CONCEPTUAL STUDY
OF
ARTICULATED STABLE OCEAN PLATFORM

FINAL REPORT
PART II
(VOLUME IV)

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PREPARED FOR

CARDEROCK DIVISION
NAVAL SURFACE WARFARE CENTER

DTIC QUALITY INSPECTED 4

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MEH Project 44271

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FIELD	GROUP	SUB-GROUP	
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19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

A conceptual study has been completed to evaluate the feasibility of a new concept of a floating storage platform - the Articulated Stable Ocean Platform (ASOP). The unique aspects of the ASOP is the articulation of the stabilize buoys which were introduced for the purposes of reducing wave load and overall vessel motion. The ASOP was designed to have a fuel storage capability of 1 million barrels and to support a topside up to 12,000 kips in total weight. The fuel storage tanks were designed in such a way that the draft of the platform would remain unchanged at any loading condition without adjusting the ballast. This greatly simplified the operations and allowed the platform to continue other activities while loading and off-loading.

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The study shows that the ASOP has adequate stability and satisfies the stability requirement of the certifying authorities. Both numerical analysis and model test showed that the ASOP offers exceptional motion response characteristics in all its degrees of freedom. In terms of platform motion response, the ASOP is capable of operating in more severe weather conditions than a conventional surface vessel type platform. A seven body (six buoys and the hull) coupled motion analysis in ocean environment was performed and results in general agreed with the model test. However, both numerical analysis and model tests showed that the articulated buoys have no clear advantage over fixed buoys in the global motion of the ASOP. The reduction of forces by using articulation did not significantly improve the motion of the platform. Furthermore, the analysis and model test showed that compared to the fixed buoy case, using articulations increased the slow drift motions of the ASOP in random waves. The study also indicated that the introduction of articulations complicated the hydrostatic stability of the platform. Damaged stability was the governing factor in determination of the size of the articulated buoys. In conclusion, this conceptual study indicated that the fuel storage ASOP is a viable concept. Its large storage capability and exceptional motion characteristics allow many applications both in civil and military purpose.

Preliminary Report No. OMB-95-214-1

MODEL STUDIES OF ARTICULATED STABLE OCEAN PLATFORM

VOLUME IV

JUNE 1996

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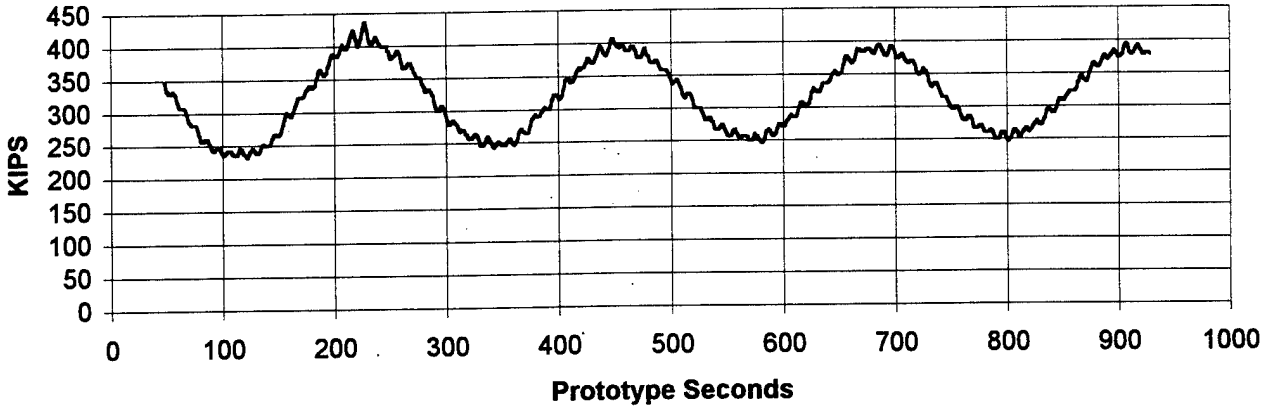
APPENDIX I

FILTERED TIME HISTORY PLOTS

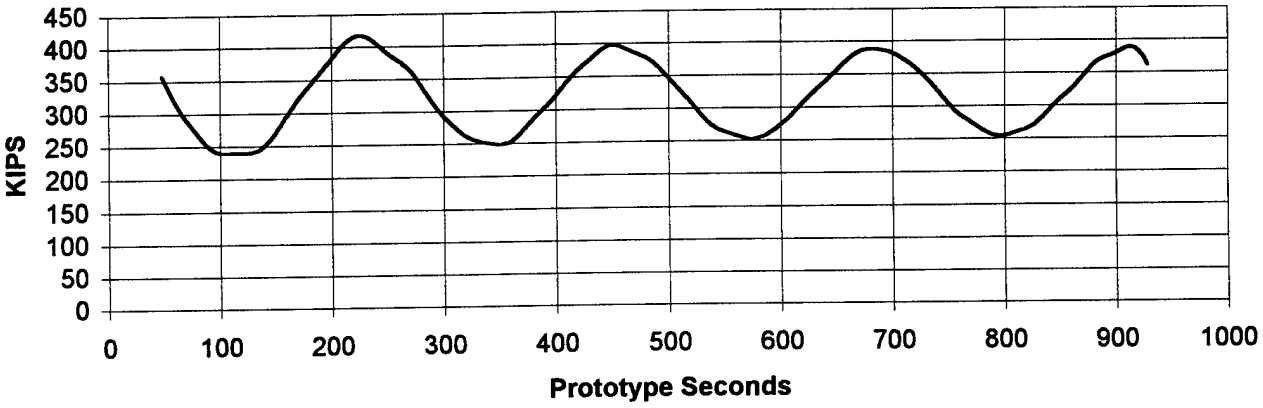
PART 2 OF 2

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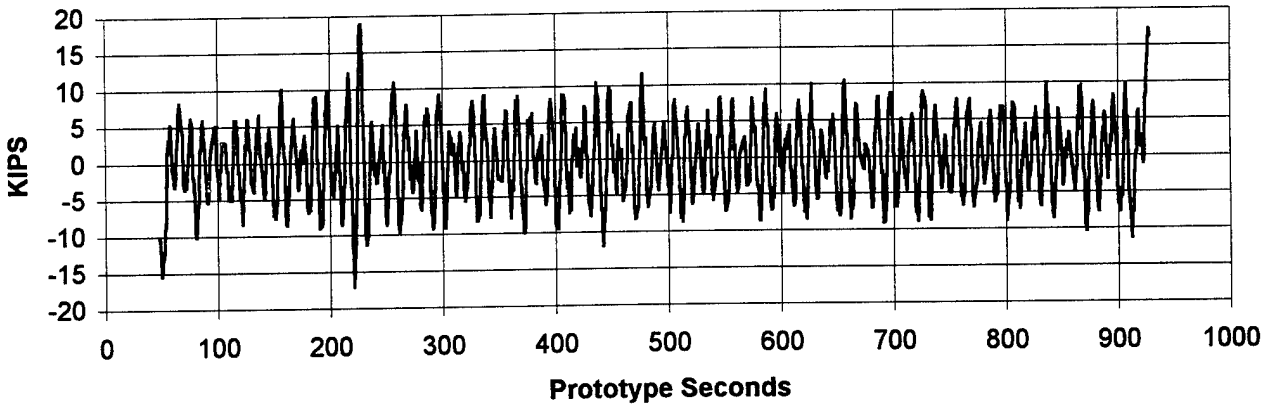
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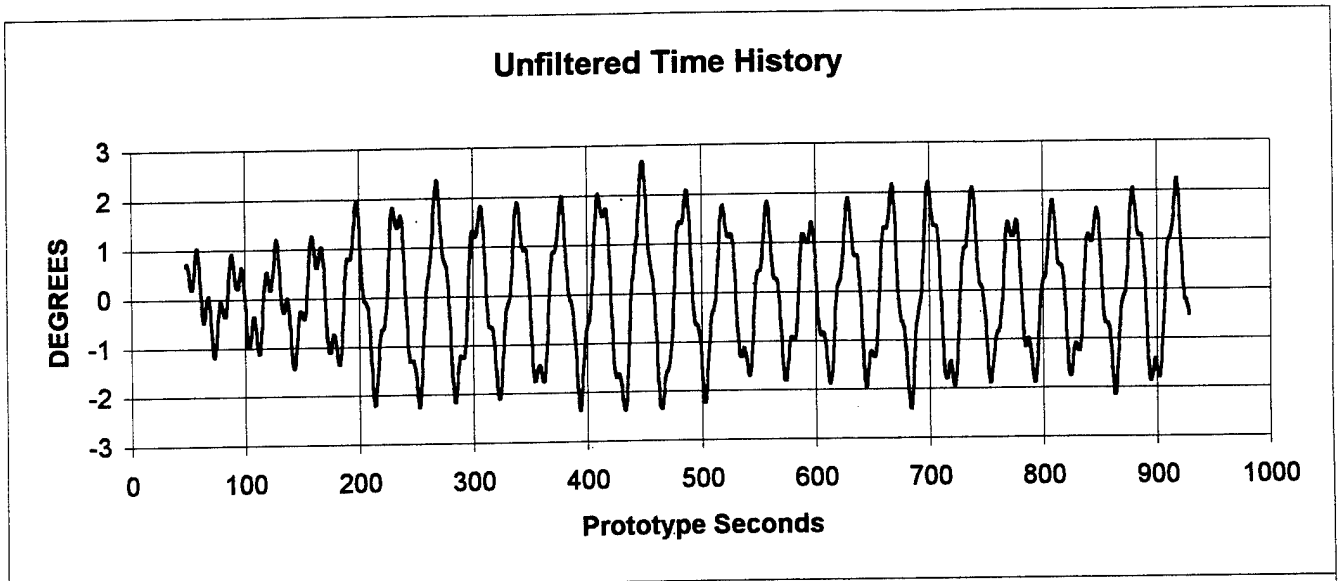
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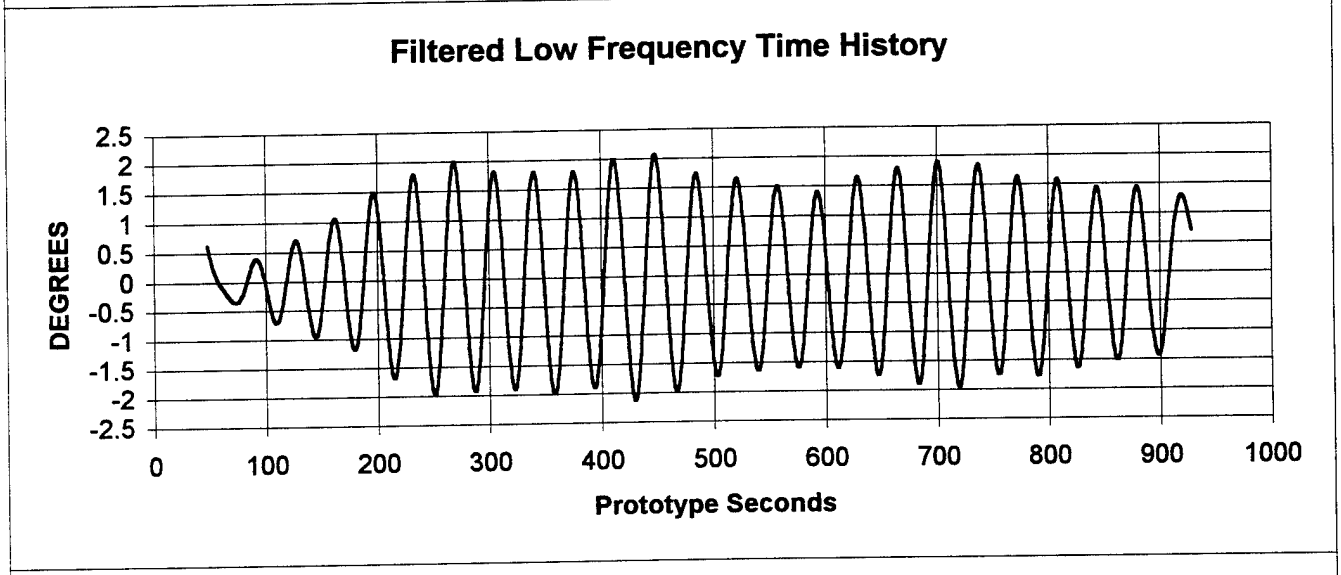


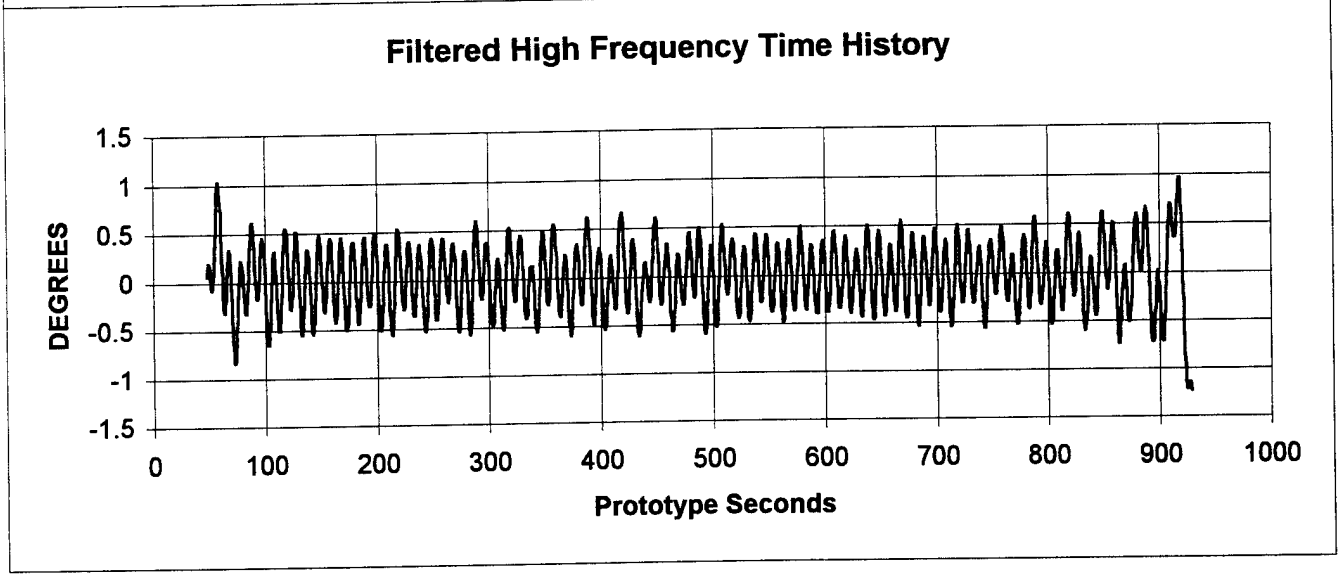
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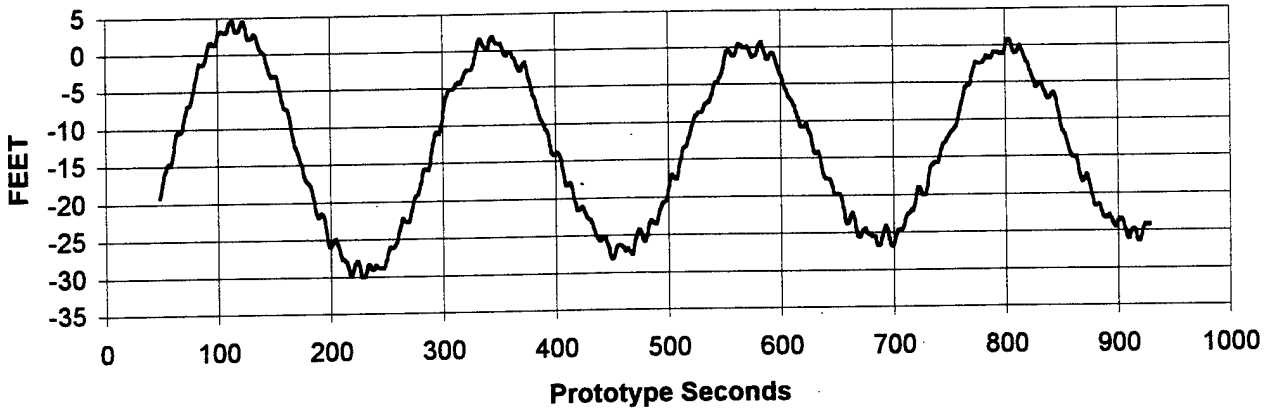




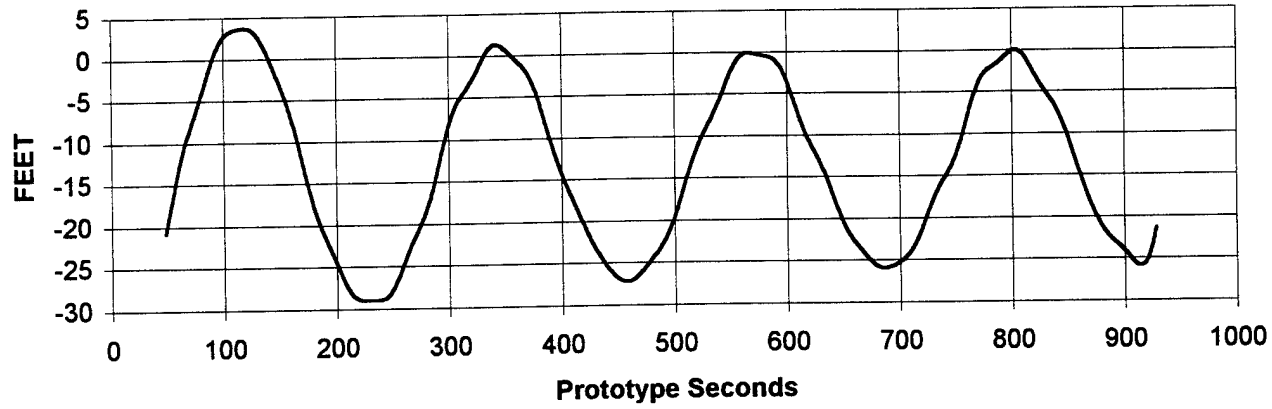


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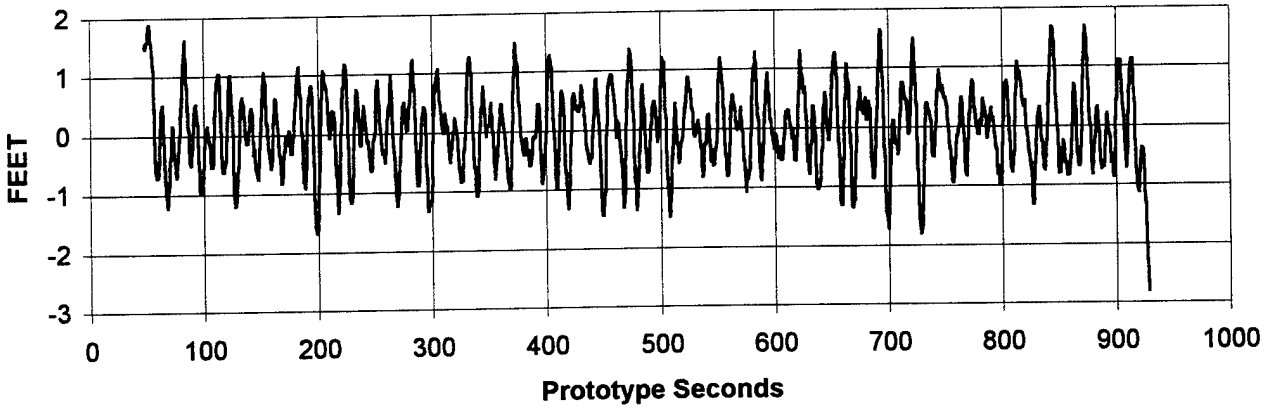
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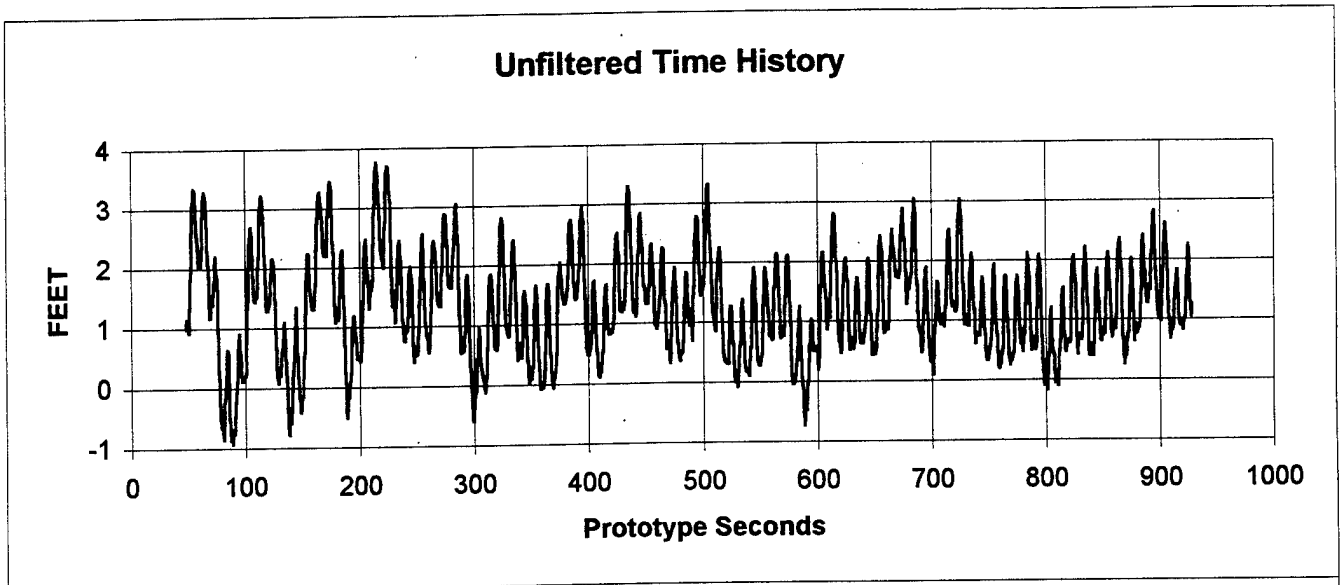
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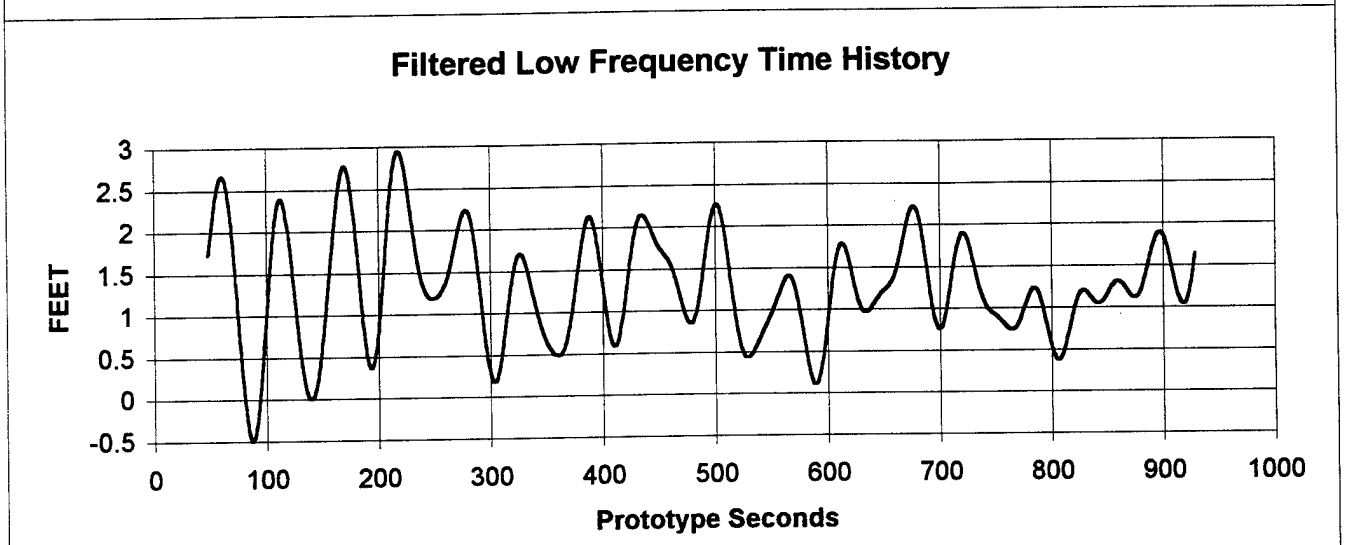


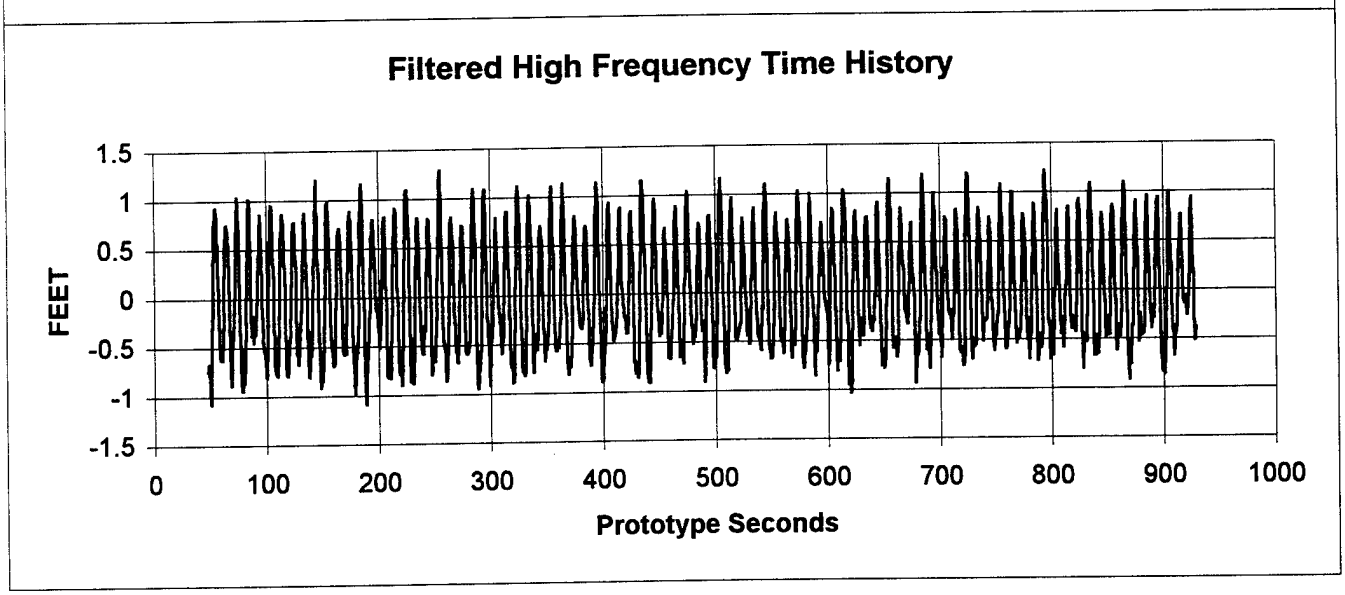
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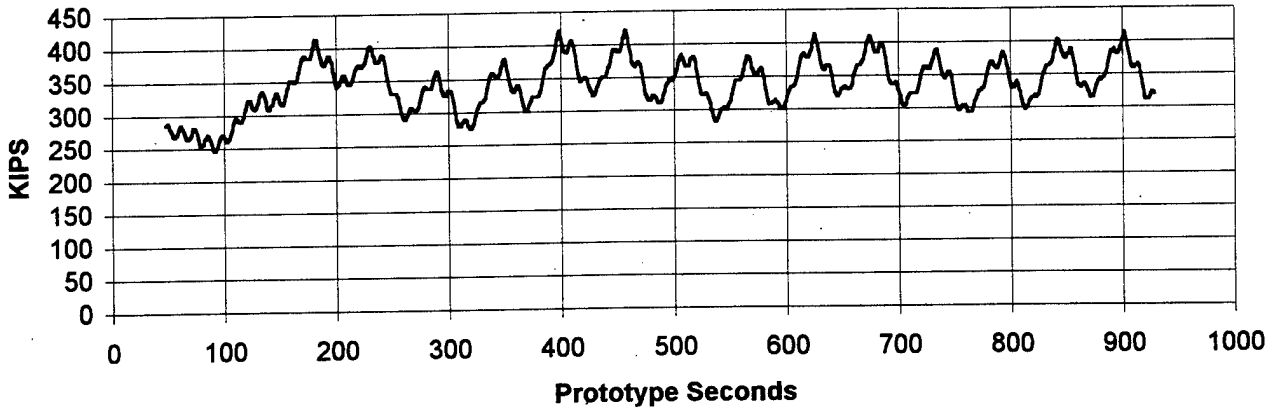




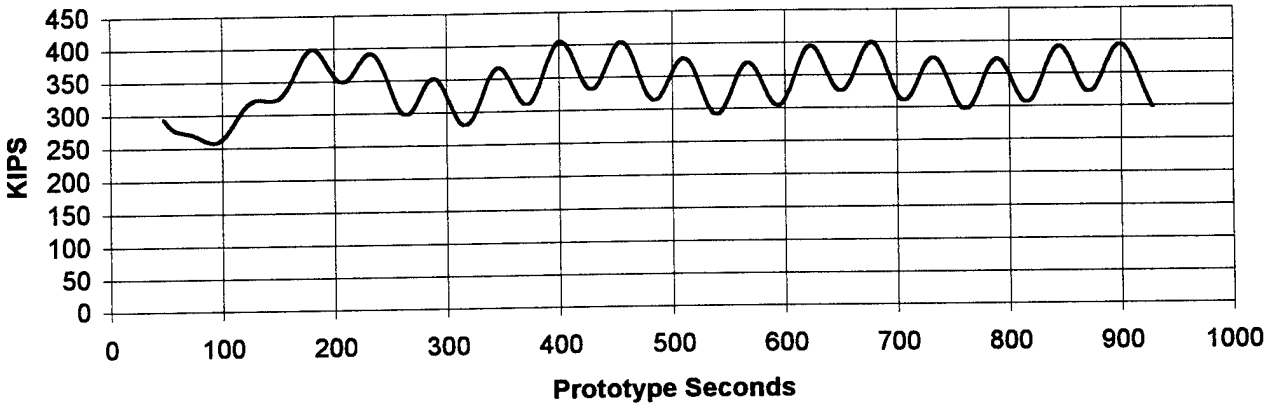


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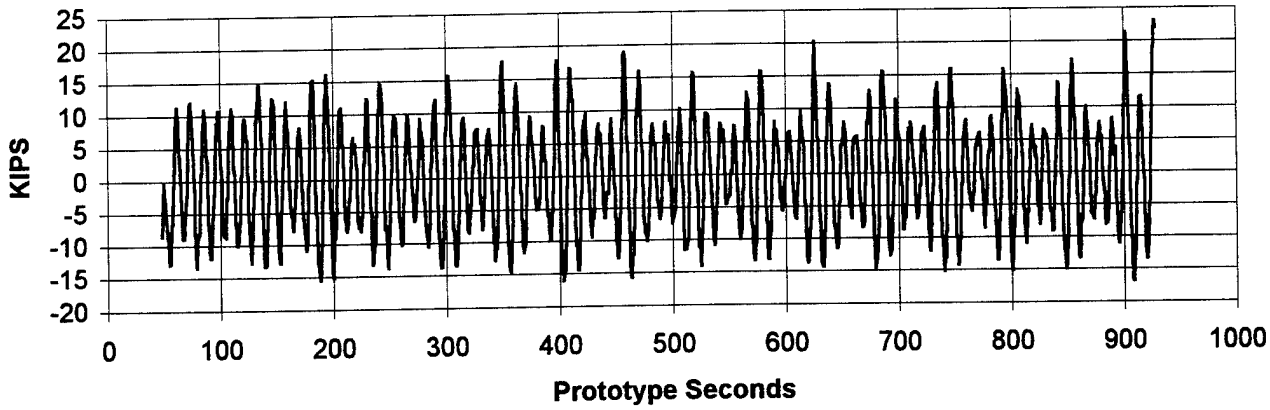
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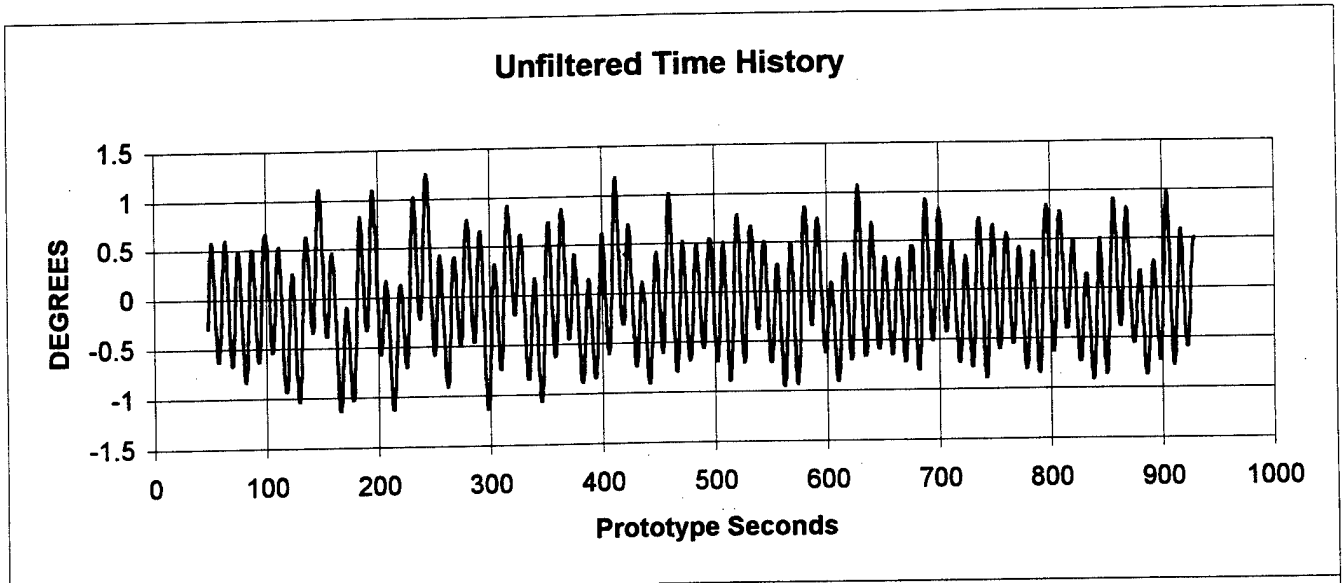
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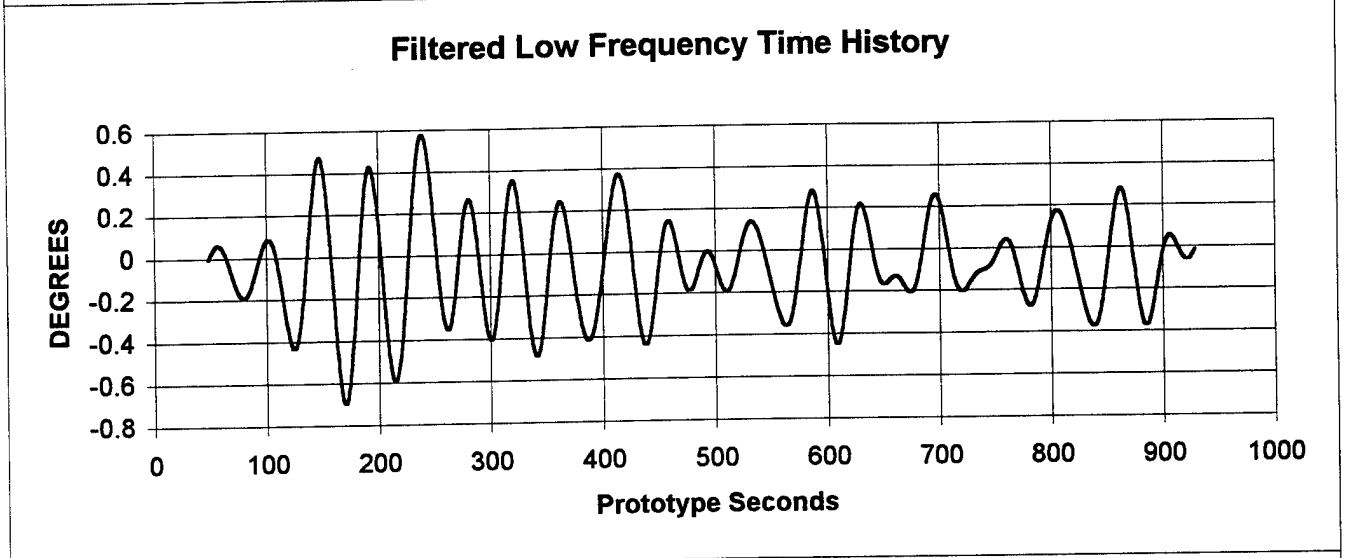


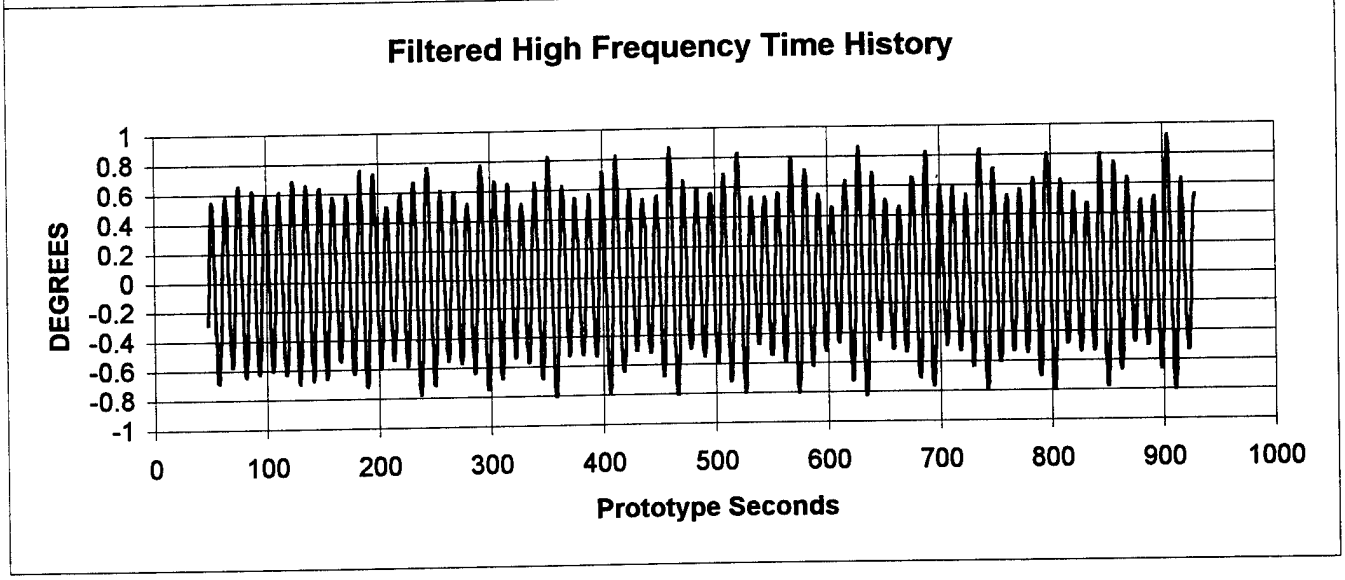
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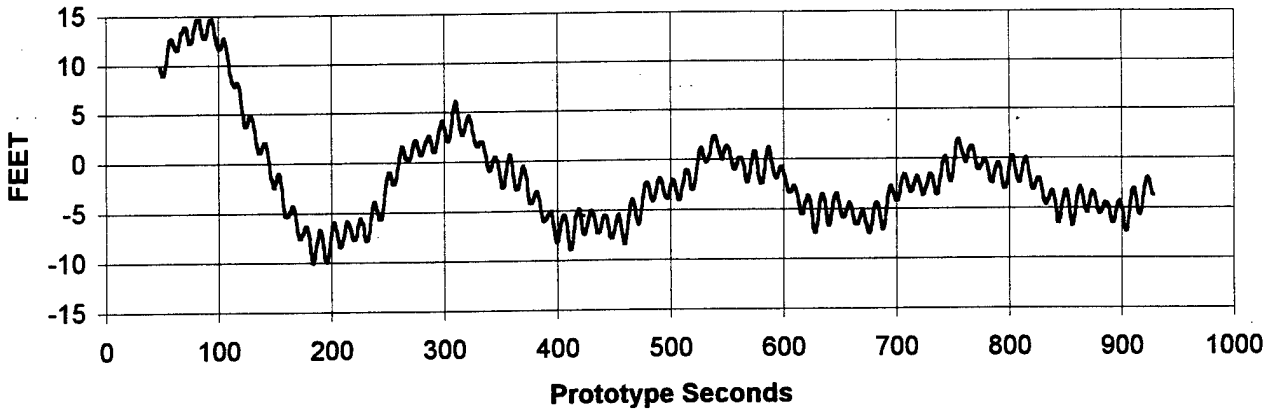




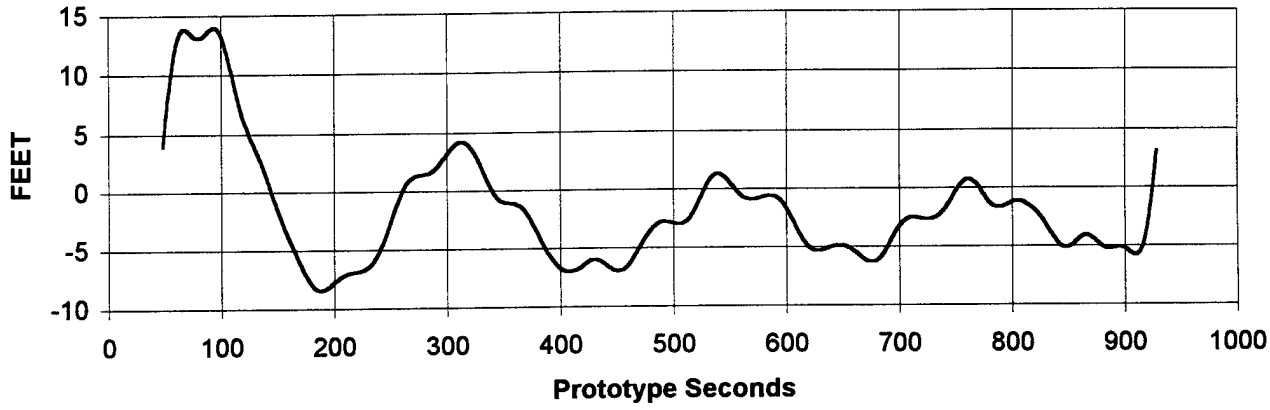


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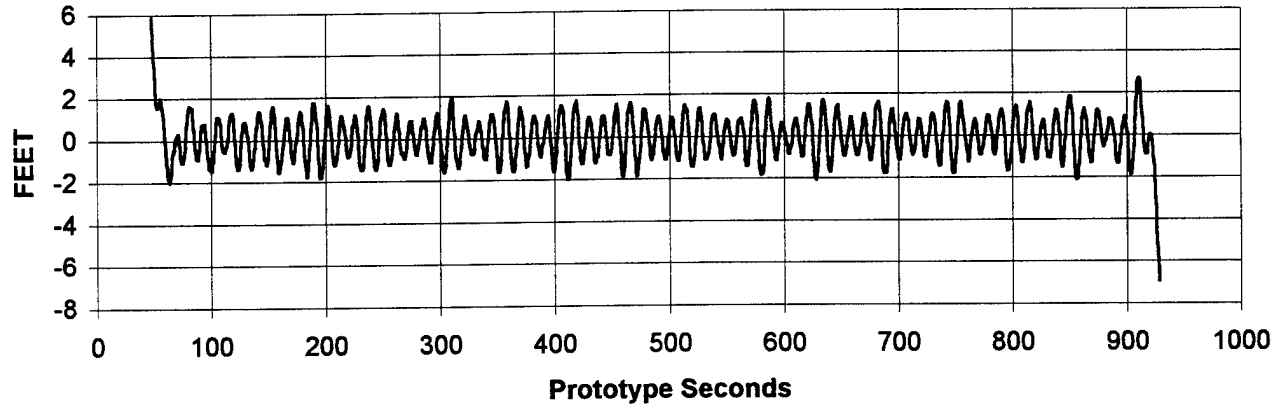
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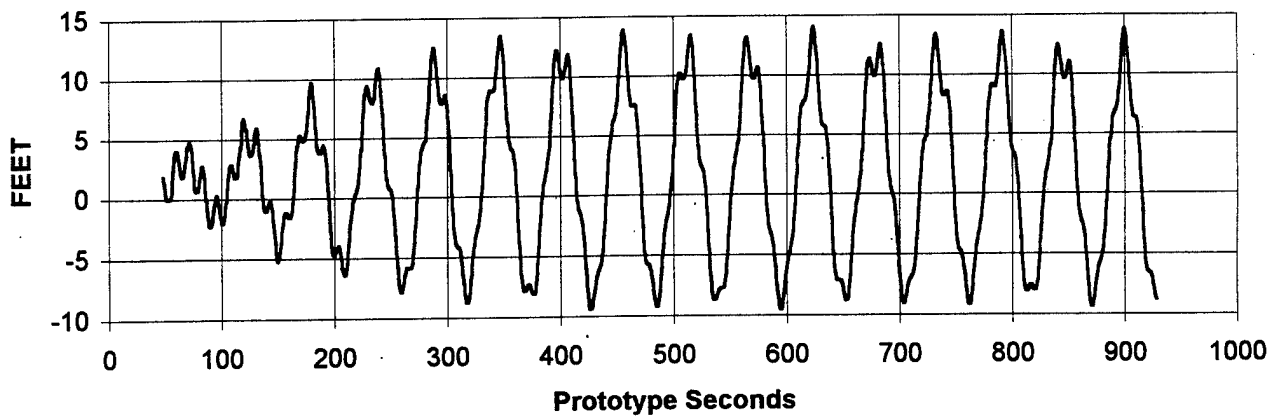


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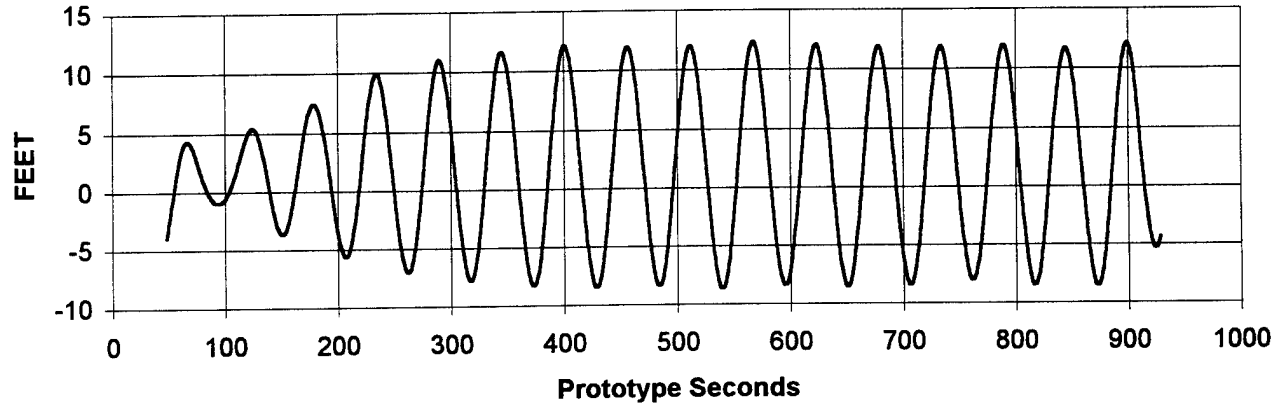


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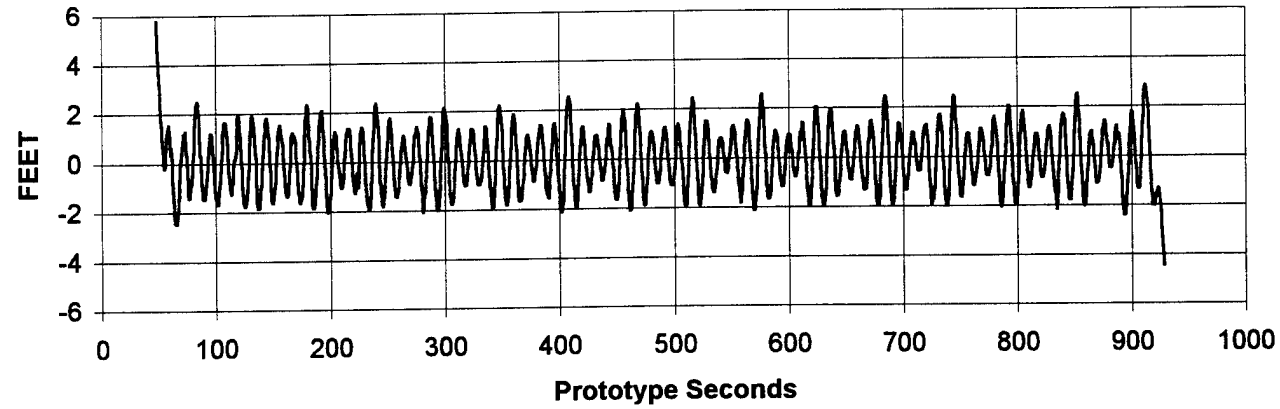
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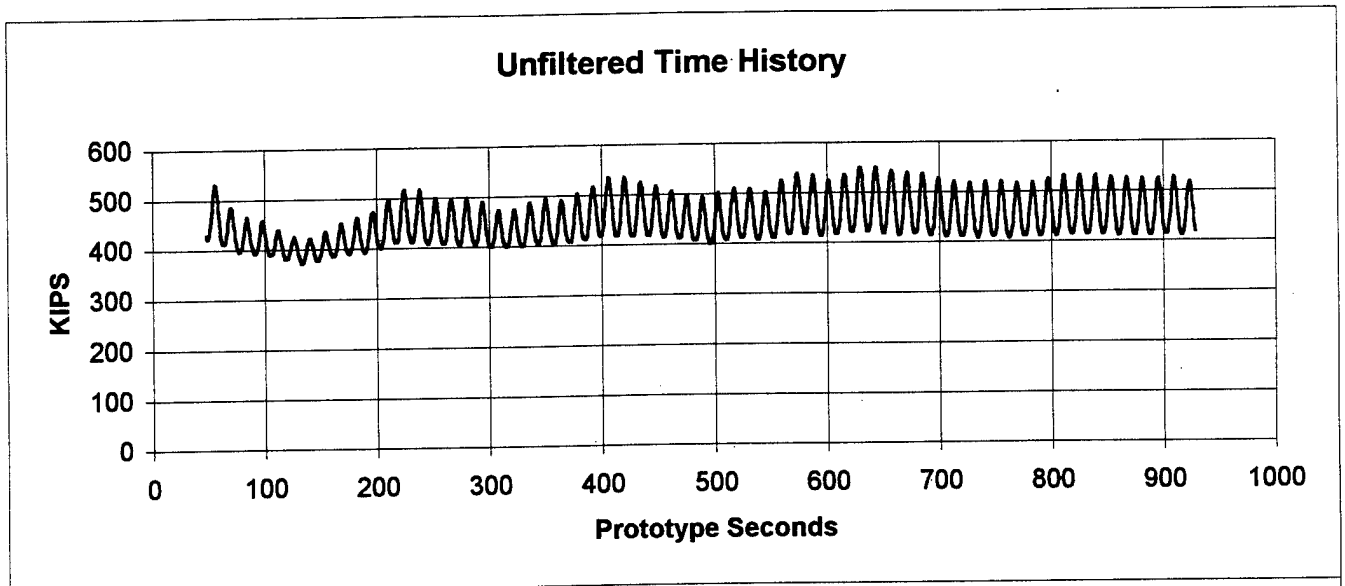
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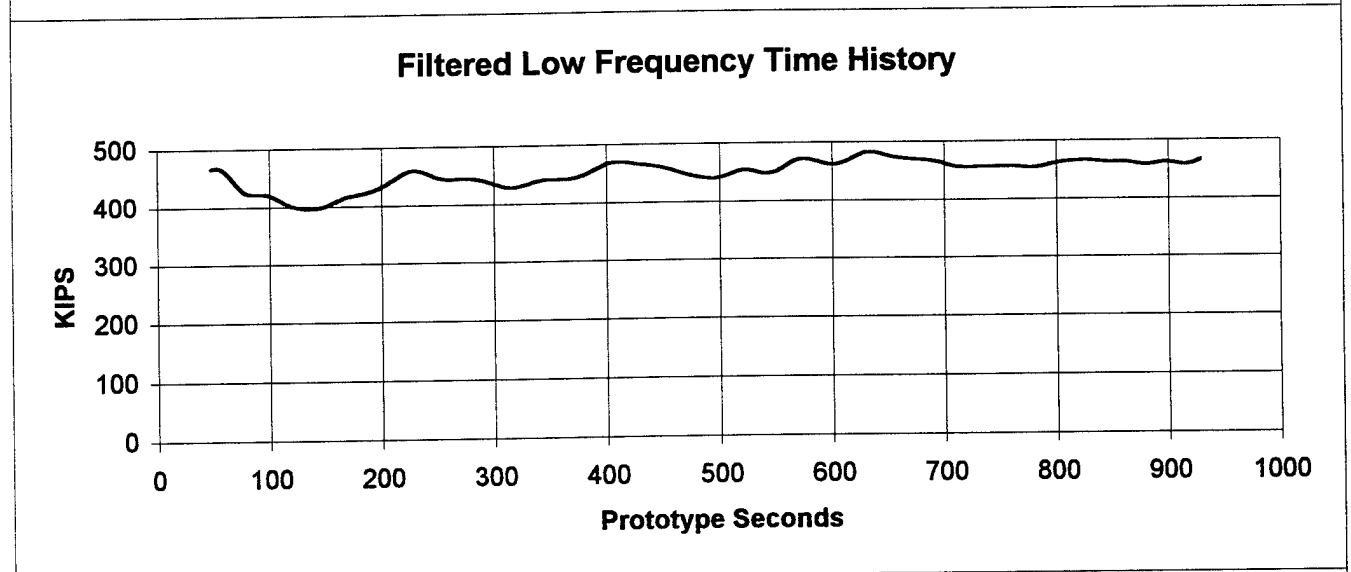


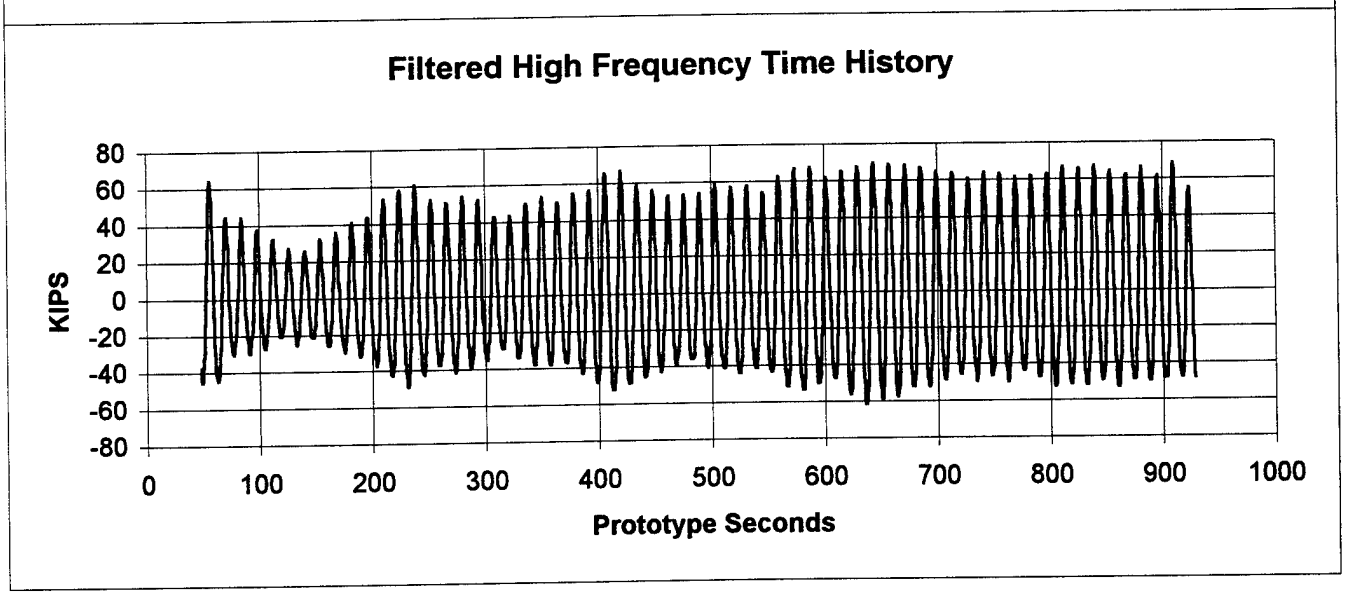
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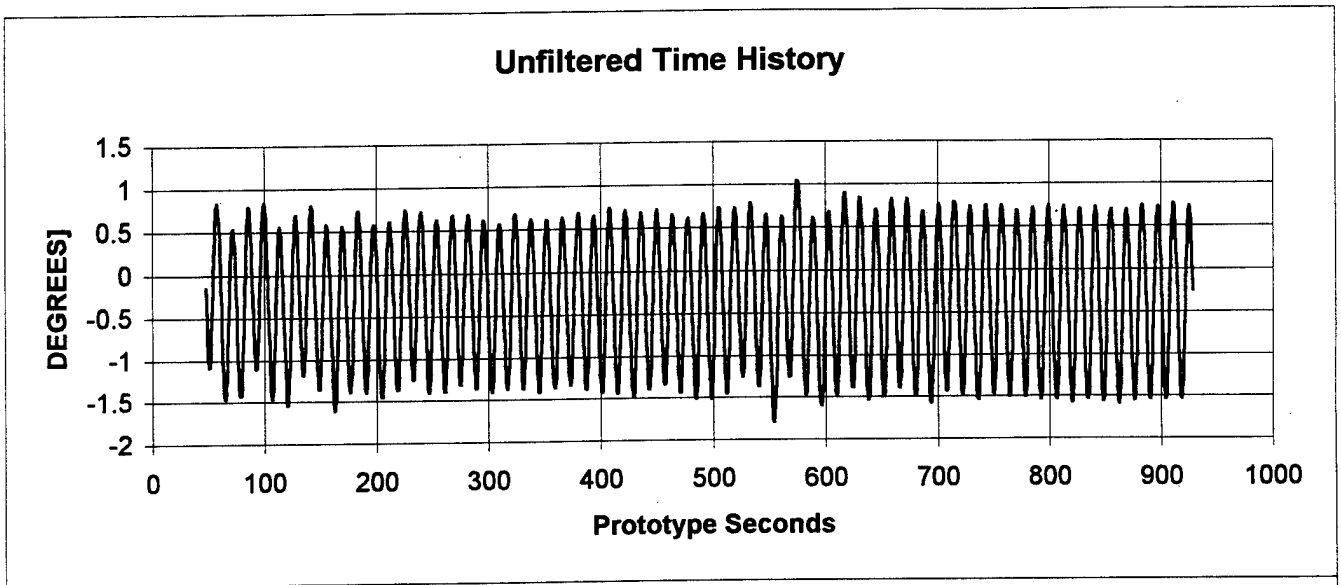


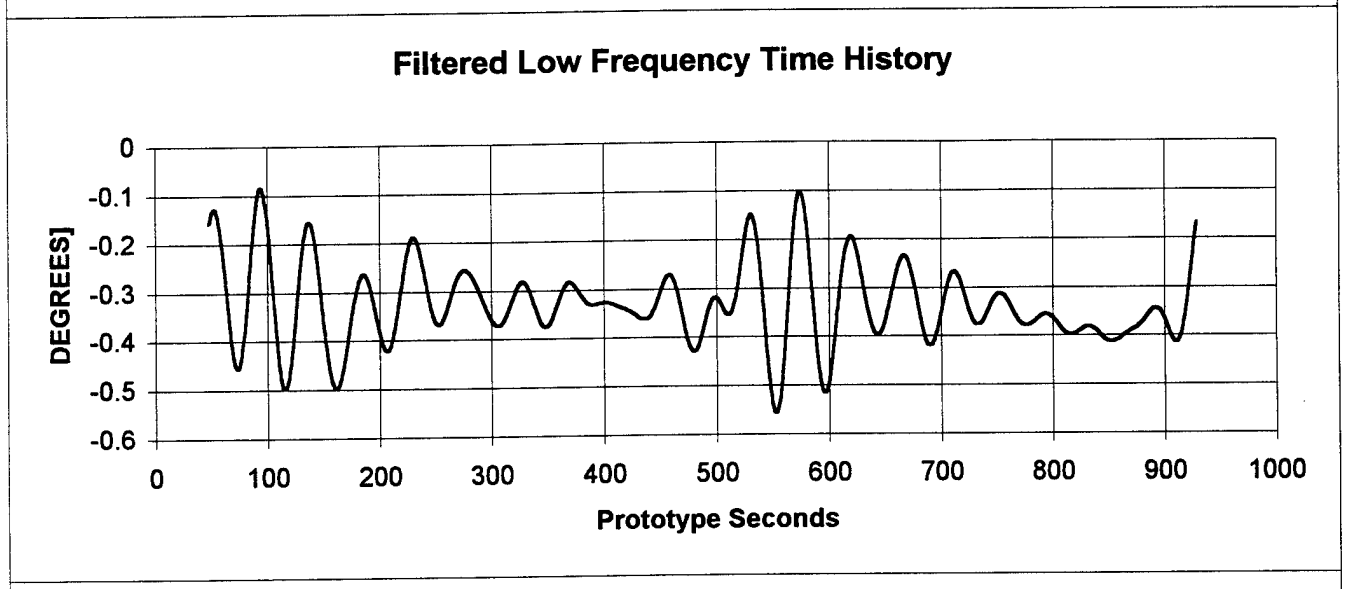
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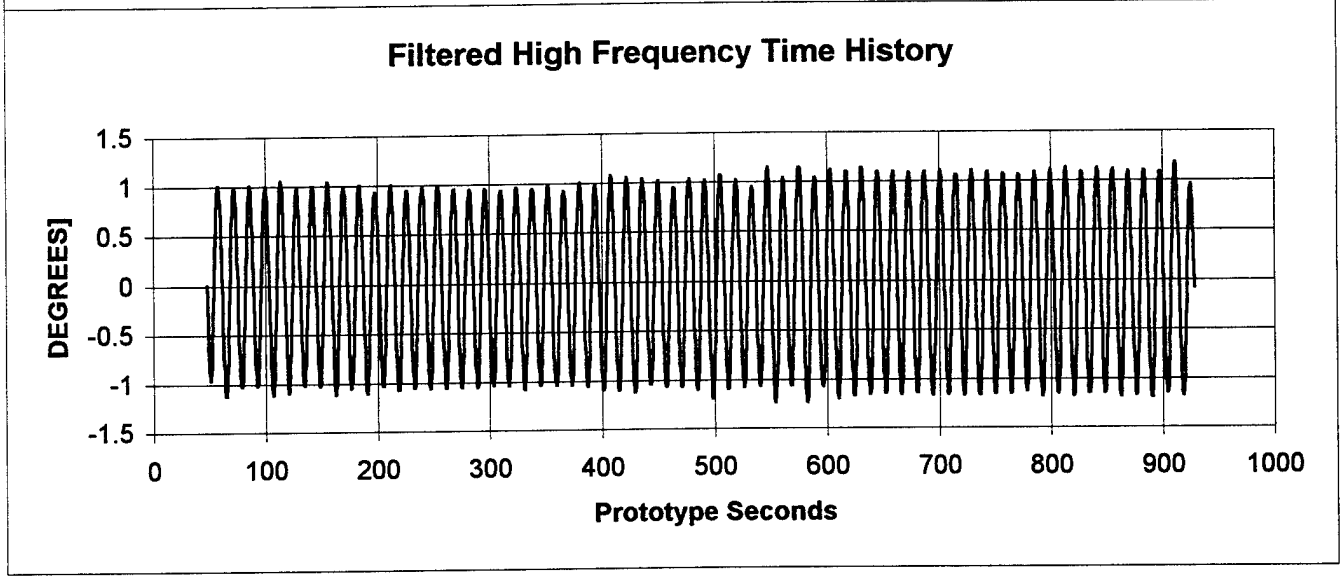






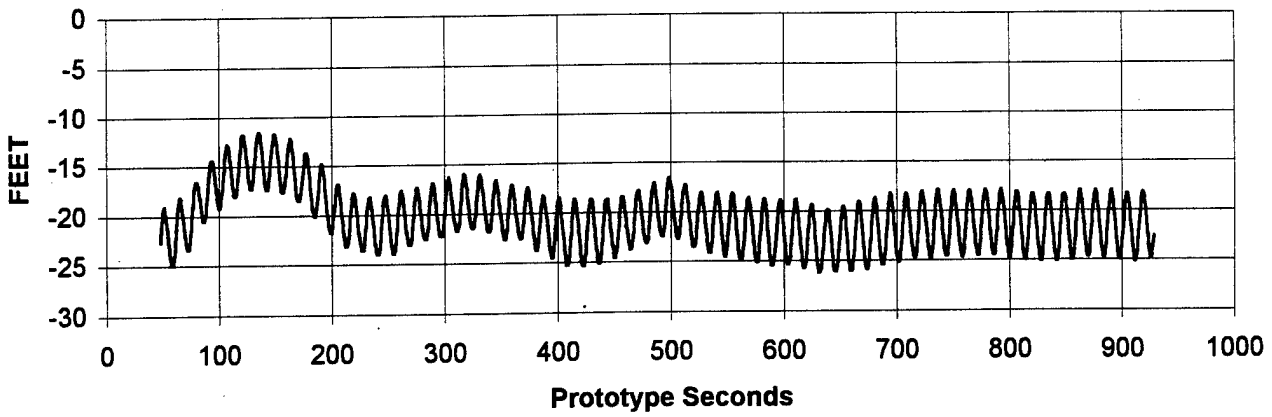

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Prototype Seconds


Filtered Low Frequency Time History
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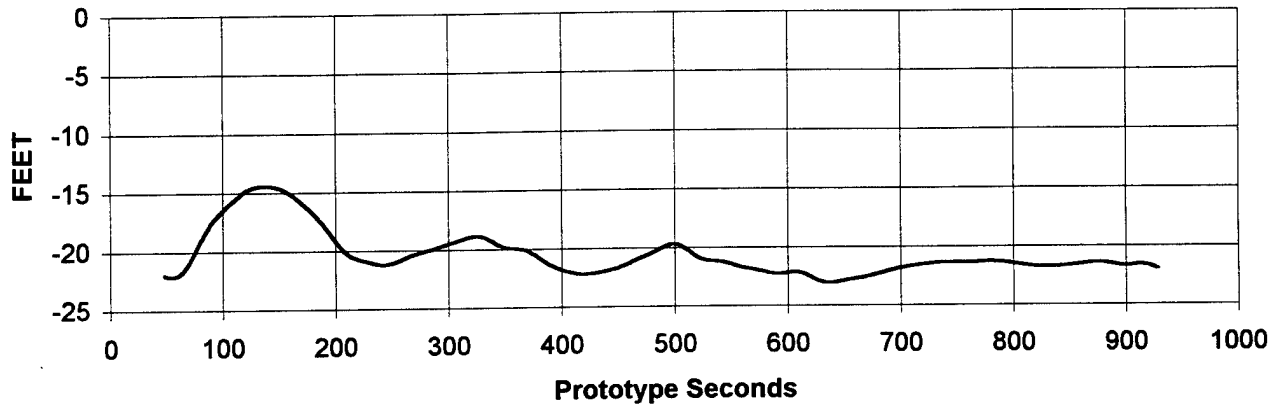

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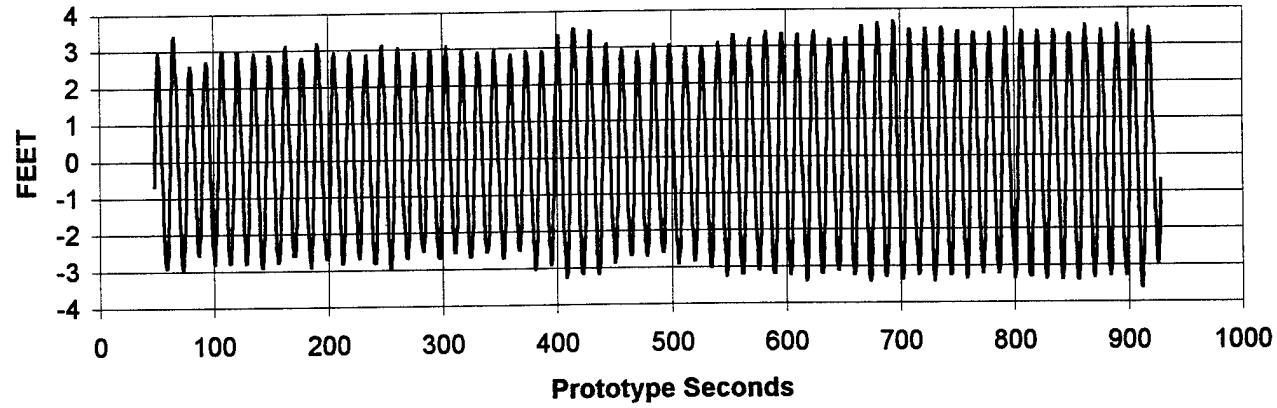
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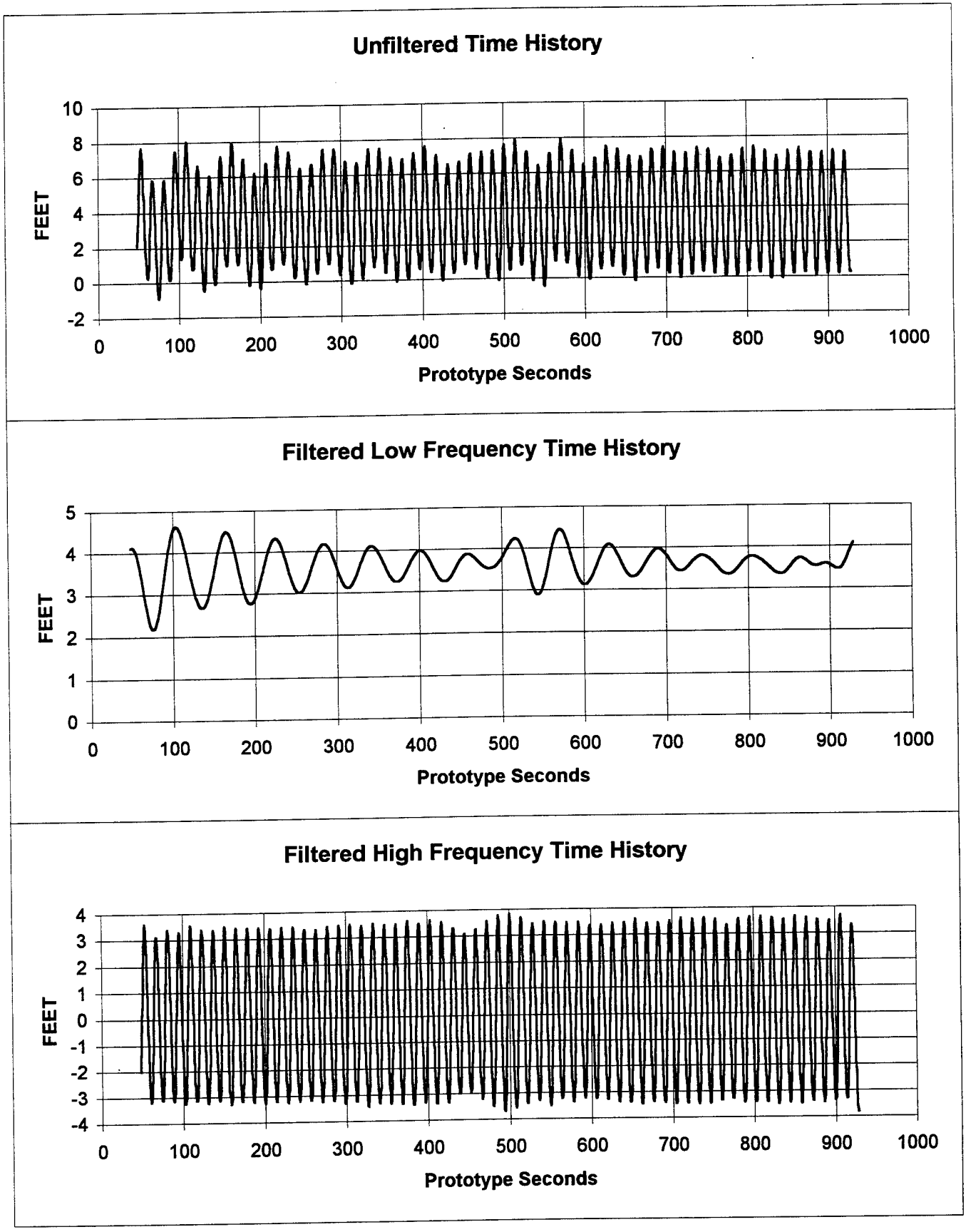
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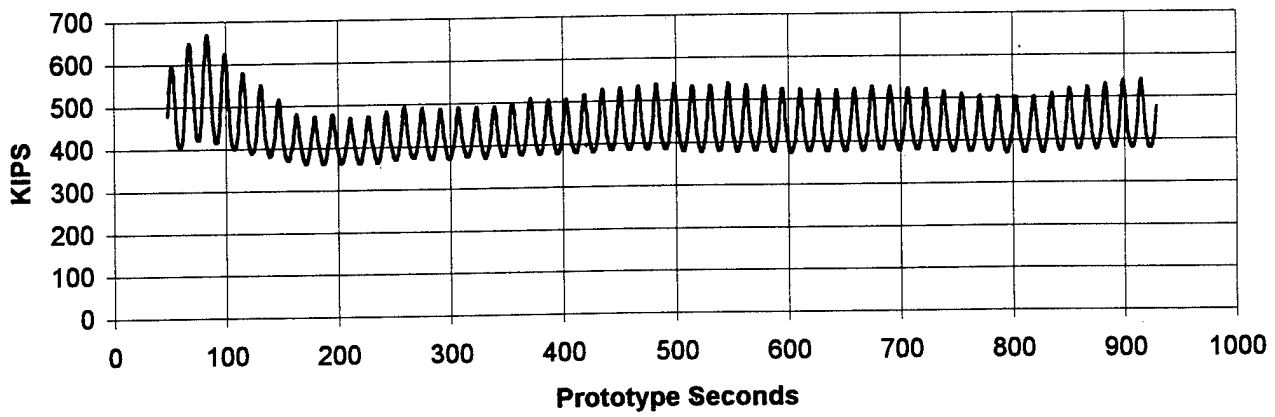


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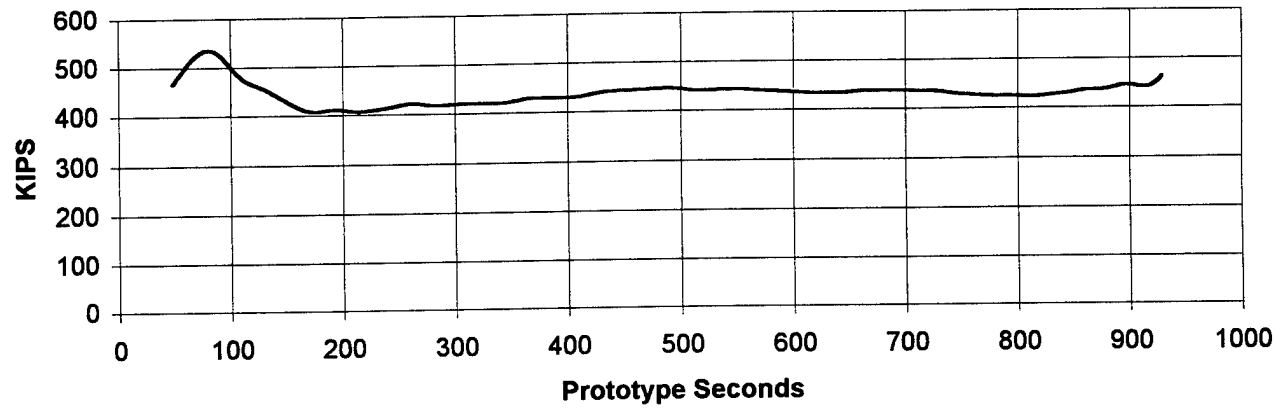


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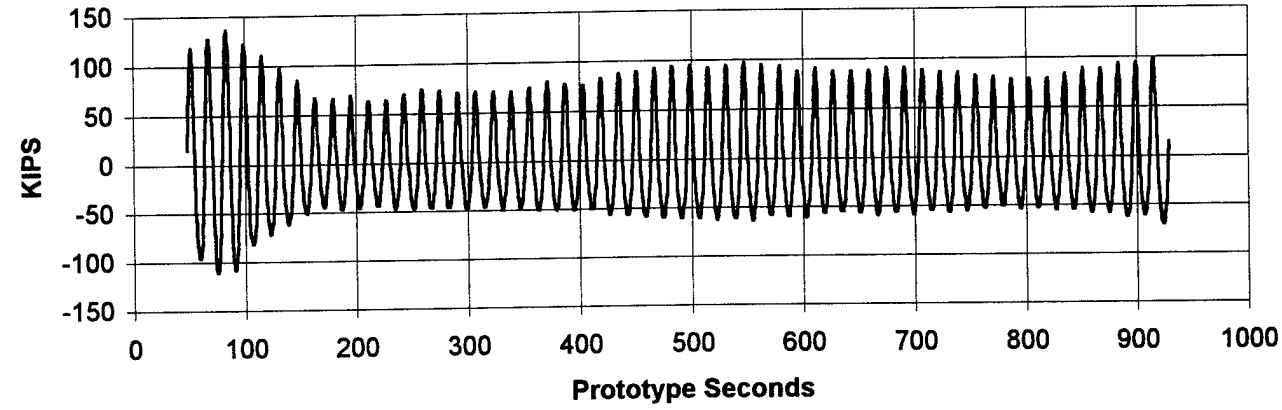
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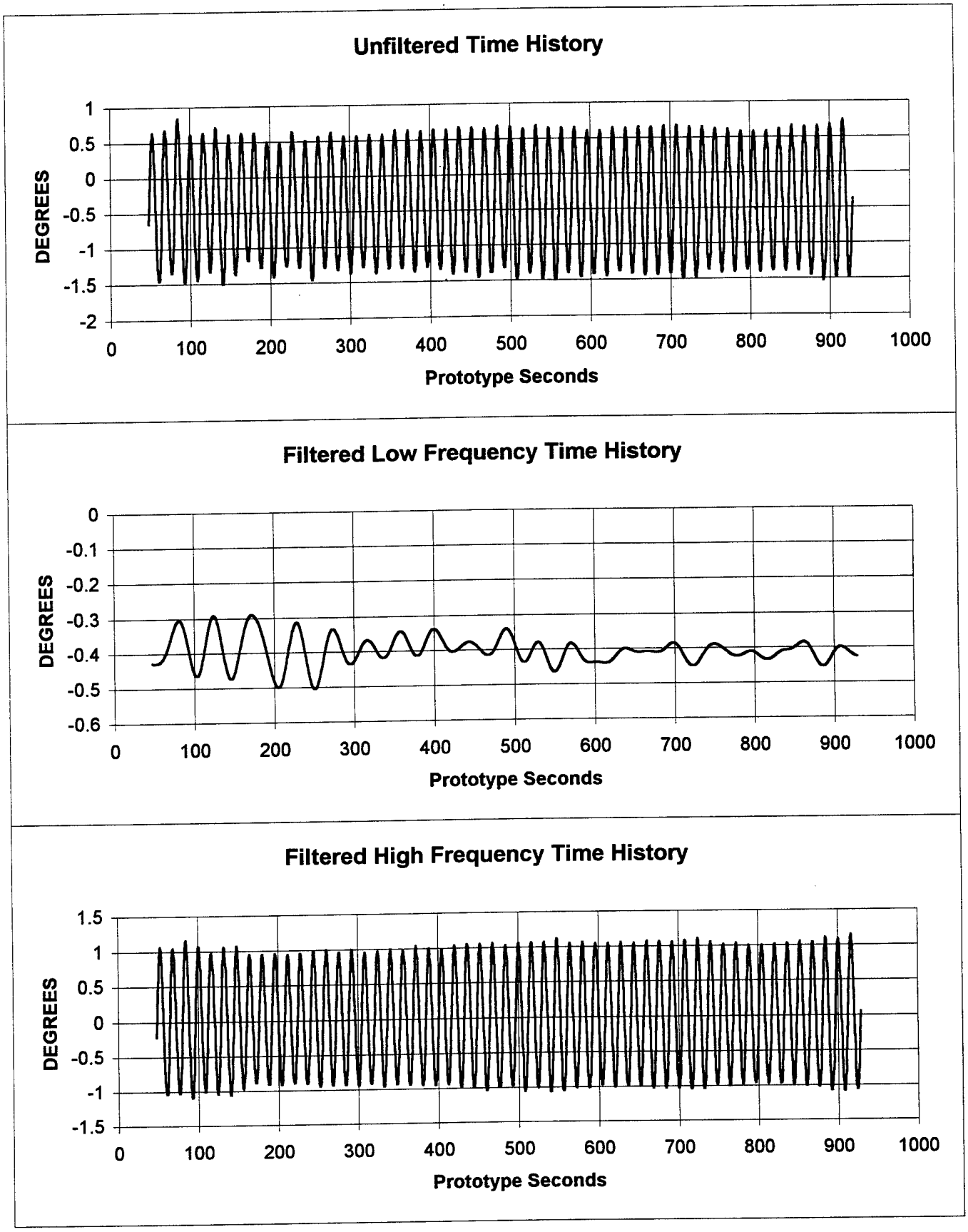
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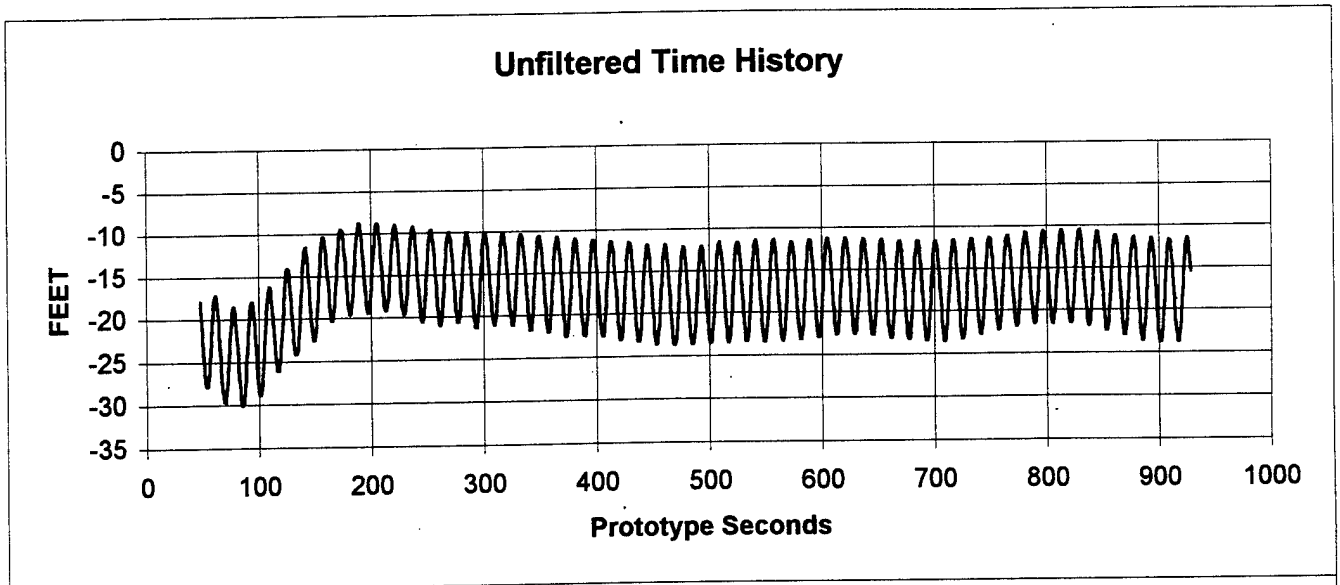
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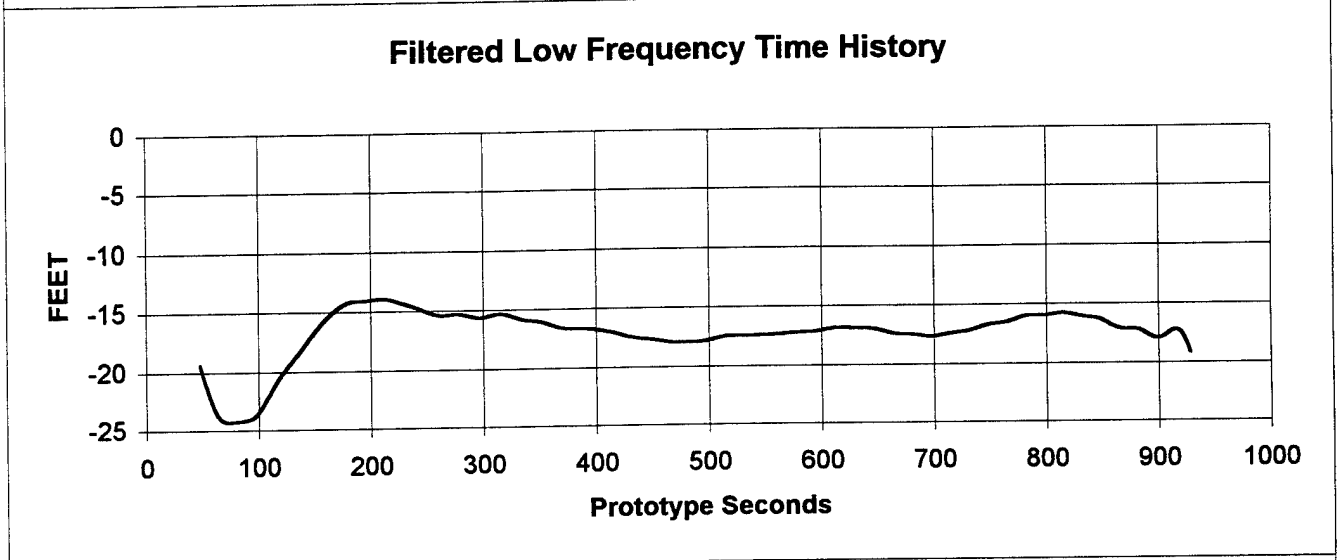


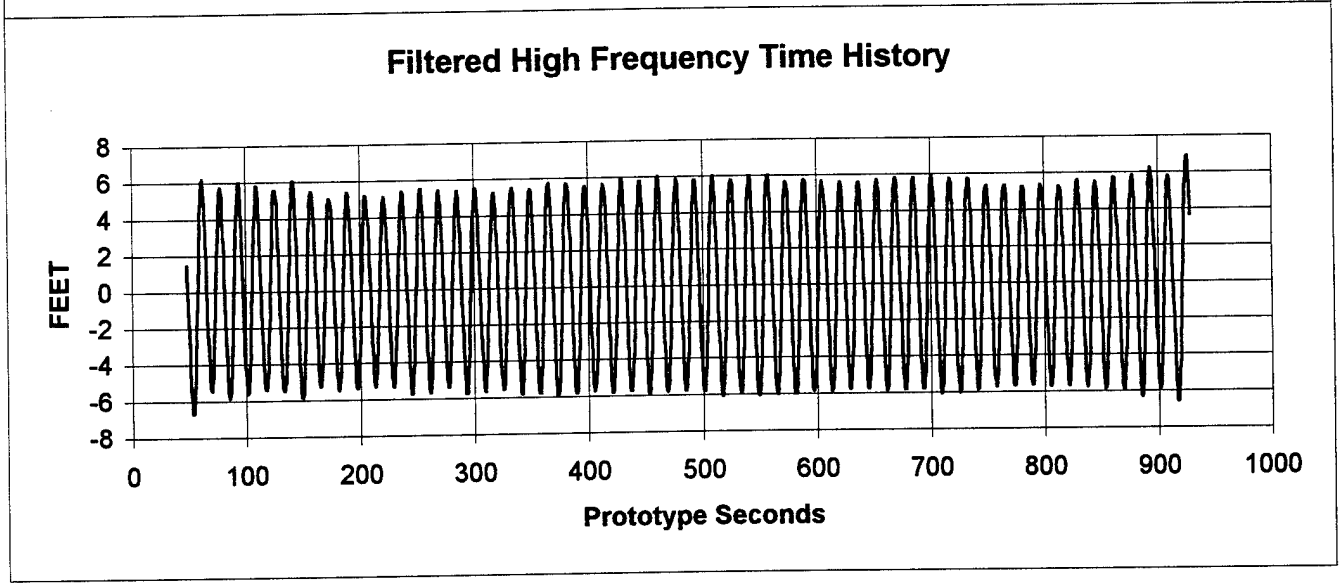
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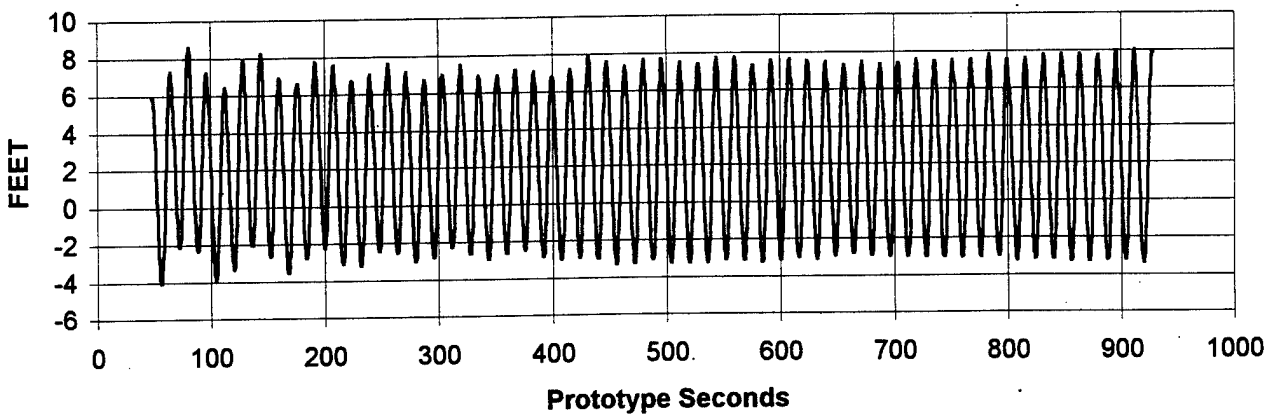




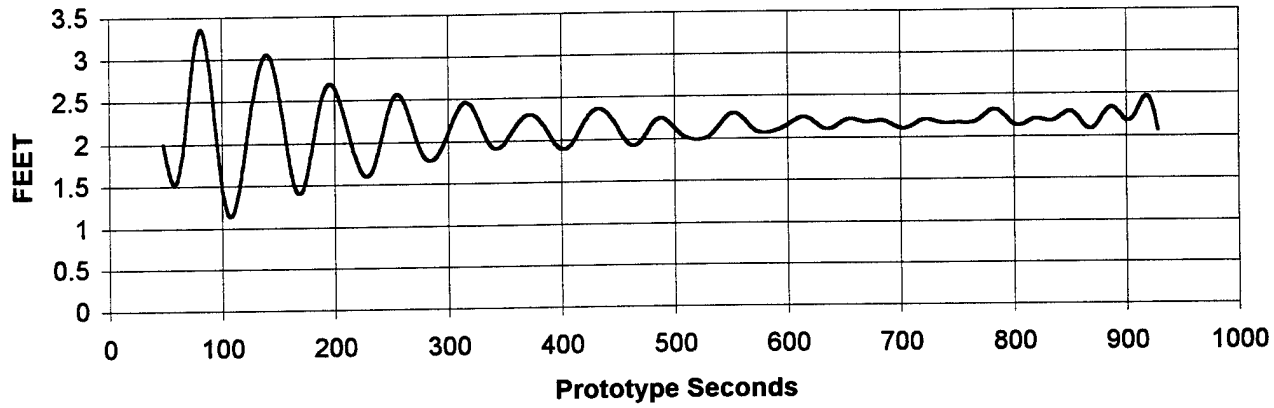


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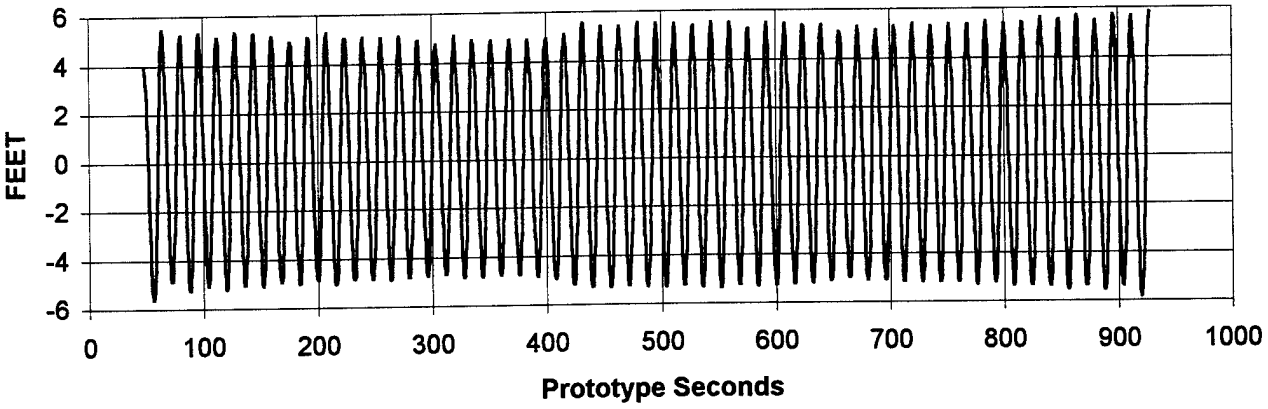
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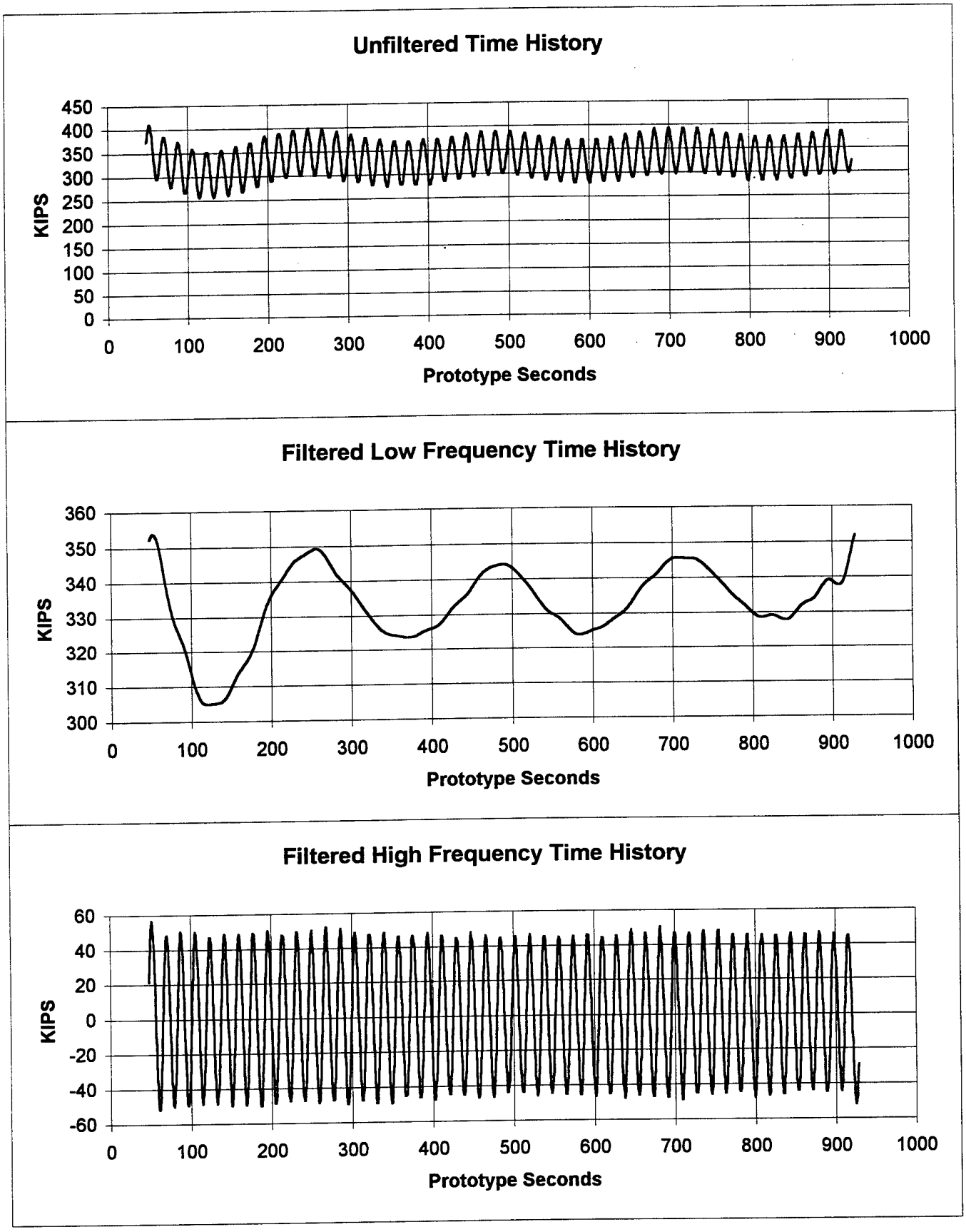
Filtered Low Frequency Time History



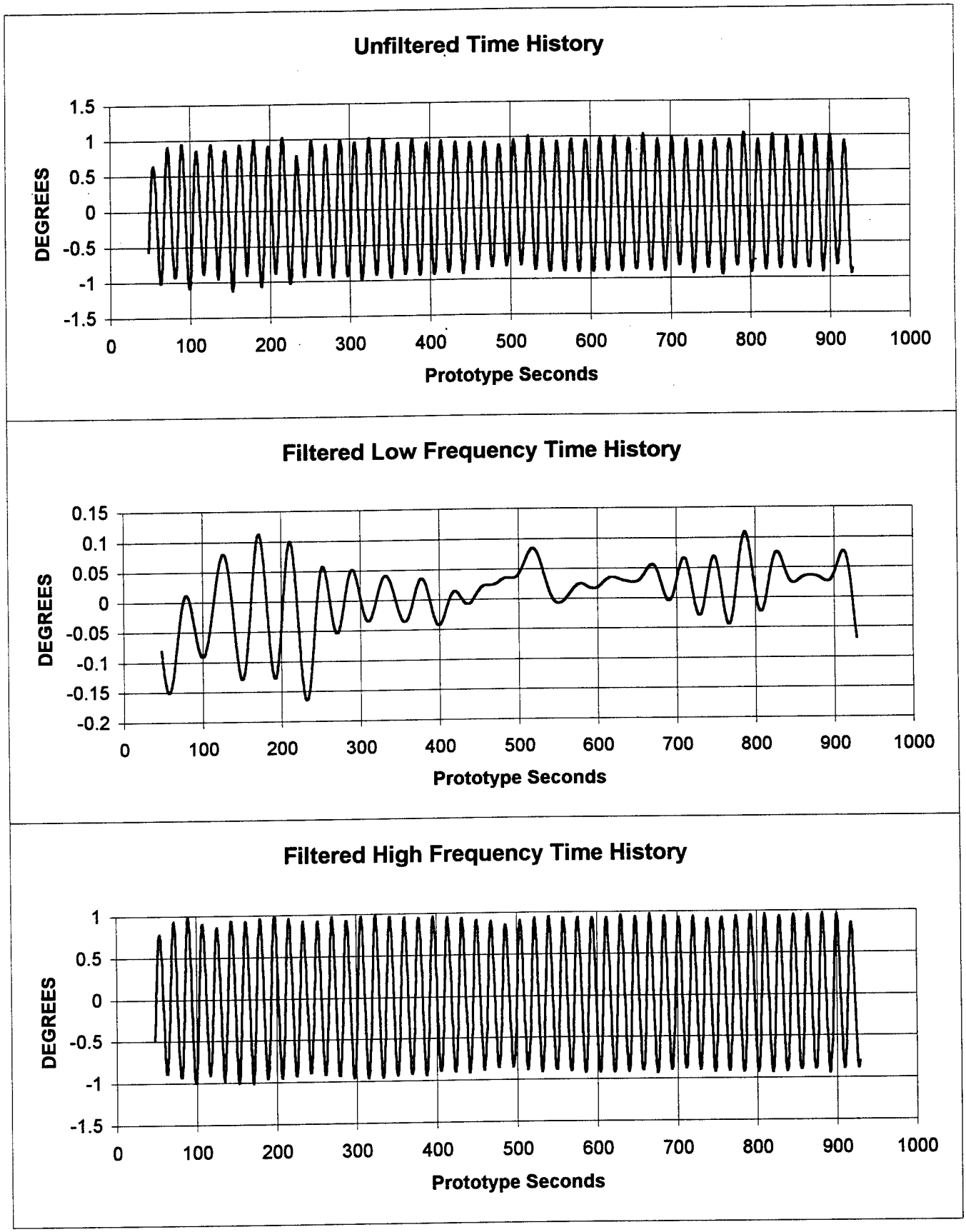
Filtered High Frequency Time History



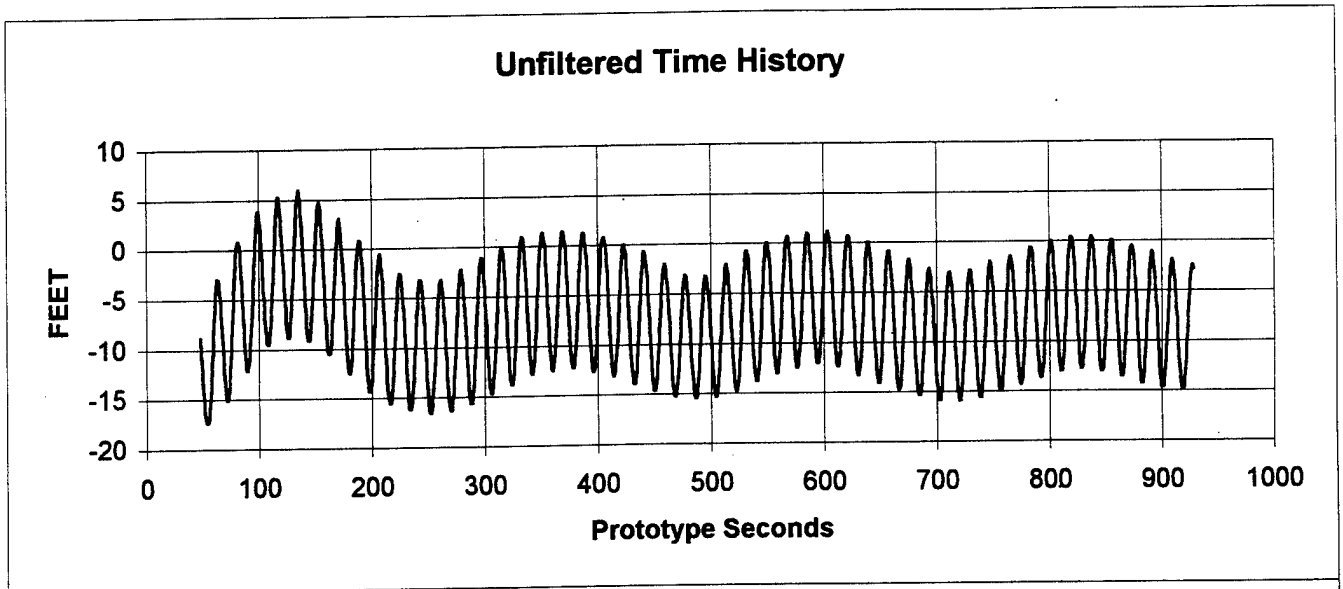
TEST A707 - ML_1 TENSION

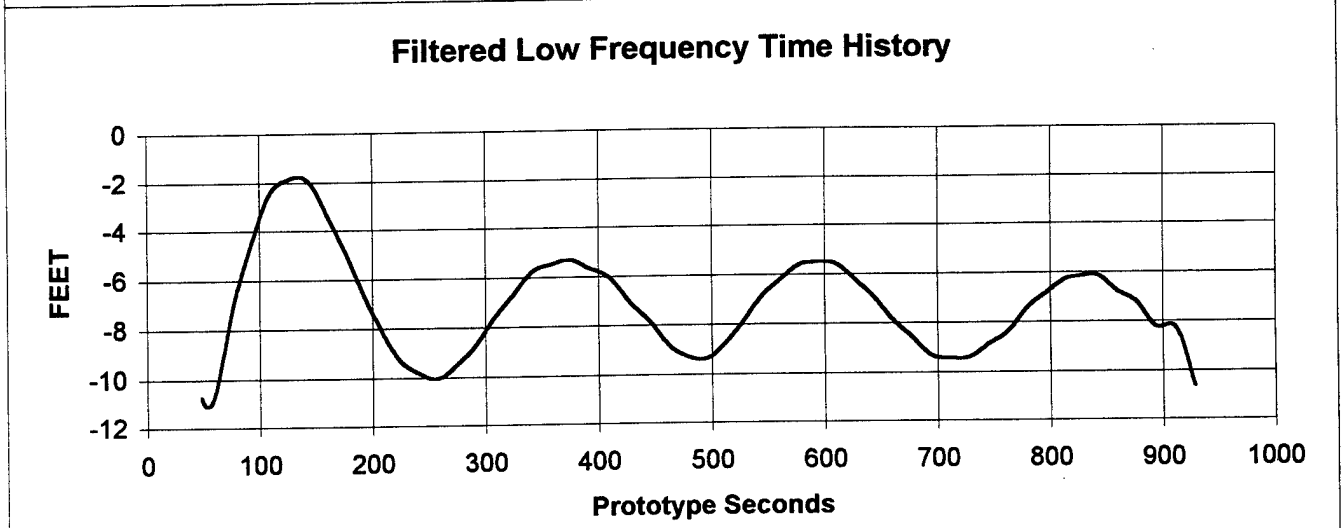


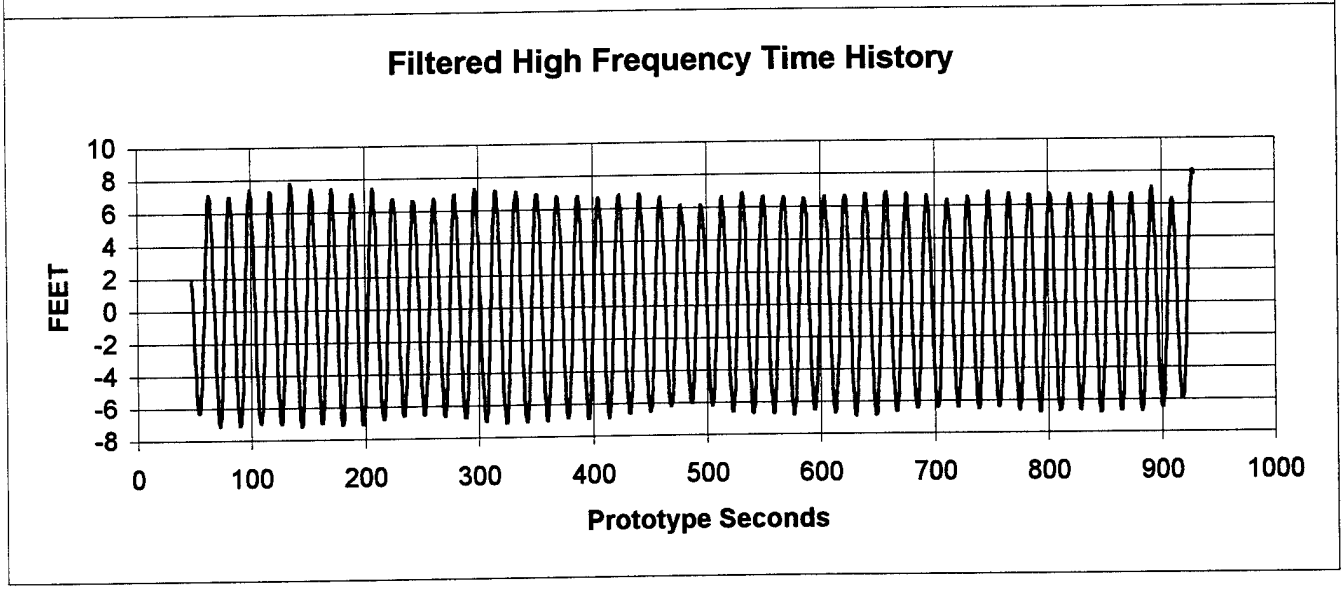
TEST A707 - PITCH



TEST A707 - PT SURGE

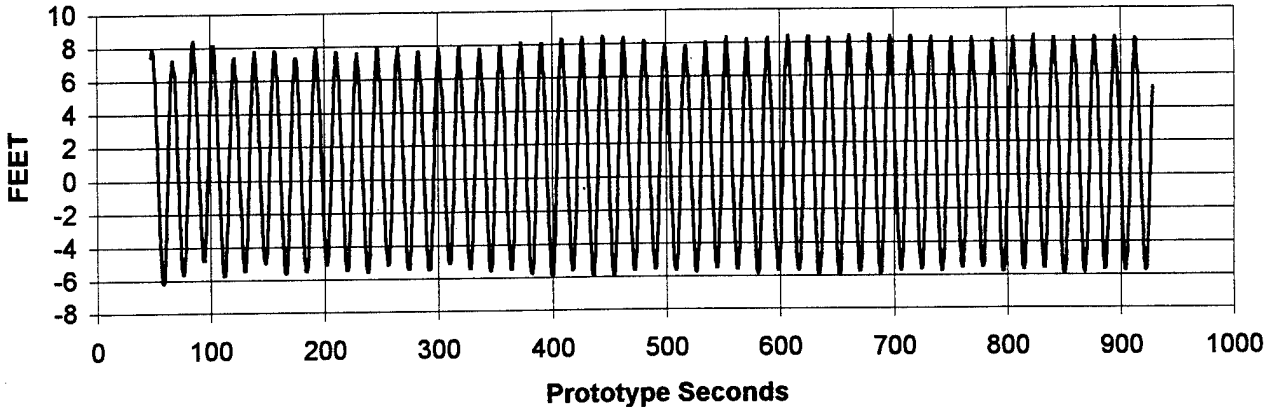




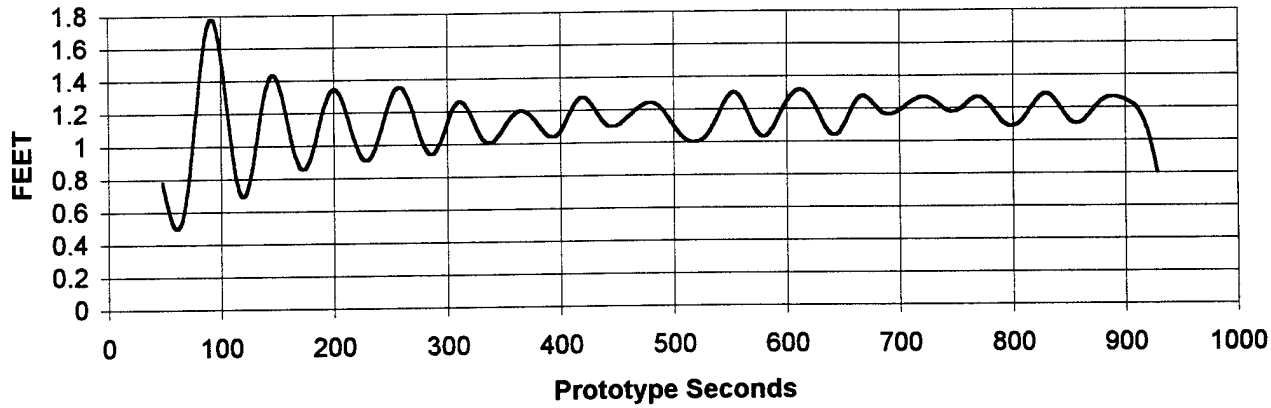


TEST A707 - PT HEAVE

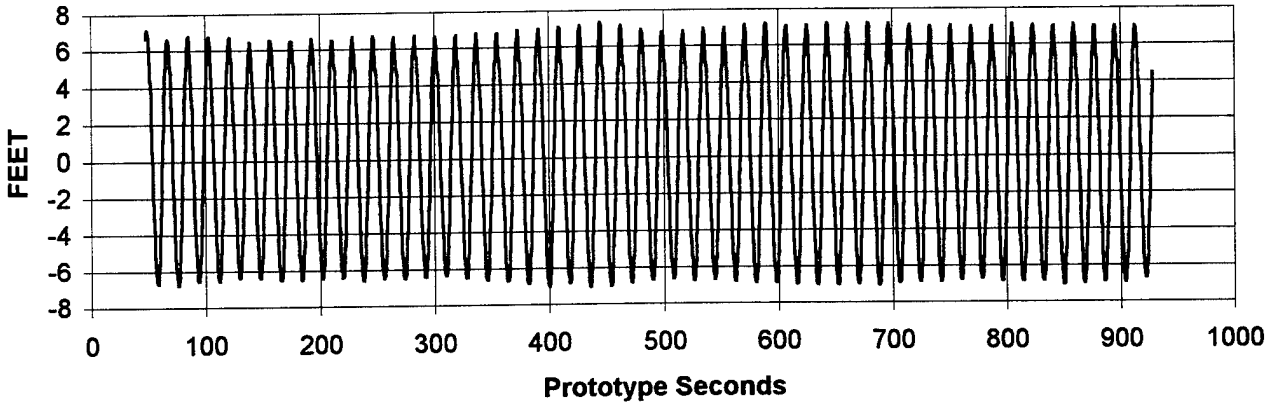
Unfiltered Time History



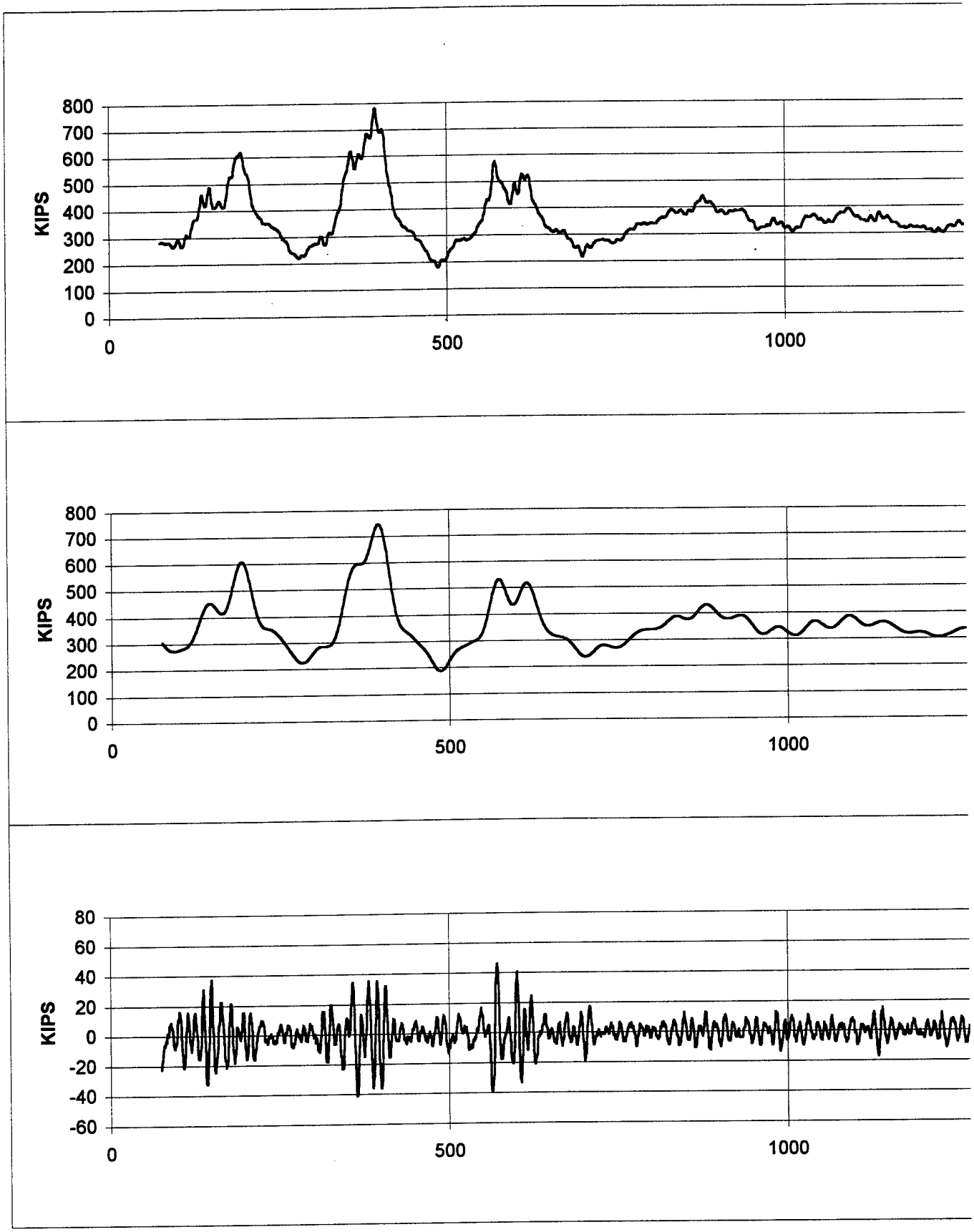
Filtered Low Frequency Time History



Filtered High Frequency Time History

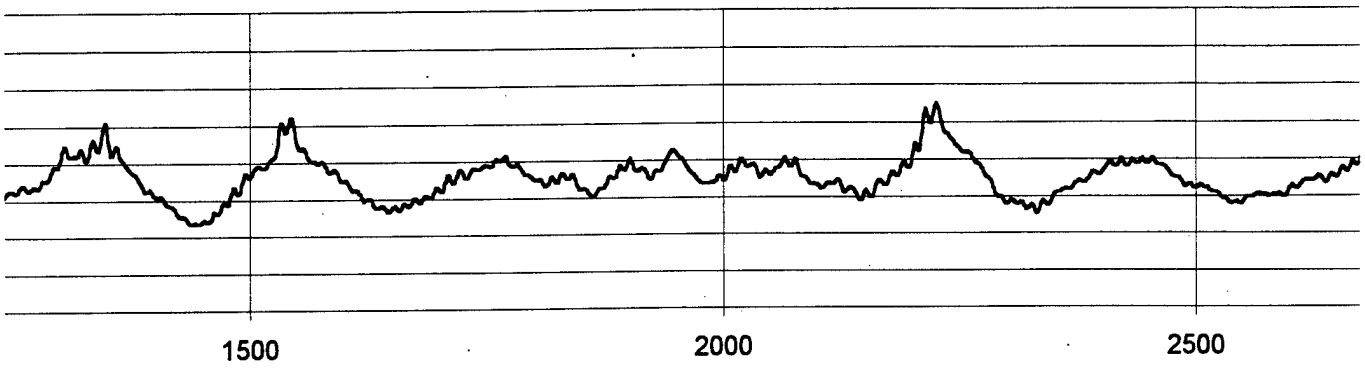


TEST A708 - ML_1 TENSION

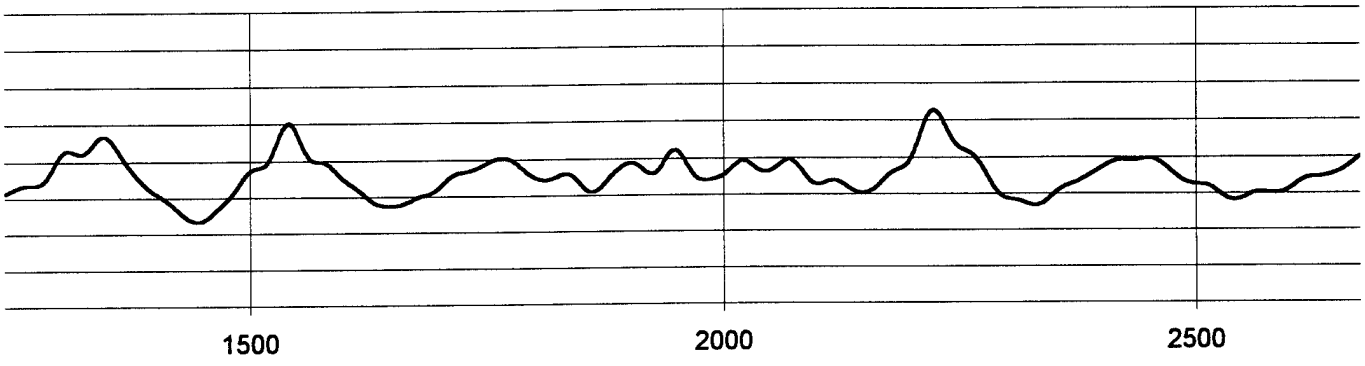


TEST A708 - ML_1 TENSION

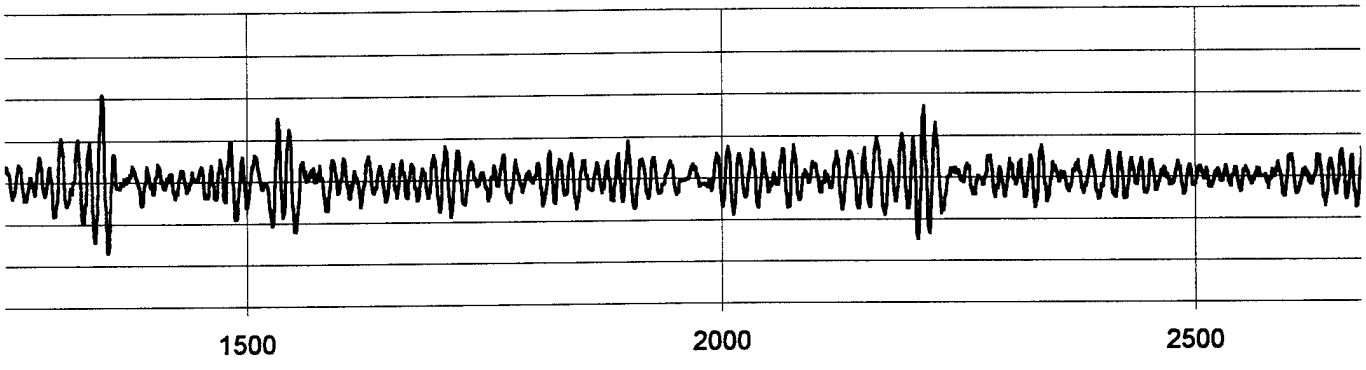
Unfiltered Time History



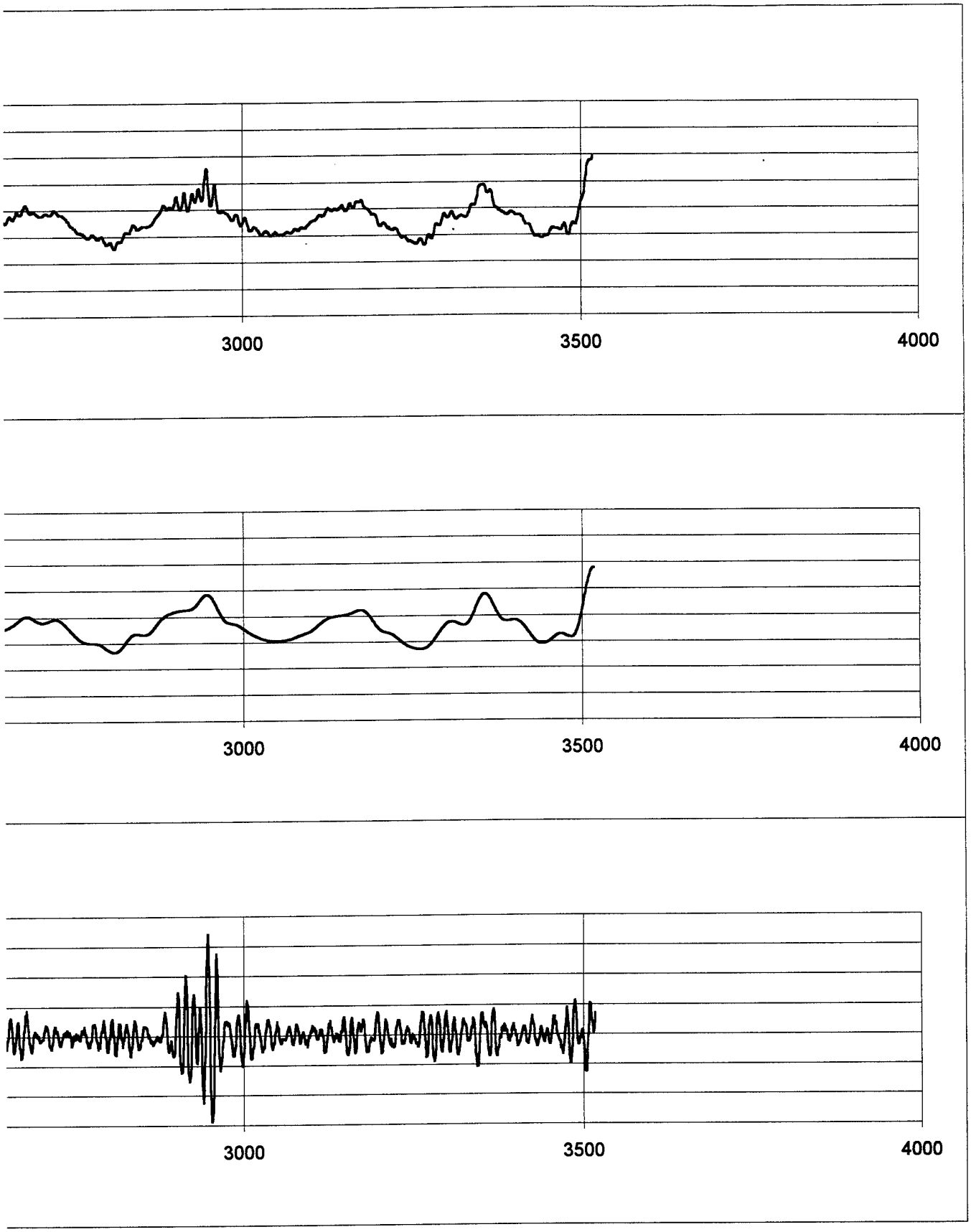
Filtered Low Frequency Time History



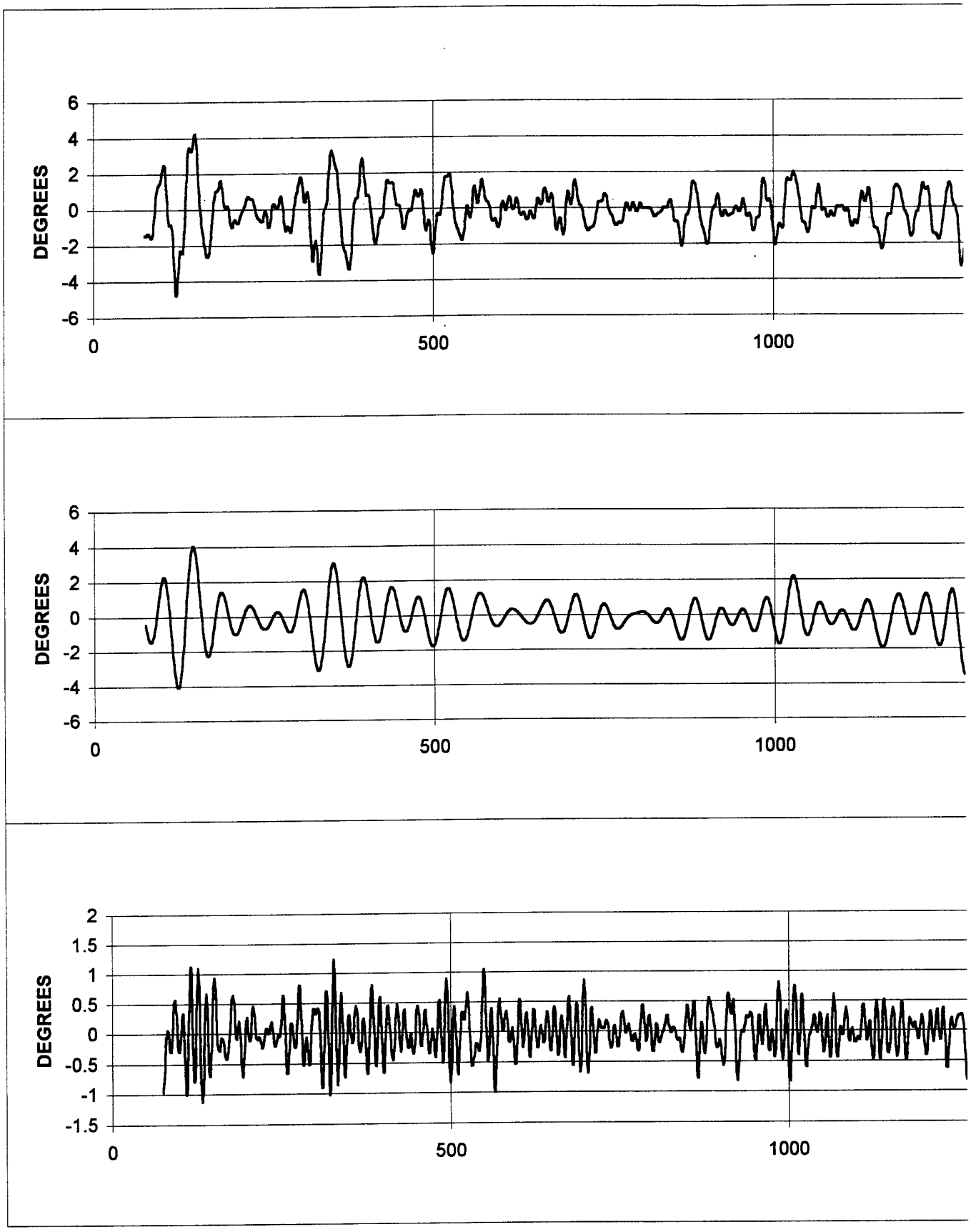
Filtered High Frequency Time History



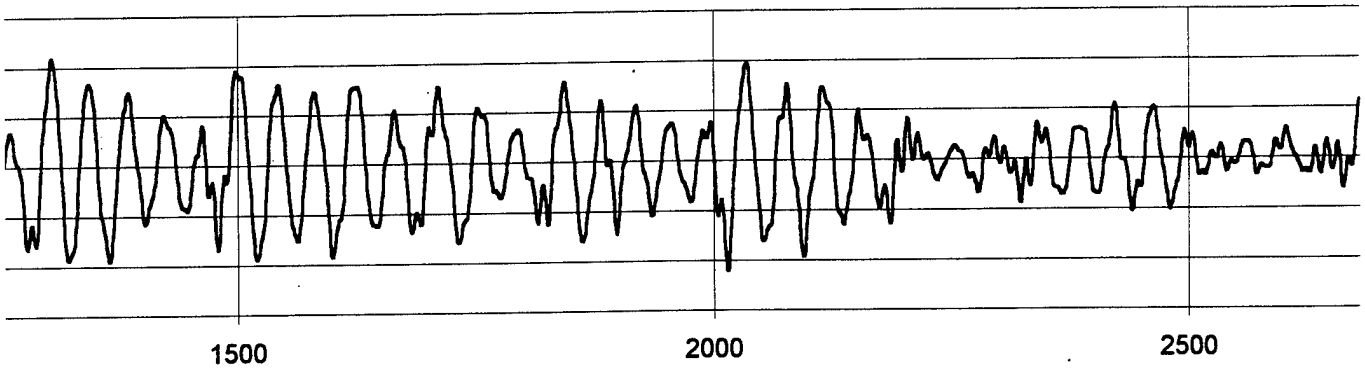
TEST A708 - ML_1 TENSION



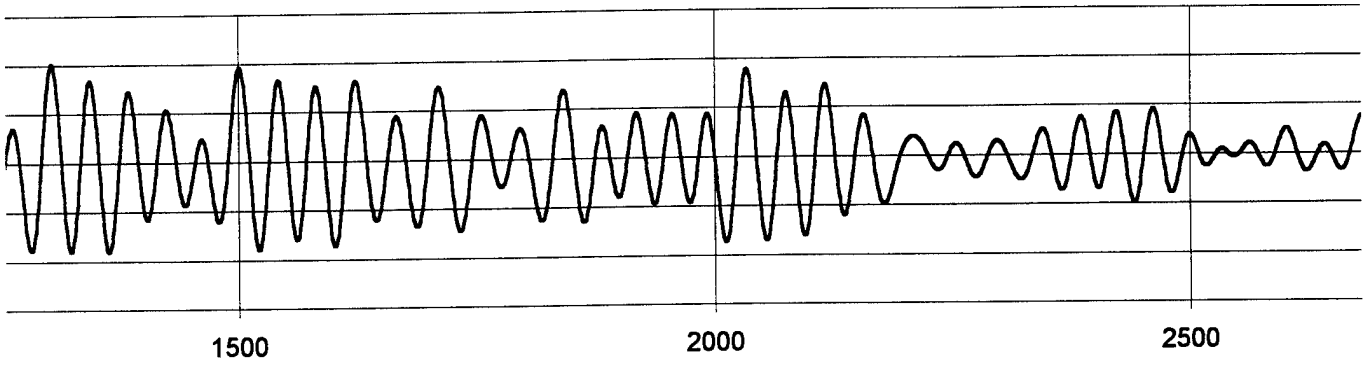
TEST A708 - PITCH



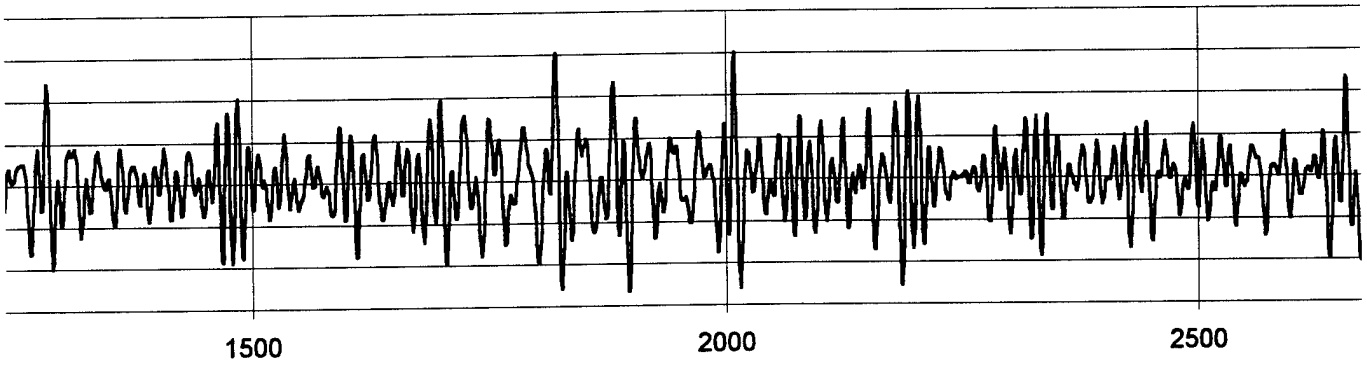
Unfiltered Time History



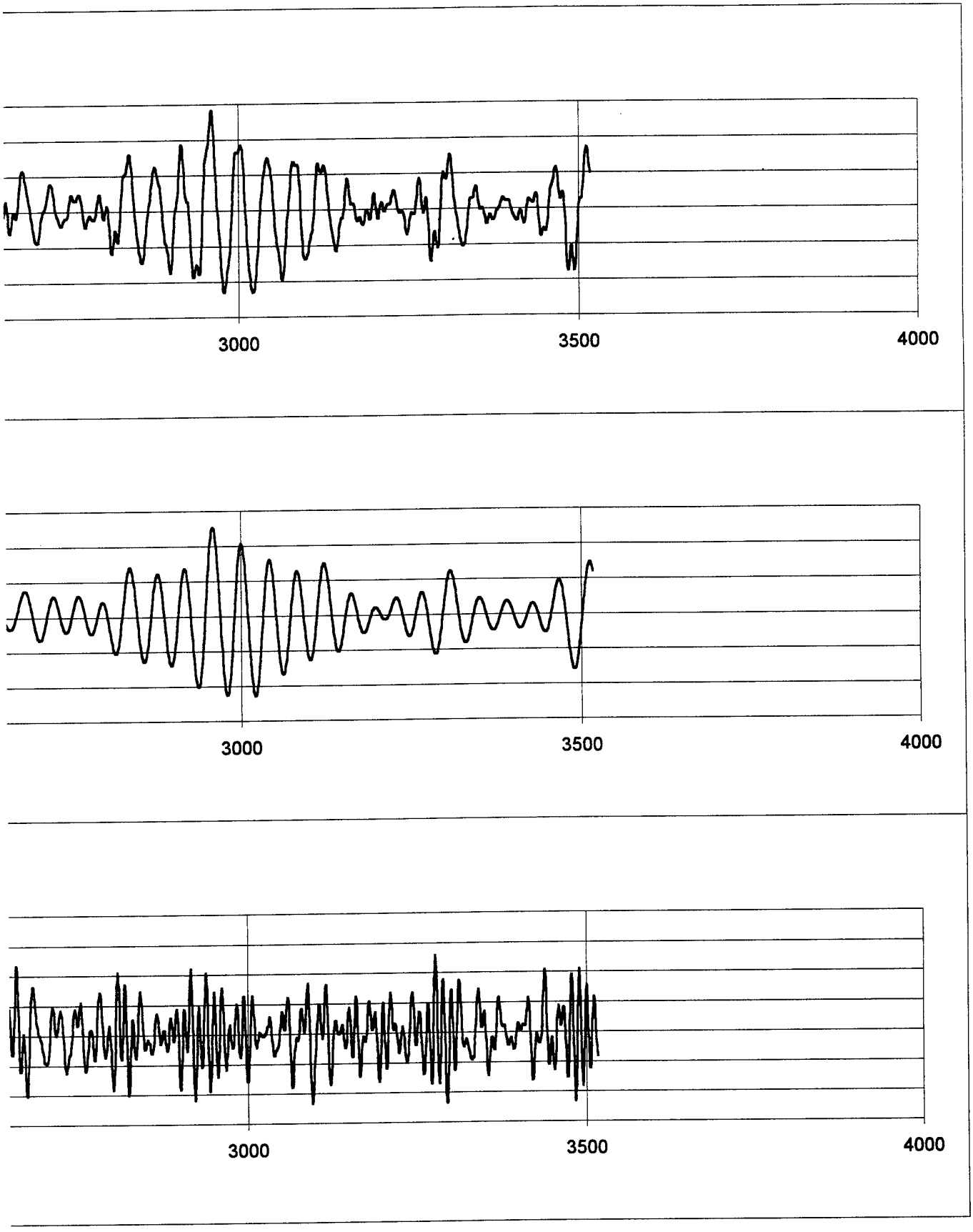
Filtered Low Frequency Time History



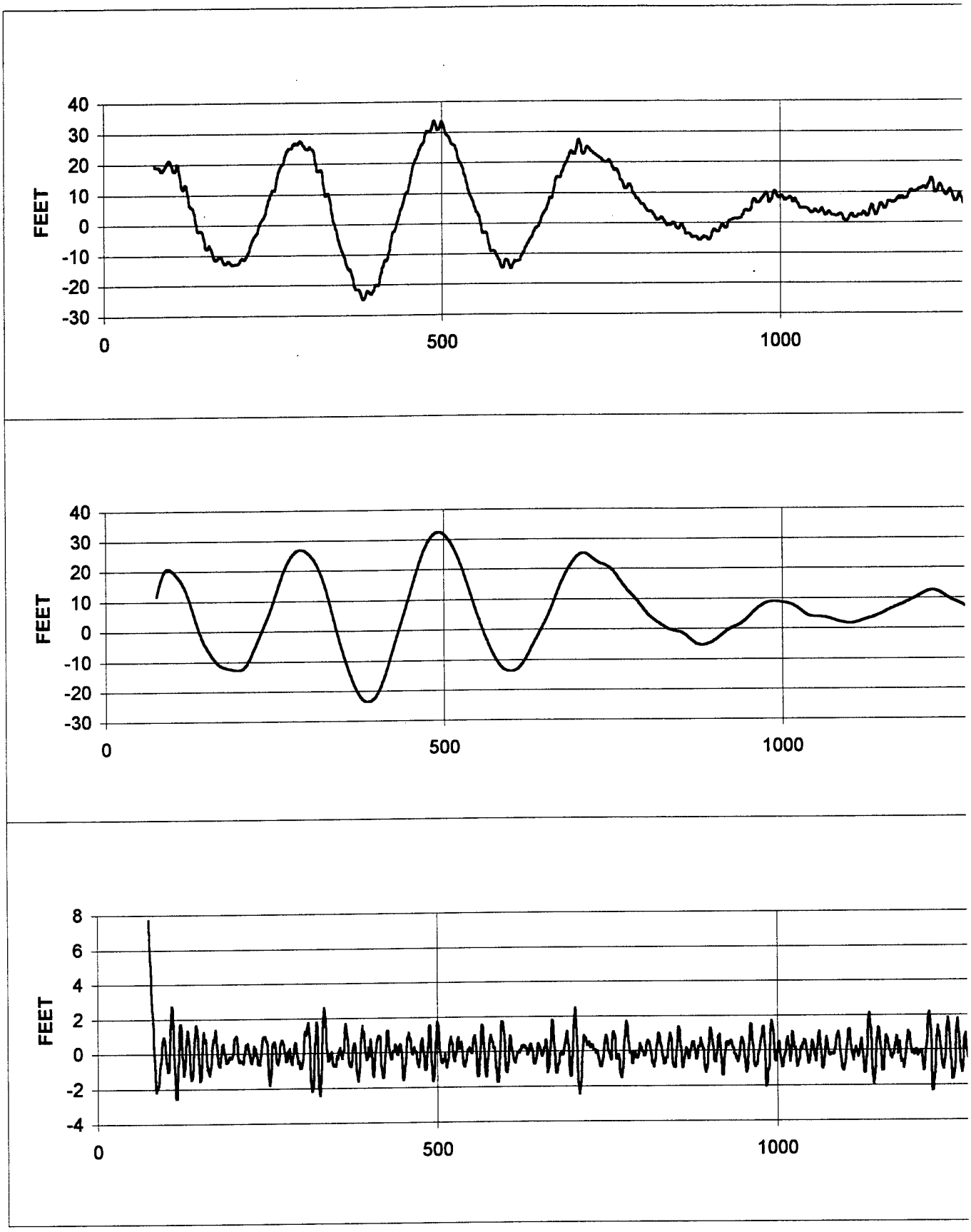
Filtered High Frequency Time History



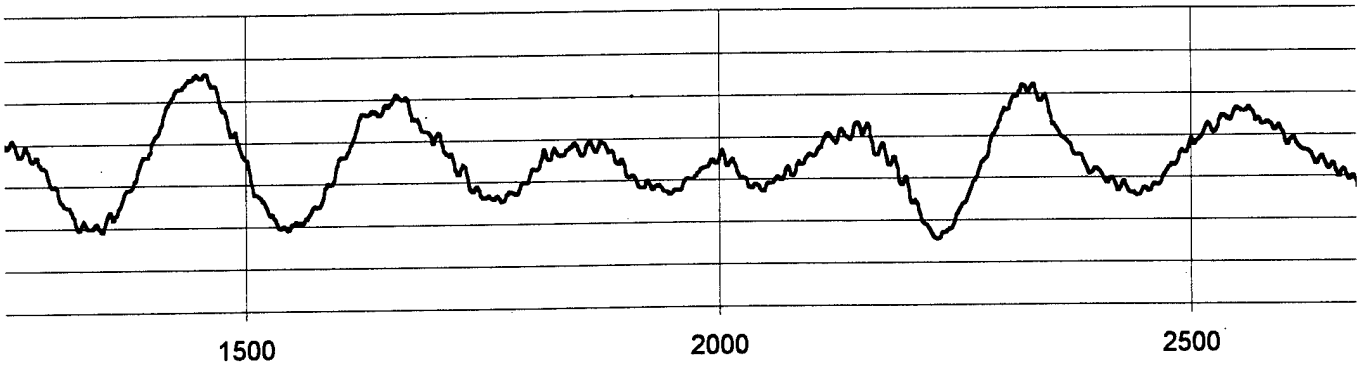
TEST A708 - PITCH



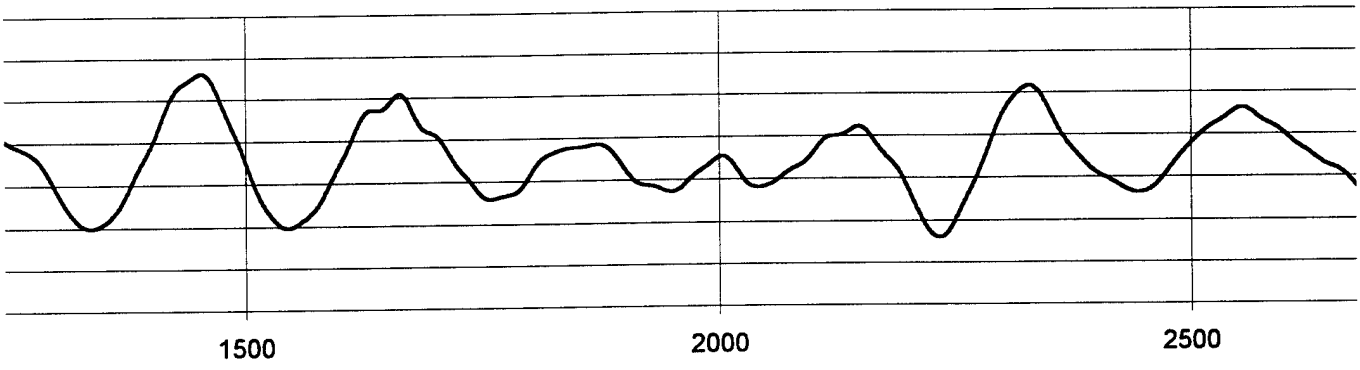
TEST A708 - PT SURGE



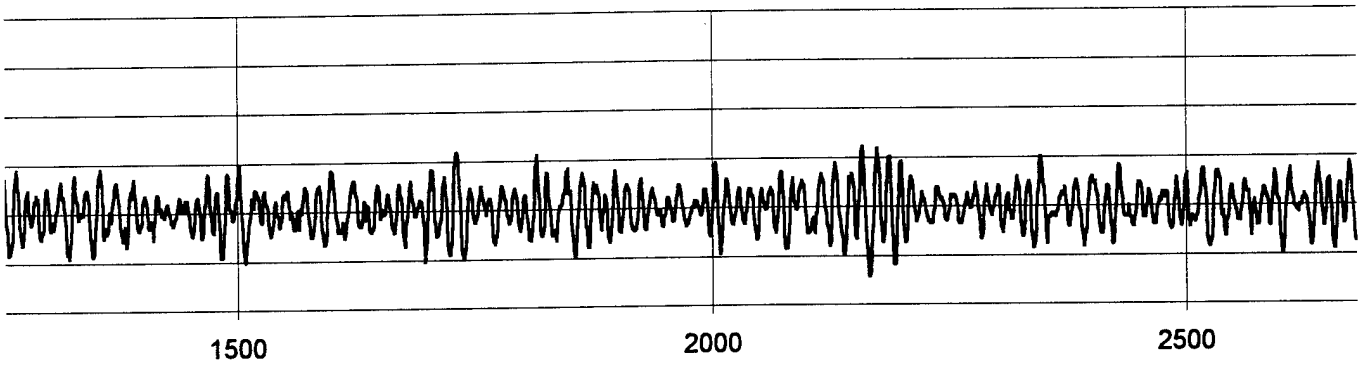
Unfiltered Time History



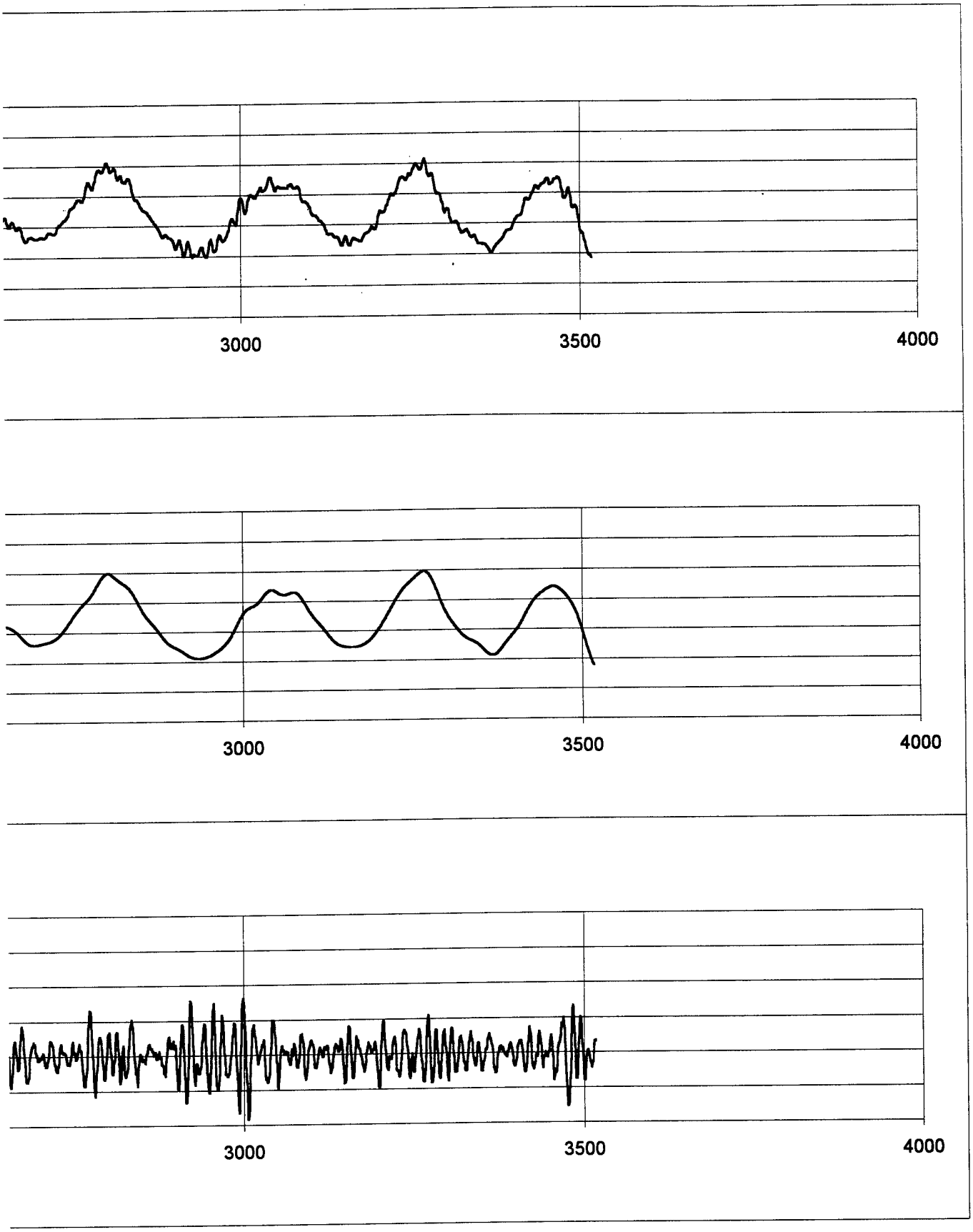
Filtered Low Frequency Time History



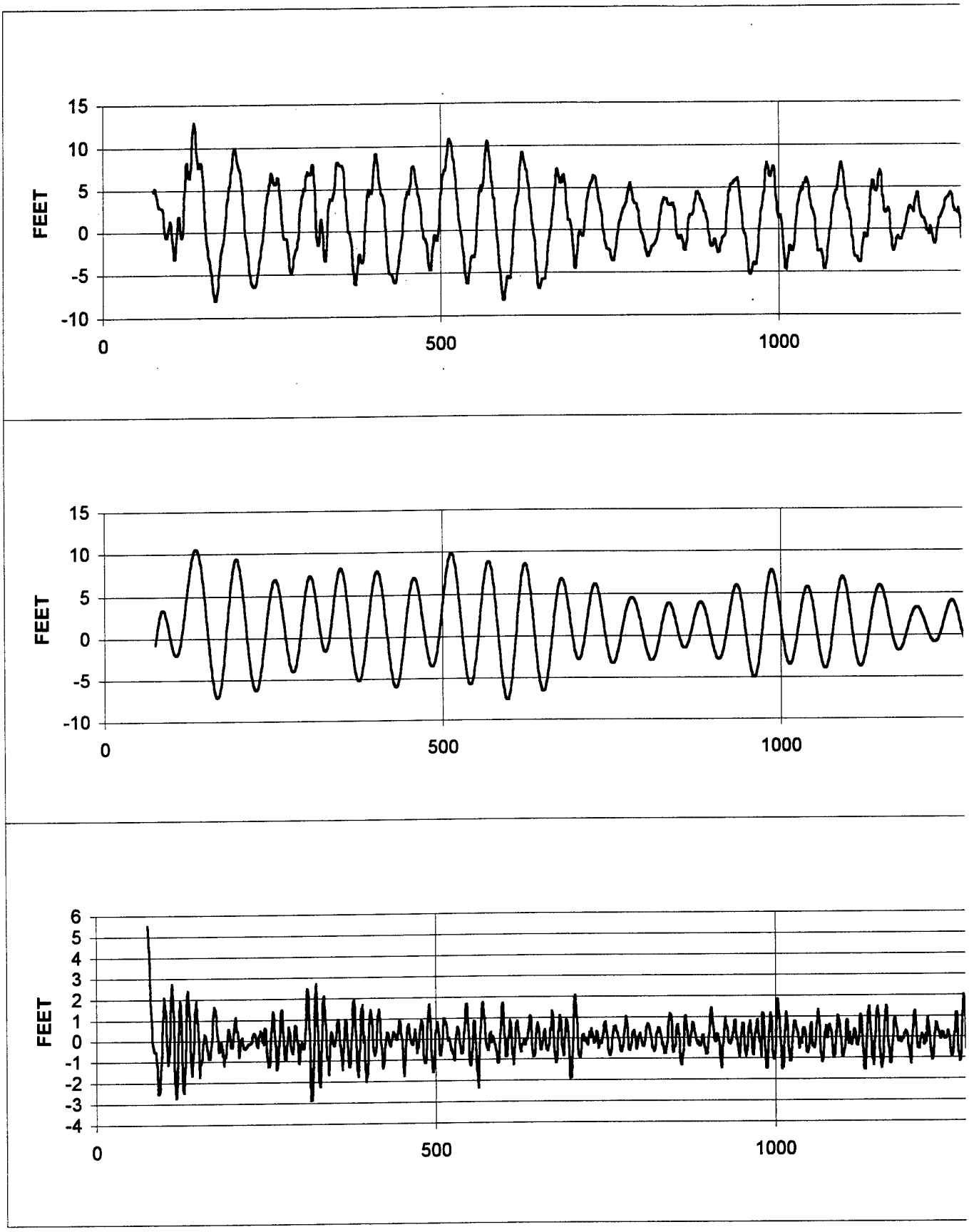
Filtered High Frequency Time History



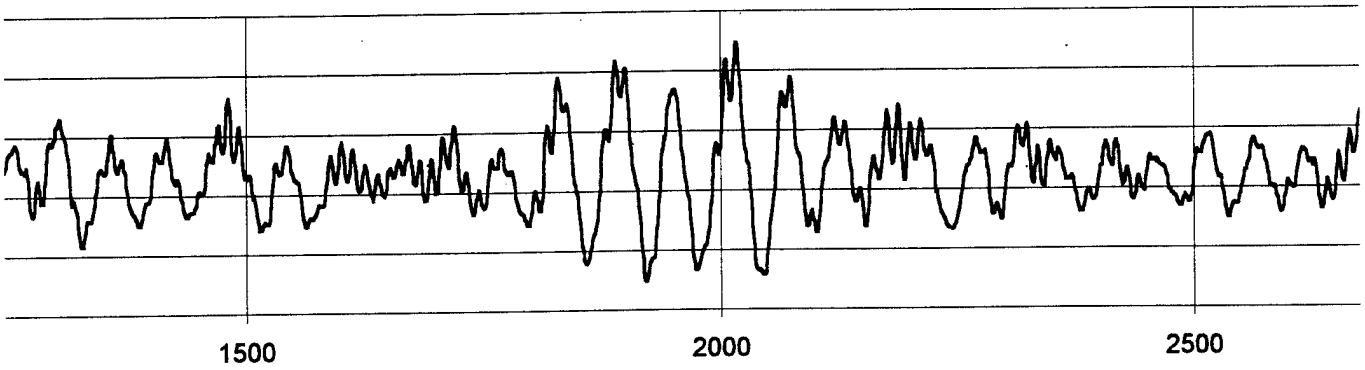
TEST A708 - PT SURGE



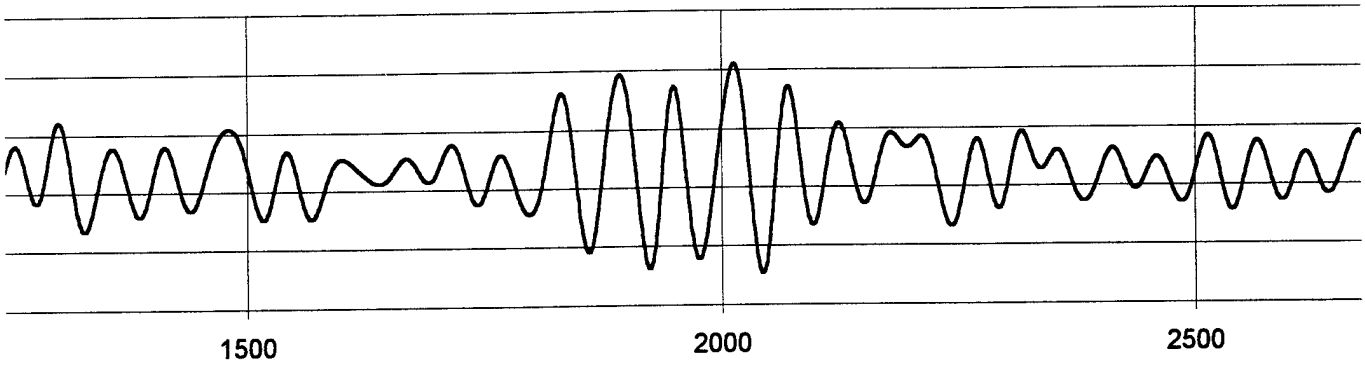
TEST A708 - PT HEAVE



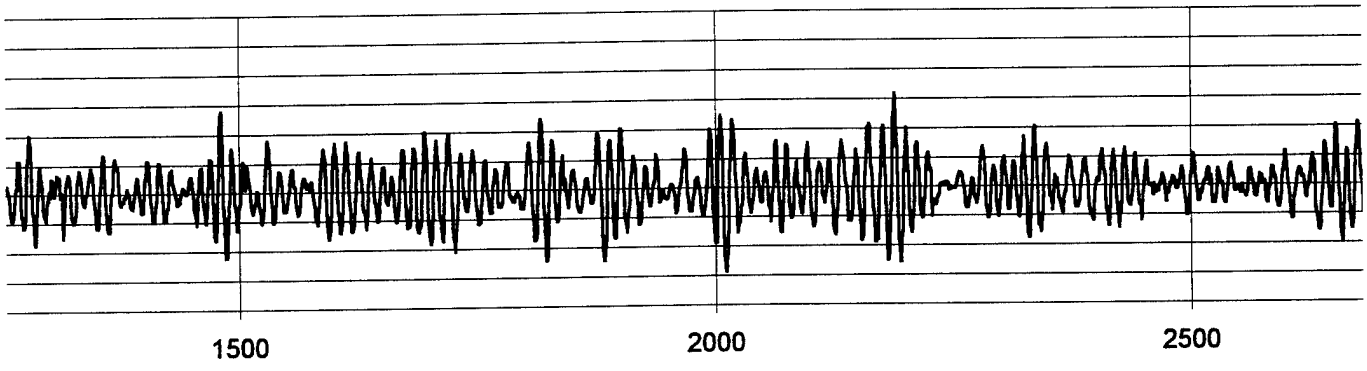
Unfiltered Time History



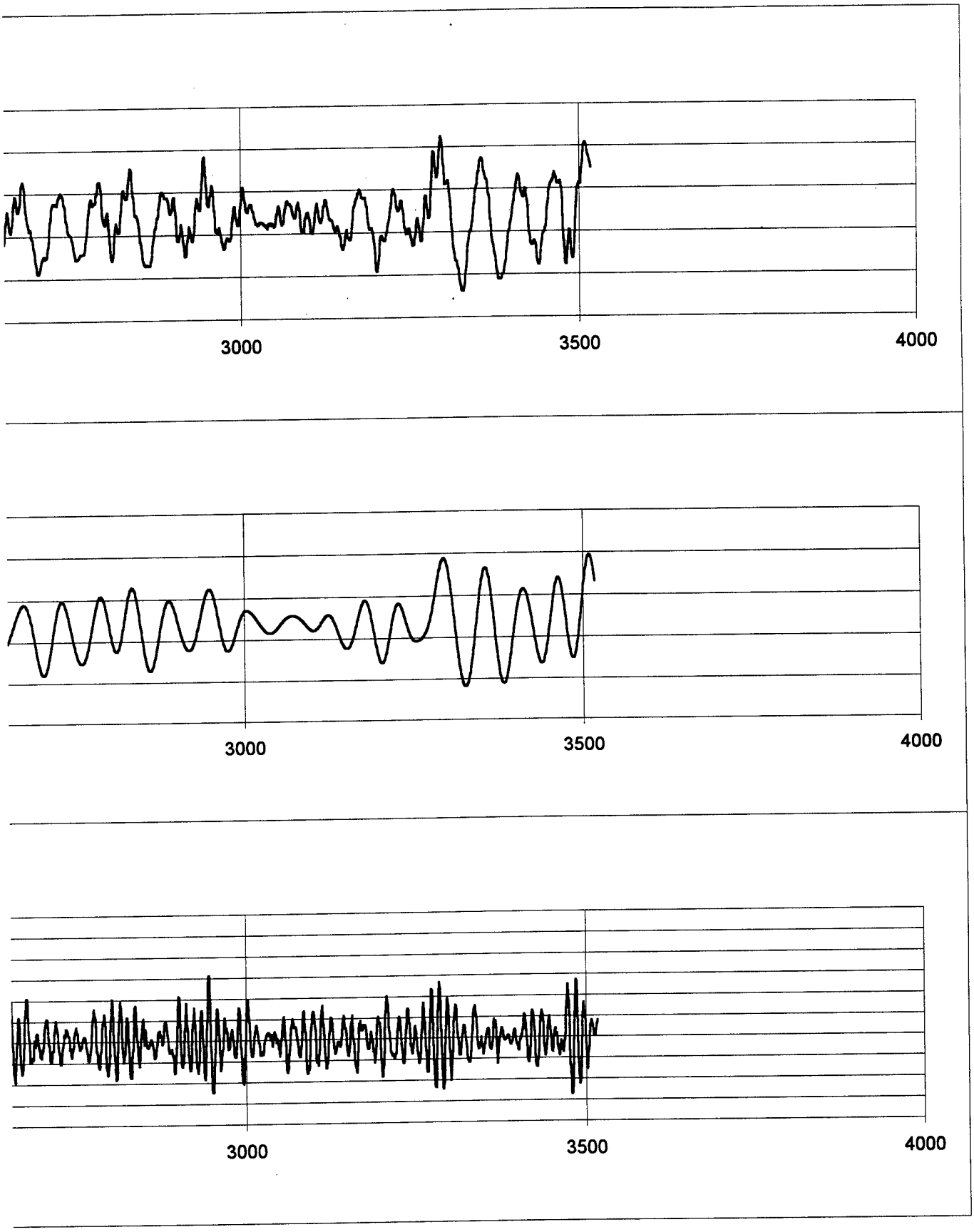
Filtered Low Frequency Time History



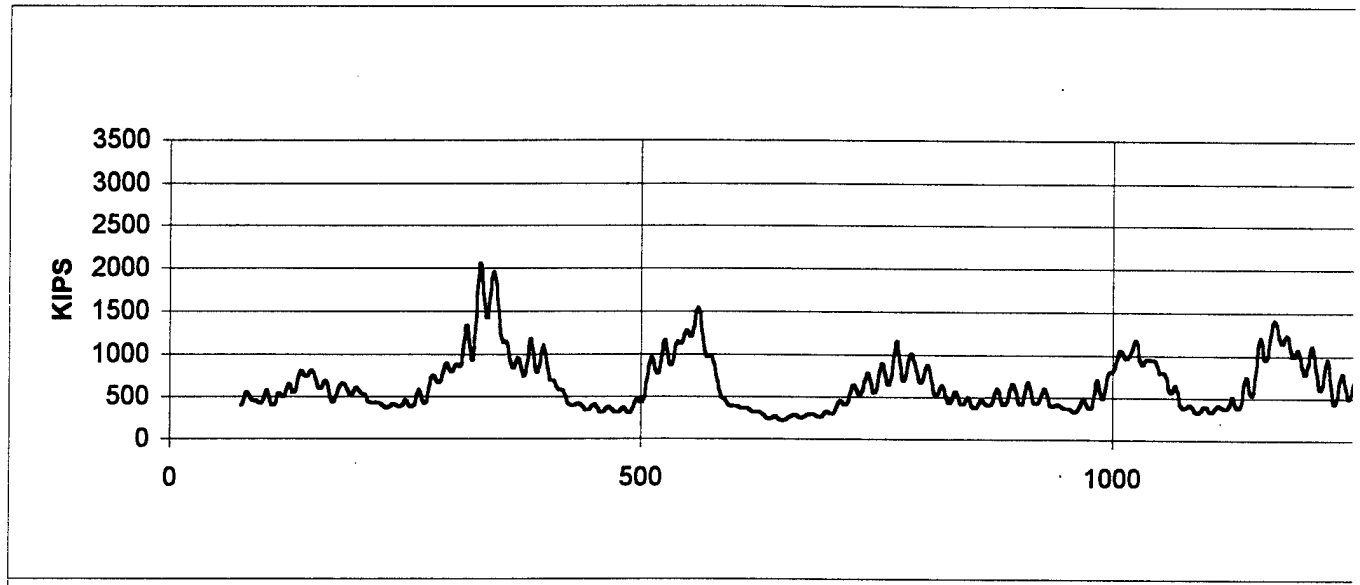
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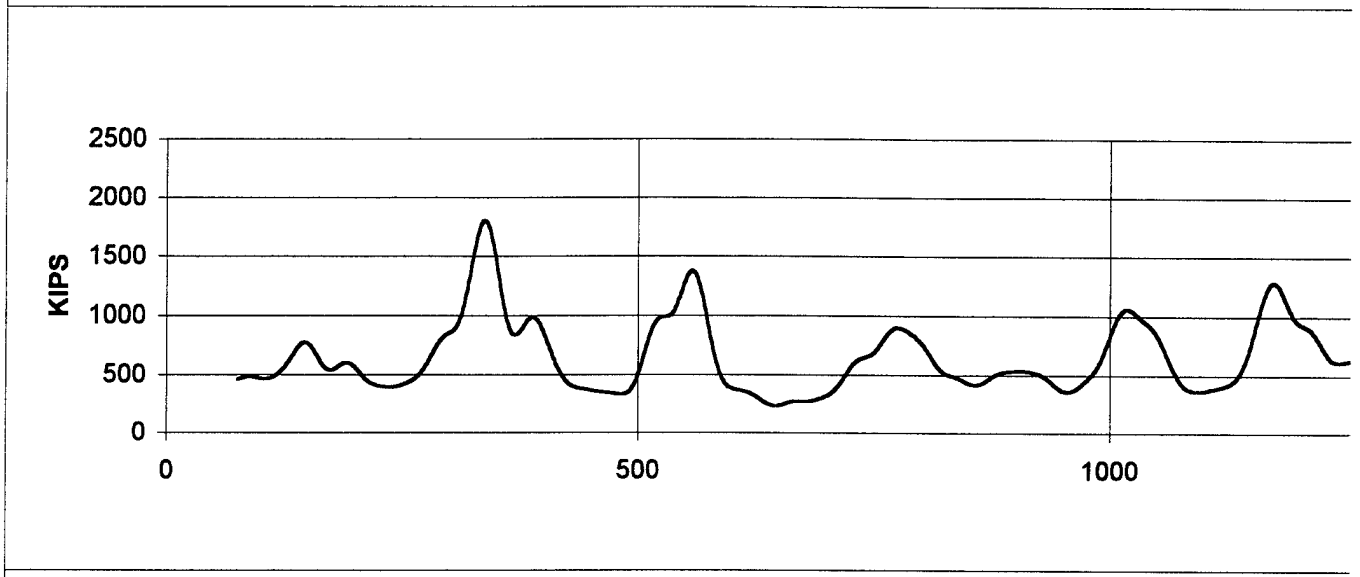


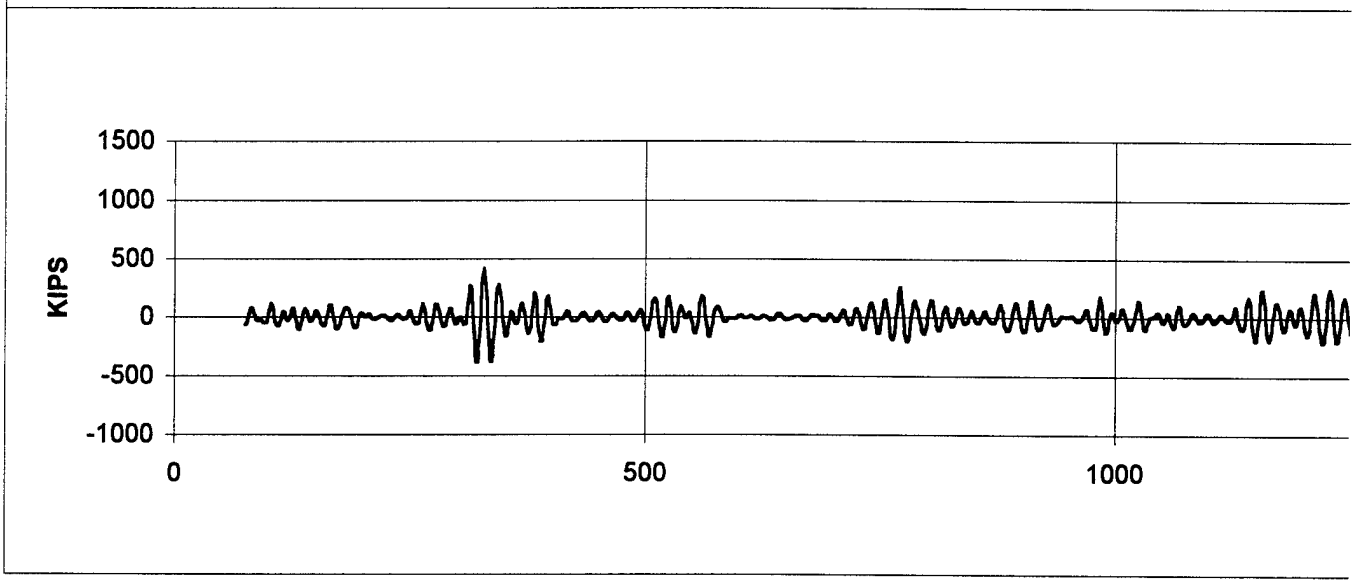
TEST A708 - PT HEAVE



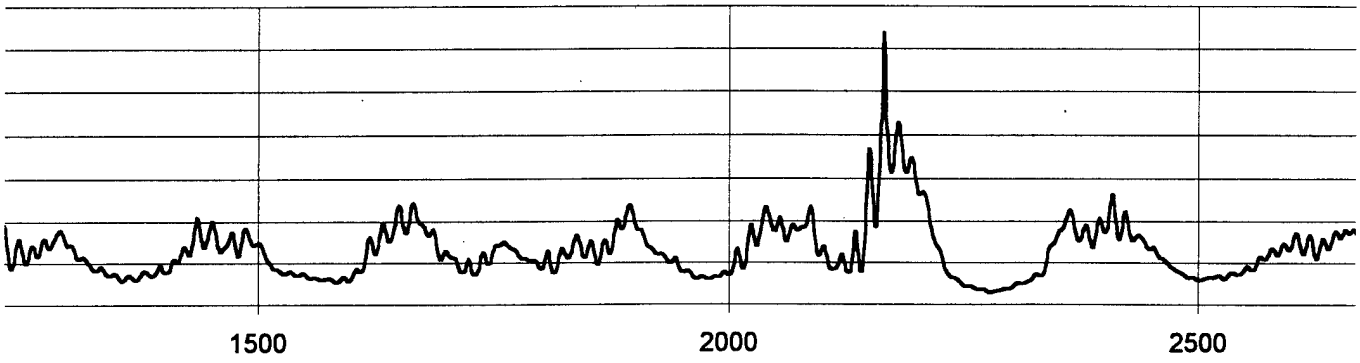
TEST A709 - ML_1 TENSION



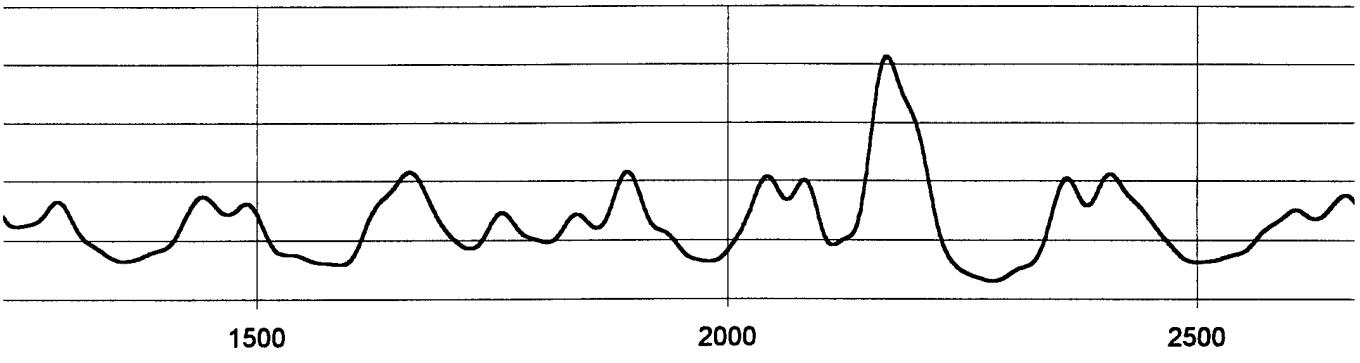




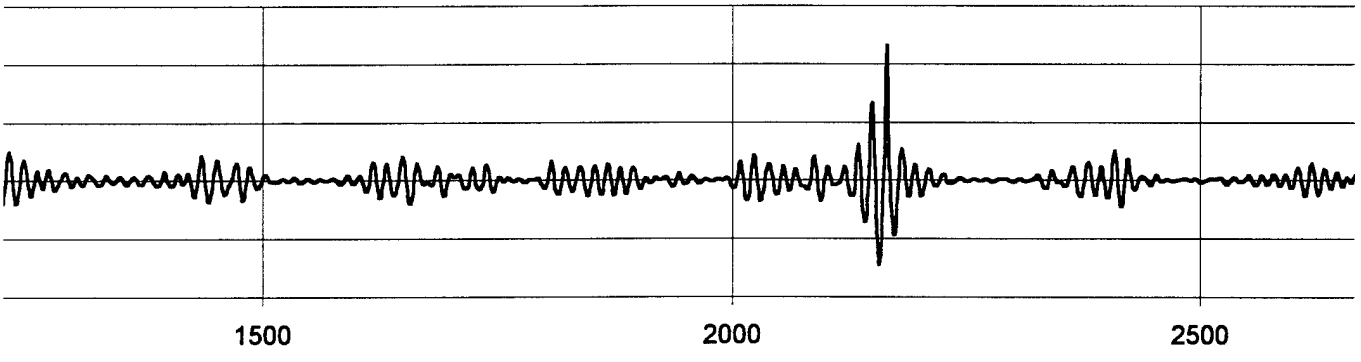
Unfiltered Time History



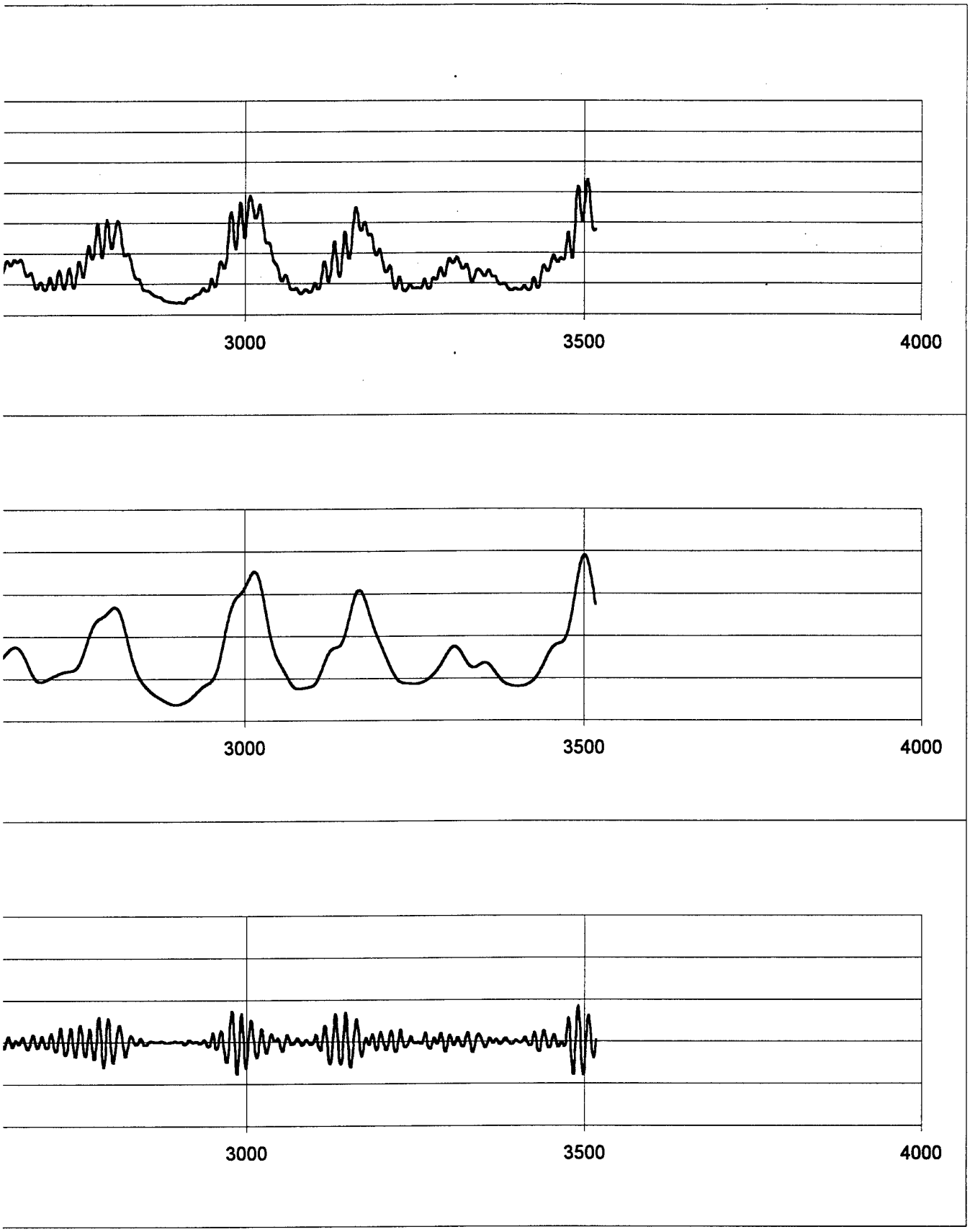
Filtered Low Frequency Time History



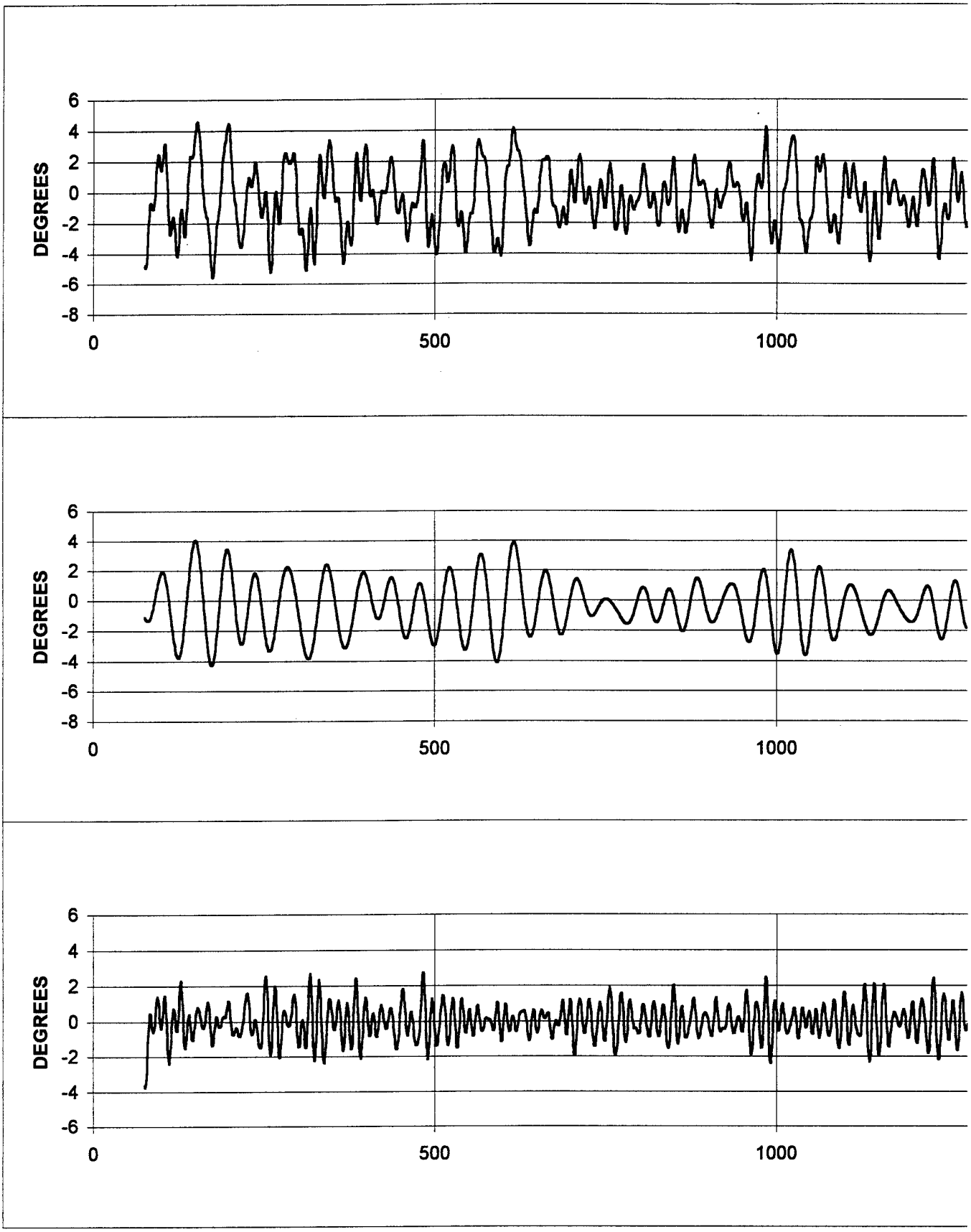
Filtered High Frequency Time History



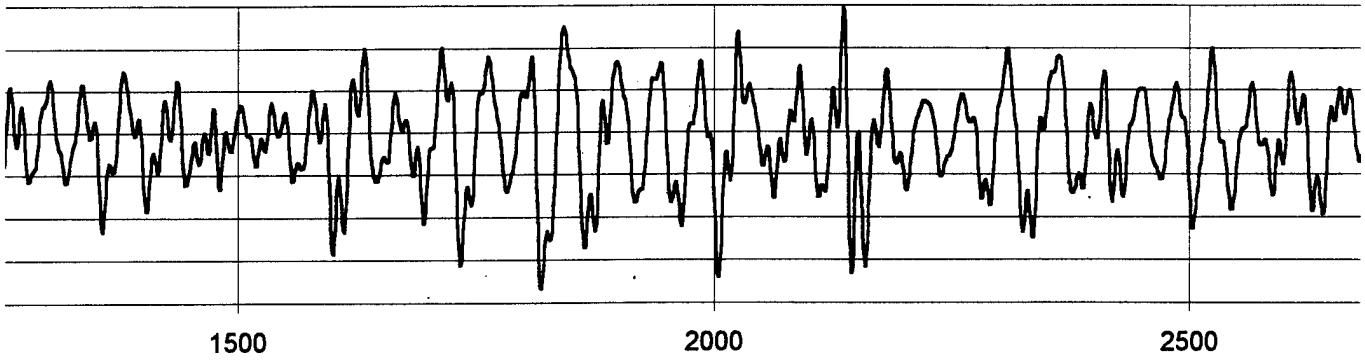
TEST A709 - ML_1 TENSION



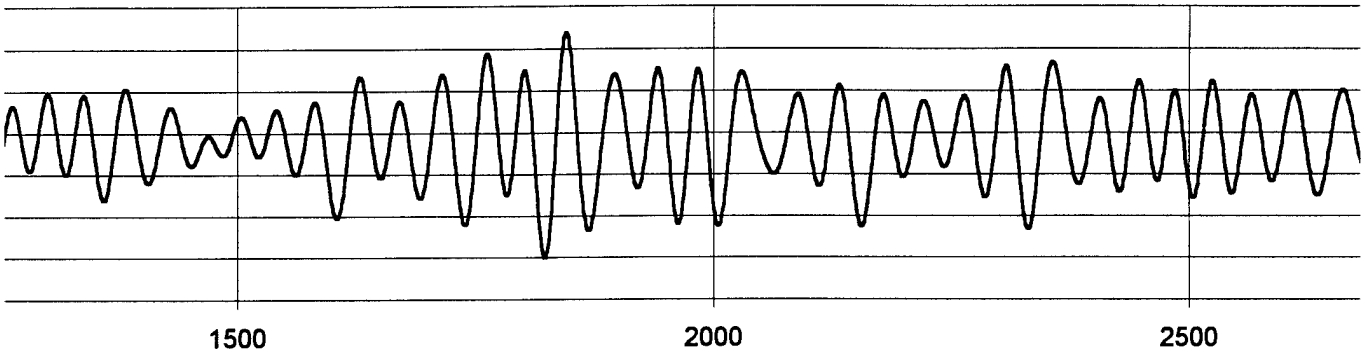
TEST A709 - PITCH



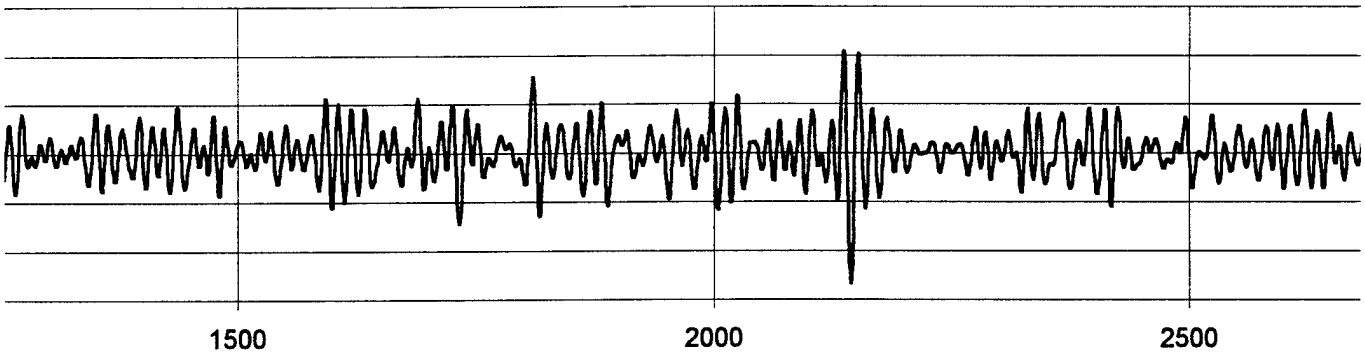
Unfiltered Time History



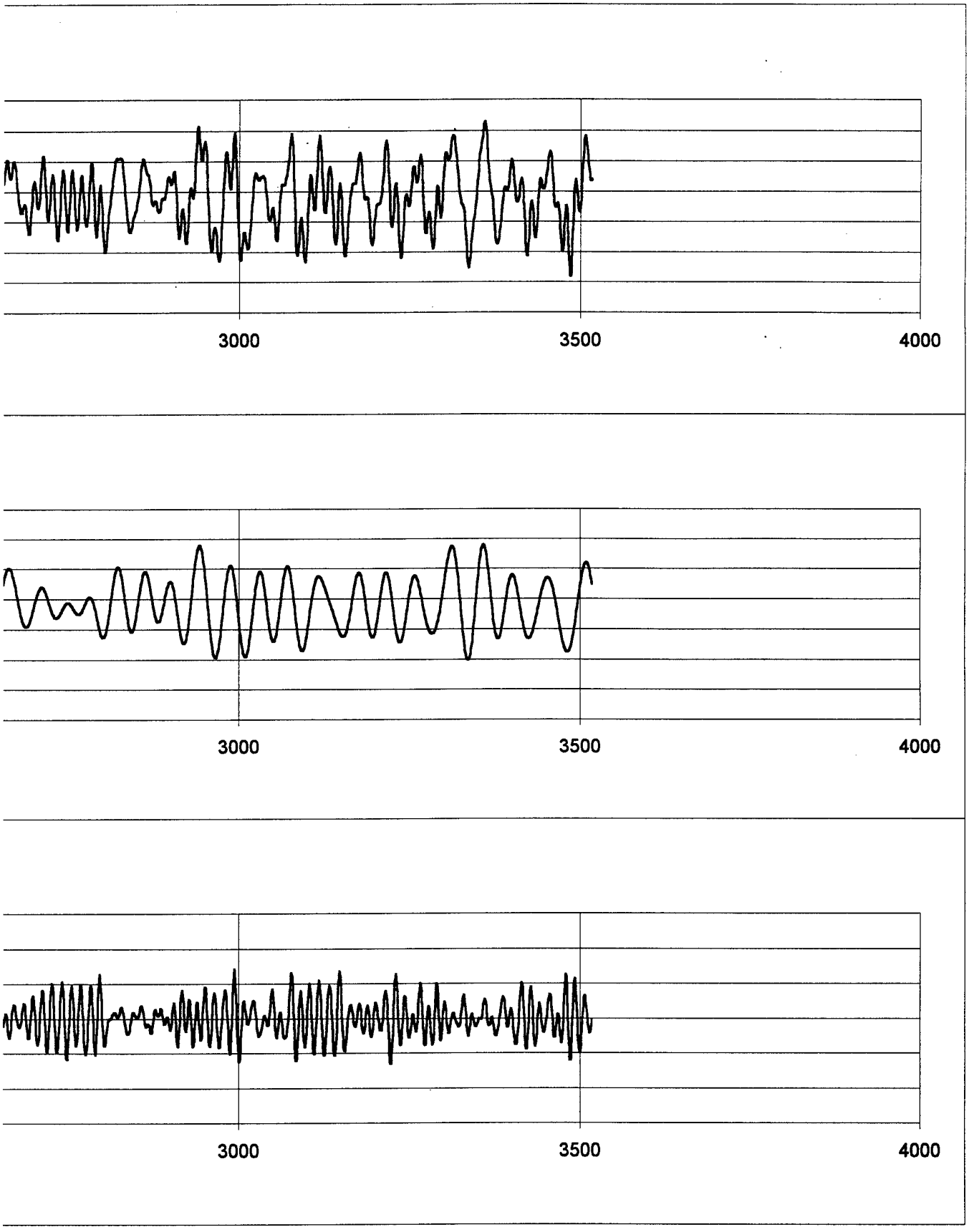
Filtered Low Frequency Time History



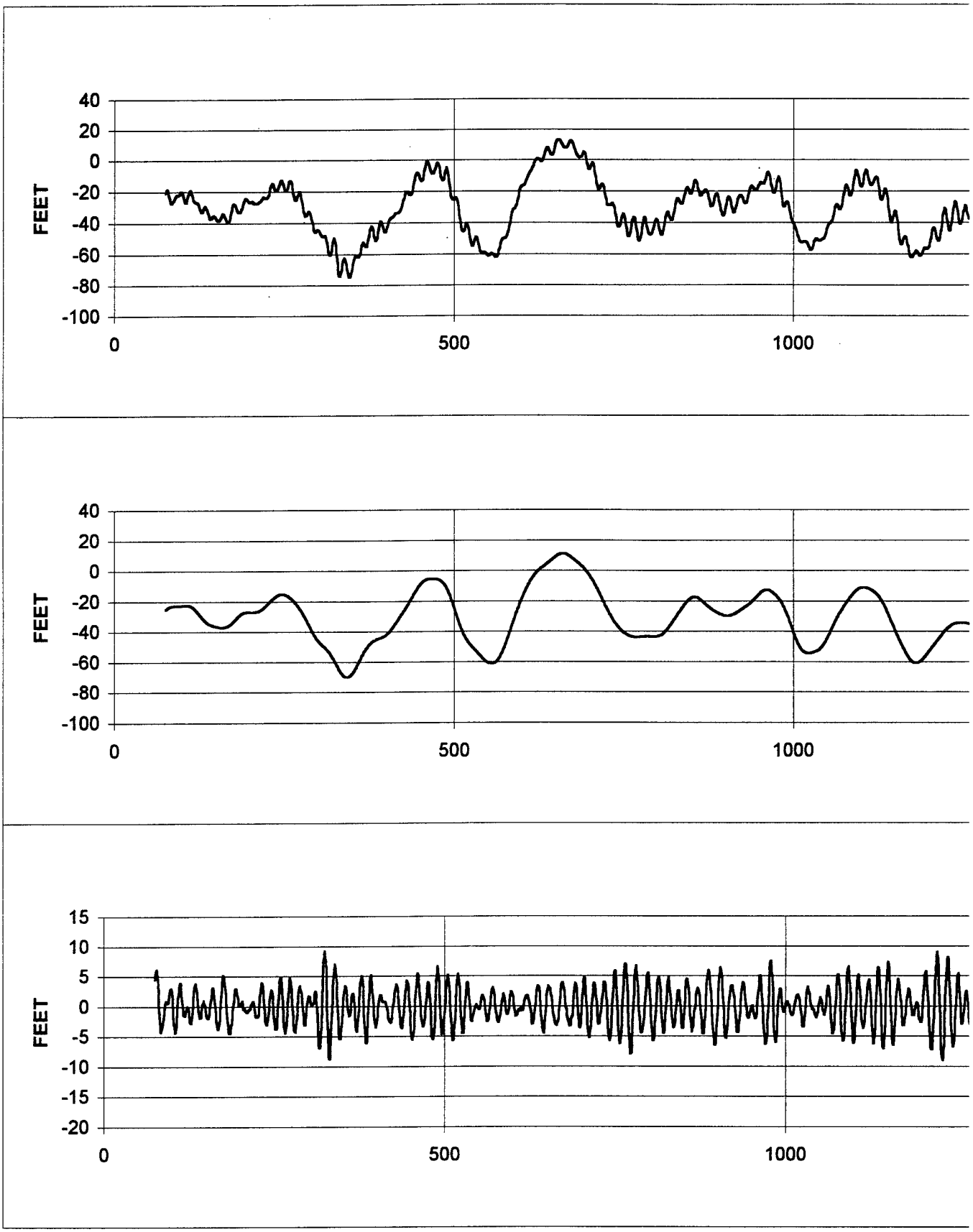
Filtered High Frequency Time History



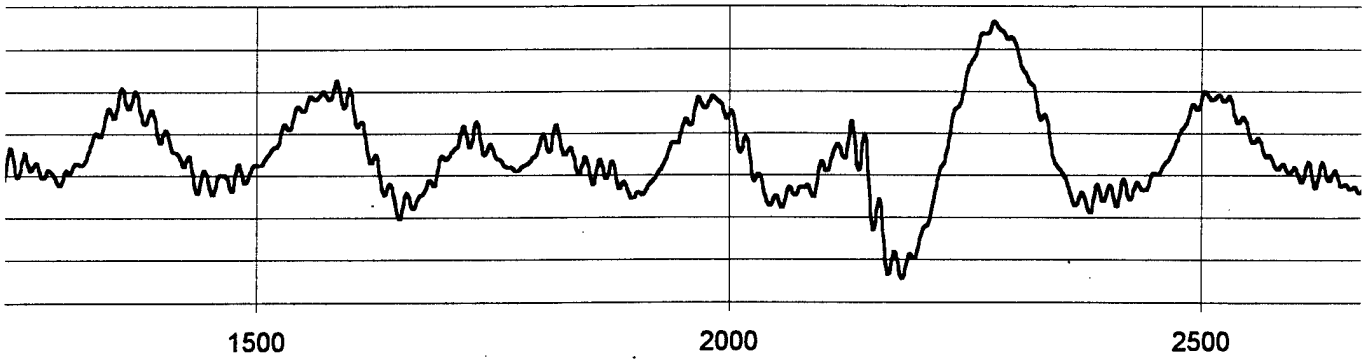
TEST A709 - PITCH



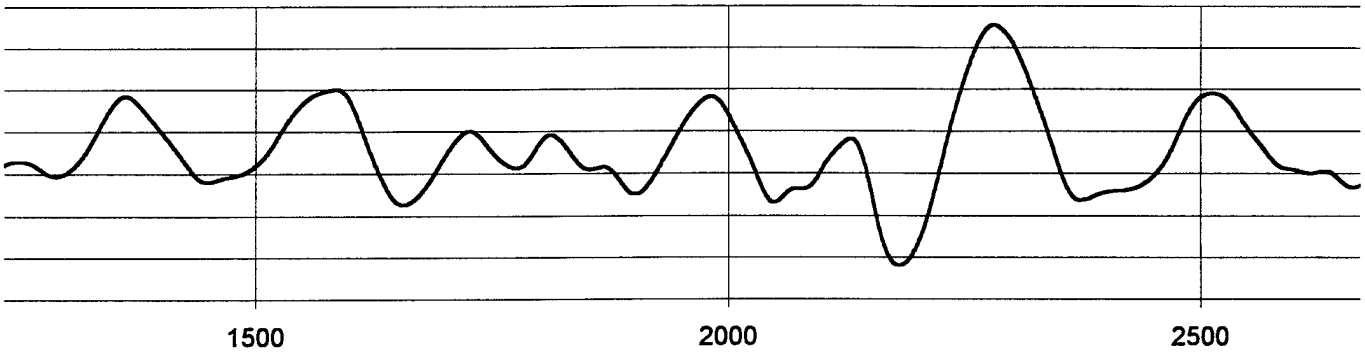
TEST A709 - PT SURGE



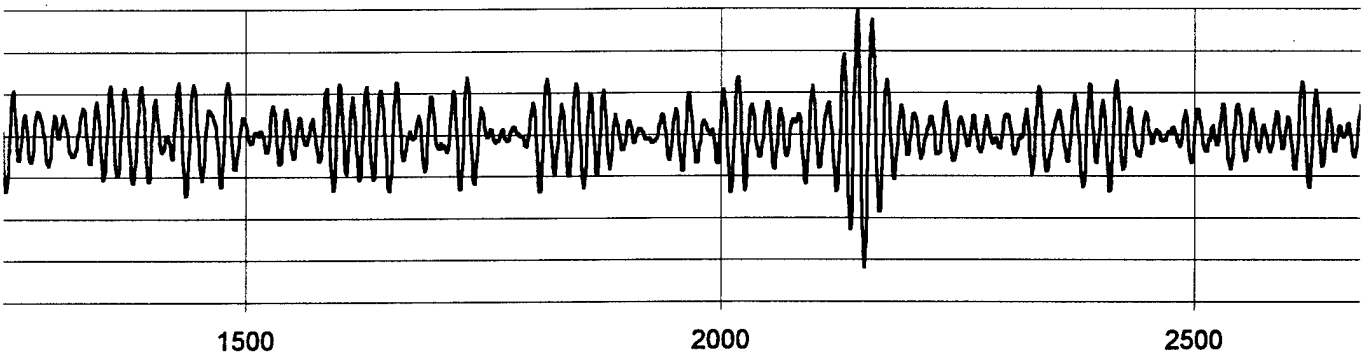
Unfiltered Time History



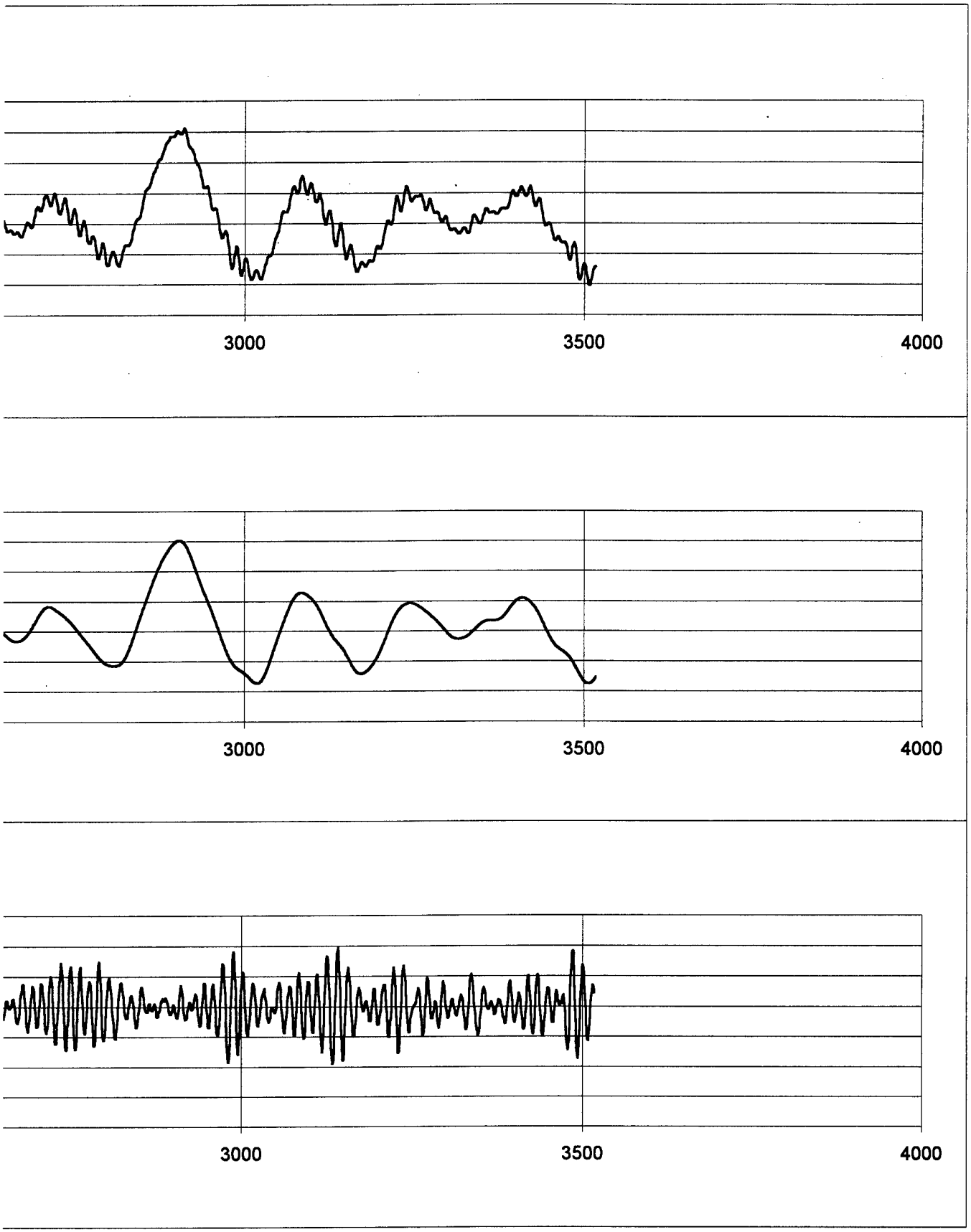
Filtered Low Frequency Time History



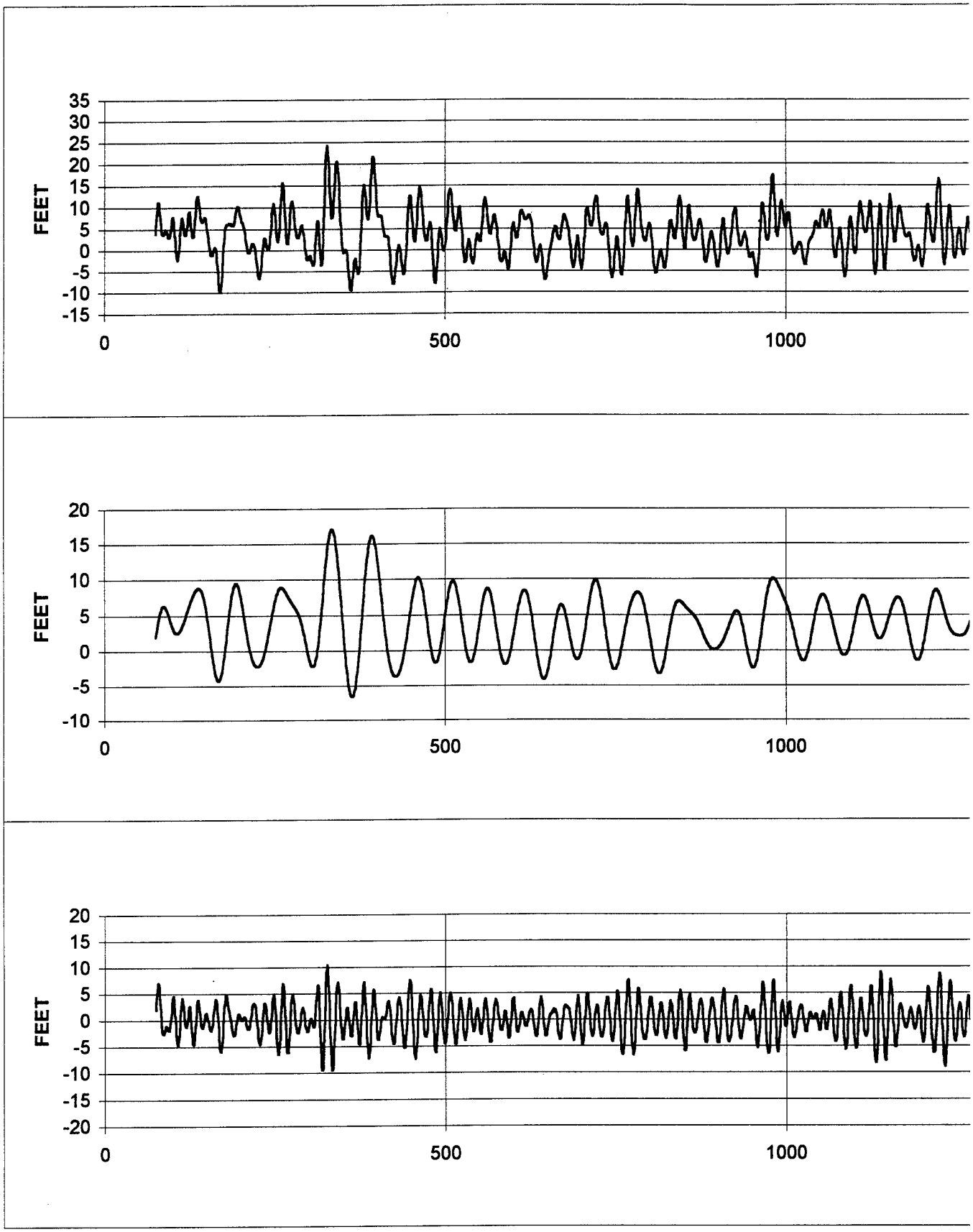
Filtered High Frequency Time History



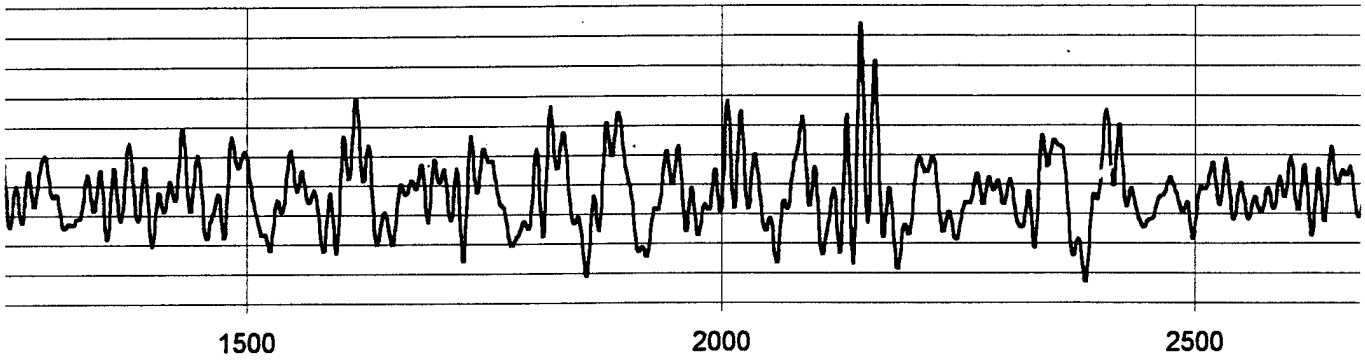
TEST A709 - PT SURGE



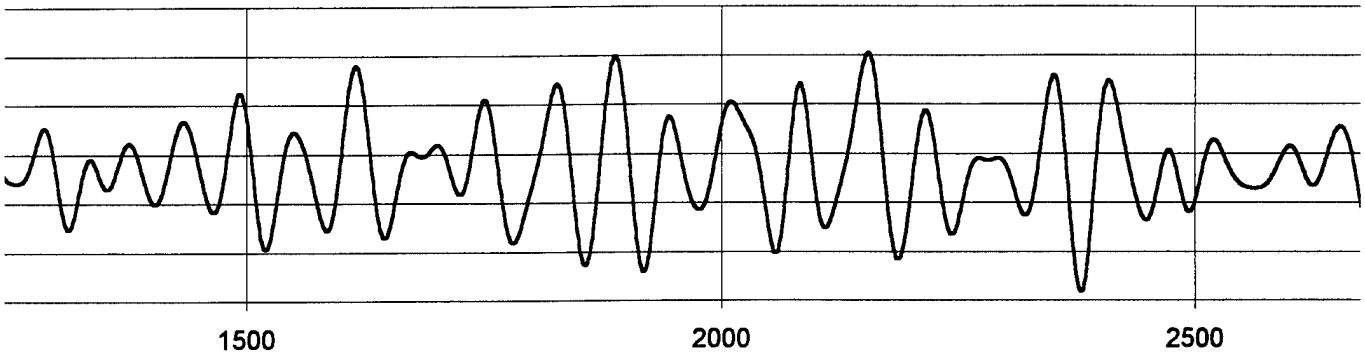
TEST A709 - PT HEAVE



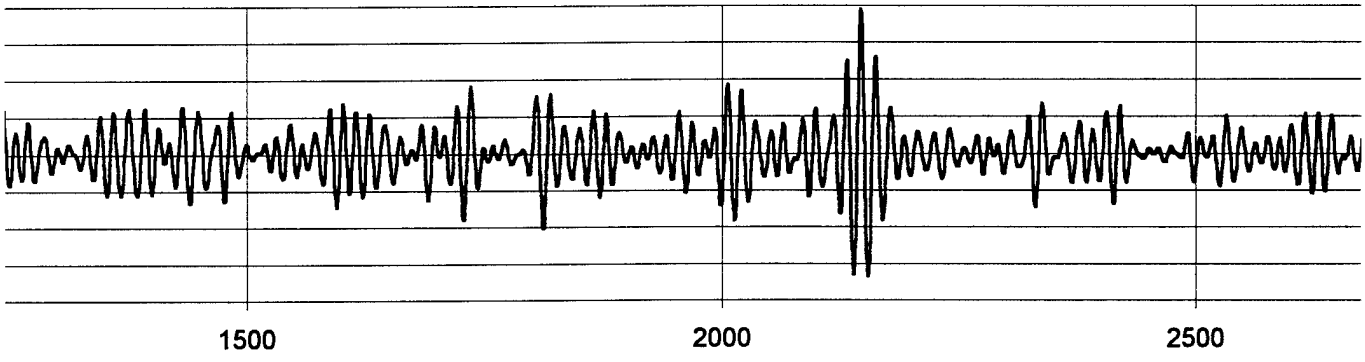
Unfiltered Time History



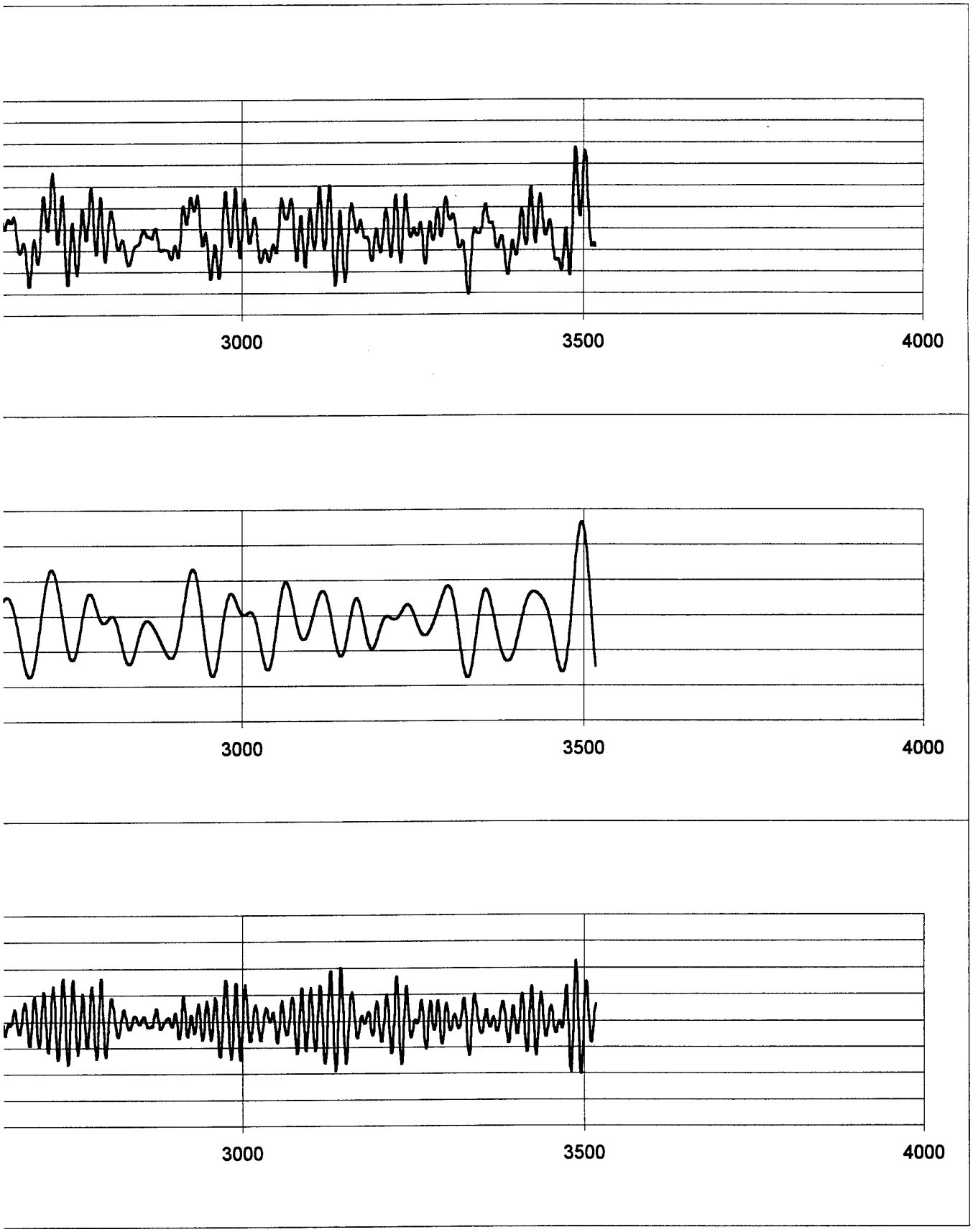
Filtered Low Frequency Time History



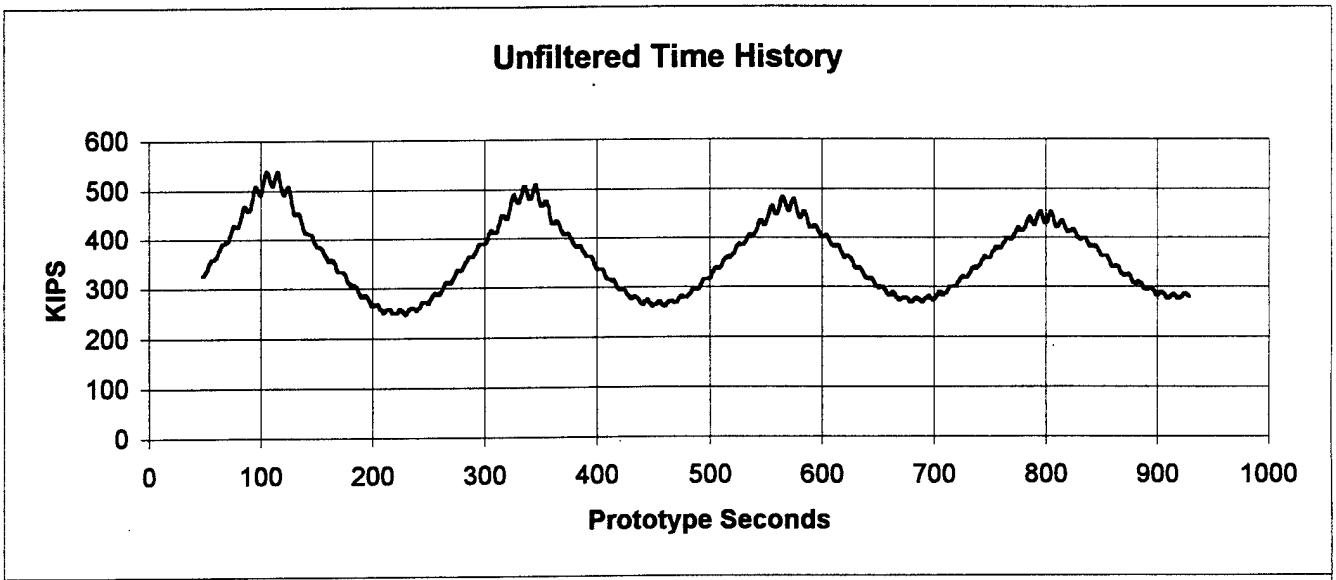
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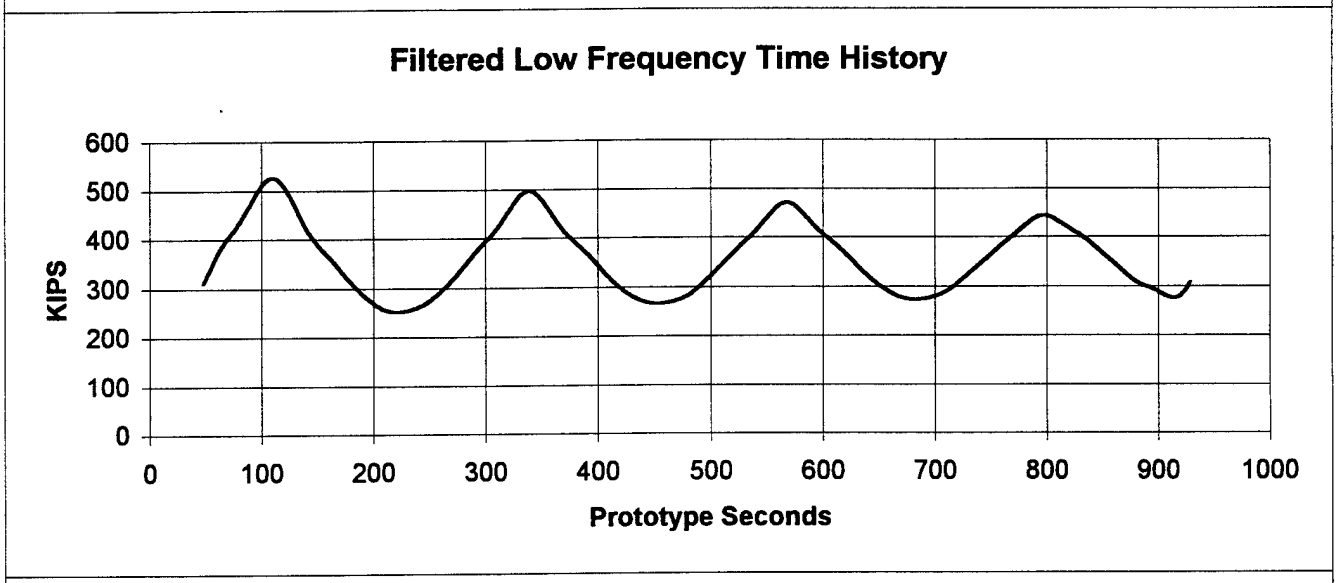


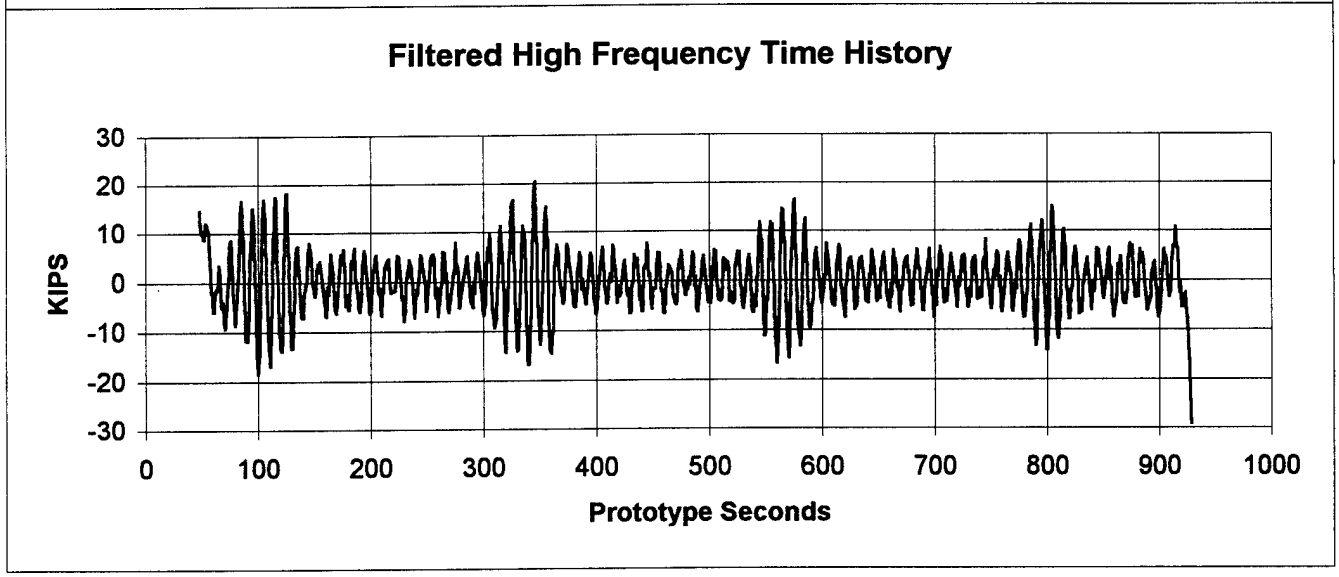
TEST A709 - PT HEAVE

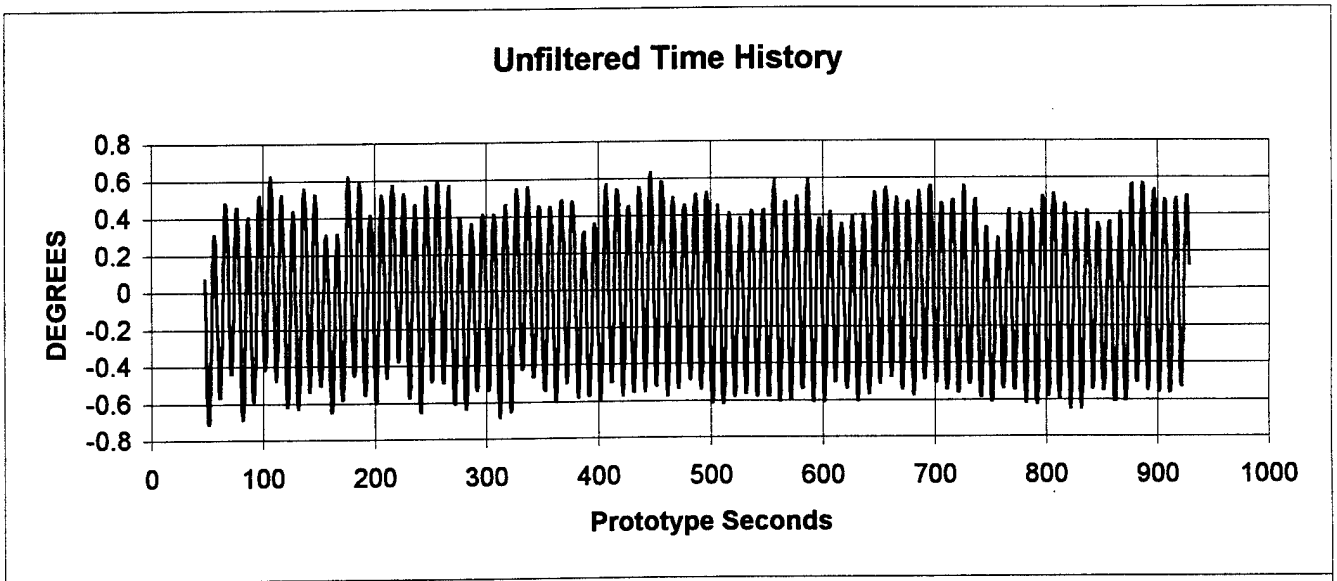


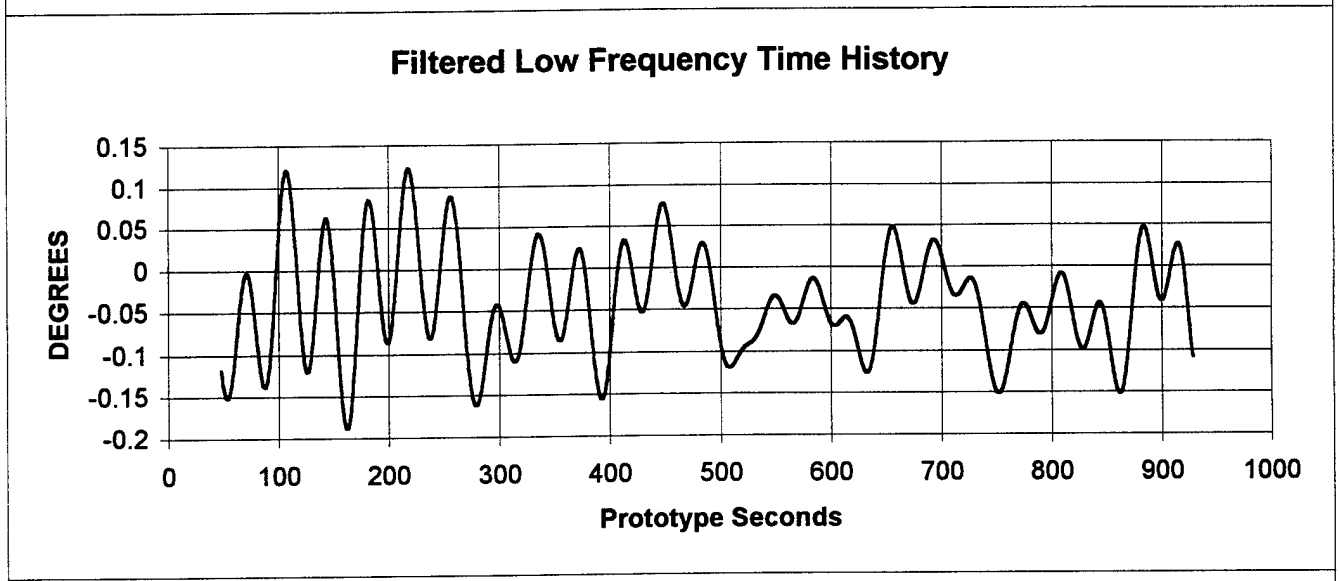
TEST A803 - ML_1 TENSION

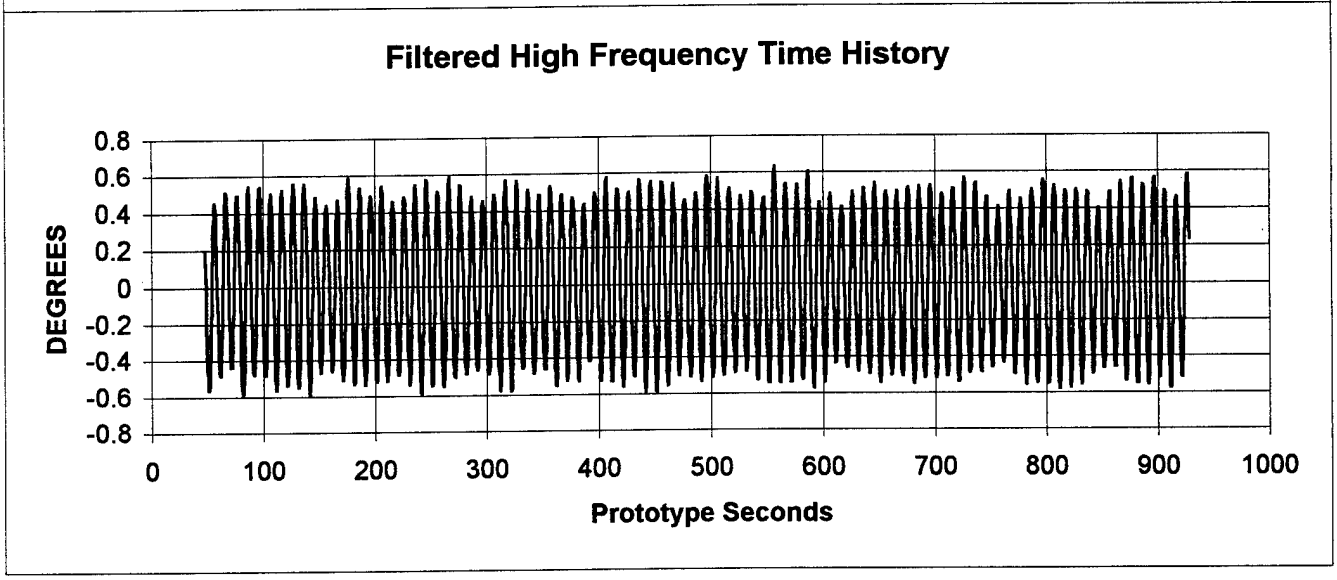




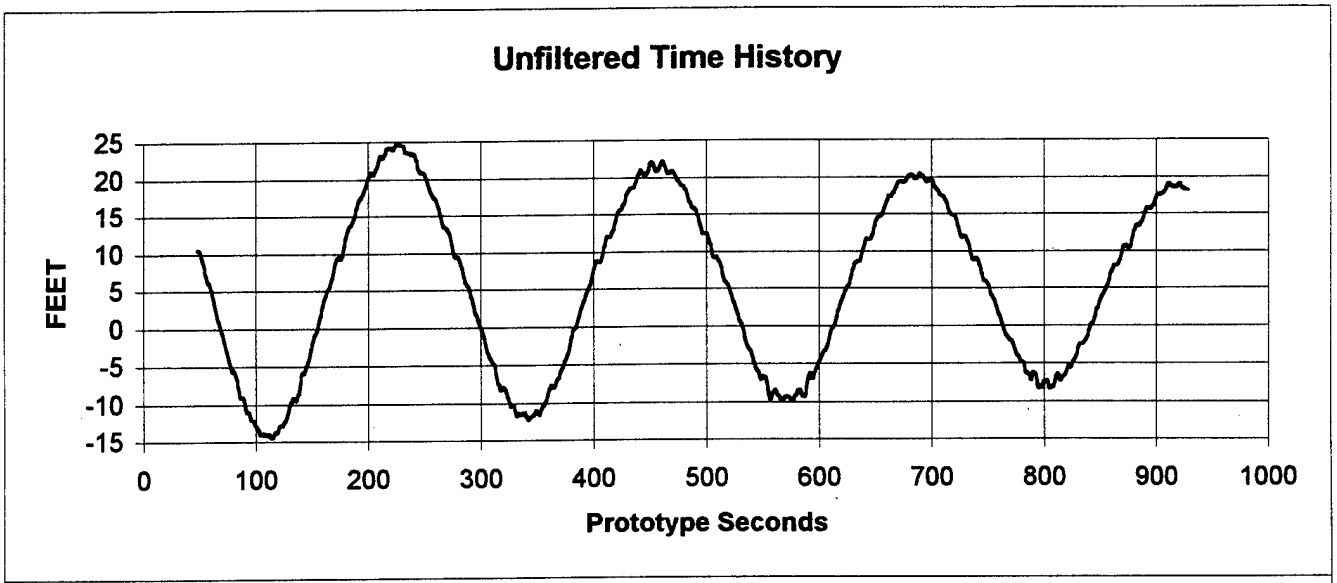


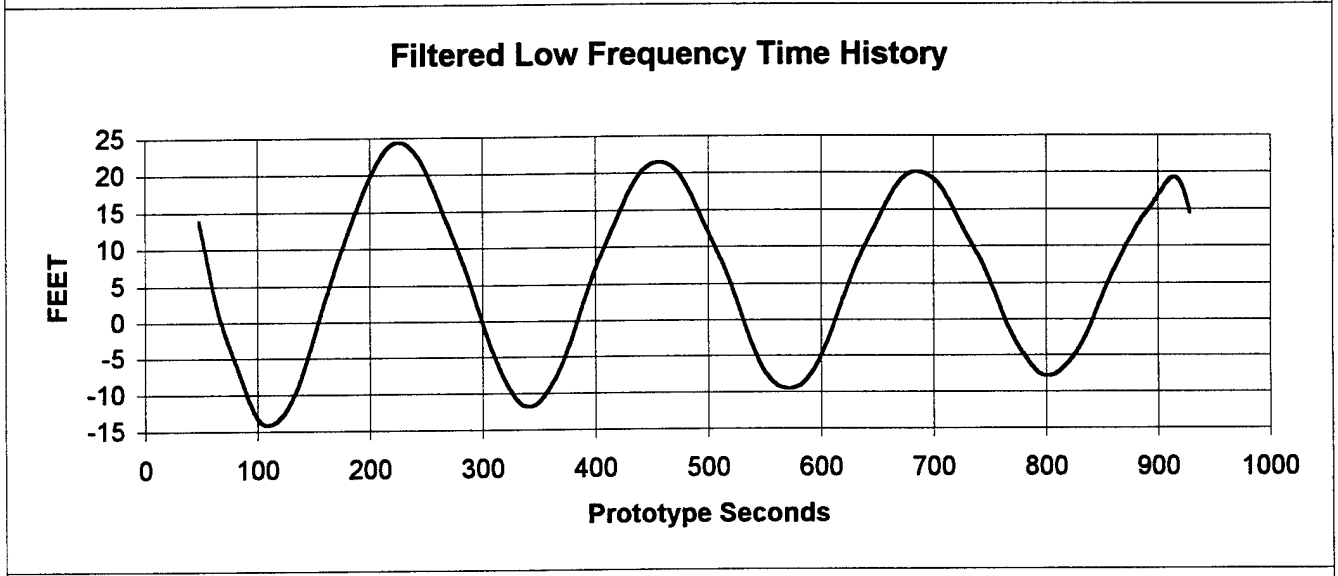

Unfiltered Time History
DEGREES
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
0
100
200
300
400
500
600
700
800
900
1000
Prototype Seconds

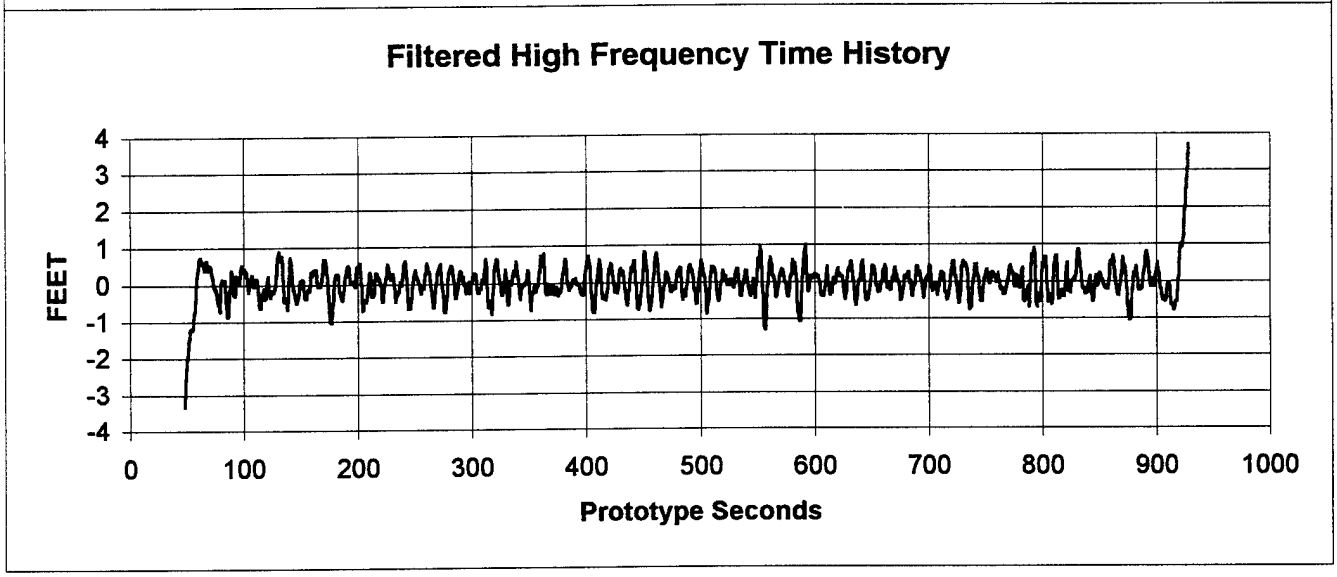

Filtered Low Frequency Time History
DEGREES
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
0
100
200
300
400
500
600
700
800
900
1000
Prototype Seconds


Filtered High Frequency Time History
DEGREES
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
0
100
200
300
400
500
600
700
800
900
1000
Prototype Seconds

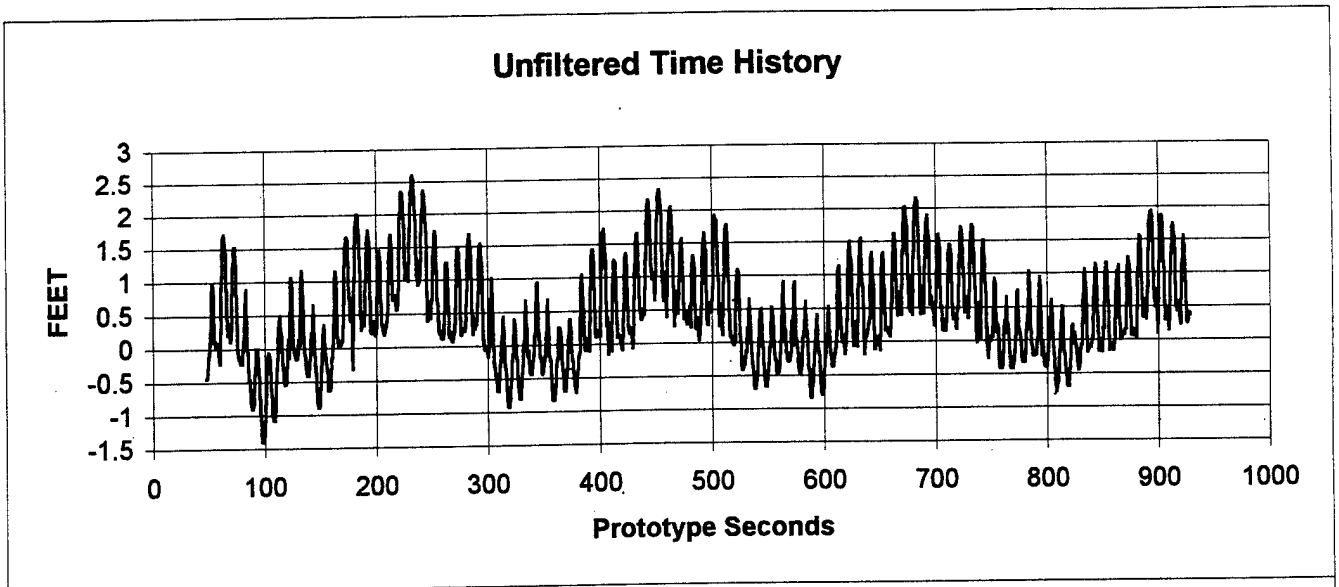
TEST A803 - PT SURGE

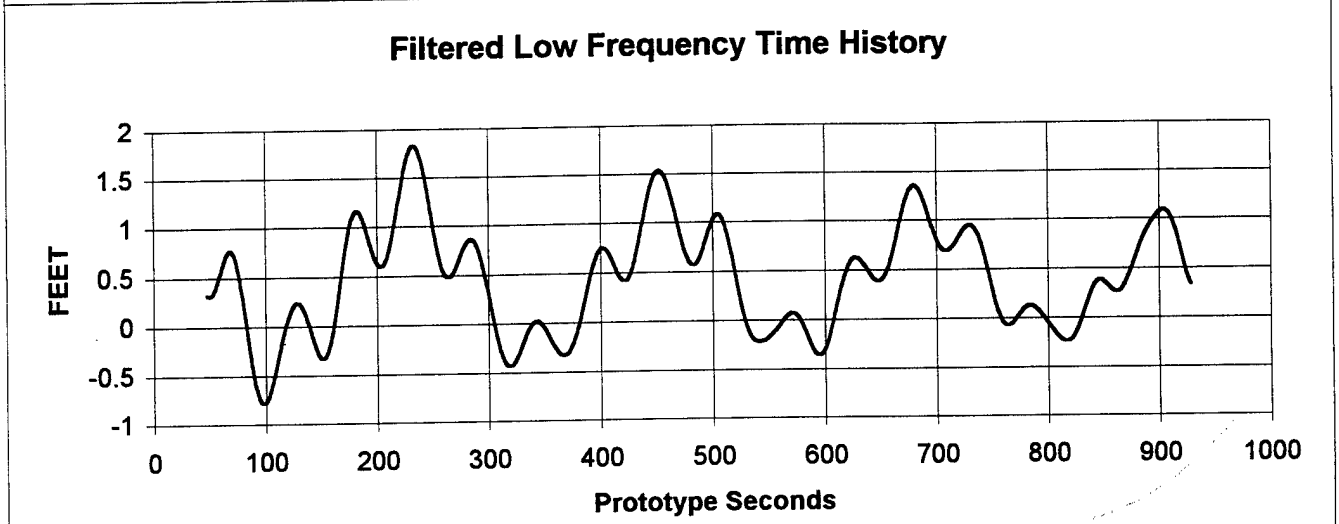


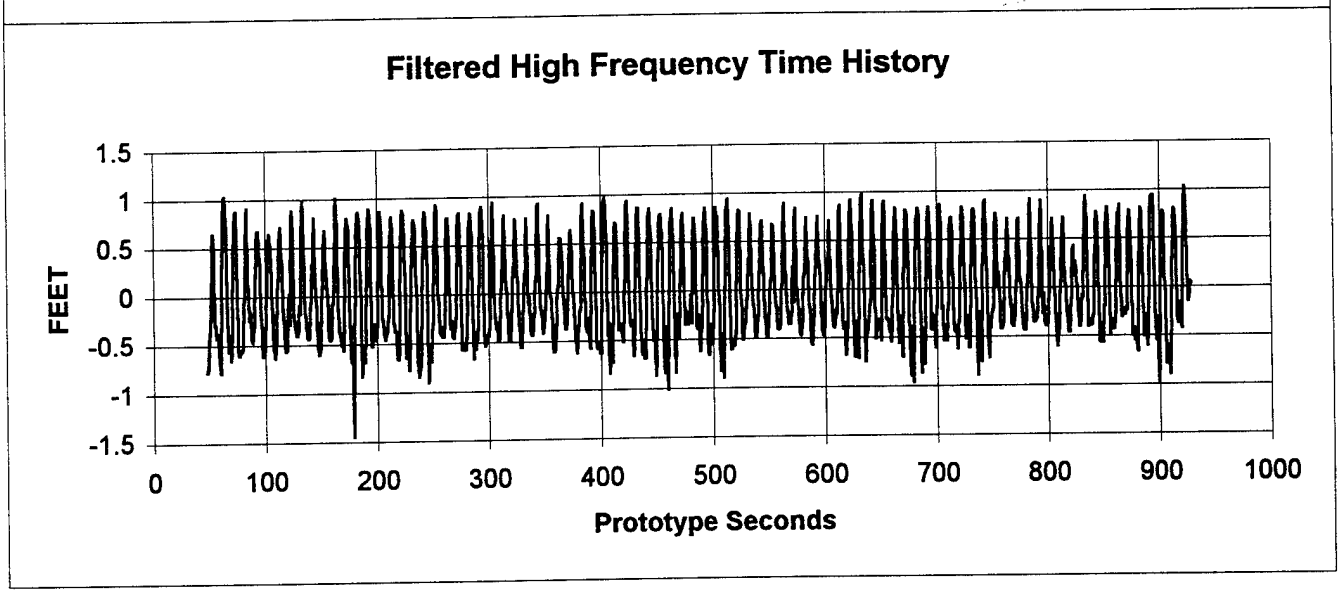




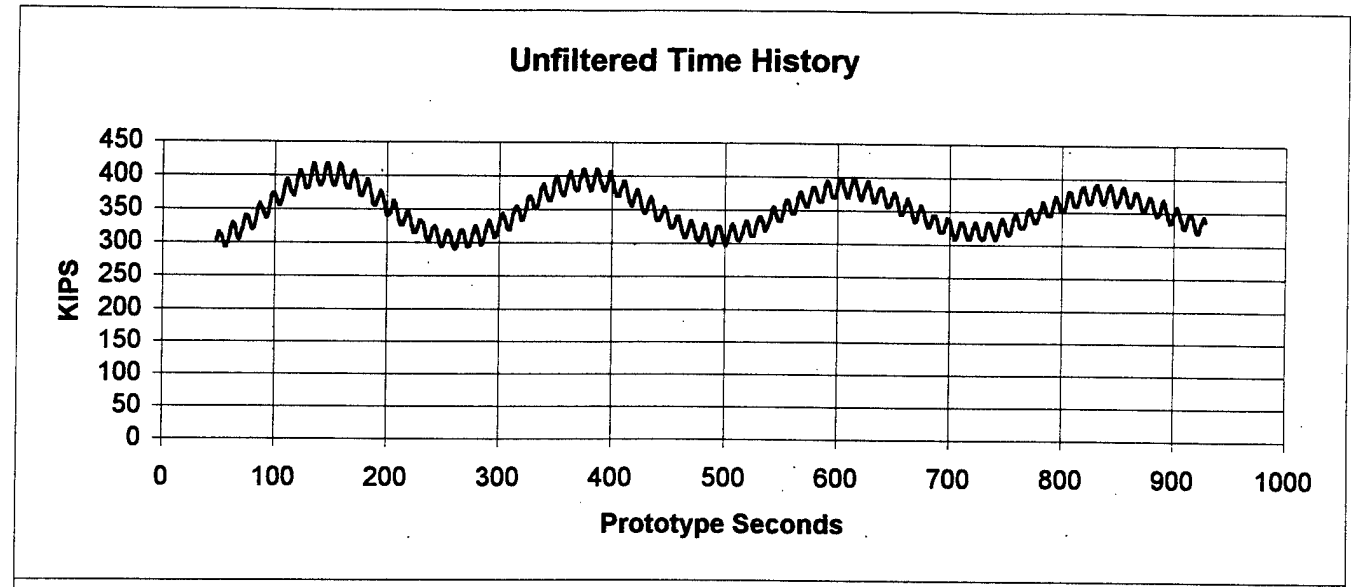
TEST A803 - PT HEAVE

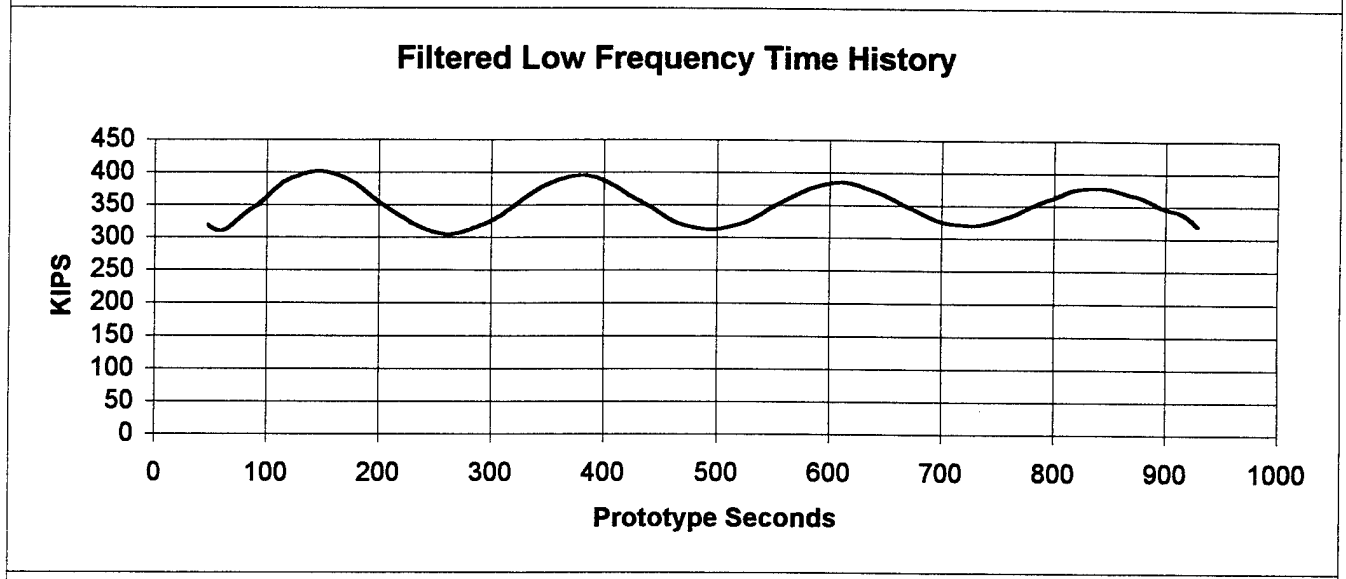


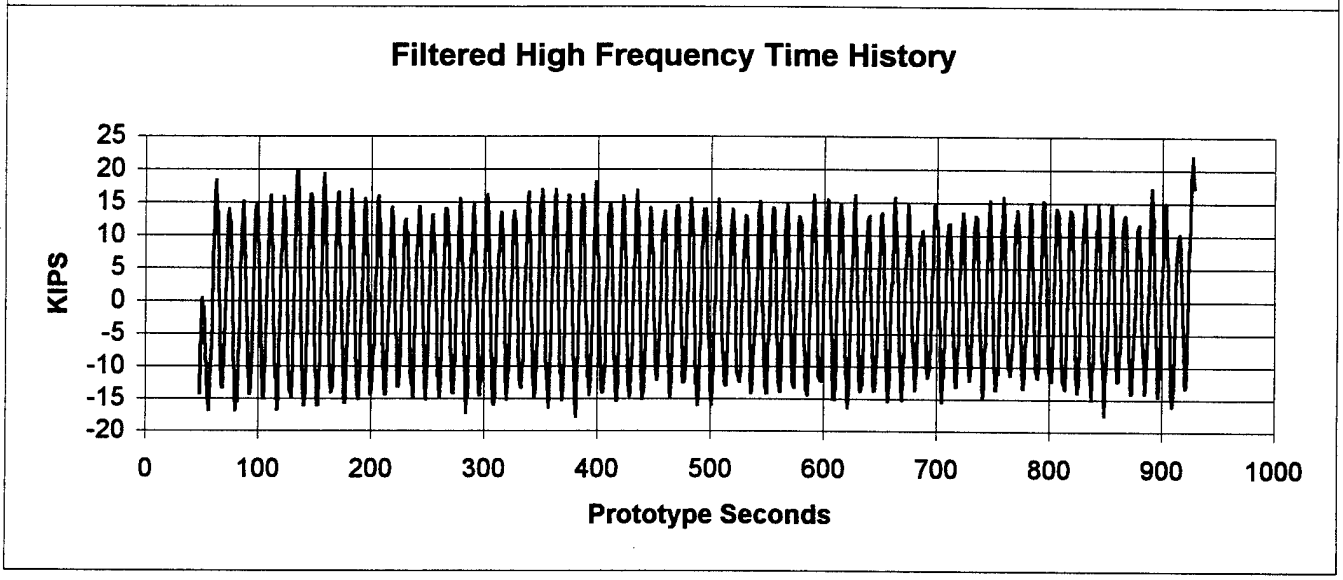




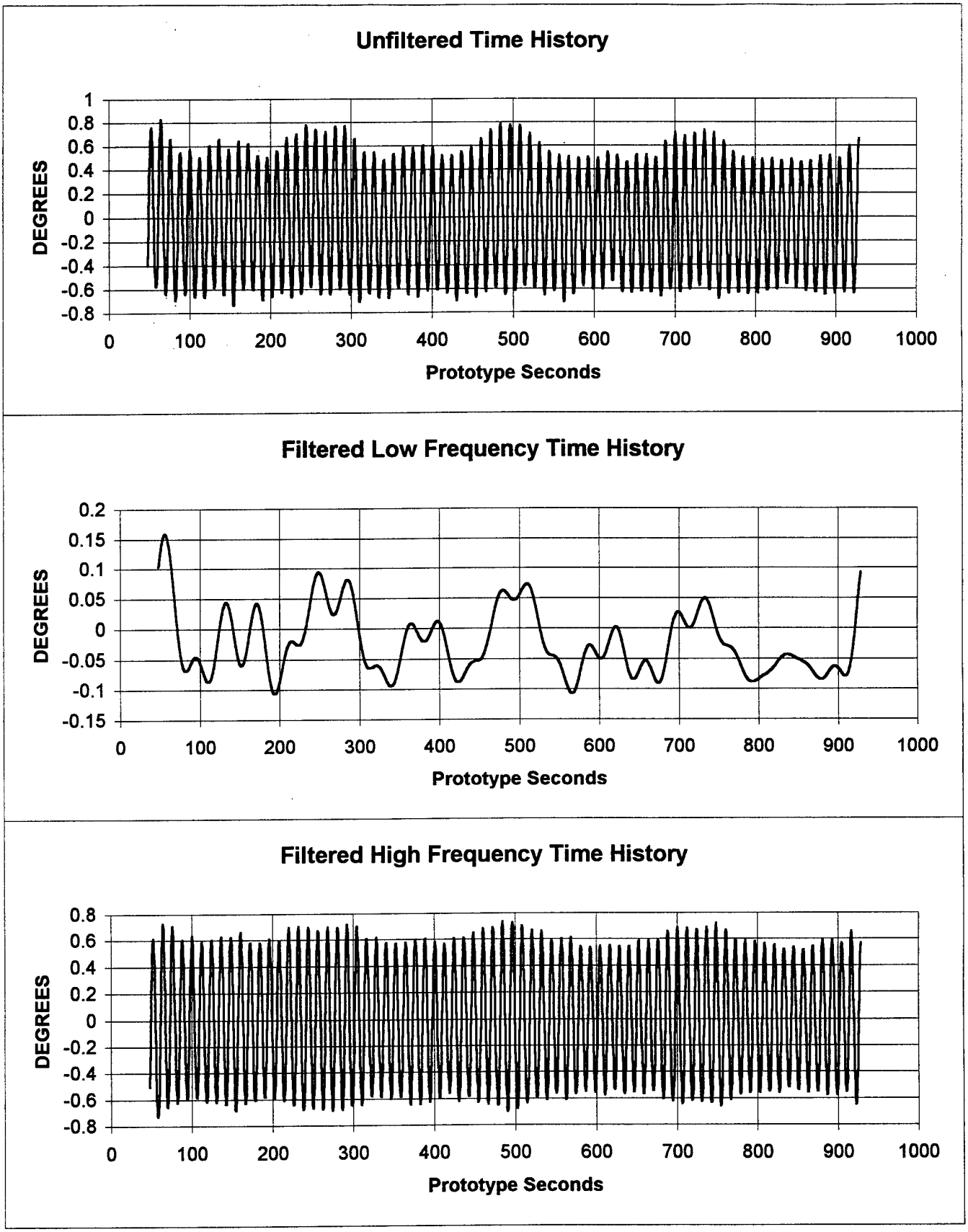
TEST A804 - ML_1 TENSION





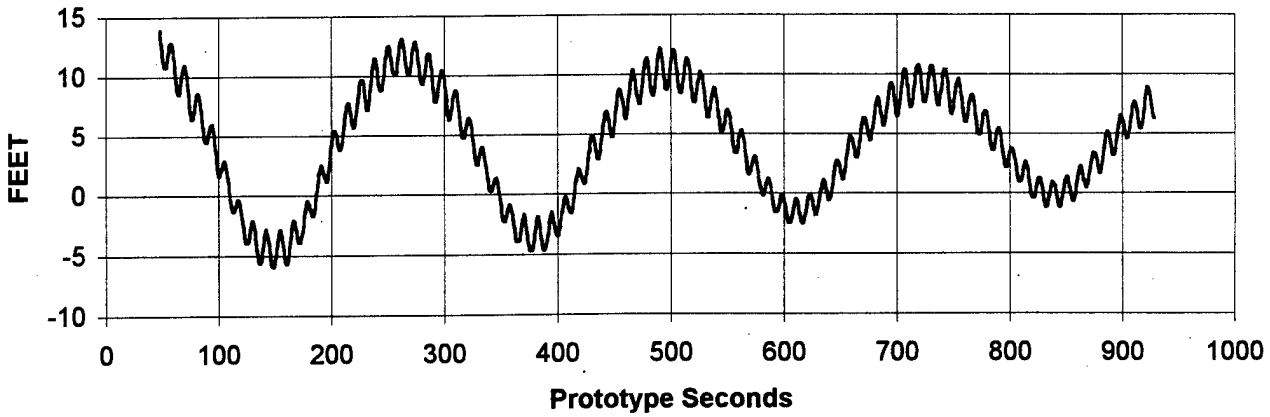


TEST A804 - PITCH

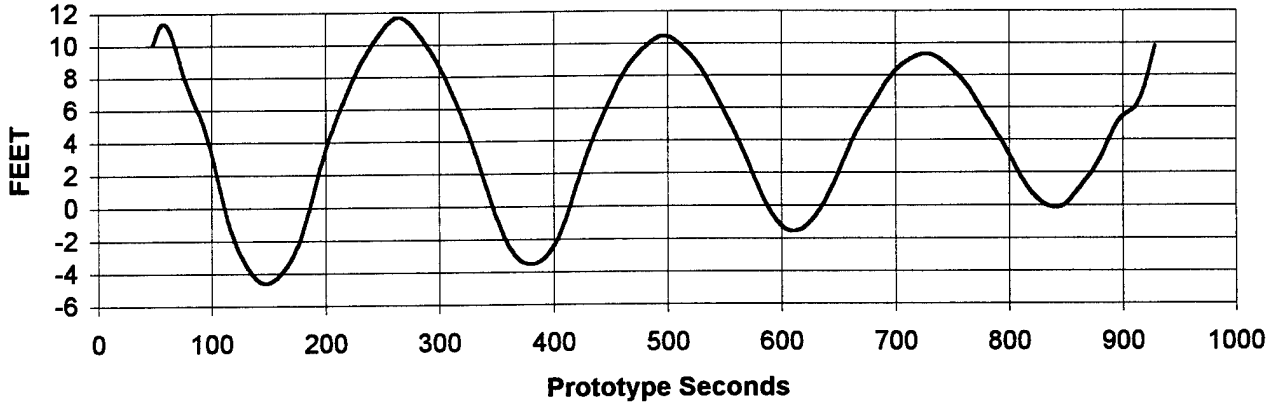


TEST A804 - PT SURGE

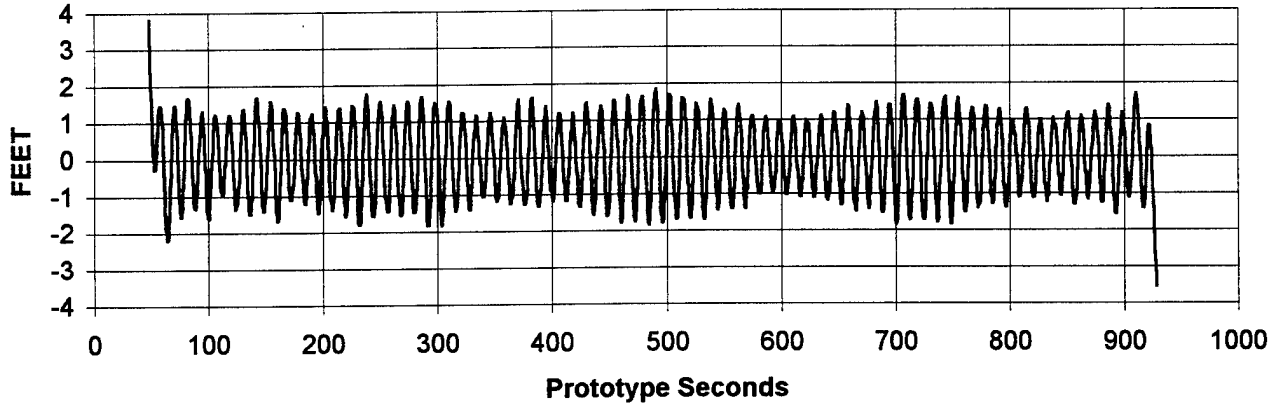
Unfiltered Time History



Filtered Low Frequency Time History

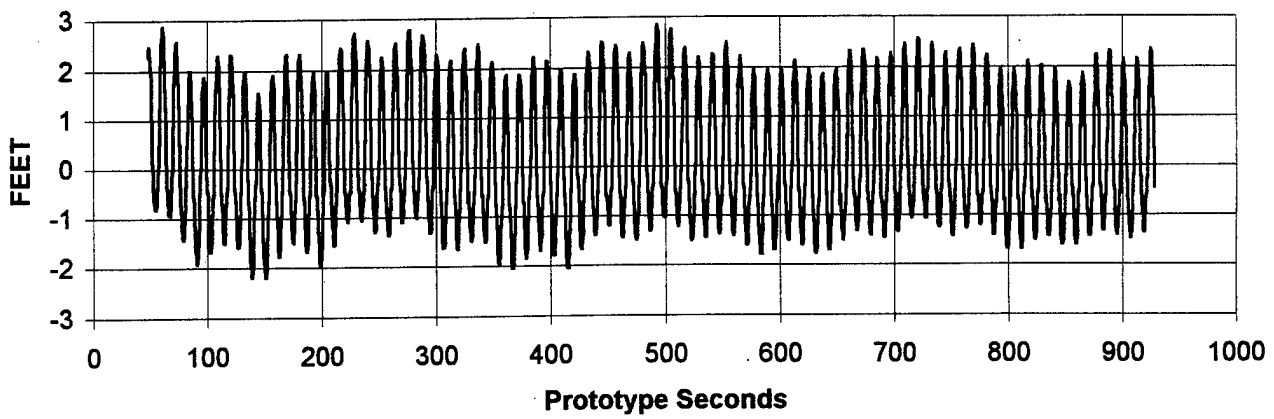


Filtered High Frequency Time History

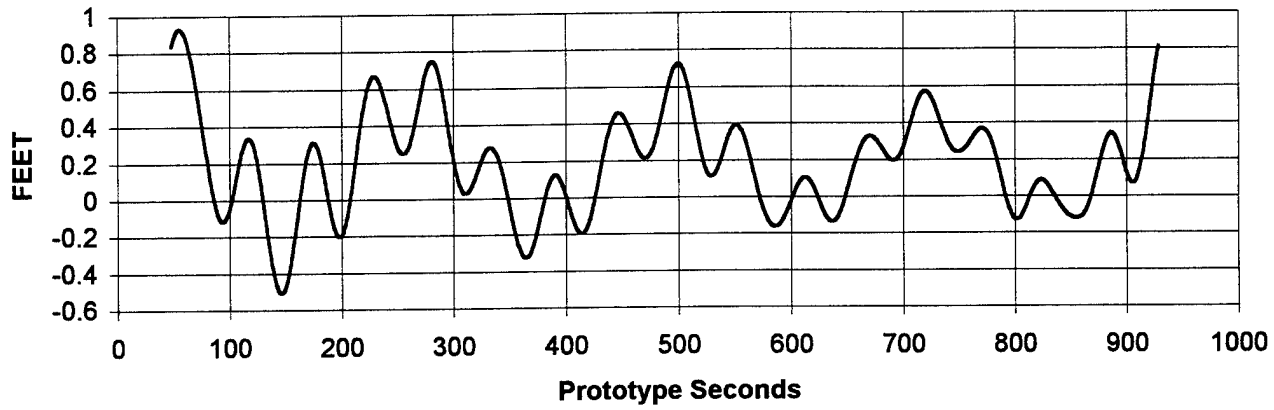


TEST A804 - PT HEAVE

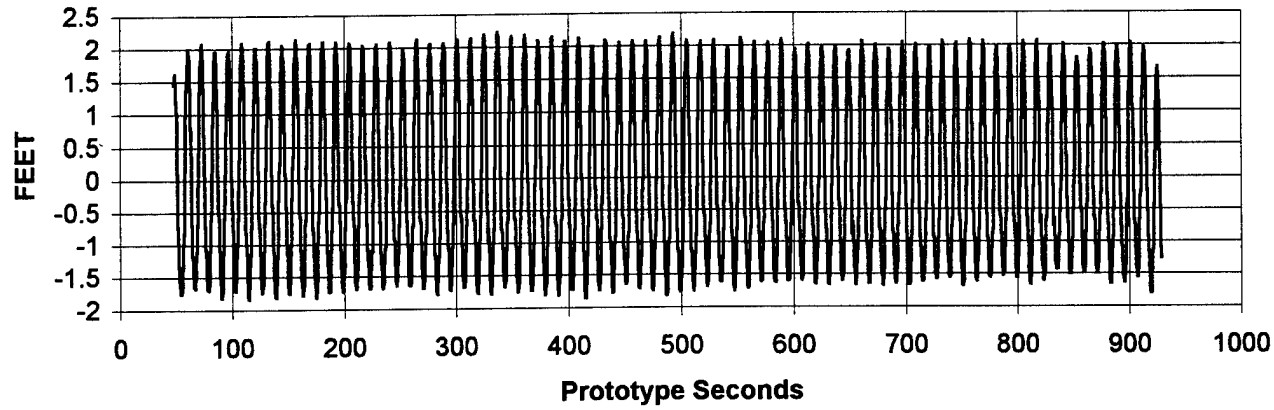
Unfiltered Time History



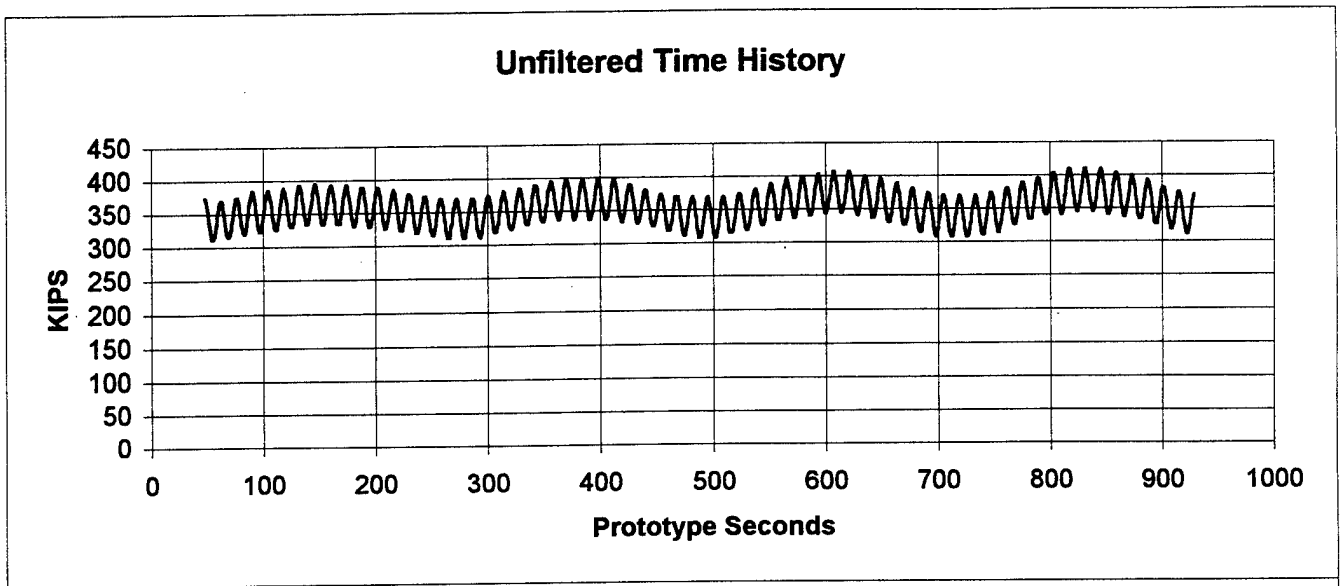
Filtered Low Frequency Time History

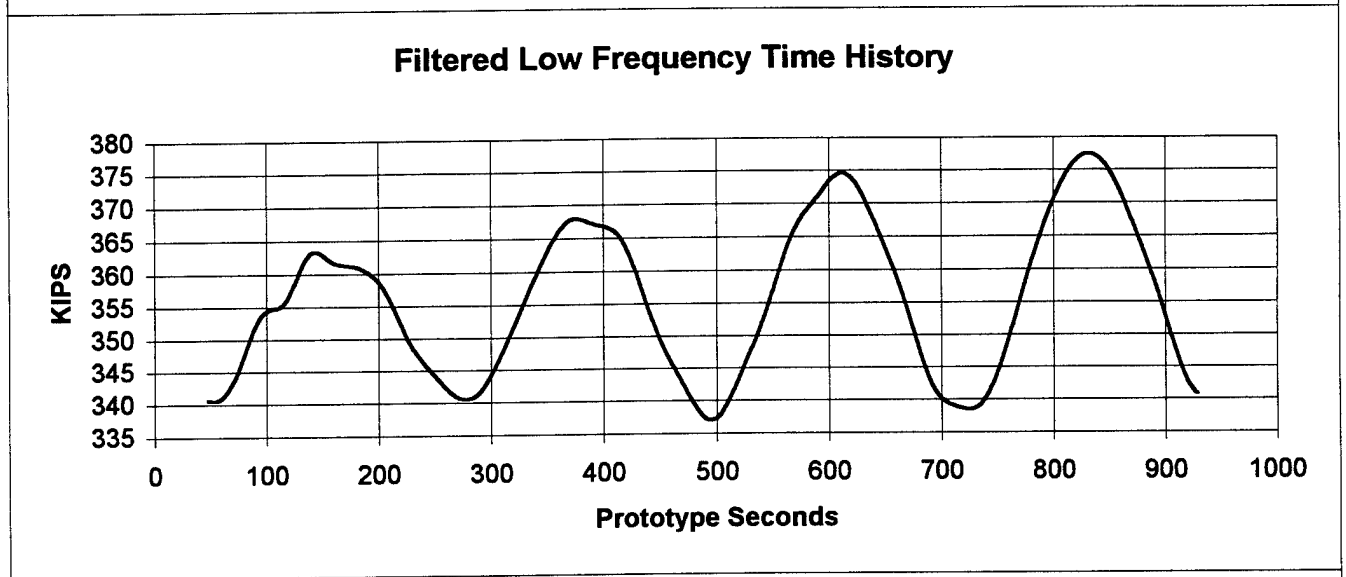


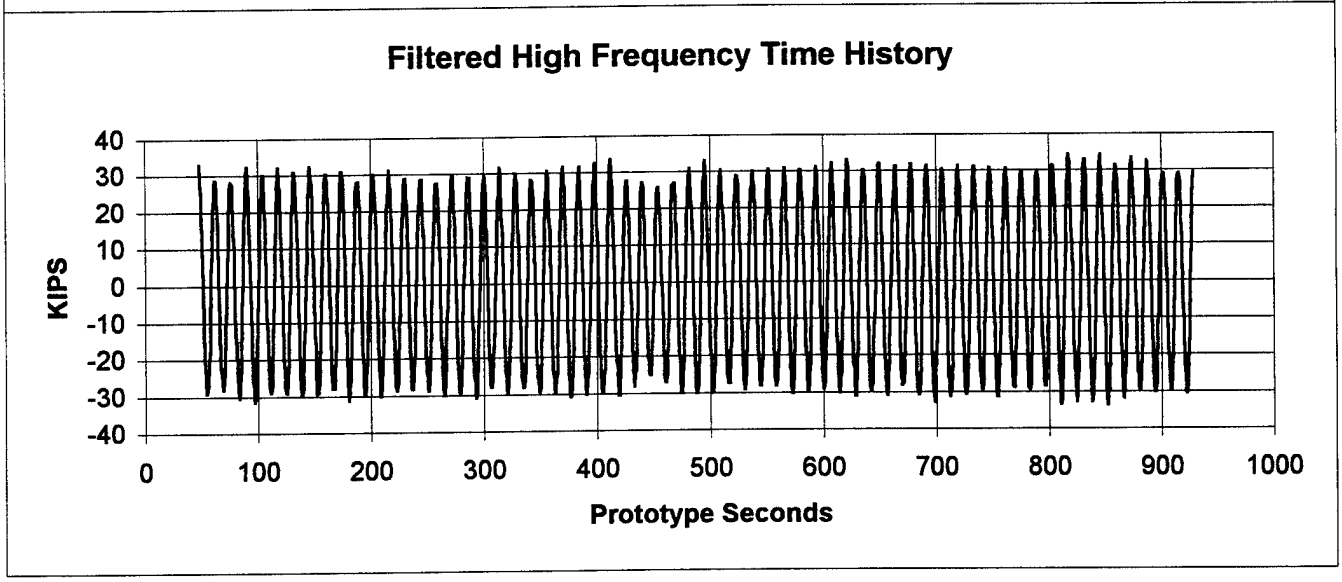
Filtered High Frequency Time History



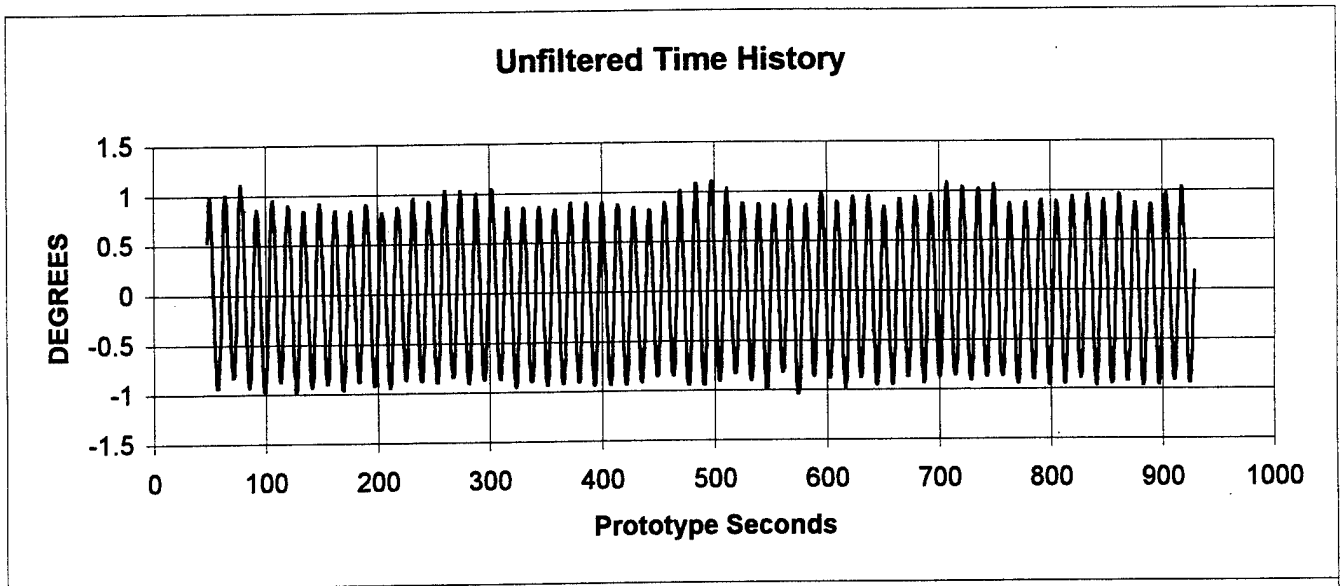
TEST A805 - ML_1 TENSION

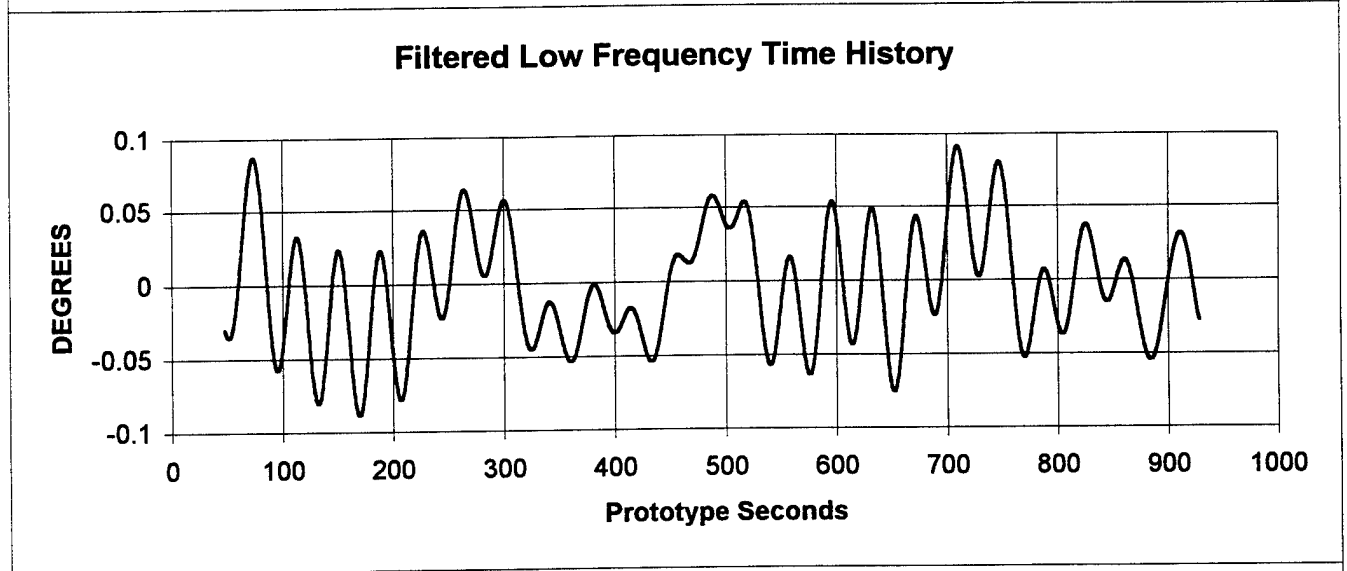


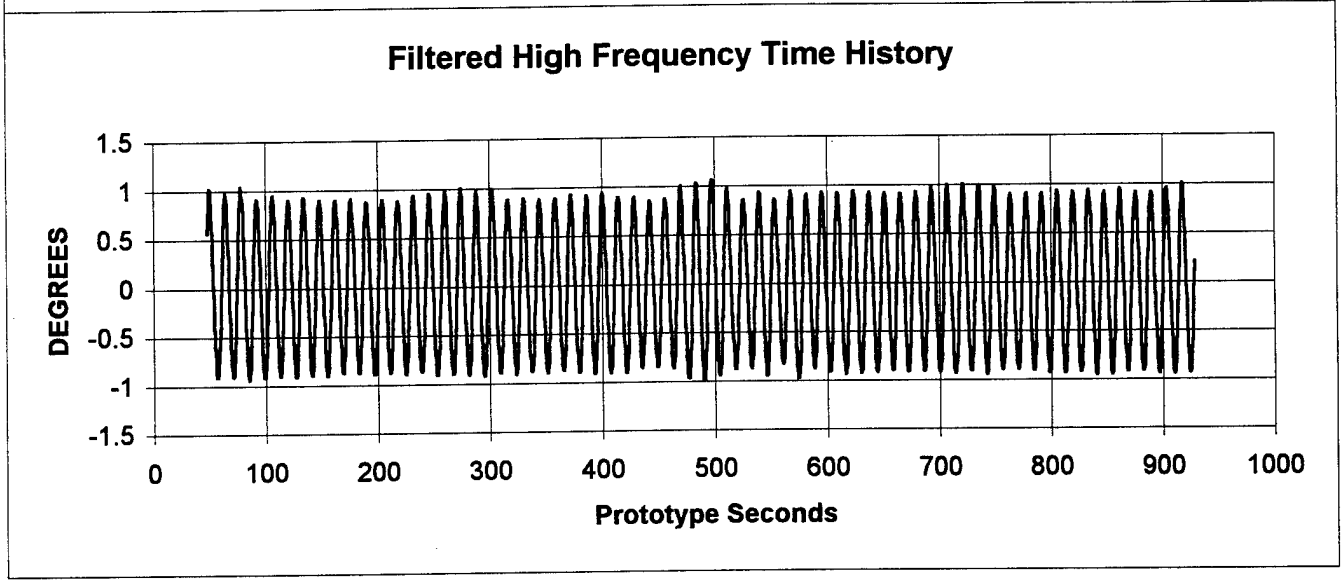




TEST A805 - PITCH

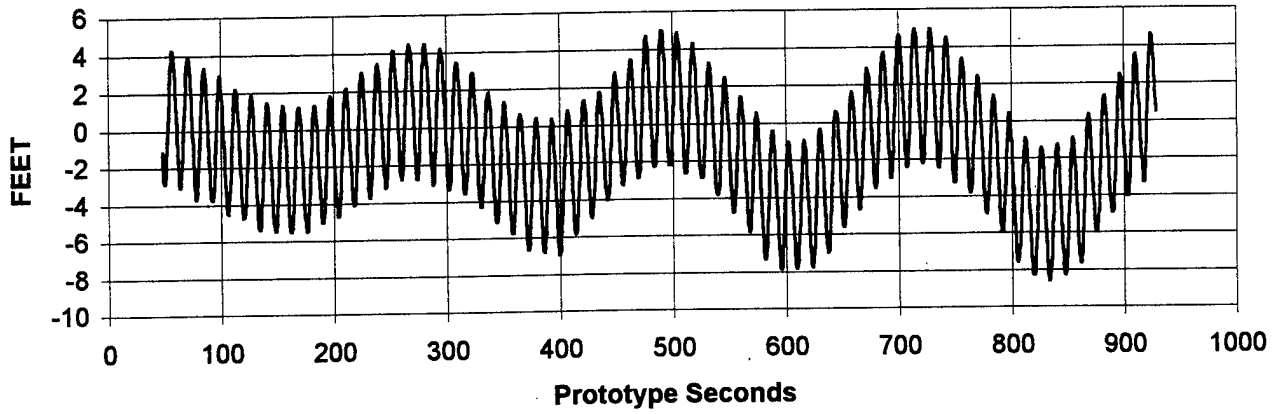




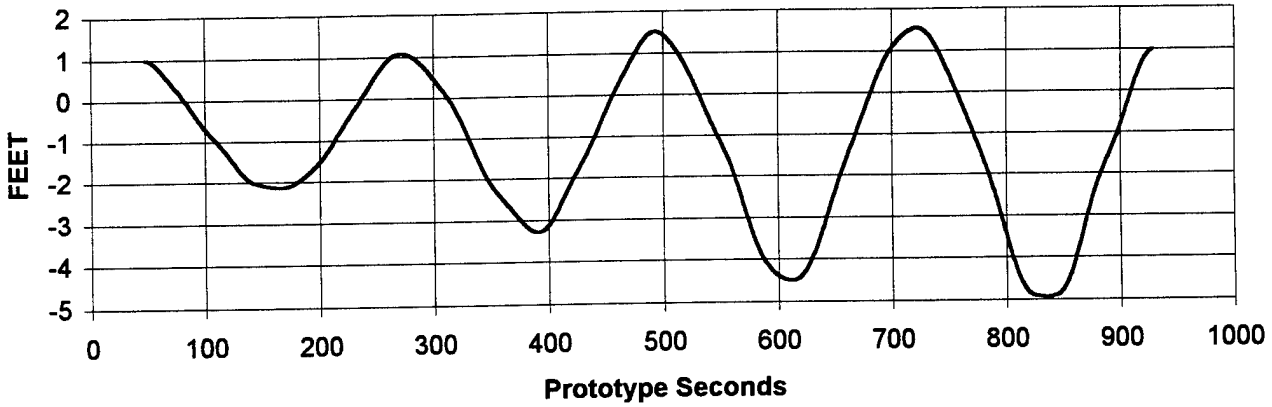


TEST A805 - PT SURGE

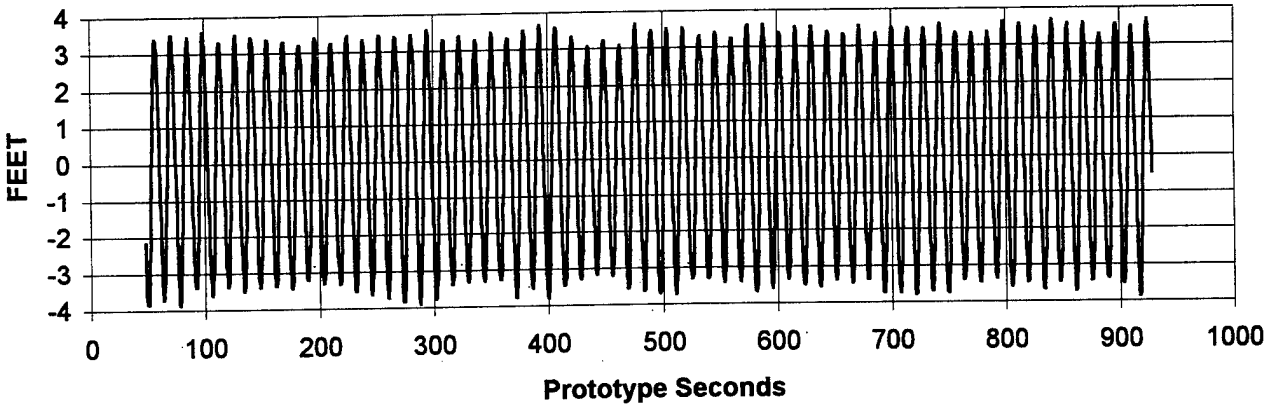
Unfiltered Time History



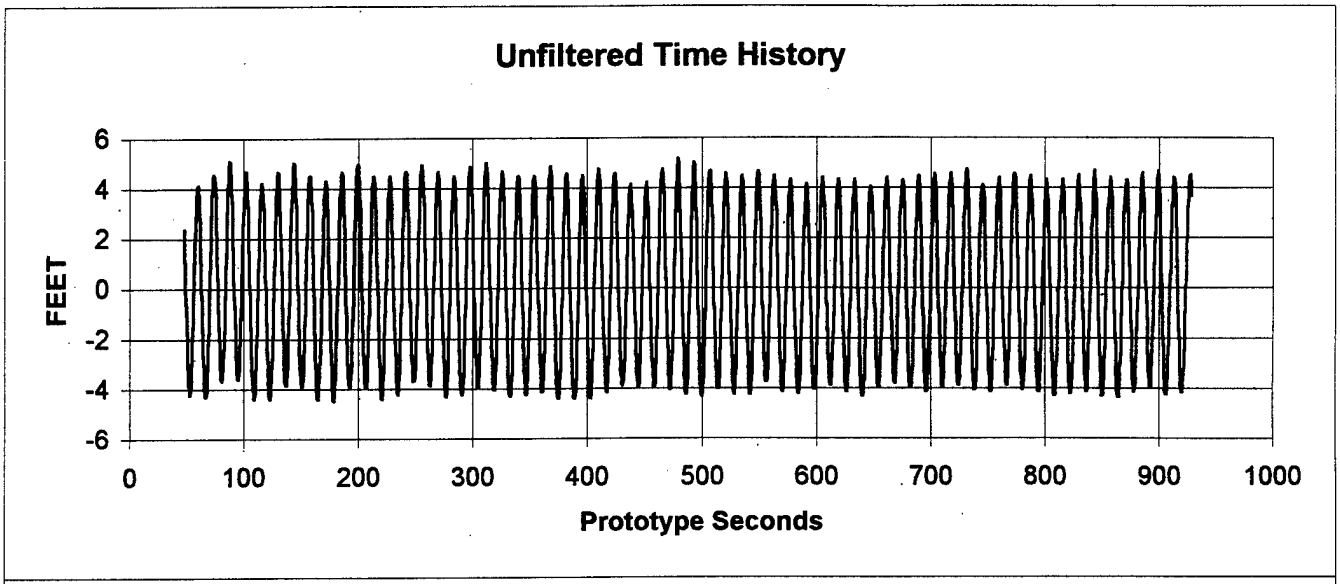
Filtered Low Frequency Time History

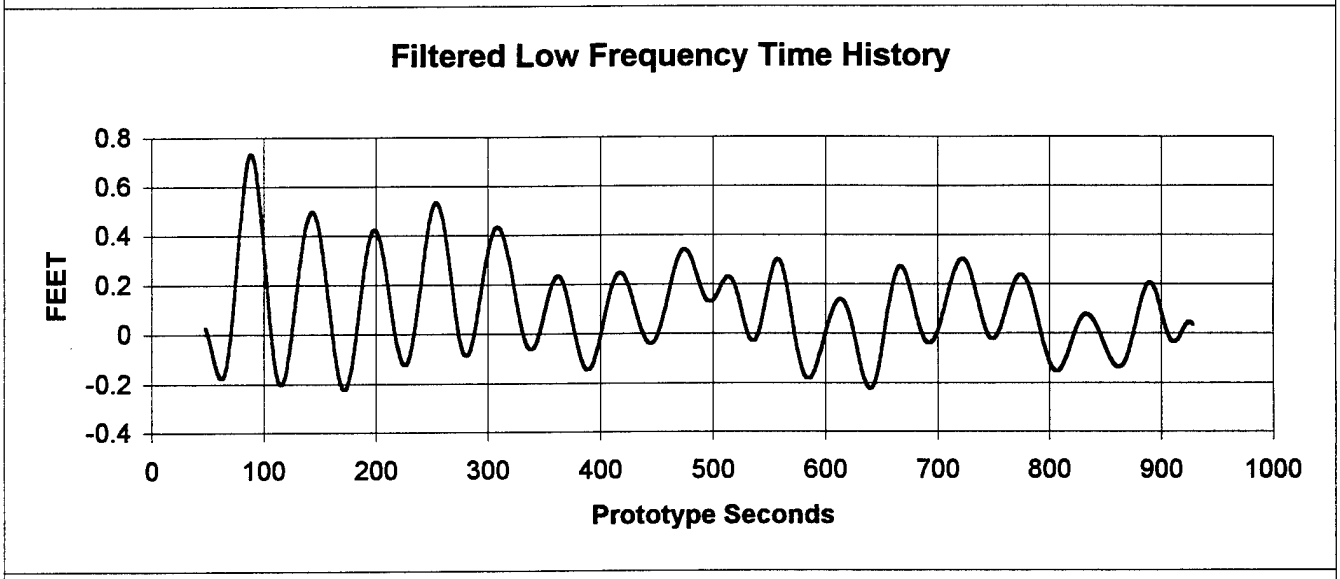


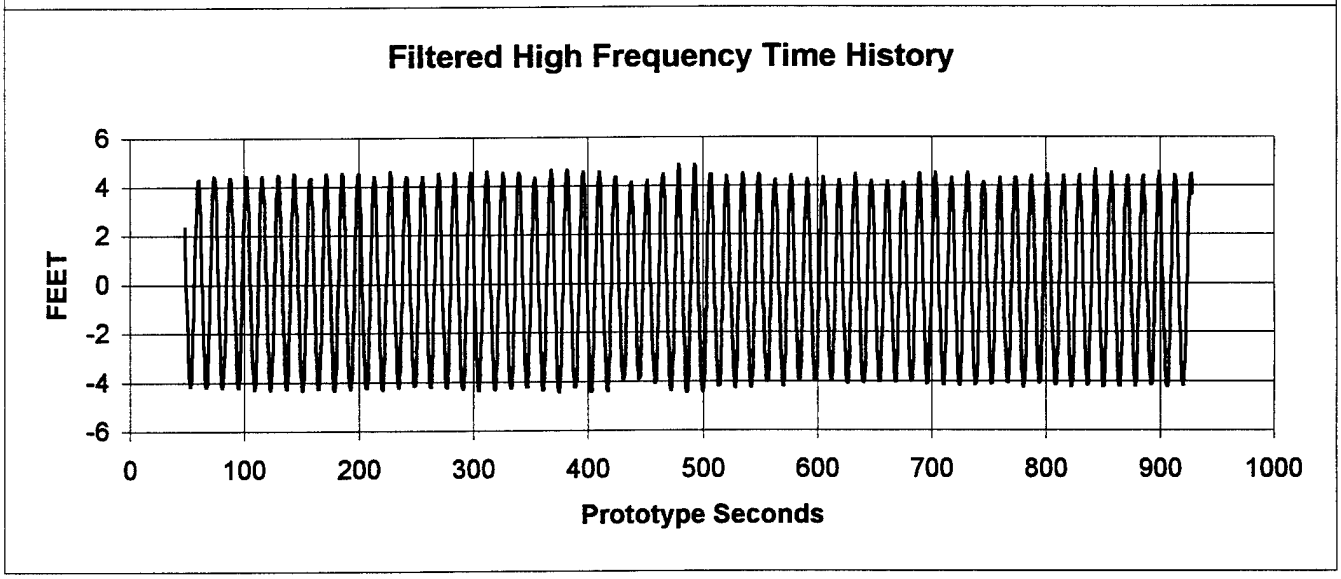
Filtered High Frequency Time History



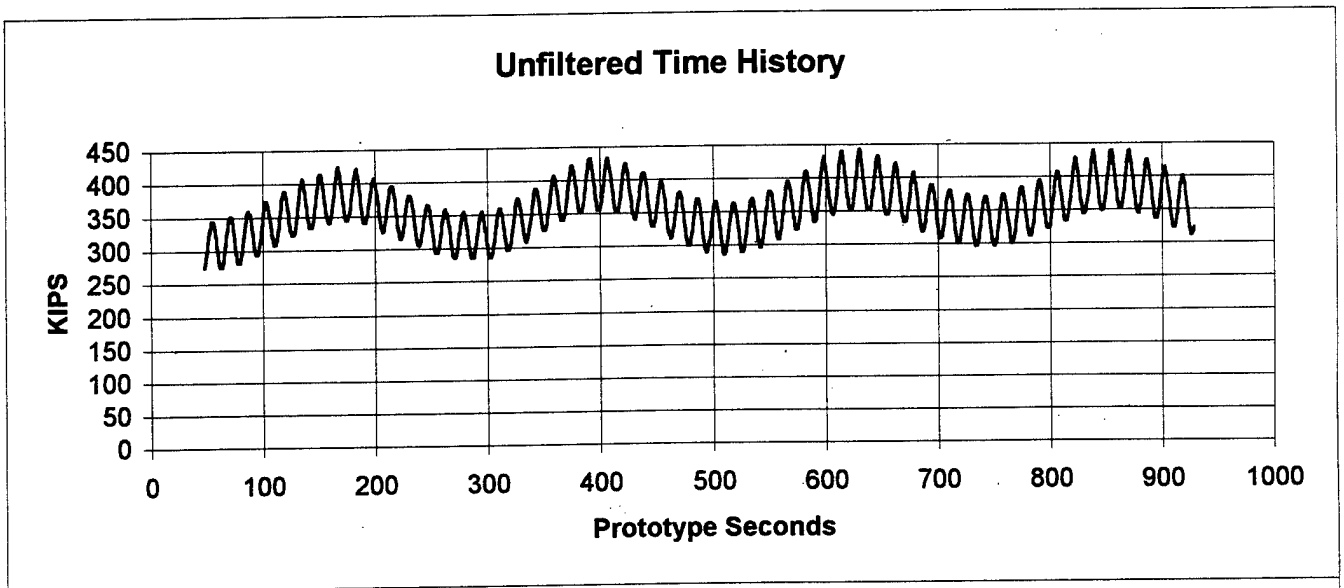
TEST A805 - PT HEAVE

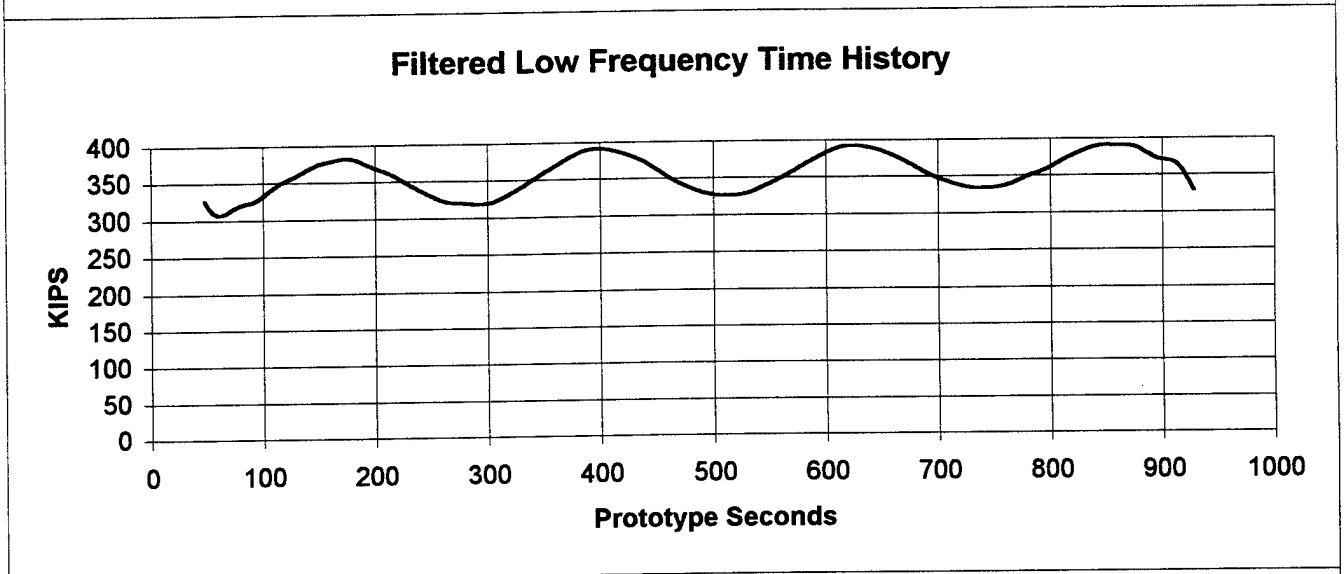


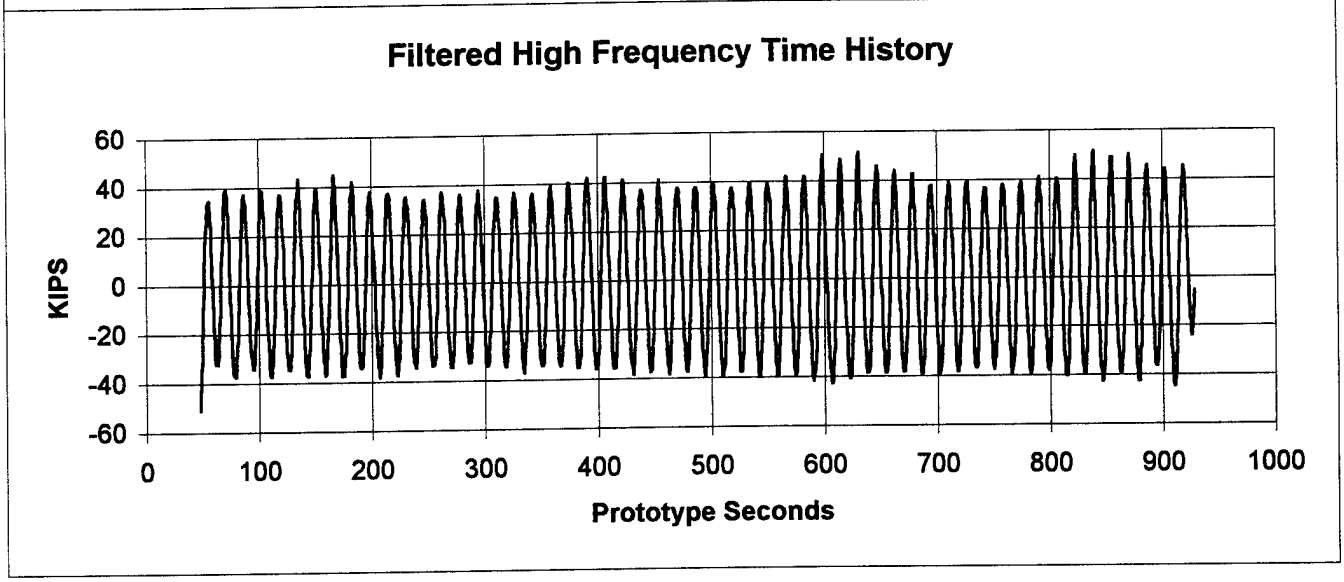




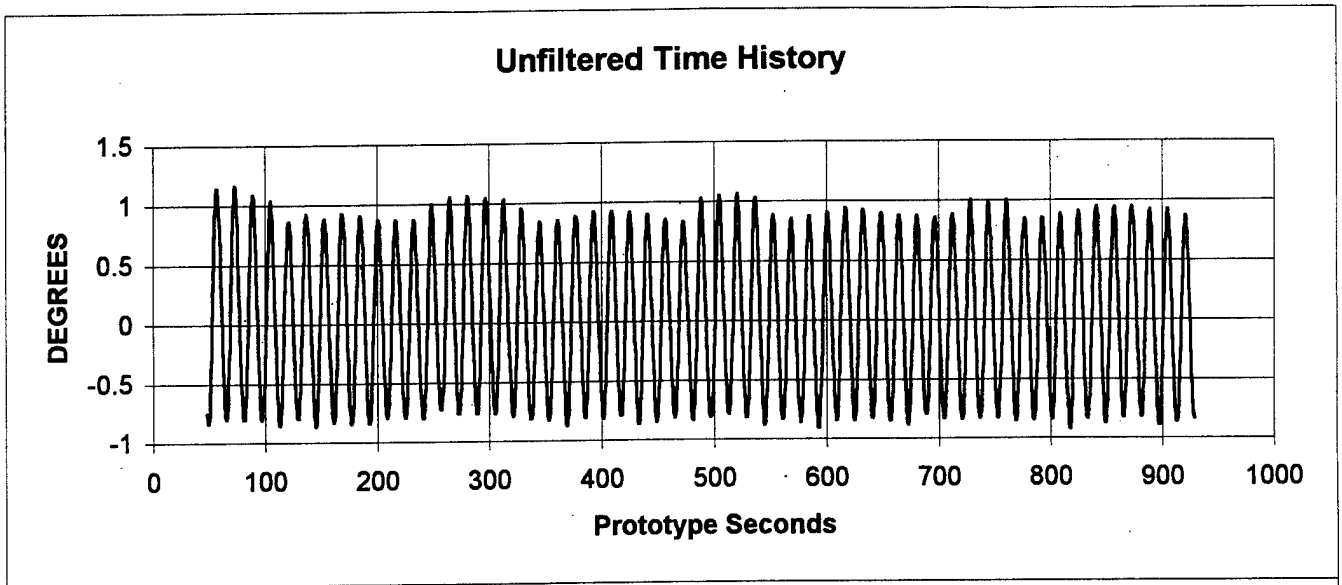
TEST A806 - ML_1 TENSION

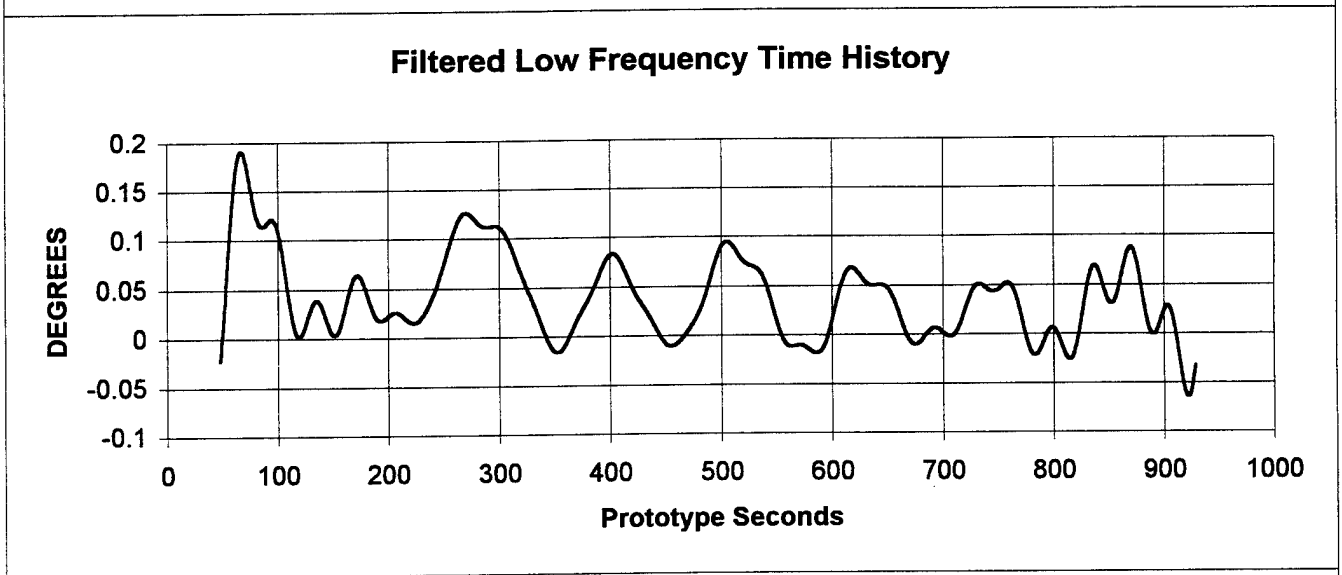


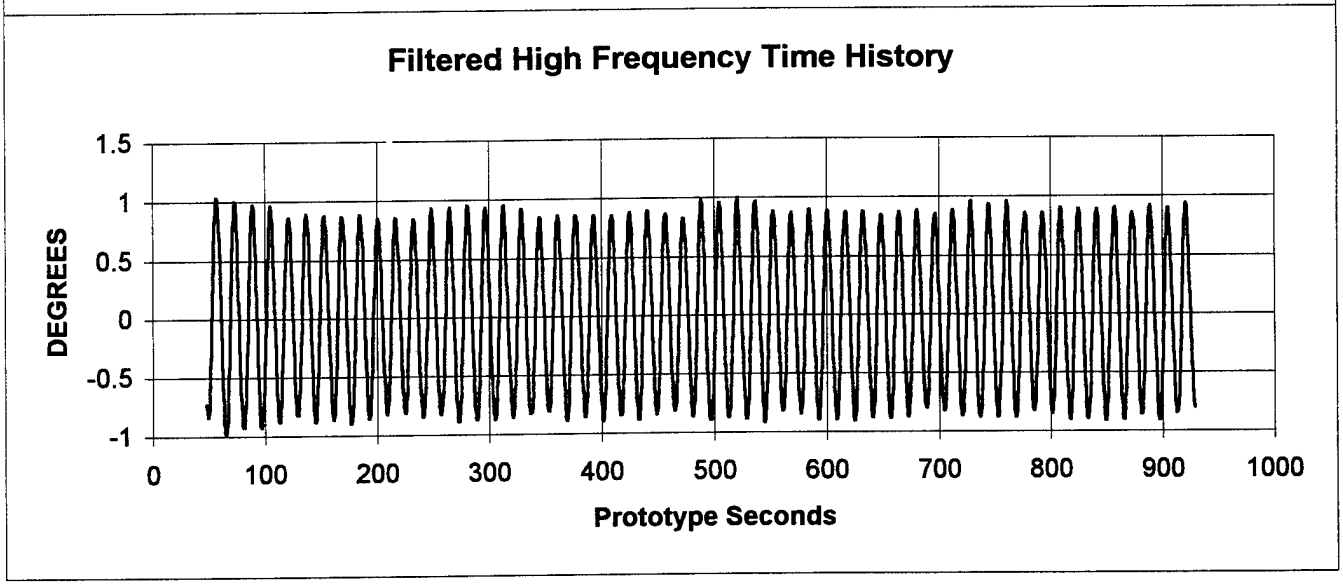




TEST A806 - PITCH

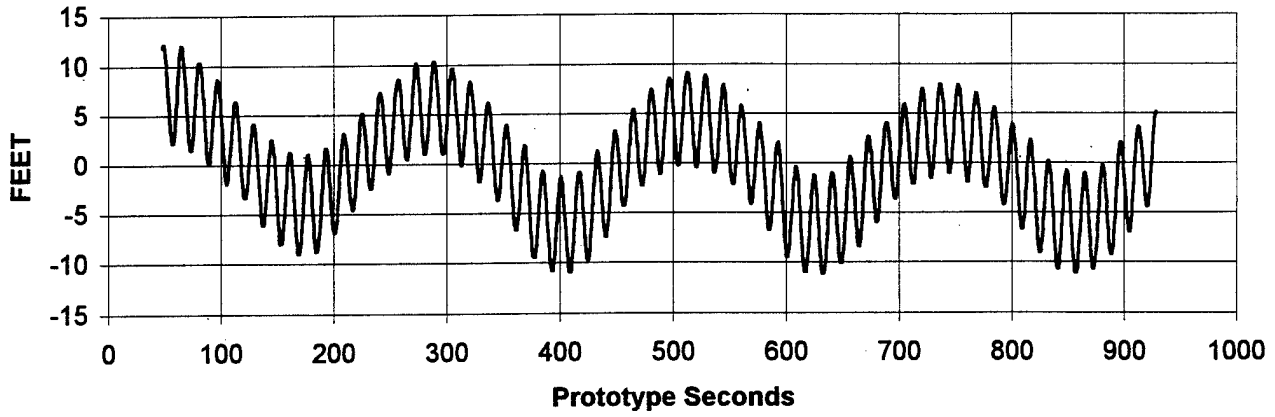




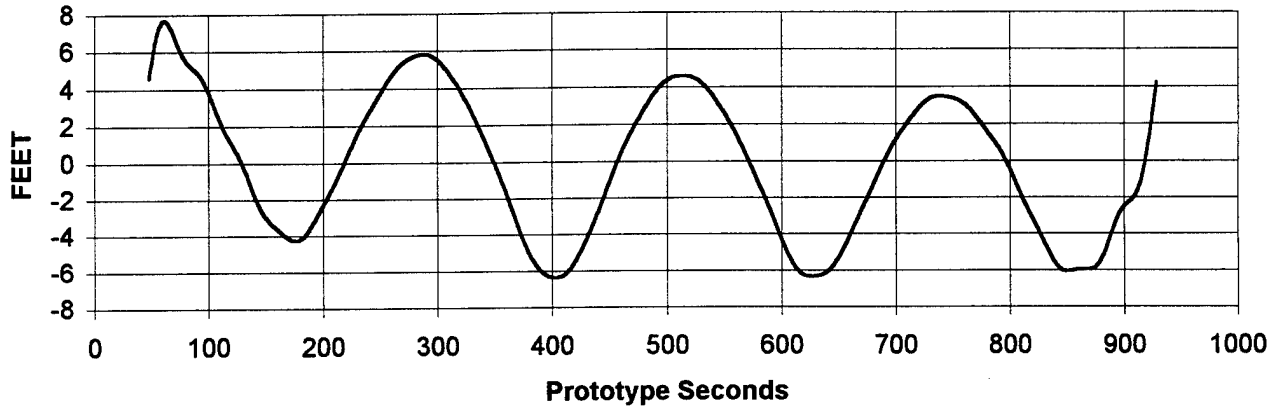


TEST A806 - PT SURGE

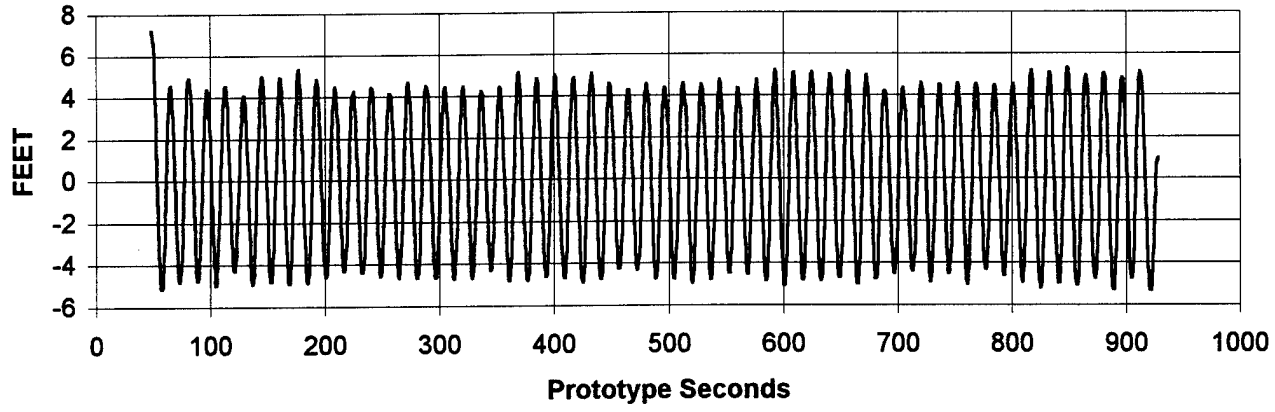
Unfiltered Time History



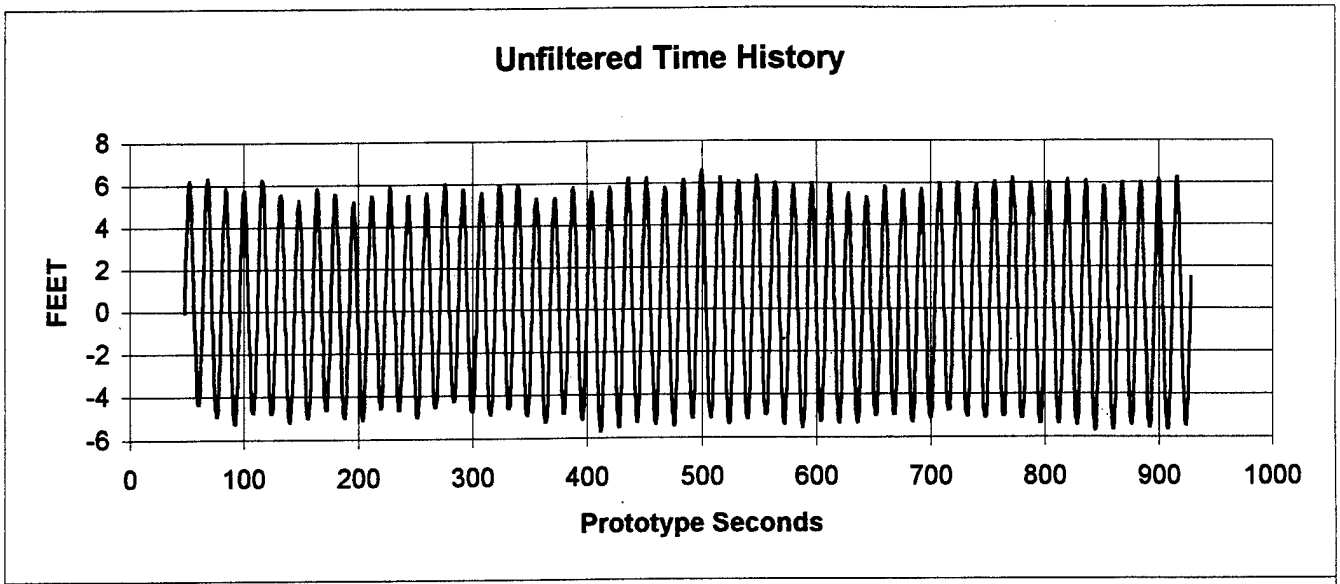
Filtered Low Frequency Time History

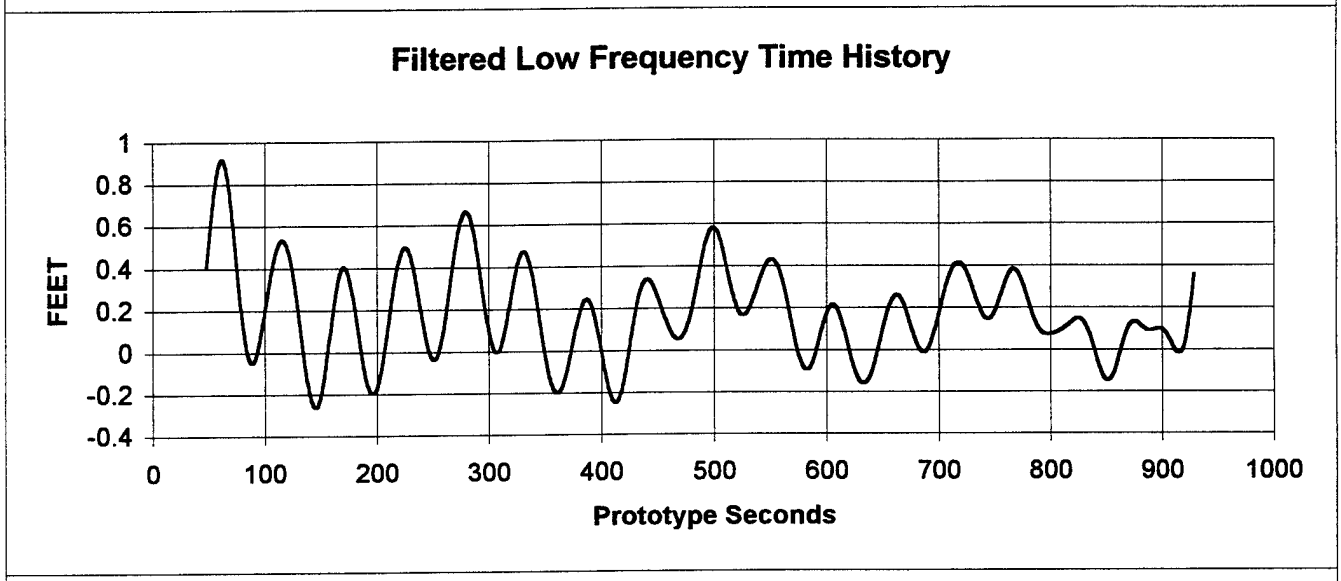


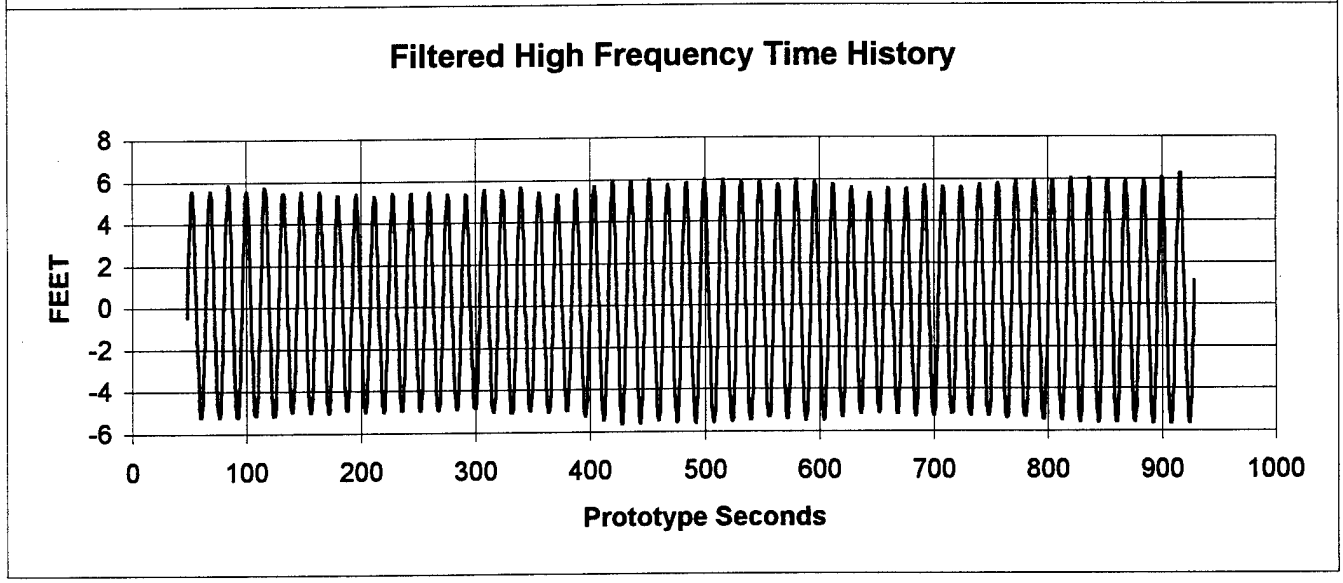
Filtered High Frequency Time History



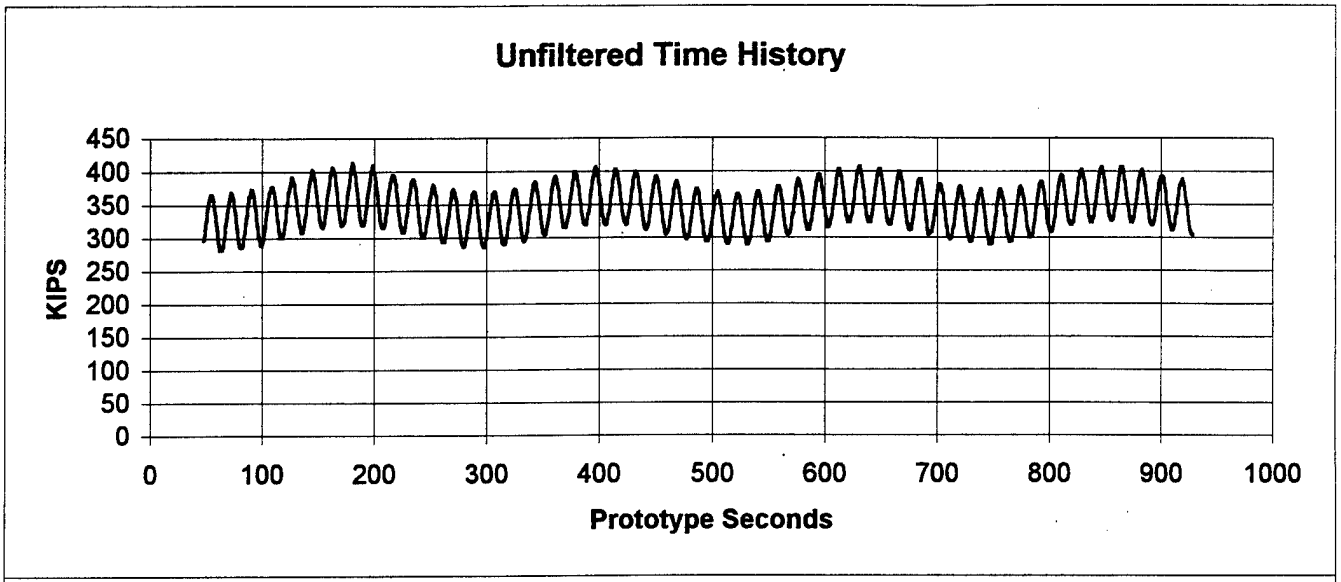
TEST A806 - PT HEAVE

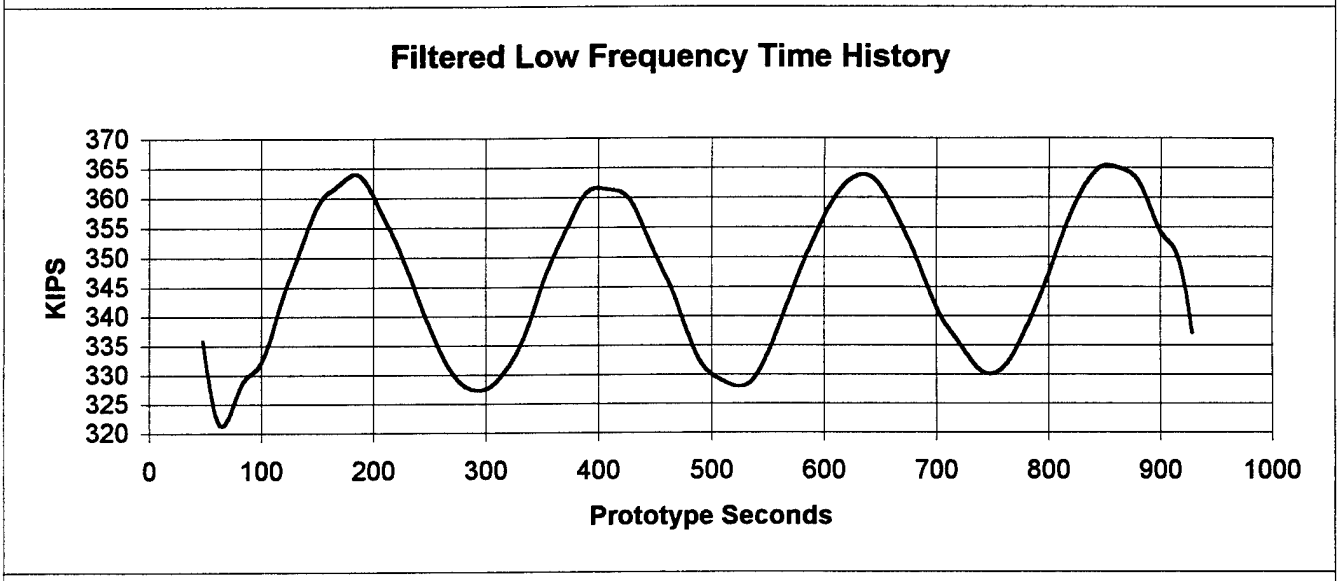


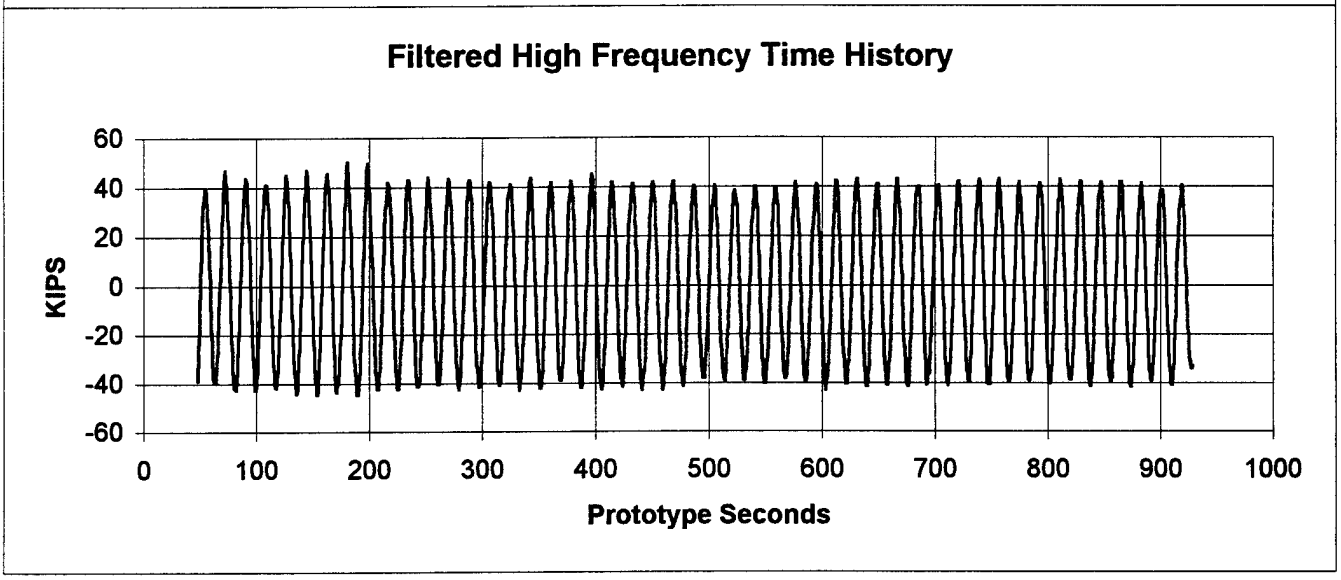




TEST A807 - ML_1 TENSION

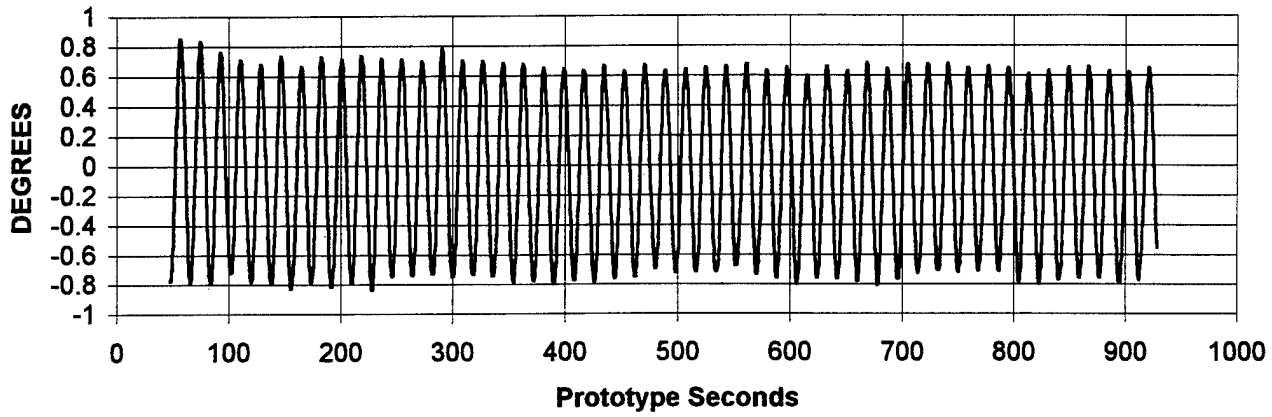




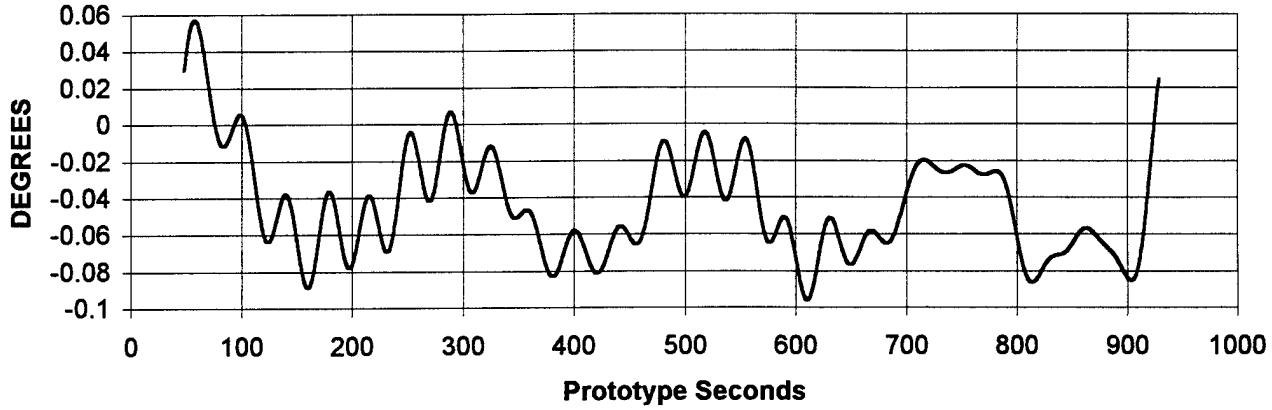


TEST A807 - PITCH

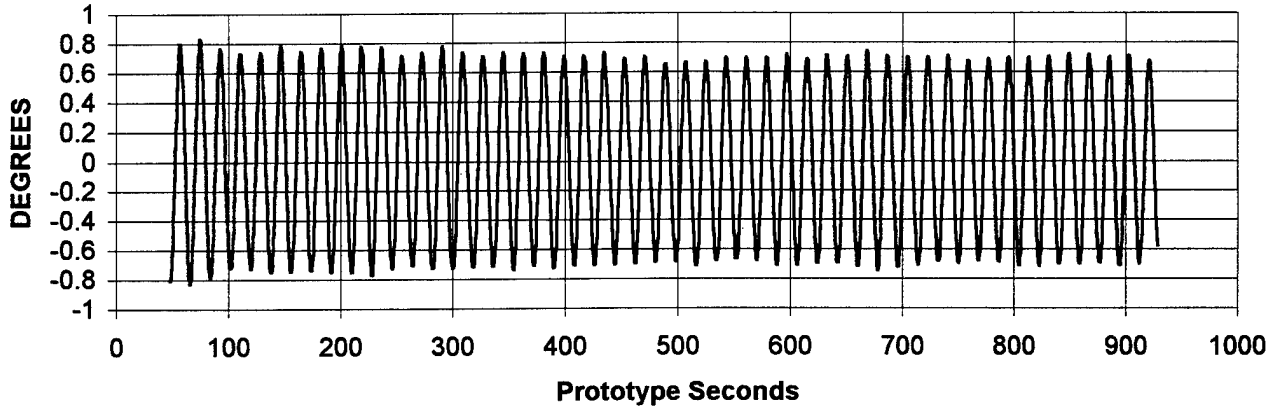
Unfiltered Time History



Filtered Low Frequency Time History

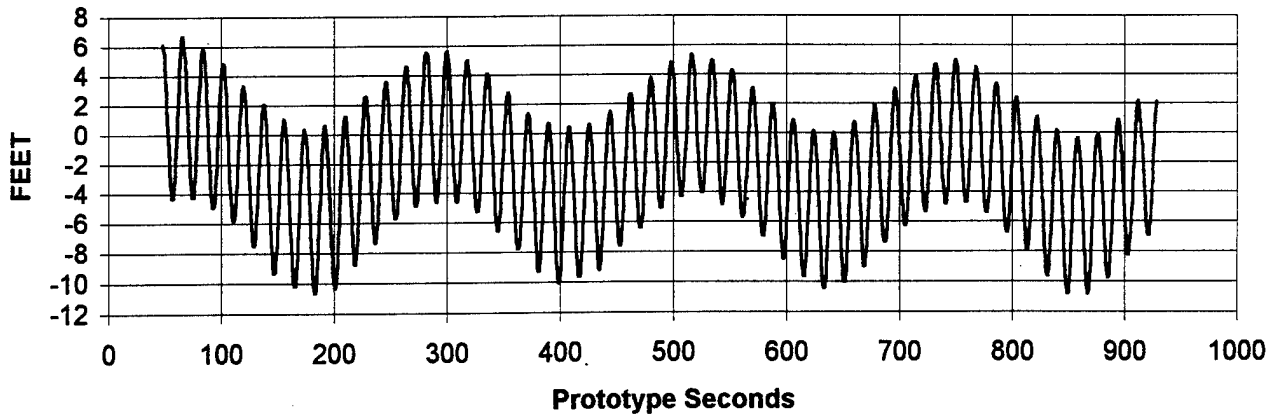


Filtered High Frequency Time History

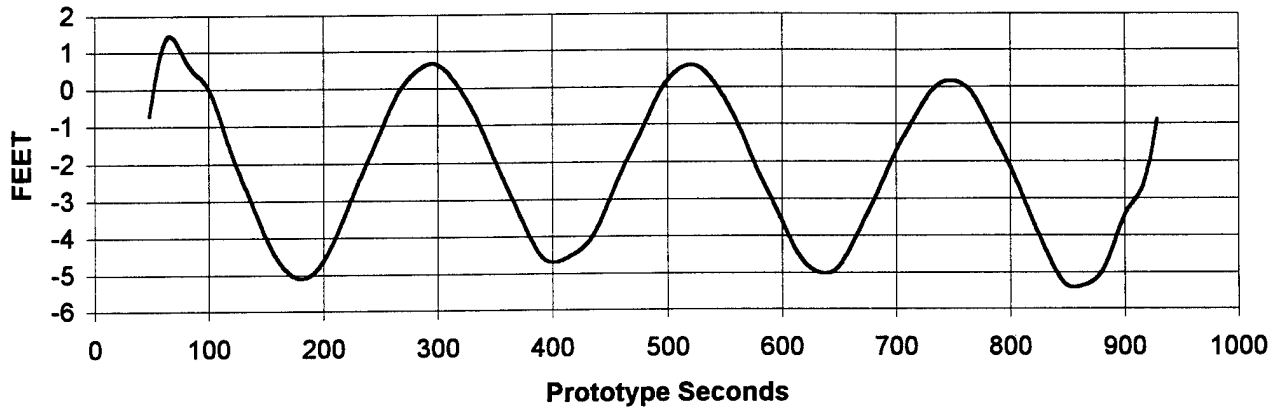


TEST A807 - PT SURGE

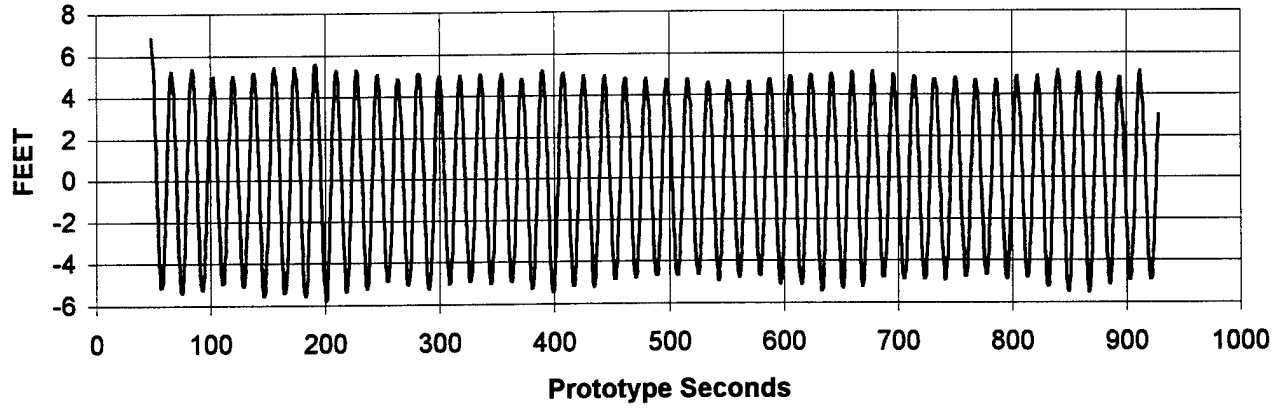
Unfiltered Time History



Filtered Low Frequency Time History

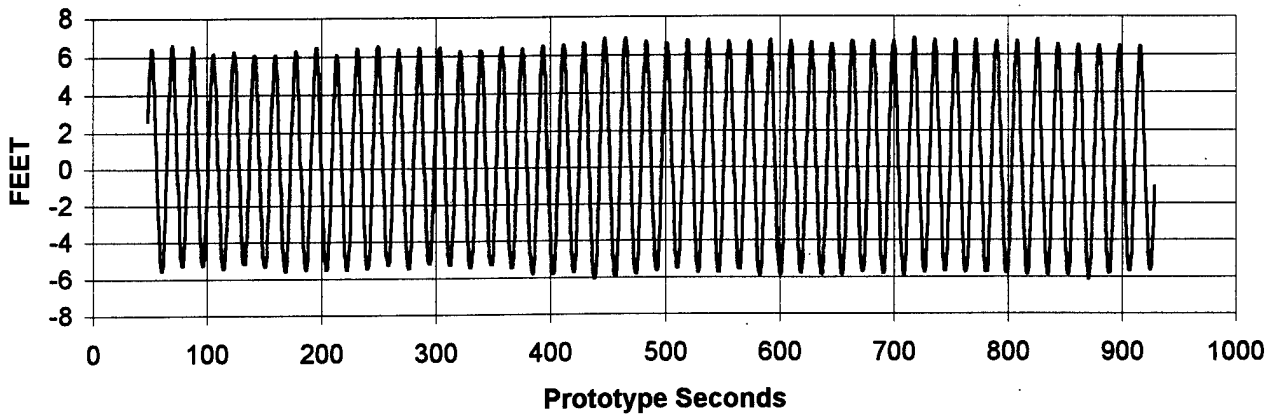


Filtered High Frequency Time History

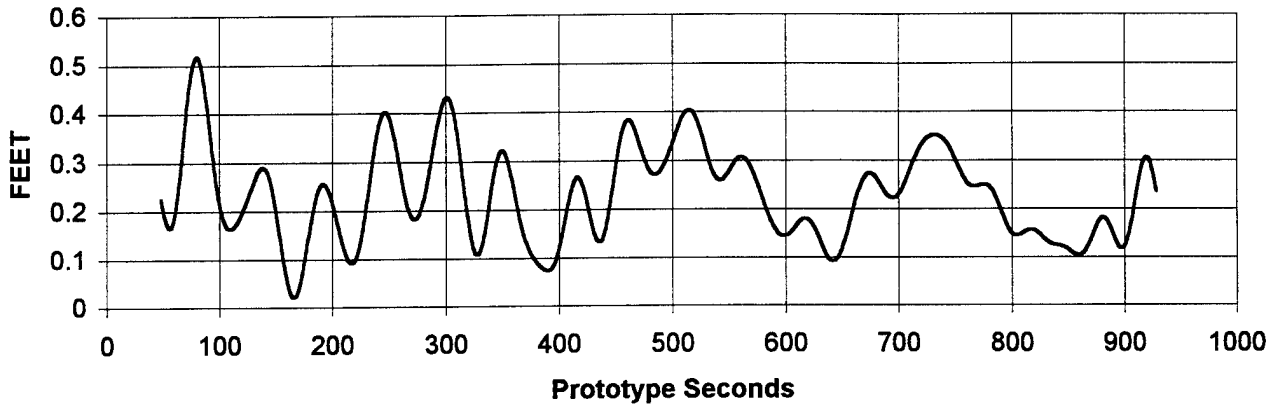


TEST A807 - PT HEAVE

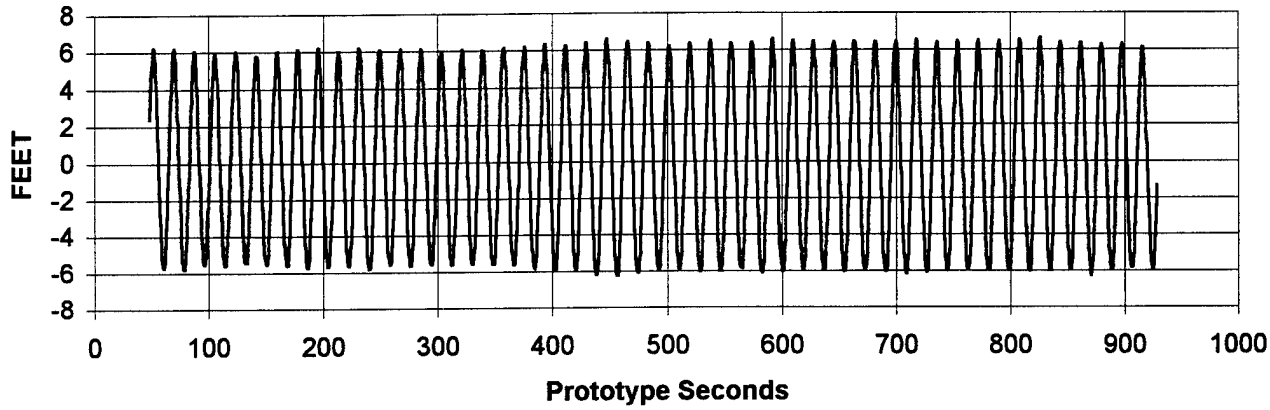
Unfiltered Time History



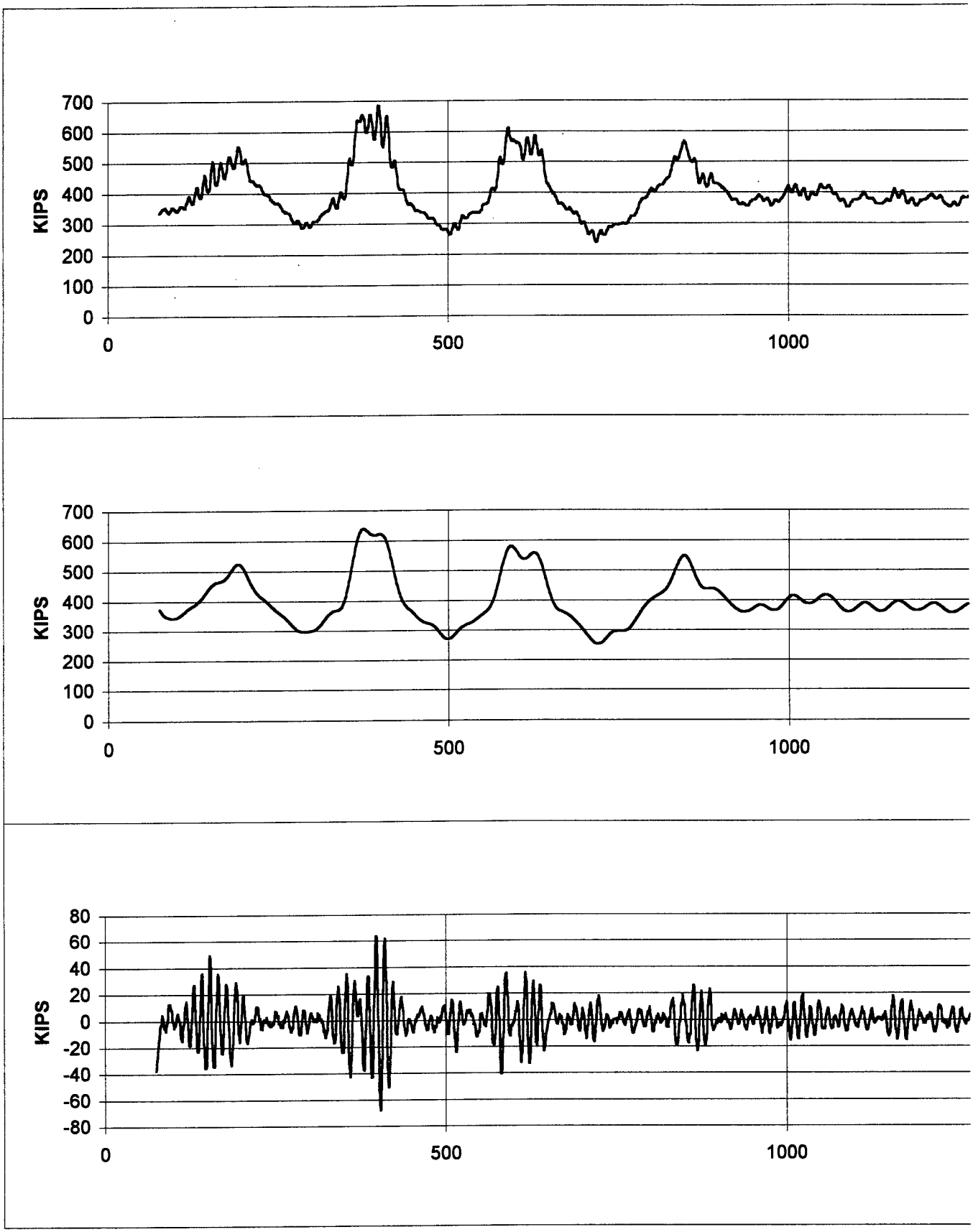
Filtered Low Frequency Time History



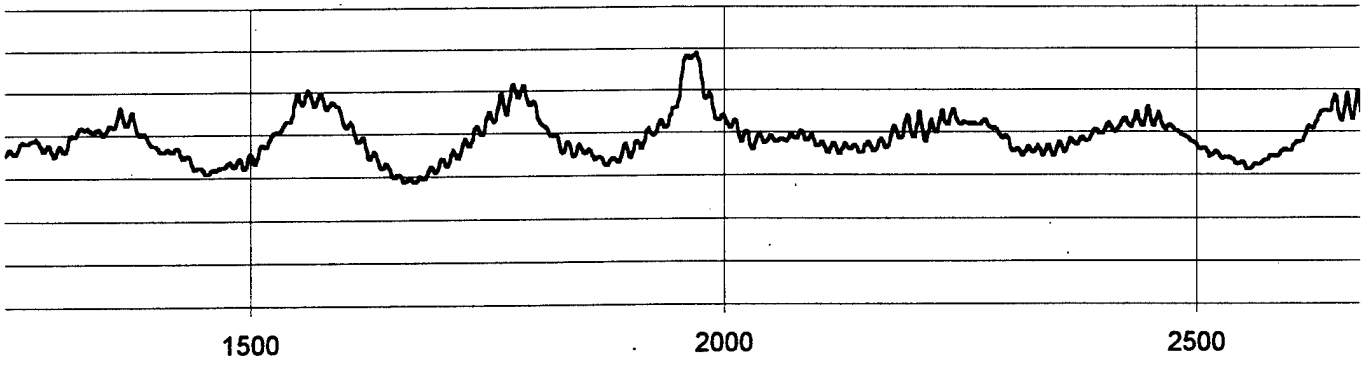
Filtered High Frequency Time History



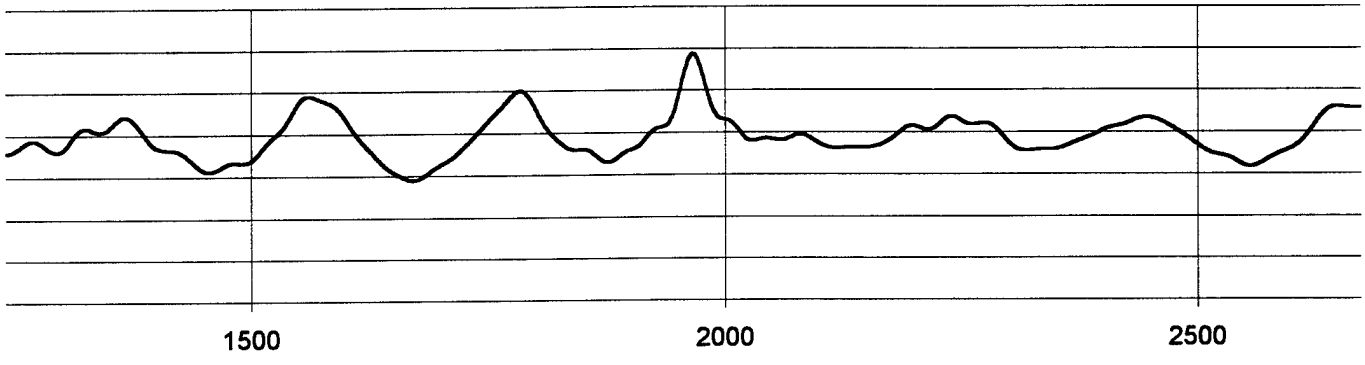
TEST A808 - ML_1 TENSION



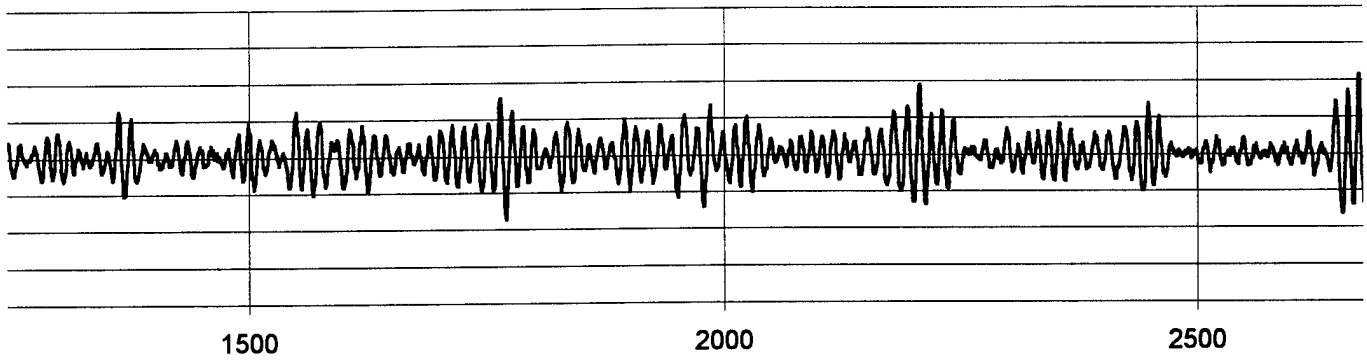
Unfiltered Time History



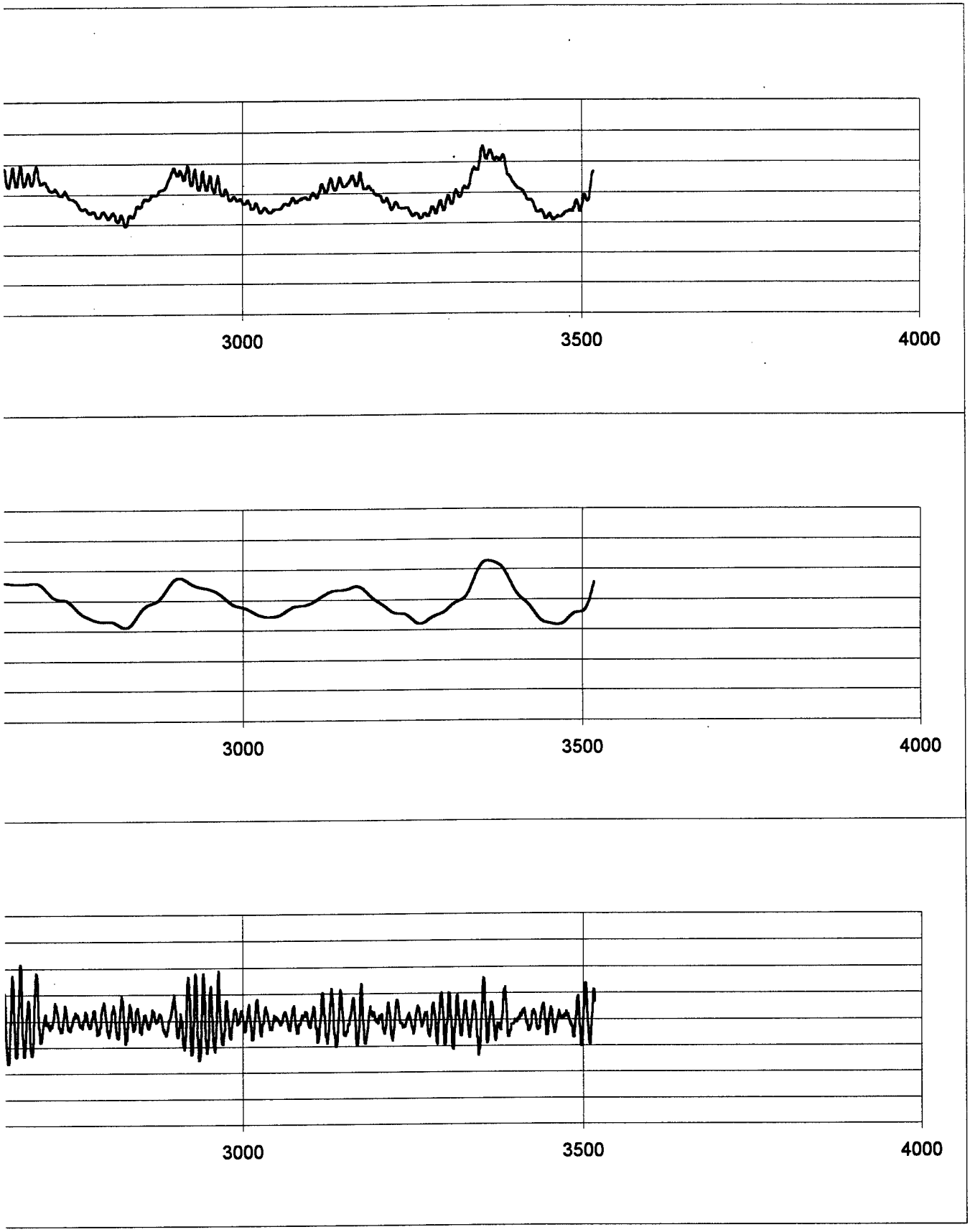
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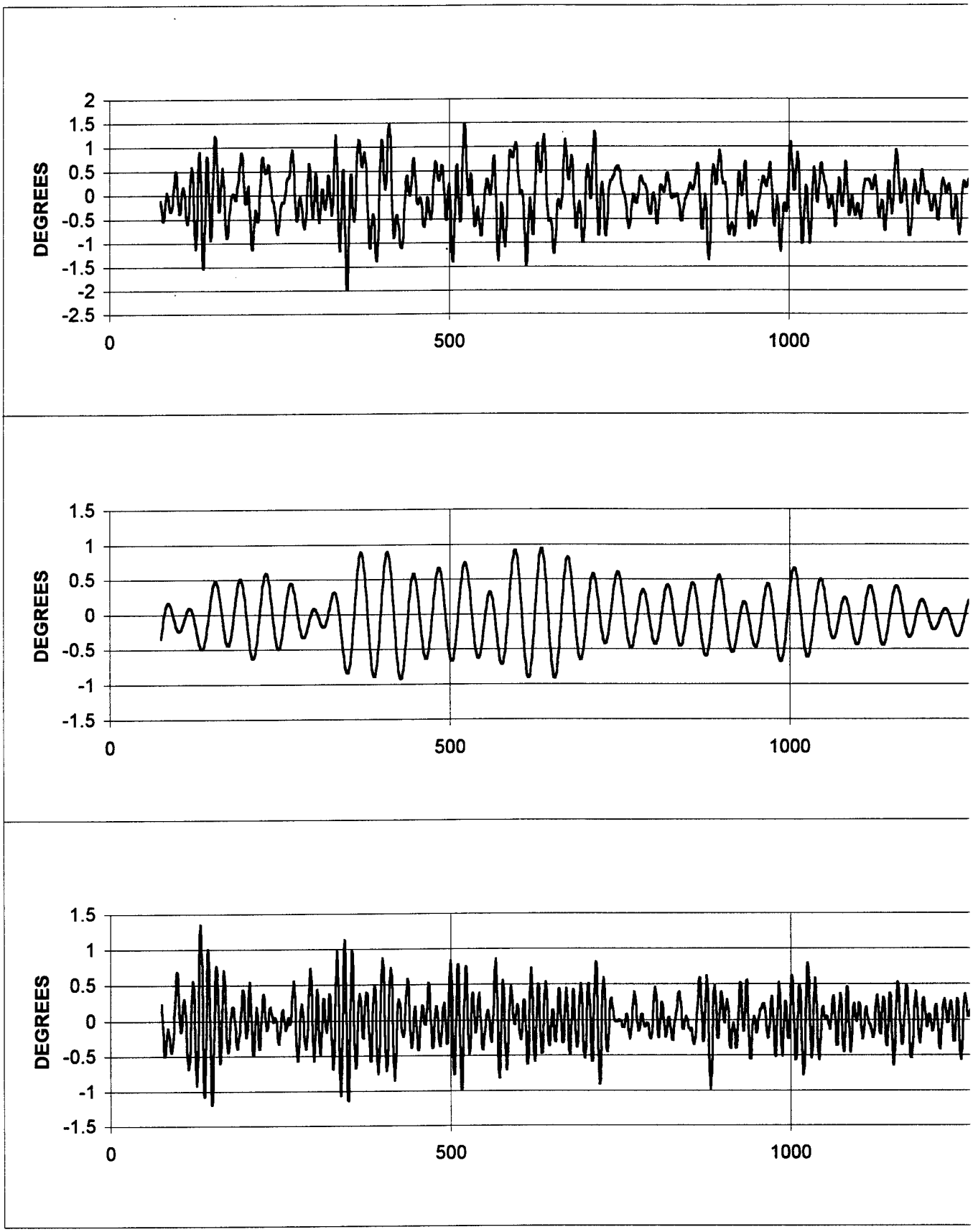
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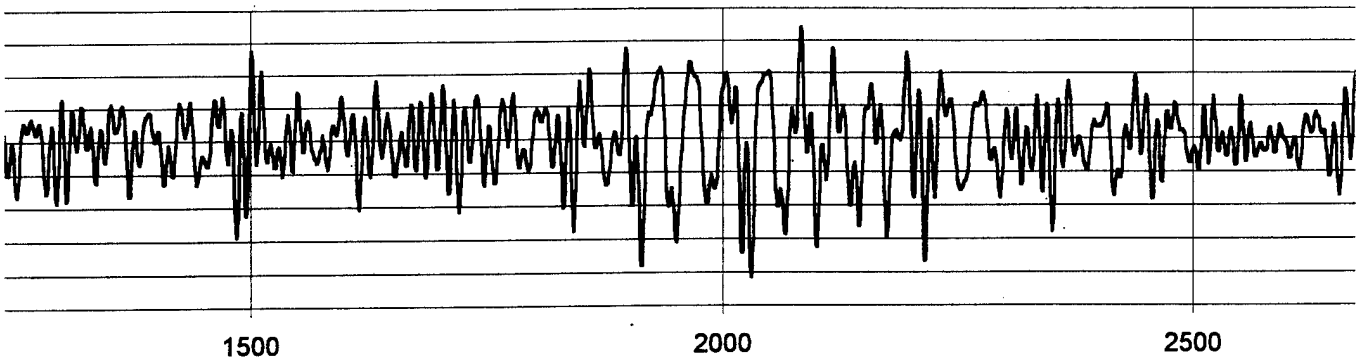
TEST A808 - ML_1 TENSION



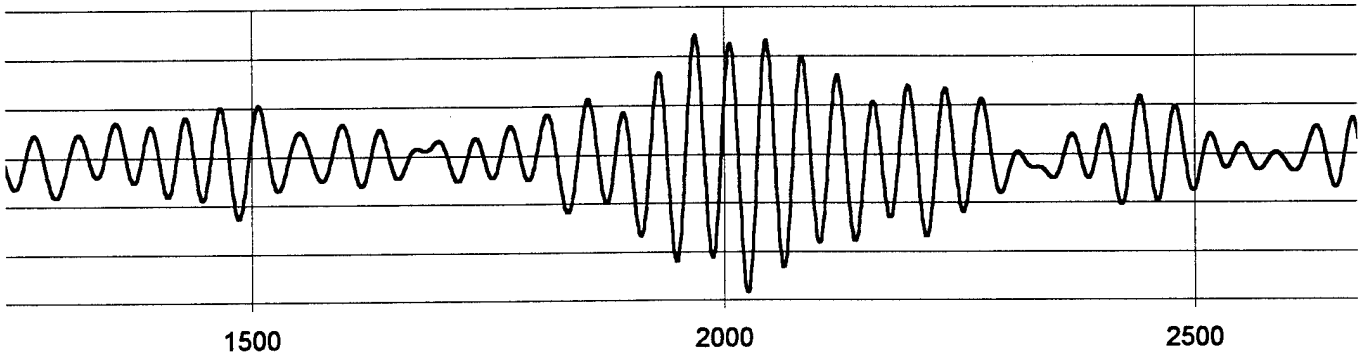
TEST A808 - PITCH



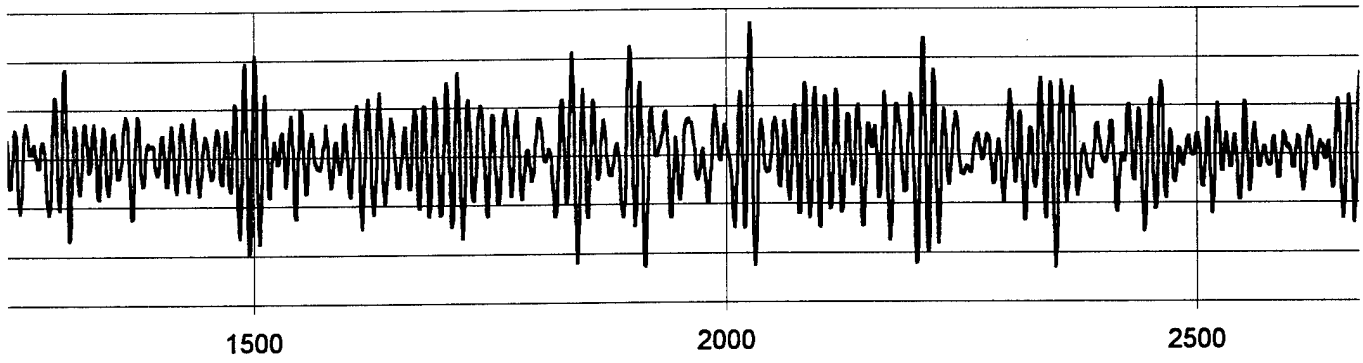
Unfiltered Time History



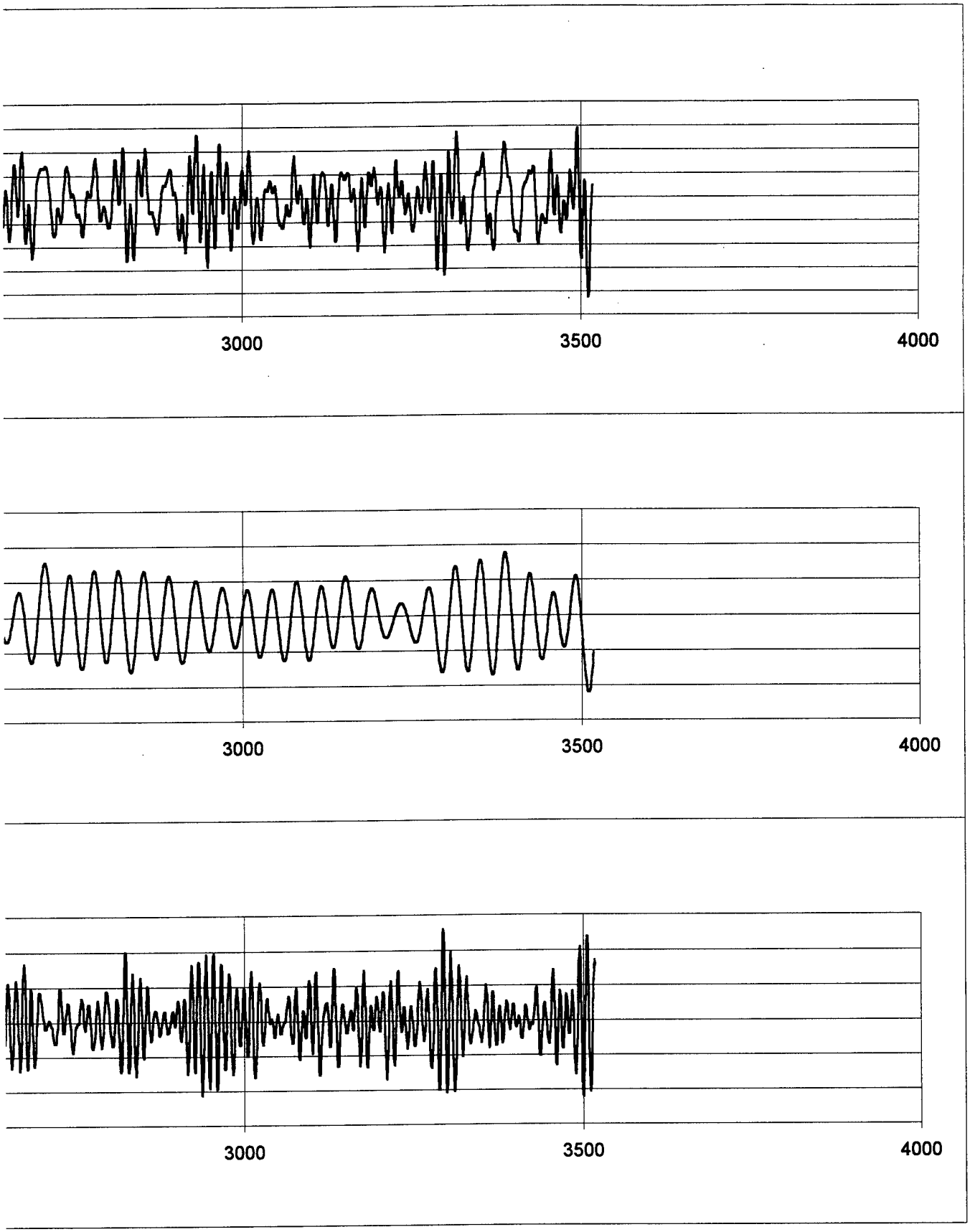
Filtered Low Frequency Time History



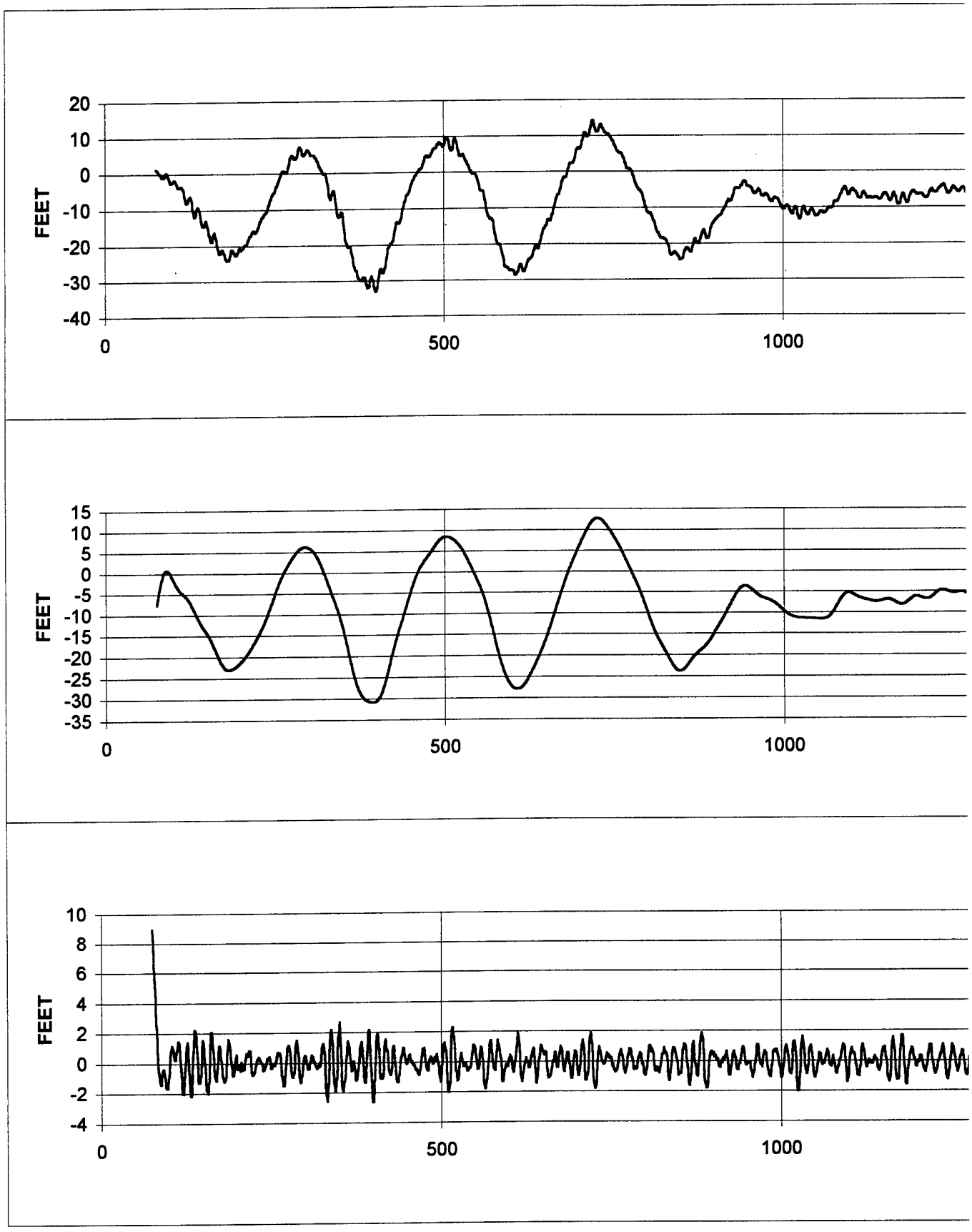
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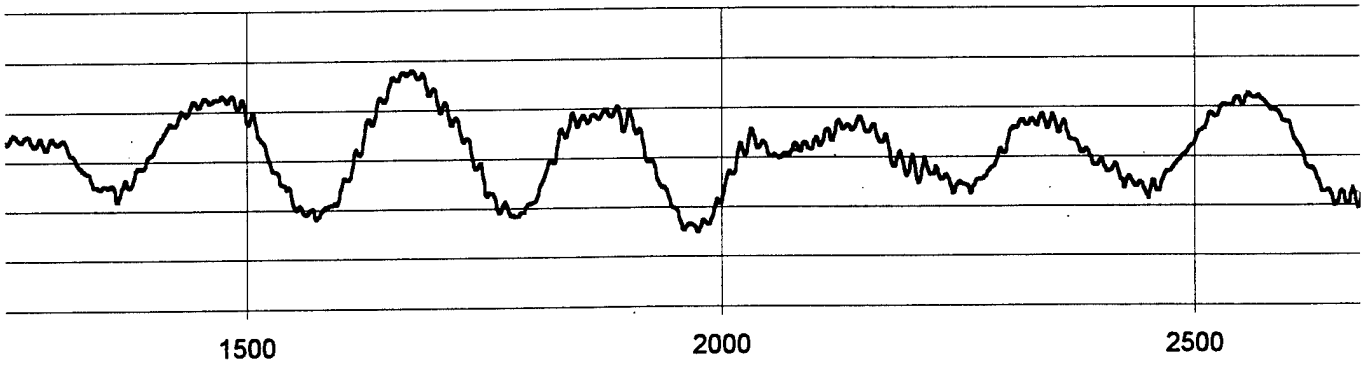
TEST A808 - PITCH



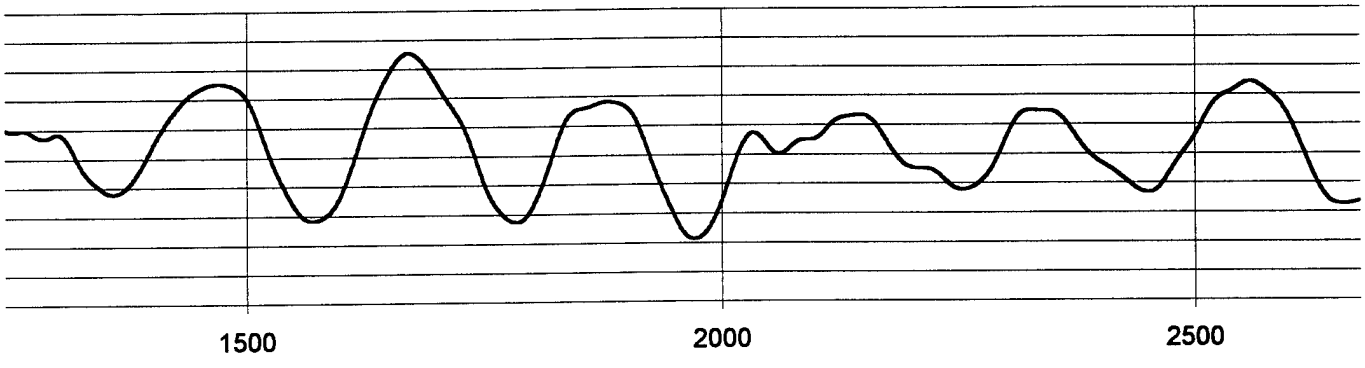
TEST A808 - PT SURGE



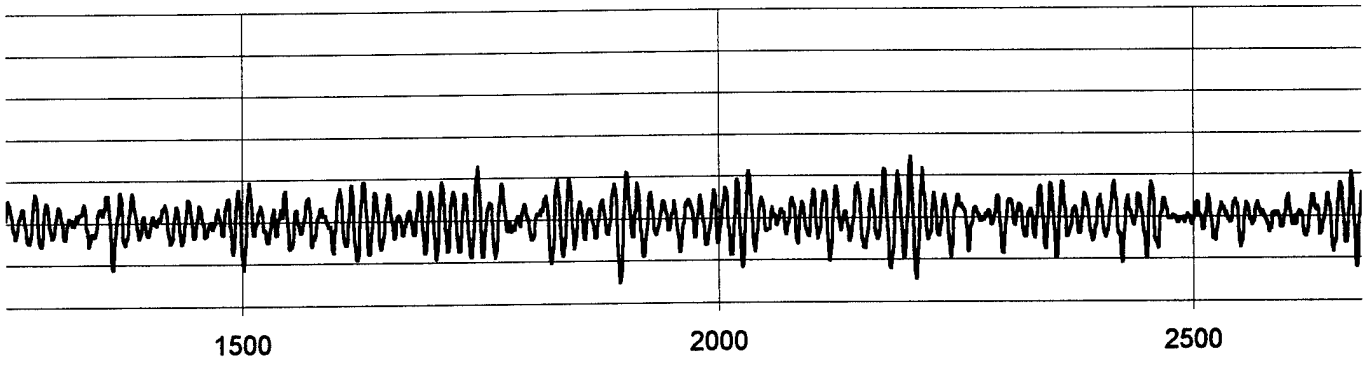
Unfiltered Time History



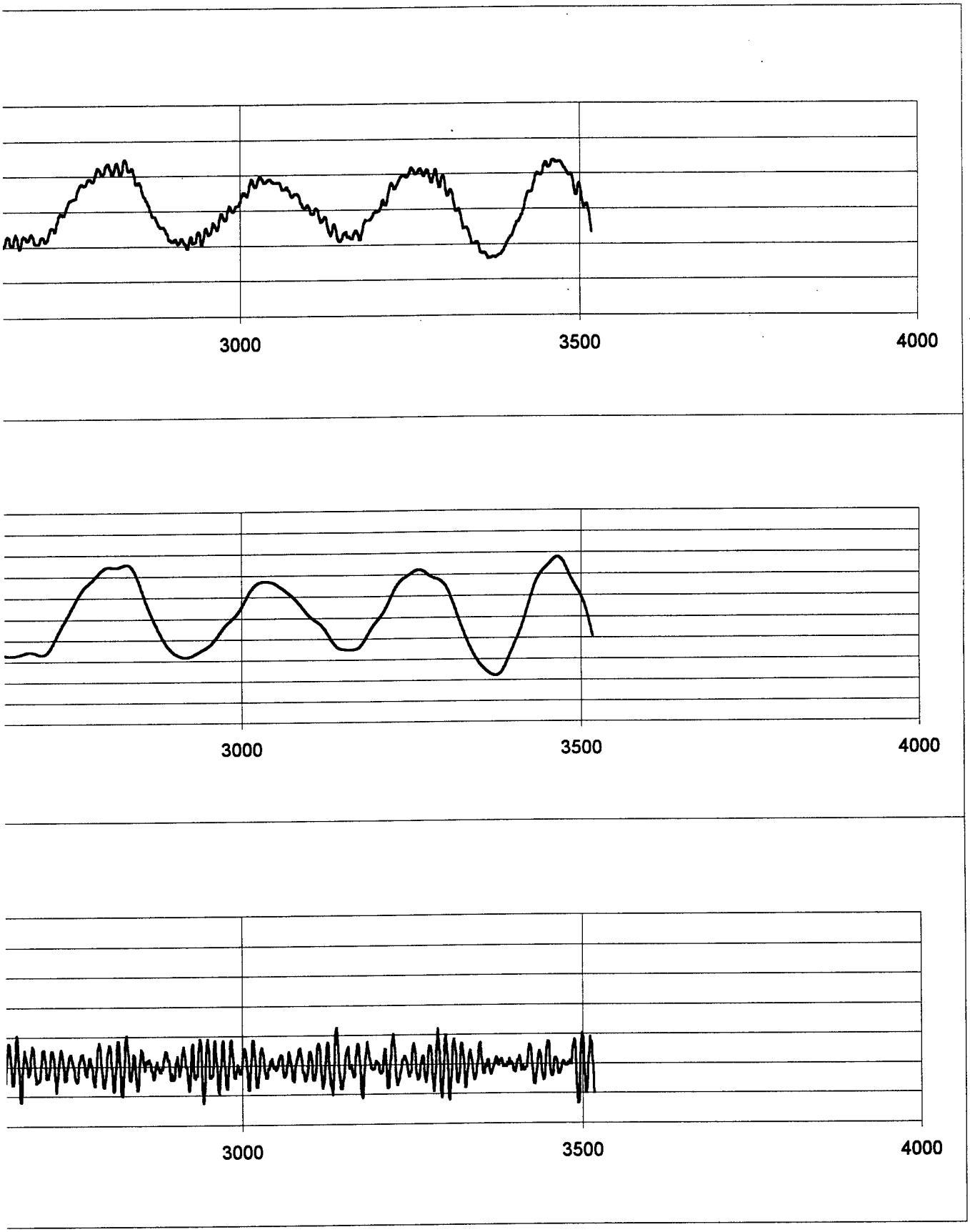
Filtered Low Frequency Time History



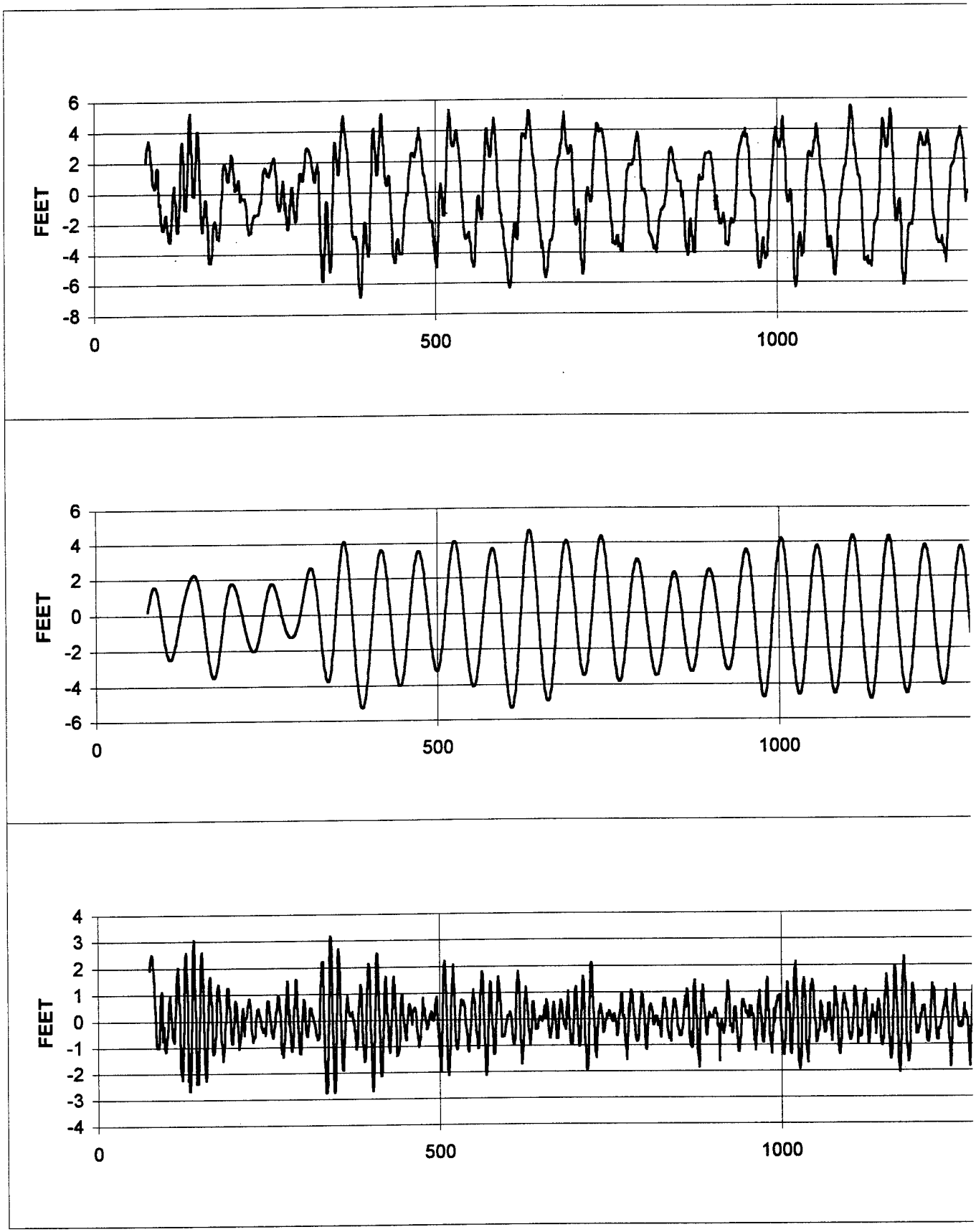
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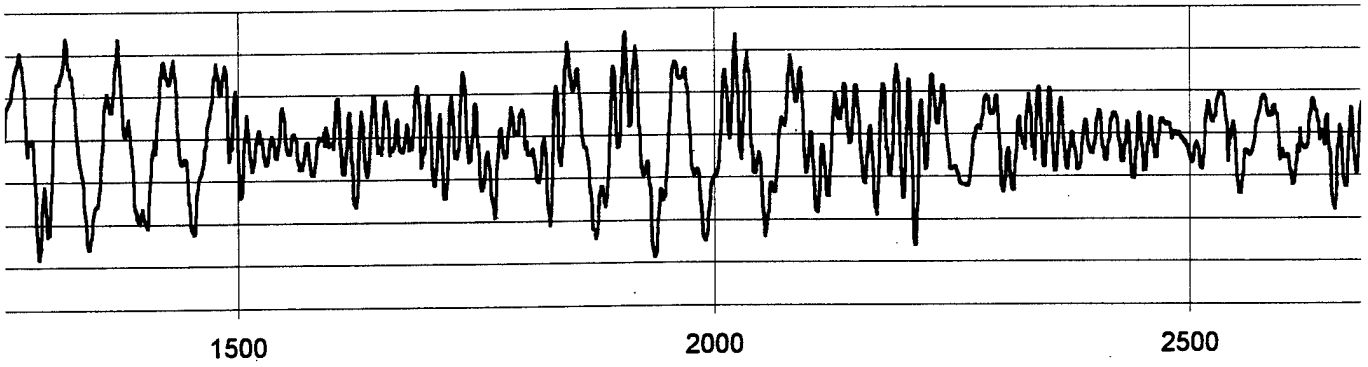
TEST A808 - PT SURGE



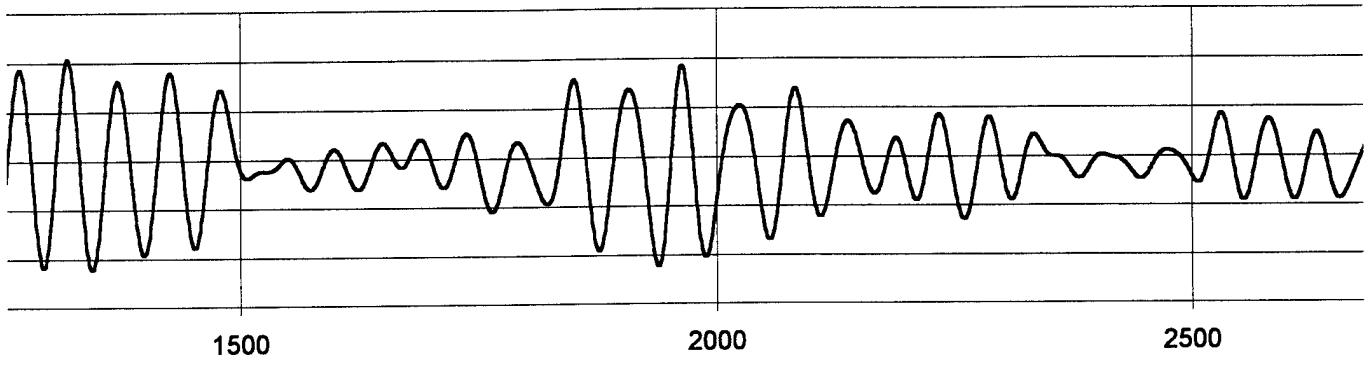
TEST A808 - PT HEAVE



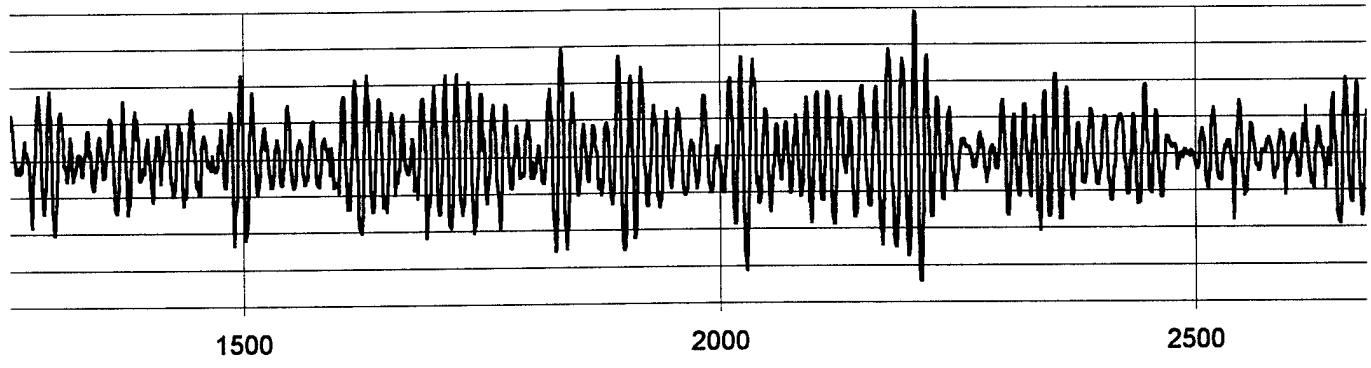
Unfiltered Time History



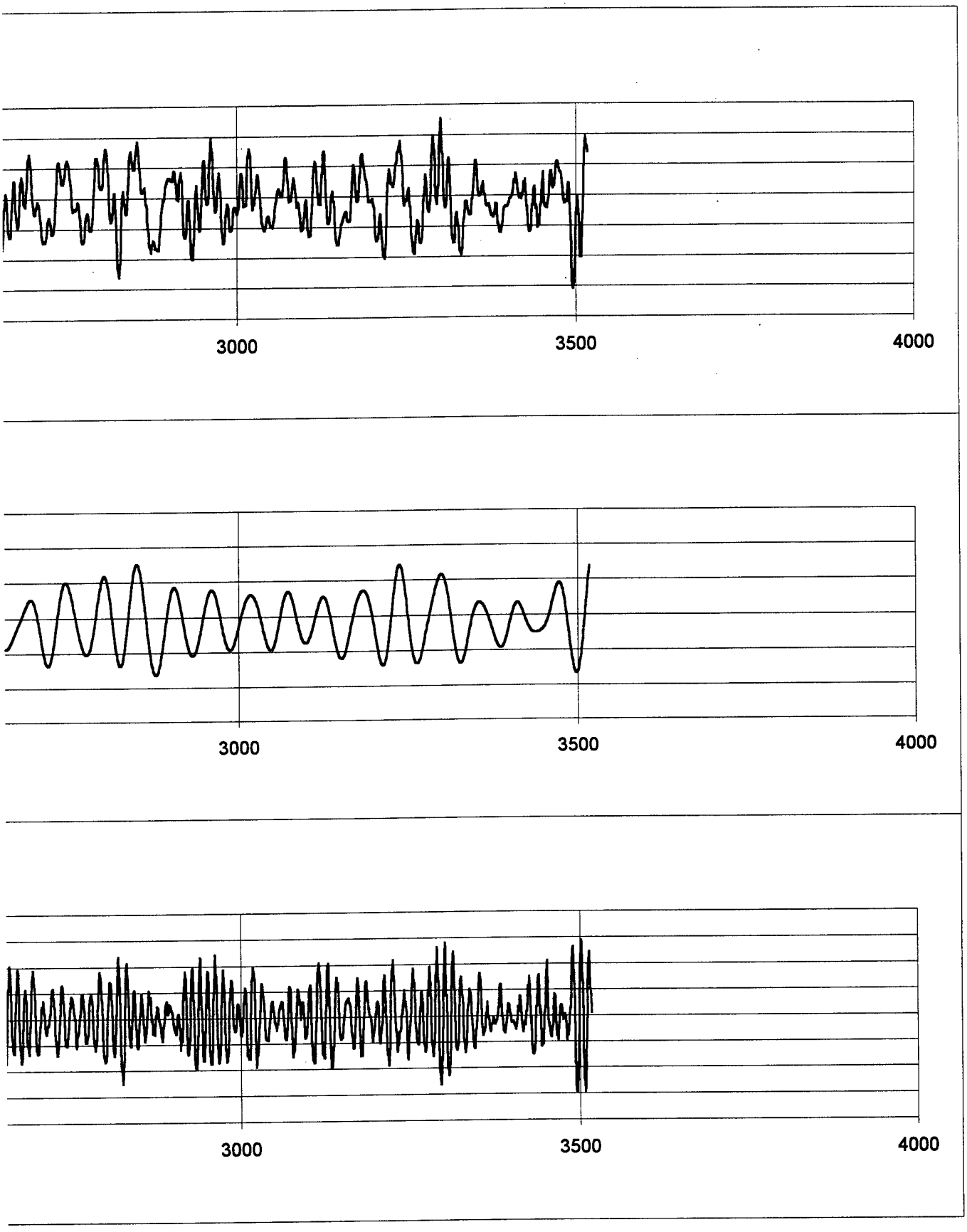
Filtered Low Frequency Time History



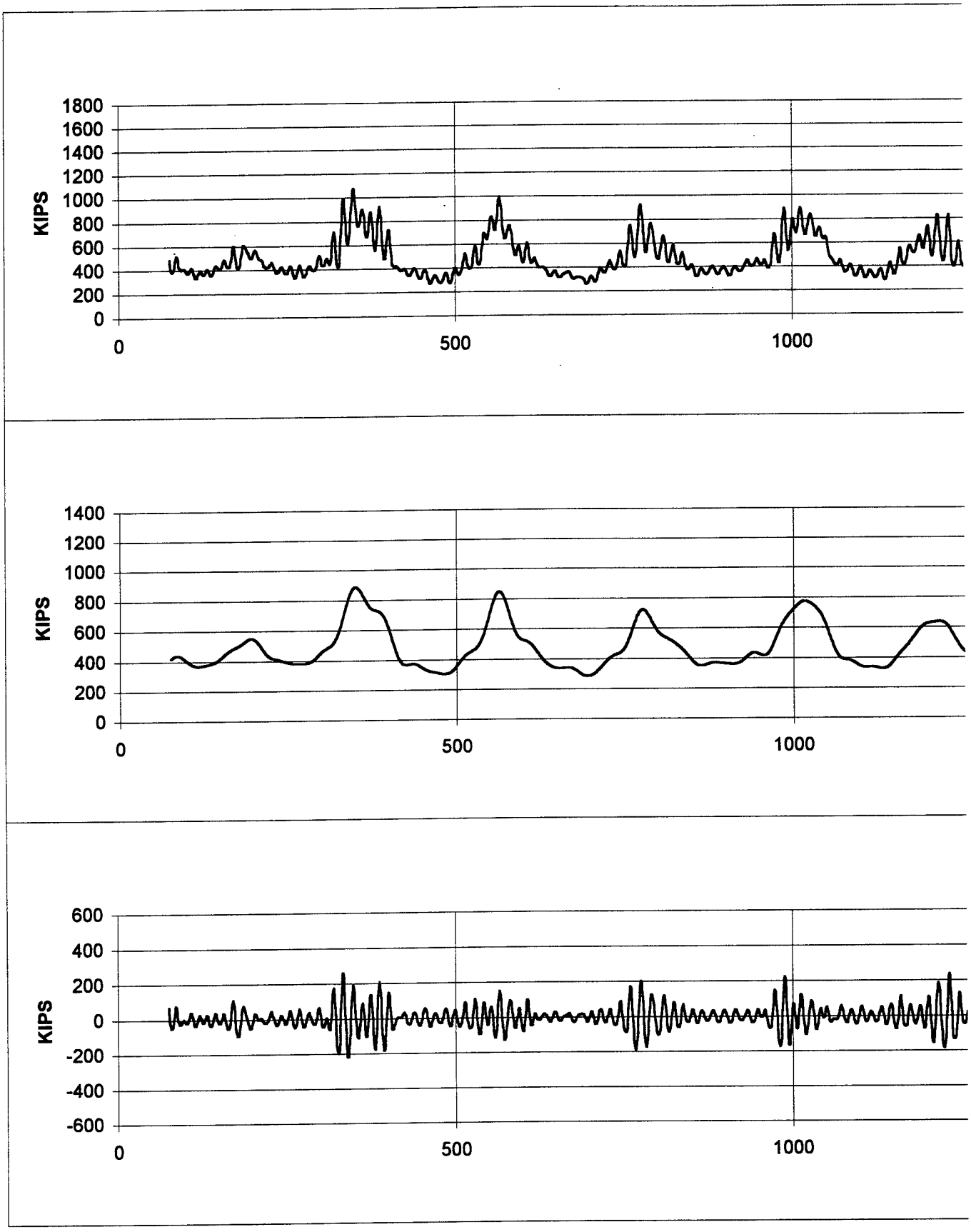
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TEST A808 - PT HEAVE

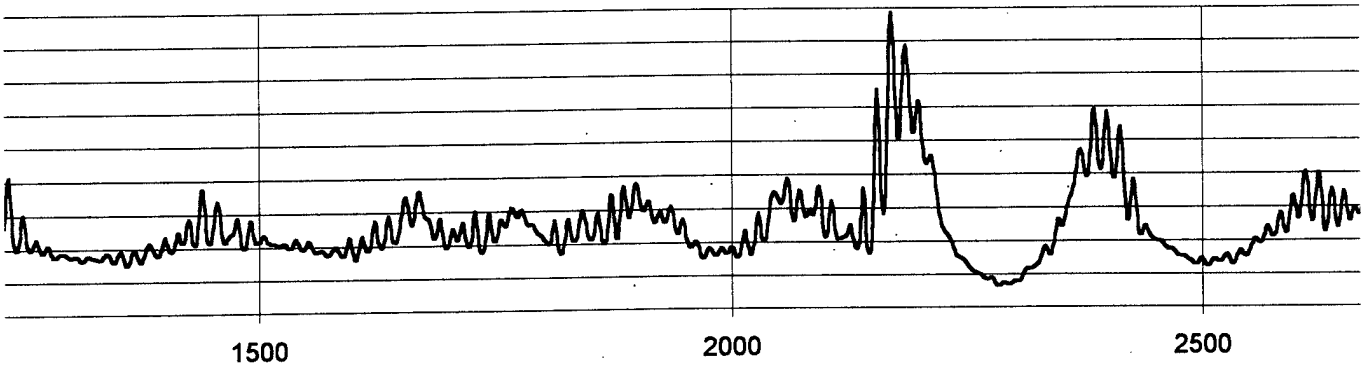


TEST A809 - ML_1 TENSION

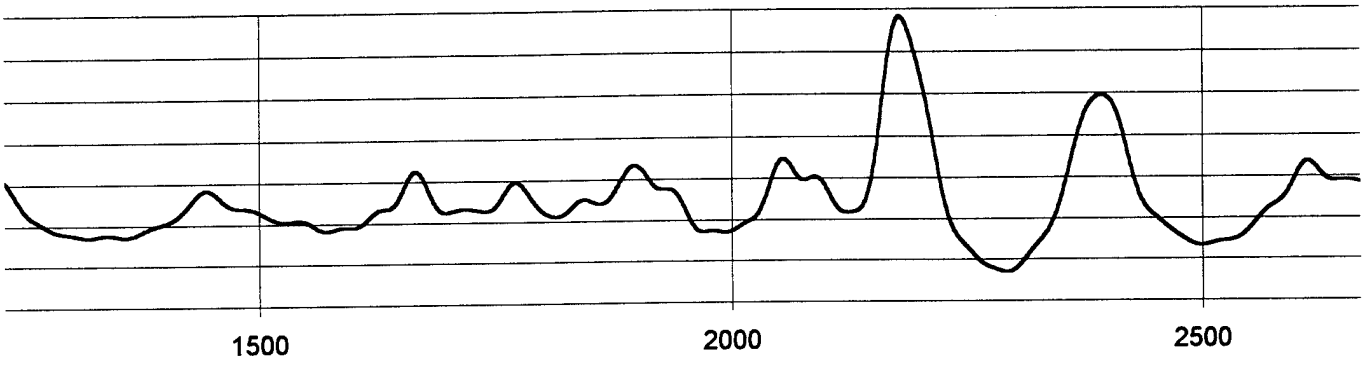


TEST A809 - ML_1 TENSION

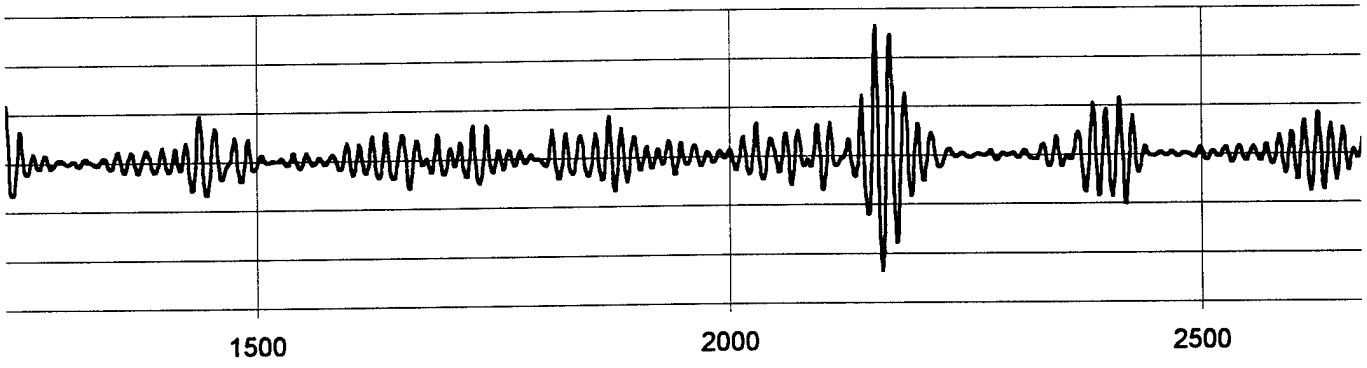
Unfiltered Time History



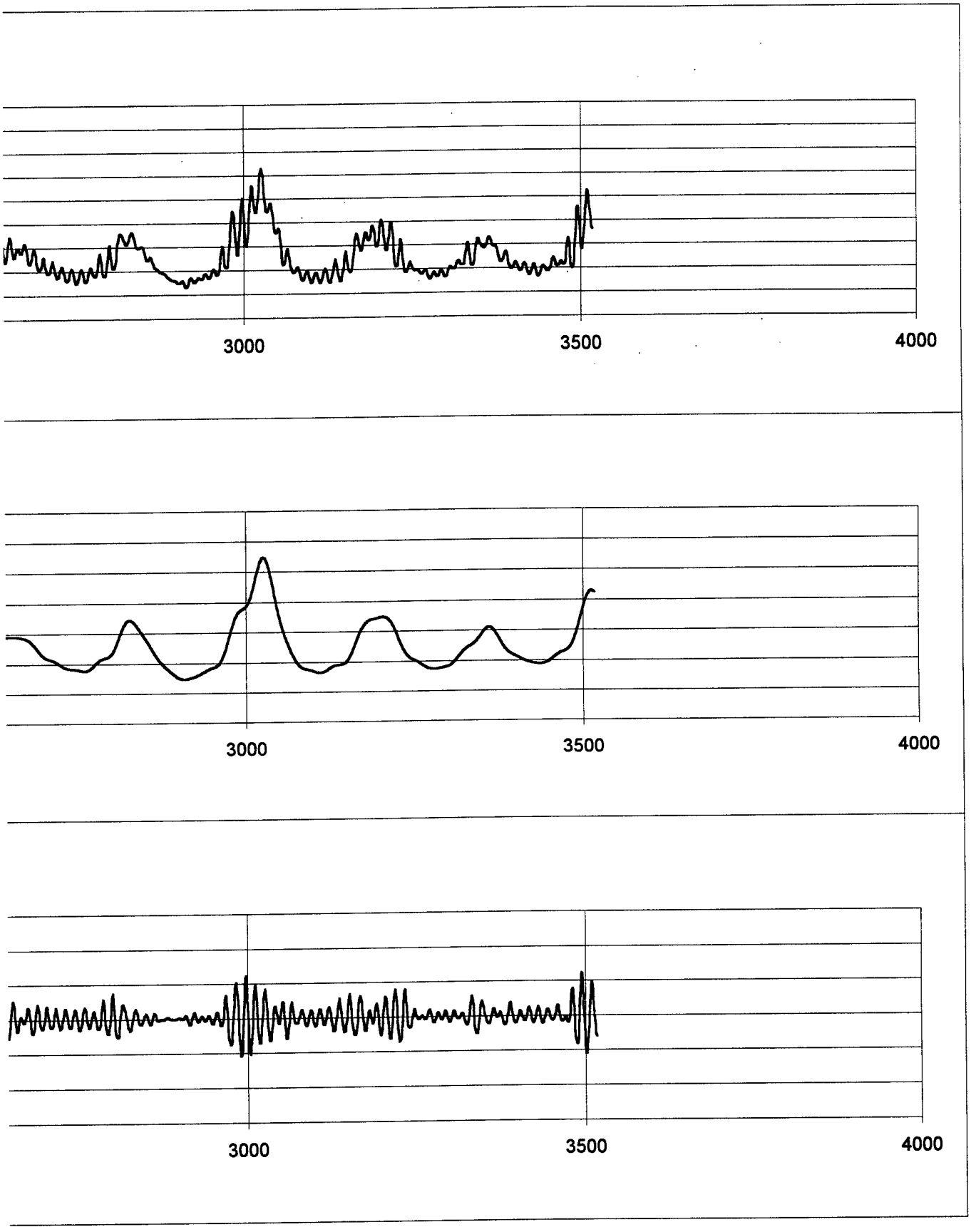
Filtered Low Frequency Time History



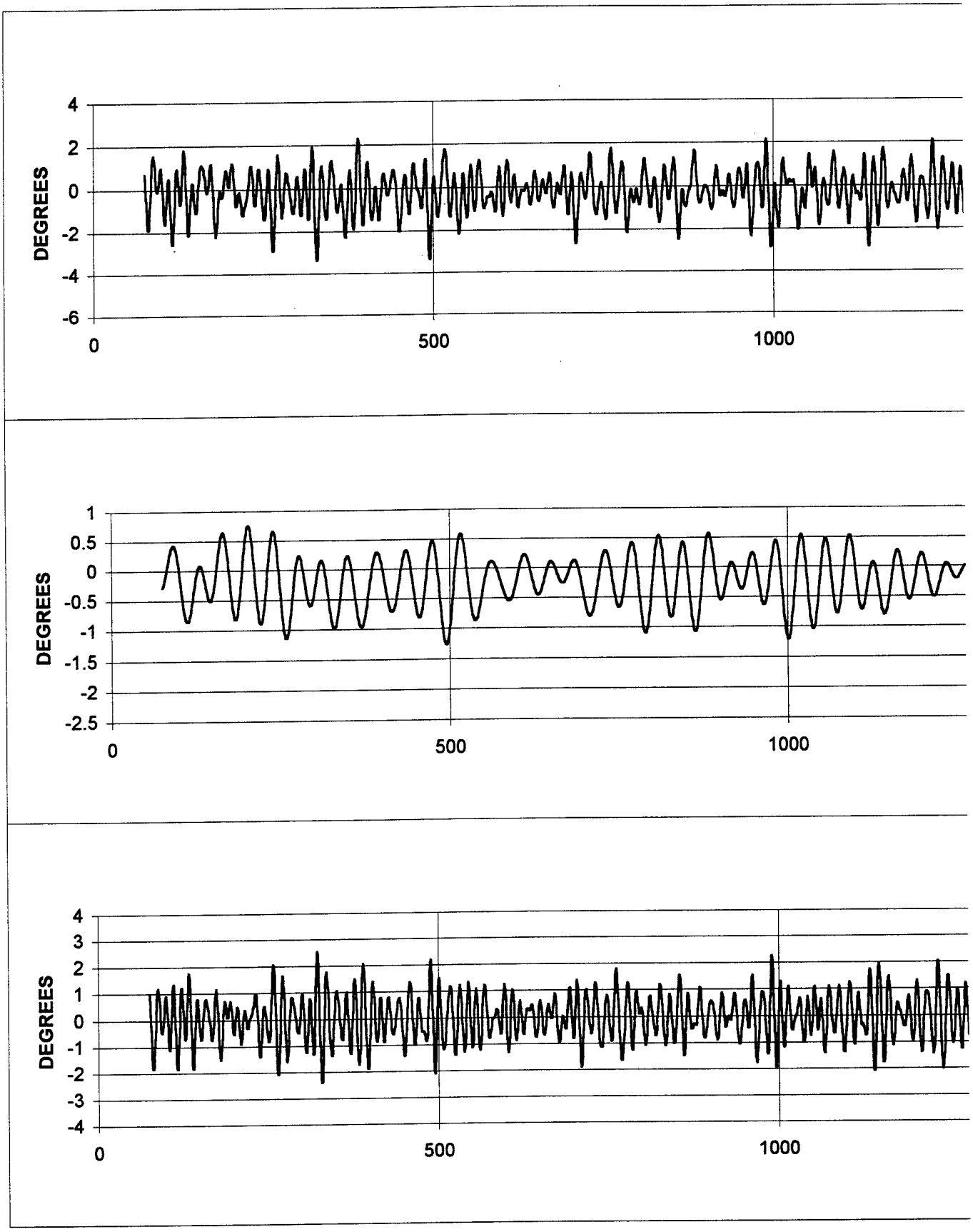
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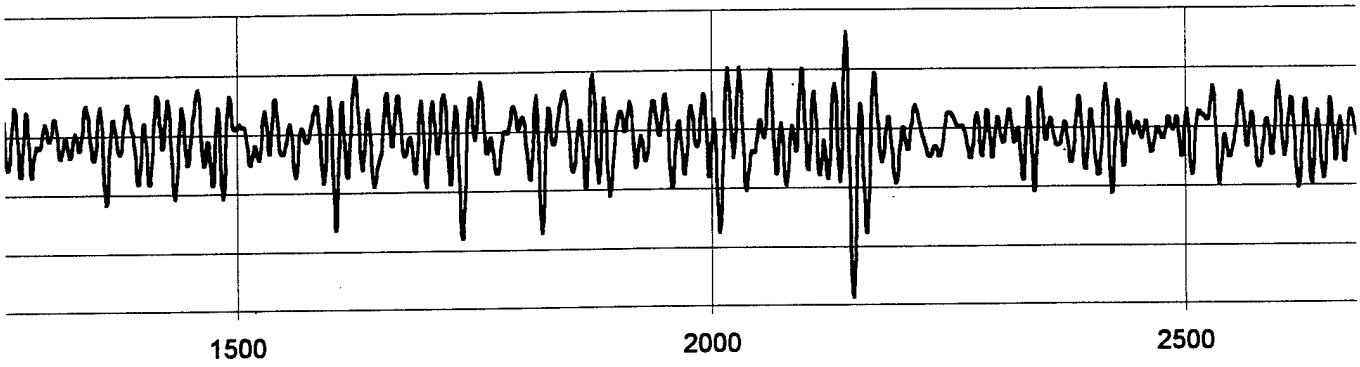
TEST A809 - ML_1 TENSION



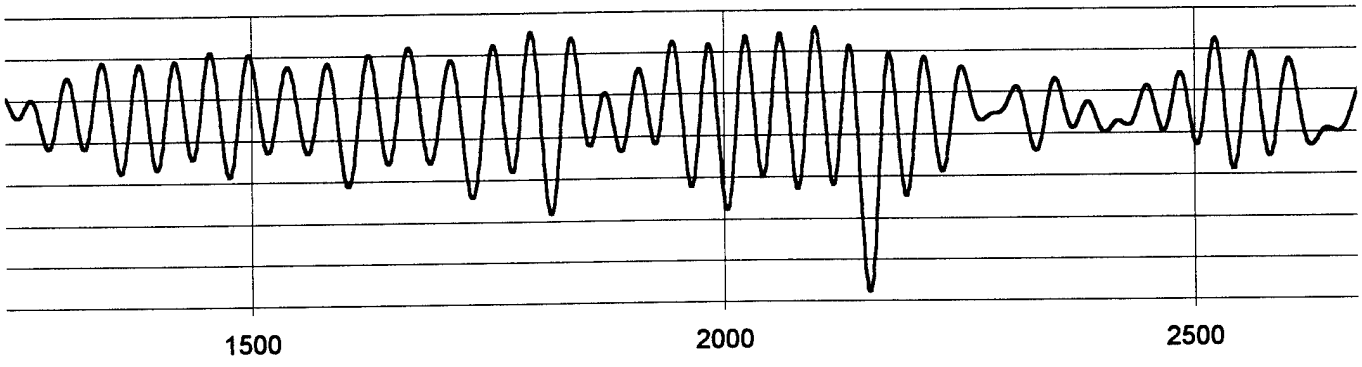
TEST A809 - PITCH



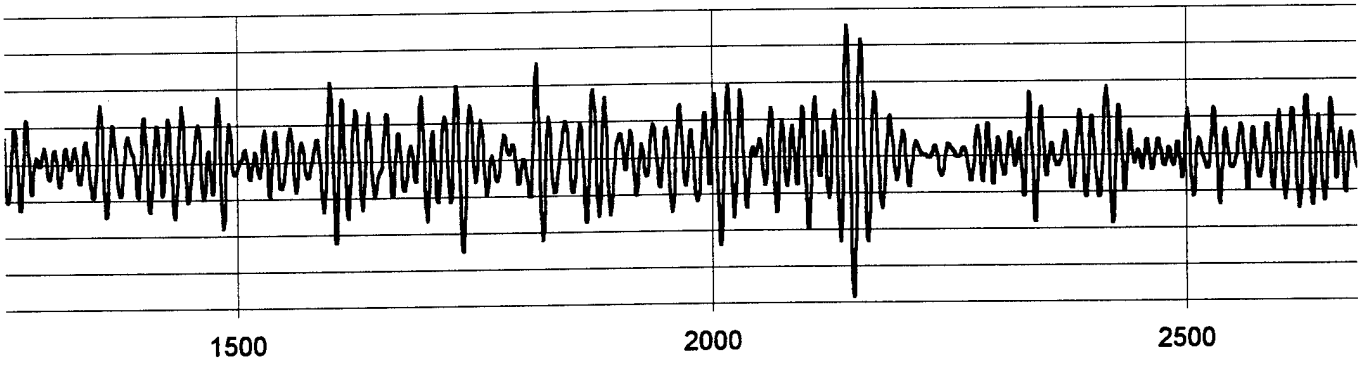
Unfiltered Time History



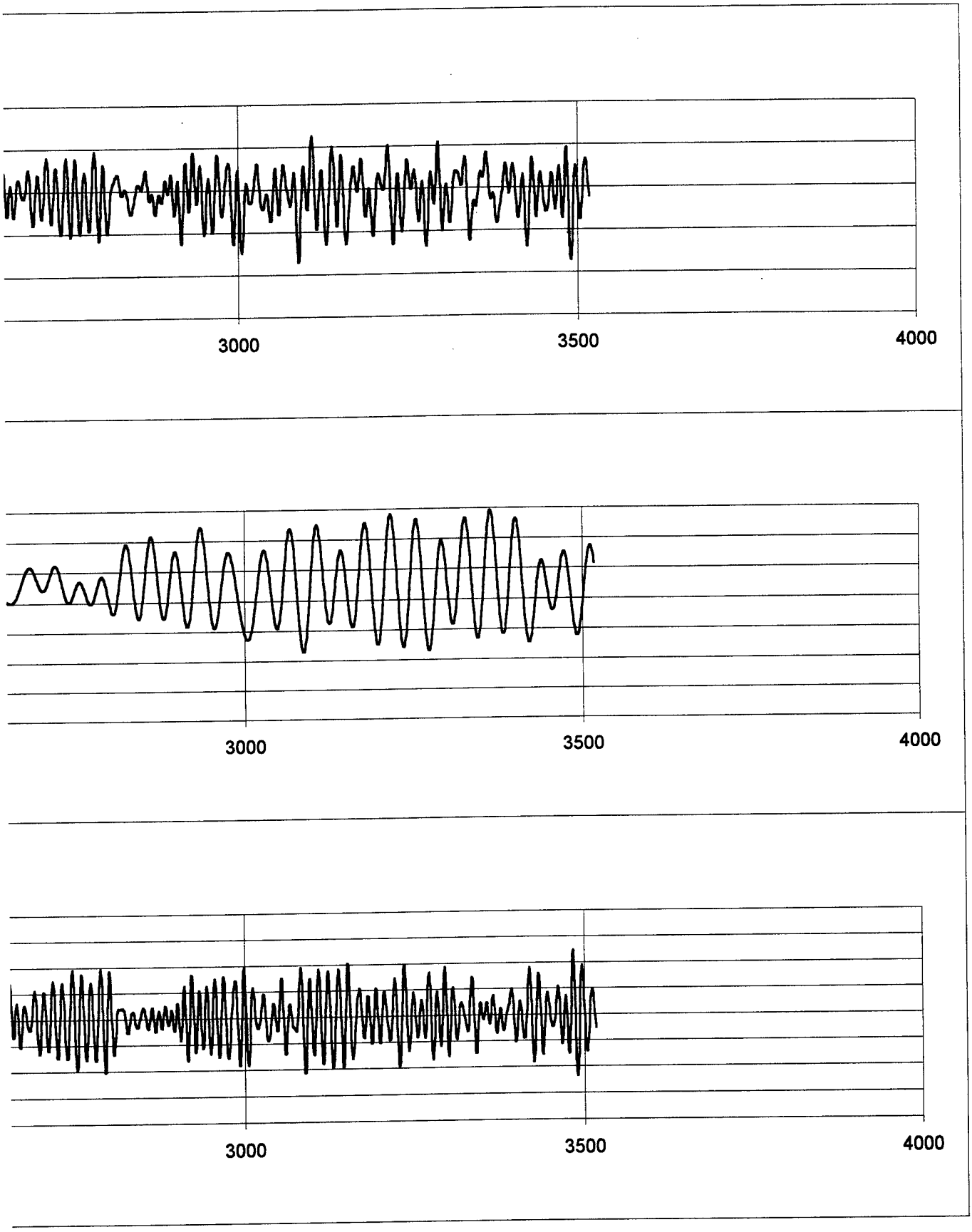
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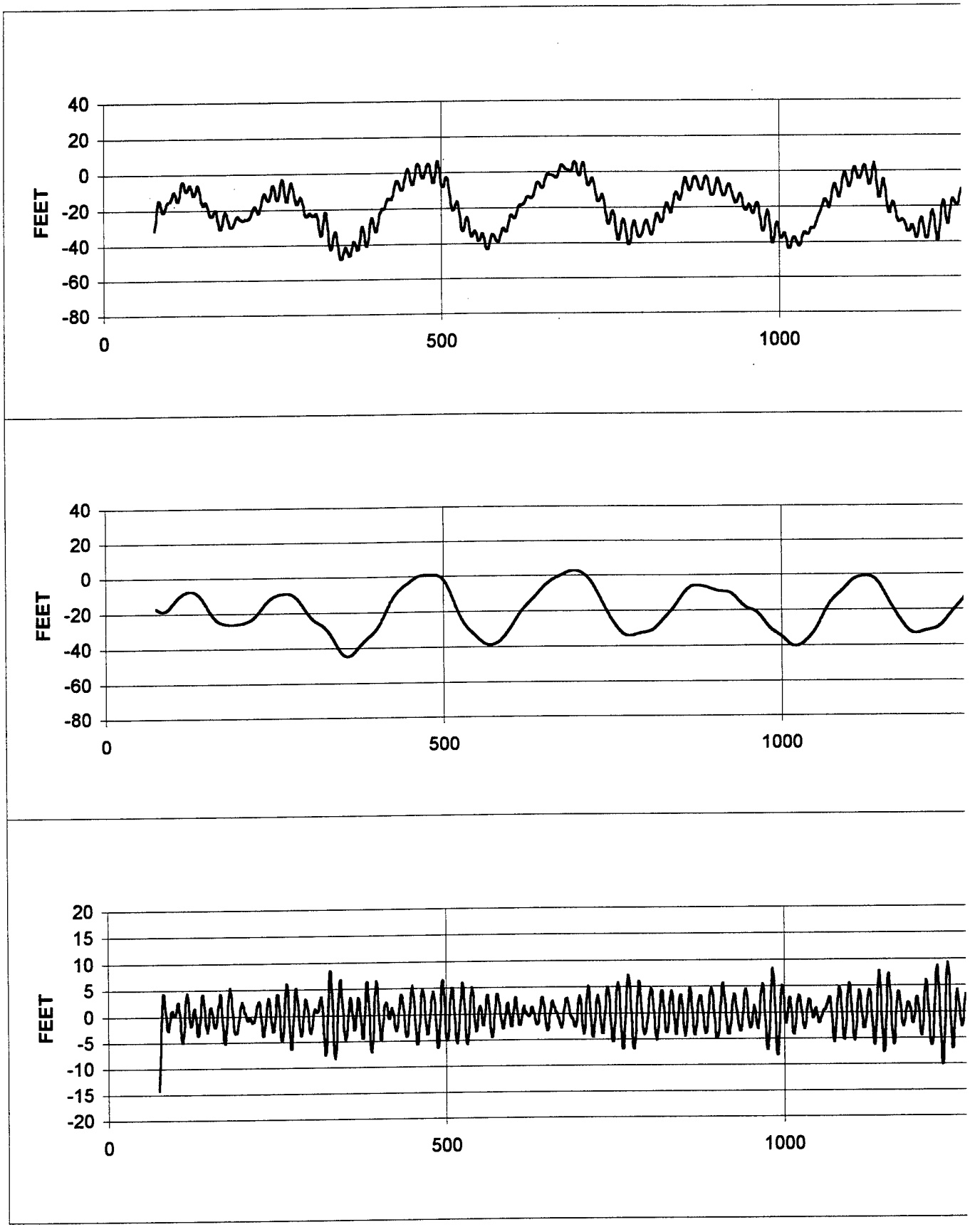
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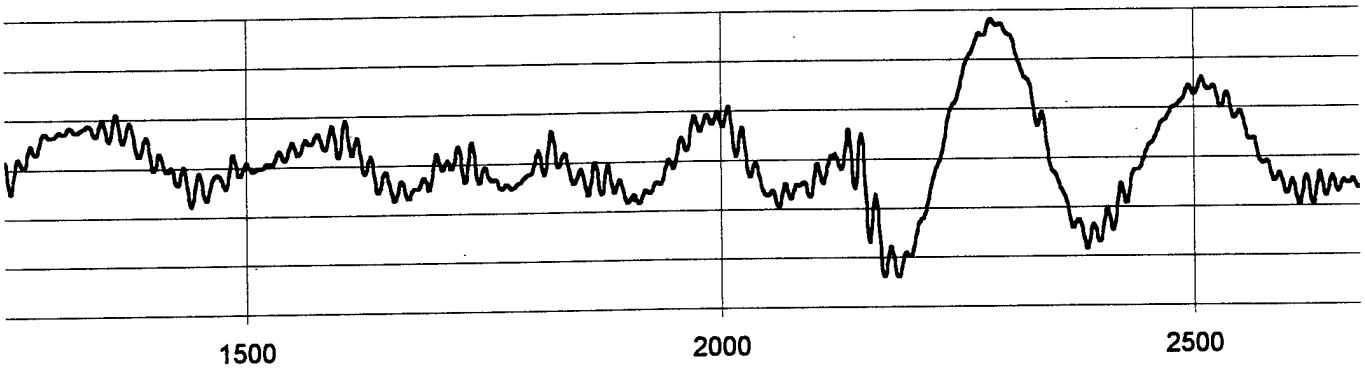
TEST A809 - PITCH



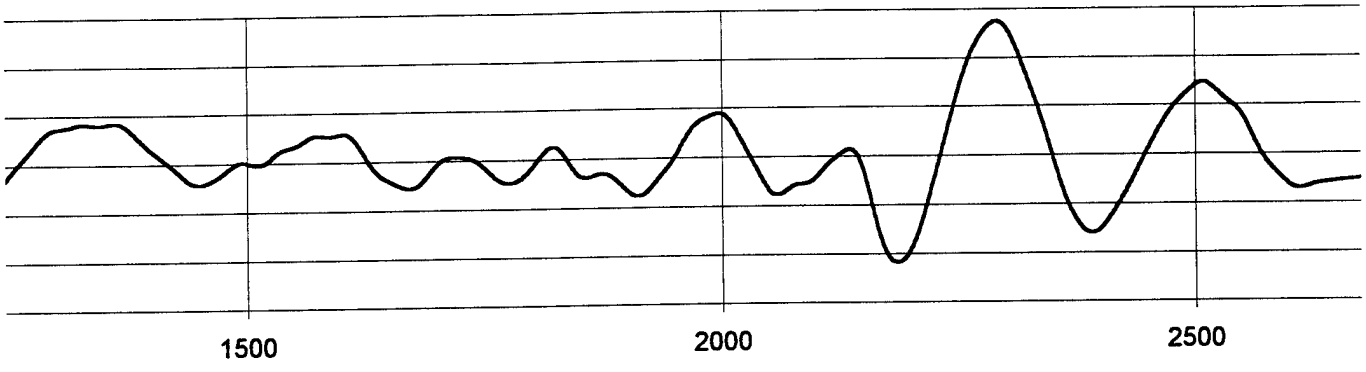
TEST A809 - PT SURGE



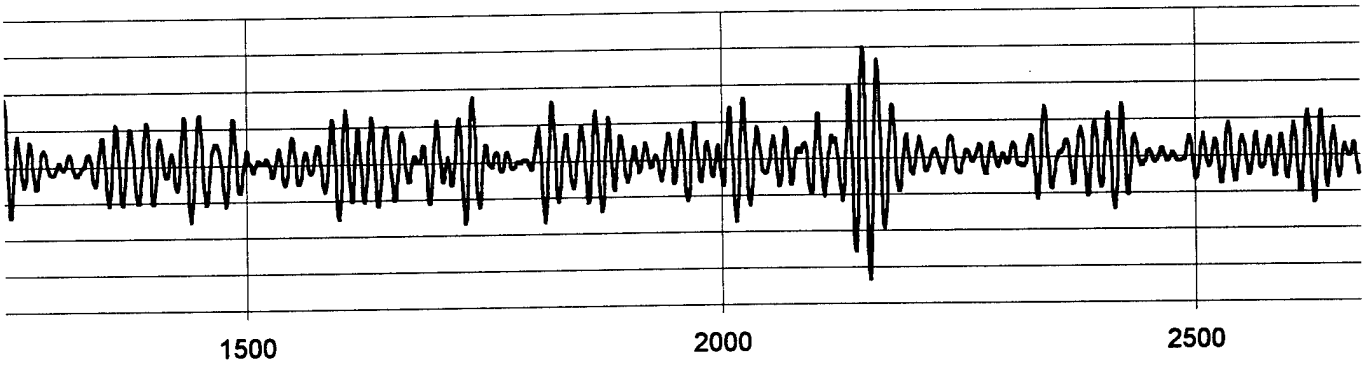
Unfiltered Time History



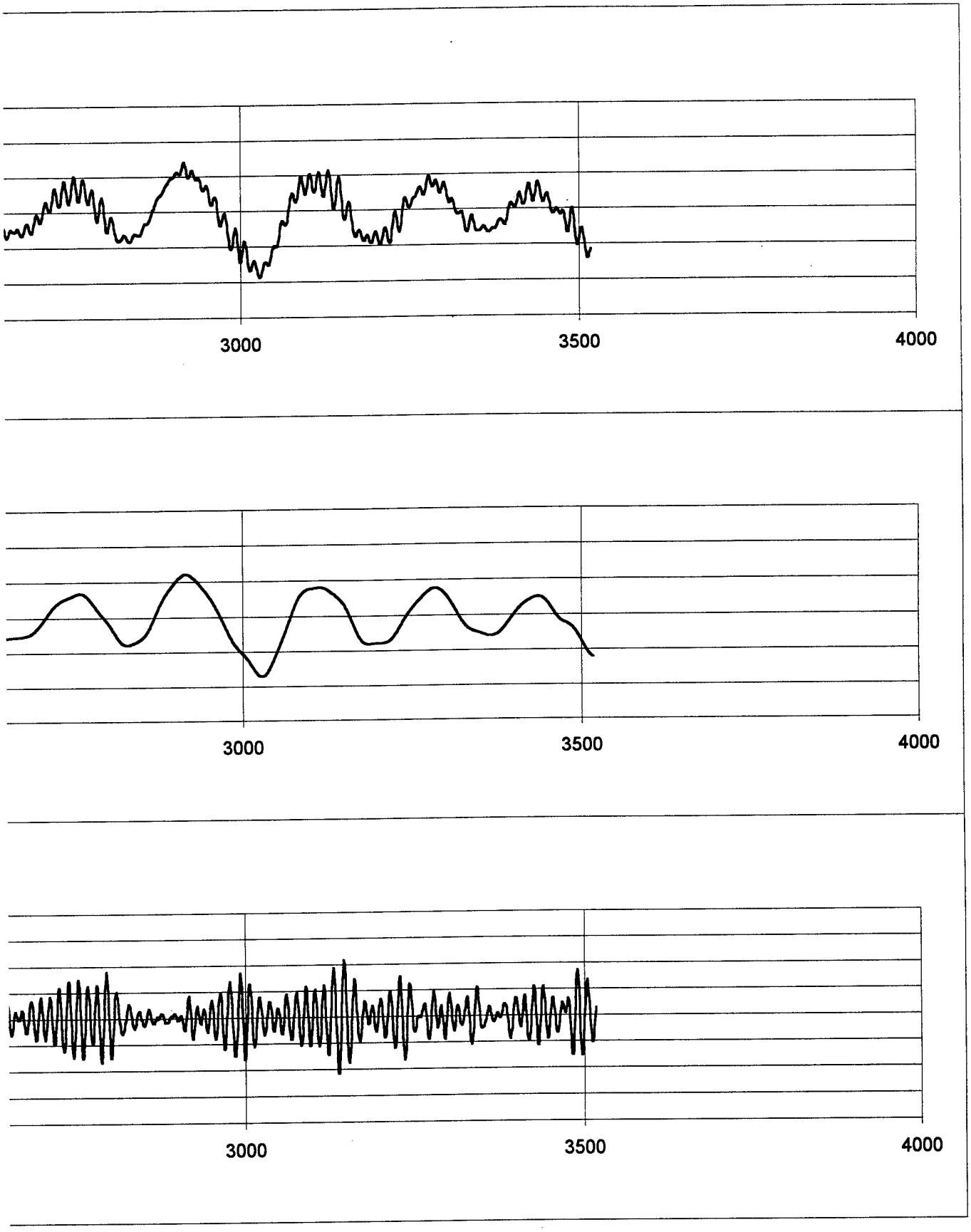
Filtered Low Frequency Time History



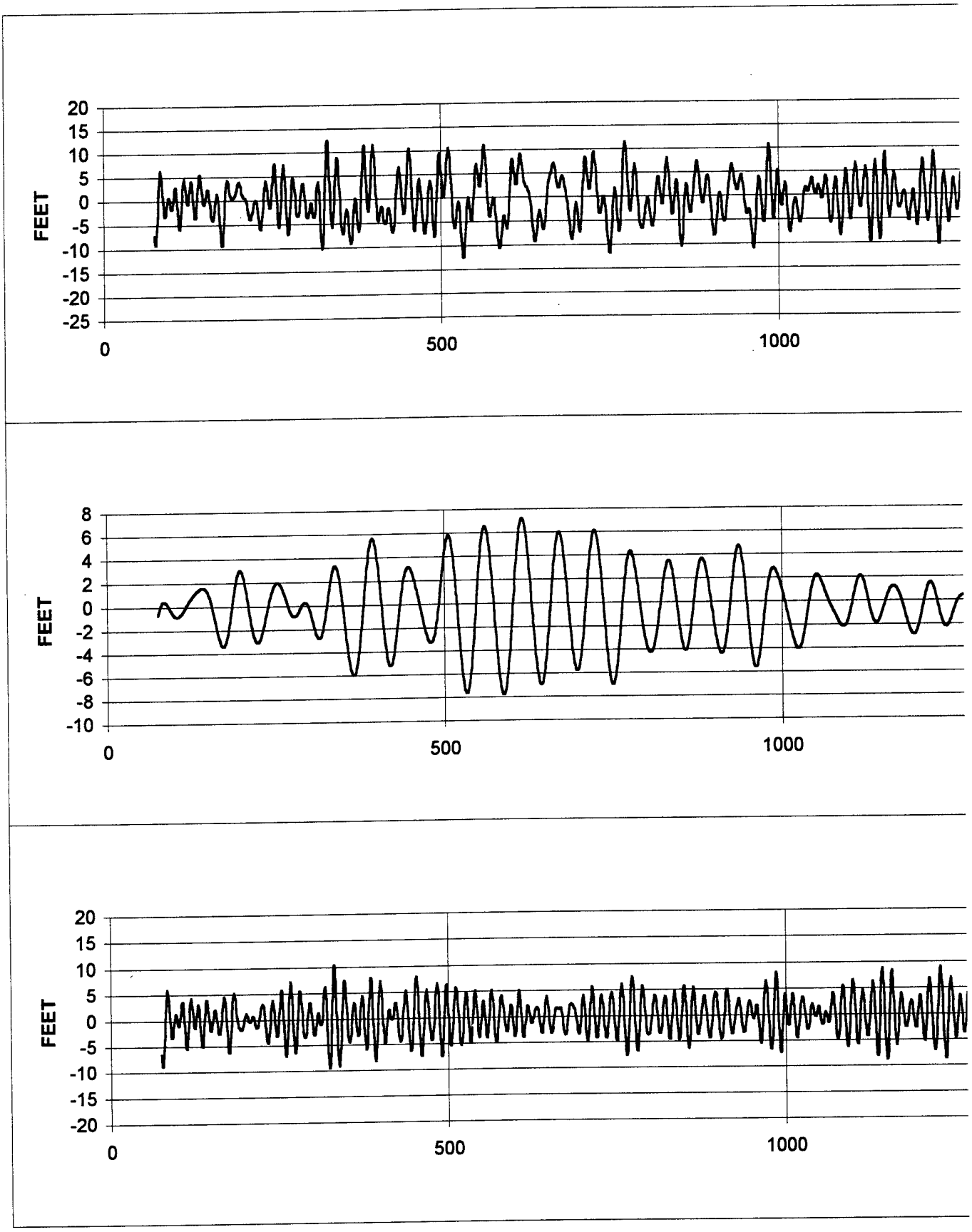
Filtered High Frequency Time History



TEST A809 - PT SURGE

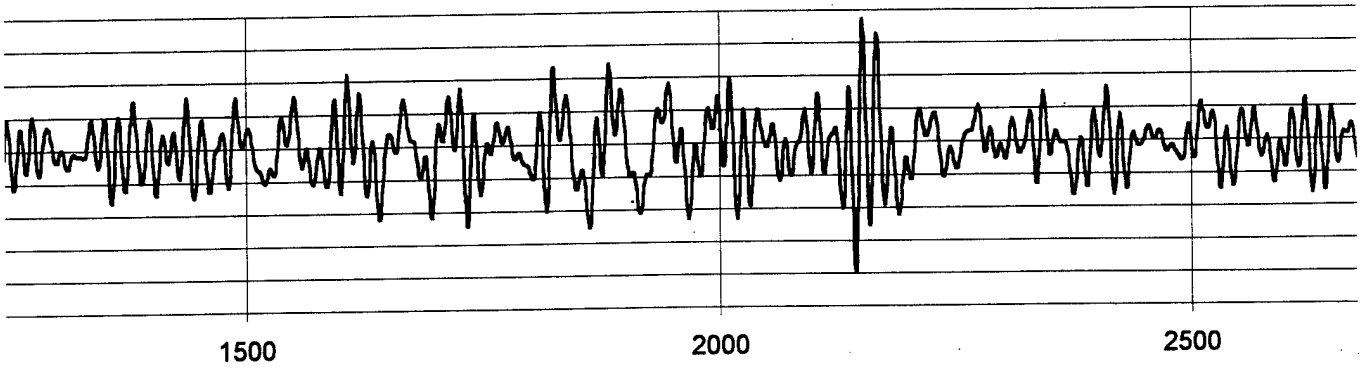


TEST A809 - PT HEAVE

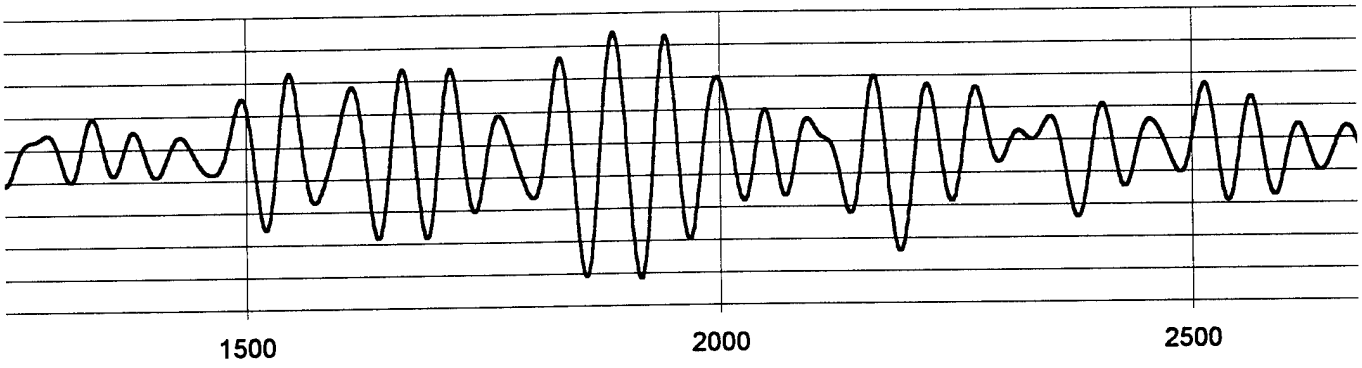


TEST A809 - PT HEAVE

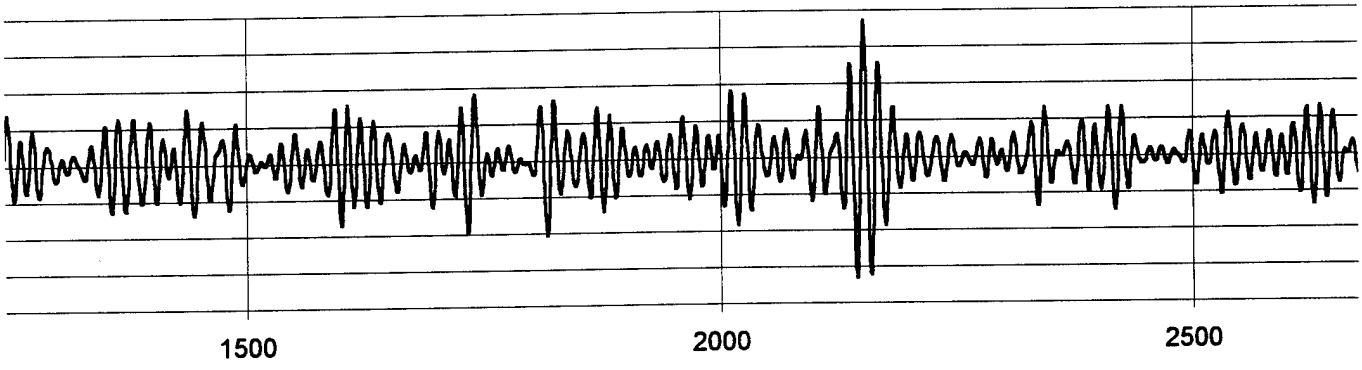
Unfiltered Time History



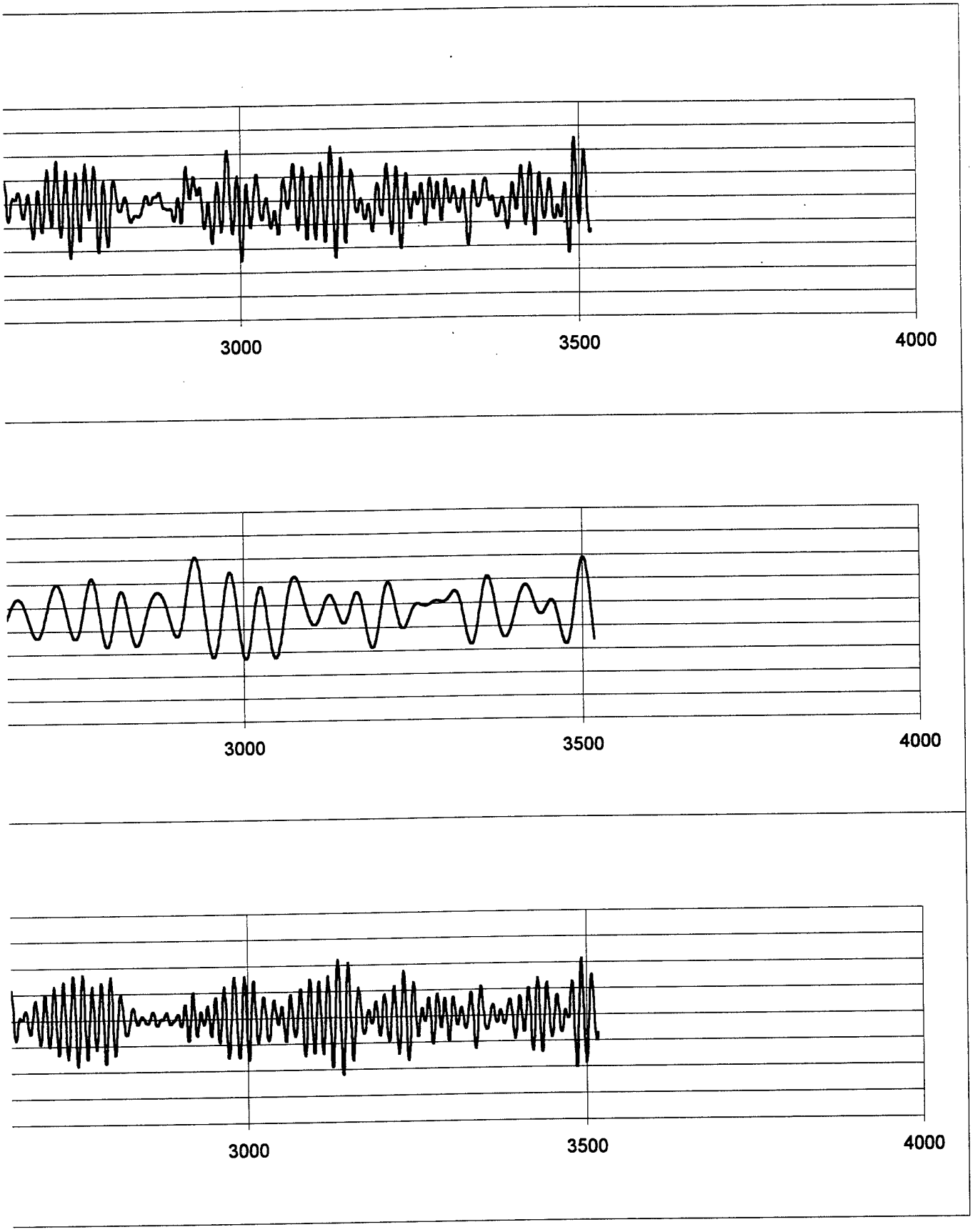
Filtered Low Frequency Time History



Filtered High Frequency Time History

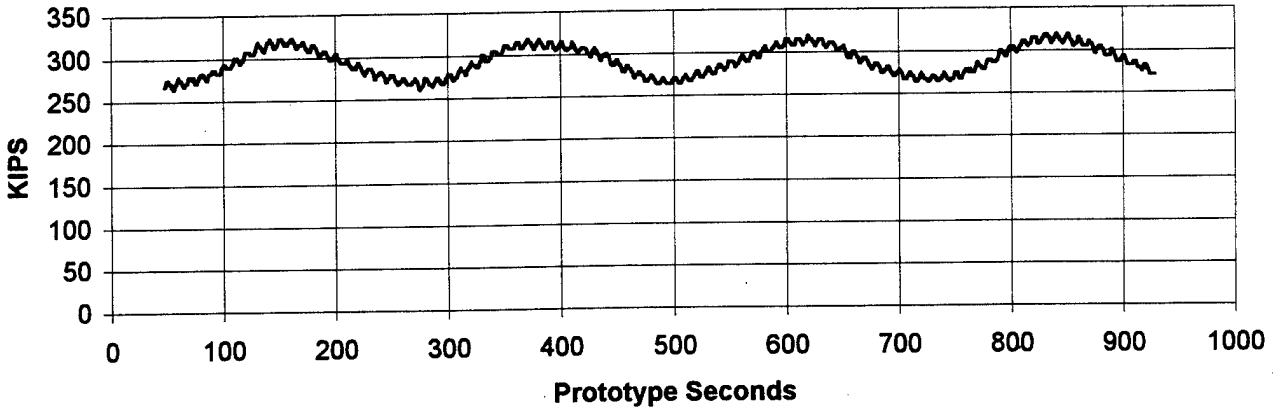


TEST A809 - PT HEAVE

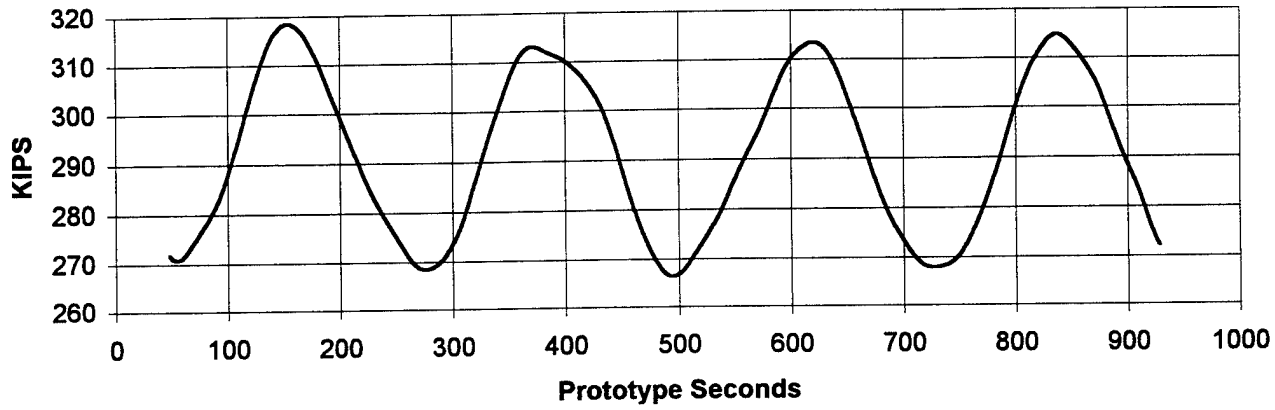


TEST A903 - ML_1 TENSION

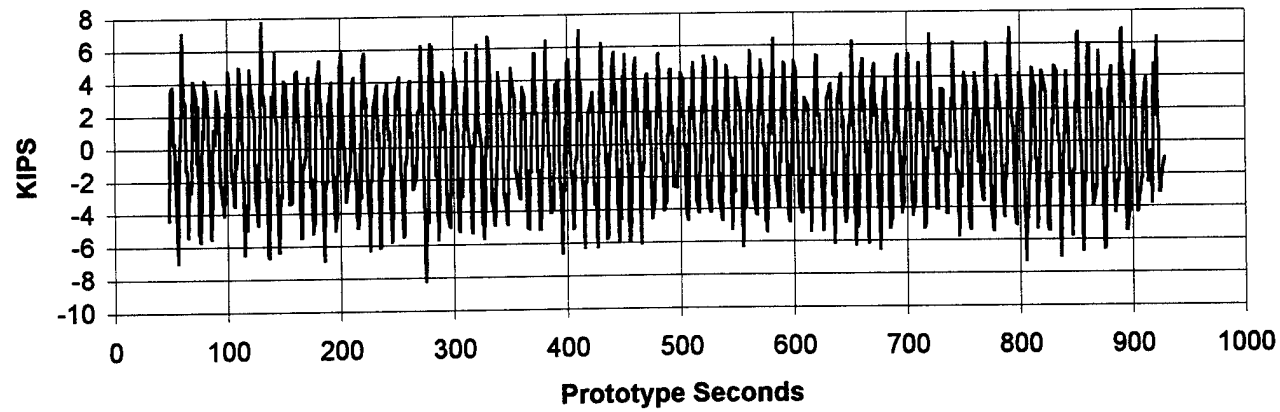
Unfiltered Time History



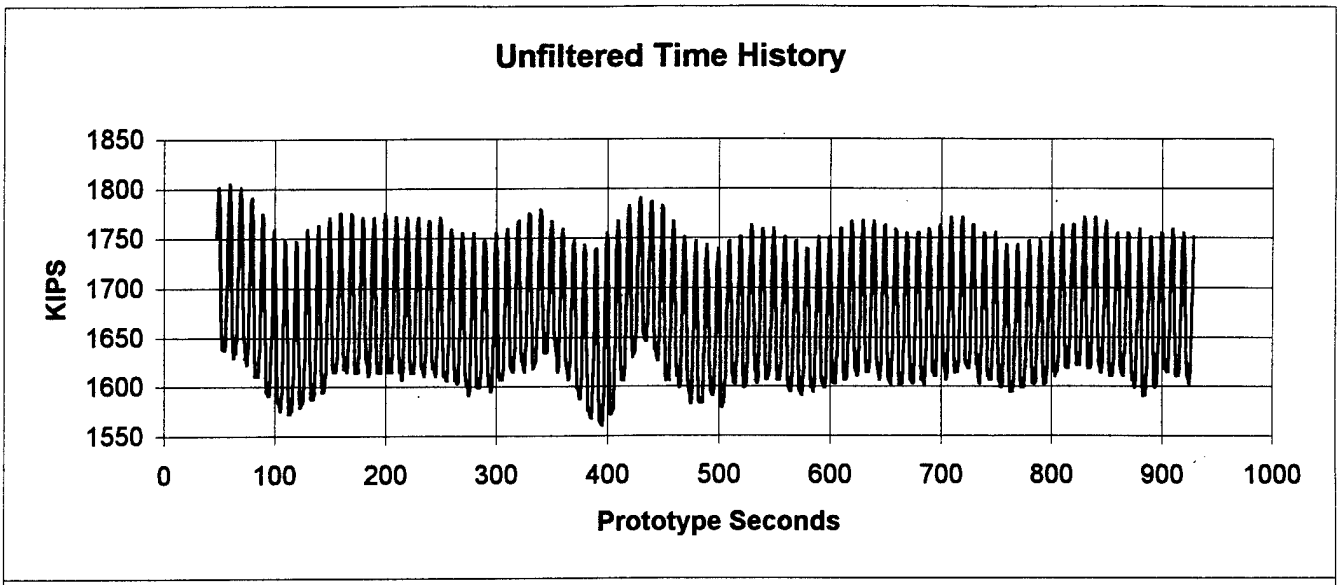
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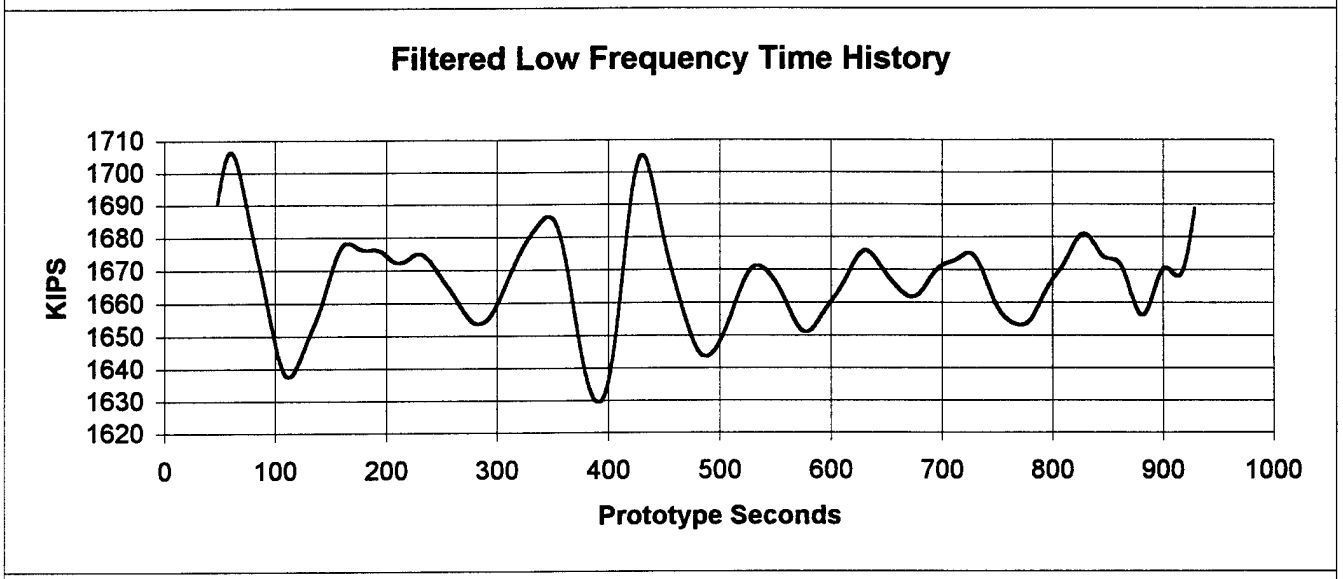


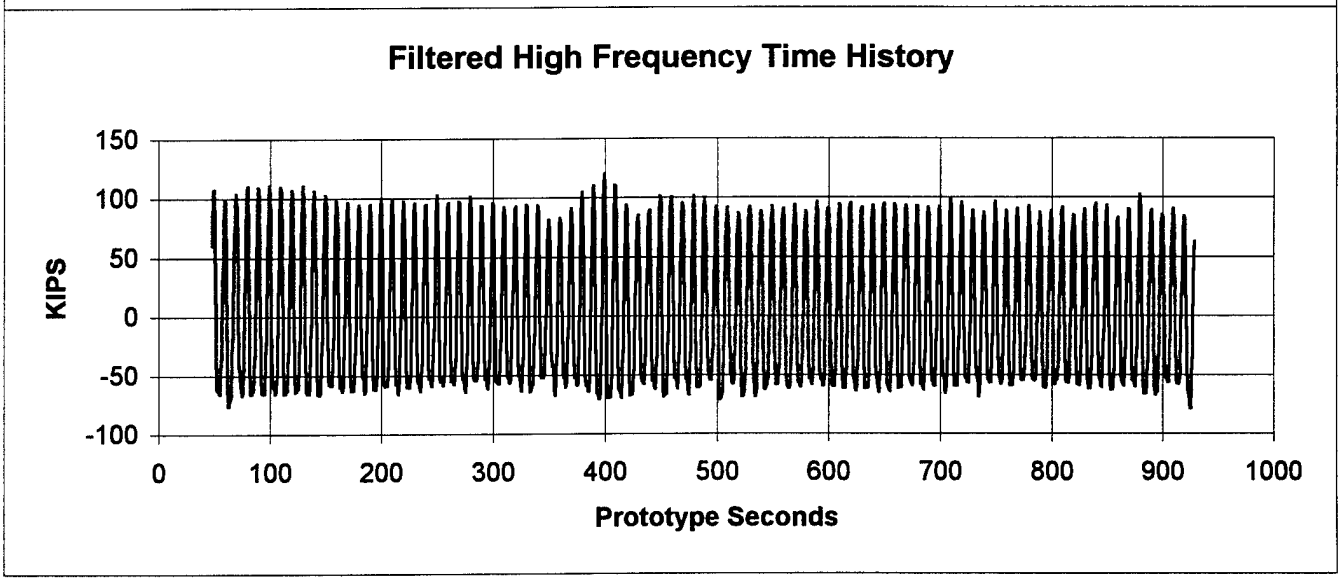
Filtered High Frequency Time History



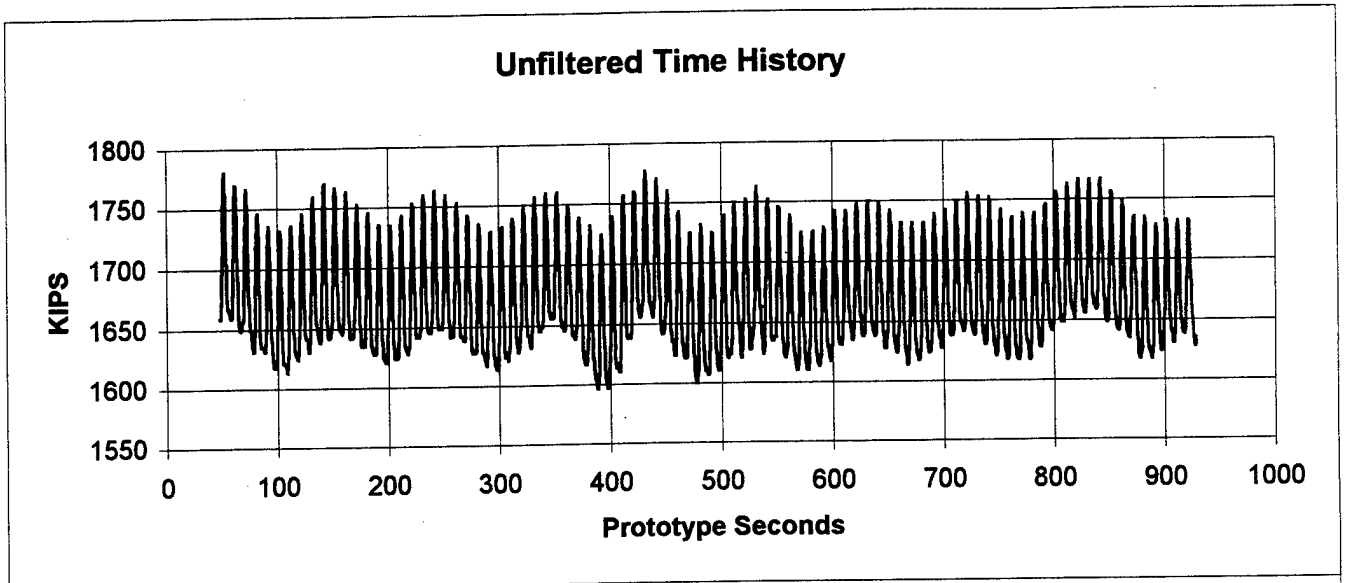
TEST A903 - BUOY 1 TENSION

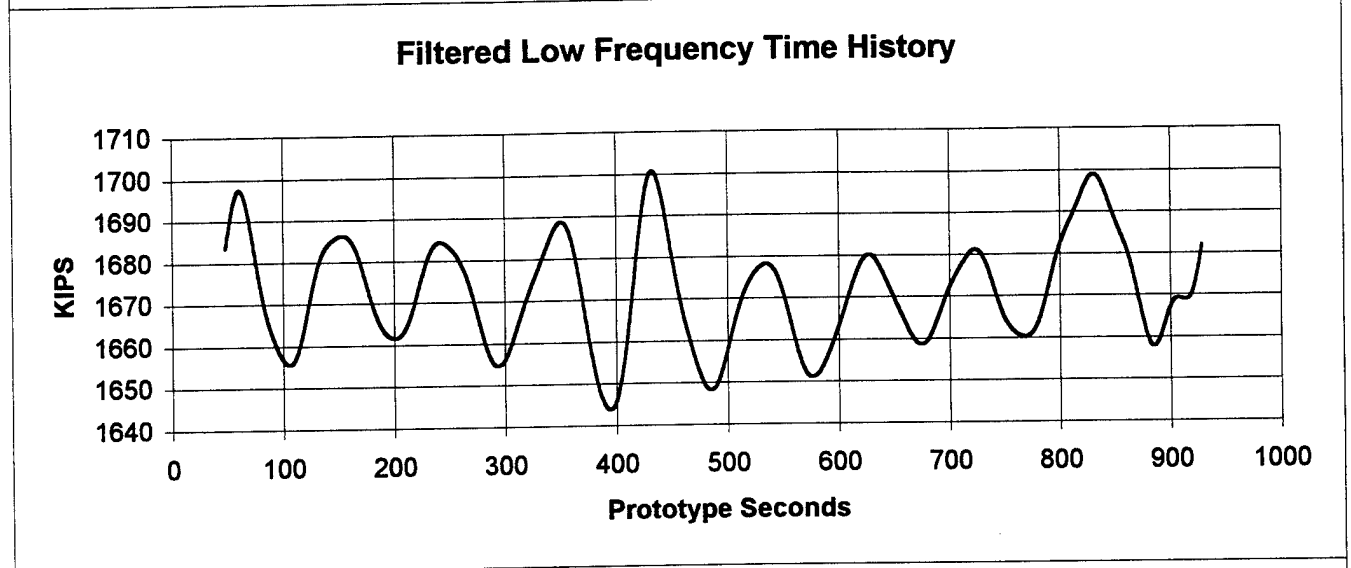


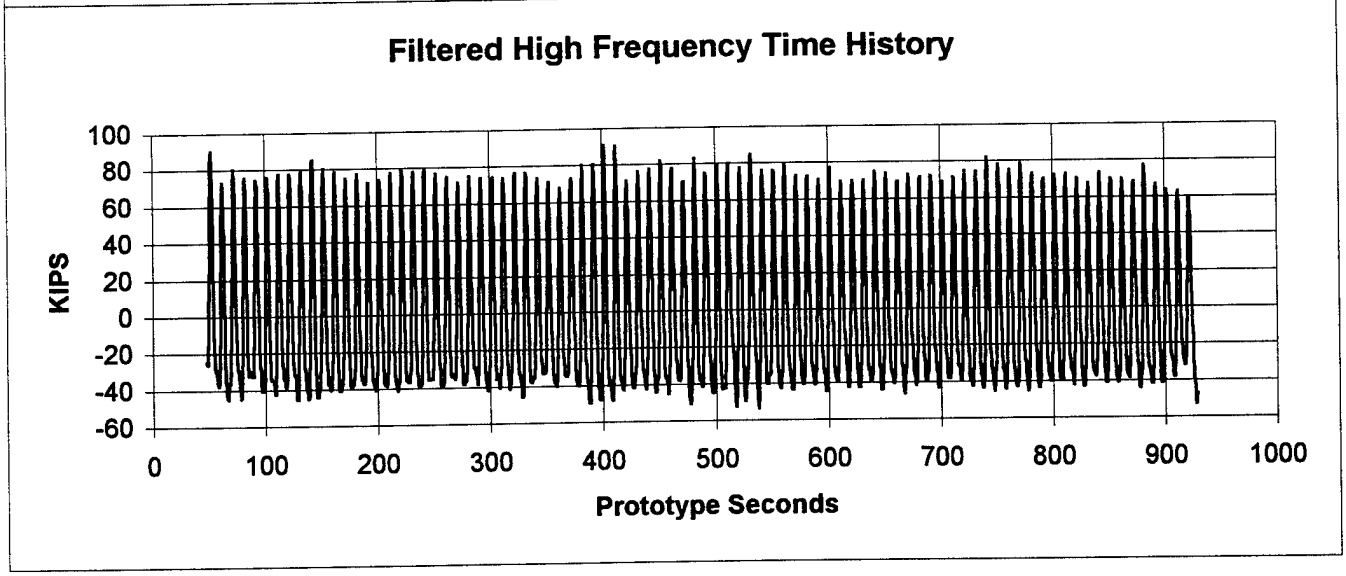




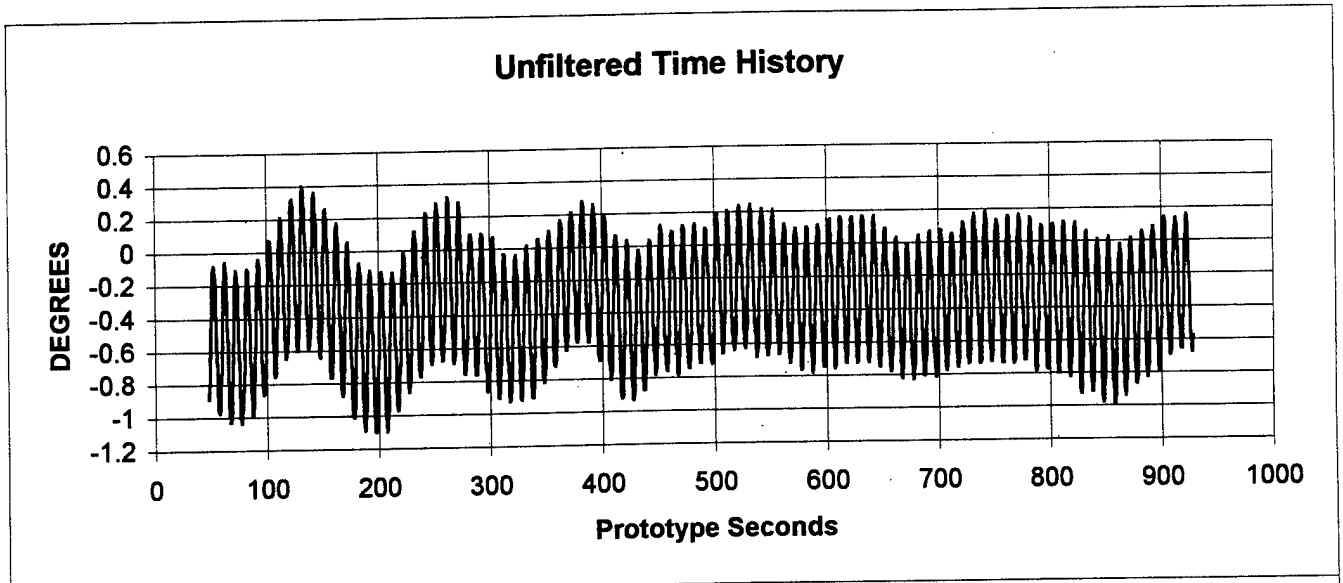
TEST A903 - BUOY 2 TENSION

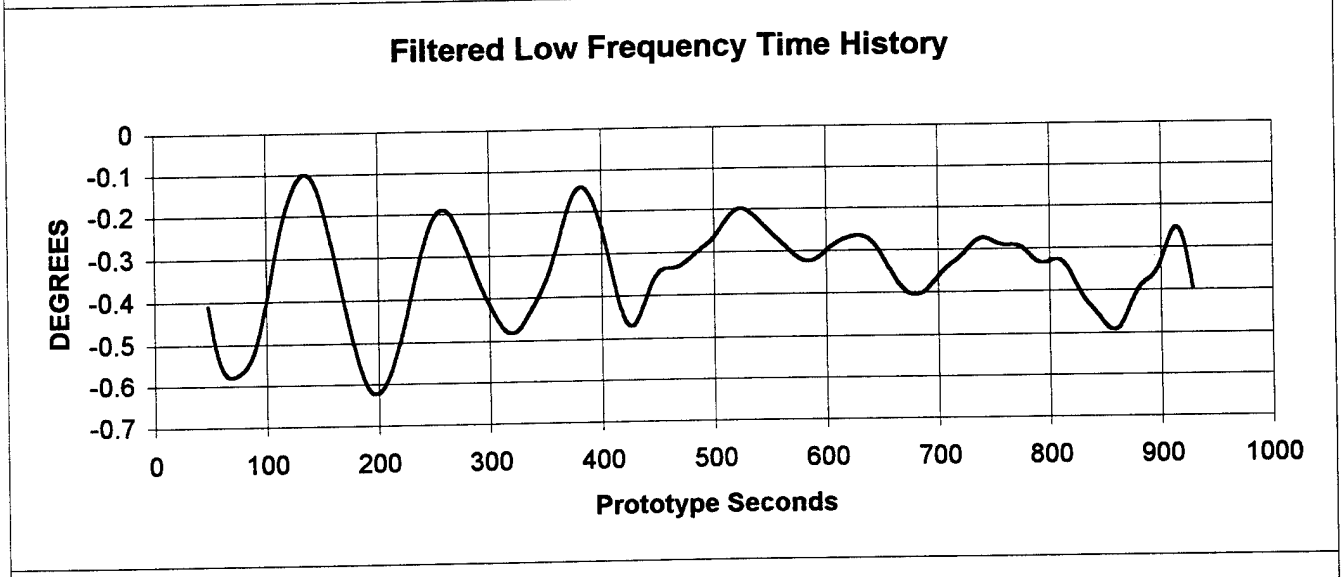


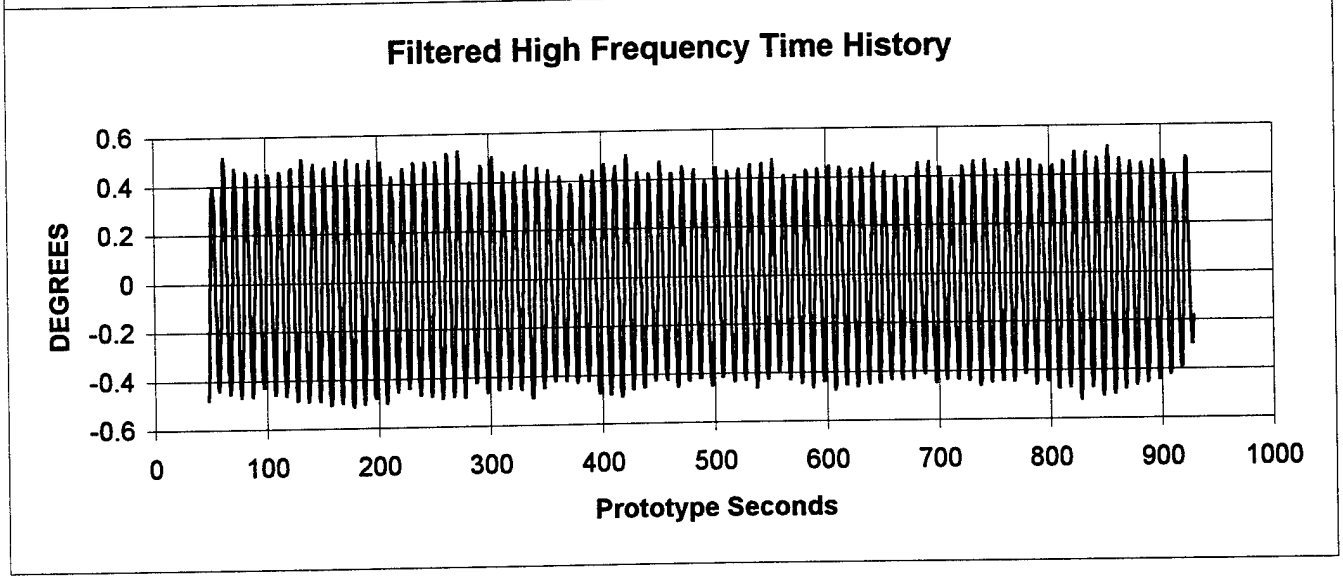




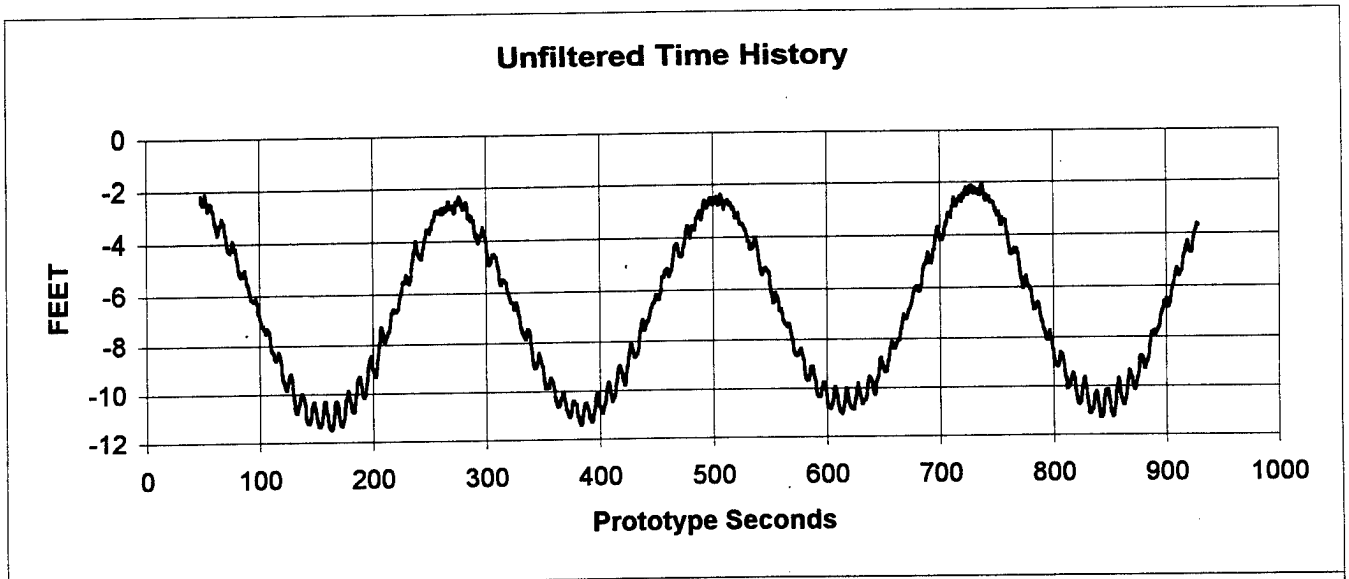
TEST A903 - PITCH

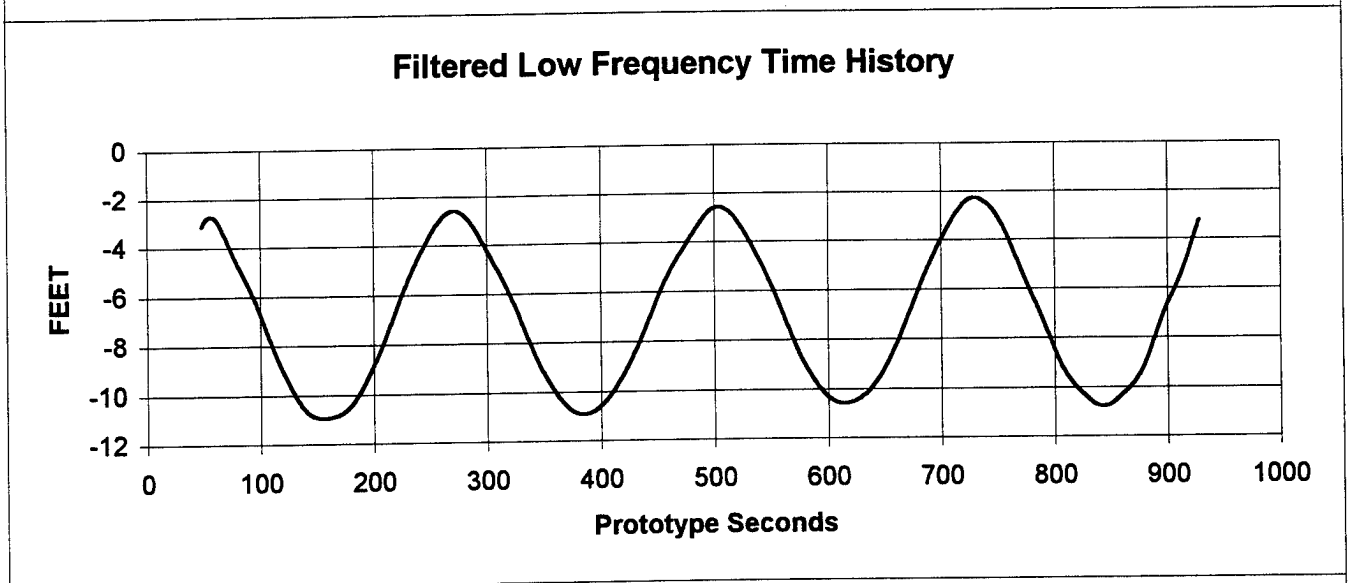


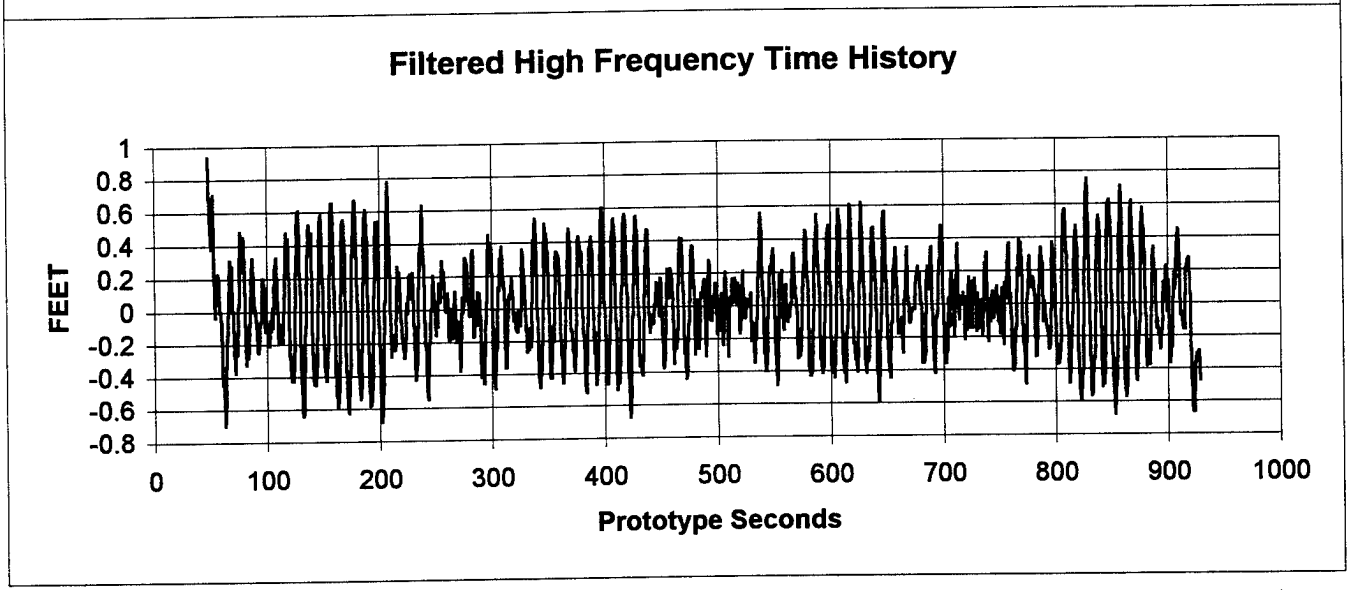




TEST A903 - PT SURGE

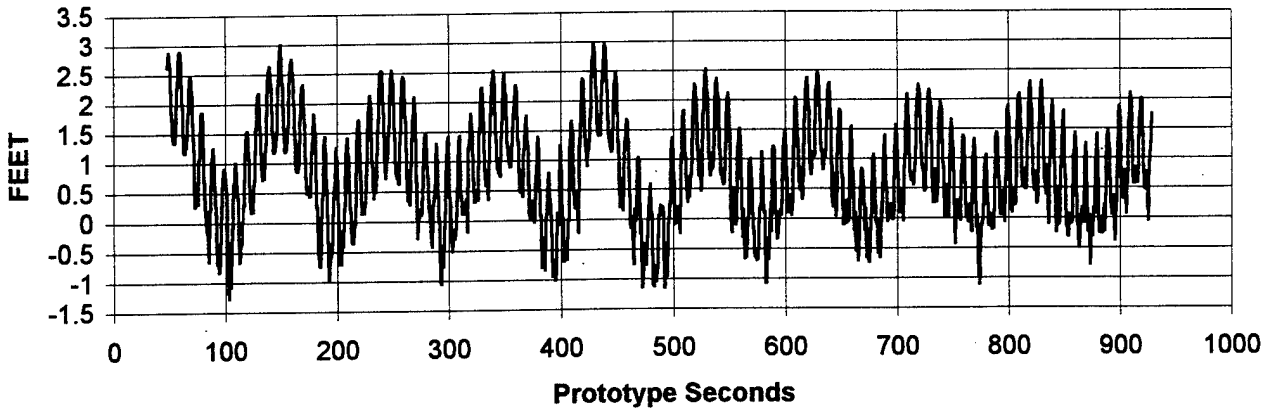




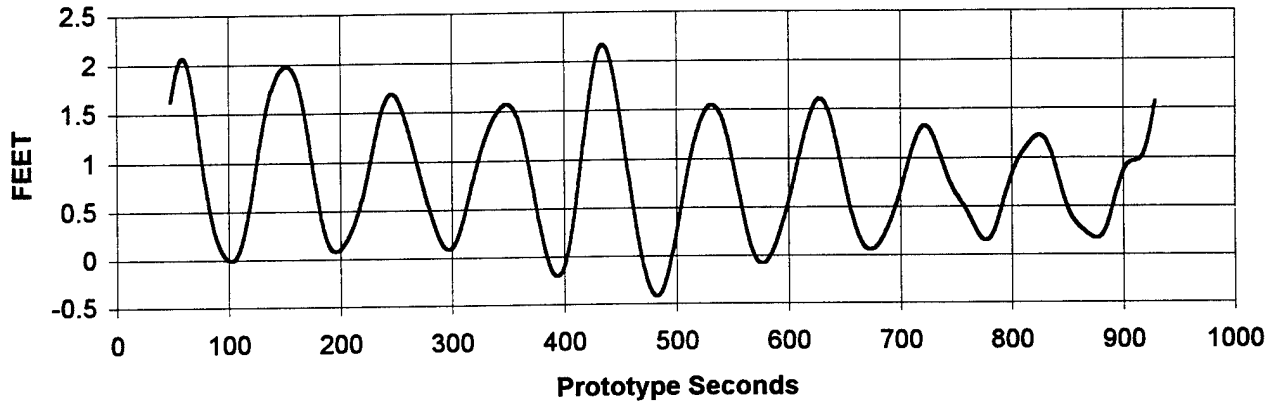


TEST A903 - PT HEAVE

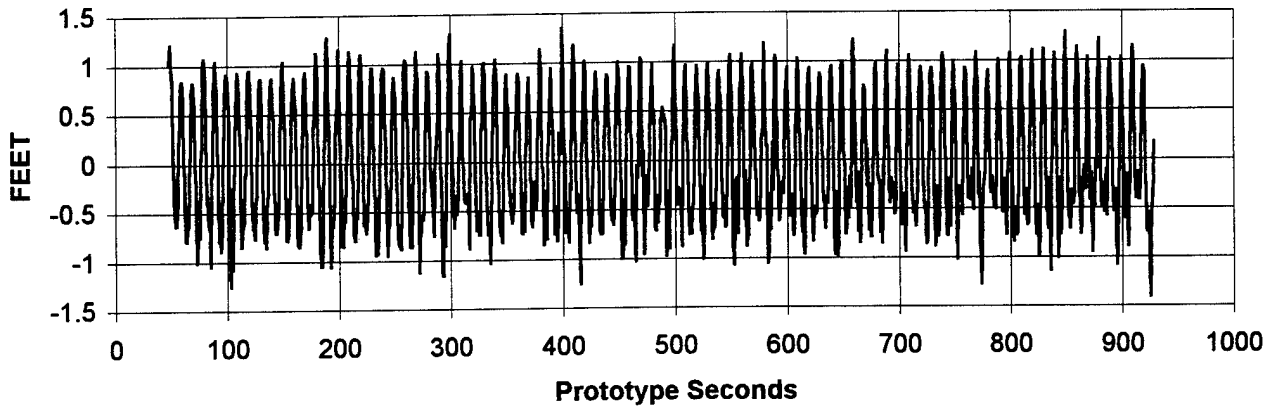
Unfiltered Time History



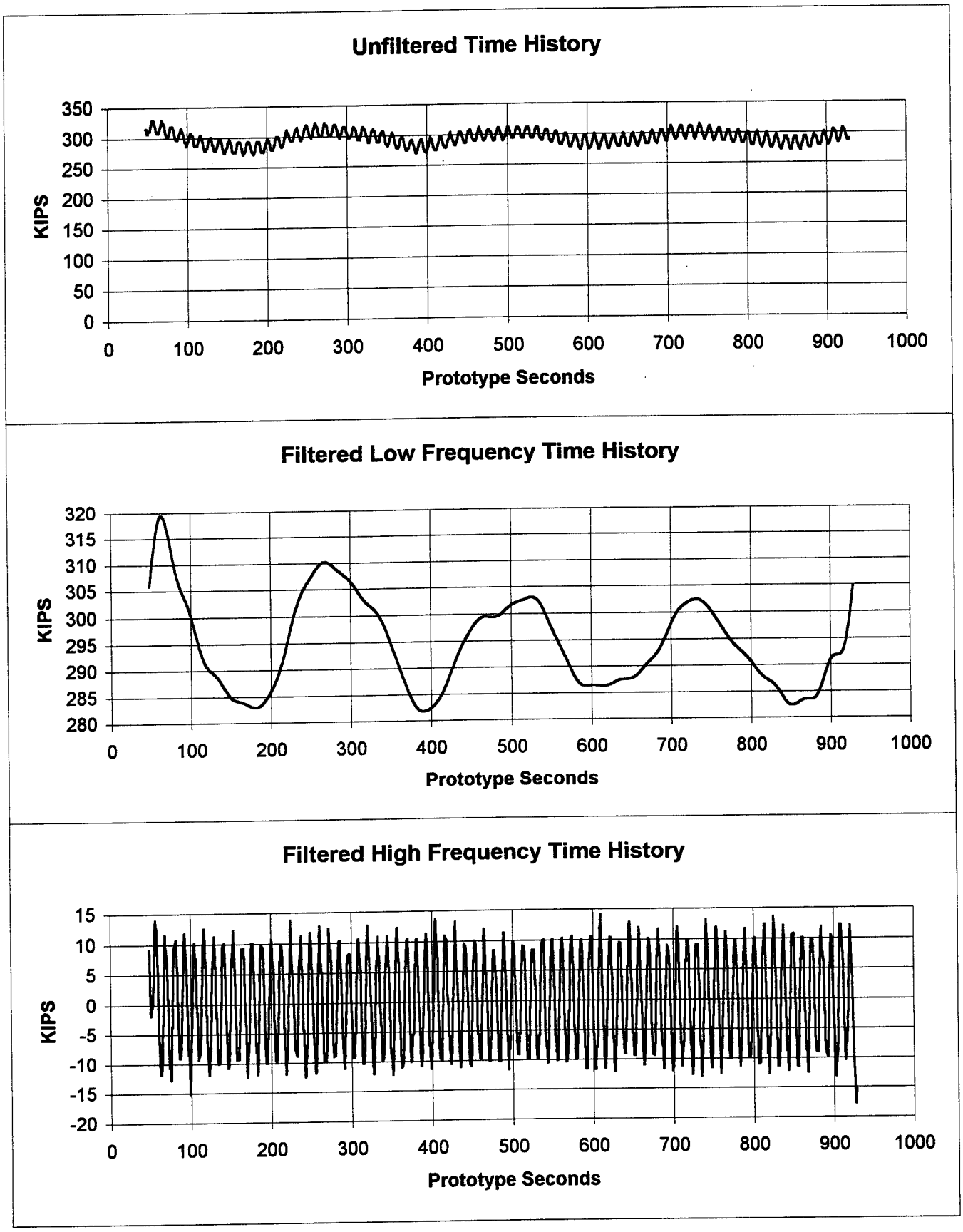
Filtered Low Frequency Time History



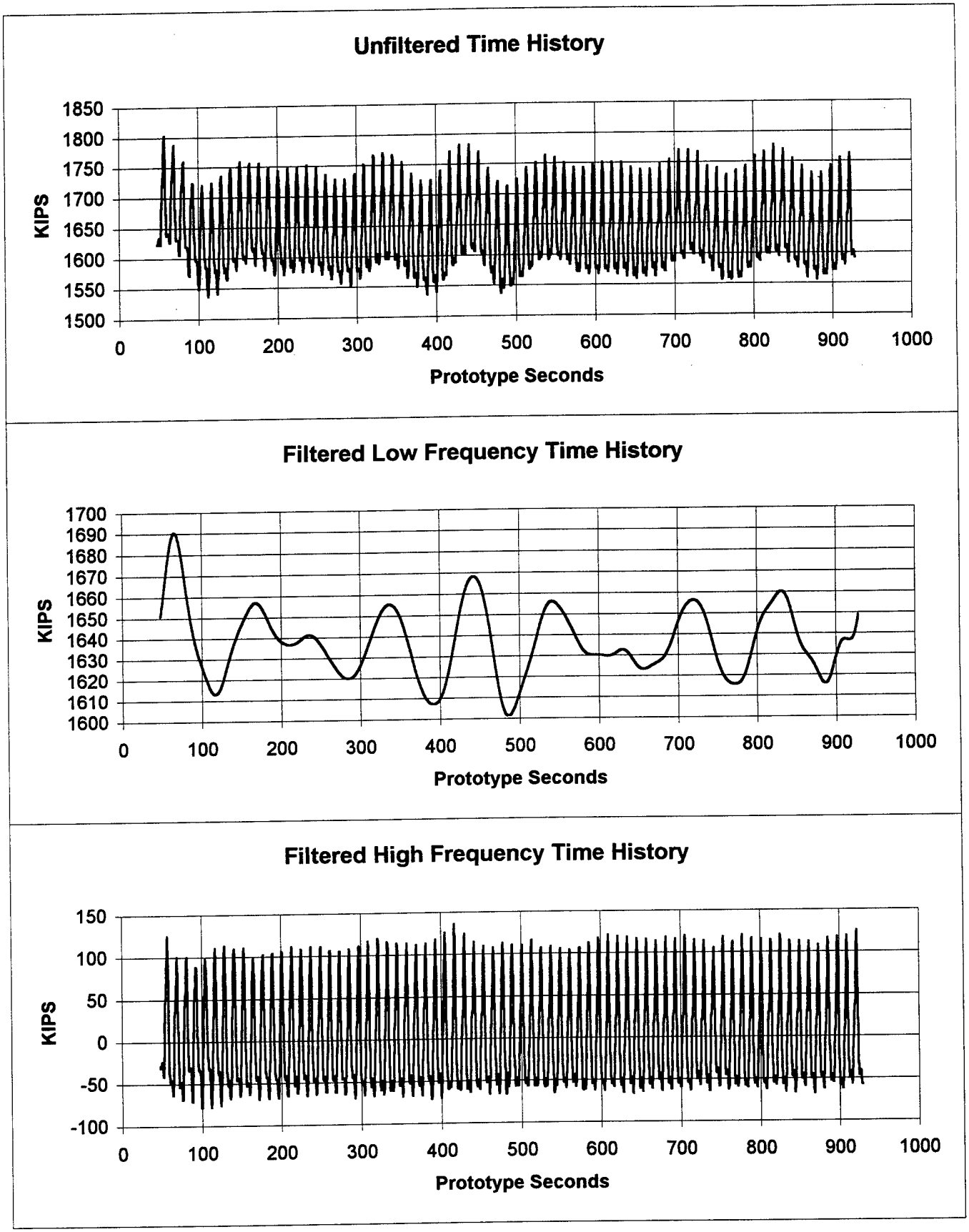
Filtered High Frequency Time History



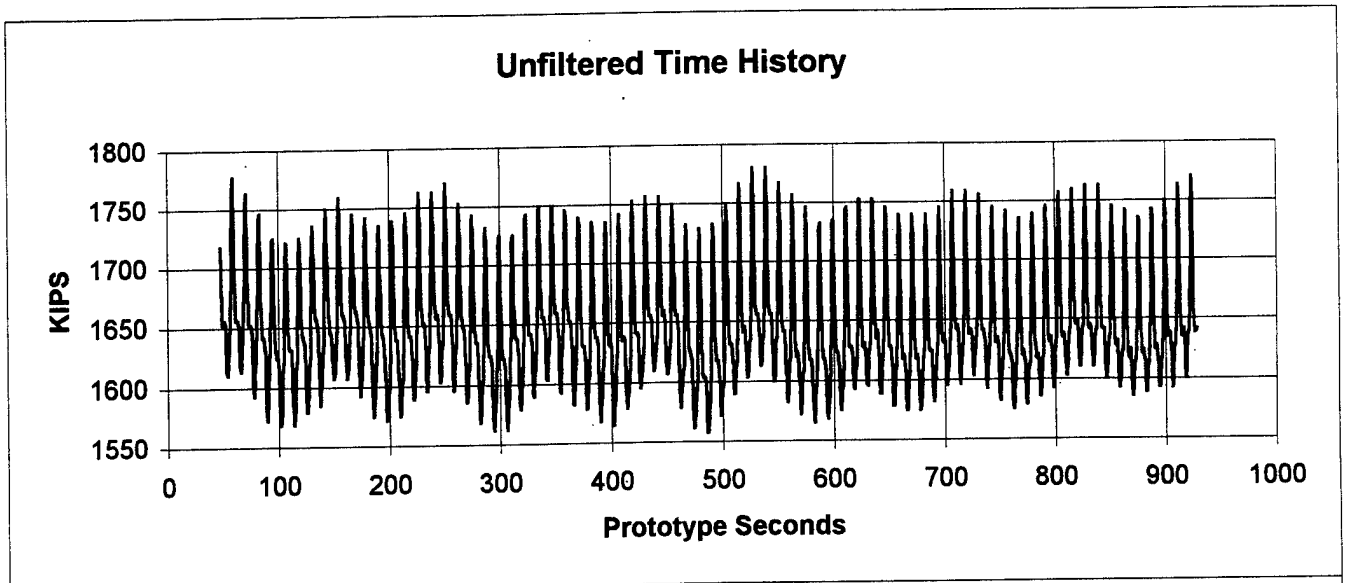
TEST A904 - ML_1 TENSION

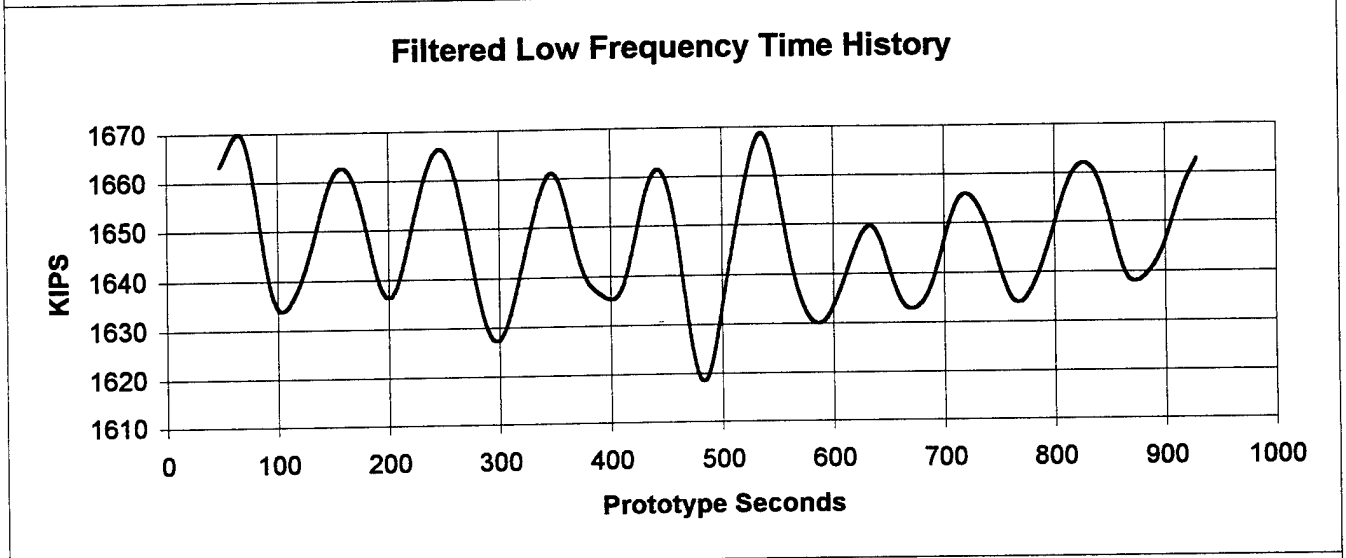


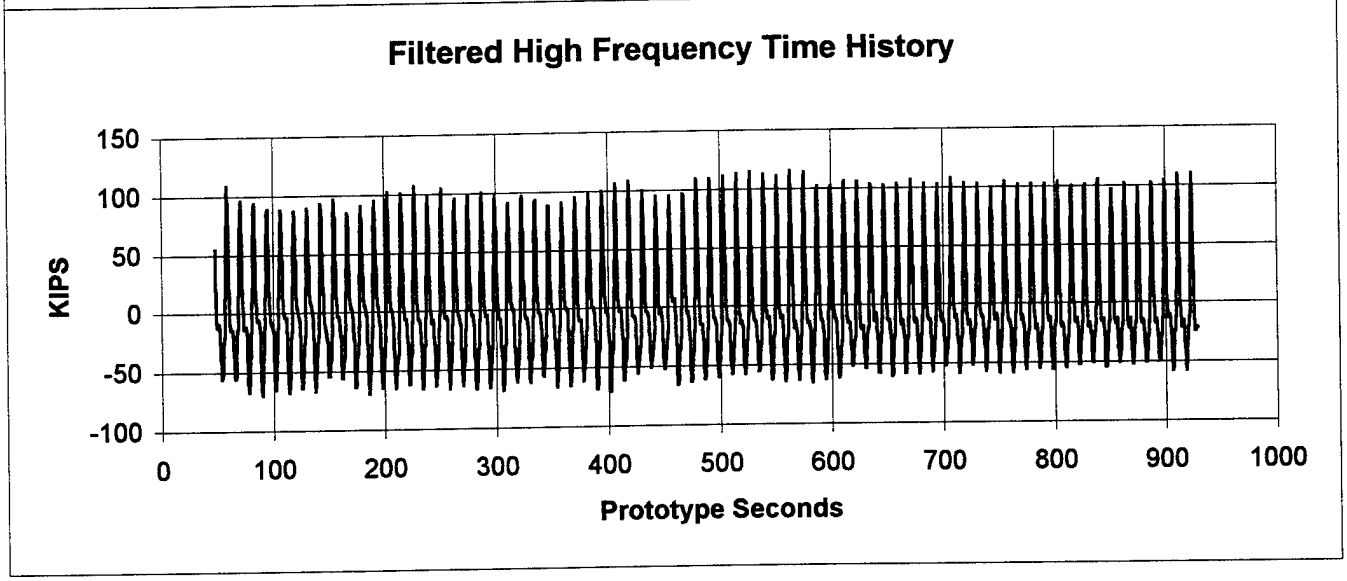
TEST A904 - BUOY 1 TENSION



TEST A904 - BUOY 2 TENSION

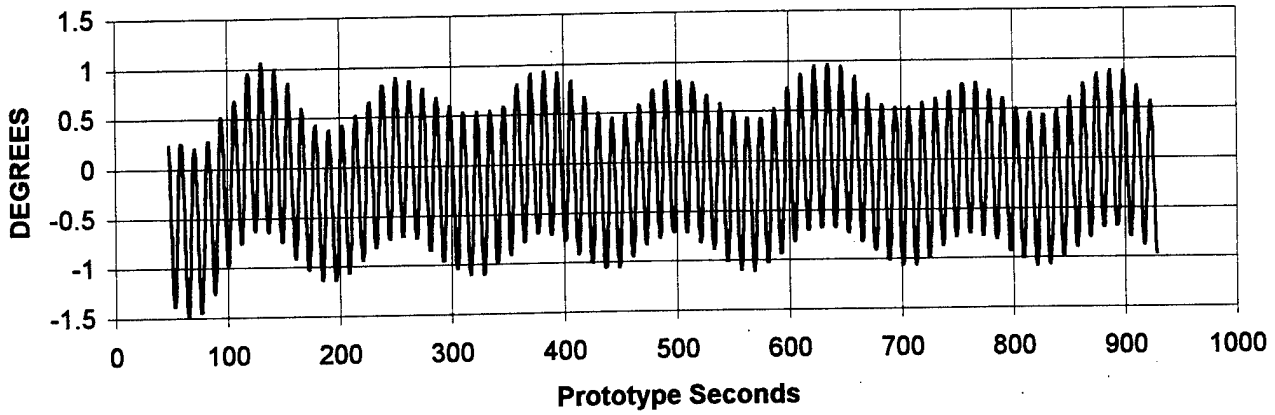




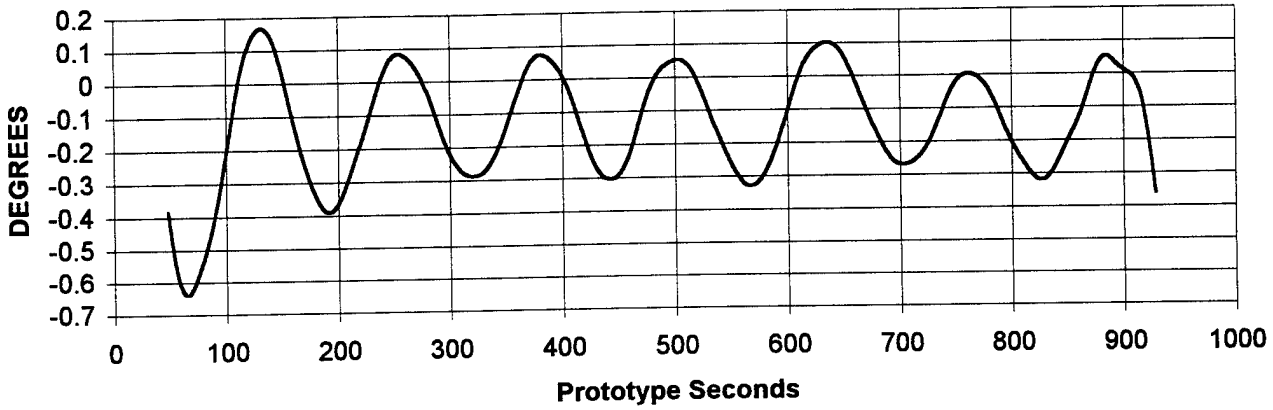


TEST A904 - PITCH

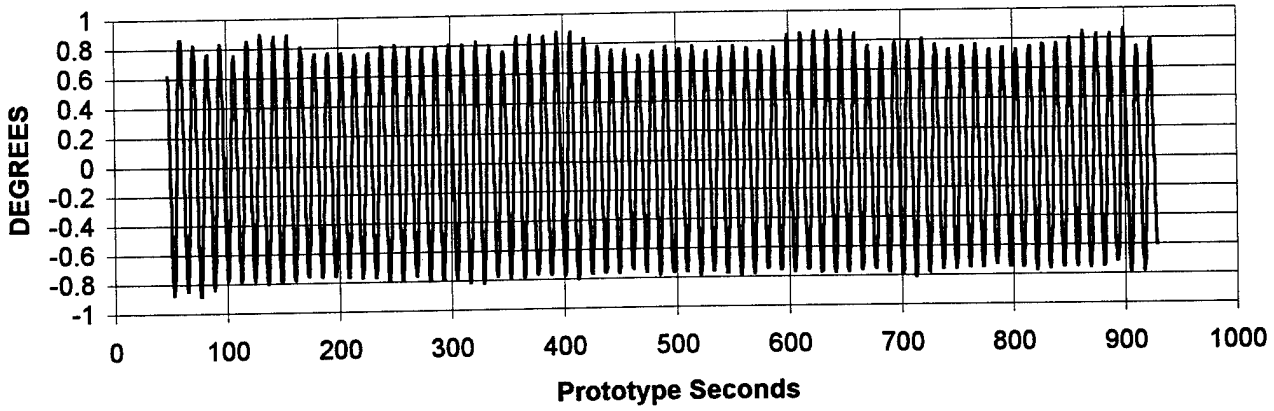
Unfiltered Time History



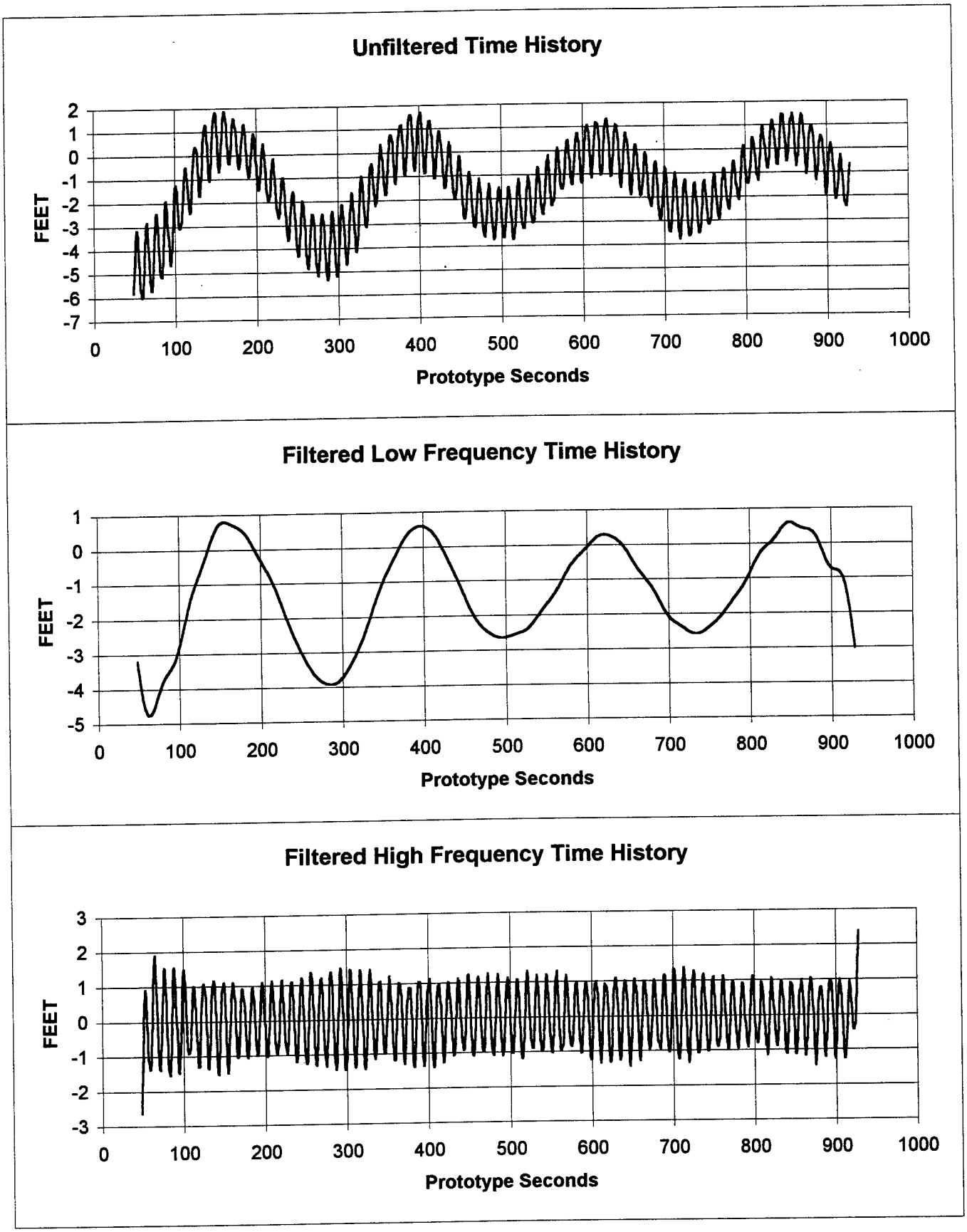
Filtered Low Frequency Time History



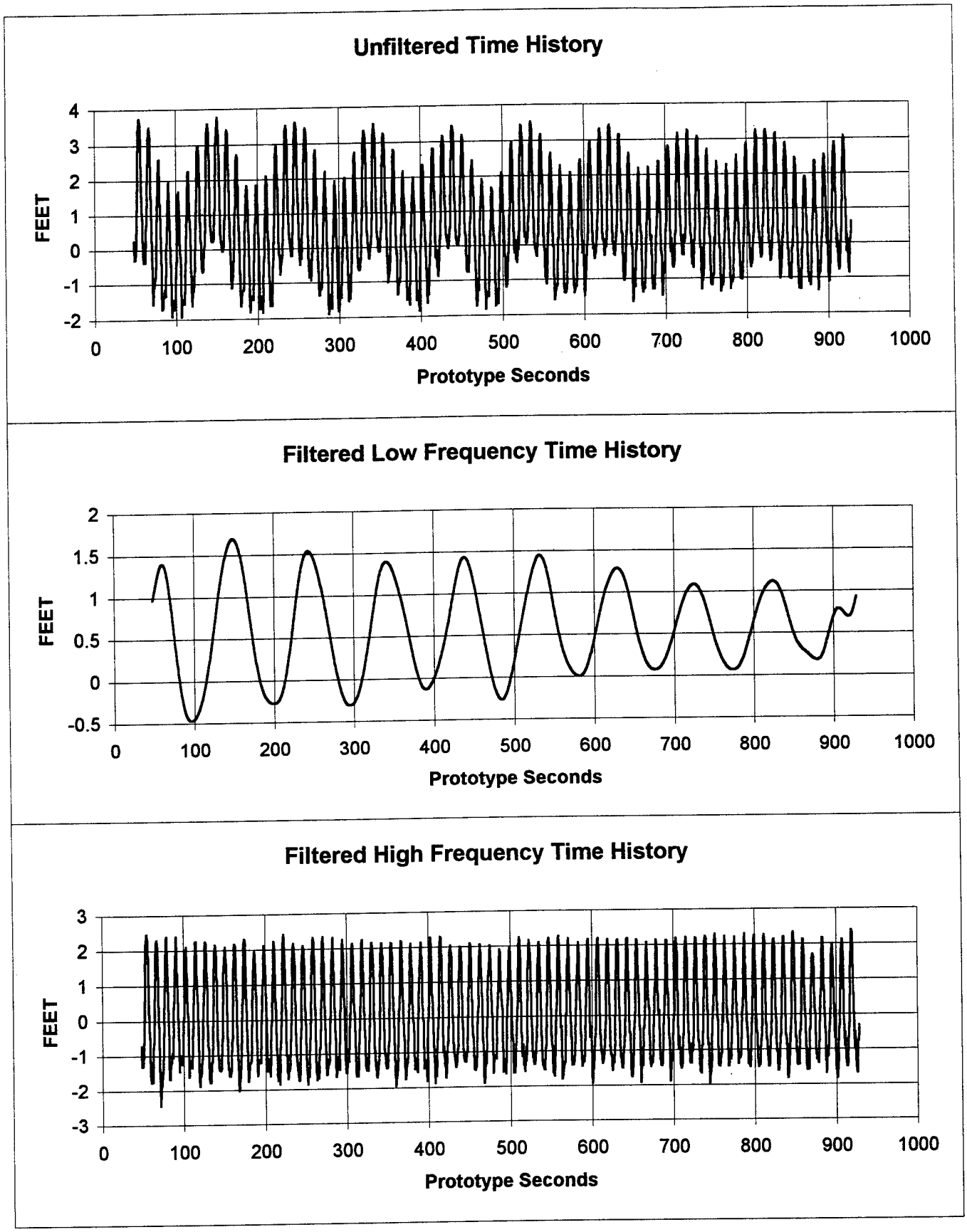
Filtered High Frequency Time History



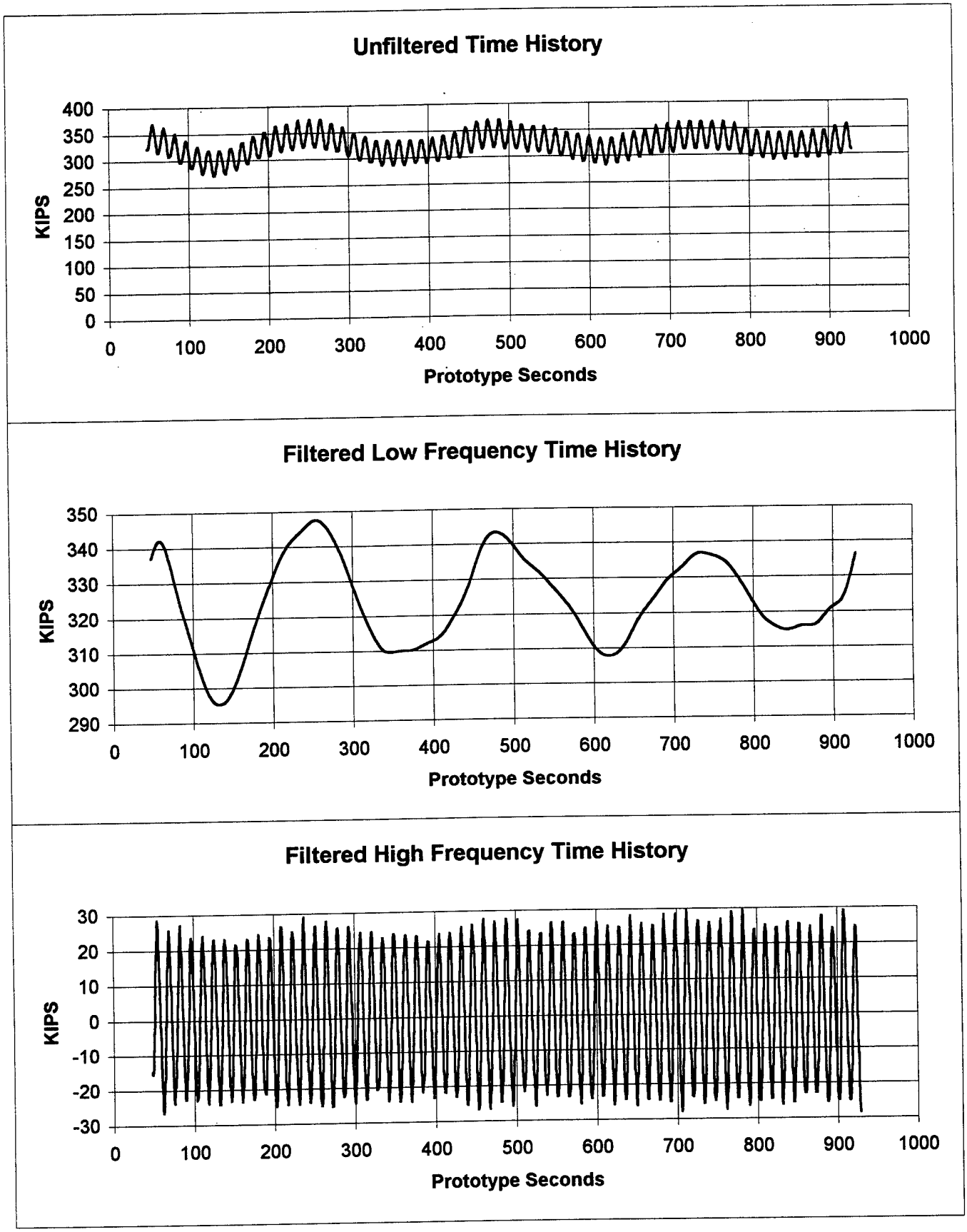
TEST A904 - PT SURGE



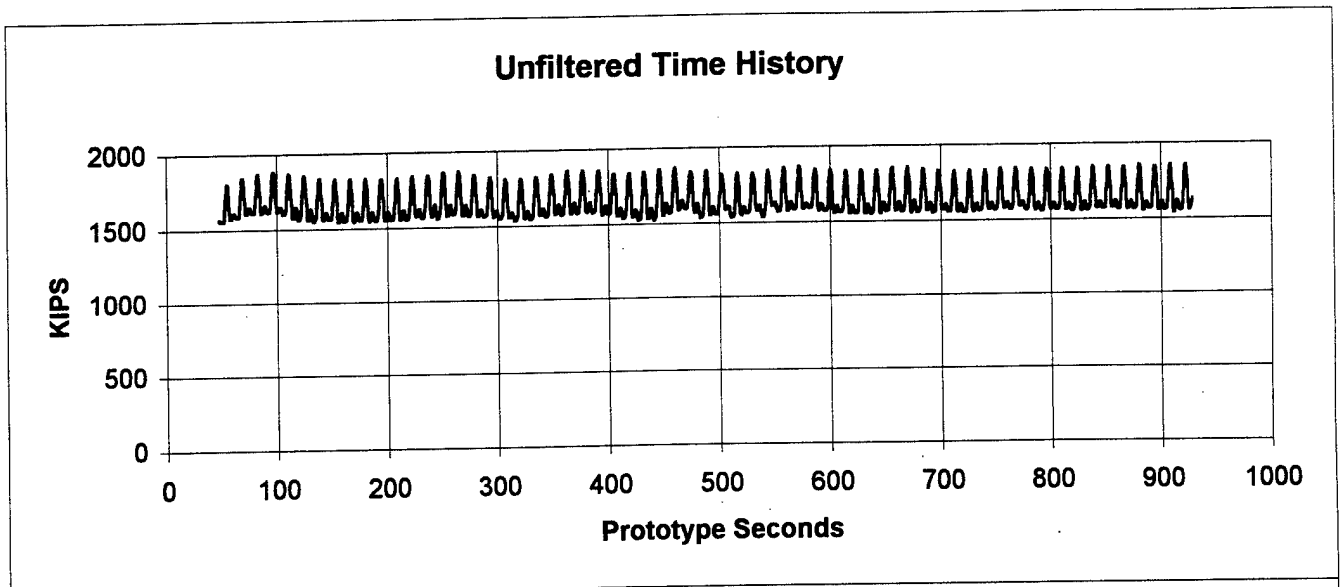
TEST A904 - PT HEAVE

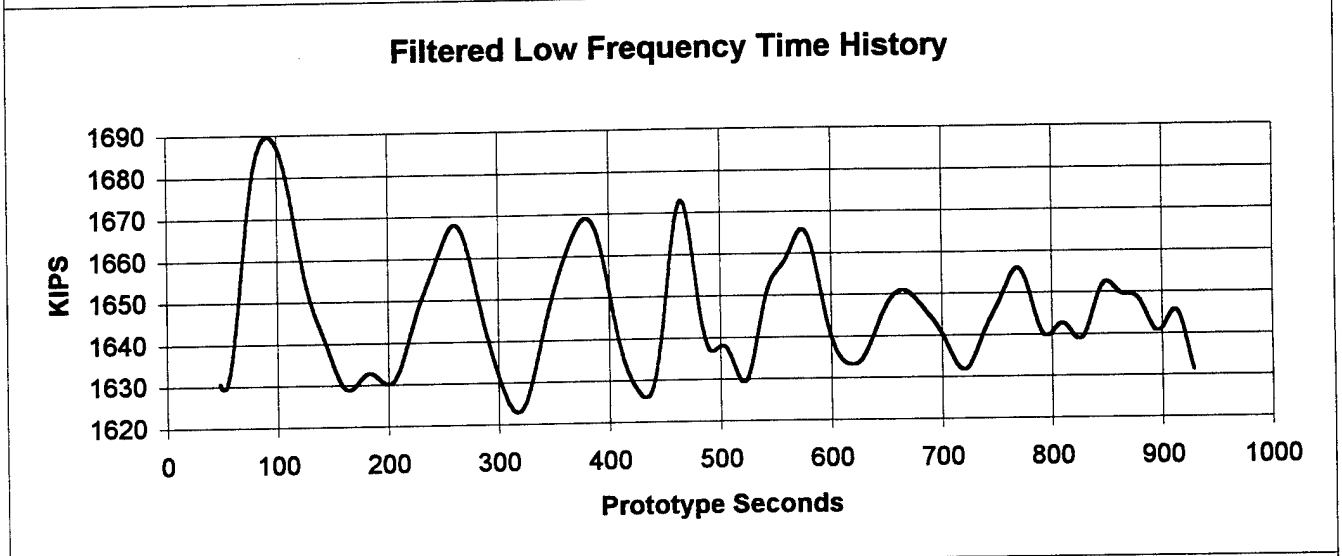


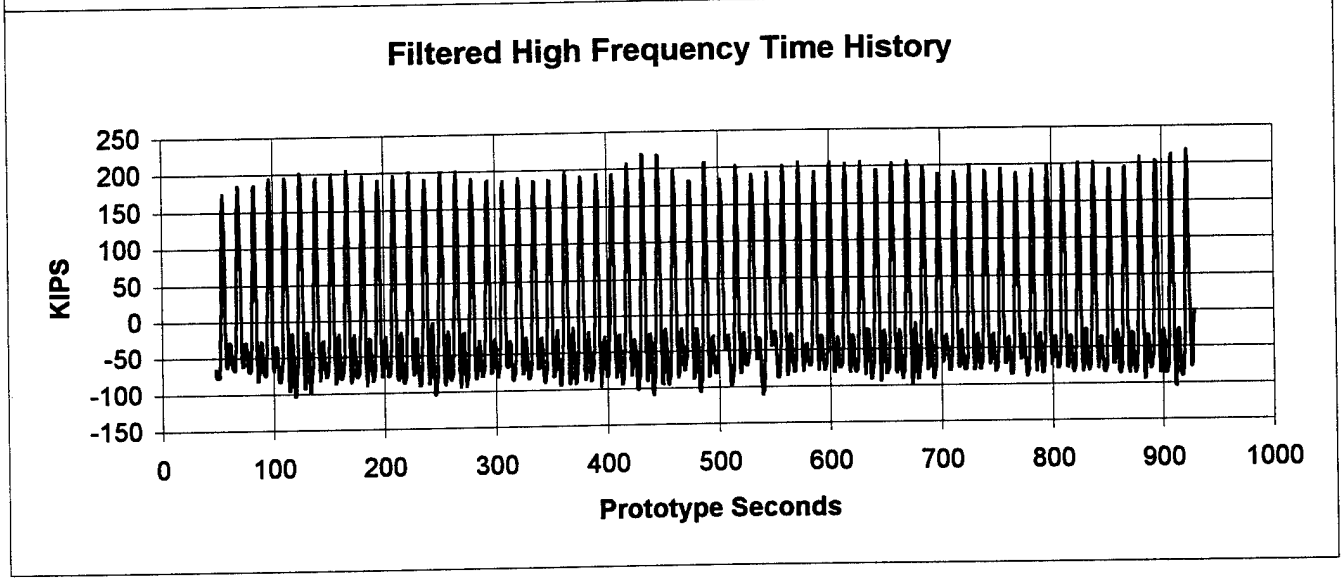
TEST A905 - ML_1 TENSION



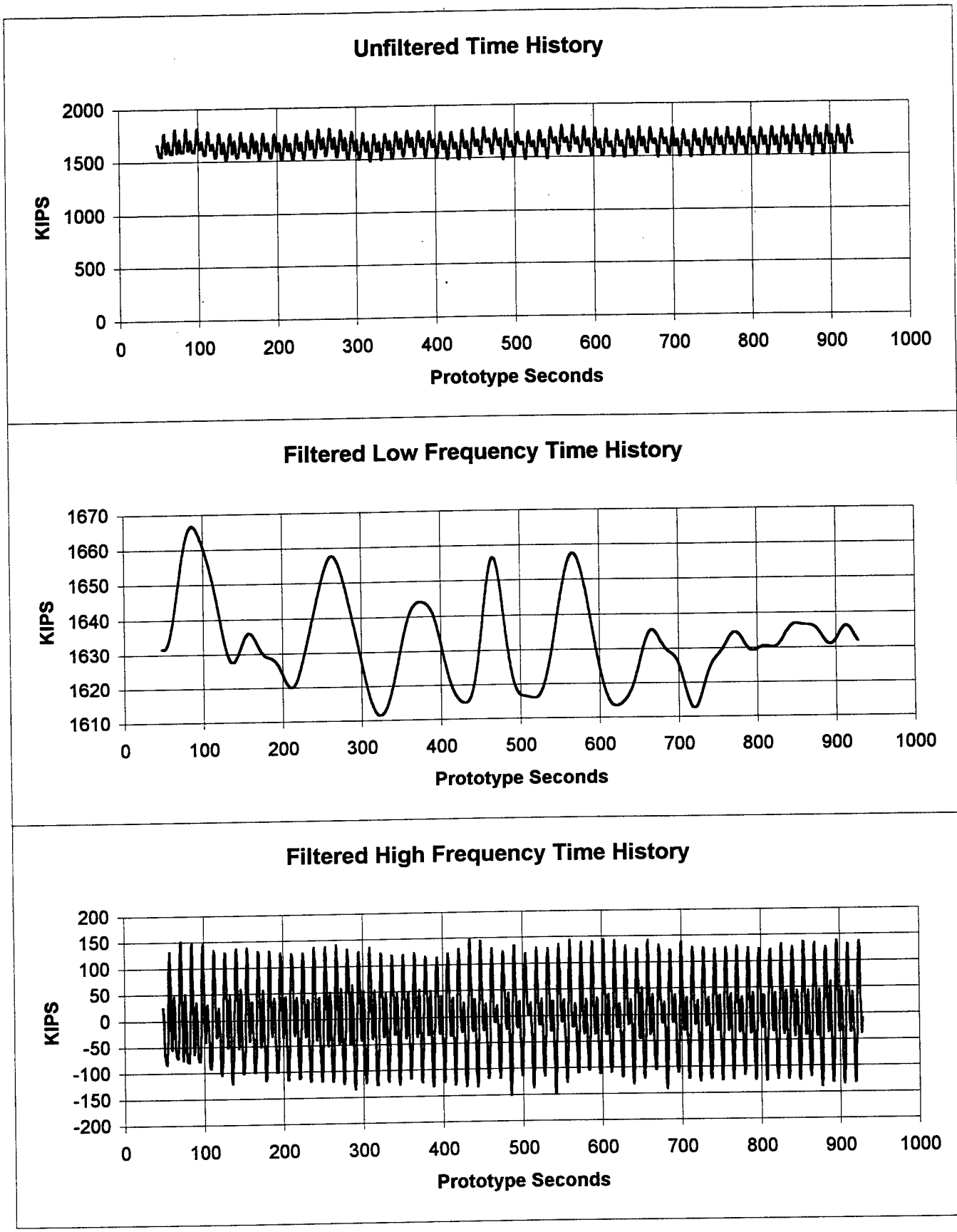
TEST A905 - BUOY 1 TENSION



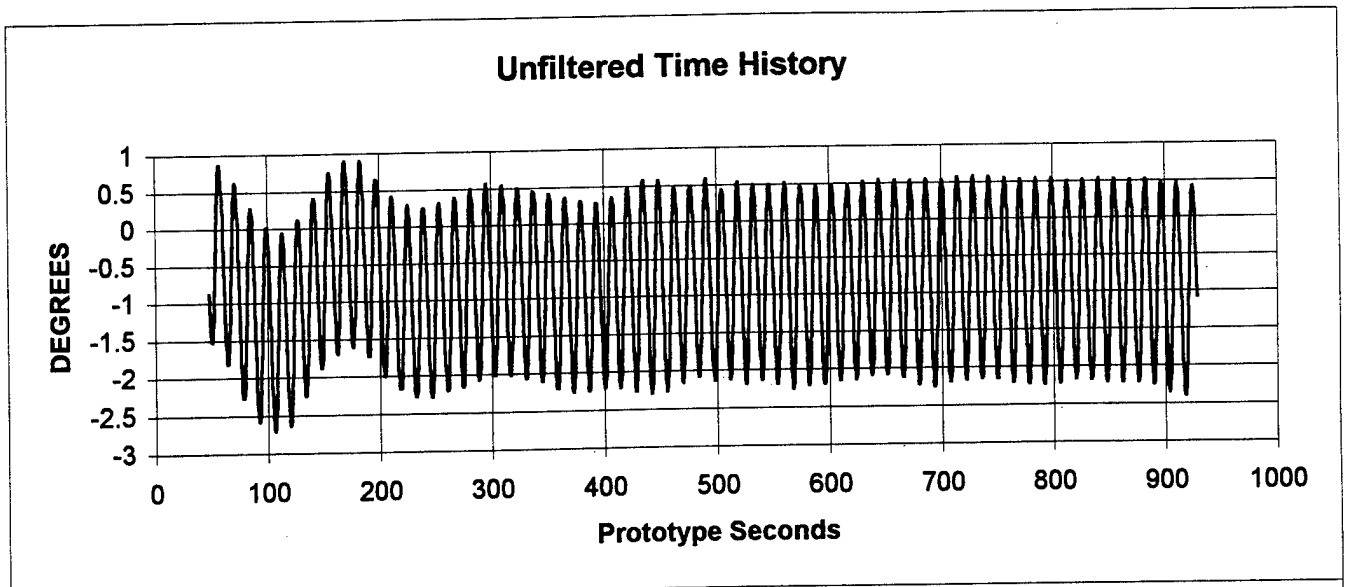


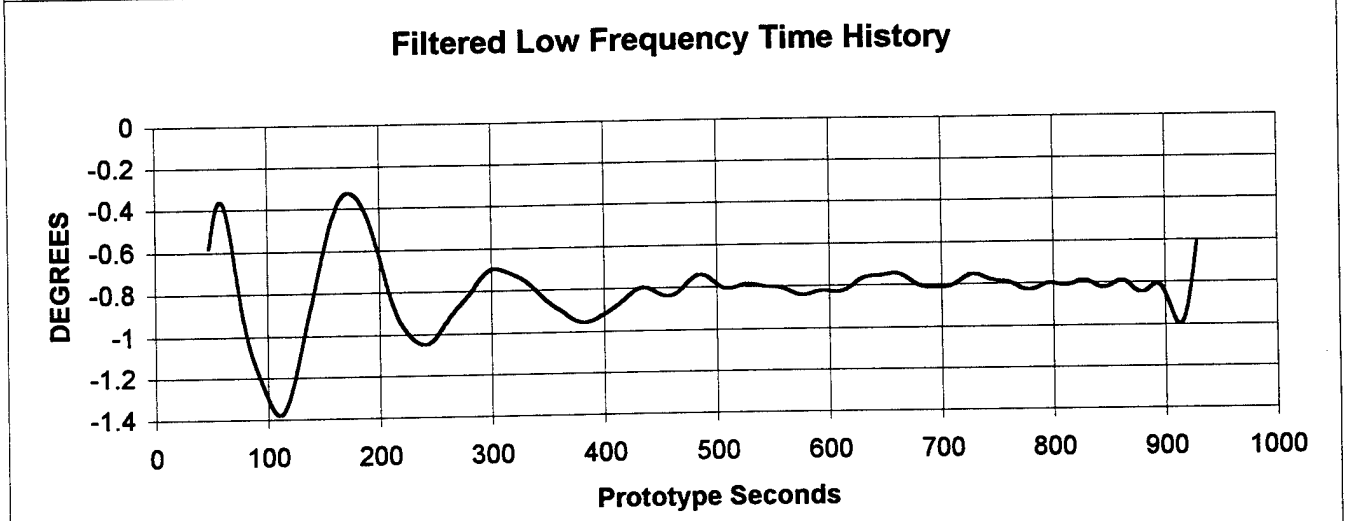


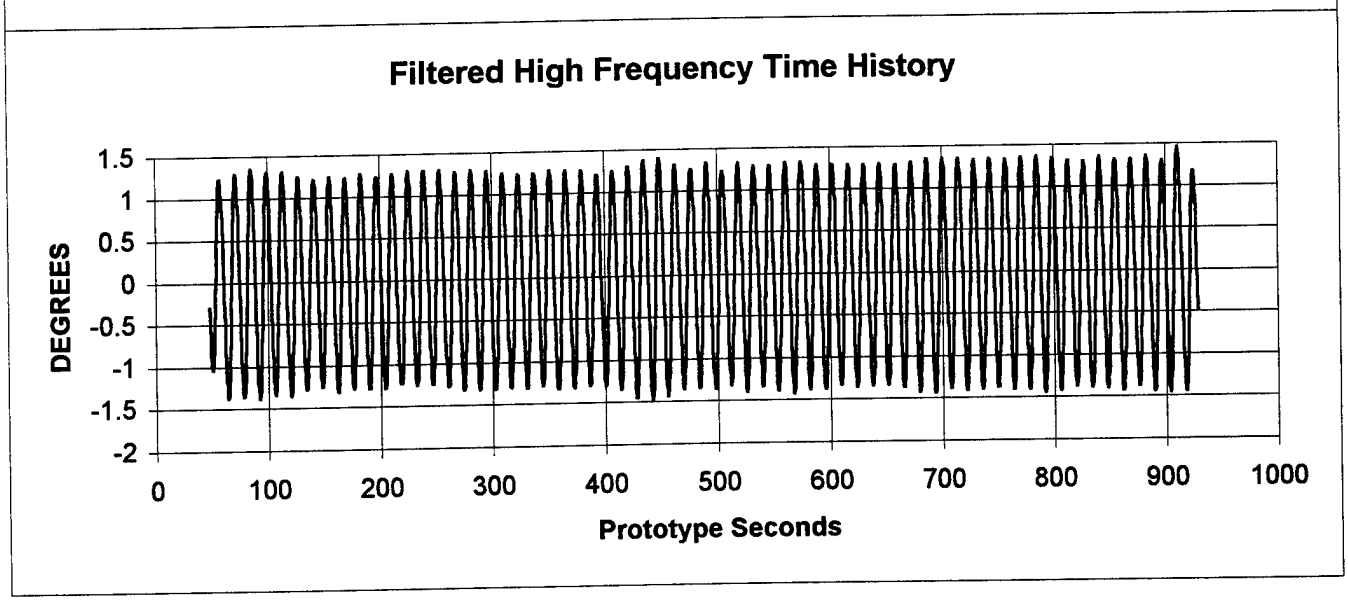
TEST A905 - BUOY 2 TENSION



TEST A905 - PITCH

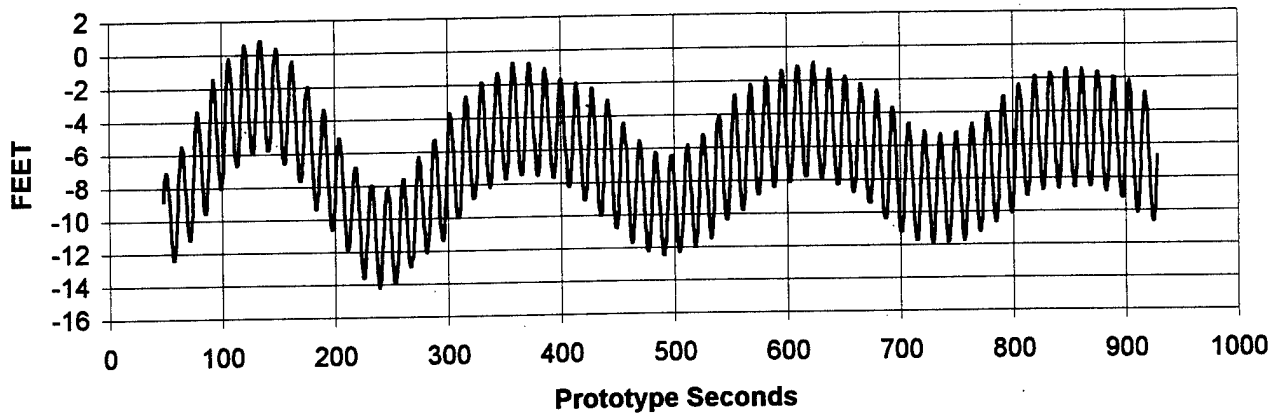




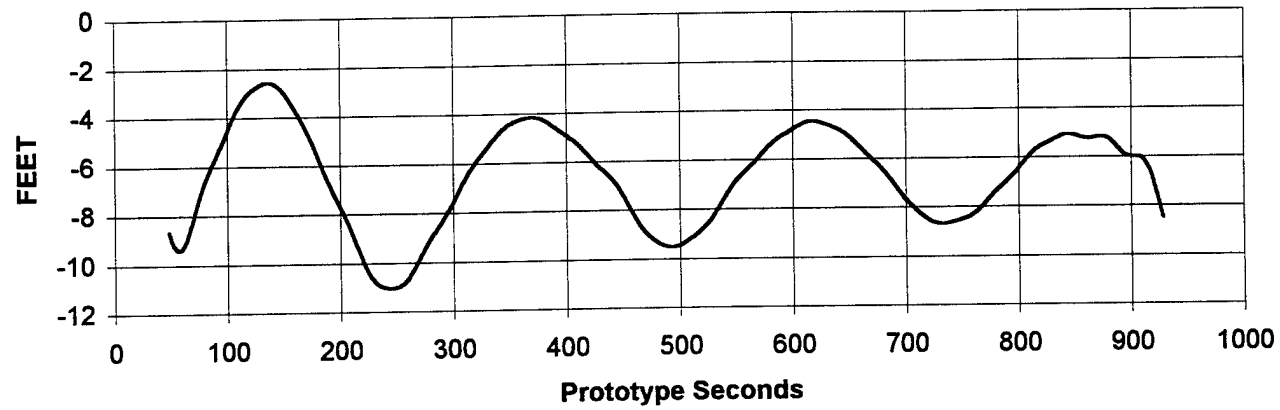


TEST A905 - PT SURGE

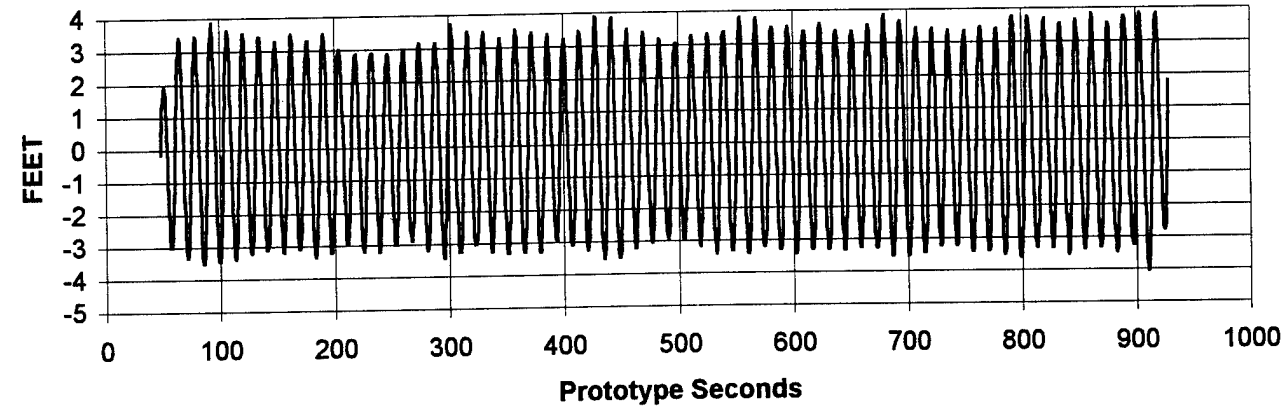
Unfiltered Time History



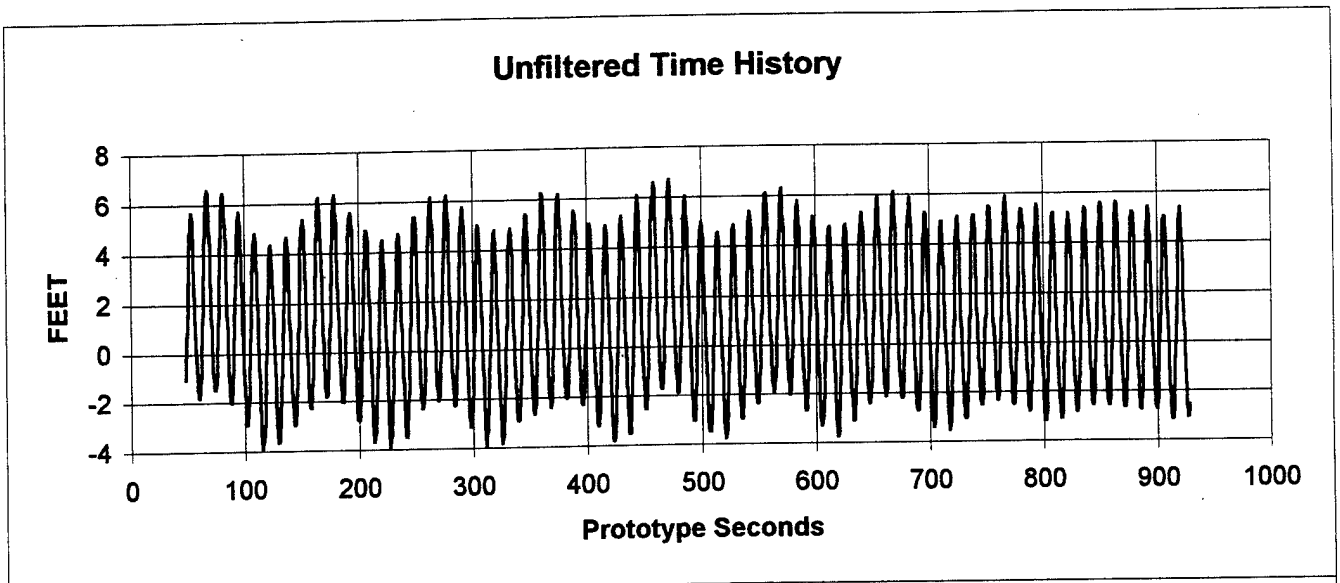
Filtered Low Frequency Time History

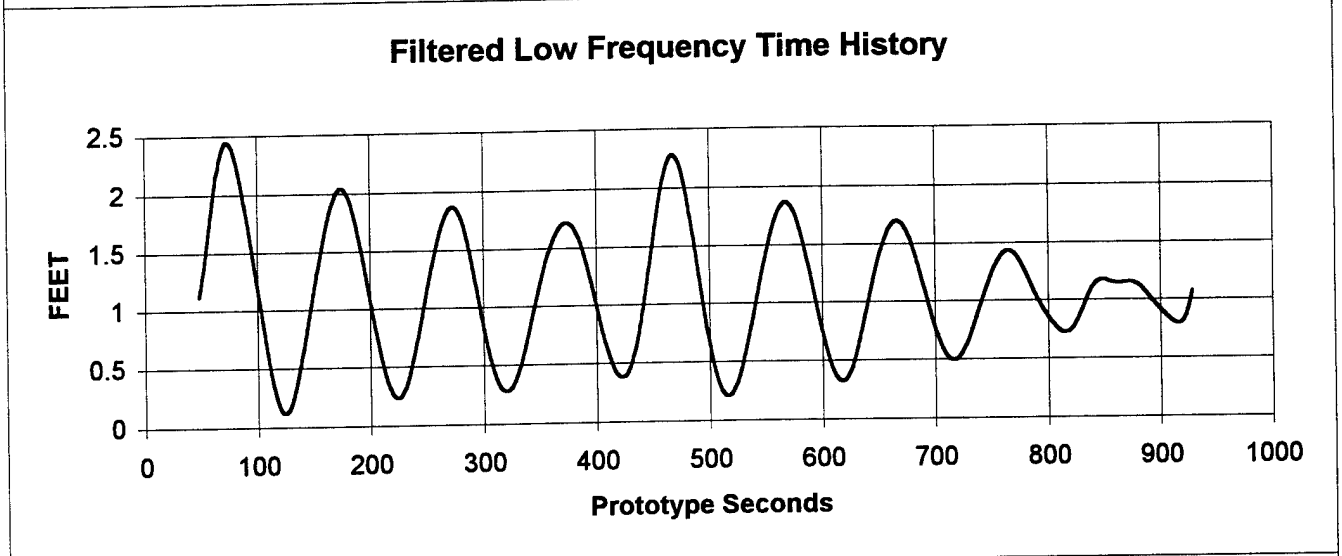


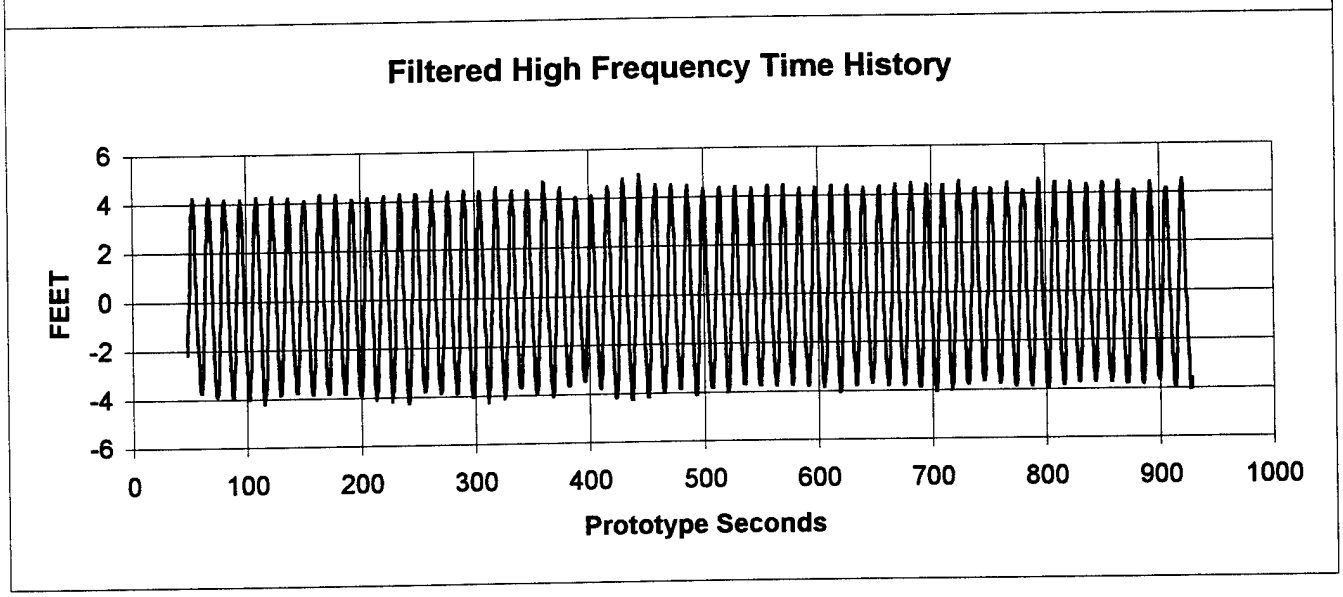
Filtered High Frequency Time History



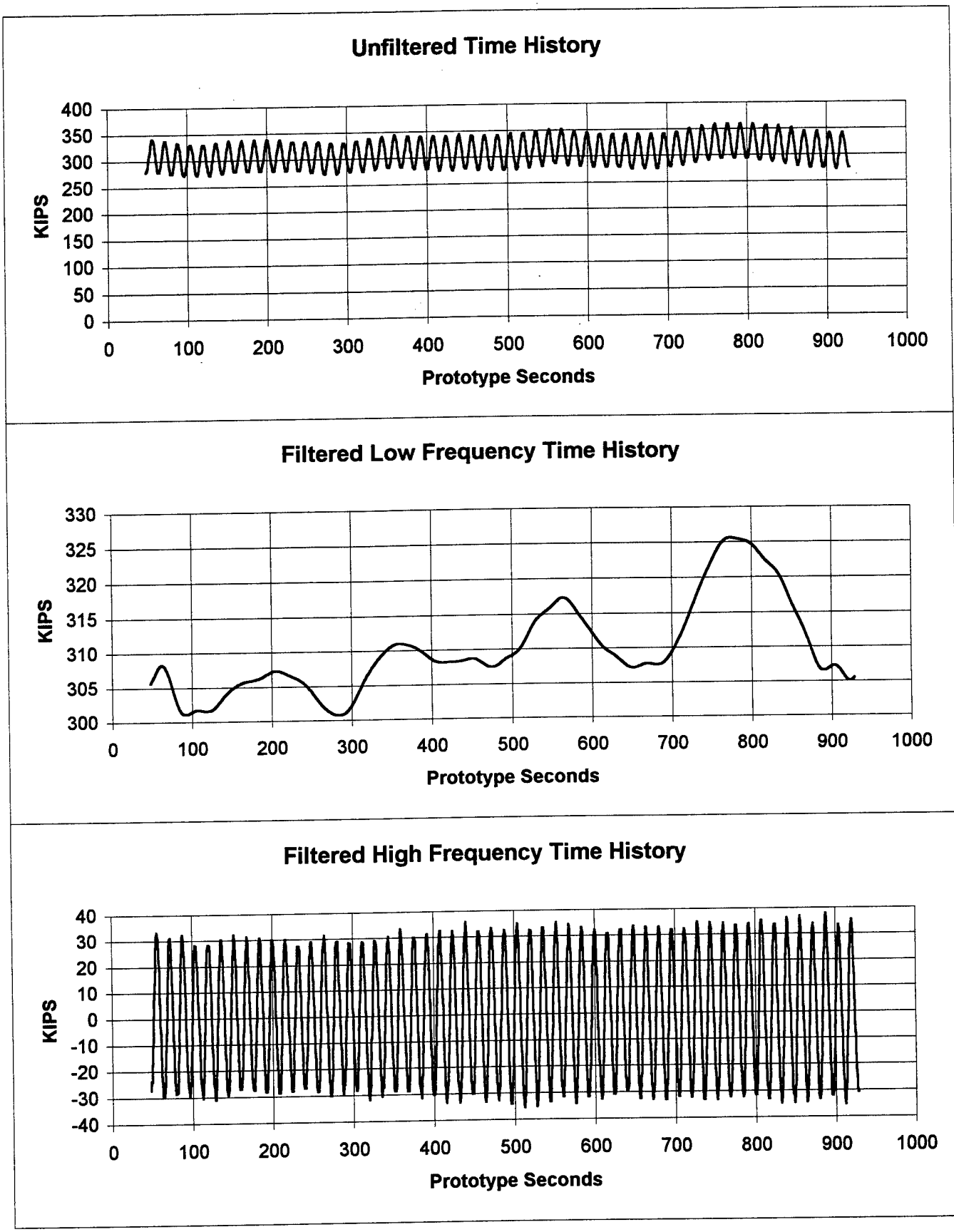
TEST A905 - PT HEAVE



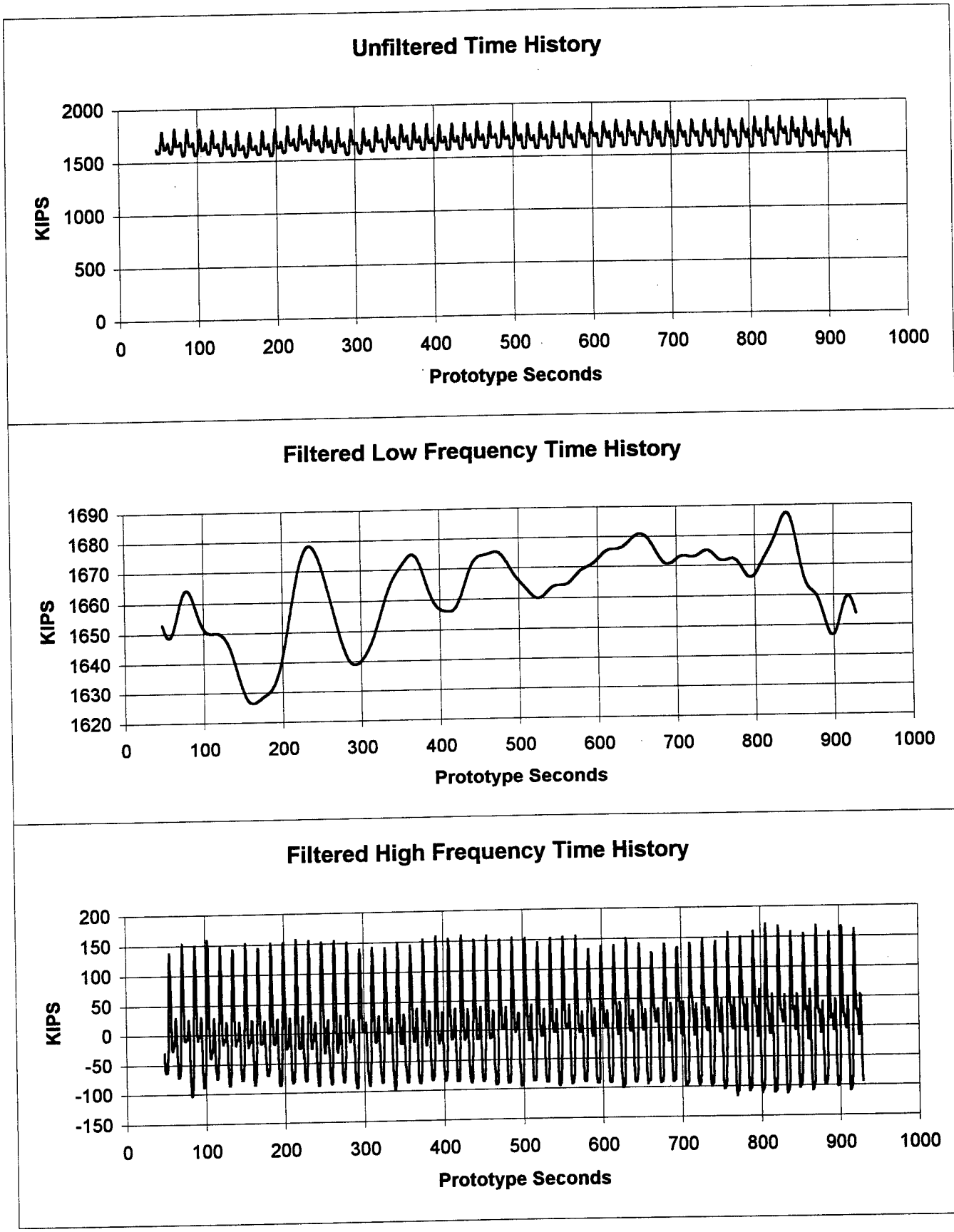




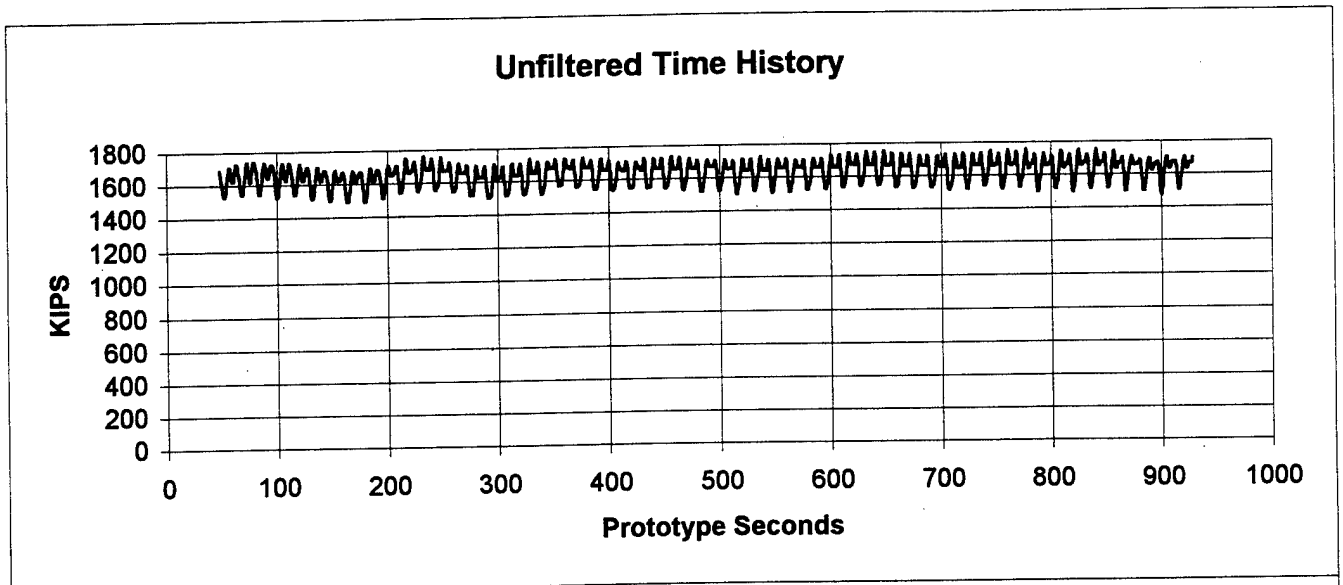
TEST A906 - ML_1 TENSION

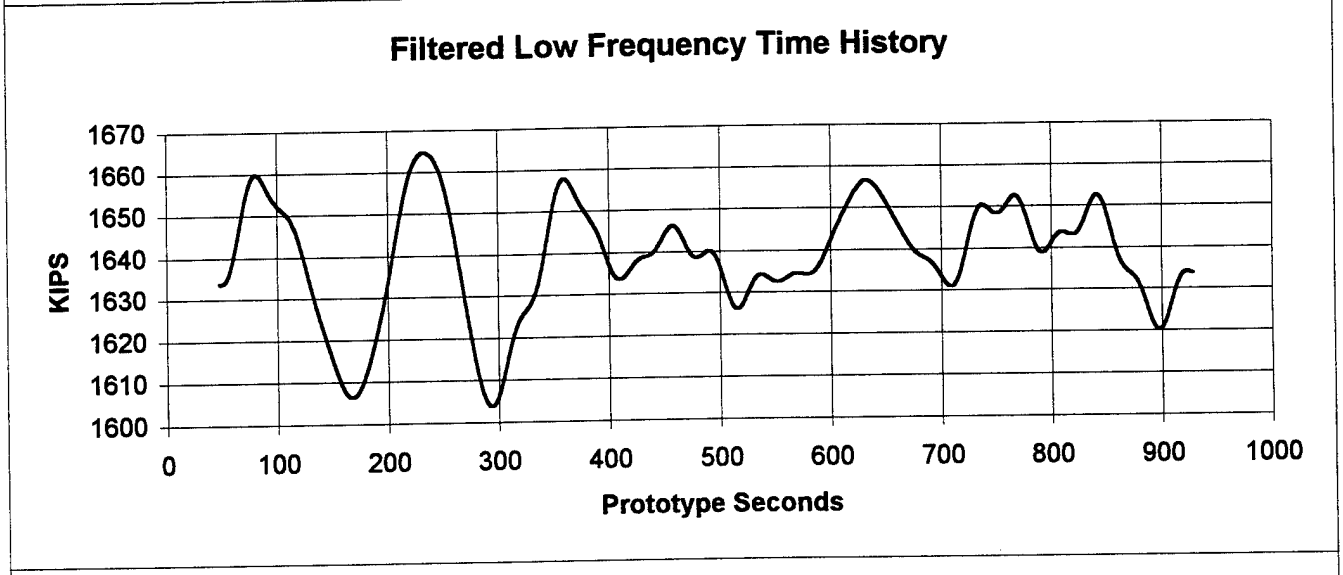


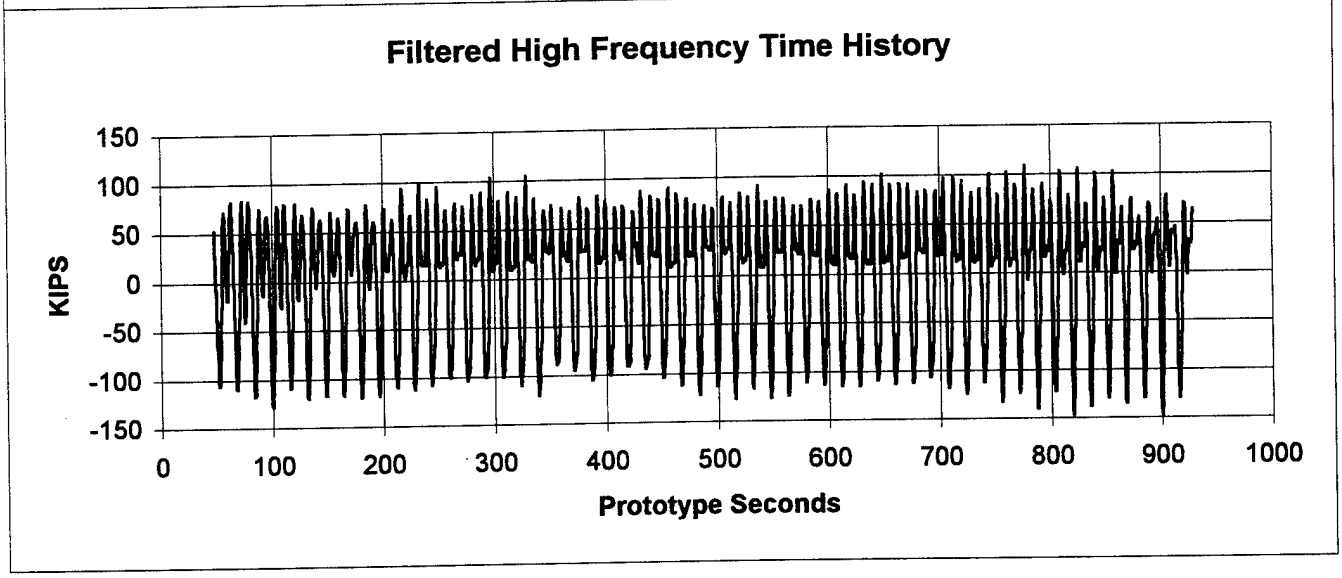
TEST A906 - BUOY 1 TENSION



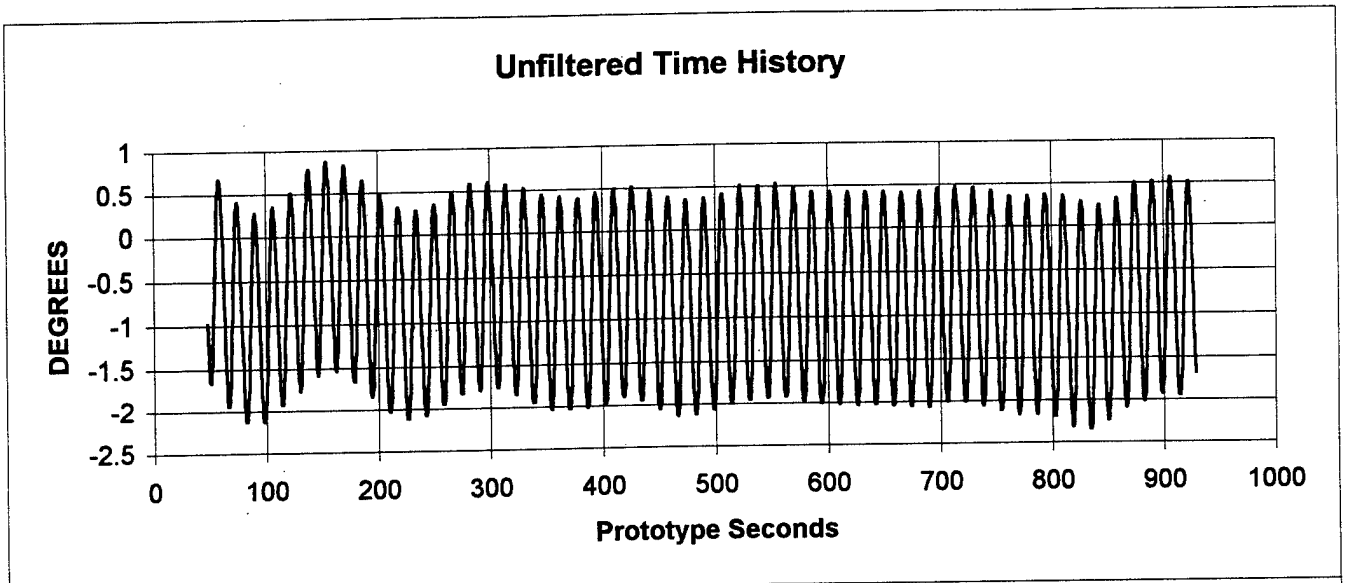
TEST A906 - BUOY 2 TENSION

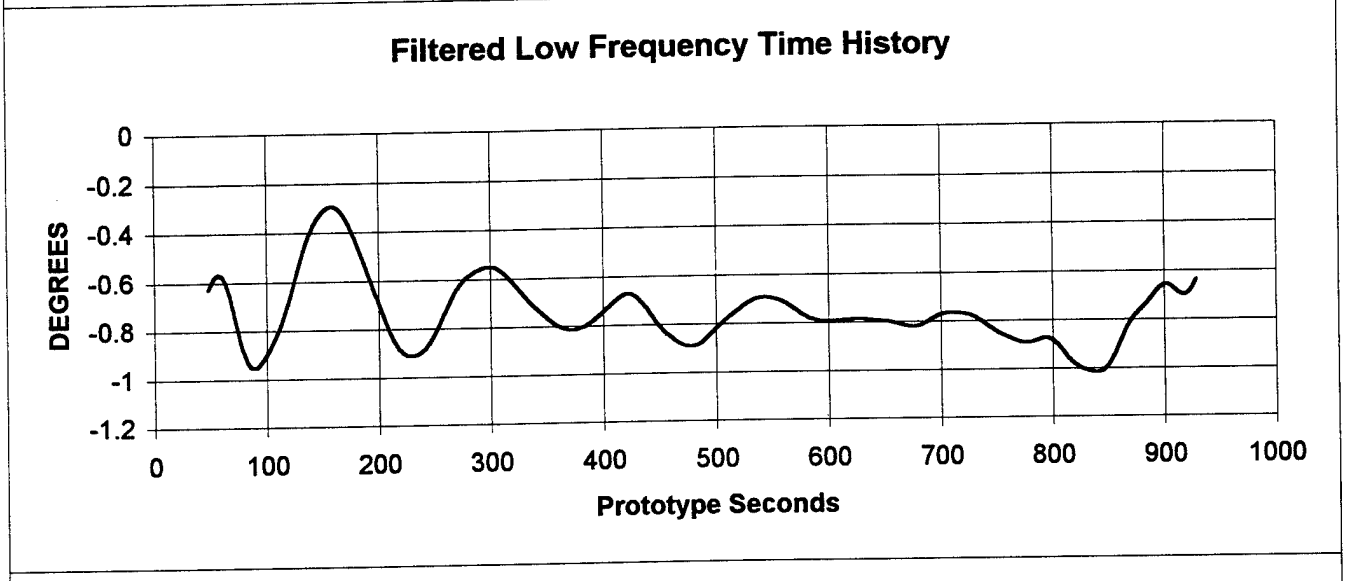


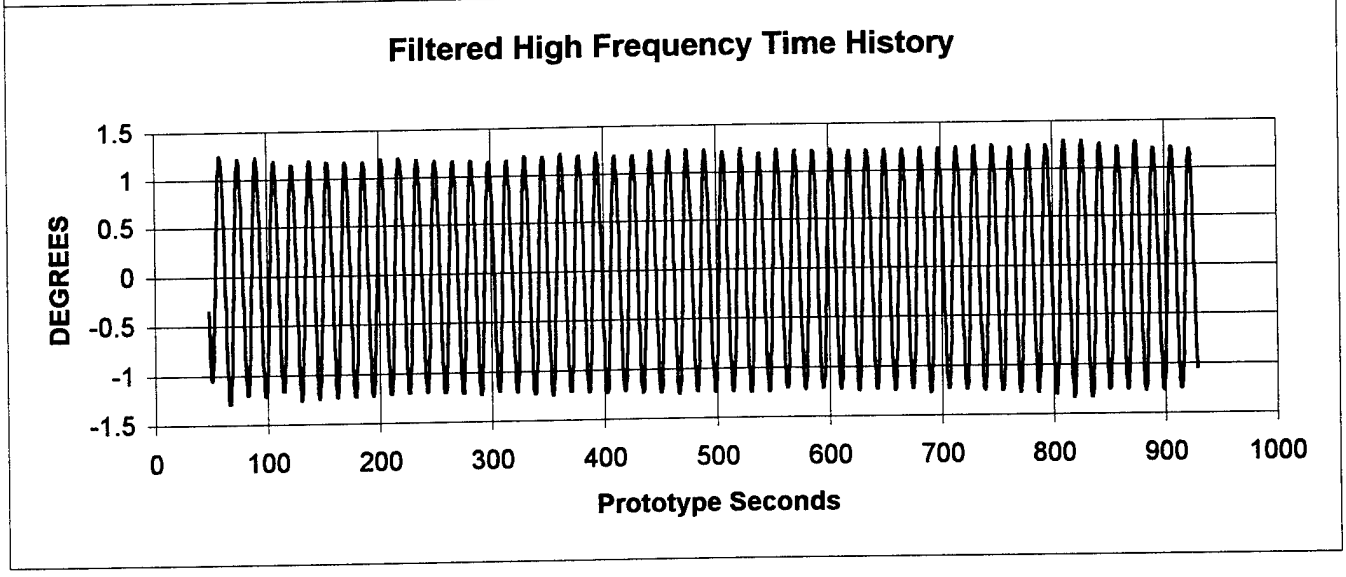




TEST A906 - PITCH

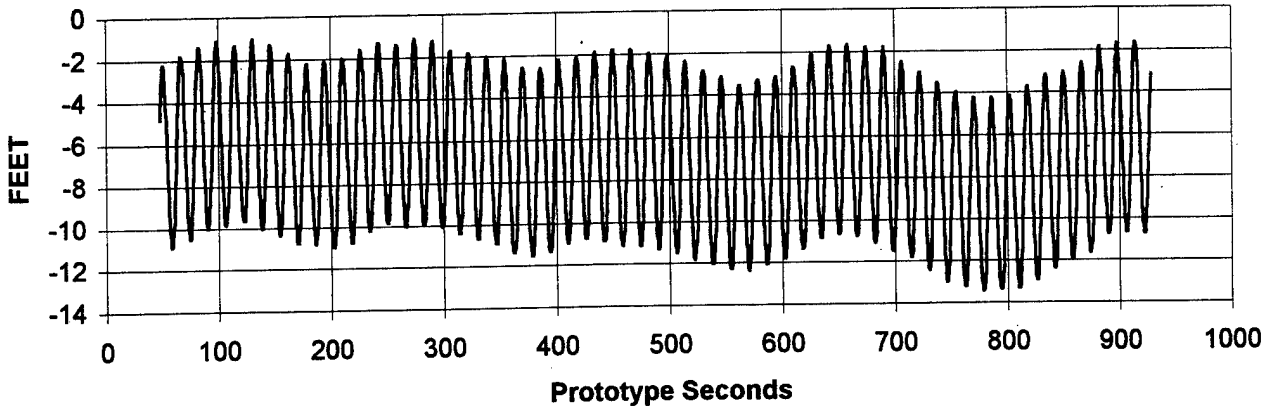




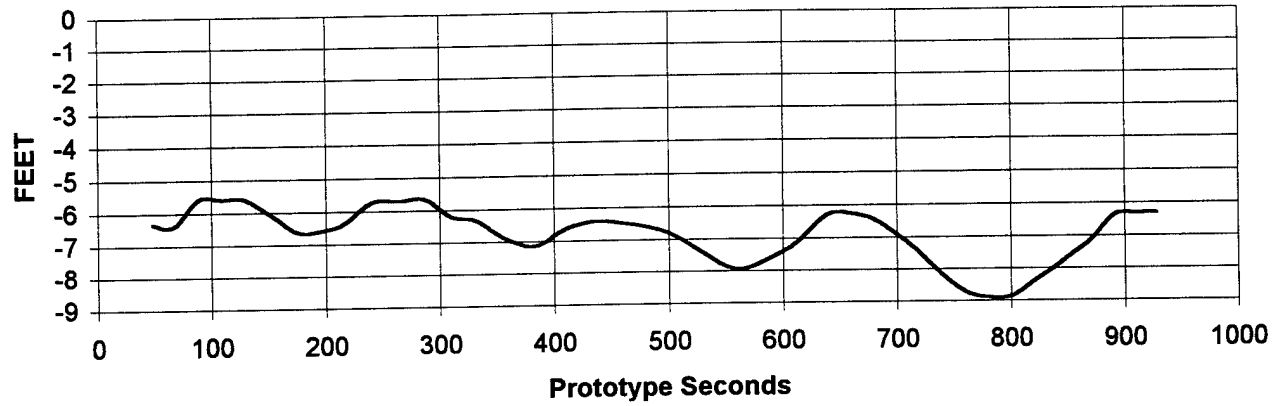


TEST A906 - PT SURGE

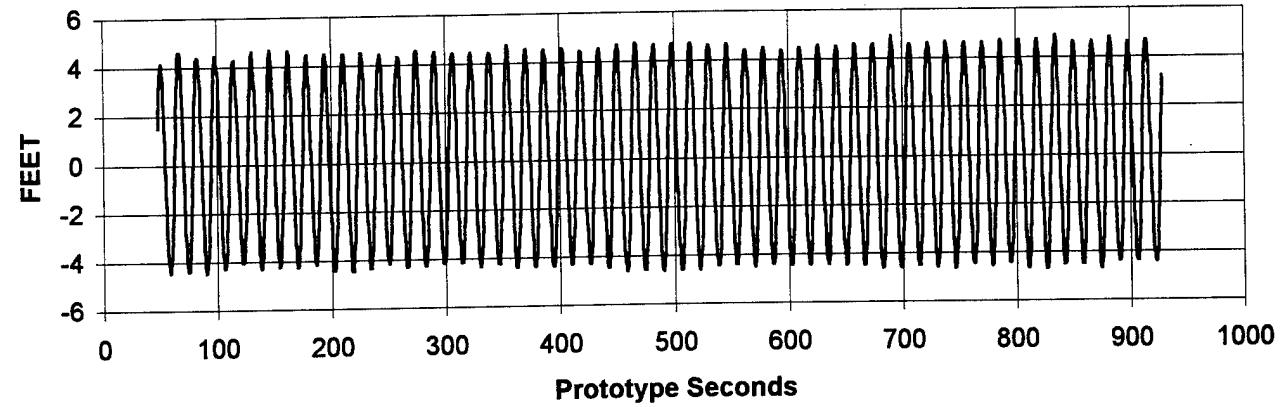
Unfiltered Time History



Filtered Low Frequency Time History

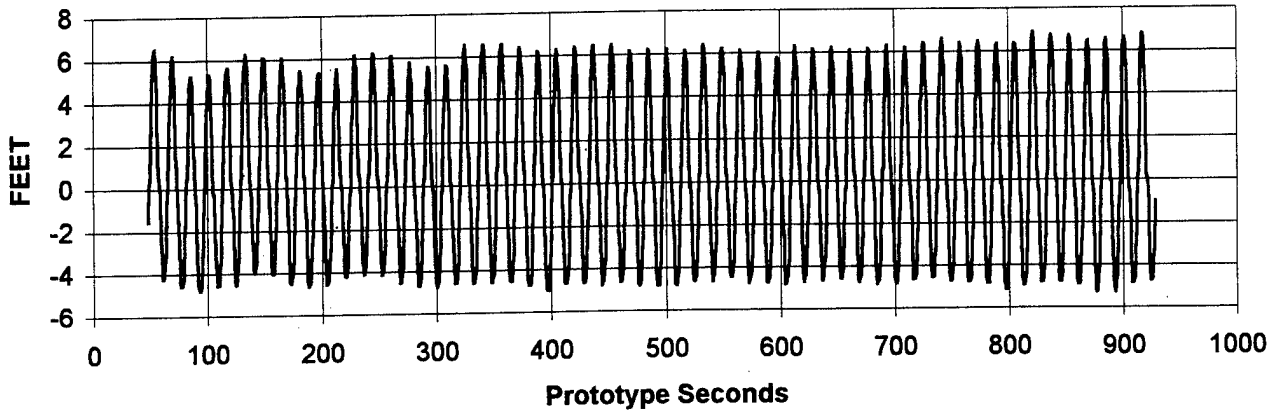


Filtered High Frequency Time History

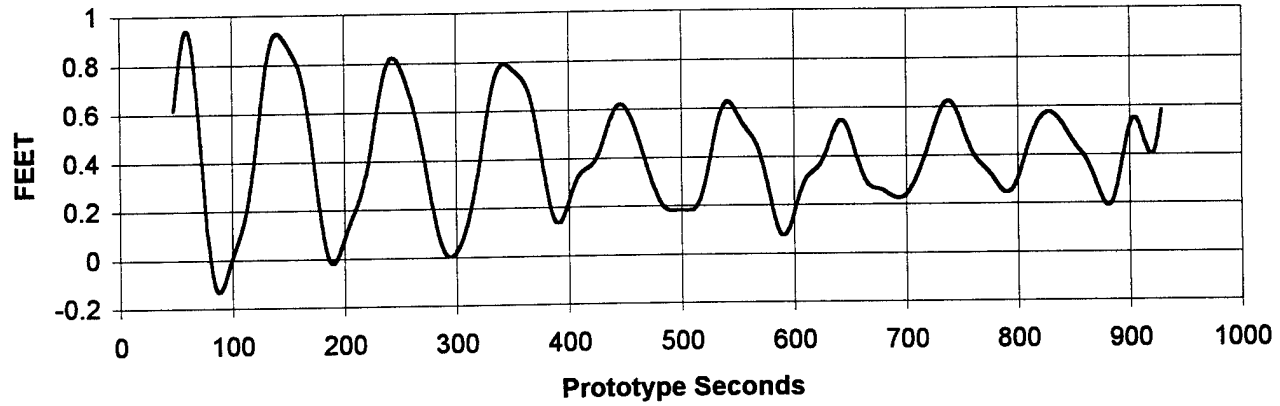


TEST A906 - PT HEAVE

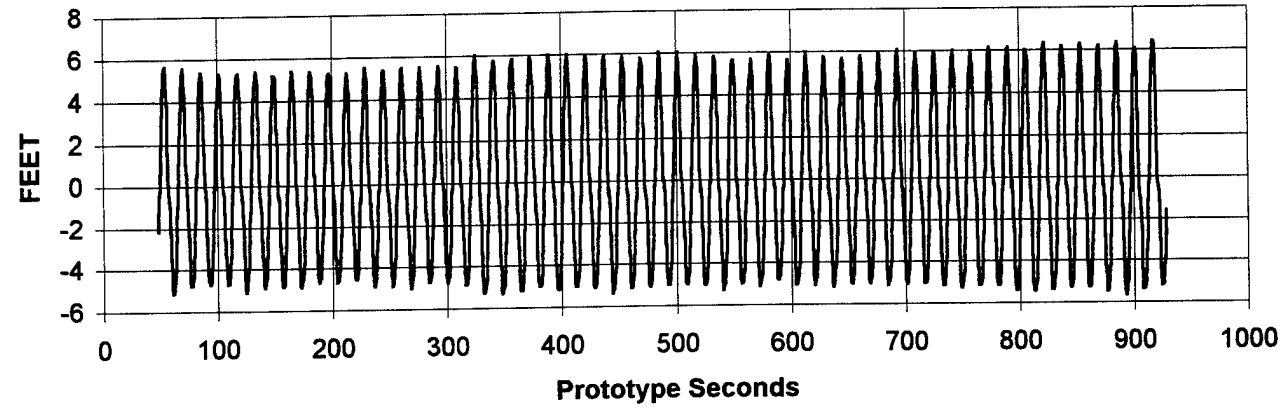
Unfiltered Time History



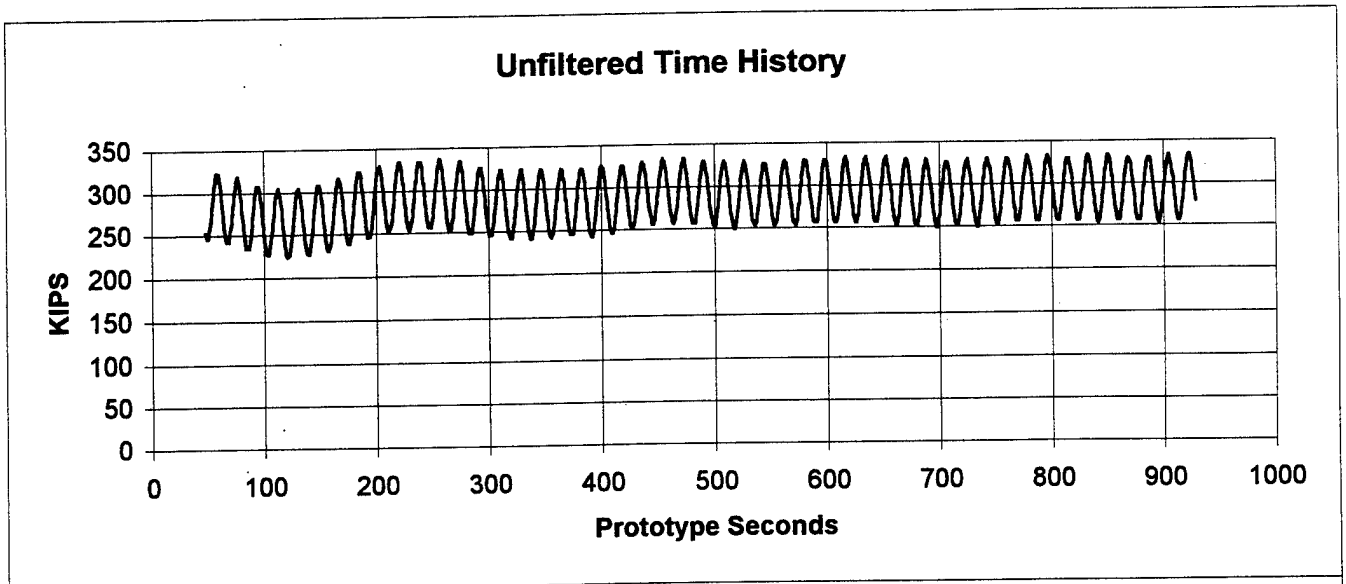
Filtered Low Frequency Time History

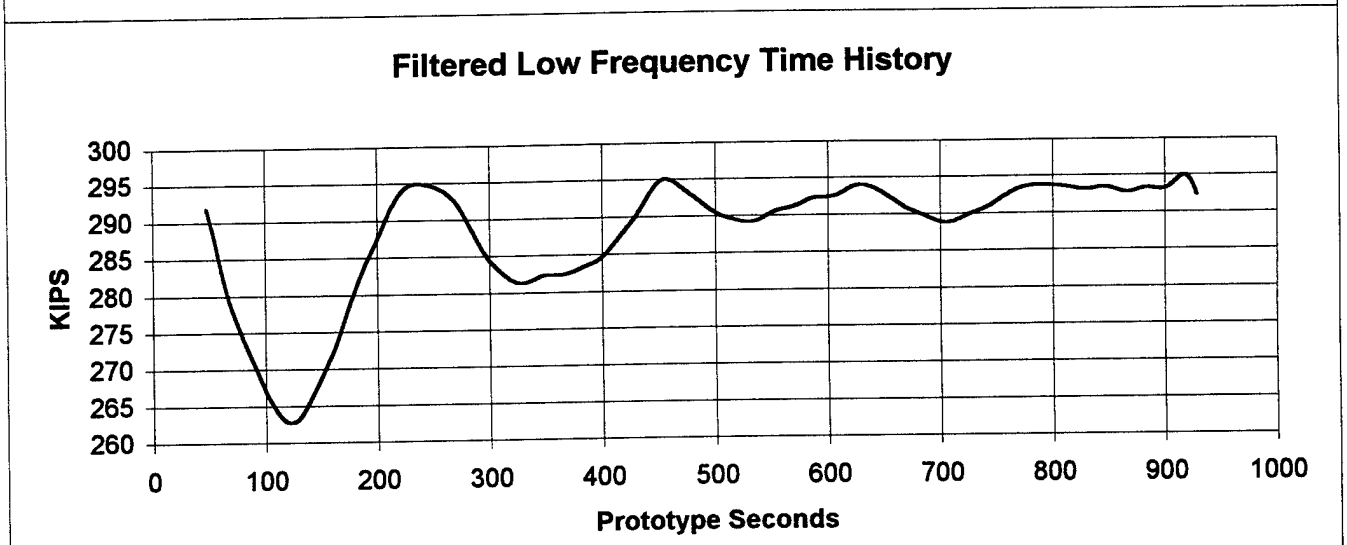


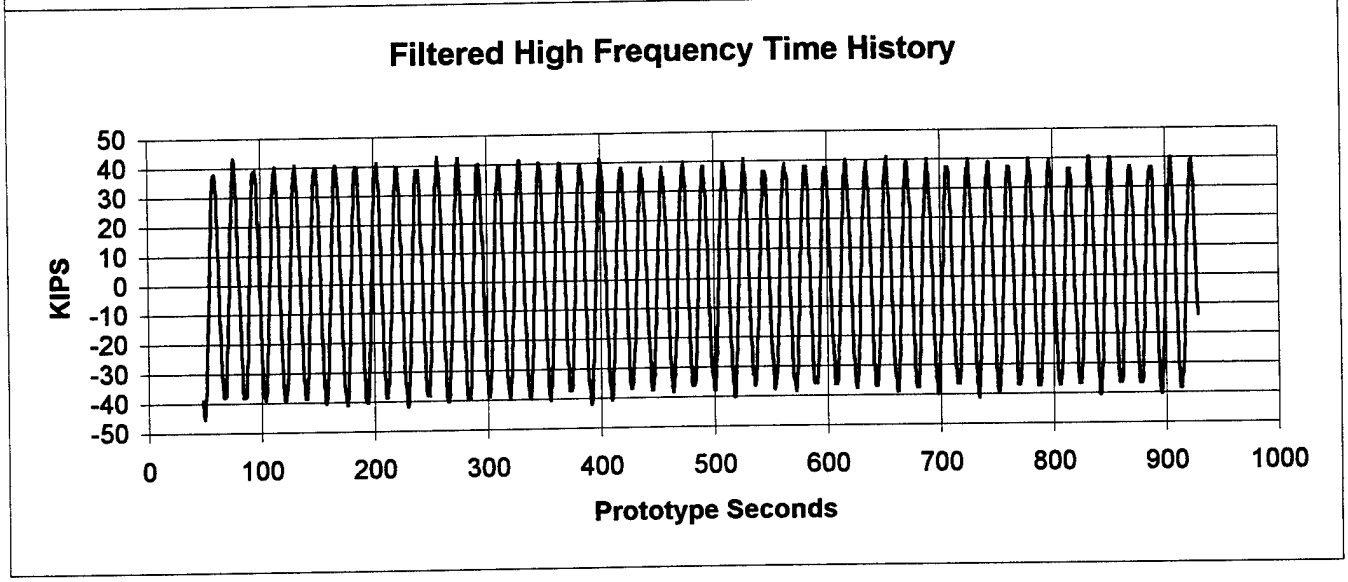
Filtered High Frequency Time History



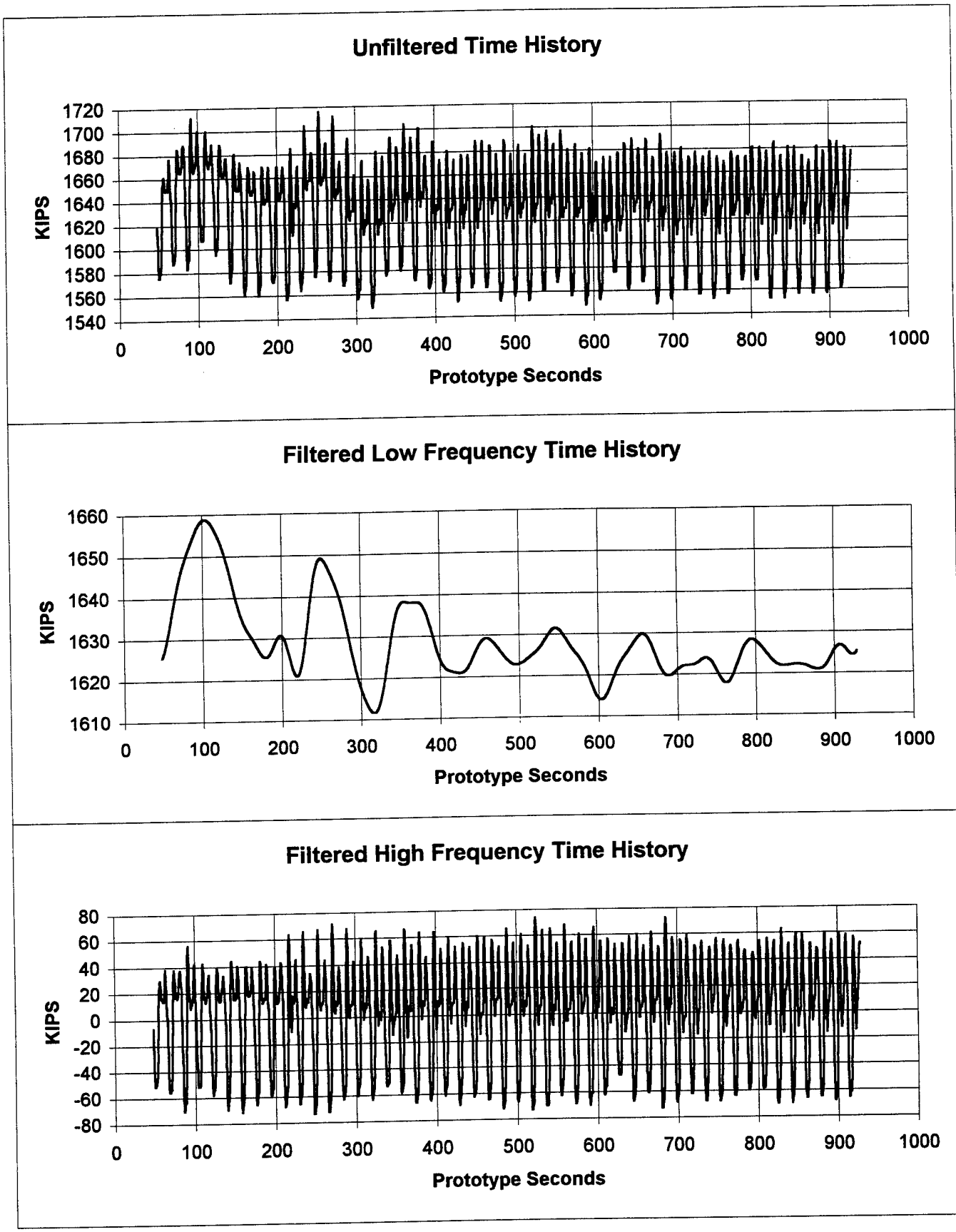
TEST A907 - ML_1 TENSION



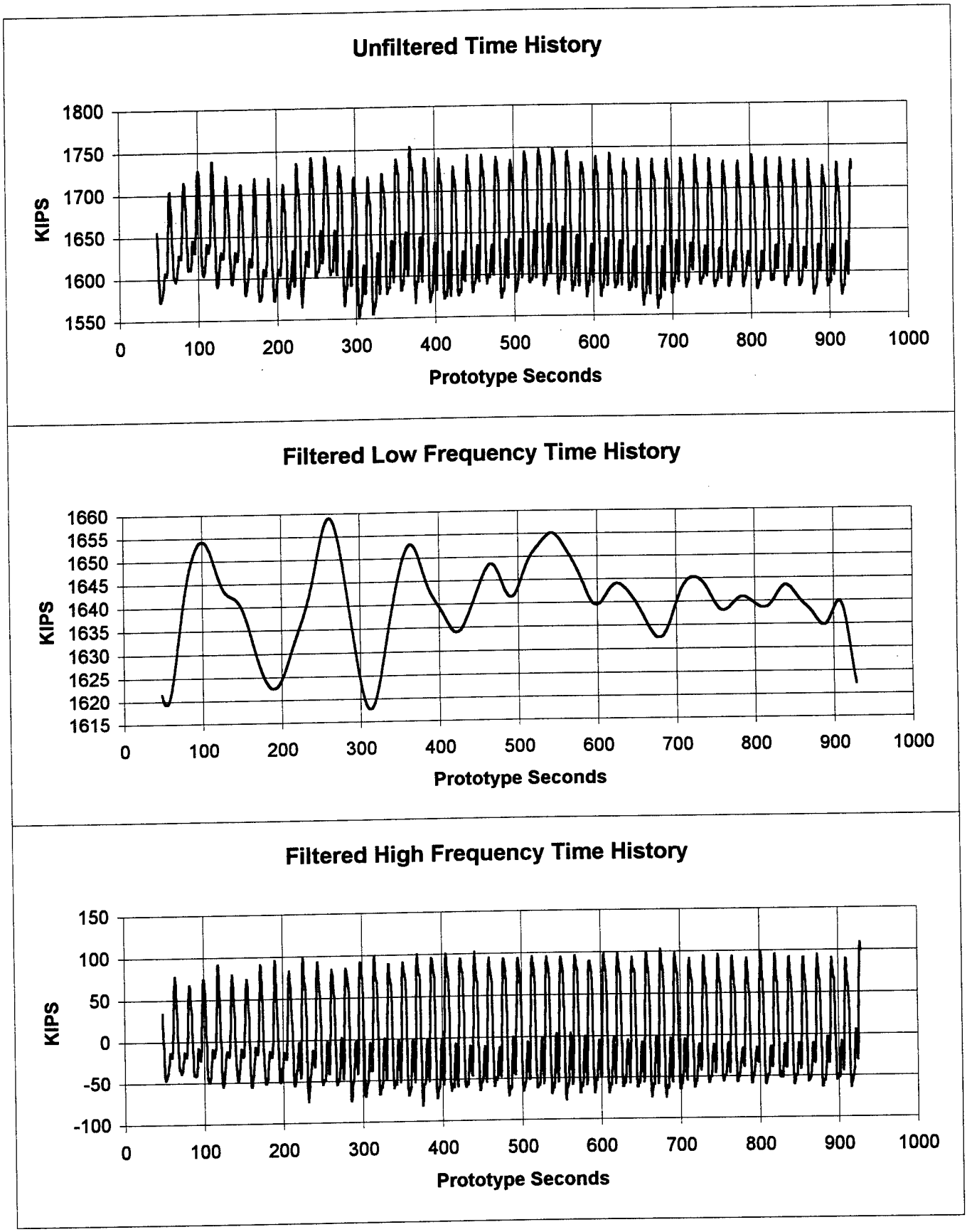




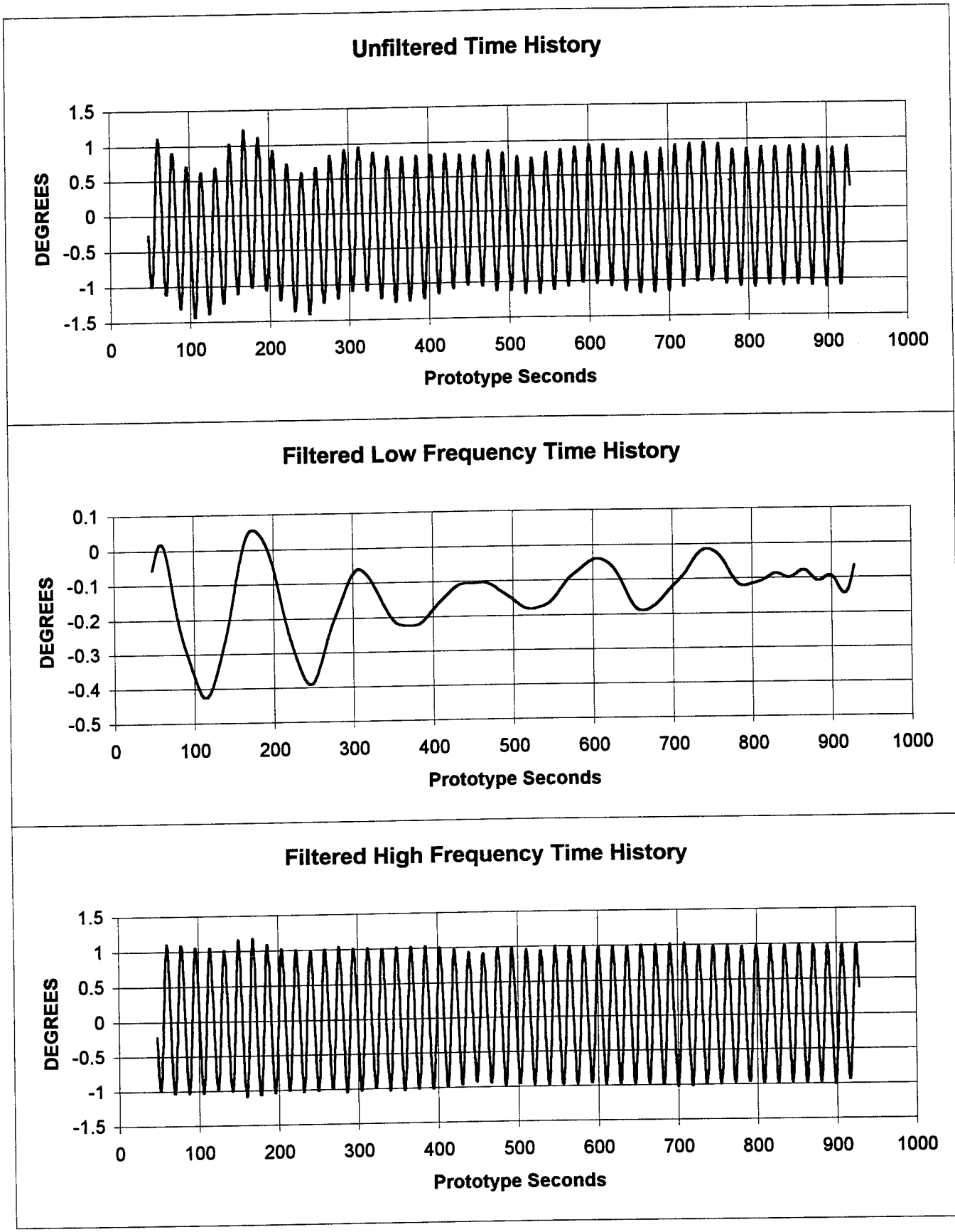
TEST A907 - BUOY 1 TENSION



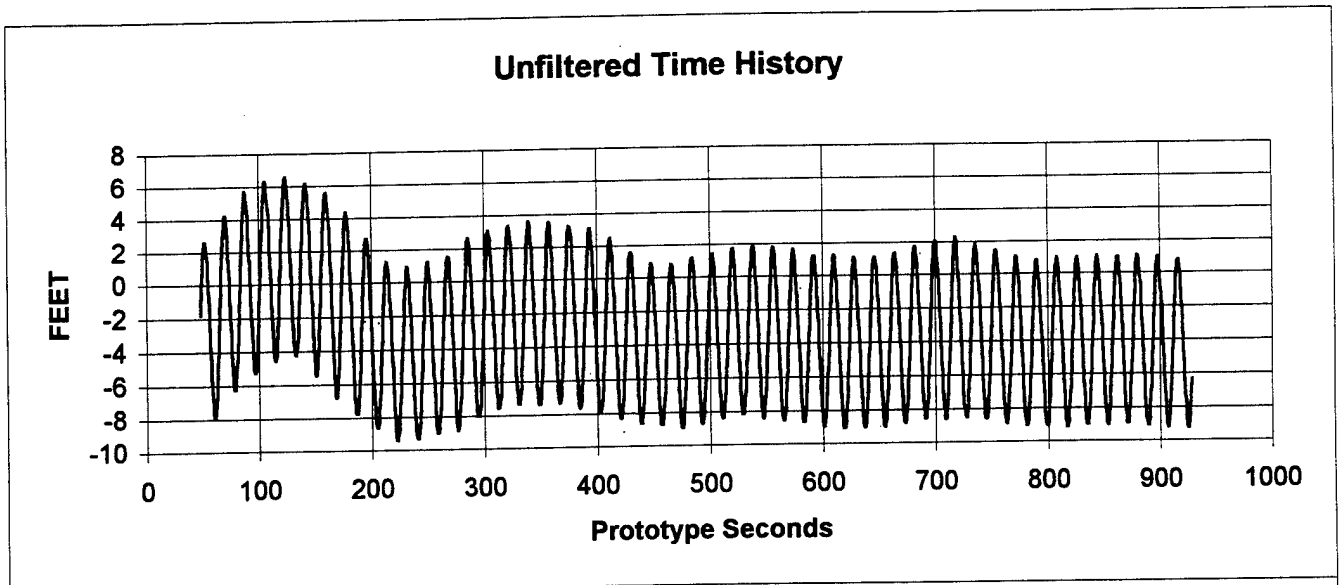
TEST A907 - BUOY 2 TENSION

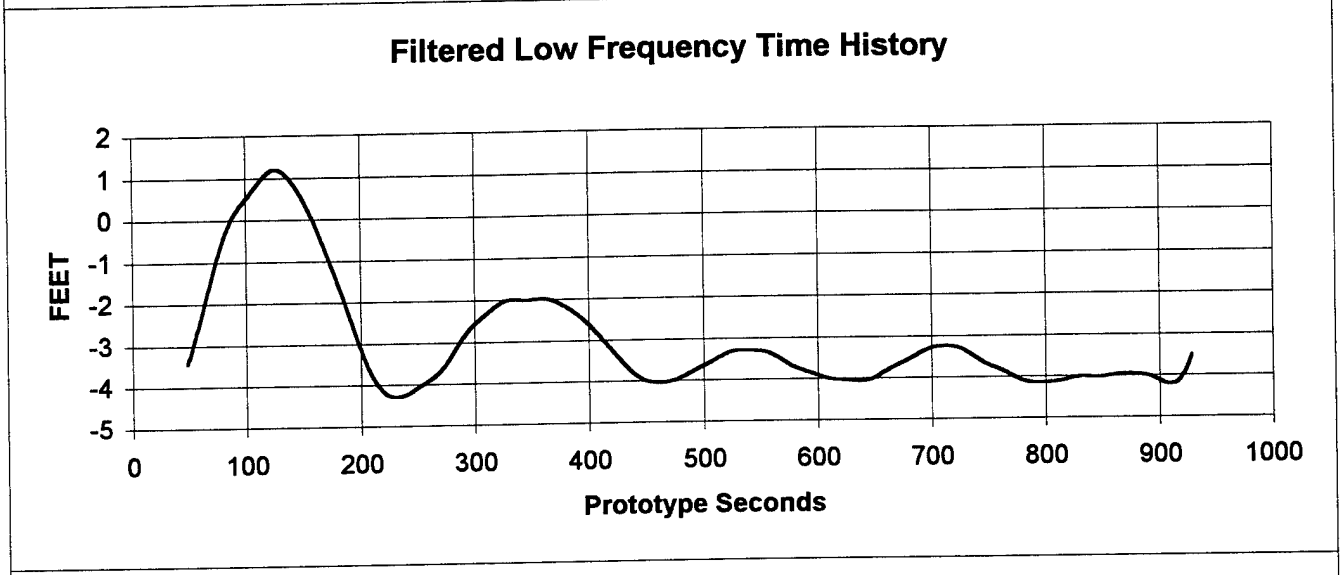


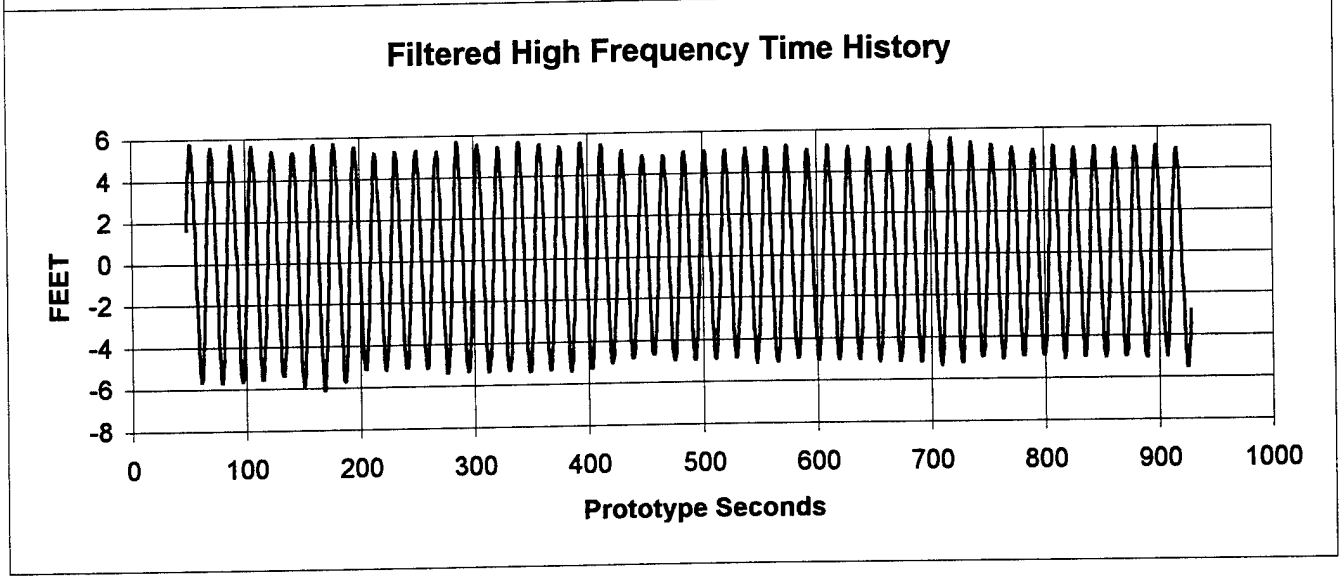
TEST A907 - PITCH



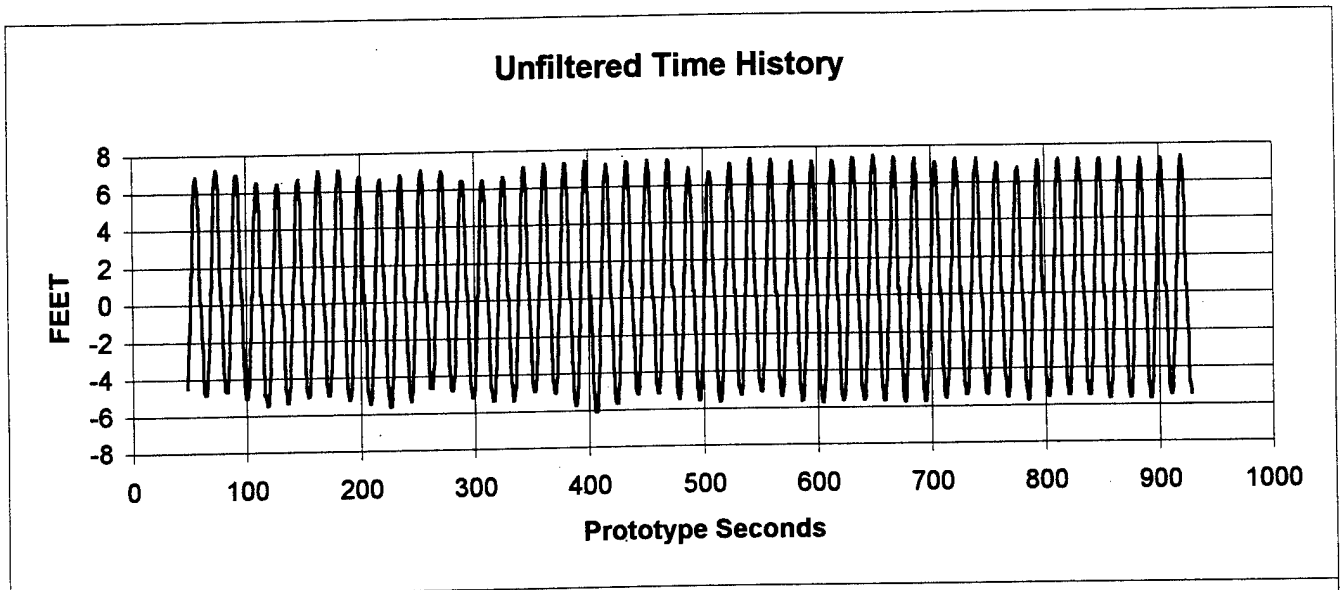
TEST A907 - PT SURGE

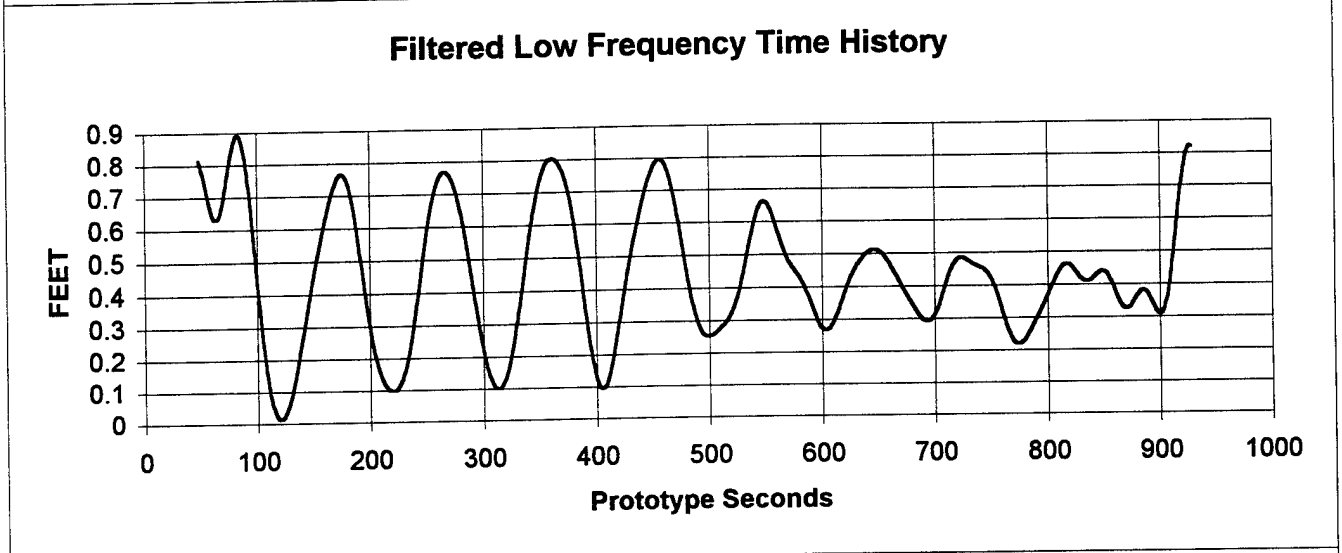


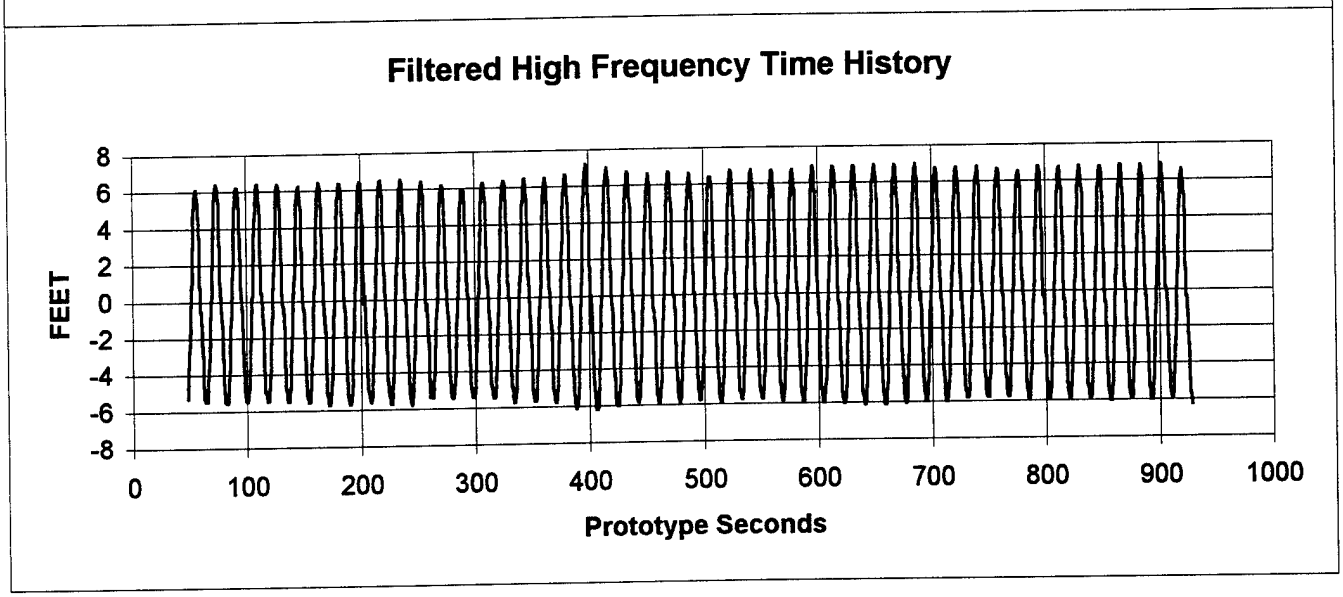




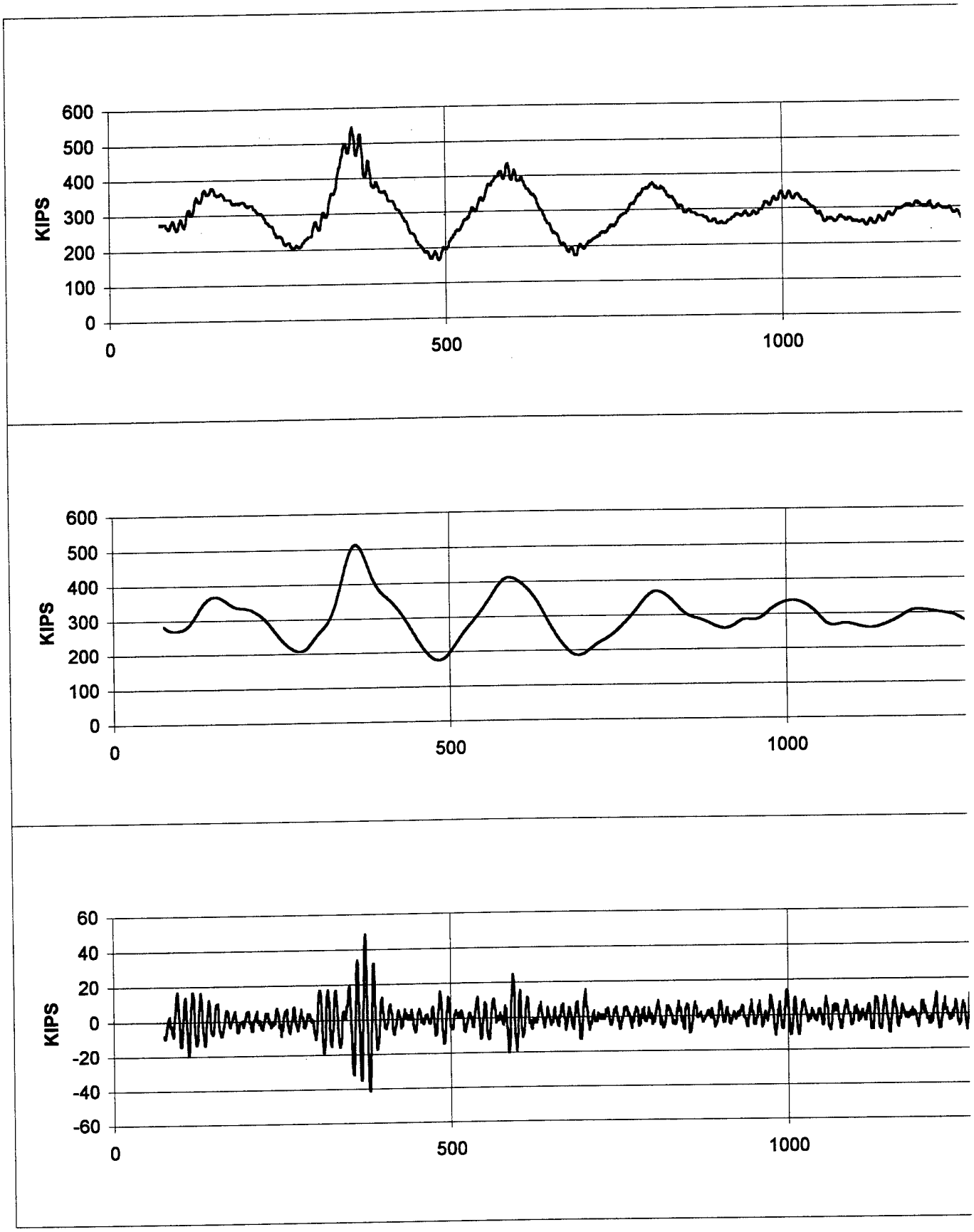
TEST A907 - PT HEAVE





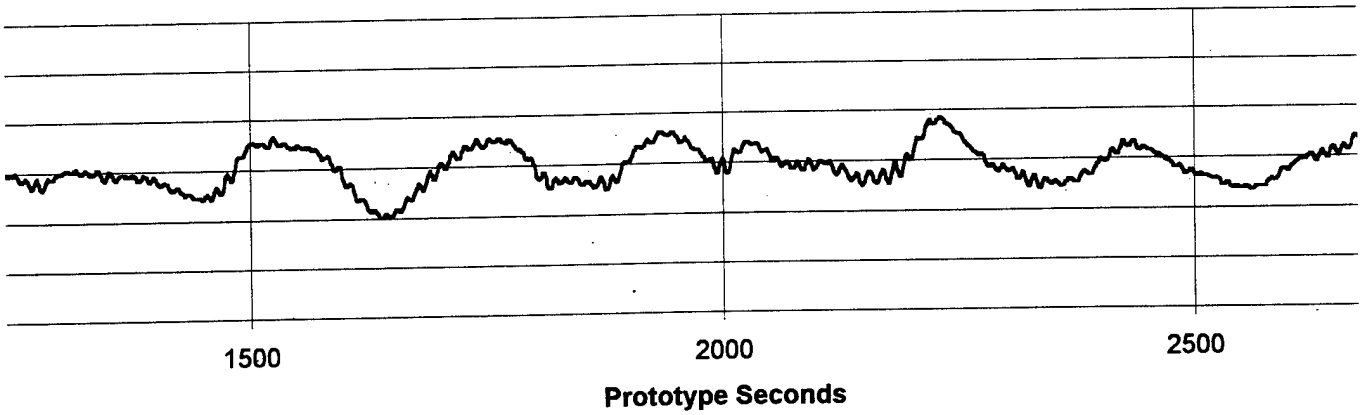


TEST A908 - ML_1 TENSION

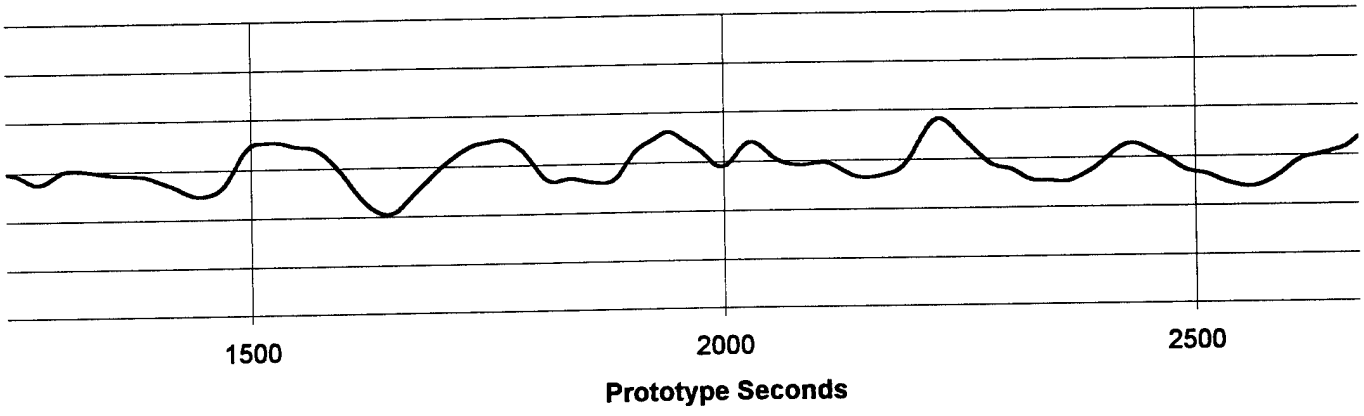


TEST A908 - ML_1 TENSION

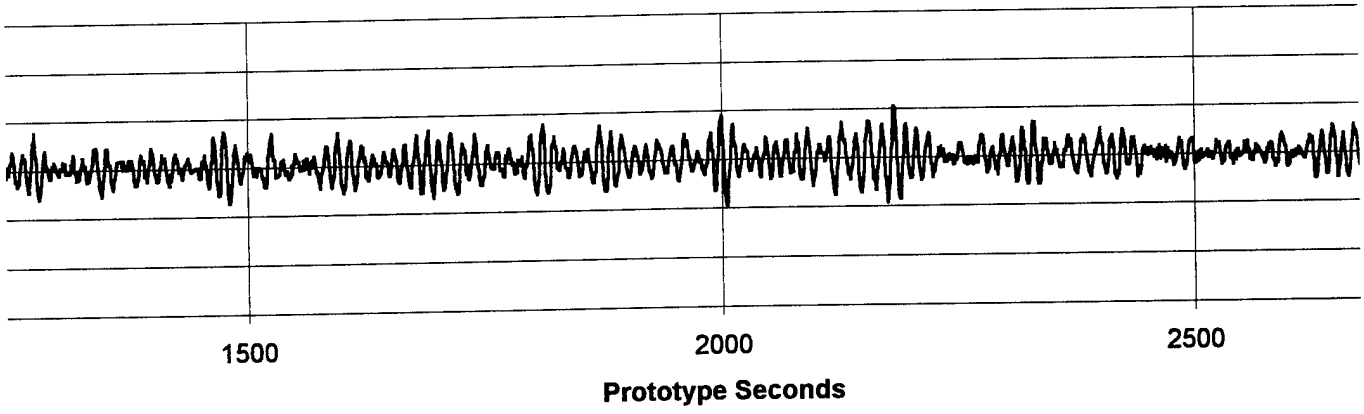
Unfiltered Time History



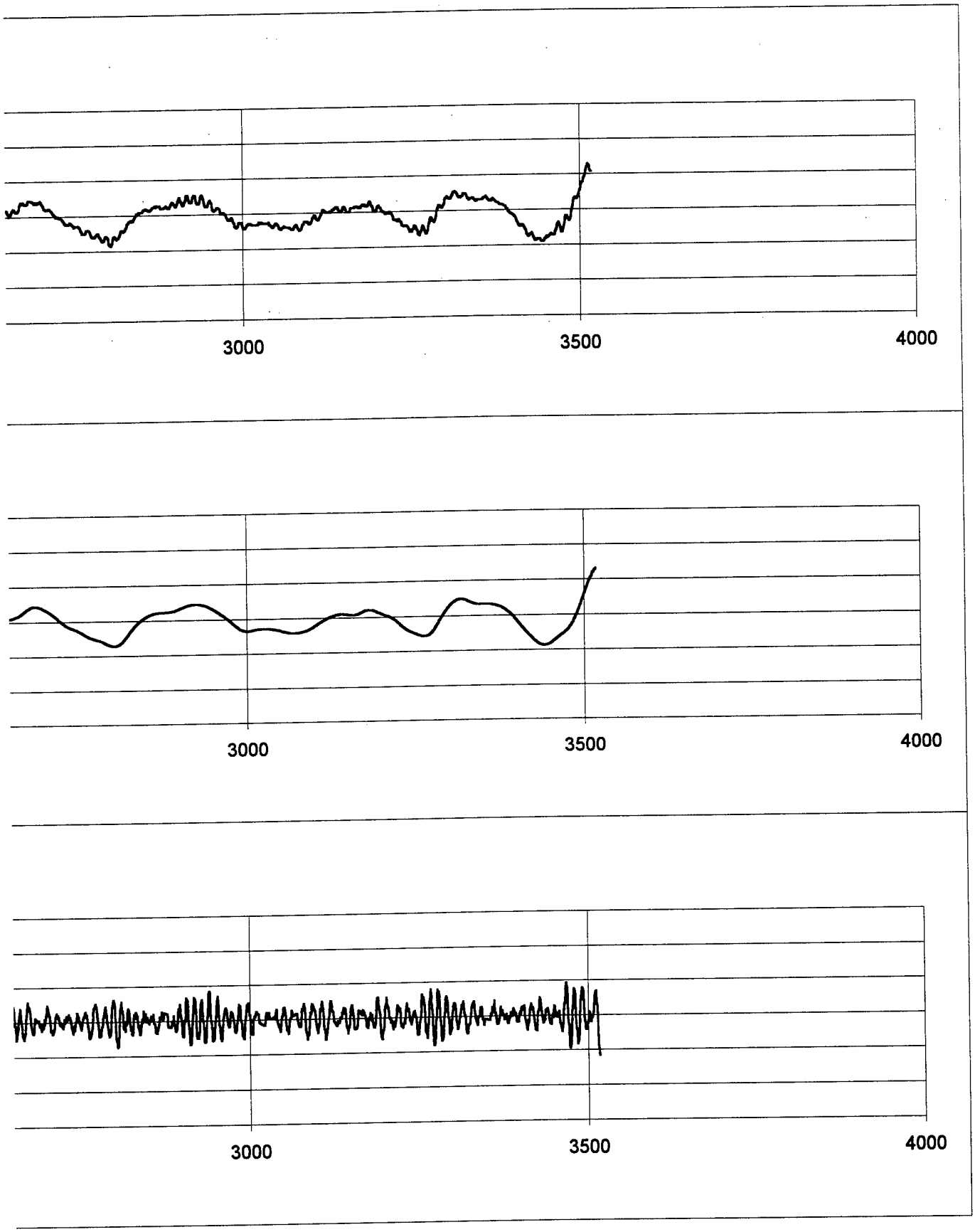
Filtered Low Frequency Time History



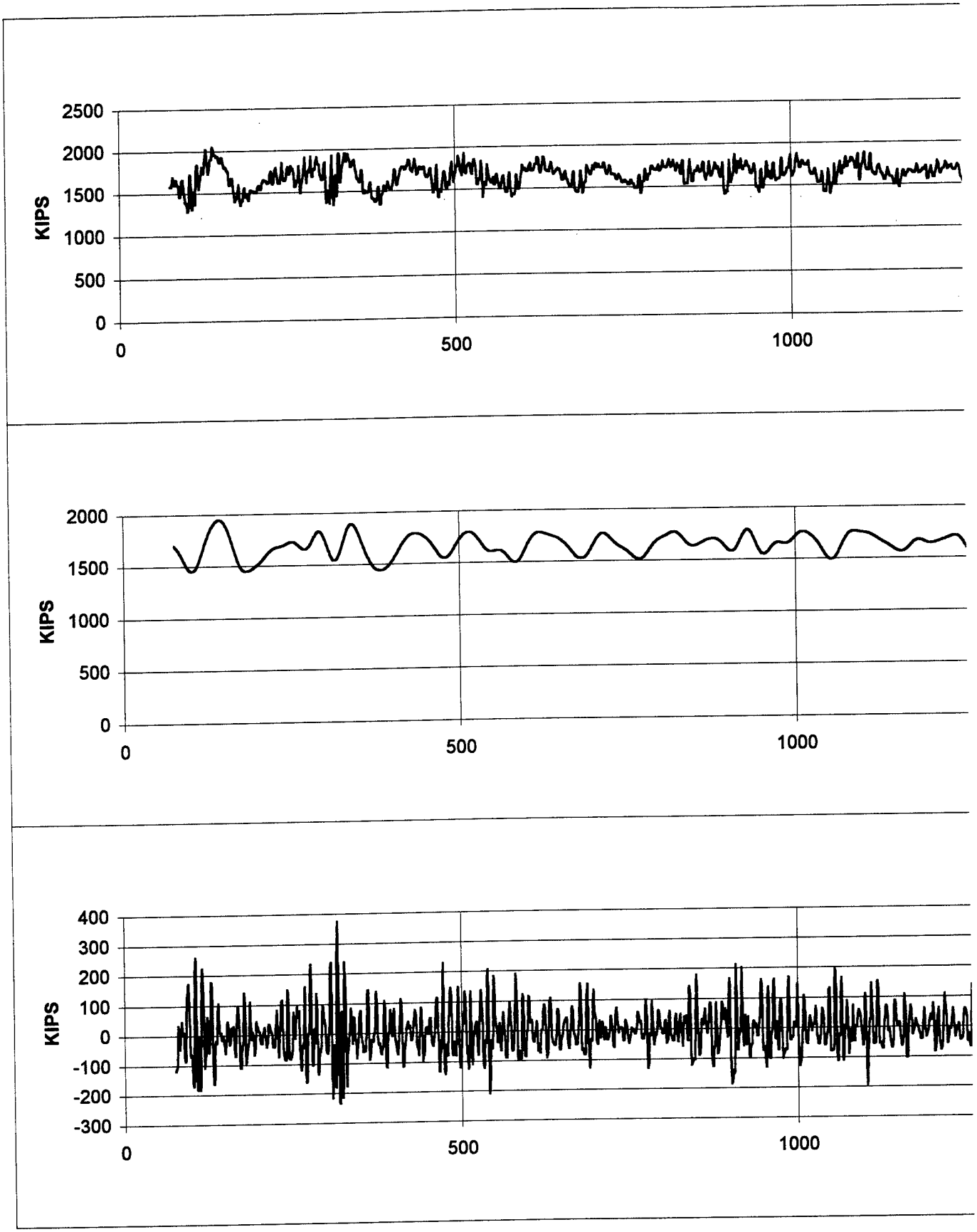
Filtered High Frequency Time History



TEST A908 - ML_1 TENSION

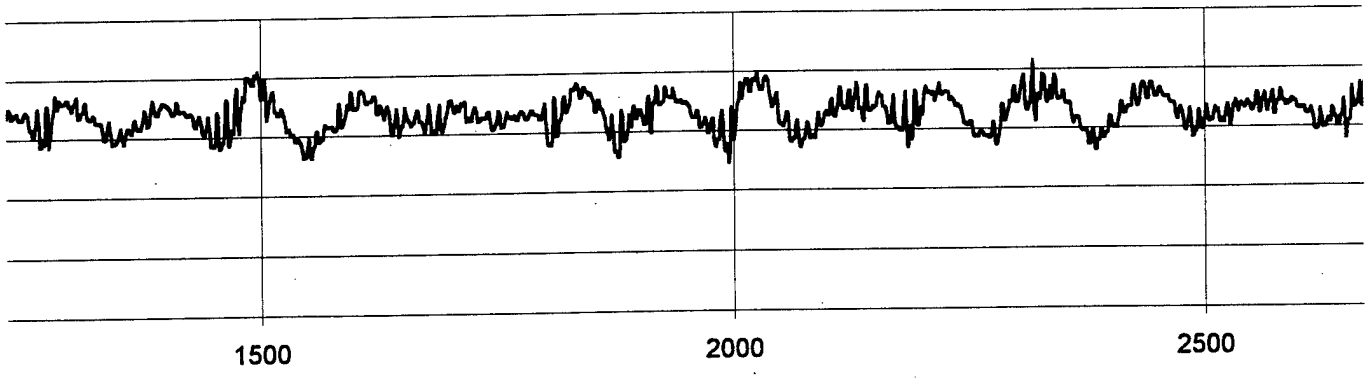


TEST A908 - BUOY 1 TENSION

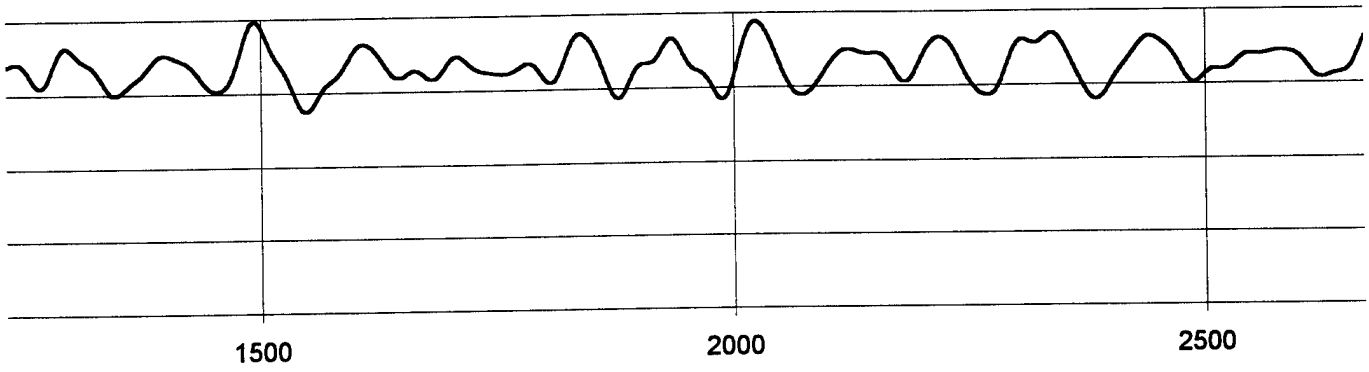


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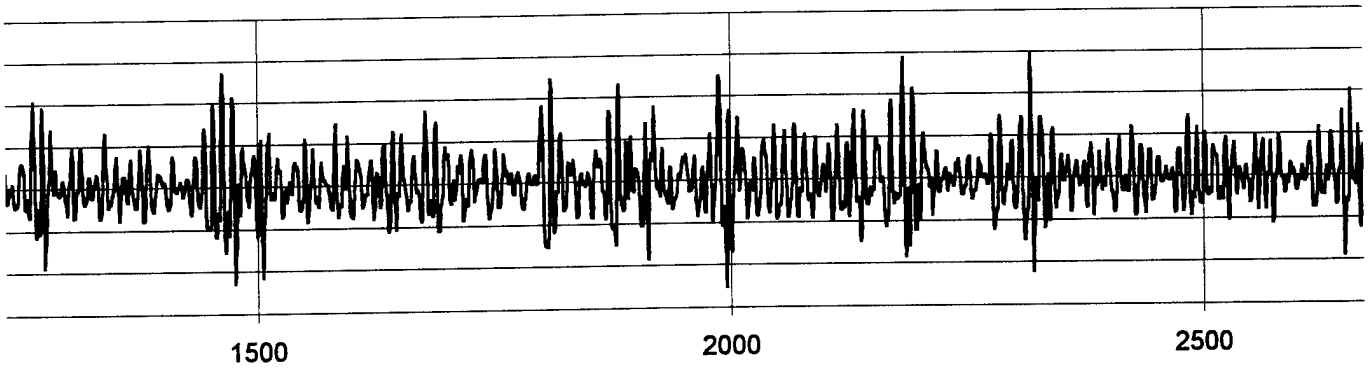
Unfiltered Time History



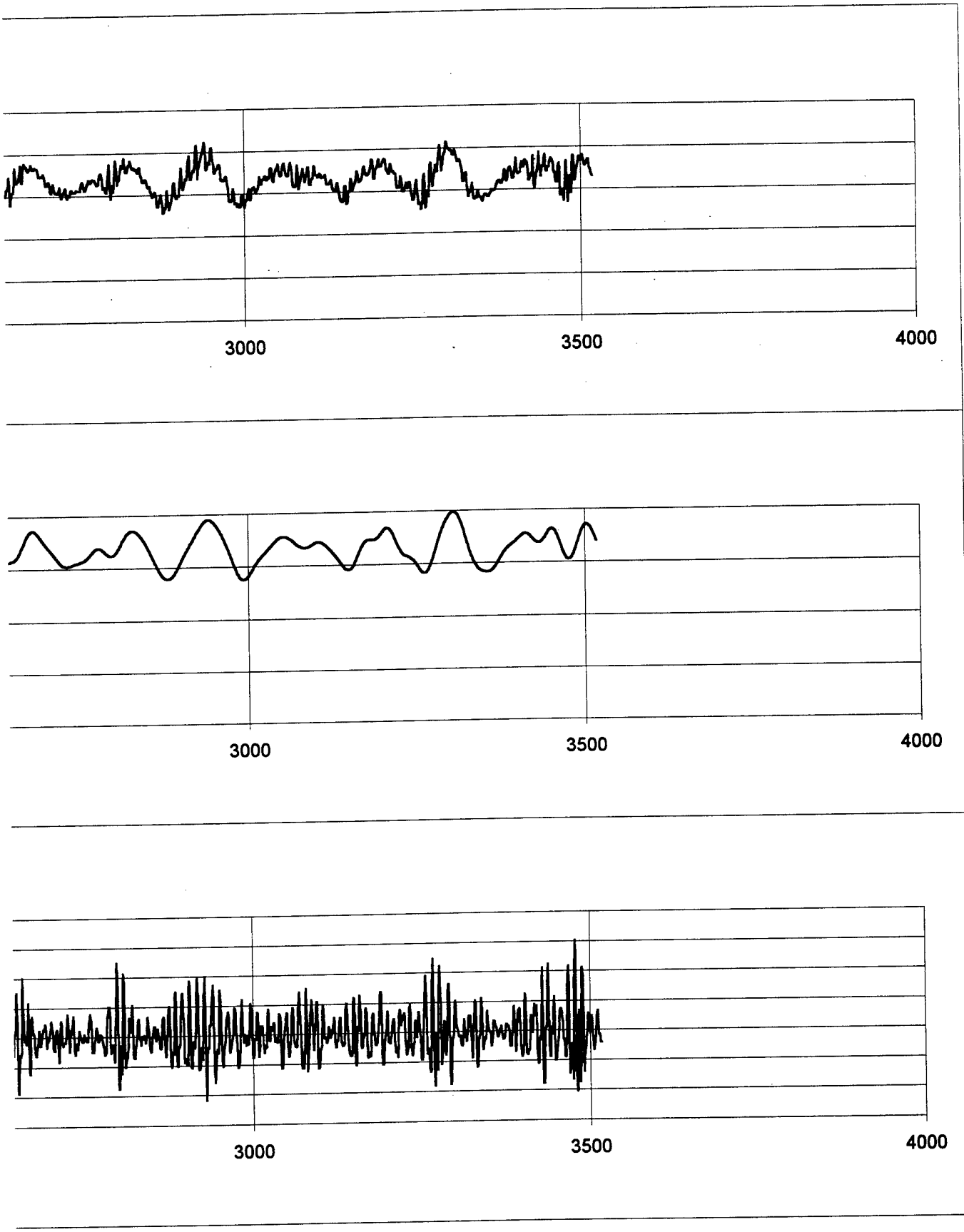
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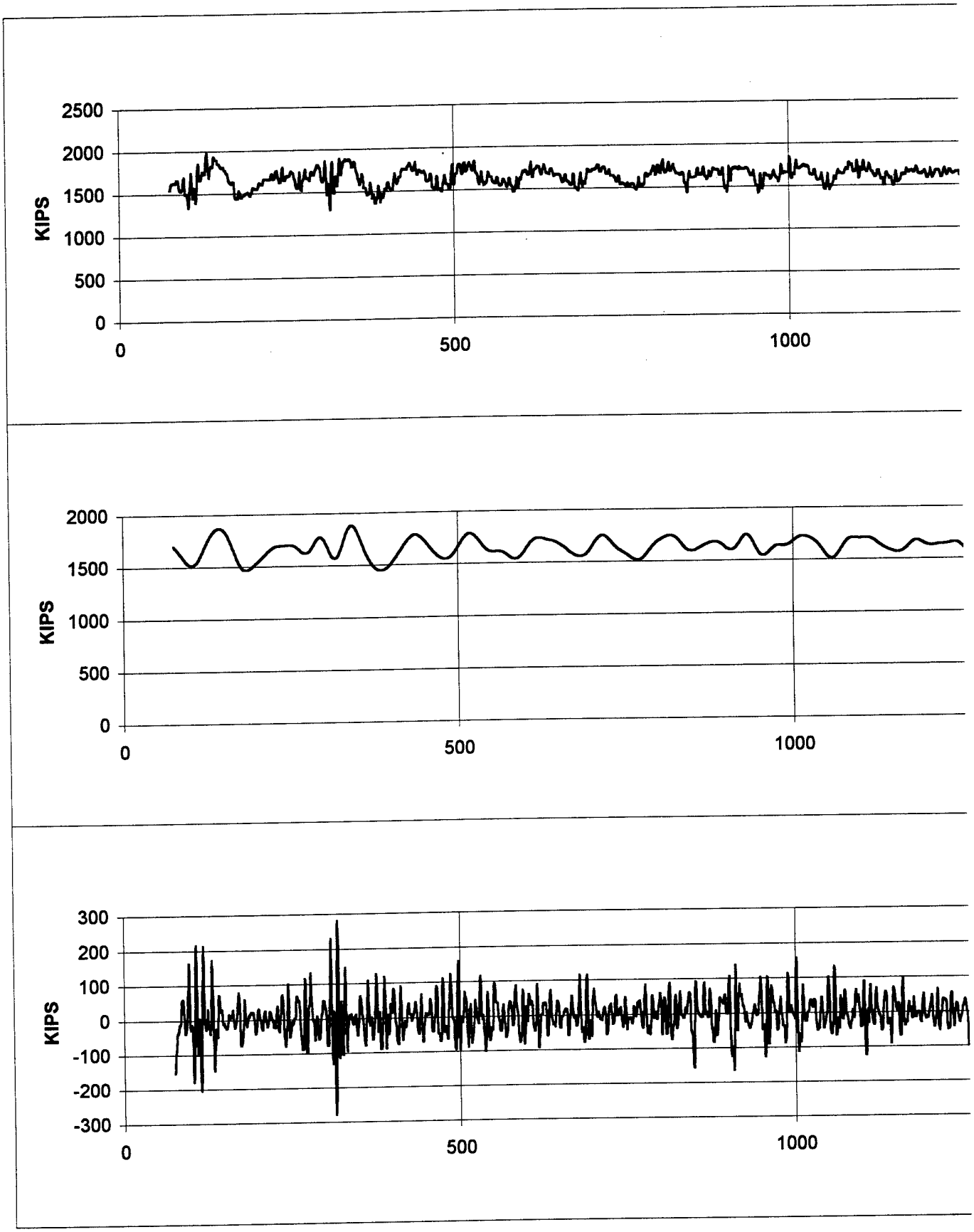
Filtered High Frequency Time History



TEST A908 - BUOY 1 TENSION

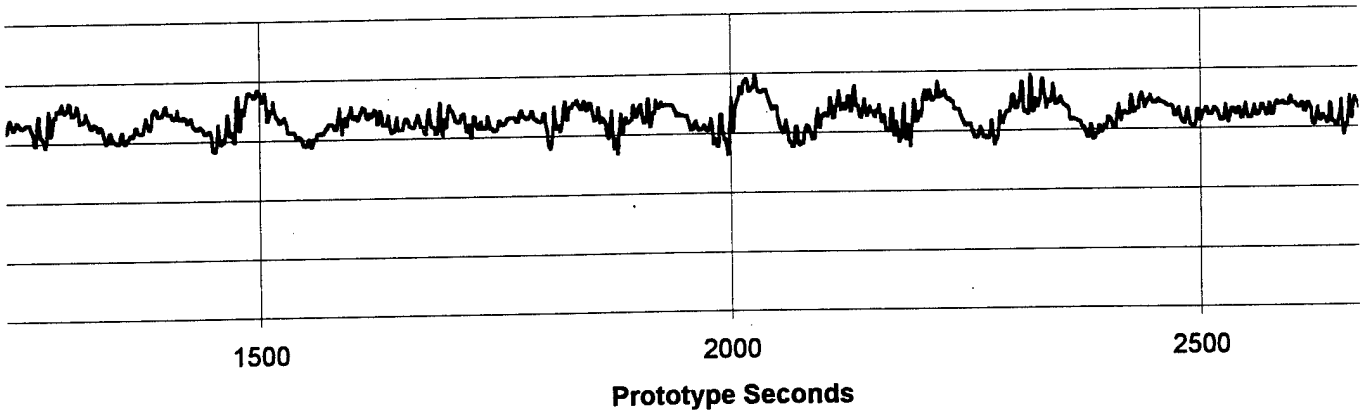


TEST A908 - BUOY 2 TENSION

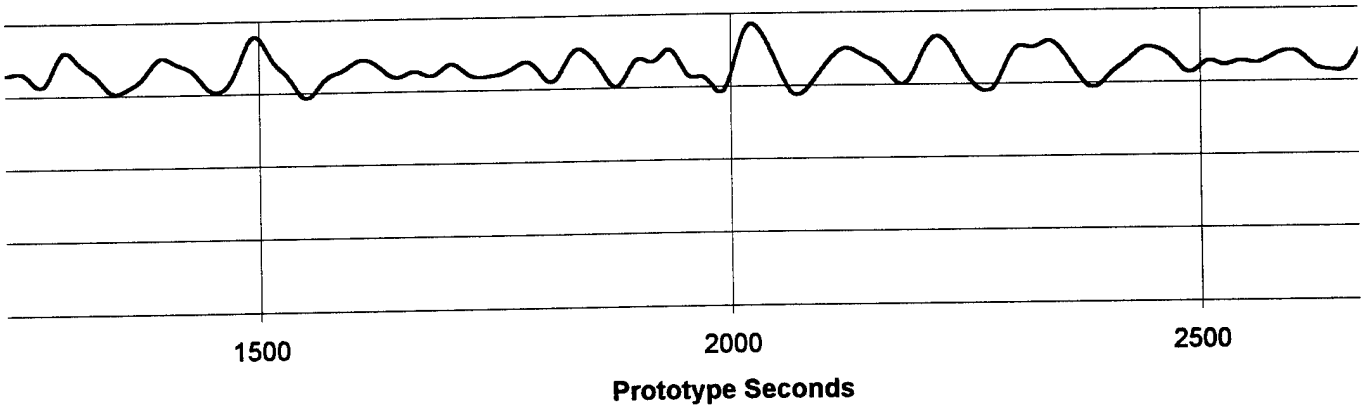


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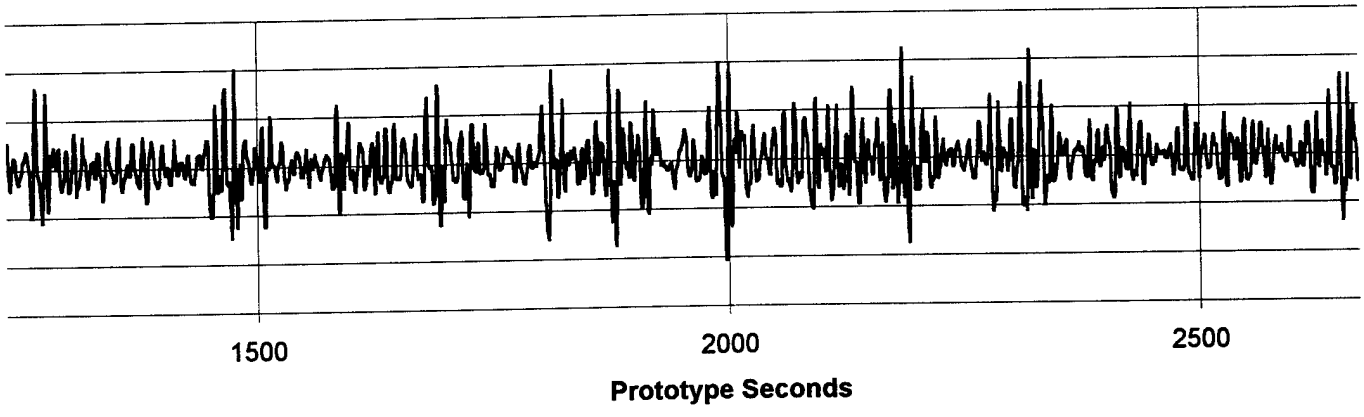
Unfiltered Time History



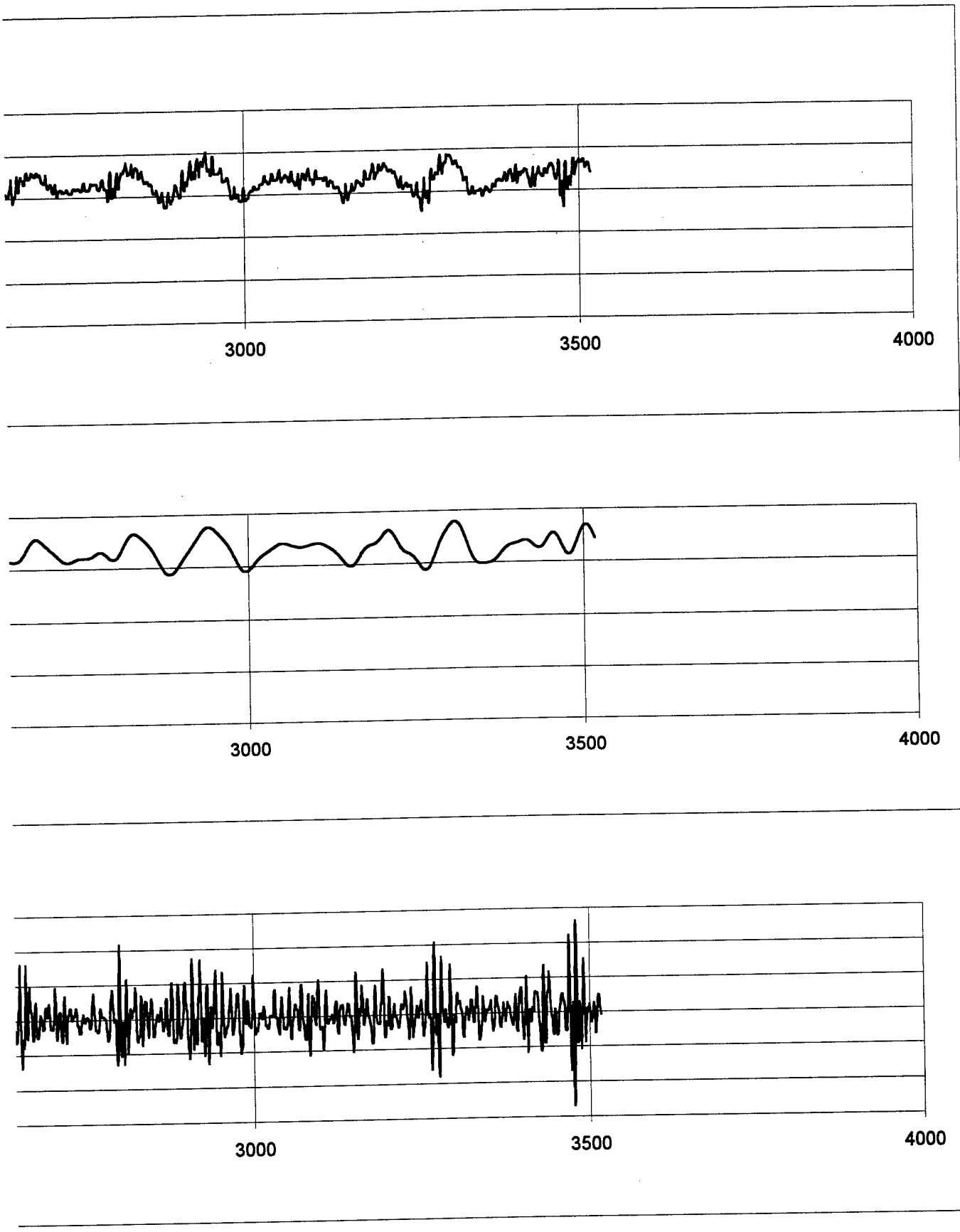
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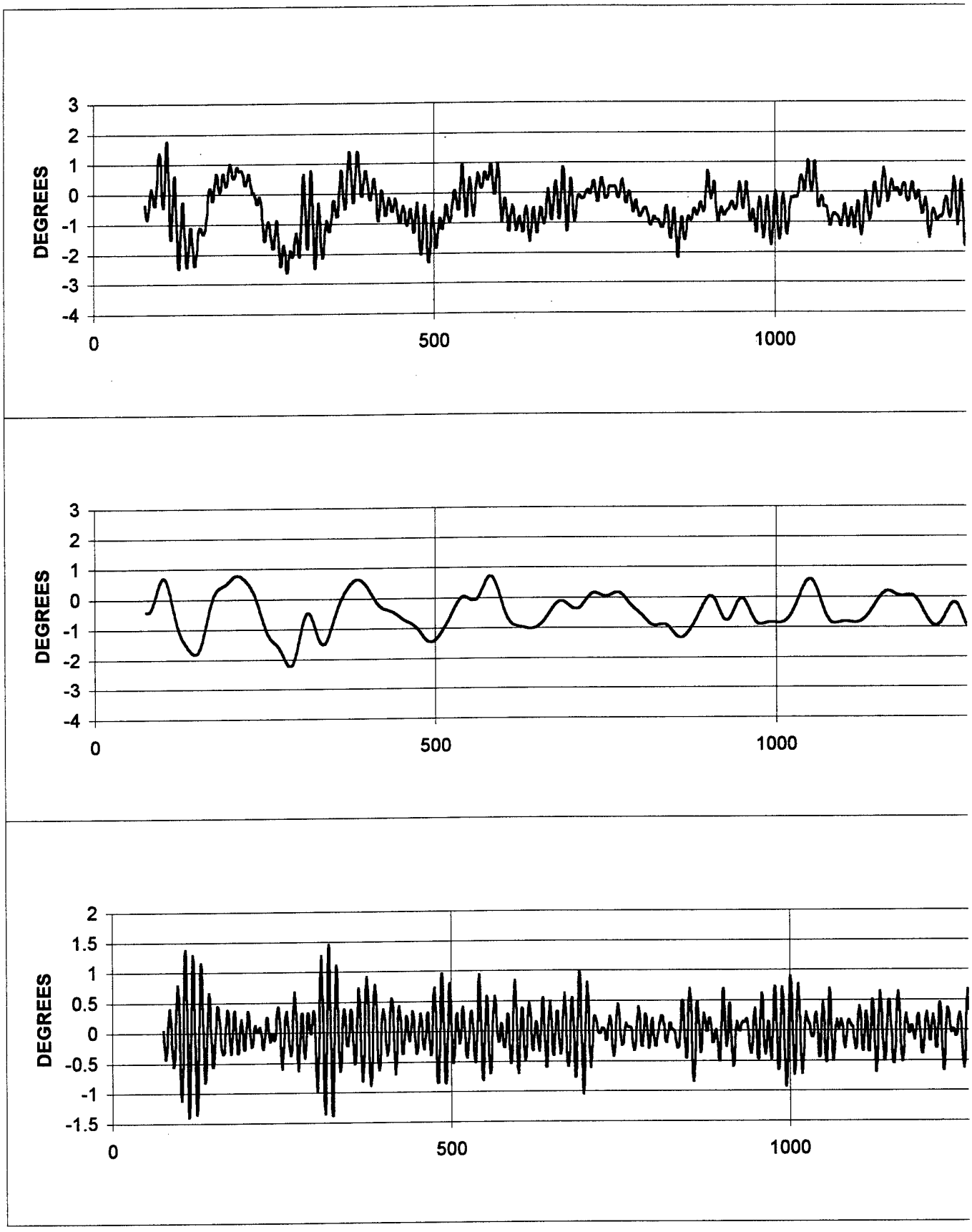
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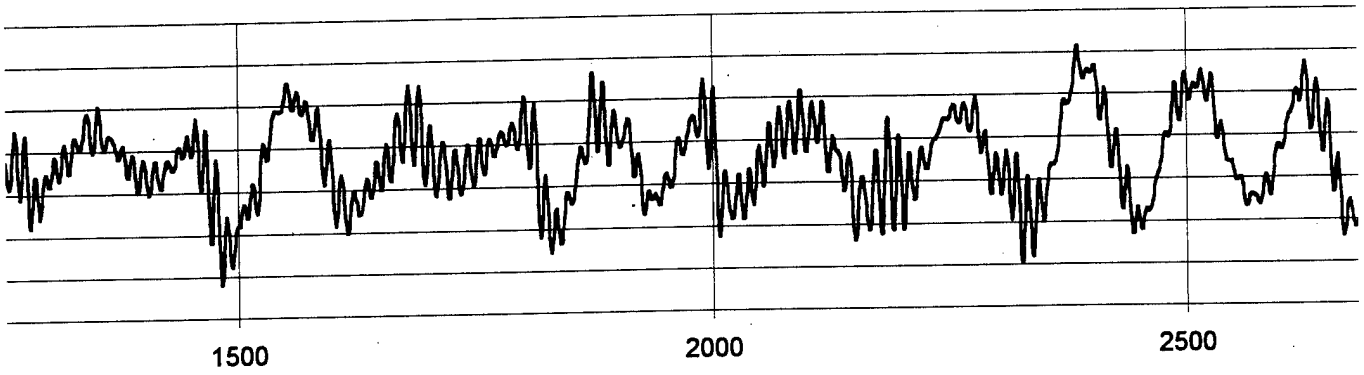
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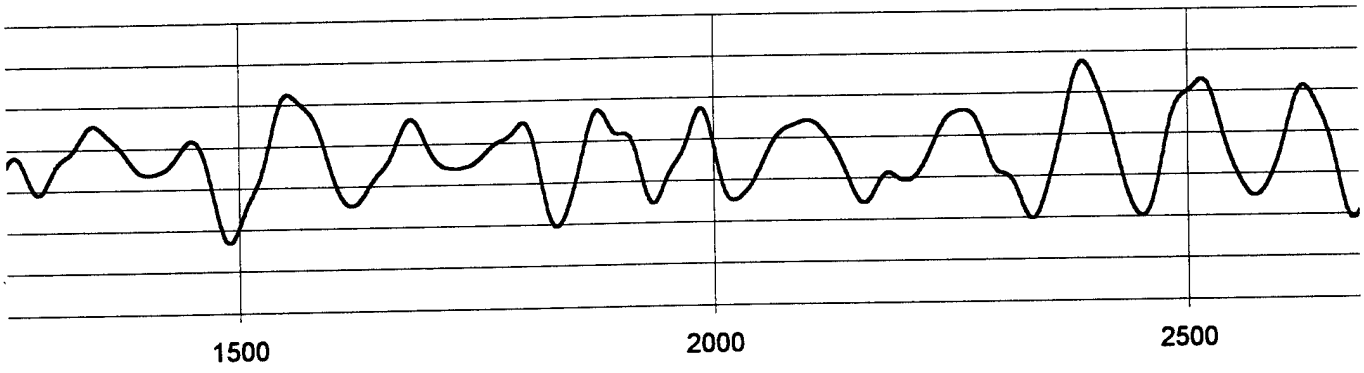
TEST A908 - PITCH



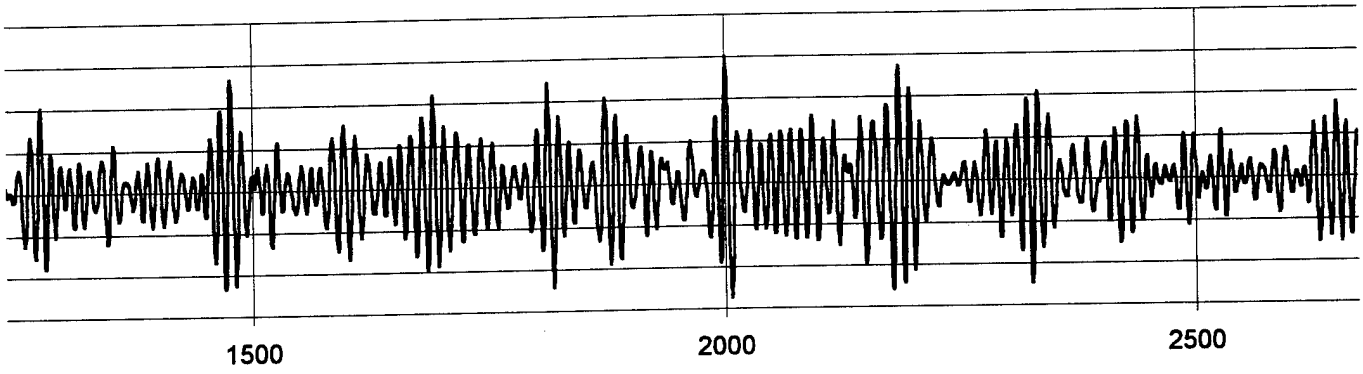
Unfiltered Time History



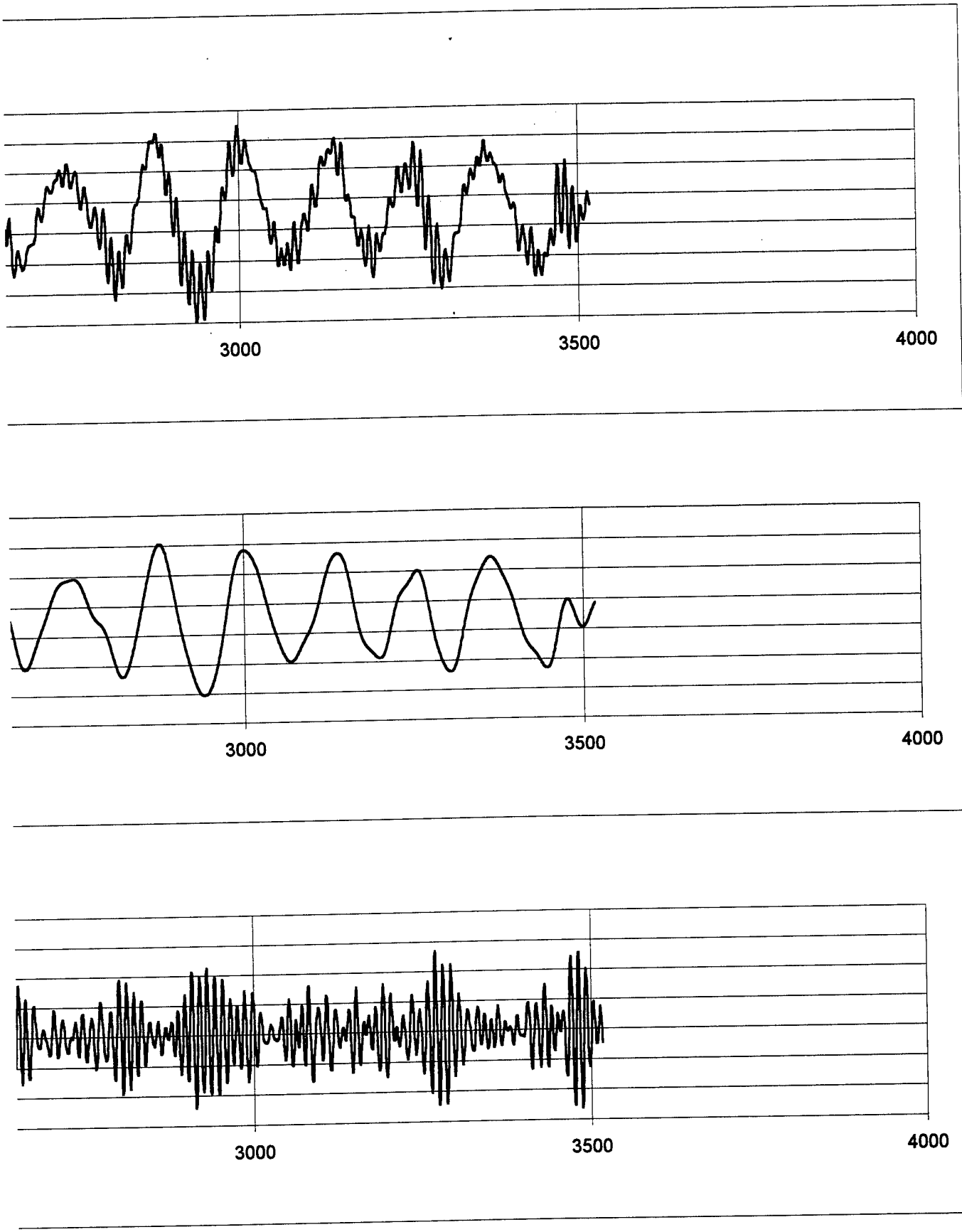
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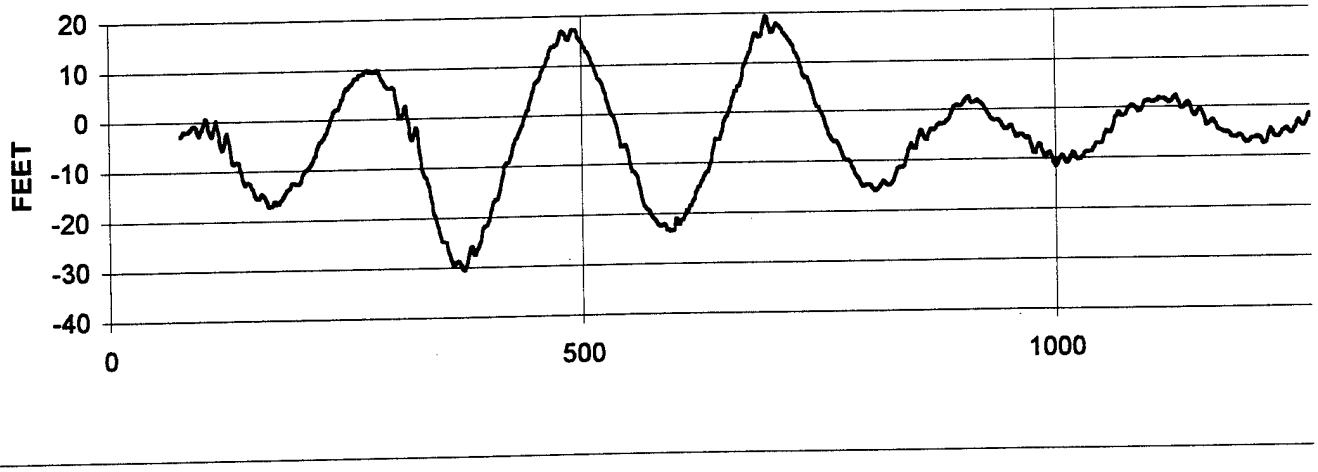
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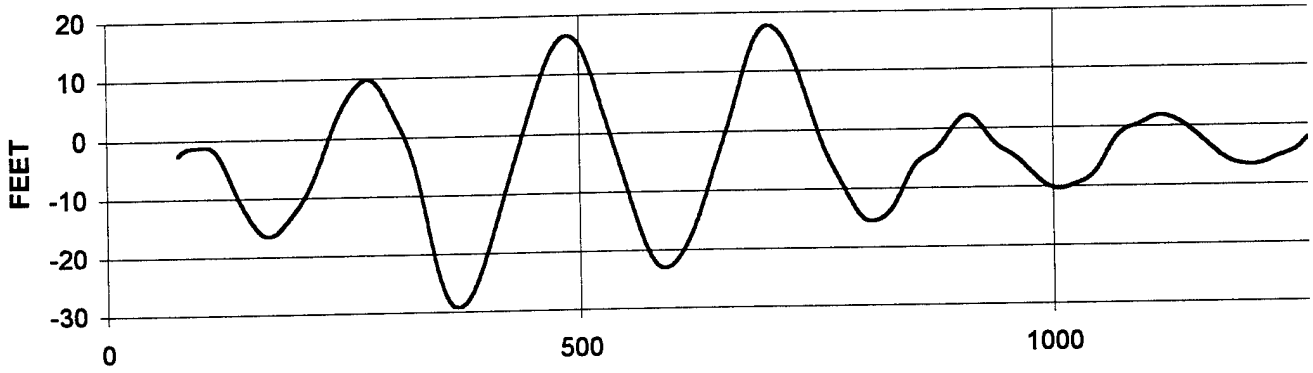


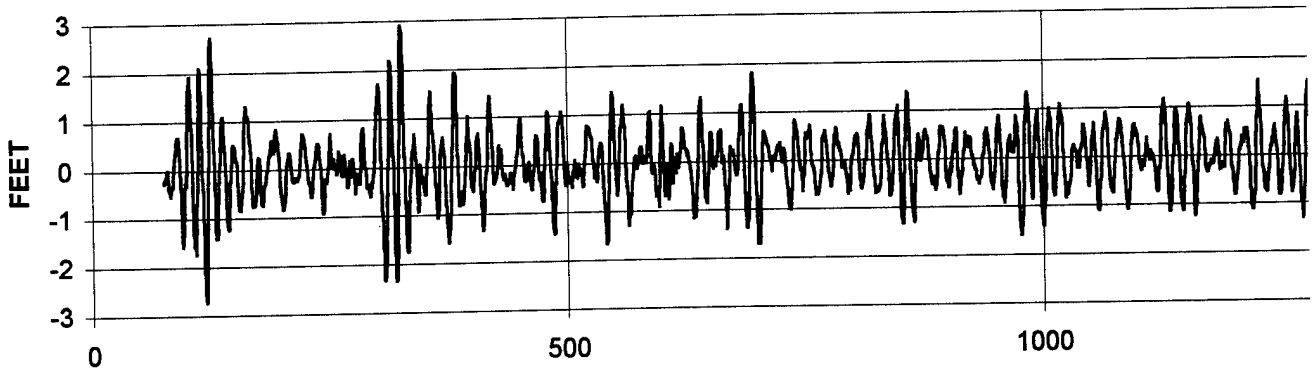
TEST A908 - PITCH



TEST A908 - PT SURGE

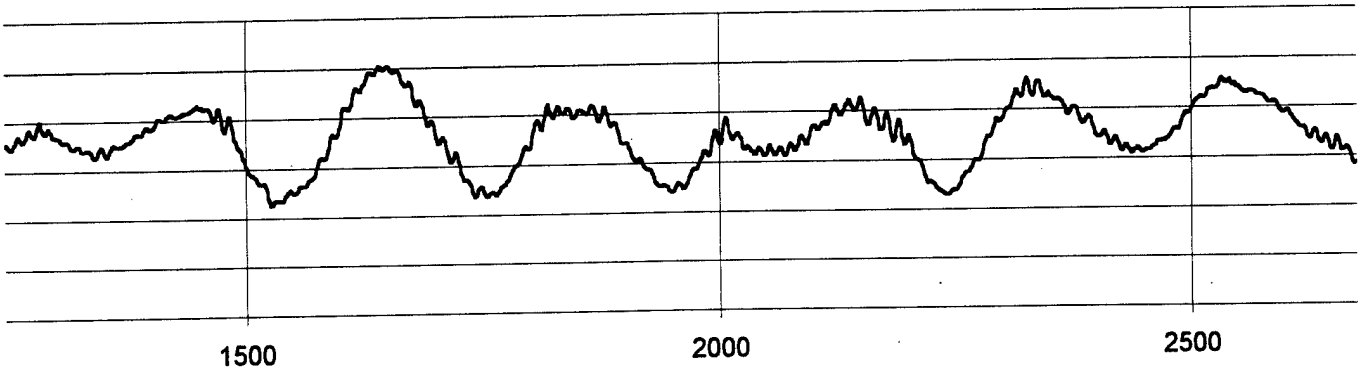




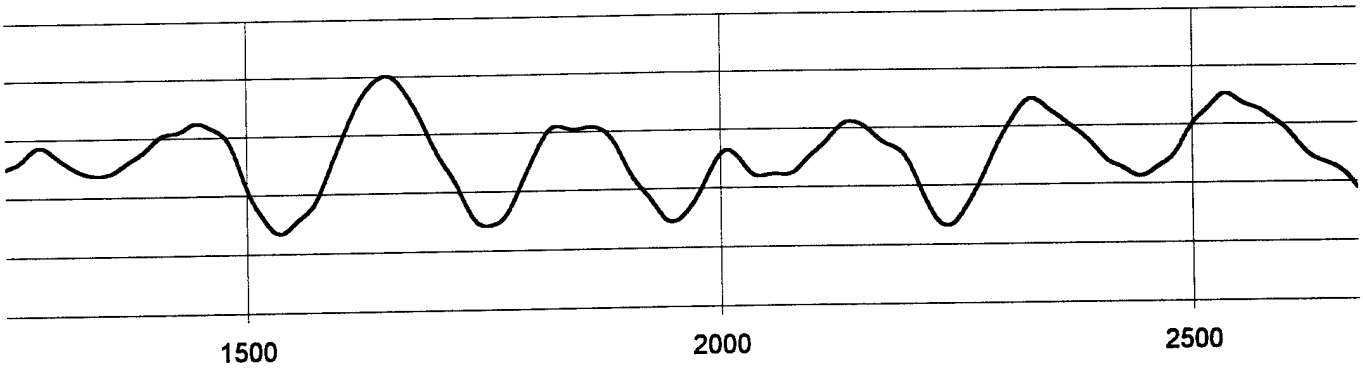


TEST A908 - PT SURGE

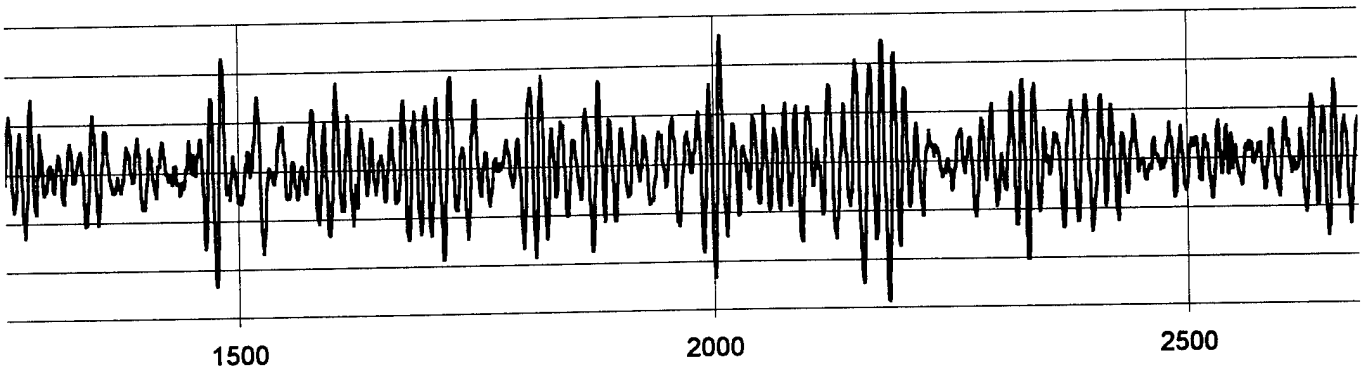
Unfiltered Time History



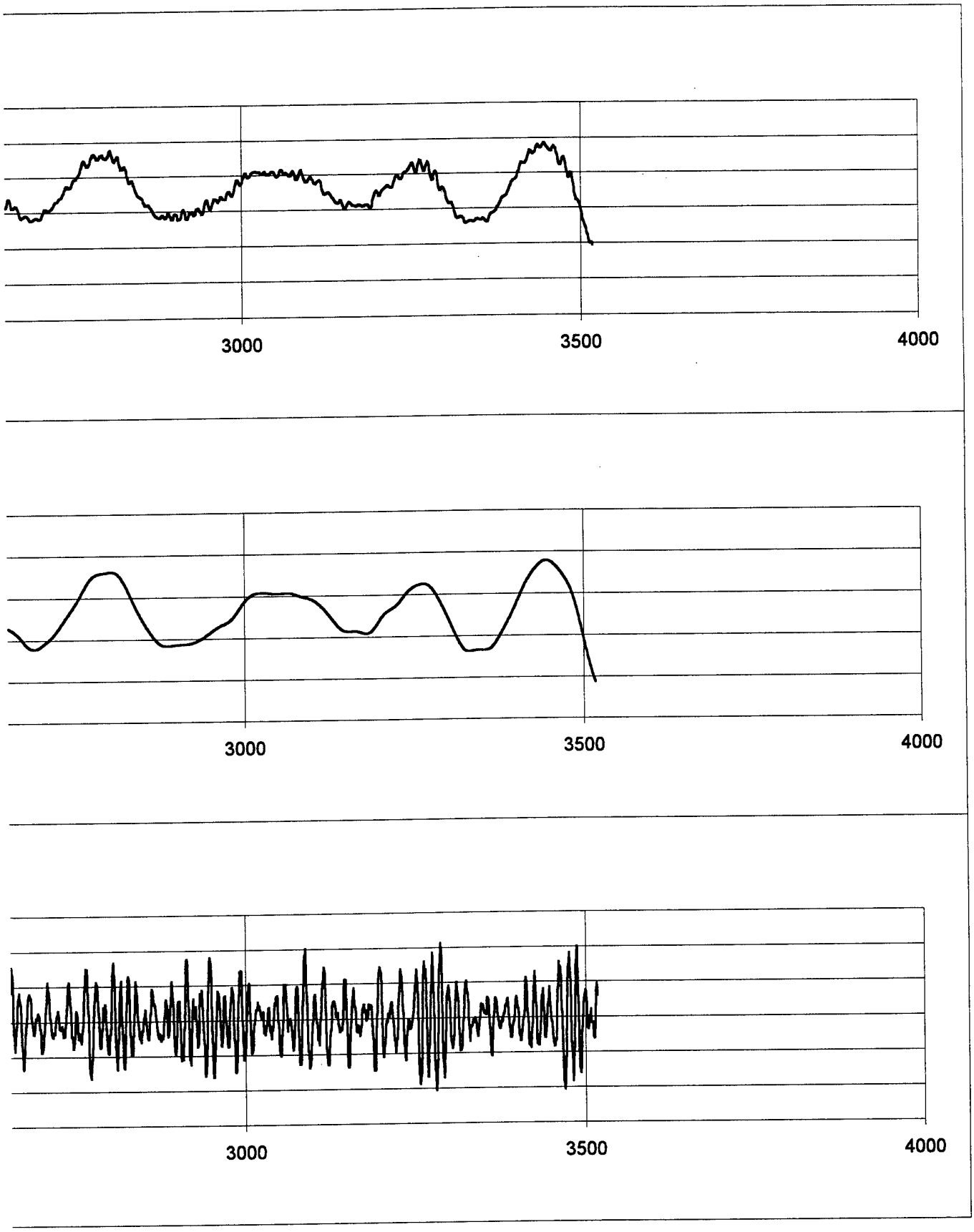
Filtered Low Frequency Time History



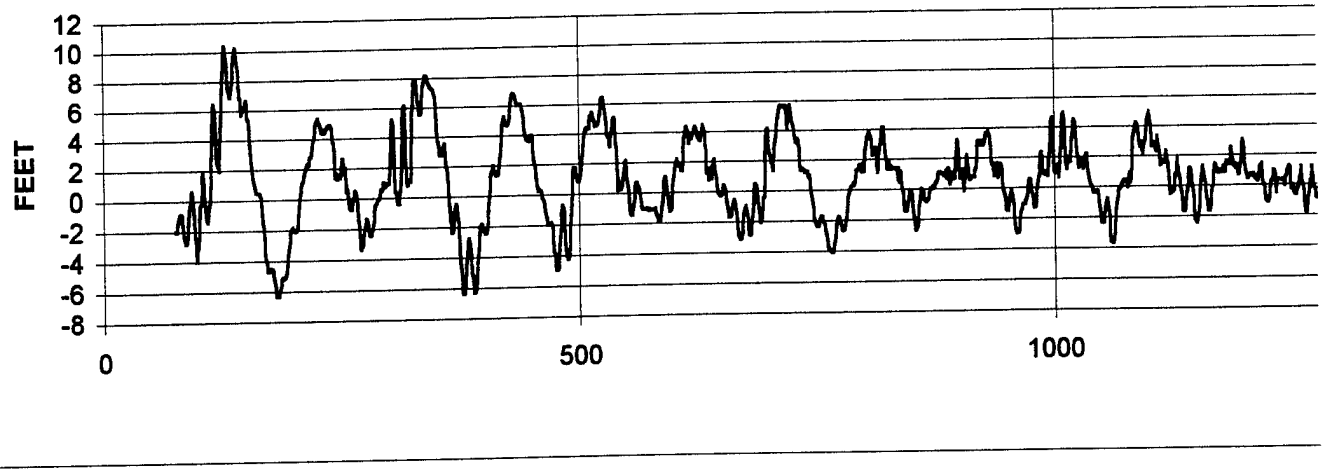
Filtered High Frequency Time History

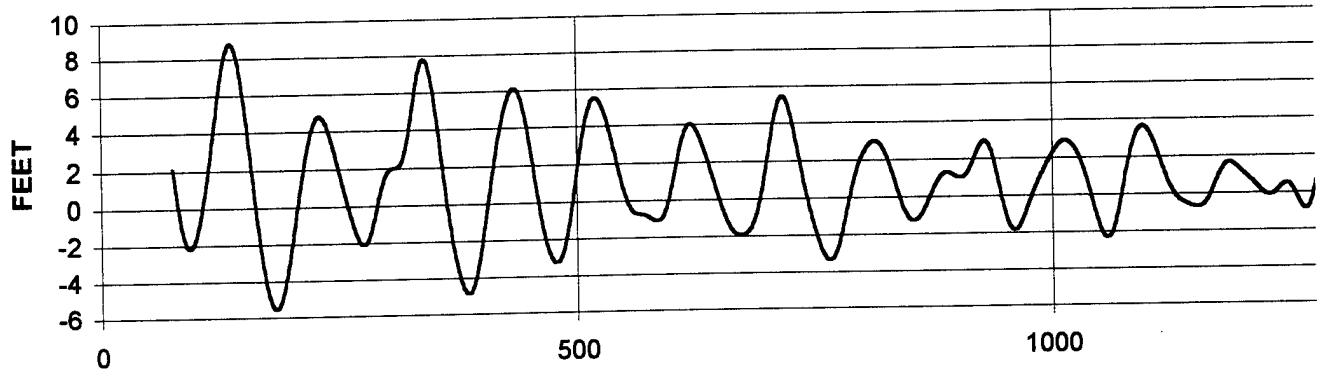


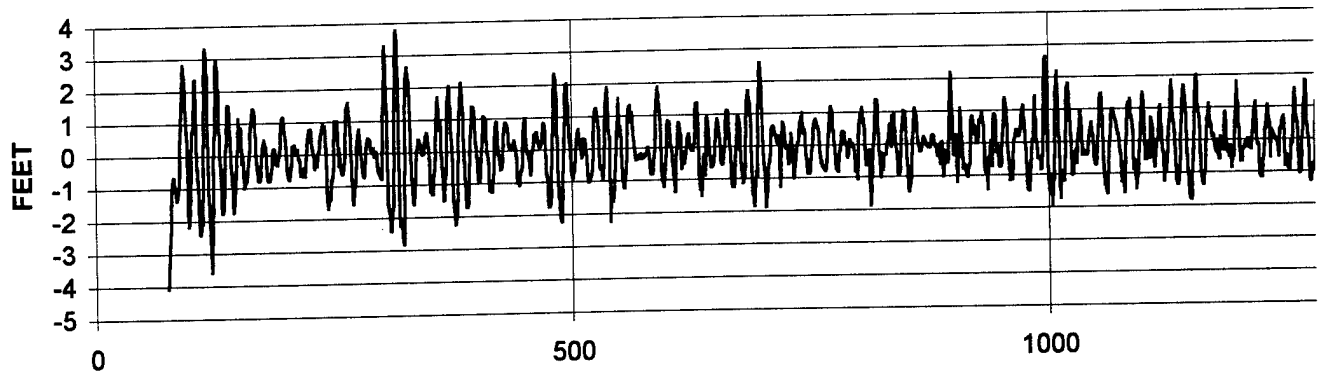
TEST A908 - PT SURGE



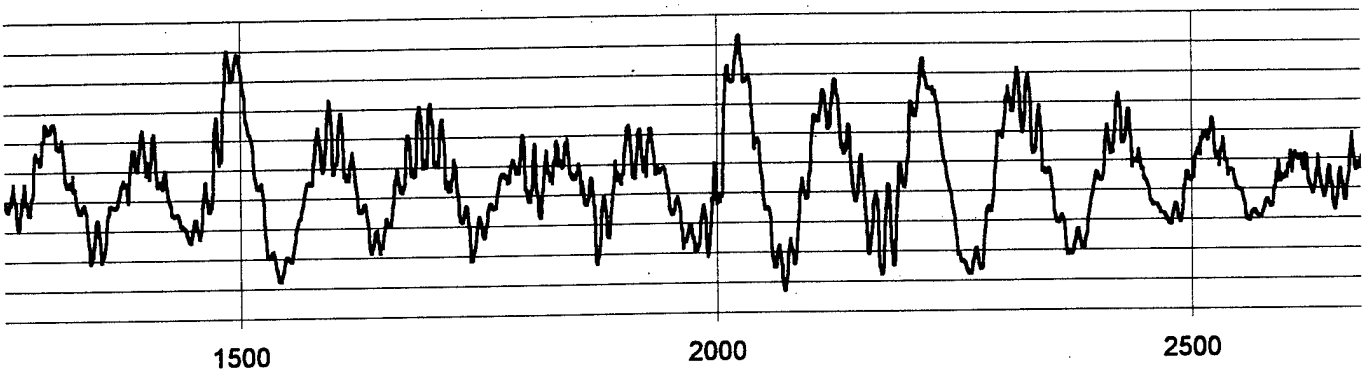
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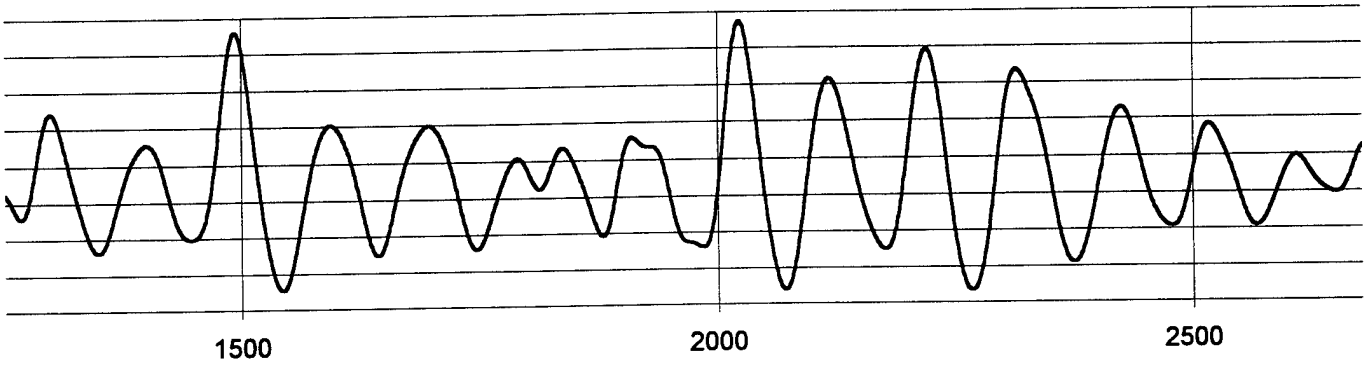




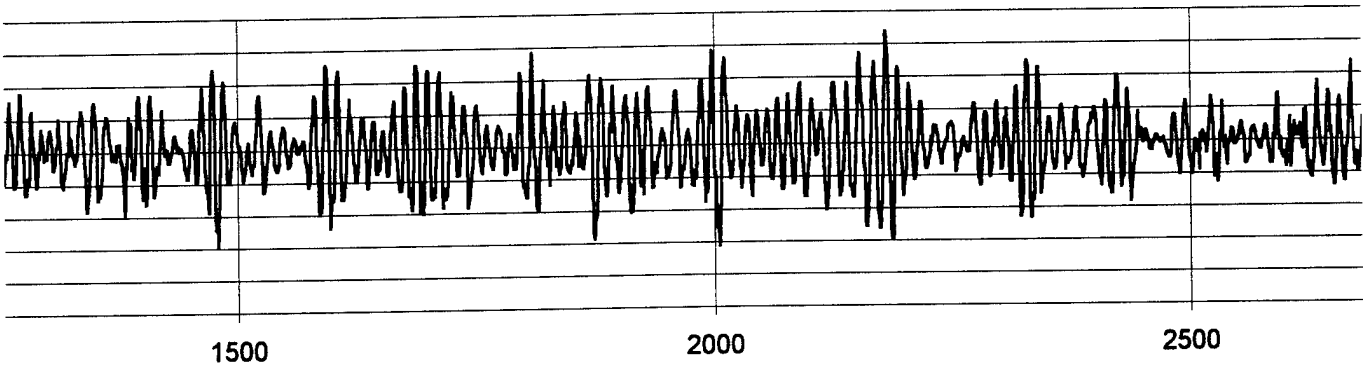
Unfiltered Time History



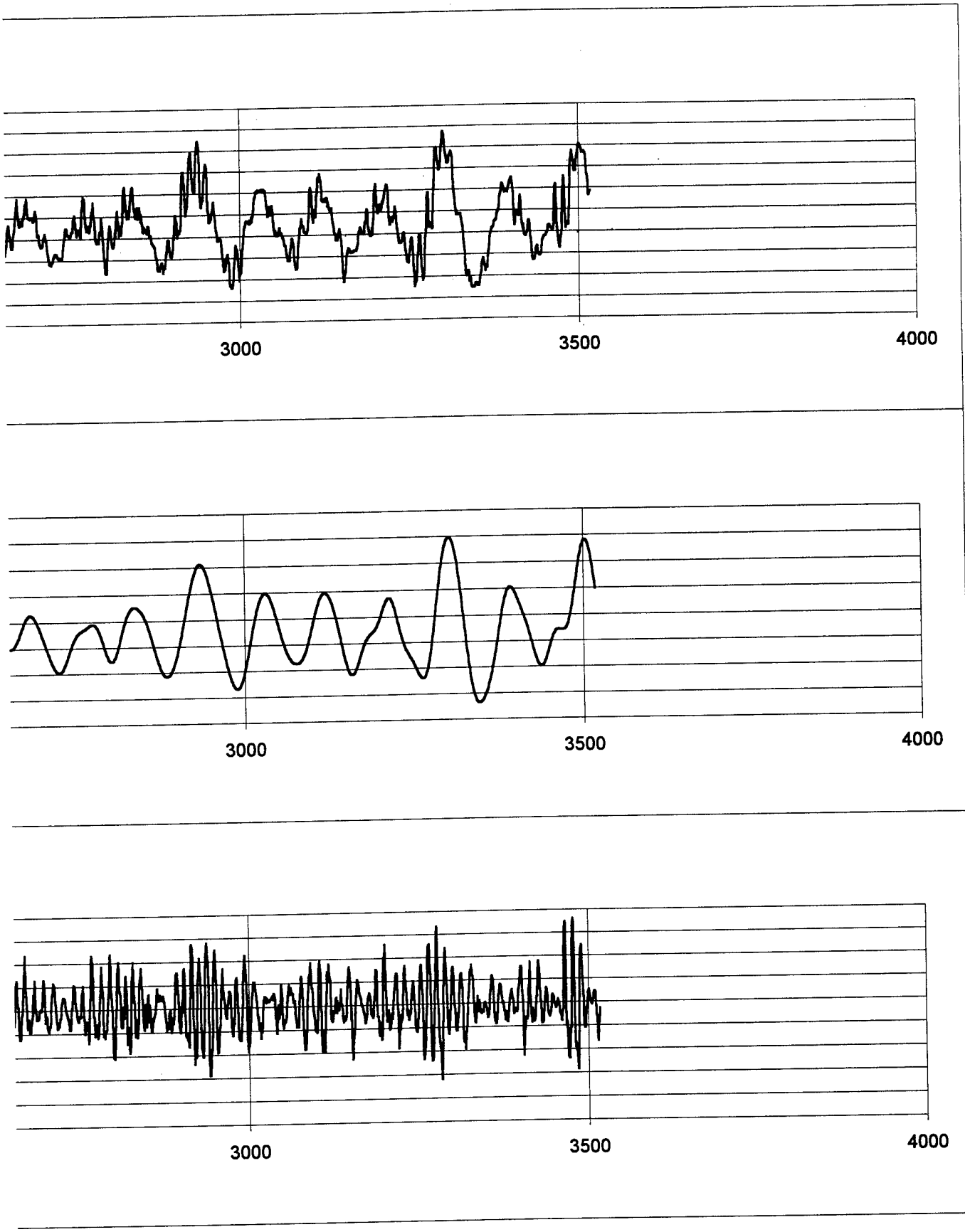
Filtered Low Frequency Time History



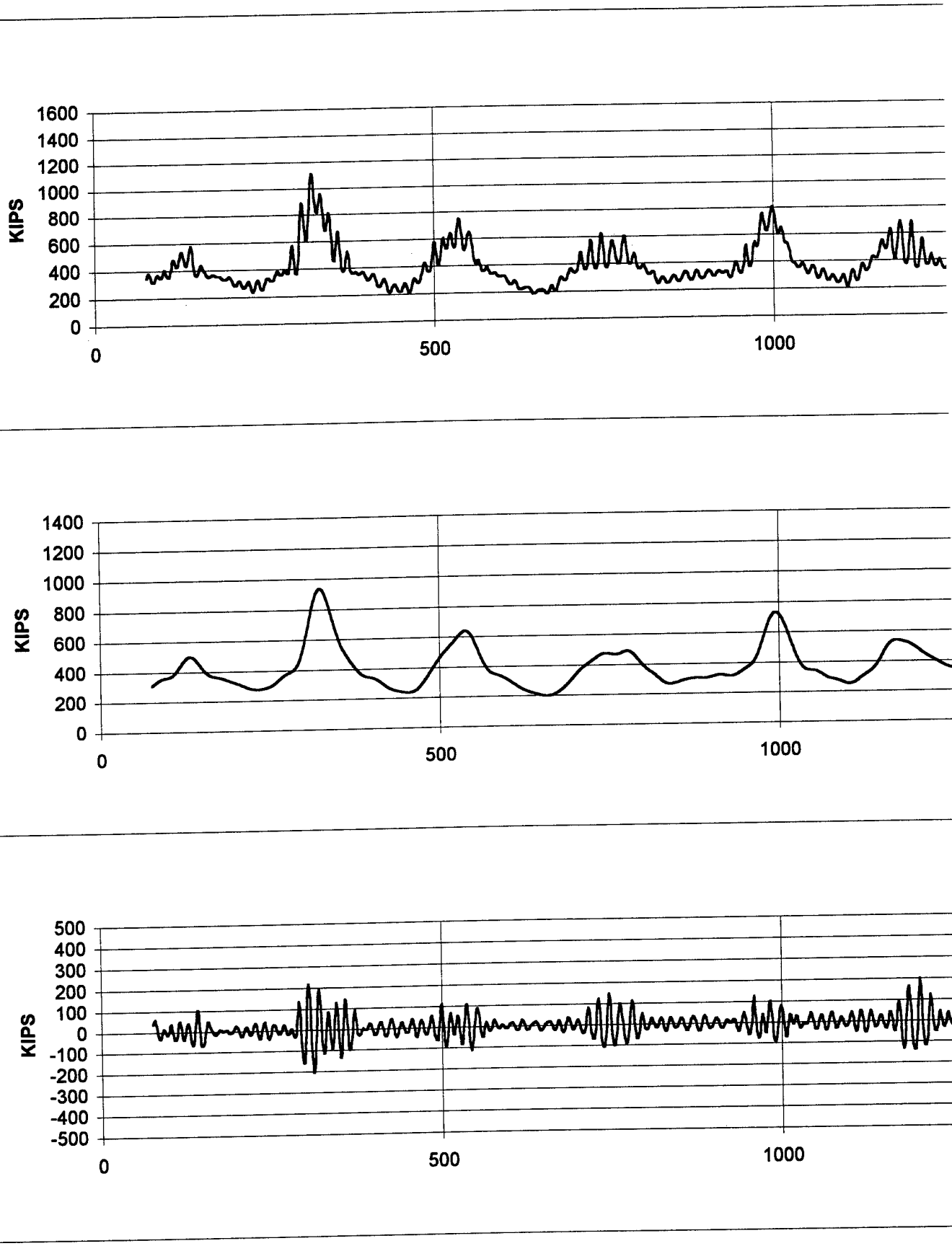
Filtered High Frequency Time History



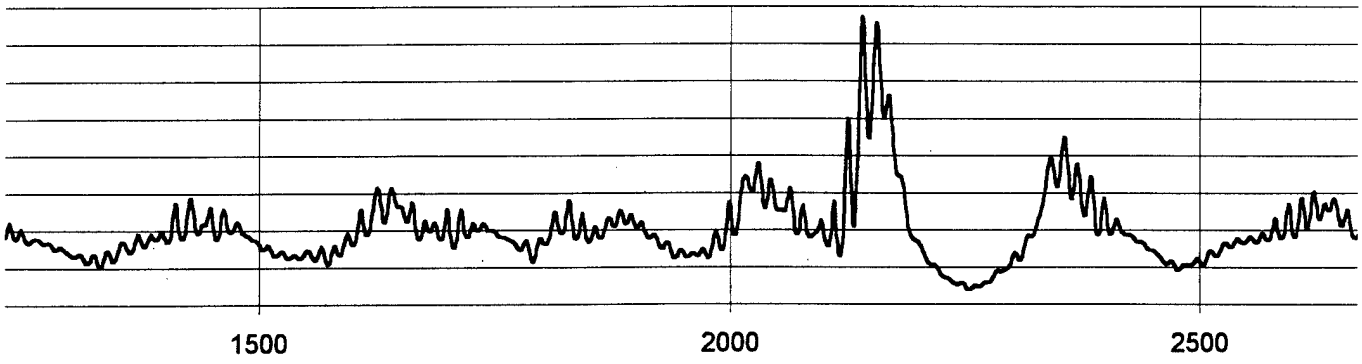
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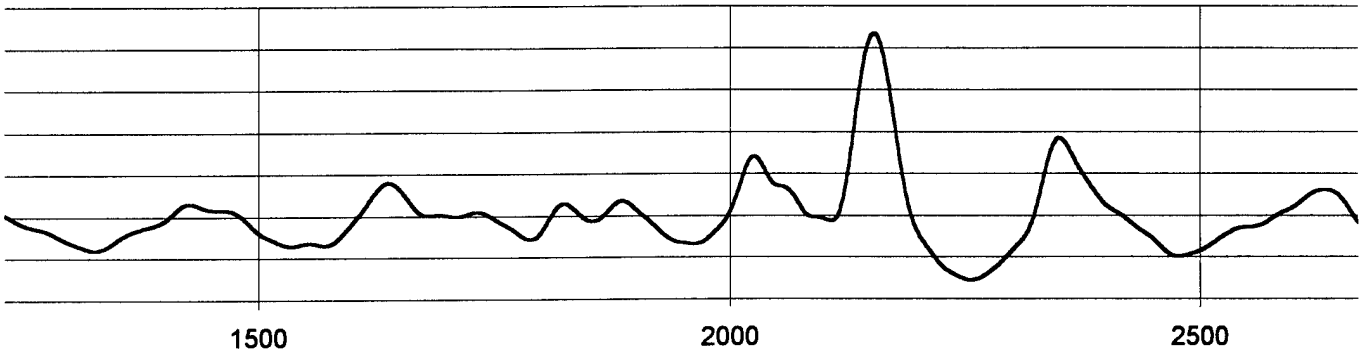
TEST A909 - ML_1 TENSION



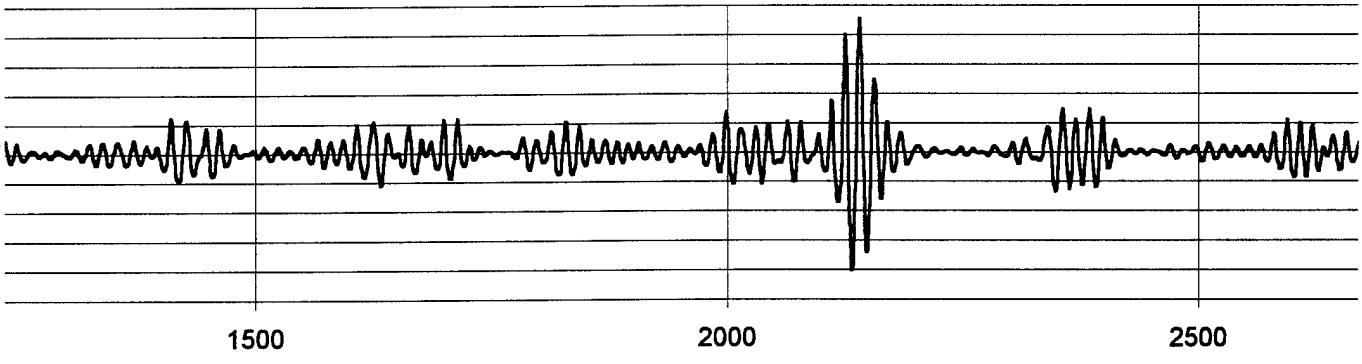
Unfiltered Time History



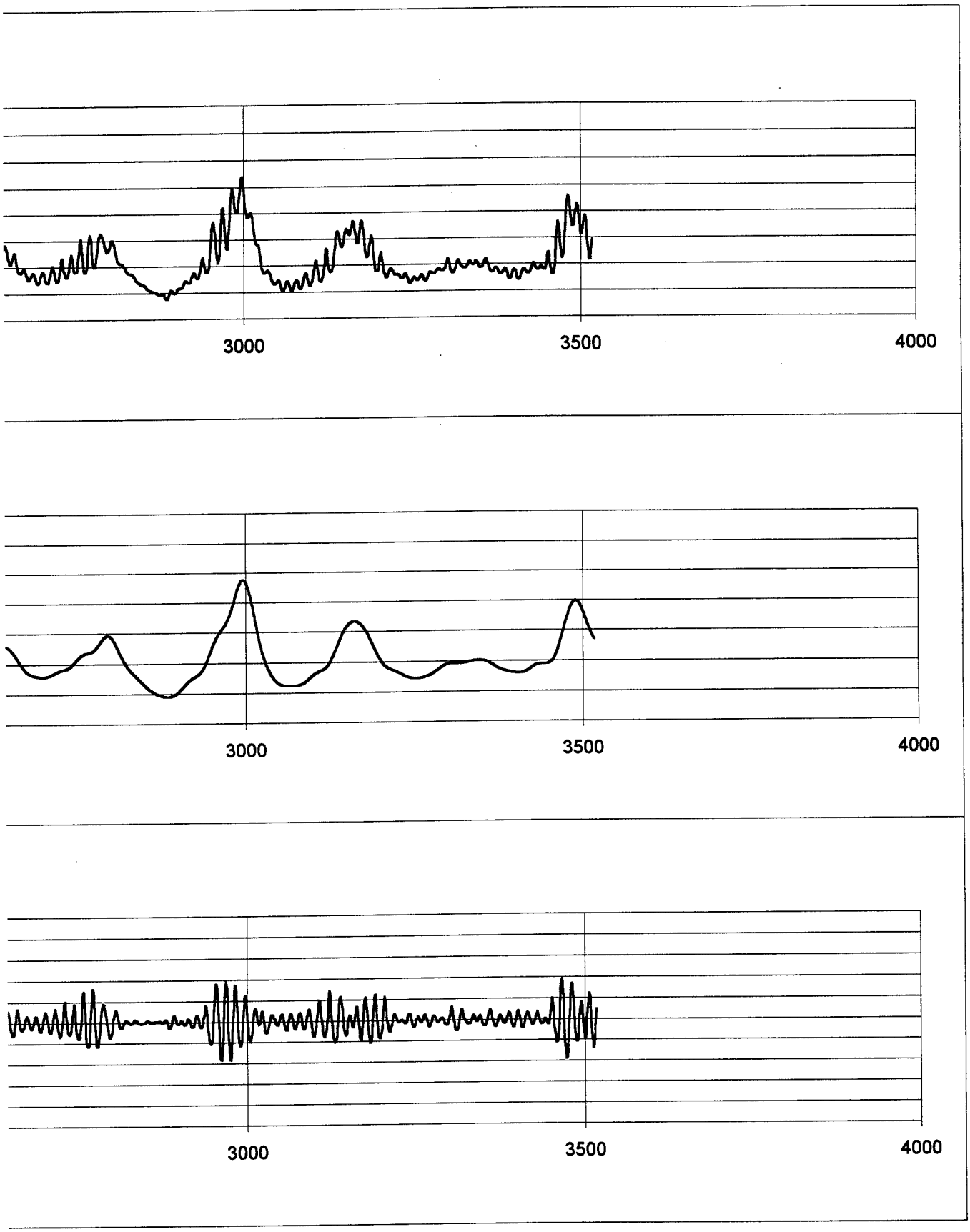
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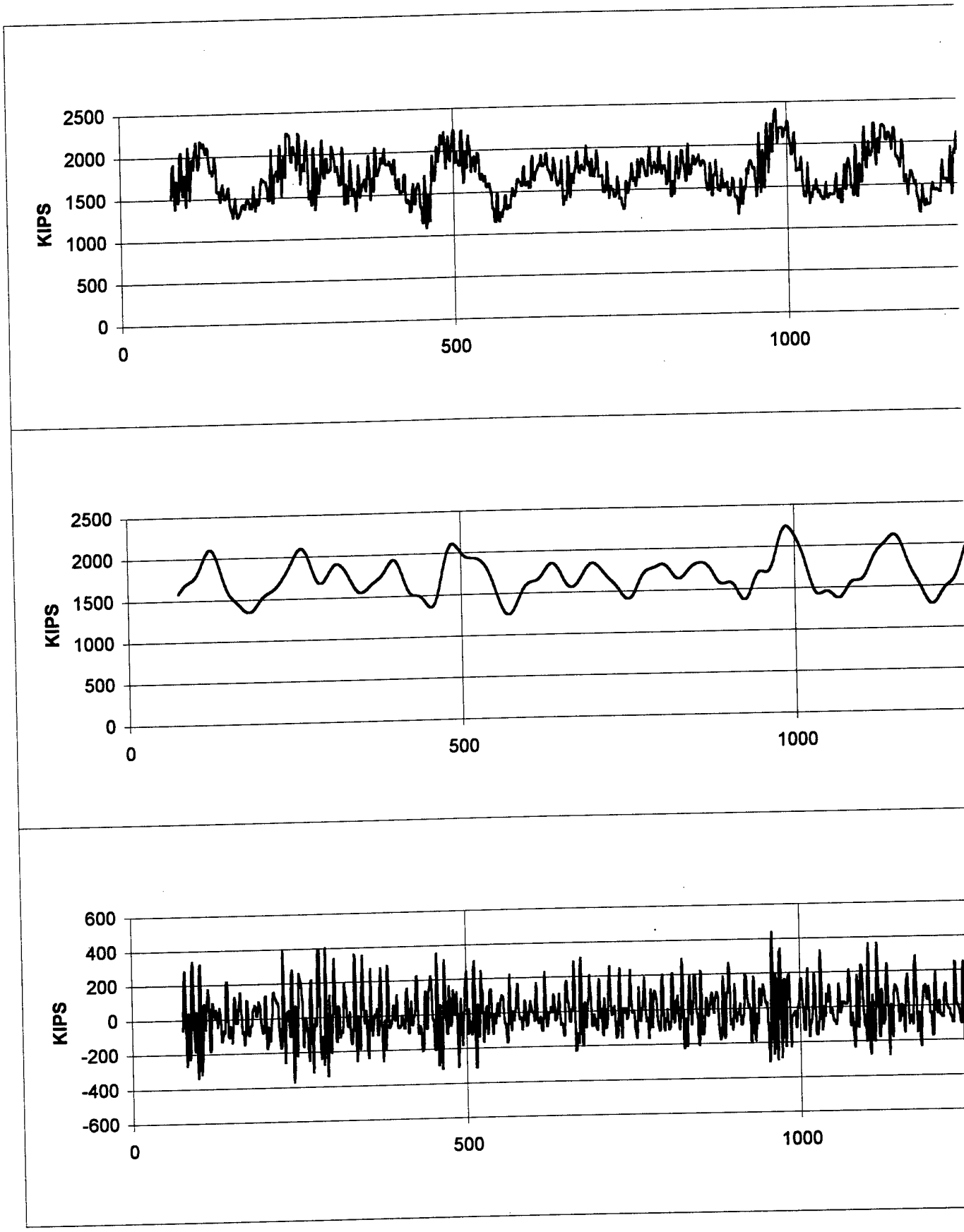
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TEST A909 - ML_1 TENSION

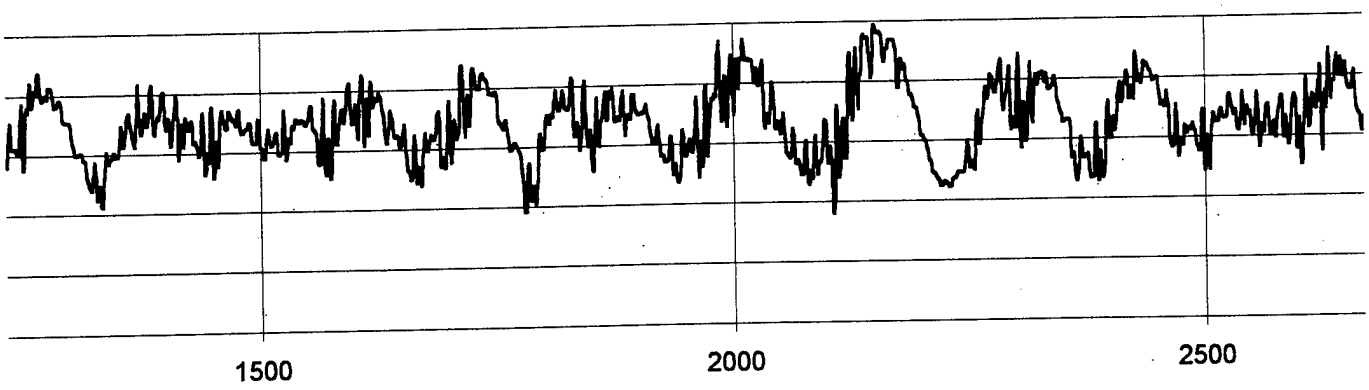


TEST A909 - BUOY 1 TENSION

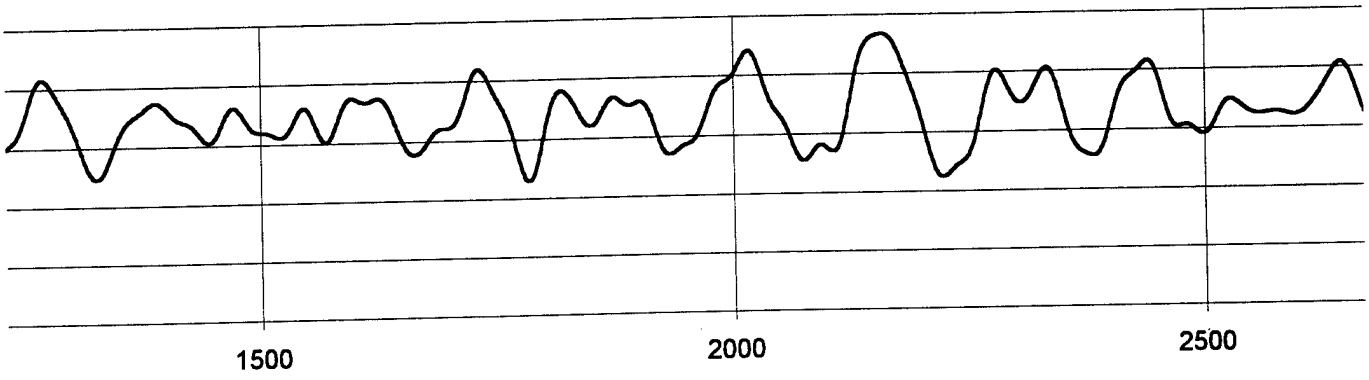


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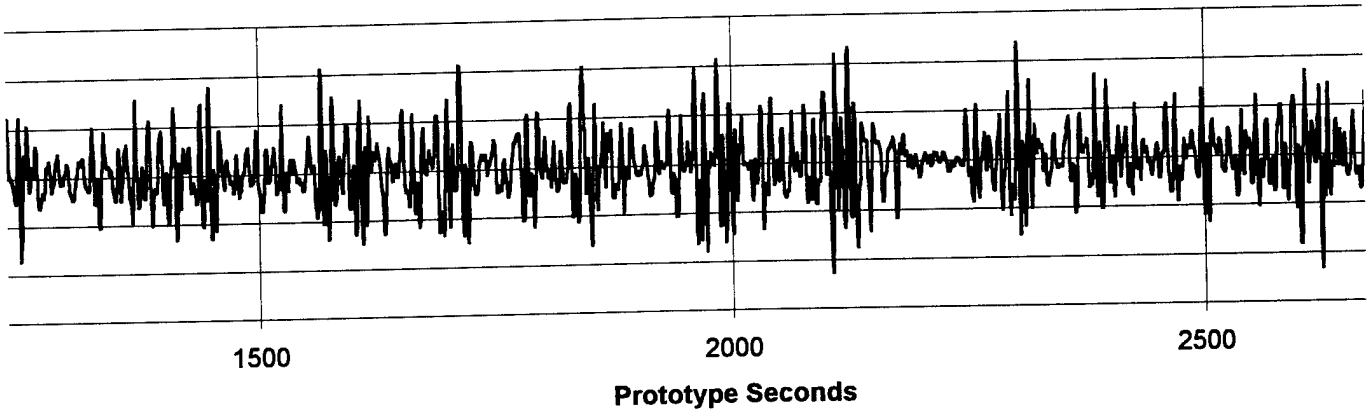
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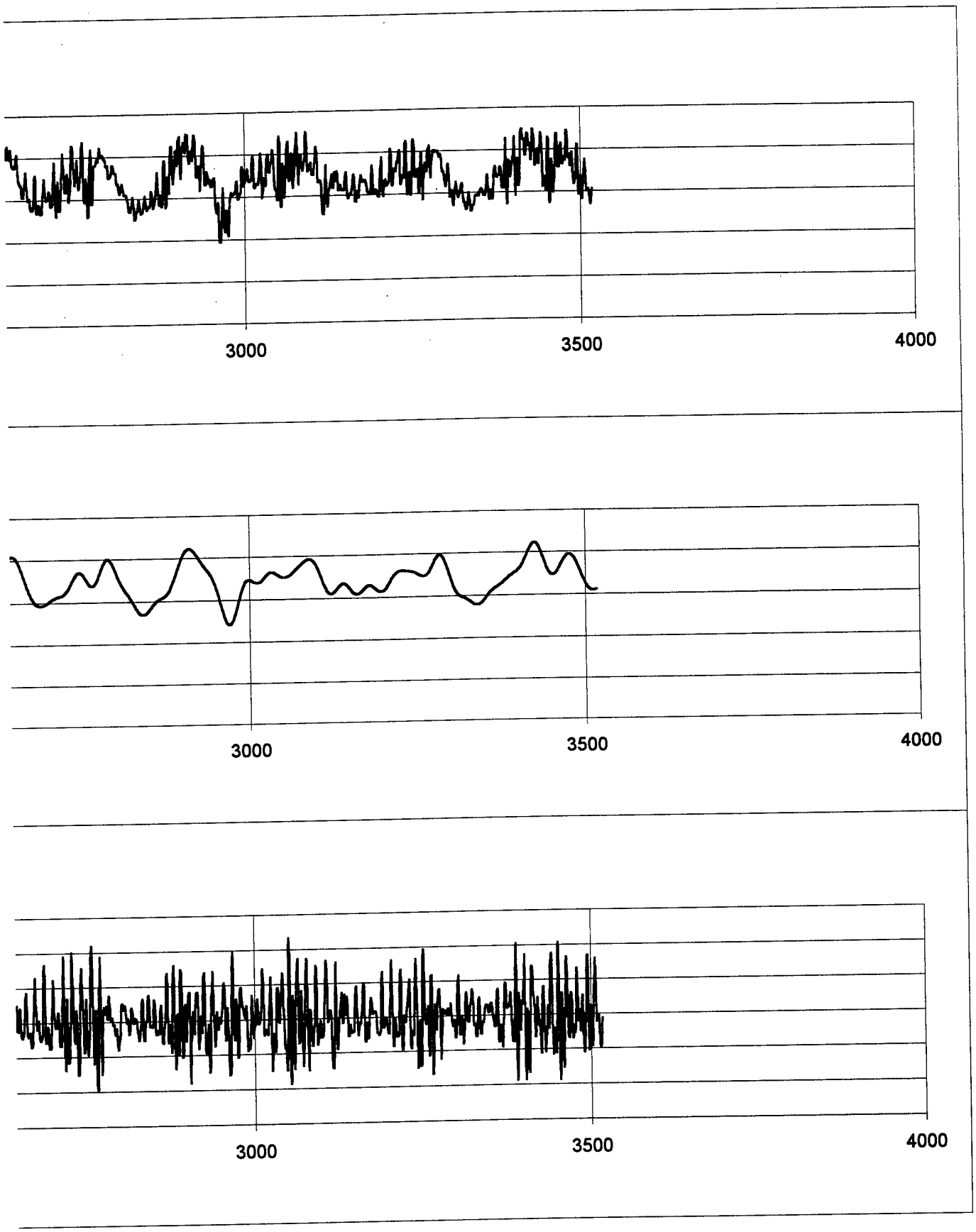
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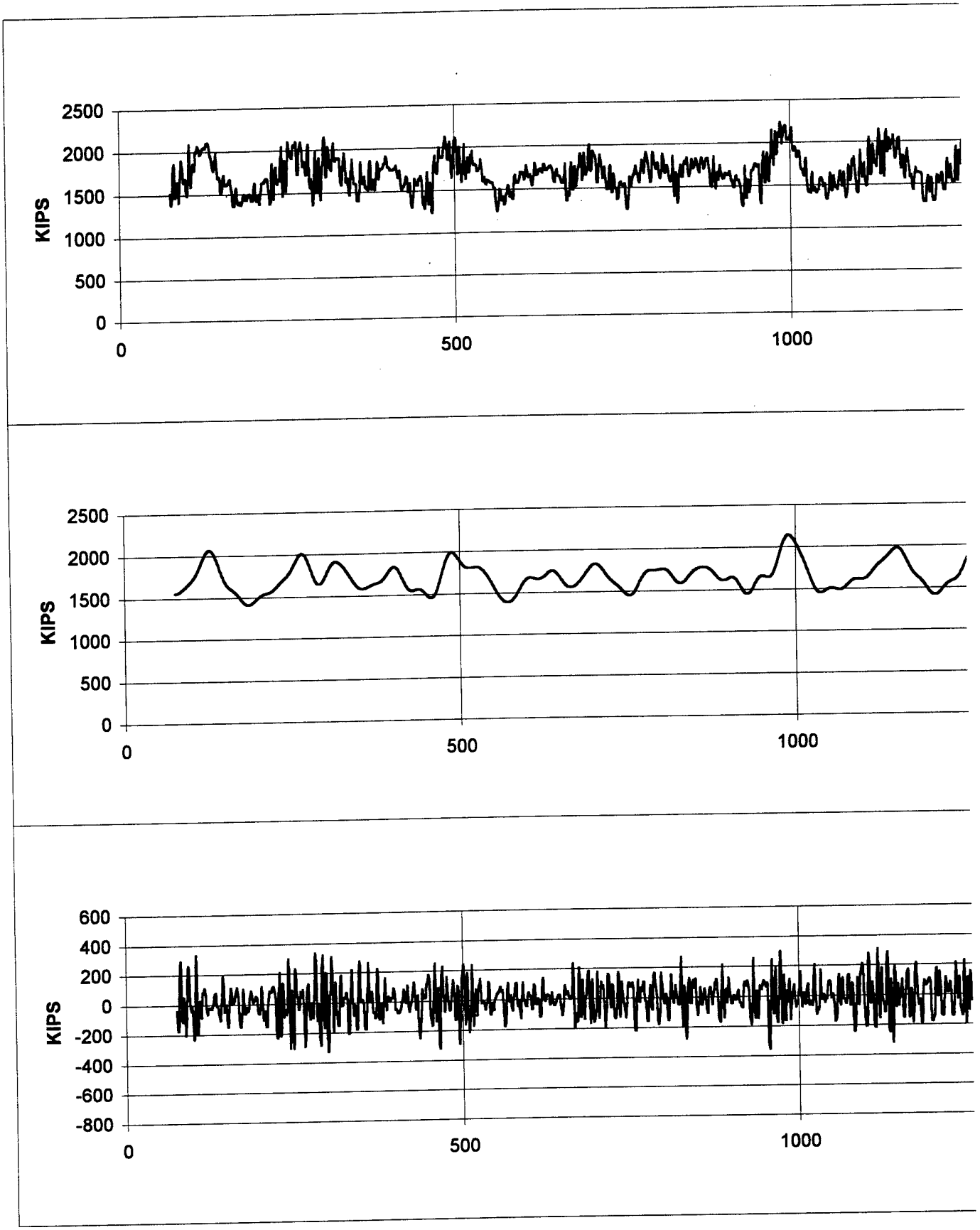
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TEST A909 - BUOY 1 TENSION

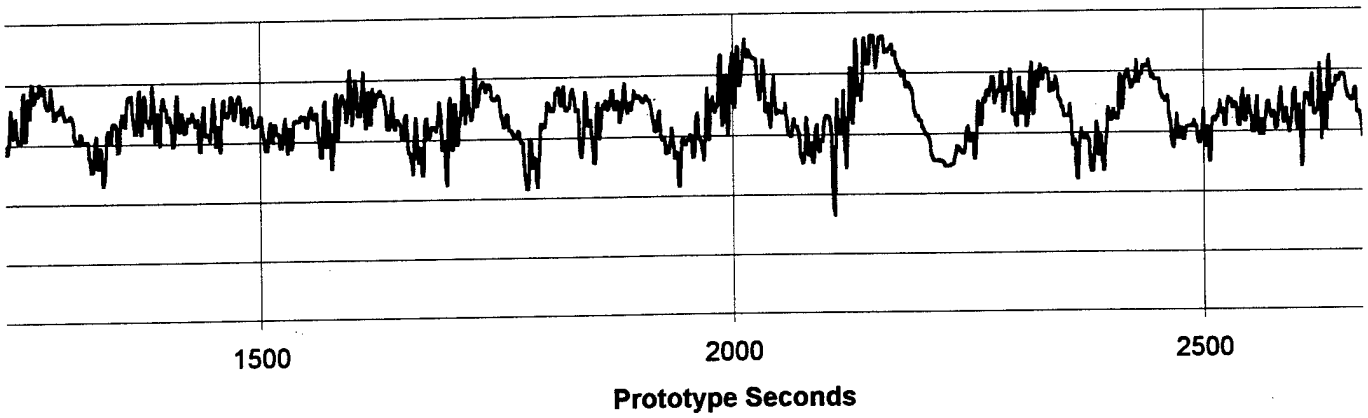


TEST A909 - BUOY 2 TENSION

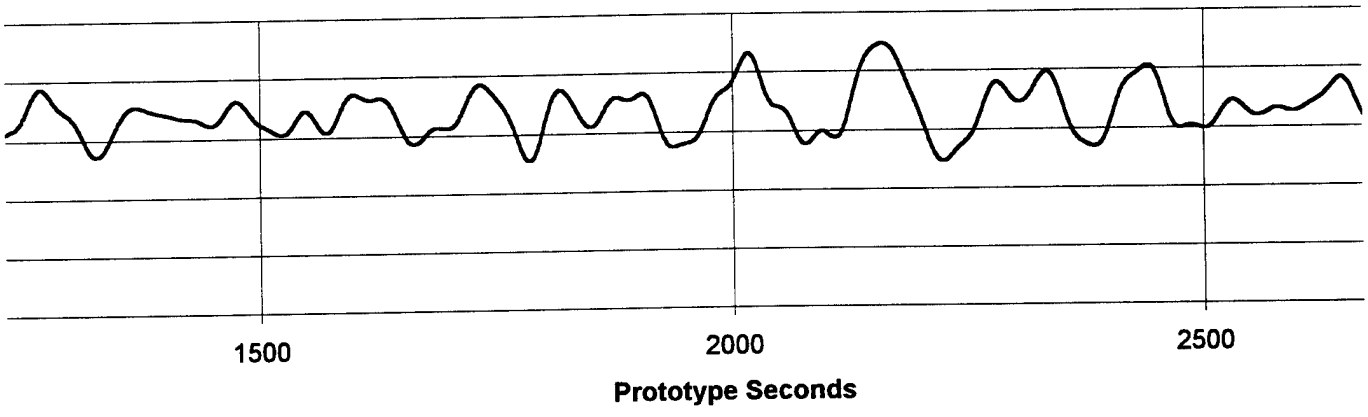


TEST A909 - BUOY 2 TENSION

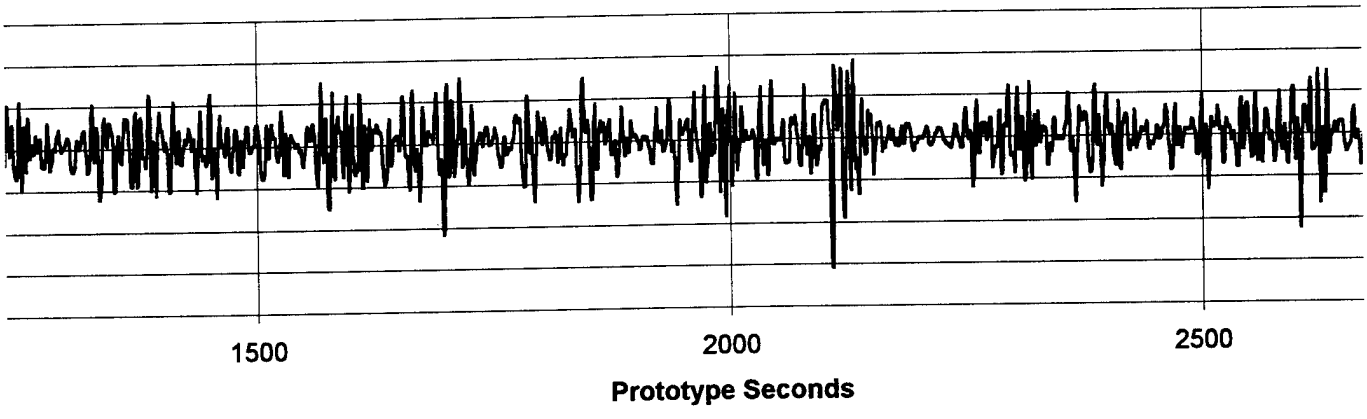
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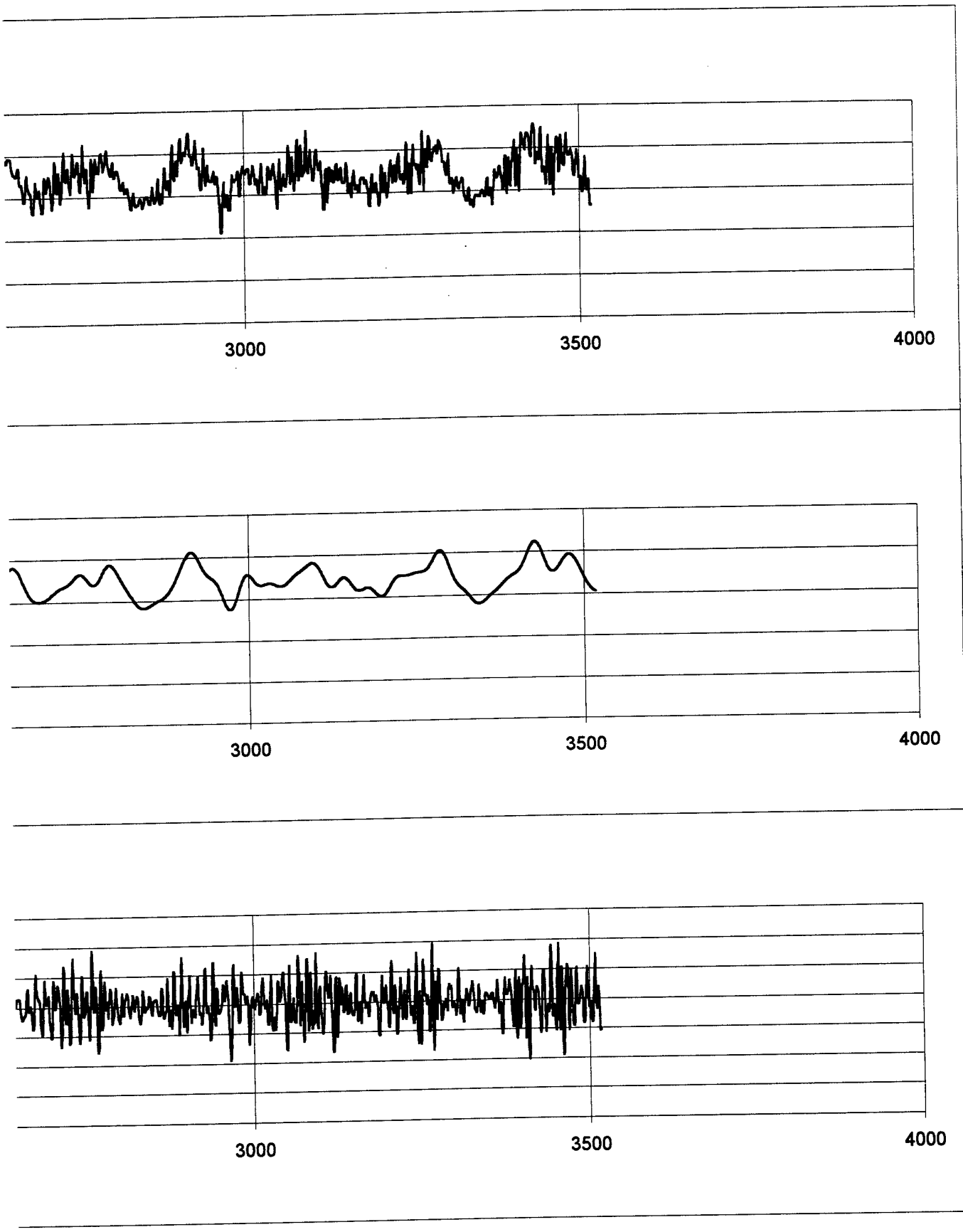
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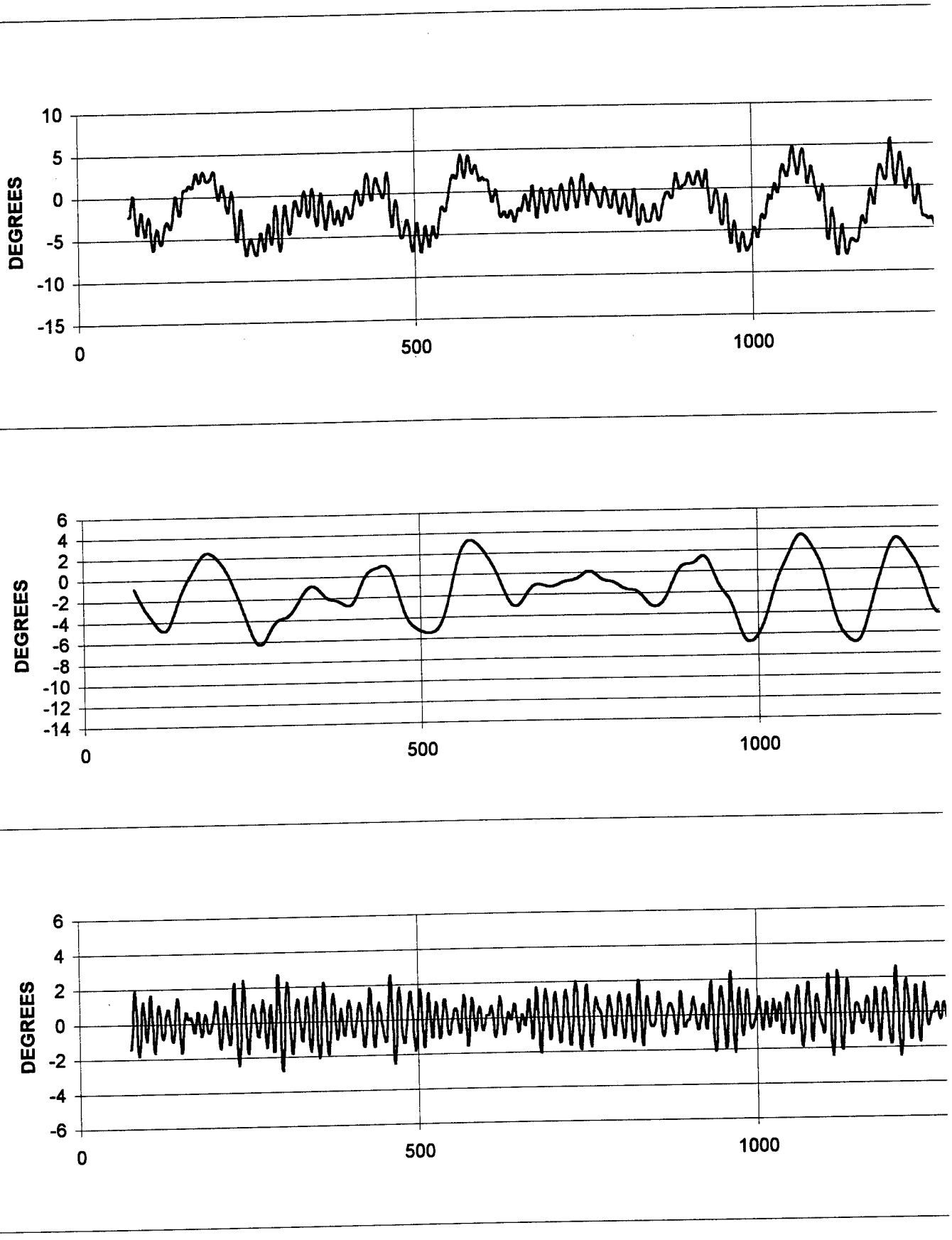
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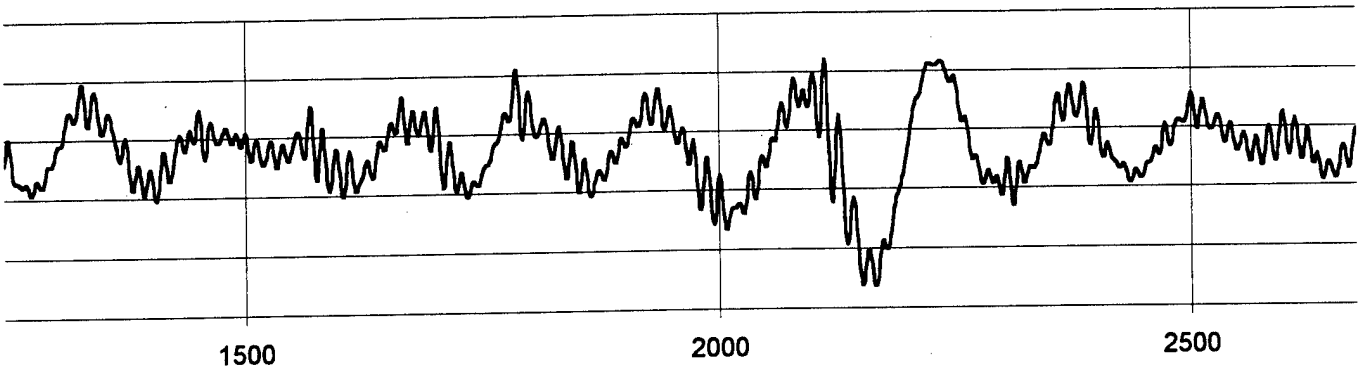
TEST A909 - BUOY 2 TENSION



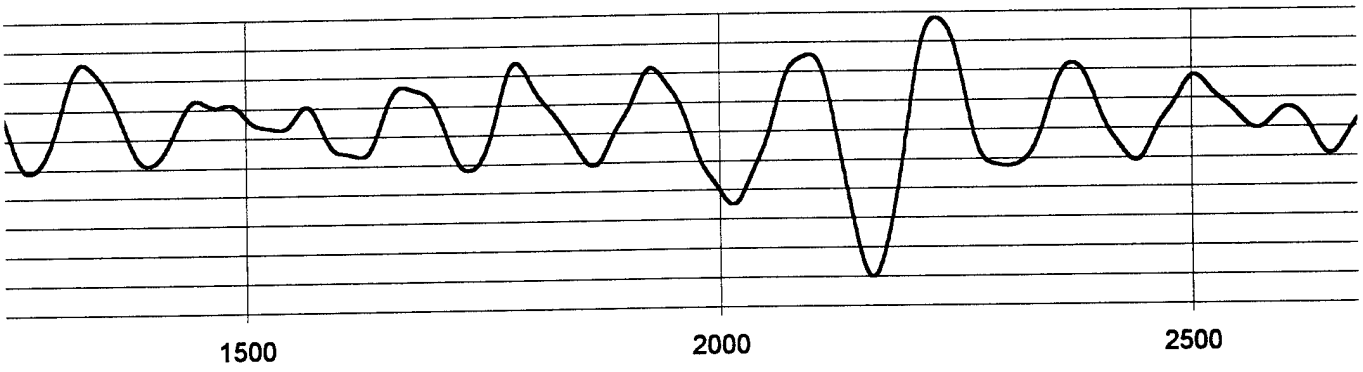
TEST A909 - PITCH



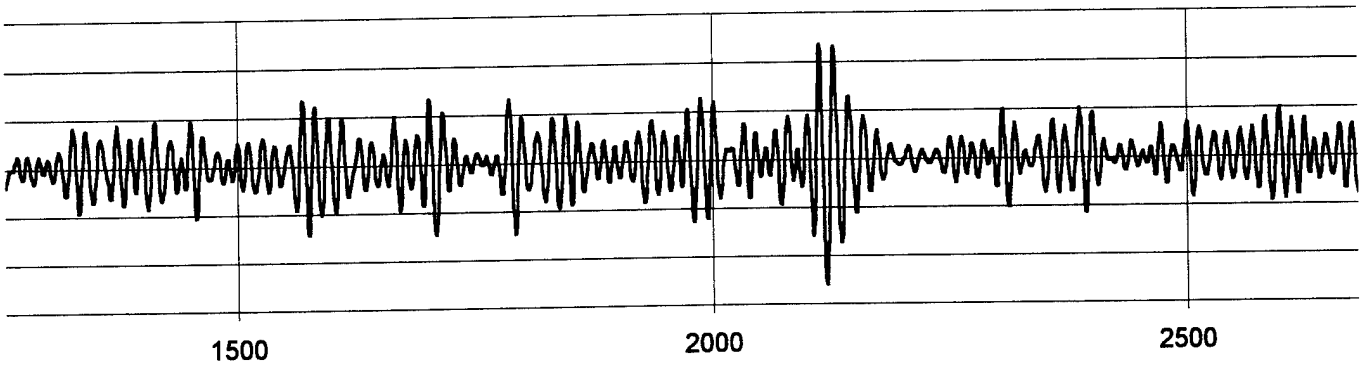
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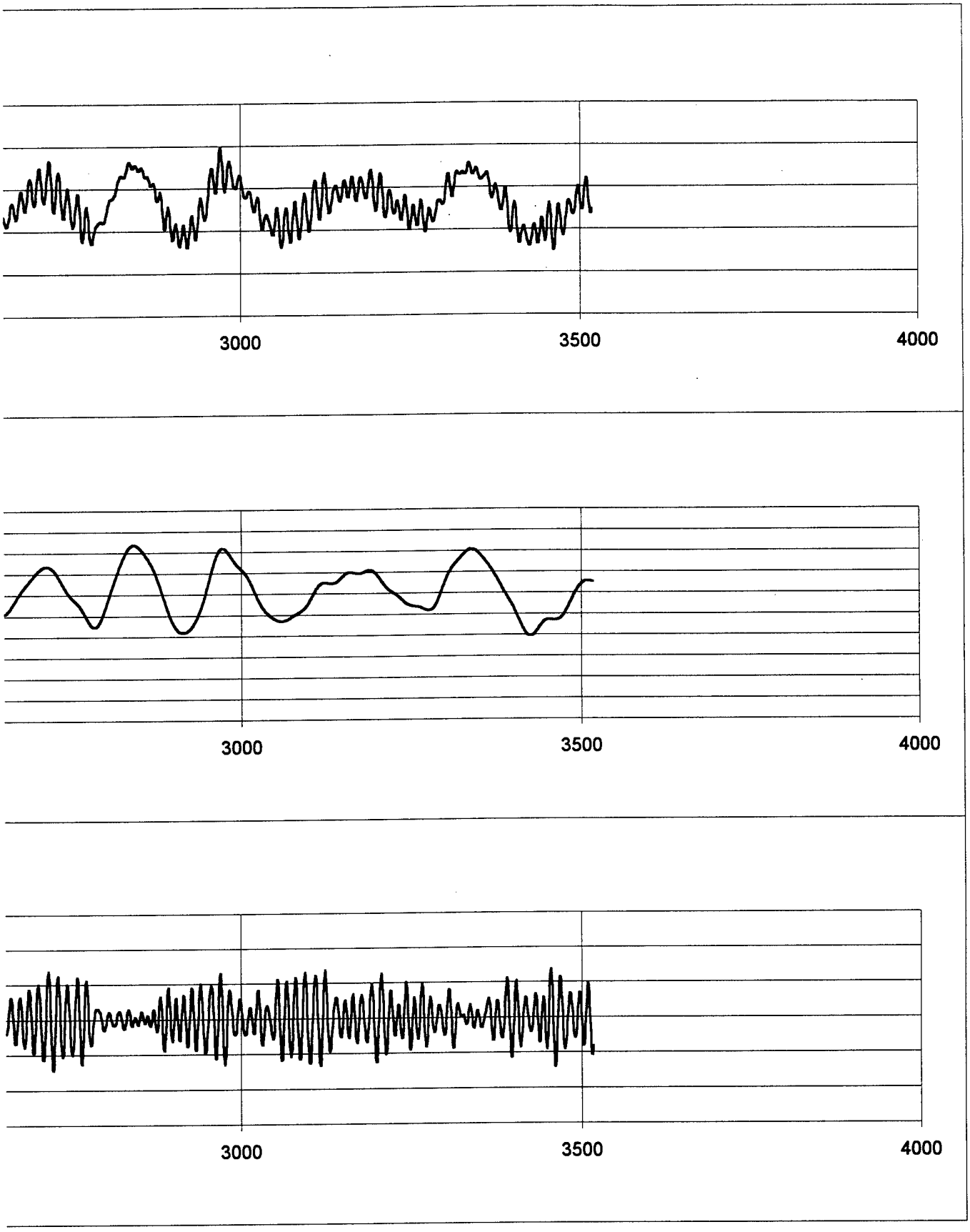
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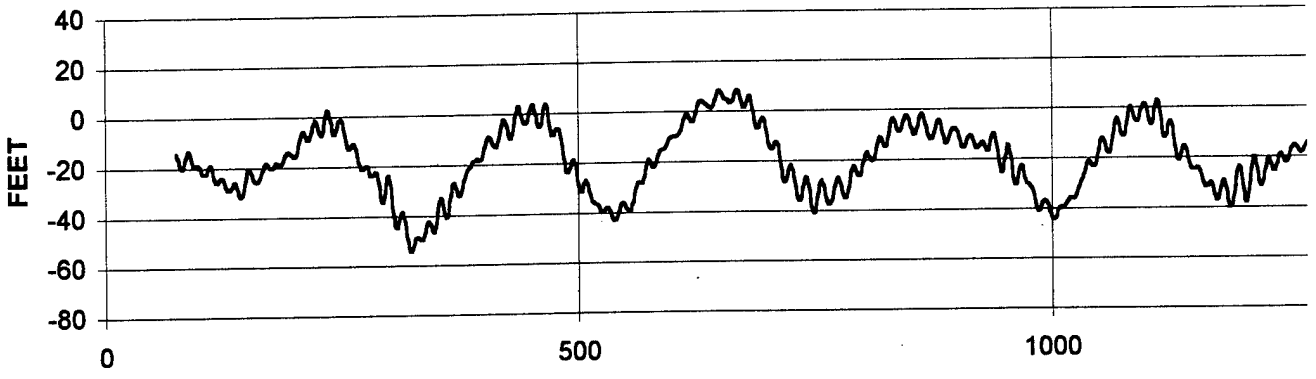
Filtered High Frequency Time History

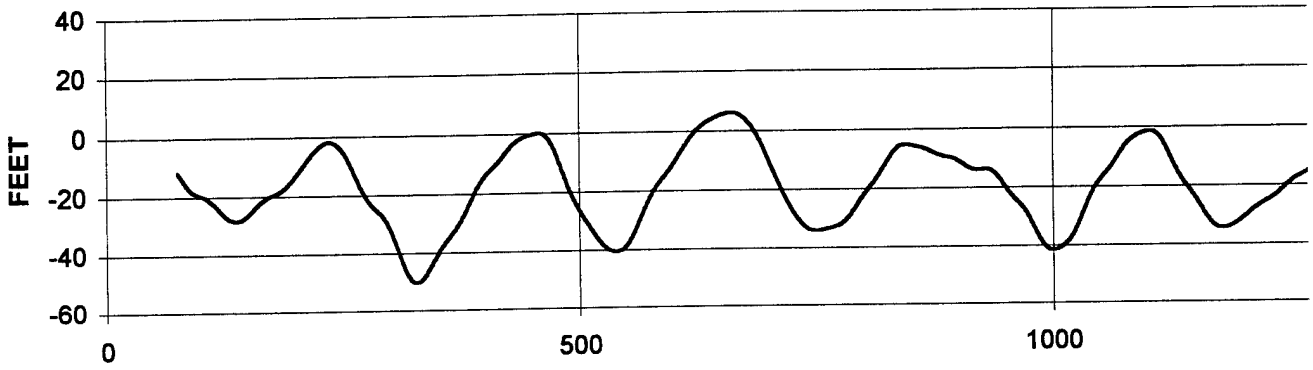


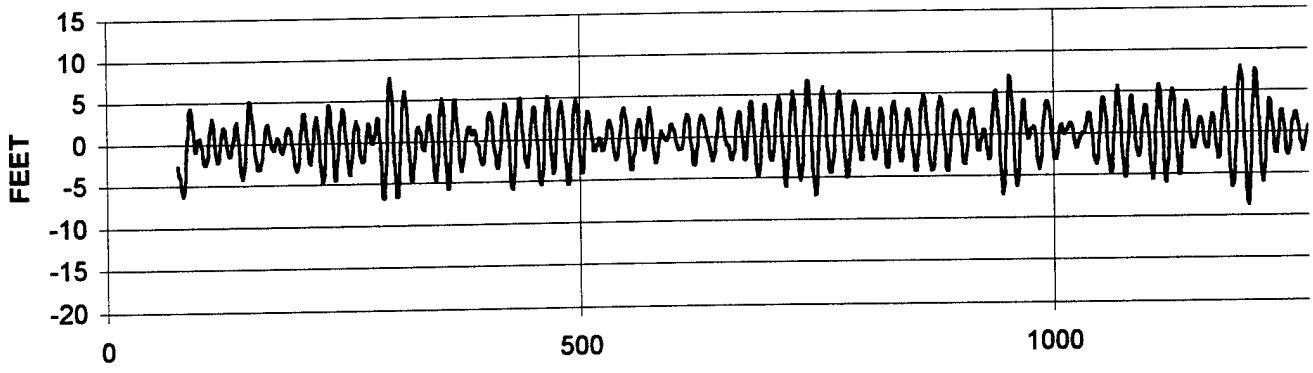
TEST A909 - PITCH



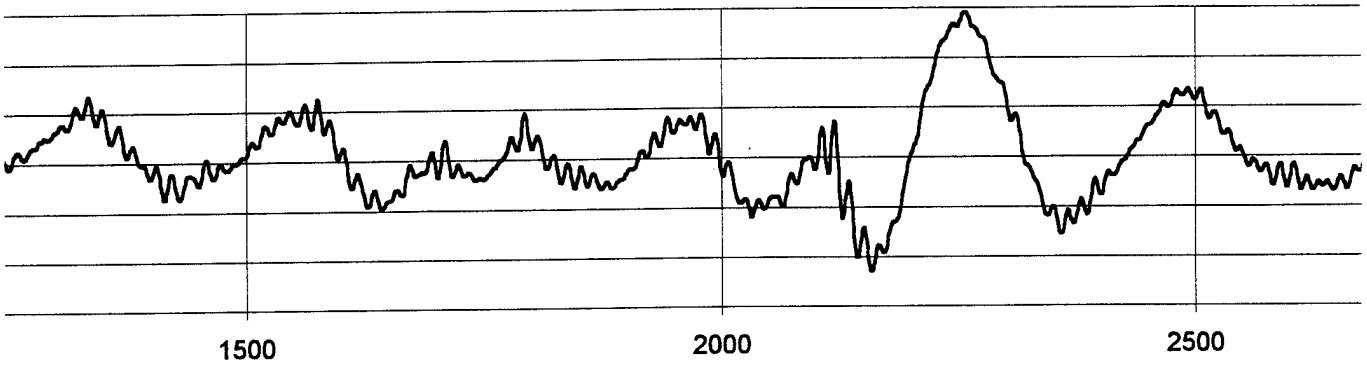
TEST A909 - PT SURGE



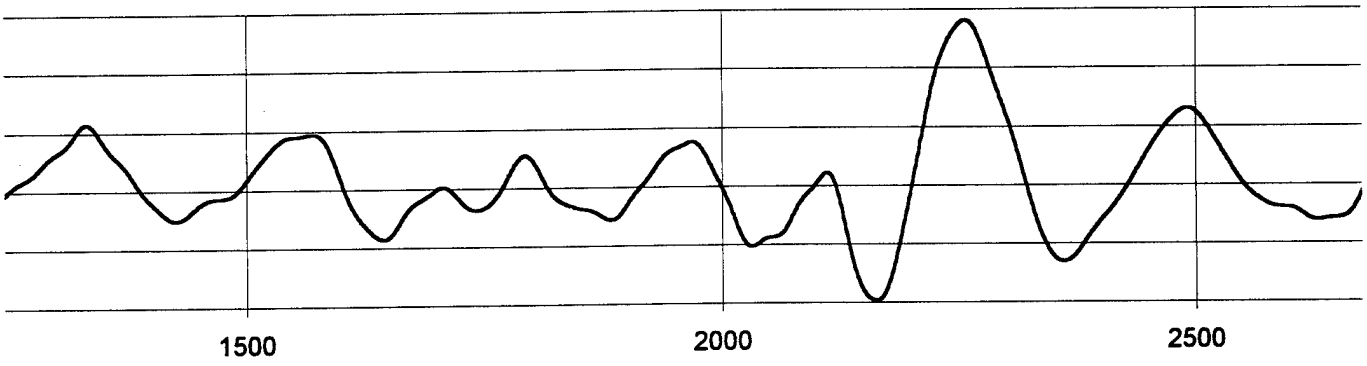




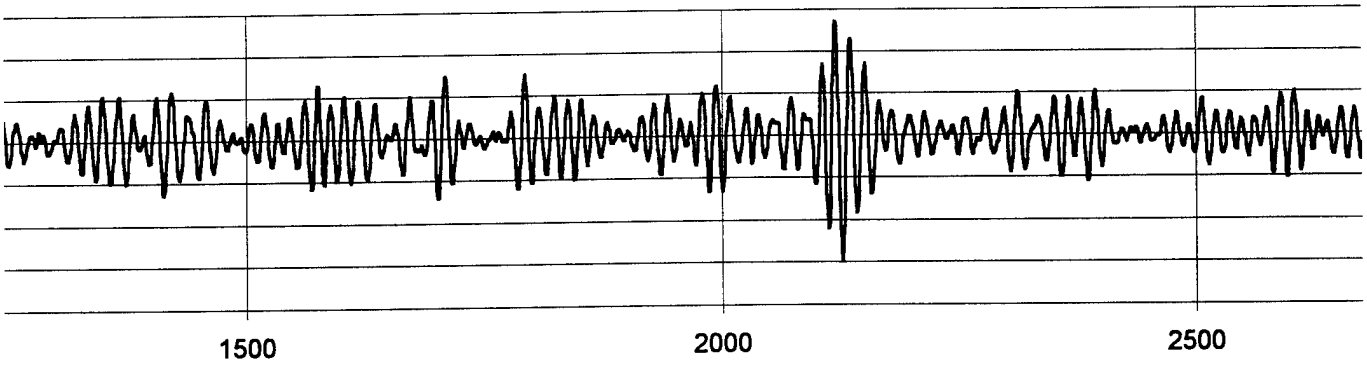
Unfiltered Time History



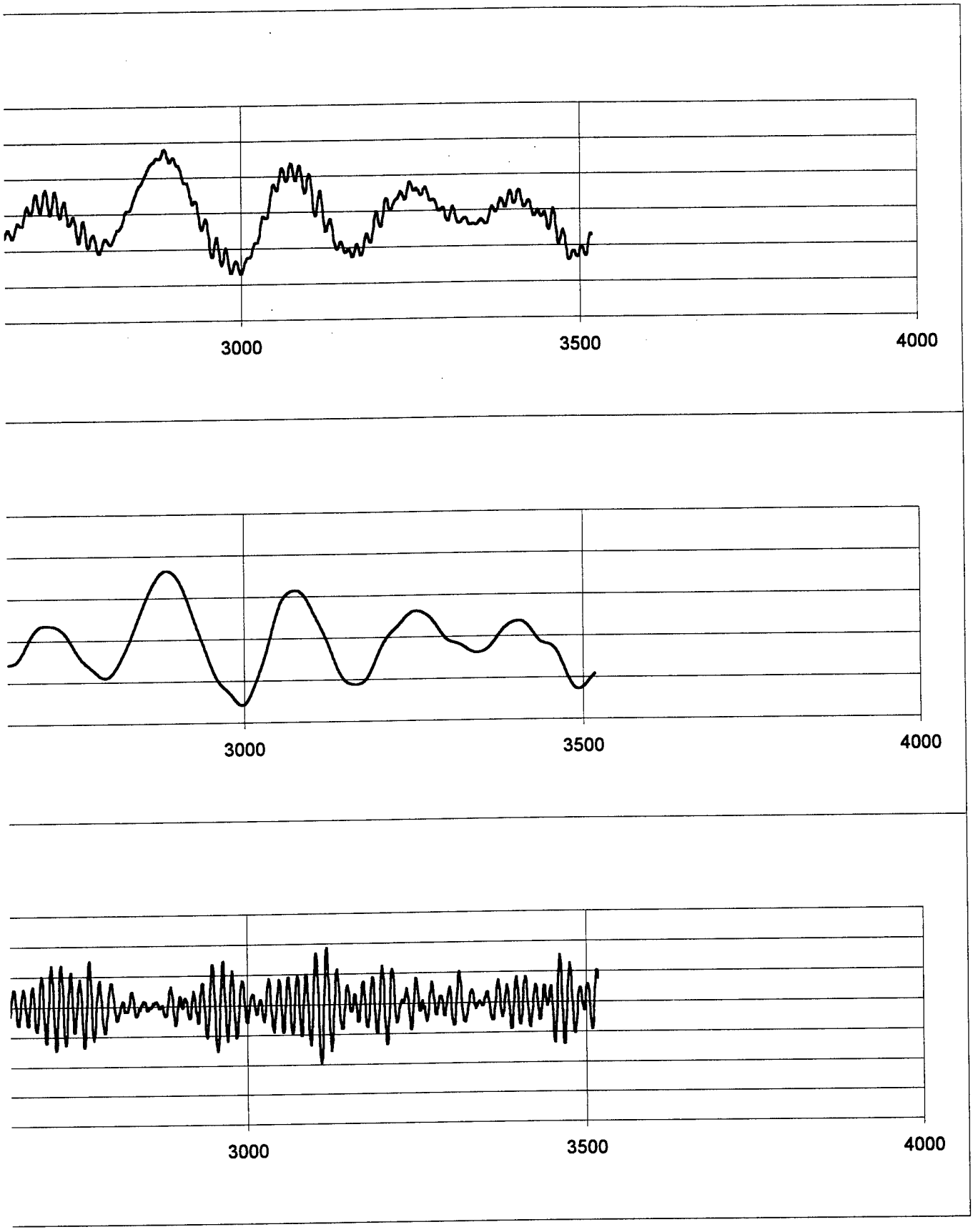
Filtered Low Frequency Time History



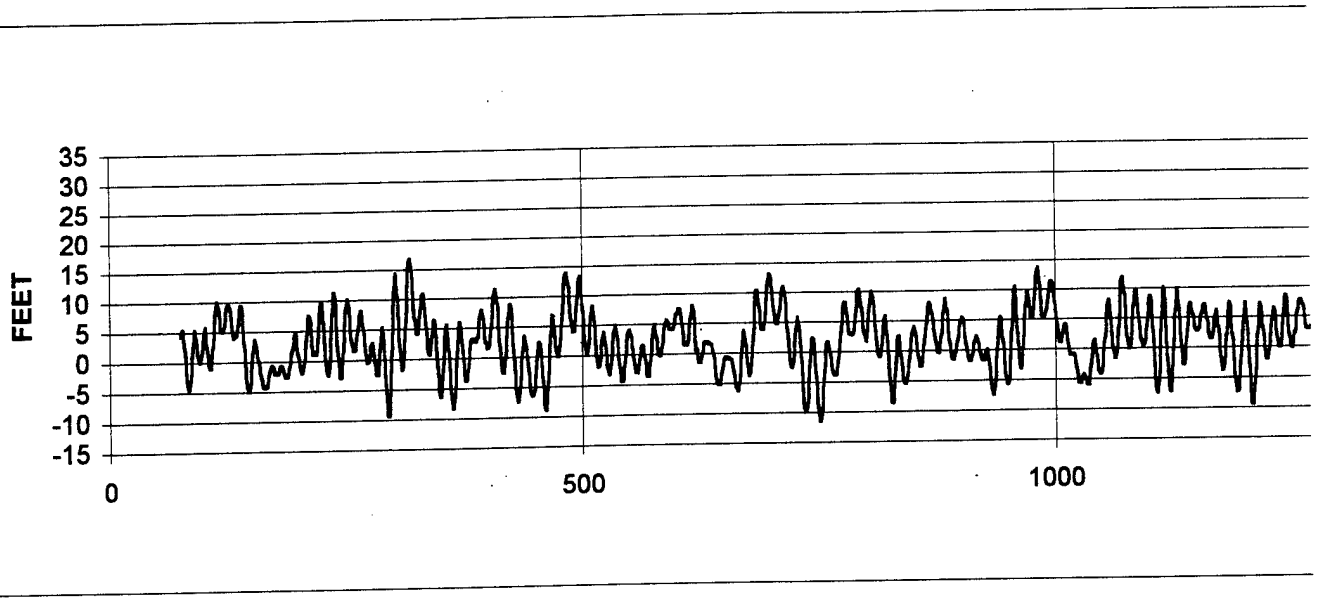
Filtered High Frequency Time History

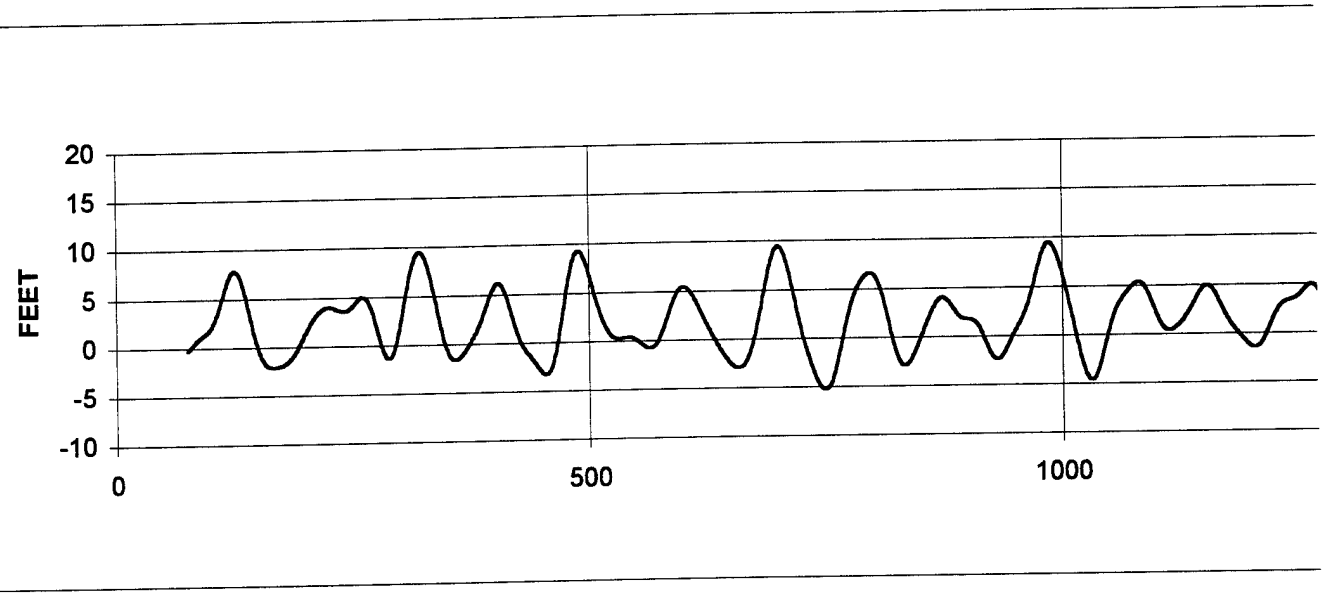


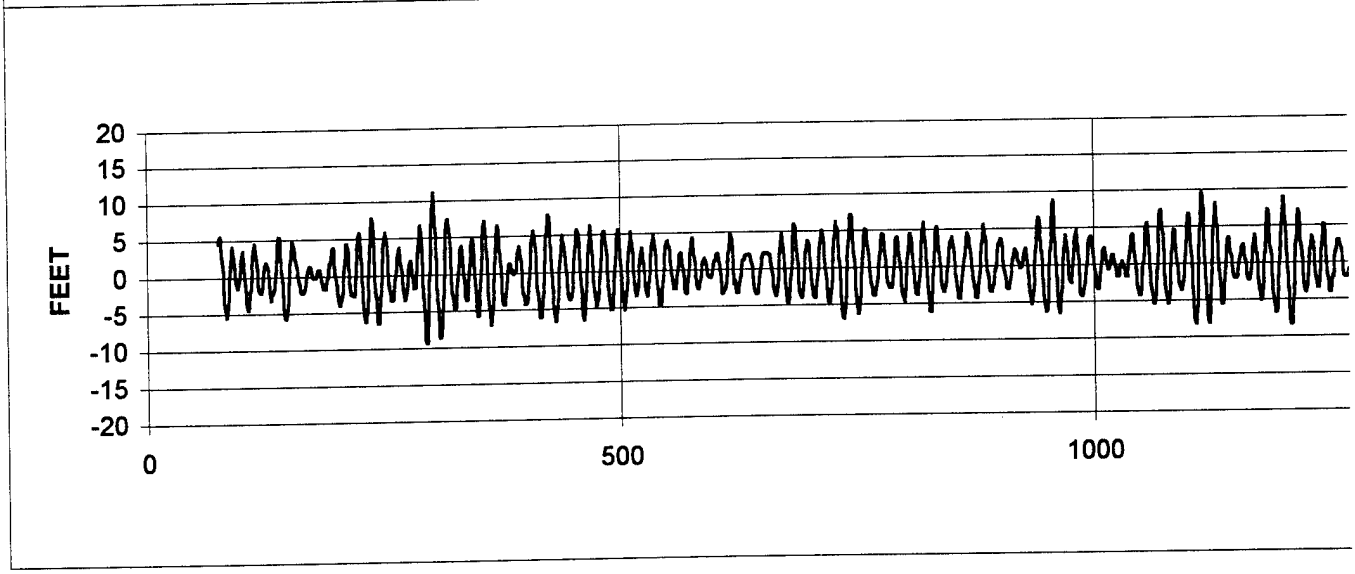
TEST A909 - PT SURGE



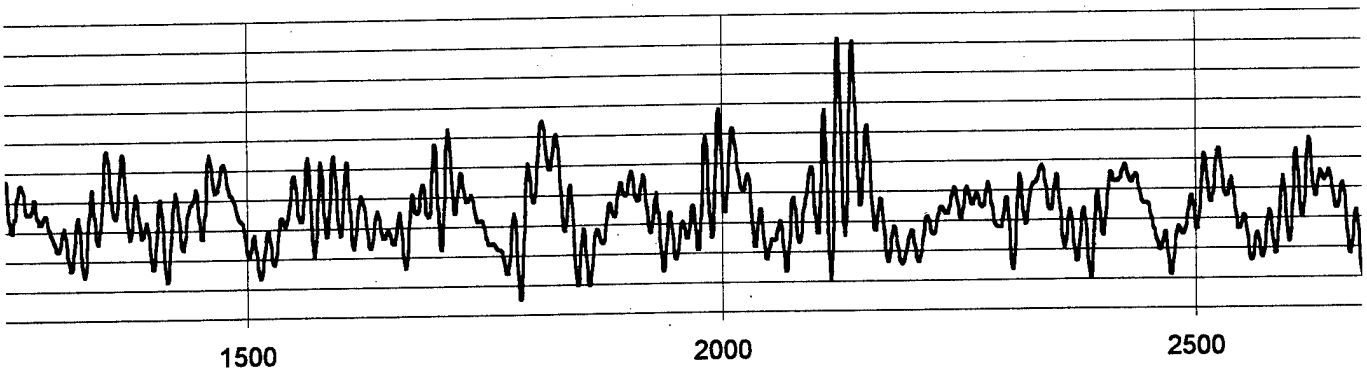
TEST A909 - PT HEAVE



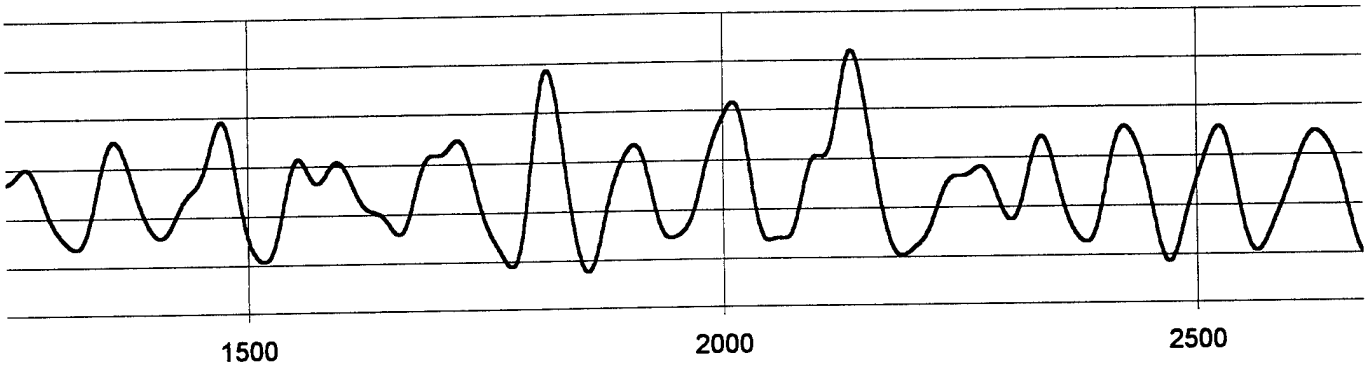




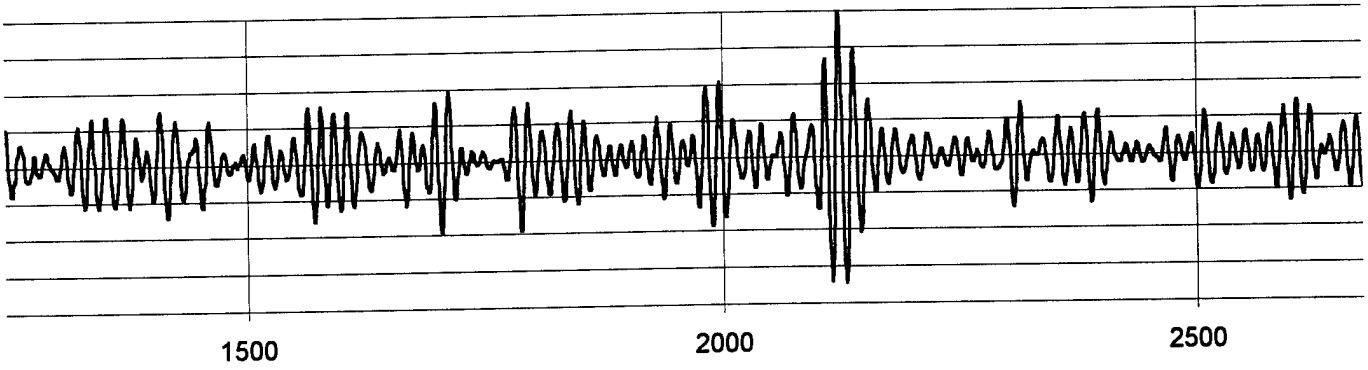
Unfiltered Time History



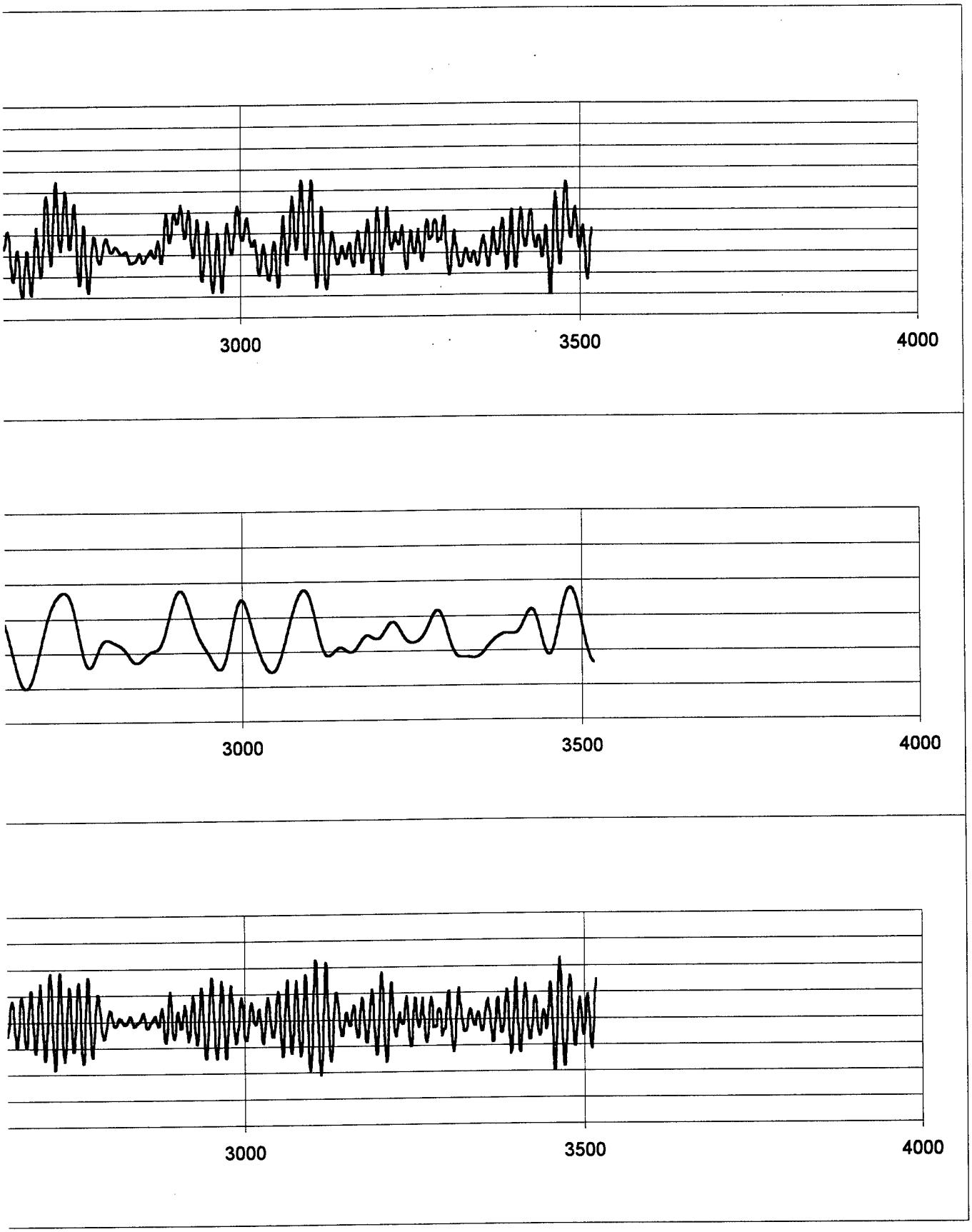
Filtered Low Frequency Time History



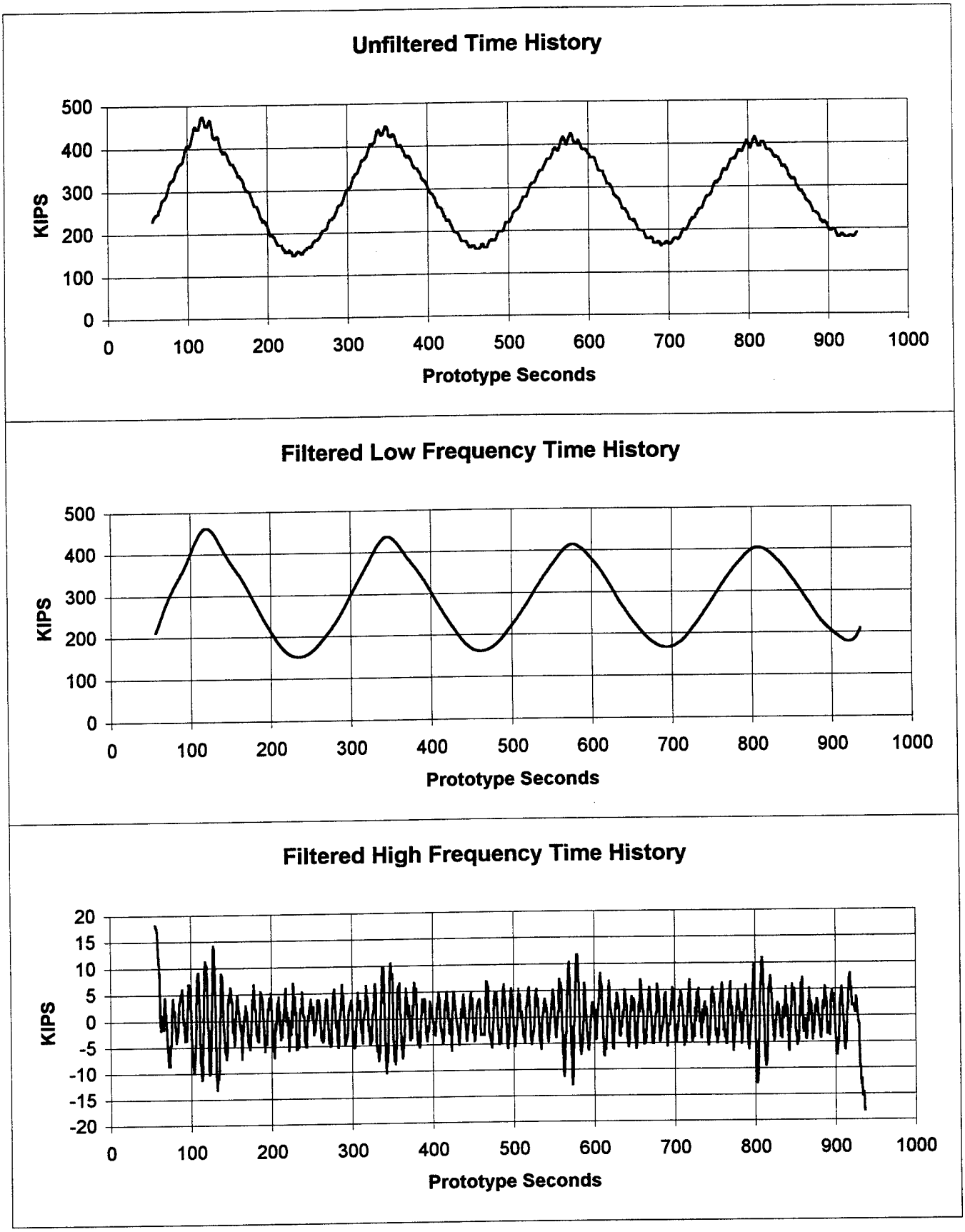
Filtered High Frequency Time History



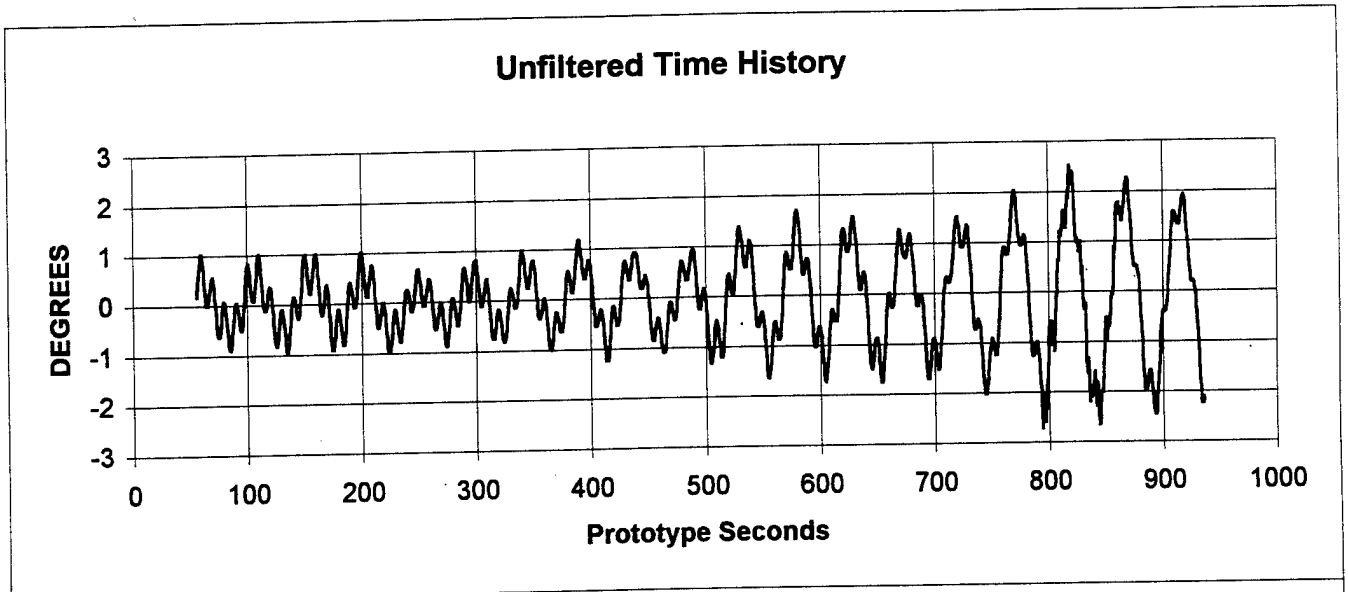
TEST A909 - PT HEAVE

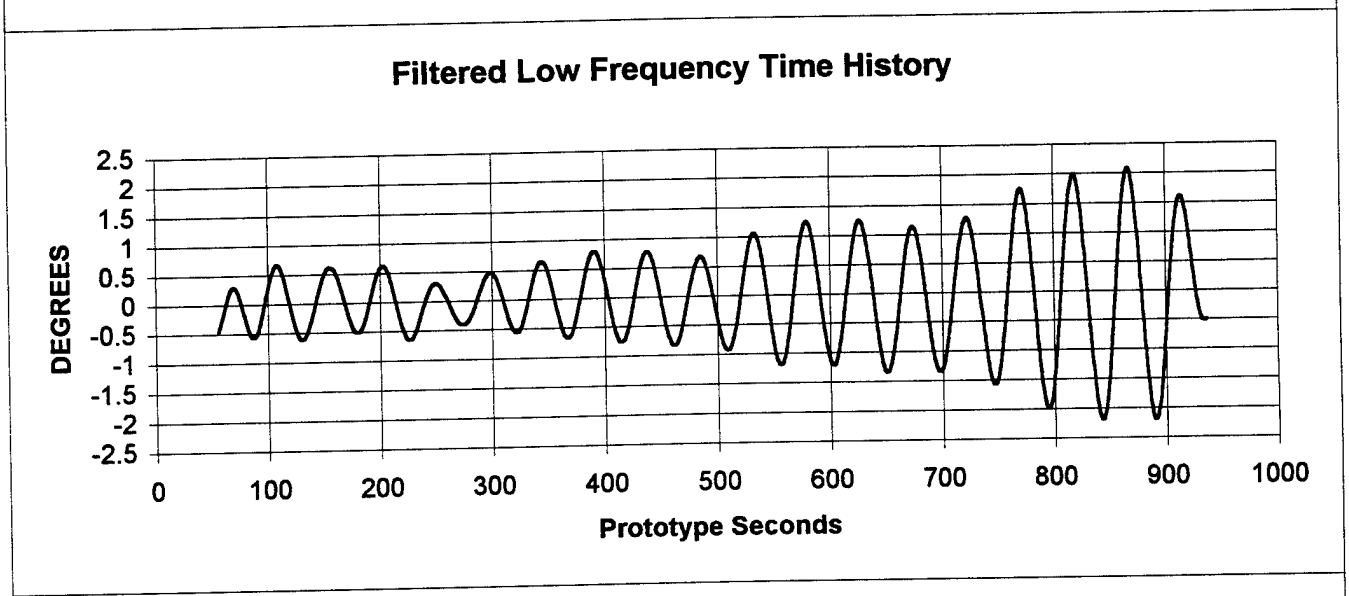


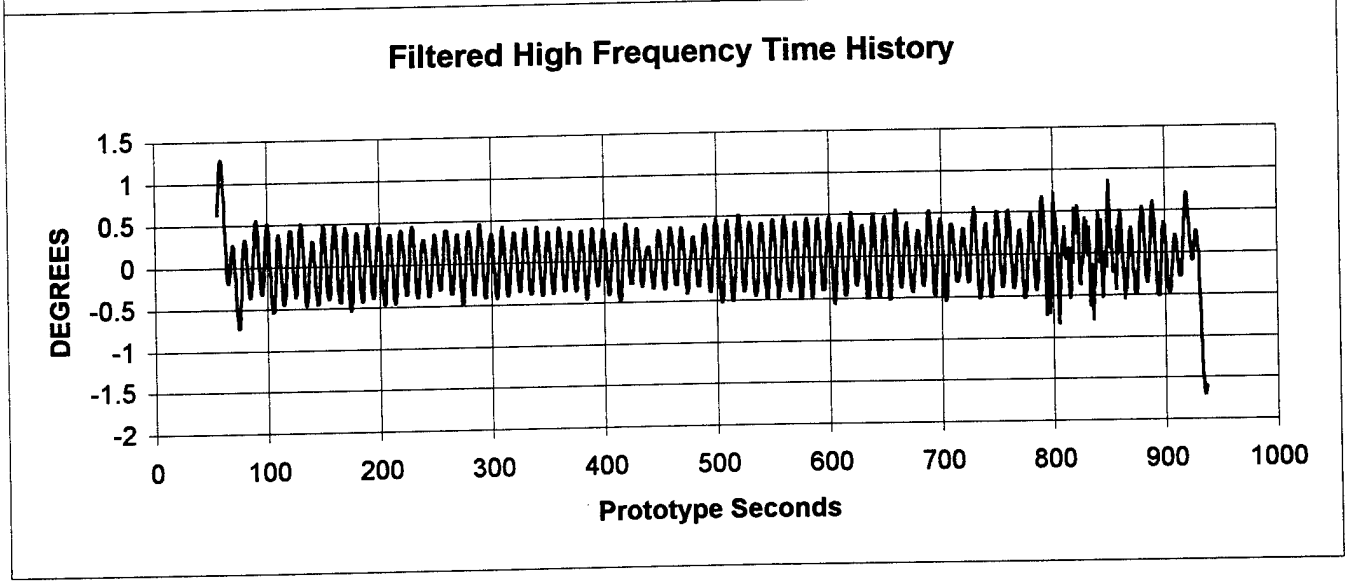
TEST A1003 - ML_1 TENSION



TEST A1003 - PITCH

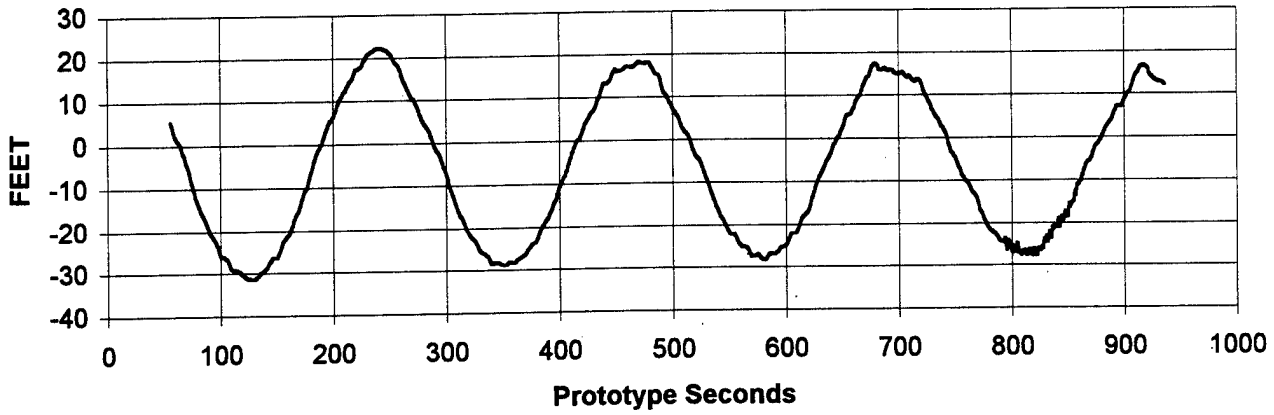




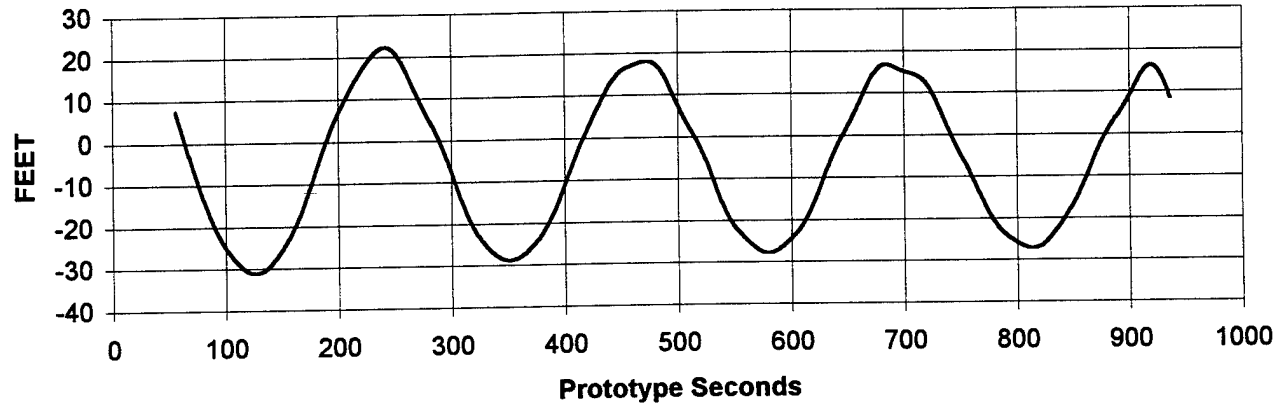


TEST A1003 - PT SURGE

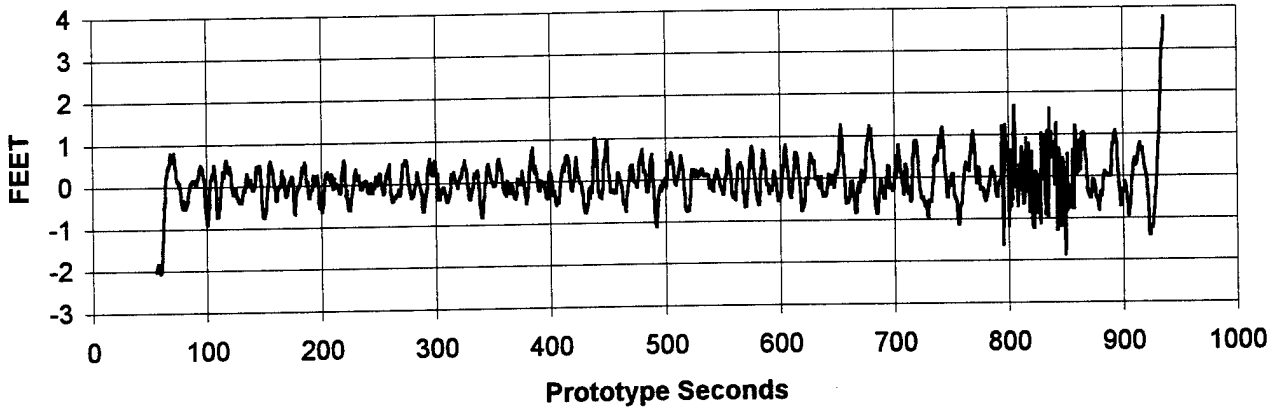
Unfiltered Time History



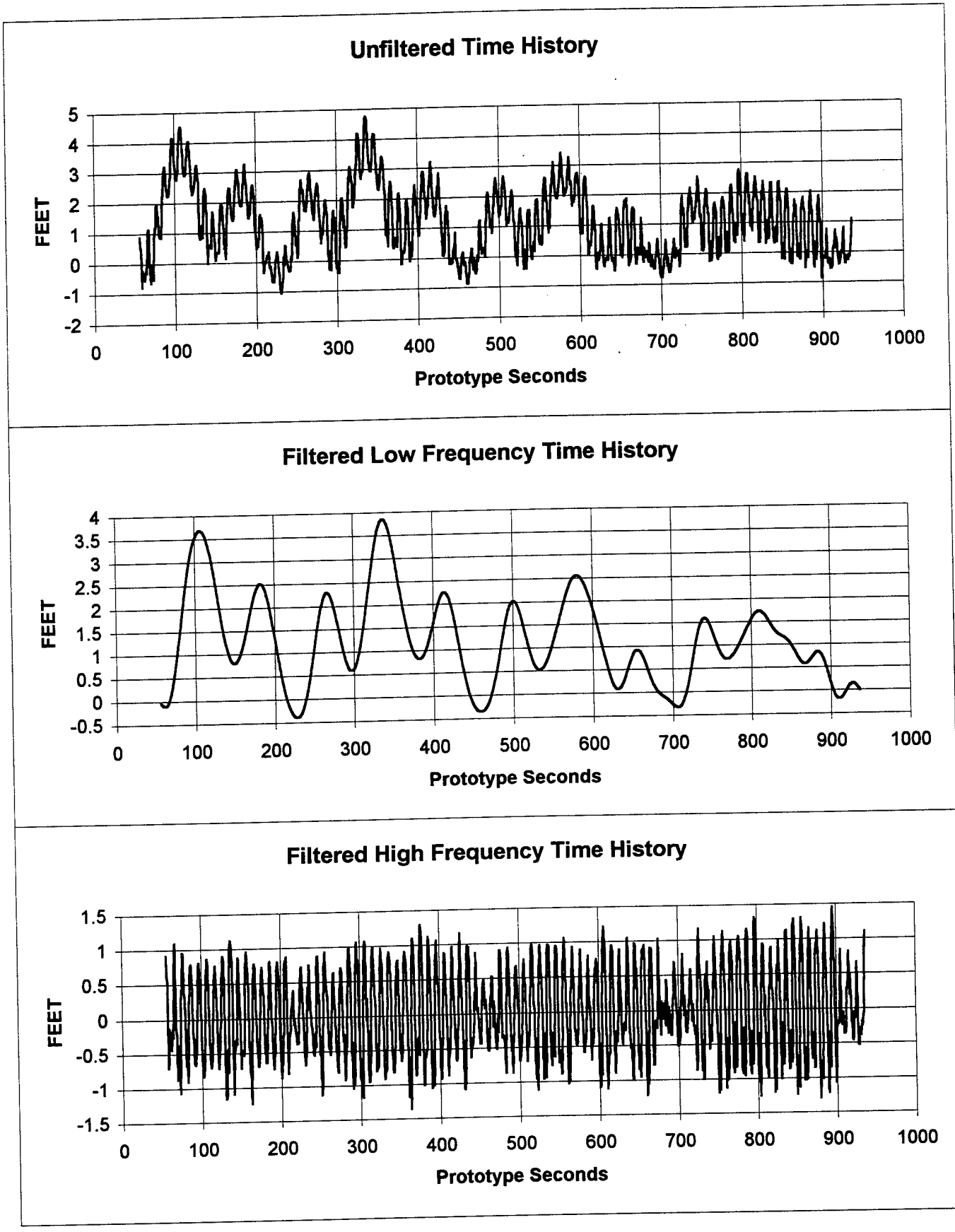
Filtered Low Frequency Time History



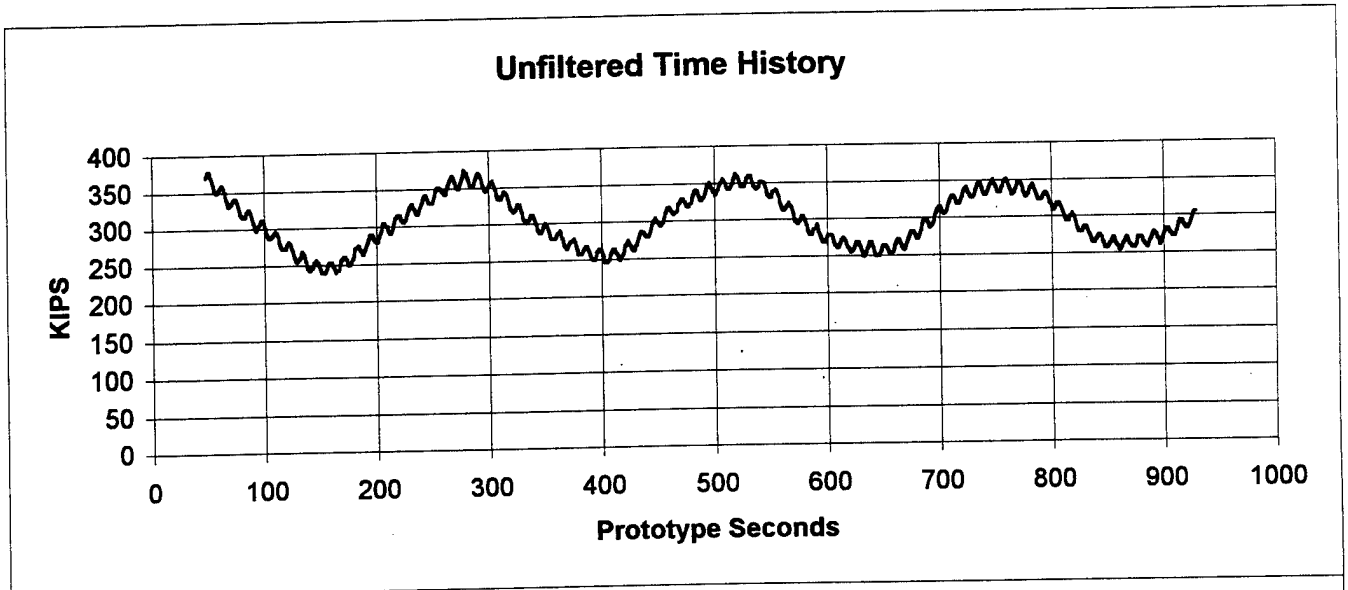
Filtered High Frequency Time History

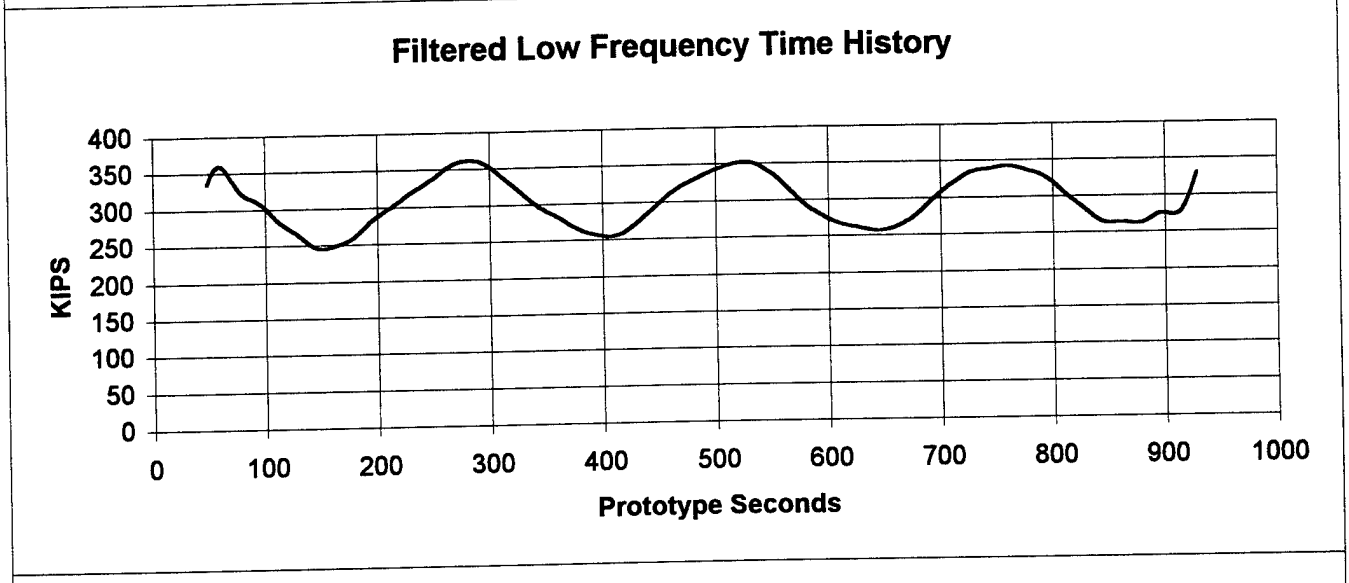


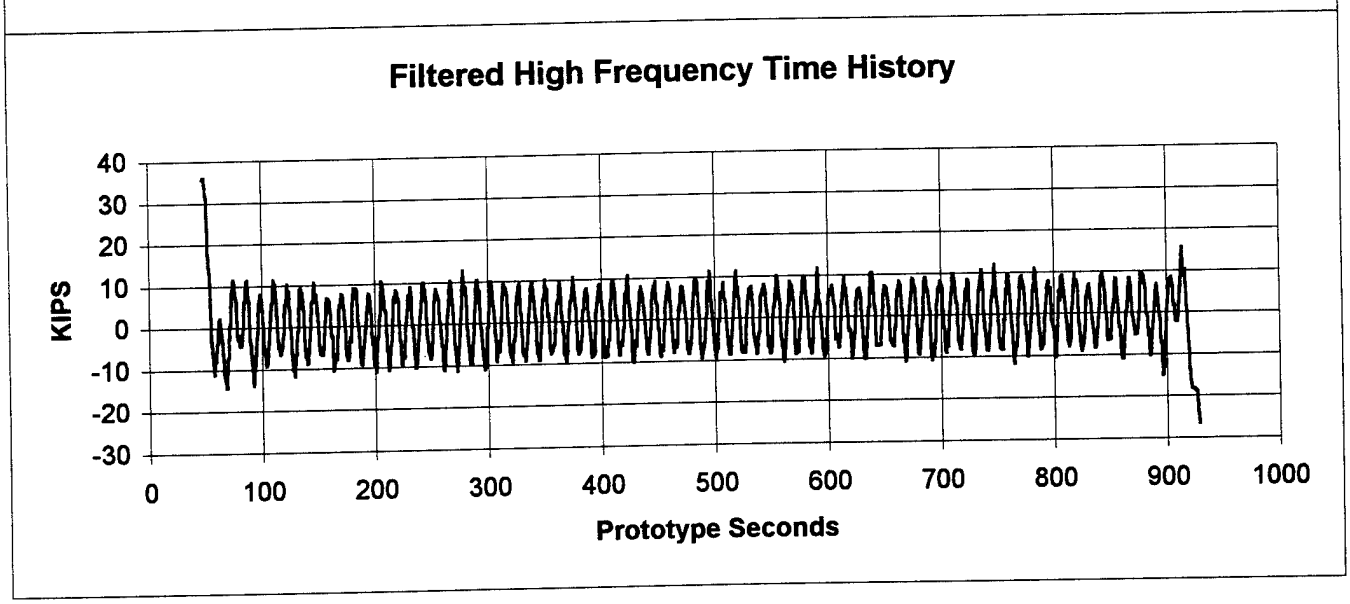
TEST A1003 - PT HEAVE



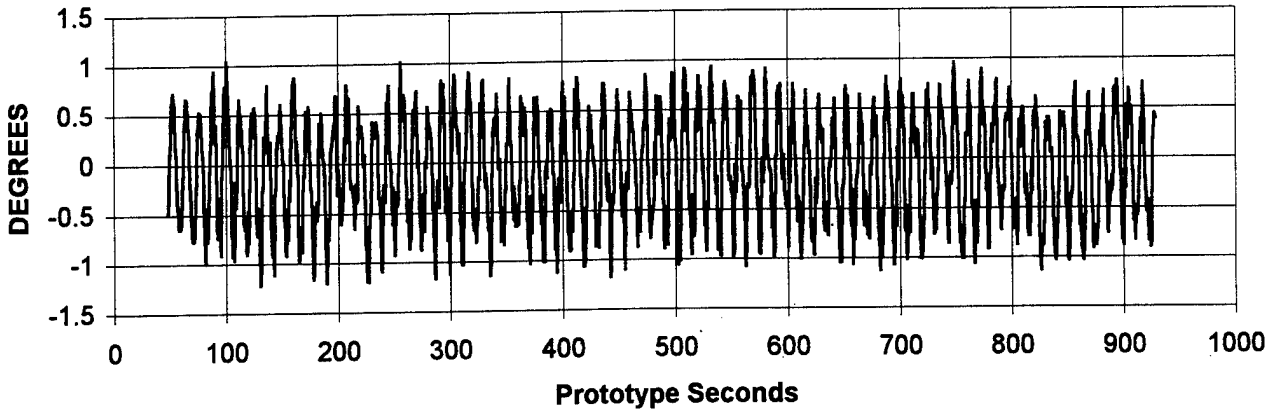
TEST A1004 - ML_1 TENSION

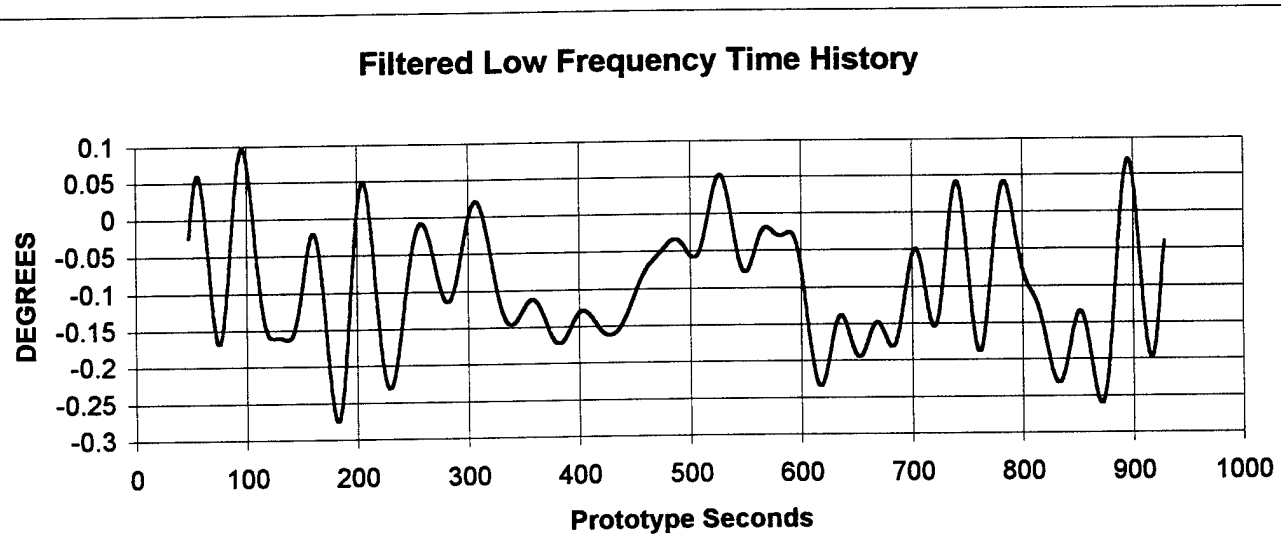


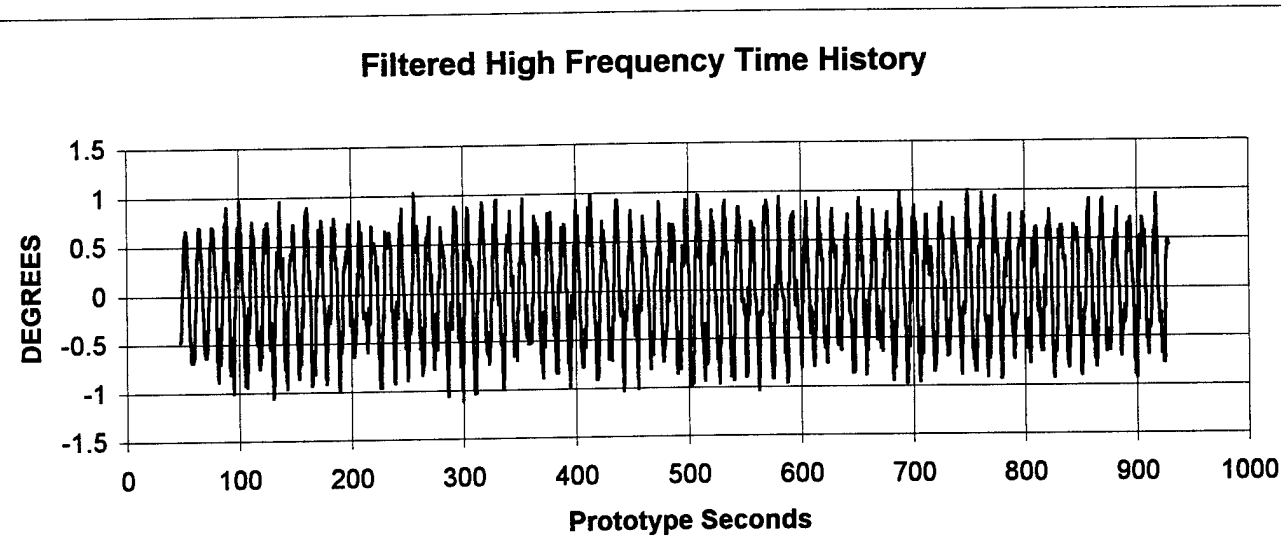




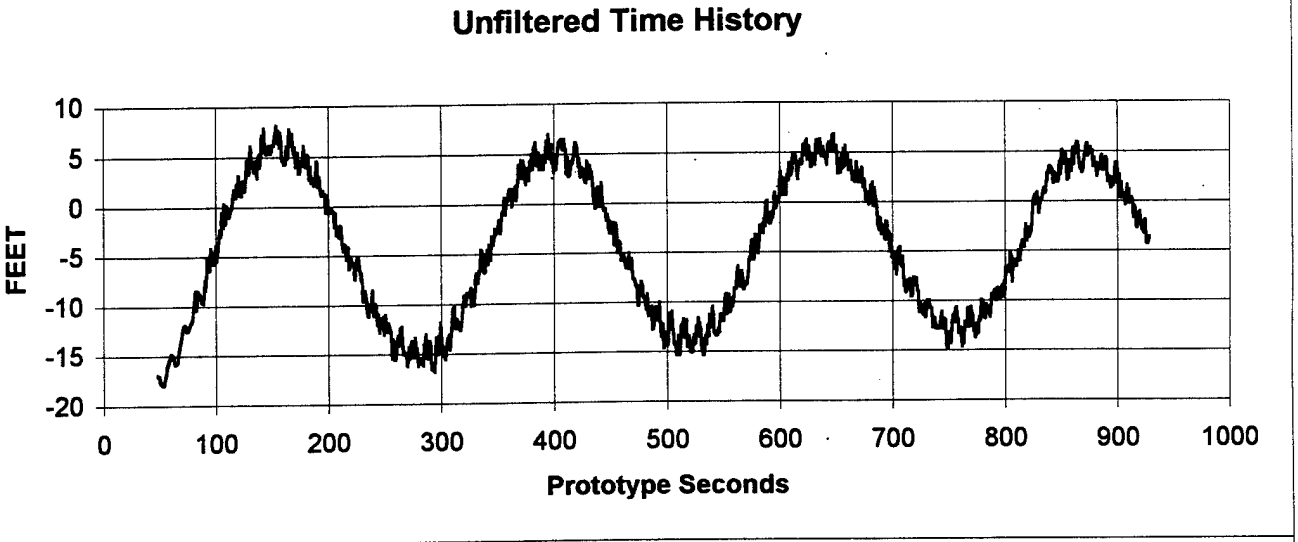
TEST A1004 - PITCH

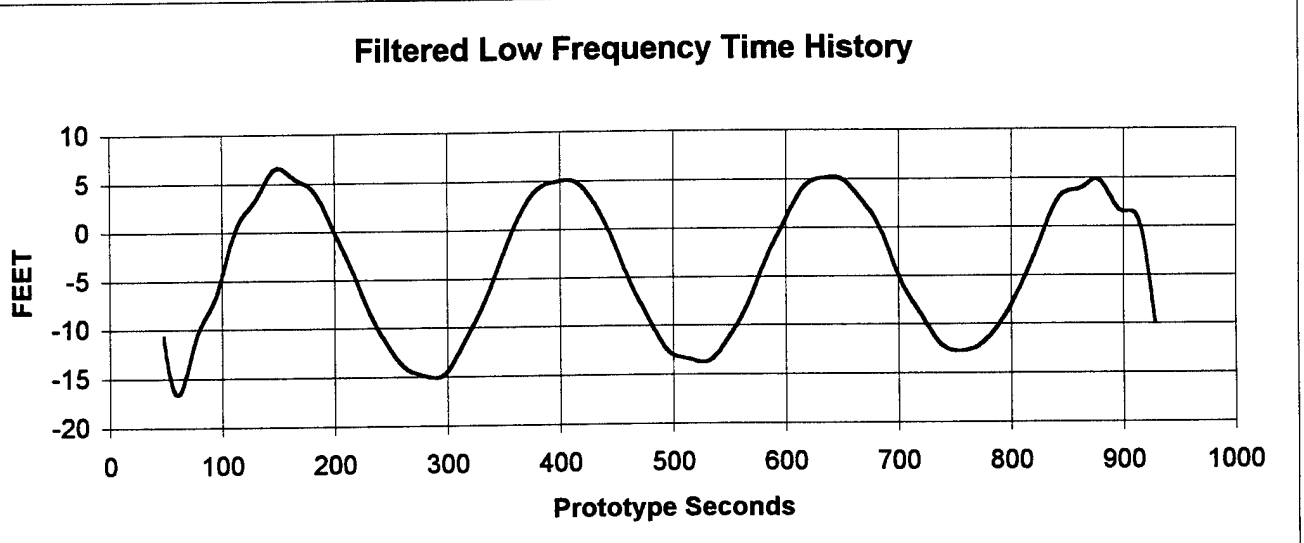


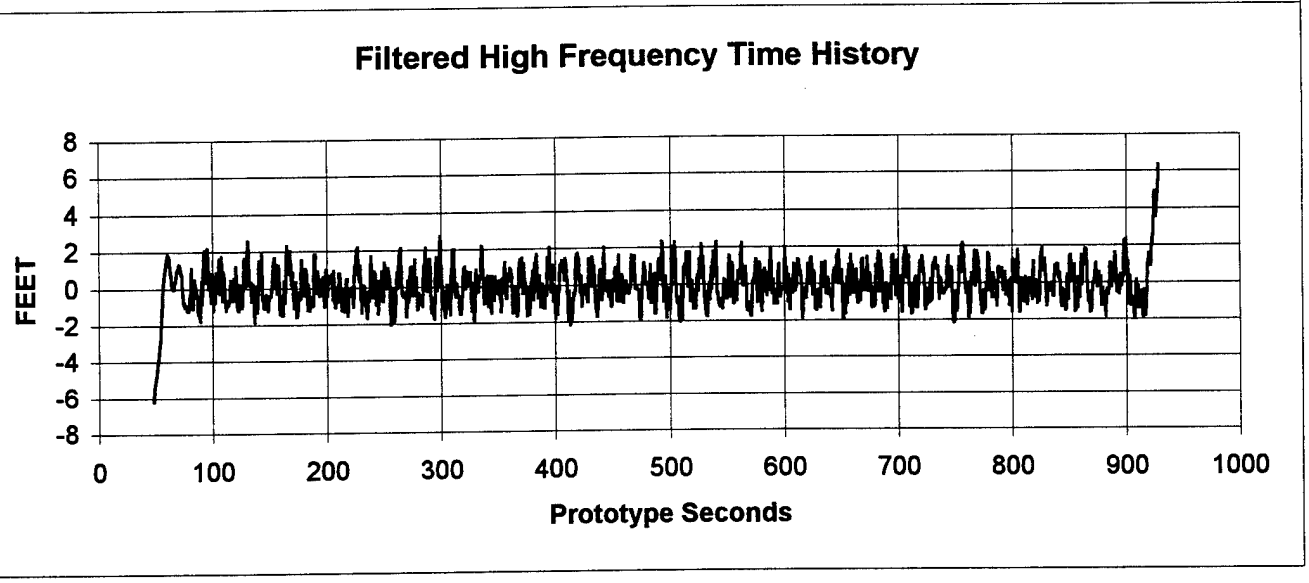




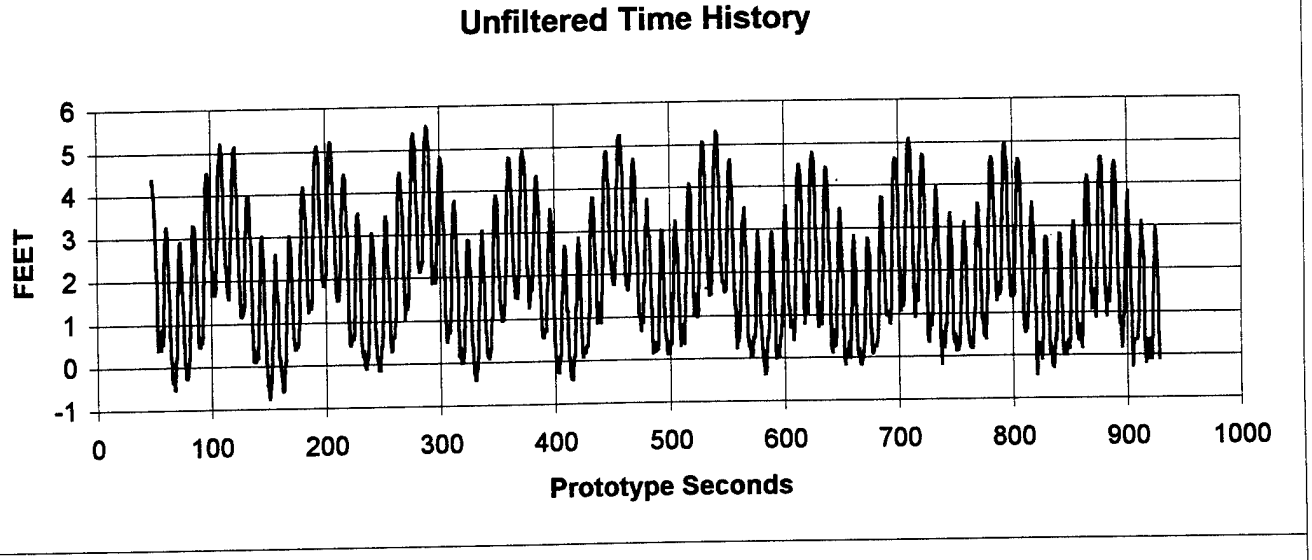
TEST A1004 - PT SURGE

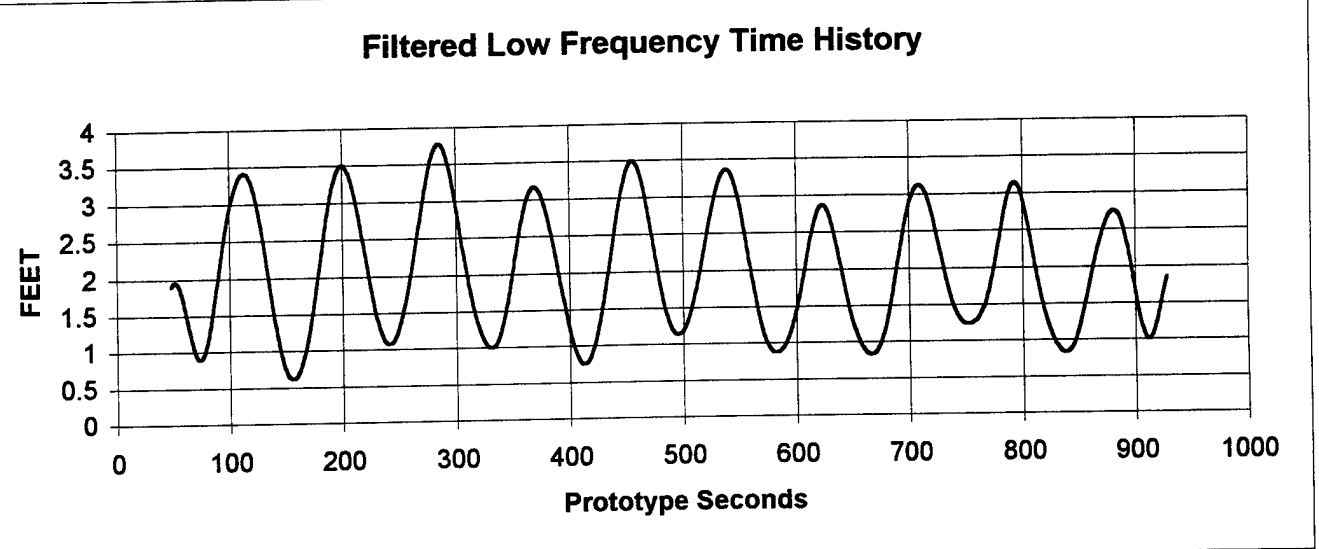


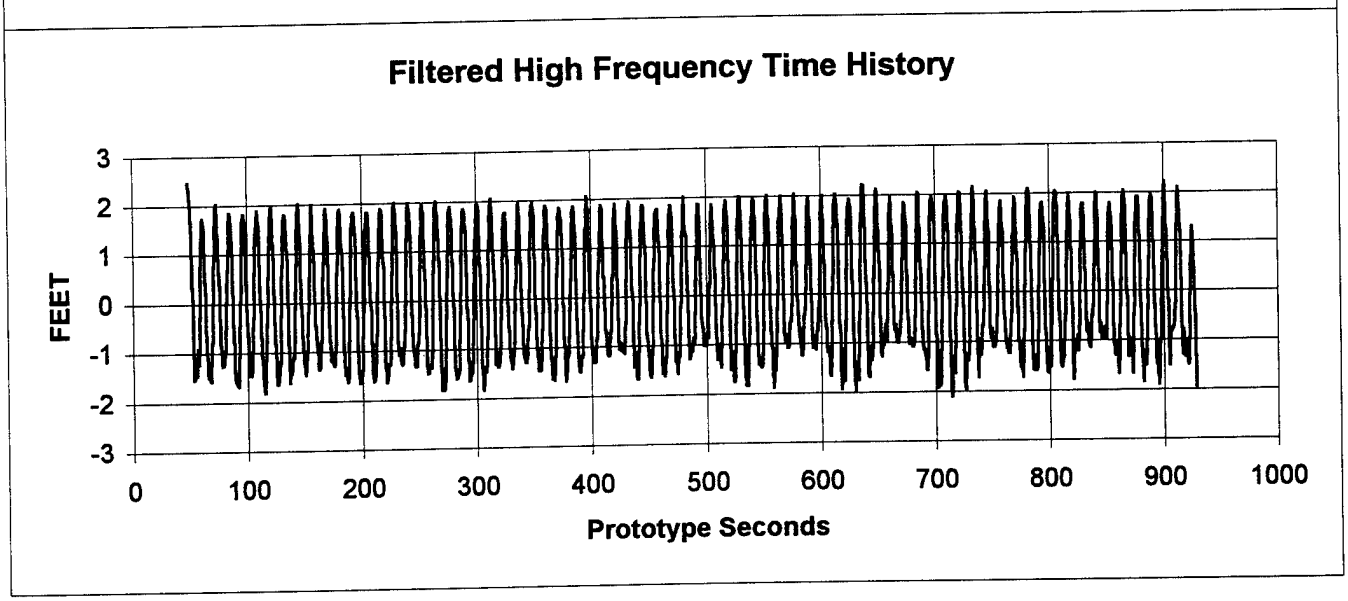




TEST A1004 - PT HEAVE

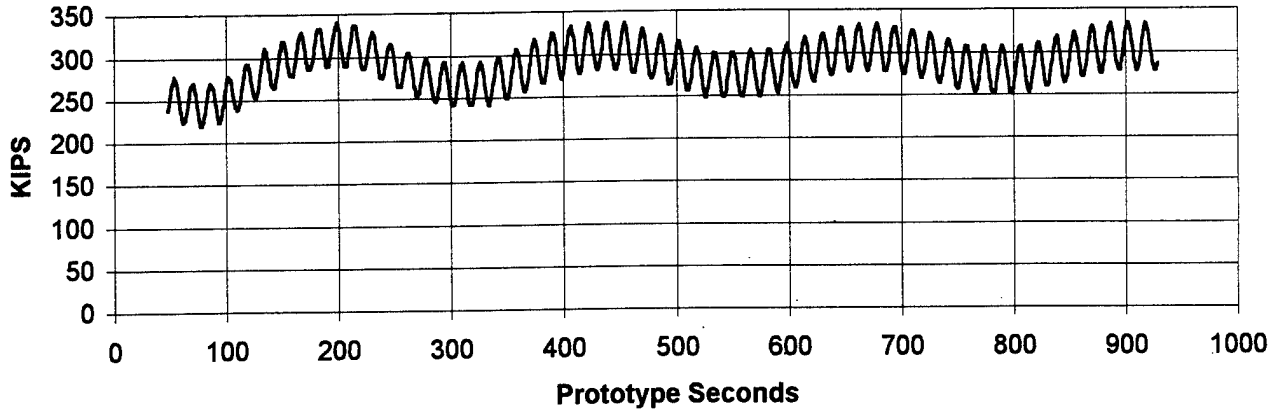




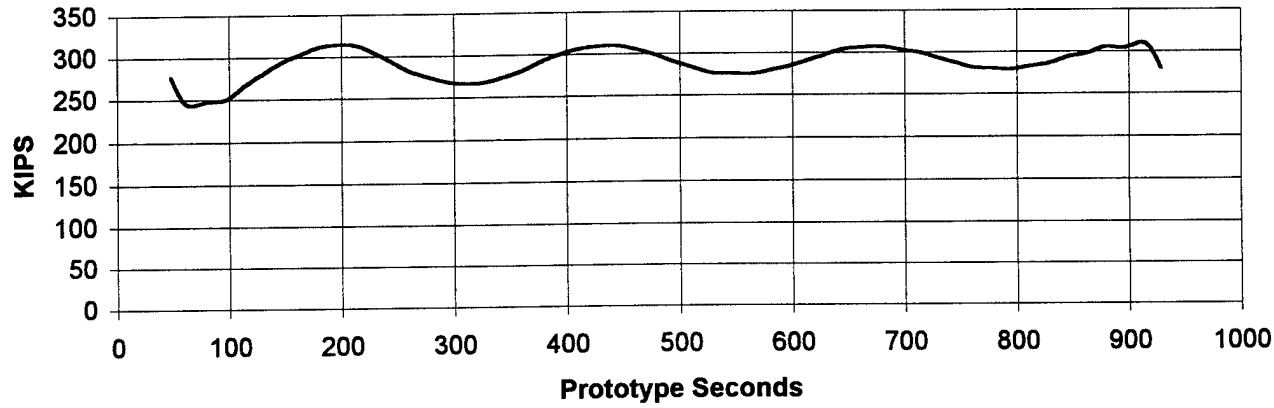


TEST A1005 - ML_1 TENSION

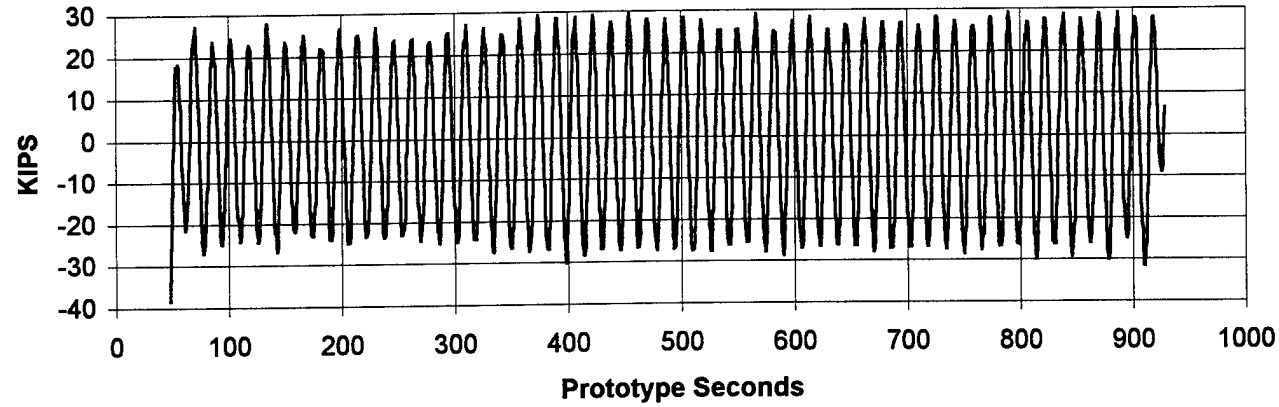
Unfiltered Time History



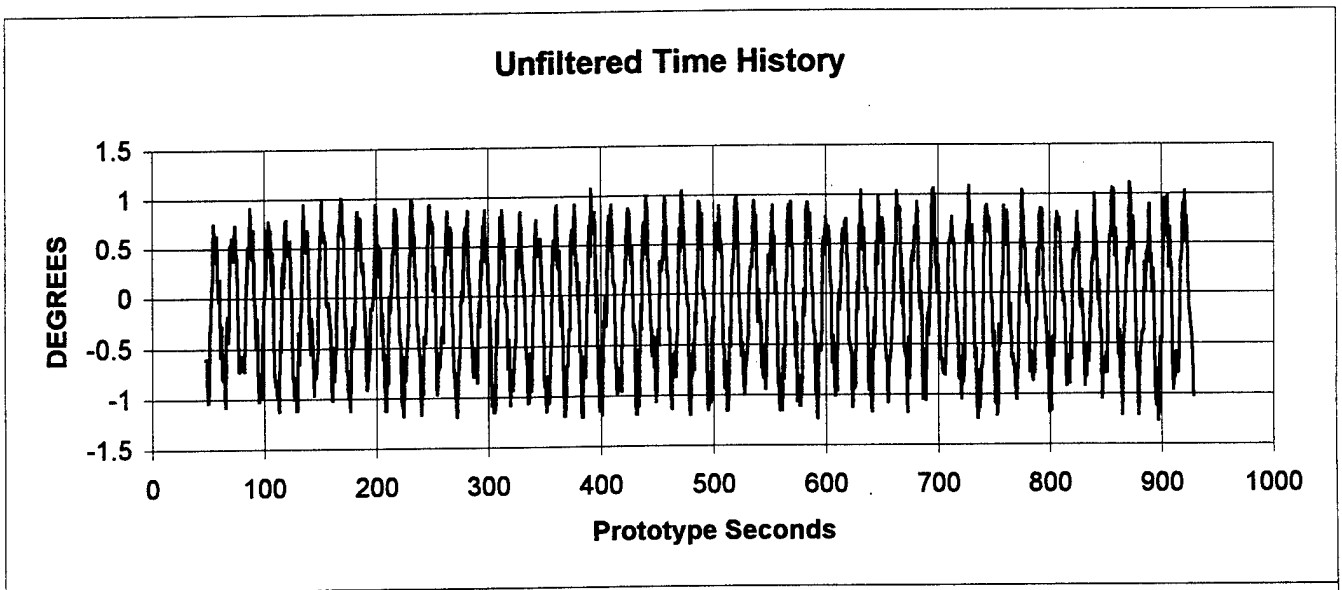
Filtered Low Frequency Time History

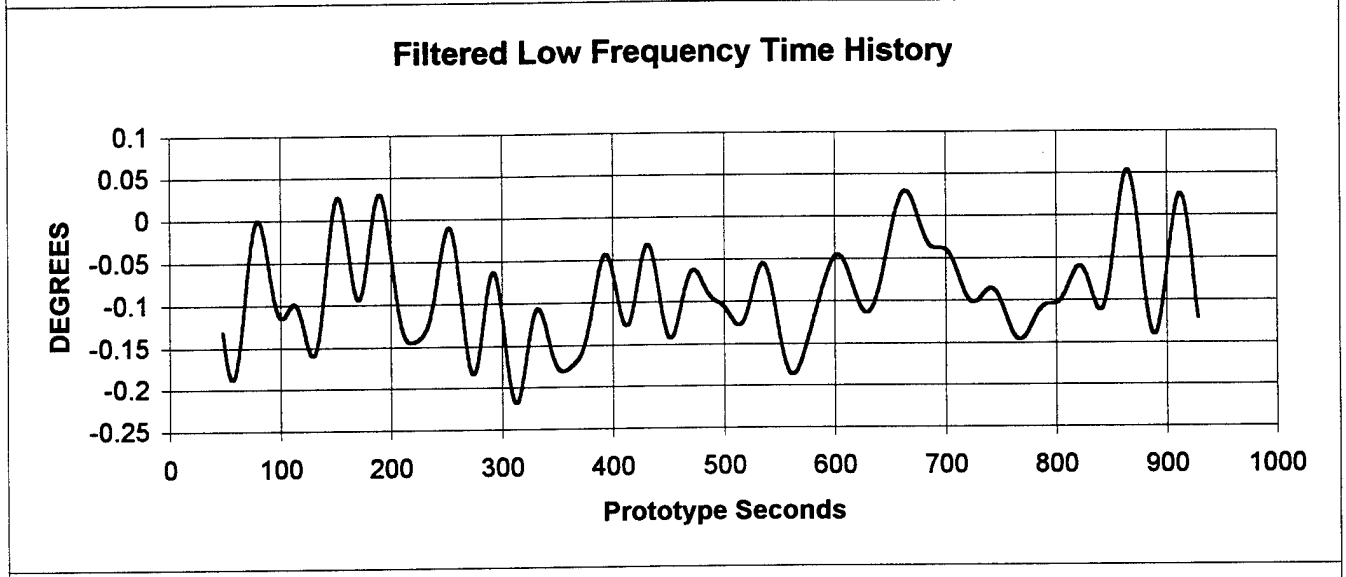


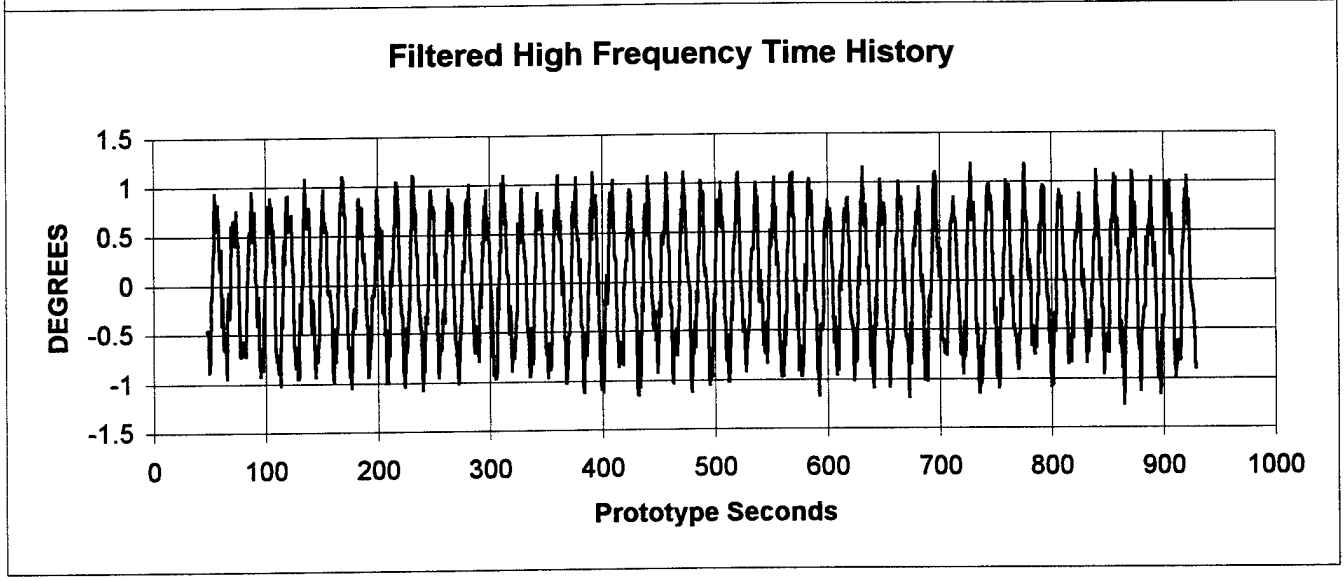
Filtered High Frequency Time History



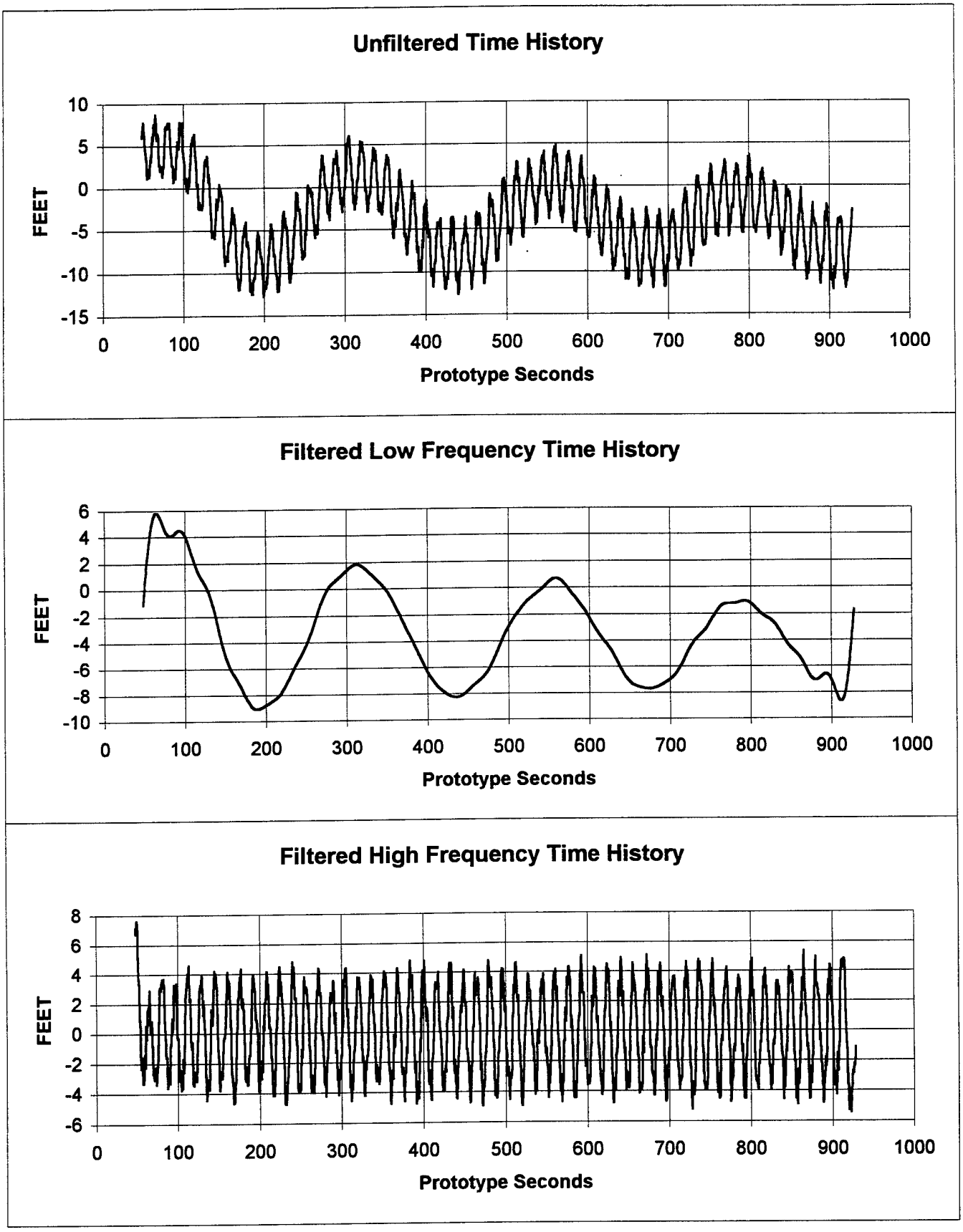
TEST A1005 - PITCH



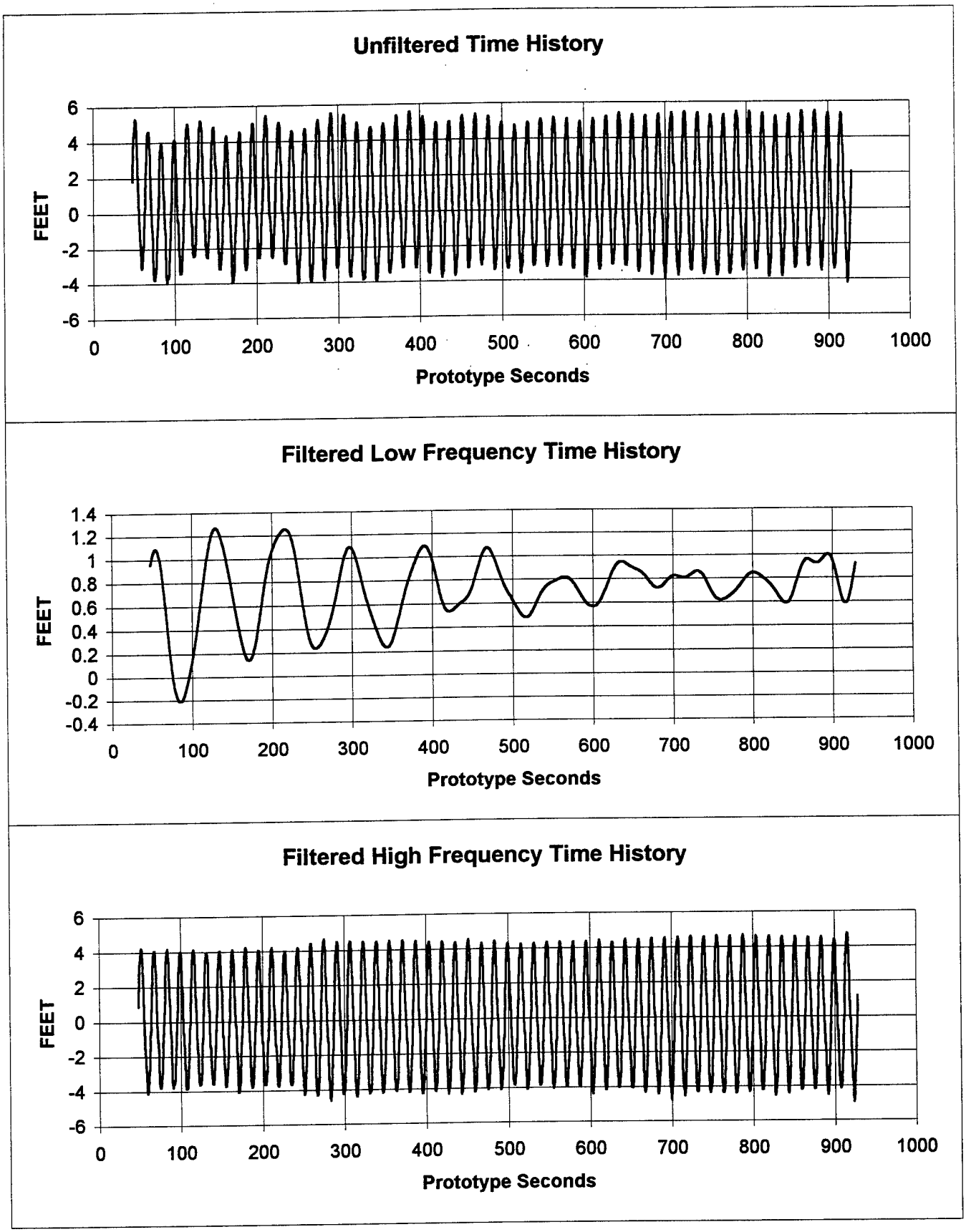




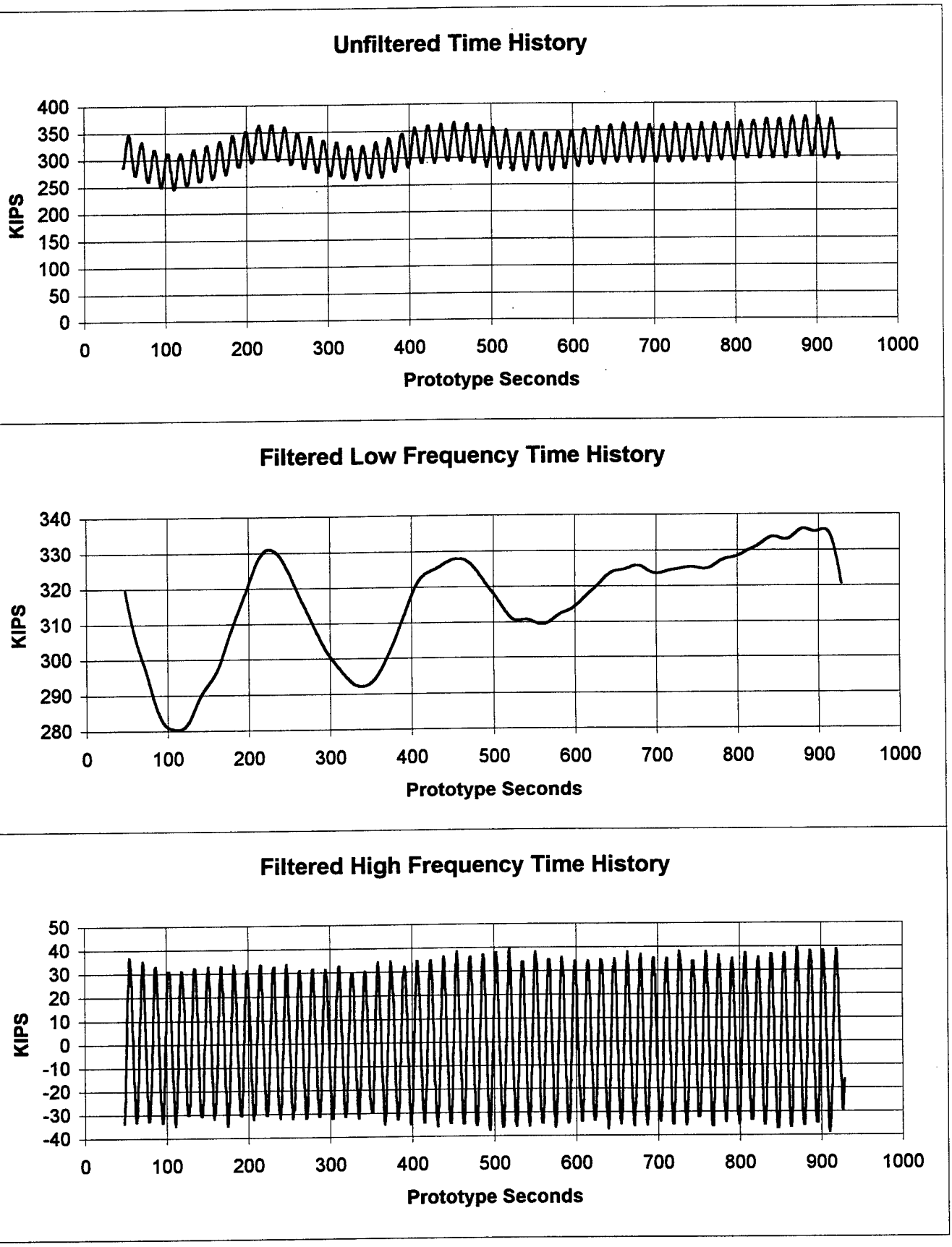
TEST A1005 - PT SURGE



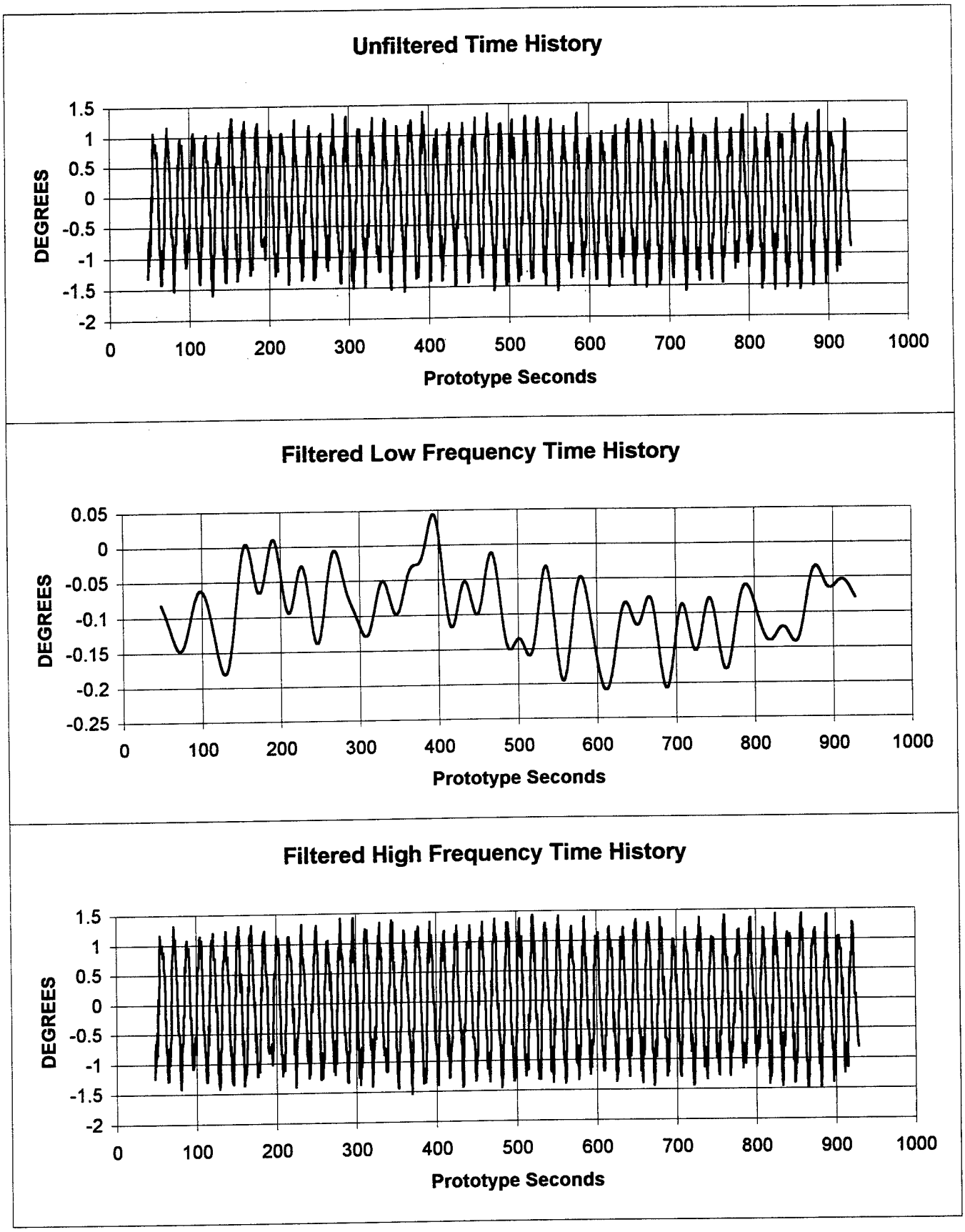
TEST A1005 - PT HEAVE



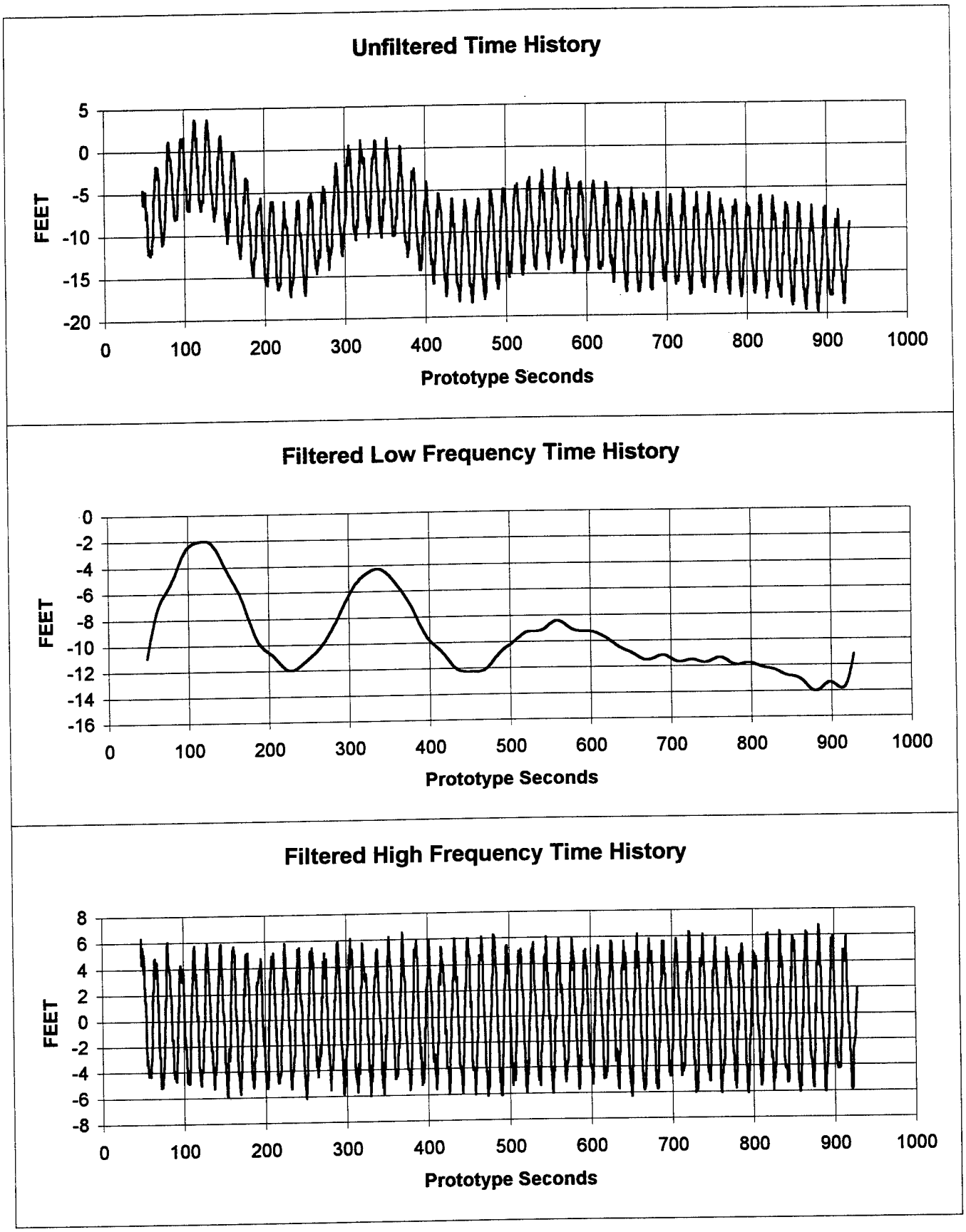
TEST A1006 - ML_1 TENSION



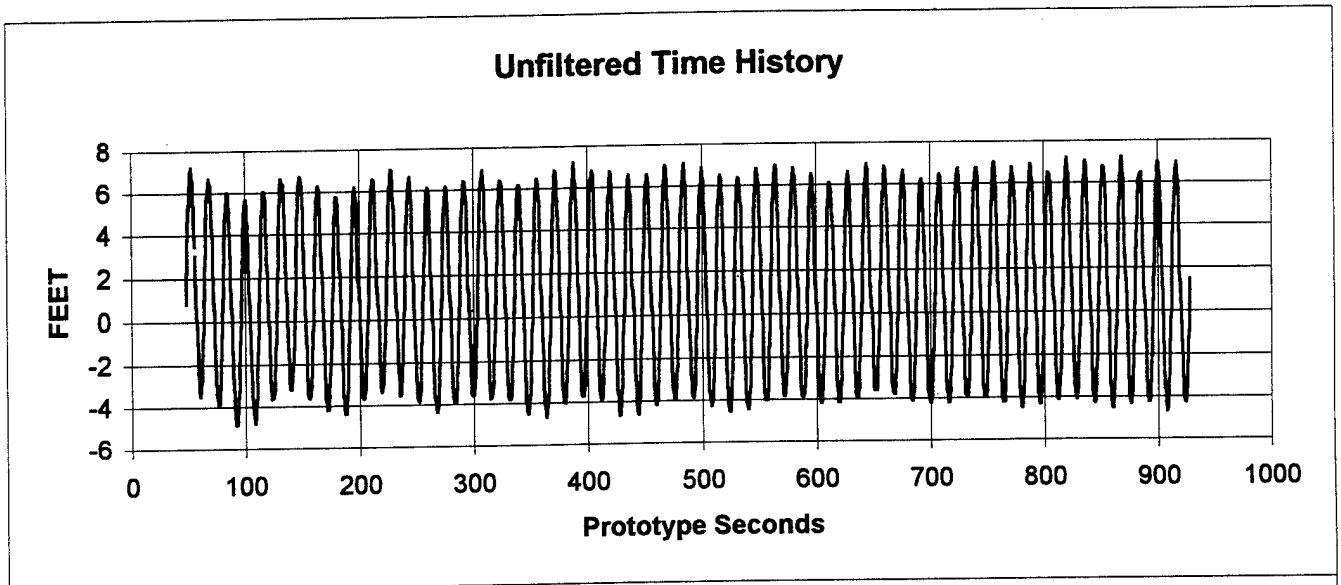
TEST A1006 - PITCH

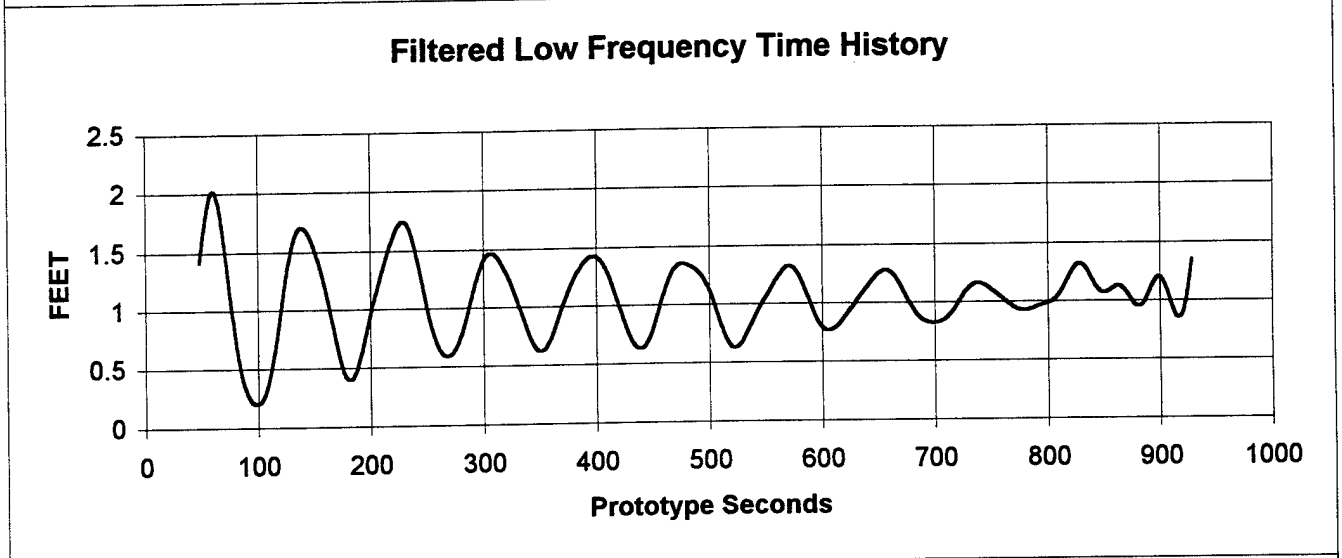


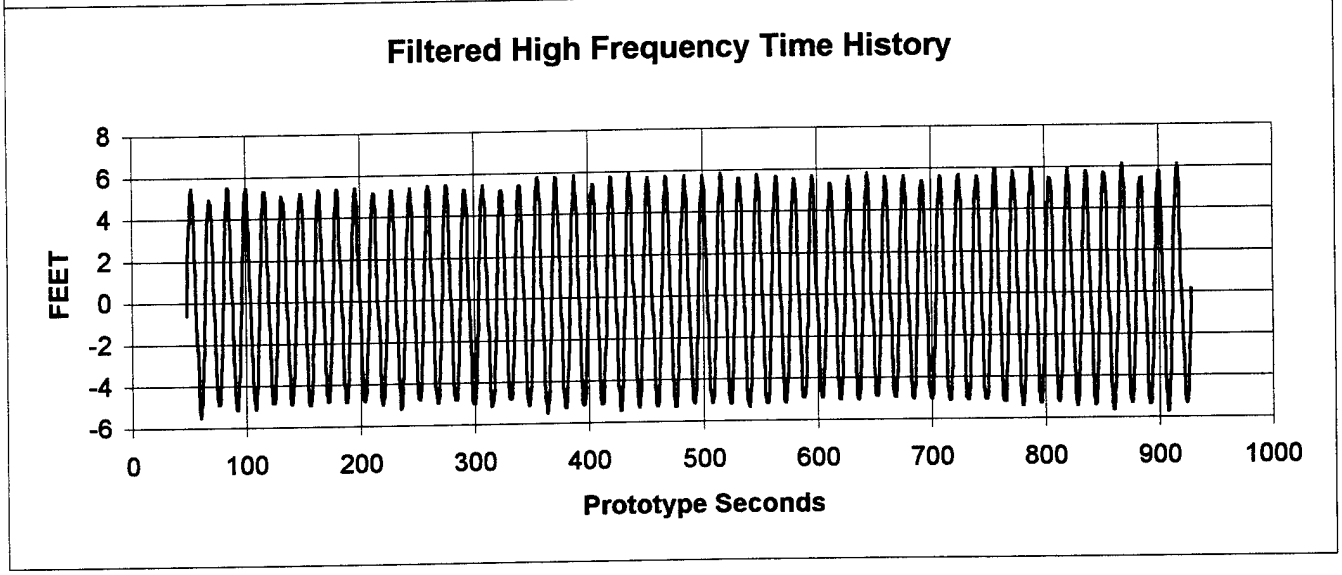
TEST A1006 - PT SURGE



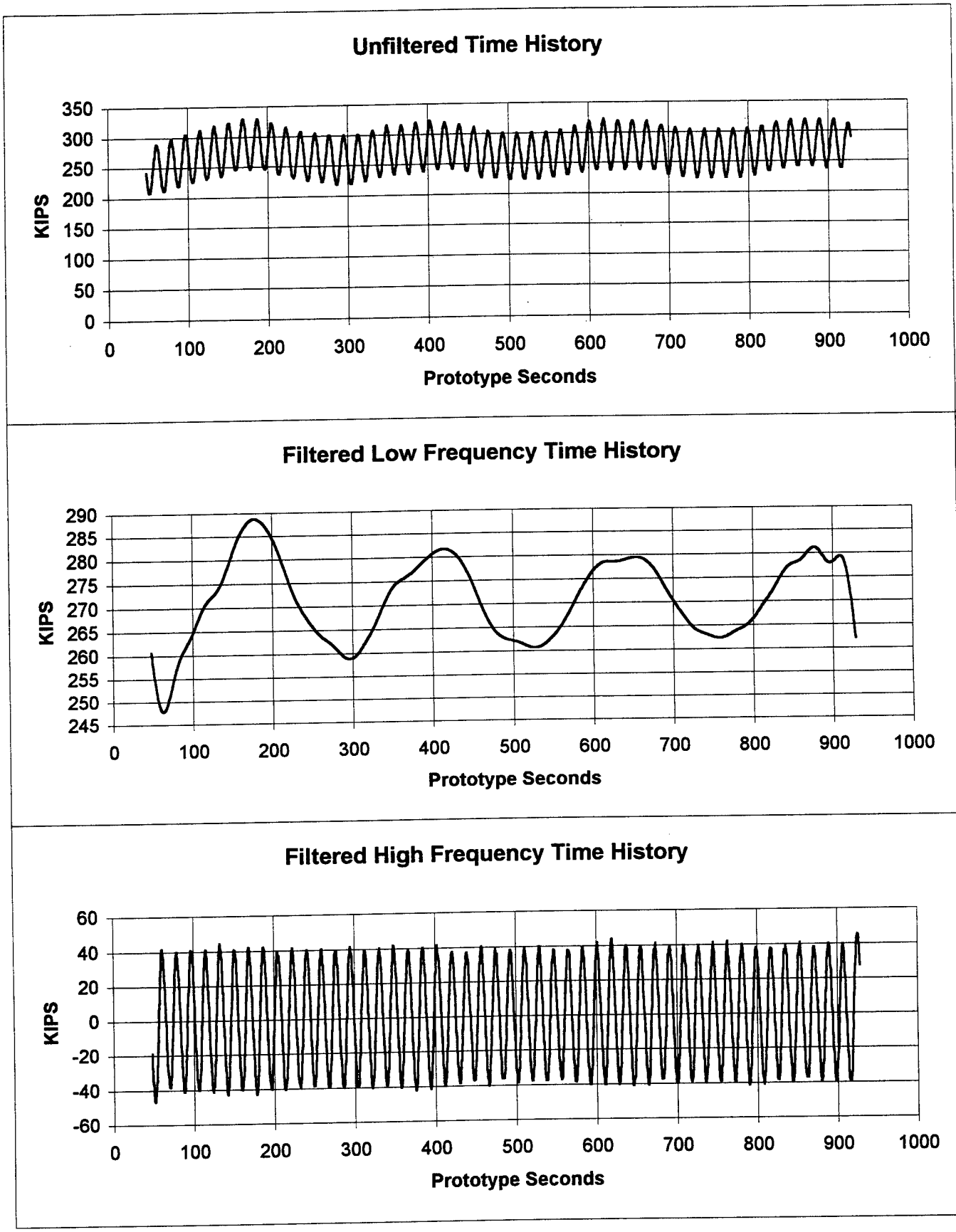
TEST A1006 - PT HEAVE



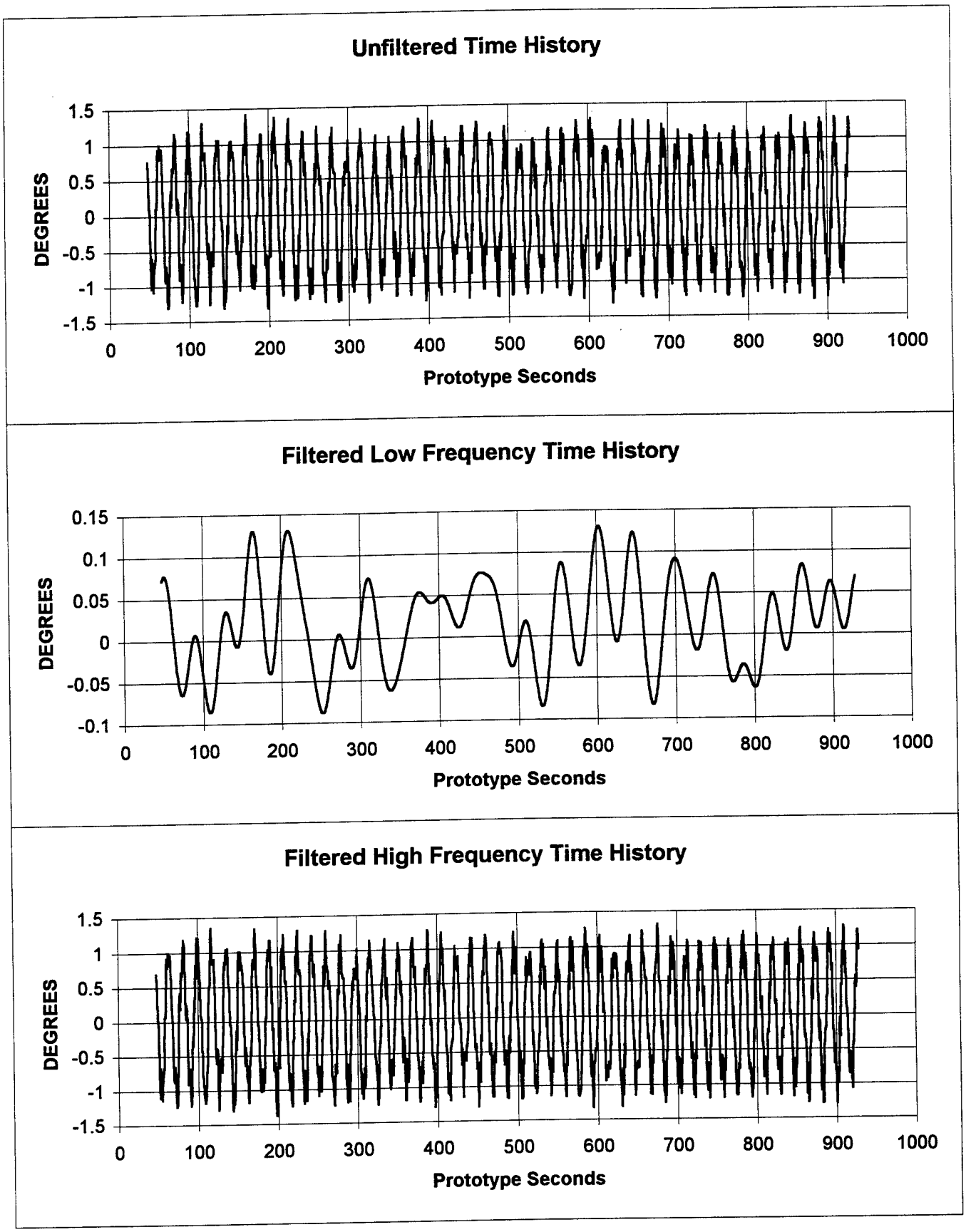




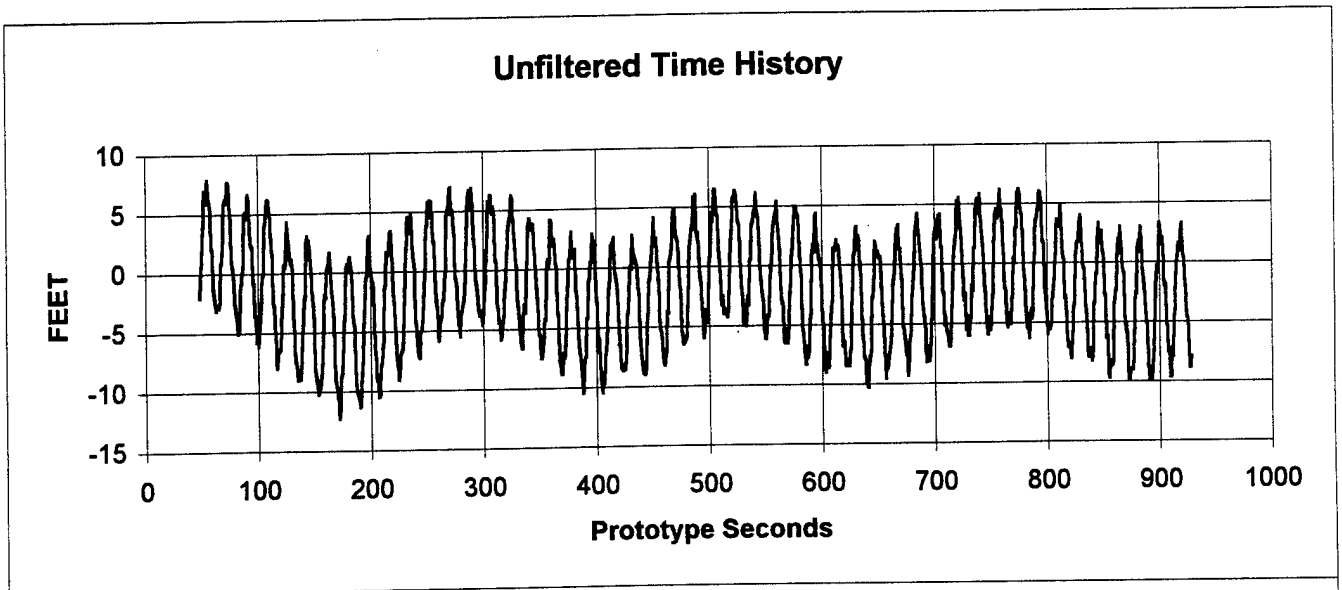
TEST A1007 - ML_1 TENSION

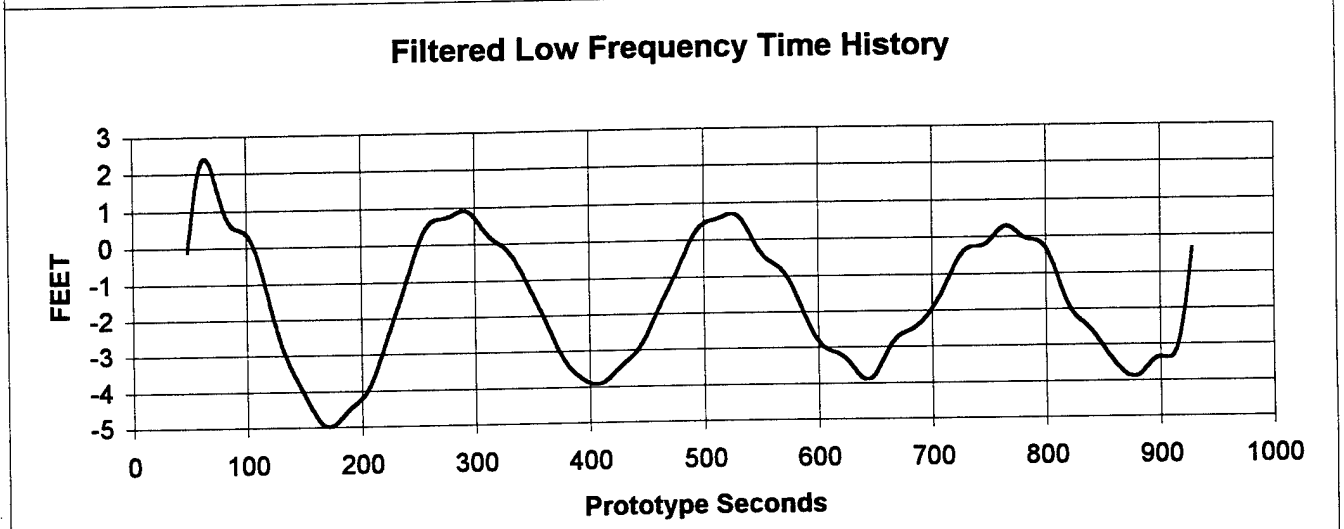


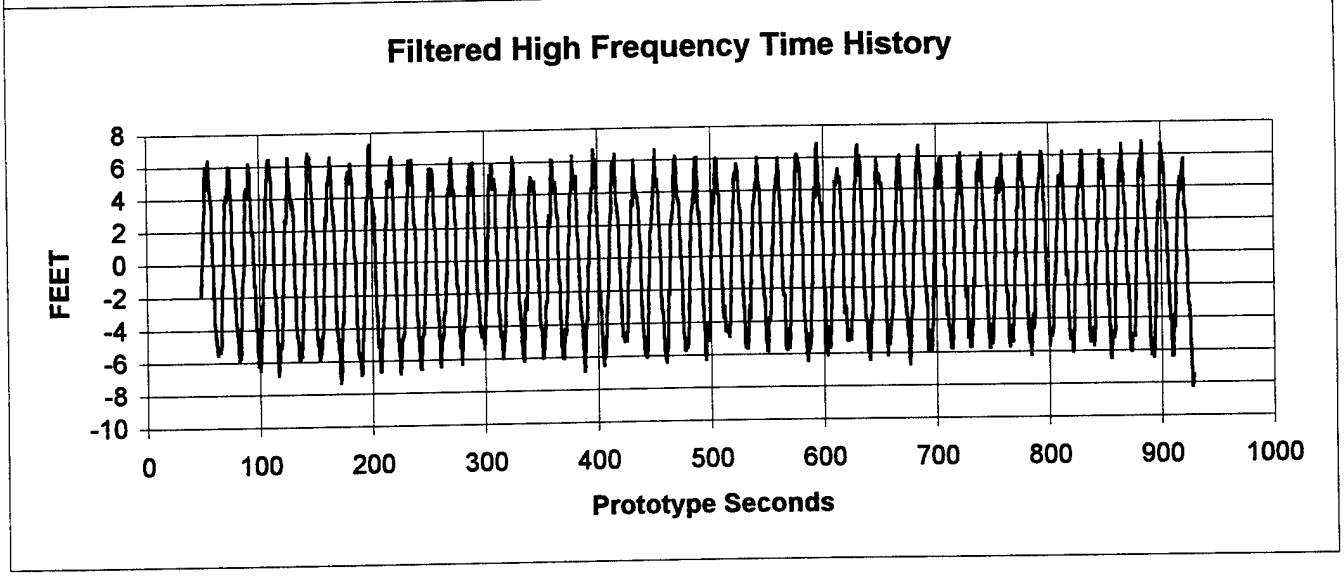
TEST A1007 - PITCH



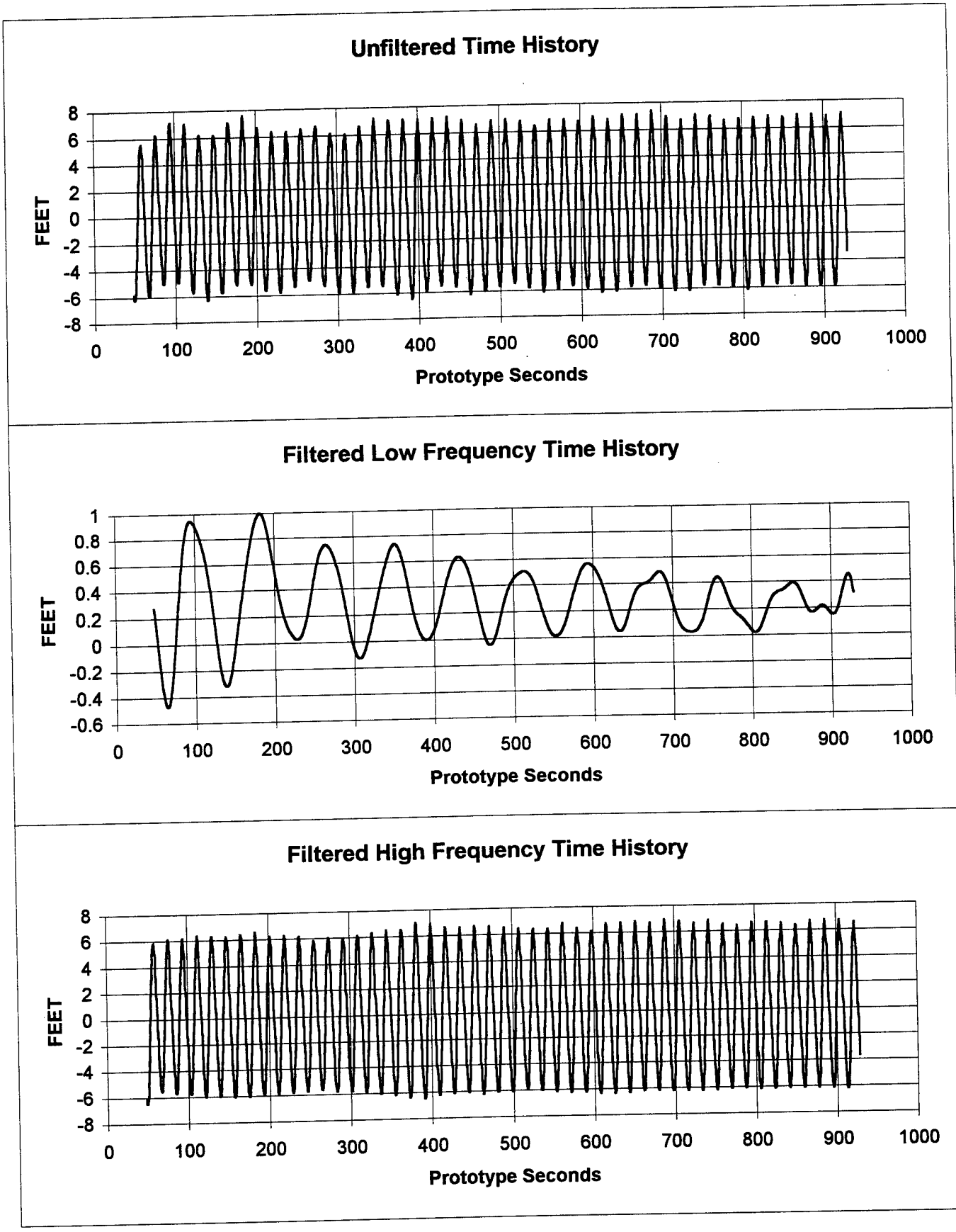
TEST A1007 - PT SURGE



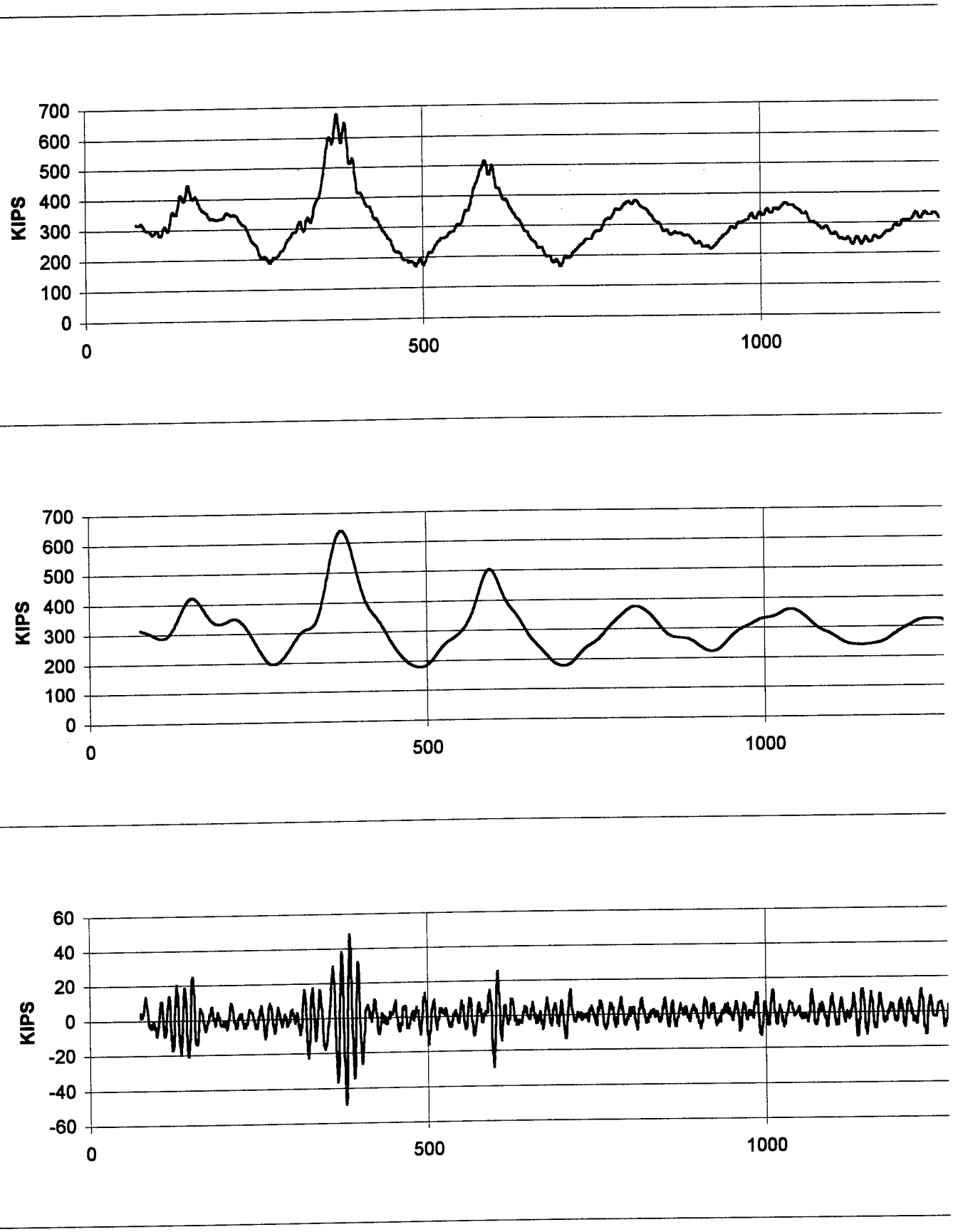




TEST A1007 - PT HEAVE

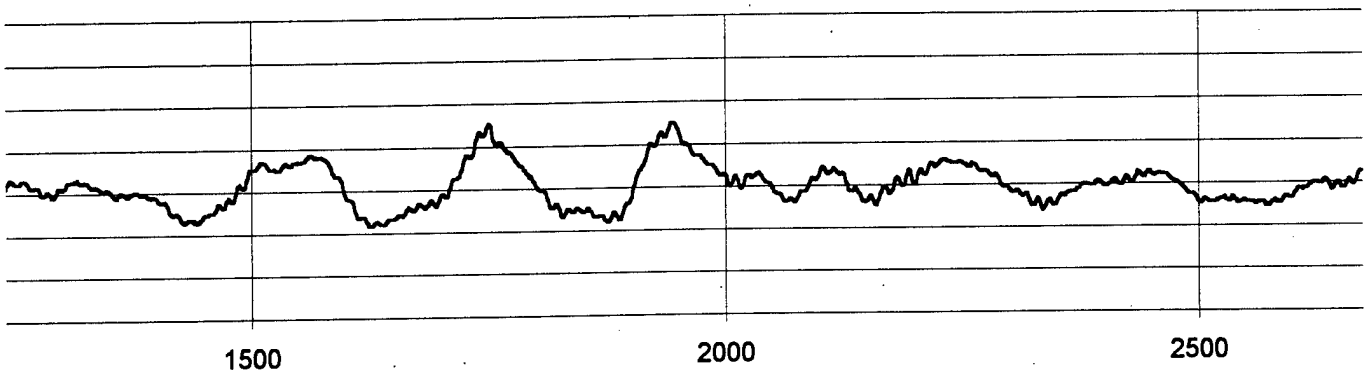


TEST A1008 - ML_1 TENSION

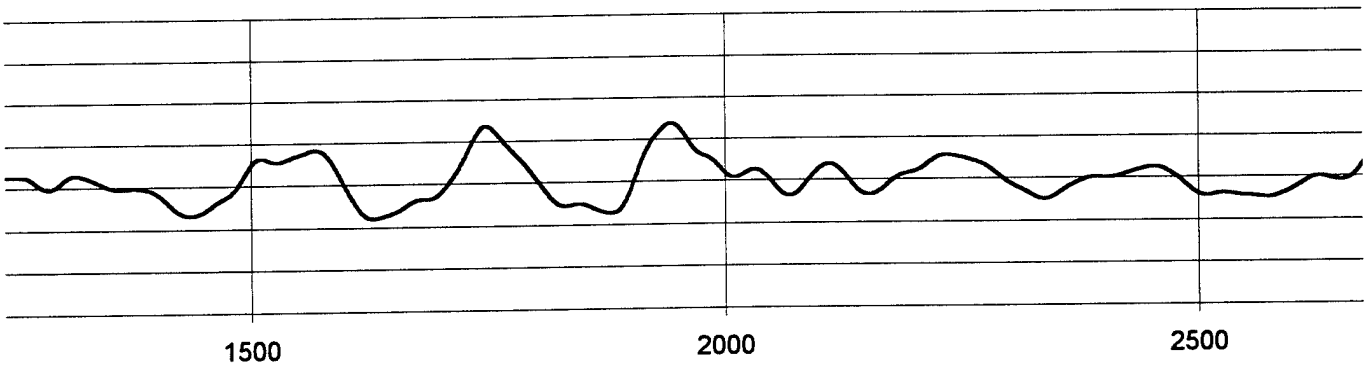


TEST A1008 - ML_1 TENSION

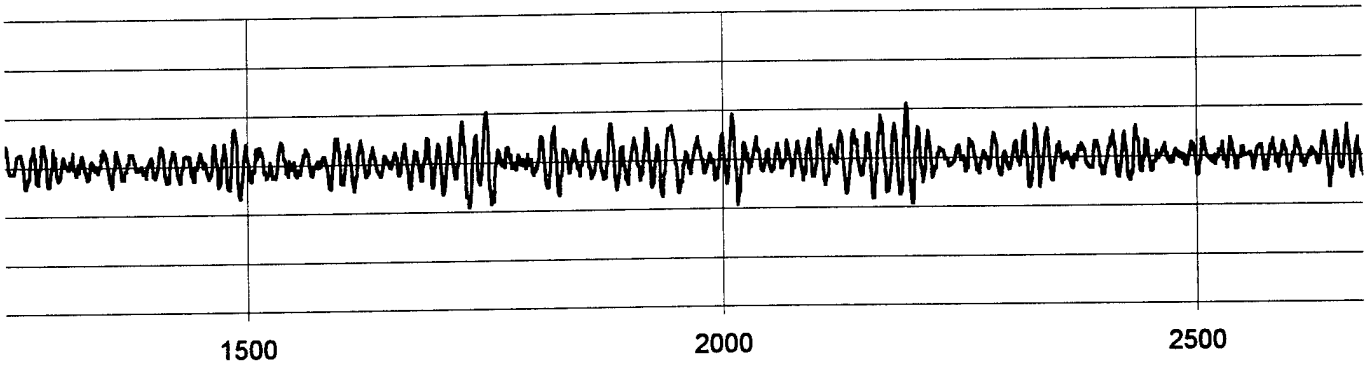
Unfiltered Time History



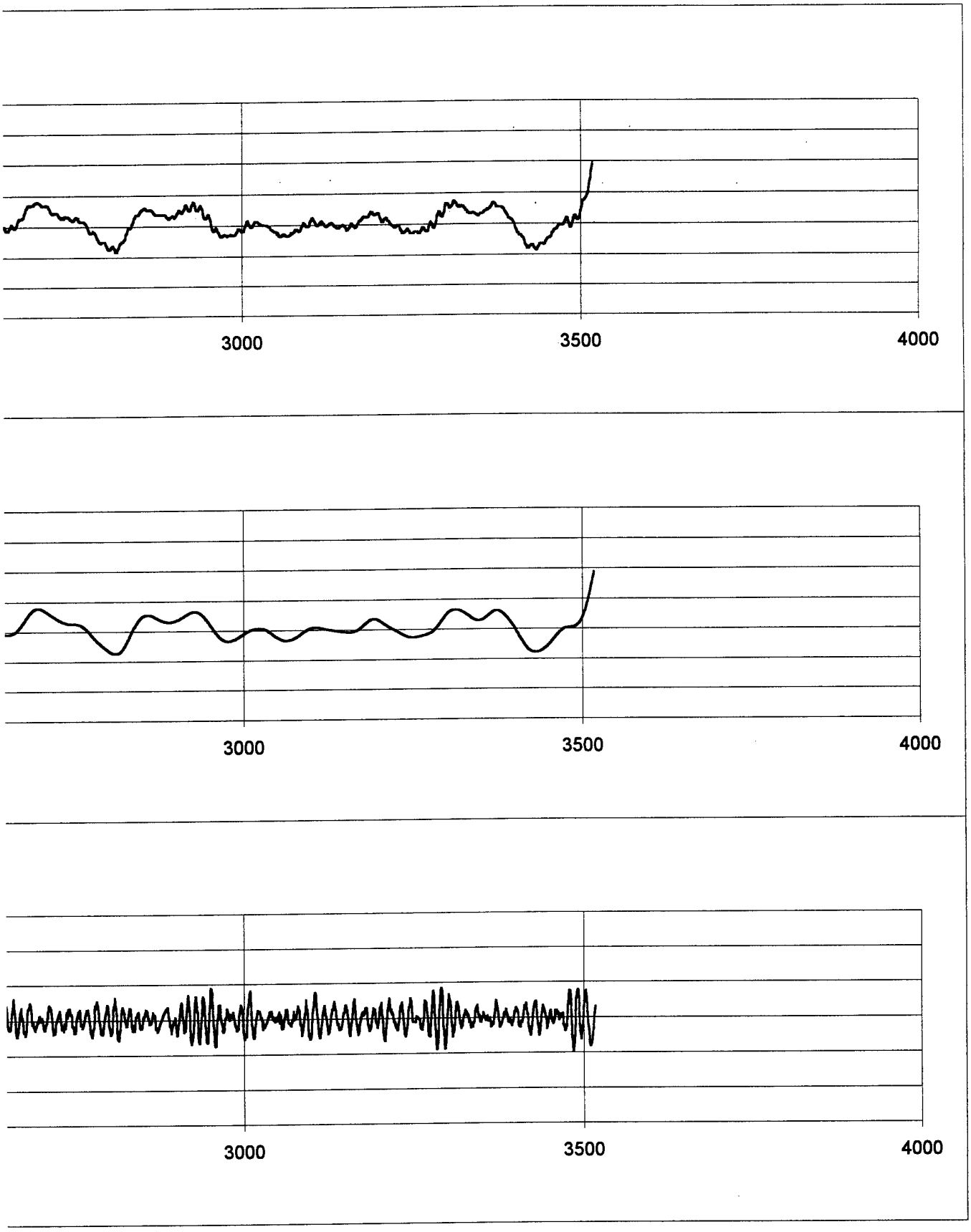
Filtered Low Frequency Time History



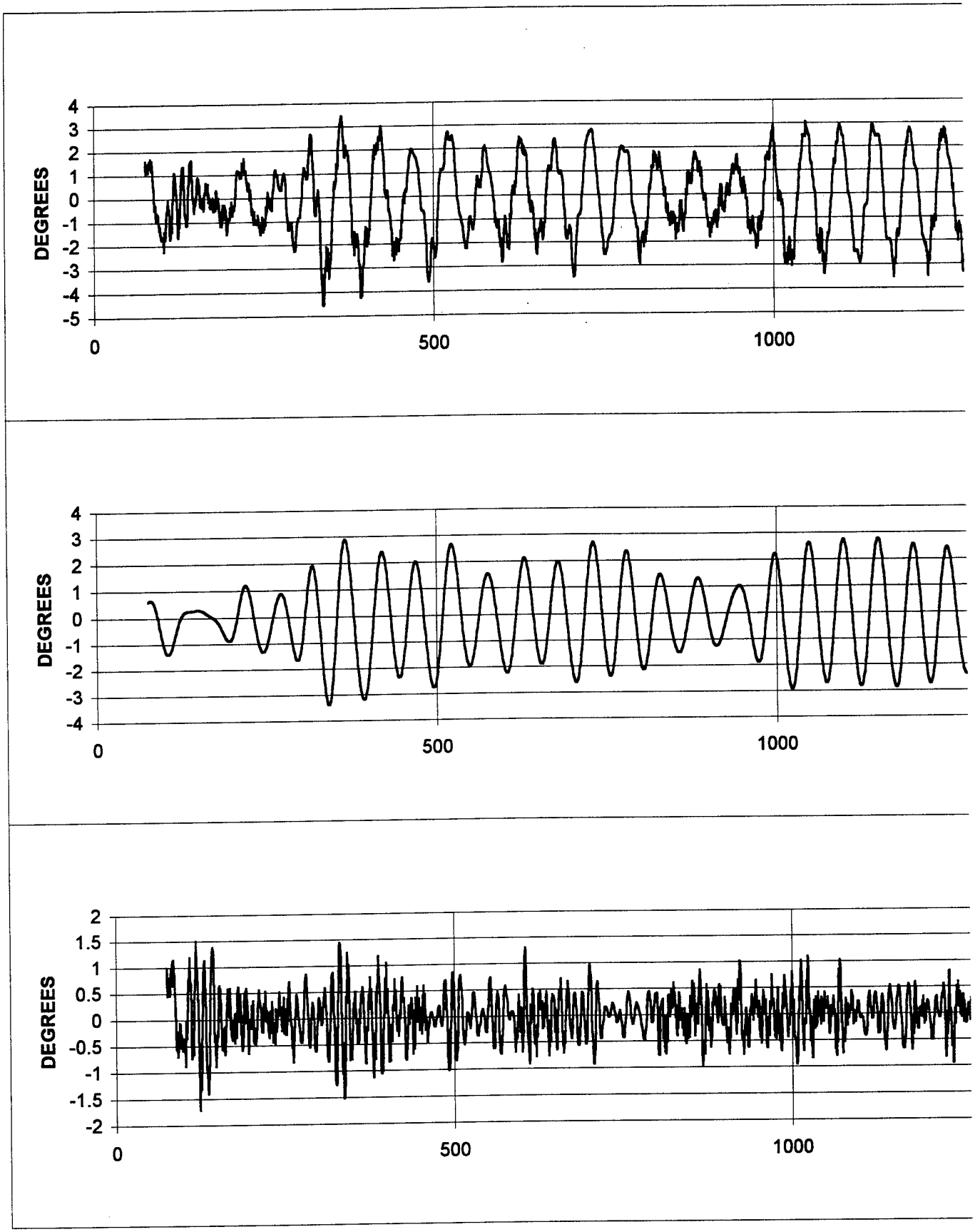
Filtered High Frequency Time History



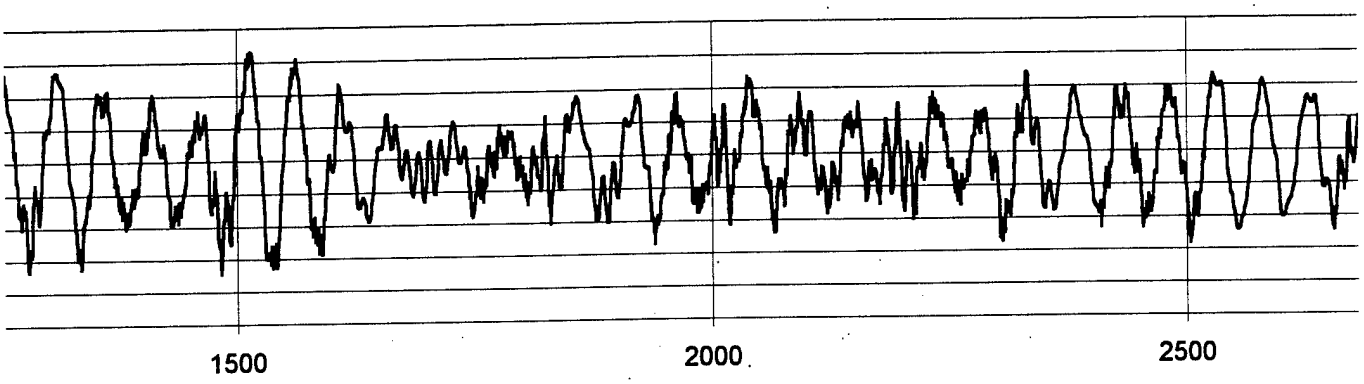
TEST A1008 - ML_1 TENSION



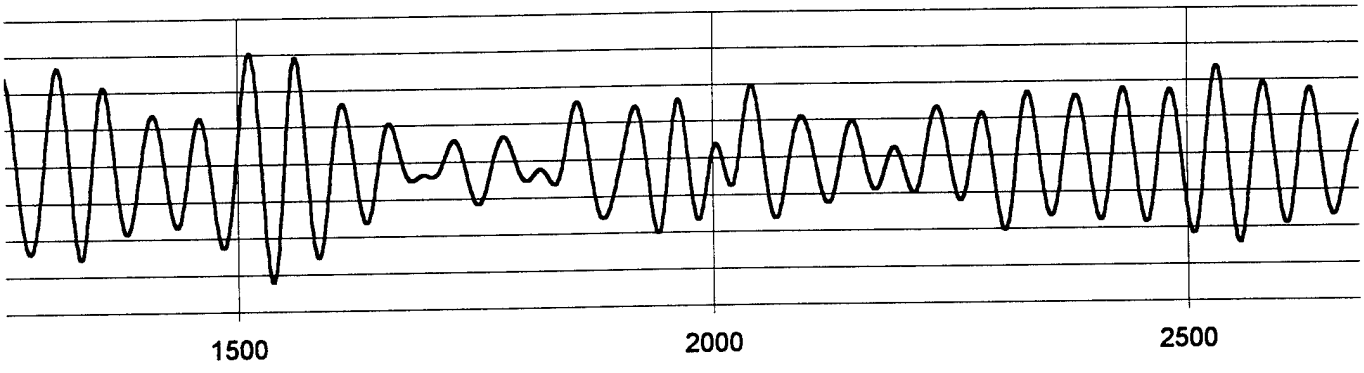
TEST A1008 - PITCH



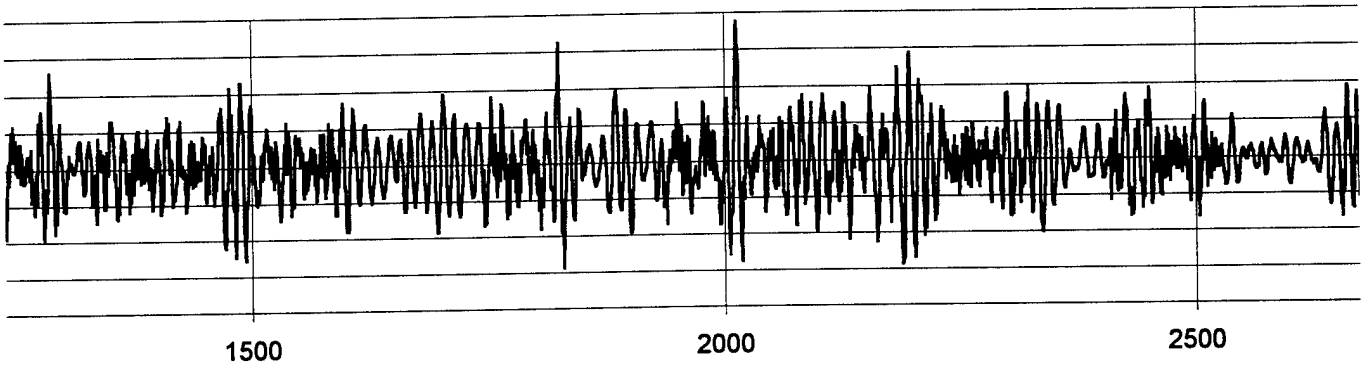
Unfiltered Time History



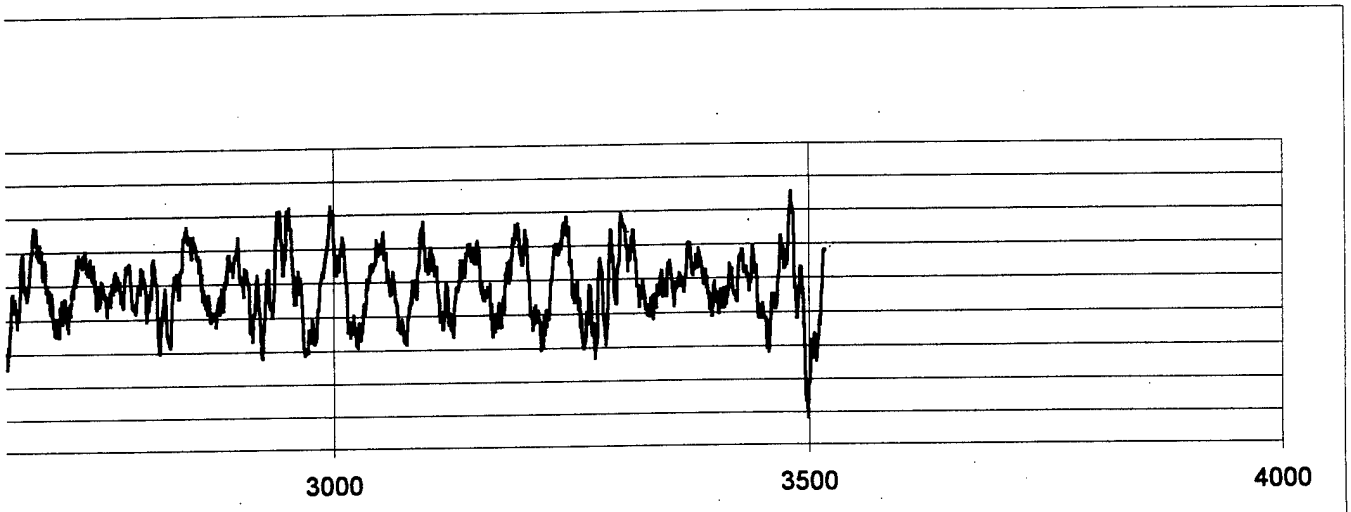
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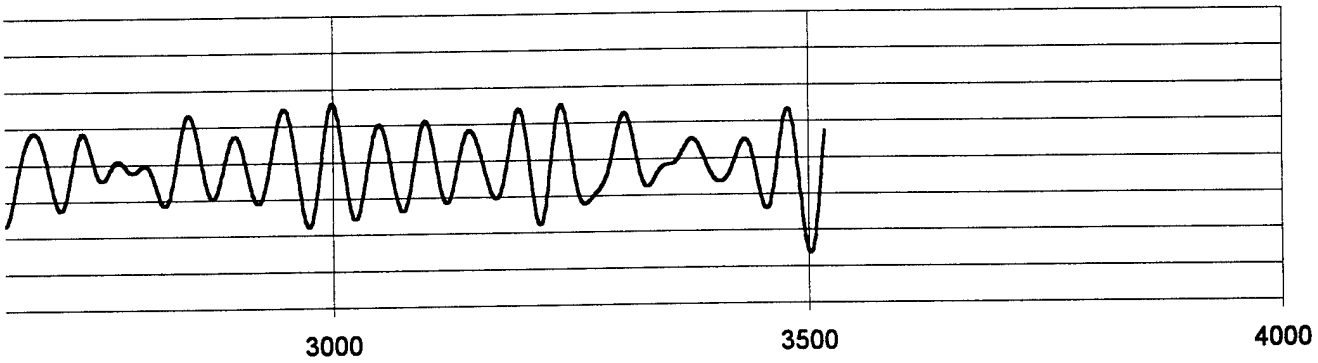


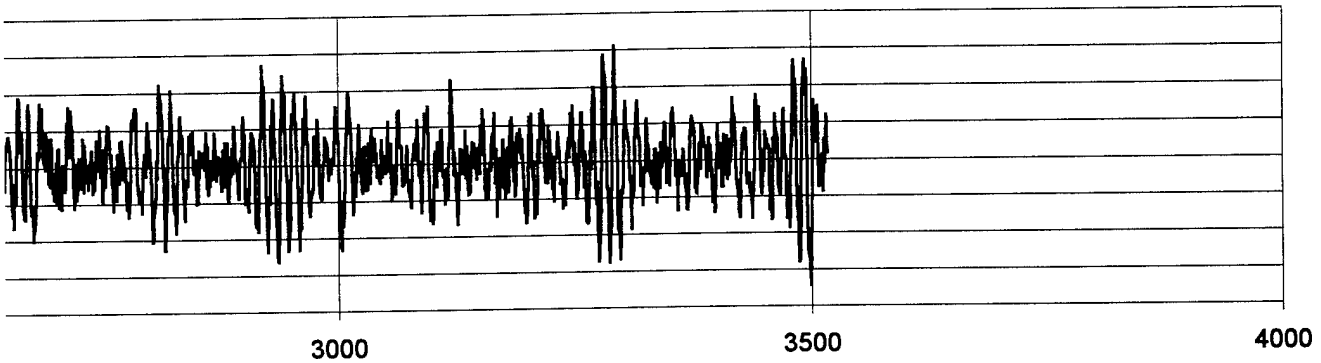
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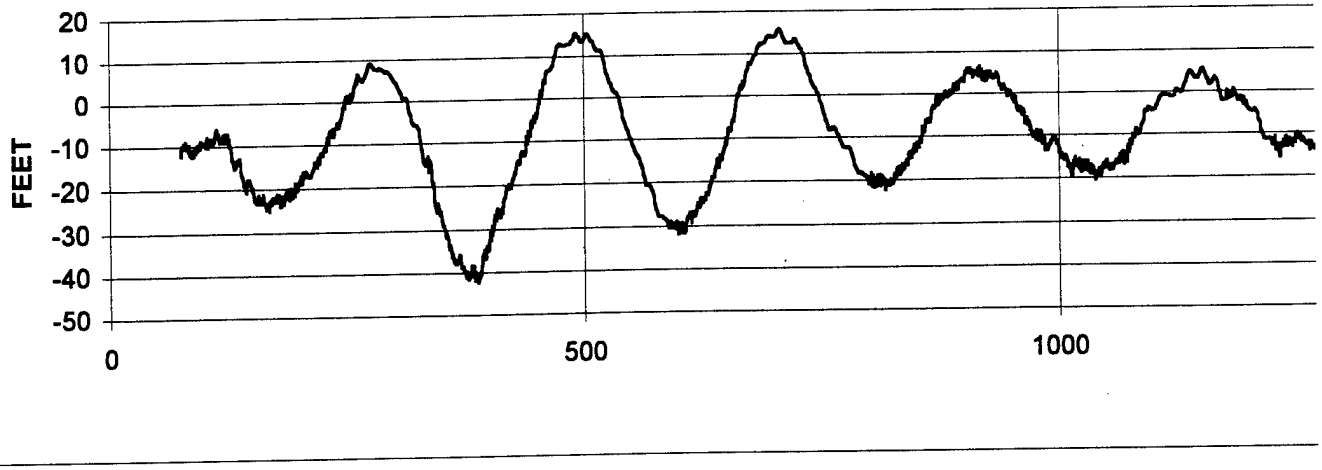
TEST A1008 - PITCH

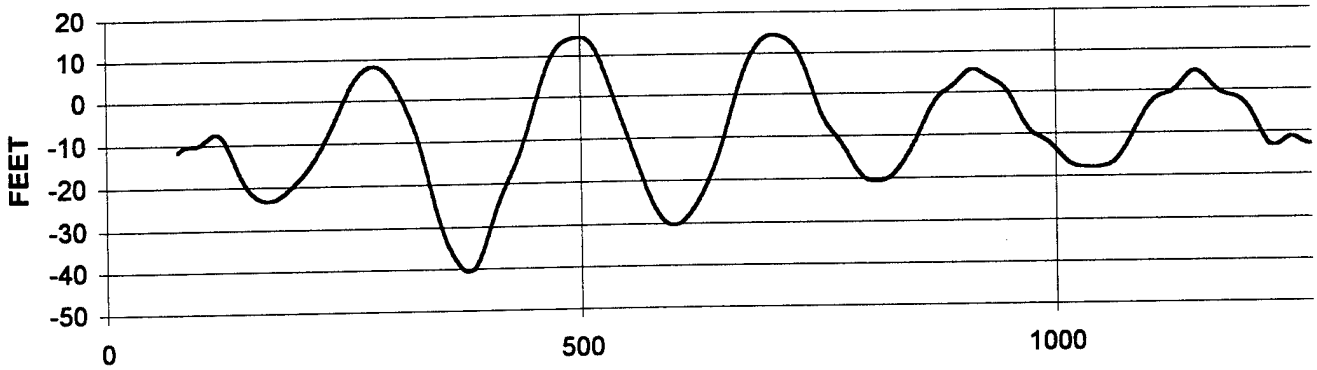


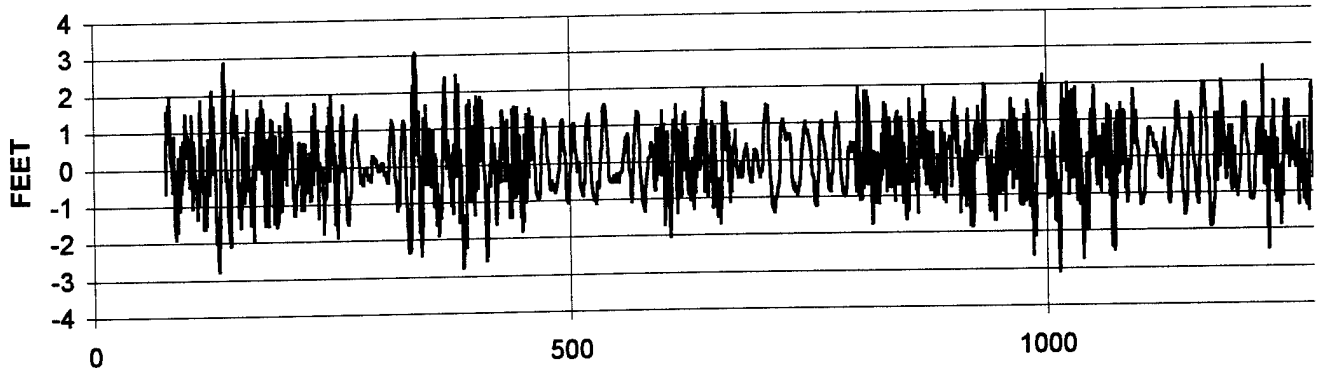




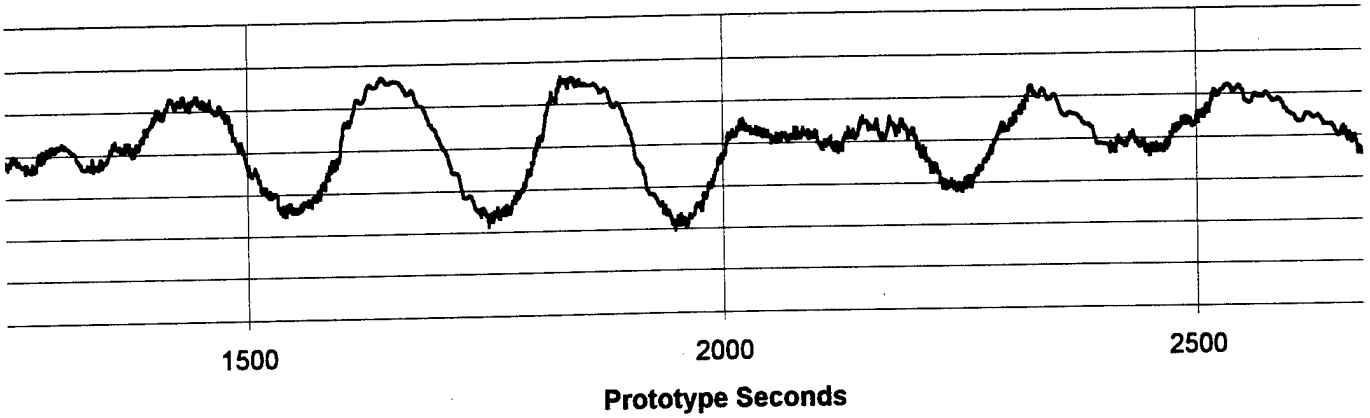
TEST A1008 - PT SURGE



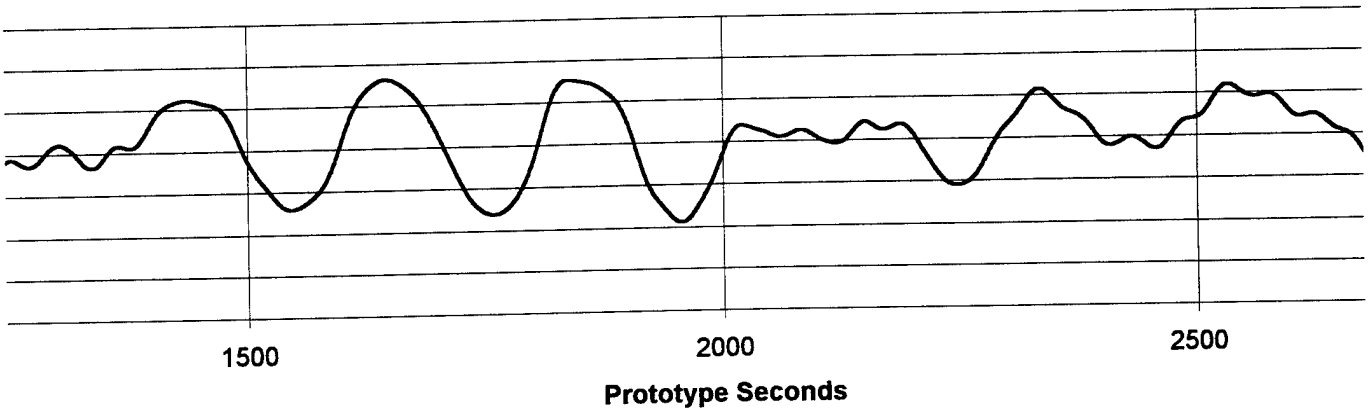




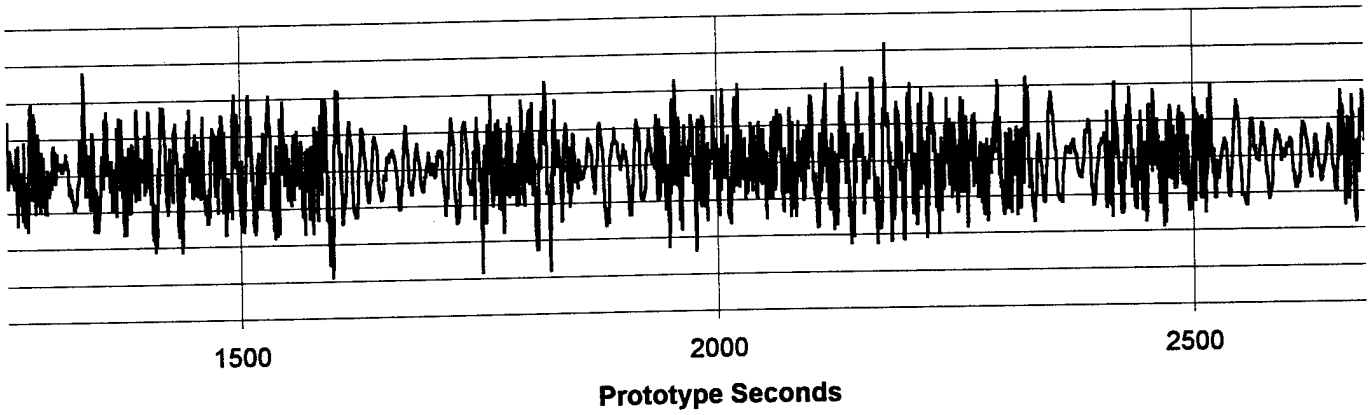
Unfiltered Time History



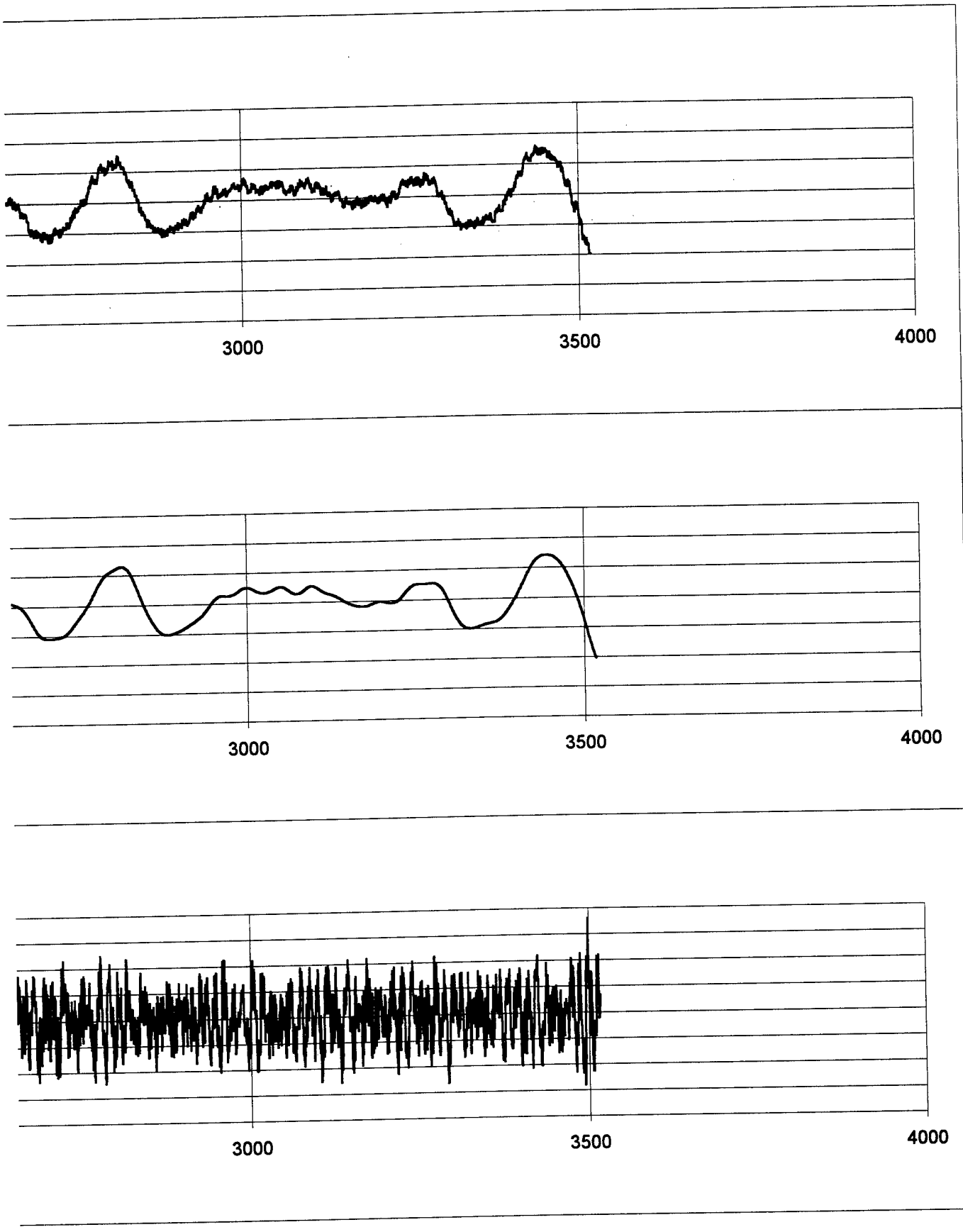
Filtered Low Frequency Time History



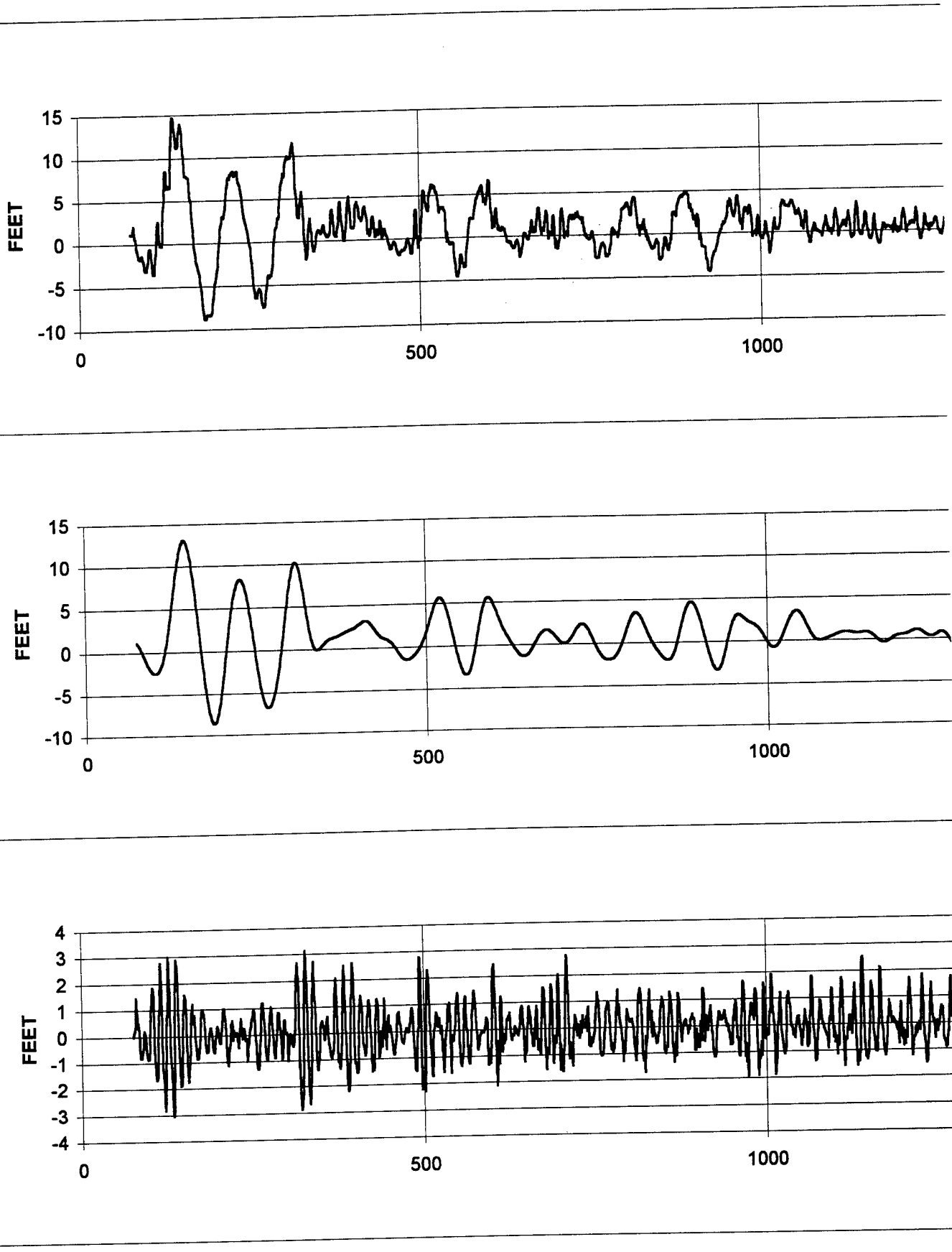
Filtered High Frequency Time History



TEST A1008 - PT SURGE

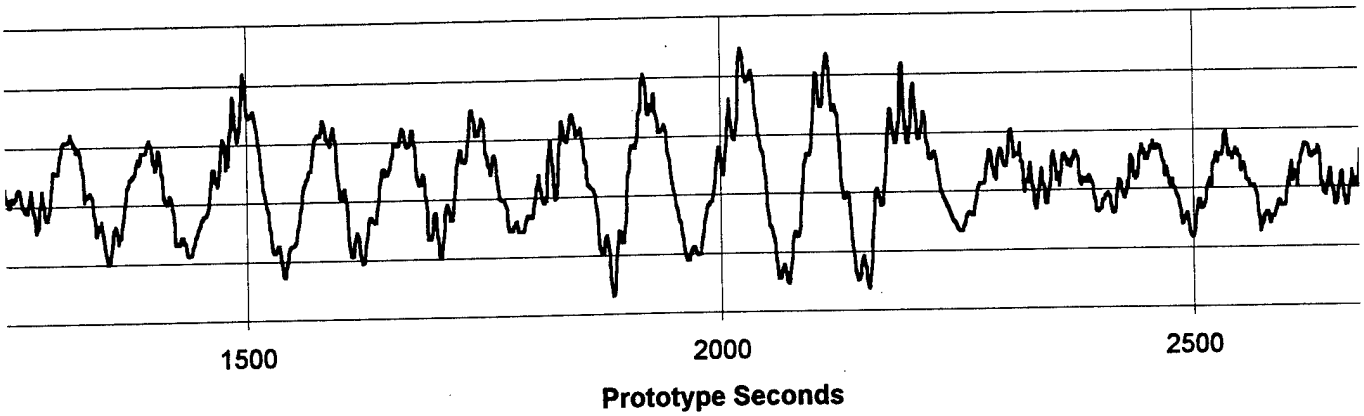


TEST A1008 - PT HEAVE

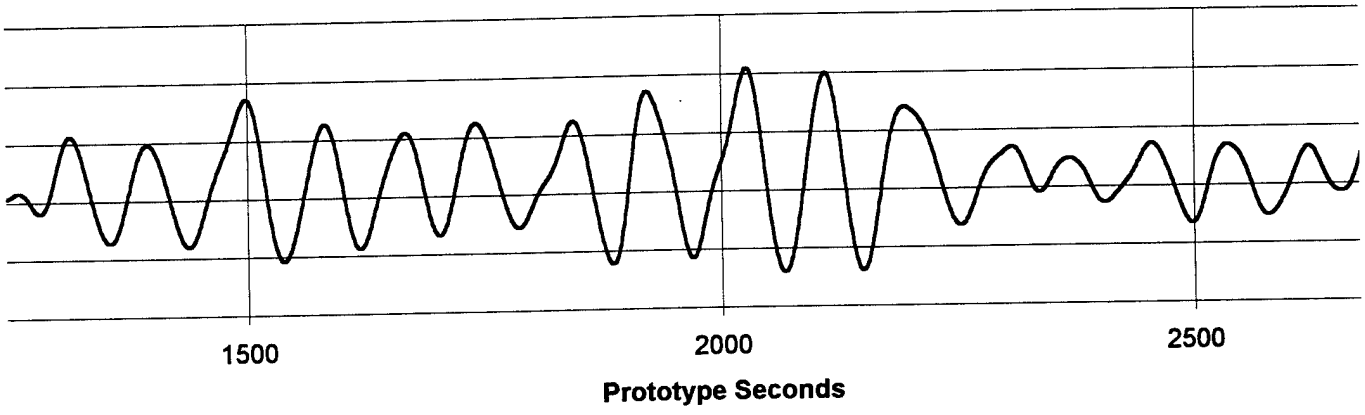


TEST A1008 - PT HEAVE

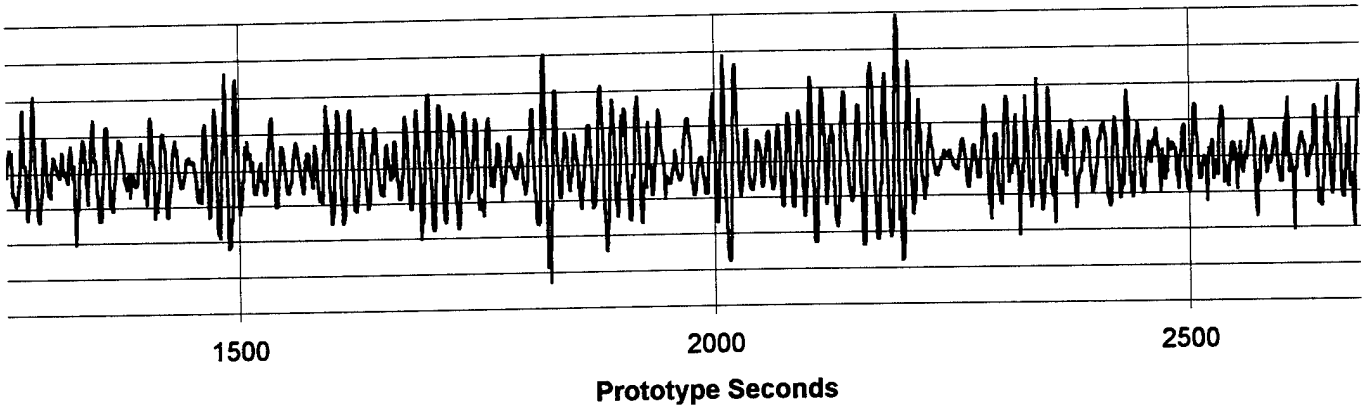
Unfiltered Time History



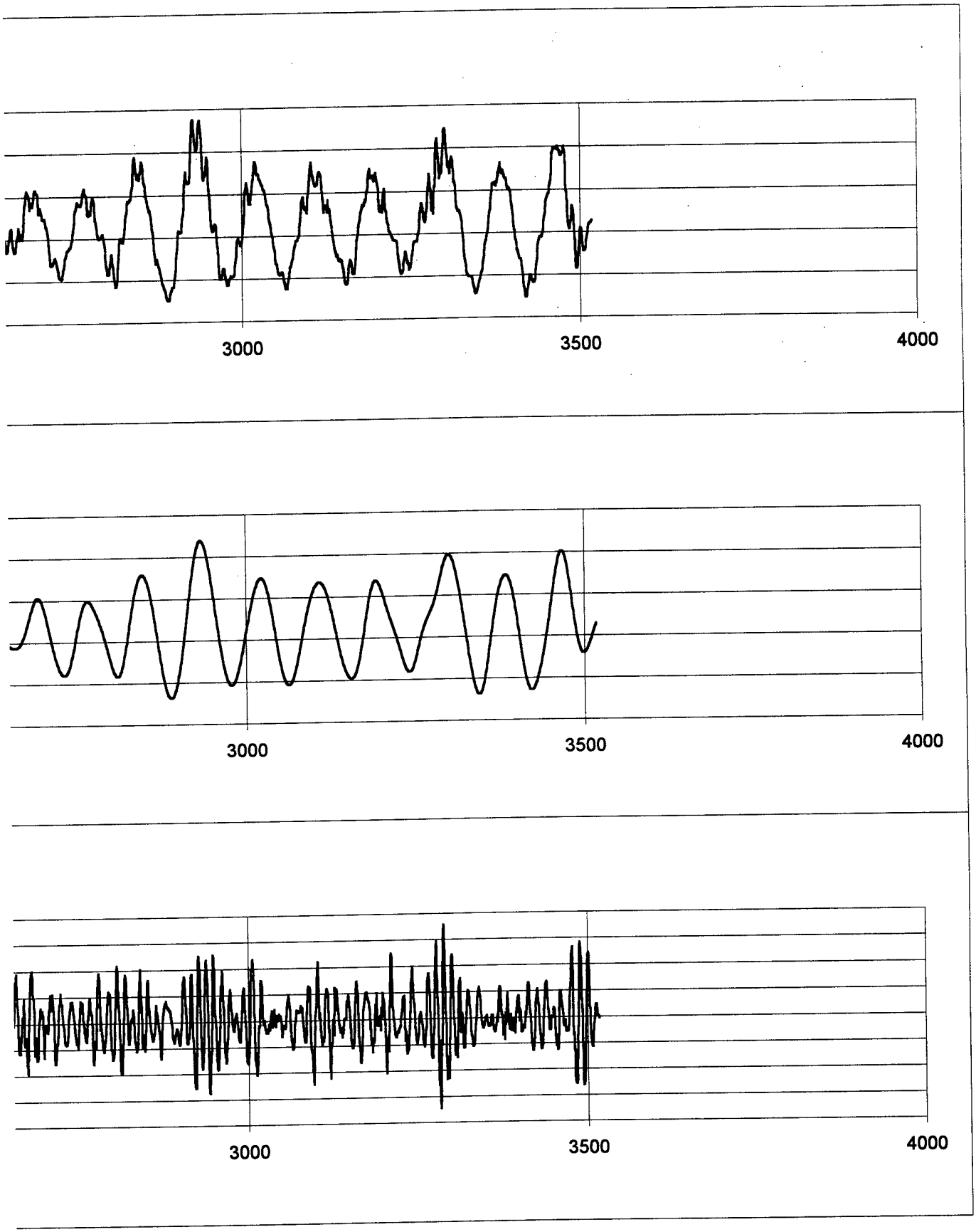
Filtered Low Frequency Time History



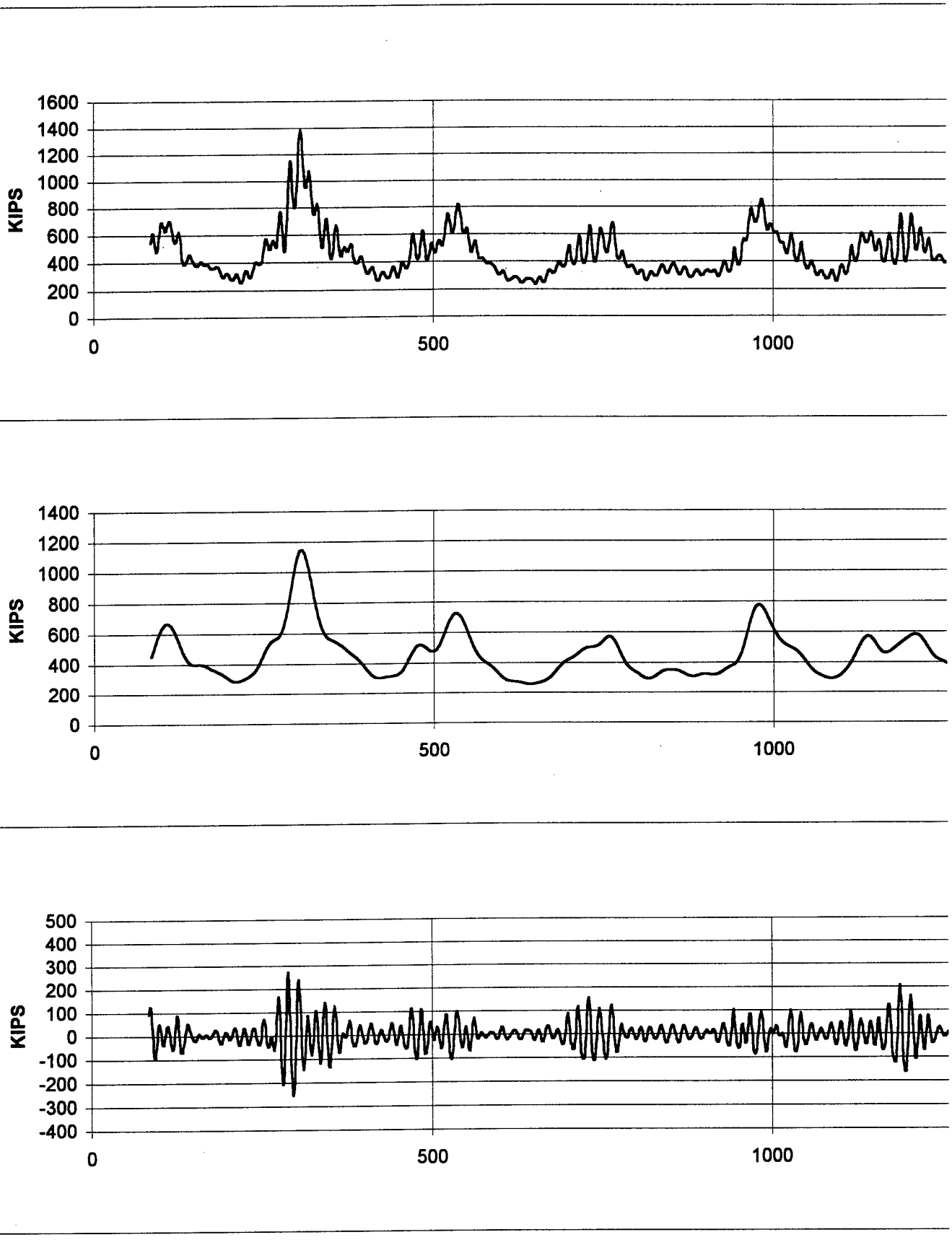
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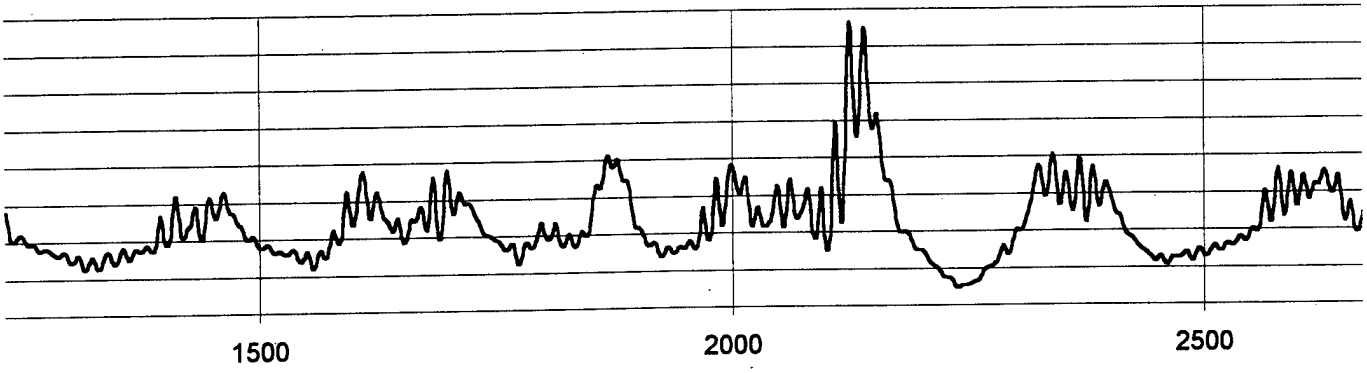


TEST A1009 - ML_1 TENSION

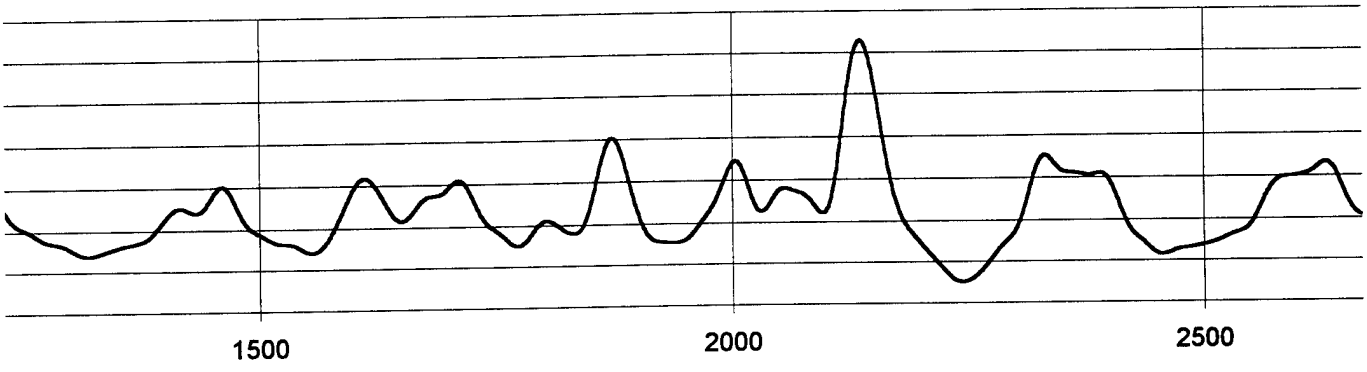


TEST A1009 - ML_1 TENSION

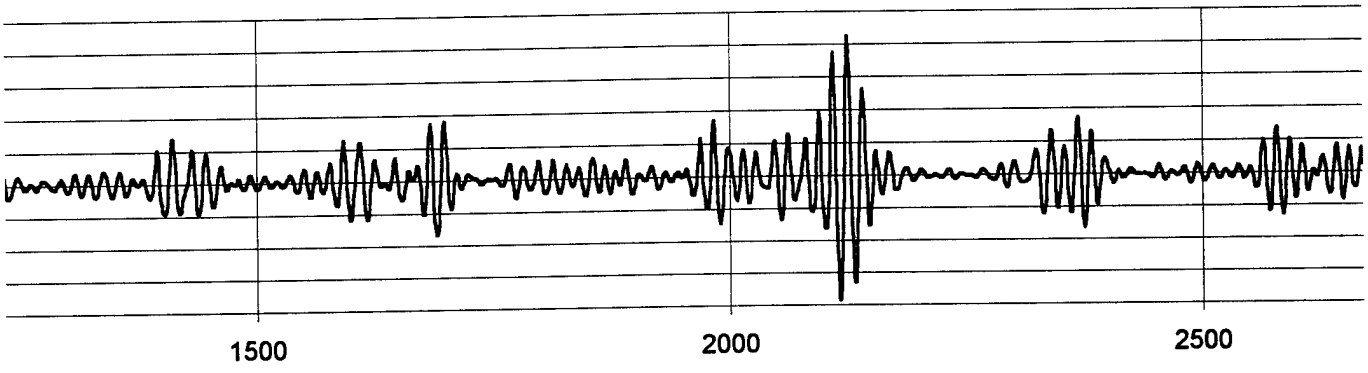
Unfiltered Time History



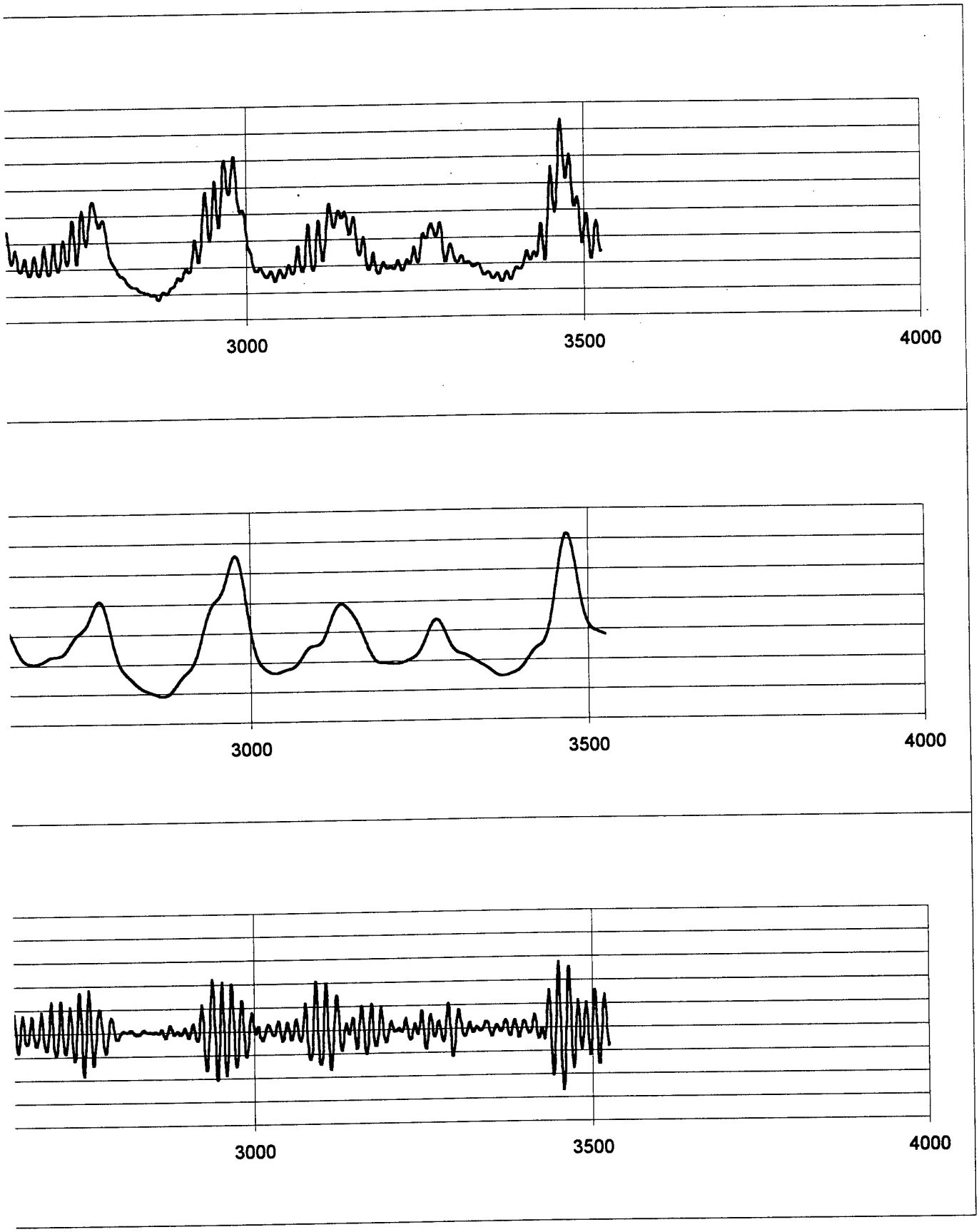
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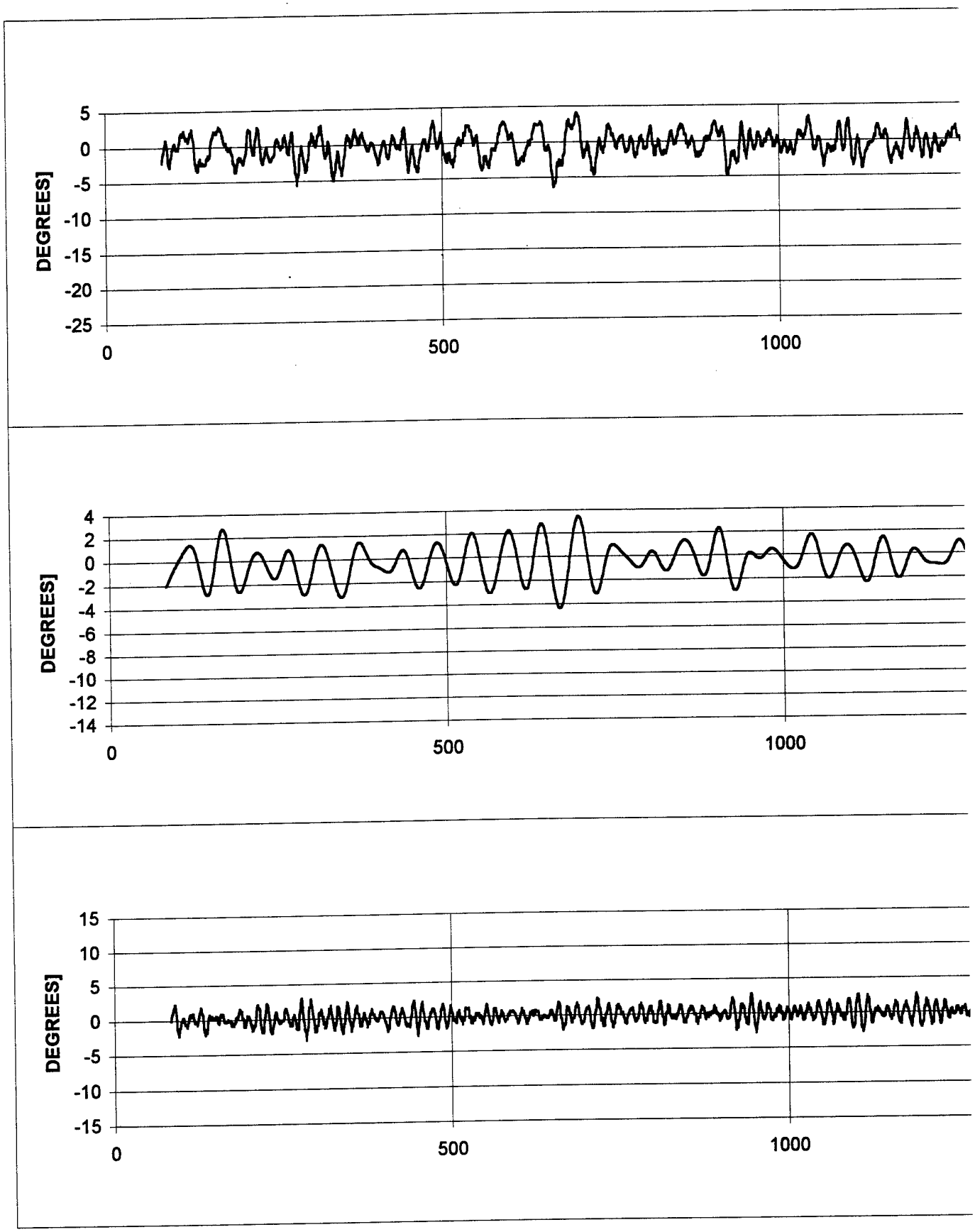
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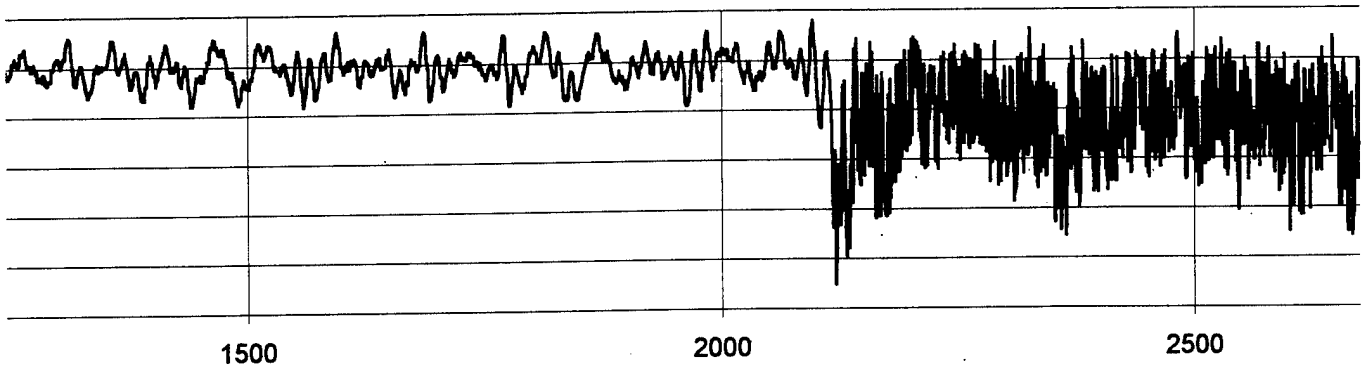
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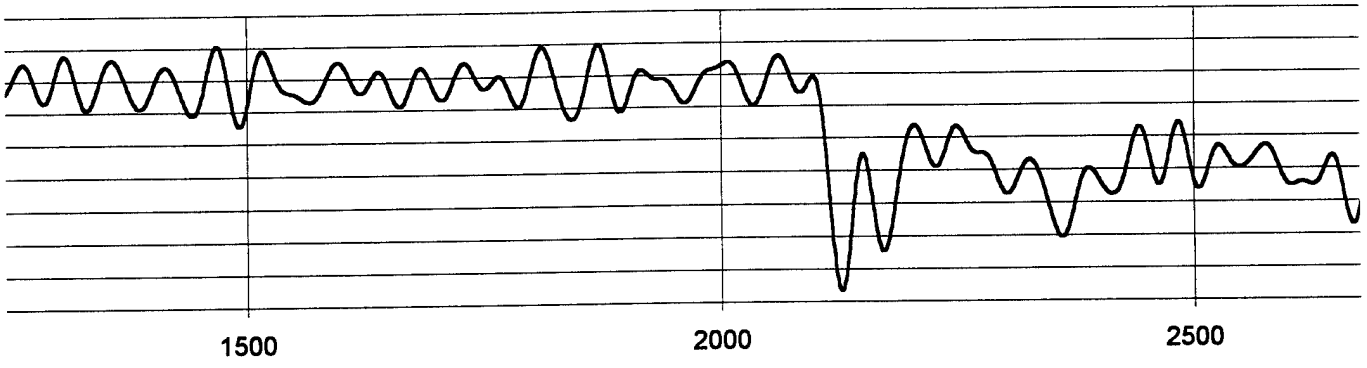
TEST A1009 - PITCH



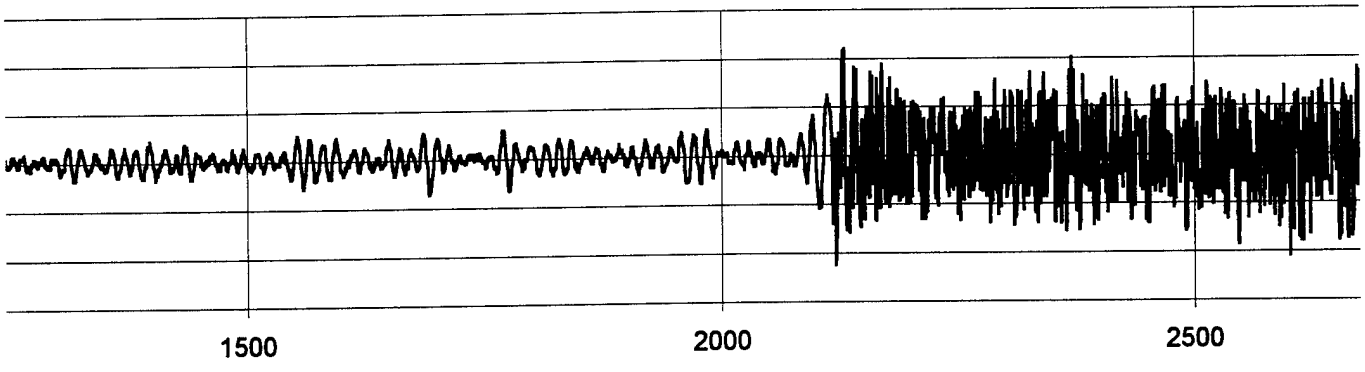
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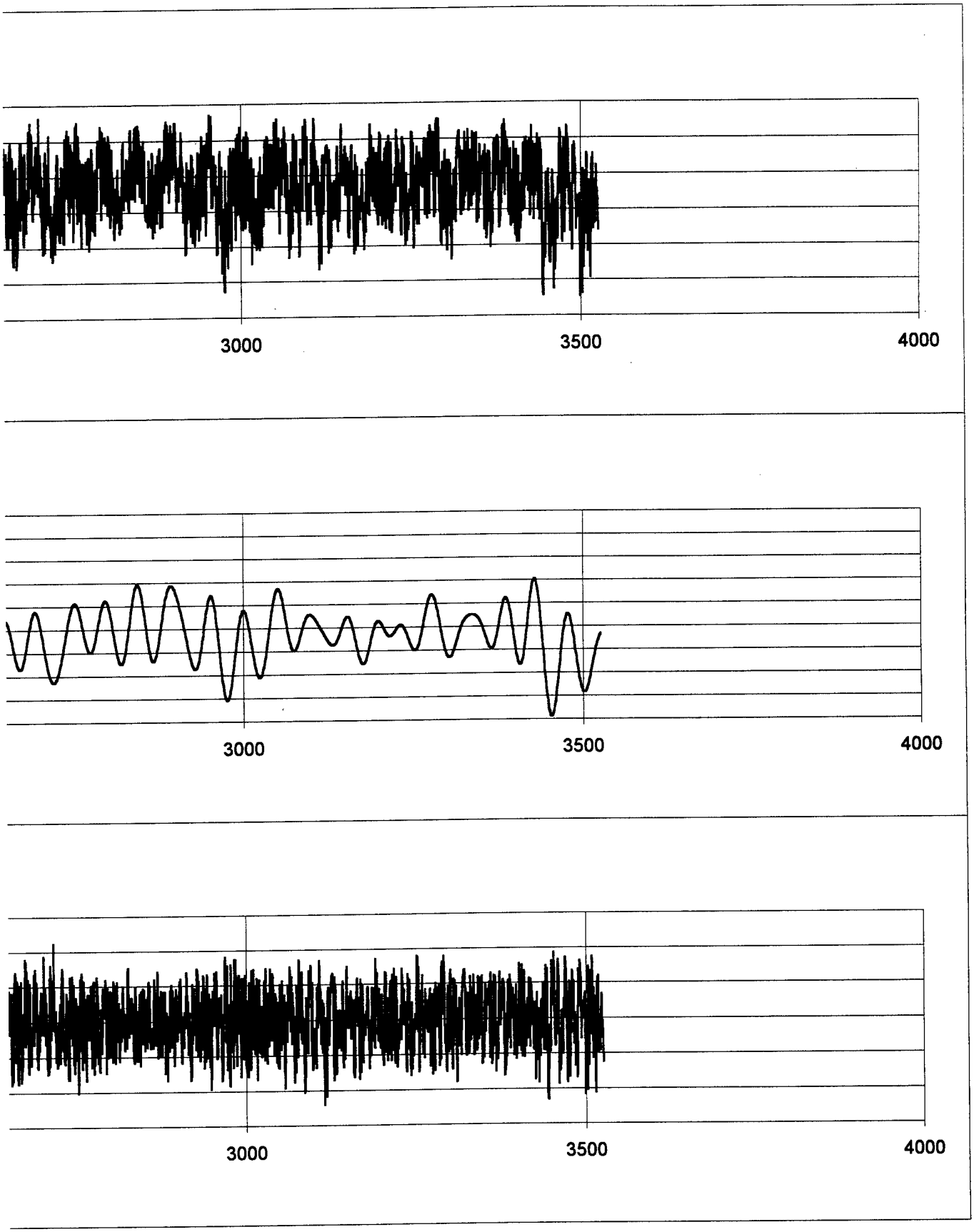
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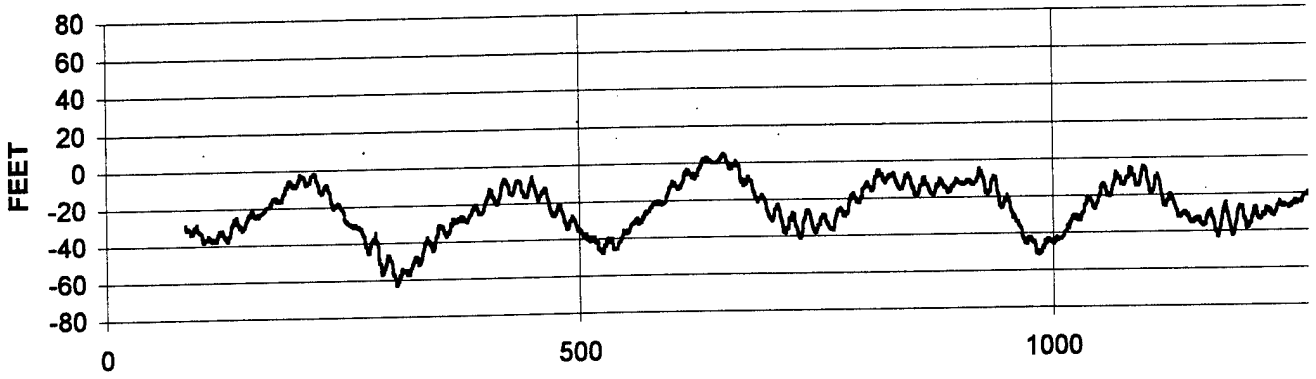
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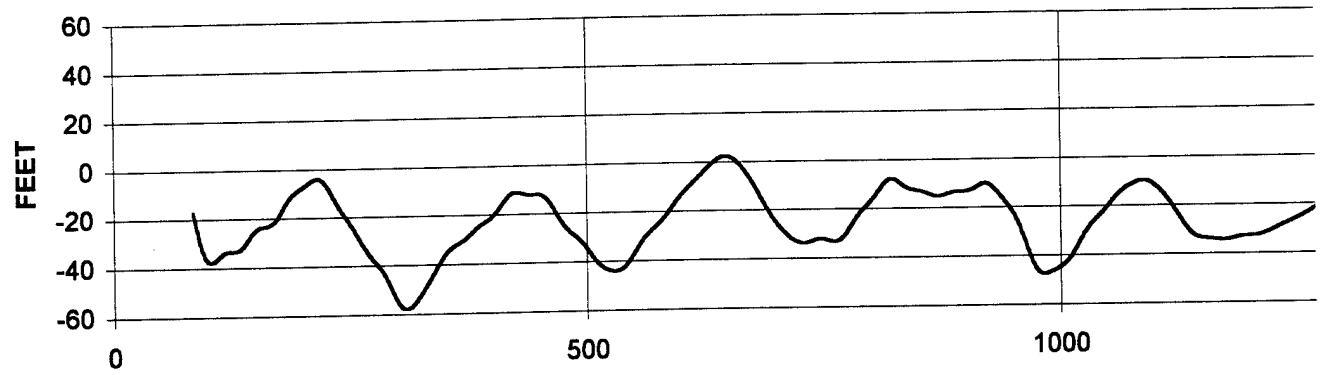


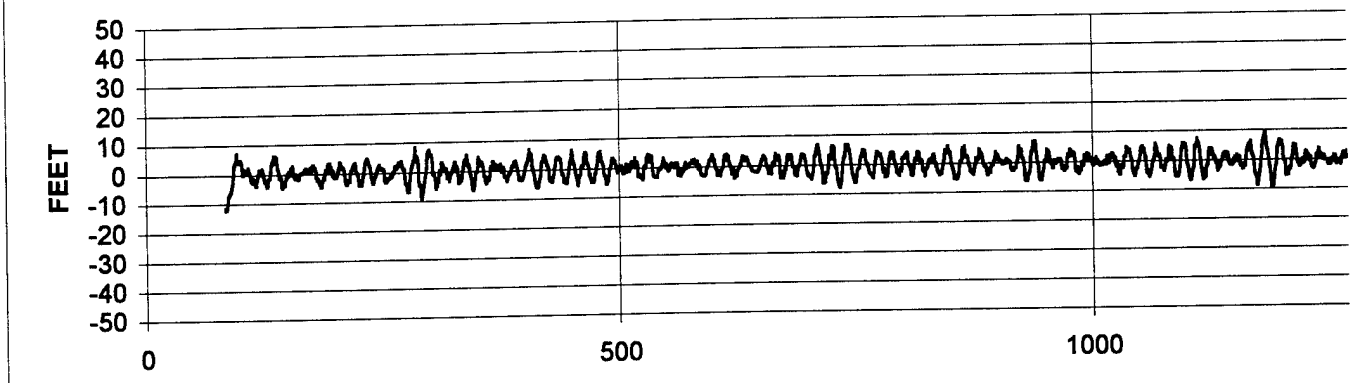
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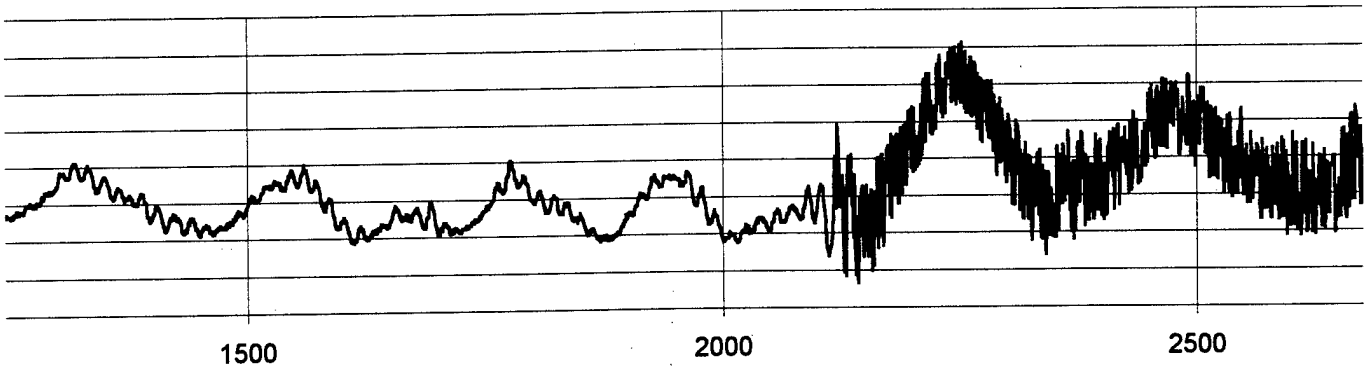
TEST A1009 - PT SURGE



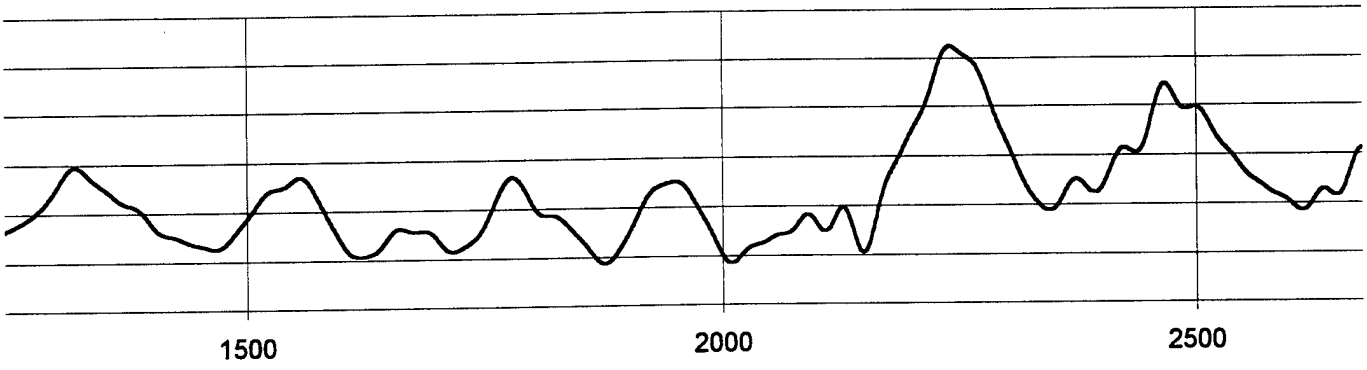




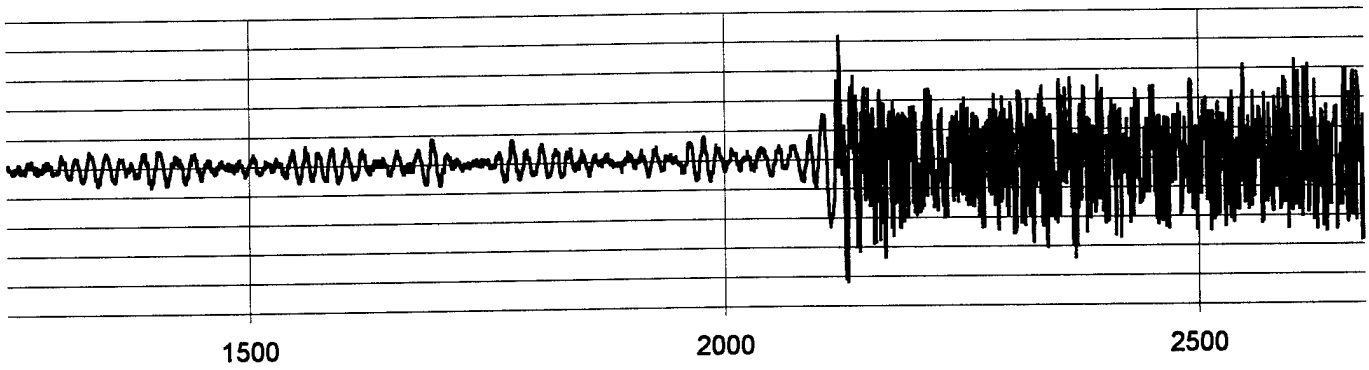
Unfiltered Time History



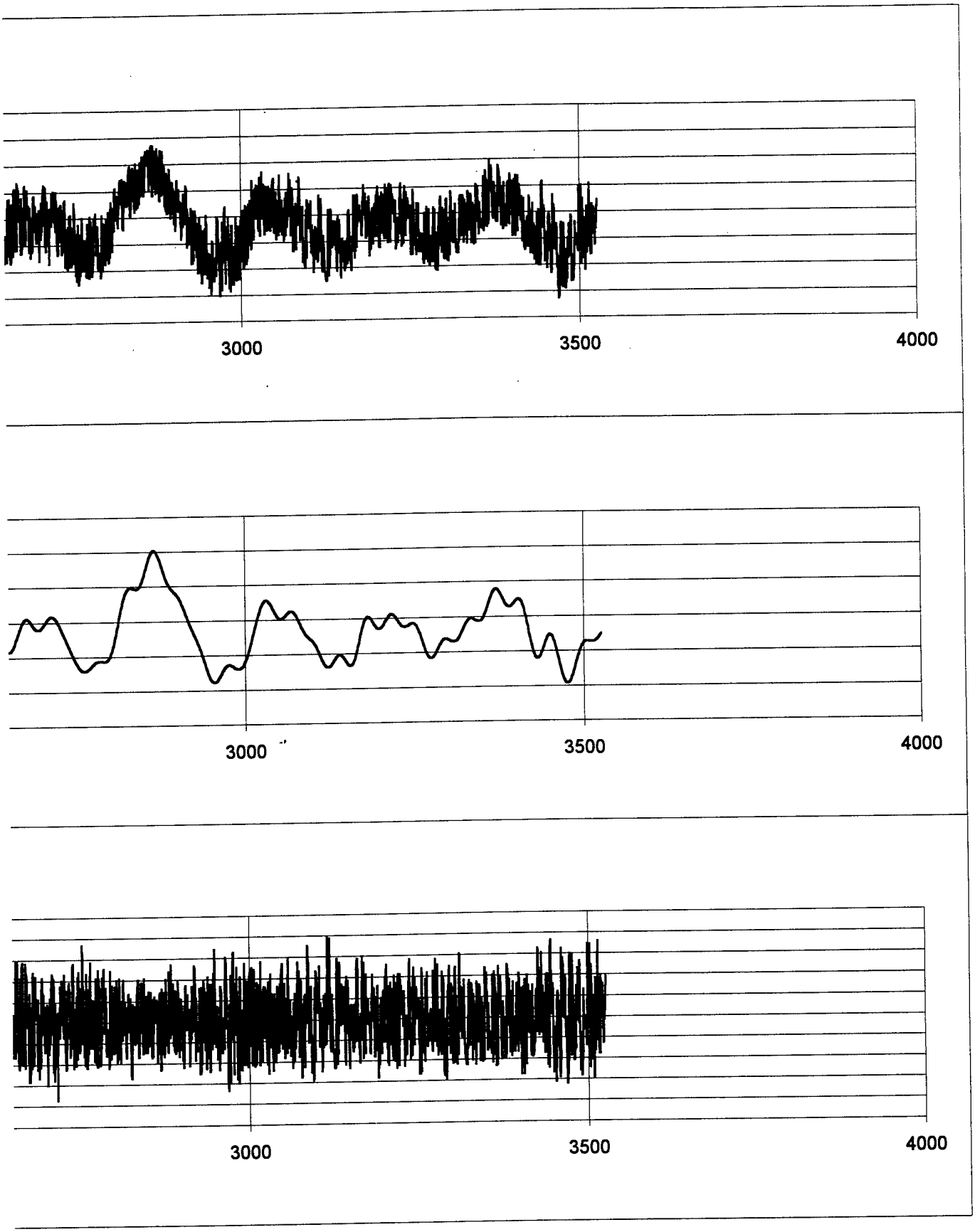
Filtered Low Frequency Time History



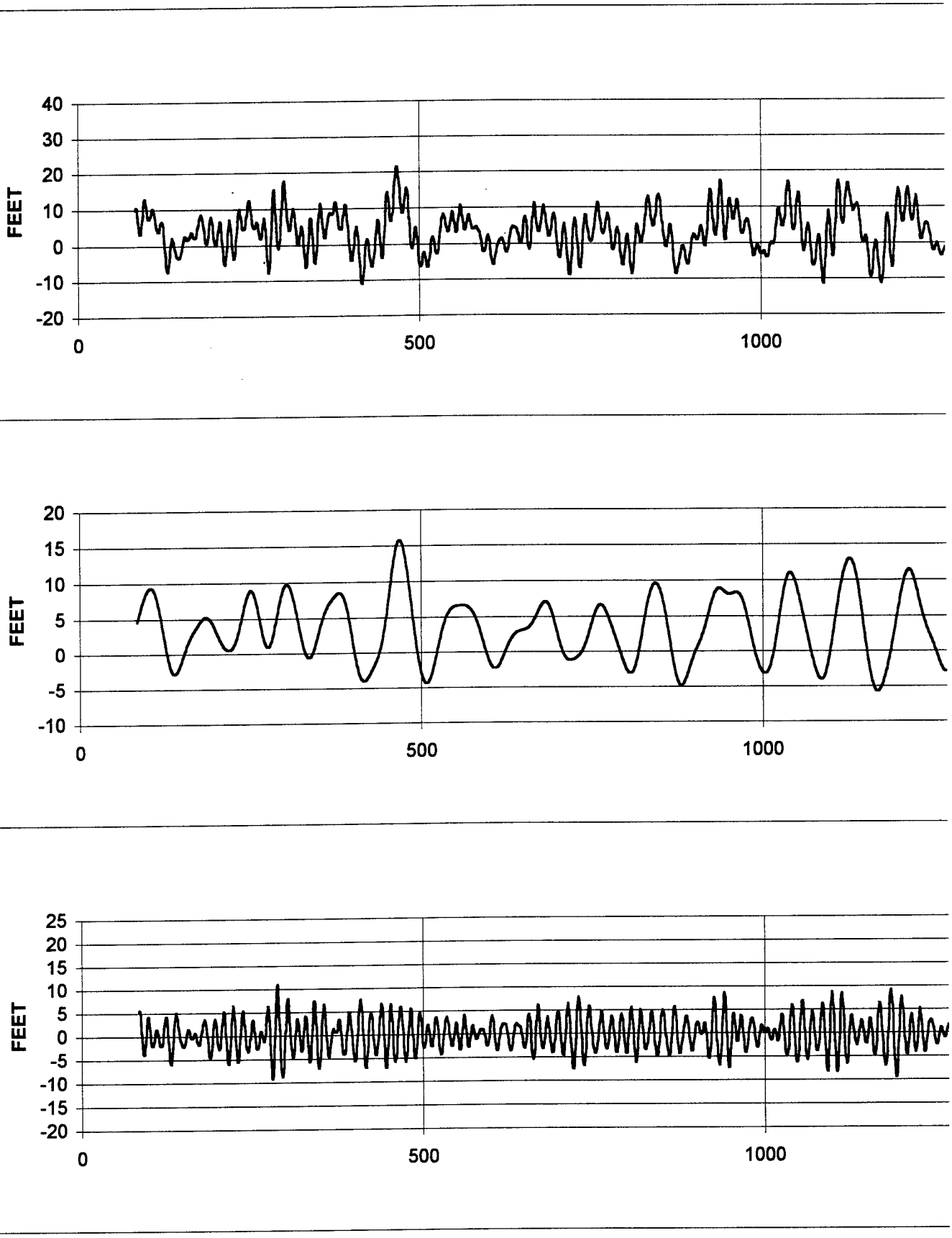
Filtered High Frequency Time History



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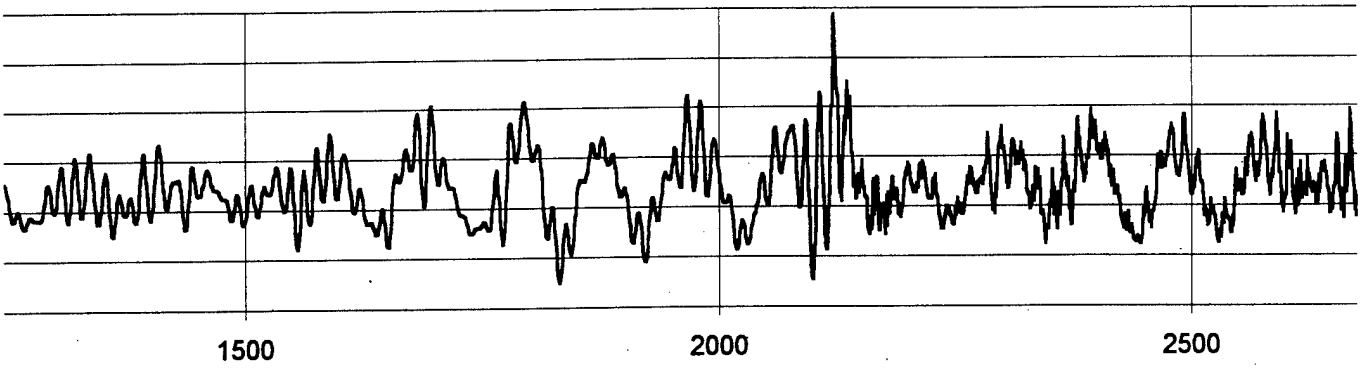


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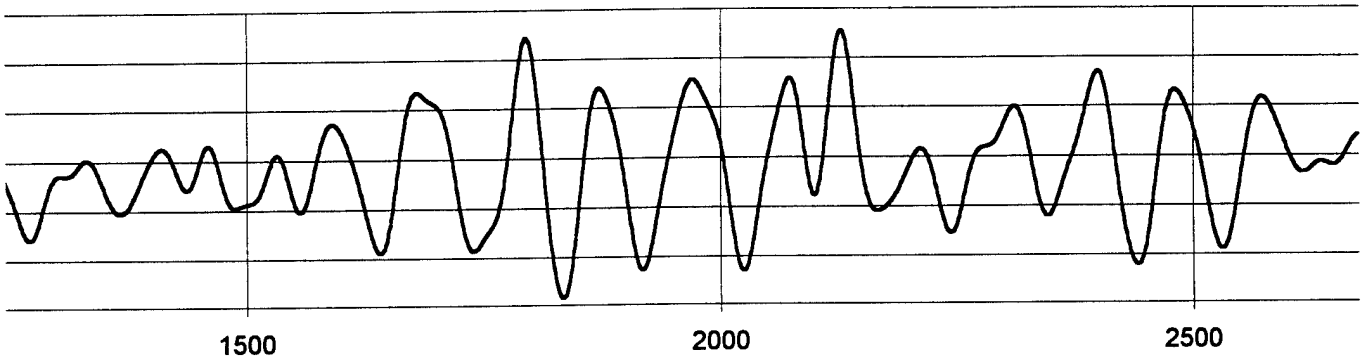


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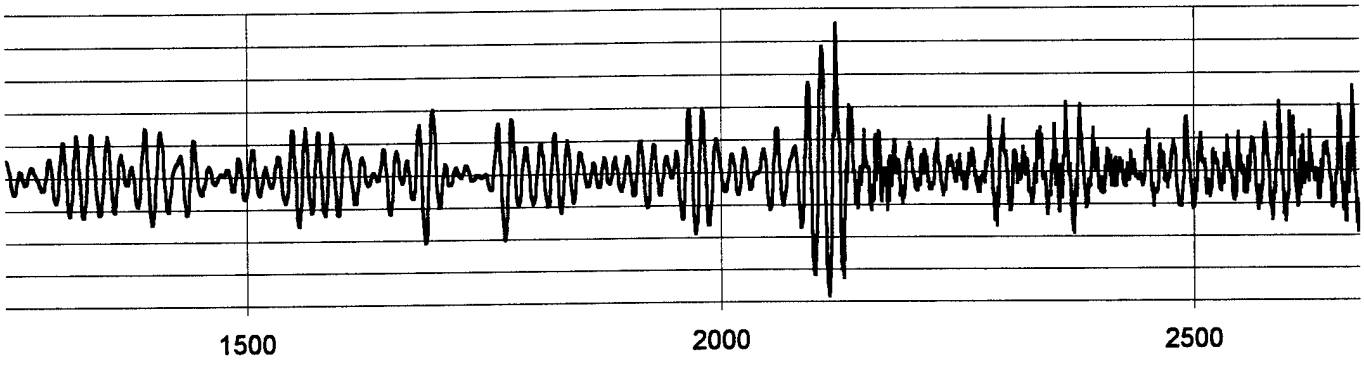
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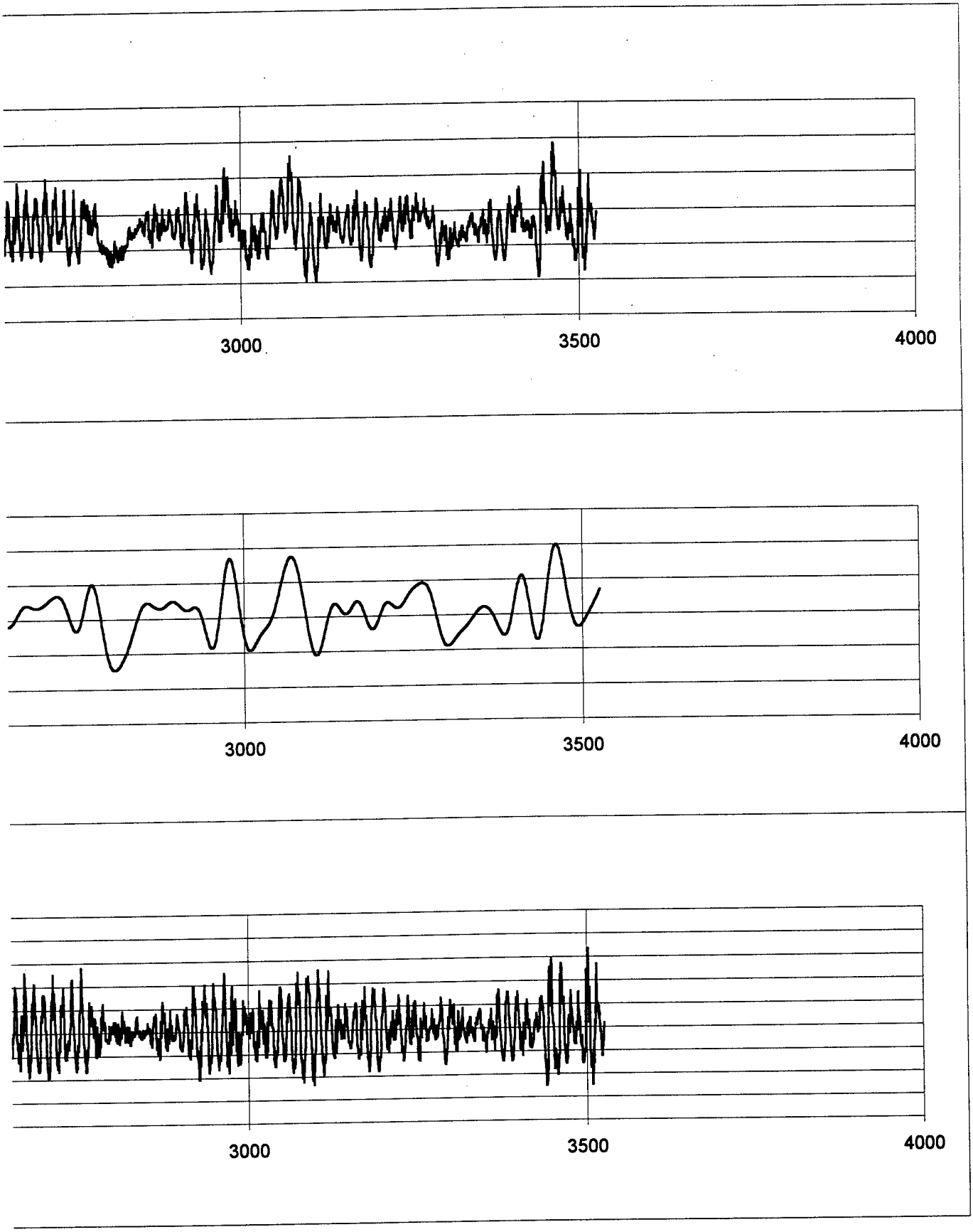
Filtered Low Frequency Time History



Filtered High Frequency Time History

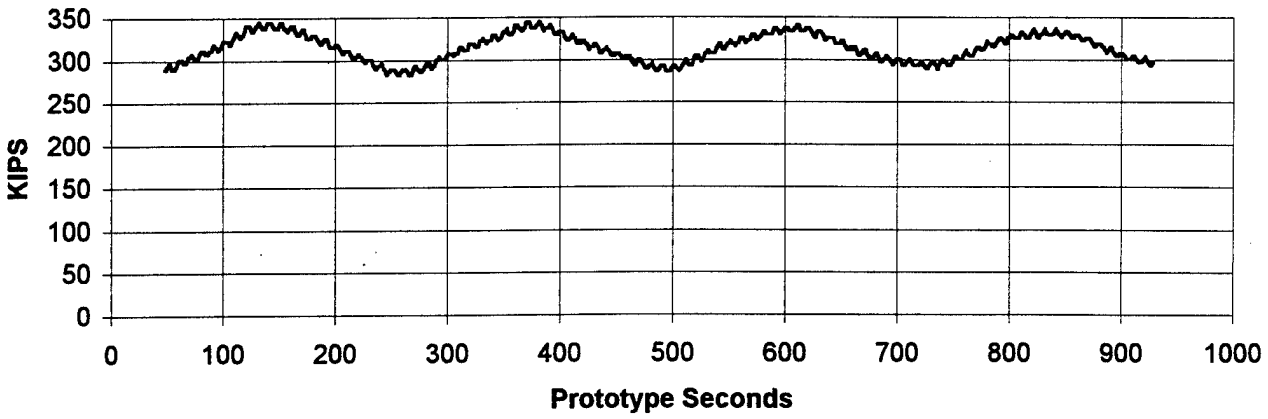


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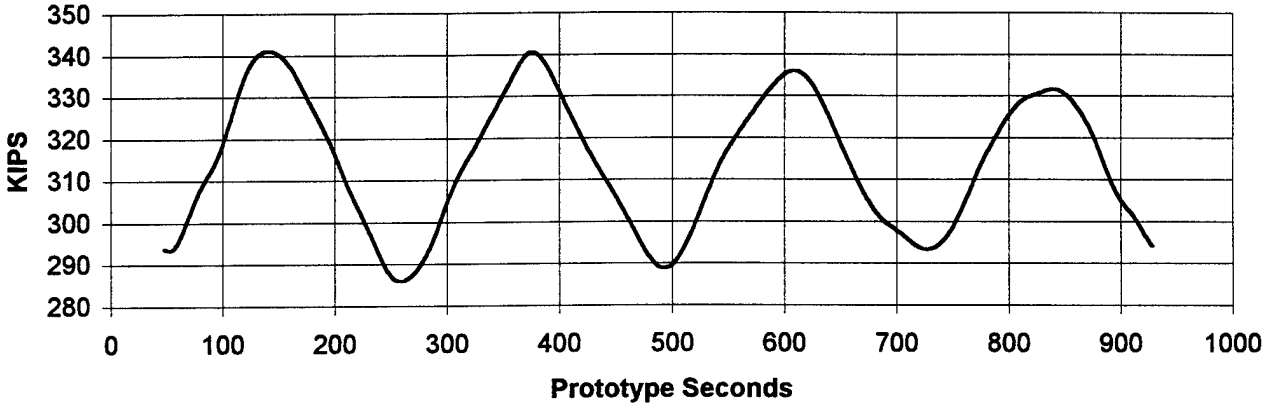


TEST A1103 - ML_1 TENSION

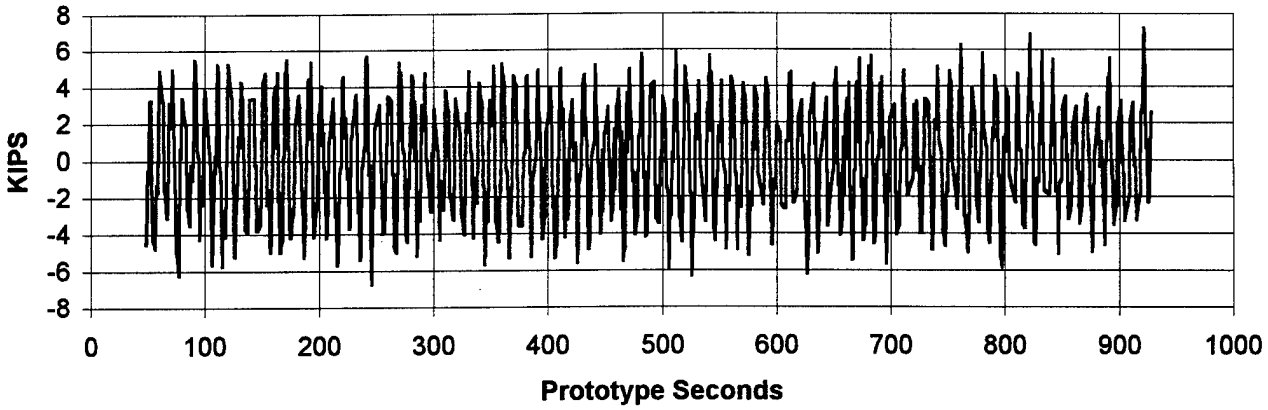
Unfiltered Time History



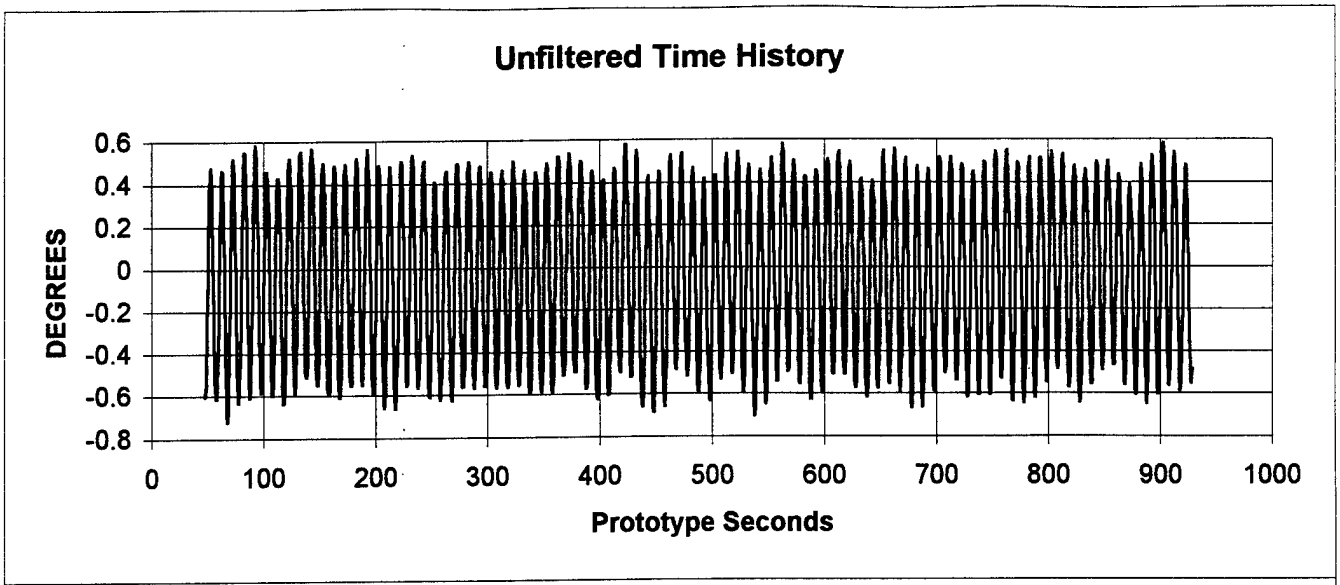
Filtered Low Frequency Time History

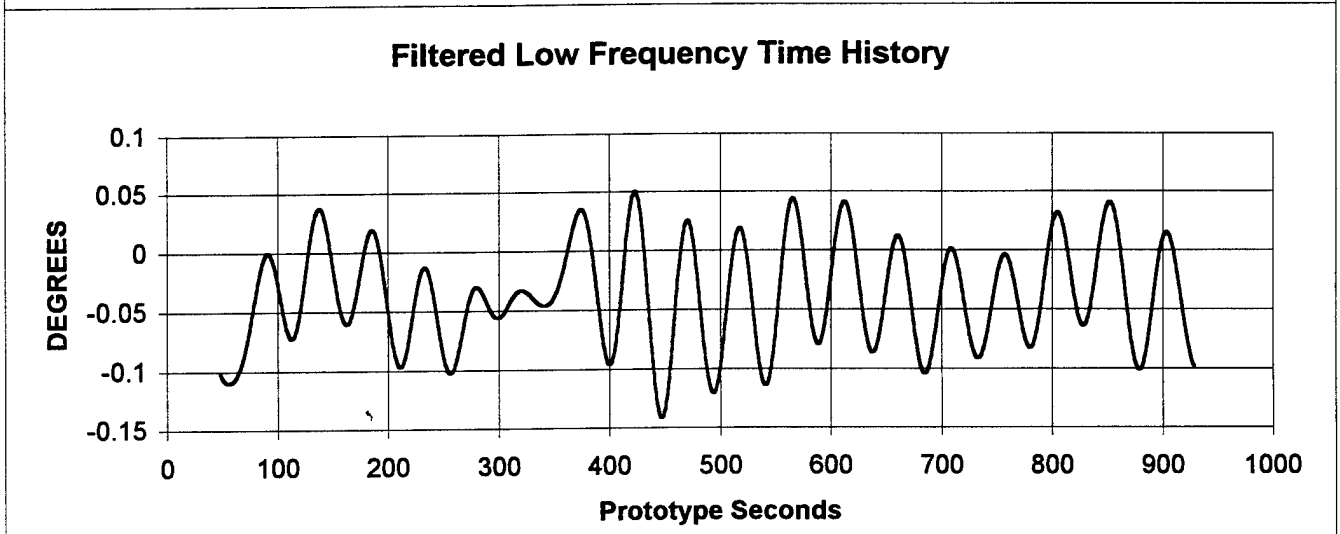


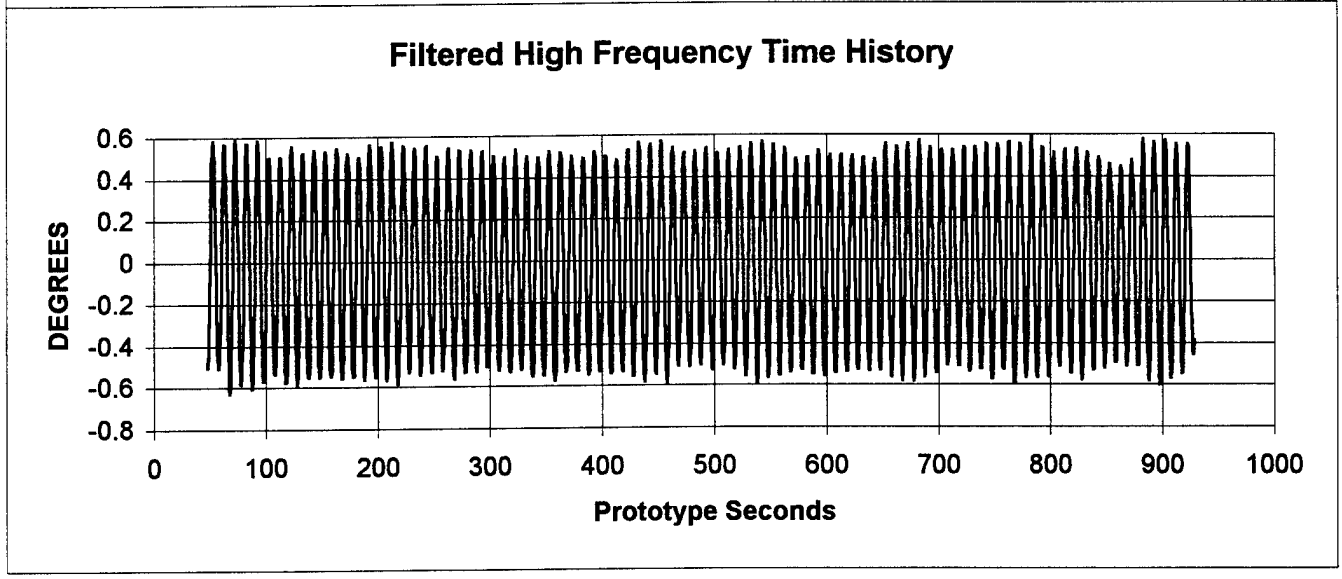
Filtered High Frequency Time History

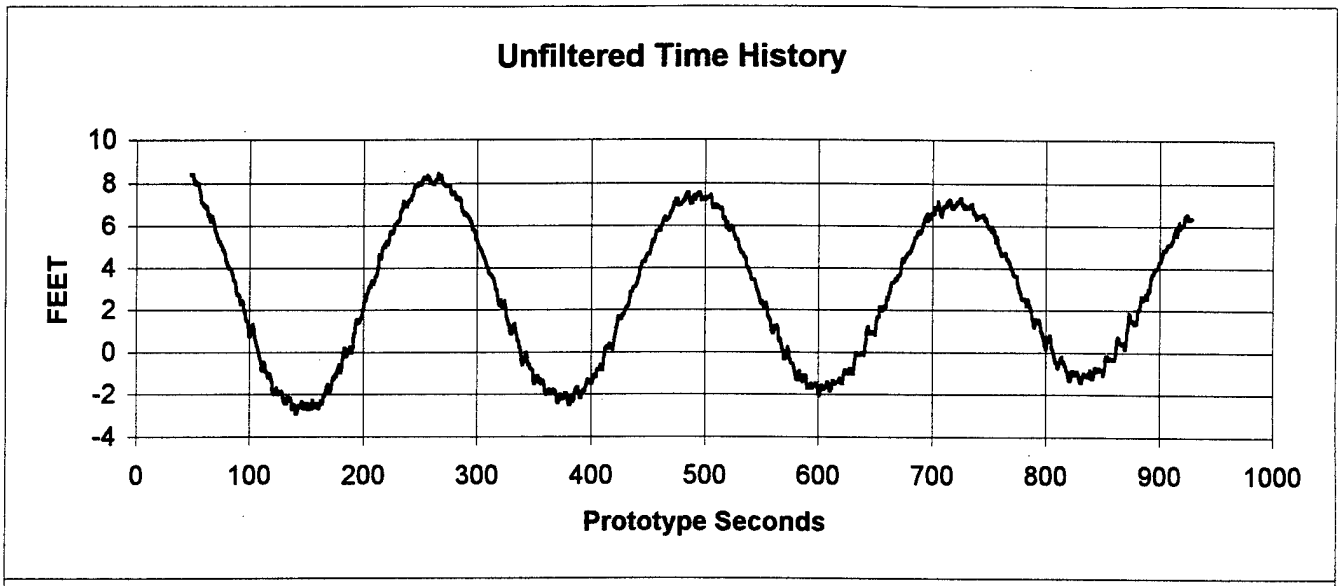


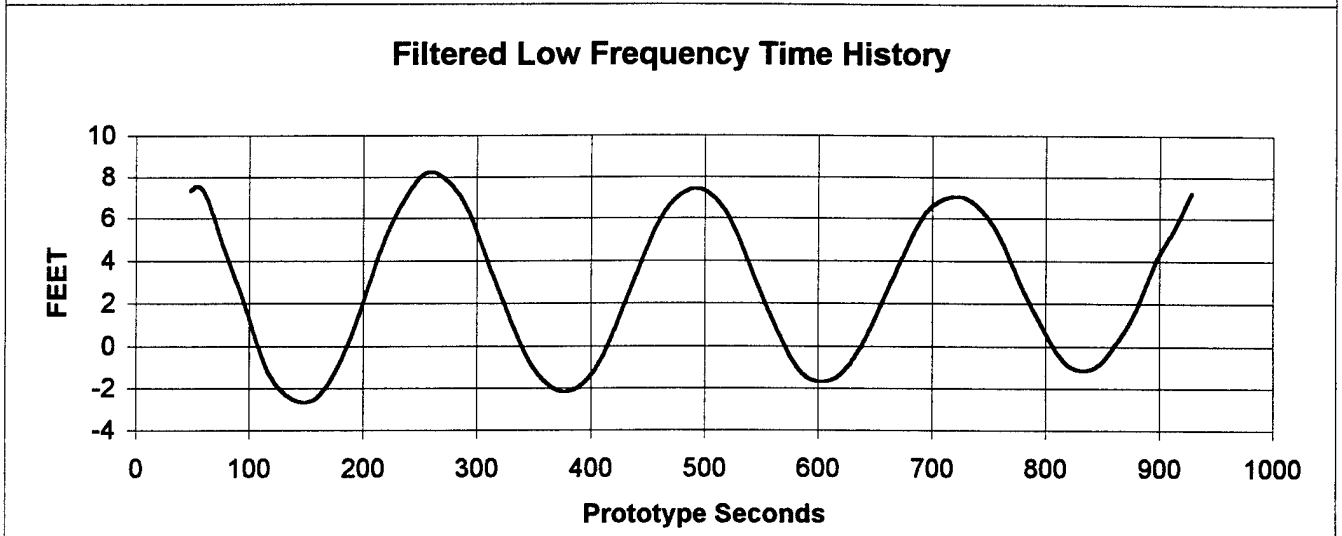
TEST A1103 - PITCH

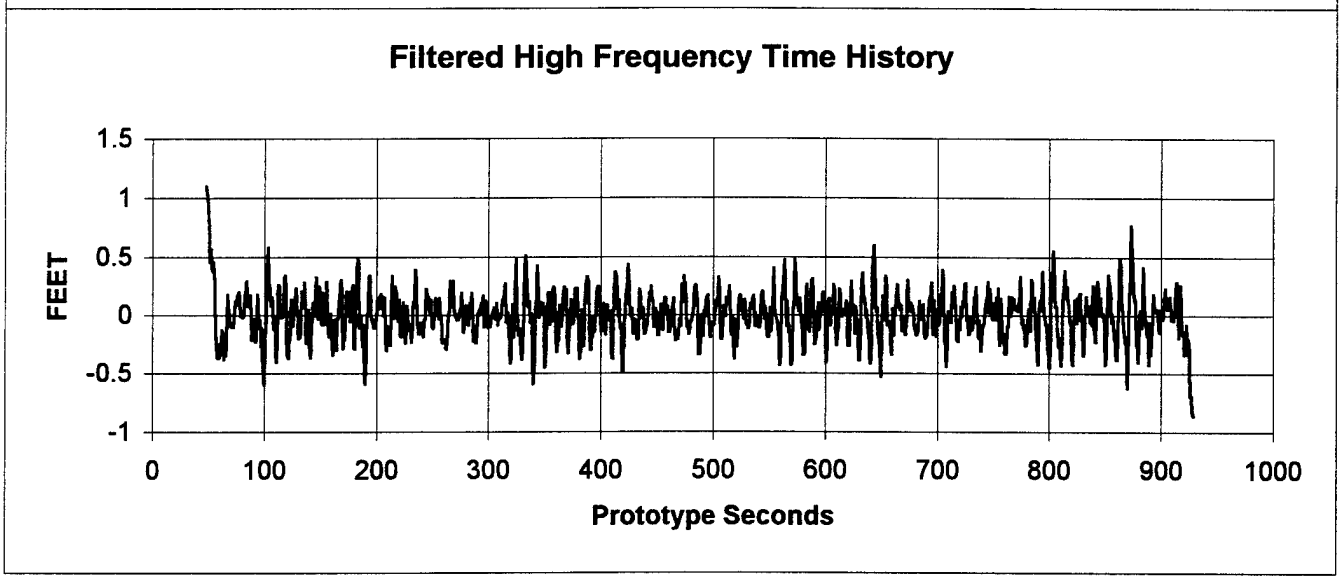




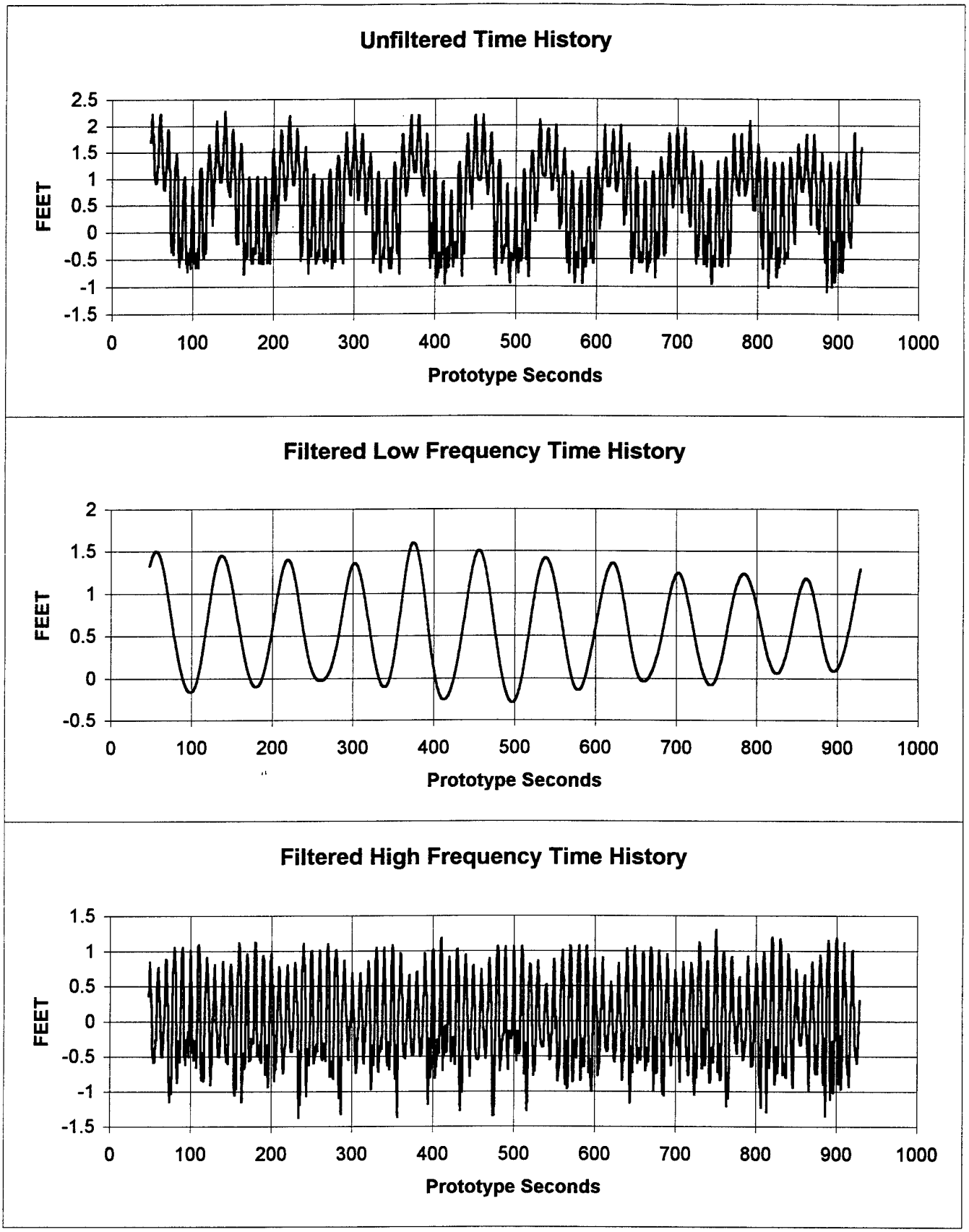



Unfiltered Time History
FEET
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8
6
4
2
0
-2
-4
0
100
200
300
400
500
600
700
800
900
1000
Prototype Seconds

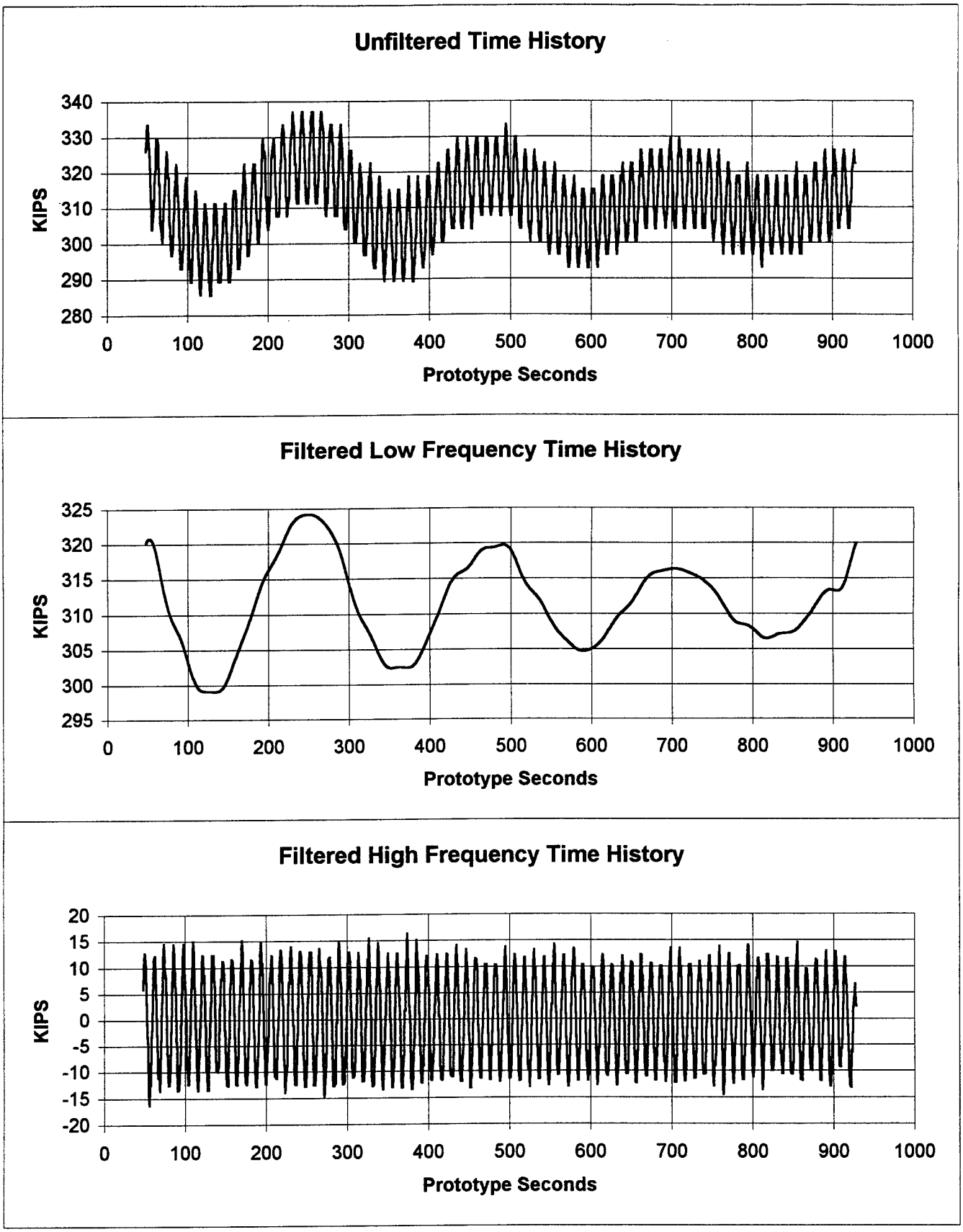

Filtered Low Frequency Time History
FEET
10
8
6
4
2
0
-2
-4
0
100
200
300
400
500
600
700
800
900
1000
Prototype Seconds


Filtered High Frequency Time History
FEET
1.5
1
0.5
0
-0.5
-1
0
100
200
300
400
500
600
700
800
900
1000
Prototype Seconds

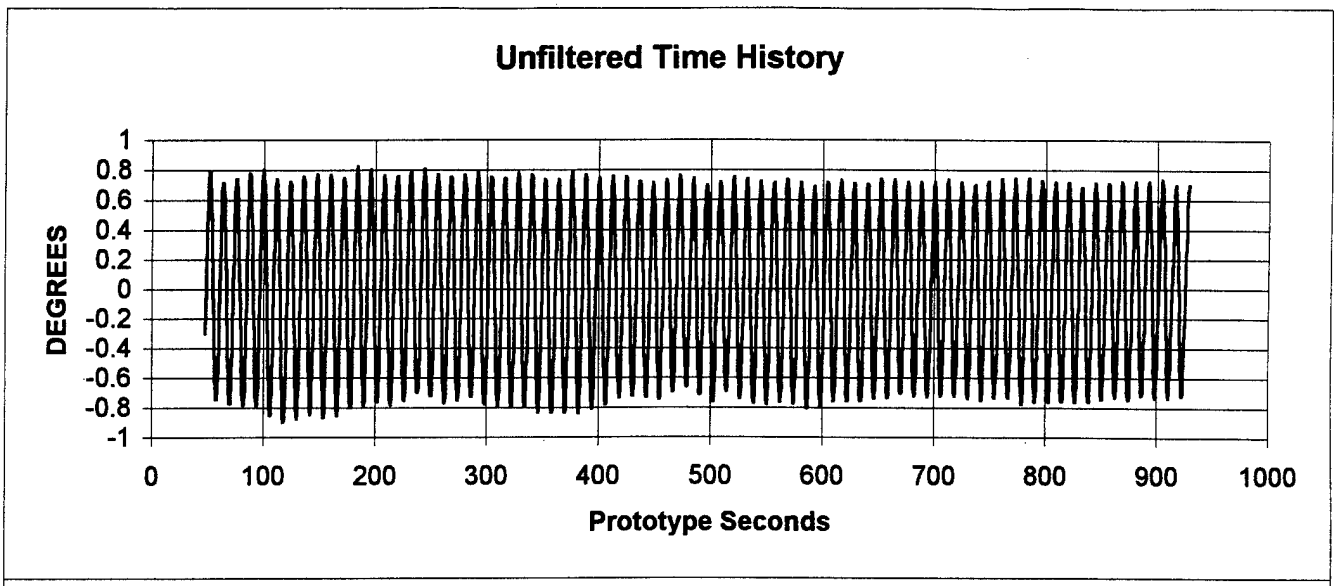
TEST A1103 - PT HEAVE

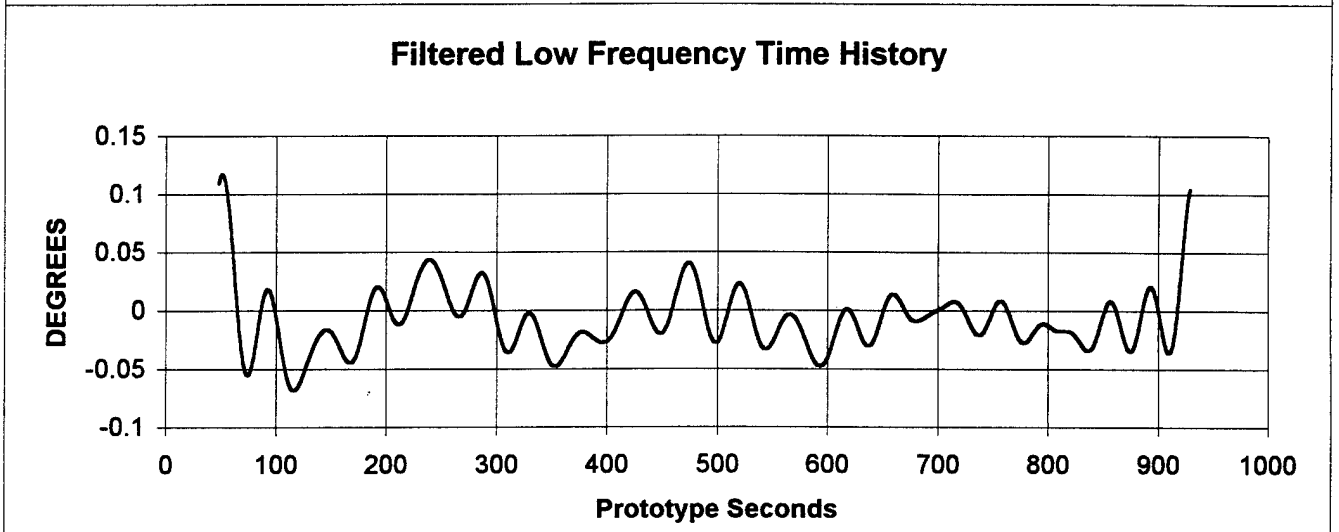


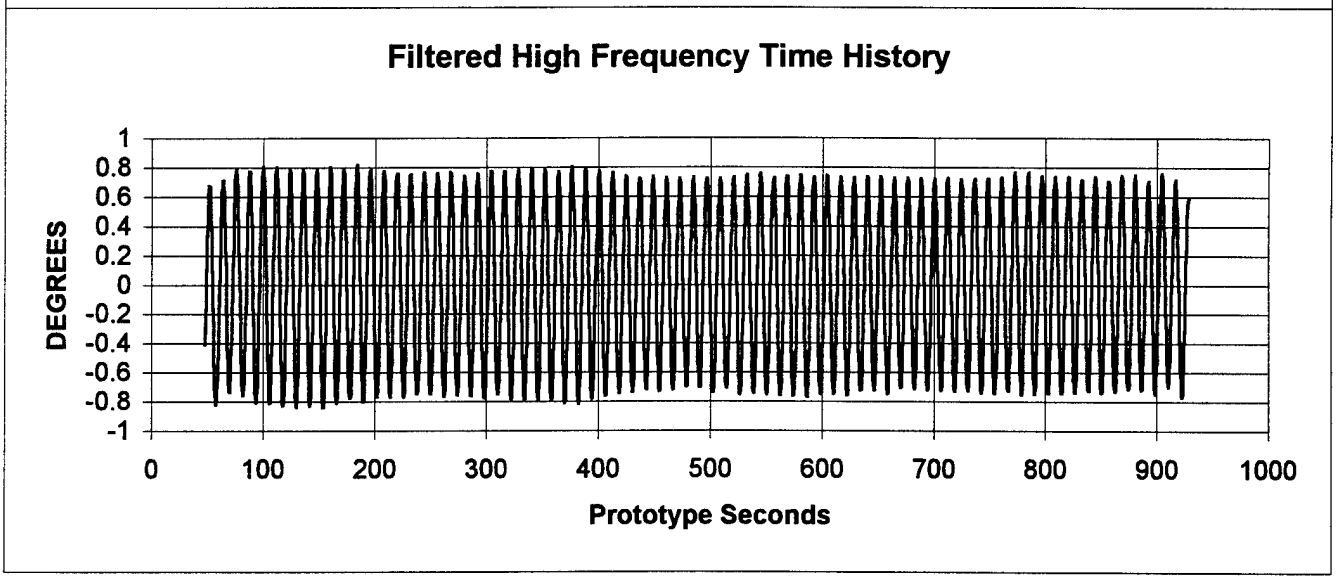
TEST A1104 - ML_1 TENSION



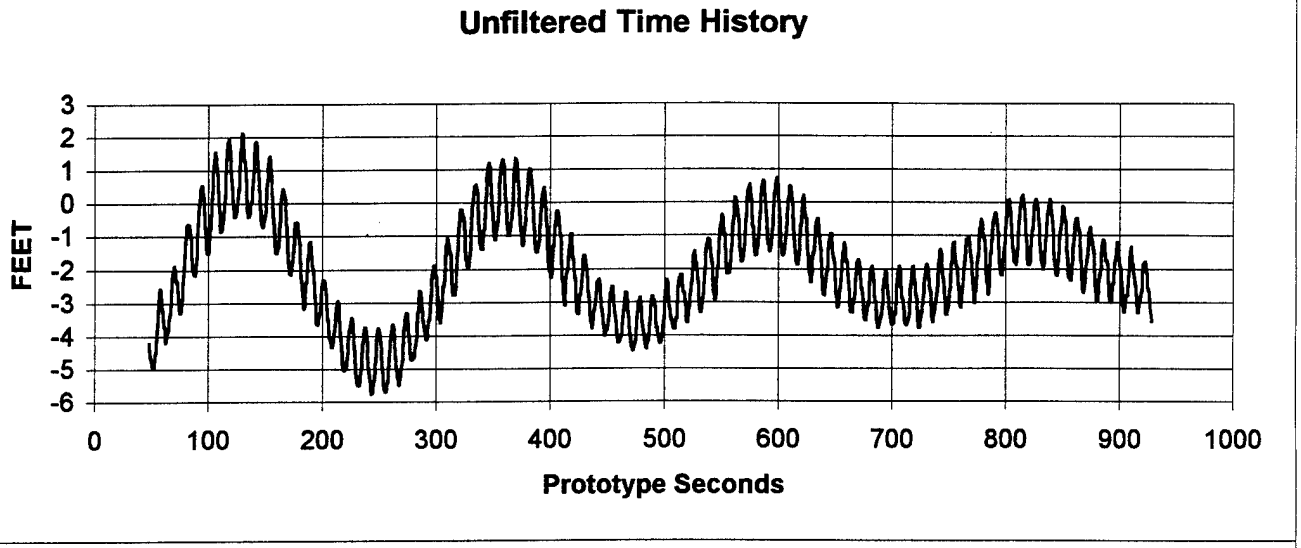
TEST A1104 - PITCH

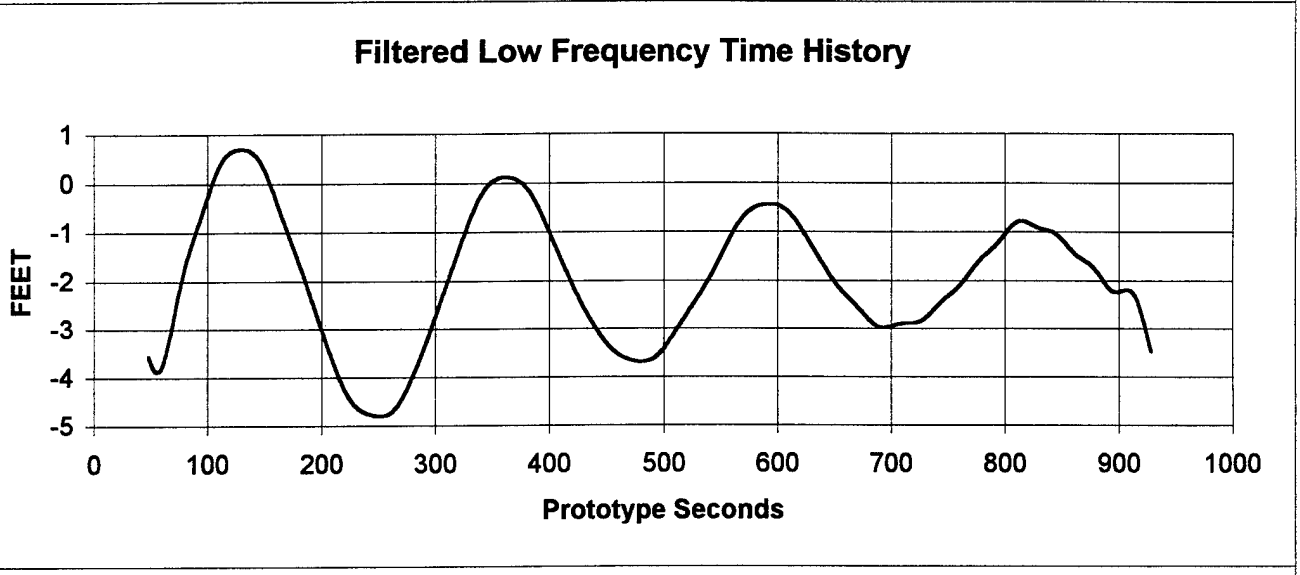


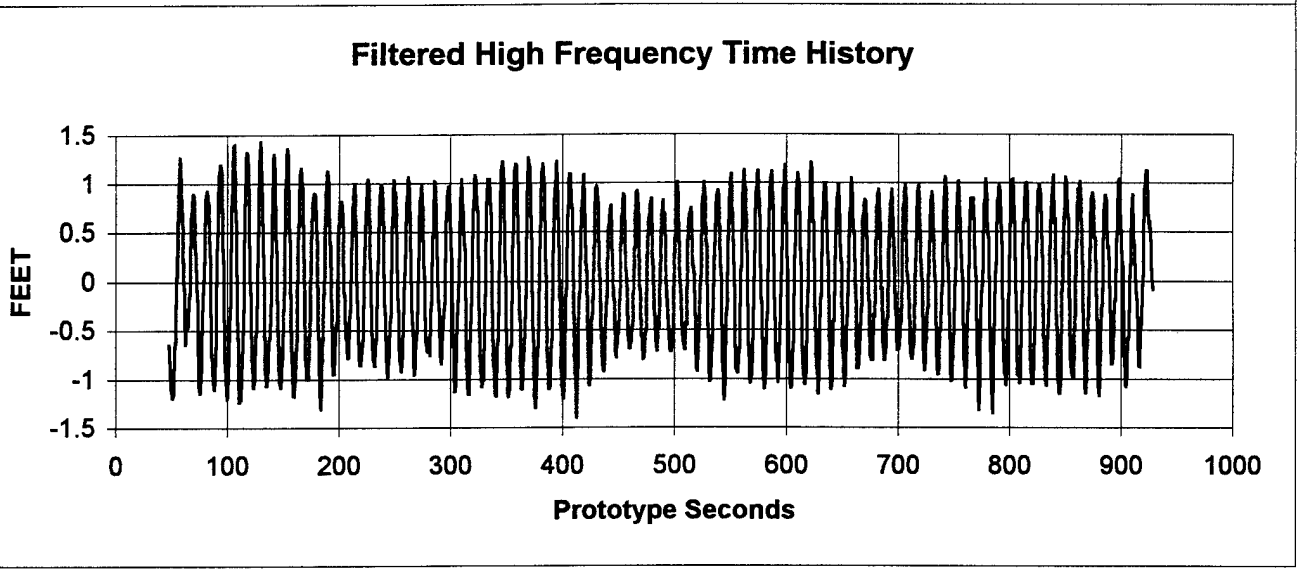




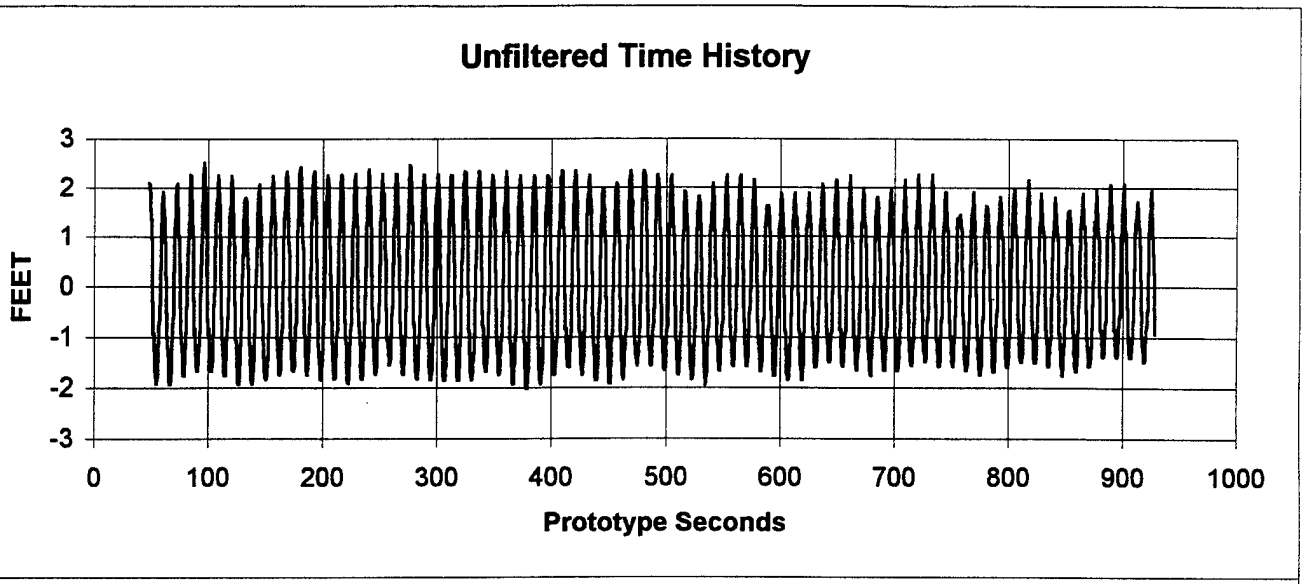
TEST A1104 - PT SURGE

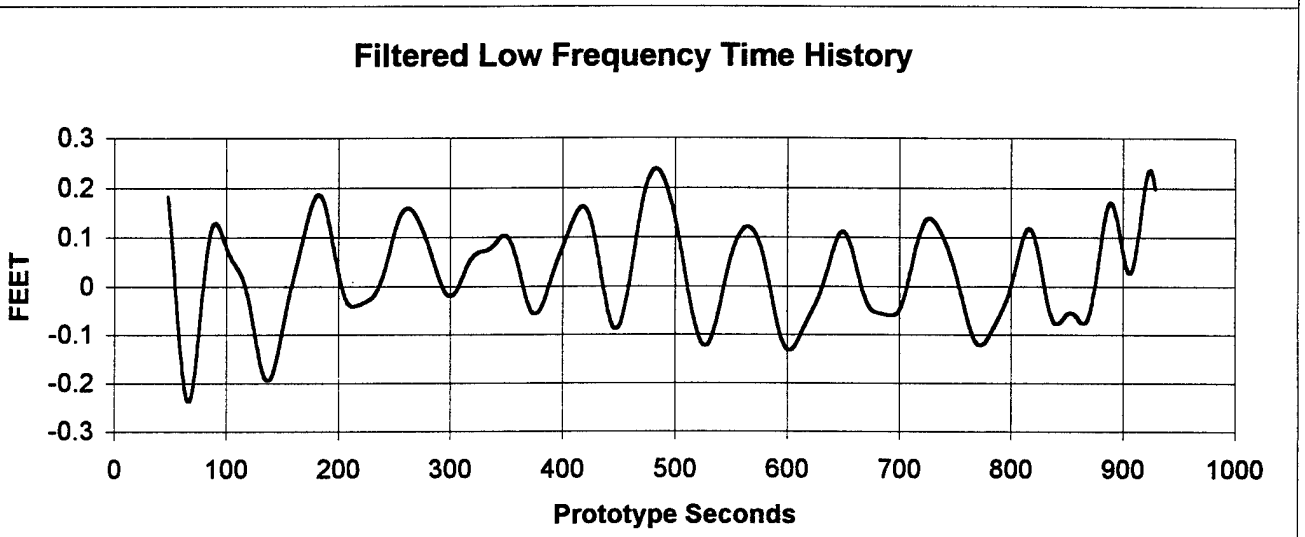


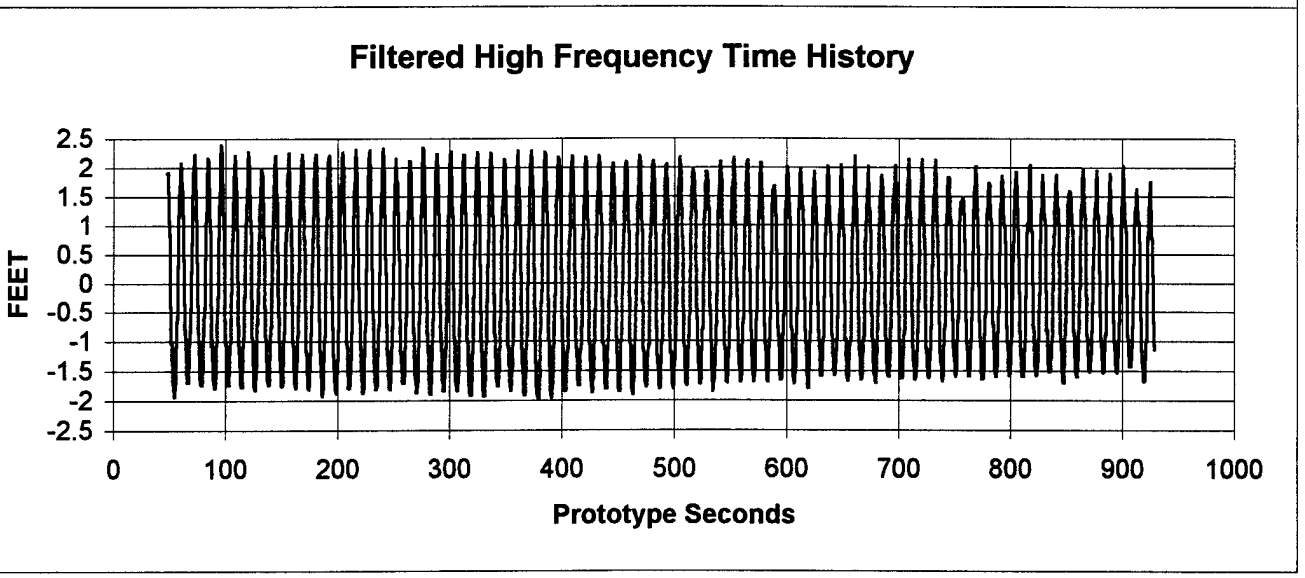




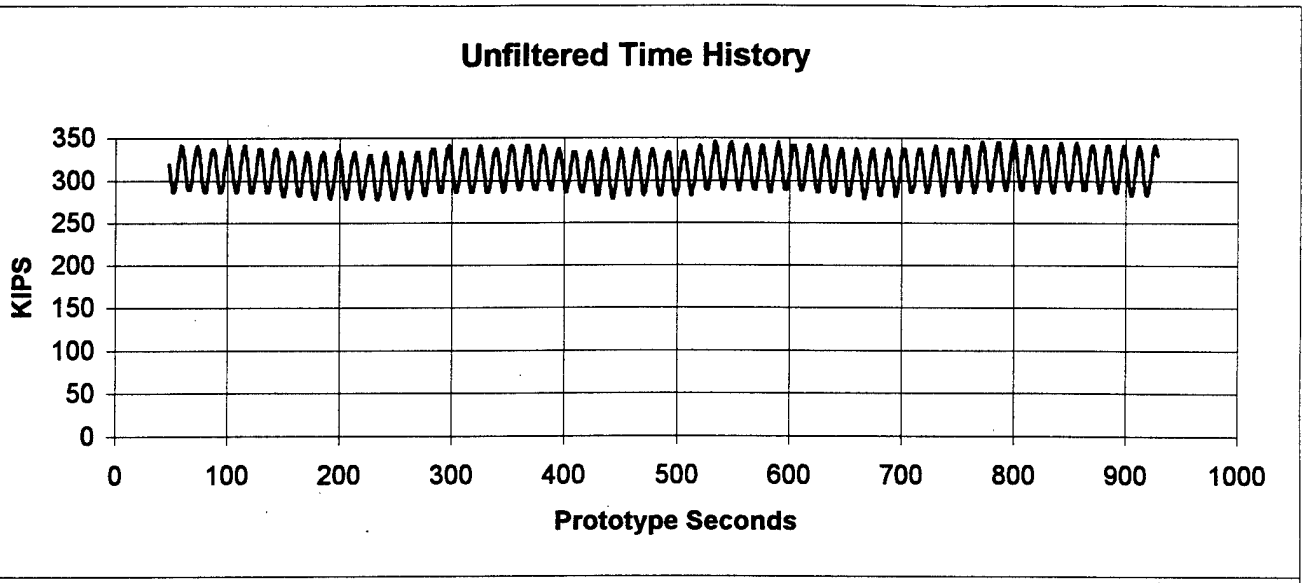
TEST A1104 - PT HEAVE

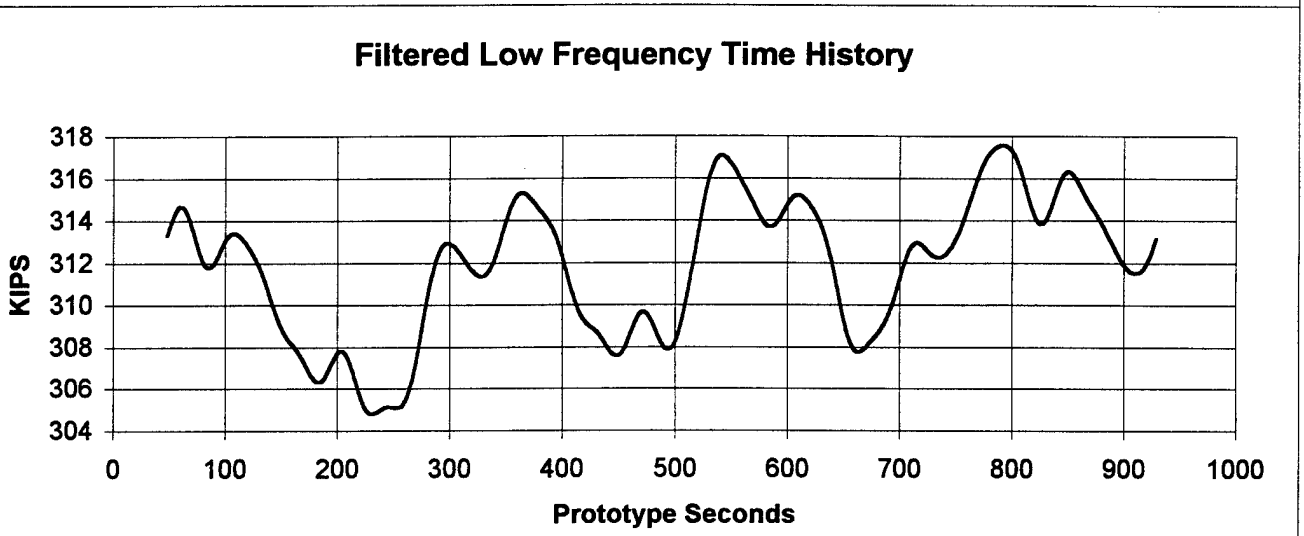


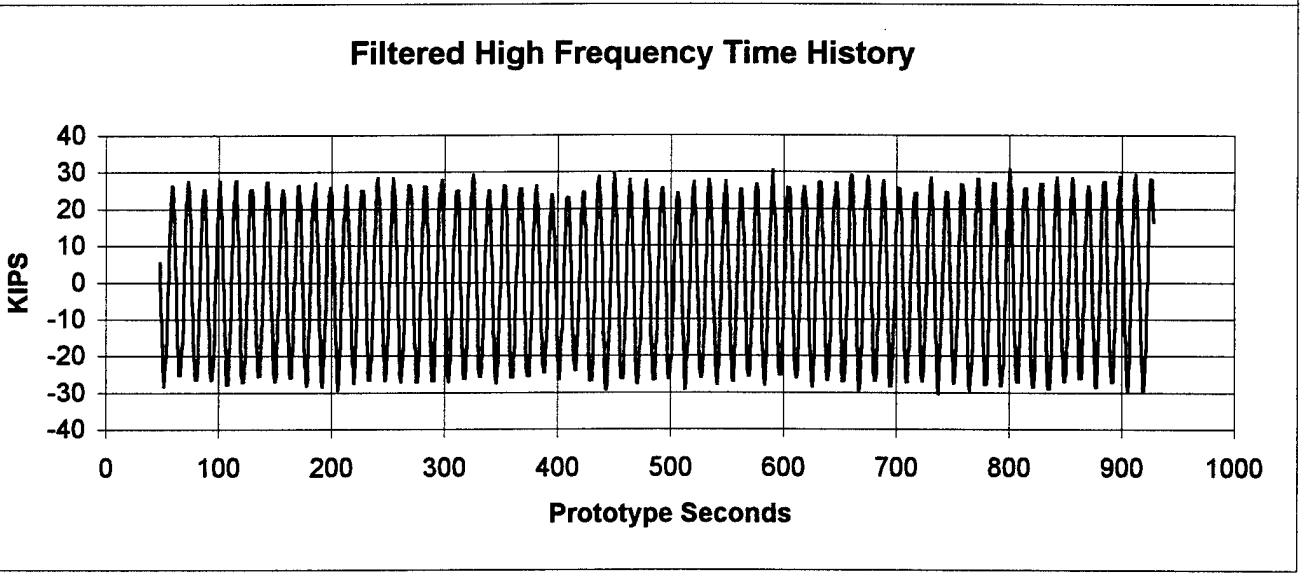




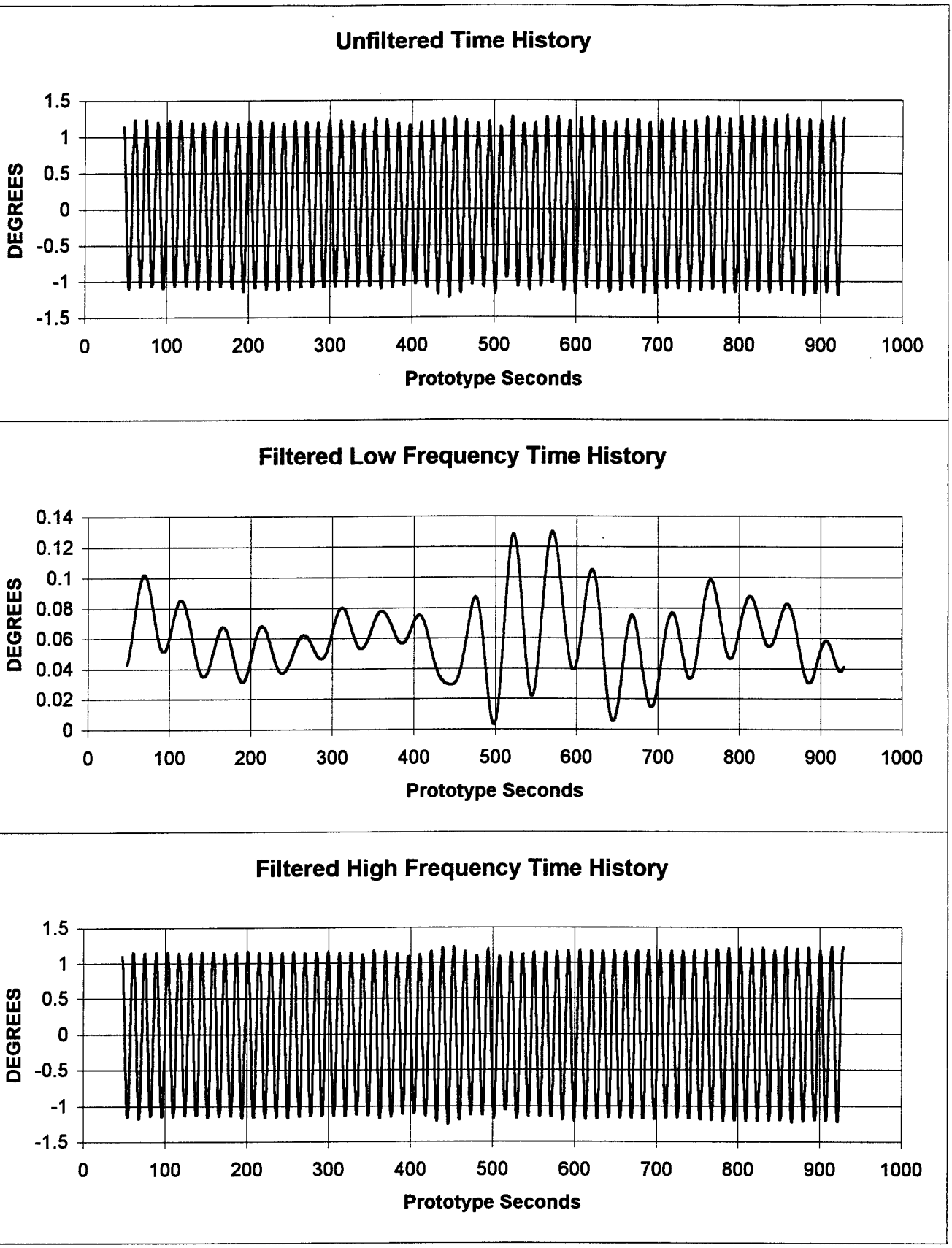
TEST A1105 - ML_1 TENSION





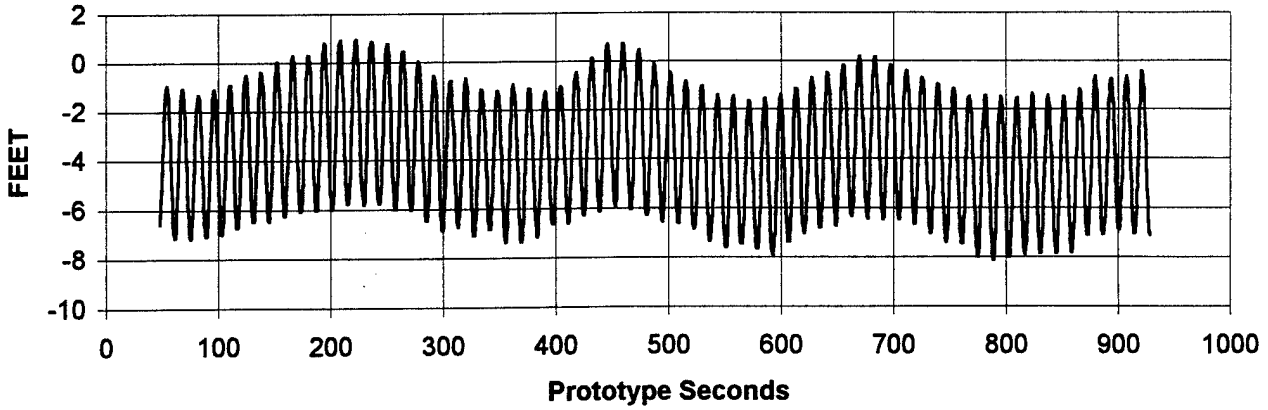


TEST A1105 - PITCH

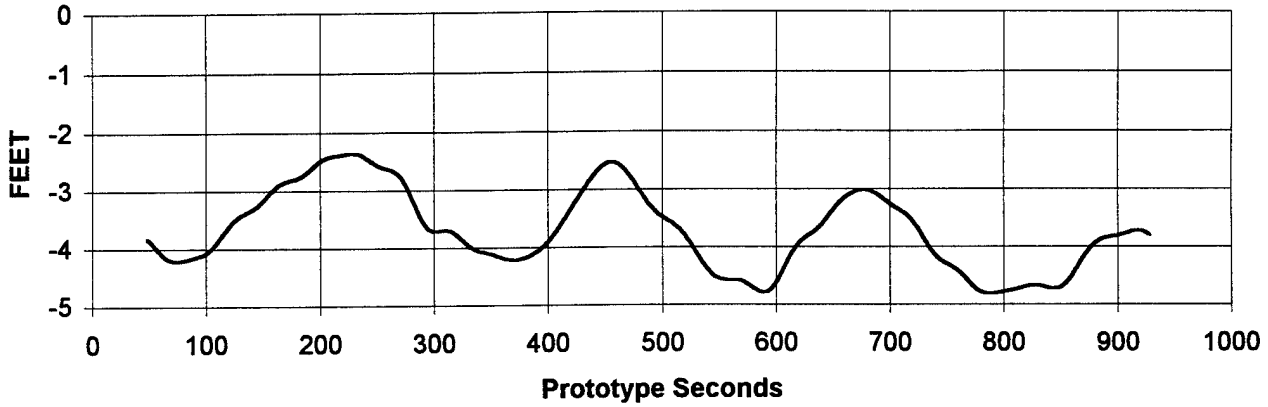


TEST A1105 - PT SURGE

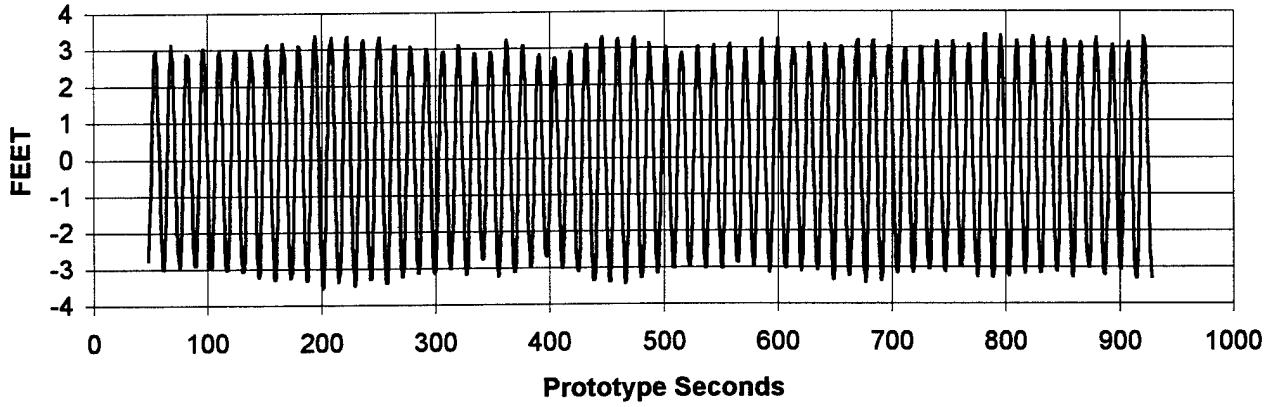
Unfiltered Time History



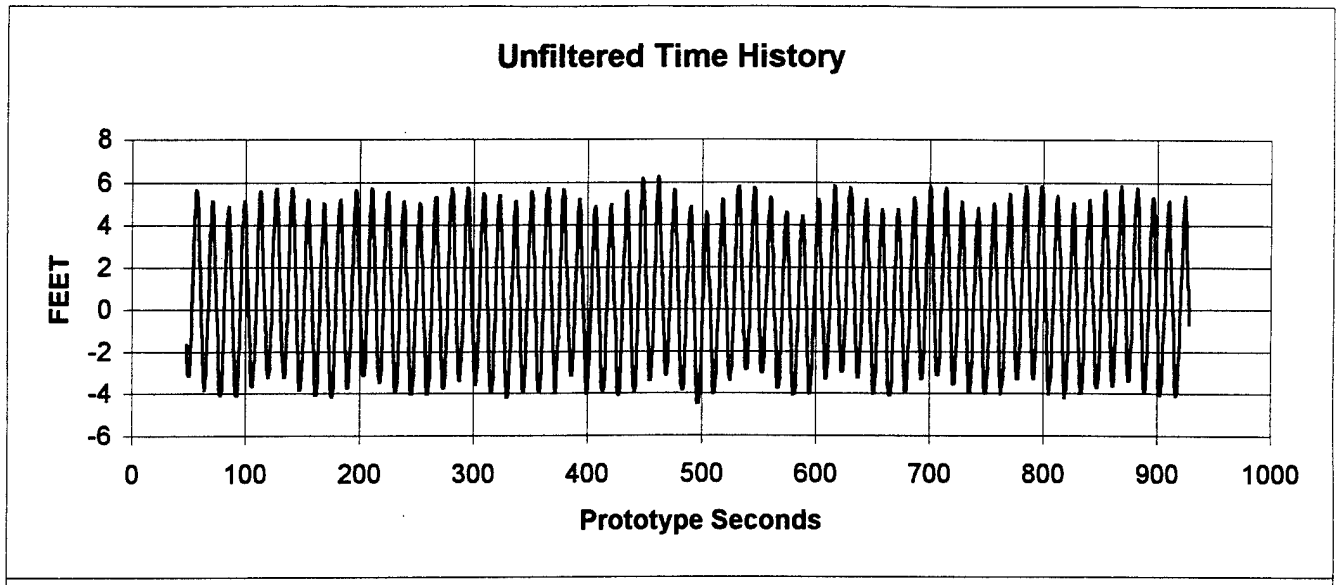
Filtered Low Frequency Time History

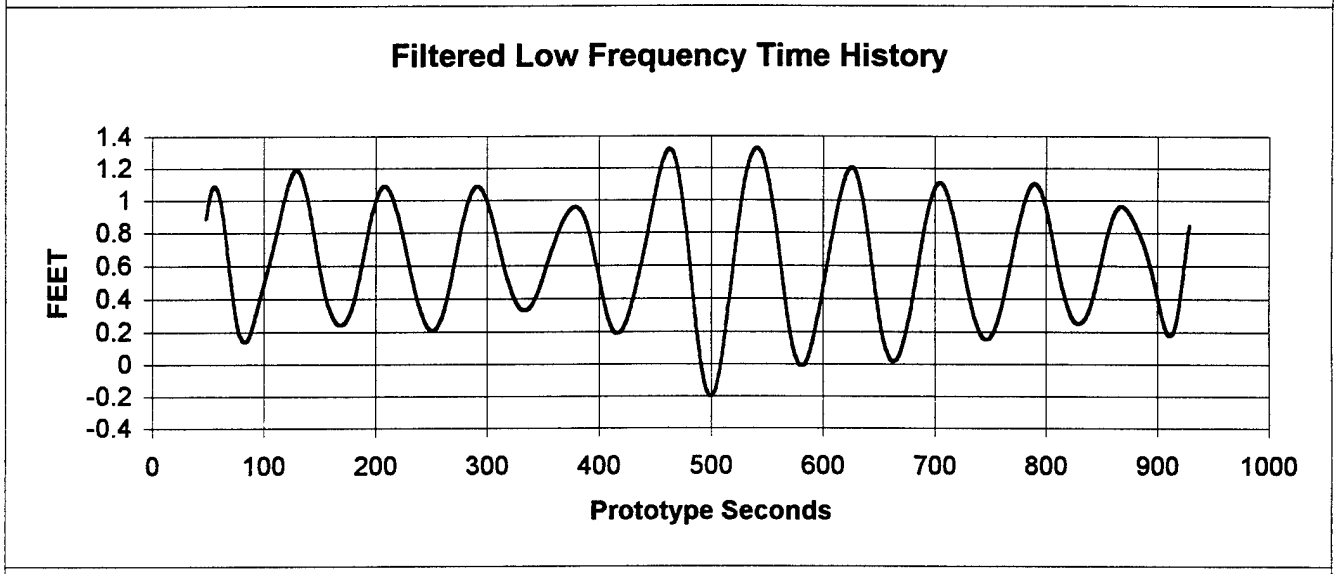


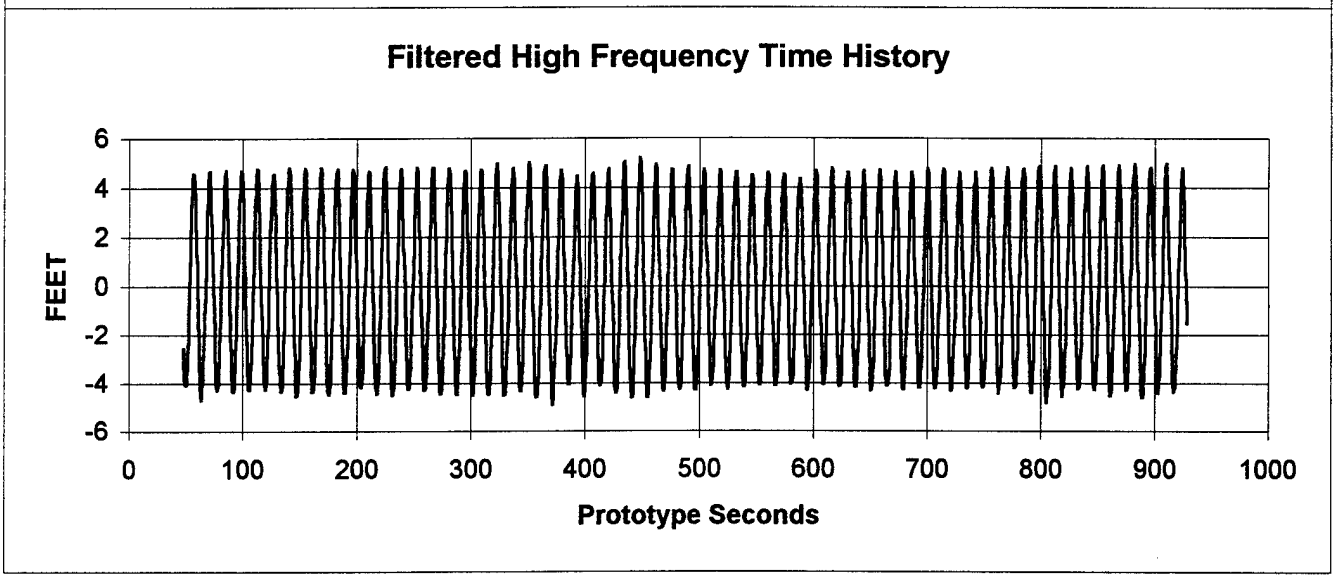
Filtered High Frequency Time History



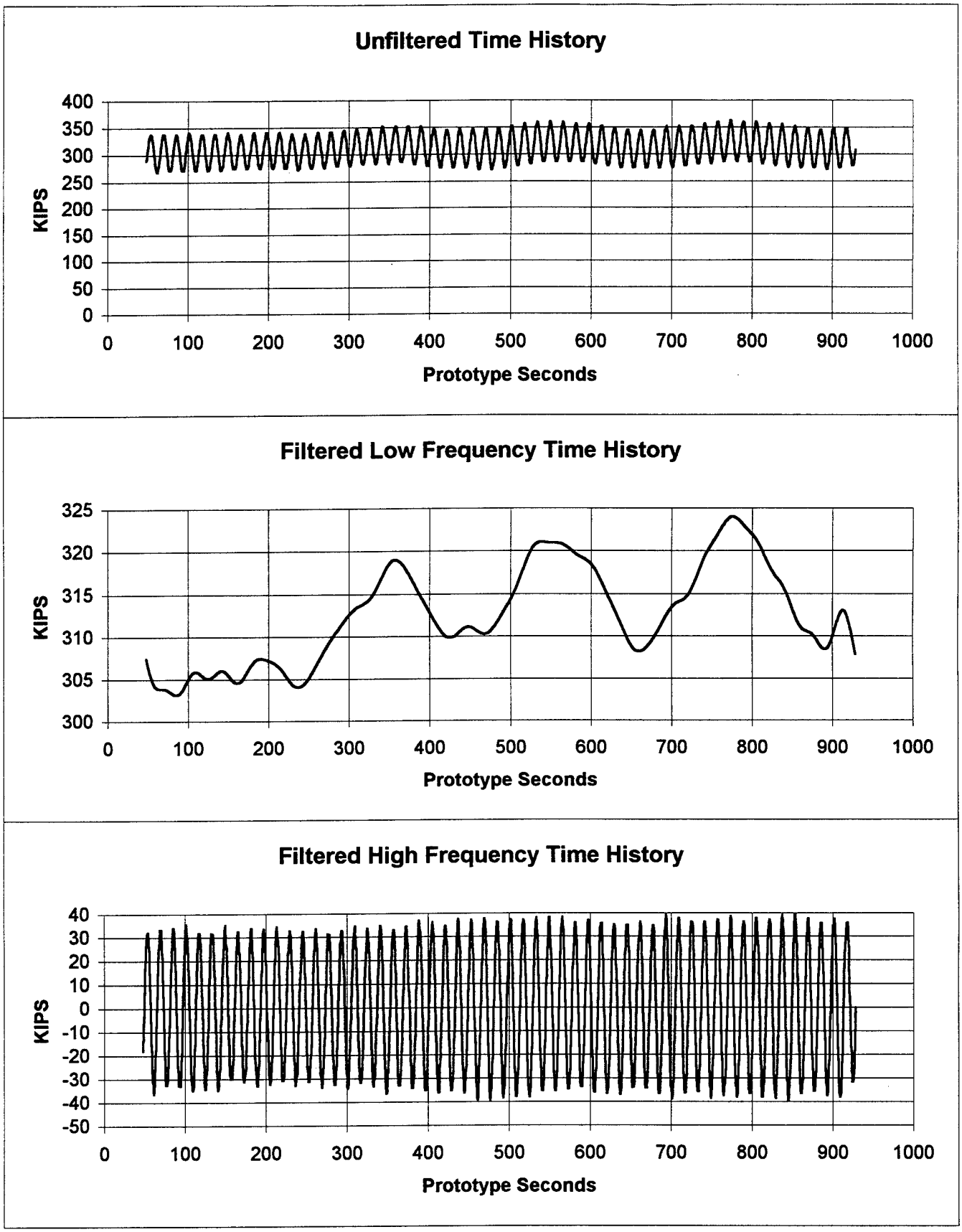
TEST A1105 - PT HEAVE



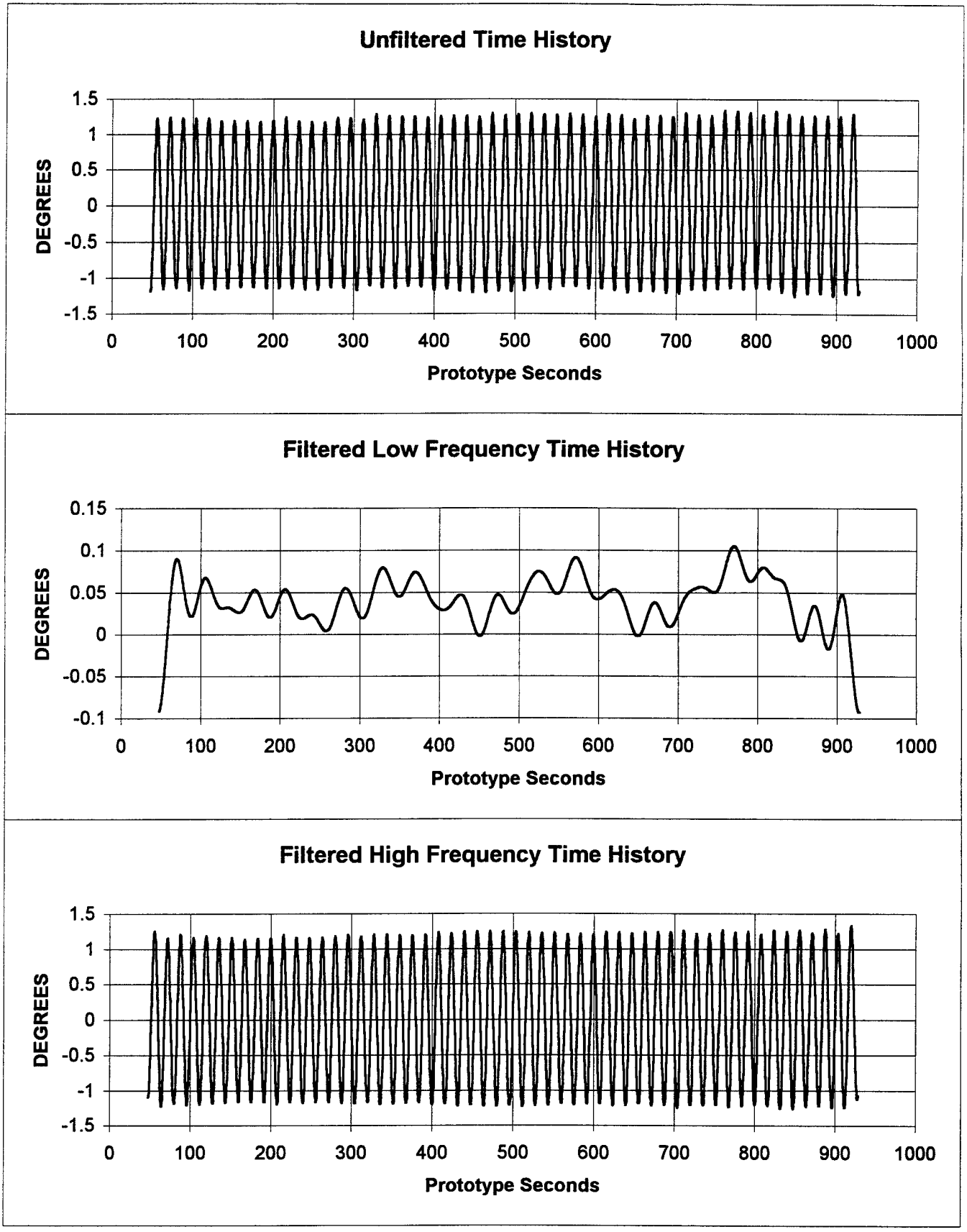




TEST A1106 - ML_1 TENSION

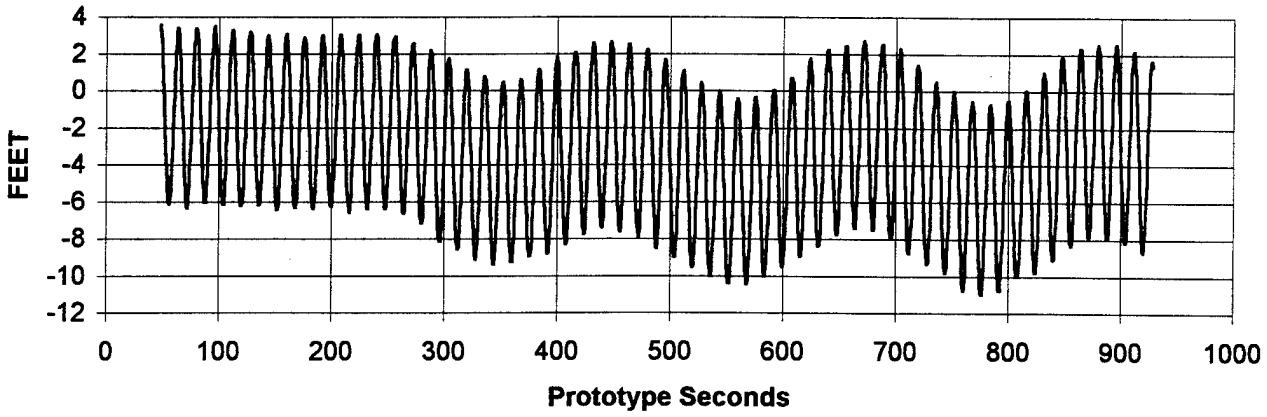


TEST A1106 - PITCH

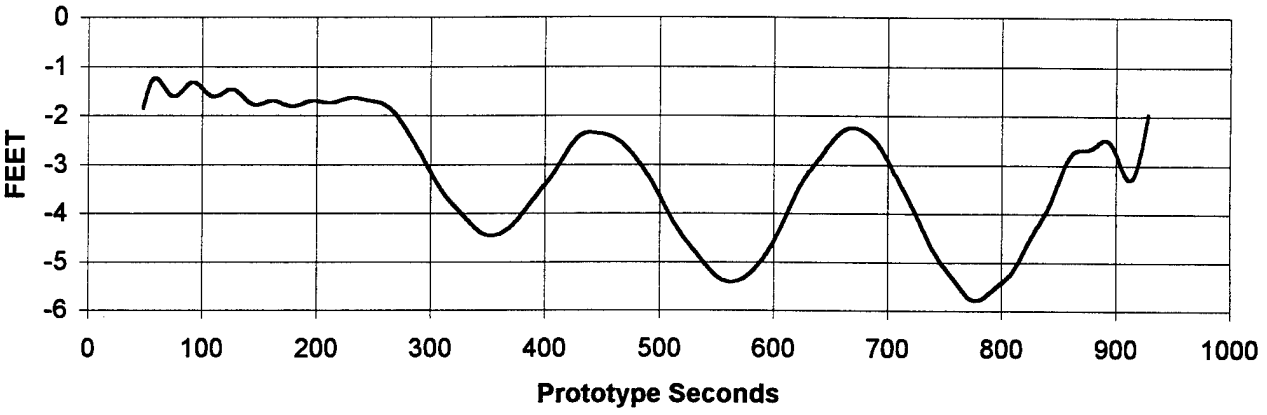


TEST A1106 - PT SURGE

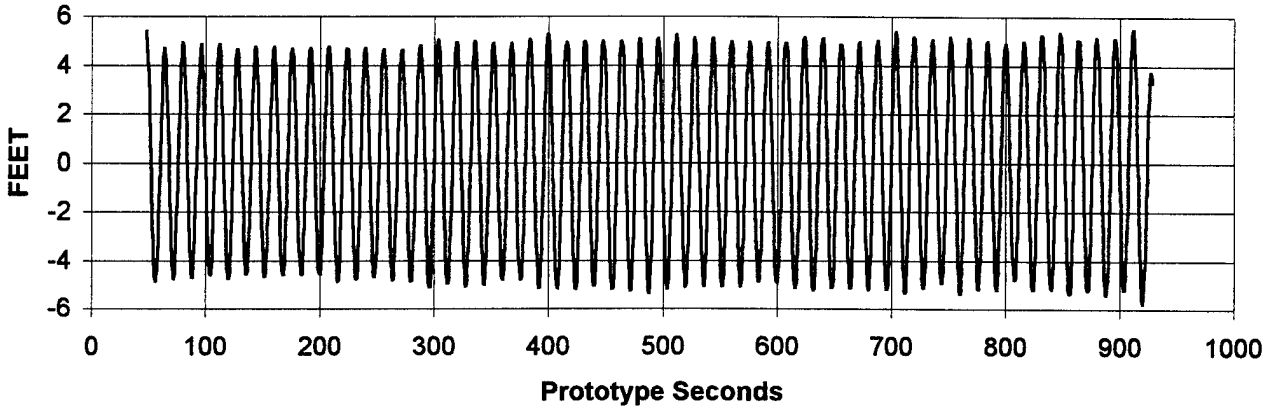
Unfiltered Time History



Filtered Low Frequency Time History

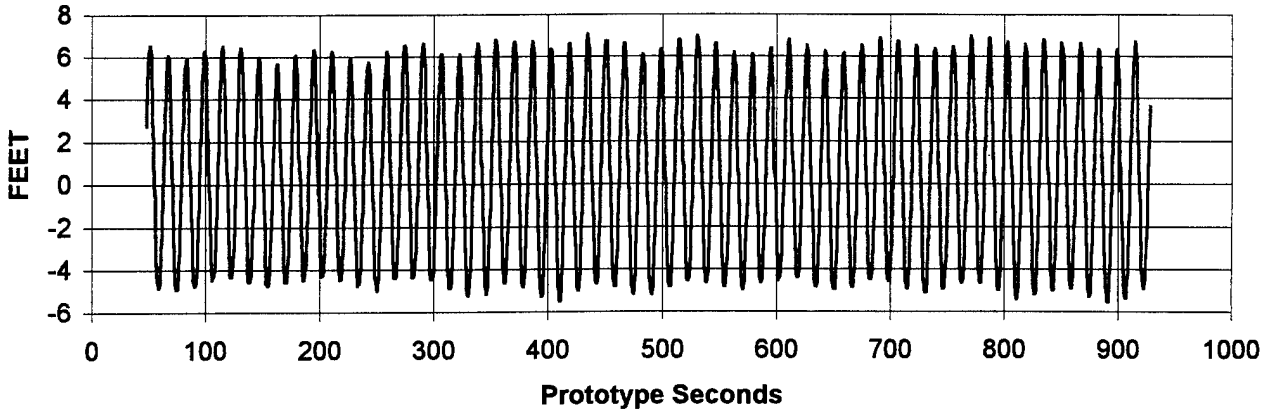


Filtered High Frequency Time History

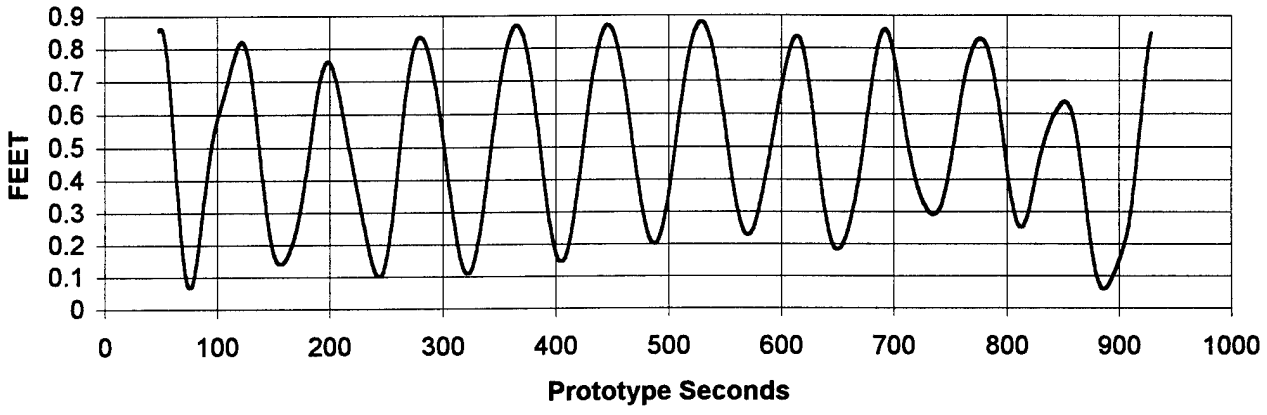


TEST A1106 - PT HEAVE

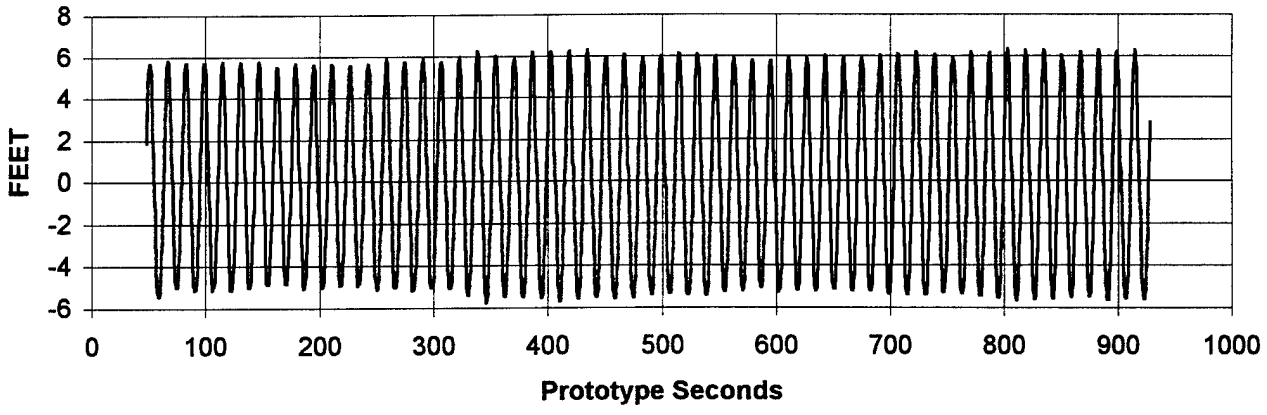
Unfiltered Time History



Filtered Low Frequency Time History

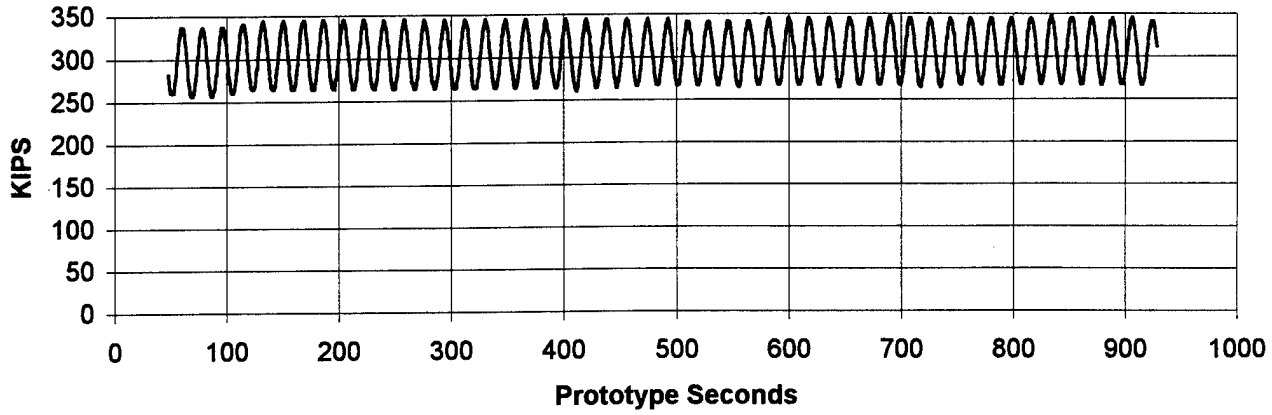


Filtered High Frequency Time History

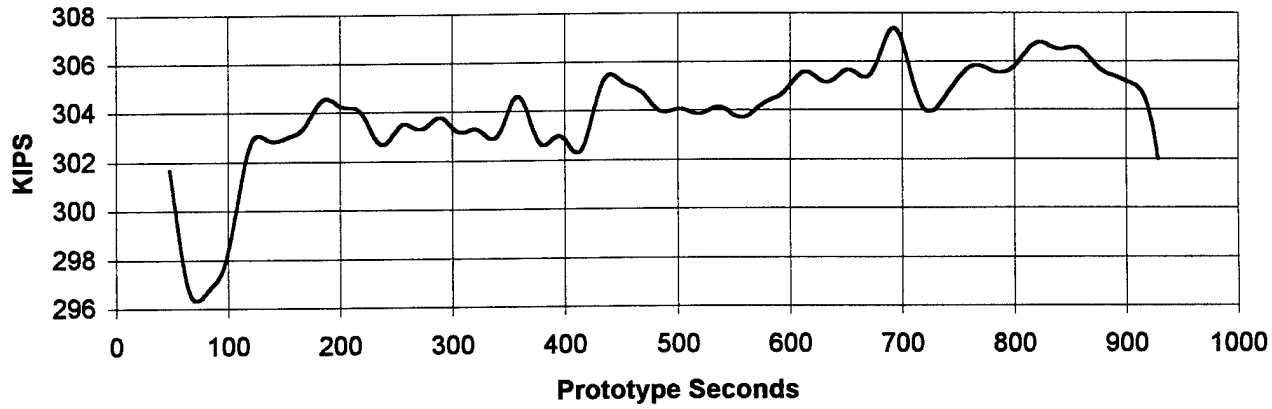


TEST A1107 - ML_1 TENSION

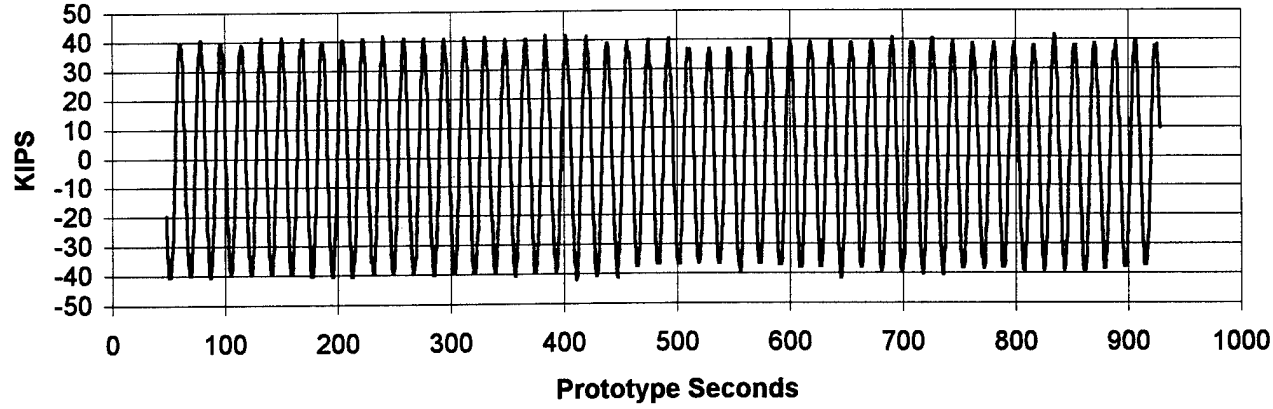
Unfiltered Time History



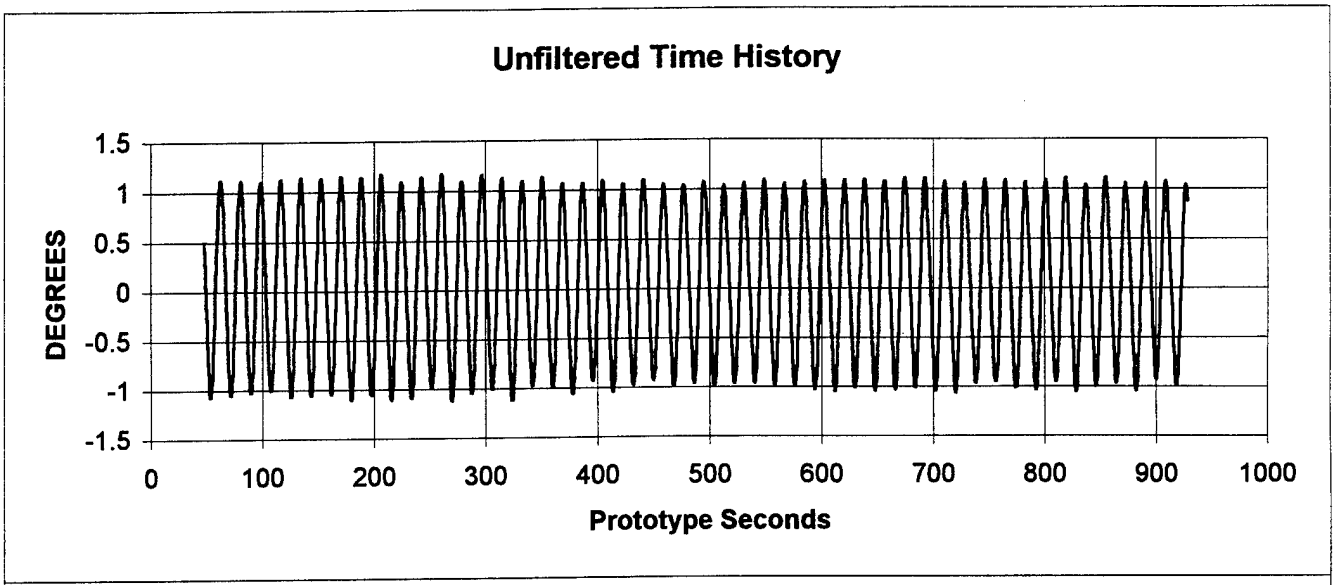
Filtered Low Frequency Time History

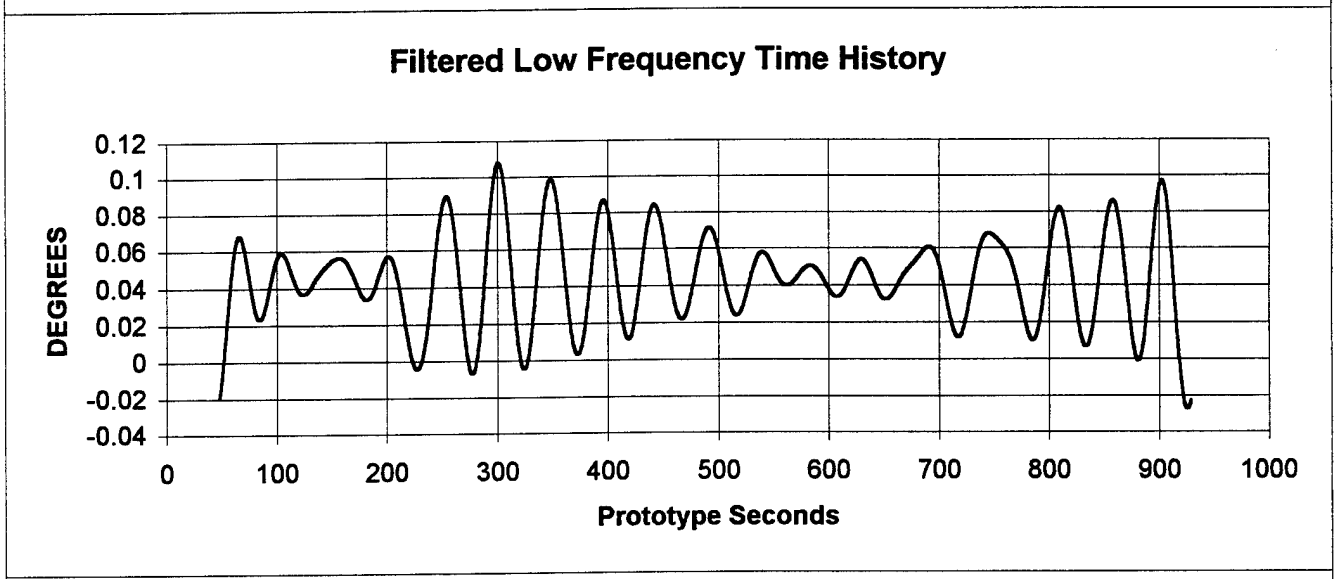


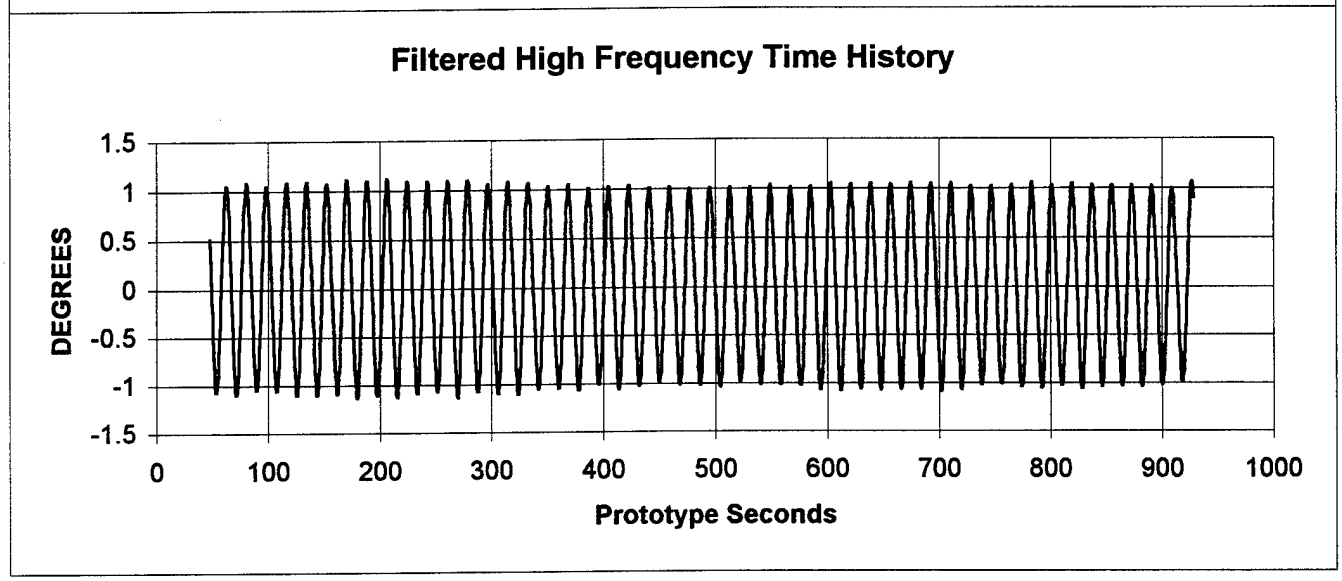
Filtered High Frequency Time History



TEST A1107 - PITCH

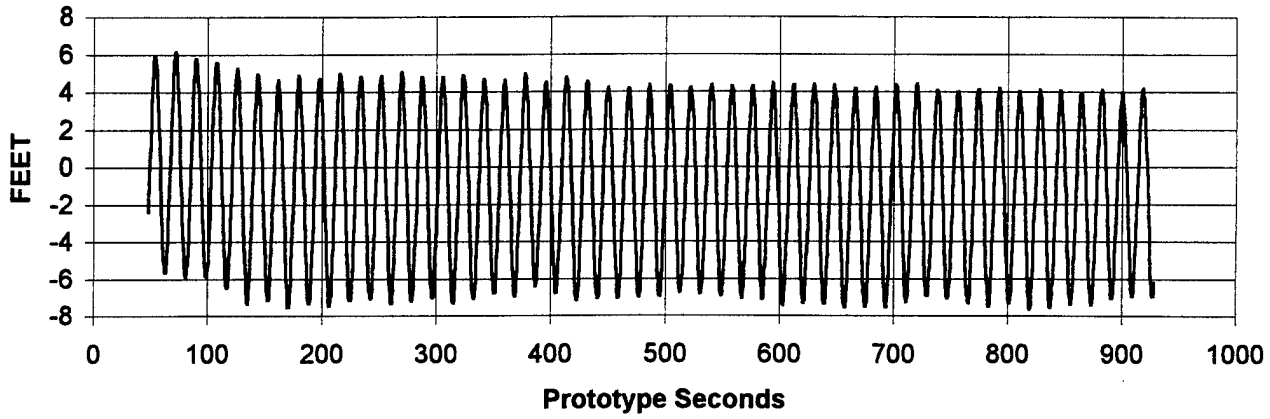




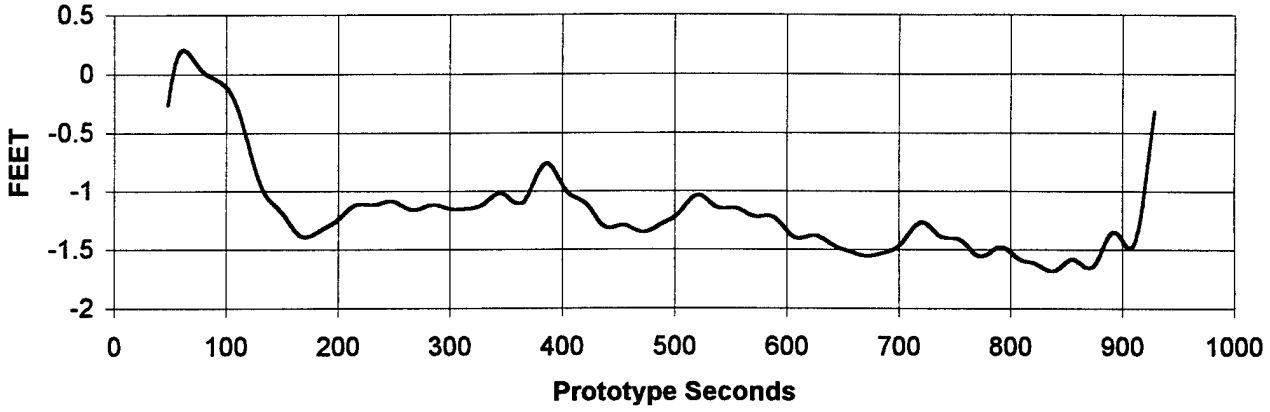


TEST A1107 - PT SURGE

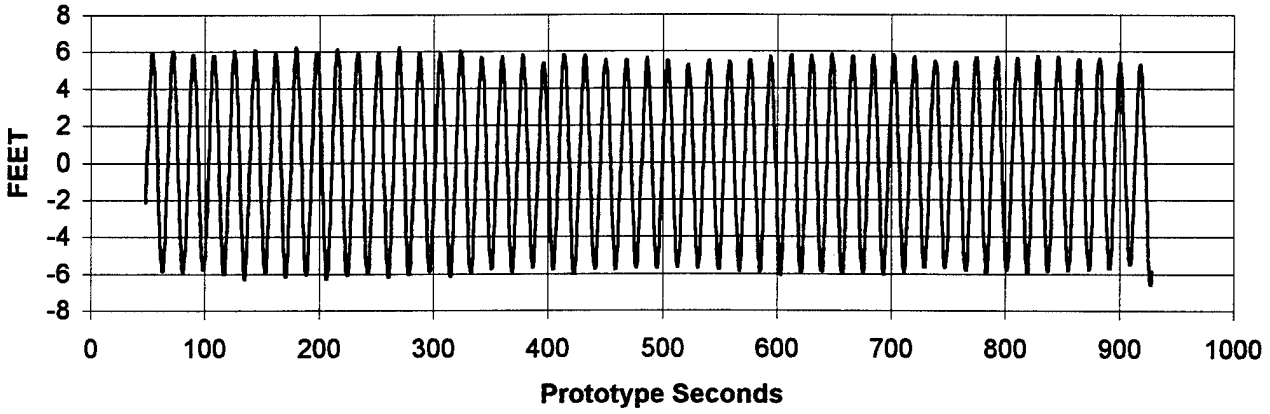
Unfiltered Time History



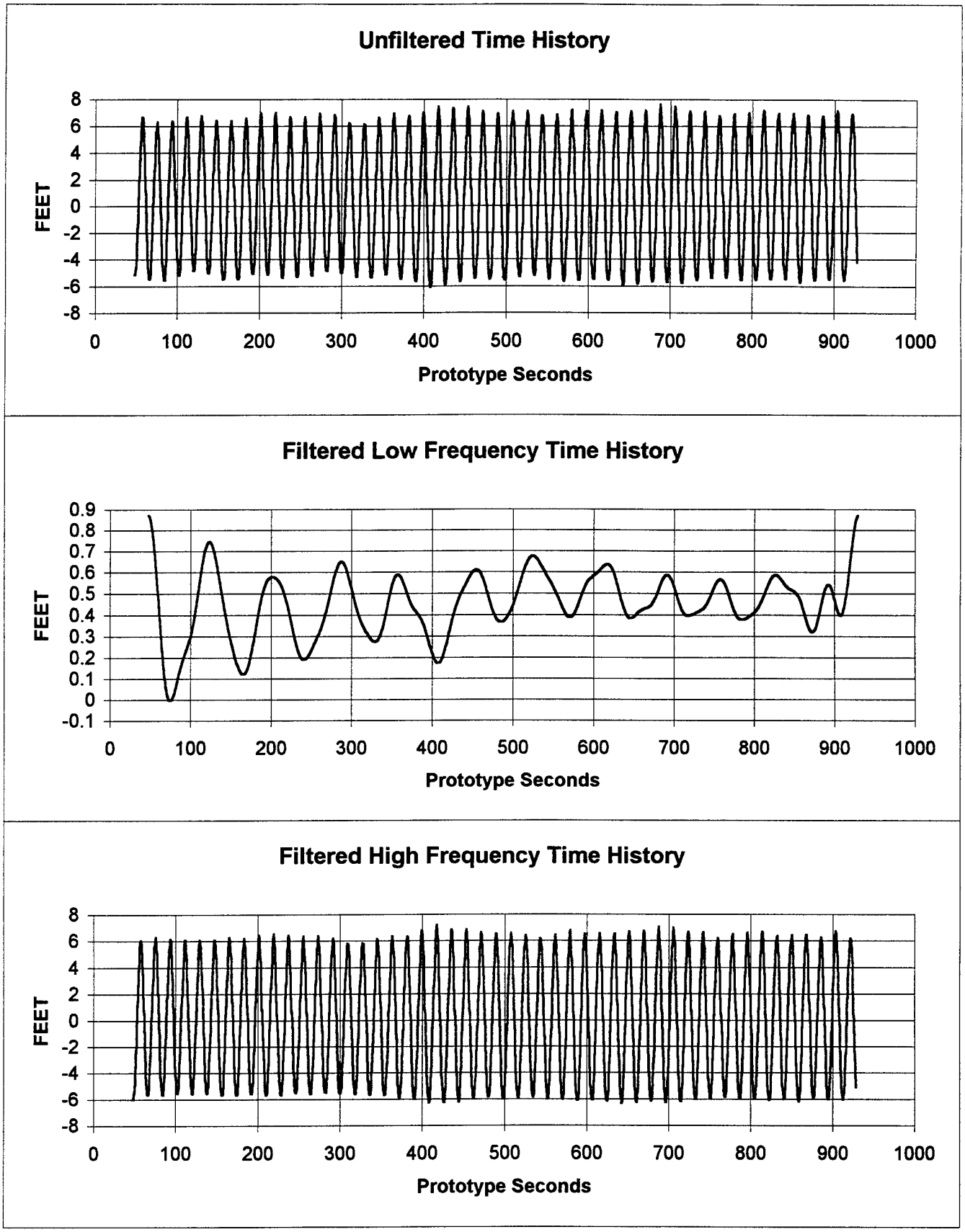
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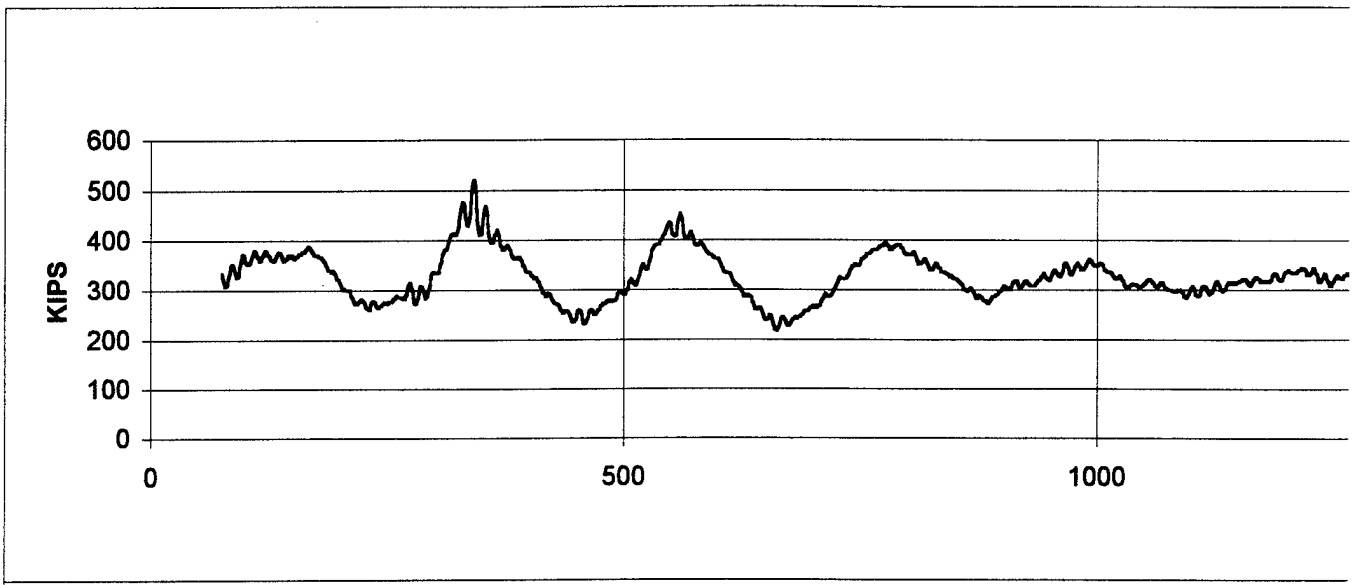
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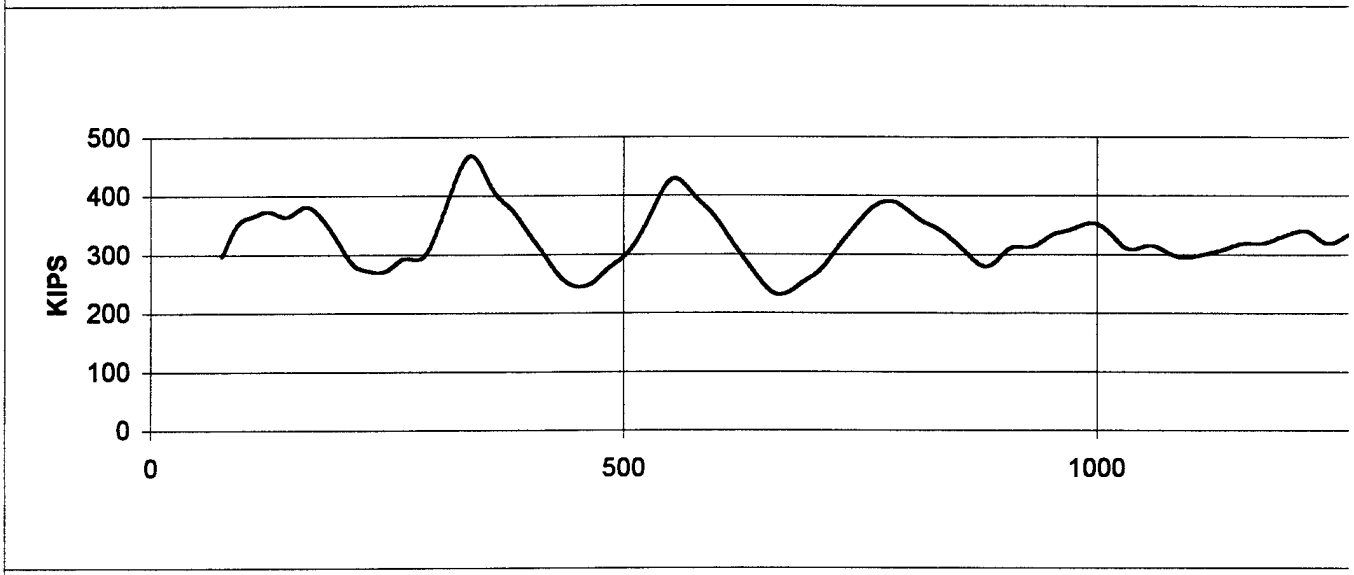


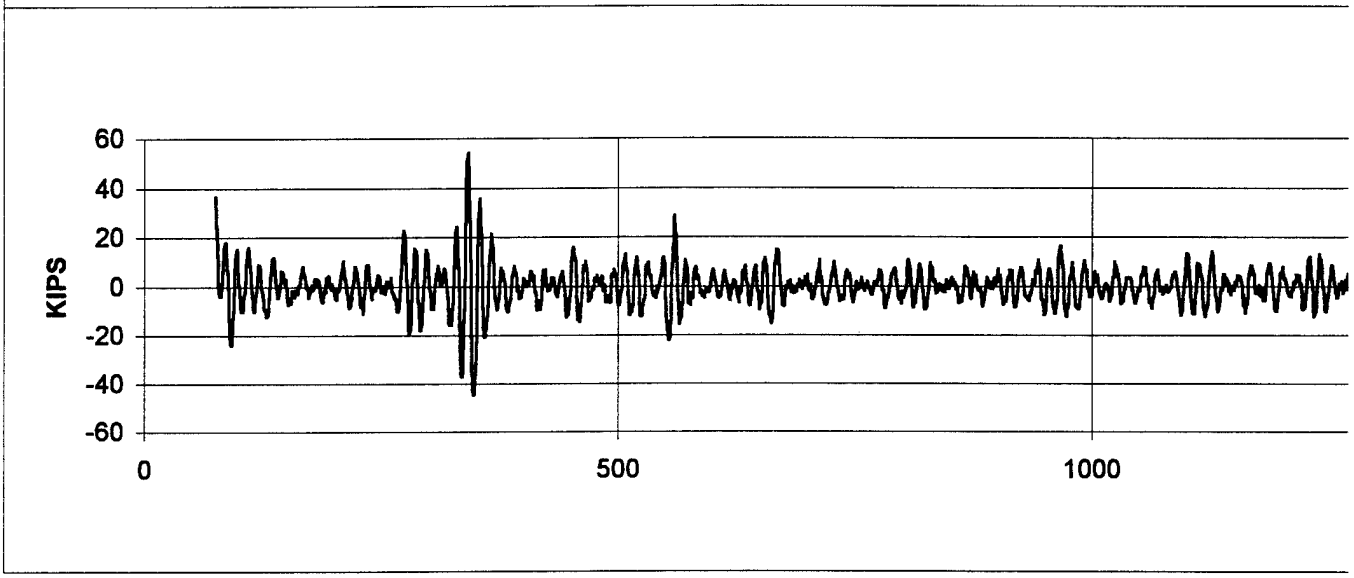
TEST A1107 - PT HEAVE



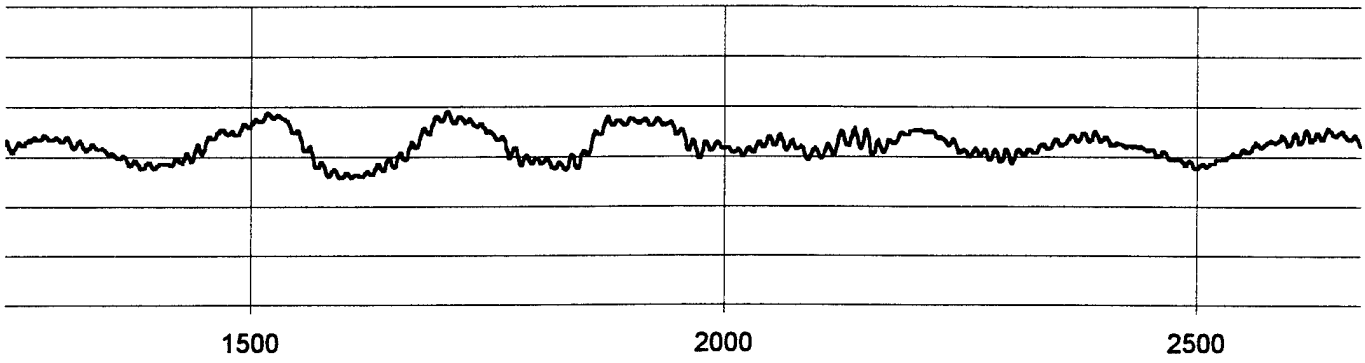
TEST A1108 - ML_1 TENSION



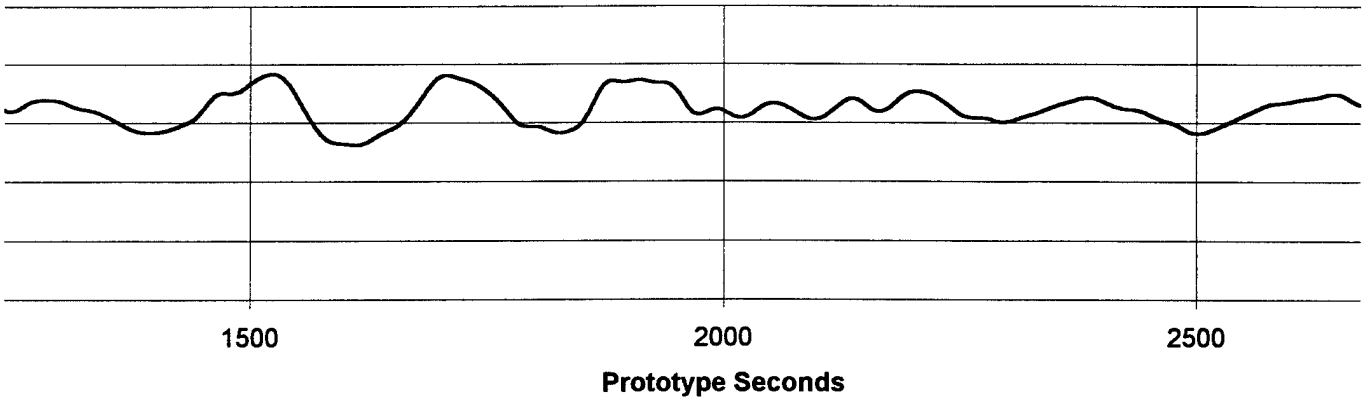




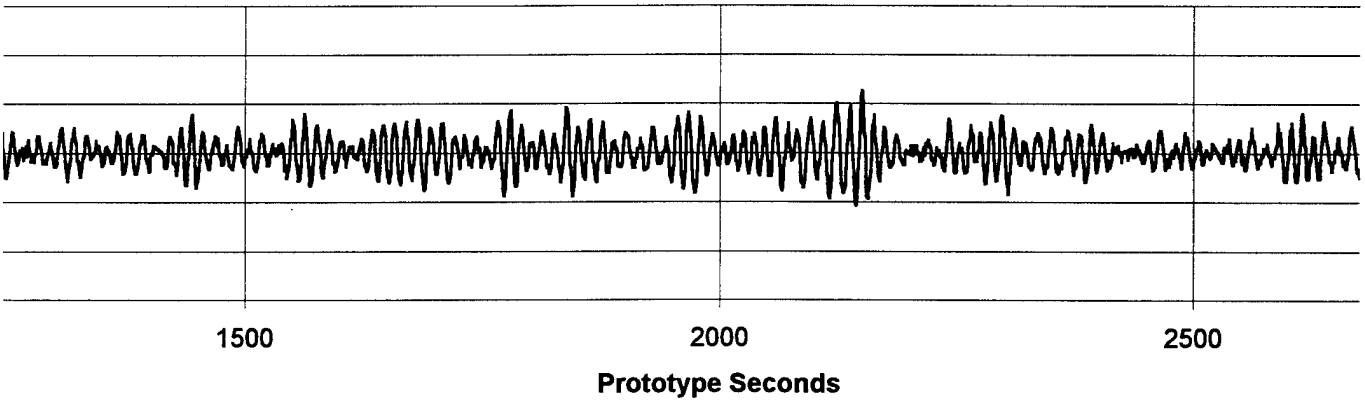
Unfiltered Time History



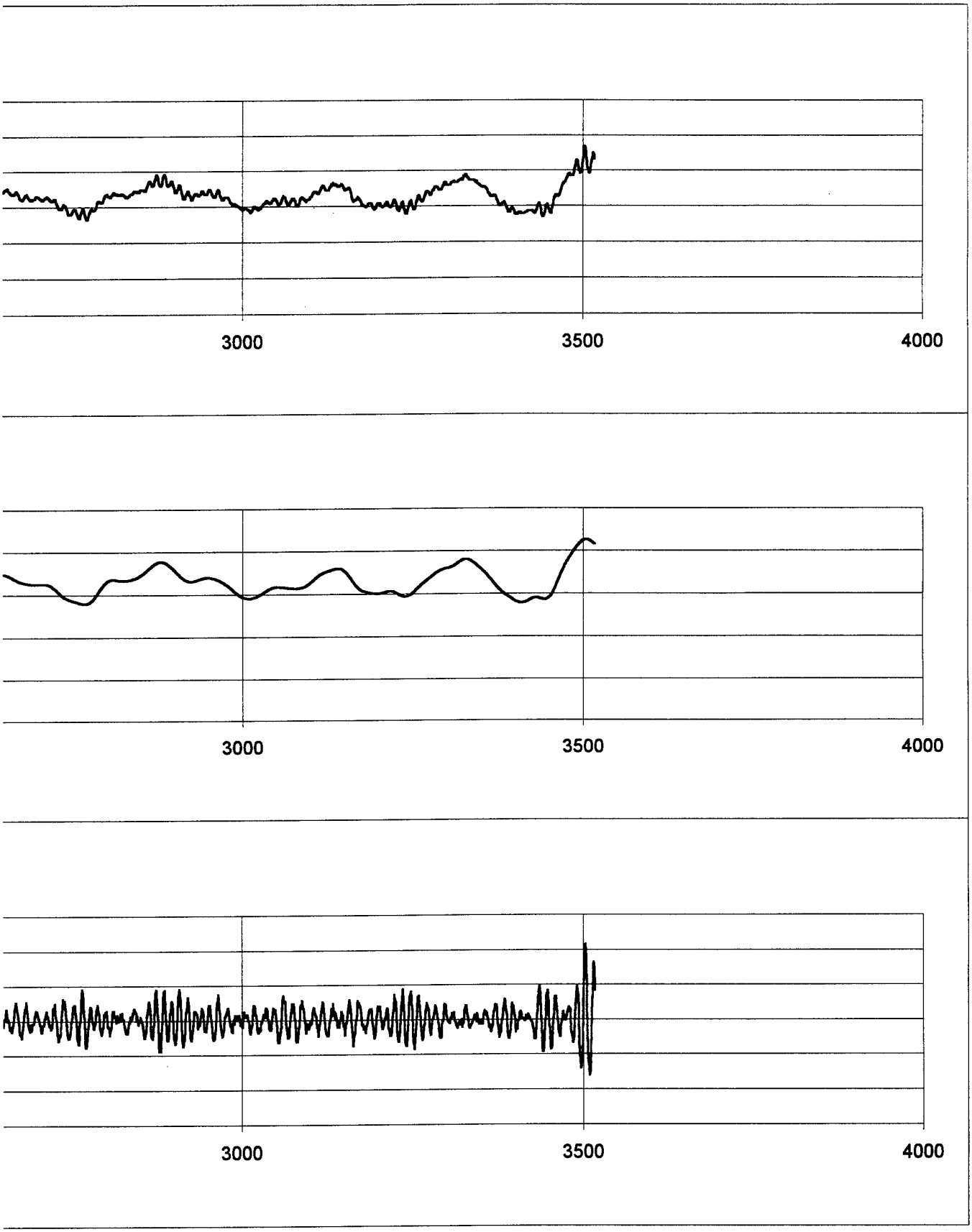
Filtered Low Frequency Time History



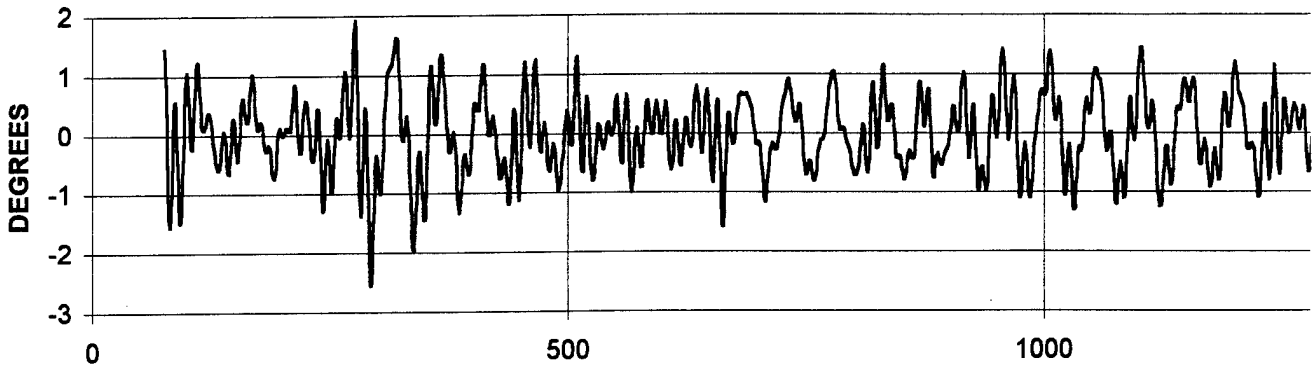
Filtered High Frequency Time History

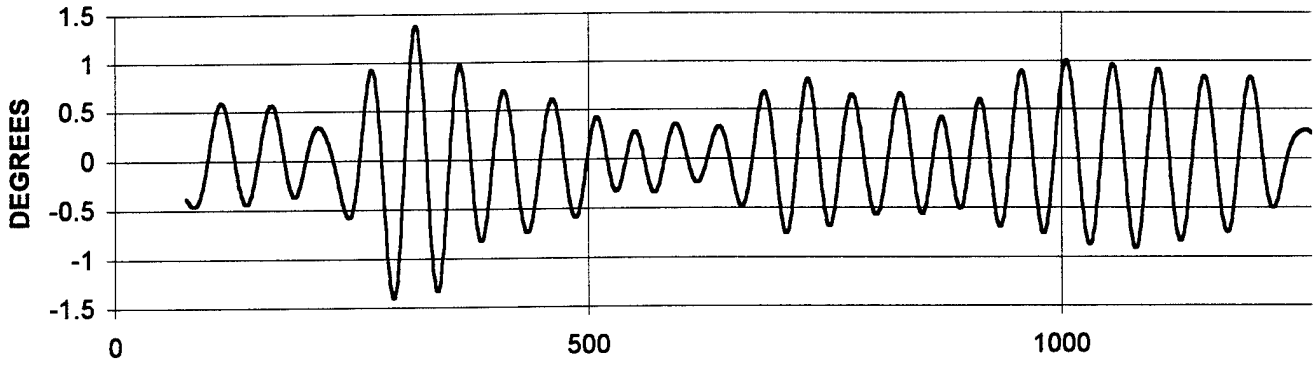


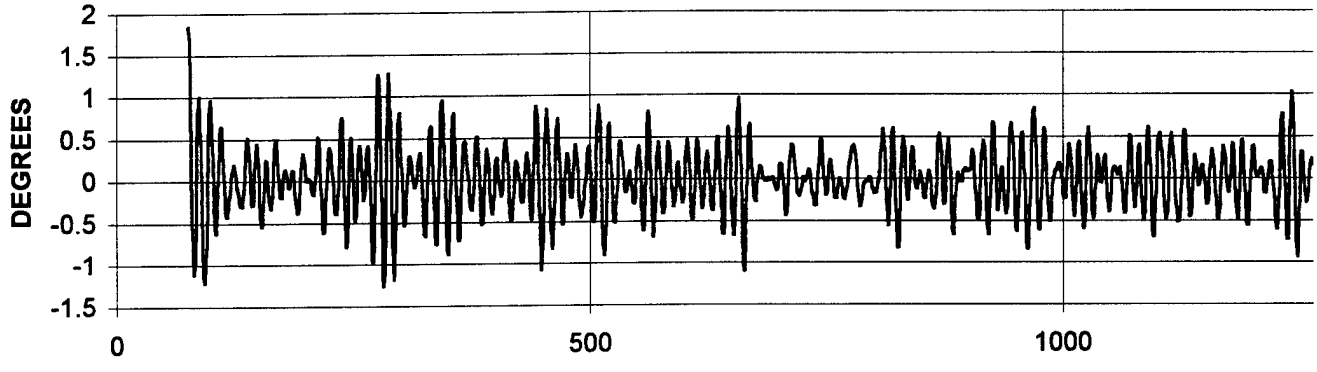
TEST A1108 - ML_1 TENSION



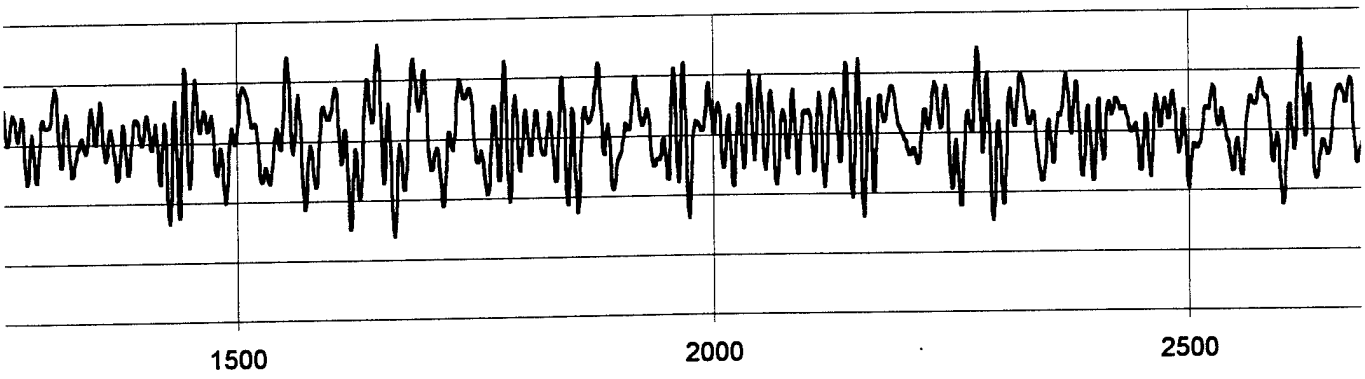
TEST A1108 - PITCH



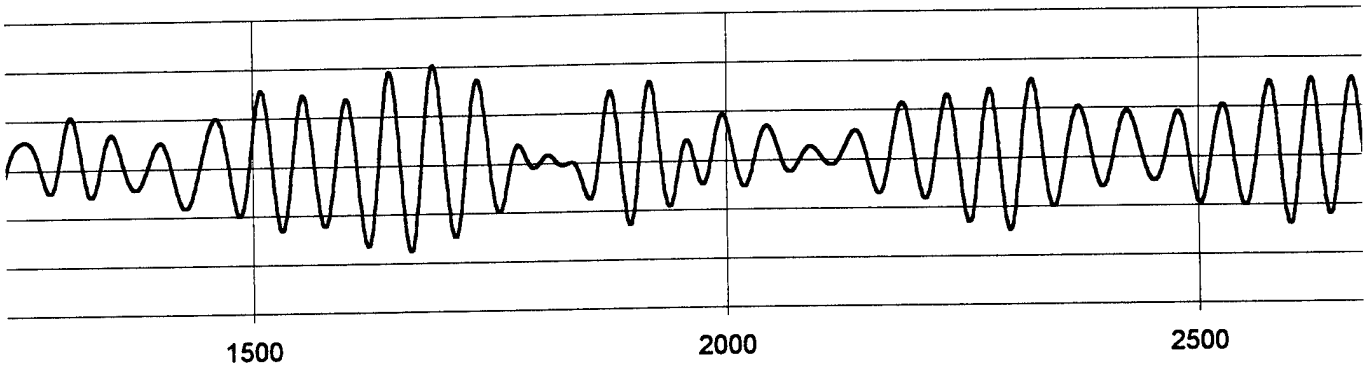




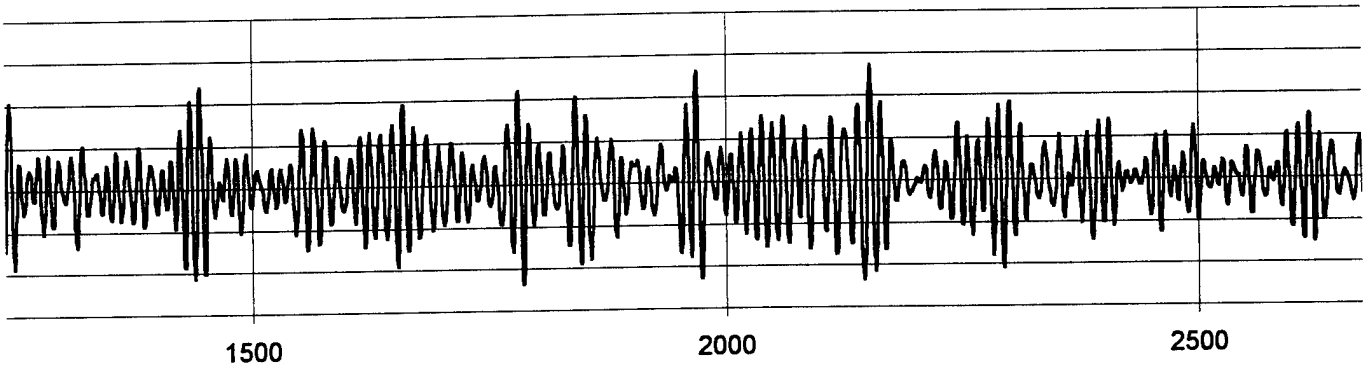
Unfiltered Time History



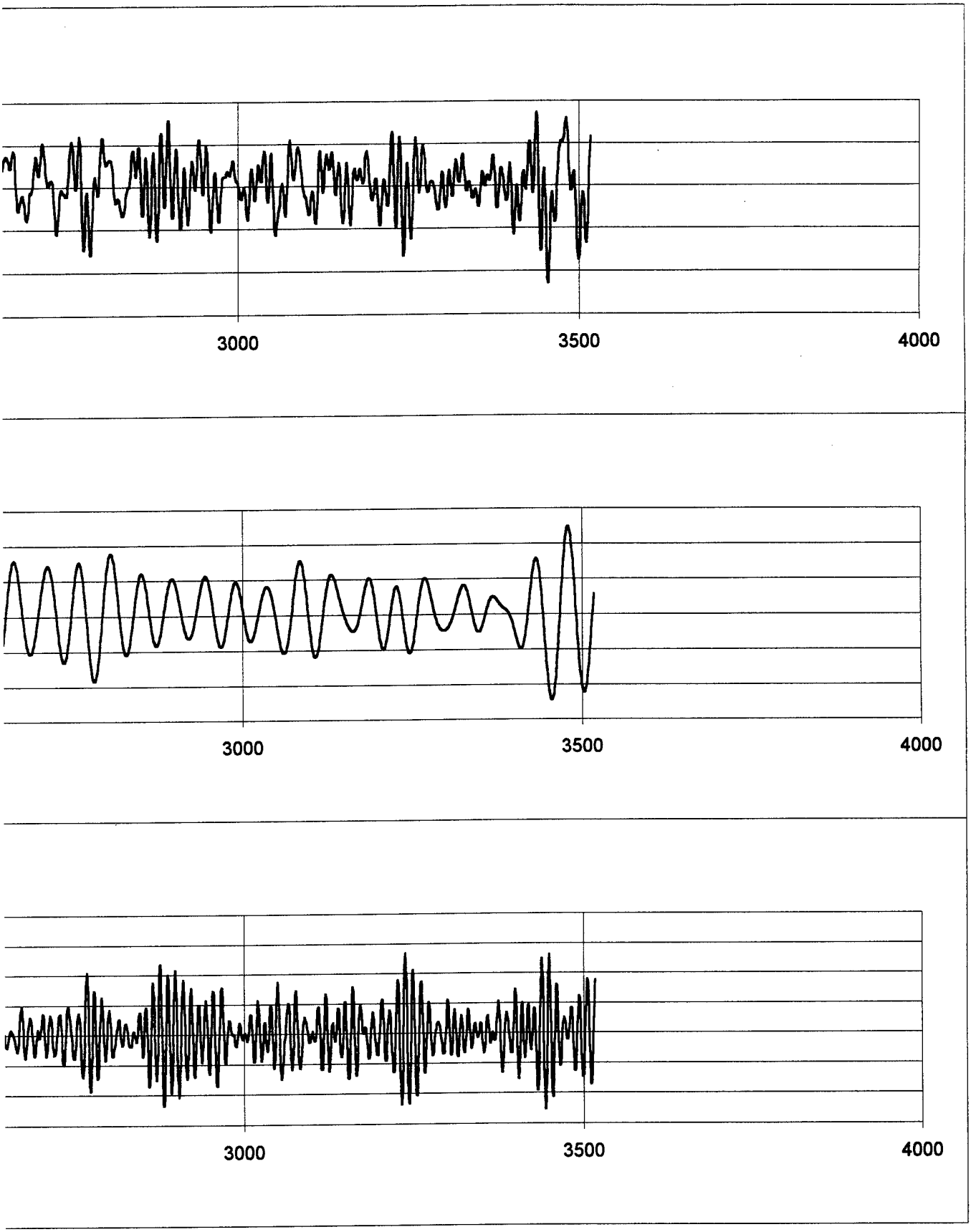
Filtered Low Frequency Time History



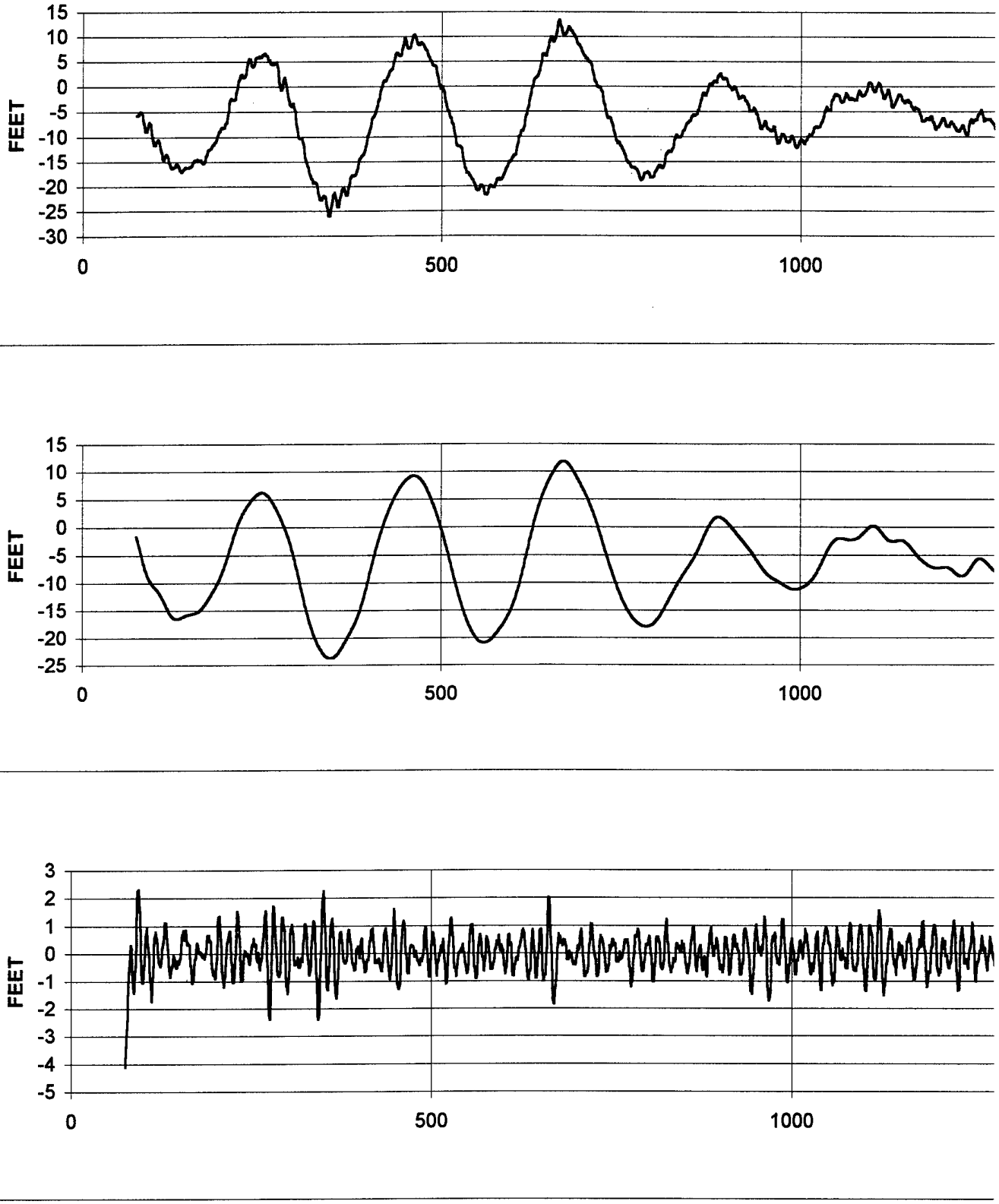
Filtered High Frequency Time History



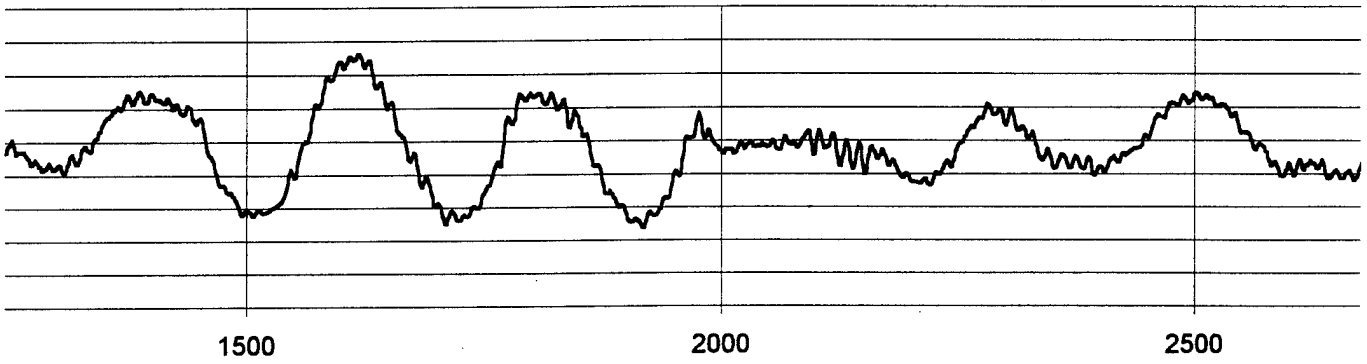
TEST A1108 - PITCH



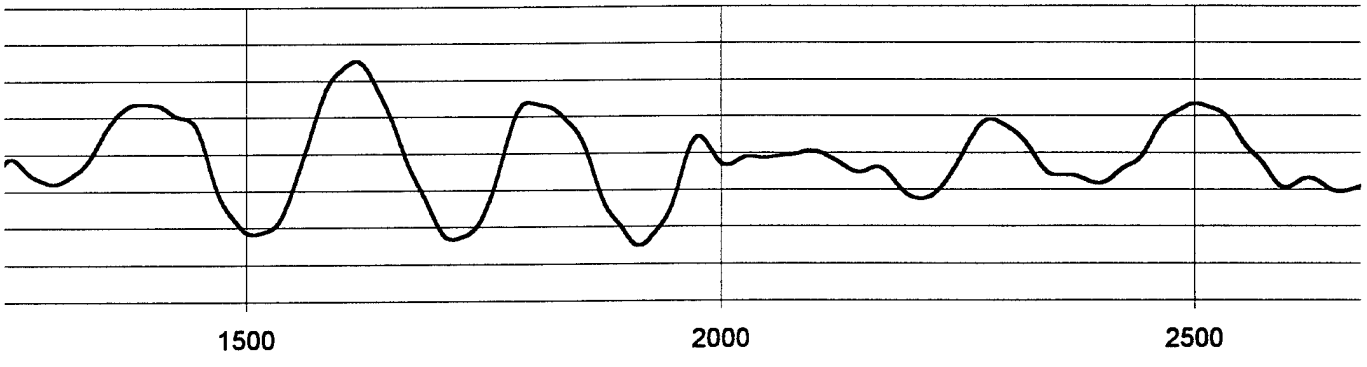
TEST A1108 - PT SURGE



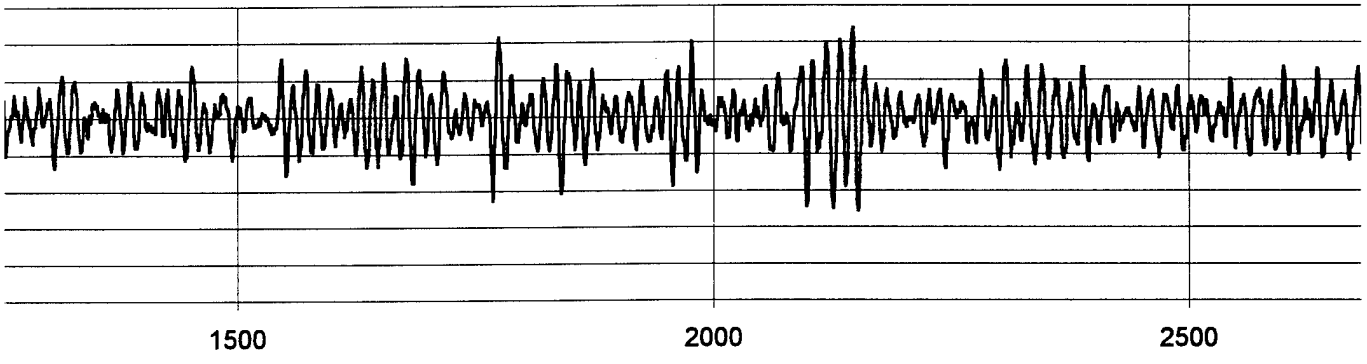
Unfiltered Time History



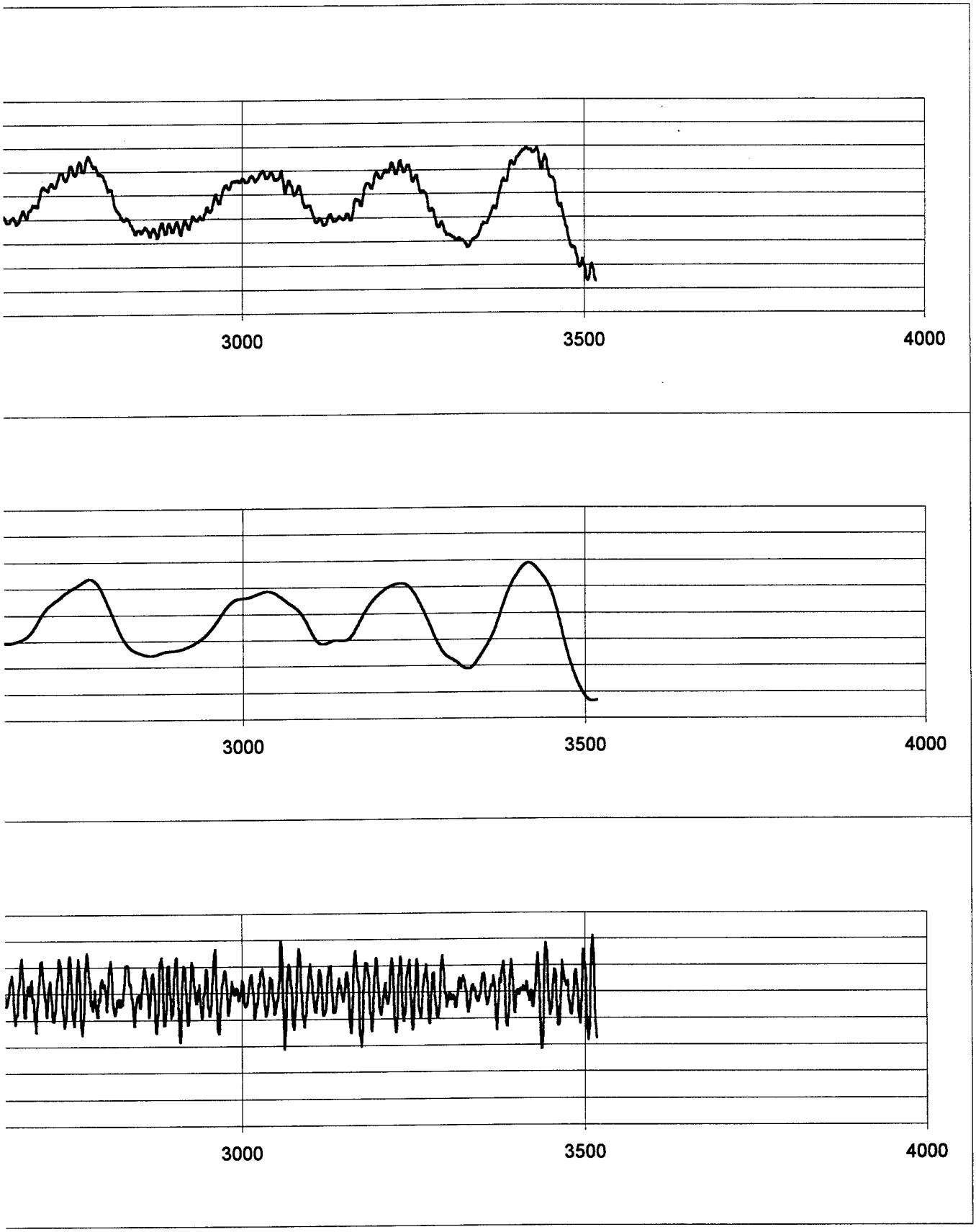
Filtered Low Frequency Time History



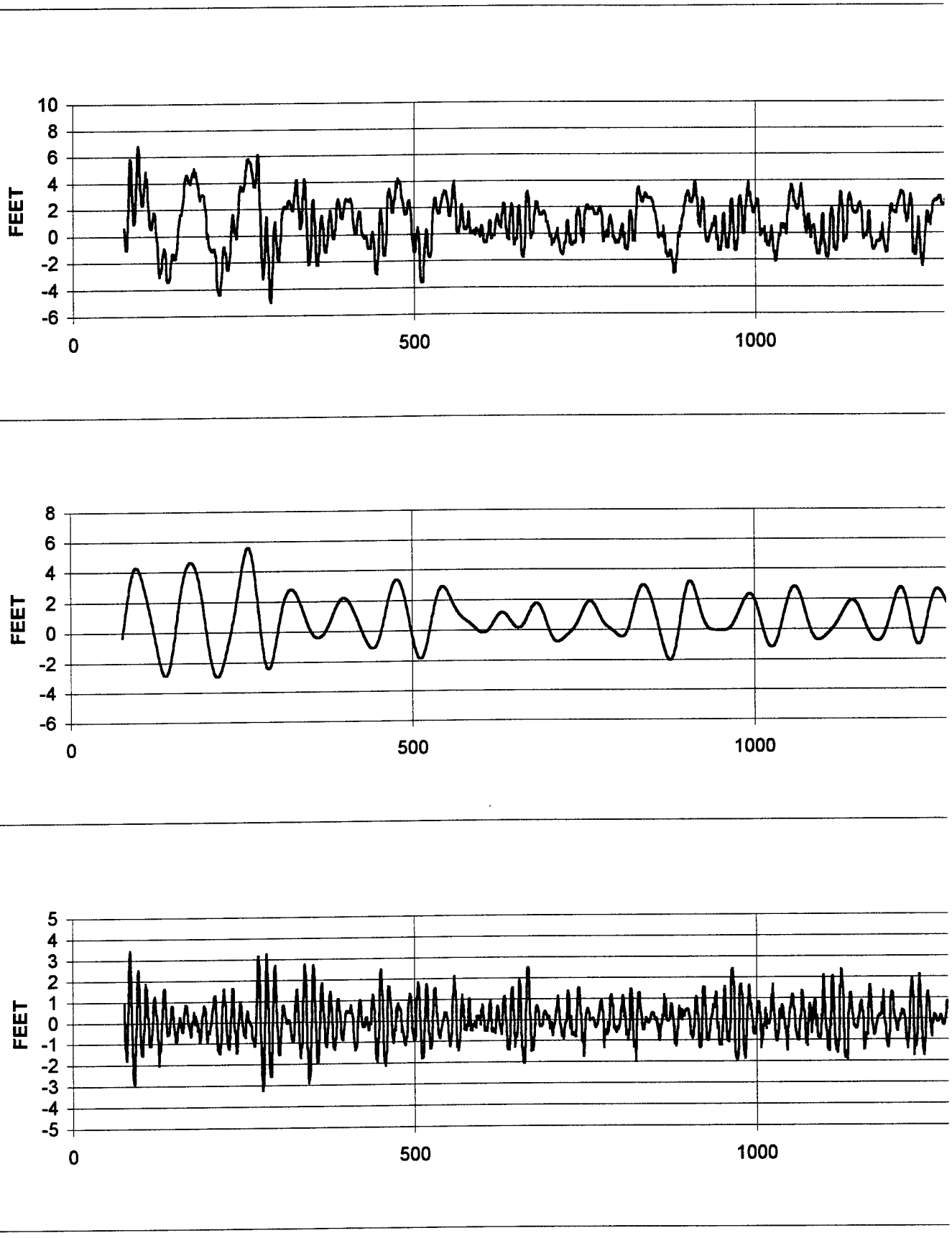
Filtered High Frequency Time History



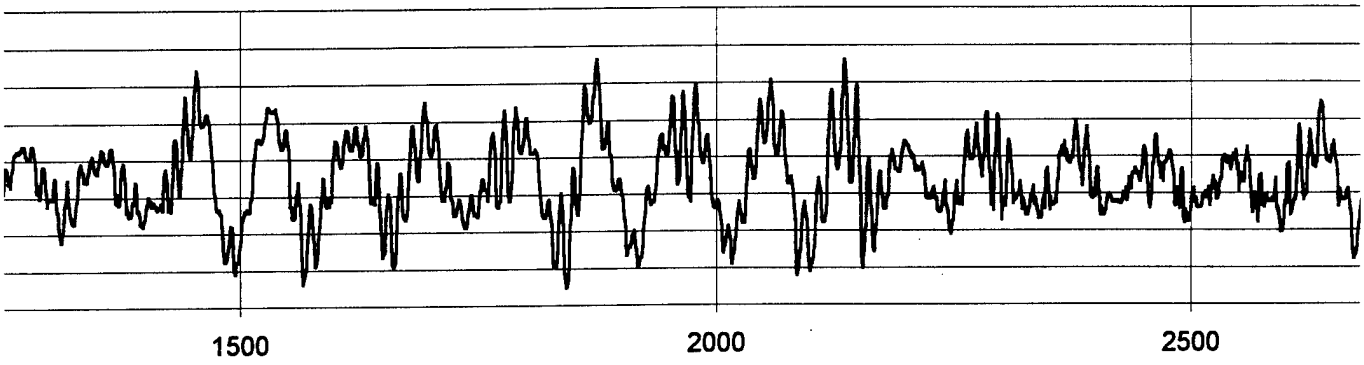
TEST A1108 - PT SURGE



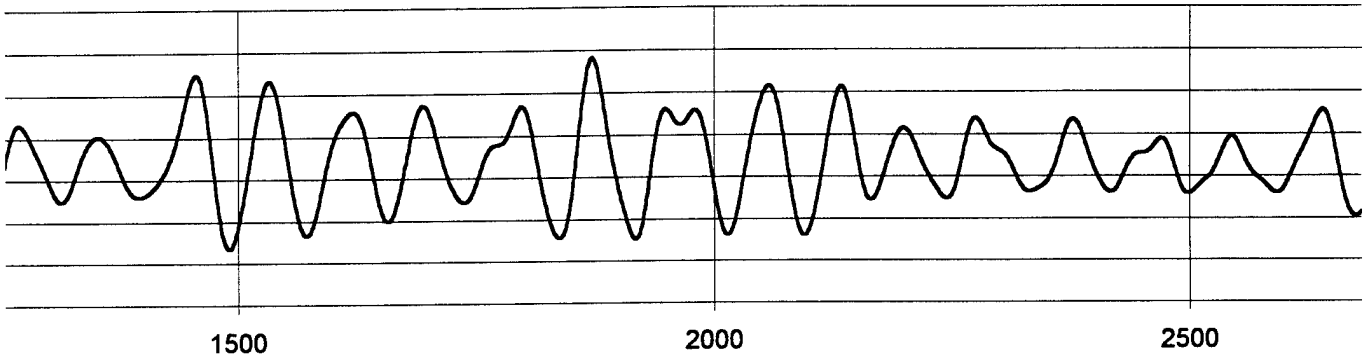
TEST A1108 - PT HEAVE



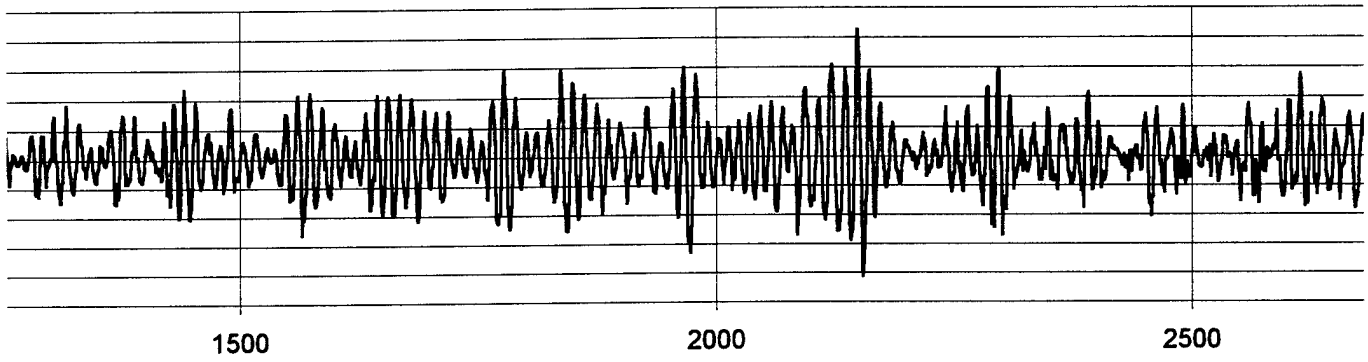
Unfiltered Time History



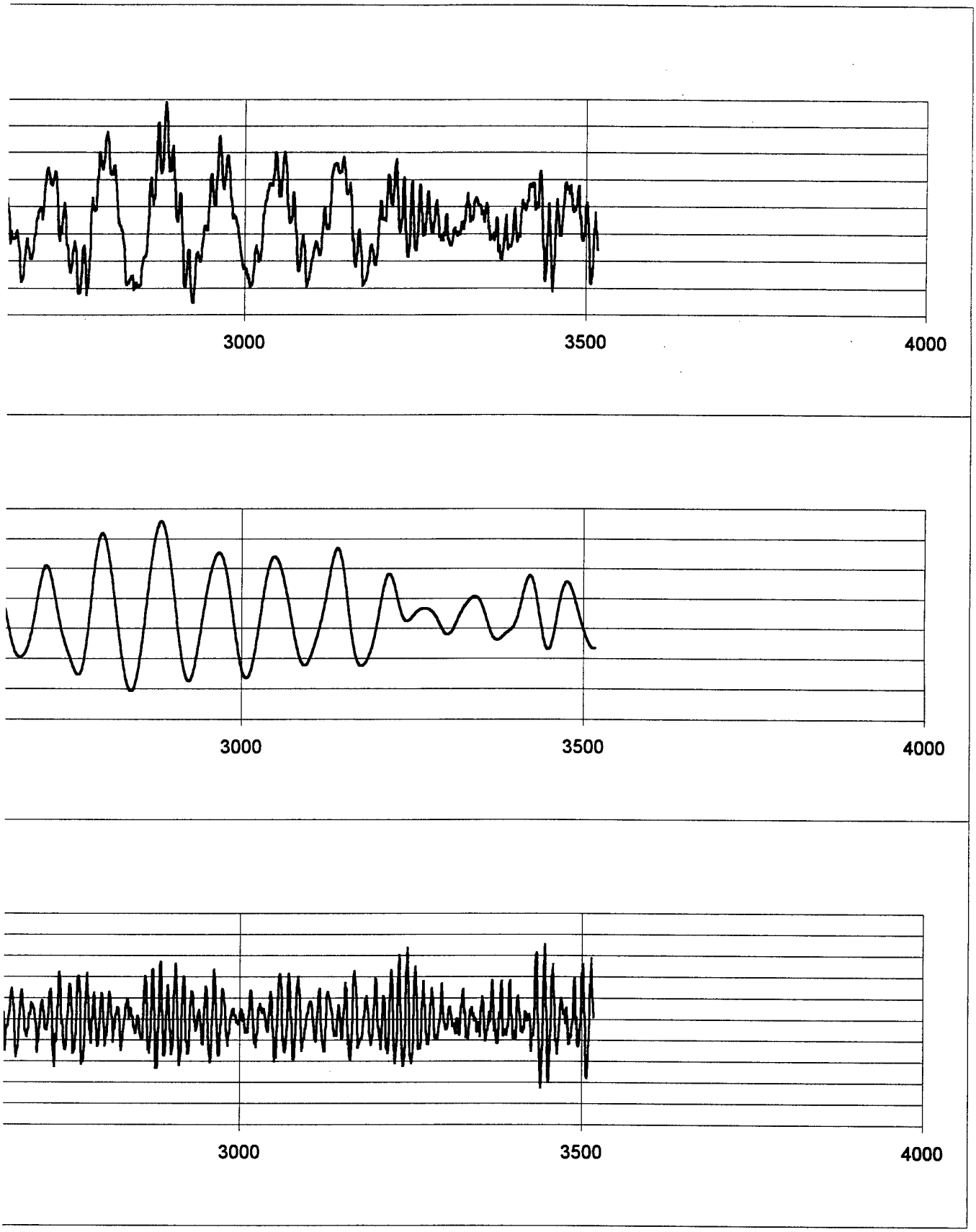
Filtered Low Frequency Time History



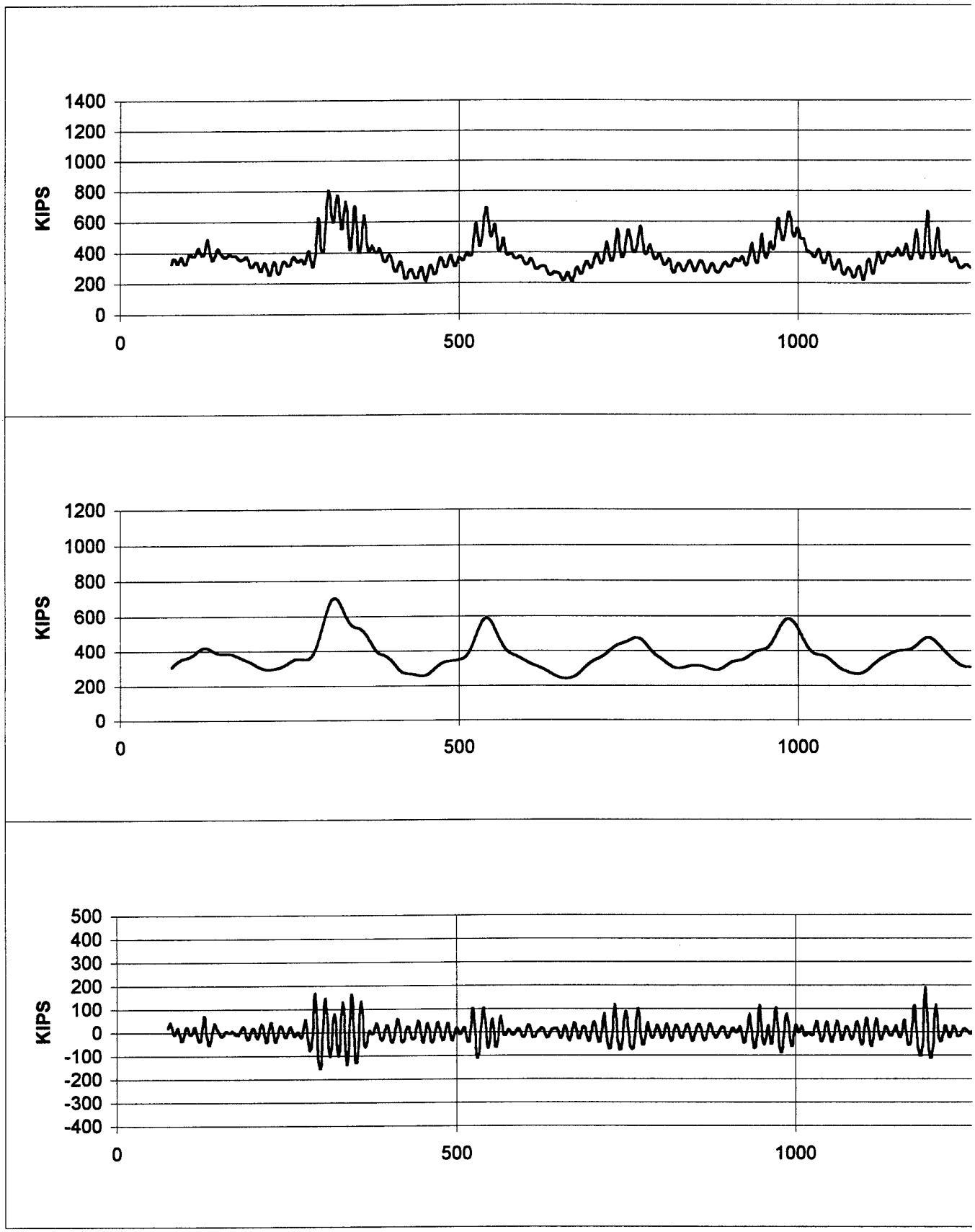
Filtered High Frequency Time History



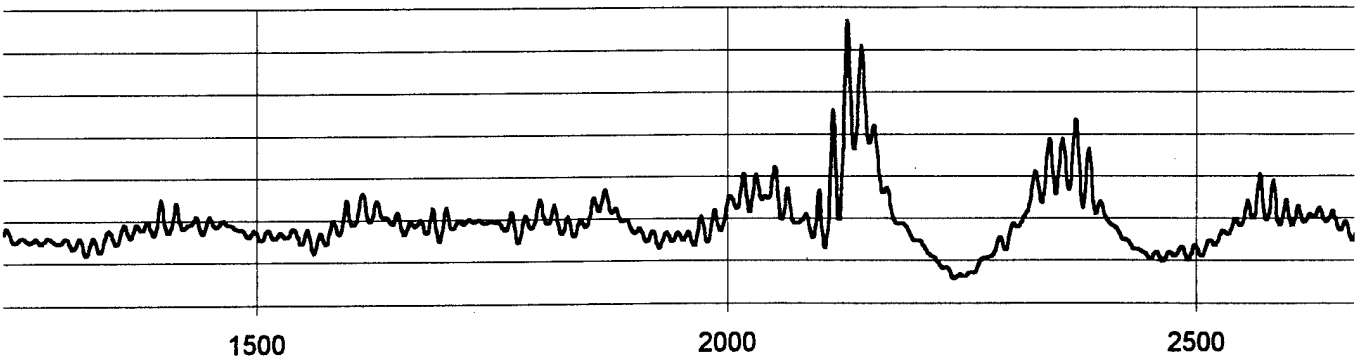
TEST A1108 - PT HEAVE



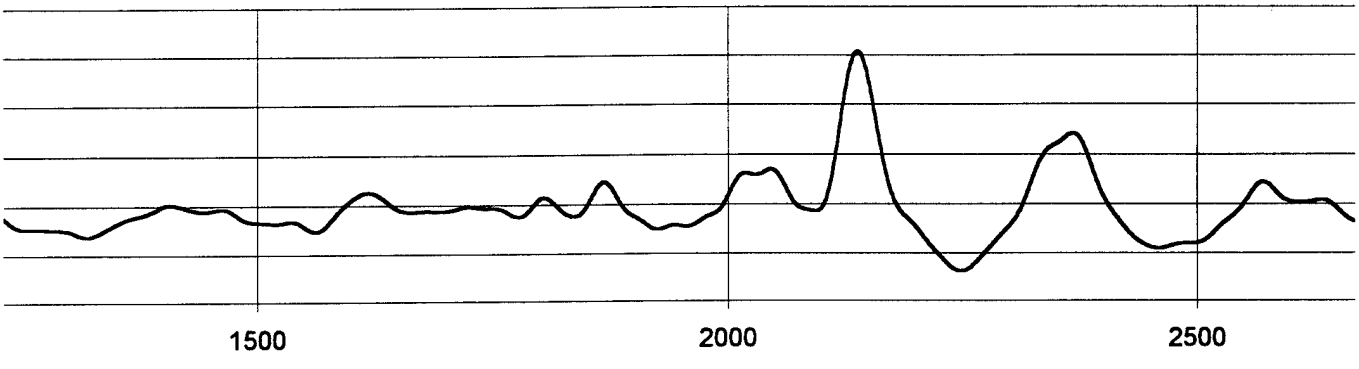
TEST A1109 - ML_1 TENSION



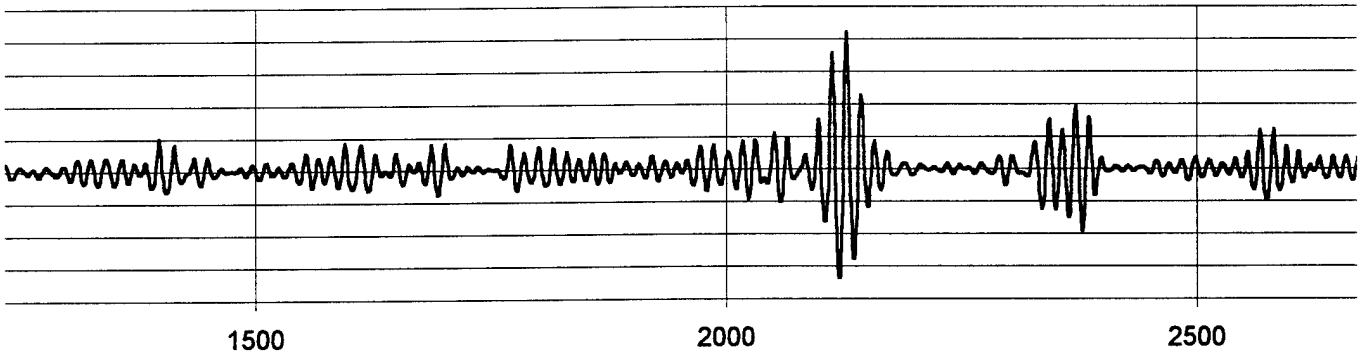
Unfiltered Time History



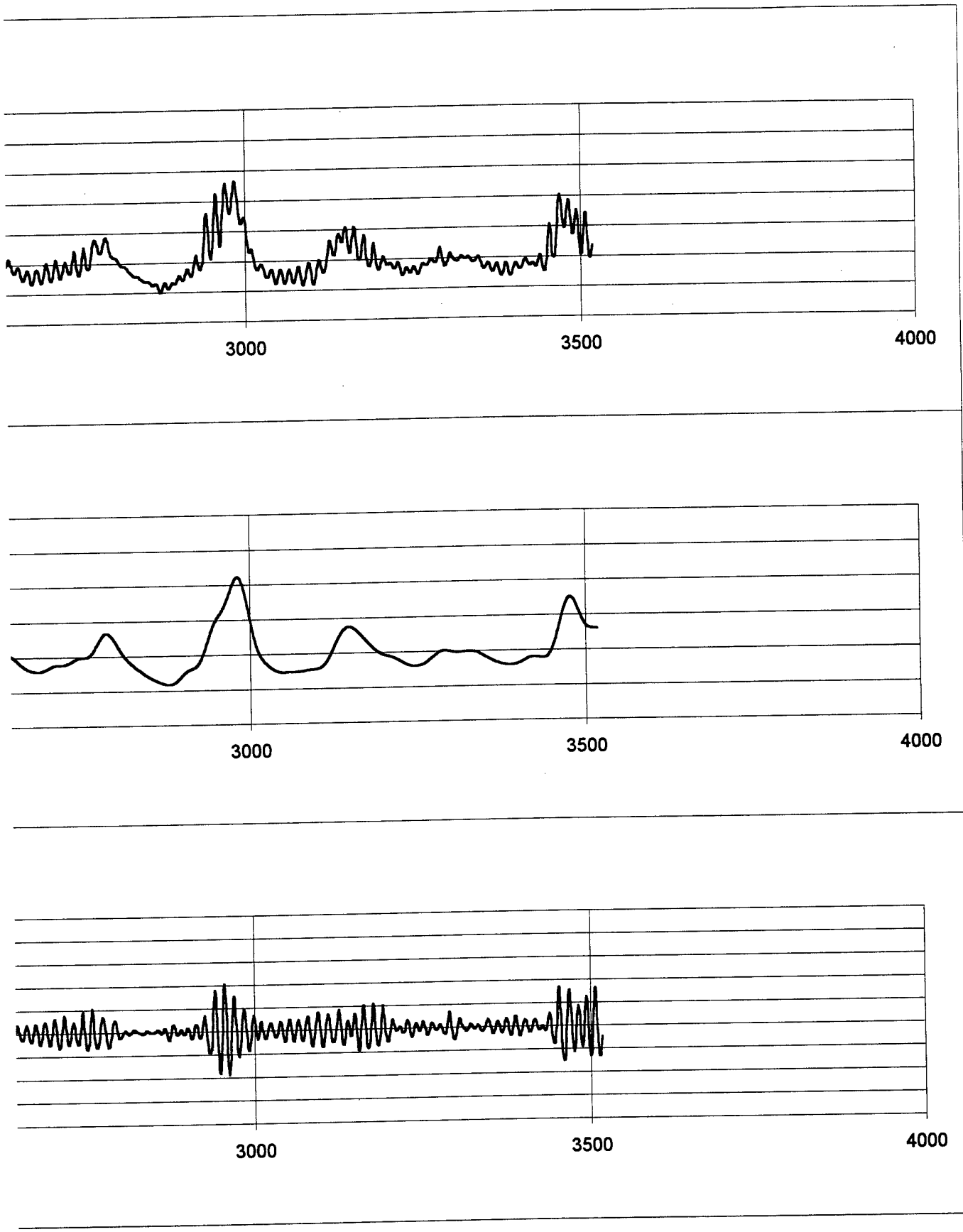
Filtered Low Frequency Time History



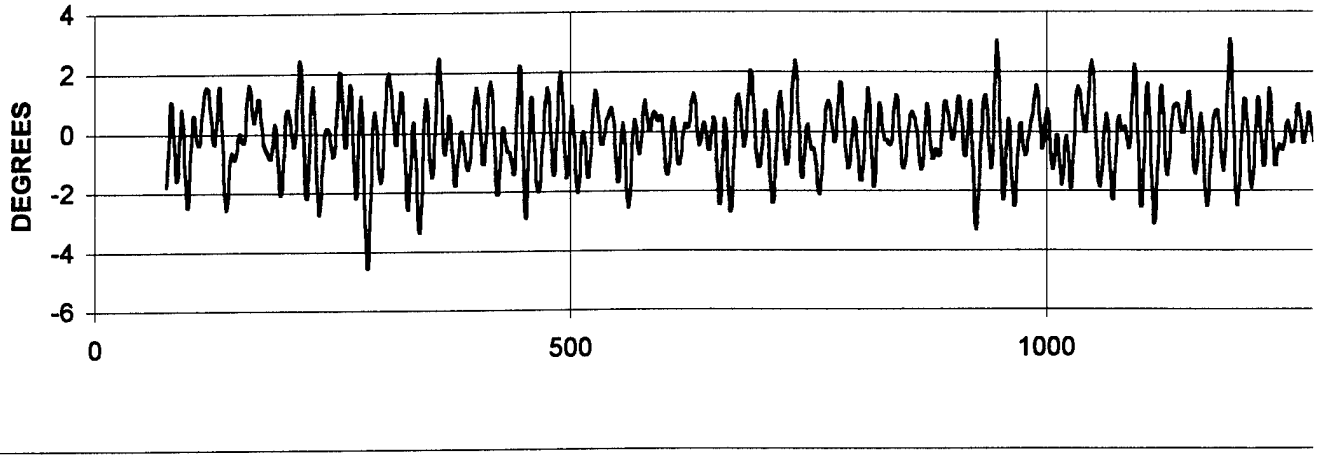
Filtered High Frequency Time History

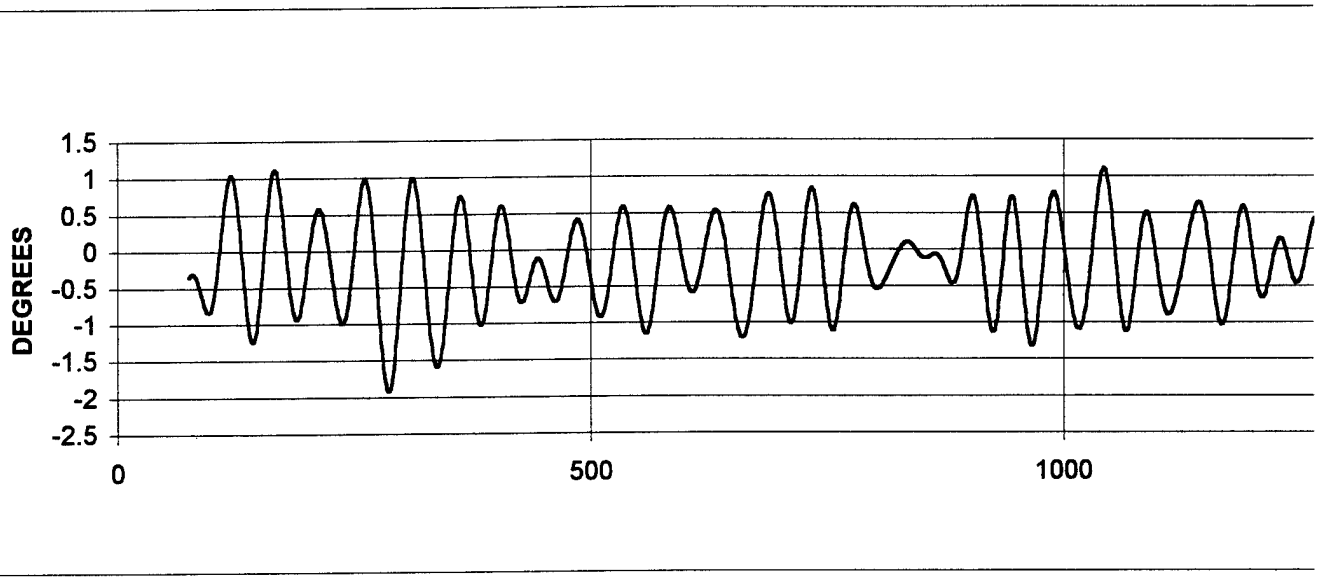


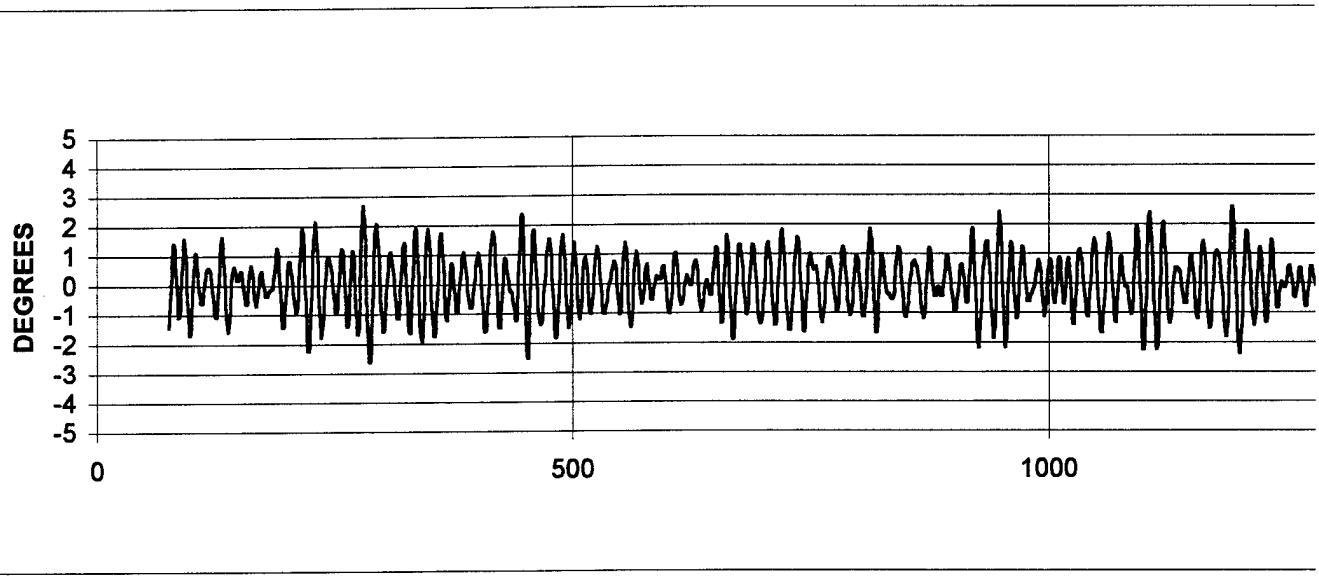
TEST A1109 - ML_1 TENSION



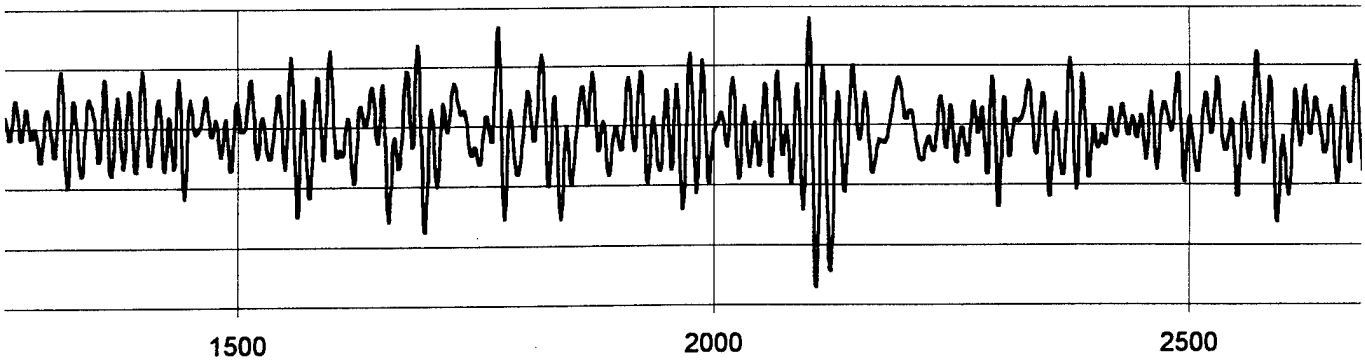
TEST A1109 - PITCH



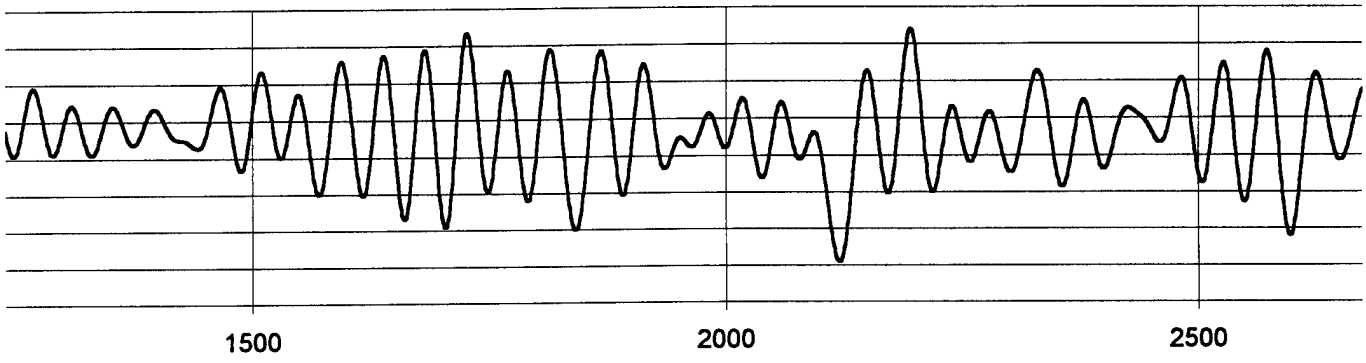




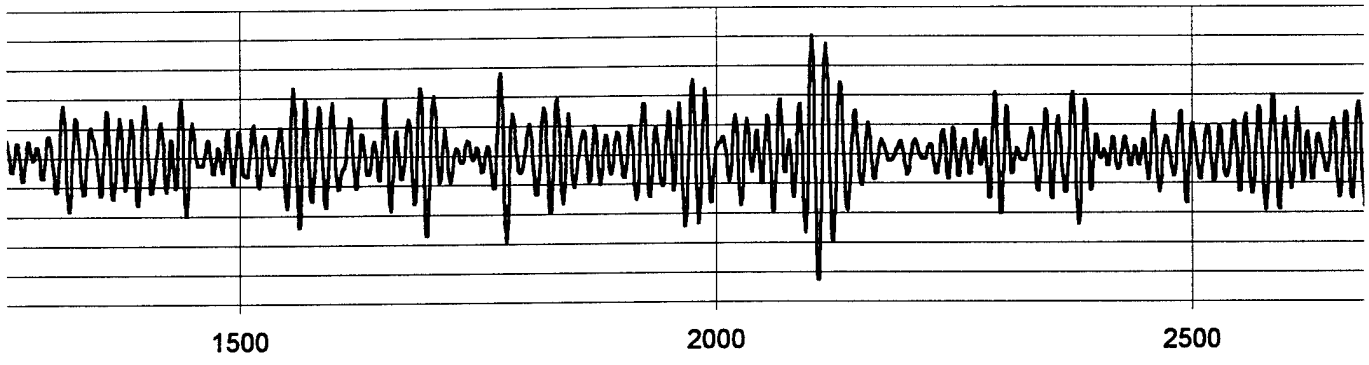
Unfiltered Time History



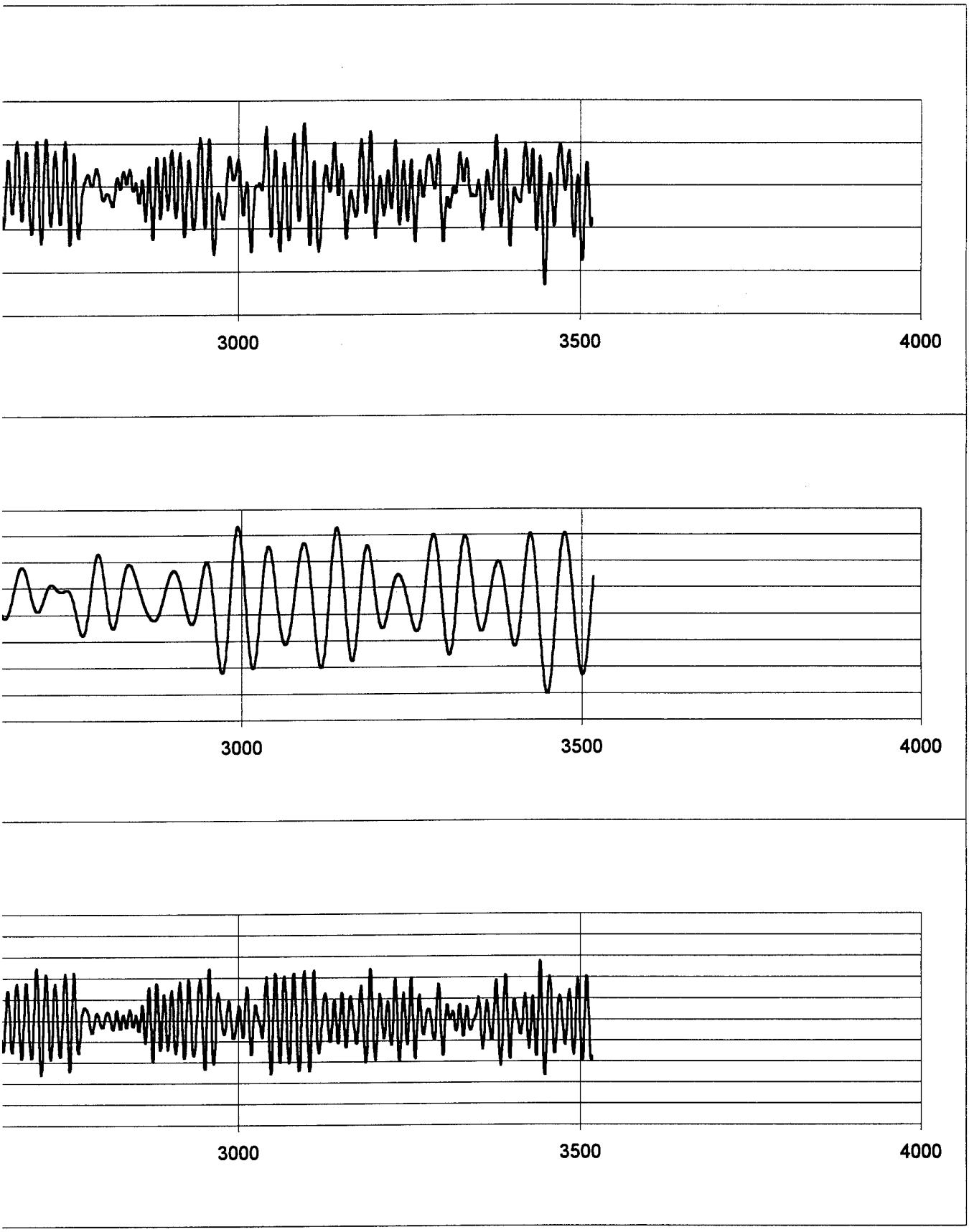
Filtered Low Frequency Time History



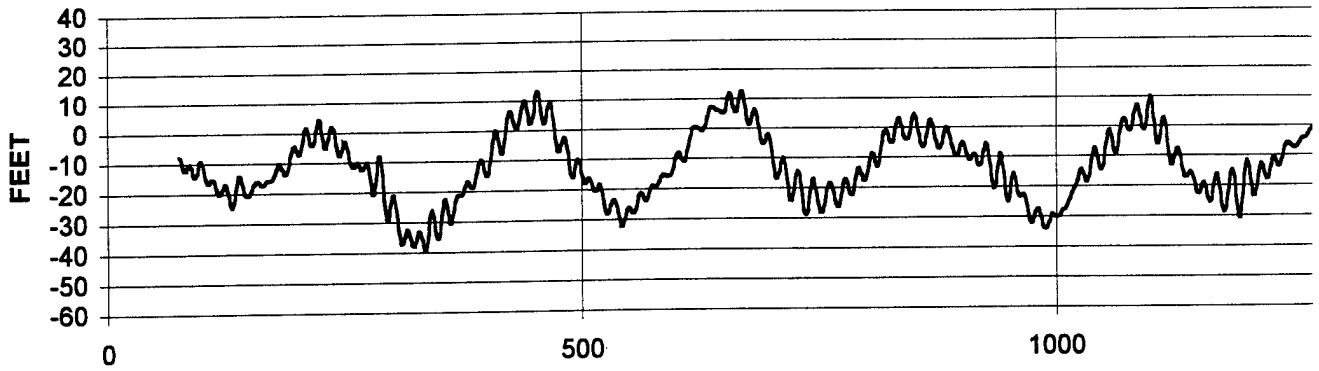
Filtered High Frequency Time History

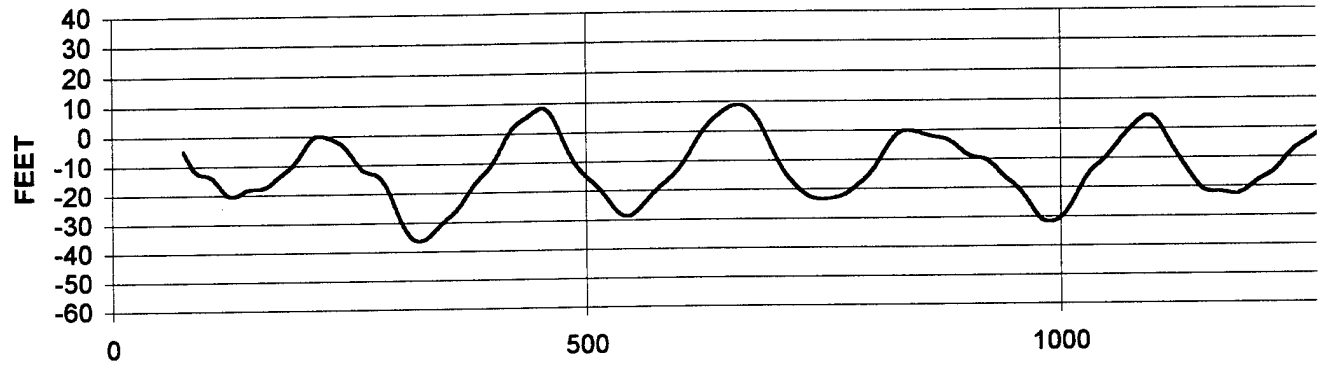


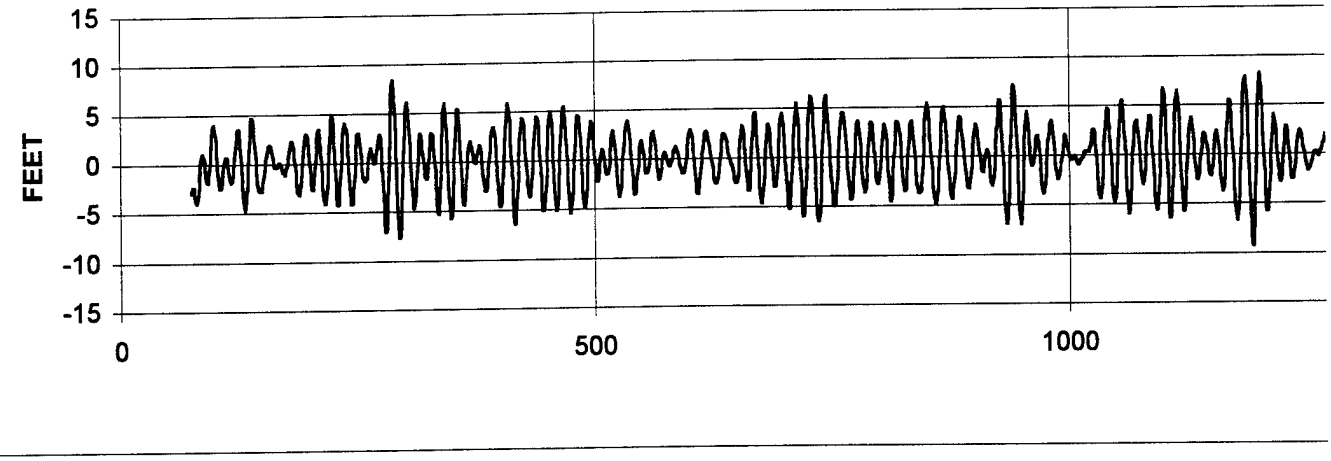
TEST A1109 - PITCH



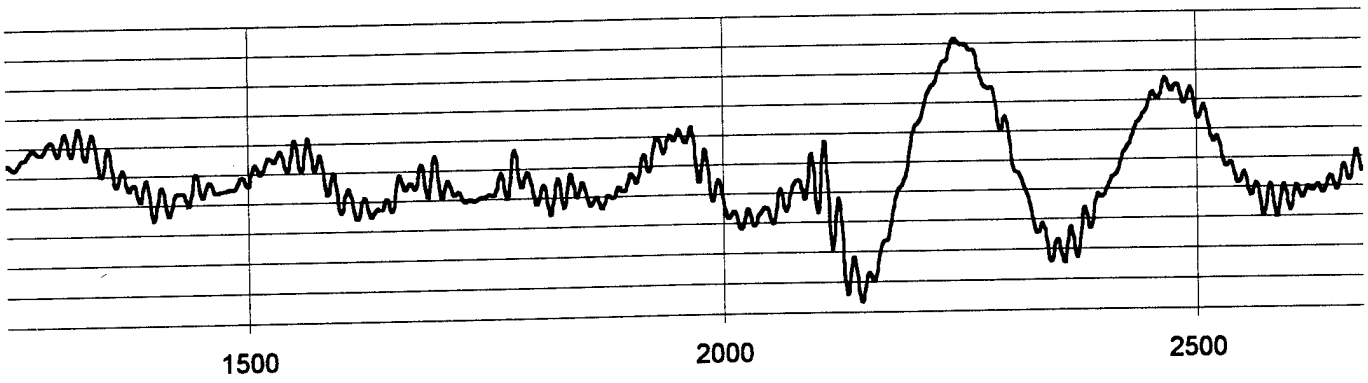
TEST A1109 - PT SURGE



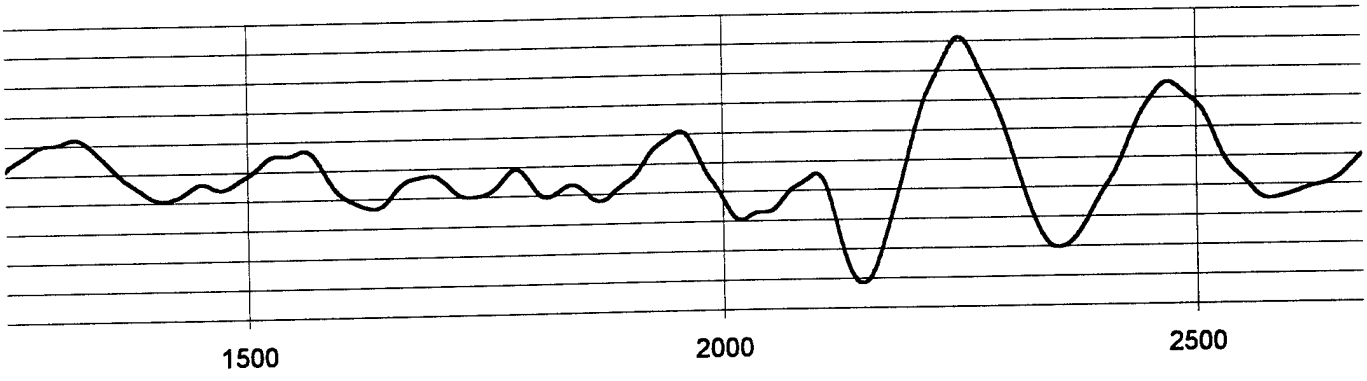




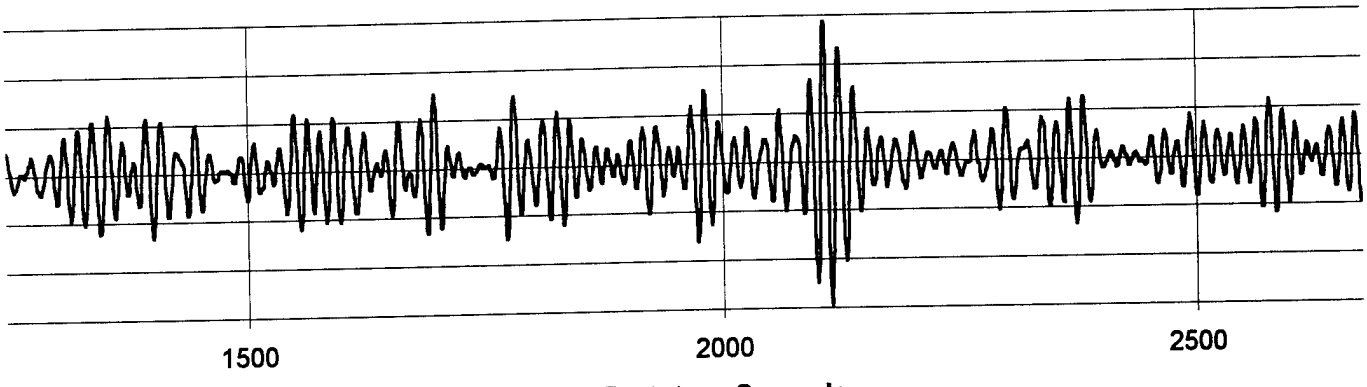
Unfiltered Time History



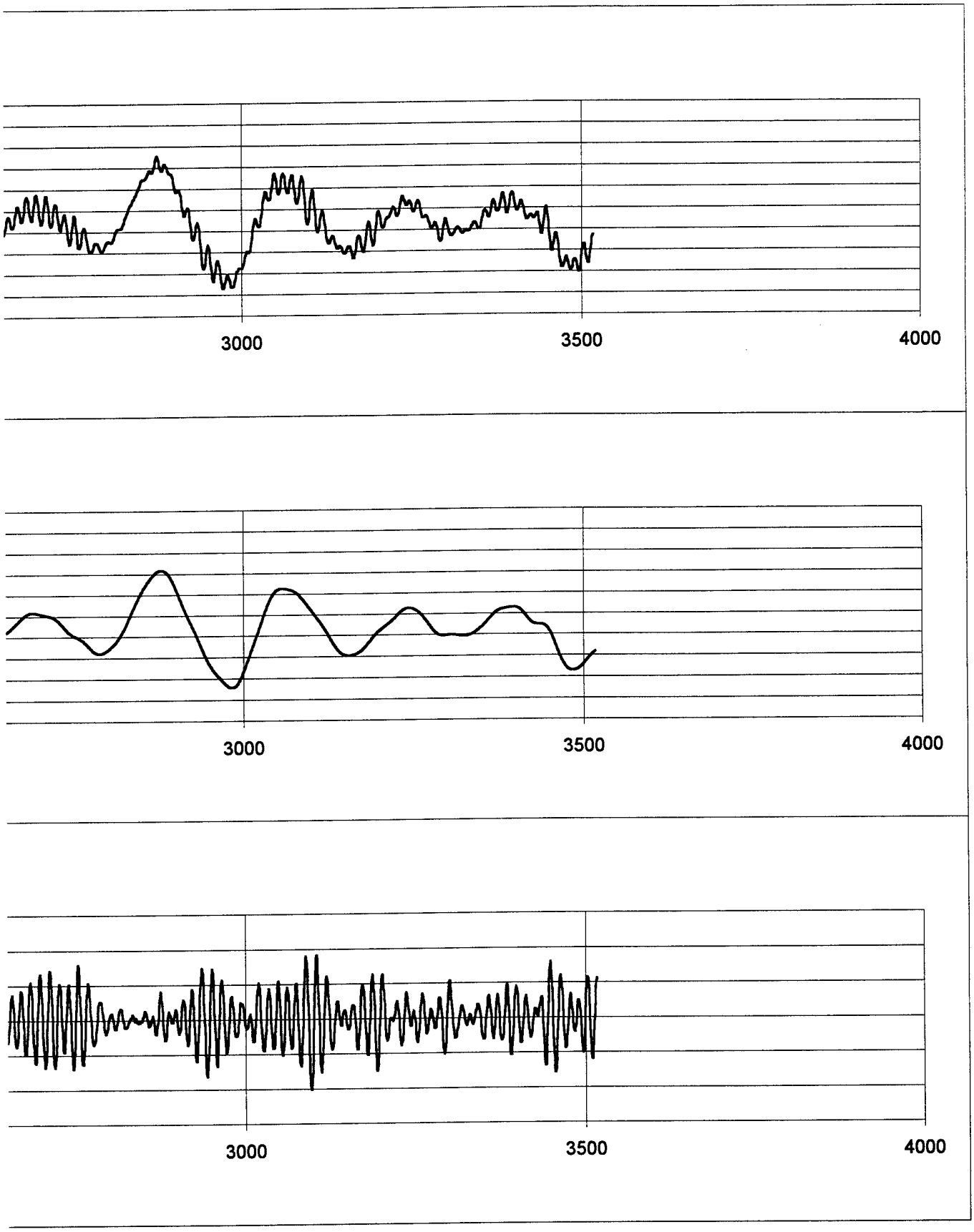
Filtered Low Frequency Time History



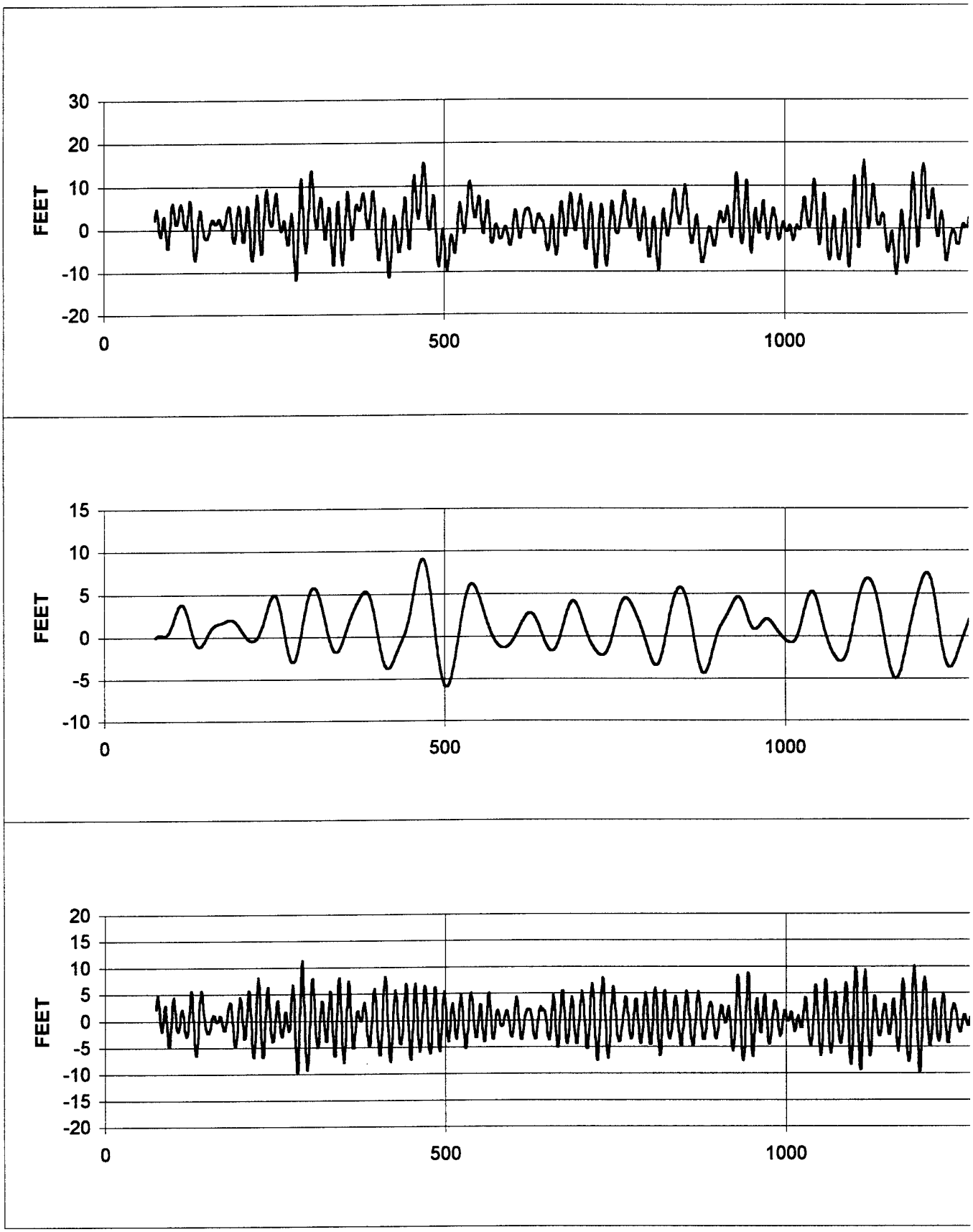
Filtered High Frequency Time History



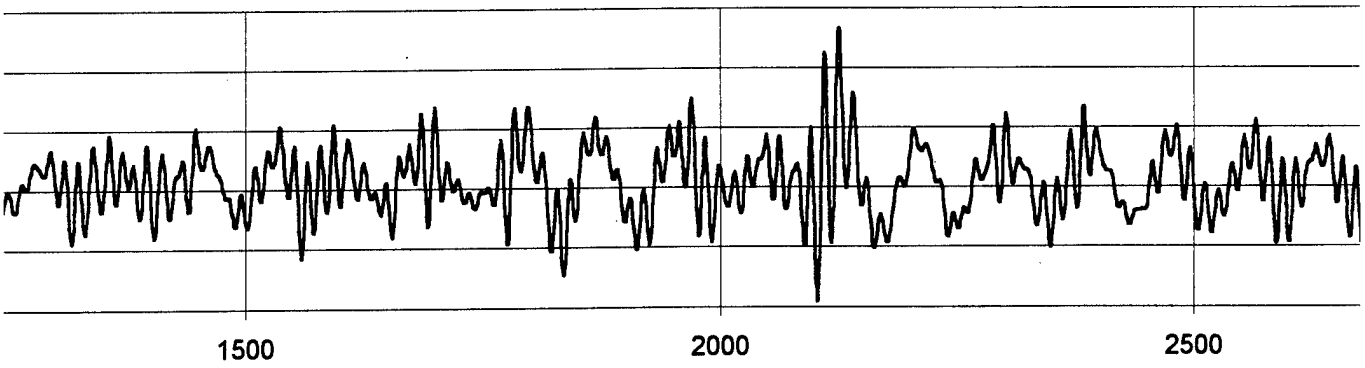
TEST A1109 - PT SURGE



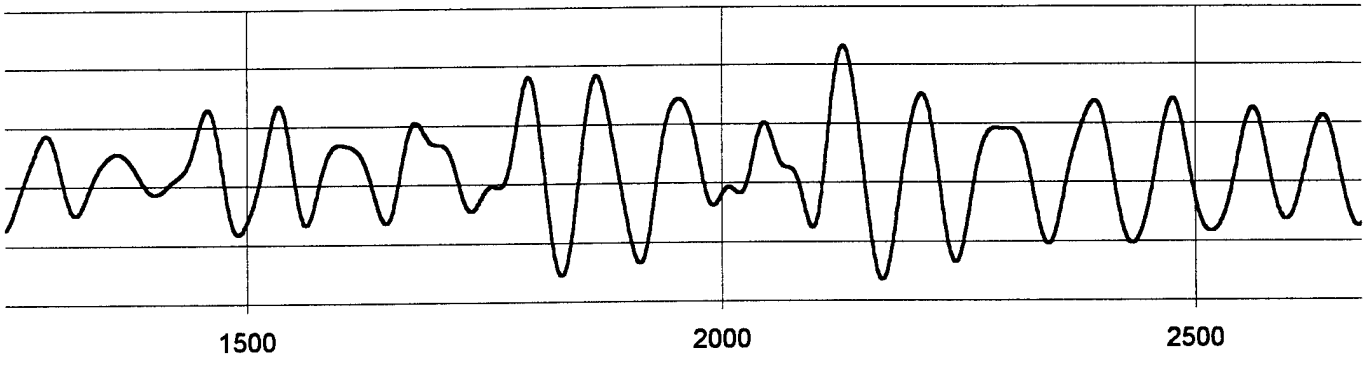
TEST A1109 - PT HEAVE



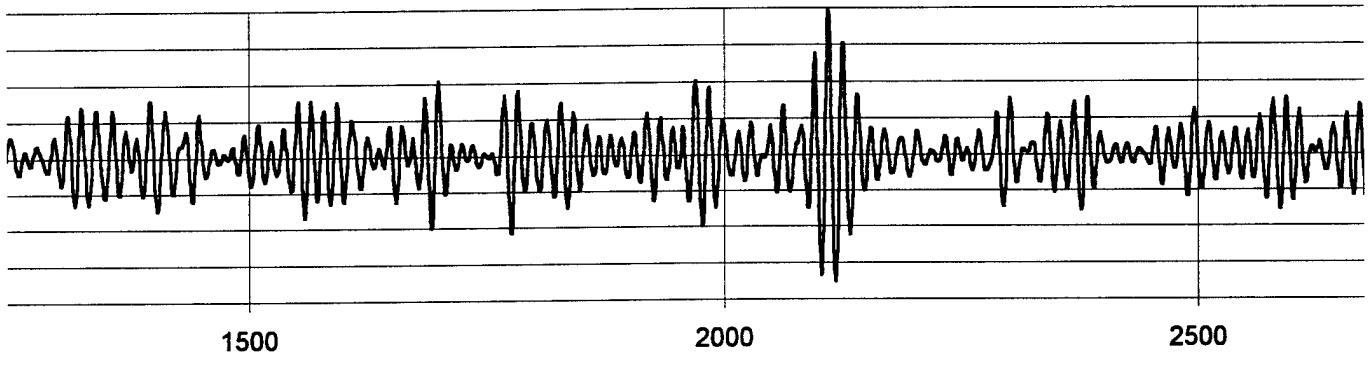
Unfiltered Time History



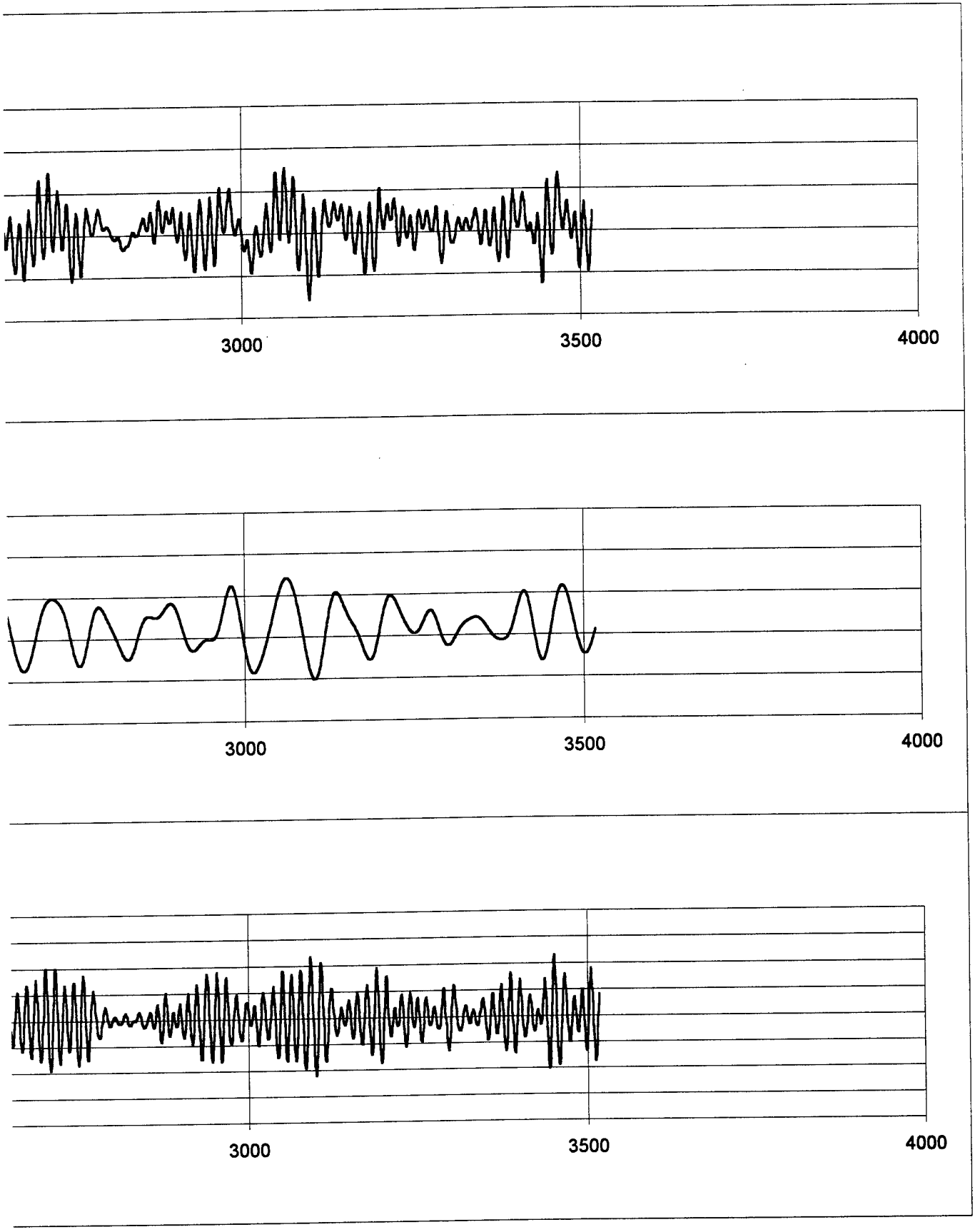
Filtered Low Frequency Time History



Filtered High Frequency Time History

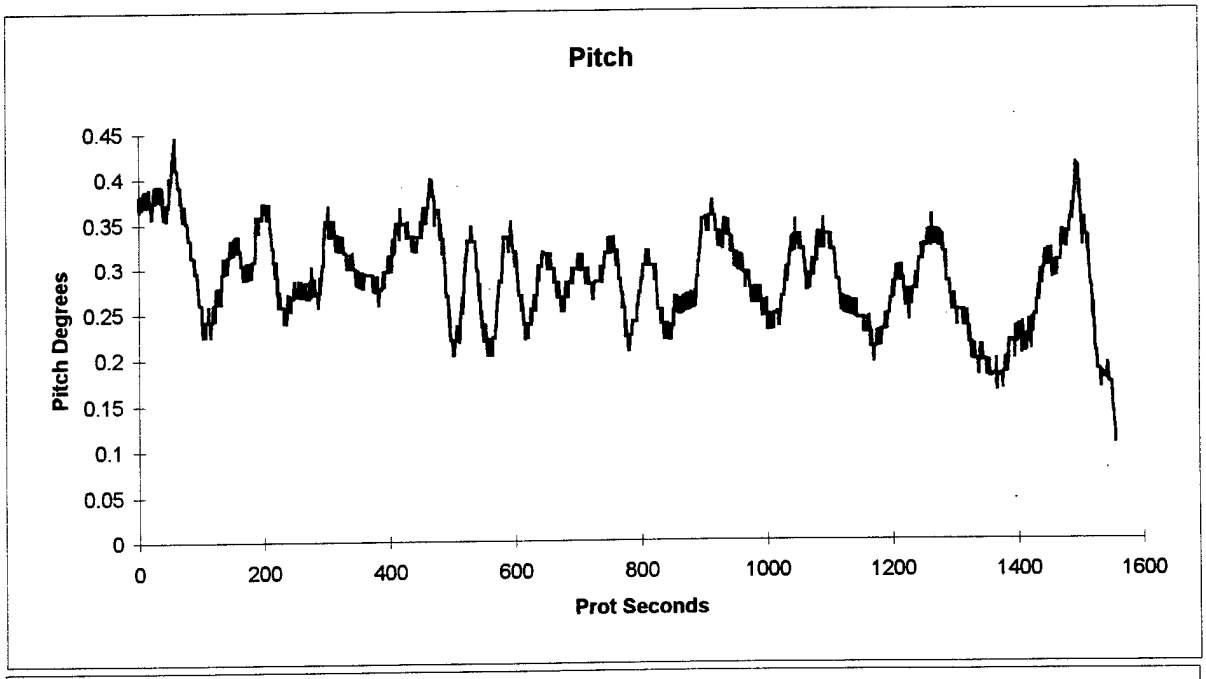


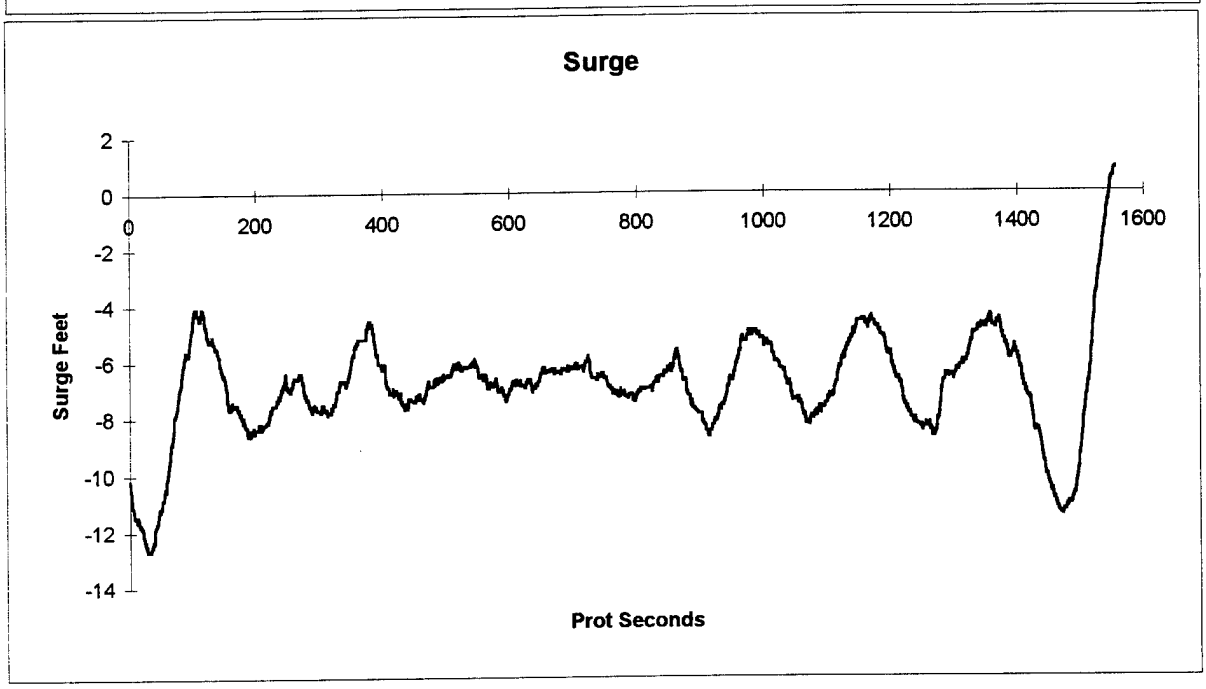
TEST A1109 - PT HEAVE

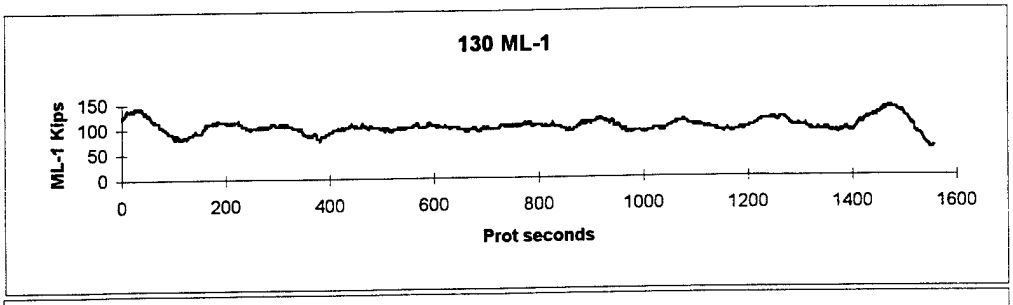


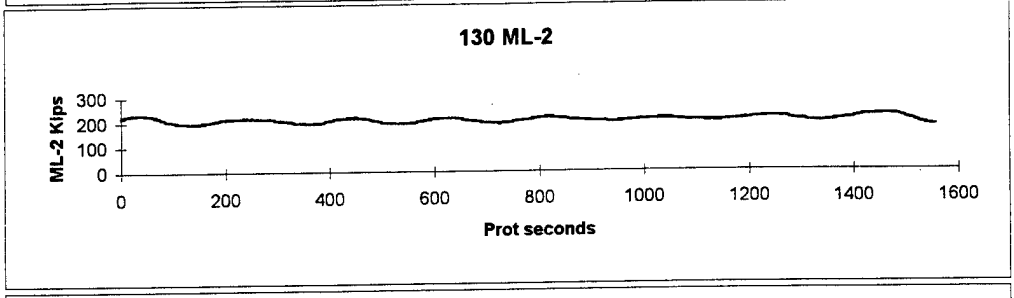
APPENDIX J

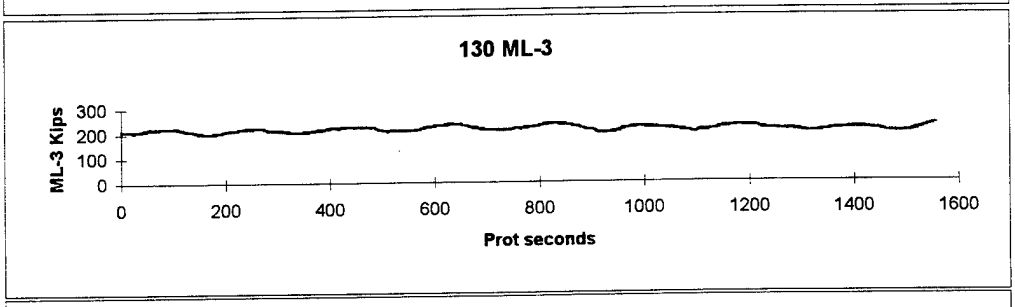
TOWING TEST TIME HISTORY PLOTS

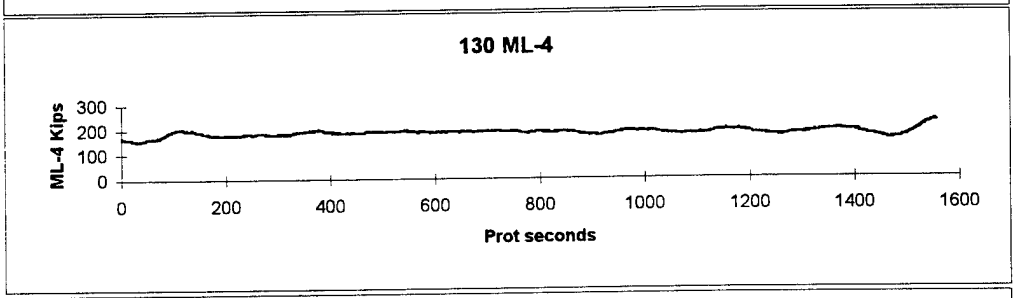

Pitch
Pitch Degrees
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
200
400
600
800
1000
1200
1400
1600
Prot Seconds

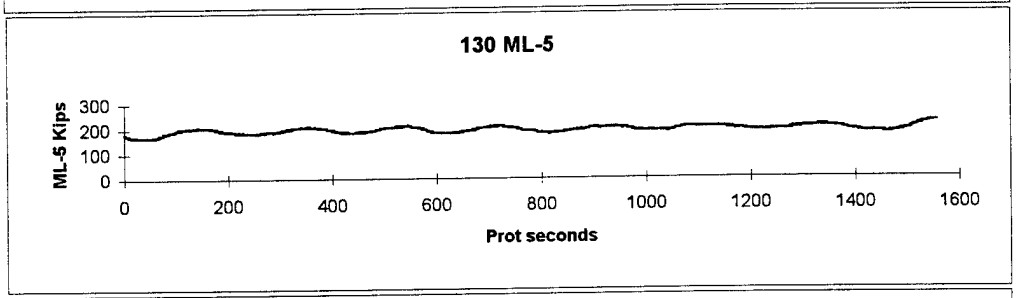

Surge
Surge Feet
2
0
-2
-4
-6
-8
-10
-12
-14
0
200
400
600
800
1000
1200
1400
1600
Prot Seconds

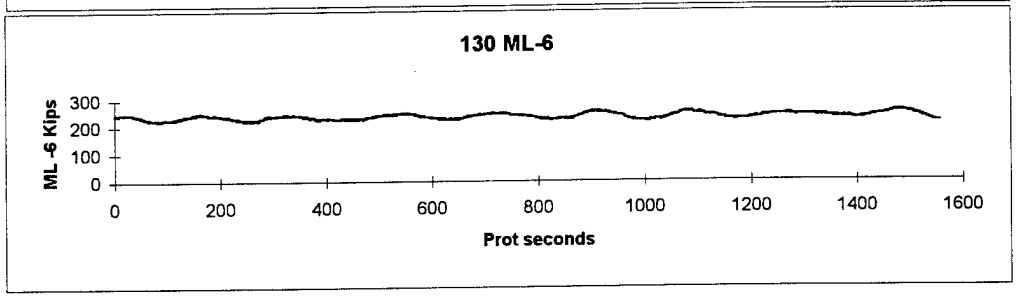

130 ML-1
ML-1 Kips
150
100
50
0
0
200
400
600
800
1000
1200
1400
1600
Prot seconds

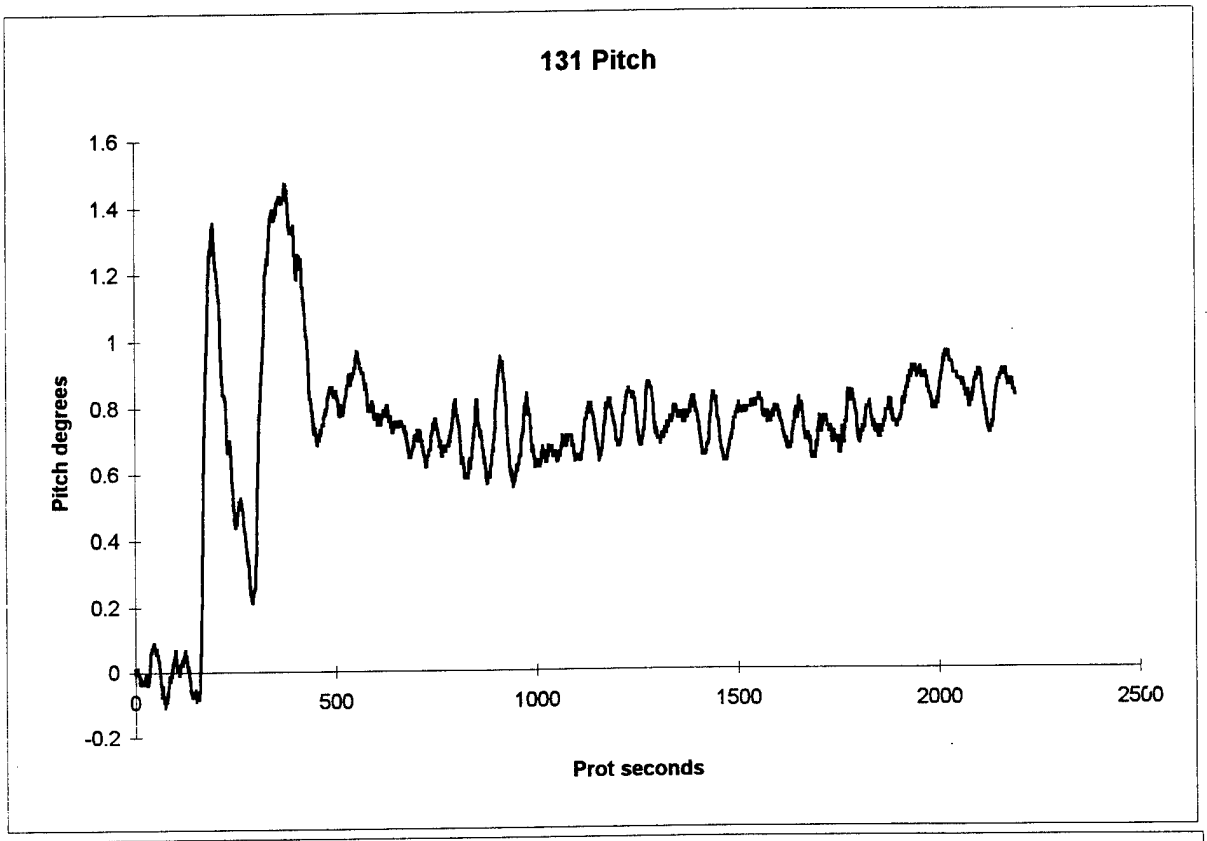

130 ML-2
ML-2 Kips
300
200
100
0
0
200
400
600
800
1000
1200
1400
1600
Prot seconds

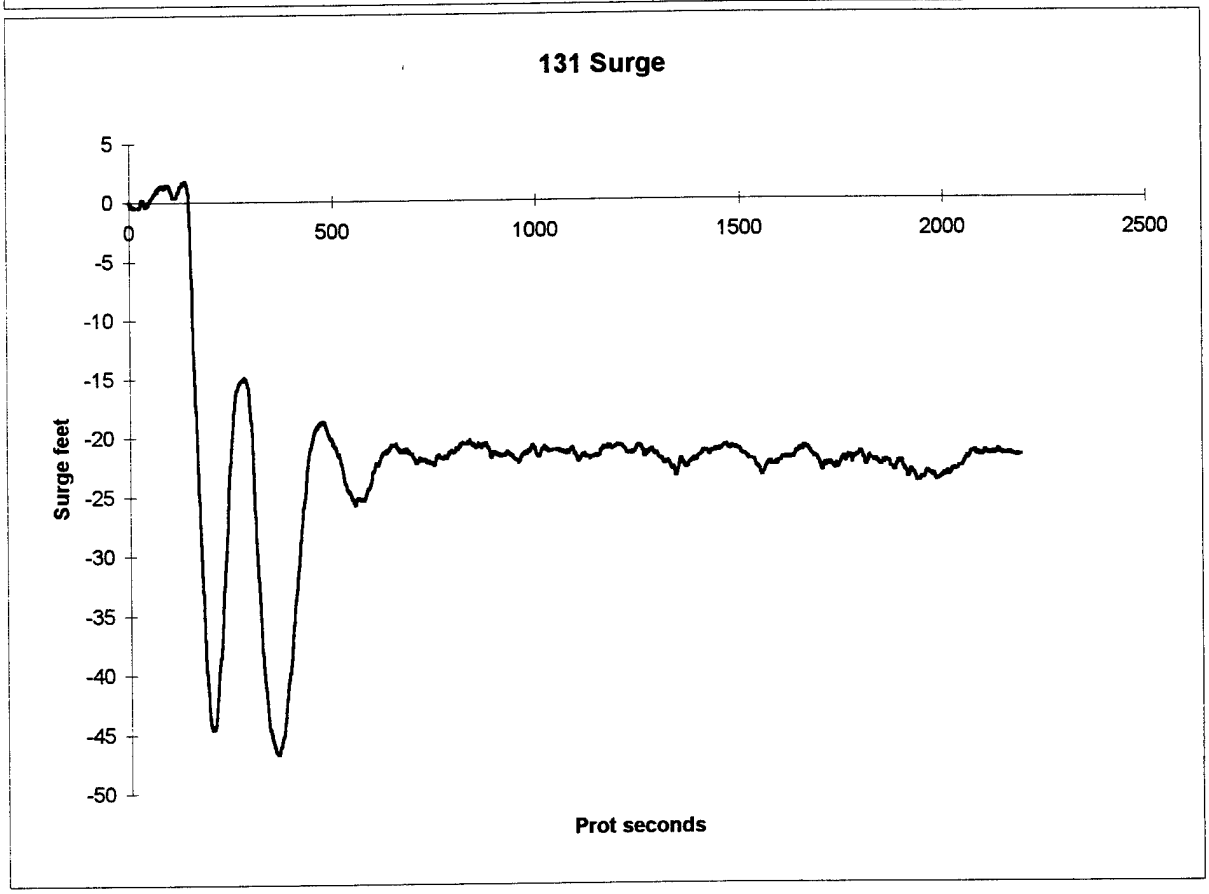

130 ML-3
ML-3 Kips
300
200
100
0
0
200
400
600
800
1000
1200
1400
1600
Prot seconds

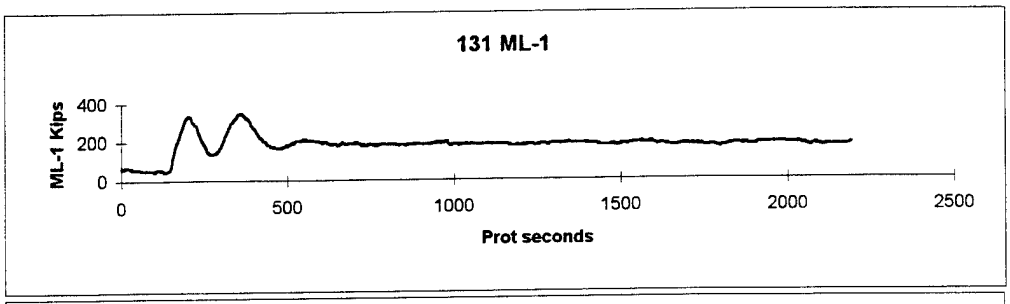

130 ML-4
ML-4 Kips
300
200
100
0
0
200
400
600
800
1000
1200
1400
1600
Prot seconds

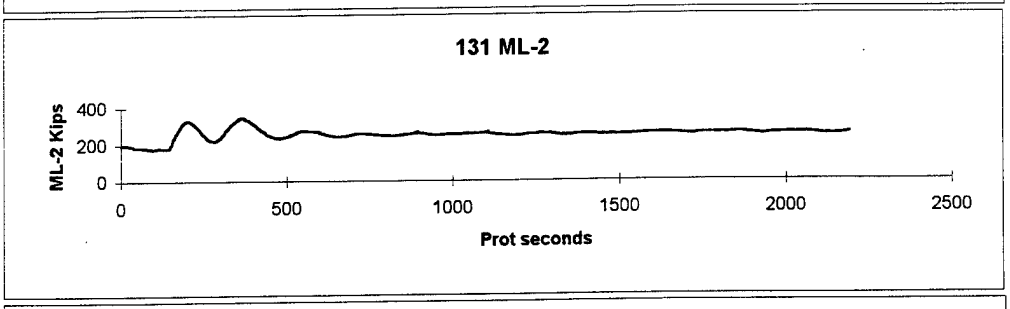

130 ML-5
ML-5 Kips
300
200
100
0
0
200
400
600
800
1000
1200
1400
1600
Prot seconds

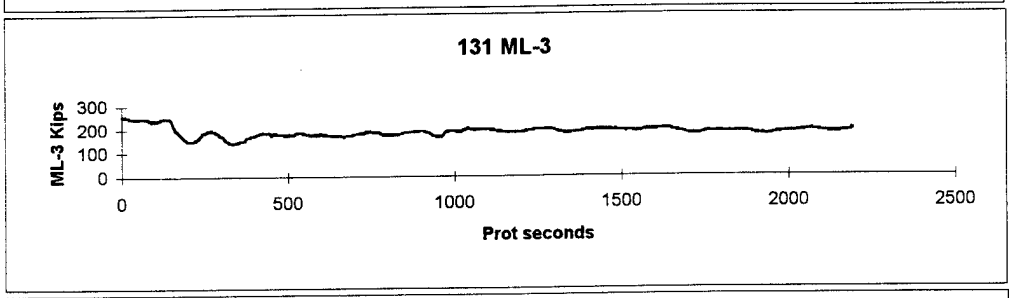

130 ML-6
ML -6 Kips
300
200
100
0
0
200
400
600
800
1000
1200
1400
1600
Prot seconds

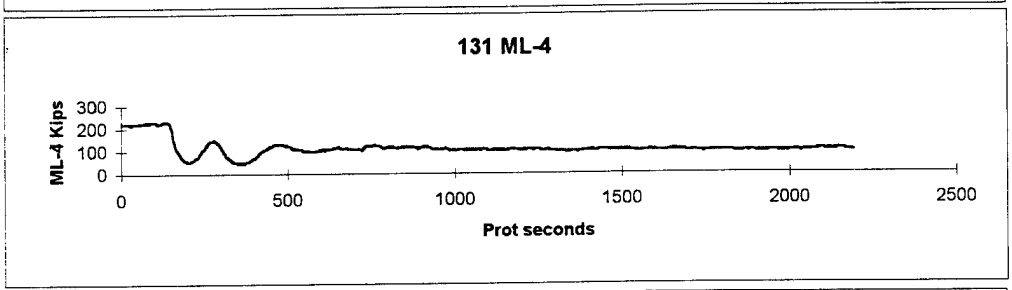

131 Pitch
Pitch degrees
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
0
500
1000
1500
2000
2500
Prot seconds

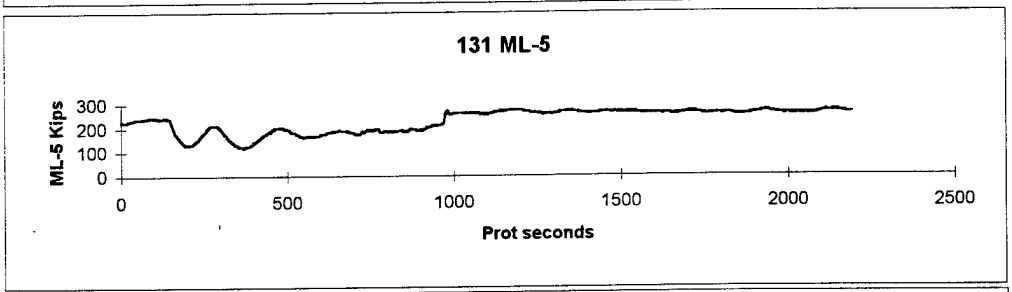

131 Surge
Surge feet
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
0
500
1000
1500
2000
2500
Prot seconds

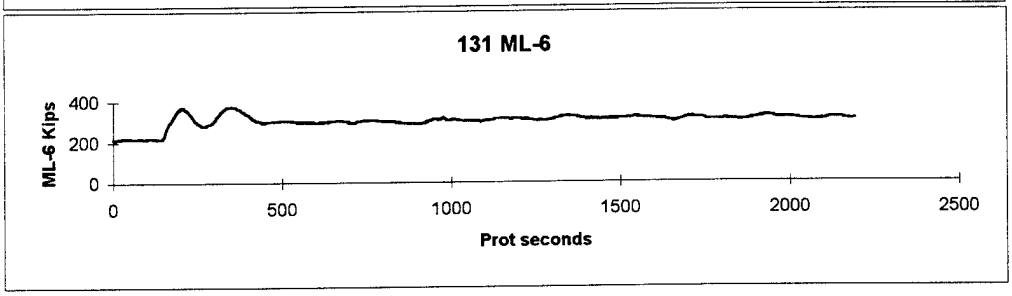

131 ML-1
ML-1 Kips
400
200
0
0
500
1000
1500
2000
2500
Prot seconds

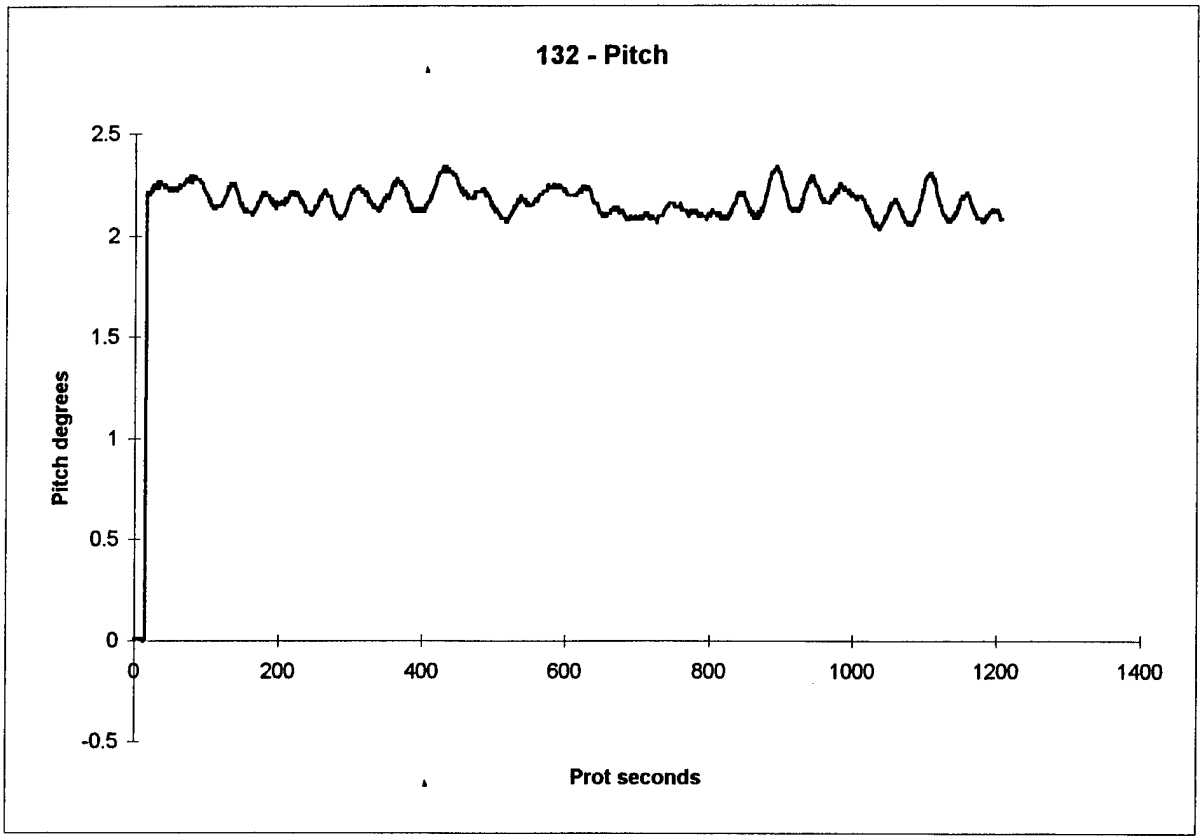

131 ML-2
ML-2 Kips
400
200
0
0
500
1000
1500
2000
2500
Prot seconds

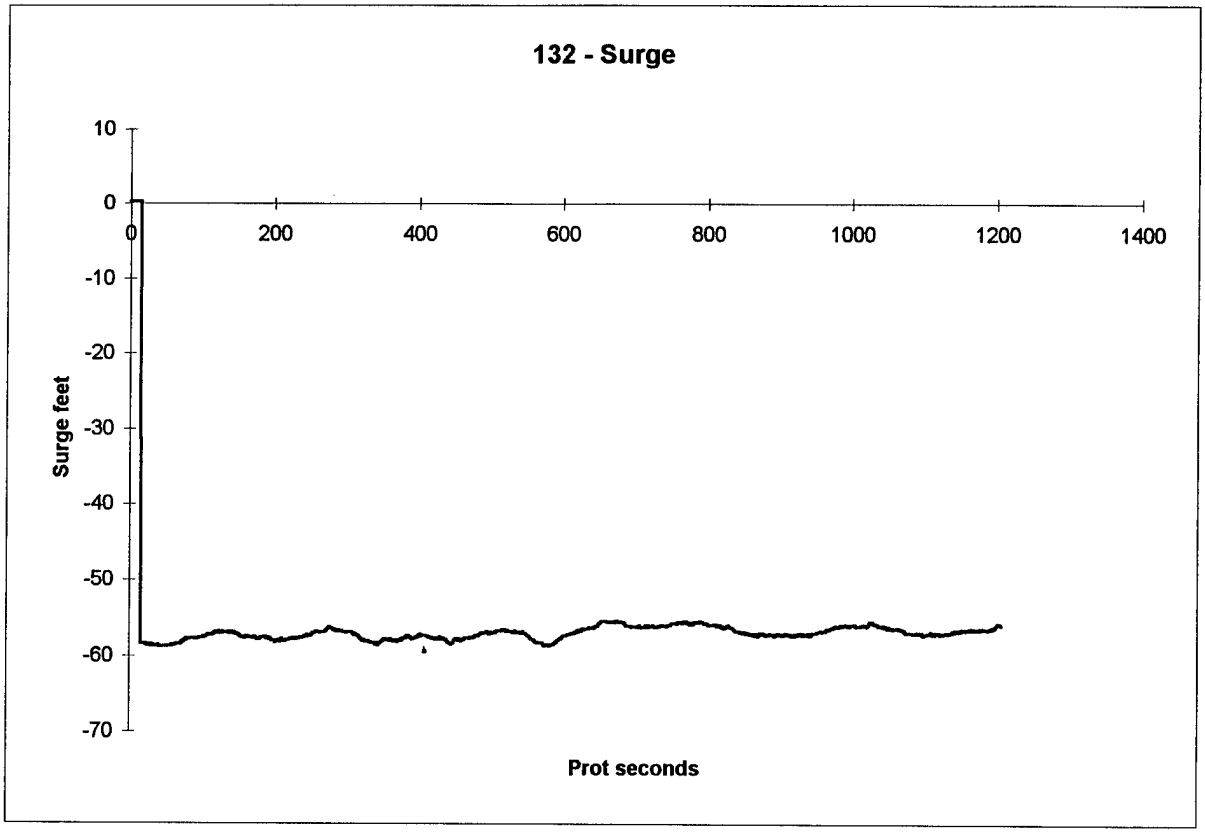

131 ML-3
ML-3 Kips
300
200
100
0
0
500
1000
1500
2000
2500
Prot seconds

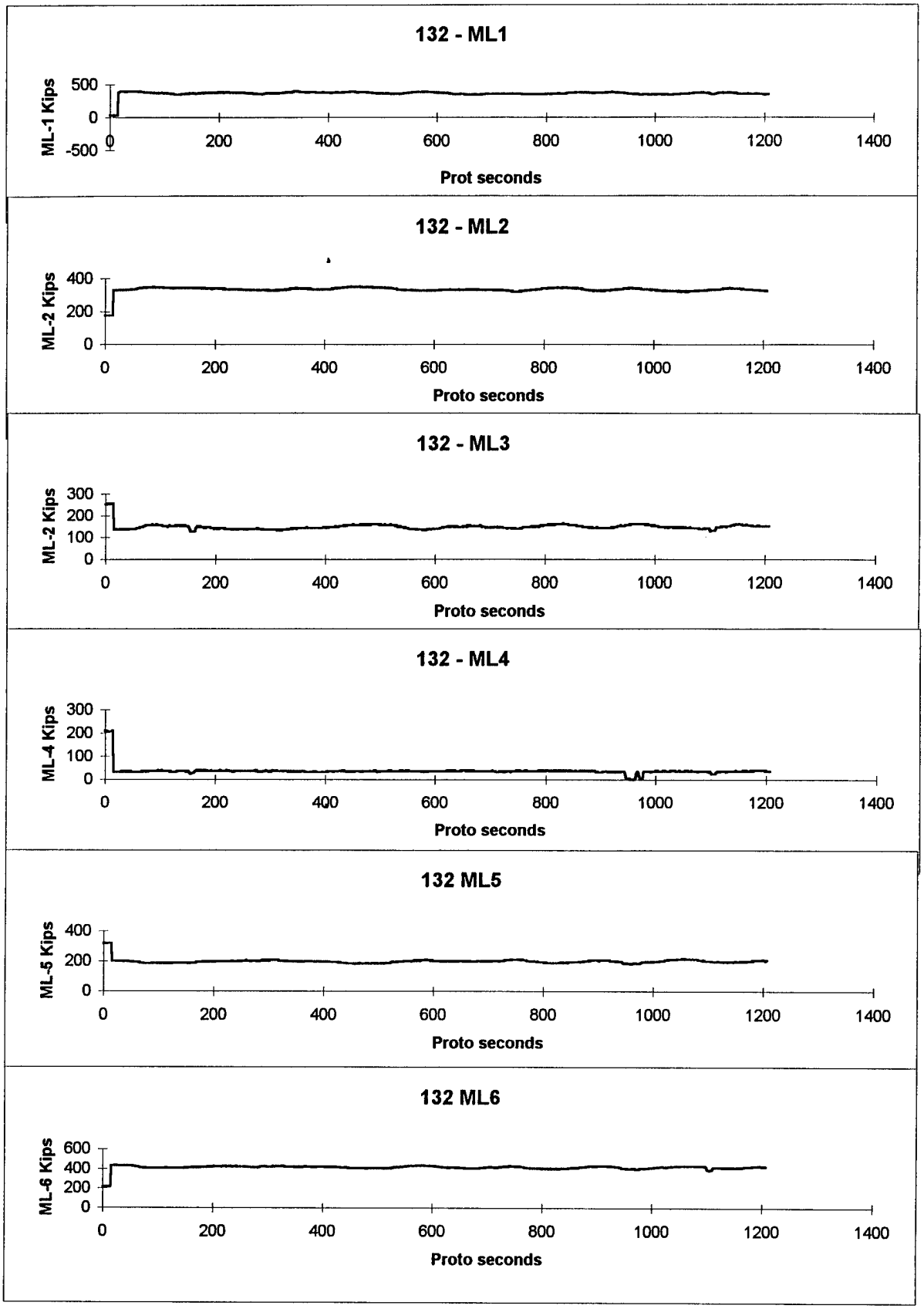

131 ML-4
ML-4 Kips
300
200
100
0
0
500
1000
1500
2000
2500
Prot seconds

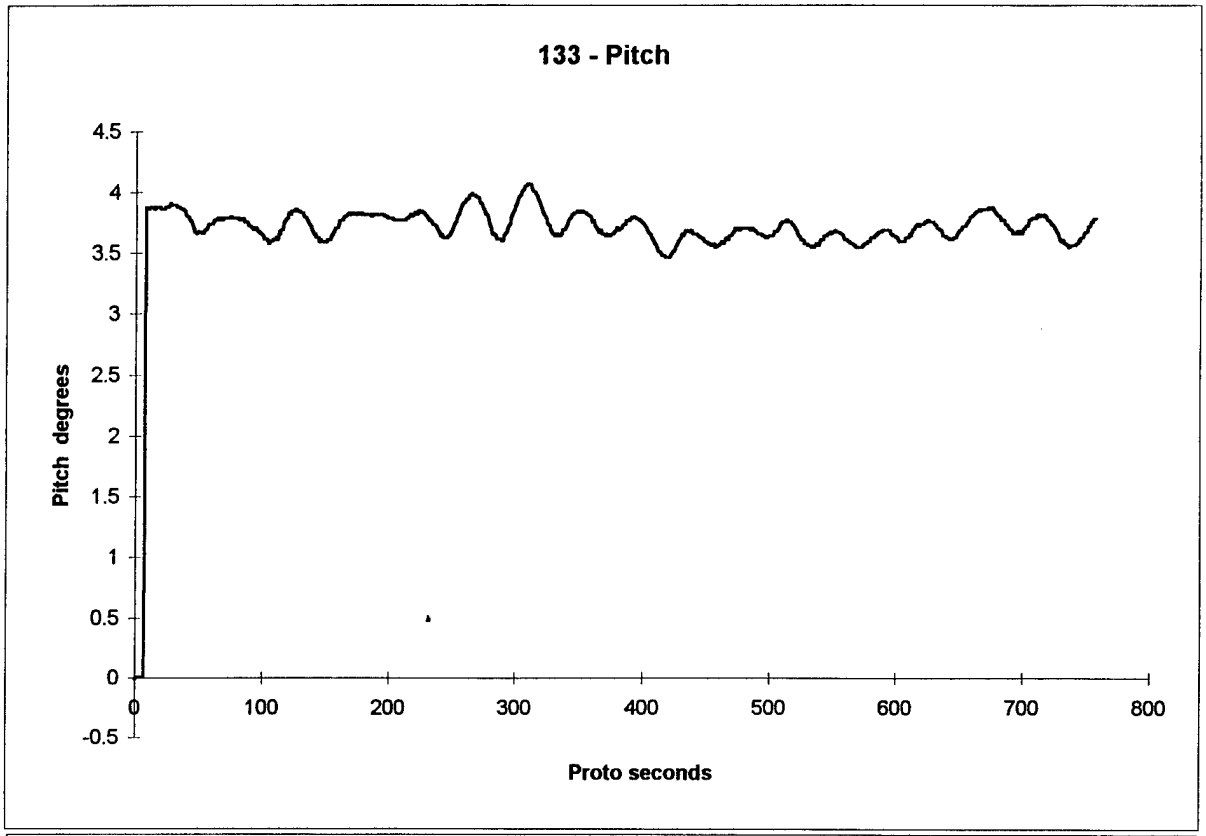

131 ML-5
ML-5 Kips
300
200
100
0
0
500
1000
1500
2000
2500
Prot seconds

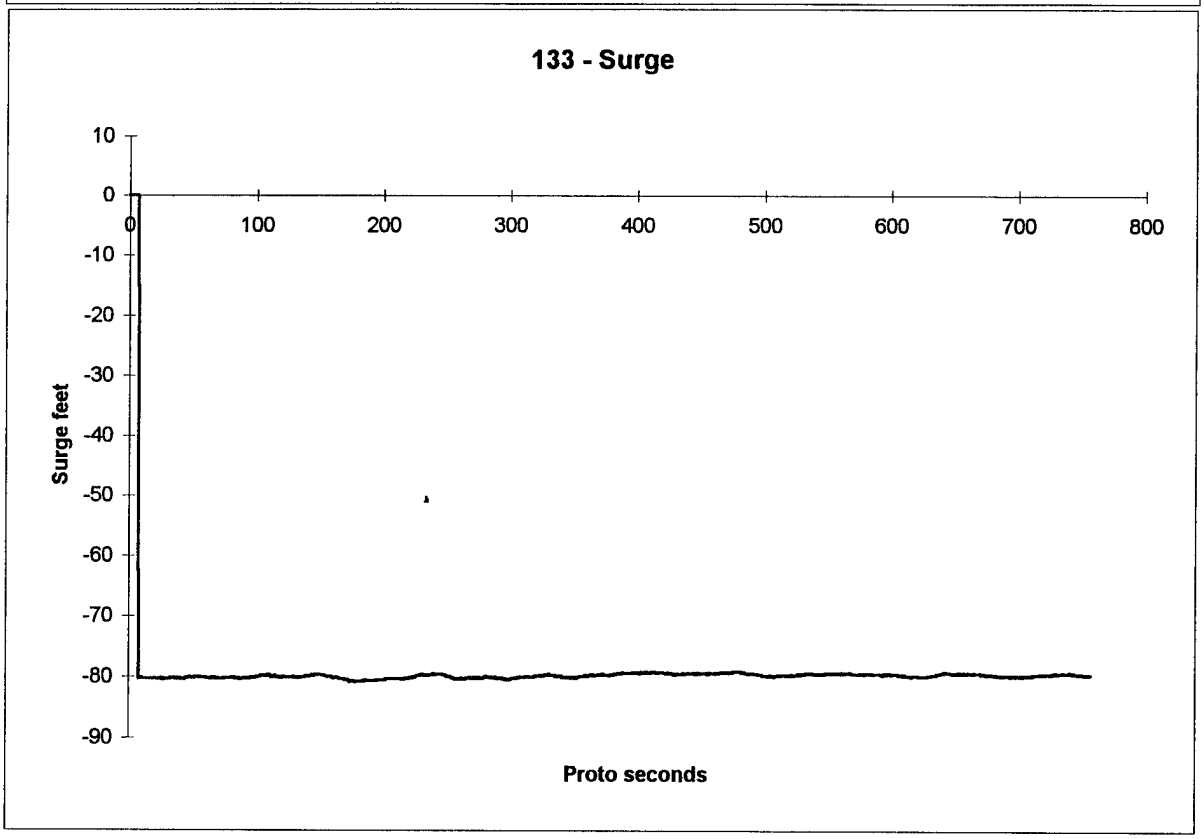

131 ML-6
ML-6 Kips
400
200
0
0
500
1000
1500
2000
2500
Prot seconds

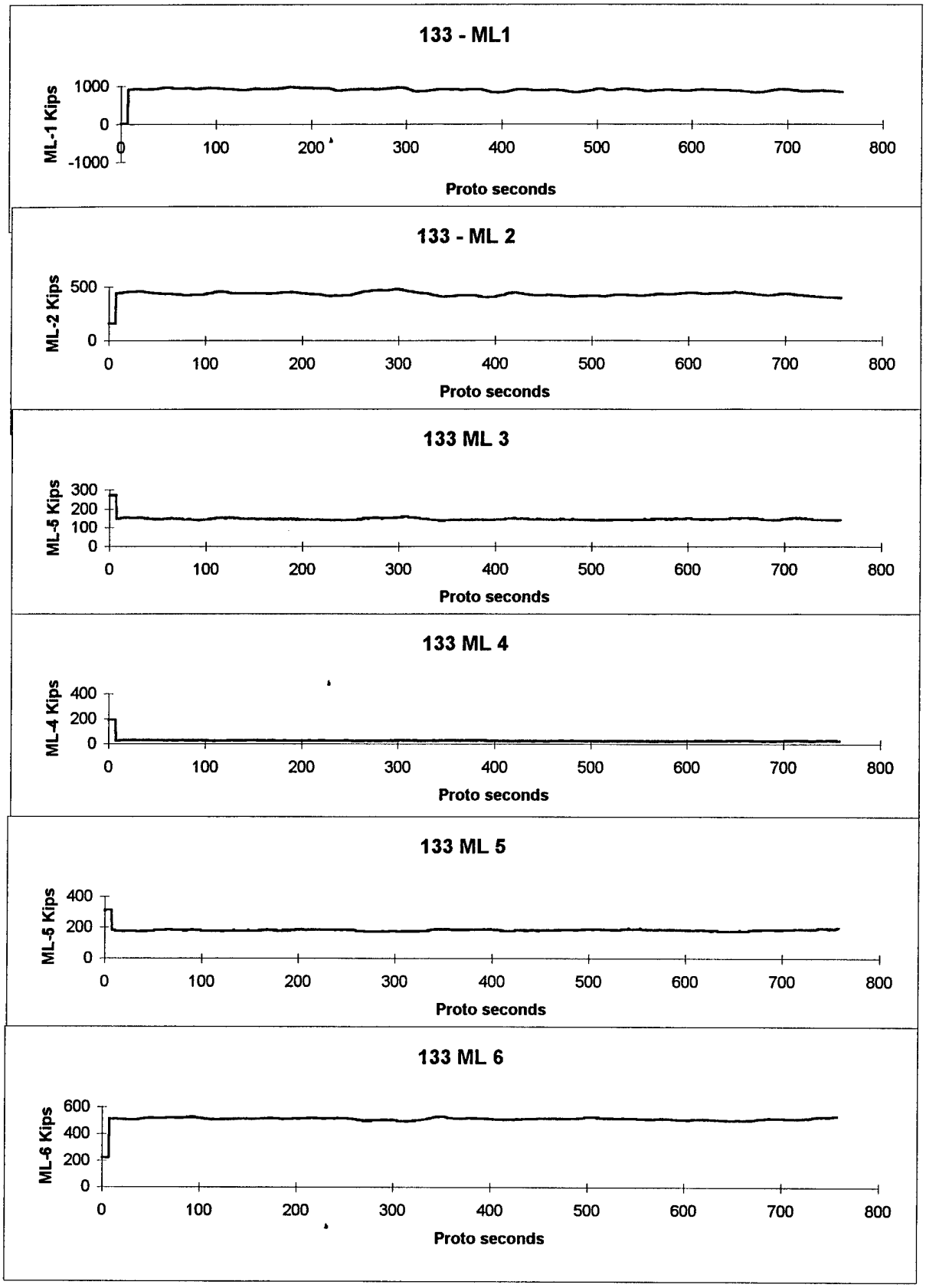

132 - Pitch
2.5
2
1.5
1
0.5
0
-0.5
Pitch degrees
0
200
400
600
800
1000
1200
1400
Prot seconds


132 - Surge
10
0
-10
-20
-30
-40
-50
-60
-70
Surge feet
0
200
400
600
800
1000
1200
1400
Prot seconds

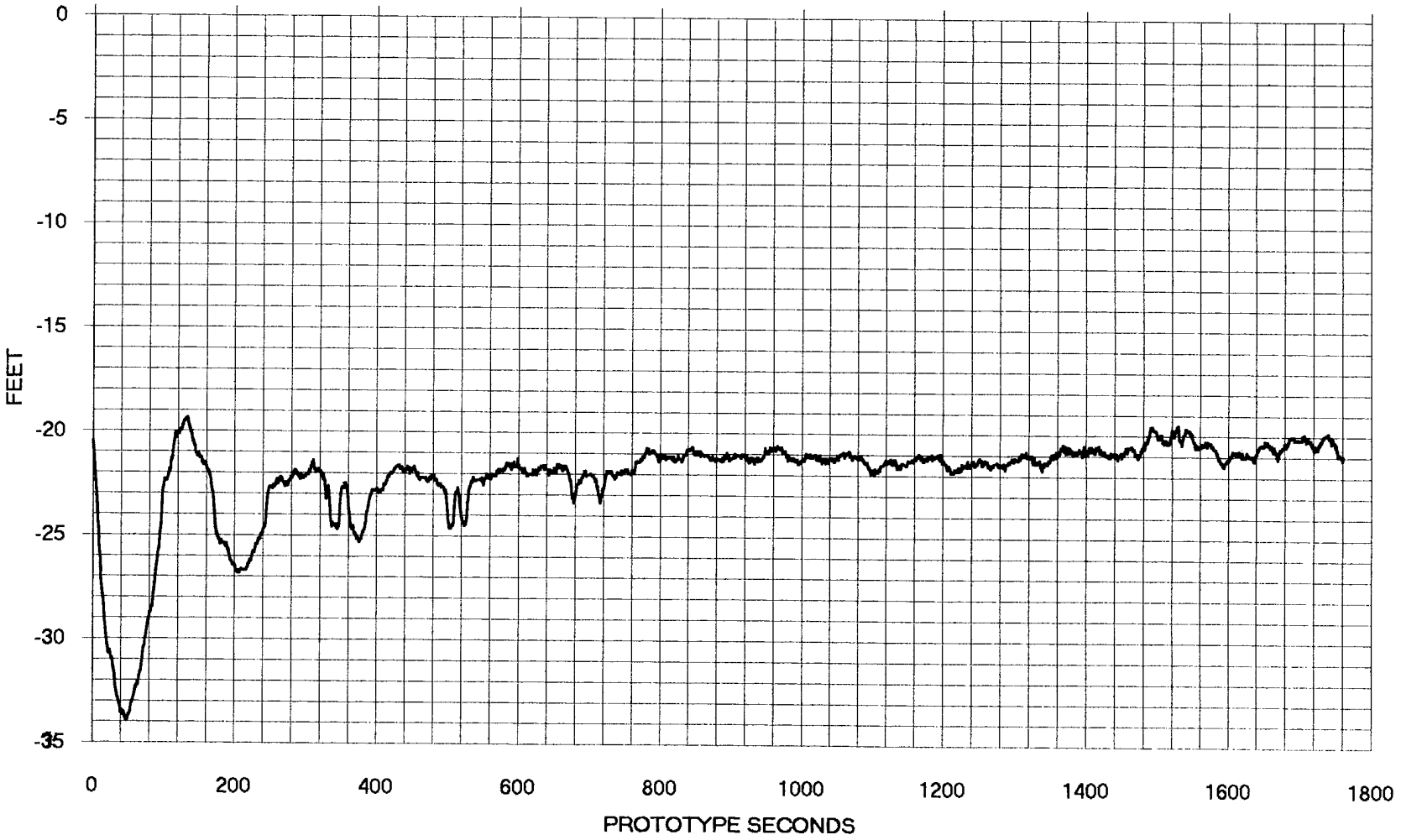

132 - ML1
ML-1 Kips
500
0
-500
0
200
400
600
800
1000
1200
1400
Prot seconds
132 - ML2
ML-2 Kips
400
200
0
0
200
400
600
800
1000
1200
1400
Proto seconds
132 - ML3
ML-2 Kips
300
200
100
0
0
200
400
600
800
1000
1200
1400
Proto seconds
132 - ML4
ML-4 Kips
300
200
100
0
0
200
400
600
800
1000
1200
1400
Proto seconds
132 ML5
ML-5 Kips
400
200
0
0
200
400
600
800
1000
1200
1400
Proto seconds
132 ML6
ML-6 Kips
600
400
200
0
0
200
400
600
800
1000
1200
1400
Proto seconds


133 - Pitch
Pitch degrees
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
0
100
200
300
400
500
600
700
800
Proto seconds

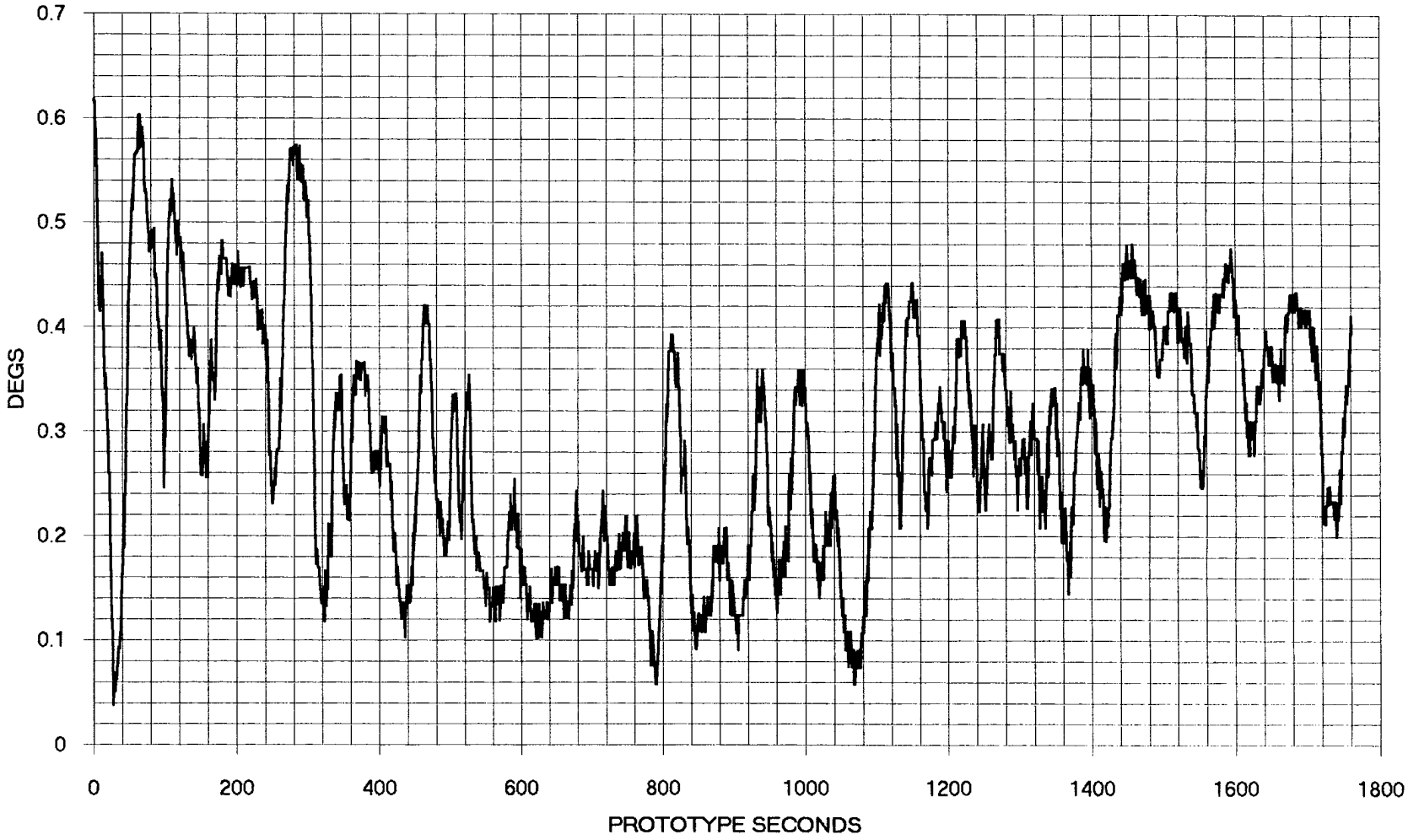

133 - Surge
Surge feet
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
0
100
200
300
400
500
600
700
800
Proto seconds


133 - ML1
ML-1 Kips
1000
0
-1000
0
100
200
300
400
500
600
700
800
Proto seconds
133 - ML 2
ML-2 Kips
500
0
0
100
200
300
400
500
600
700
800
Proto seconds
133 ML 3
ML-3 Kips
300
200
100
0
0
100
200
300
400
500
600
700
800
Proto seconds
133 ML 4
ML-4 Kips
400
200
0
0
100
200
300
400
500
600
700
800
Proto seconds
133 ML 5
ML-5 Kips
400
200
0
0
100
200
300
400
500
600
700
800
Proto seconds
133 ML 6
ML-6 Kips
600
400
200
0
0
100
200
300
400
500
600
700
800
Proto seconds

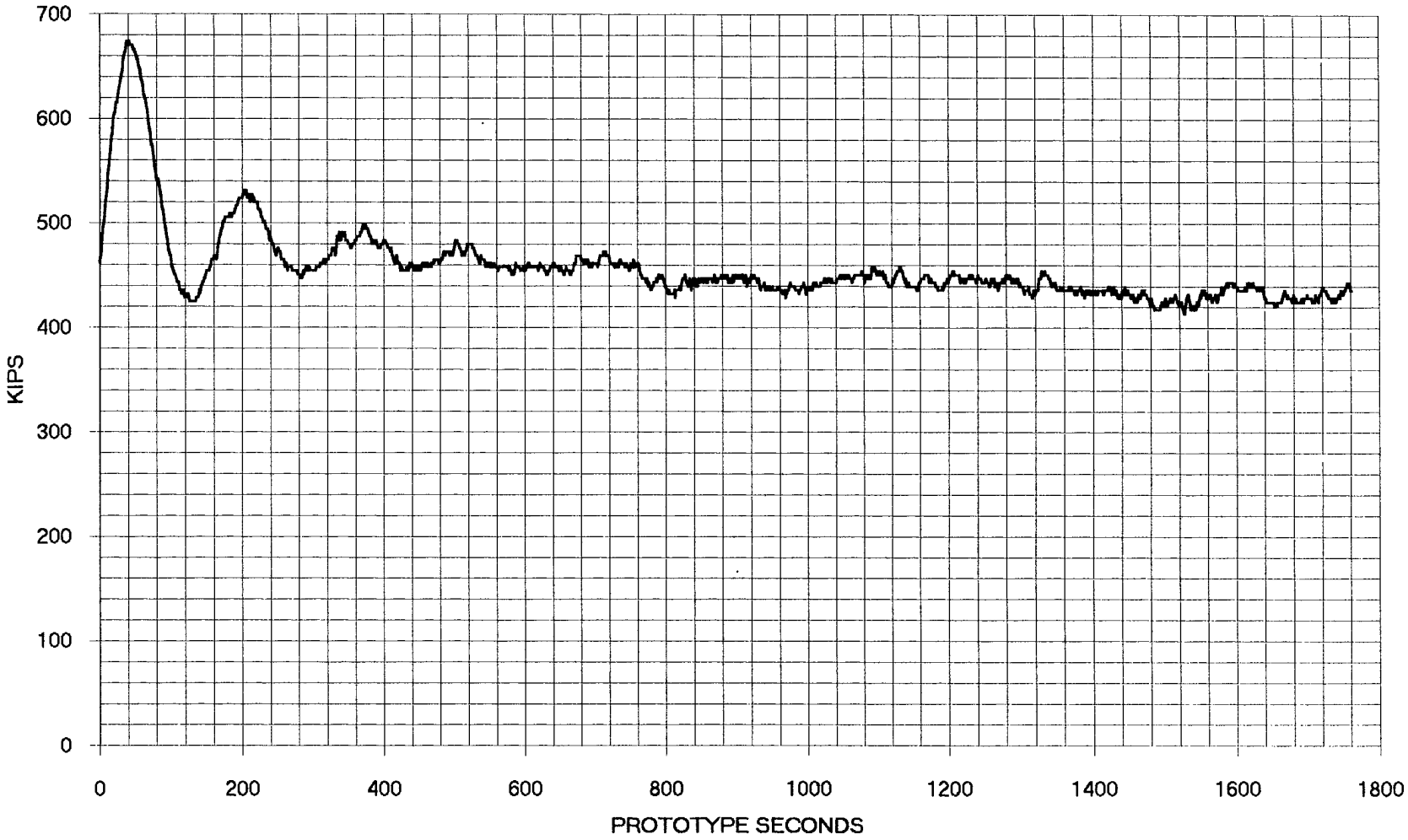
A568 - SURGE TOWING



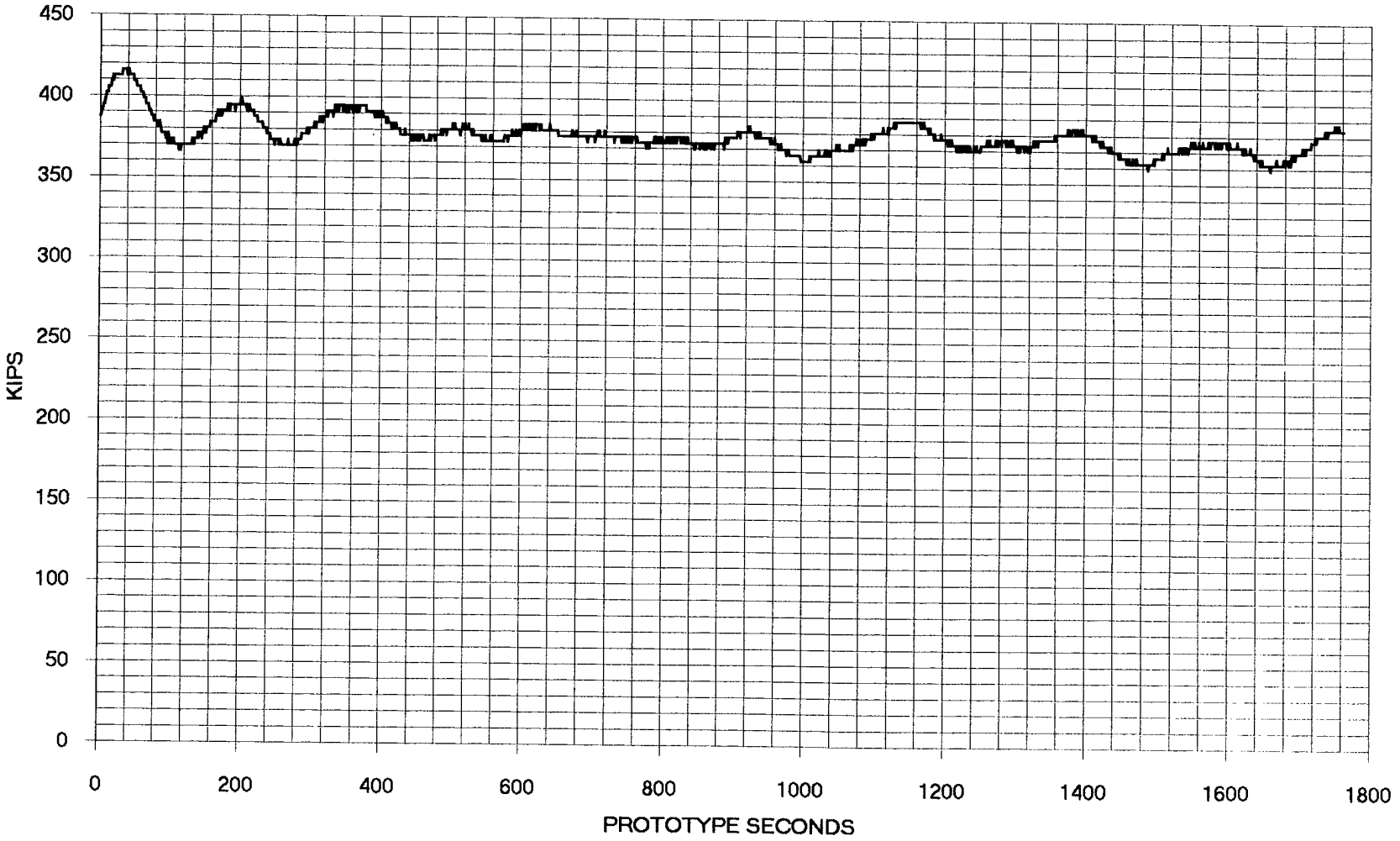
A568 - PITCH TOWING



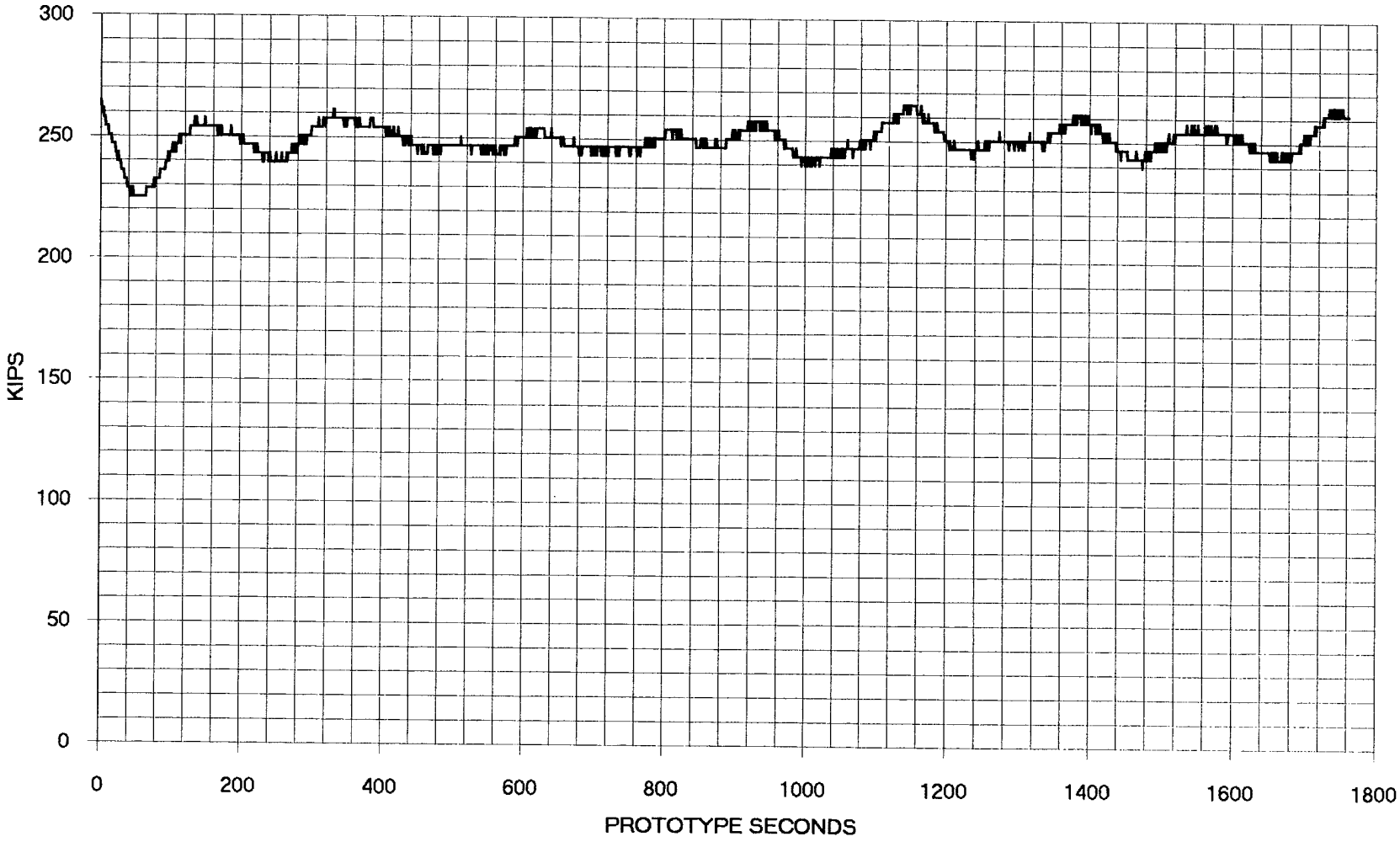
A568 -ML-1 TOWING



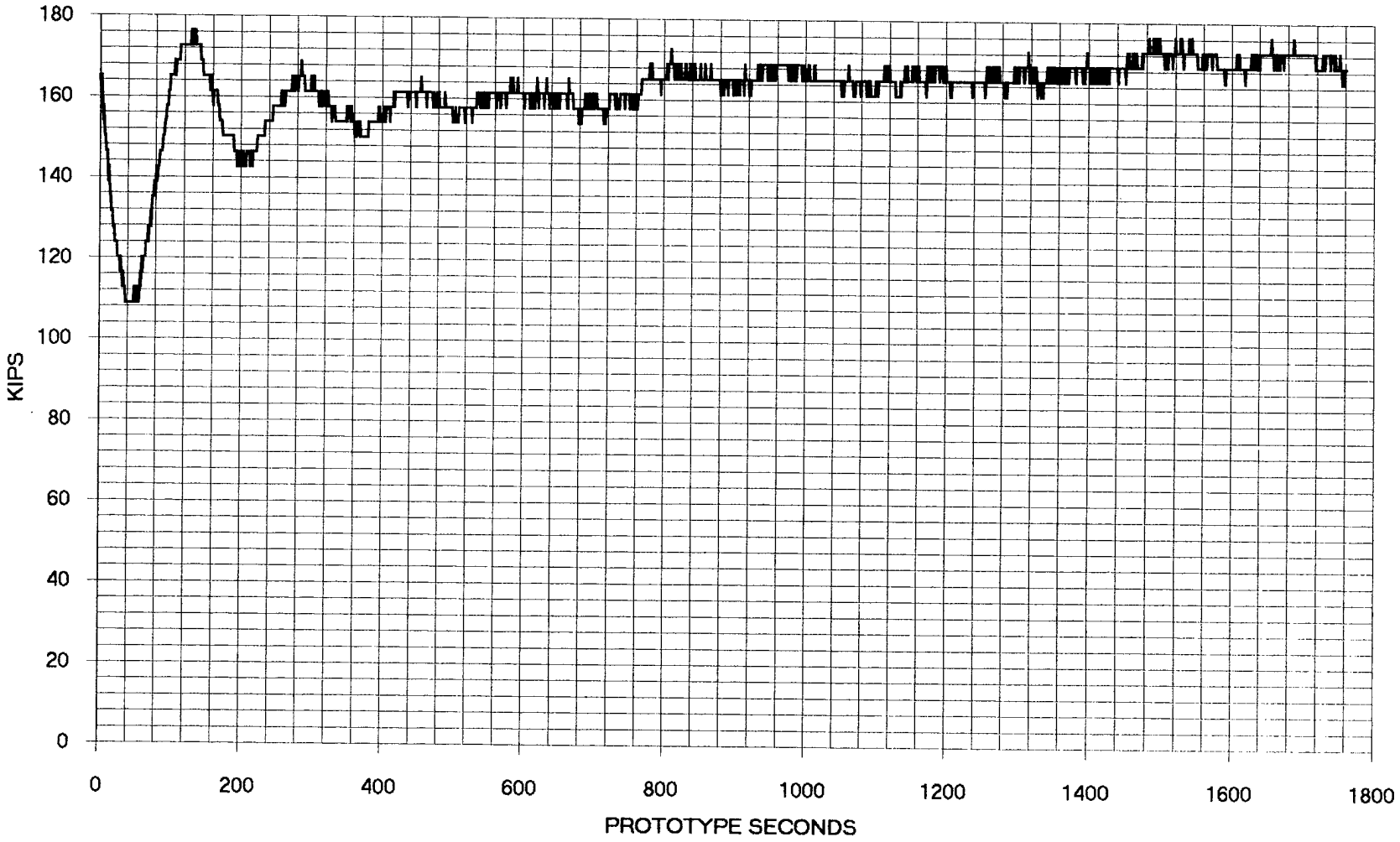
A568 - ML-2 TOWING



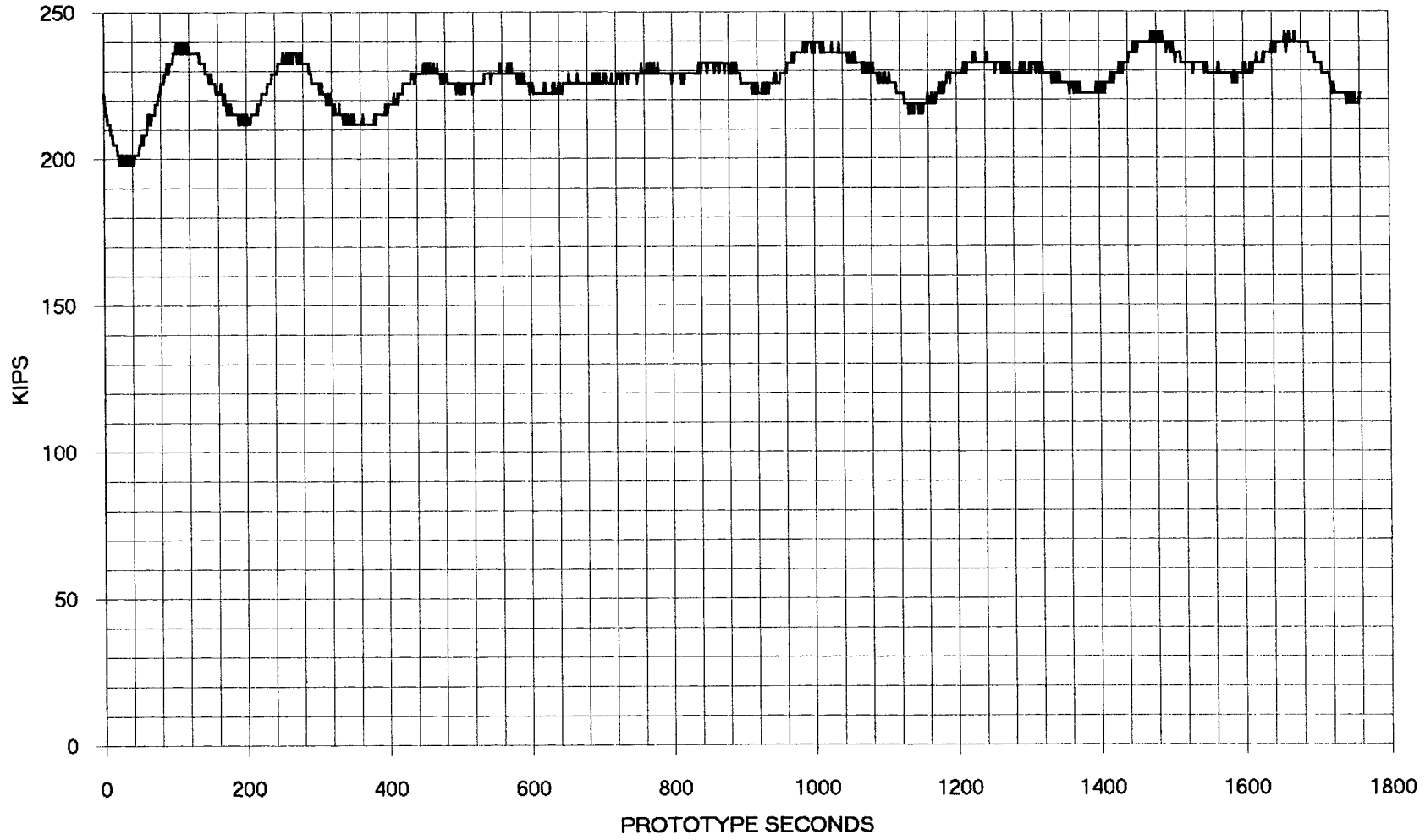
A568 - ML-3 TOWING



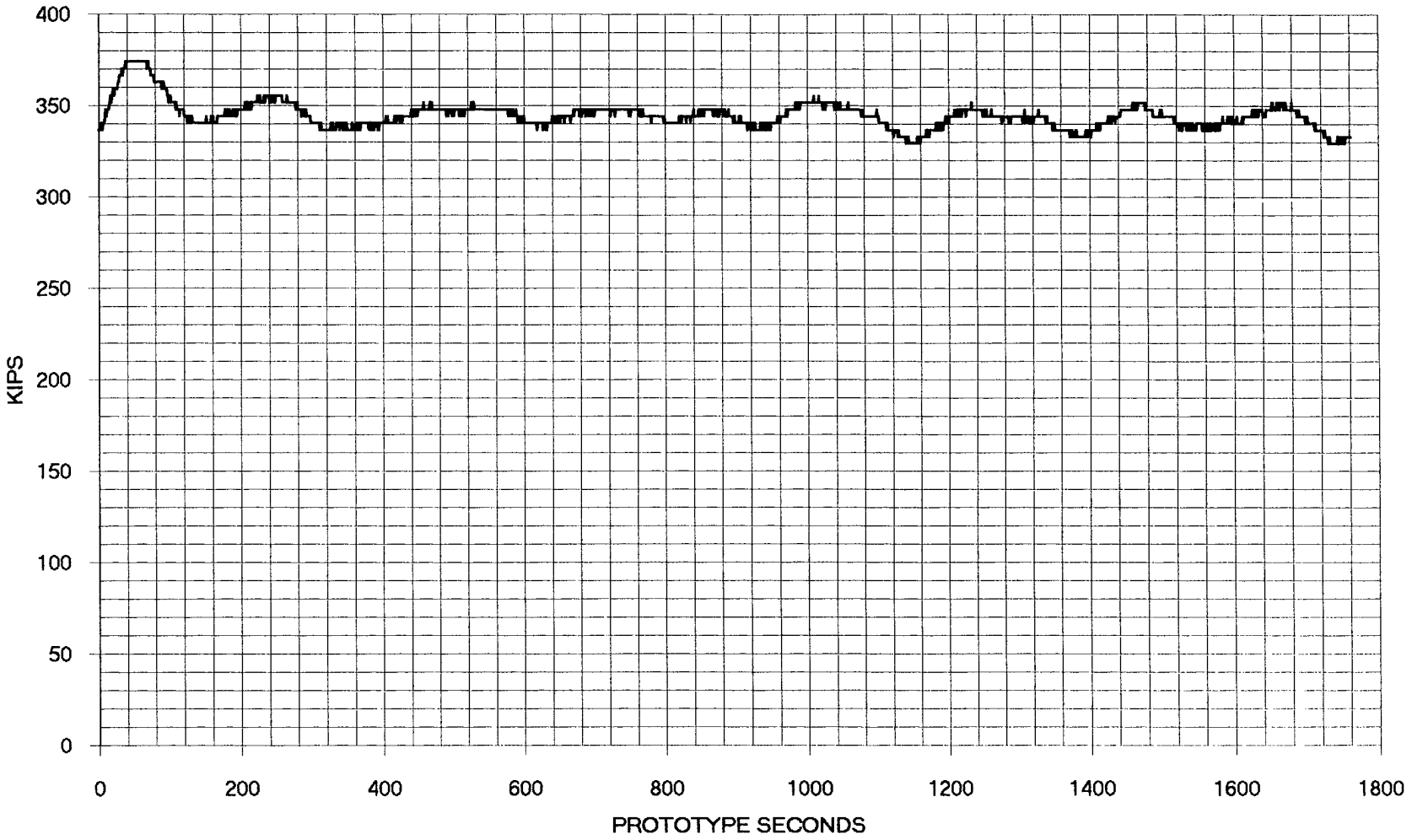
A568 - ML-4 TOWING



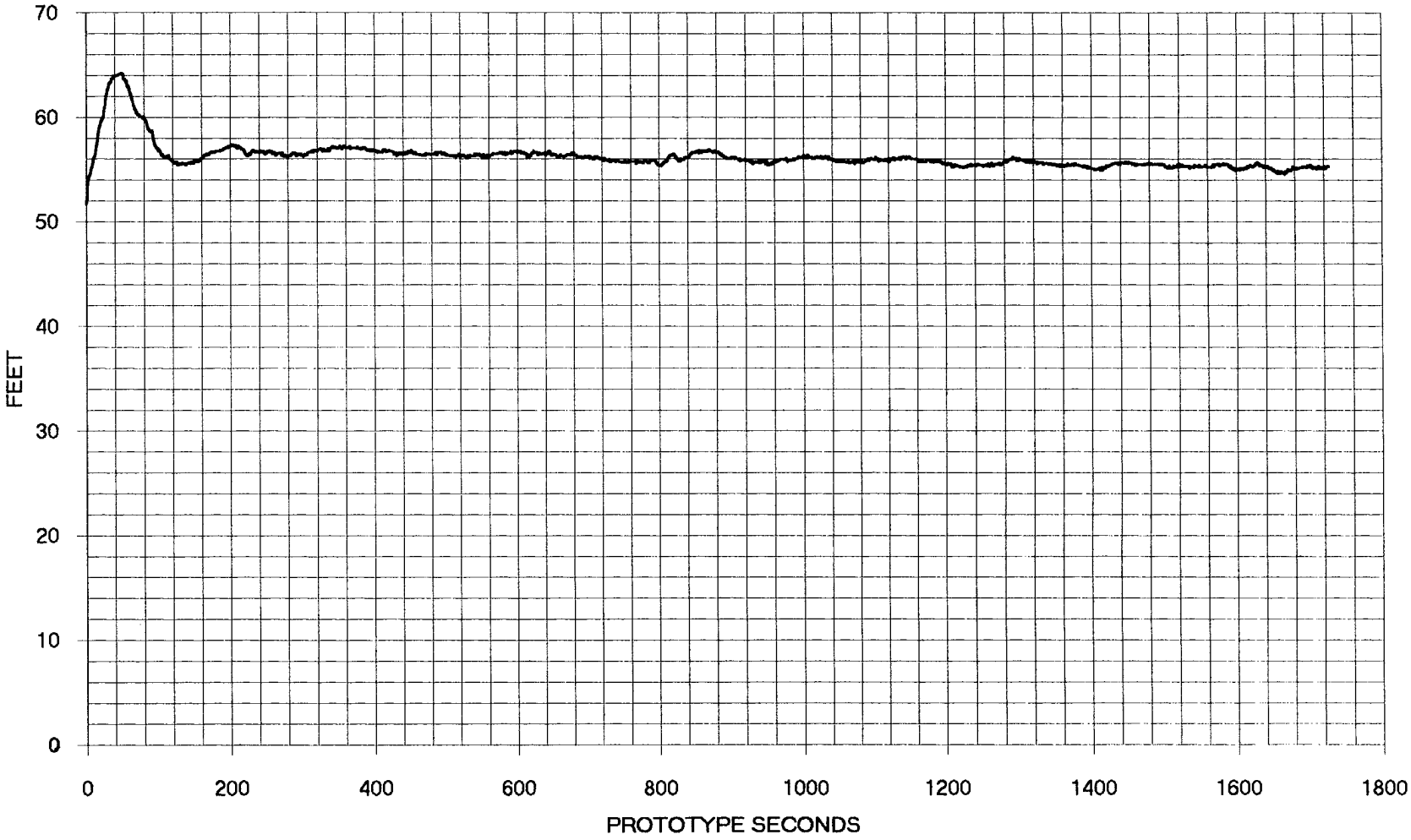
A568 - ML-5 TOWING



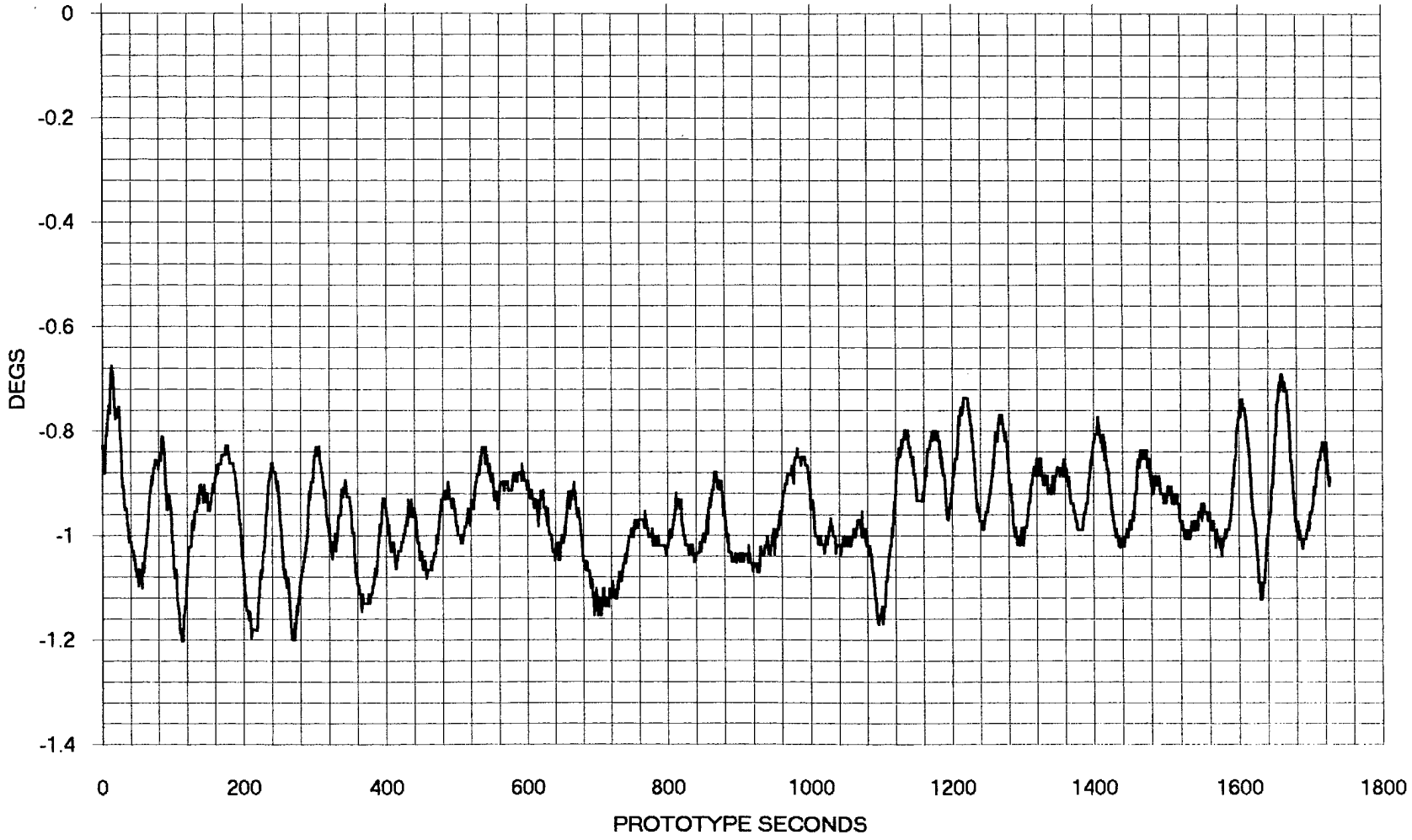
A568 - ML-6 TOWING

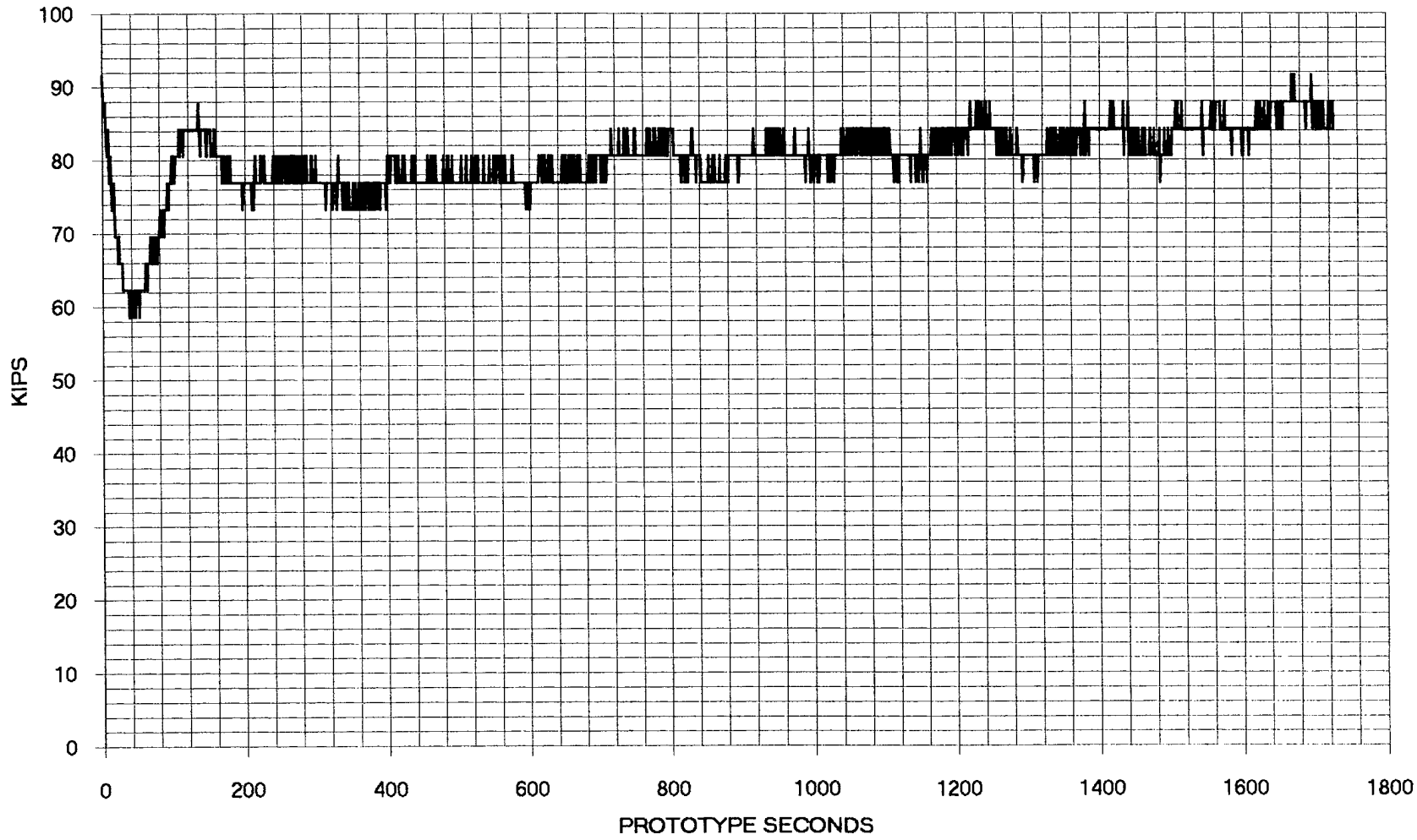


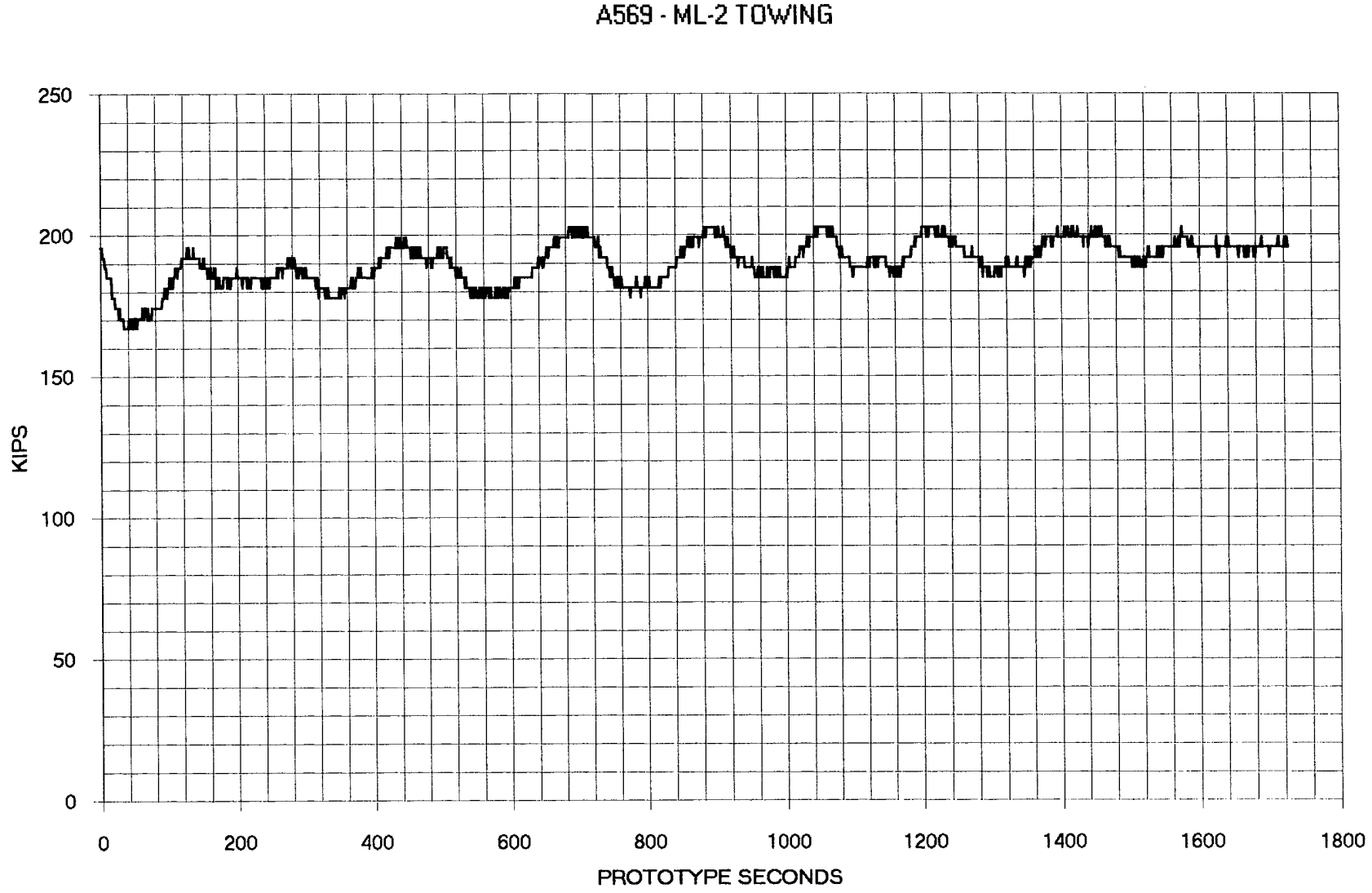
A569 - SURGE TOWING



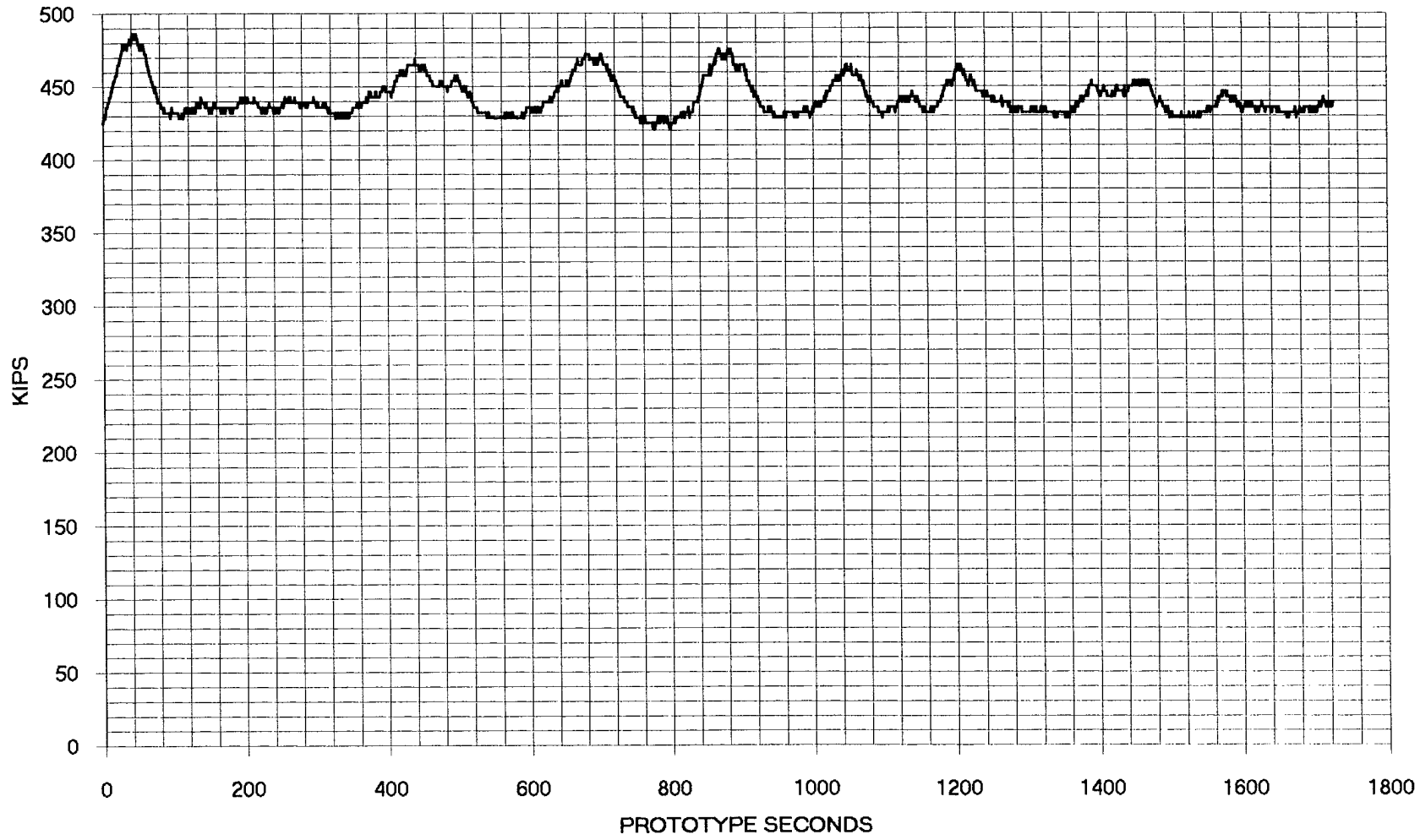
A569 - PITCH TOWING



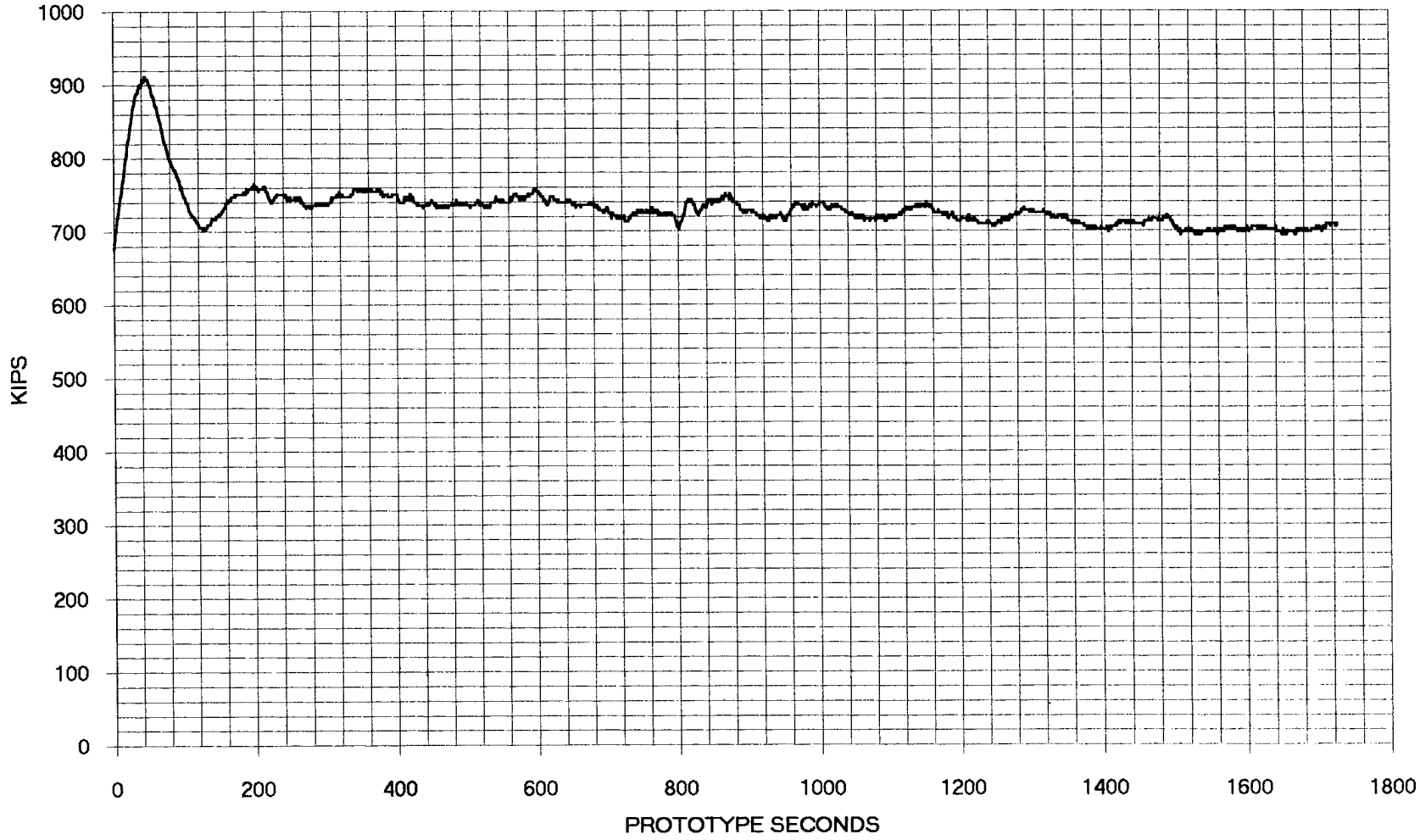

A569 - ML-1 TOWING
100
90
80
70
60
50
40
30
20
10
0
KIPS
0
200
400
600
800
1000
1200
1400
1600
1800
PROTOTYPE SECONDS


A569 - ML-2 TOWING
250
200
150
100
50
0
KIPS
0
200
400
600
800
1000
1200
1400
1600
1800
PROTOTYPE SECONDS

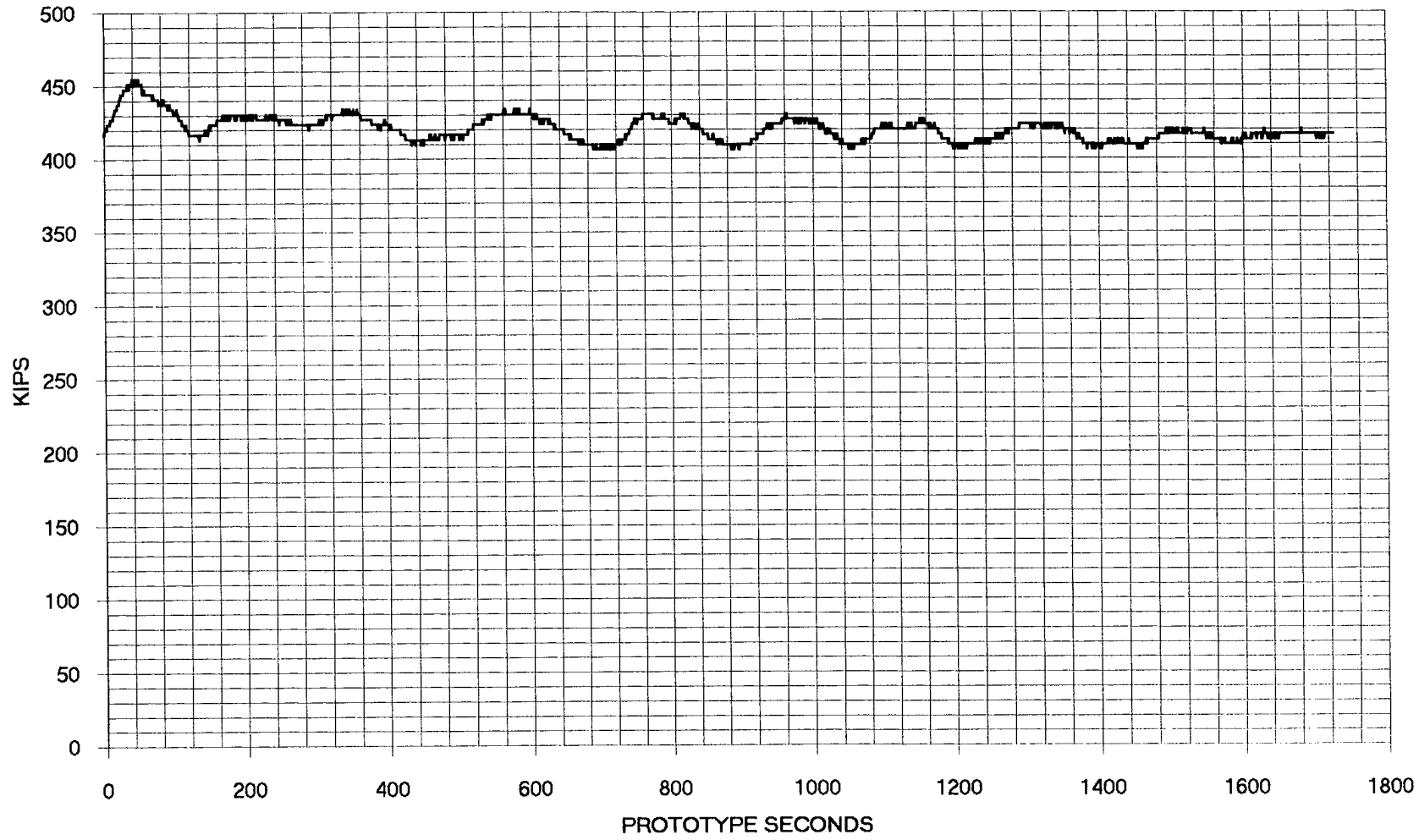
A569 - ML-3 TOWING

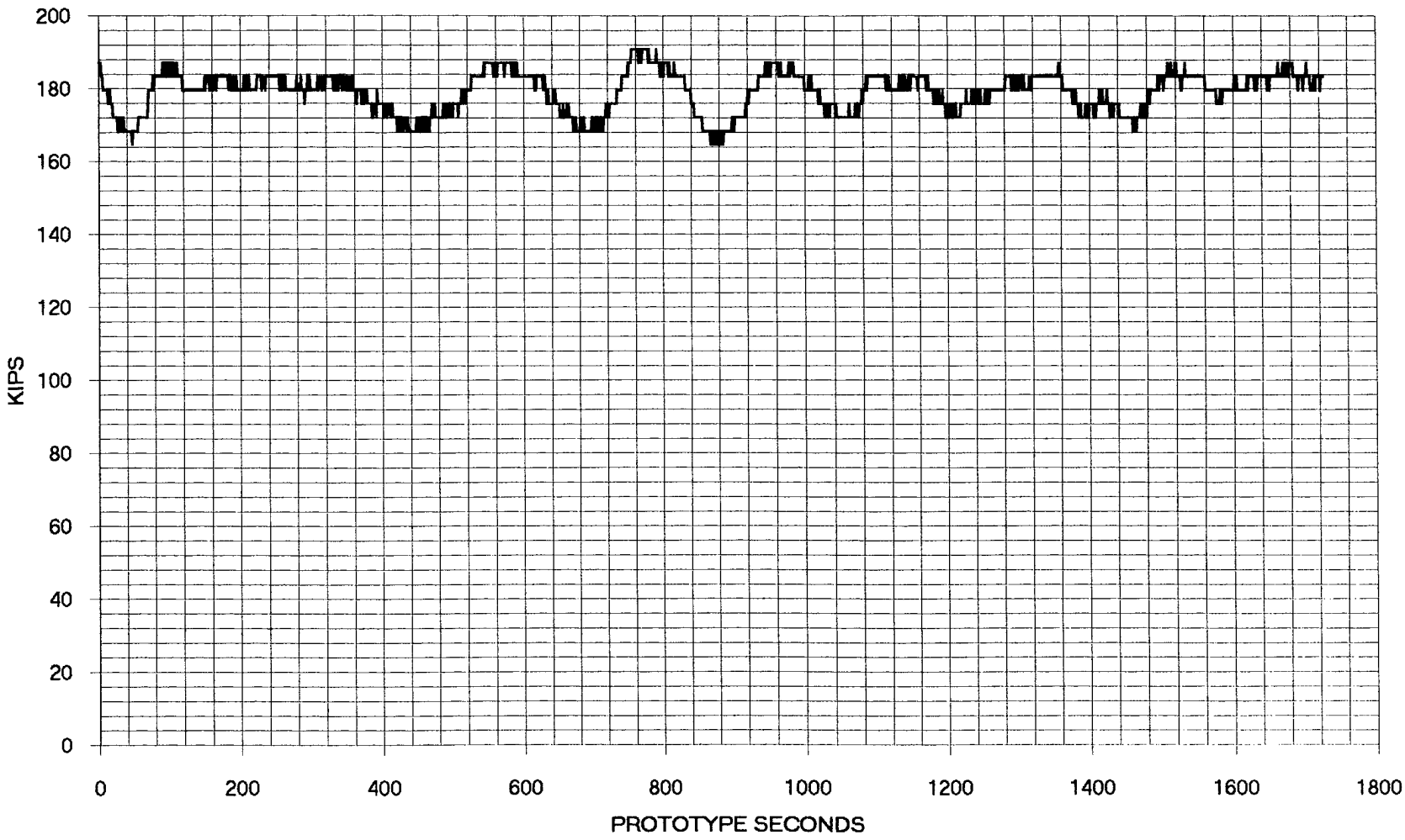


A569 - ML-4 TOWING

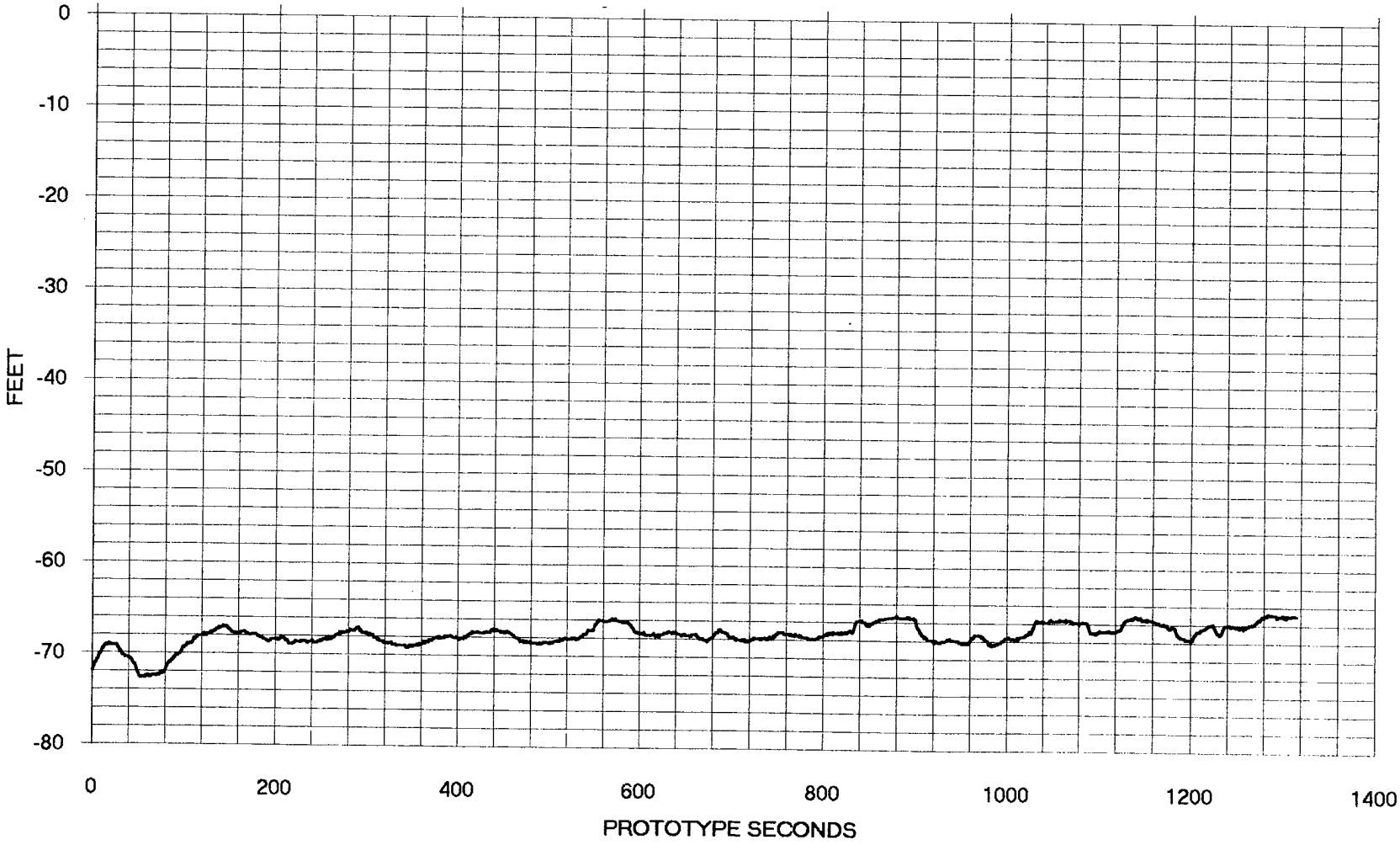


A569 - ML-5 TOWING

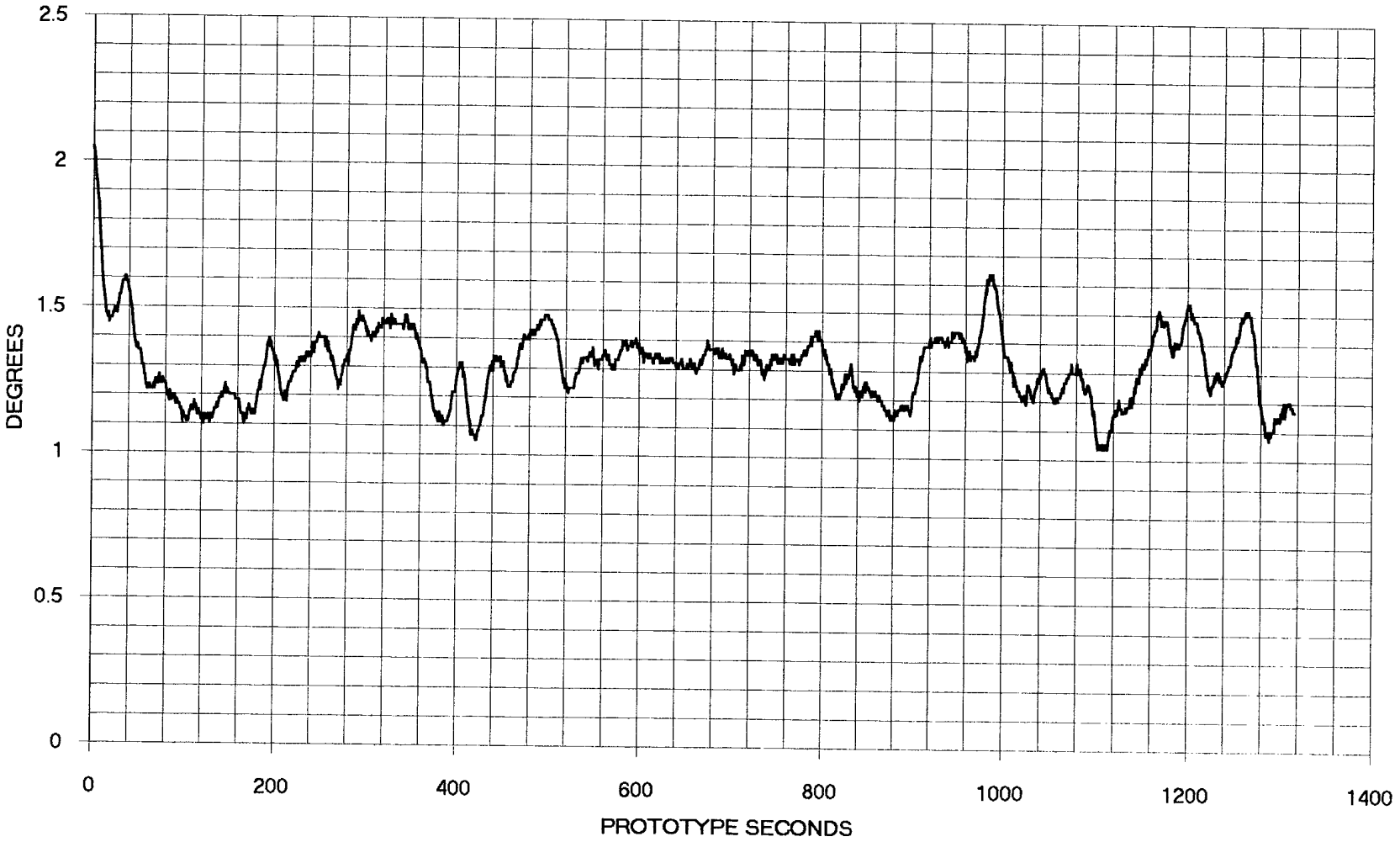


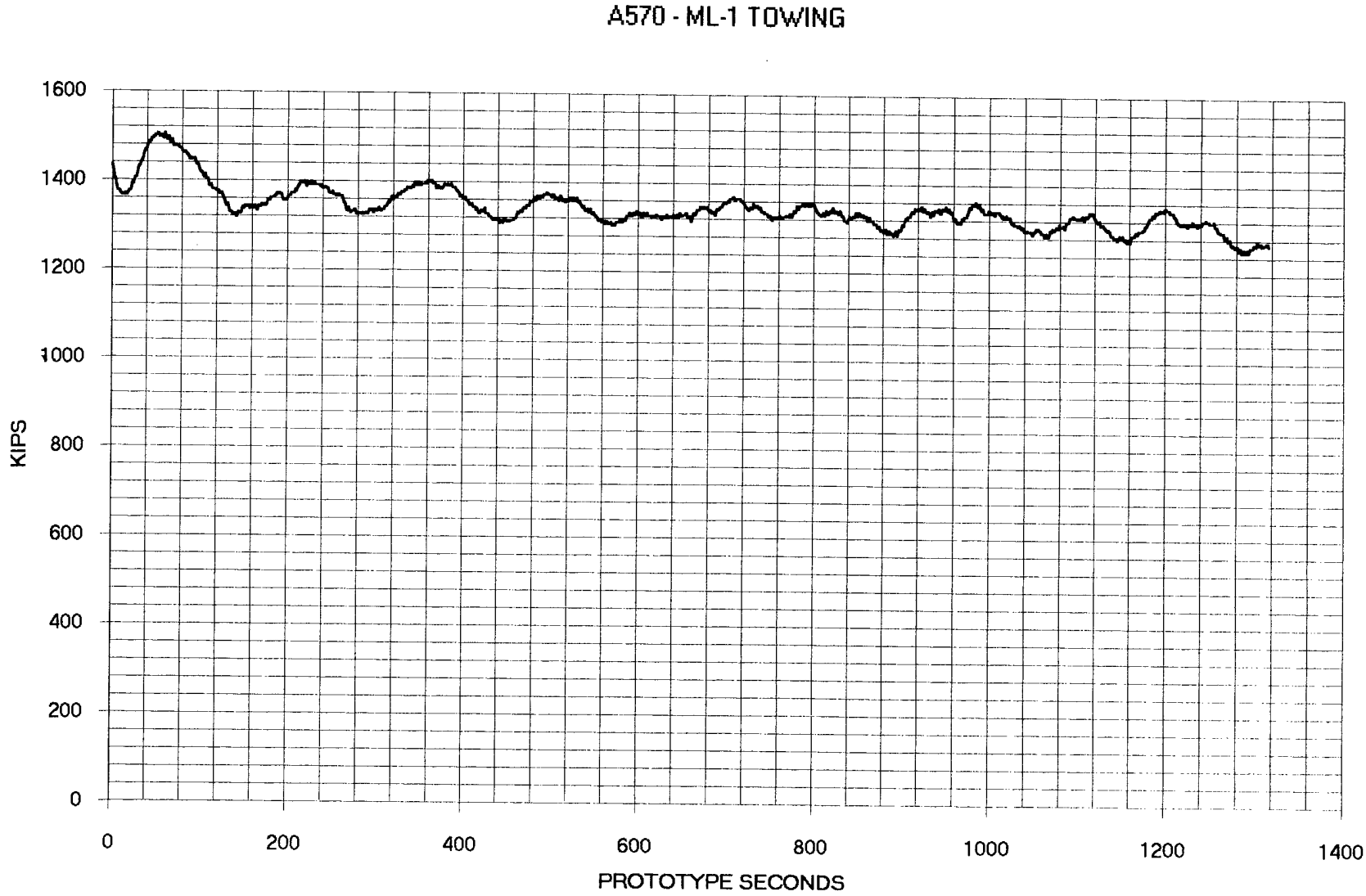

A569 - ML-6 TOWING
KIPS
200
180
160
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
1400
1600
1800
PROTOTYPE SECONDS

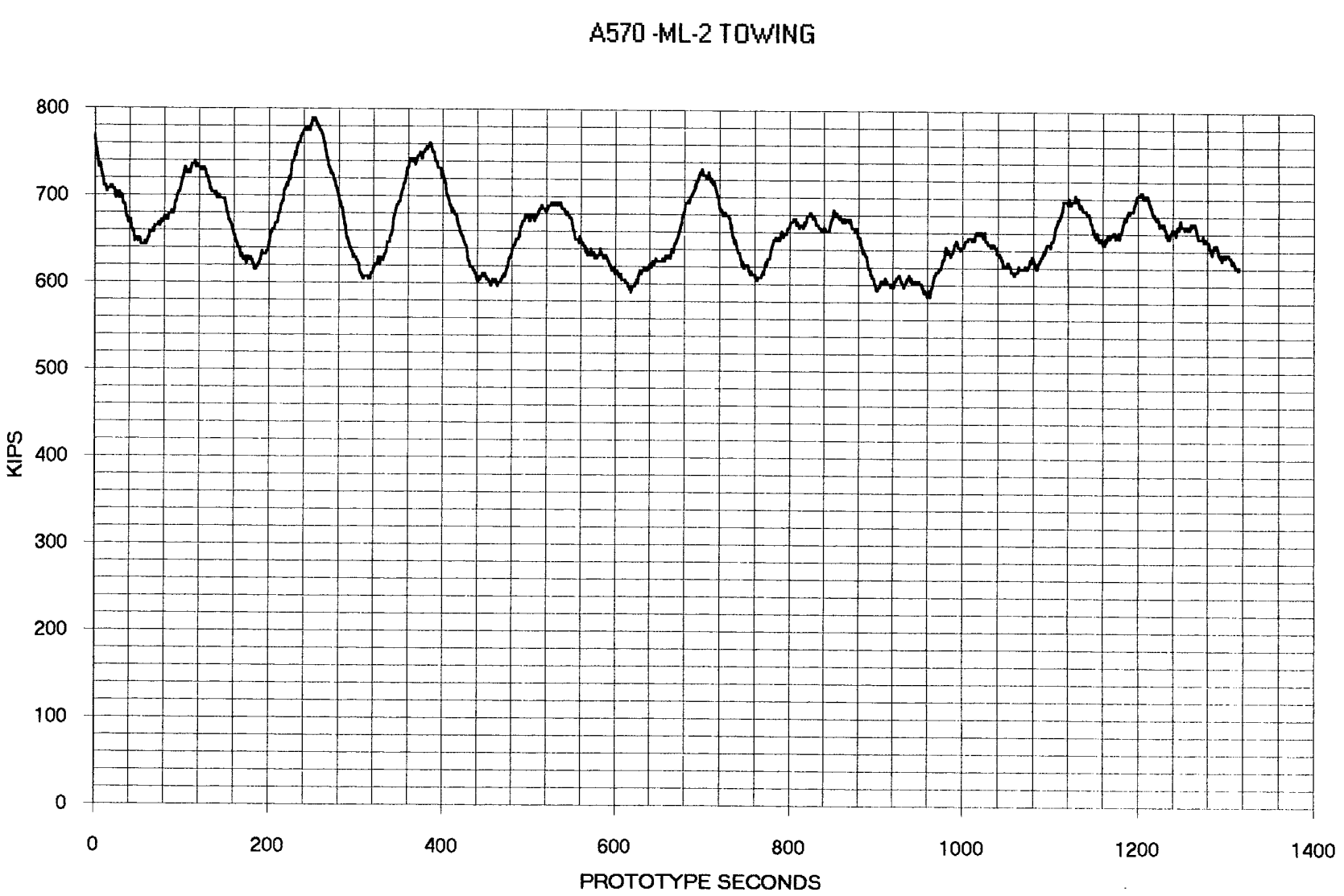
A570 - SURGE TOWING



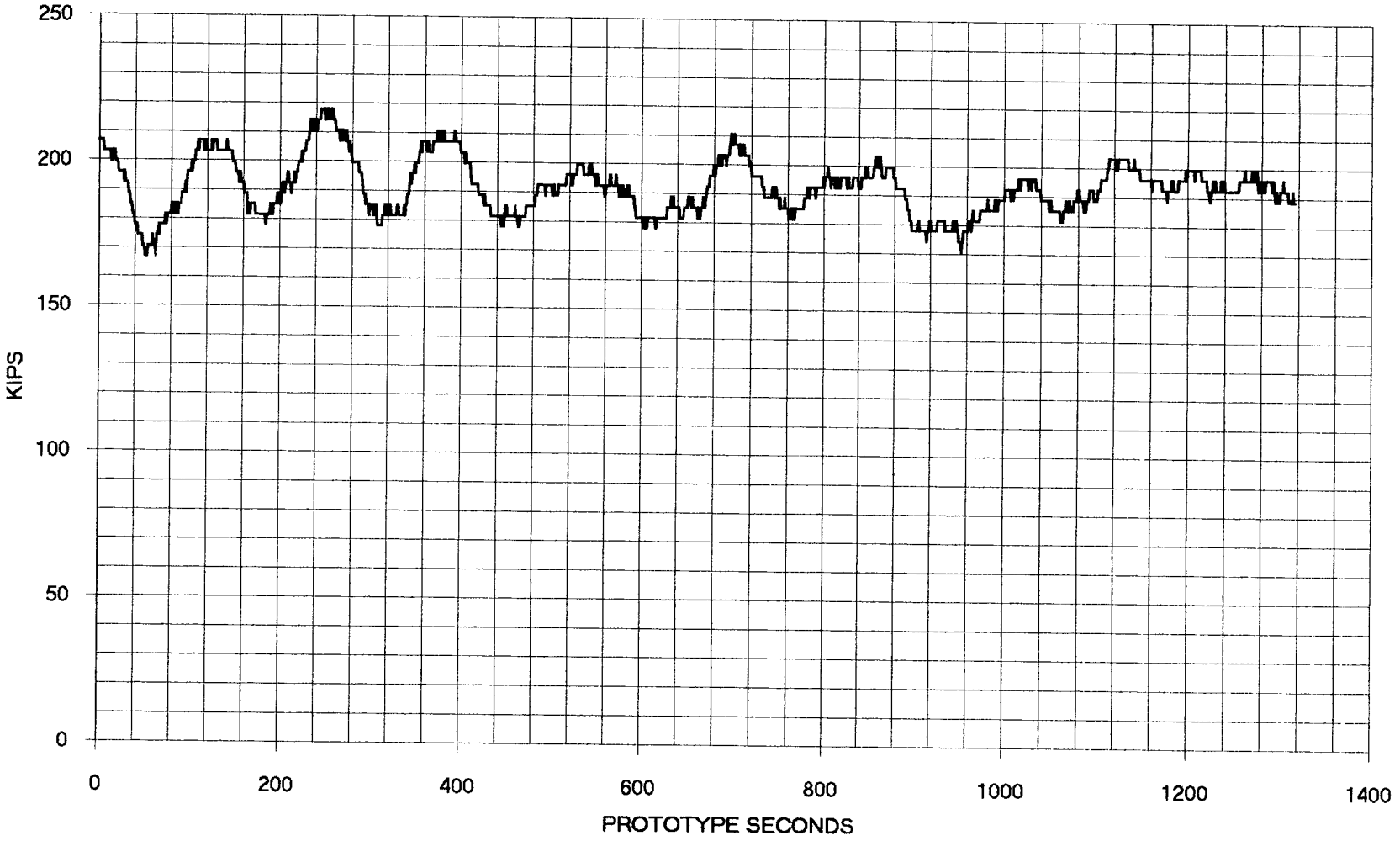
A570 - PITCH TOWING

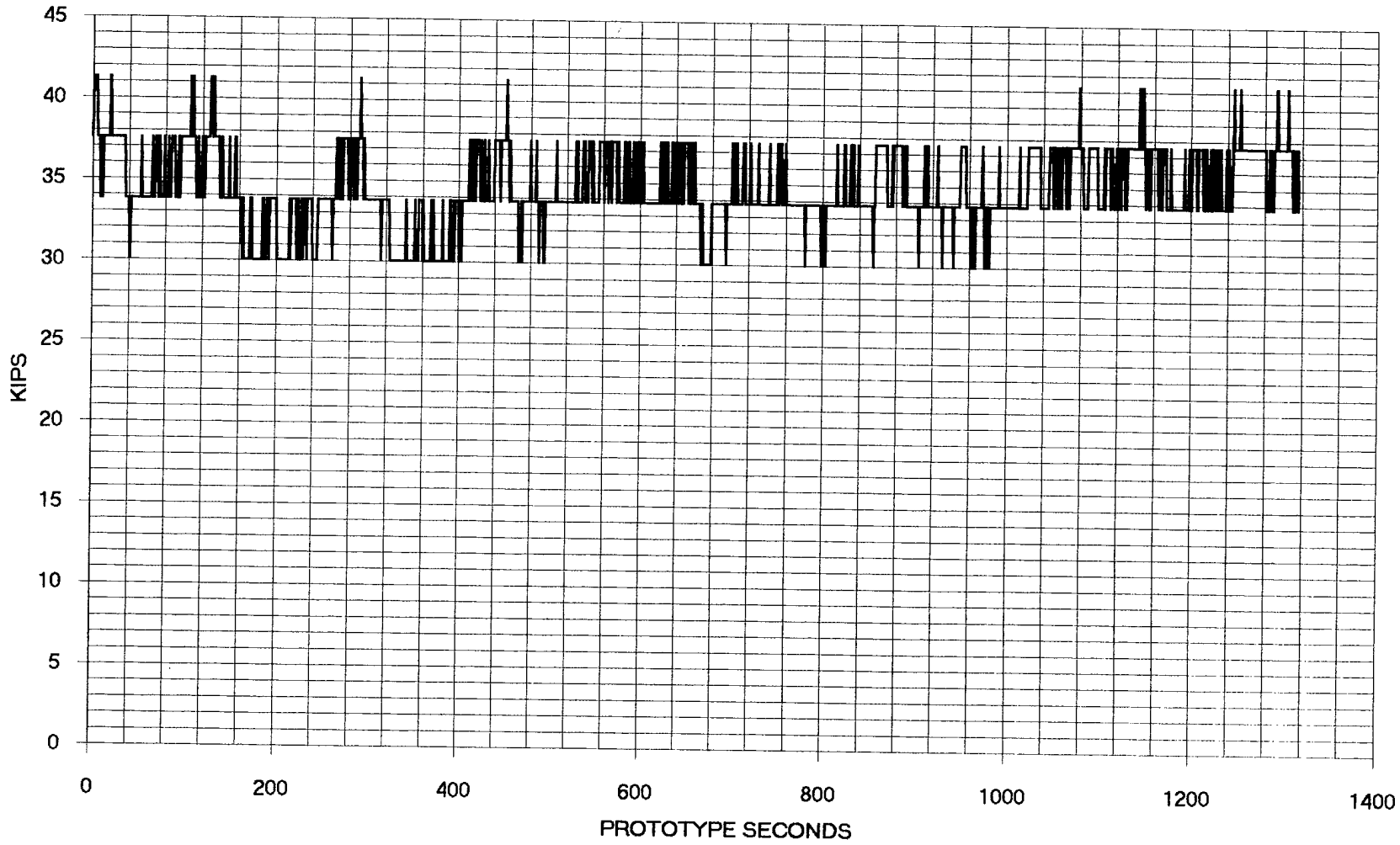


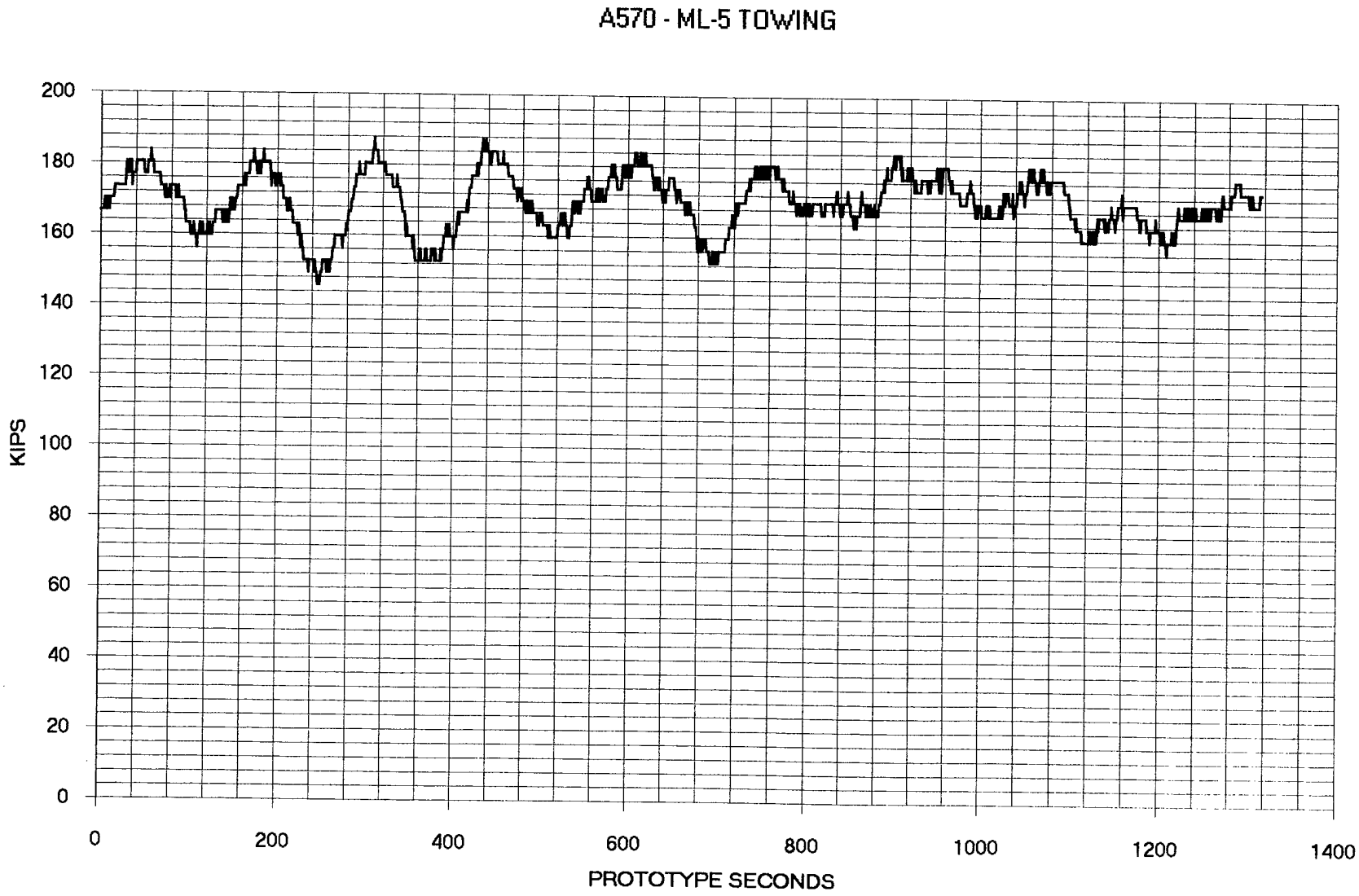

A570 - ML-1 TOWING
1600
1400
1200
1000
800
600
400
200
0
KIPS
0
200
400
600
800
1000
1200
1400
PROTOTYPE SECONDS

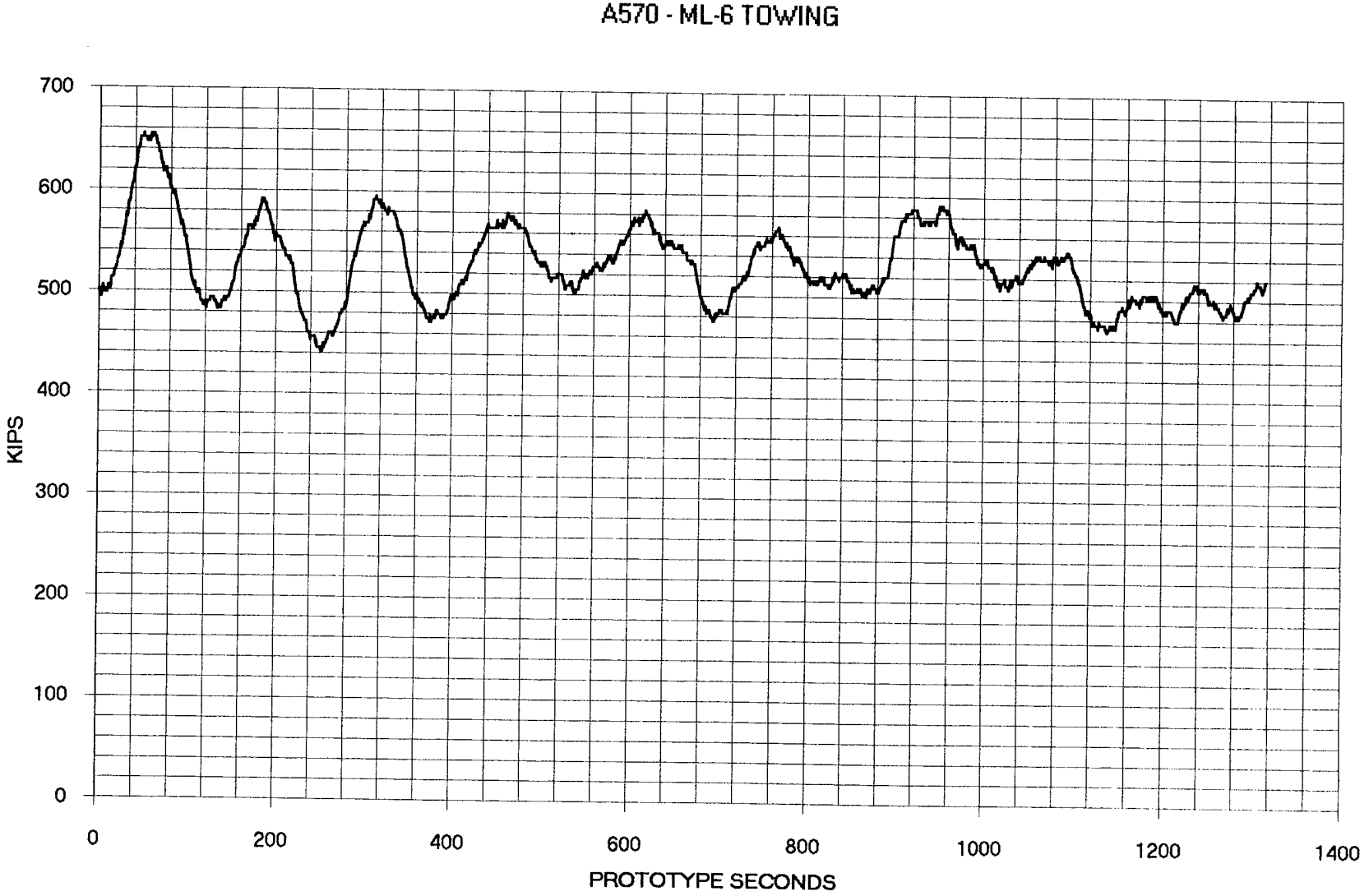

A570 -ML-2 TOWING
800
700
600
500
400
300
200
100
0
KIPS
0
200
400
600
800
1000
1200
1400
PROTOTYPE SECONDS

A570 - ML-3 TOWING

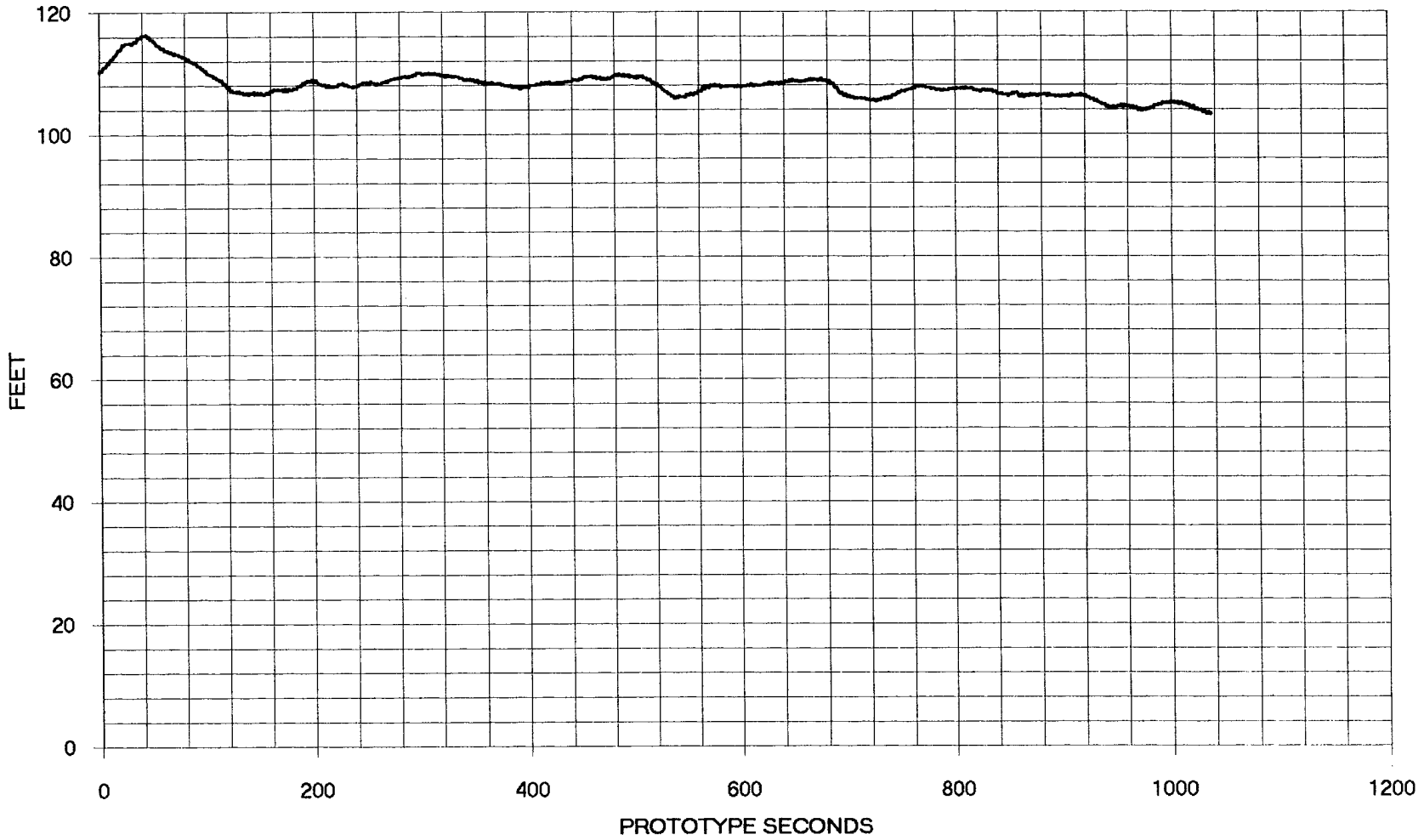


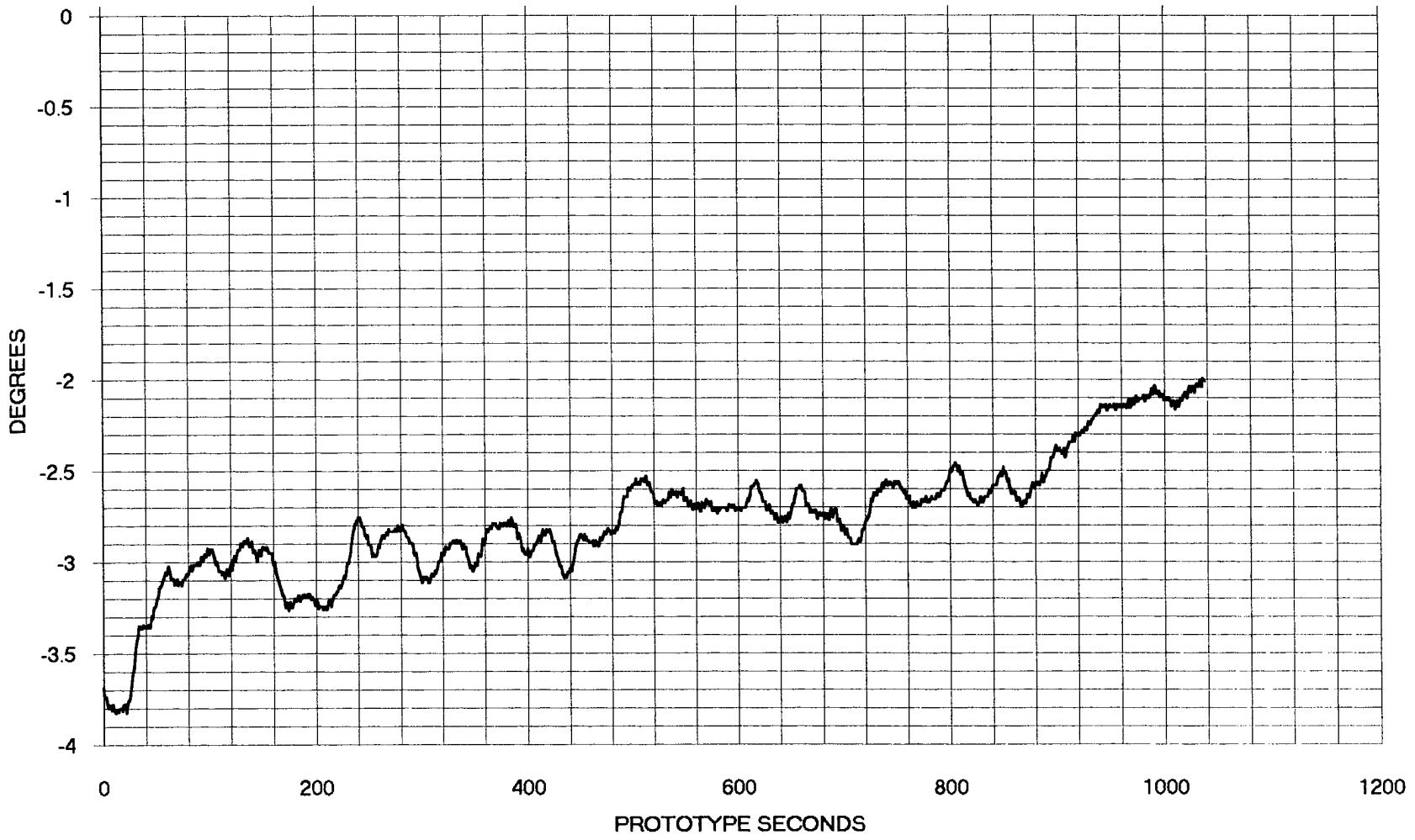

A570 - ML-4 TOWING
45
40
35
30
25
20
15
10
5
0
KIPS
0
200
400
600
800
1000
1200
1400
PROTOTYPE SECONDS

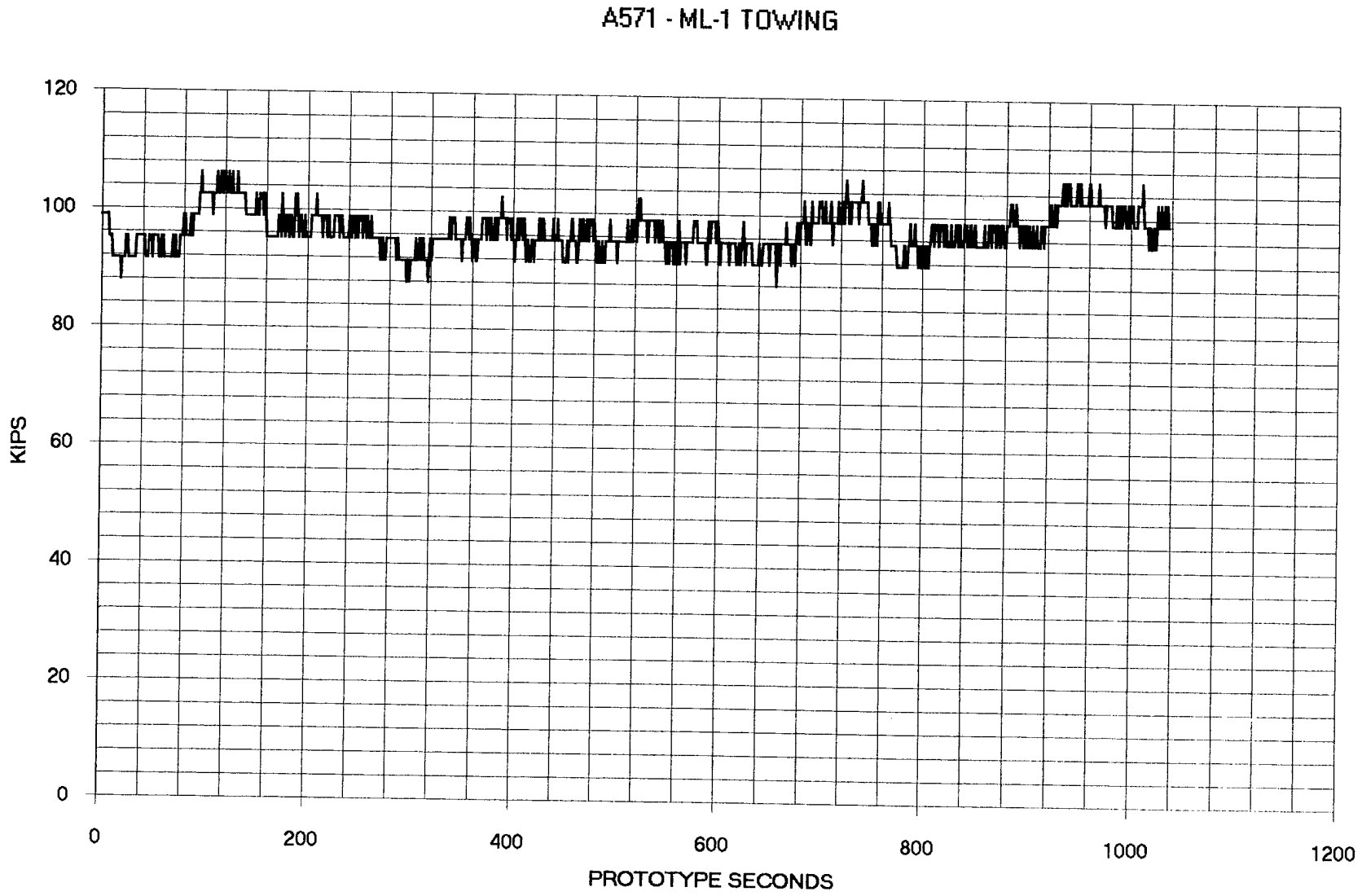

A570 - ML-5 TOWING
KIPS
200
180
160
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
1400
PROTOTYPE SECONDS

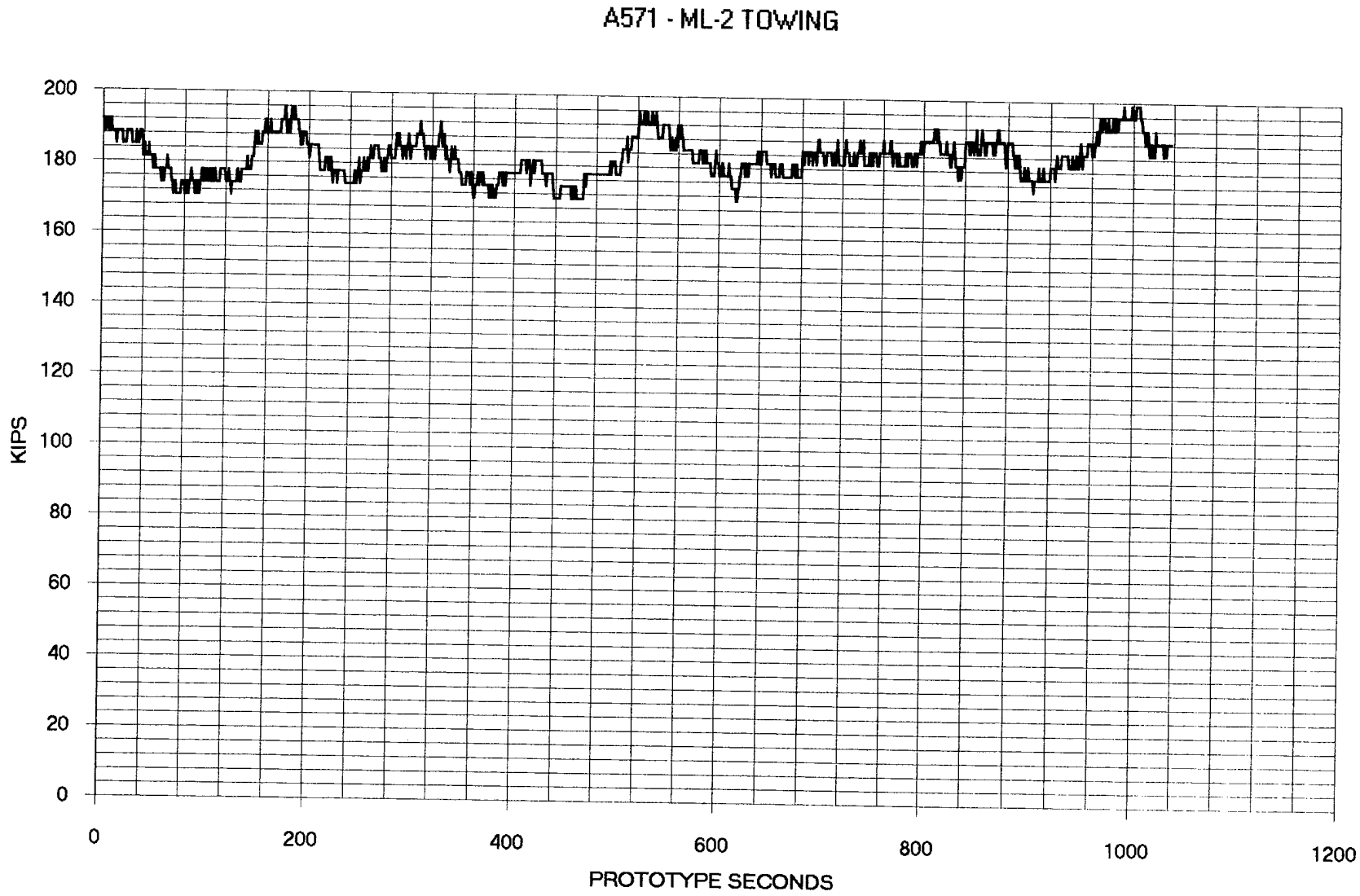

A570 - ML-6 TOWING
700
600
500
400
300
200
100
0
KIPS
0
200
400
600
800
1000
1200
1400
PROTOTYPE SECONDS

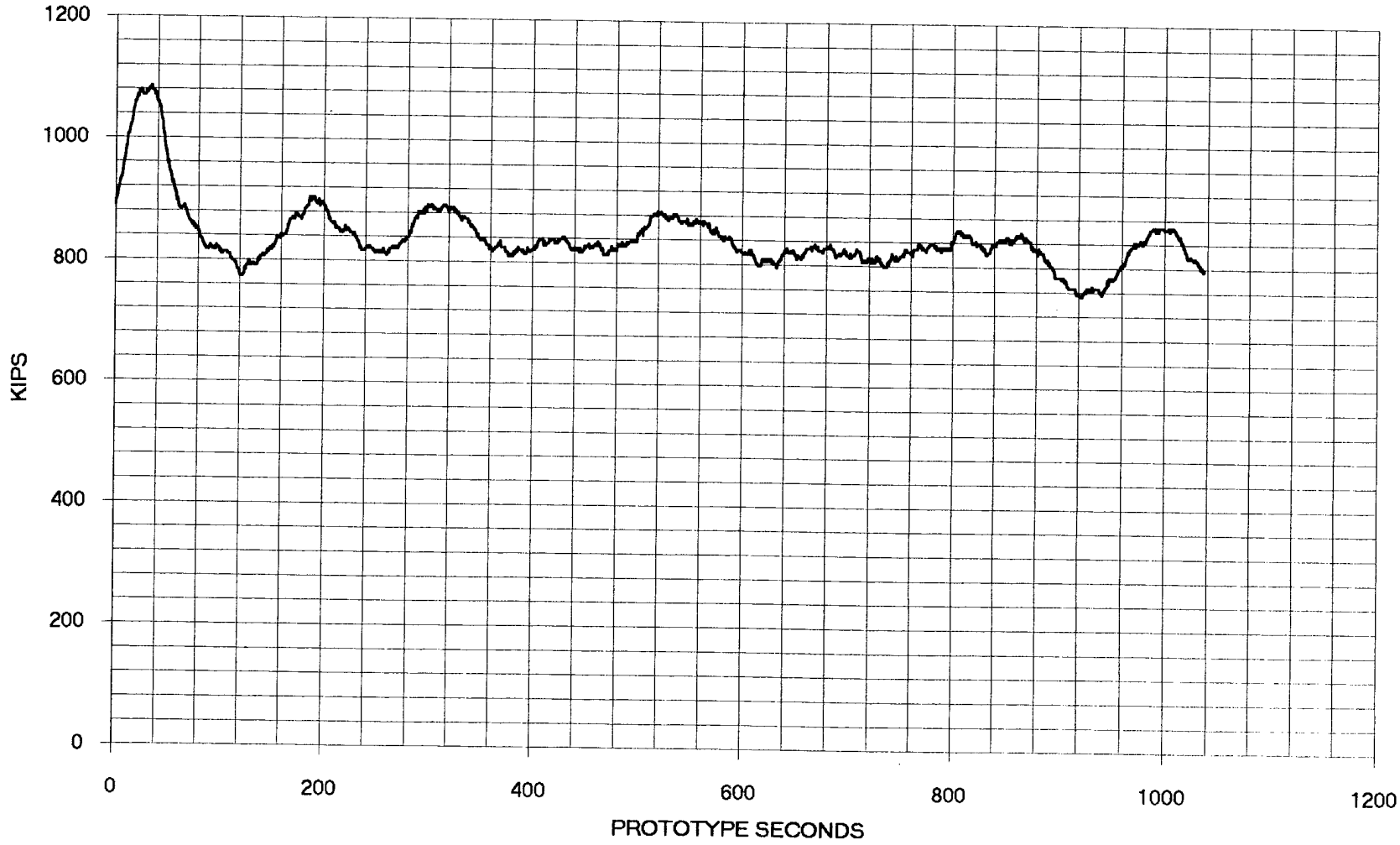
A571 - SURGE TOWING



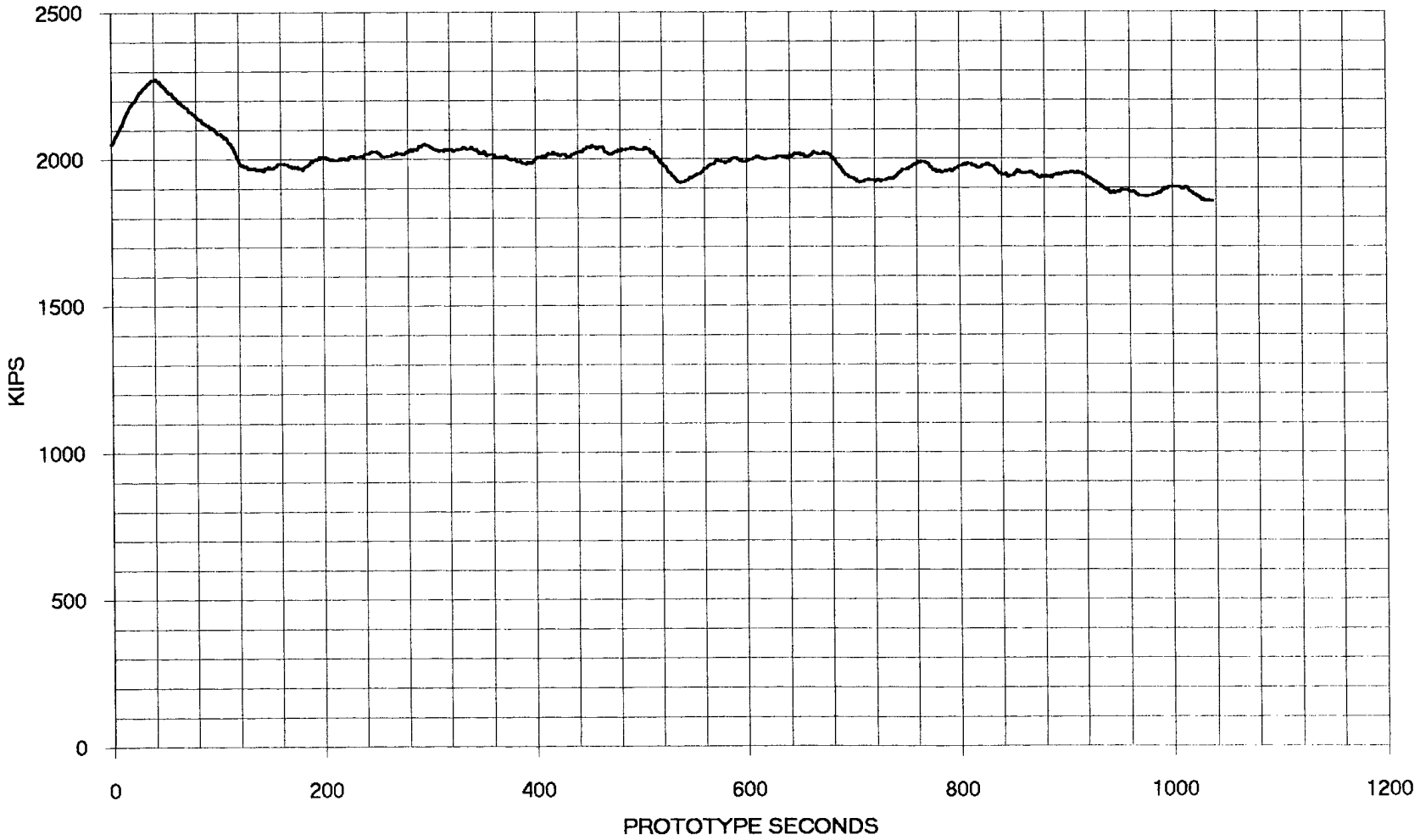

A571 - PITCH TOWING
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
DEGREES
0
200
400
600
800
1000
1200
PROTOTYPE SECONDS


A571 - ML-1 TOWING
120
100
80
60
40
20
0
KIPS
0
200
400
600
800
1000
1200
PROTOTYPE SECONDS

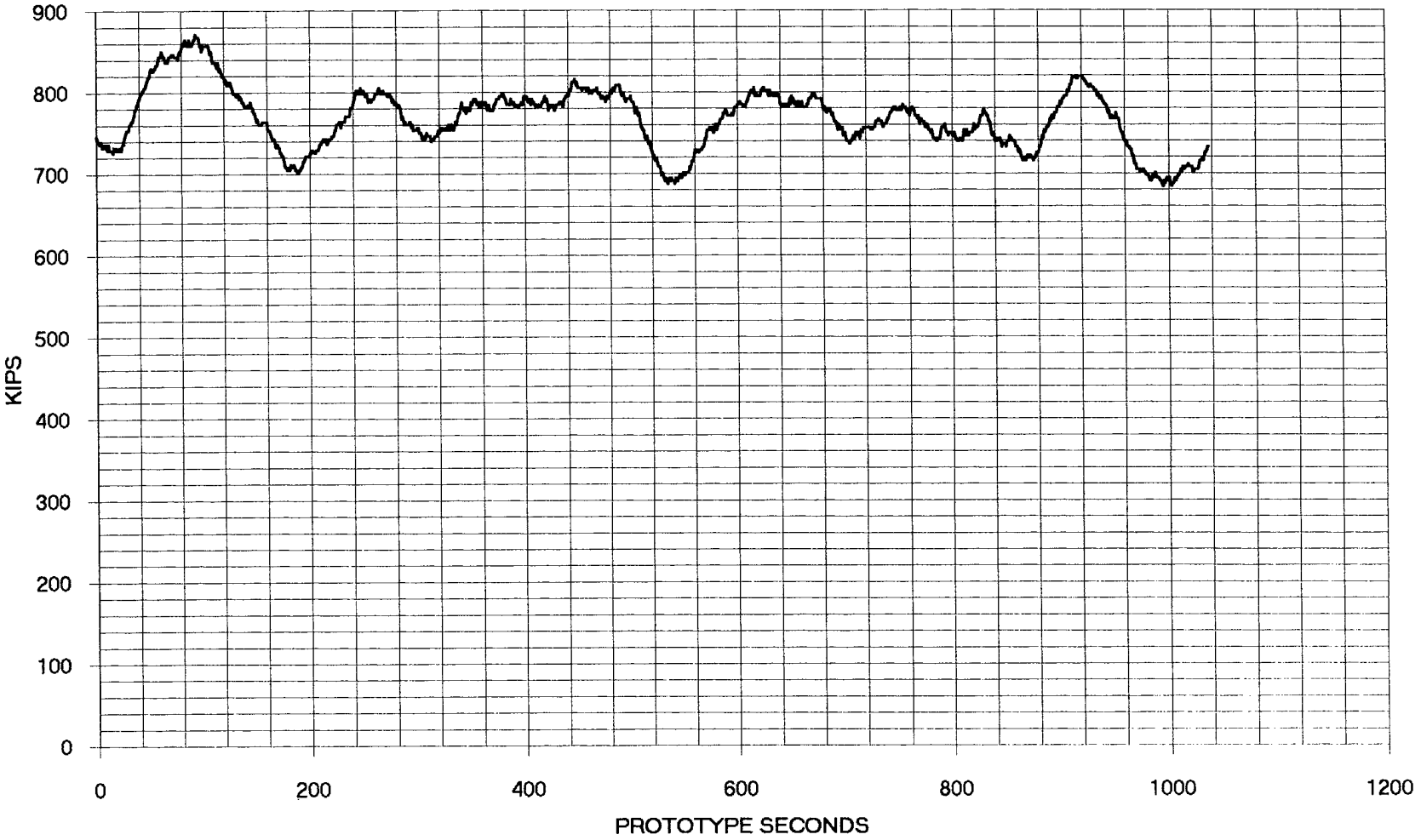

A571 - ML-2 TOWING
KIPS
200
180
160
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
PROTOTYPE SECONDS


A571 - ML-3 TOWING
1200
1000
800
600
400
200
0
KIPS
0
200
400
600
800
1000
1200
PROTOTYPE SECONDS

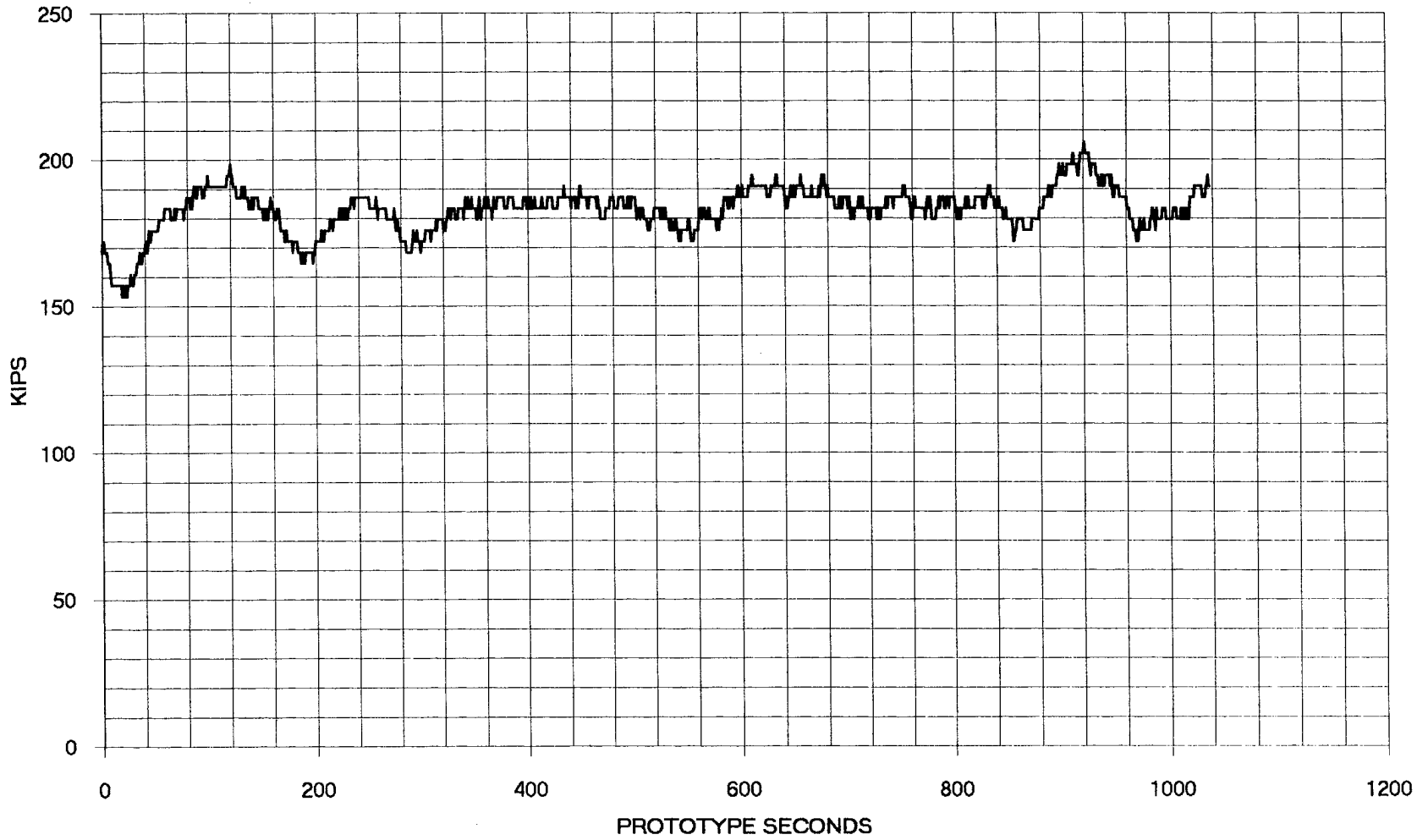
A571 - ML-4 TOWING



A571 - ML-5 TOWING



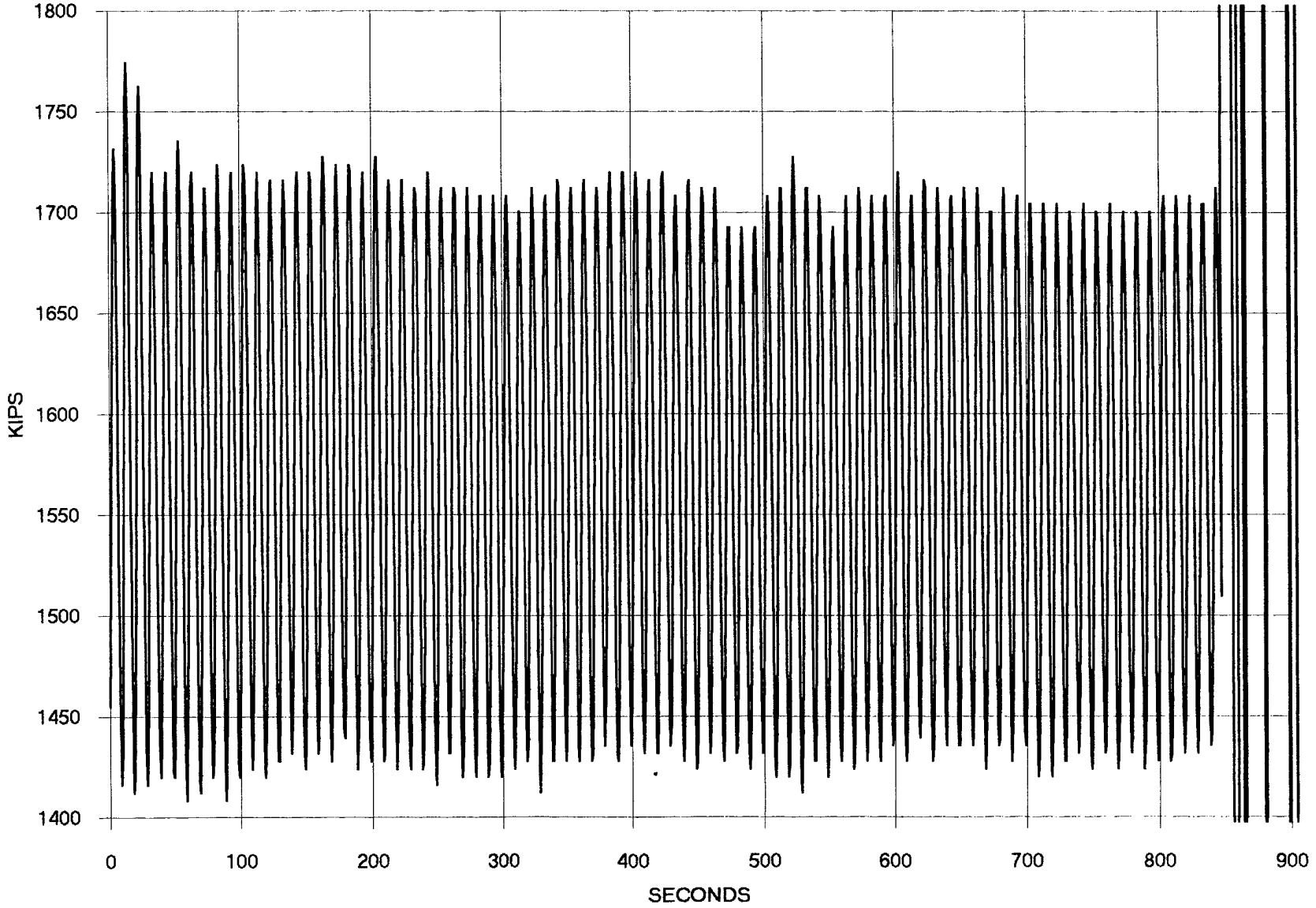
A571 - ML-6 TOWING



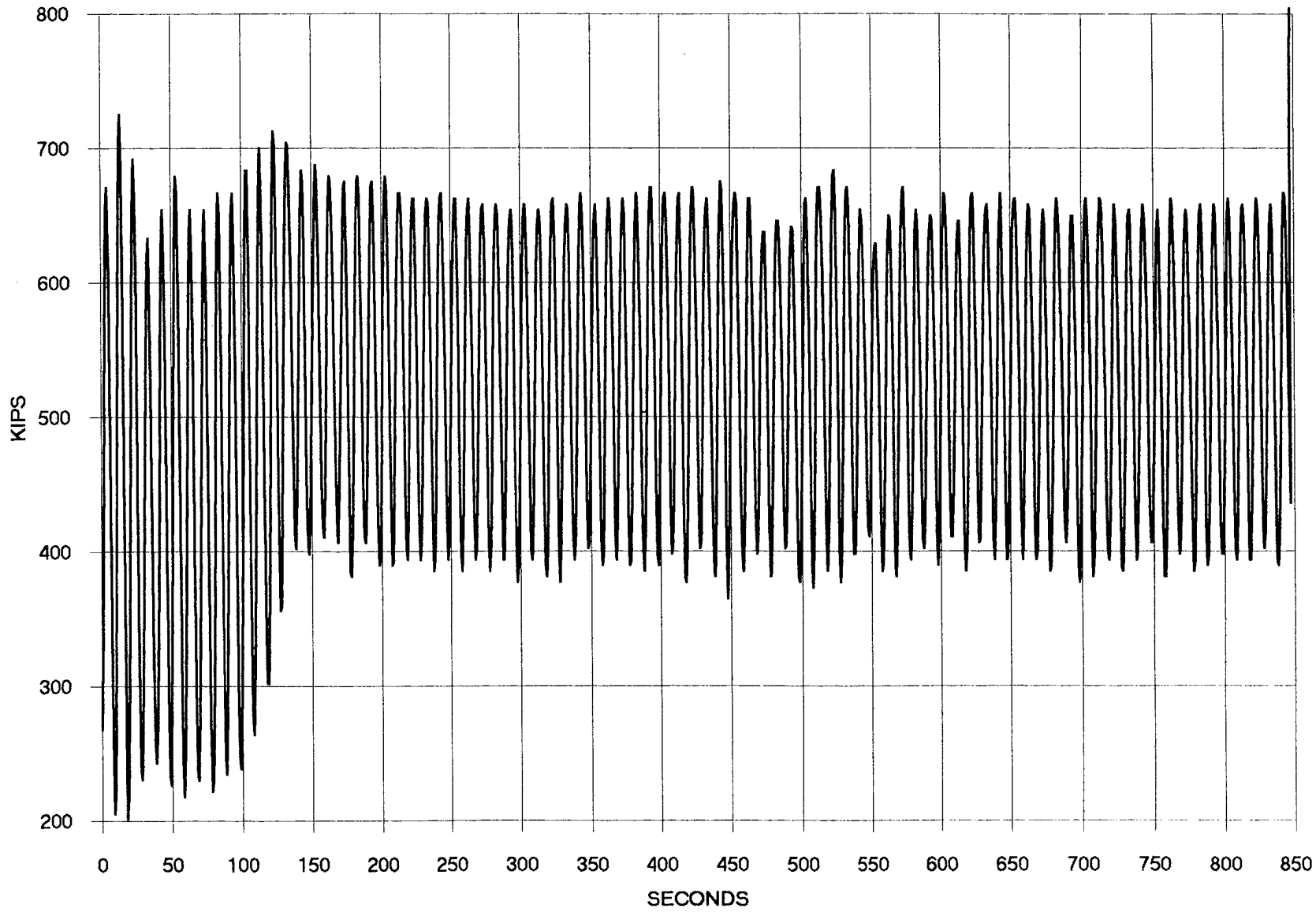
APPENDIX K

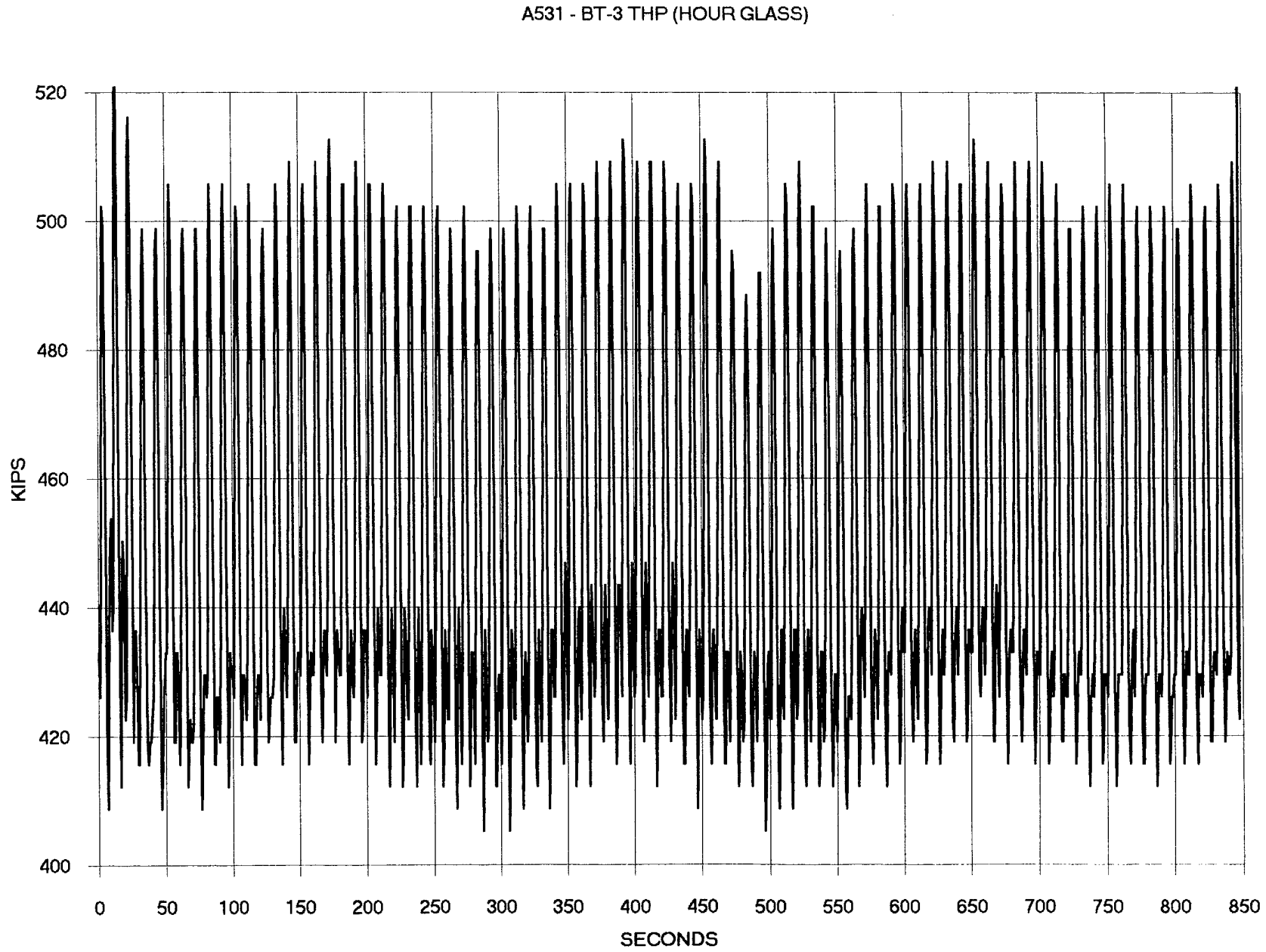
TIME HISTORY PLOTS FOR BUOY-ON-A-FIXED-BAR TESTS

A531- BT-1 THP (DRY)

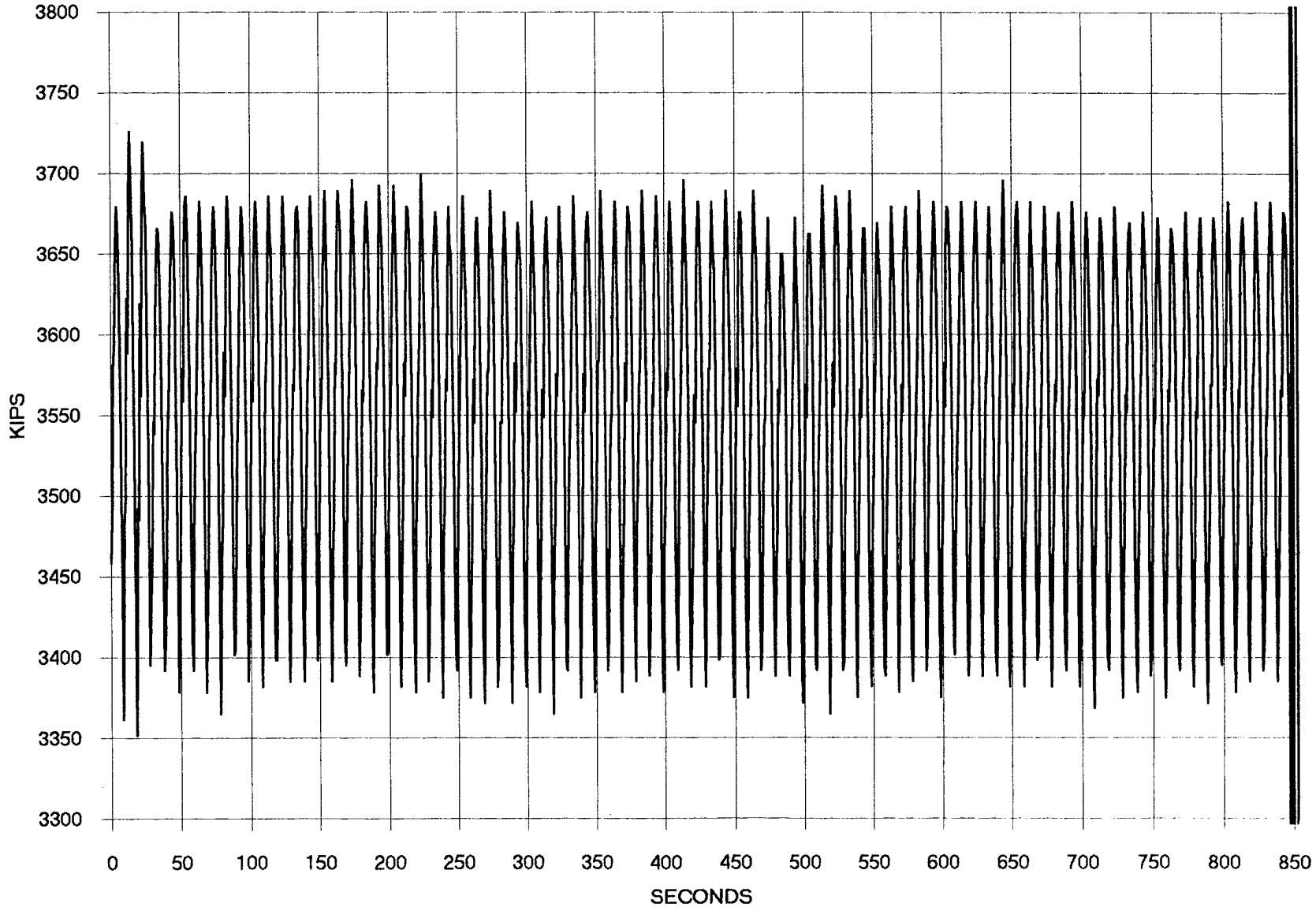


A531 - BT-2 THP (INV. CONE)

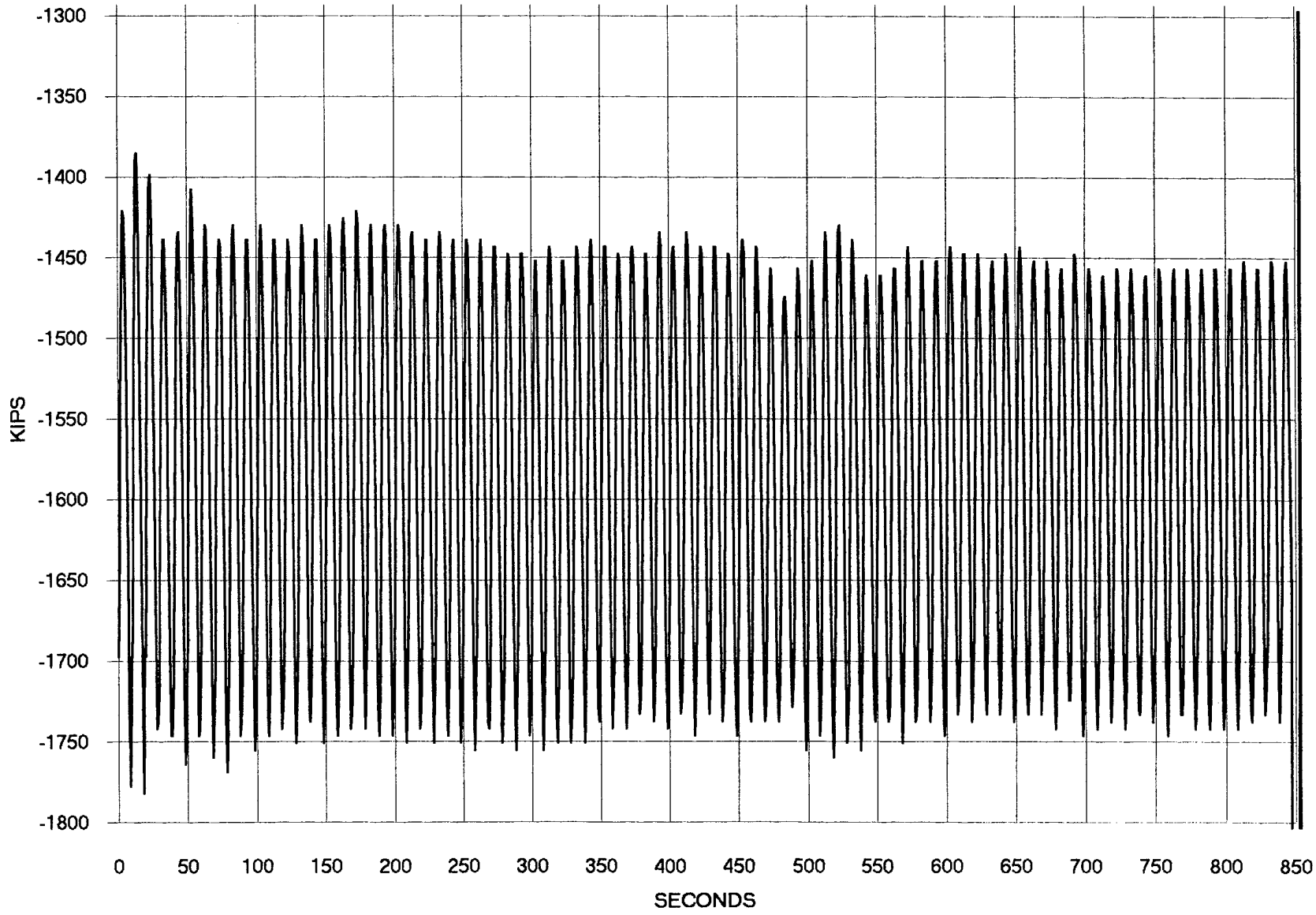


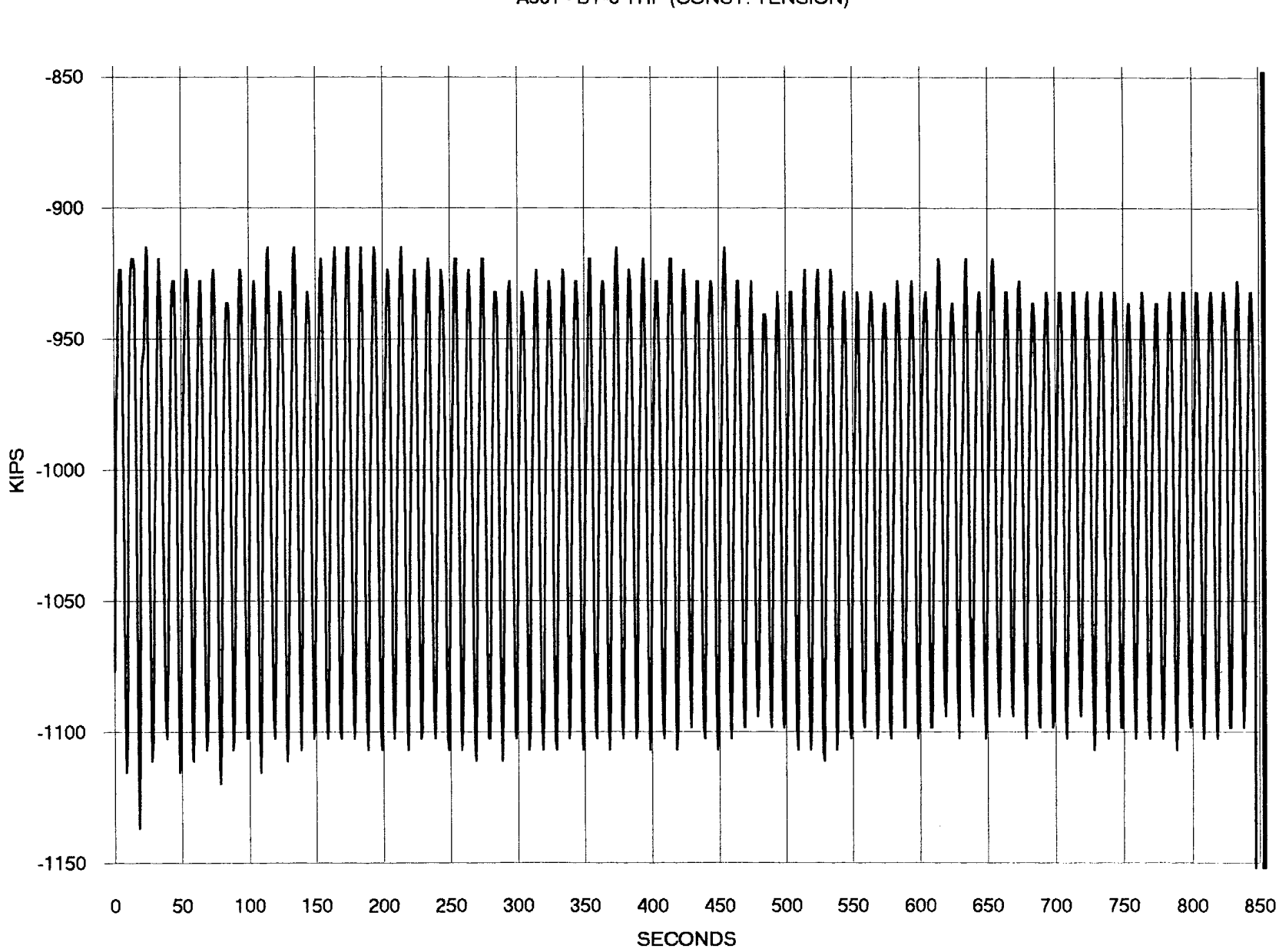

A531 - BT-3 THP (HOUR GLASS)
520
500
480
460
440
420
400
KIPS
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
SECONDS

A531 - BT-4 THP (SEGMENTED)

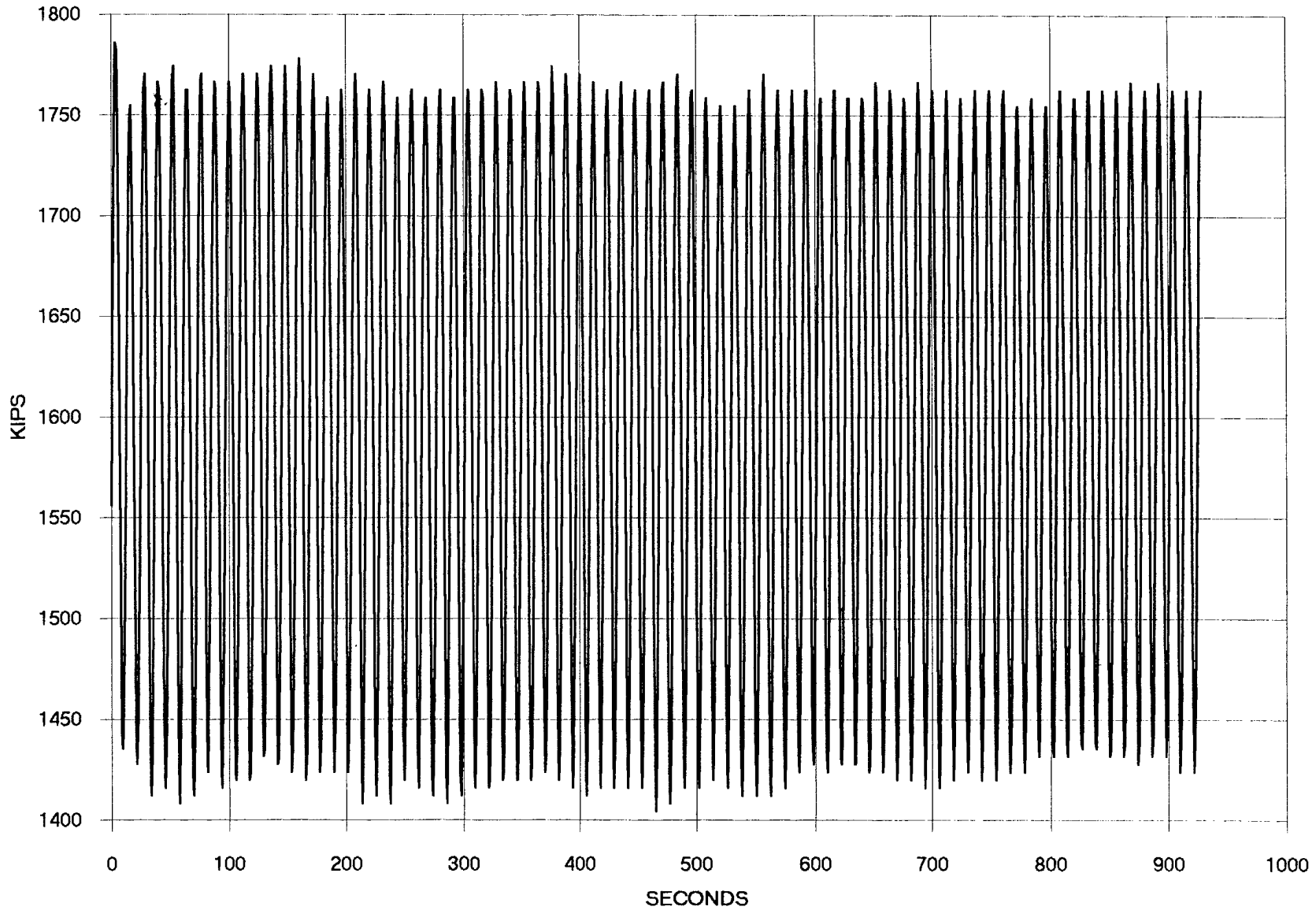


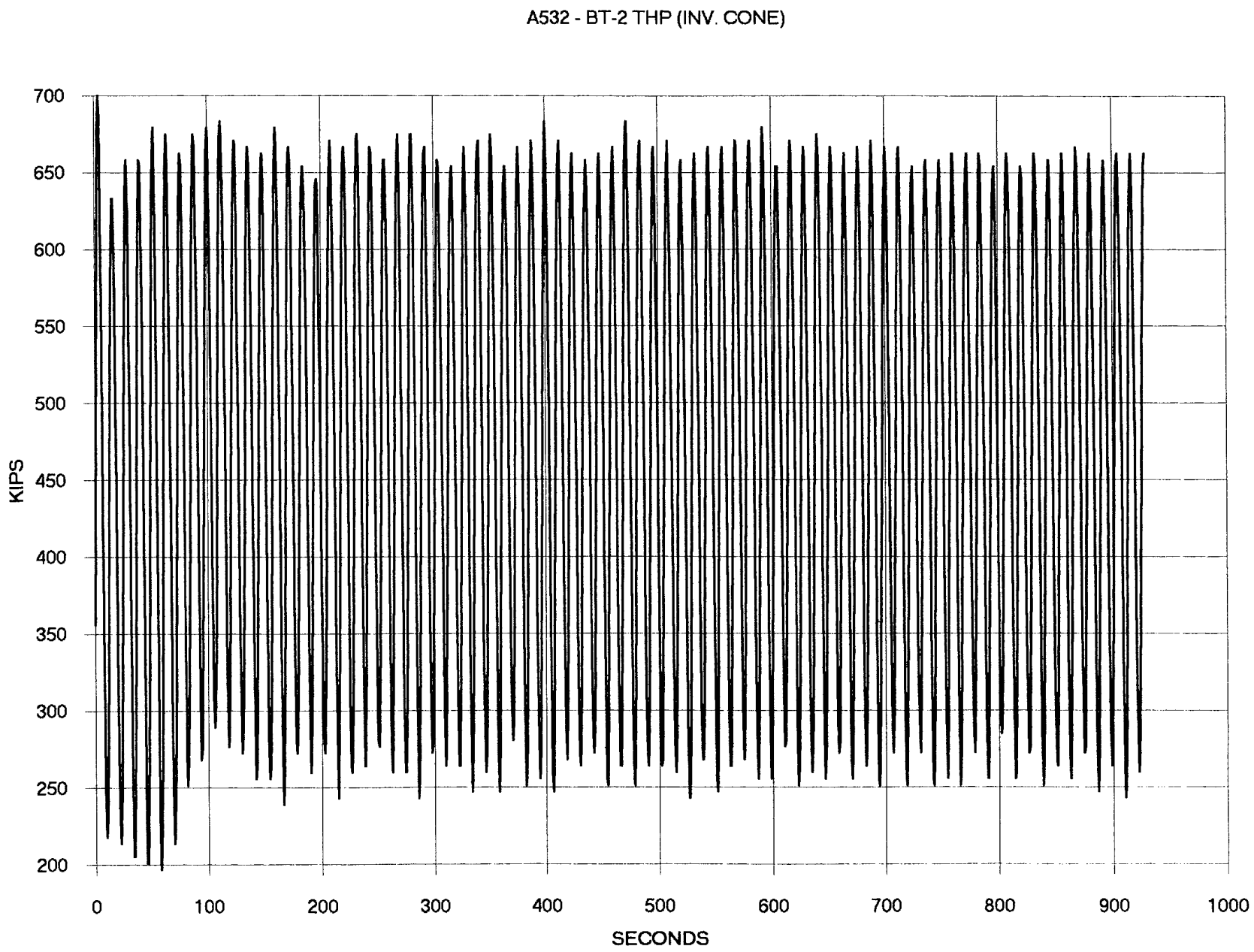
A531 - BT-5 THP (LINK BUOY)

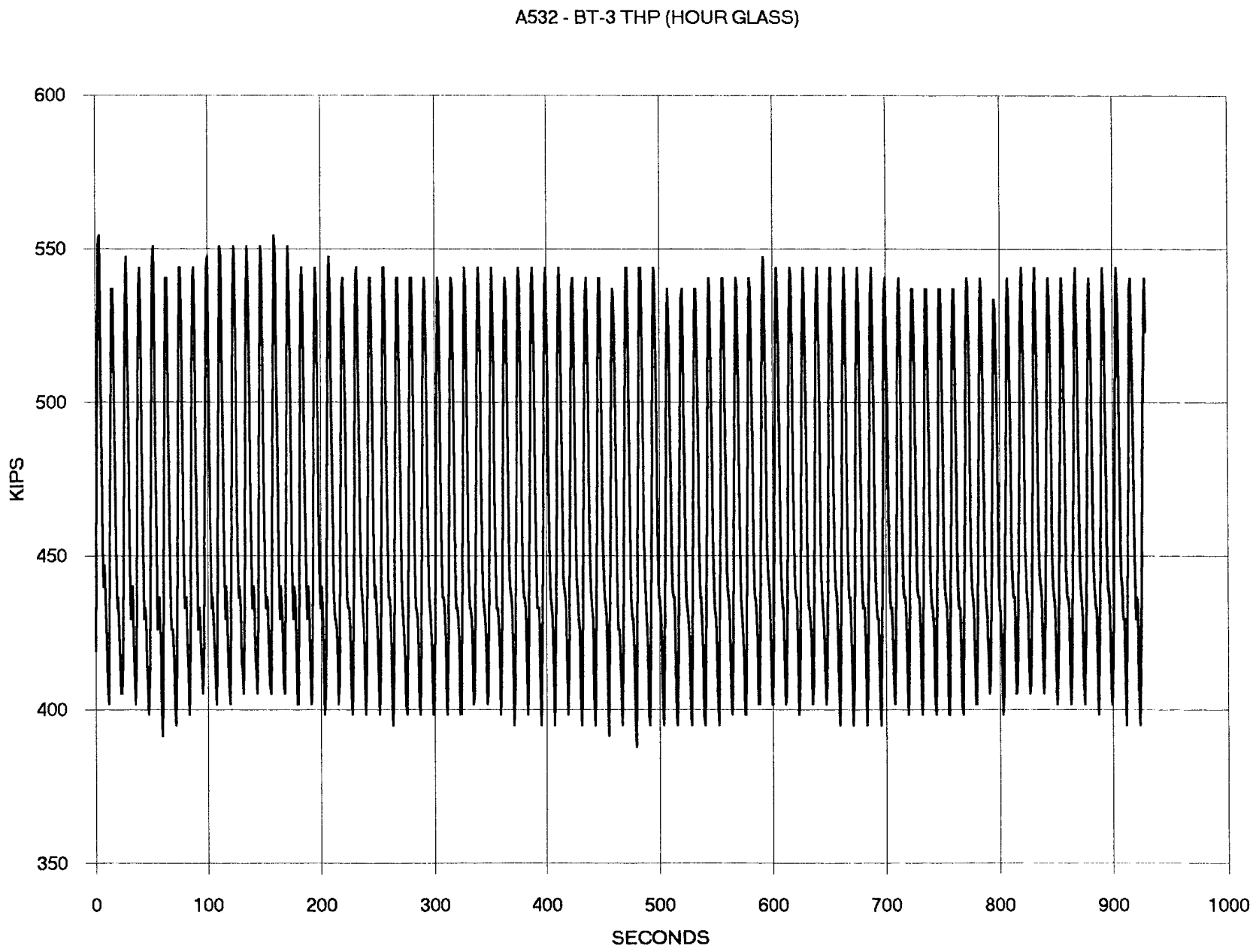



A531 - BT-6 THP (CONST. TENSION)
-850
-900
-950
-1000
-1050
-1100
-1150
KIPS
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
SECONDS

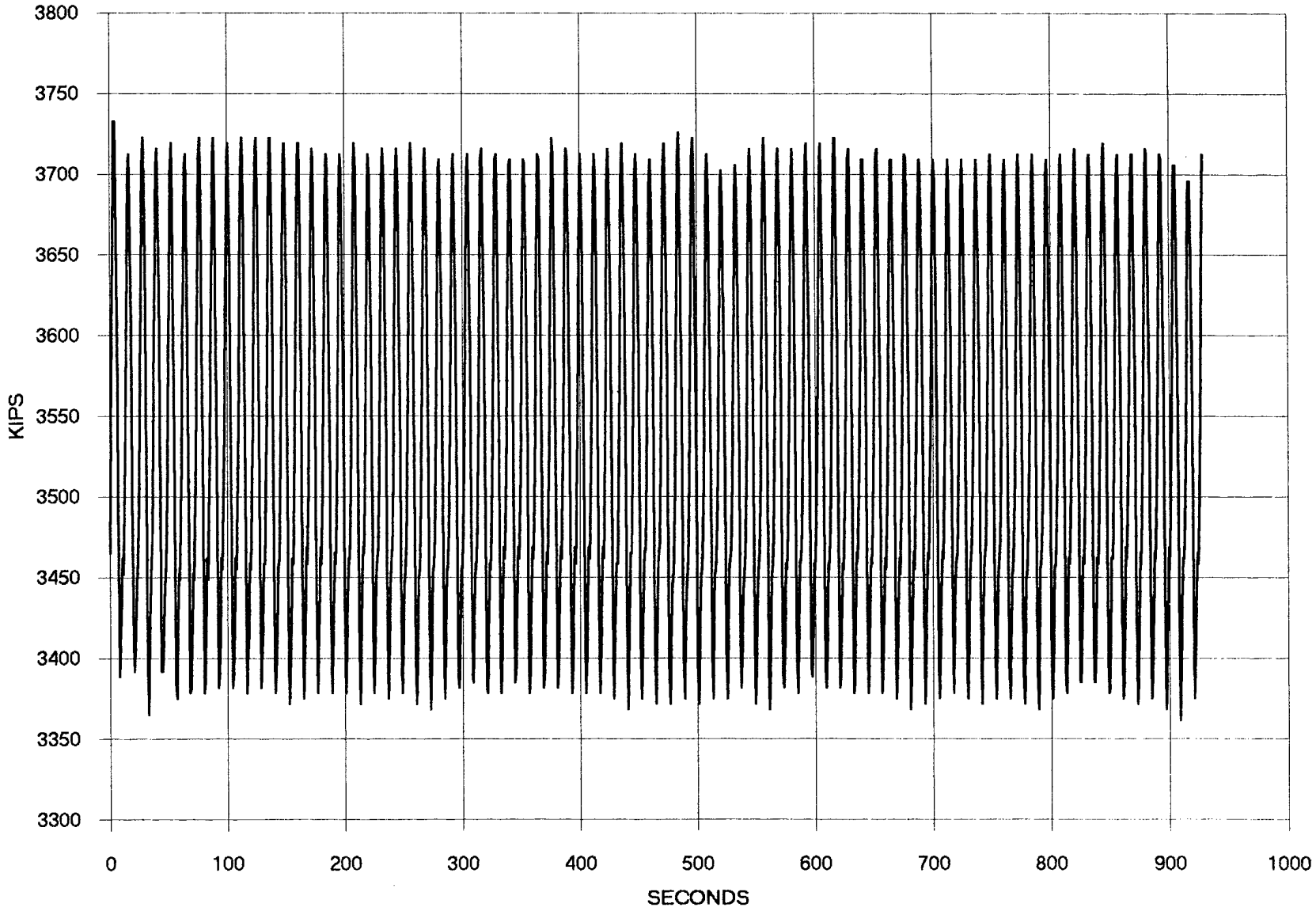
A532 - BT-1 THP (DRY)



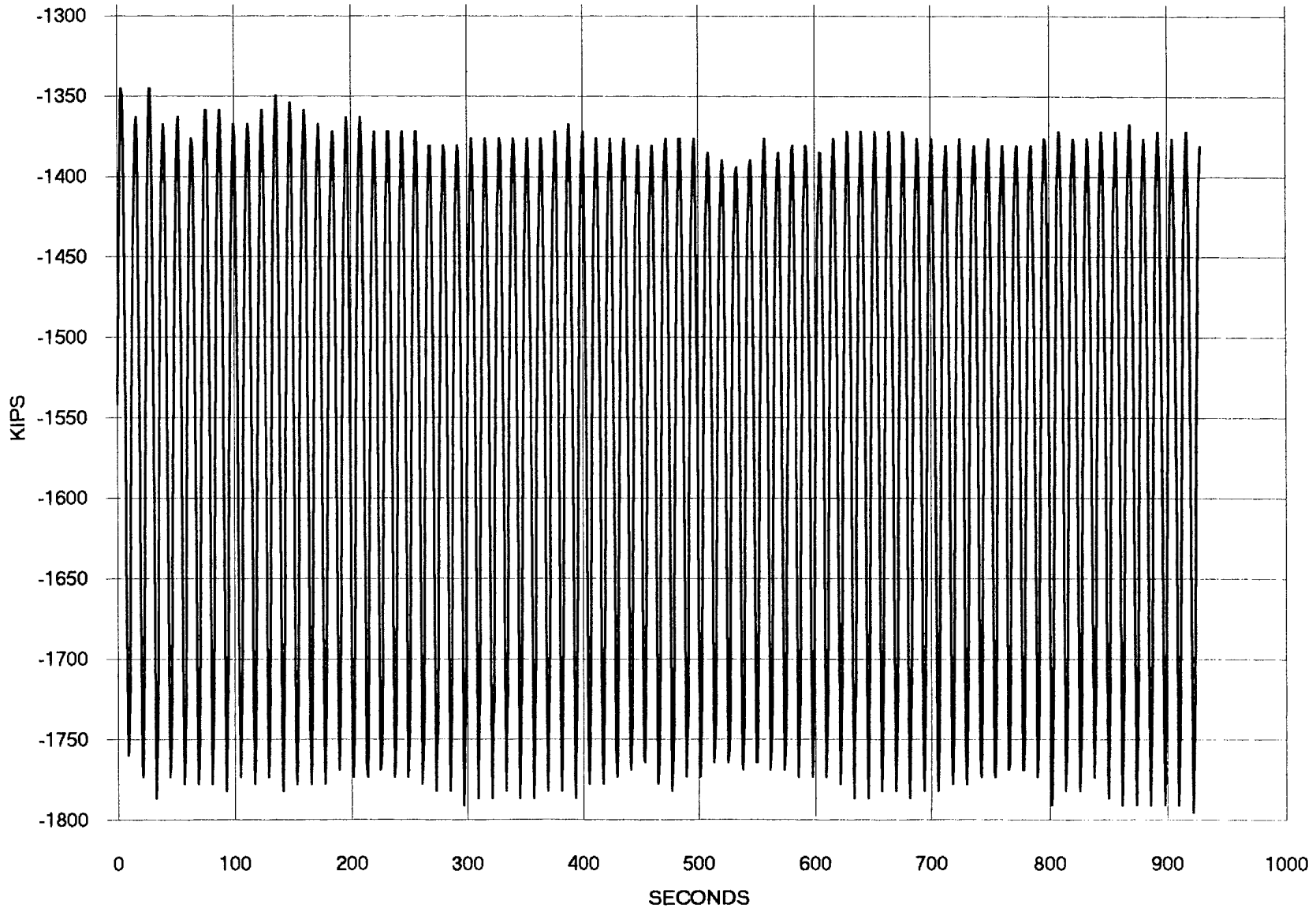

A532 - BT-2 THP (INV. CONE)
700
650
600
550
500
450
400
350
300
250
200
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

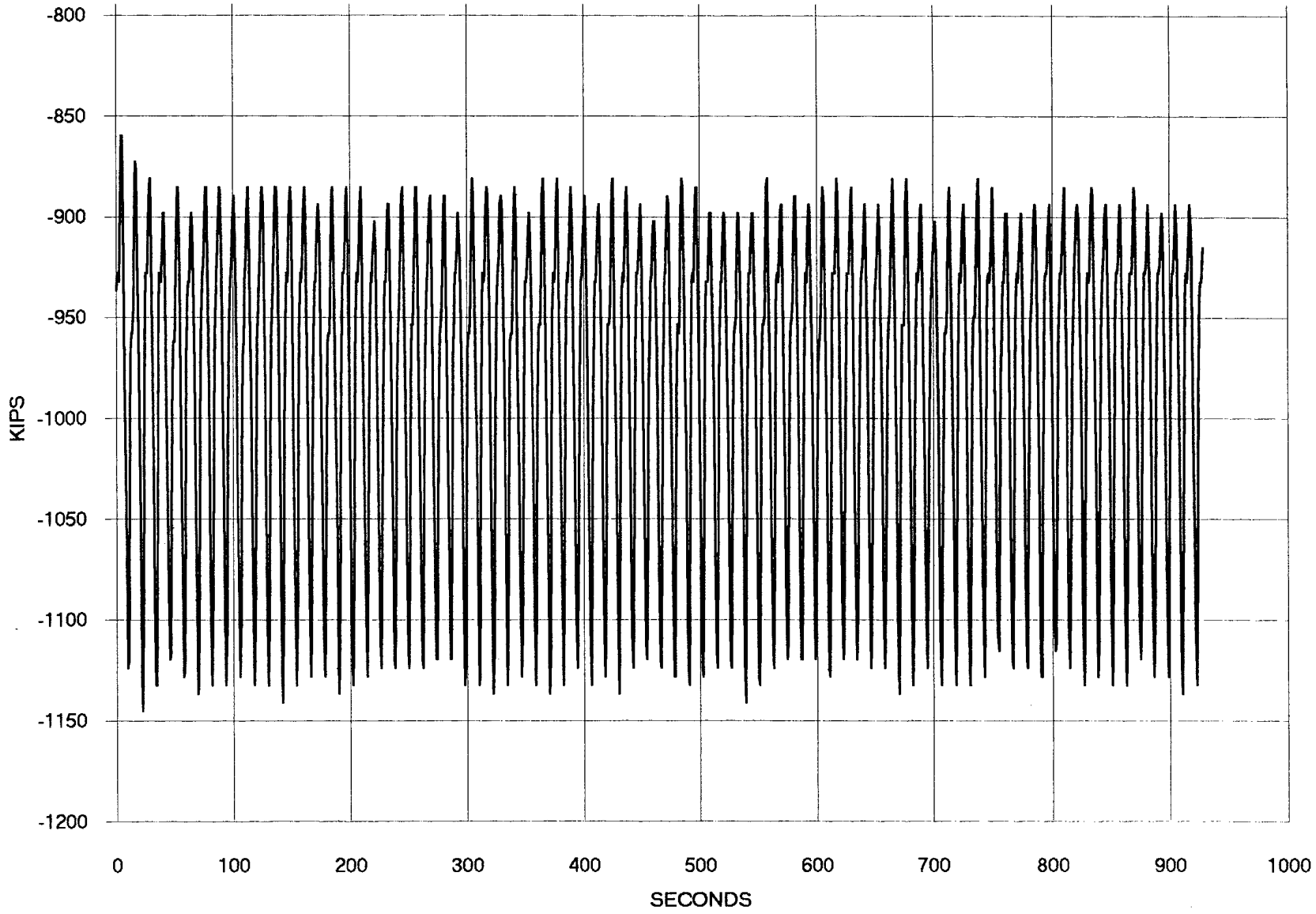

A532 - BT-3 THP (HOUR GLASS)
600
550
500
450
400
350
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

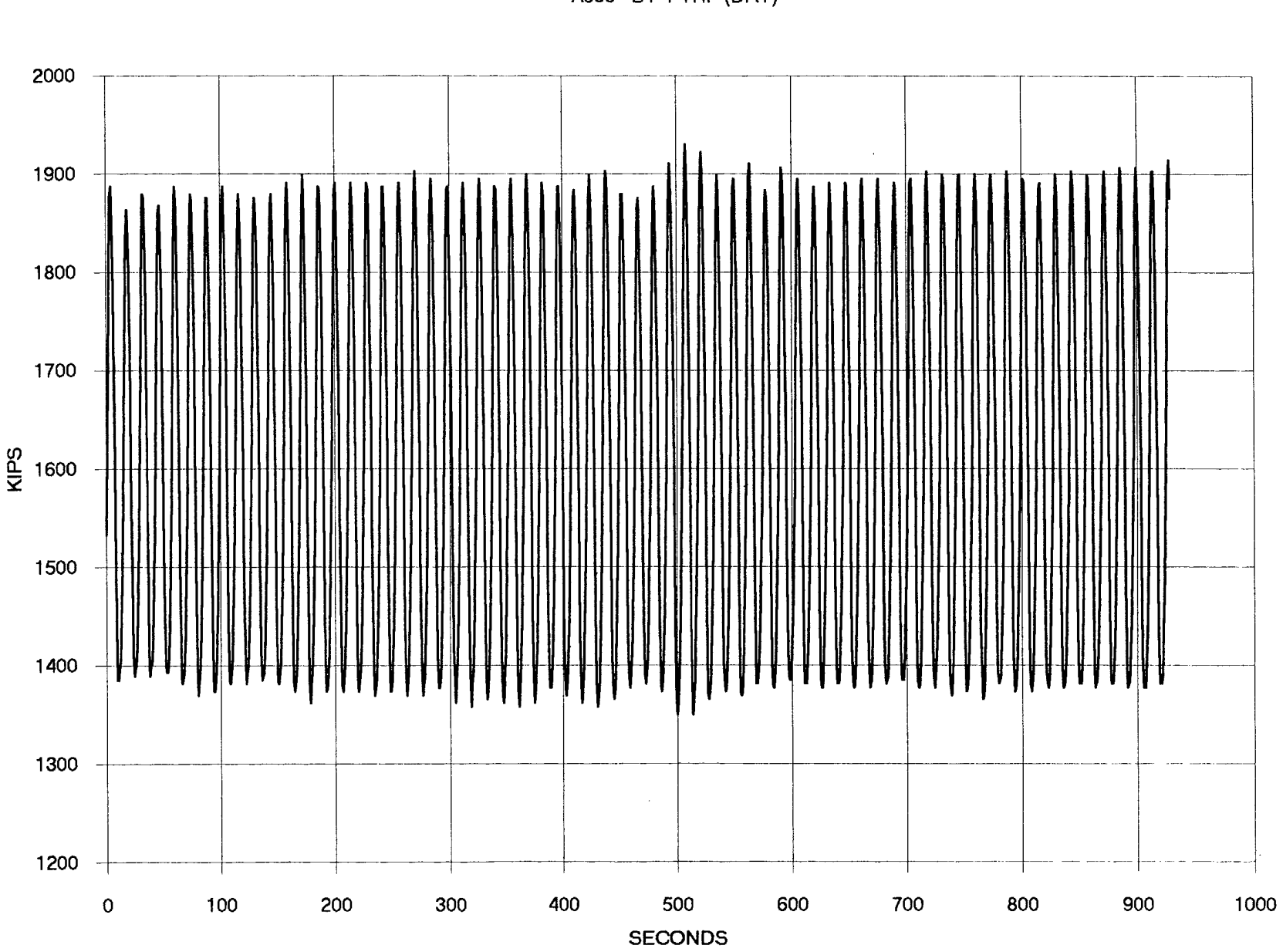
A532 - BT-4 THP (SEGMENTED)

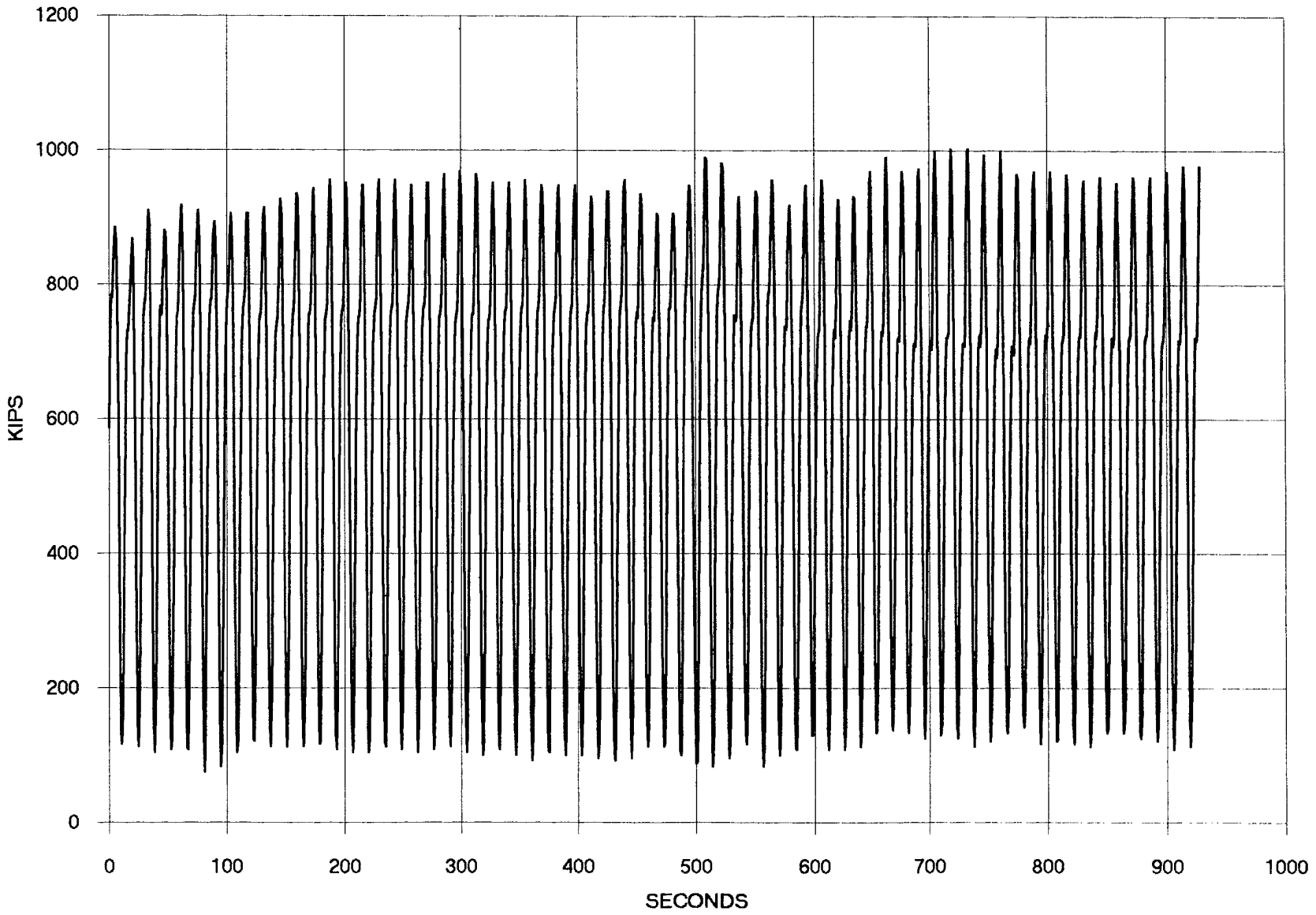


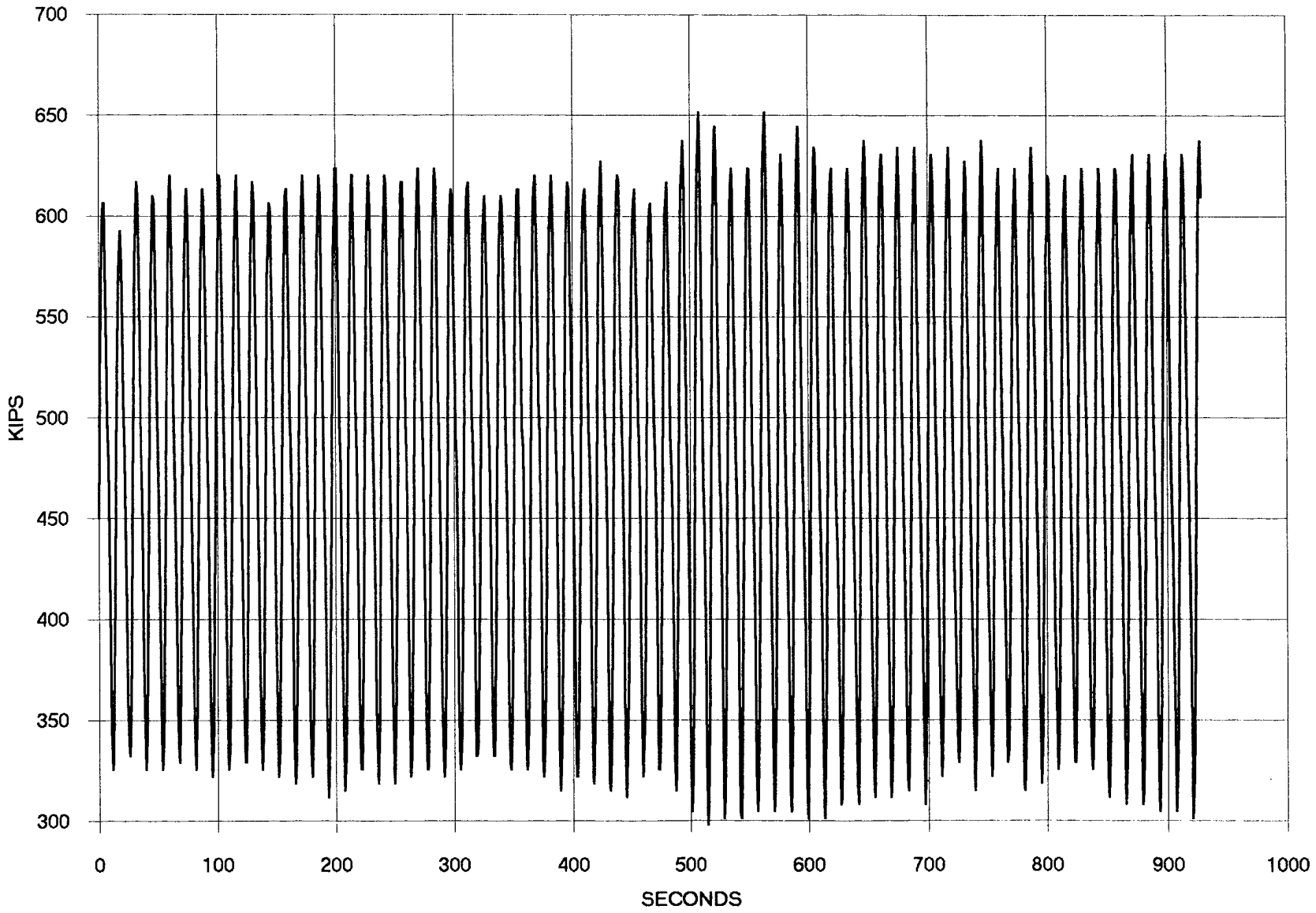
A532 - BT-5 THP (LINK BUOY)



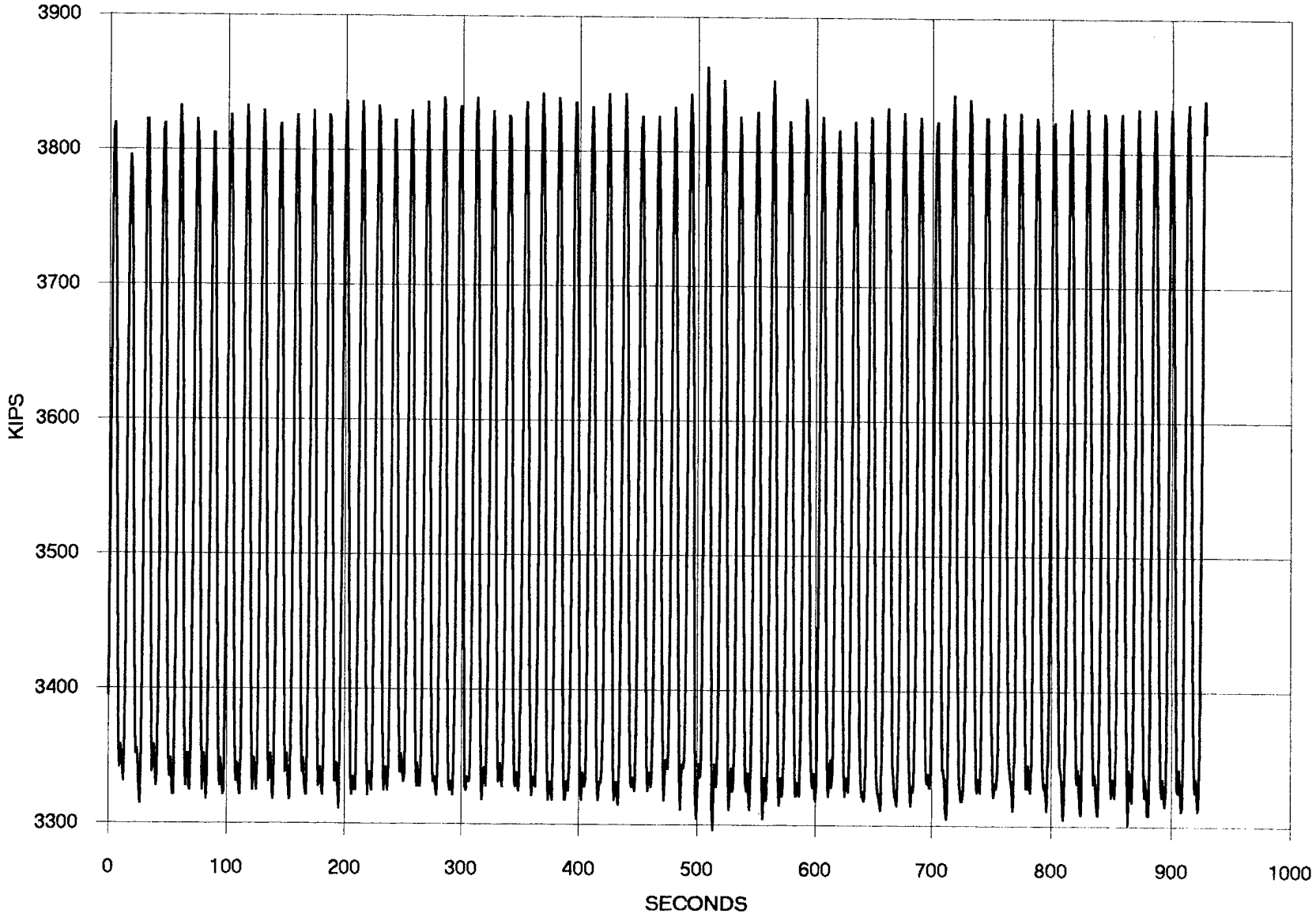

A532 - BT-6 THP (CONST. TENSION)
-800
-850
-900
-950
-1000
-1050
-1100
-1150
-1200
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS


A533 - BT-1 THP (DRY)
2000
1900
1800
1700
1600
1500
1400
1300
1200
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

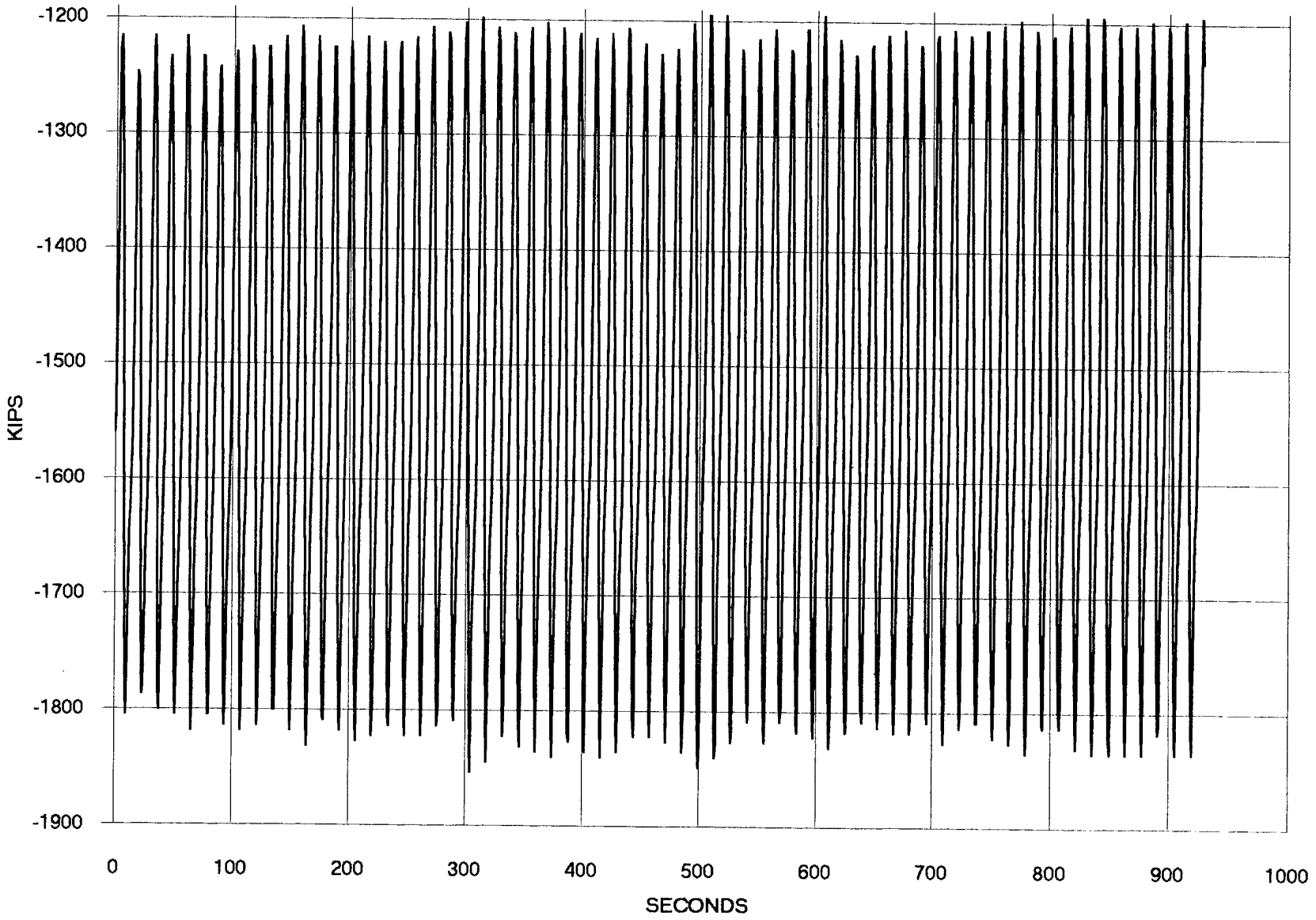

A533 - BT-2 THP (INV. CONE)
1200
1000
800
600
400
200
0
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

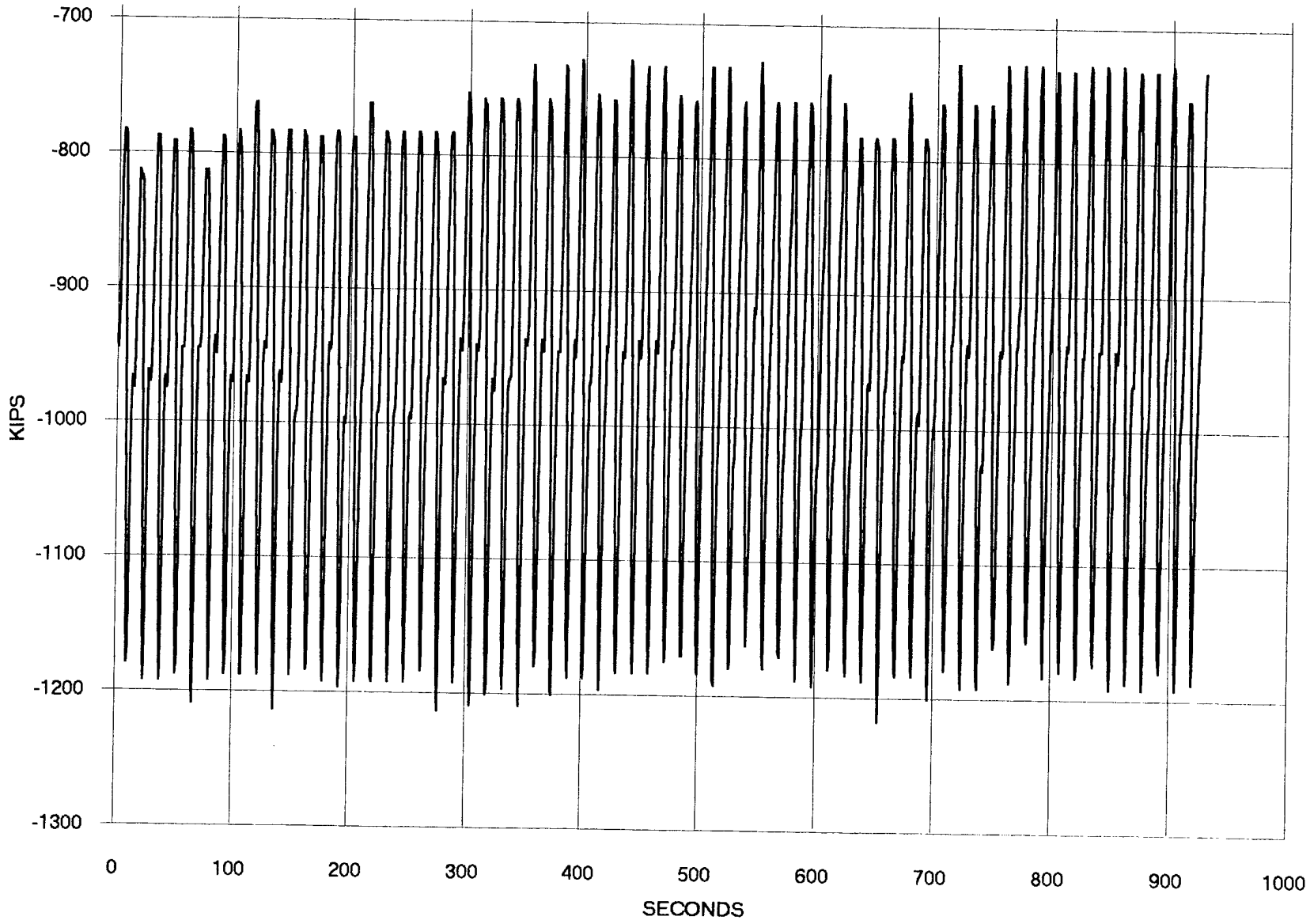

A533 - BT-3 THP (HOUR GLASS)
700
650
600
550
500
450
400
350
300
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

A533- BT-4 THP (SEGMENTED)

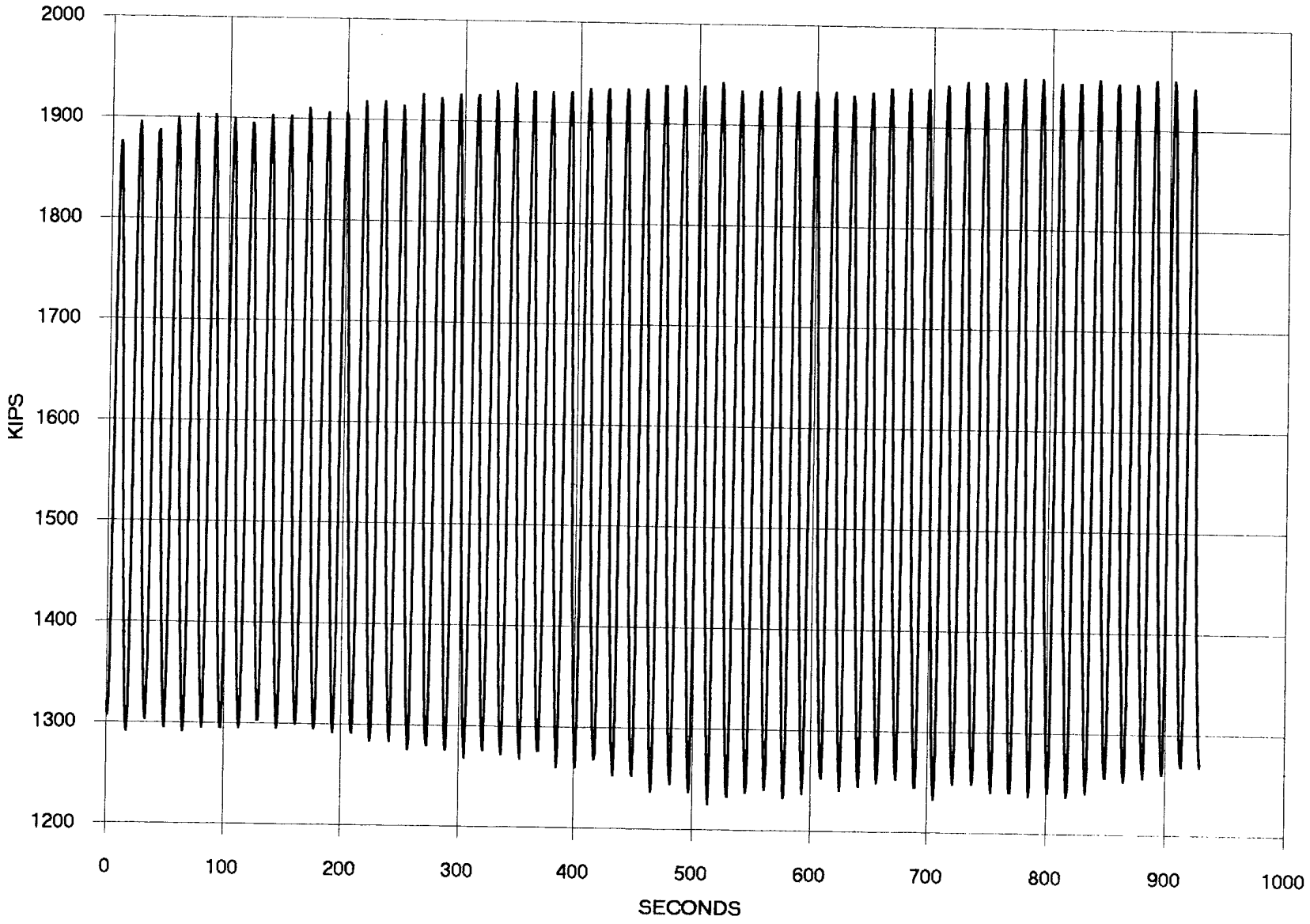


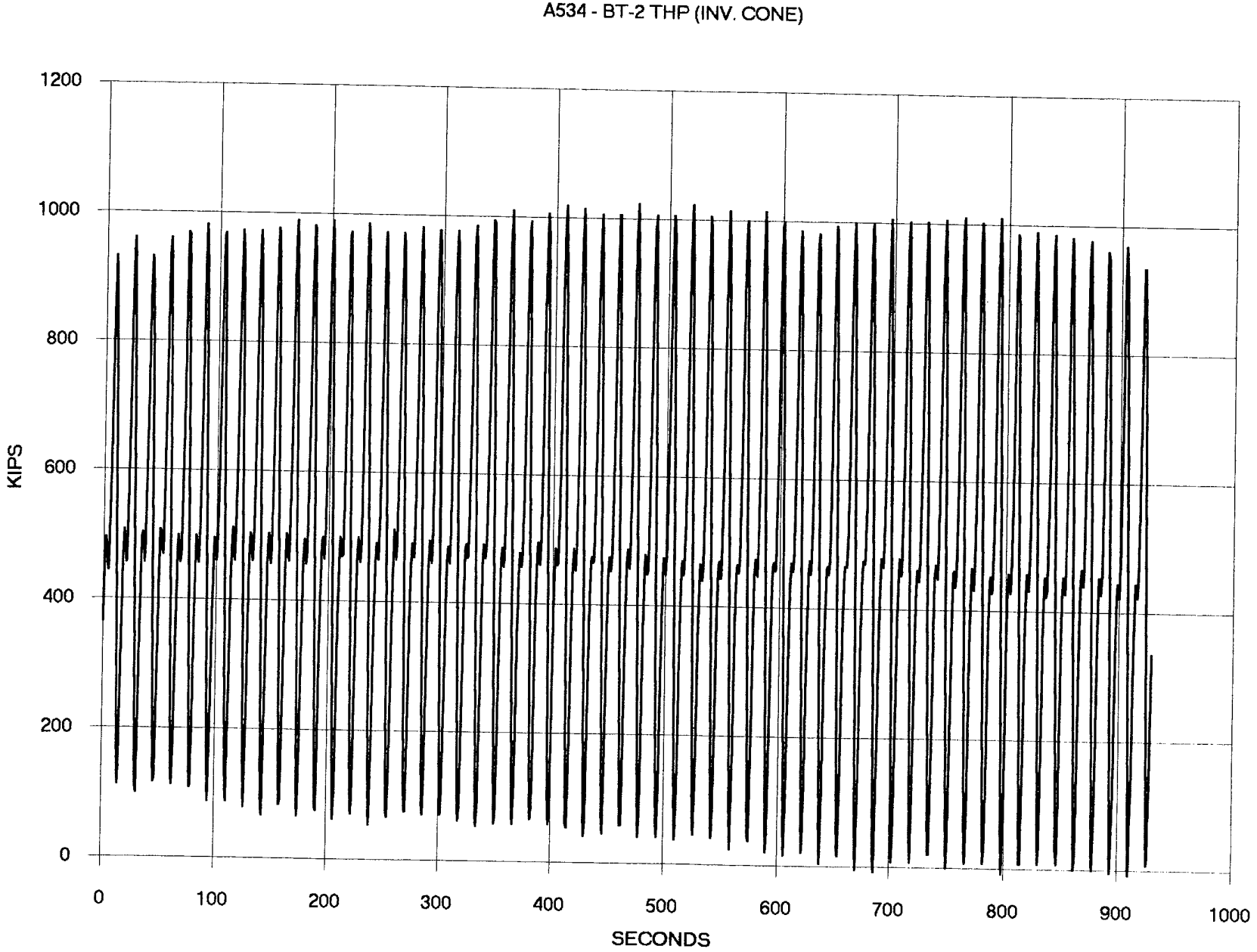
A533 - BT-5 THP (LINK BUOY)



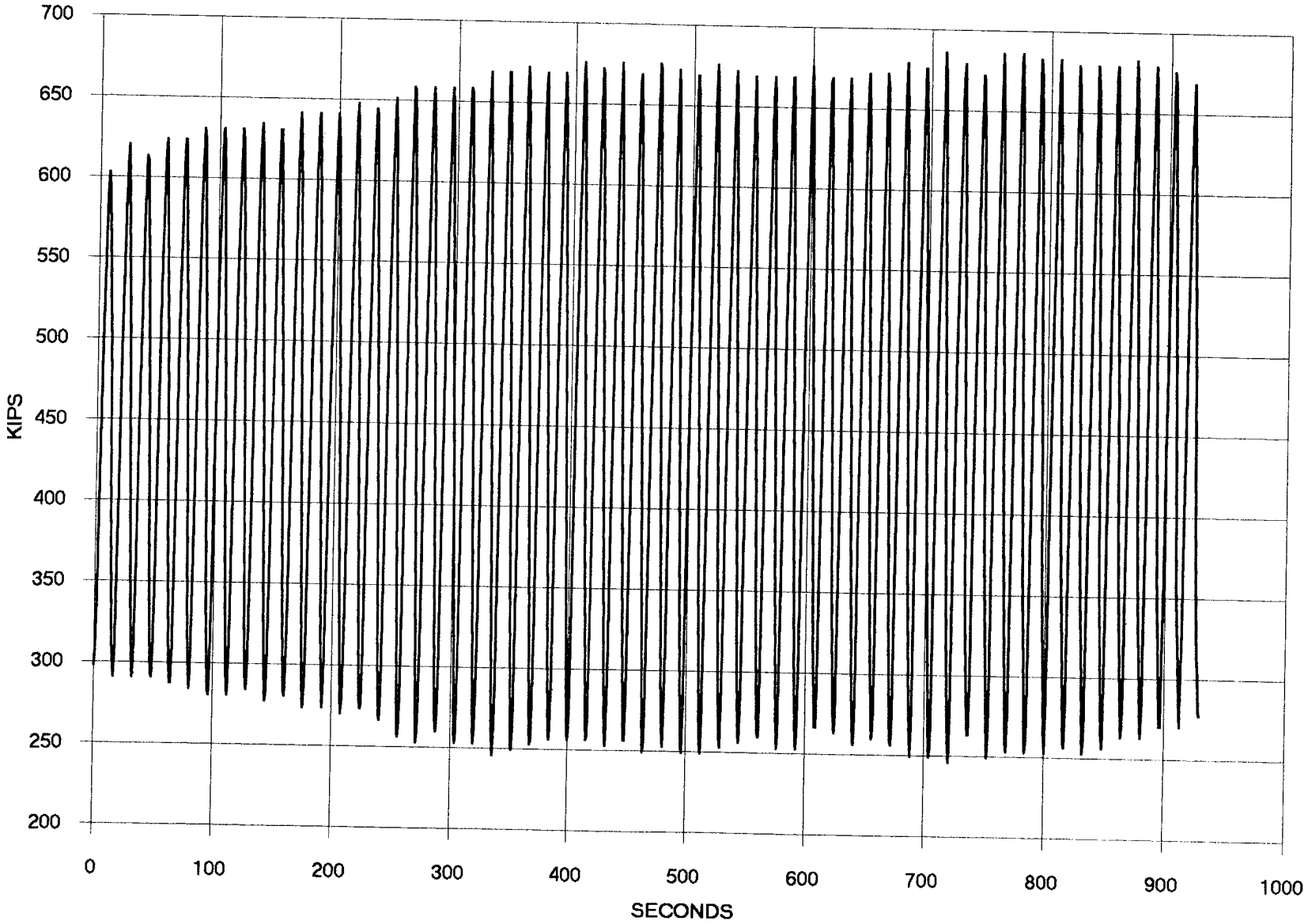

A533 - BT-6 THP (CONST. TENSION)
-700
-800
-900
-1000
-1100
-1200
-1300
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

A534- BT-1 THP (DRY)

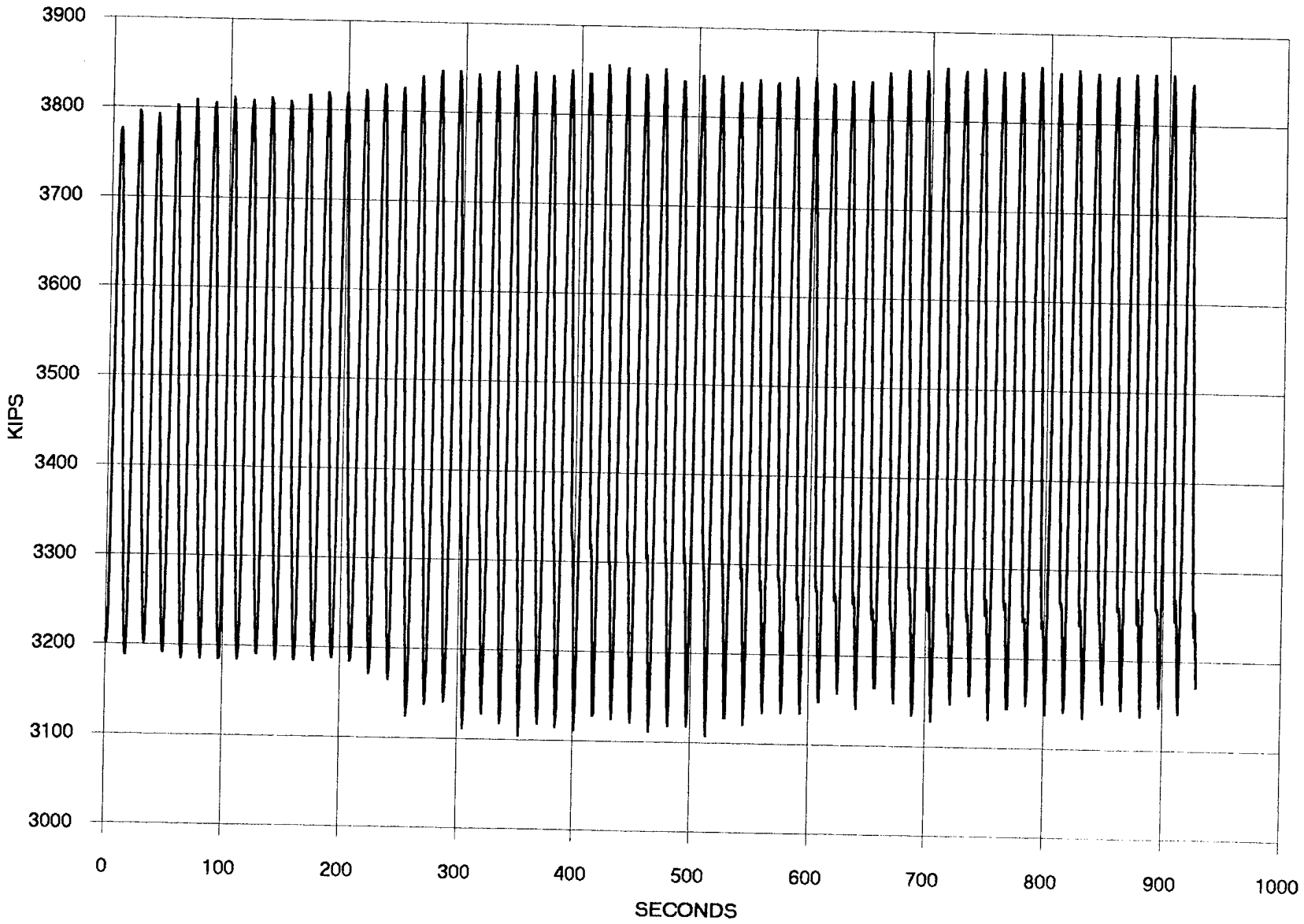


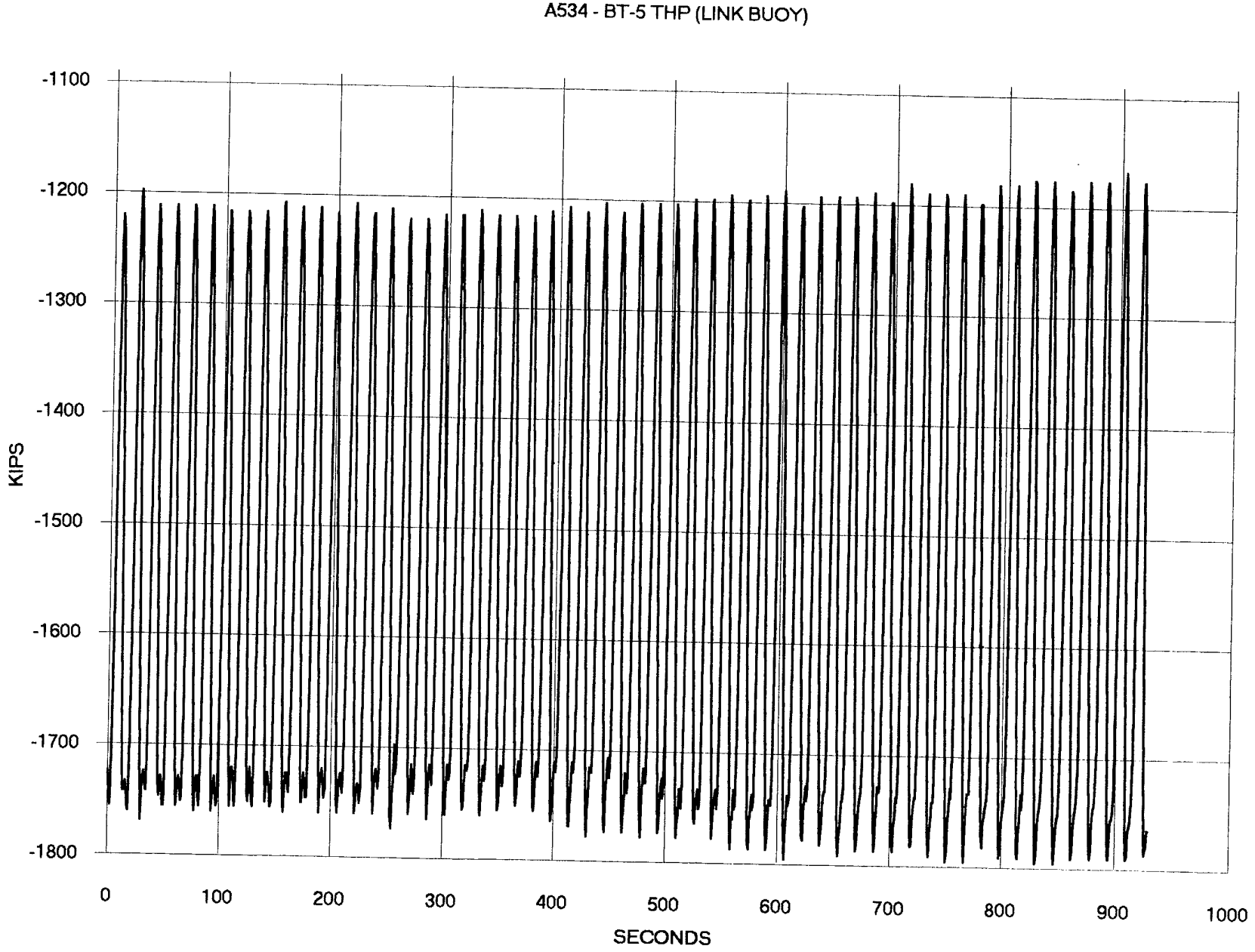

A534 - BT-2 THP (INV. CONE)
1200
1000
800
600
400
200
0
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

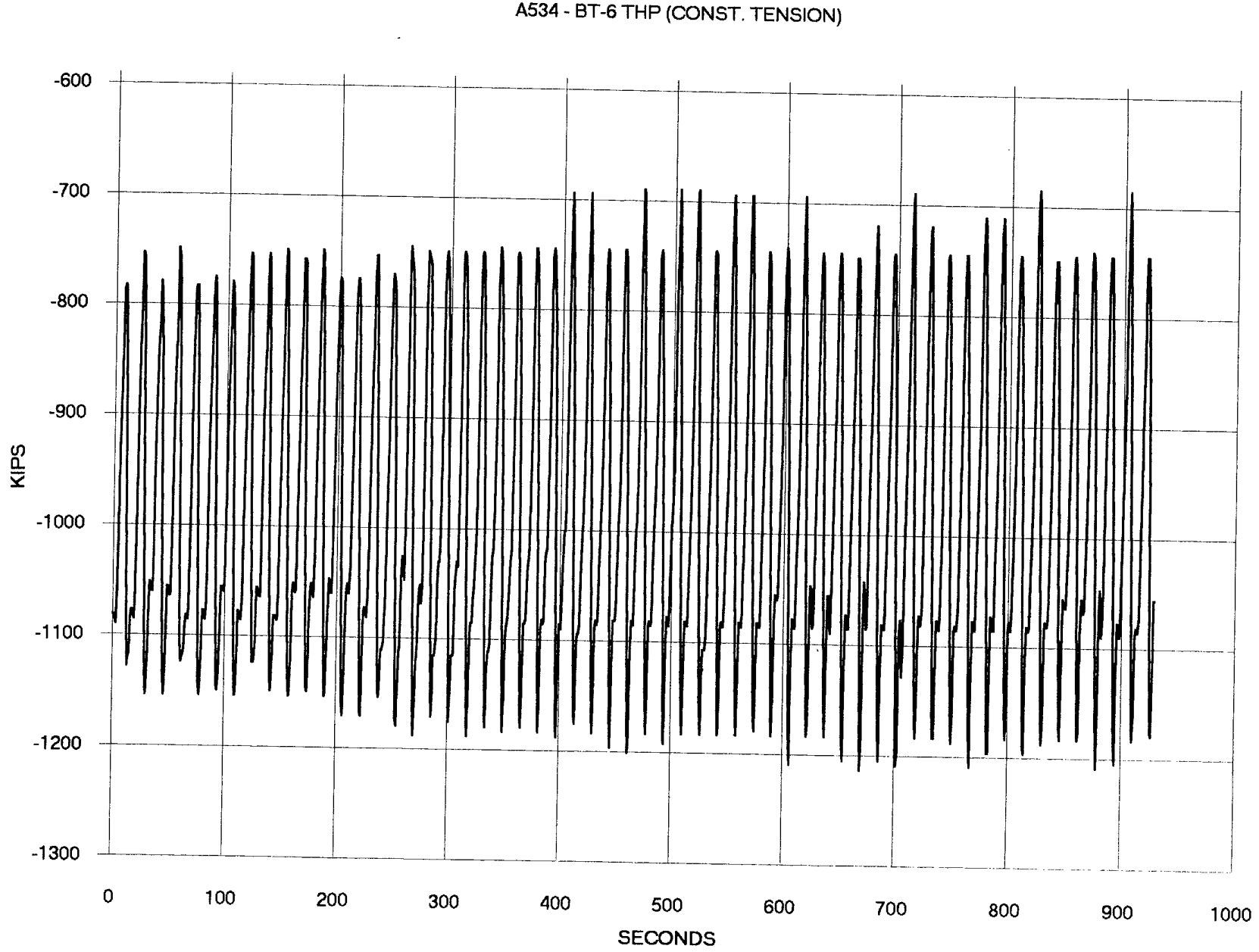
A534 - BT-3 THP (HOUR GLASS)

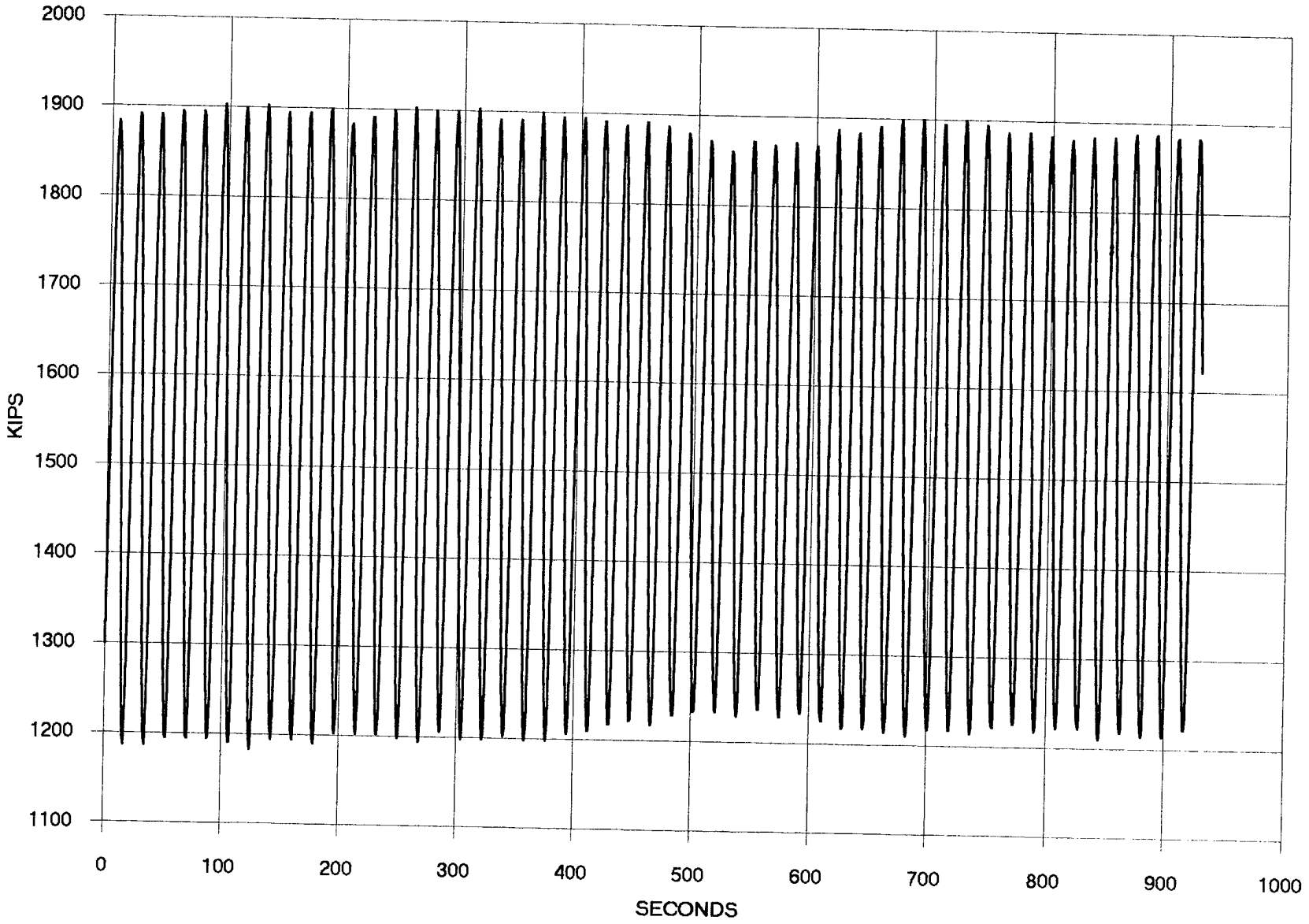


A534 - BT-4 THP (SEGMENTED)

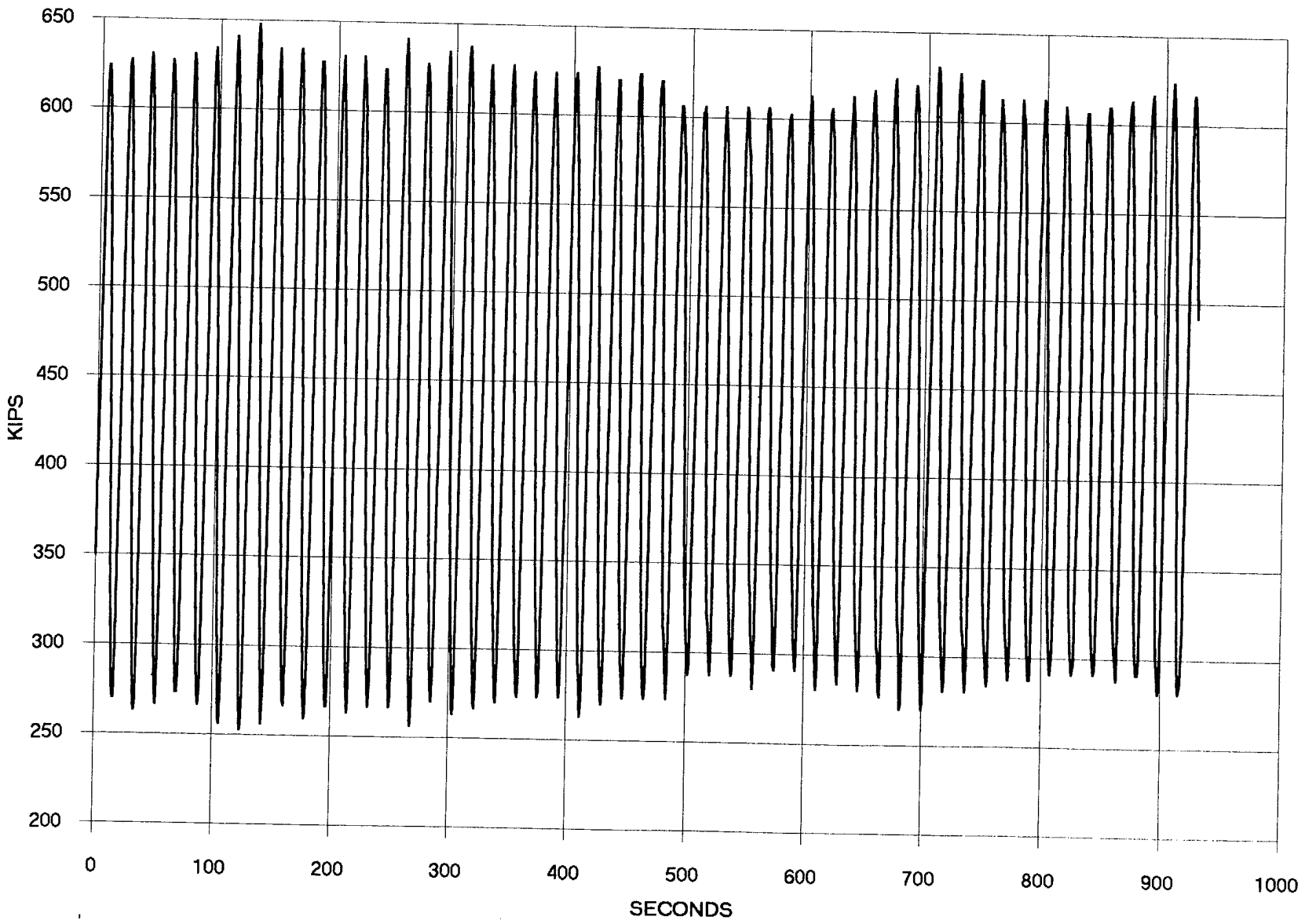


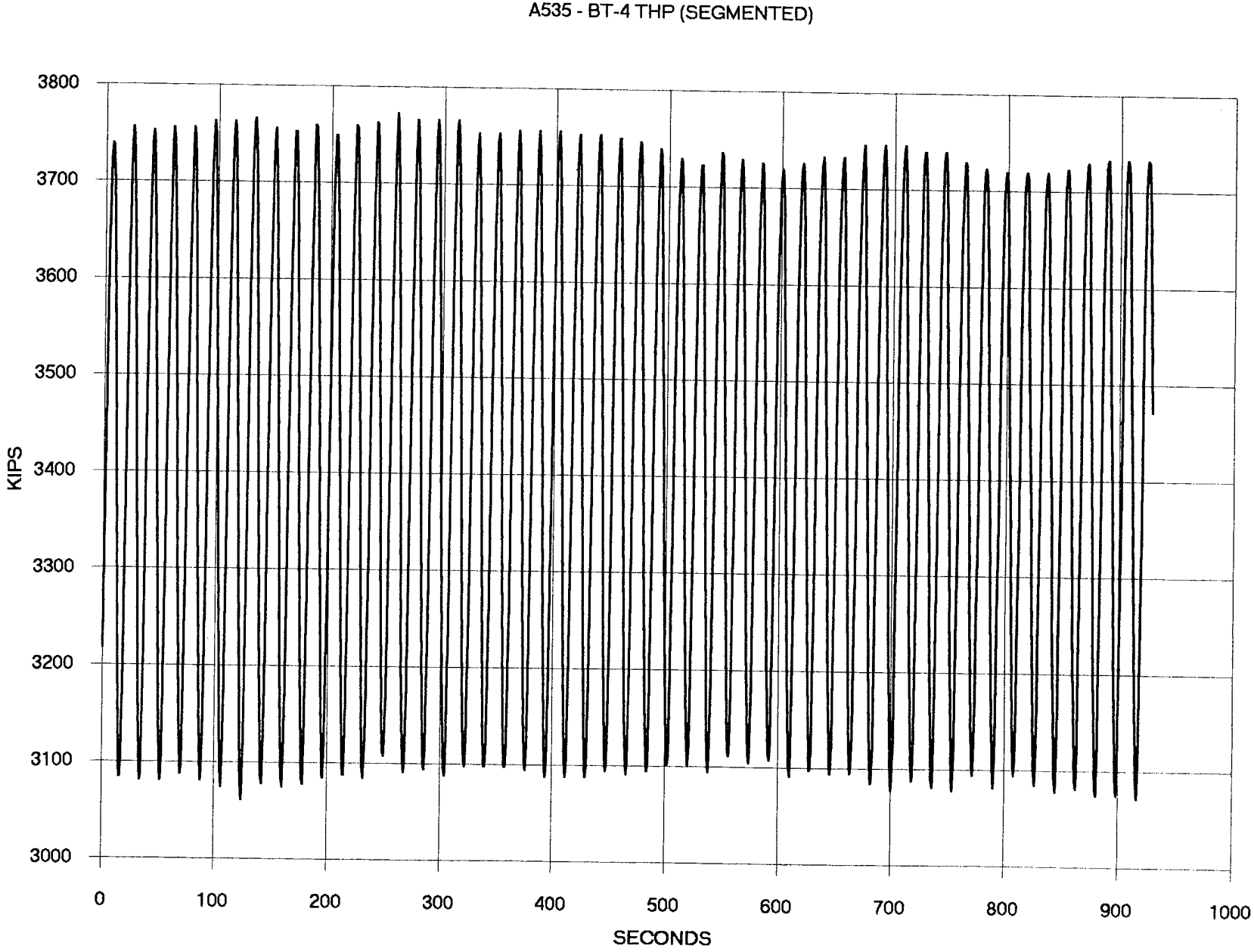

A534 - BT-5 THP (LINK BUOY)
-1100
-1200
-1300
-1400
-1500
-1600
-1700
-1800
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS


A534 - BT-6 THP (CONST. TENSION)
-600
-700
-800
-900
-1000
-1100
-1200
-1300
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

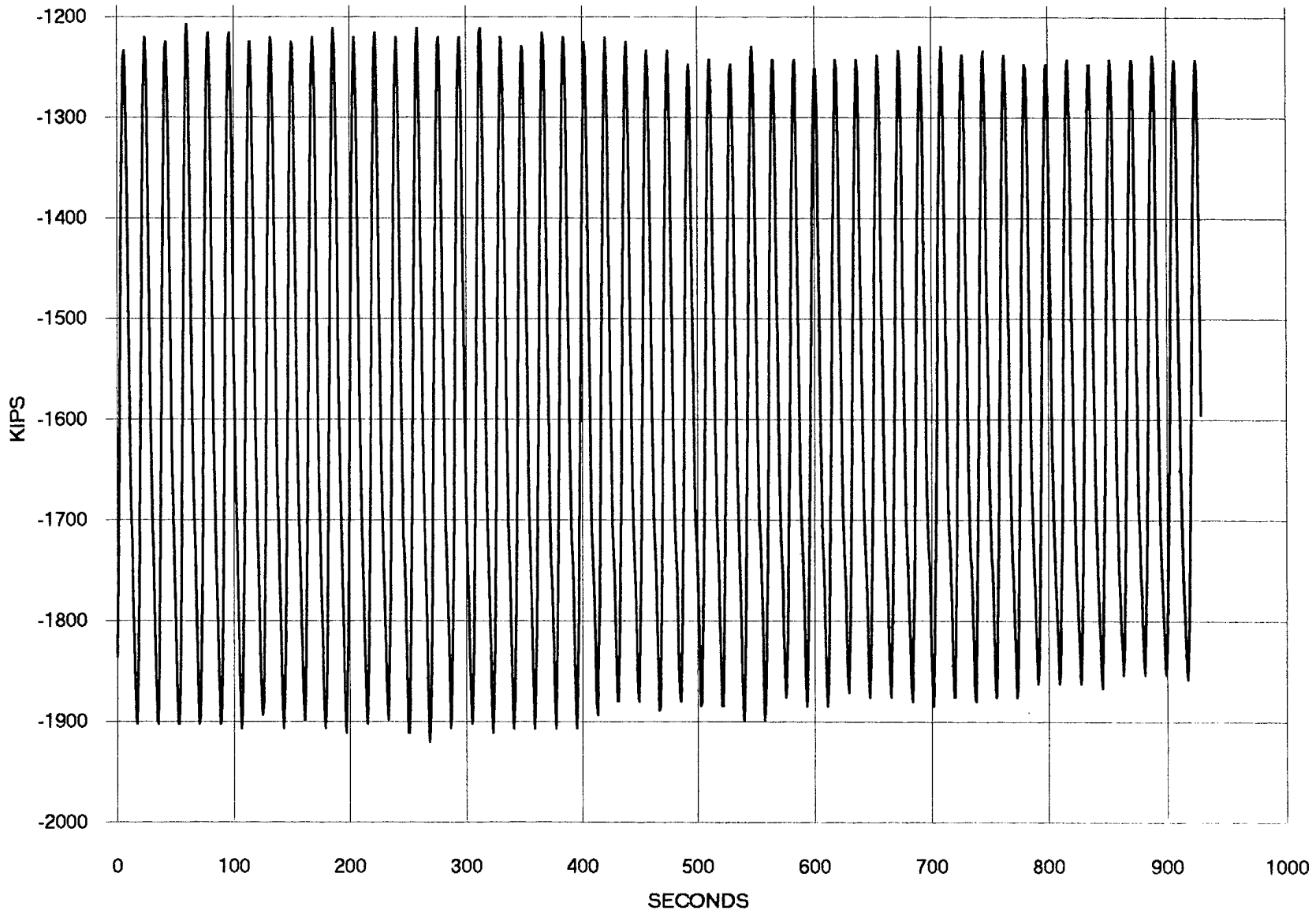

A535 - BT-1 THP (DRY)
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

A535 - BT-3 THP (HOUR GLASS)

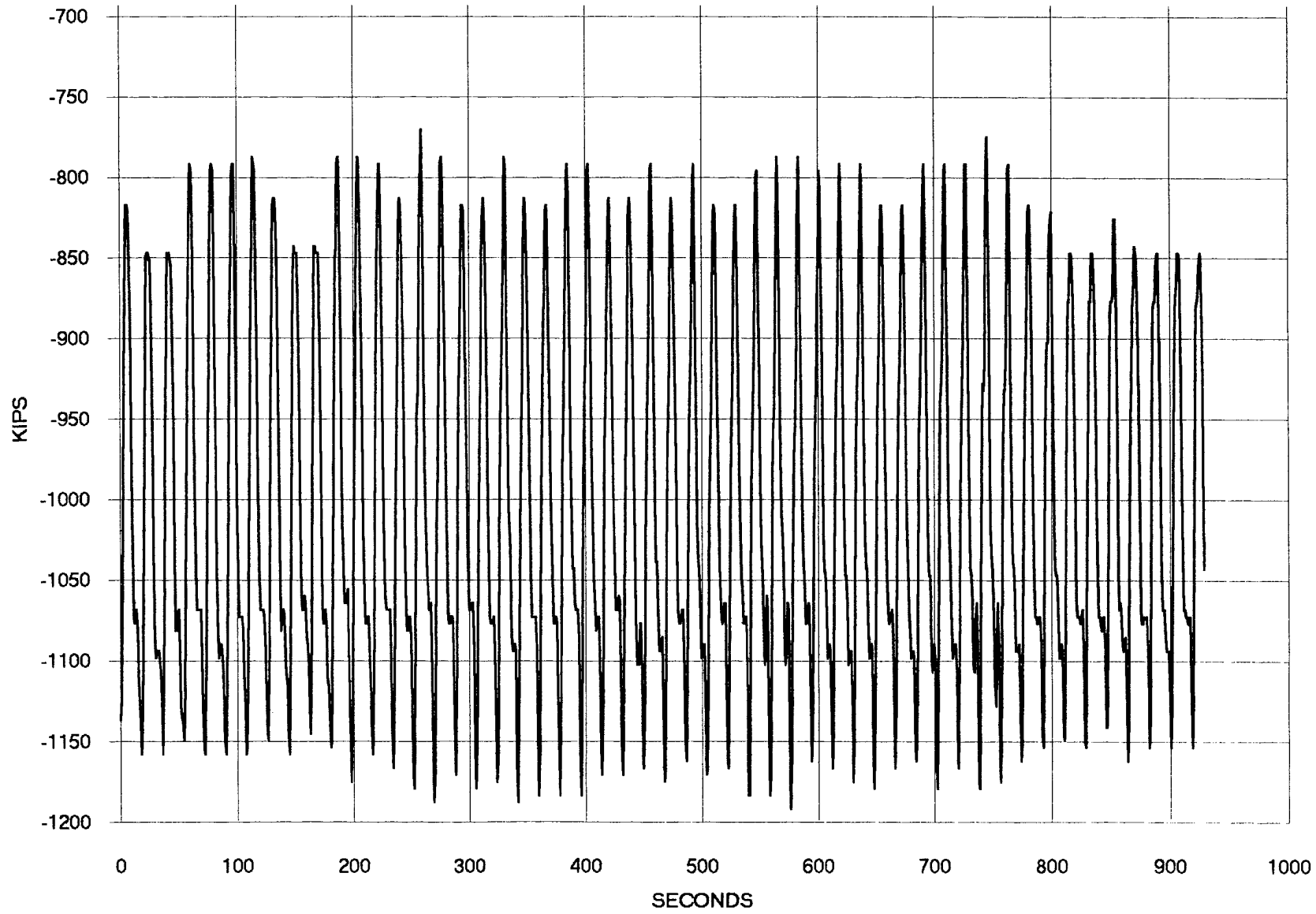


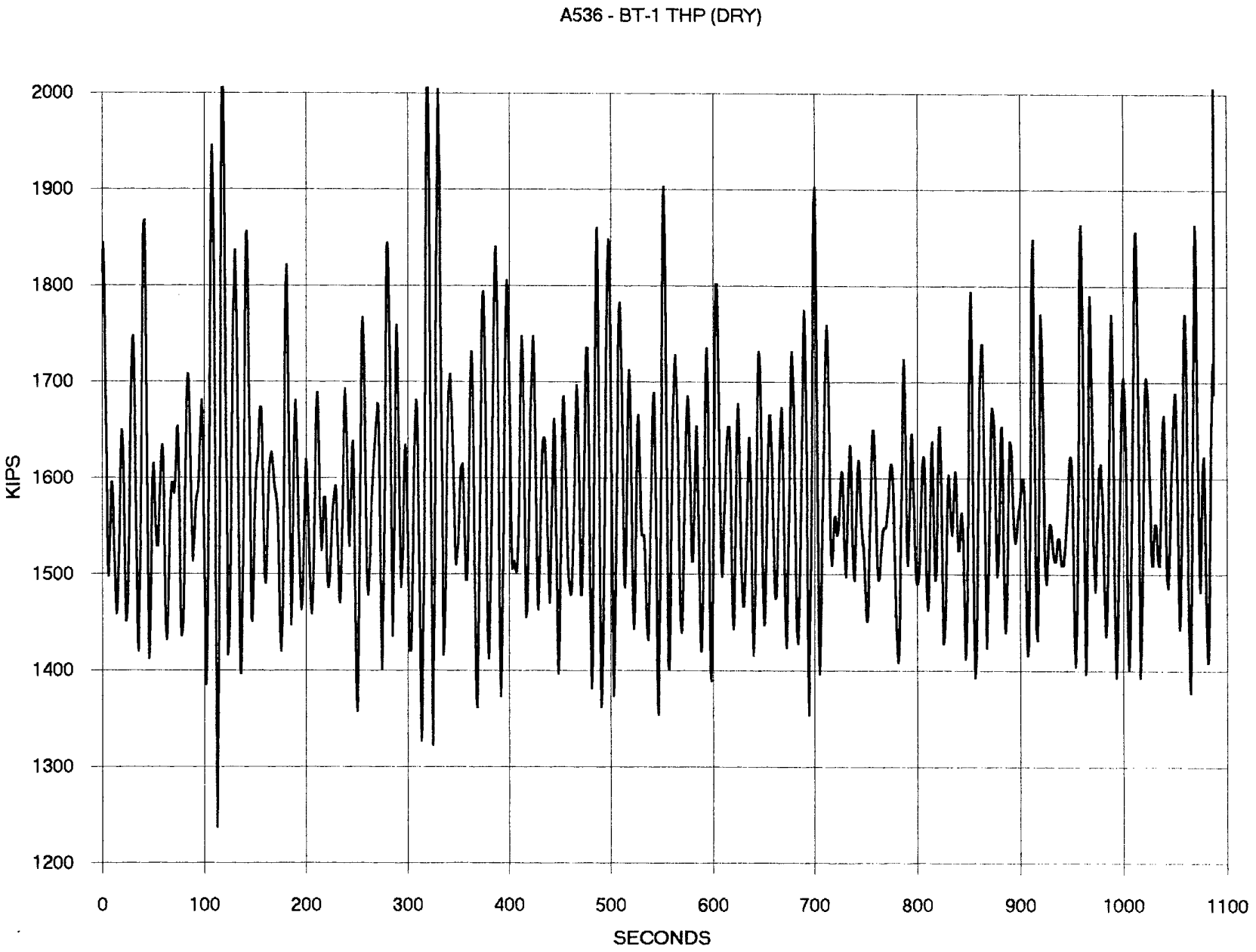

A535 - BT-4 THP (SEGMENTED)
3800
3700
3600
3500
3400
3300
3200
3100
3000
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

A535 - BT-5 THP (LINK BUOY)

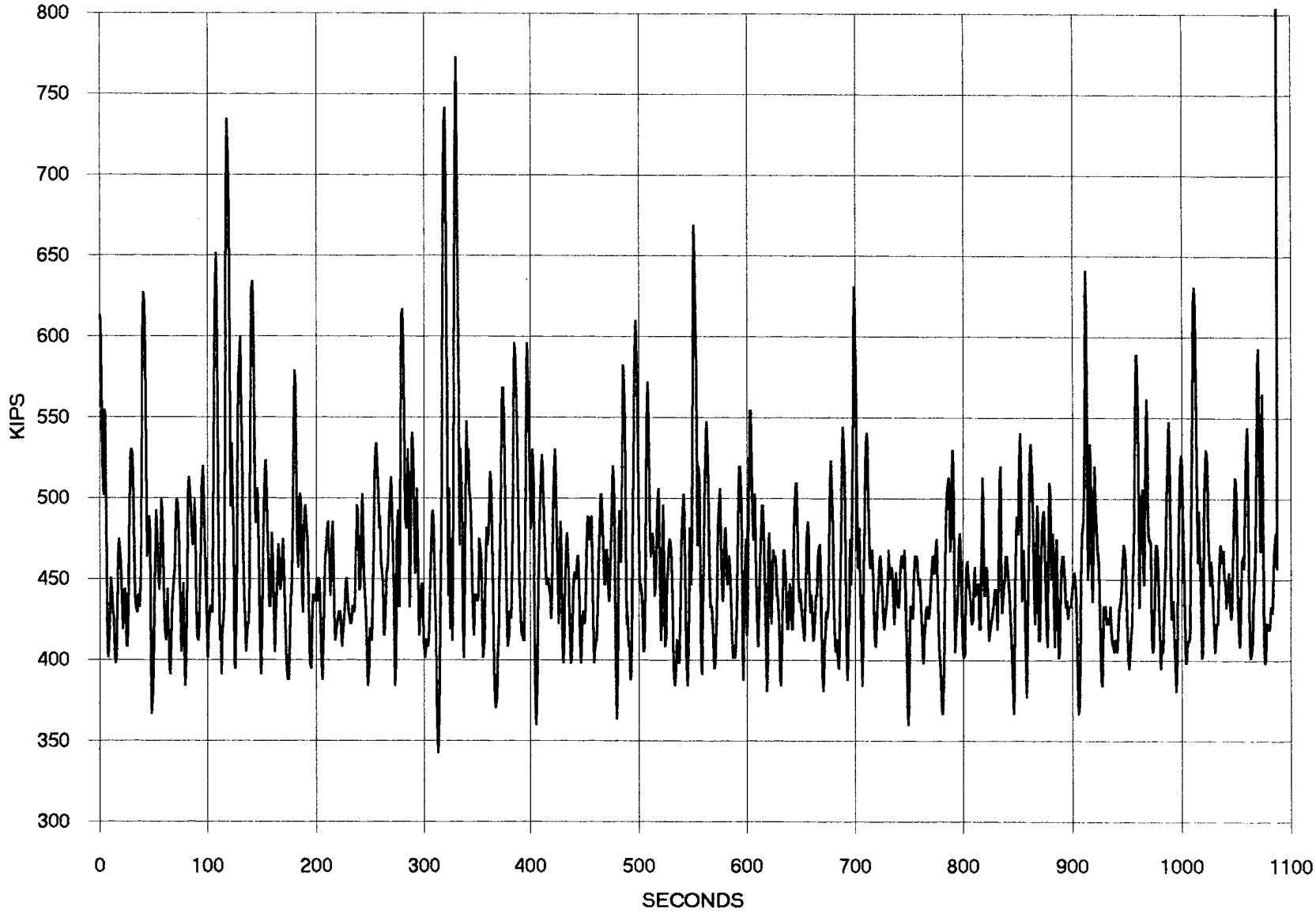


A535 - BT-6 THP (CONST. TENSION)

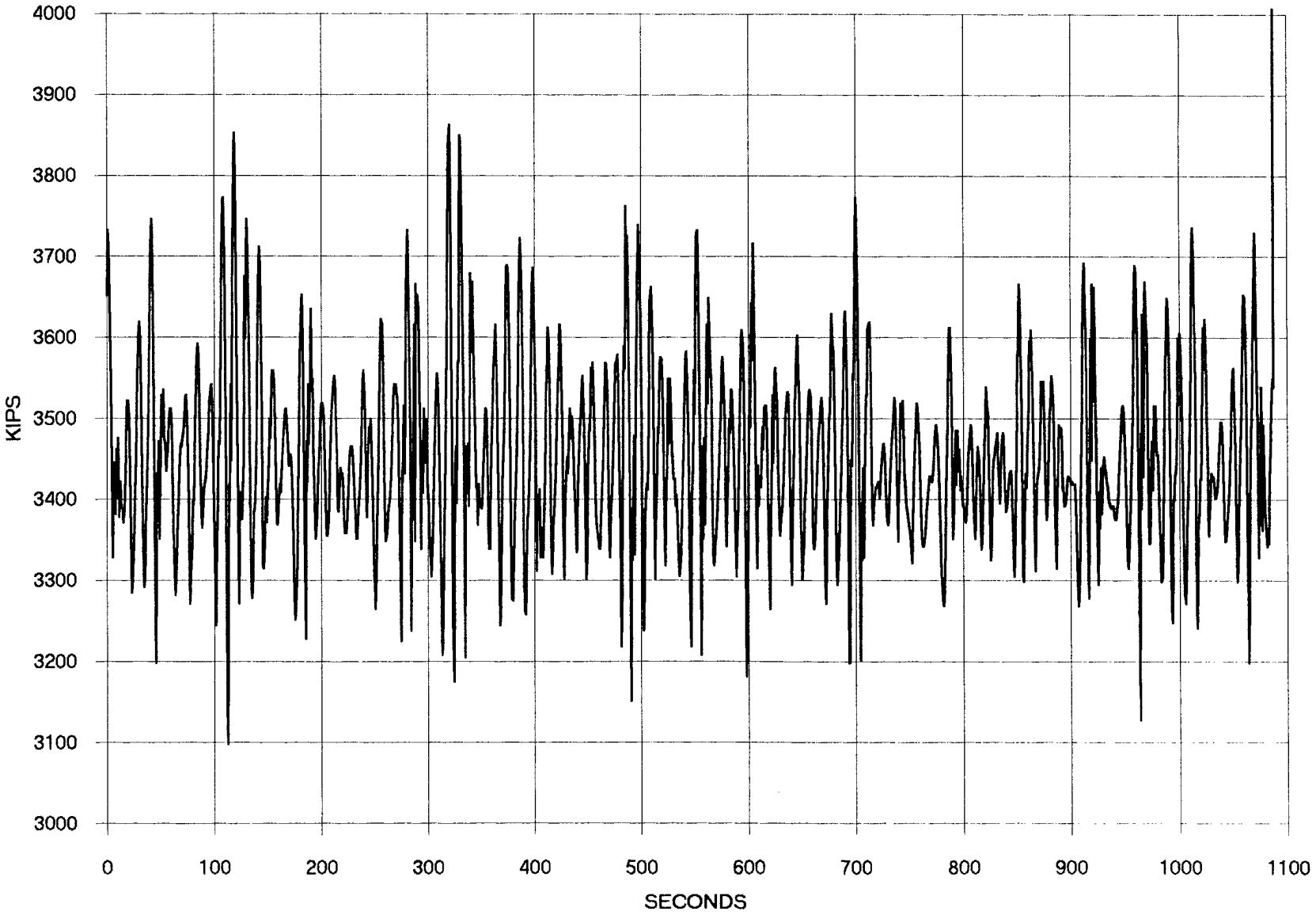


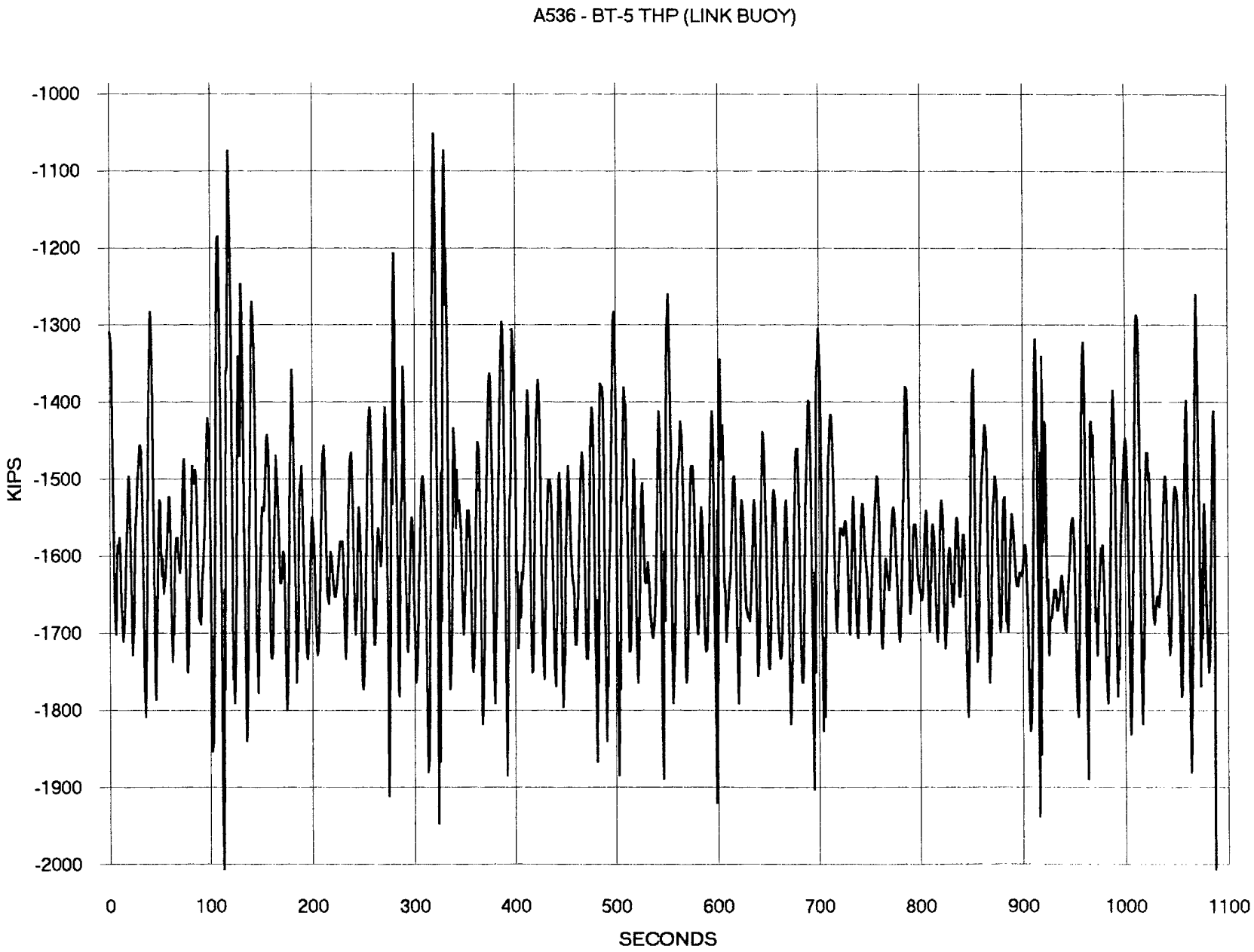

A536 - BT-1 THP (DRY)
2000
1900
1800
1700
1600
1500
1400
1300
1200
KIPS
0
100
200
300
400
500
600
700
800
900
1000
1100
SECONDS

A536 - BT-3 THP (HOUR GLASS)

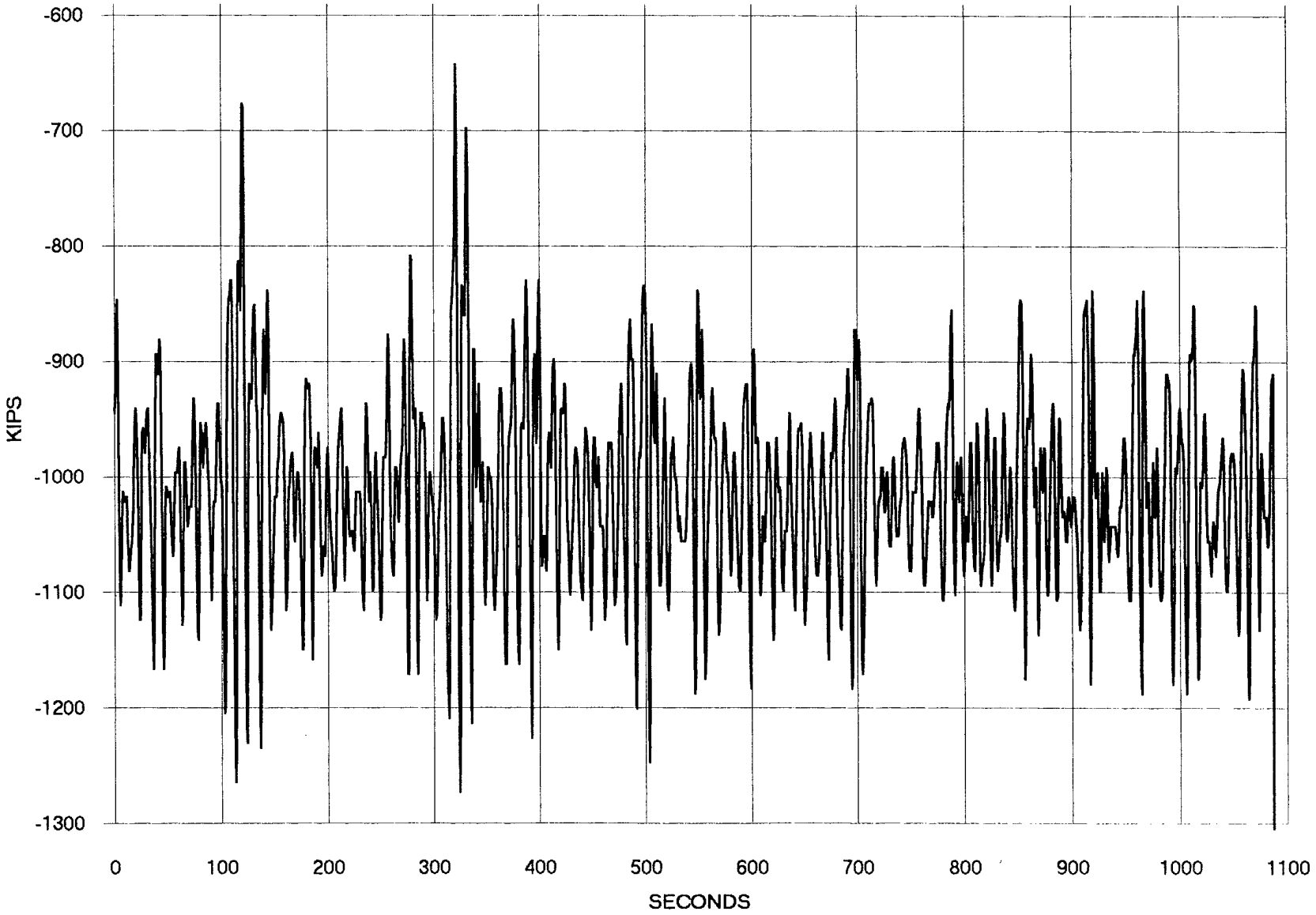


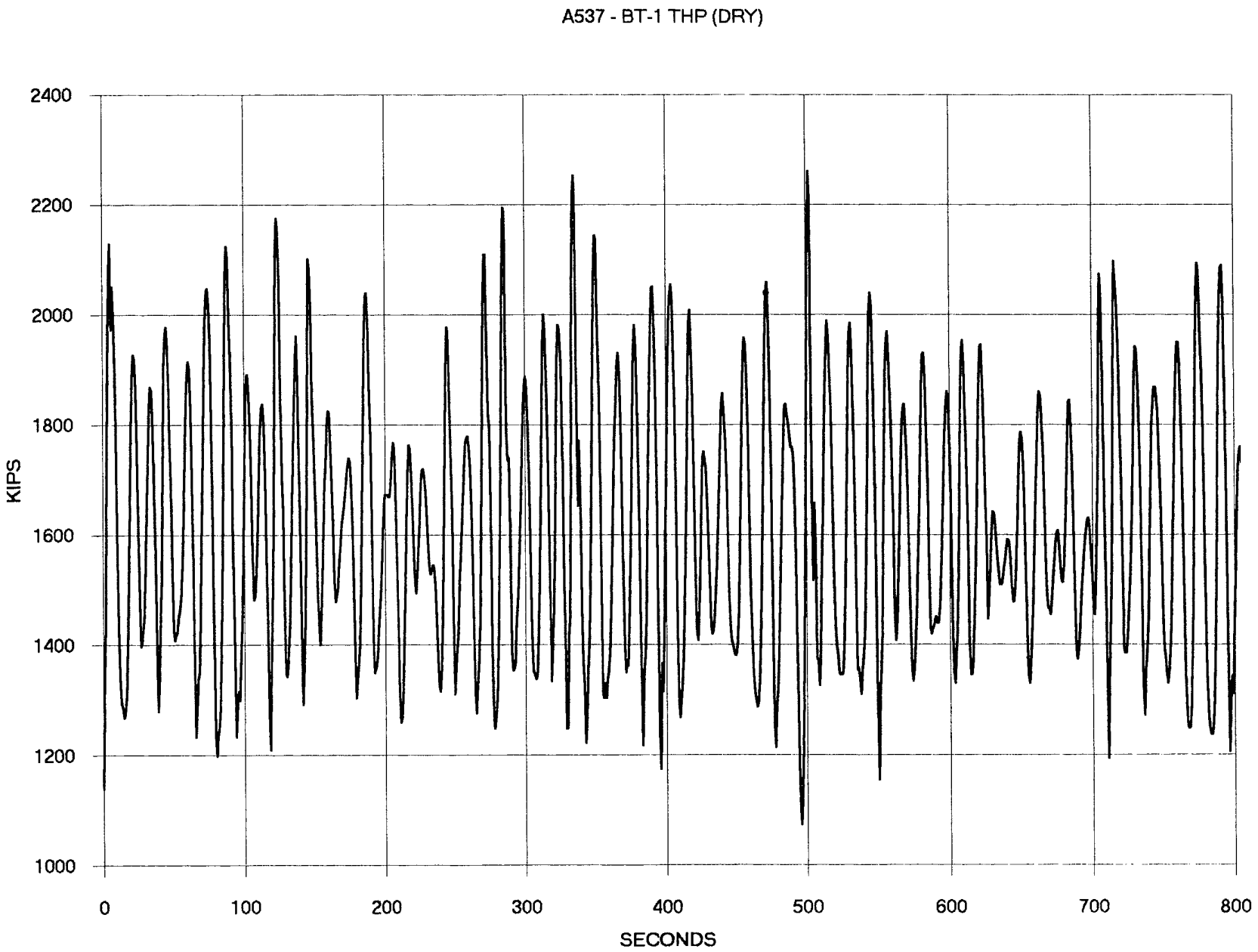
A536 - BT-4 THP (SEGMENTED)

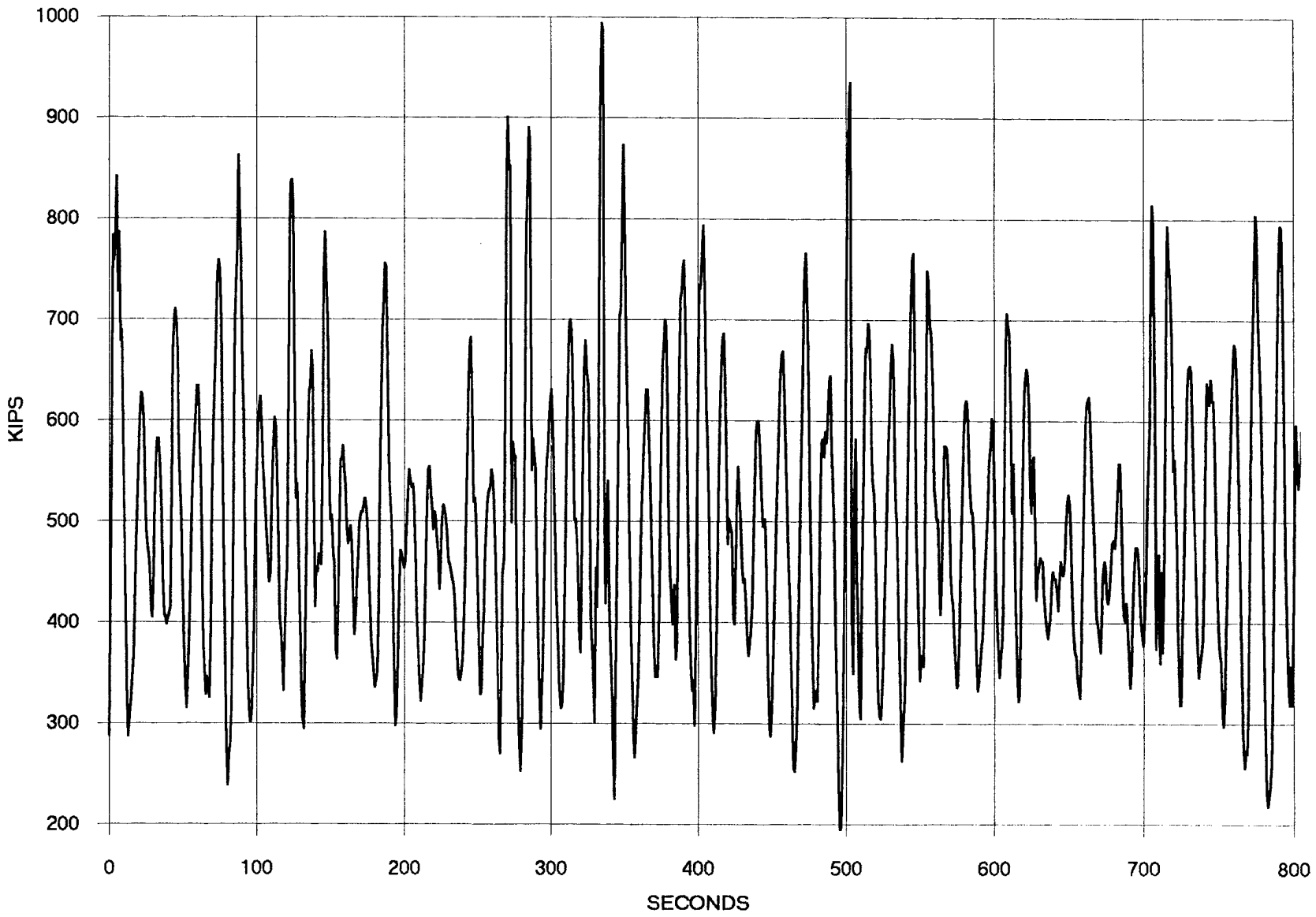



A536 - BT-5 THP (LINK BUOY)
-1000
-1100
-1200
-1300
-1400
-1500
-1600
-1700
-1800
-1900
-2000
KIPS
0
100
200
300
400
500
600
700
800
900
1000
1100
SECONDS

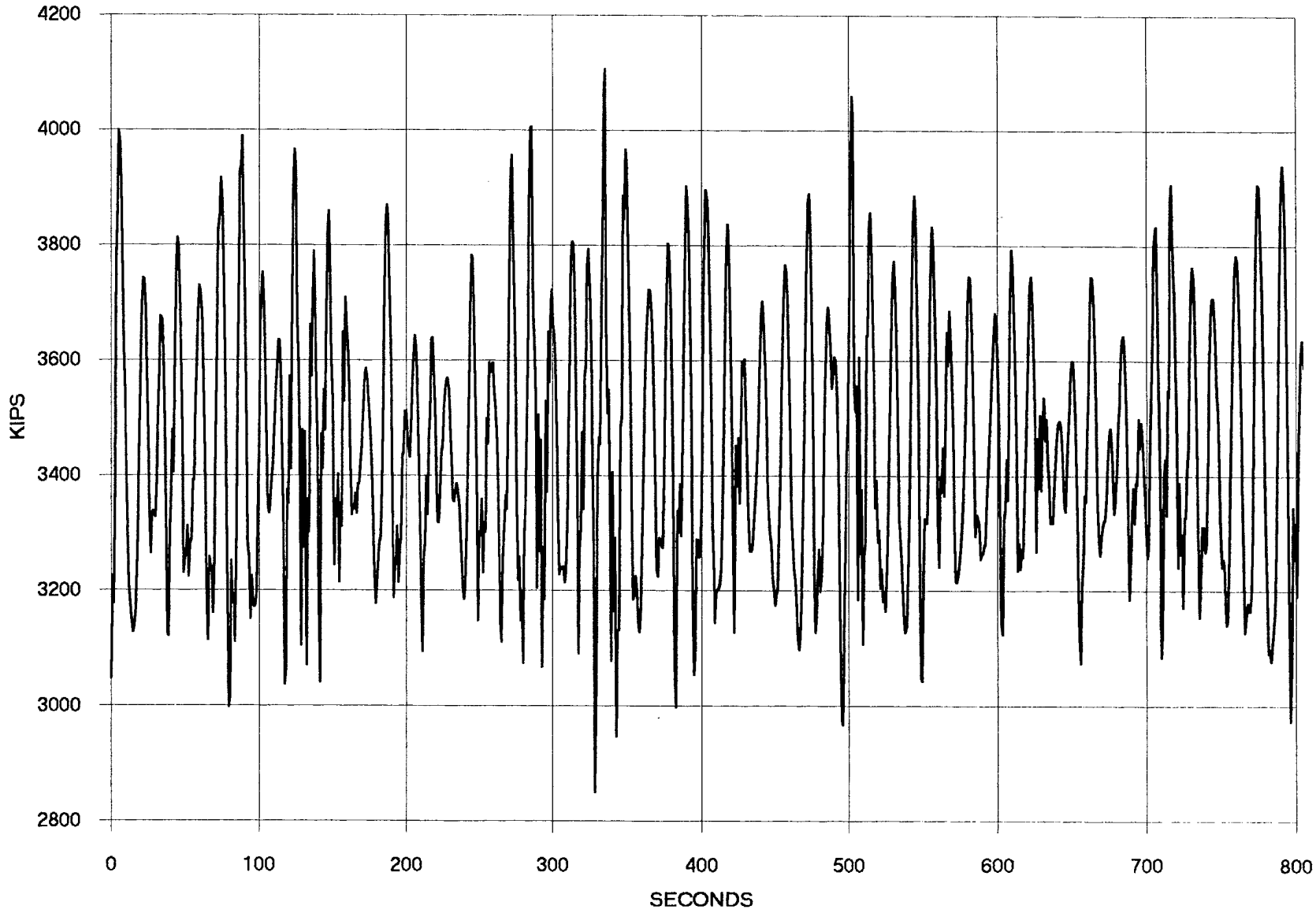
A532 - BT-6 THP (CONST. TENSION)

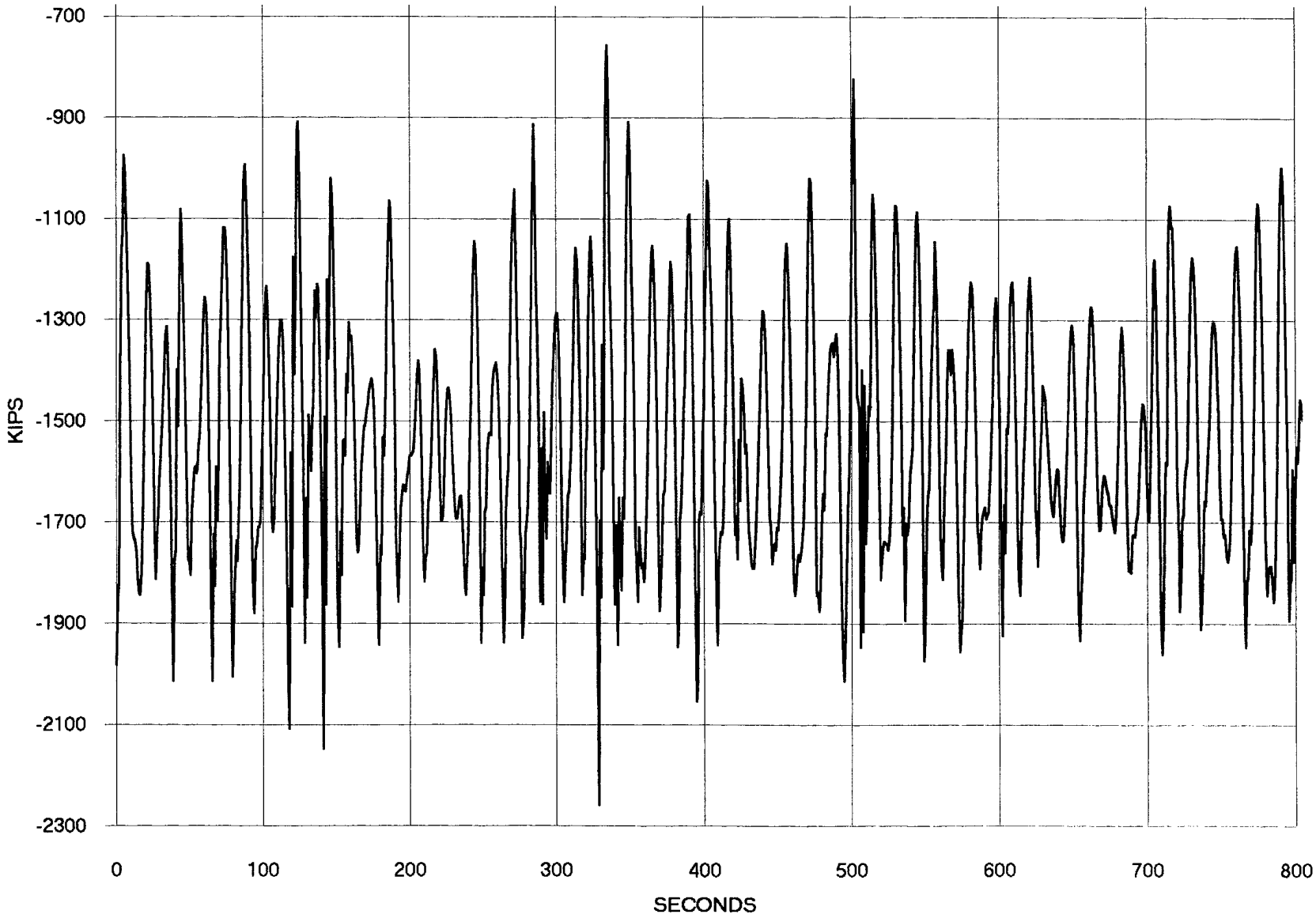


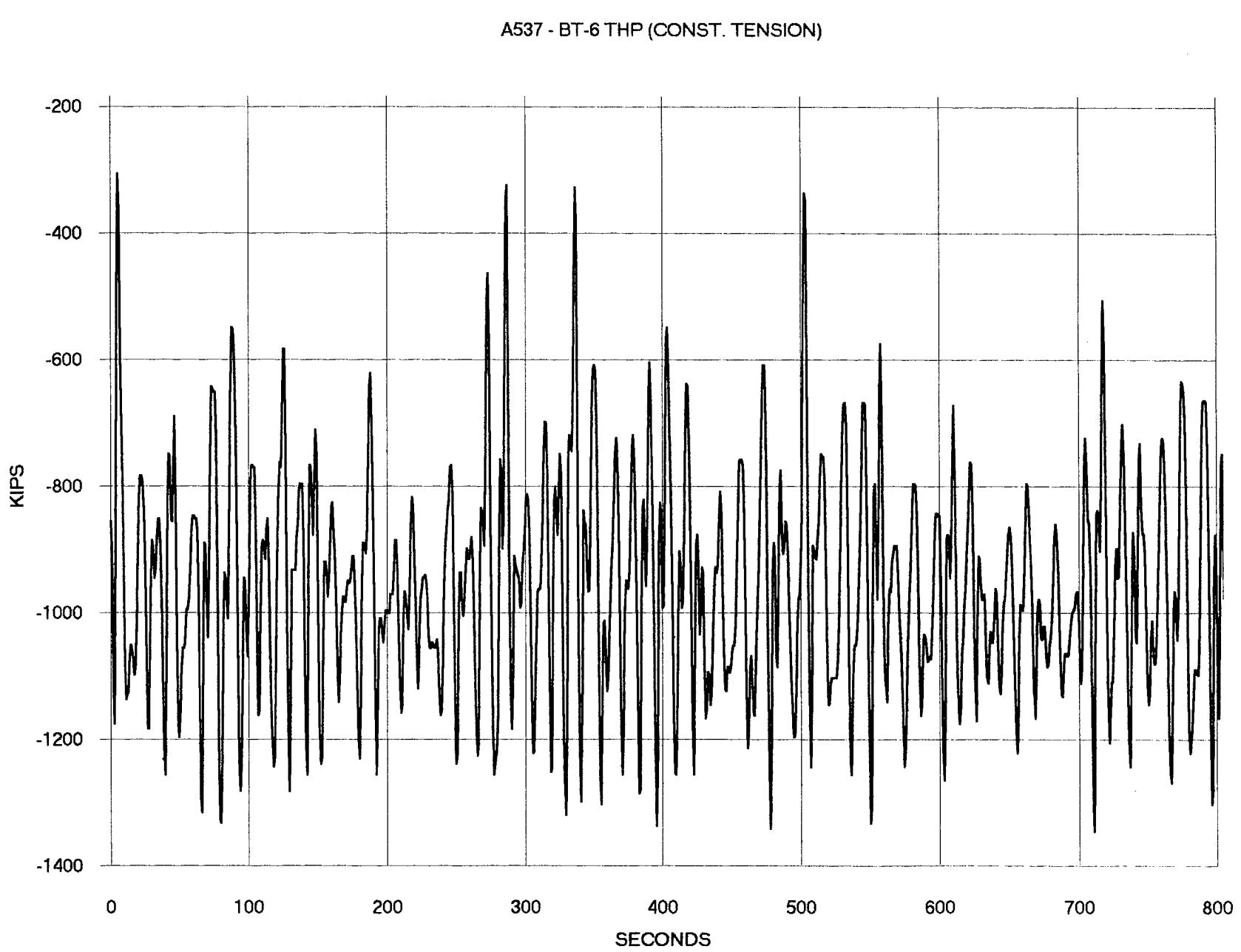

A537 - BT-1 THP (DRY)
2400
2200
2000
1800
1600
1400
1200
1000
KIPS
0
100
200
300
400
500
600
700
800
SECONDS

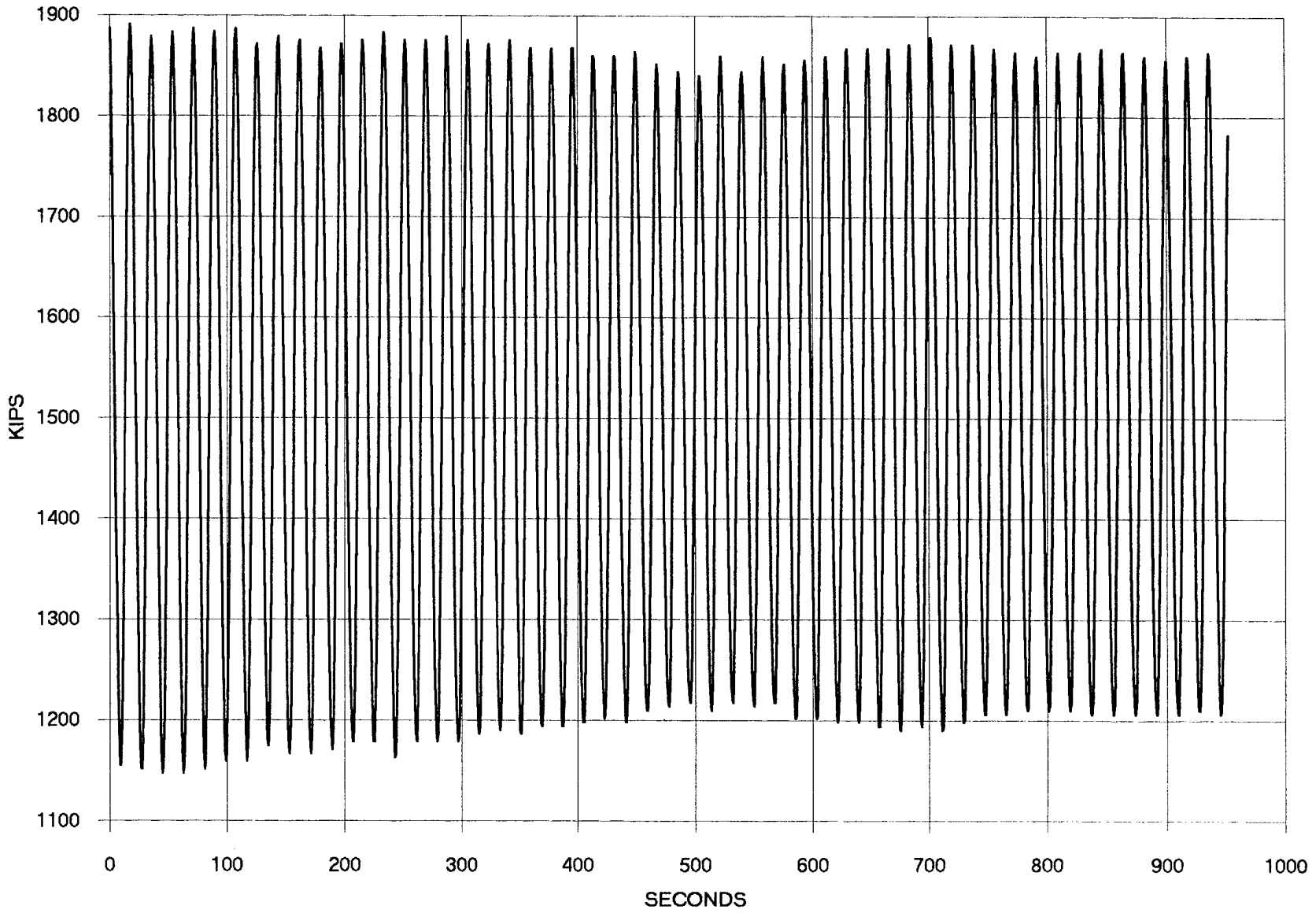

A537 - BT-3 THP (HOUR GLASS)
KIPS
1000
900
800
700
600
500
400
300
200
0
100
200
300
400
500
600
700
800
SECONDS

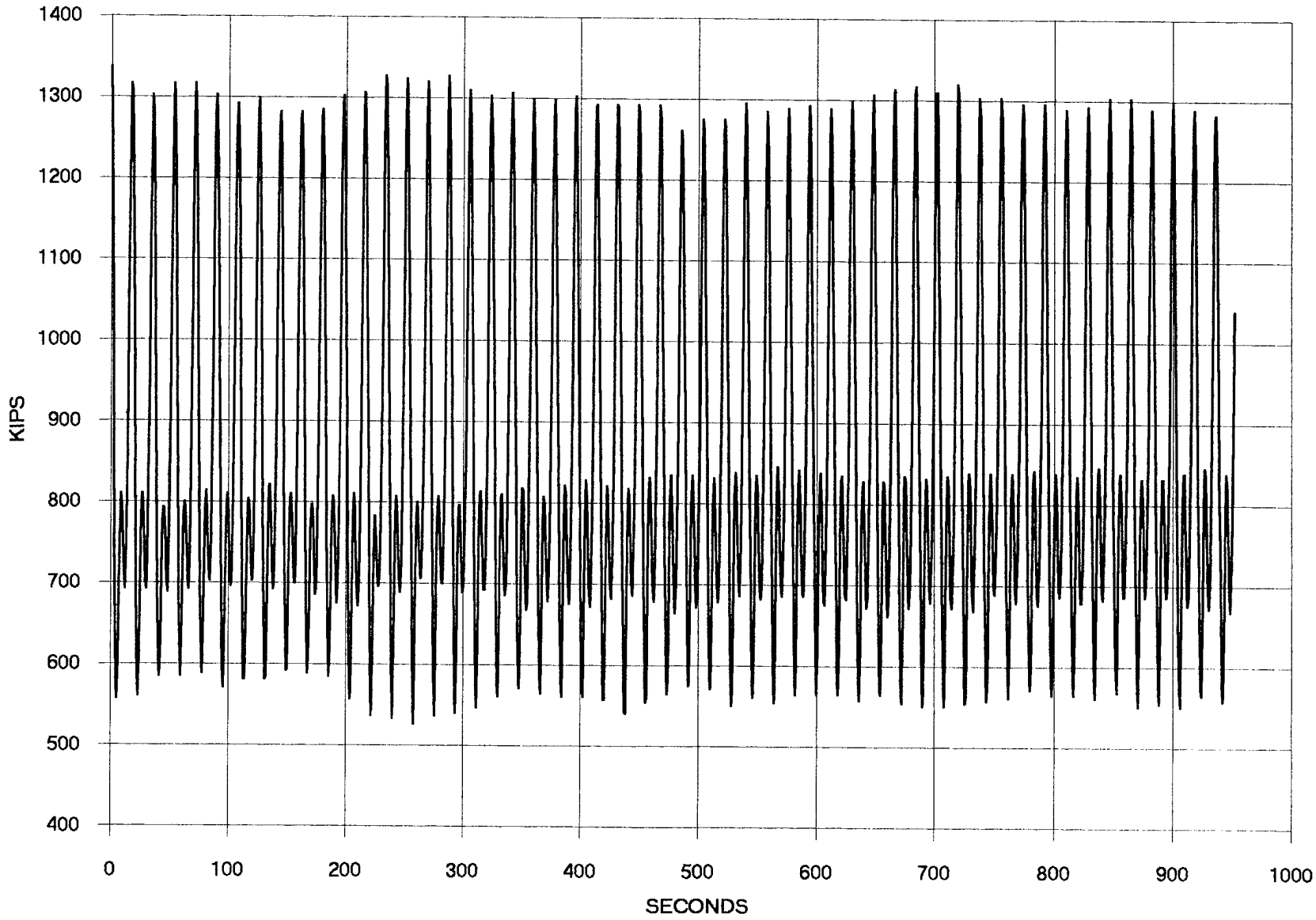
A537 - BT-4 THP (SEGMENTED)

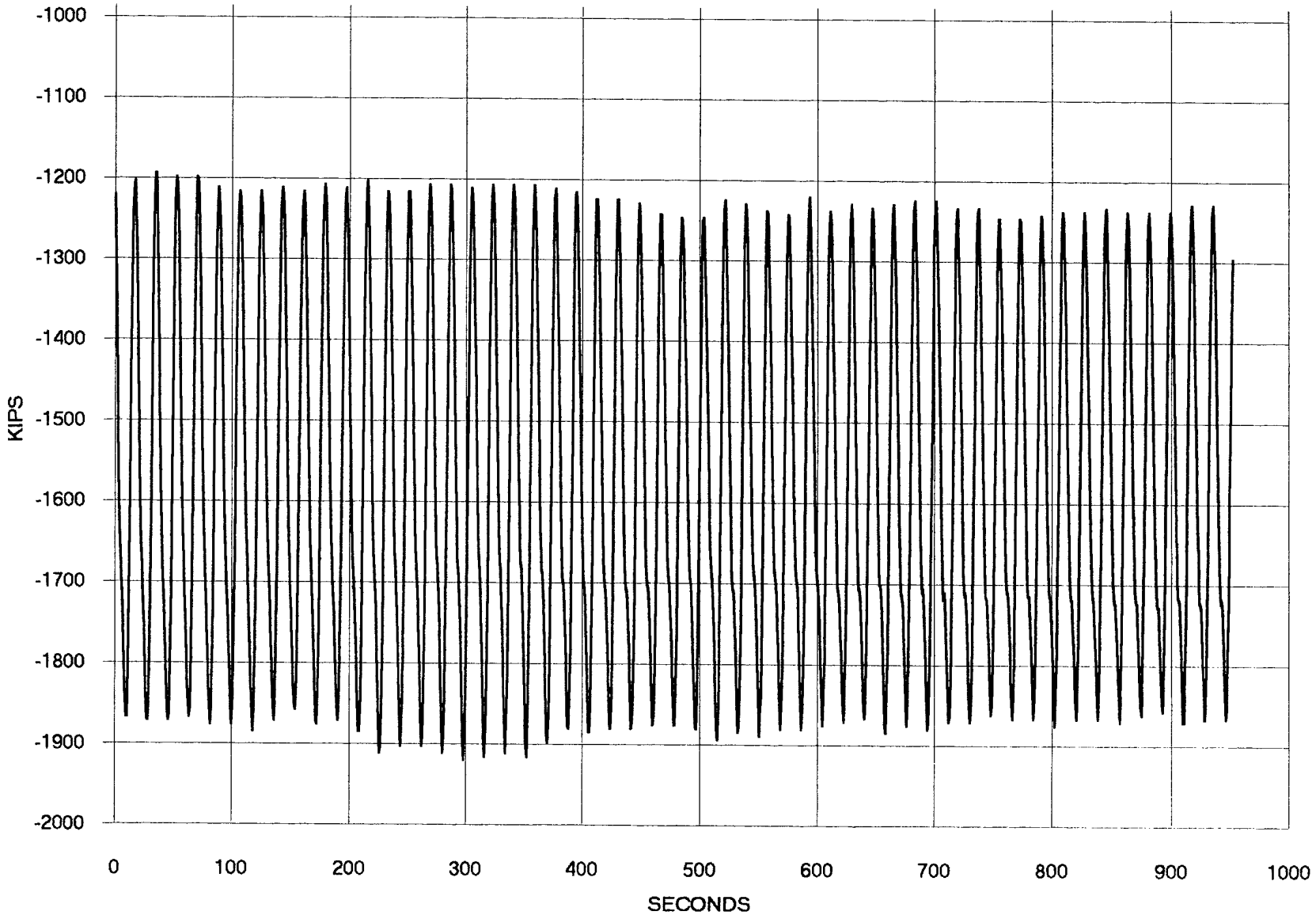



A537 - BT-5 THP (LINK BUOY)
-700
-900
-1100
-1300
-1500
-1700
-1900
-2100
-2300
KIPS
0
100
200
300
400
500
600
700
800
SECONDS

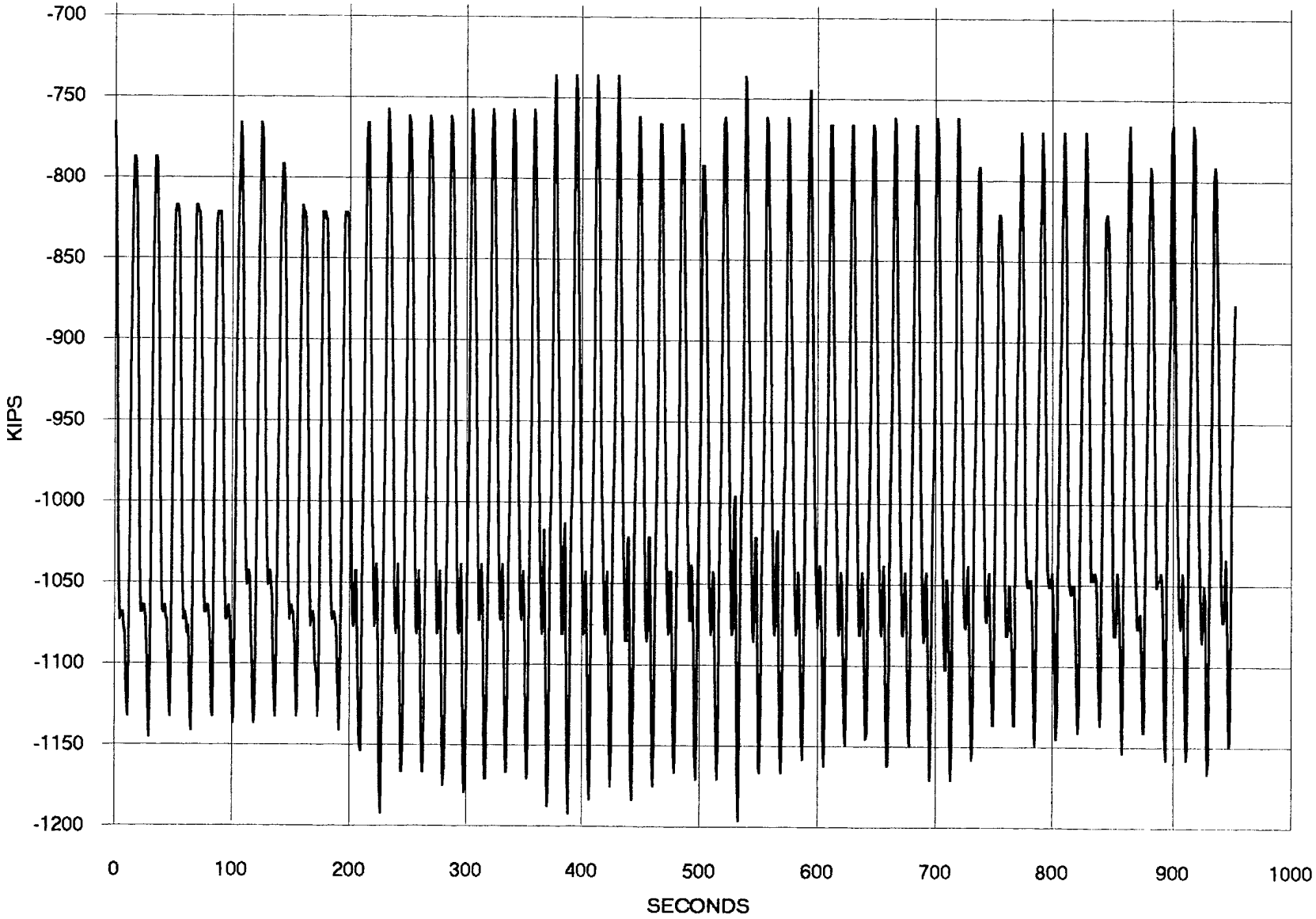

A537 - BT-6 THP (CONST. TENSION)
-200
-400
-600
-800
-1000
-1200
-1400
KIPS
0
100
200
300
400
500
600
700
800
SECONDS

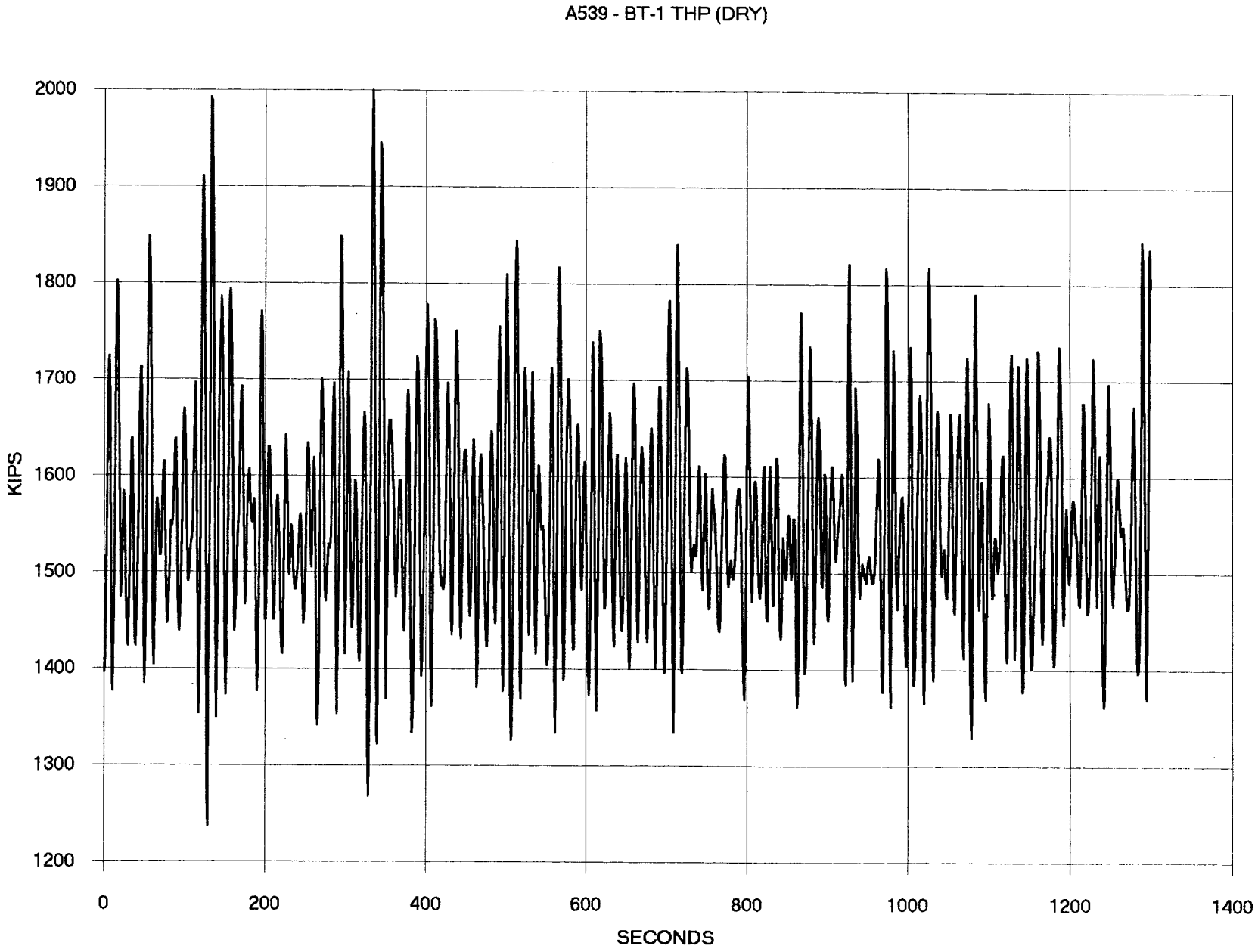

A538 - BT-1 THP (DRY)
KIPS
1900
1800
1700
1600
1500
1400
1300
1200
1100
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

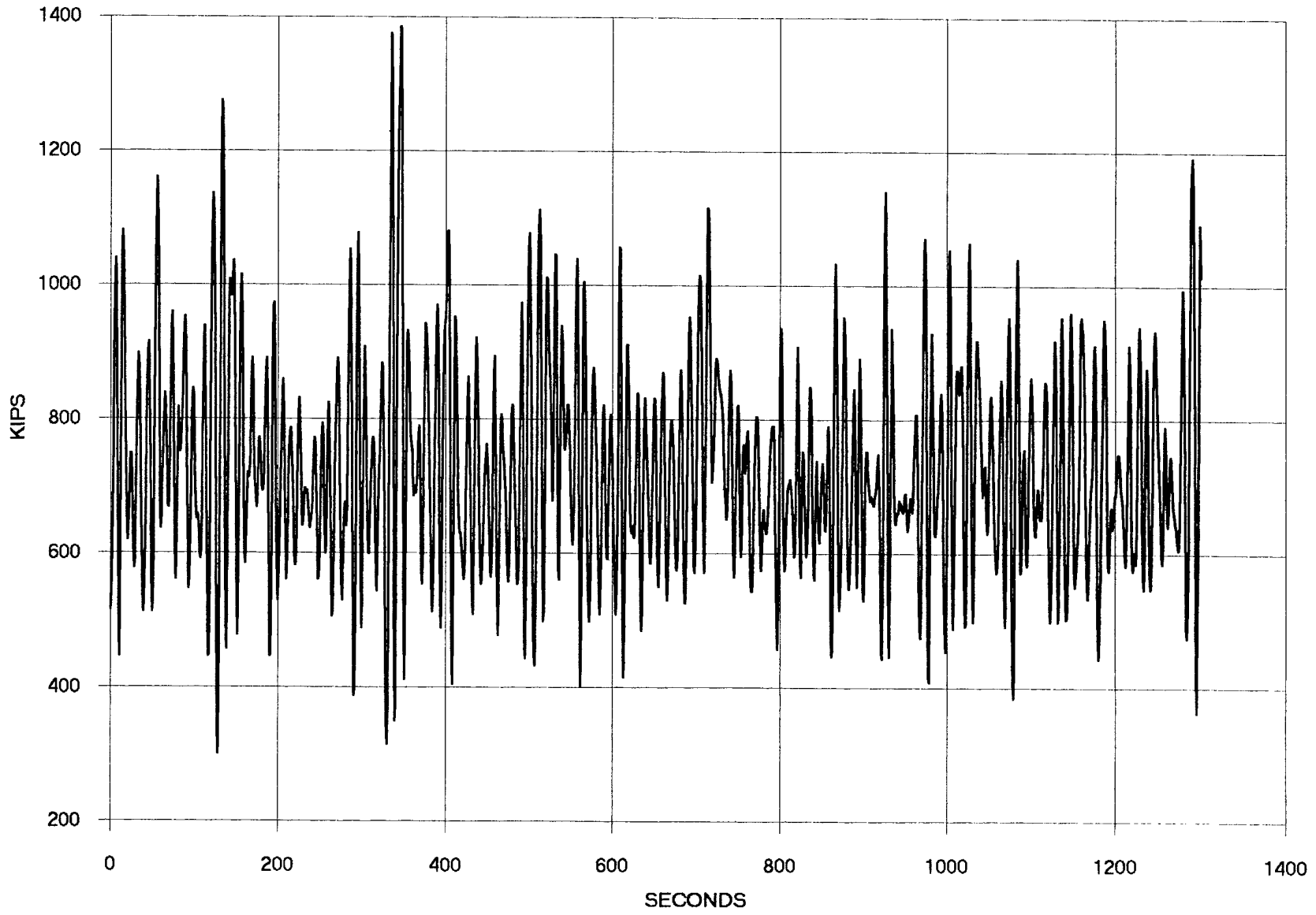

A538- BT-3 THP (INV. CONE)
KIPS
1400
1300
1200
1100
1000
900
800
700
600
500
400
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

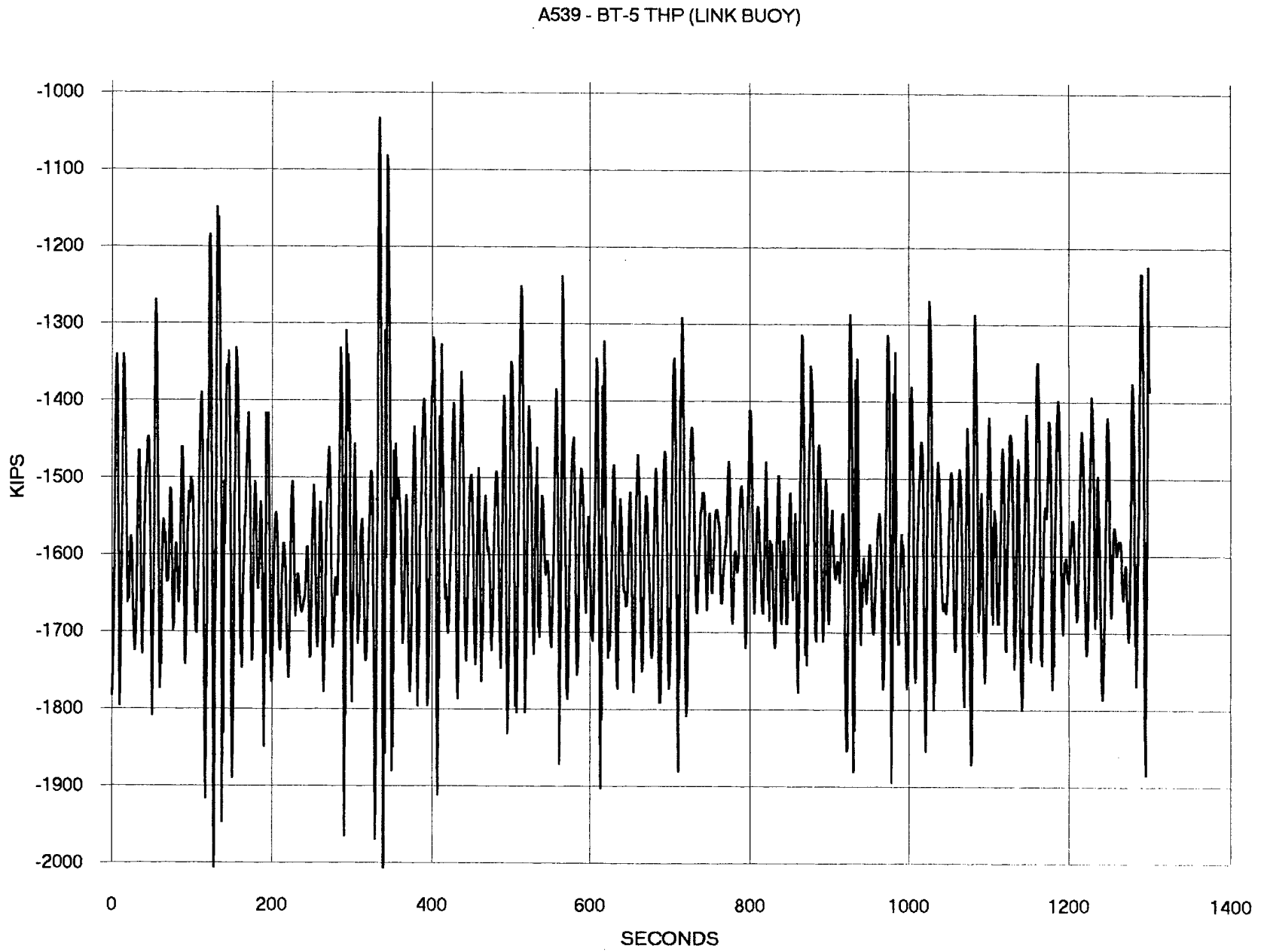

A538 - BT-5 THP (LINK BUOY)
-1000
-1100
-1200
-1300
-1400
-1500
-1600
-1700
-1800
-1900
-2000
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

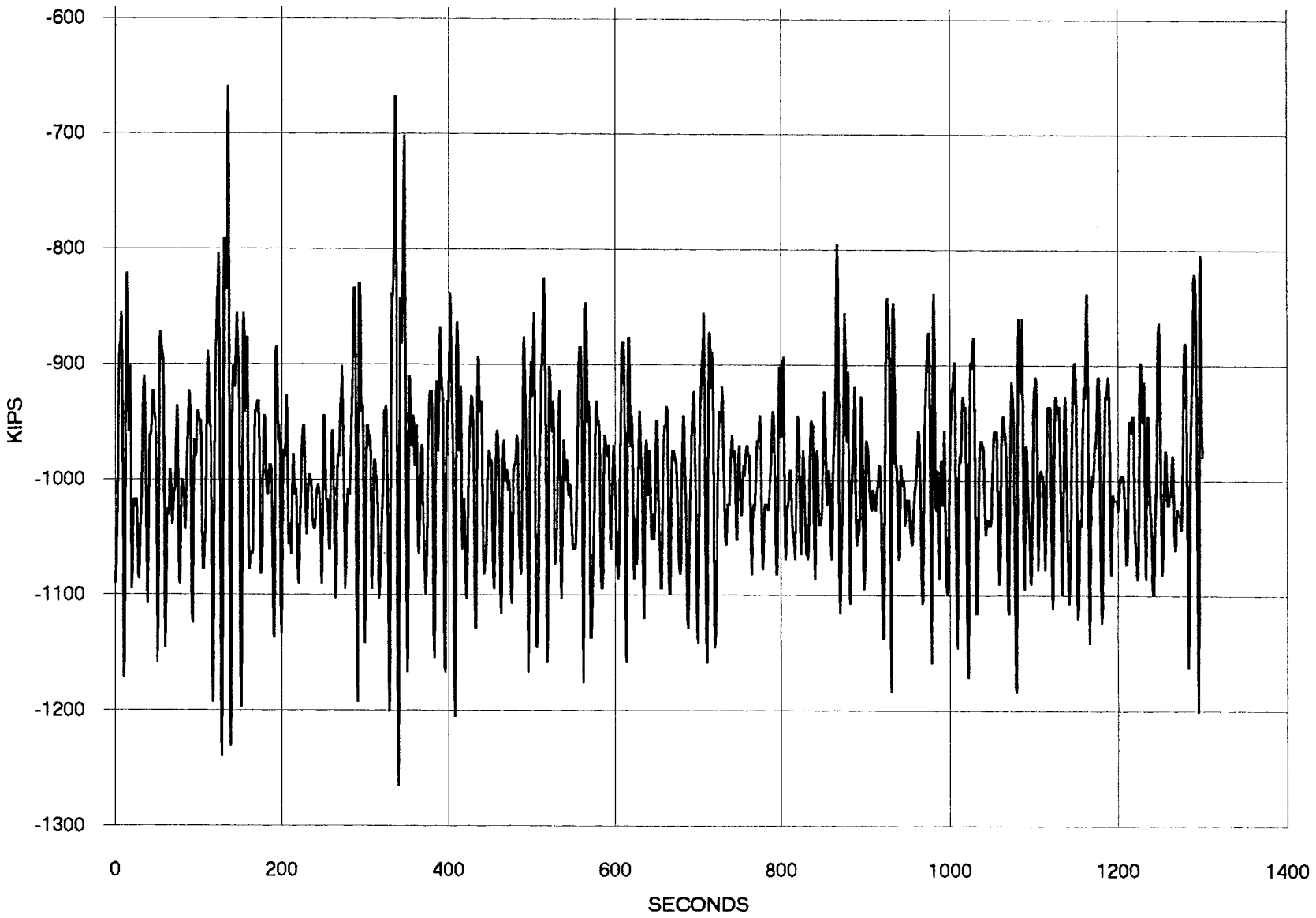
A538 - BT-6 THP (CONST. TENSION)

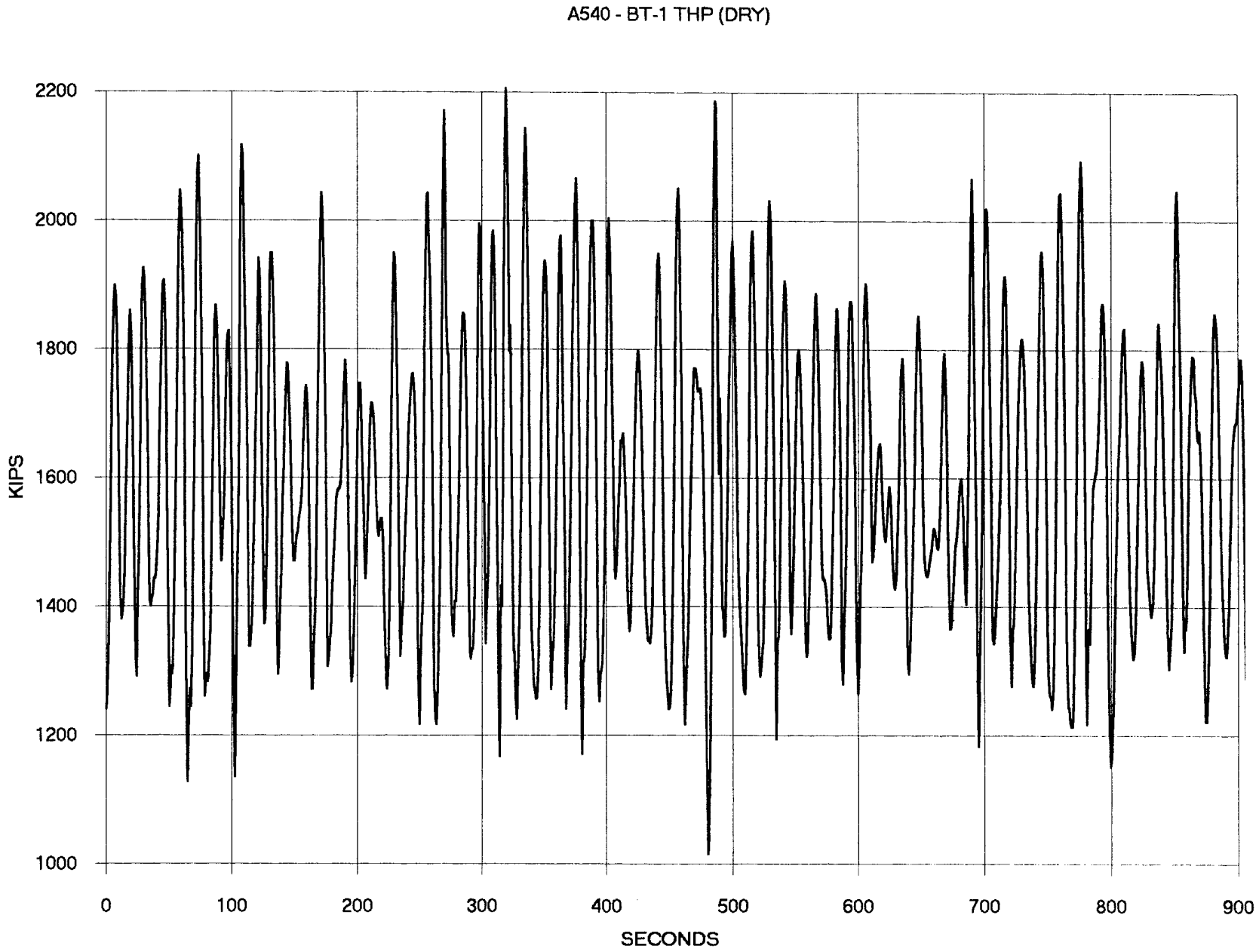



A539 - BT-1 THP (DRY)
2000
1900
1800
1700
1600
1500
1400
1300
1200
KIPS
0
200
400
600
800
1000
1200
1400
SECONDS

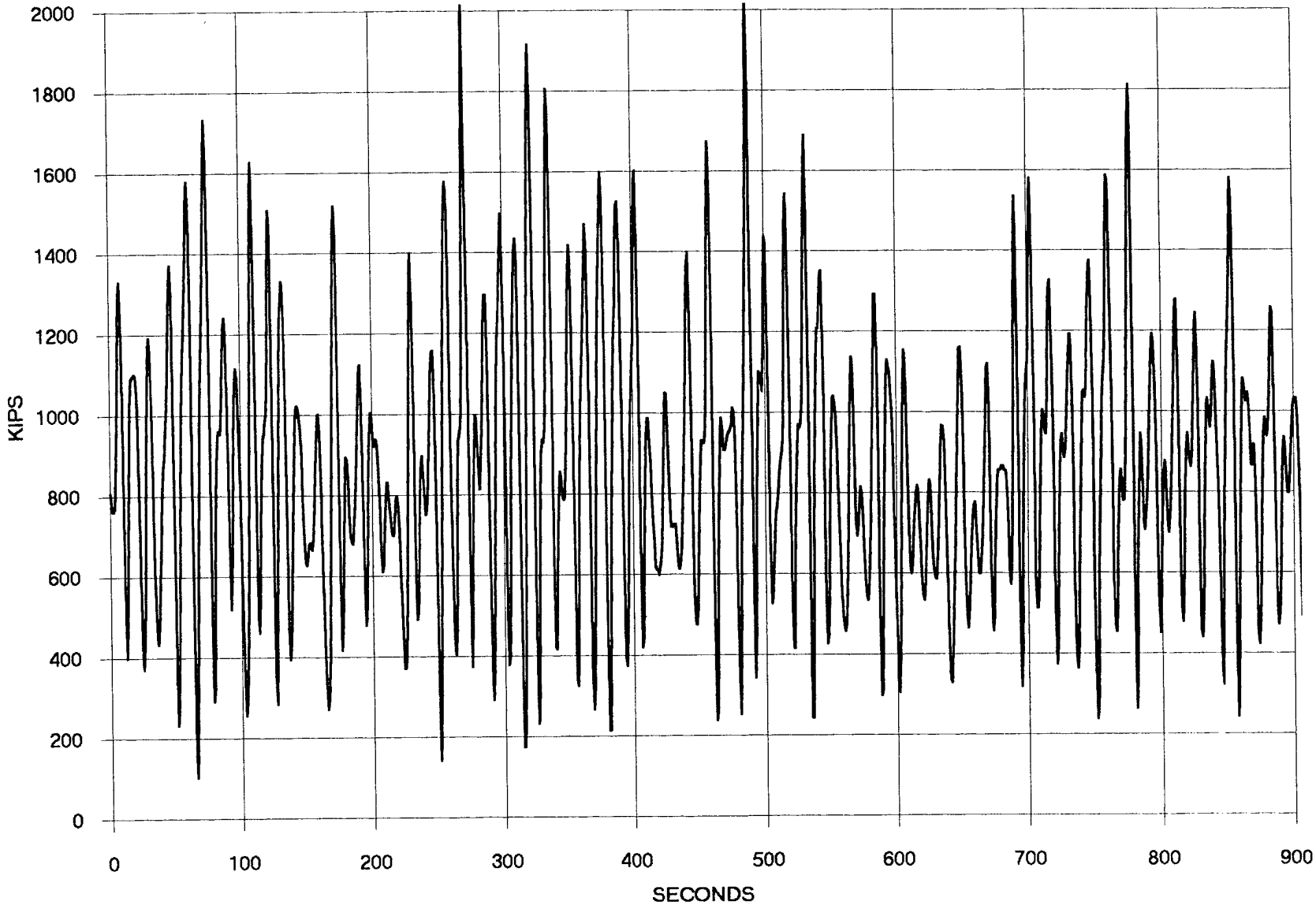

A539 - BT-3 THP (INV. CONE)
KIPS
1400
1200
1000
800
600
400
200
0
200
400
600
800
1000
1200
1400
SECONDS


A539 - BT-5 THP (LINK BUOY)
-1000
-1100
-1200
-1300
-1400
-1500
-1600
-1700
-1800
-1900
-2000
KIPS
0
200
400
600
800
1000
1200
1400
SECONDS

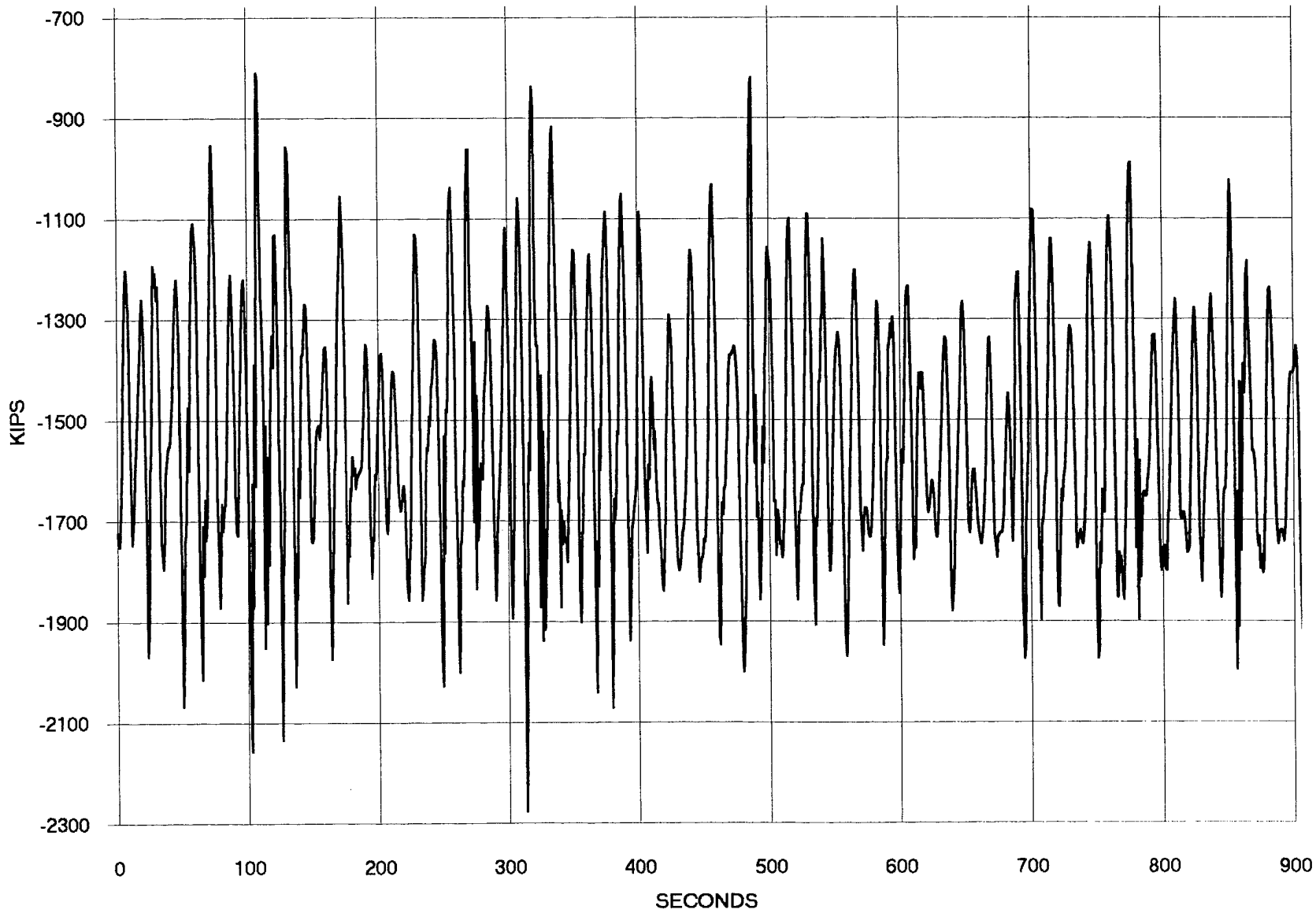

A539 - BT-6 THP (CONST. TENSION)
-600
-700
-800
-900
-1000
-1100
-1200
-1300
KIPS
0
200
400
600
800
1000
1200
1400
SECONDS

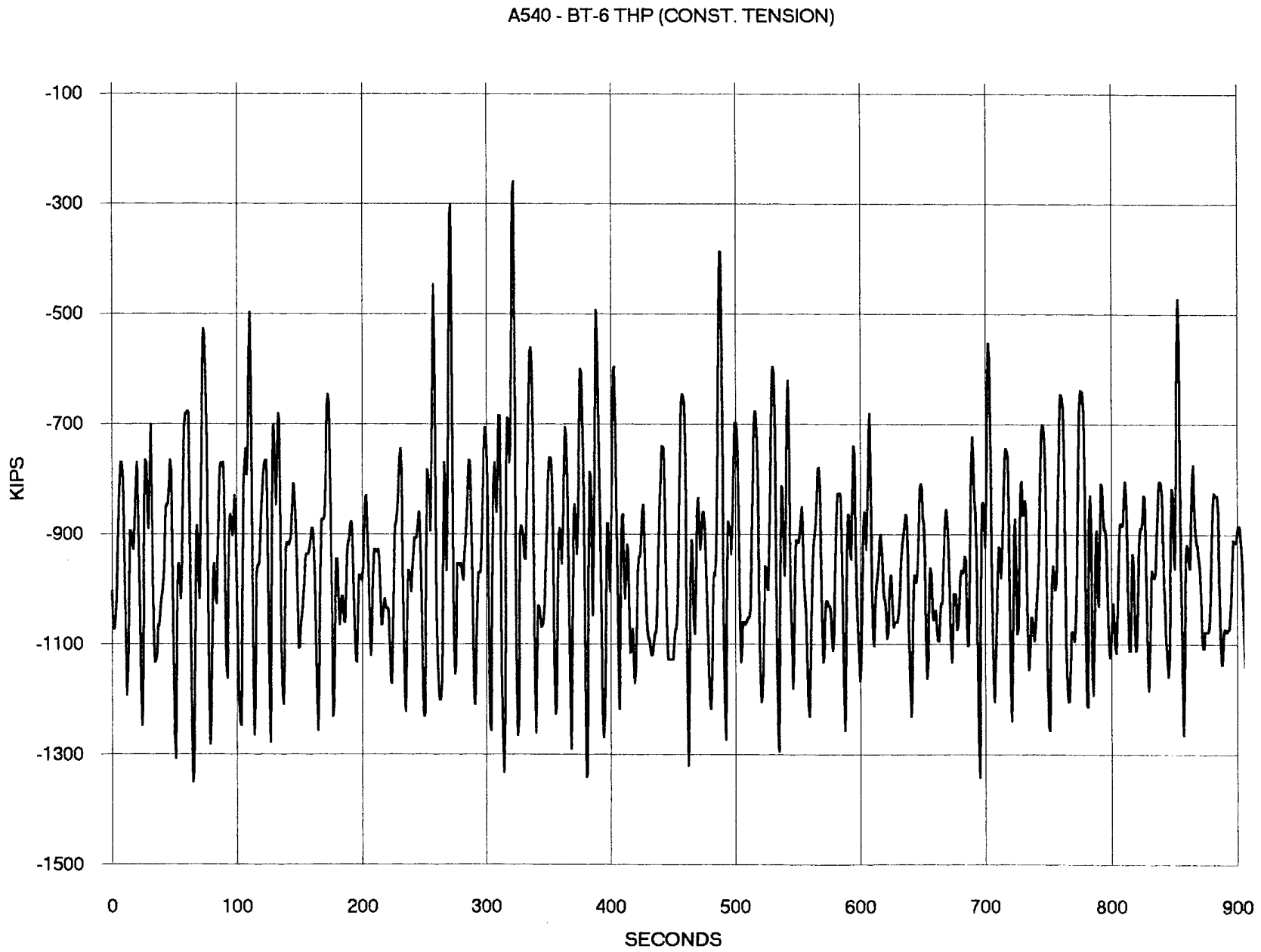

A540 - BT-1 THP (DRY)
2200
2000
1800
1600
1400
1200
1000
KIPS
0
100
200
300
400
500
600
700
800
900
SECONDS

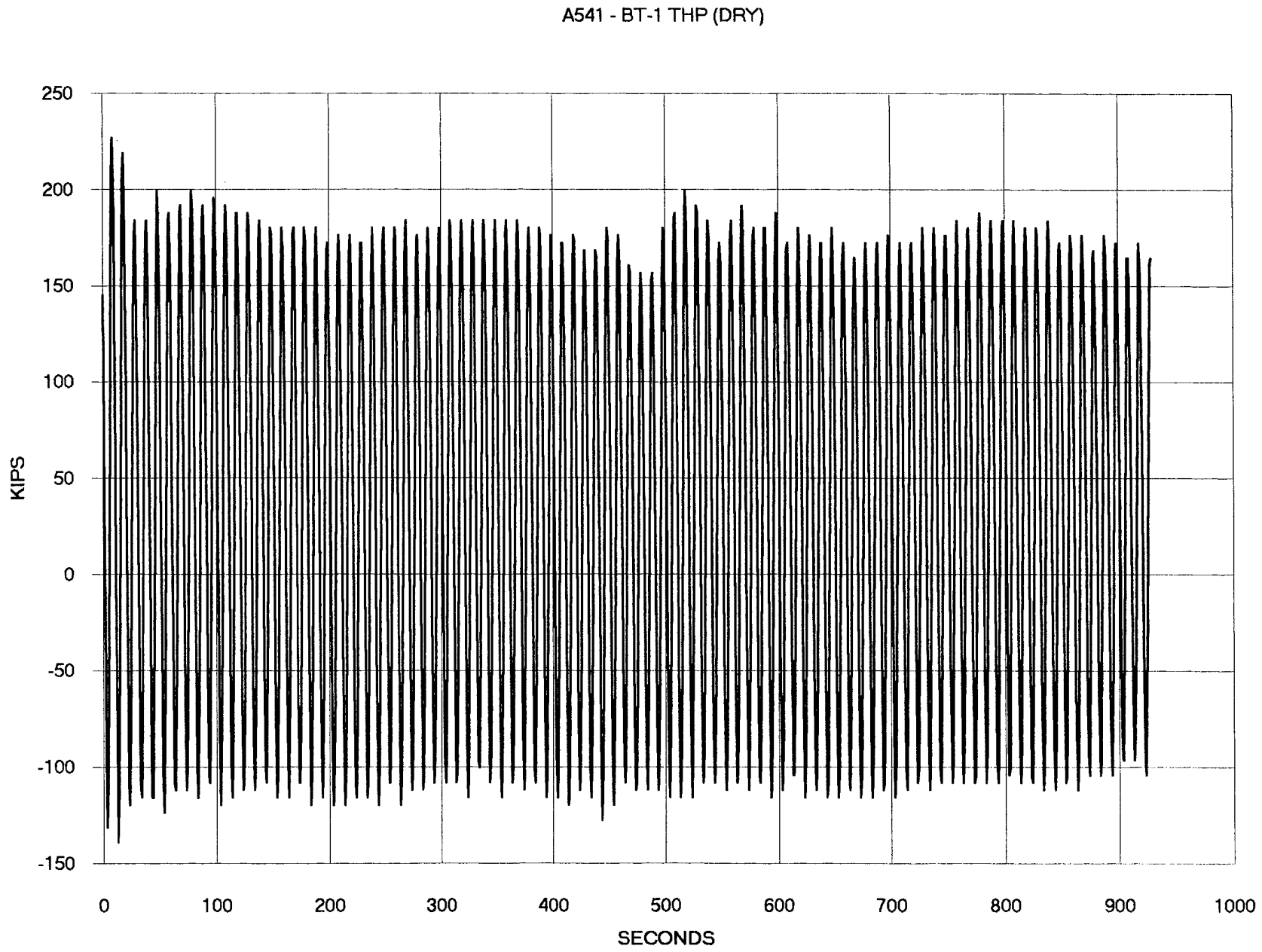
A540 - BT-3 THP (INV. CONE)



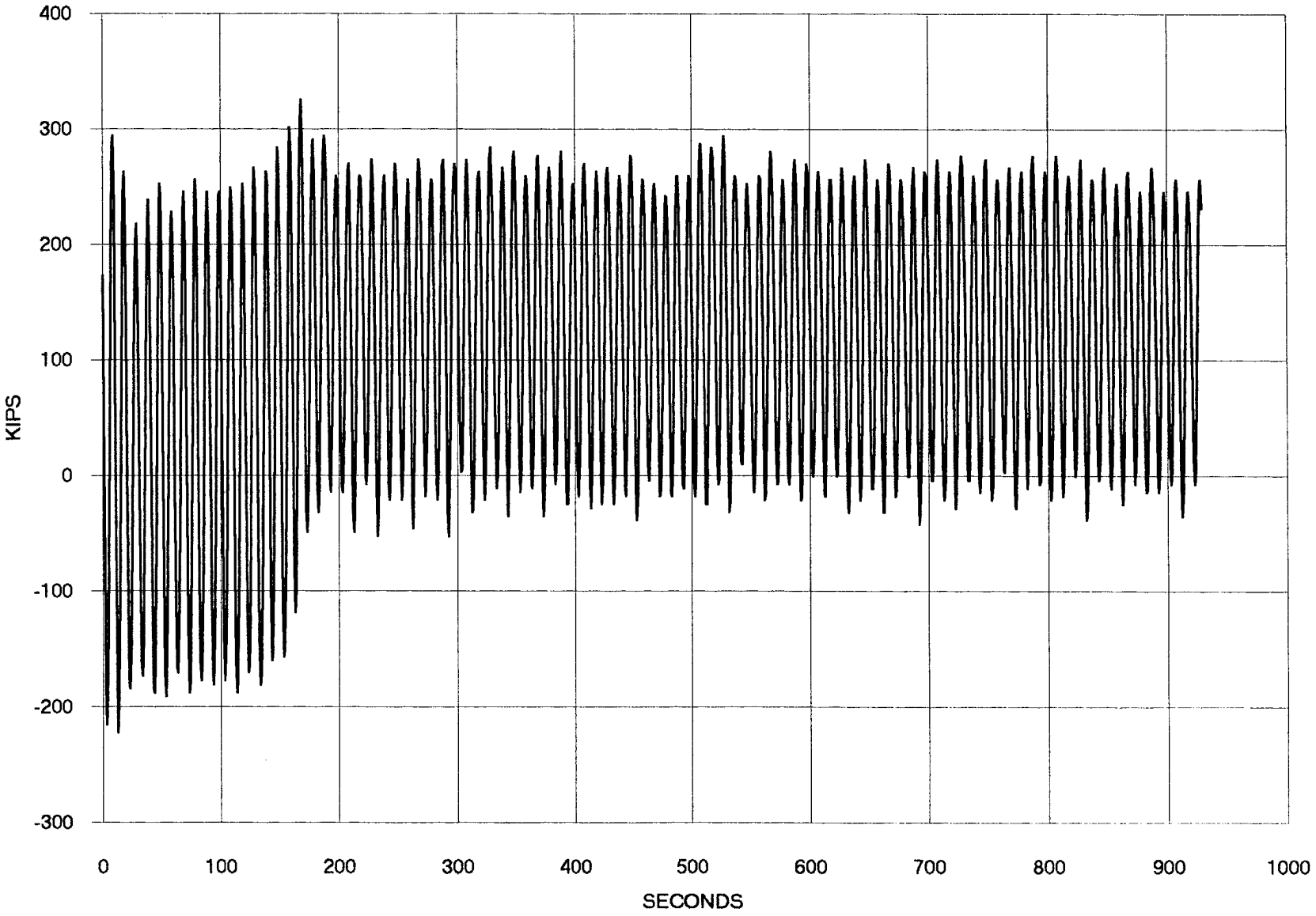
A540 - BT-5 THP (LINK BUOY)

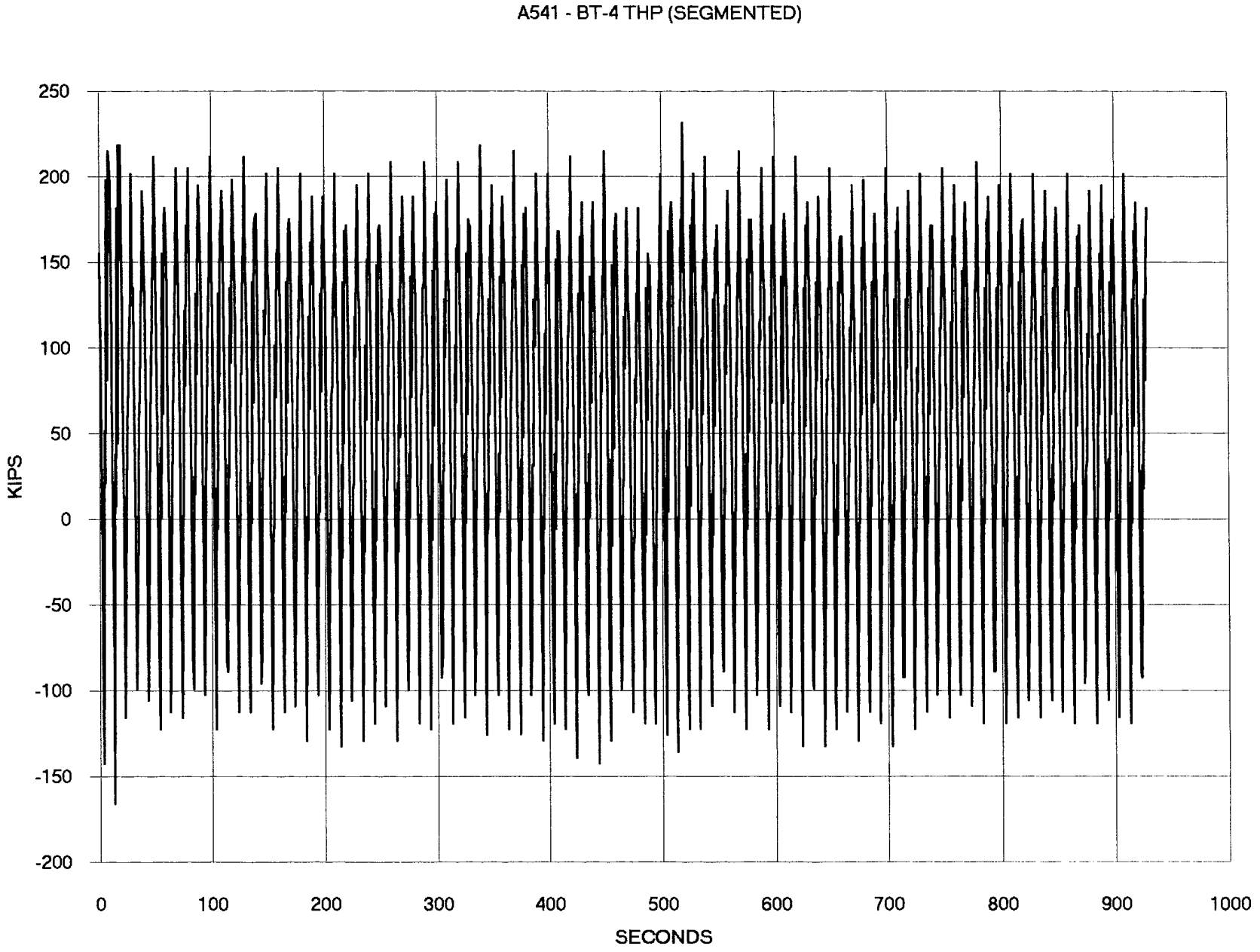


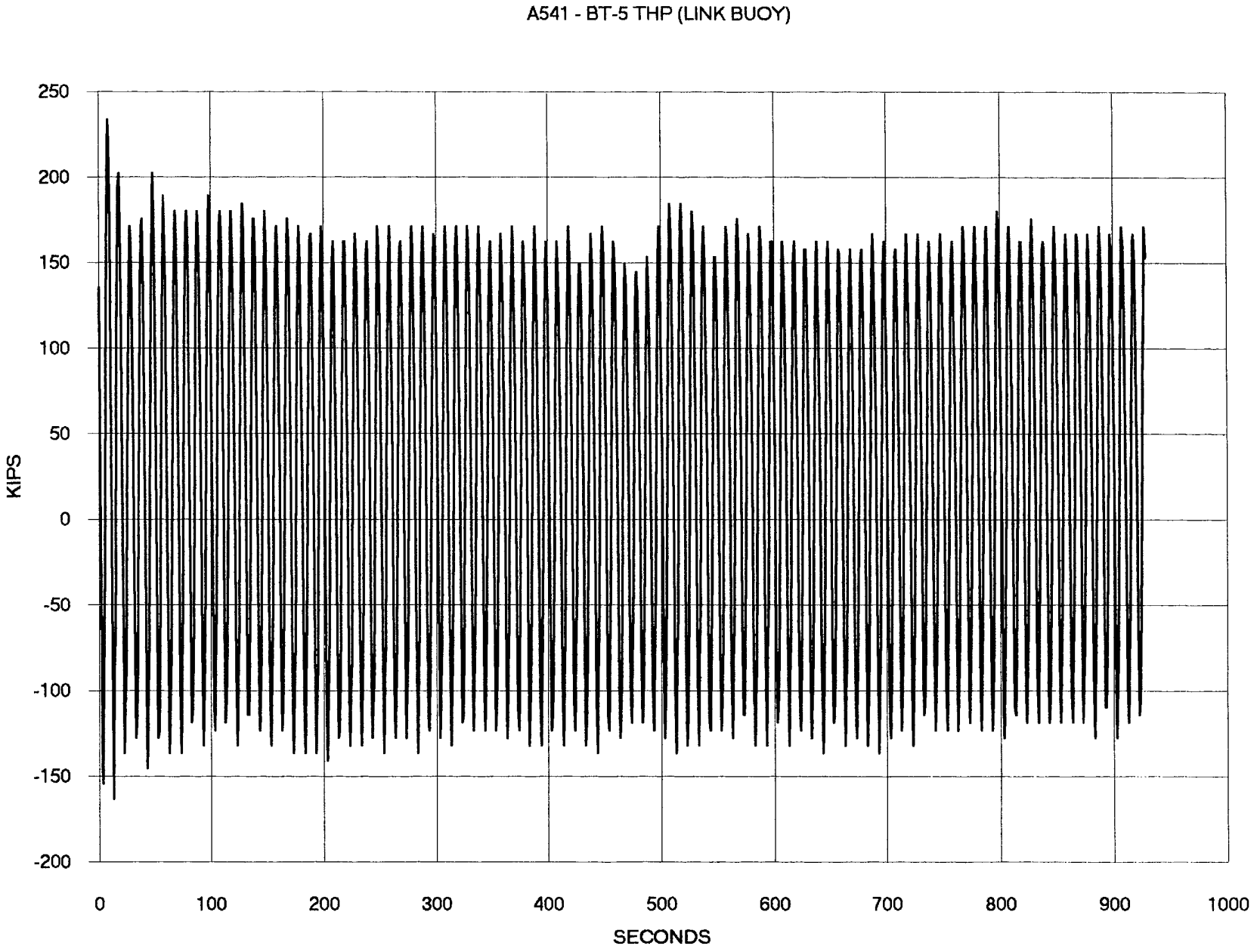

A540 - BT-6 THP (CONST. TENSION)
-100
-300
-500
-700
-900
-1100
-1300
-1500
KIPS
0
100
200
300
400
500
600
700
800
900
SECONDS

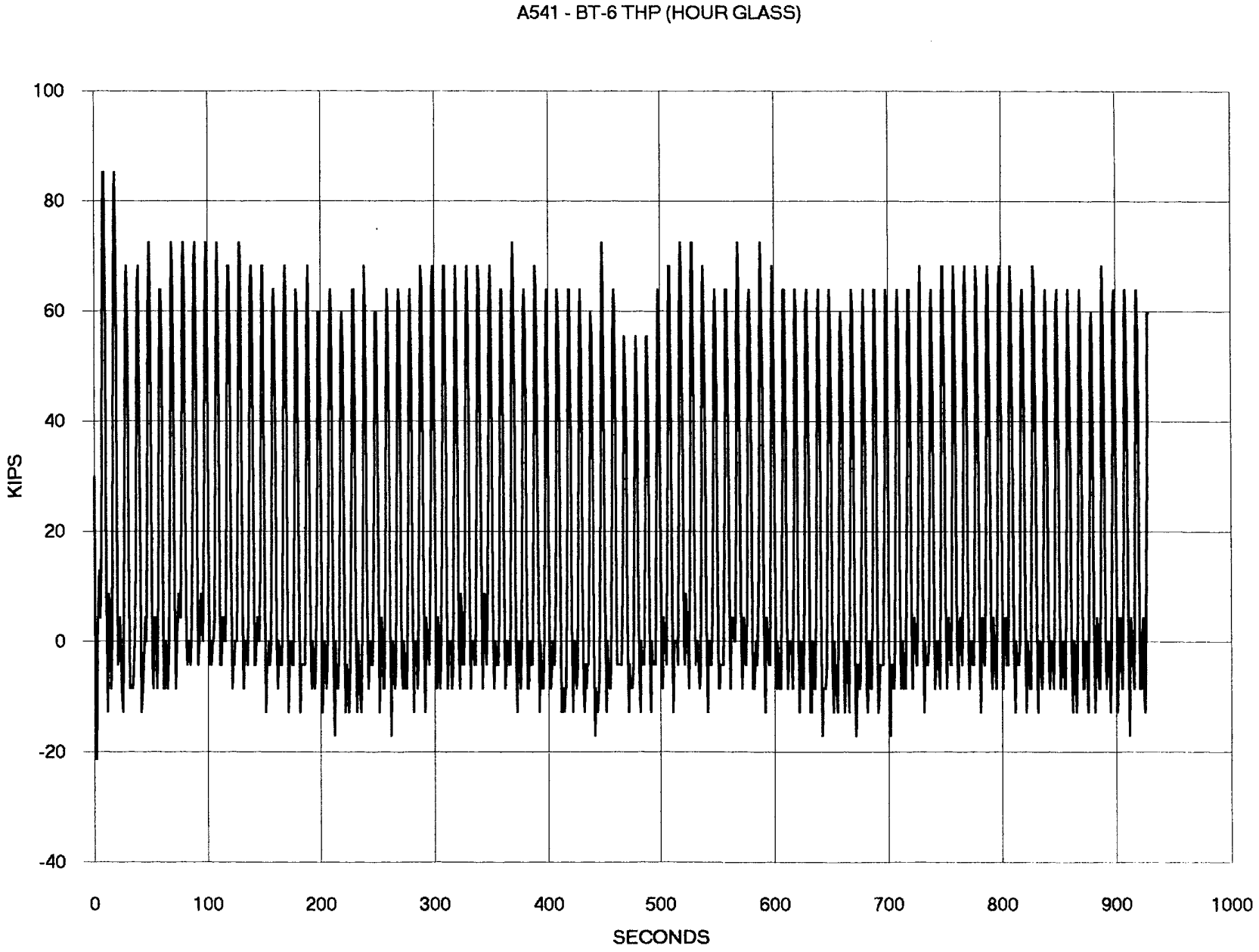

A541 - BT-1 THP (DRY)
250
200
150
100
50
0
-50
-100
-150
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

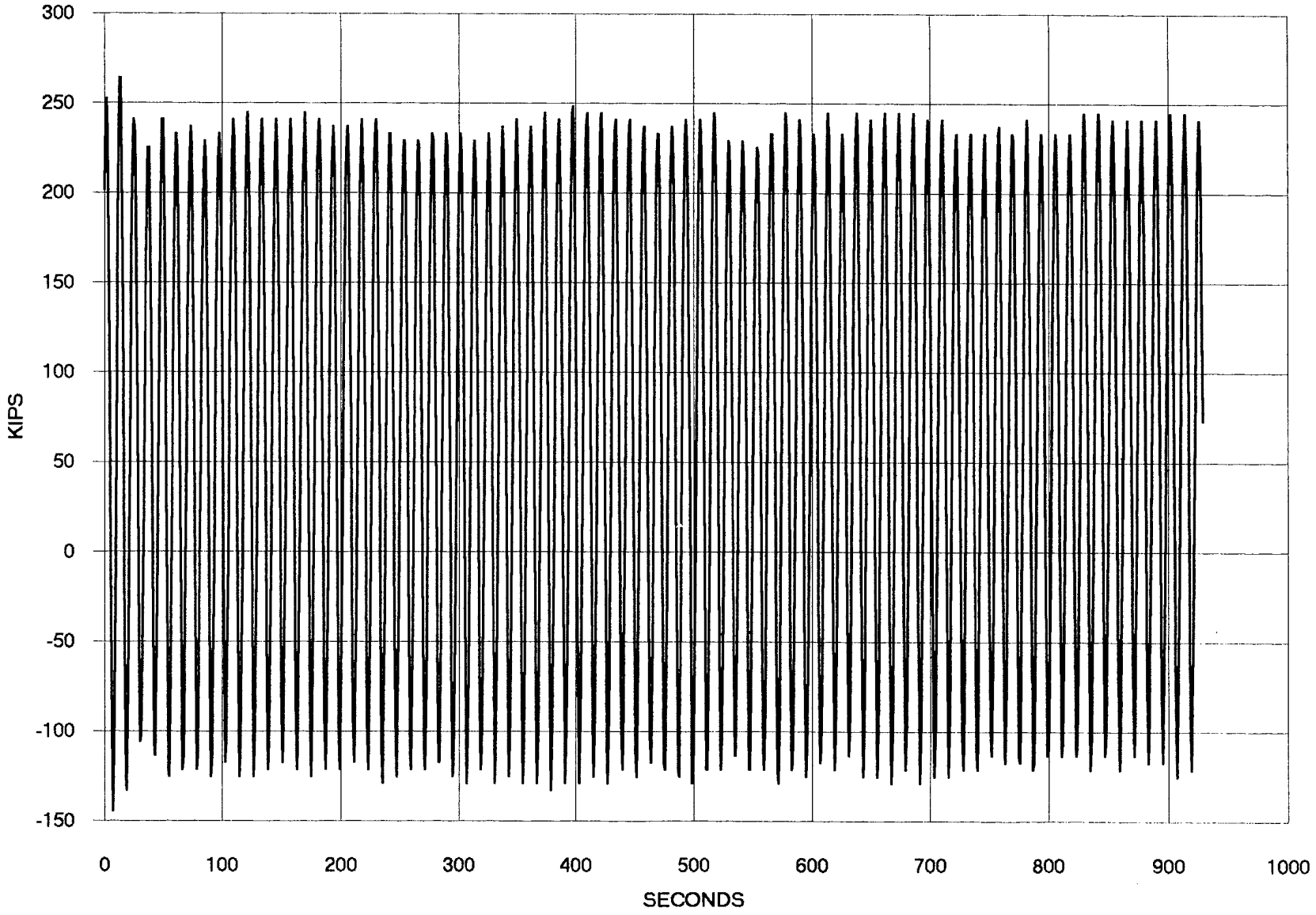
A541 - BT-3 THP (INV. CONE)



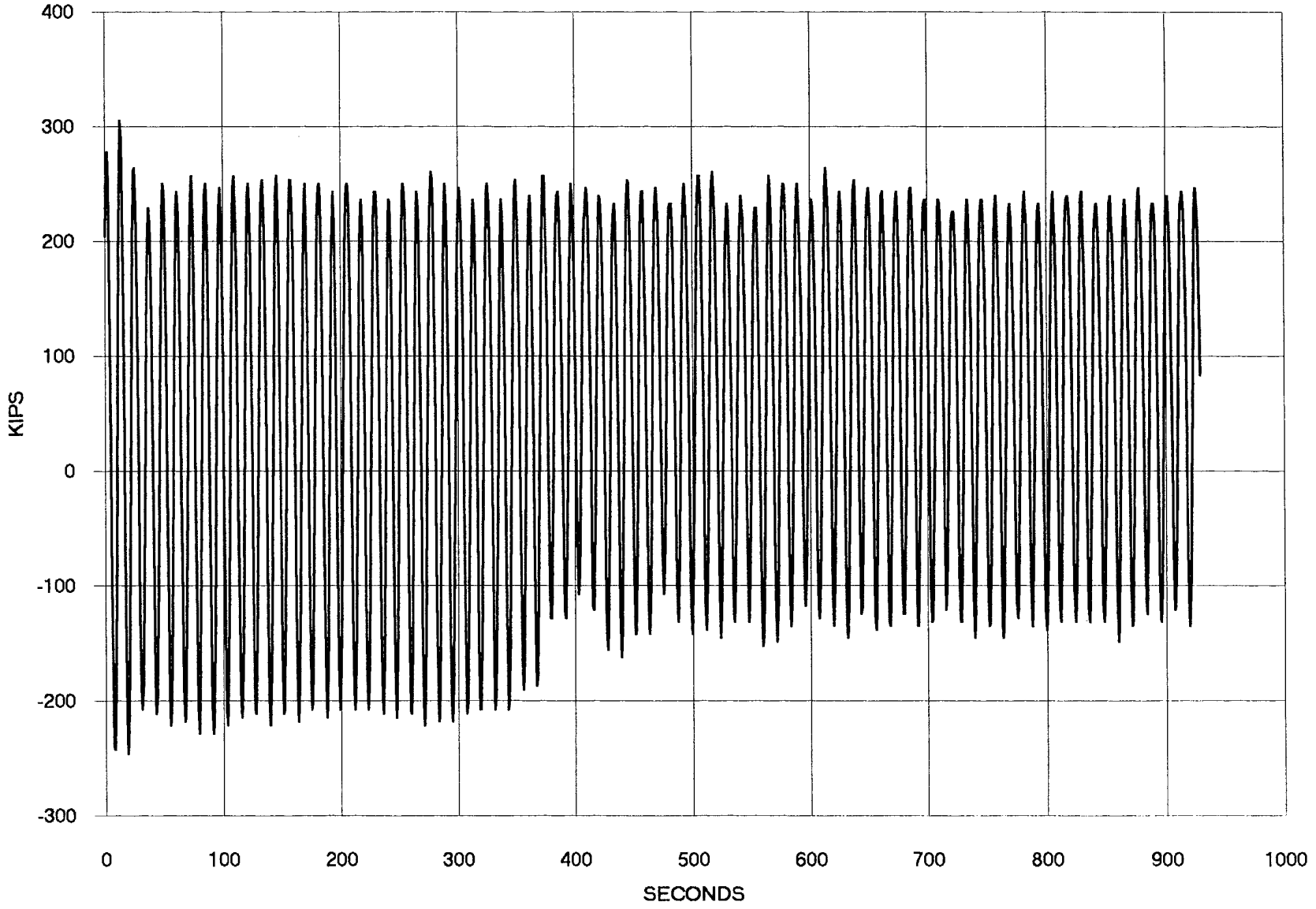

A541 - BT-4 THP (SEGMENTED)
250
200
150
100
50
0
-50
-100
-150
-200
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS


A541 - BT-5 THP (LINK BUOY)
250
200
150
100
50
0
-50
-100
-150
-200
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

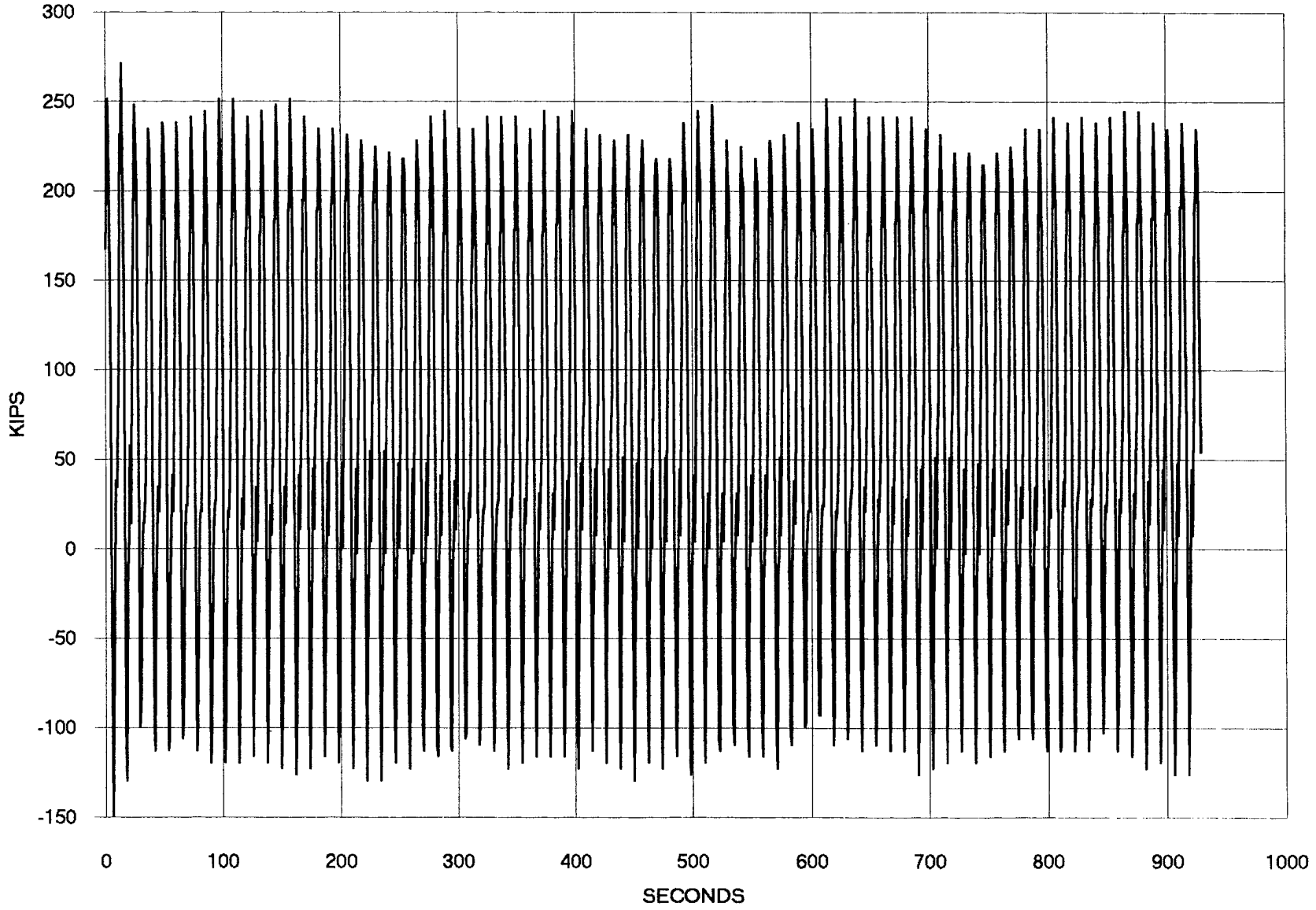

A541 - BT-6 THP (HOUR GLASS)
100
80
60
40
20
0
-20
-40
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

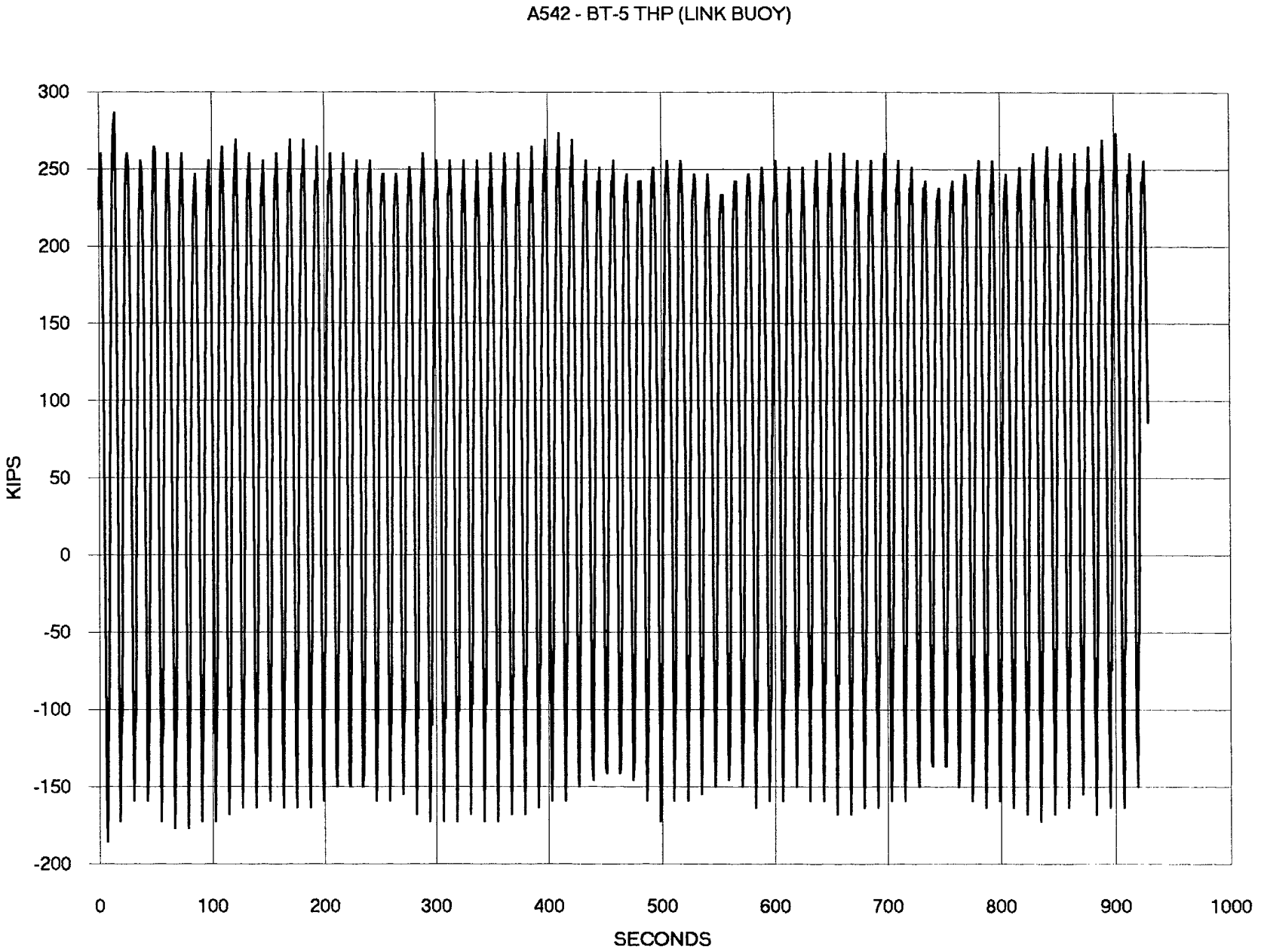

A542 - BT-1 THP (DRY)
300
250
200
150
100
50
0
-50
-100
-150
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

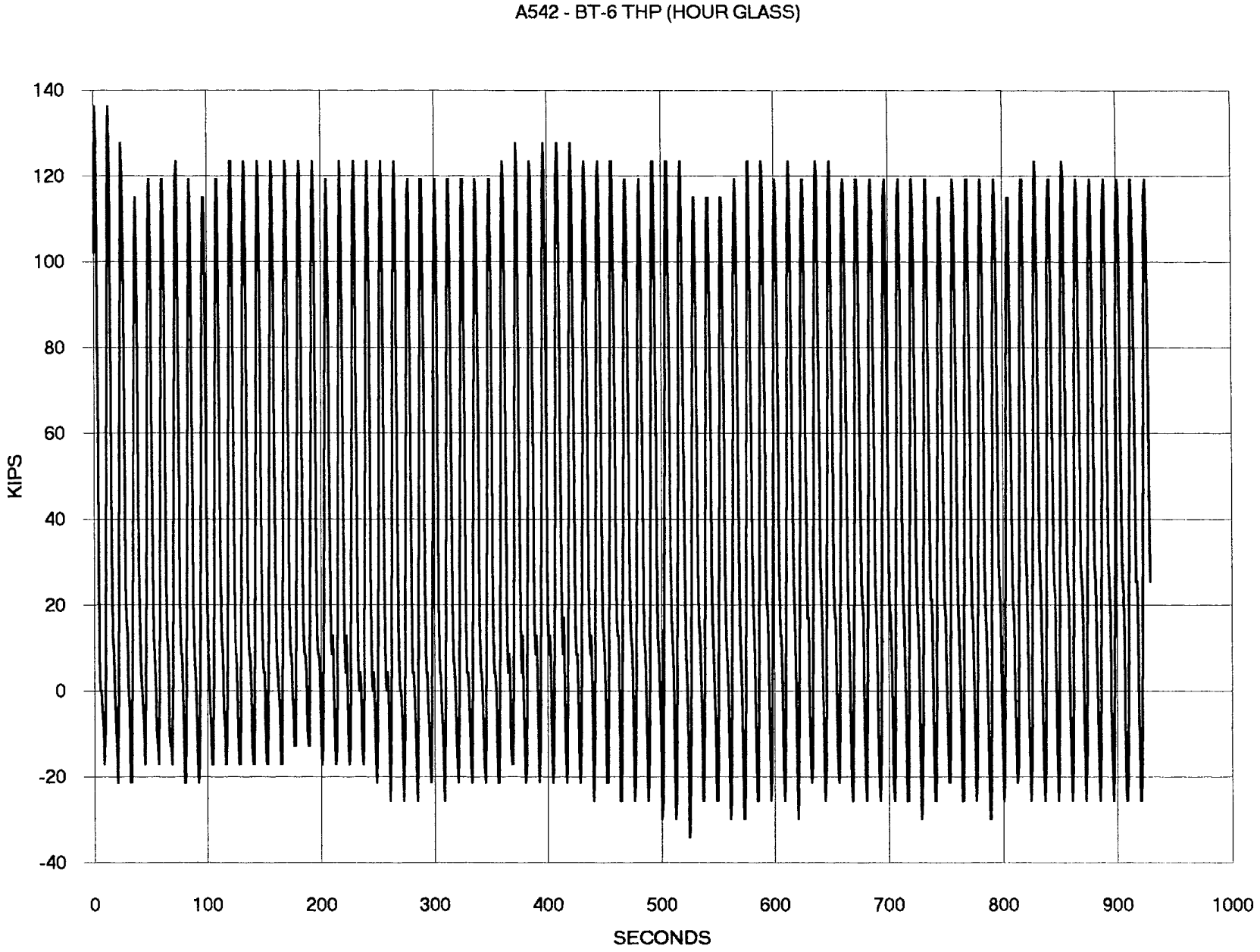
A542 - BT-3 THP (INV. CONE)



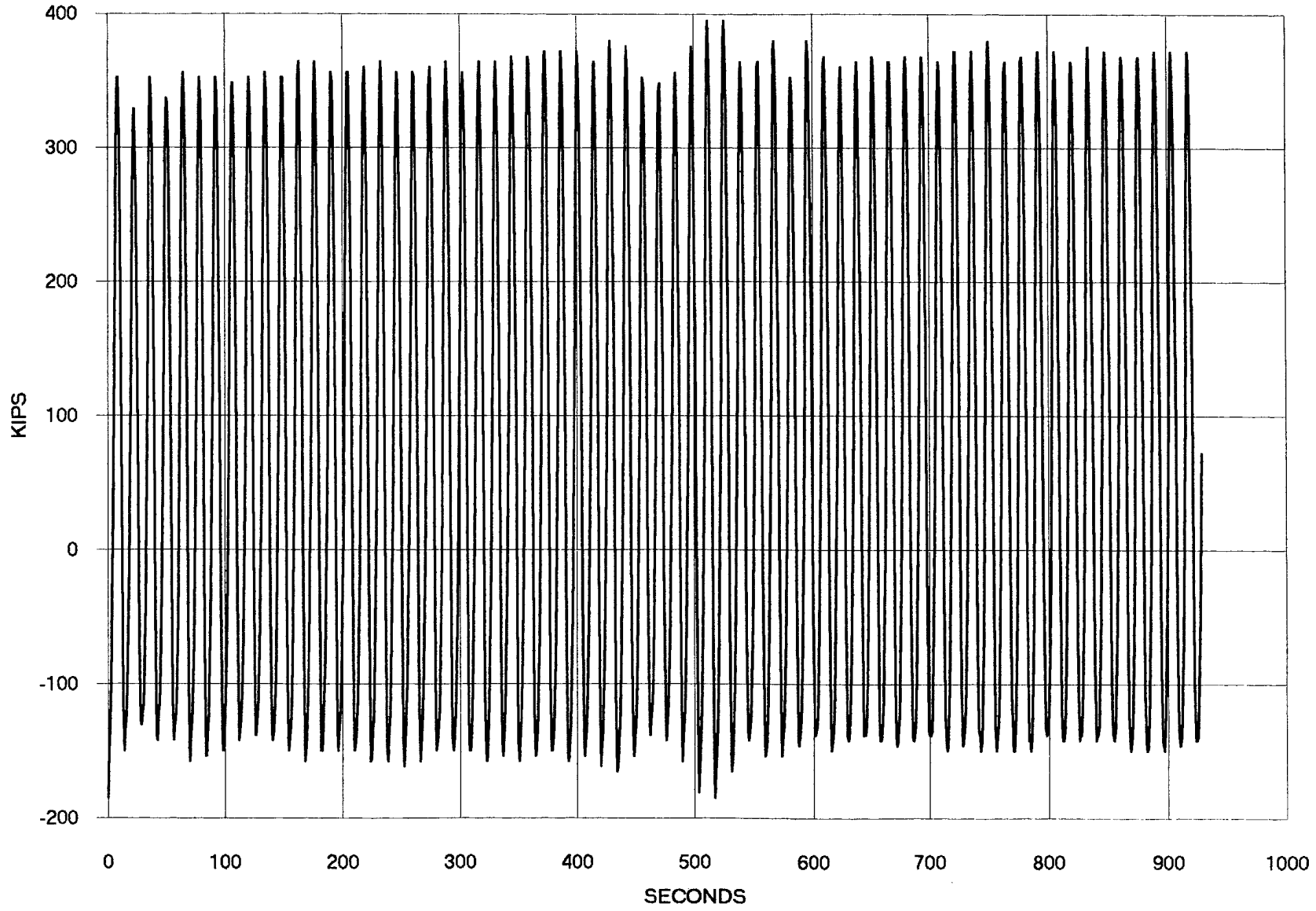
A542 - BT-4 THP (SEGMENTED)

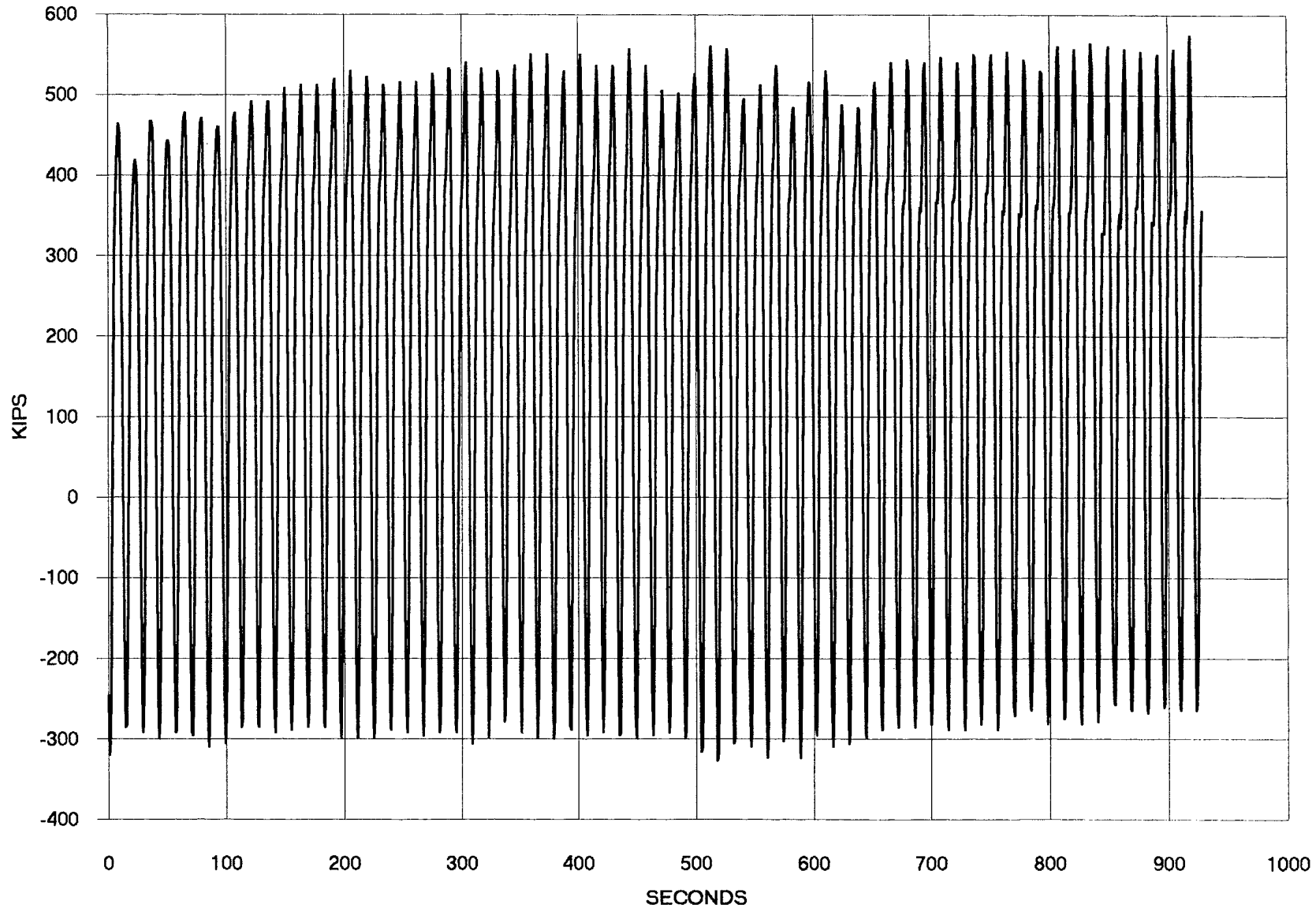



A542 - BT-5 THP (LINK BUOY)
300
250
200
150
100
50
0
-50
-100
-150
-200
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

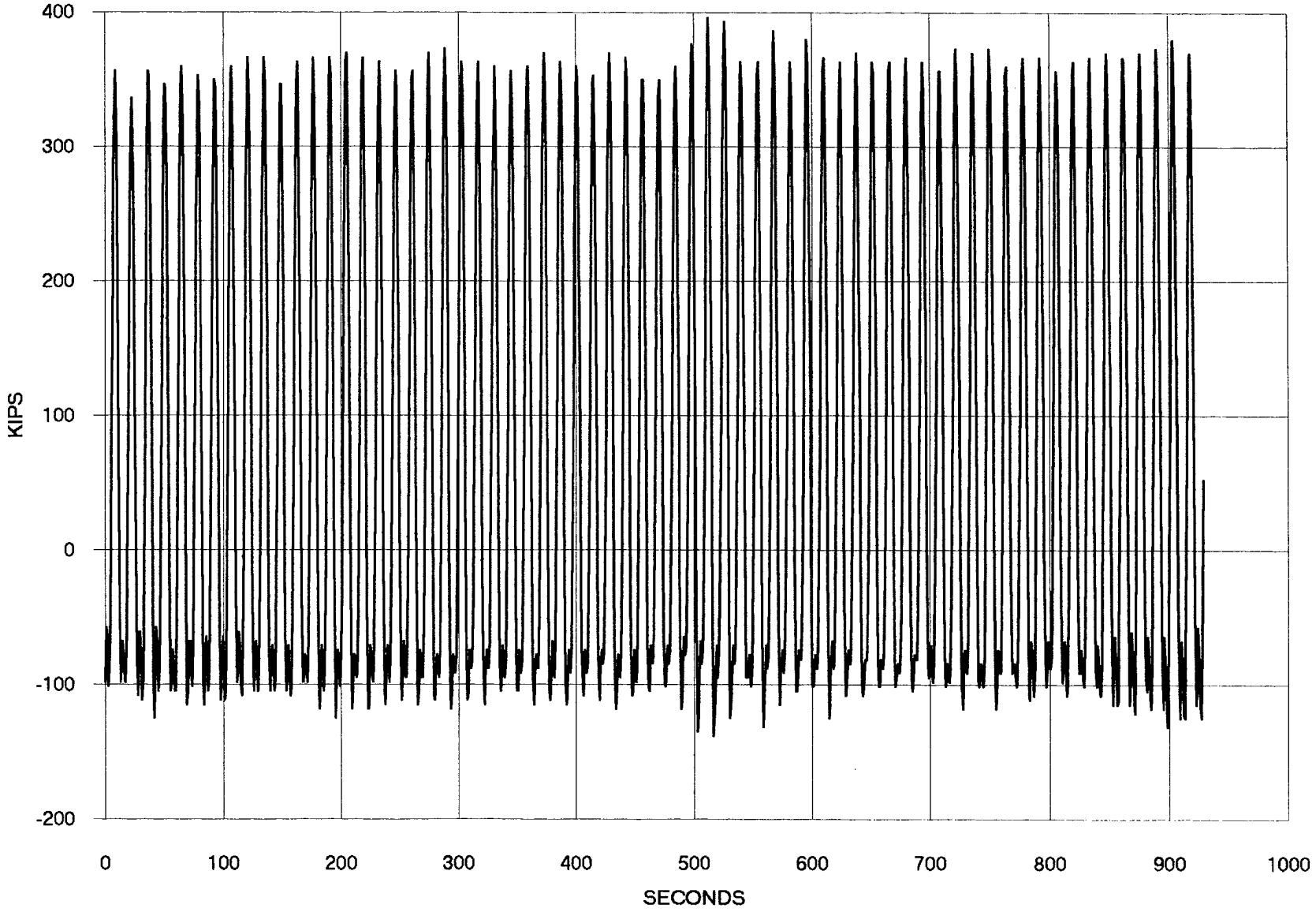

A542 - BT-6 THP (HOUR GLASS)
140
120
100
80
60
40
20
0
-20
-40
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

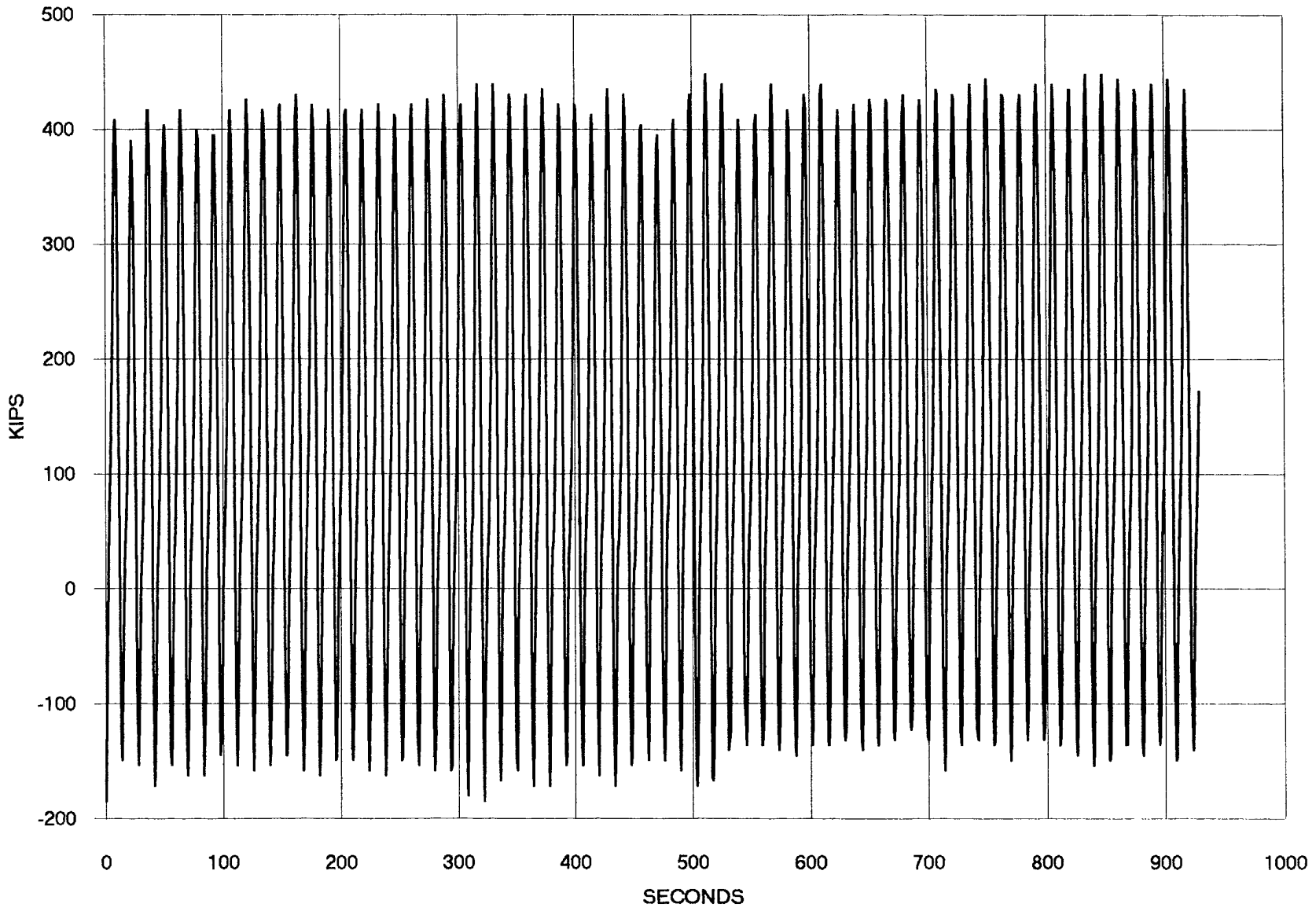
A543 - BT-1 THP (DRY)



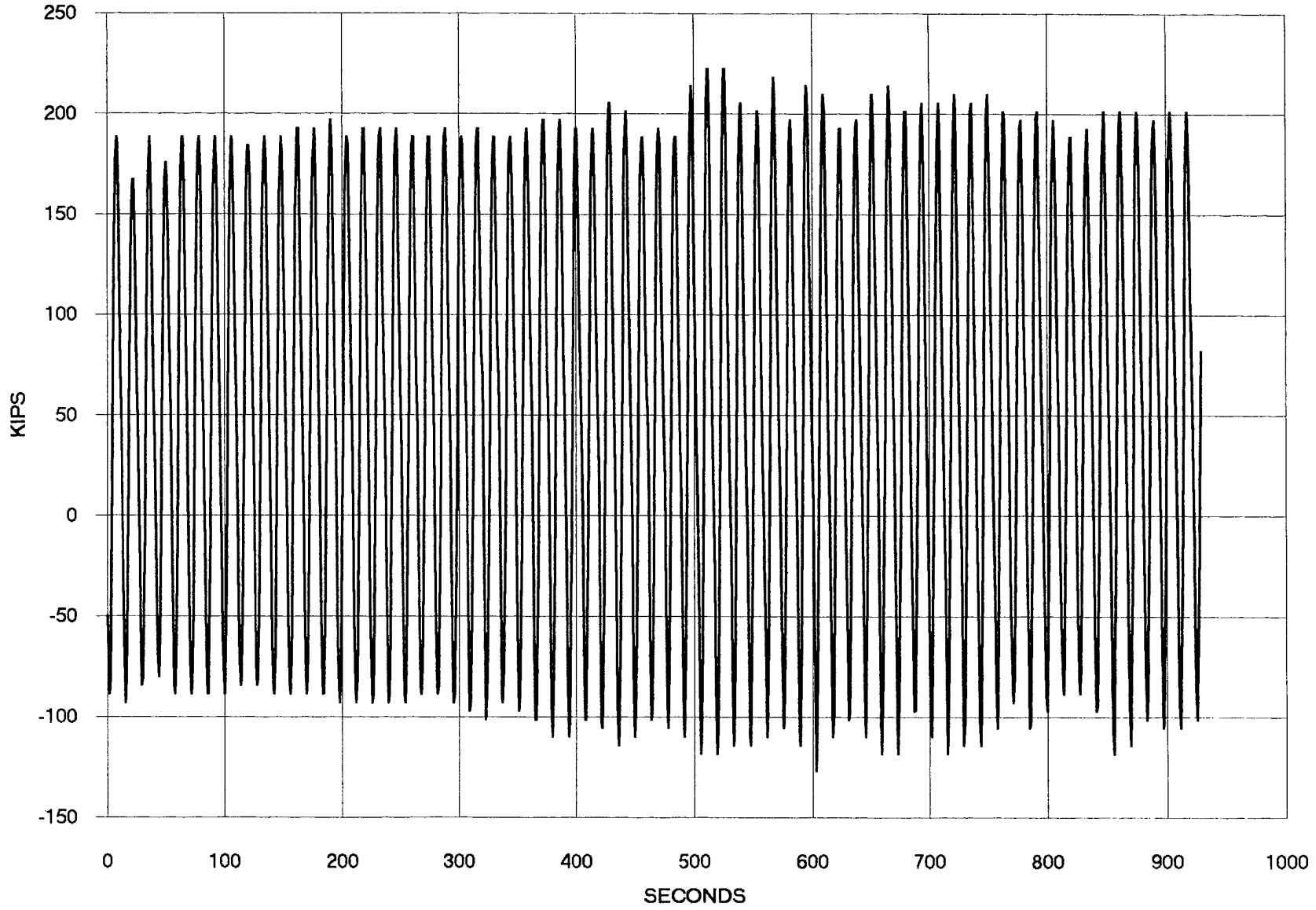

A543 - BT-3 THP (INV. CONE)
600
500
400
300
200
100
0
-100
-200
-300
-400
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

A543 - BT-4 THP (SEGMENTED)

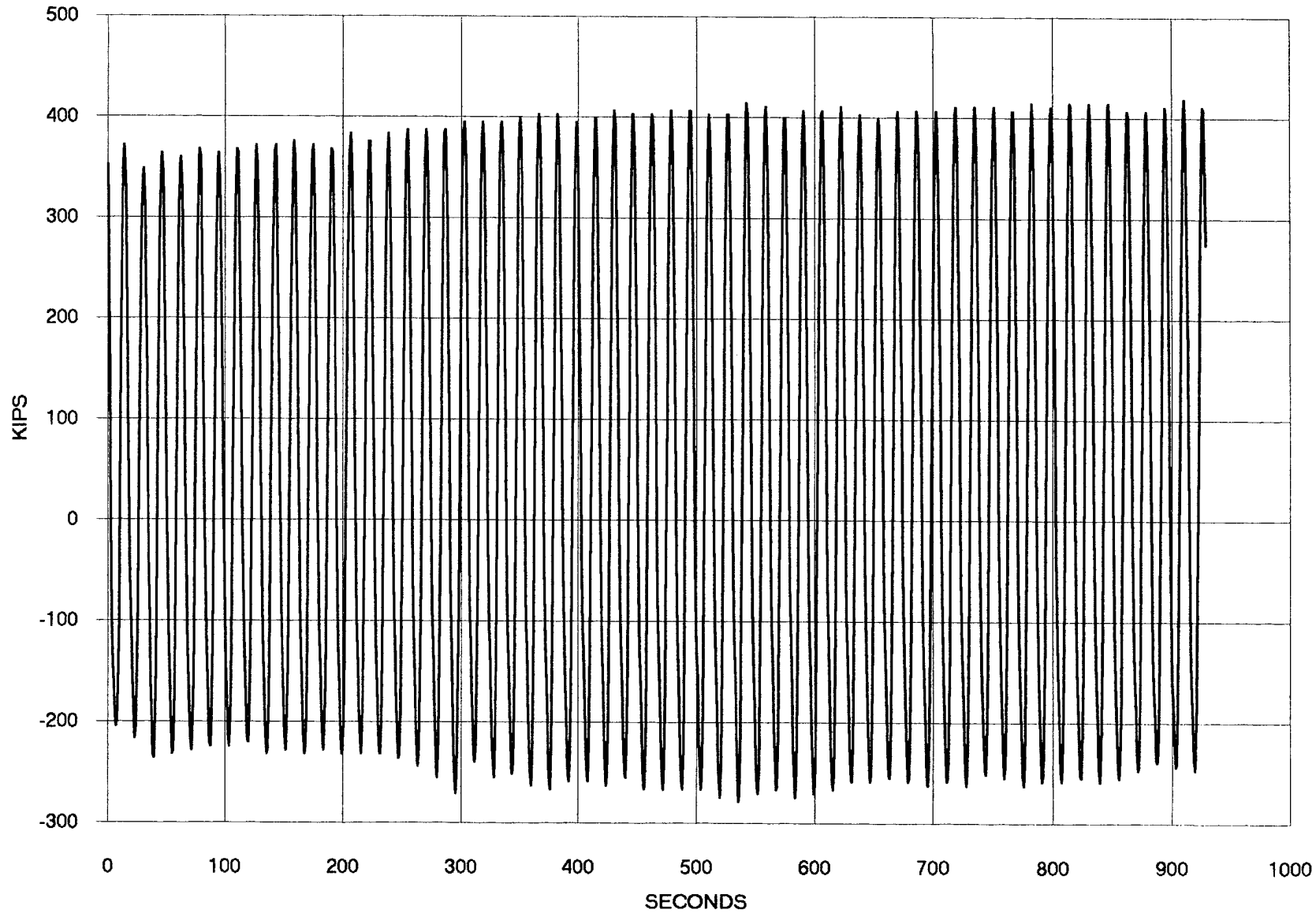


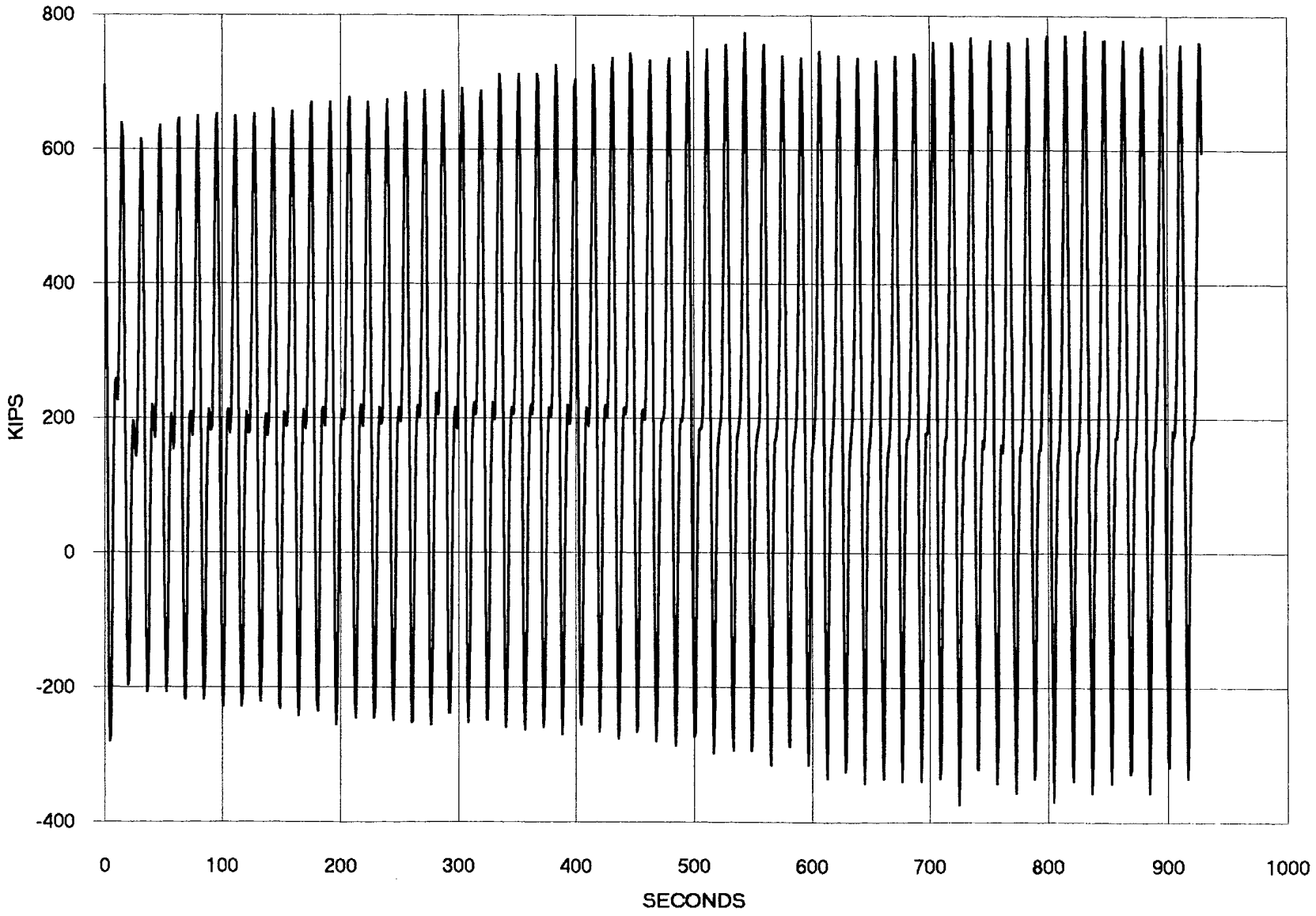

A543 - BT-5 THP (LINK BUOY)
500
400
300
200
100
0
-100
-200
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

A543 - BT-6 THP (HOUR GLASS)

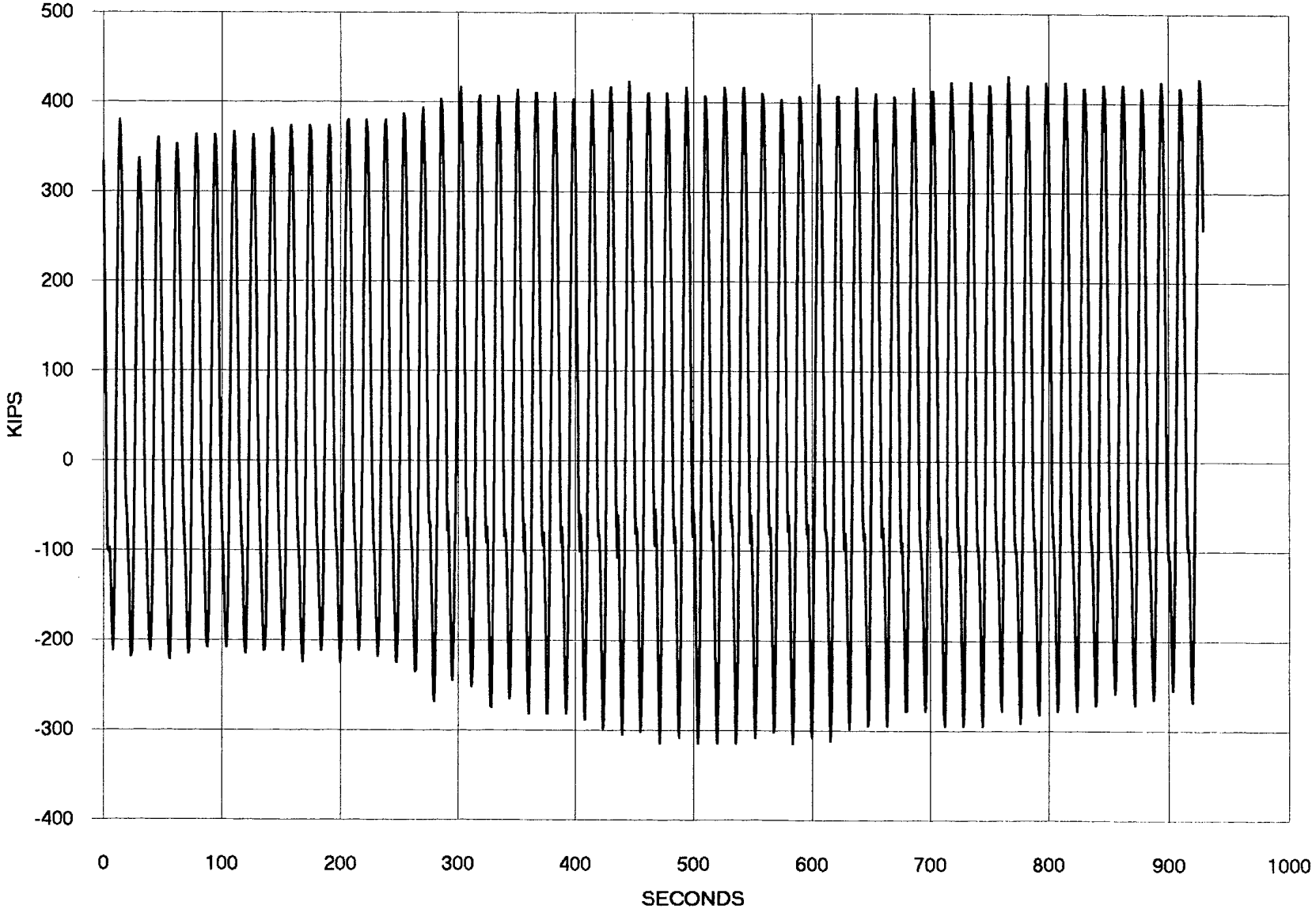


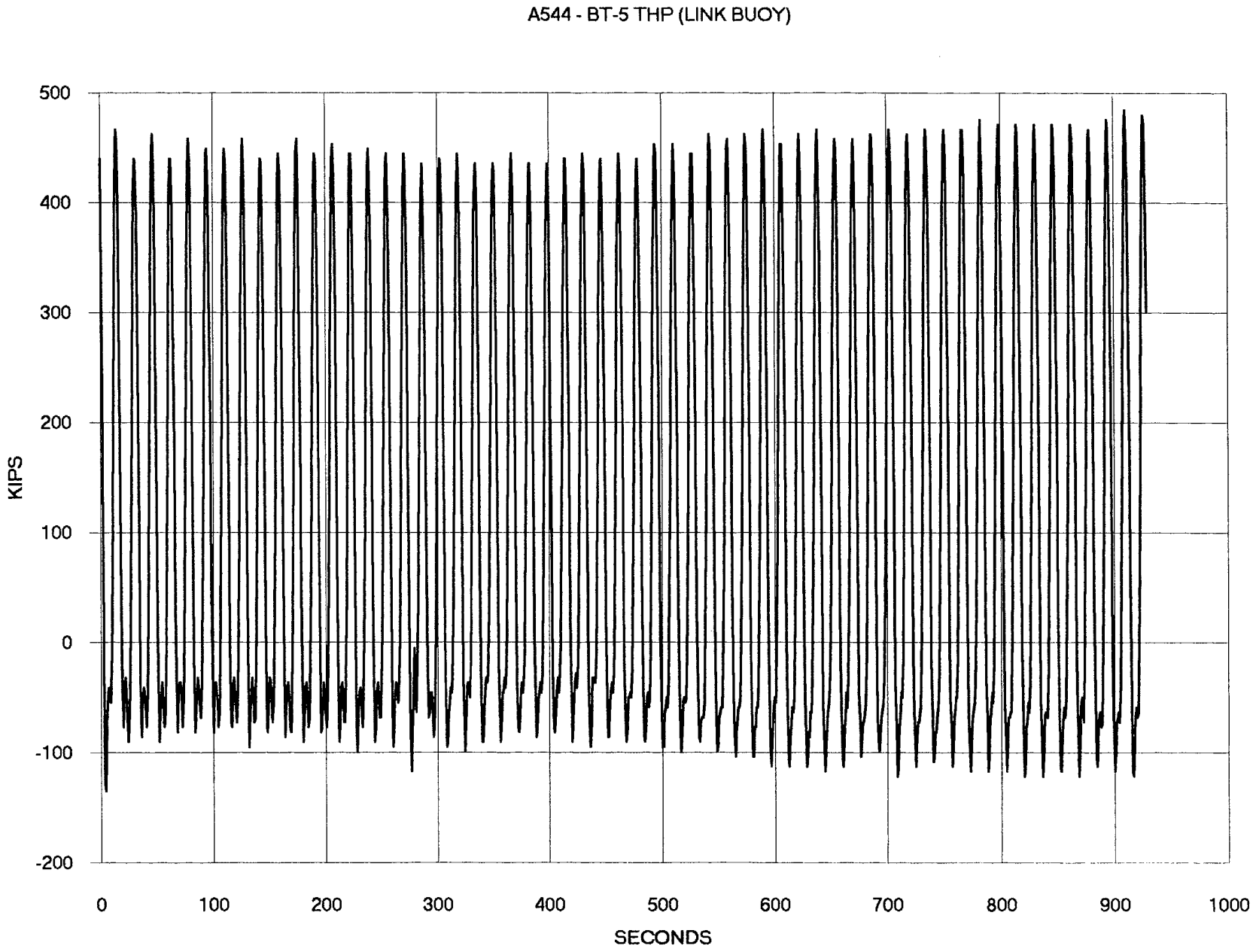
A544 - BT-1 THP (DRY)

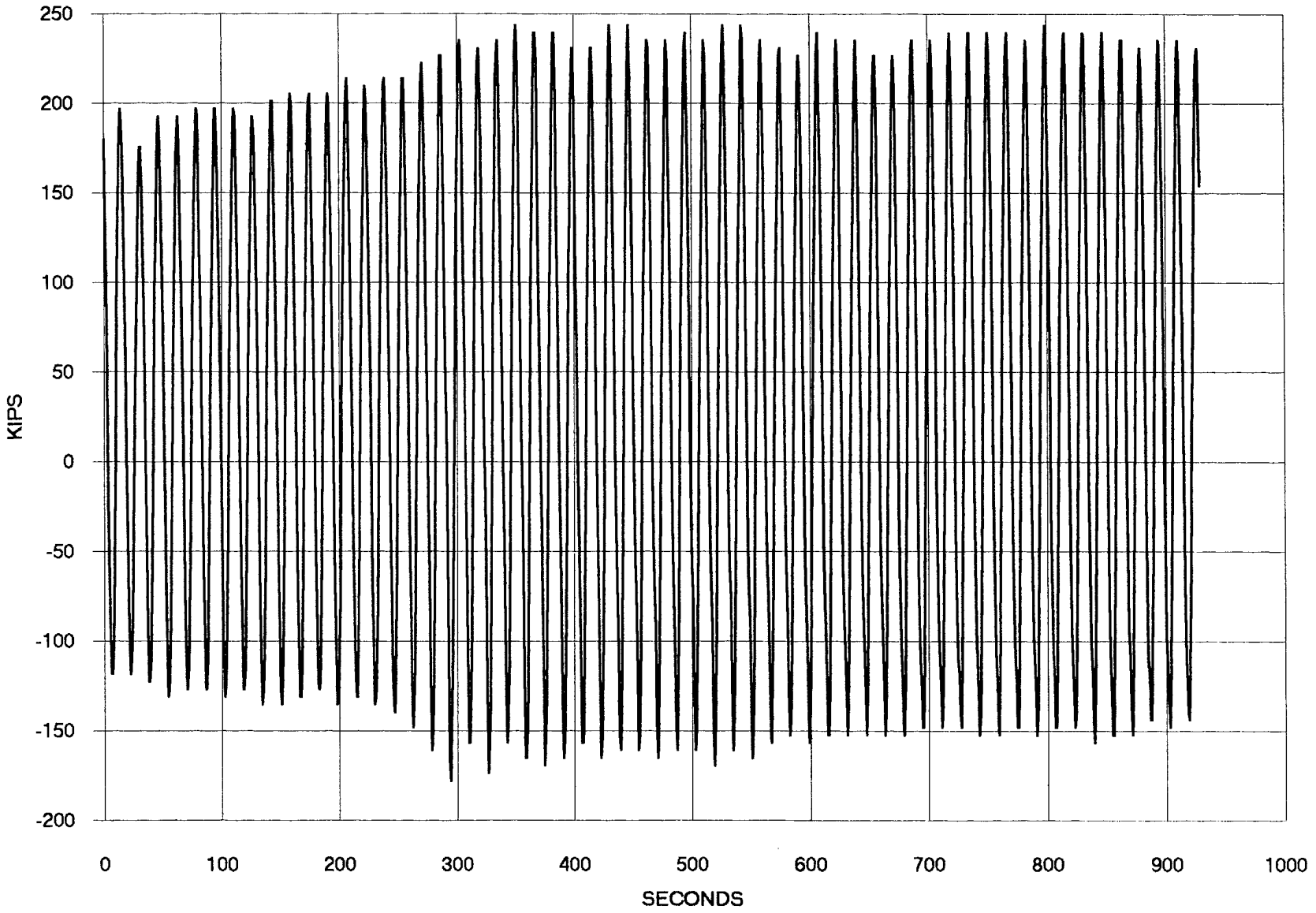


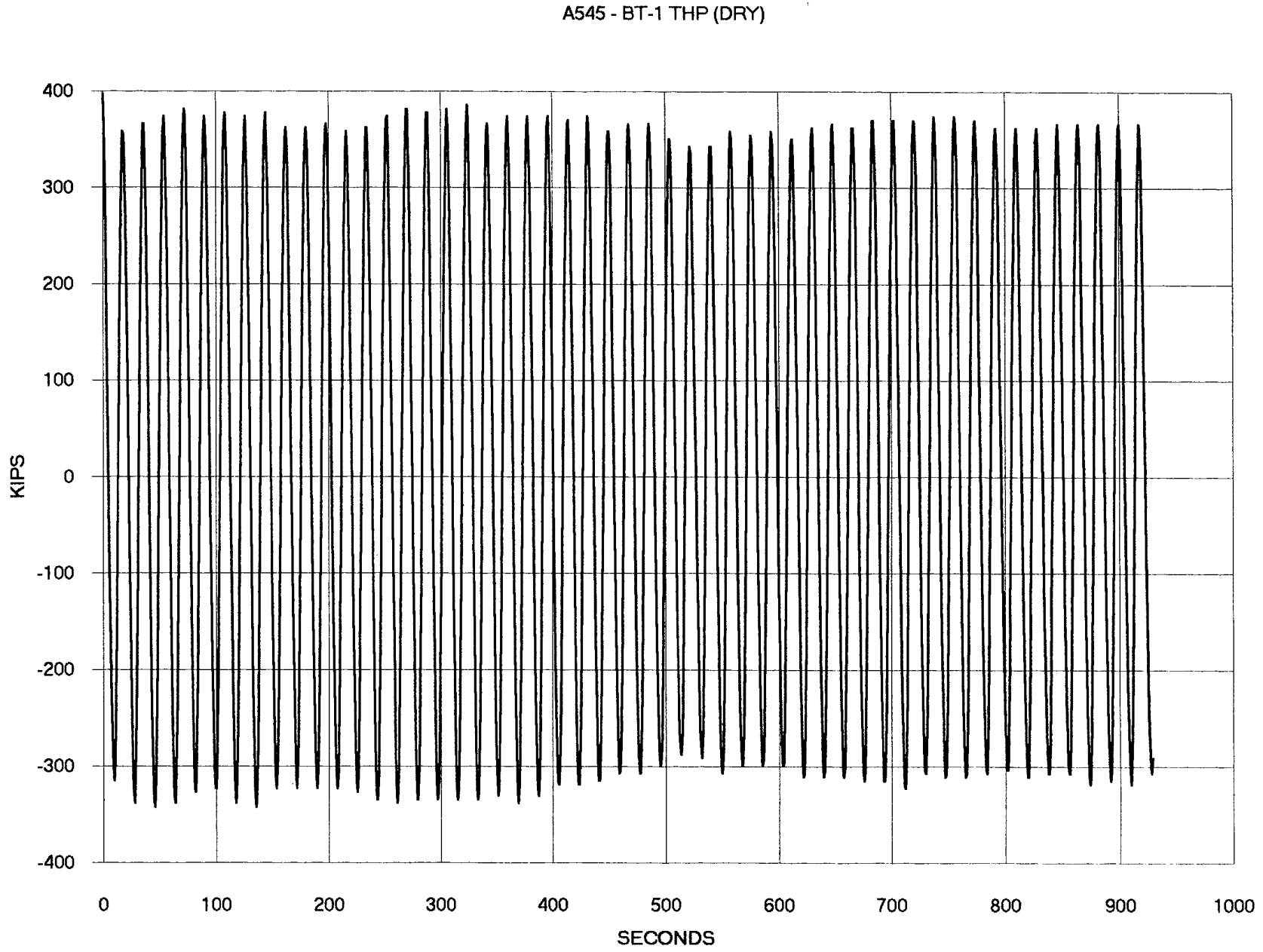

A544 - BT-3 THP (INV. CONE)
800
600
400
200
0
-200
-400
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

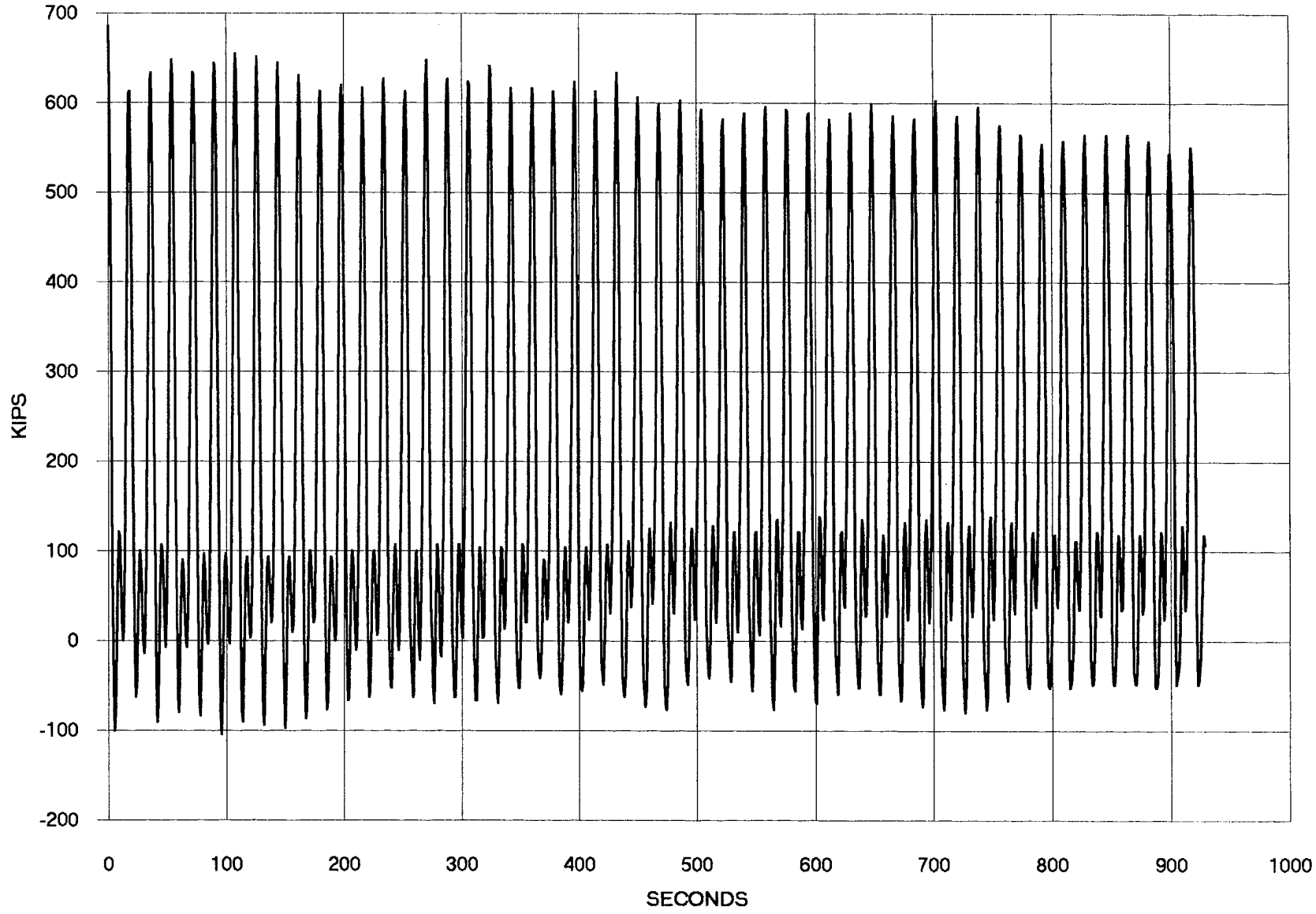
A544 - BT-4 THP (SEGMENTED)



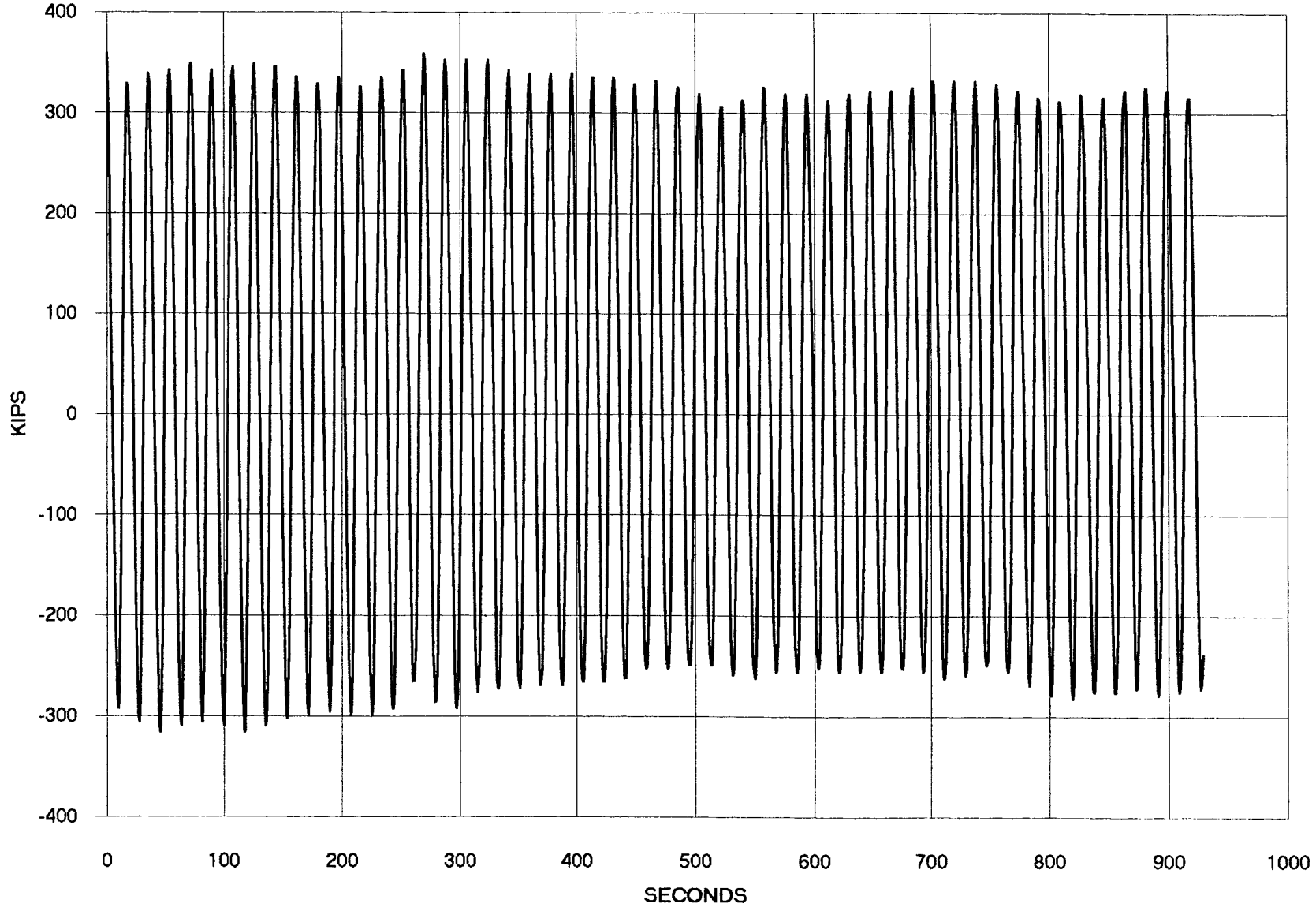

A544 - BT-5 THP (LINK BUOY)
500
400
300
200
100
0
-100
-200
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS


A544 - BT-6 THP (HOUR GLASS)
250
200
150
100
50
0
-50
-100
-150
-200
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

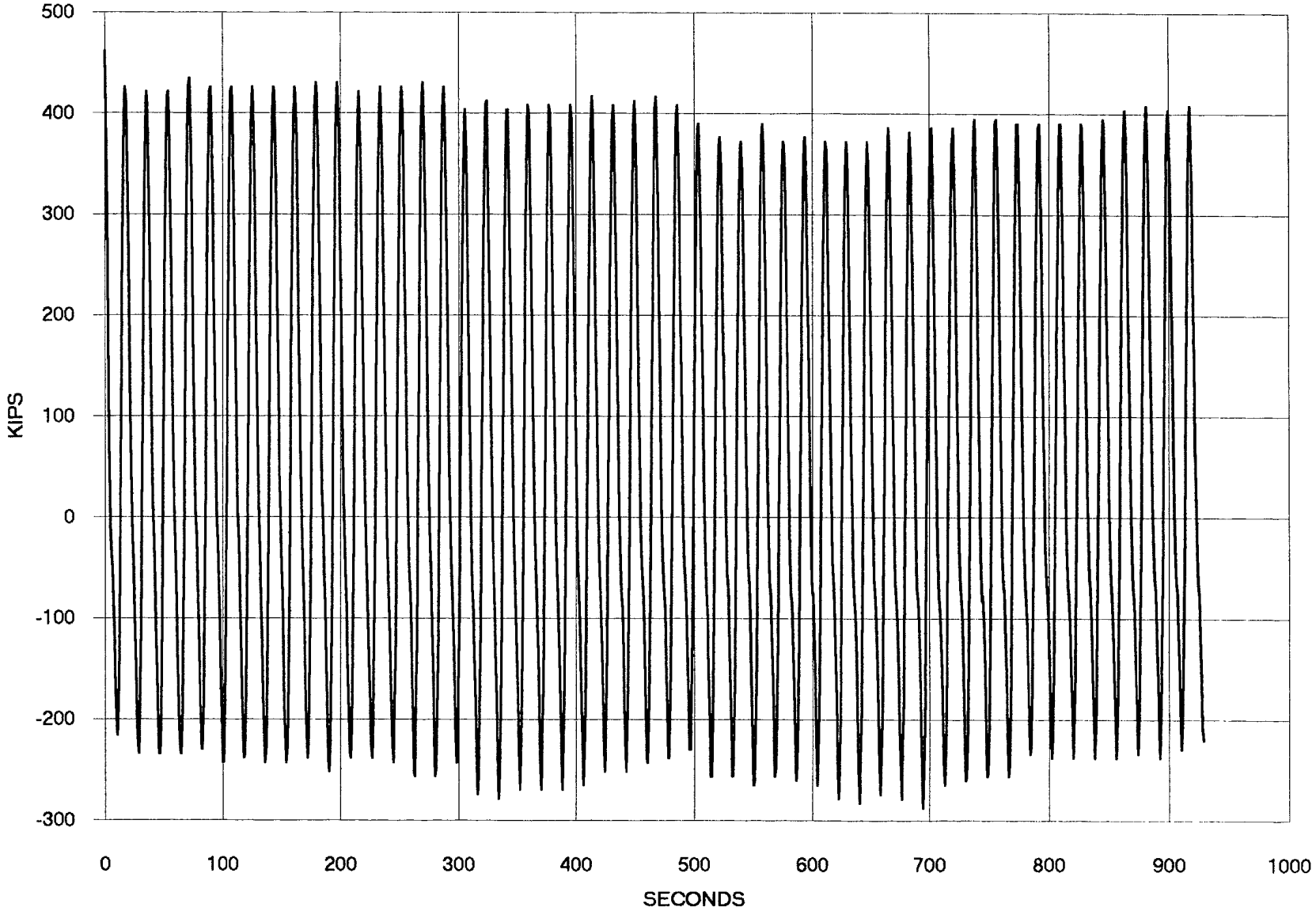

A545 - BT-1 THP (DRY)
400
300
200
100
0
-100
-200
-300
-400
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS


A545 - BT-3 THP (INV. CONE)
700
600
500
400
300
200
100
0
-100
-200
KIPS
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

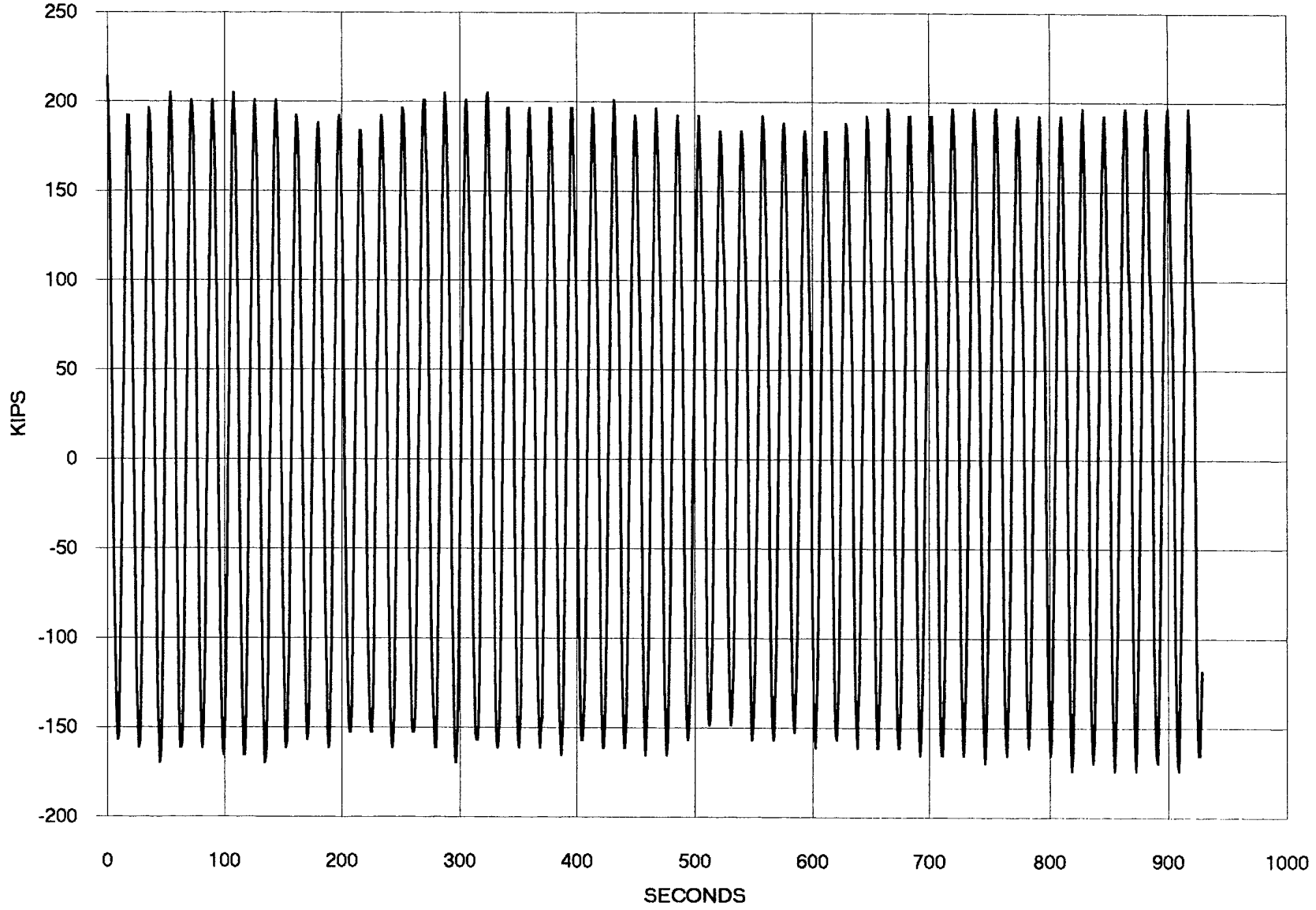
A545 - BT-4 THP (SEGMENTED)

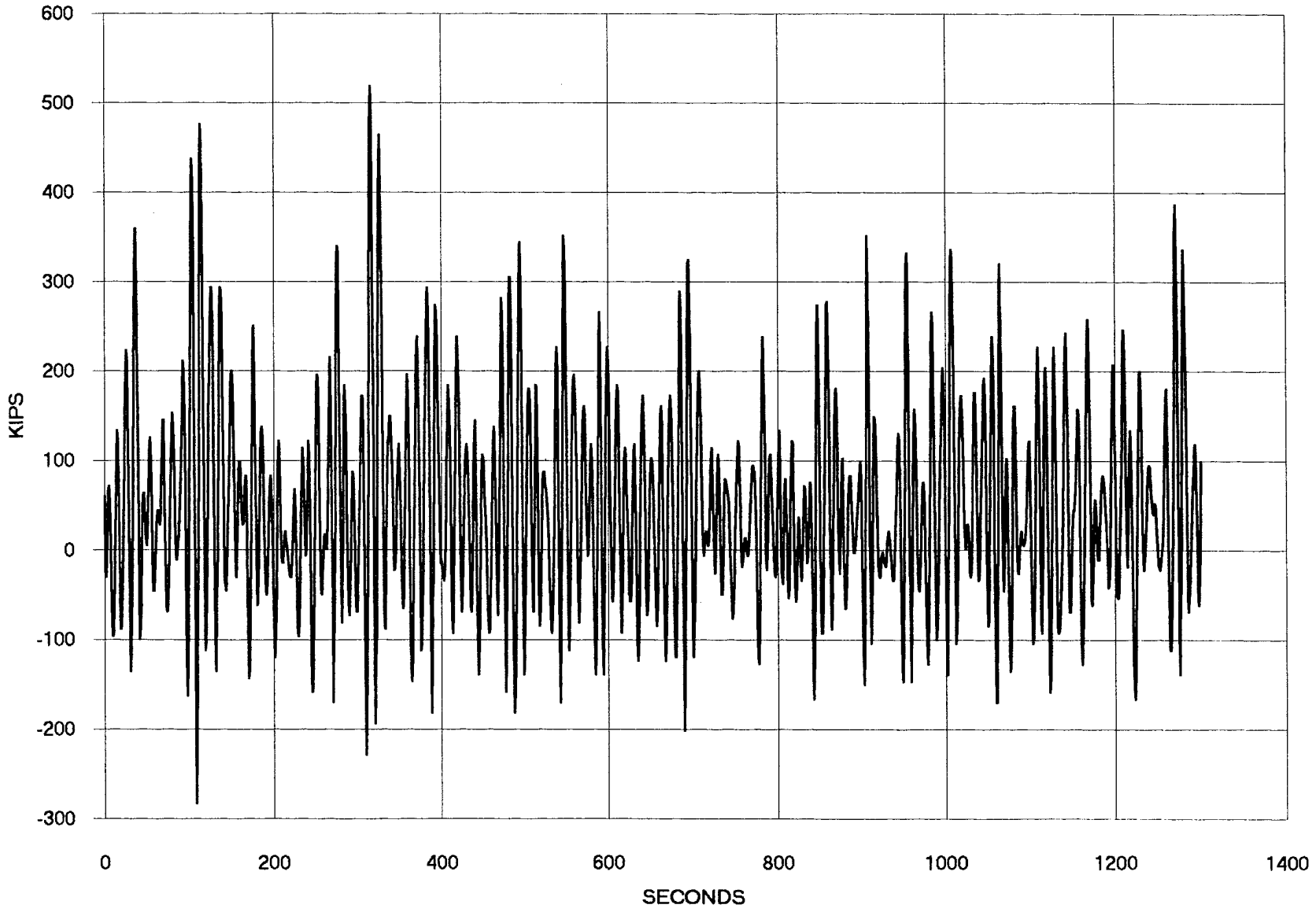


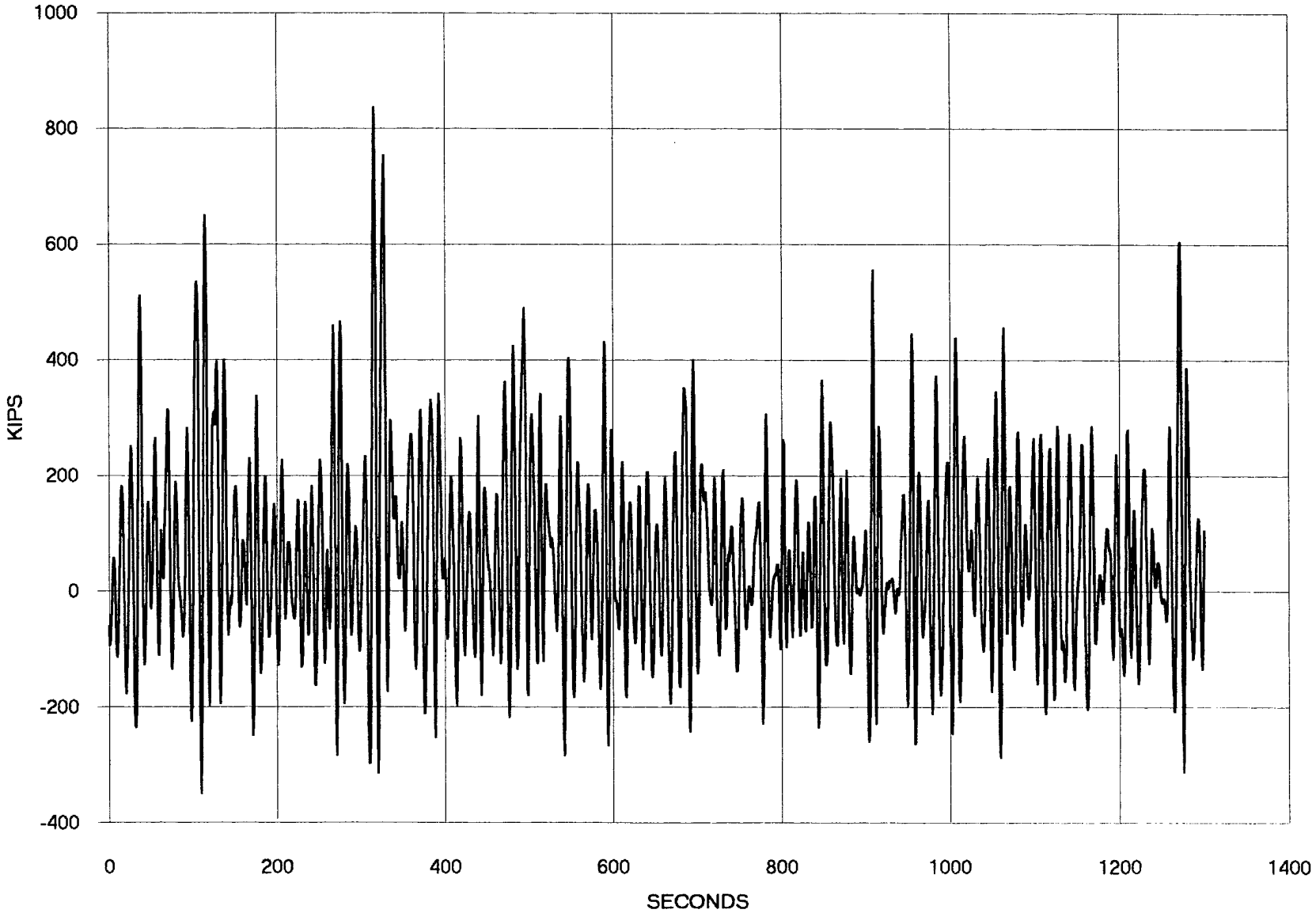
A545 - BT-5 THP (LINK BUOY)

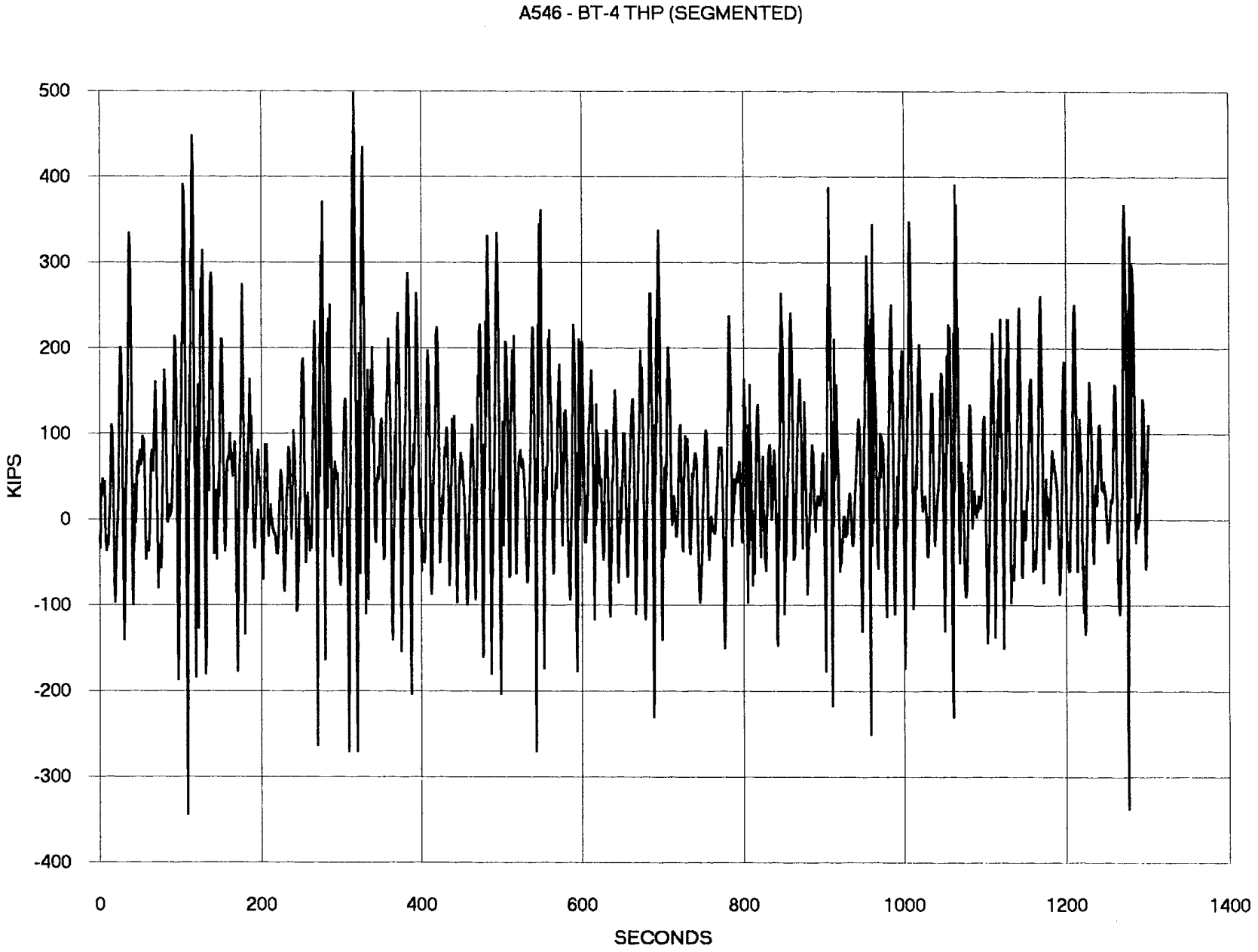


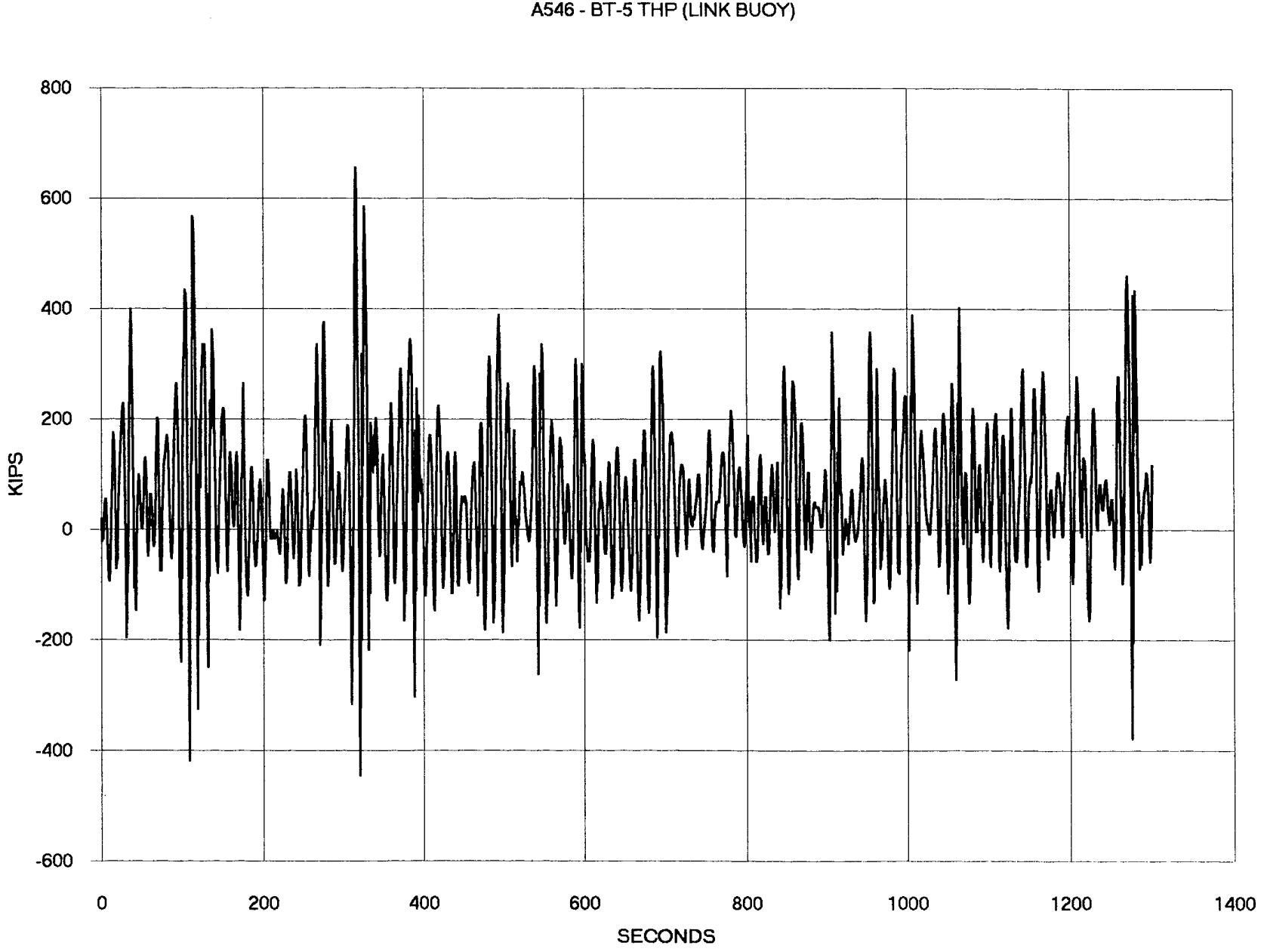
A545 - BT-6 THP (HOUR GLASS)



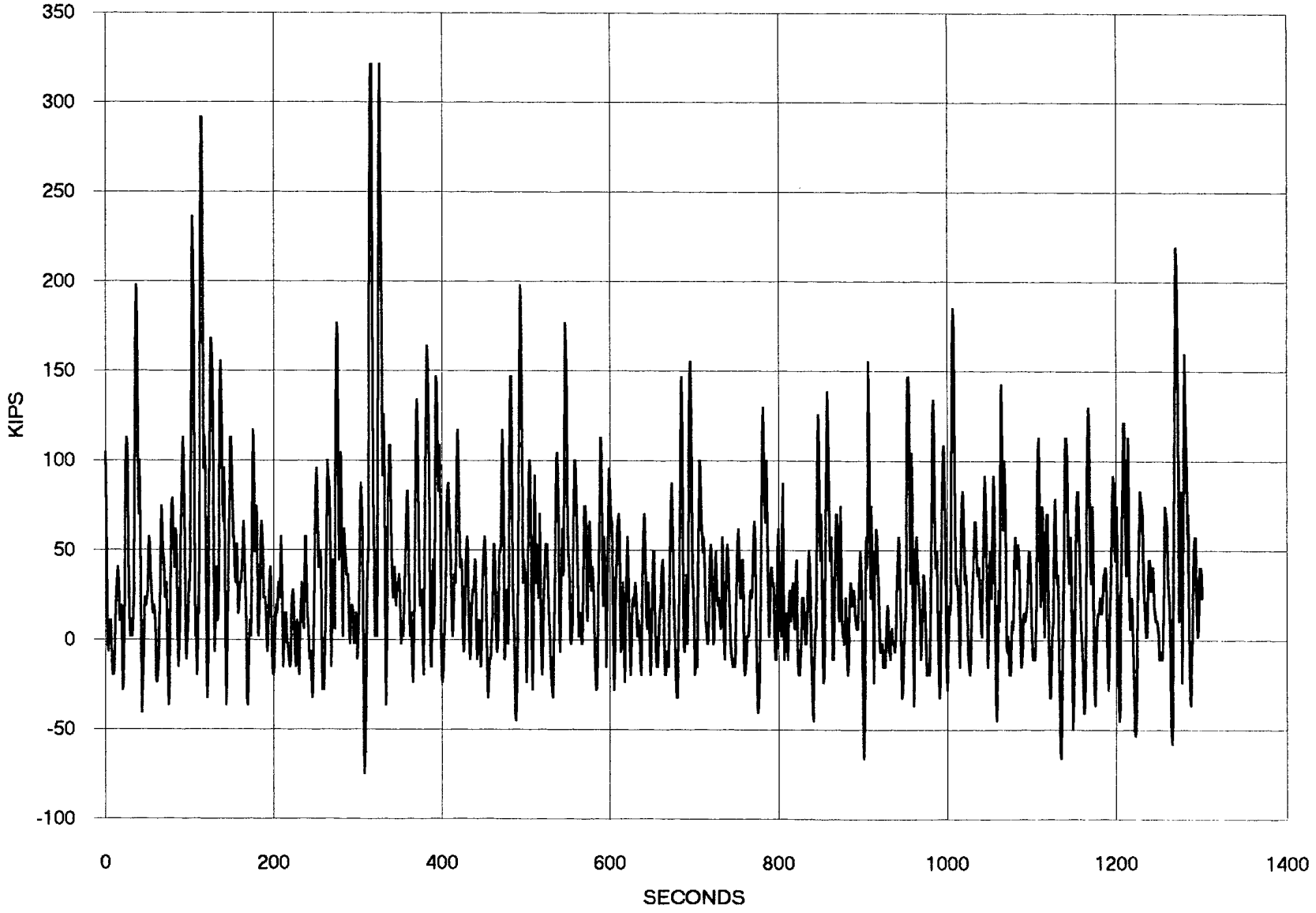

A546 - BT-1 THP (DRY)
600
500
400
300
200
100
0
-100
-200
-300
KIPS
0
200
400
600
800
1000
1200
1400
SECONDS

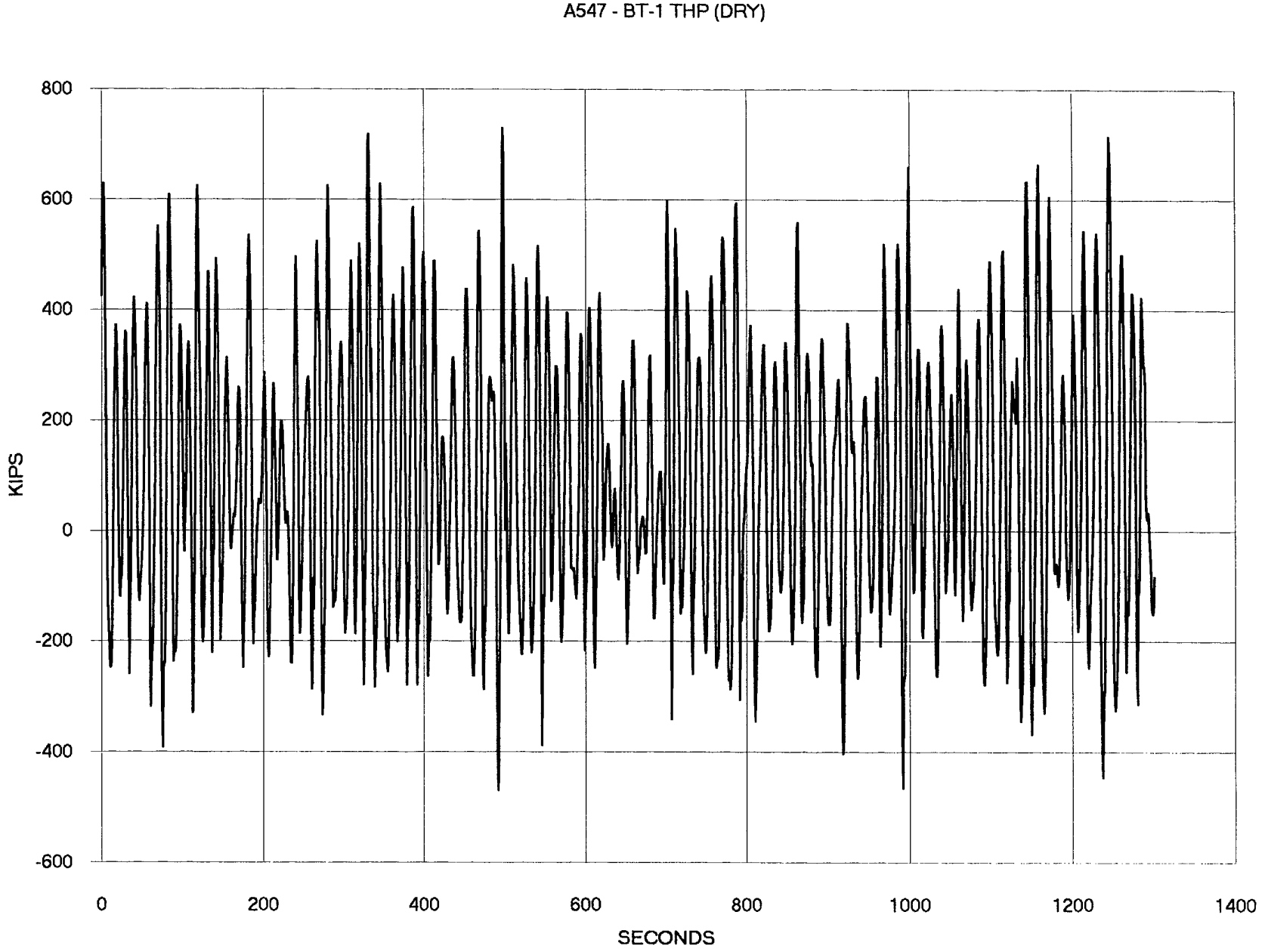

A546 - BT-3 THP (INV. CONE)
1000
800
600
400
200
0
-200
-400
KIPS
0
200
400
600
800
1000
1200
1400
SECONDS

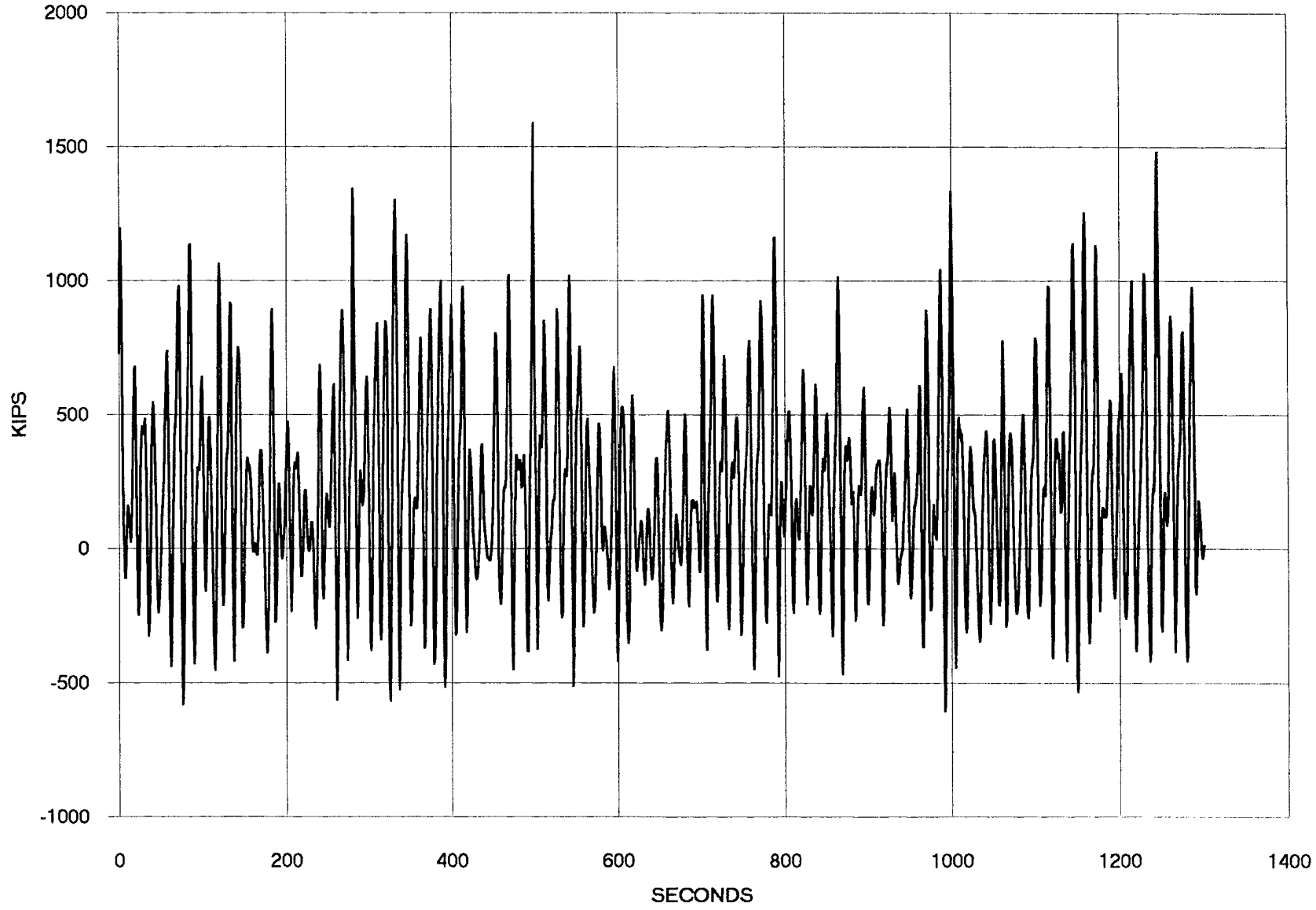

A546 - BT-4 THP (SEGMENTED)
500
400
300
200
100
0
-100
-200
-300
-400
KIPS
0
200
400
600
800
1000
1200
1400
SECONDS

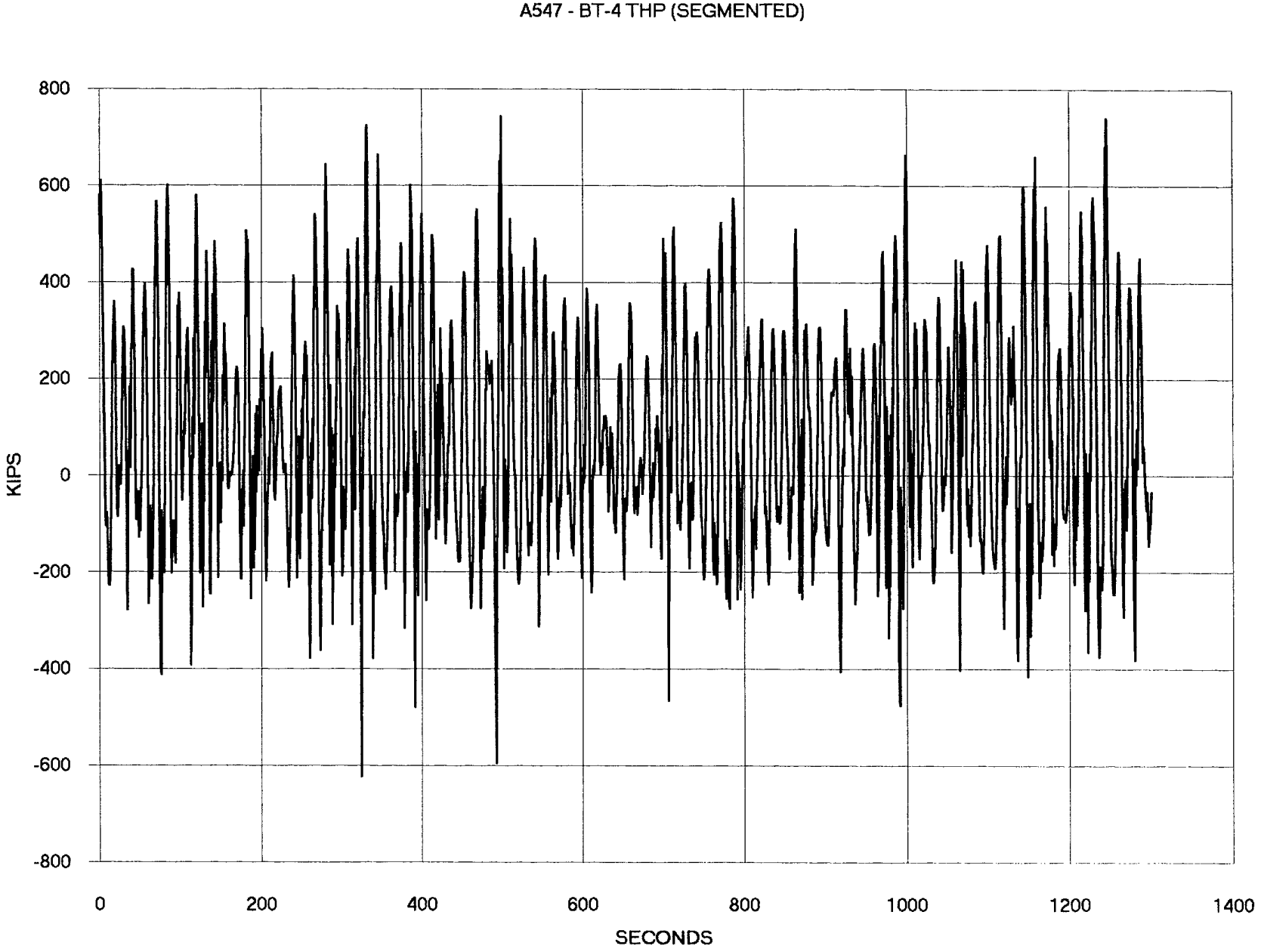

A546 - BT-5 THP (LINK BUOY)
800
600
400
200
0
-200
-400
-600
KIPS
0
200
400
600
800
1000
1200
1400
SECONDS

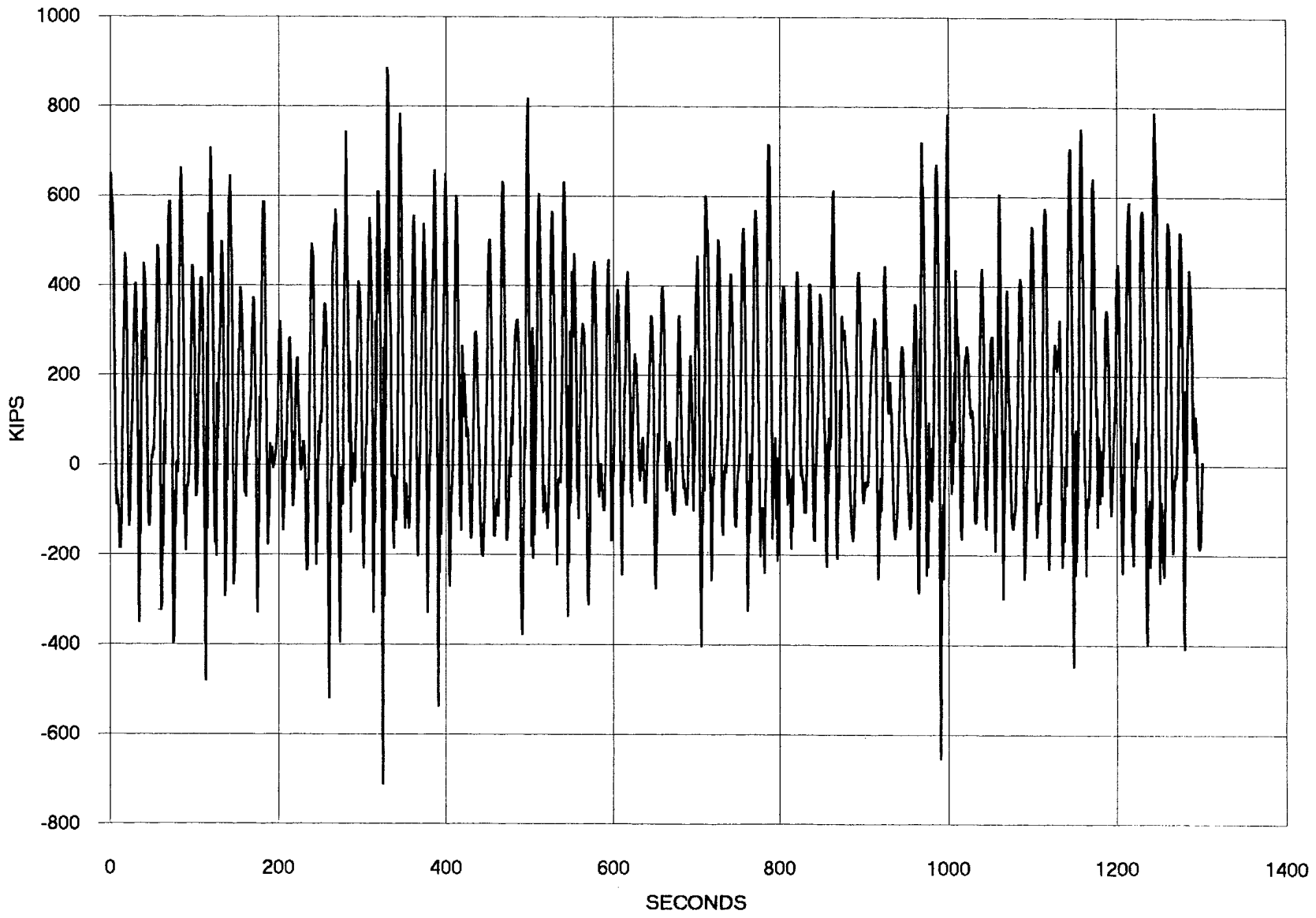
A546 - BT-6 THP (HOUR GLASS)

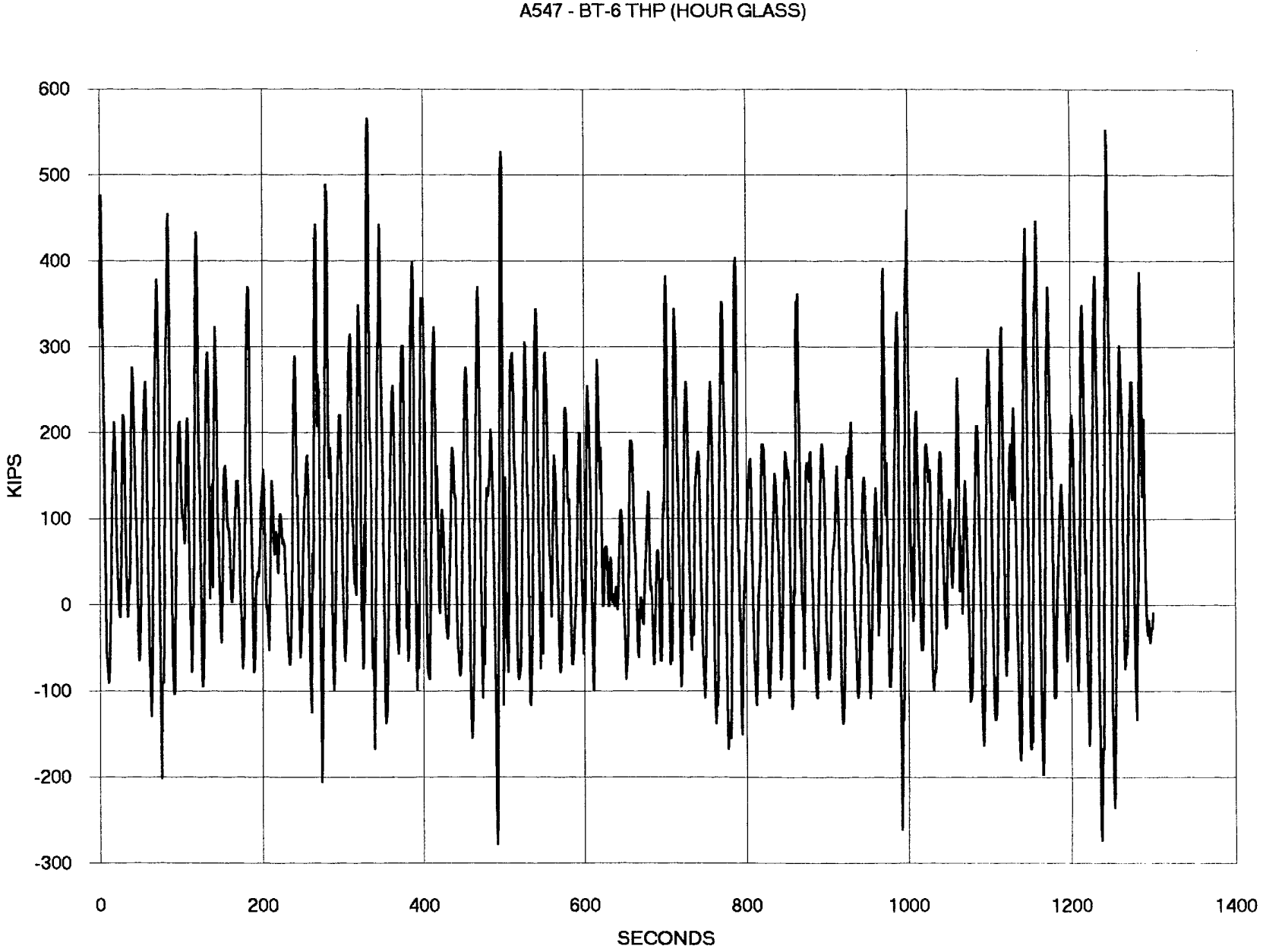



A547 - BT-1 THP (DRY)
800
600
400
200
0
-200
-400
-600
KIPS
0
200
400
600
800
1000
1200
1400
SECONDS


A547 - BT-3 THP (INV. CONE)
2000
1500
1000
500
0
-500
-1000
KIPS
0
200
400
600
800
1000
1200
1400
SECONDS


A547 - BT-4 THP (SEGMENTED)
800
600
400
200
0
-200
-400
-600
-800
KIPS
0
200
400
600
800
1000
1200
1400
SECONDS

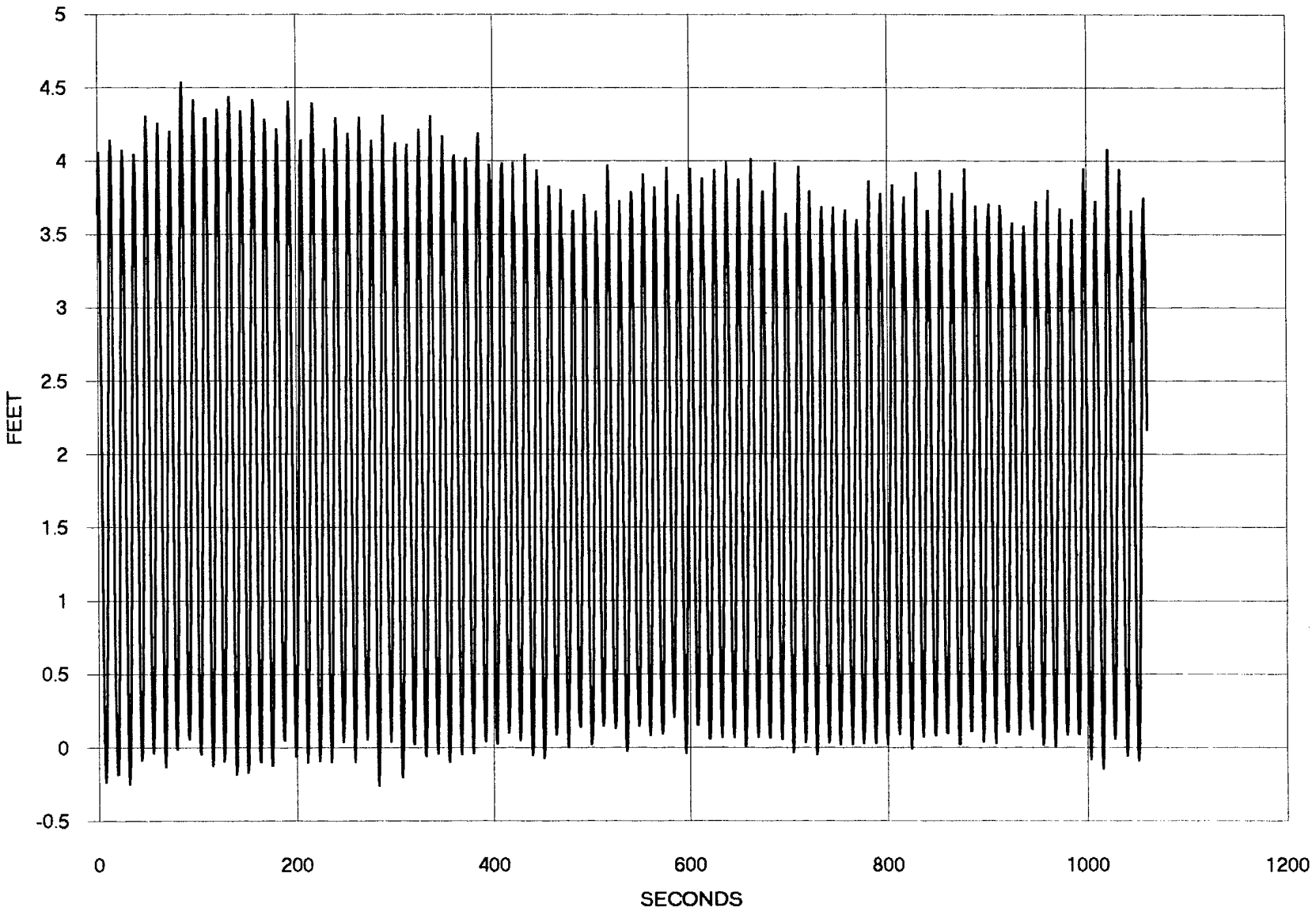

A547 - BT-5 THP (LINK BUOY)
1000
800
600
400
200
0
-200
-400
-600
-800
KIPS
0
200
400
600
800
1000
1200
1400
SECONDS

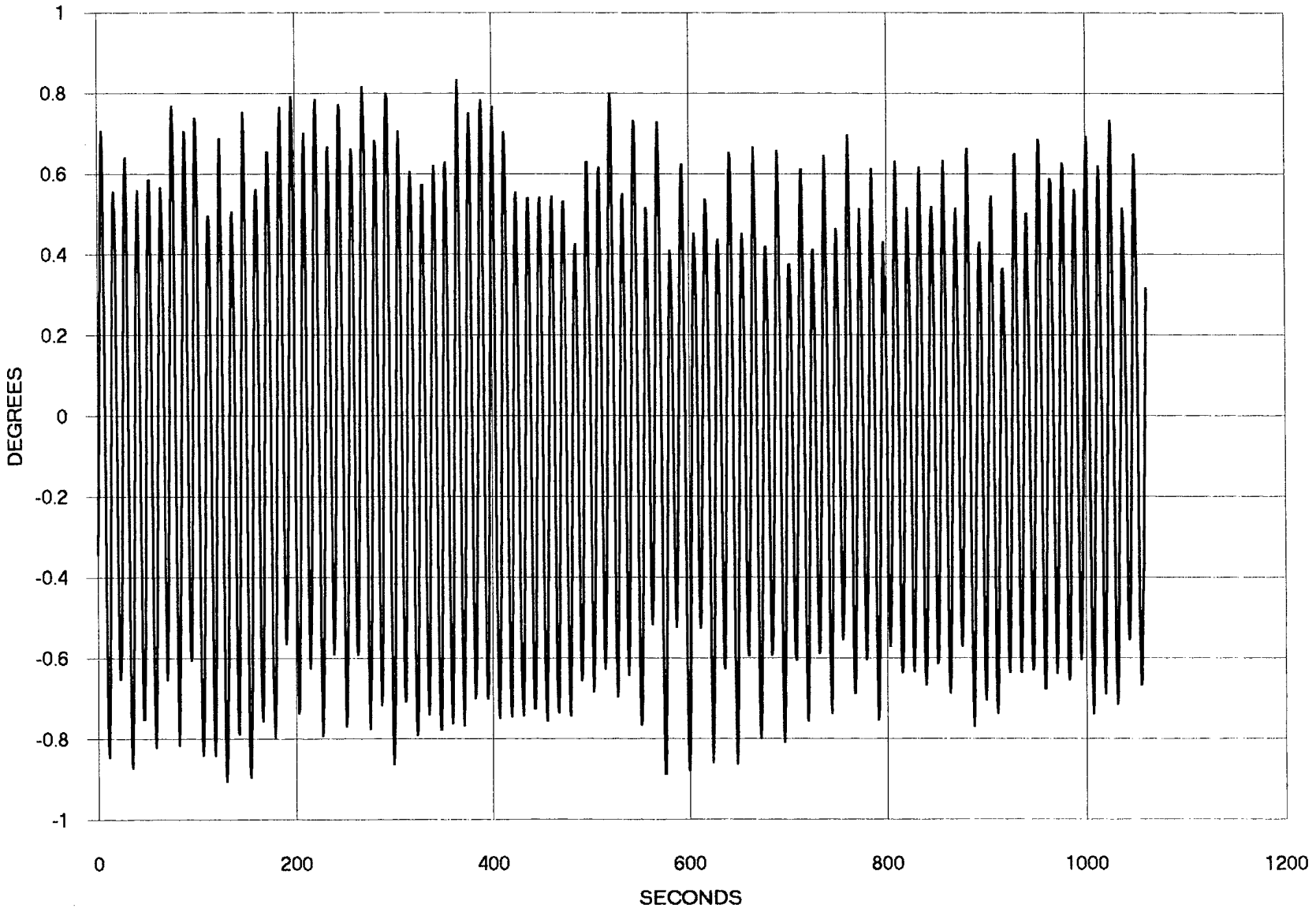

A547 - BT-6 THP (HOUR GLASS)
600
500
400
300
200
100
0
-100
-200
-300
KIPS
0
200
400
600
800
1000
1200
1400
SECONDS

APPENDIX L

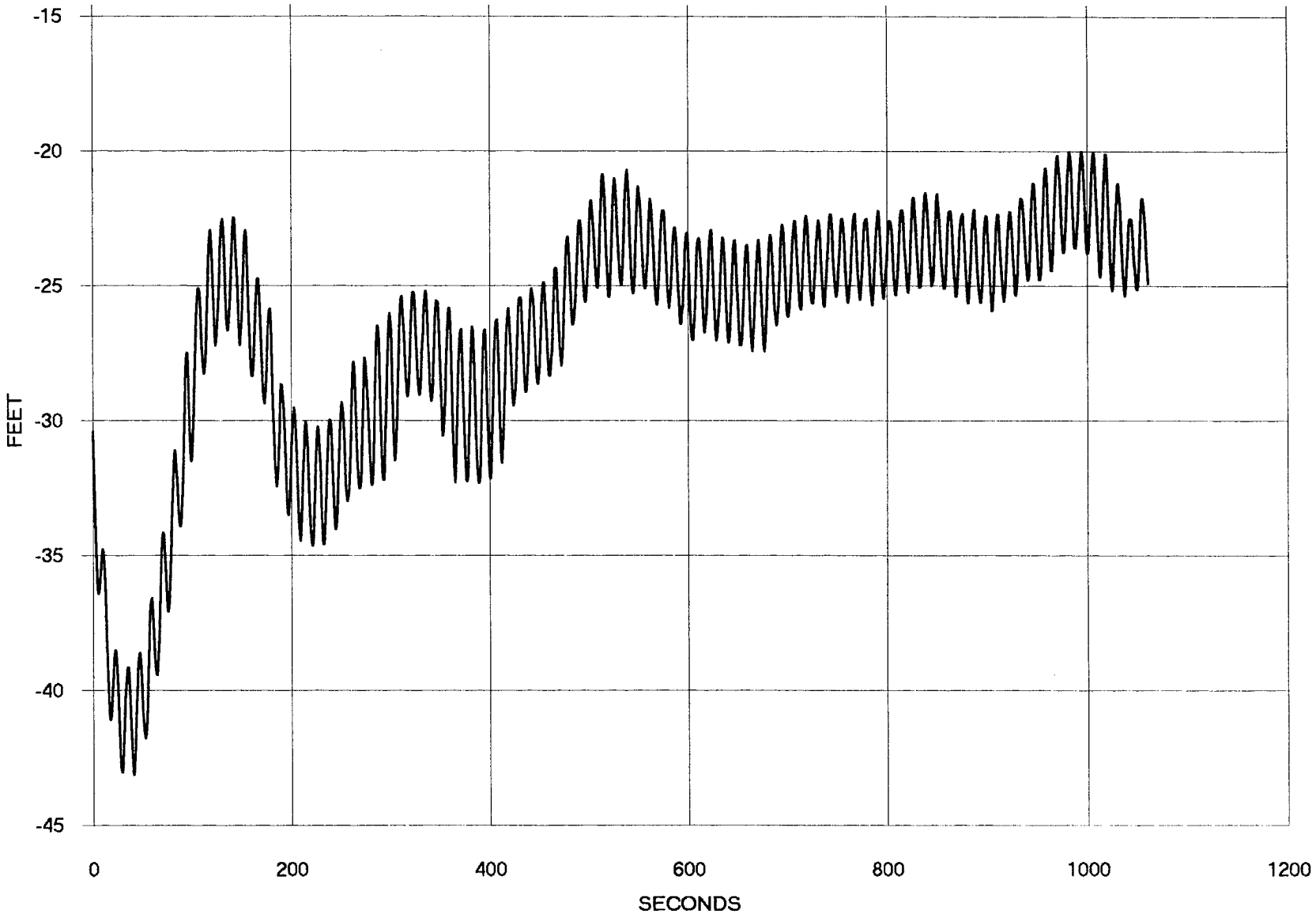
TIME HISTORY PLOTS, SEMI-SUBMERSIBLE SEAKEEPING, HINGED BUOYS

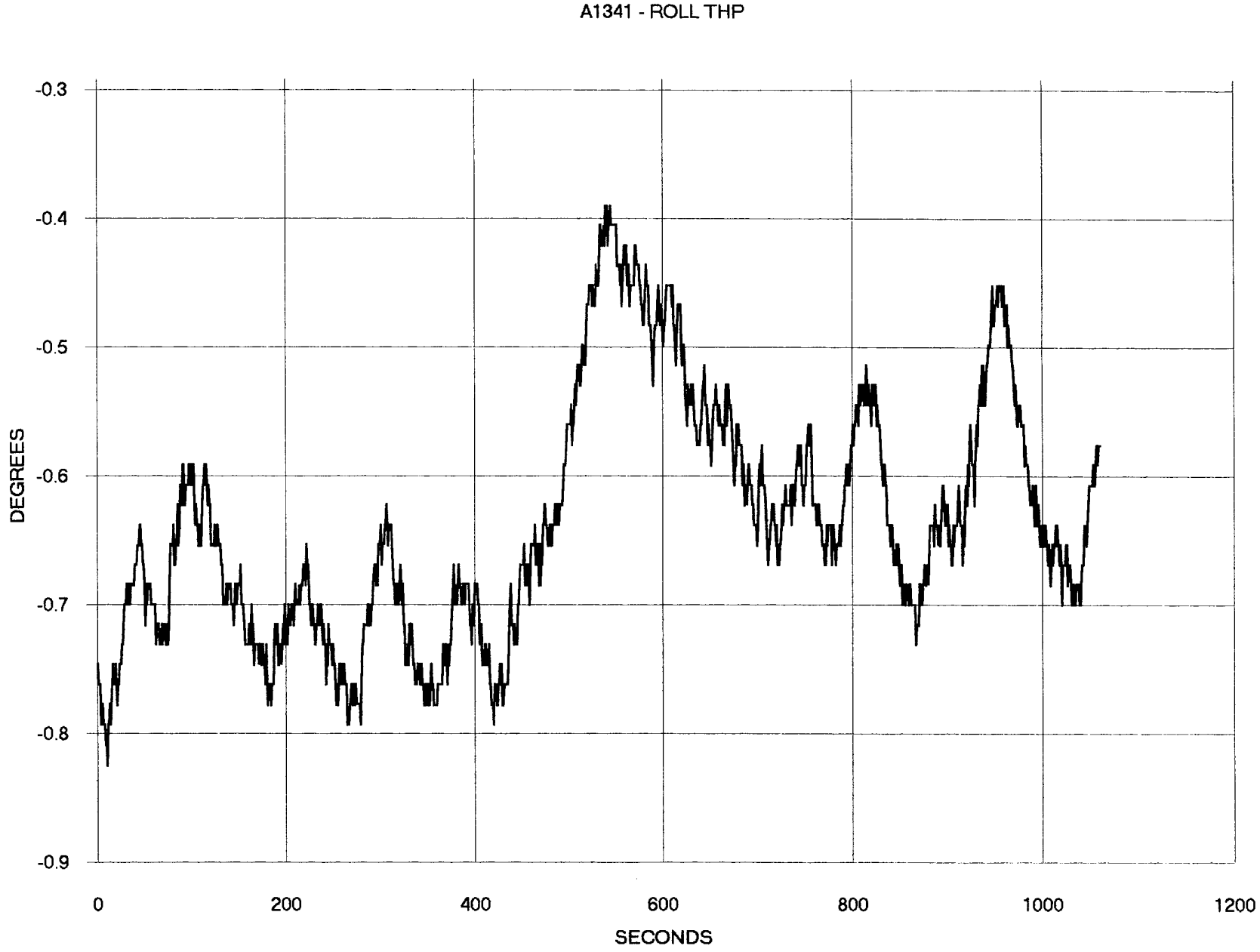
A1341 - HEAVE THP



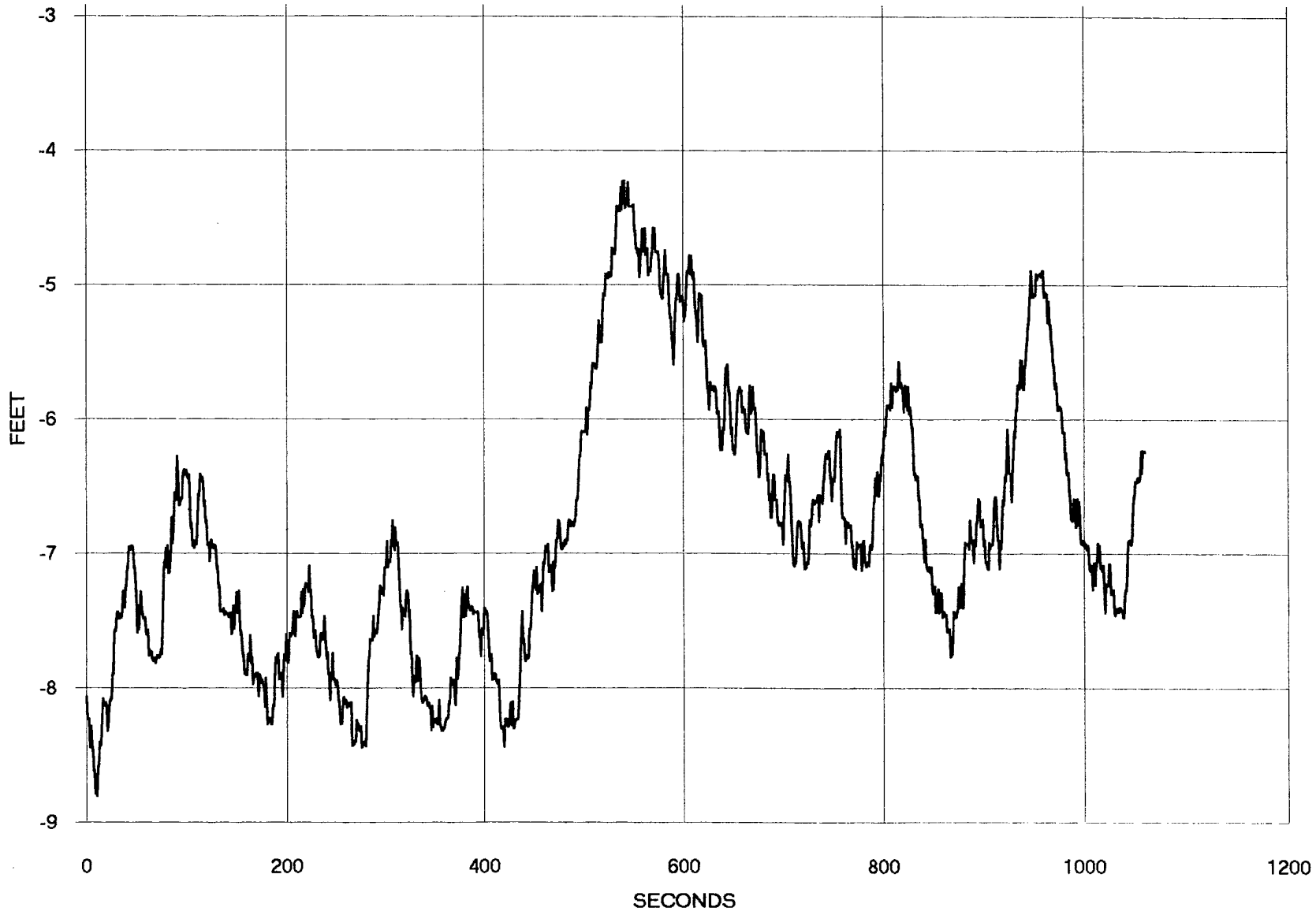

A1341 - PITCH THP
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
DEGREES
0
200
400
600
800
1000
1200
SECONDS

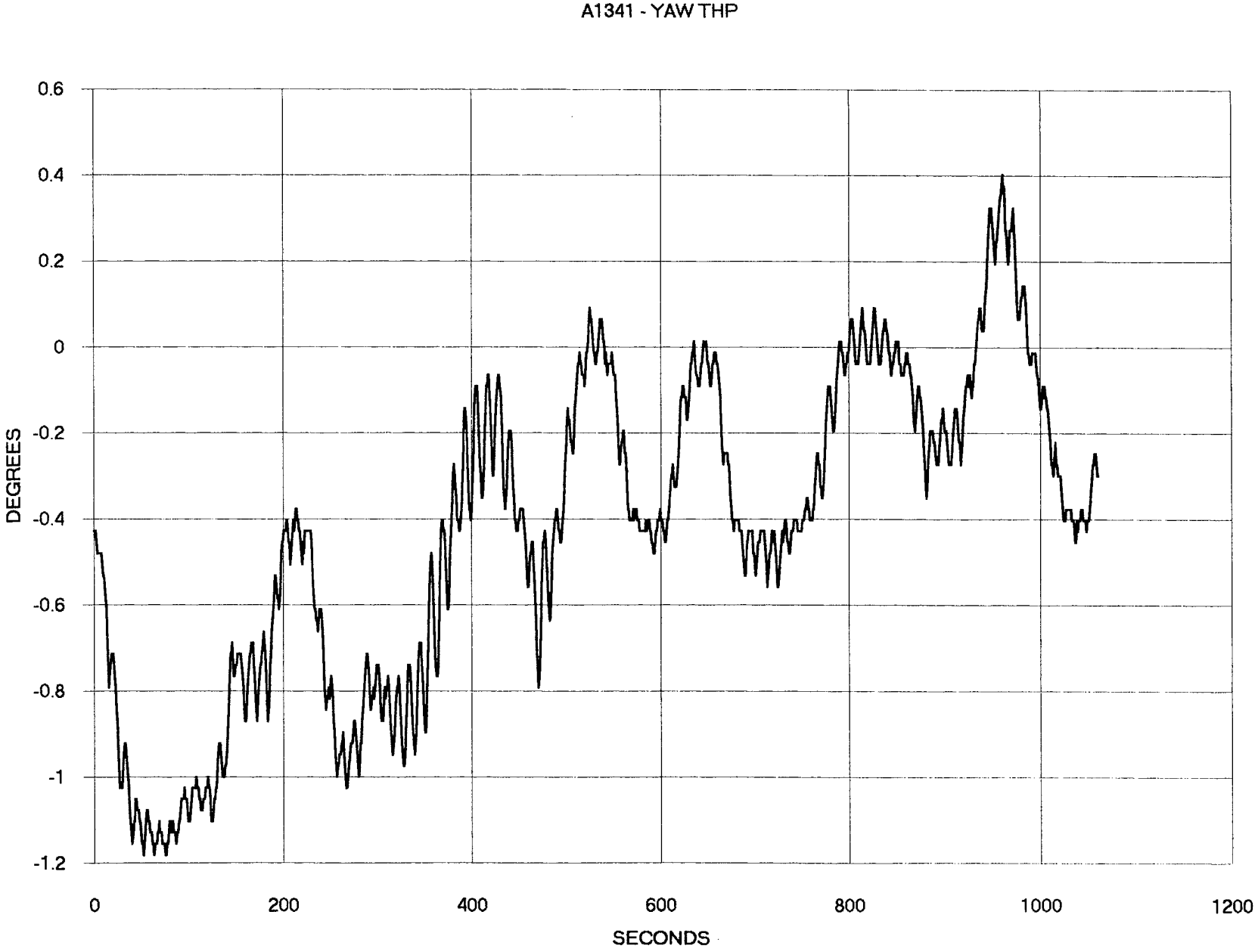
A1341 - SURGE THP



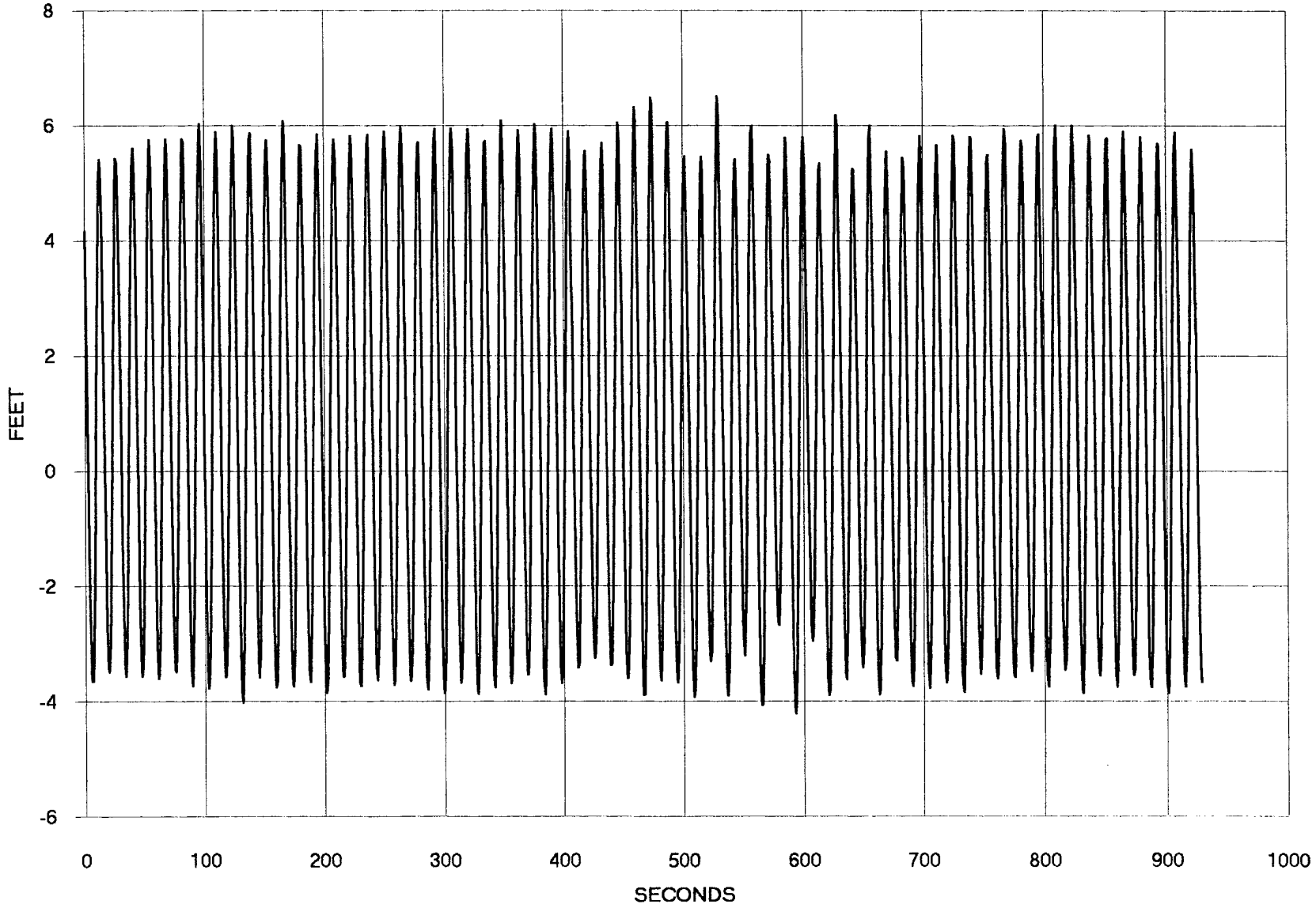

A1341 - ROLL THP
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
DEGREES
0
200
400
600
800
1000
1200
SECONDS

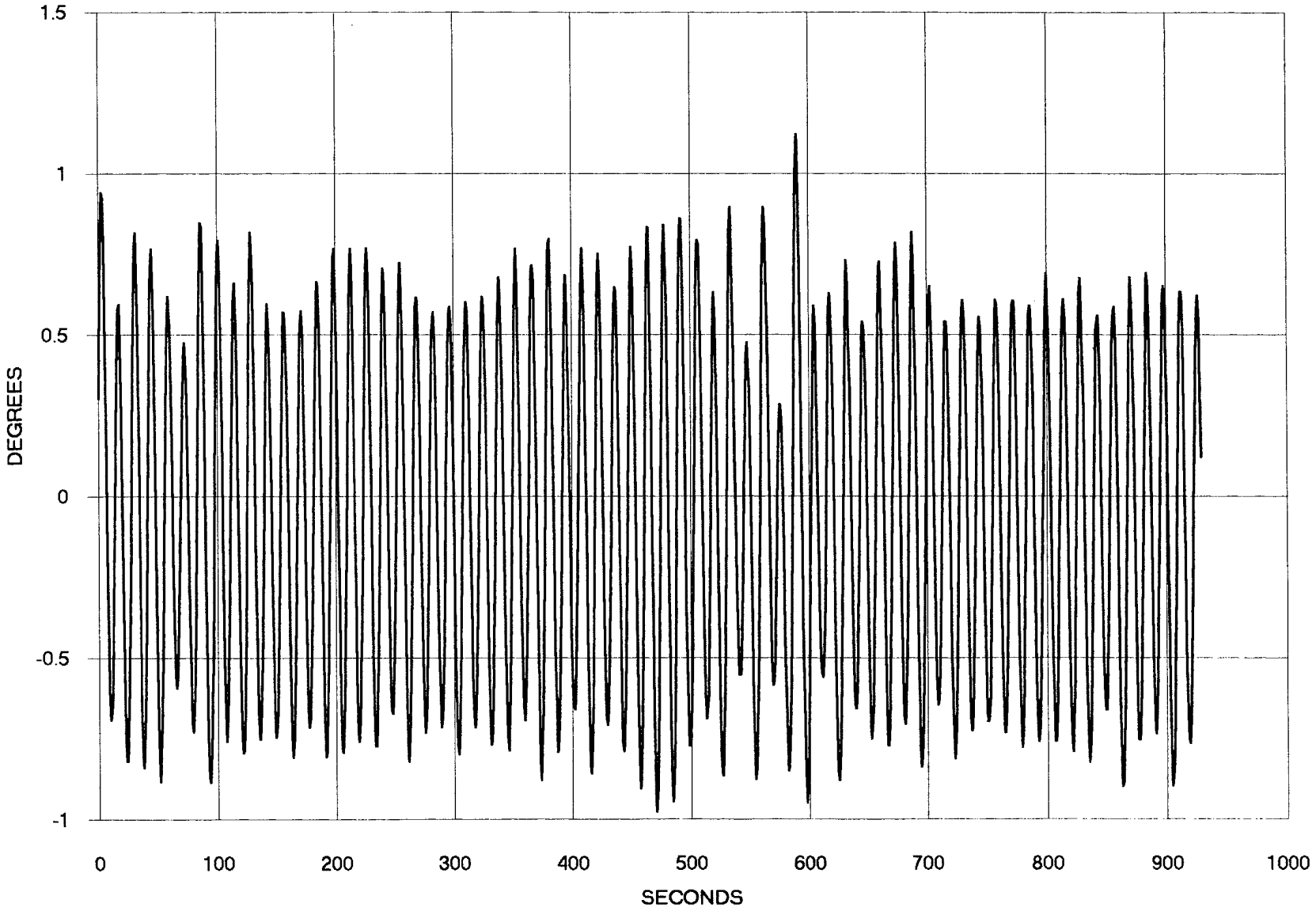
A1341 - SWAY THP



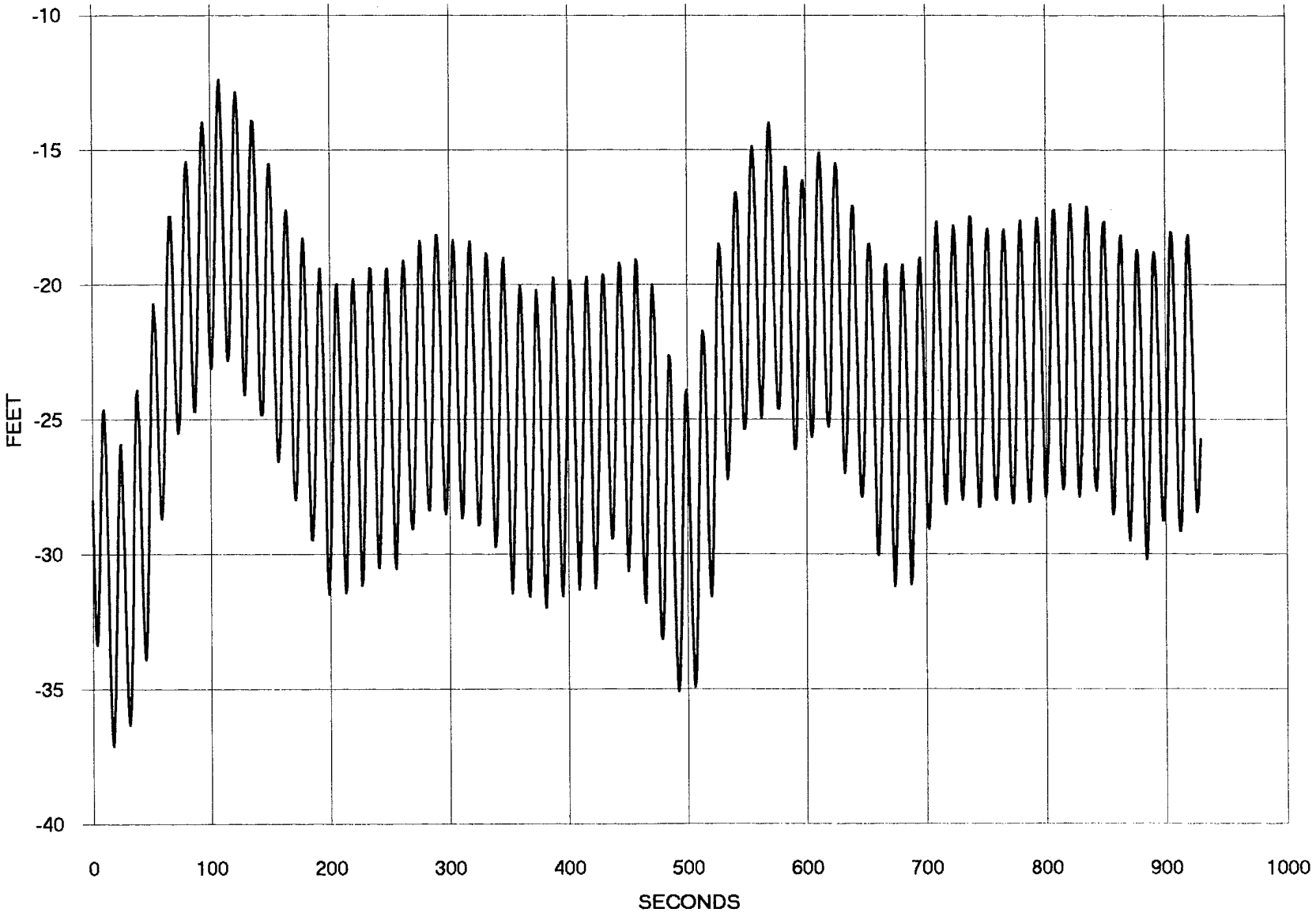

A1341 - YAW THP
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
DEGREES
0
200
400
600
800
1000
1200
SECONDS

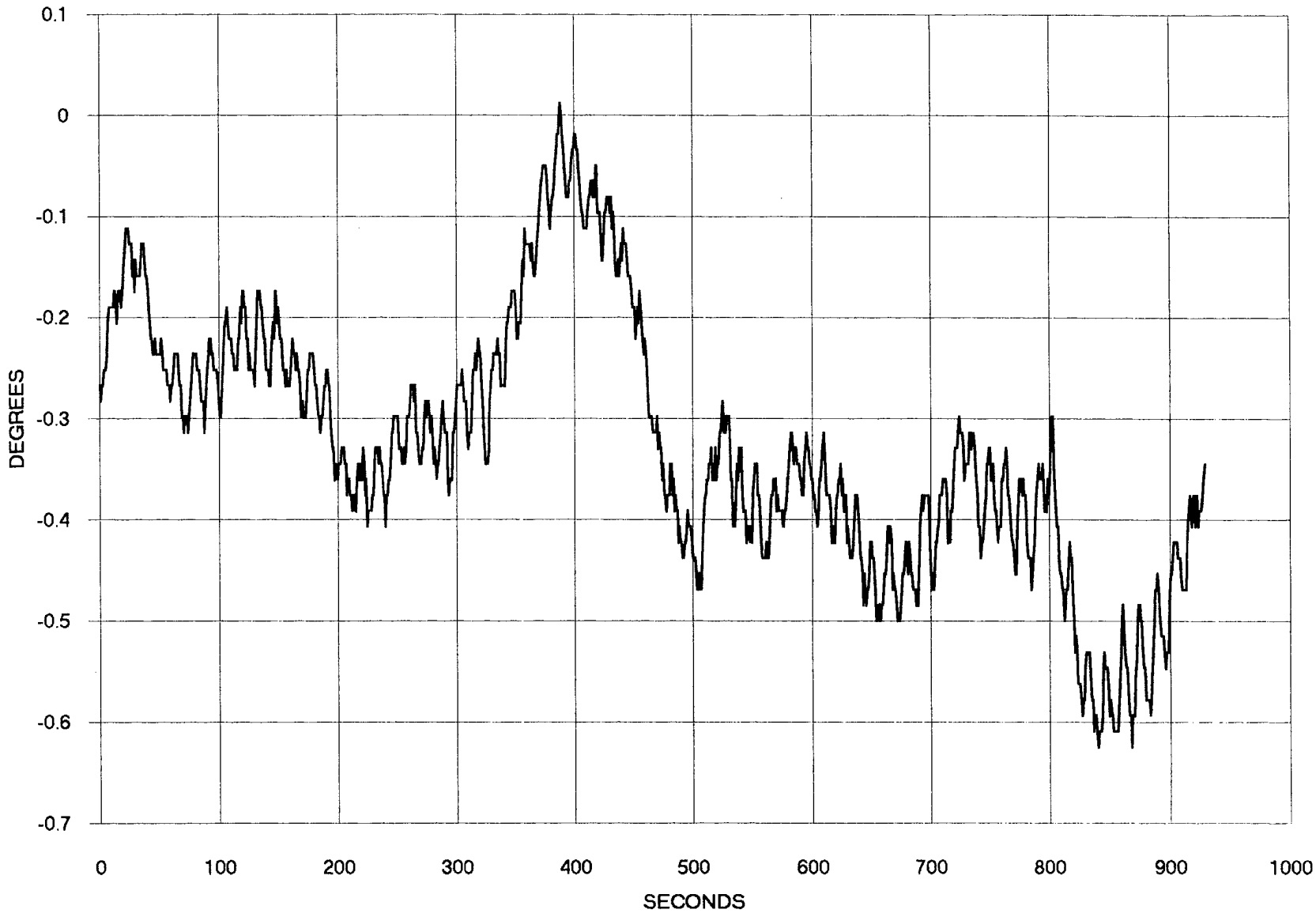
A1342 - HEAVE THP

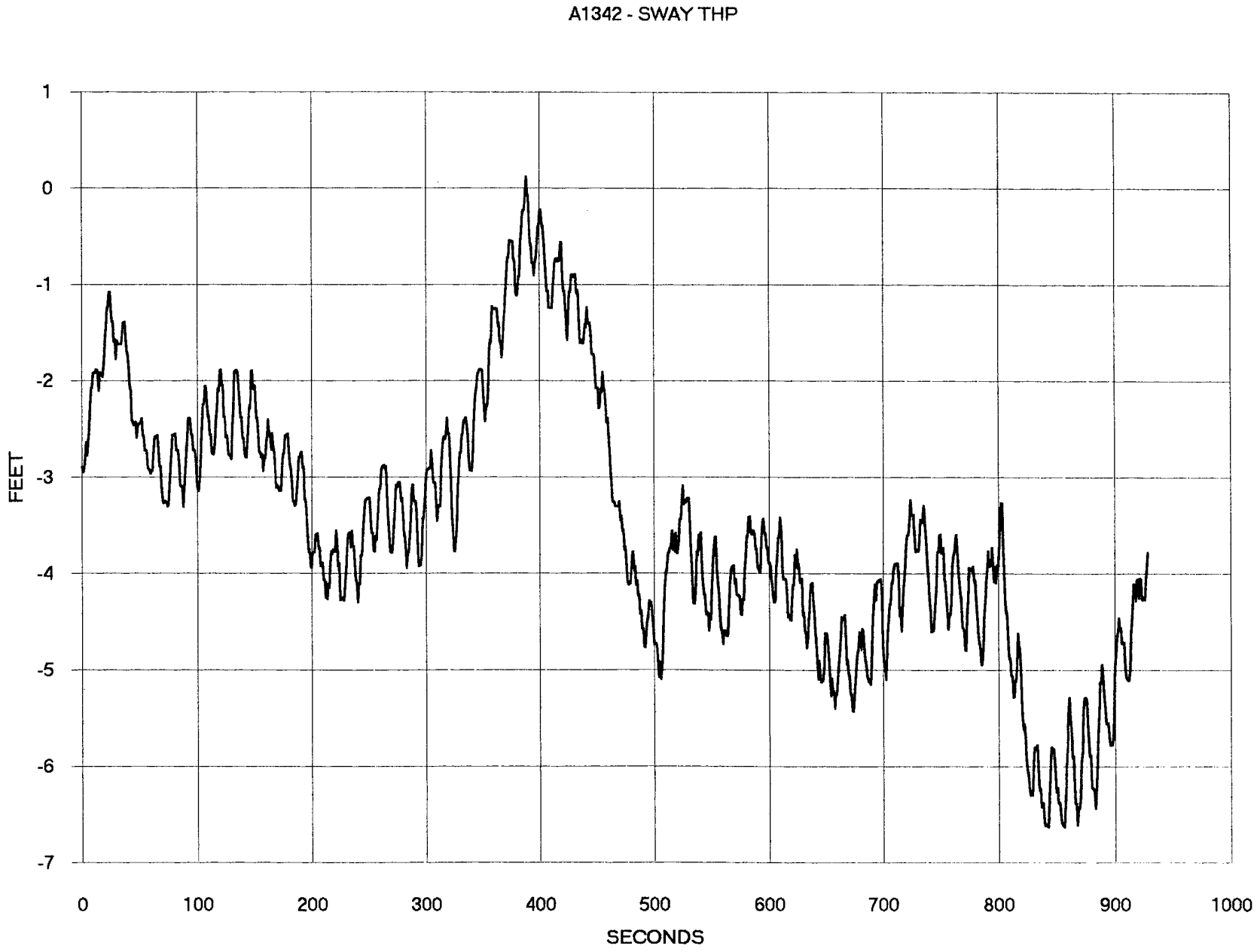


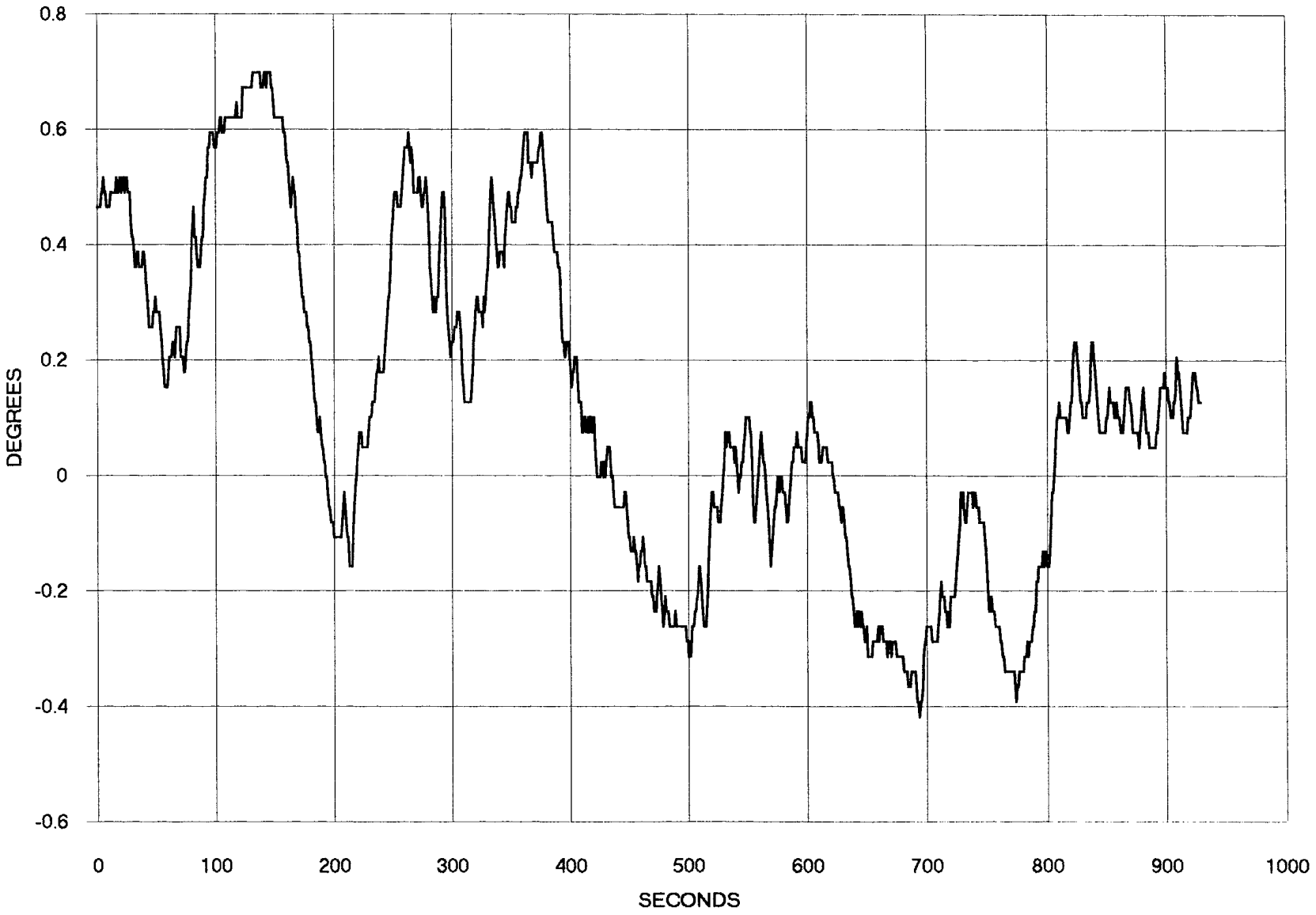

A1342 - PITCH THP
1.5
1
0.5
0
-0.5
-1
DEGREES
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

A1342 - SURGE THP

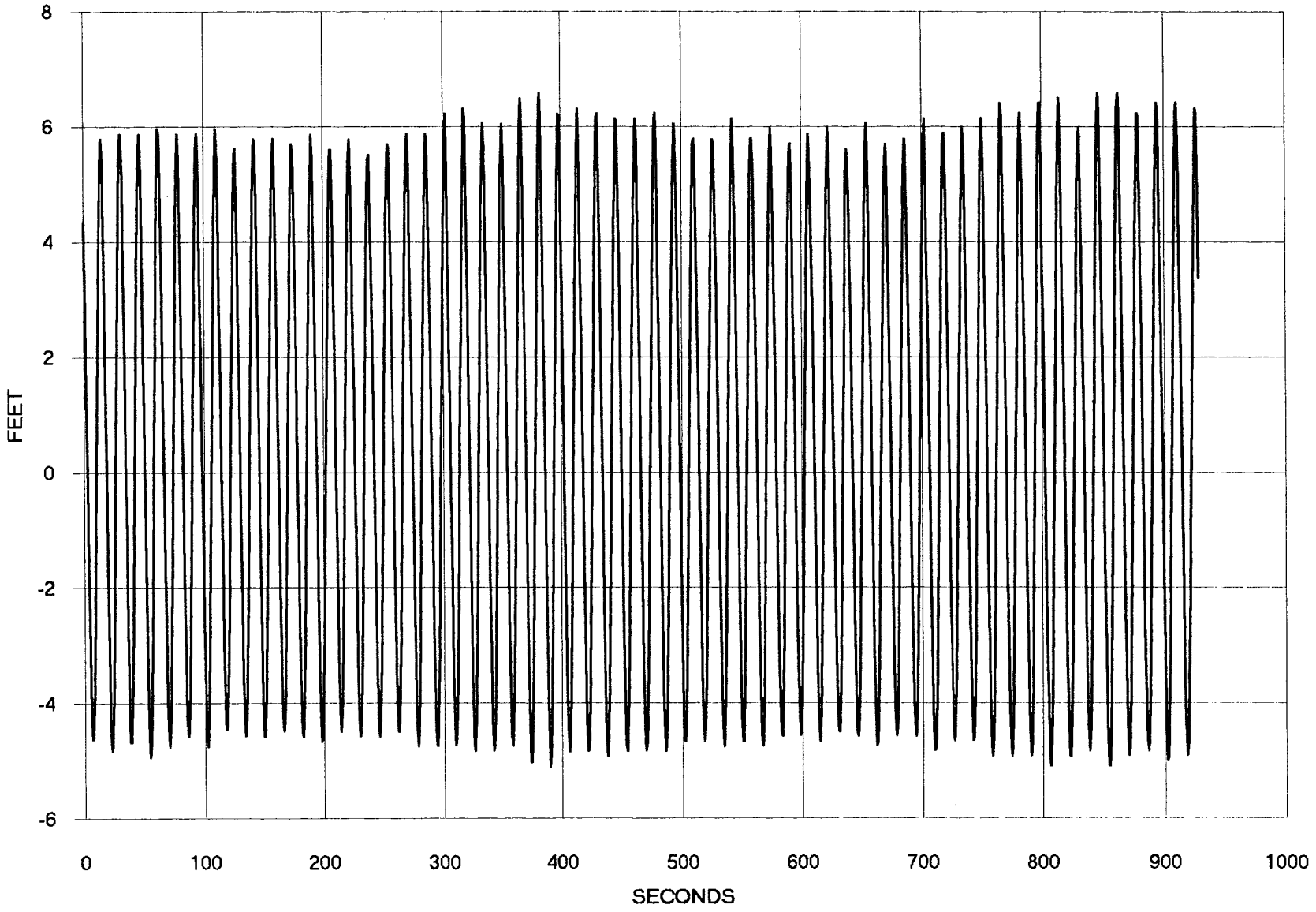



A1342 - ROLL THP
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
DEGREES
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

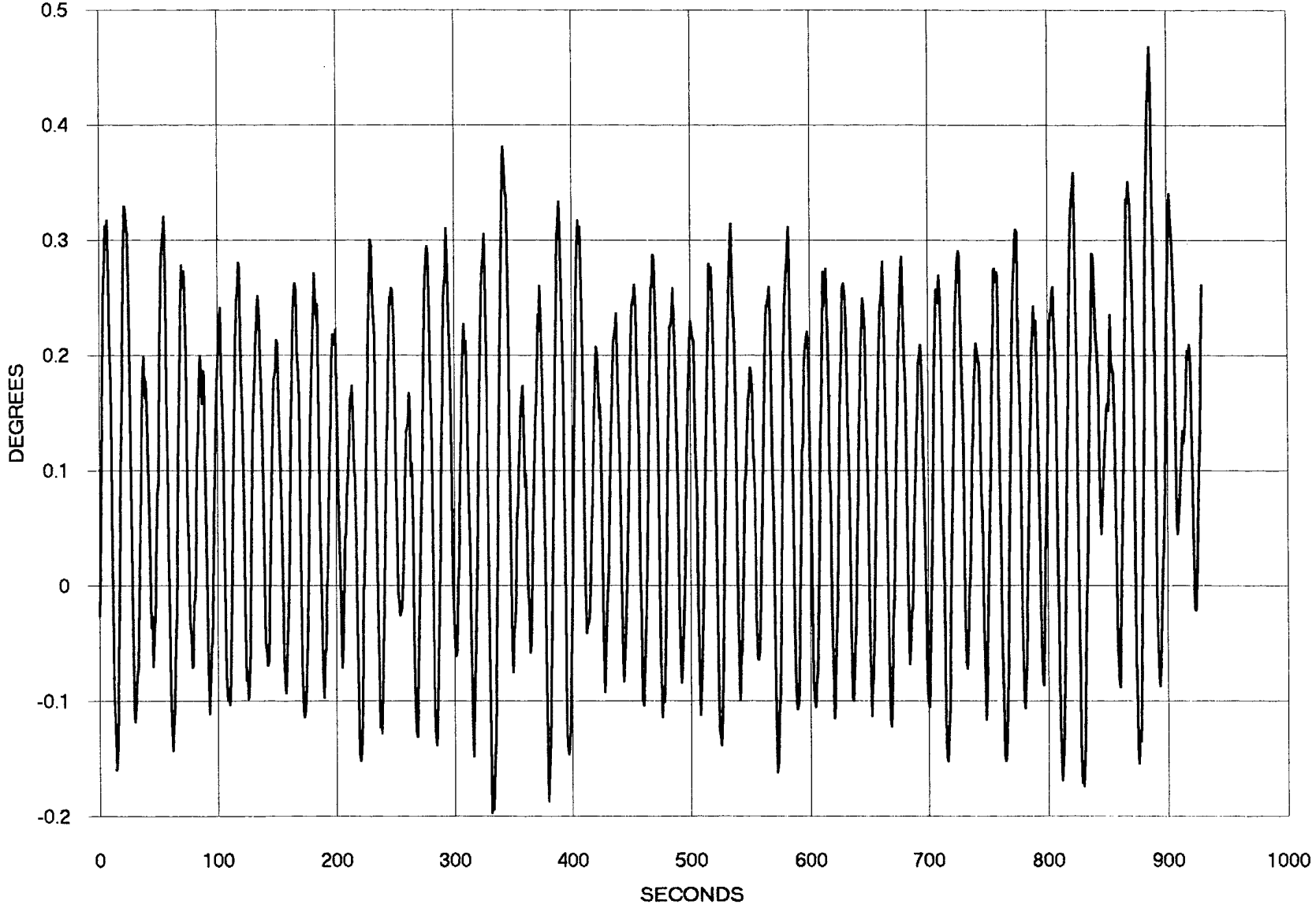

A1342 - SWAY THP
1
0
-1
-2
-3
-4
-5
-6
-7
FEET
0
100
200
300
400
500
600
700
800
900
1000
SECONDS


A1342 - YAW THP
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
DEGREES
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

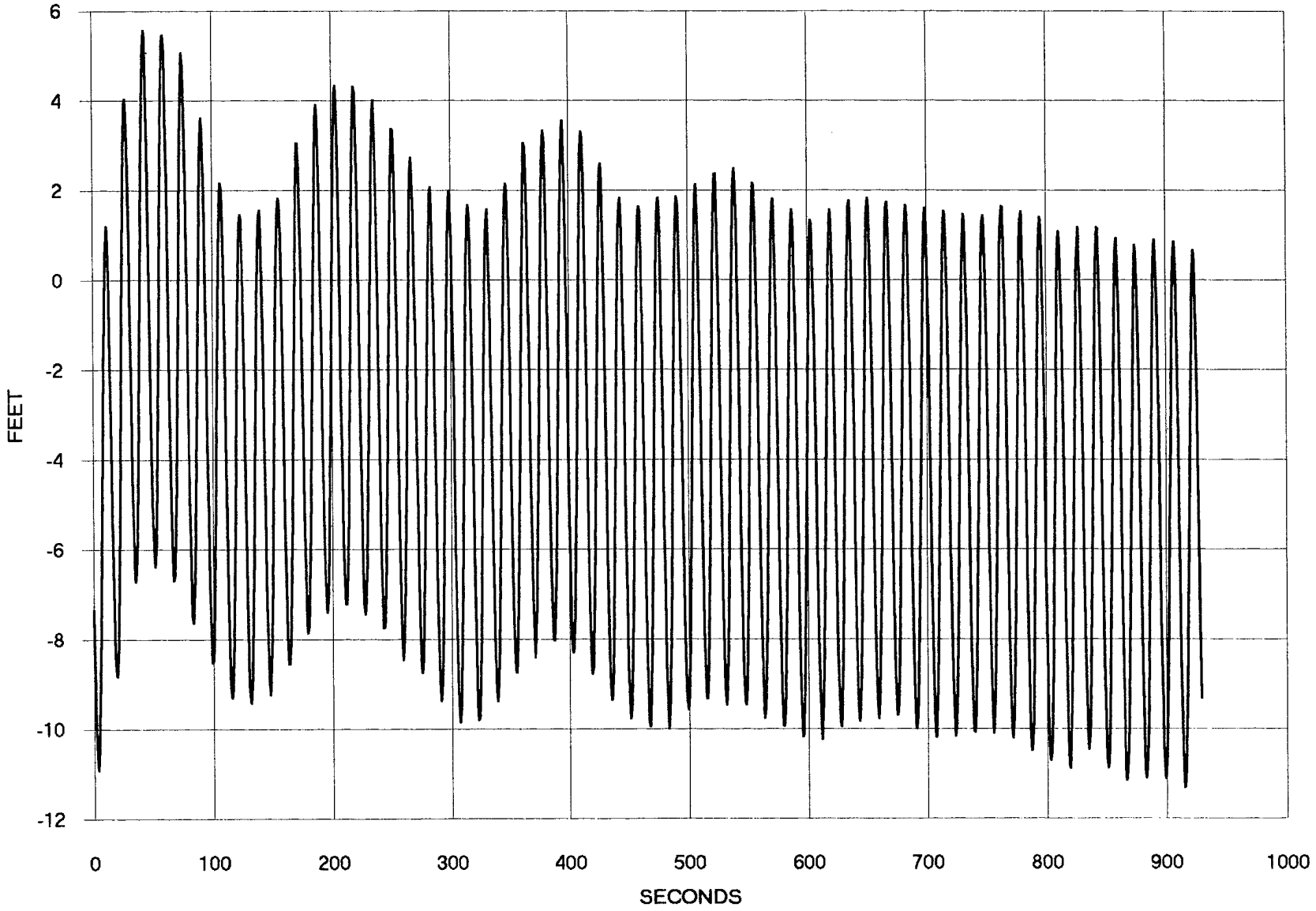
A1343 - HEAVE THP



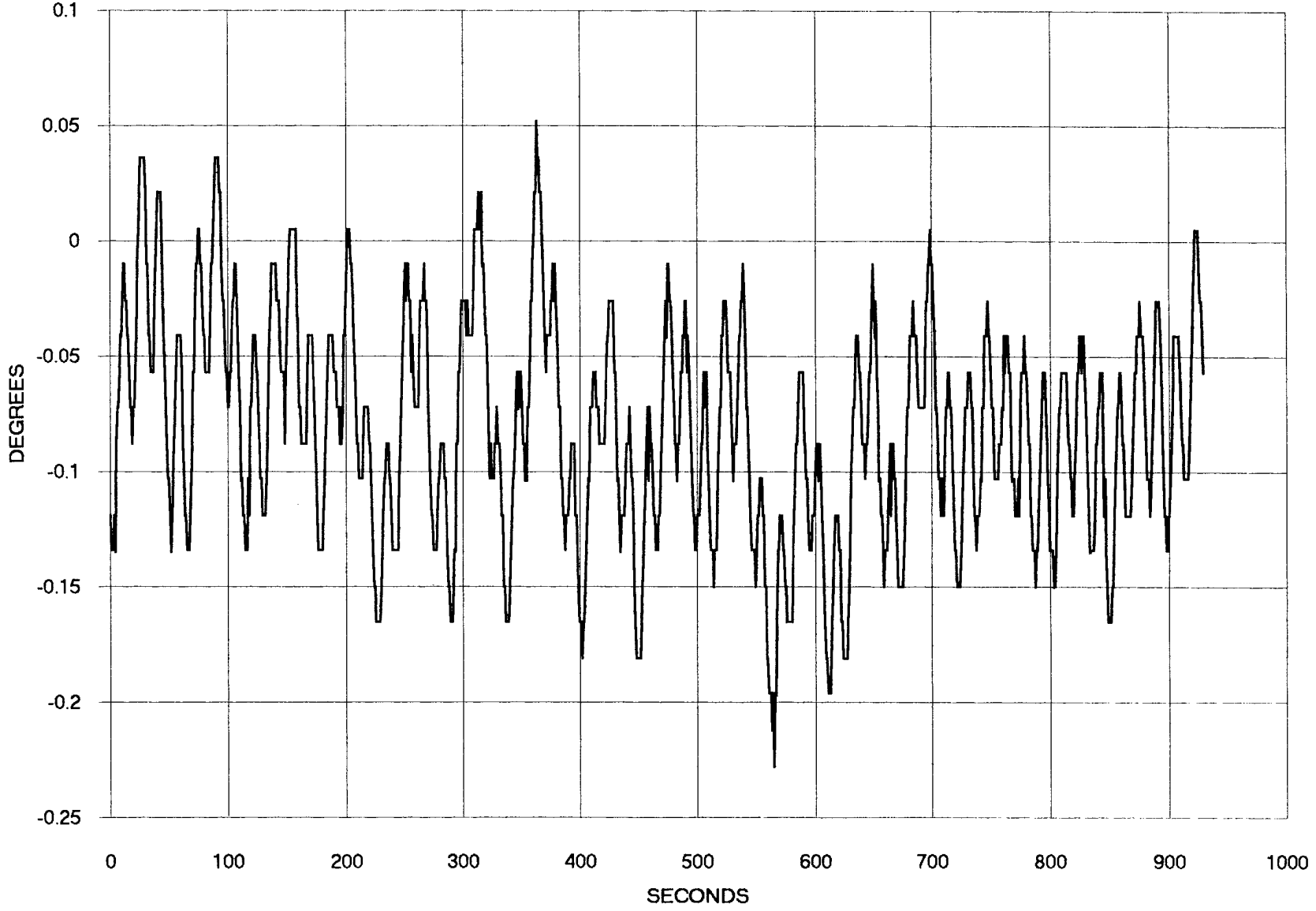
A1343 - PITCH THP

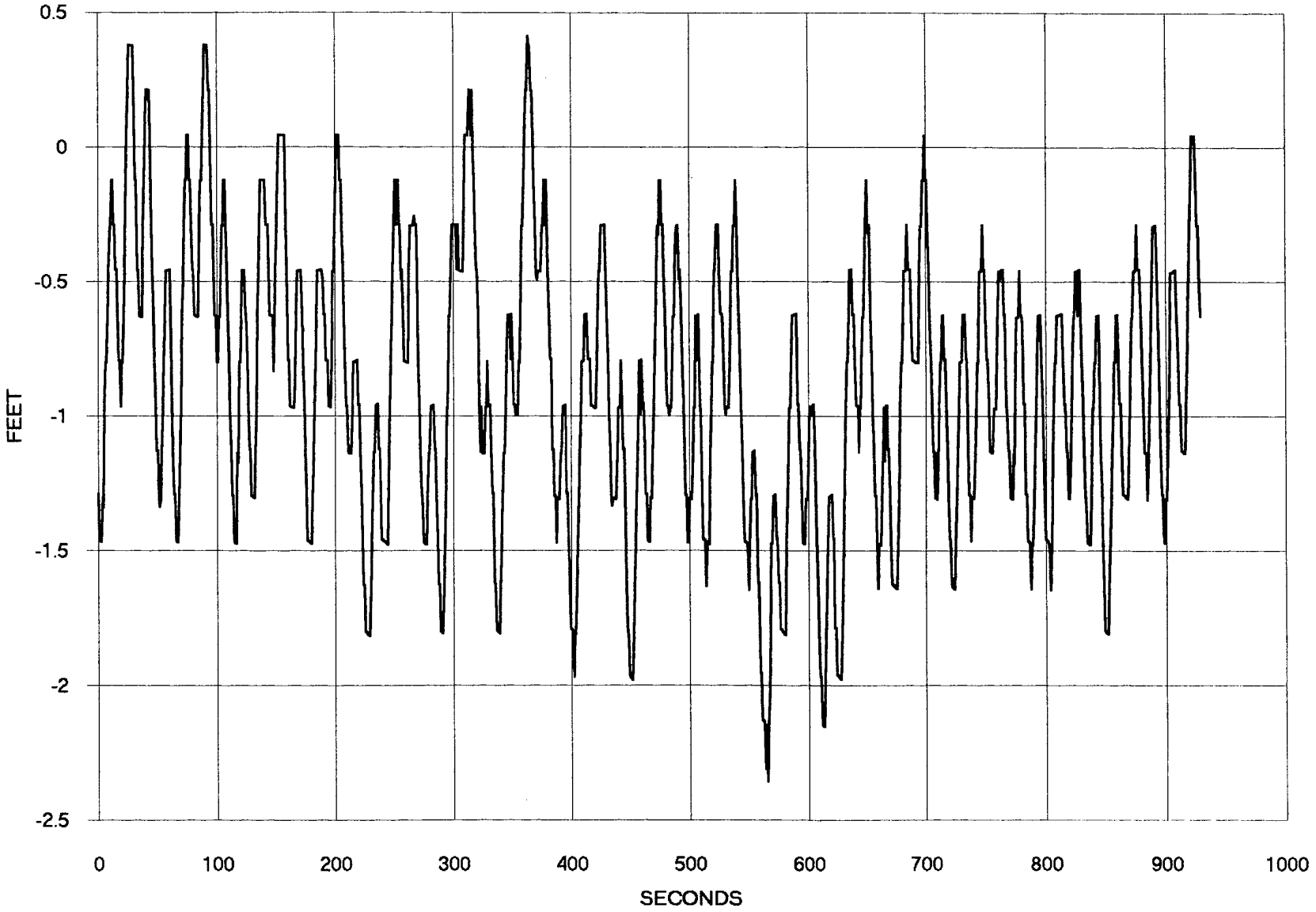


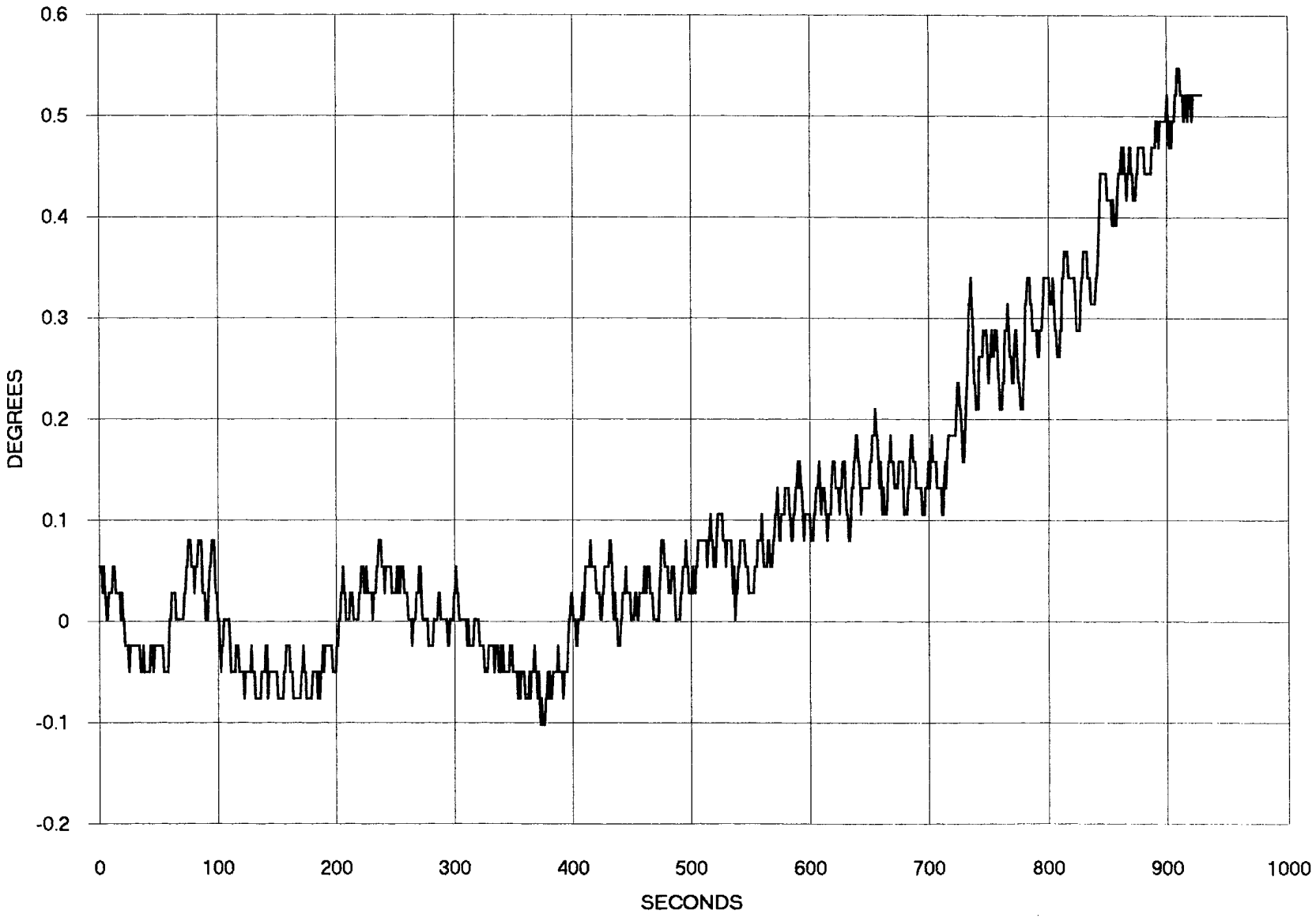
A1343 - SURGE THP



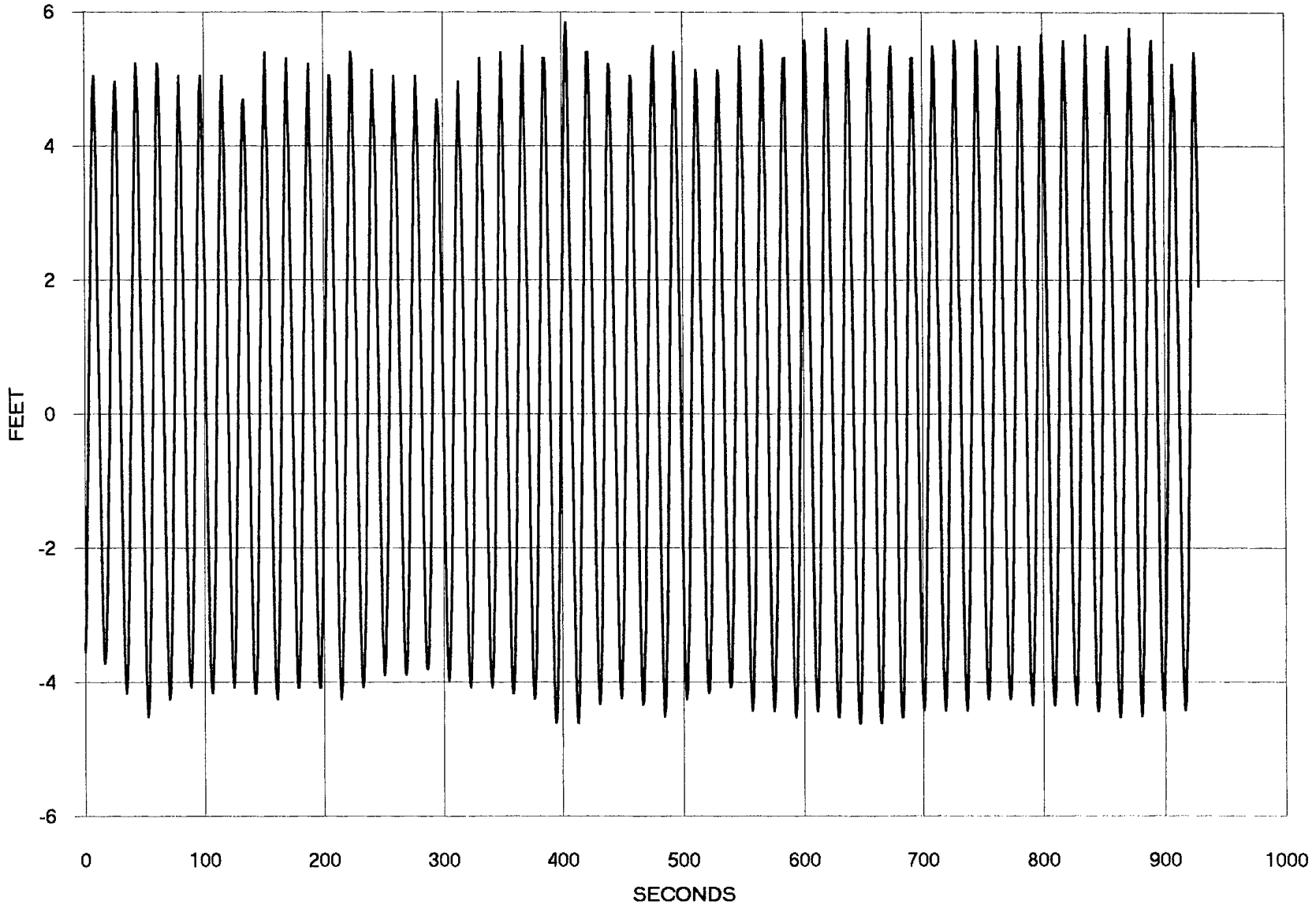
A1343 - ROLL THP

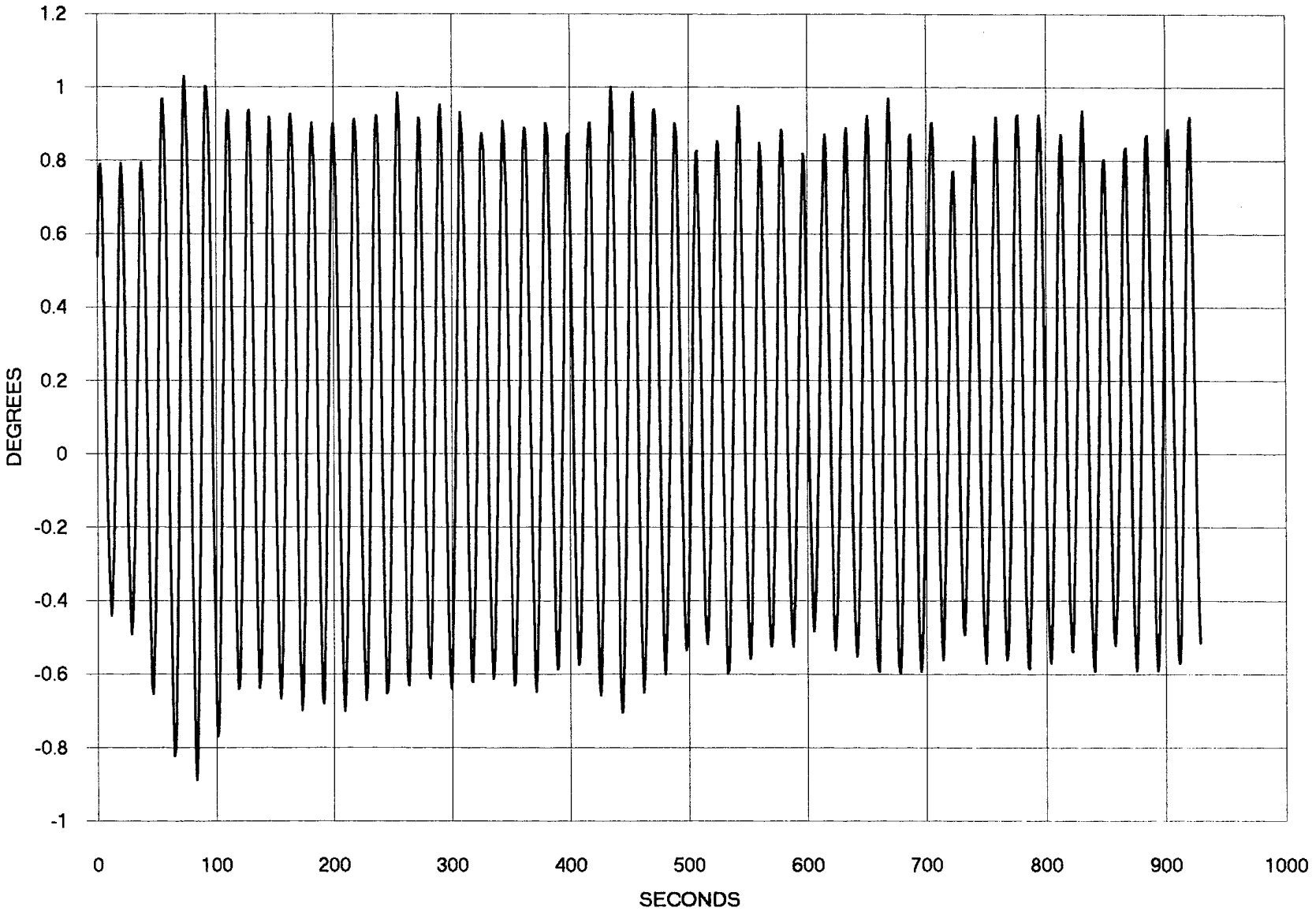



A1343 - SWAY THP
0.5
0
-0.5
-1
-1.5
-2
-2.5
FEET
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

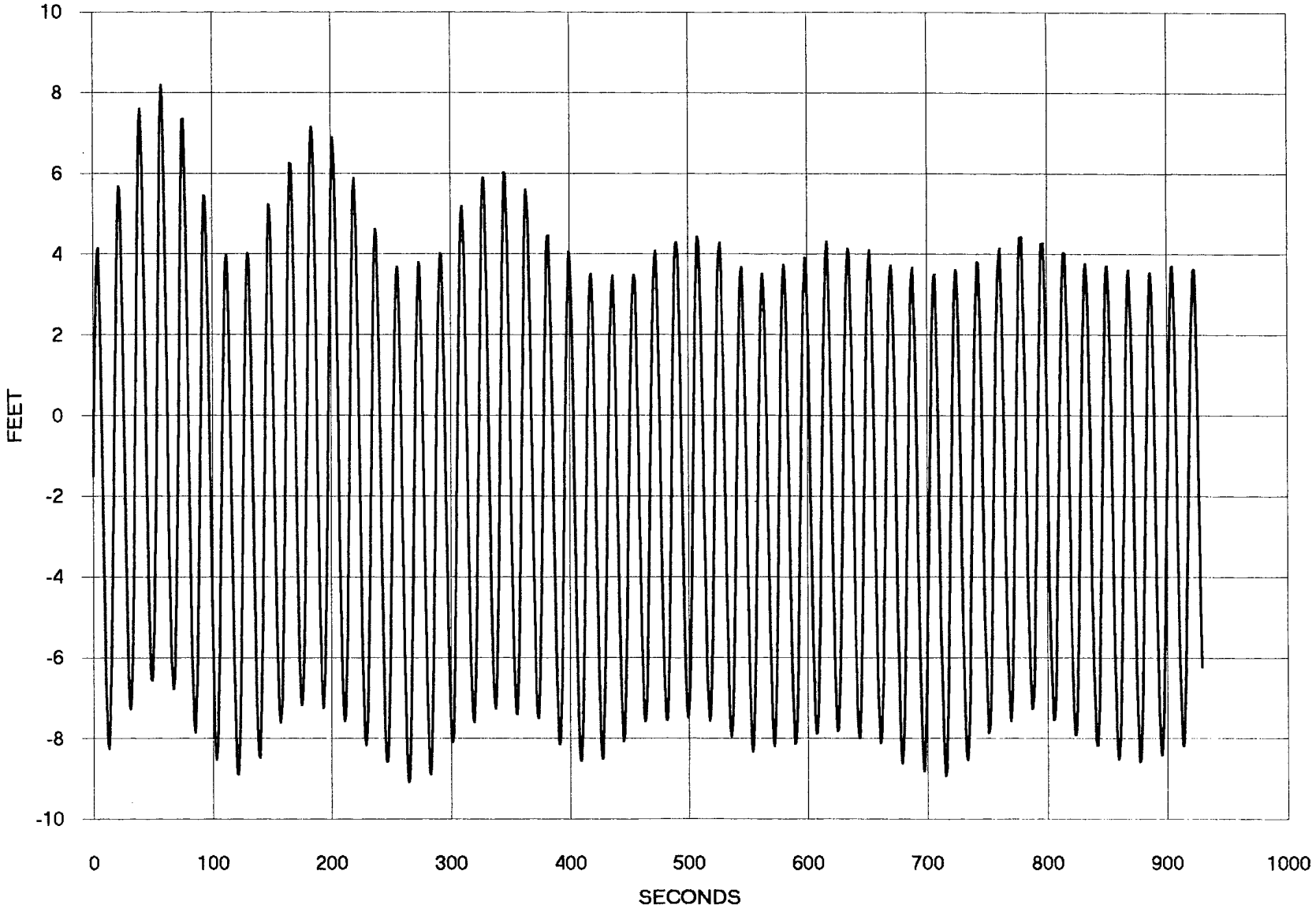

A1343 - YAW THP
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
DEGREES
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

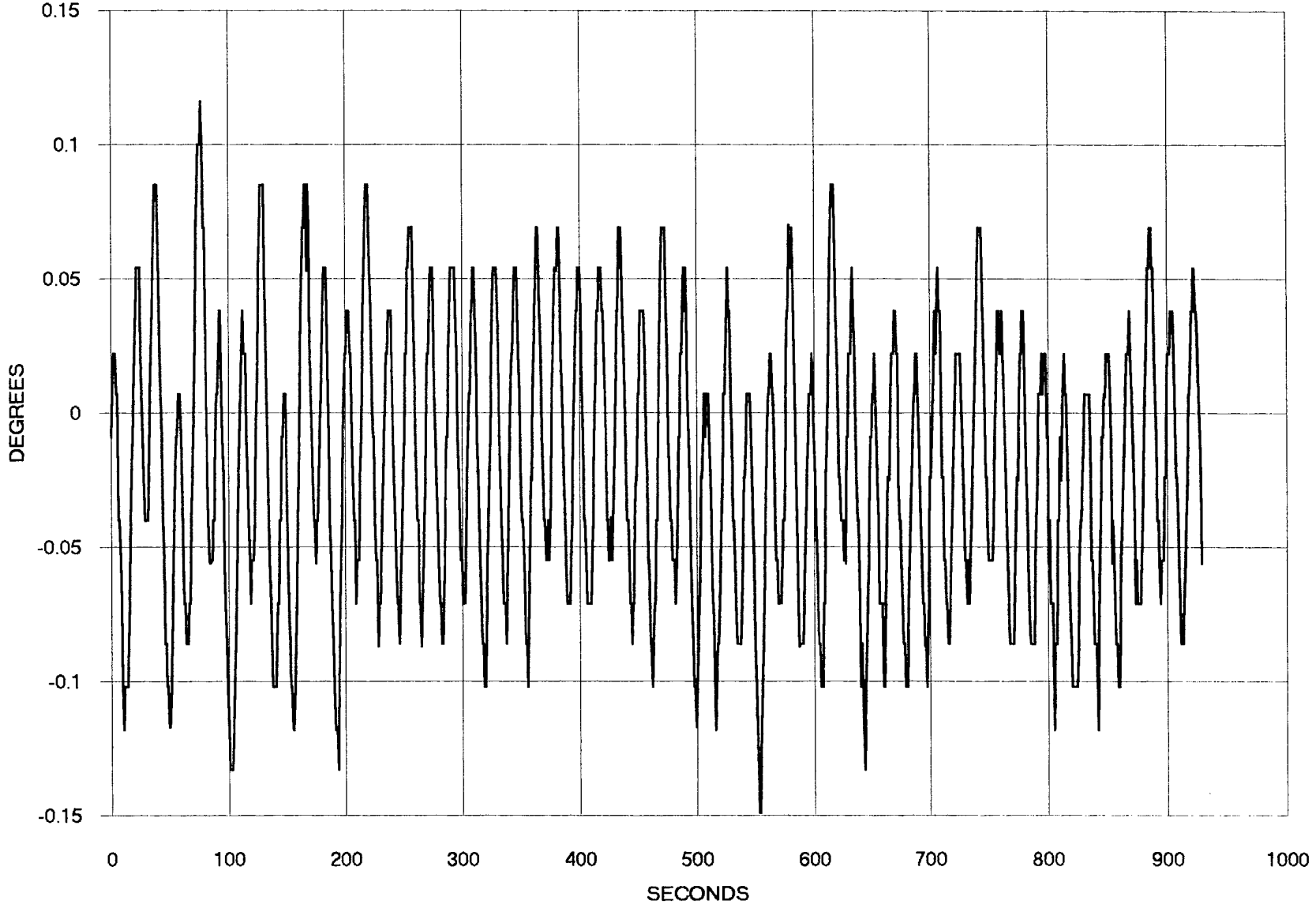
A1344 - HEAVE THP



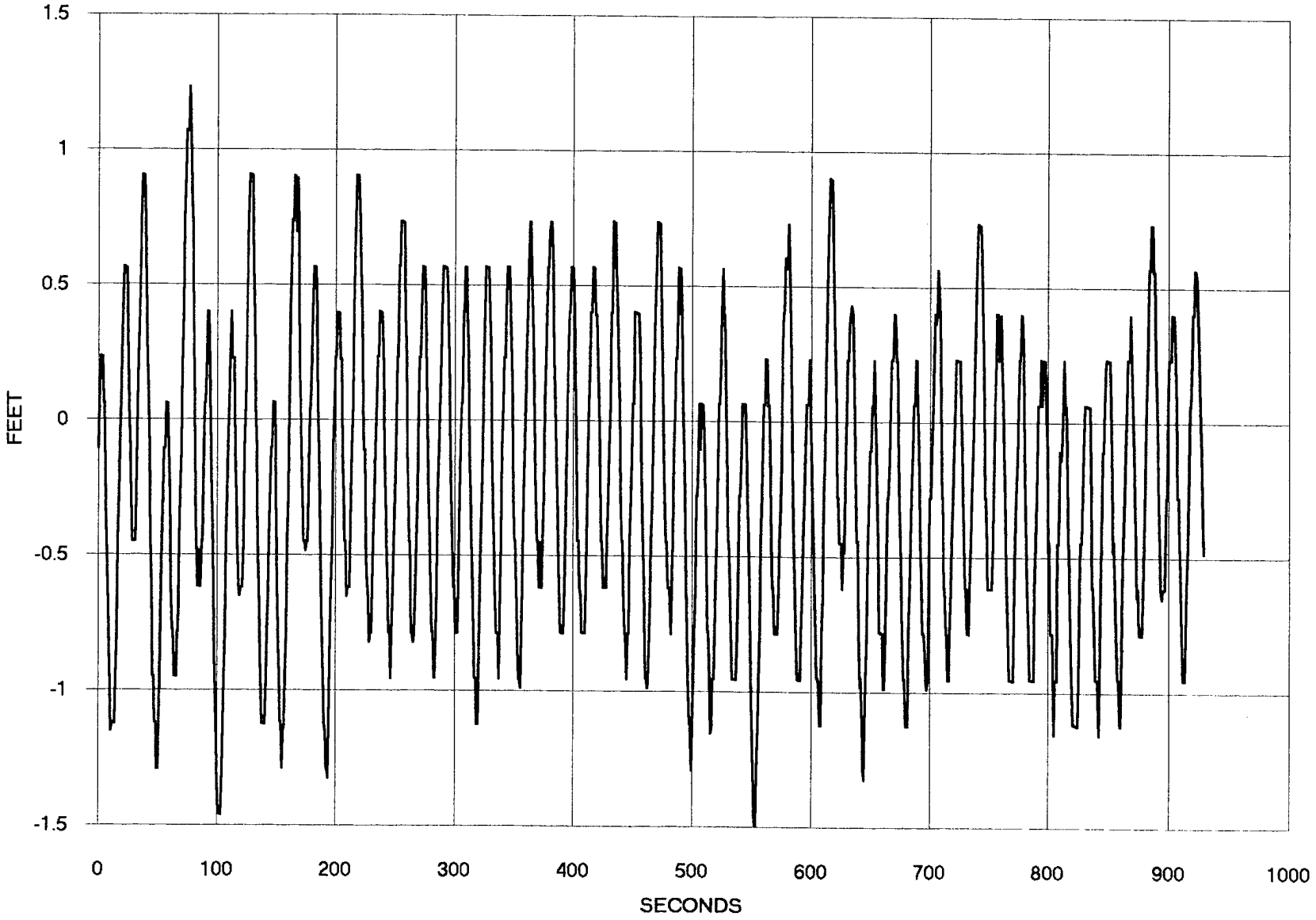

A1344 - PITCH THP
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
DEGREES
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

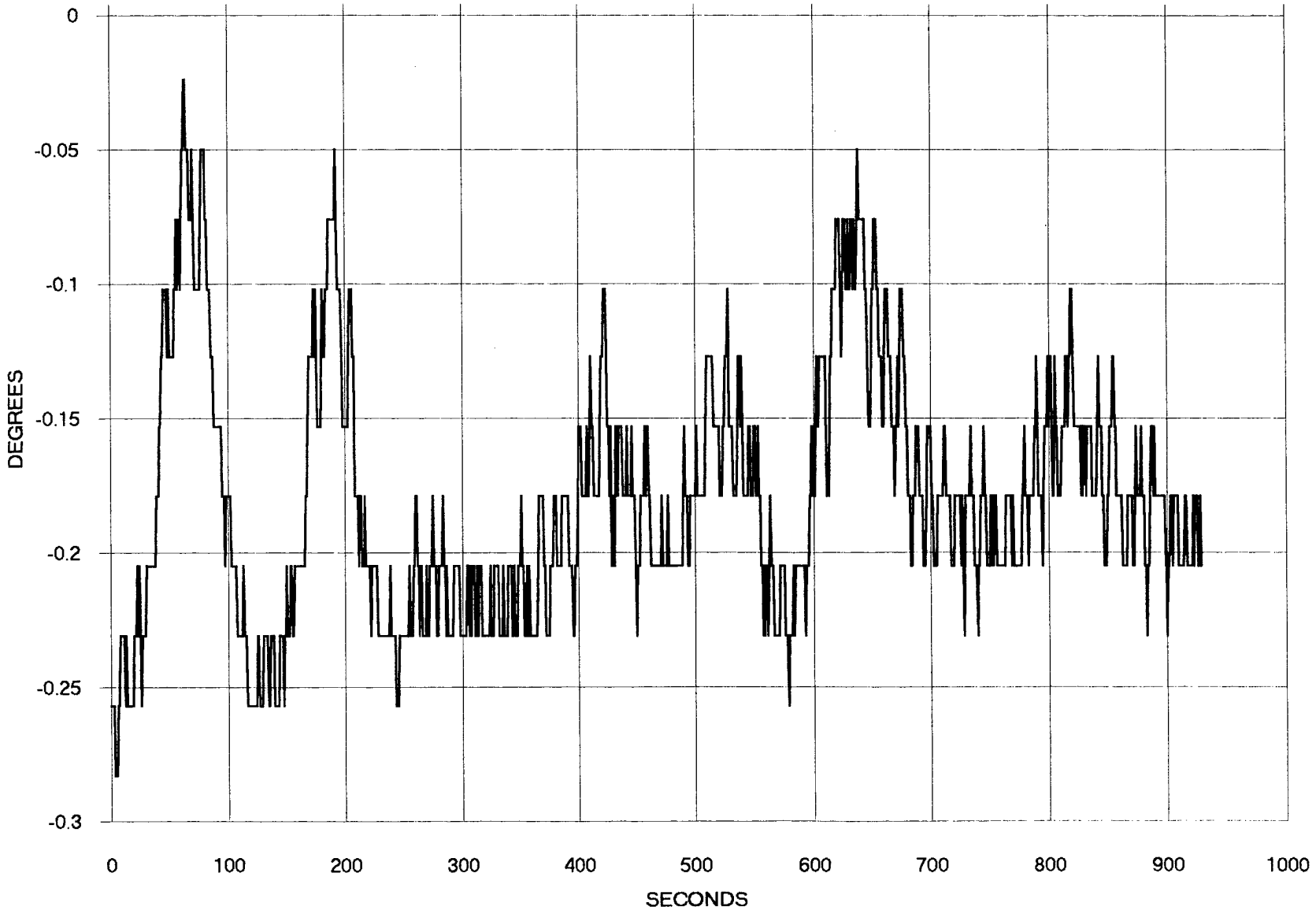
A1344 - SURGE THP




A1344 - ROLL THP
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
DEGREES
0
100
200
300
400
500
600
700
800
900
1000
SECONDS

A1344 - SWAY THP




A1344 - YAW THP
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
DEGREES
0
100
200
300
400
500
600
700
800
900
1000
SECONDS