



Health & Safety  
Executive

**OFFSHORE TECHNOLOGY  
REPORT - OTO 98 123**

**Explosions in Full Scale Offshore  
Module Geometries  
Preliminary Data Report for Test 27**

# Explosions in Full Scale Offshore Module Geometries

Health & Safety Executive Contract MaTSU 8847/3522

## Preliminary Data Report for Test 27

Summary of Experimental Conditions	
Date	22nd January 1998
Time	13:42
Test Series	G
Confinement Configuration	C3
Obstacle Configuration	O2
Ignition Position	(X:13.5, Y:5, Z:4.25)
Mean Equivalence Ratio	1.11
Water Sprays	Perimeter Deluge
Polythene Cut	No

All data contained in this preliminary report is subject to final confirmation.

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Table 1: Flame Arrival Times

Ionisation Probe	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)	Flame Arrival Time (msec)
IP-1	0.5	0.5	2.0	409.1
IP-2	6.0	0.5	2.0	373.2
IP-3	10.0	0.5	2.0	335.1
IP-4	14.0	0.5	2.0	316.7
IP-5	18.0	0.5	2.0	338.0
IP-6	22.0	0.5	2.0	377.1
IP-7	27.5	0.5	2.0	417.6
IP-8	0.5	4.0	2.0	390.0
IP-9	6.0	4.0	2.0	362.7
IP-10	14.0	4.0	2.0	283.7
IP-11	22.0	4.0	2.0	371.7
IP-12	27.5	4.0	2.0	407.6
IP-13	0.5	8.0	2.0	313.3
IP-14	6.0	8.0	2.0	364.4
IP-15	-	-	-	-
IP-16	14.0	8.0	2.0	318.8
IP-17	-	-	-	-
IP-18	23.5	8.0	2.0	386.1
IP-19	27.5	8.0	2.0	380.8
IP-20	0.5	11.5	2.0	-
IP-21	2.0	11.5	2.0	-
IP-22	6.0	11.5	2.0	-
IP-23	10.0	11.5	2.0	507.7
IP-24	14.0	11.5	2.0	703.3
IP-25	18.0	11.5	2.0	-
IP-26	22.0	11.5	2.0	-
IP-27	26.0	11.5	2.0	-
IP-28	27.5	11.5	2.0	-
IP-29	0.5	0.5	4.0	-
IP-30	6.0	0.5	4.0	-
IP-31	10.0	0.5	4.0	339.1
IP-32	14.0	0.5	4.0	303.4
IP-33	18.0	0.5	4.0	337.7

Ionisation Probe	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)	Flame Arrival Time (msec)
IP-34	22.0	0.5	4.0	363.7
IP-35	26.0	0.5	4.0	399.0
IP-36	27.5	0.5	4.0	-
IP-37	0.5	4.0	4.0	401.2
IP-38	6.0	4.0	4.0	363.6
IP-39	14.0	4.0	4.0	129.5
IP-40	22.0	4.0	4.0	331.4
IP-41	26.0	4.0	4.0	382.0
IP-42	27.5	4.0	4.0	397.5
IP-43	0.5	8.0	4.0	-
IP-44	2.0	8.0	4.0	-
IP-45	6.0	8.0	4.0	361.6
IP-46	-	-	-	-
IP-47	14.0	8.0	4.0	292.1
IP-48	-	-	-	-
IP-49	22.0	8.0	4.0	367.0
IP-50	26.0	8.0	4.0	360.2
IP-51	27.5	8.0	4.0	361.6
IP-52	26.0	10.0	4.0	-
IP-53	27.5	10.0	4.0	-
IP-54	0.5	11.5	4.0	416.8
IP-55	2.0	11.5	4.0	415.9
IP-56	6.0	11.5	4.0	407.9
IP-57	10.0	11.5	4.0	375.4
IP-58	14.0	11.5	4.0	359.9
IP-59	18.0	11.5	4.0	363.2
IP-60	22.0	11.5	4.0	398.1
IP-61	26.0	11.5	4.0	436.5
IP-62	27.5	11.5	4.0	405.3
IP-63	0.5	0.5	6.0	388.4
IP-64	6.0	0.5	6.0	368.2
IP-65	10.0	0.5	6.0	342.6
IP-66	14.0	0.5	6.0	322.4
IP-67	18.0	0.5	6.0	346.9

Ionisation Probe	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)	Flame Arrival Time (msec)
IP-68	22.0	0.5	6.0	354.6
IP-69	27.5	0.5	6.0	356.7
IP-70	0.5	4.0	6.0	374.2
IP-71	6.0	4.0	6.0	356.8
IP-72	14.0	4.0	6.3	261.2
IP-73	22.0	4.0	6.0	358.3
IP-74	27.5	4.0	6.0	398.9
IP-75	0.5	8.0	6.0	386.0
IP-76	6.0	8.0	6.0	358.8
IP-77	-	-	-	-
IP-78	14.0	8.0	6.0	304.6
IP-79	-	-	-	-
IP-80	22.0	8.0	6.0	371.3
IP-81	27.5	8.0	6.0	403.1
IP-82	0.5	11.5	6.0	421.0
IP-83	2.0	11.5	6.0	407.9
IP-84	6.0	11.5	6.0	-
IP-85	10.0	11.5	6.0	370.1
IP-86	14.0	11.5	6.0	358.9
IP-87	18.0	11.5	6.0	332.8
IP-88	22.0	11.5	6.0	388.1
IP-89	26.0	11.5	6.0	-
IP-90	27.5	11.5	6.0	395.8
IP-91	27.5	6.0	4.0	-
IP-92	0.5	6.0	7.5	391.0
IP-93	6.0	6.0	7.5	355.1
IP-94	14.0	6.0	7.5	304.4
IP-95	22.0	6.0	7.5	362.0
IP-96	27.5	6.0	7.5	356.4

**Table 2: Internal Overpressures**

Pressure Transducer	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)	Maximum Overpressure (mbar)	1.5ms Running Average			
					Maximum Overpressure (mbar)	Time of Arrival (ms)	Idealised Profile Representation	
							Rise Time (ms)	Duration (ms)
PI-1	0.8	0.5	0.0	411	407	398.3	58.7	66.1
PI-2	6.0	0.5	0.0	313	308	370.8	53.4	121.1
PI-3	12.5	0.5	0.0	255	248	385.8	108.6	145.5
PI-4	22.0	0.5	0.0	307	303	383.9	62.5	96.1
PI-5	27.5	0.5	0.0	298	286	425.3	11.2	19.3
PI-6	0.5	6.0	0.0	121	118	390.8	61.1	72.5
PI-7	9.0	6.0	0.0	351	347	389.2	88.2	116.5
PI-8	14.0	6.0	0.0	390	371	398.0	105.6	123.8
PI-9	21.0	6.0	0.4	390	376	380.3	65.7	98.7
PI-10	27.5	6.0	0.0	345	333	398.8	62.3	73.2
PI-11	0.5	11.5	0.0	333	323	427.7	17.4	27.7
PI-12	12.3	11.5	0.0	349	343	374.3	68.4	111.3
PI-13	27.5	11.5	0.0	213	208	394.2	65.6	80.5
PI-14	0.5	0.5	4.0	338	333	394.8	62.3	80.5
PI-15	4.5	0.6	4.0	256	250	382.7	68.0	104.7
PI-16	12.0	0.0	5.5	217	209	381.4	99.9	139.9
PI-17	12.0	0.5	4.0	216	204	378.0	105.5	147.1
PI-18	22.0	0.5	4.0	253	242	389.3	79.1	131.3
PI-19	27.5	0.5	4.0	239	228	394.6	62.5	115.5
PI-20	10.2	4.0	4.0	240	231	383.8	107.0	144.9
PI-21	0.5	7.0	4.0	387	367	386.3	52.0	108.0
PI-22	18.0	8.0	4.0	245	239	373.4	83.4	164.6
PI-23	27.5	6.0	4.0	313	298	392.7	57.3	119.8
PI-24	0.5	11.5	4.0	260	253	391.7	59.7	76.4
PI-25	10.0	11.5	4.0	223	219	370.9	75.6	127.9
PI-26	18.0	11.5	4.0	278	271	371.0	63.3	116.4
PI-27	27.5	11.5	4.0	275	264	397.0	58.9	125.1
PI-28	0.8	0.8	8.0	274	260	393.4	63.3	90.2
PI-29	13.9	1.7	8.0	241	236	378.5	99.7	194.6
PI-30	26.1	1.7	8.0	-	-	-	-	-
PI-31	6.9	3.3	8.0	282	276	350.8	44.9	145.9
PI-32	19.2	8.7	8.0	405	370	372.9	65.8	149.4
PI-33	1.1	11.1	8.0	331	298	396.5	60.7	109.4
PI-34	12.8	11.2	8.0	252	248	374.0	81.5	137.4
PI-35	26.1	11.3	8.0	354	337	394.6	57.6	143.4

Table 3 : External Overpressures

Pressure Transducer	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)	Maximum Overpressure (mbar)	Maximum Overpressure 1.5ms Running Average (mbar)
PE-1	34.5	5.5	0.0	225	219
PE-2	40.0	6.0	1.0	168	164
PE-3	52.0	6.0	1.0	125	122
PE-4	76.0	6.0	1.0	72	69
PE-5	46.8	25.2	1.0	111	103
PE-6	61.4	39.8	1.0	75	73
PE-7	14.0	18.0	1.0	210	205
PE-8	14.0	24.0	1.0	182	179
PE-9	14.0	36.0	1.0	115	114
PE-10	14.0	60.0	1.0	82	81
PE-11	-21.2	25.2	1.0	170	161
PE-12	14.0	-6.0	0.0	195	190
PE-13	-6.0	6.0	0.0	322	306

Table 4: Gas Concentrations

Measuring Position	X Co-ord (m)	Y Co-ord (m)	Z Co-ord (m)	Natural Gas Concentration (%)
1	24.0	4.0	1.1	9.9
2	12.0	8.5	0.8	9.8
3	1.0	2.9	1.4	9.8
4	7.3	7.7	1.6	9.7
5	14.2	5.1	4.5	9.8
6	26.8	1.6	6.4	9.8
7	4.2	8.7	4.8	9.7
8	19.0	7.0	6.7	9.9



**Table 5: Weather Conditions**

Air Temperature (°C)	Atmospheric Pressure (mbar)	Wind Speed (ms <sup>-1</sup> )	Wind Direction (° from Magnetic North)	Relative Humidity (%)
7.4	989	1.8	335	-

**Table 6: Confinement Configuration**

Confinement Configuration	Rig Face*	Confinement
C3	North	Open
	East	Open
	South	Open
	West	Open
	Roof	1/3 Open
	Floor	Confined

\* - Origin is at the junction of the West and South faces at ground level.

**Table 7: Conditions Inside the Rig Prior to Filling**

Air Temperature (°C)	Relative Humidity (%)
9	-

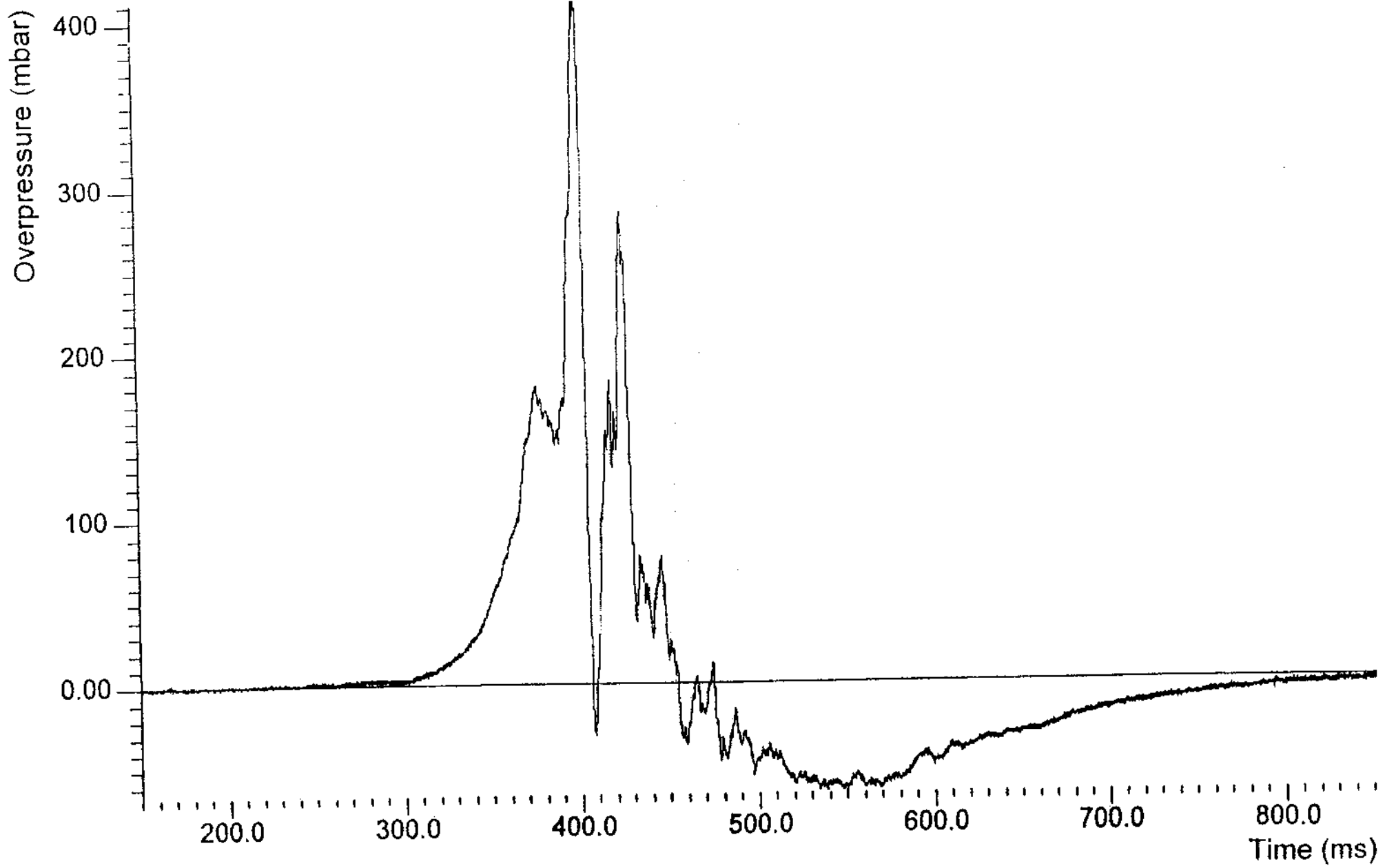
**Table 8: Water Deluge Configuration**

<b>Nozzle Type</b>	Open Pendent
<b>Number of Nozzles in Mezzanine Deck</b>	44 ('K' factor 80)
<b>Number of Nozzles in Cellar Deck</b>	27 ('K' factor 57)
<b>Water Inlet Pressure (barg)</b>	2.0
<b>Water Pressure at Nozzle (barg)</b>	1.8
<b>Total Water Flowrate (l min<sup>-1</sup>)</b>	7630
<b>Area Coverage - Cellar Deck (l min<sup>-1</sup>m<sup>-2</sup>)</b>	22.7

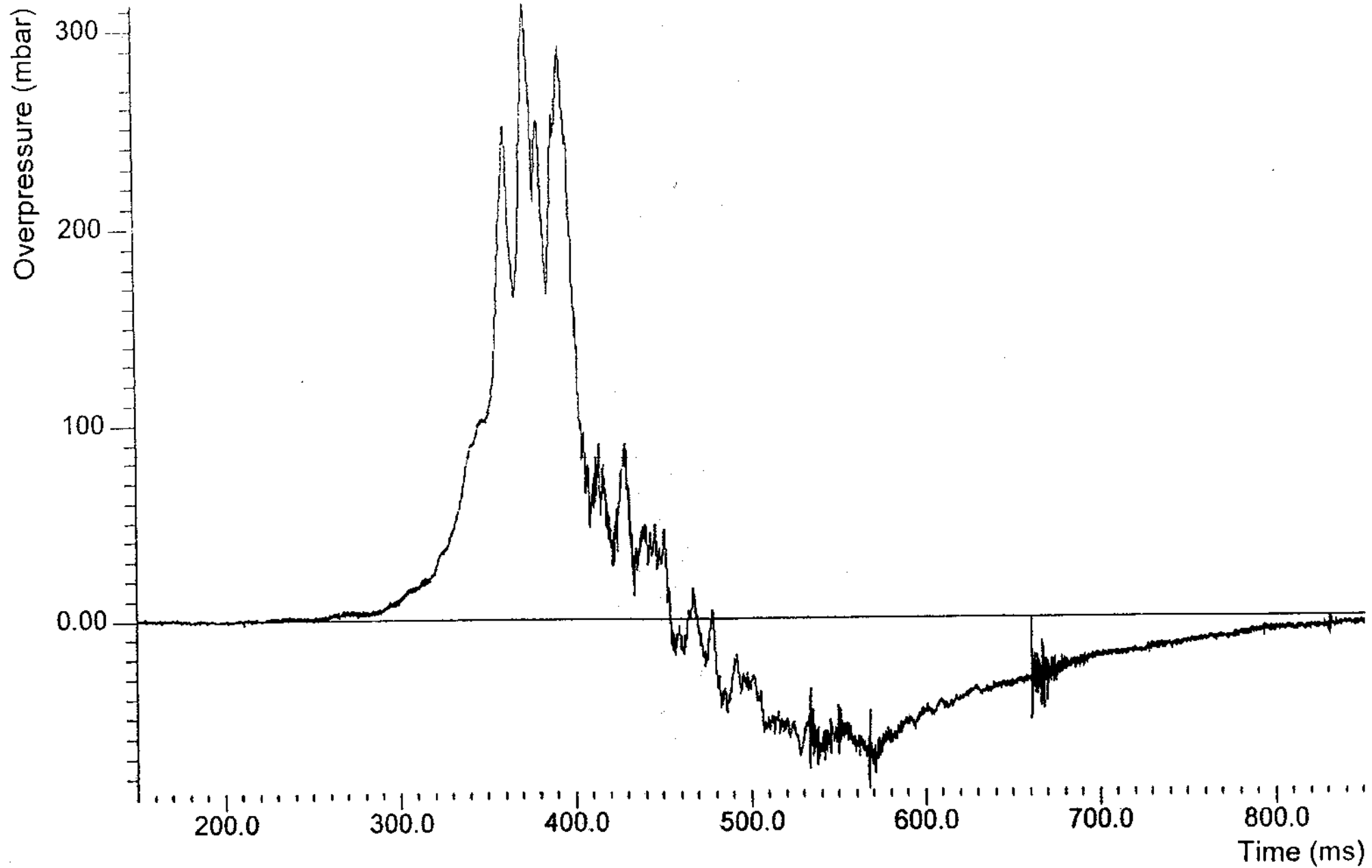
There was perimeter deluge only i.e. only nozzles locations within 2m of the sides of the test rig were used.

## **Appendix A: Internal Overpressure Profiles**

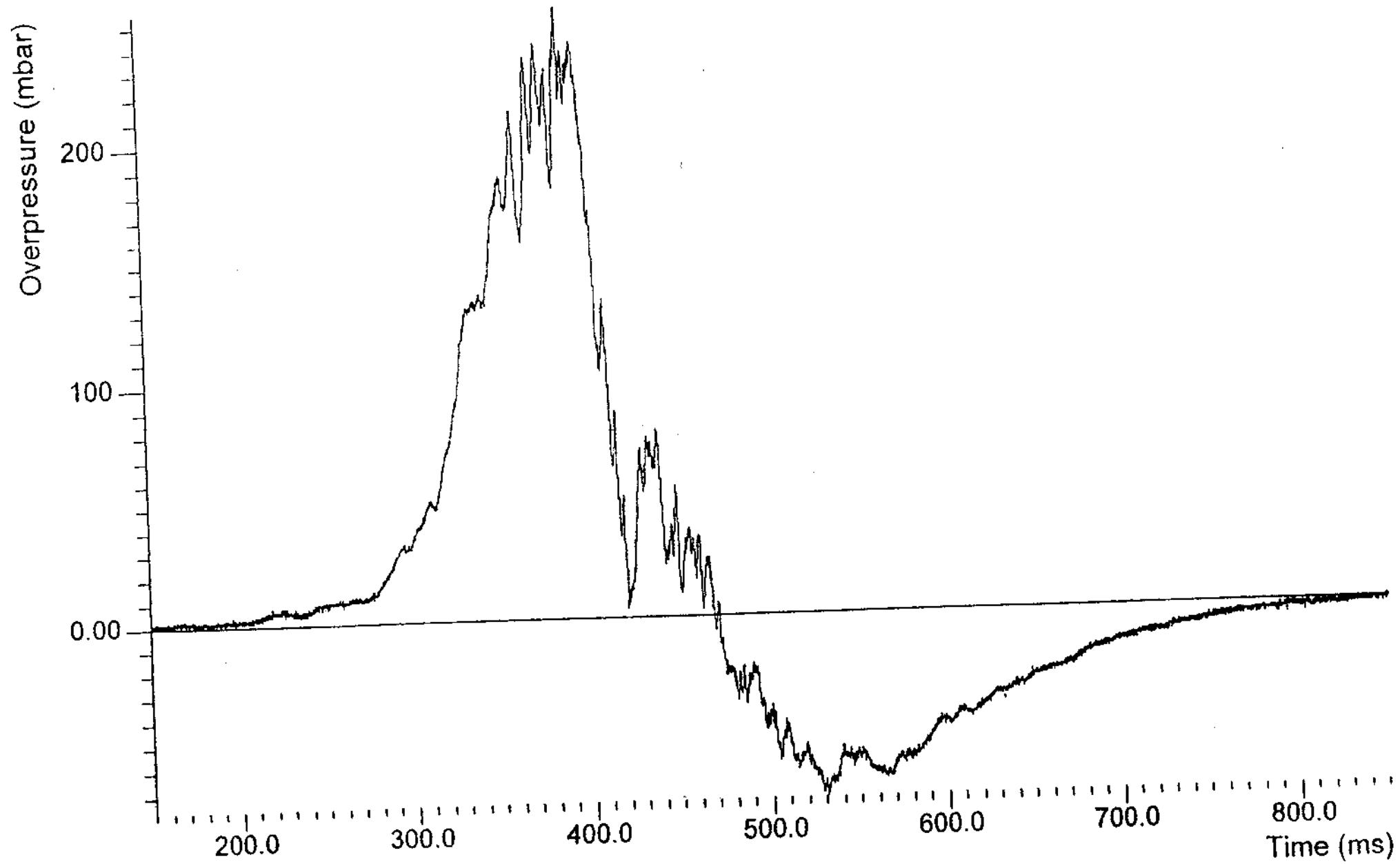
Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PI-1



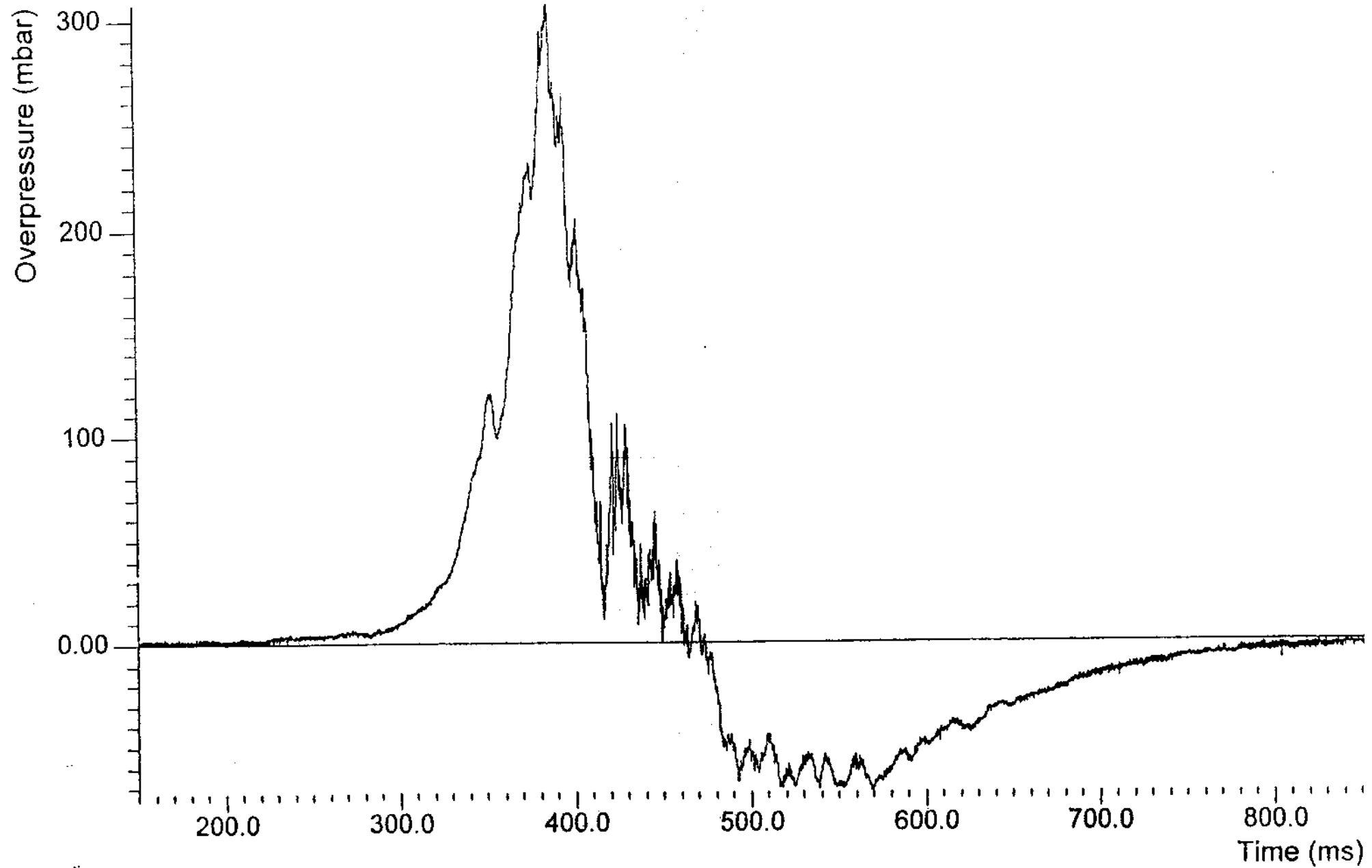
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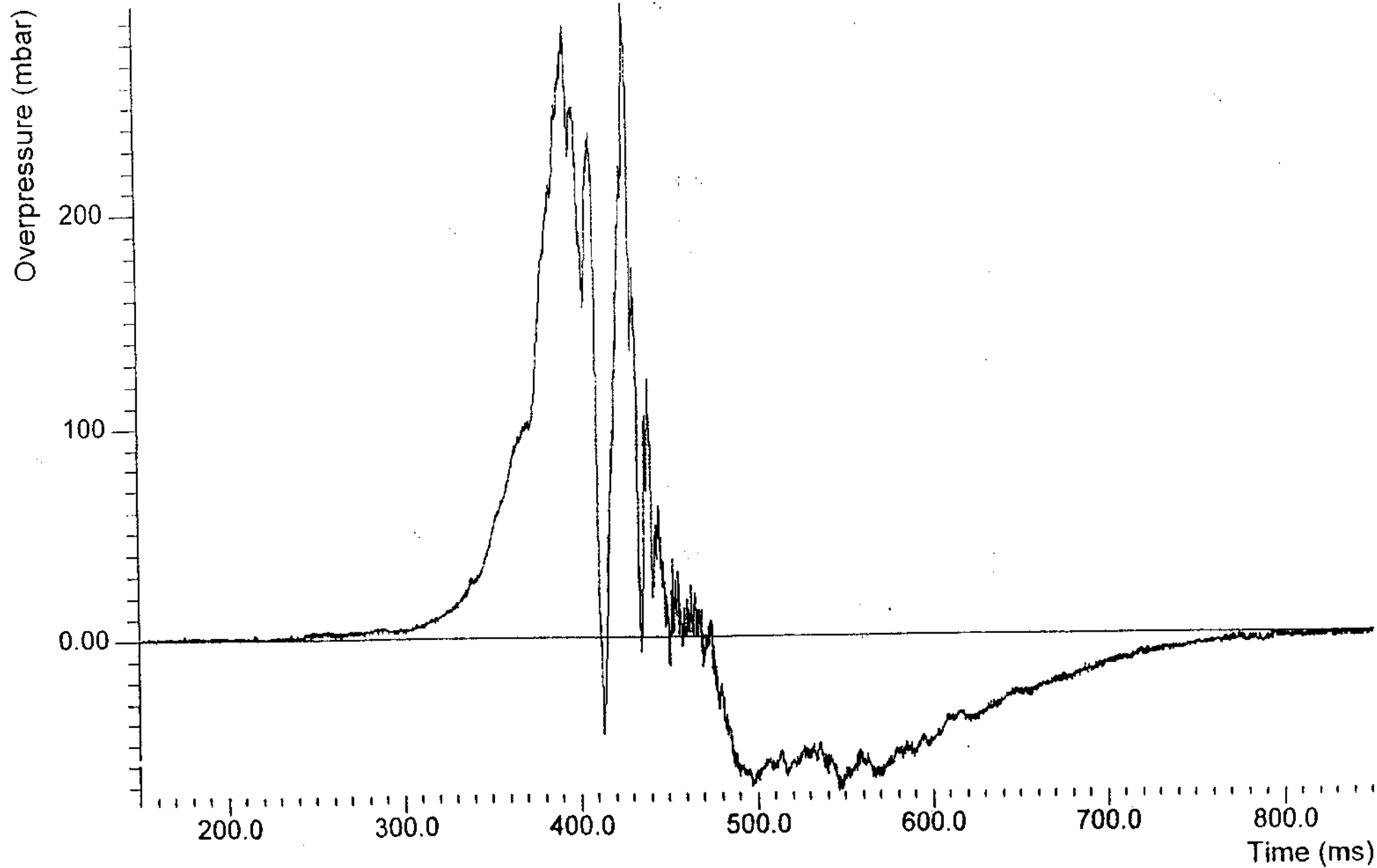
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Transducer no: PI-3



Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PI-4

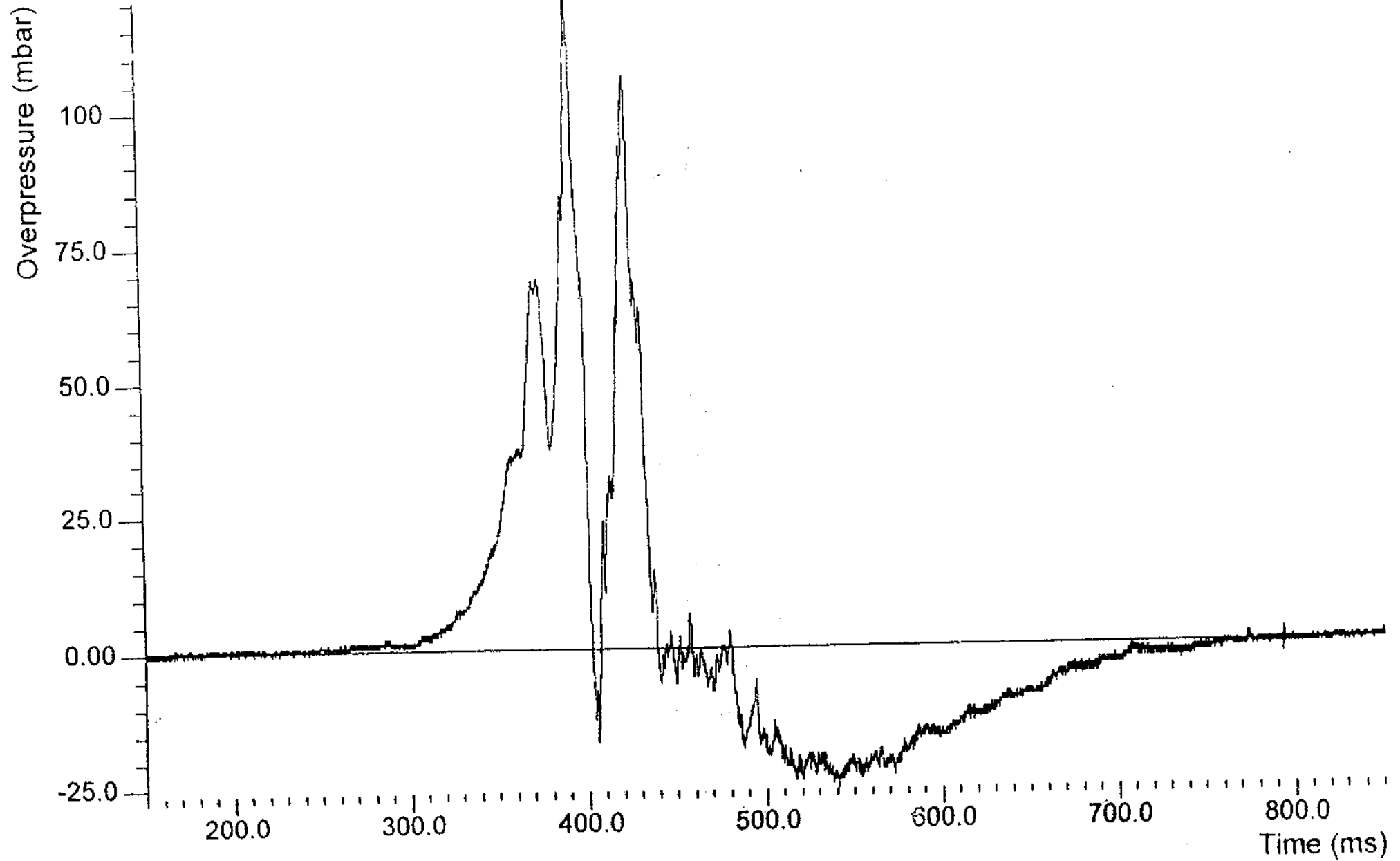


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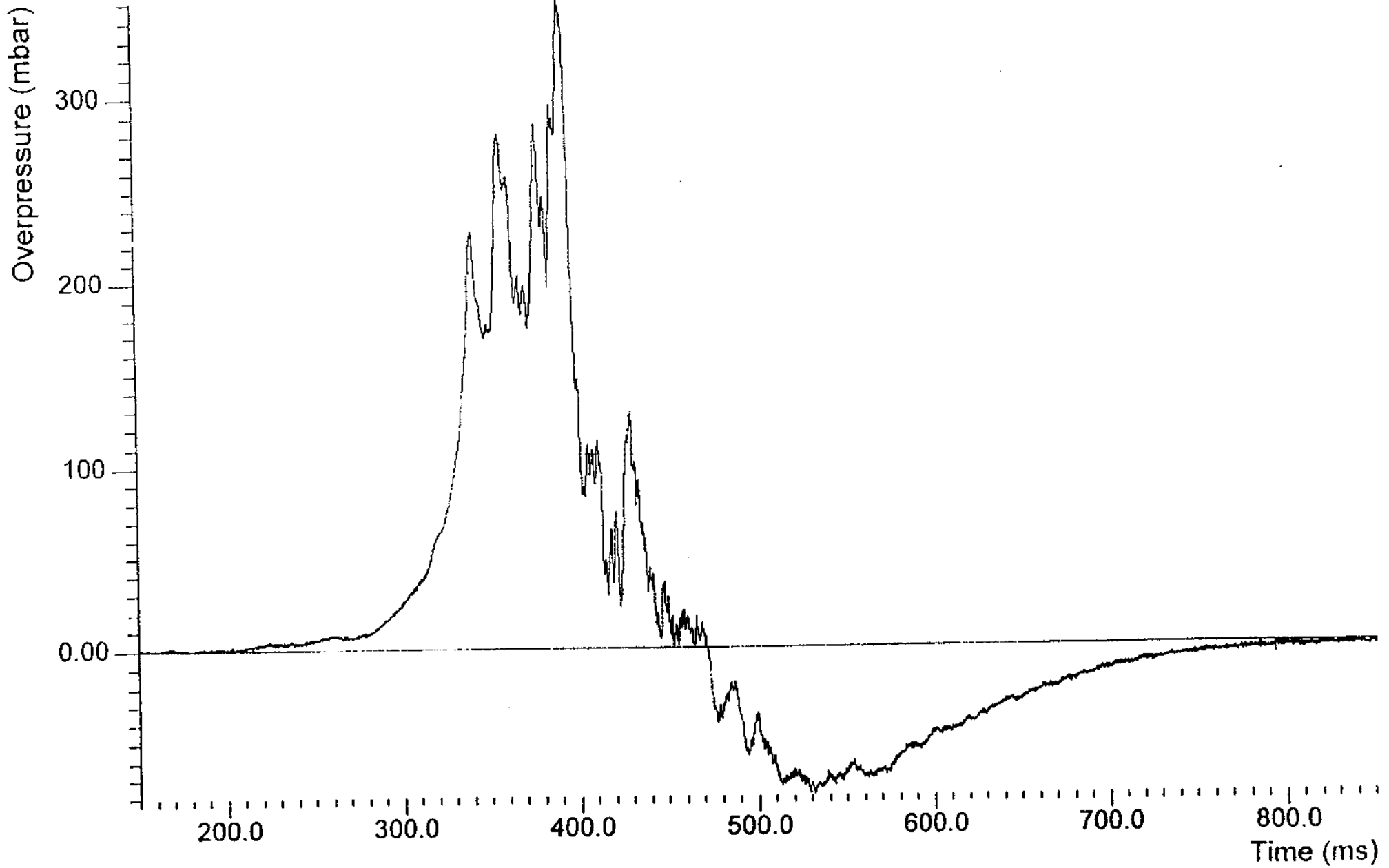




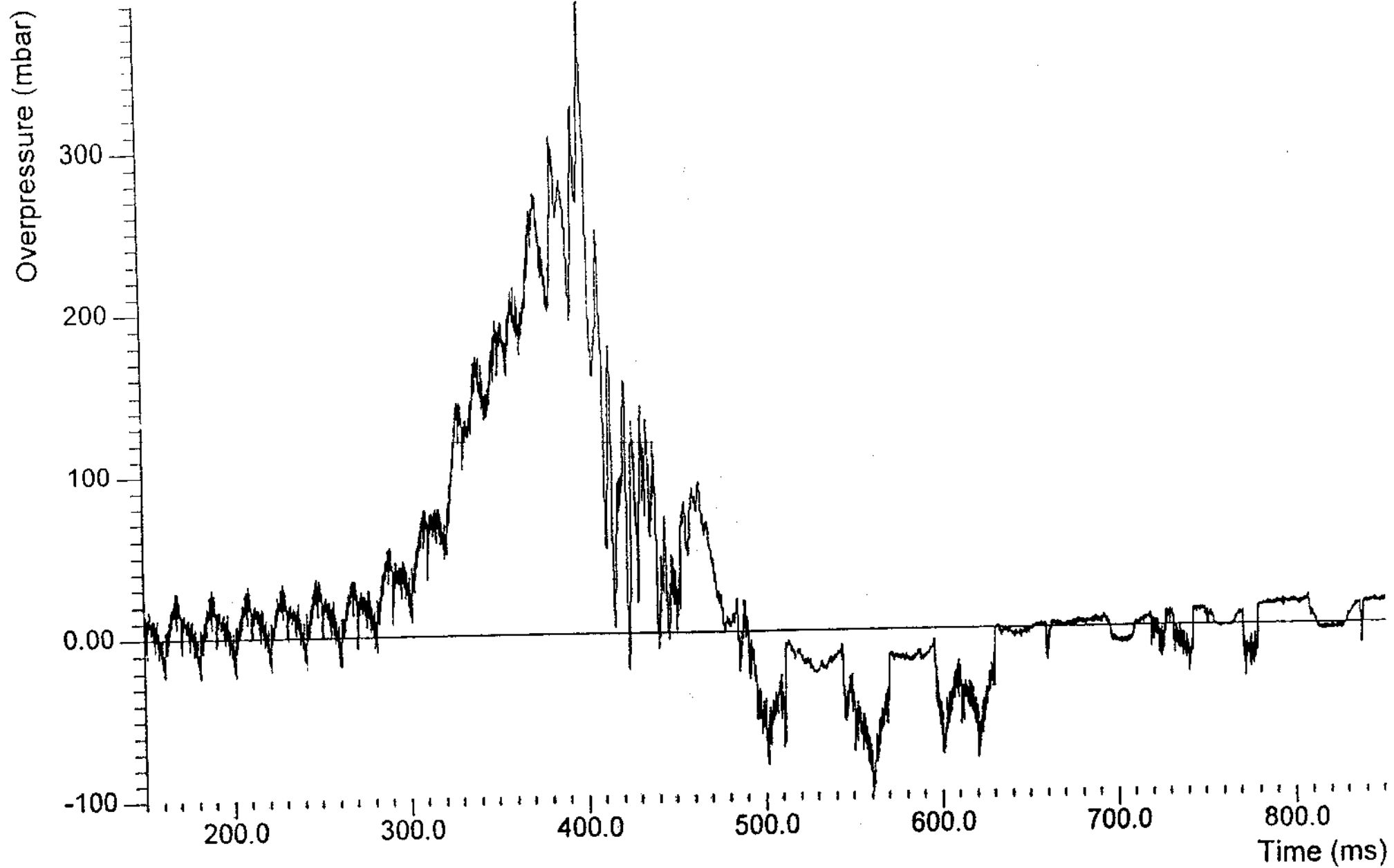
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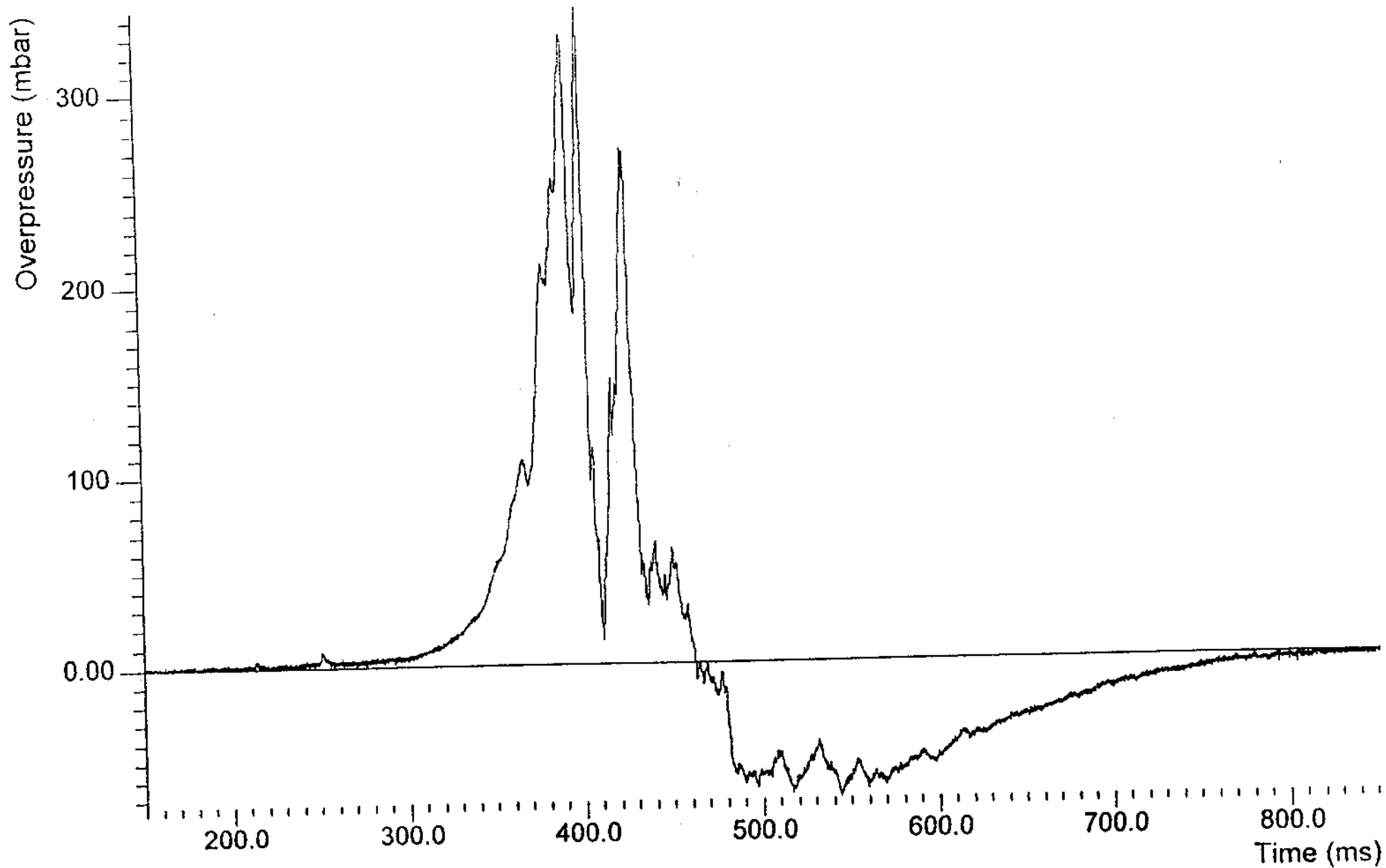
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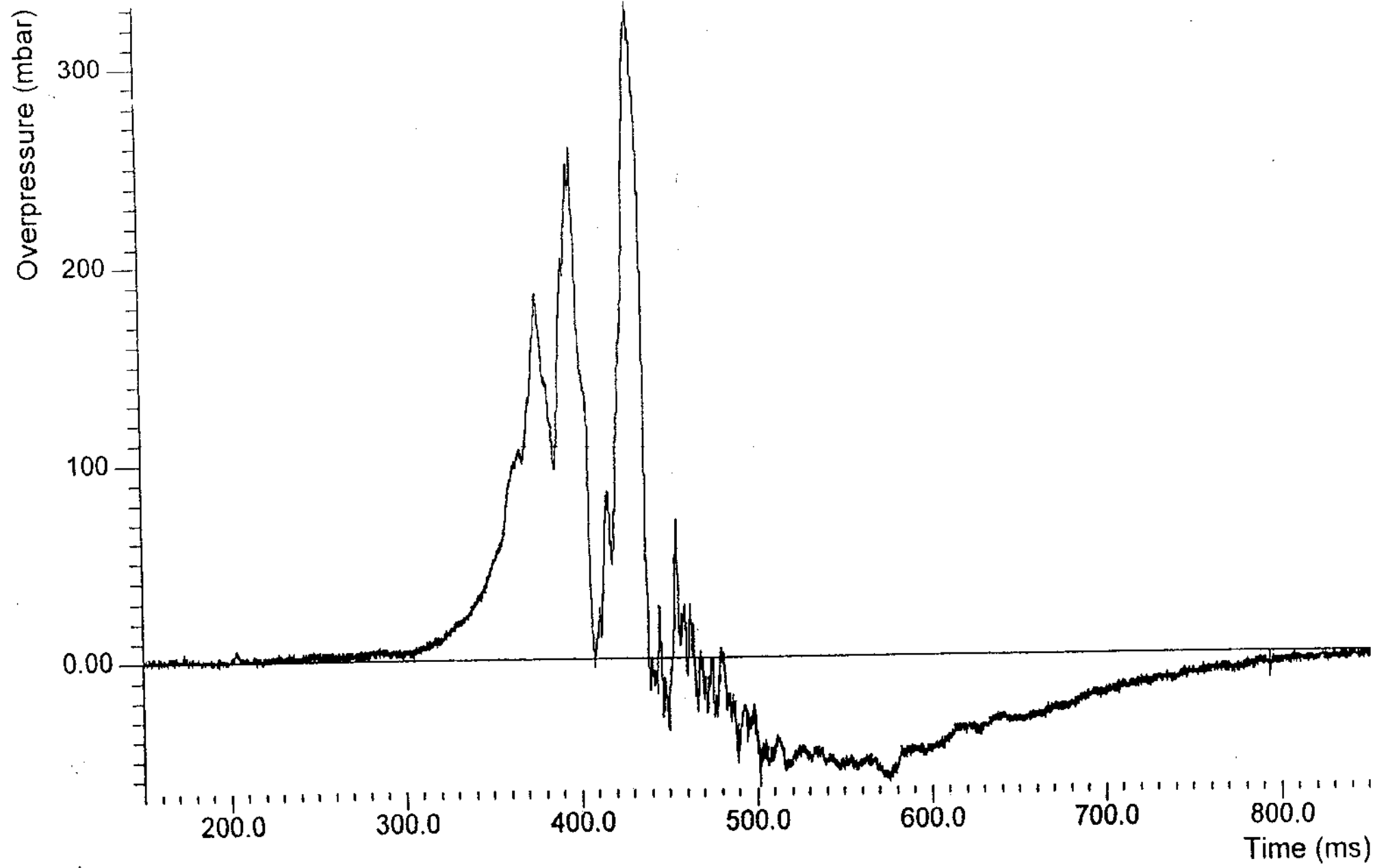
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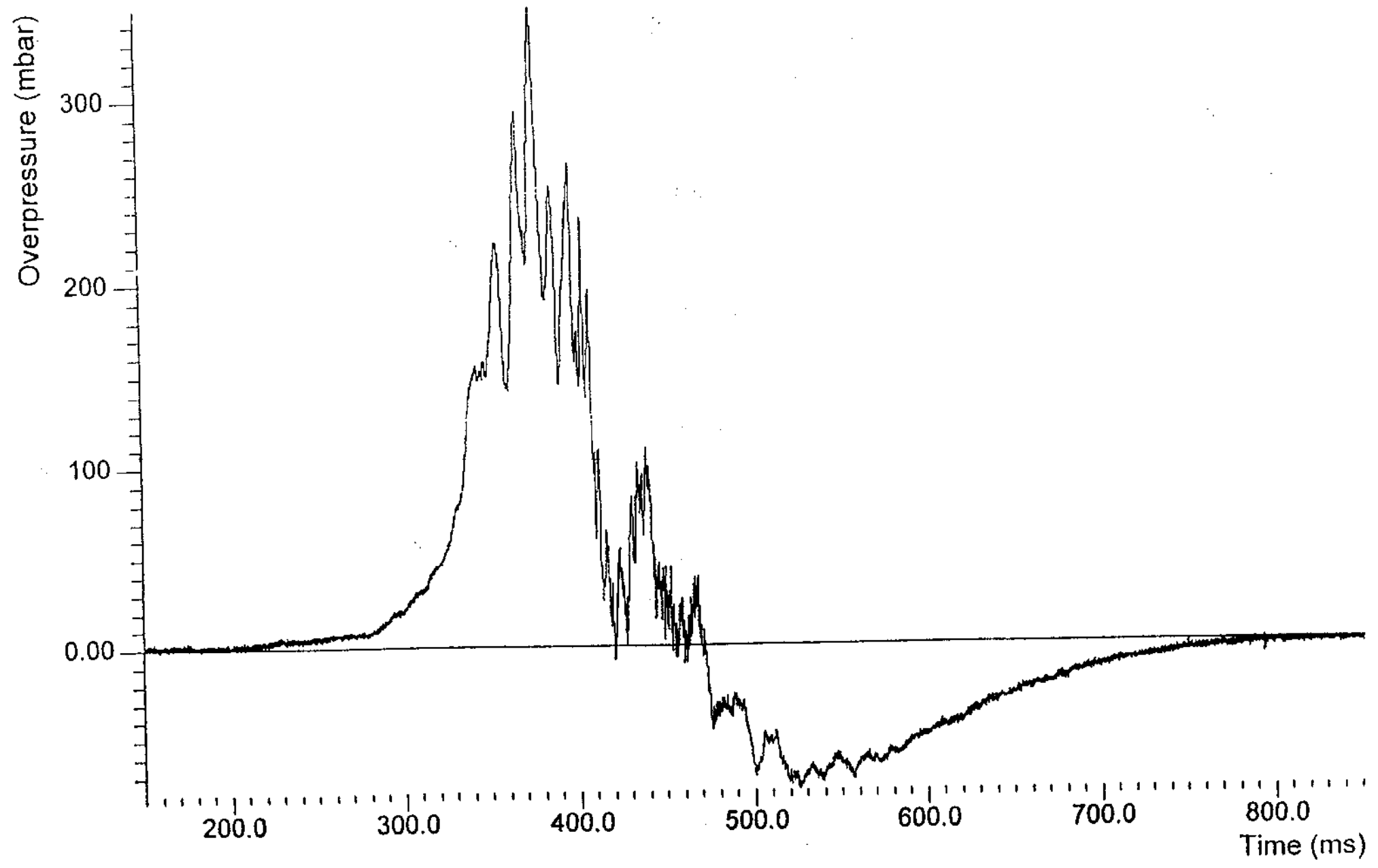
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Transducer no: PI-10



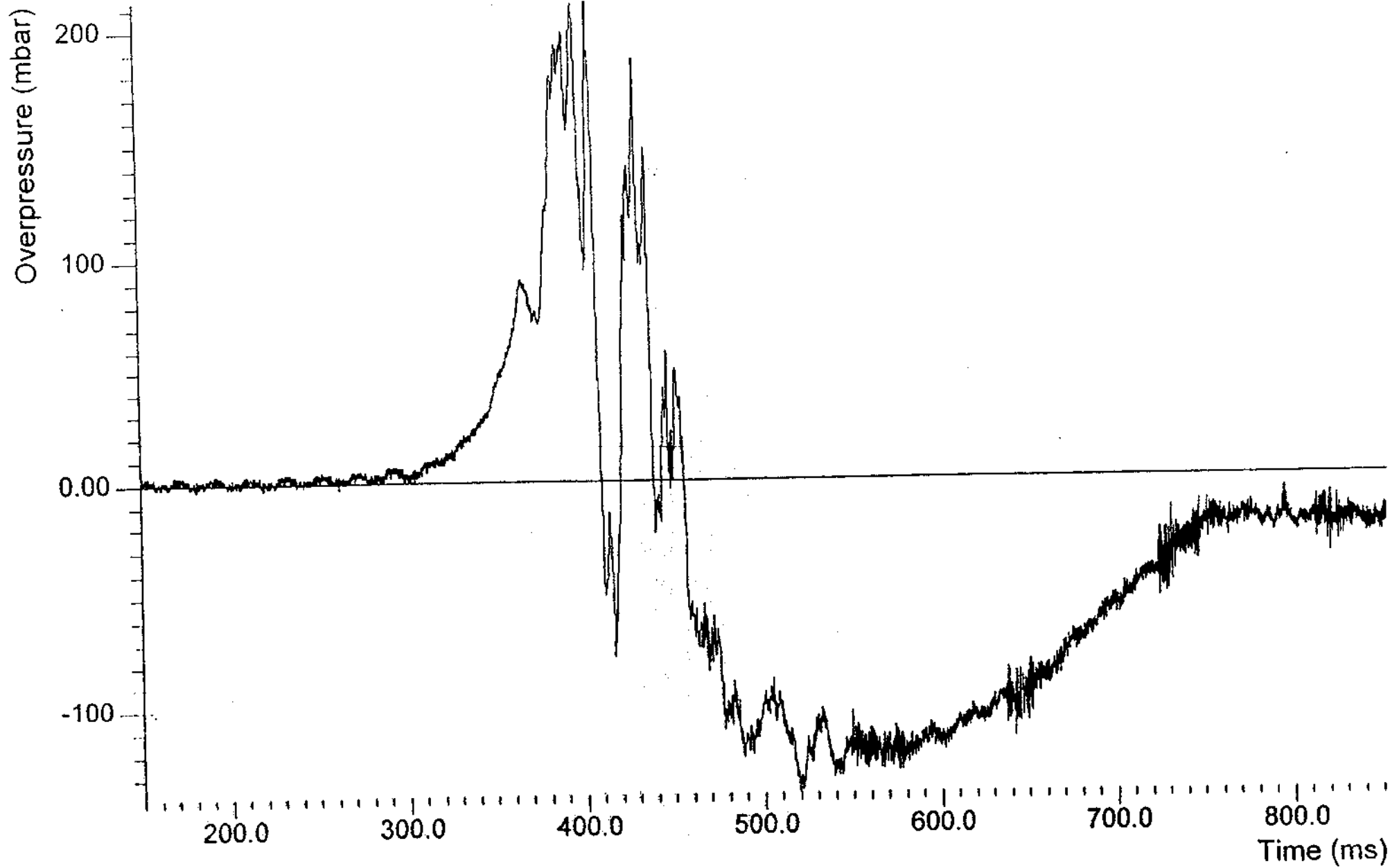
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Transducer no: PI-11



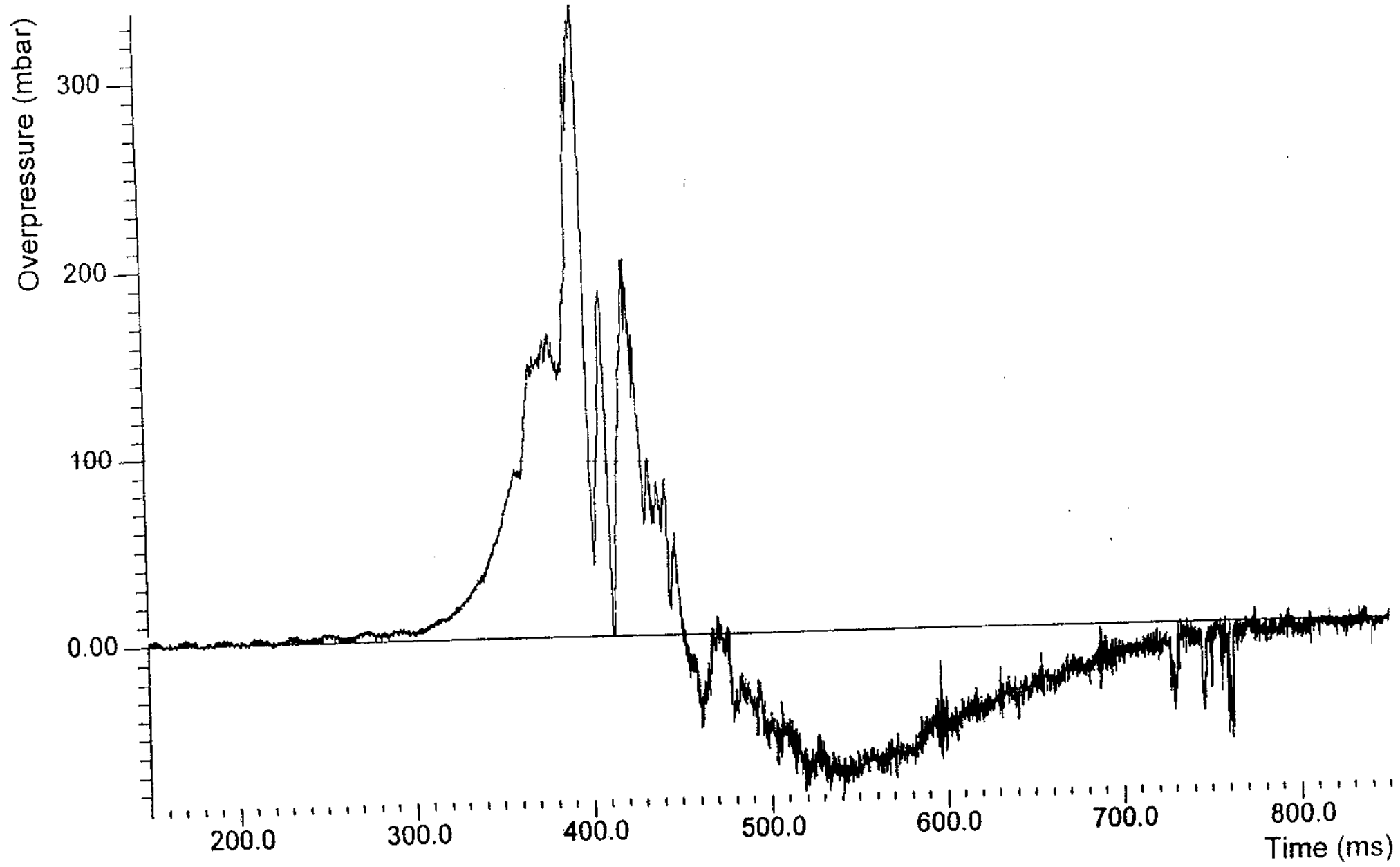
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Transducer no: PI-13

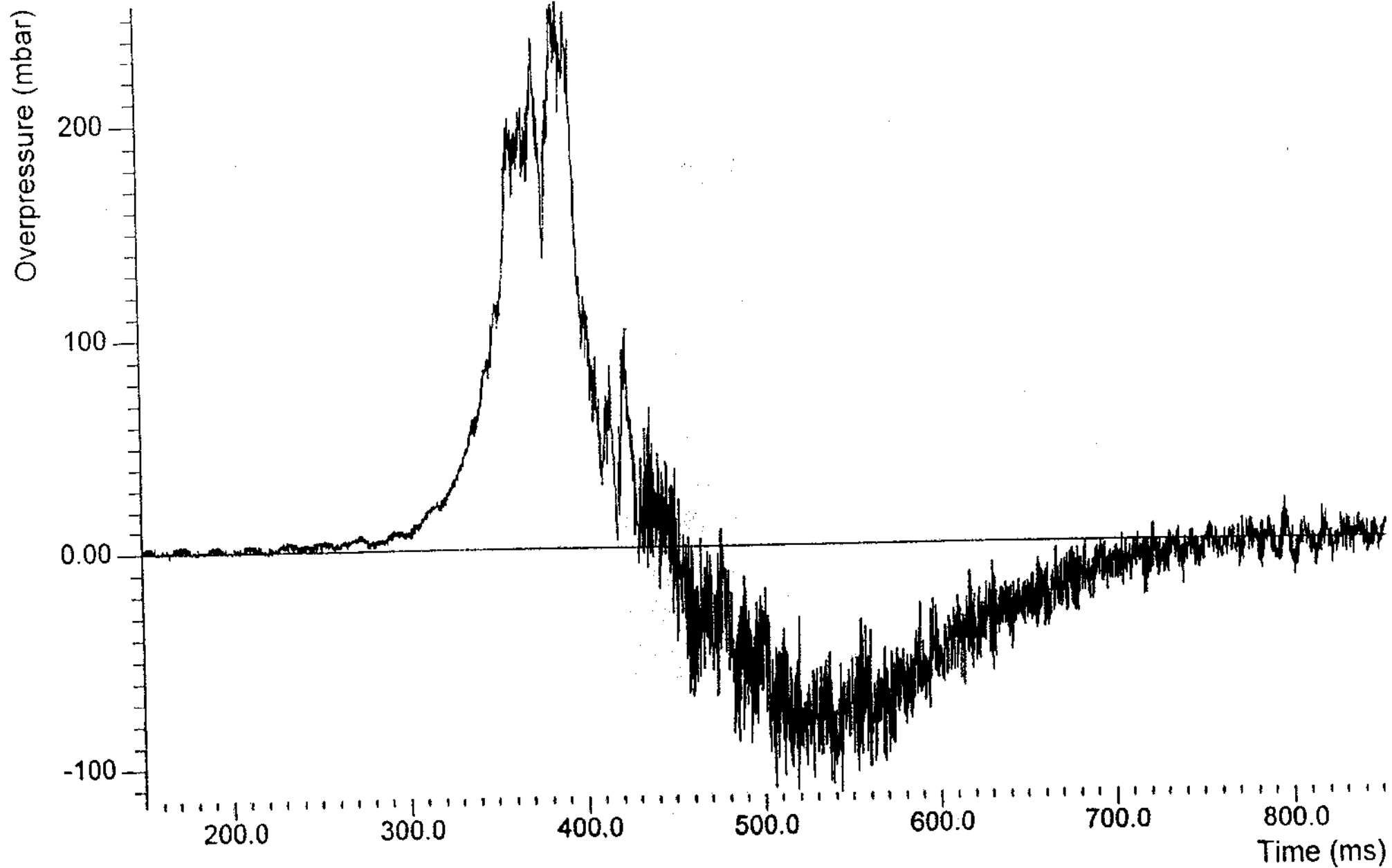


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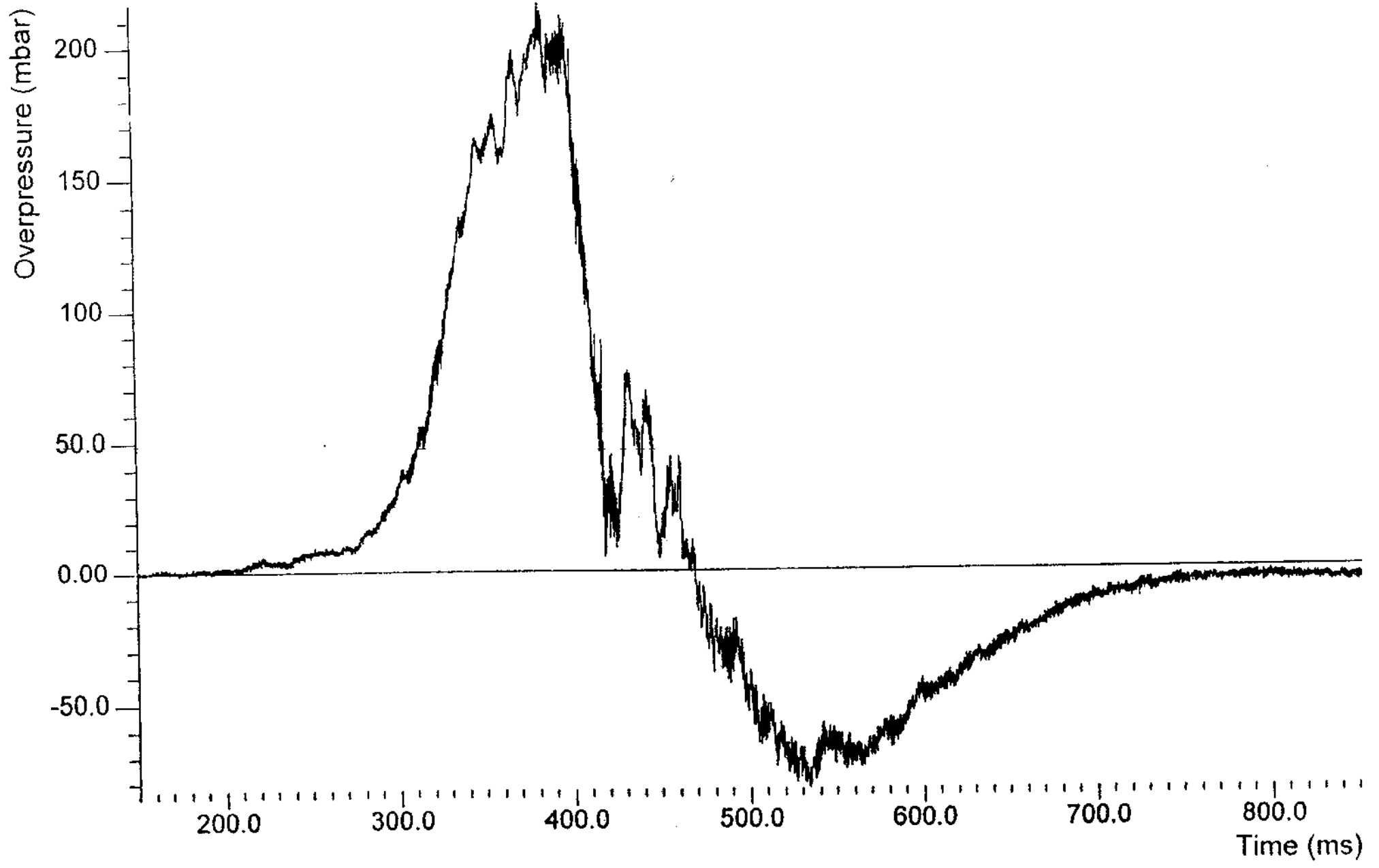




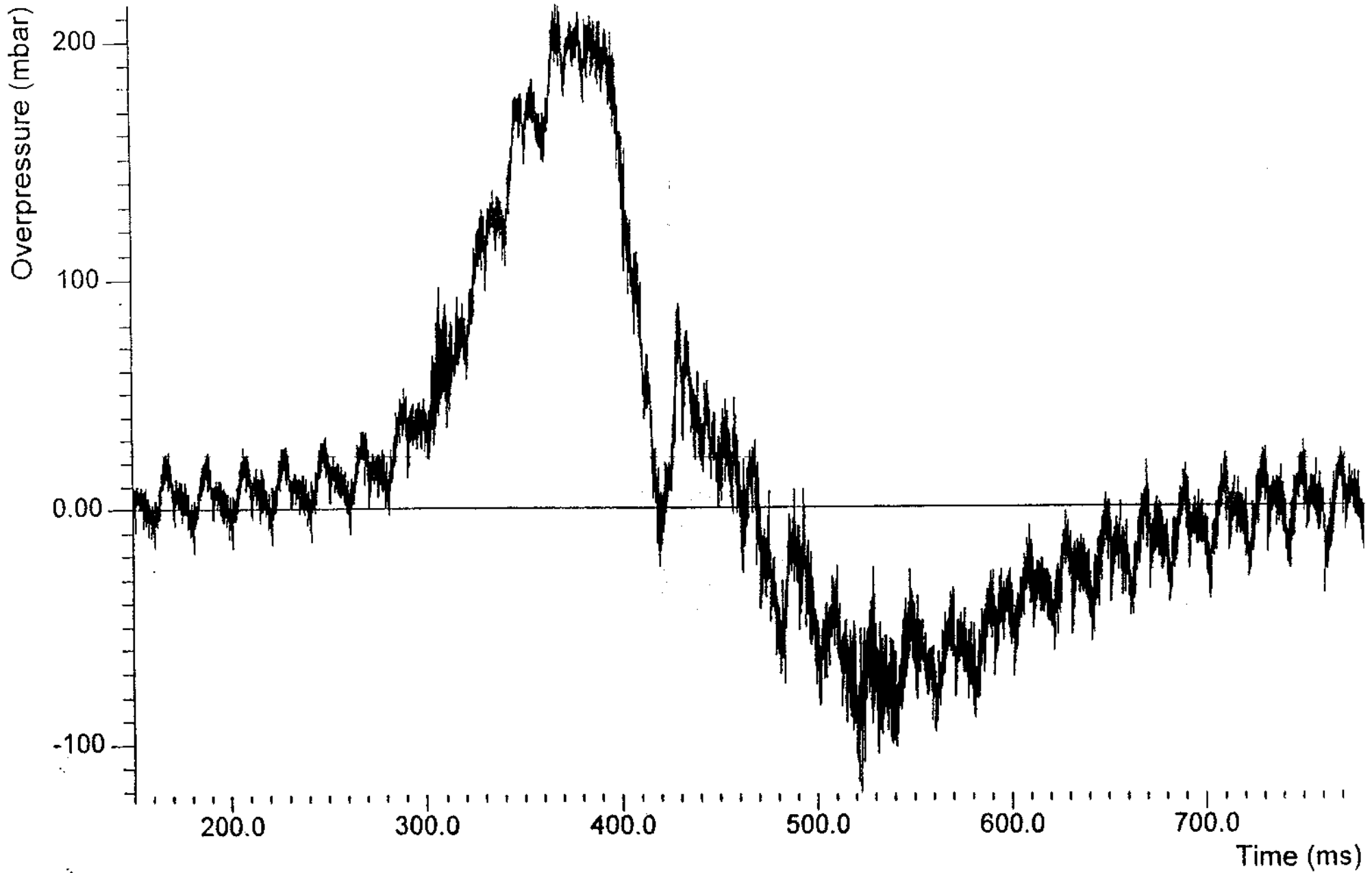
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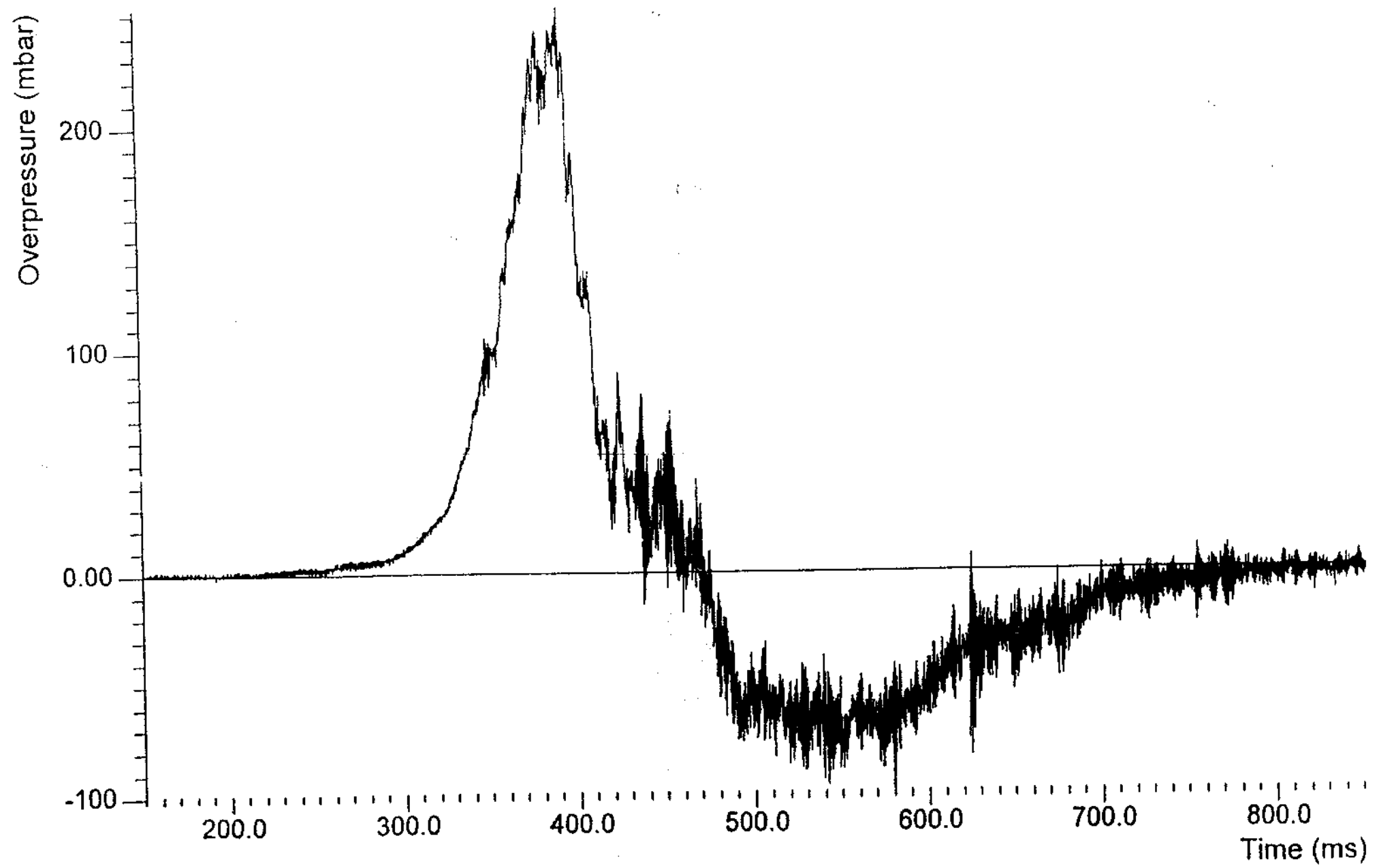
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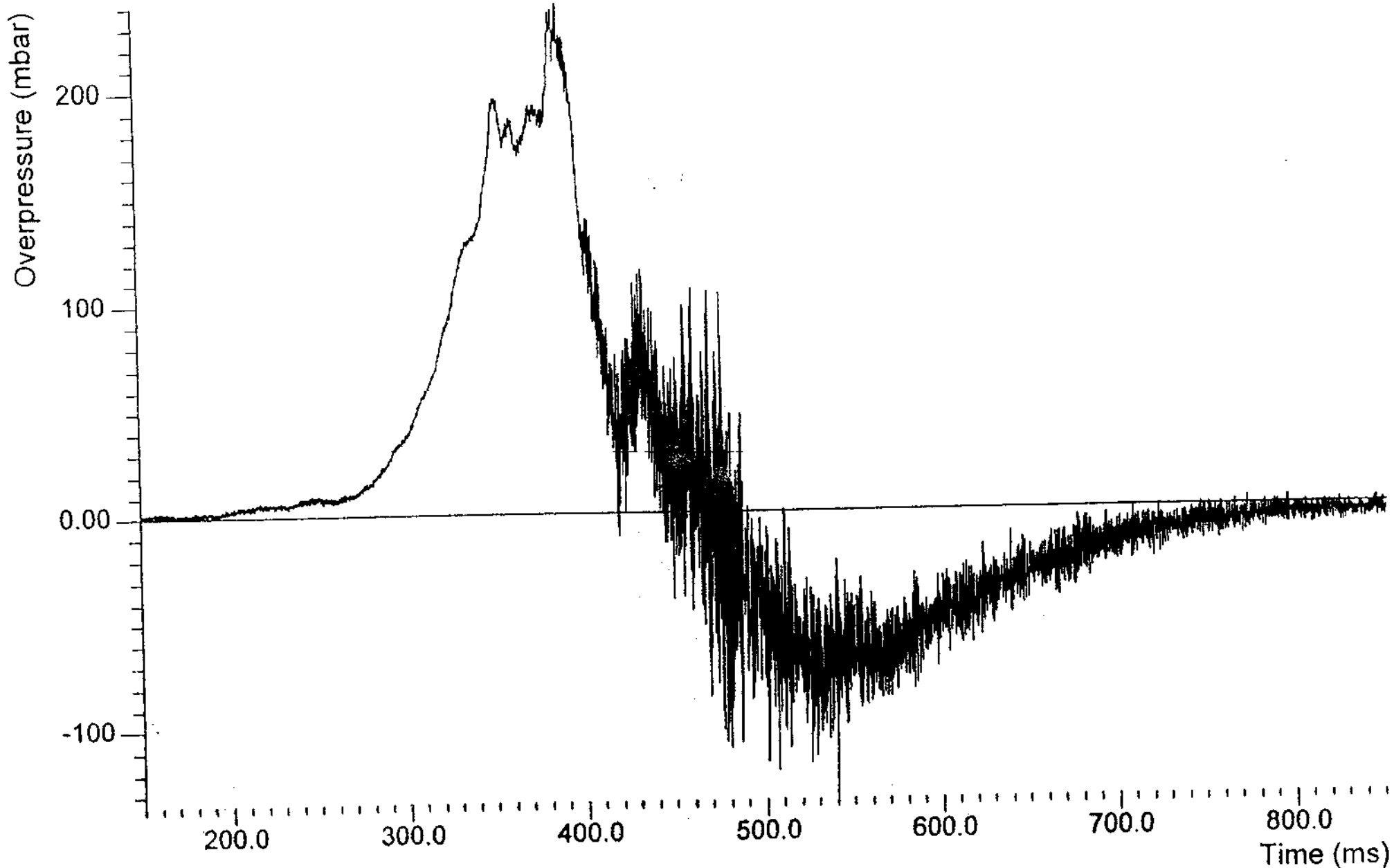
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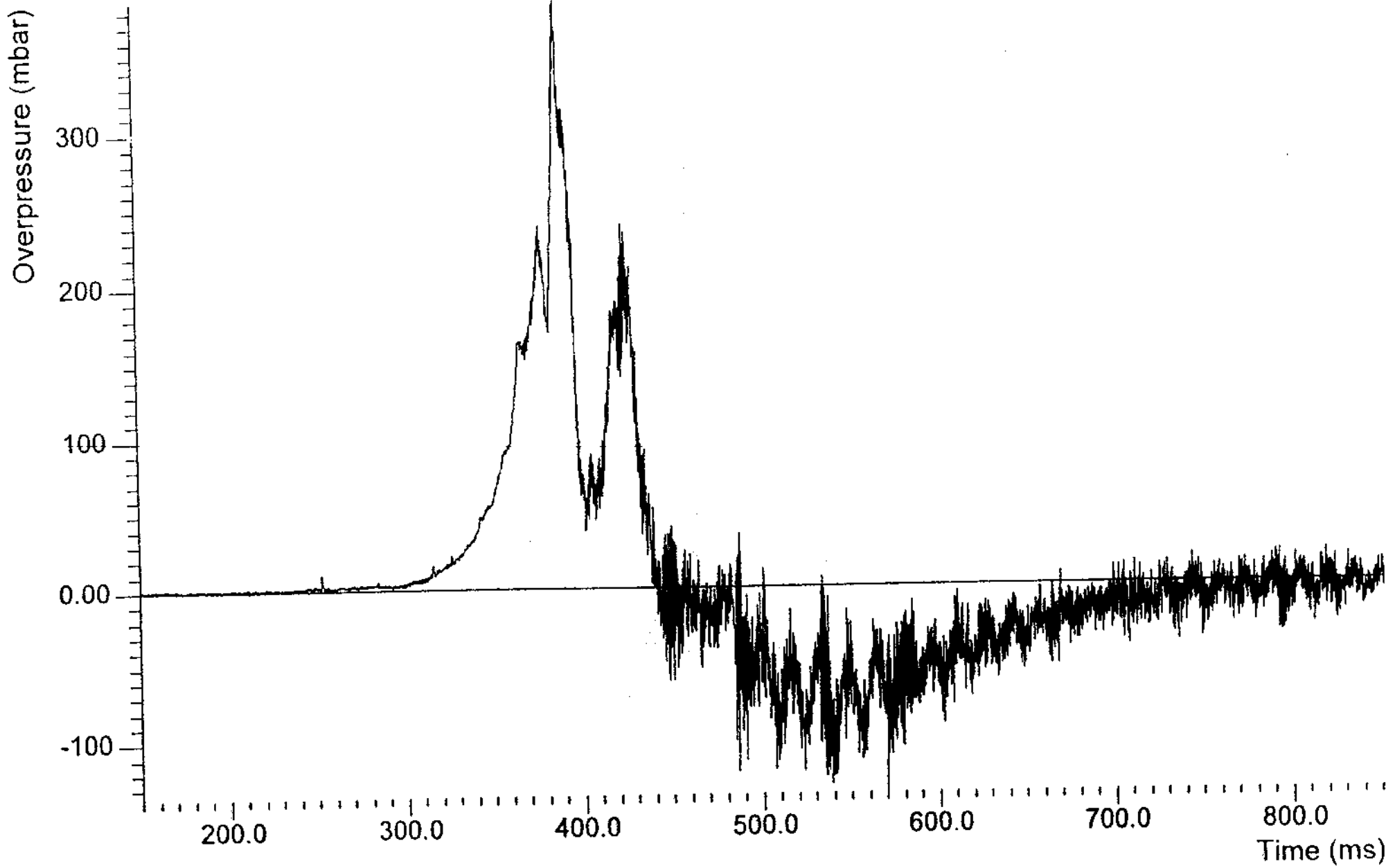
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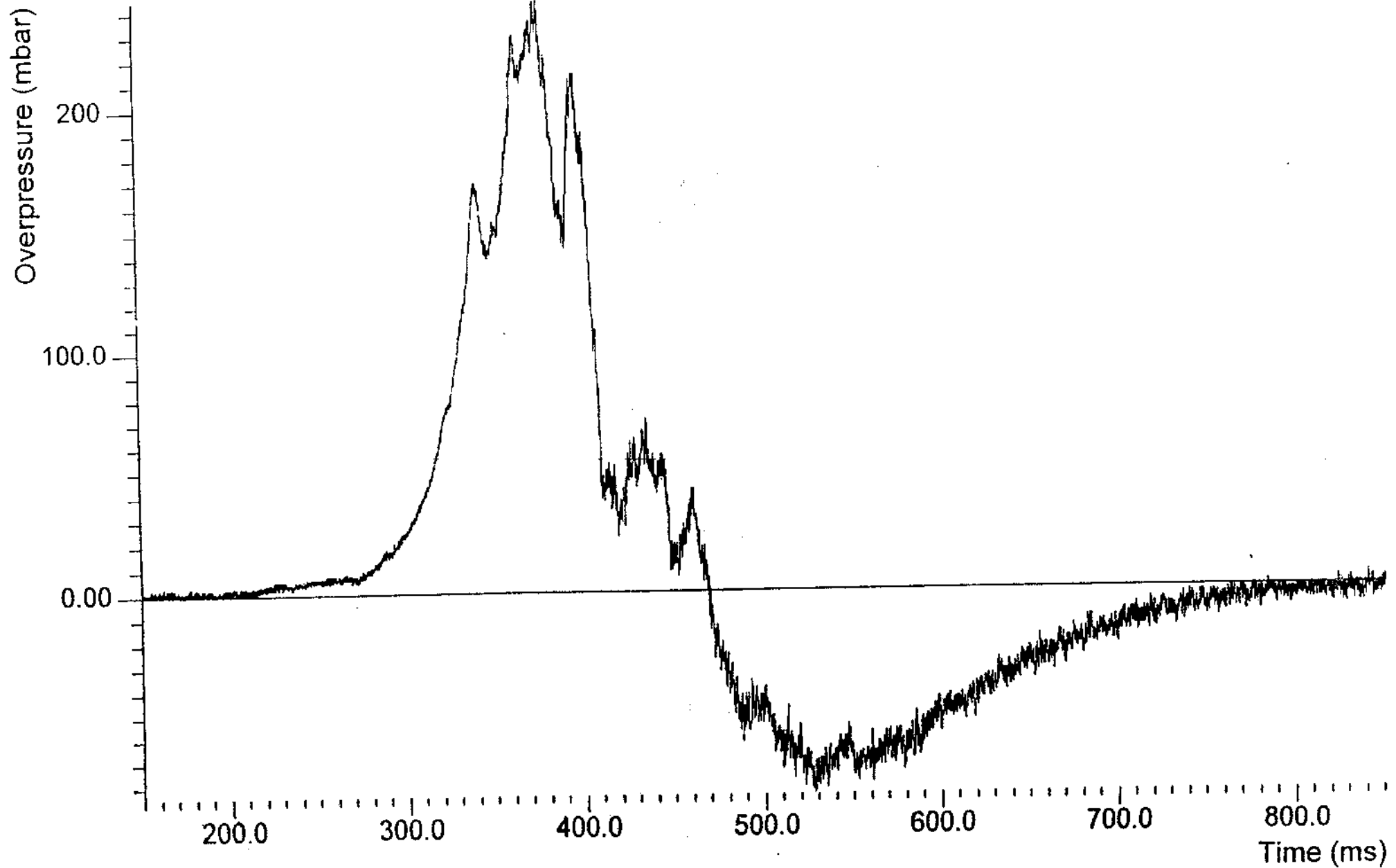
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Transducer no: PI-20



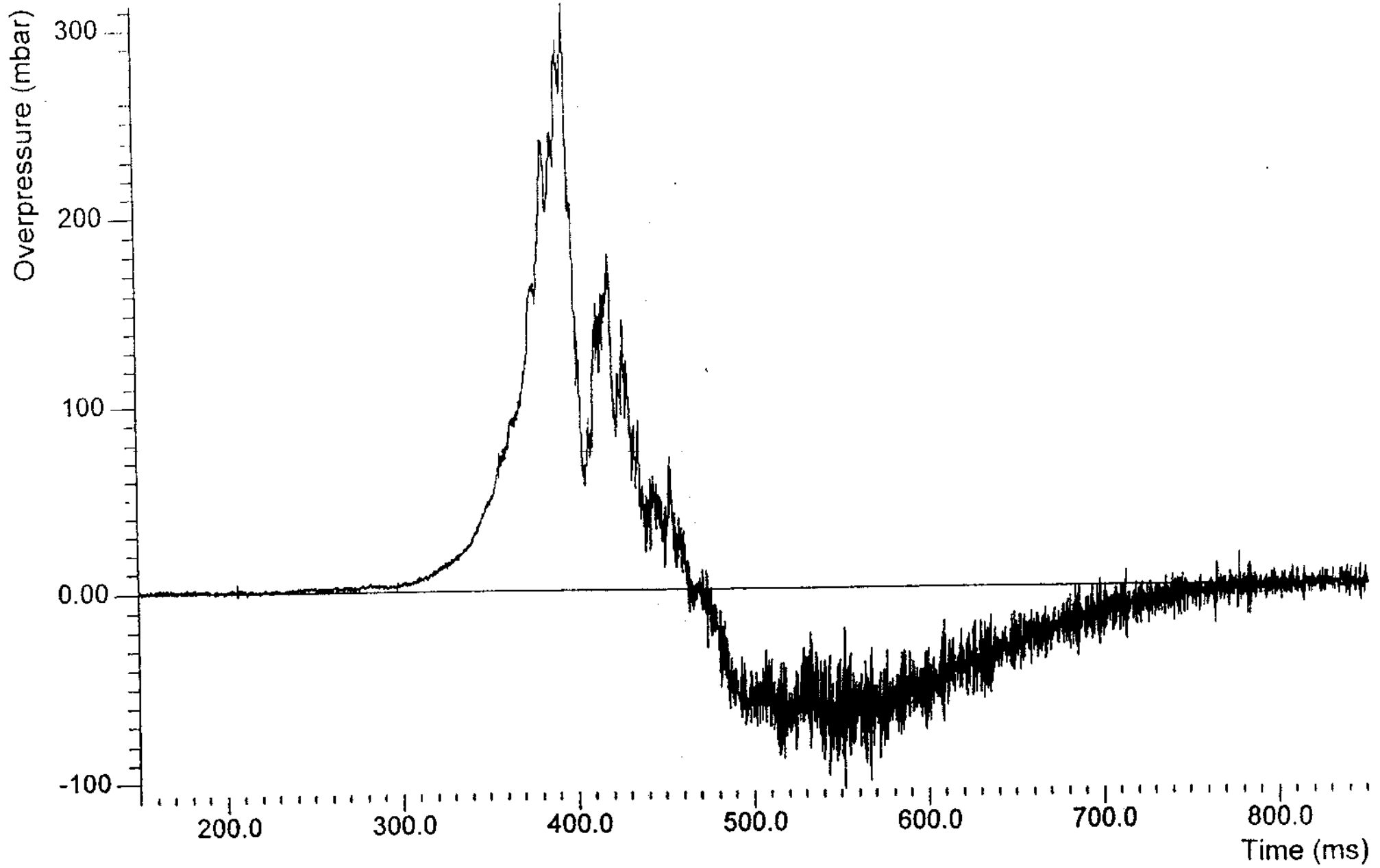
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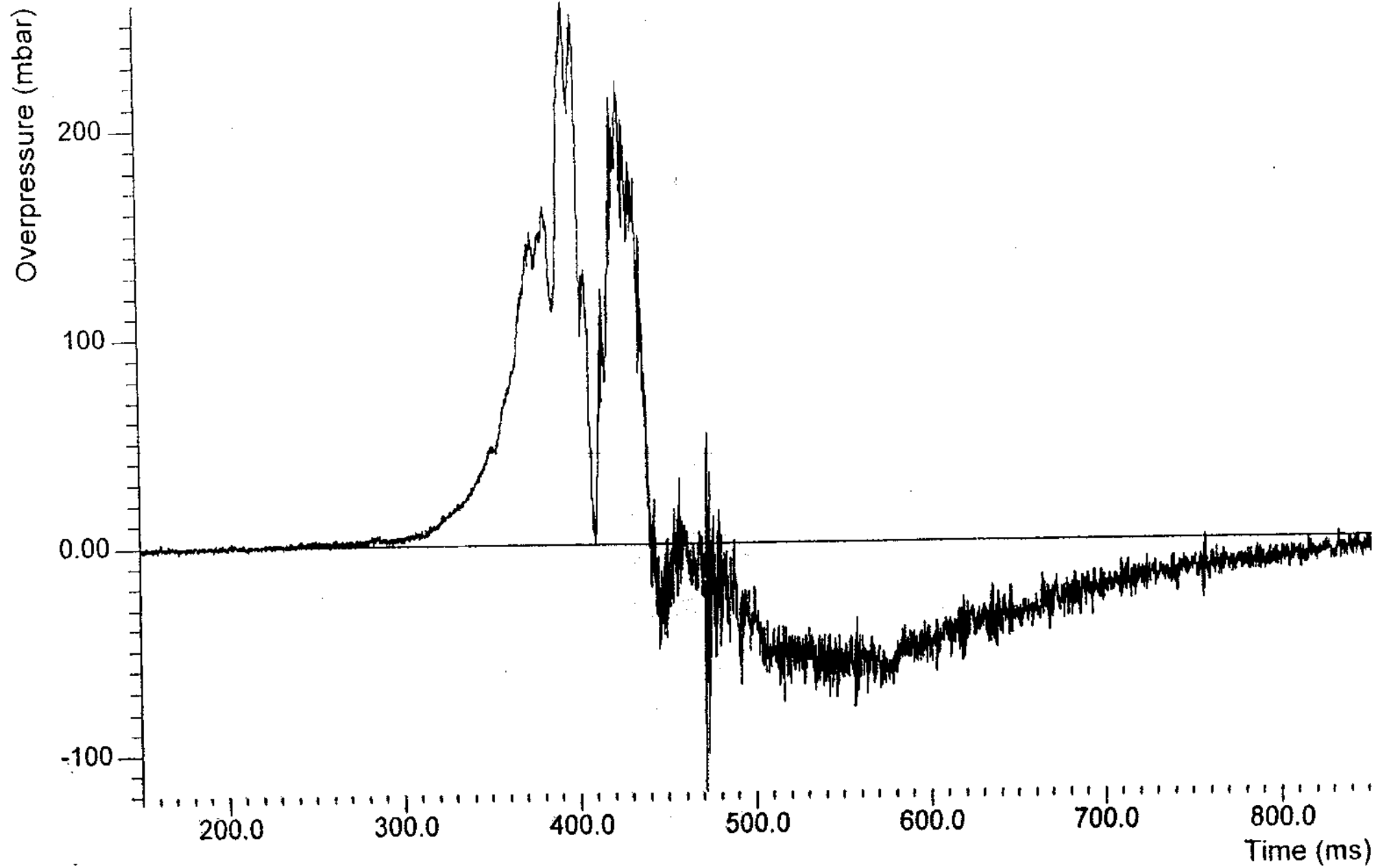


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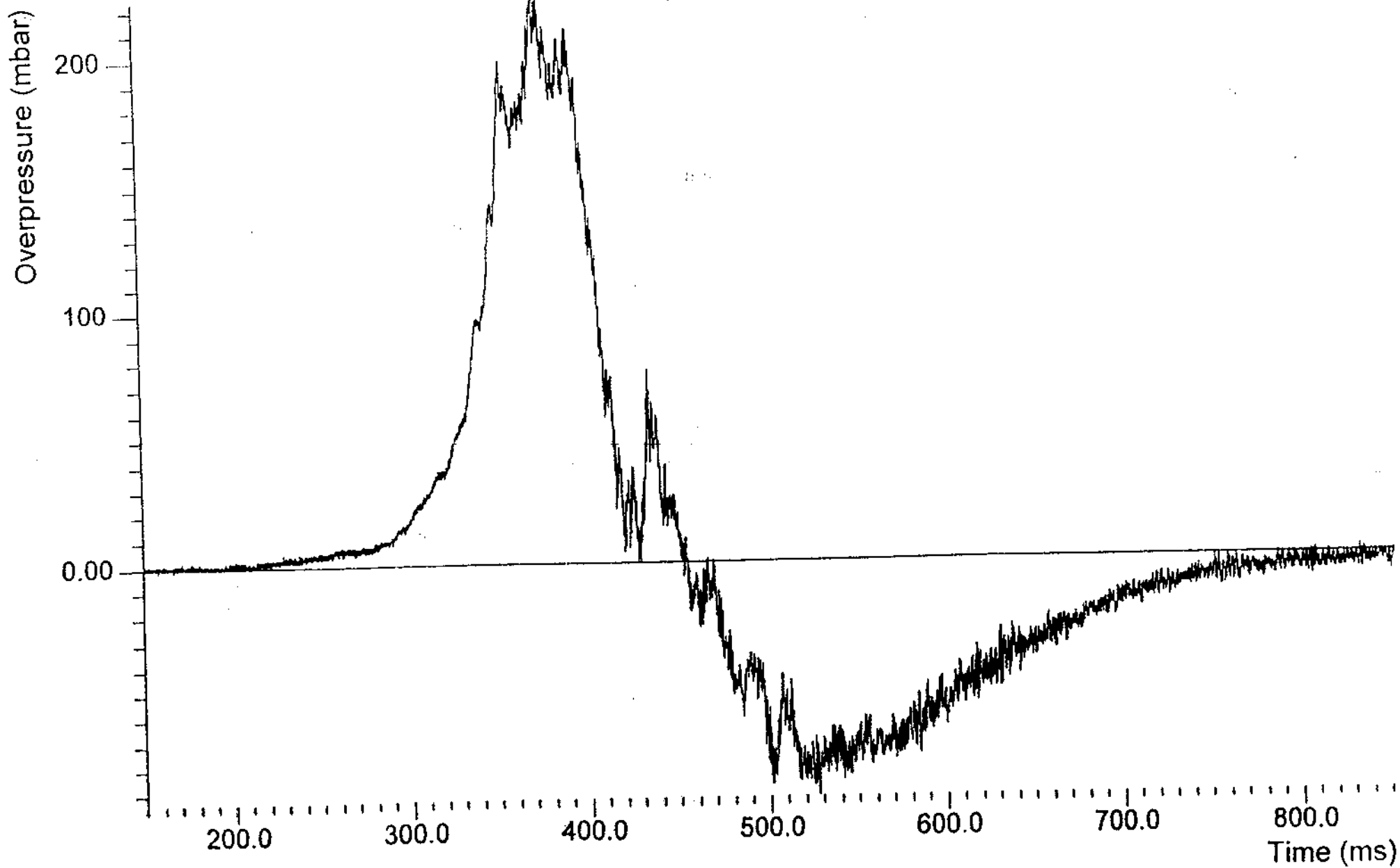




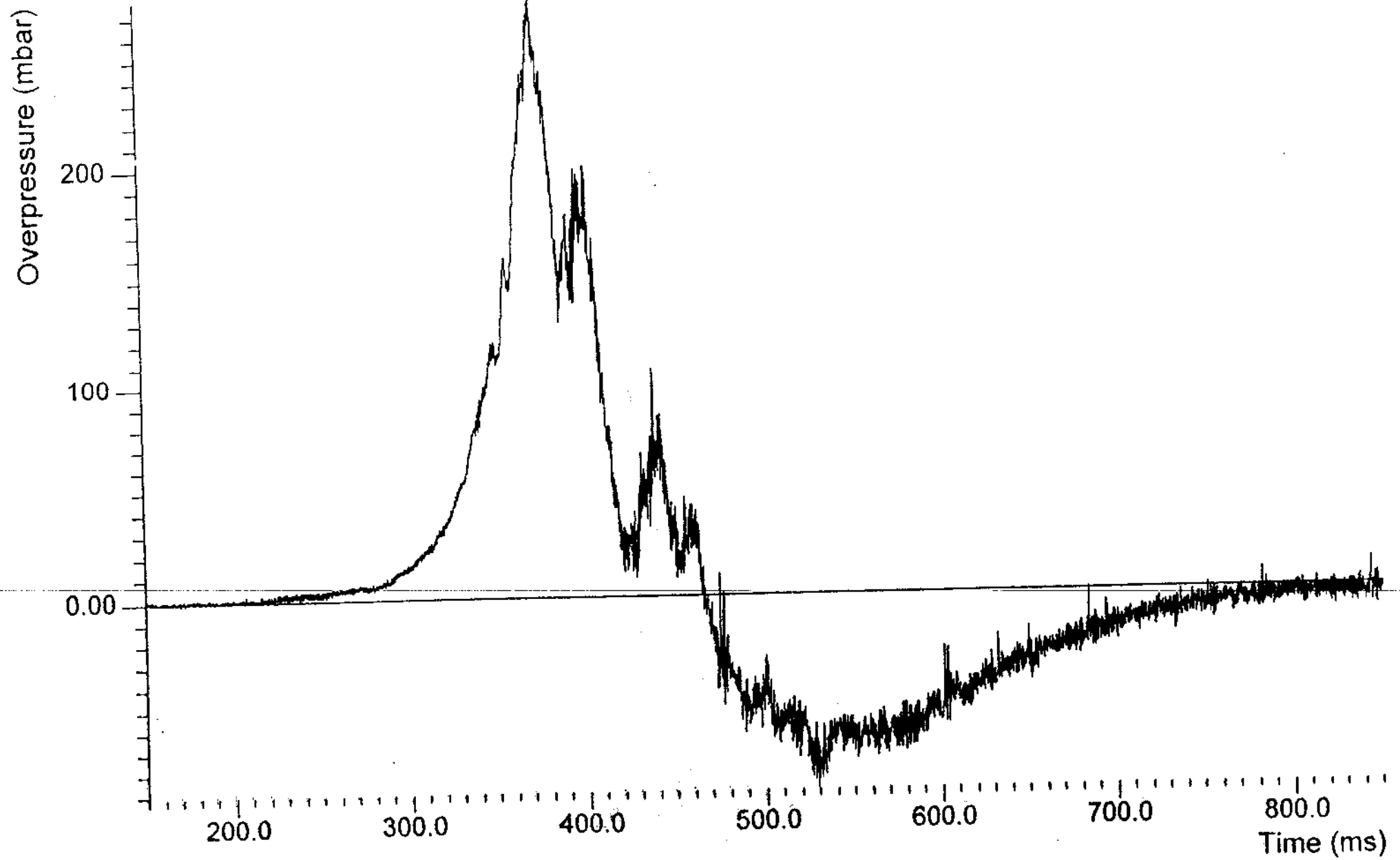
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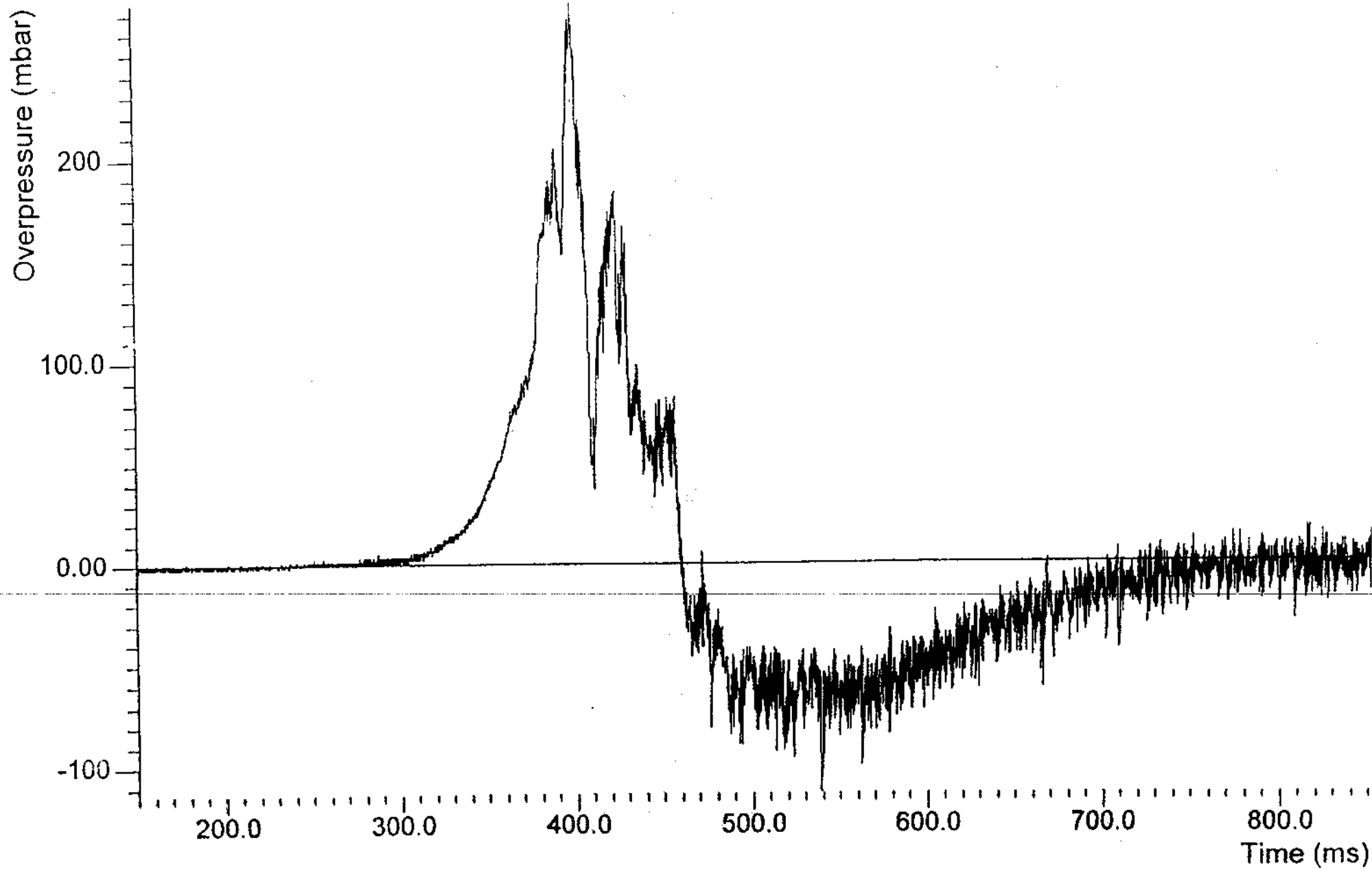
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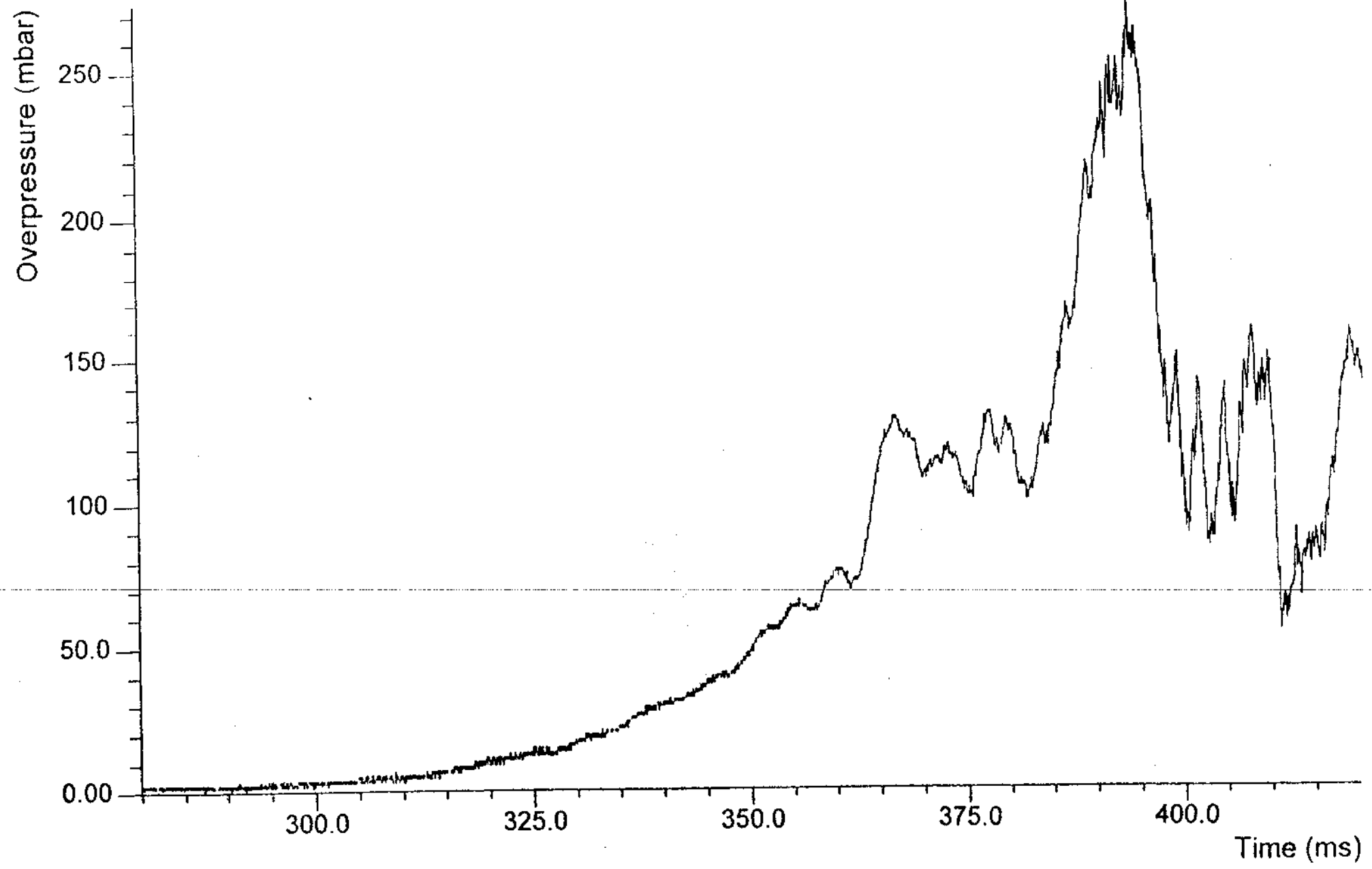
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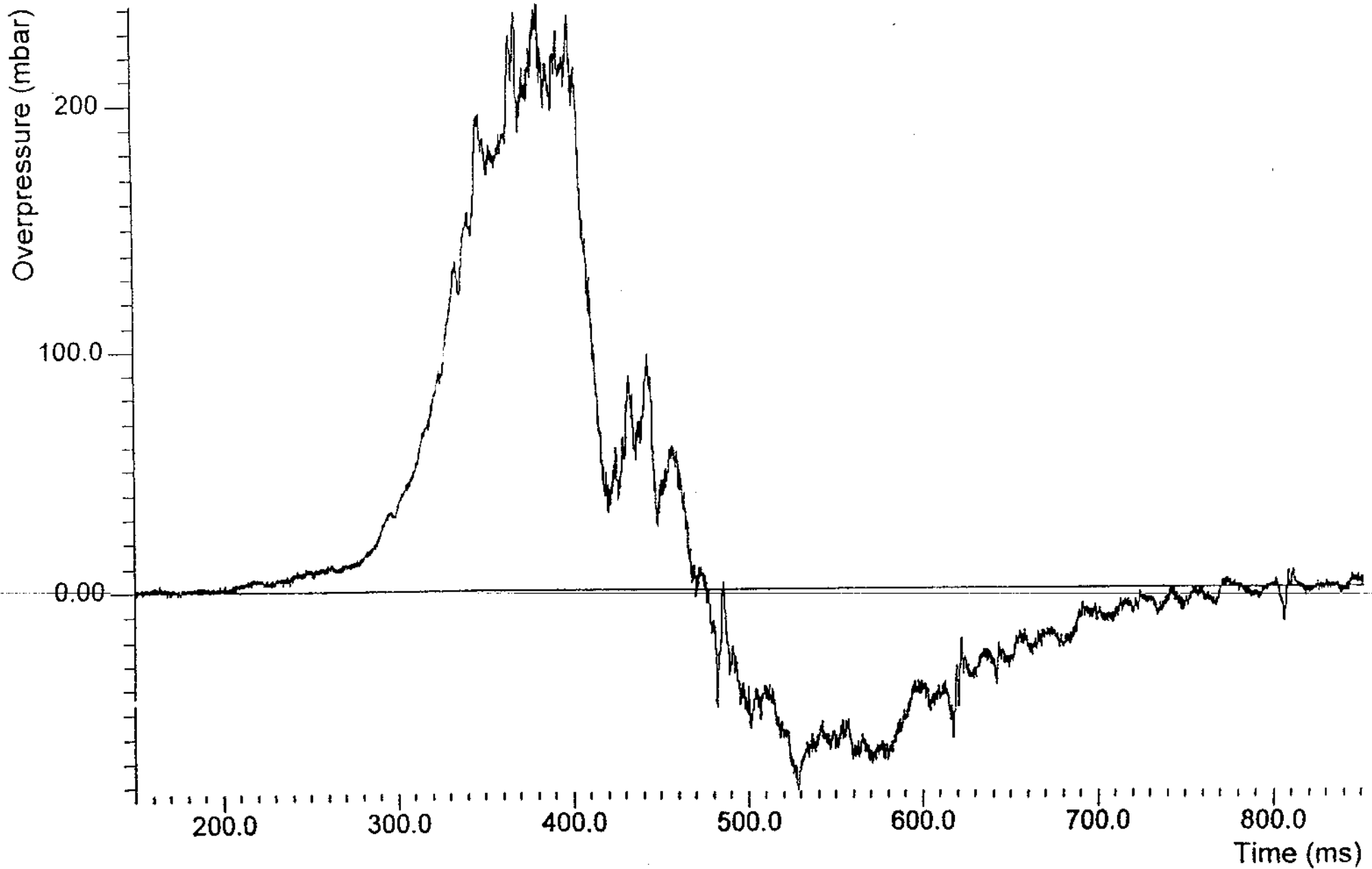
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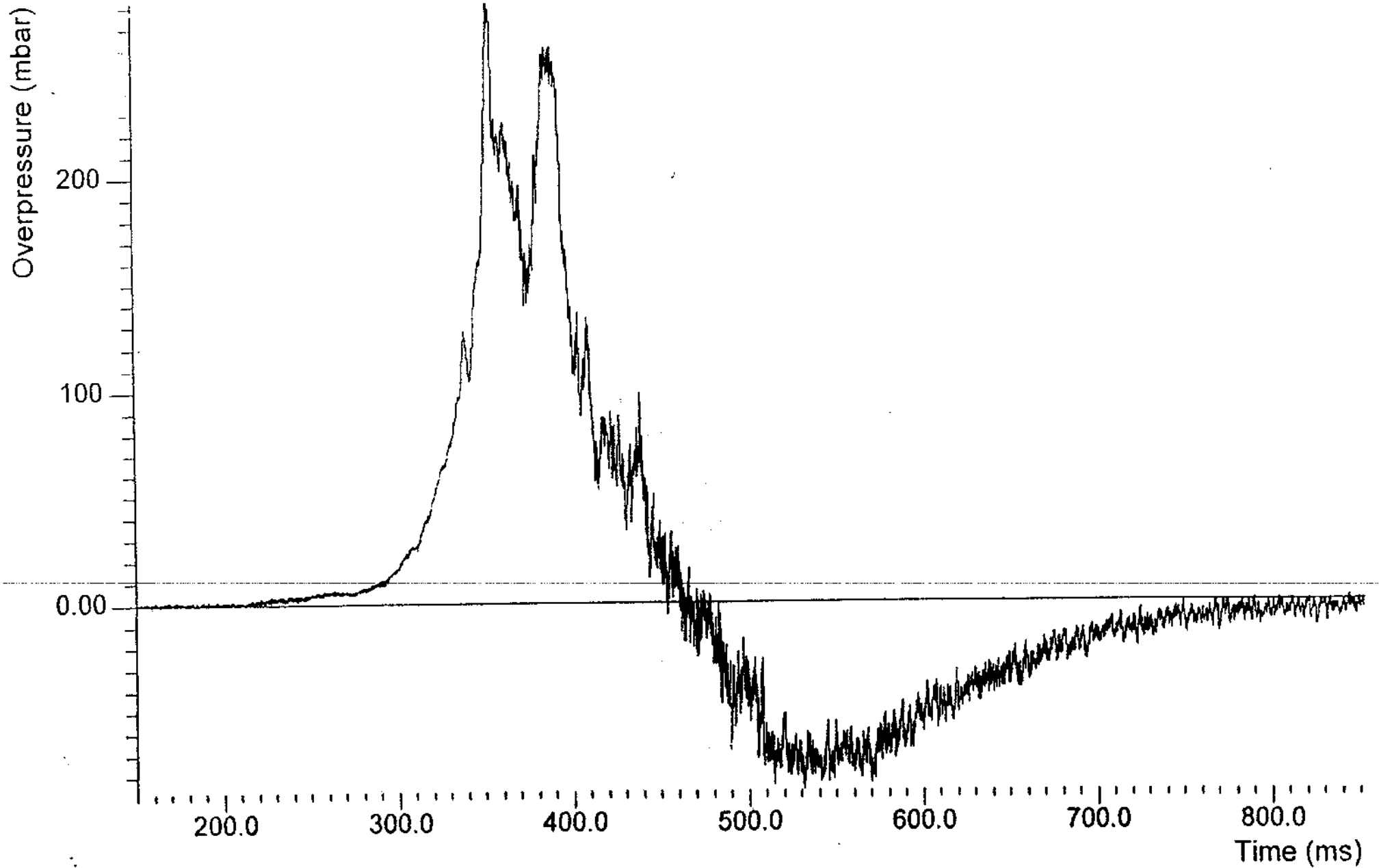
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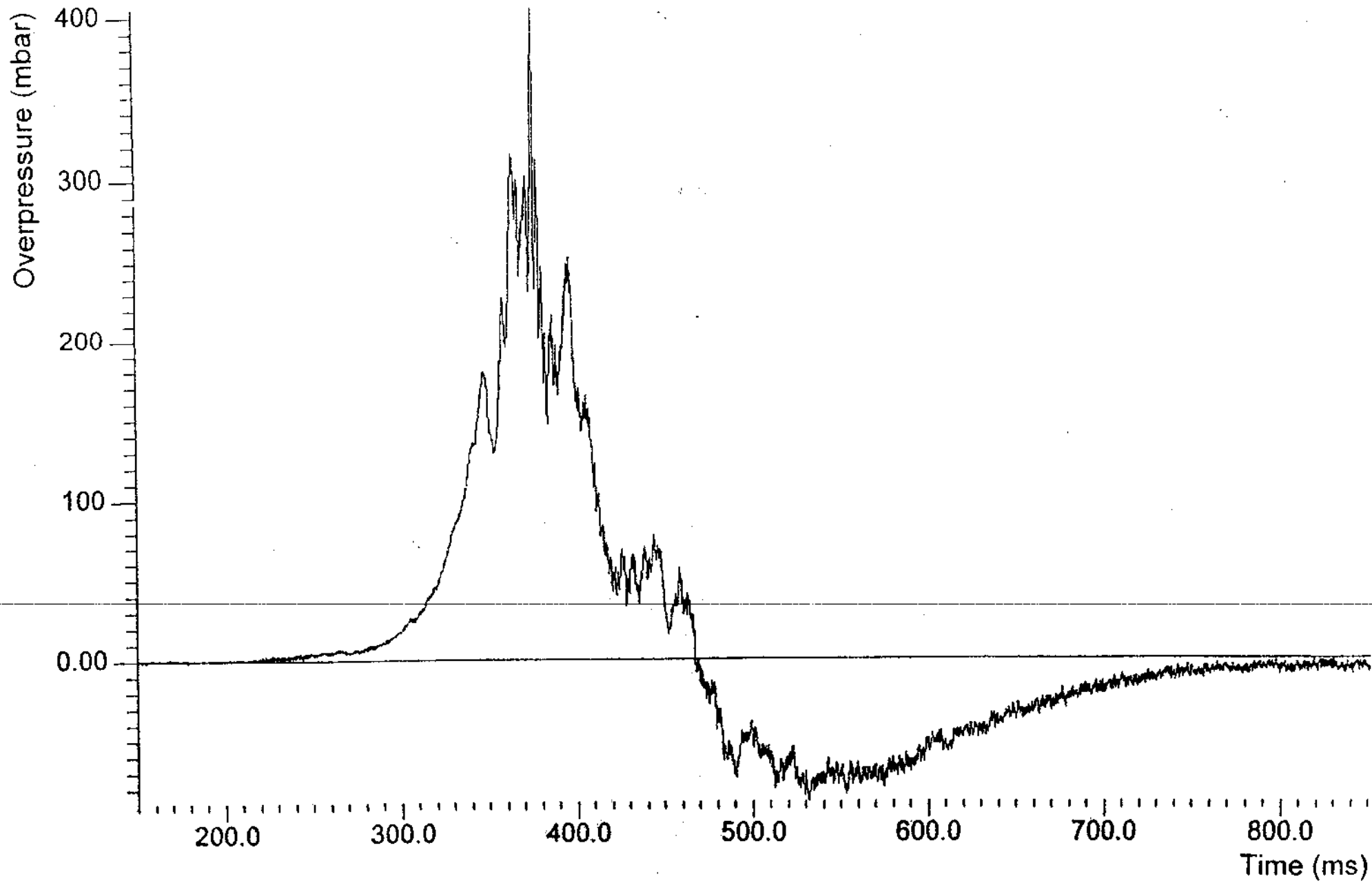
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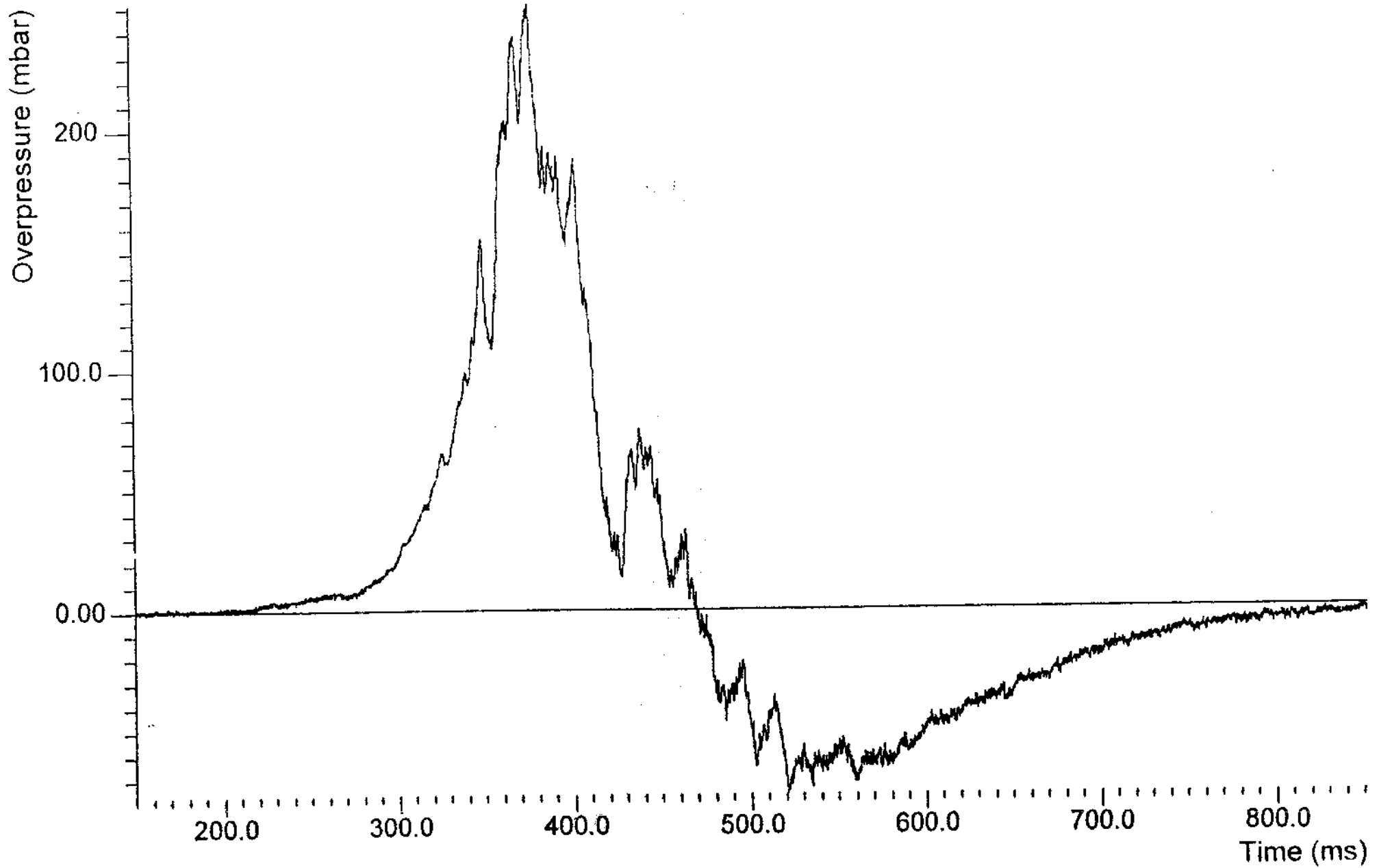


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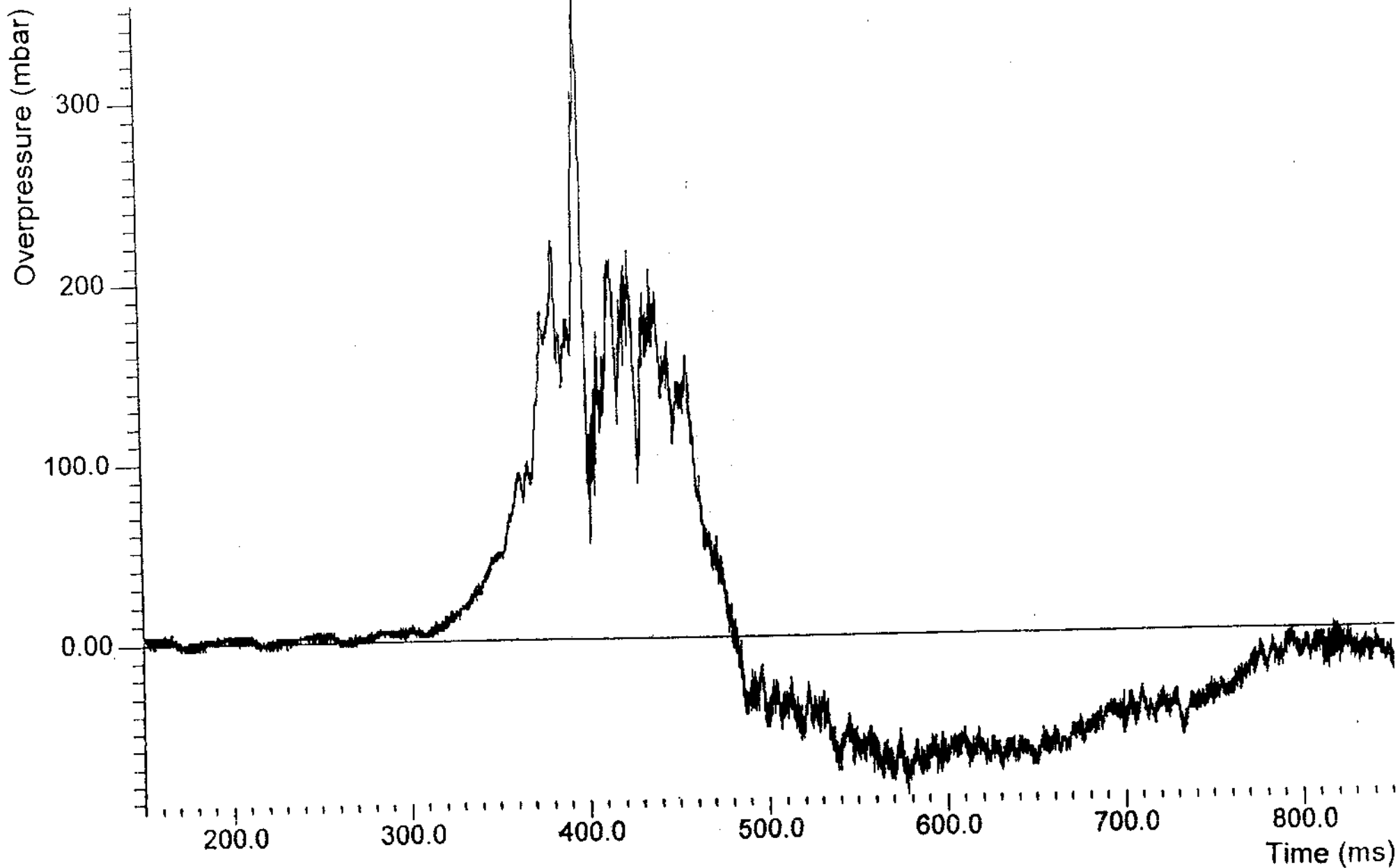




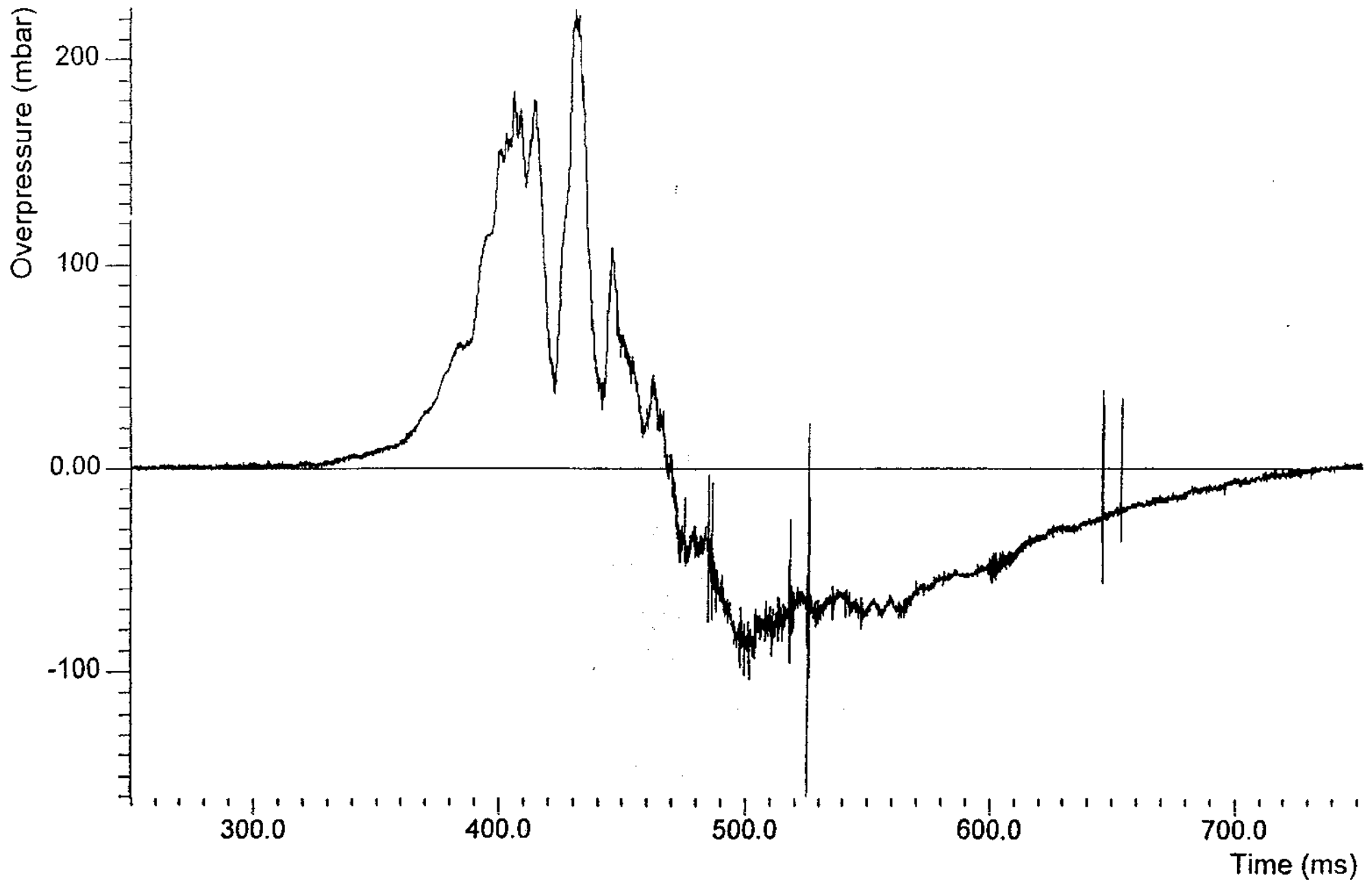
Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PI-34



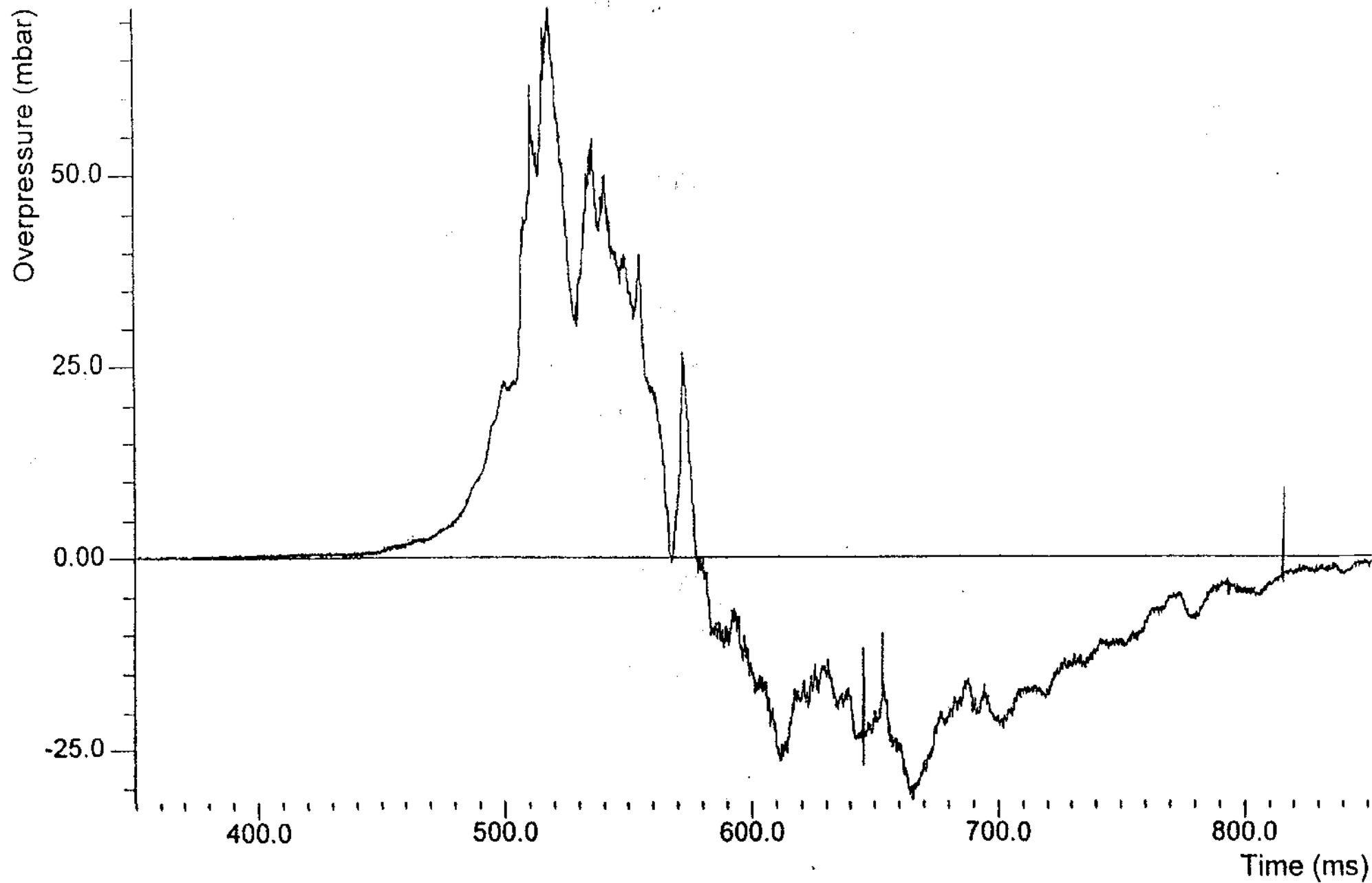
Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PI-35



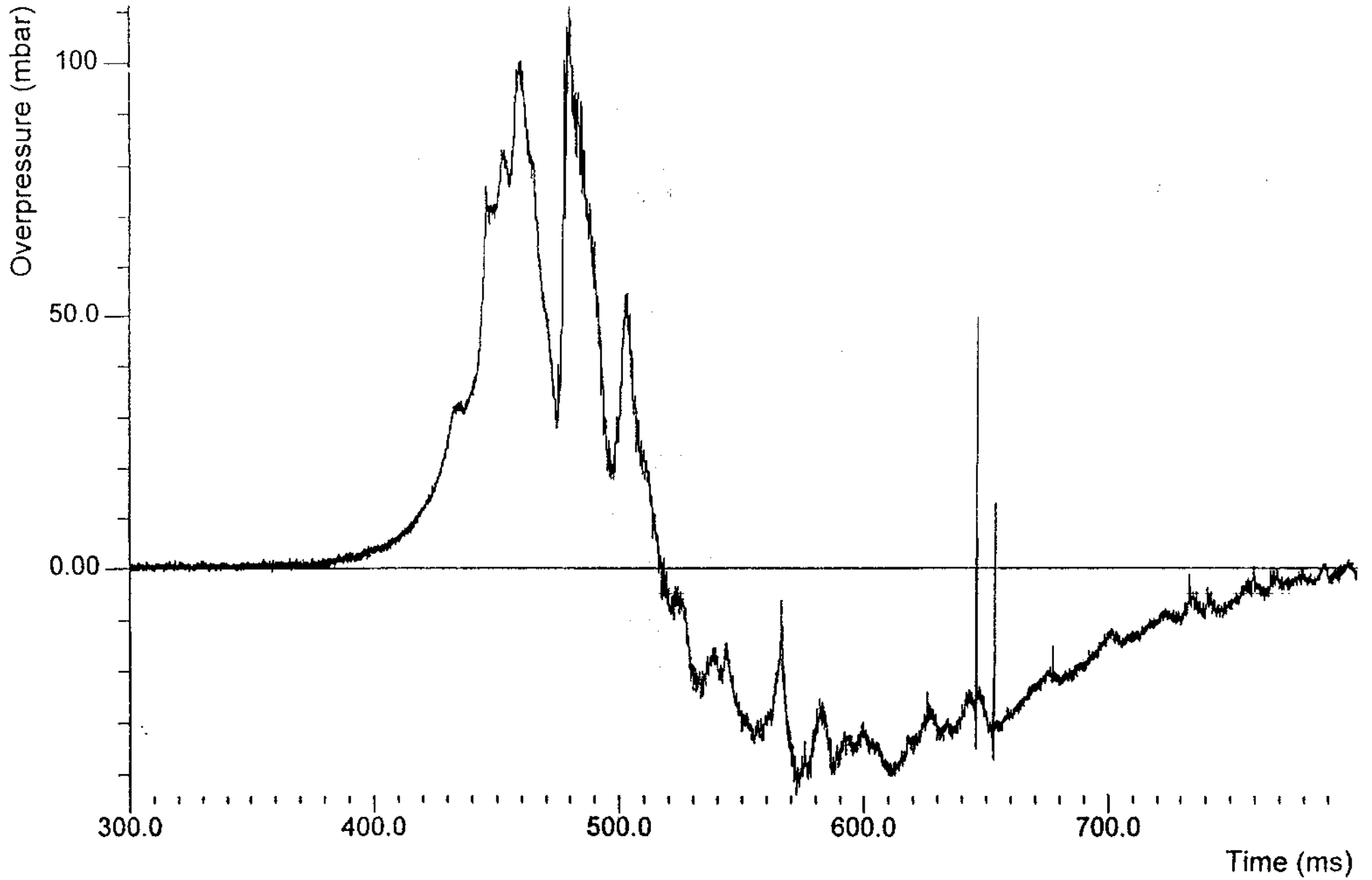
Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PE-1



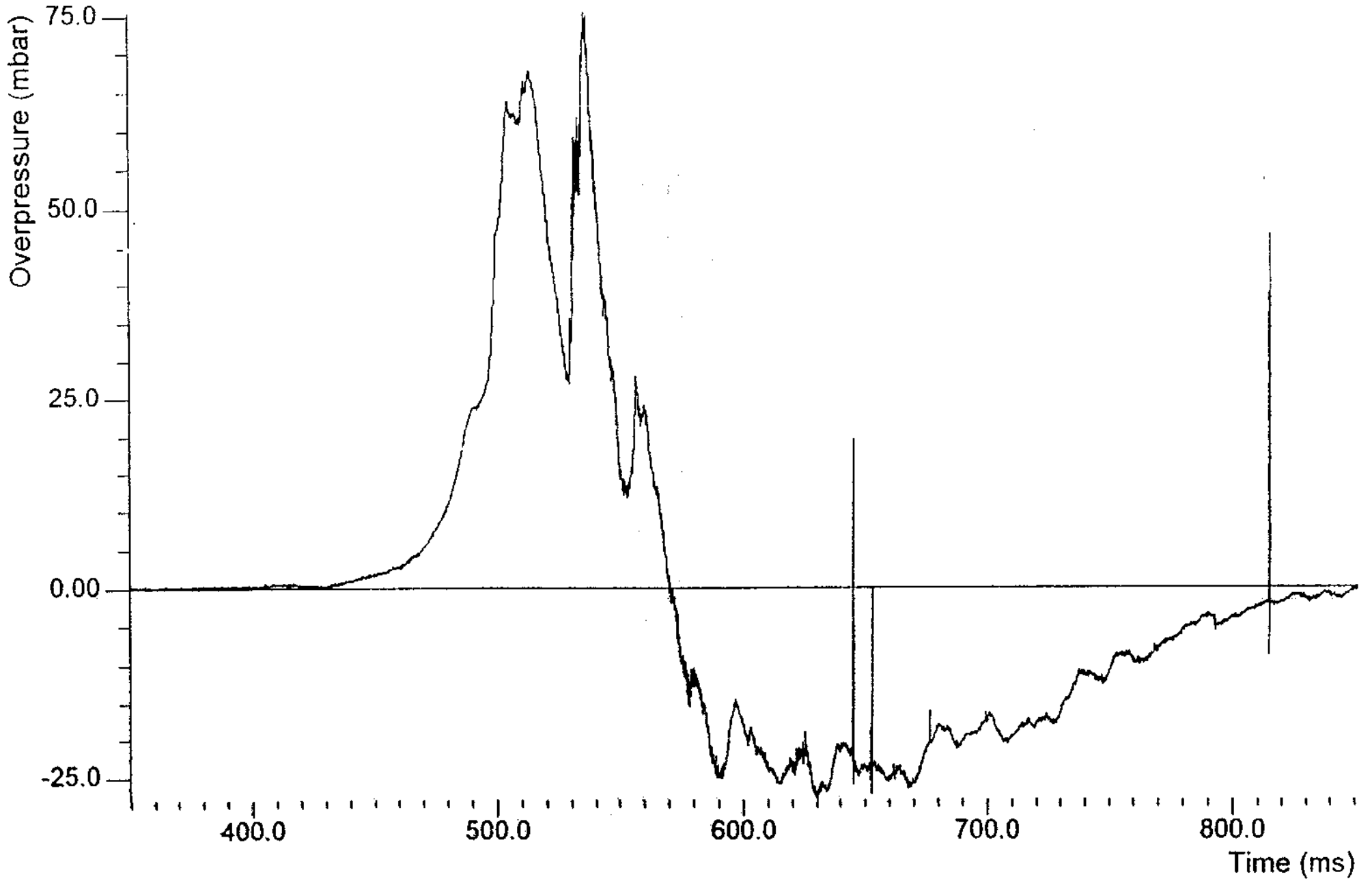
Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PE-4



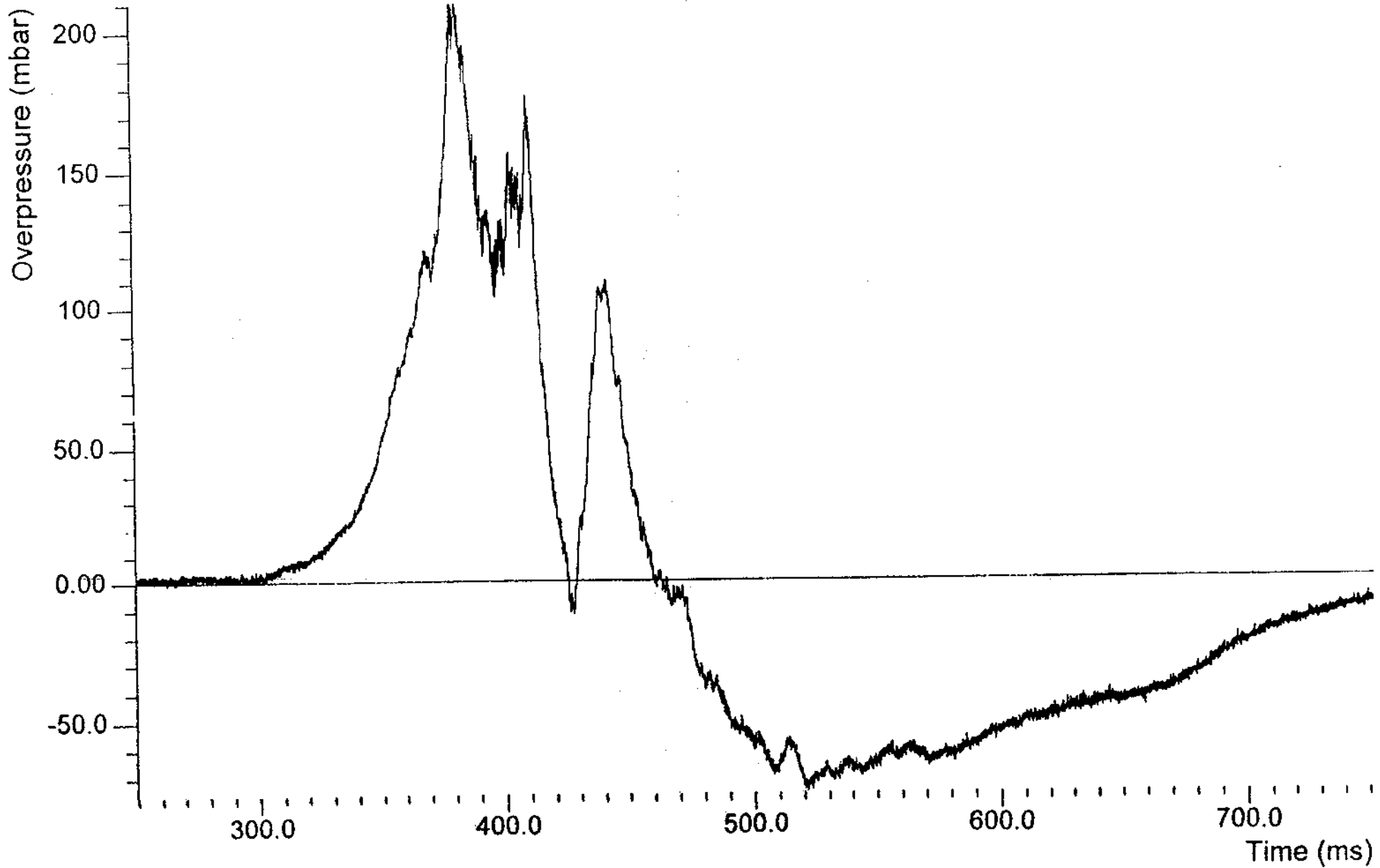
Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PE-5



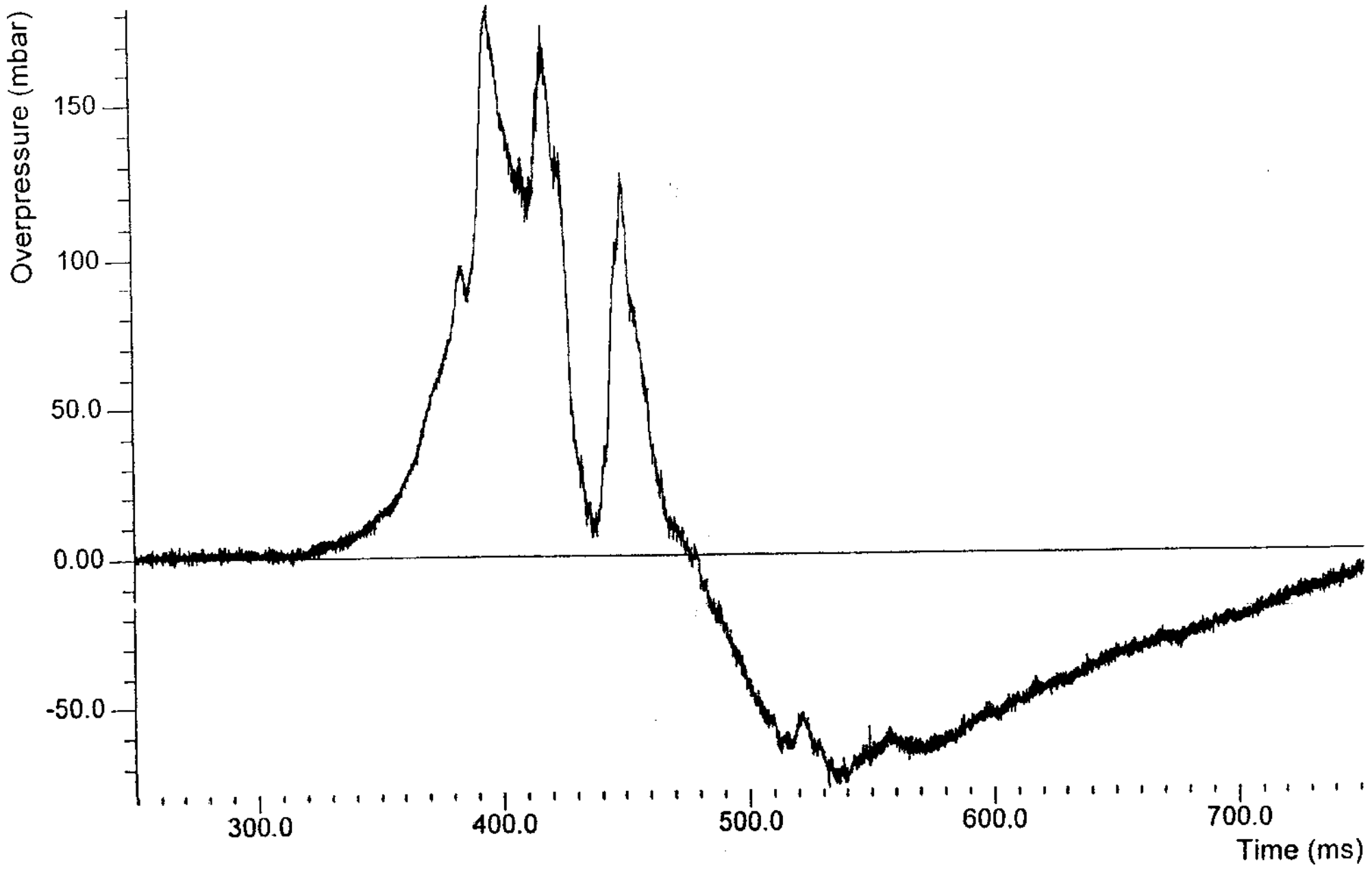
Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PE-6



Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PE-7

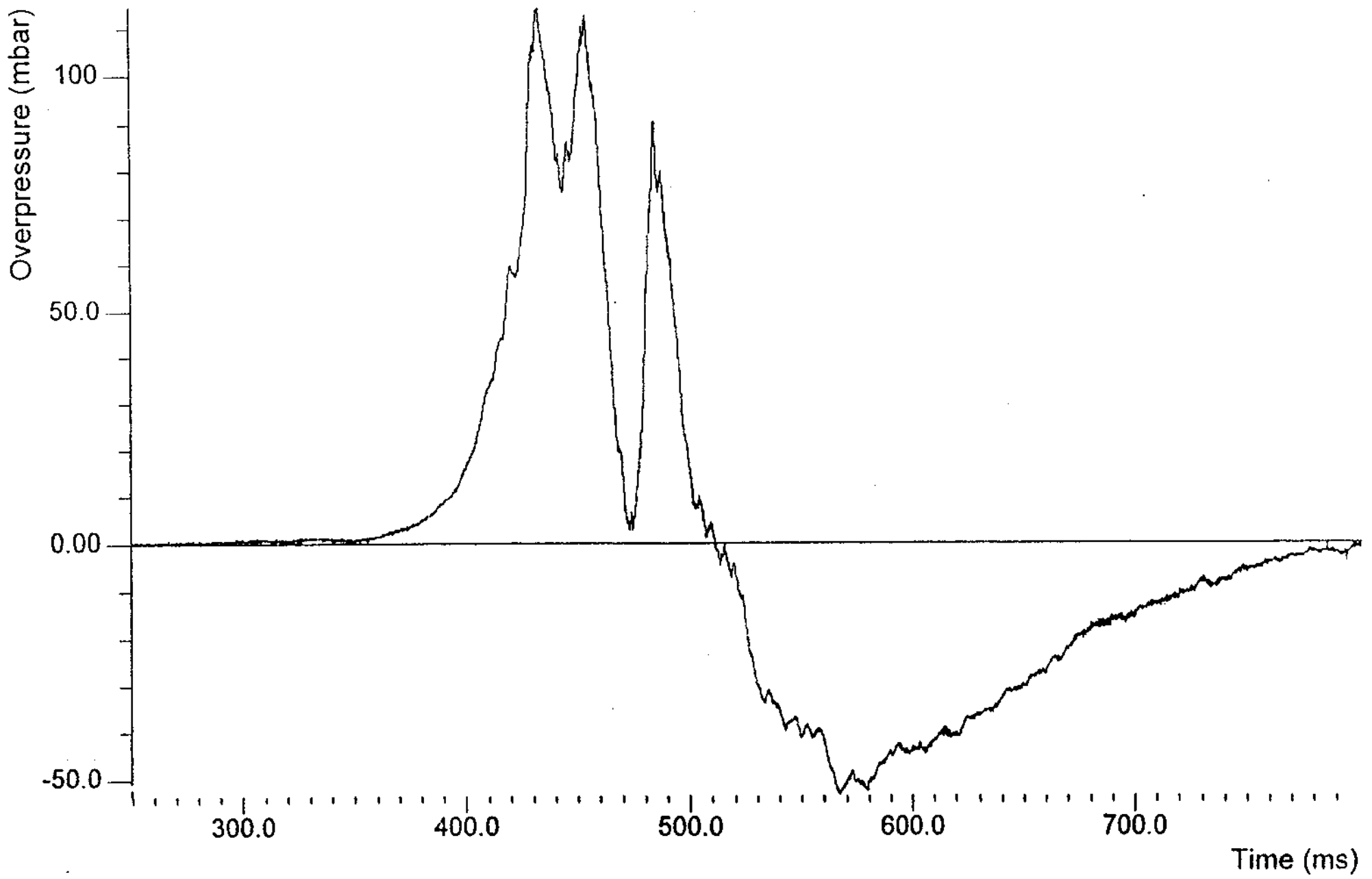


Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PE-8

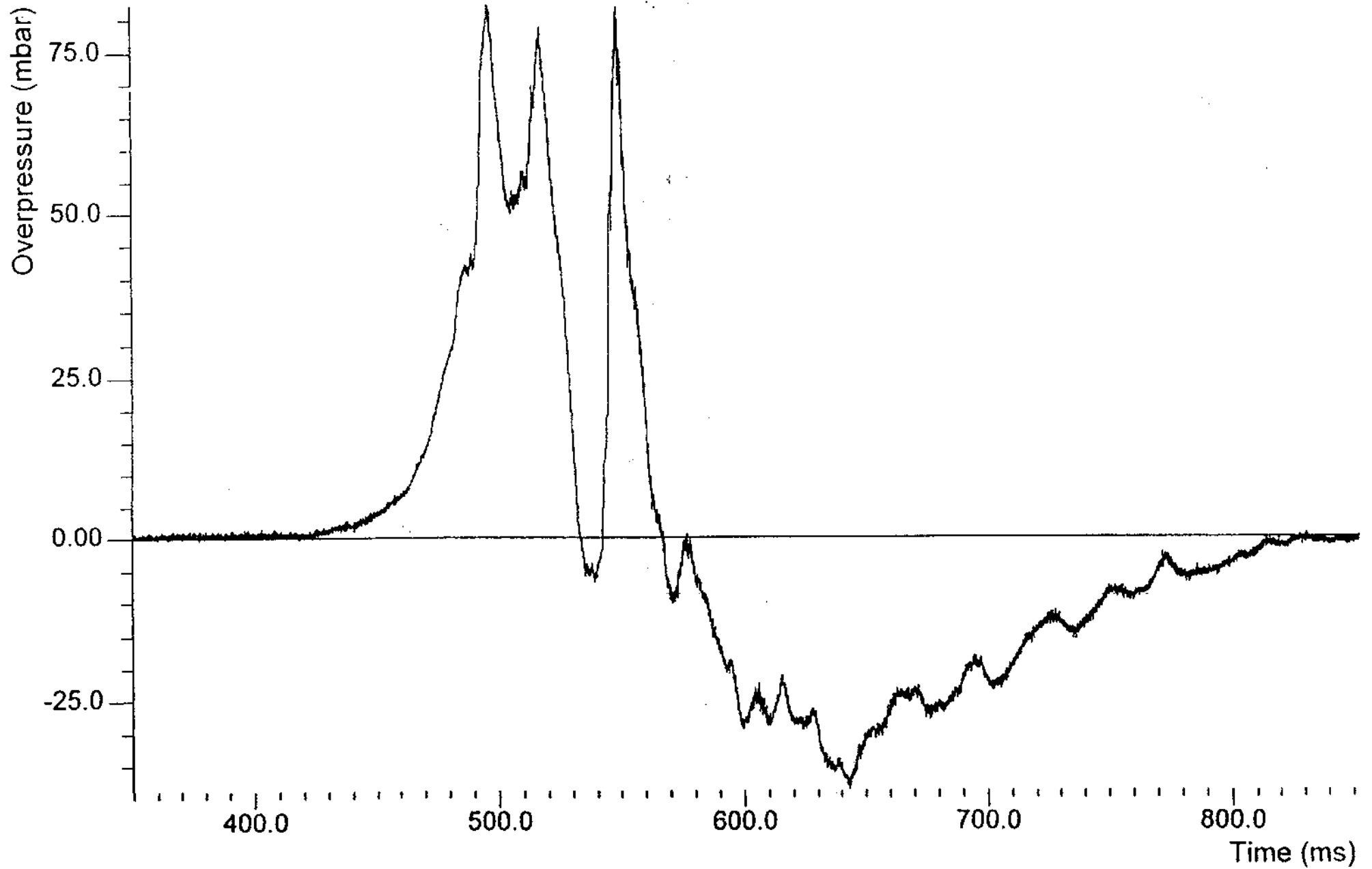




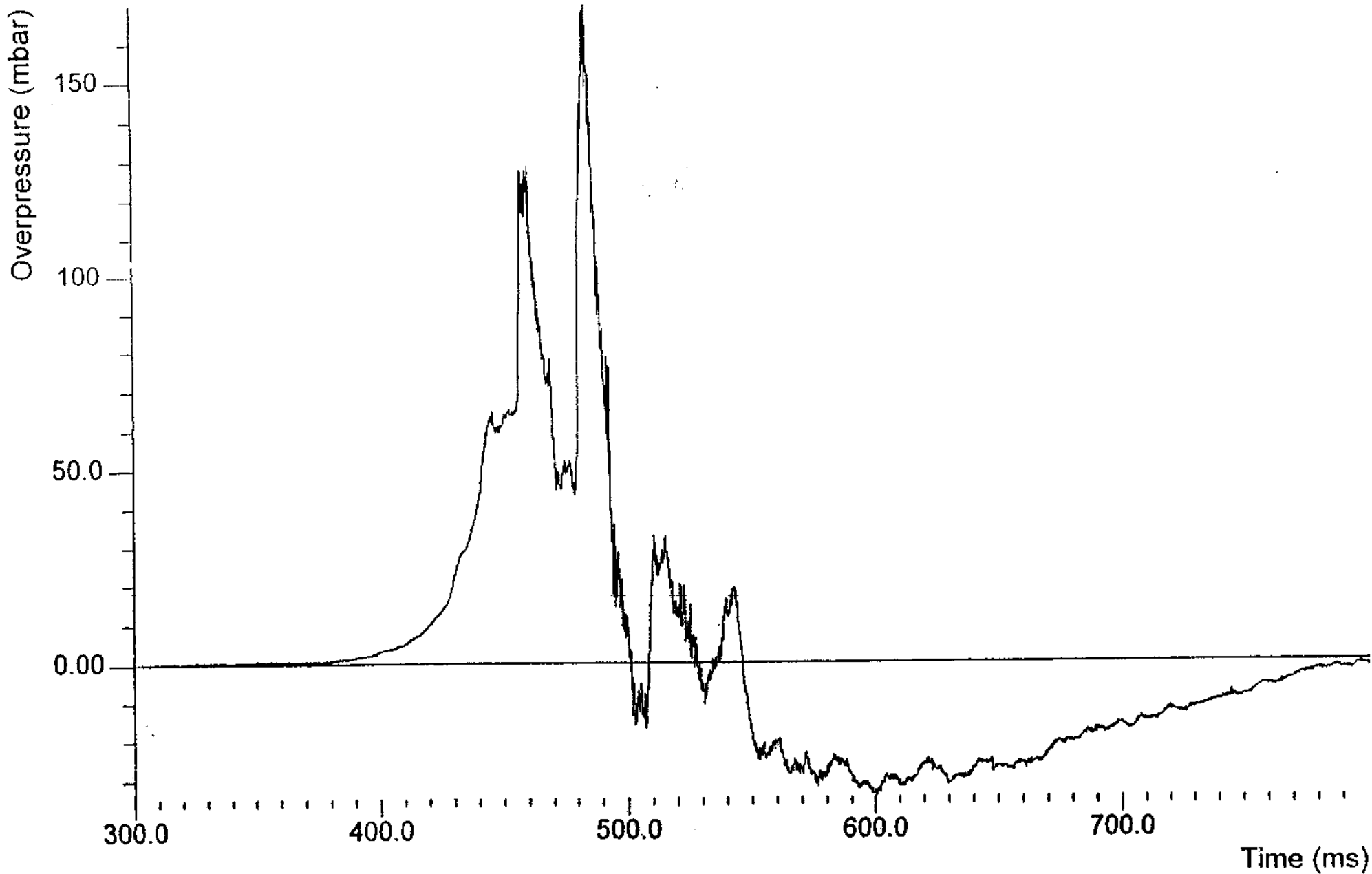
Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PE-9



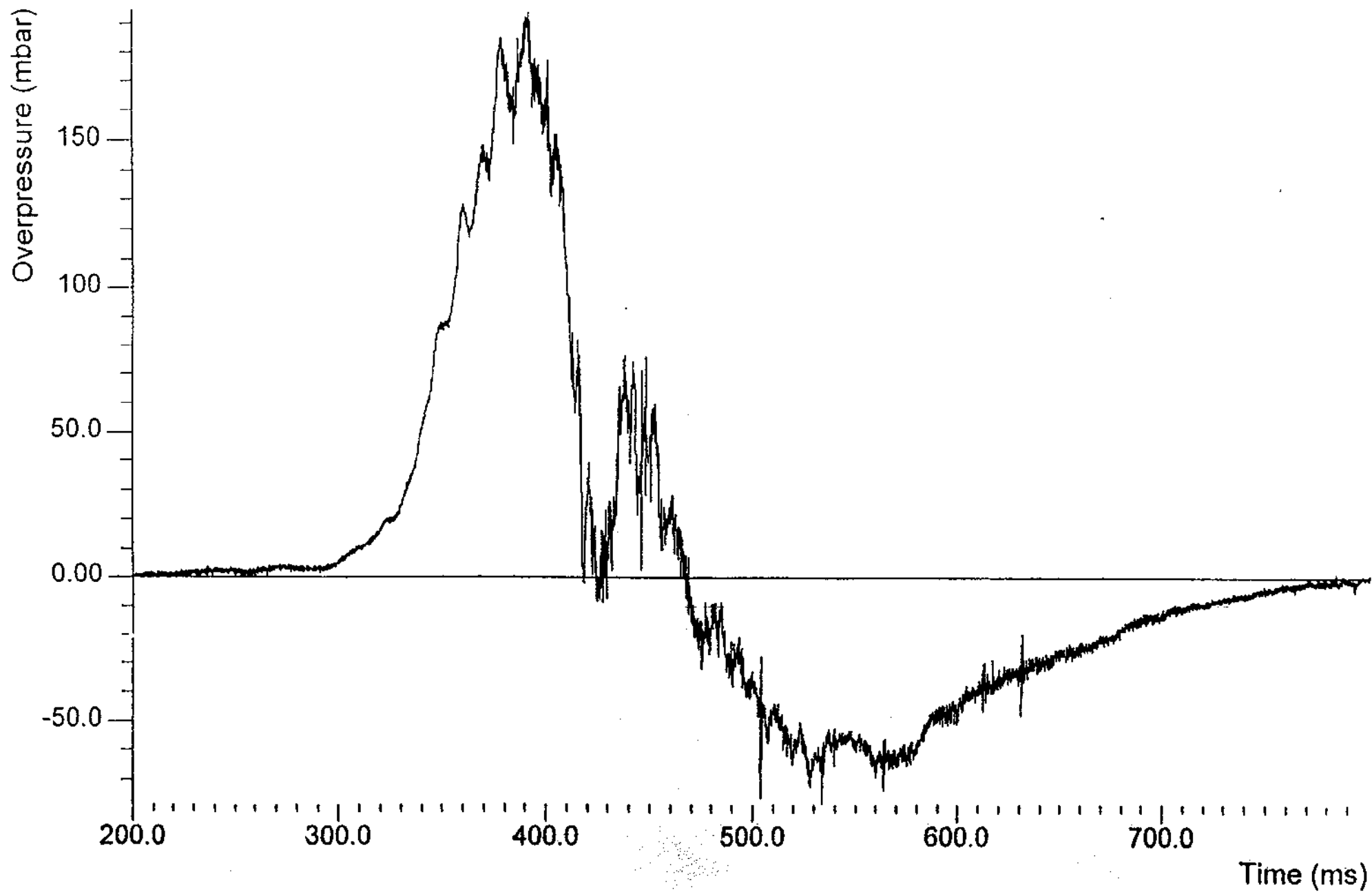
Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PE-10



Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PE-11



Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PE-12



Test: HSE 27 (O2, I2, C3, OP)  
Transducer no: PE-13

