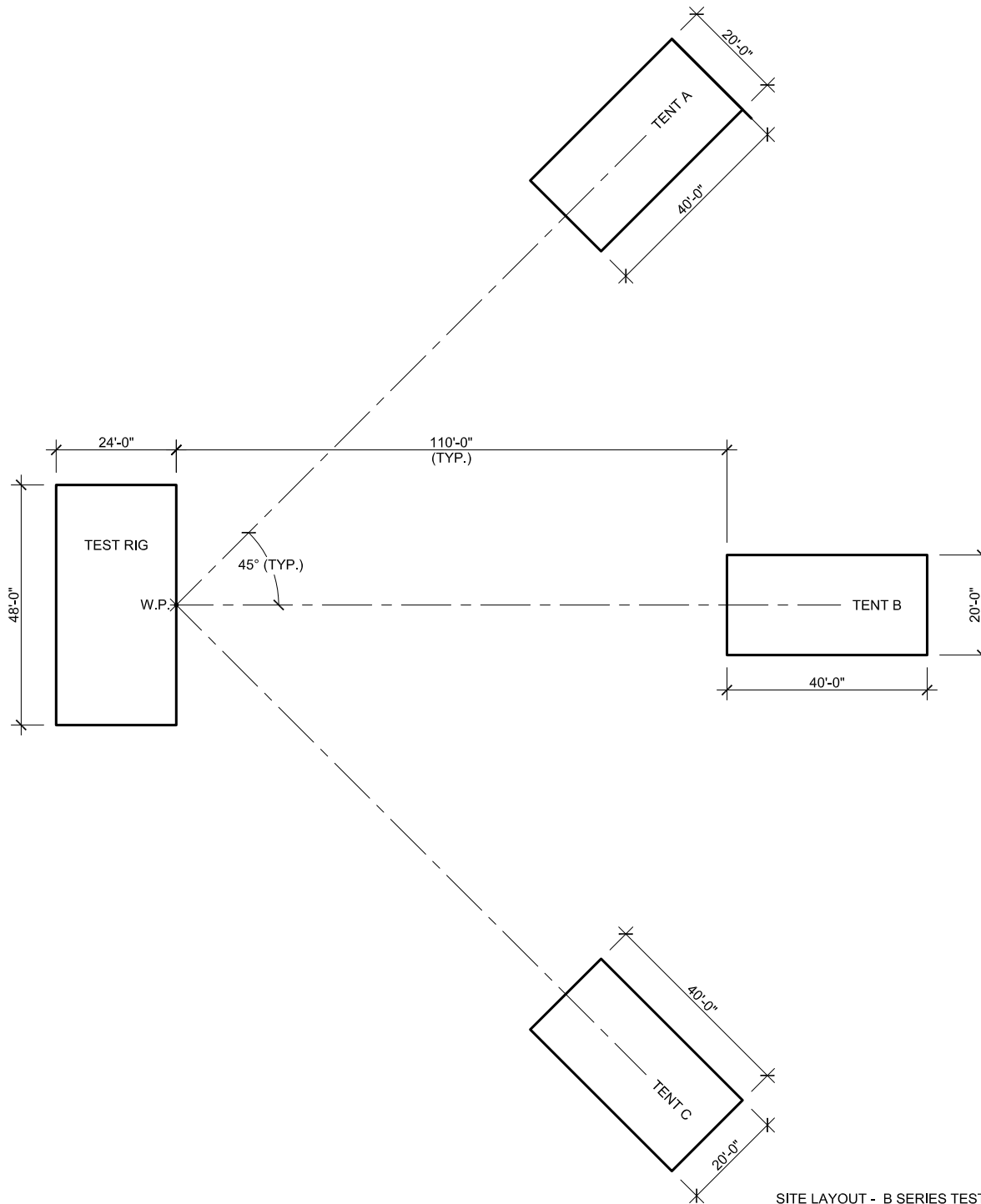


Test A03: Non-Wind Rated Pole Tent without Sides
Accelerometer 2: Roof (z-direction)



ANNEX C.

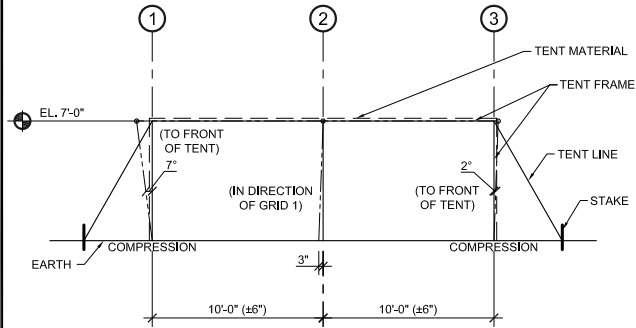
TEST SERIES B - FULL PLOTS OF TEST DATA



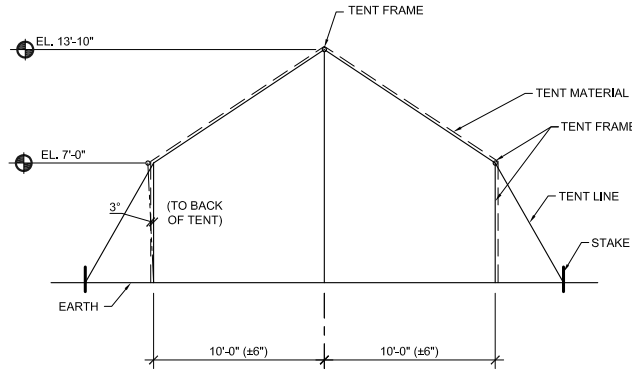
SITE LAYOUT - B SERIES TESTS
SCALE: N.T.S.

1

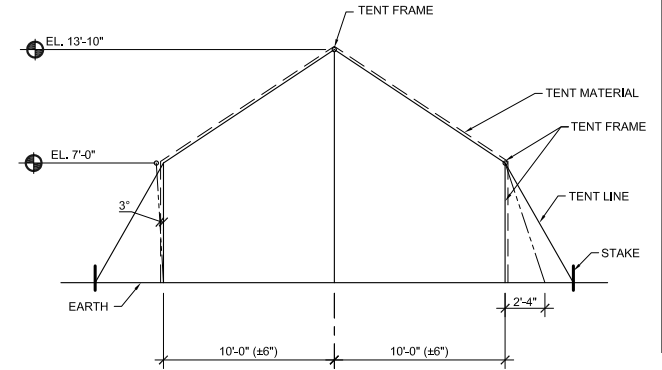
AMERICAN PETROLEUM INSTITUTE
B SERIES TESTS
SITE LAYOUT
BAKER ENGINEERING & RISK CONSULTANTS 3350 Oakwell Court, Suite 100 San Antonio, TX 78218-3024



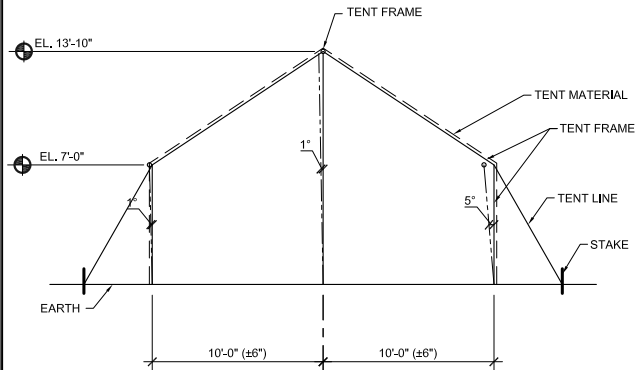
TENT A - SECTION 1/GRID A
SCALE: N.T.S.



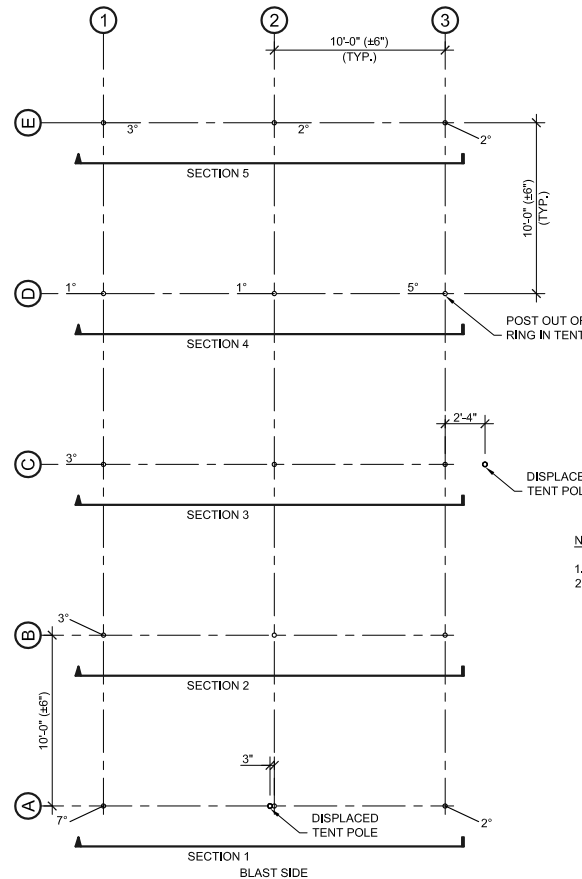
TENT A - SECTION 2/GRID B
SCALE: N.T.S.



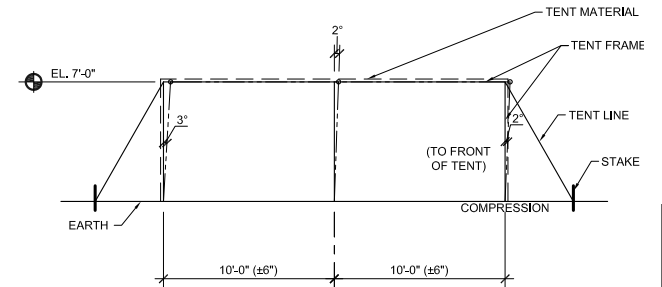
TENT A - SECTION 3/GRID C
SCALE: N.T.S.



TENT A - SECTION 4/GRID D
SCALE: N.T.S.



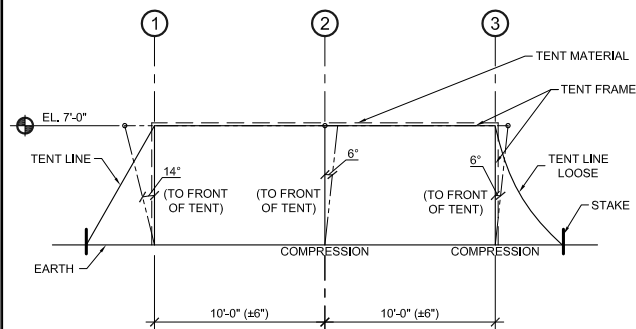
TENT A LAYOUT - TEST B01
SCALE: N.T.S.



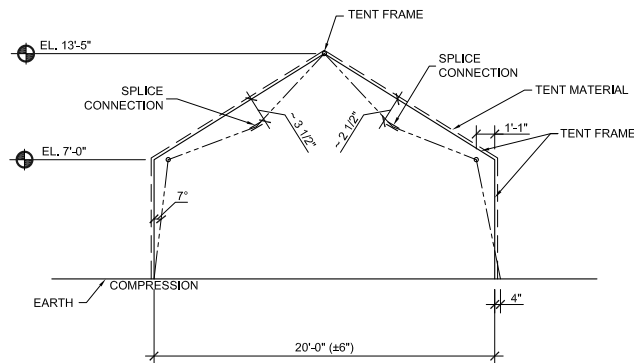
TENT A - SECTION 5/GRID E
SCALE: N.T.S.

NOTE:

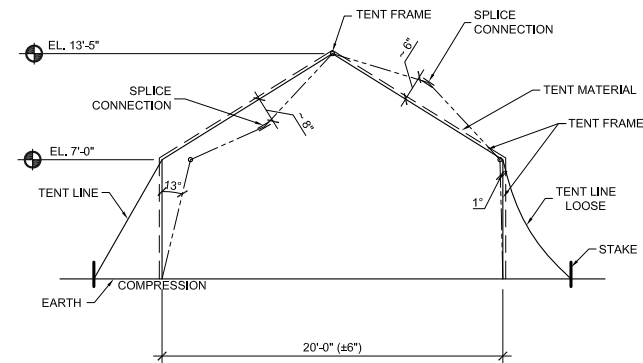
1. PERIMETER POLE HEIGHT 7'-0".
2. INTERIOR POLE HEIGHT 13'-10".



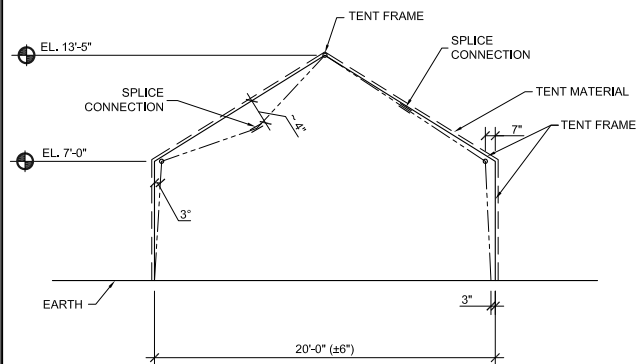
TENT B - SECTION 1/GRID A
SCALE: N.T.S.



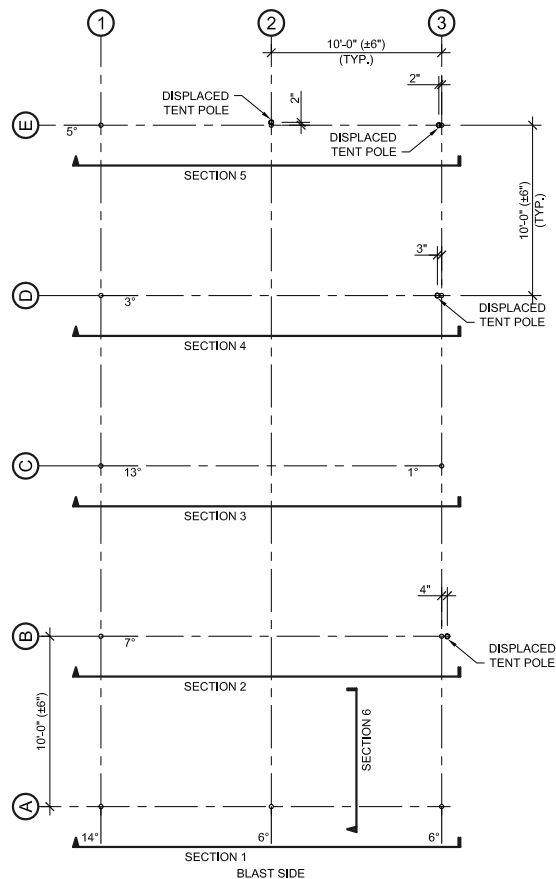
TENT B - SECTION 2/GRID B
SCALE: N.T.S.



TENT B - SECTION 3/GRID C
SCALE: N.T.S.

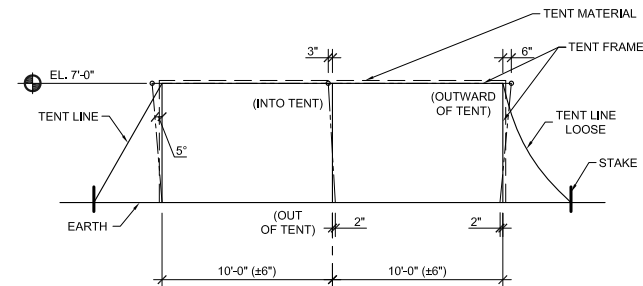


TENT B - SECTION 4/GRID D
SCALE: N.T.S.



TENT B LAYOUT - TENT TEST B01
SCALE: N.T.S.

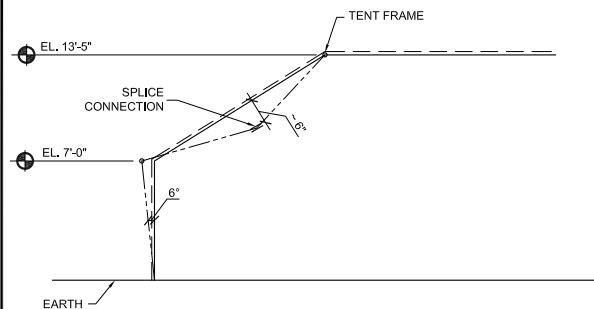
1
S1.3



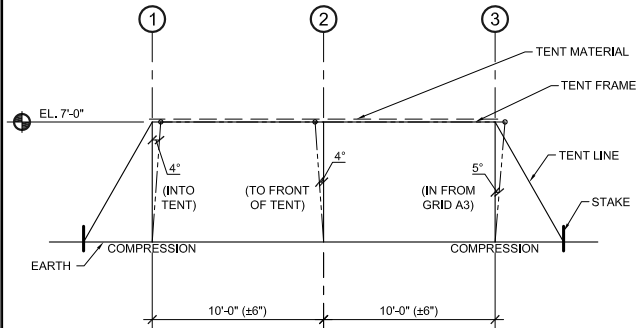
TENT B - SECTION 5/GRID E
SCALE: N.T.S.

NOTE:

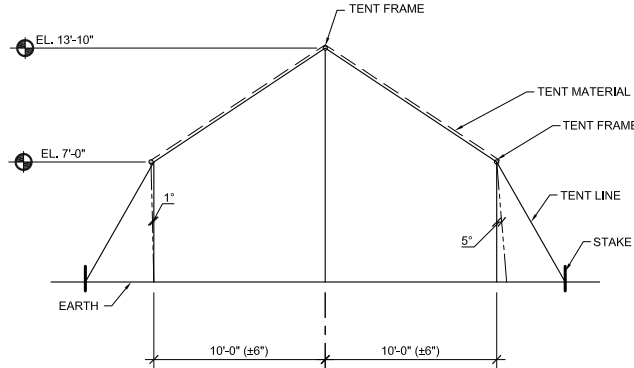
1. PERIMETER POLE HEIGHT 7'-0".
2. INTERIOR POLE HEIGHT 13'-5".



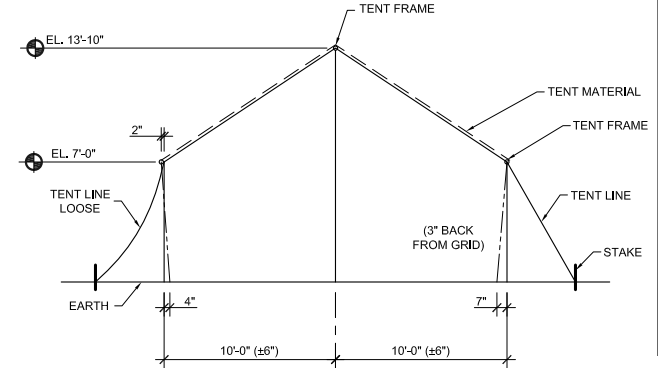
TENT B - SECTION 6/GRID 2
SCALE: N.T.S.



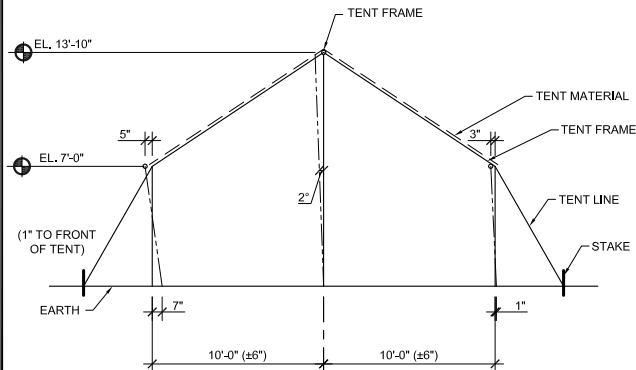
TENT C - SECTION 1/GRID A
SCALE: N.T.S.



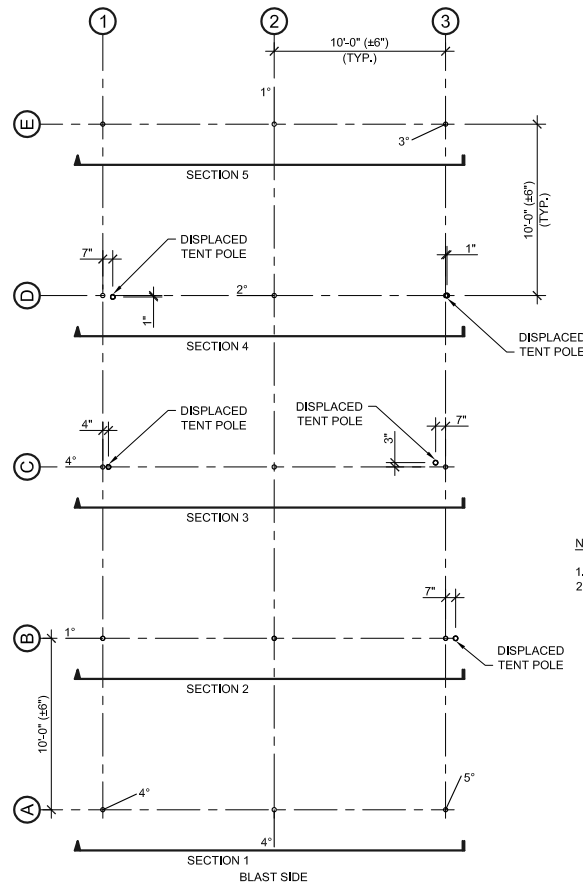
TENT C - SECTION 2/GRID B
SCALE: N.T.S.



TENT C - SECTION 3/GRID C
SCALE: N.T.S.



TENT C - SECTION 4/GRID D
SCALE: N.T.S.



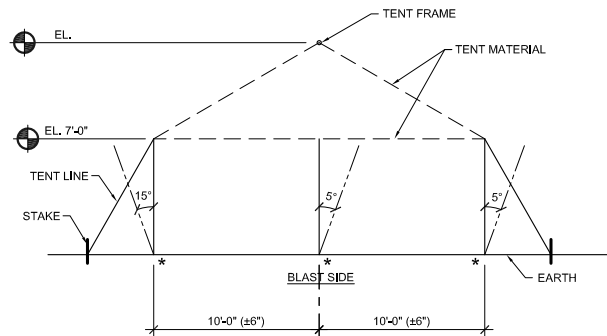
TENT C LAYOUT - TENT TEST B01
SCALE: N.T.S.

NOTE:

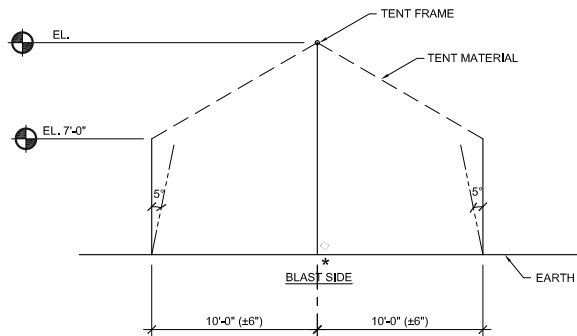
1. PERIMETER POLE HEIGHT 7'-0".
2. INTERIOR POLE HEIGHT 13'-10".

AMERICAN PETROLEUM INSTITUTE
POST TEST B01
DEFORMATIONS
POLE TENT W/O SIDES
LAYOUT (TENT C)

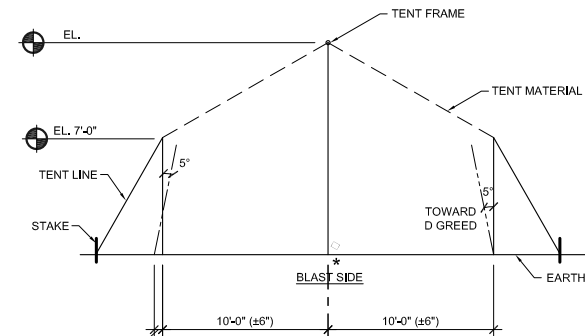
BAKER ENGINEERING & RISK CONSULTANTS
3150 Oakwell Court, Suite 100
San Antonio, TX 78216-3024



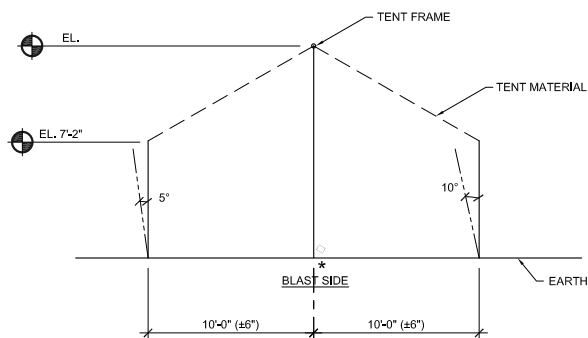
TENT A - SECTION 1/ GRID A
SCALE: N.T.S.



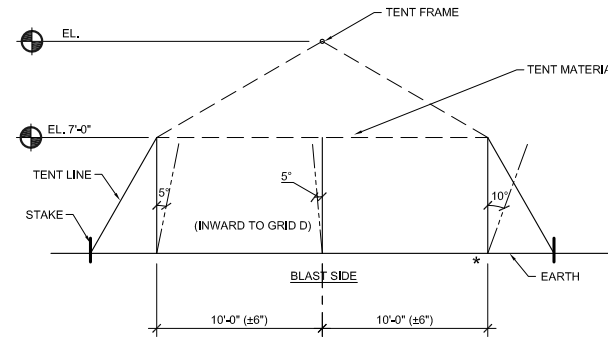
TENT A - SECTION 2/ GRID B
SCALE: N.T.S.



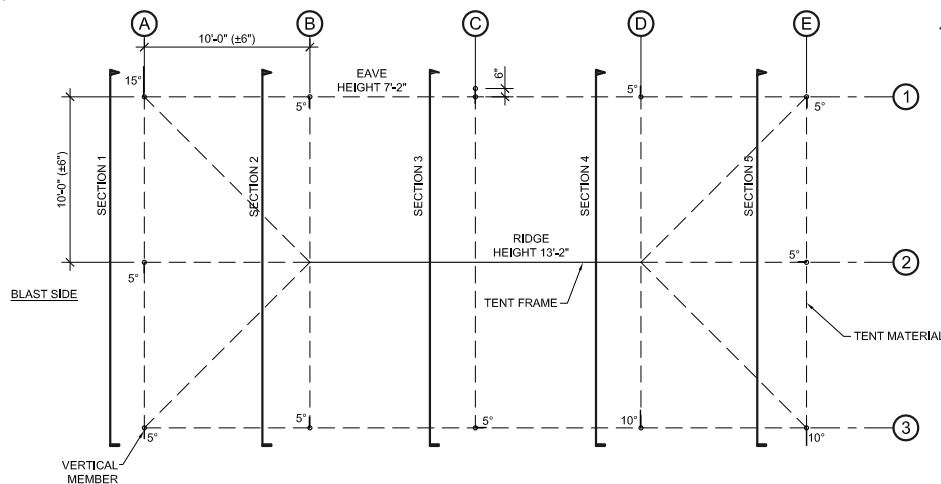
TENT A - SECTION 3/ GRID C
SCALE: N.T.S.



TENT A - SECTION 4/ GRID D
SCALE: N.T.S.

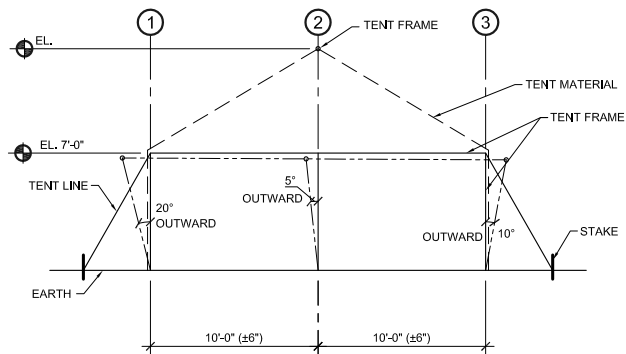


TENT A - SECTION 5/ GRID E
SCALE: N.T.S.

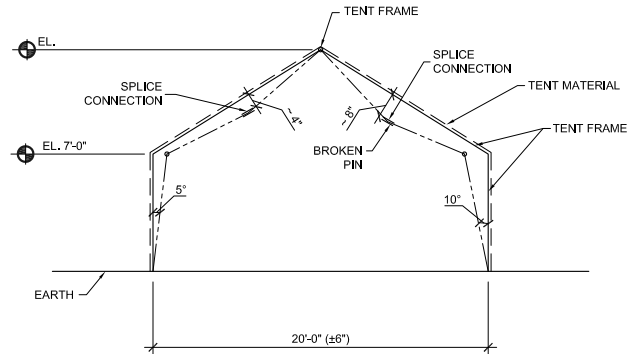


TENT A LAYOUT - TENT TEST B06
SCALE: N.T.S.

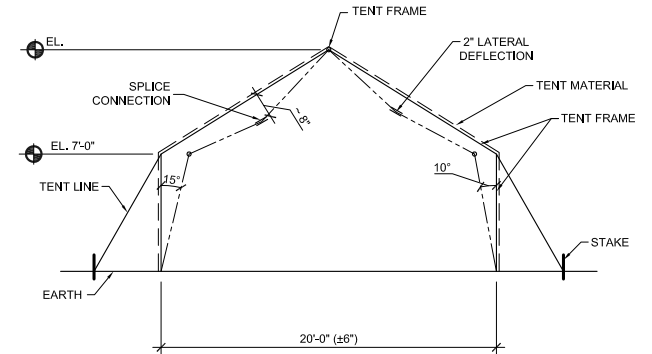
NOTE:
* - EMBEDDED
○ - STRAIGHT



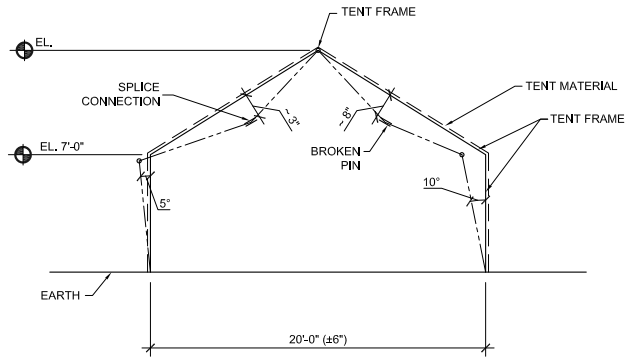
TENT B - SECTION 1/GRID A
SCALE: N.T.S.



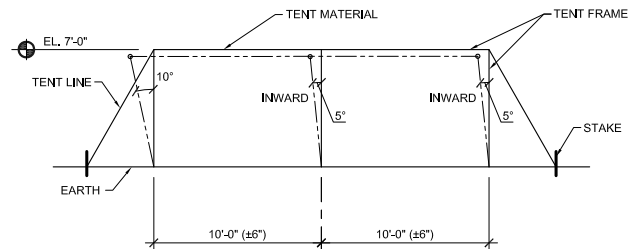
TENT B - SECTION 2/GRID B
SCALE: N.T.S.



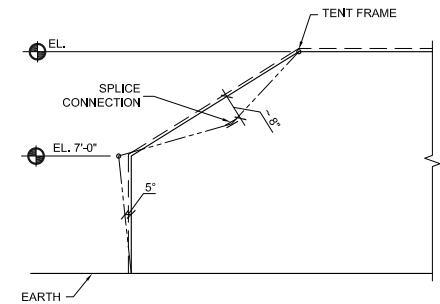
TENT B - SECTION 3/GRID C
SCALE: N.T.S.



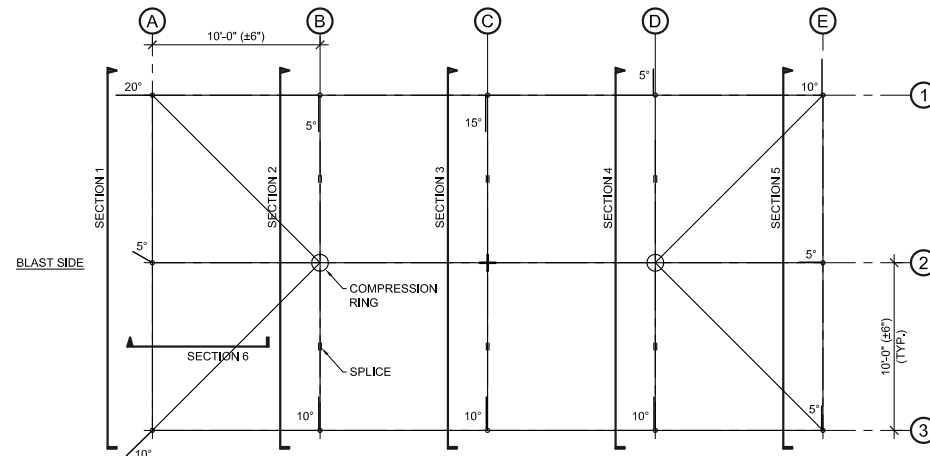
TENT B - SECTION 4/GRID D
SCALE: N.T.S.



TENT B - SECTION 5/GRID E
SCALE: N.T.S.



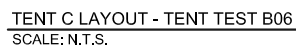
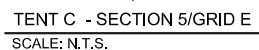
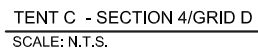
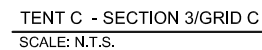
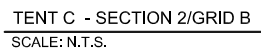
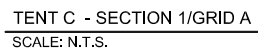
TENT B - SECTION 6/GRID 2
SCALE: N.T.S.



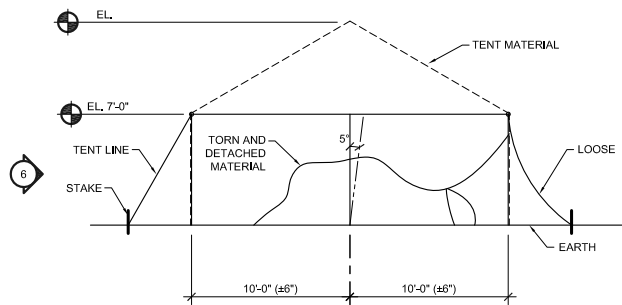
TENT B LAYOUT - TENT TEST B06
SCALE: N.T.S.

NOTE:

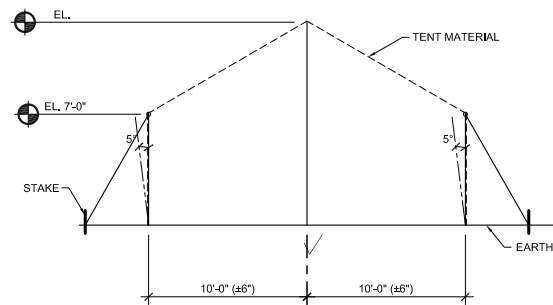
1. CRINKLING TENT IS SWAYING AS WIND BLOWS.
2. POSTS W/ ROUND PLATES.



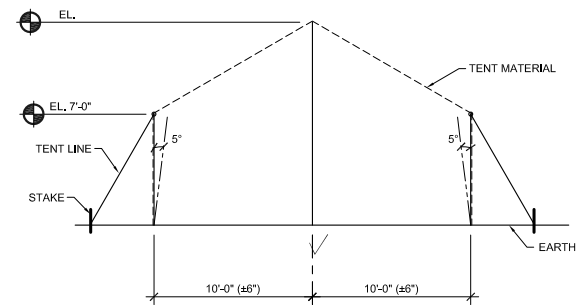
* - EMBEDDED
◇ - STRAIGHT



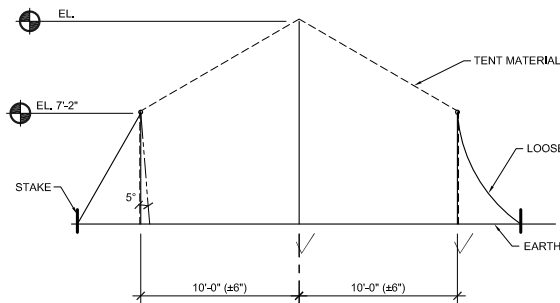
TENT A - SECTION 1/ GRID A
SCALE: N.T.S.



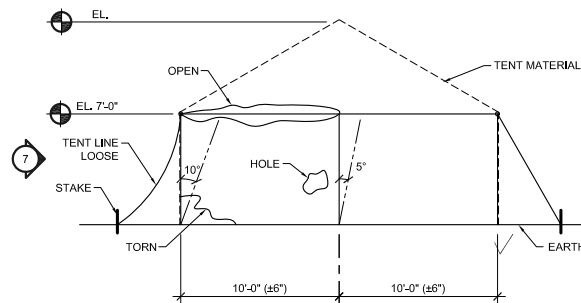
TENT A - SECTION 2/ GRID B
SCALE: N.T.S.



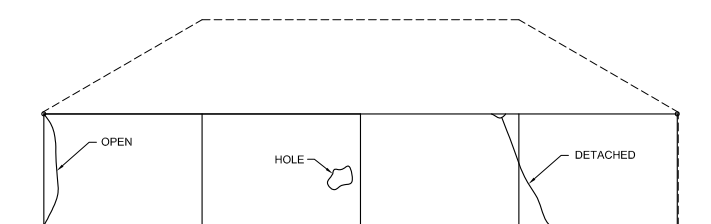
TENT A - SECTION 3/ GRID C
SCALE: N.T.S.



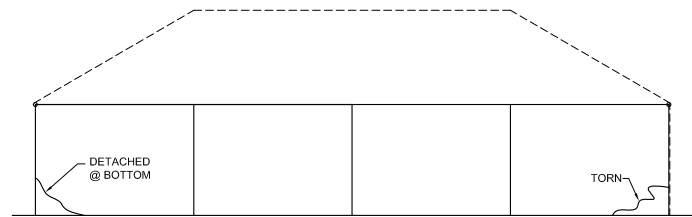
TENT A - SECTION 4/ GRID D
SCALE: N.T.S.



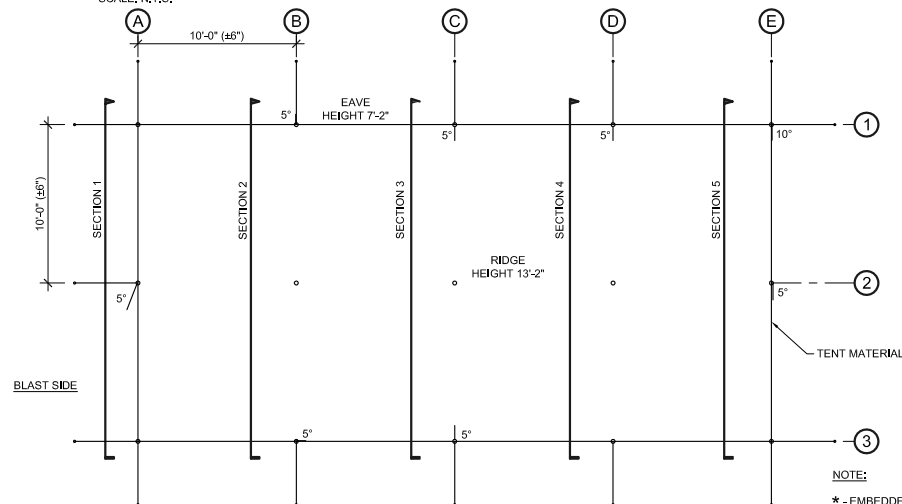
TENT A - SECTION 5/ GRID E
SCALE: N.T.S.



TENT A - ELEVATION 6
SCALE: N.T.S.

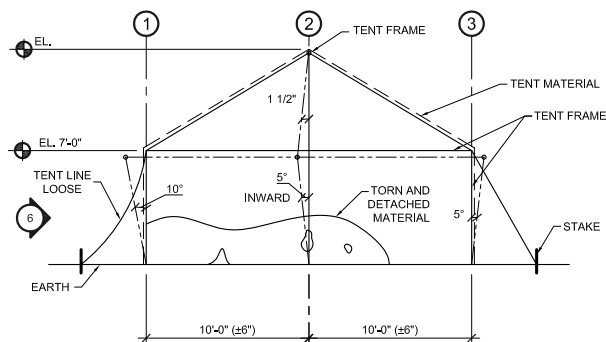


TENT A - ELEVATION 7
SCALE: N.T.S.

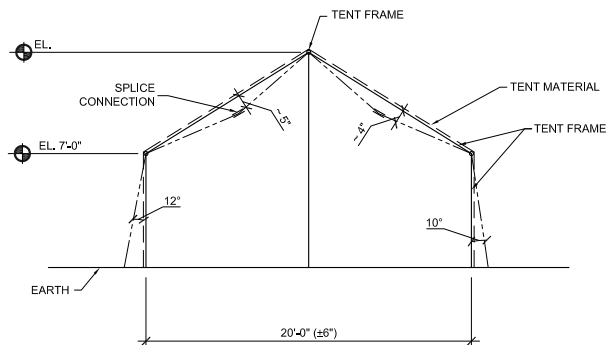


TENT A LAYOUT - TENT TEST B08
SCALE: N.T.S.

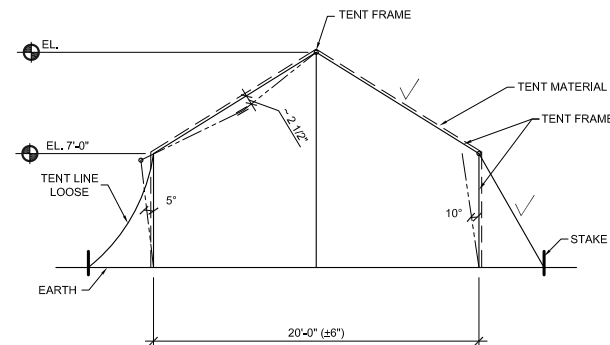
NOTE:
* - EMBEDDED
○ - STRAIGHT



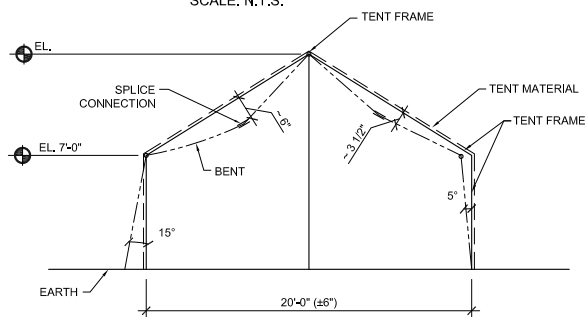
TENT B - SECTION 1/GRID A
SCALE: N.T.S.



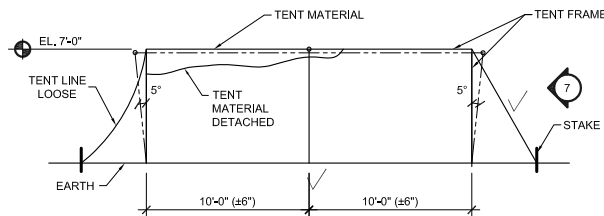
TENT B - SECTION 2/GRID B
SCALE: N.T.S.



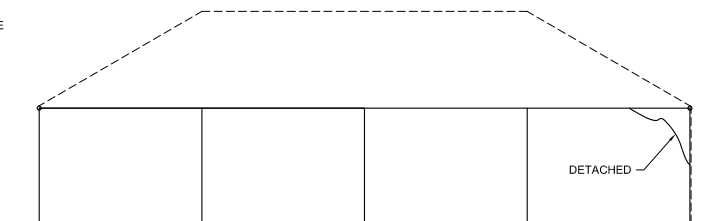
TENT B - SECTION 3/GRID C
SCALE: N.T.S.



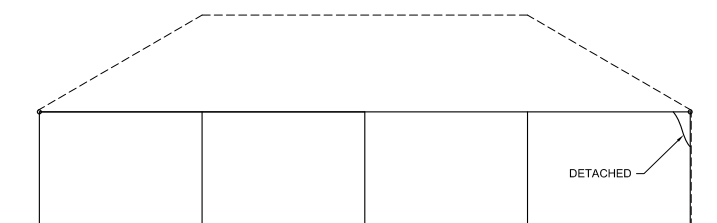
TENT B - SECTION 4/GRID D
SCALE: N.T.S.



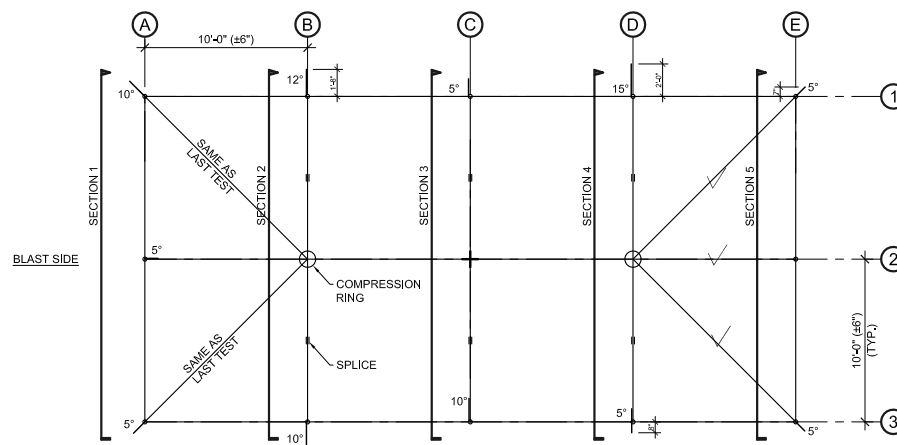
TENT B - SECTION 5/GRID E
SCALE: N.T.S.



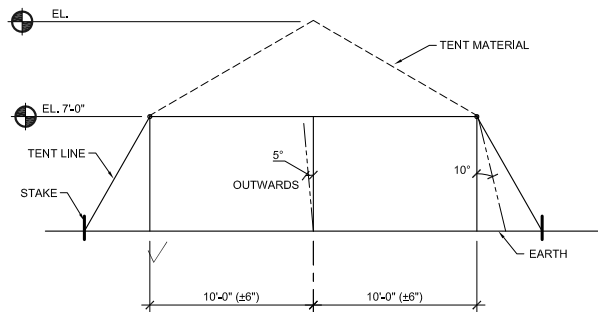
TENT B - ELEVATION 6
SCALE: N.T.S.



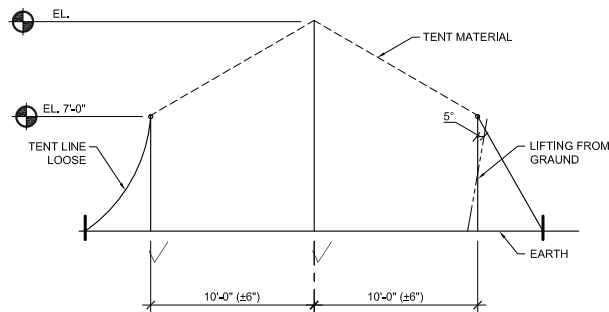
TENT B - ELEVATION 7
SCALE: N.T.S.



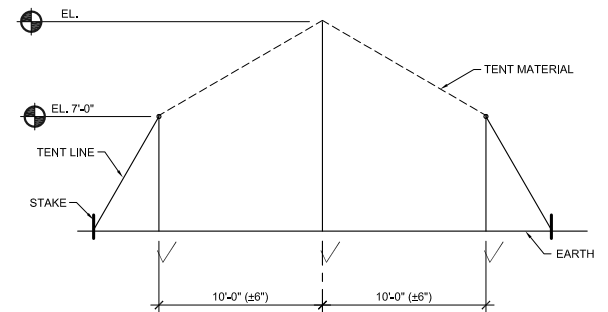
TENT B LAYOUT - TENT TEST B08
SCALE: N.T.S.



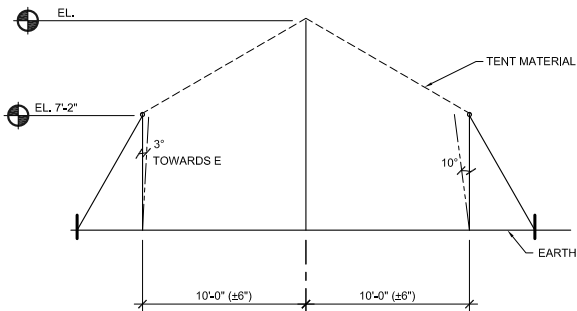
TENT C - SECTION 1/ GRID A
SCALE: N.T.S.



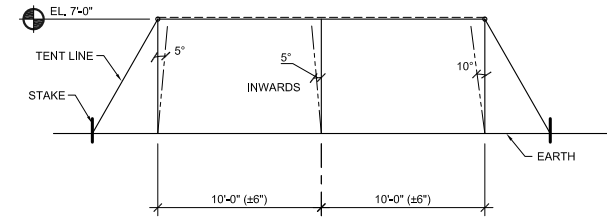
TENT C - SECTION 2/ GRID B
SCALE: N.T.S.



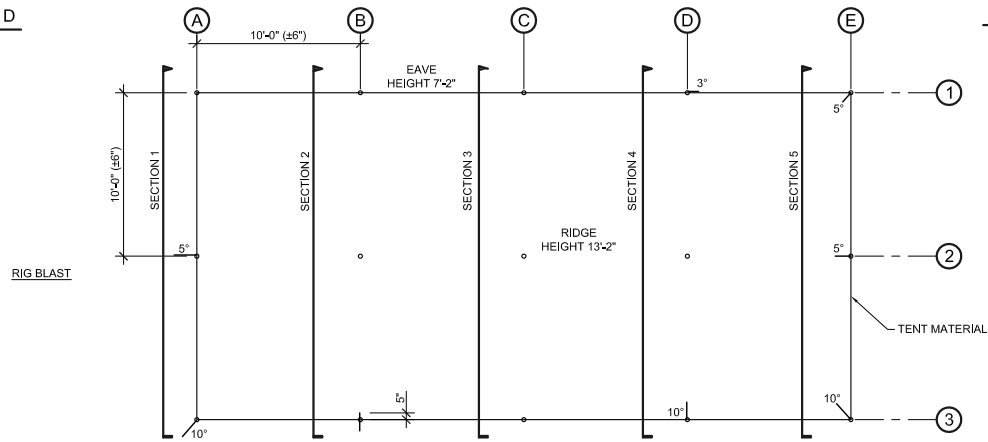
TENT C - SECTION 3/ GRID C
SCALE: N.T.S.



TENT C - SECTION 4/ GRID D
SCALE: N.T.S.



TENT C - SECTION 5/ GRID E
SCALE: N.T.S.



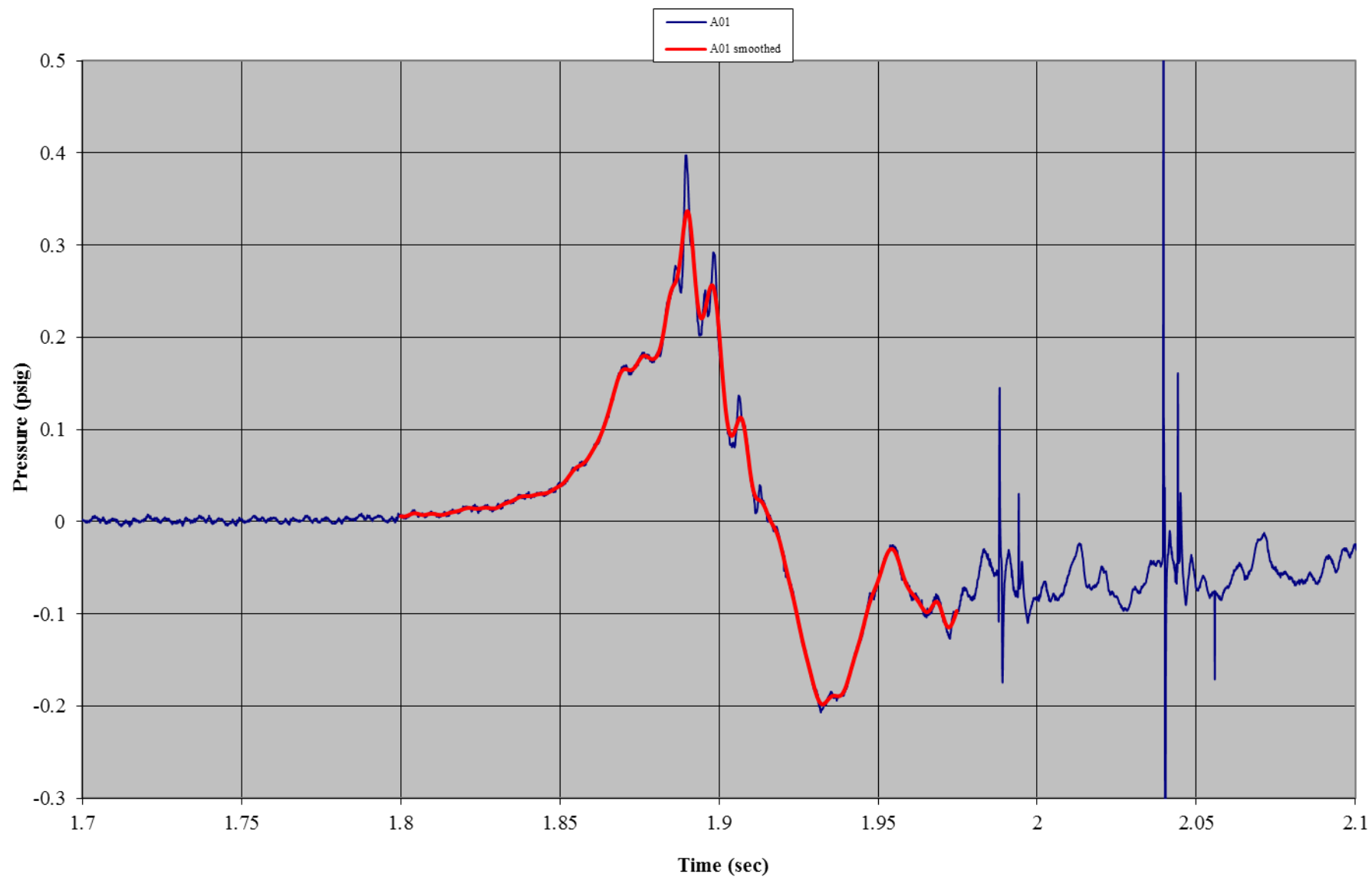
TENT C LAYOUT - TENT TEST B08
SCALE: N.T.S.

NOTE:
* - EMBEDDED
- - - STRAIGHT

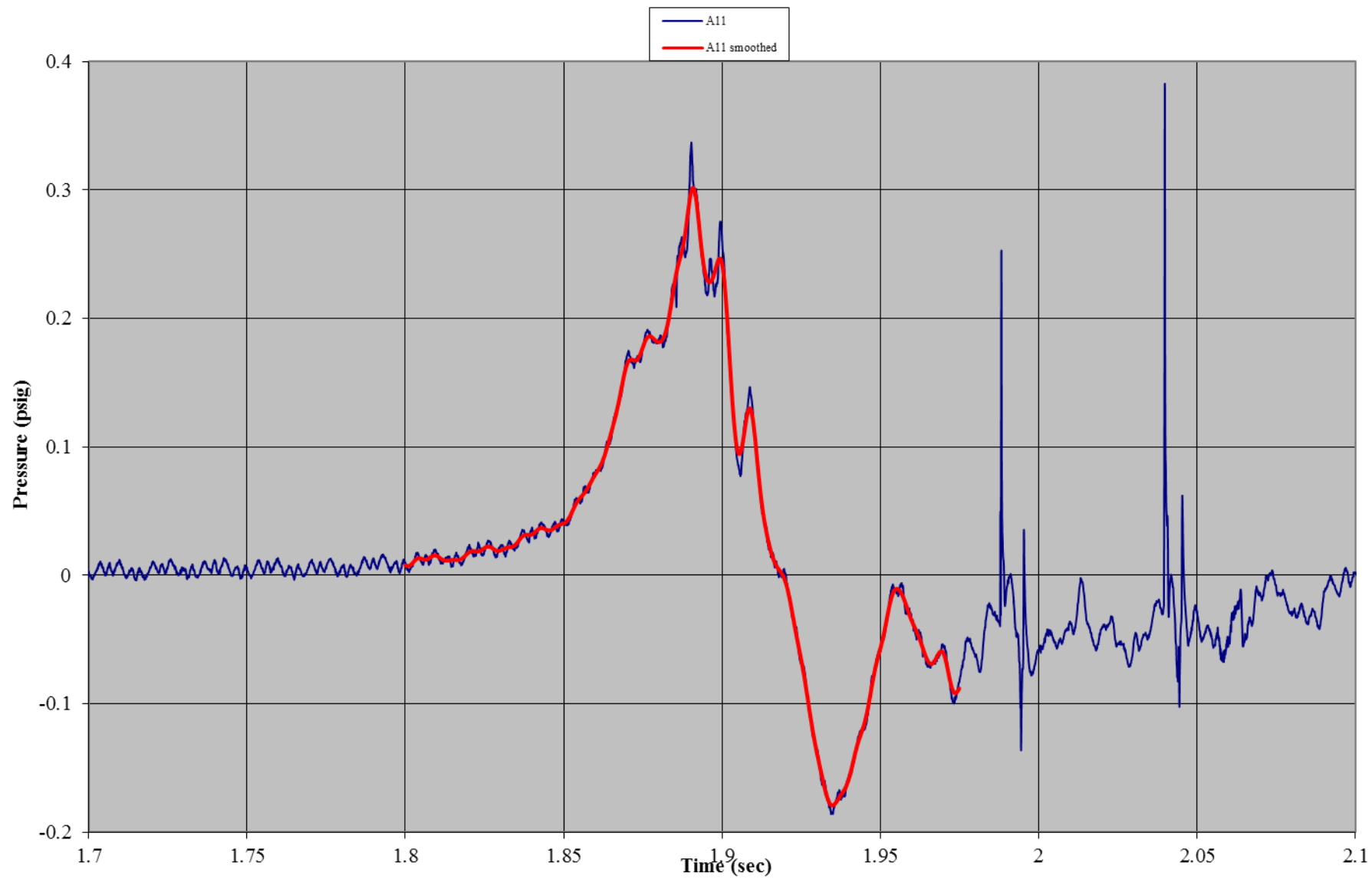
1

Test B01: Tent A

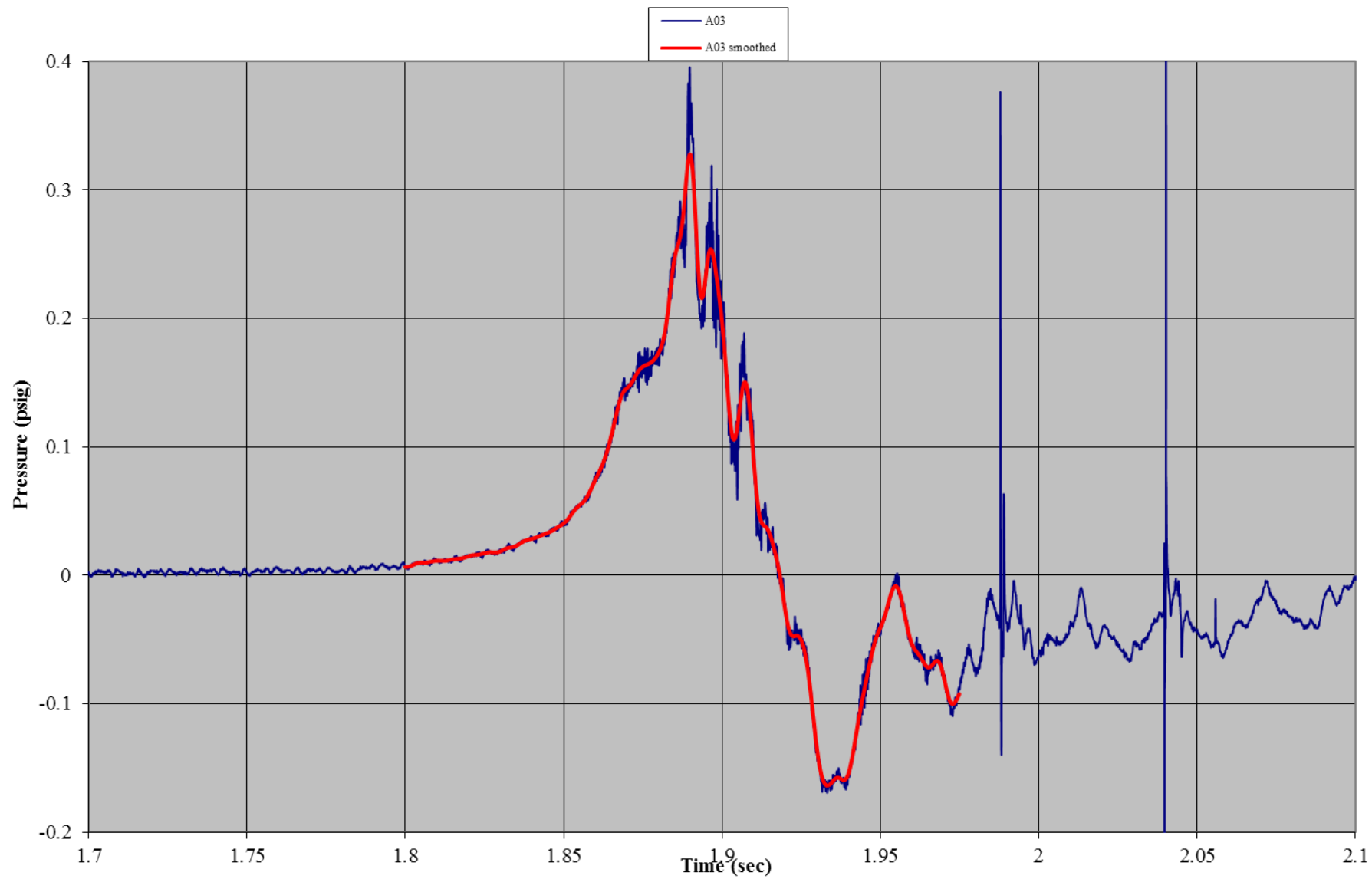
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 01: Front Wall, Left Bottom



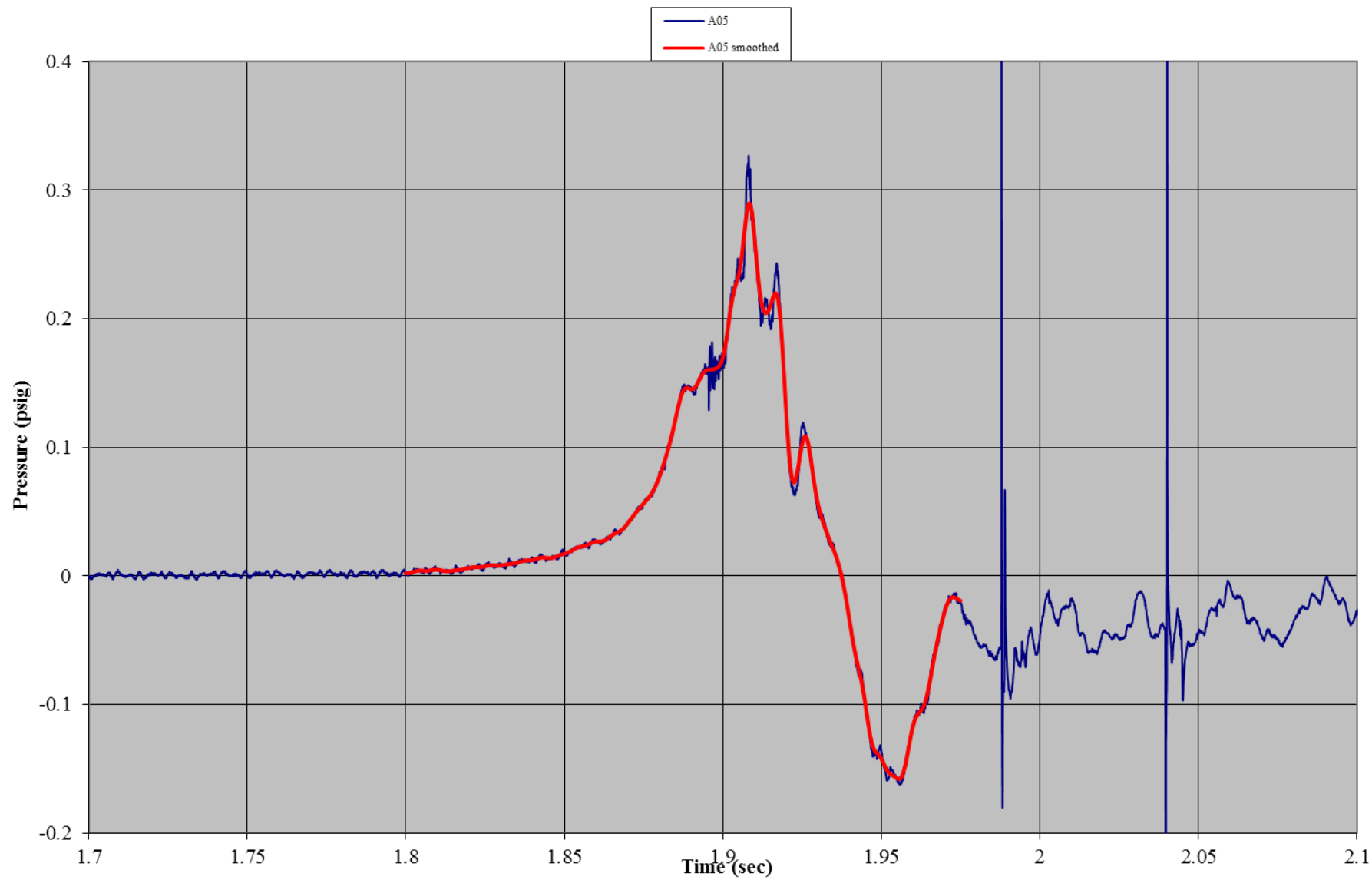
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 11: Front Wall, Right Bottom



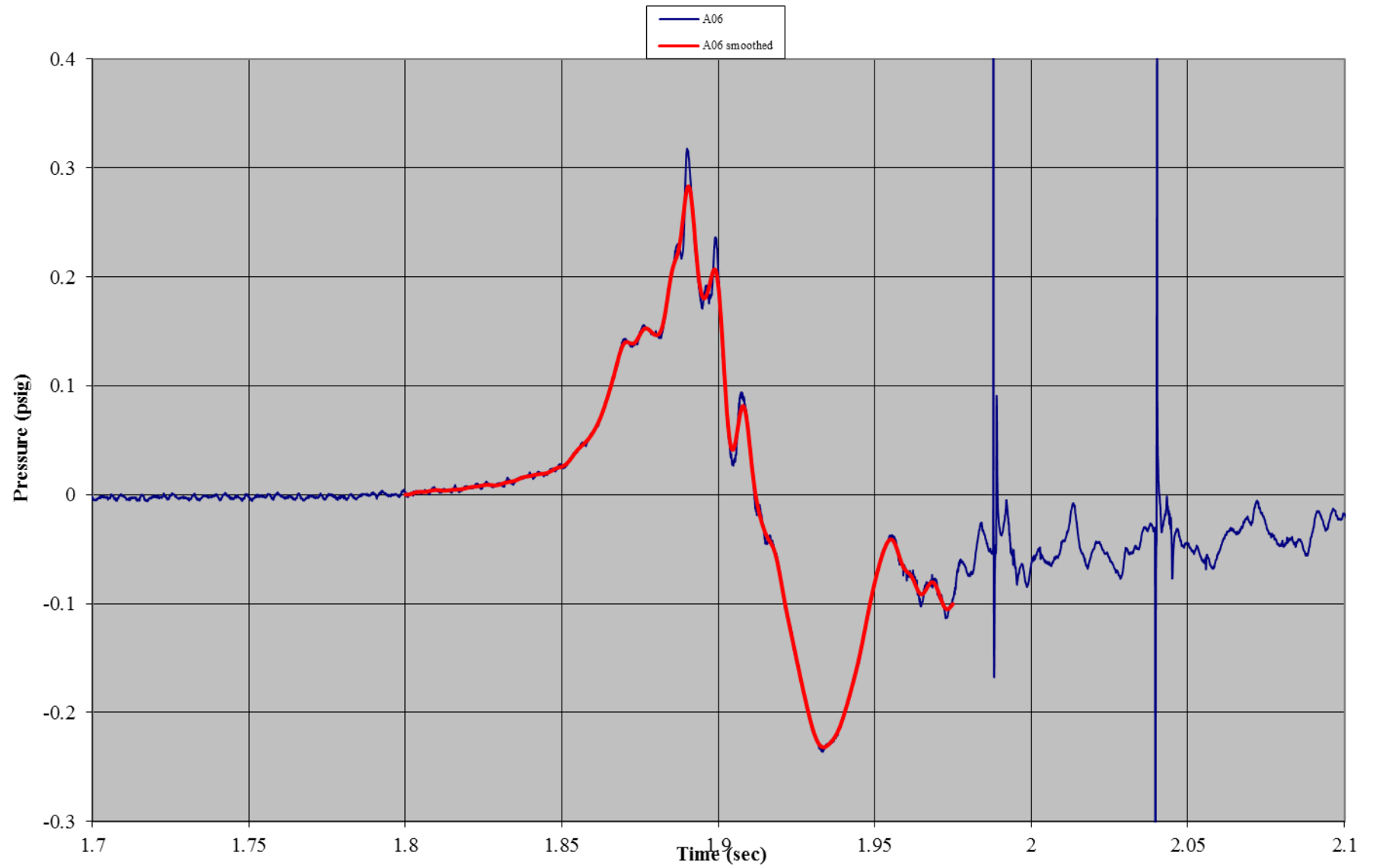
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 03: Front Wall, Center Bottom



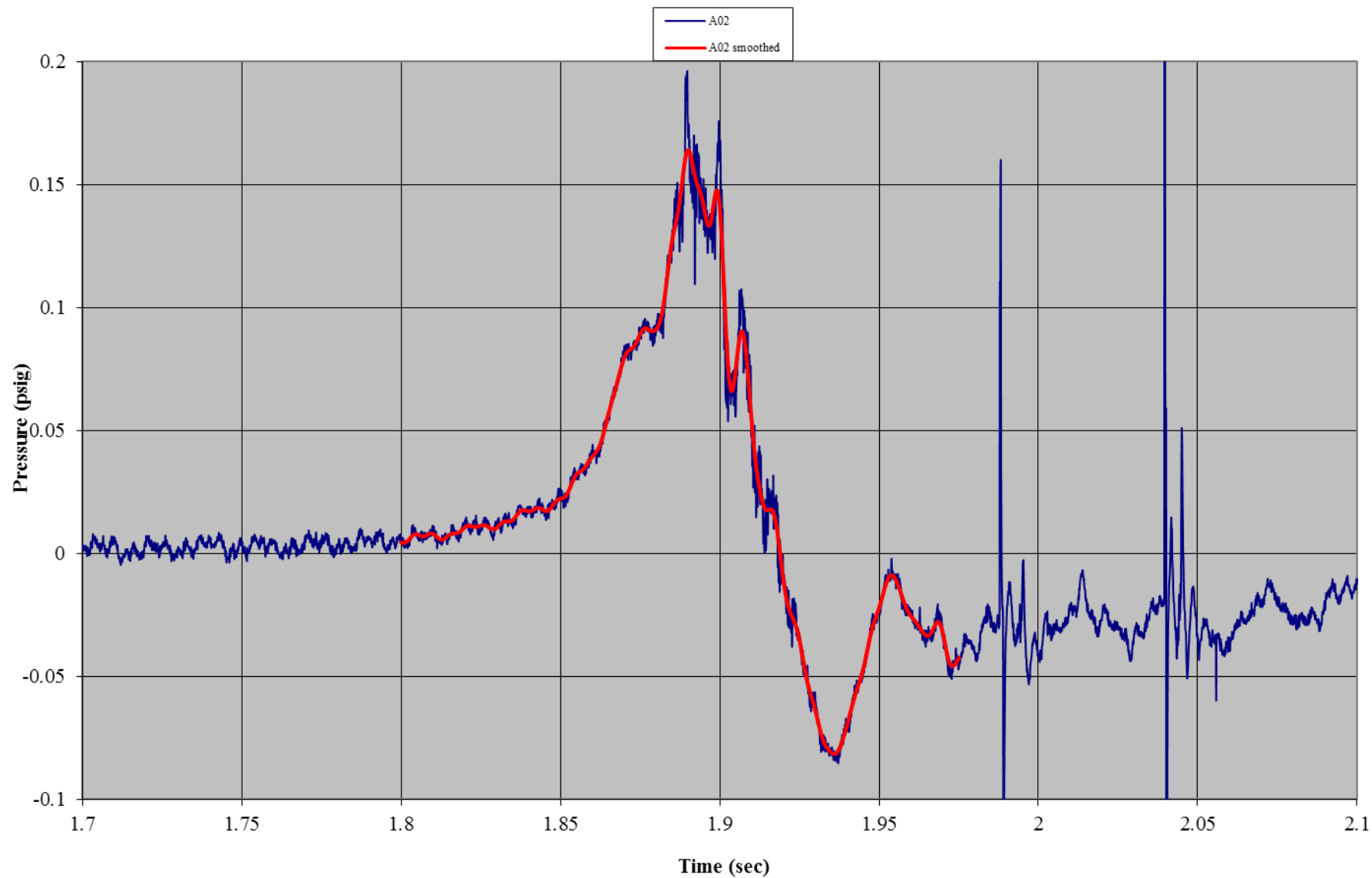
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



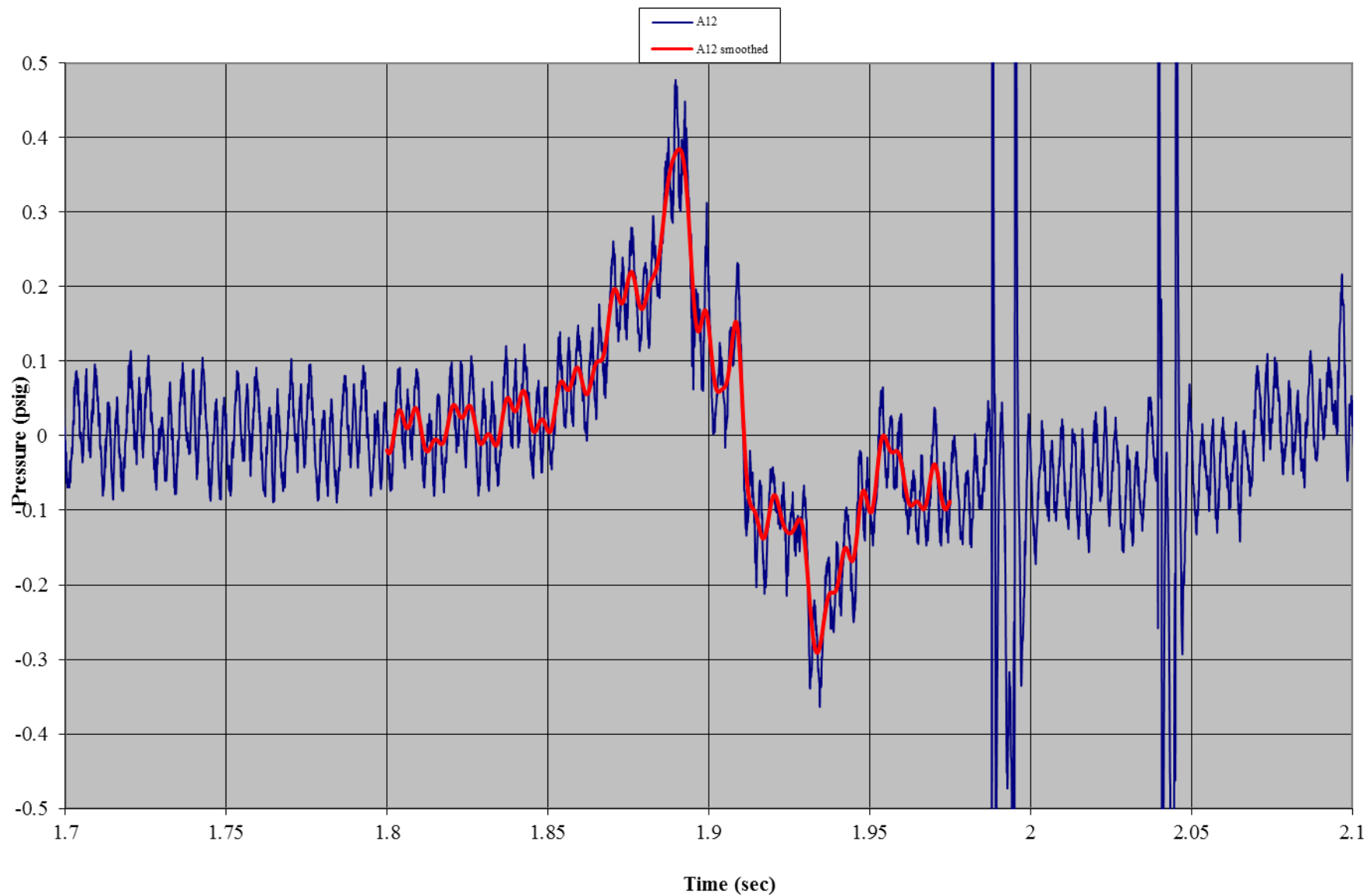
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 06: Front Wall, Center Top



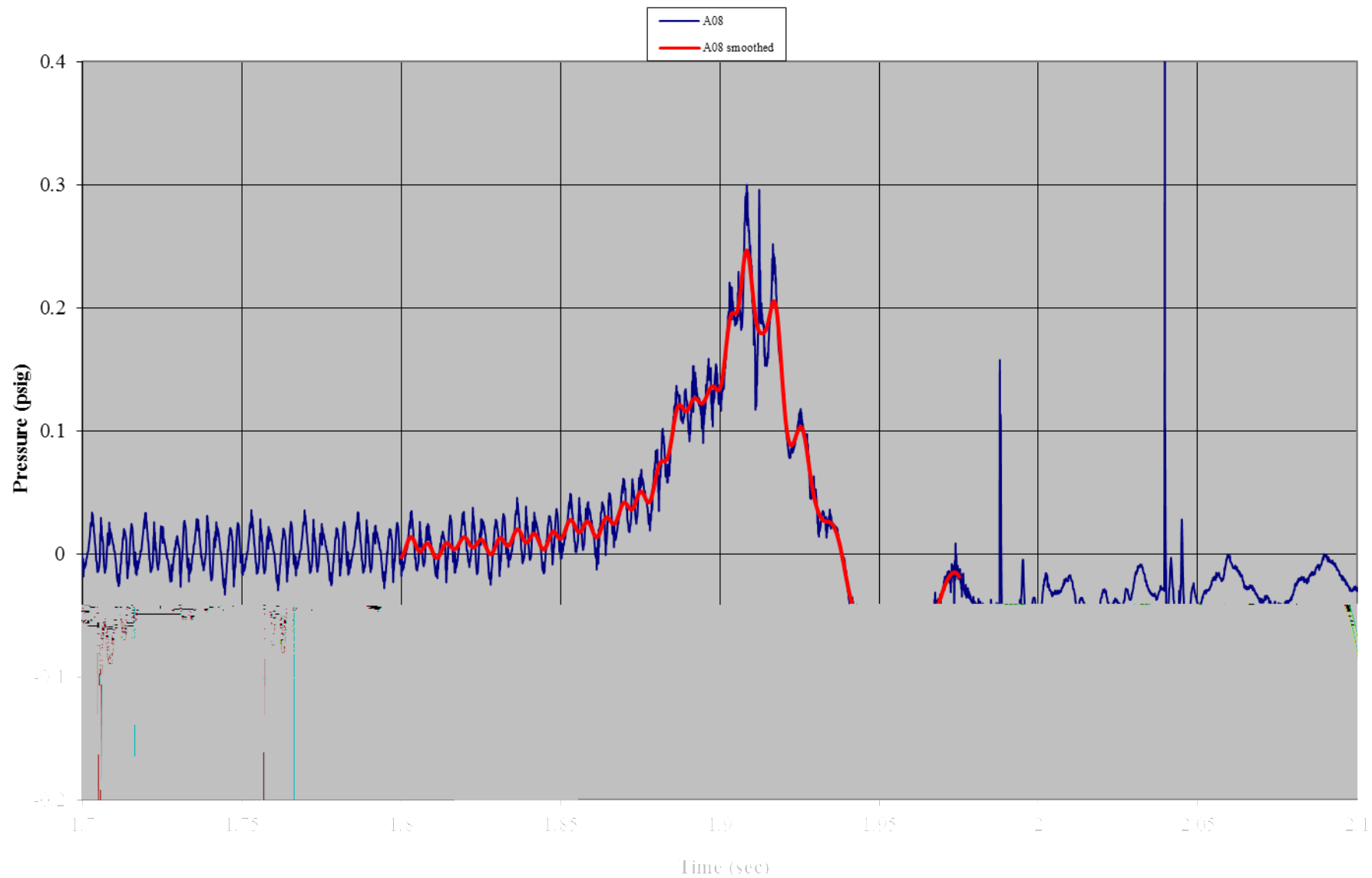
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



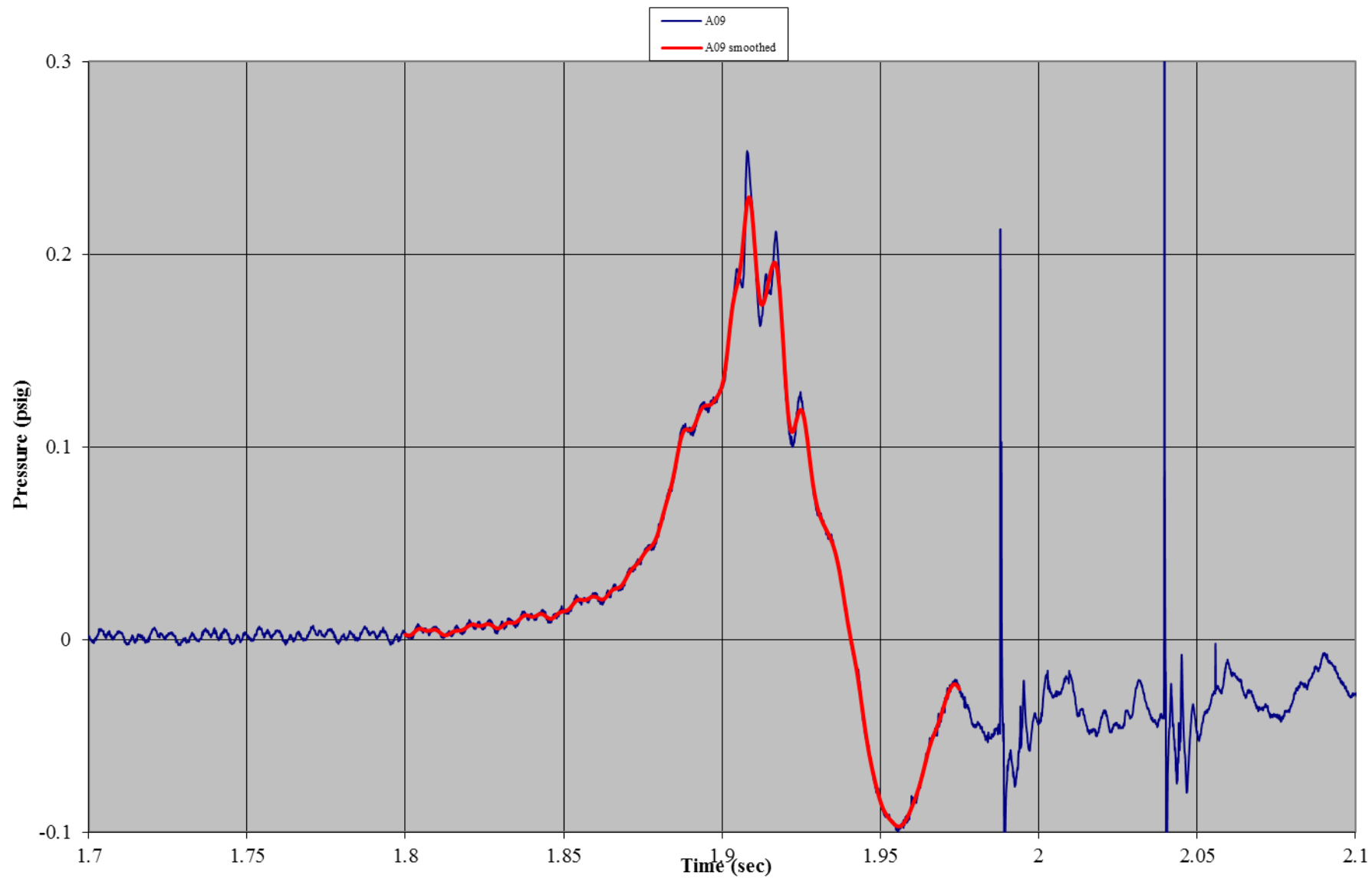
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



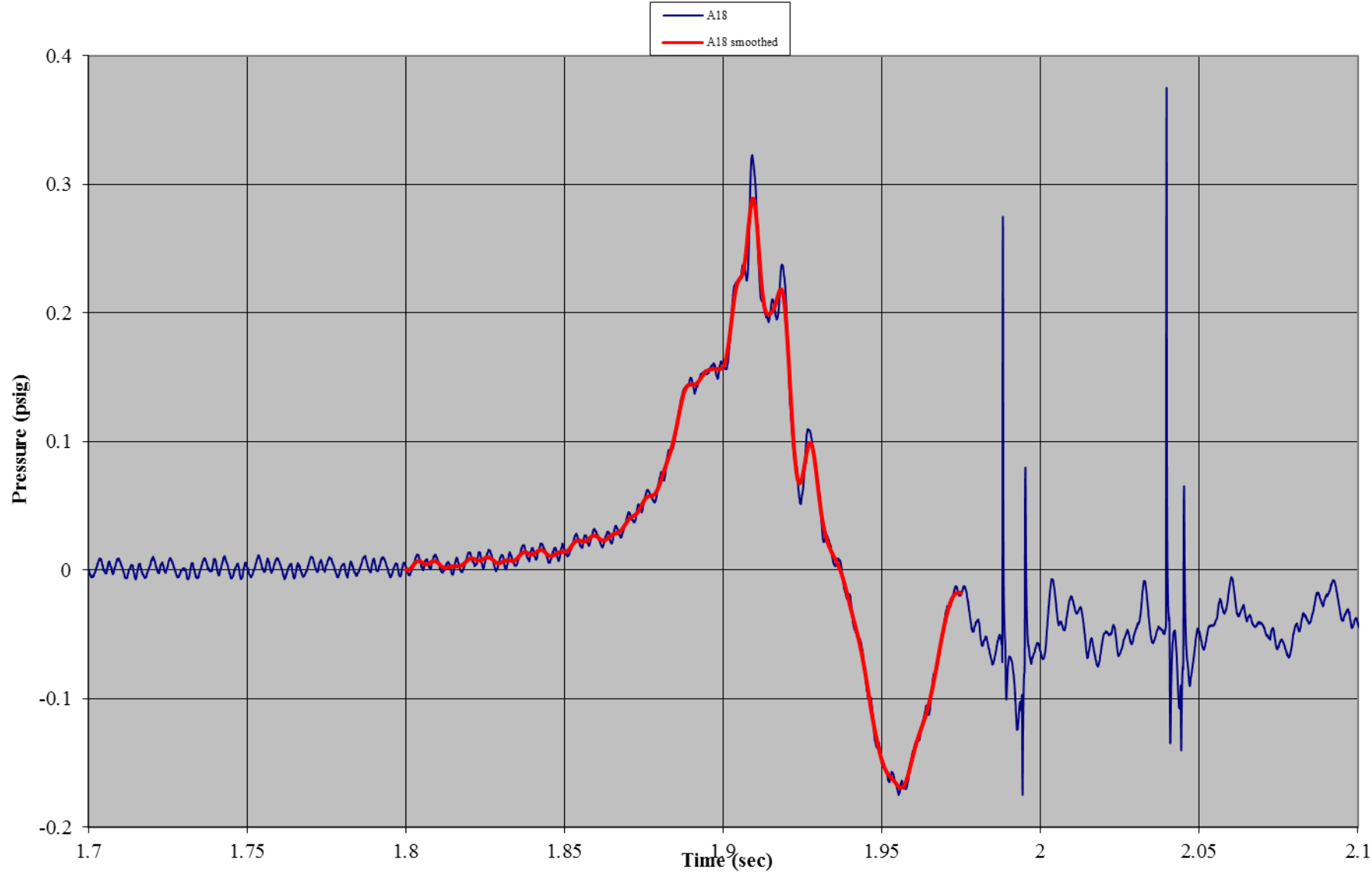
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 08: Left Side Wall, Bottom



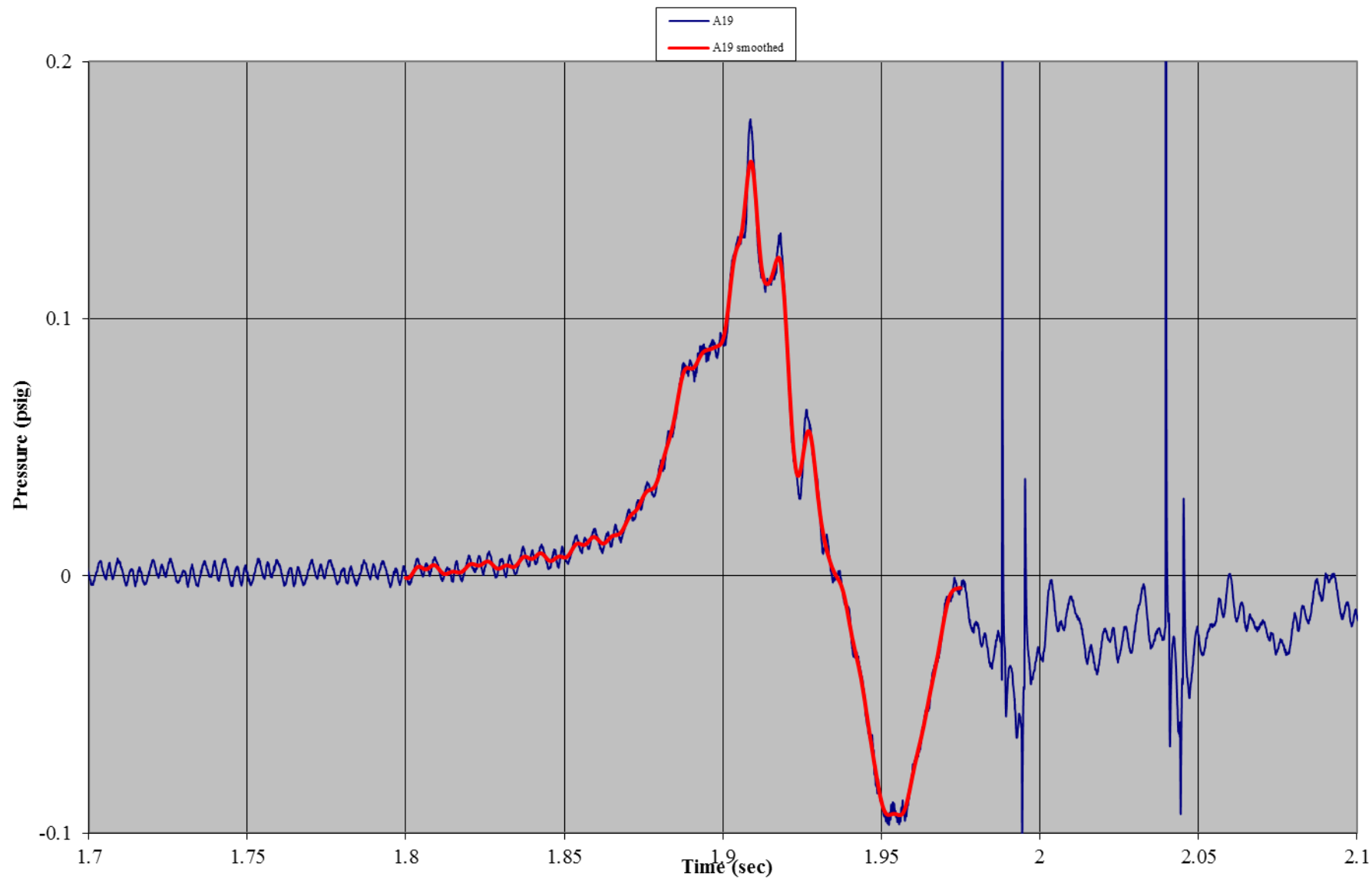
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



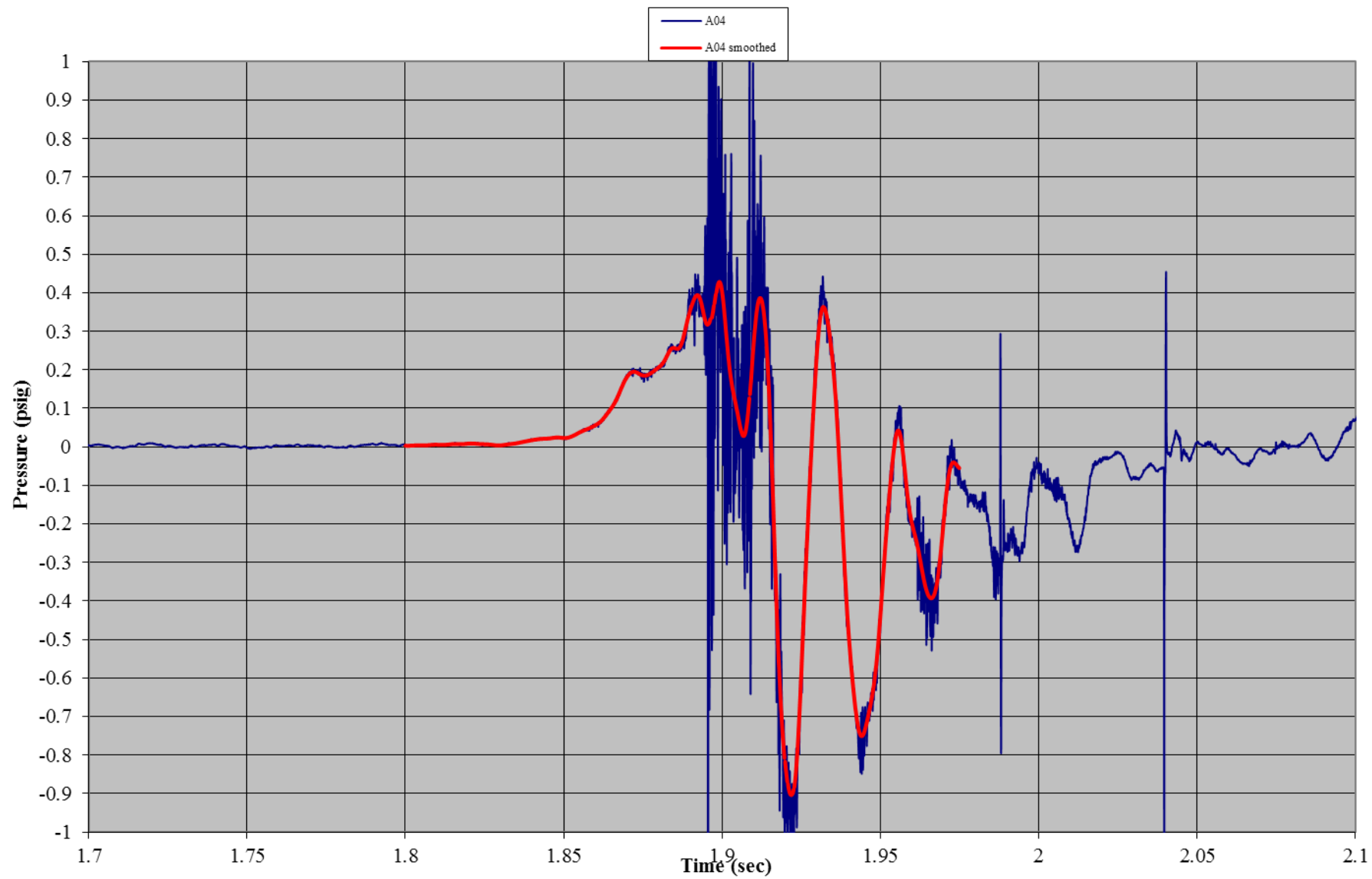
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 18: Right Side Wall, Bottom



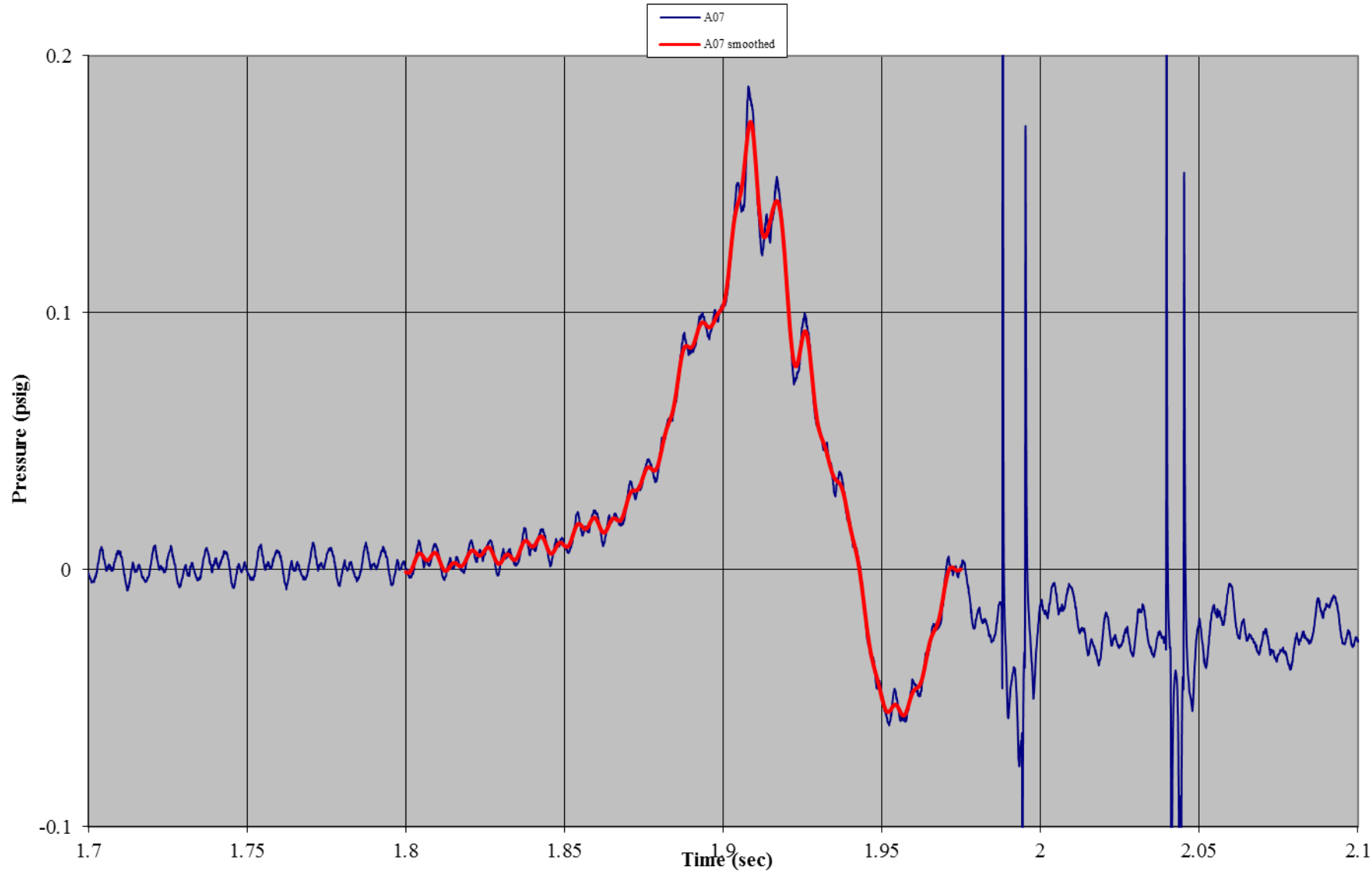
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



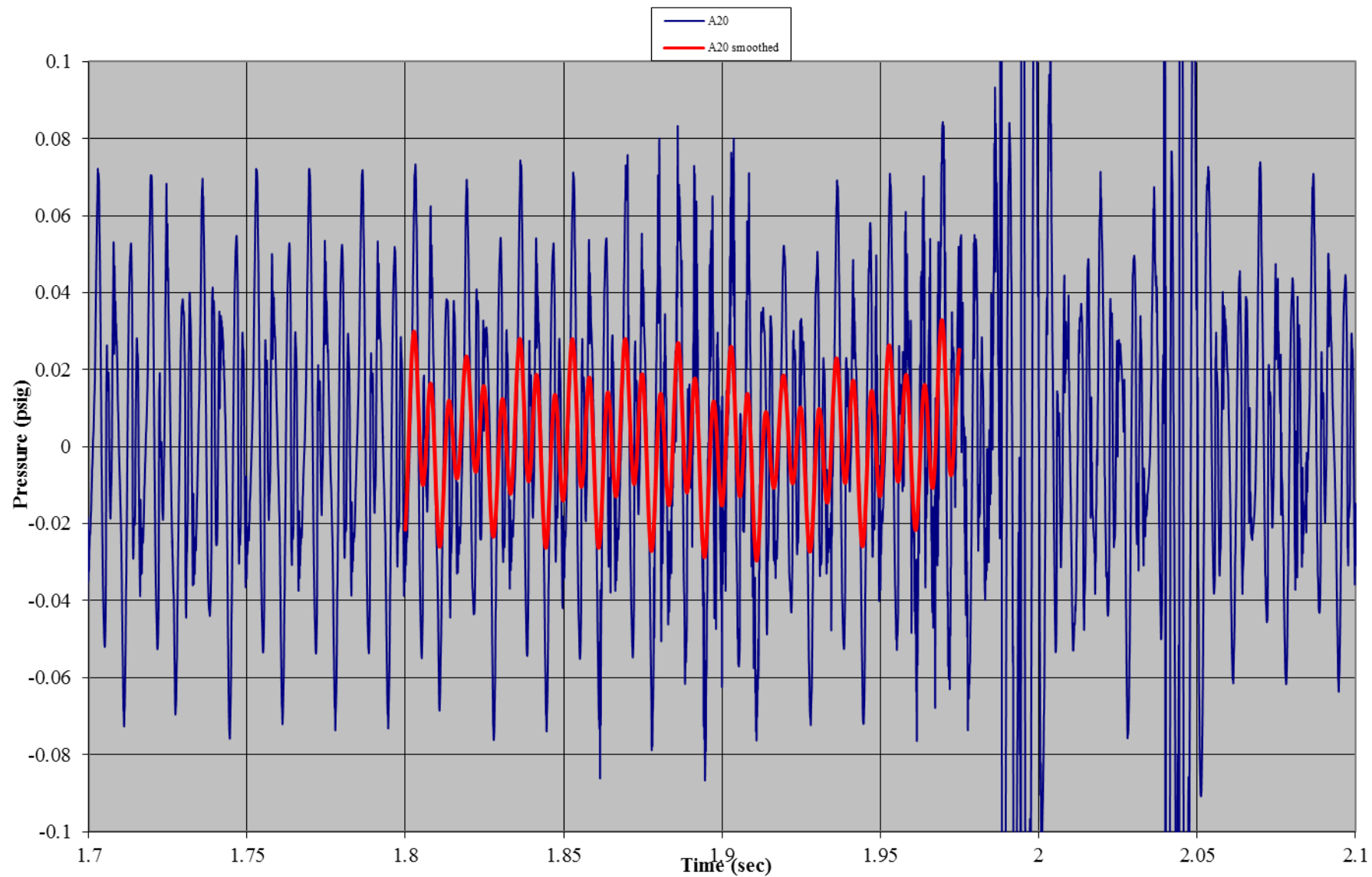
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 04: Interior, Ground



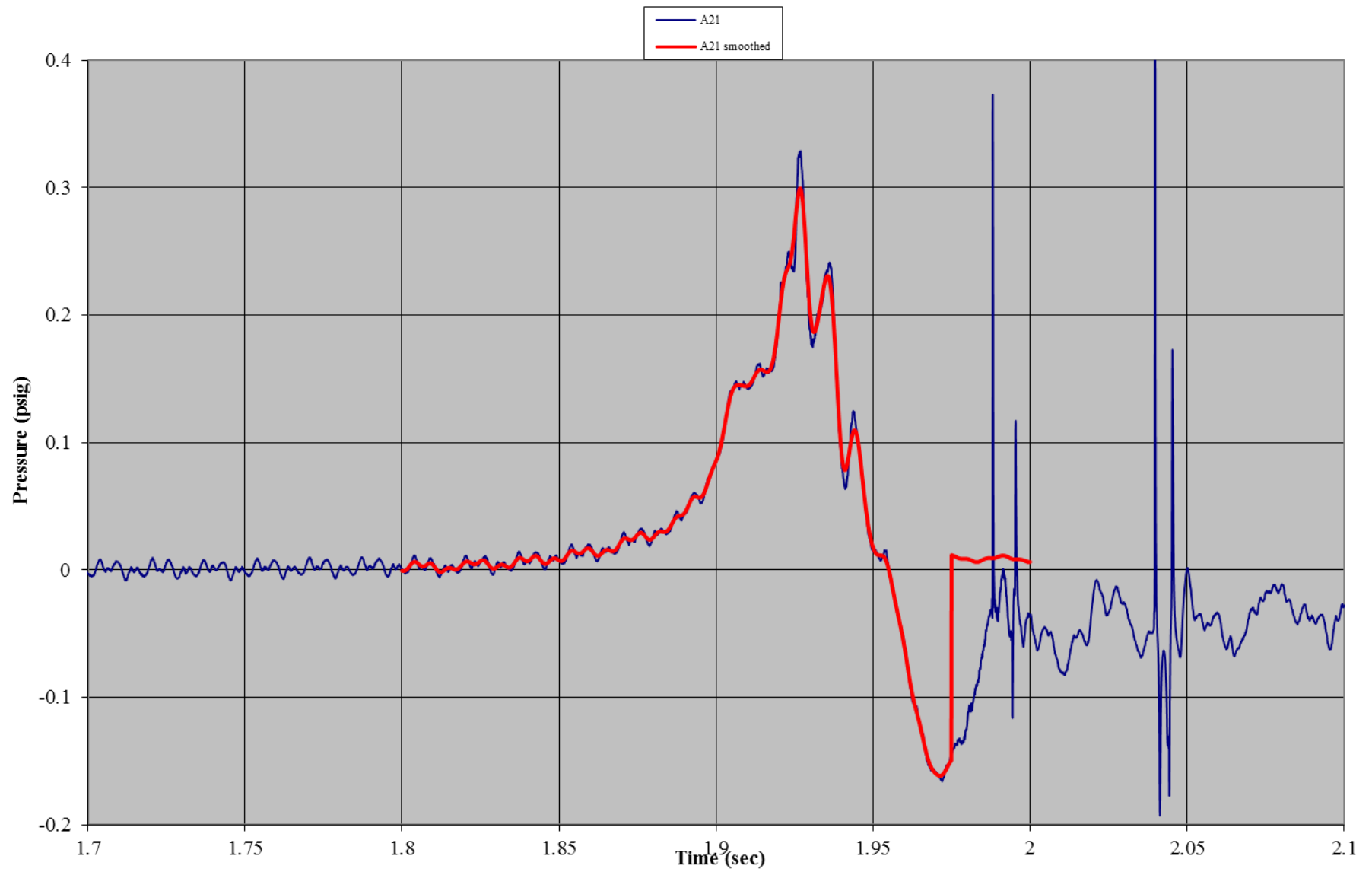
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 07: Roof, Front



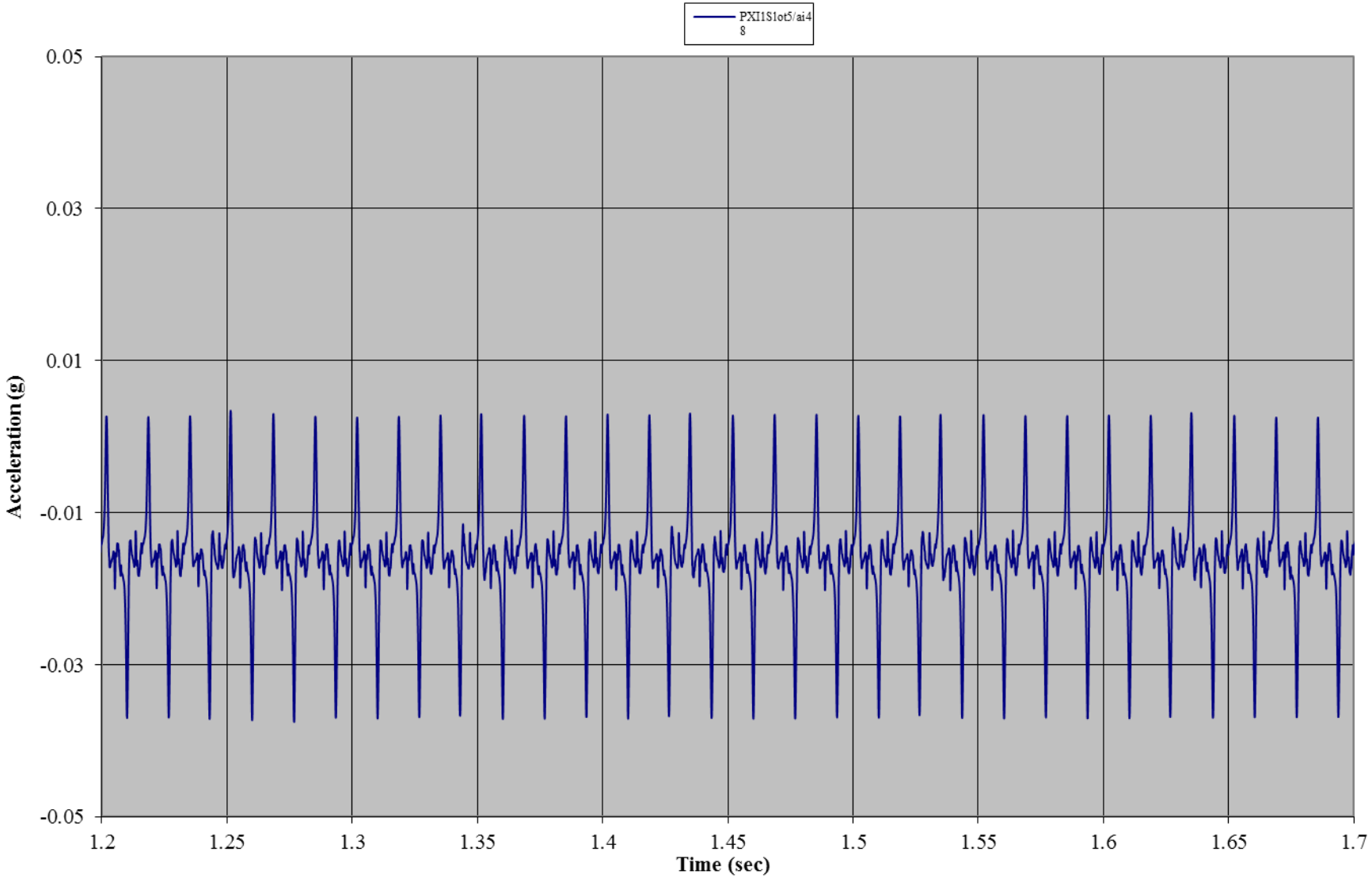
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 20: Roof, Back



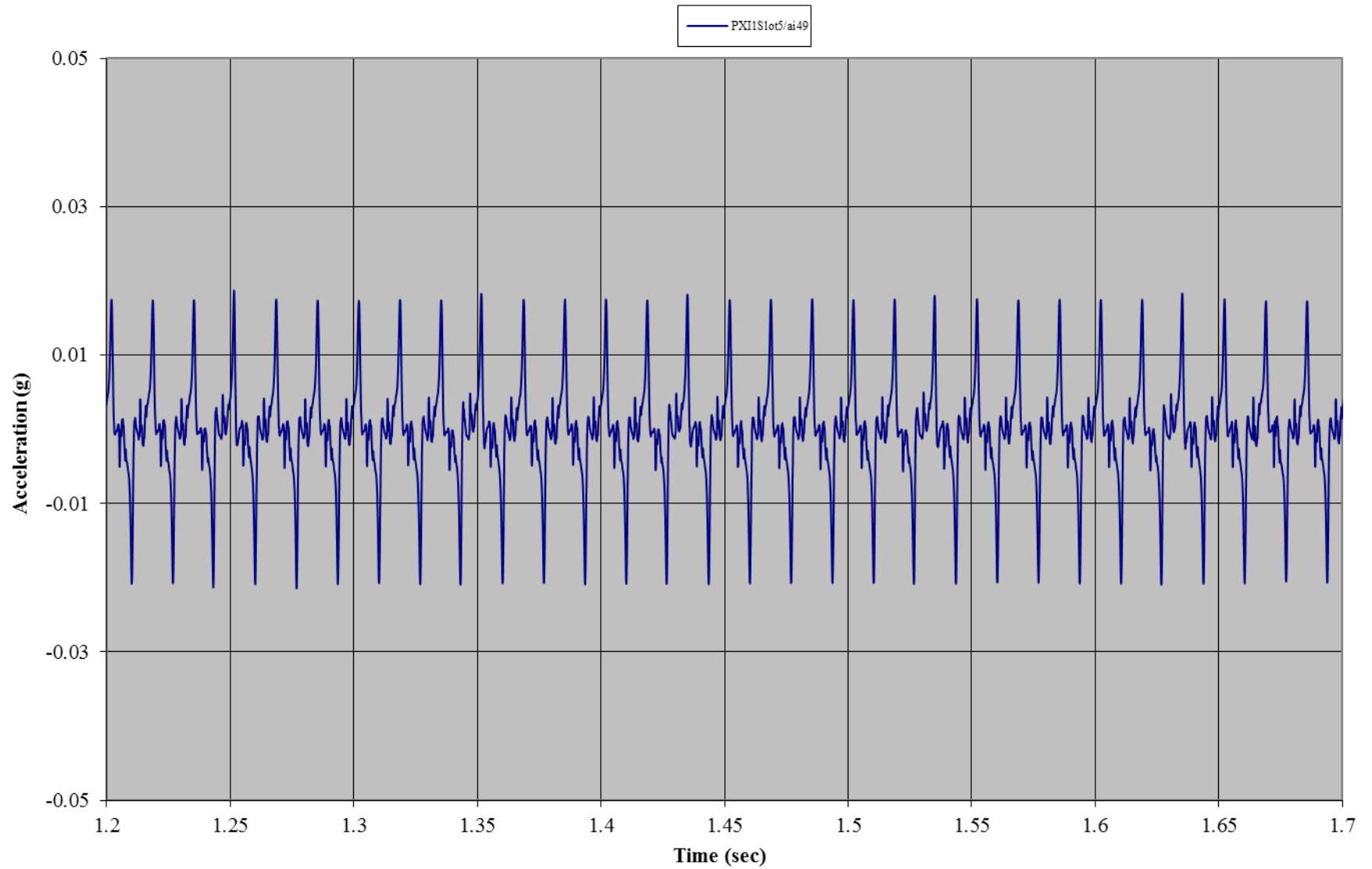
Test B01: Non-Wind Rated Pole Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



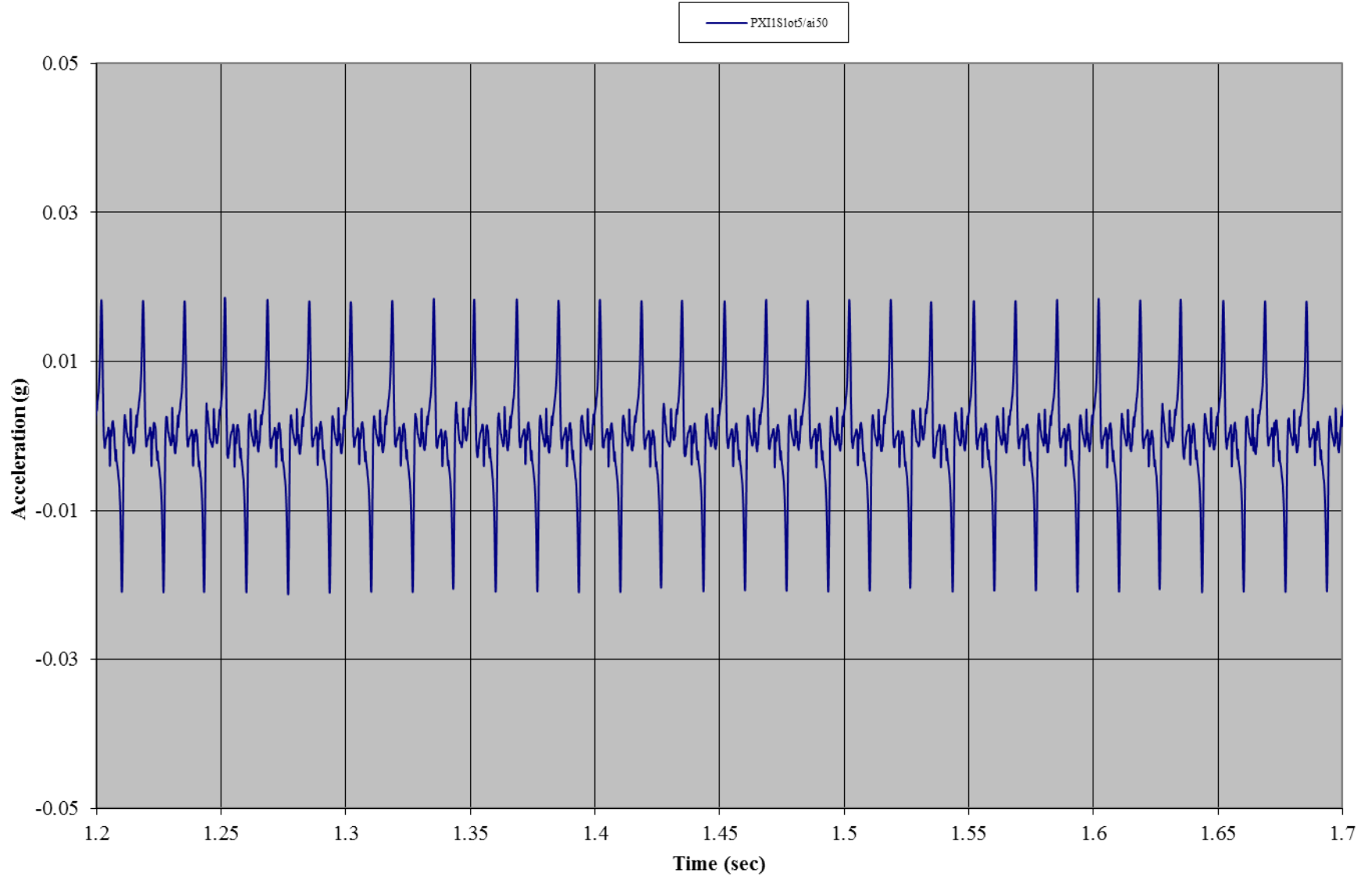
Test B01: Non-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (x-direction)



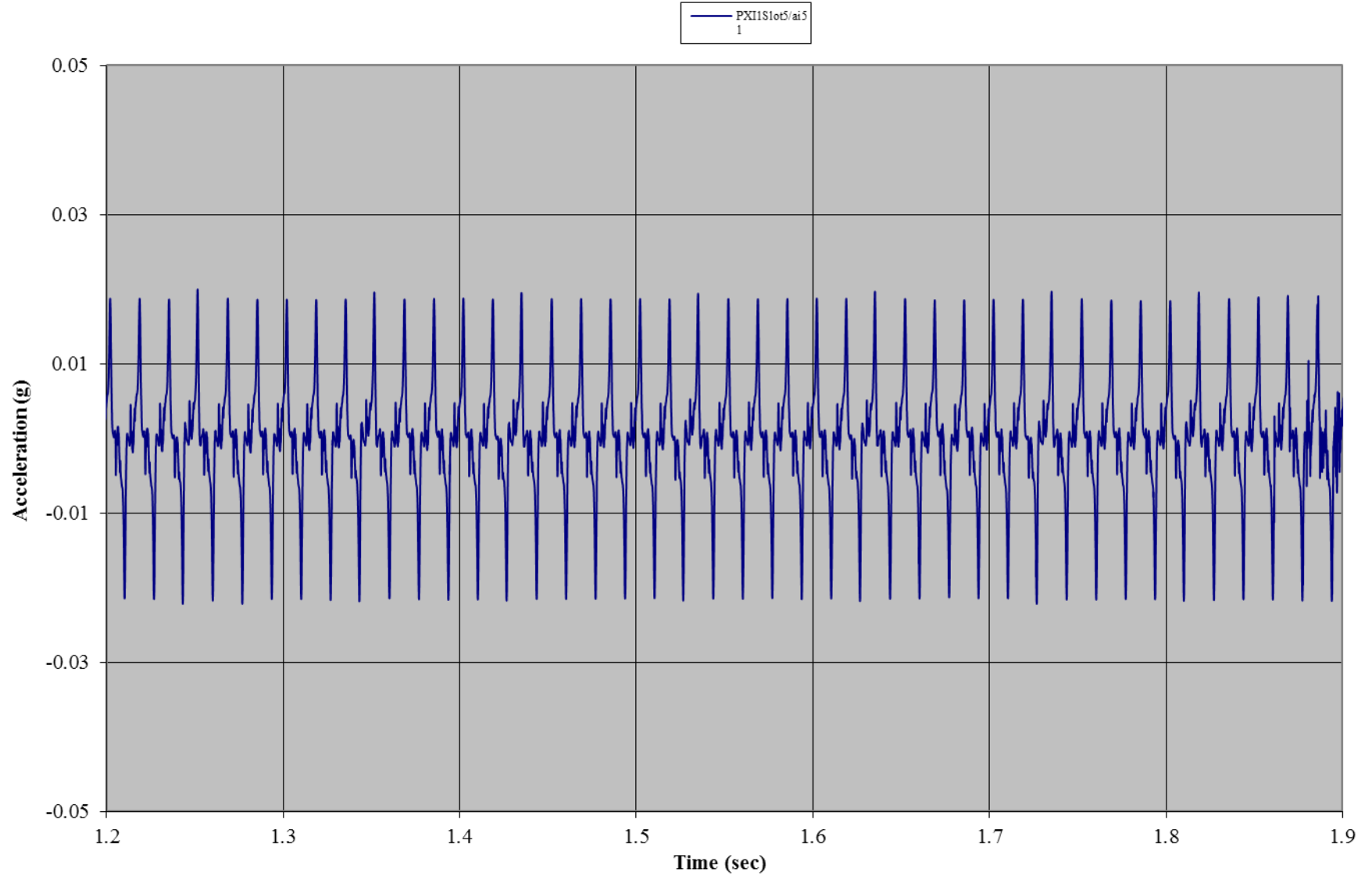
Test B01: Non-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (y-direction)



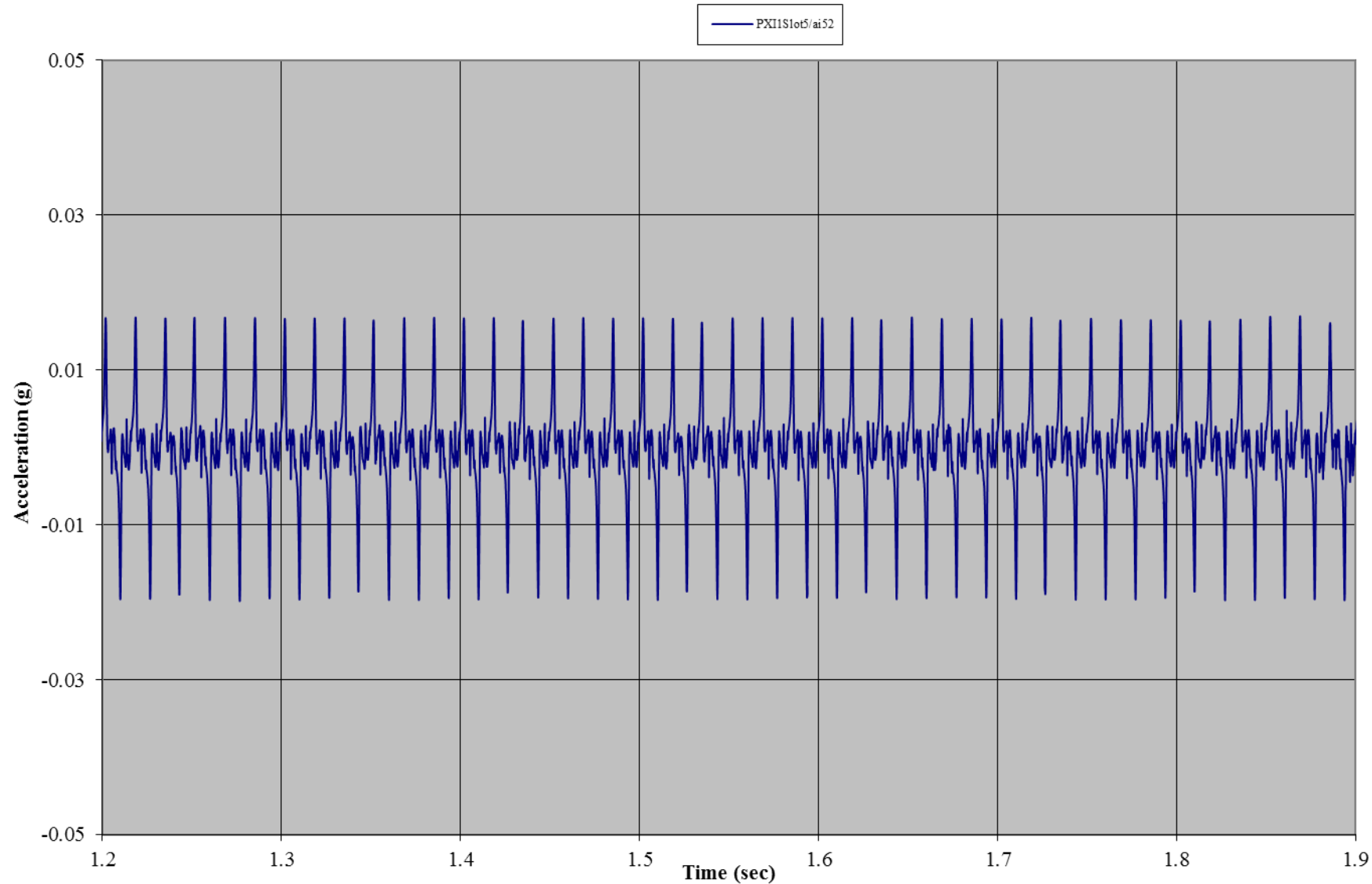
Test B01: Non-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (z-direction)



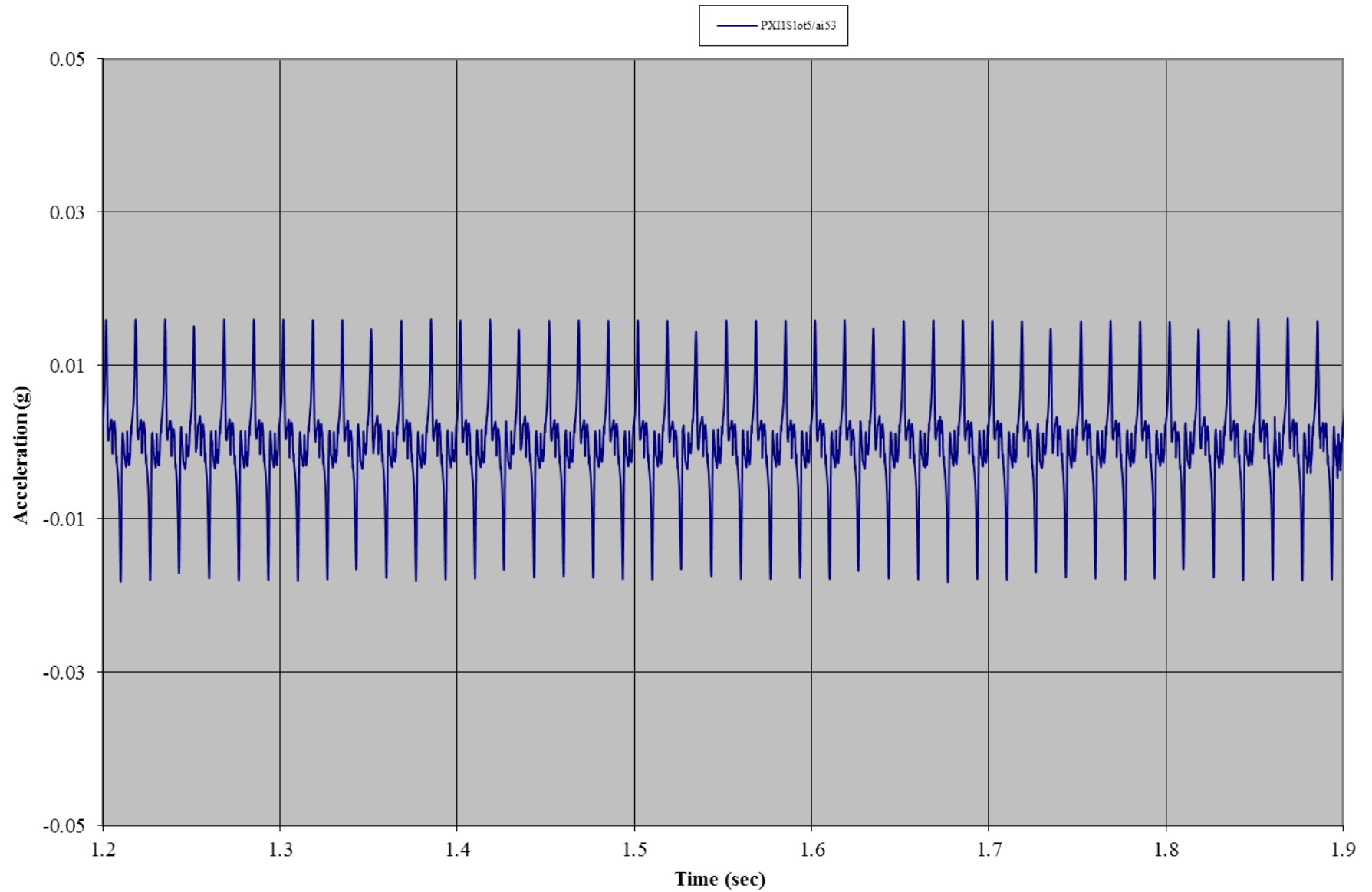
Test B01: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (x-direction)



Test B01: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (y-direction)

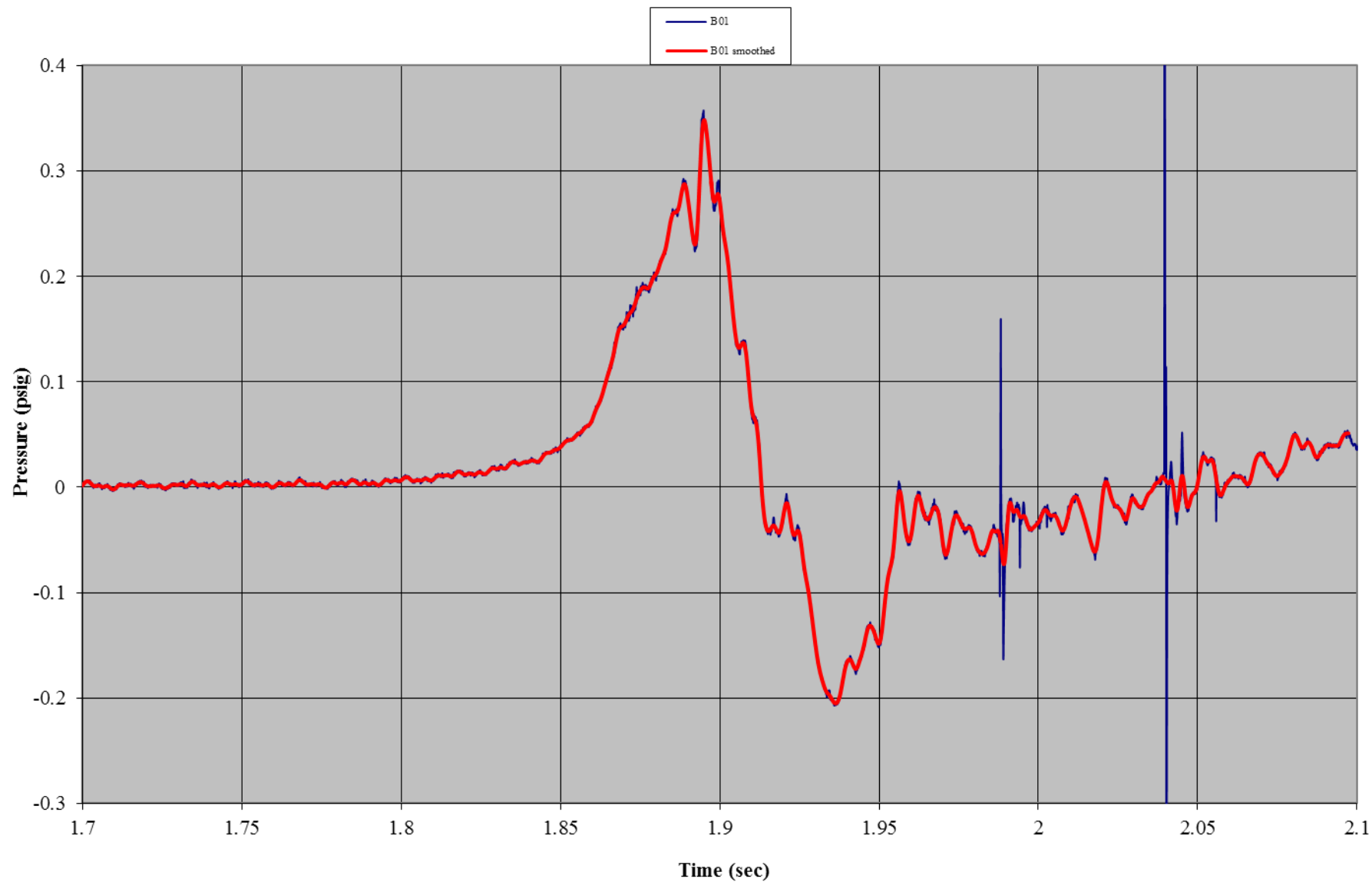


Test B01: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (z-direction)

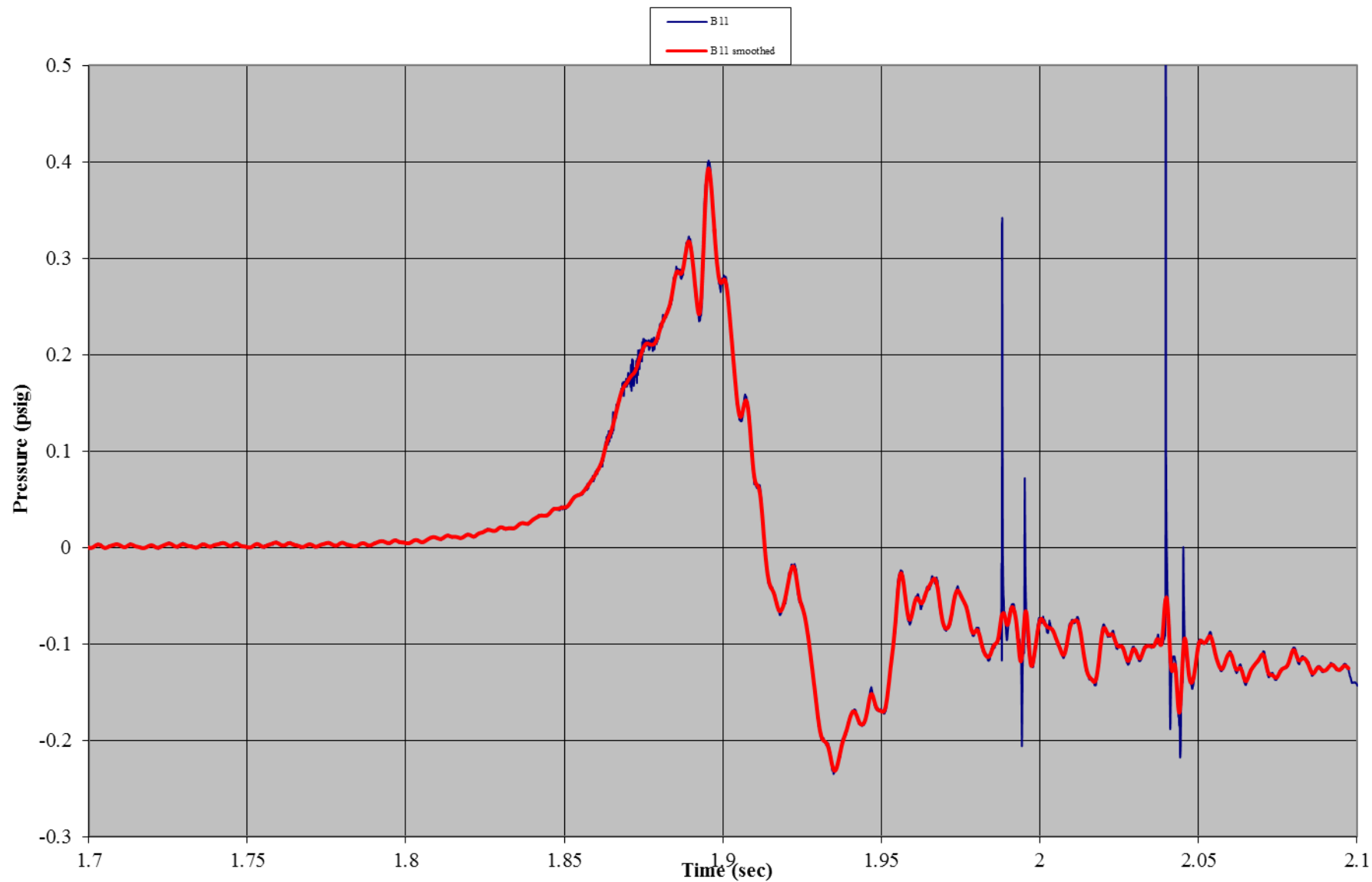


Test B01: Tent B

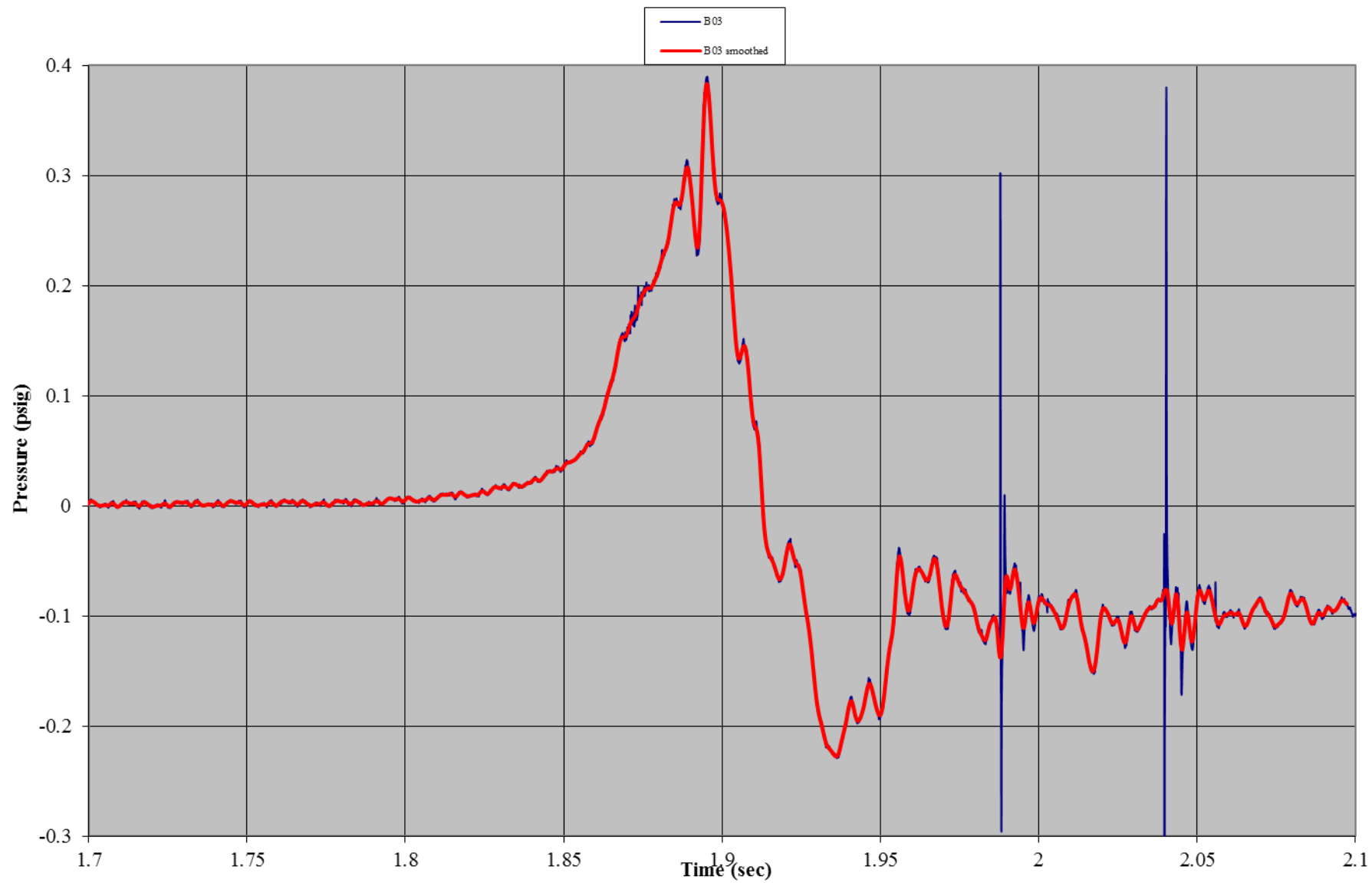
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 01: Front Wall, Left Bottom



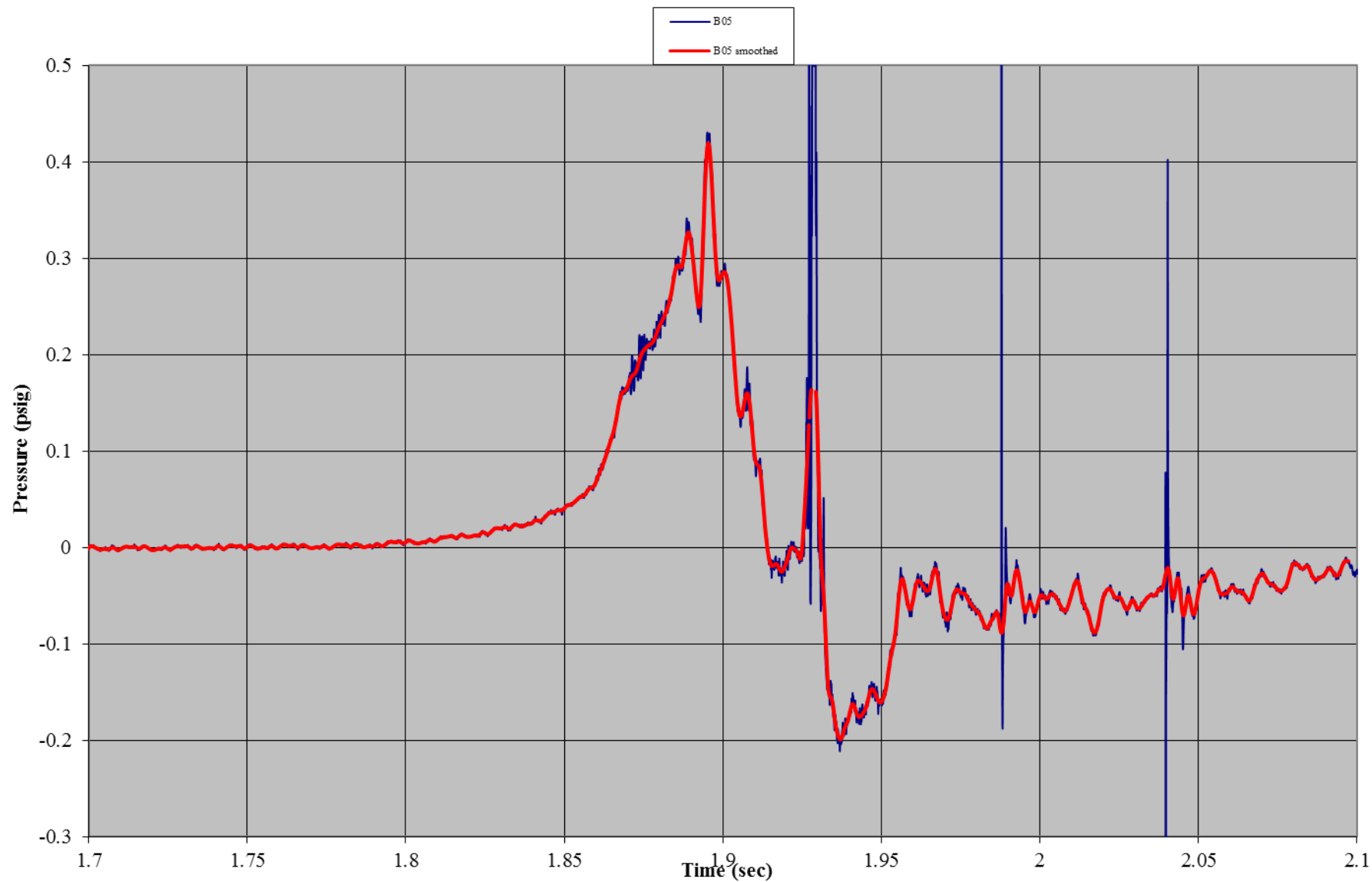
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 11: Front Wall, Right Bottom



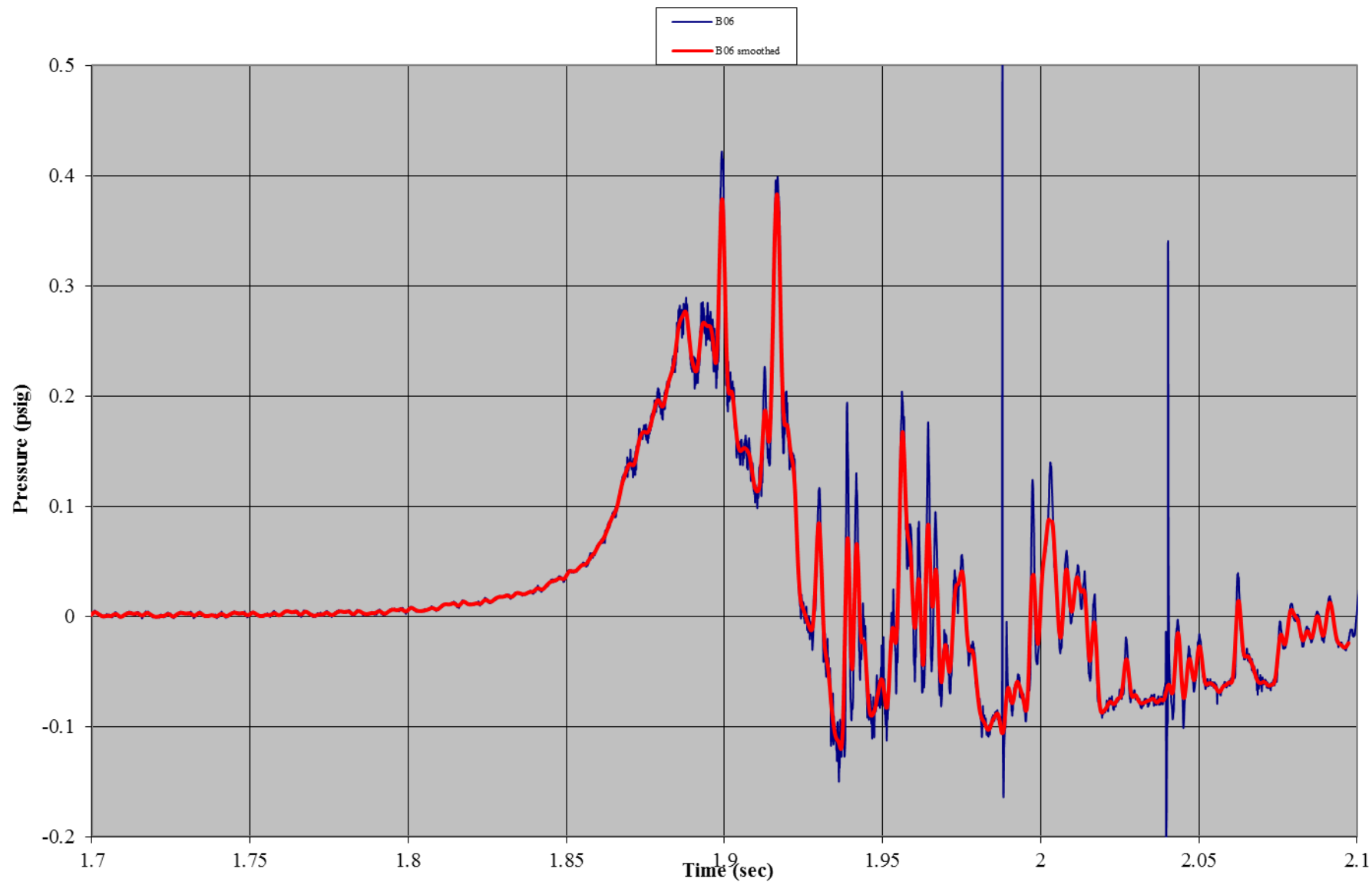
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 03: Front Wall, Center Bottom



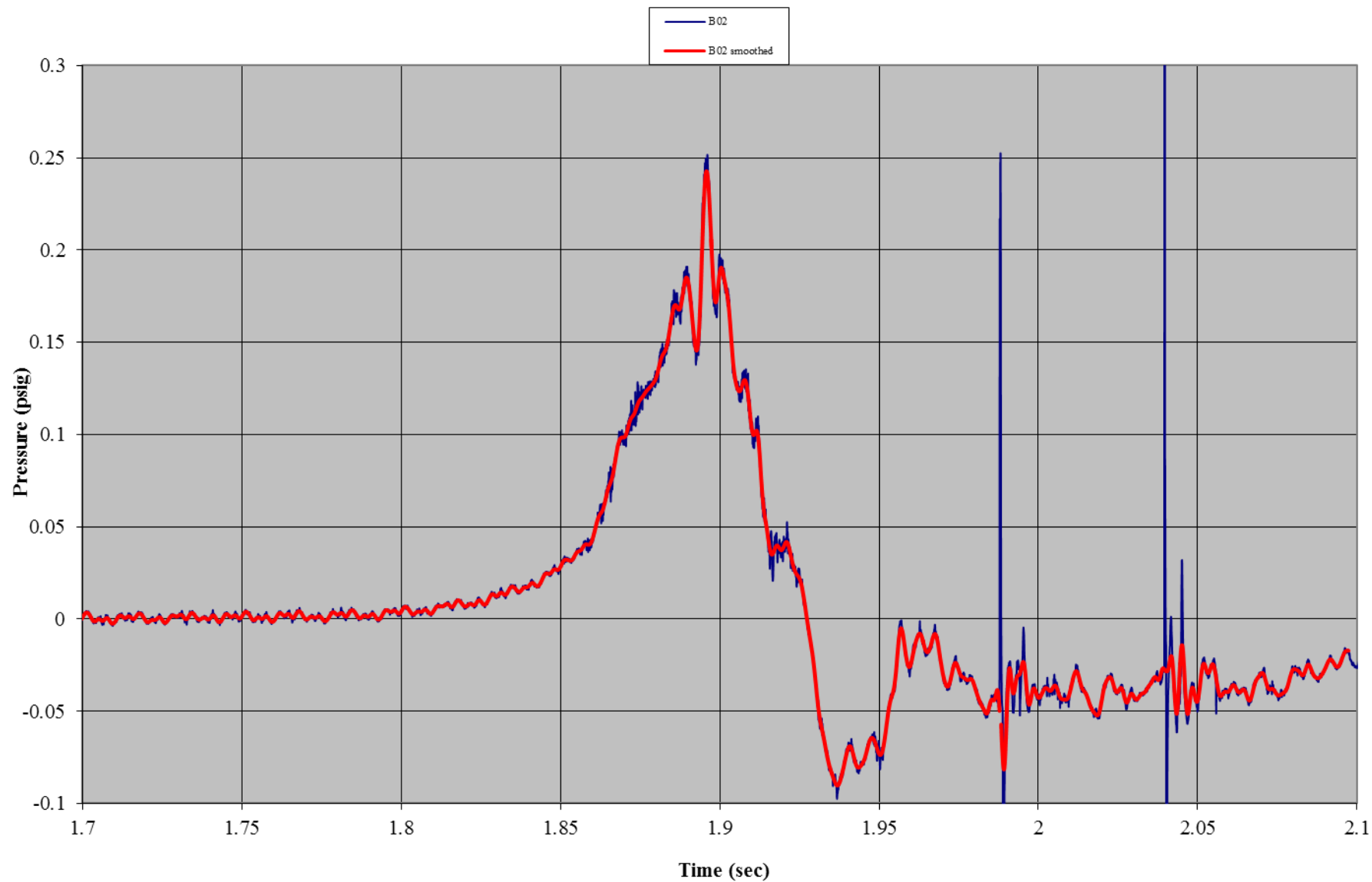
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



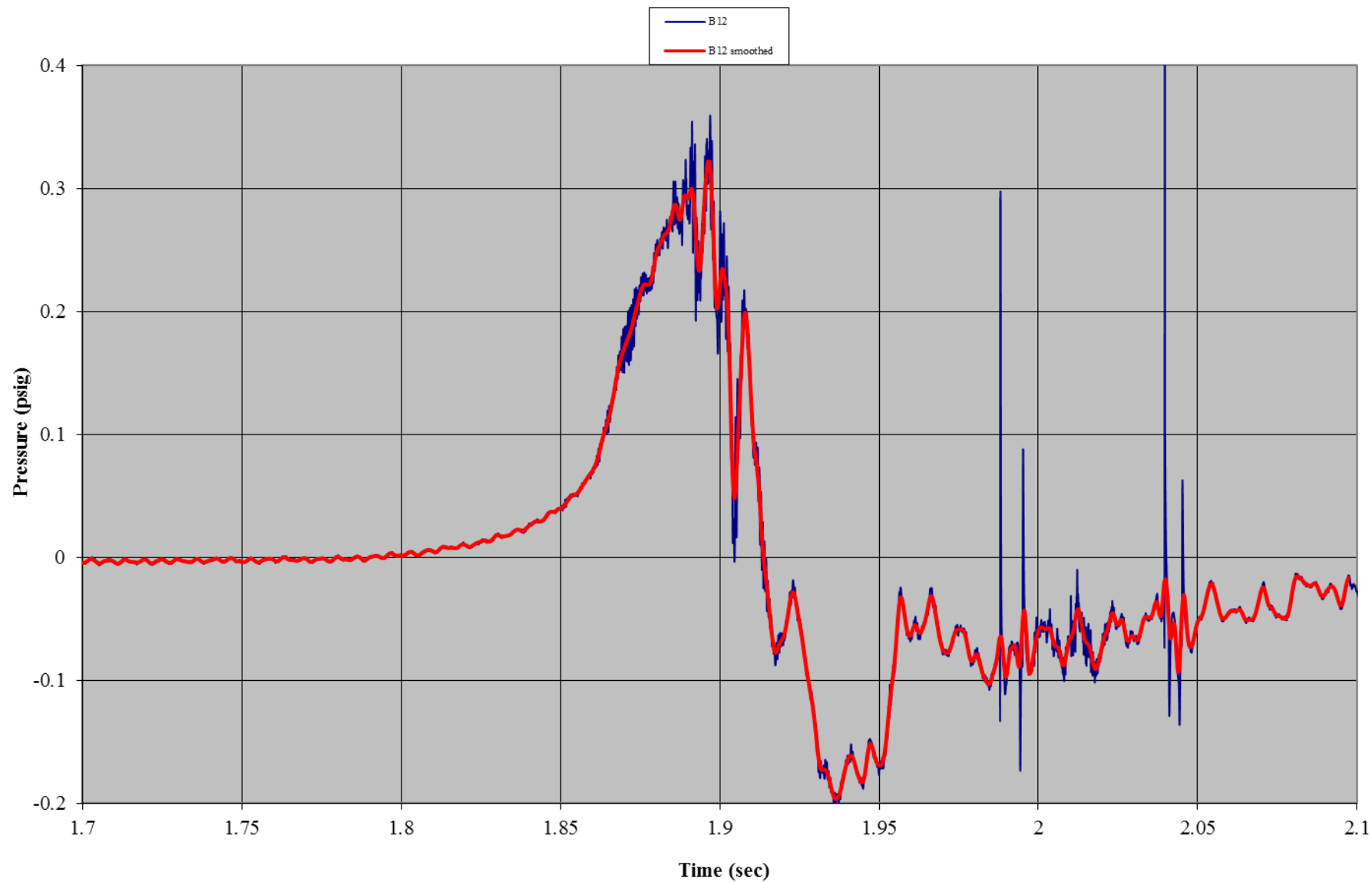
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 06: Front Wall, Center Top



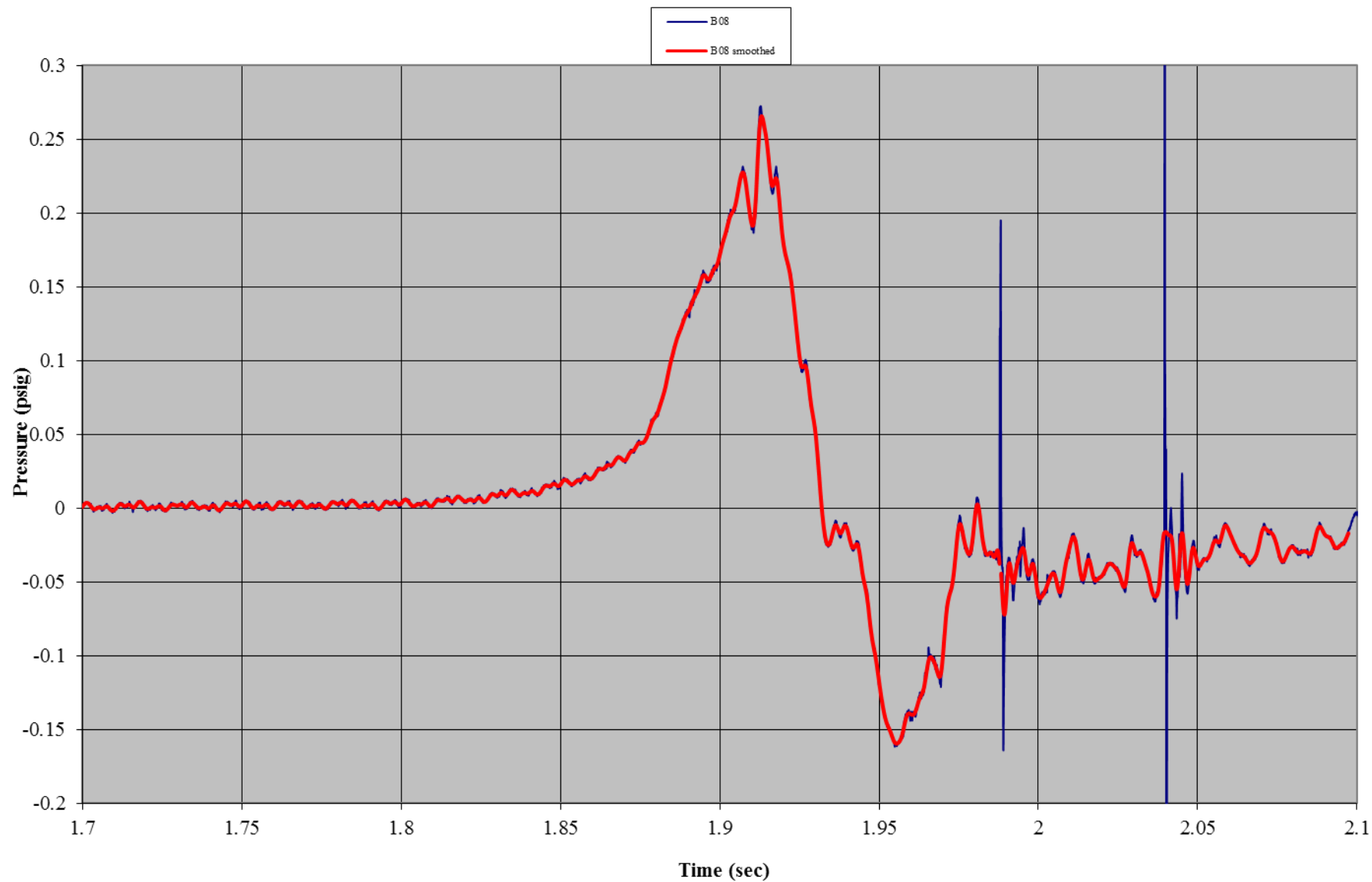
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



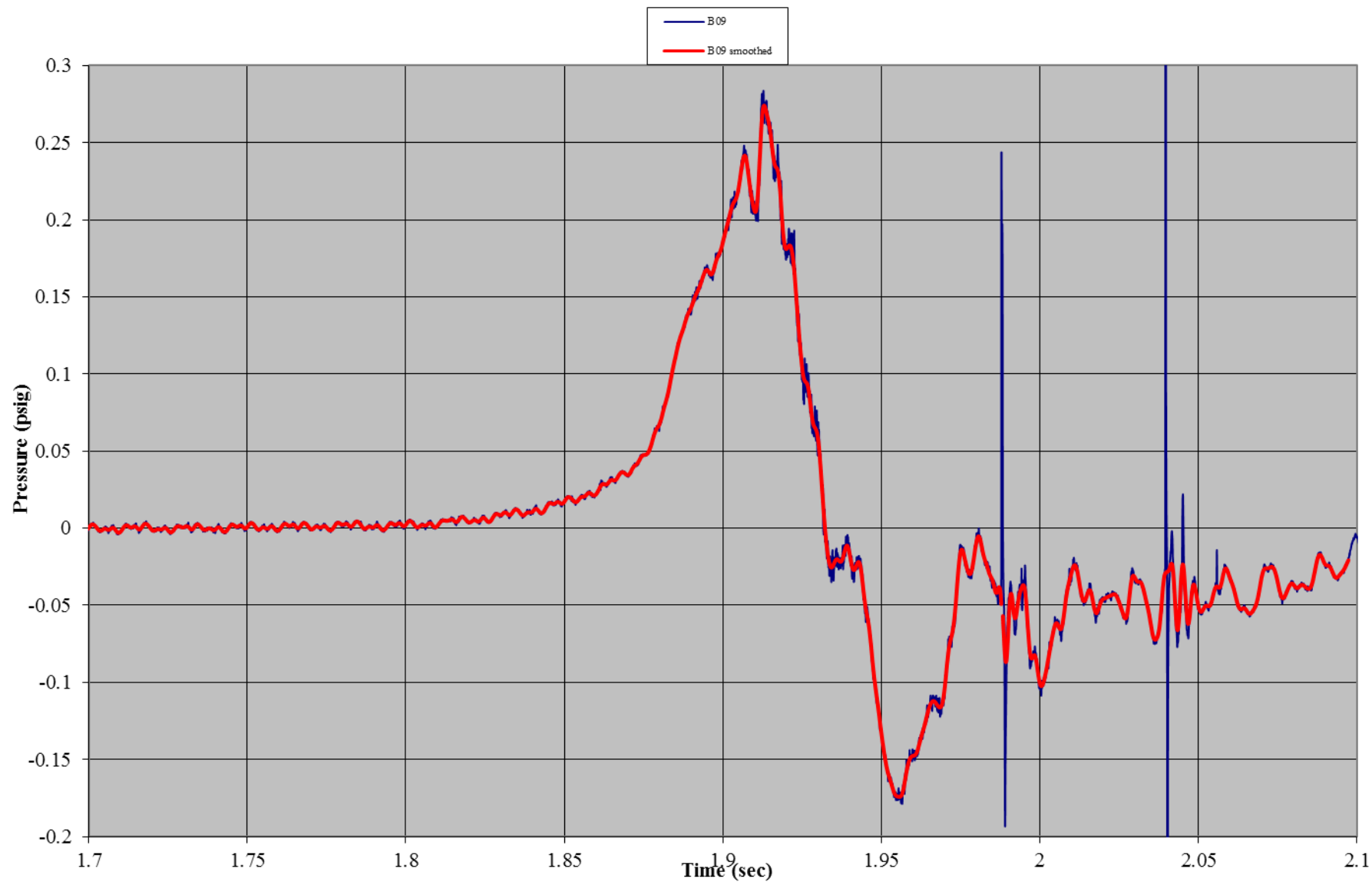
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



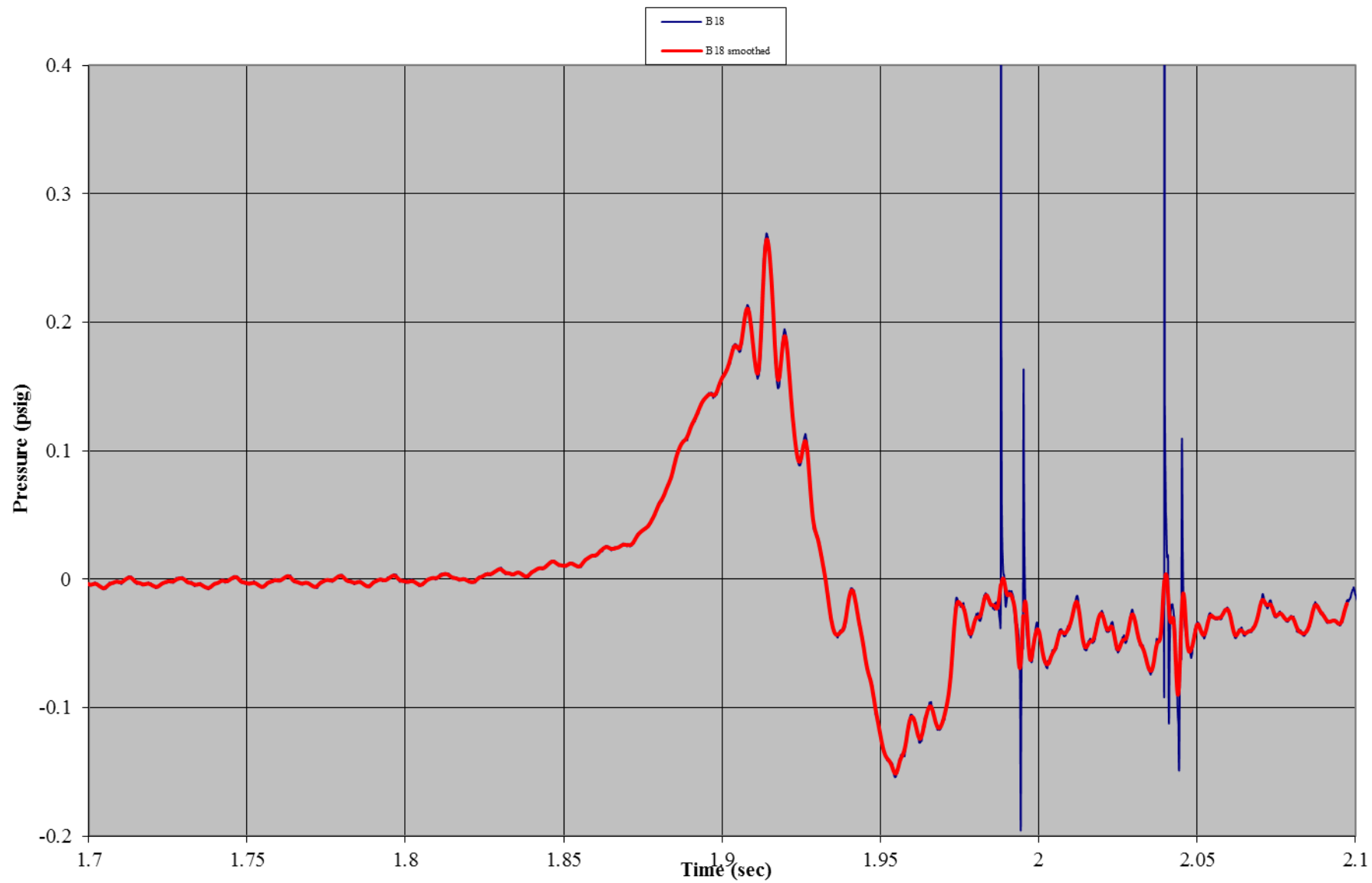
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 08: Left Side Wall, Bottom



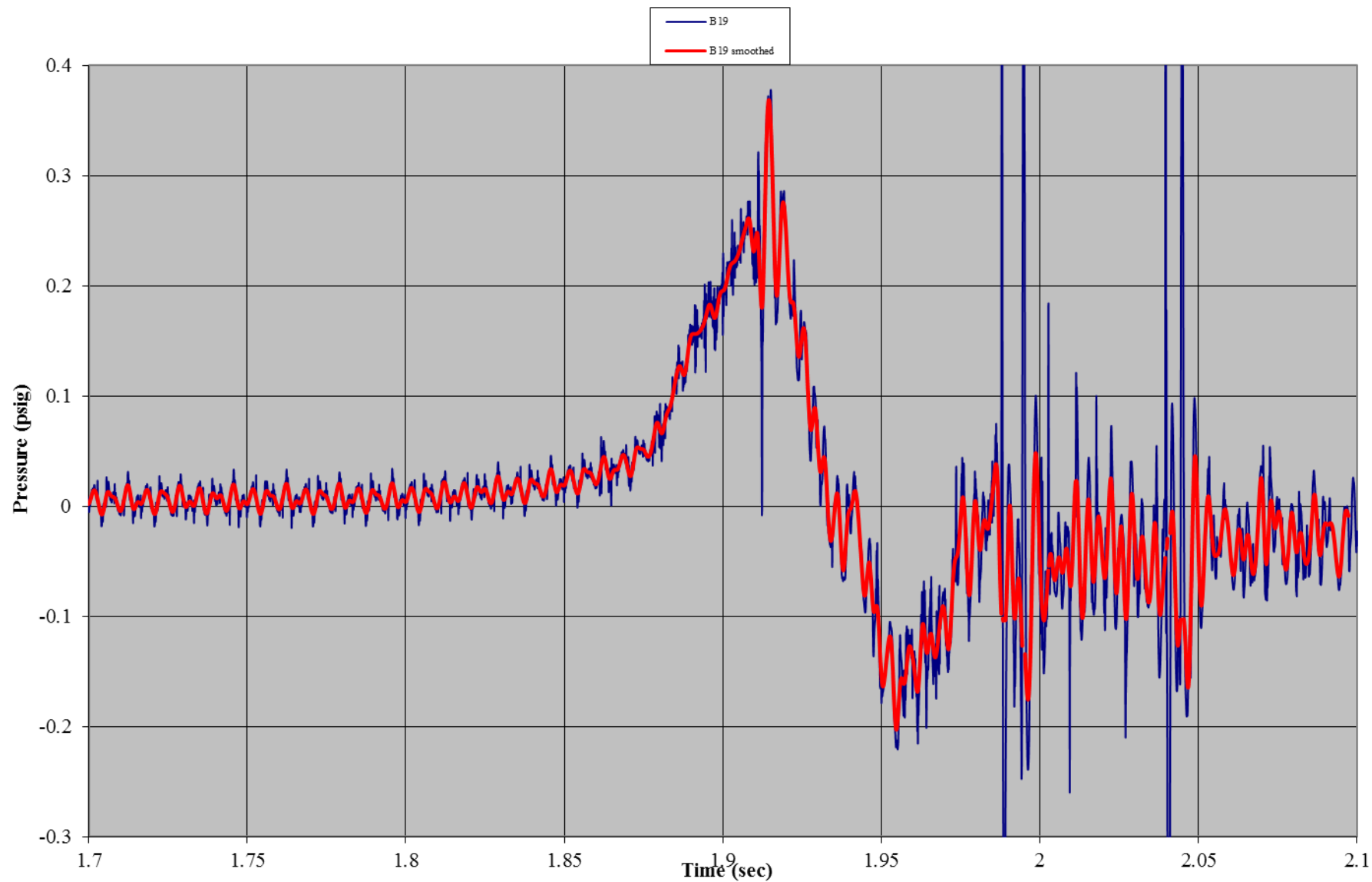
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



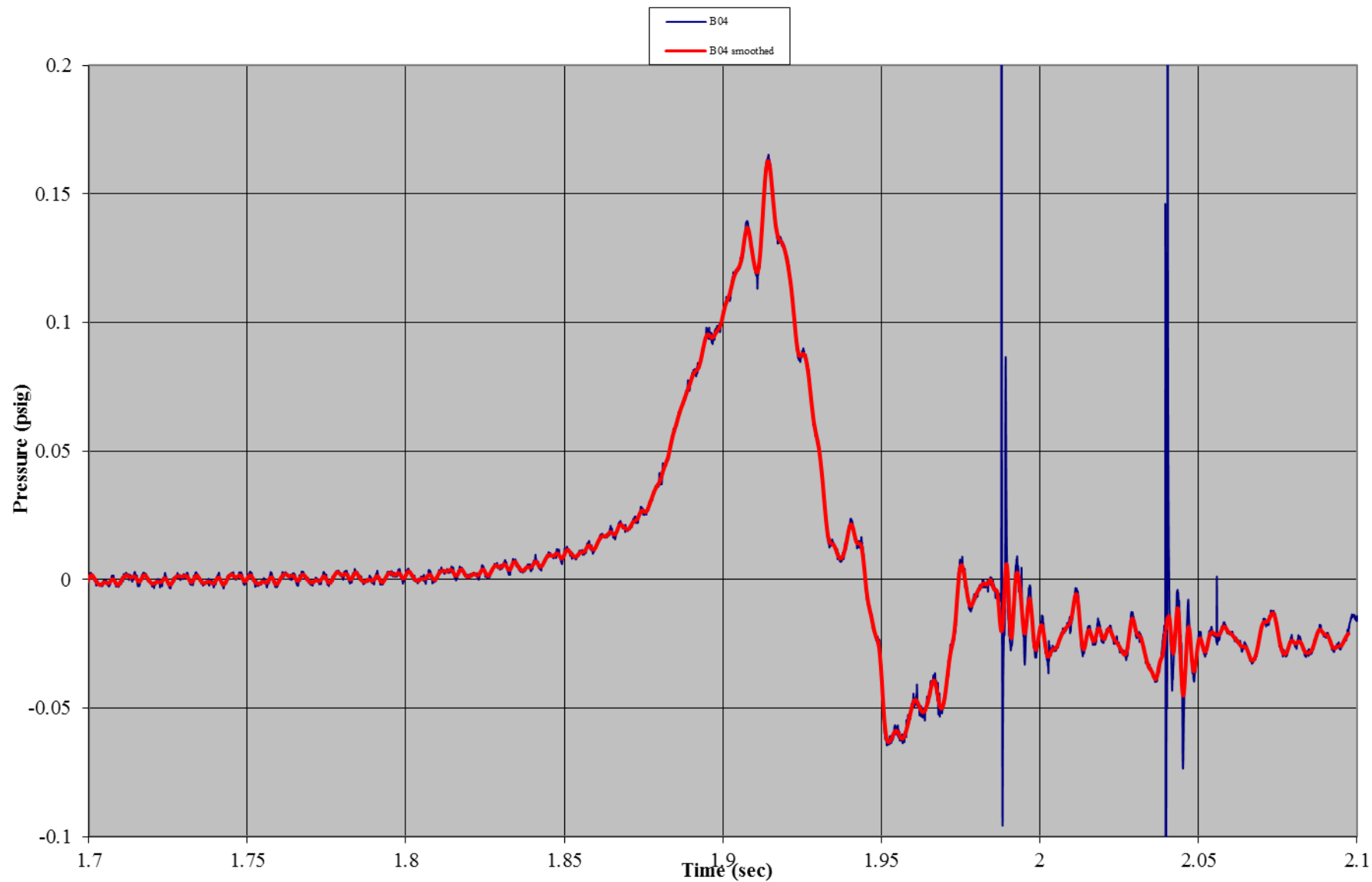
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 18: Right Side Wall, Bottom



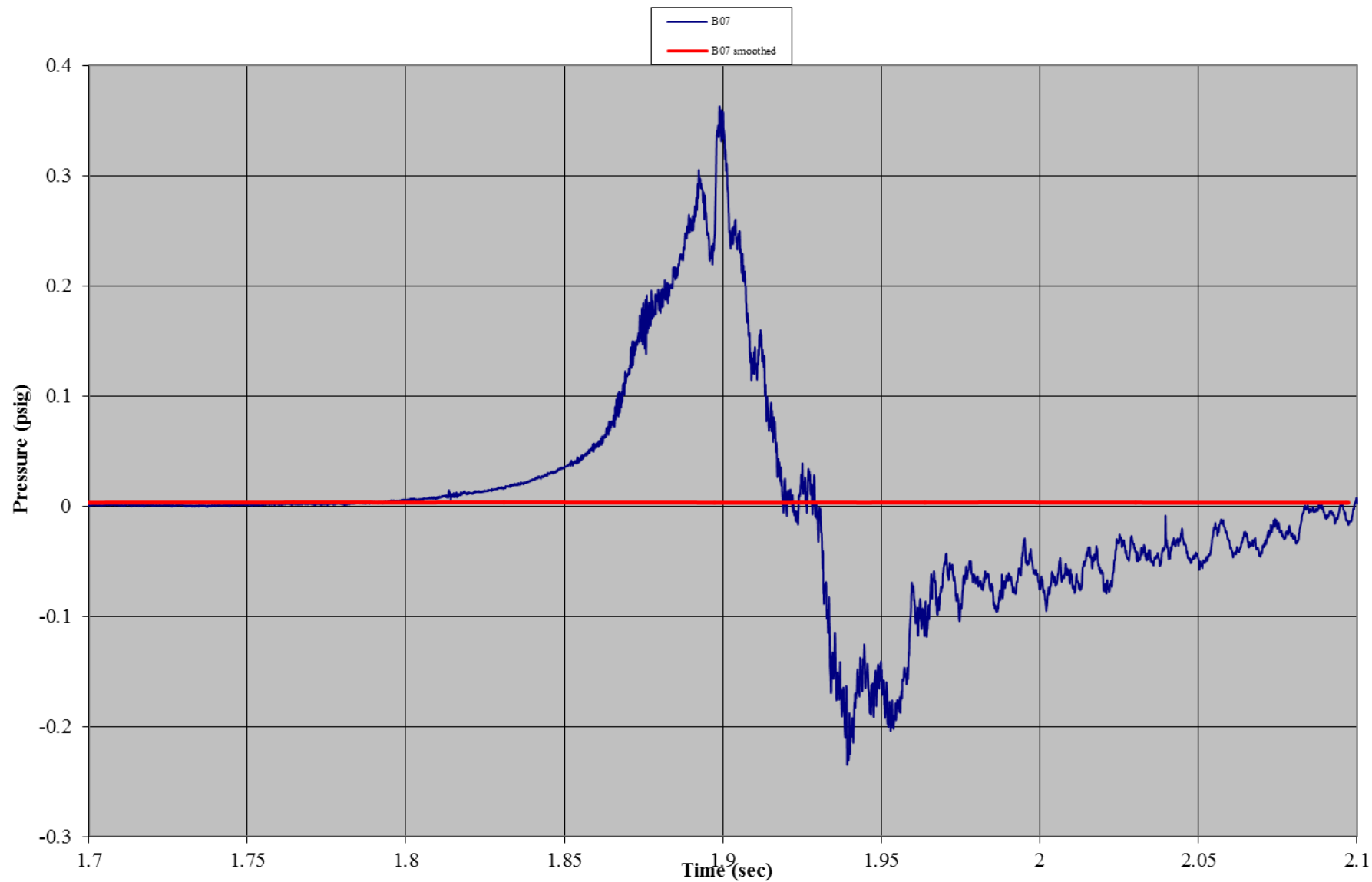
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



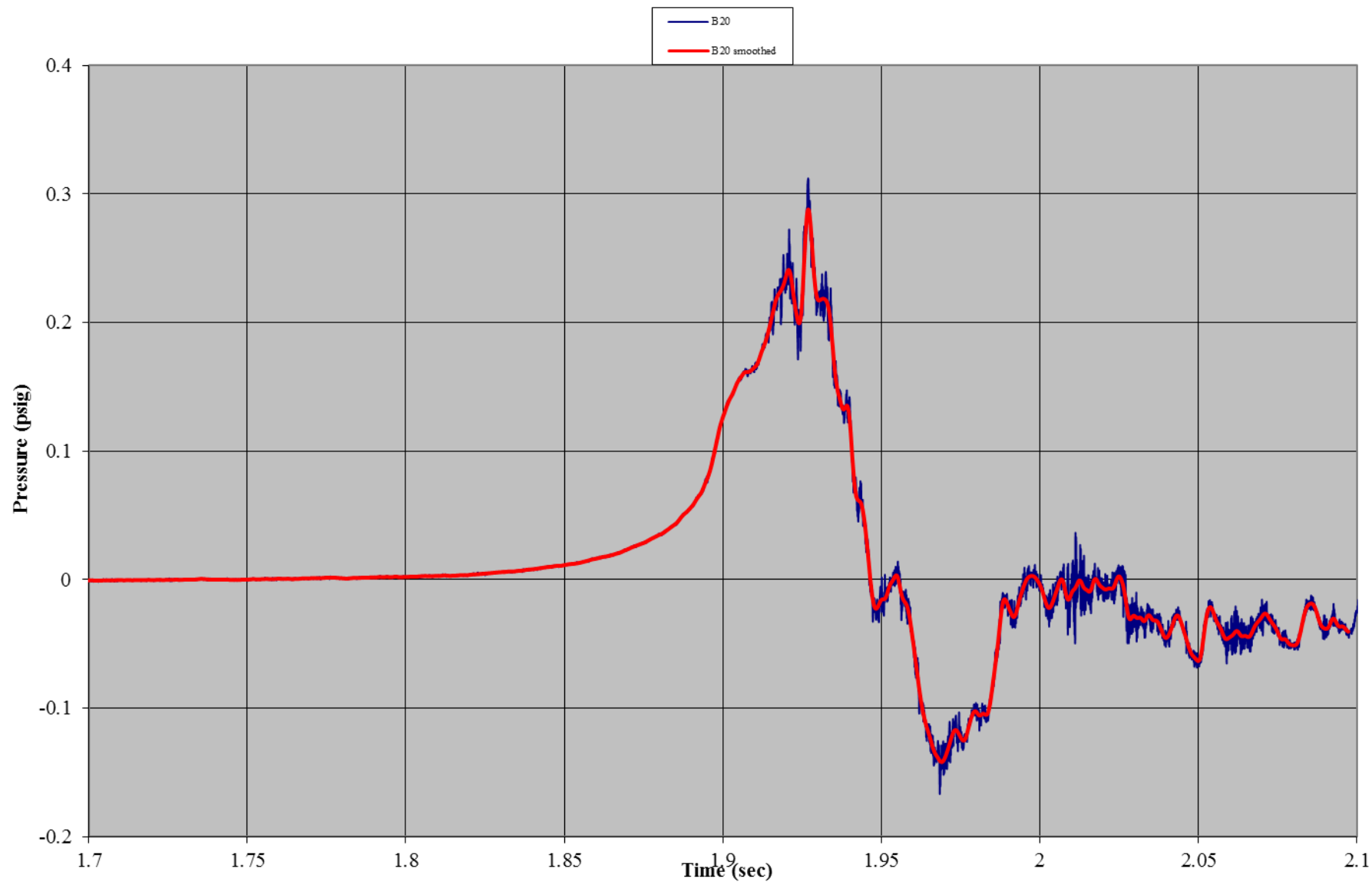
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 04: Interior, Ground



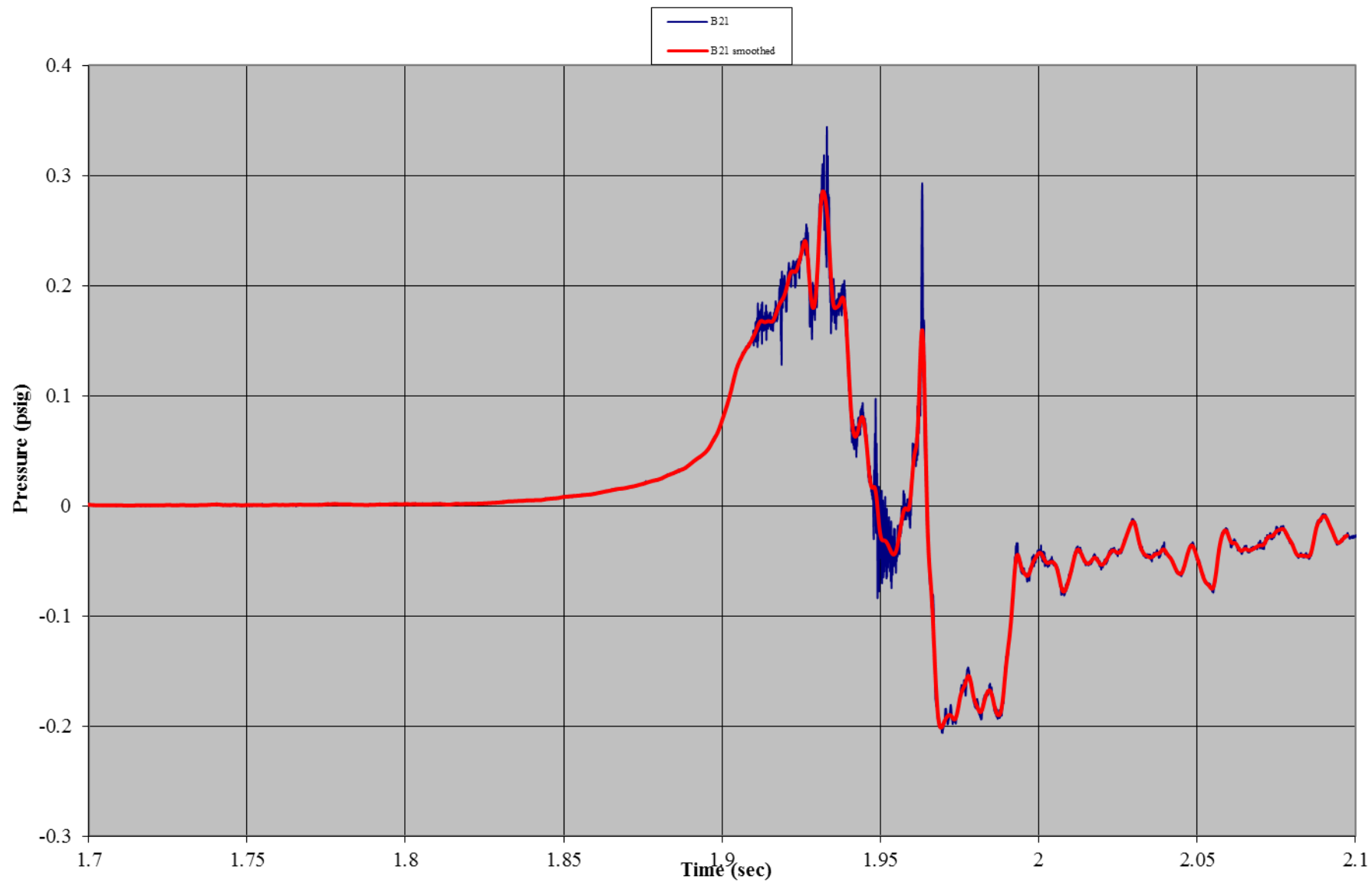
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 07: Roof, Front



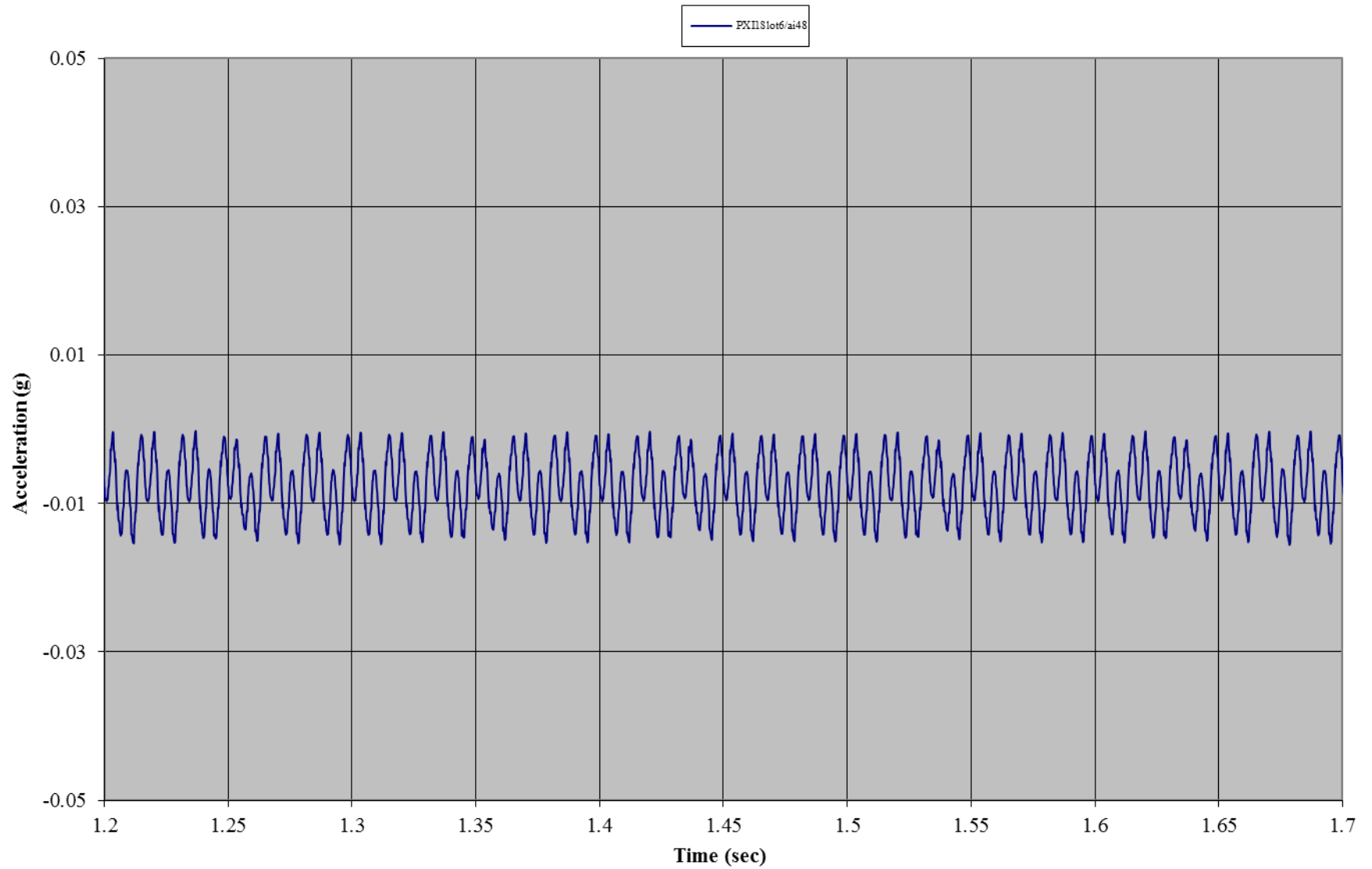
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 20: Roof, Back



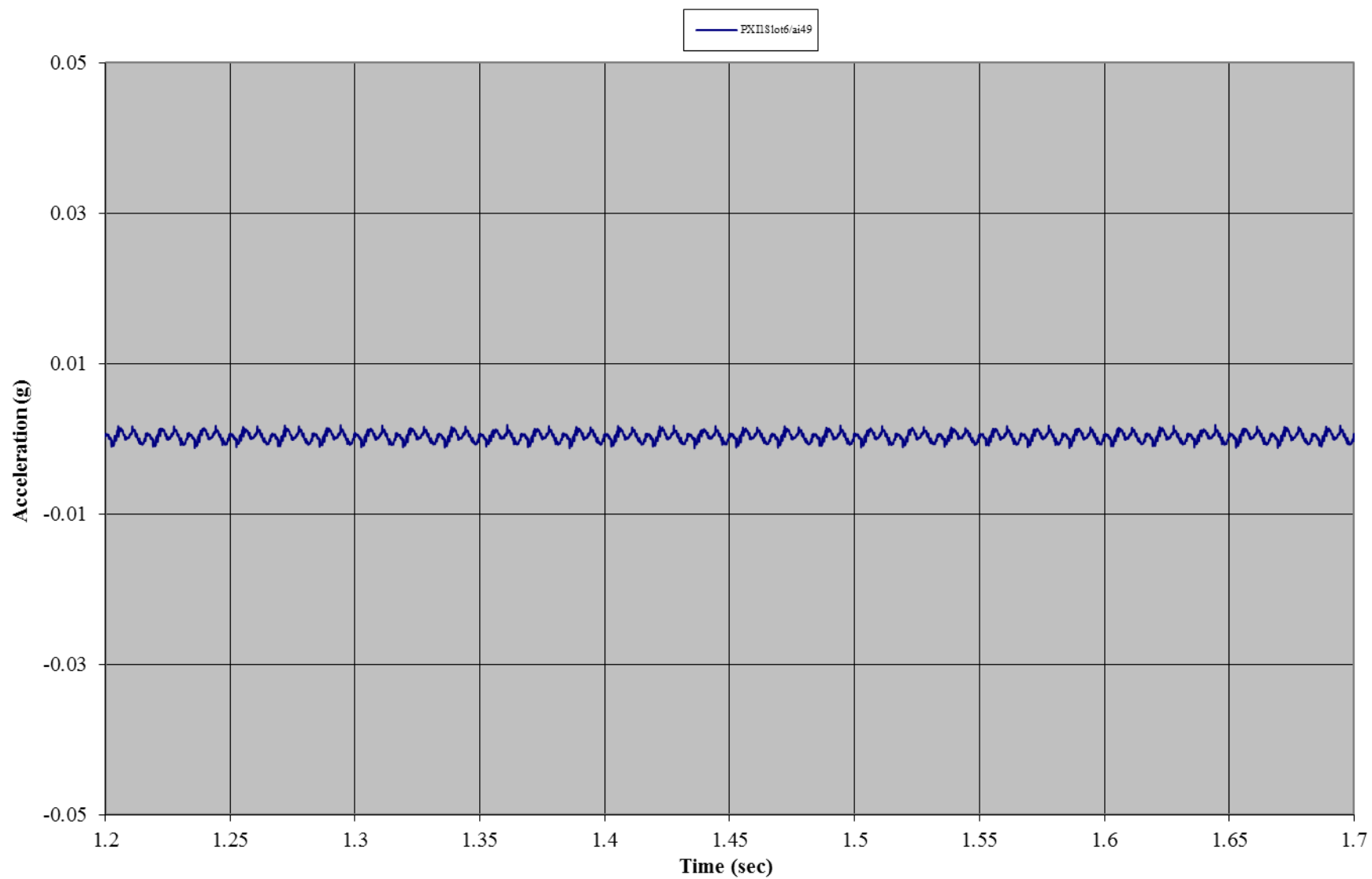
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



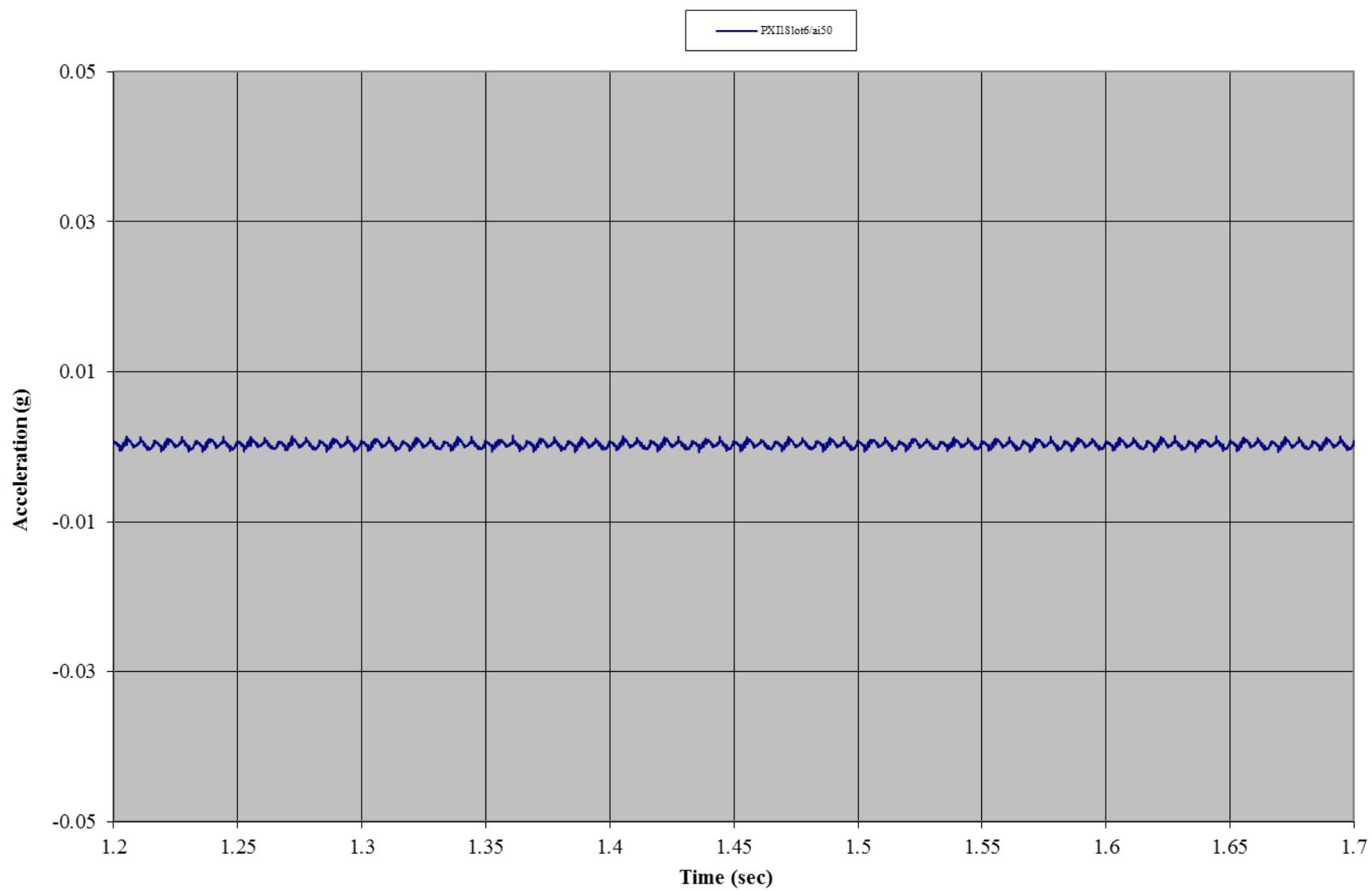
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (x-direction)



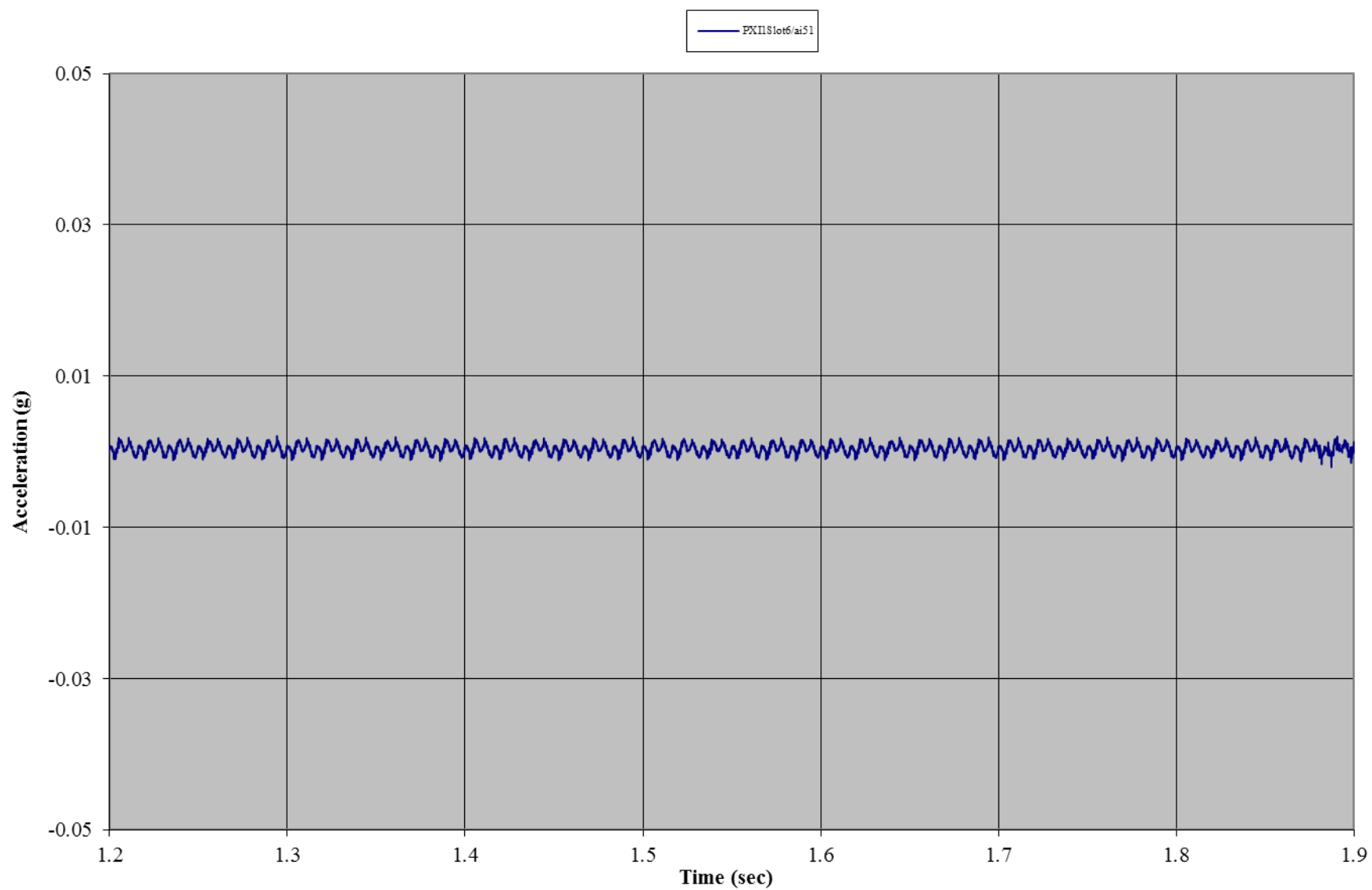
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (y-direction)



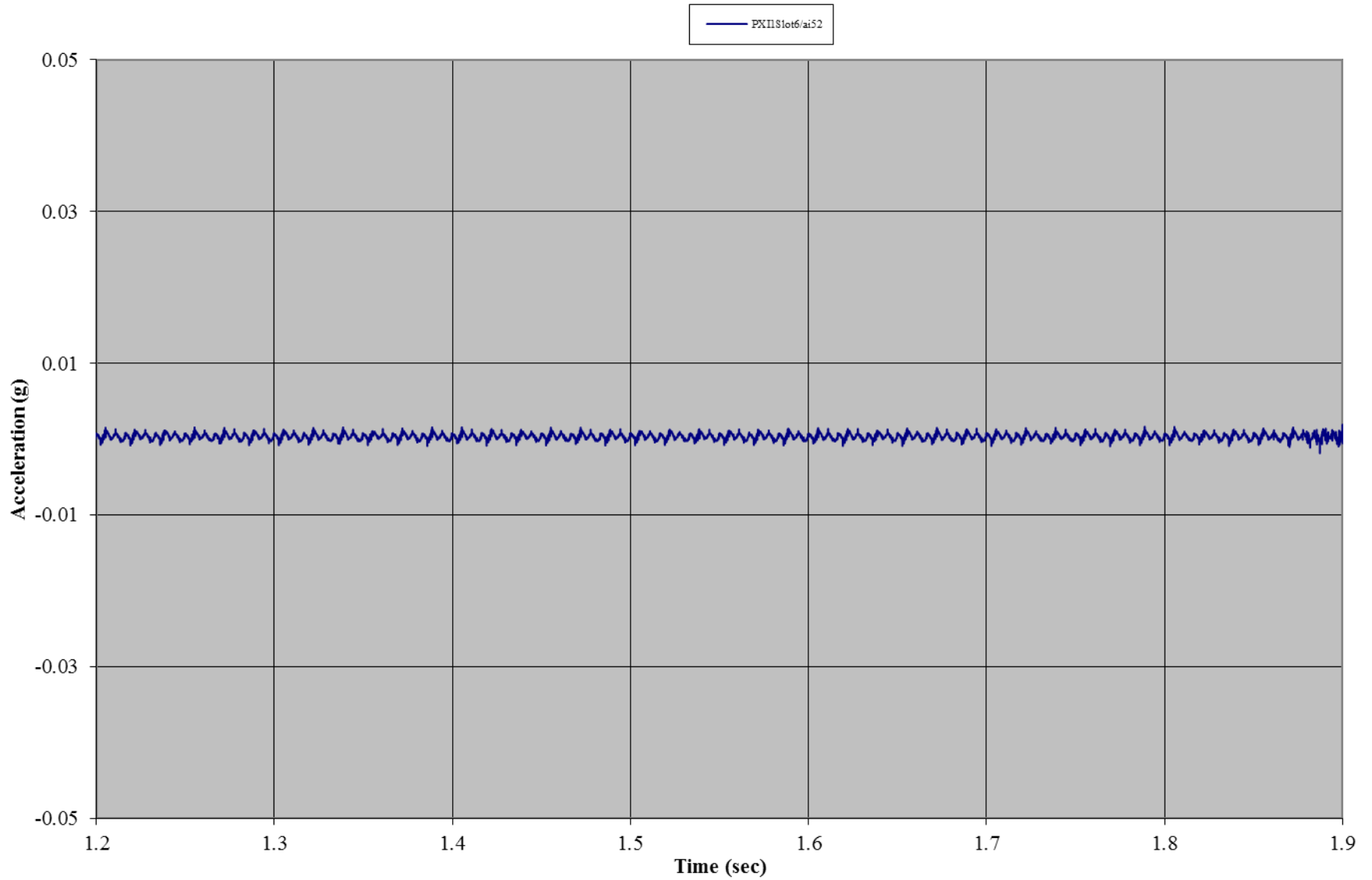
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (z-direction)



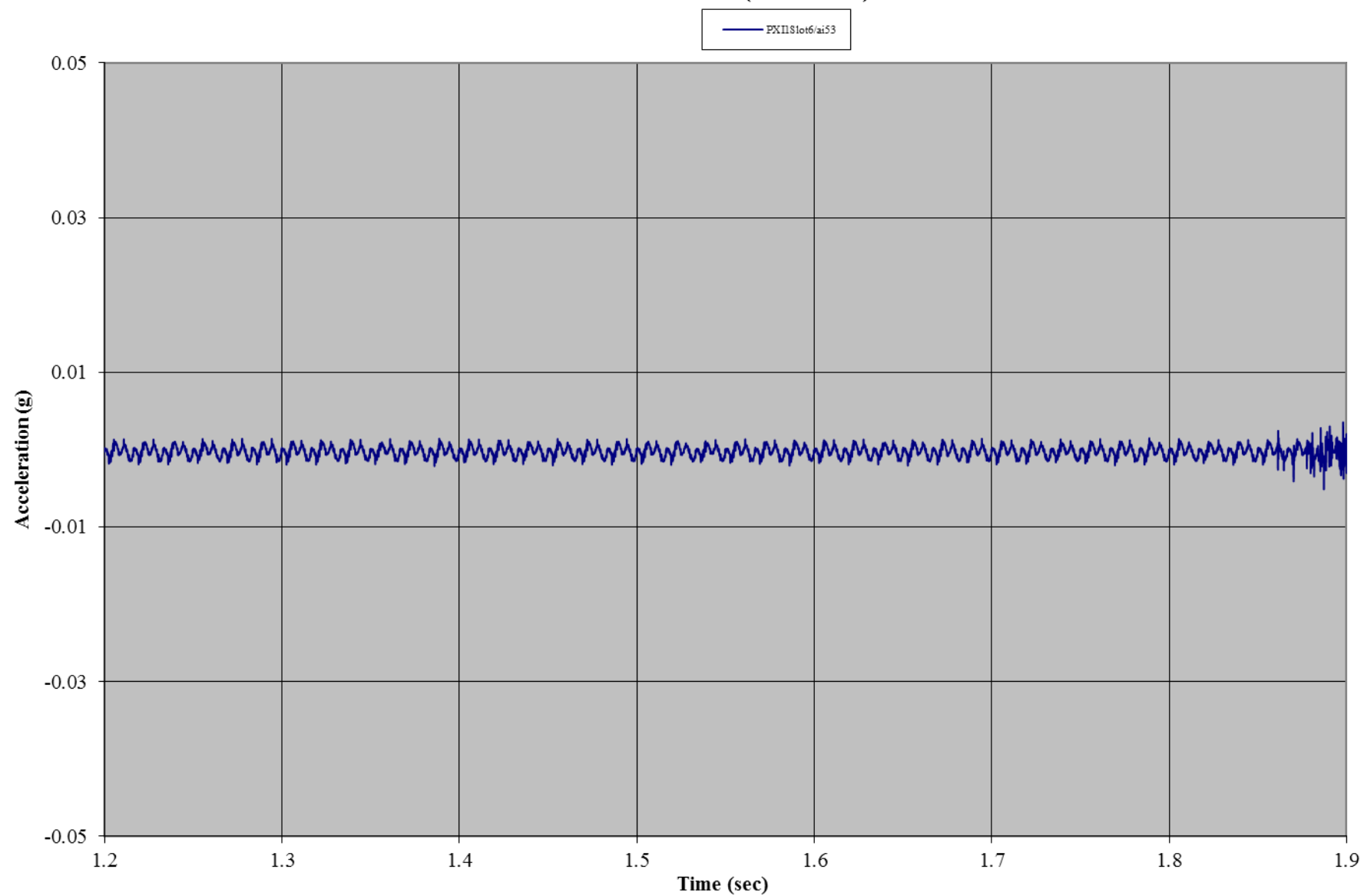
Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (x-direction)



Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (y-direction)

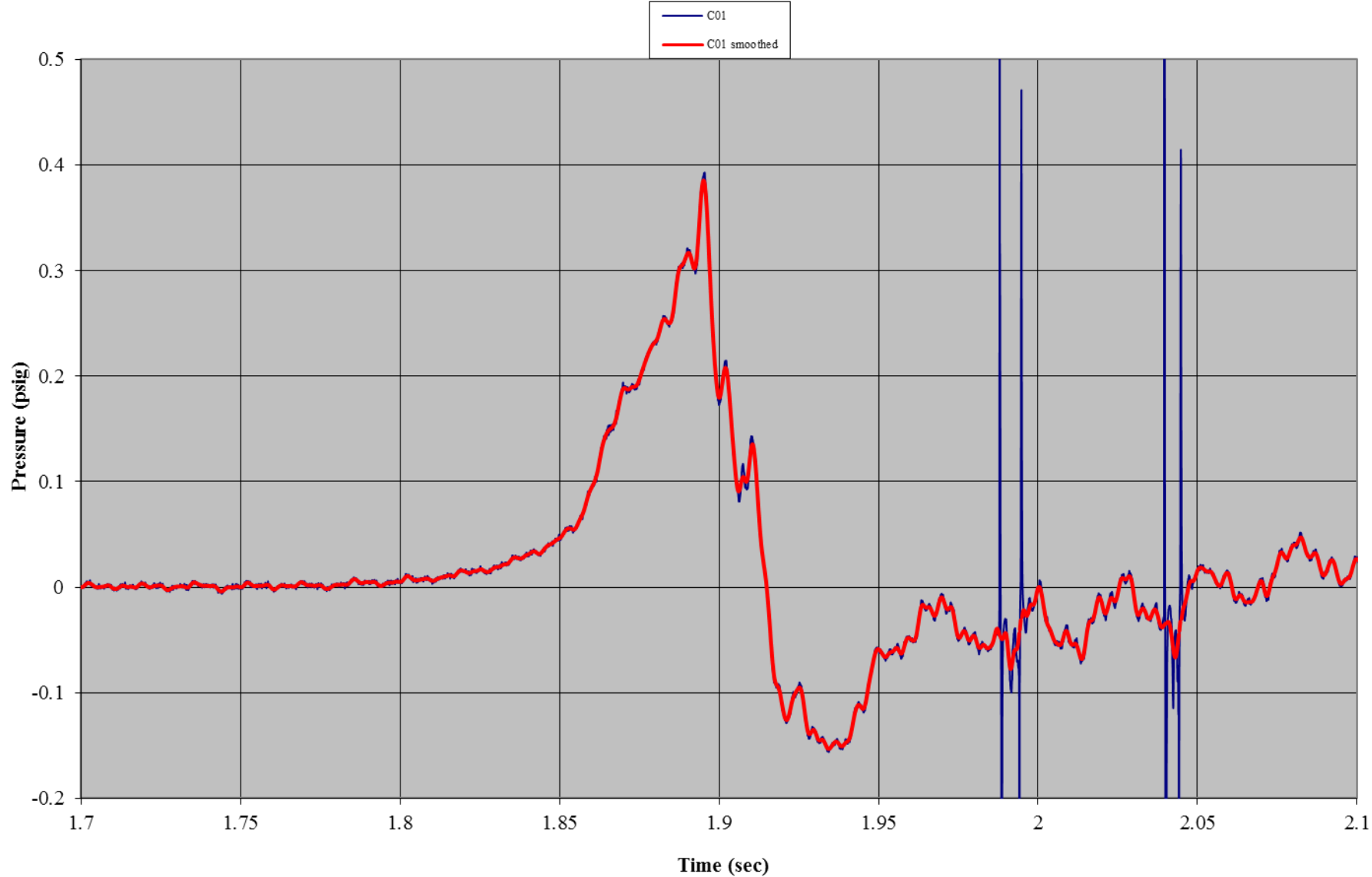


Test B01: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (z-direction)

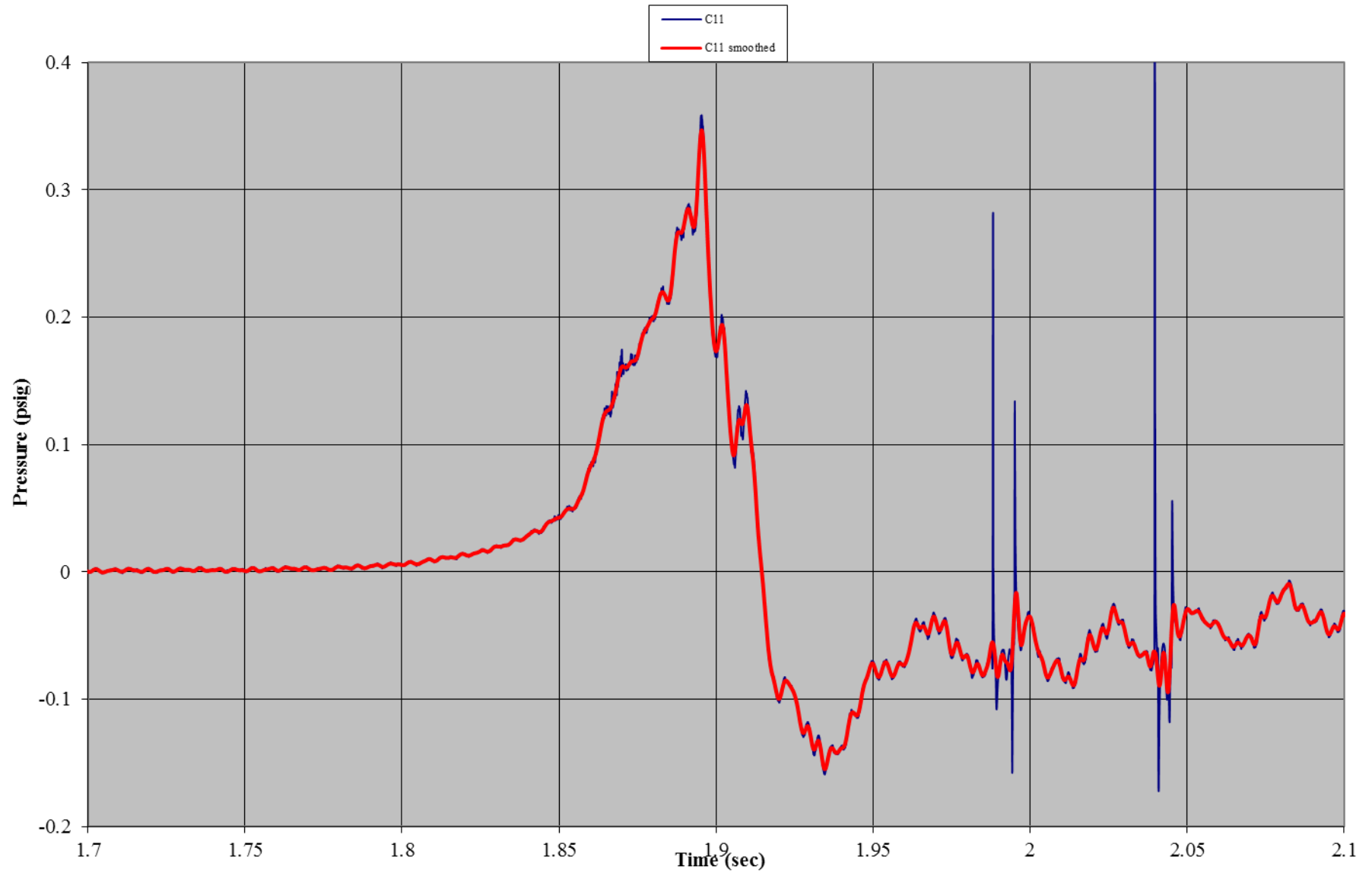


Test B01: Tent C

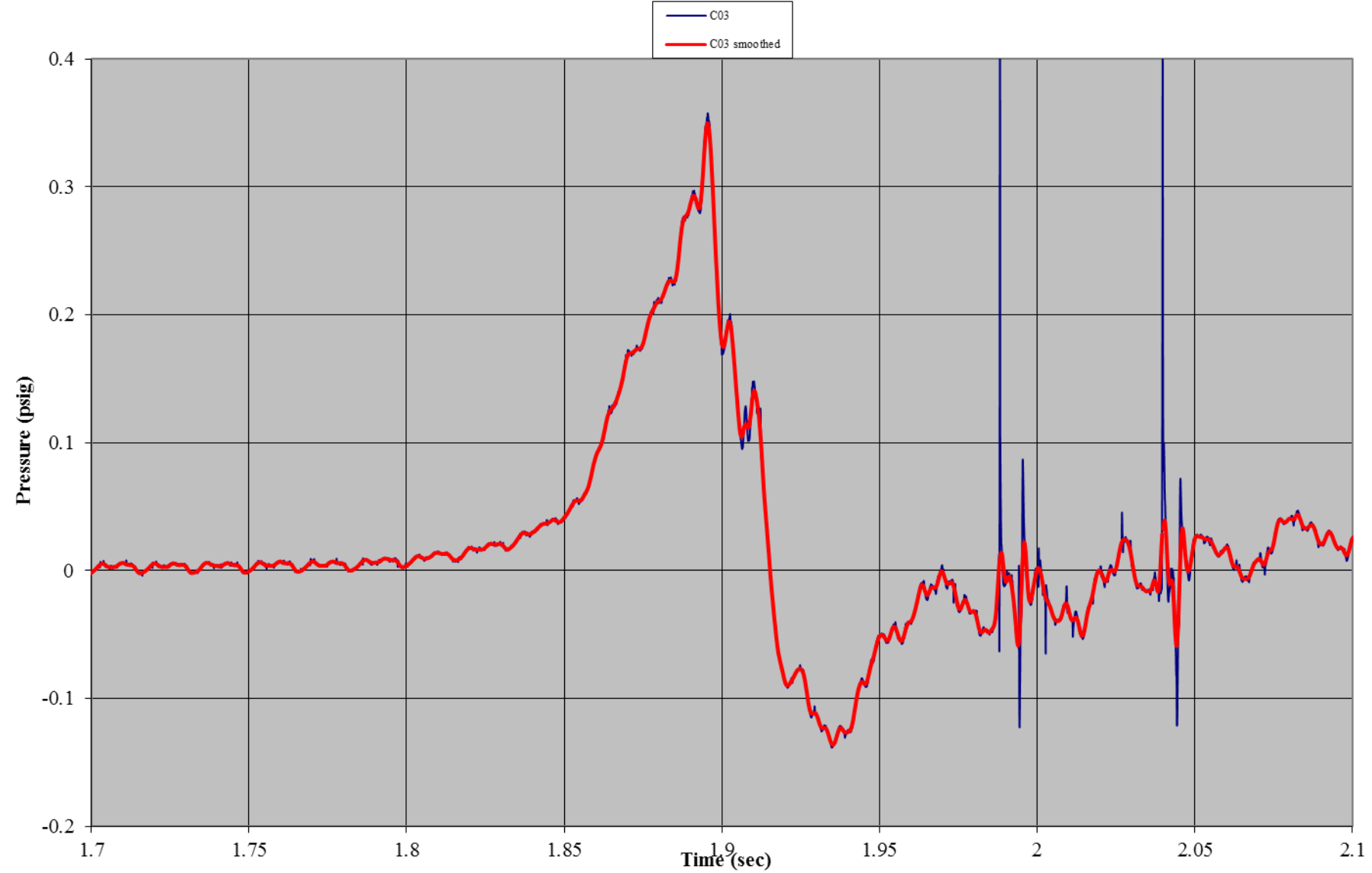
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 01: Front Wall, Left Bottom



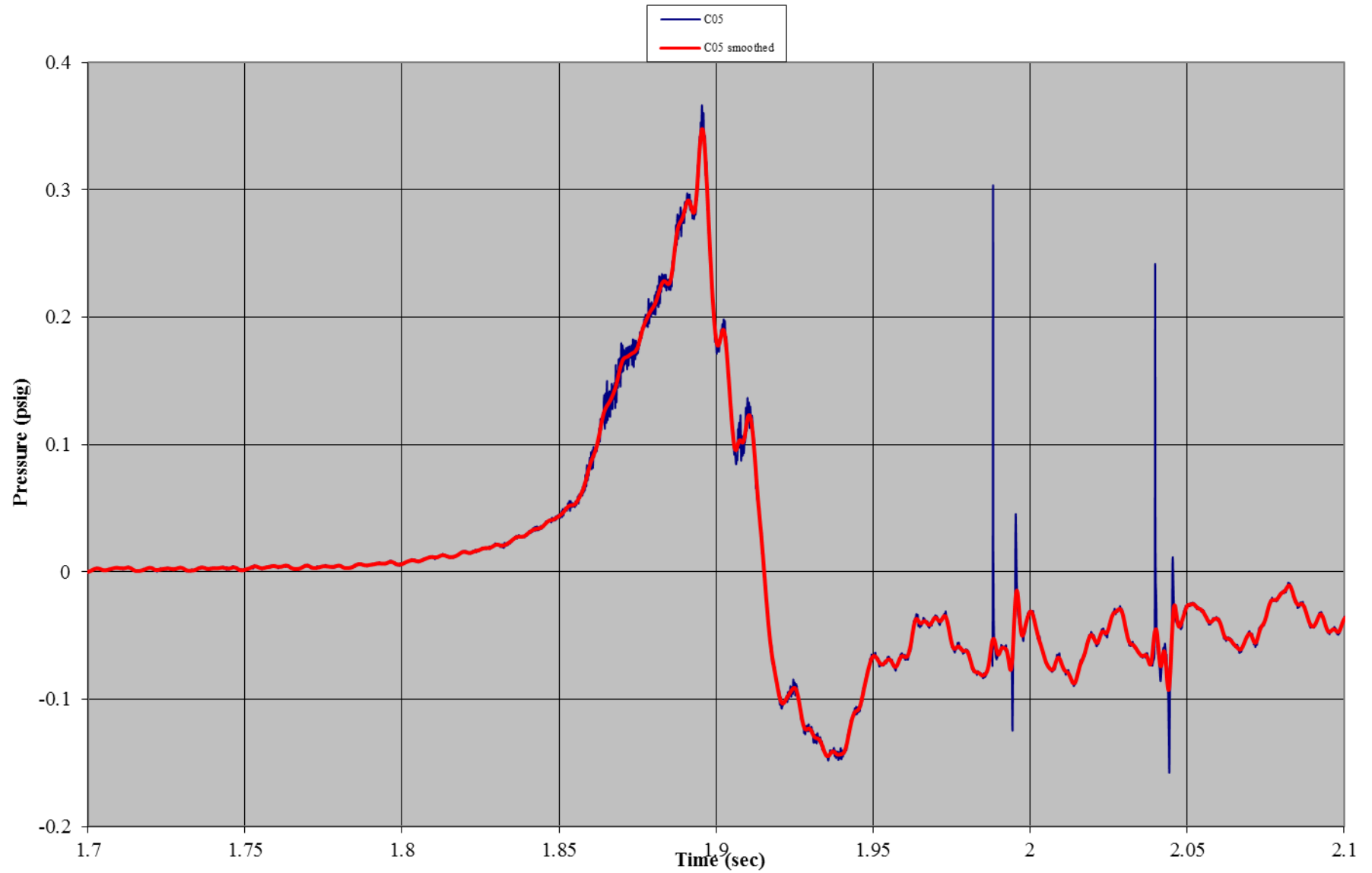
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 11: Front Wall, Right Bottom



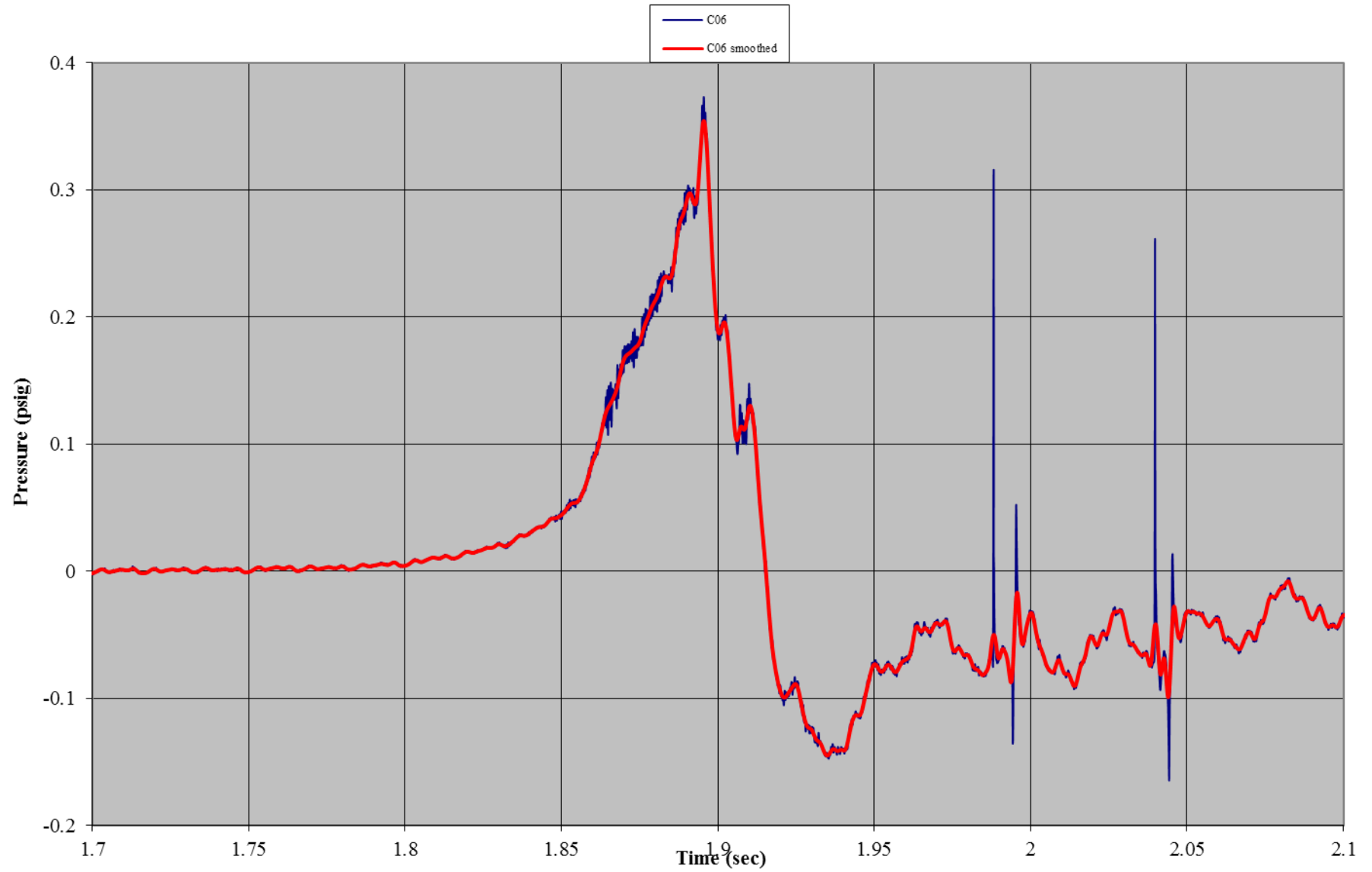
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 03: Front Wall, Center Bottom



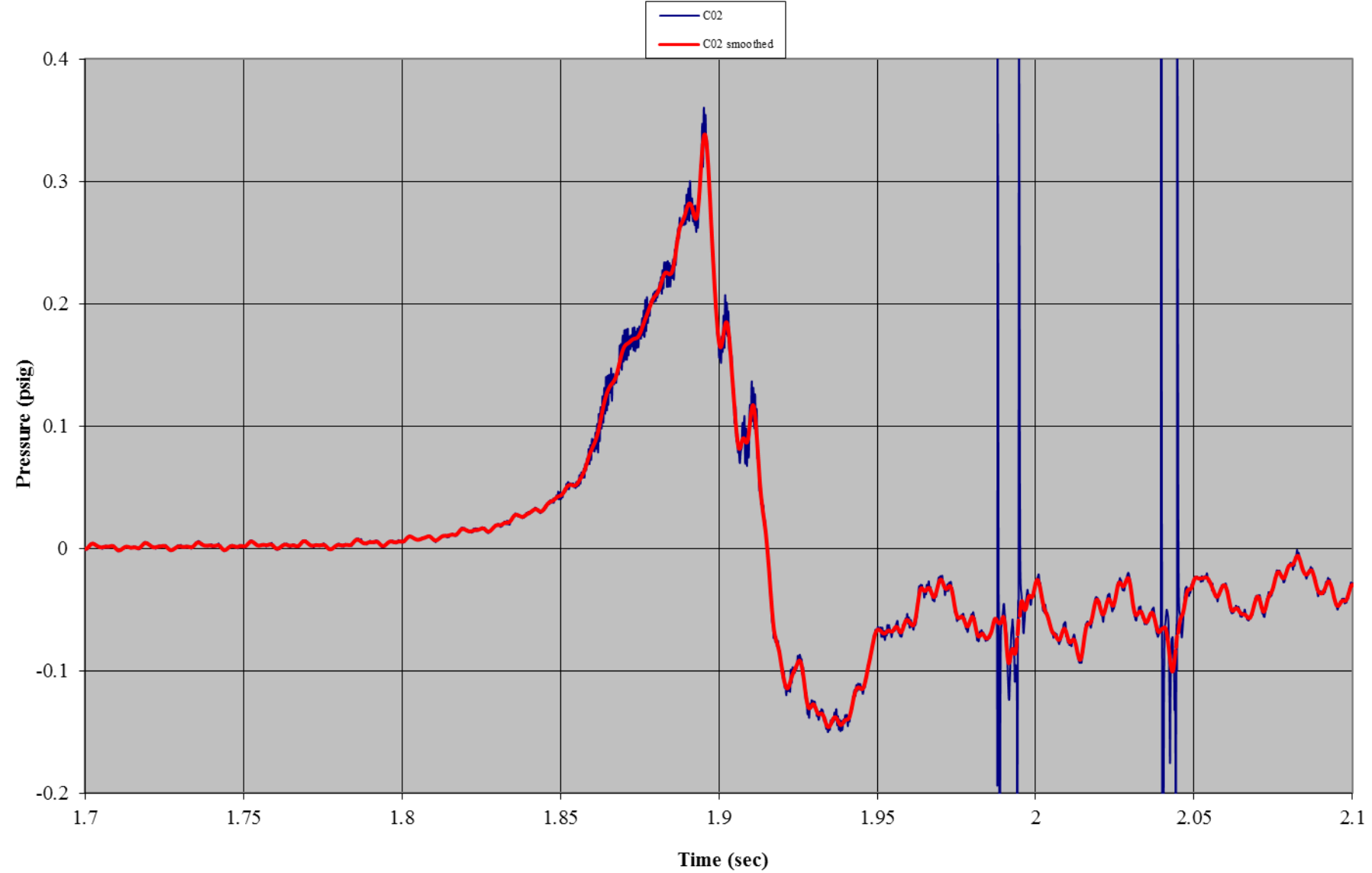
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 05: Front Wall, Center Mid-Height



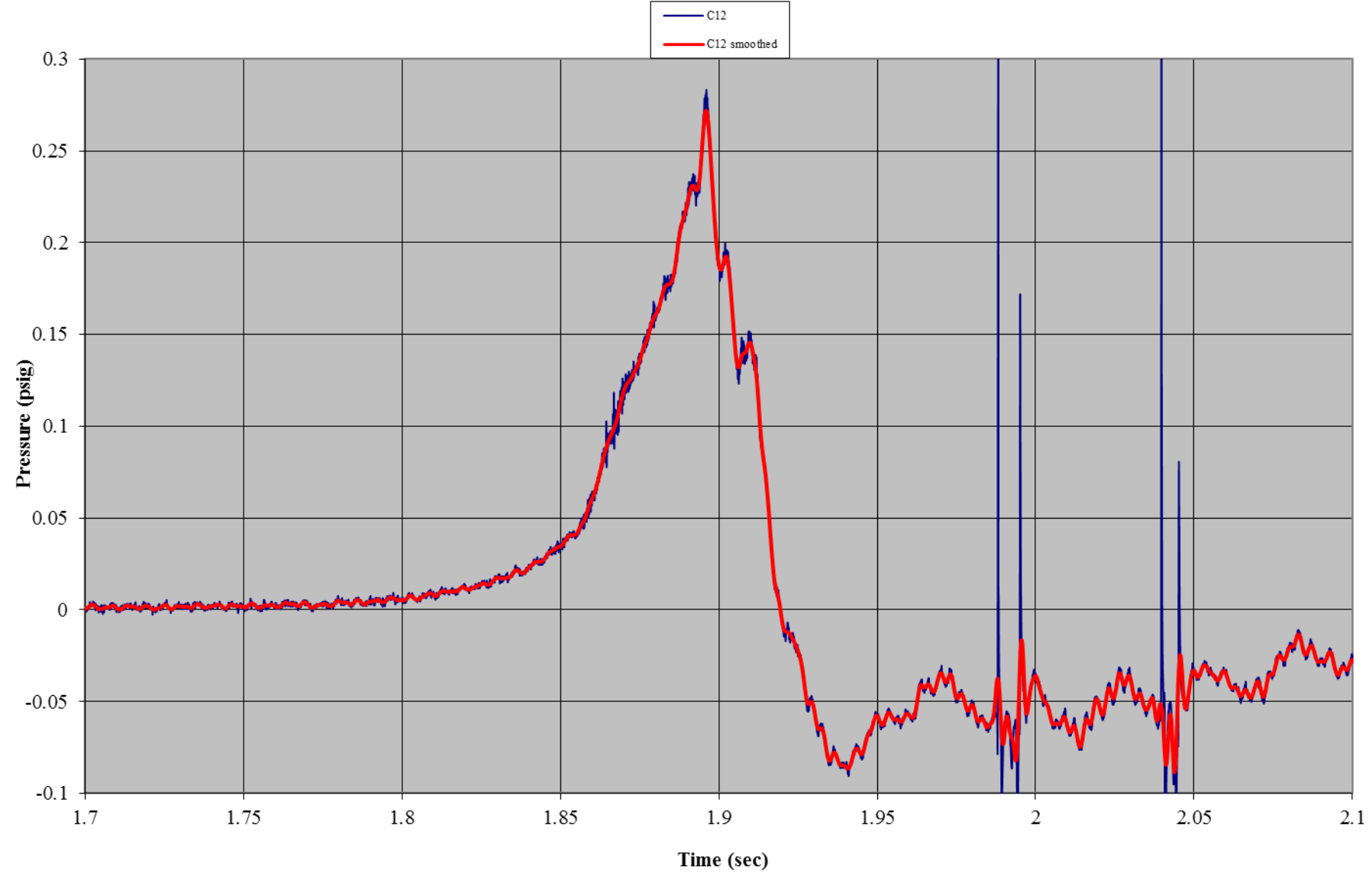
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 06: Front Wall, Center Top



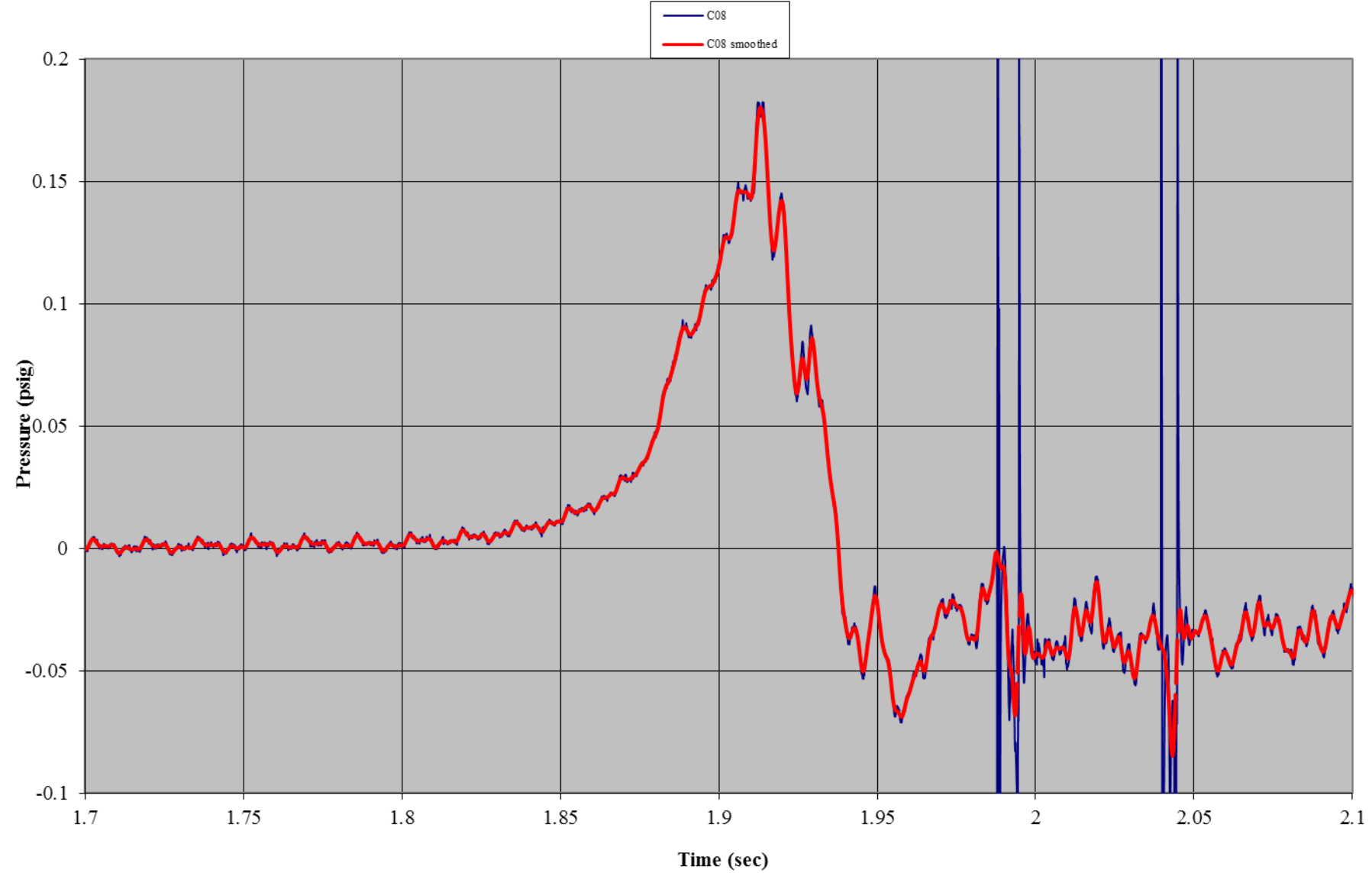
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 02: Front Wall, Left Mid-Height



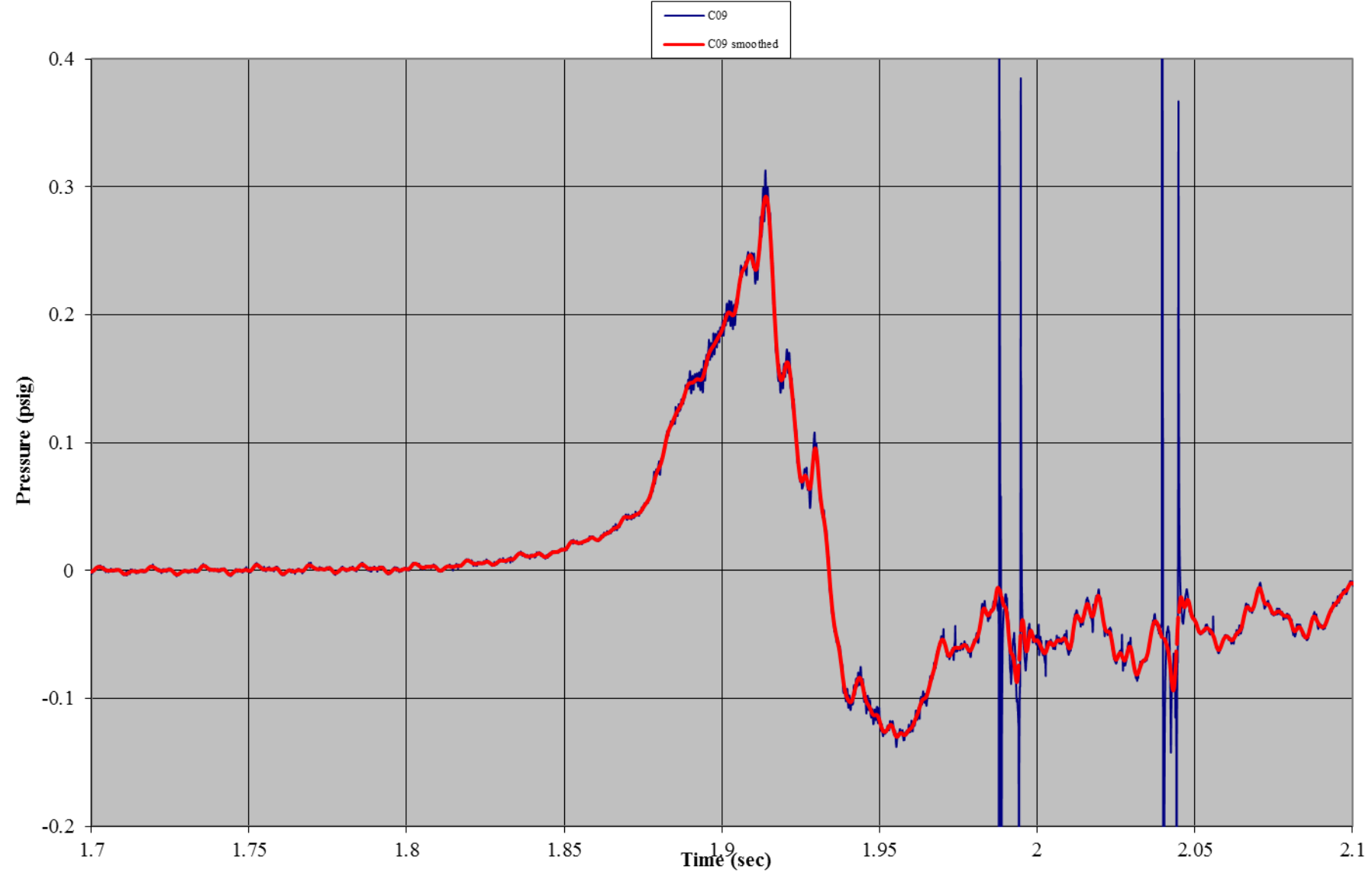
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 12: Front Wall, Right Mid-Height



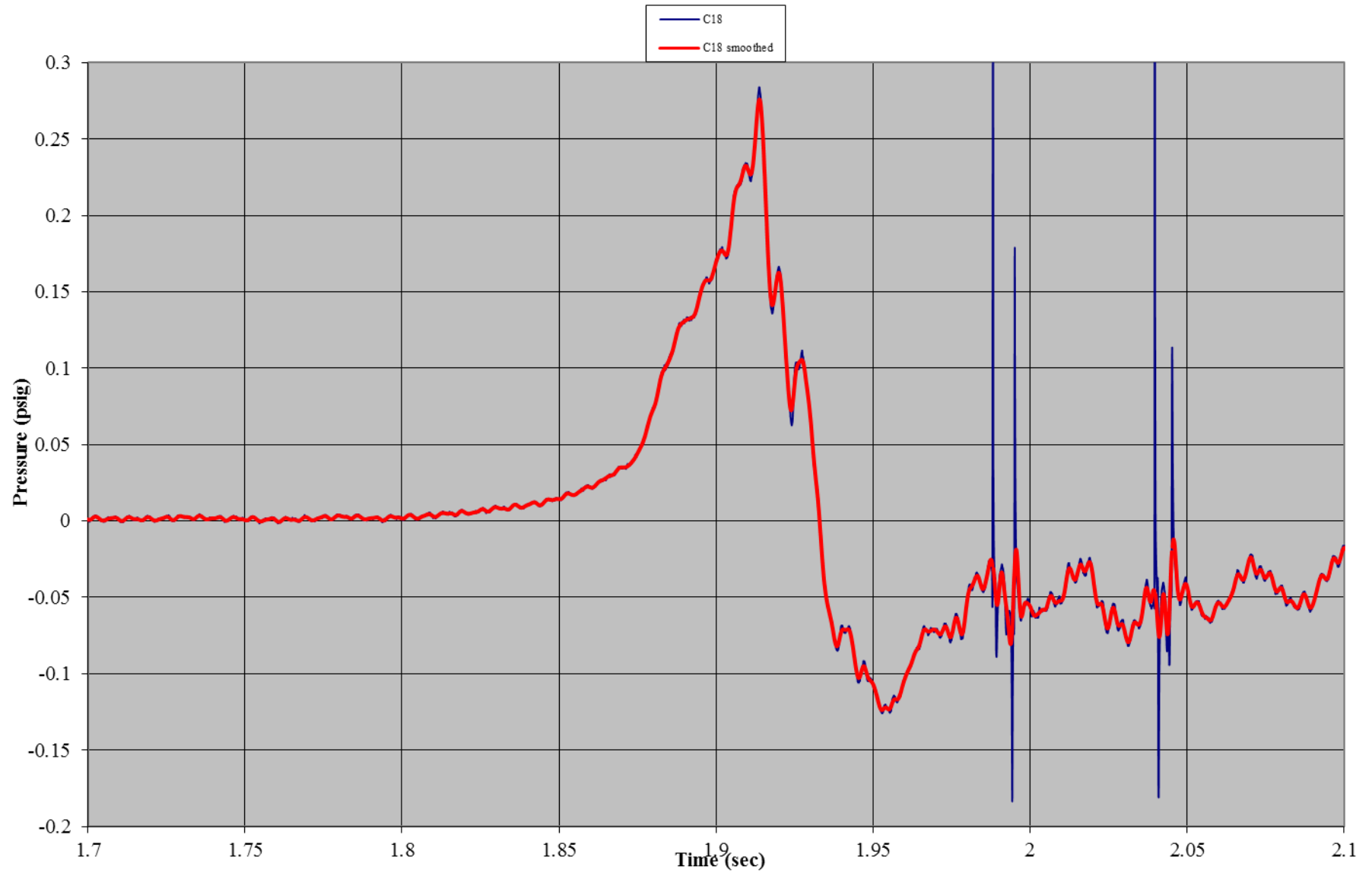
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 08: Left Side Wall, Bottom



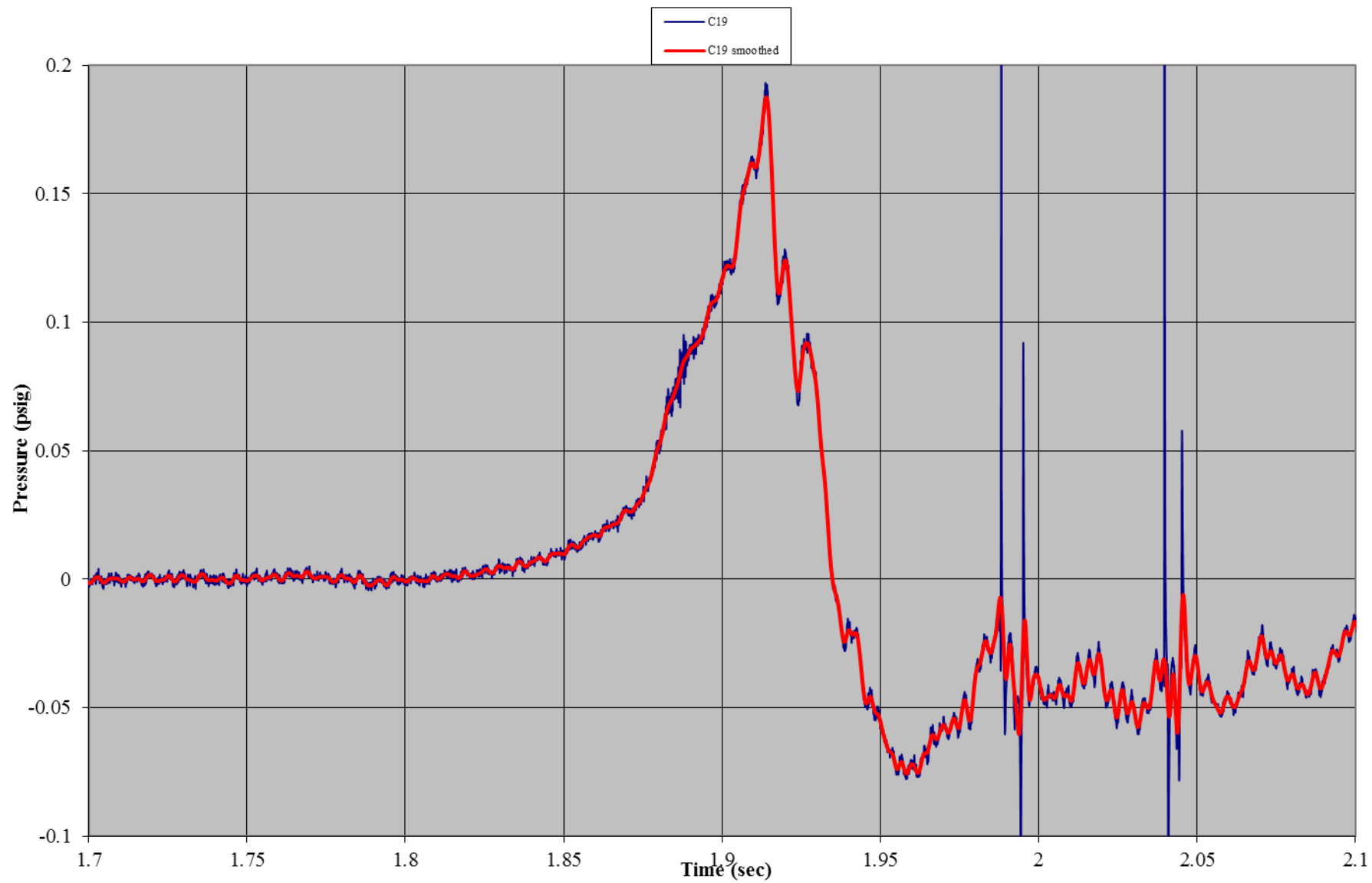
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 09: Left Side Wall, Mid-Height



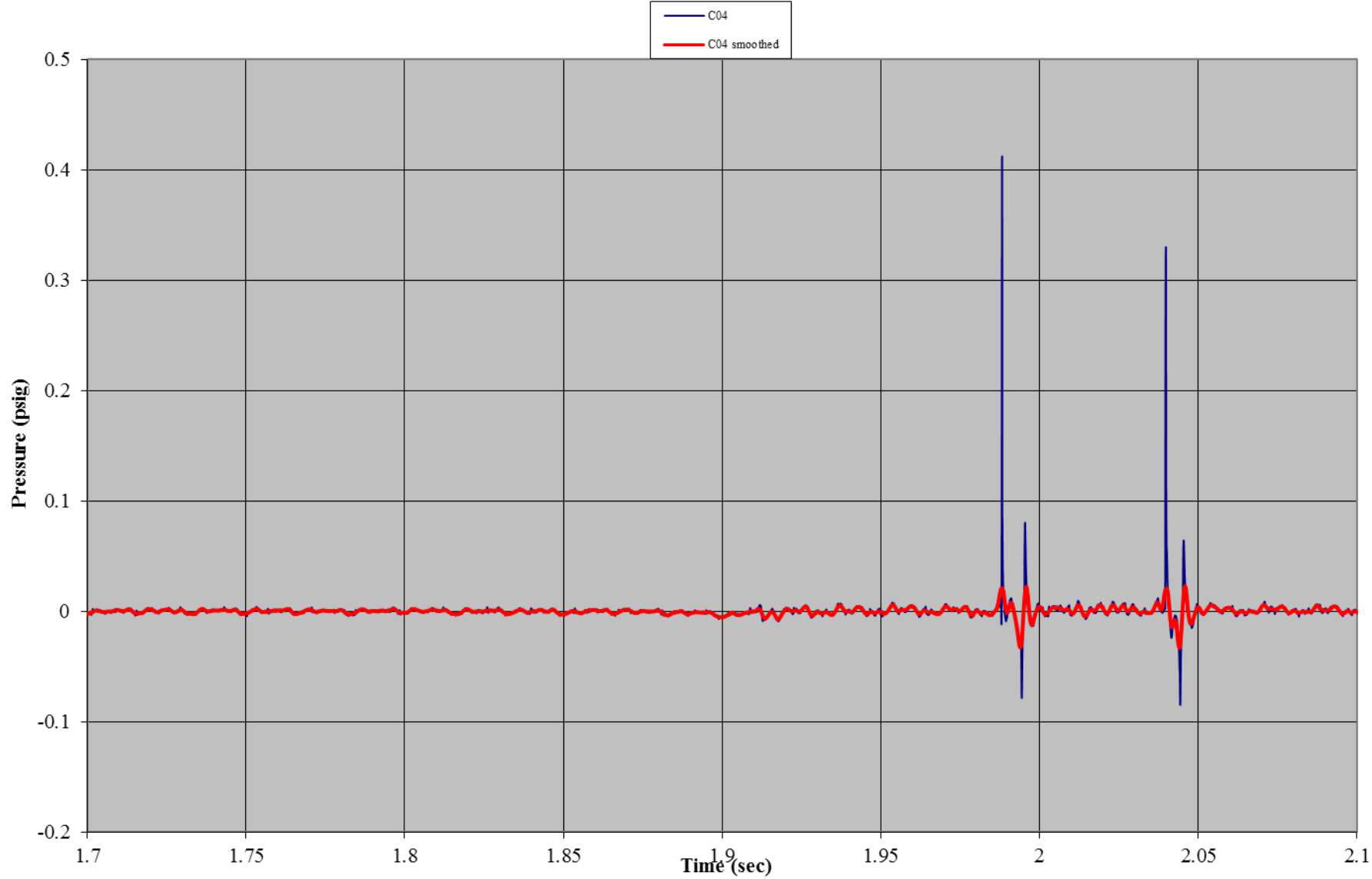
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 18: Right Side Wall, Bottom



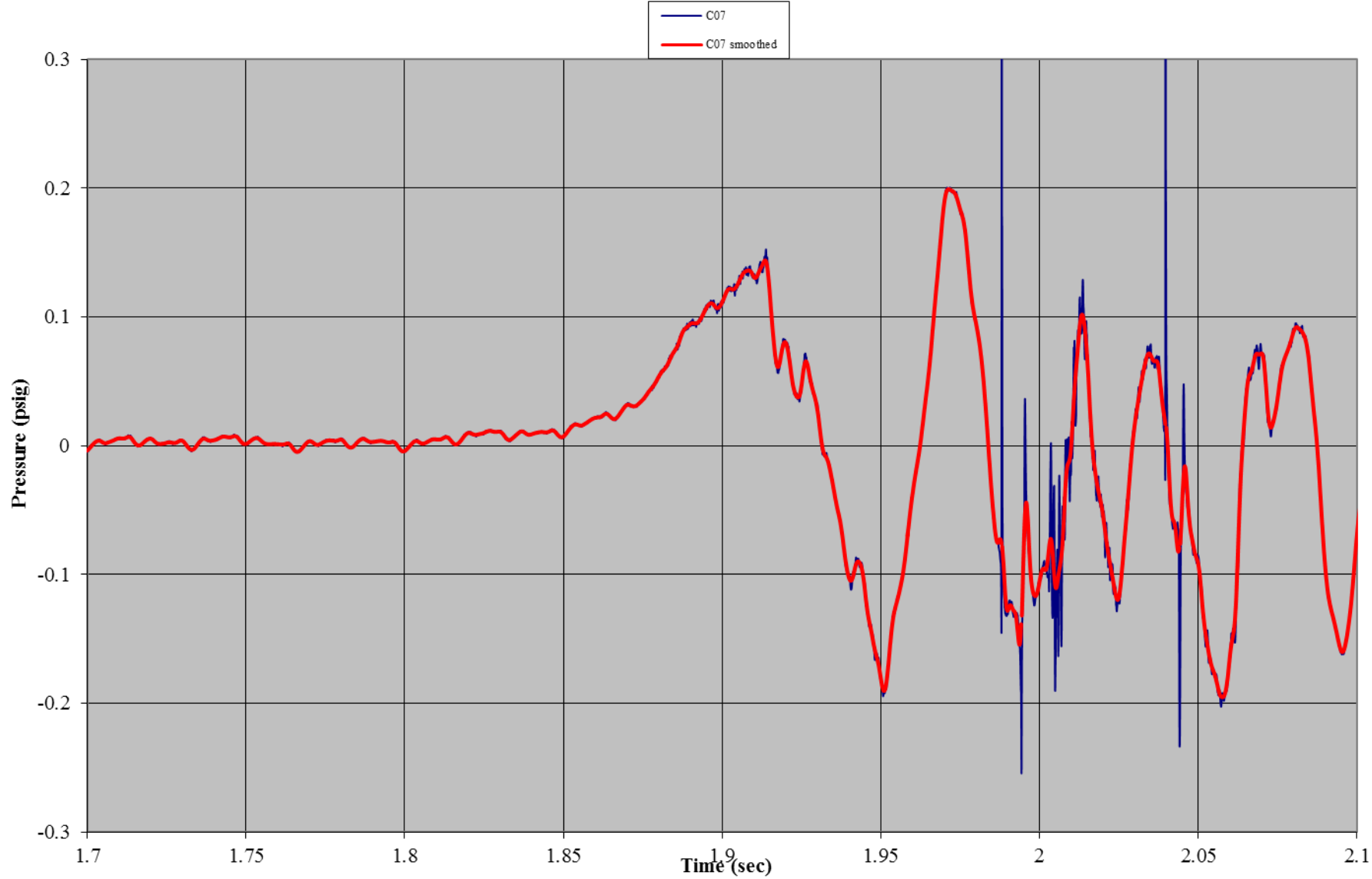
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 19: Right Side Wall, Mid-Height



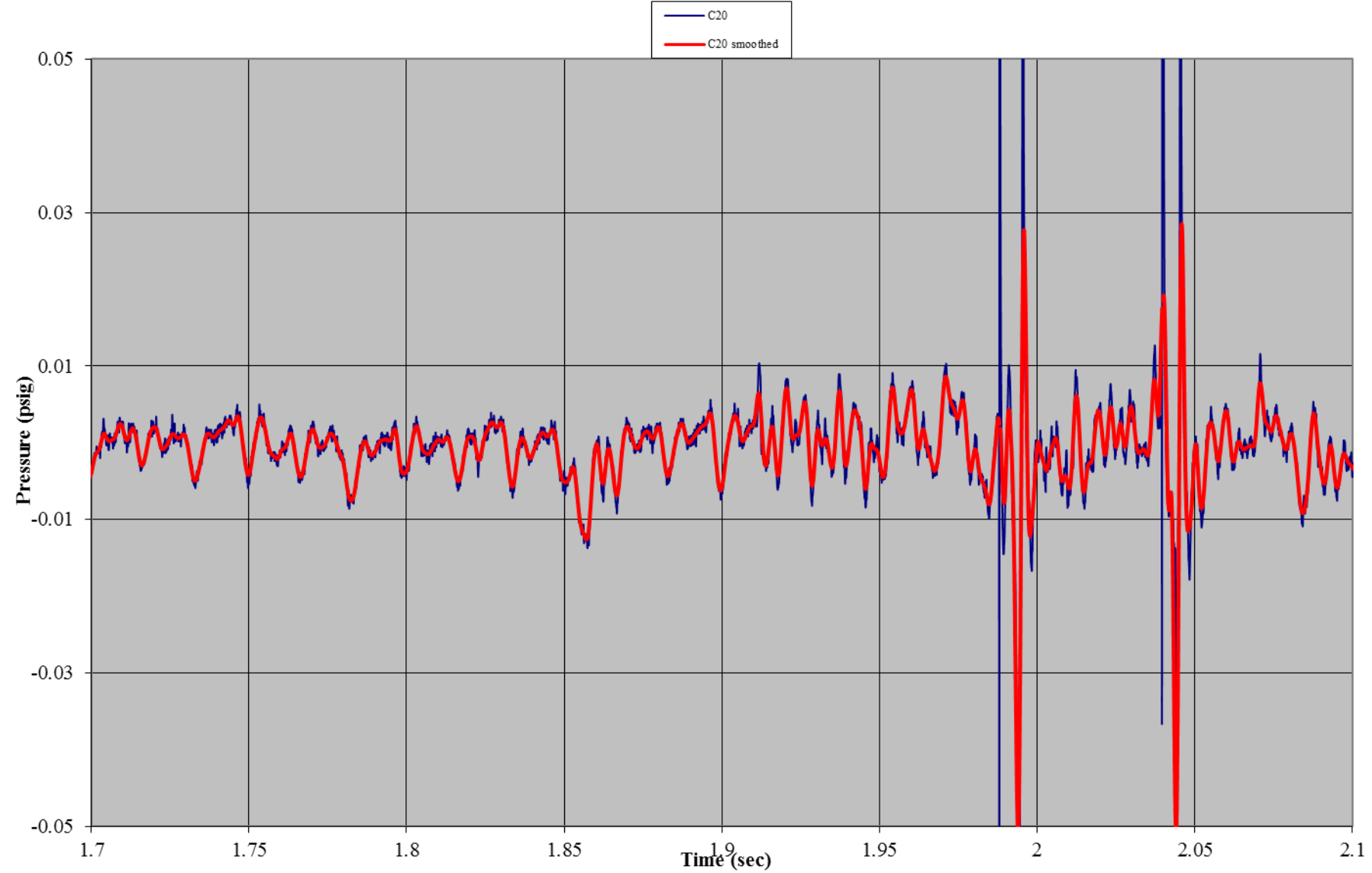
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 04: Interior, Ground



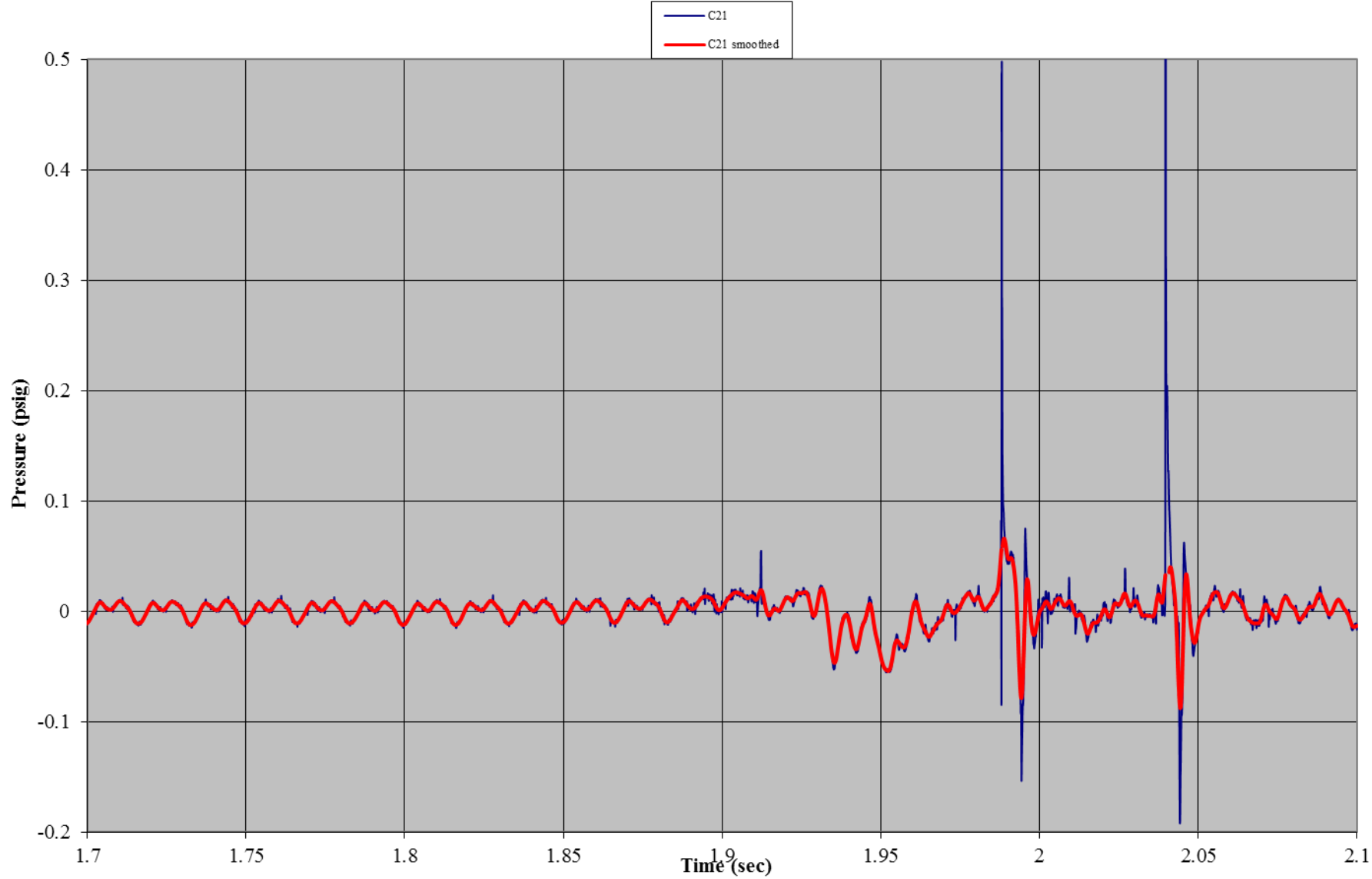
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 07: Roof, Front



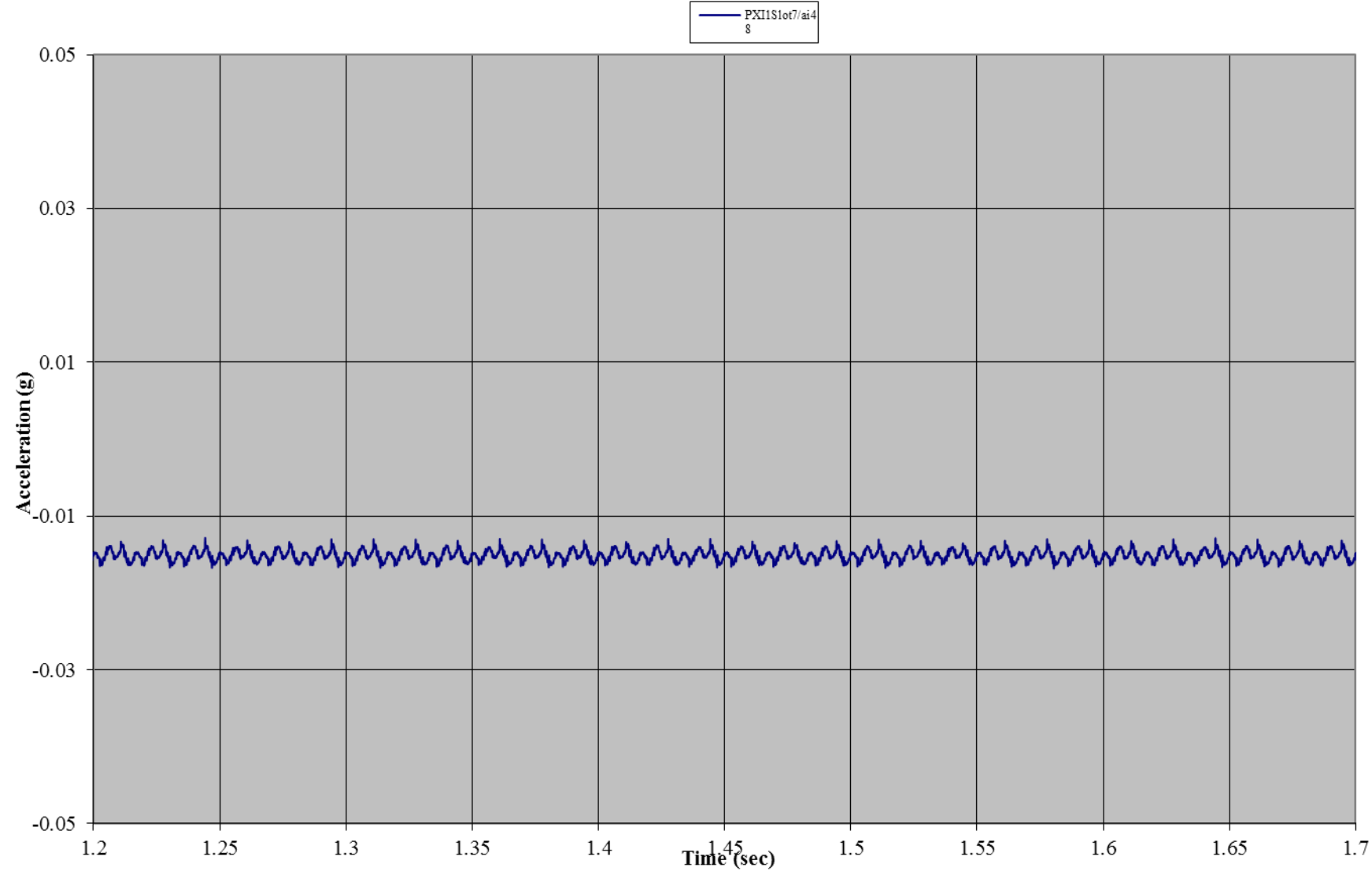
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 20: Roof, Back



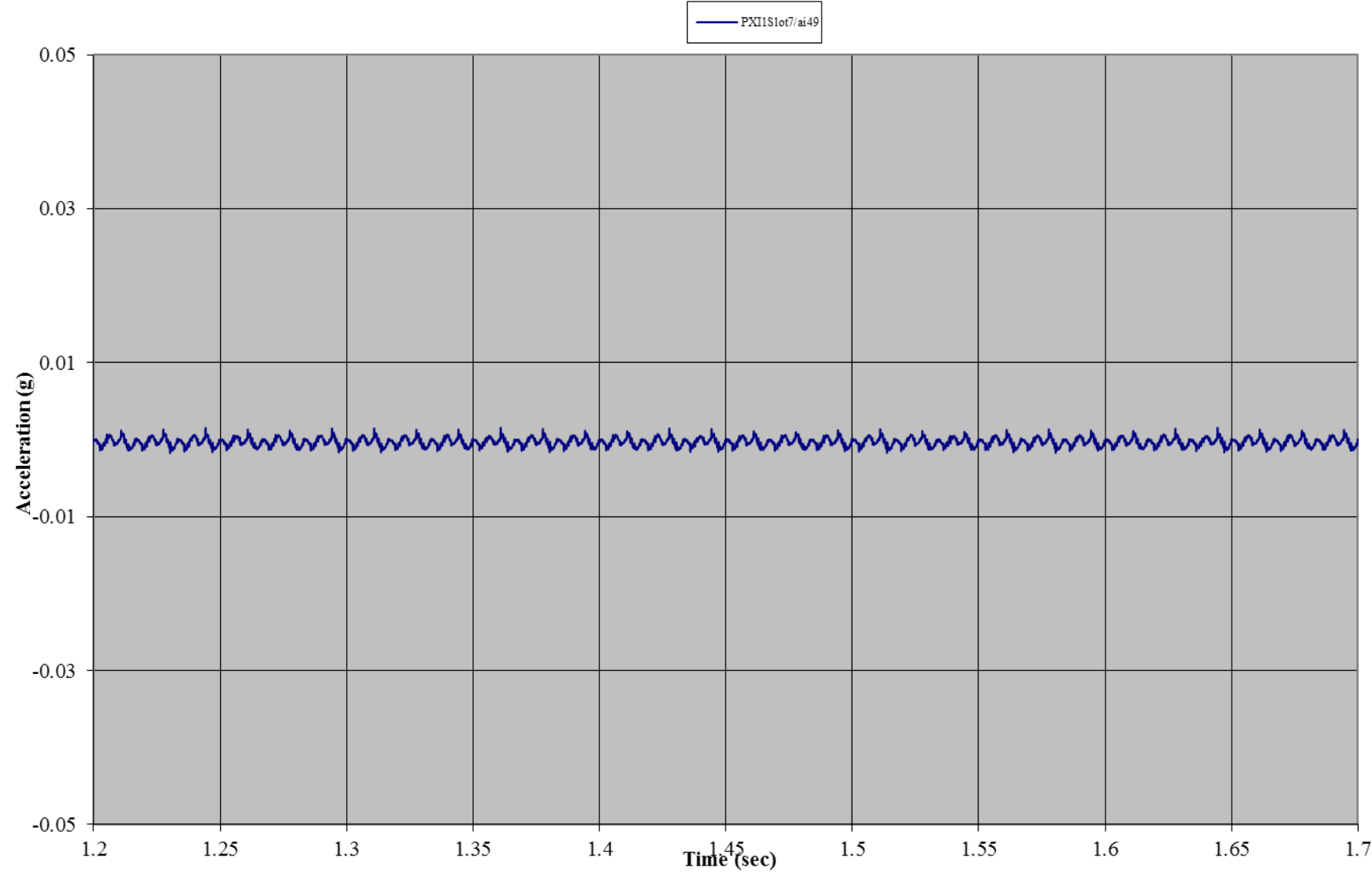
Test B01: Non-Wind Rated Pole Tent without Sides
Gauge 21: Back Wall, Center Mid-Height



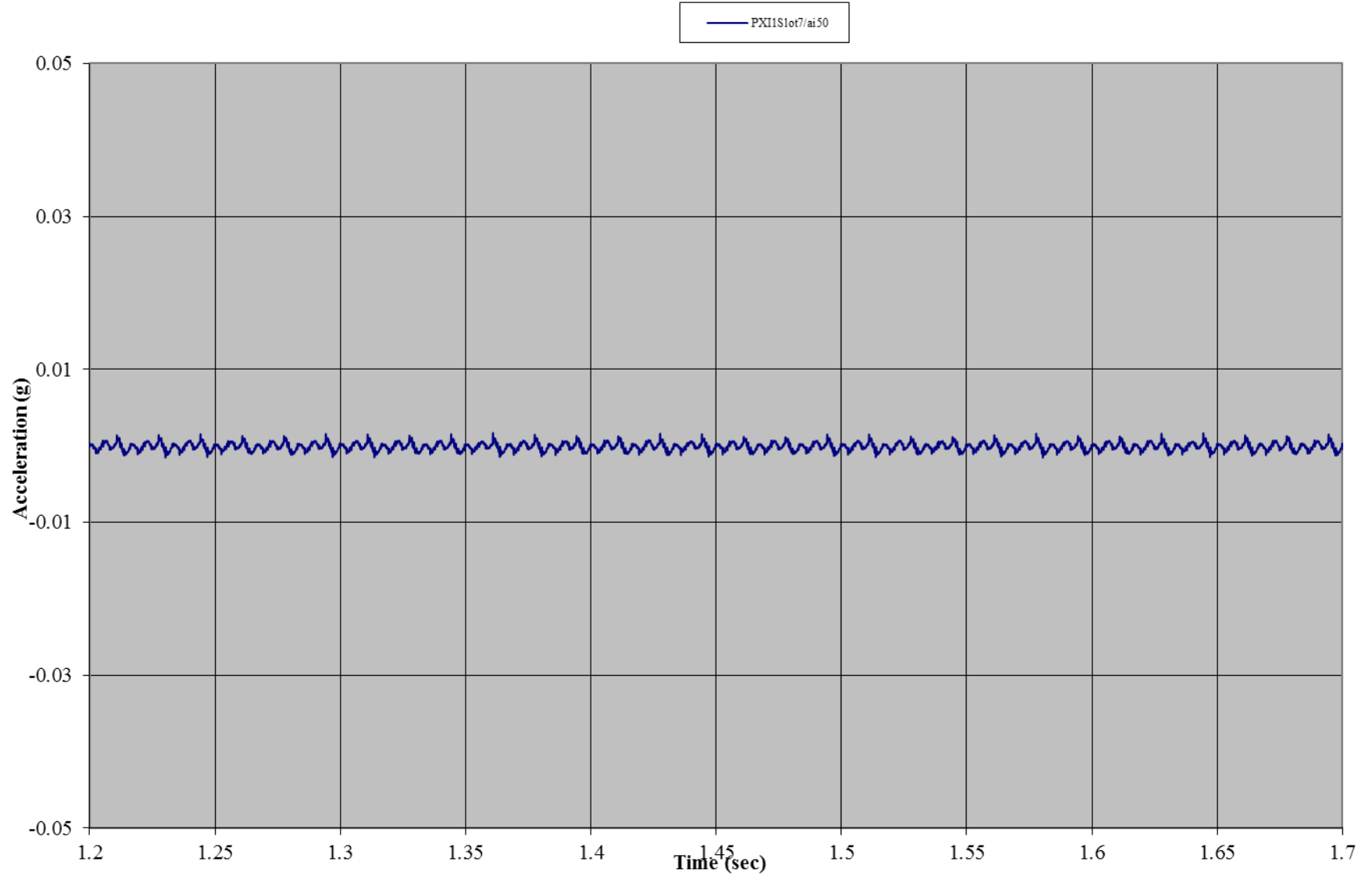
Test B01: Non-Wind Rated Pole Tent without Sides
Accelerometer 1: Front Wall (x-direction)



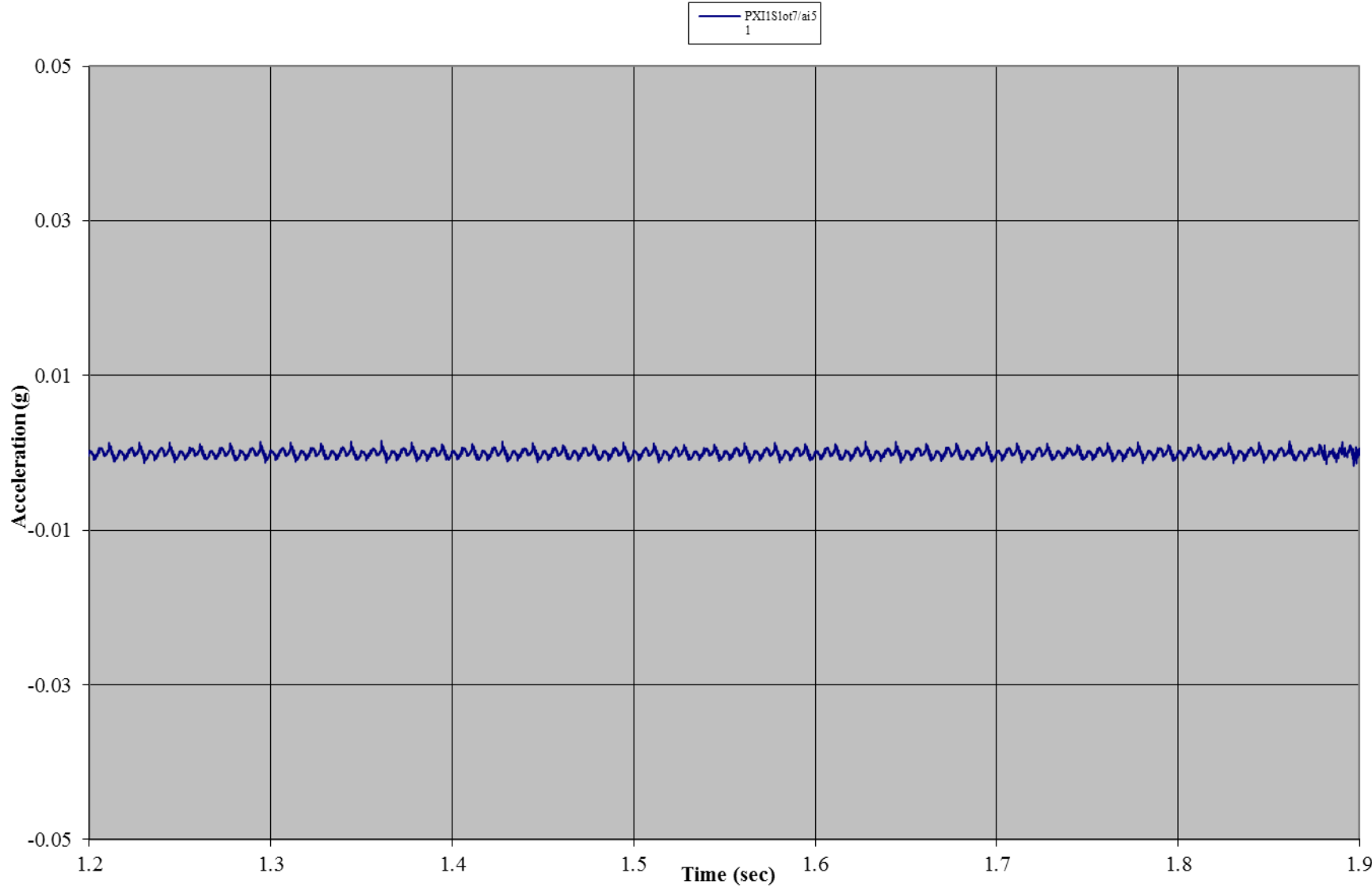
Test B01: Non-Wind Rated Pole Tent without Sides
Accelerometer 1: Front Wall (y-direction)



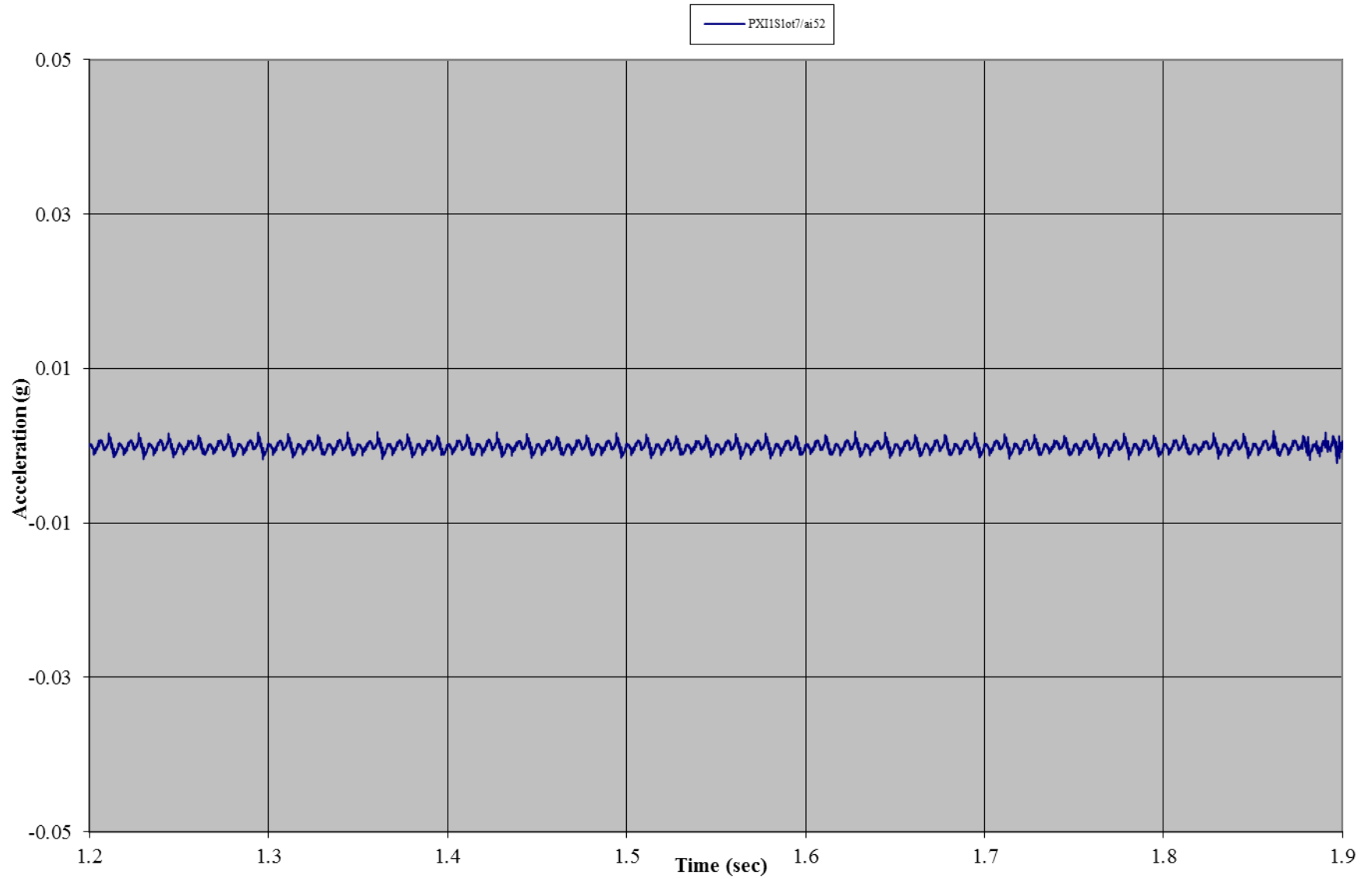
Test B01: Non-Wind Rated Pole Tent without Sides
Accelerometer 1: Front Wall (z-direction)



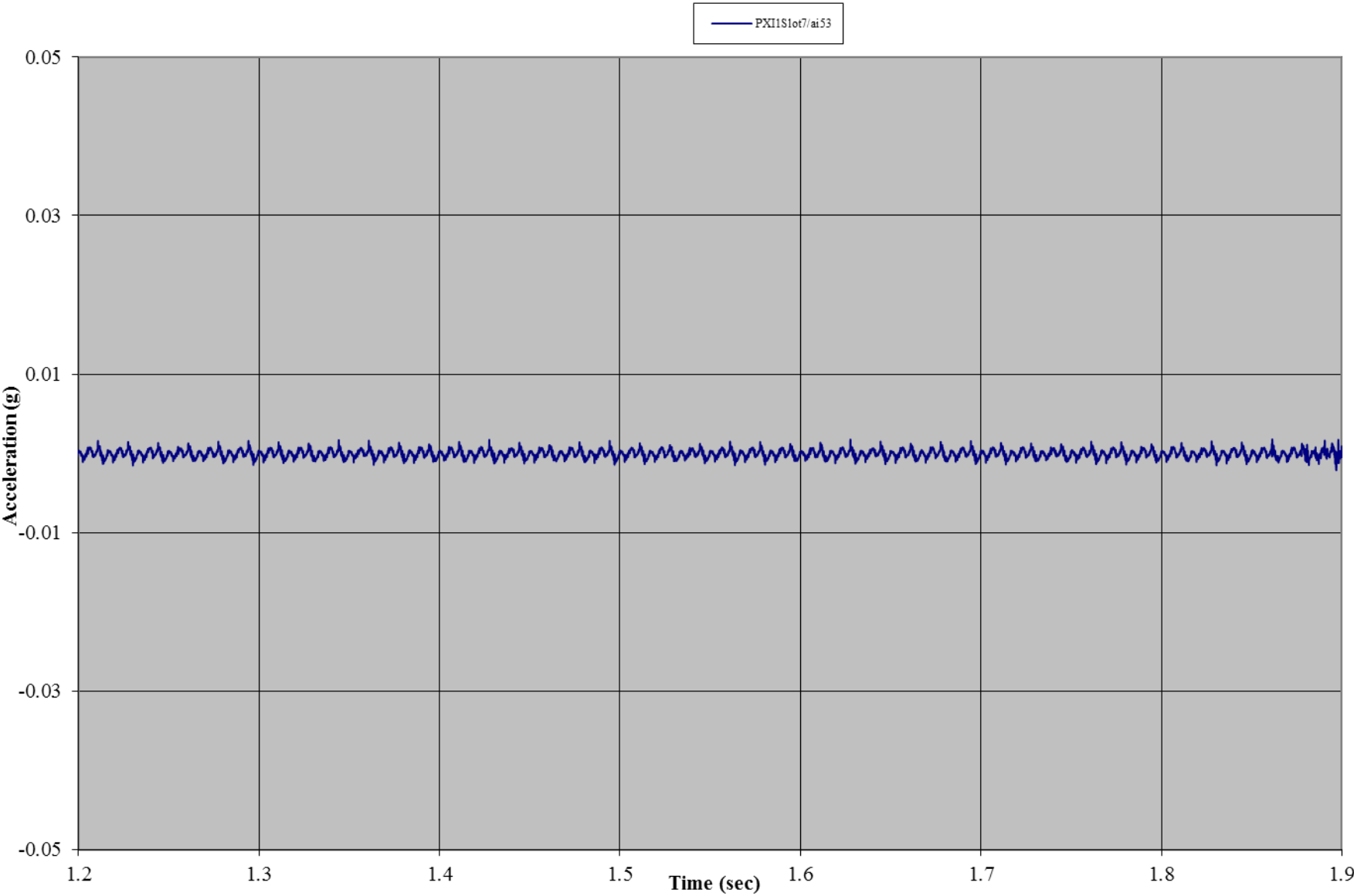
Test B01: Non-Wind Rated Pole Tent without Sides
Accelerometer 2: Roof (x-direction)



Test B01: Non-Wind Rated Pole Tent without Sides
Accelerometer 2: Roof (y-direction)

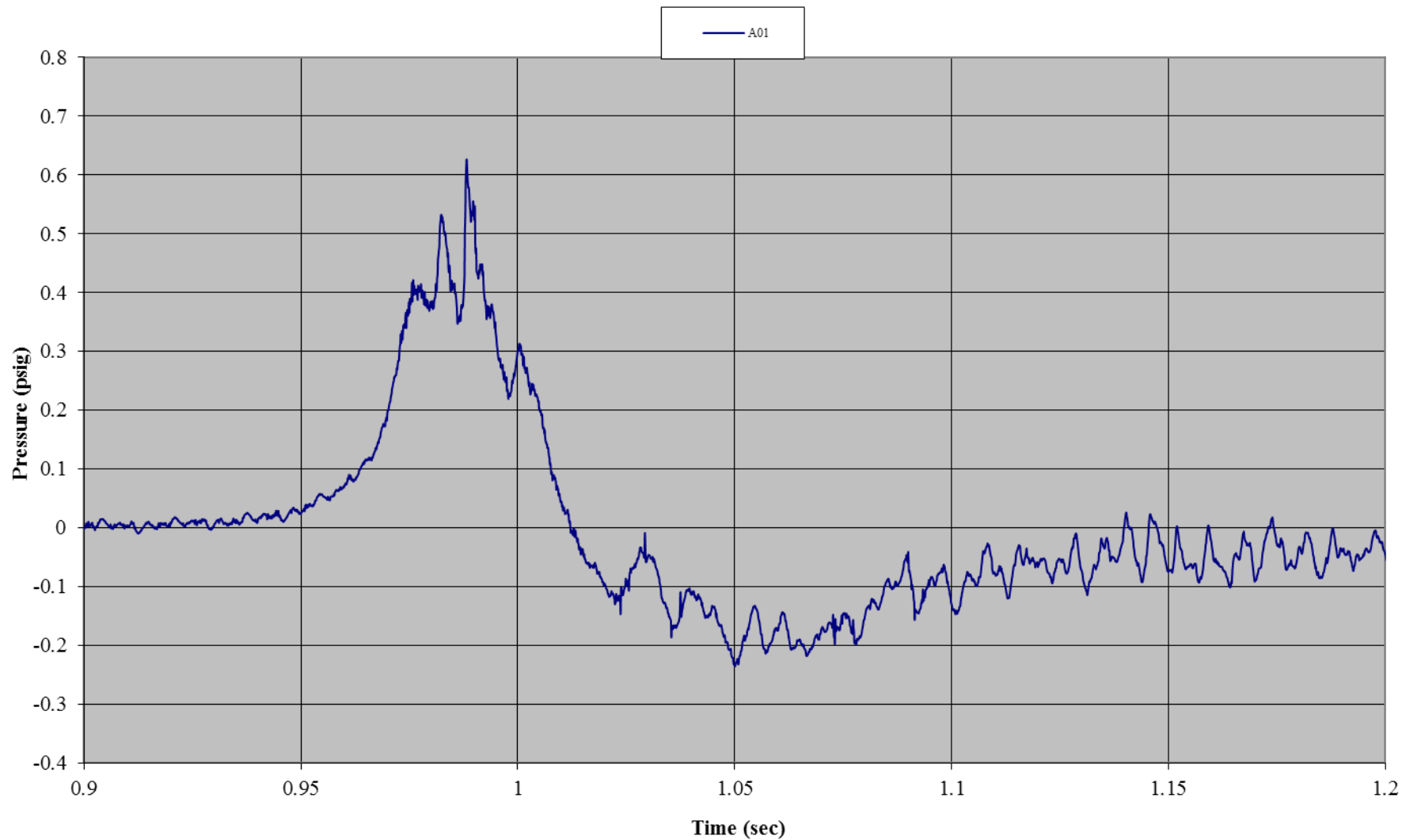


Test B01: Non-Wind Rated Pole Tent without Sides
Accelerometer 2: Roof (z-direction)

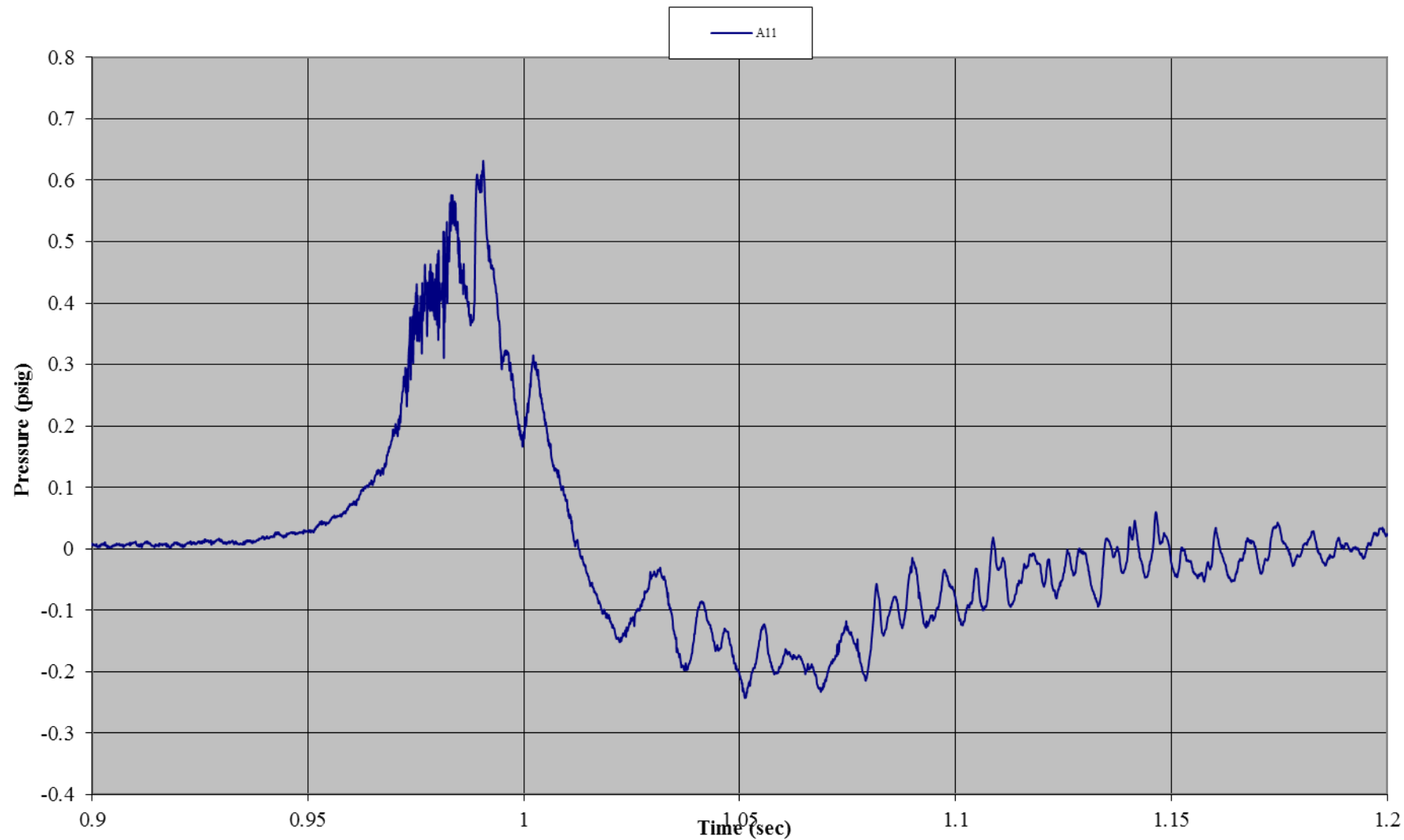


Test B06: Tent A

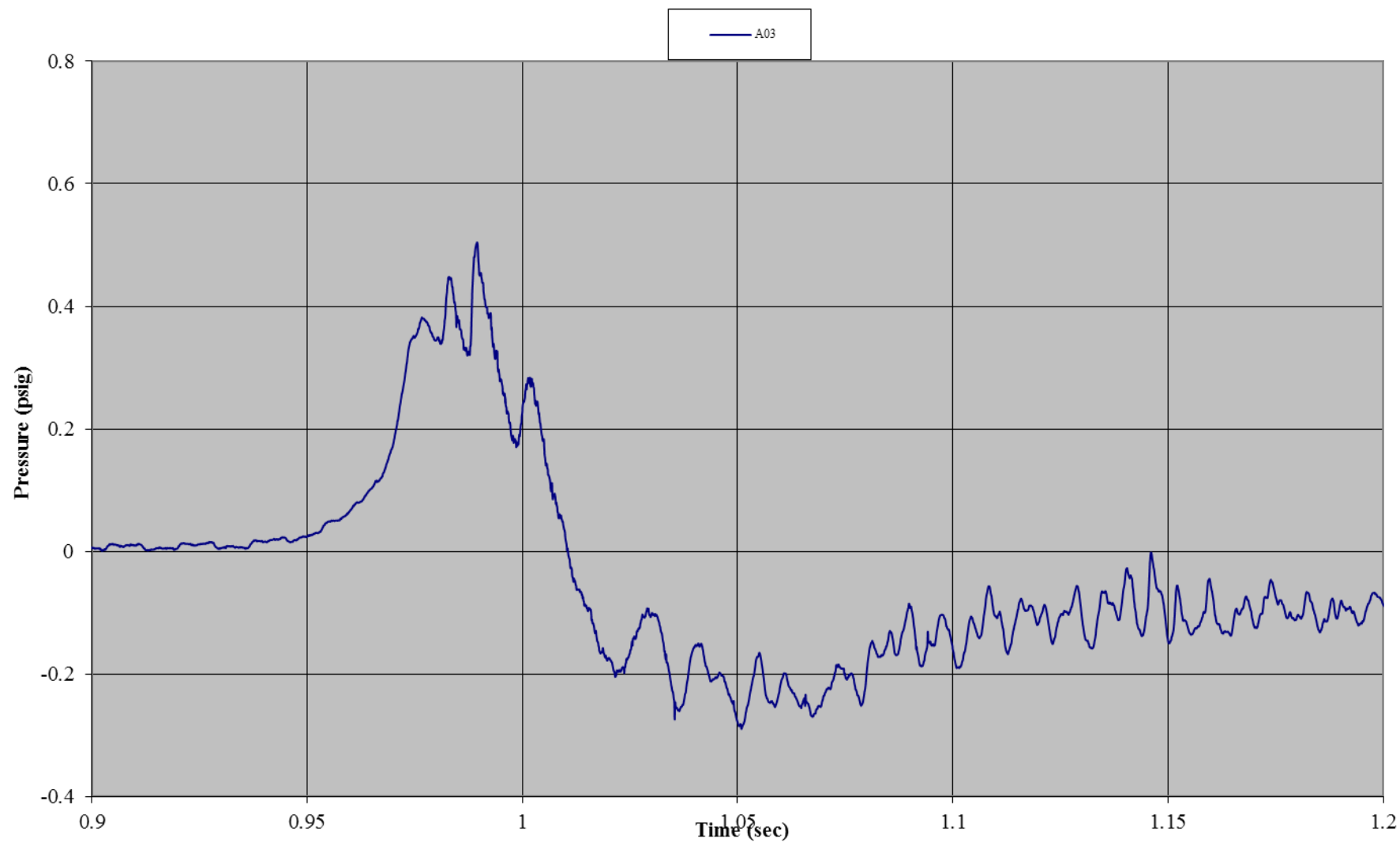
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 01: Front Wall, Left Bottom



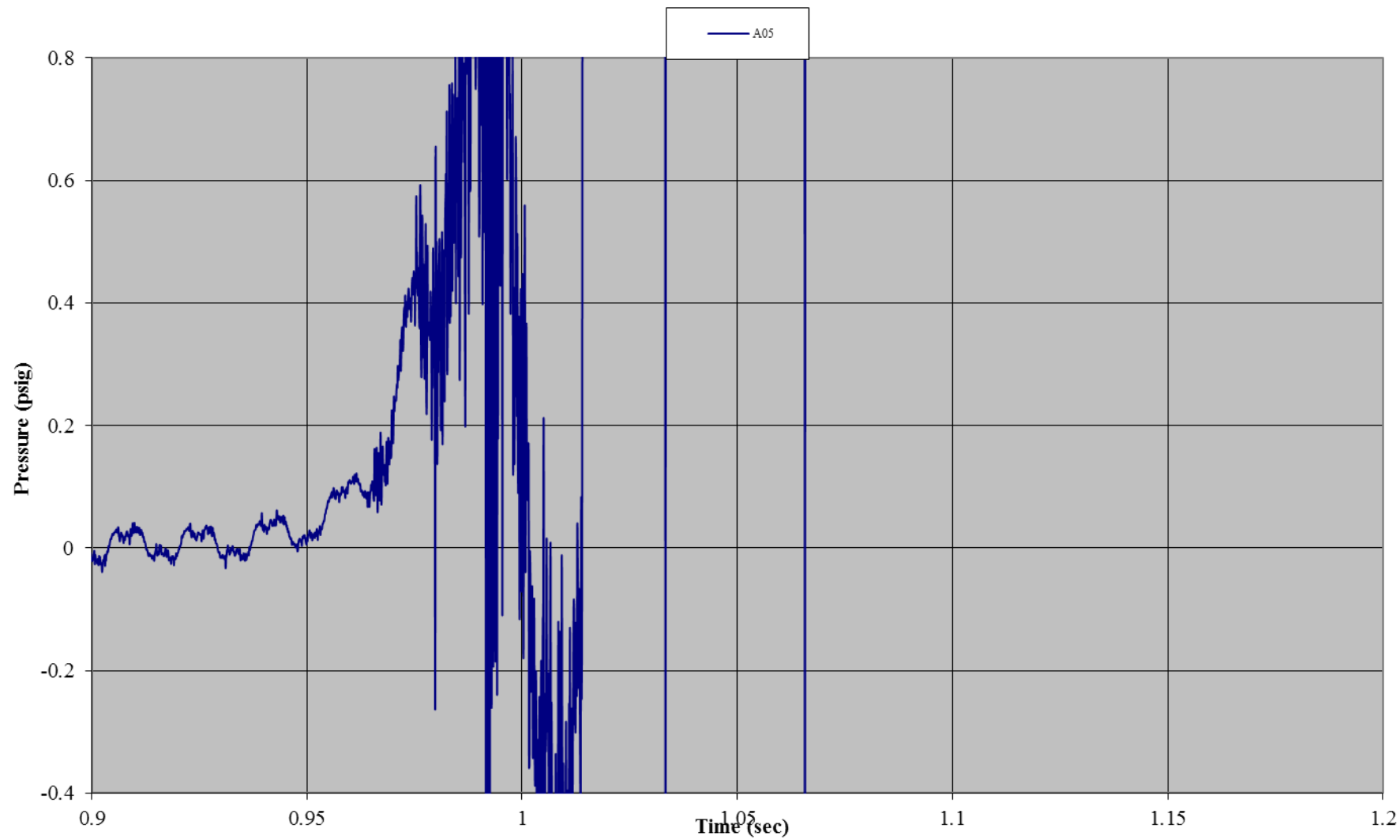
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 11: Front Wall, Right Bottom



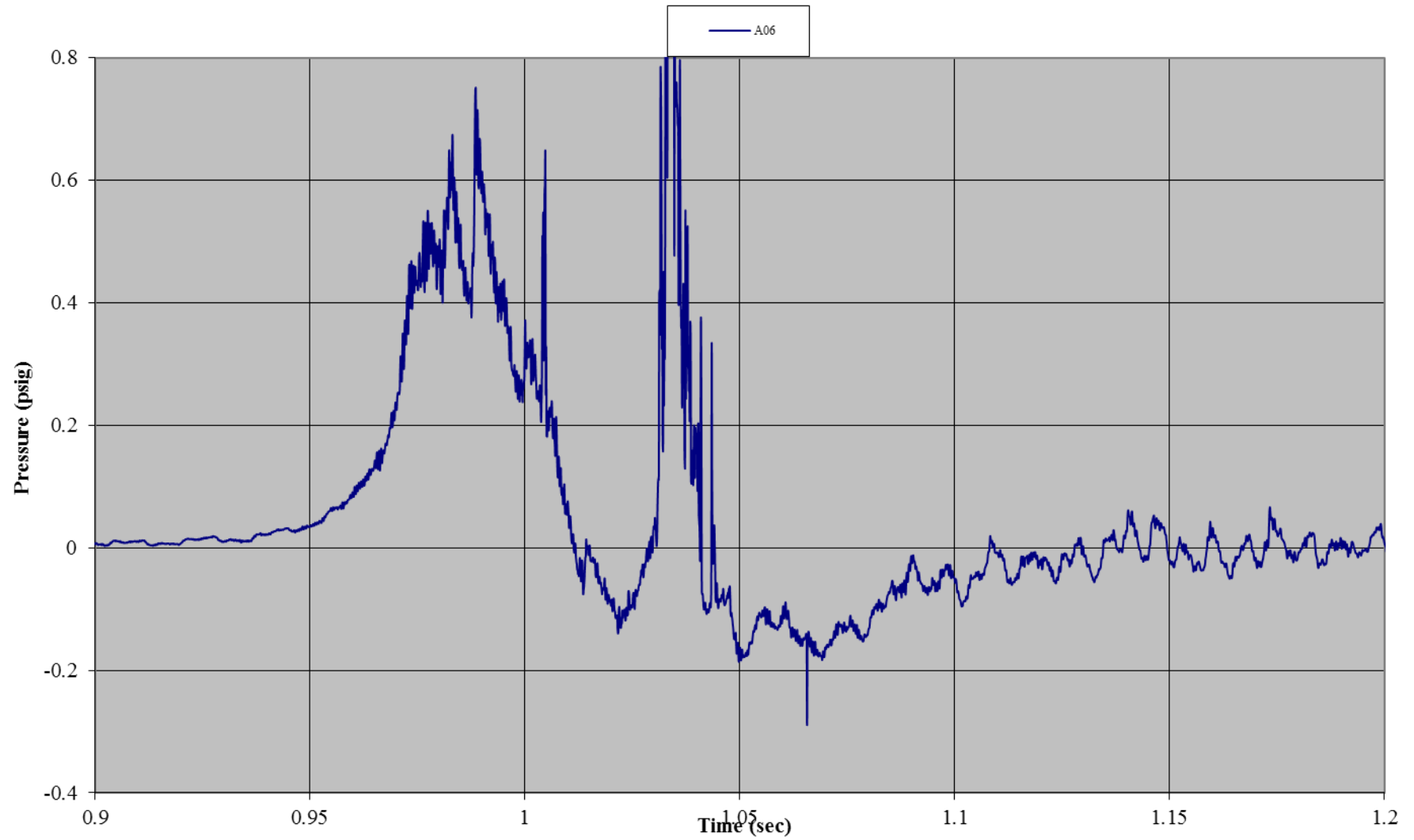
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 03: Front Wall, Center Bottom



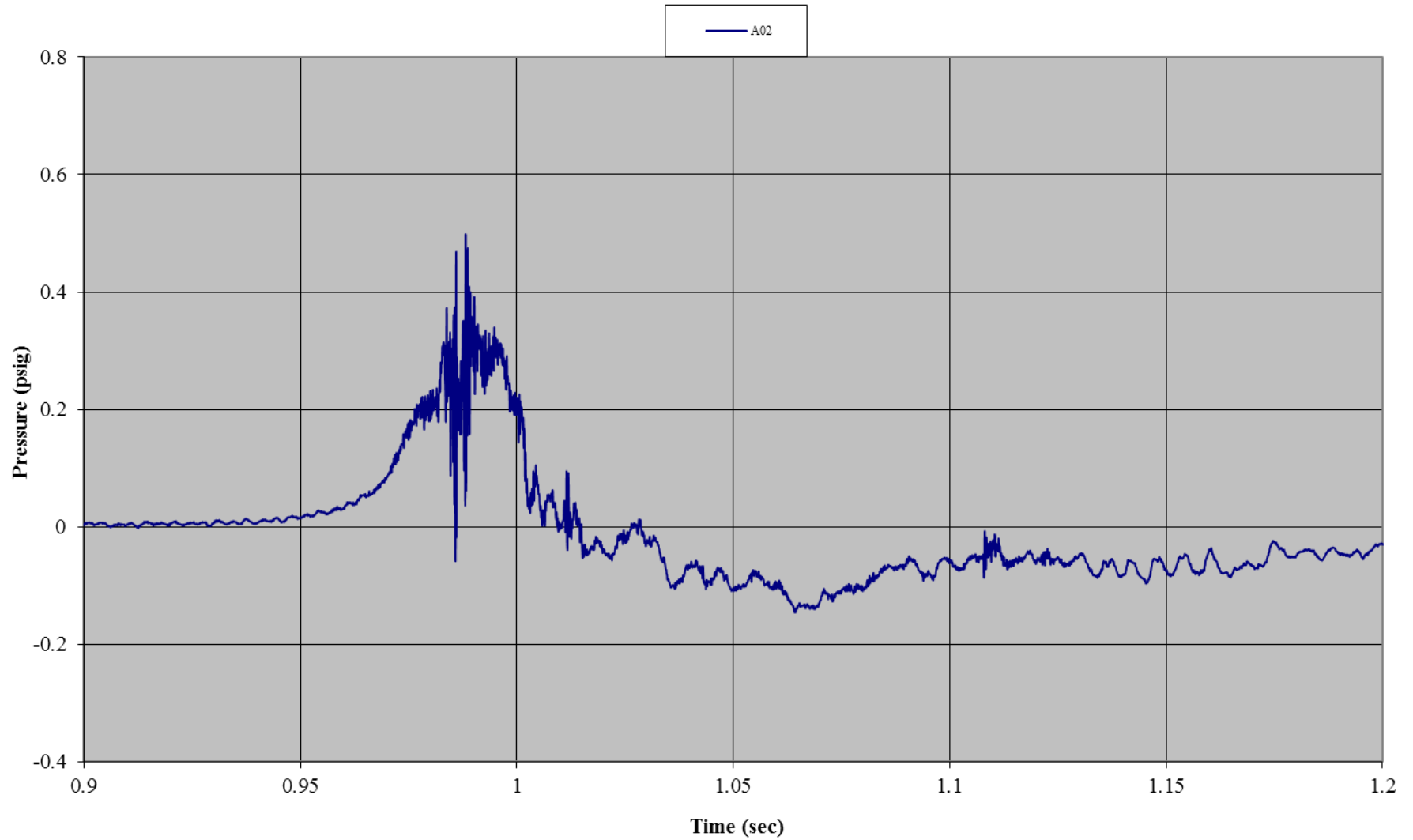
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



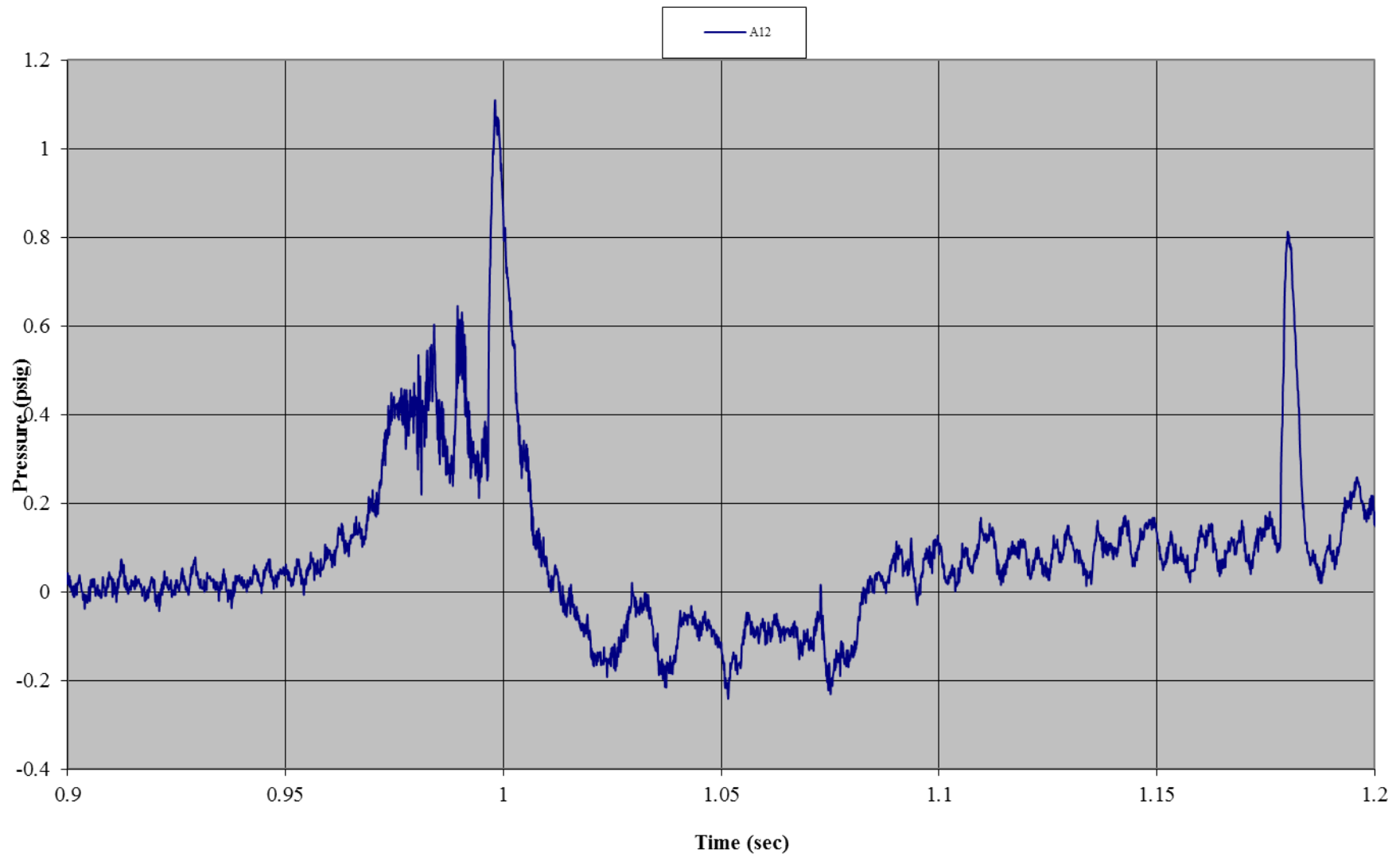
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 06: Front Wall, Center Top



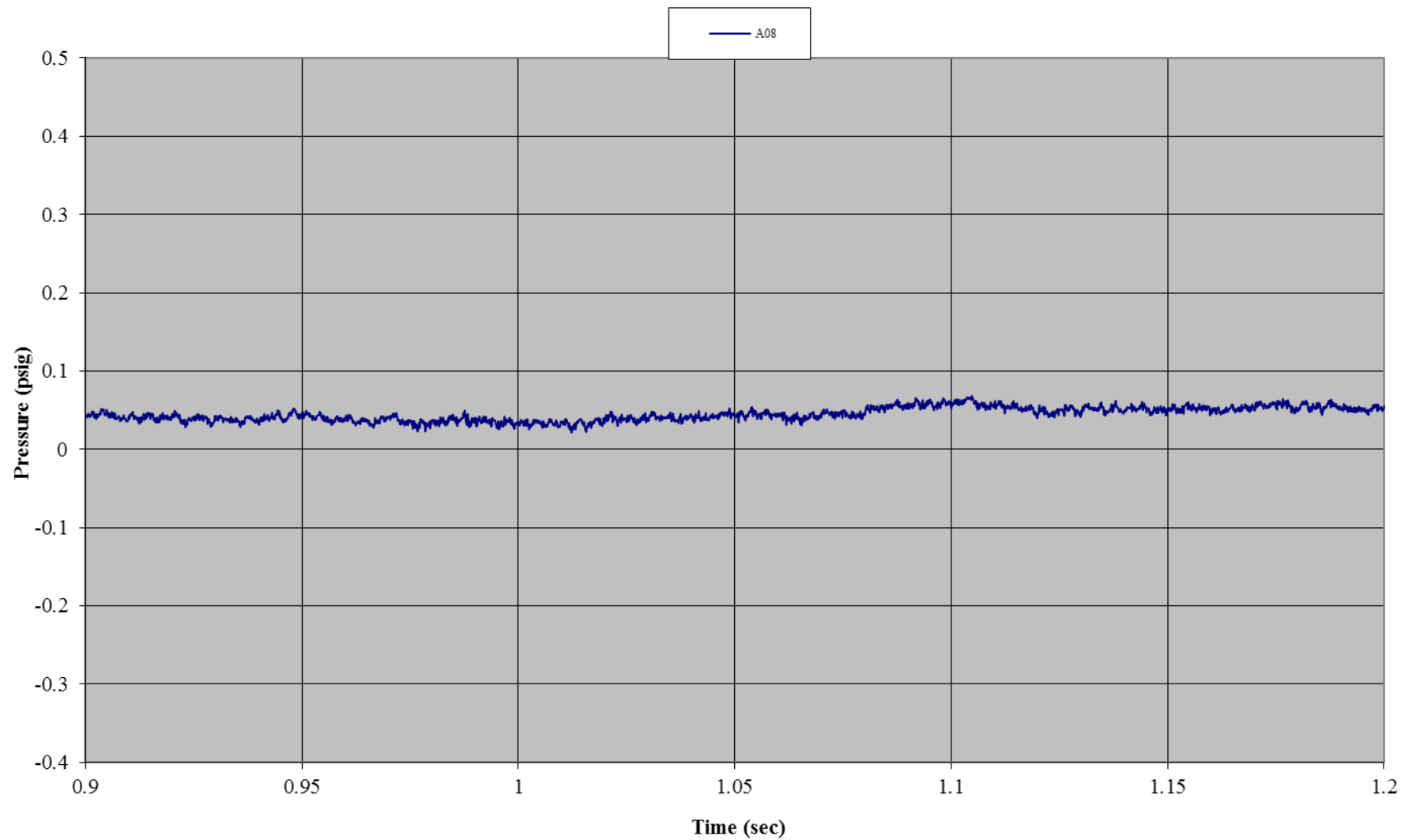
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



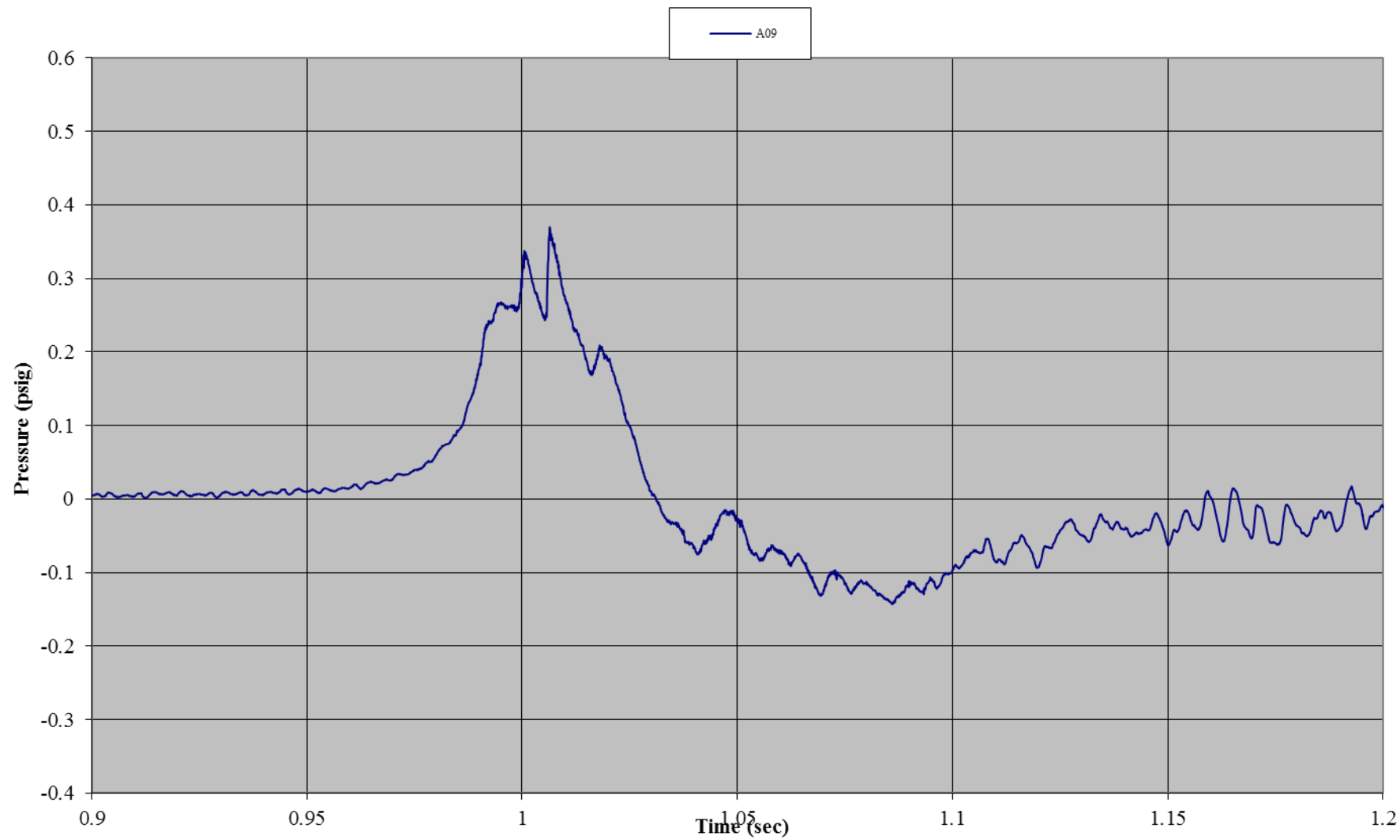
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



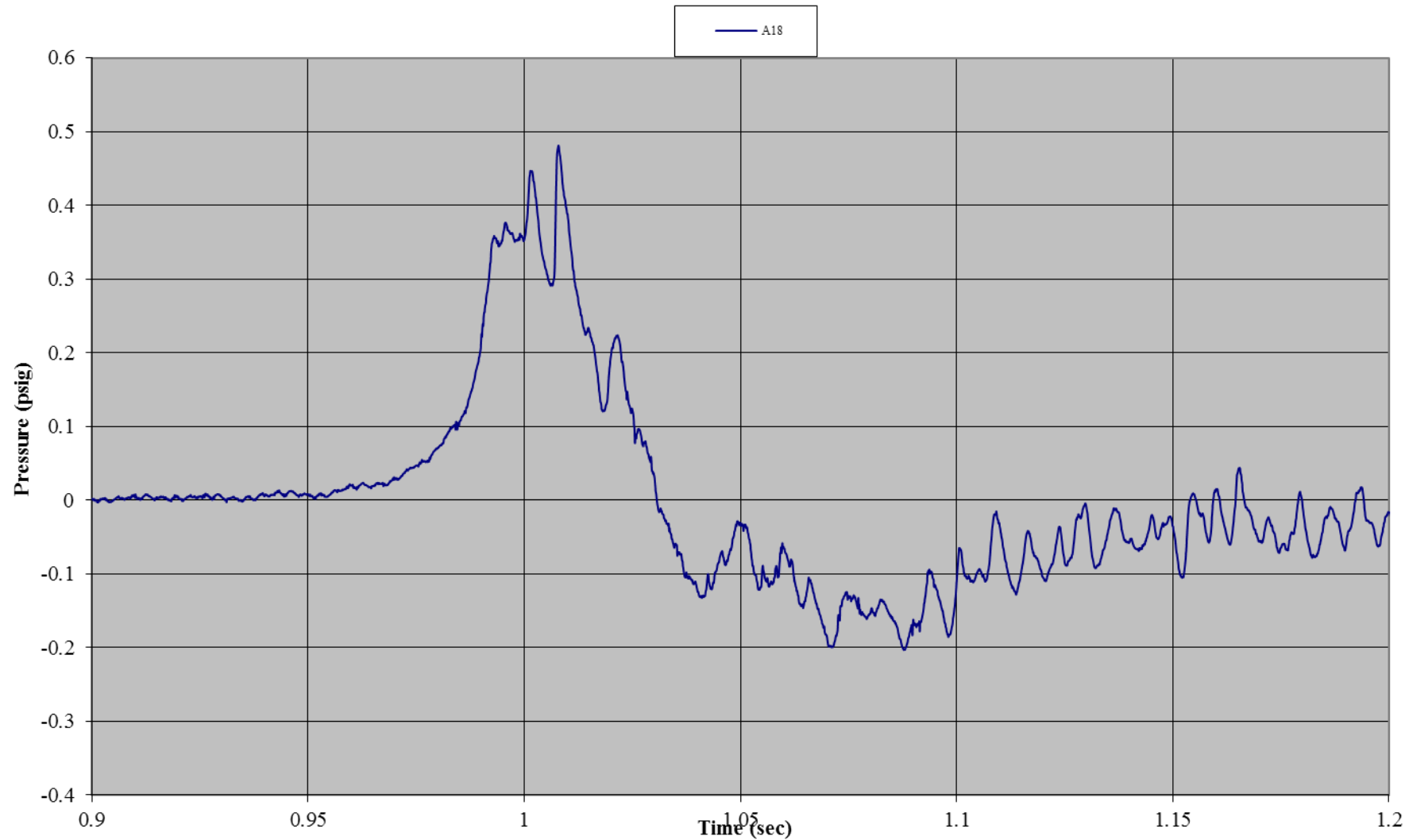
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 08: Left Side Wall, Bottom



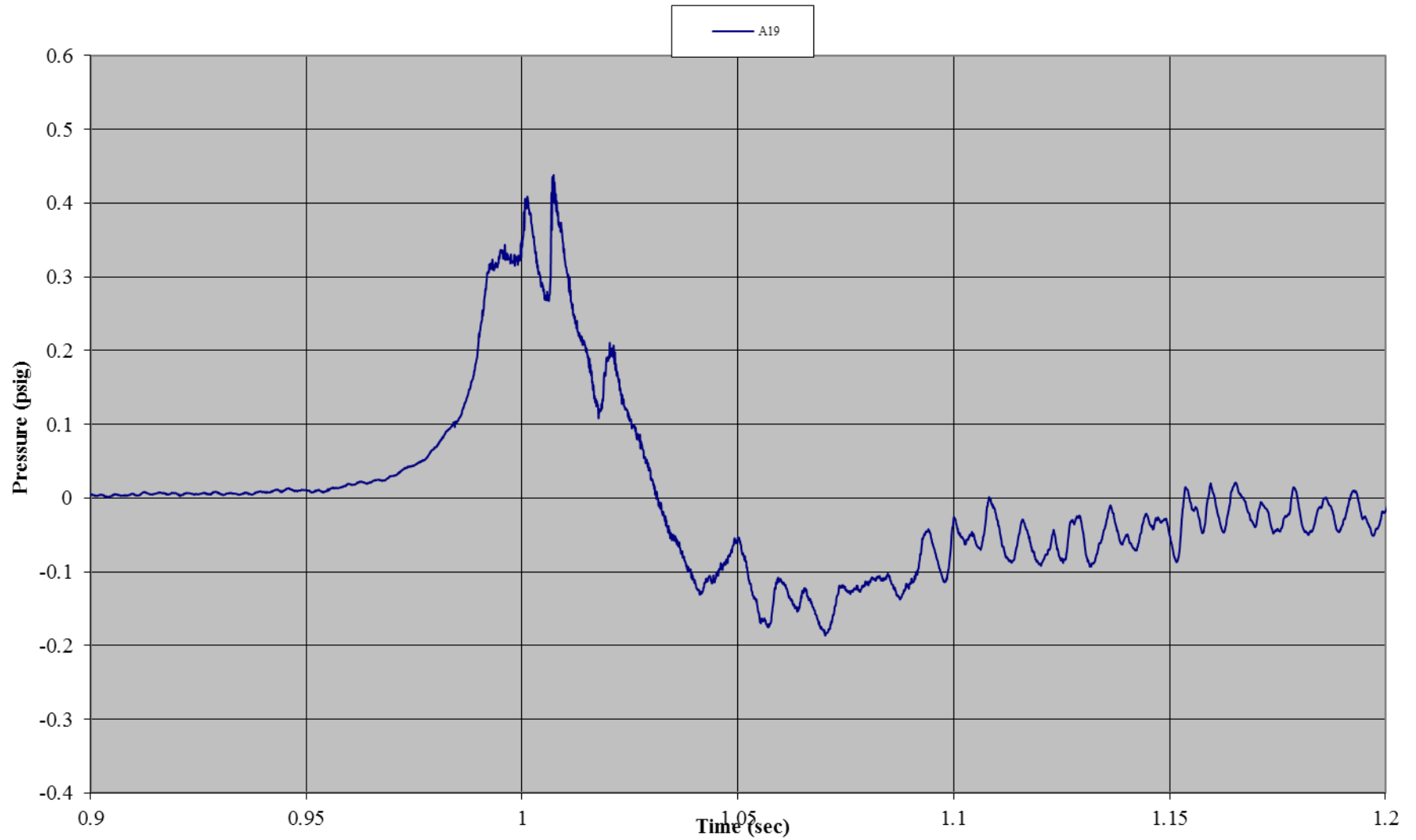
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



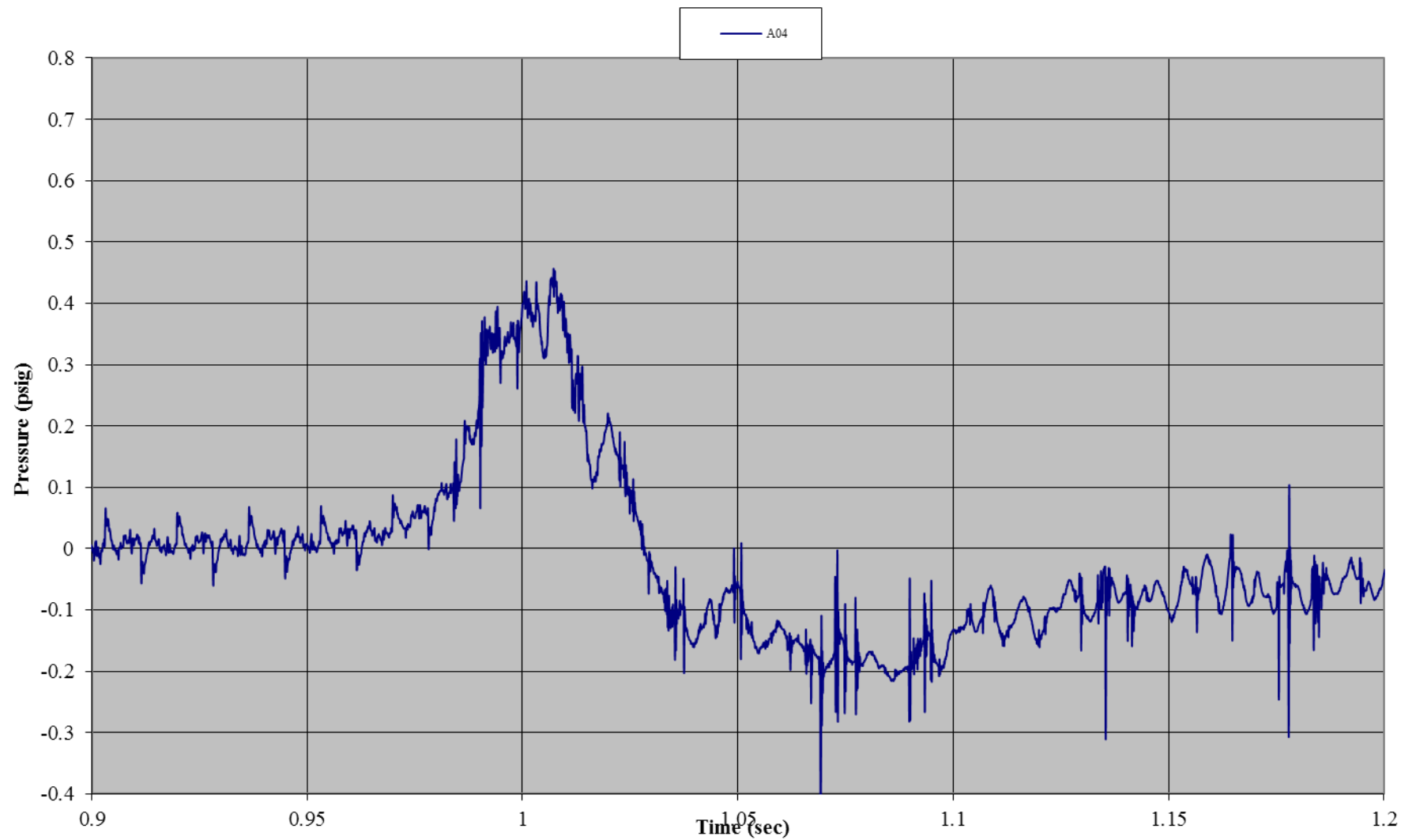
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 18: Right Side Wall, Bottom



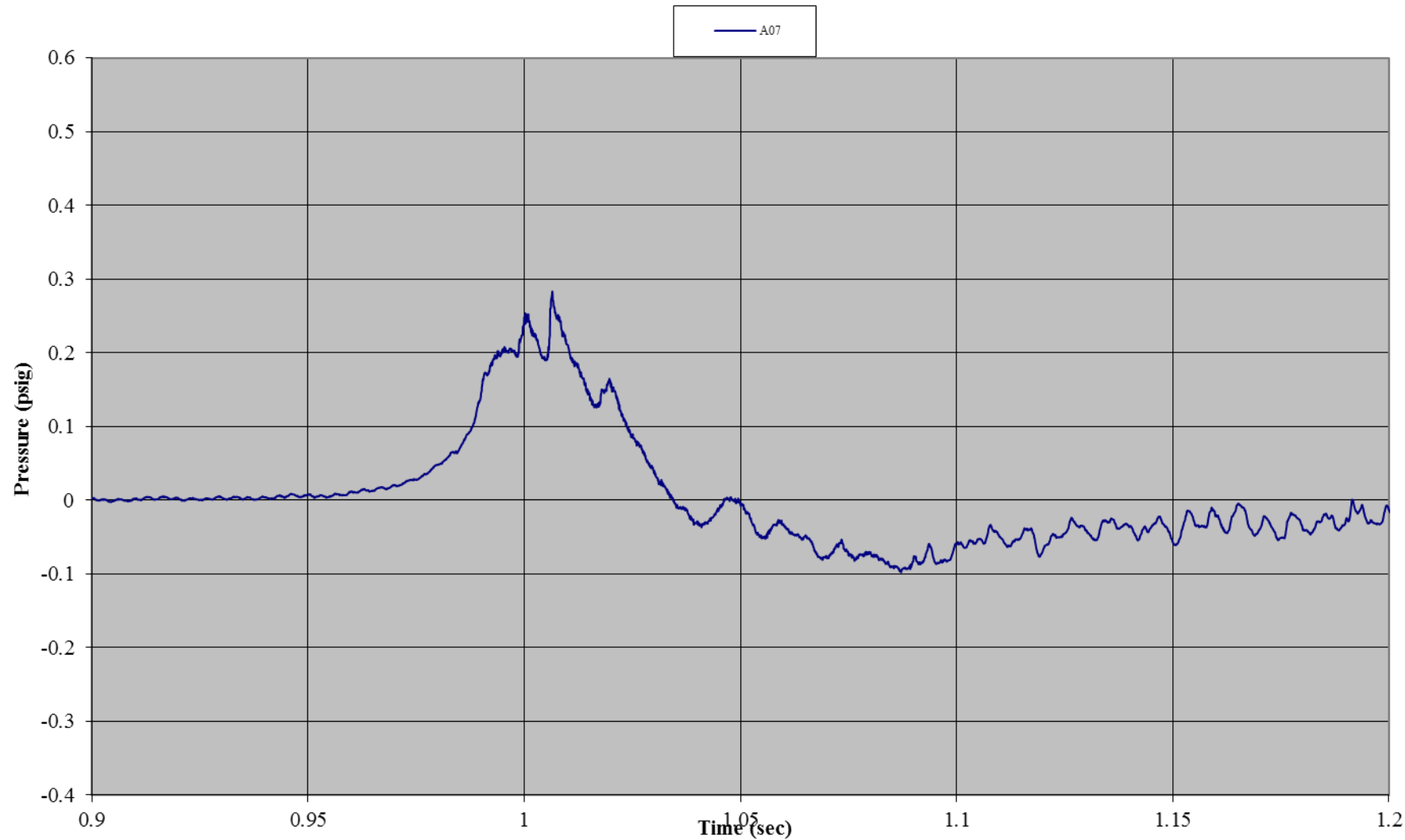
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



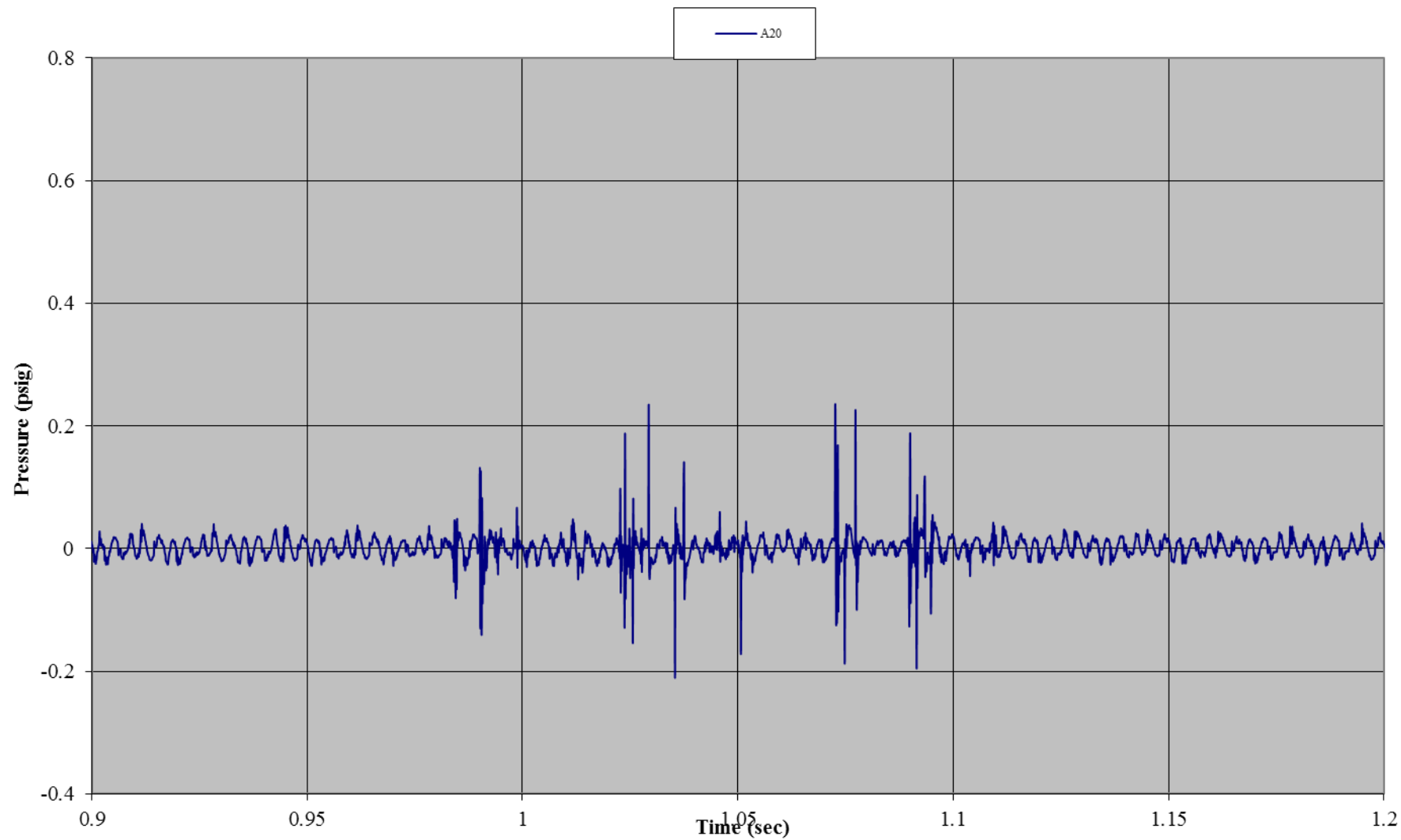
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 04: Interior, Ground



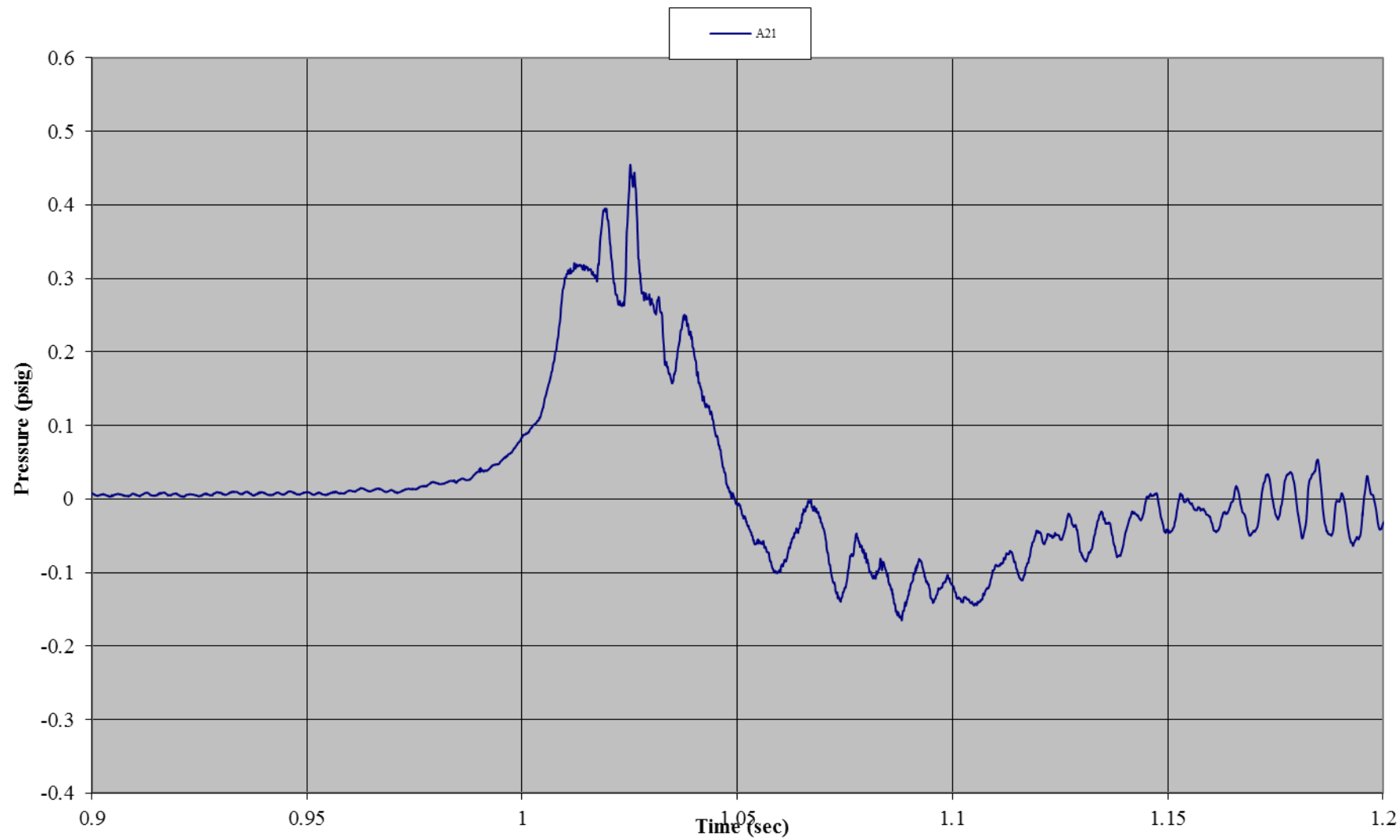
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 07: Roof, Front



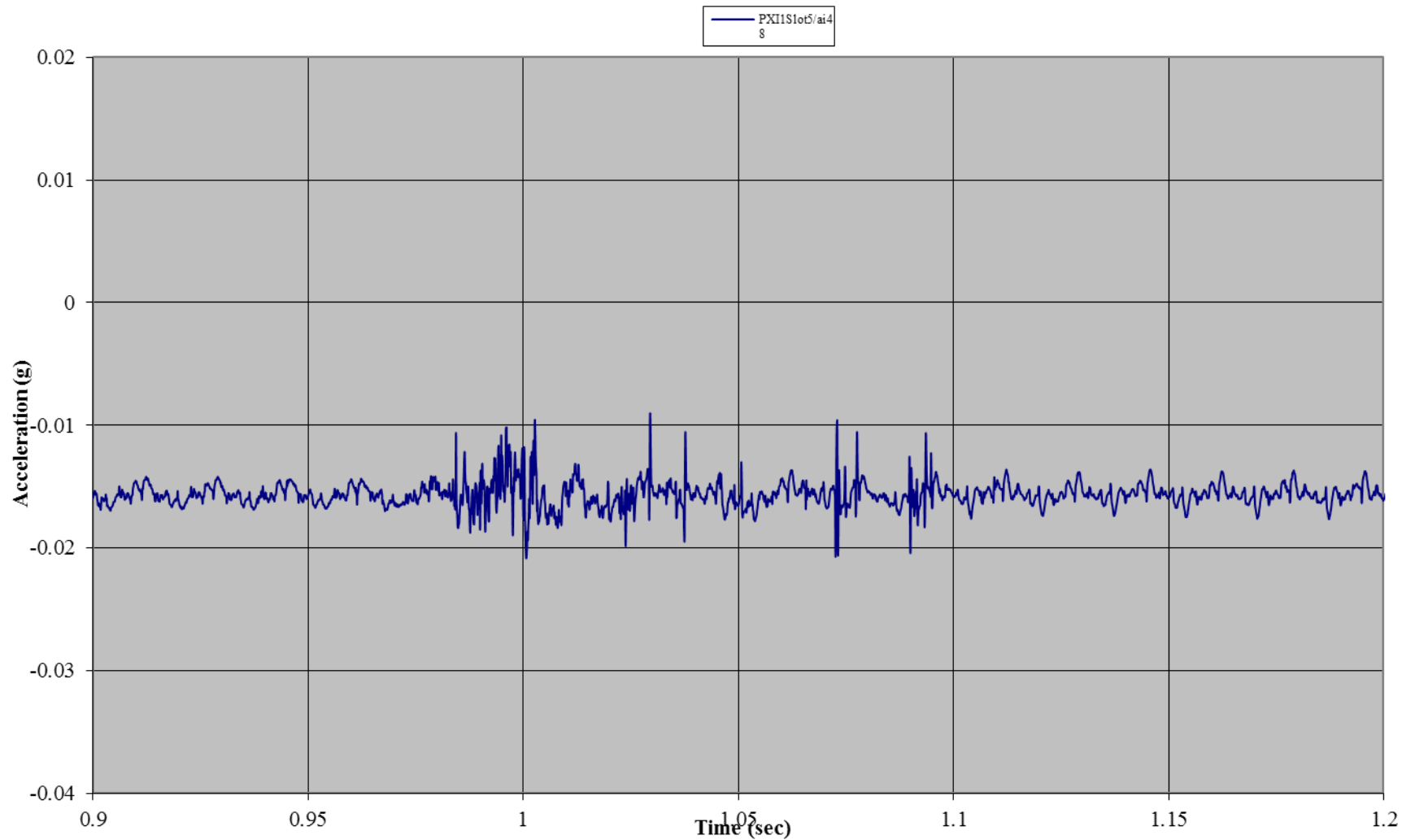
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 20: Roof, Back



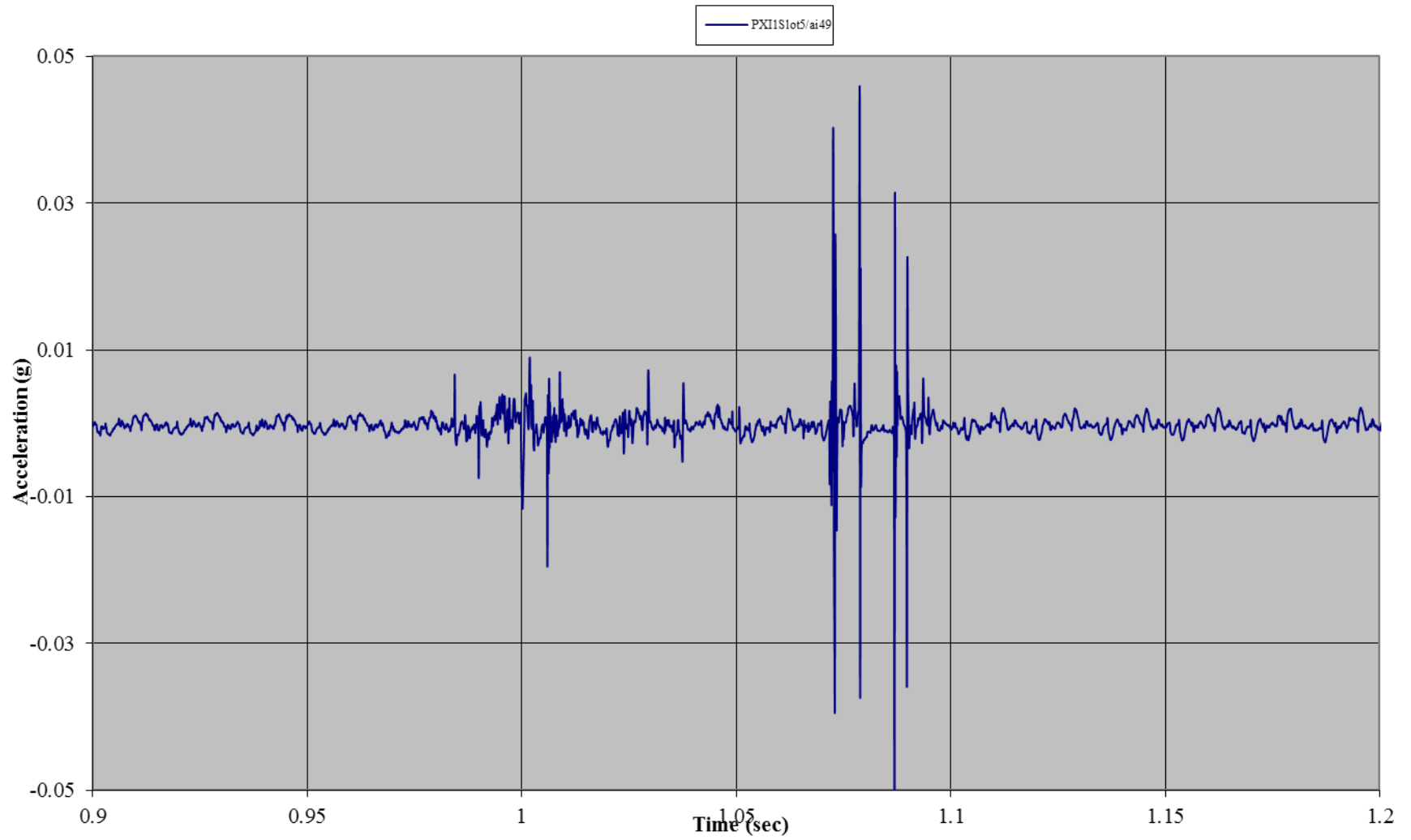
Test B06: Non-Wind Rated Pole Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



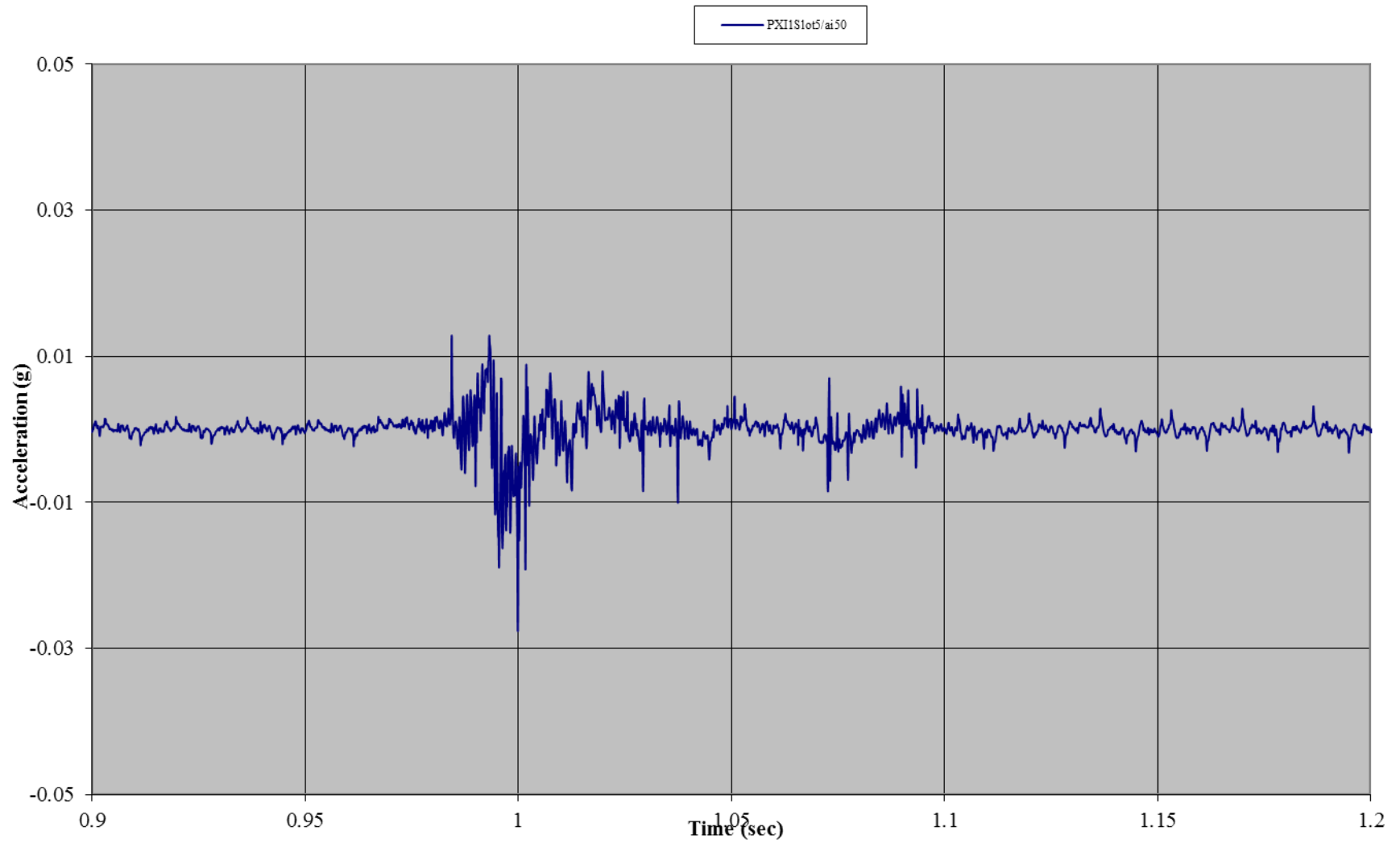
Test B06: Non-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (x-direction)



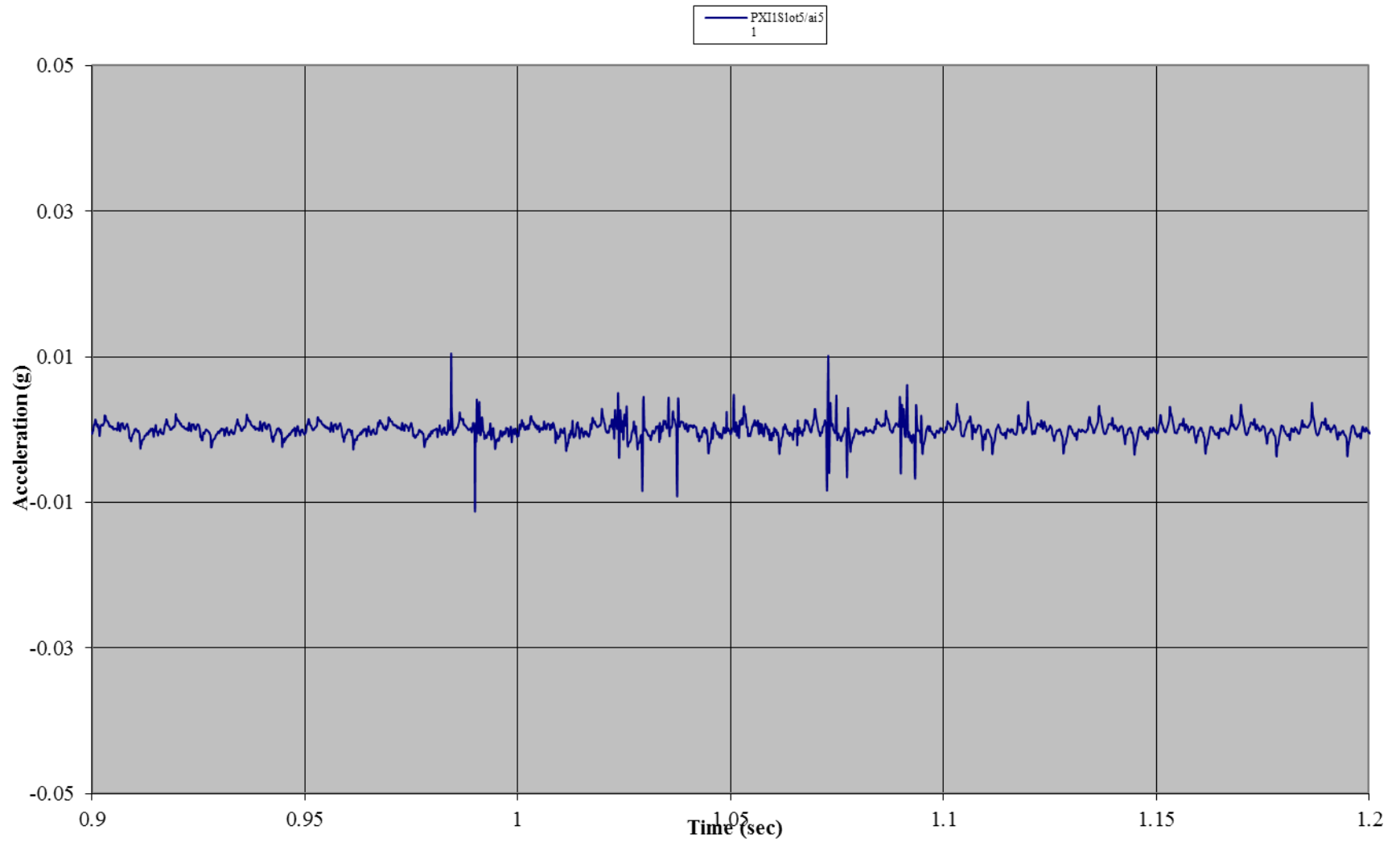
Test B06: Non-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (y-direction)



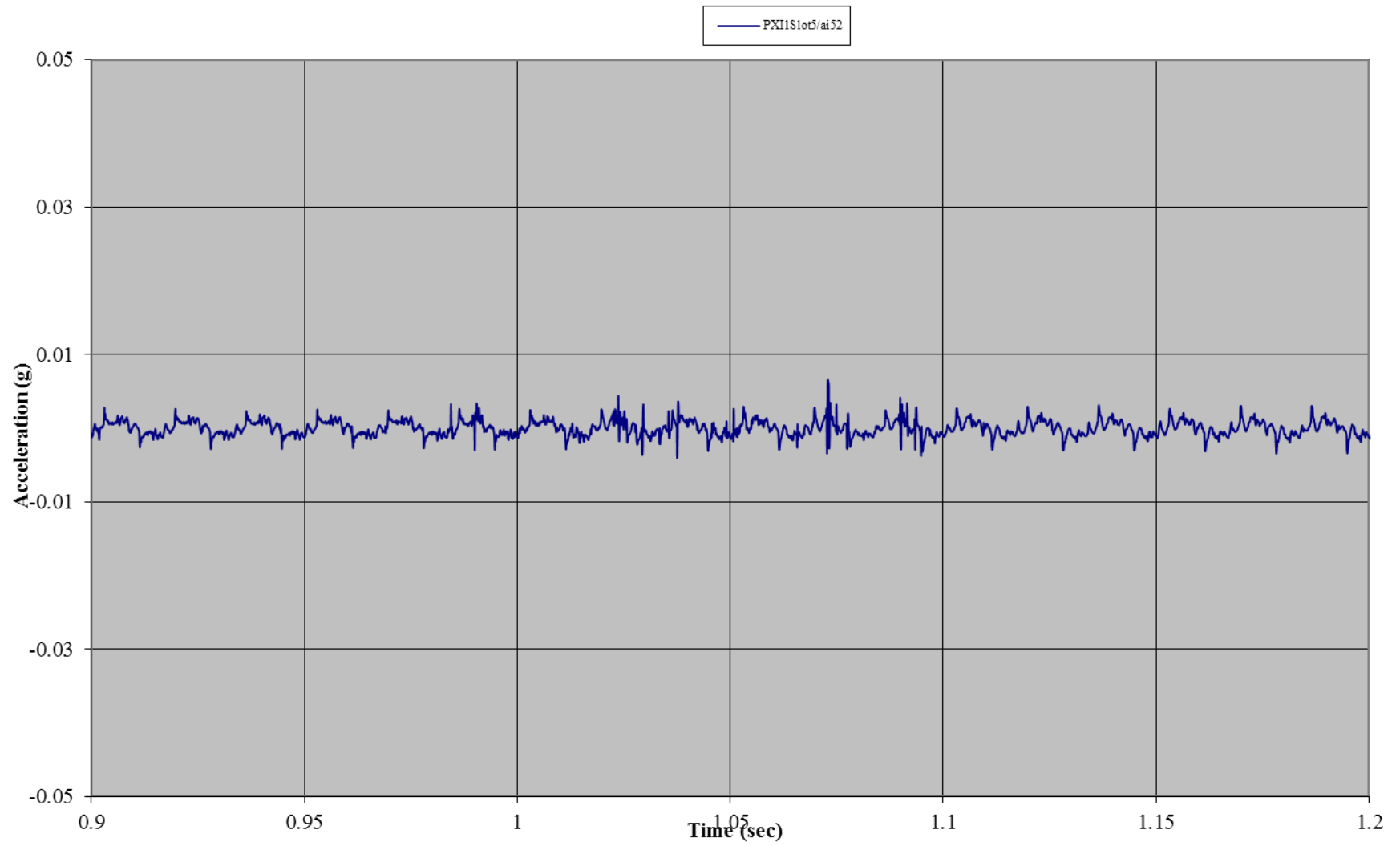
Test B06: Non-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (z-direction)



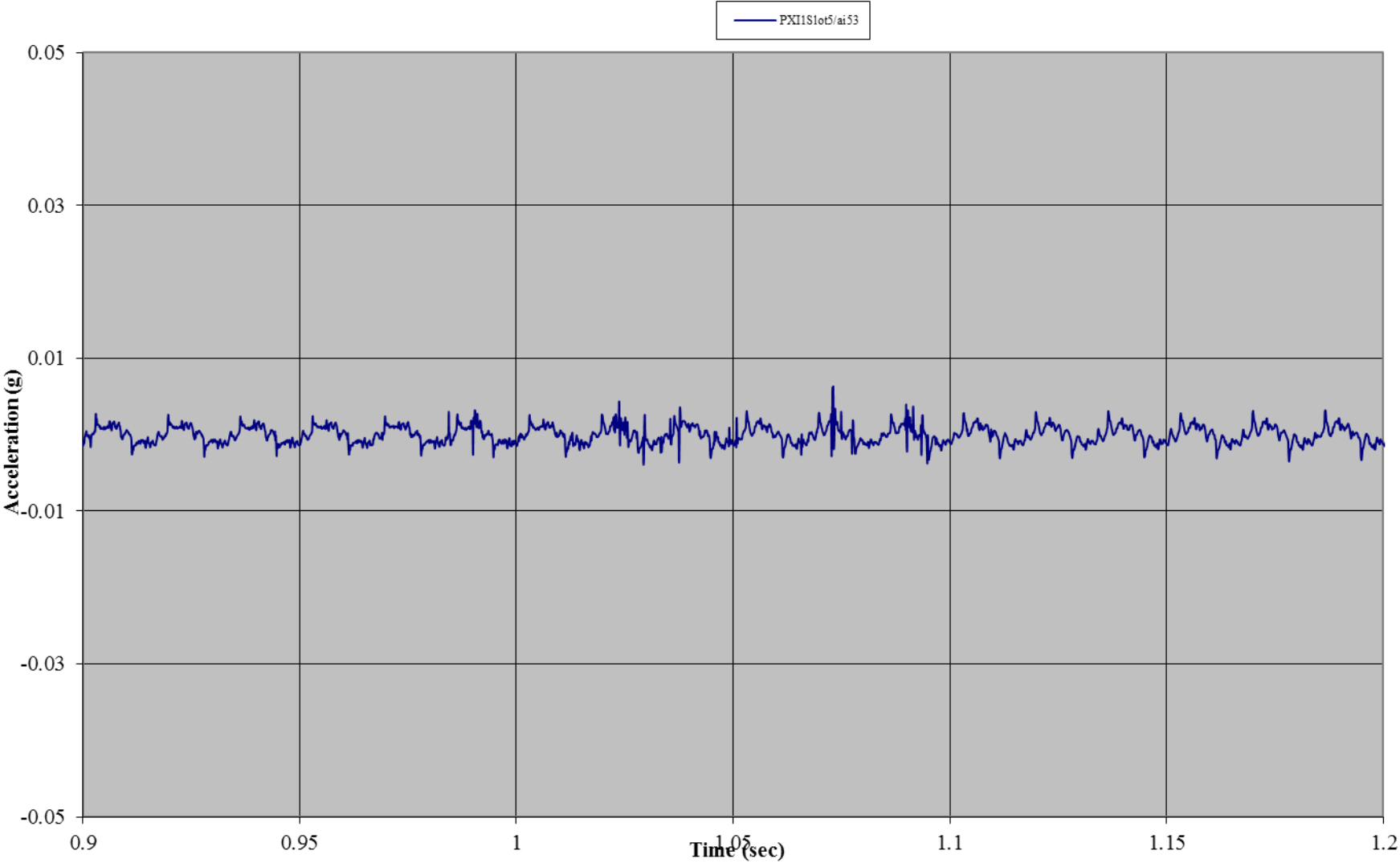
Test B06: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (x-direction)



Test B06: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (y-direction)

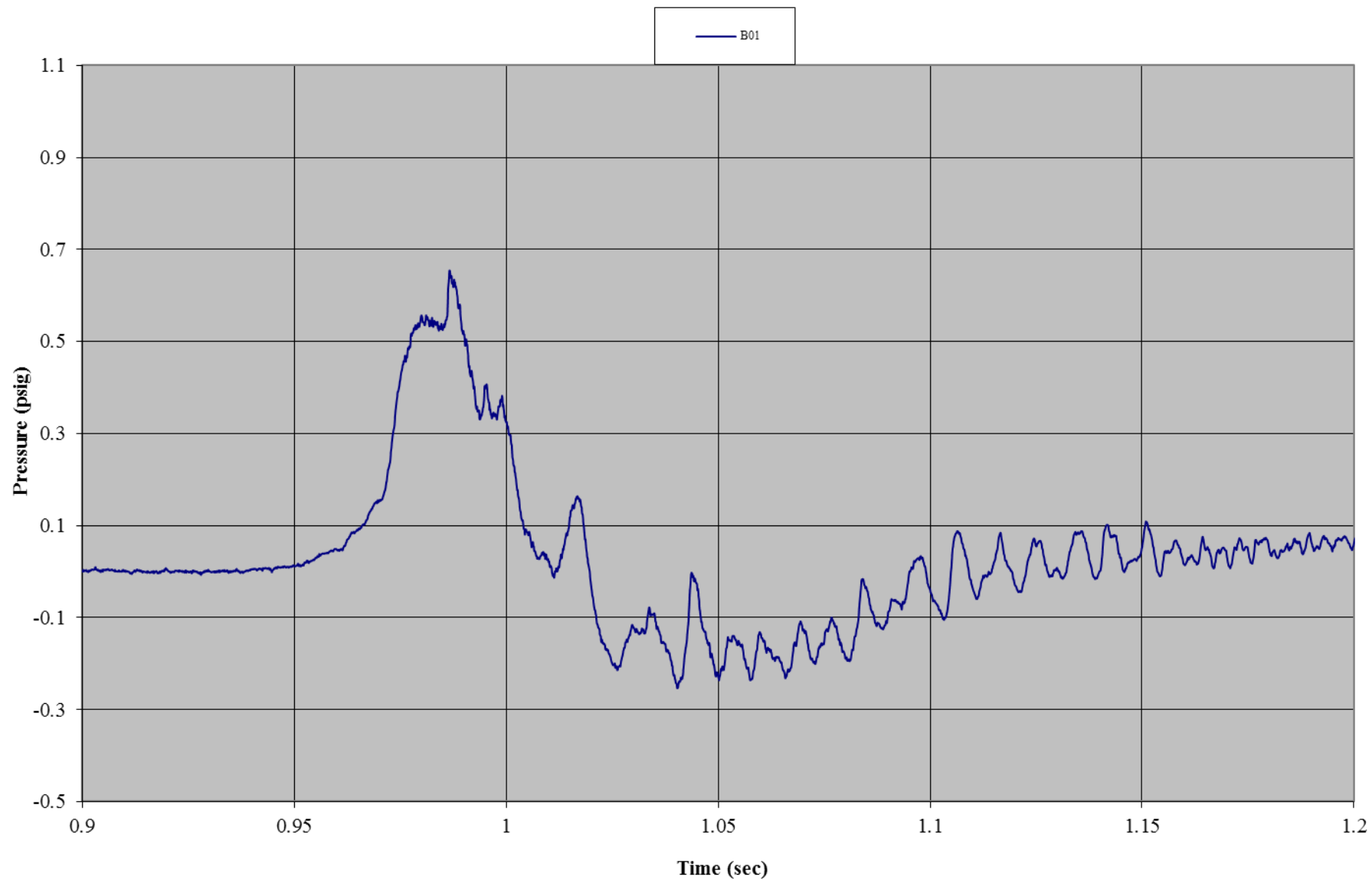


Test B06: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (z-direction)

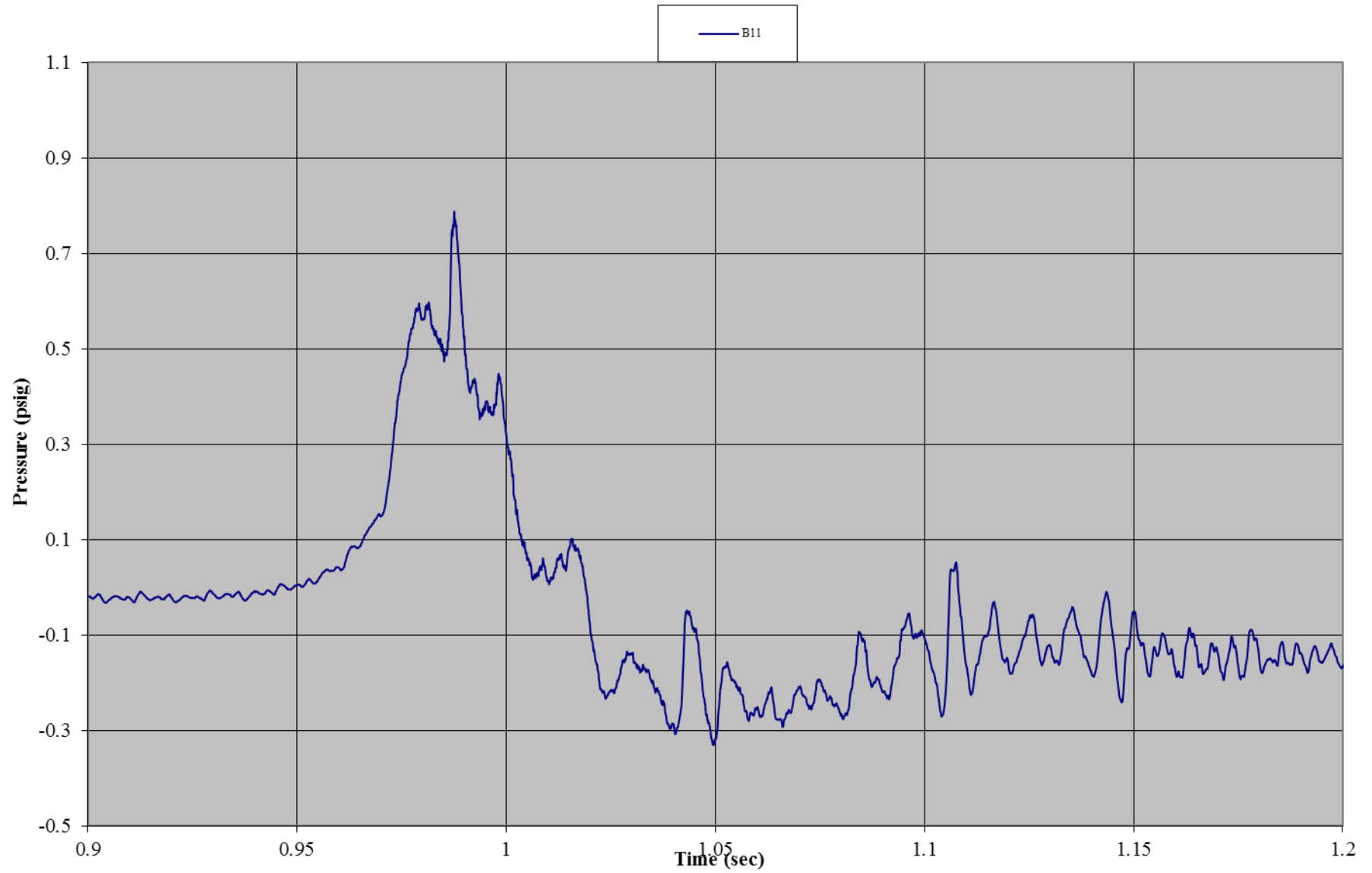


Test B06: Tent B

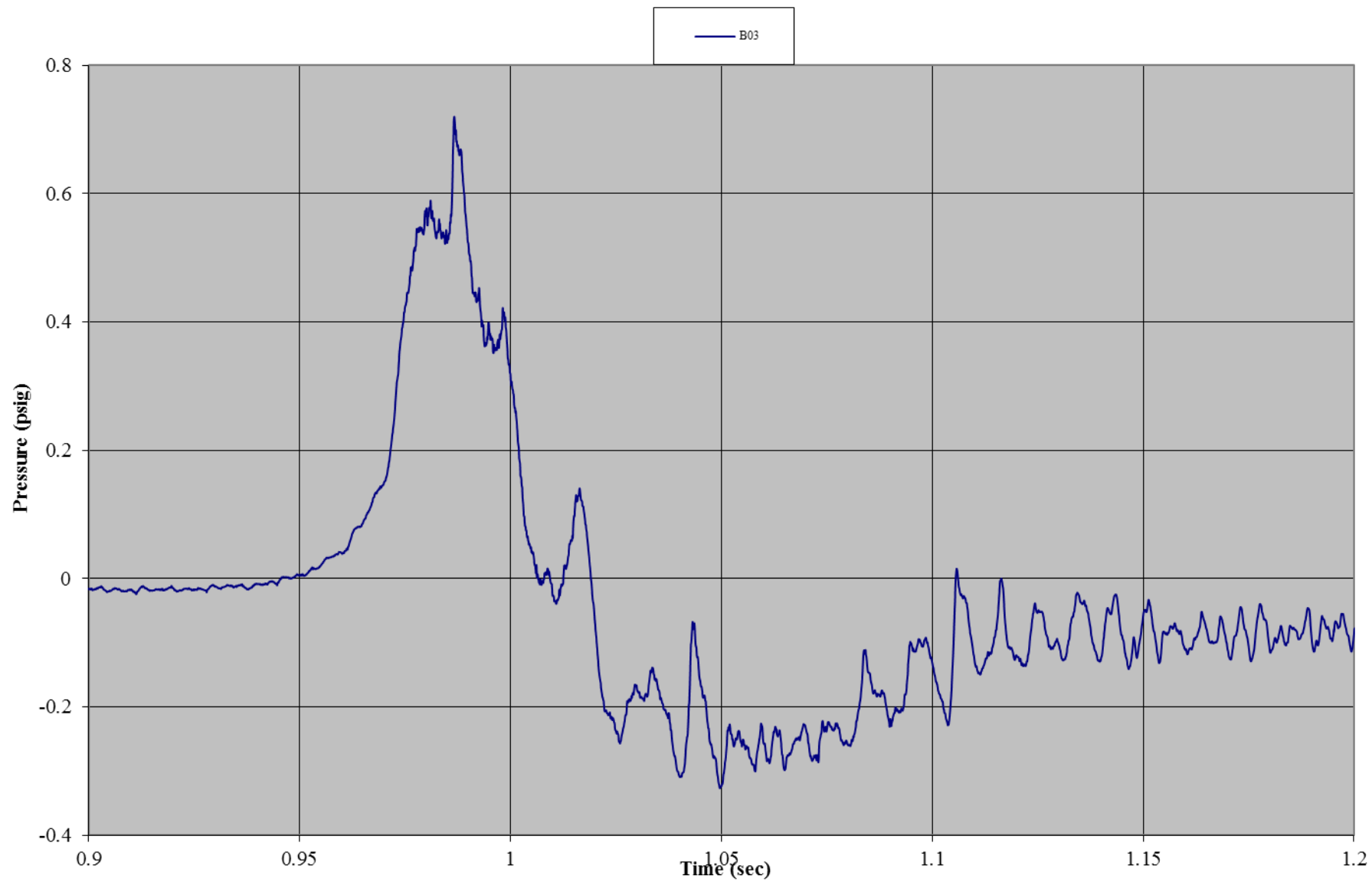
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 01: Front Wall, Left Bottom



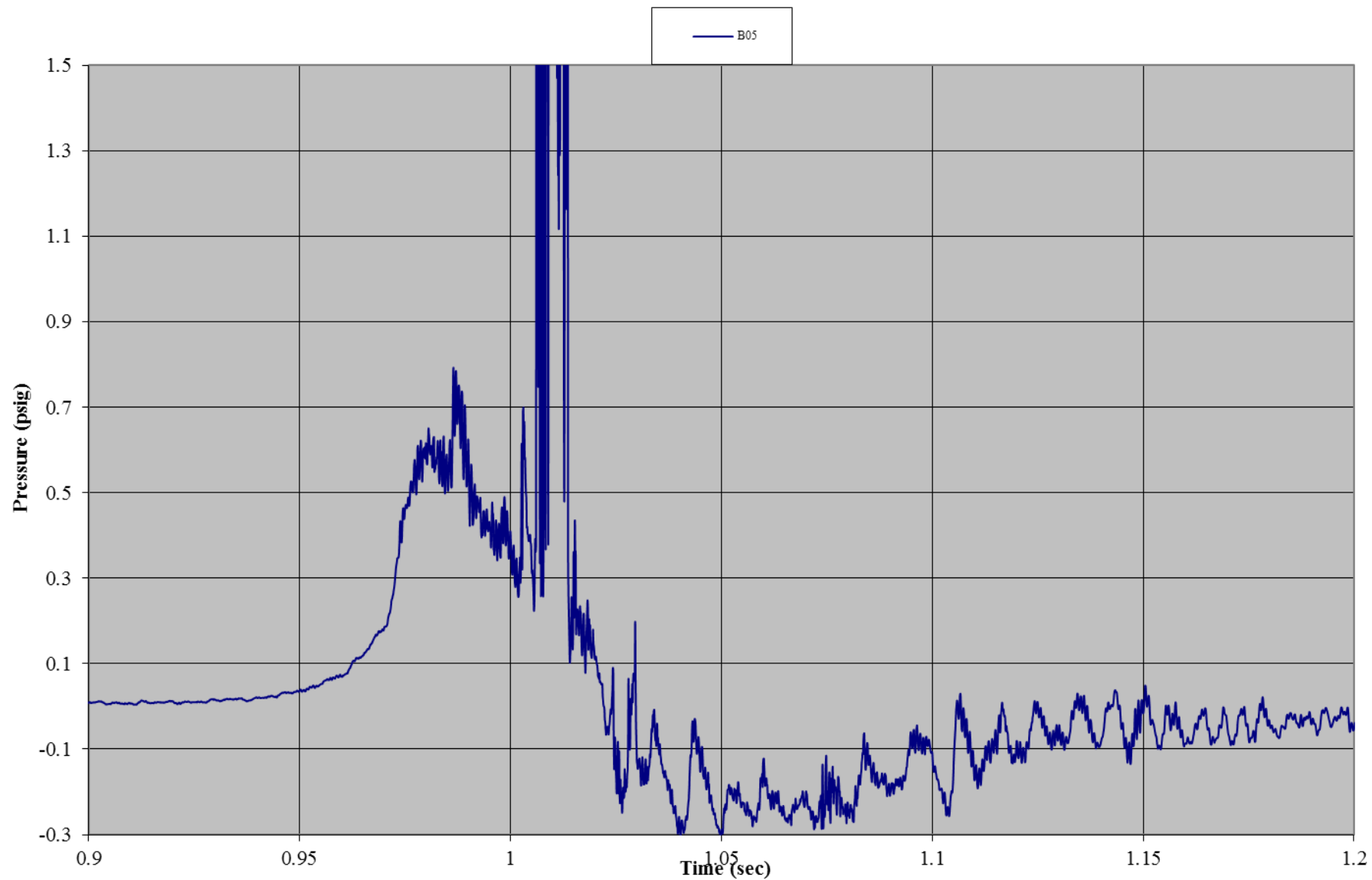
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 11: Front Wall, Right Bottom



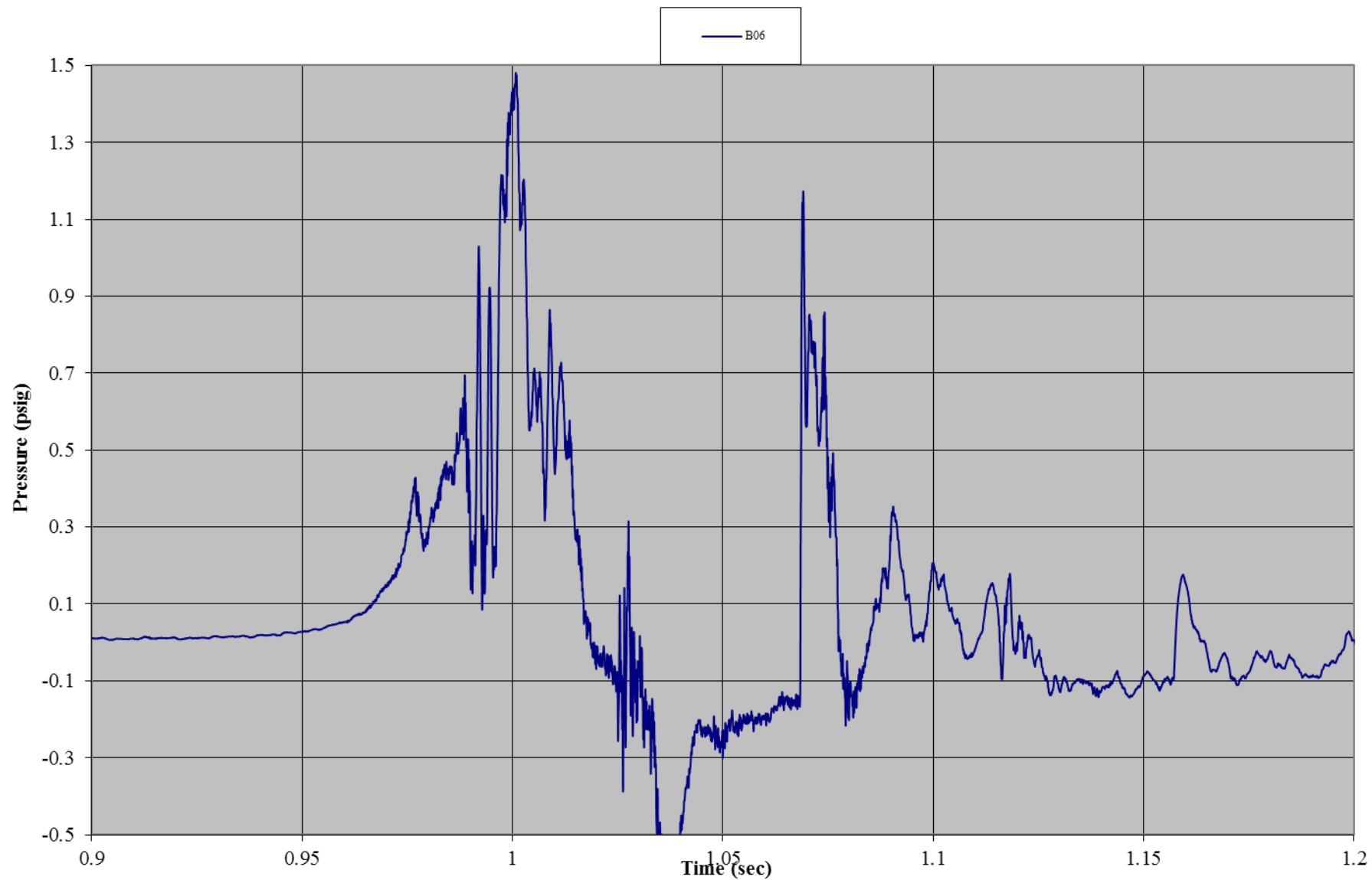
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 03: Front Wall, Center Bottom



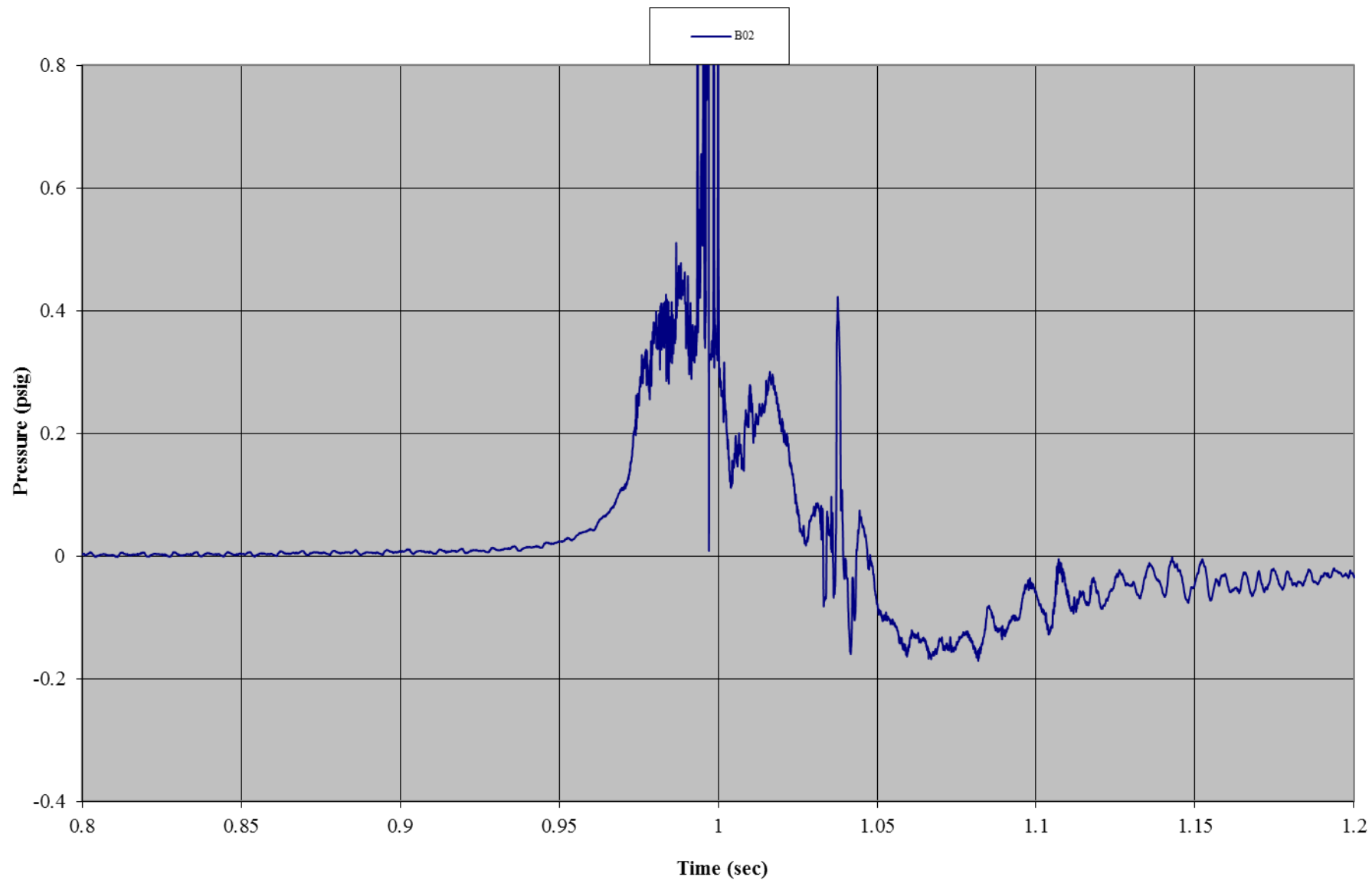
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



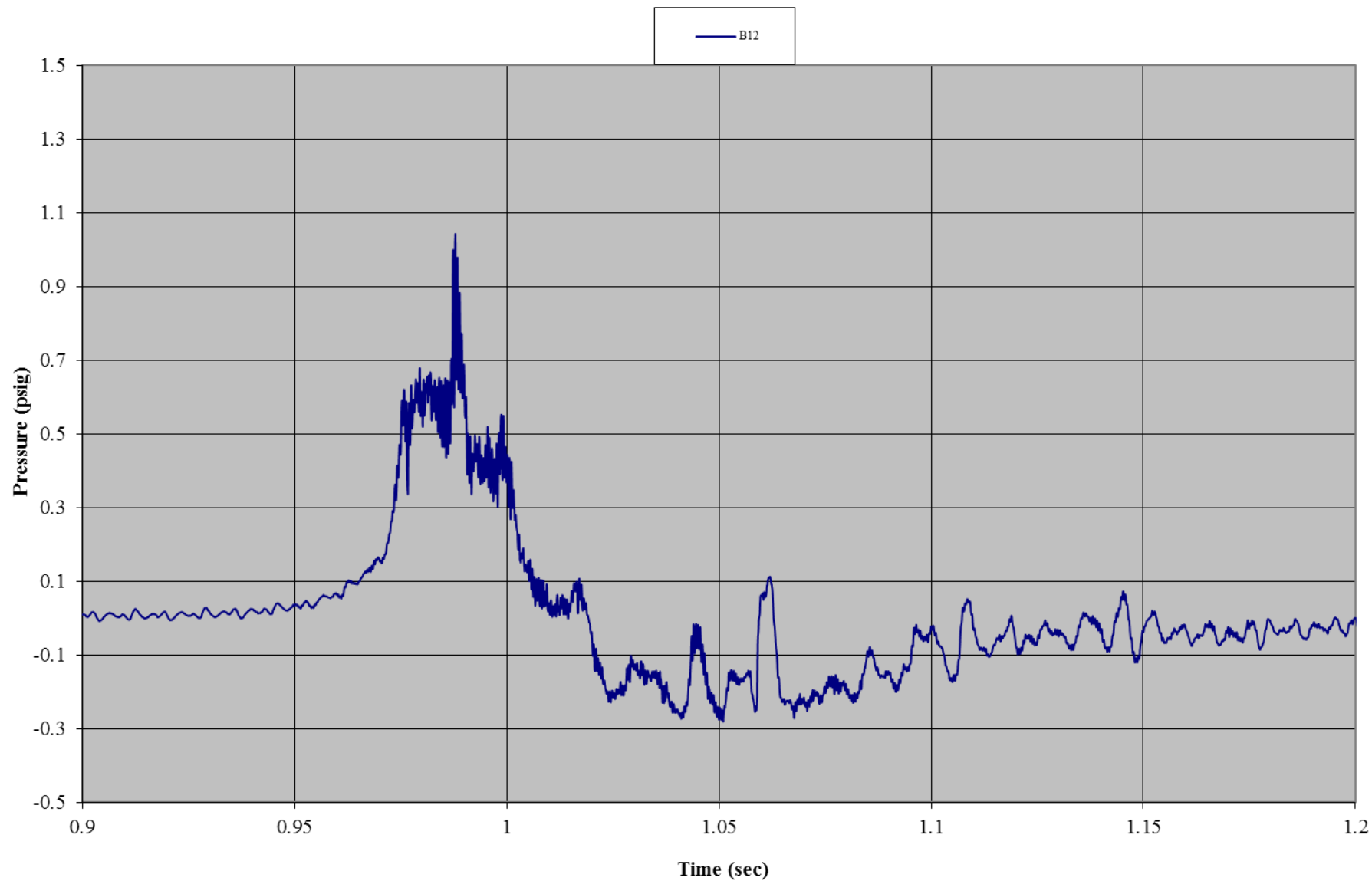
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 06: Front Wall, Center Top



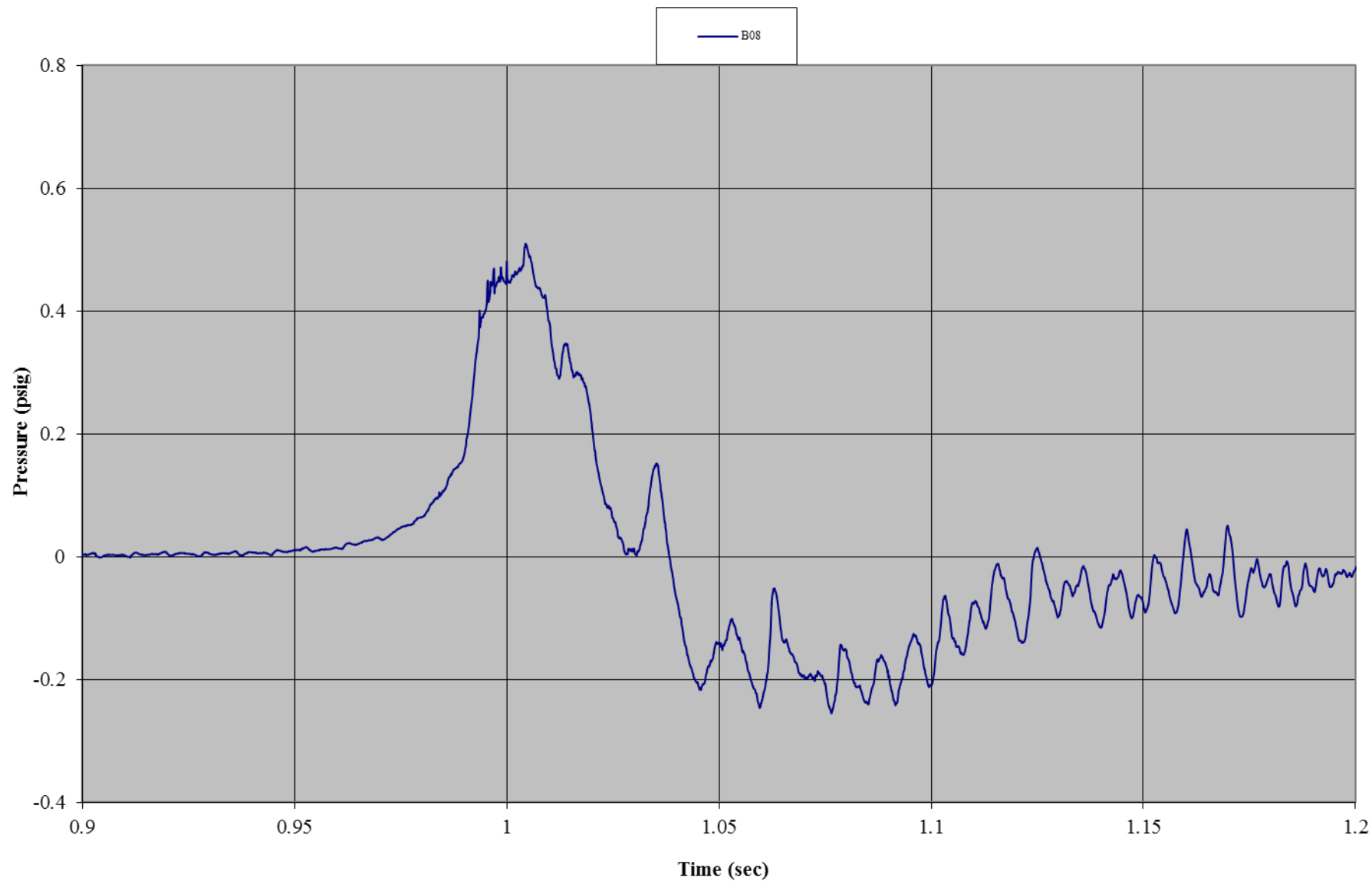
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



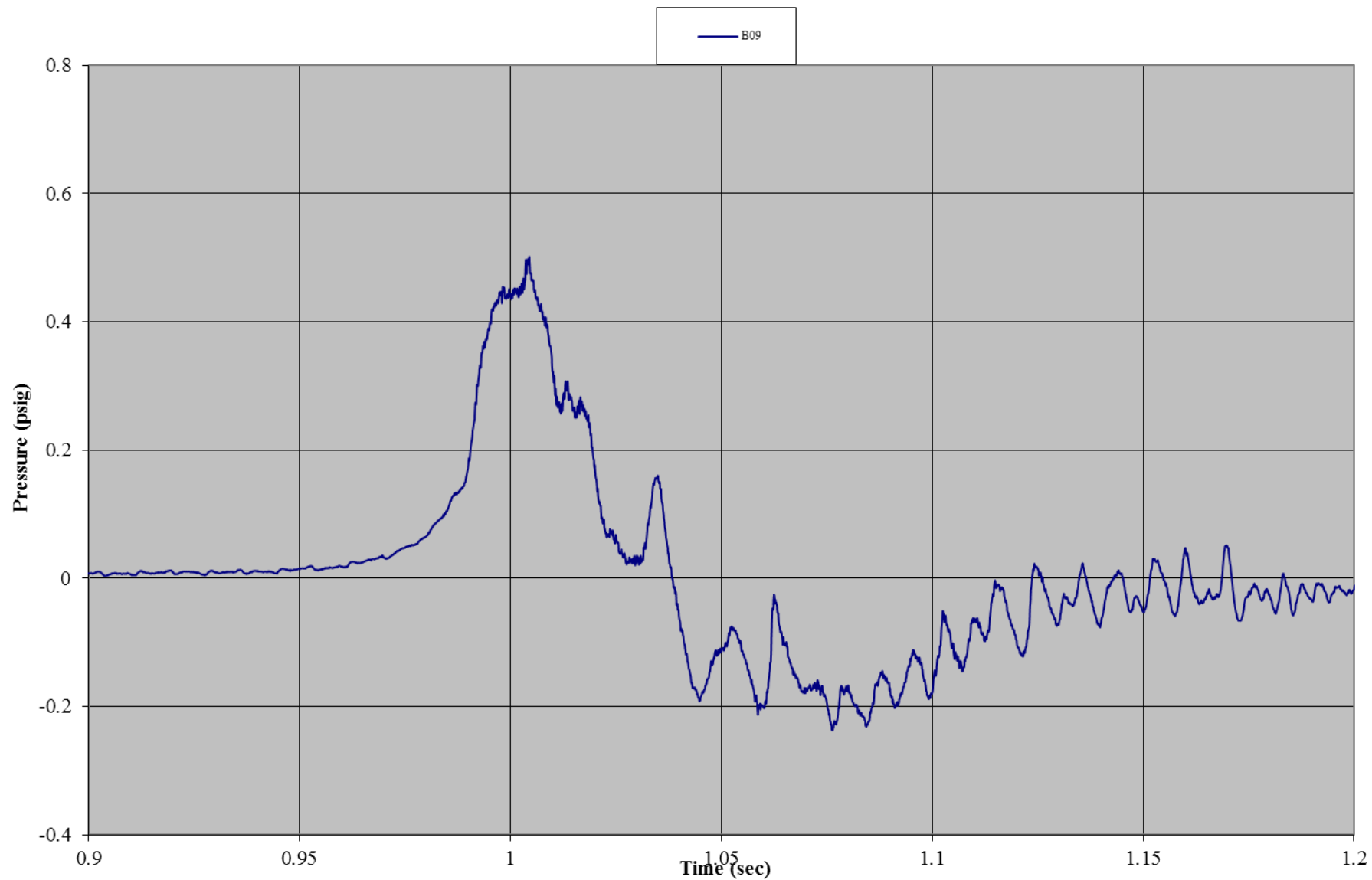
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



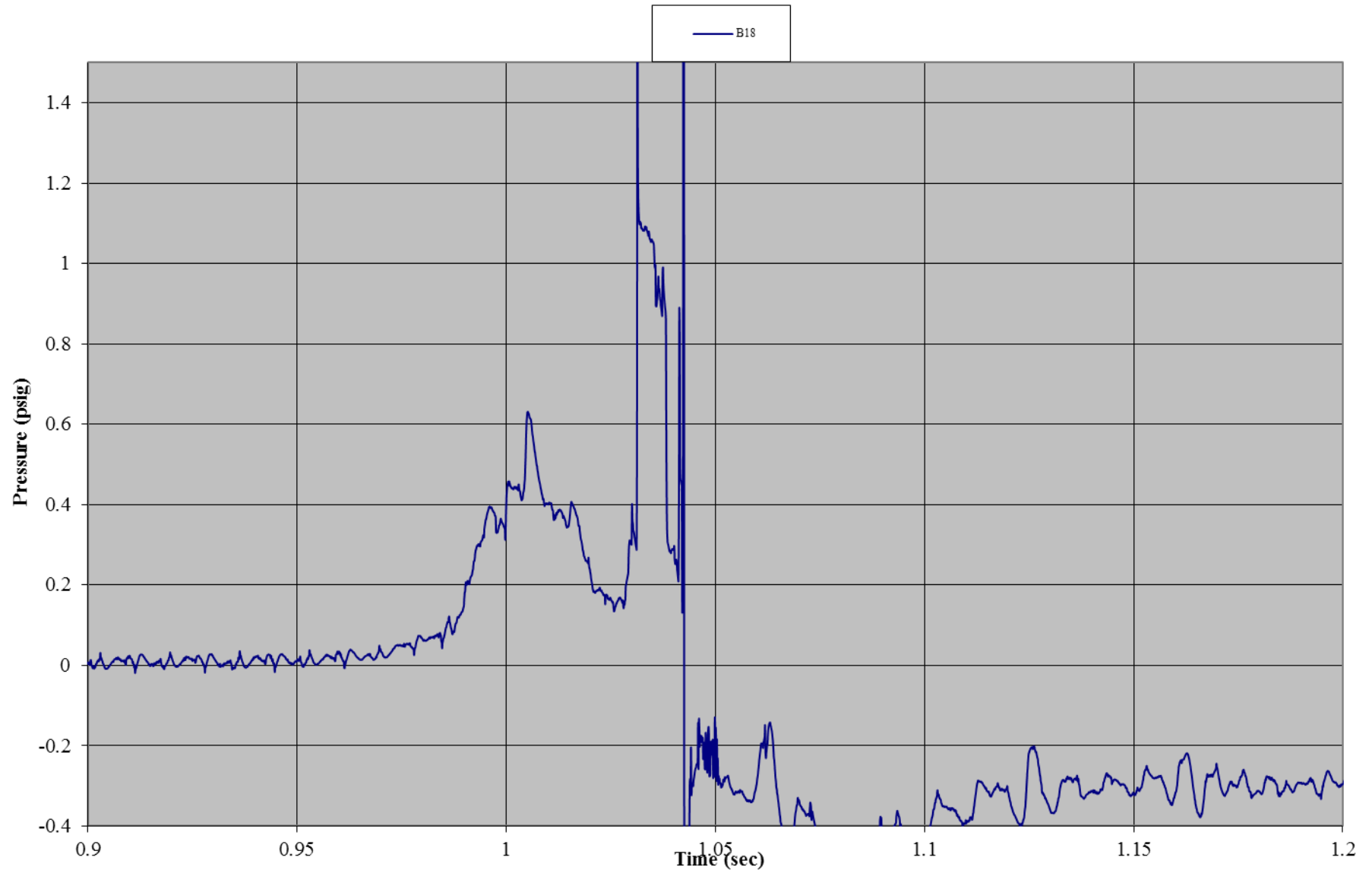
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 08: Left Side Wall, Bottom



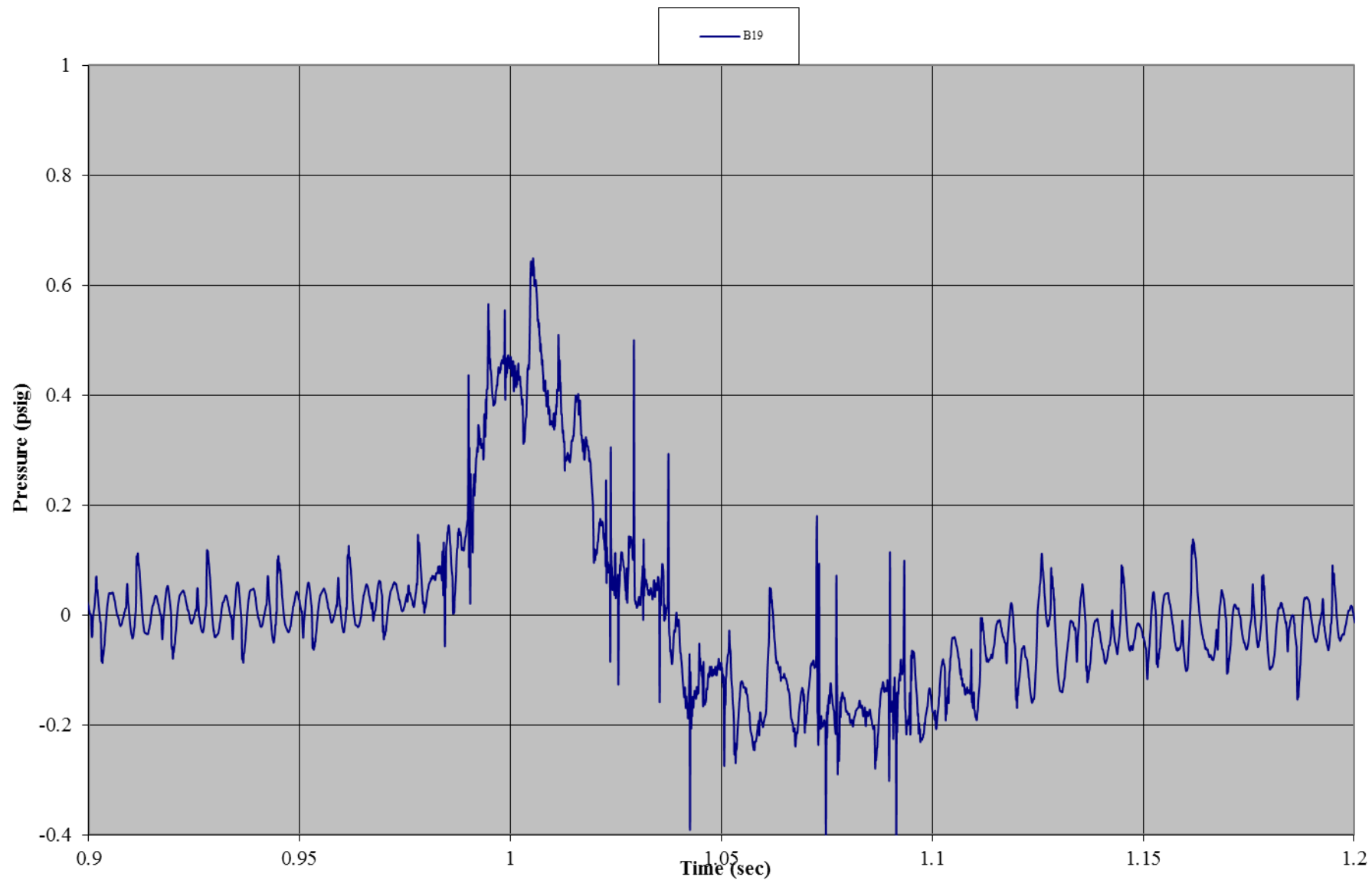
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



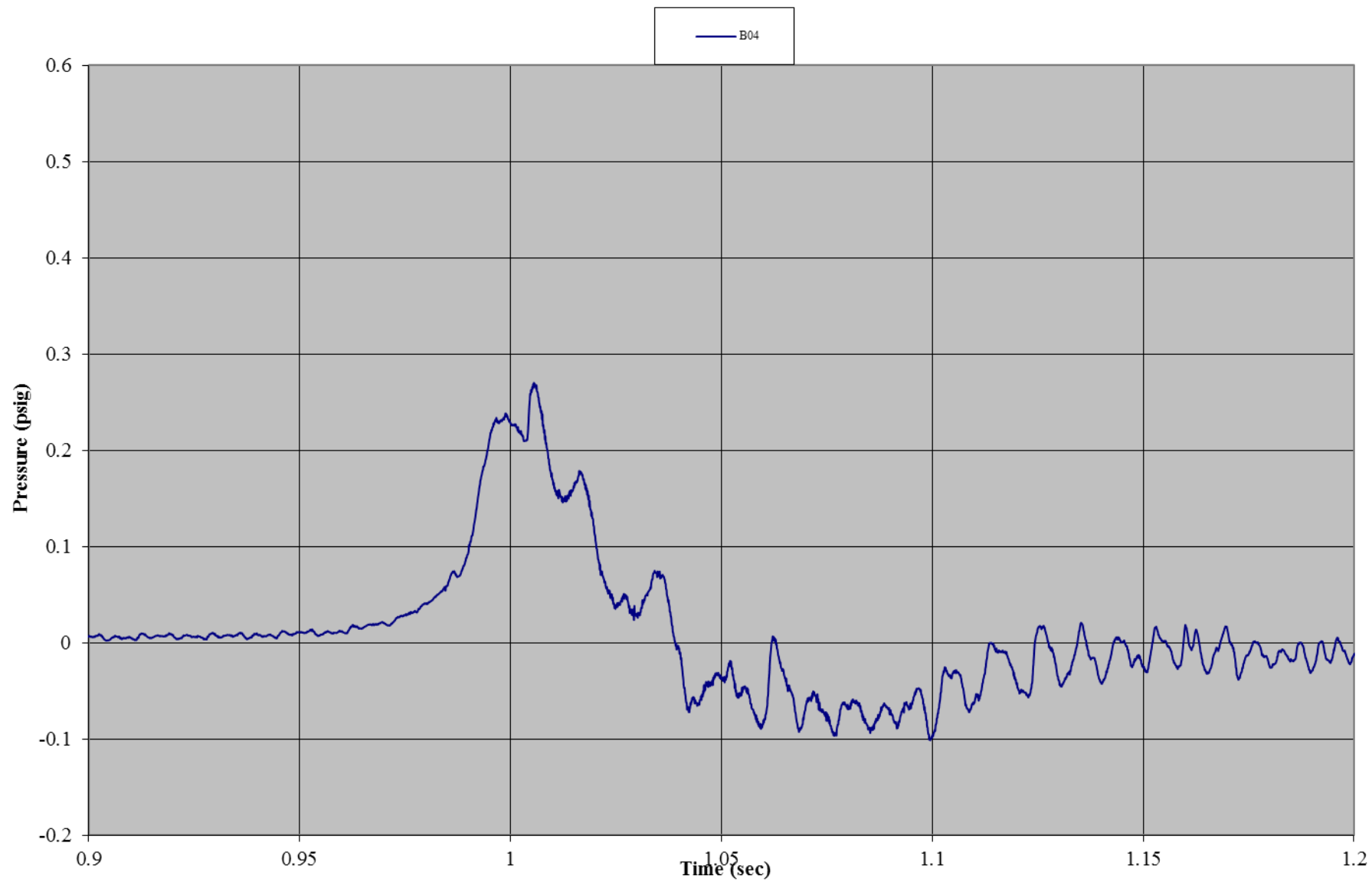
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 18: Right Side Wall, Bottom



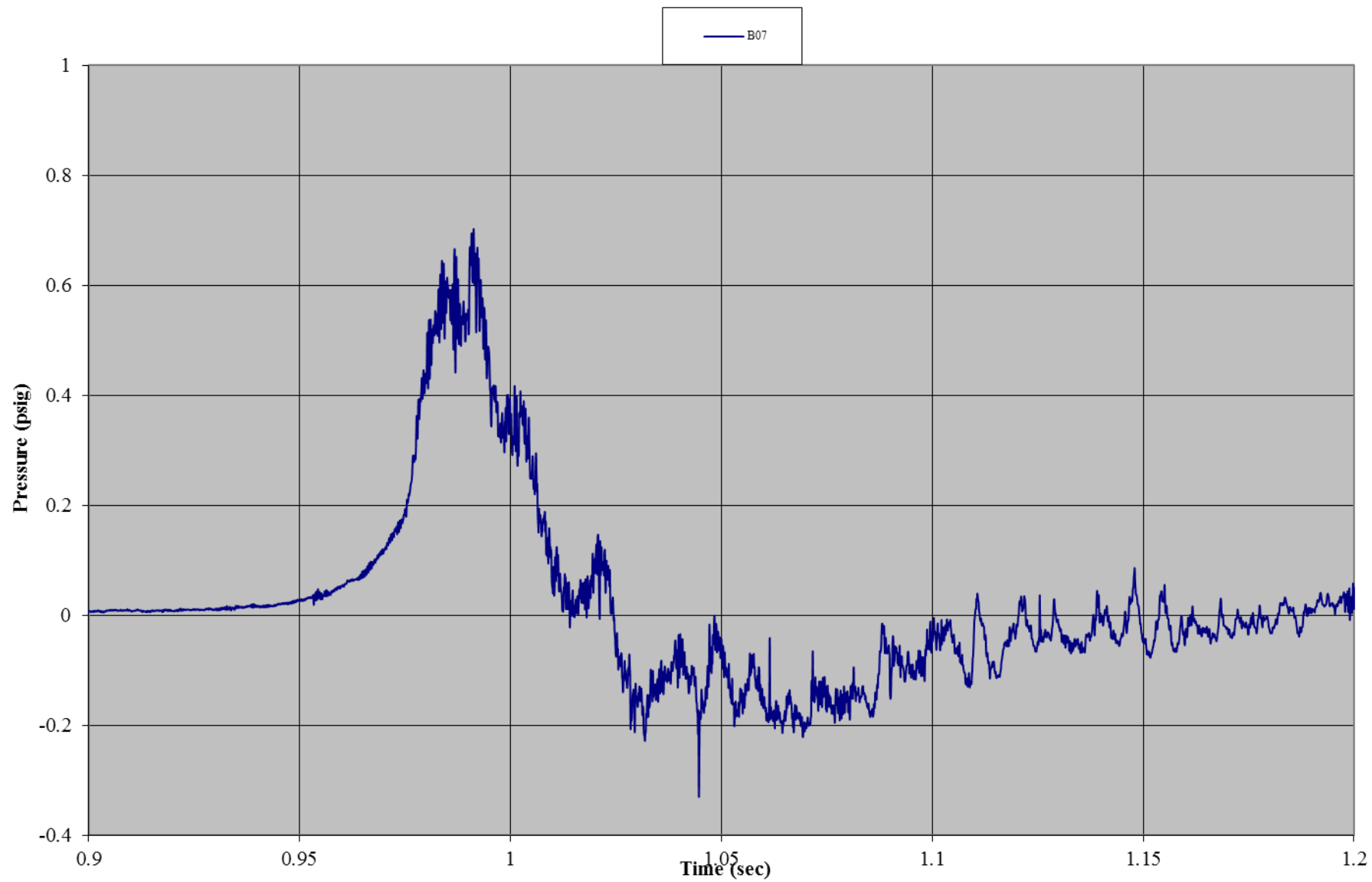
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



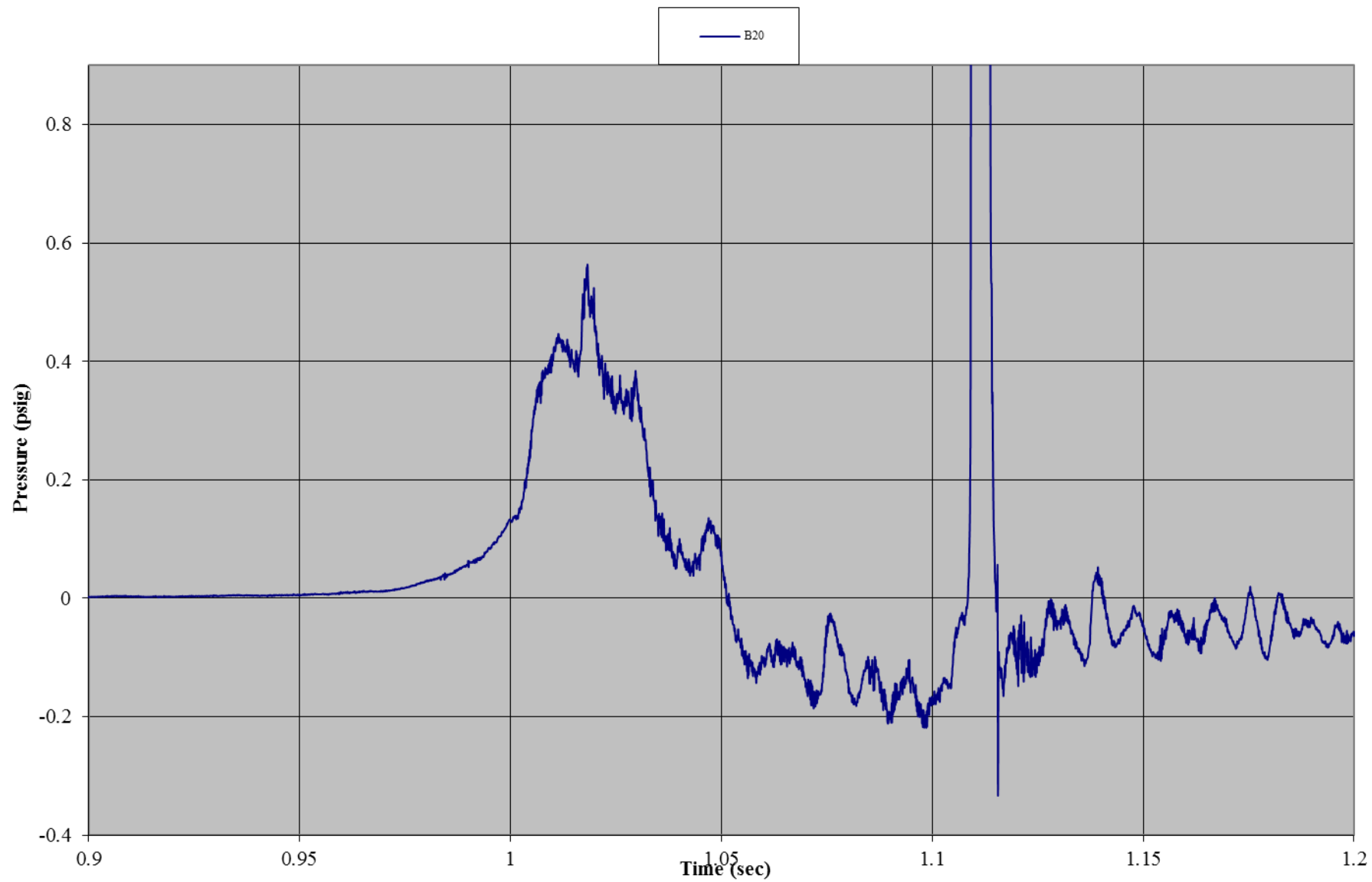
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 04: Interior, Ground



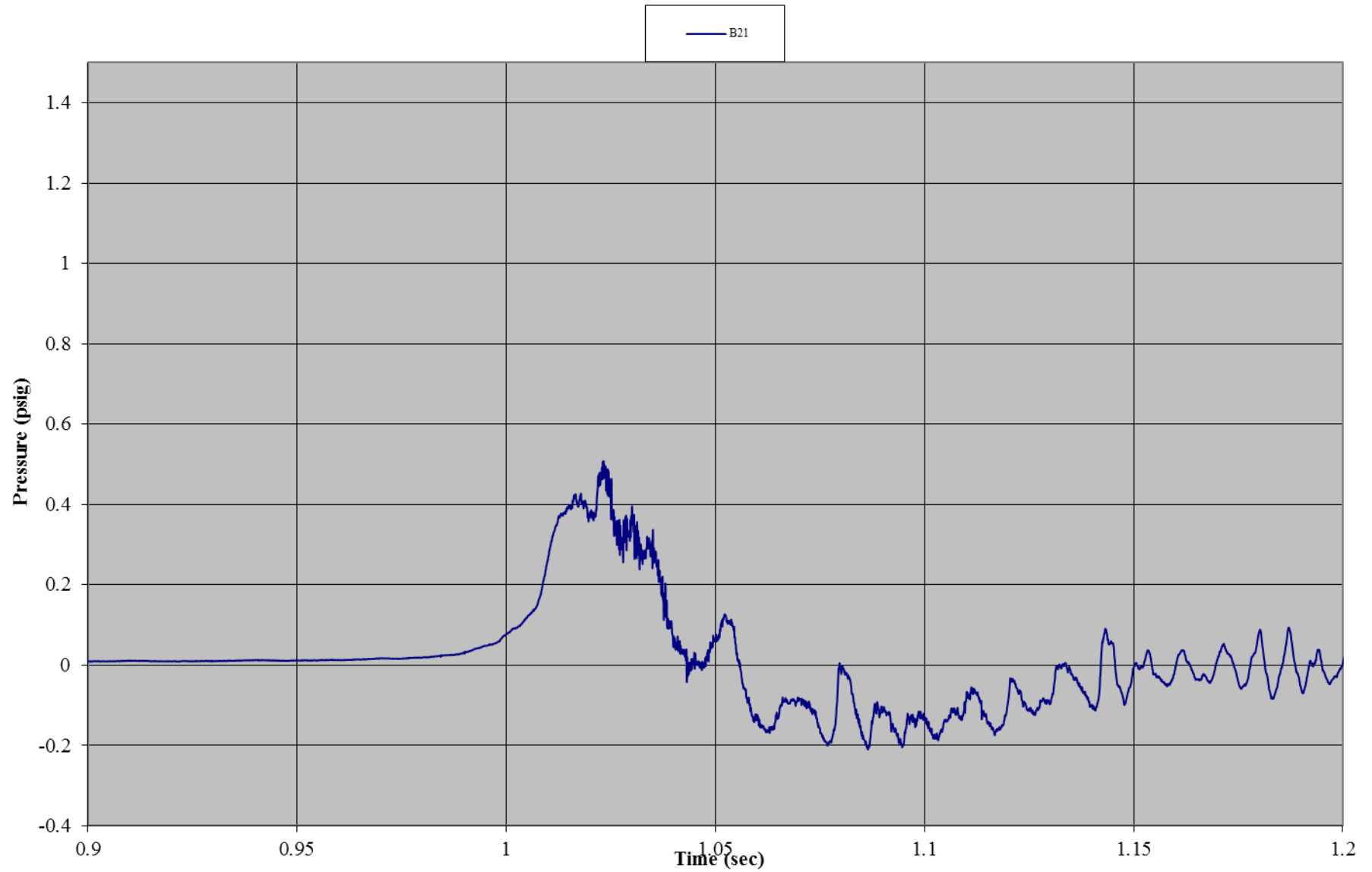
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 07: Roof, Front



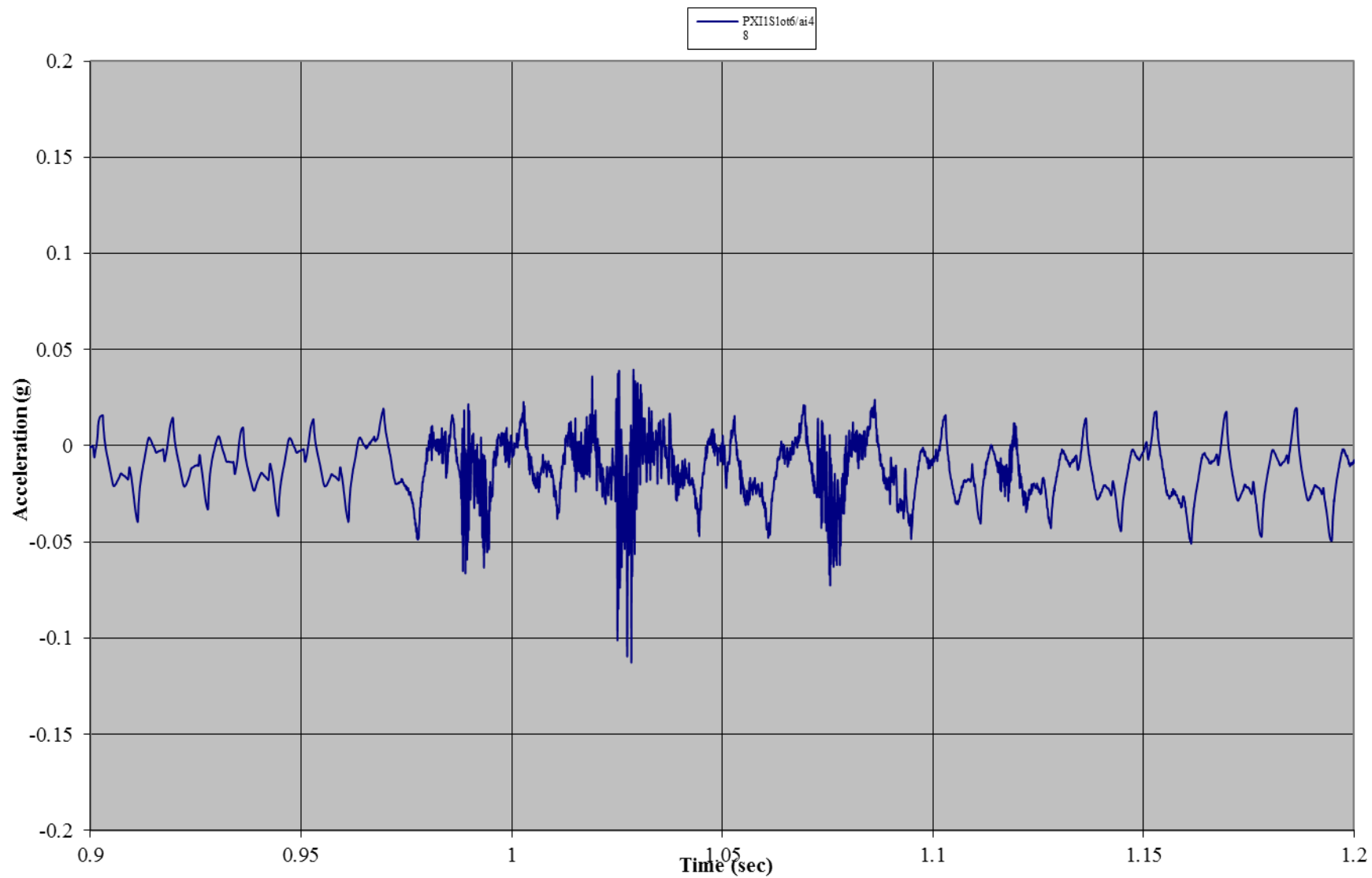
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 20: Roof, Back



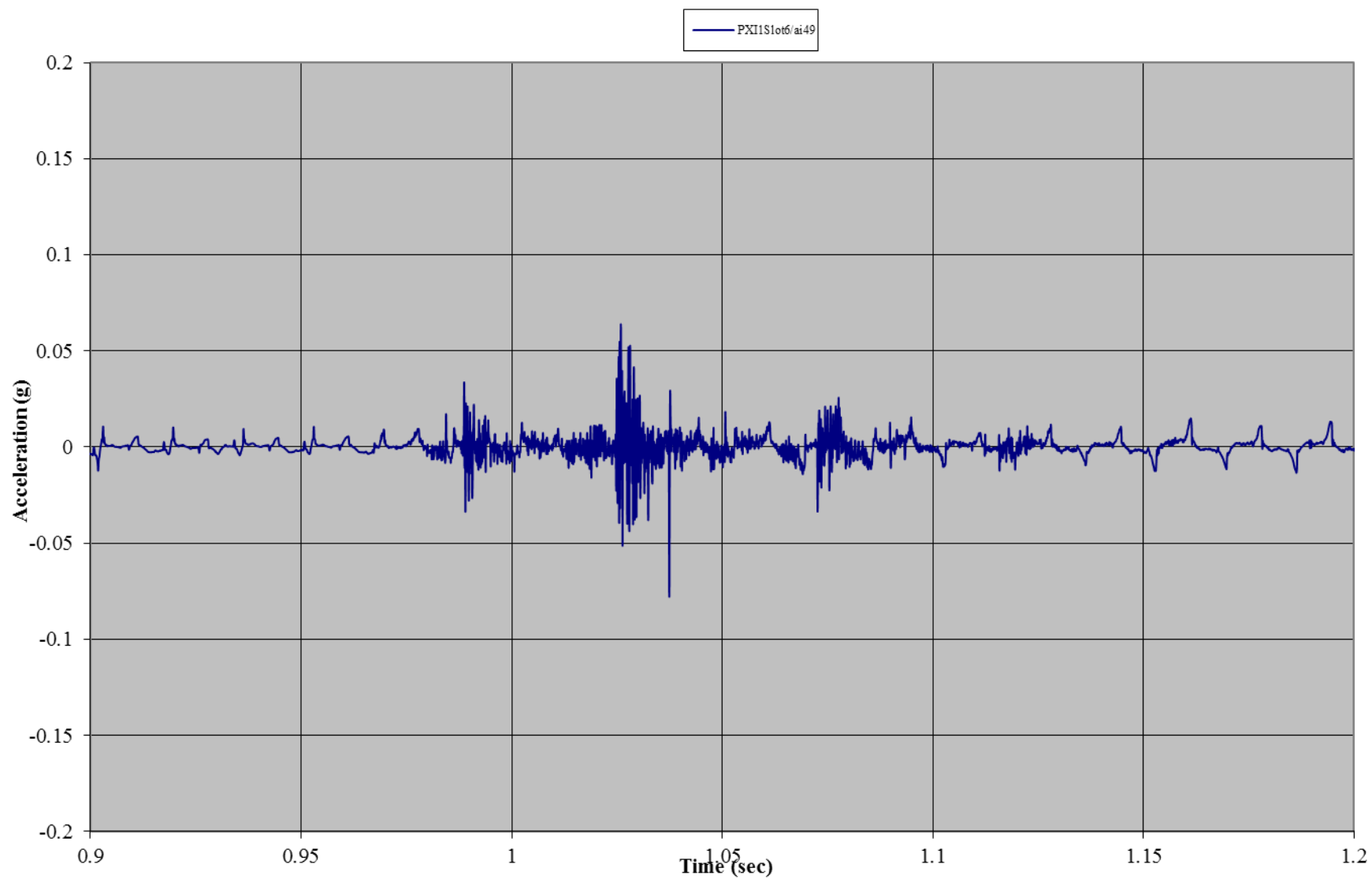
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



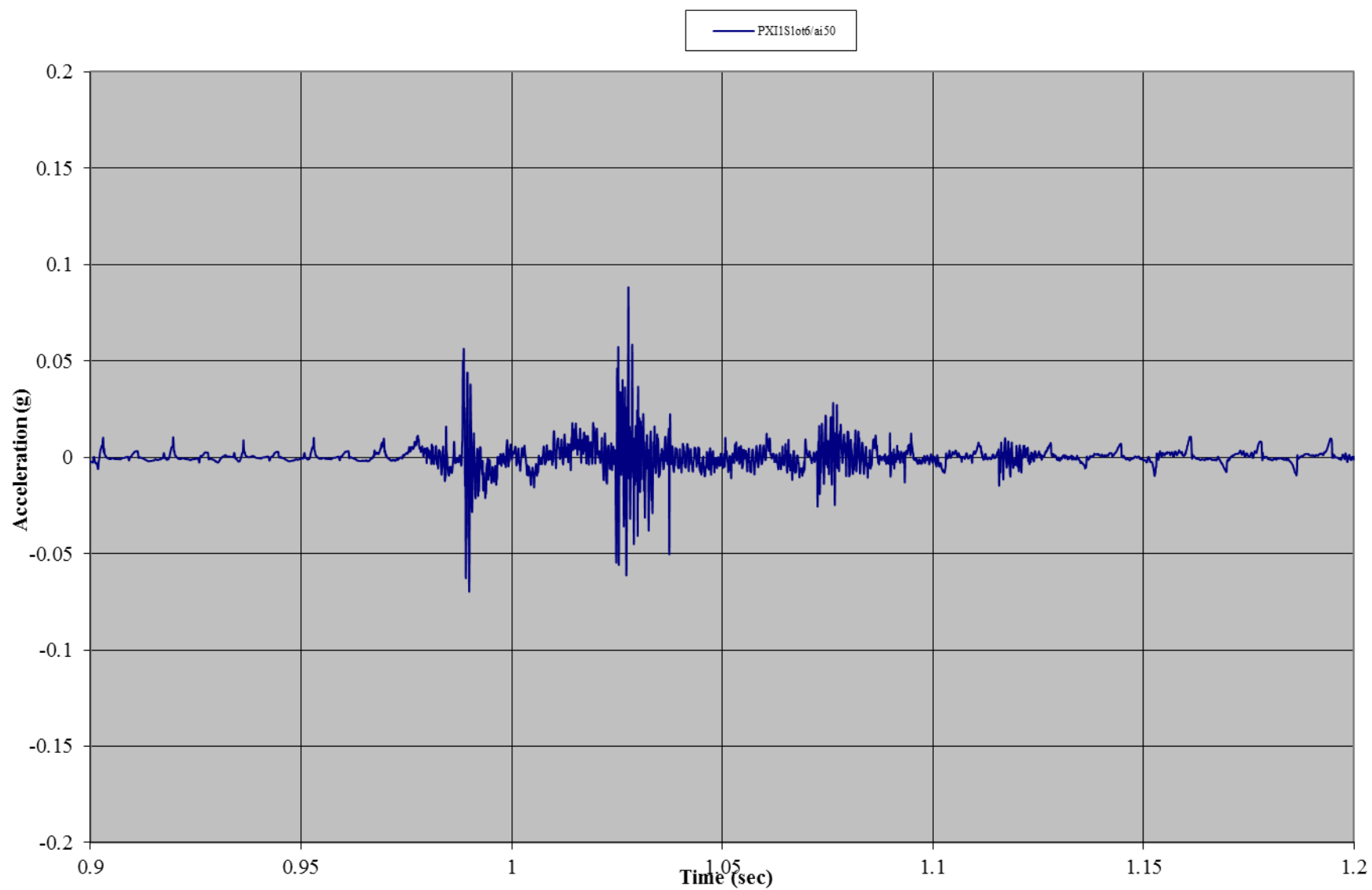
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (x-direction)



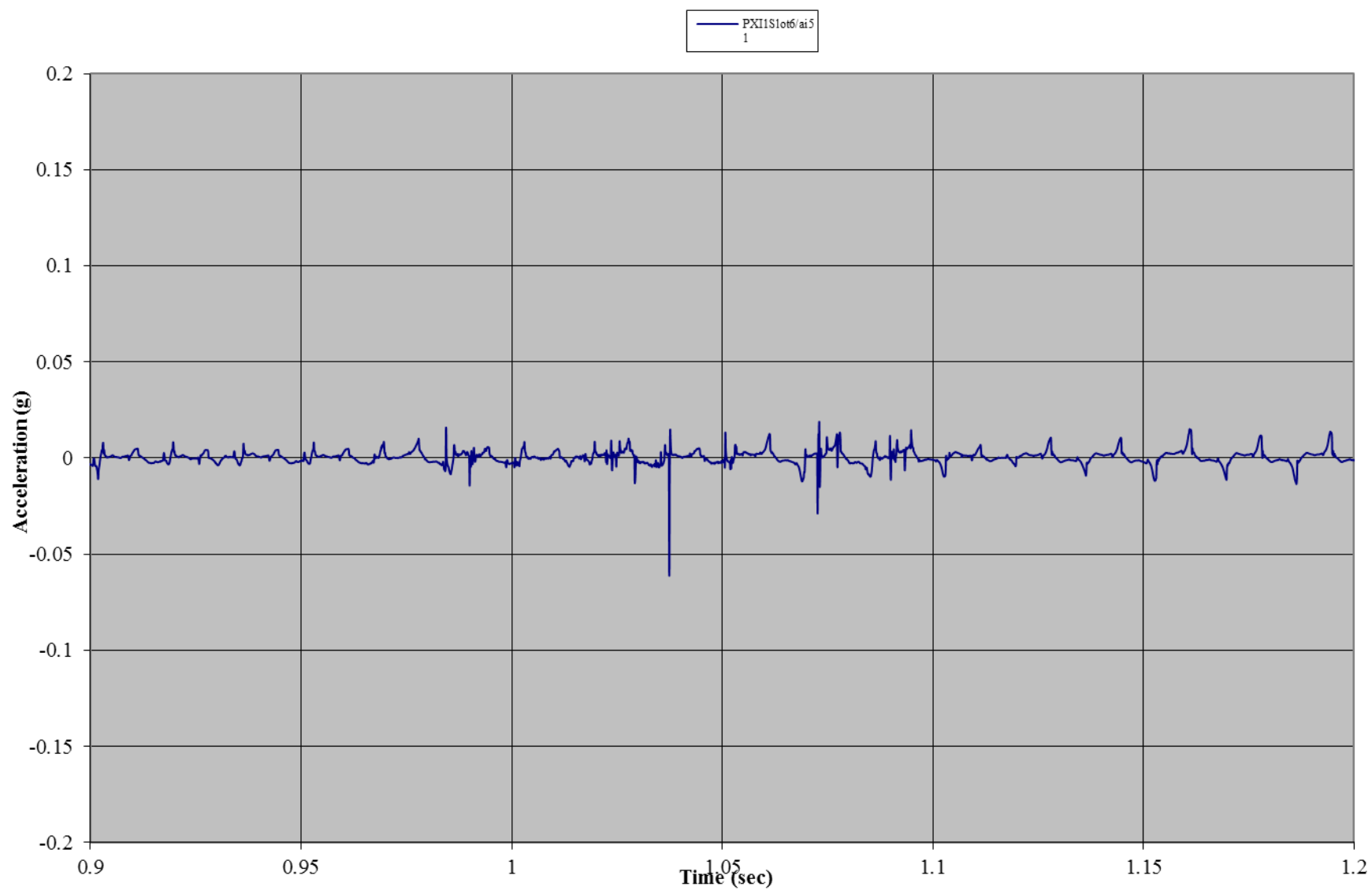
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (y-direction)



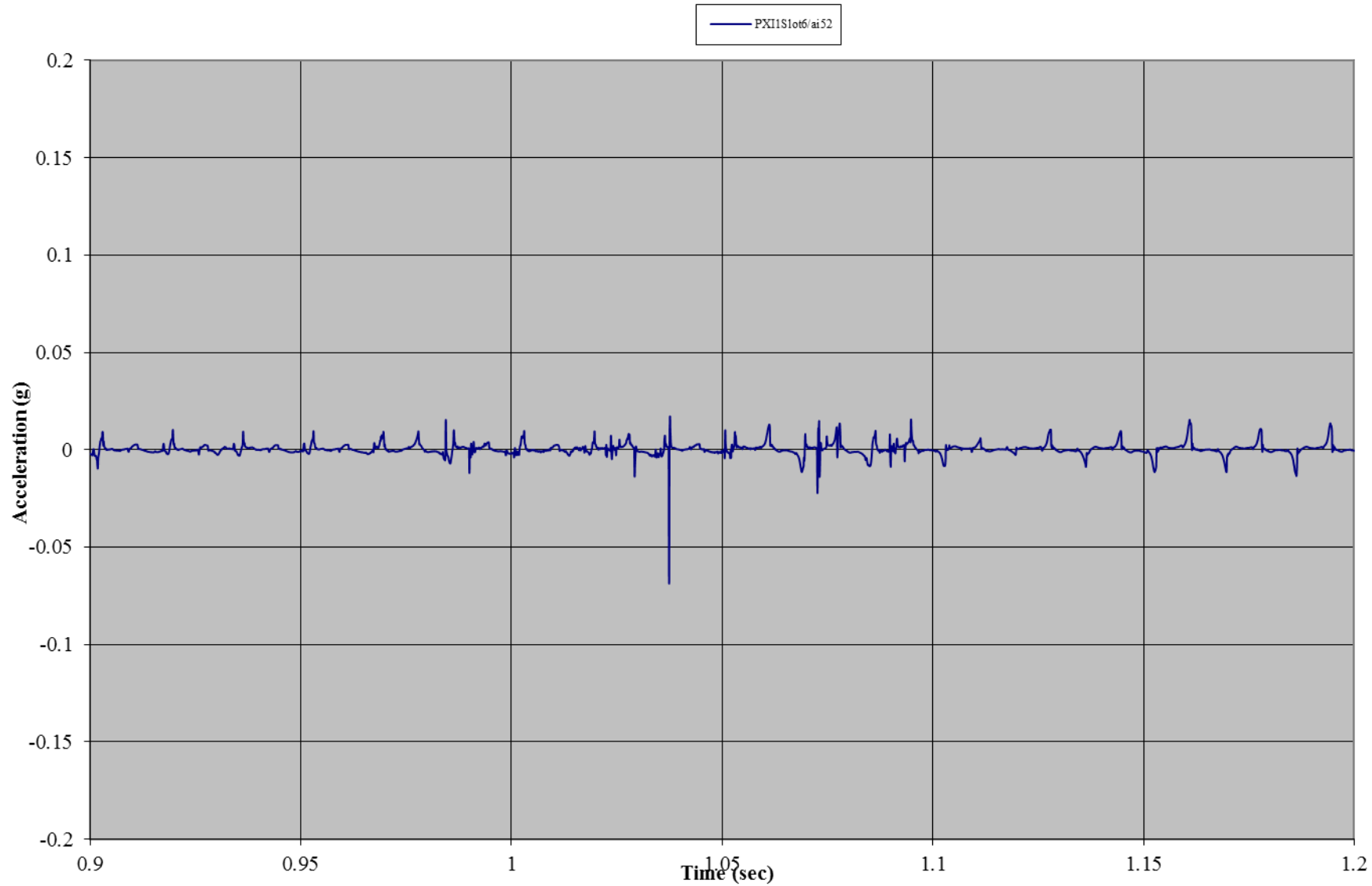
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (z-direction)



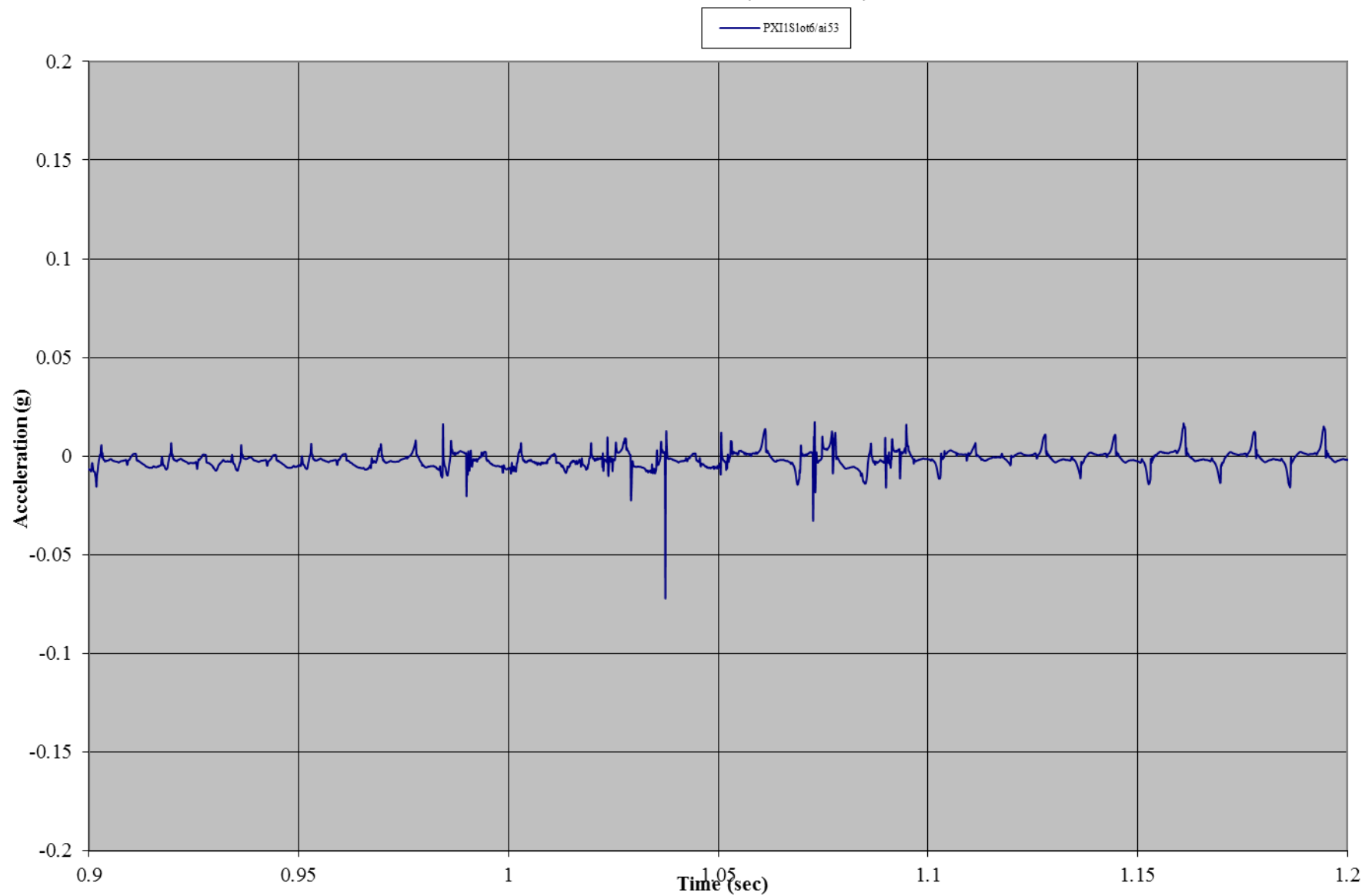
Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (x-direction)



Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (y-direction)

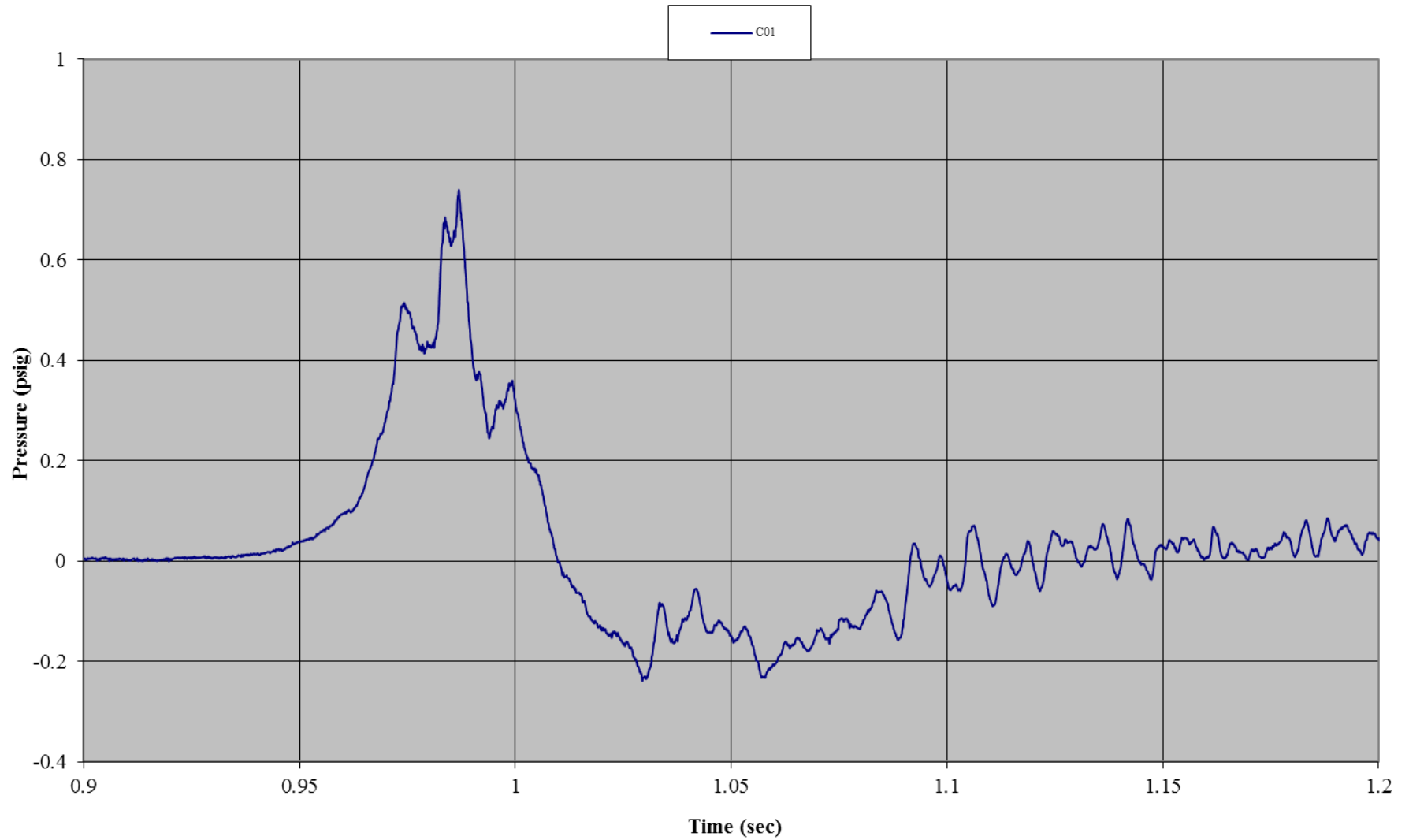


Test B06: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (z-direction)

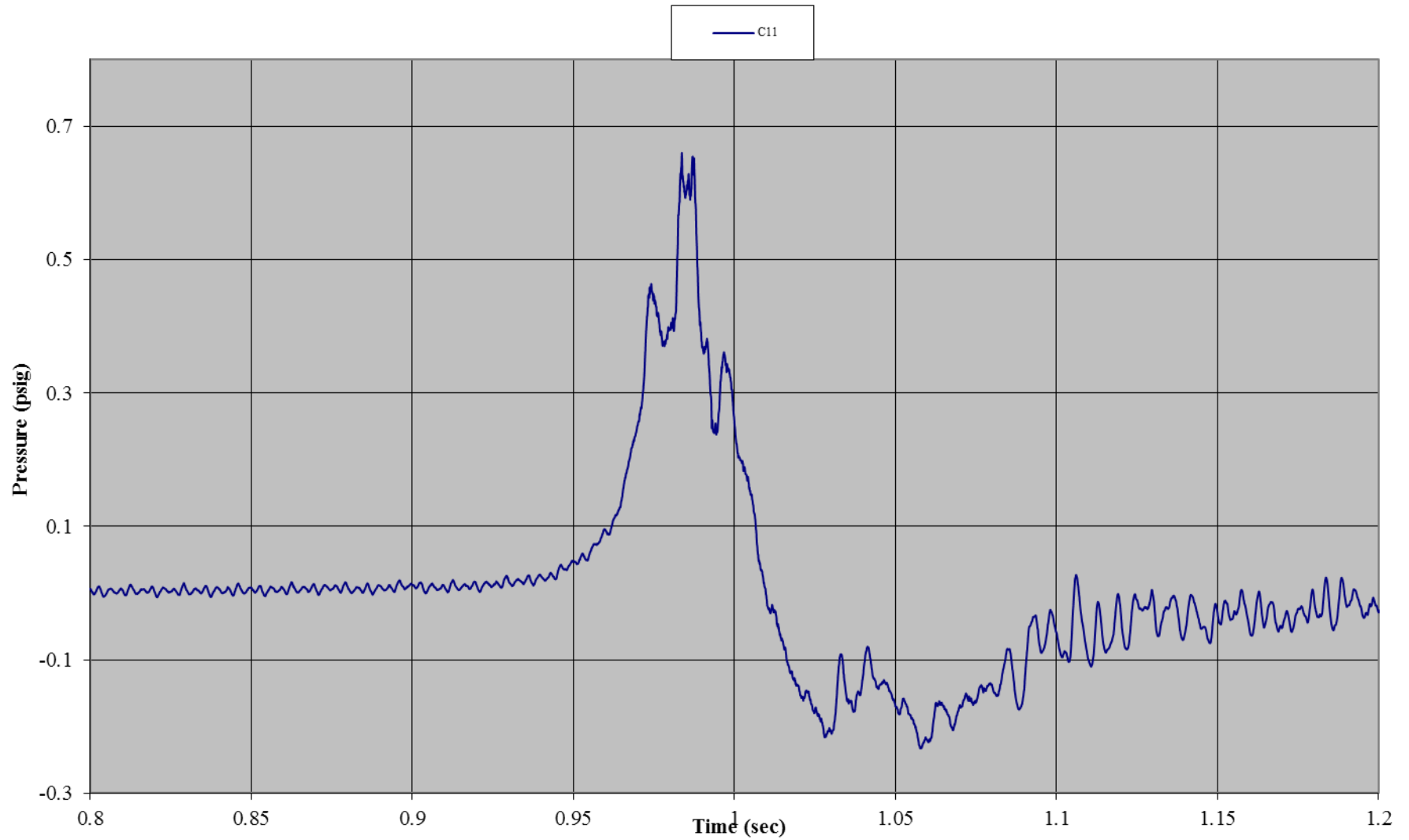


Test B06: Tent C

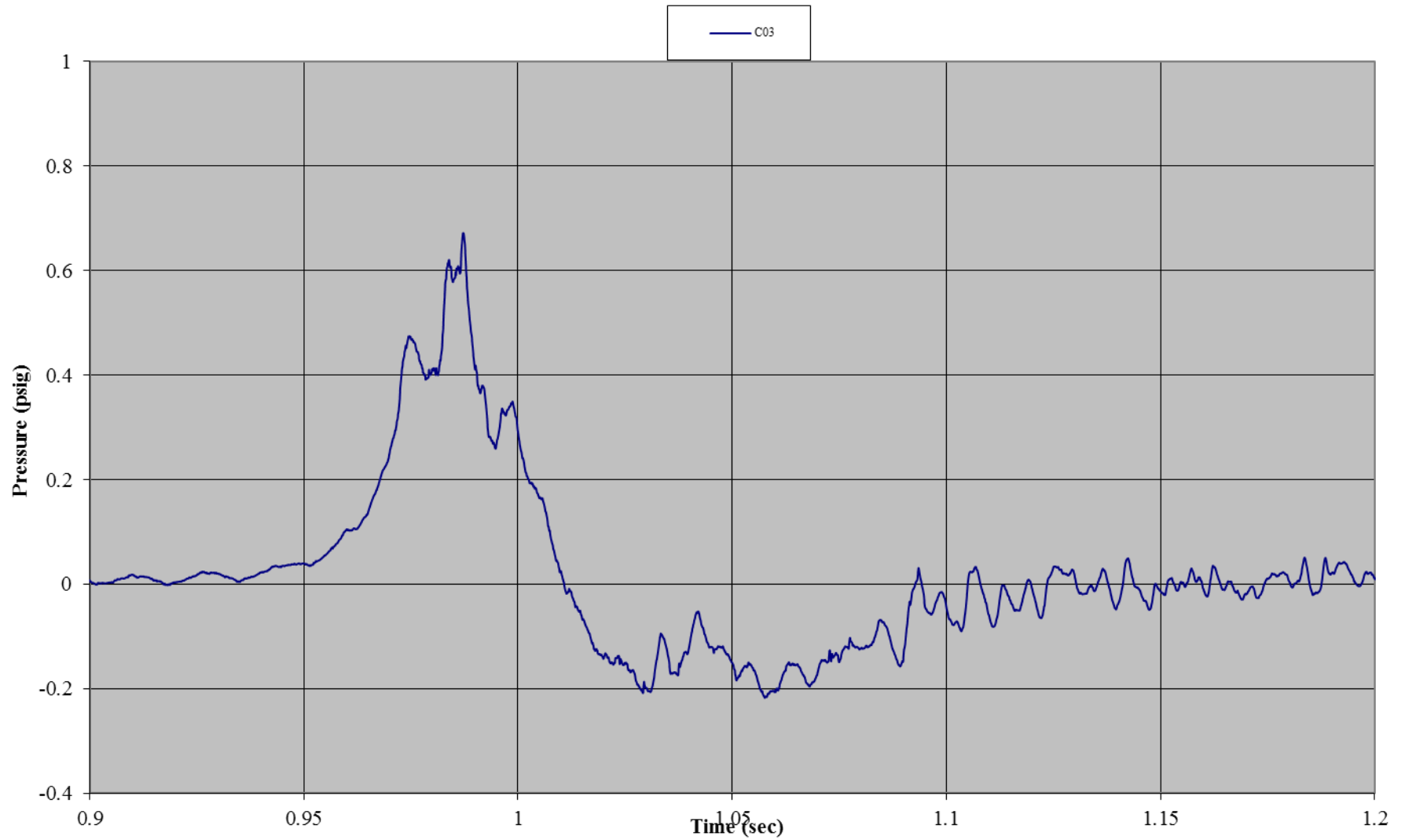
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 01: Front Wall, Left Bottom



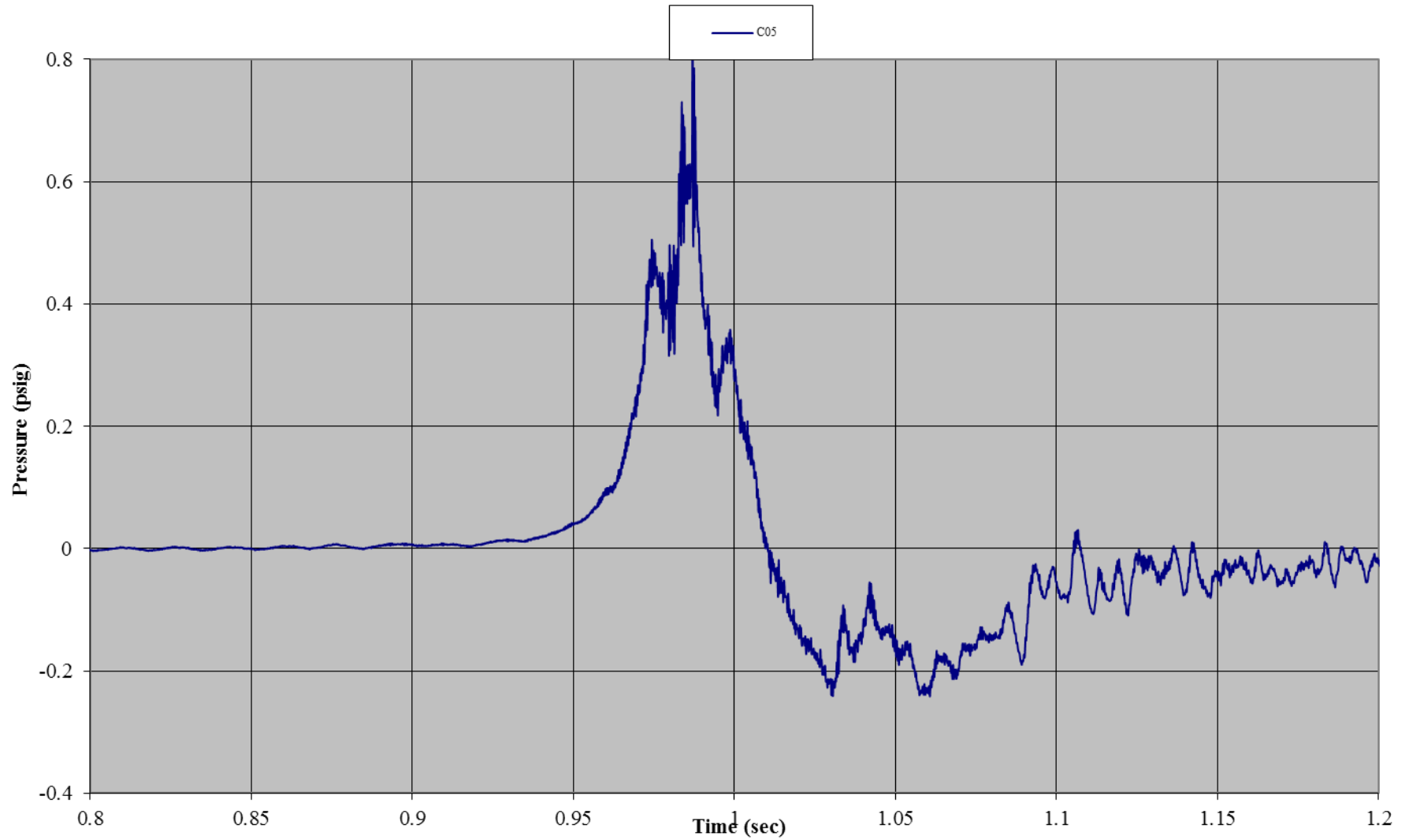
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 11: Front Wall, Right Bottom



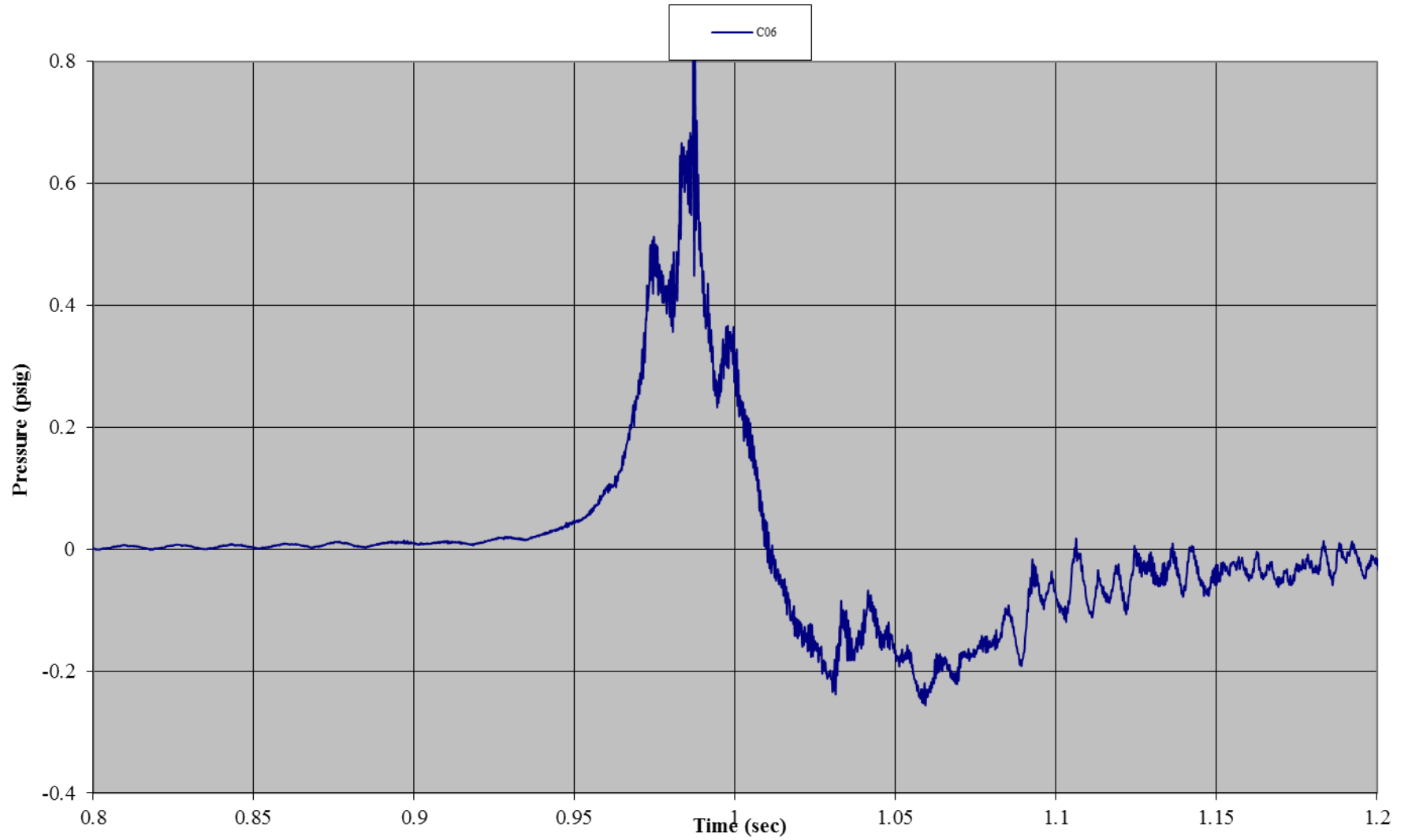
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 03: Front Wall, Center Bottom



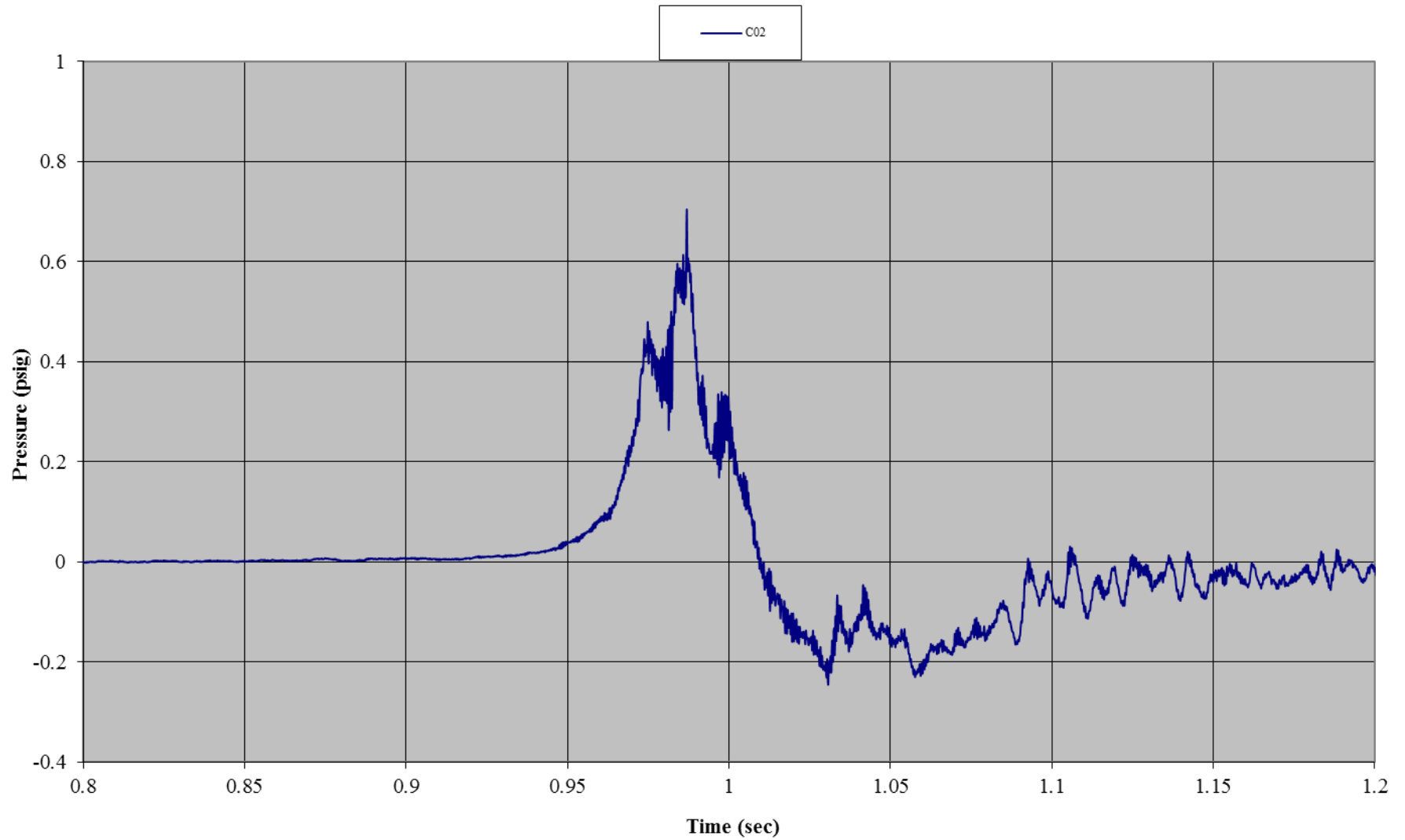
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 05: Front Wall, Center Mid-Height



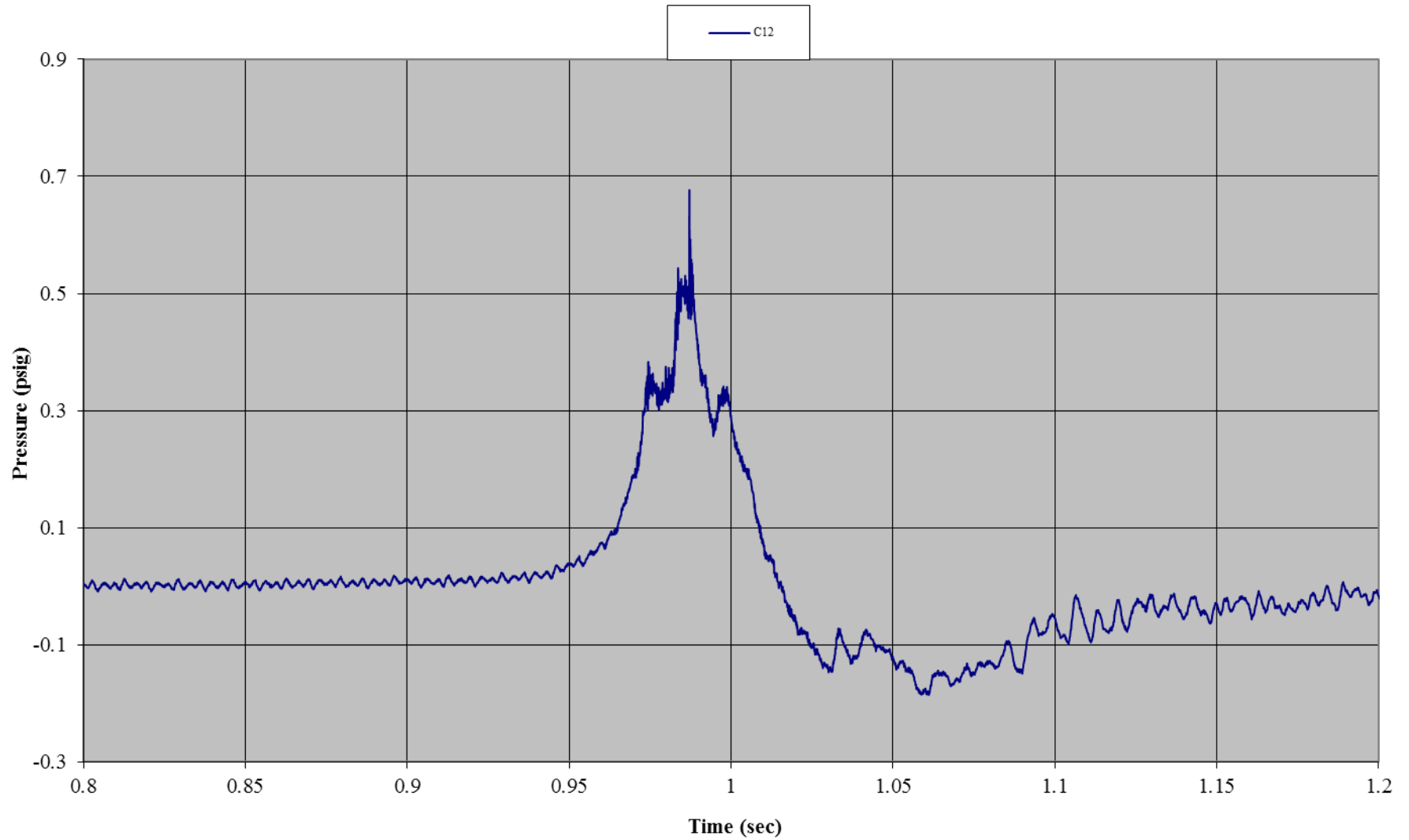
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 06: Front Wall, Center Top



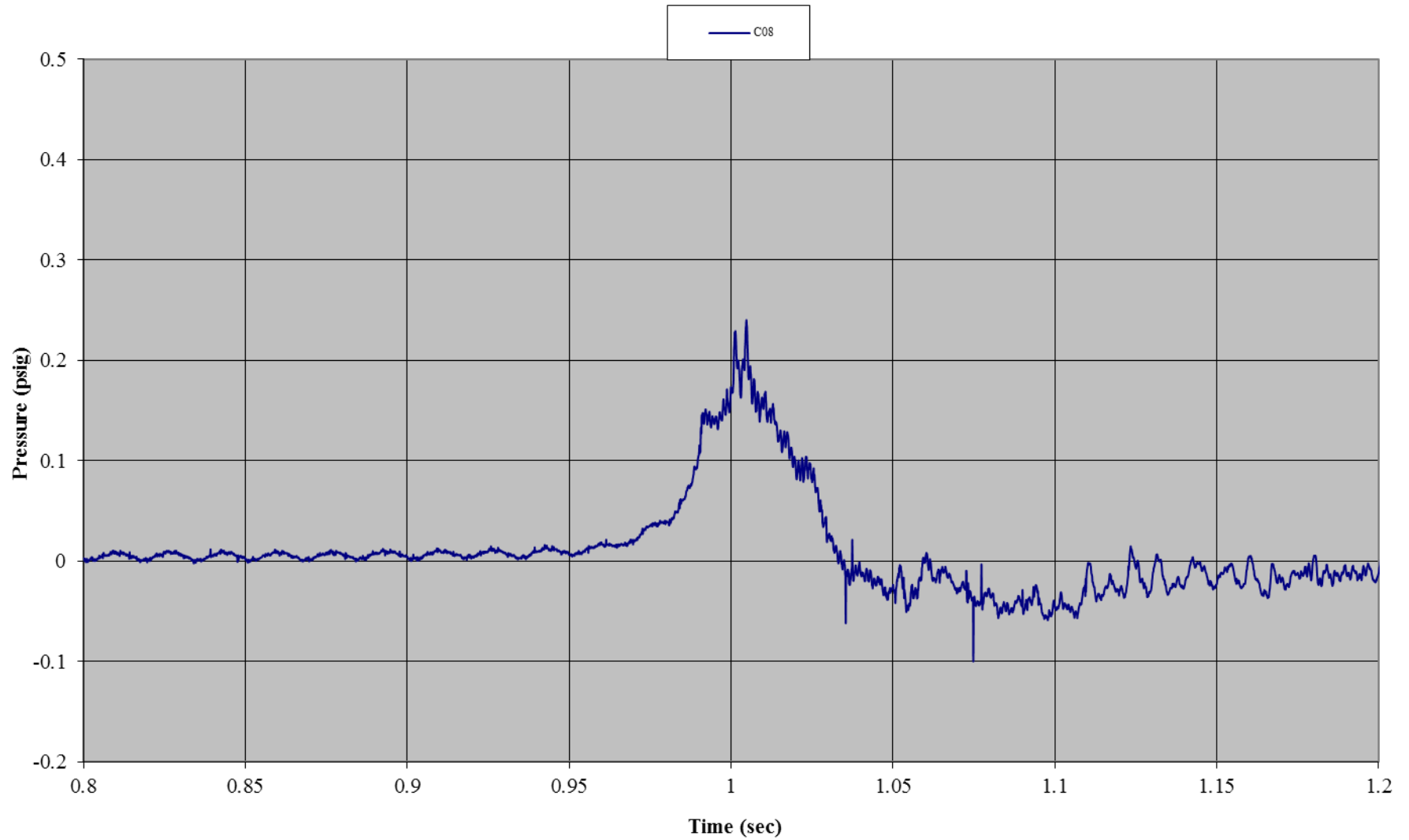
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 02: Front Wall, Left Mid-Height



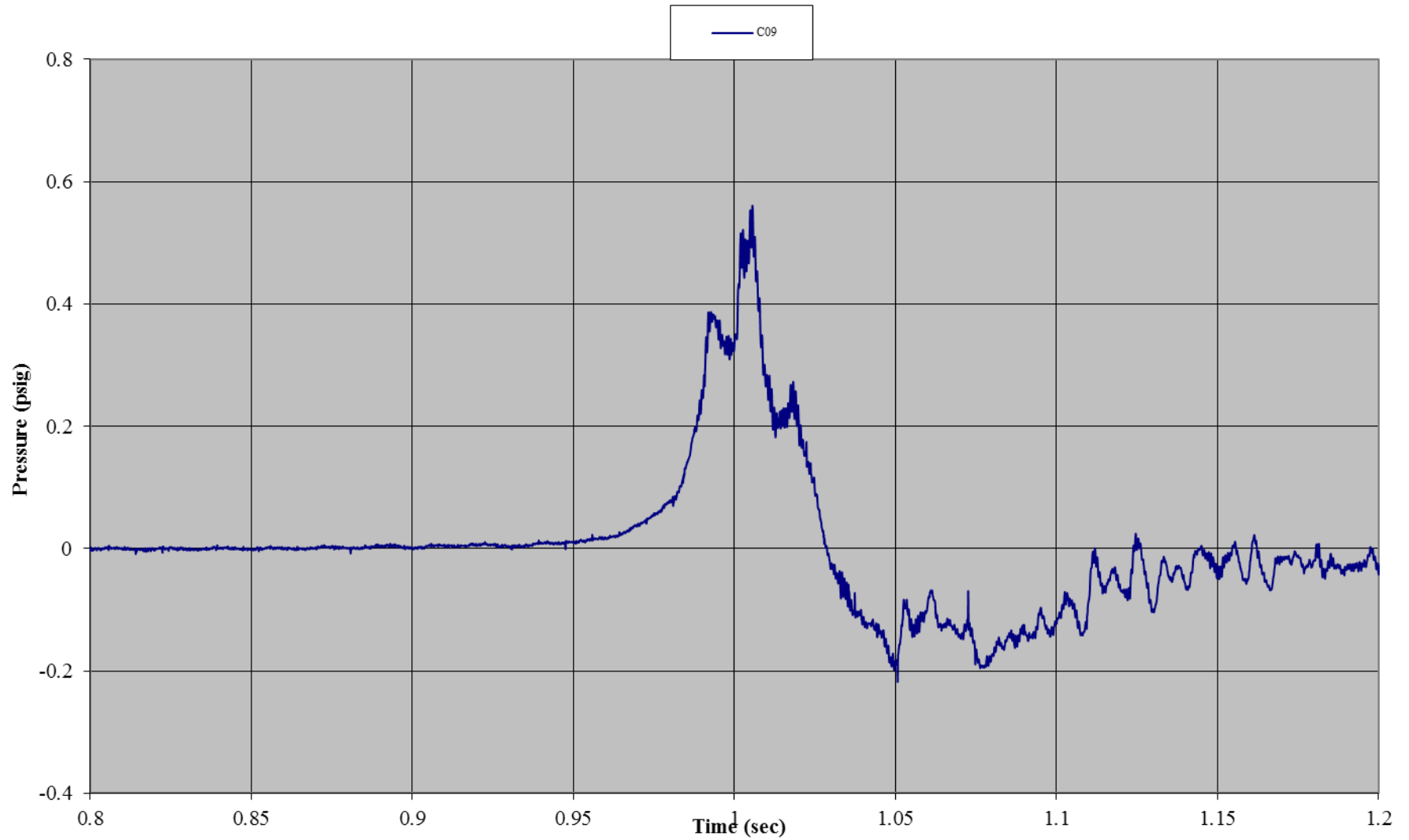
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 12: Front Wall, Right Mid-Height



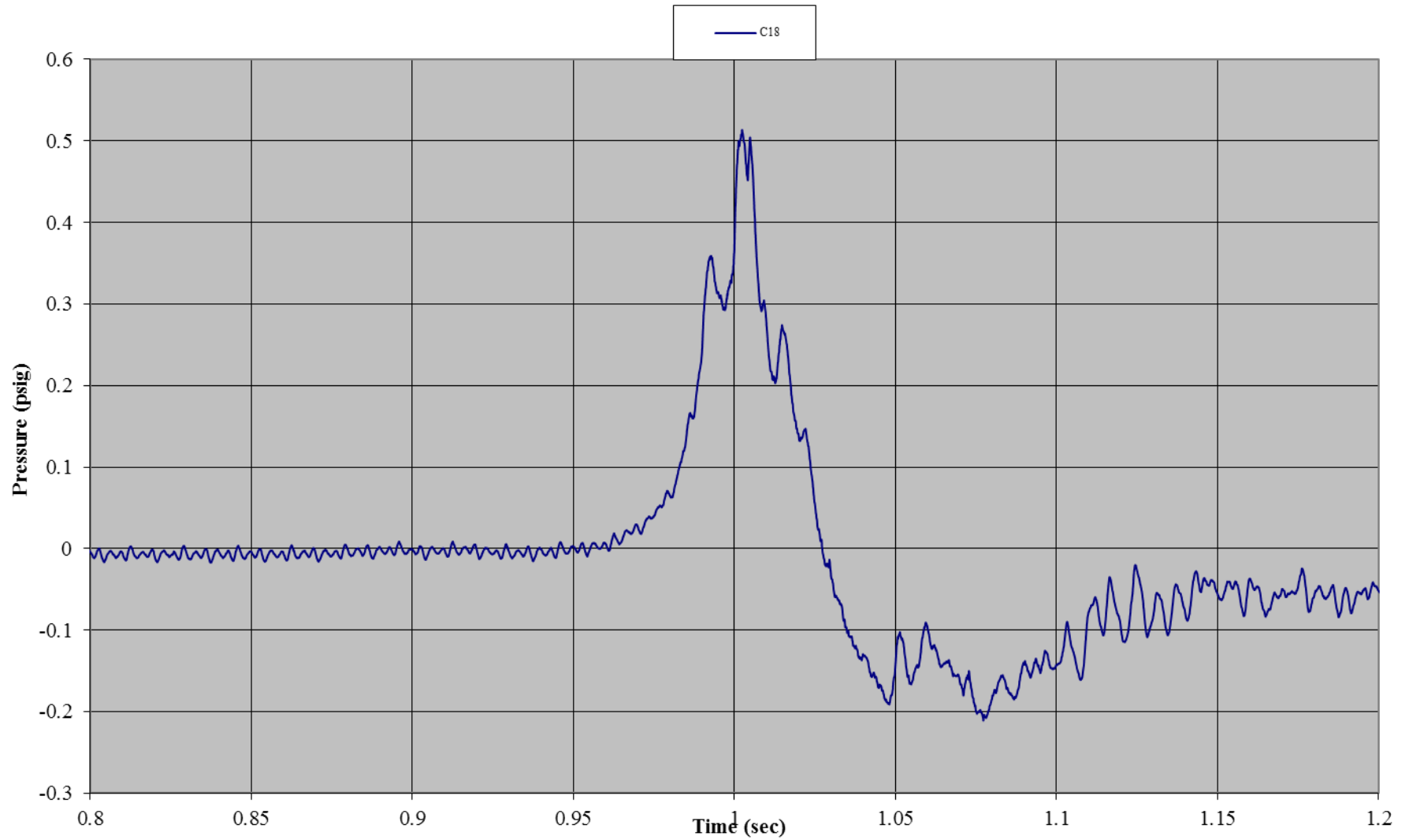
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 08: Left Side Wall, Bottom



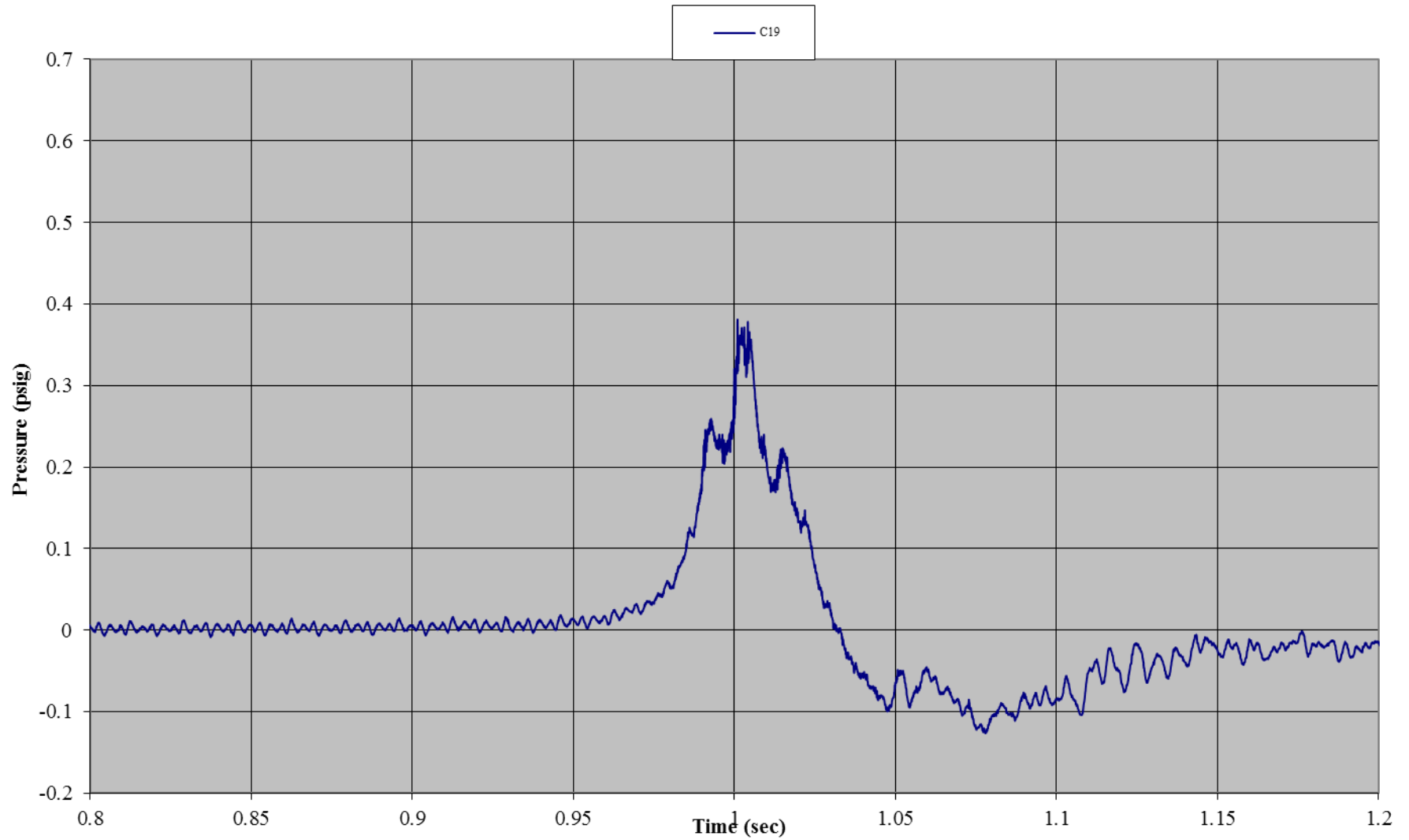
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 09: Left Side Wall, Mid-Height



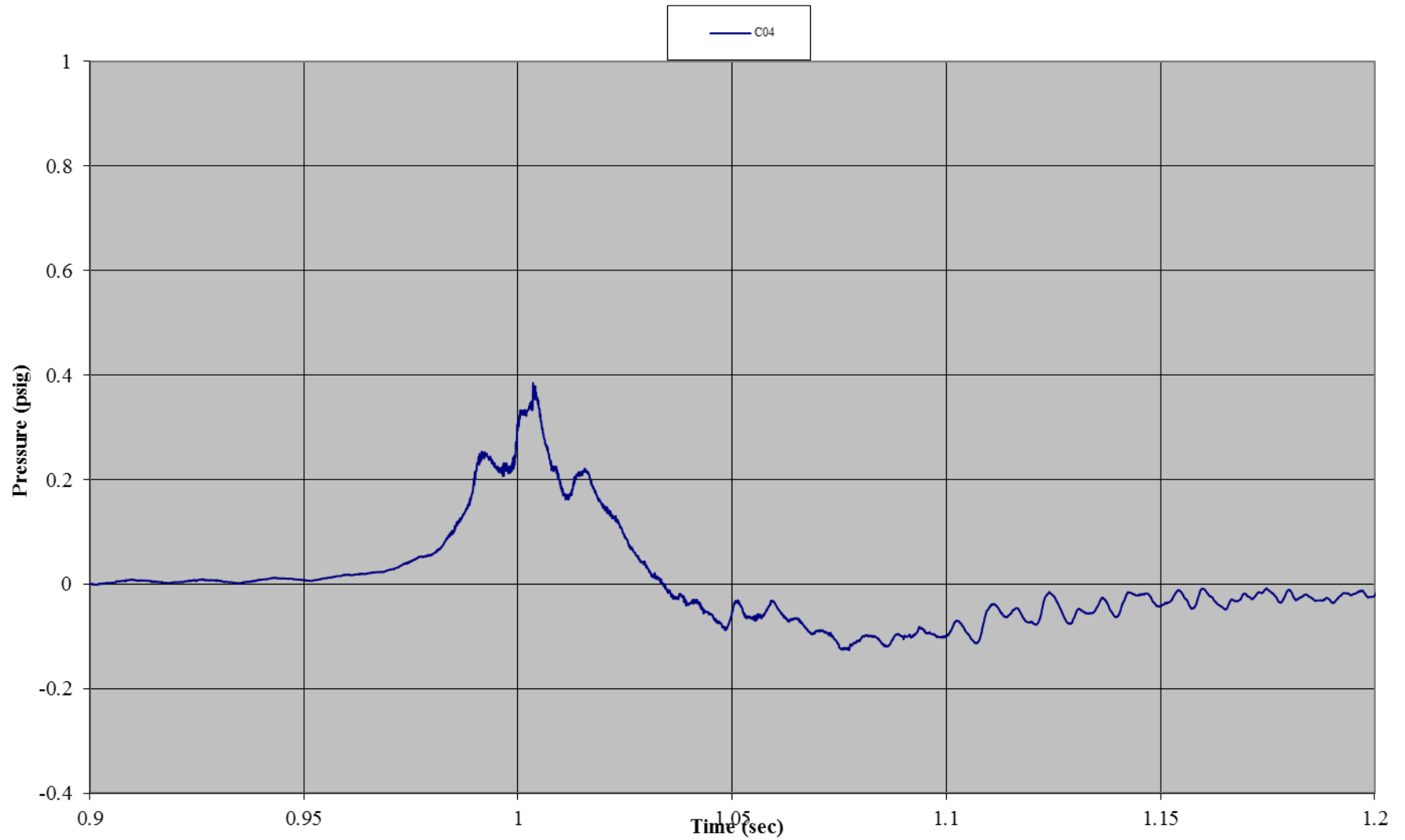
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 18: Right Side Wall, Bottom



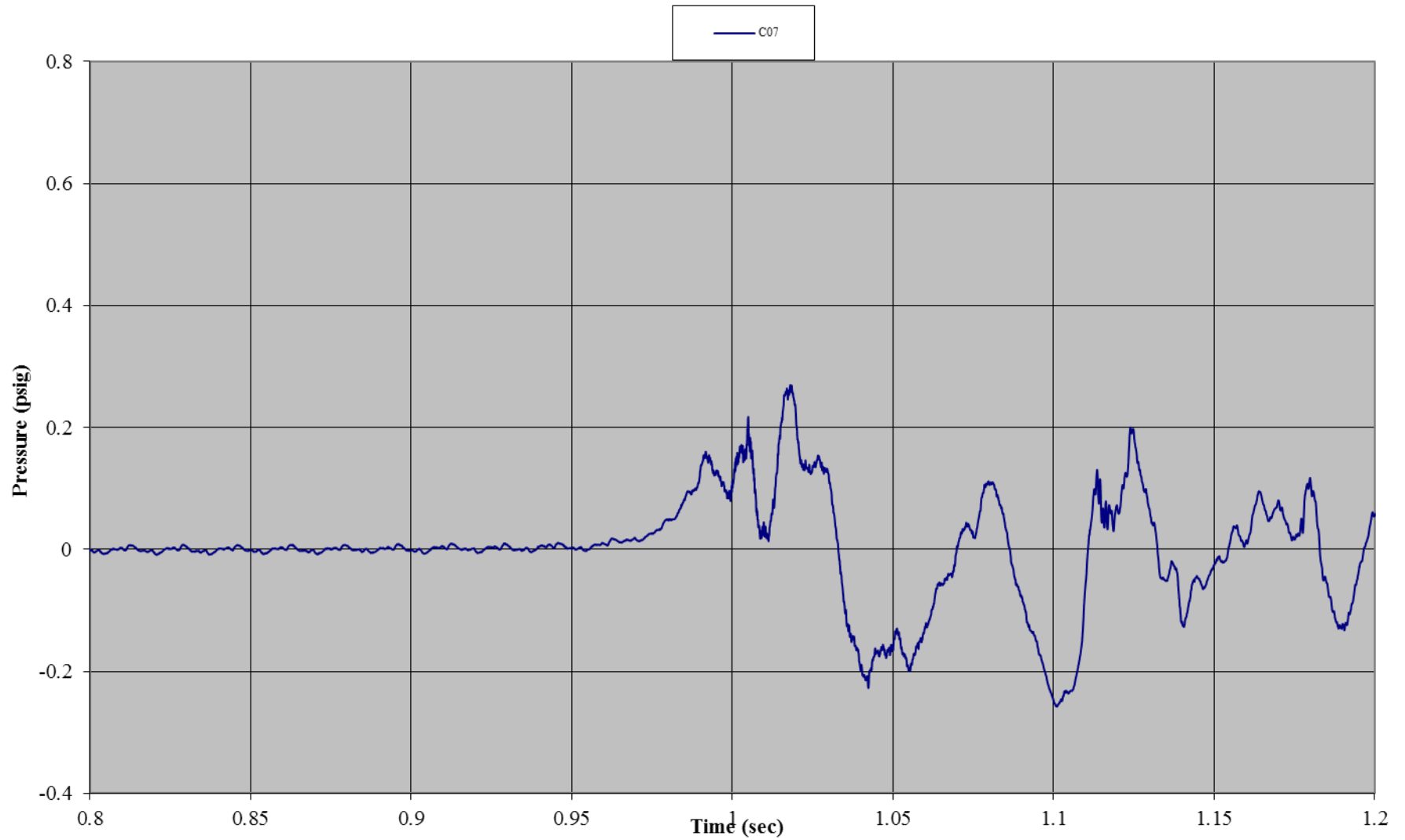
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 19: Right Side Wall, Mid-Height



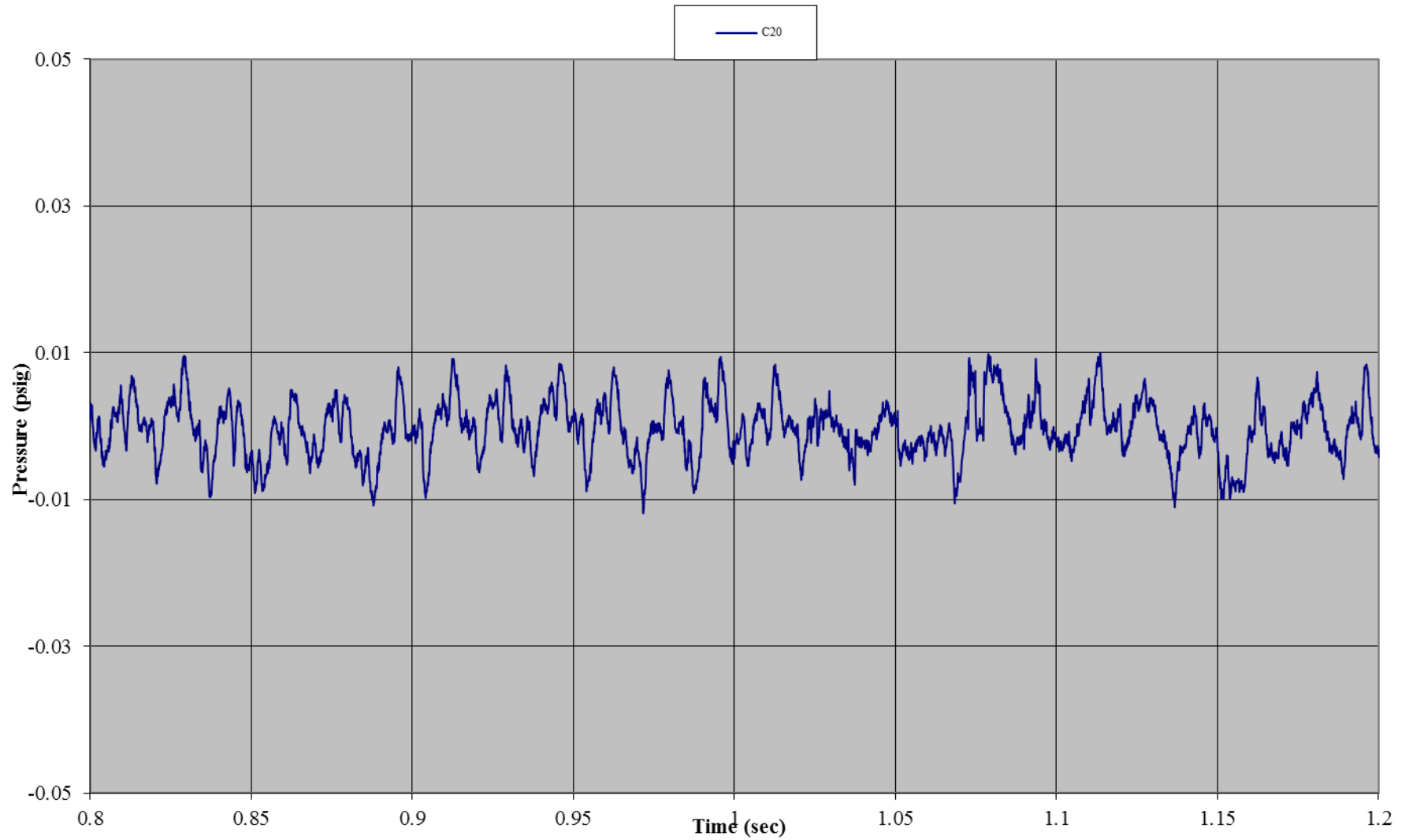
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 04: Interior, Ground



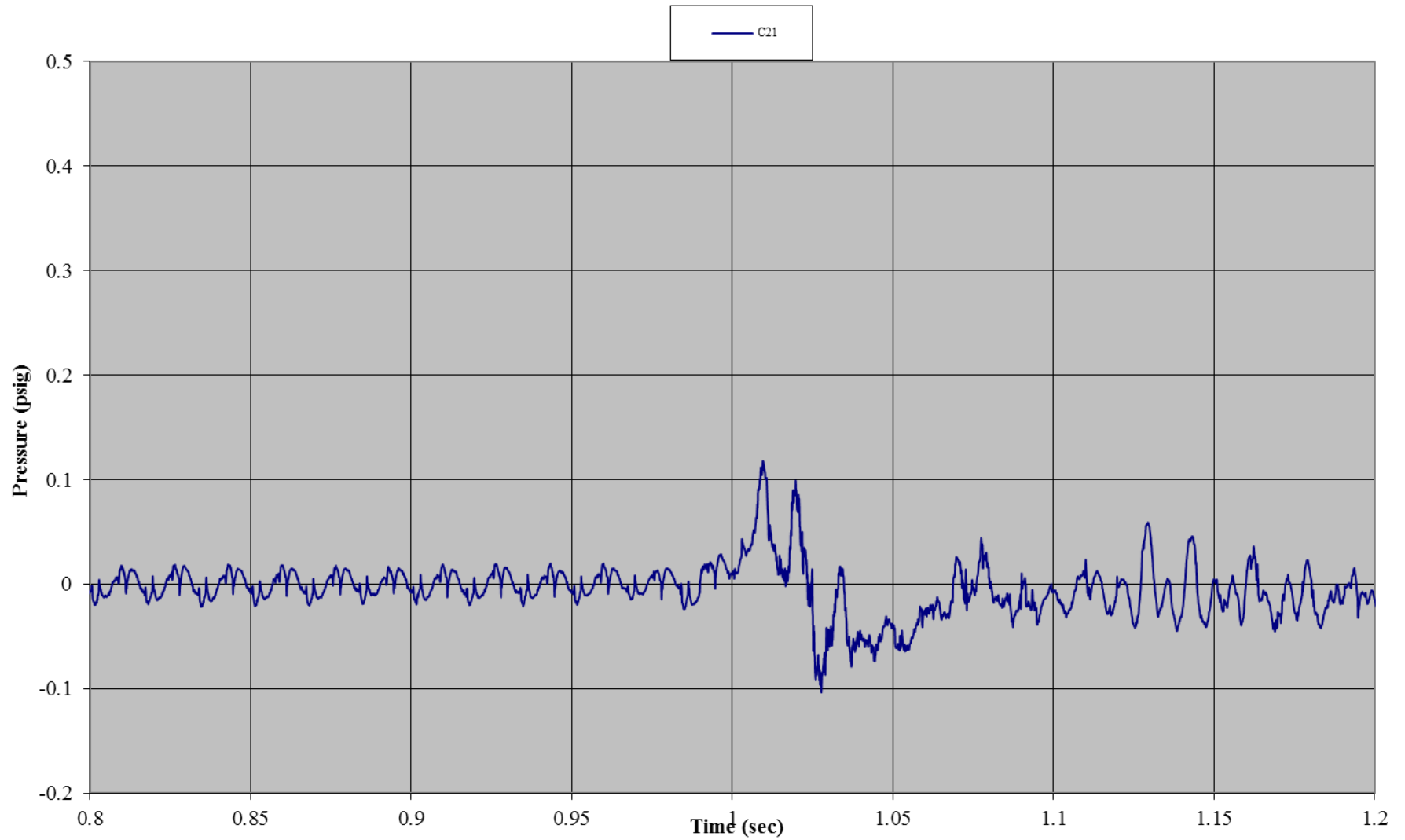
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 07: Roof, Front



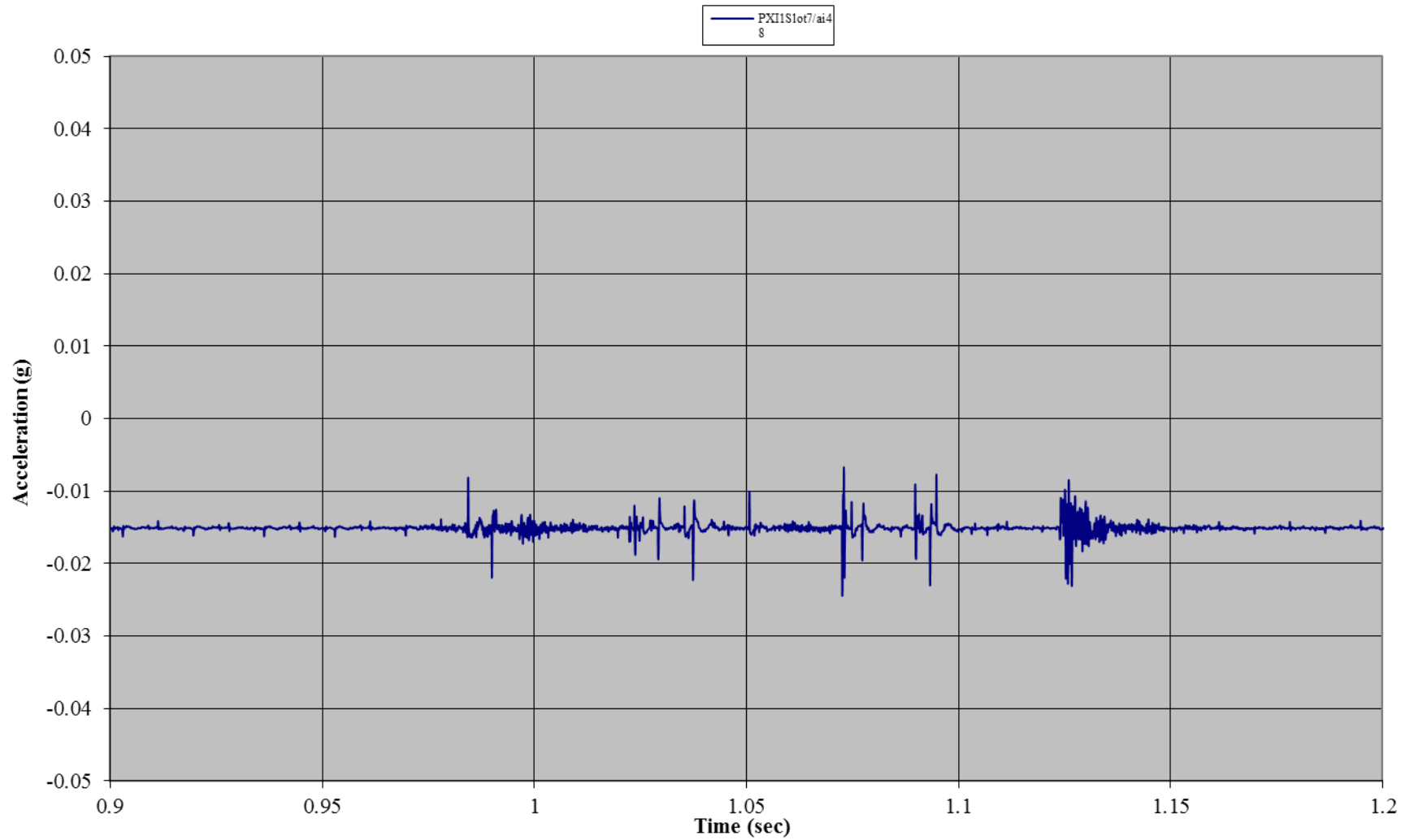
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 20: Roof, Back



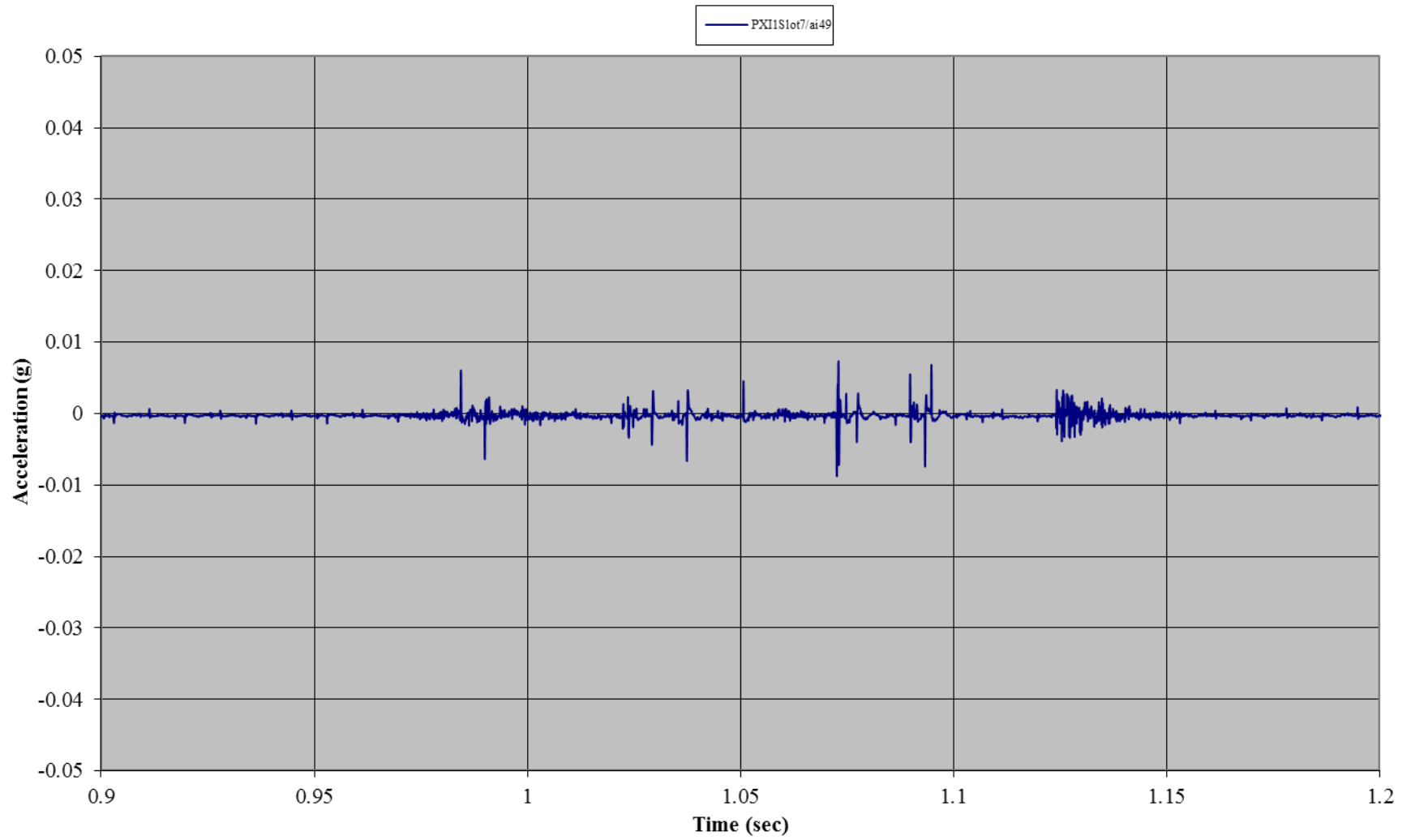
Test B06: Non-Wind Rated Pole Tent without Sides
Gauge 21: Back Wall, Center Mid-Height



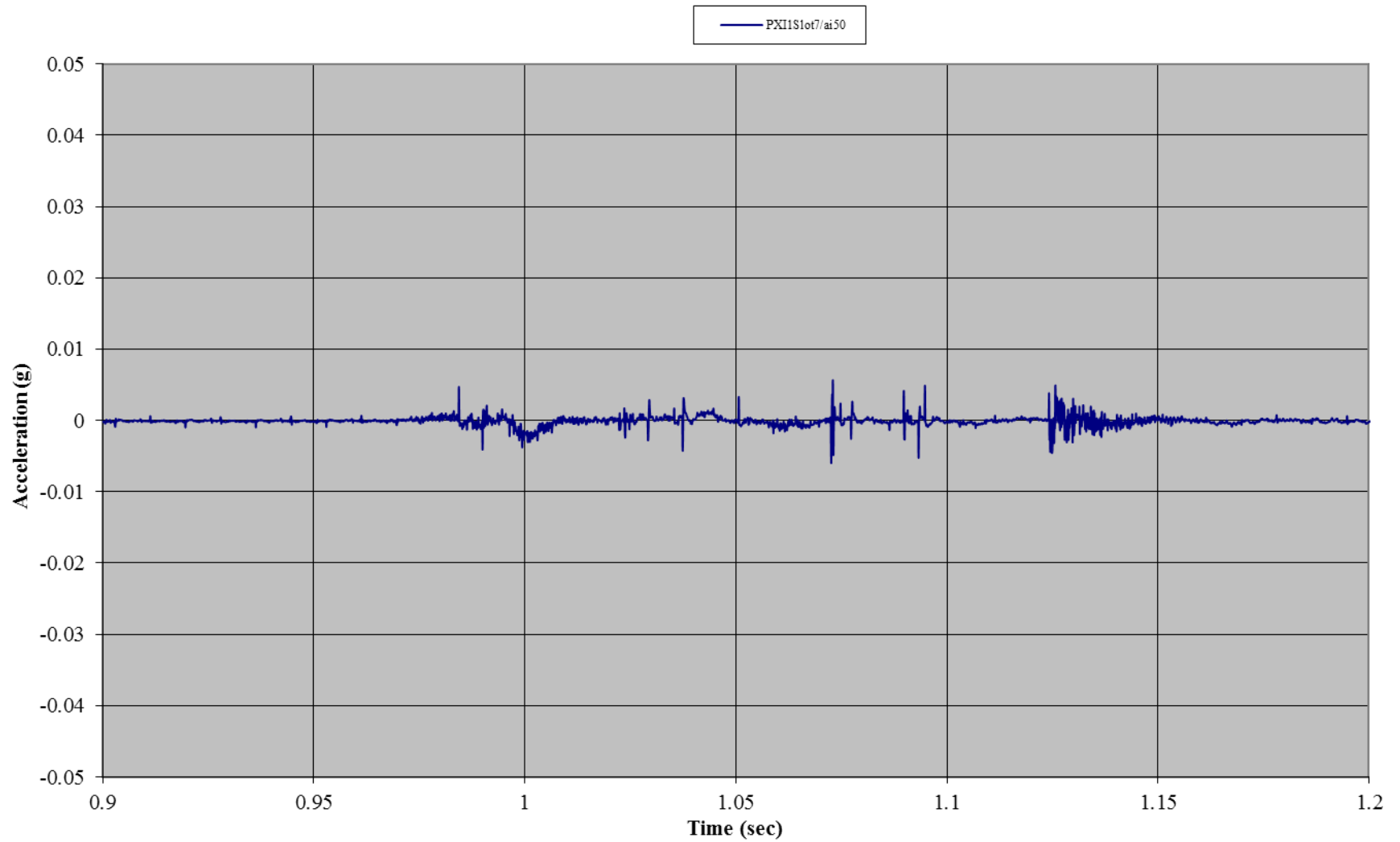
Test B06: Non-Wind Rated Pole Tent without Sides
Accelerometer 1: Front Wall (x-direction)



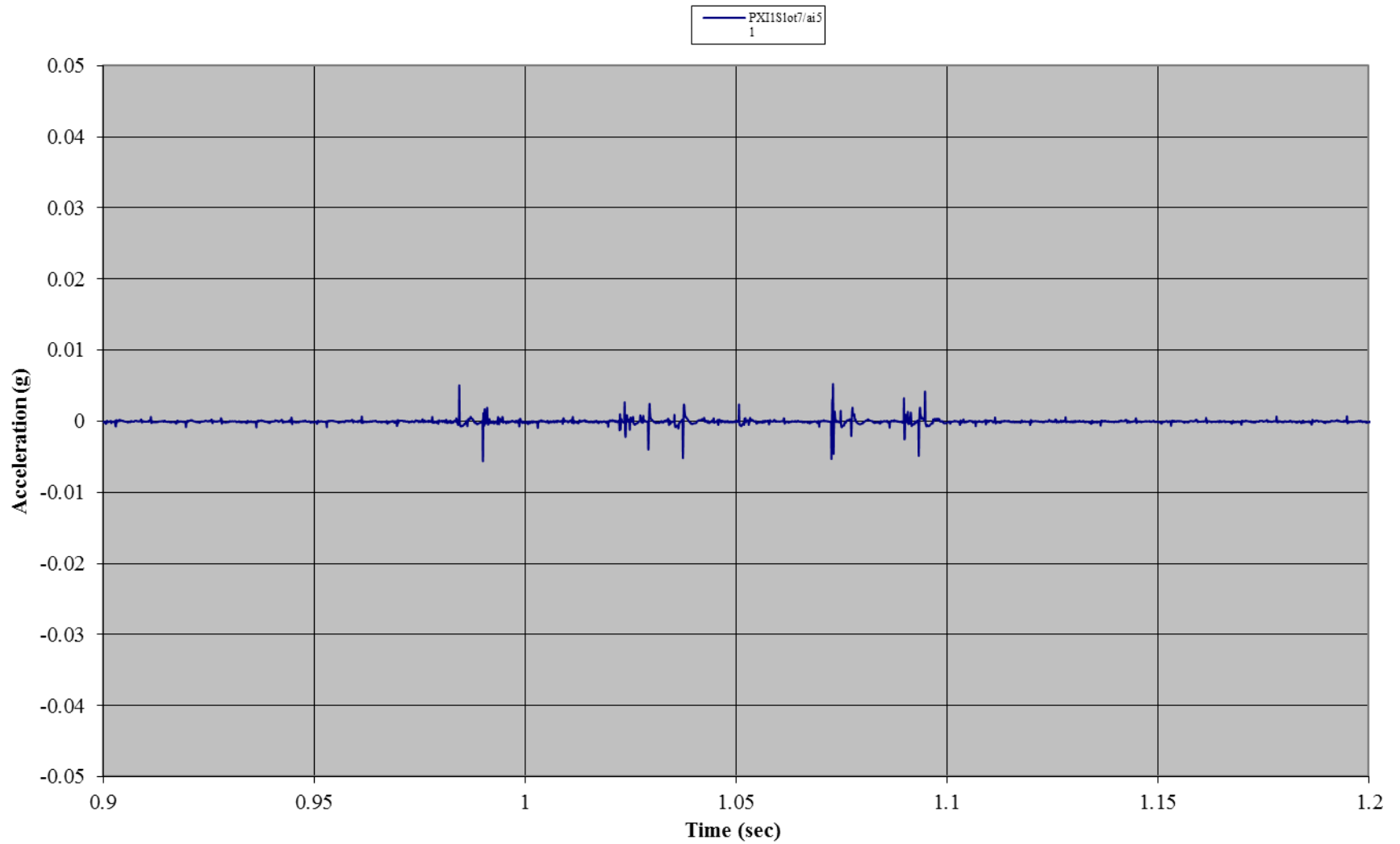
Test B06: Non-Wind Rated Pole Tent without Sides
Accelerometer 1: Front Wall (y-direction)



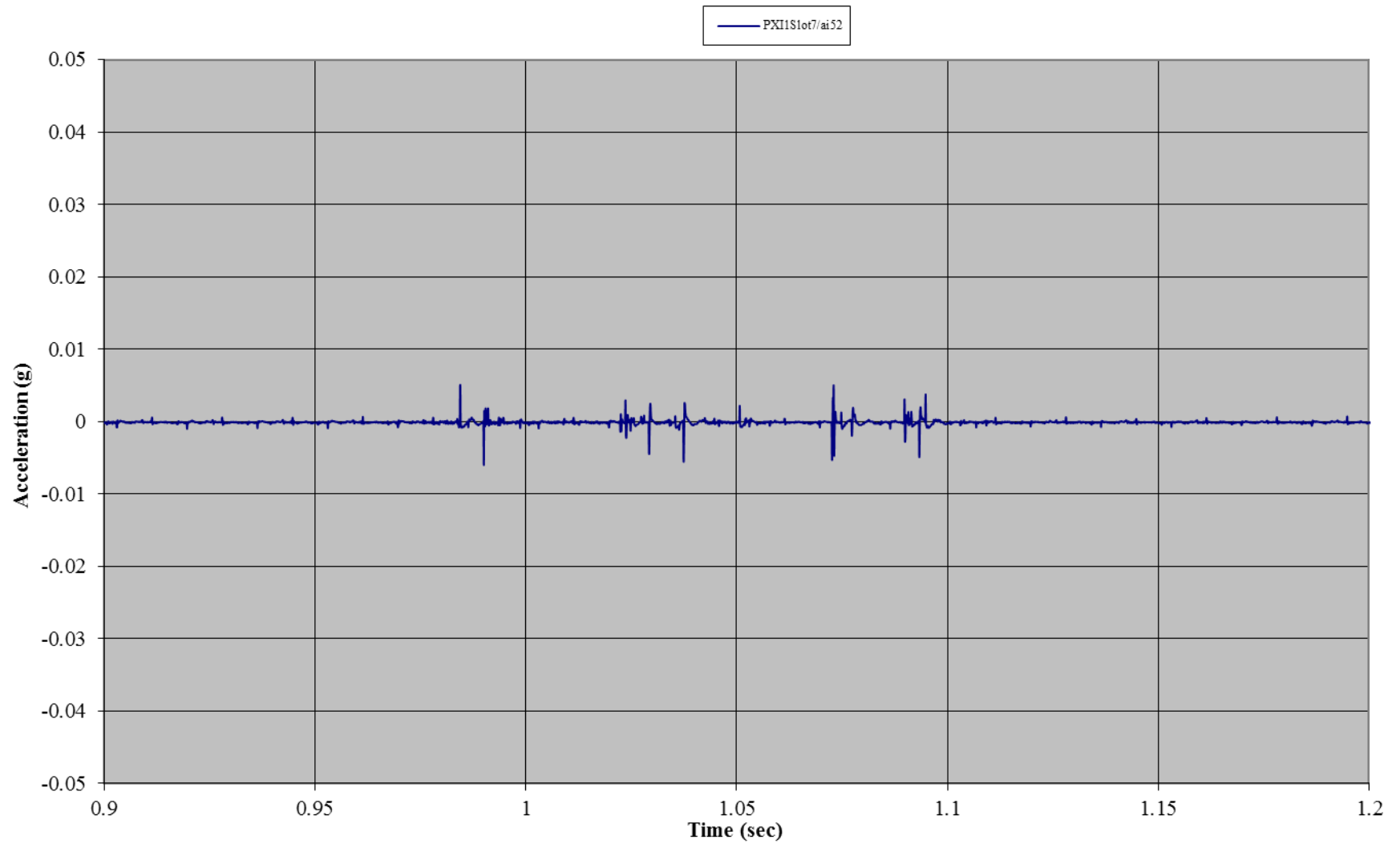
Test B06: Non-Wind Rated Pole Tent without Sides
Accelerometer 1: Front Wall (z-direction)



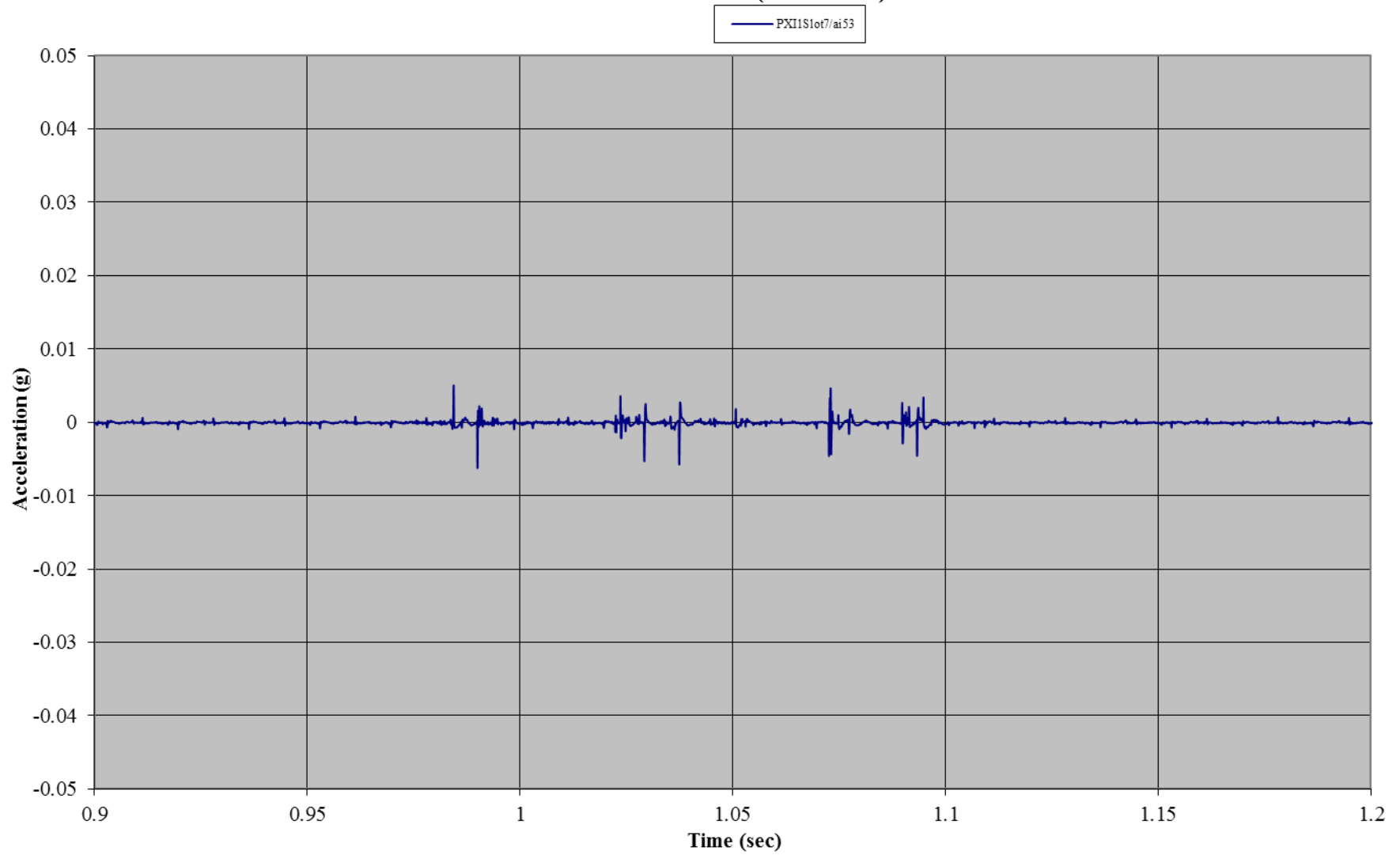
Test B06: Non-Wind Rated Pole Tent without Sides
Accelerometer 2: Roof (x-direction)



Test B06: Non-Wind Rated Pole Tent without Sides
Accelerometer 2: Roof (y-direction)

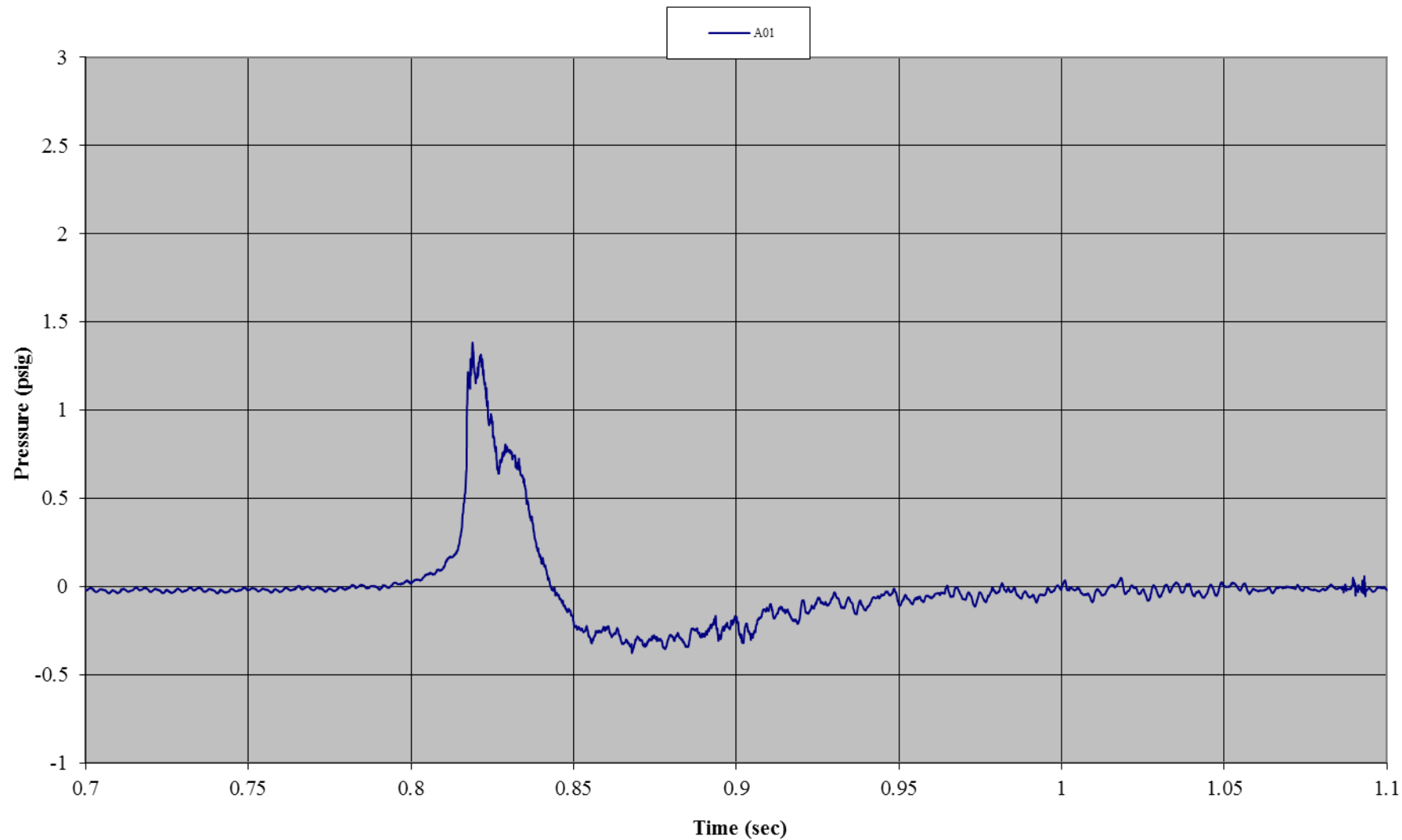


Test B06: Non-Wind Rated Pole Tent without Sides
Accelerometer 2: Roof (z-direction)

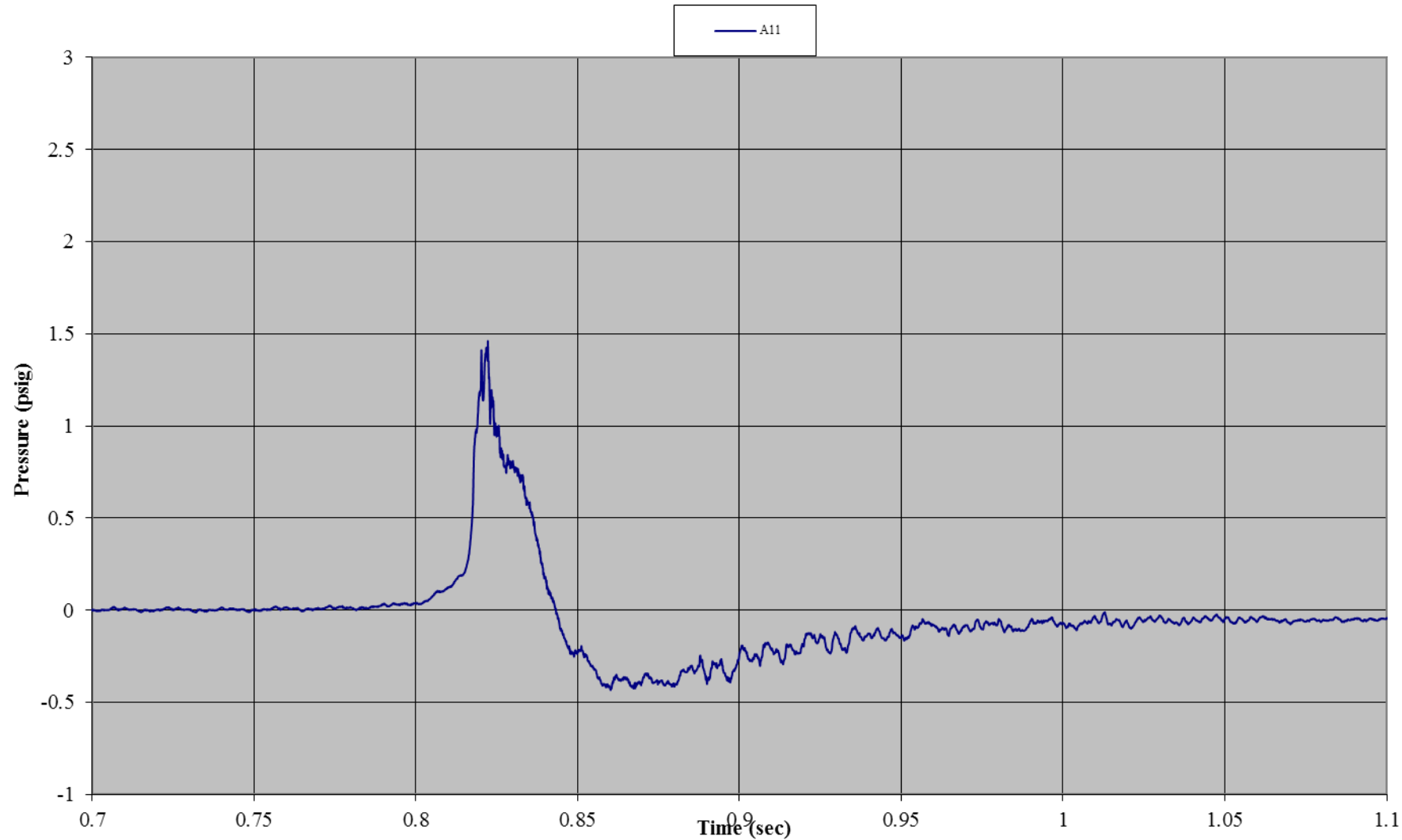


Test B08: Tent A

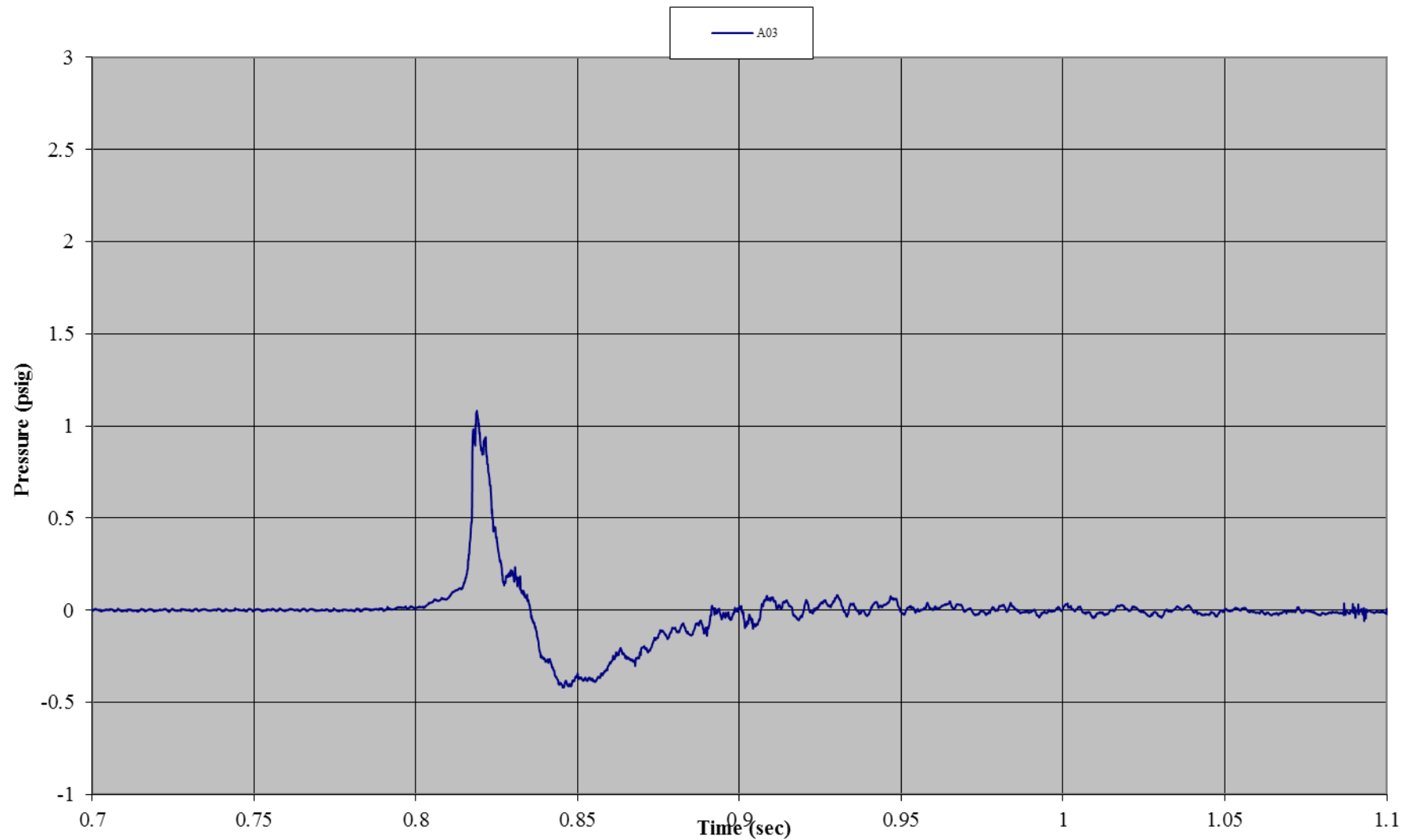
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 01: Front Wall, Left Bottom



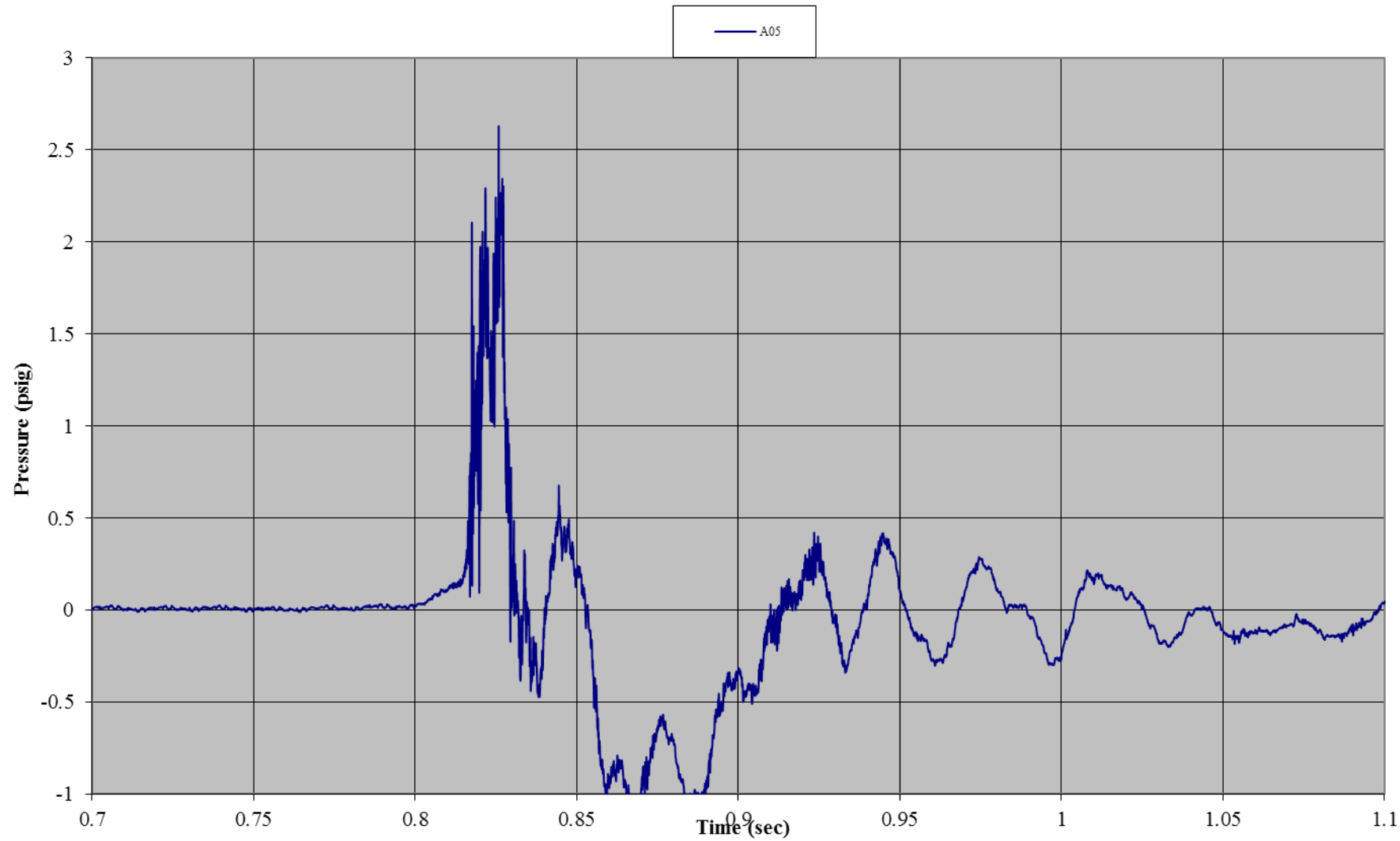
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 11: Front Wall, Right Bottom



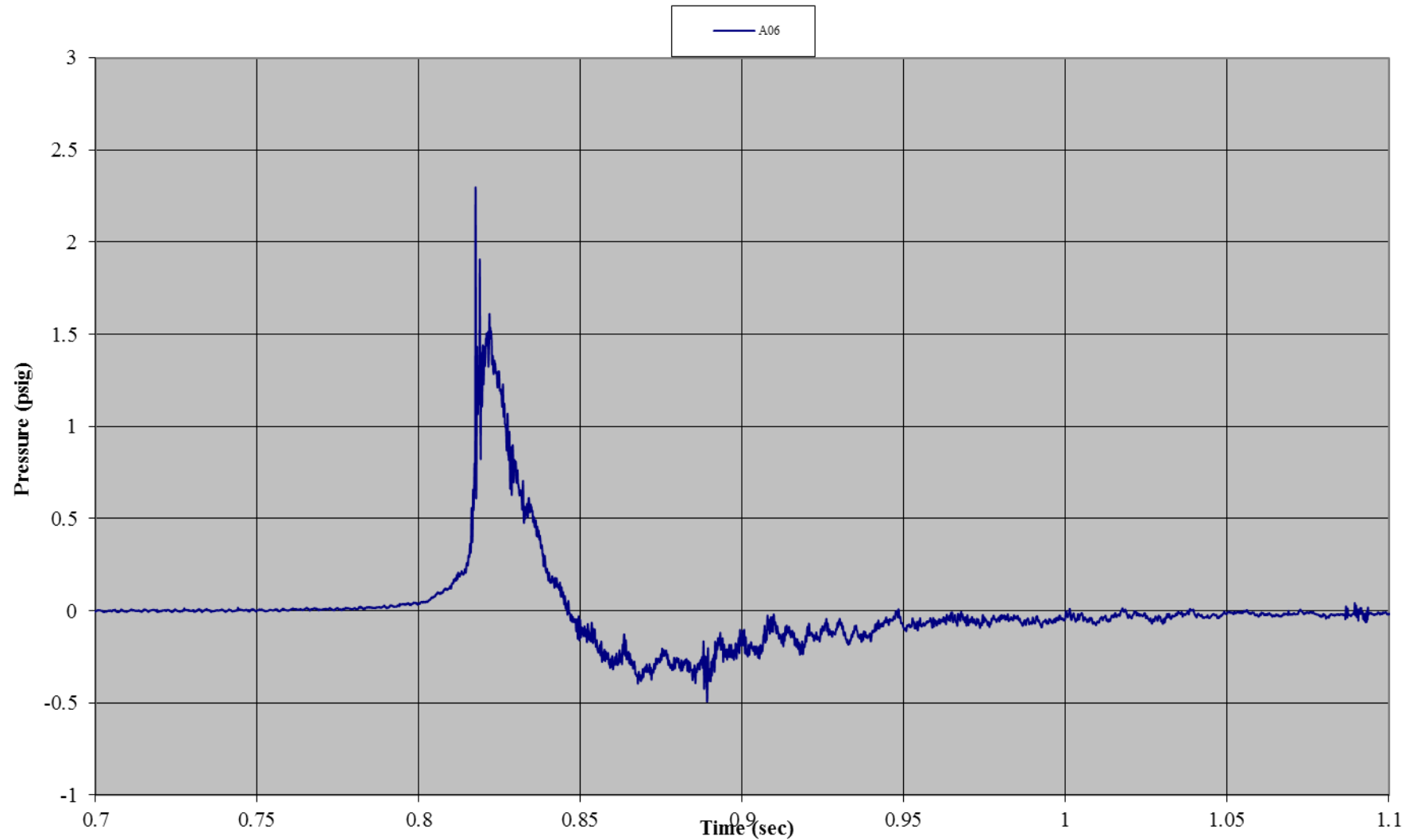
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 03: Front Wall, Center Bottom



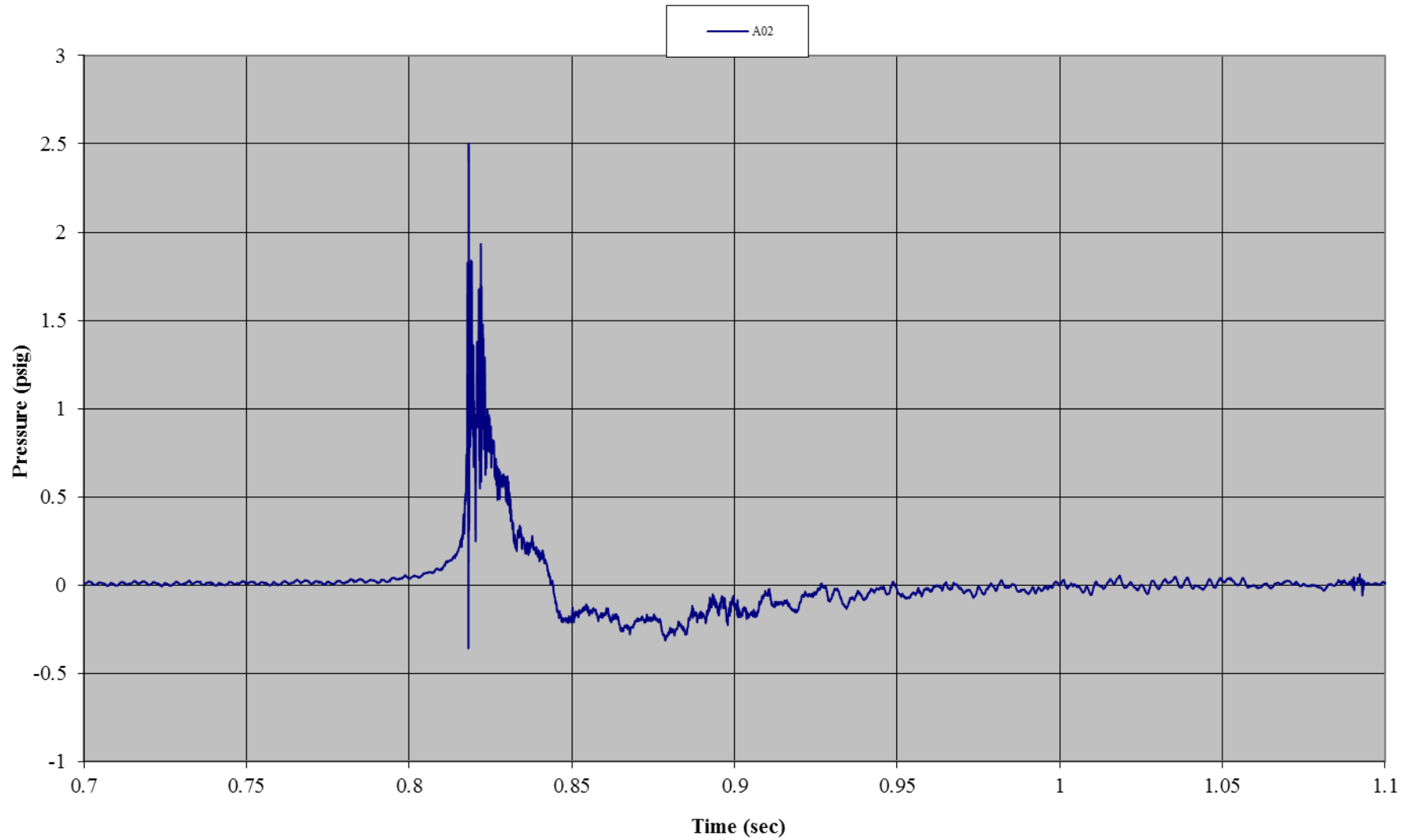
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



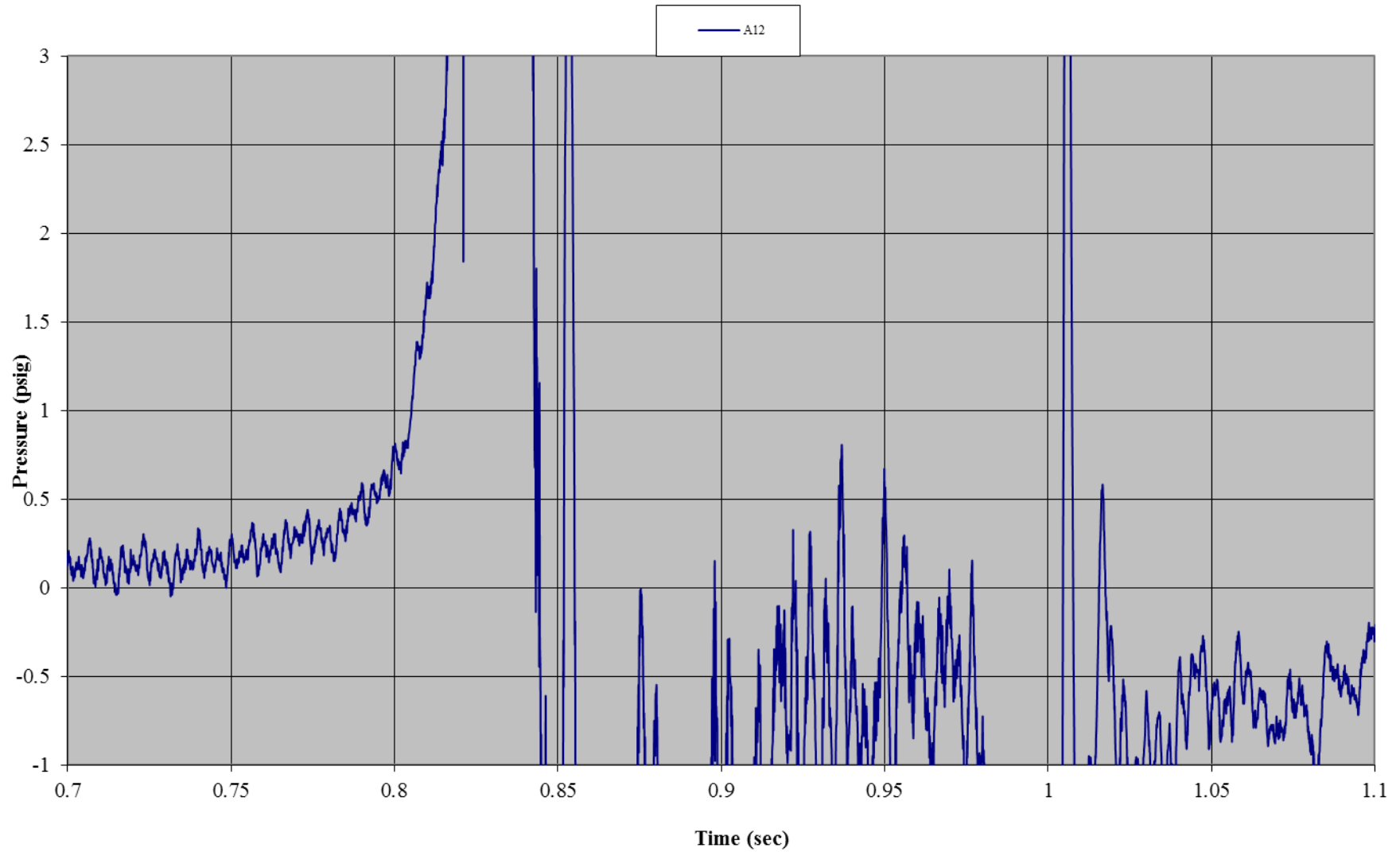
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 06: Front Wall, Center Top



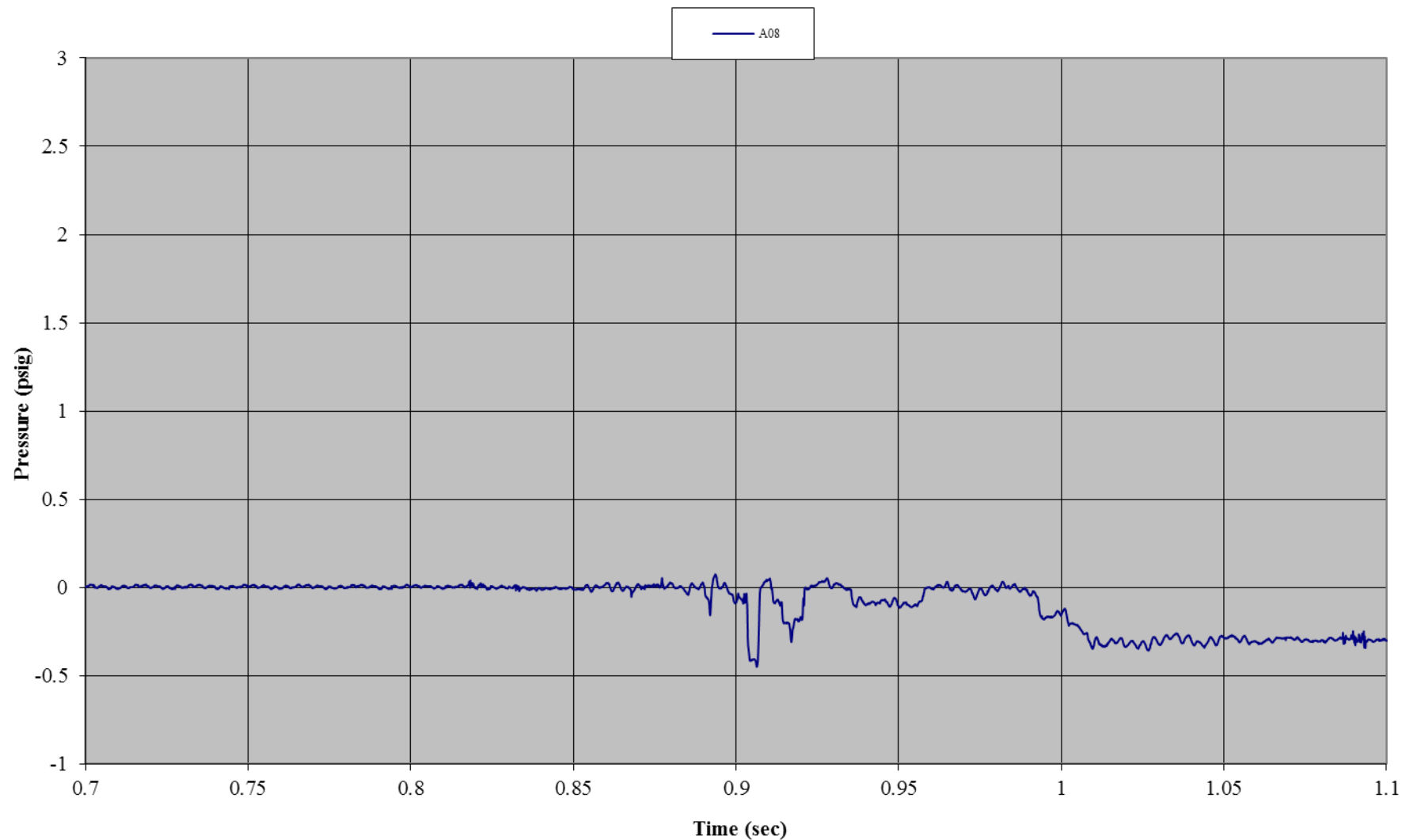
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



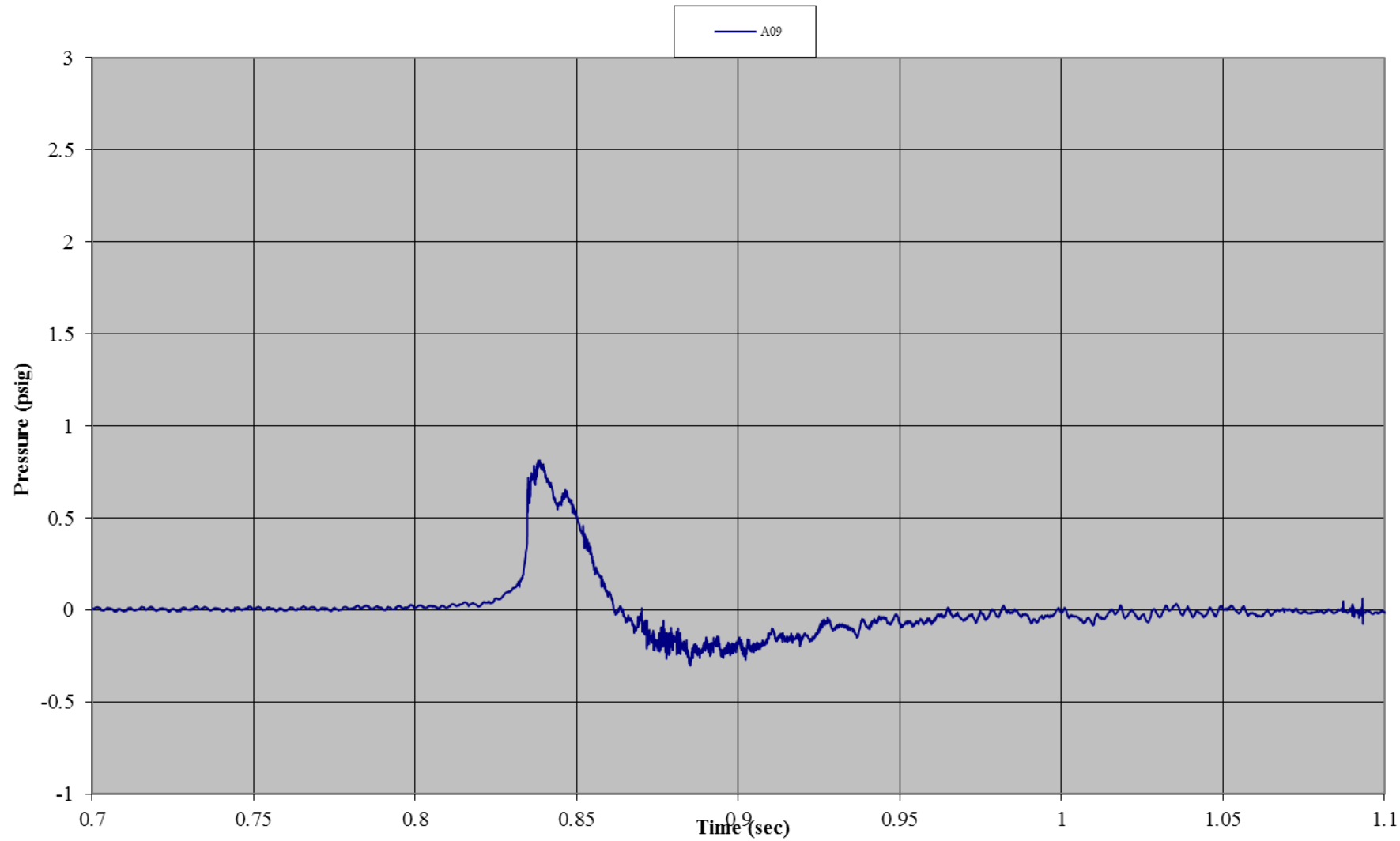
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



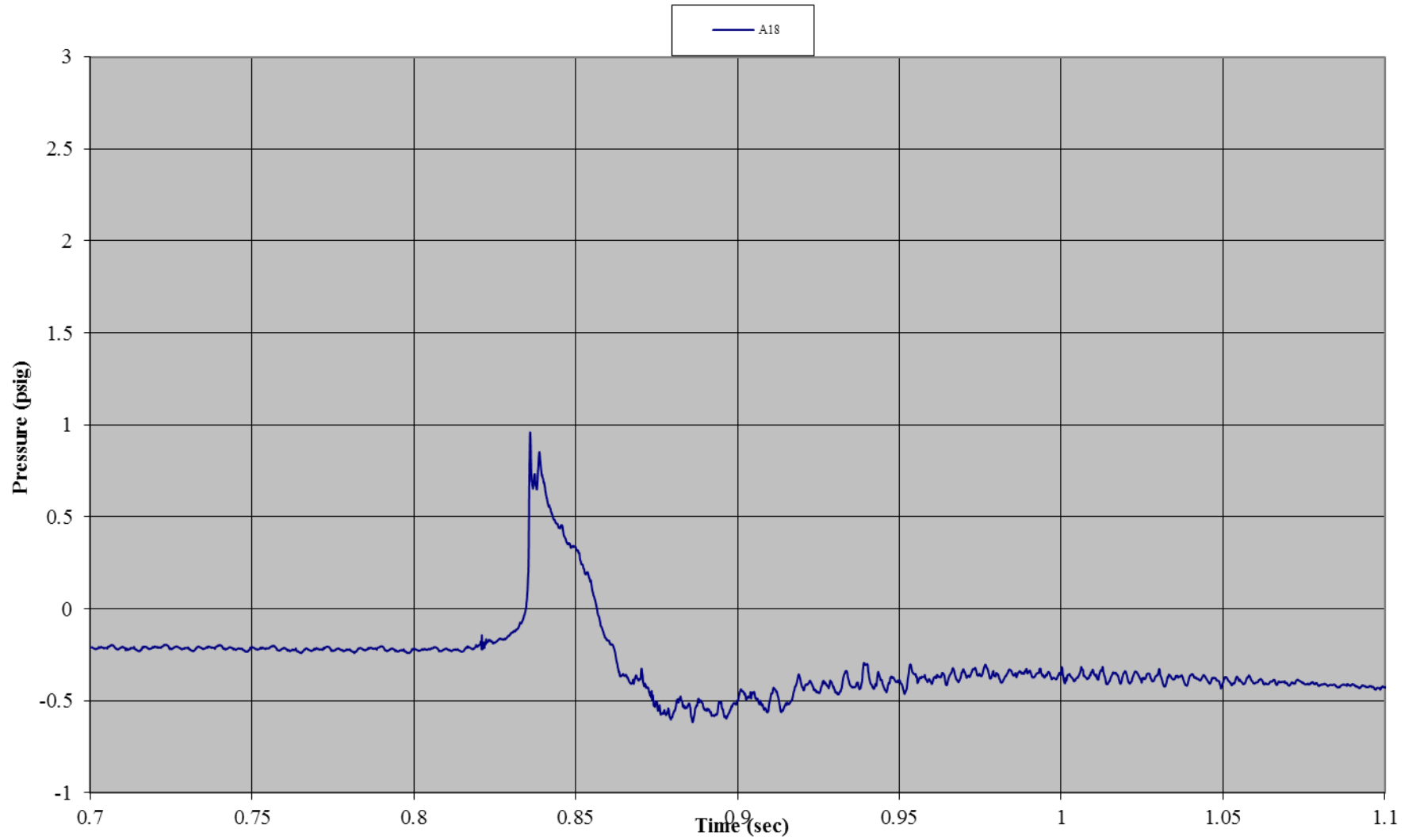
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 08: Left Side Wall, Bottom



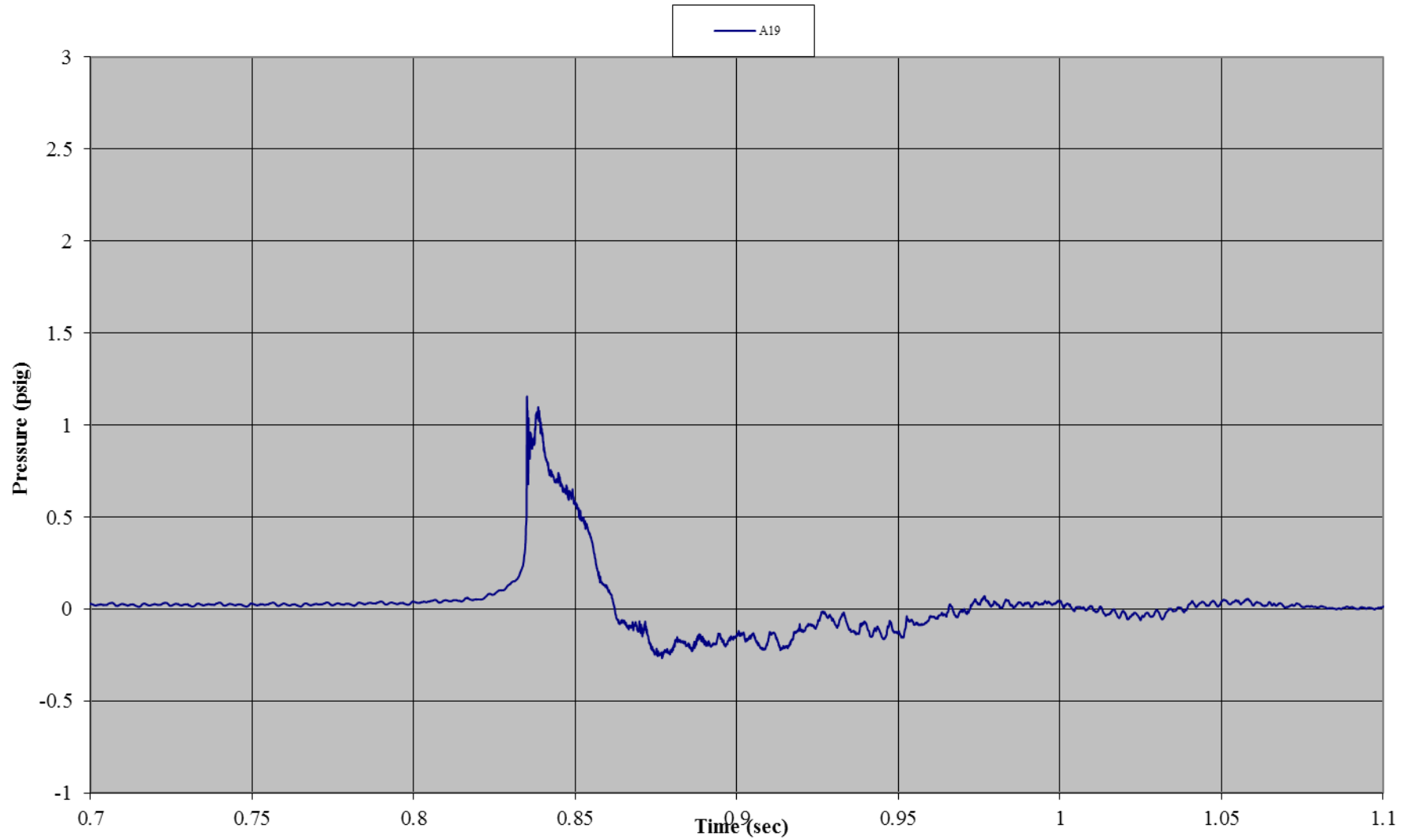
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



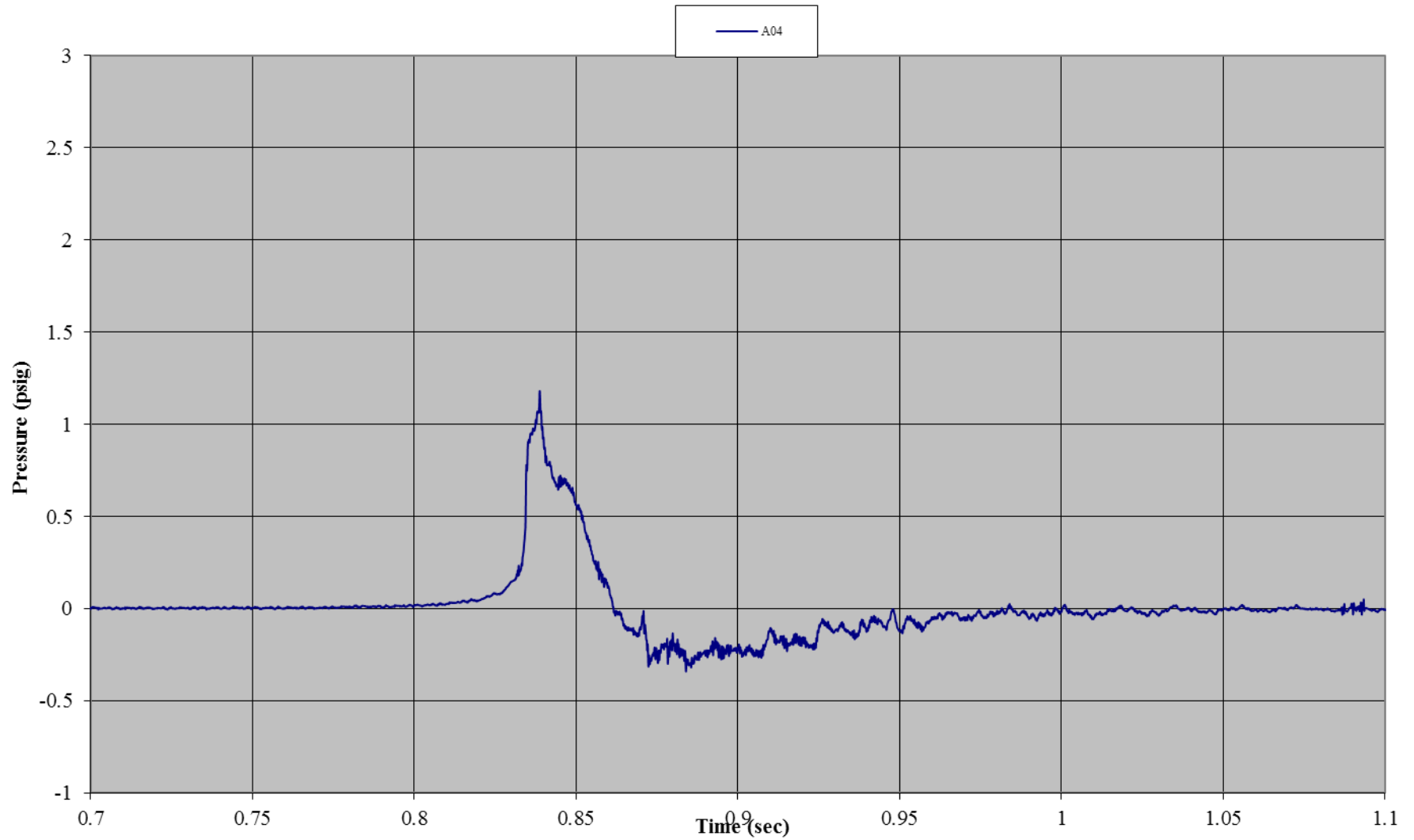
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 18: Right Side Wall, Bottom



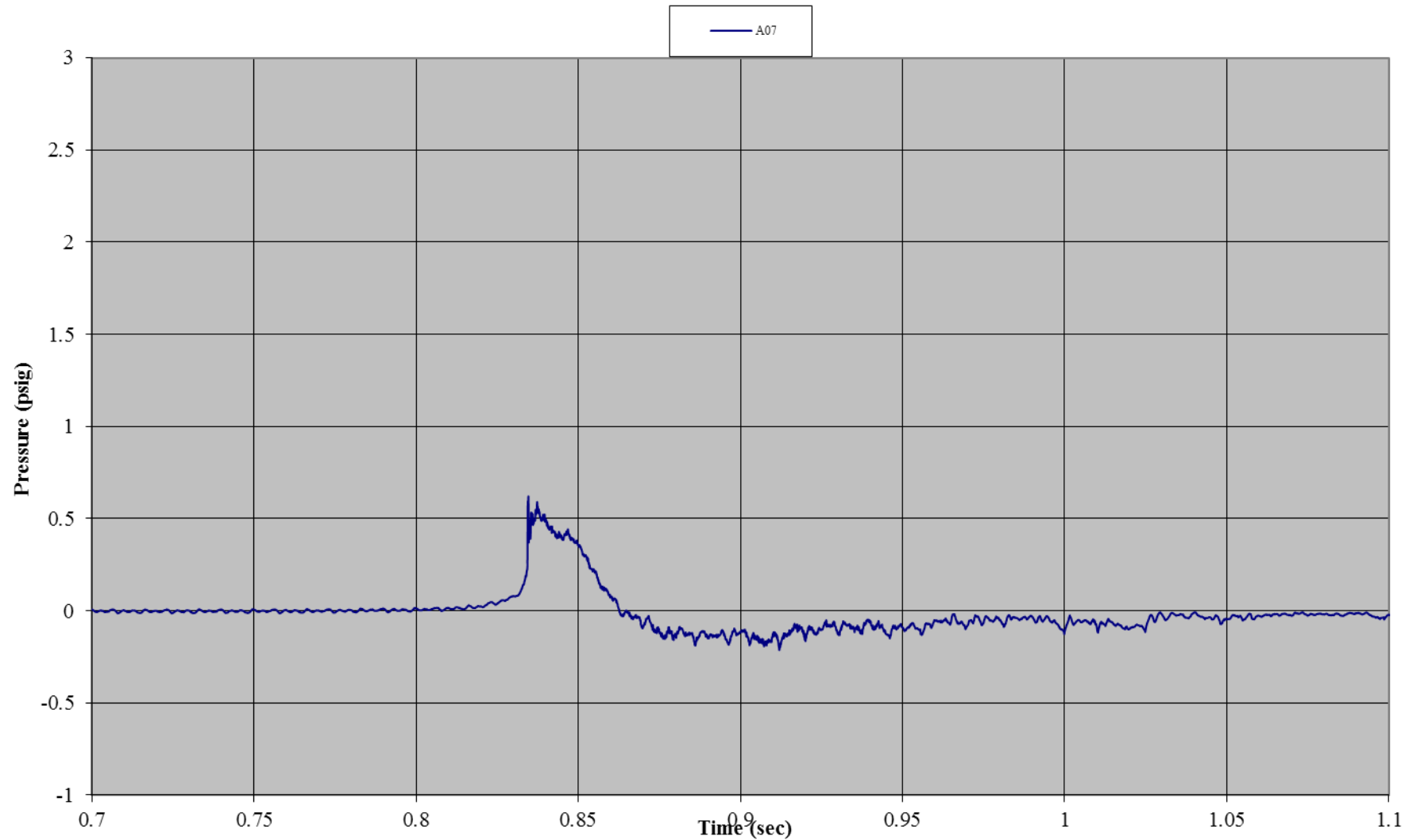
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



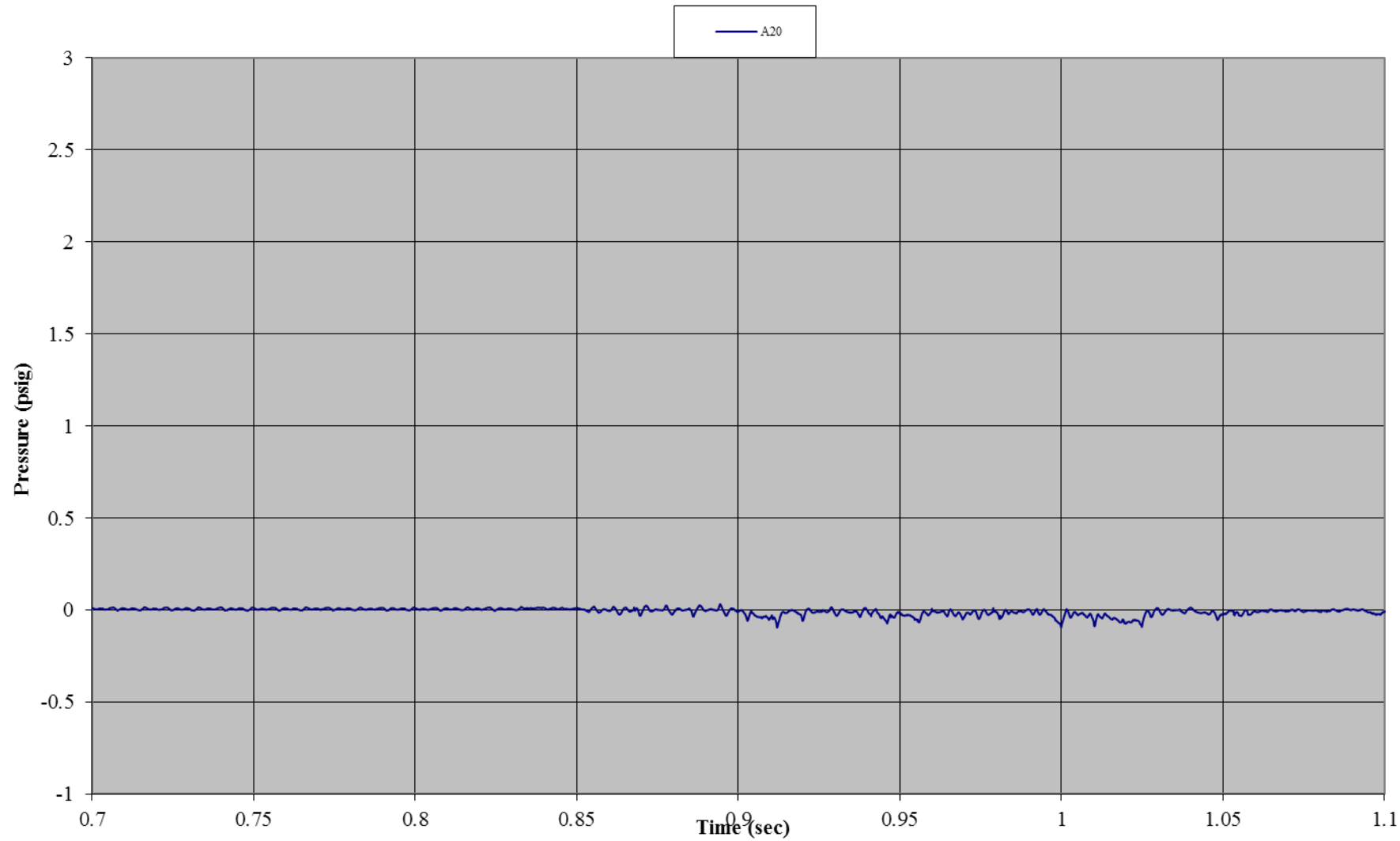
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 04: Interior, Ground



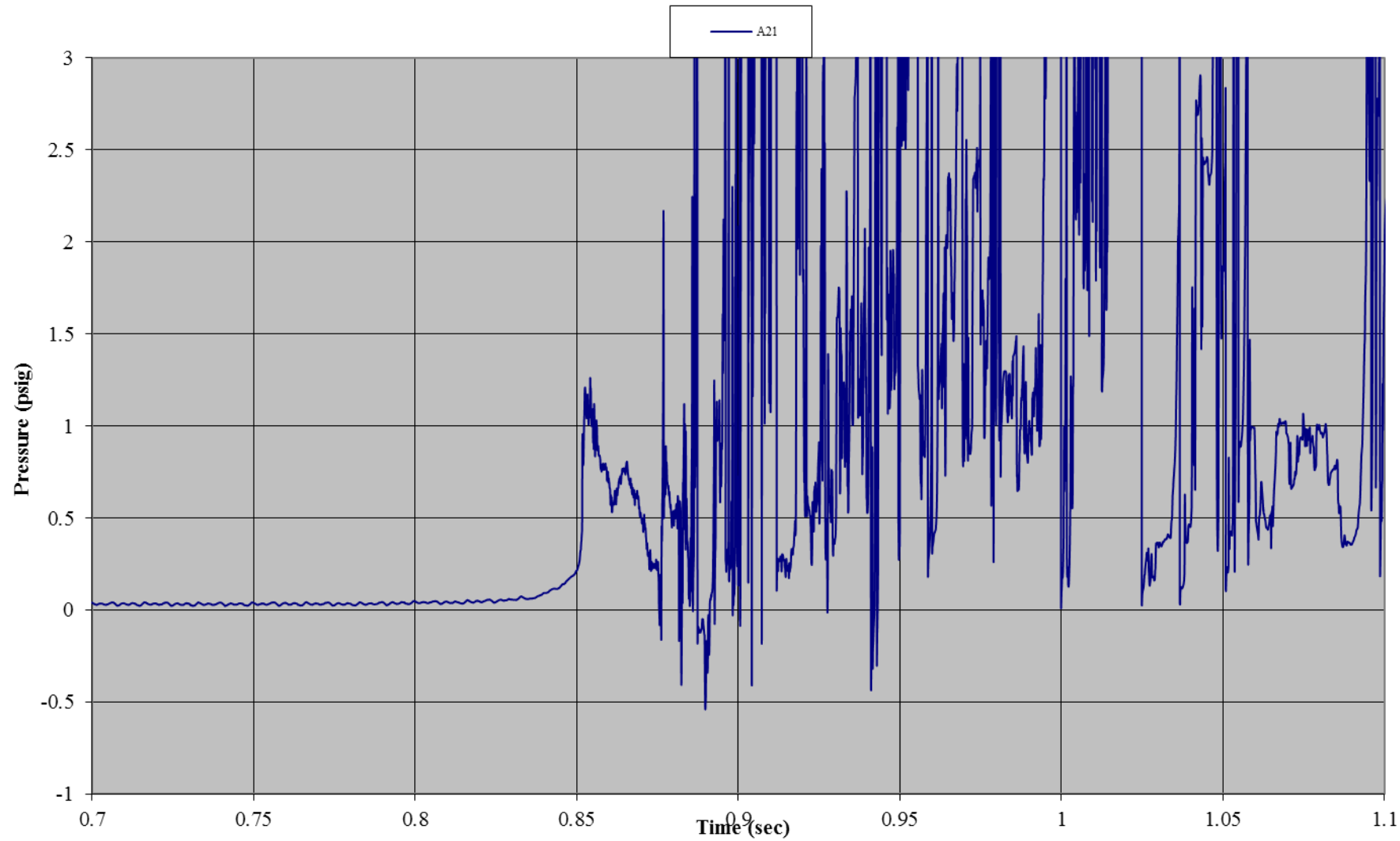
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 07: Roof, Front



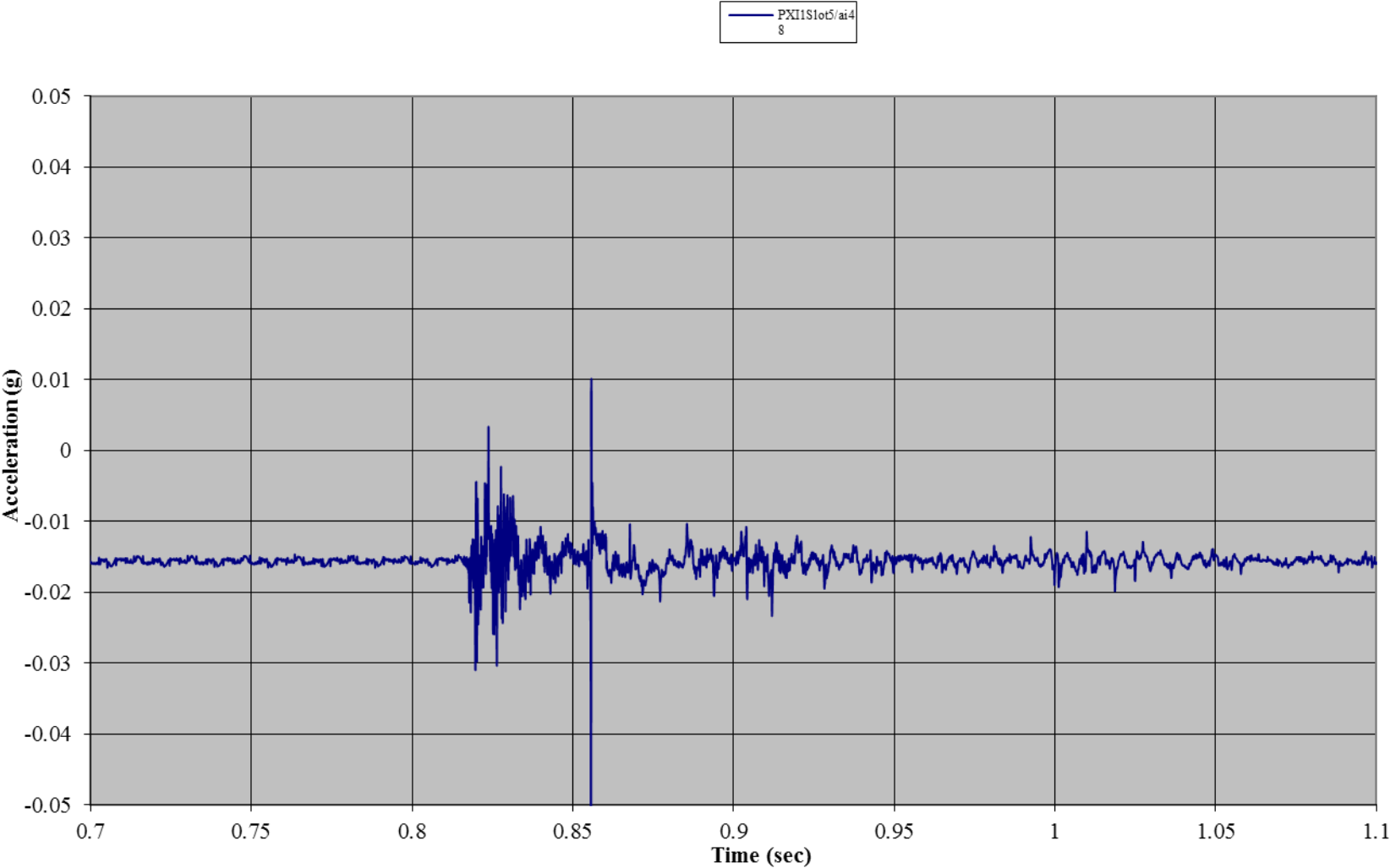
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 20: Roof, Back



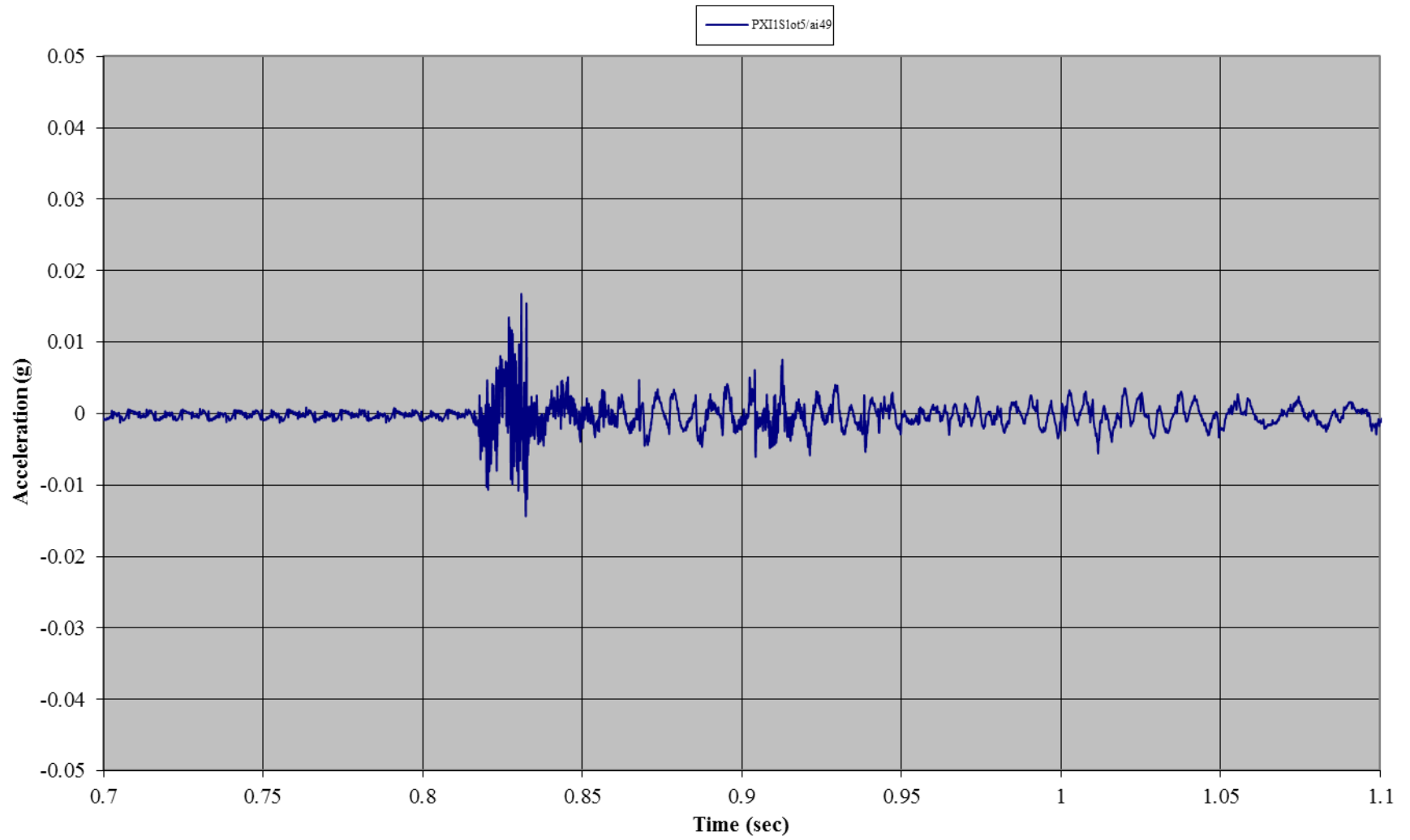
Test B08: Non-Wind Rated Pole Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



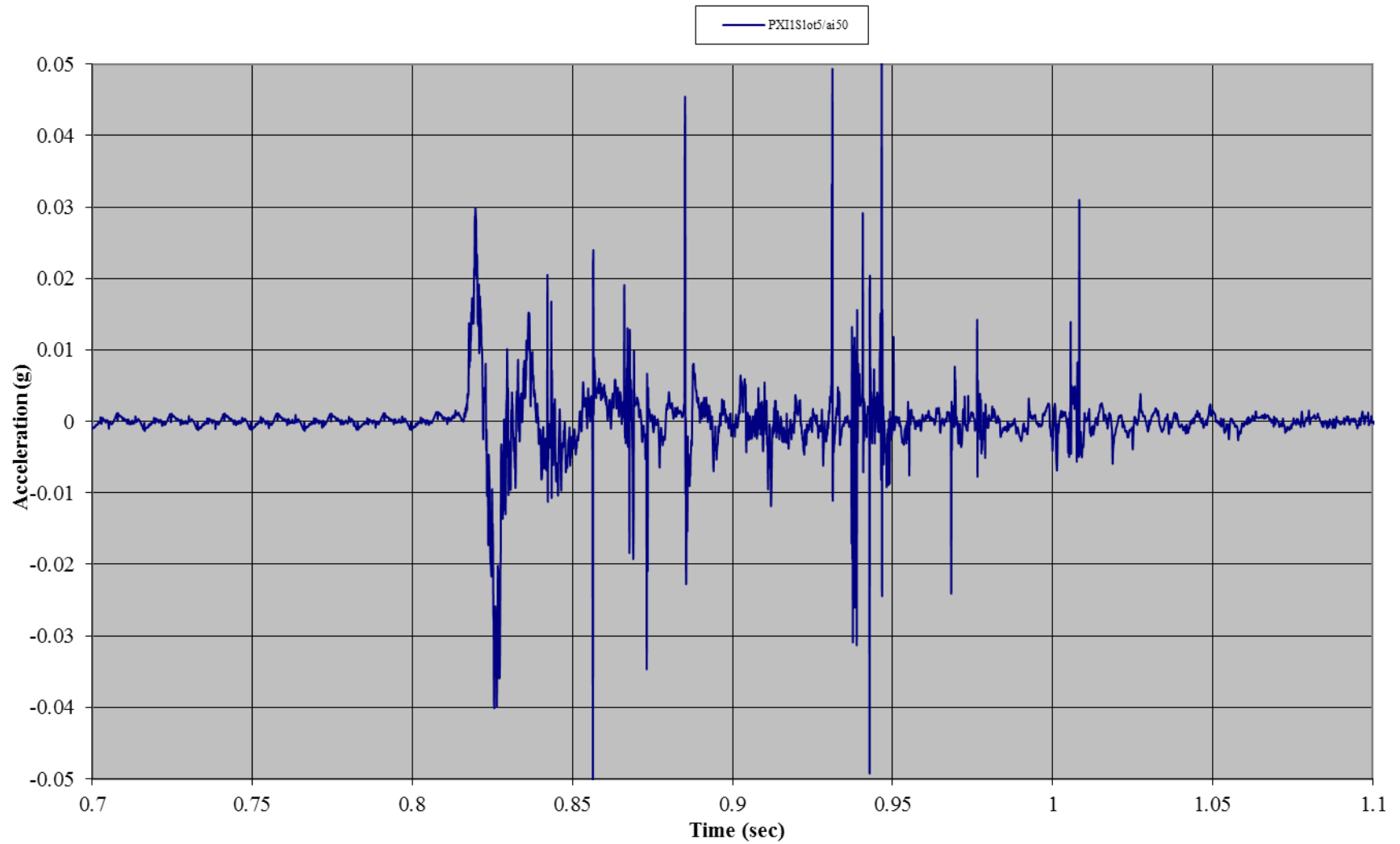
Test B08: Non-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (x-direction)



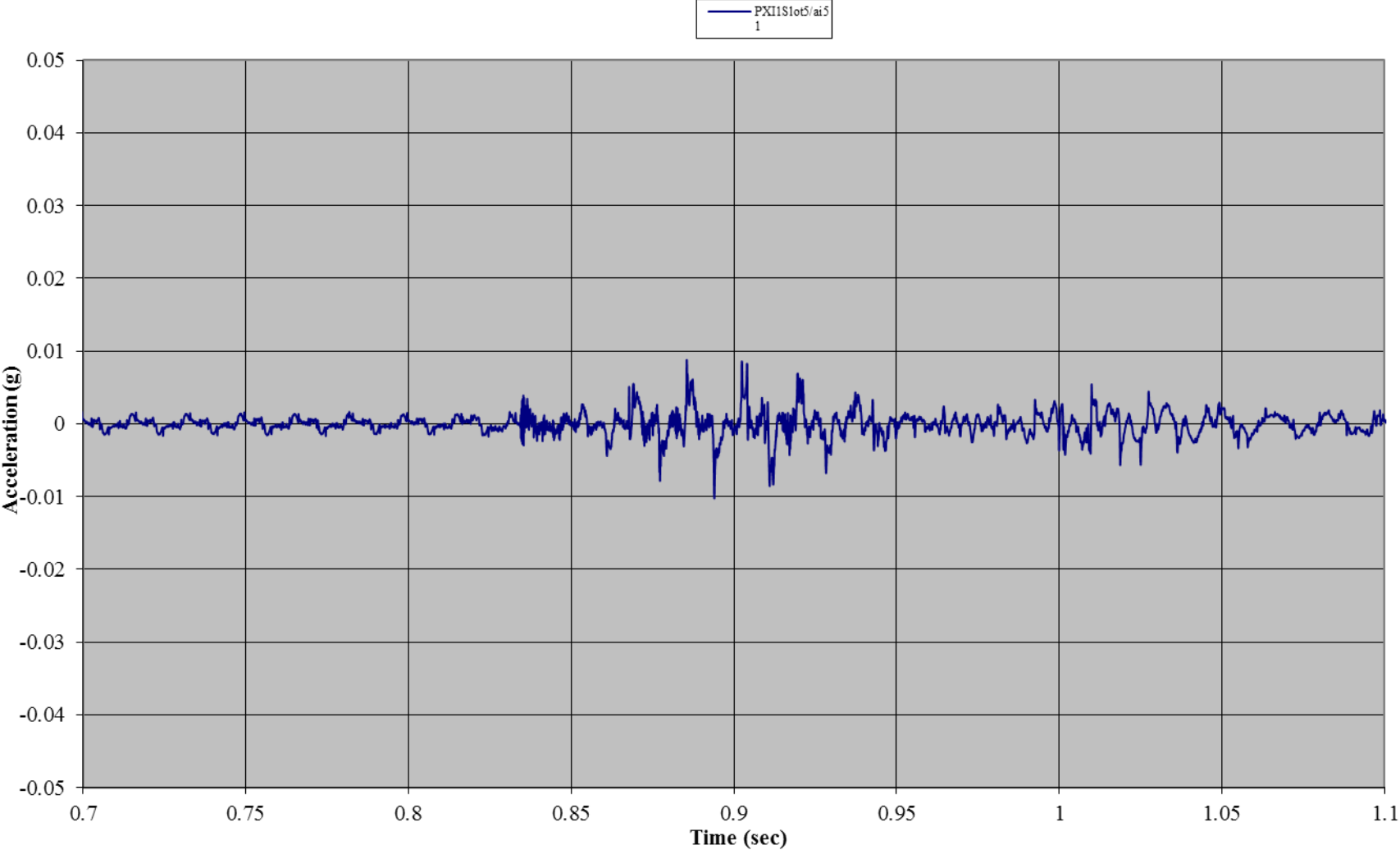
Test B08: Non-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (y-direction)



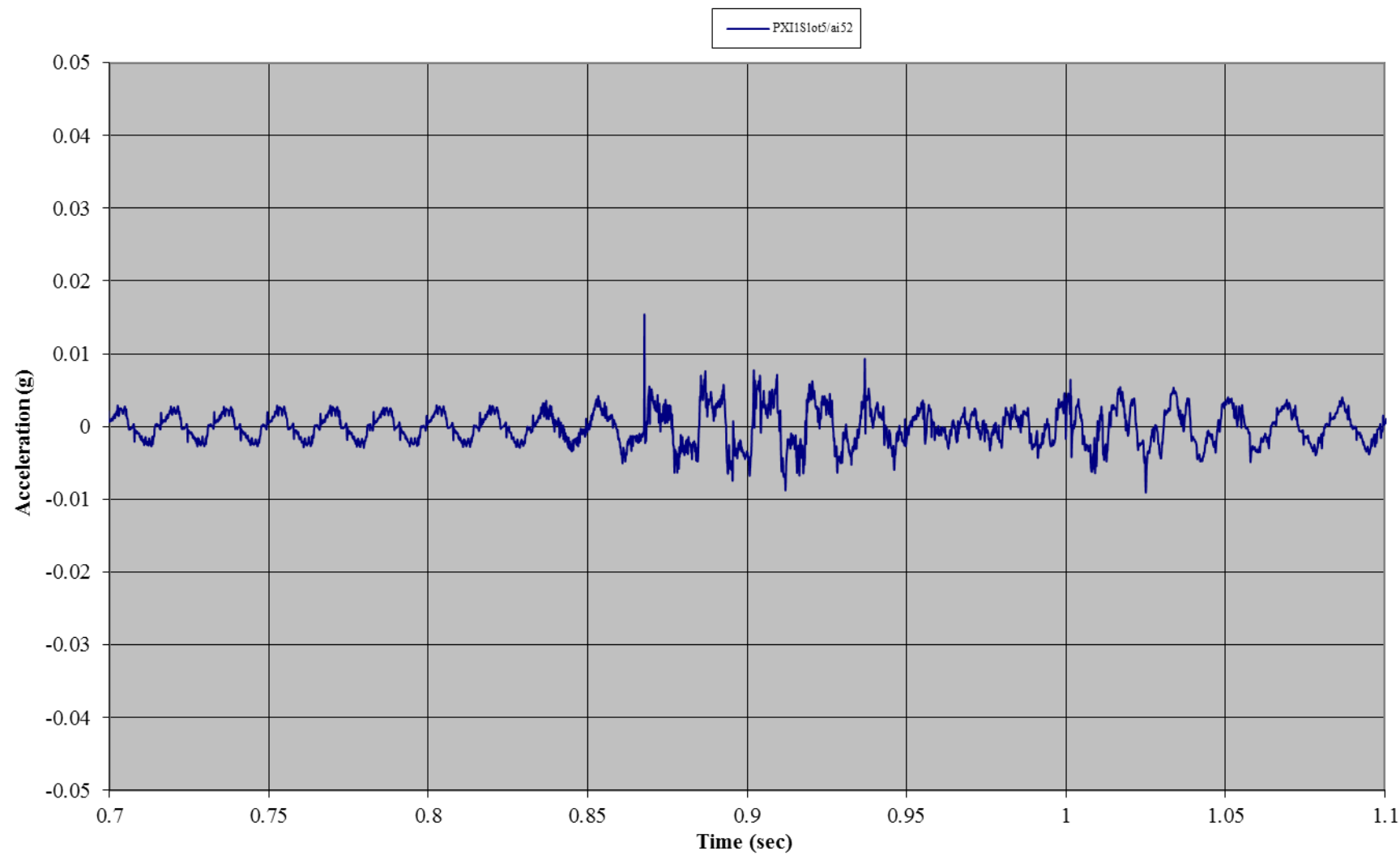
Test B08: Non-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (z-direction)



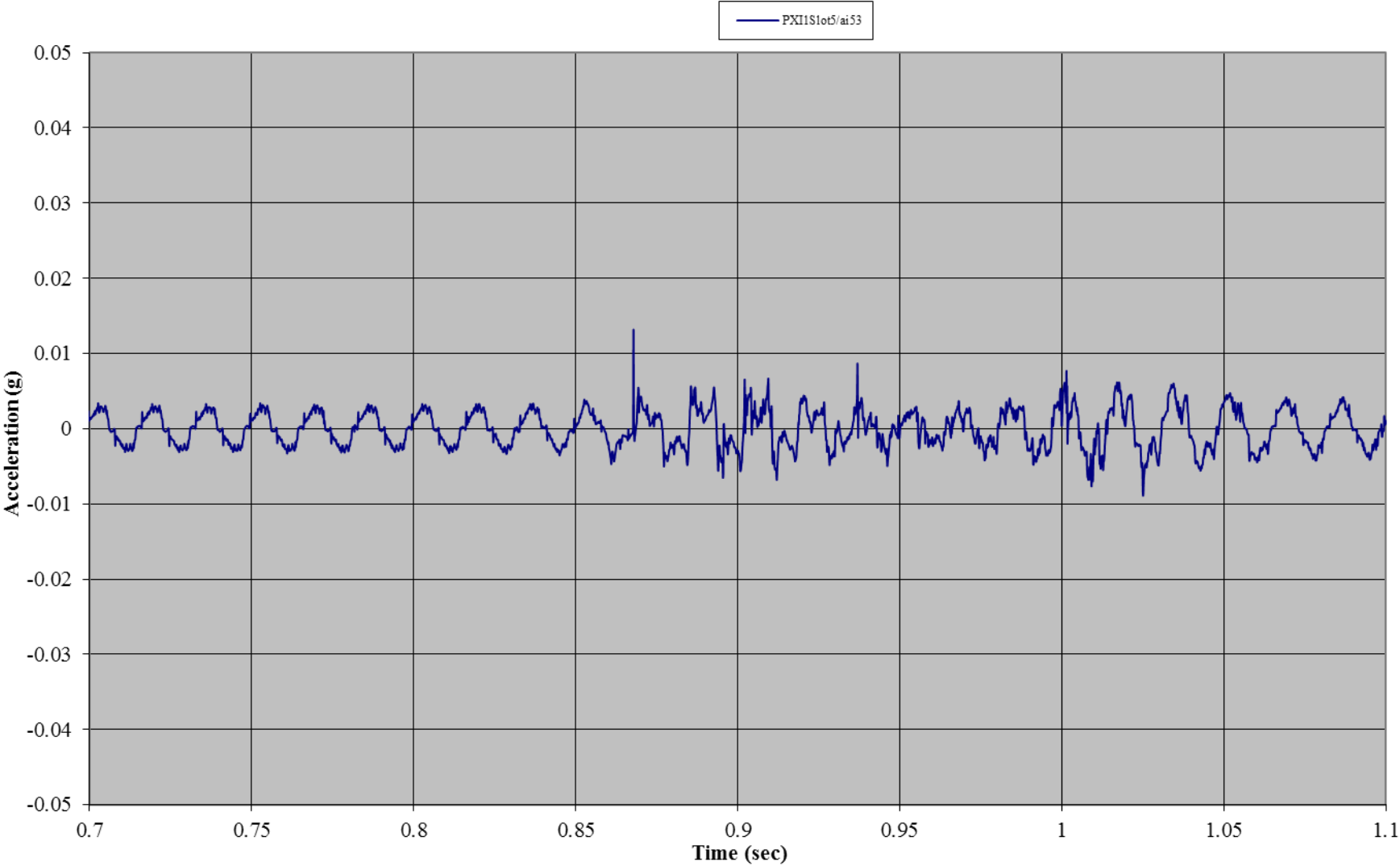
Test B08: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (x-direction)



Test B08: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (y-direction)

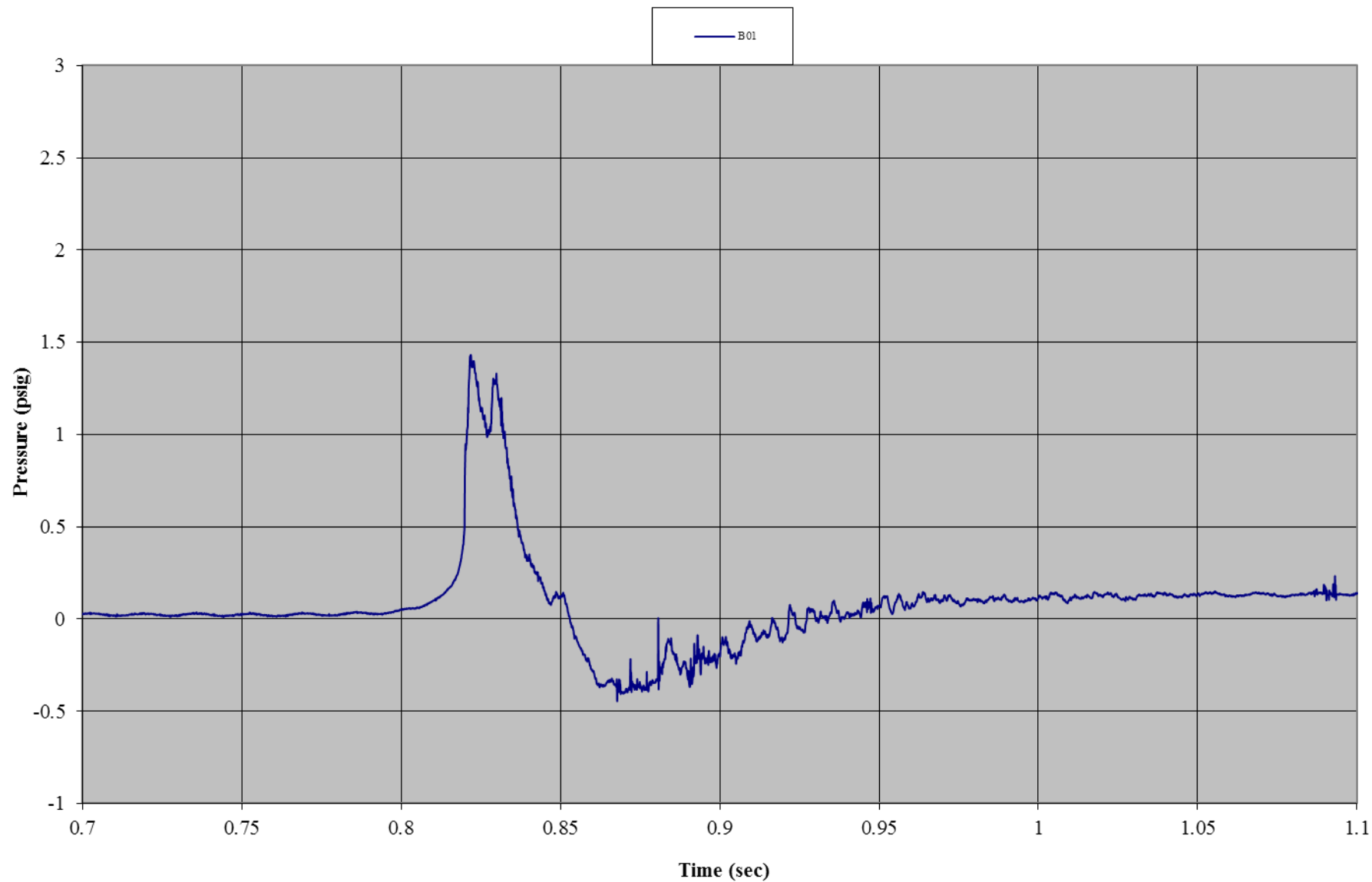


Test B08: Non-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (z-direction)

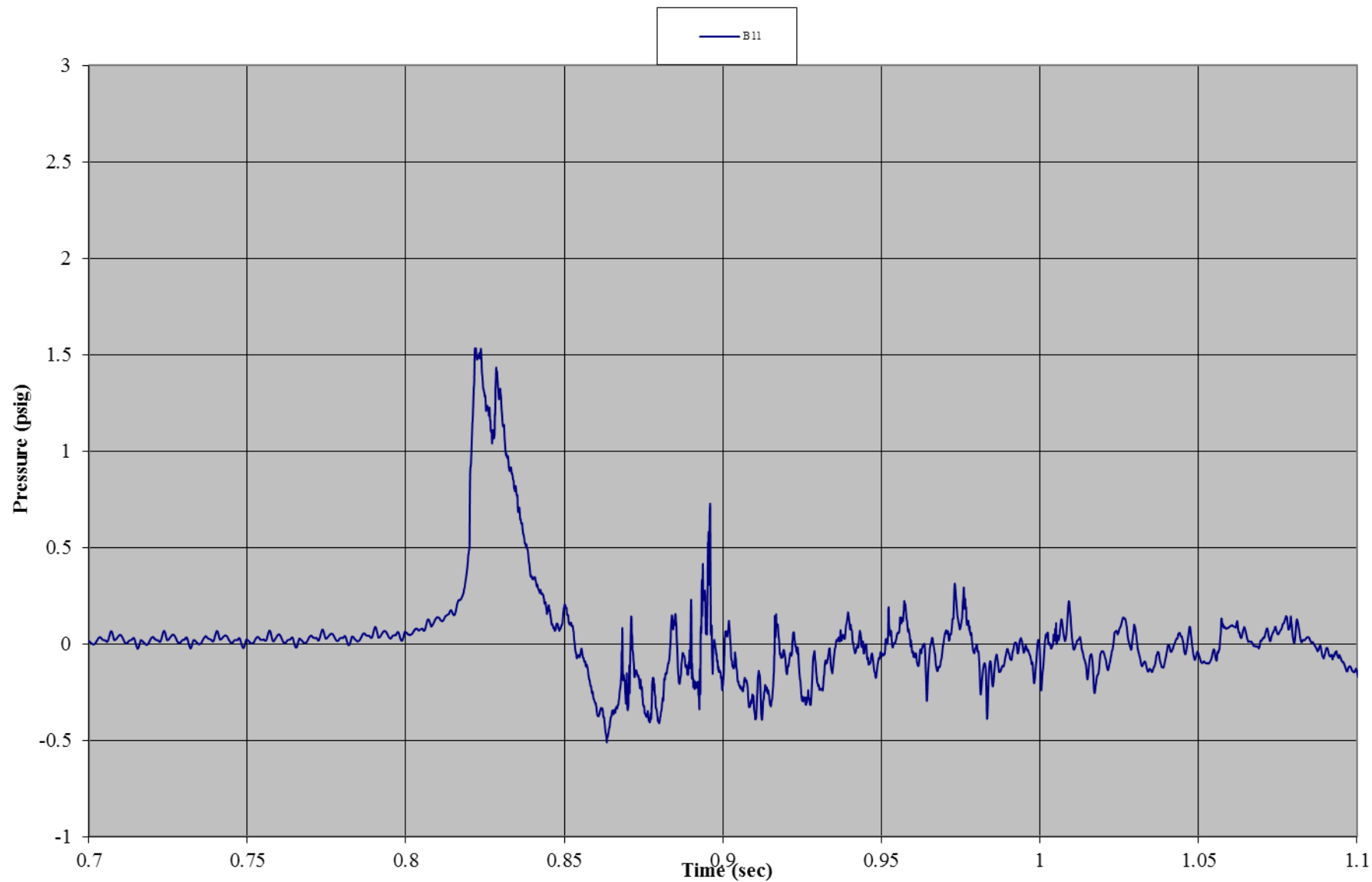


Test B08: Tent B

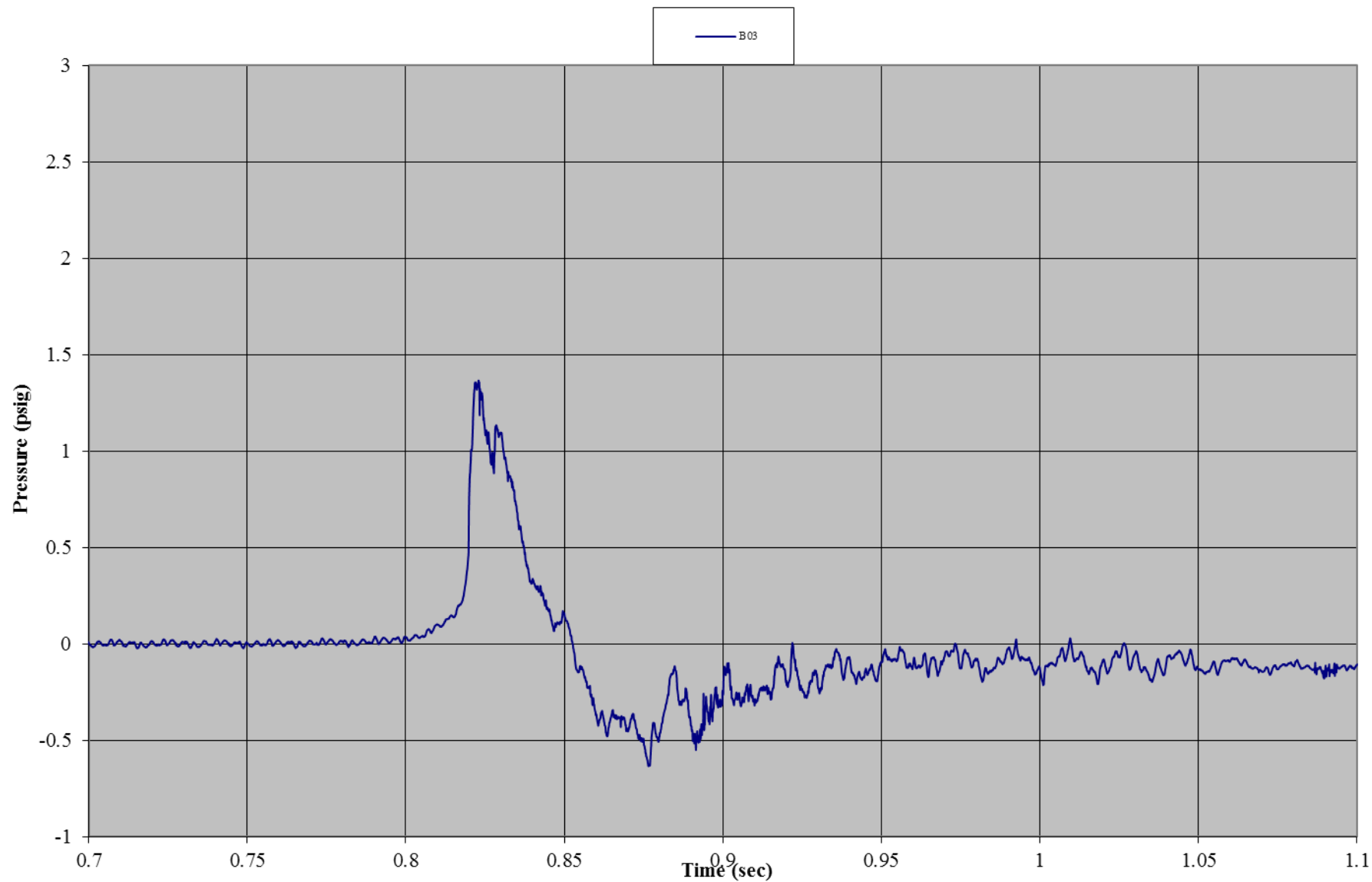
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 01: Front Wall, Left Bottom



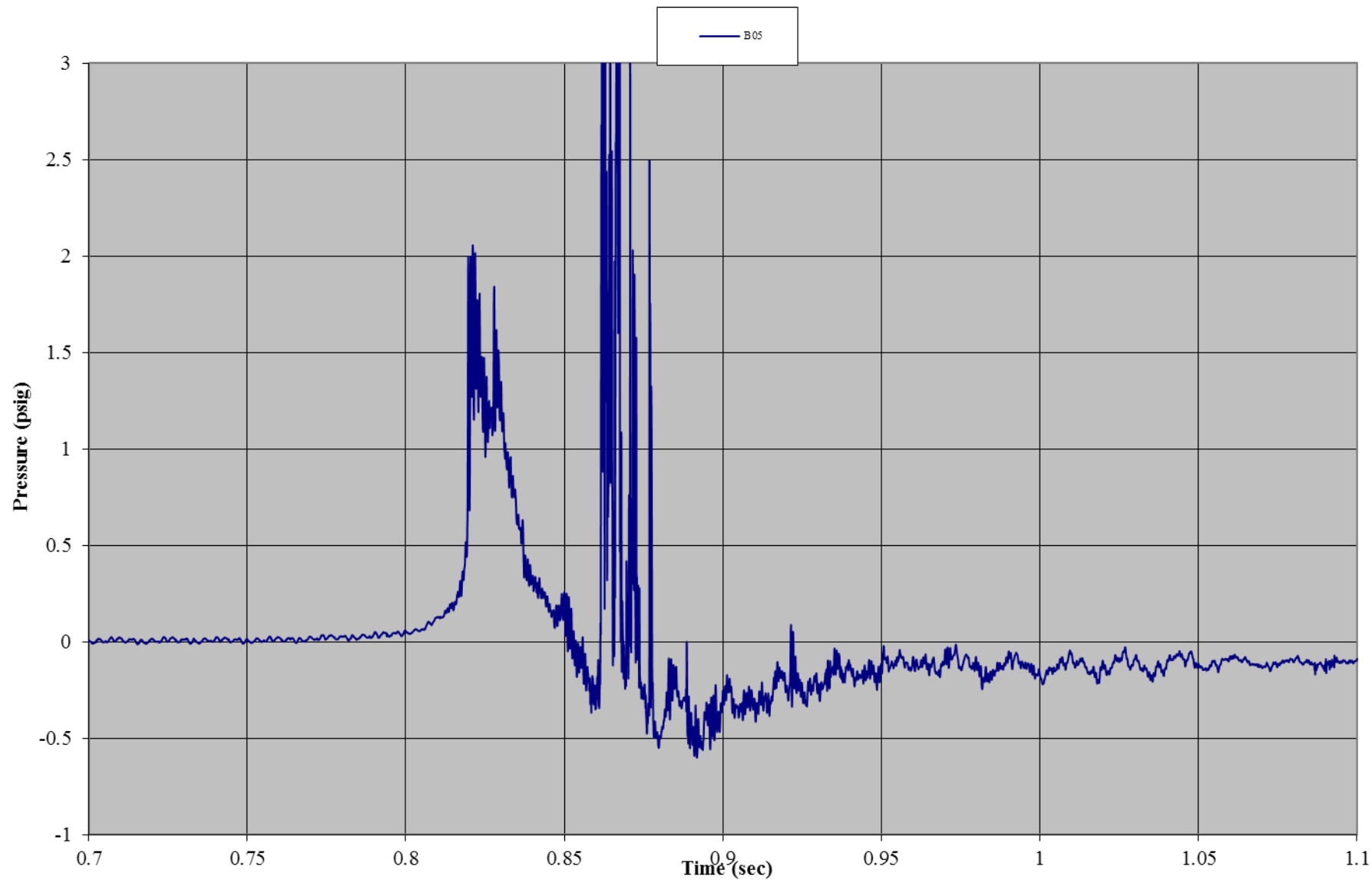
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 11: Front Wall, Right Bottom



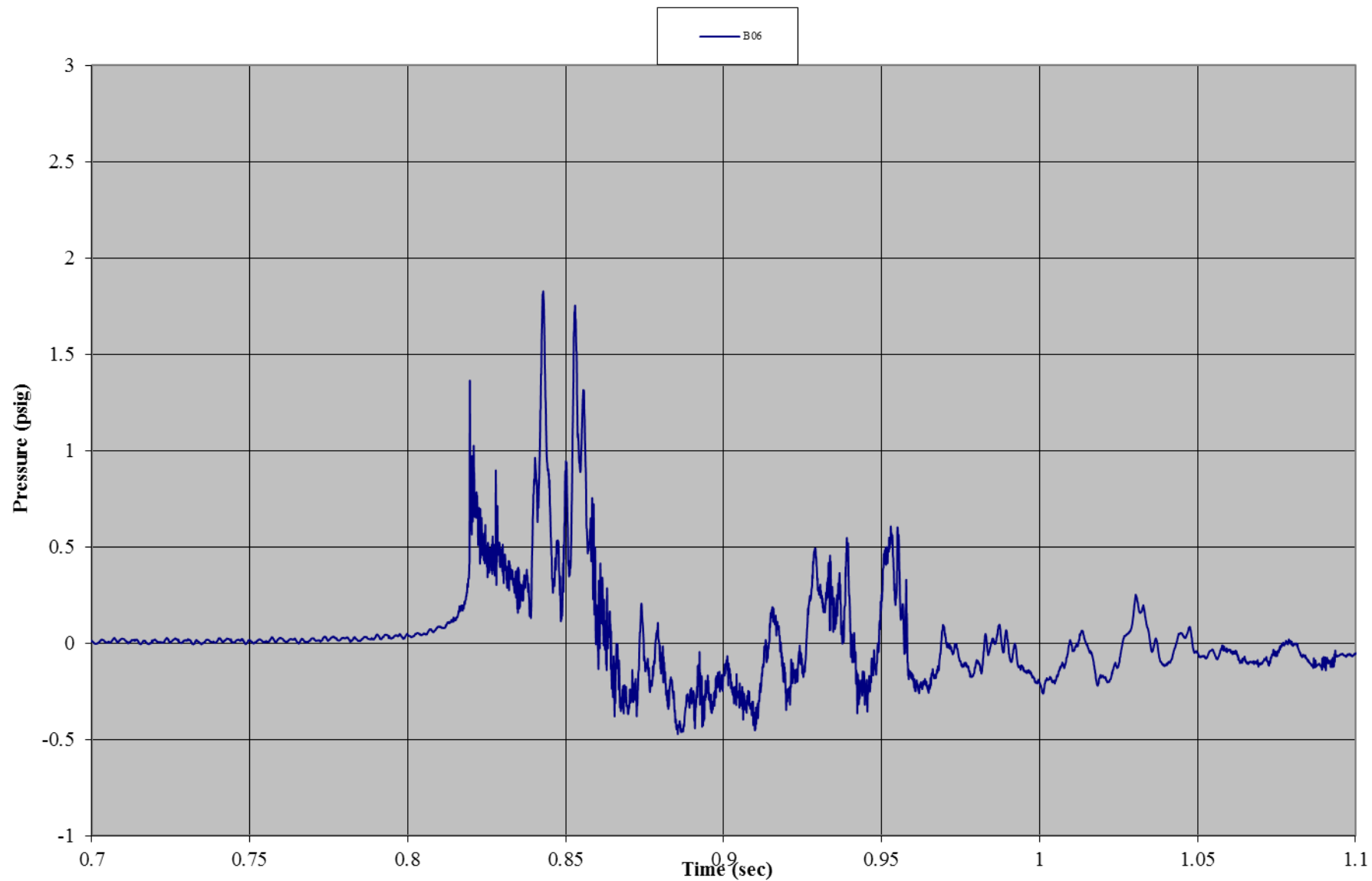
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 03: Front Wall, Center Bottom



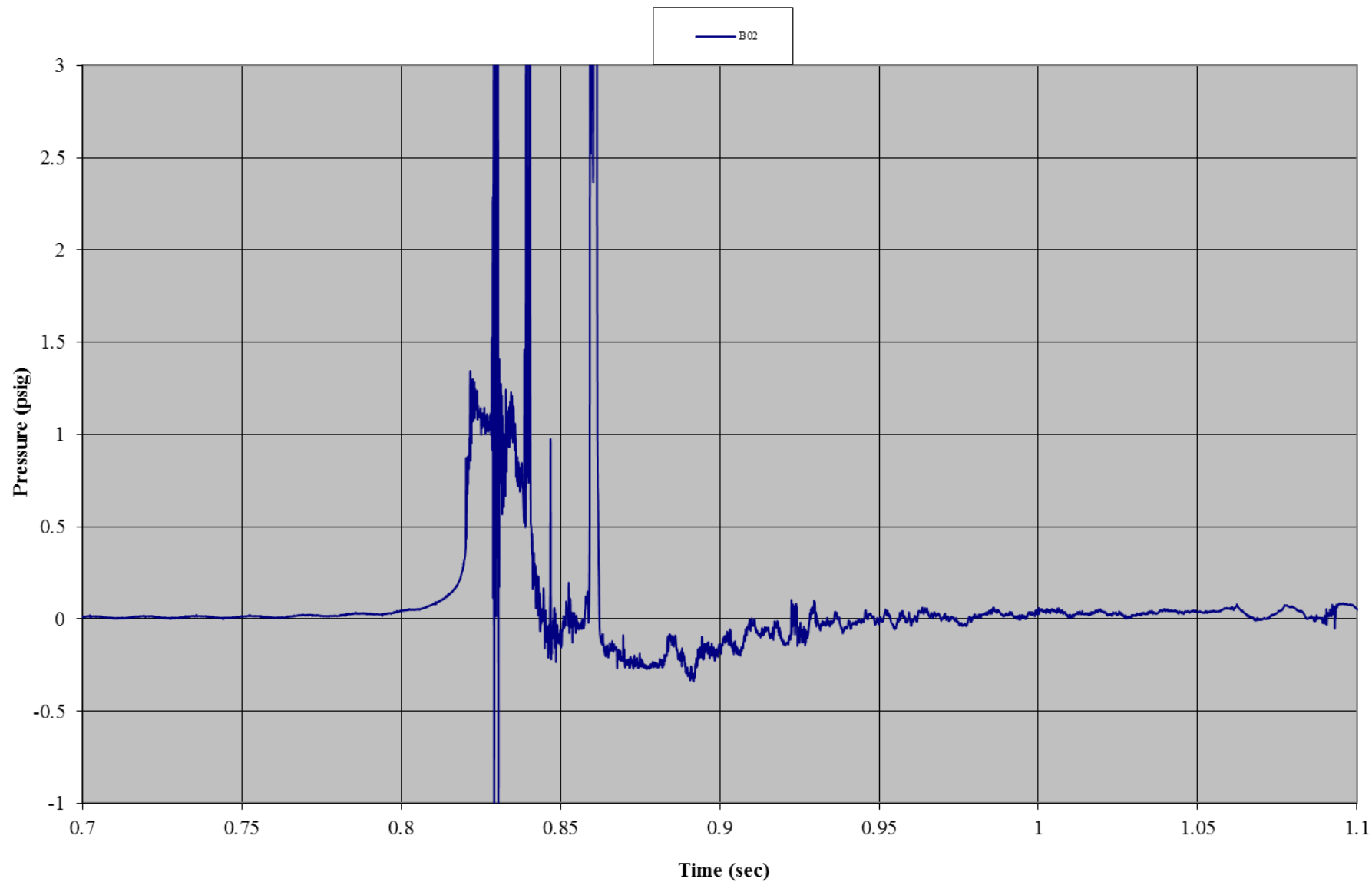
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



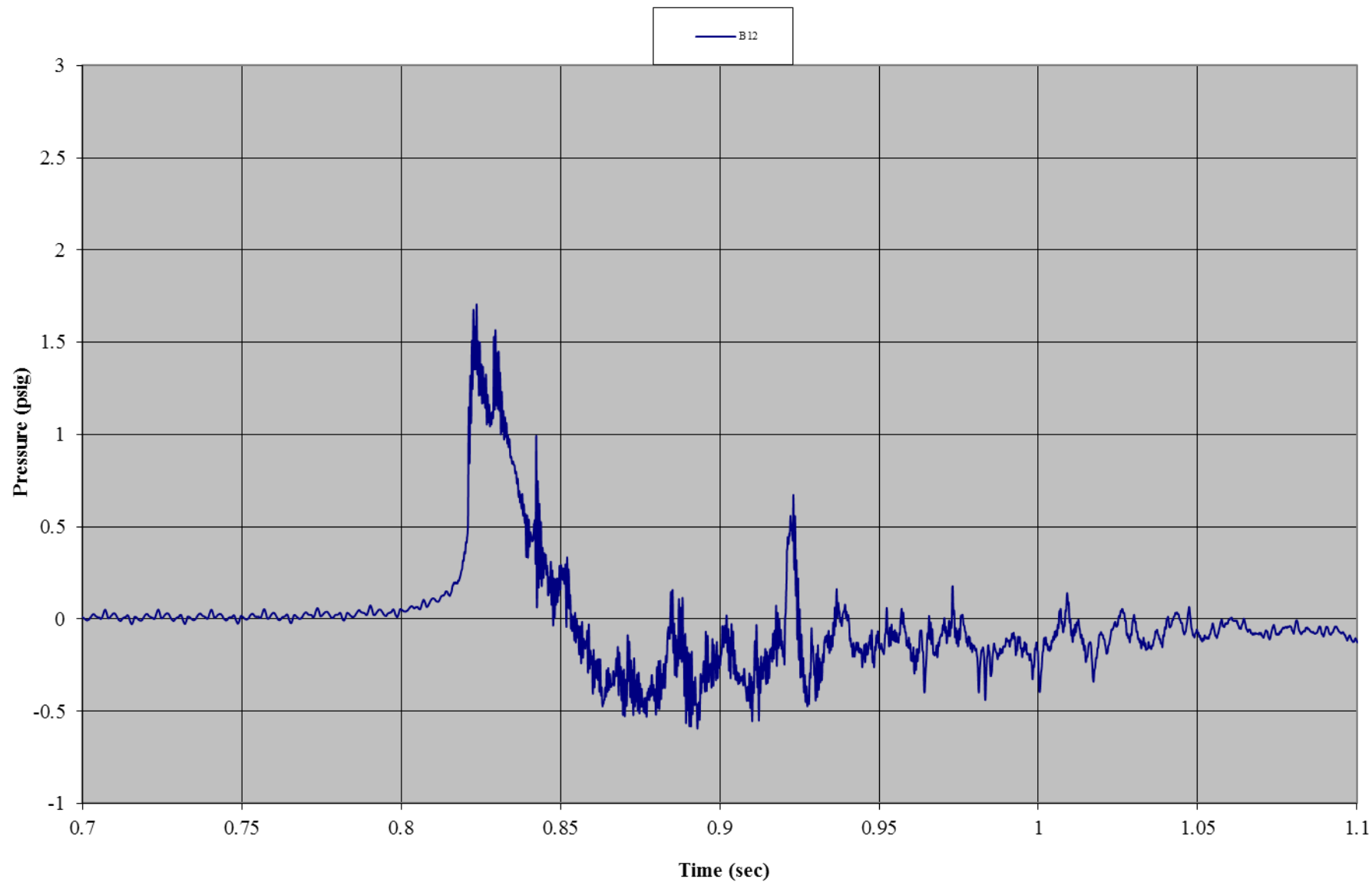
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 06: Front Wall, Center Top



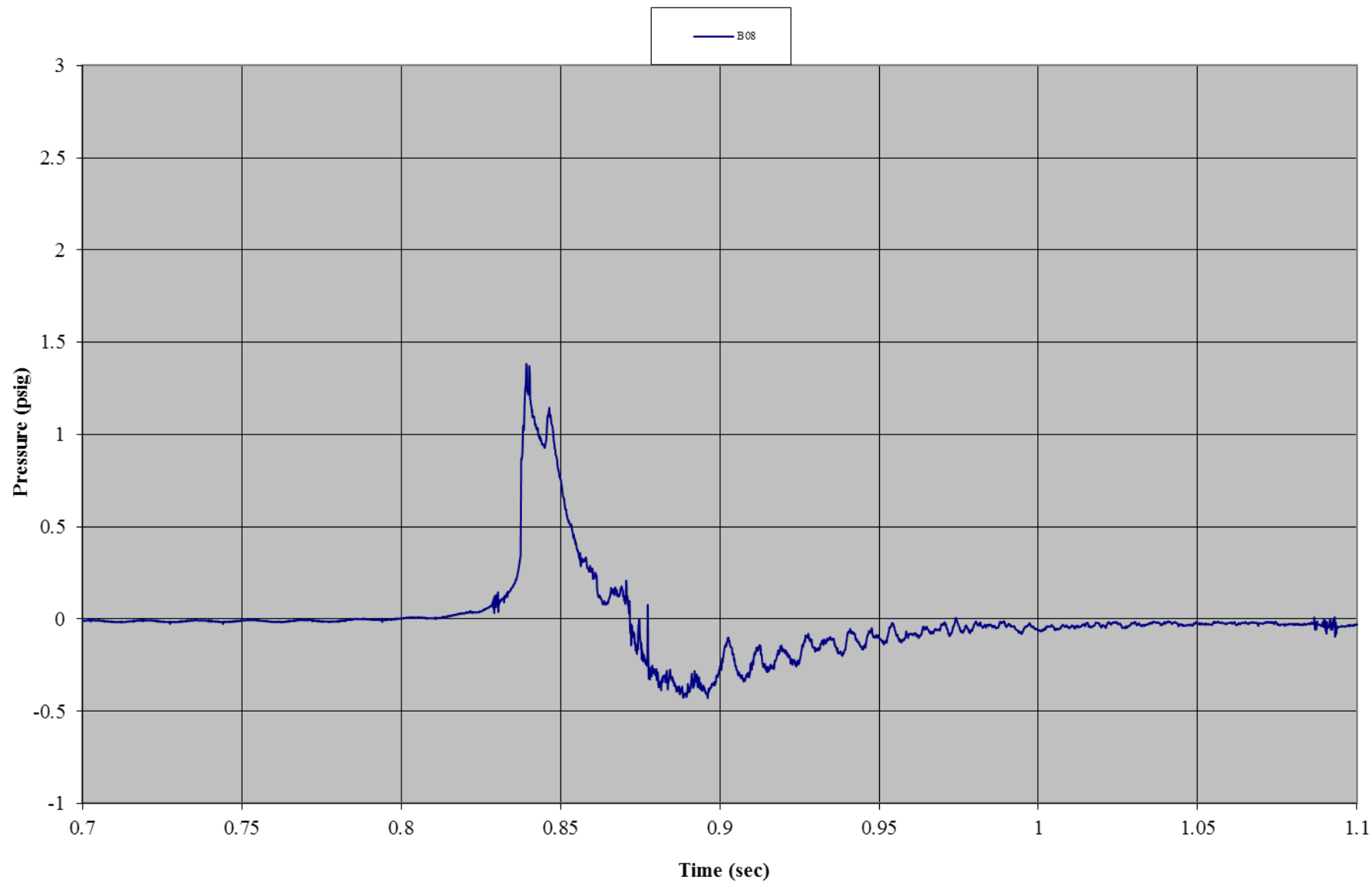
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



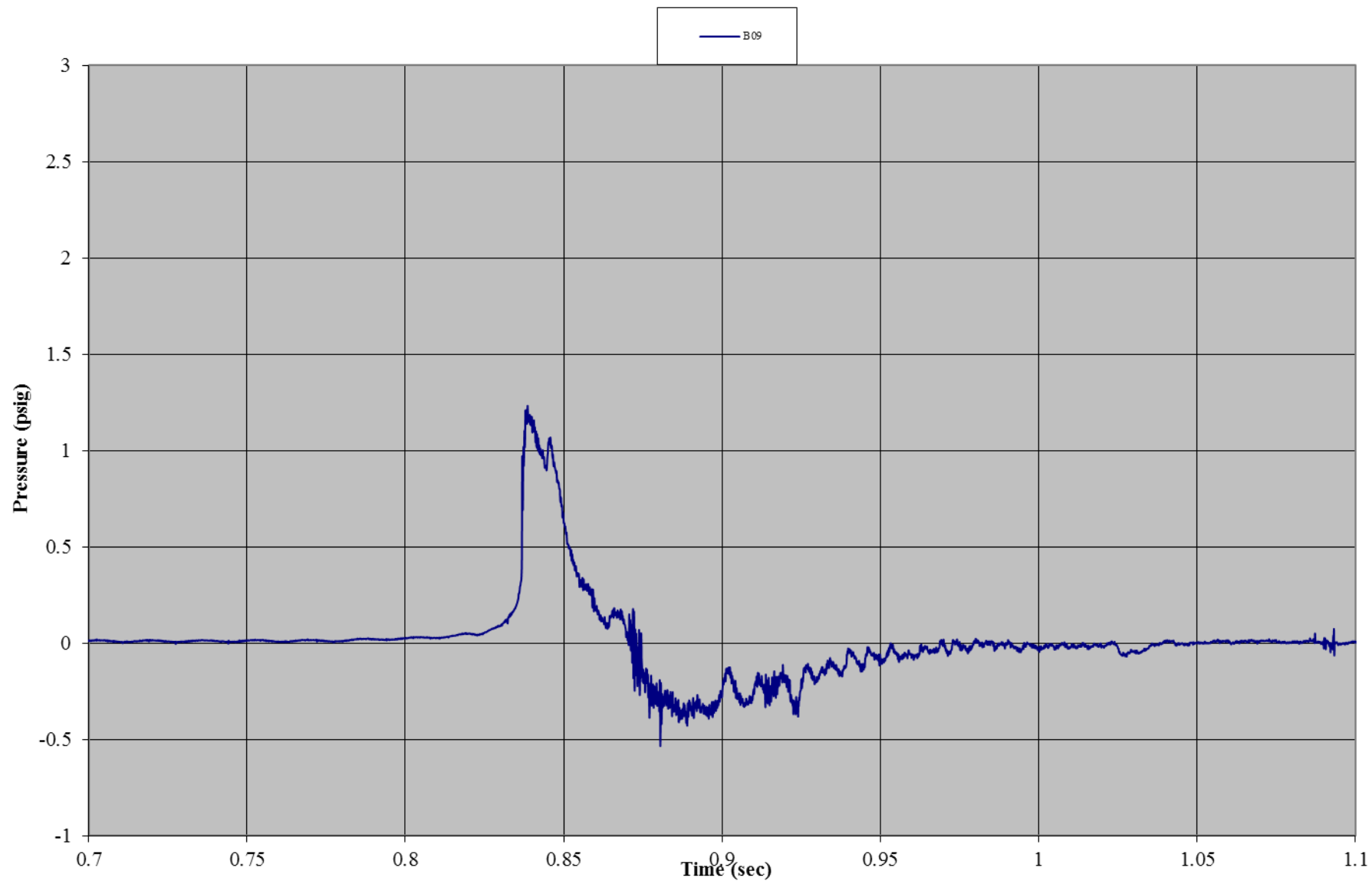
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



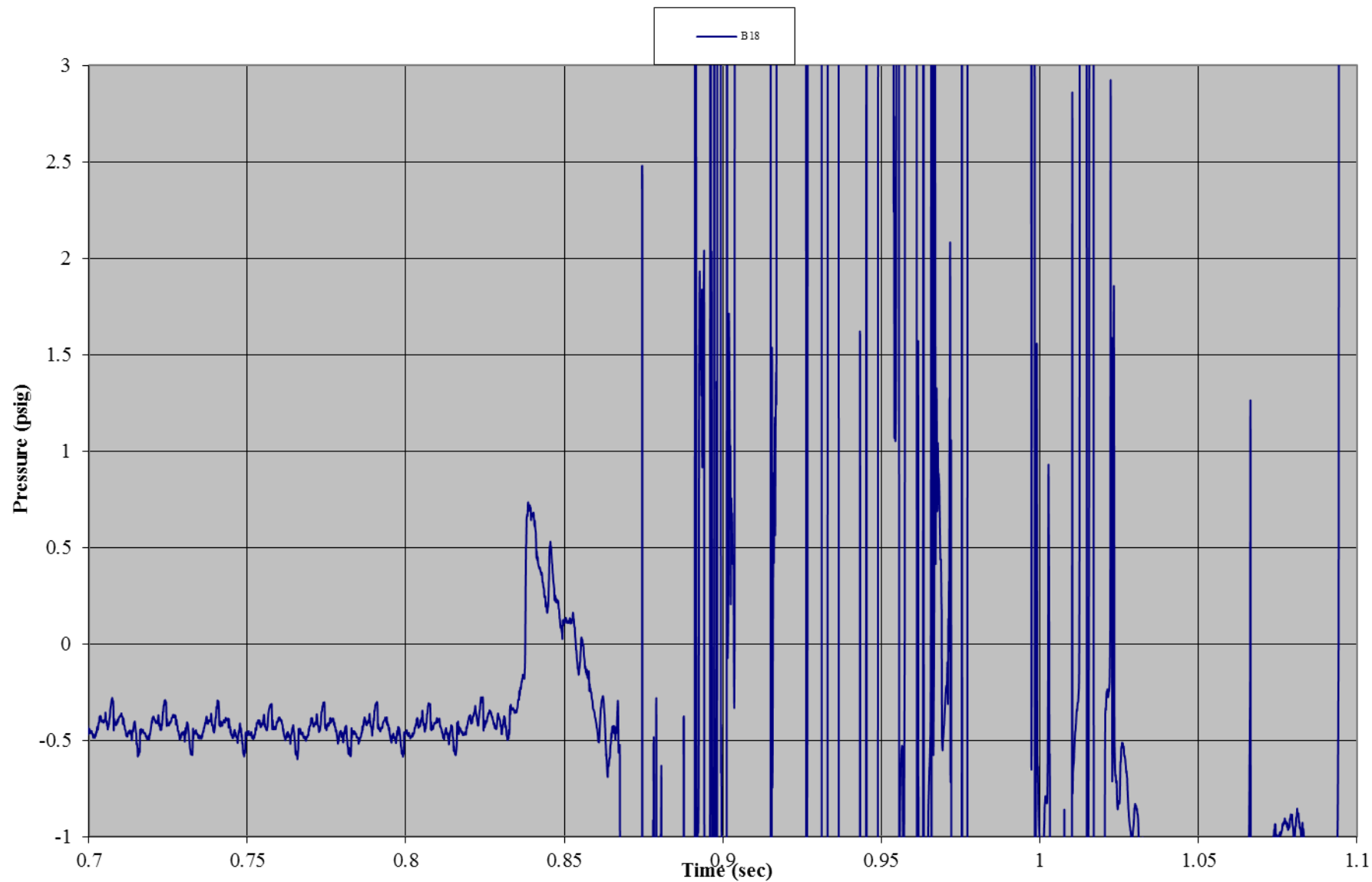
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 08: Left Side Wall, Bottom



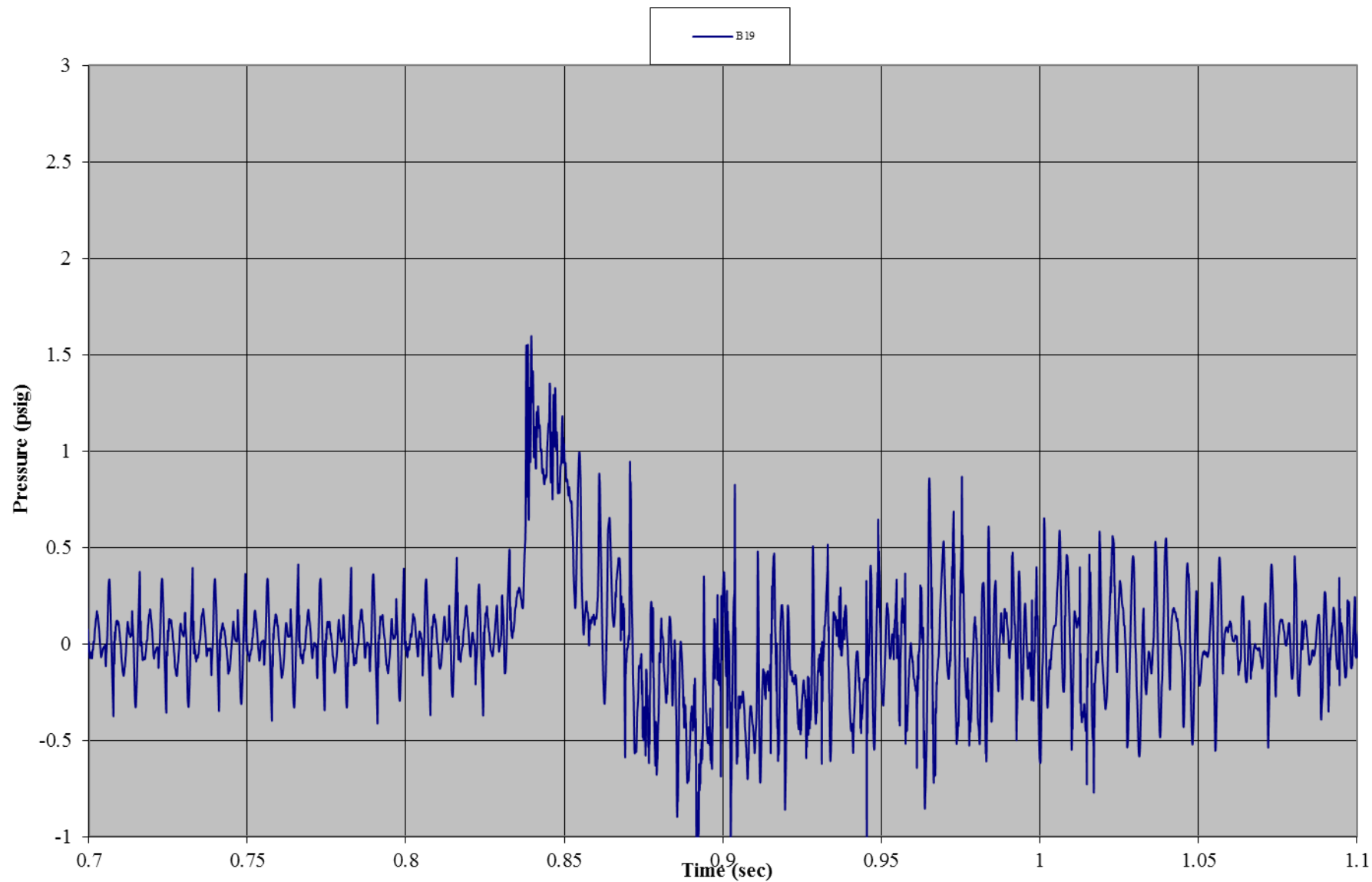
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



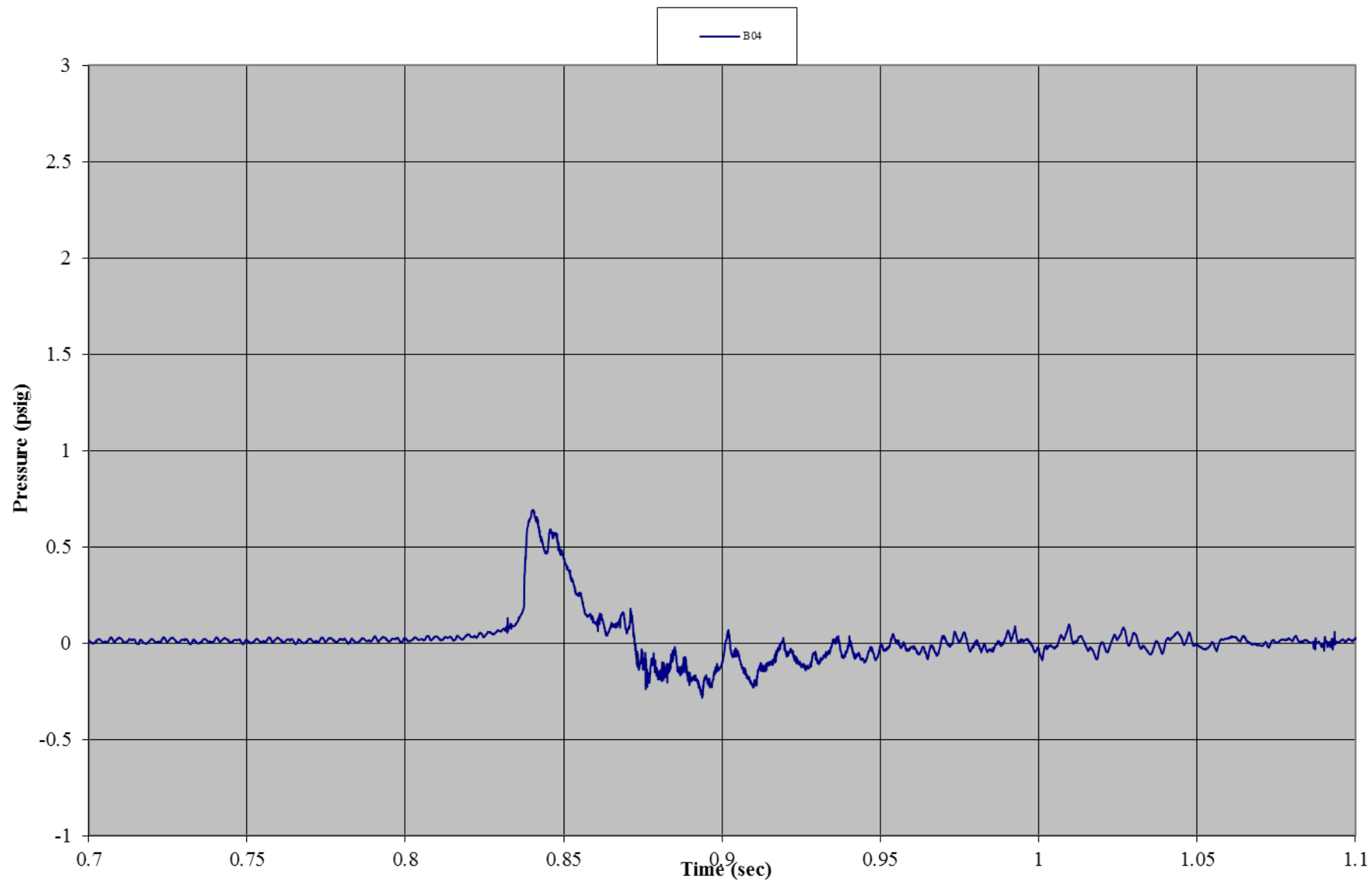
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 18: Right Side Wall, Bottom



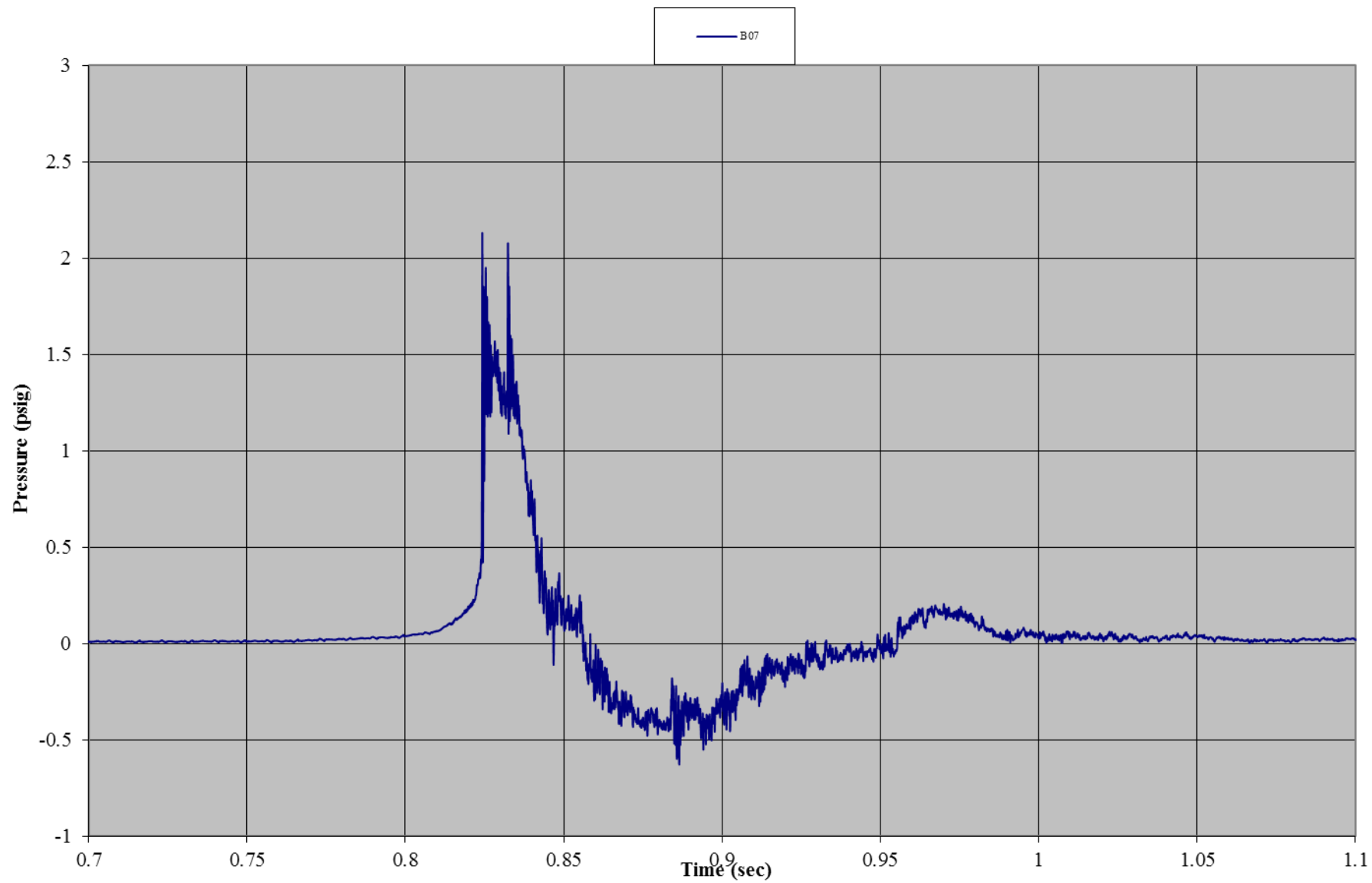
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



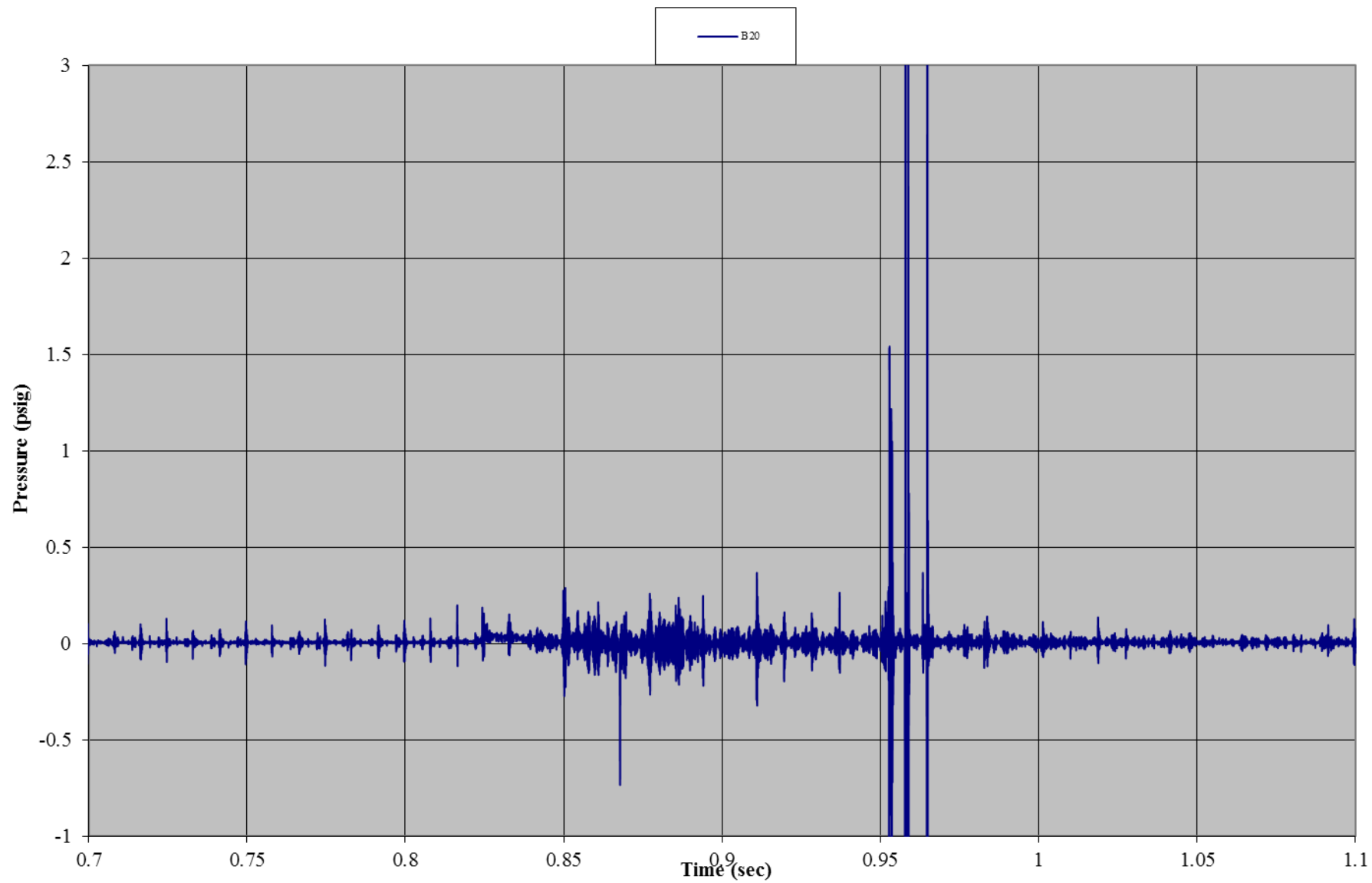
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 04: Interior, Ground



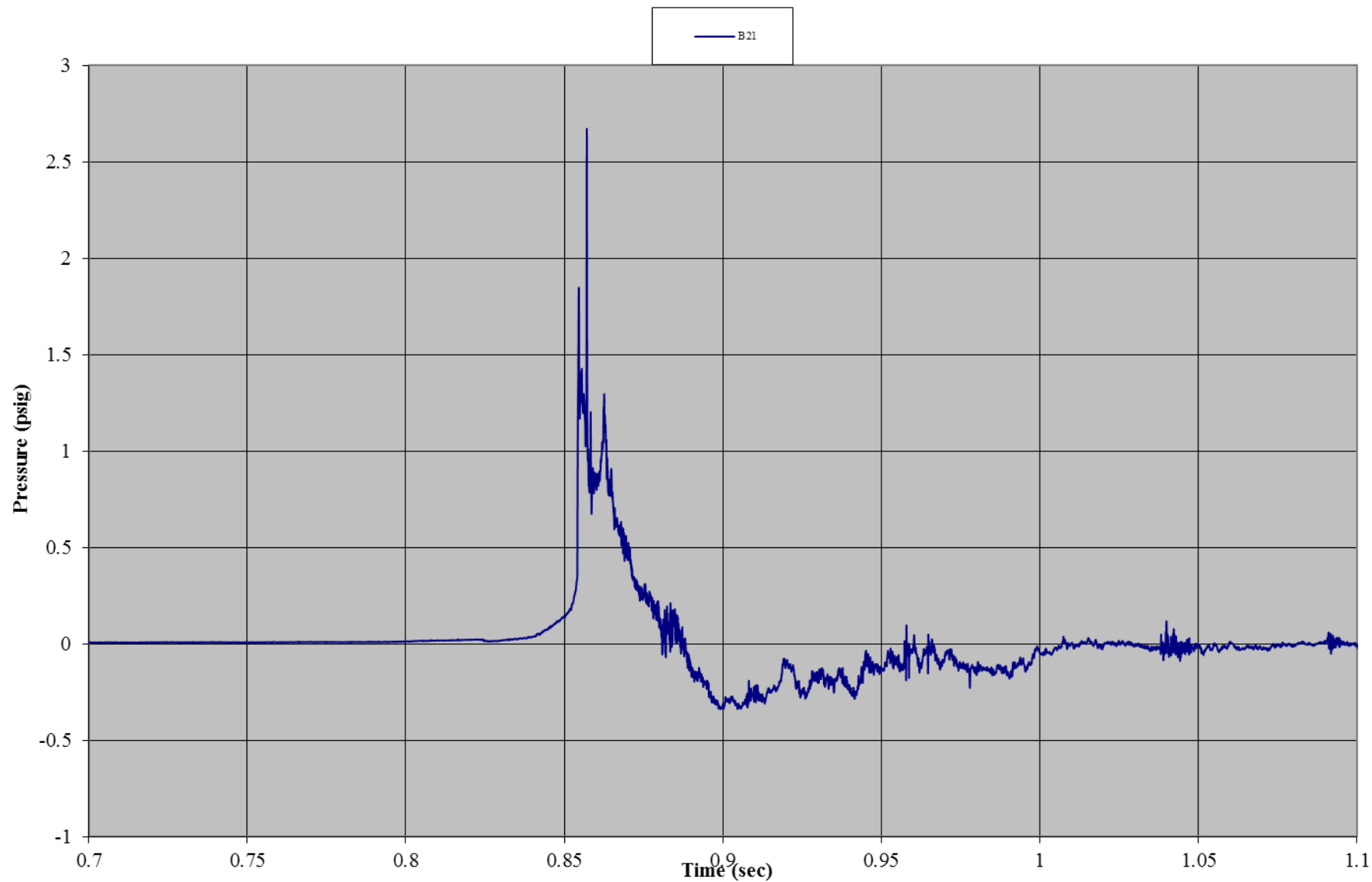
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 07: Roof, Front



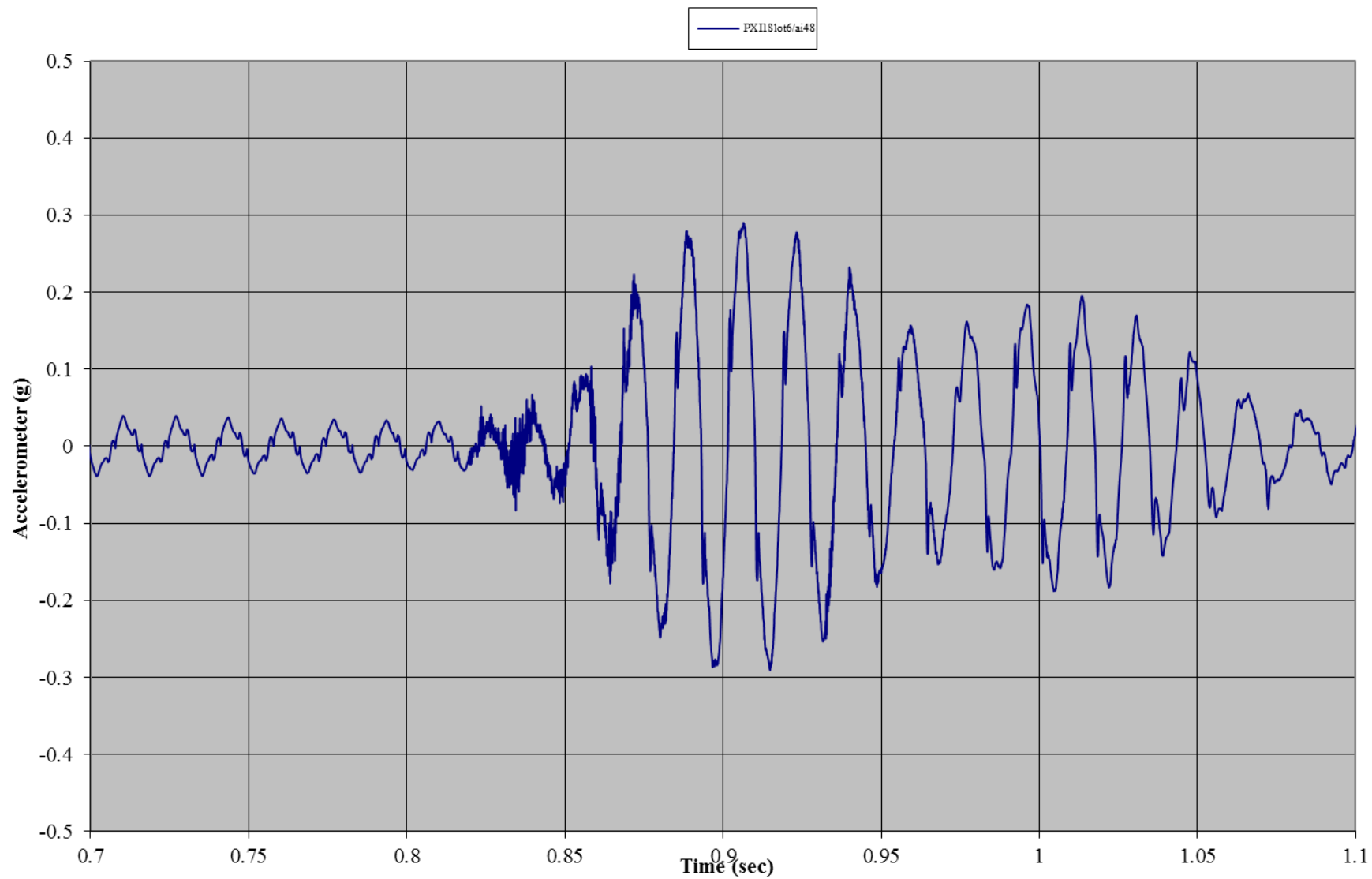
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 20: Roof, Back



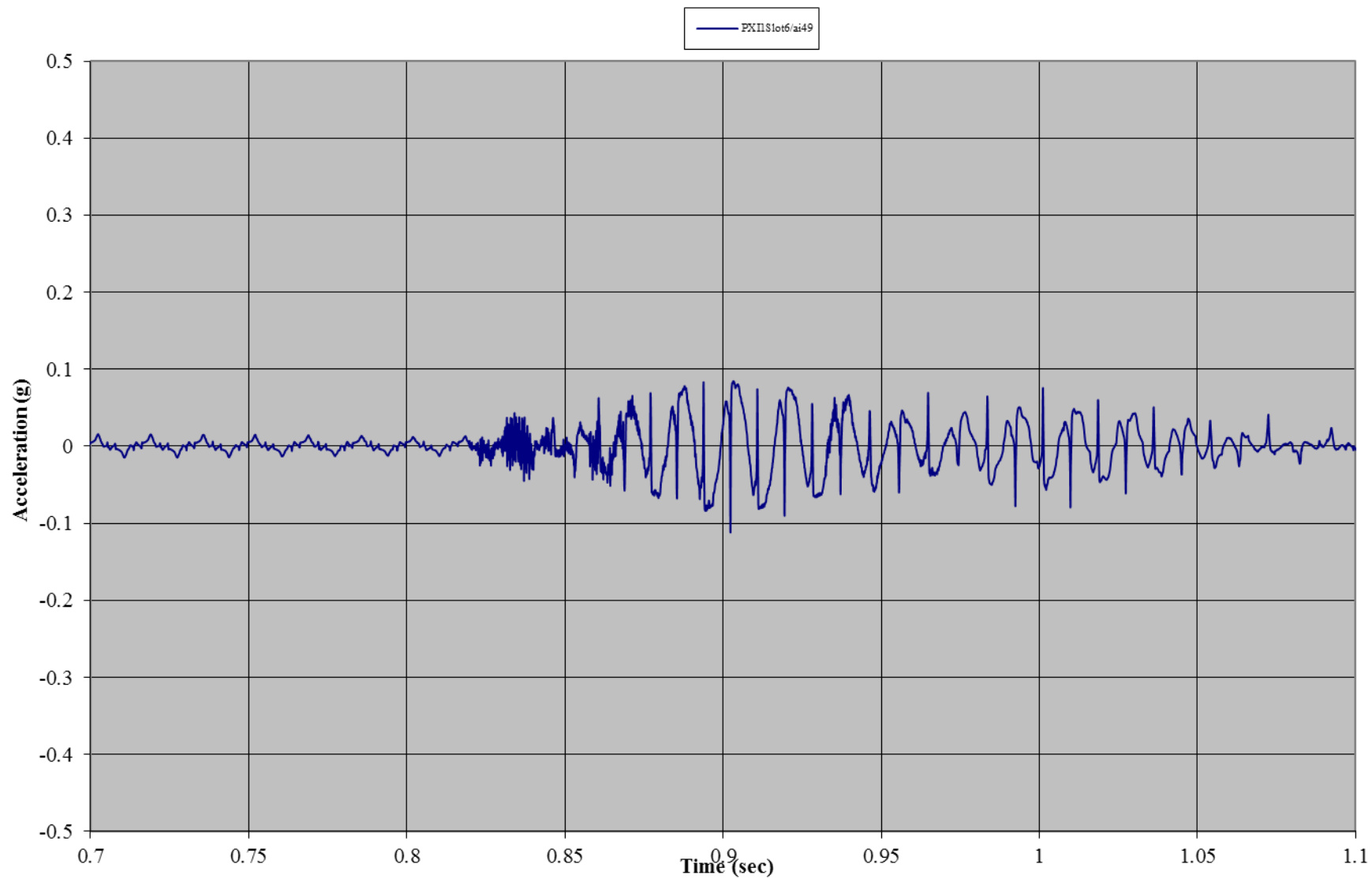
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



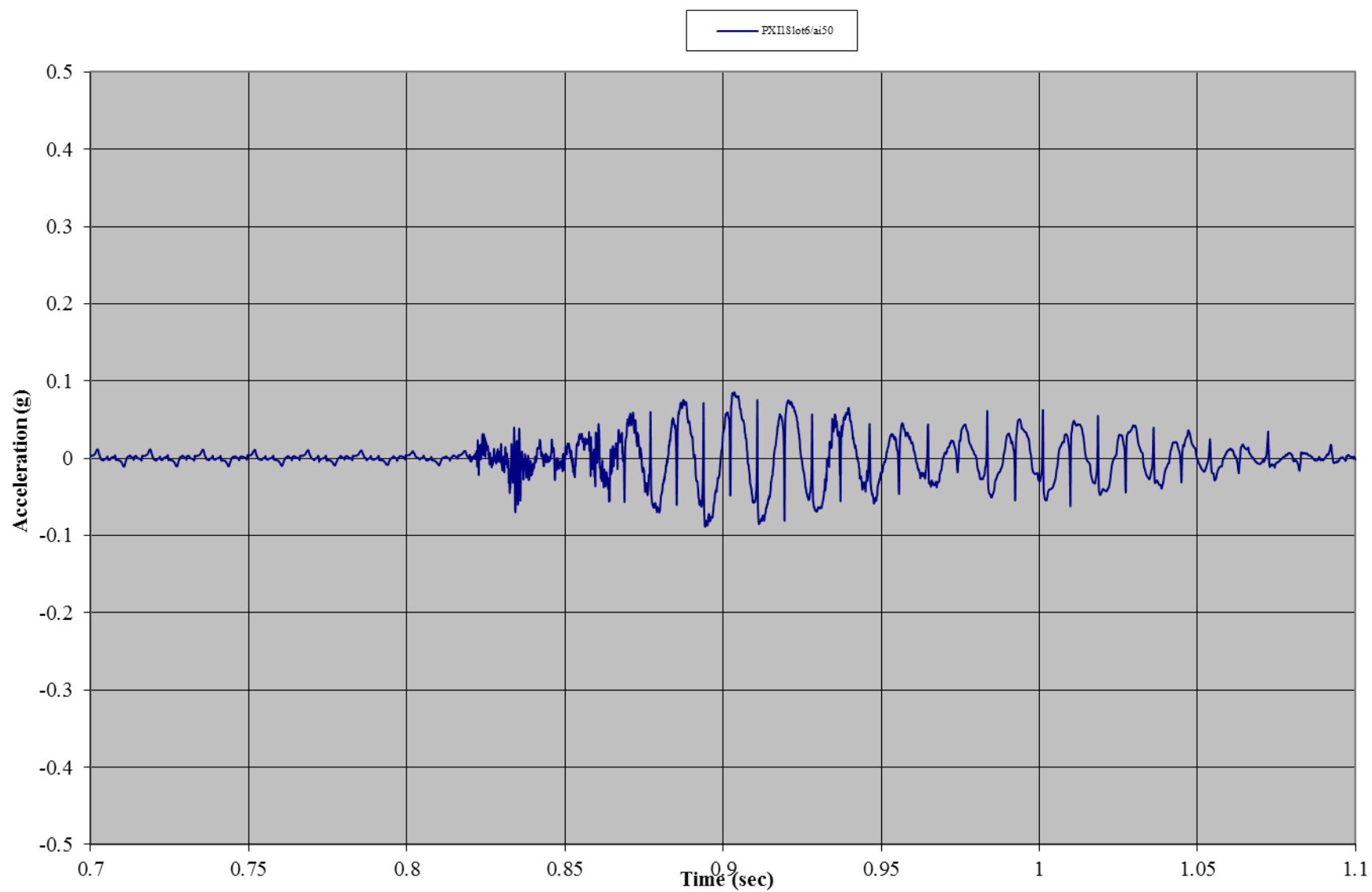
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (x-direction)



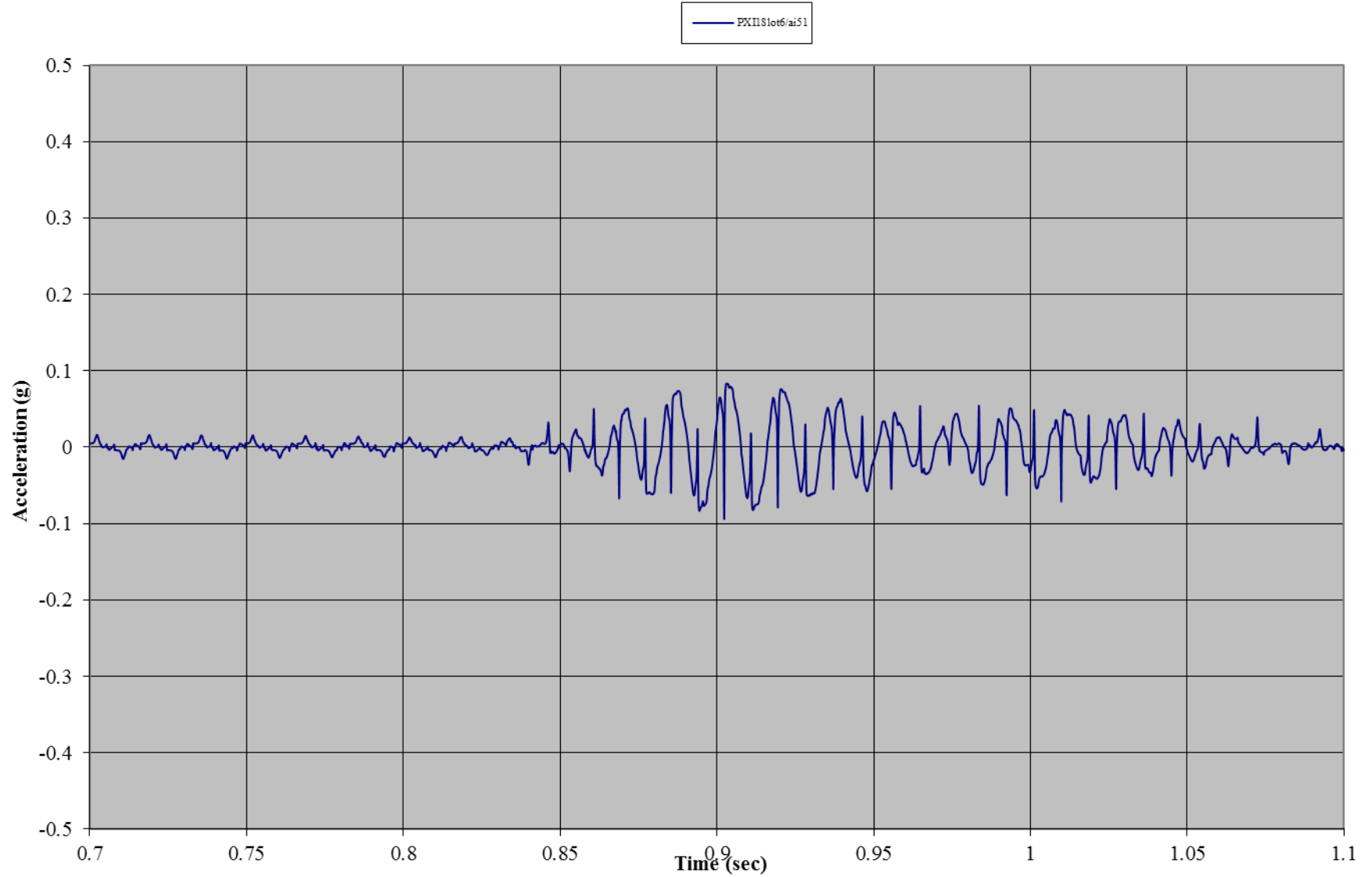
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (y-direction)



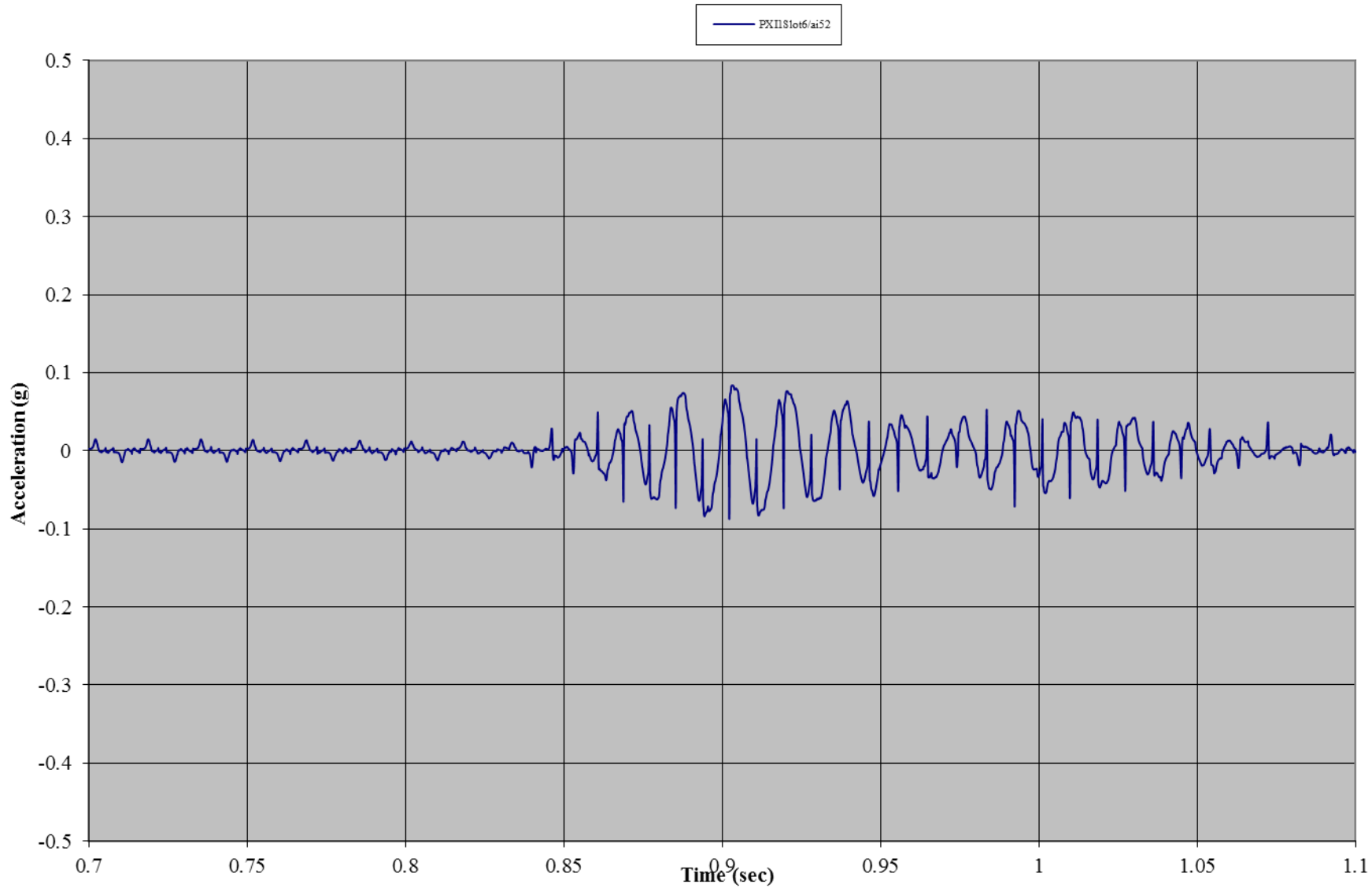
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (z-direction)



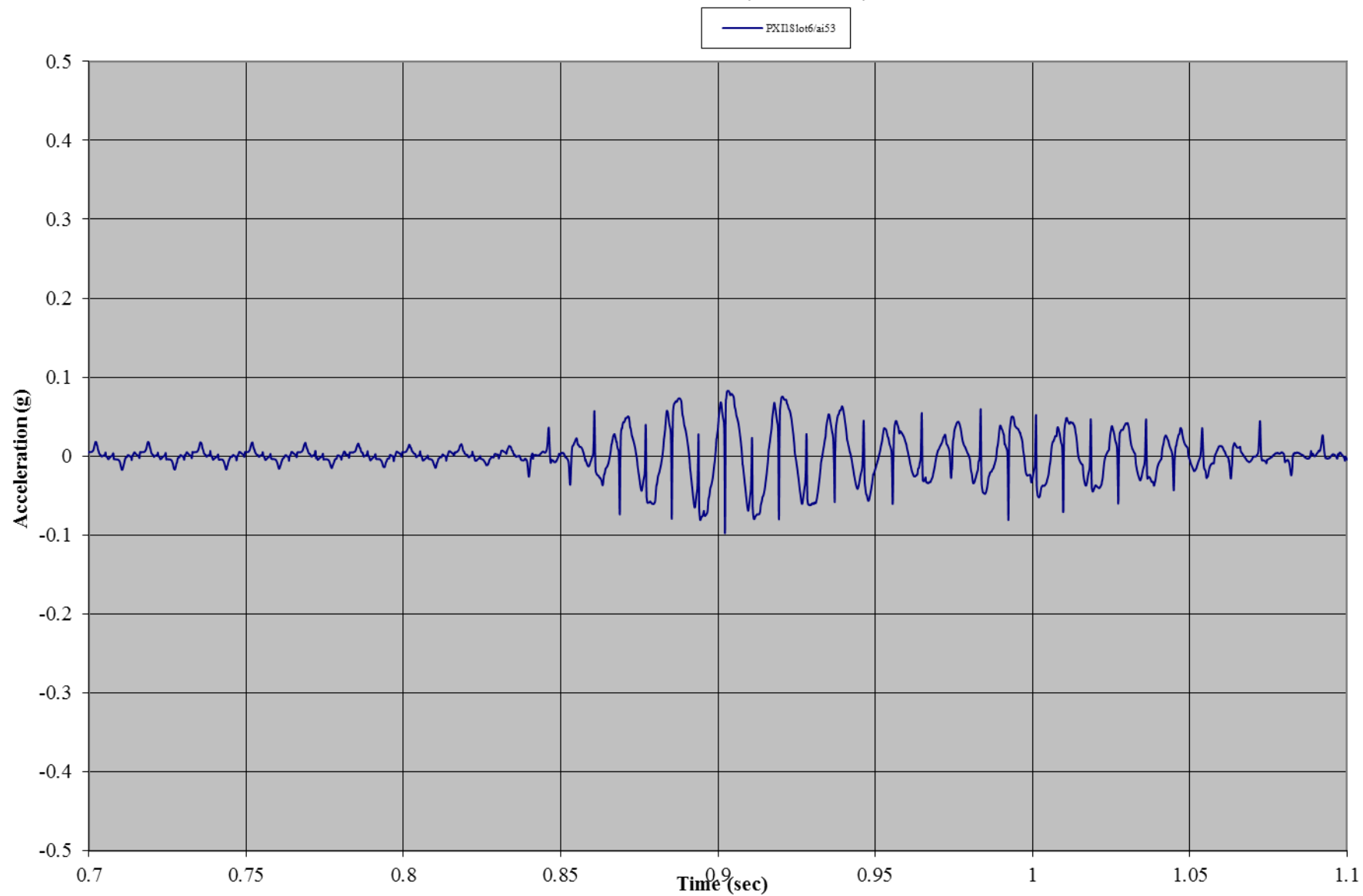
Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (x-direction)



Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (y-direction)

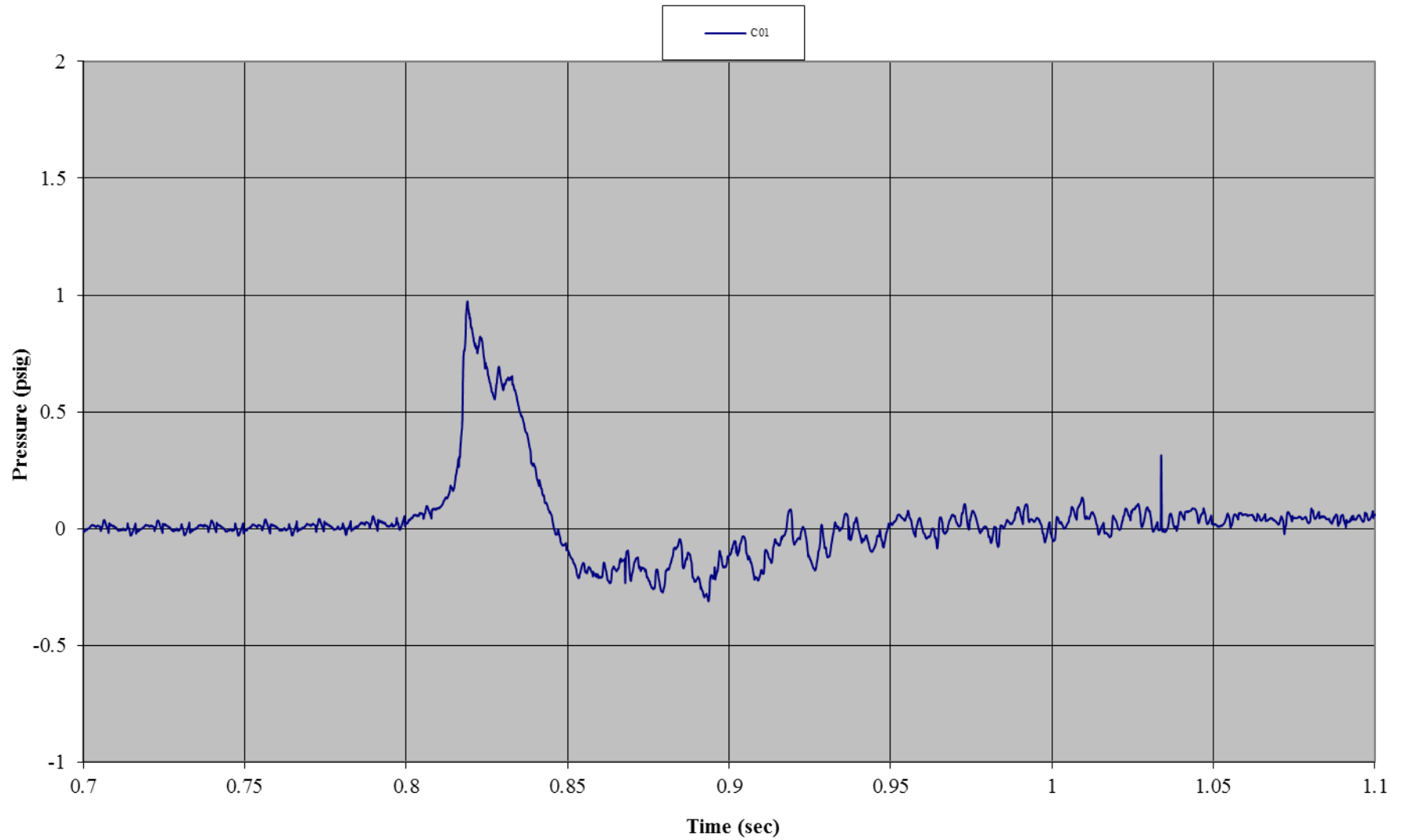


Test B08: Non-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (z-direction)

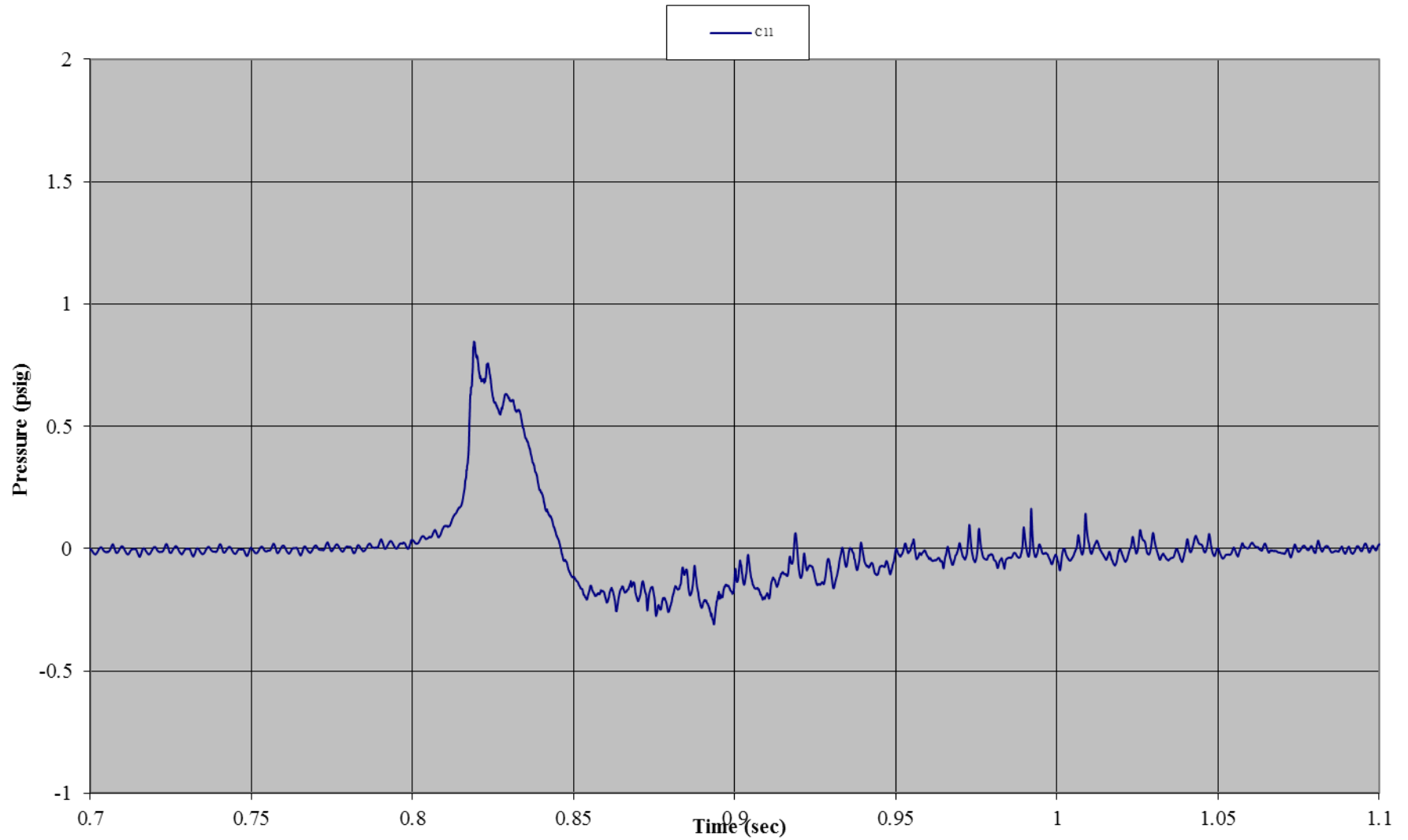


Test B08: Tent C

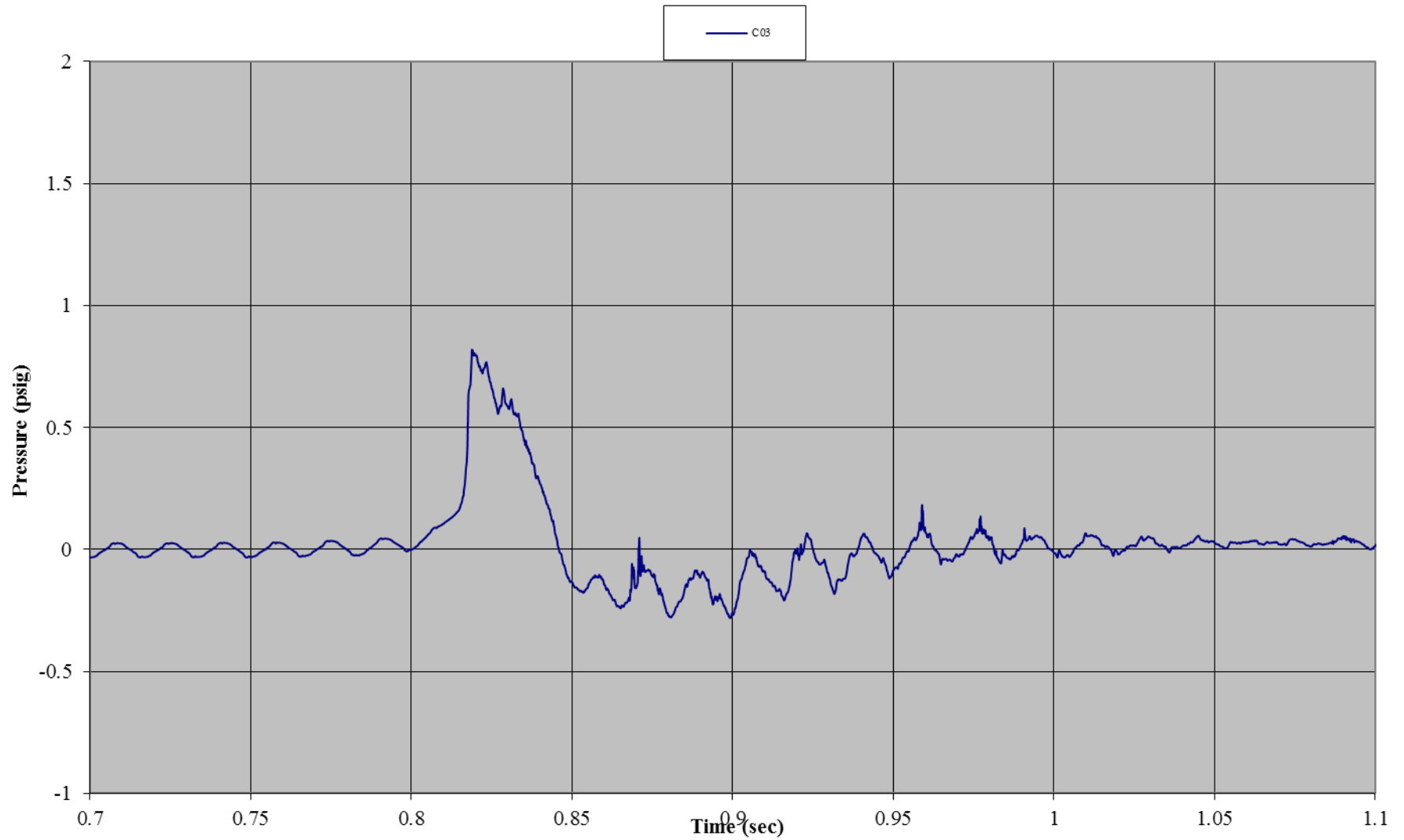
Test B08: Non-Wind Pole Tent without Sides
Gauge 01: Front Wall, Left Bottom



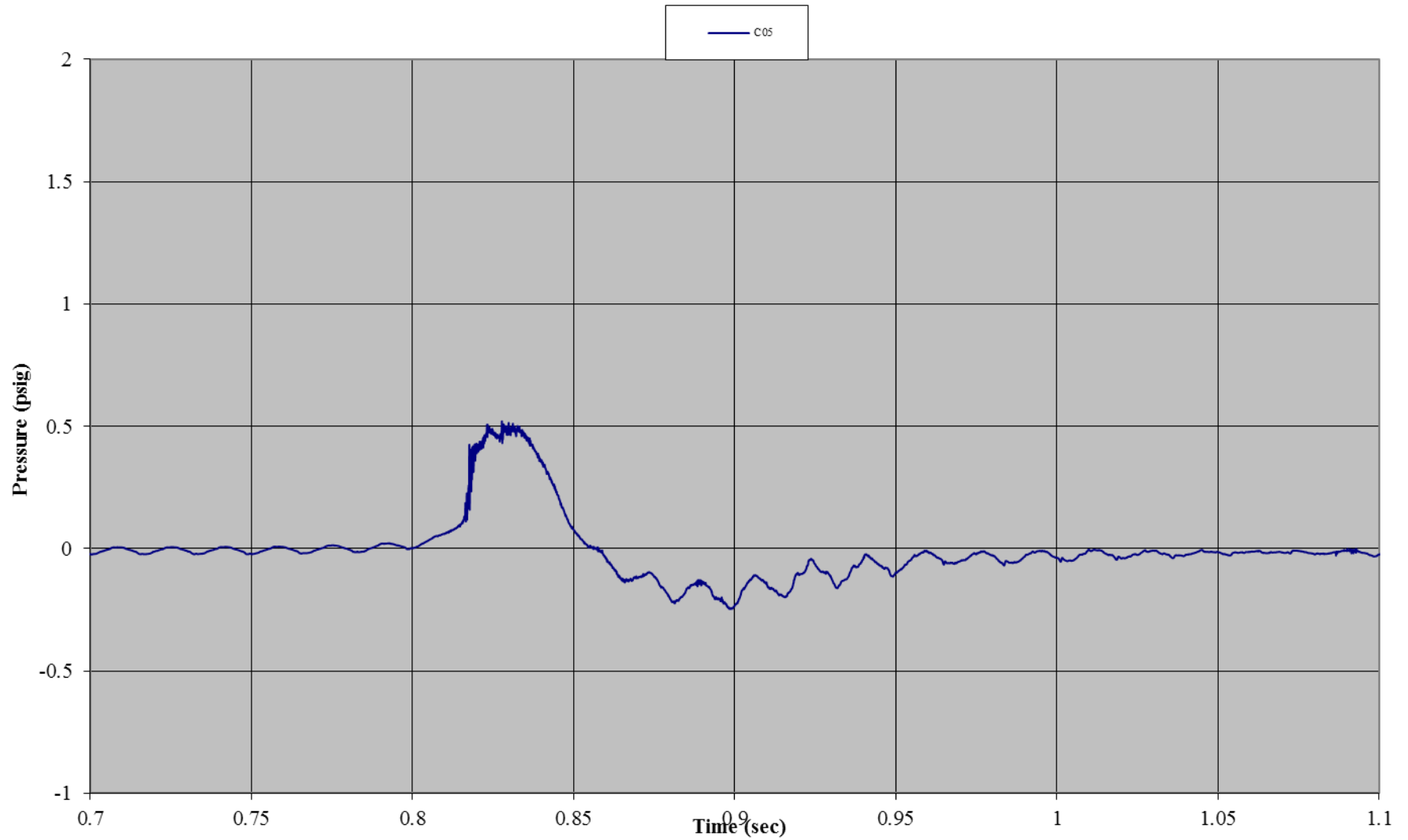
Test B08: Non-Wind Pole Tent without Sides
Gauge 11: Front Wall, Right Bottom



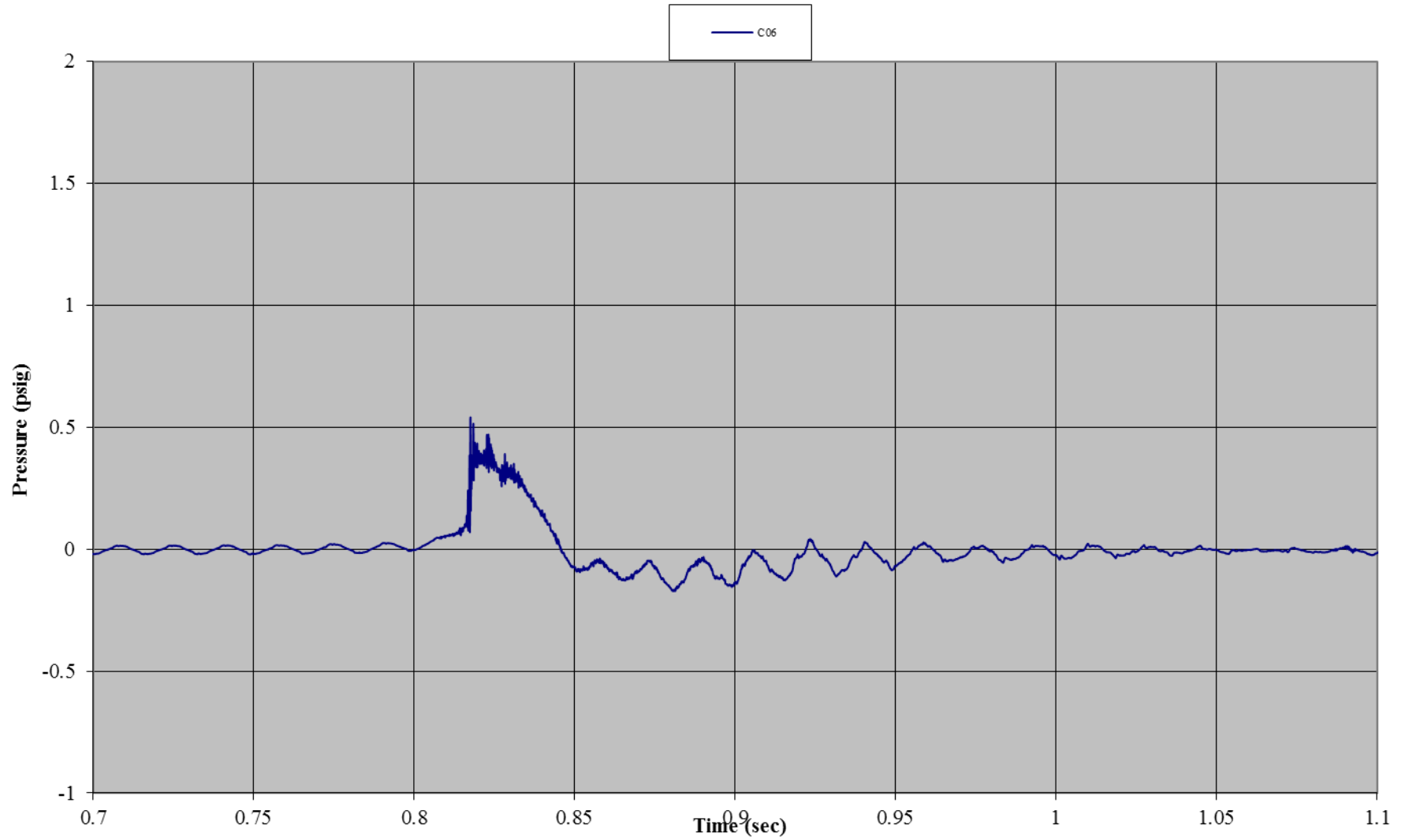
Test B08: Non-Wind Pole Tent without Sides
Gauge 03: Front Wall, Center Bottom



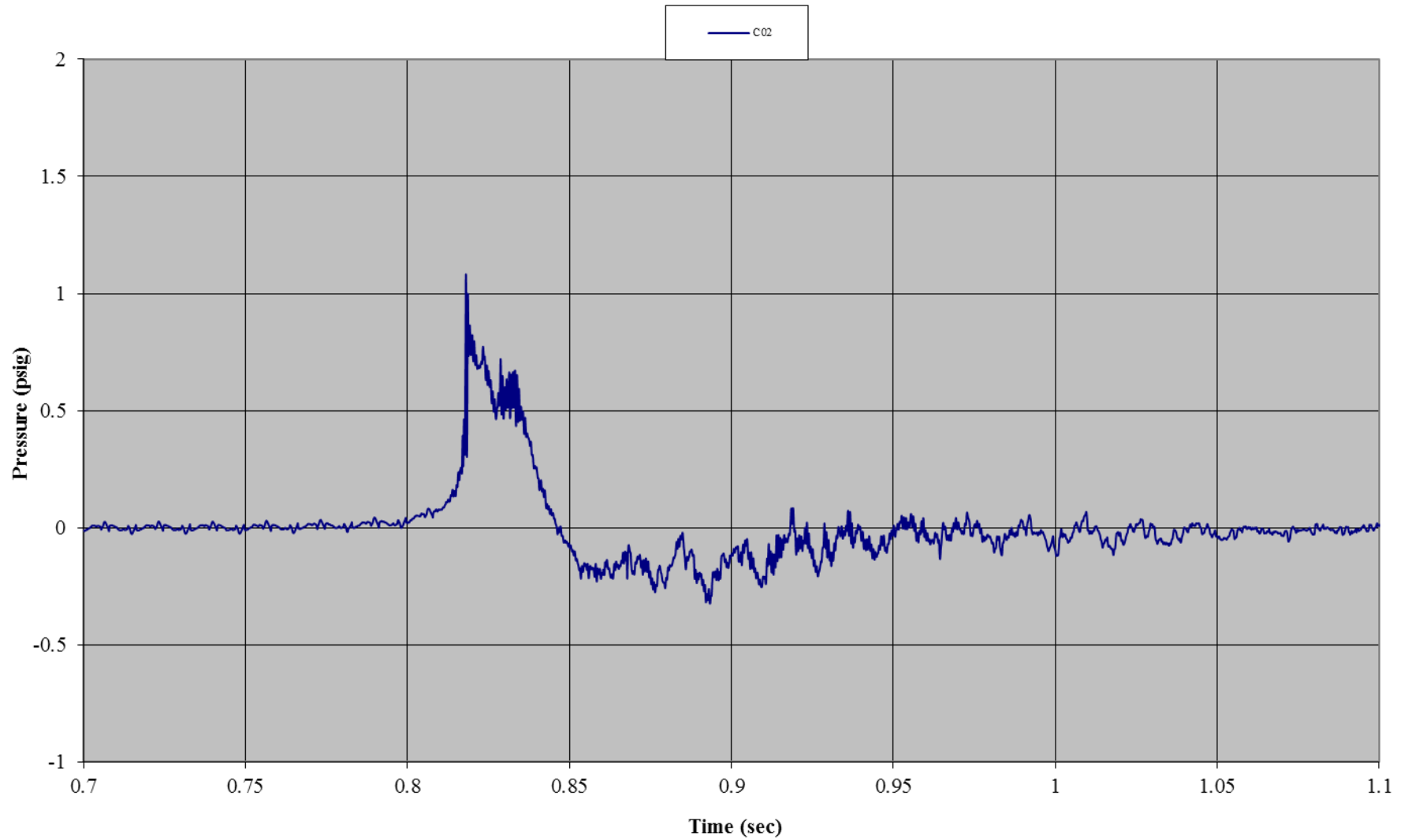
Test B08: Non-Wind Pole Tent without Sides
Gauge 05: Front Wall, Center Mid-Height



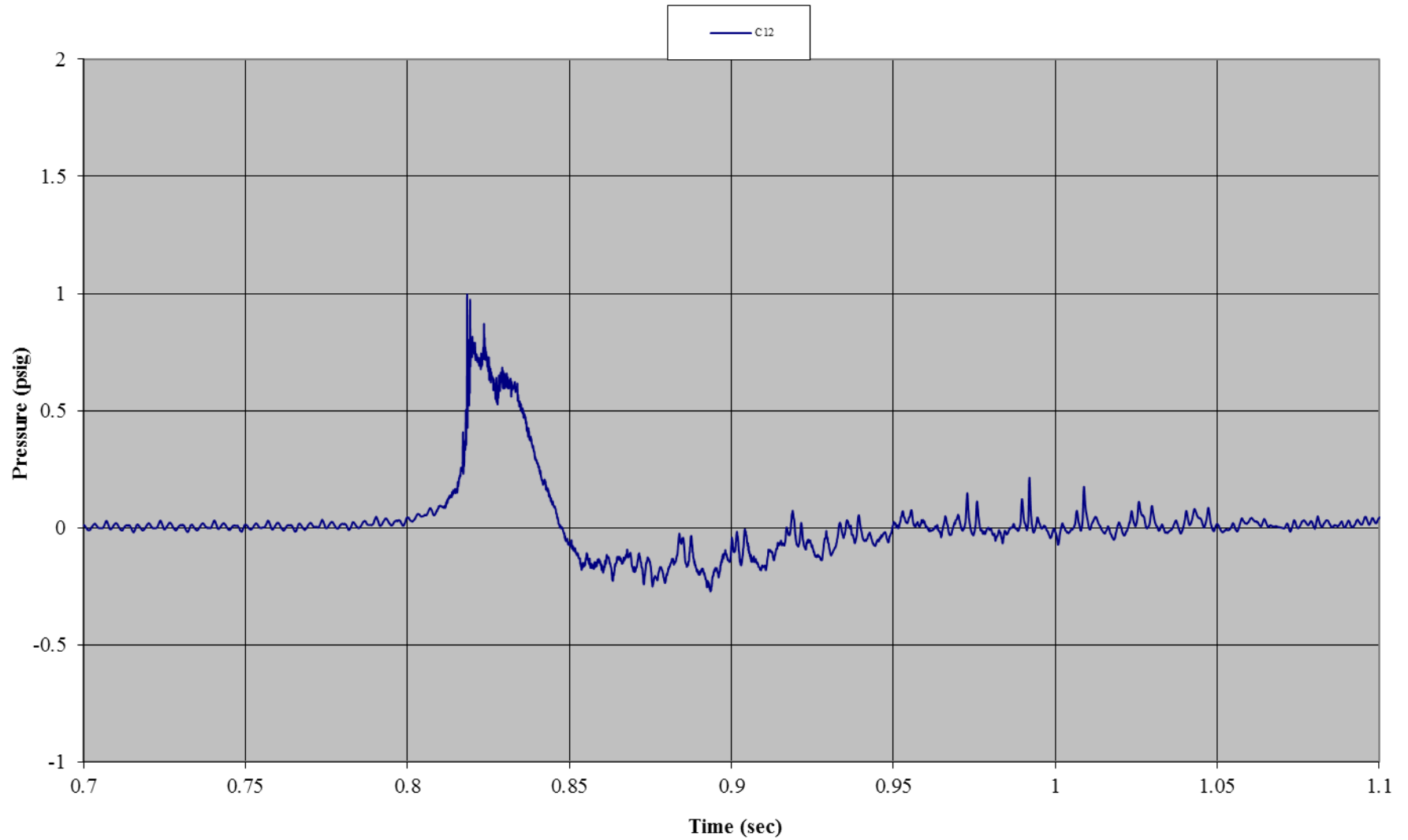
Test B08: Non-Wind Pole Tent without Sides
Gauge 06: Front Wall, Center Top



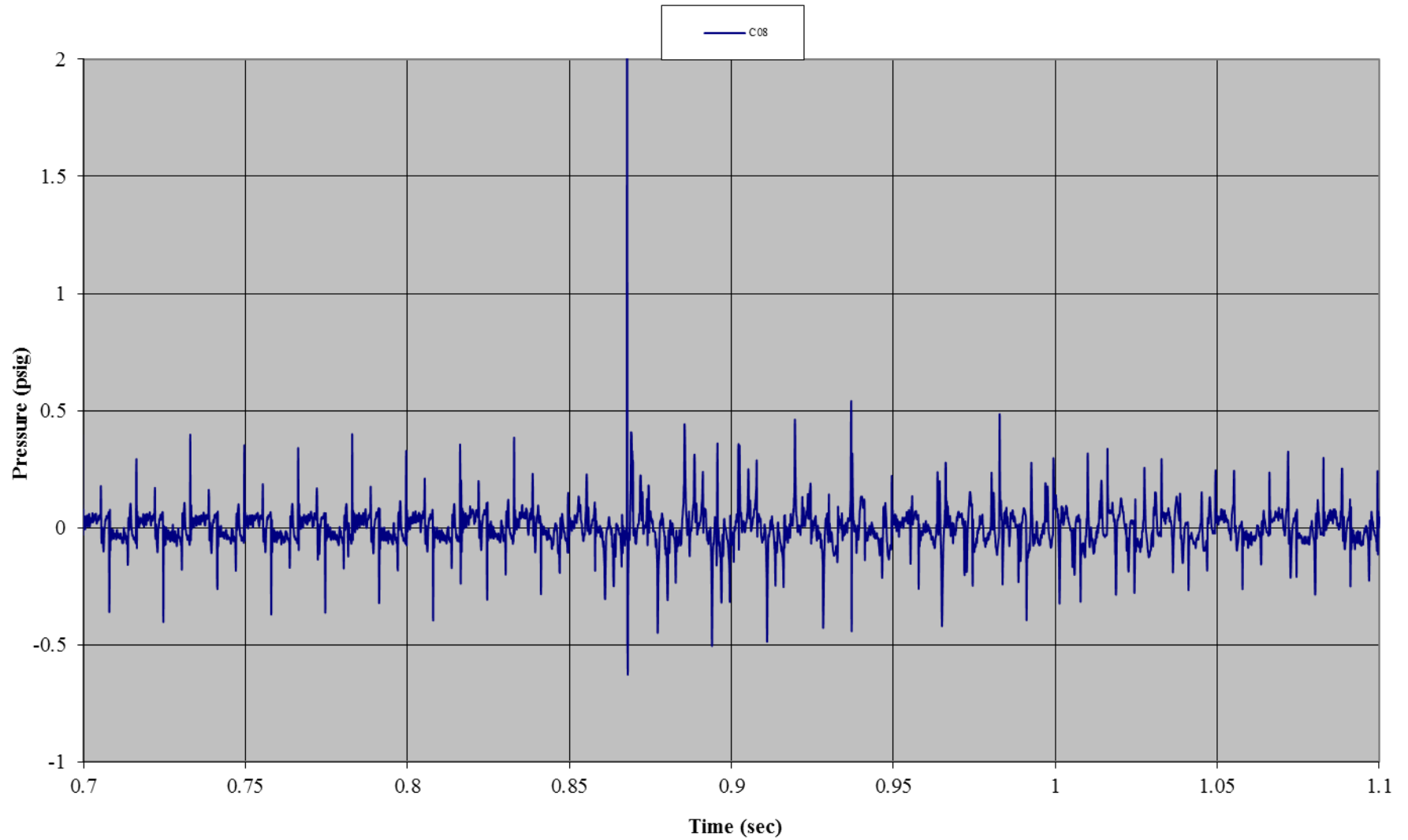
Test B08: Non-Wind Pole Tent without Sides
Gauge 02: Front Wall, Left Mid-Height



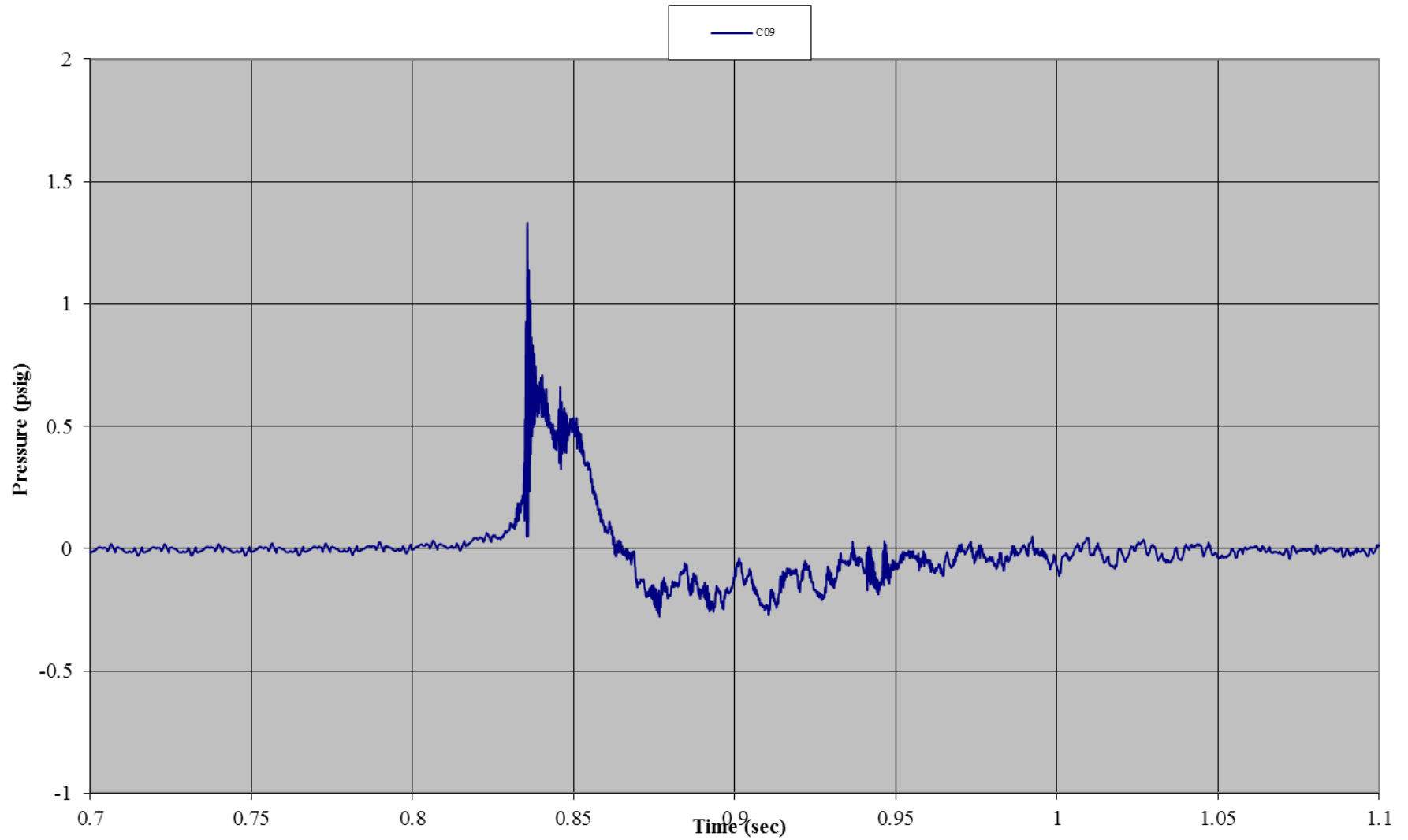
Test B08: Non-Wind Pole Tent without Sides
Gauge 12: Front Wall, Right Mid-Height



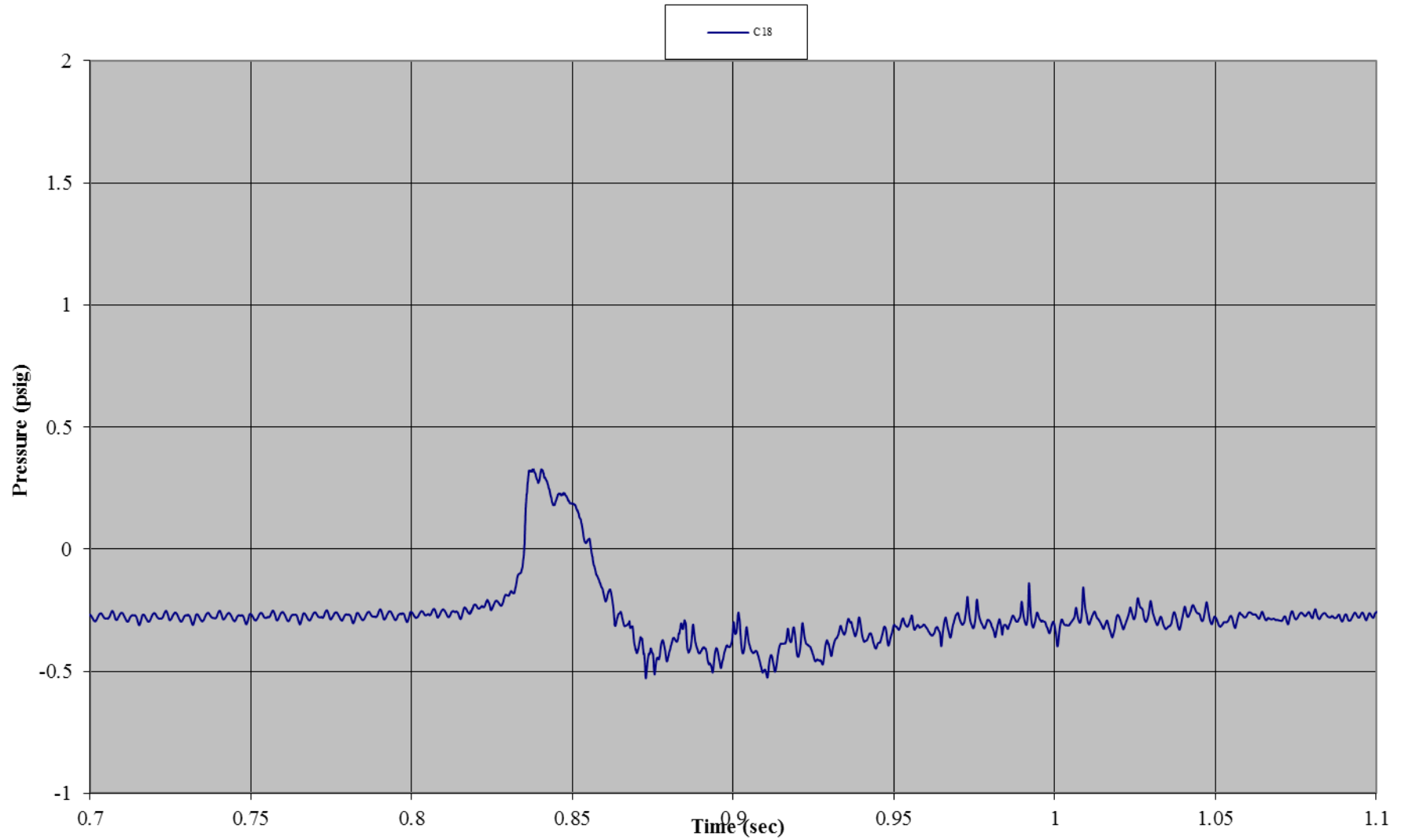
Test B08: Non-Wind Pole Tent without Sides
Gauge 08: Left Side Wall, Bottom



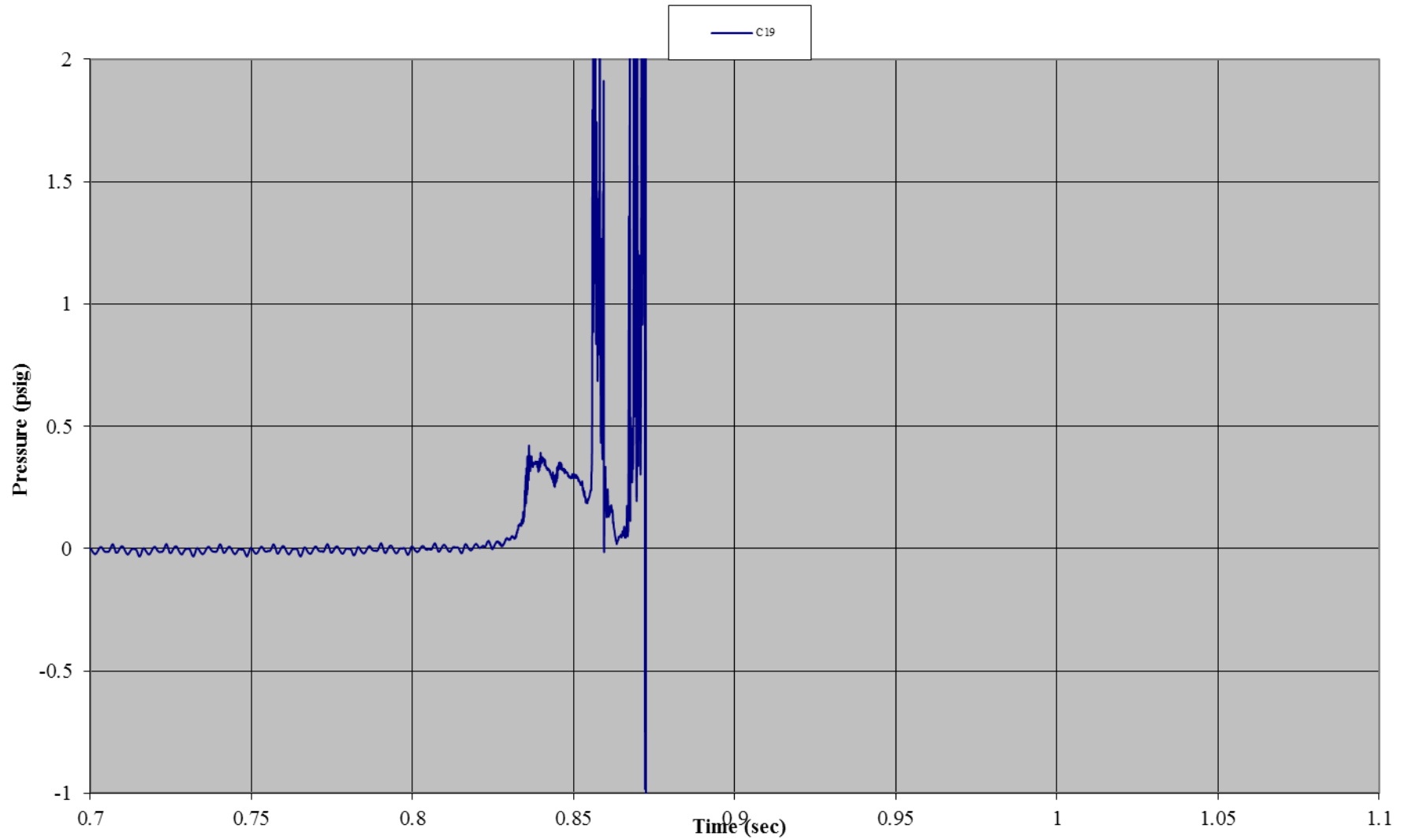
Test B08: Non-Wind Pole Tent without Sides
Gauge 09: Left Side Wall, Mid-Height



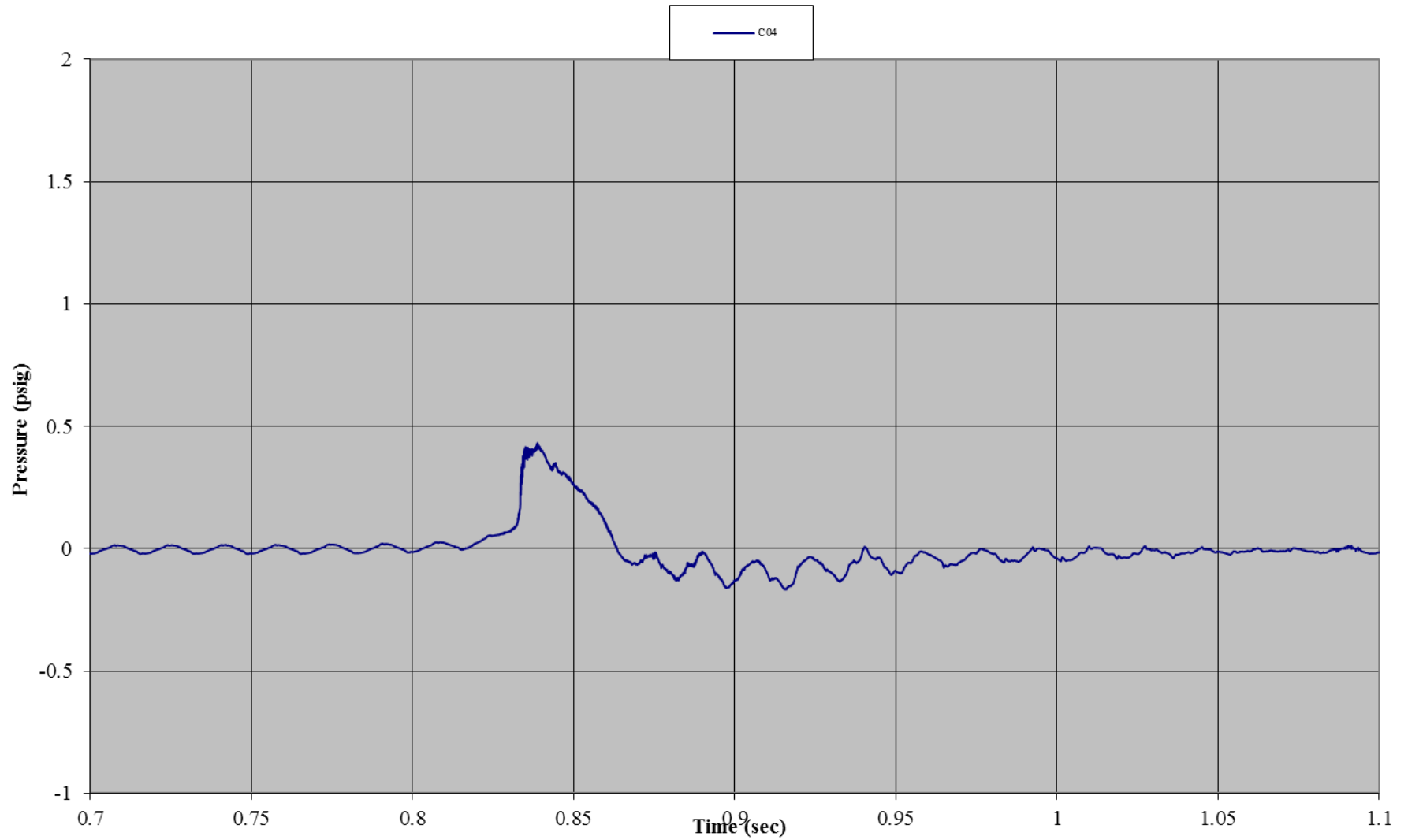
Test B08: Non-Wind Pole Tent without Sides
Gauge 18: Right Side Wall, Bottom



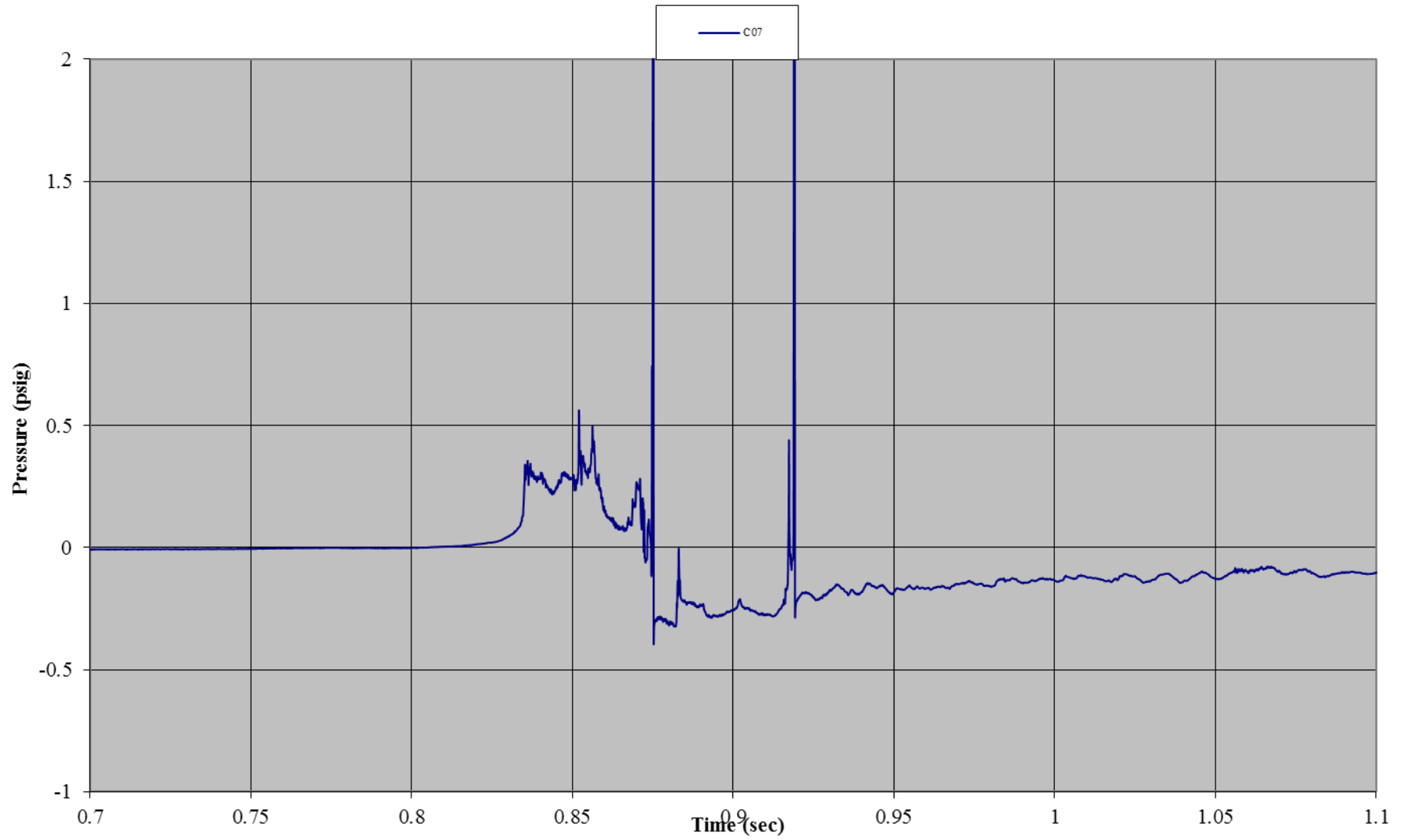
Test B08: Non-Wind Pole Tent without Sides
Gauge 19: Right Side Wall, Mid-Height



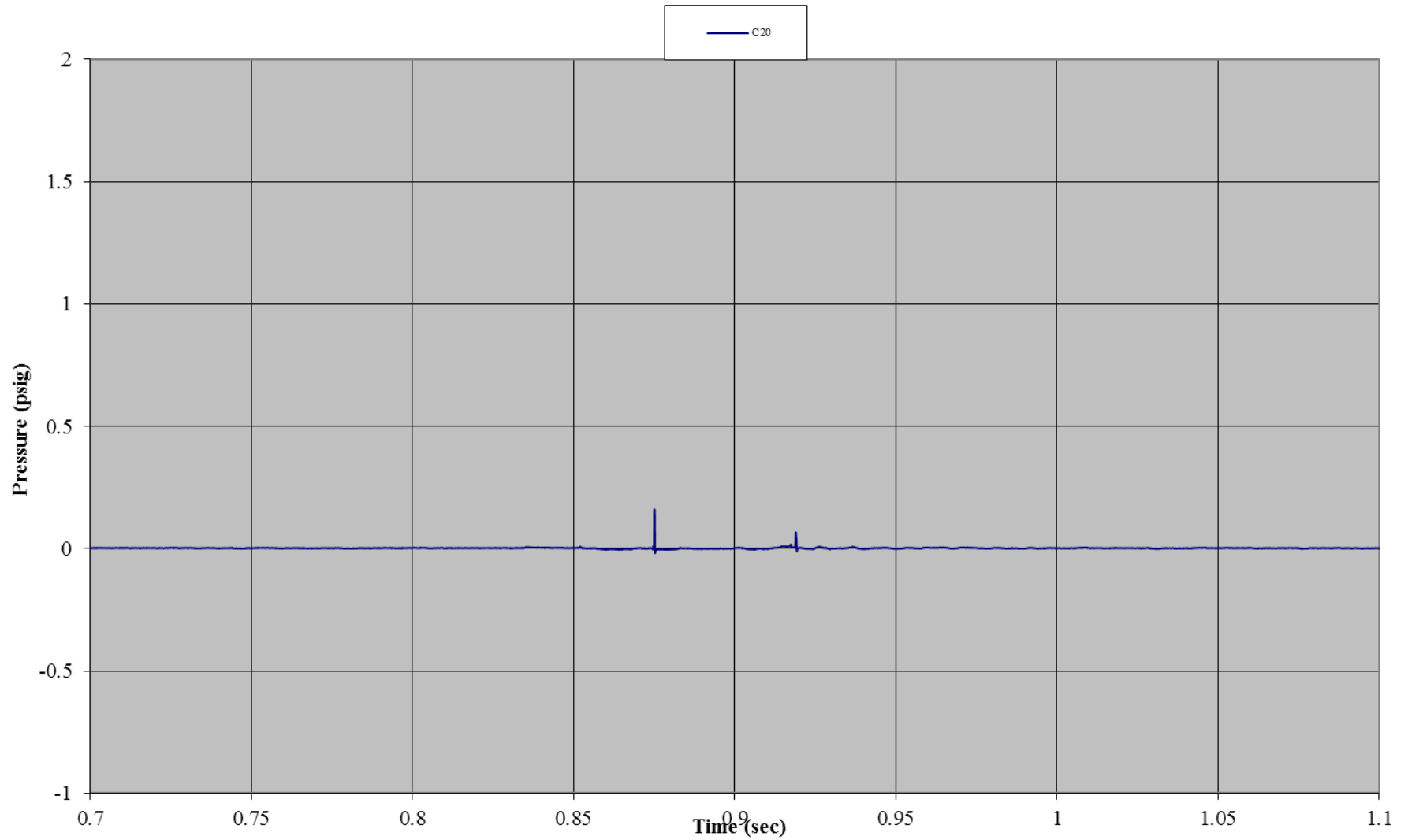
Test B08: Non-Wind Pole Tent without Sides
Gauge 04: Interior, Ground



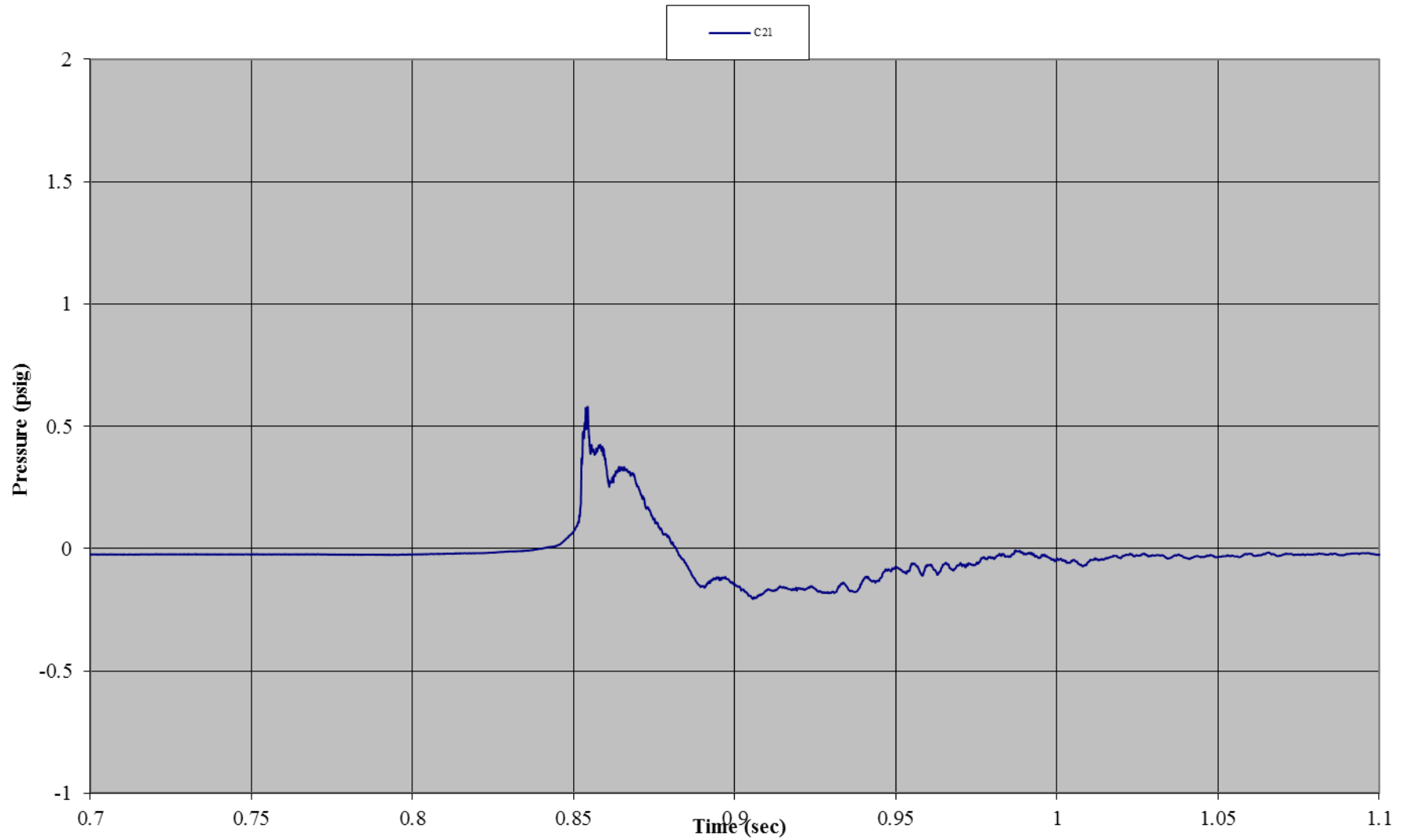
Test B08: Non-Wind Pole Tent without Sides
Gauge 07: Roof, Front



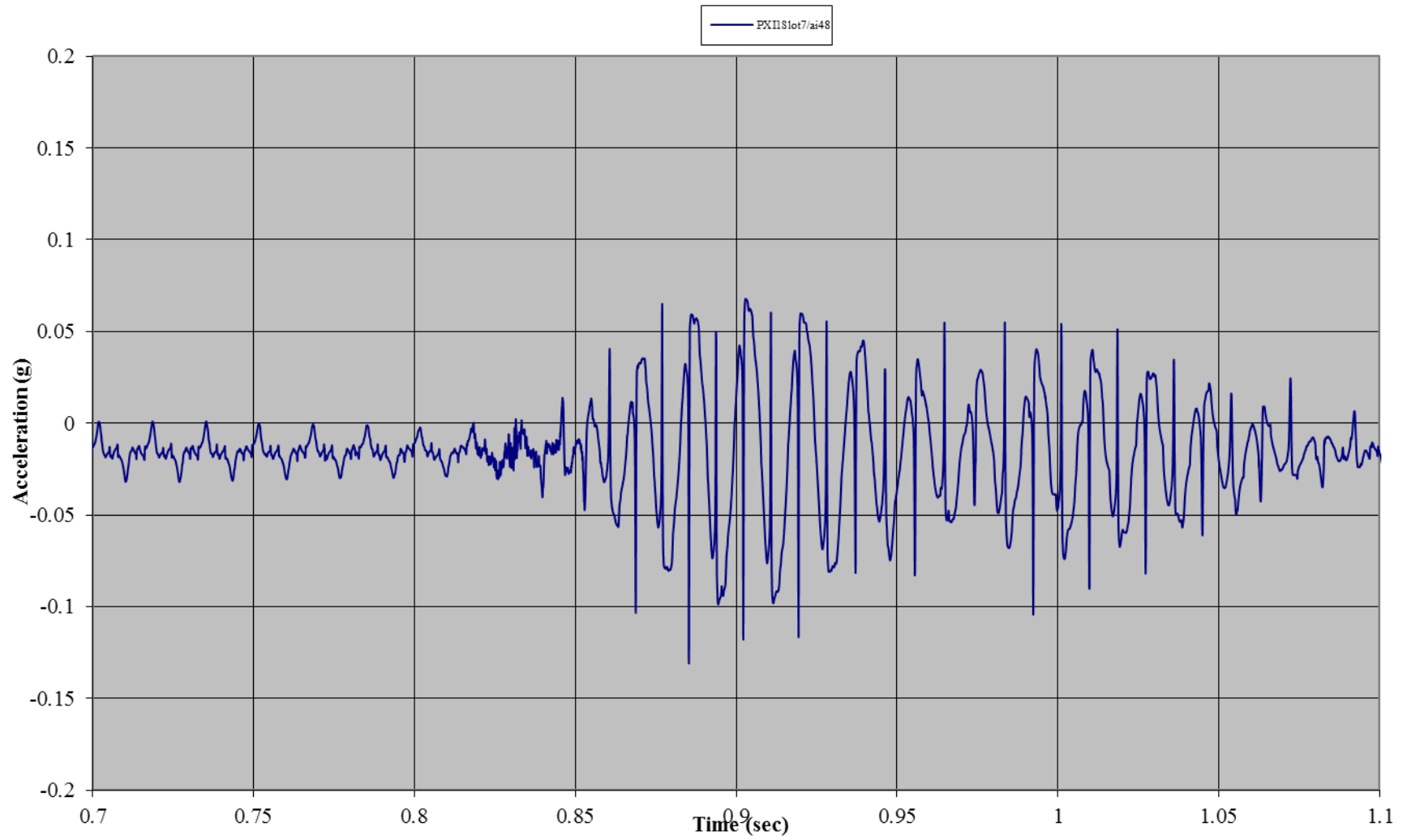
Test B08: Non-Wind Pole Tent without Sides
Gauge 20: Roof, Back



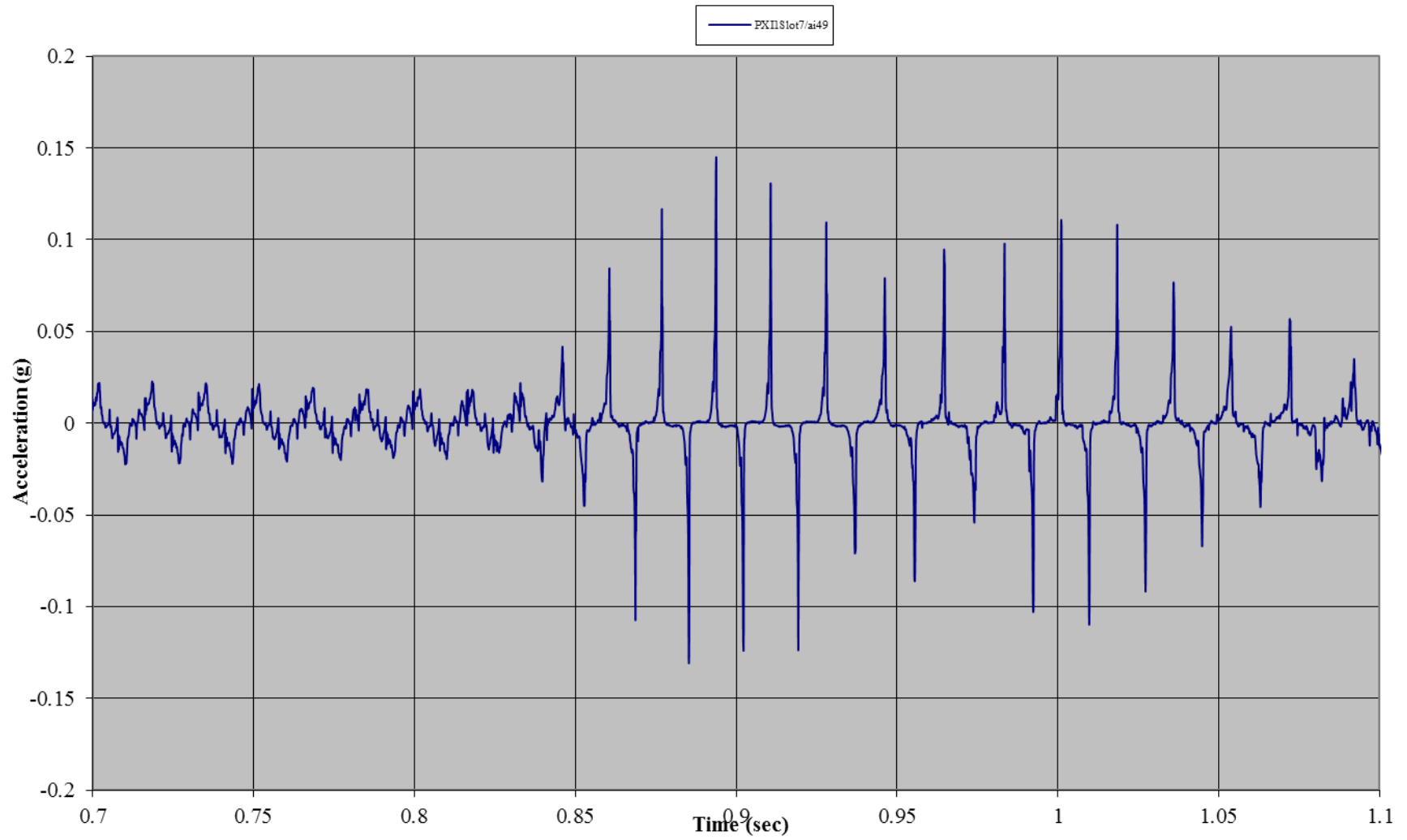
Test B08: Non-Wind Pole Tent without Sides
Gauge 21: Back Wall, Center Mid-Height



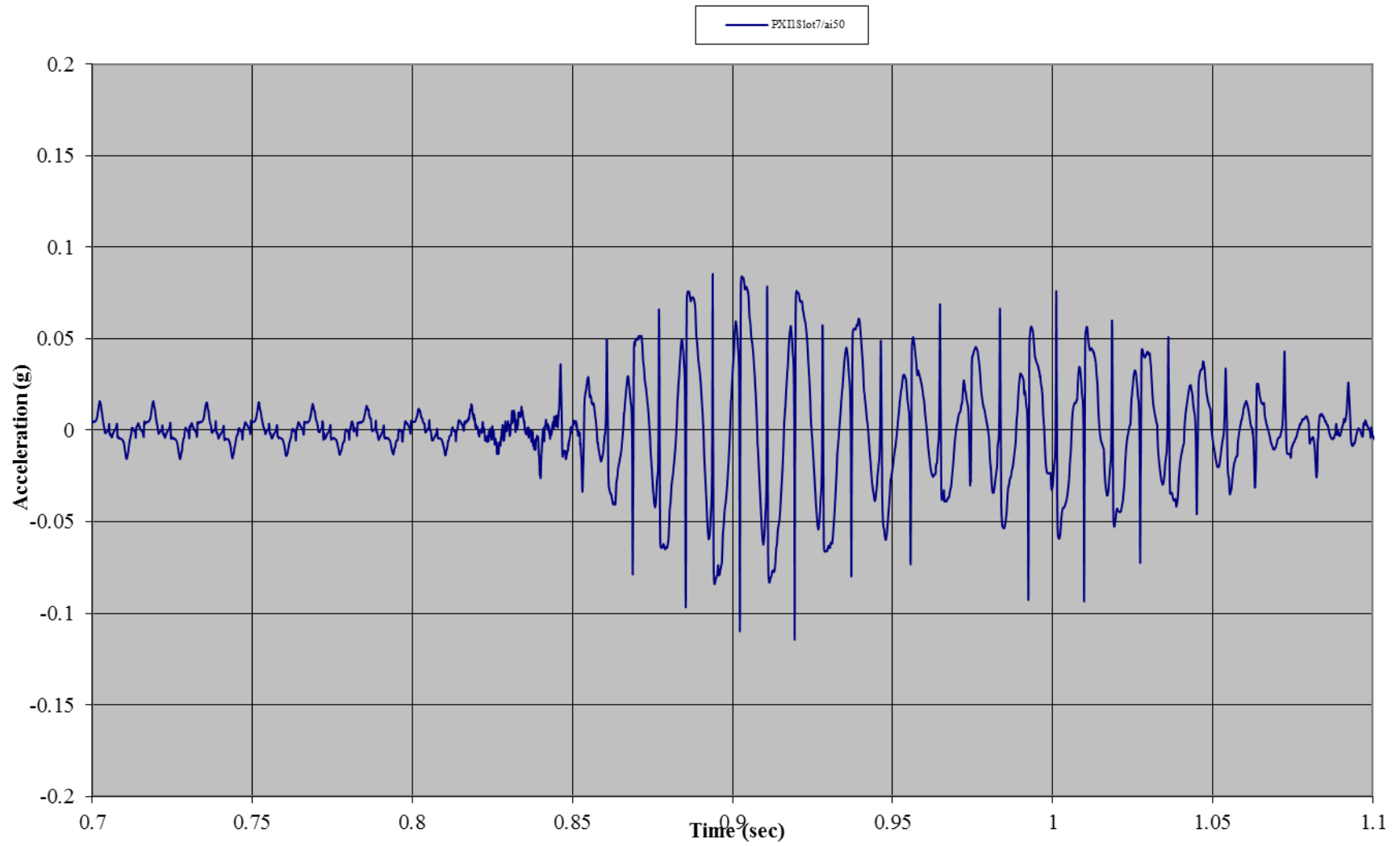
Test B08: Non-Wind Pole Tent without Sides
Accelerometer 1: Front Wall (x-direction)



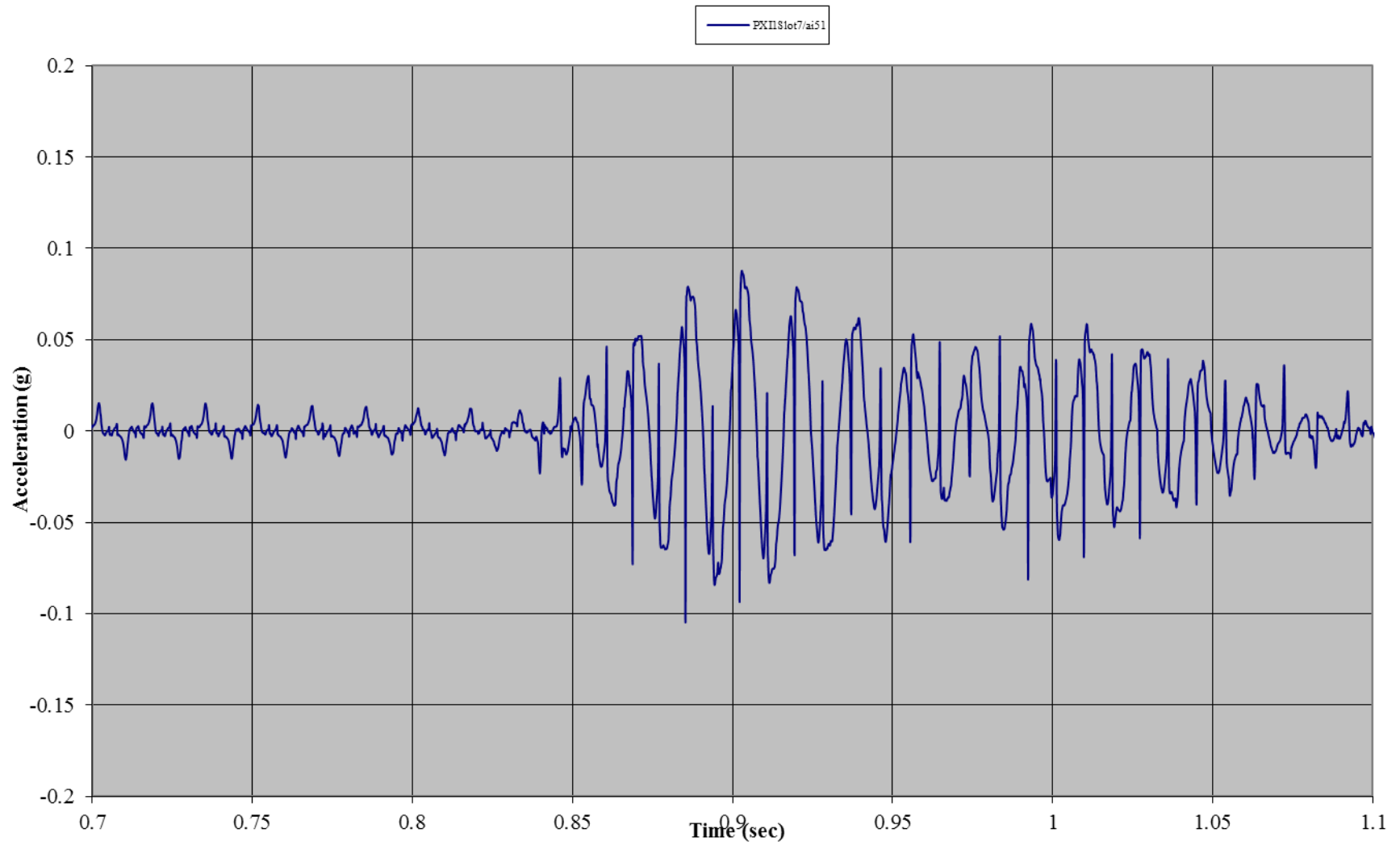
Test B08: Non-Wind Pole Tent without Sides
Accelerometer 1: Front Wall (y-direction)



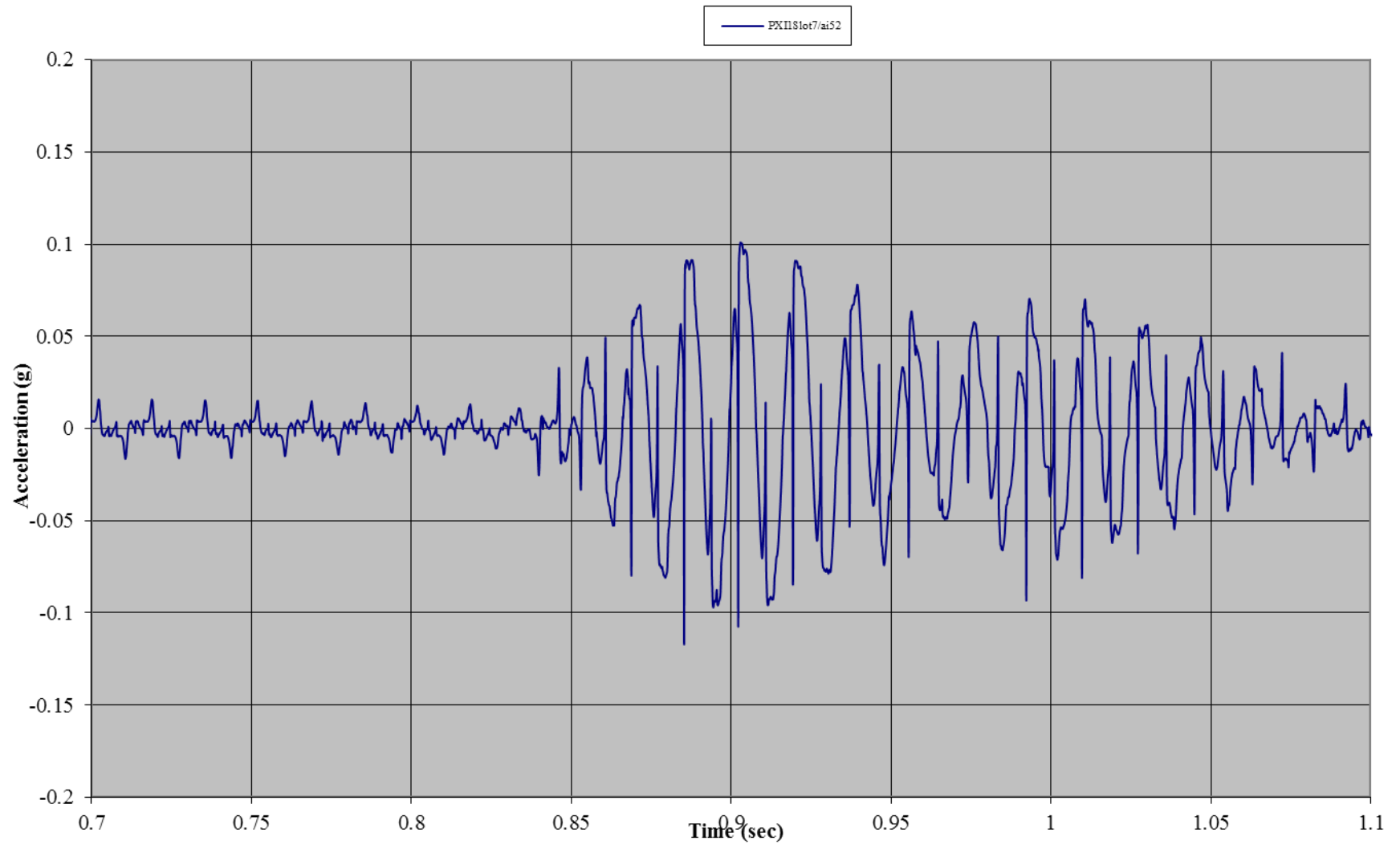
Test B08: Non-Wind Pole Tent without Sides
Accelerometer 1: Front Wall (z-direction)



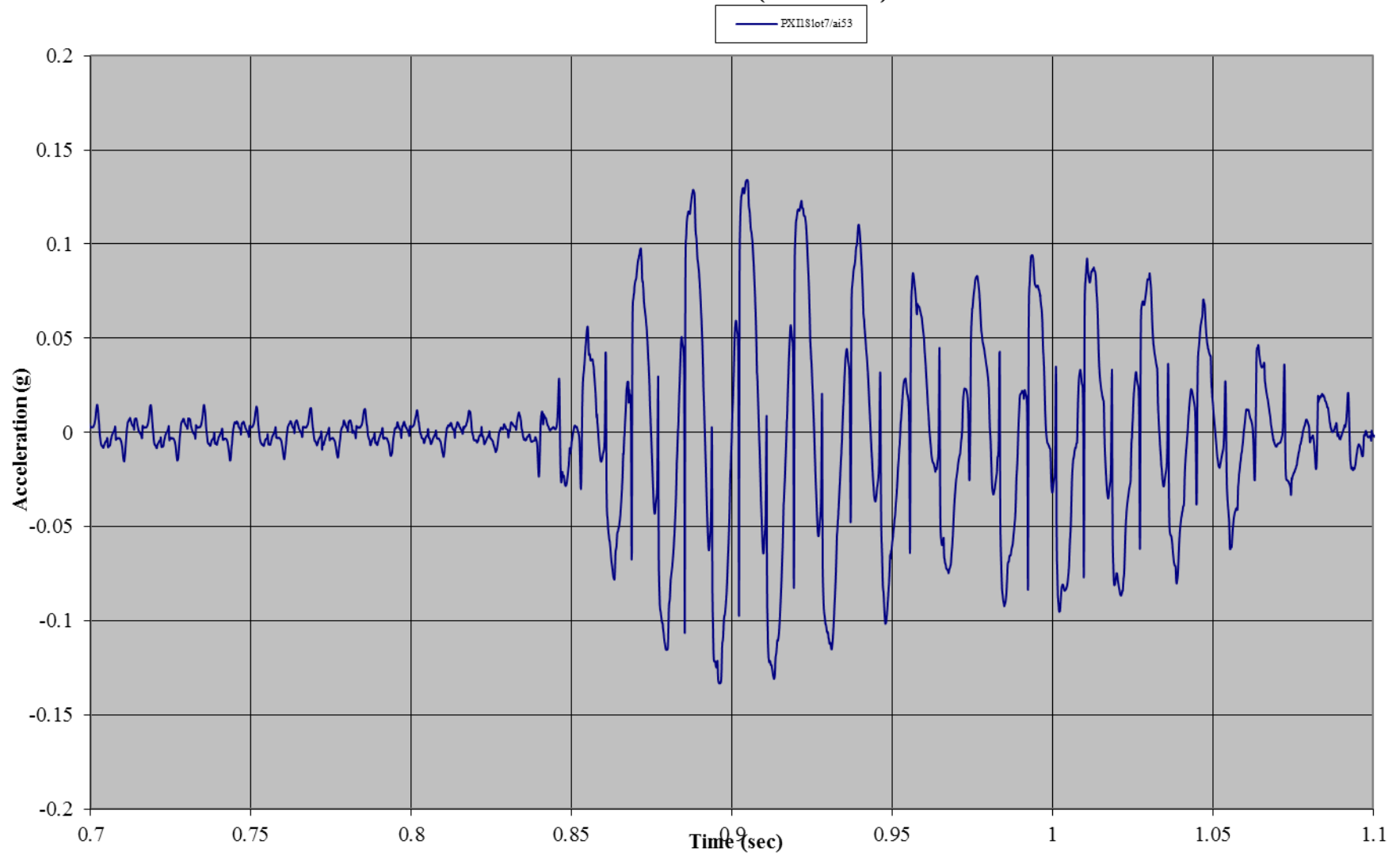
Test B08: Non-Wind Pole Tent without Sides
Accelerometer 2: Roof (x-direction)



Test B08: Non-Wind Pole Tent without Sides
Accelerometer 2: Roof (y-direction)

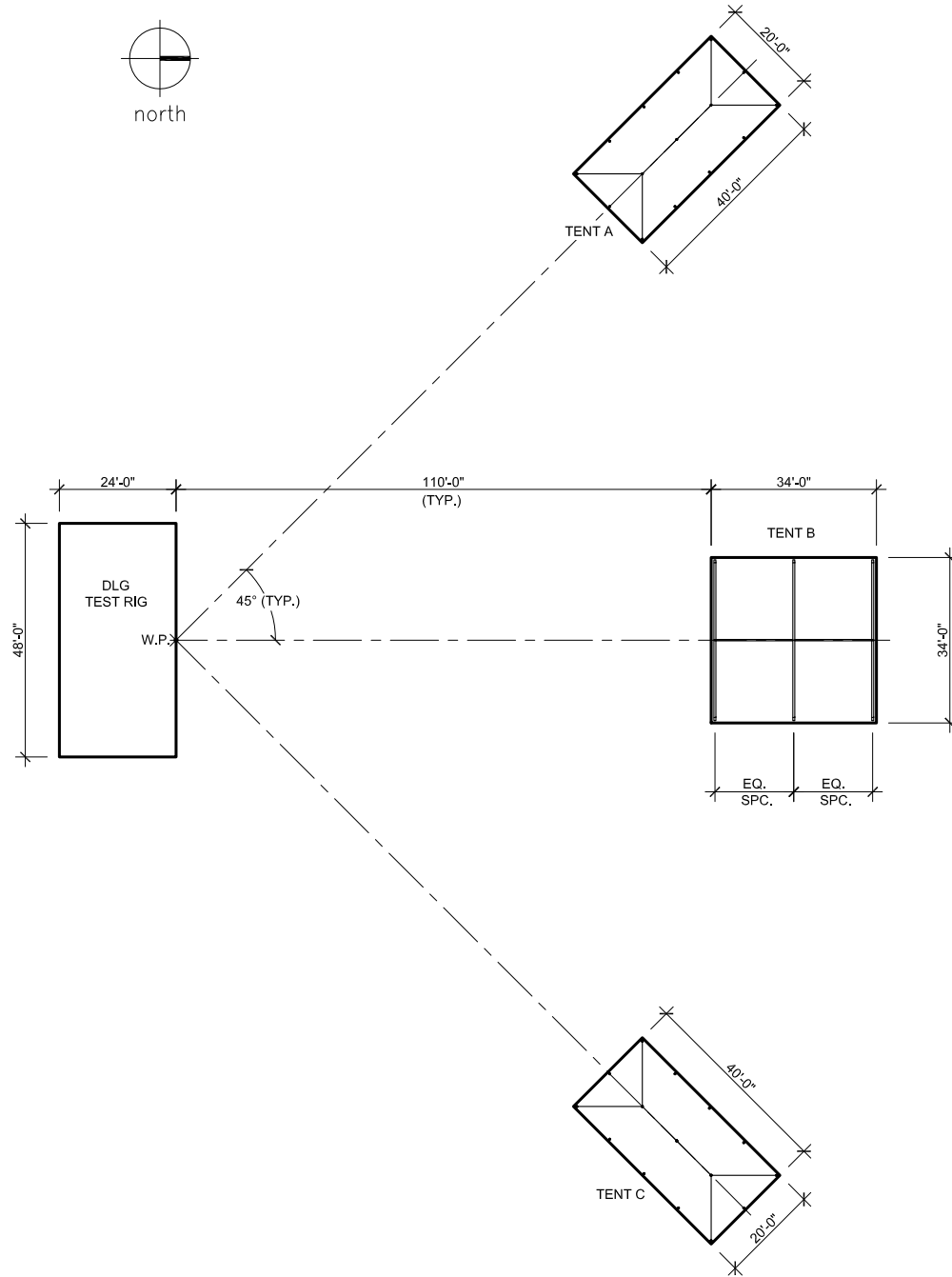


Test B08: Non-Wind Pole Tent without Sides
Accelerometer 2: Roof (z-direction)




ANNEX D.

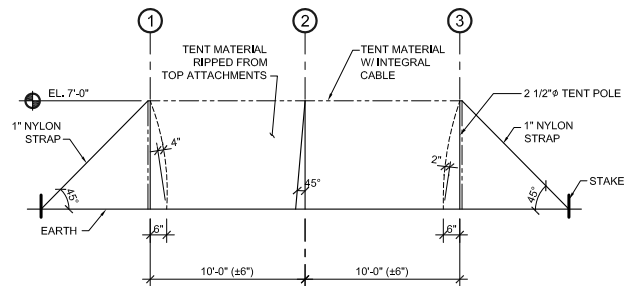
TEST SERIES C - FULL PLOTS OF TEST DATA



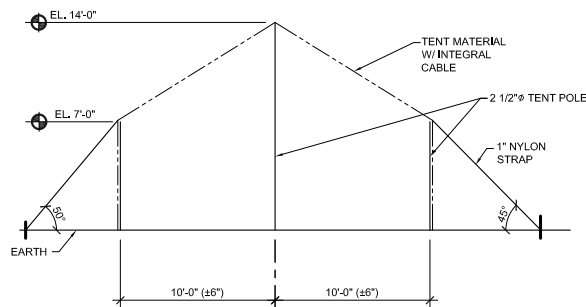
SITE LAYOUT - TENT TEST C01
SCALE: N.T.S.

1

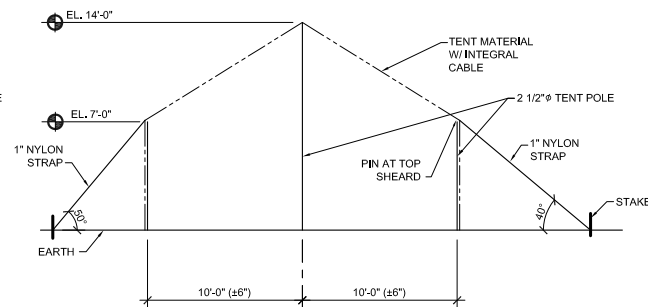
AMERICAN PETROLEUM INSTITUTE
TENT TEST C01
SITE LAYOUT
 BAKER ENGINEERING & RISK CONSULTANT 3150 Oakwell Court, Suite 100 San Antonio, TX 78216-3024



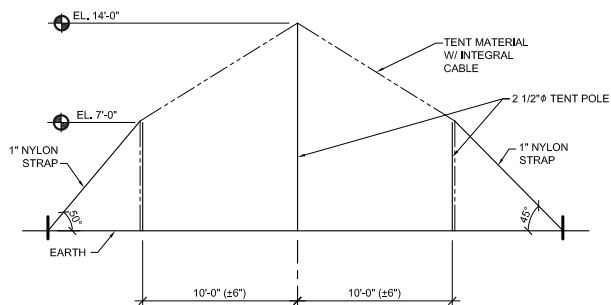
TENT A - SECTION 1/ GRID A
SCALE: N.T.S.



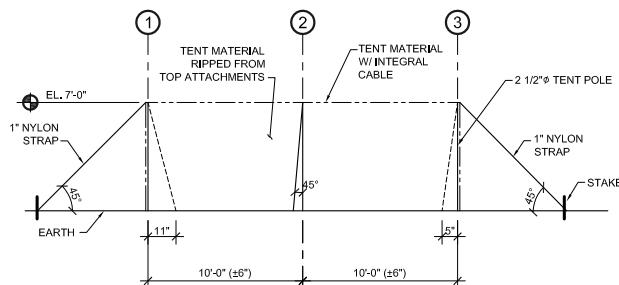
TENT A - SECTION 2/ GRID B
SCALE: N.T.S.



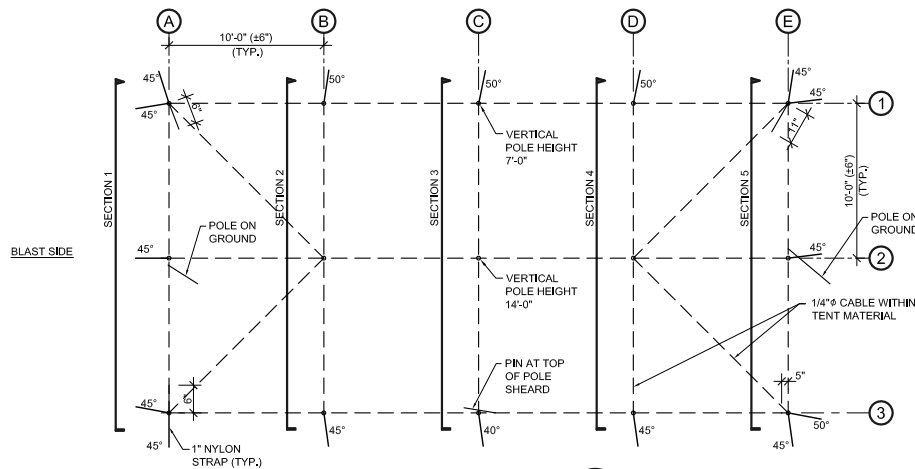
TENT A - SECTION 3/ GRID C
SCALE: N.T.S.



TENT A - SECTION 4/ GRID D
SCALE: N.T.S.

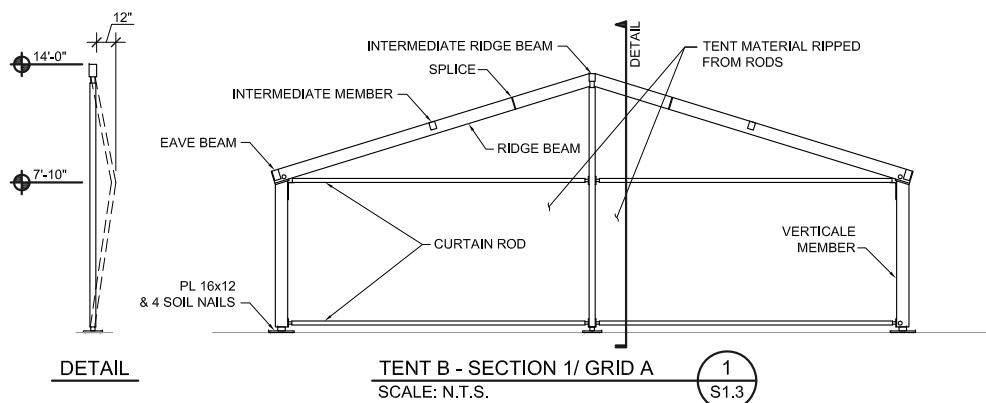
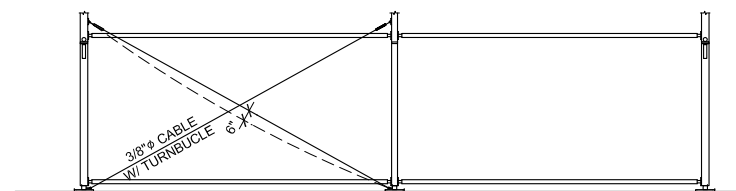
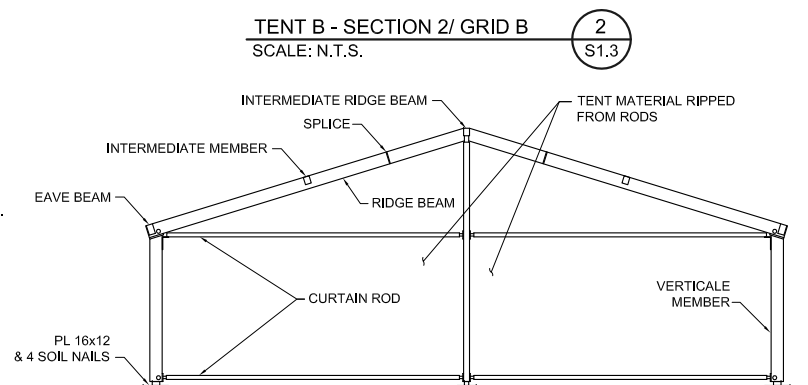
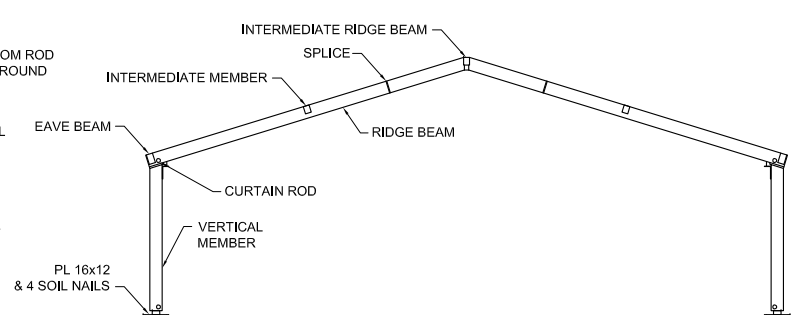
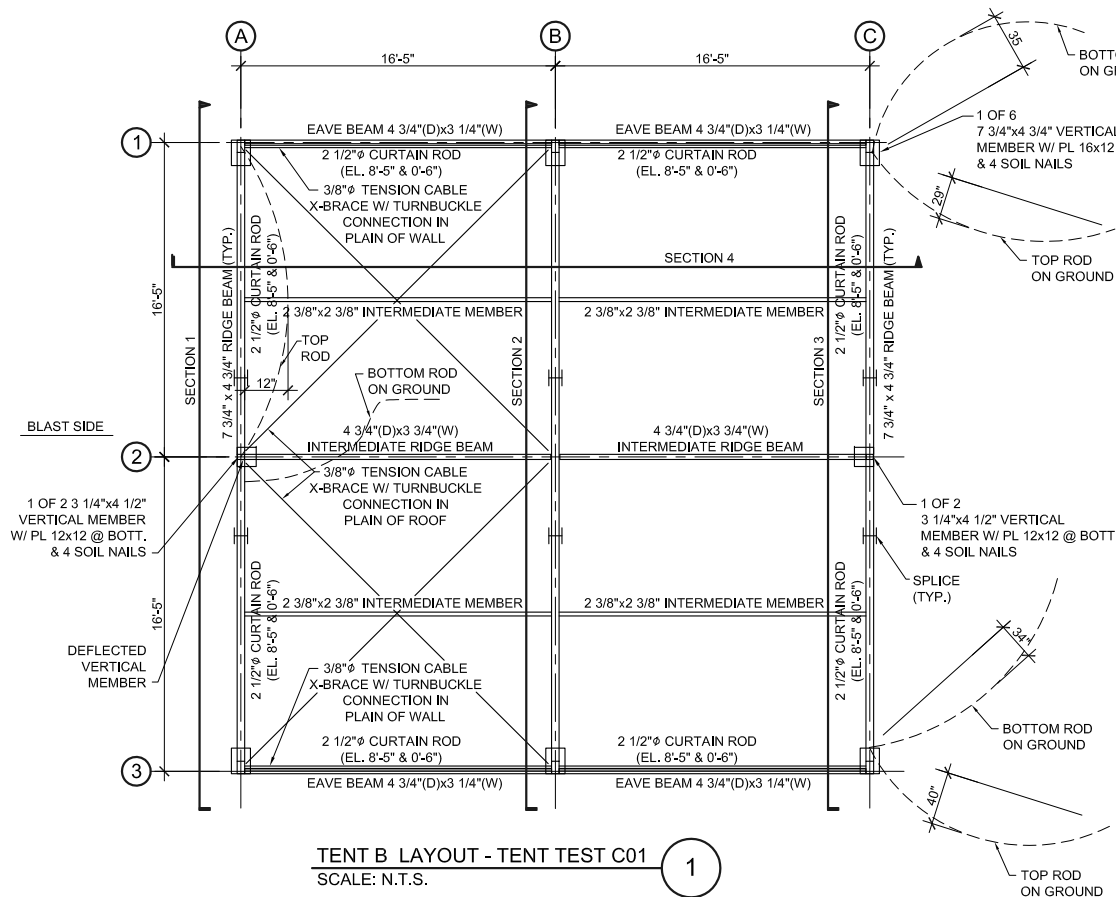


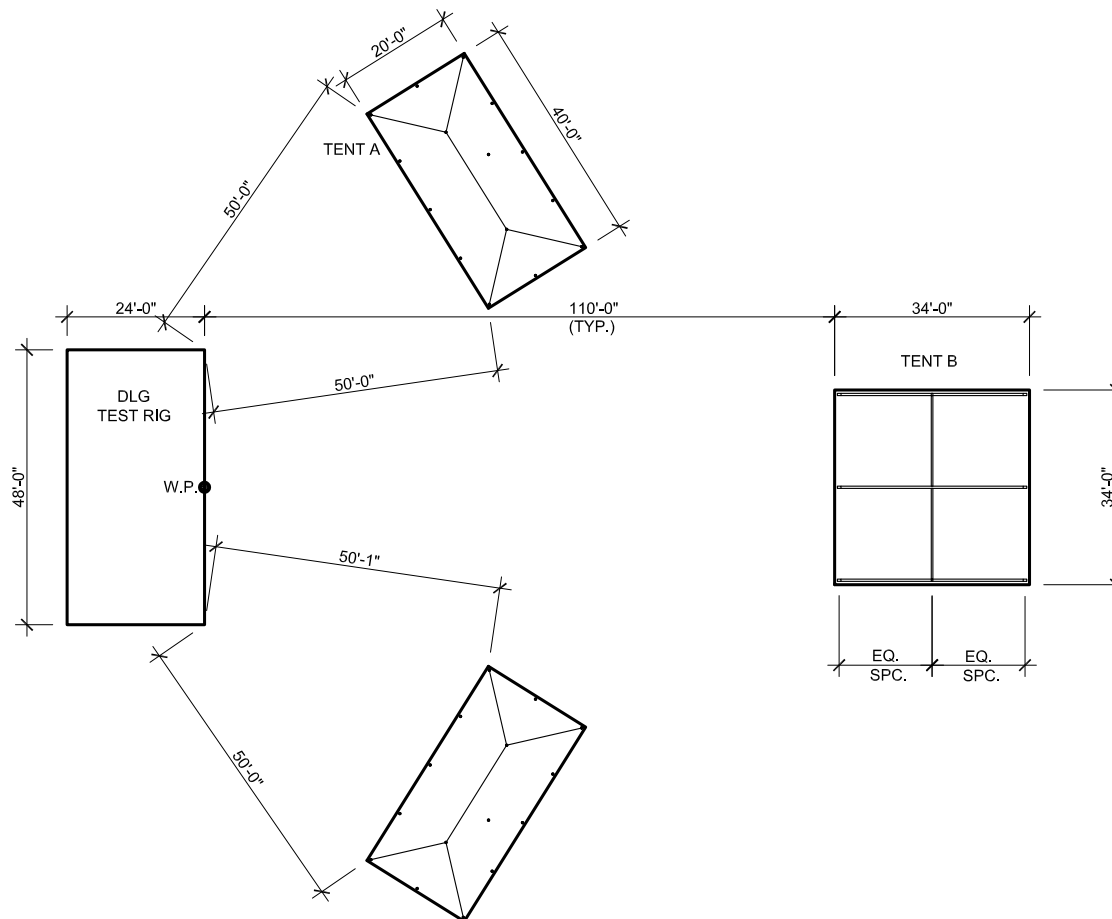
TENT A - SECTION 5/ GRID E
SCALE: N.T.S.



TENT A LAYOUT - TENT TEST C01
SCALE: N.T.S.


1

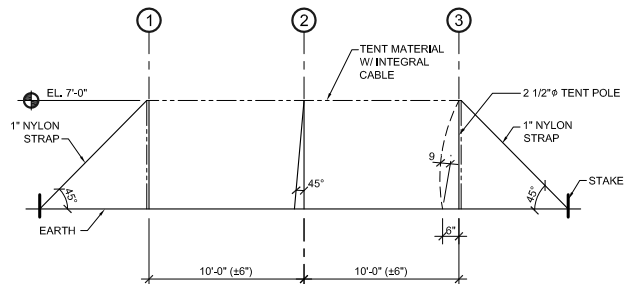




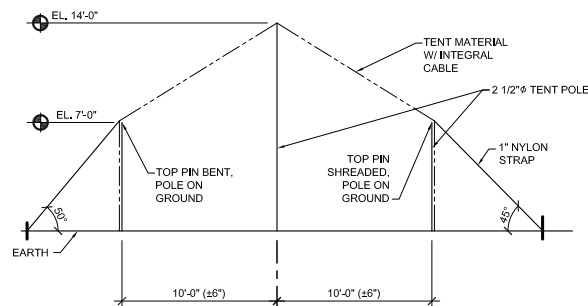
SITE LAYOUT - TENT TEST C02
SCALE: N.T.S.

1

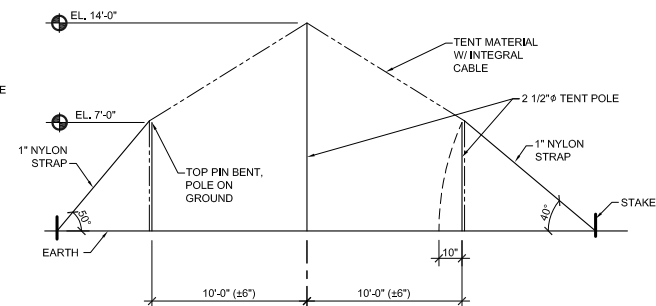
AMERICAN PETROLEUM INSTITUTE
TENT TEST C02
SITE LAYOUT
 BAKER ENGINEERING & RISK CONSULTANTS 3150 Oakwell Court, Suite 100 San Antonio, TX 78216-3024



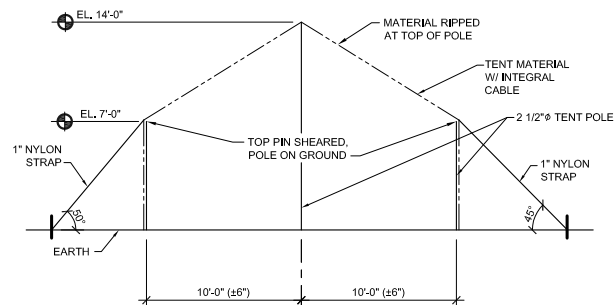
TENT A - SECTION 1/ GRID A
SCALE: N.T.S.



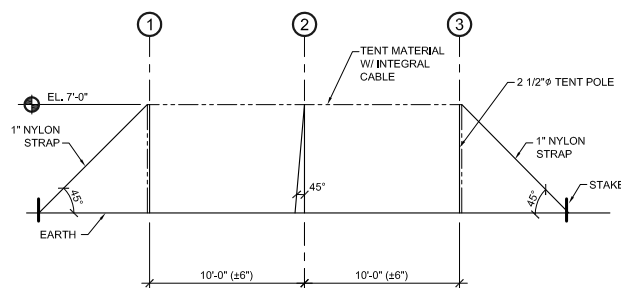
TENT A - SECTION 2/ GRID B
SCALE: N.T.S.



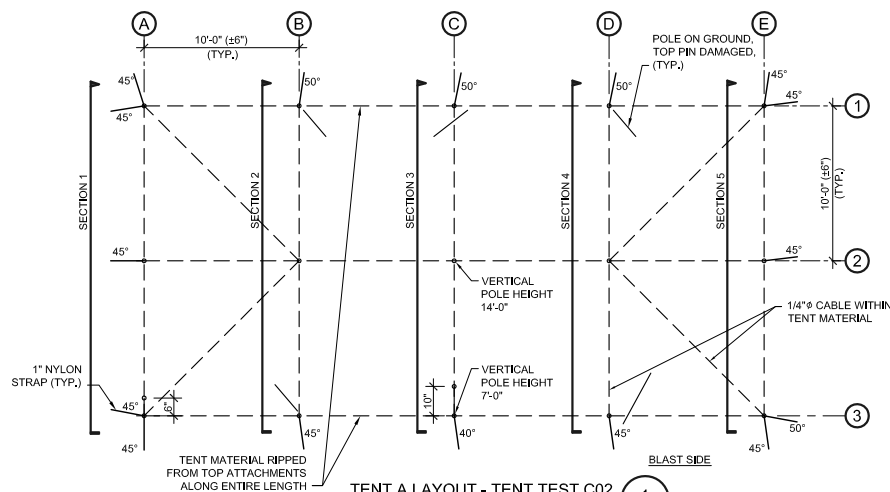
TENT A - SECTION 3/ GRID C
SCALE: N.T.S.



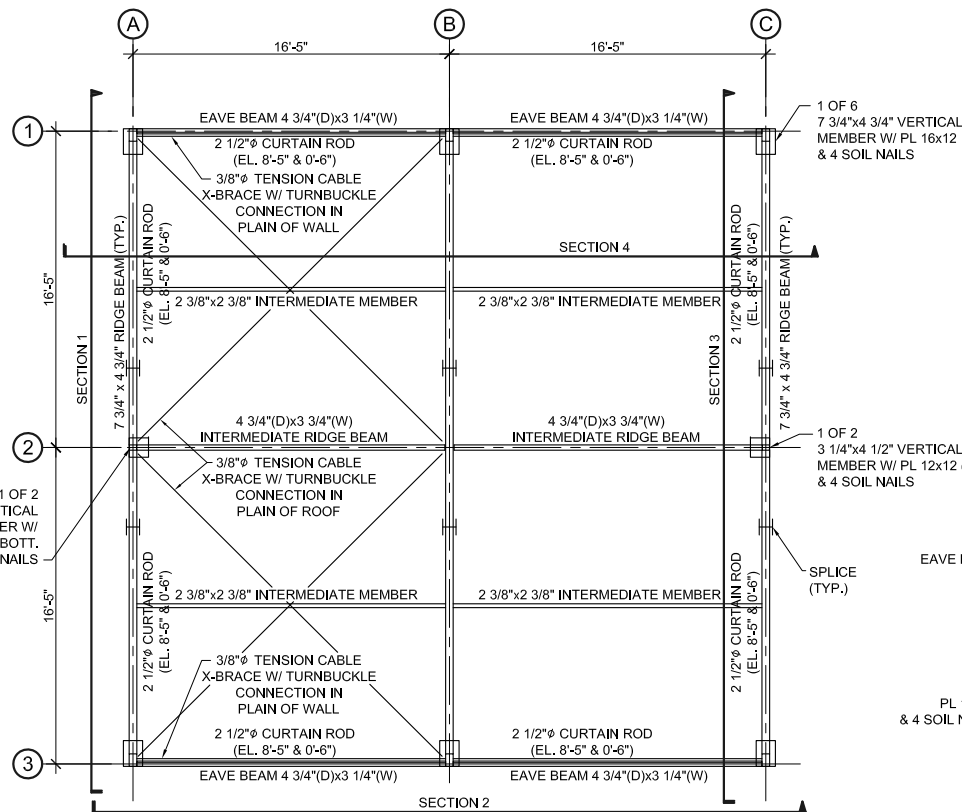
TENT A - SECTION 4/ GRID D
SCALE: N.T.S.



TENT A - SECTION 5/ GRID E
SCALE: N.T.S.



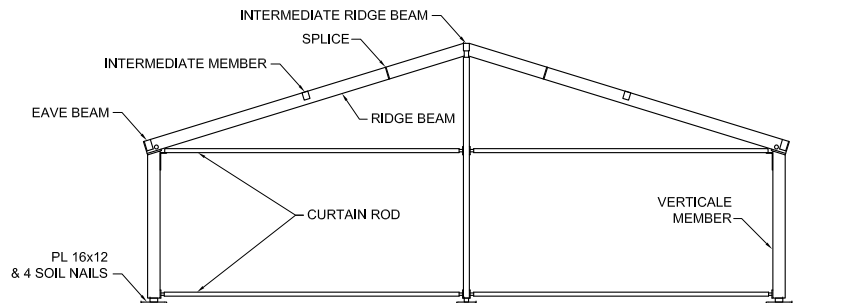
TENT A LAYOUT - TENT TEST C02
SCALE: N.T.S.



TENT B LAYOUT - TENT TEST C02
SCALE: N.T.S.

1

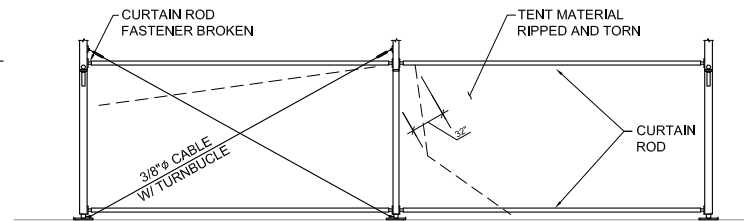
BLAST SIDE



TENT B - SECTION 1/ GRID A
SCALE: N.T.S.

1

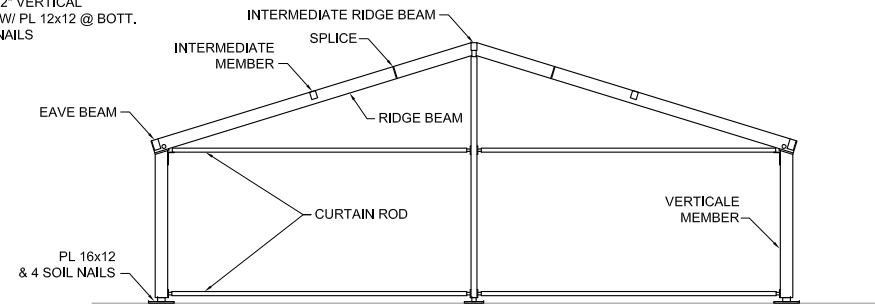
S1.3



TENT B - SECTION 2/ GRID B
SCALE: N.T.S.

2

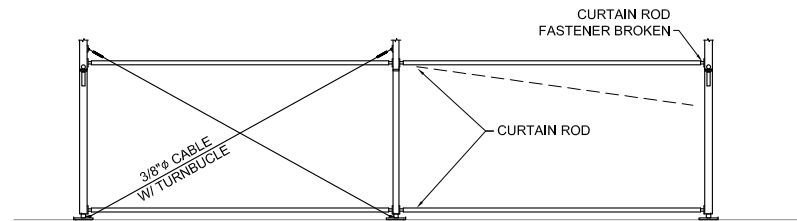
S1.3



TENT B - SECTION 3/ GRID C
SCALE: N.T.S.

3

S1.3



TENT B - SECTION 4/ GRID 1
SCALE: N.T.S.

4

S1.3

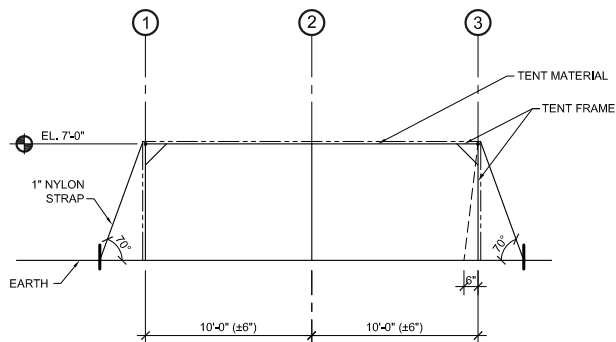
AMERICAN PETROLEUM INSTITUTE

TENT TEST C02

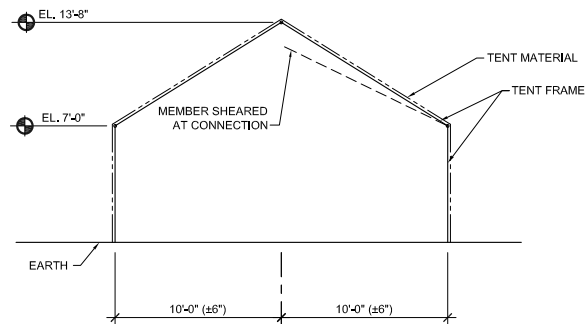
MOMENT FRAME TENT
LAYOUT (TENT B)



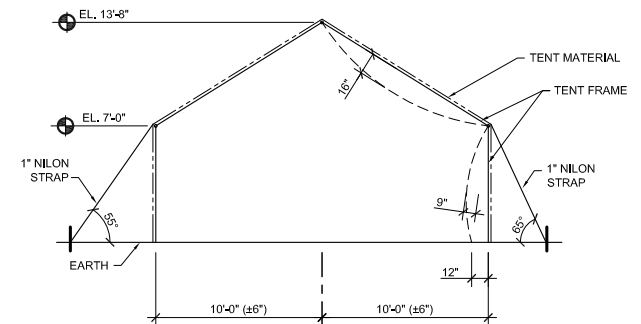
BAKER ENGINEERING & RISK CONSULTANTS, INC.
3150 Oakwell Court, Suite 100
San Antonio, TX 78216-3024



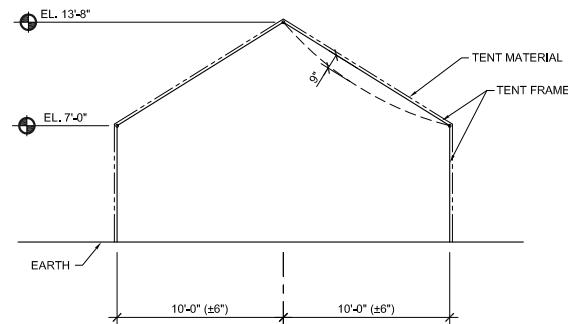
TENT C - SECTION 1/ GRID A
SCALE: N.T.S.



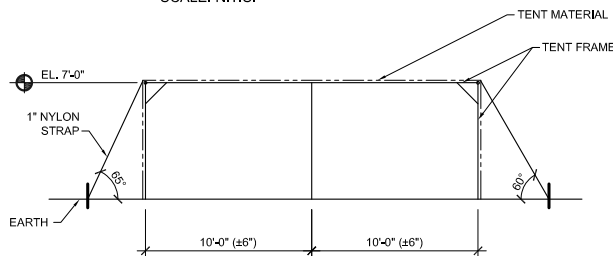
TENT C - SECTION 2/ GRID B
SCALE: N.T.S.



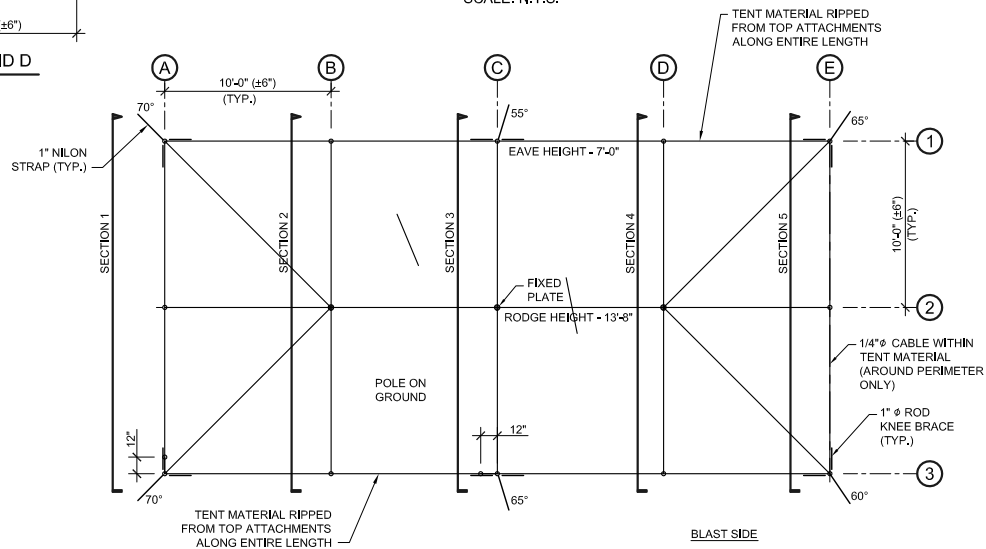
TENT C - SECTION 3/ GRID C
SCALE: N.T.S.



TENT C - SECTION 4/ GRID D
SCALE: N.T.S.



TENT C - SECTION 5/ GRID E
SCALE: N.T.S.

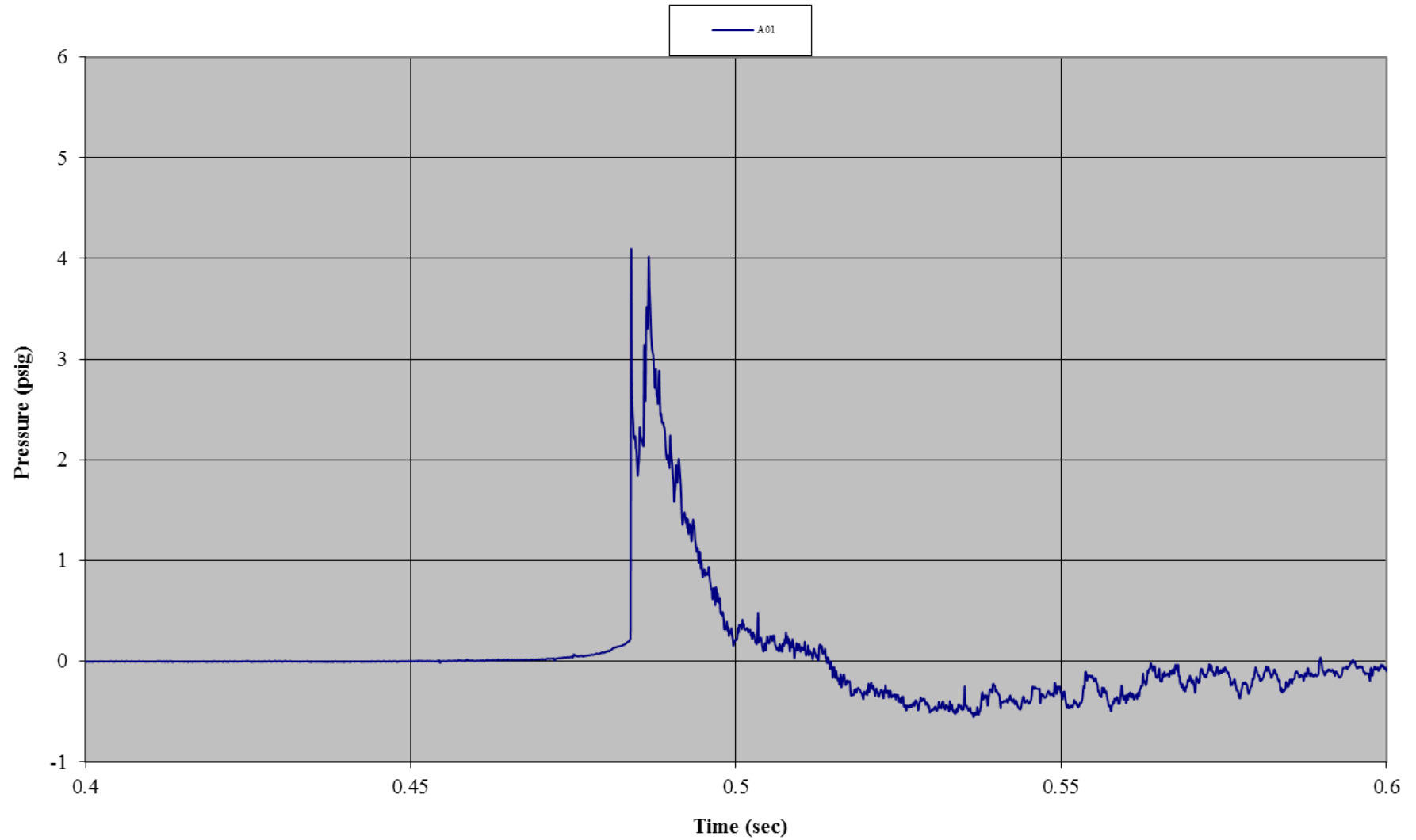


TENT C LAYOUT - TENT TEST C02
SCALE: N.T.S.

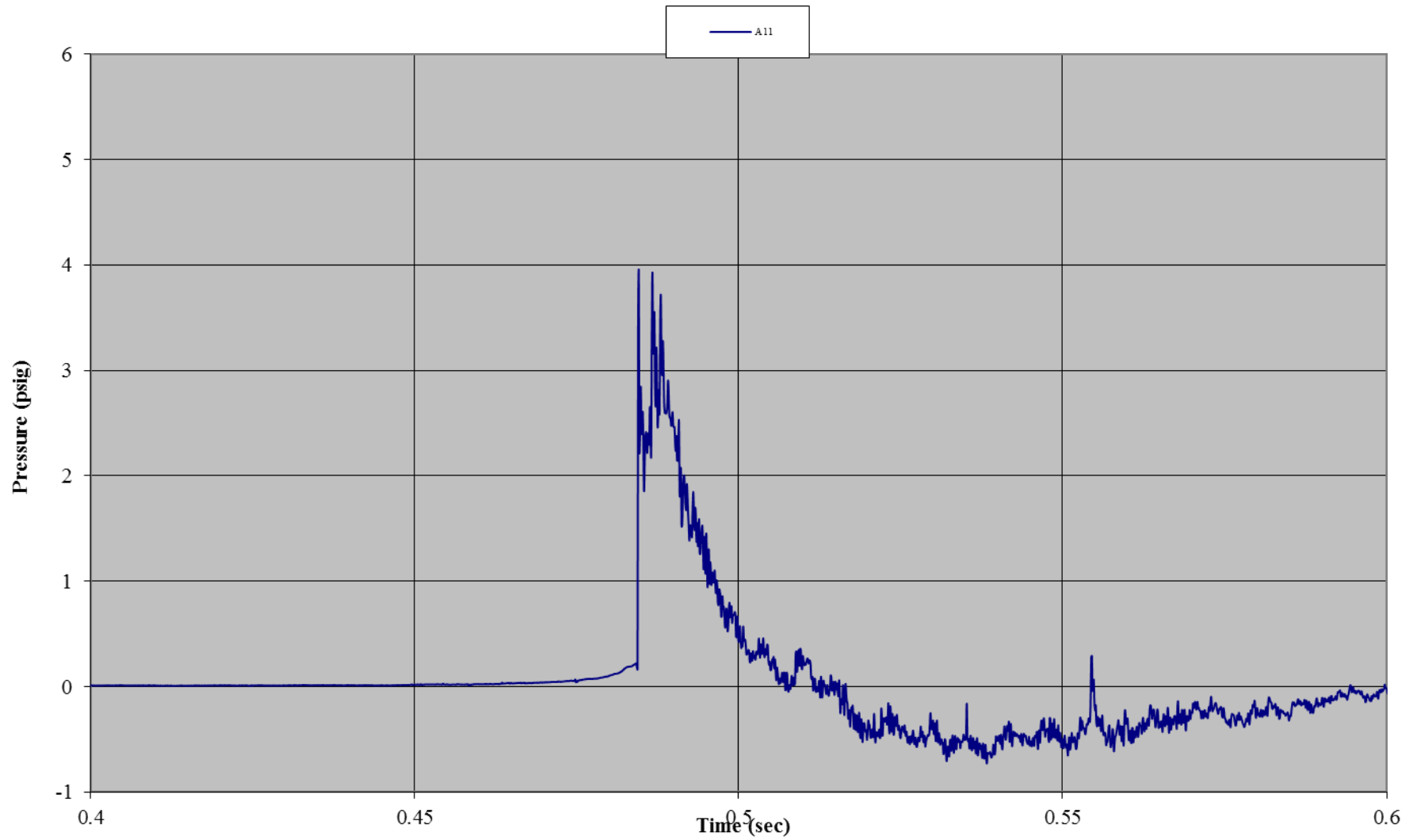
1

Test C01: Tent A

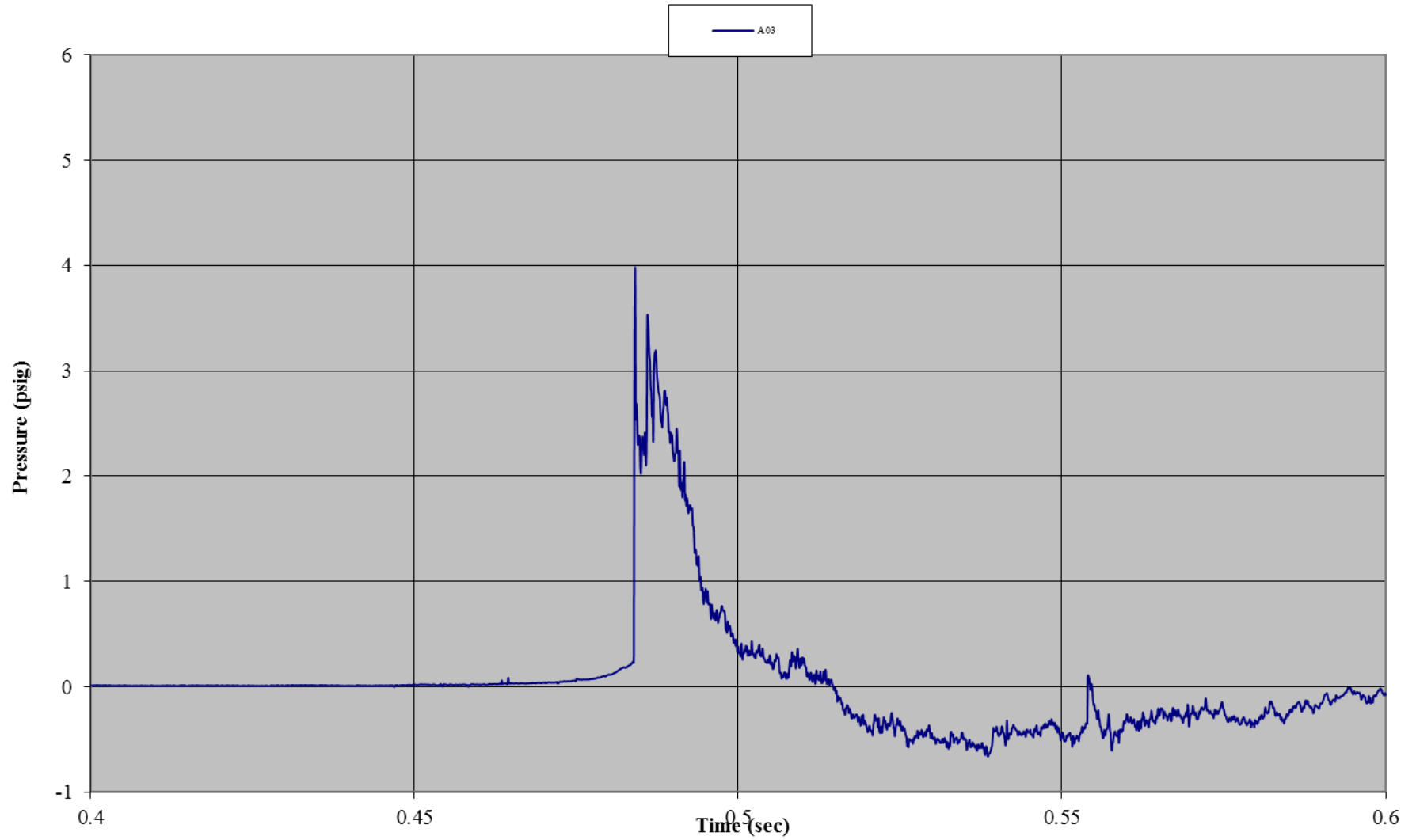
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 01: Front Wall, Left Bottom



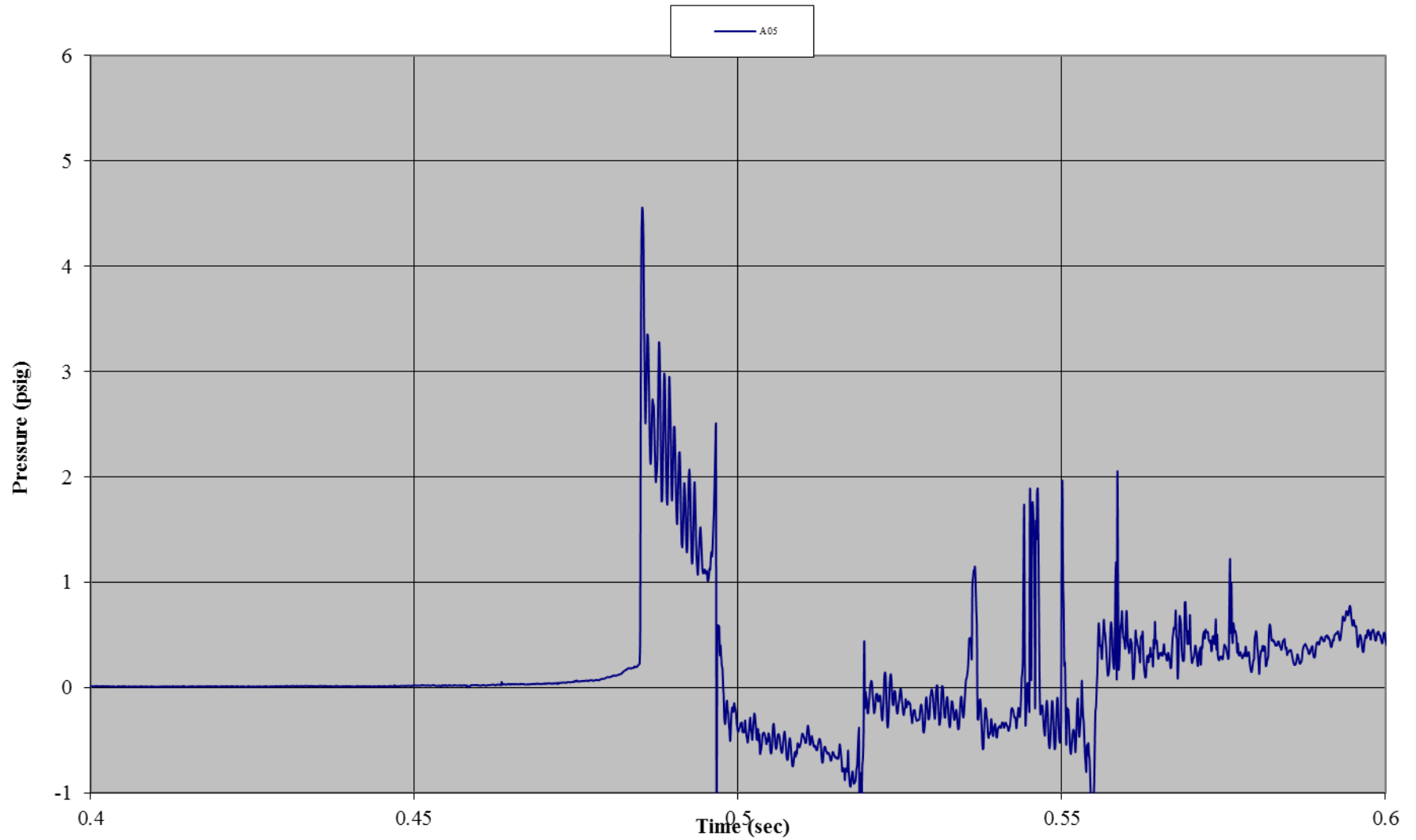
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 11: Front Wall, Right Bottom



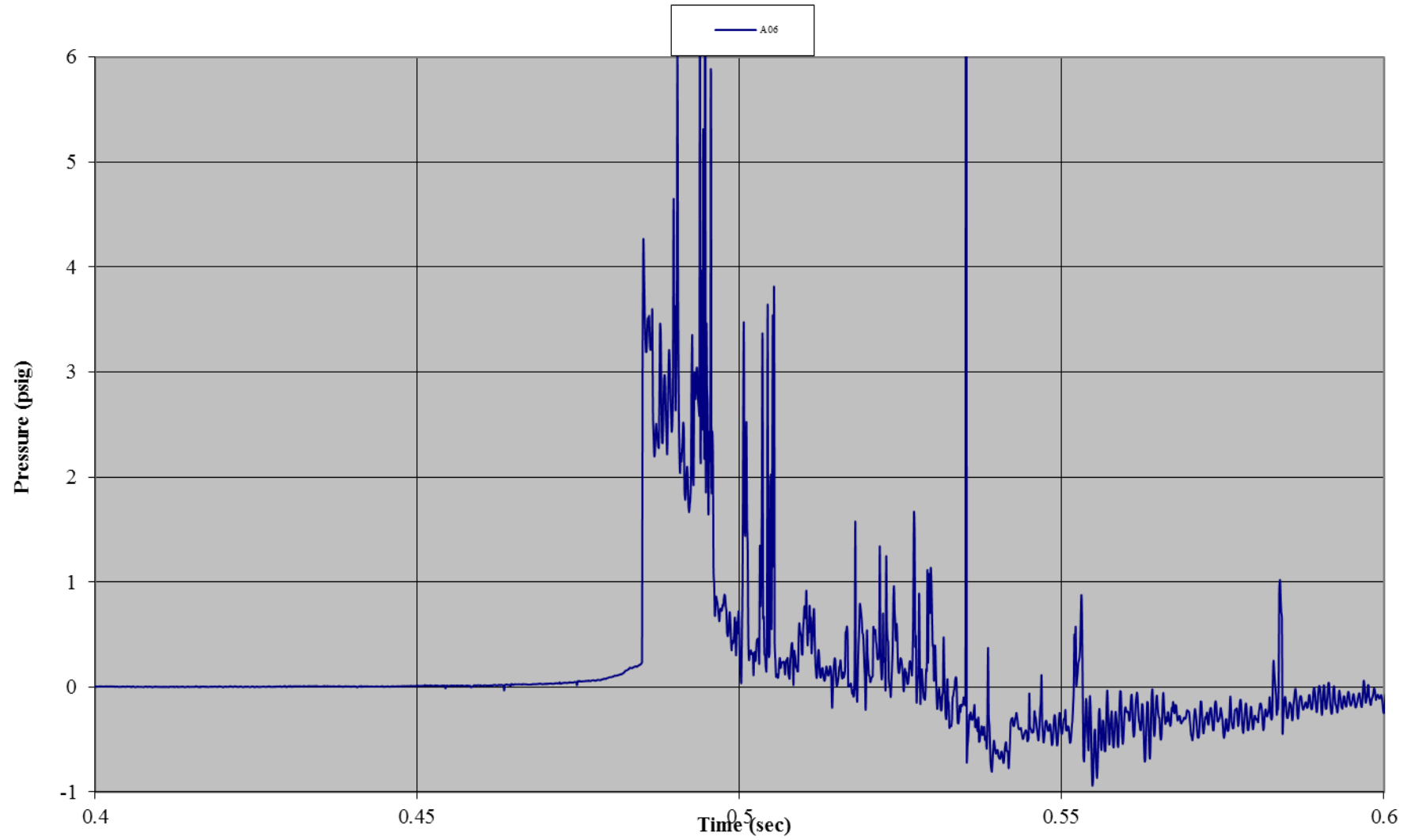
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 03: Front Wall, Center Ground



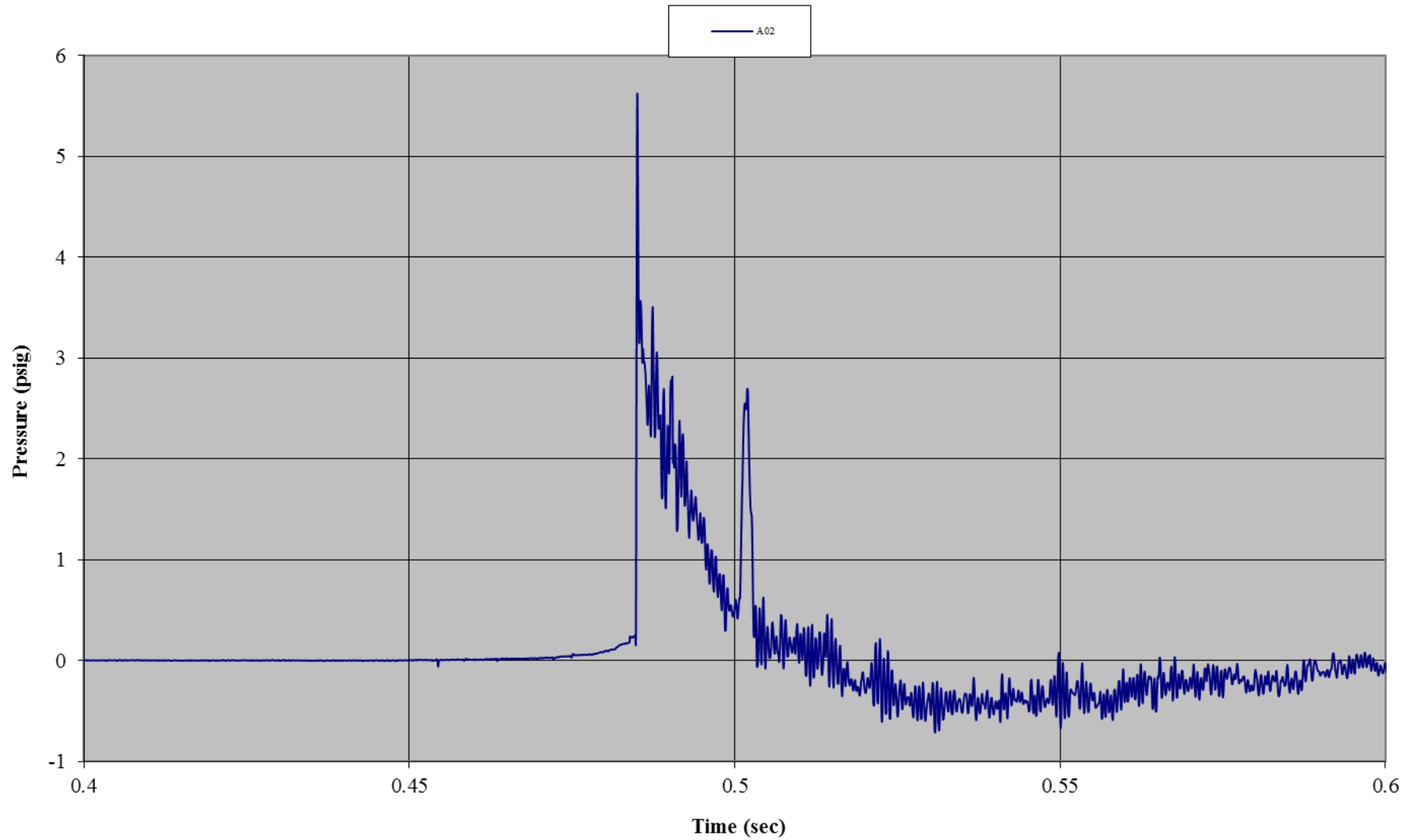
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



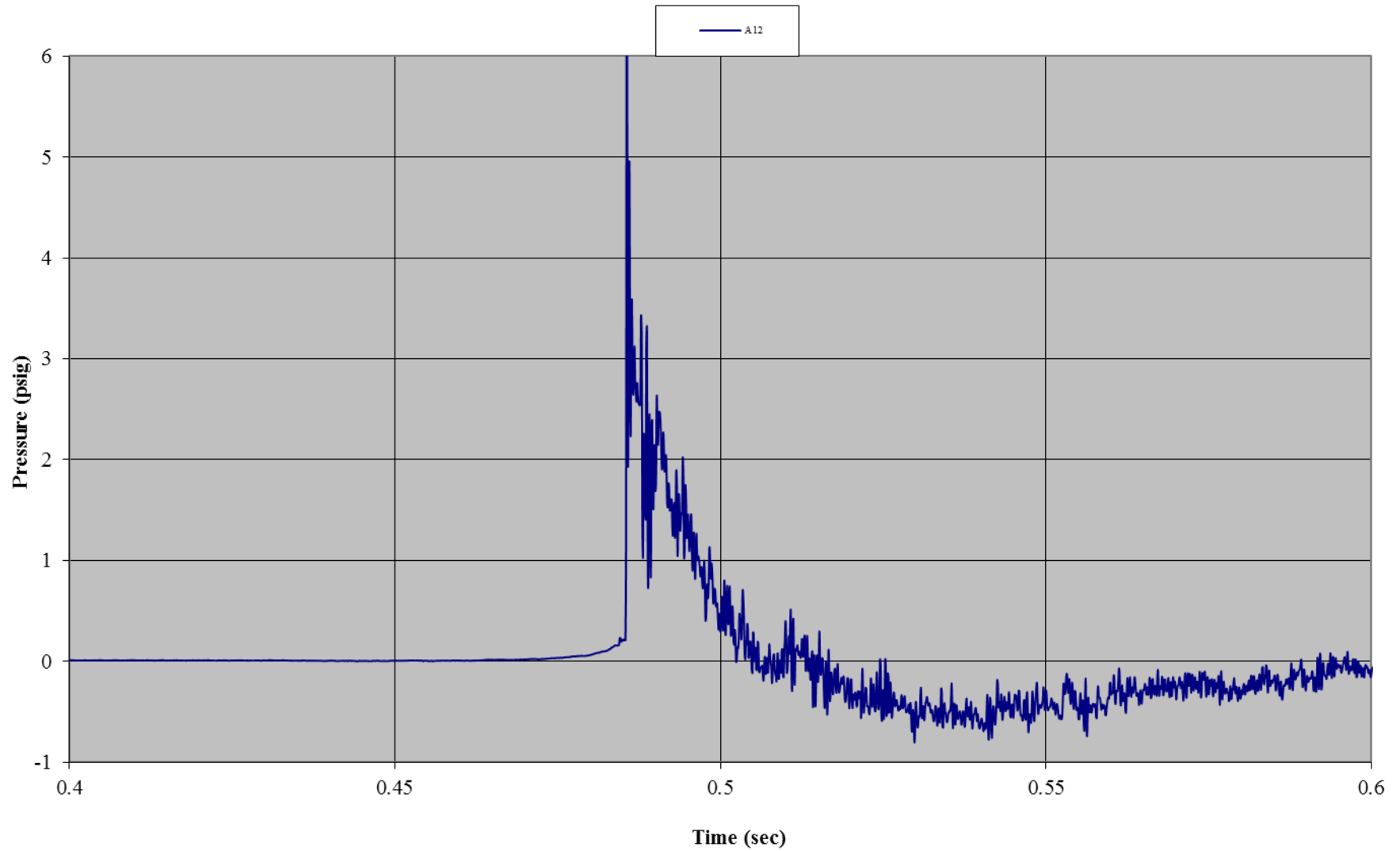
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 06: Front Wall, Center Top



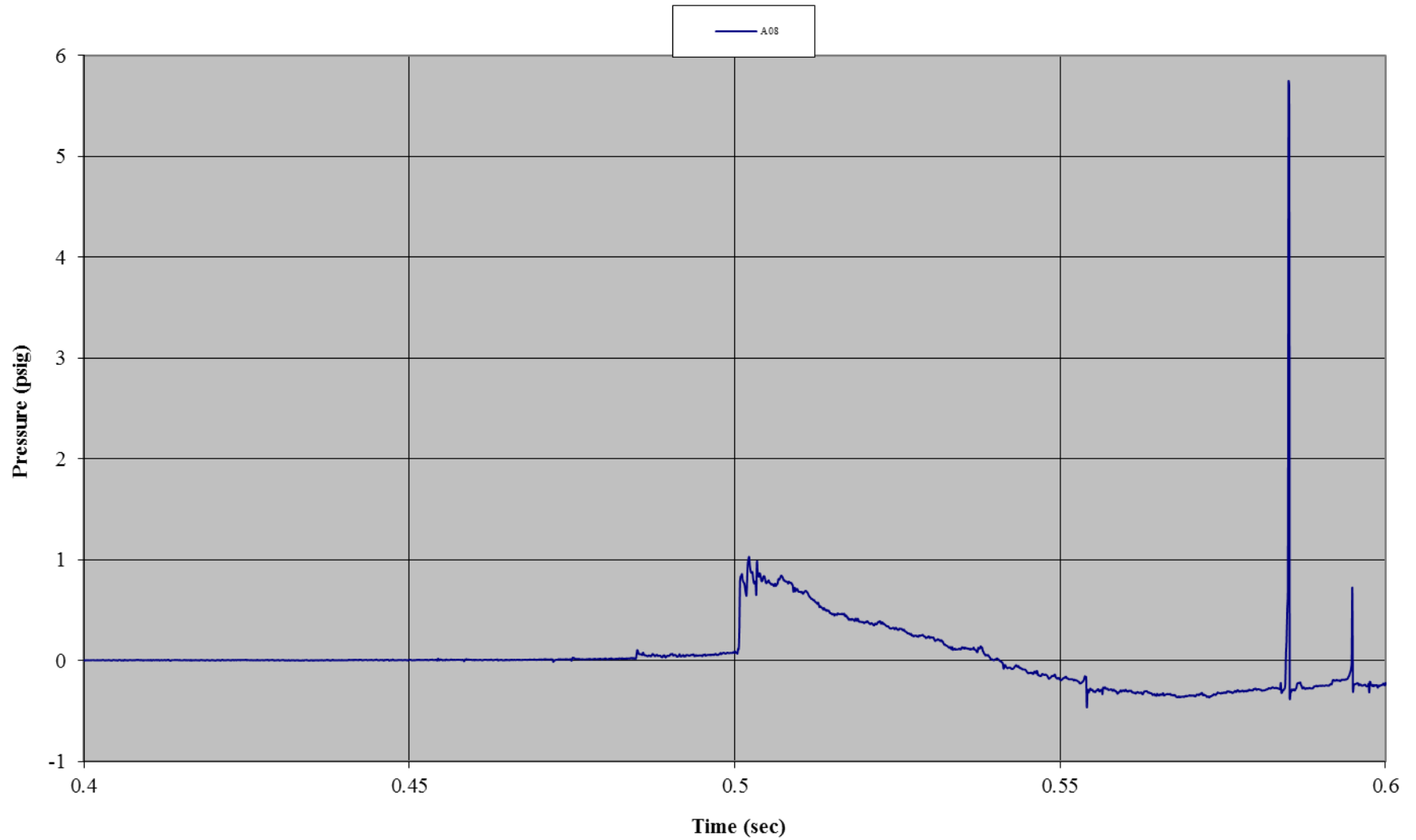
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



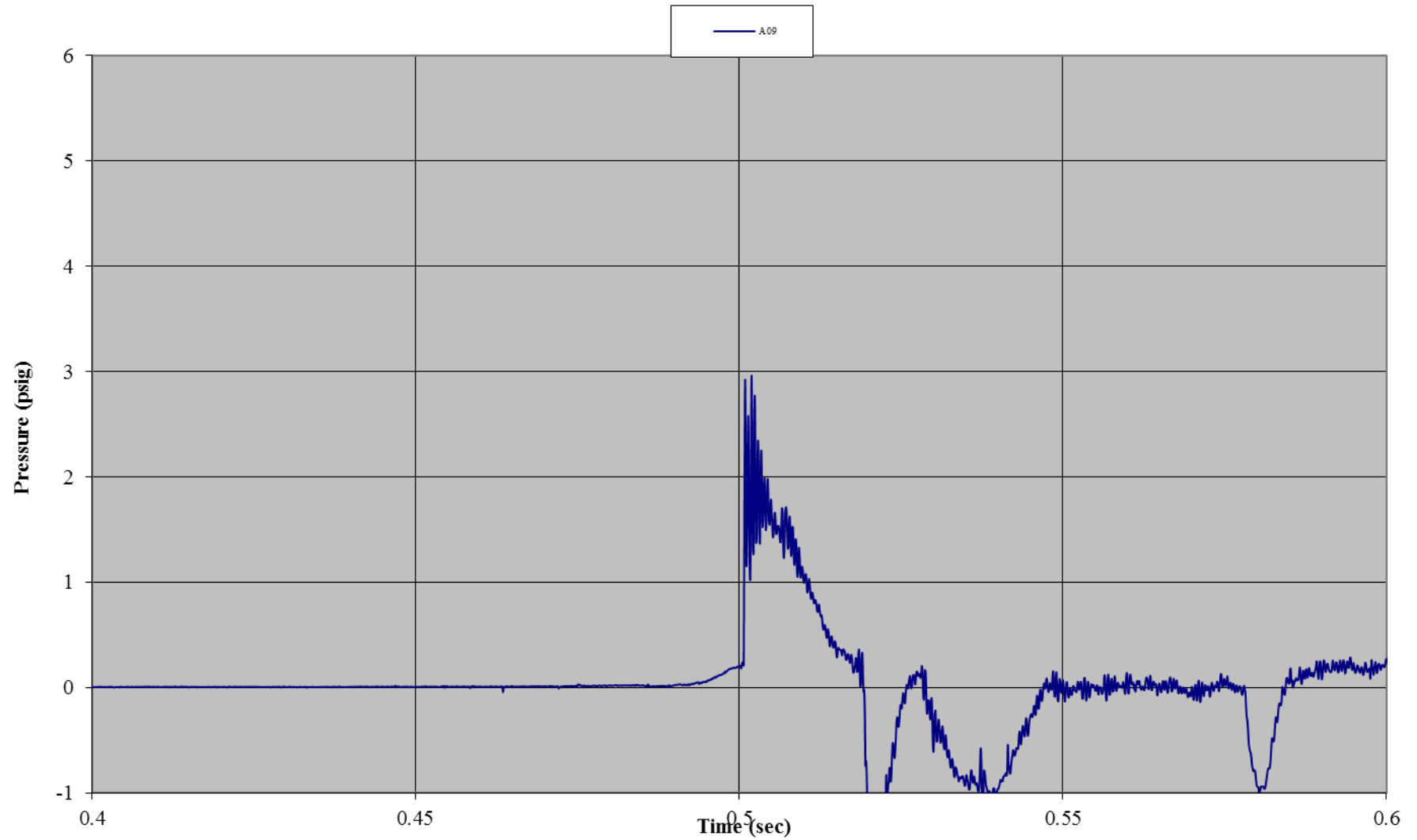
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



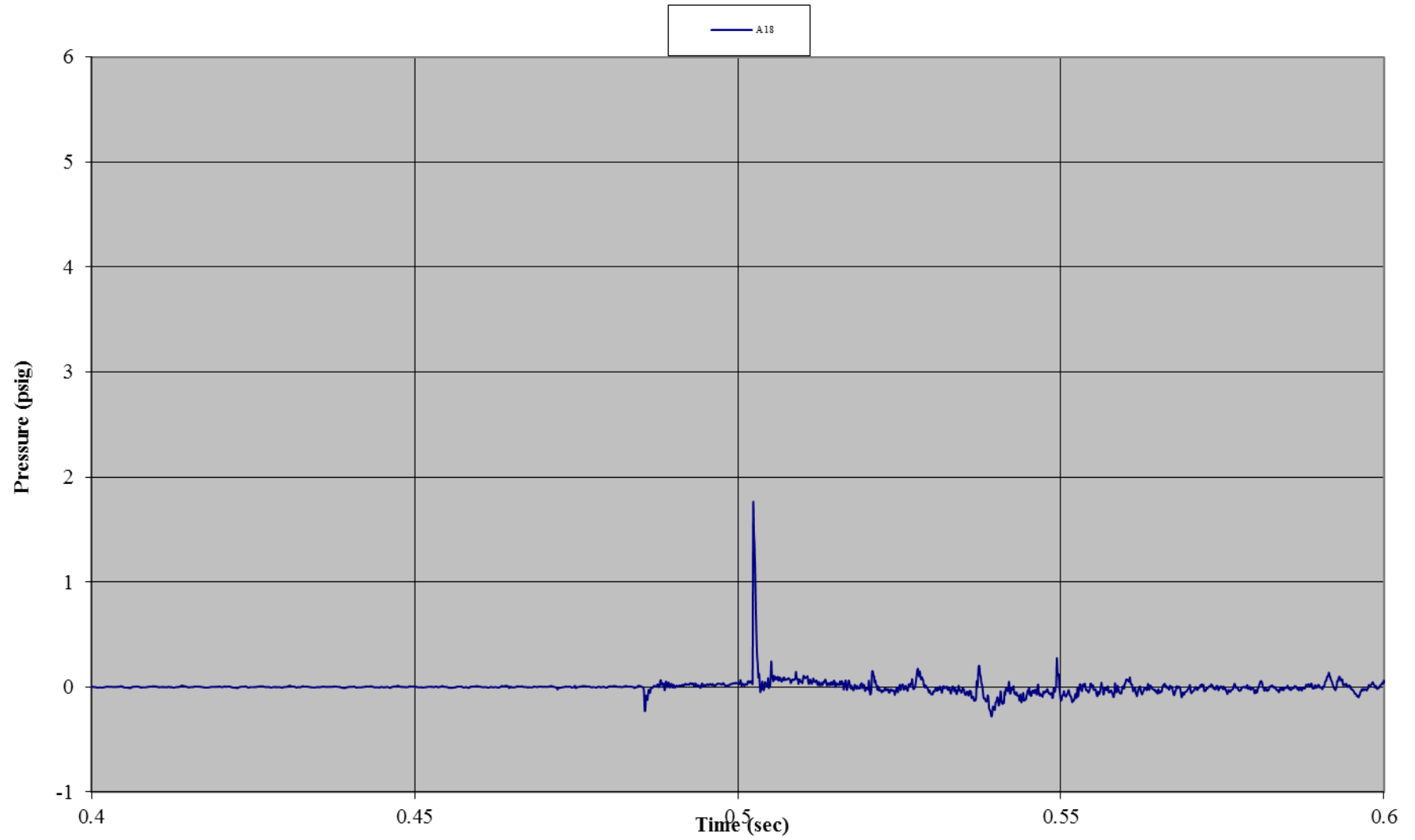
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 08: Left Side Wall, Bottom



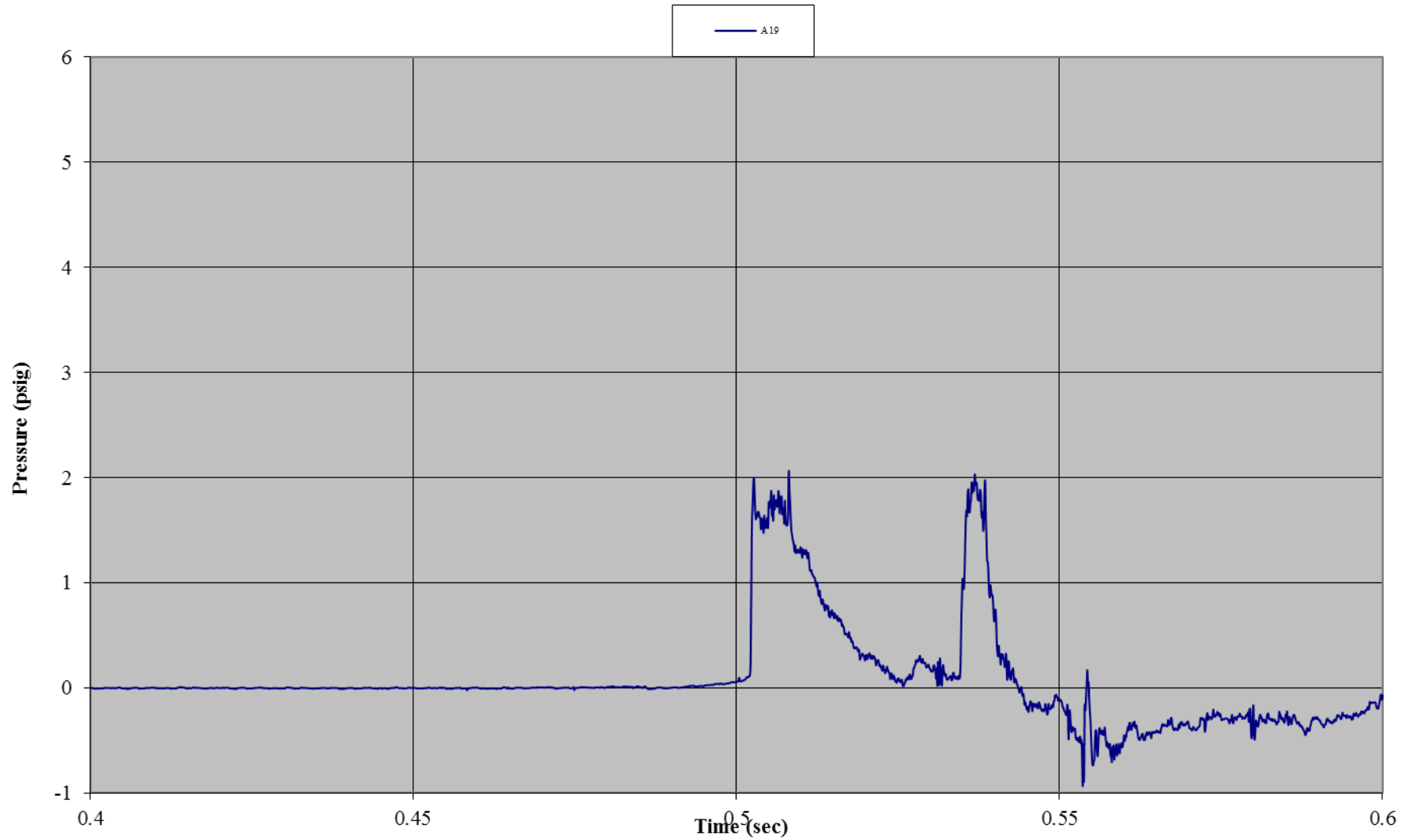
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



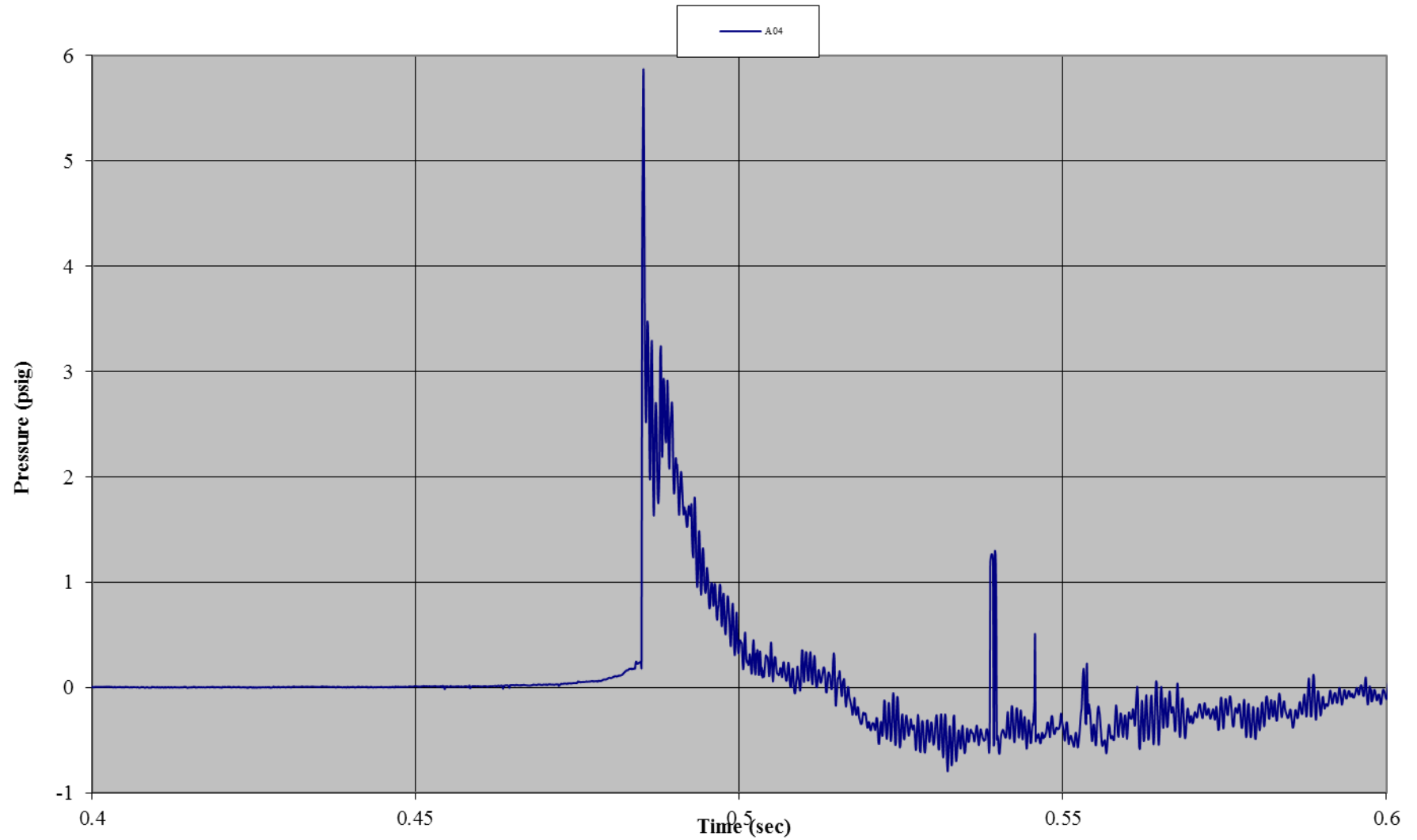
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 18: Right Side Wall, Bottom



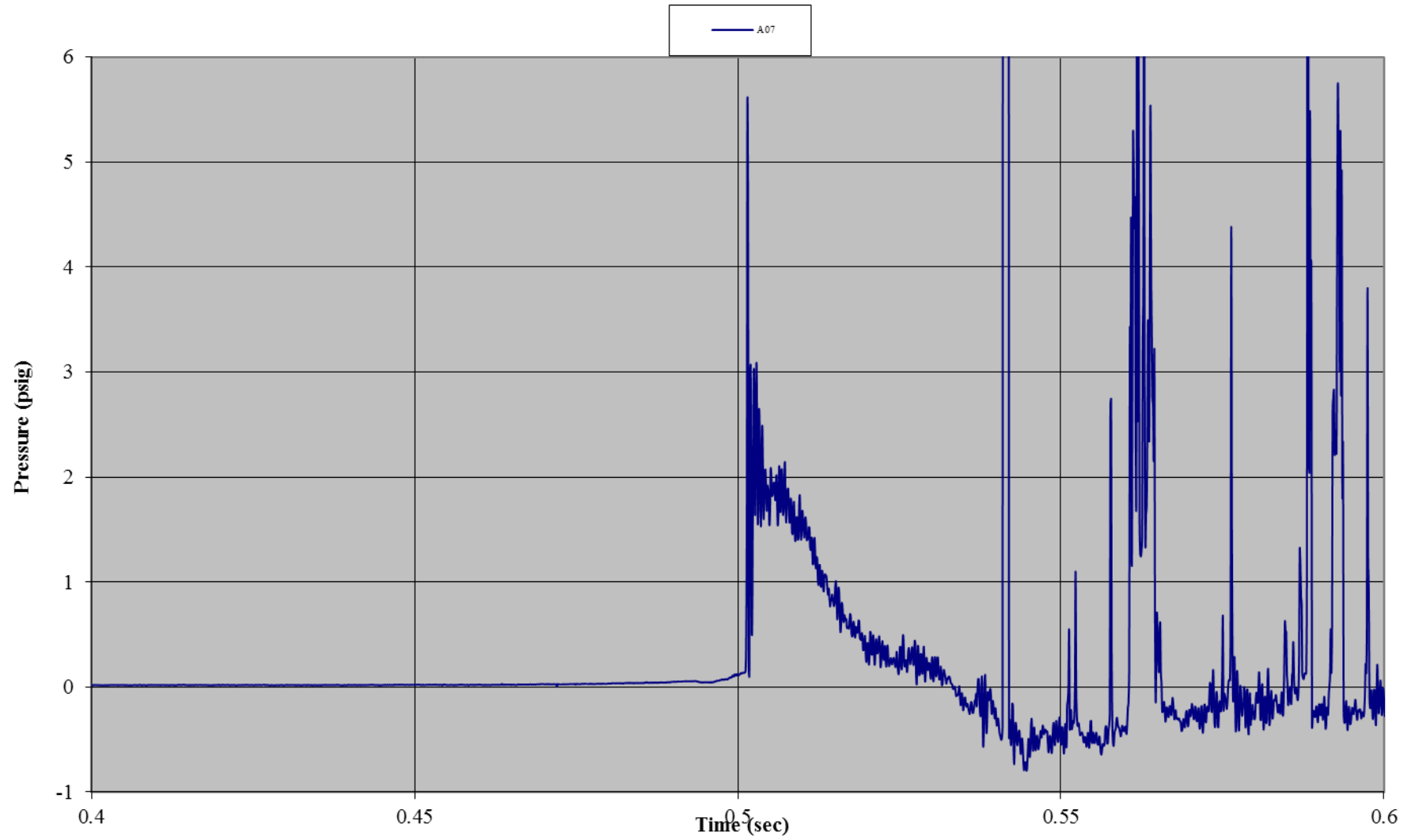
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



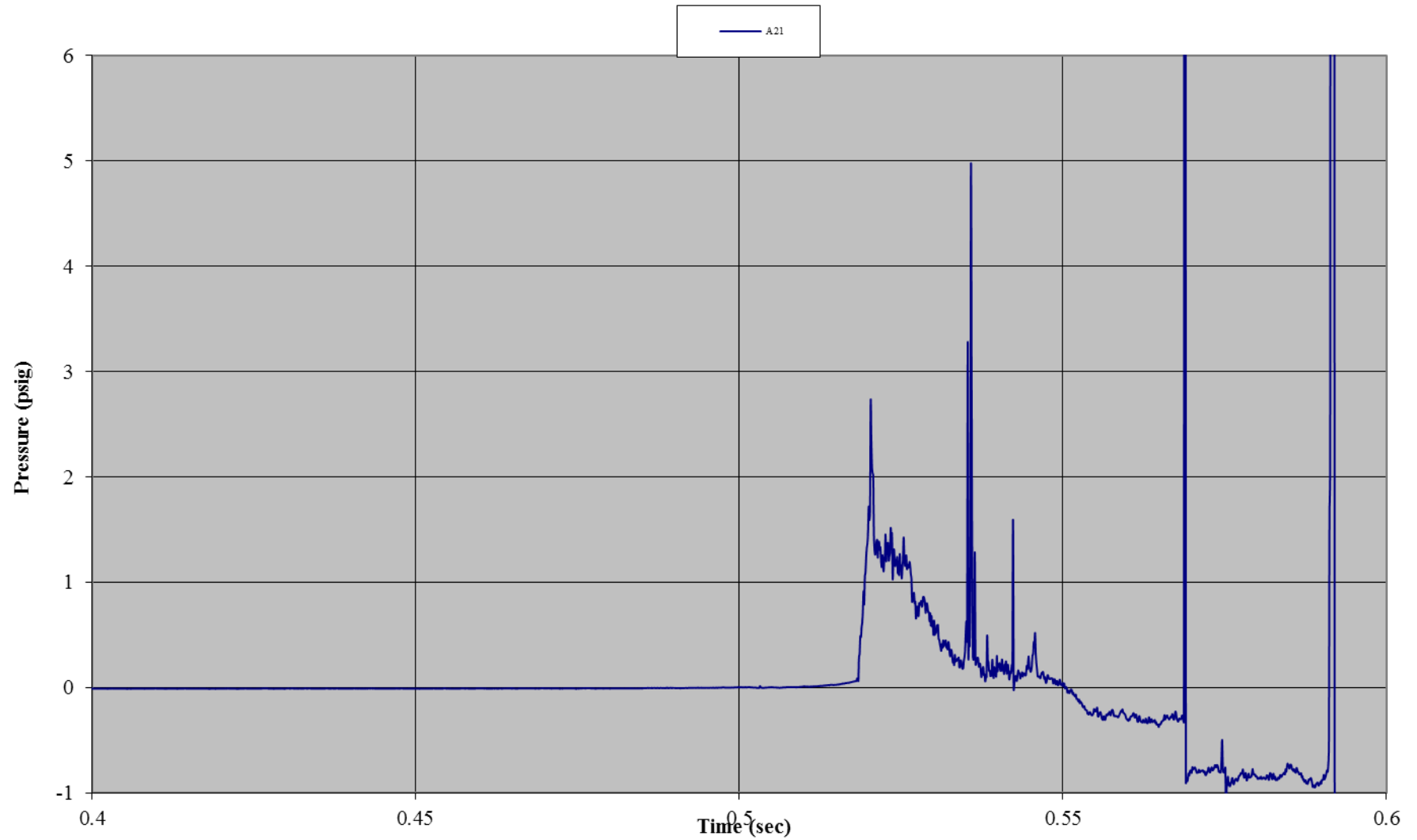
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 04: Front Wall, Center Bottom



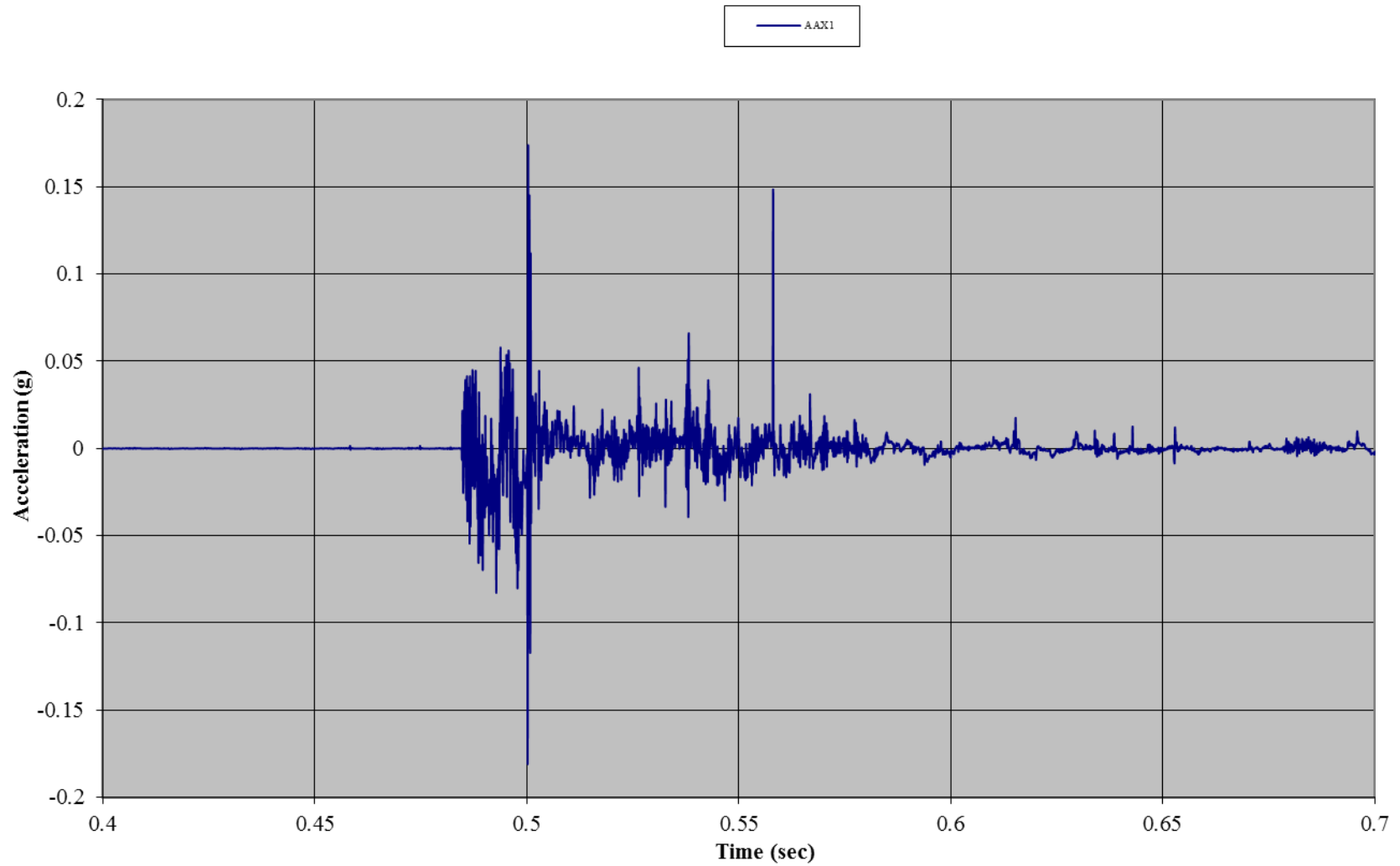
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 07: Front Wall, Top Edge at Center



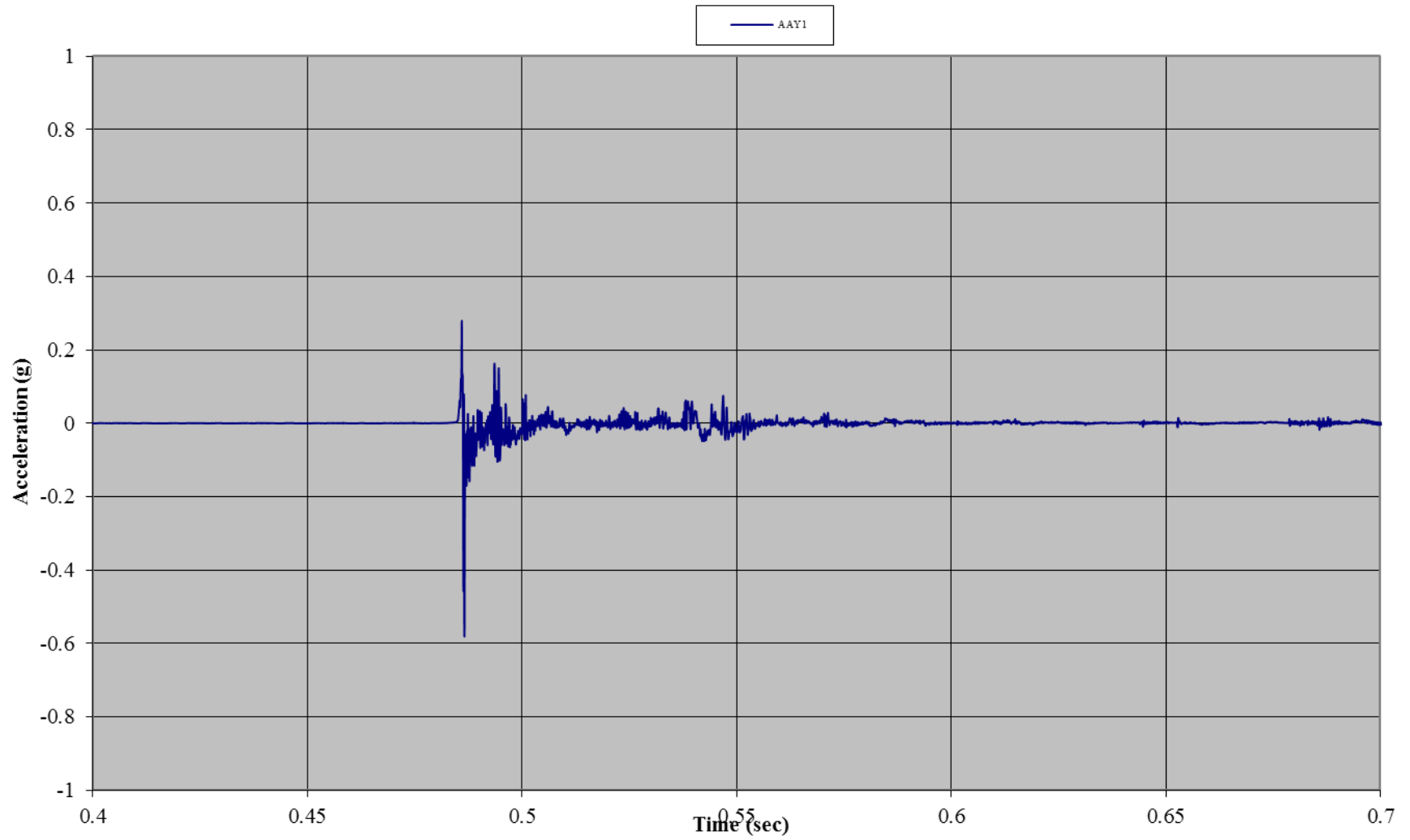
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



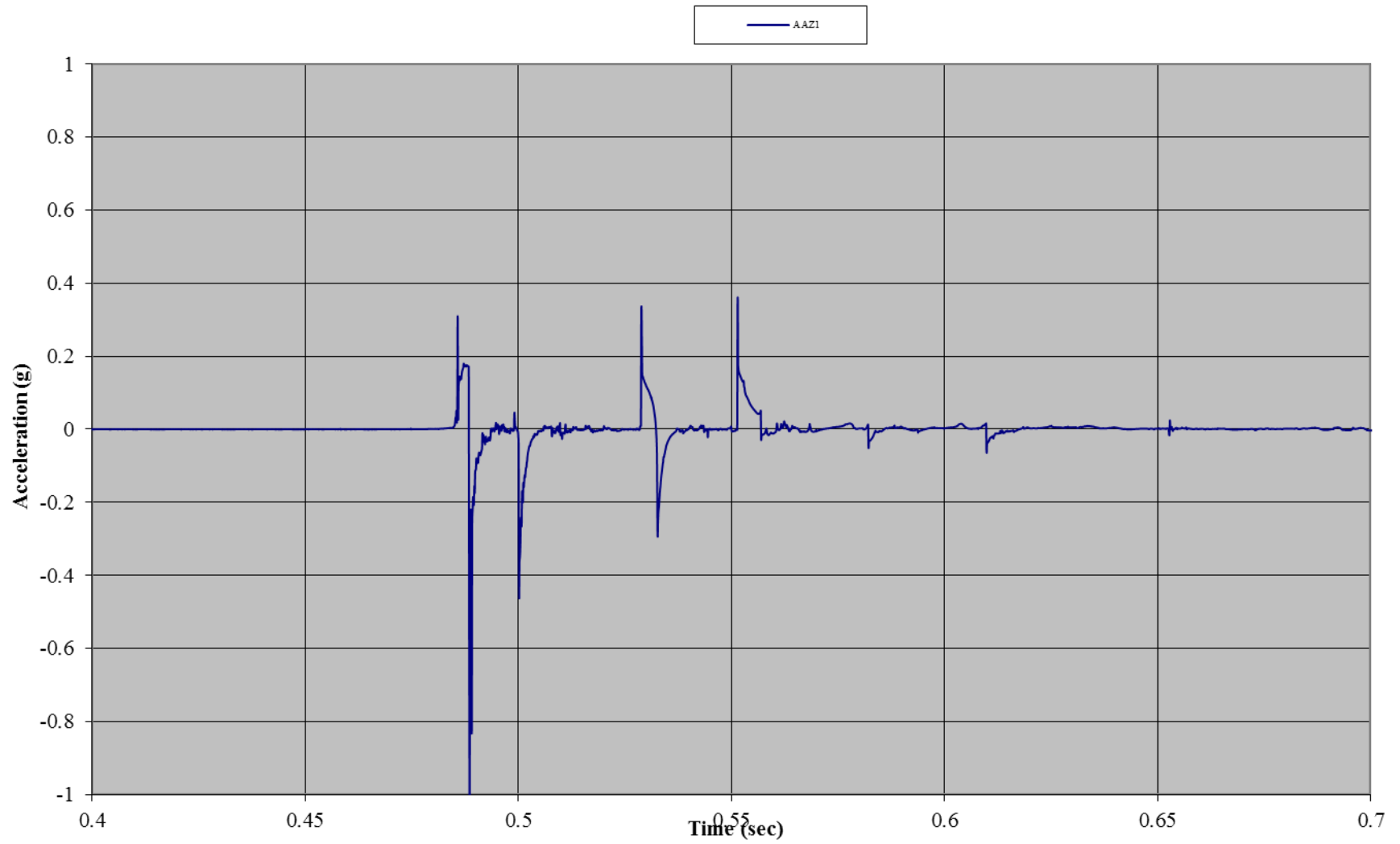
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (x-direction)



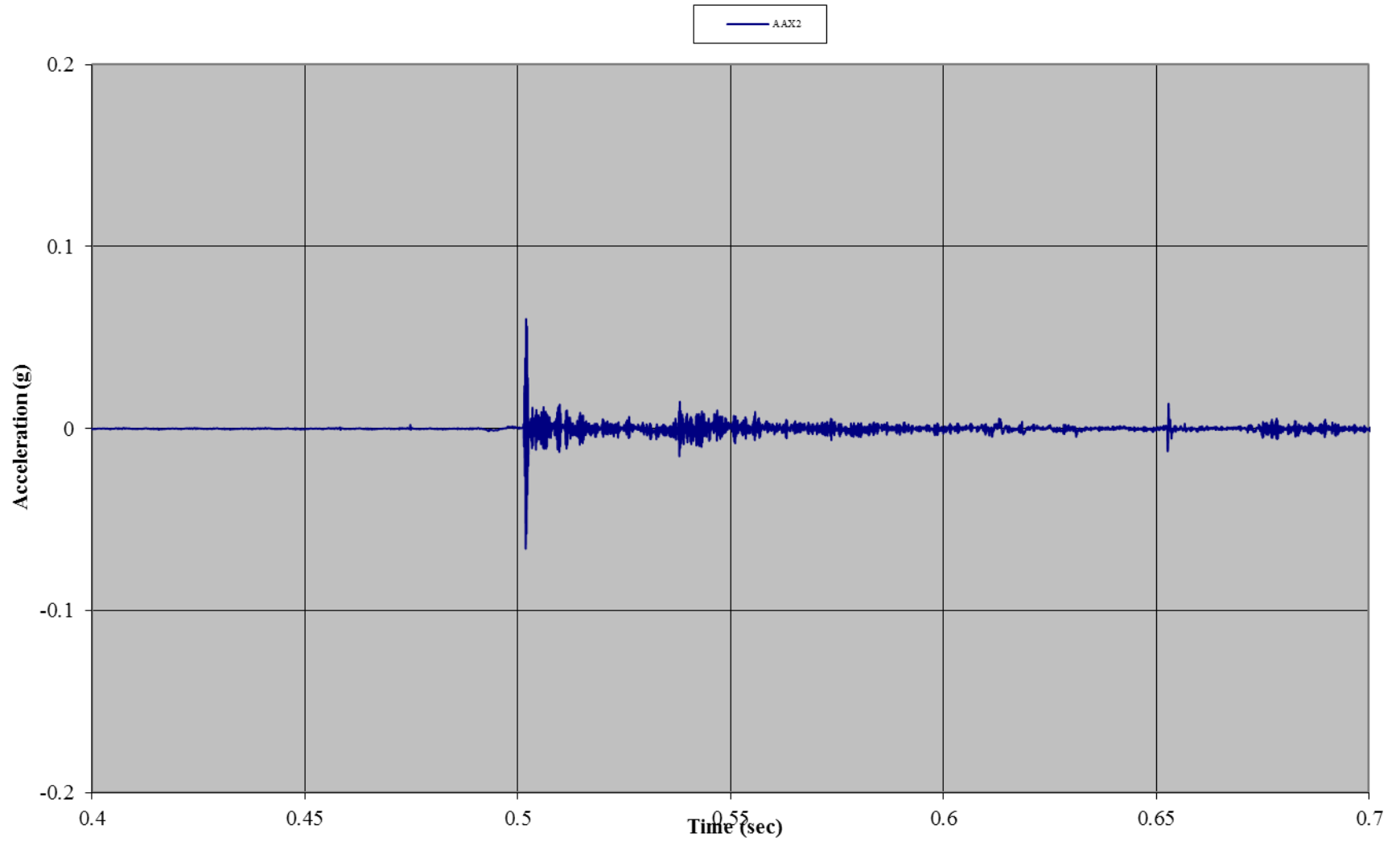
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (y-direction)



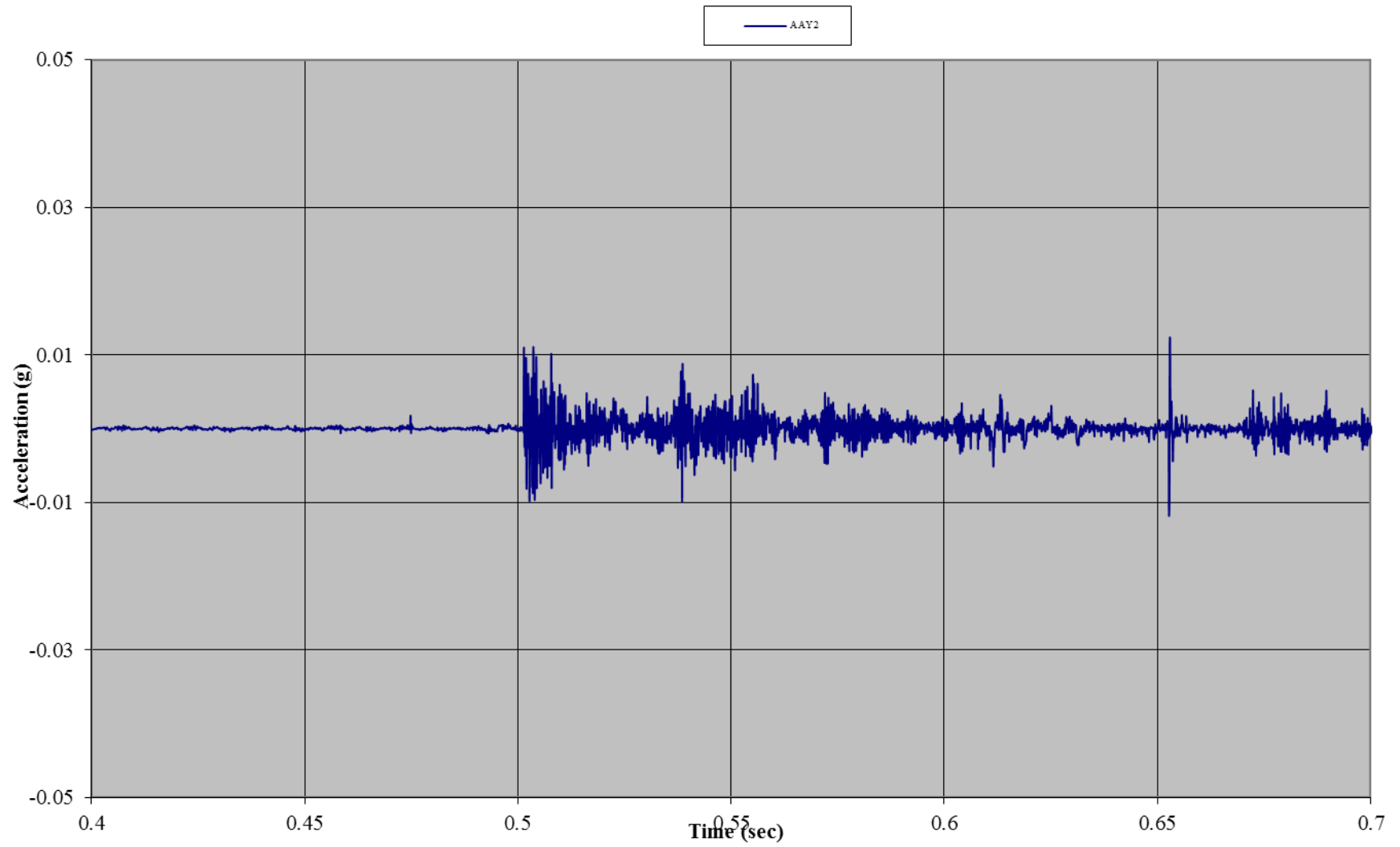
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (z-direction)



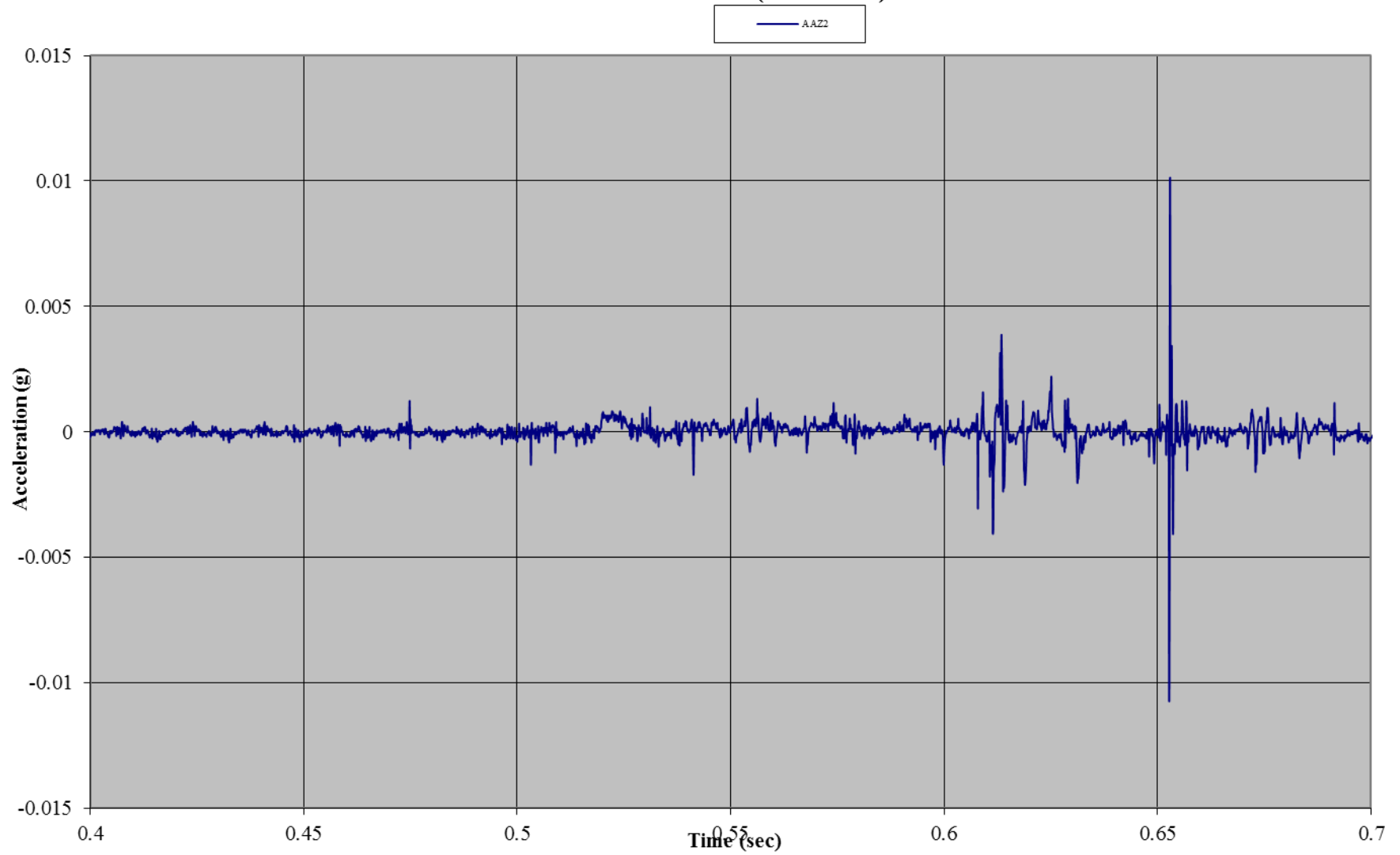
Test C01: 90 mph-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (x-direction)



Test C01: 90 mph-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (y-direction)

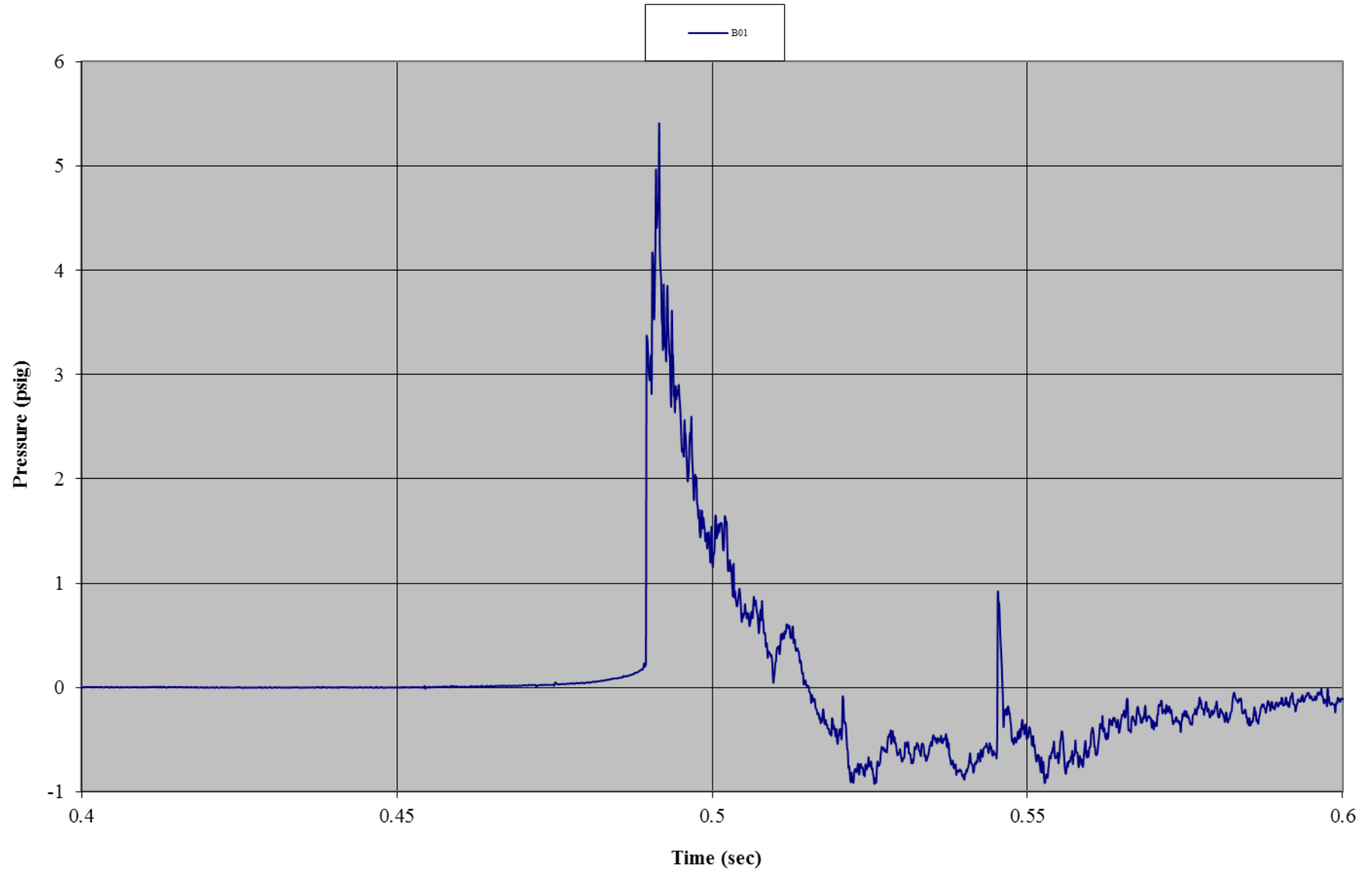


Test C01: 90 mph-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (z-direction)

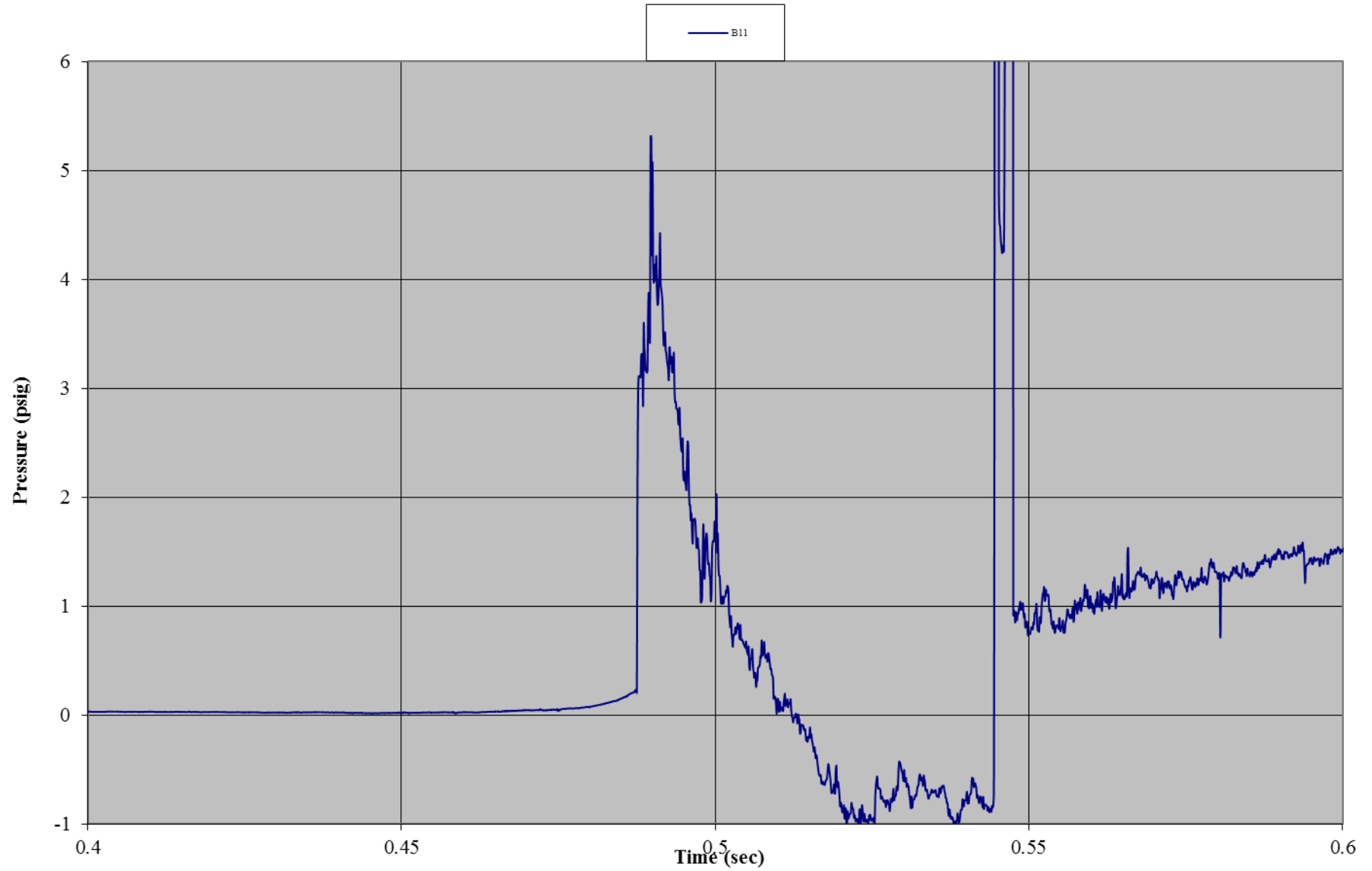


Test C01: Tent B

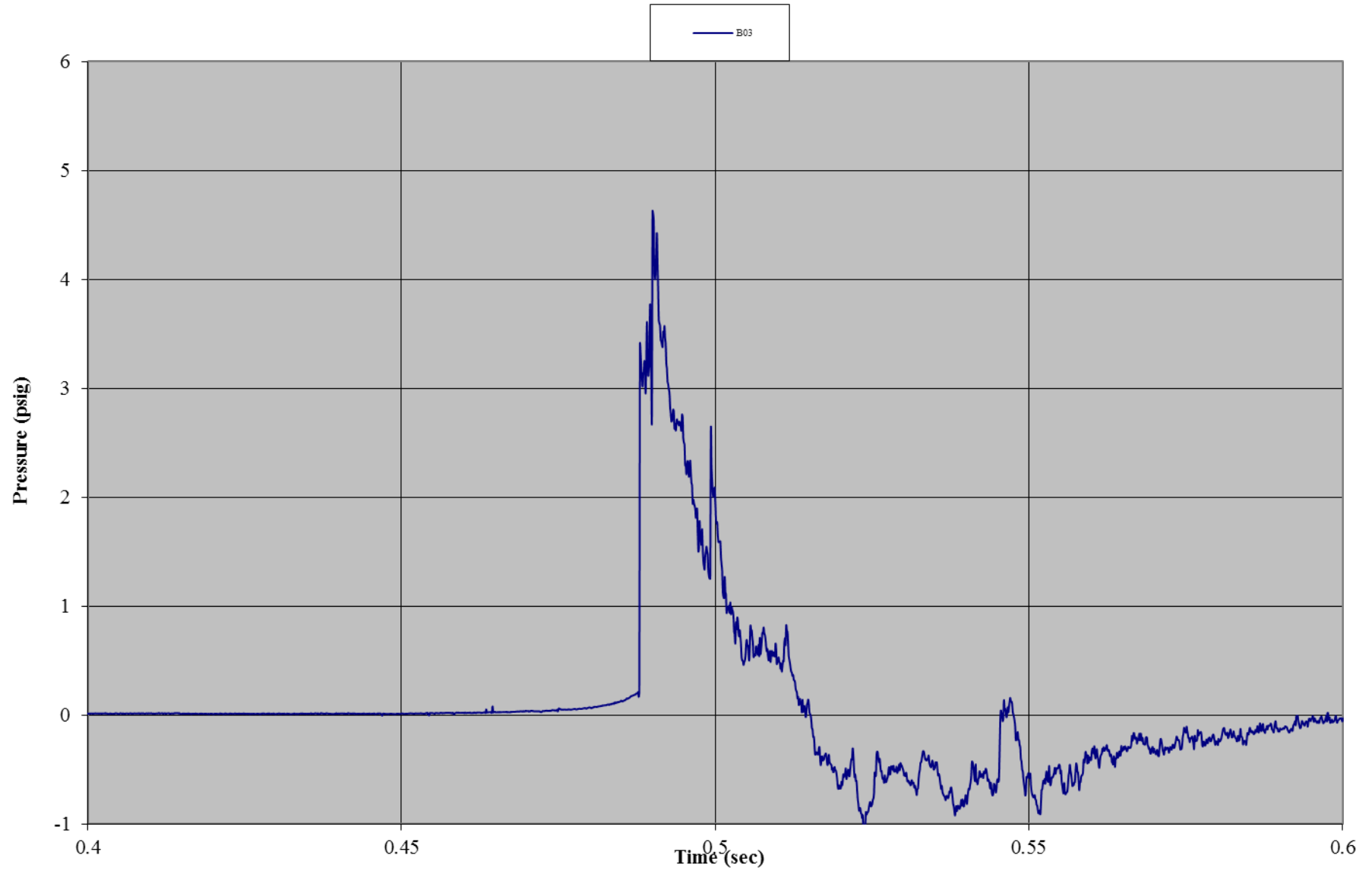
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 01: Front Wall, Left Bottom



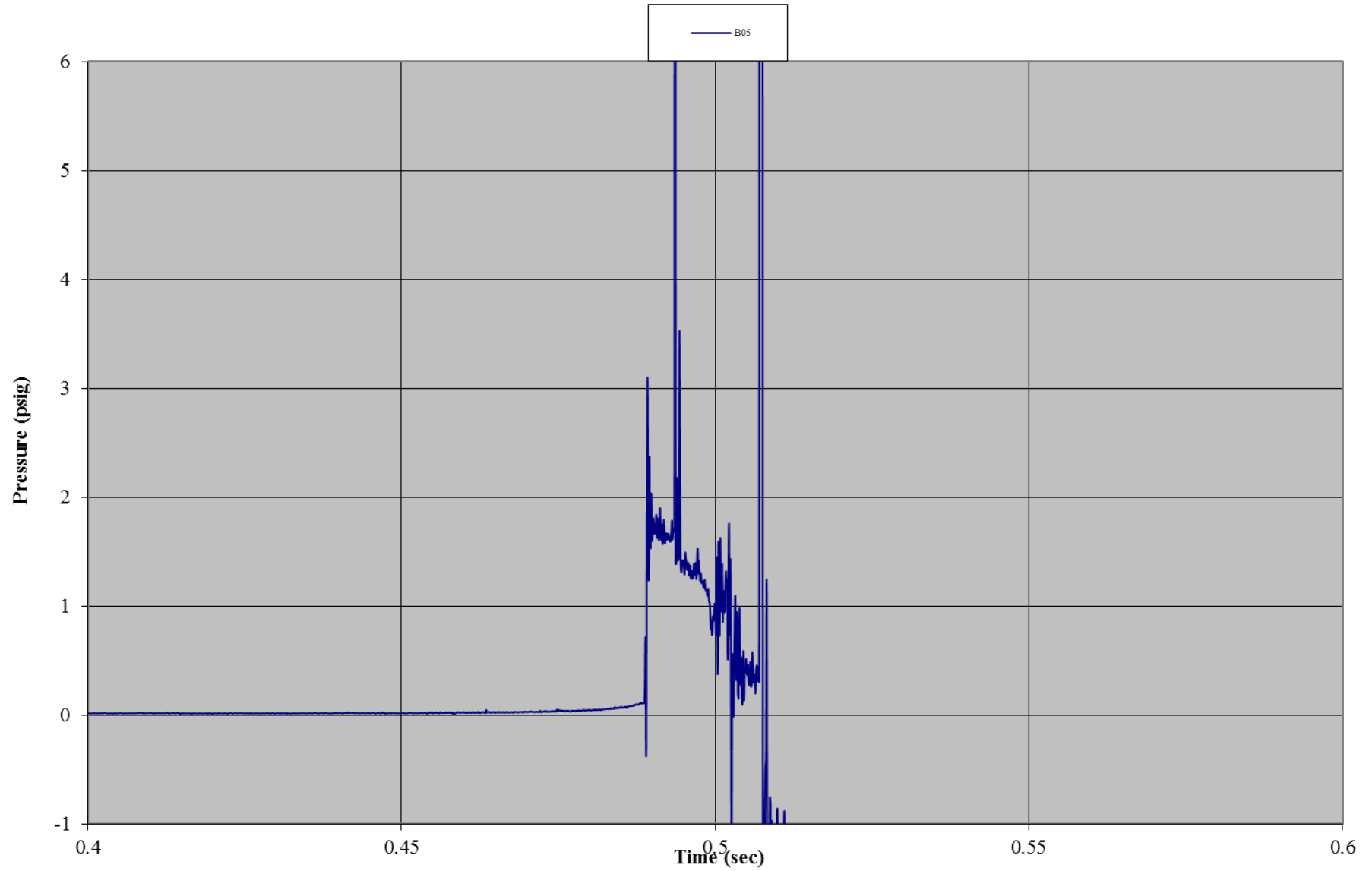
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 11: Front Wall, Right Bottom



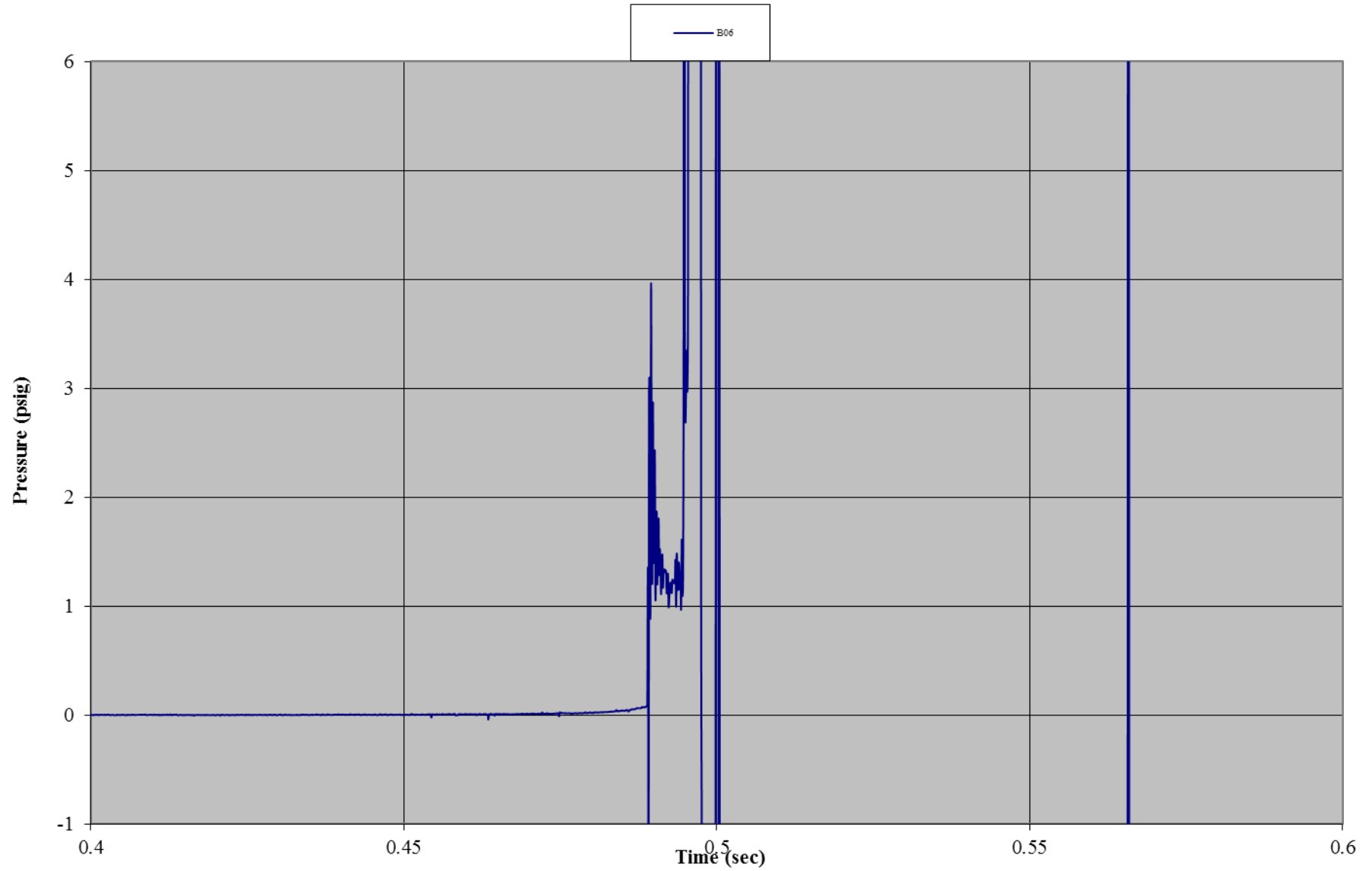
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 03: Front Wall, Center Ground



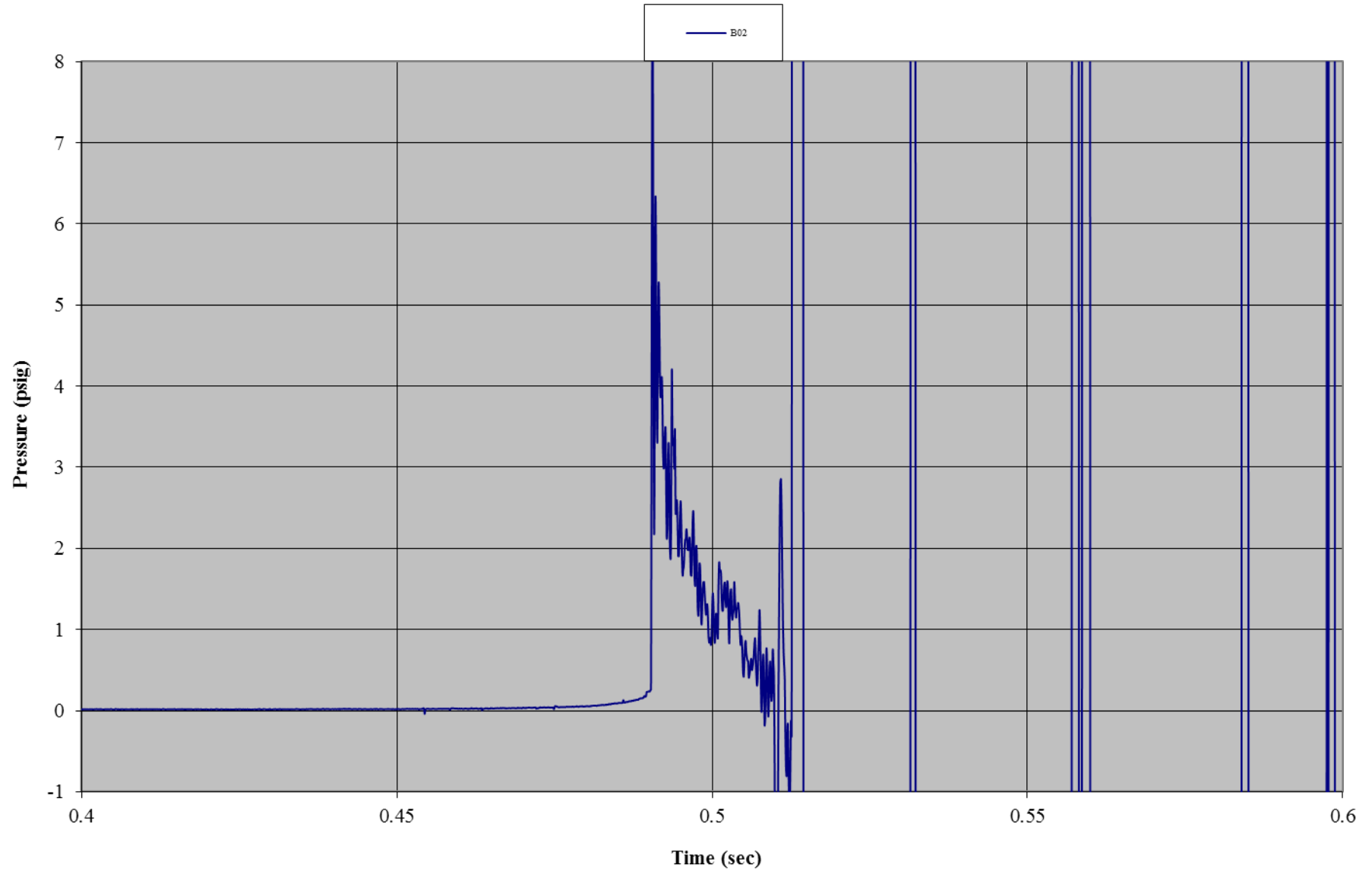
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



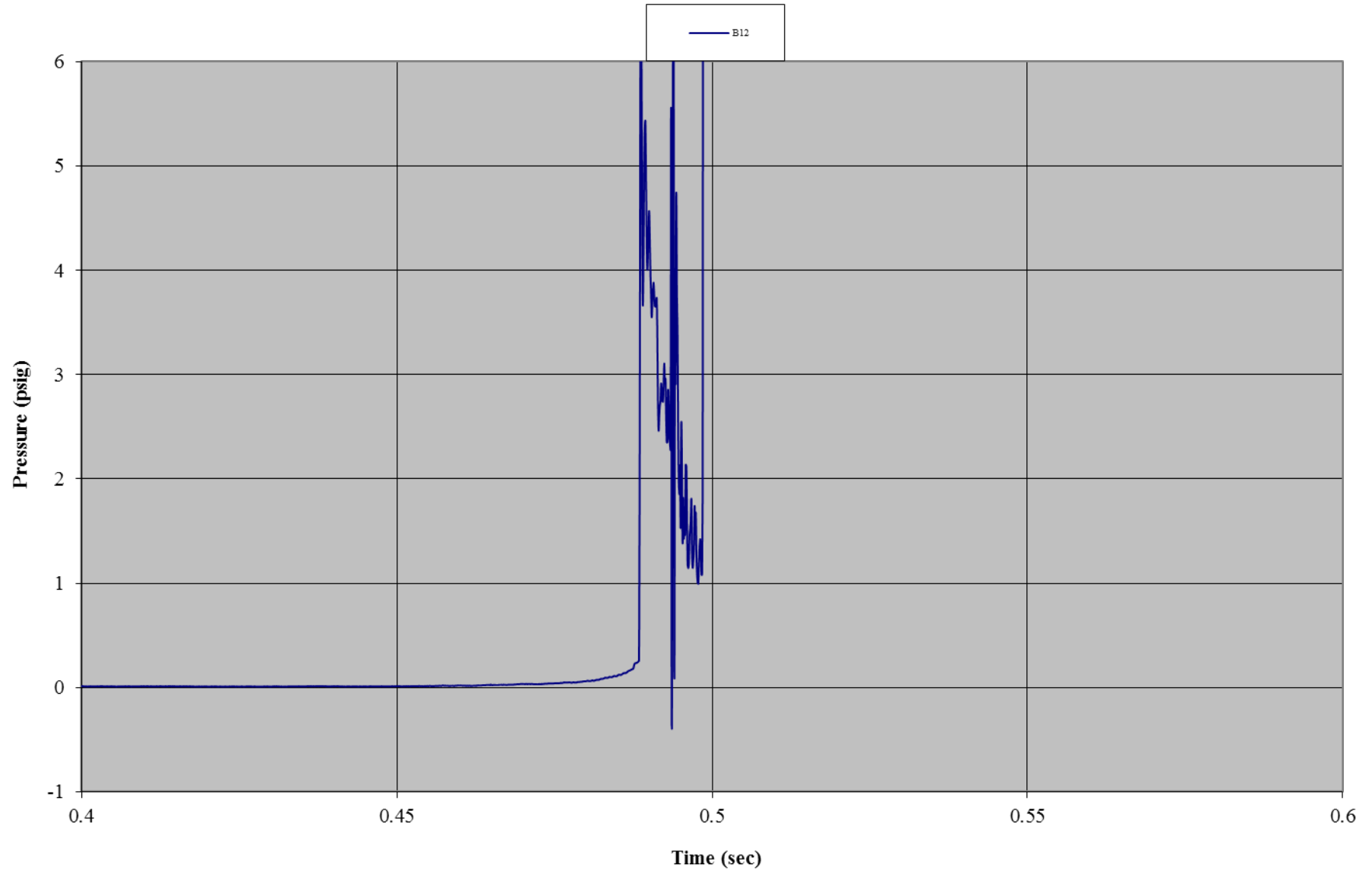
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 06: Front Wall, Center Top



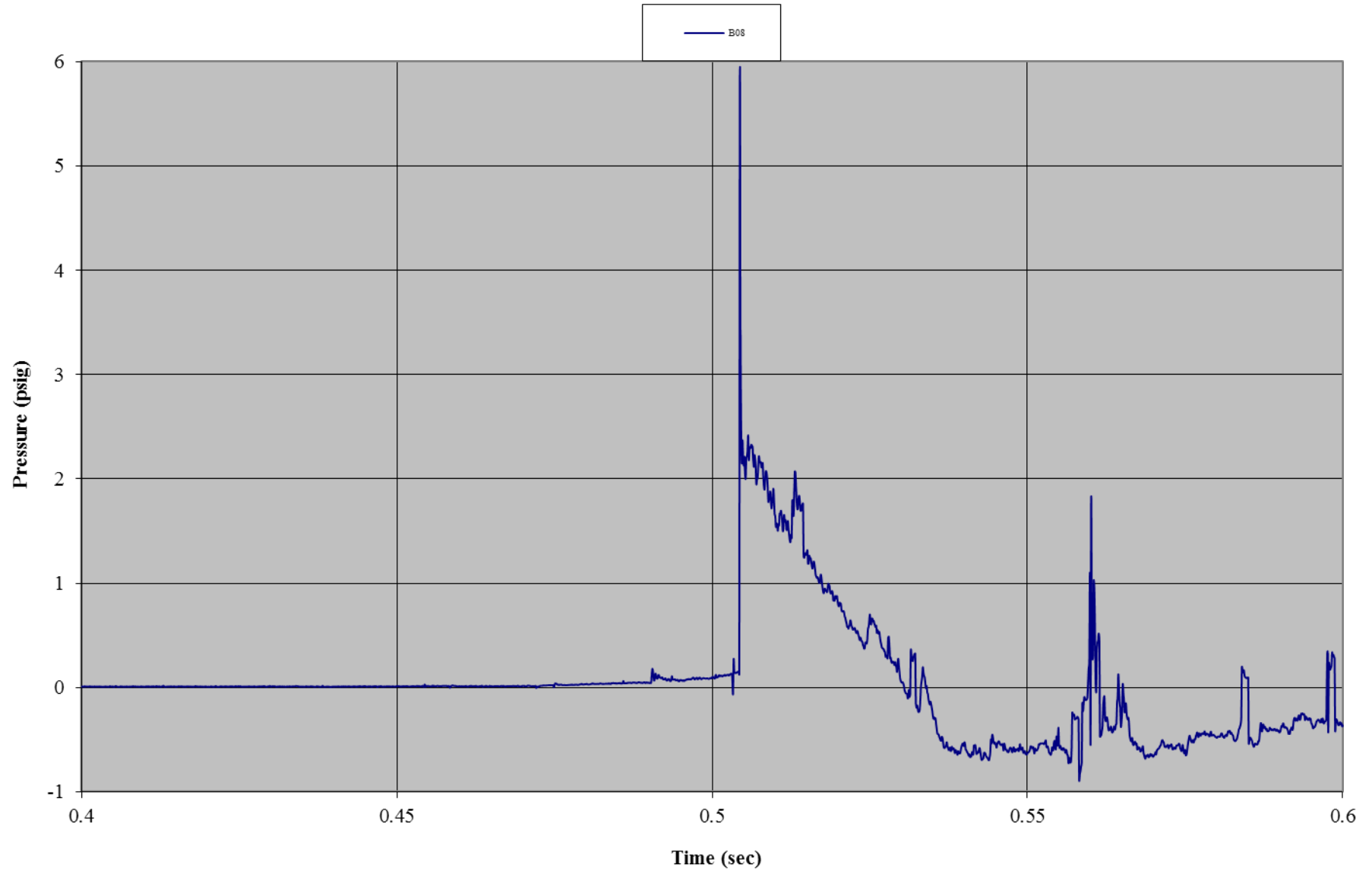
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



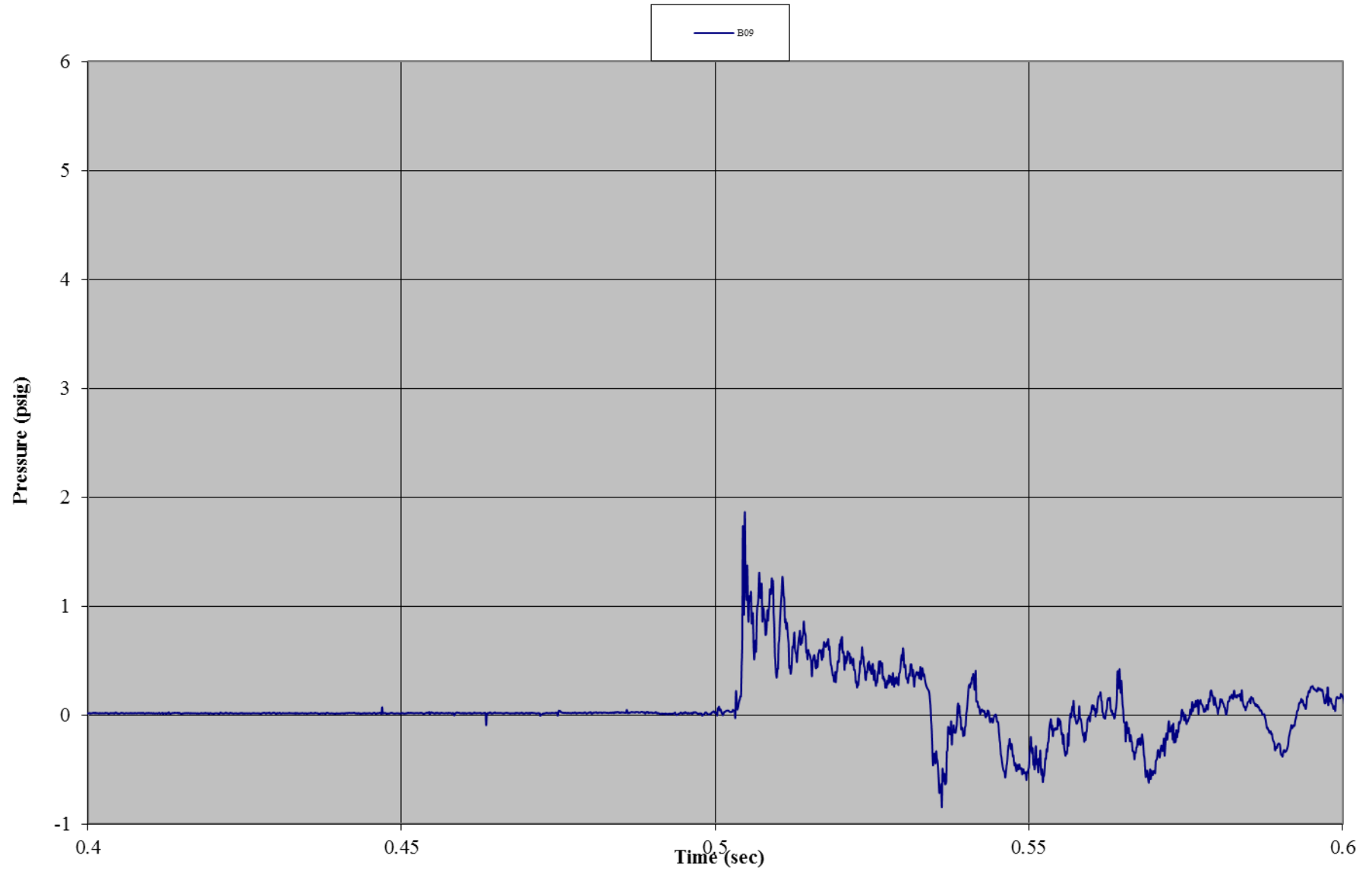
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



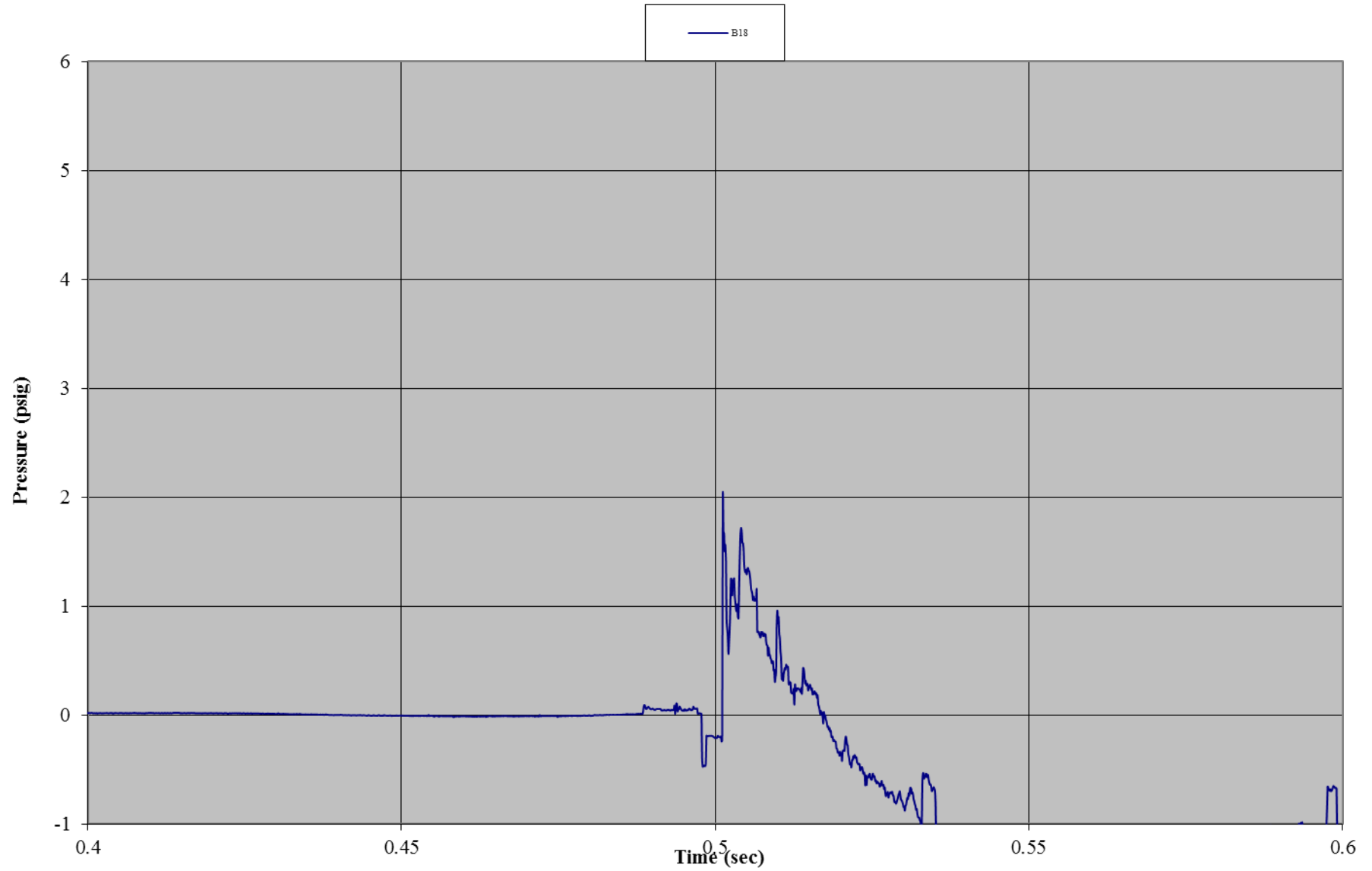
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 08: Left Side Wall, Bottom



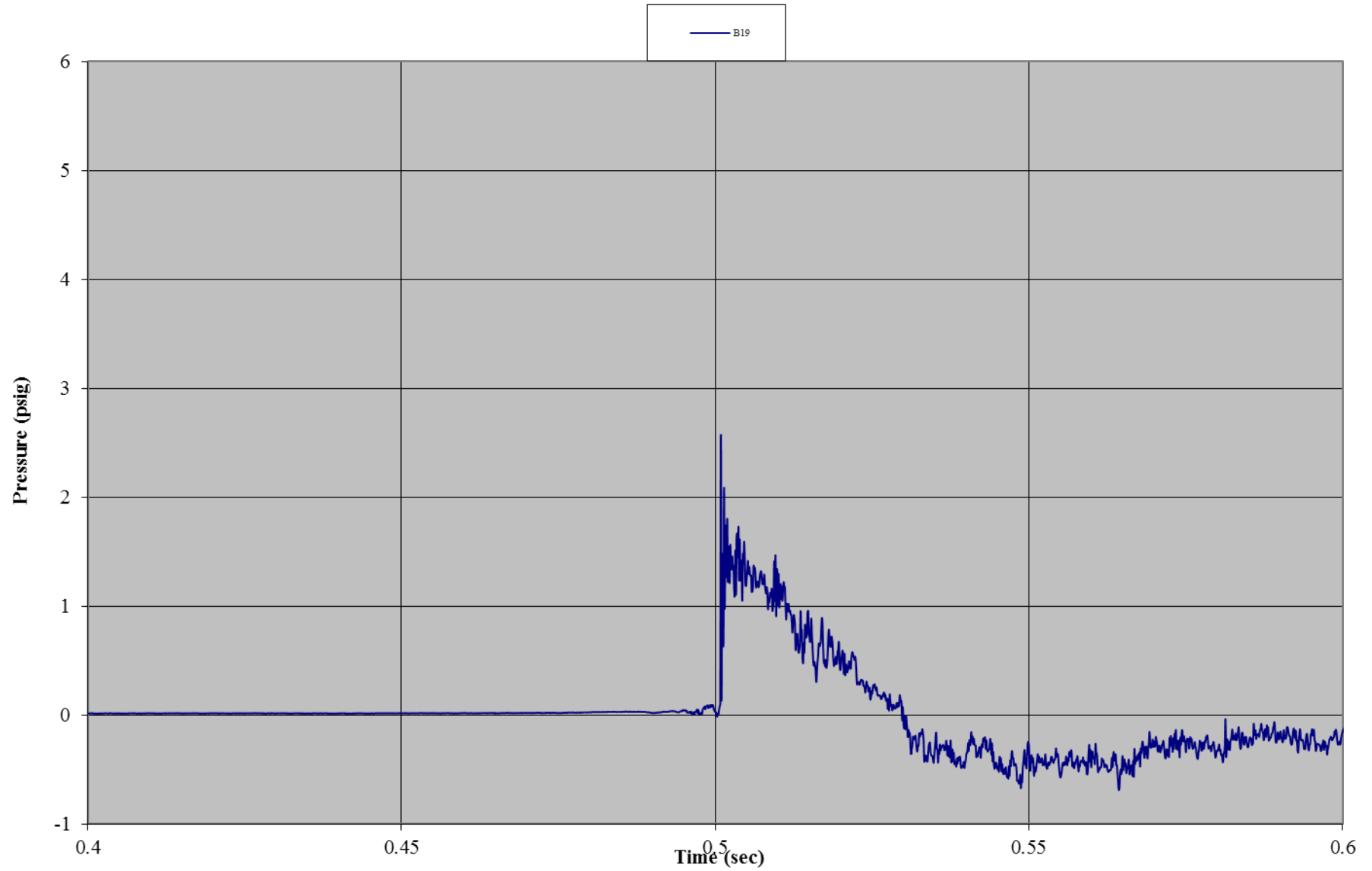
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



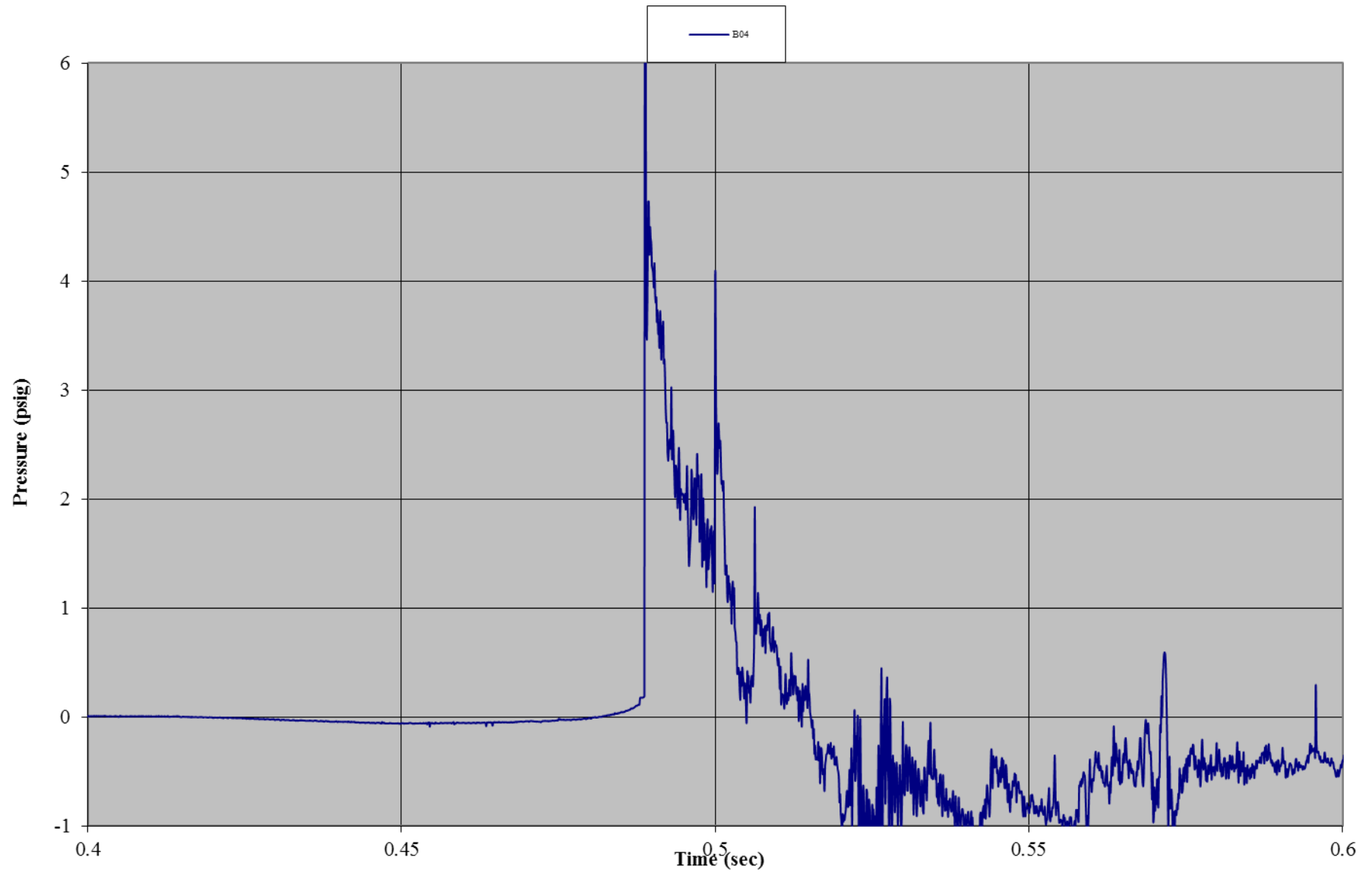
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 18: Right Side Wall, Bottom



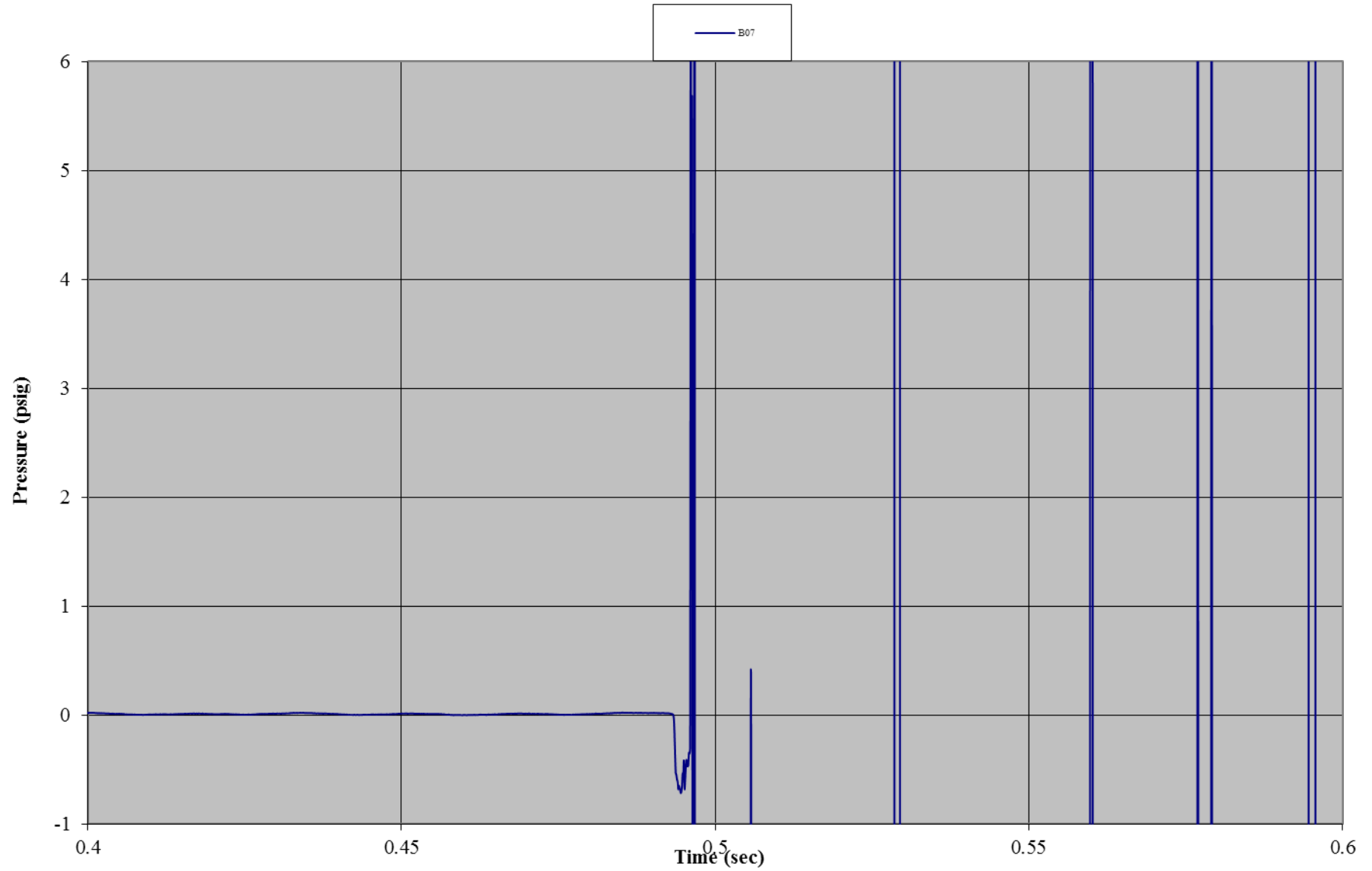
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



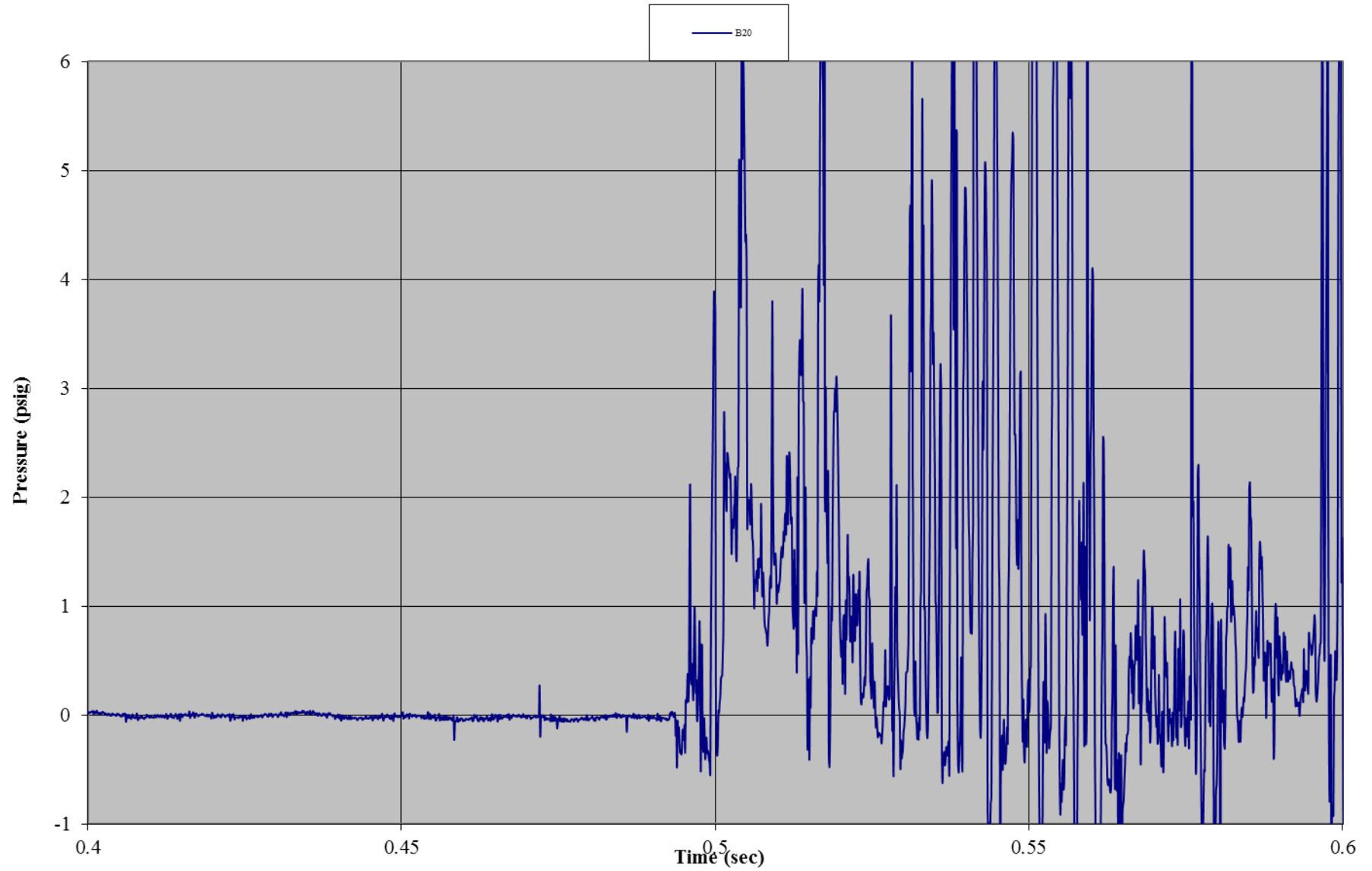
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 04: Front Wall, Center Bottom



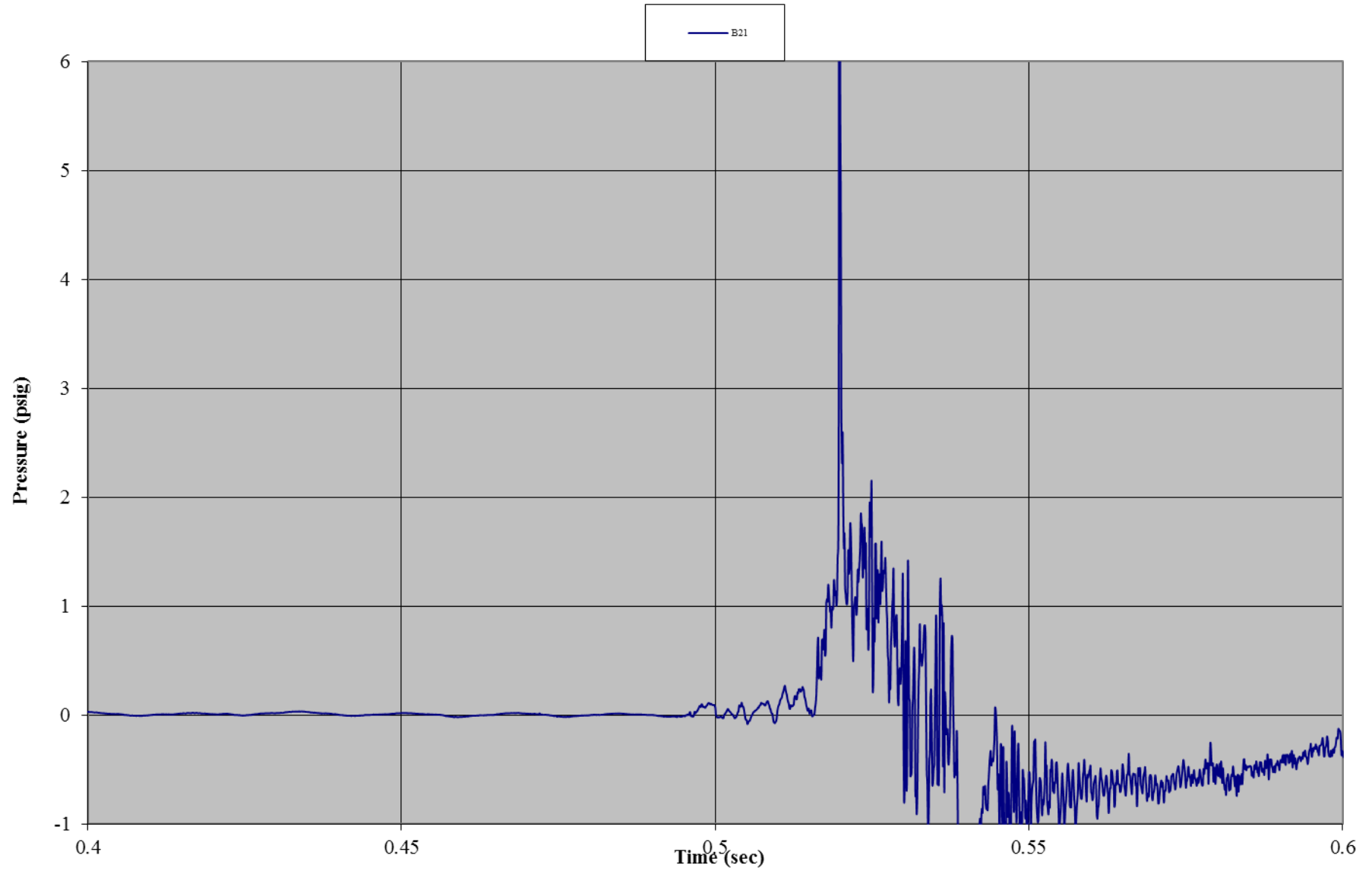
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 07: Roof, Left



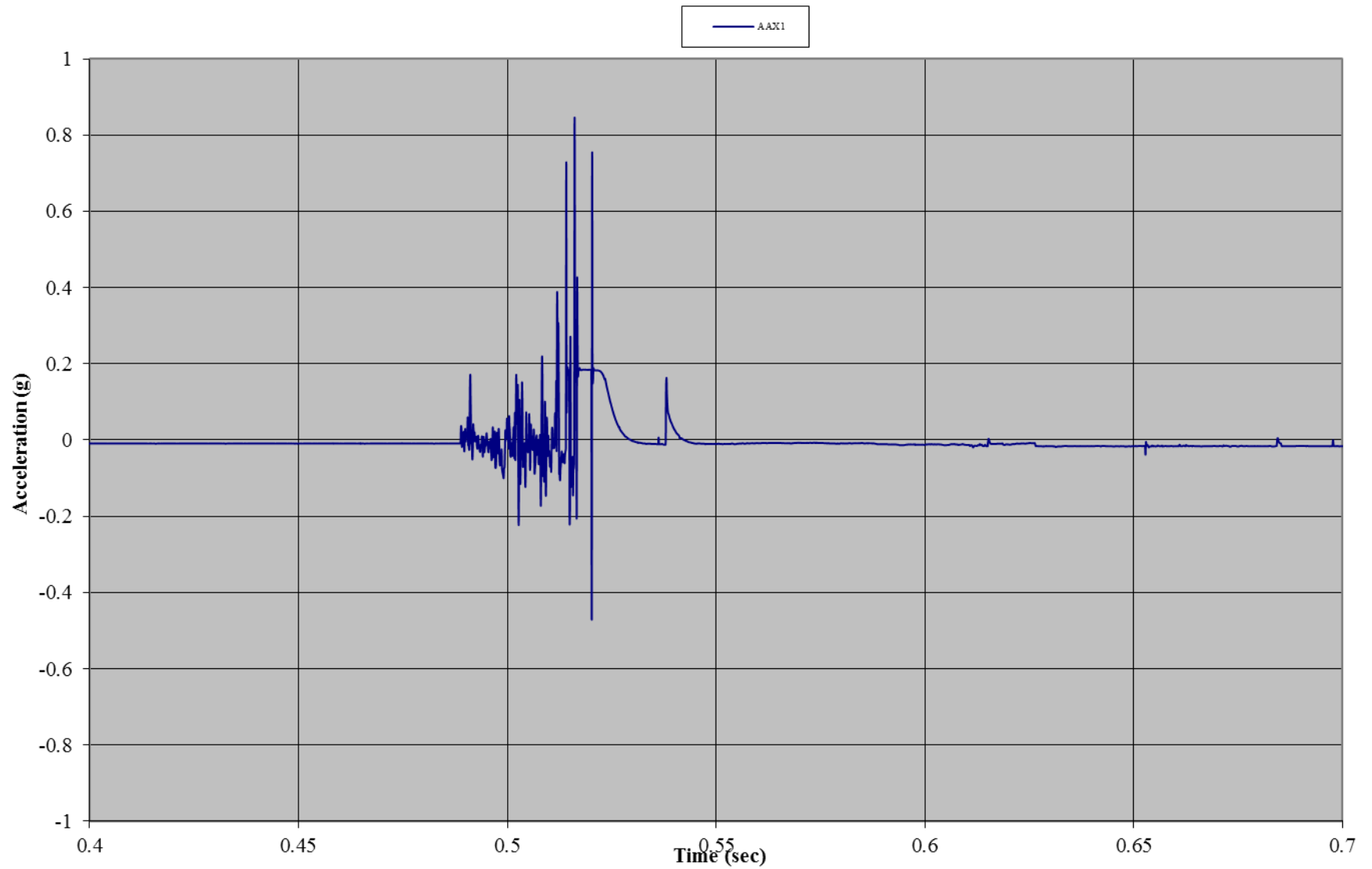
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 20: Roof, Right



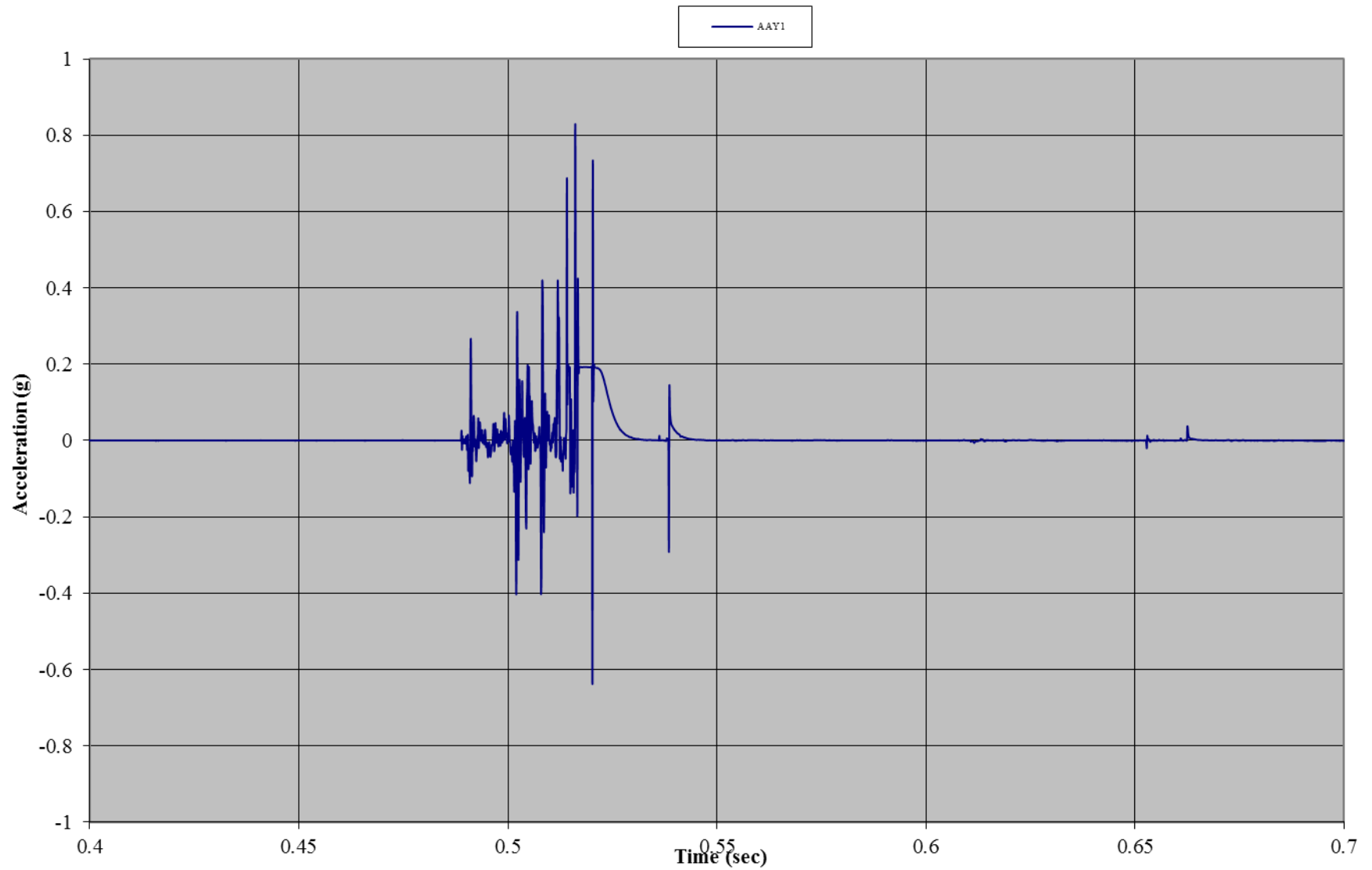
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



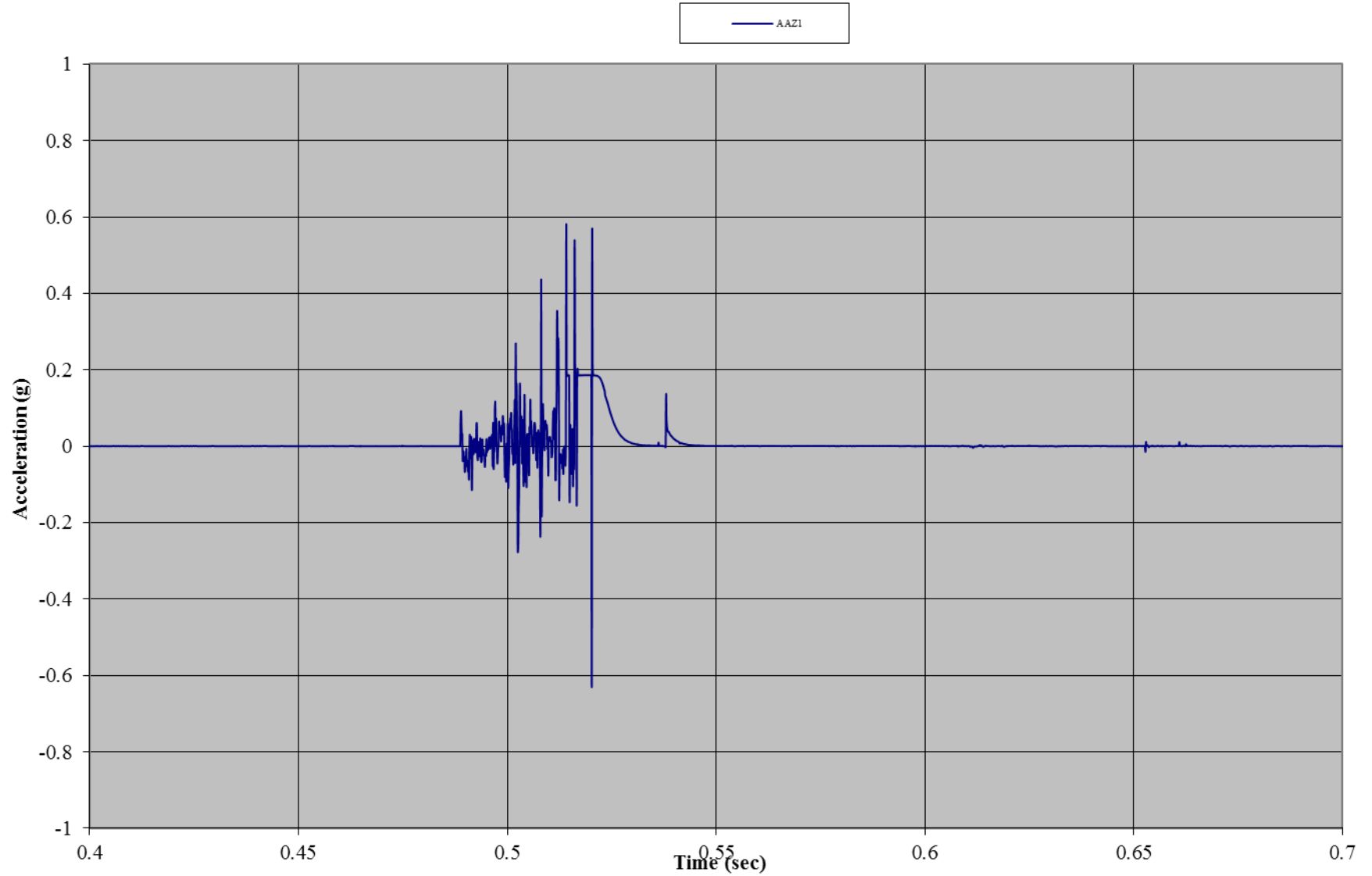
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Accelerometer 1: Front Wall (x-direction)



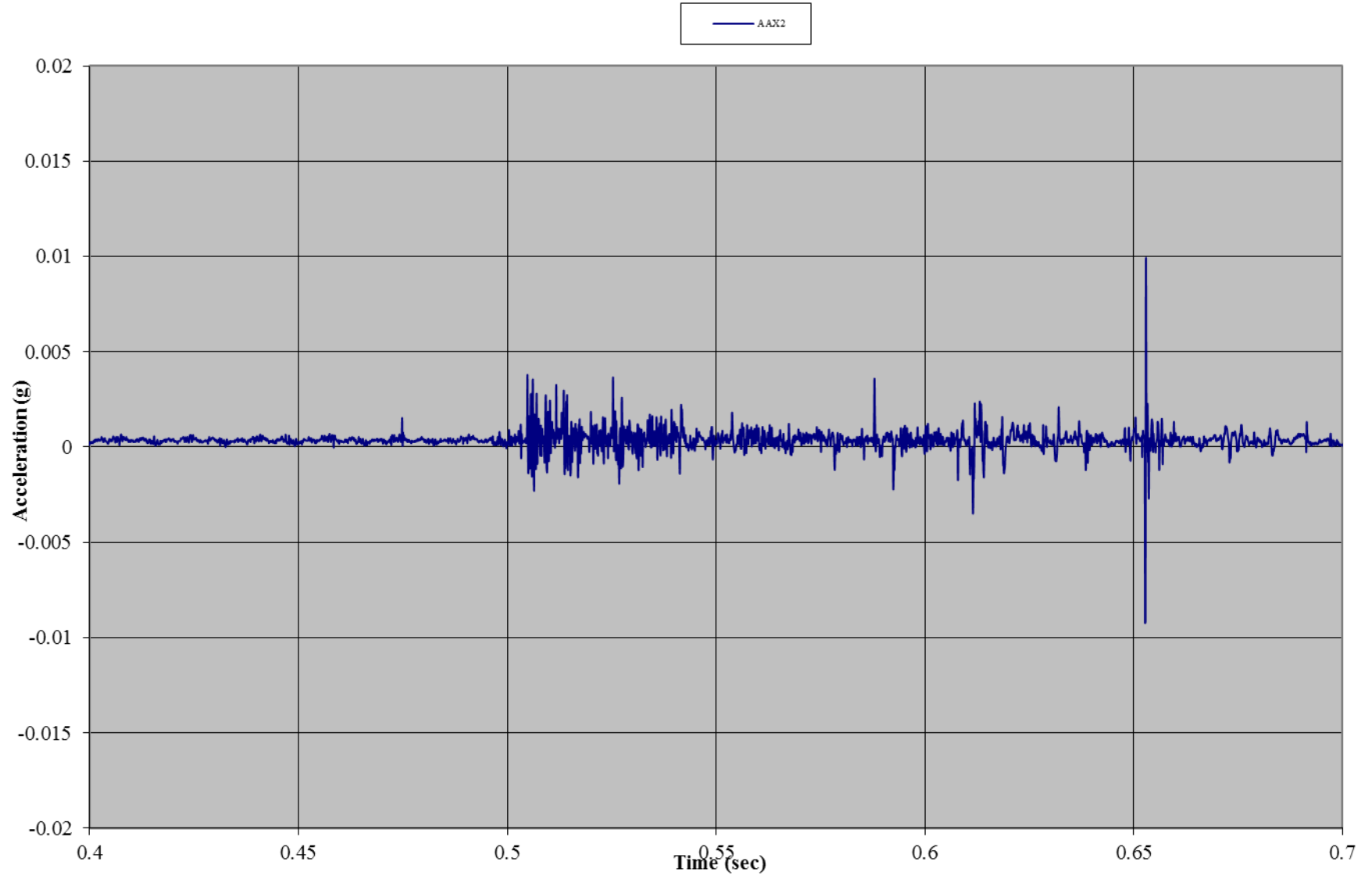
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Accelerometer 1: Front Wall (y-direction)



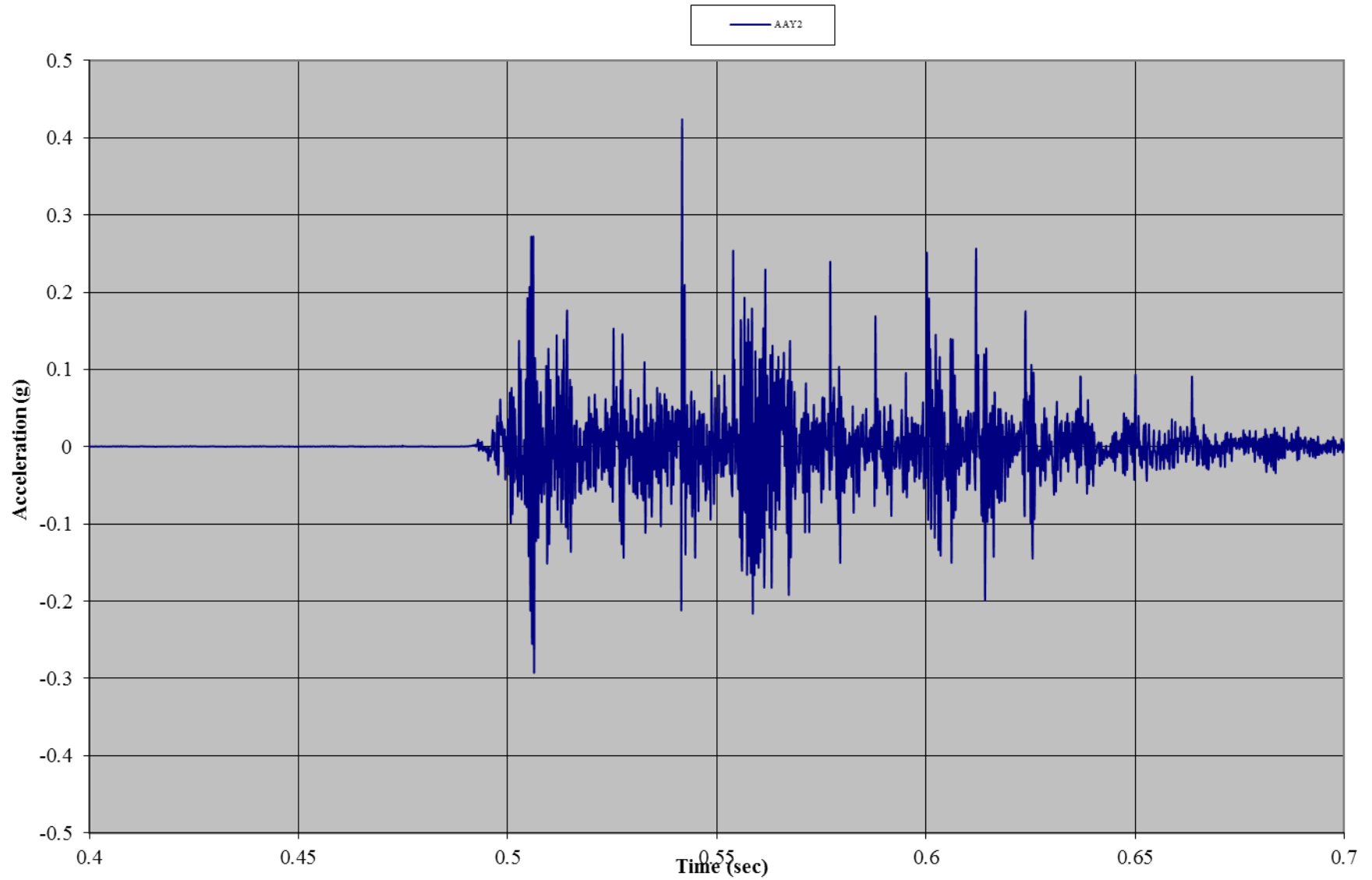
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Accelerometer 1: Front Wall (z-direction)



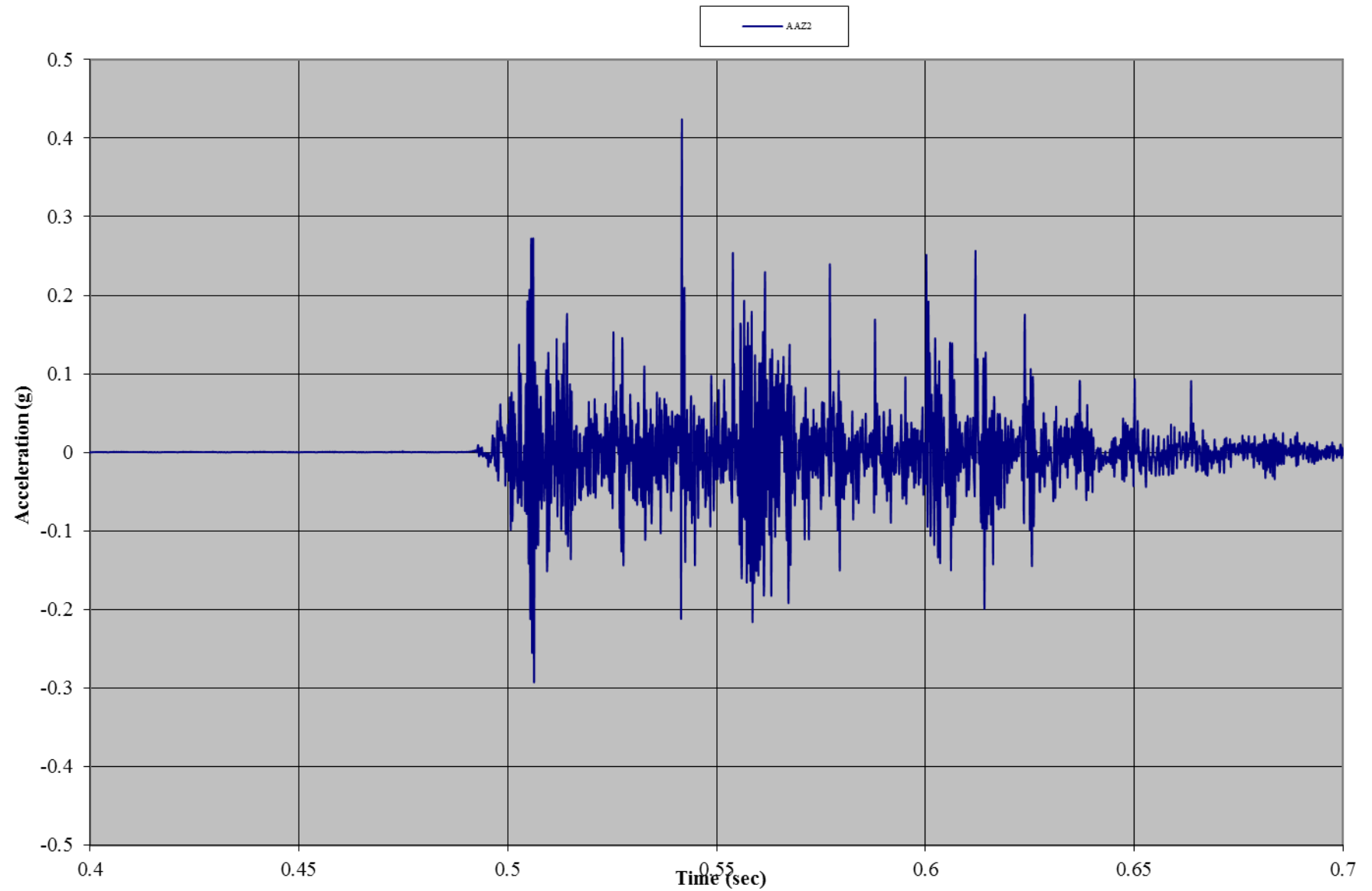
Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Accelerometer 2: Roof (x-direction)



Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Accelerometer 2: Roof (y-direction)

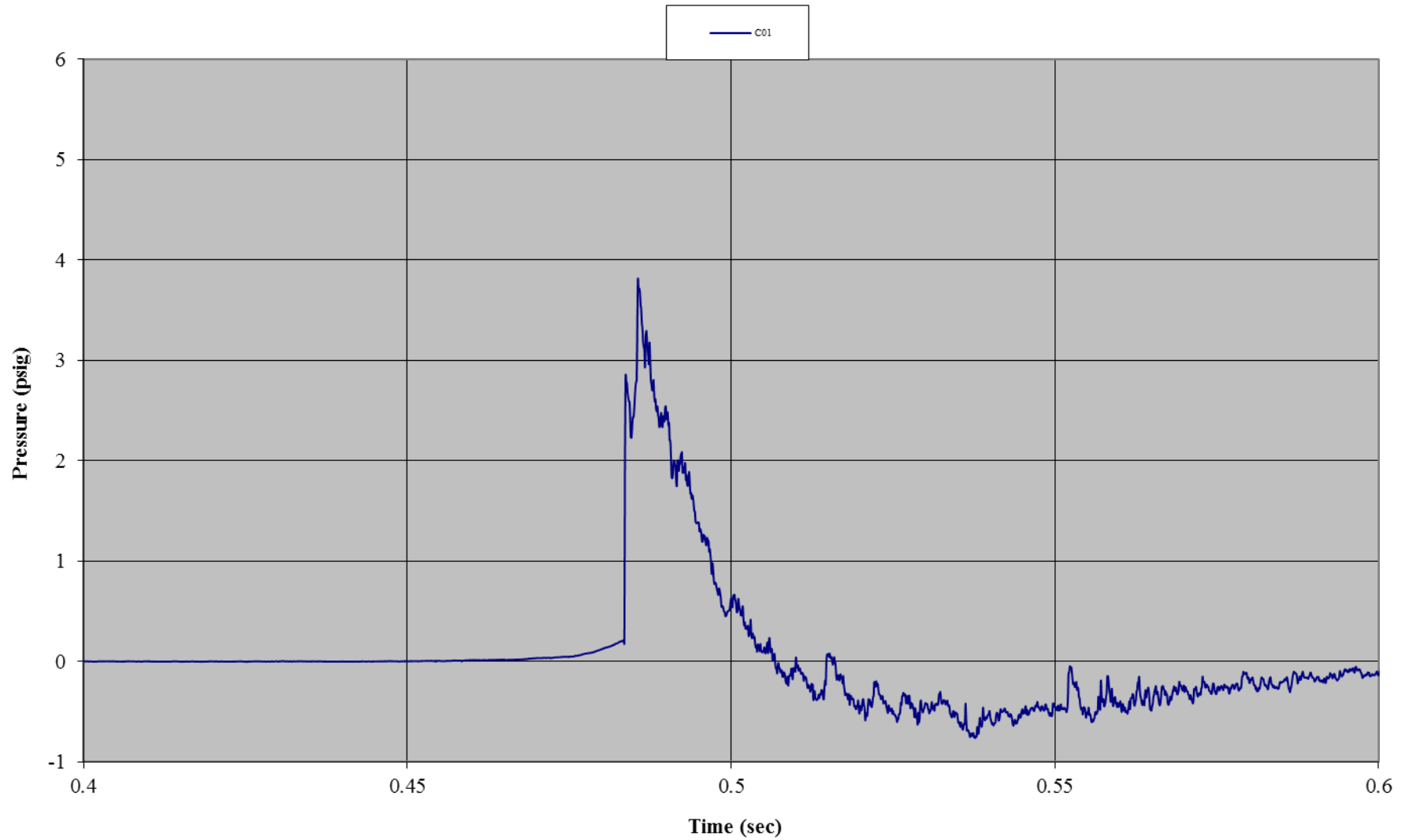


Test C01: 90 mph-Wind Rigid Frame Tent with Sides
Accelerometer 2: Roof (z-direction)

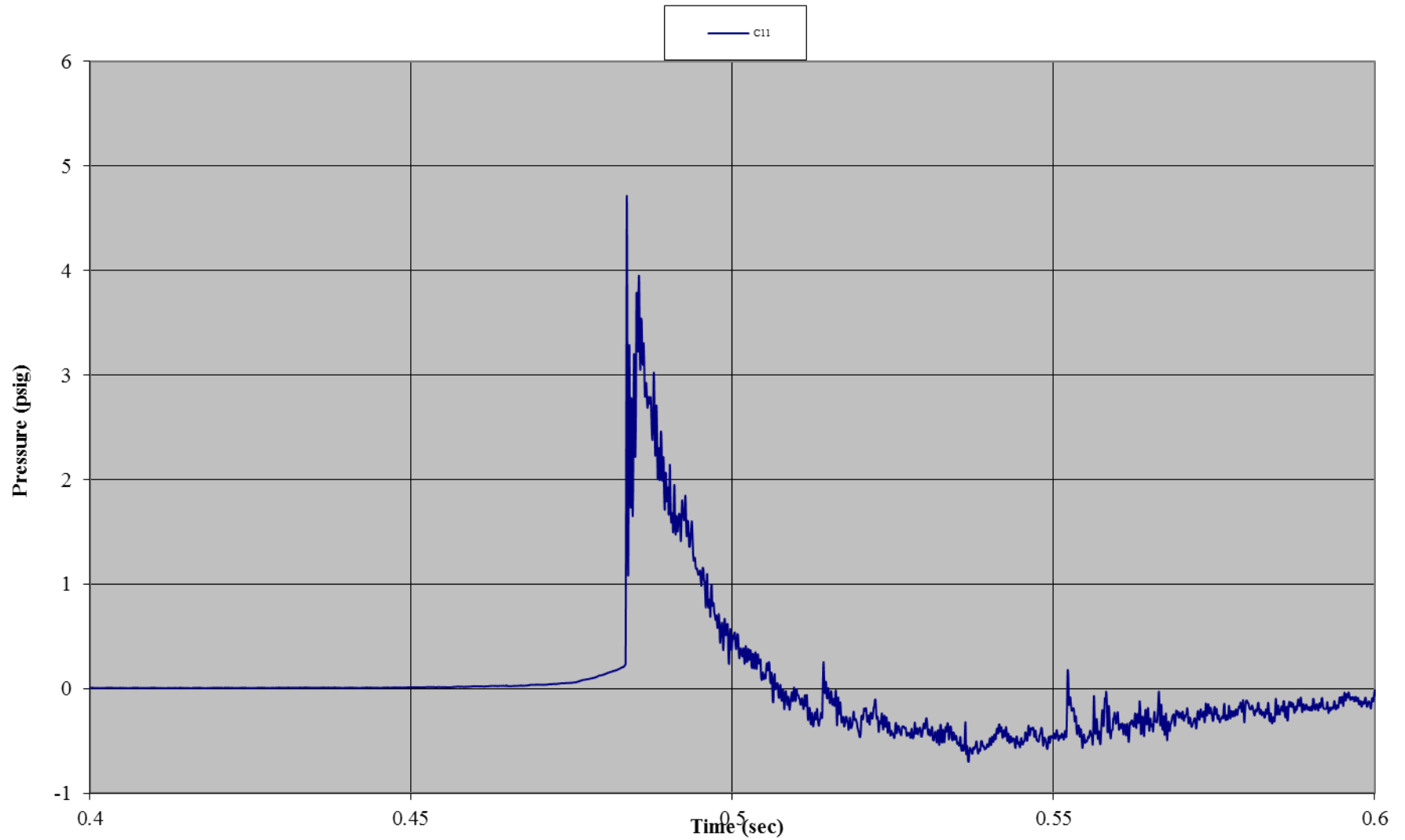


Test C01: Tent C

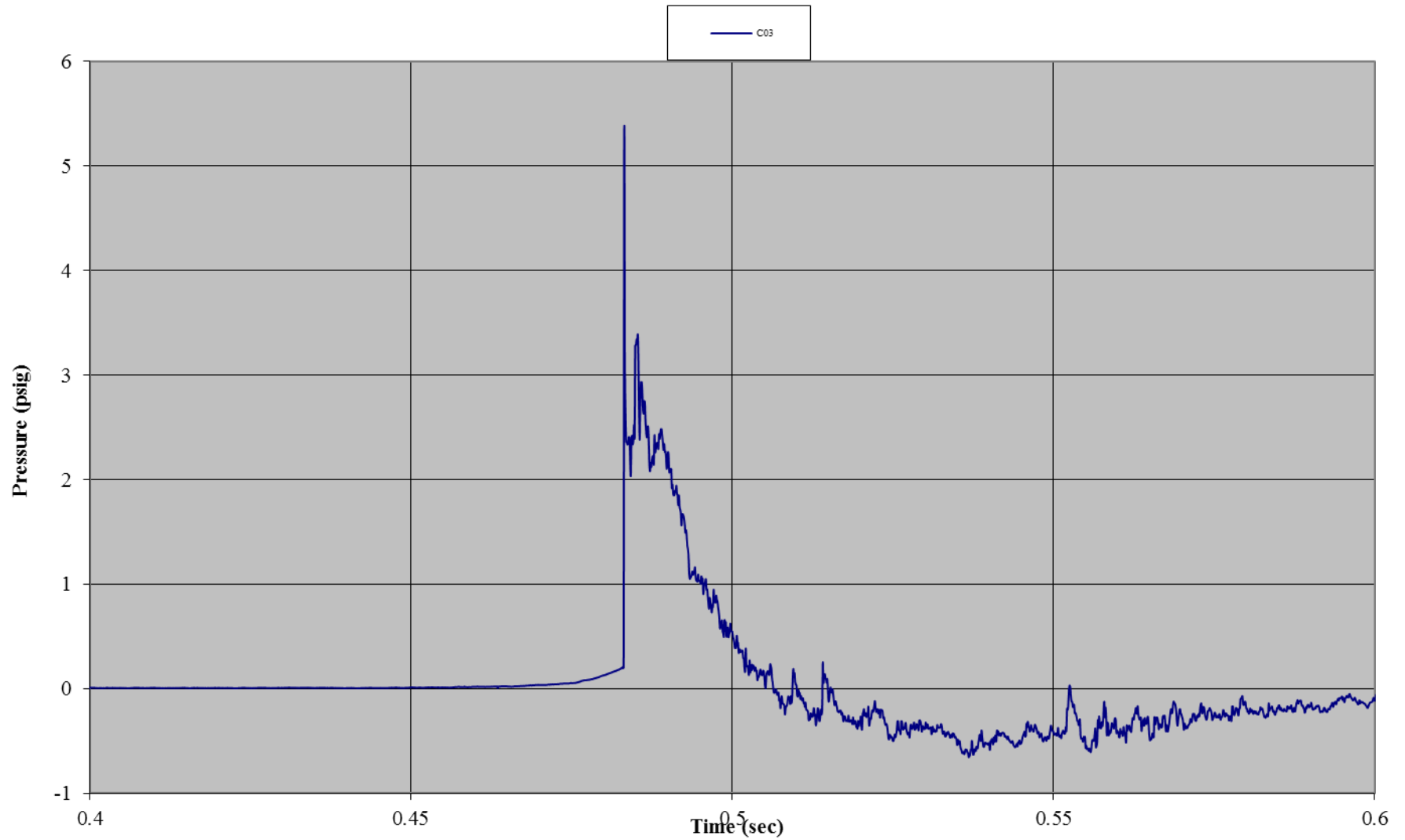
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 01: Front Wall, Left Bottom



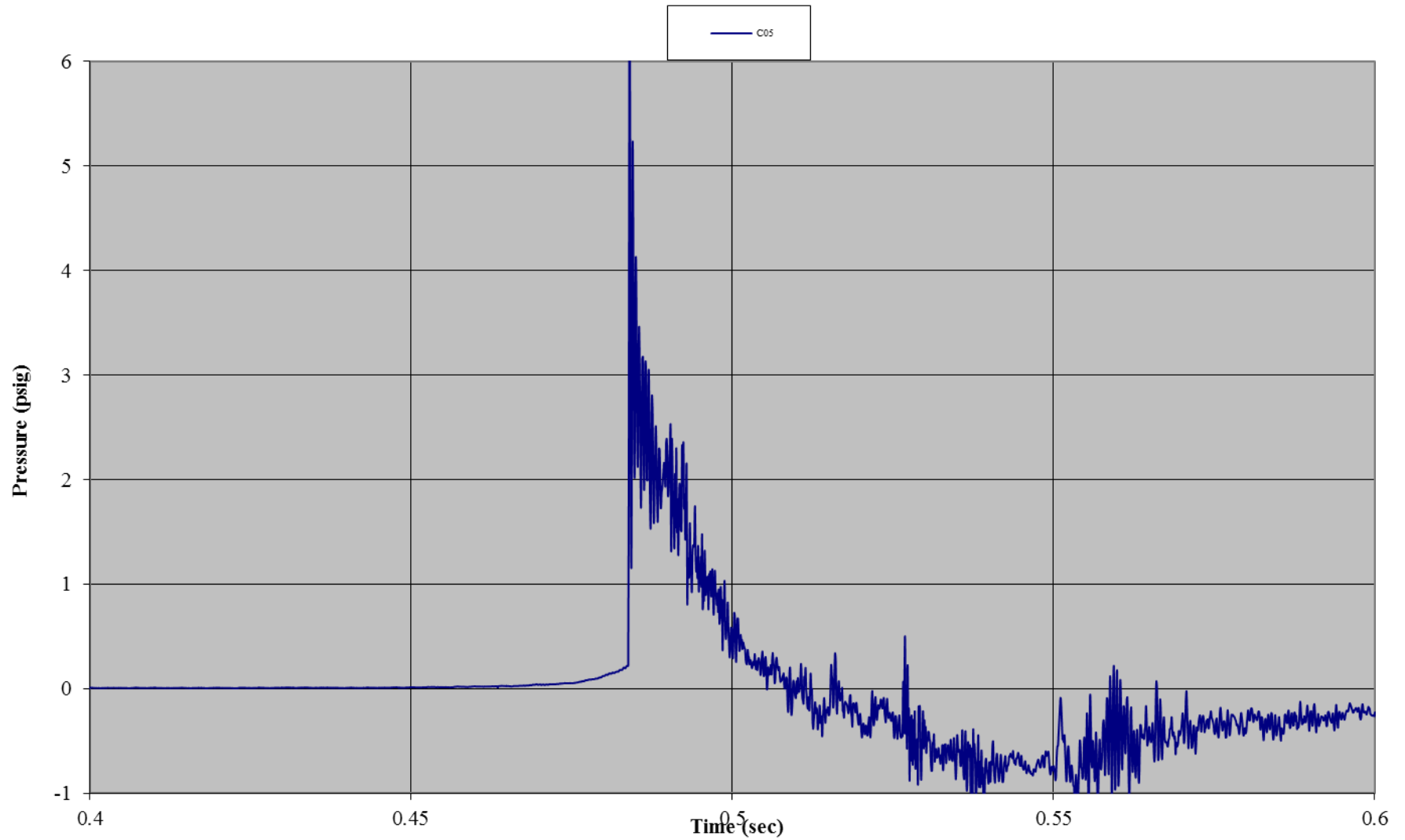
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 11: Front Wall, Right Bottom



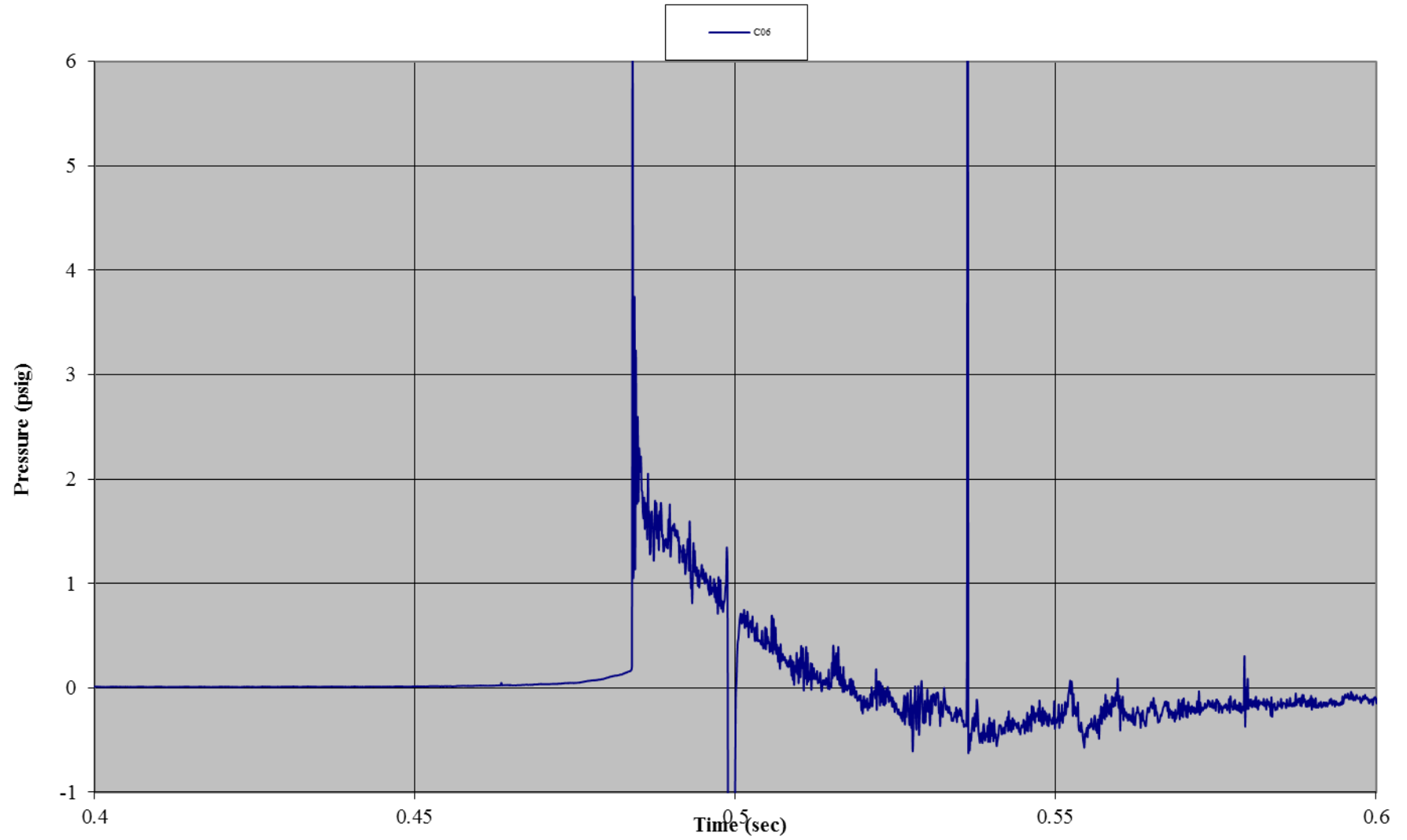
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 03: Front Wall, Center Ground



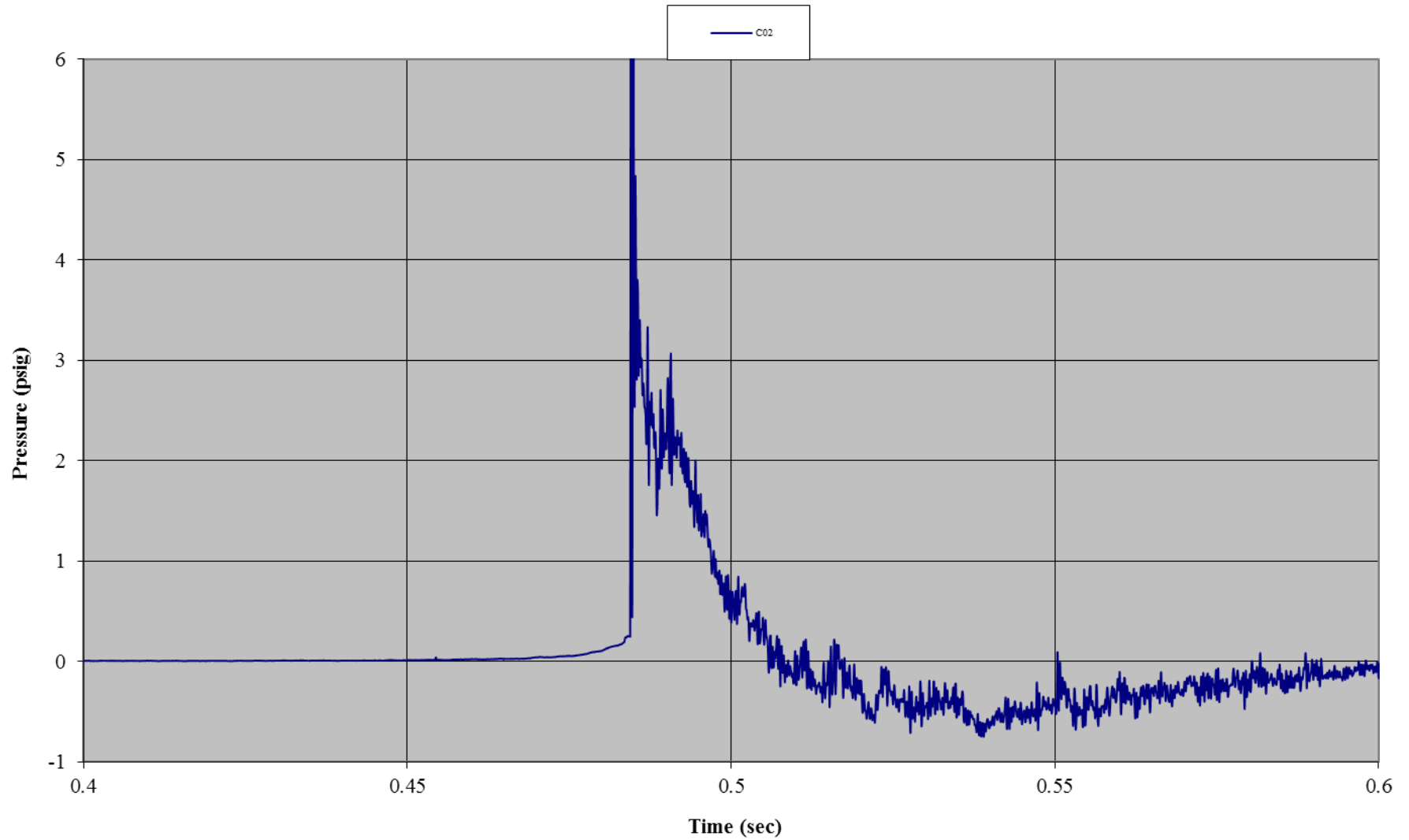
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



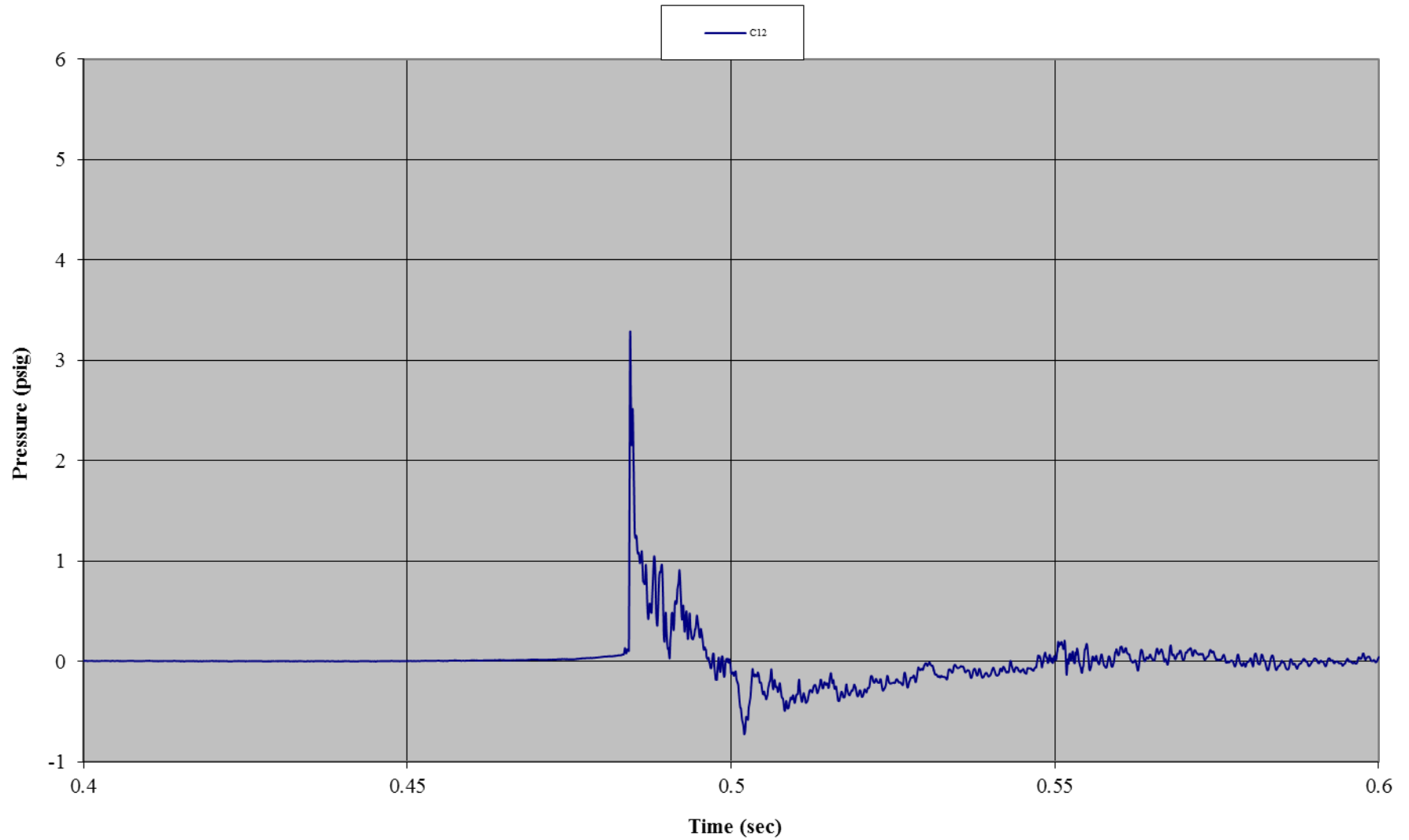
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 06: Front Wall, Center Top



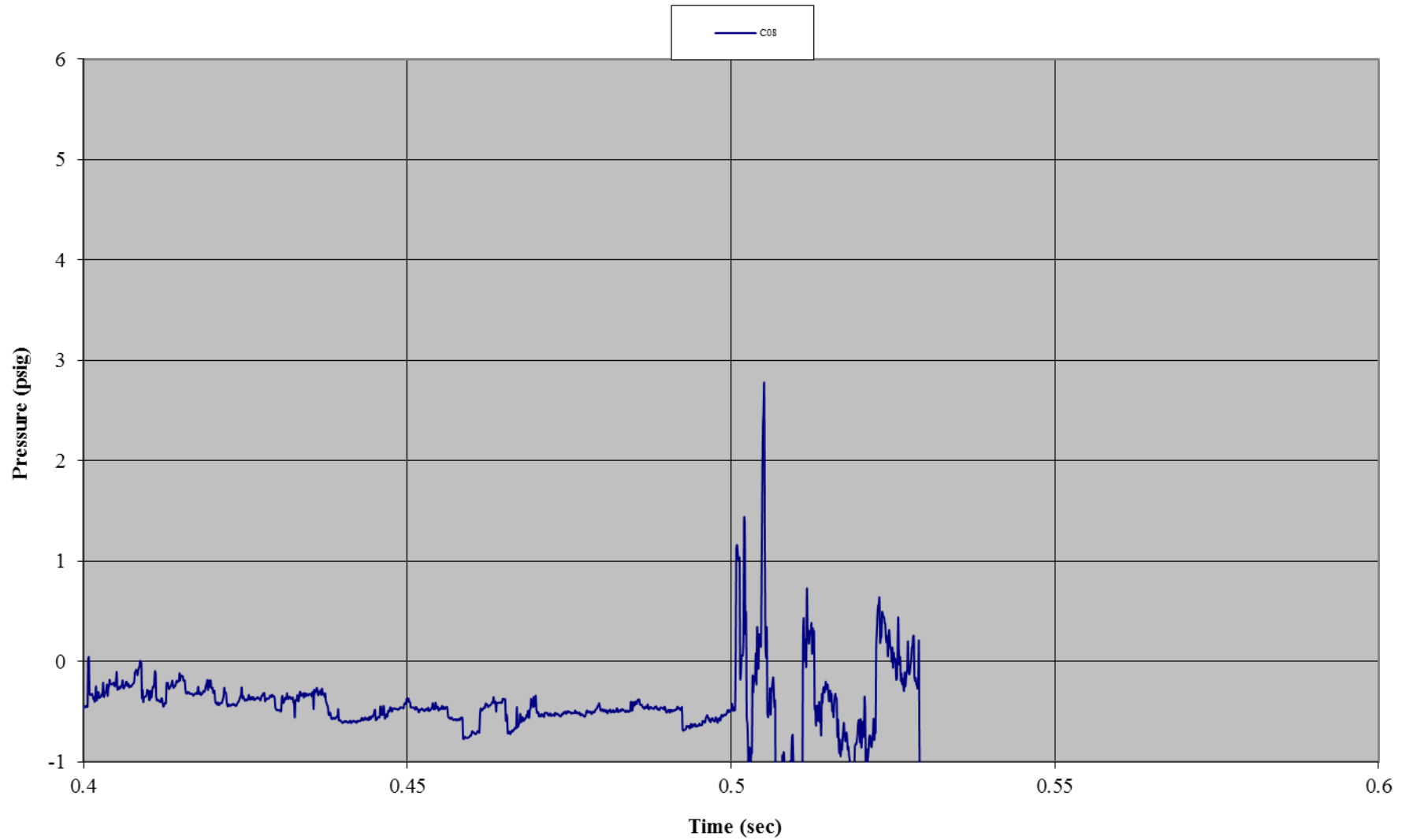
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



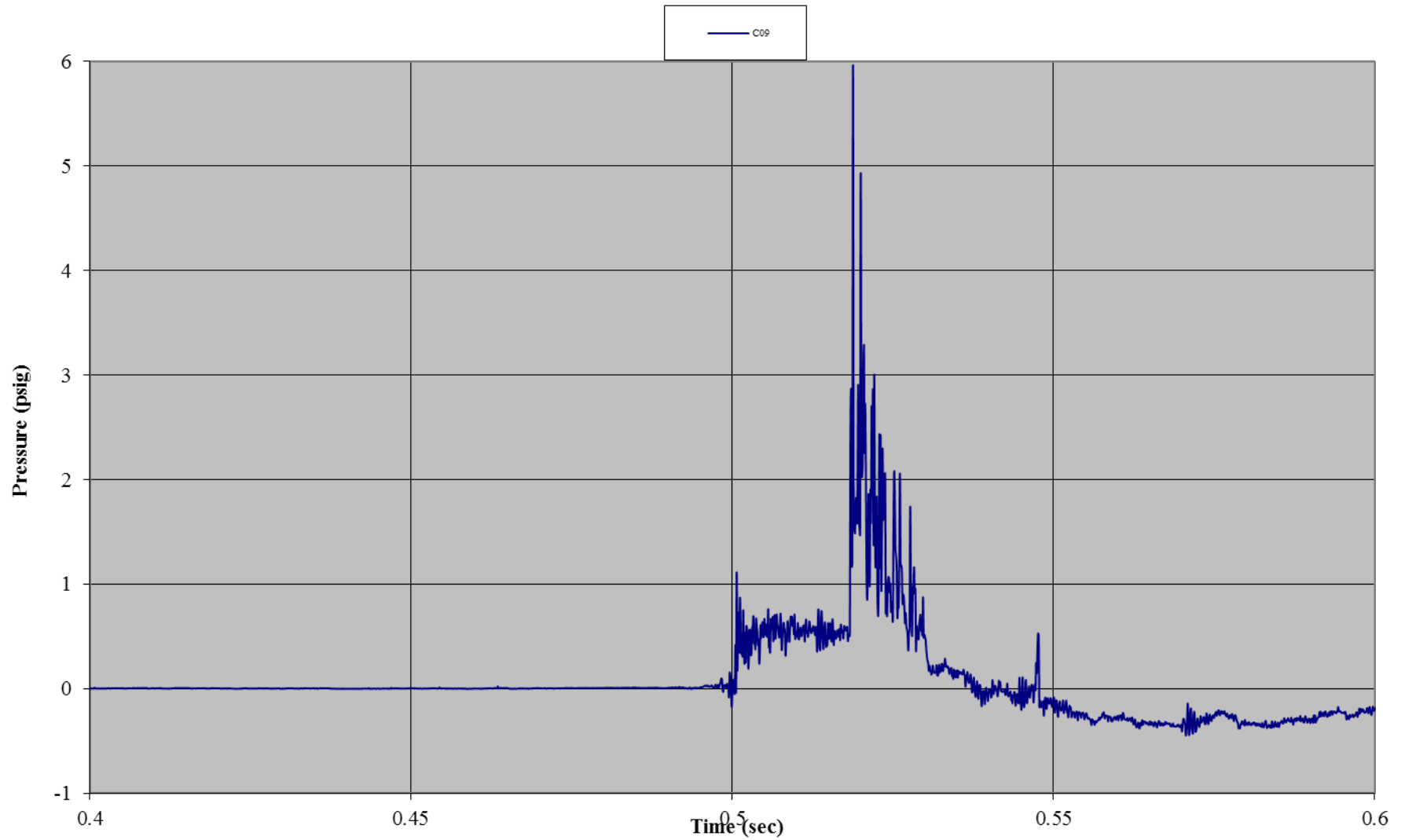
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



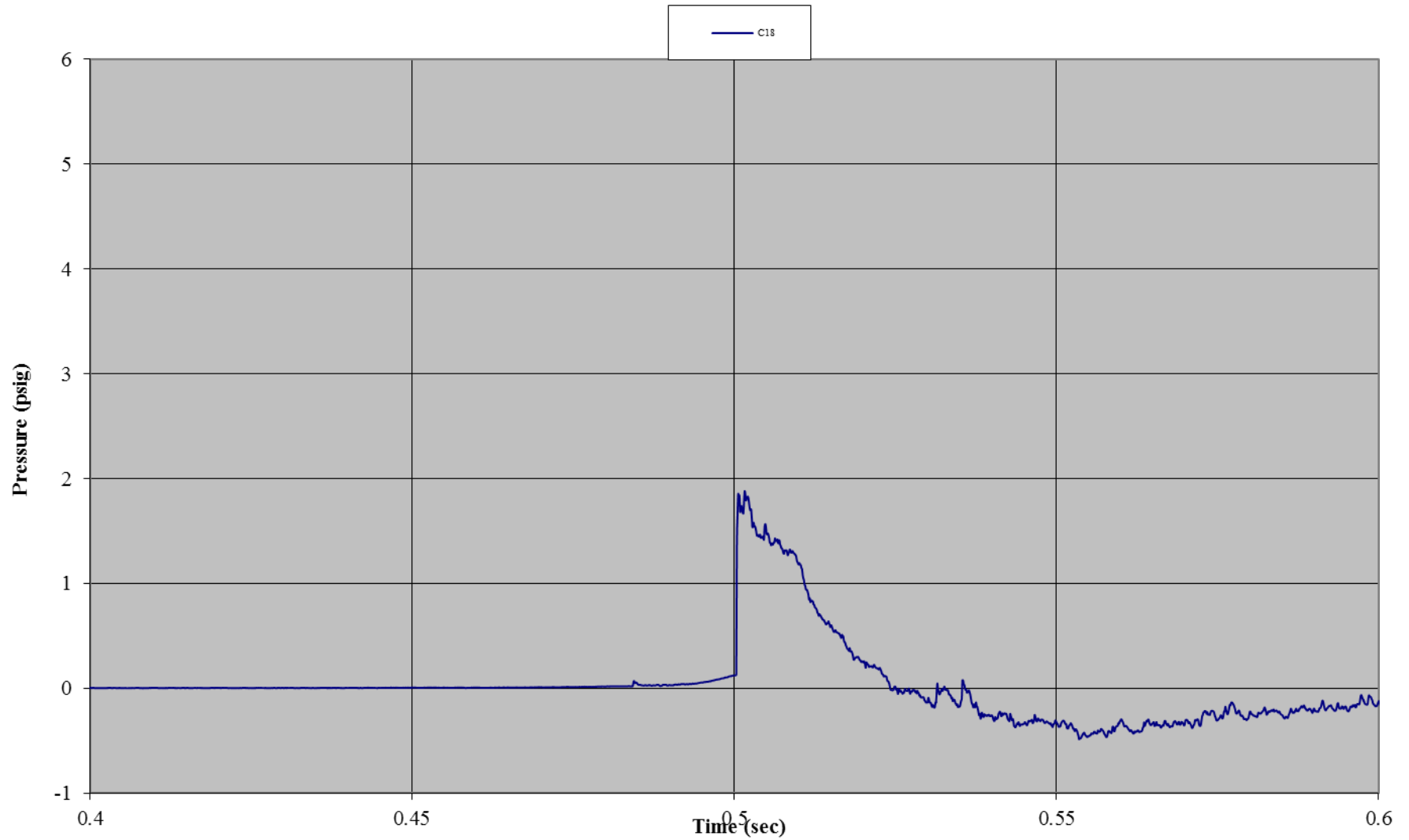
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 08: Left Side Wall, Bottom



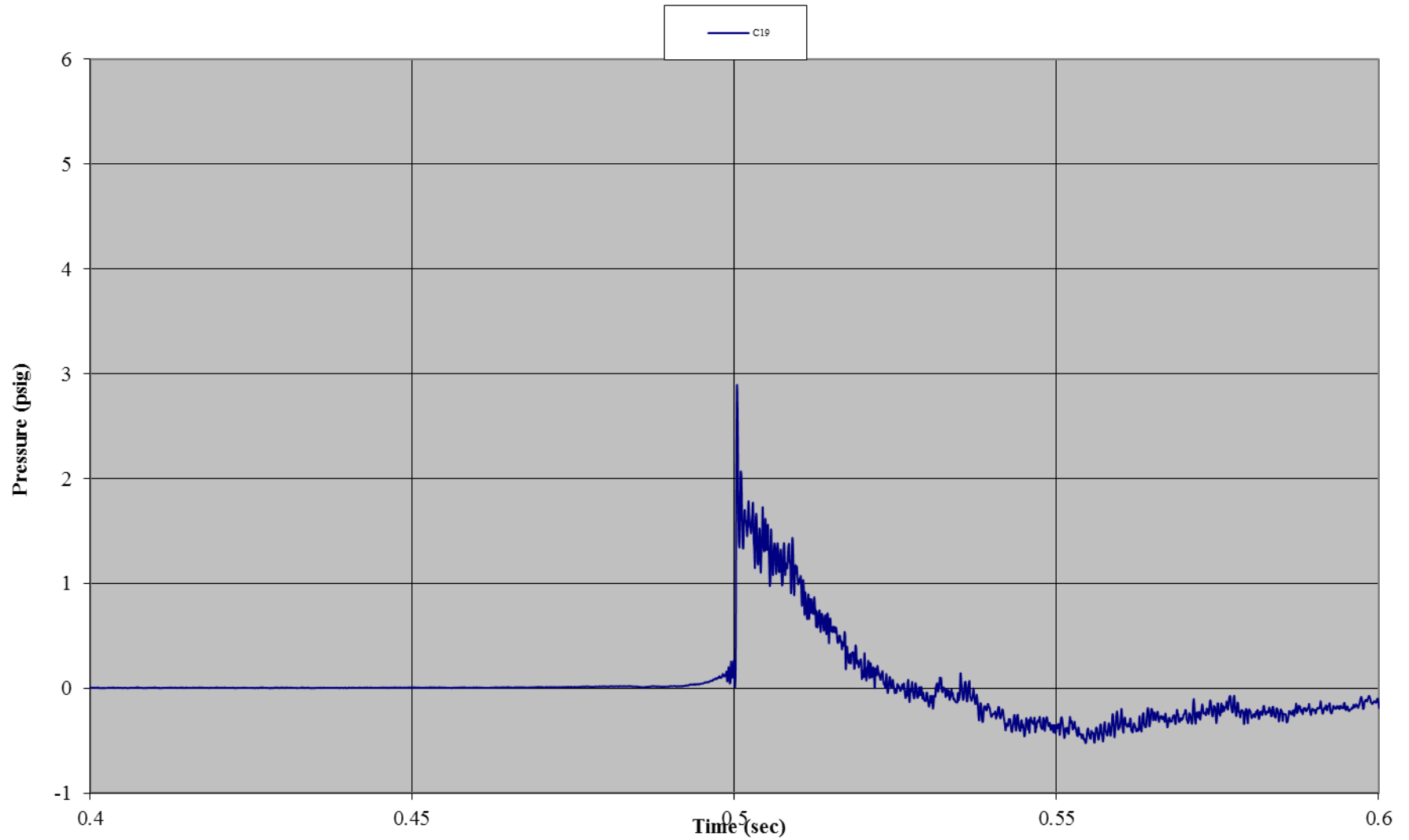
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



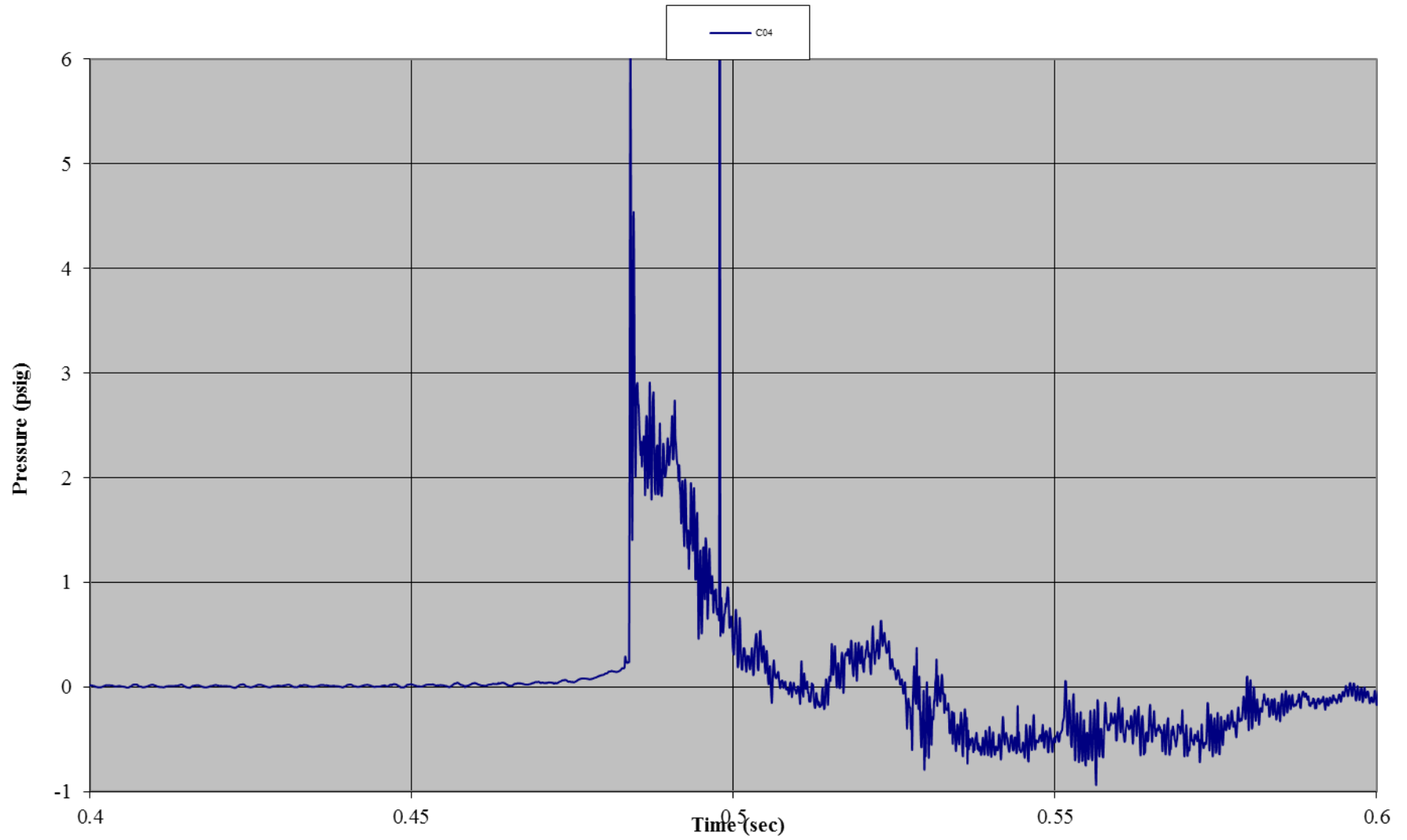
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 18: Right Side Wall, Bottom



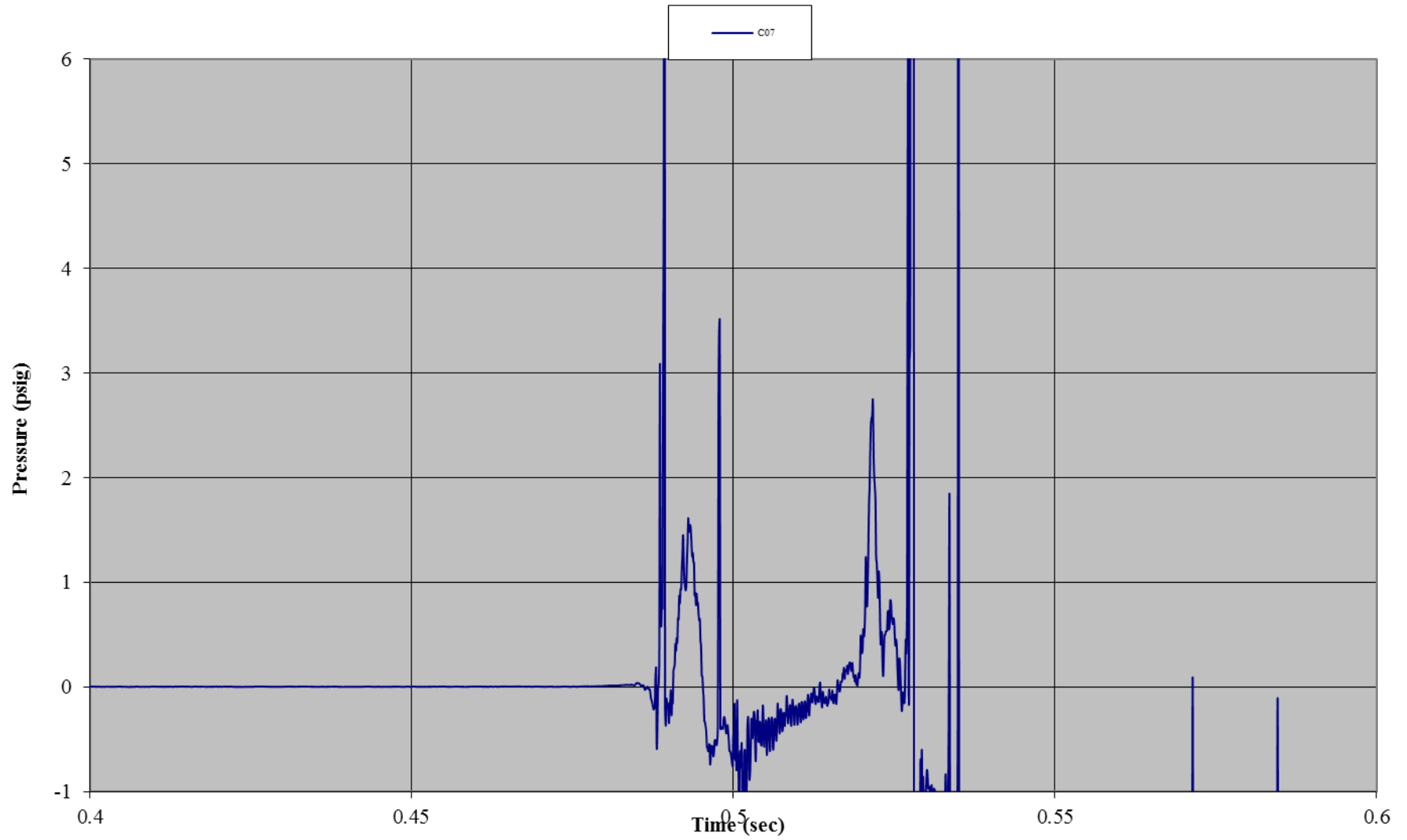
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



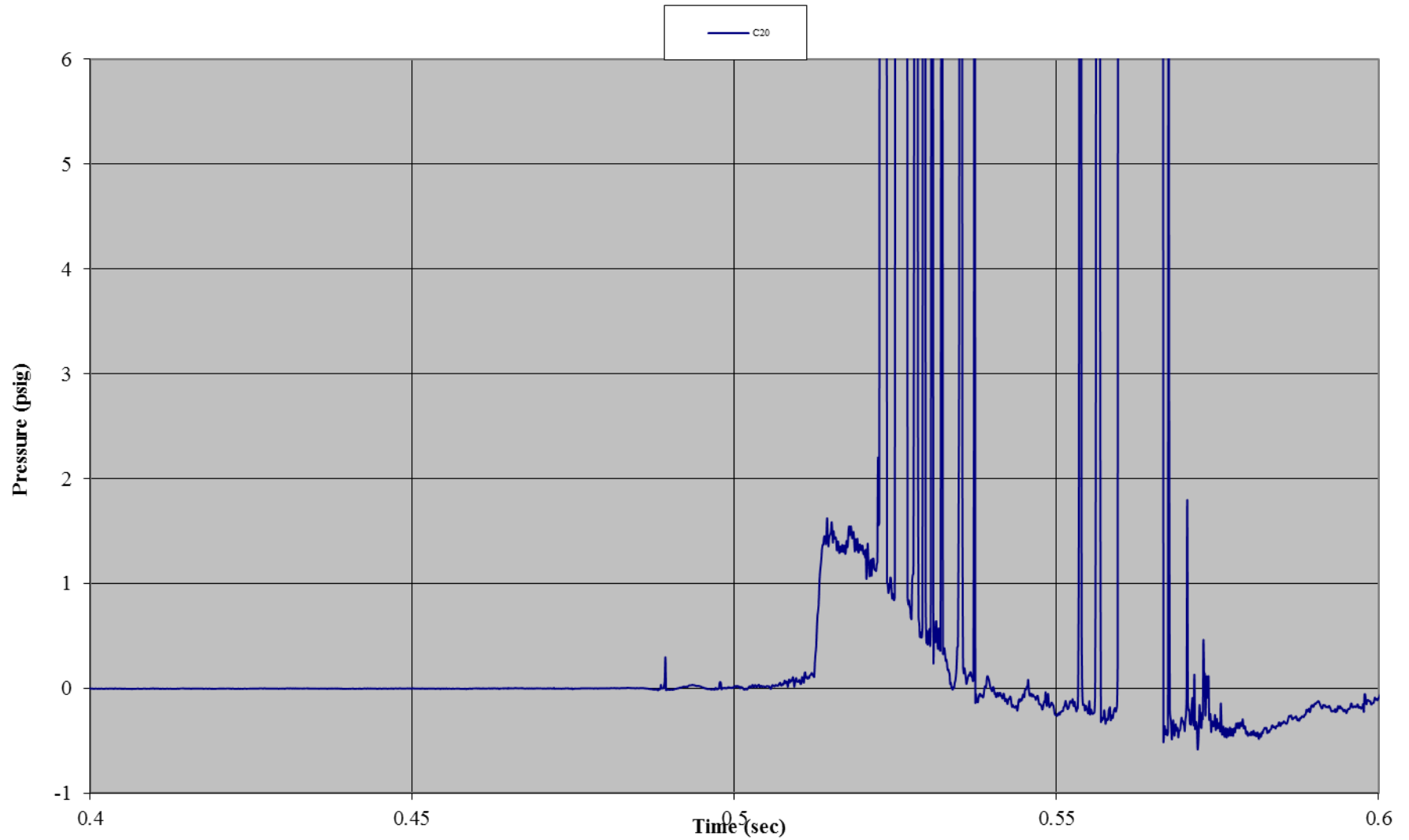
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 04: Front Wall, Center Bottom



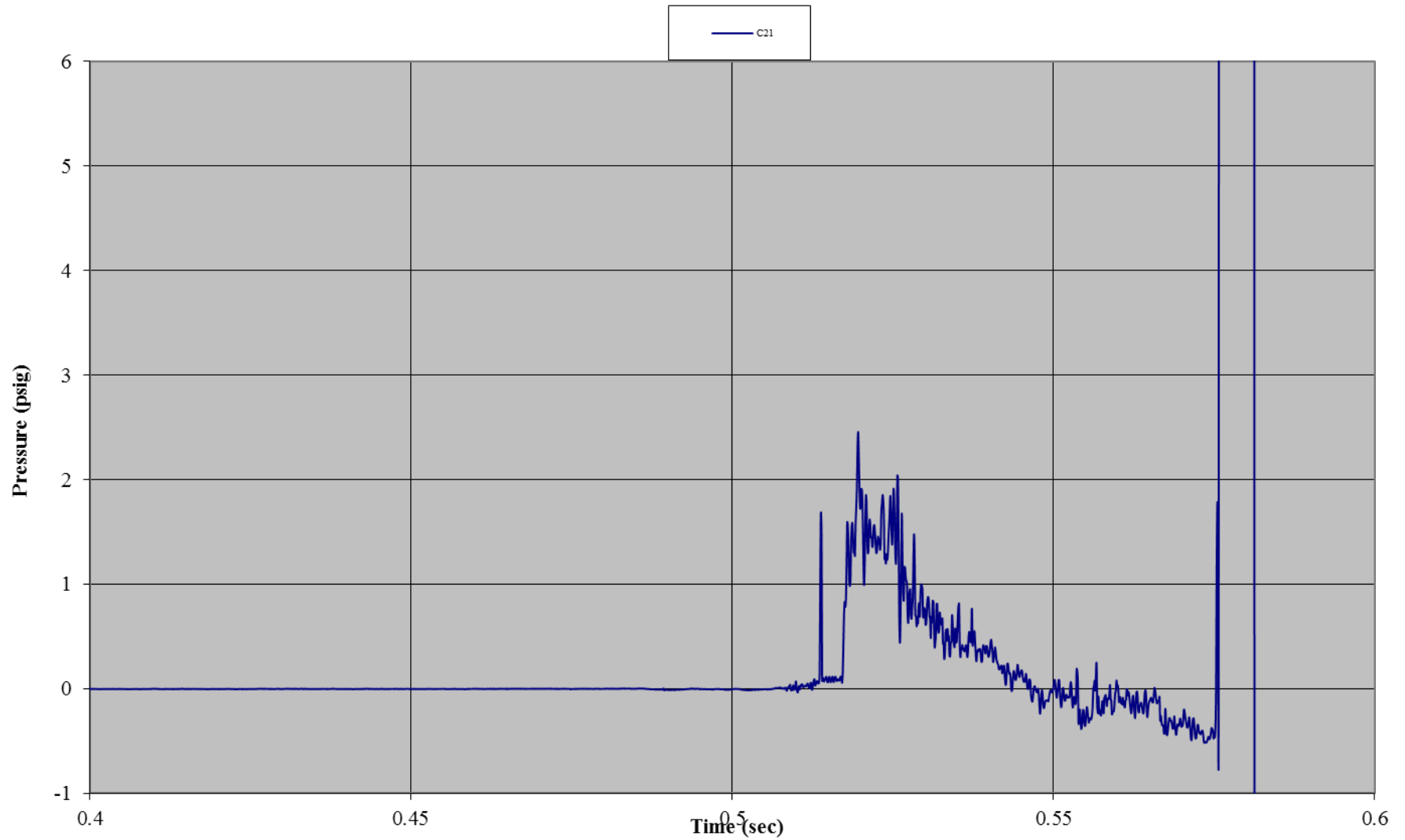
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 07: Roof, Left



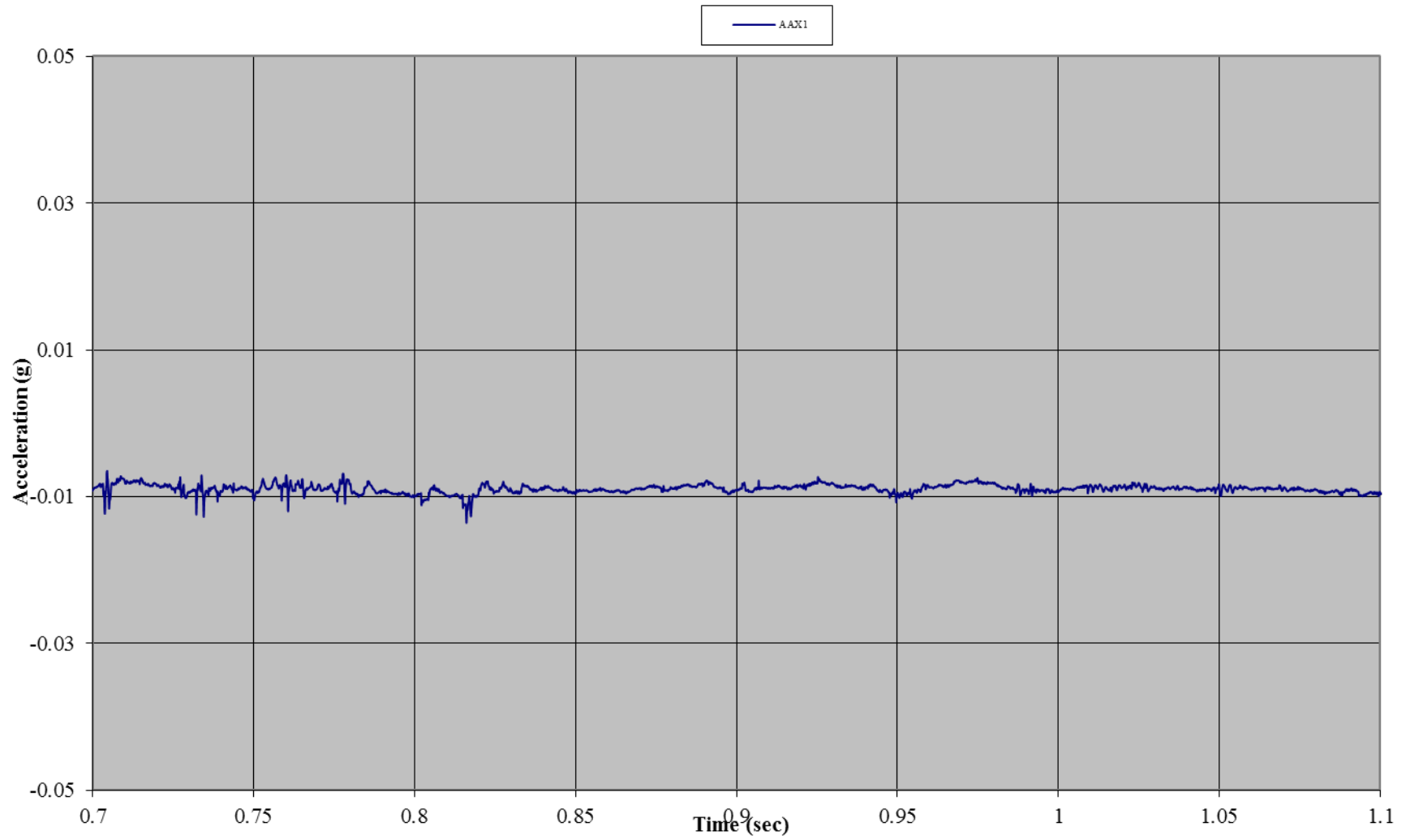
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 20: Roof, Right



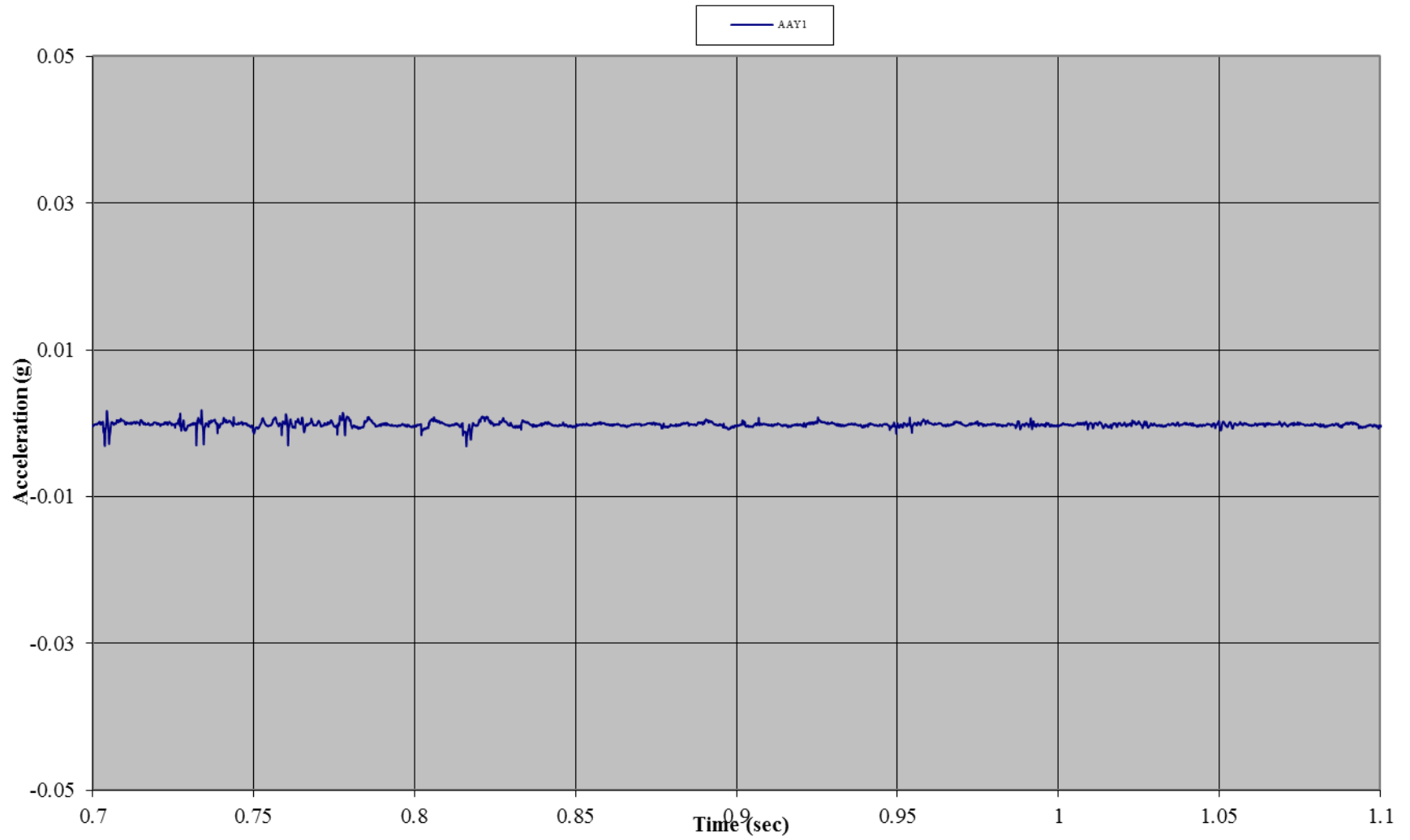
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



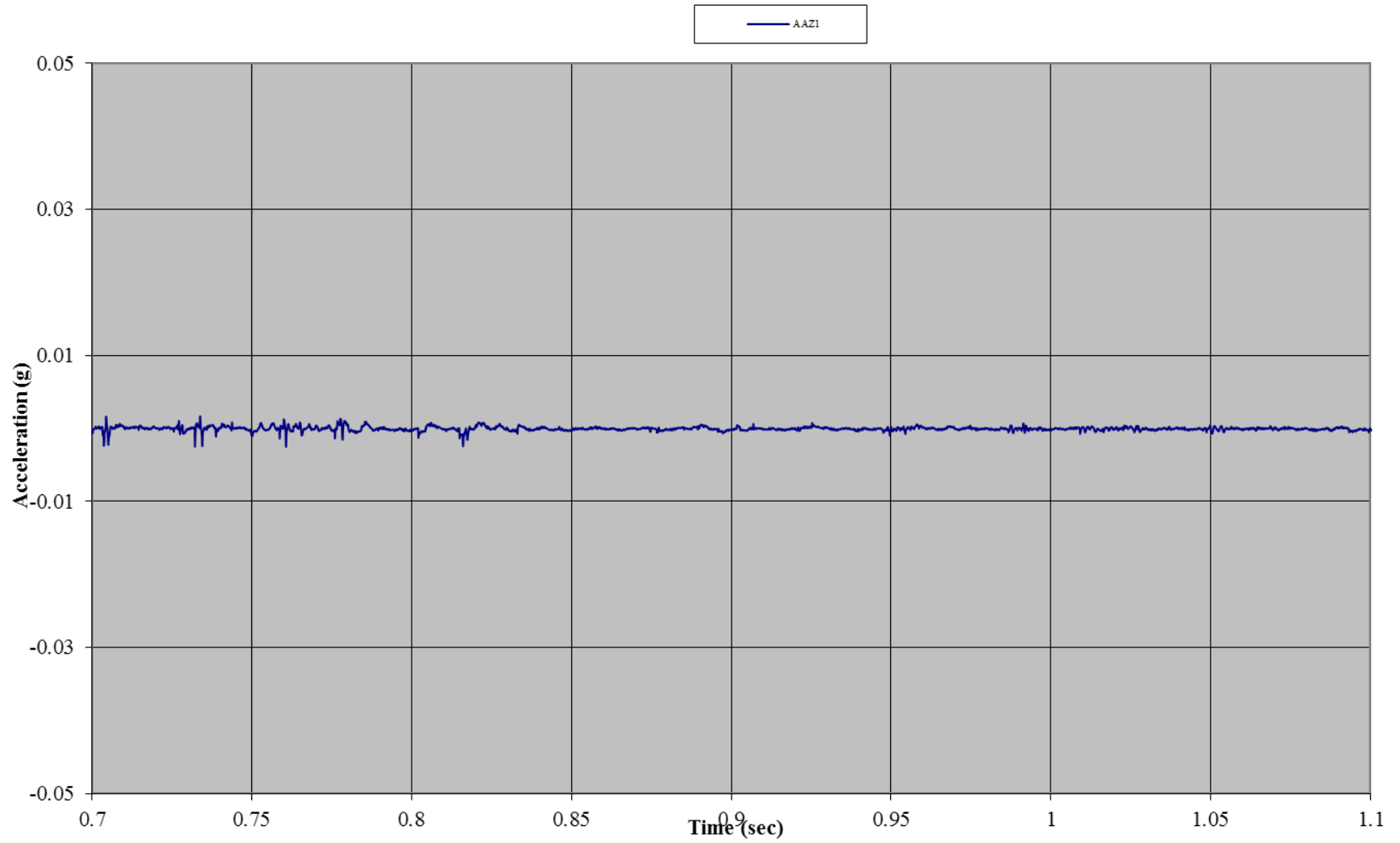
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (x-direction)



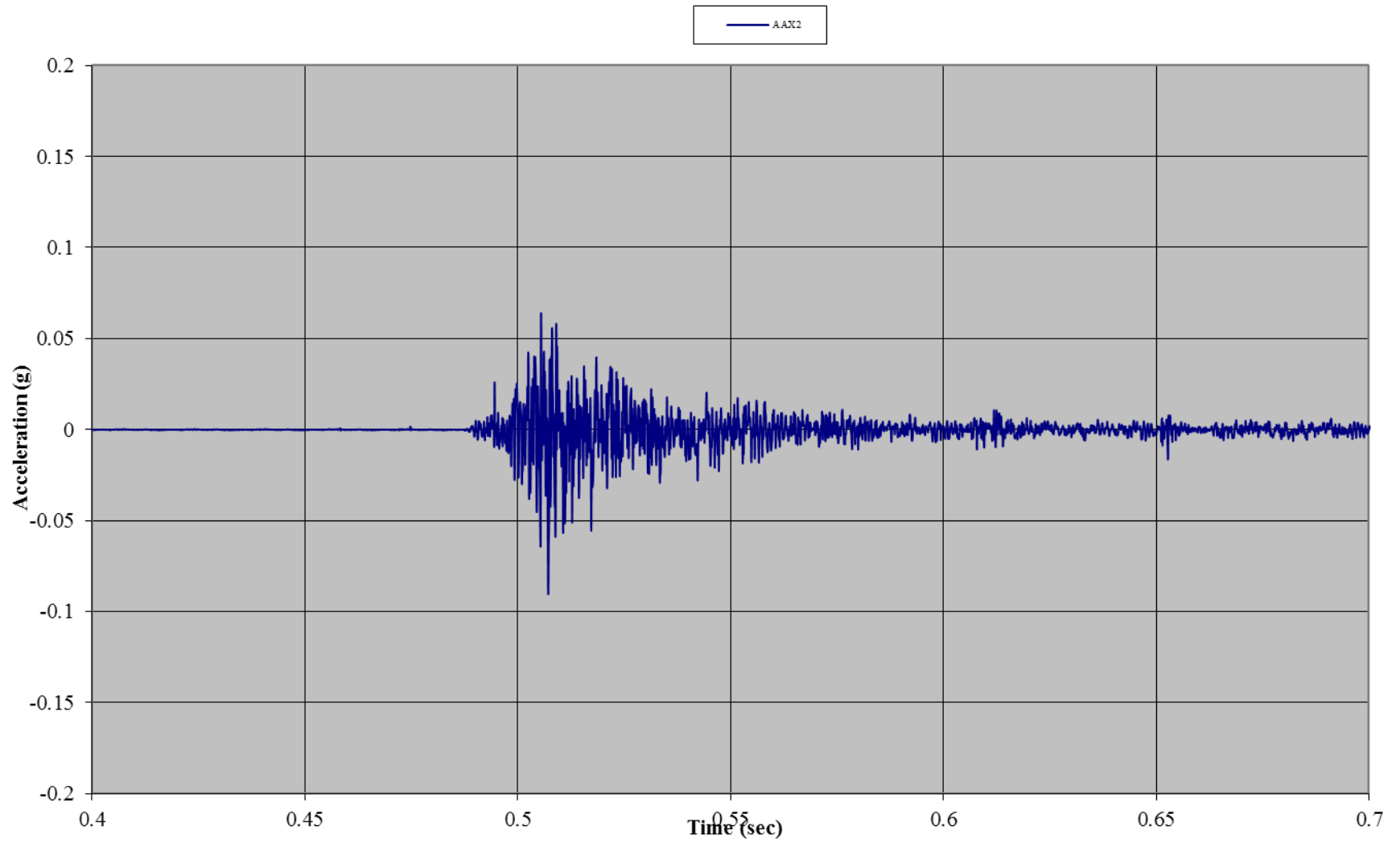
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (y-direction)



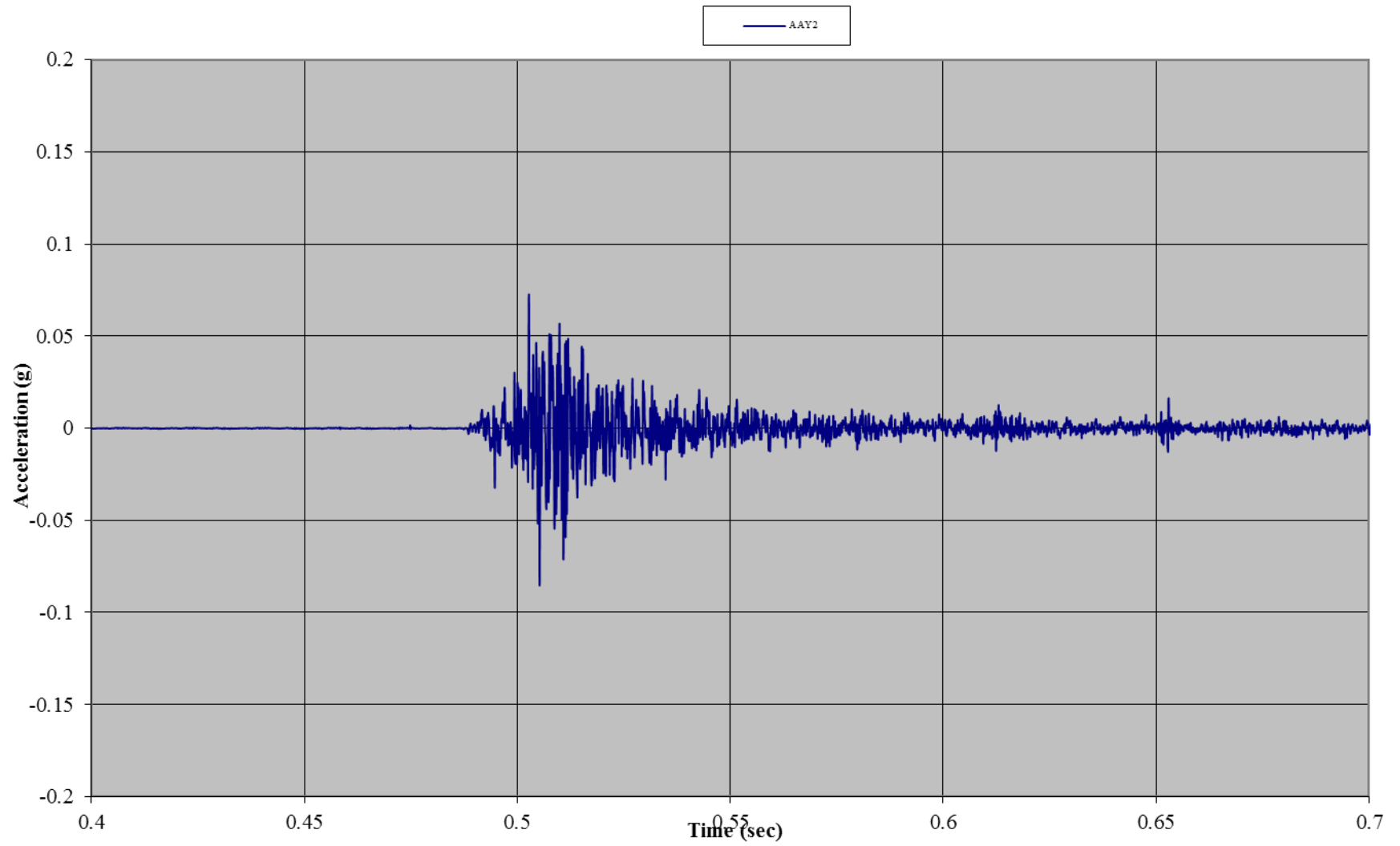
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (z-direction)



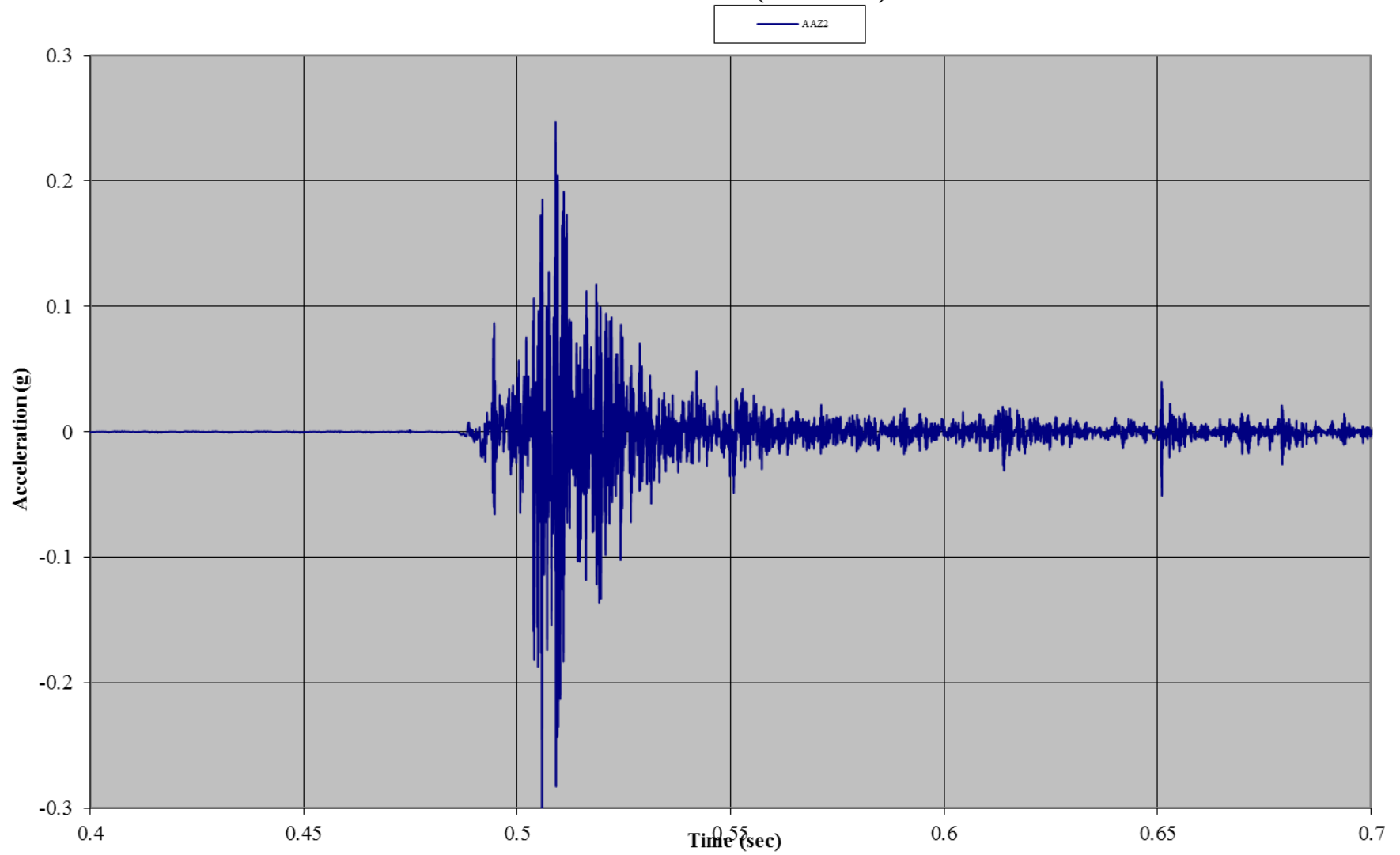
Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (x-direction)



Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (y-direction)

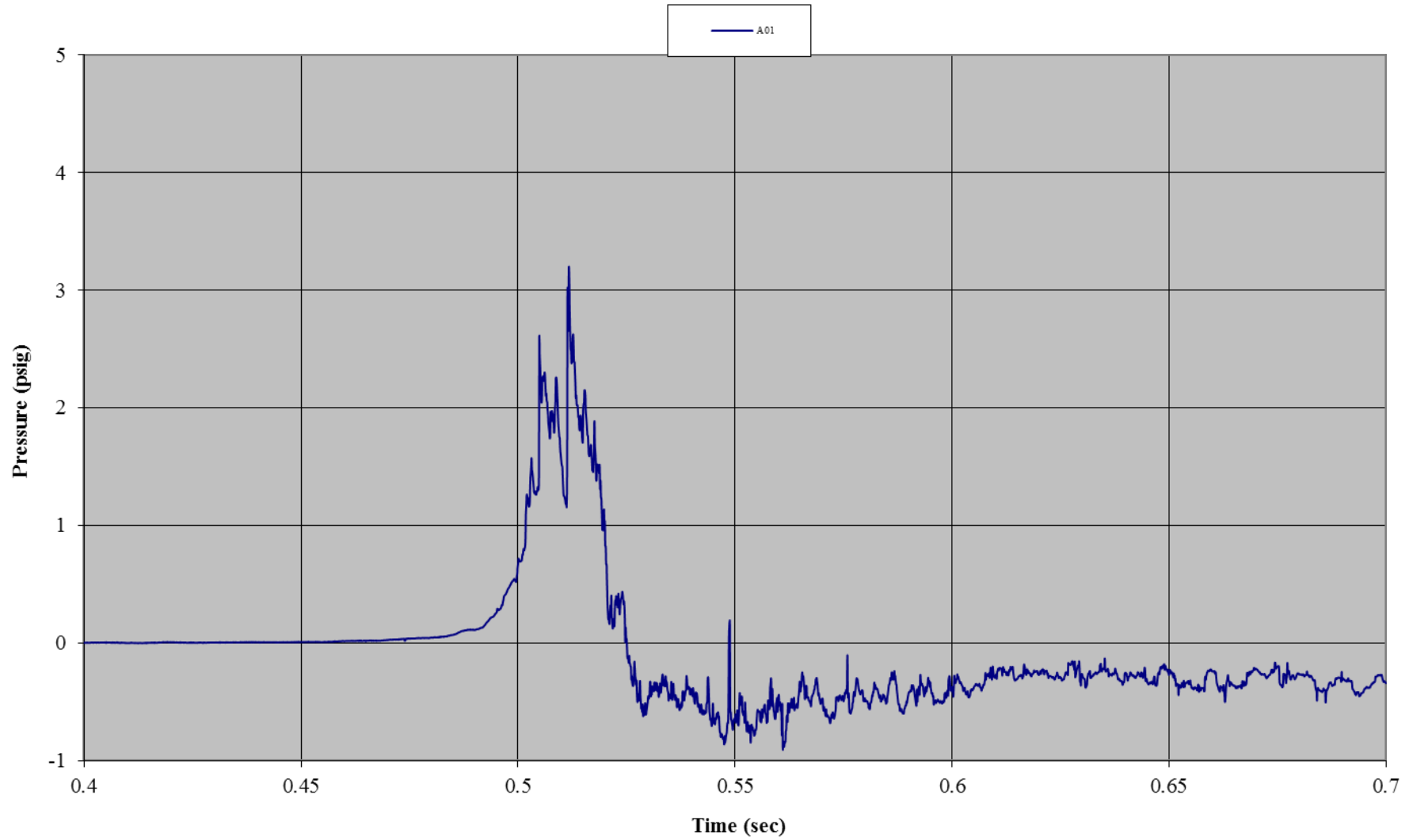


Test C01: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (z-direction)

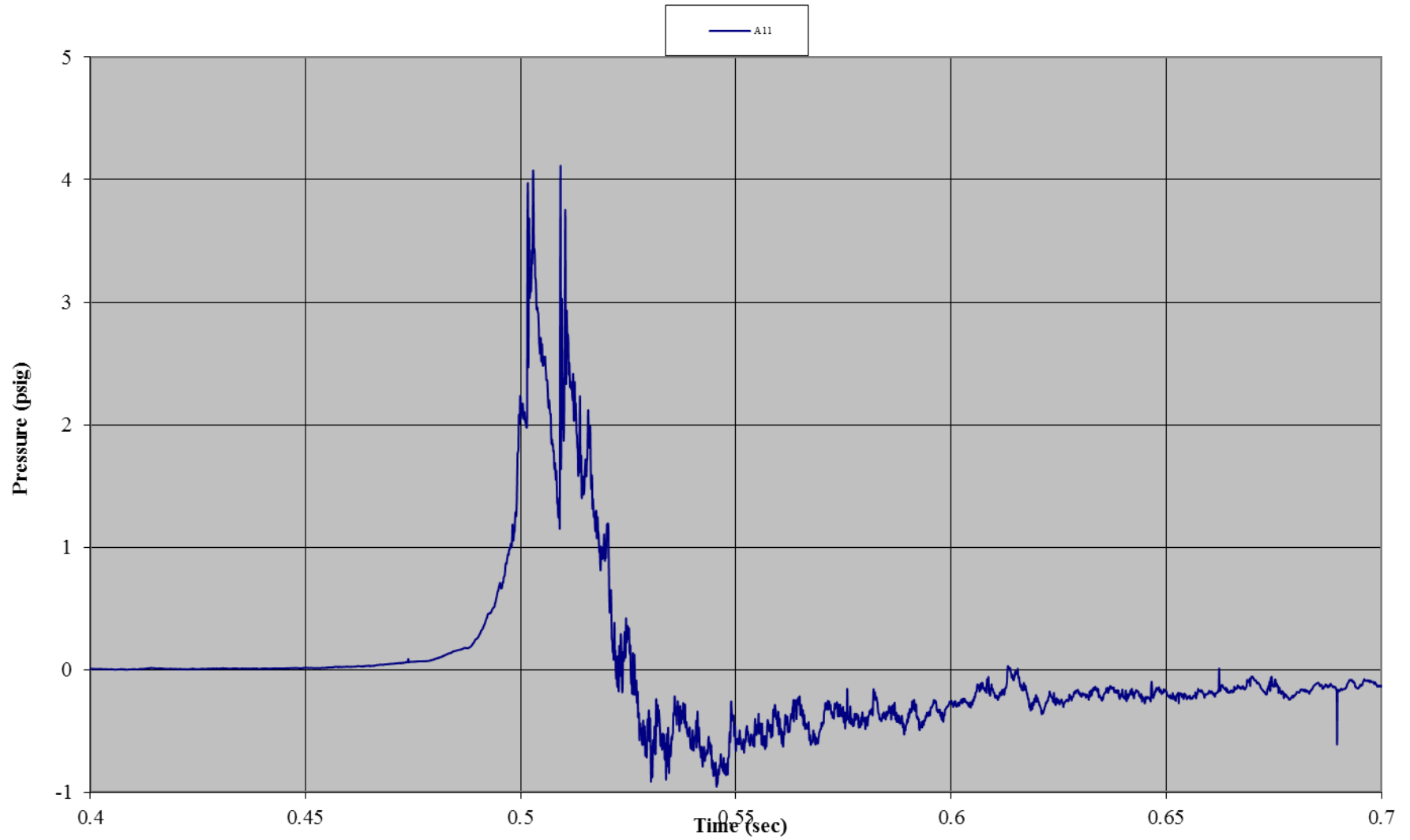


Test C02: Tent A

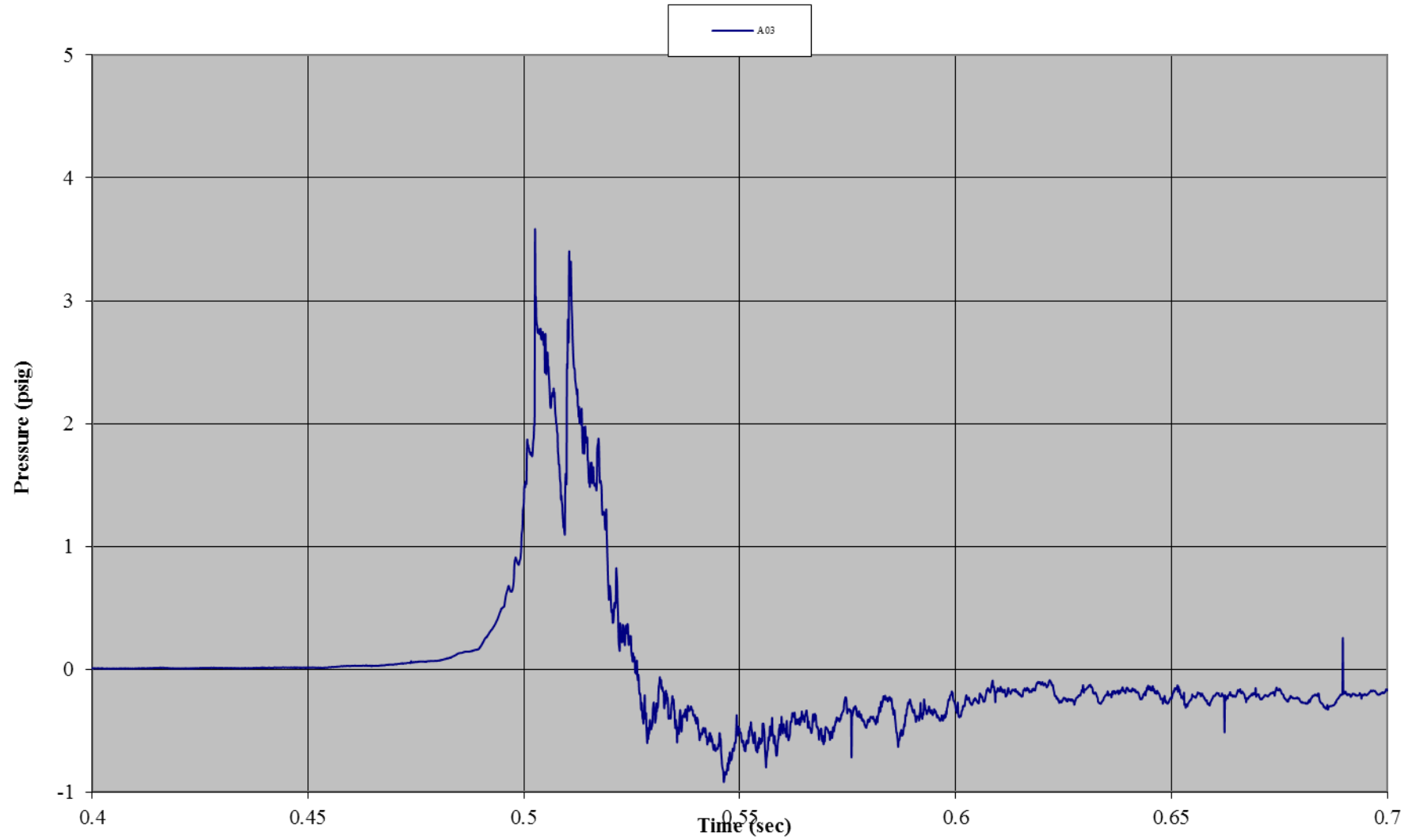
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 01: Front Wall, Left Bottom



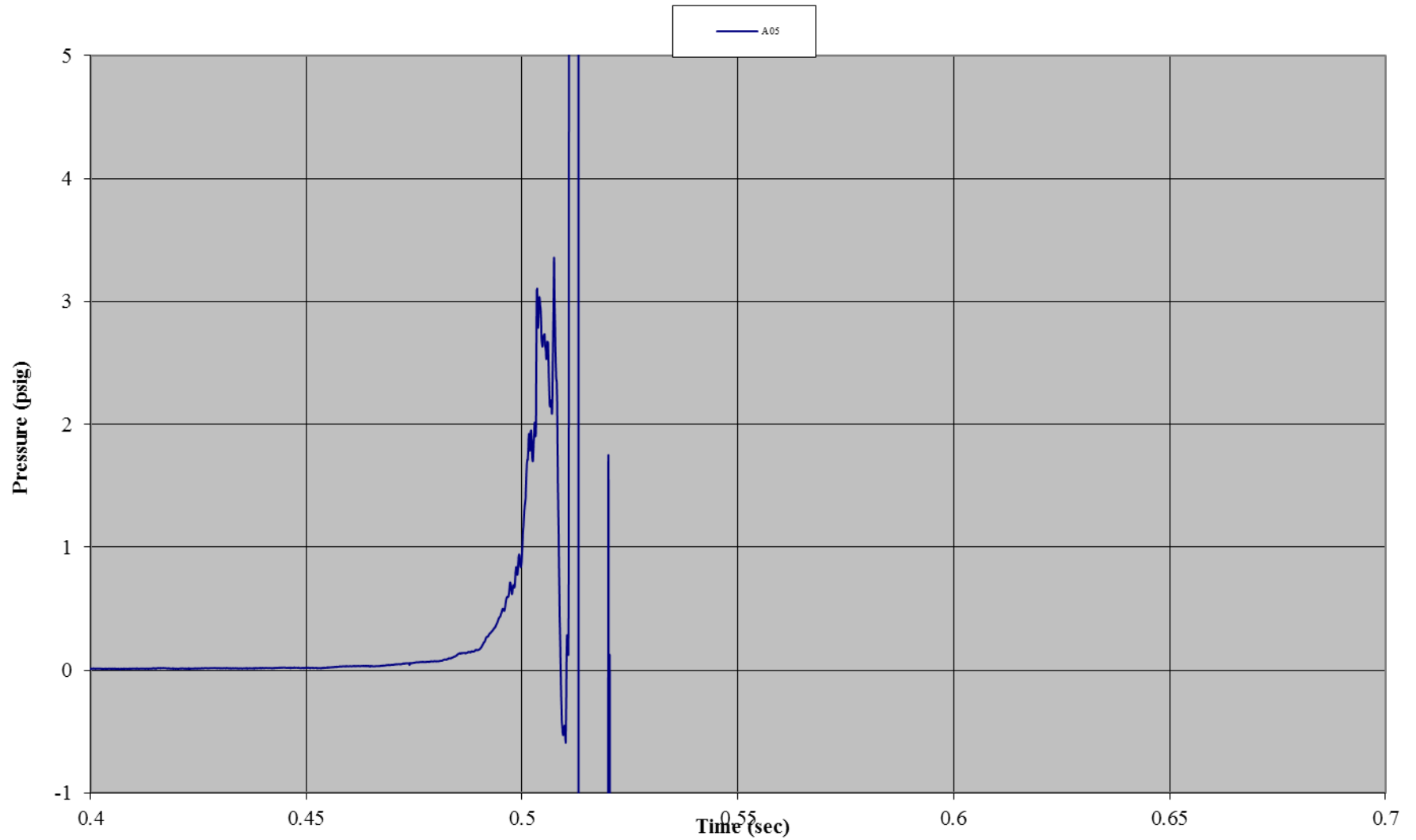
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 11: Front Wall, Right Bottom



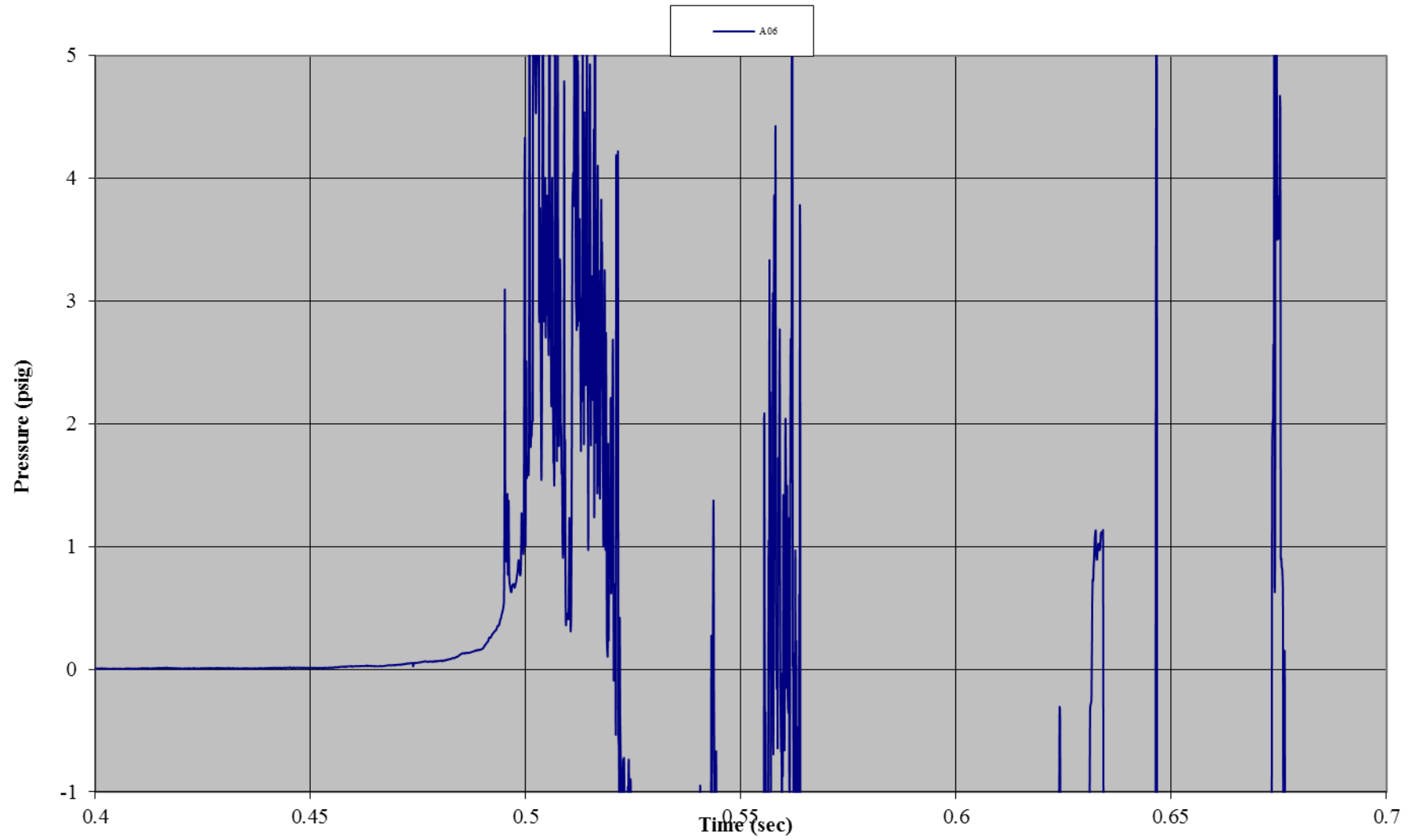
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 03: Front Wall, Center Ground



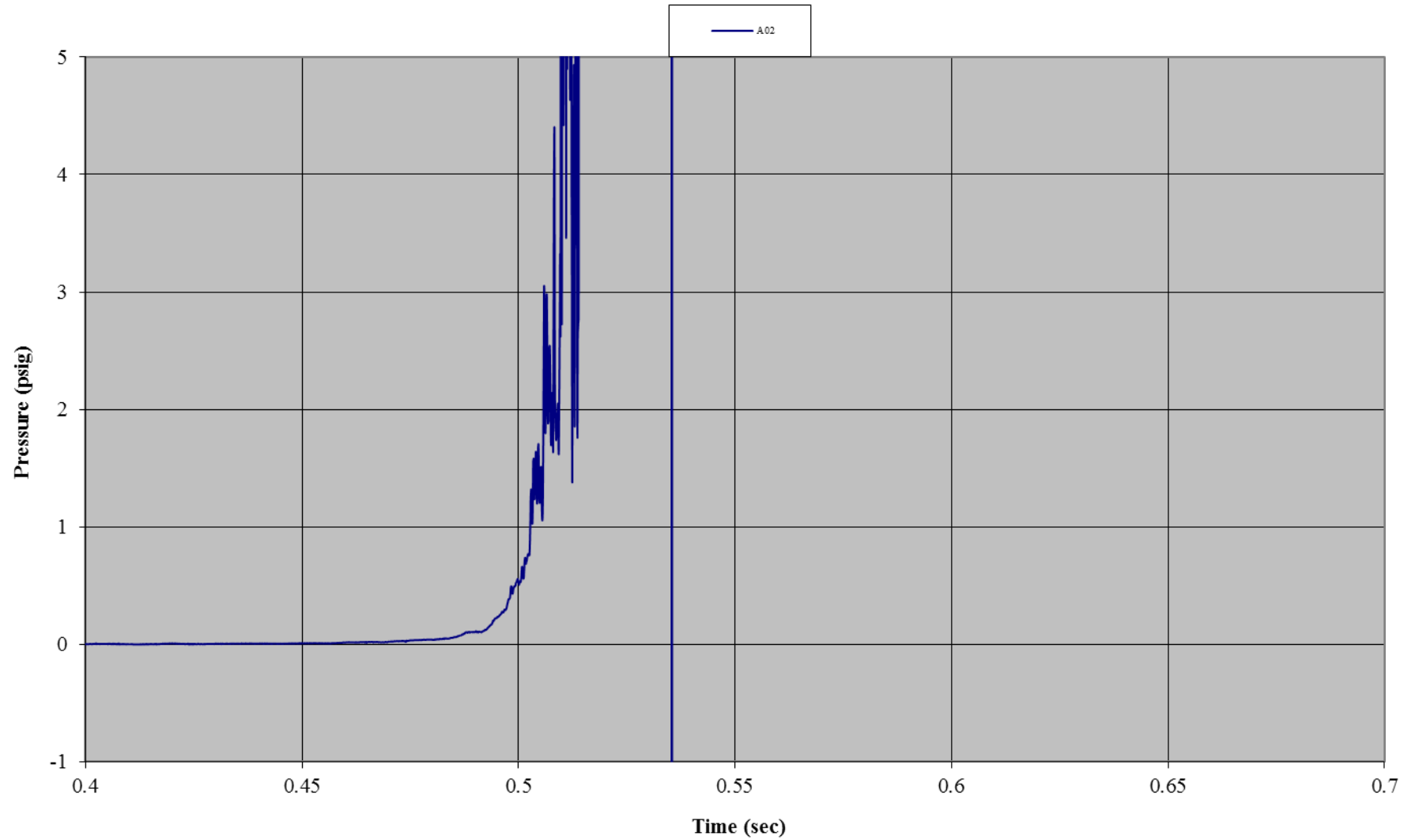
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



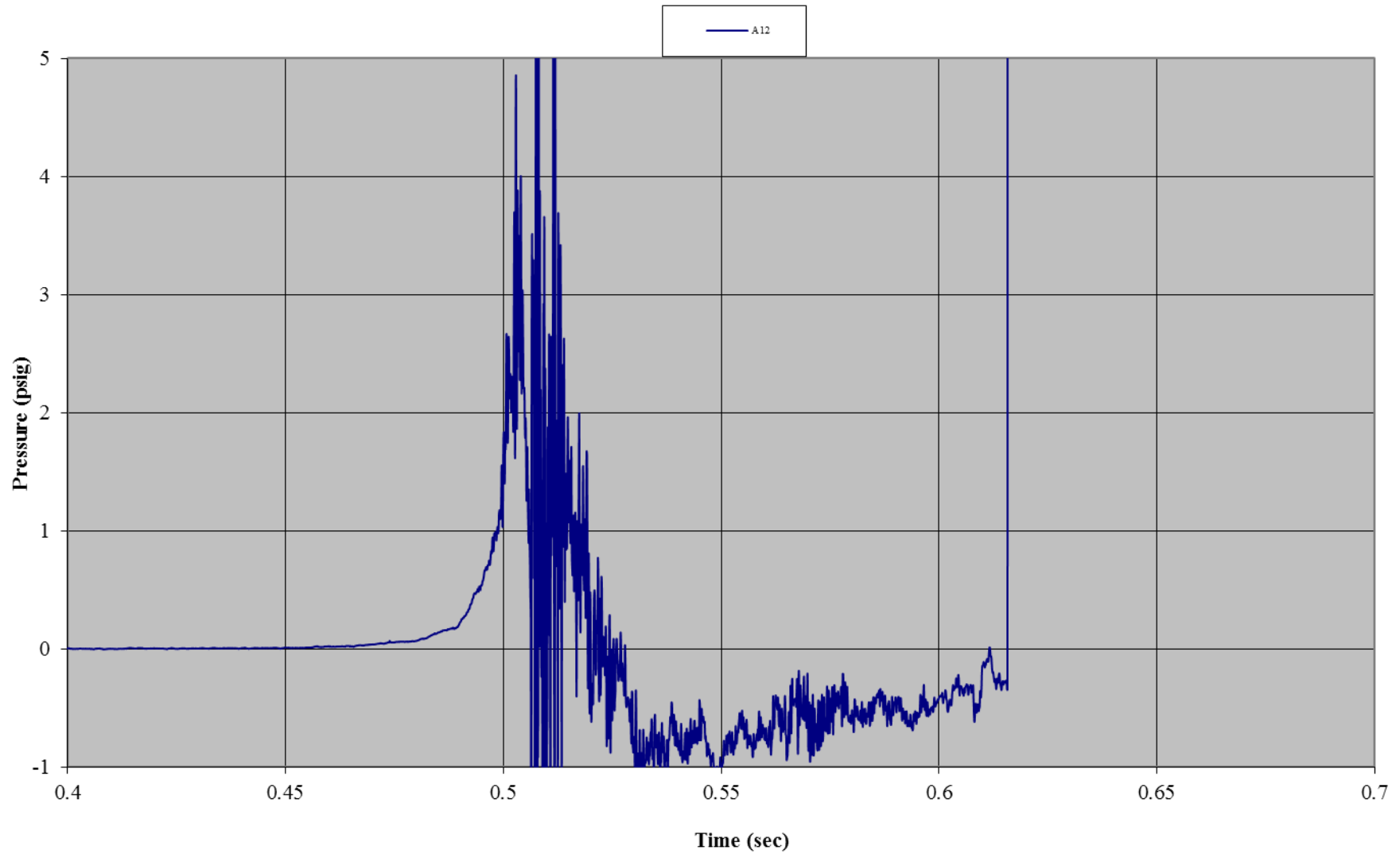
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 06: Front Wall, Center Top



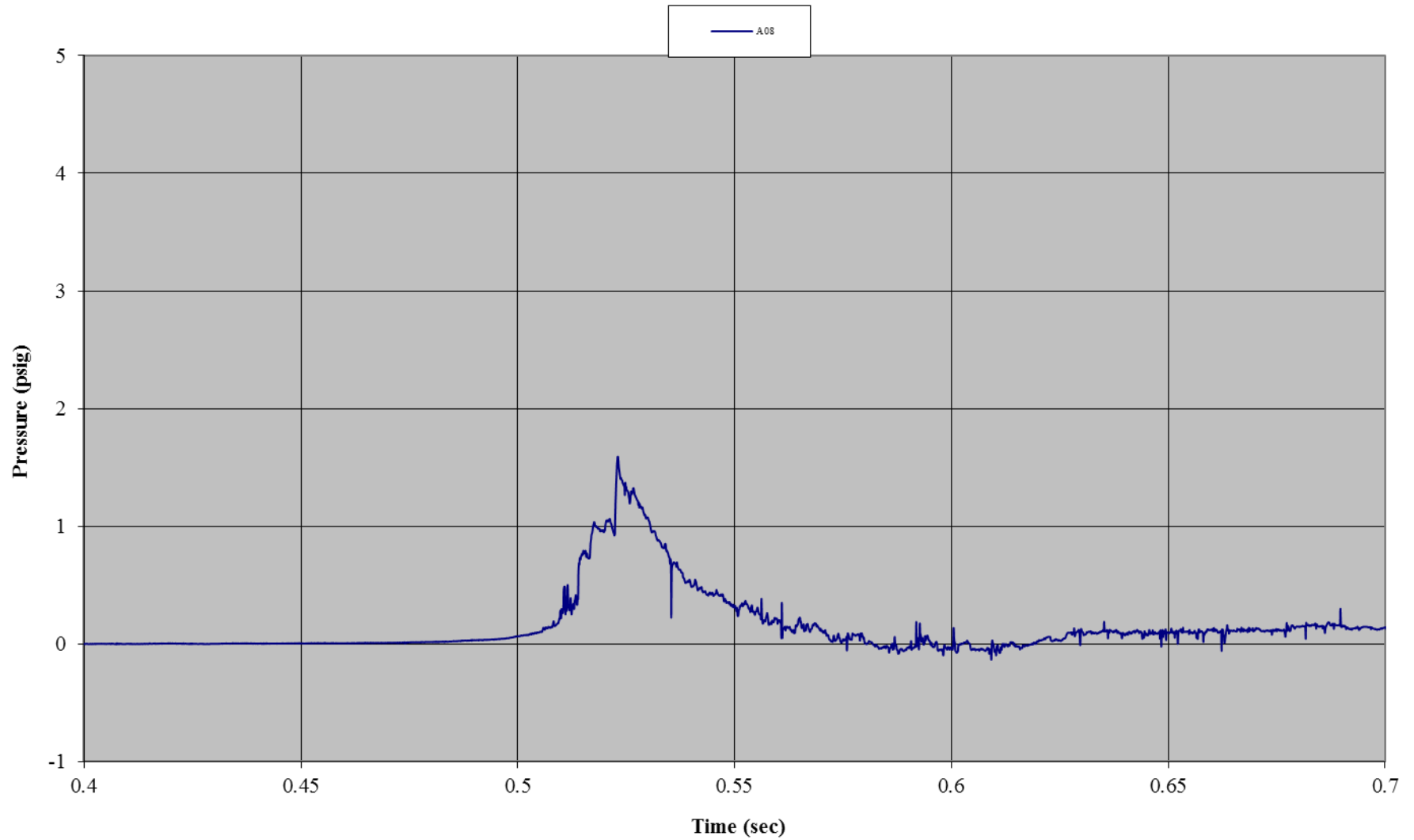
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



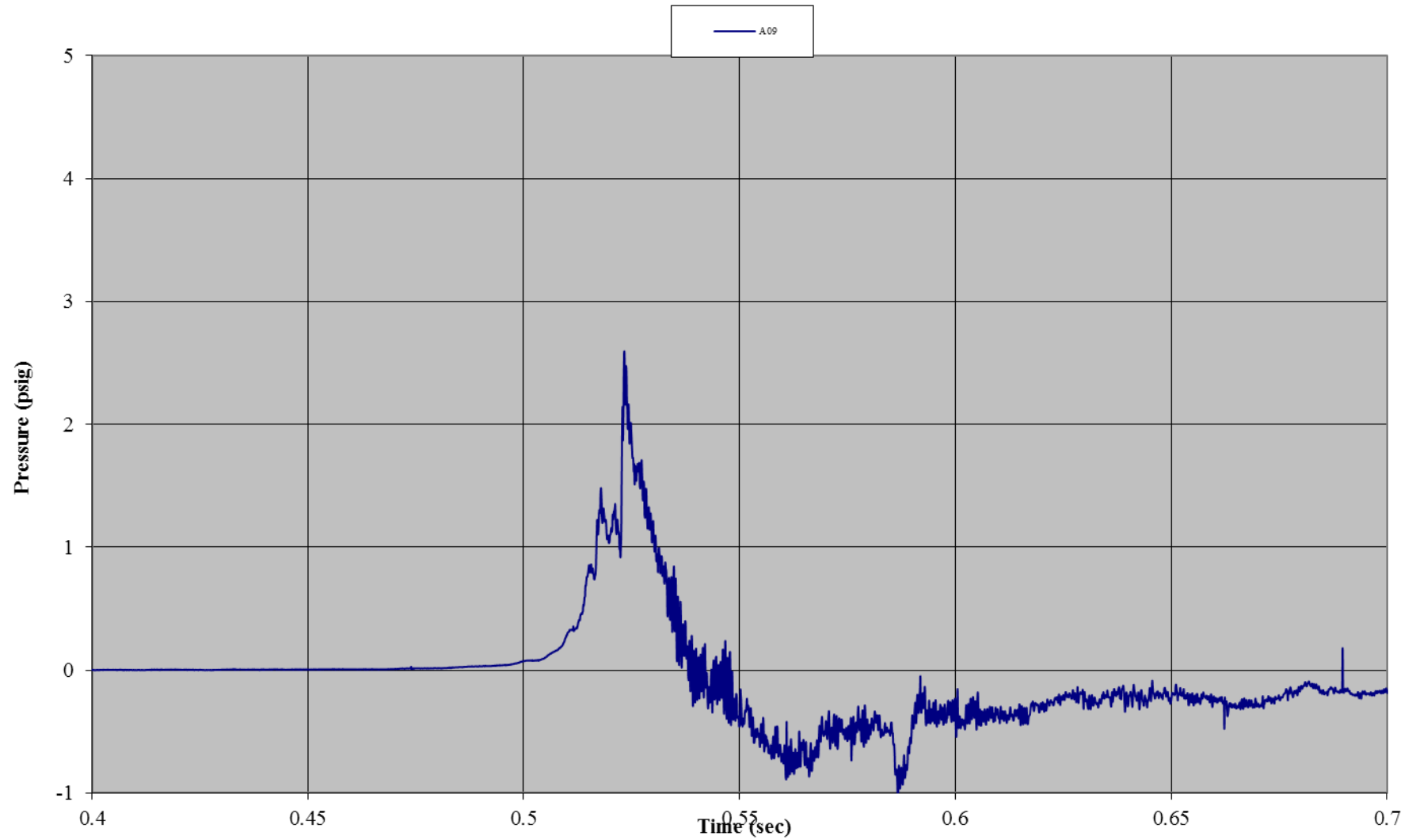
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



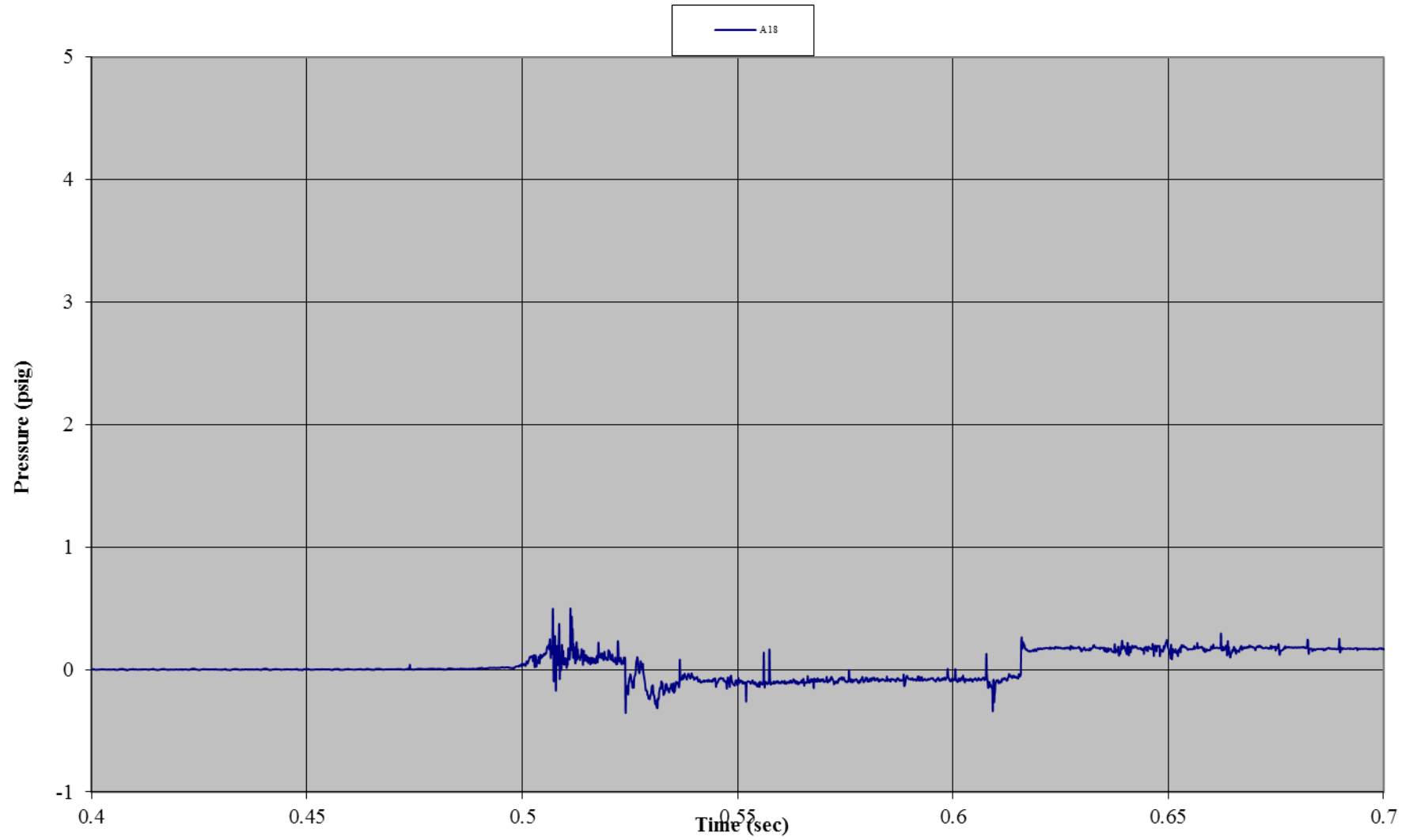
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 08: Left Side Wall, Bottom



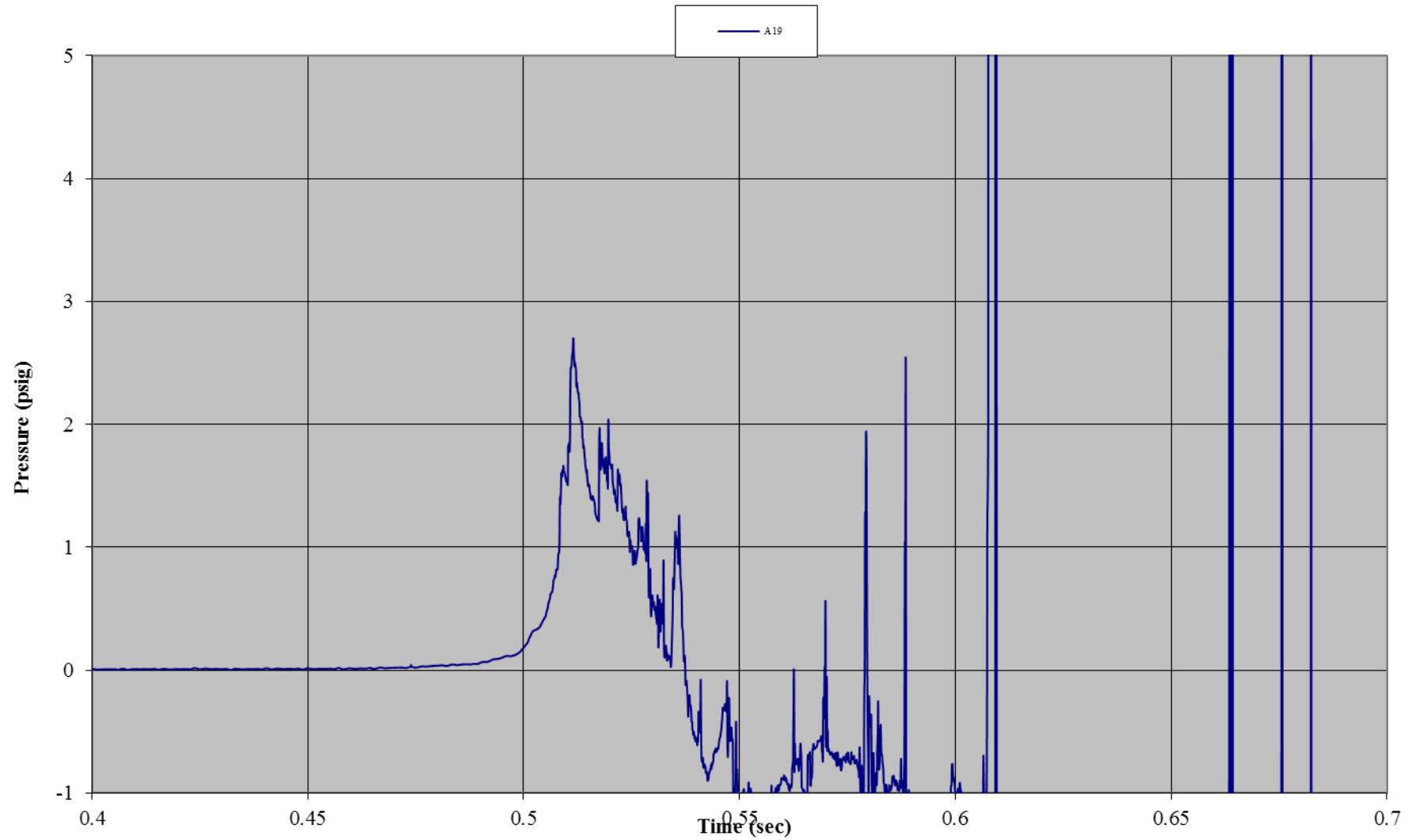
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



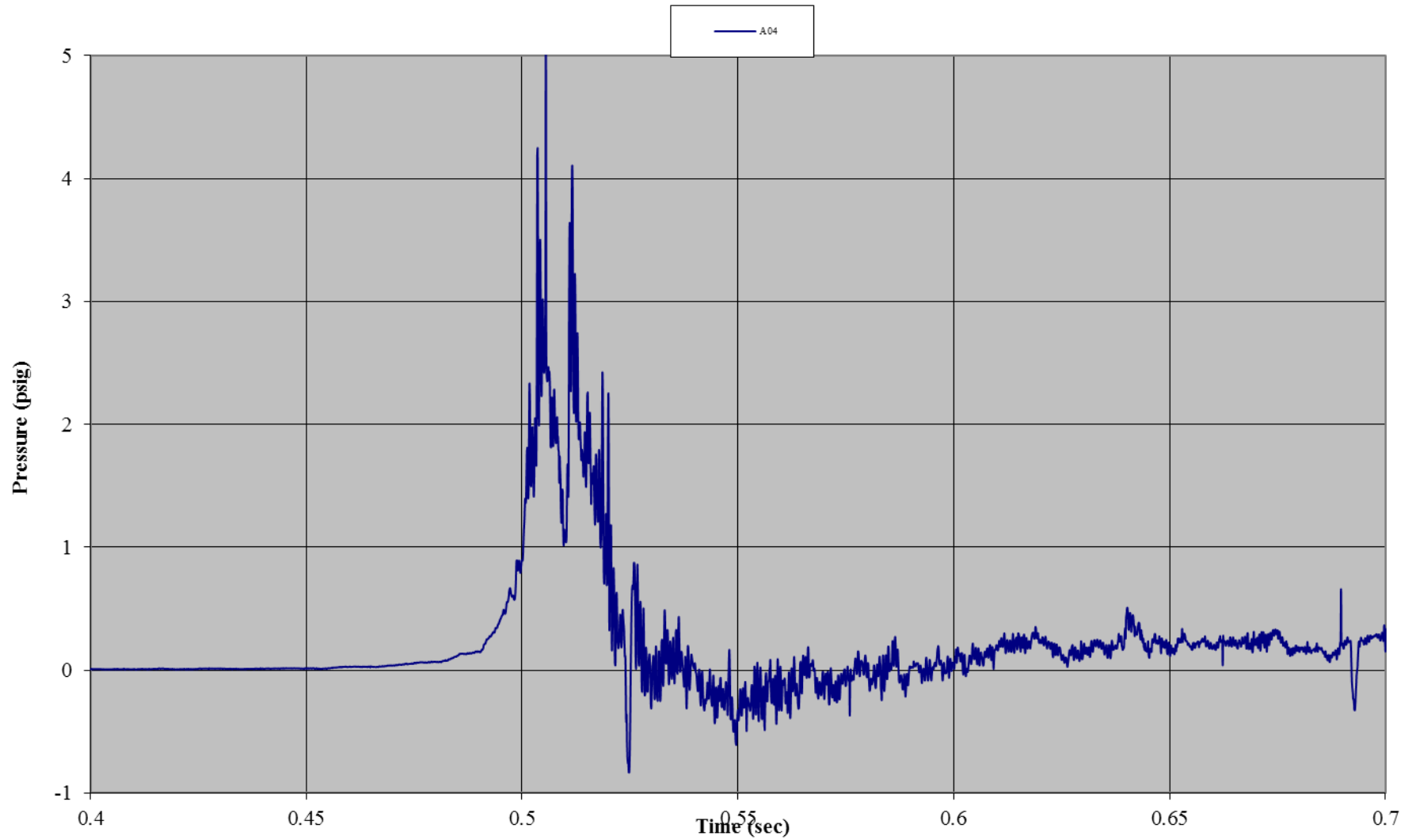
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 18: Right Side Wall, Bottom



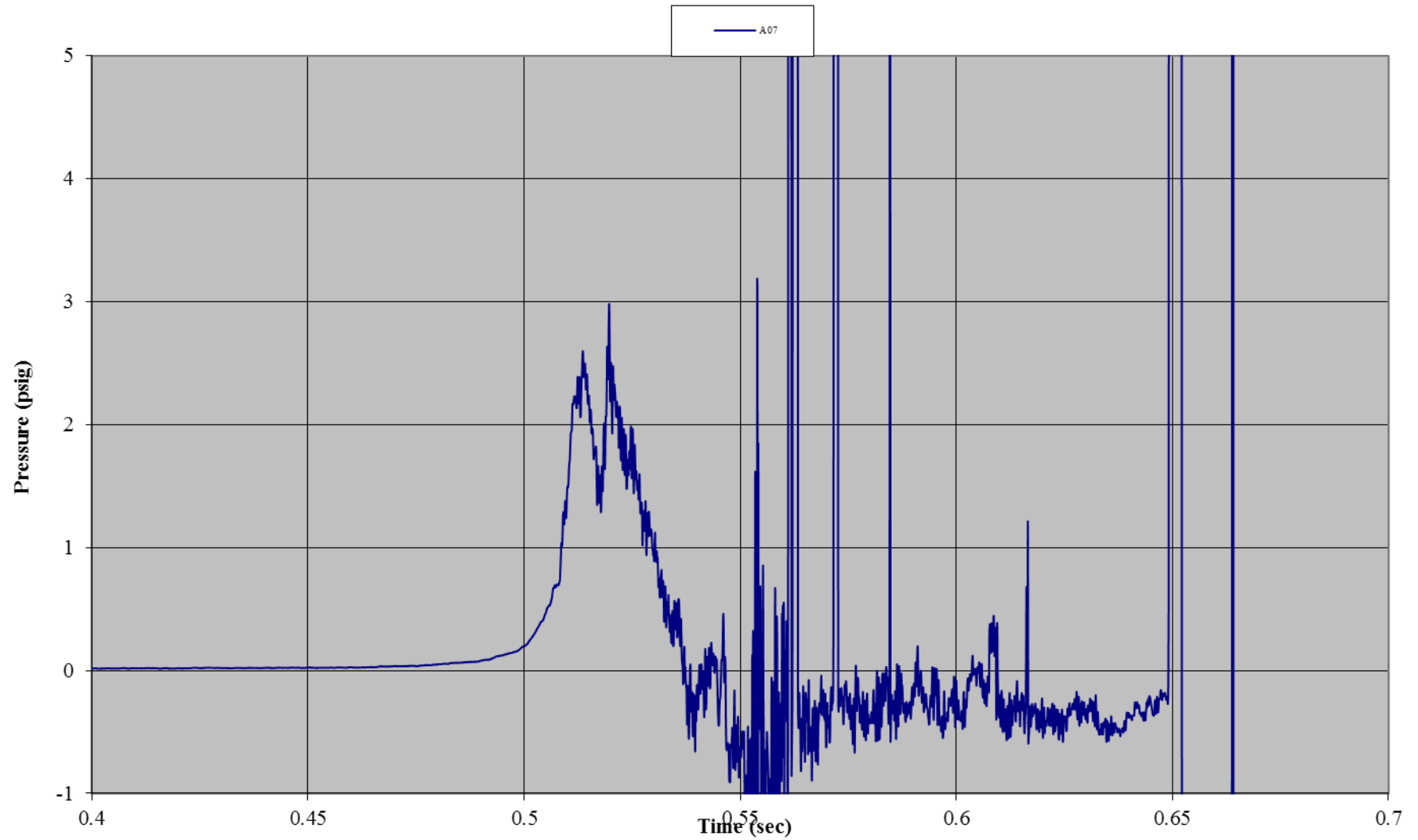
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



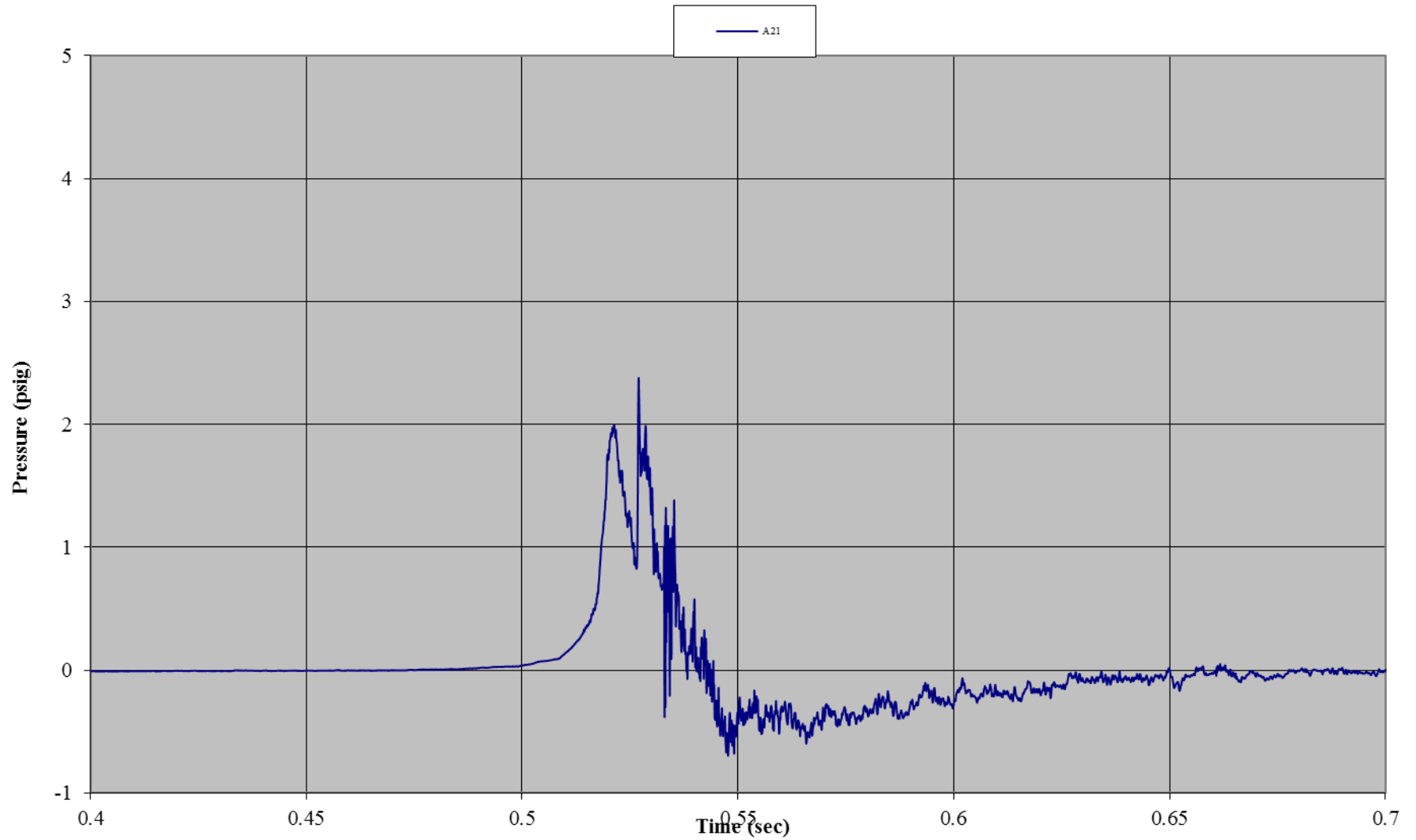
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 04: Front Wall, Center Bottom



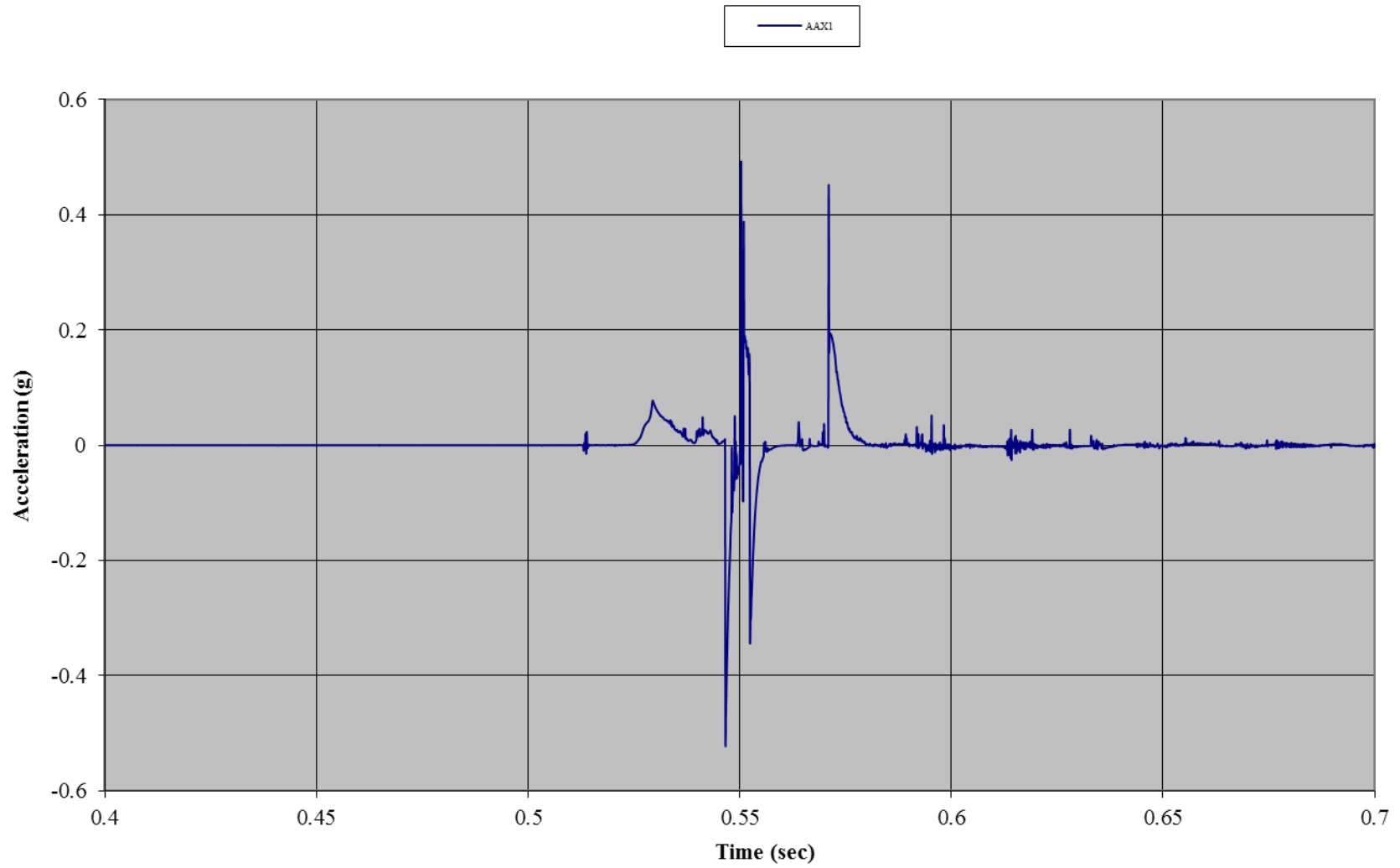
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 07: Front Wall, Top Edge at Center



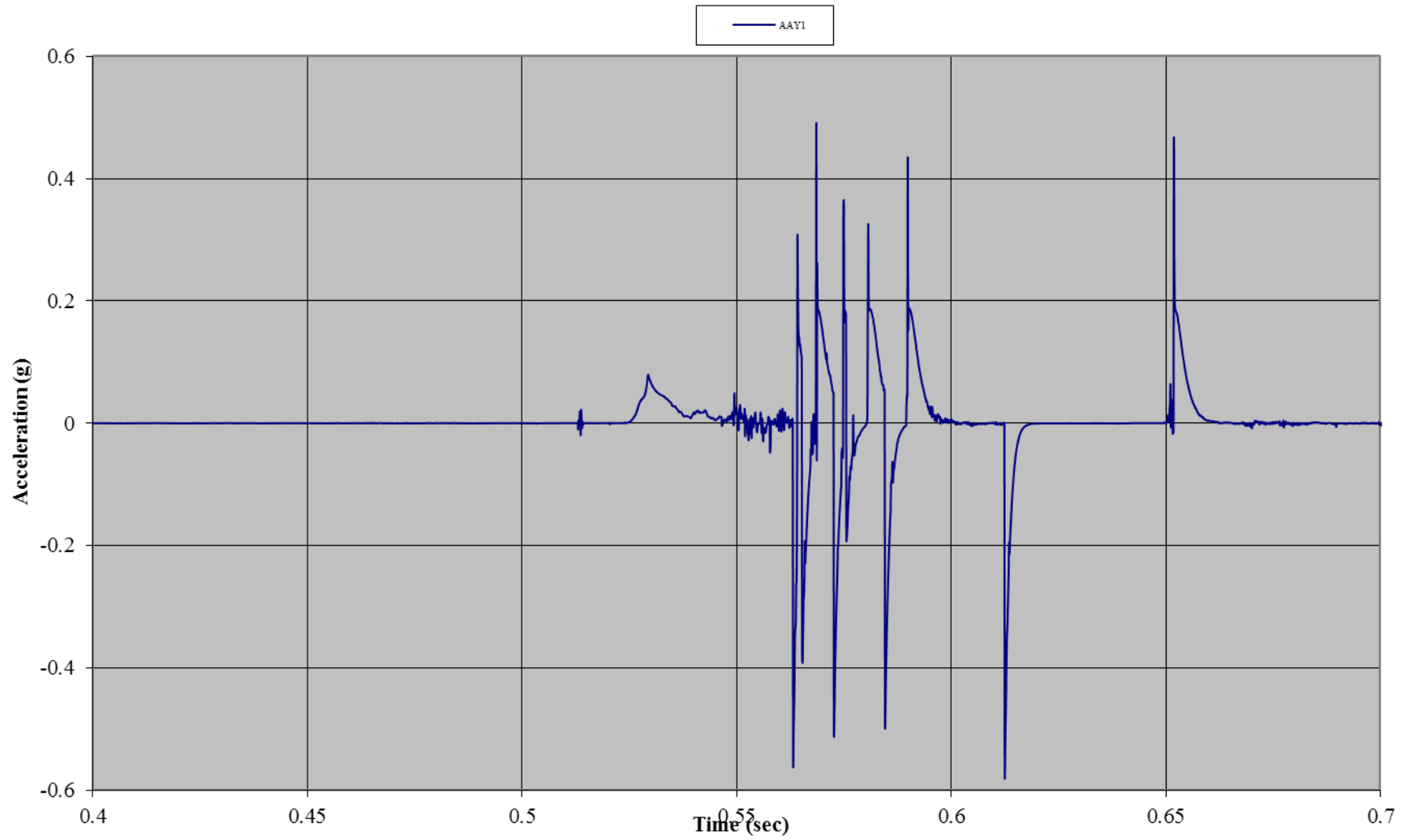
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



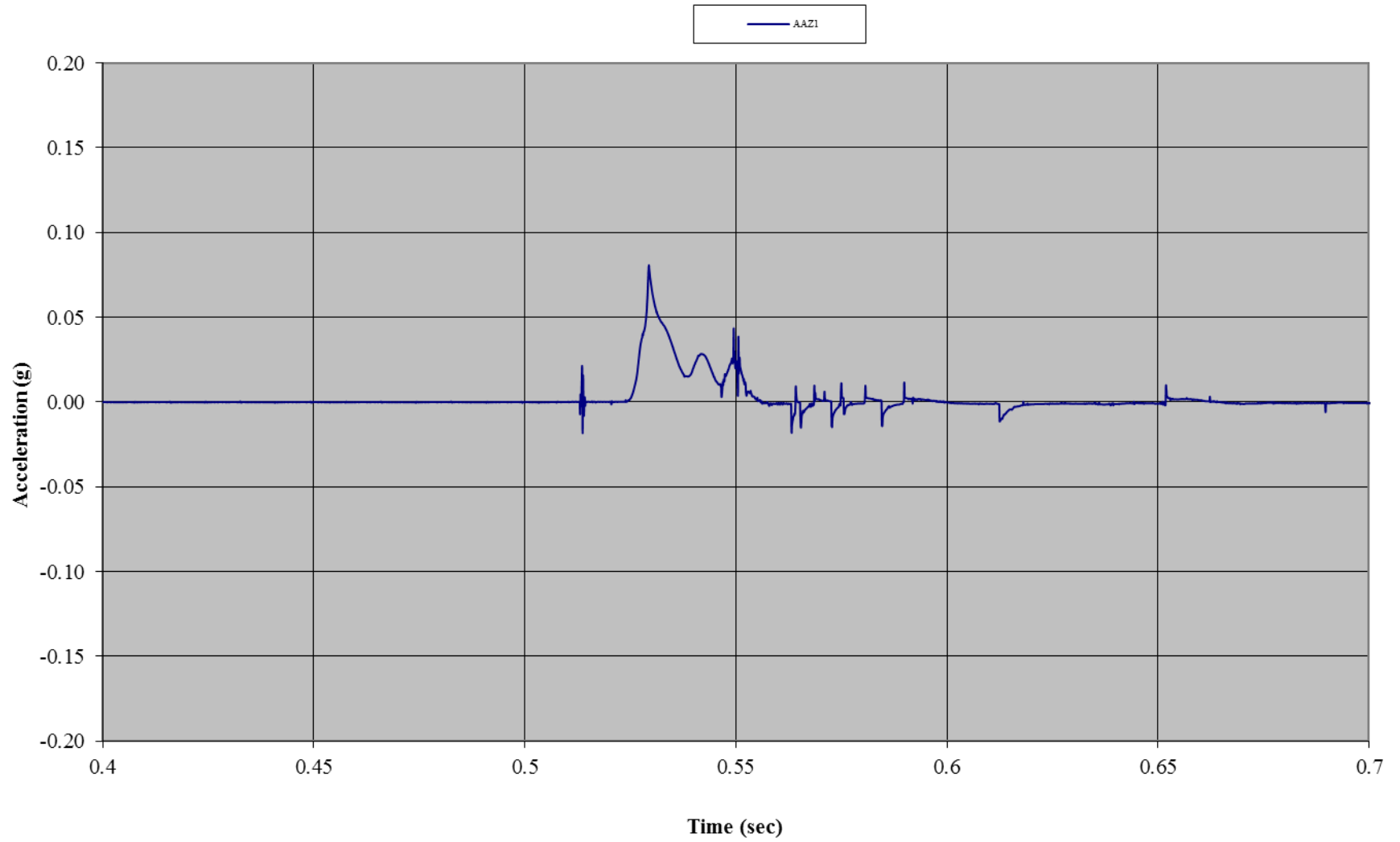
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (x-direction)



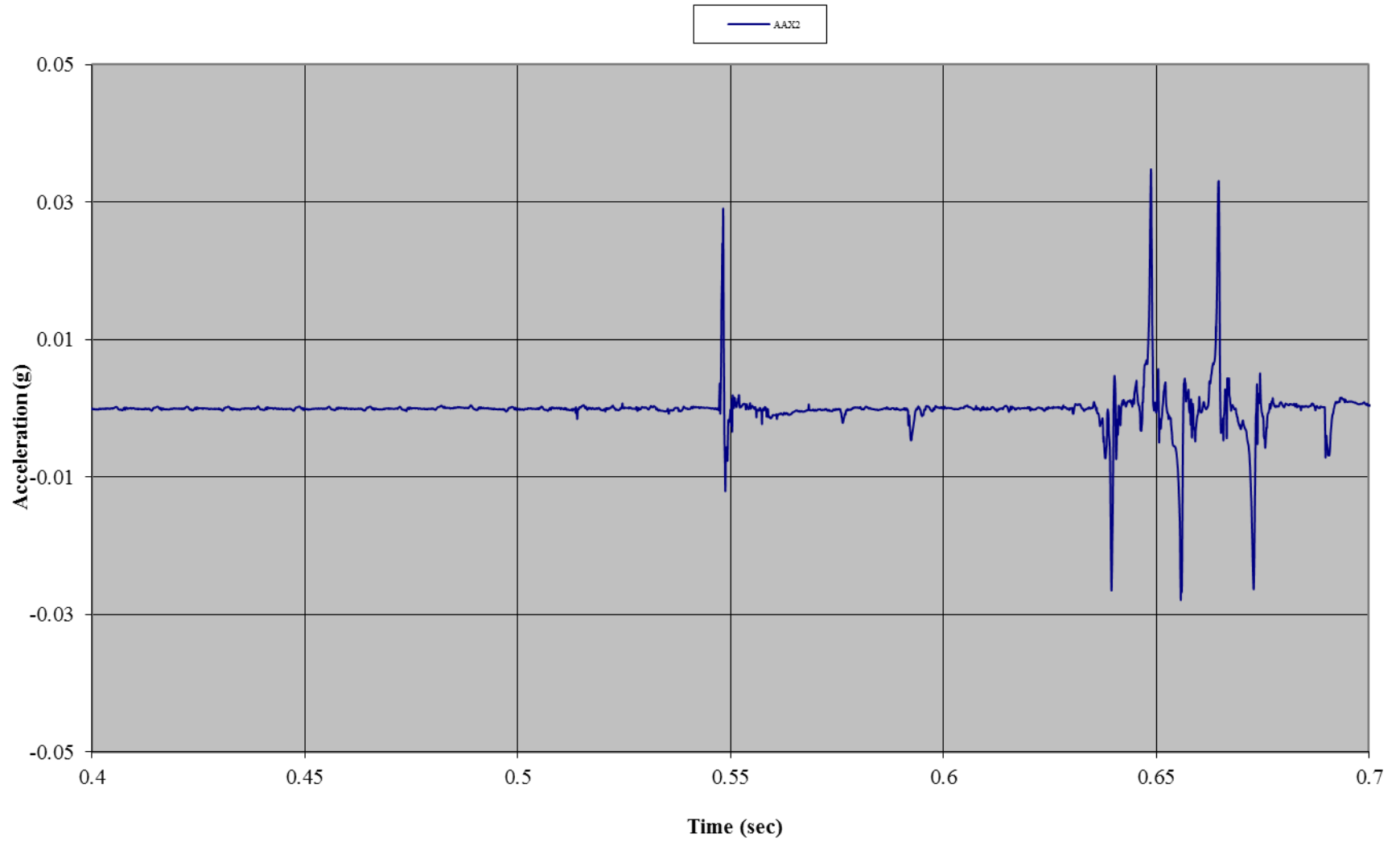
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (y-direction)



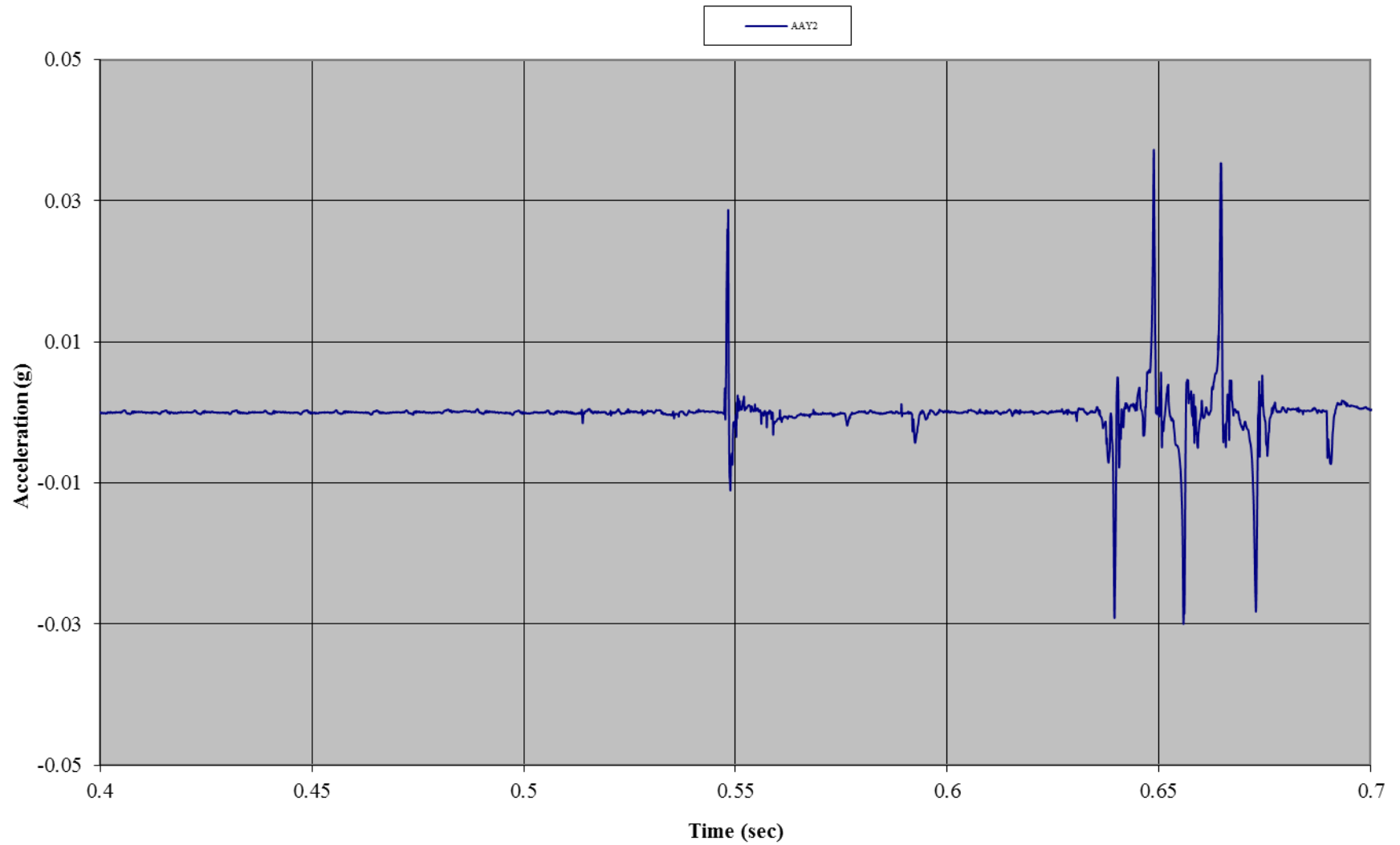
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Accelerometer 1: Front Wall (z-direction)



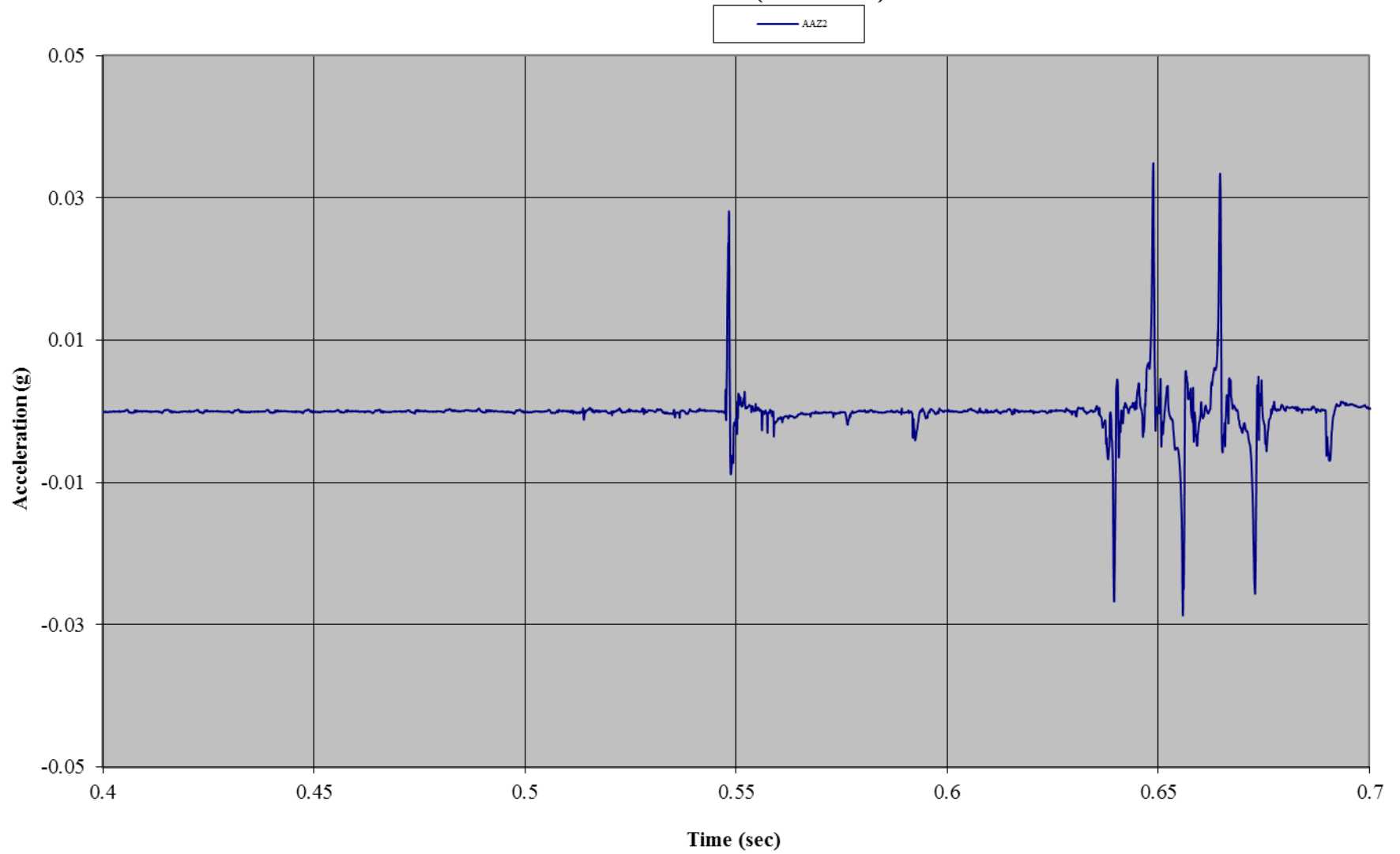
Test C02: 90 mph-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (x-direction)



Test C02: 90 mph-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (y-direction)

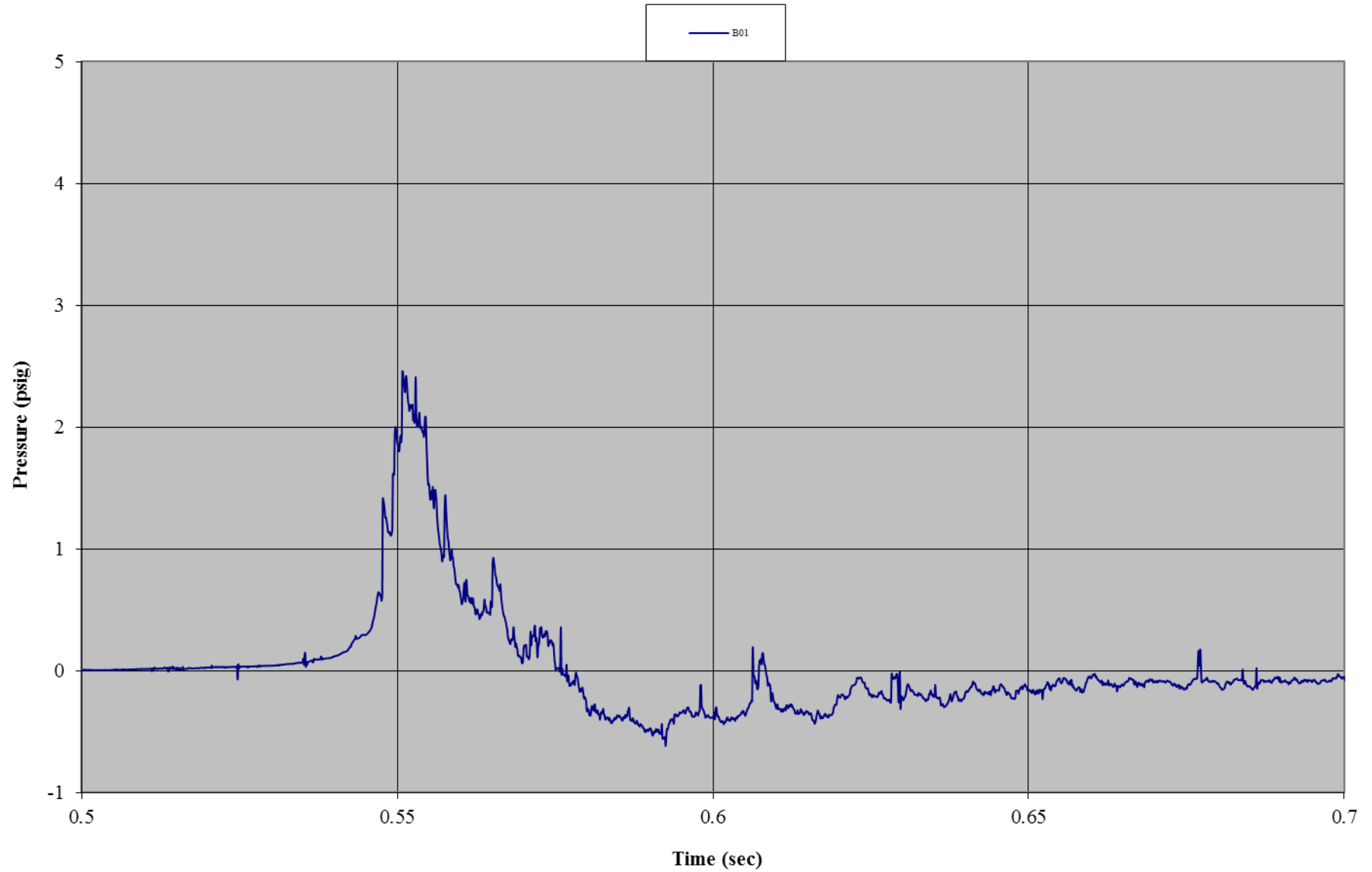


Test C02: 90 mph-Wind Rated Pole Tent with Sides
Accelerometer 2: Roof (z-direction)

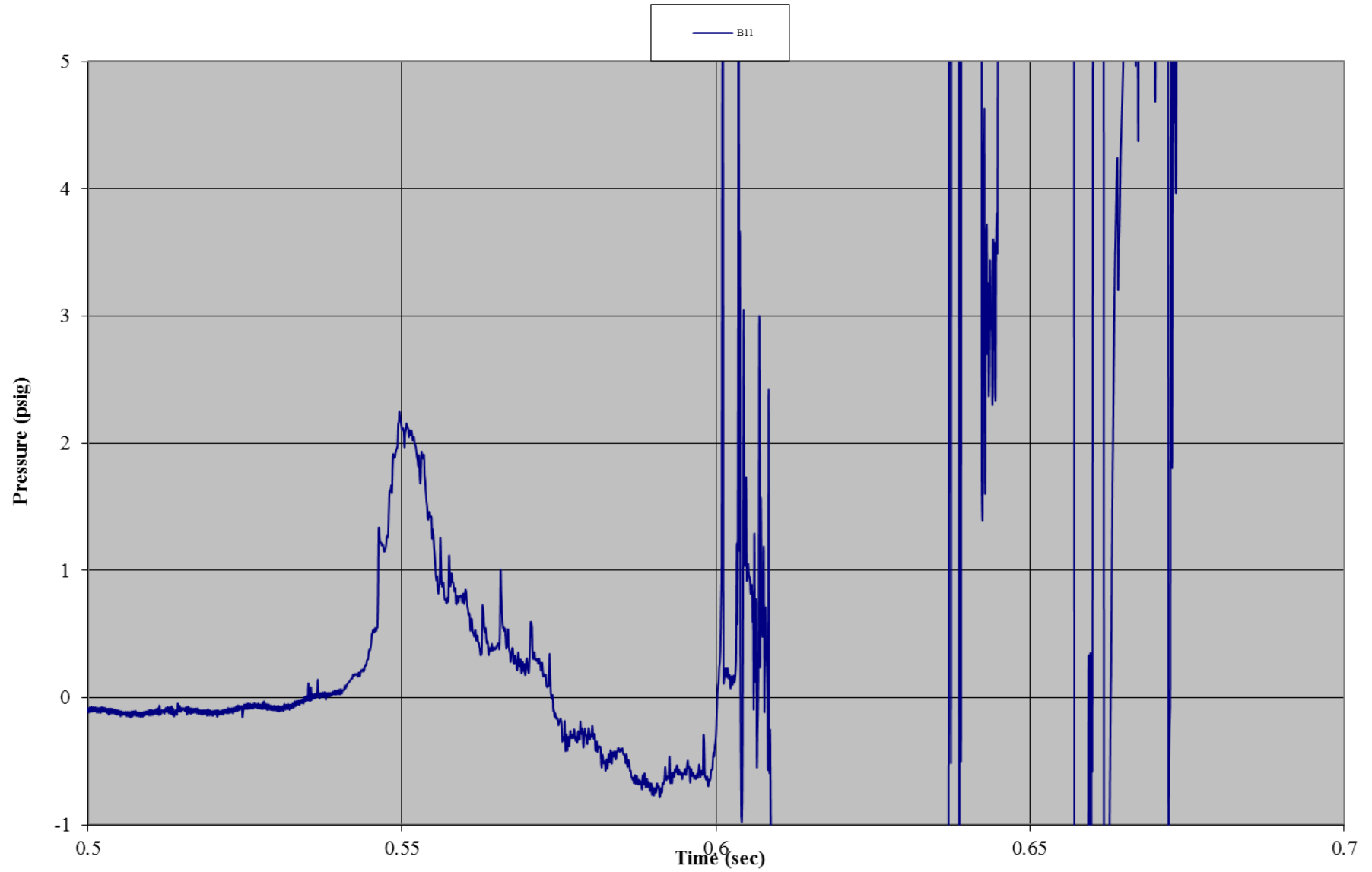


Test C02: Tent B

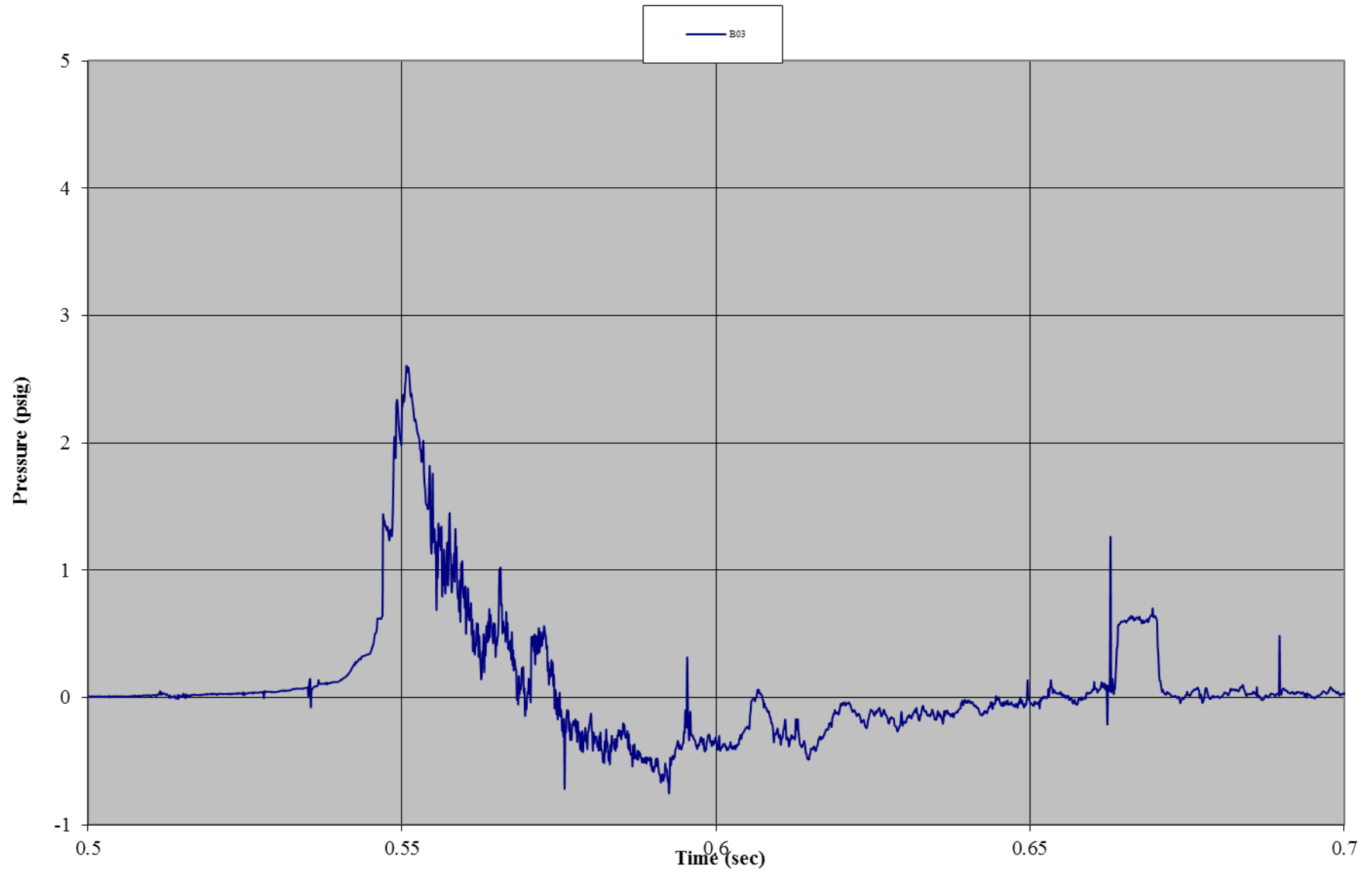
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 01: Front Wall, Left Bottom



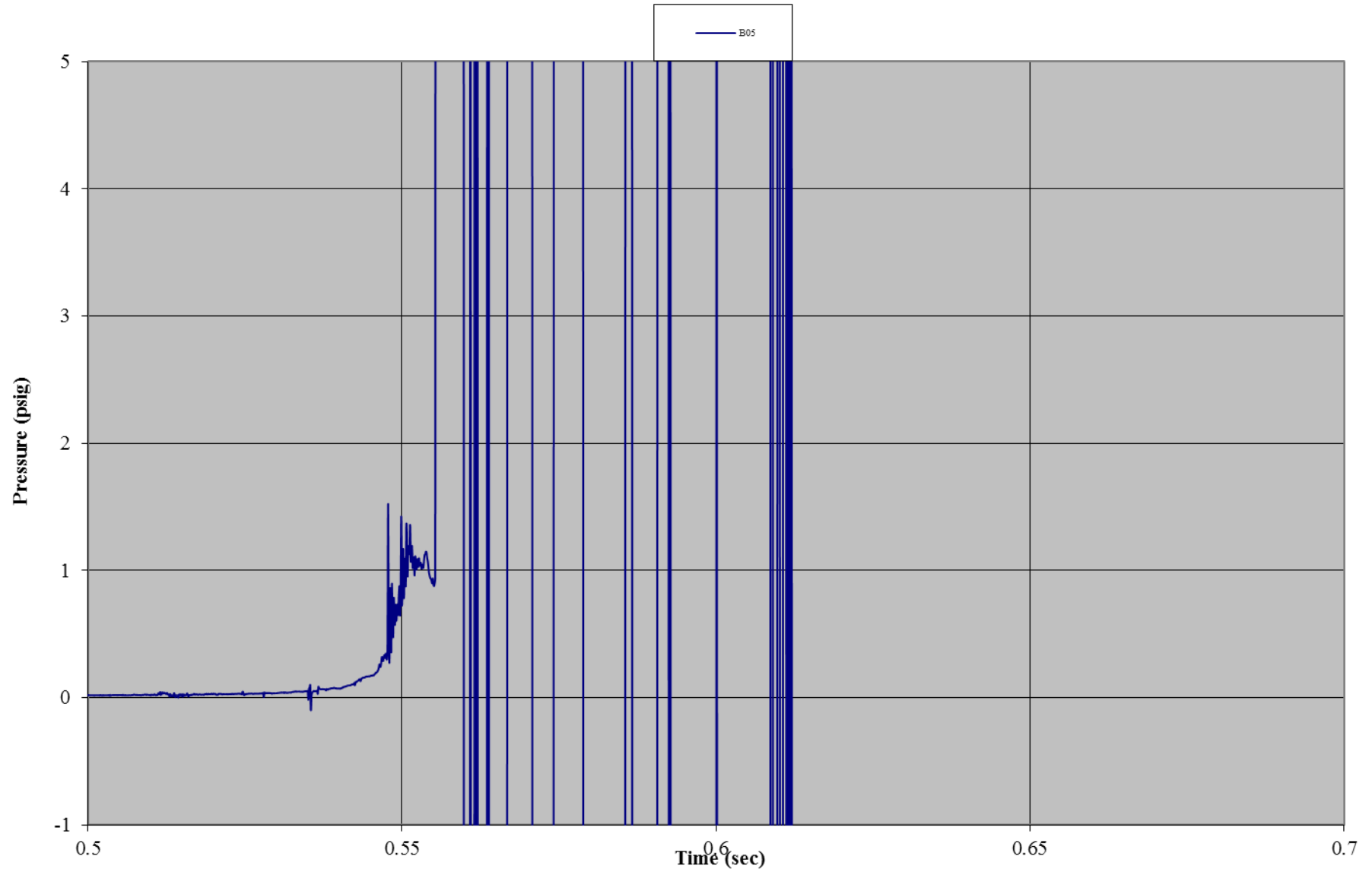
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 11: Front Wall, Right Bottom



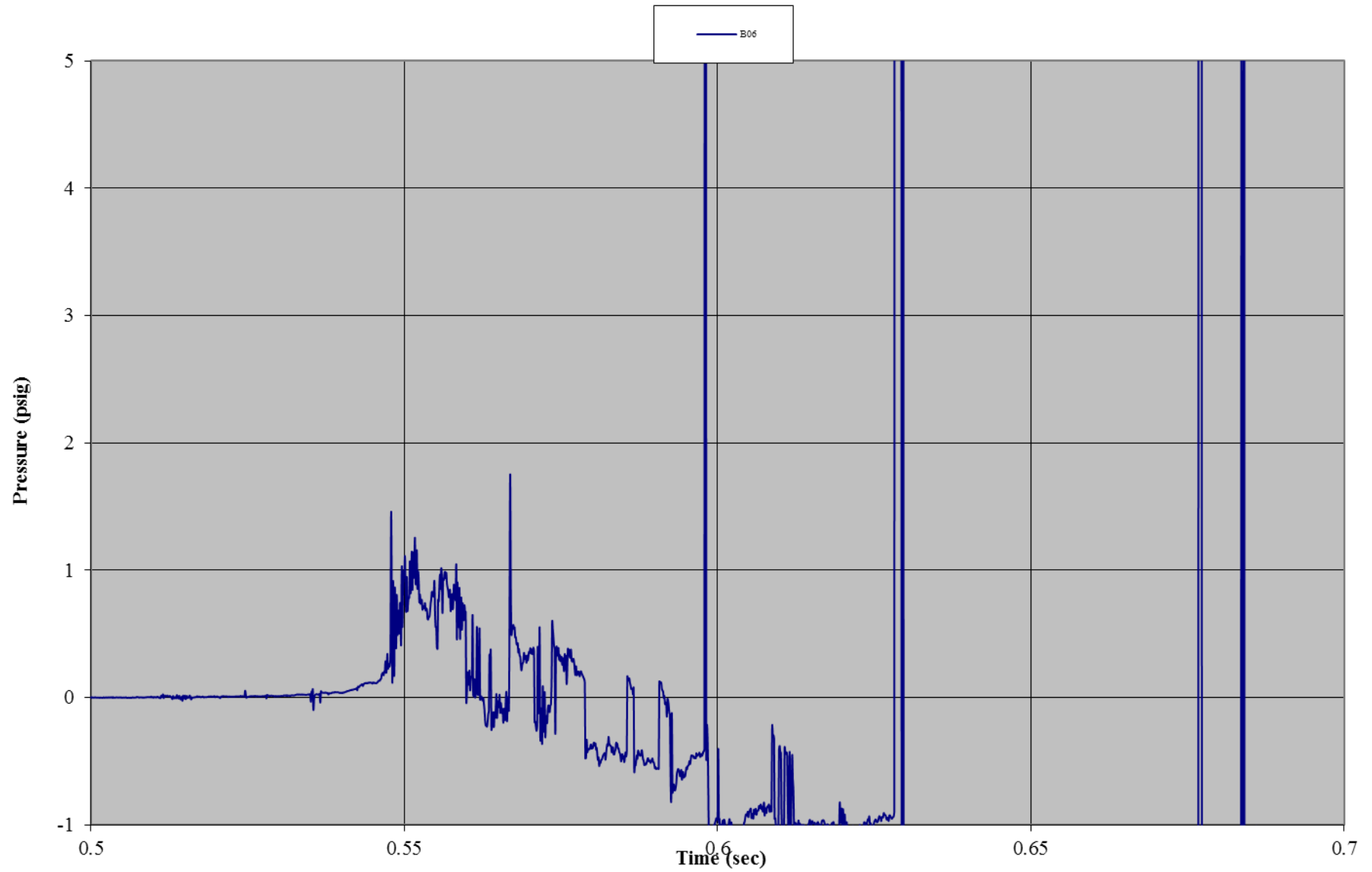
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 03: Front Wall, Center Ground



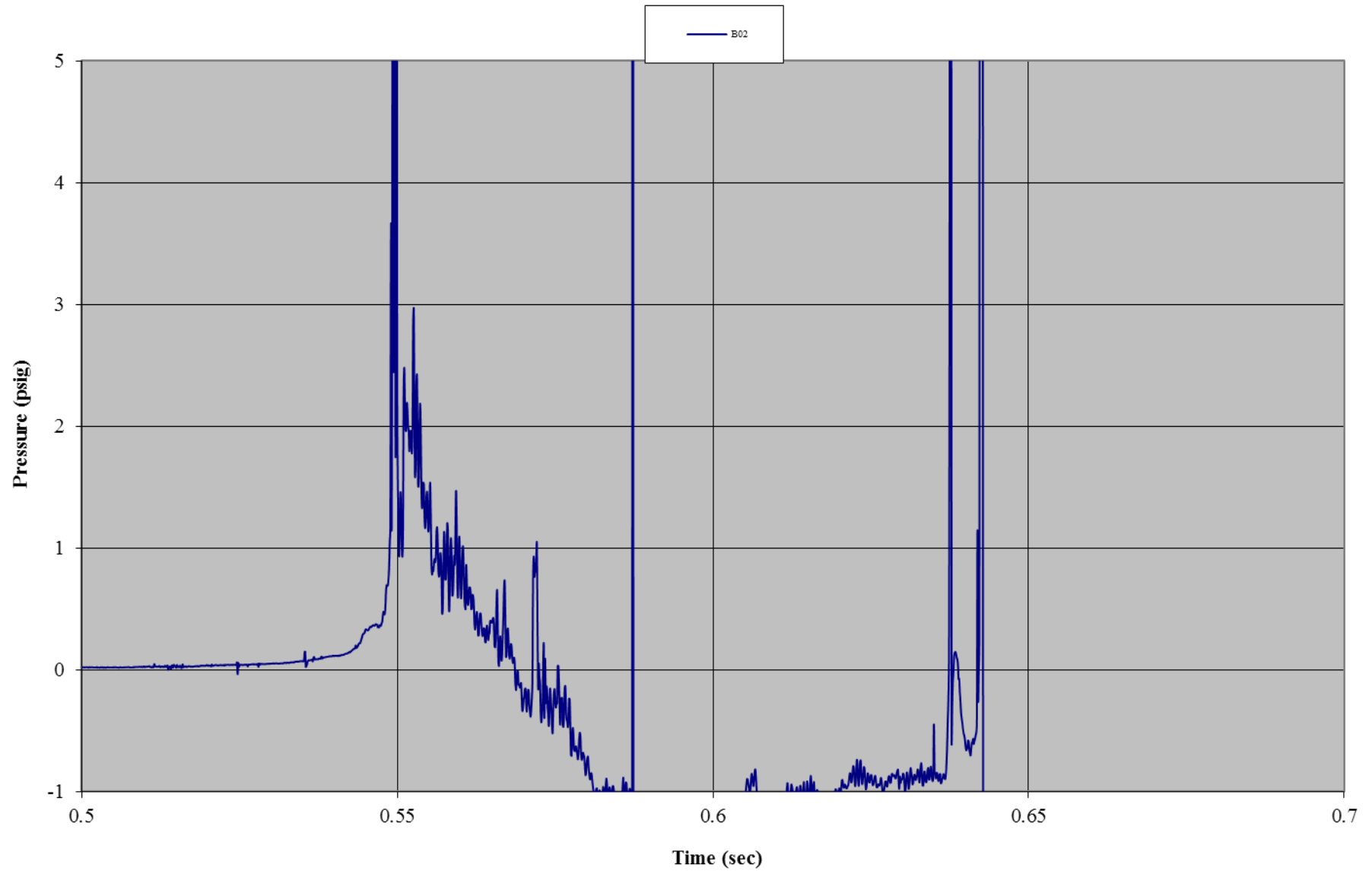
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



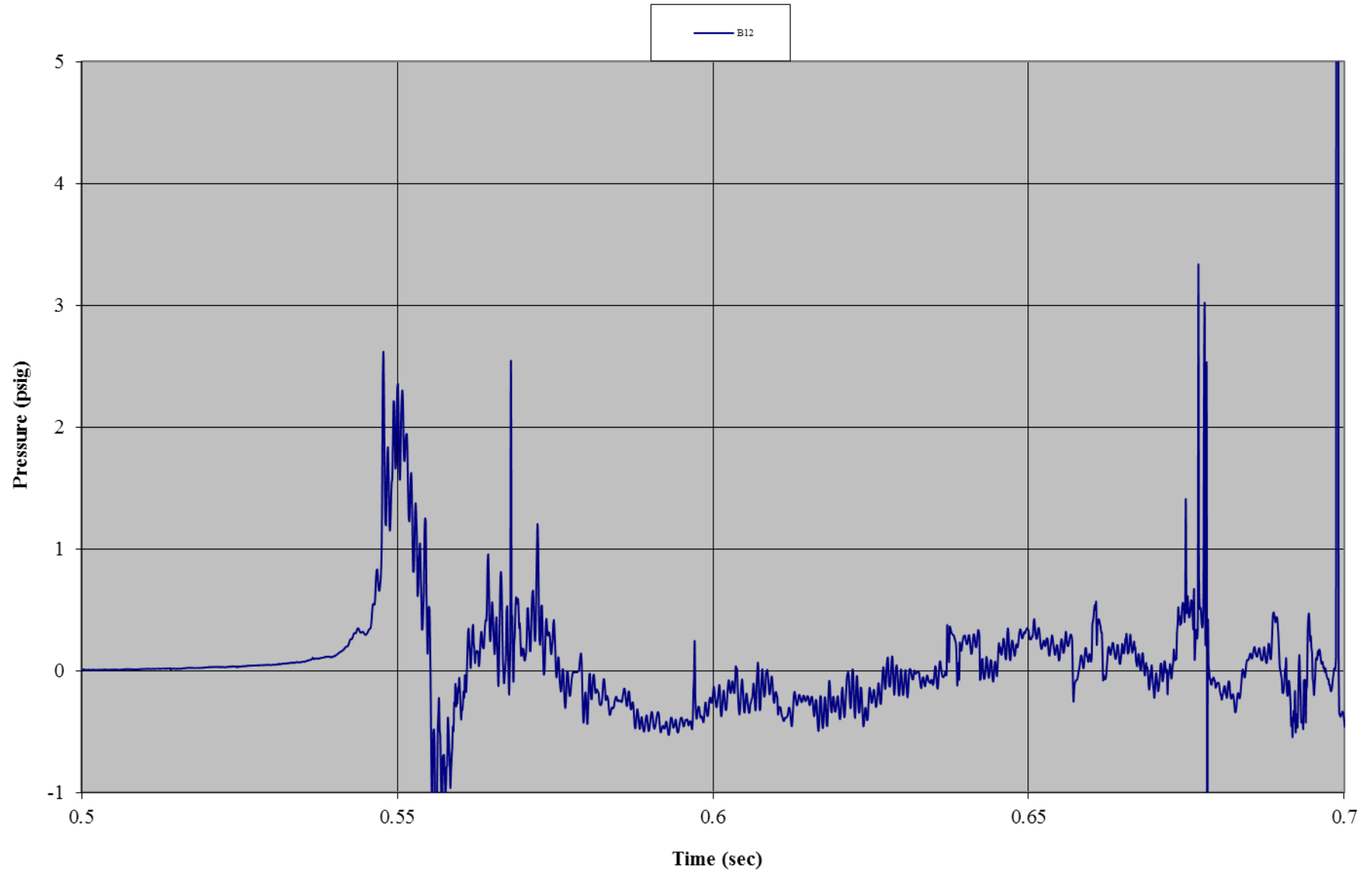
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 06: Front Wall, Center Top



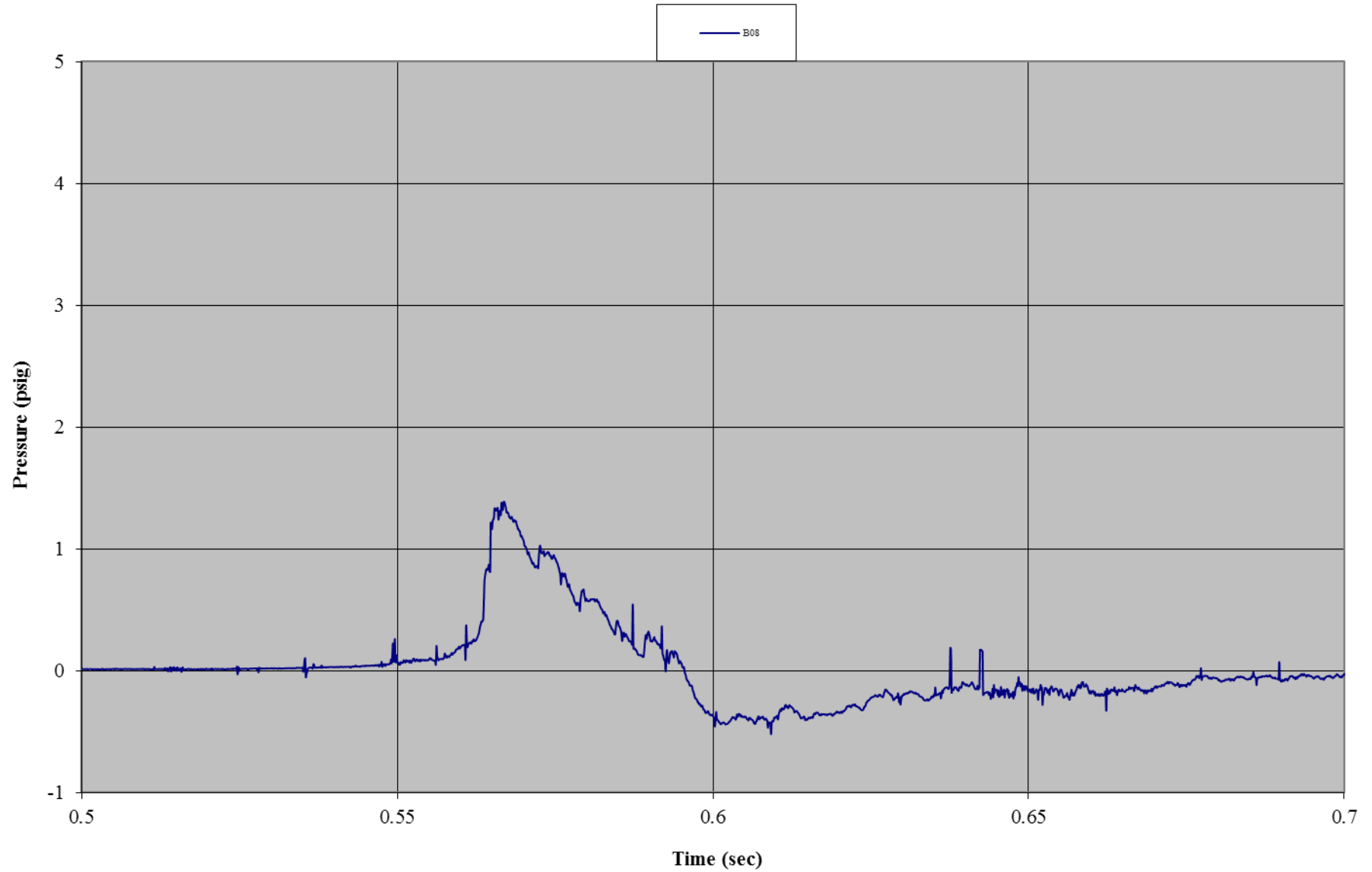
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



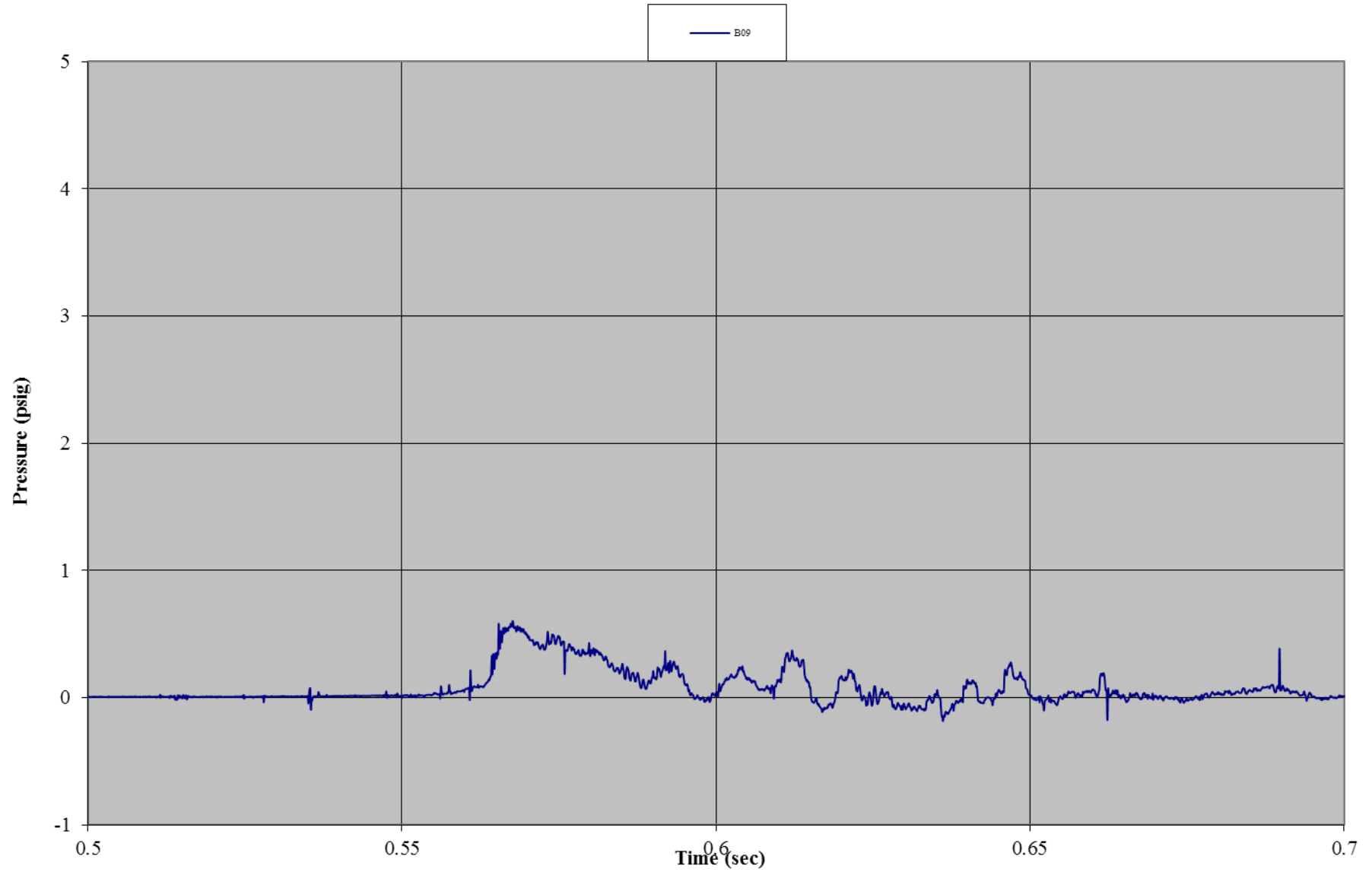
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



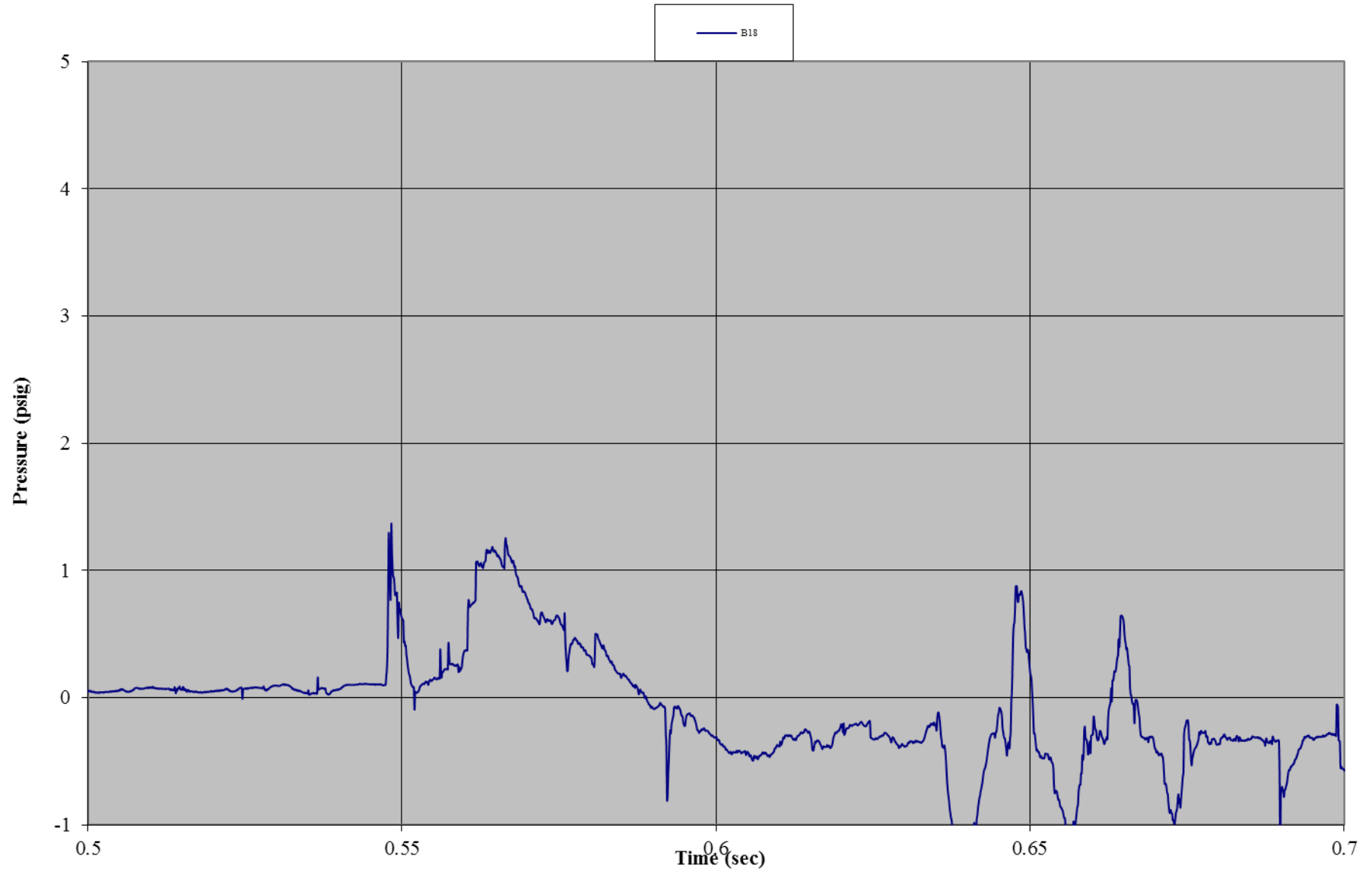
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 08: Left Side Wall, Bottom



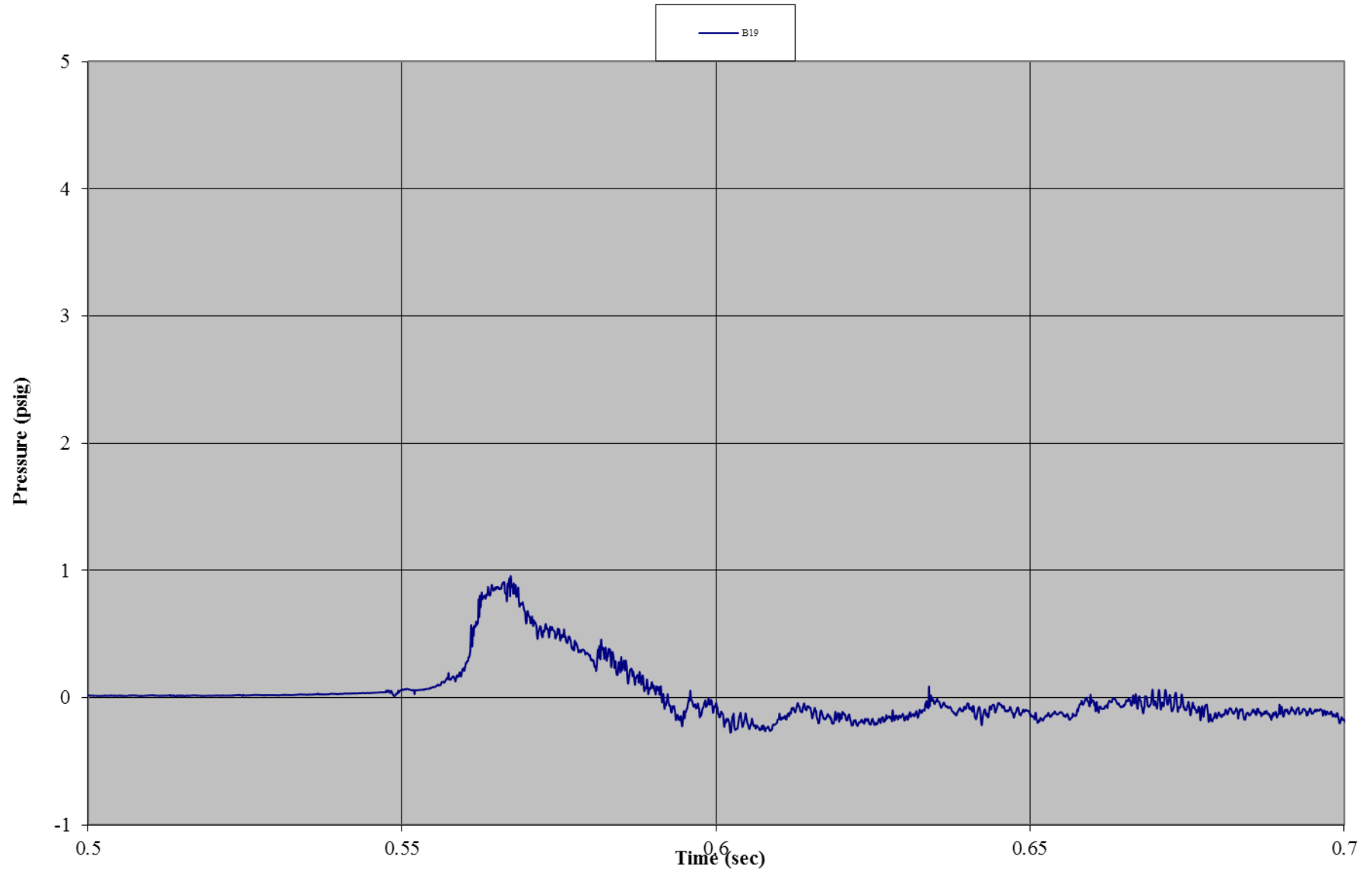
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



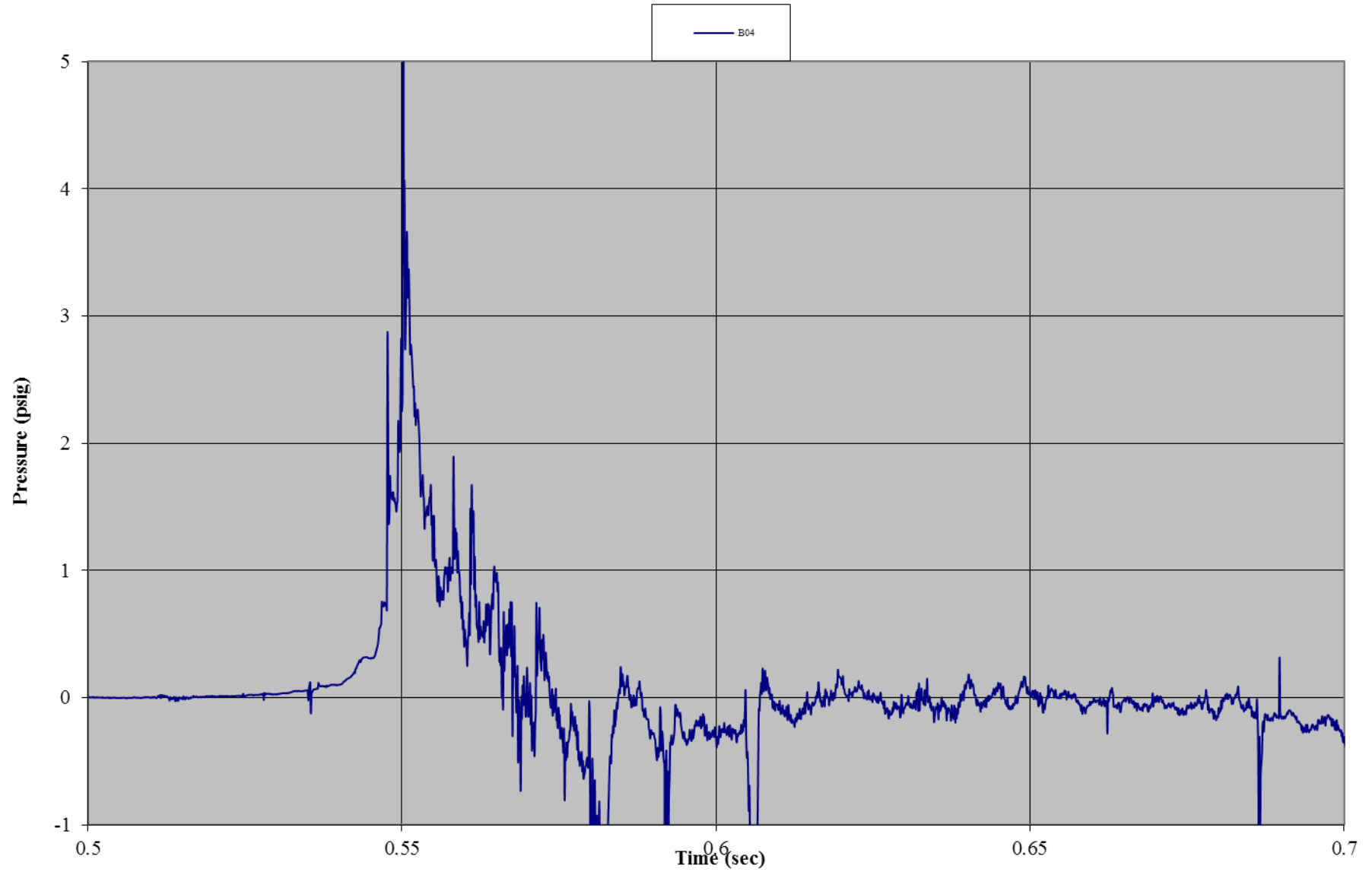
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 18: Right Side Wall, Bottom



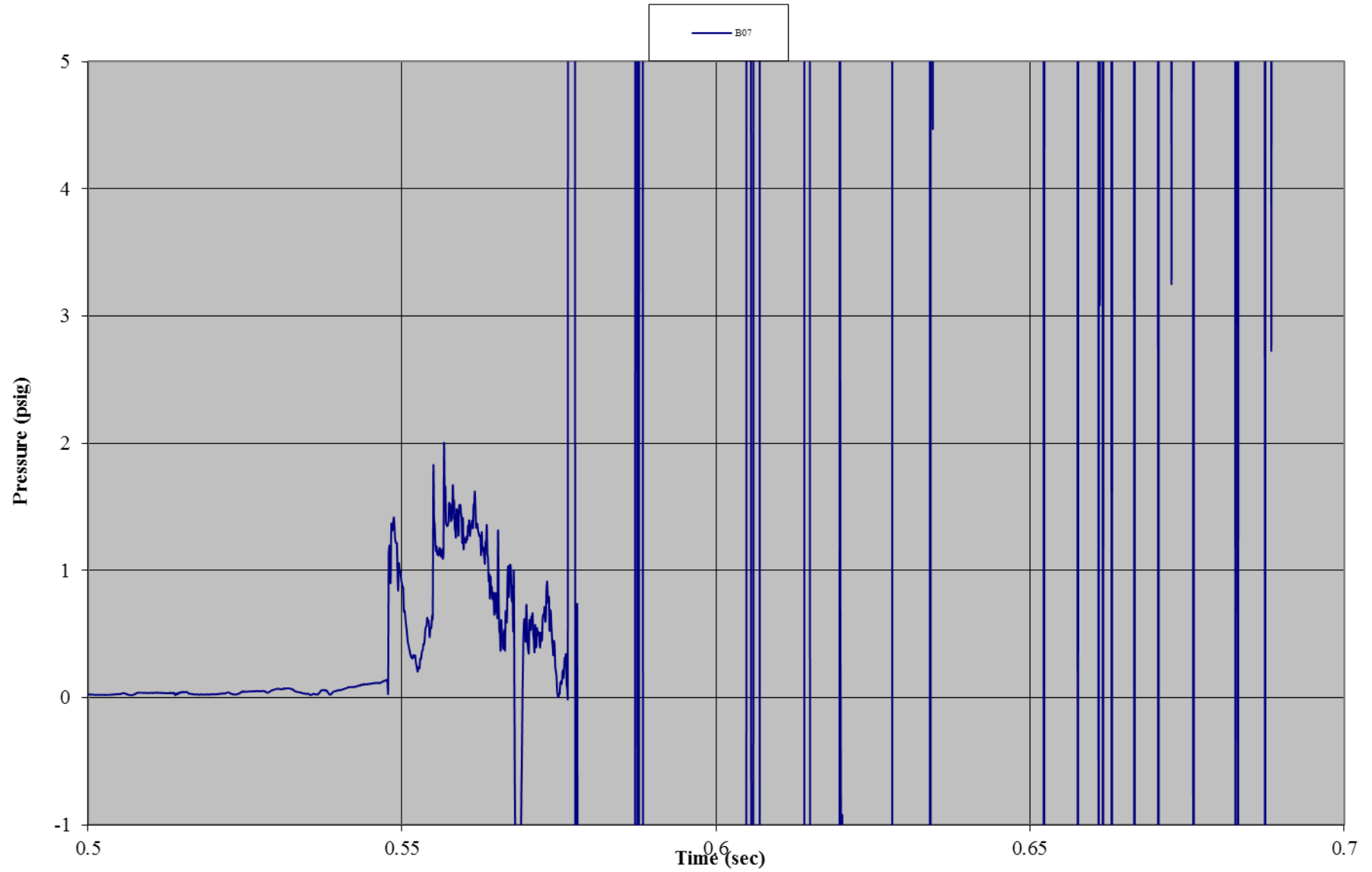
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



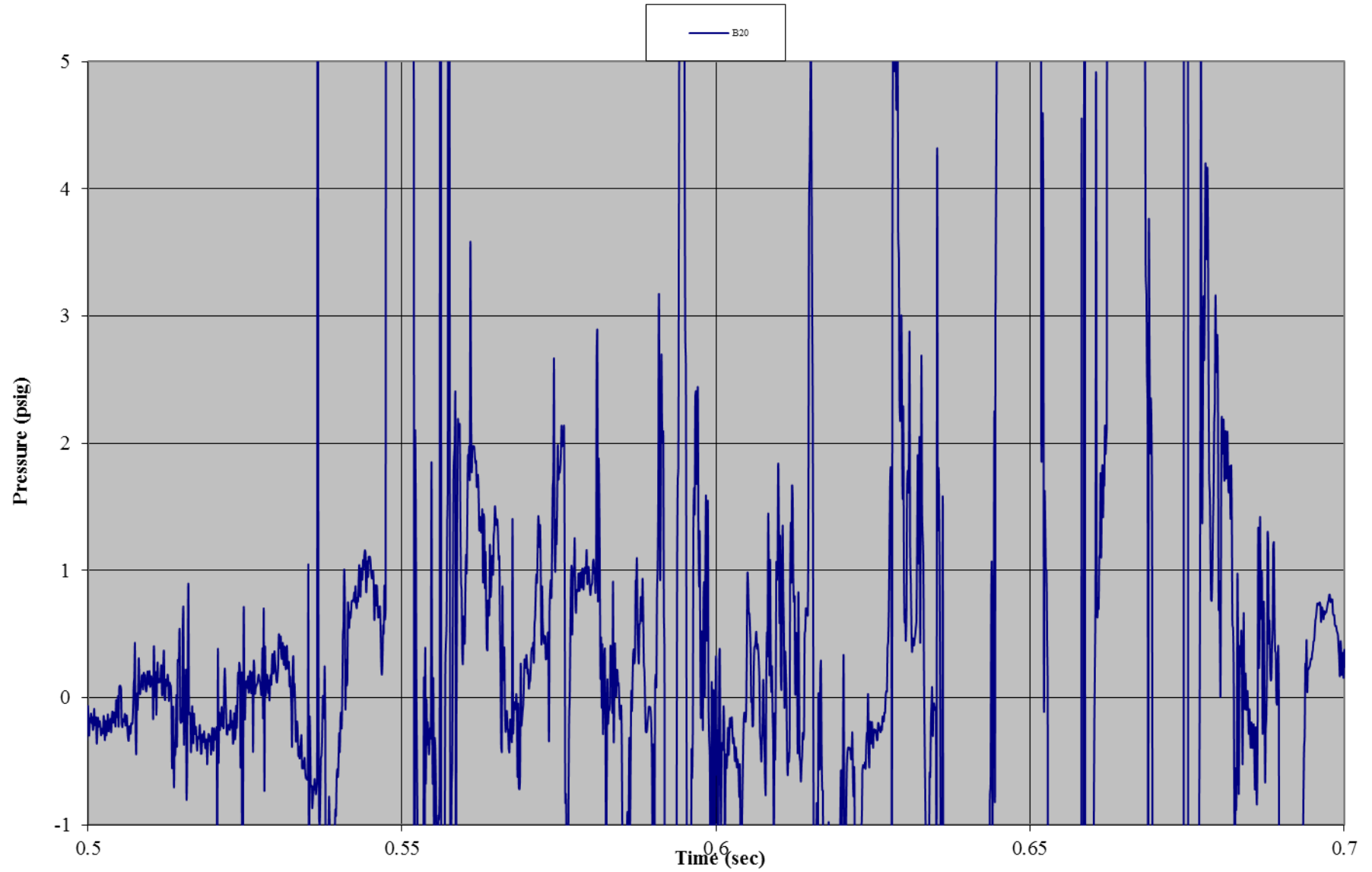
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 04: Front Wall, Center Bottom



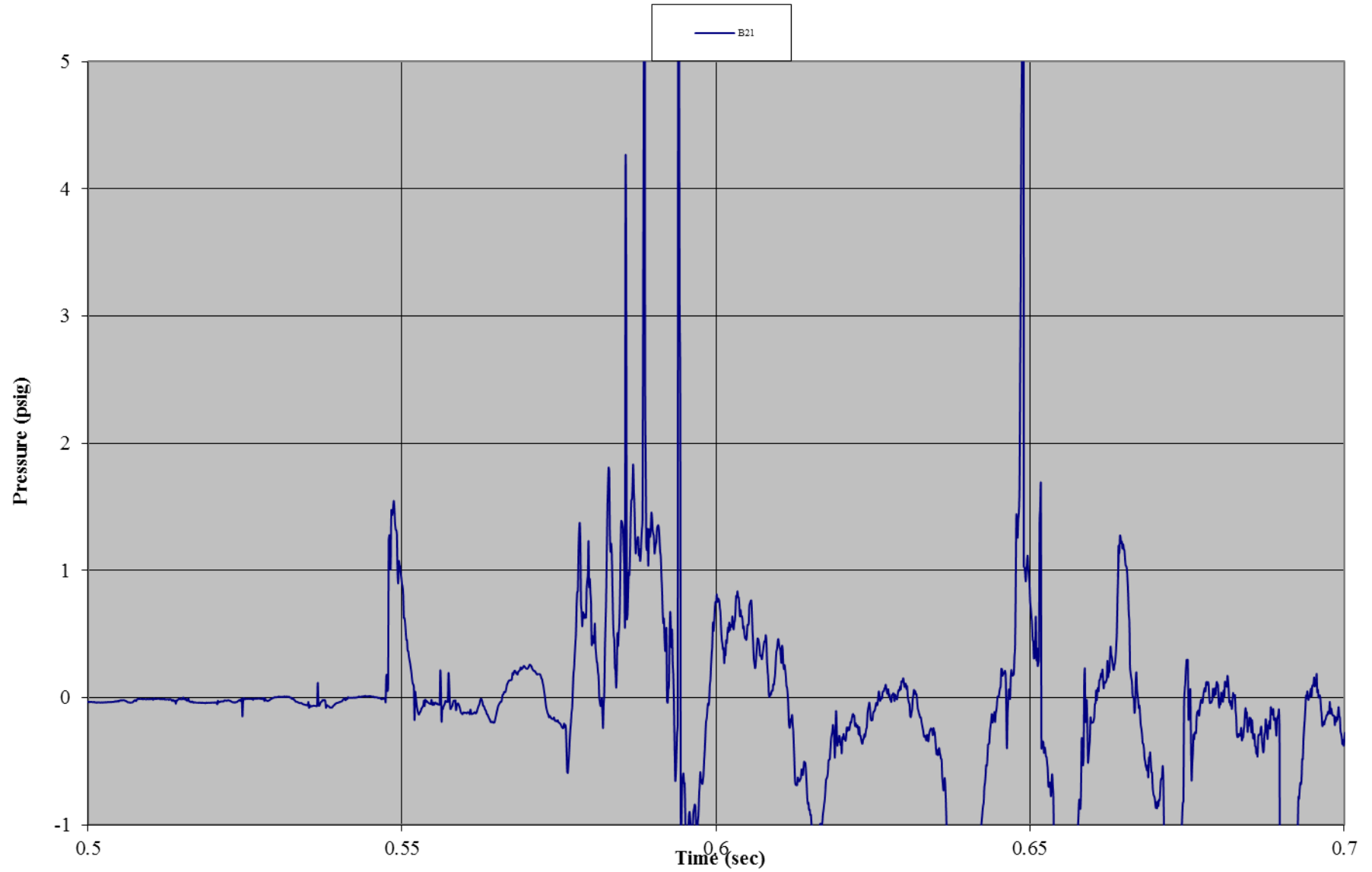
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 07: Roof, Left



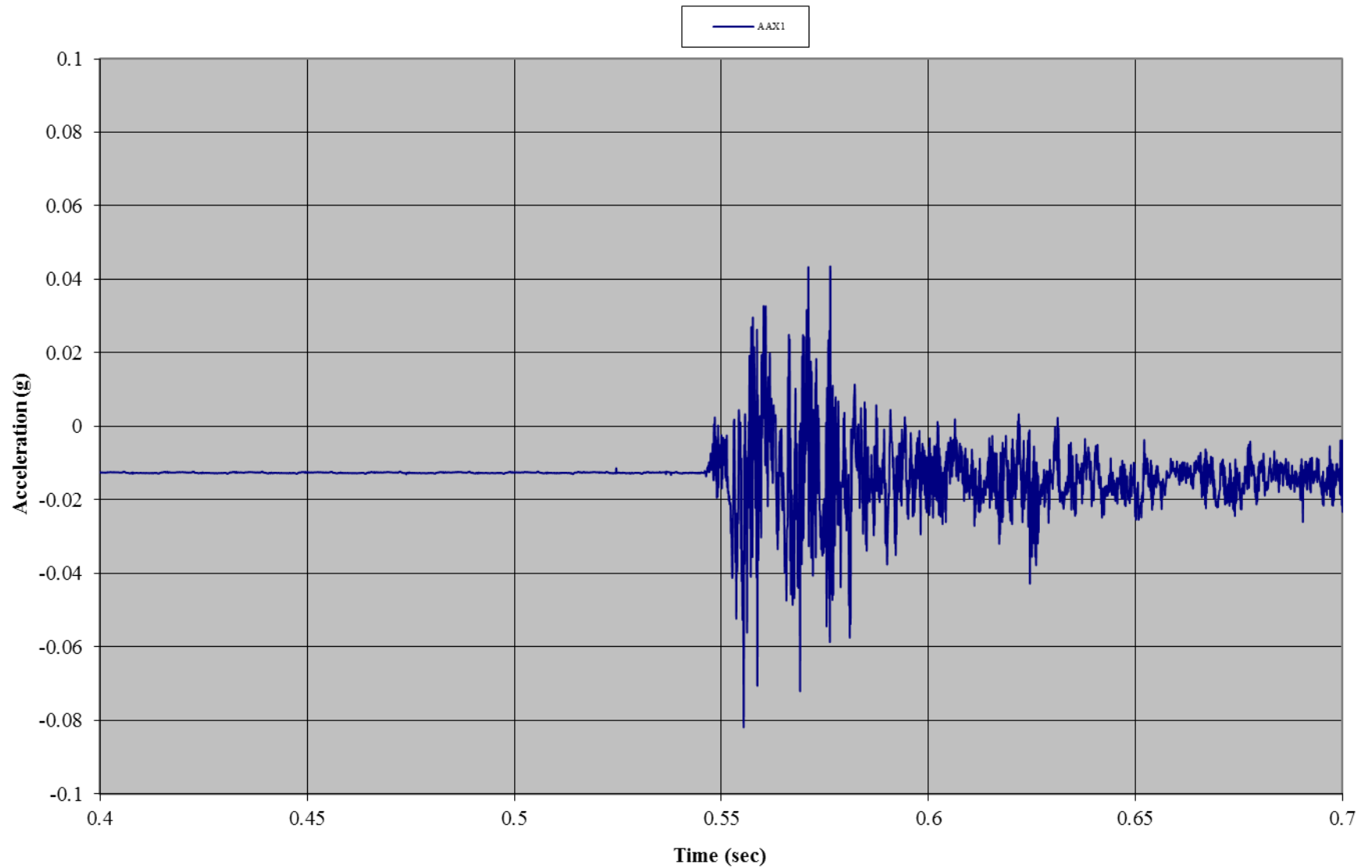
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 20: Roof, Right



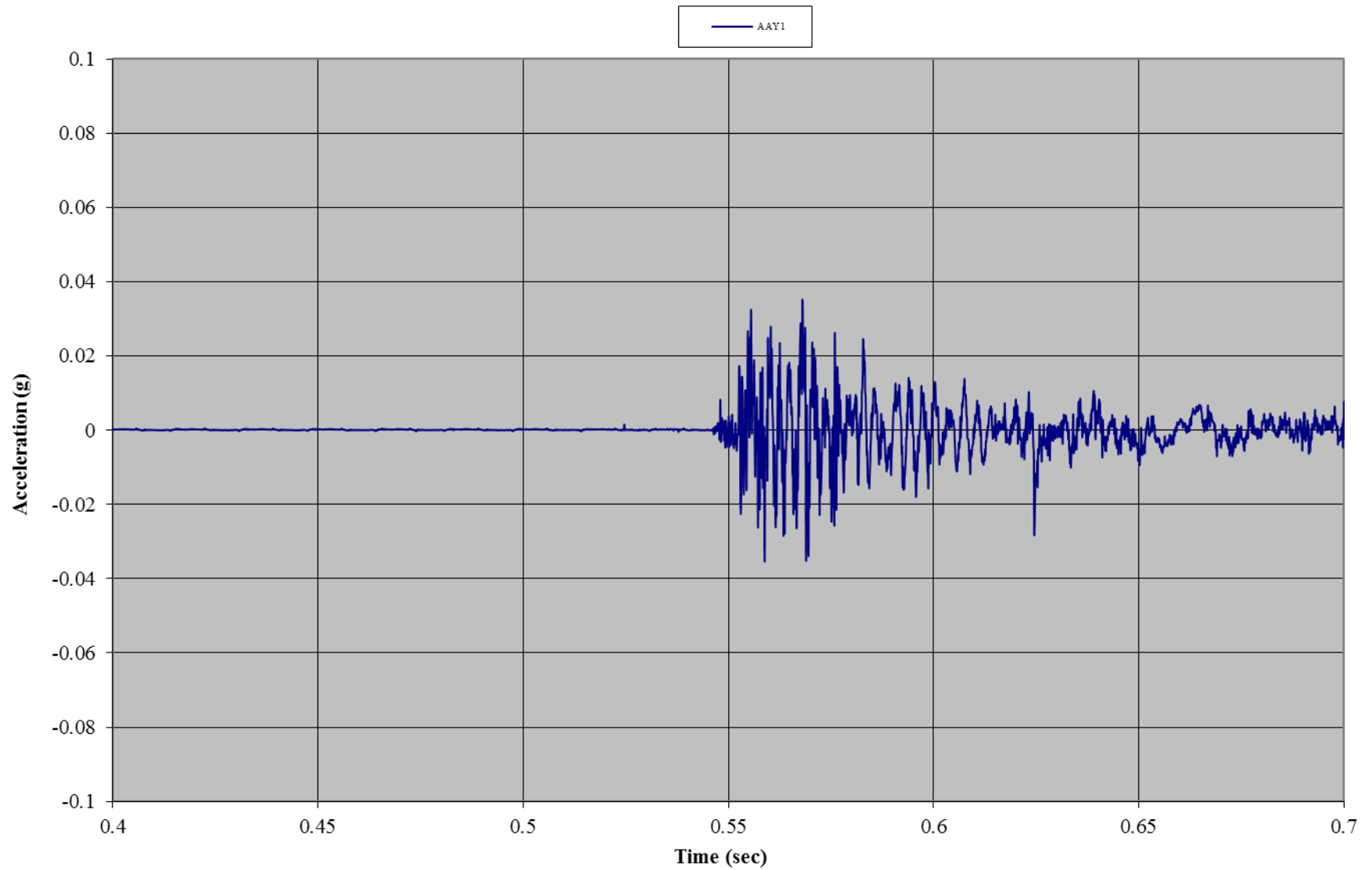
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



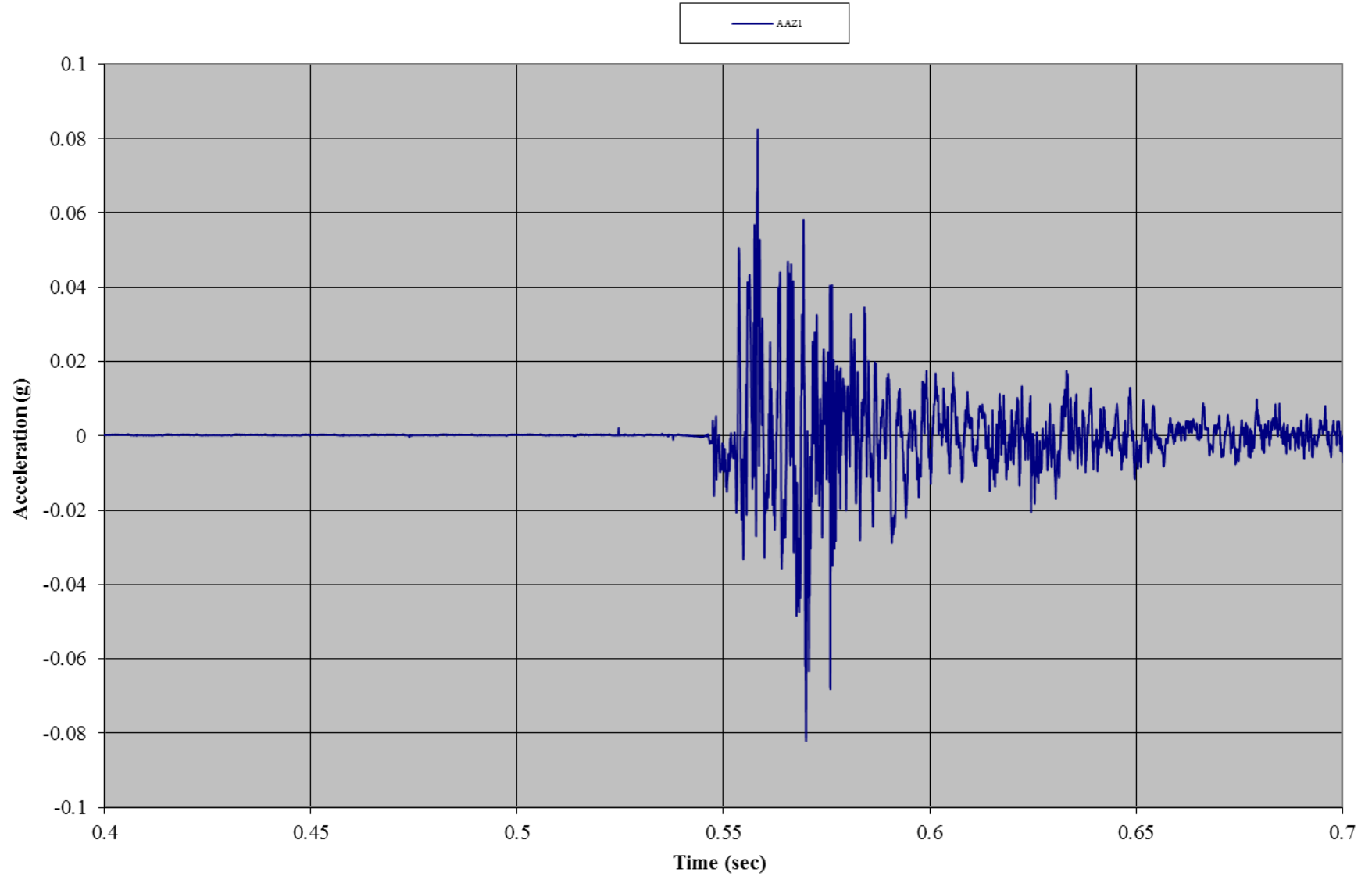
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Accelerometer 1: Front Wall (x-direction)



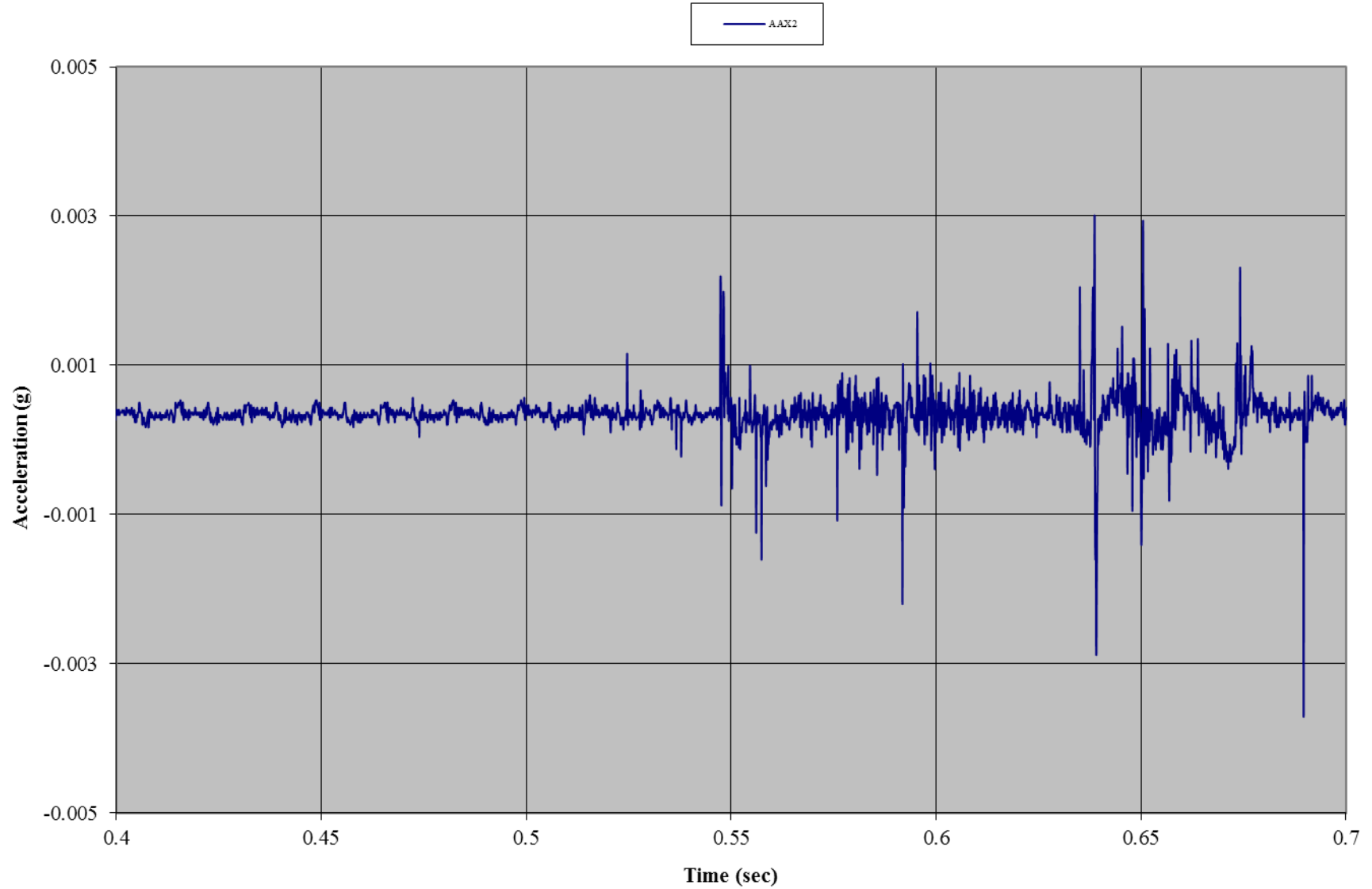
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Accelerometer 1: Front Wall (y-direction)



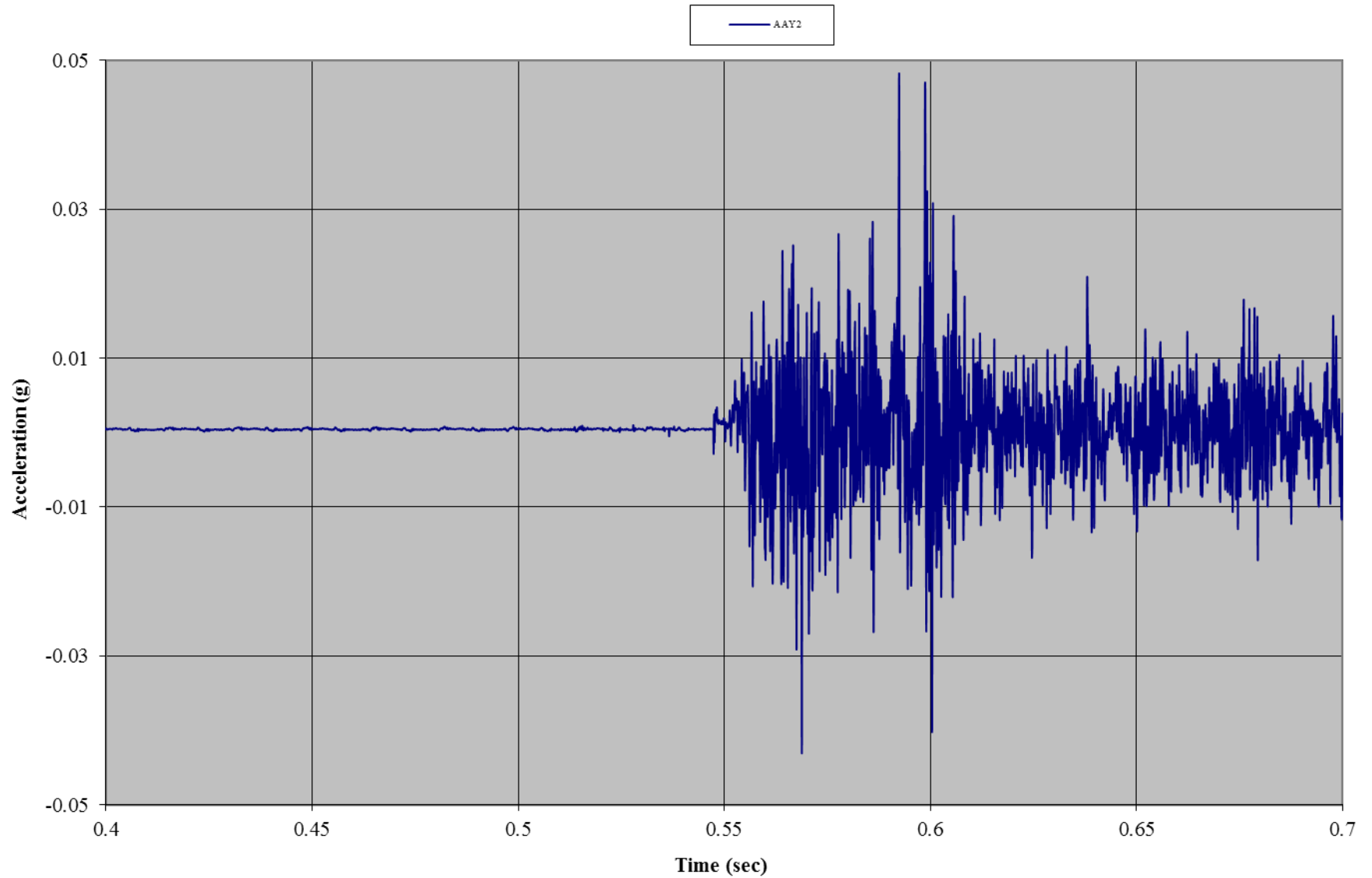
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Accelerometer 1: Front Wall (z-direction)



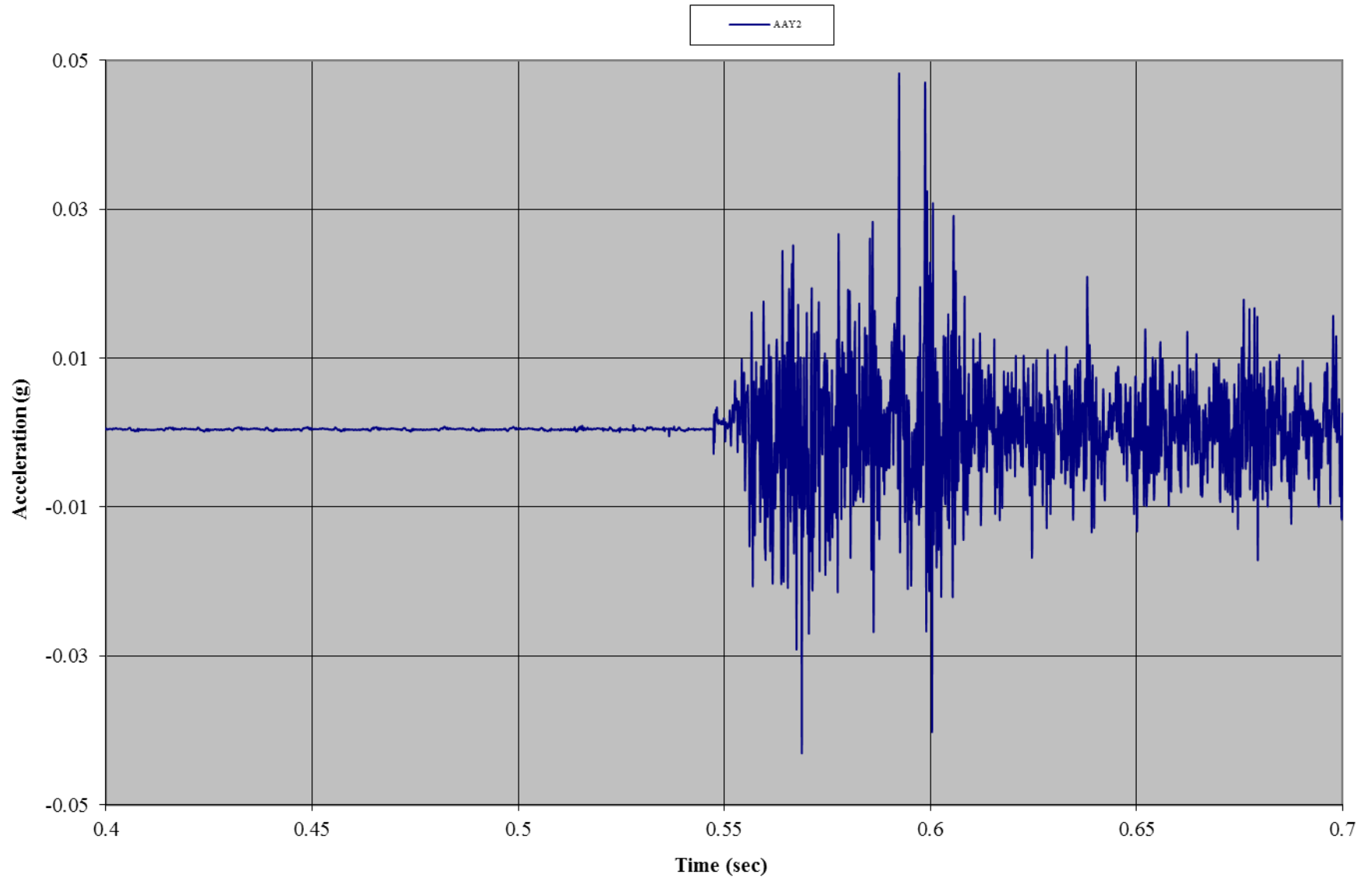
Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Accelerometer 2: Roof (x-direction)



Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Accelerometer 2: Roof (y-direction)

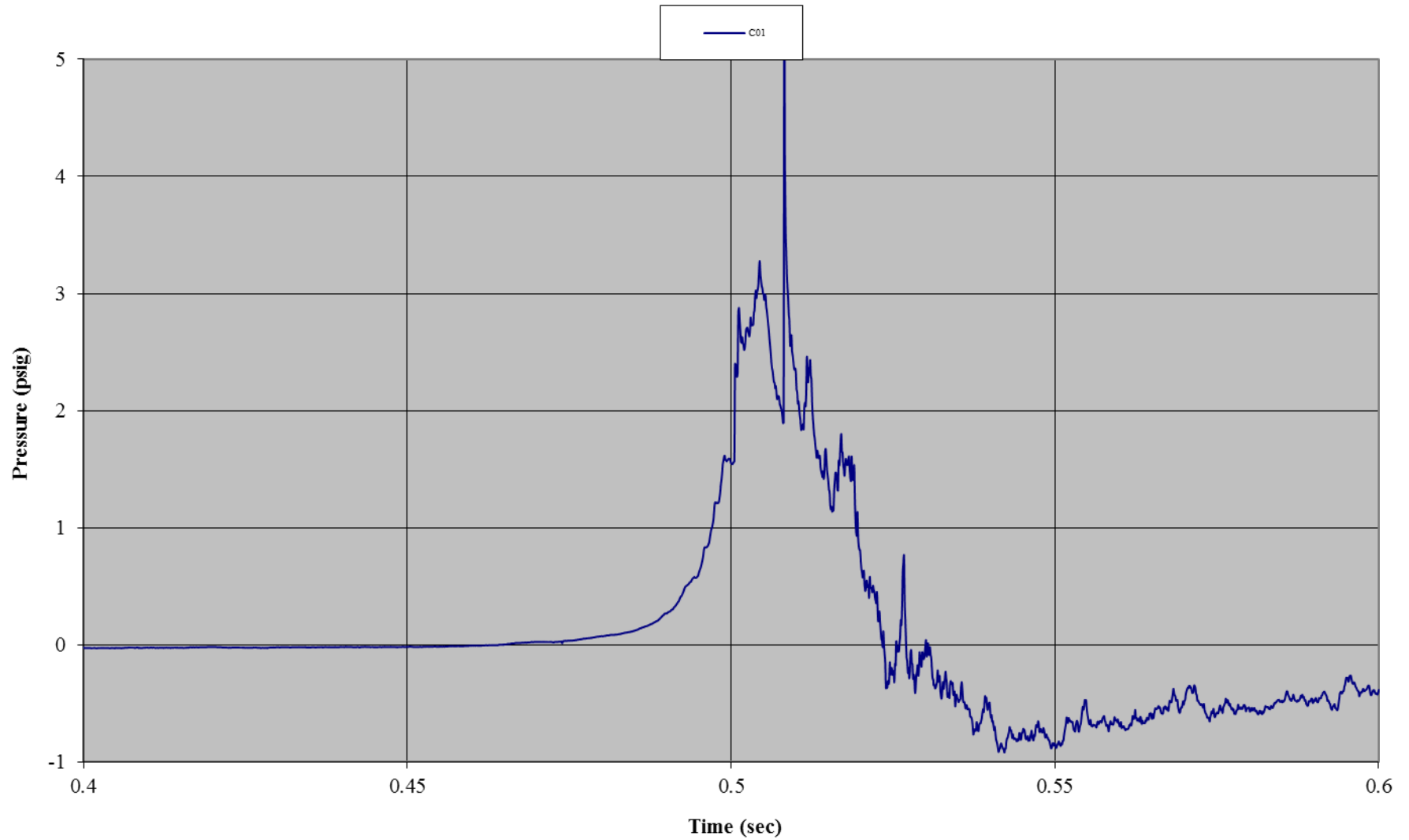


Test C02: 90 mph-Wind Rated Rigid Frame Tent with Sides
Accelerometer 2: Roof (y-direction)

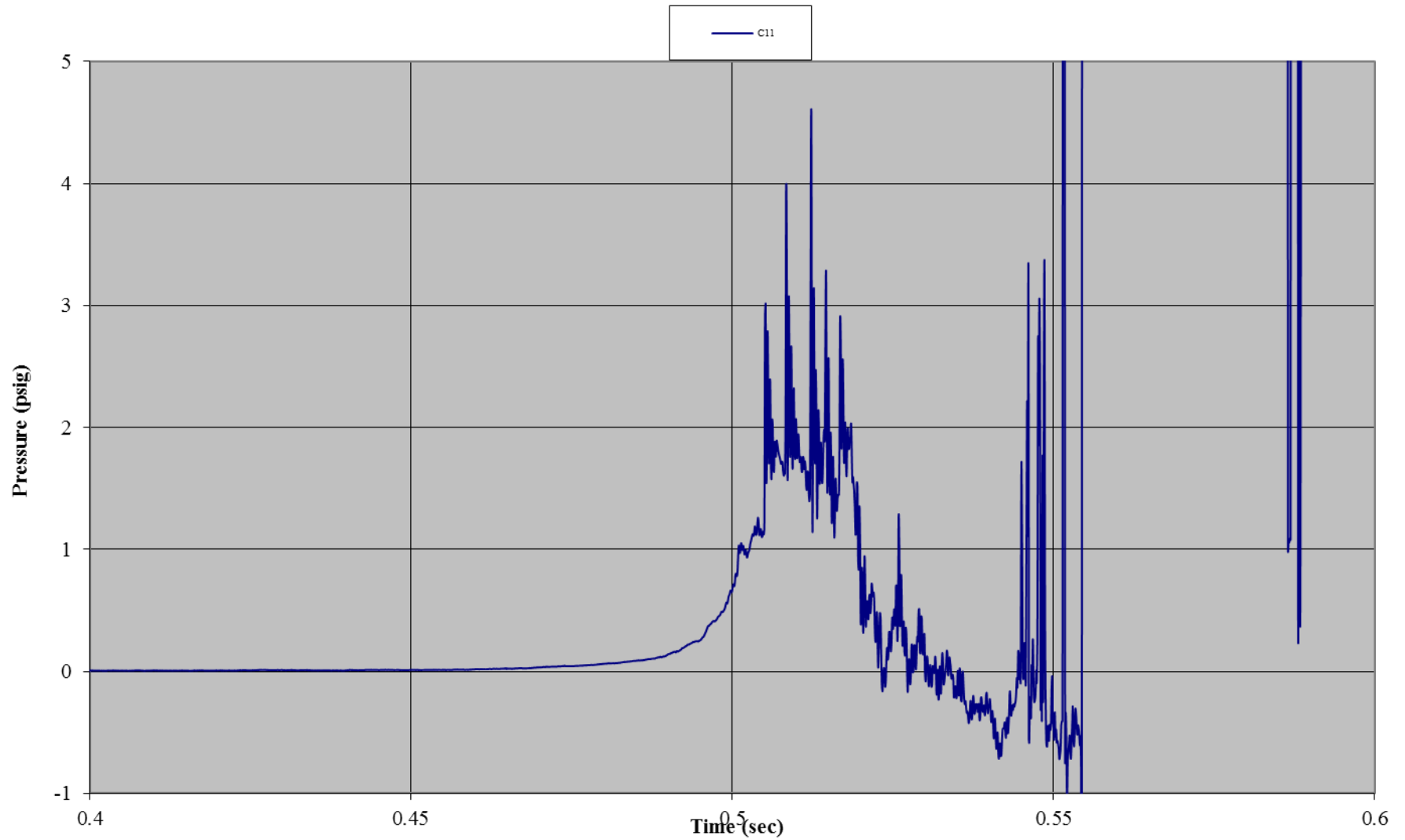


Test C02: Tent C

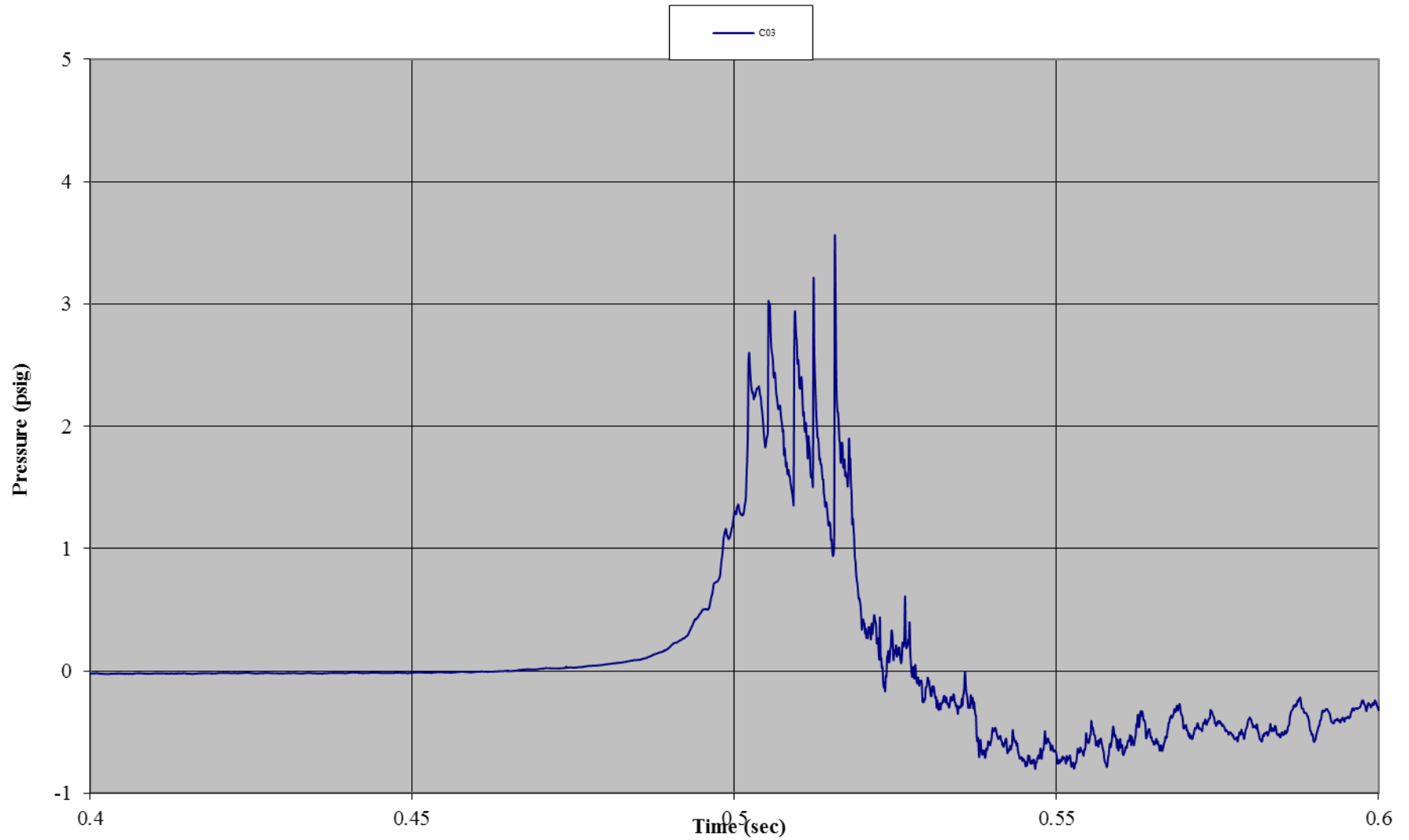
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 01:Front Wall, Left Bottom



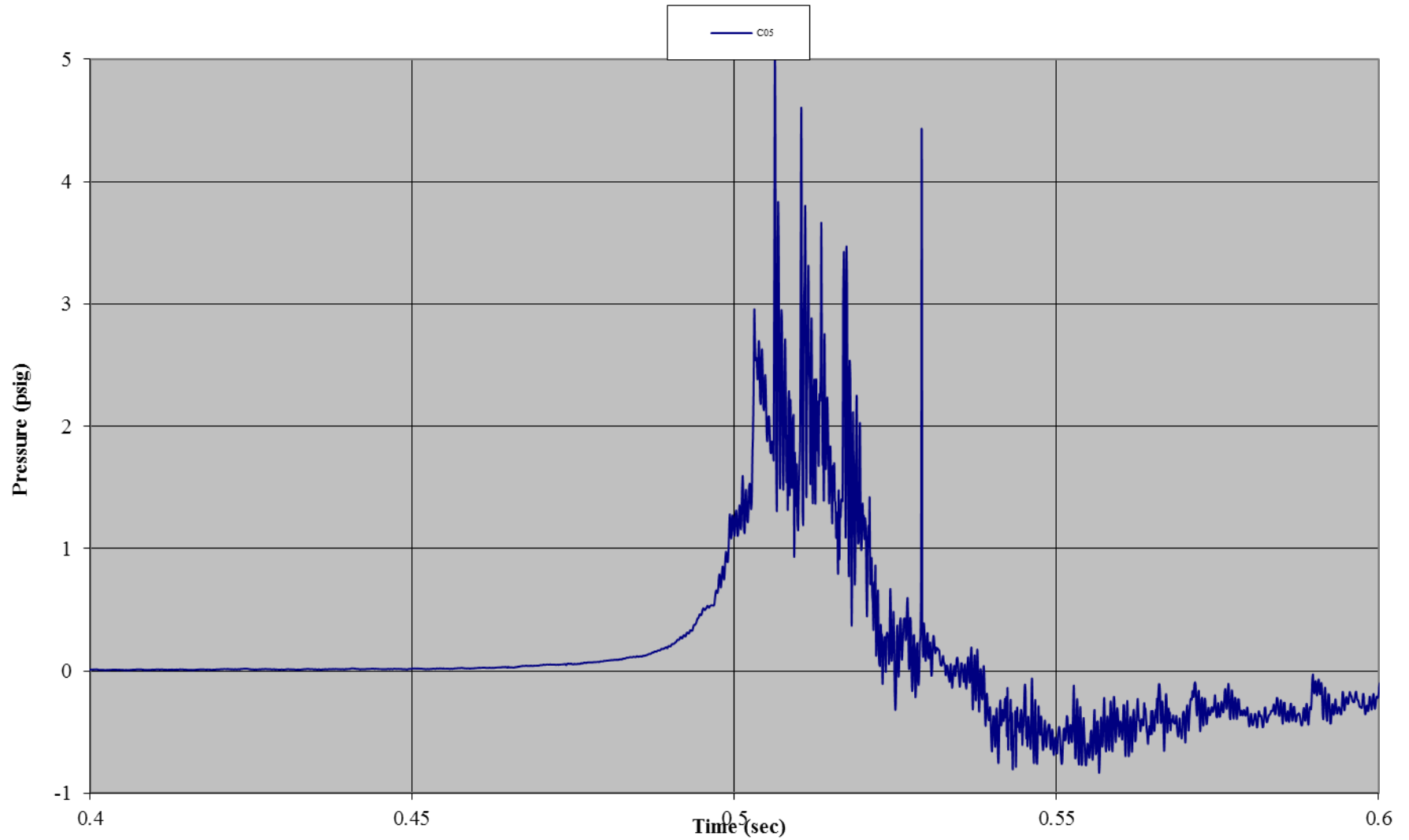
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 11: Front Wall, Right Bottom



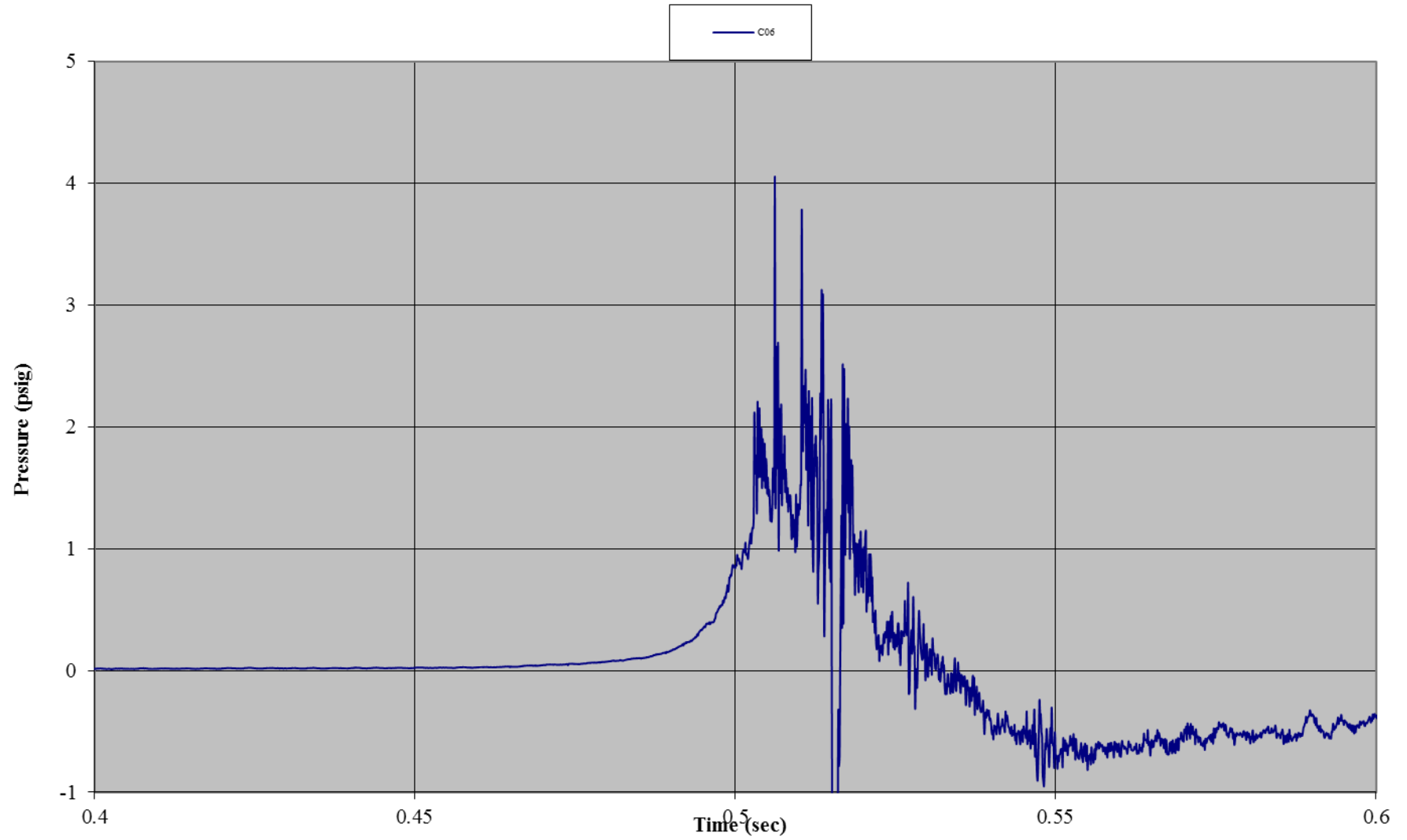
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 03: Front Wall, Center Ground



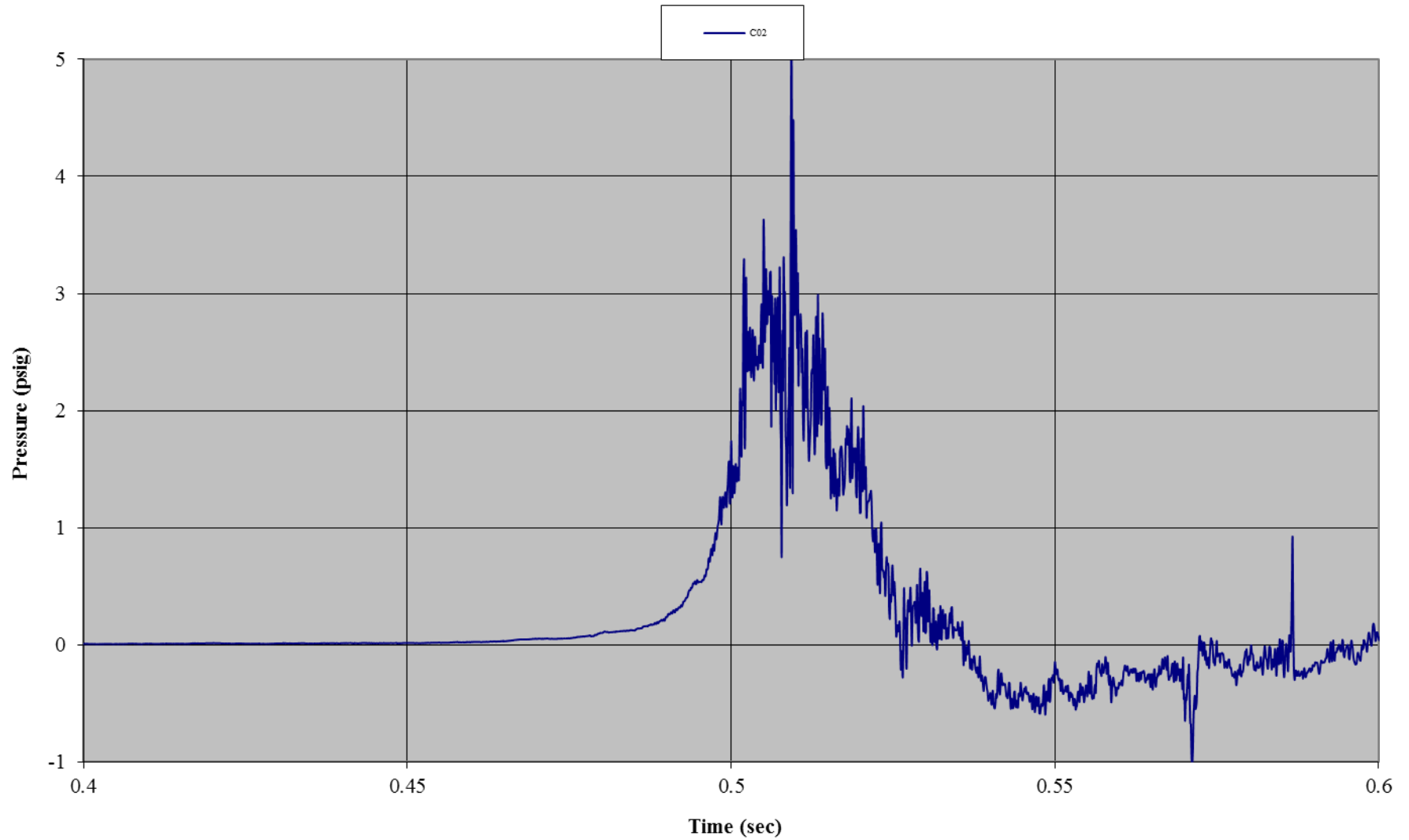
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 05: Front Wall, Center Mid-Height



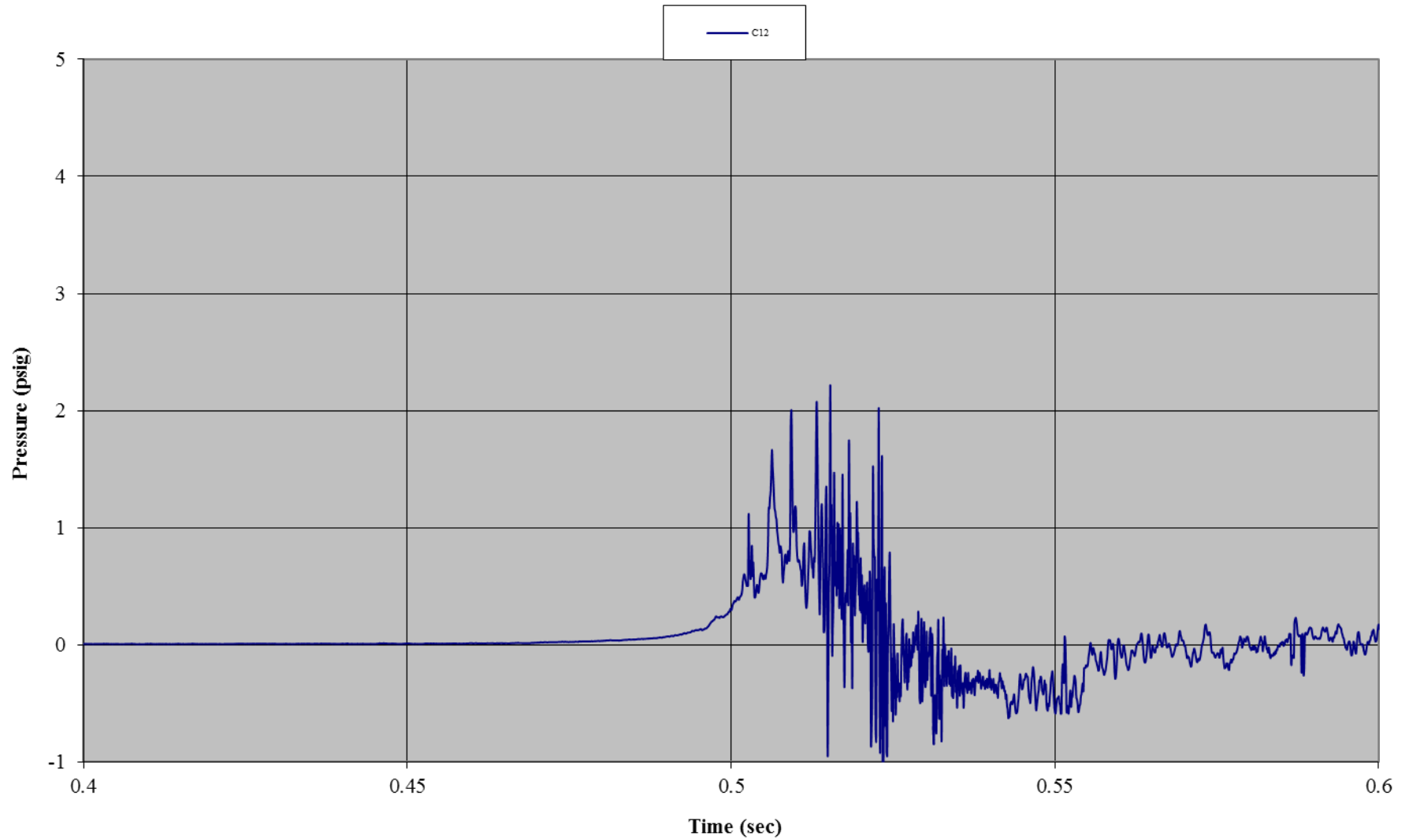
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 06: Front Wall, Center Top



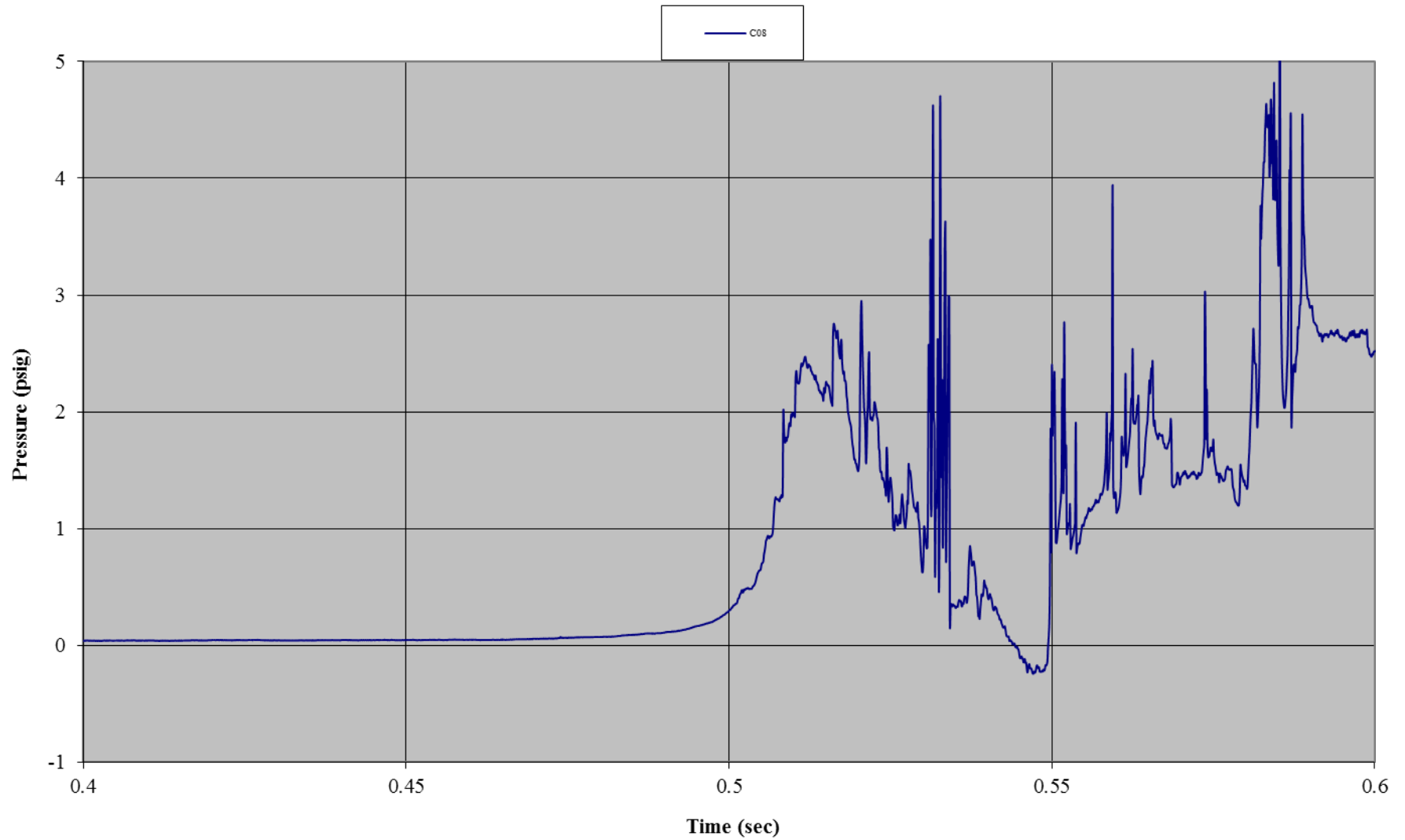
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 02: Front Wall, Left Mid-Height



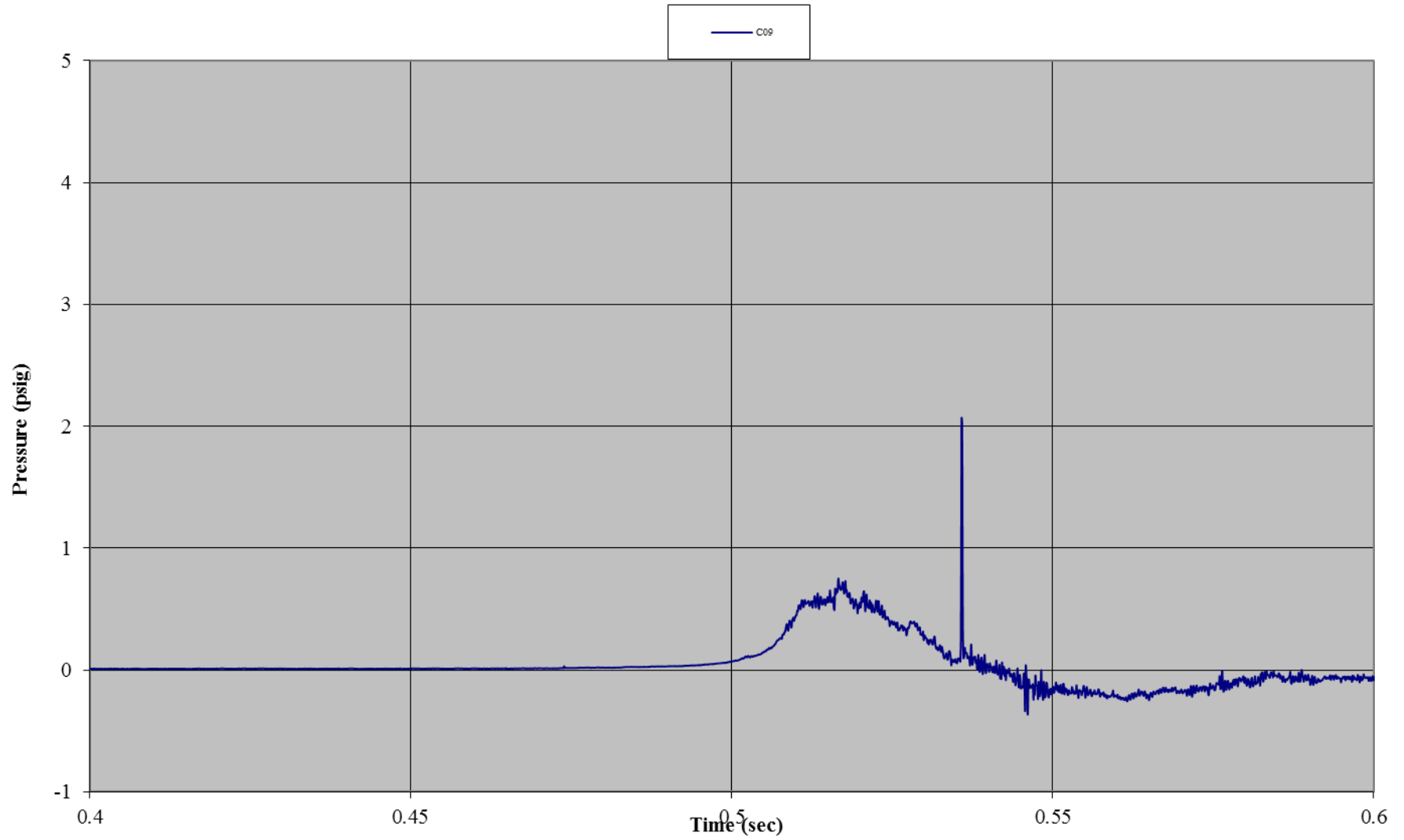
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 12: Front Wall, Right Mid-Height



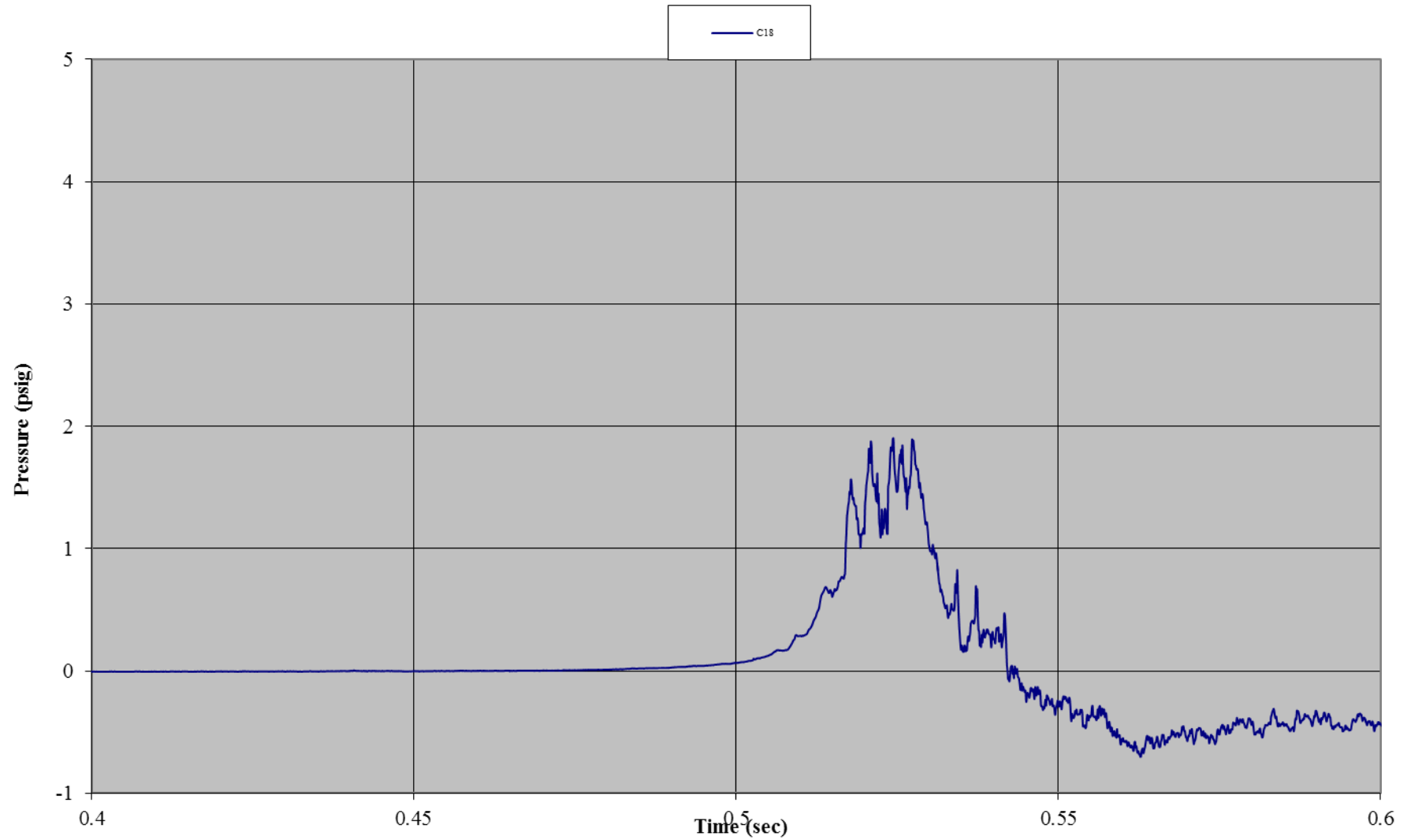
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 08: Left Side Wall, Bottom



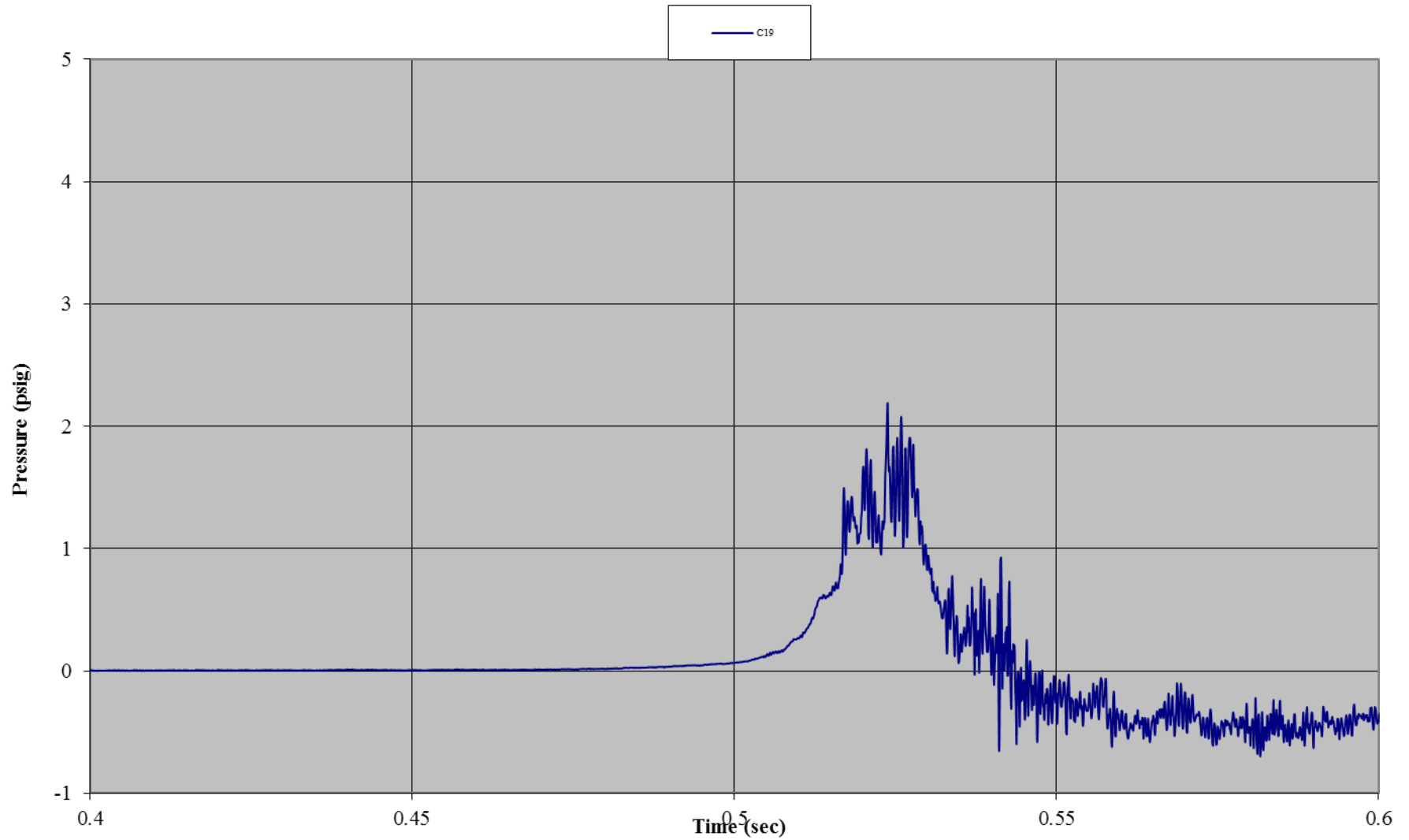
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 09: Left Side Wall, Mid-Height



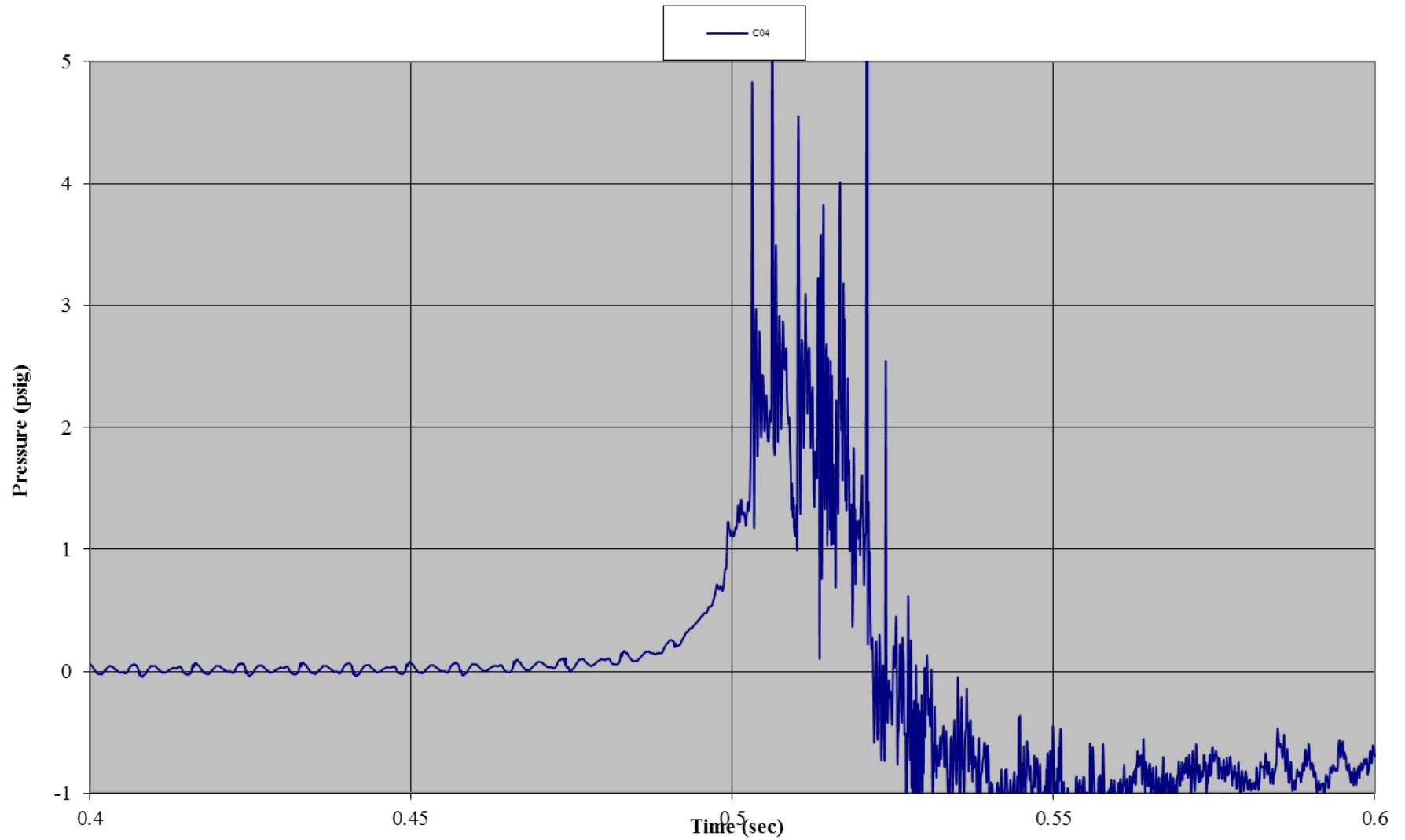
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 18: Right Side Wall, Bottom



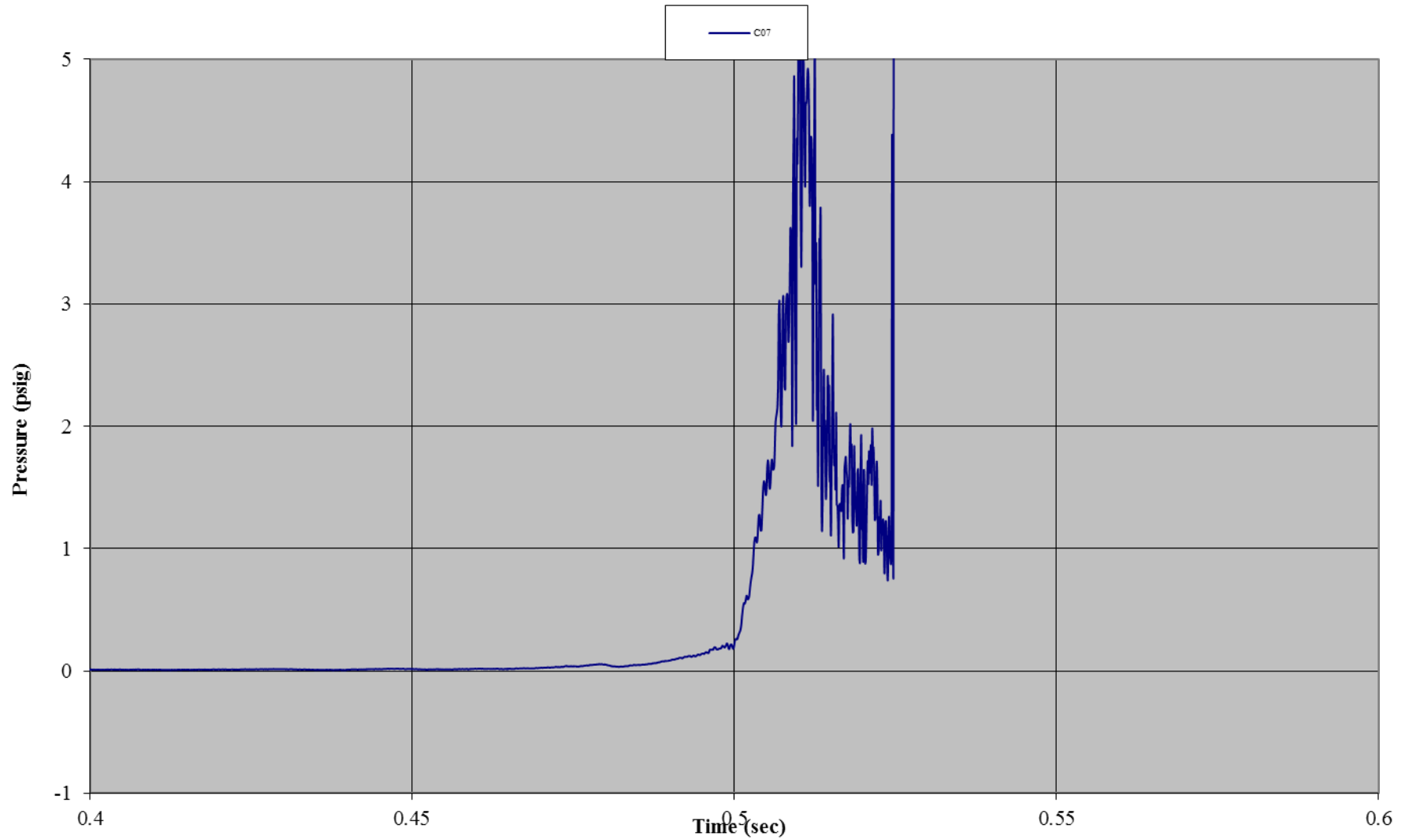
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 19: Right Side Wall, Mid-Height



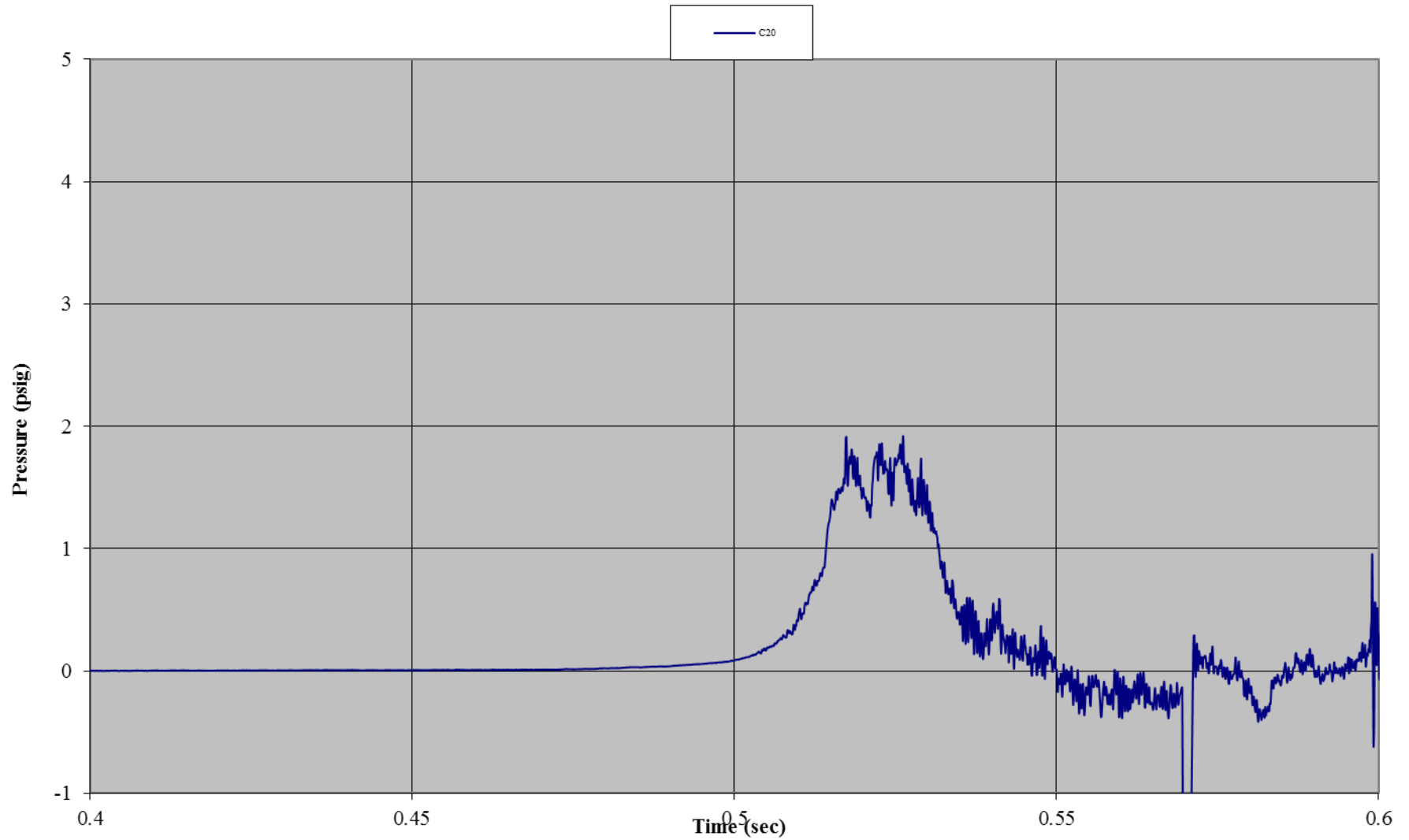
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 04: Front Wall, Center Bottom



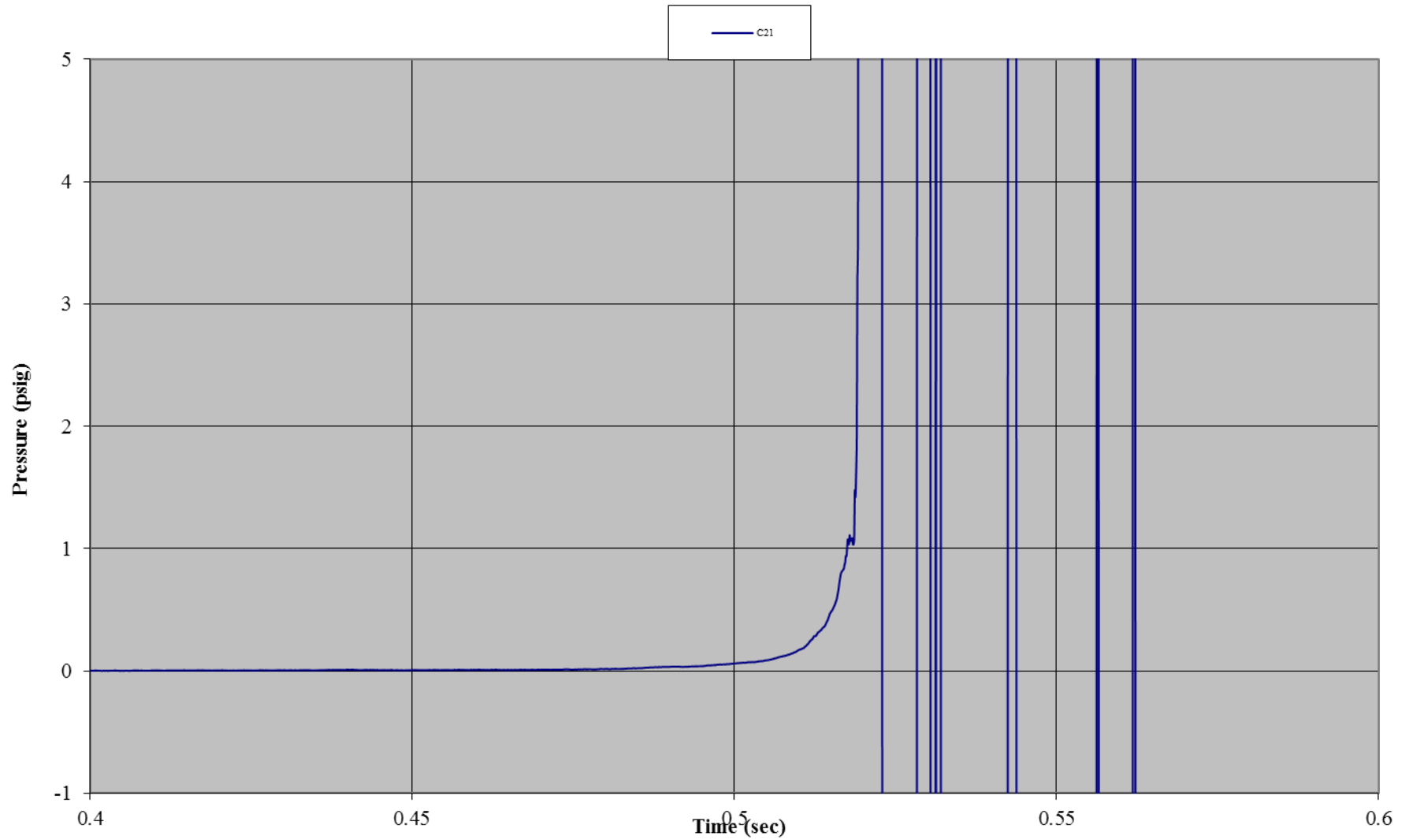
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 07: Roof, Left



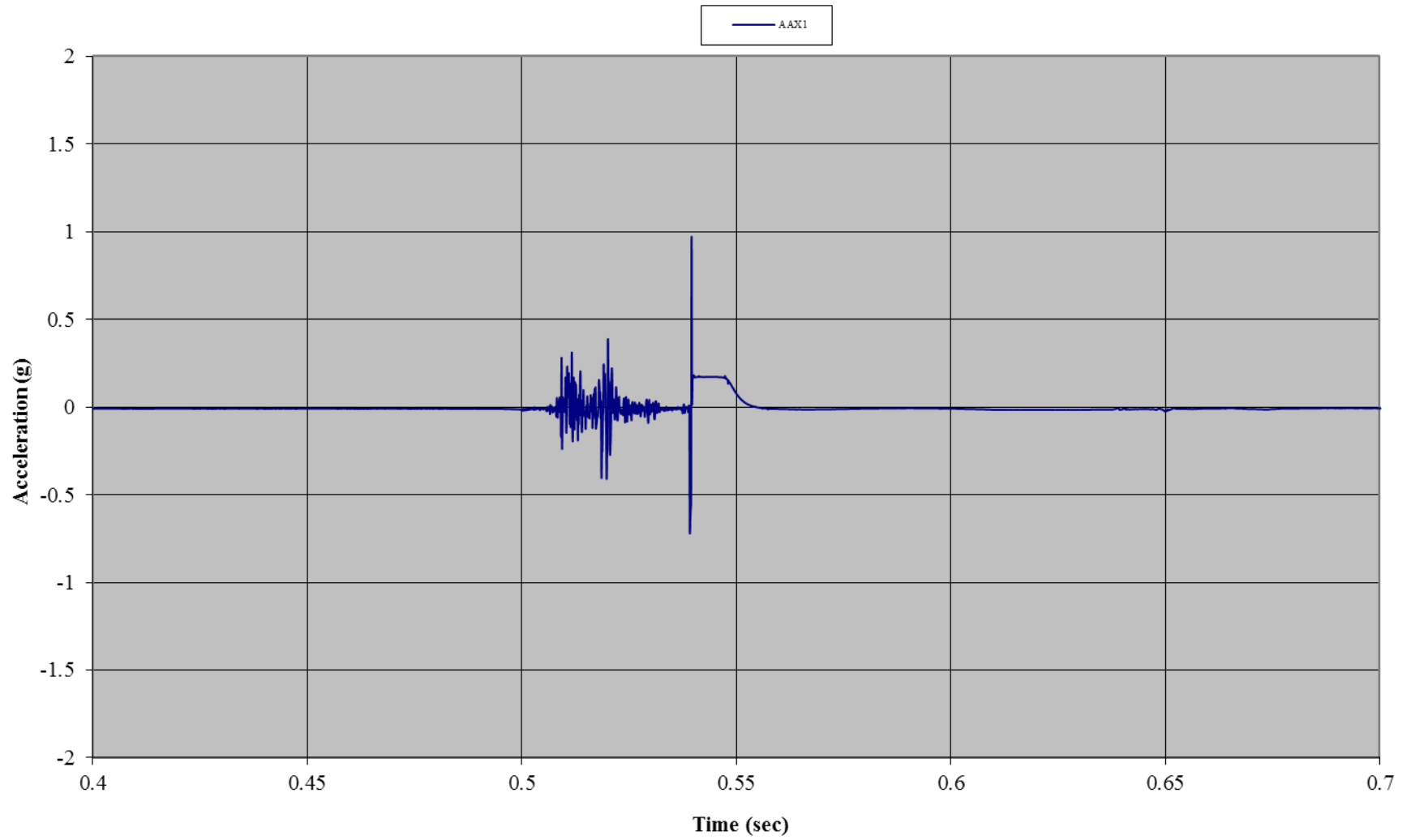
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 20: Roof, Right



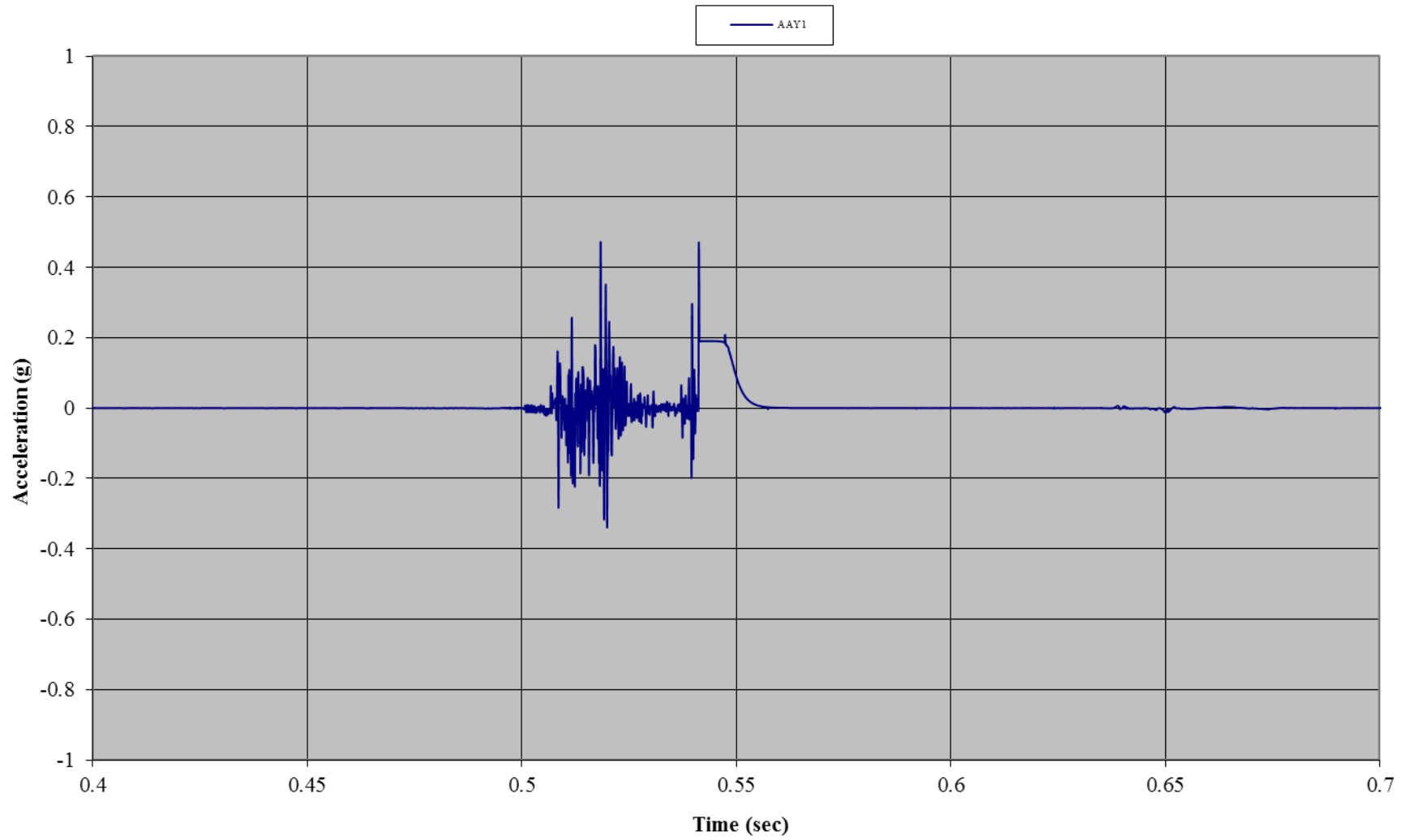
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Gauge 21: Back Wall, Center Mid-Height



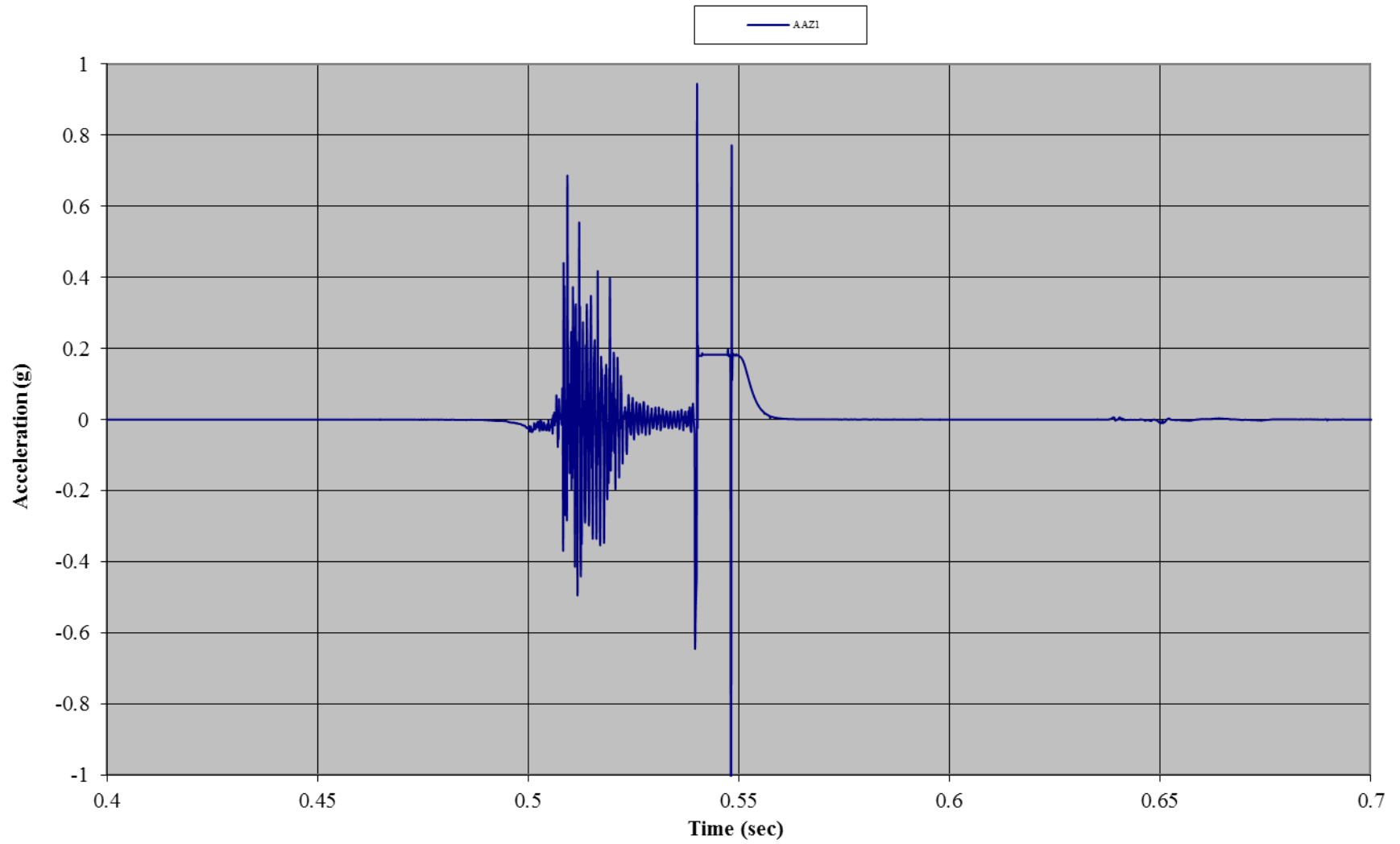
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (x-direction)



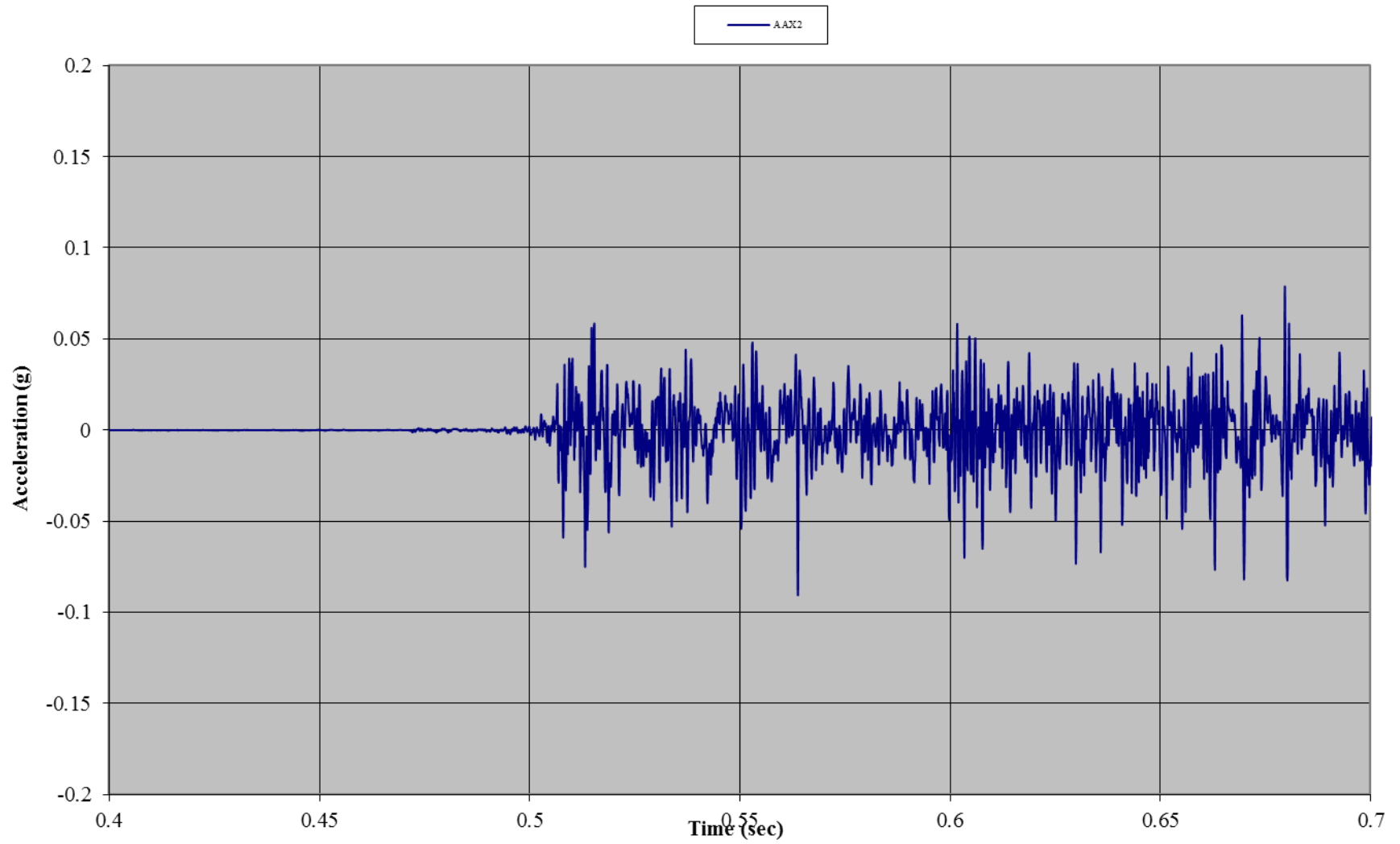
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (y-direction)



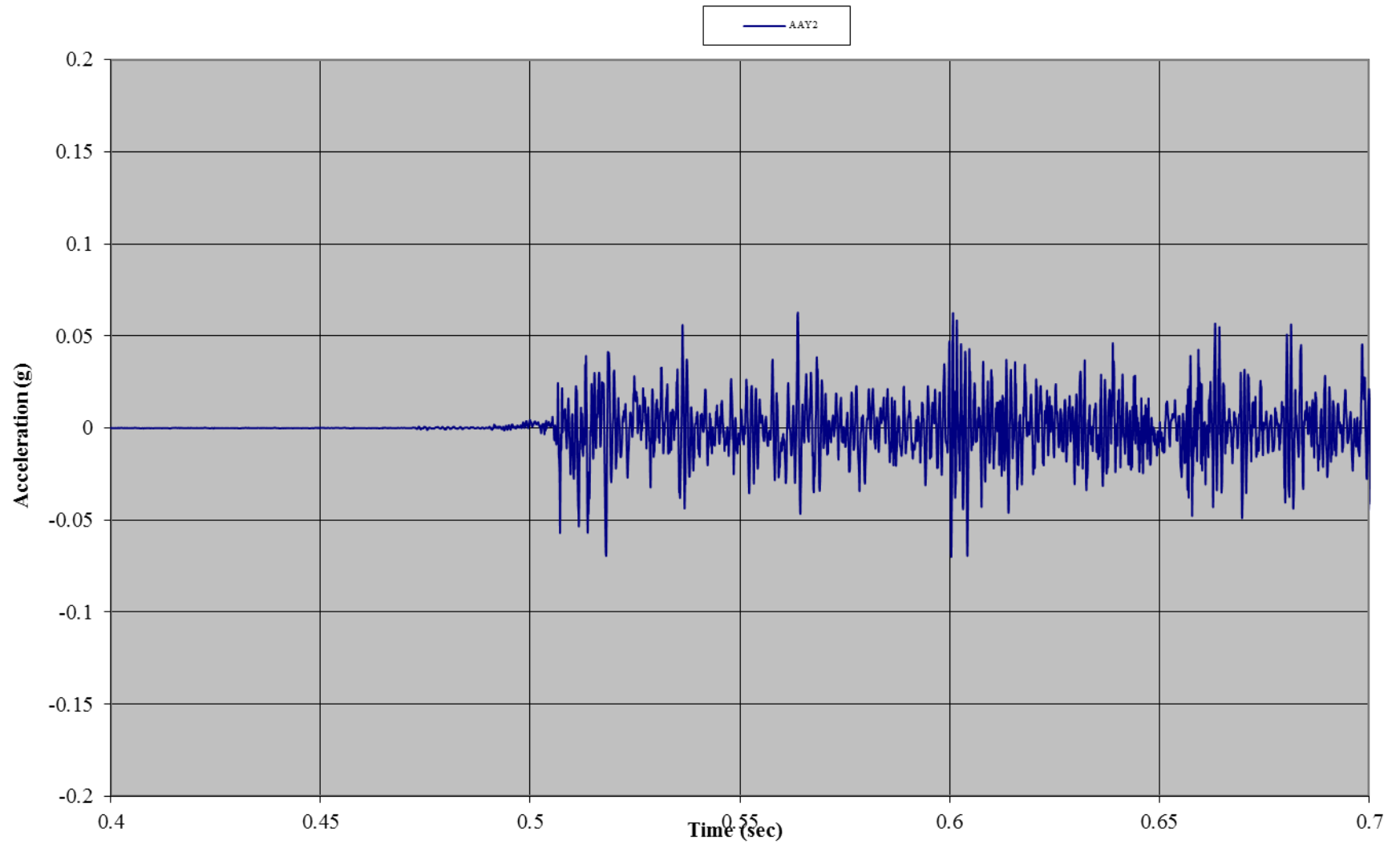
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (z-direction)



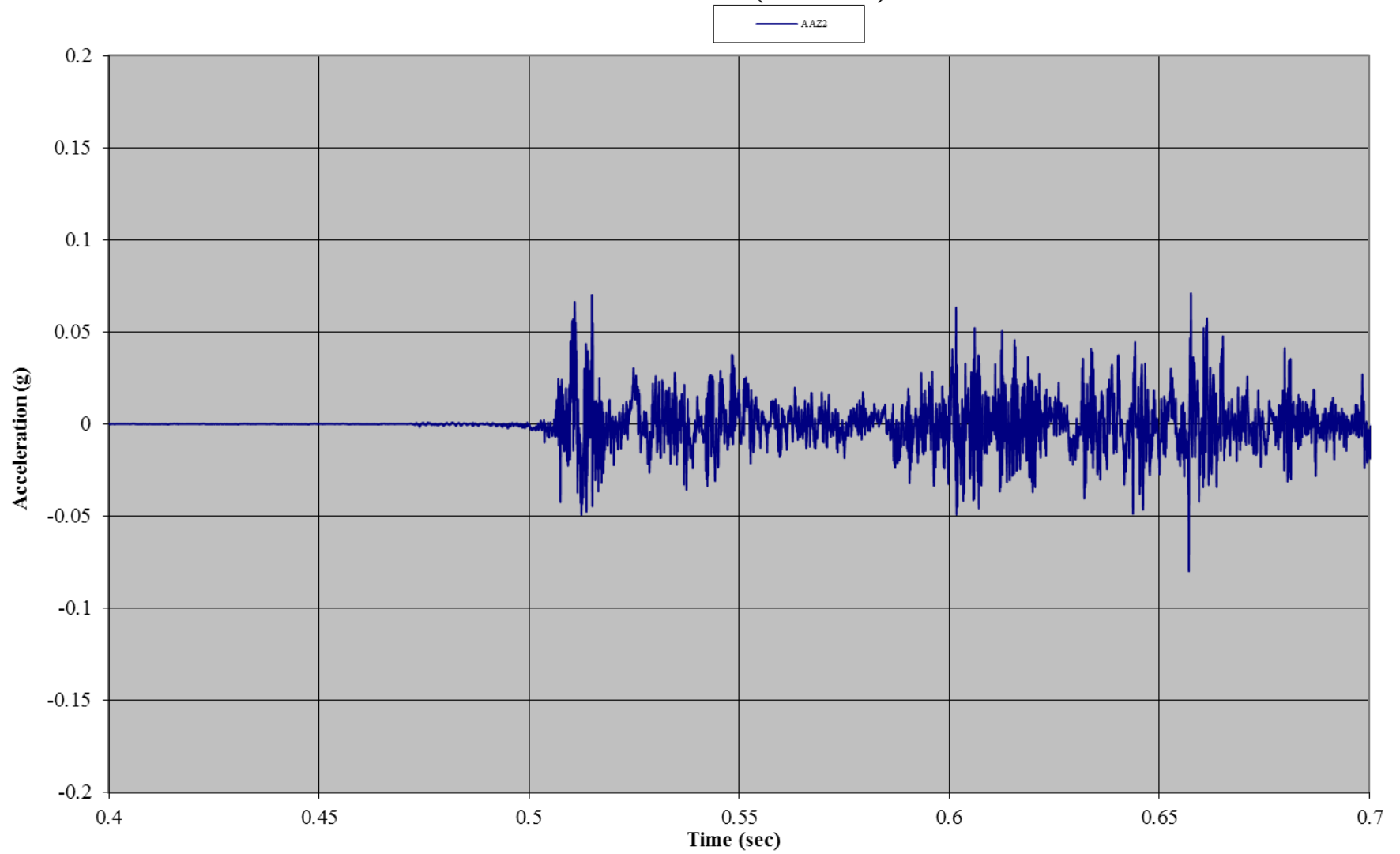
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (x-direction)



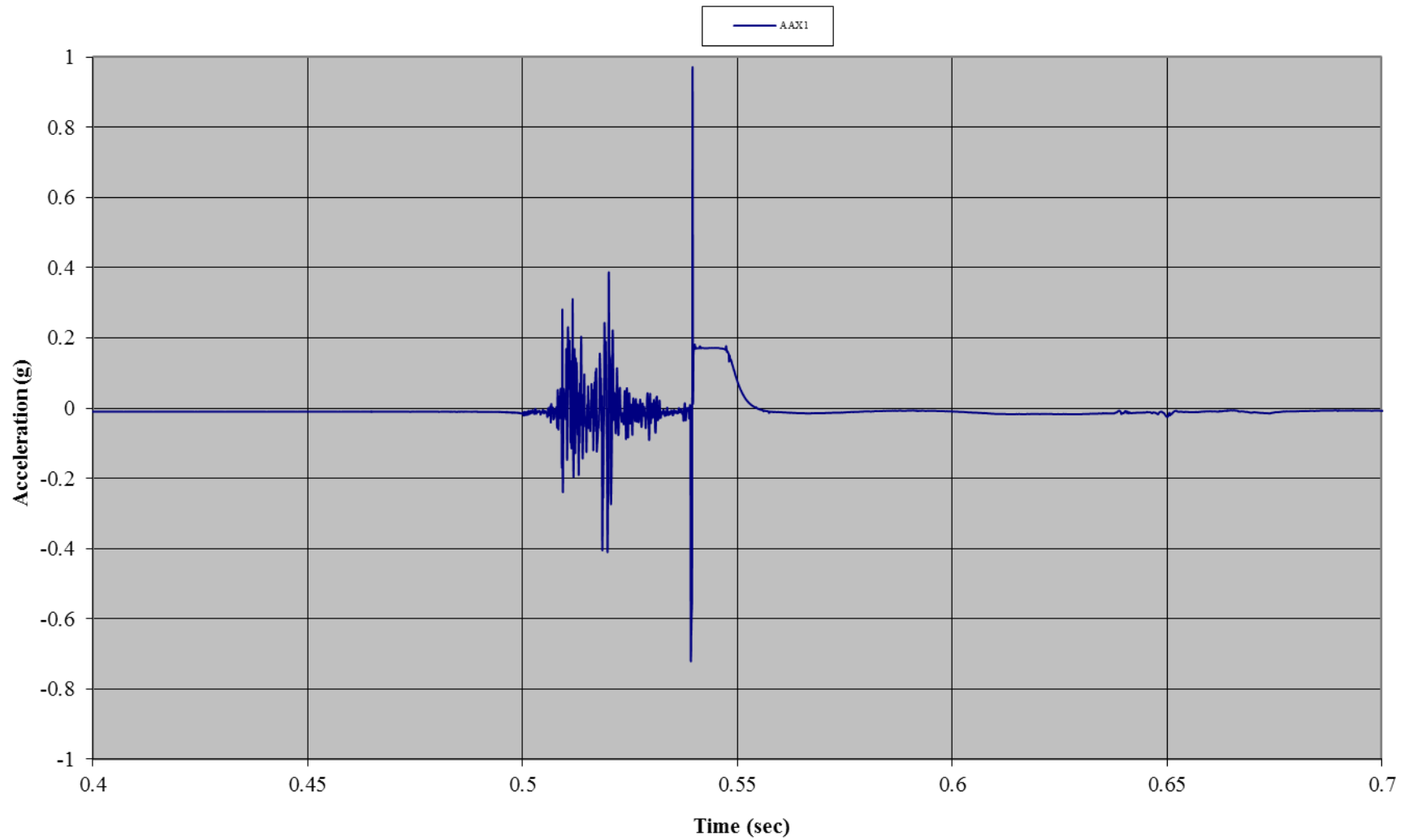
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (y-direction)



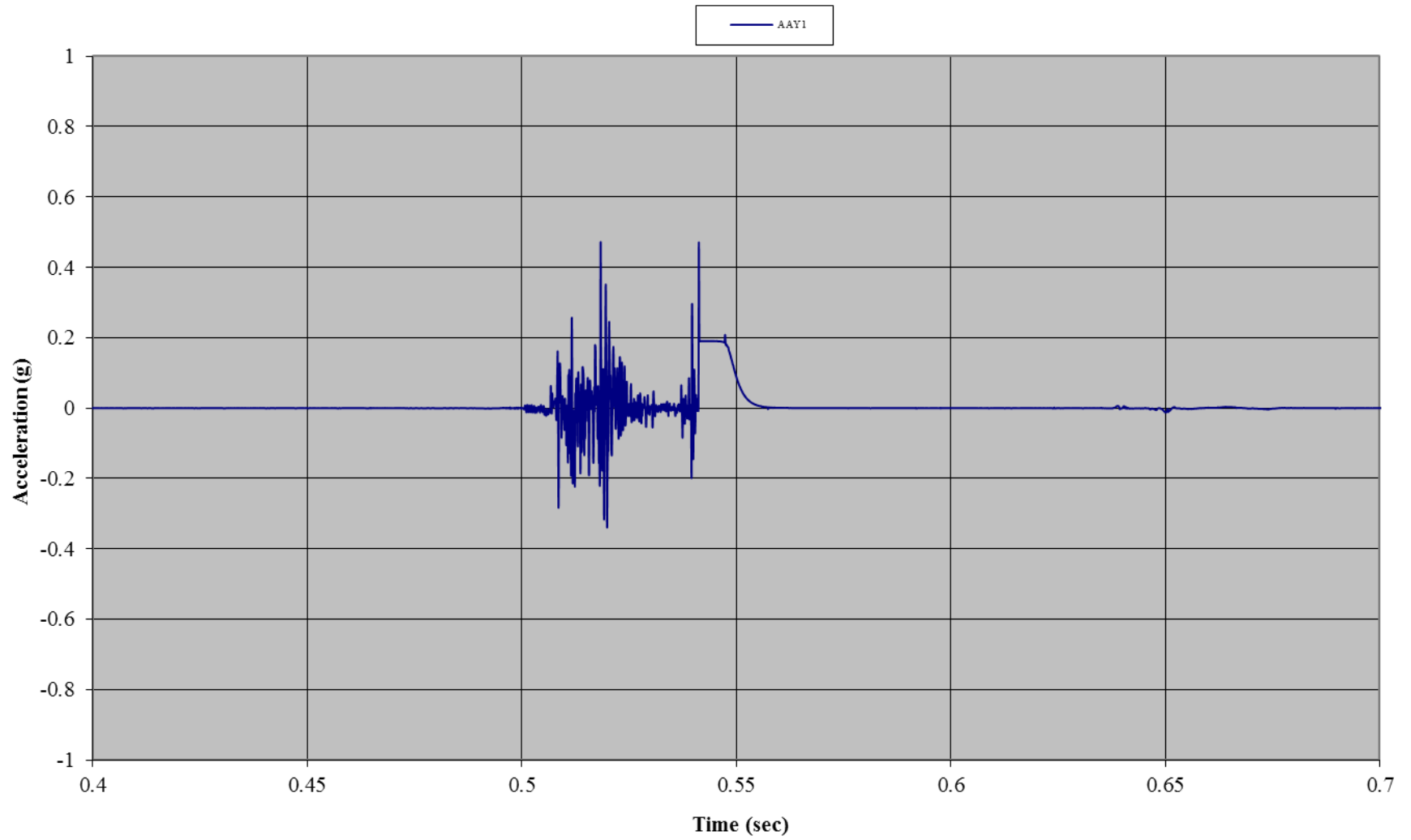
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (z-direction)



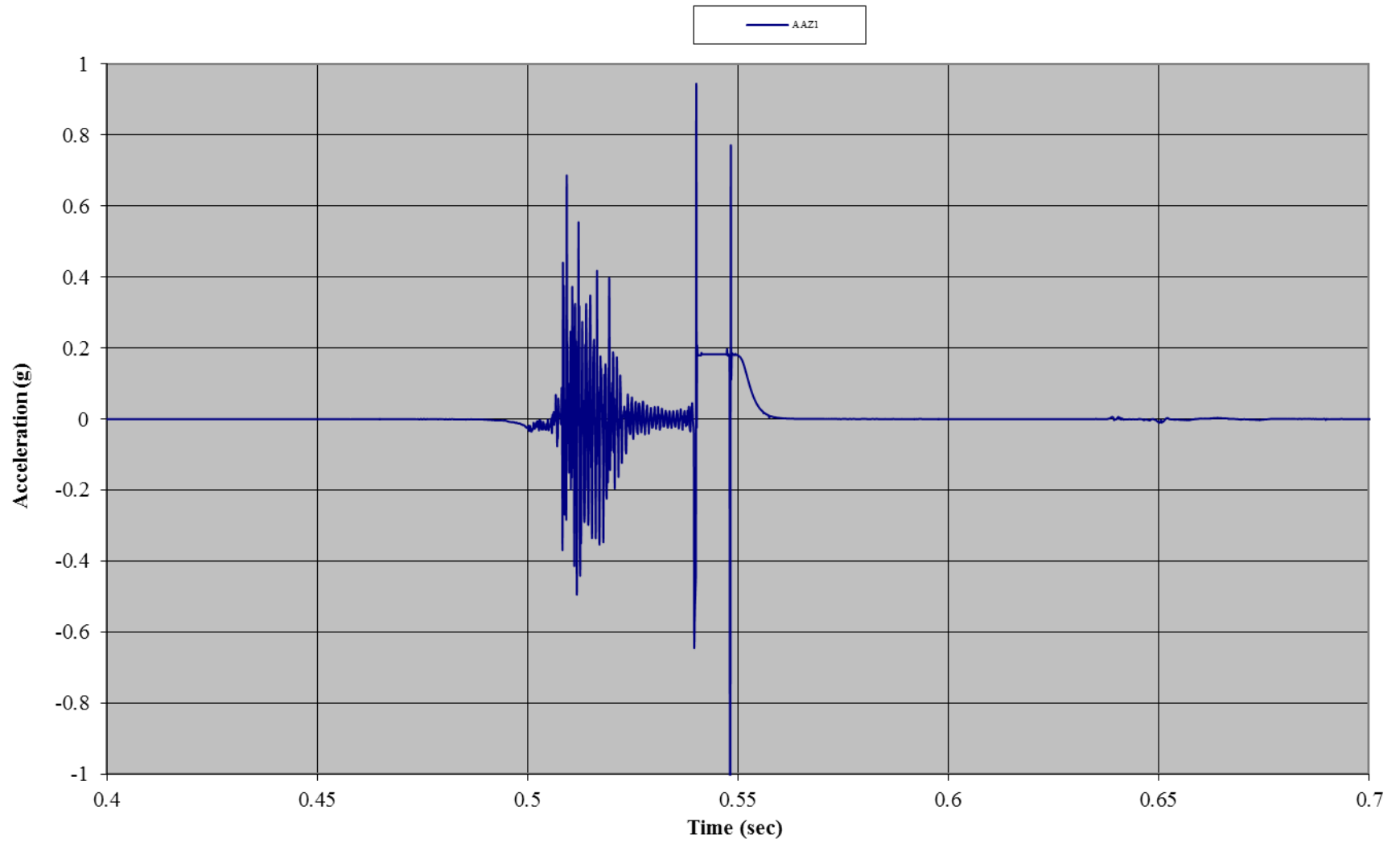
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (x-direction)



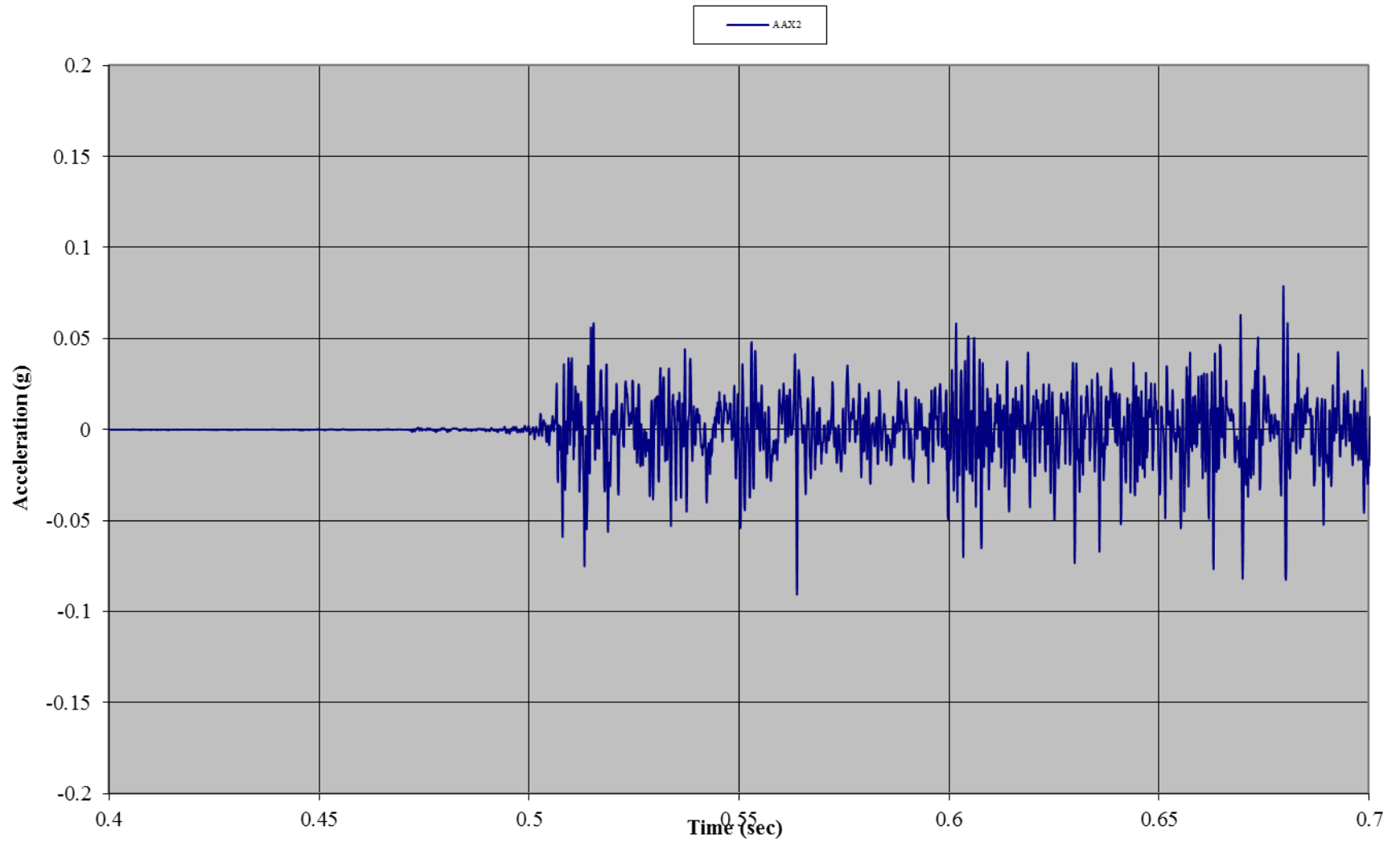
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (y-direction)



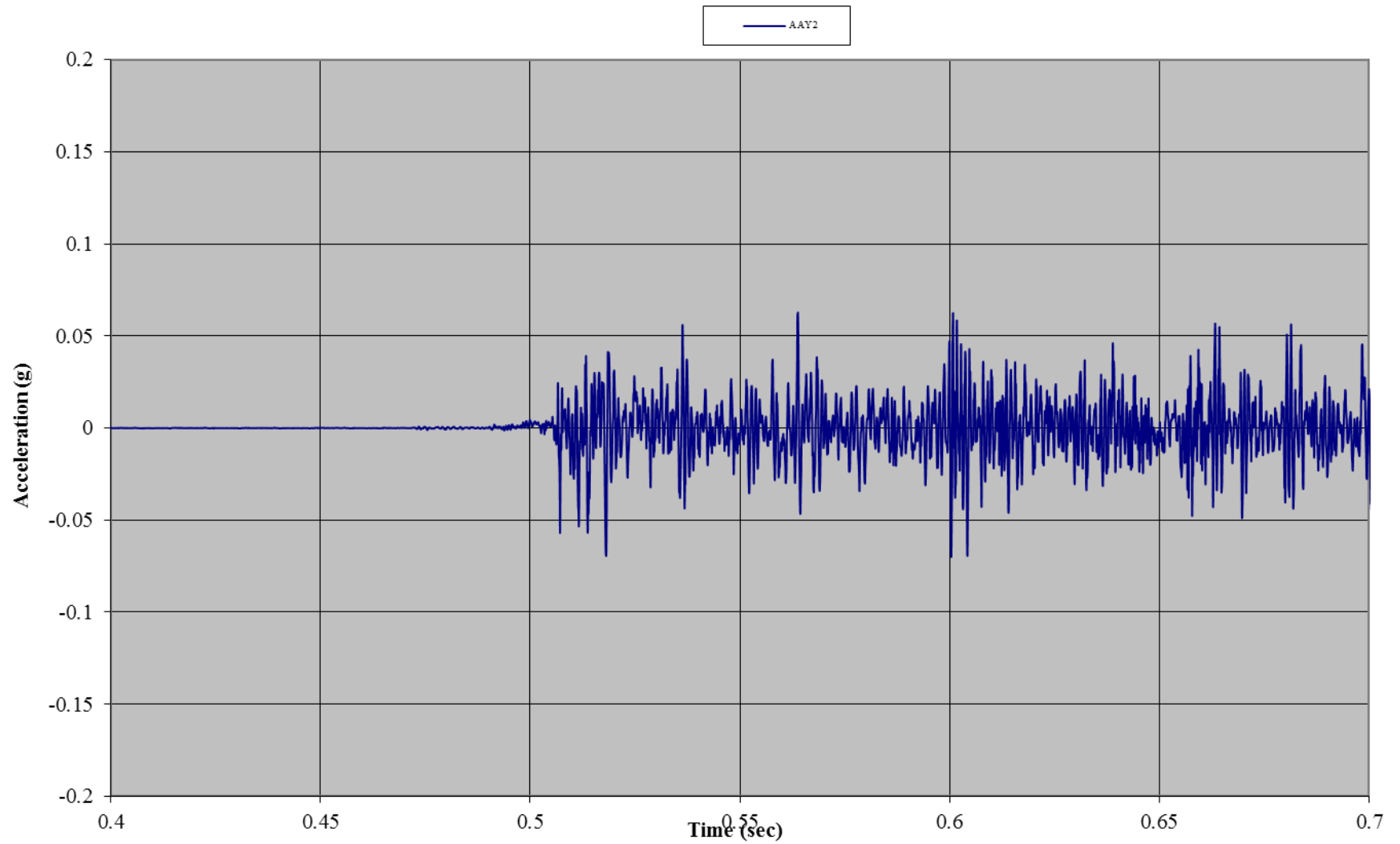
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 1: Front Wall (z-direction)



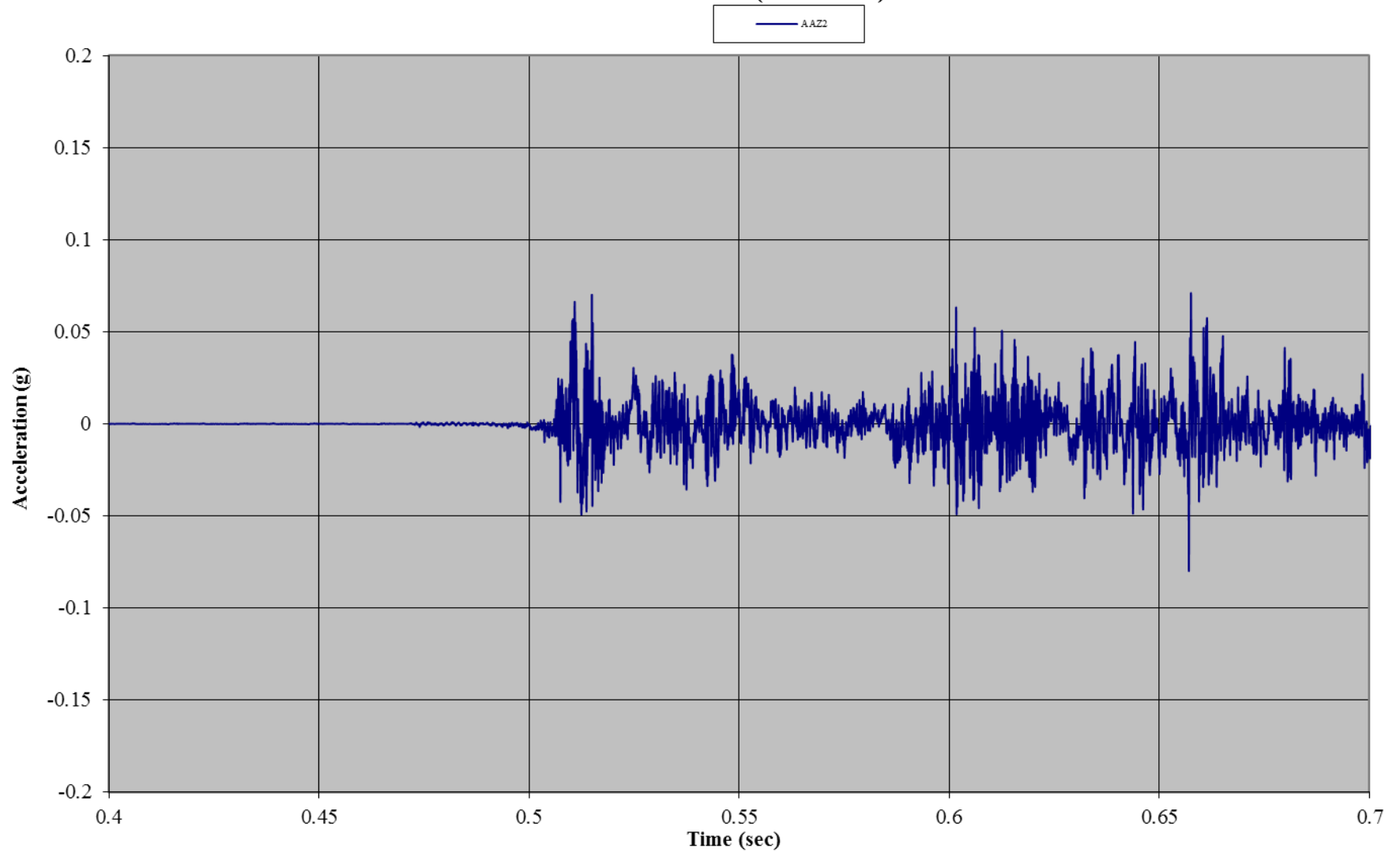
Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (x-direction)



Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (y-direction)



Test C02: 90 mph-Wind Rated Flexible Frame Tent with Sides
Accelerometer 2: Roof (z-direction)





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