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A Study of Shock Mitigating Materials in a Split Hopkinson Bar Configuration

Phase I

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A Study of Shock Mitigating Materials in a Split Hopkinson Bar Configuration Phase I

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Abstract

A study to compare three thickness values, 0.125, 0.250, and 0.500 in., of seventeen, unconfined materials for their shock mitigating characteristics with a split Hopkinson bar configuration has been completed. The nominal input as measured by strain gages on the incident Hopkinson bar is 50 fps peak (1500 μs peak) with a 100 μs duration (measured at 10% amplitude) for these tests. It is hypothesized that a shock mitigating material has four purposes: to lengthen the shock pulse, to attenuate the shock pulse, to mitigate high frequency content in the shock pulse, and to absorb energy. Both time domain and frequency domain analyses of the split Hopkinson bar data have been performed to compare the materials' achievement of these purposes.

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A Study of Shock Mitigating Materials in a Split Hopkinson Bar Configuration Phase I

Introduction

Sandia National Laboratories (SNL) designs mechanical systems with electronics that must survive high shock environments. These mechanical systems include penetrators that must survive soil, rock, and ice penetration, nuclear transportation casks that must survive transportation environments, and laydown weapons that must survive delivery impact of 125 fps. These mechanical systems contain electronics that may operate during and after the high shock environment and that must be protected from the high shock environments. A study has been started to improve the packaging techniques for the advanced electronics utilized in these mechanical systems because current packaging techniques are inadequate for these more sensitive electronics. In many cases, it has been found that the packaging techniques currently used not only do not mitigate the shock environment but actually amplify the shock environment [1]. An ambitious goal for this packaging study is to avoid amplification and possibly attenuate the shock environment before it reaches the electronics contained in the various mechanical systems.

As part of the investigation of packaging techniques, a two phase study of shock mitigating materials is being conducted. The purpose of the first phase reported here is to examine the performance of a joint that consists of shock mitigating material sandwiched in between steel and to compare the performance of the shock mitigating materials. A split Hopkinson bar experimental configuration simulates this joint and has been used to study the shock mitigating characteristics of seventeen, unconfined materials. The nominal input for these tests is an incident compressive wave with 50 fps peak (1500 $\mu\epsilon$ peak) amplitude and a 100 μs duration (measured at 10% amplitude).

It is hypothesized that a shock mitigating material has four purposes: to lengthen the shock pulse, to attenuate the shock pulse, to mitigate high frequency content in the shock pulse, and to absorb energy. Both time domain and frequency domain analyses of the split Hopkinson bar data have been performed to evaluate the materials' achievement of these purposes. No attempt has been made to compute stress-strain or to develop constitutive relationships for these materials because of the variation of these materials' properties with stress. Additionally, since the impedance mismatch between the steel Hopkinson bars

and the shock mitigating materials tested is so large, it is impossible to calculate the material properties from these data.

Experimental Configuration

This study to compare seventeen, unconfined materials for their shock mitigating characteristics has been completed with a split Hopkinson bar experimental configuration shown in Figure 1. Each sample was placed between two bars of hardened, maraging steel. Samples with thickness of 0.125 in., 0.250 in., and 0.500 in. were tested for each material. The thickness values were chosen because they are typical thickness values used in actual applications. The bars and material samples have a nominal 0.75 in. diameter. The incident bar is the bar impacted by the projectile. The transmission bar is the bar beyond the sample. The incident bar is 48 in. long with strain gages mounted in the middle of the bar at 24 in., and the transmission bar is 55.5 in. long with strain gages mounted 10 in. from the interface with the shock mitigating material. A kickoff bar (18 in. long) was placed at the end of the second bar to prevent the tensile pulse from entering into the transmission bar and interfering with the transmitted pulse. The kickoff bar was required for the shock mitigating materials testing because the transmitted pulses are very long in duration. The alternative to a kickoff bar is a transmission bar that is long enough to allow the measurement of the transmitted wave without interference from the tensile wave. This alternative was not practical for these materials. Strain gages were mounted on the bars with AE-10 epoxy. This epoxy was used because anomalies were observed in the data obtained with strain gages mounted with lower strength, quicker curing epoxies. The nominal input as the incident compressive wave was 50 fps peak (1500 $\mu\epsilon$ peak) with a 100 μs duration (measured at 10% amplitude) for these tests. Incident, reflected, and transmitted velocities were measured for each material using the strain gages, and these measurements provided the basis for comparing the materials' responses.

Considerable effort was made during the initial portion of the experiments to align the two steel bars. The bars are positioned using two-axis alignment stages made by Newport. Each Hopkinson bar has a two-axis alignment stage on each end. The bars are aligned to minimize the reflection at the bar-to-bar interface without any shock mitigating material in between the bars. Figure 2 shows the incident and reflected wave achieved with the best alignment obtainable for this experimental configuration. Dow Corning 321 Dry Film Lubricant gave the least reflection at the interface. The reflected wave occurs at about 0.24 ms and has a magnitude of about 130 psi or 0.46% of the incident stress wave. This alignment is considered acceptable for these experiments.

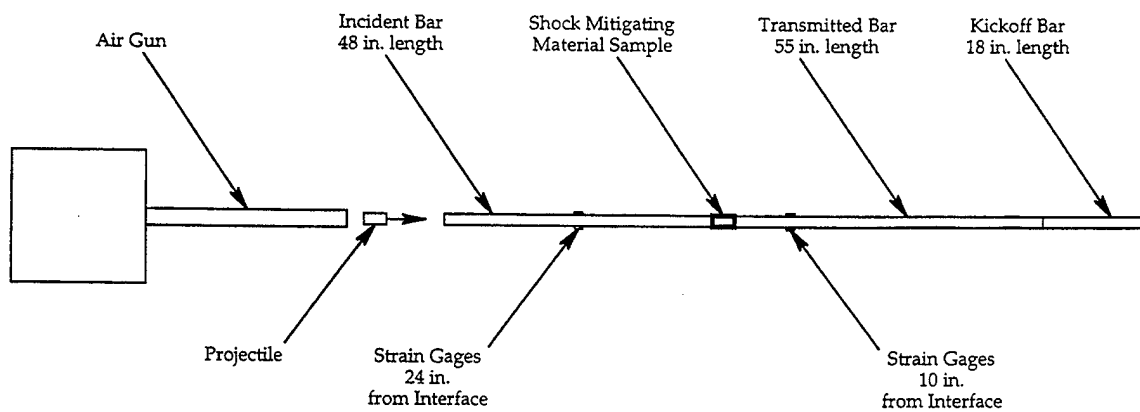


Figure 1: Split Hopkinson Bar Experimental Configuration for Shock Mitigating Materials.

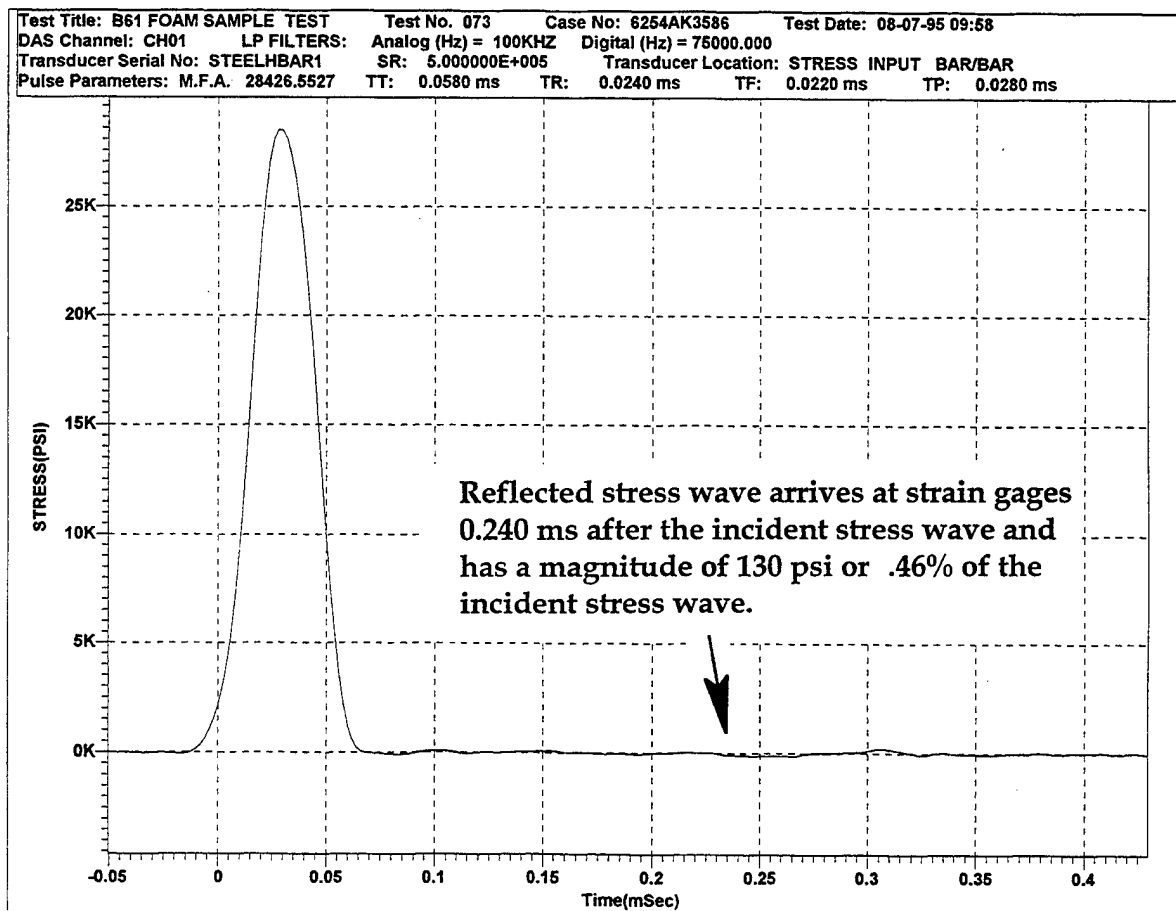


Figure 2: Incident and Reflected Stress Waves for Initial Bar to Bar Alignment

Split Hopkinson Bar Time Domain Data Analyses

The split Hopkinson bar data has been analyzed to evaluate the four different purposes of a shock mitigating material. Measured peak velocity values from split Hopkinson bar testing of the shock mitigating materials have been tabulated. Table I provides a comparison of the peak velocity magnitudes for seventeen shock mitigating materials with one thickness of approximately 0.125 in. Any velocity value can be converted to microstrain by multiplying by 30. For example, the peak velocity on the incident compressive shock is 50 fps or 1500 $\mu\epsilon$. Exact thickness values are shown. As can be seen in Table I, materials, such as Lexan, G-10 Epoxy, Phenolic, 828 DEA GMB, and 828 CTBN DEA GMB, transmitted a large percentage of the shock pulse and are good shock transmitters. Other materials, such as Teflon rod, drastically attenuated the shock pulse and are good shock mitigators. Figures 3 and 4 show the incident, reflected and transmitted velocity pulses for a good shock transmitter, phenolic and cotton cloth, and for a good shock mitigator, Teflon rod, respectively. The time duration of the transmitted pulse is increased several times by a good shock mitigator as shown in Figure 4.

The shock mitigating materials did not perform the same for the nominal thickness values tested of 0.125 in., 0.250 in. and 0.500 in. Tables III-XIX show the variation of the peak velocities as a function of thickness for each material shown in Table I. These results are not surprising because the materials do not have linear characteristics in this unconfined configuration. The results for one sample at each thickness value are shown, but two or three samples were tested for each material and each thickness. Generally, the multiple samples were consistent with each other. Appendix A contains a time history of the incident and reflected waves and a time history of the transmitted wave for three thickness values of the seventeen shock mitigating materials.

The equation that for the energy dissipated in the material samples is [2]:

$$E_{DISS} = E_{INC} - (E_{REF} + E_{TRANS}) \quad (1)$$

where:

E_{DISS} = energy dissipated in the shock mitigating material,

E_{INC} = energy in the incident stress wave,

E_{REF} = energy in the reflected stress wave,

E_{TRANS} = energy transmitted to the second bar, and

$E = 0.5 E_M \epsilon^2$ with

E_M = modulus of elasticity (psi) and

ϵ^2 = the corresponding strain vector squared.

The units for E_{DISS} are psi because E_{DISS} represents energy per unit volume.

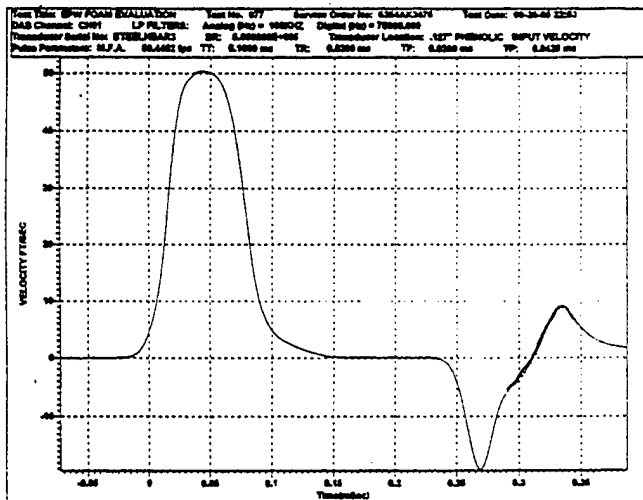
There are not significant differences in E_{DISS} for the different materials; E_{DISS} is the same low magnitude for all the materials. Ideally, E_{DISS} , as defined by the equation above, should be zero if the Hopkinson bars remain elastic. In practical application, E_{DISS} will not be zero because of noise in the measurements. The low magnitude of E_{DISS} is indicative of low noise in the measurements.

In this split Hopkinson bar configuration, the strain gaged bars are transducers, and the transmitted bar measures the energy absorbed and transmitted by the material sample. The strain in the transmitted bar can be used to calculate the energy absorbed by the sample as per the equation:

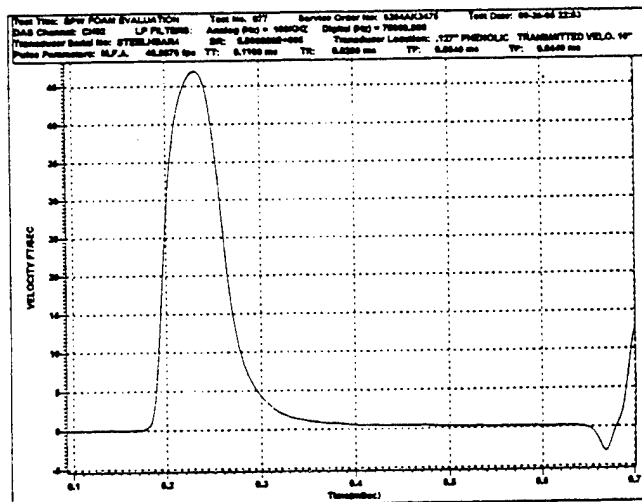
$$E_{DISS} = 0.5 E_M \epsilon^2_{TRANS} \quad (2)$$

Since the stress wave has a velocity, then it cannot remain in the sample but must continue traveling on into the transmitted bar. As a consequence, the energy is calculated using equation (2). Table II summarizes the peak incident and peak transmitted energies for the seventeen materials.

If the stress wave could be stopped in the sample, then equation (1) could be used to calculate the energy absorbed by the sample. An additional problem with the use of equation (2) is that the modulus of elasticity for these materials is not constant and is highly strain-rate dependent. This modulus variation also prevents the use of equation (2). Finally, to apply equation (2) using shock mitigating material response requires that the strain is measured on the material sample. This is a difficult, if not impossible, measurement with current techniques.

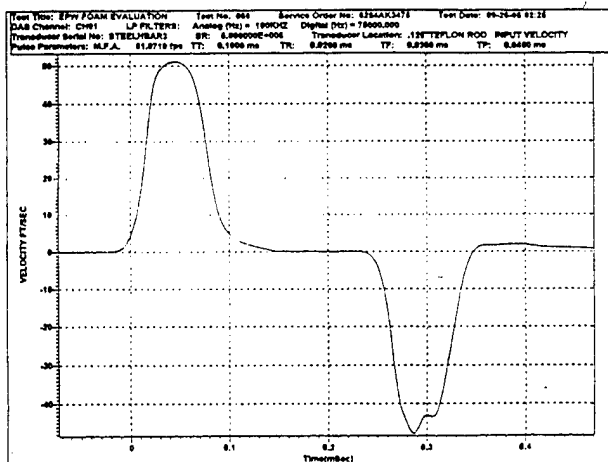


Incident and Reflected

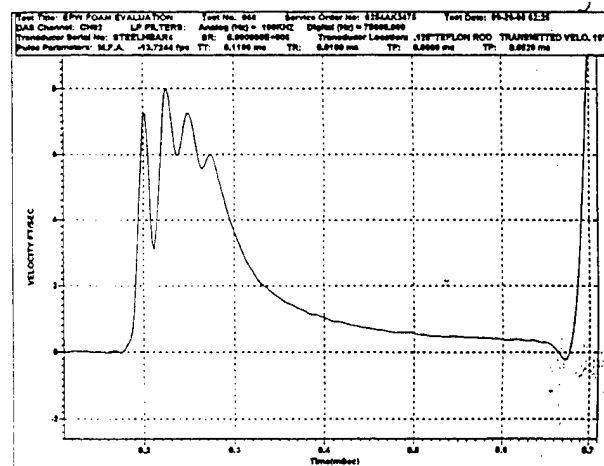


Transmitted

Figure 3: Split Hopkinson Bar Data for A Good Shock Transmitter, Phenolic and Cotton Cloth.



Incident and Reflected



Transmitted

Figure 4: Split Hopkinson Bar Data for A Good Shock Mitigator, Teflon Rod.

**Table I: Comparison of Material Responses for a
Nominal 0.125 in. Material Thickness.**

Material	Thickness	Peak* Incident Velocity (fps)	Peak* Reflected Velocity (fps)	Peak* Transmitted Velocity (fps)
Hi Density Polyethylene Rod	0.127 in.	52	43	9
Teflon Rod	0.128 in.	50	45	7
Lexan Rod	0.126 in.	52	31	25
G-10 Epoxy & Fiberglass Cloth	0.129 in.	52	34	51
Phenolic & Cotton Cloth	0.127 in.	51	20	48
Adiprene L-100	0.121 in.	52	50	3.5
828/DEA/GMB**	0.125 in.	52	32	25
828/CTBN/DEA GMB***	0.121 in.	52	34	22
PET 90A Polyurethane Rubber	0.121 in.	51	50	2.5
Sylgard 184	0.122 in.	54	53	2
HSII Silicone Rubber (Pink)	0.121 in.	54	54	0.5
Sylgard 184 & GMB**	0.121 in.	52	51	2.5
GE RTV 630	0.121 in.	52	51	3
Polyurethane Foam (20 lb)	0.121 in.	54	52	2.5
Polyurethane Foam (10 lb)	0.126 in.	54	52	2.0
Polyurethane Foam (6 lb)	0.127 in.	54	54	0.3
Polysulfide Rubber PRC1422	0.125 in.	51	49	2.5

* Peak velocity values may be converted to microstrain by multiplying by 30. For example, the peak velocity on the incident compressive shock is 50 fps or 1500 μs . The duration for all incident compressive shocks is 100 μs measured at 10% duration.

** 828 is a base, DEA is a curing agent, GMB is glass-filled microballoons.

*** CTBN is a resin, see ** above for other components.

Table II: Comparison of Incident Energy and Transmitted Energy for a Nominal 0.125 in. Material Thickness.

Material	Thickness	Peak Incident Energy (psi)	Peak Transmitted Energy (psi)
Hi Density Polyethylene Rod	0.127 in.	0.6084	0.0182 (3%)
Teflon Rod	0.128 in.	0.5625	0.0110 (20%)
Lexan Rod	0.126 in.	0.6084	0.1406 (23%)
G-10 Epoxy & Fiberglass Cloth	0.129 in.	0.6084	0.5852 (96%)
Phenolic & Cotton Cloth	0.127 in.	0.5852	0.5184 (89%)
Adiprene L-100	0.121 in.	0.6084	0.0031 (0.5%)
828/DEA/GMB*	0.125 in.	0.6084	0.1406 (23%)
828/CTBN/DEA GMB**	0.121 in.	0.6084	0.1089 (18%)
PET 90A Polyurethane Rubber	0.121 in.	0.5852	0.0014 (0.2%)
Sylgard 184	0.122 in.	0.6561	0.0009 (1%)
HSII Silicone Rubber (Pink)	0.121 in.	0.6561	0.0001(0%)
Sylgard 184 & GMB**	0.121 in.	0.6084	0.0014 (20%)
GE RTV 630	0.121 in.	0.6084	0.0020 (0.2%)
Polyurethane Foam (20 lb)	0.121 in.	0.6561	0.0014 (0.2%)
Polyurethane Foam (10 lb)	0.126 in.	0.6561	0.0009 (0.1%)
Polyurethane Foam (6 lb)	0.127 in.	0.6561	0.0000(0%)
Polysulfide Rubber PRC1422	0.125 in.	0.5852	0.0014 (0.2%)

* 828 is a base, DEA is a curing agent, GMB is glass-filled microballoons.

** CTBN is a resin, see ** above for other components.

Table III: Peak Responses for Hi Density Polyethylene Rod.

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.127 in.	52	43	9
0.252 in.	55	47	9
0.501 in.	54	49	6.4

Table IV: Peak Responses for Teflon Rod.

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.128 in.	50	45	7
0.252 in.	50	46	4.5
0.502 in.	50	48	4.0

Table V: Peak Responses for Lexan Rod.

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.126 in.	52	31	25
0.252 in.	52	40	22
0.501 in.	54	45	18

Table VI: Peak Responses for G-10 Epoxy & Fiberglass Cloth.

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.129 in.	52	34	51
0.251 in.	51	20	48
0.501 in.	51	30	42

Table VII: Peak Responses for Phenolic & Cotton Cloth.

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.127 in.	51	20	48
0.250 in.	53	30	43
0.502 in.	53	36	34

Table VIII: Peak Responses for Adiprene L-100.

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.121 in.	52	50	3.5
0.248 in.	50	48	2
0.497 in.	52	51	1.3

Table IX: Peak Responses for 828/DEA/GMB.

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.125 in.	52	32	25
0.251 in.	52	39	23
0.502 in.	55	46	22

Table X: Peak Responses for 828/CTBN/DEA/GMB.

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.121 in.	52	34	22
0.251 in.	53	41	22
0.500 in.	52	45	19

Table XI: Peak Responses for PET 90A Polyurethane Rubber.

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.121 in.	51	50	2.5
0.250 in.	54	52	1.2
0.499 in.	54	53	0.7

Table XII: Peak Responses for Sylgard 184.

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.122 in.	54	53	2
0.249 in.	50	50	0.2
0.501 in.	52	52	0.1

Table XIII: Peak Responses for HSII Silicone Rubber (Pink).

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.121 in.	54	54	0.5
0.250 in.	51	51	0.1
0.501 in.	50	50	0.05

Table XIV: Peak Responses for Sylgard 184 with GMB.

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.121 in.	52	51	2.5
0.249 in.	54	54	0.6
0.497 in.	54	54	0.2

Table XV: Peak Responses for GE RTV 630.

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.121 in.	52	51	3
0.250 in.	50	50	0.4
0.497 in.	52	52	0.2

Table XVI: Peak Responses for Polyurethane Foam (20 lb).

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.121 in.	54	52	2.5
0.250 in.	54	53	1.6
0.500 in.	50	49	1.9

Table XVII: Peak Responses for Polyurethane Foam (10 lb).

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.126 in.	54	52	2.00
0.251 in.	54	54	0.45
0.500 in.	54	53	0.45

Table XVIII: Peak Responses for Polyurethane Foam (6 lb).

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.127 in.	54	54	0.30
0.253 in.	54	54	0.30
0.503 in.	52	52	0.25

Table XIX: Peak Responses for Polysulfide Rubber PRC1422.

<u>Thickness</u>	<u>Incident (fps)</u>	<u>Reflected (fps)</u>	<u>Transmitted (fps)</u>
0.127 in.	51	49	2.5
0.253 in.	51	50	0.9
0.503 in.	52	51	0.5

Split Hopkinson Bar Frequency Domain Data Analyses

Frequency response function (frf) magnitudes for a reflected frf, $H_{ref}(j\omega)$, and a transmitted frf, $H_{trans}(j\omega)$, were calculated for the seventeen materials listed in Table I as shown below in equation (3).

$$H(j\omega) = \frac{H_1 + H_2}{2} \quad (3)$$

where,

$$H_1(j\omega) = \frac{\sum_{n=1}^3 G_{xy}}{\sum_{n=1}^3 G_{xx}} \quad (4)$$

and

$$H_2(j\omega) = \frac{\sum_{n=1}^3 G_{yy}}{\sum_{n=1}^3 G_{yx}} \quad (5)$$

where:

$H_1(j\omega)$ = frequency response function to minimize noise on the input, x ,

$H_2(j\omega)$ = frequency response function to minimize noise on the output, y ,

G_{xx} = auto-spectrum for the input, x ,

G_{yy} = auto-spectrum for the output, y ,

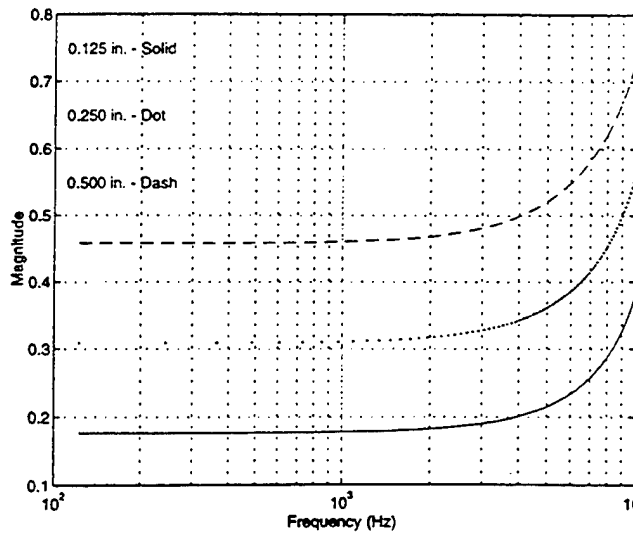
G_{xy} = cross-spectrum between the input, x , and the output, y , and

G_{yx} = cross-spectrum between the output, y , and the input, x .

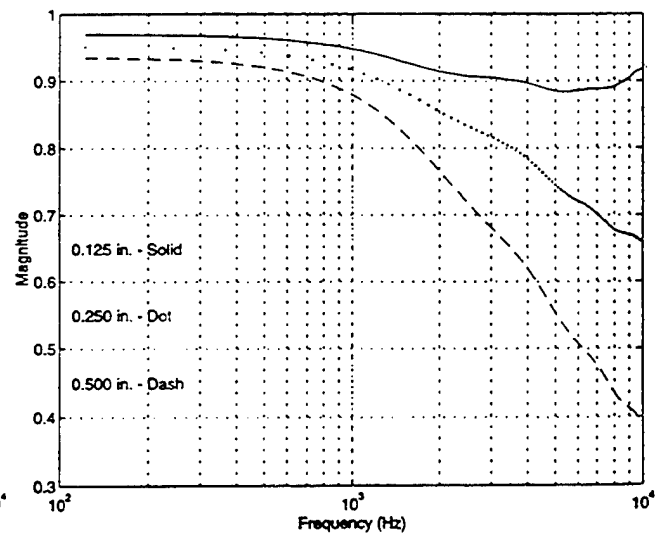
For the reflected frf, $H_{ref}(j\omega)$, the input, x , is the incident wave, and the output, y , is the reflected wave. For the transmitted frf, $H_{trans}(j\omega)$, the input, x , is the incident wave, and the output, y , is the transmitted wave. These frf's are not normalized so that they show relative magnitudes for comparison. The frf magnitudes are plotted up to a maximum frequency of 10,000 Hz because the 100 μ s pulse does not have coherence beyond 10,000 Hz. The frequency resolution for HSII Silicone and Sylgard 184 with GMB is 24 Hz. All of the other fifteen materials had a frequency resolution of 122 Hz.

Three samples were tested for each thickness and averaged for the frf calculation except for the Sylgard 184 and GMB material that only had two samples at each thickness. Further details of calculating the frf's have been reported previously and are not repeated here [3]. Materials such as Sylgard and HSII Silicone transmit a relatively short duration, low magnitude pulse, so their transmission frf magnitudes are essentially noise. Examples of frf magnitudes for a good shock transmitter, phenolic and cotton cloth, and for a good shock mitigator, teflon rod, are shown in Figures 5 and 6, respectively. The frf magnitudes show that a good shock mitigator reflects more of the high frequency data than a good shock transmitter that tends to transmit flatter frequency content into the structure beyond the material.

A comparison of the shock mitigating materials frequency response function magnitudes is given in Table XX. An average for the three thickness values is given at low frequency and high frequency for both the reflected frf magnitude and the transmitted frf magnitude. Appendix B contains plots of a reflected frf magnitude comparing the three thickness values and of a transmitted frf magnitude comparing the three thickness values for each of the seventeen shock mitigating material.

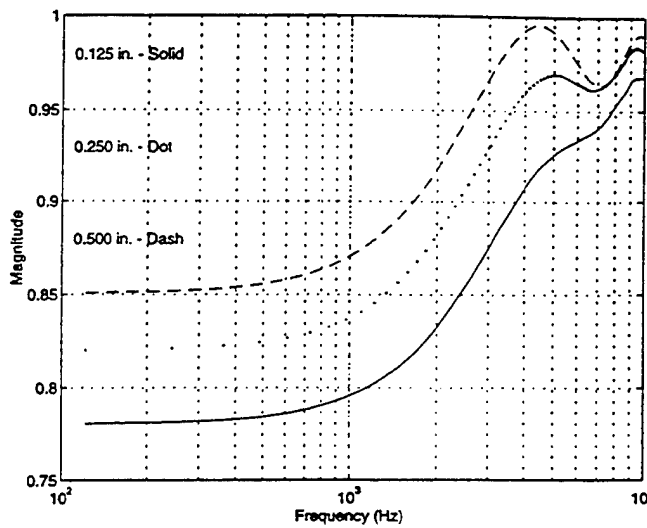


Reflected FRF

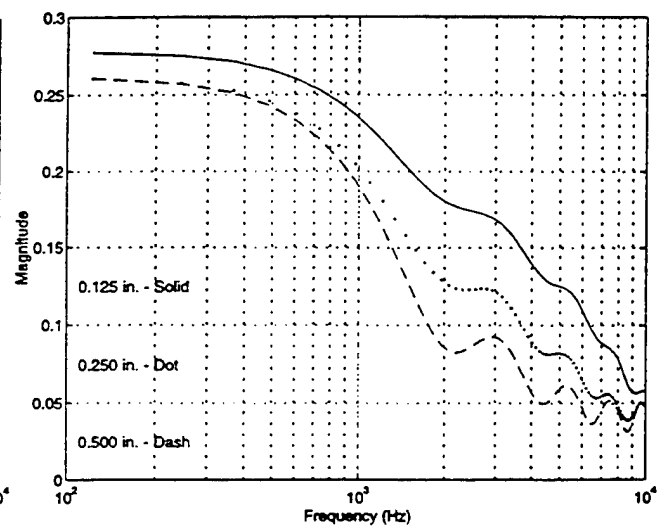


Transmitted FRF

Figure 5: Frequency Response Function Magnitudes for a Good Shock Transmitter, Phenolic and Cotton Cloth.



Reflected FRF



Transmitted FRF

Figure 6: Frequency Response Function Magnitudes for a Good Shock Mitigator, Teflon Rod.

Table XX: Comparison of Shock Mitigating Material Frequency Response Function Magnitudes

Material	Reflected Low Frequency	Reflected High Frequency	Transmitted Low Frequency	Transmitted High Frequency
Hi Density Polyethylene Rod	0.73	1.00	0.40	0.10
Teflon Rod	0.83	1.00	0.27	0.05
Lexan Rod	0.60	0.80	0.85	0.30
G-10 Epoxy & Fiberglass Cloth	0.25	0.50	0.95	0.80
Phenolic & Cotton Cloth	0.30	0.50	0.95	0.70
Adiprene L-100	0.95	1.00	0.20	0.03
828/DEA/GMB*	0.60	0.80	0.75	0.30
828/CTBN/DEA GMB**	0.45	0.80	0.70	0.30
PET 90A Polyurethane Rubber	0.96	1.00	0.15	0.02
Sylgard 184	0.97	1.00	0.08	0.01
HSII Silicone Rubber (Pink)	1.02	1.00	0.01	0.01
Sylgard 184 & GMB*	1.00	1.00	0.04	0.02
GE RTV 630	0.96	0.90	0.08	0.02
Polyurethane Foam (20 lb)	0.96	1.00	0.15	0.02
Polyurethane Foam (10 lb)	0.99	1.00	0.09	0.02
Polyurethane Foam (6 lb)	1.01	1.00	0.03	0.10
Polysulfide Rubber PRC1422	0.98	1.00	0.08	0.02

* 828 is a base, DEA is a curing agent, GMB is glass-filled microballoons.

** CTBN is a resin, see ** above for other components.

The shock mitigator reflects the high frequency back into the incident bar (or the penetrator case, for example) instead of absorbing the high frequency portion of the velocity wave. This may not be an attractive feature since it may be damaging to other components in some cases. It would be best if the shock mitigating material actually absorbed the high frequency shock.

Conclusions

The first part of a study to evaluate seventeen, unconfined materials for four shock mitigating characteristics has been completed. The analysis of the split Hopkinson bar data shows that the amplitude of the transmitted shock pulse decreases with increasing thickness for all seventeen materials. A good shock mitigating material is one that transmits a substantially lower amplitude shock than the incident shock. Additionally, the pulse duration is lengthened by a good shock mitigating material so that the transmitted shock pulse becomes a low frequency pulse. An energy analysis has shown that no energy is absorbed by the material as long as the Hopkinson bars remain elastic. The peak incident energy and peak transmitted energy has been calculated and tabulated for each material. Frequency response function magnitudes have been calculated for these materials. The high frequency content is reflected at the interface between the Hopkinson bars and the shock mitigating material because of the large impedance mismatch. However, the reflection of high frequency portion of the shock at the interface with the shock mitigating material may not be desirable in some applications because the reflected shock may damage some other components or portions of a structure.

Future Work

The second portion of the shock mitigating material study will continue with five materials from the first part of the study. These materials were chosen because they demonstrated the desired characteristics of a shock mitigating material and for their ease of use in real structures. These materials are: Teflon, Sylgard 184, GE RTV 630, HS II Silicone, and Polysulfide Rubber. These materials will be evaluated at ambient, -65°F, and +165°F. Two thickness values of 0.125 and 0.250 in. will be used. Both confined and unconfined samples will be evaluated at the two load conditions of 25 fps (750 $\mu\epsilon$) and 50 fps (1500 $\mu\epsilon$) with a 100 μs pulse duration for both amplitudes.

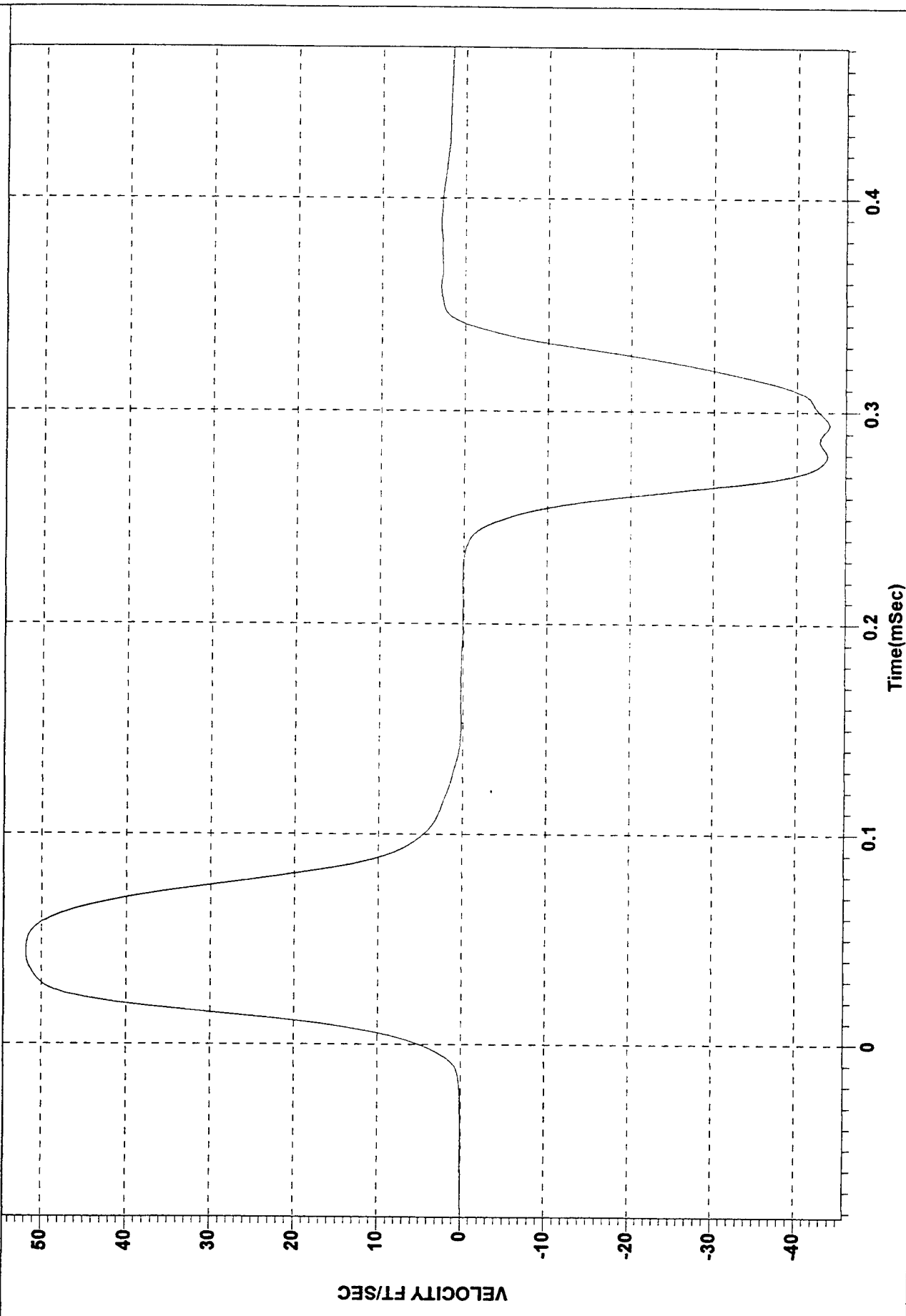
References

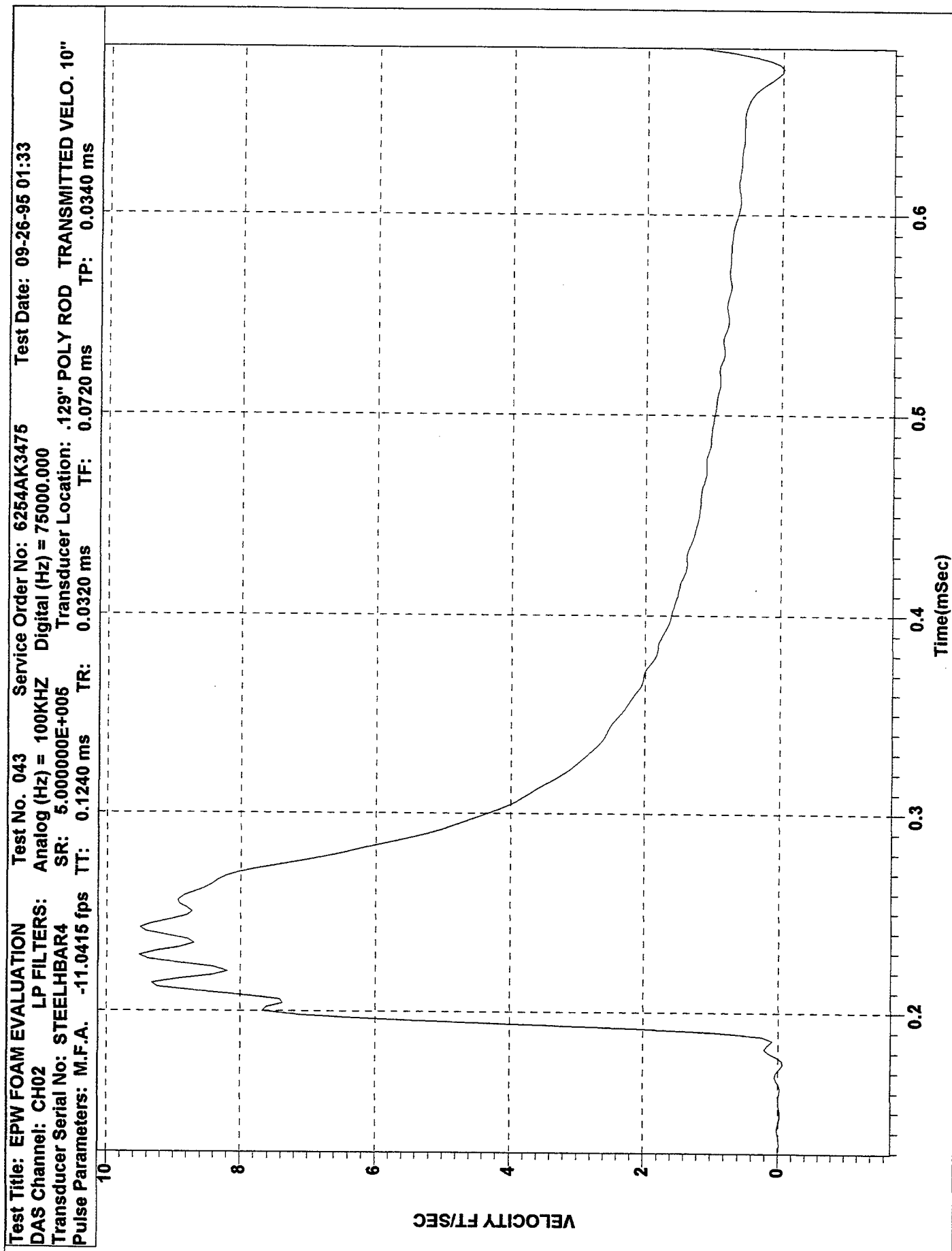
1. Bateman, V. I., R. L. Mayes, and G. H. James, "Structural Response Measurements to Insure Penetrator Data Integrity," *Proceedings of the 64th Shock and Vibration Symposium*, Vol. I, Fort Walton Beach, FL, October 1993, pp. 145-154.
2. Lindholm, U. S., and L. M. Yeakley, "High Strain-Rate Testing: Tension and Compression," *Experimental Mechanics*, Vol. 8, 1968, pp. 1-9.
3. Bateman, V. I., R. G. Bell, and N. T. Davie, "Evaluation of Shock Isolation Techniques for a Piezoresistive Accelerometer," *Proceedings of the 60th Shock and Vibration Symposium*, David Taylor Research Center, Portsmouth, VA, November 1989.

Appendix A

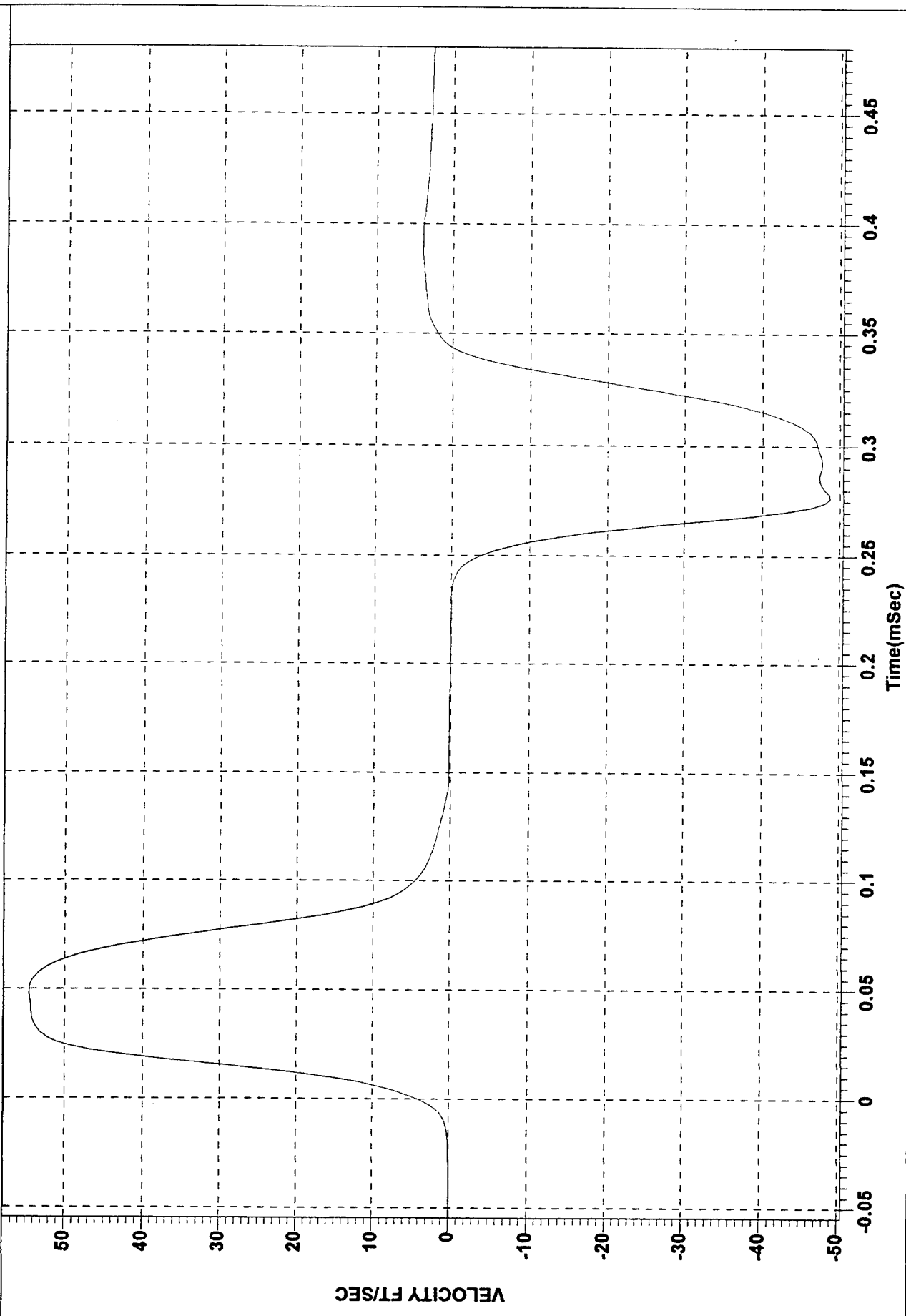
**A Time History Plot of the Incident and Reflected
Waves and A Time History Plot of the Transmitted
Wave for Three Thickness Values of the Seventeen
Shock Mitigating Materials**

Test Title: EPW FOAM EVALUATION Test No. 043 Service Order No: 6254AK3475 Test Date: 09-26-95 01:33
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Transducer Serial No: STEELHBAR3 SR: 5.000000E+005 Transducer Location: .129" POLY ROD INPUT VELOCITY
Pulse Parameters: M.F.A. 51.9082 fps TT: 0.1000 ms TR: 0.0240 ms TF: 0.0380 ms TP: 0.0440 ms

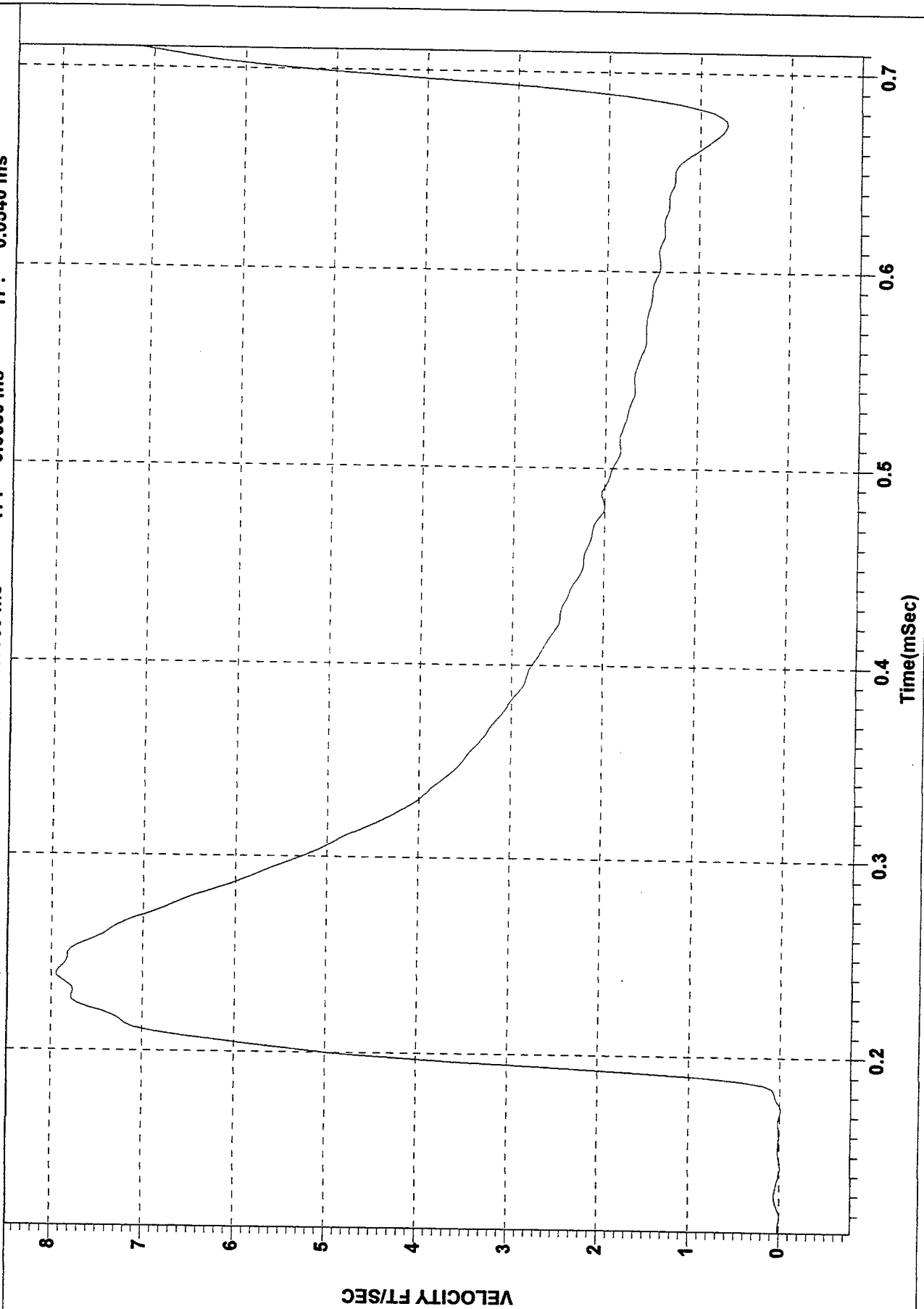




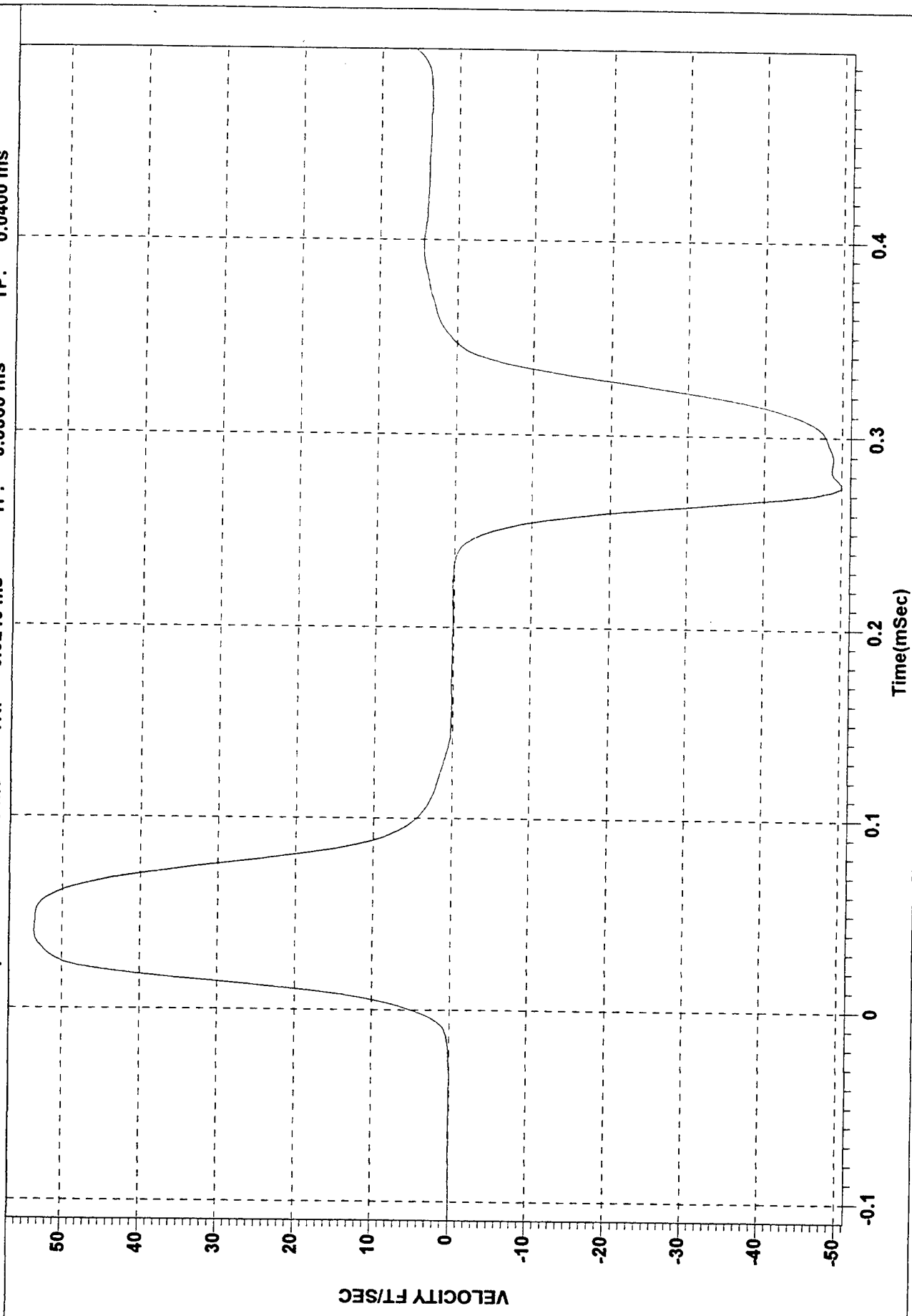
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 Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .251" POLY ROD INPUT VELOCITY
 Pulse Parameters: M.F.A. 54.7092 fps TT: 0.0980 ms TR: 0.0240 ms TF: 0.0340 ms TP: 0.0500 ms



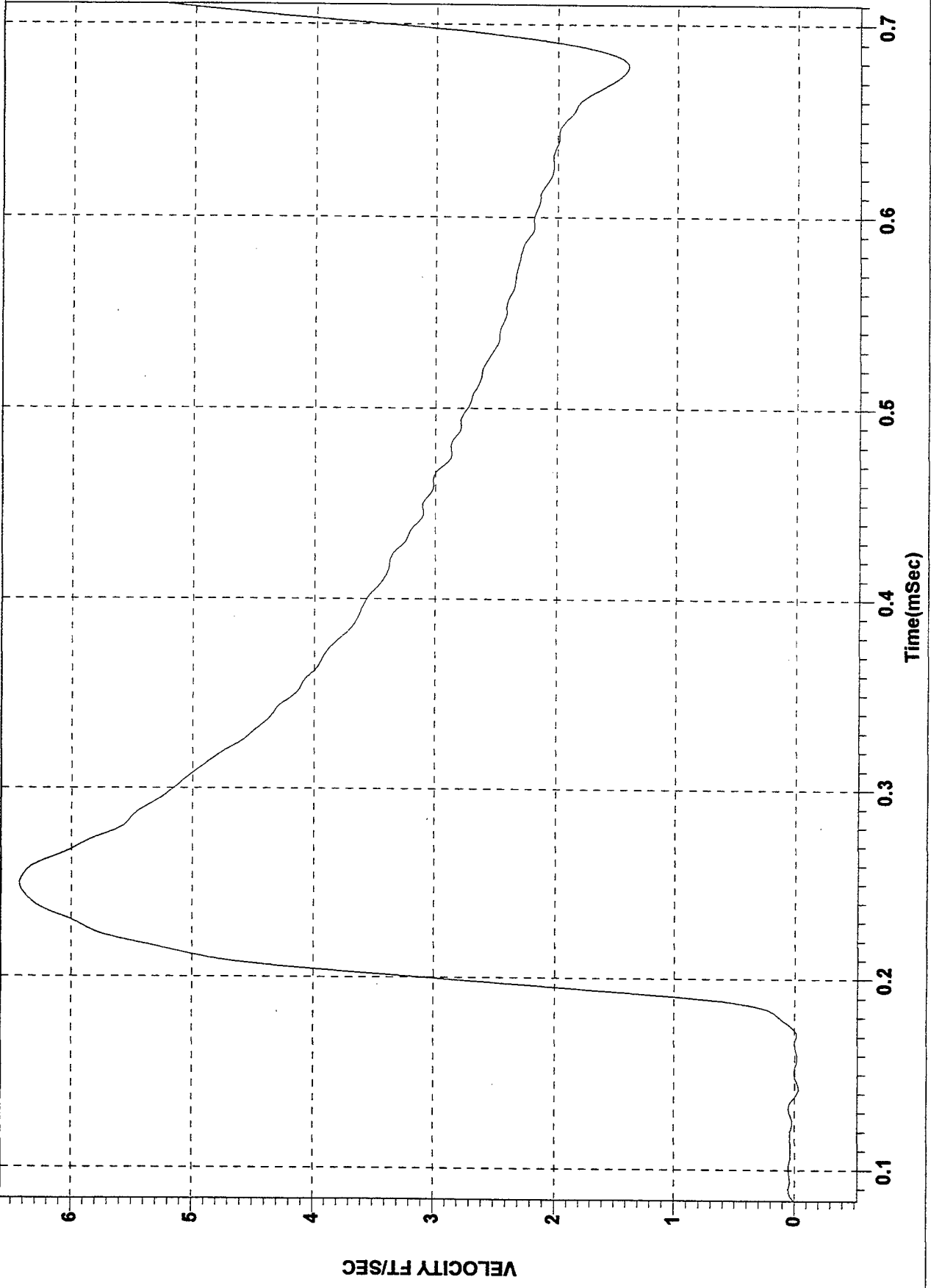
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Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .251" POLY ROD TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 8.7841 fps TT: 0.1700 ms TR: 0.0360 ms TF: 0.0860 ms TP: 0.0540 ms



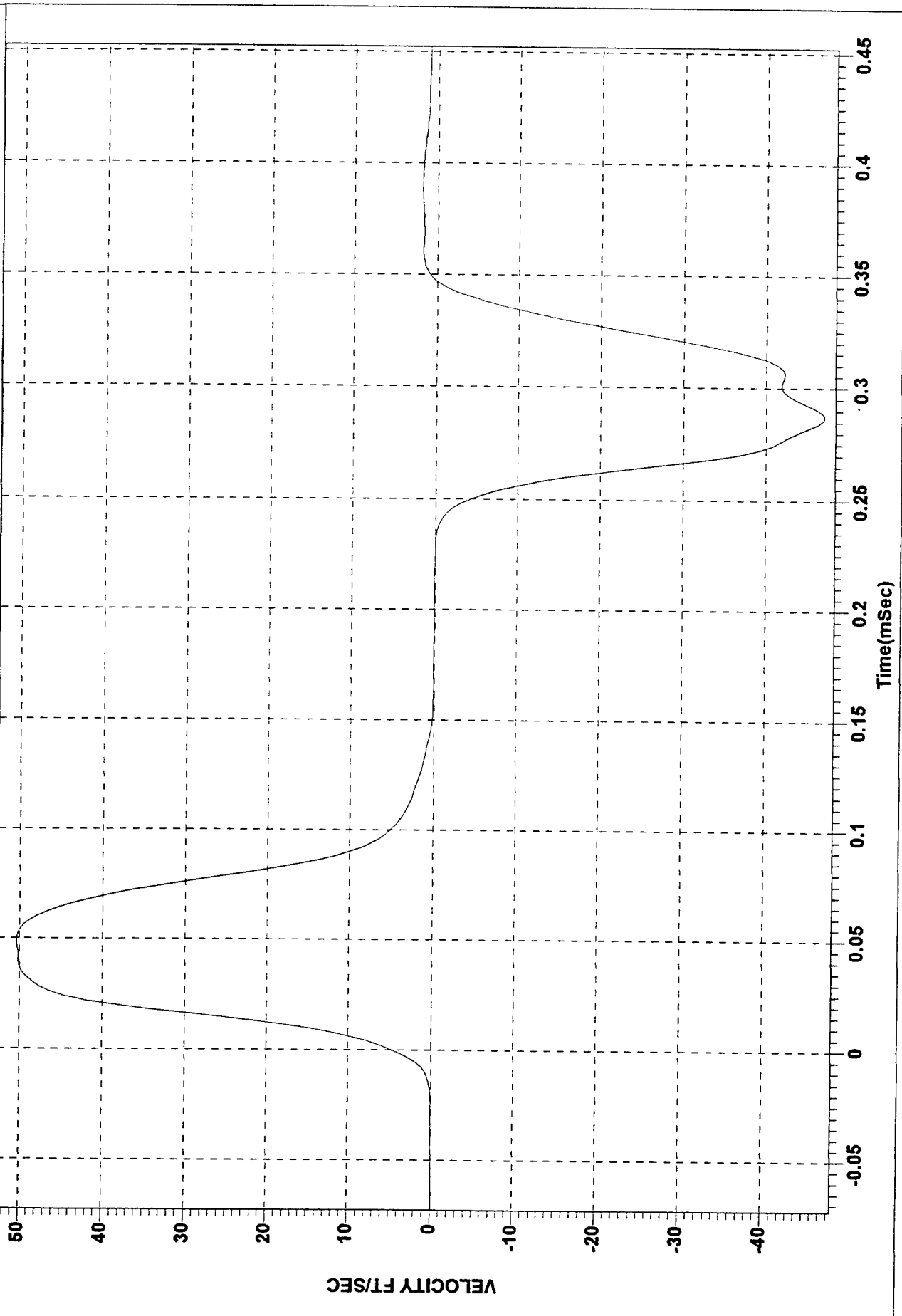
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Transducer Serial No: STEELHBAR3 SR: 5.000000E+005 Transducer Location: .502" POLY ROD INPUT VELOCITY
Pulse Parameters: M.F.A. 53.7453 fps TT: 0.0980 ms TR: 0.0240 ms TF: 0.0360 ms TP: 0.0400 ms



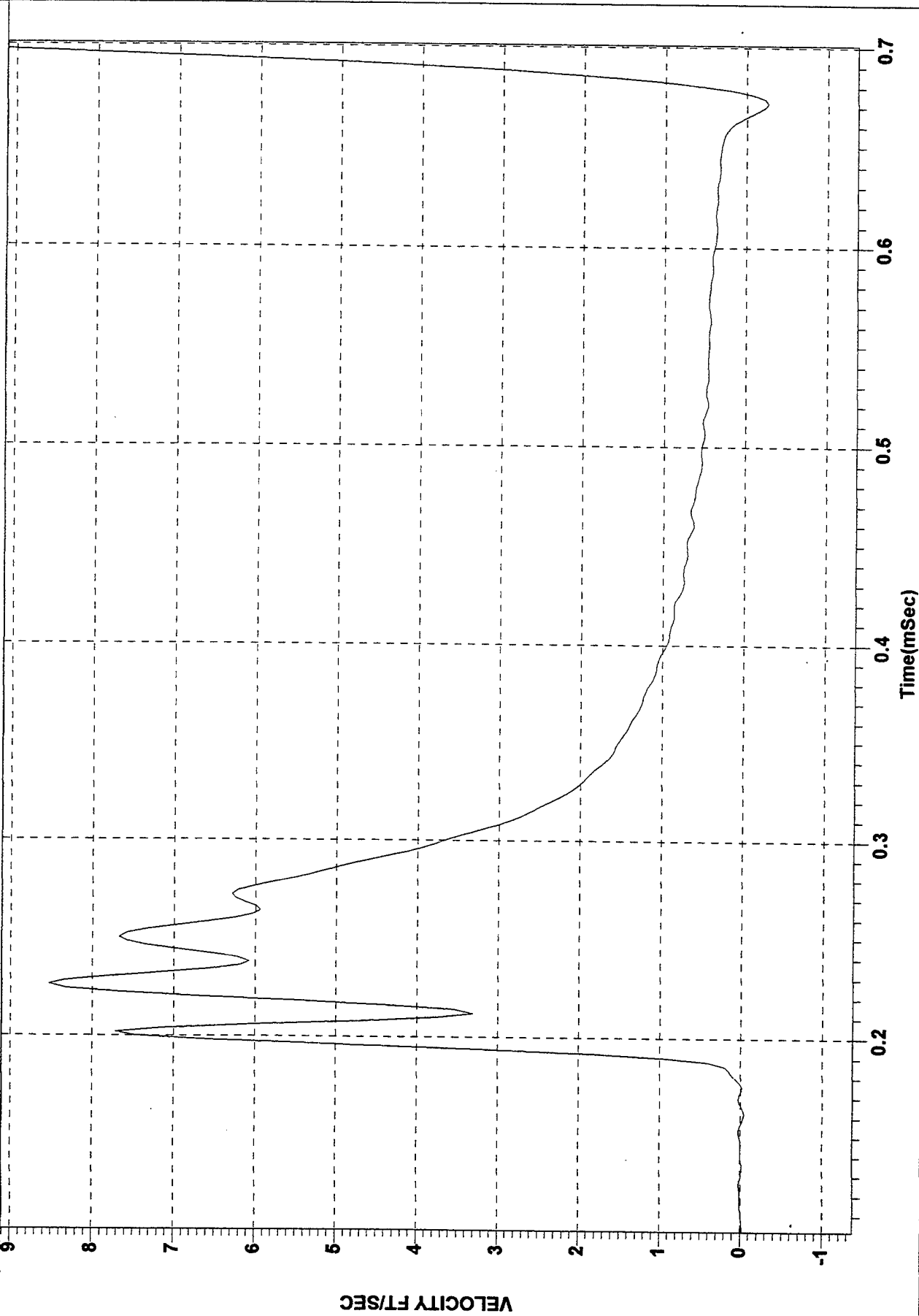
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Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .502" POLY ROD TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. -6.9899 fps TT: 0.1440 ms TR: 0.0940 ms TF: 0.0400 ms TP: 0.1000 ms



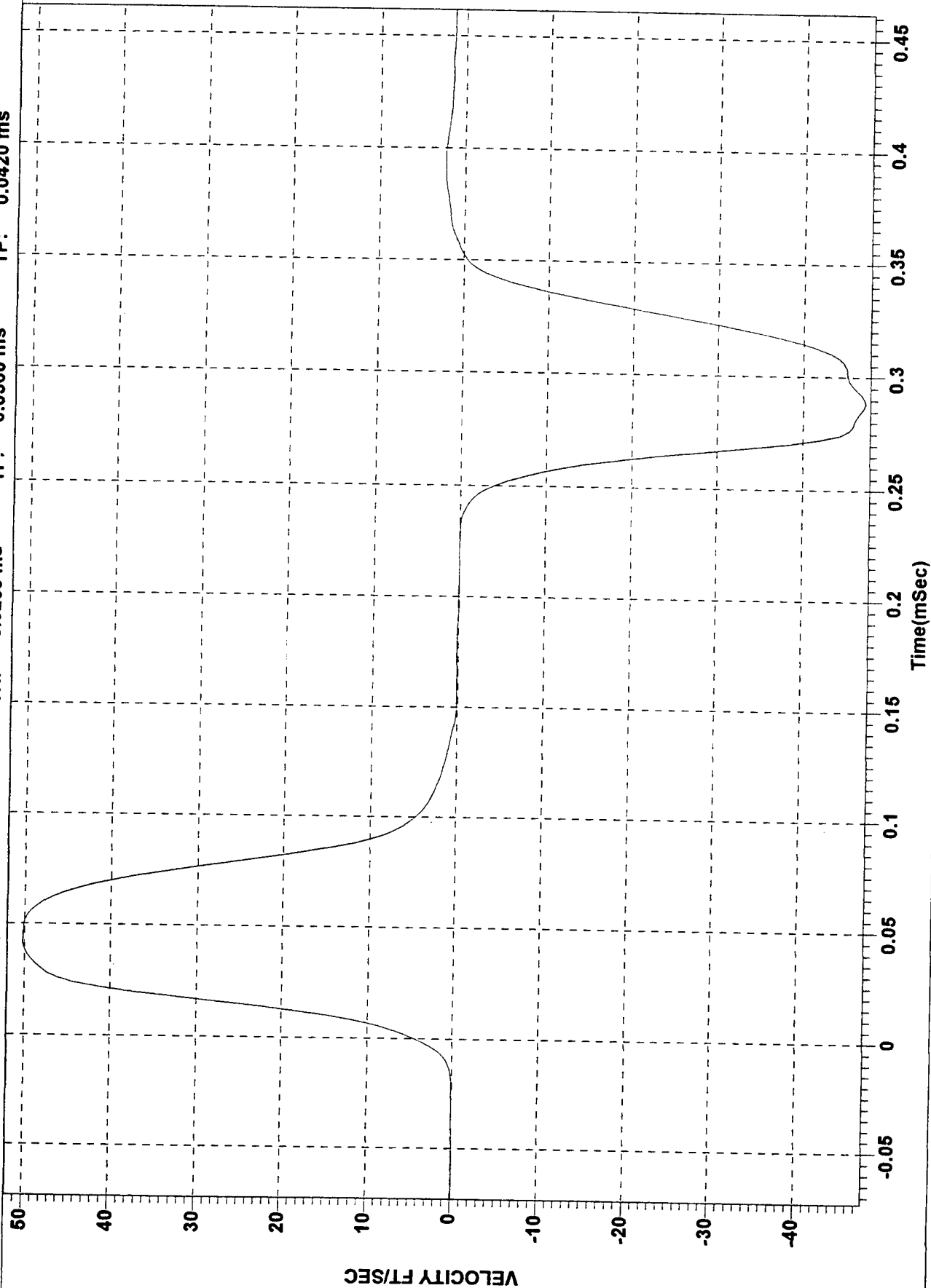
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Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .127"TEFLON ROD INPUT VELOCITY
Pulse Parameters: M.F.A. 50.3933 fps TT: 0.1020 ms TR: 0.0260 ms TF: 0.0380 ms TP: 0.0500 ms



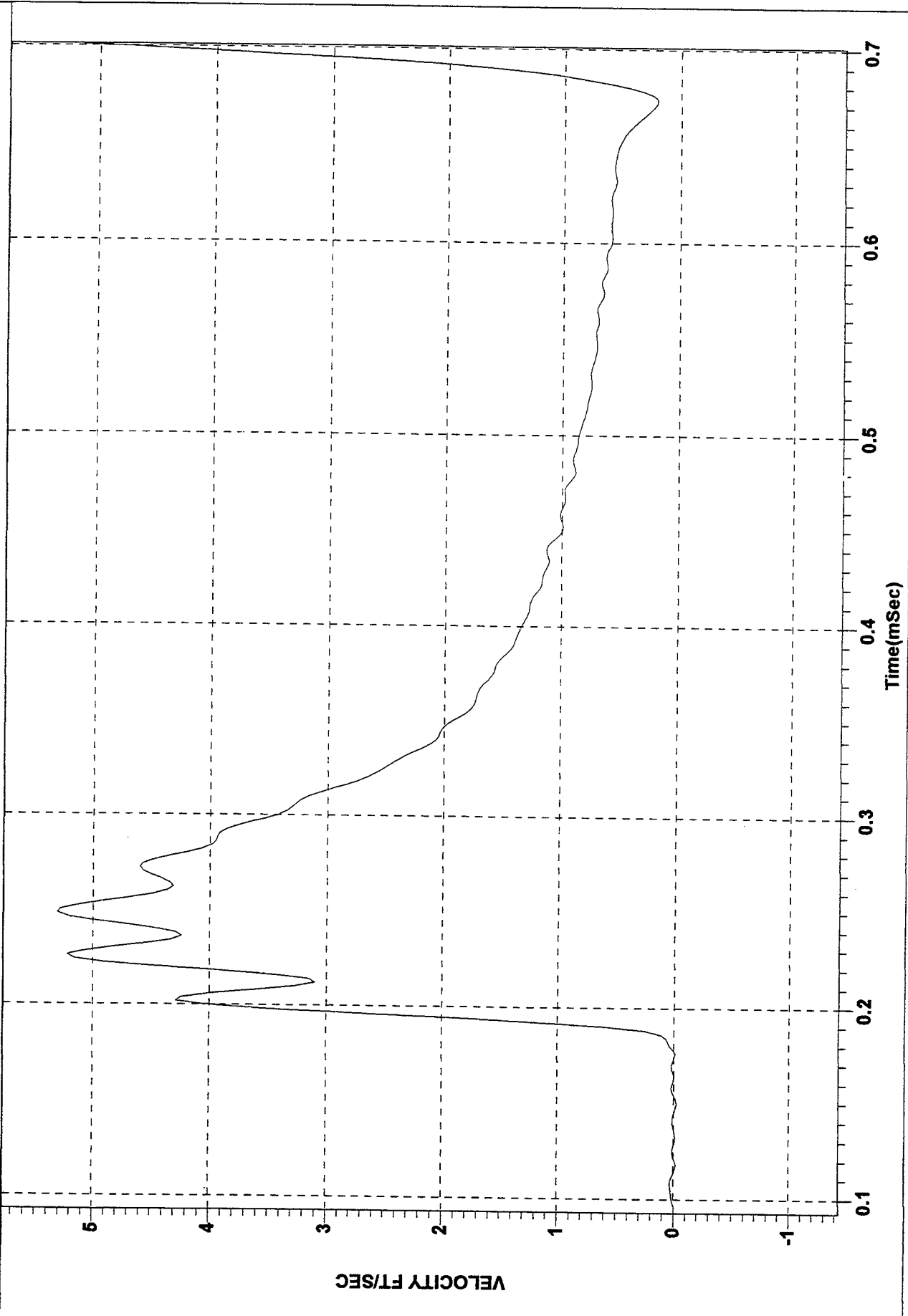
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Pulse Parameters: M.F.A. -13.9838 fps TT: 0.1200 ms TR: 0.0180 ms TF: 0.0620 ms TP: 0.0520 ms



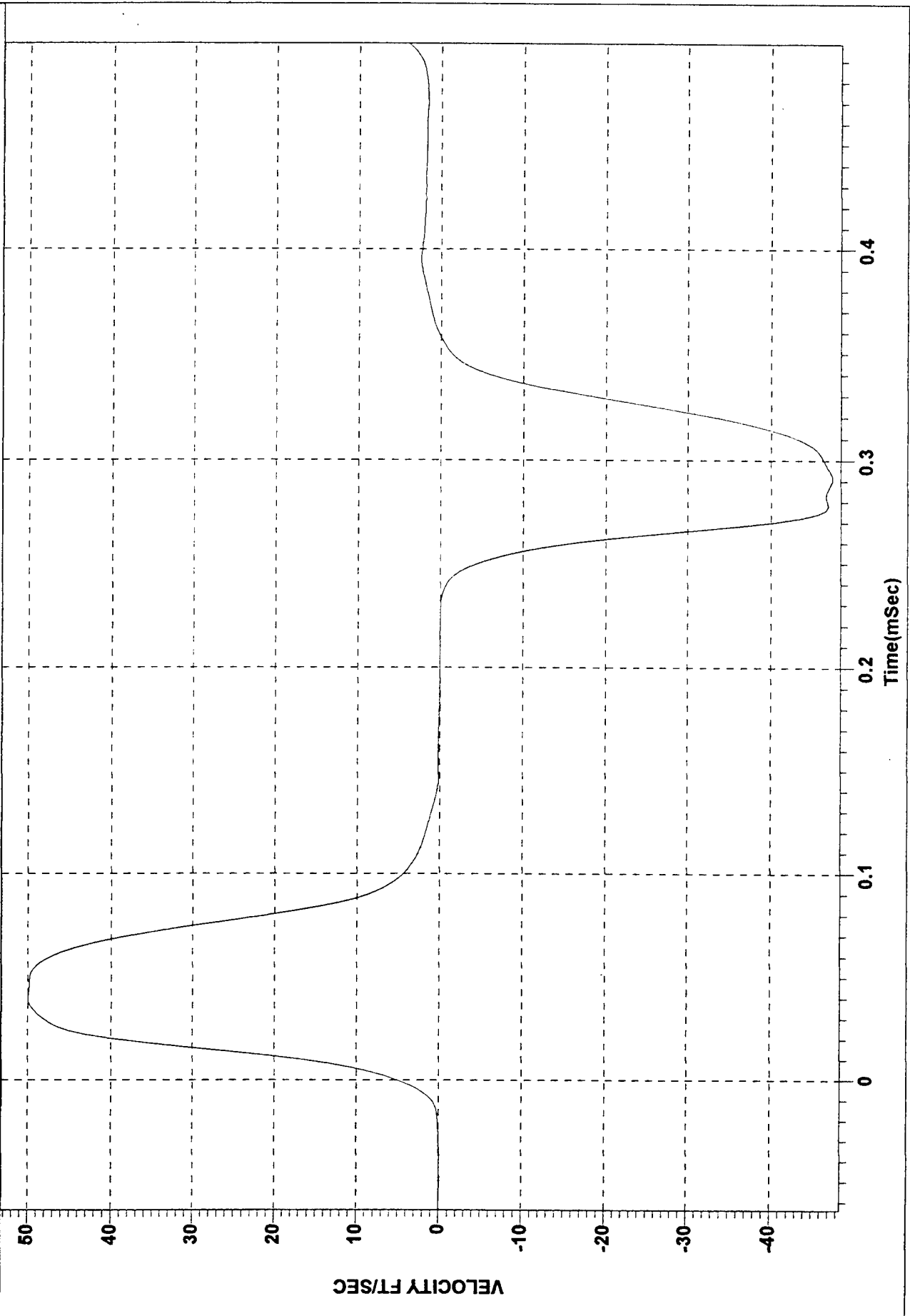
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Transducer Serial No: STEELHBAR3 SR: 5.000000E+005 Transducer Location: .252"TEFLON ROD INPUT VELOCITY
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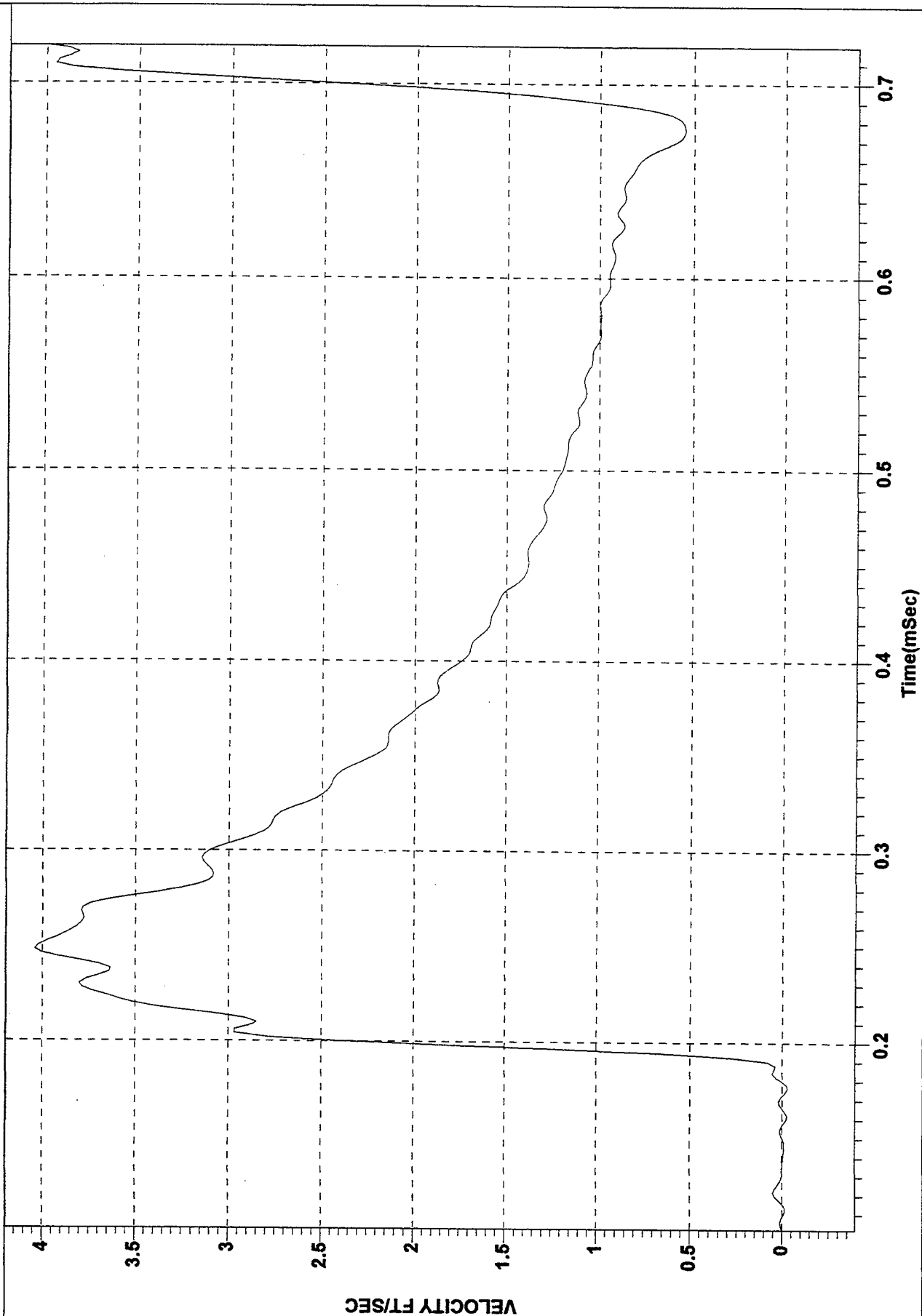
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Pulse Parameters: M.F.A. -8.2336 fps TT: 0.1140 ms TR: 0.0360 ms TF: 0.0680 ms TP: 0.0420 ms



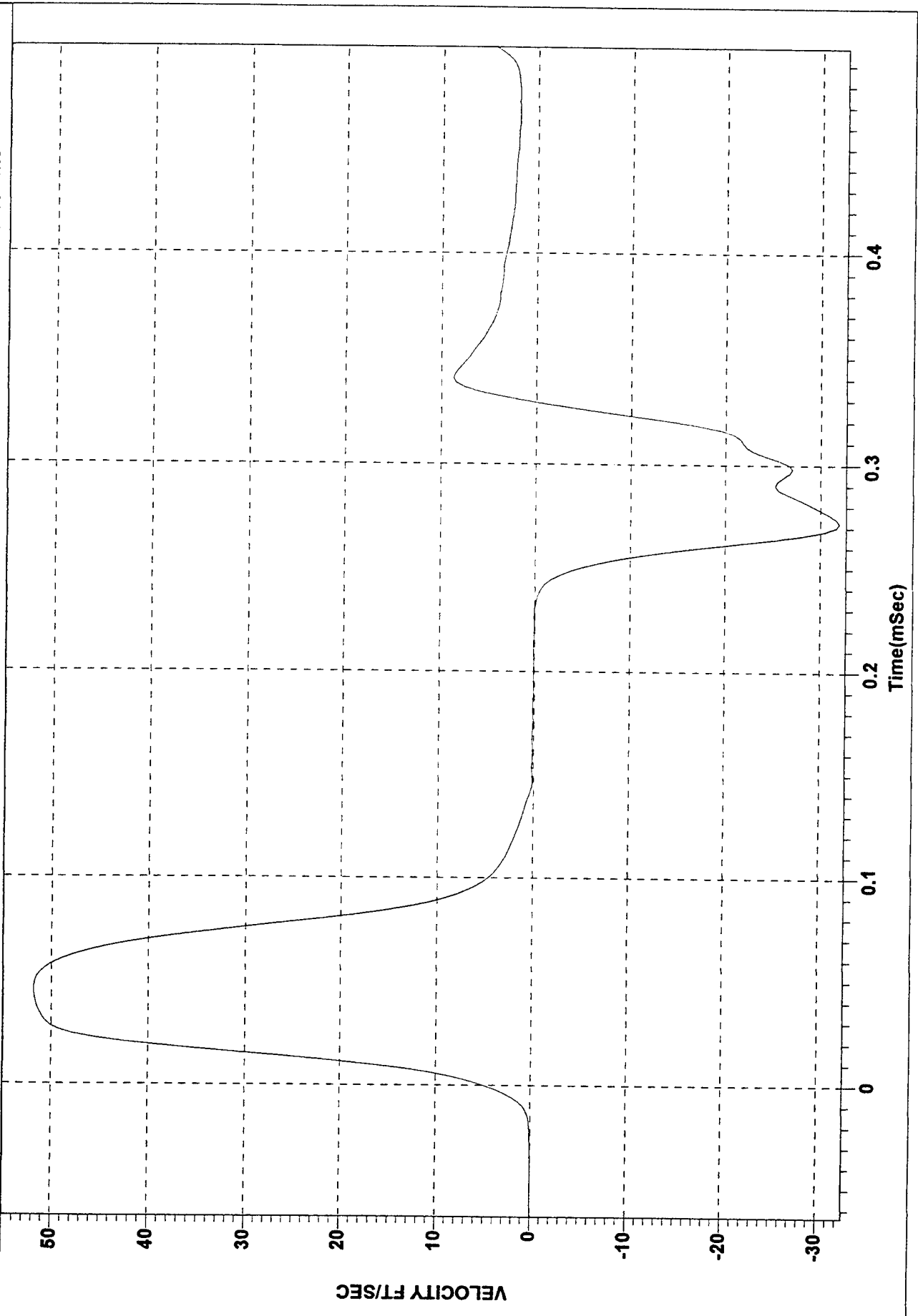
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Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .502"TEFLON ROD INPUT VELOCITY
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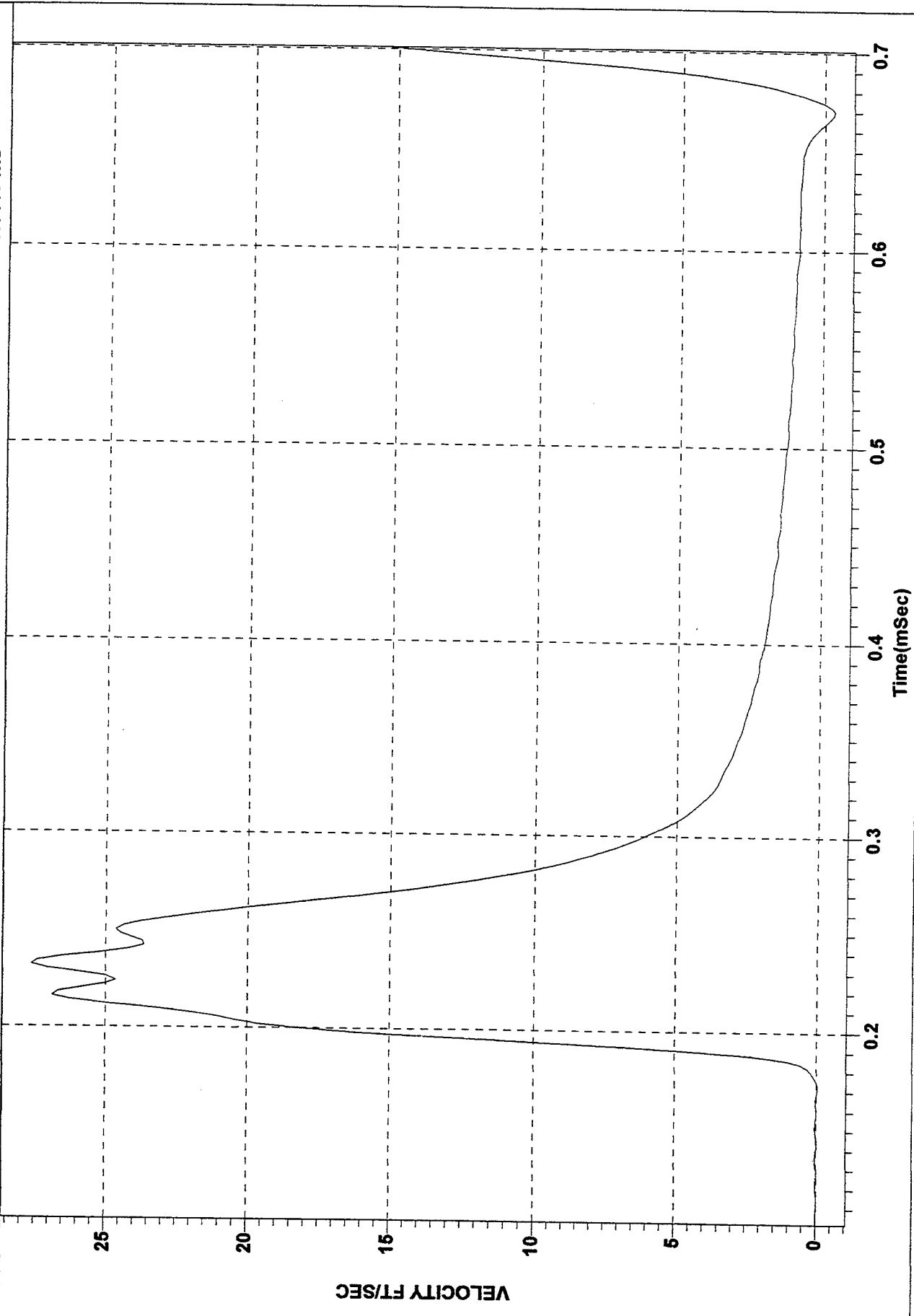
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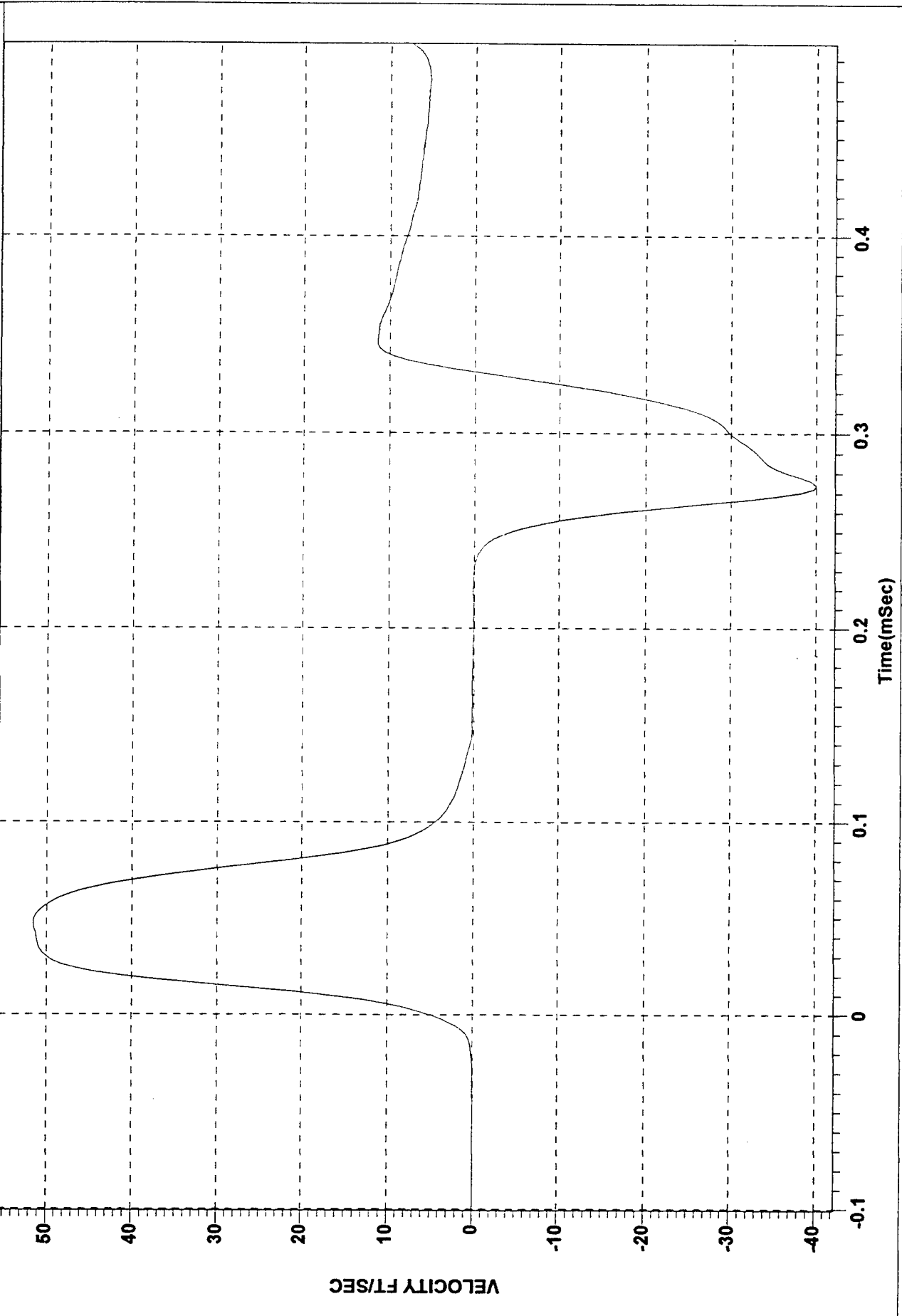
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DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .126" LEXAN ROD INPUT VELOCITY
Pulse Parameters: M.F.A. 51.8955 fps TT: 0.1020 ms TR: 0.0260 ms TF: 0.0380 ms TP: 0.0480 ms



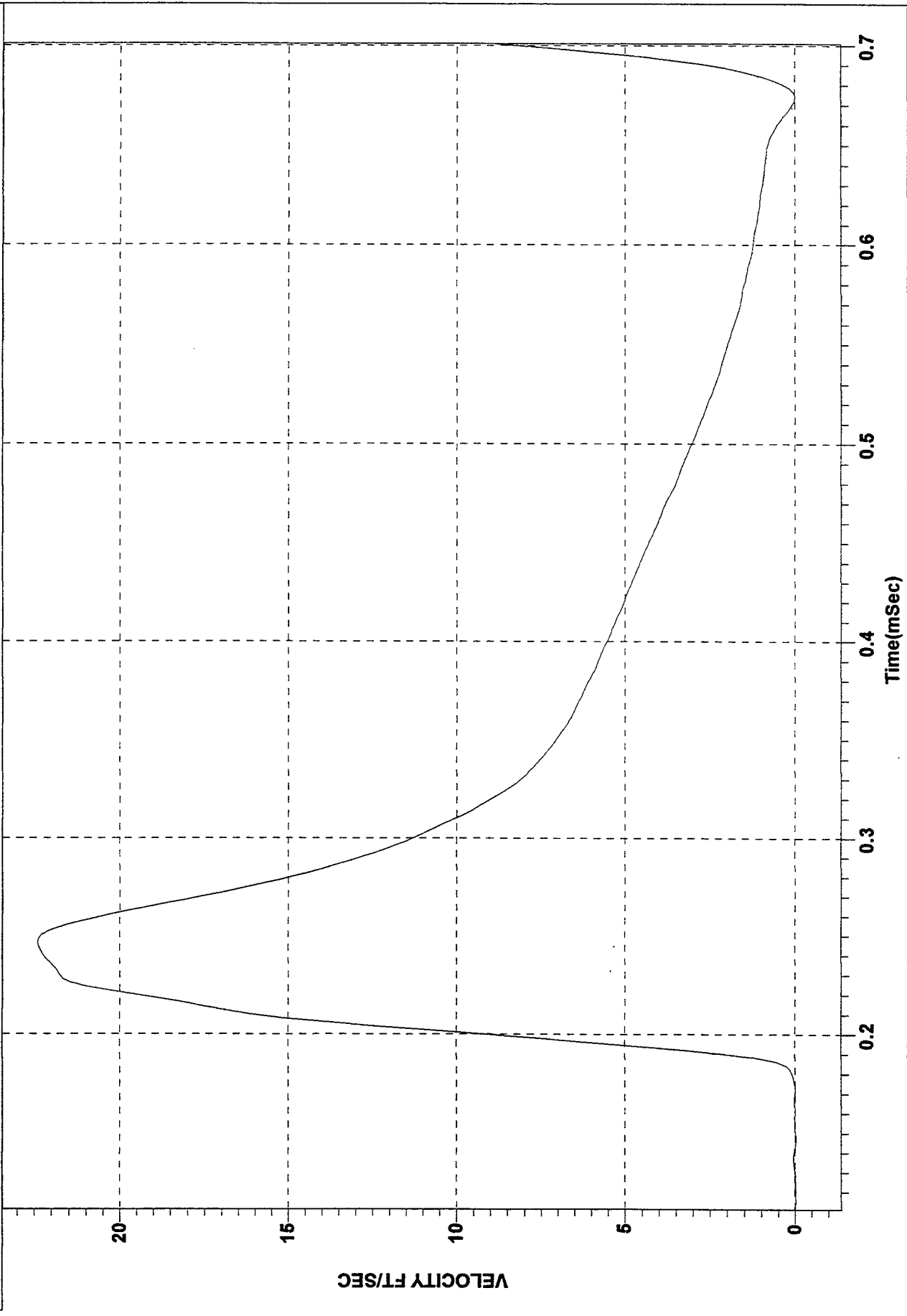
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DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .126" LEXAN ROD TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 27.6245 fps TT: 0.1660 ms TR: 0.0240 ms TF: 0.1160 ms TP: 0.0440 ms



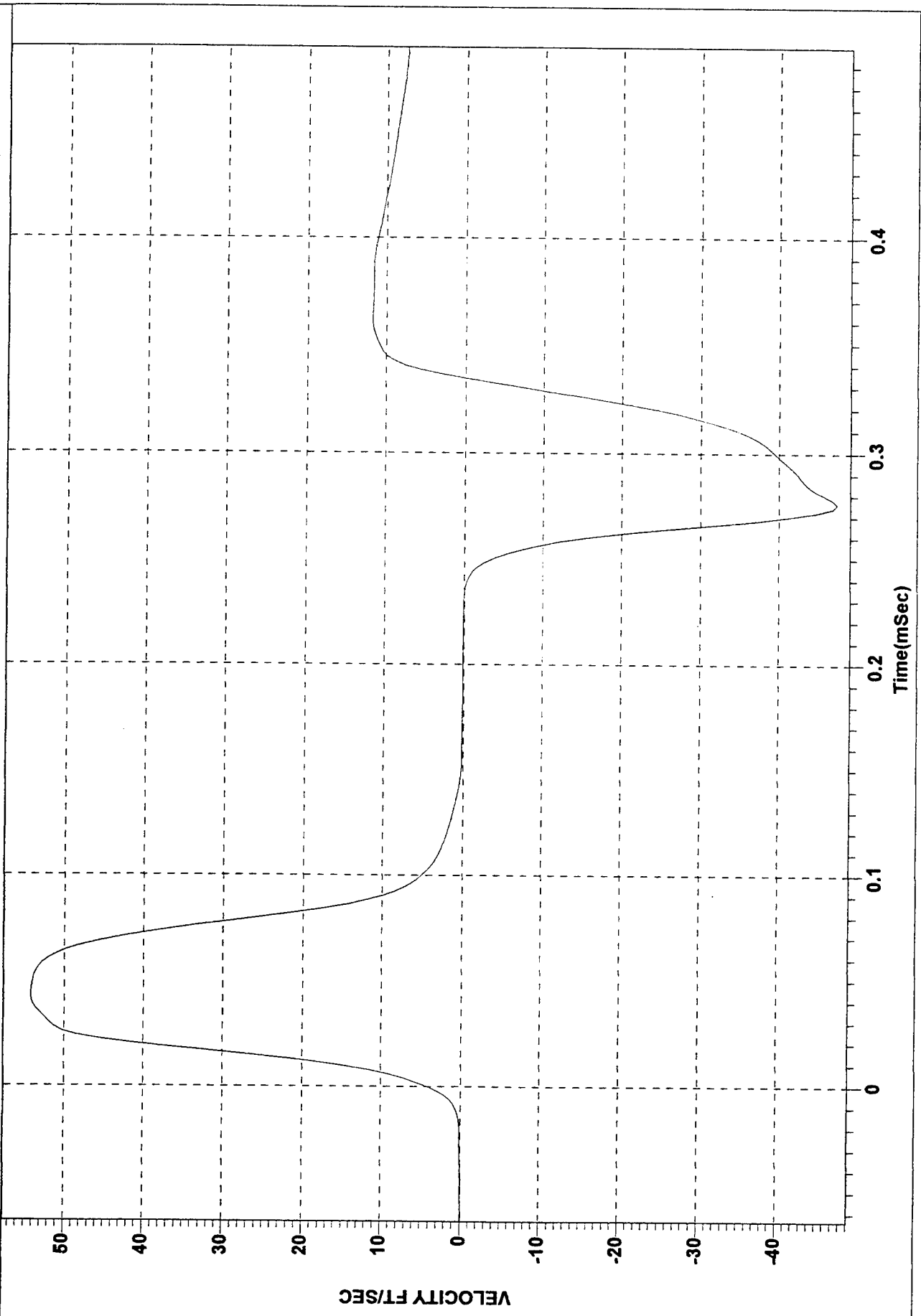
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Transducer Serial No: STEELHBAR3 SR: 5.000000E+005 Transducer Location: .252" LEXAN ROD INPUT VELOCITY
Pulse Parameters: M.F.A. 51.5862 fps TT: 0.0980 ms TR: 0.0240 ms TF: 0.0360 ms TP: 0.0480 ms



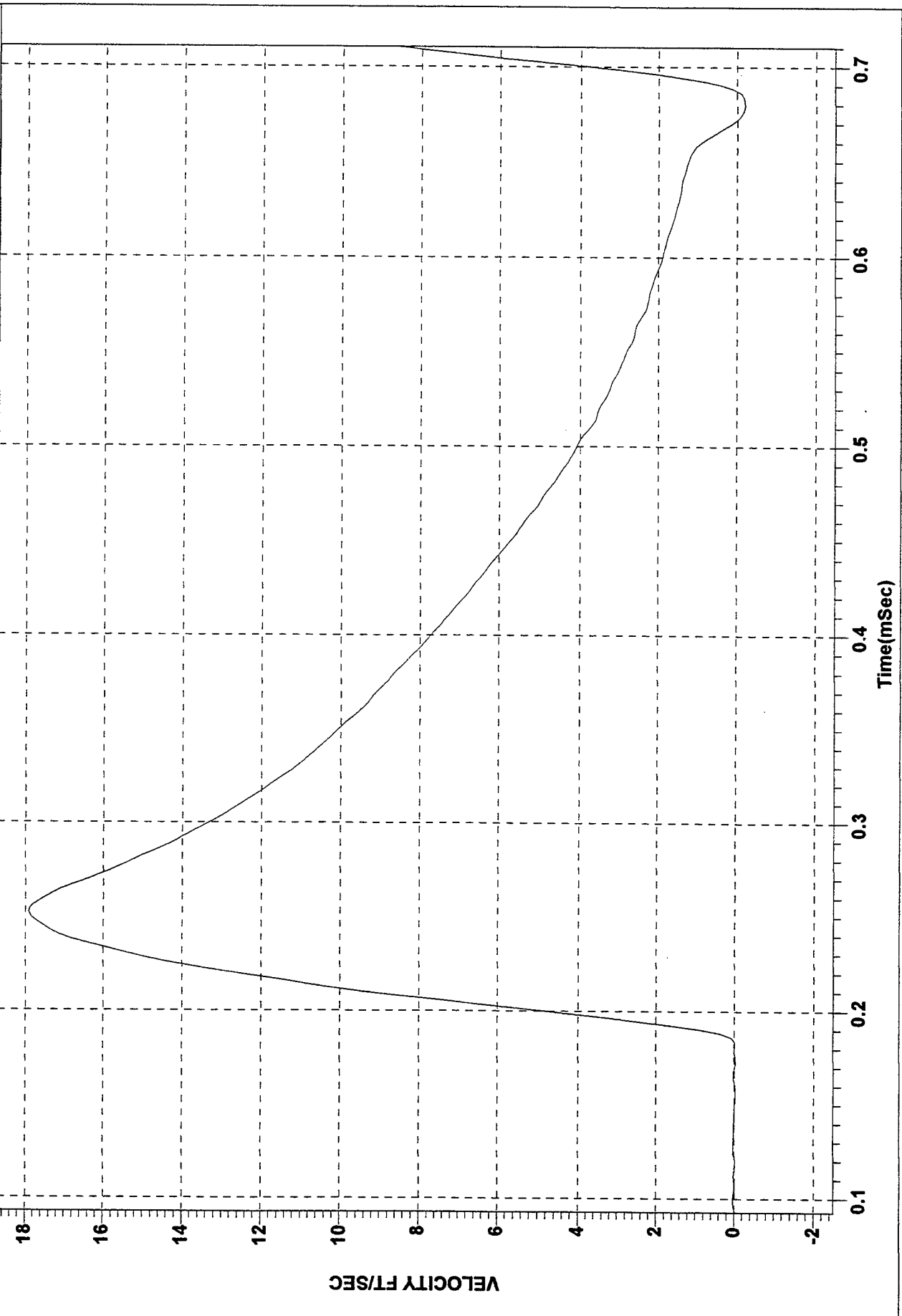
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Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .252" LEXAN ROD TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 22.4058 fps TT: 0.3460 ms TR: 0.0320 ms TF: 0.2760 ms TP: 0.0560 ms



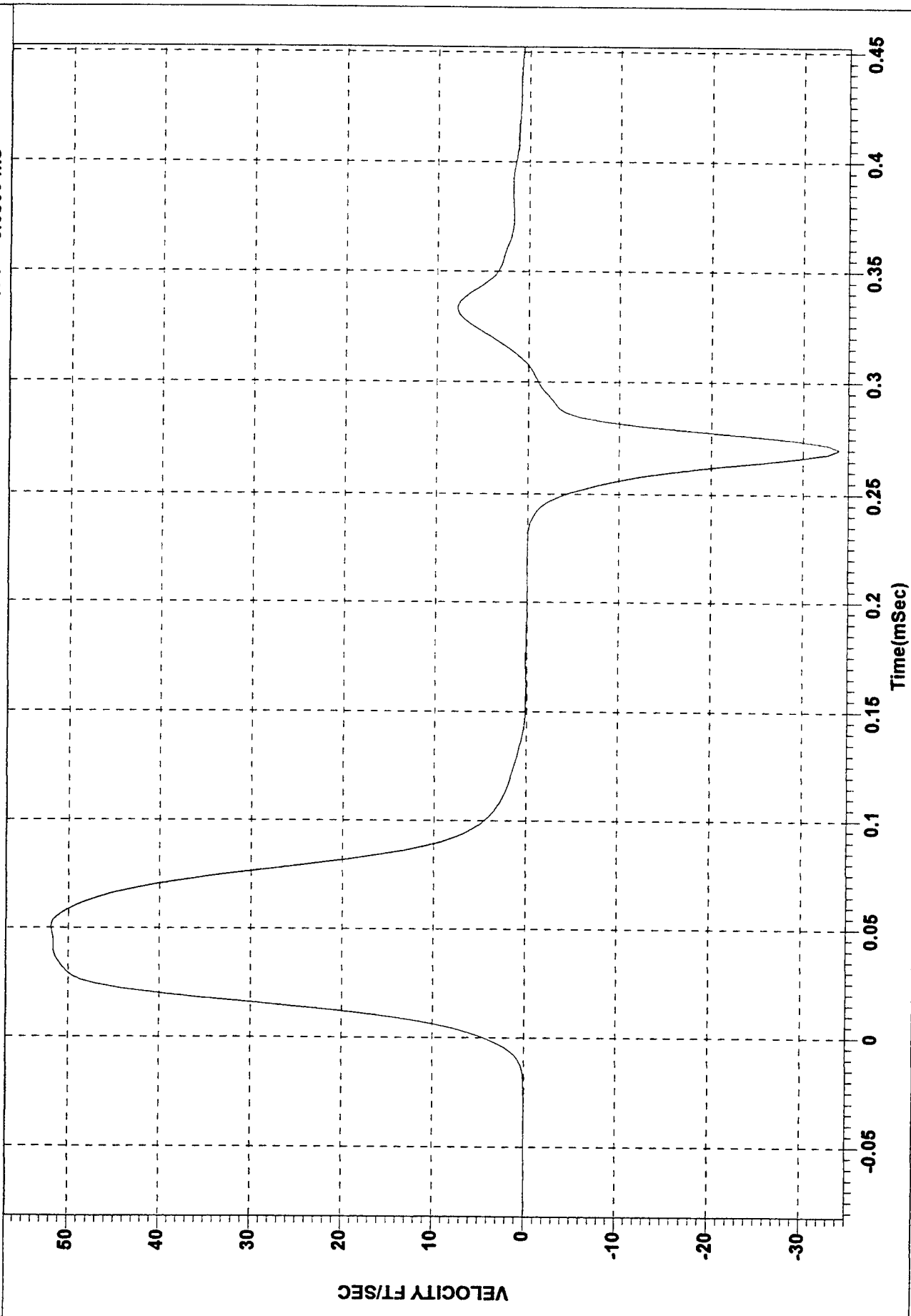
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 DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
 Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .501" LEXAN ROD INPUT VELOCITY
 Pulse Parameters: M.F.A. 54.2786 fps TT: 0.1000 ms TR: 0.0260 ms TF: 0.0360 ms TP: 0.0420 ms



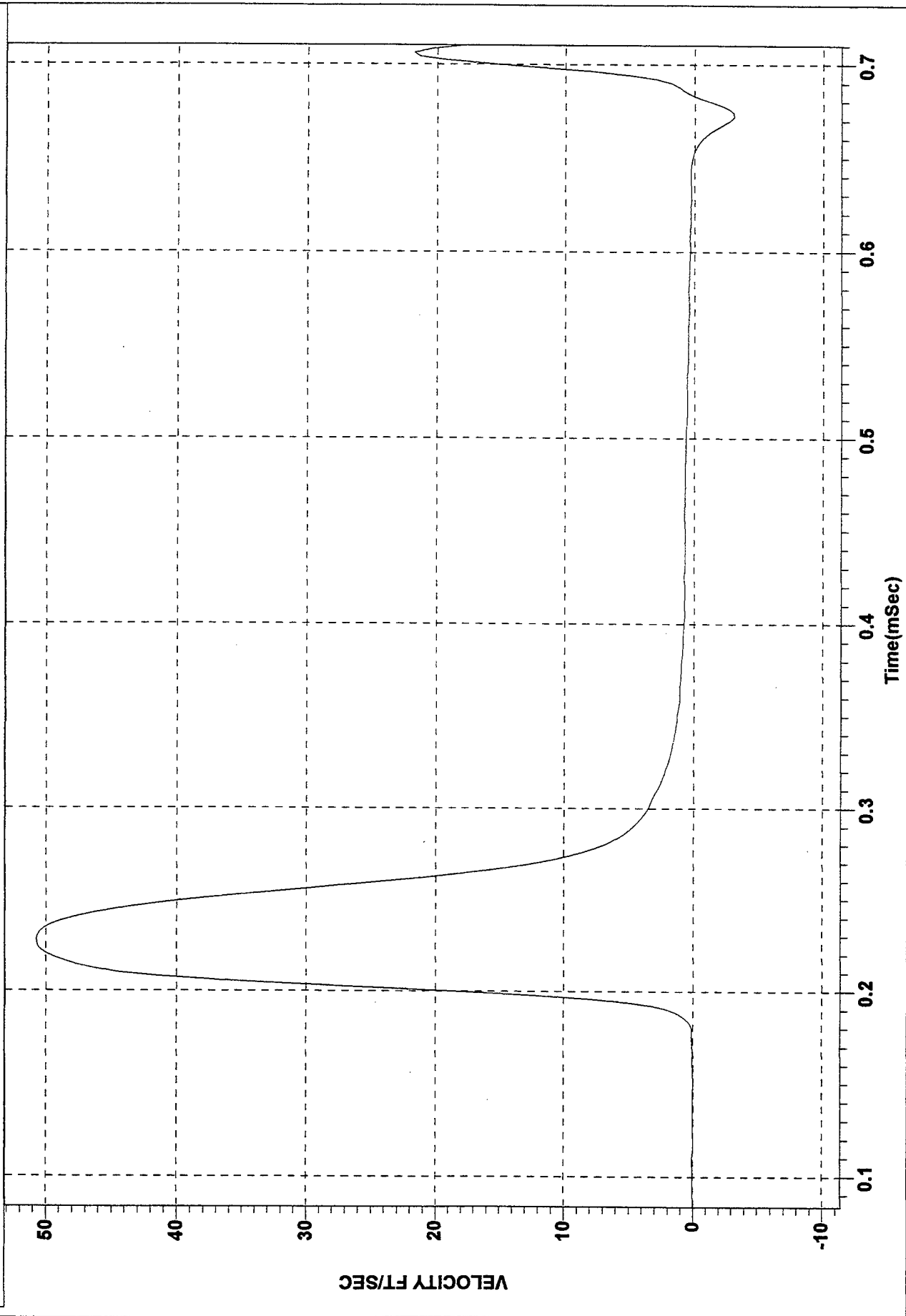
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DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .501" LEXAN ROD TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 17.9230 fps TT: 0.4200 ms TR: 0.0440 ms TF: 0.3420 ms TP: 0.0600 ms



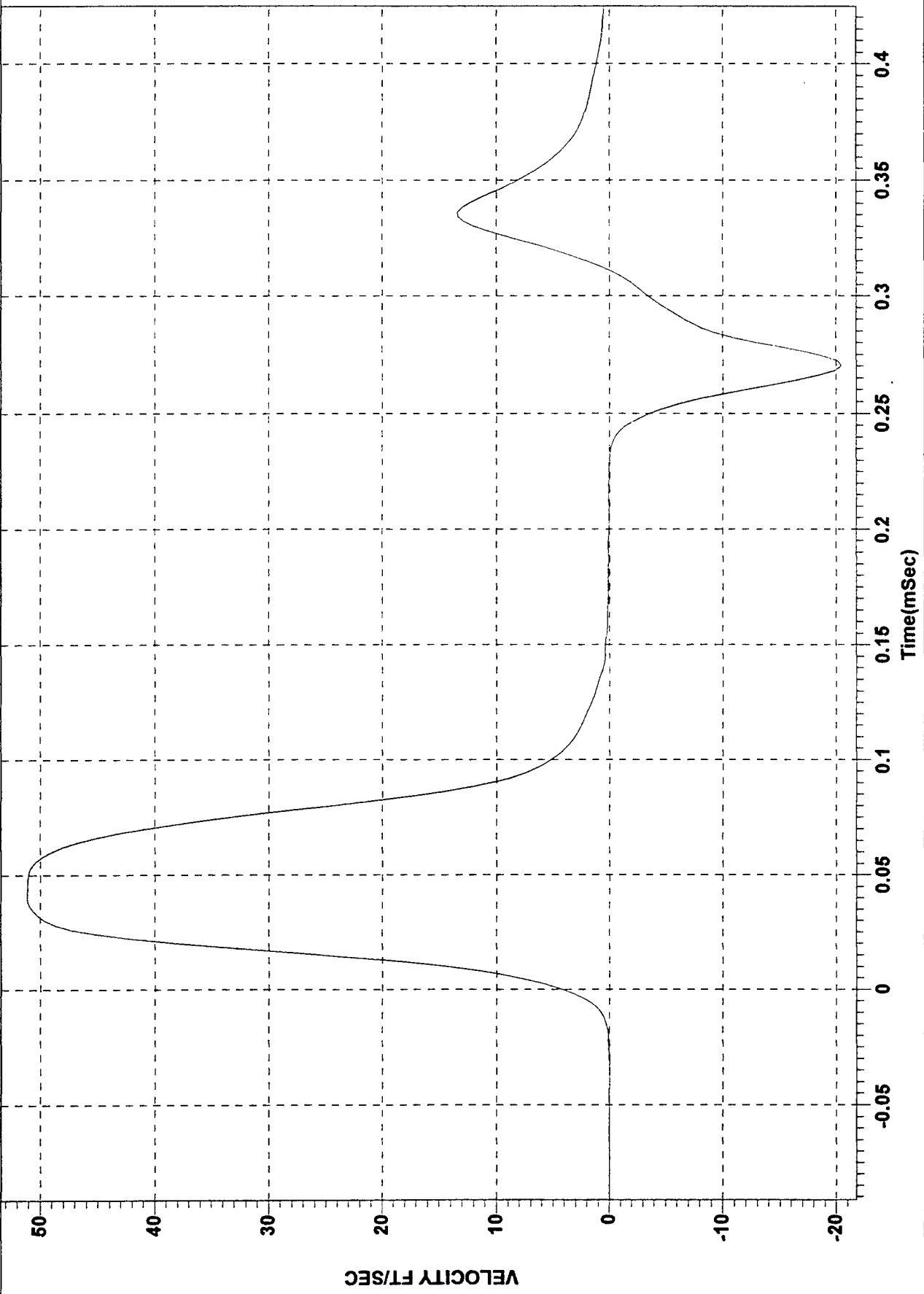
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DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .129" G-10 EPOX INPUT VELOCITY
Pulse Parameters: M.F.A. 51.9569 fps TT: 0.0980 ms TR: 0.0240 ms TF: 0.0340 ms TP: 0.0500 ms



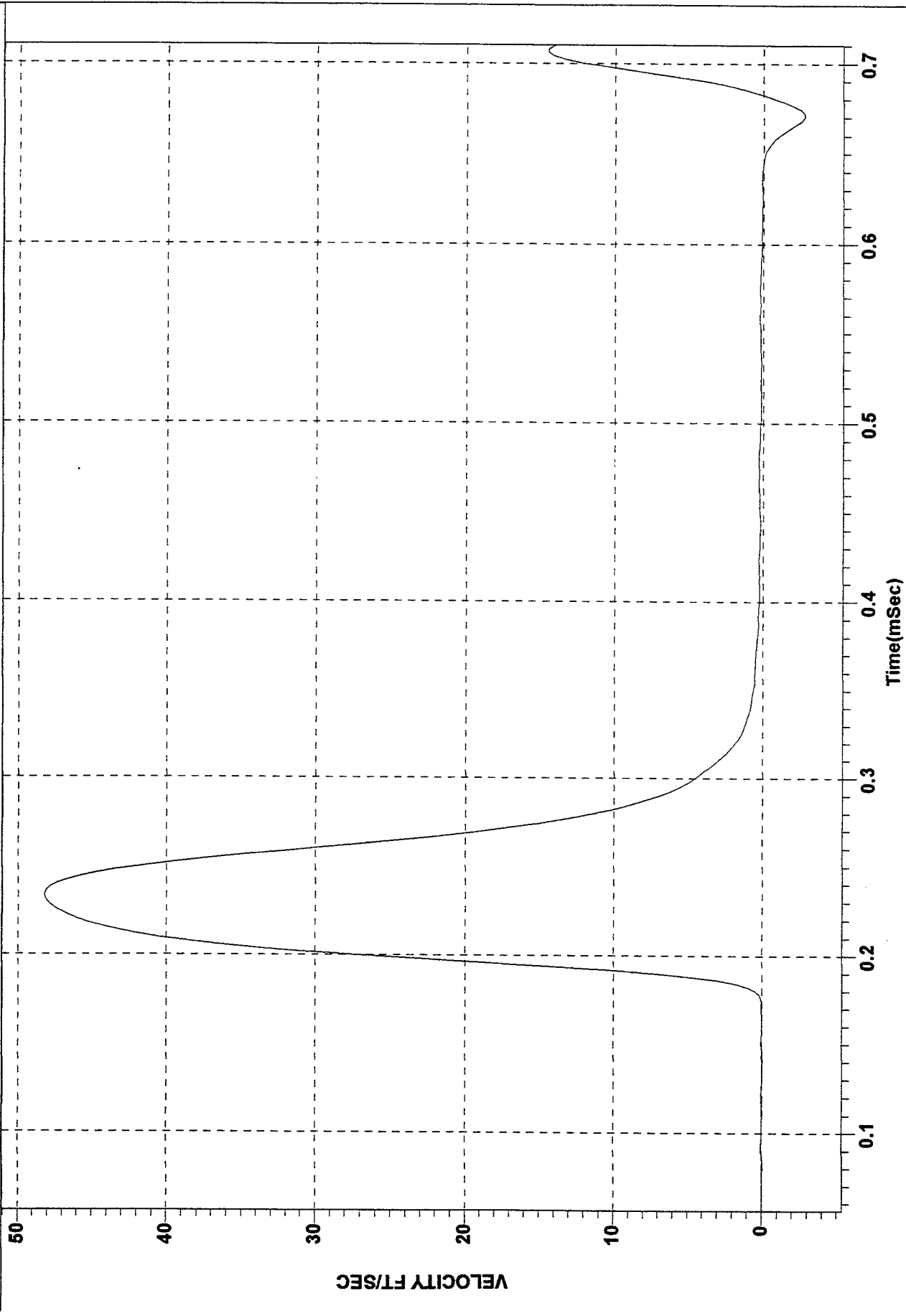
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DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .129" G-10 EPOX TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 50.7456 fps TT: 0.0960 ms TR: 0.0200 ms TF: 0.0460 ms TP: 0.0360 ms



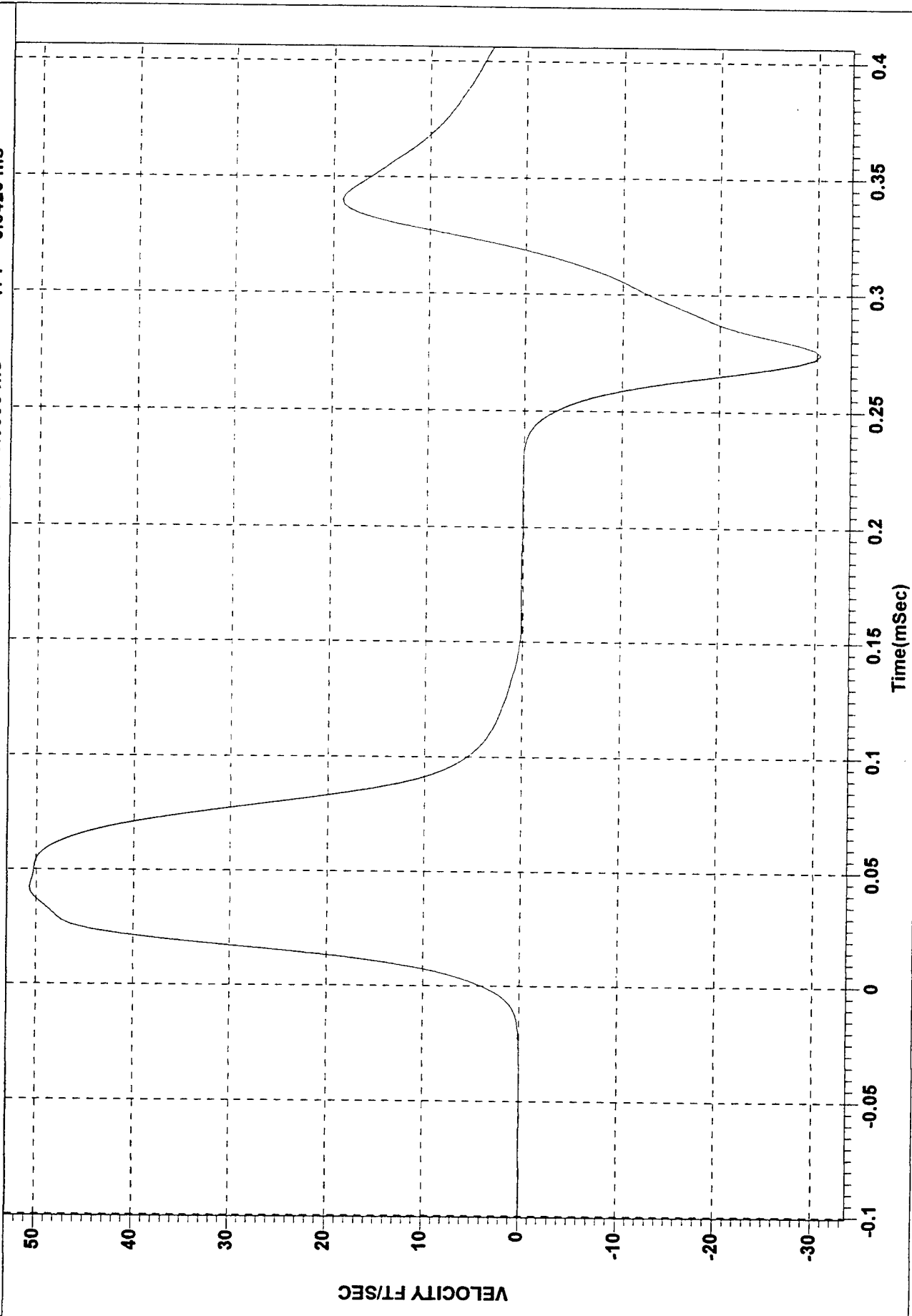
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DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR3 SR: 5.000000E+005 Transducer Location: .251" G-10 EPOX INPUT VELOCITY
Pulse Parameters: M.F.A. 51.1794 fps TT: 0.1020 ms TR: 0.0260 ms TF: 0.0380 ms TP: 0.0420 ms



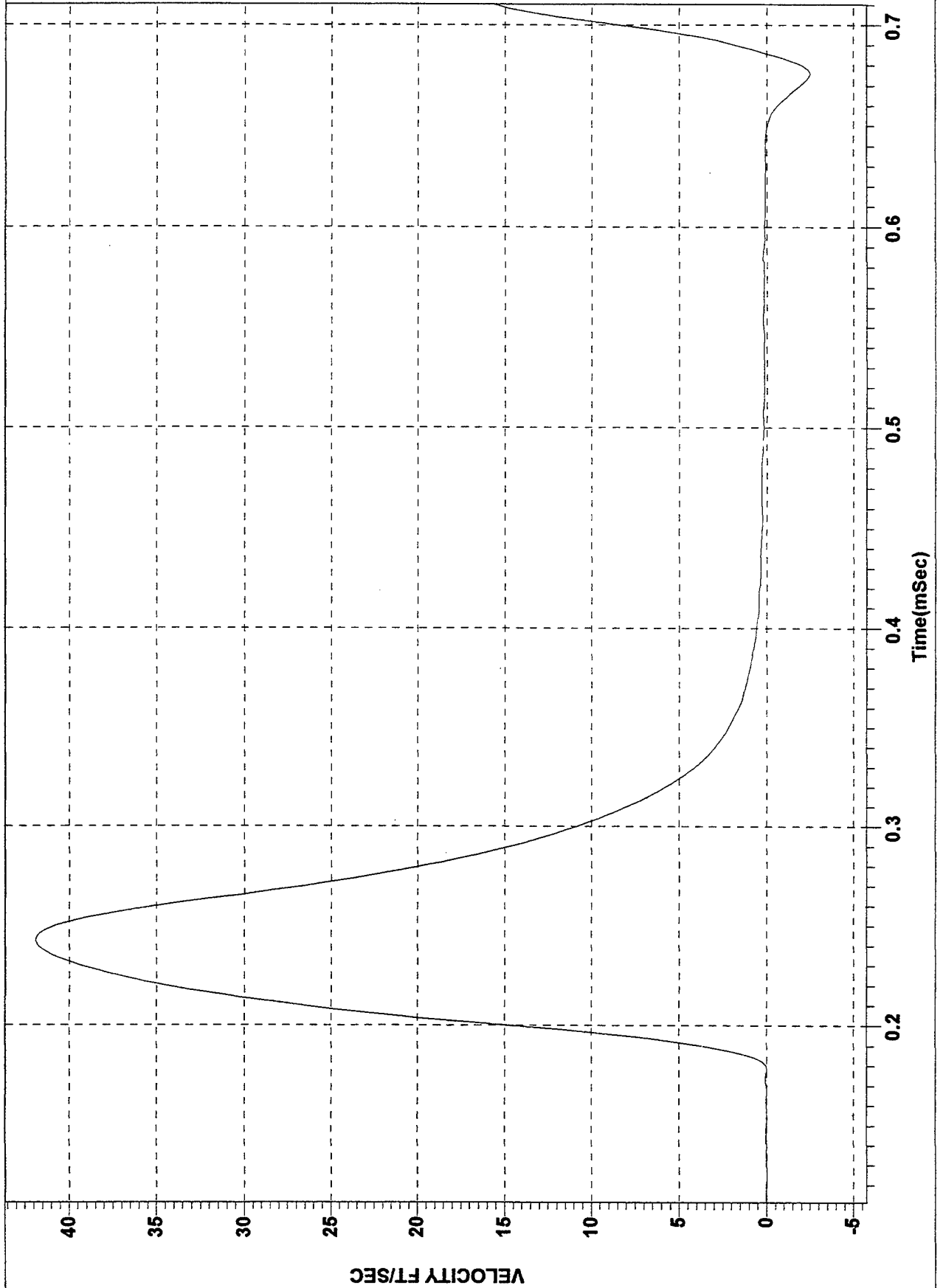
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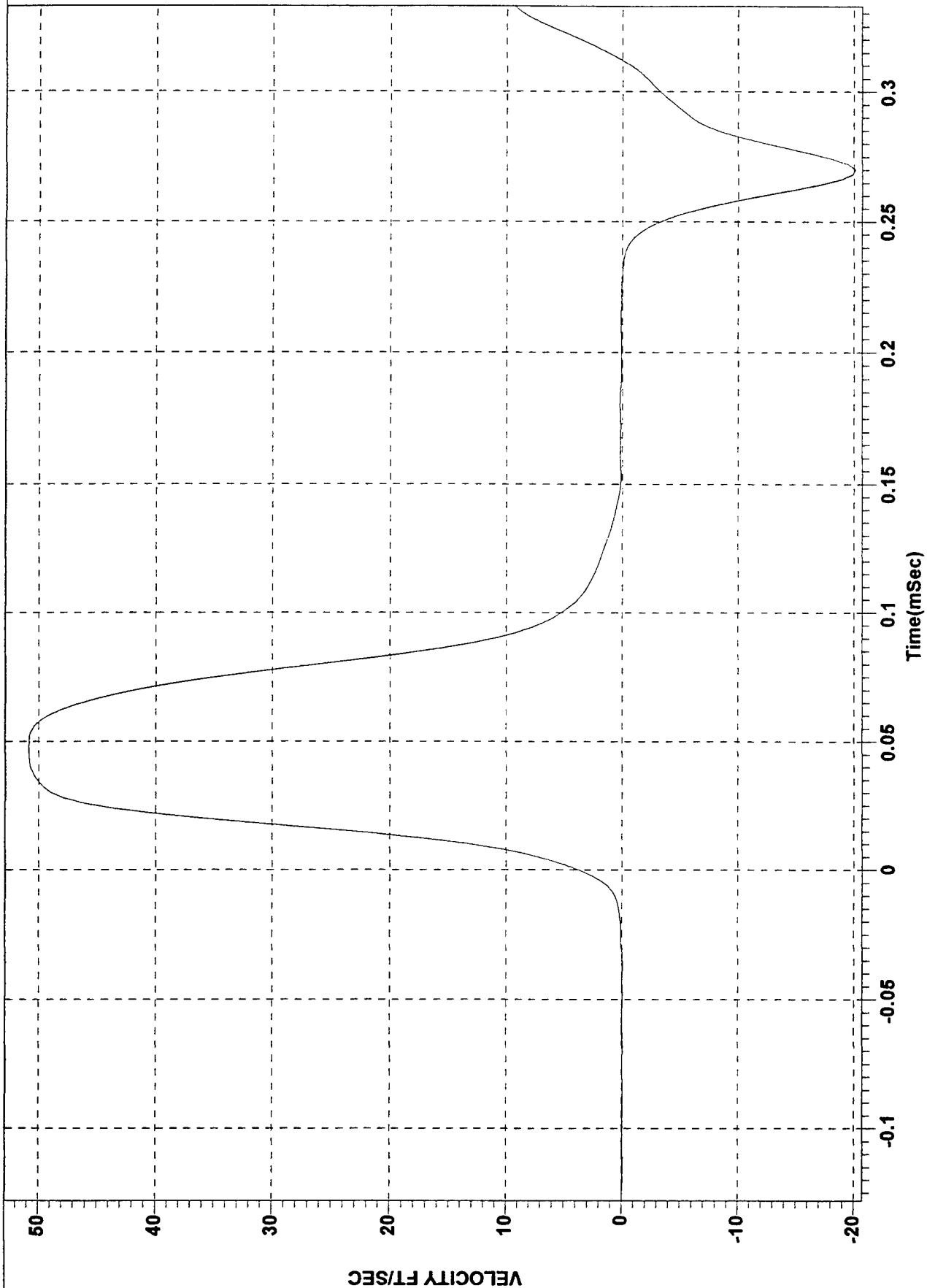
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Pulse Parameters: M.F.A. 50.7324 fps TT: 0.1020 ms TR: 0.0260 ms TF: 0.0380 ms TP: 0.0420 ms



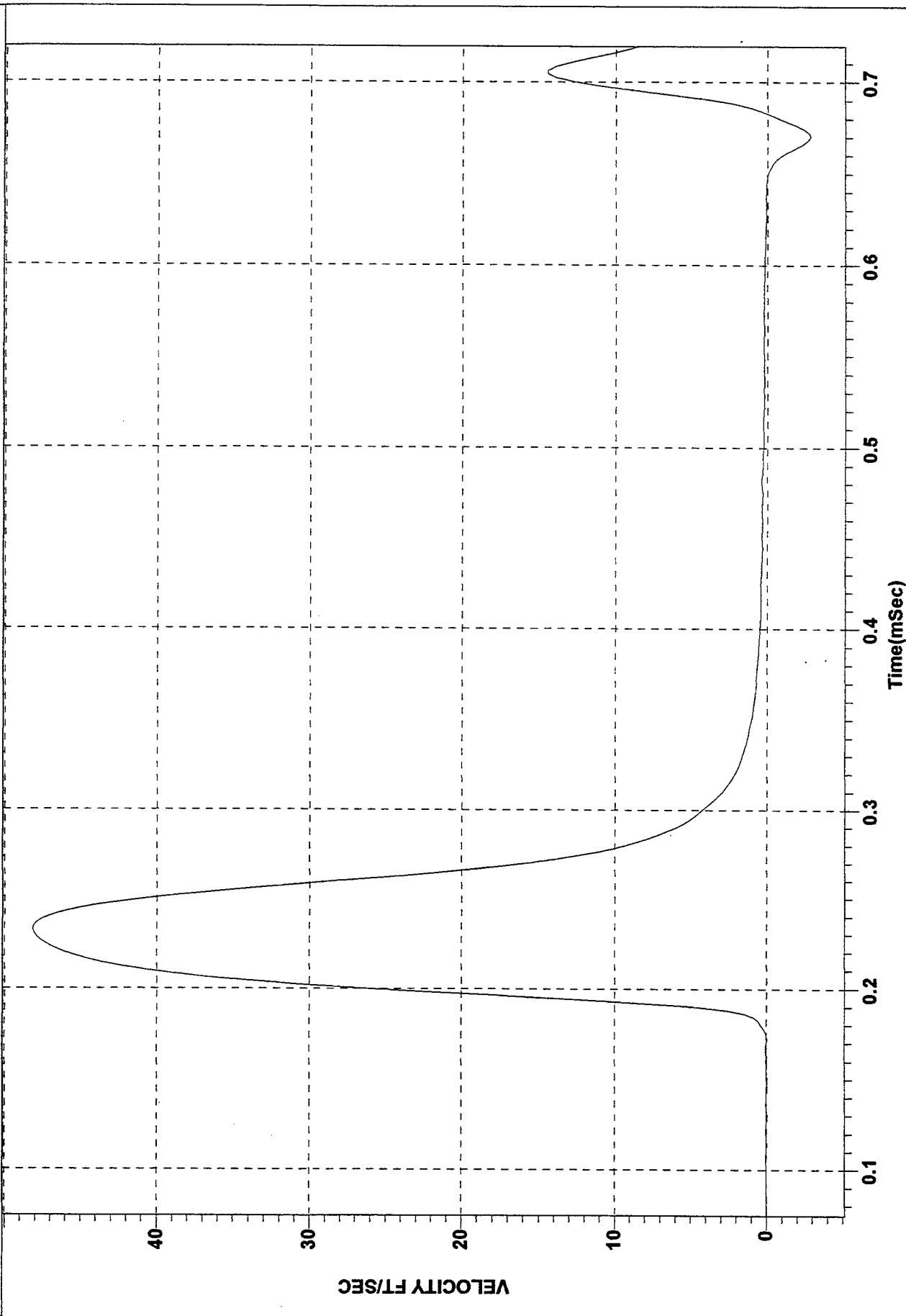
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Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .501" G-10 EPOX TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 41.9074 fps TT: 0.1400 ms TR: 0.0380 ms TF: 0.0740 ms TP: 0.0520 ms



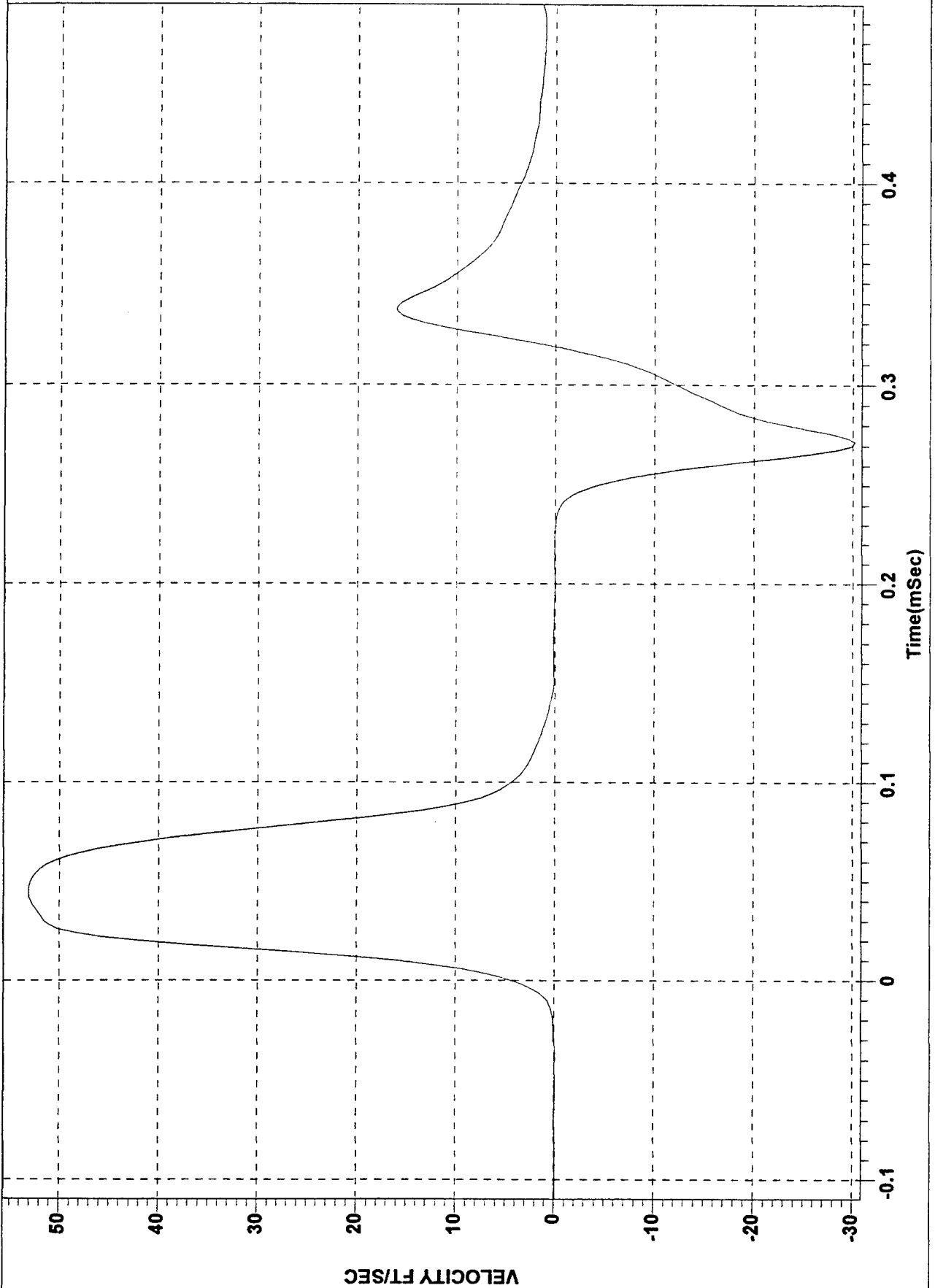
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Pulse Parameters: M.F.A. 50.8918 fps TT: 0.1000 ms TR: 0.0240 ms TF: 0.0380 ms TP: 0.0440 ms



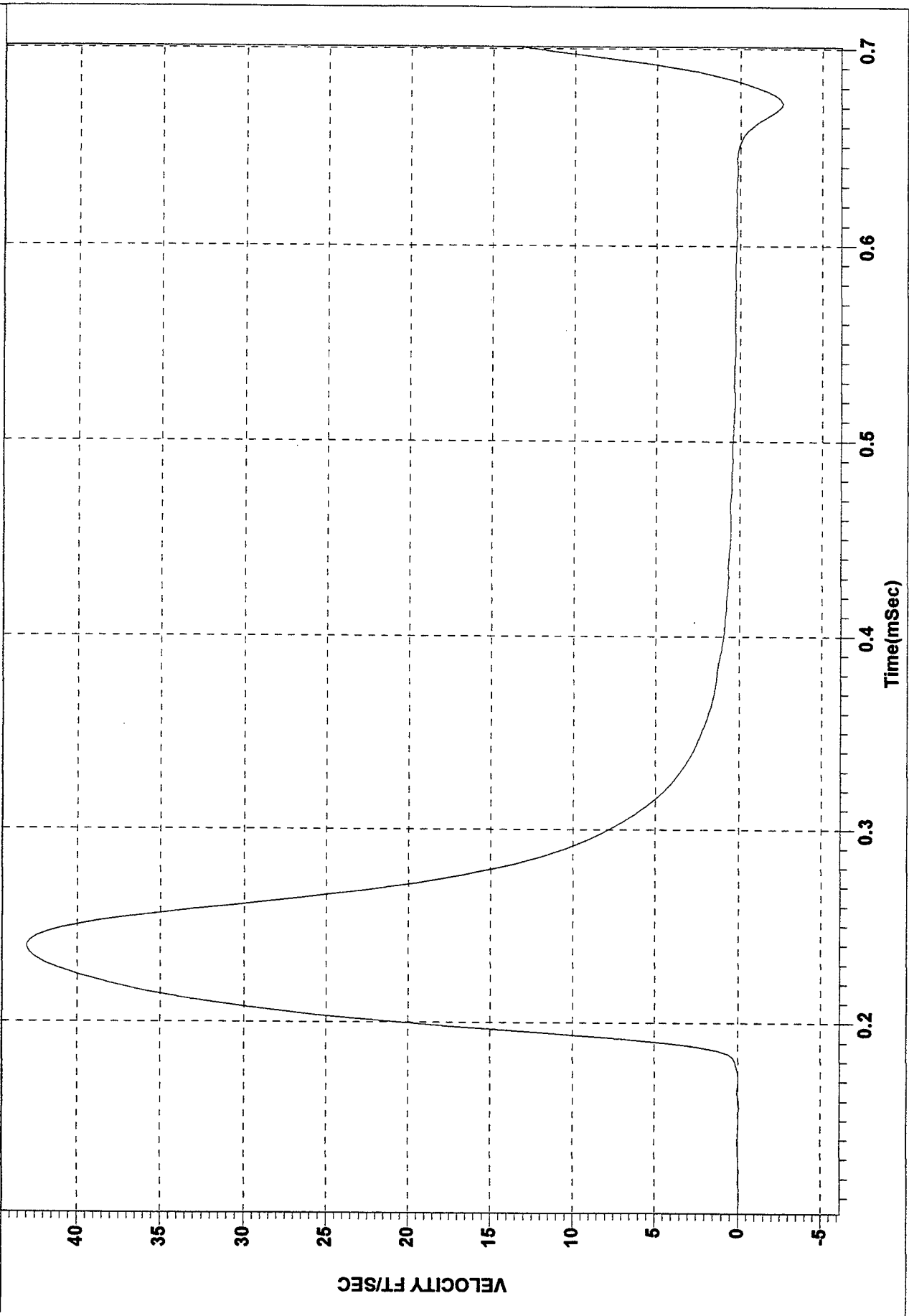
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 Pulse Parameters: M.F.A. 48.1781 fps TT: 0.1080 ms TR: 0.0260 ms TF: 0.0500 ms TP: 0.0440 ms



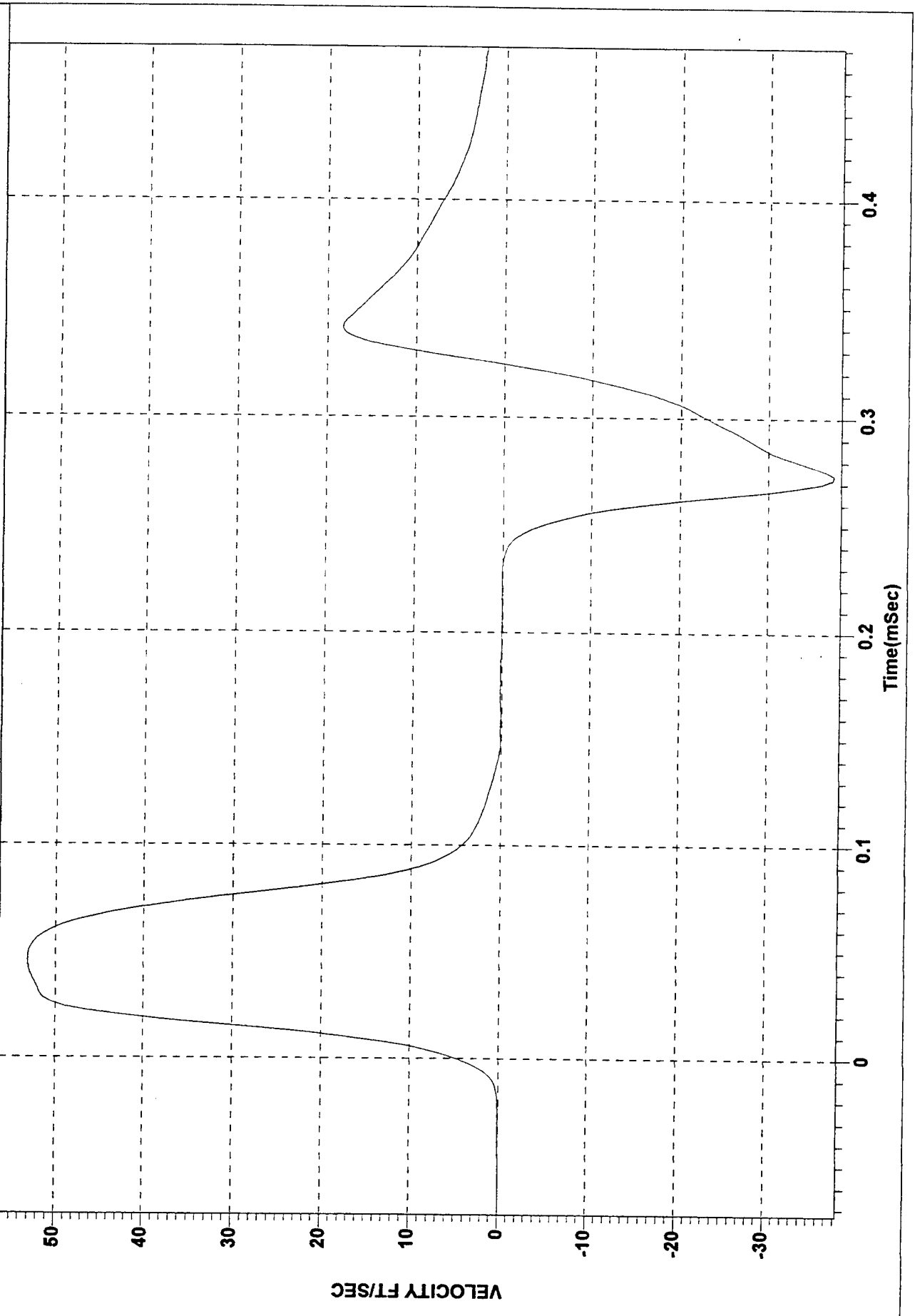
Test Title: EPW FOAM EVALUATION Test No. 080 Service Order No: 6254AK3475 Test Date: 09-26-95 23:03
 DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
 Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .250" PHENOLIC INPUT VELOCITY
 Pulse Parameters: M.F.A. 53.1925 fps TT: 0.0980 ms TR: 0.0240 ms TF: 0.0340 ms TP: 0.0460 ms



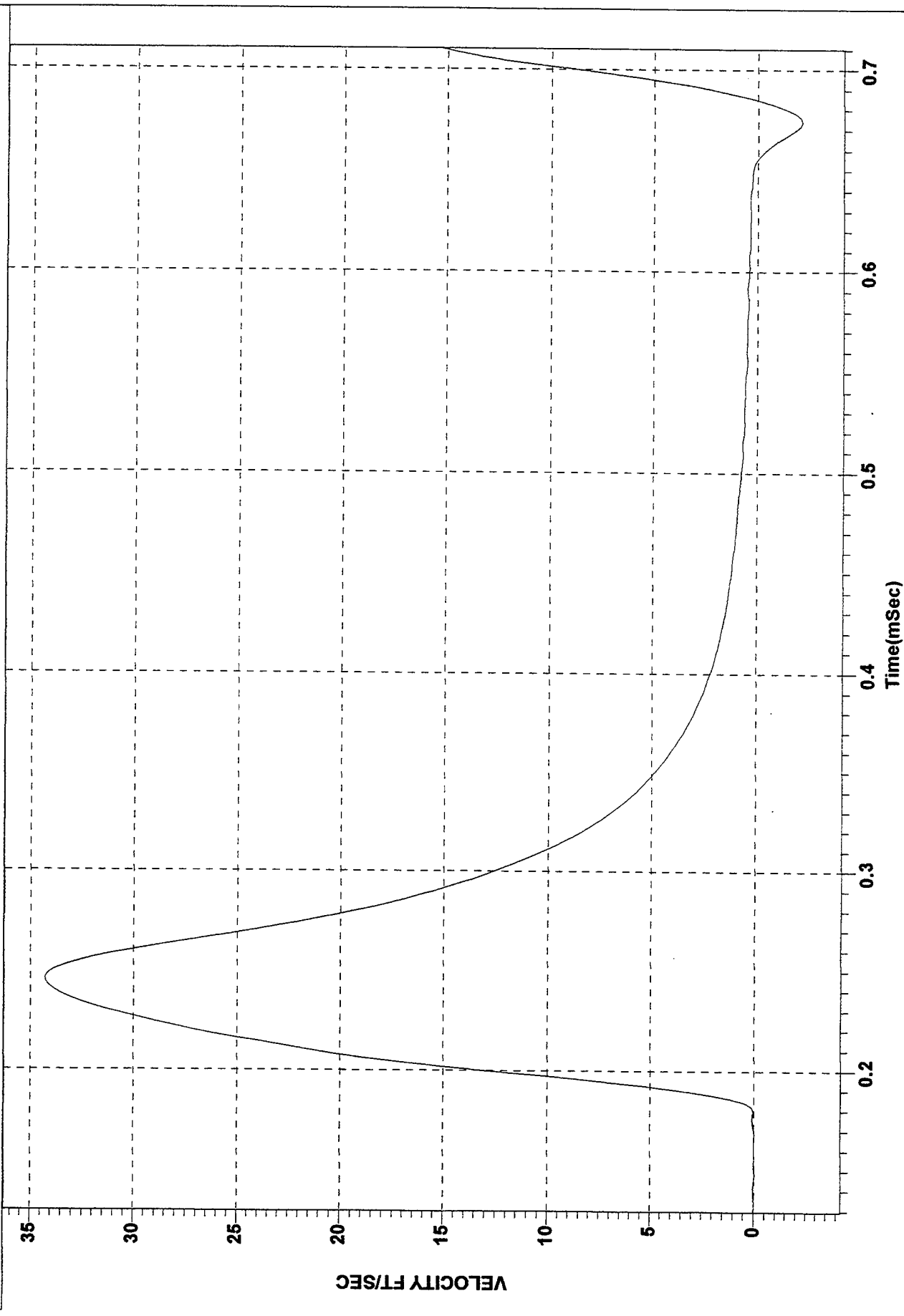
Test Title: EPW FOAM EVALUATION Test No. 080 Service Order No: 6254AK3475 Test Date: 09-26-95 23:03
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+006 Transducer Location: .250" PHENOLIC TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 43.0124 fps TT: 0.1340 ms TR: 0.0340 ms TF: 0.0720 ms TP: 0.0500 ms



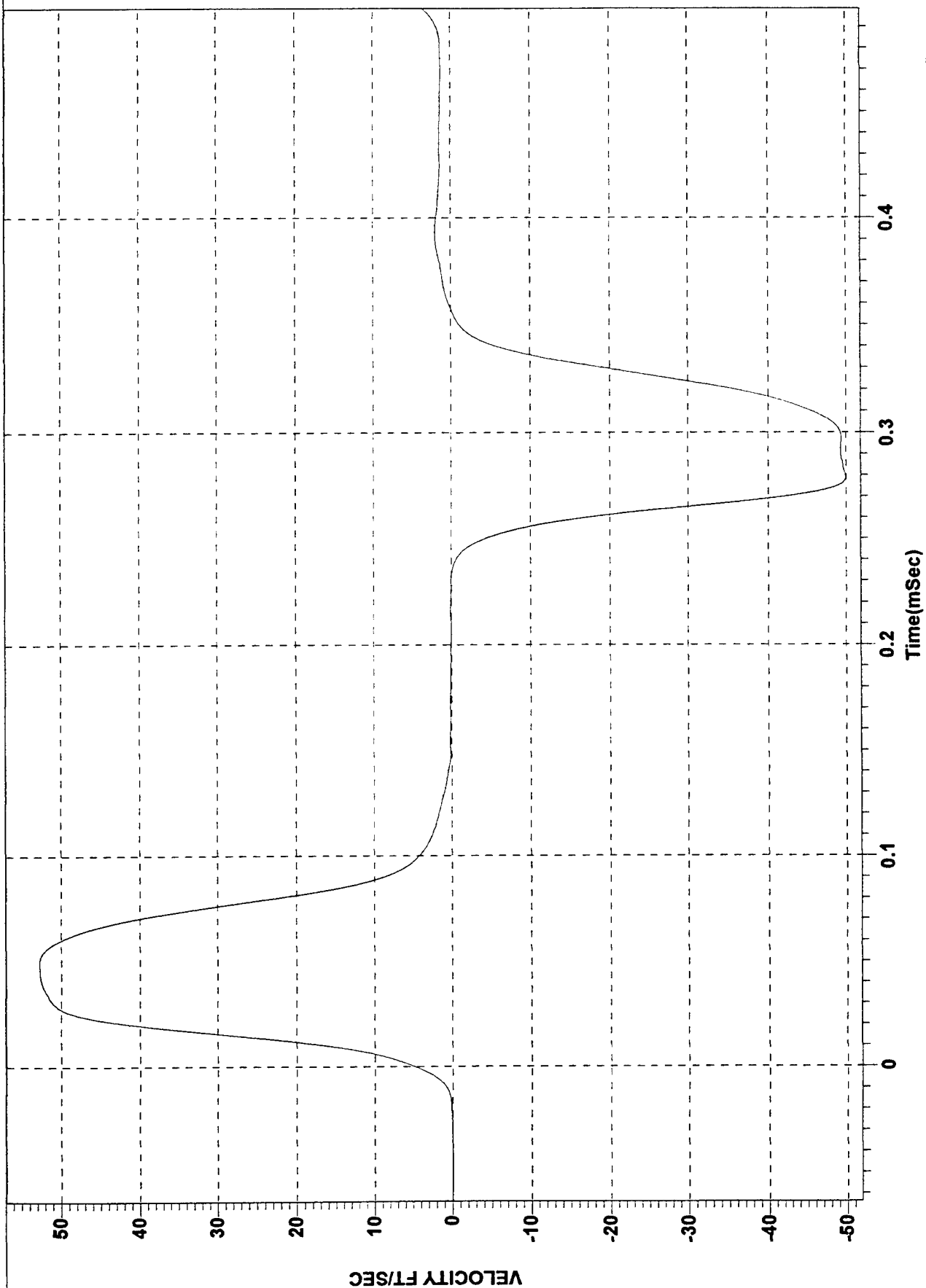
Test Title: EPW FOAM EVALUATION Test No. 085 Service Order No: 6254AK3475 Test Date: 09-26-95 23:21
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .502" PHENOLIC INPUT VELOCITY
Pulse Parameters: M.F.A. 53.1417 fps TT: 0.0980 ms TR: 0.0240 ms TF: 0.0340 ms TP: 0.0460 ms



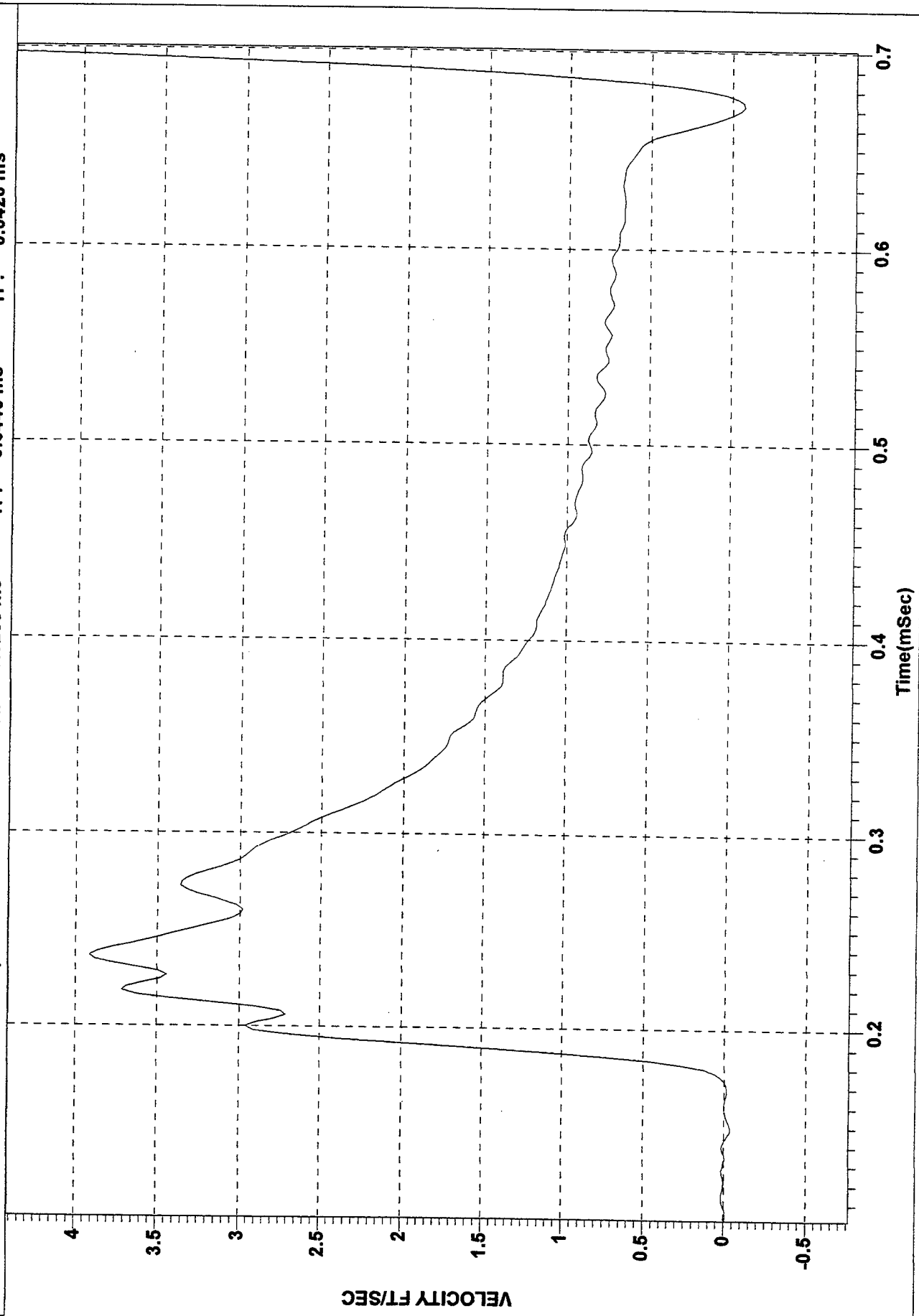
Test Title: EPW FOAM EVALUATION Test No. 085 Service Order No: 6254AK3475 Test Date: 09-26-95 23:21
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .502" PHENOLIC TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 34.3264 fps TT: 0.1840 ms TR: 0.0420 ms TF: 0.1140 ms TP: 0.0580 ms



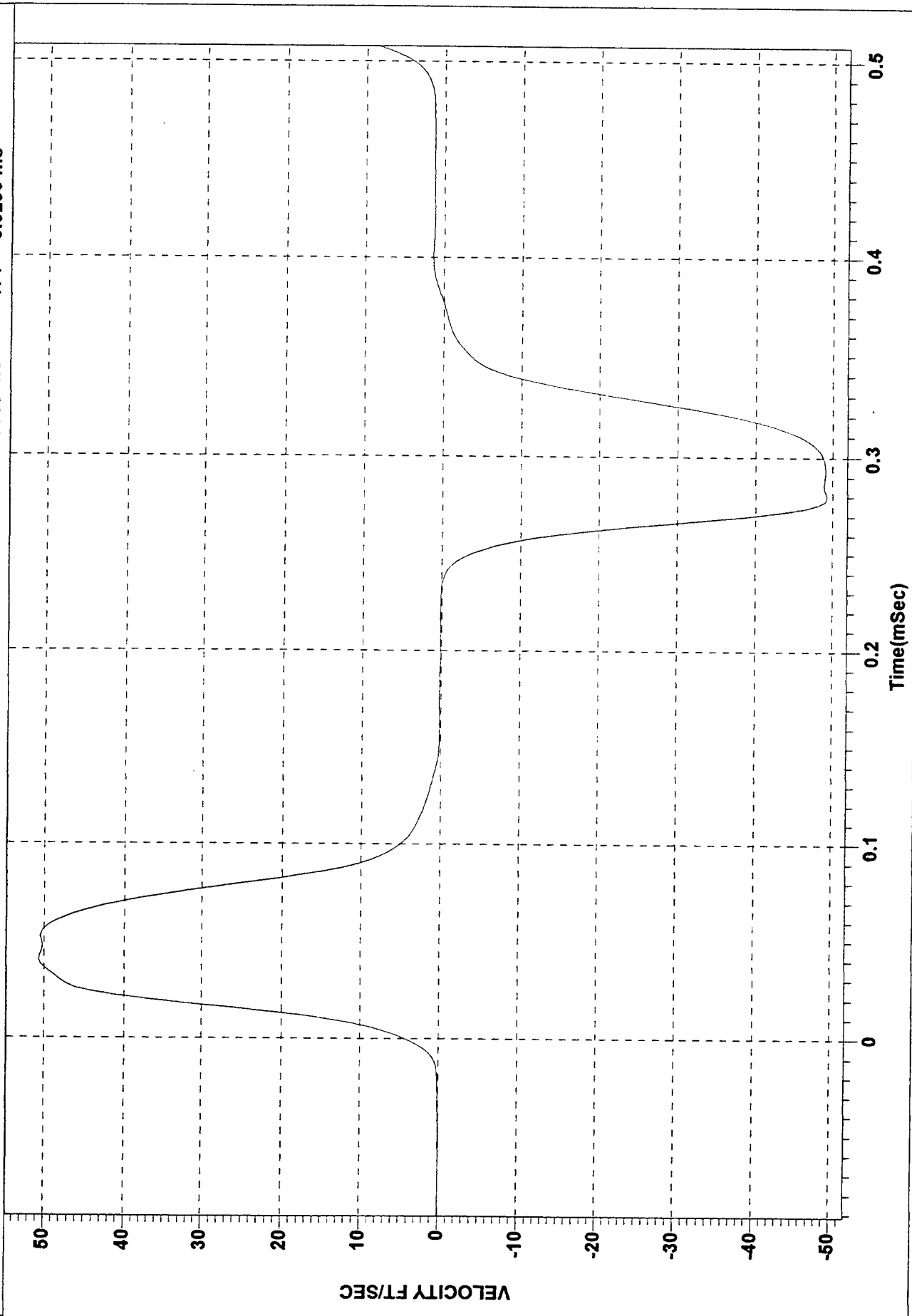
Test Title: EPW FOAM EVALUATION Test No. 088 Service Order No: 6254AK3475 Test Date: 09-26-95 23:47
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR3 SR: 5.000000E+005 Transducer Location: .121" ADIPRENE INPUT VELOCITY
Pulse Parameters: M.F.A. 52.7661 fps TT: 0.0980 ms TR: 0.0240 ms TF: 0.0360 ms TP: 0.0500 ms



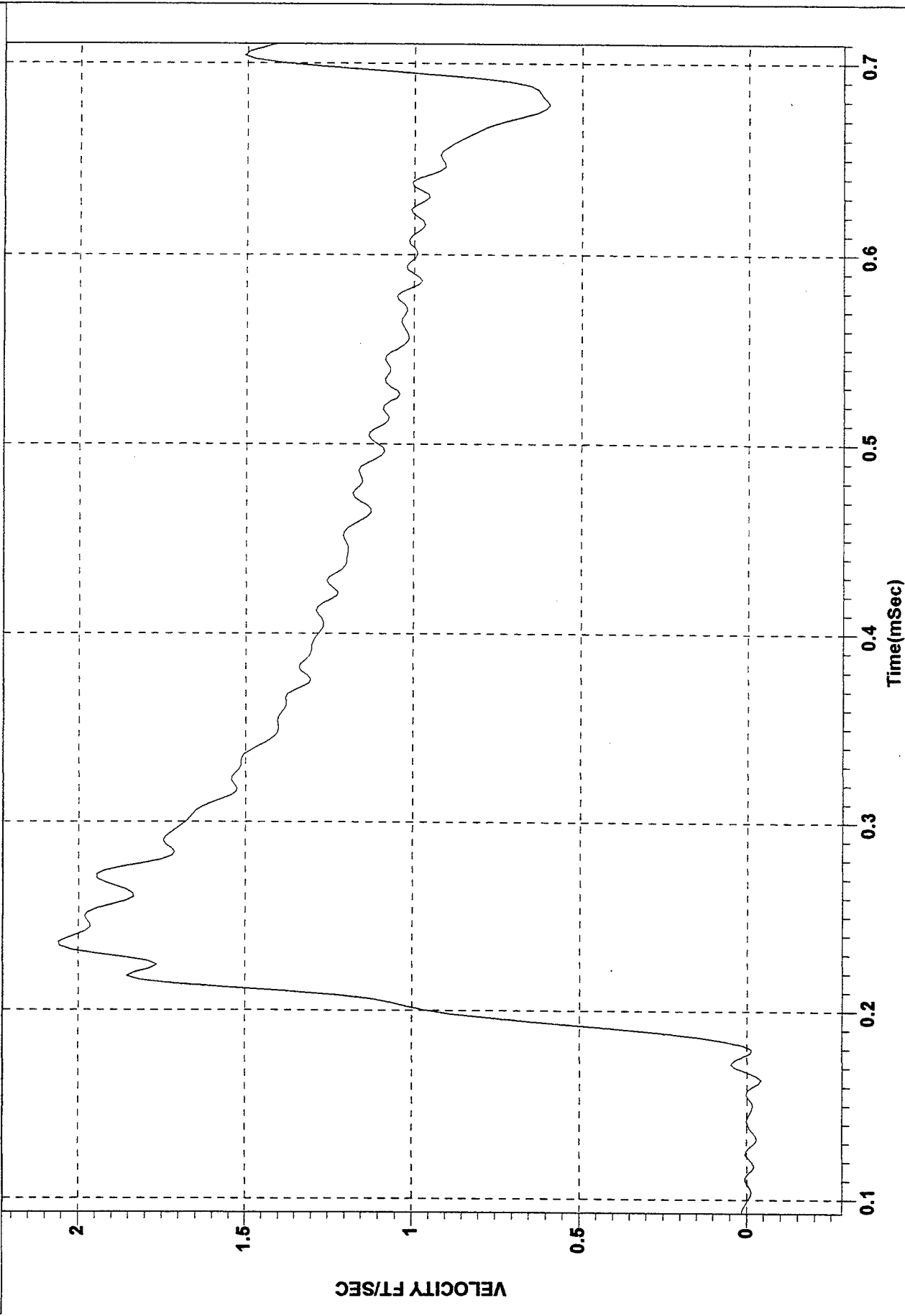
Test Title: EPW FOAM EVALUATION Test No. 088 Service Order No: 6254AK3475 Test Date: 09-26-95 23:47
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .121" ADIPRENE TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. -7.7943 fps TT: 0.0980 ms TR: 0.0200 ms TF: 0.0440 ms TP: 0.0420 ms



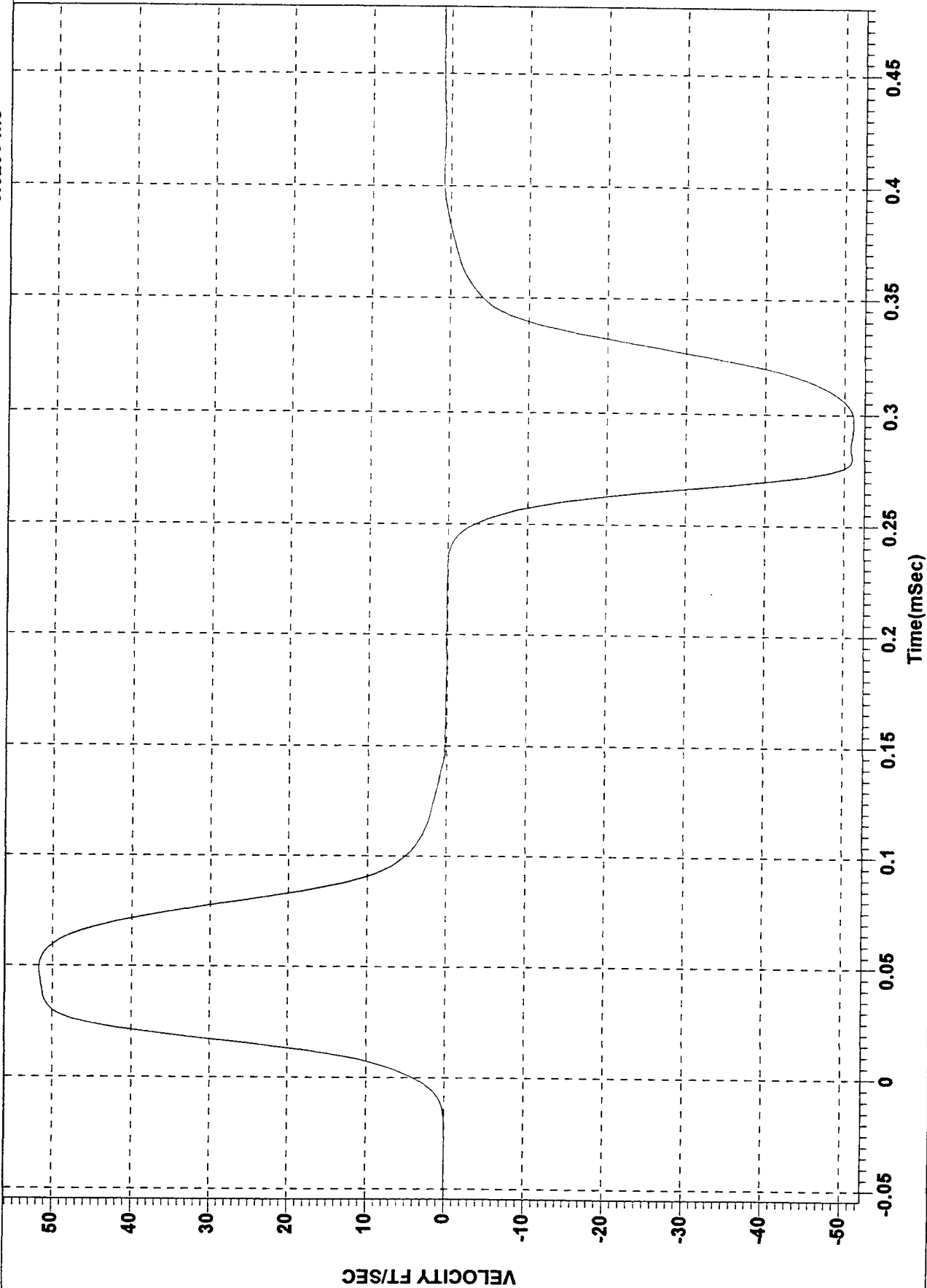
Test Title: EPW FOAM EVALUATION Test No. 089 Service Order No: 6254AK3475 Test Date: 09-27-95 01:00
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .248" ADIPRENE INPUT VELOCITY
Pulse Parameters: M.F.A. -52.2970 fps TT: 0.0880 ms TR: 0.0240 ms TF: 0.0560 ms TP: 0.0280 ms



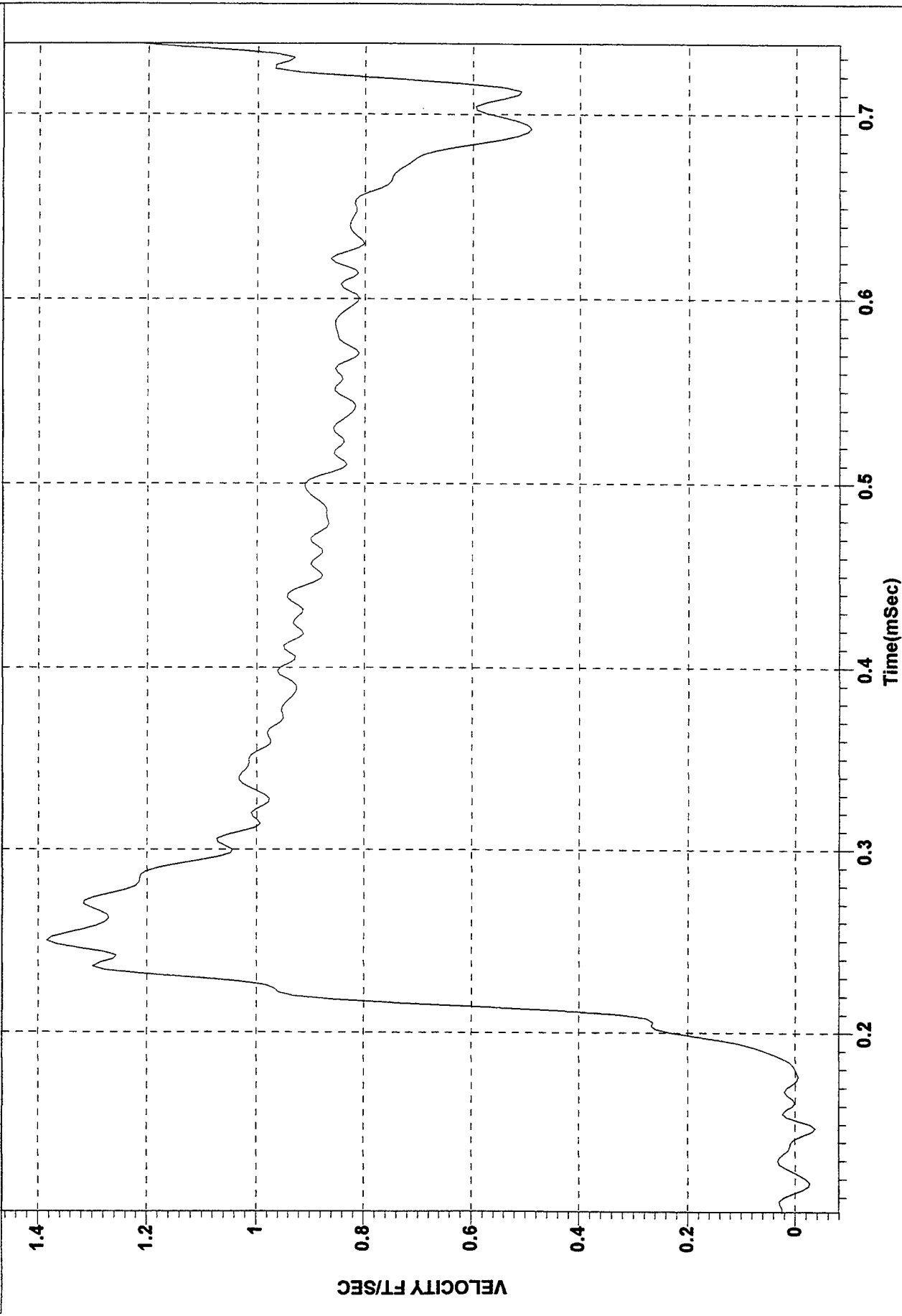
Test Title: EPW FOAM EVALUATION Test No. 089 Service Order No: 6254AK3475 Test Date: 09-27-95 01:00
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .248" ADIPRENE TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 3.7617 fps TT: 0.2960 ms TR: 0.0700 ms TF: 0.1940 ms TP: 0.0980 ms



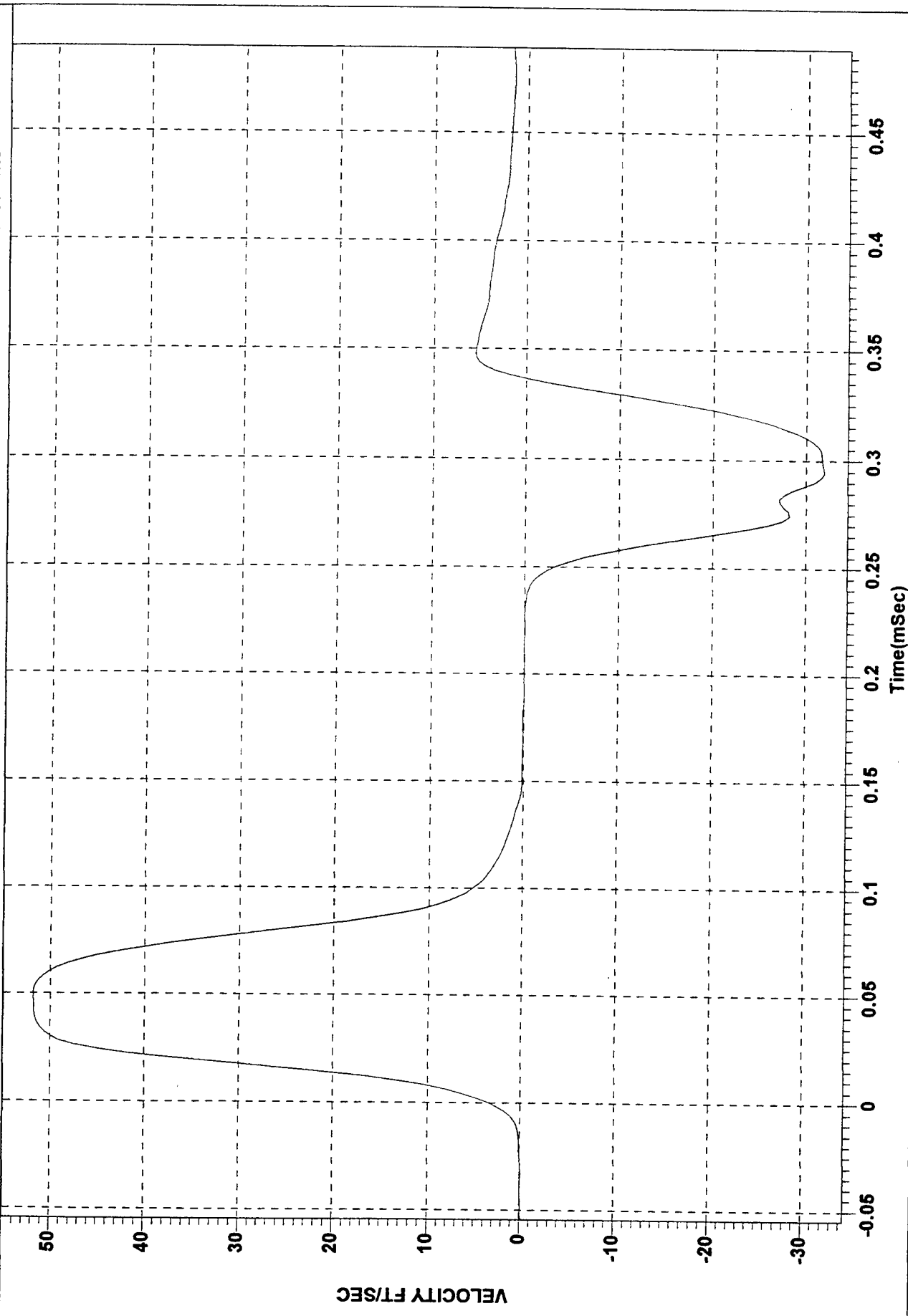
Test Title: EPW FOAM EVALUATION Test No. 093 Service Order No: 6254AK3475 Test Date: 09-27-95 01:16
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .497" ADIPRENE INPUT VELOCITY
Pulse Parameters: M.F.A. -58.1455 fps TT: 0.0920 ms TR: 0.0220 ms TF: 0.0620 ms TP: 0.0260 ms



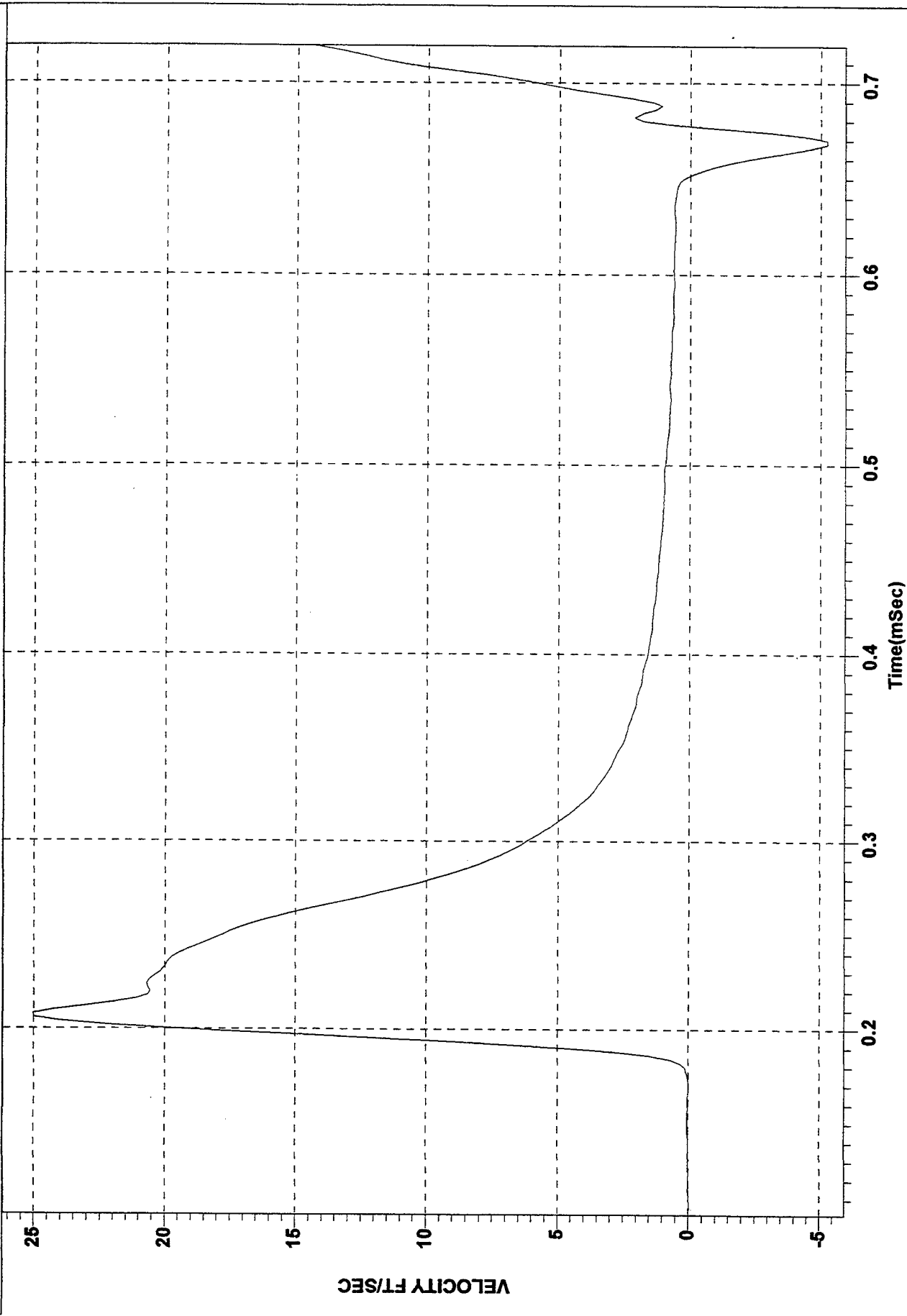
Test Title: EPW FOAM EVALUATION Test No. 093 Service Order No: 6254AK3475 Test Date: 09-27-95 01:16
 DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
 Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .497" ADIPRENE TRANSMITTED VELO. 10"
 Pulse Parameters: M.F.A. 2.2939 fps TT: 0.4620 ms TR: 0.0680 ms TF: 0.3560 ms TP: 0.0880 ms



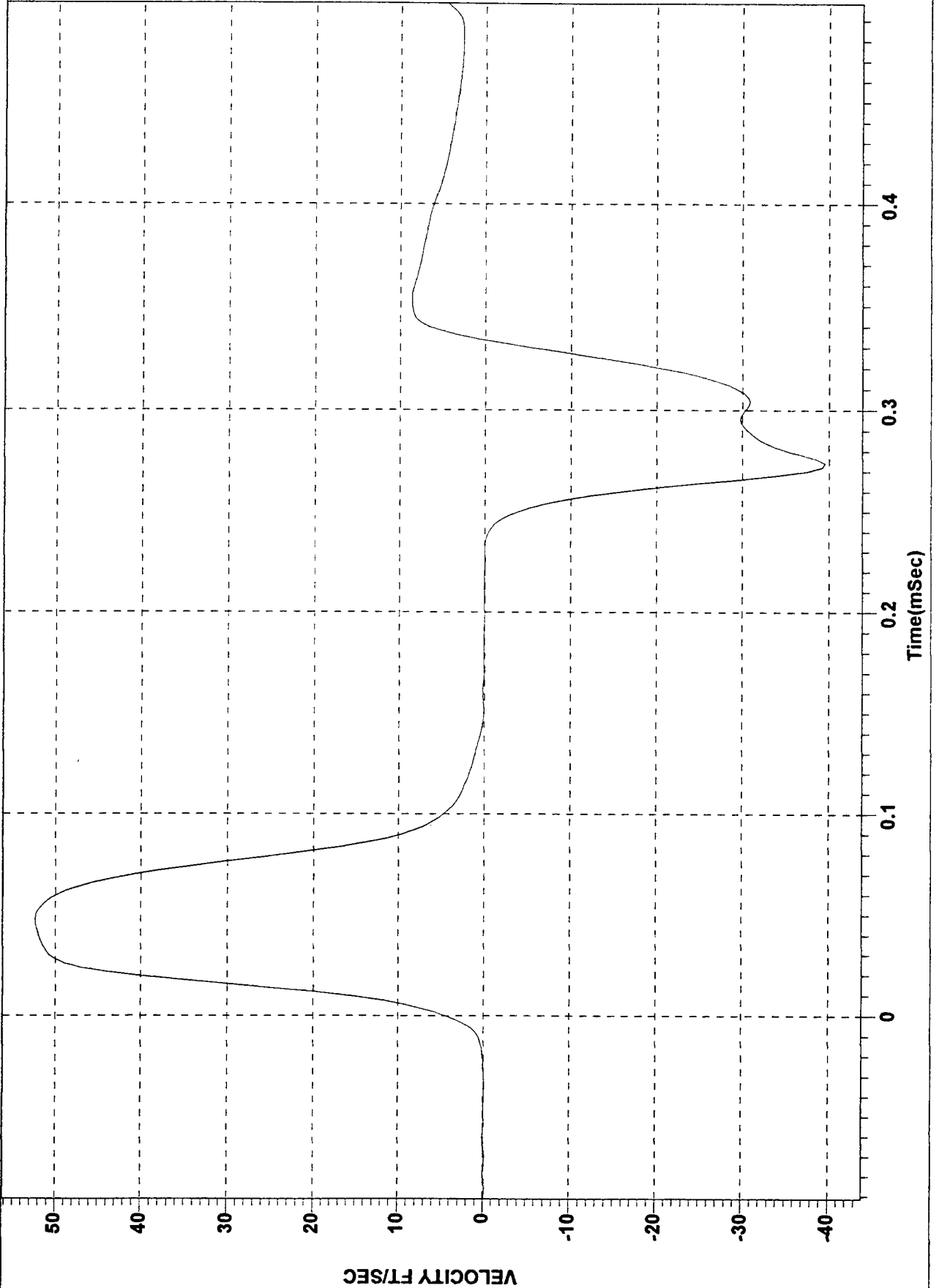
Test Title: EPW FOAM EVALUATION Test No. 003 Service Order No: 6254AK3475 Test Date: 09-27-95 01:57
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR3 SR: 5.000000E+005 Transducer Location: .125"828/DEA/GM INPUT VELOCITY
Pulse Parameters: M.F.A. 51.9088 fps TT: 0.1000 ms TR: 0.0240 ms TF: 0.0380 ms TP: 0.0480 ms



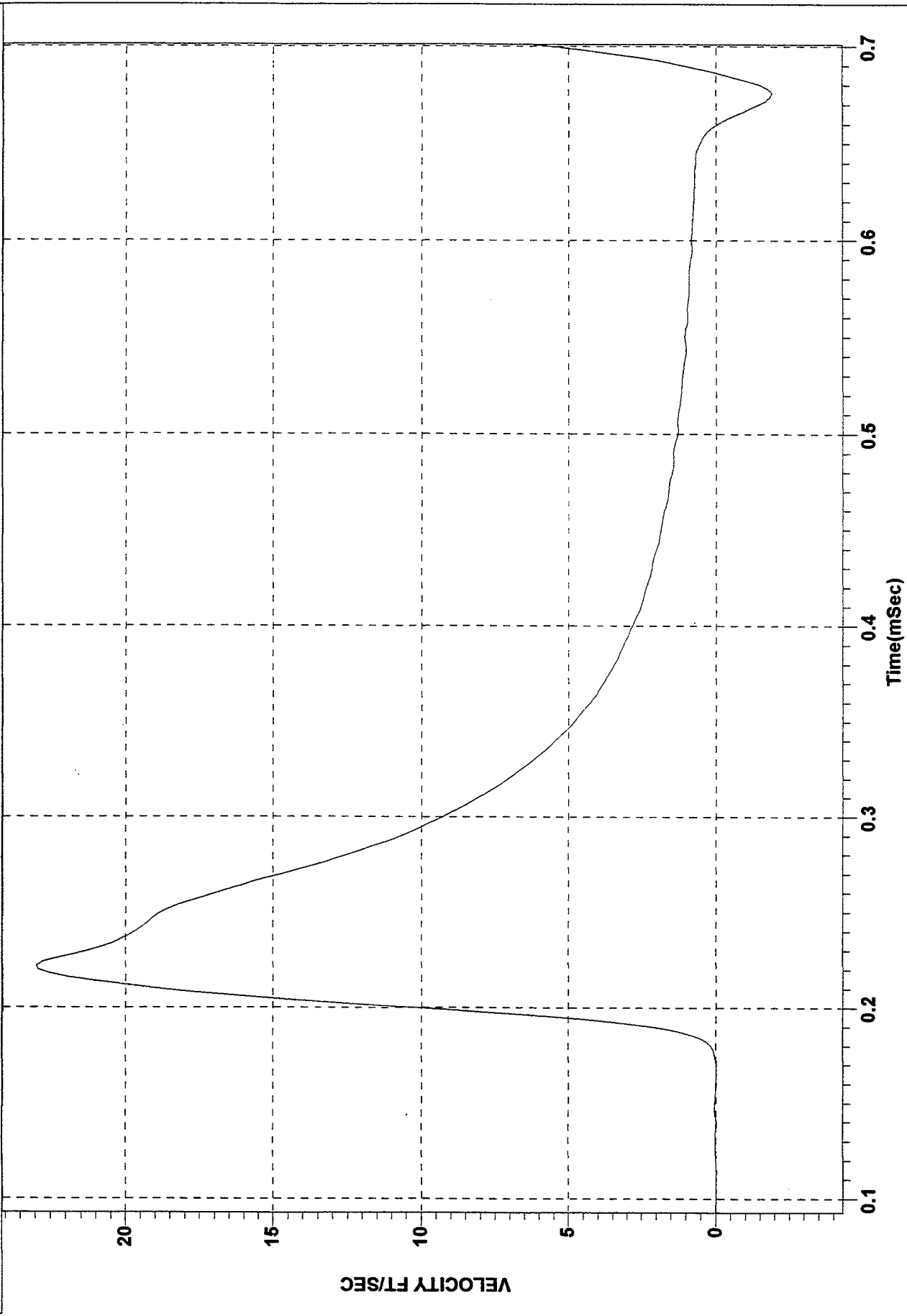
Test Title: EPW FOAM EVALUATION Test No. 003 Service Order No: 6254AK3475 Test Date: 09-27-95 01:57
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .125"828/DEA/GM TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 25.0344 fps TT: 0.1680 ms TR: 0.0180 ms TF: 0.1420 ms TP: 0.0220 ms



Test Title: EPW FOAM EVALUATION Test No. 004 Service Order No: 6254AK3475 Test Date: 09-27-95 02:03
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR3 SR: 5.000000E+005 Transducer Location: .251"828/DEA/GM INPUT VELOCITY
Pulse Parameters: M.F.A. 52.4790 fps TT: 0.1000 ms TR: 0.0260 ms TF: 0.0360 ms TP: 0.0480 ms



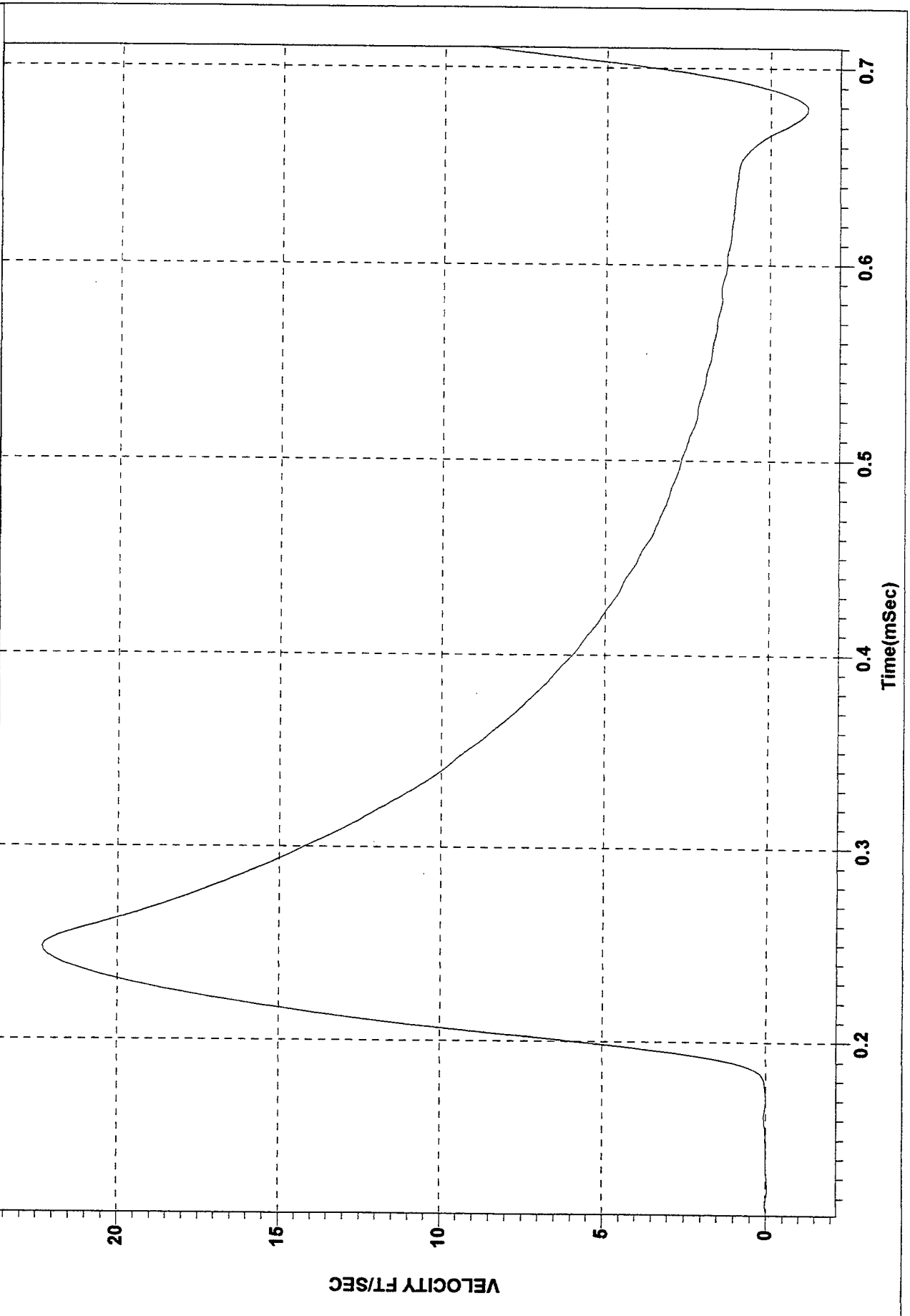
Test Title: EPW FOAM EVALUATION Test No. 004 Service Order No: 6254AK3475 Test Date: 09-27-95 02:03
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .251"828/DEA/GM TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 22.9953 fps TT: 0.2320 ms TR: 0.0240 ms TF: 0.1900 ms TP: 0.0320 ms



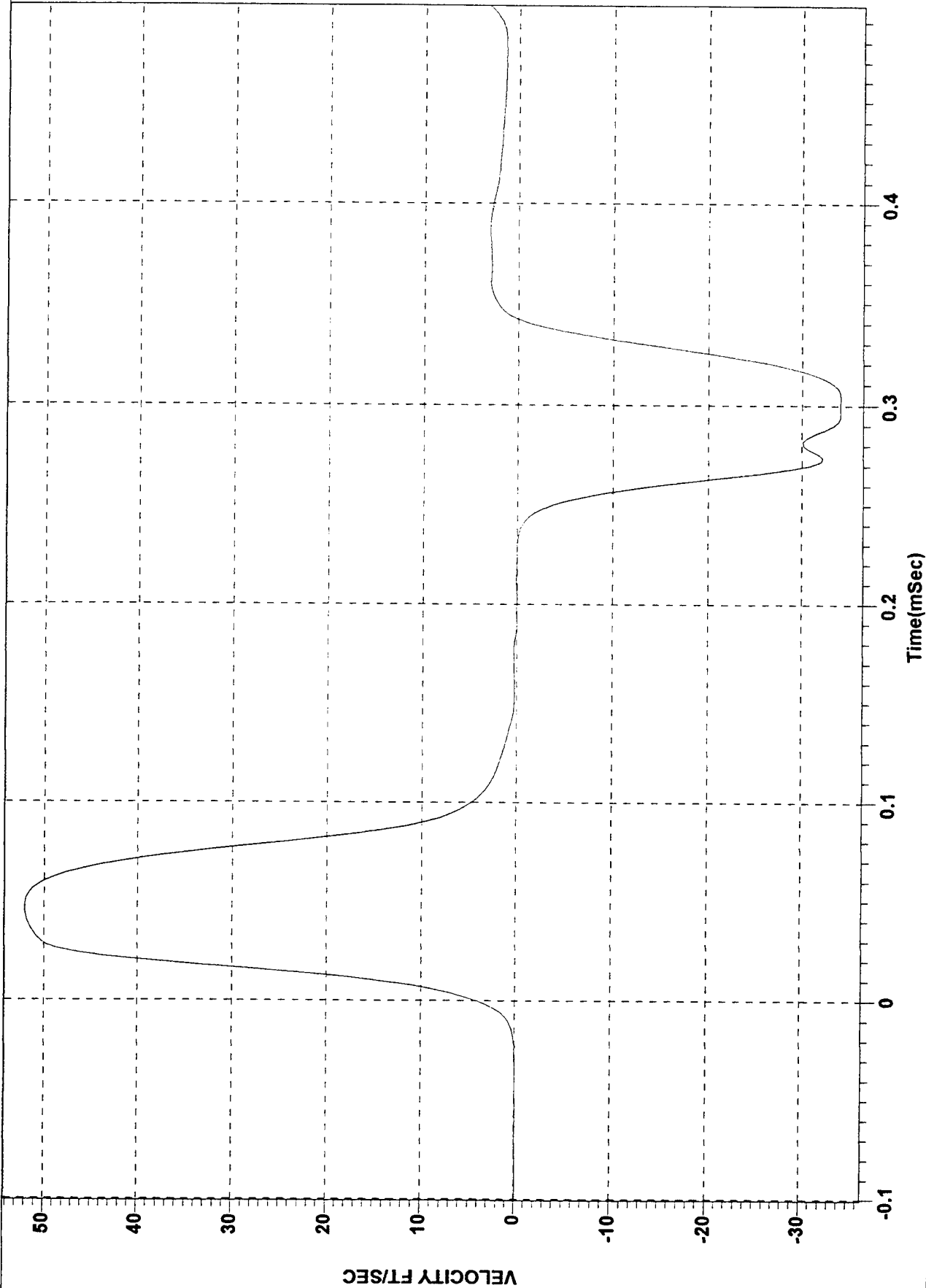
Pulse Parameters: M.F.A. 54.7401 fps



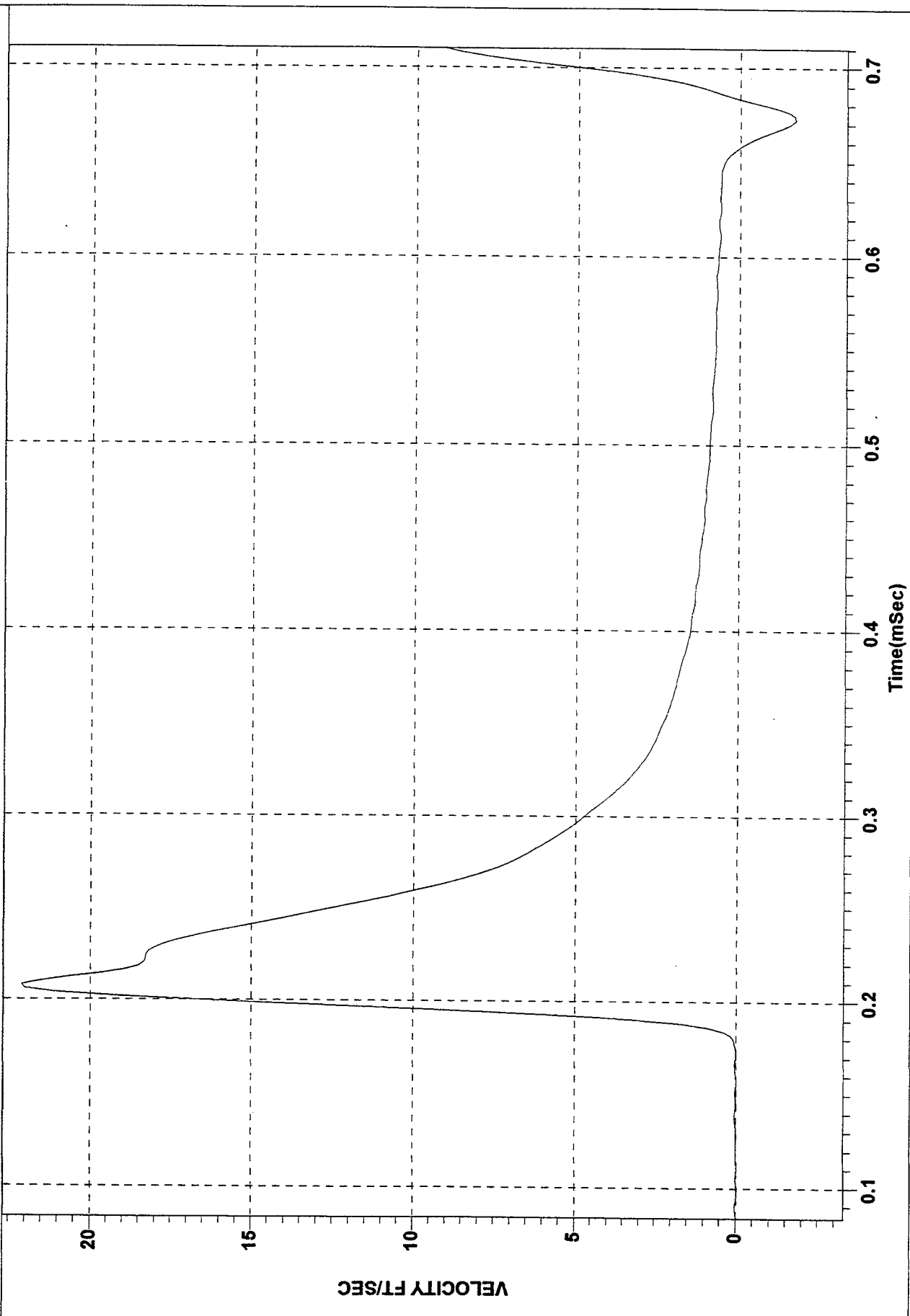
Test Title: EPW FOAM EVALUATION Test No. 009 Service Order No: 6254AK3475 Test Date: 09-27-95 02:39
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .502"828/DEA/GM TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 22.3227 fps TT: 0.3300 ms TR: 0.0400 ms TF: 0.2600 ms TP: 0.0560 ms



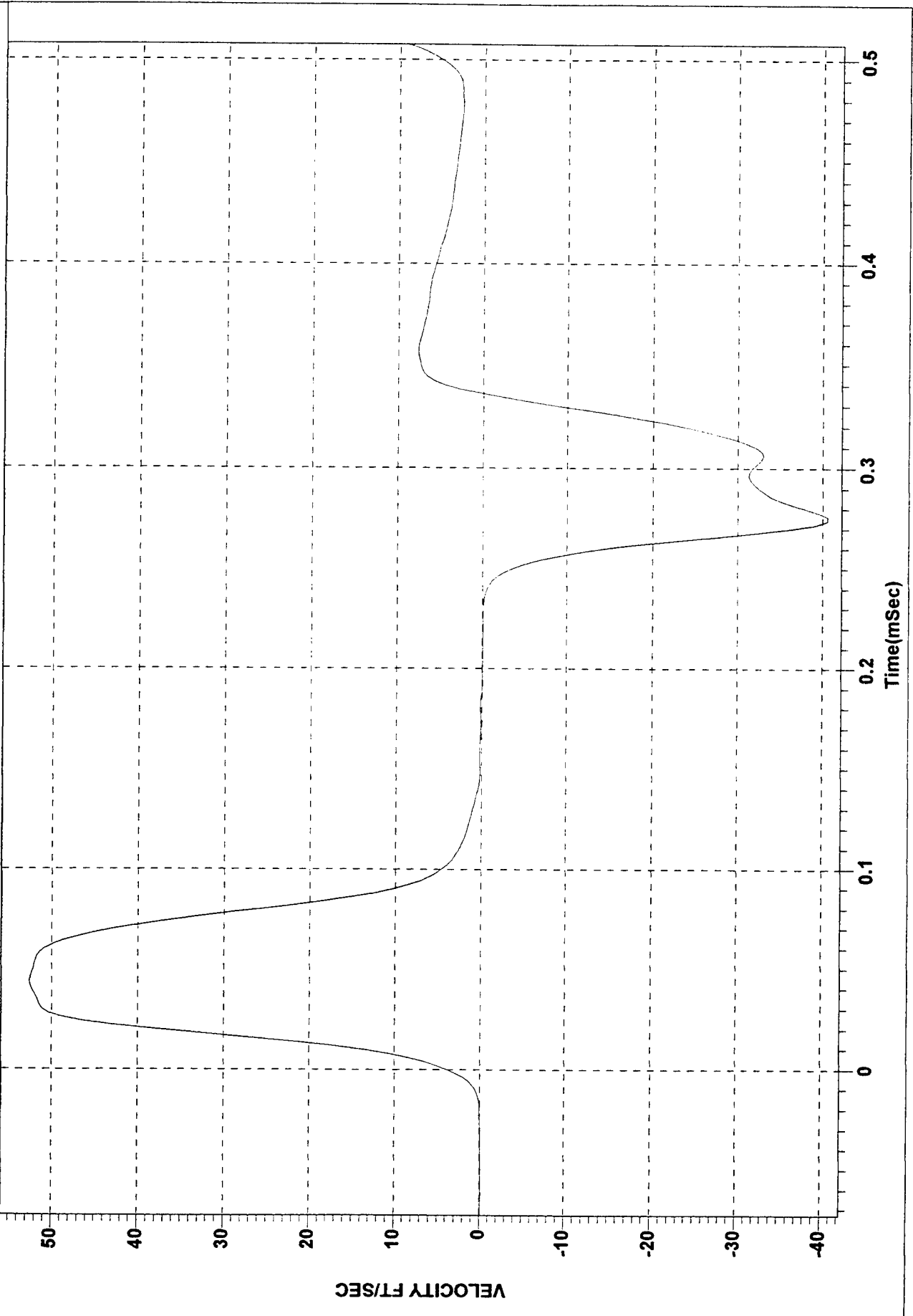
Test Title: EPW FOAM EVALUATION Test No. 012 Service Order No: 6254AK3475 Test Date: 09-27-95 03:41
 DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
 Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .121" 828 CTBN INPUT VELOCITY
 Pulse Parameters: M.F.A. 52.0763 fps TT: 0.1000 ms TR: 0.0260 ms TF: 0.0360 ms TP: 0.0460 ms



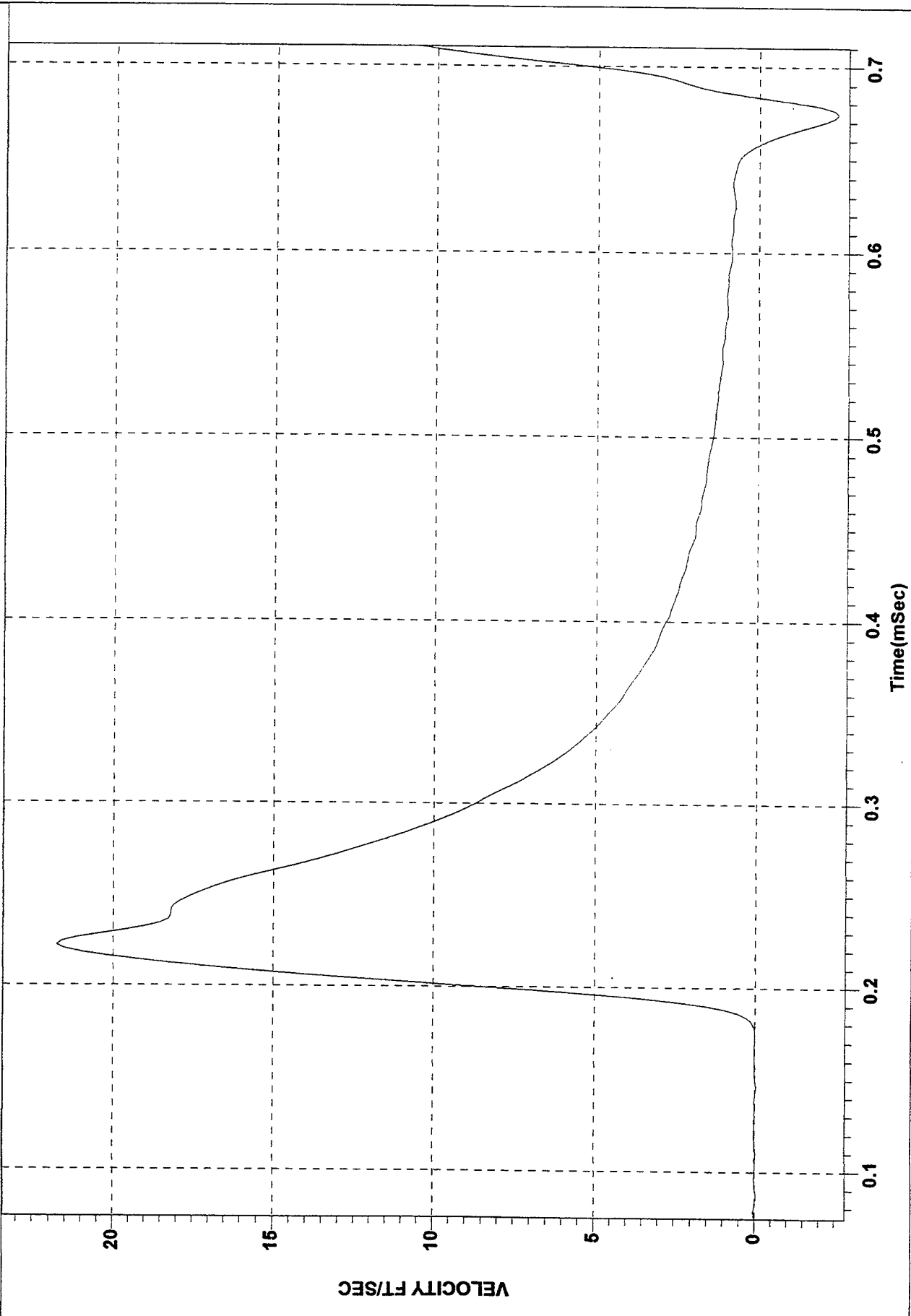
Test Title: EPW FOAM EVALUATION Test No. 012 Service Order No: 6254AK3475 Test Date: 09-27-95 03:41
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .121" 828 CTBN TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 22.1048 fps TT: 0.1660 ms TR: 0.0160 ms TF: 0.1420 ms TP: 0.0200 ms



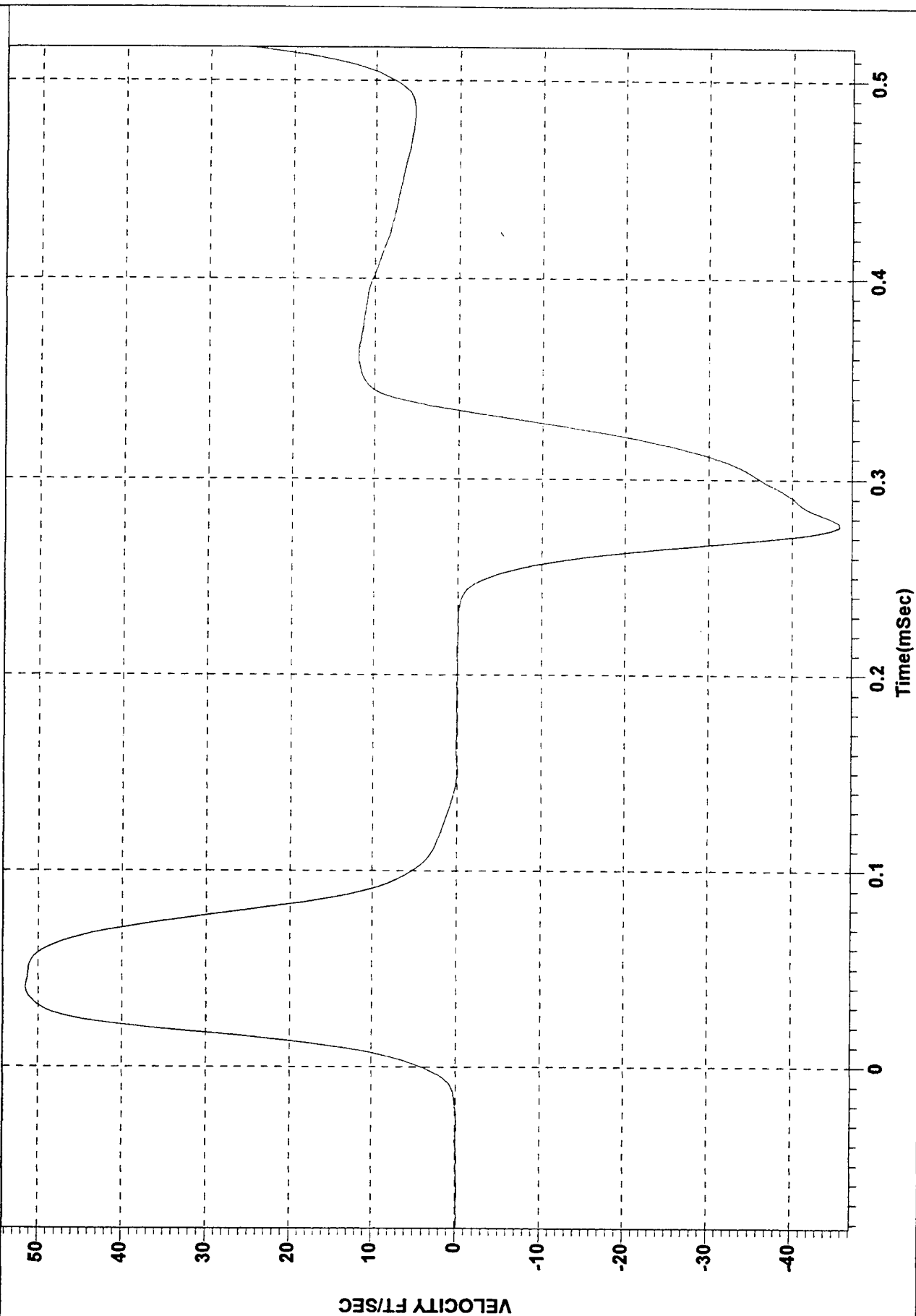
Test Title: EPW FOAM EVALUATION Test No. 013 Service Order No: 6254AK3475 Test Date: 09-27-95 03:50
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR3 SR: 5.000000E+005 Transducer Location: .251" 828 CTBN INPUT VELOCITY
Pulse Parameters: M.F.A. 52.6753 fps TT: 0.0980 ms TR: 0.0240 ms TF: 0.0360 ms TP: 0.0420 ms



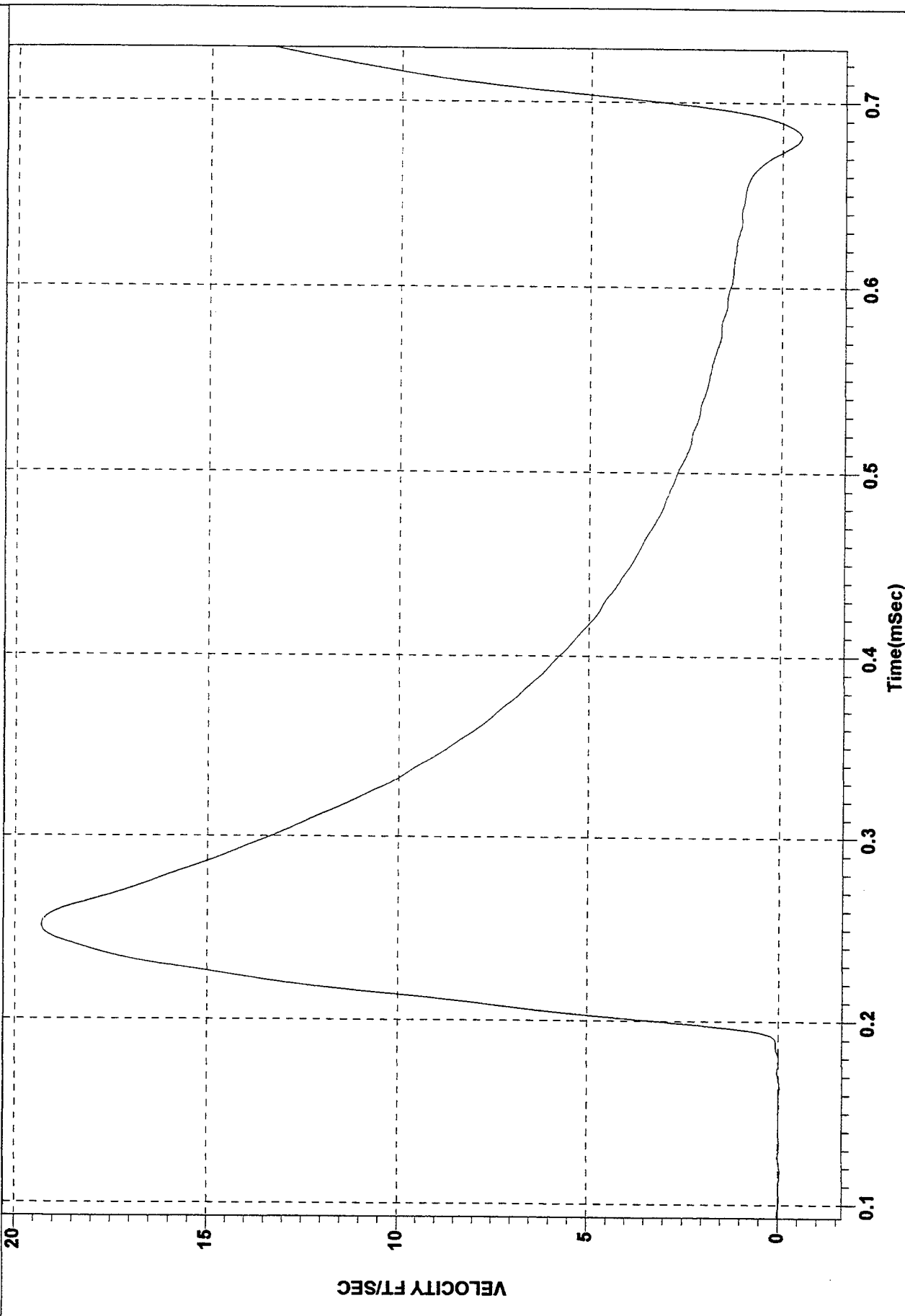
Test Title: EPW FOAM EVALUATION Test No. 013 Service Order No: 6254AK3475 Test Date: 09-27-95 03:50
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .251" 828 CTBN TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 21.7787 fps TT: 0.2440 ms TR: 0.0260 ms TF: 0.2040 ms TP: 0.0320 ms



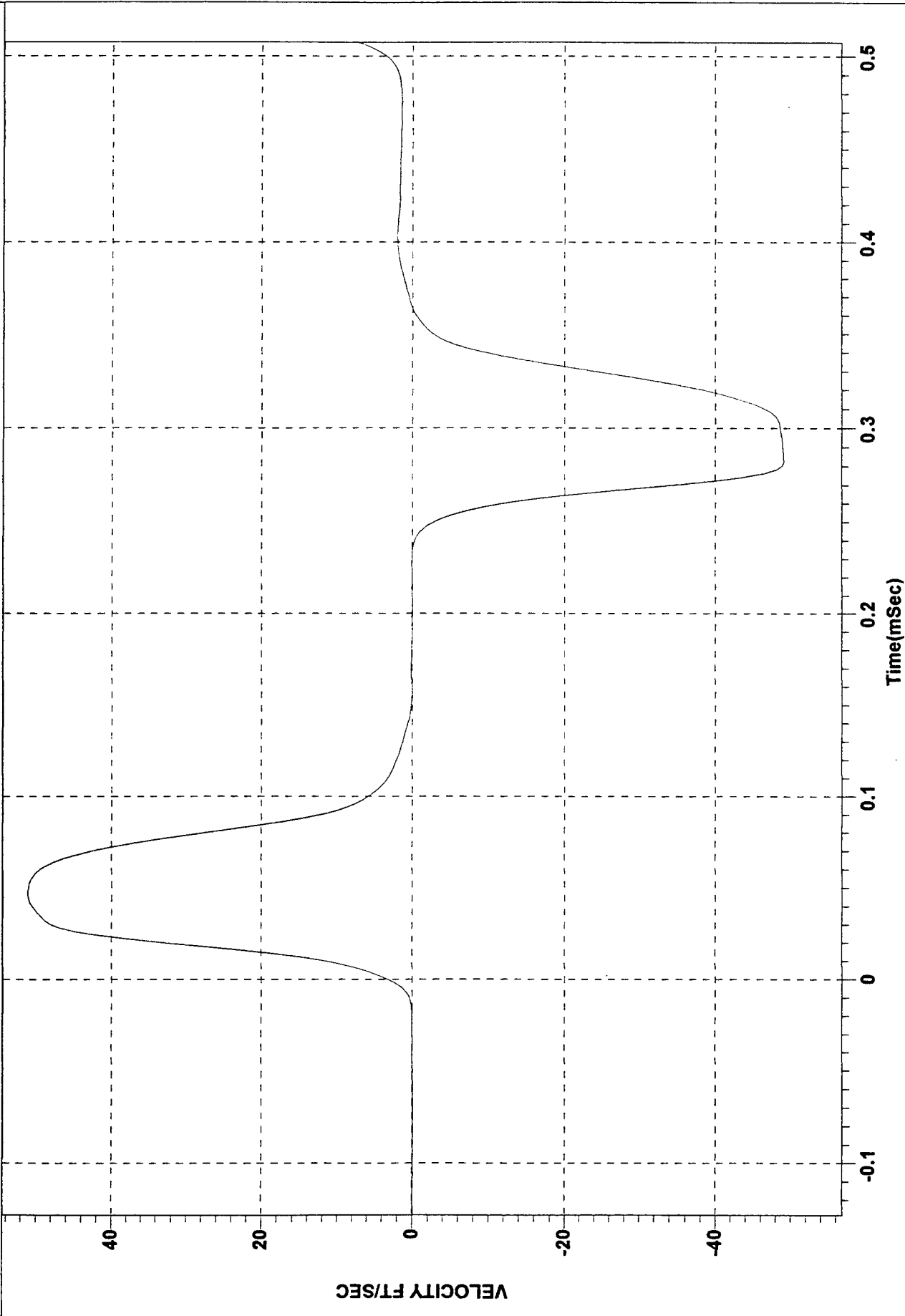
Test Title: EPW FOAM EVALUATION Test No. 018 Service Order No: 6254AK3475 Test Date: 09-27-95 04:12
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .500" 828 CTBN INPUT VELOCITY
Pulse Parameters: M.F.A. 51.6024 fps TT: 0.1020 ms TR: 0.0260 ms TF: 0.0380 ms TP: 0.0400 ms



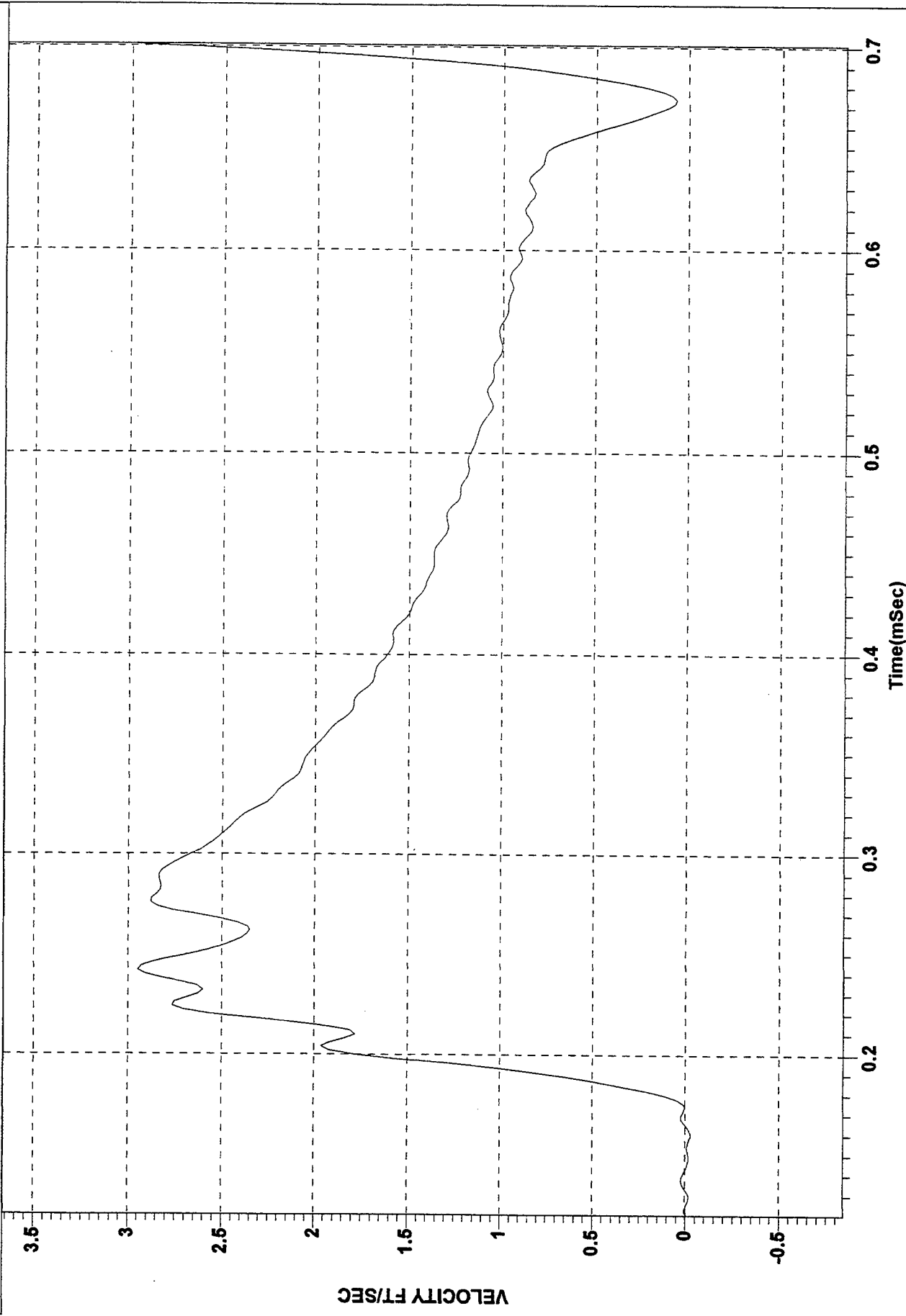
Test Title: EPW FOAM EVALUATION Test No. 018 Service Order No: 6254AK3475 Test Date: 09-27-95 04:12
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .500" 828 CTBN TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 19.3252 fps TT: 0.3520 ms TR: 0.0400 ms TF: 0.2800 ms TP: 0.0560 ms



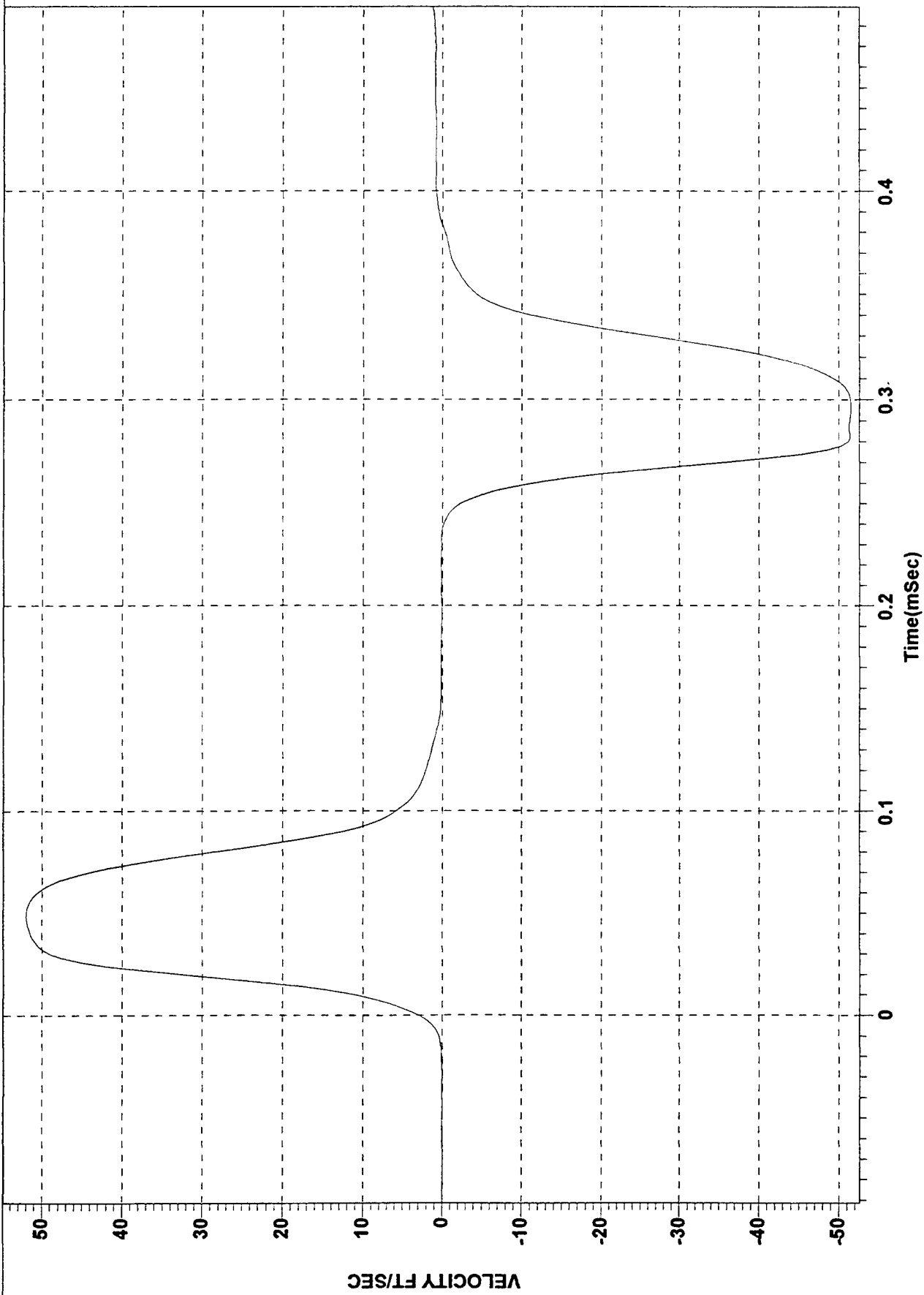
Test Title: EPW FOAM EVALUATION Test No. 021 Service Order No: 6254AK3475 Test Date: 09-27-95 20:18
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .121" PET-90A INPUT VELOCITY
Pulse Parameters: M.F.A. 51.1091 fps TT: 0.1000 ms TR: 0.0260 ms TF: 0.0360 ms TP: 0.0440 ms



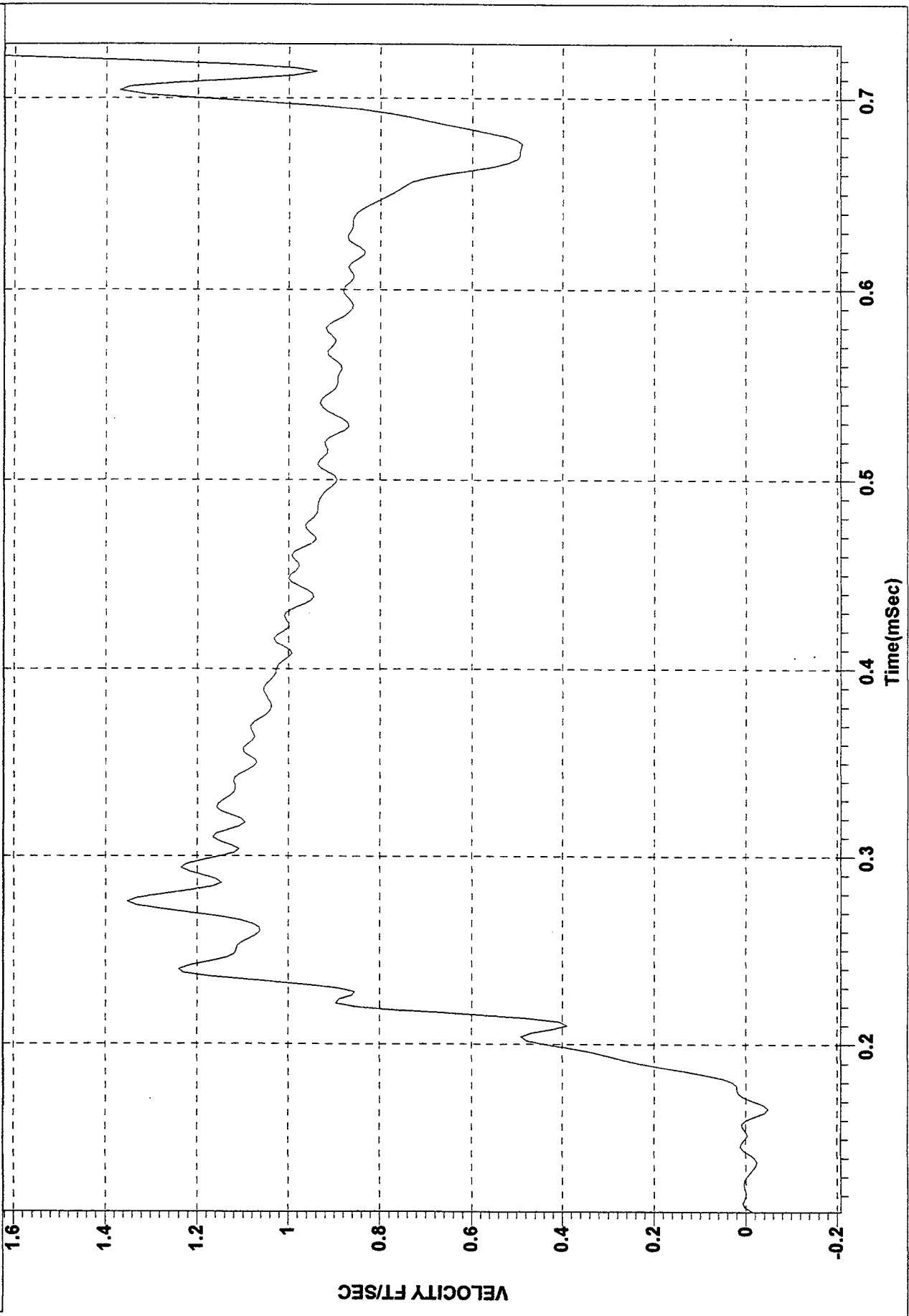
Test Title: EPW FOAM EVALUATION Test No. 021 Service Order No: 6254AK3475 Test Date: 09-27-95 20:18
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .125" PET-90A TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 9.1570 fps TT: 0.1100 ms TR: 0.0640 ms TF: 0.0380 ms TP: 0.0680 ms



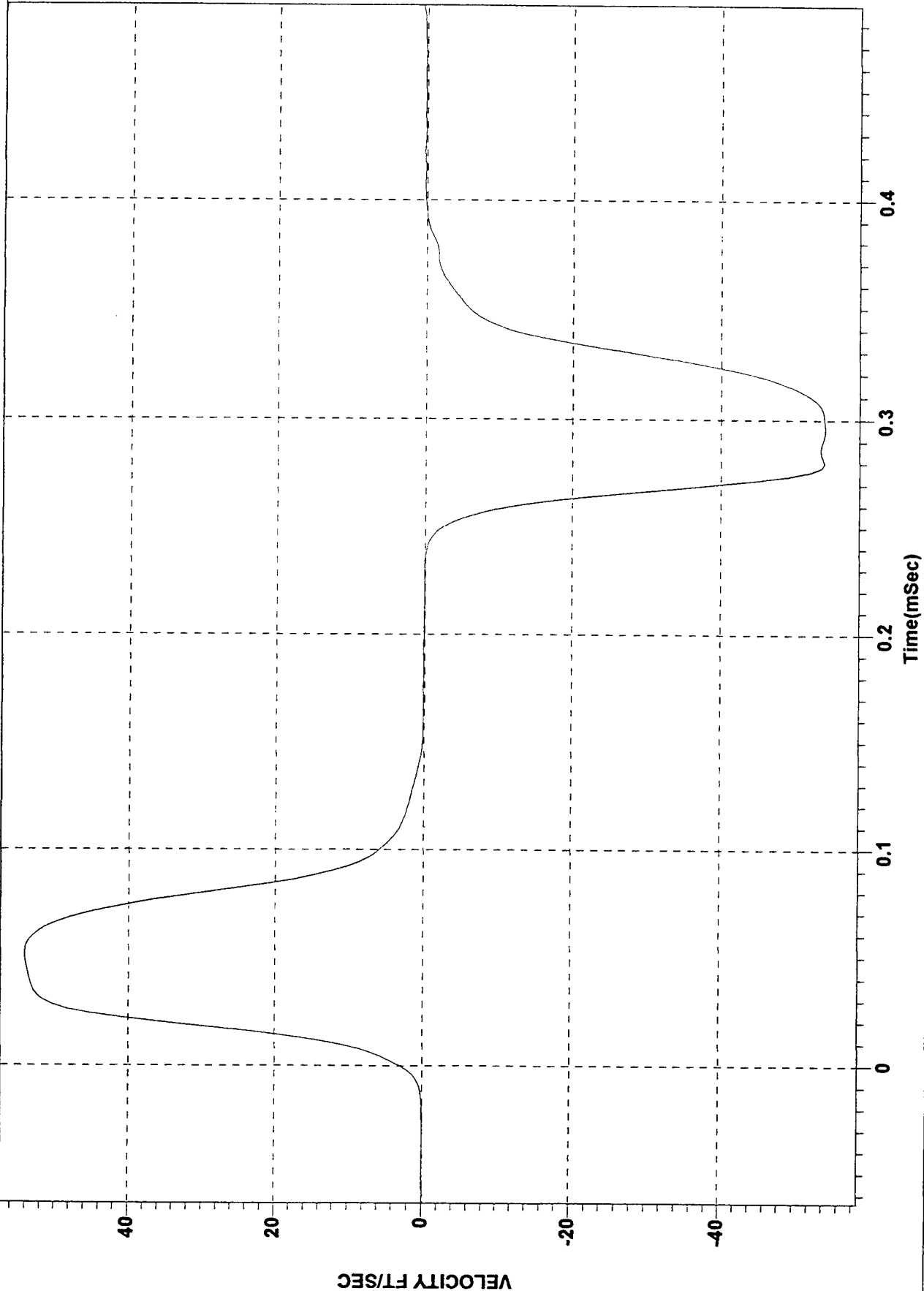
Test Title: EPW FOAM EVALUATION Test No. 025 Service Order No: 6254AK3475 Test Date: 09-27-95 20:32
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR3 SR: 5.000000E+005 Transducer Location: .250" PET-90A INPUT VELOCITY
Pulse Parameters: M.F.A. -58.2368 fps TT: 0.0900 ms TR: 0.0240 ms TF: 0.0580 ms TP: 0.0280 ms



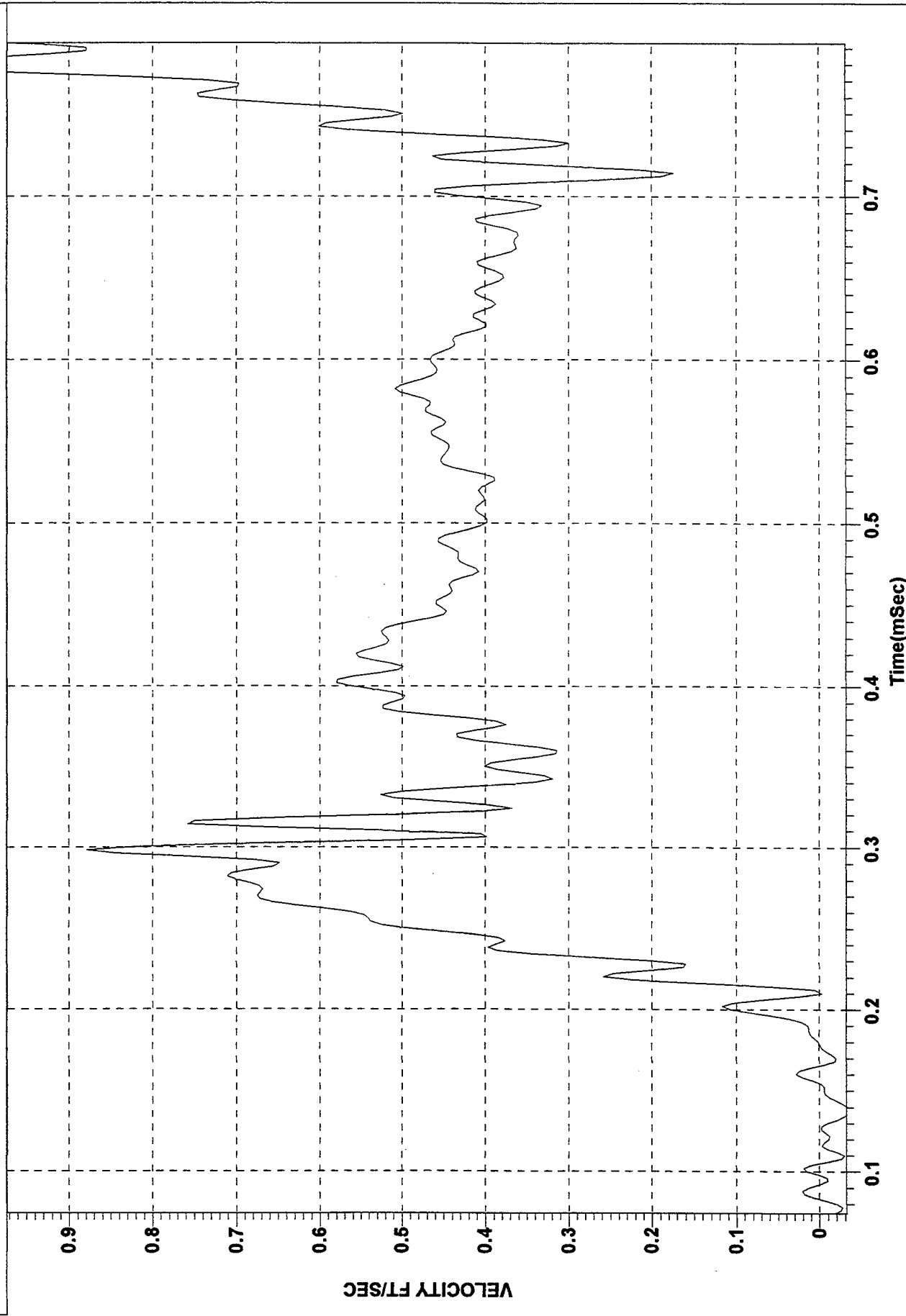
Test Title: EPW FOAM EVALUATION Test No. 025 Service Order No: 6254AK3475 Test Date: 09-27-95 20:32
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .250" PET-90A TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 3.4585 fps TT: 0.3360 ms TR: 0.0720 ms TF: 0.2440 ms TP: 0.0840 ms



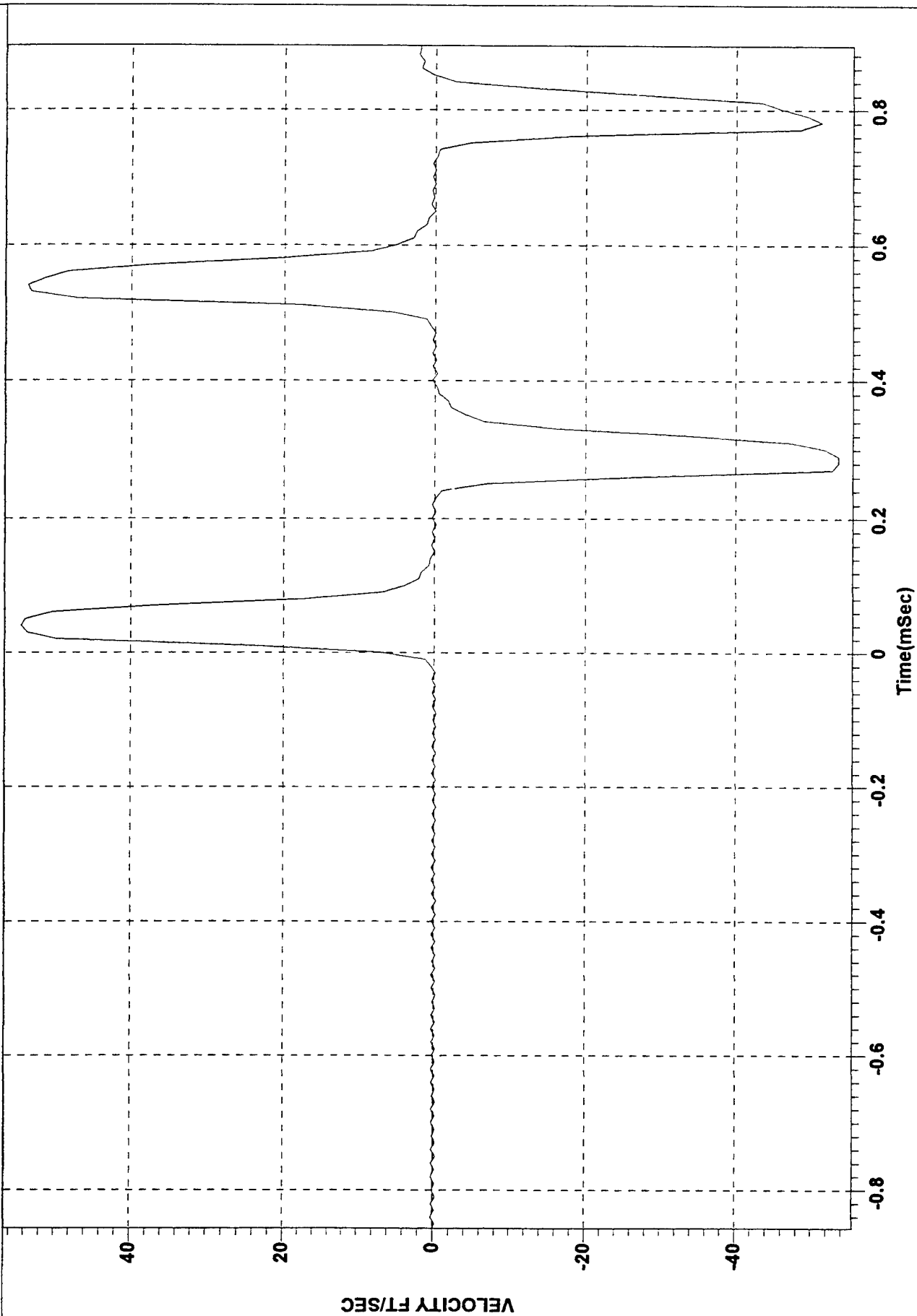
Test Title: EPW FOAM EVALUATION Test No. 028 Service Order No: 6254AK3475 Test Date: 09-27-95 21:00
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .499" PET-90A INPUT VELOCITY
Pulse Parameters: M.F.A. -62.8460 fps TT: 0.0940 ms TR: 0.0200 ms TF: 0.0680 ms TP: 0.0220 ms



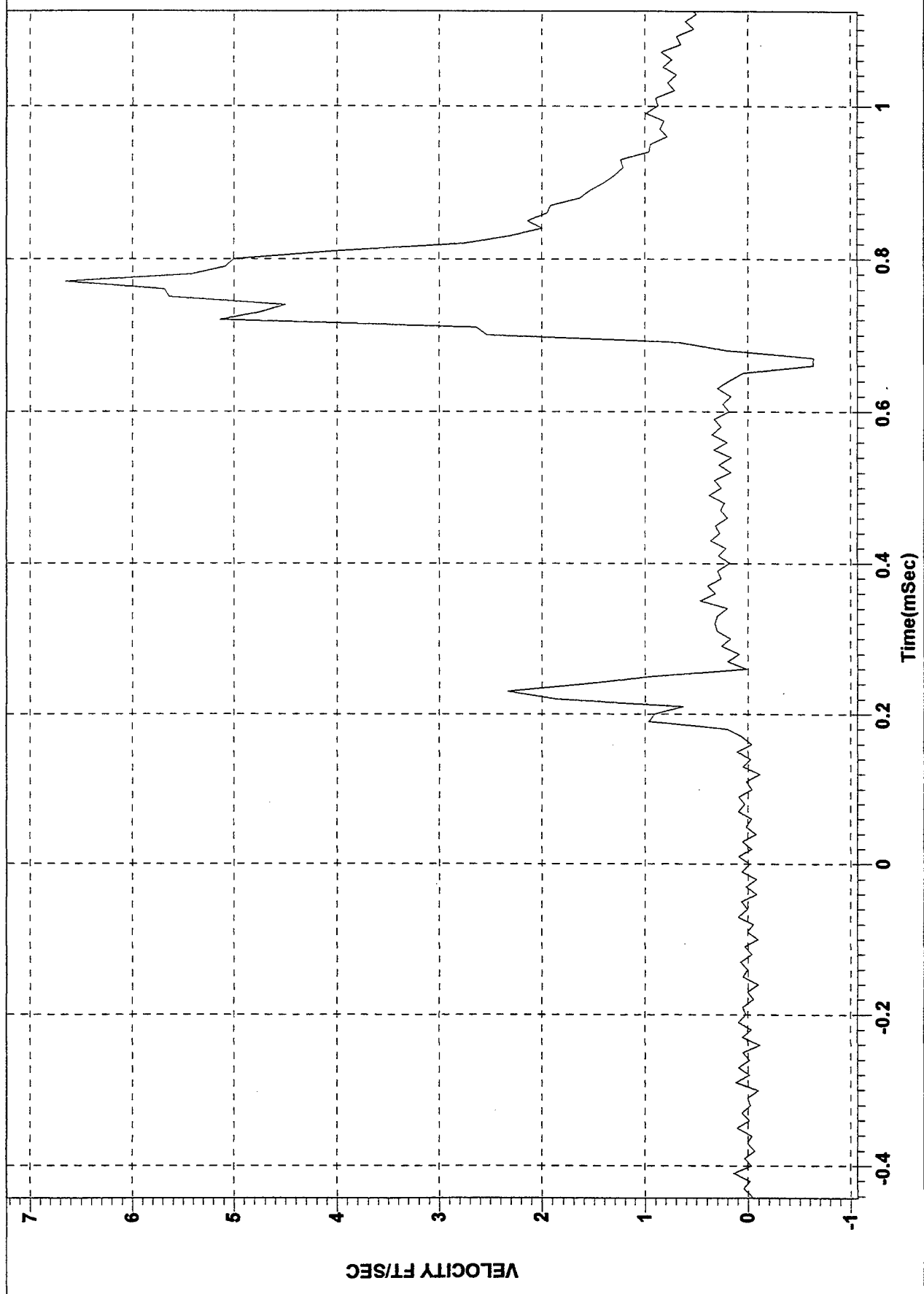
Test Title: EPW FOAM EVALUATION Test No. 028 Service Order No: 6254AK3476 Test Date: 09-27-95 21:00
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .499" PET-90A TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 1.8911 fps TT: 2.2820 ms TR: 1.0920 ms TF: 0.1840 ms TP: 1.5960 ms



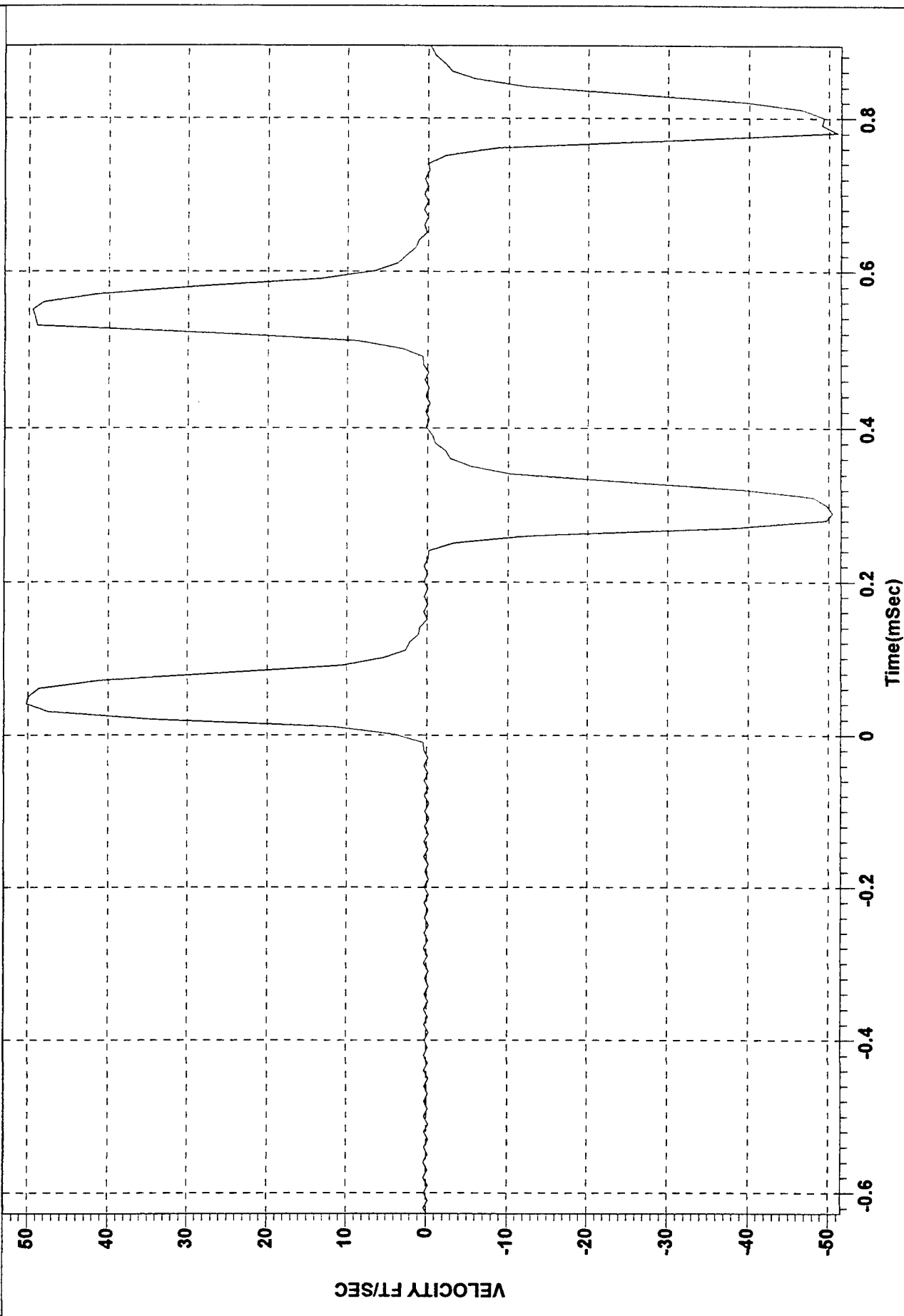
Test Title: EPW FOAM EVALUATION Test No. 030 Service Order No: 6254AK3475 Test Date: 09-27-95 21:24
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR3 SR: 1.000000E+005 Transducer Location: .122" SYLGARD INPUT VELOCITY
Pulse Parameters: M.F.A. 54.5126 fps TT: 0.1100 ms TR: 0.0300 ms TF: 0.0400 ms TP: 0.0500 ms



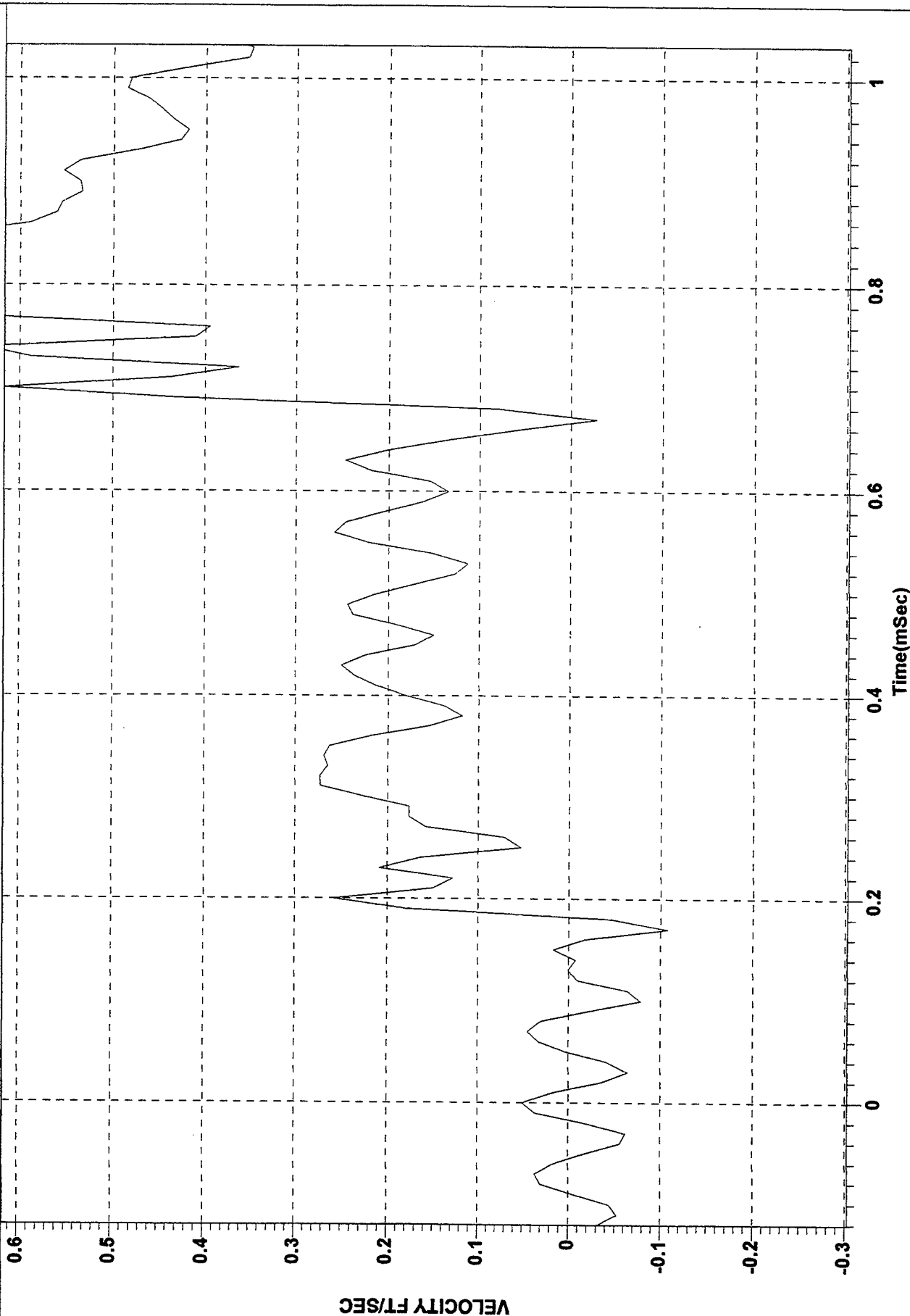
Test Title: EPW FOAM EVALUATION Test No. 030 Service Order No: 6254AK3475 Test Date: 09-27-95 21:24
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR4 SR: 1.000000E+005 Transducer Location: .122" SYLGARD TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. -17.6074 fps TT: 0.1200 ms TR: 0.0400 ms TF: 0.0800 ms TP: 0.0400 ms



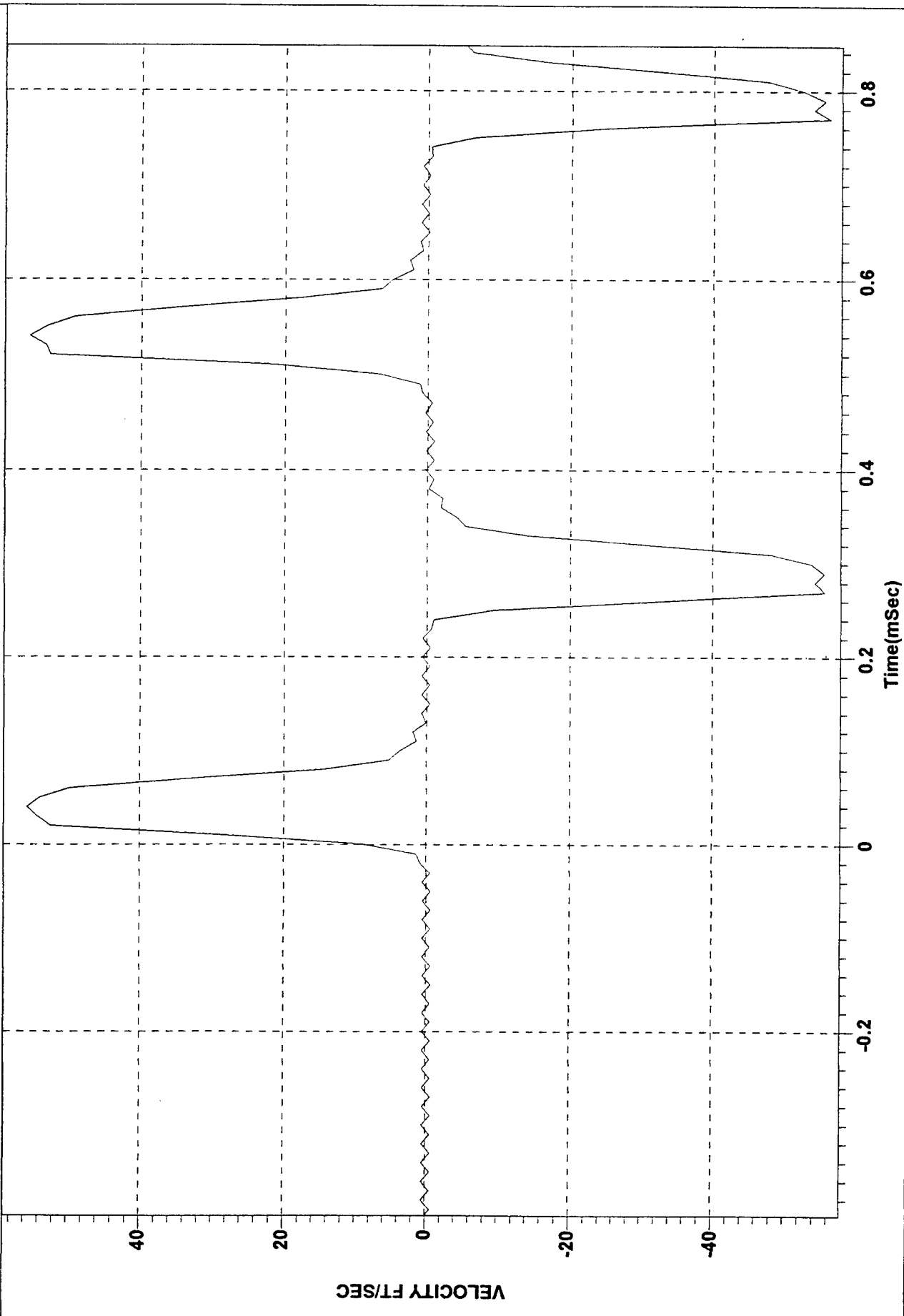
Test Title: EPW FOAM EVALUATION Test No. 033 Service Order No: 6254AK3475 Test Date: 09-27-95 21:44
 DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
 Transducer Serial No: STEELHBR3 SR: 1.000000E+005 Transducer Location: .249" SYLGARD INPUT VELOCITY
 Pulse Parameters: M.F.A. 54.4114 fps TT: 0.1000 ms TR: 0.0300 ms TF: 0.0700 ms TP: 0.0300 ms



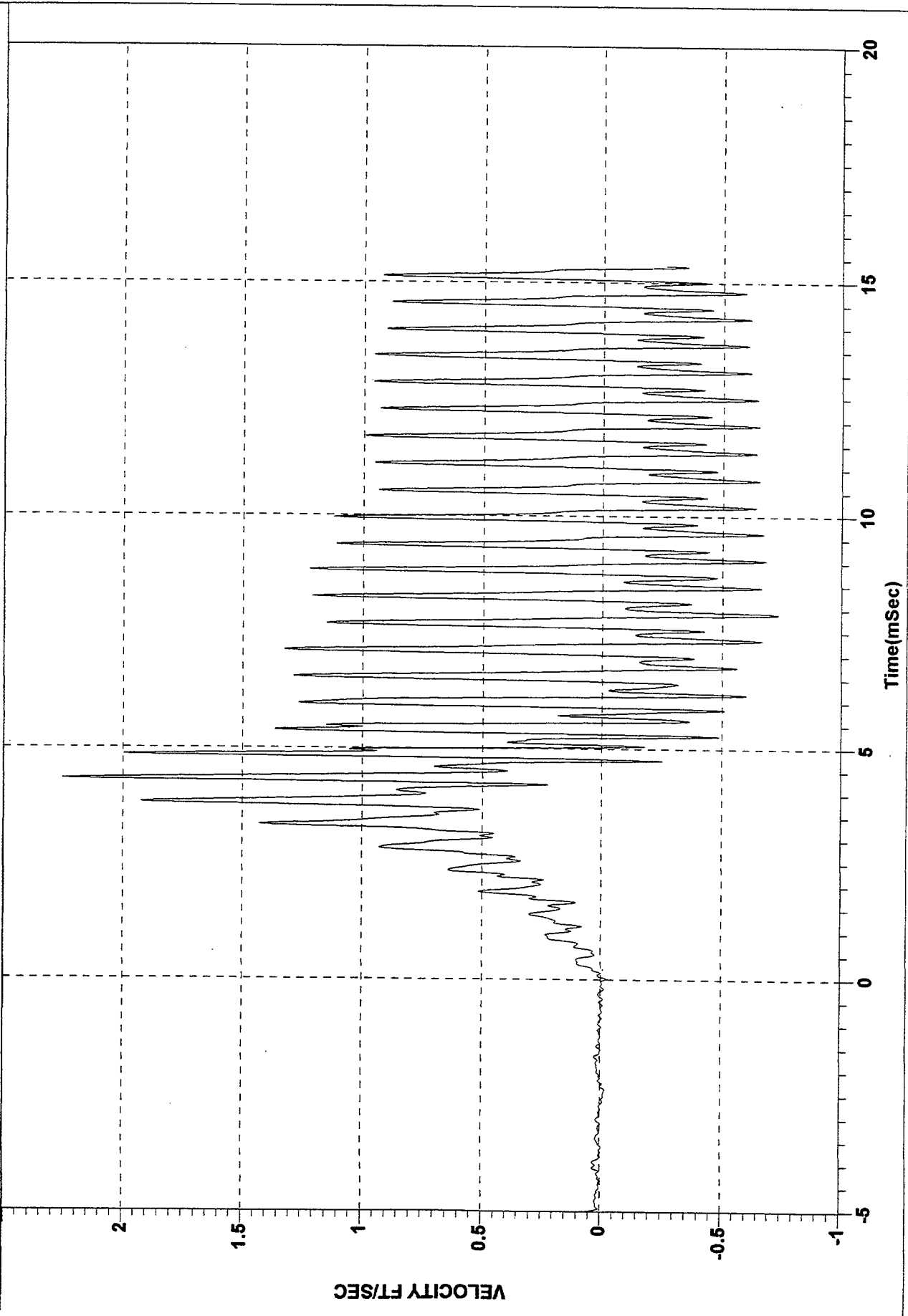
Test Title: EPW FOAM EVALUATION Test No. 033 Service Order No: 6254AK3475 Test Date: 09-27-95 21:44
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 30000.000
Transducer Serial No: STEELHBAR4 SR: 1.000000E+005 Transducer Location: .249" SYLGARD TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 4.6829 fps TT: 0.2600 ms TR: 0.0700 ms TF: 0.1400 ms TP: 0.1100 ms



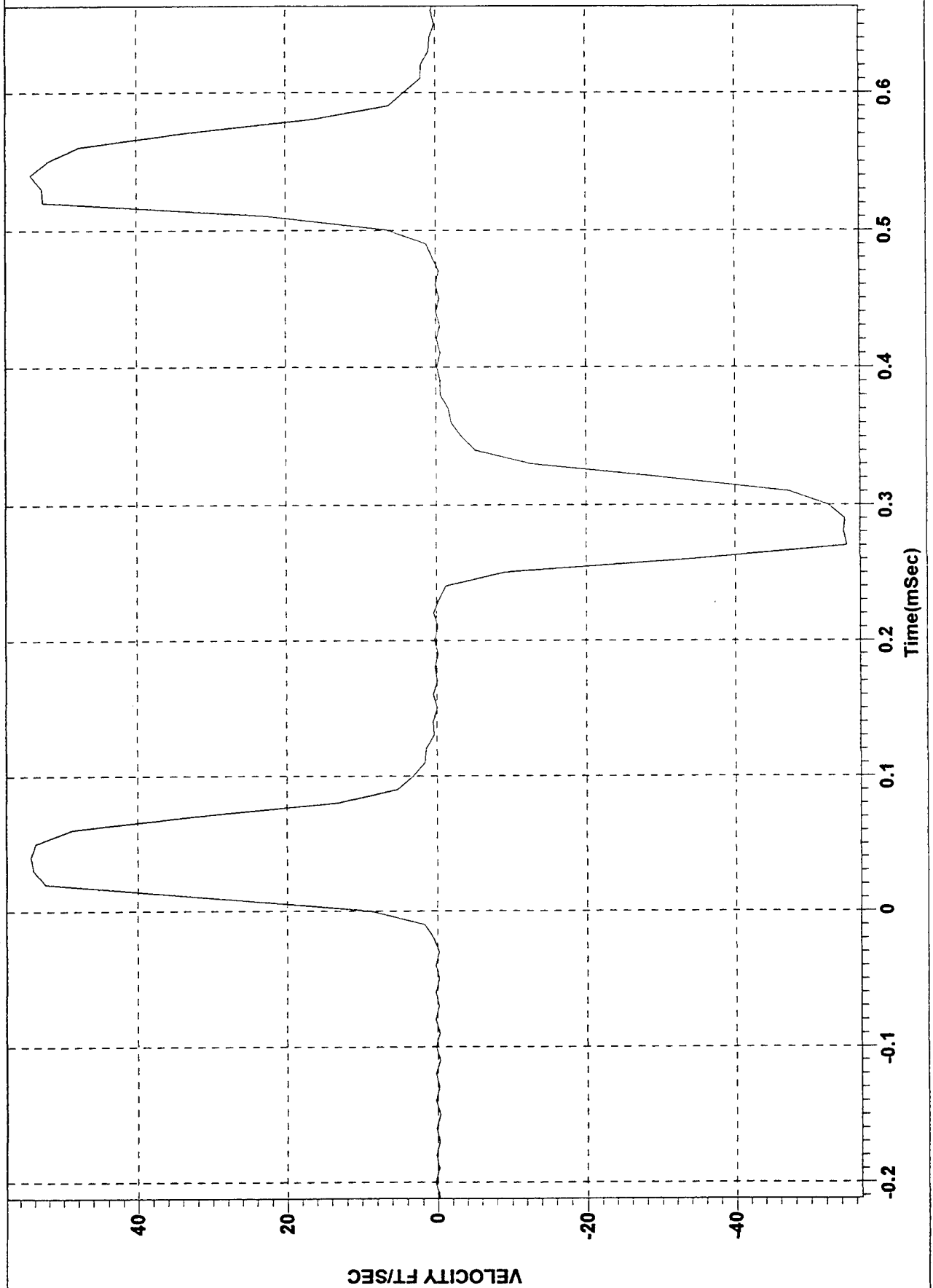
Test Title: EPW FOAM EVALUATION Test No. 037 Service Order No: 6254AK3475 Test Date: 09-27-95 22:03
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBR3 SR: 1.000000E+005 Transducer Location: .501" SYLGARD INPUT VELOCITY
Pulse Parameters: M.F.A. 65.5465 fps TT: 0.1000 ms TR: 0.0300 ms TF: 0.0700 ms TP: 0.0300 ms



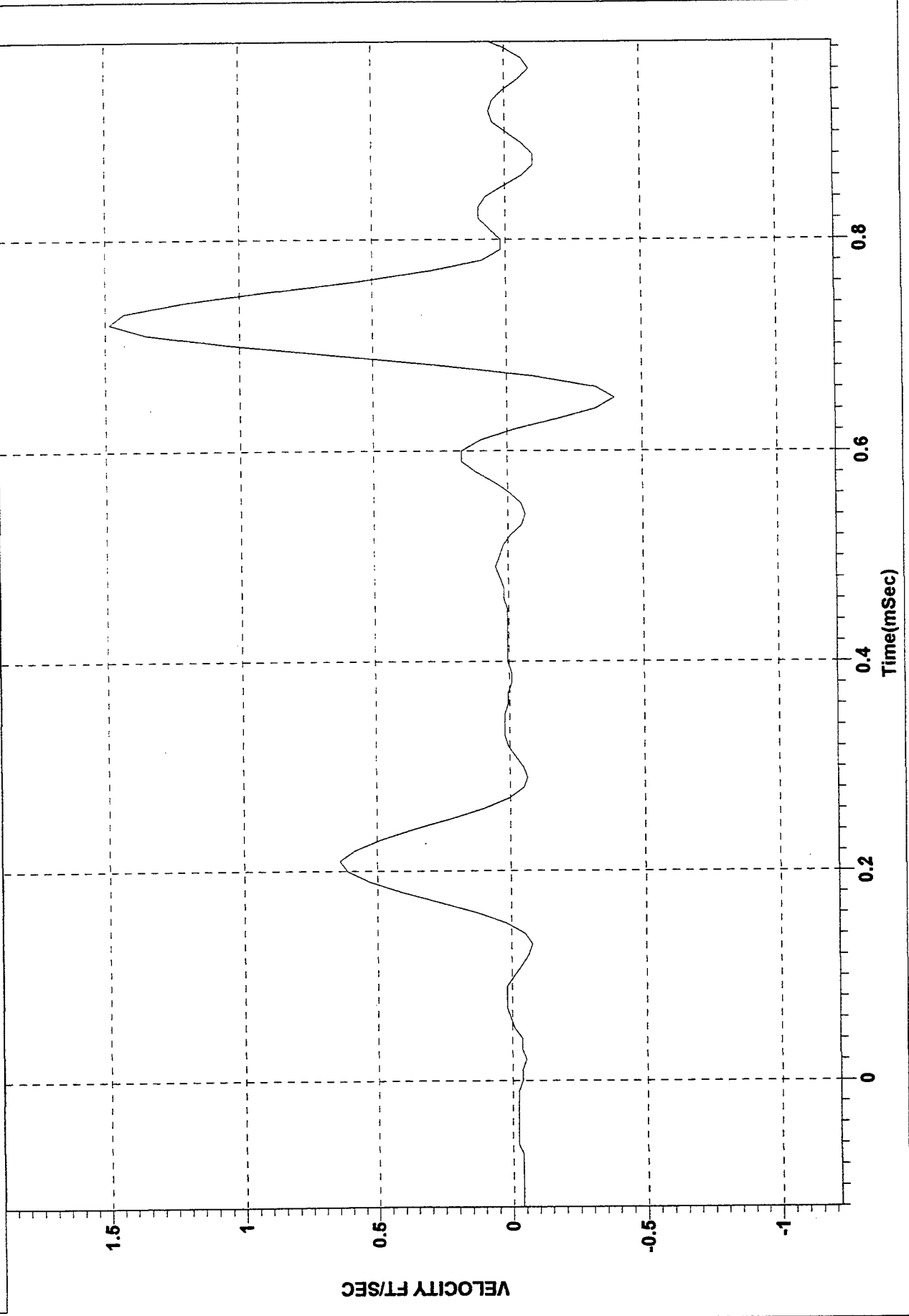
Test Title: EPW FOAM EVALUATION Test No. 037 Service Order No: 6254AK3475 Test Date: 09-27-95 22:03
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 10000.000
Transducer Serial No: STEELHBAR4 SR: 1.000000E+005 Transducer Location: .501" SYLGARD TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 2.2595 fps TT: 0.4900 ms TR: 0.0800 ms TF: 0.3700 ms TP: 0.1000 ms



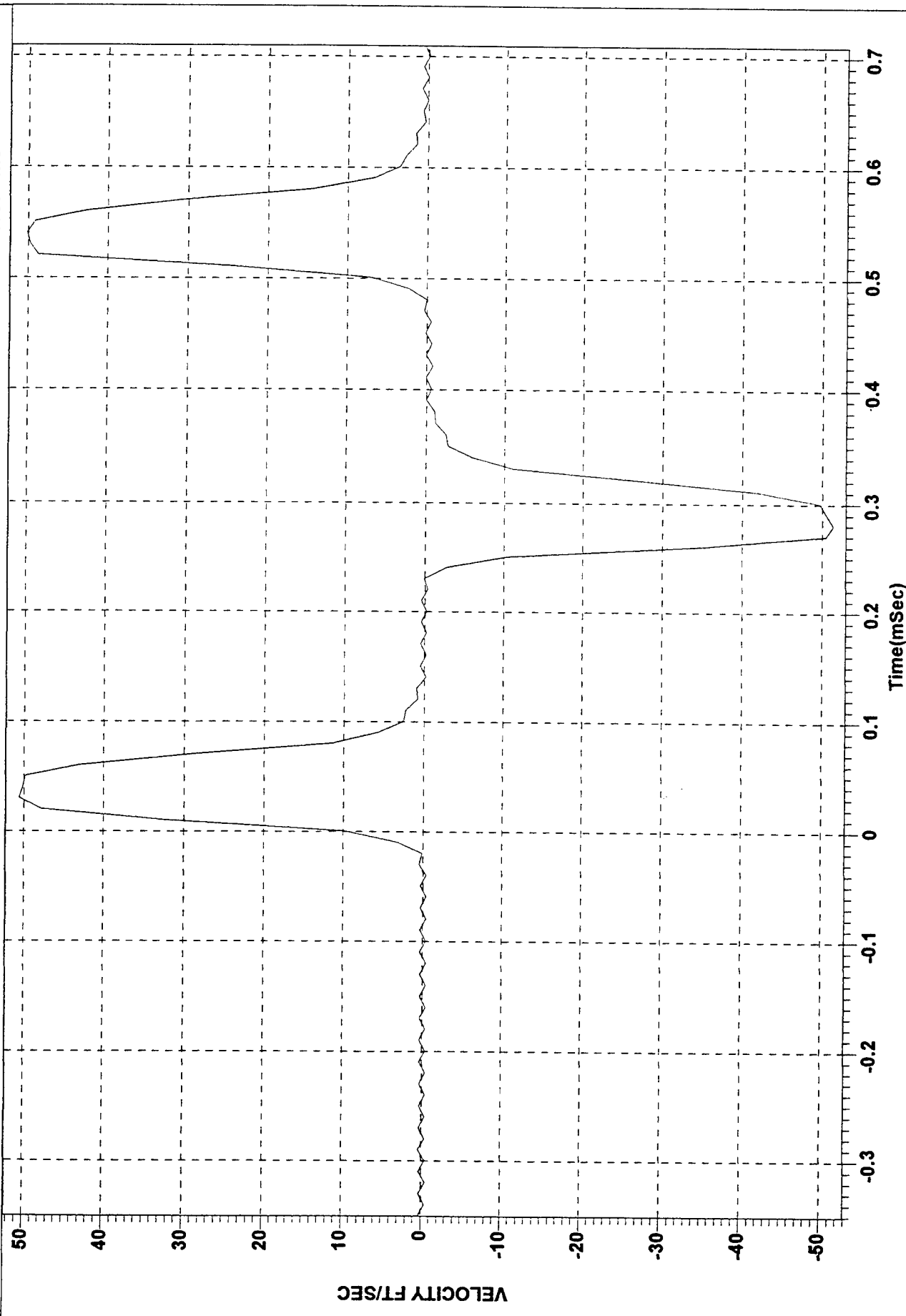
Test Title: EPW FOAM EVALUATION Test No. 039 Service Order No: 6254AK3475 Test Date: 09-27-95 22:36
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR3 SR: 1.000000E+005 Transducer Location: .121"PINK HS-II INPUT VELOCITY
Pulse Parameters: M.F.A. -56.5455 fps TT: 0.1100 ms TR: 0.0300 ms TF: 0.0700 ms TP: 0.0300 ms



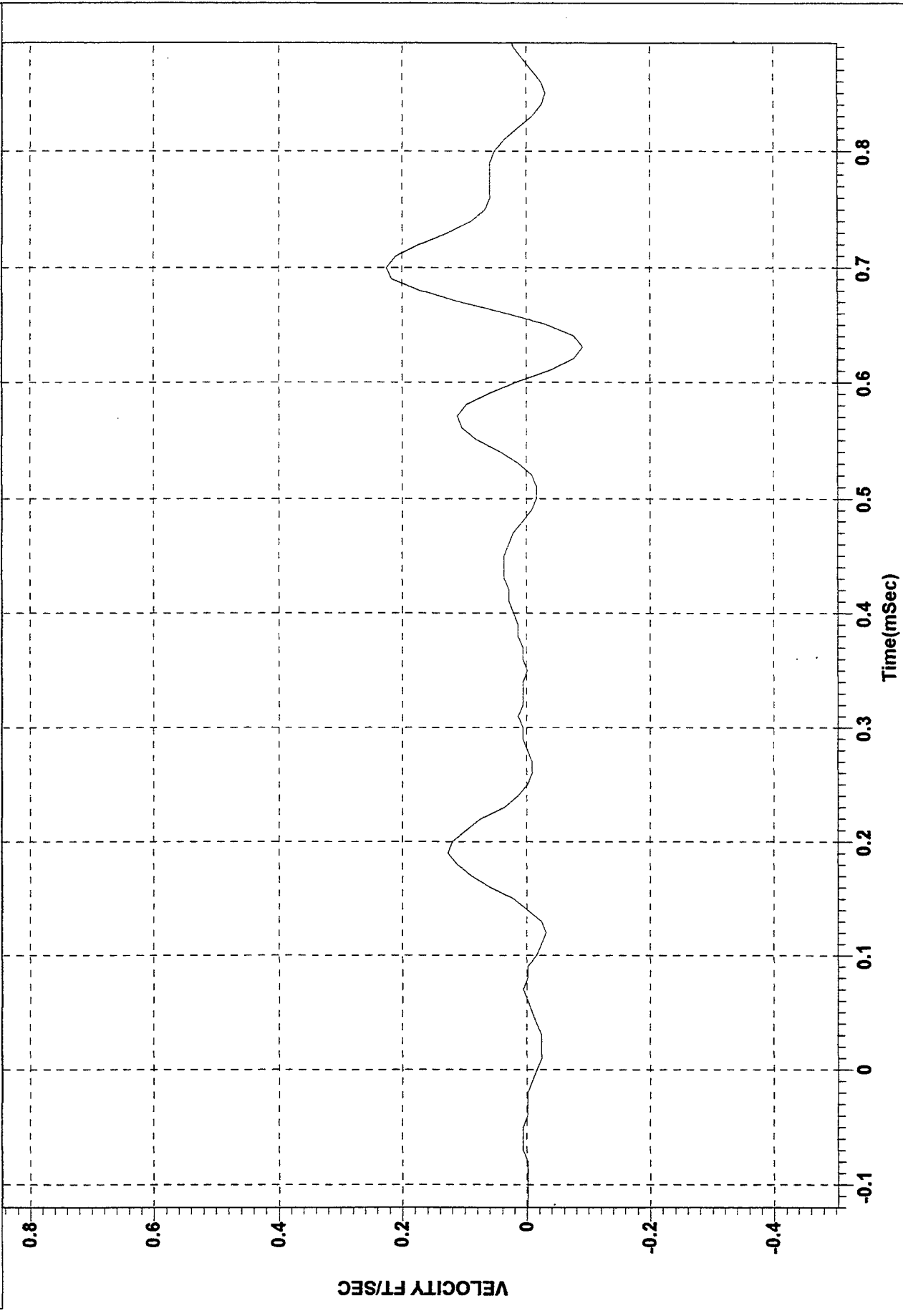
Test Title: EPW FOAM EVALUATION Test No. 039 Service Order No: 6254AK3475 Test Date: 09-27-95 22:36
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 10000.000
Transducer Serial No: STEELHIBAR4 SR: 1.000000E+005 Transducer Location: .121"PINK HS-II TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 28.5325 fps TT: 0.1100 ms TR: 0.0400 ms TF: 0.0500 ms TP: 0.0500 ms



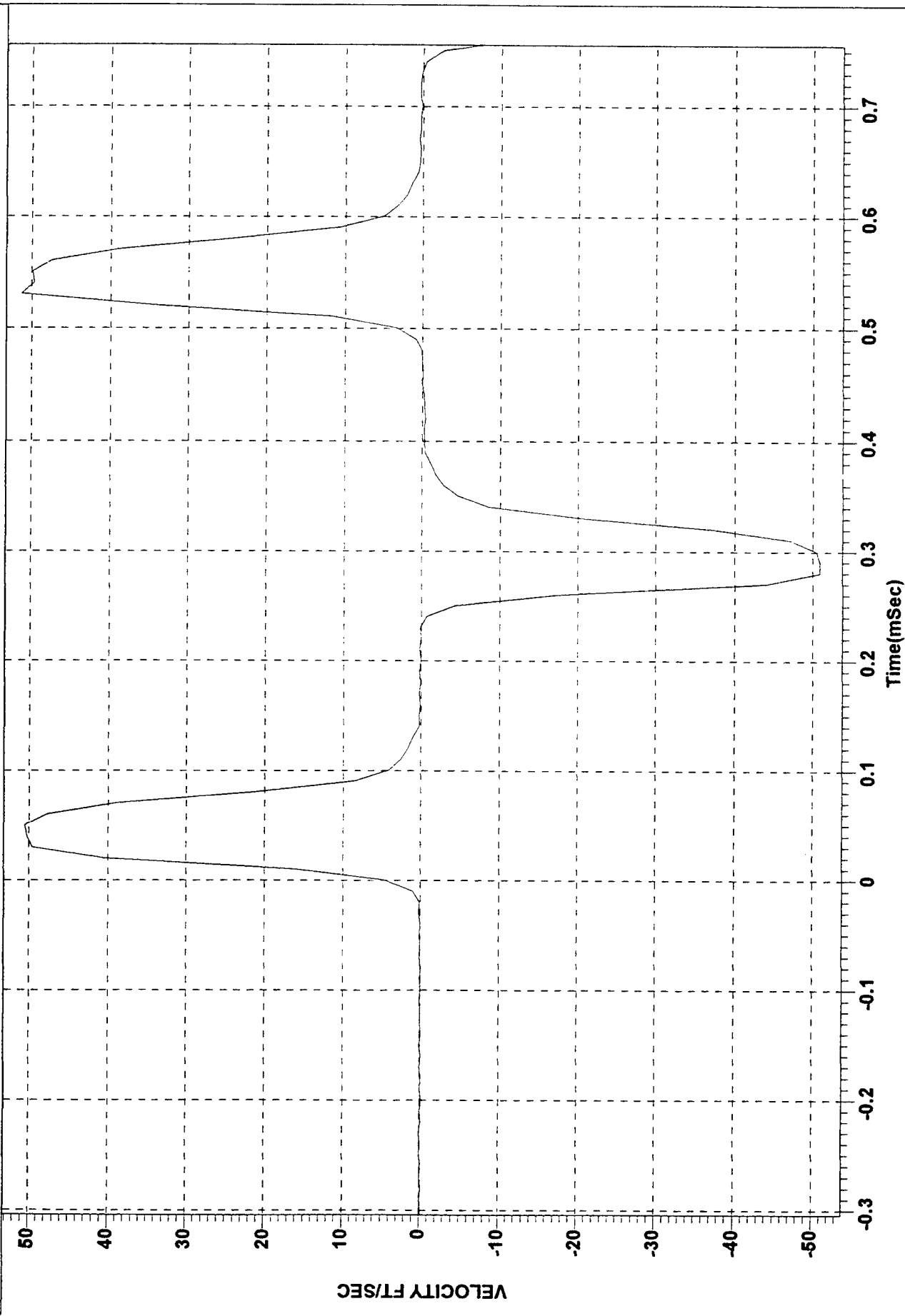
Test Title: EPW FOAM EVALUATION Test No. 042 Service Order No: 6254AK3475 Test Date: 09-27-95 22:50
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR3 SR: 1.000000E+005 Transducer Location: .250"PINK HS-II INPUT VELOCITY
Pulse Parameters: M.F.A. 54.1601 fps TT: 0.1100 ms TR: 0.0300 ms TF: 0.0600 ms TP: 0.0300 ms



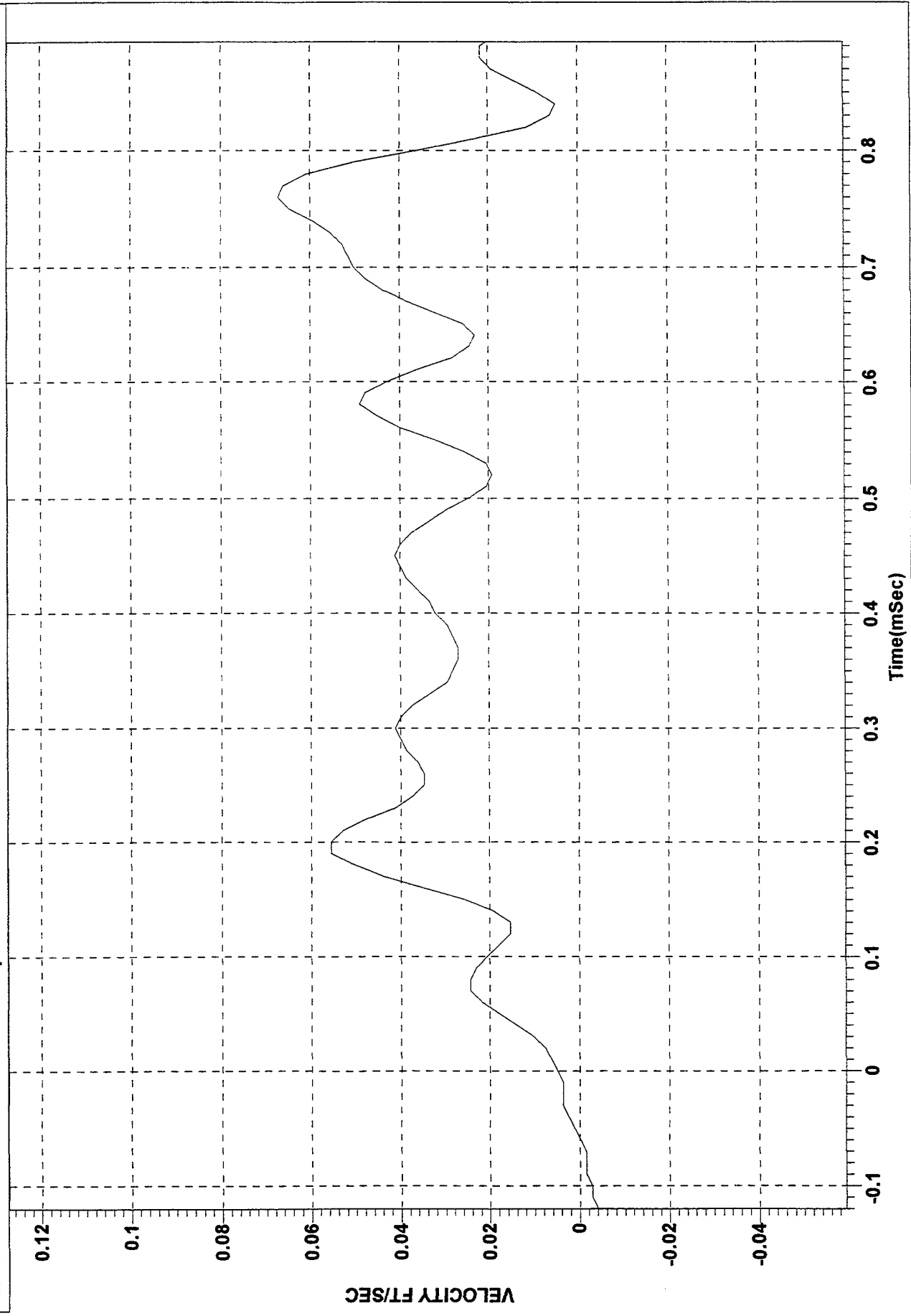
Test Title: EPW FOAM EVALUATION Test No. 042 Service Order No: 6254AK3475 Test Date: 09-27-95 22:50
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 10000.000
Transducer Serial No: STEELHBAR4 SR: 1.000000E+005 Transducer Location: .250"PINK HS-II TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 17.6993 fps TT: 0.1200 ms TR: 0.0500 ms TF: 0.0500 ms TP: 0.0600 ms



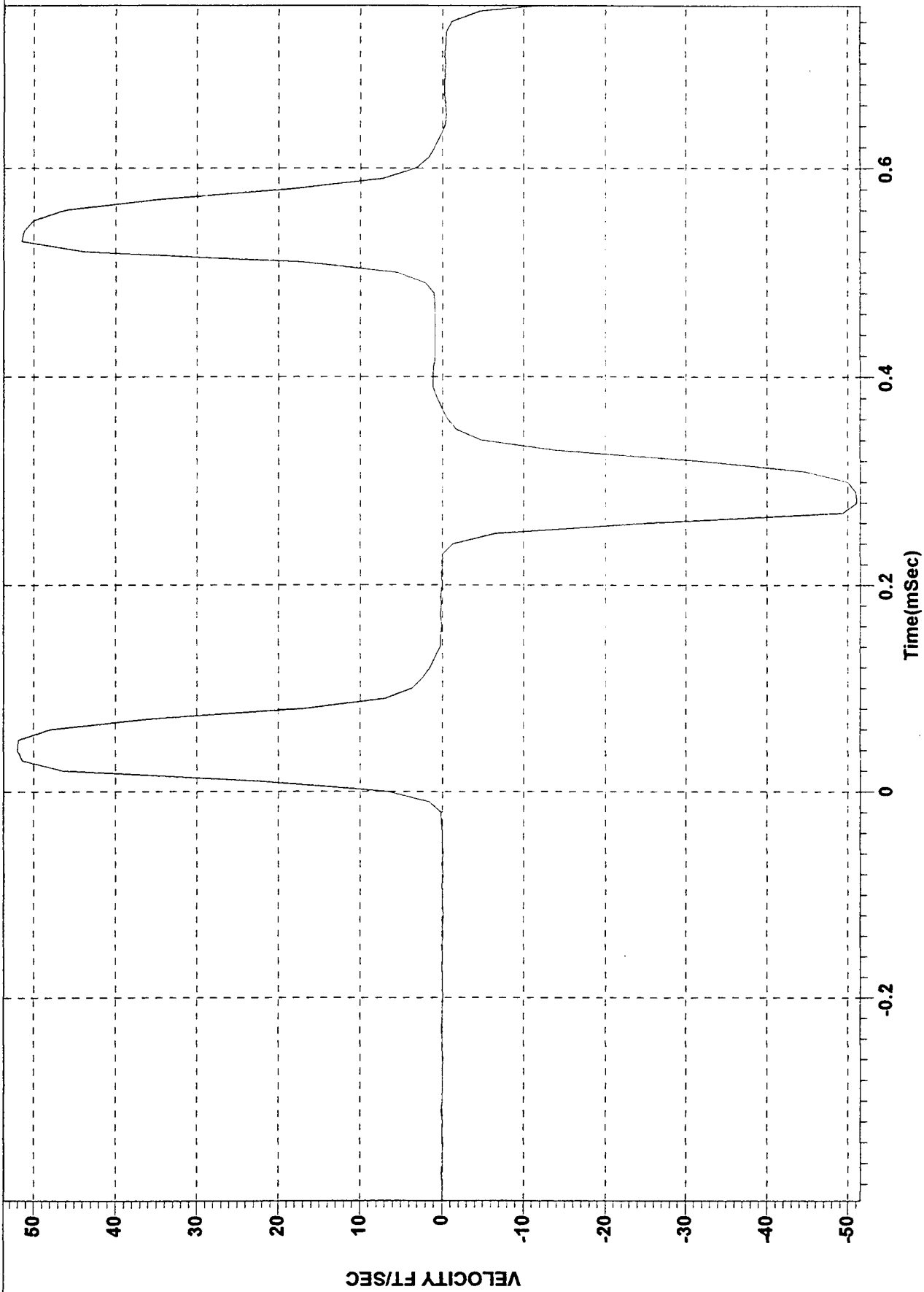
Test Title: EPW FOAM EVALUATION Test No. 045 Service Order No: 6254AK3475 Test Date: 09-27-95 23:02
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR3 SR: 1.000000E+005 Transducer Location: .501"PINK HS-II INPUT VELOCITY
Pulse Parameters: M.F.A. 57.6051 fps TT: 0.1100 ms TR: 0.0300 ms TF: 0.0800 ms TP: 0.0300 ms



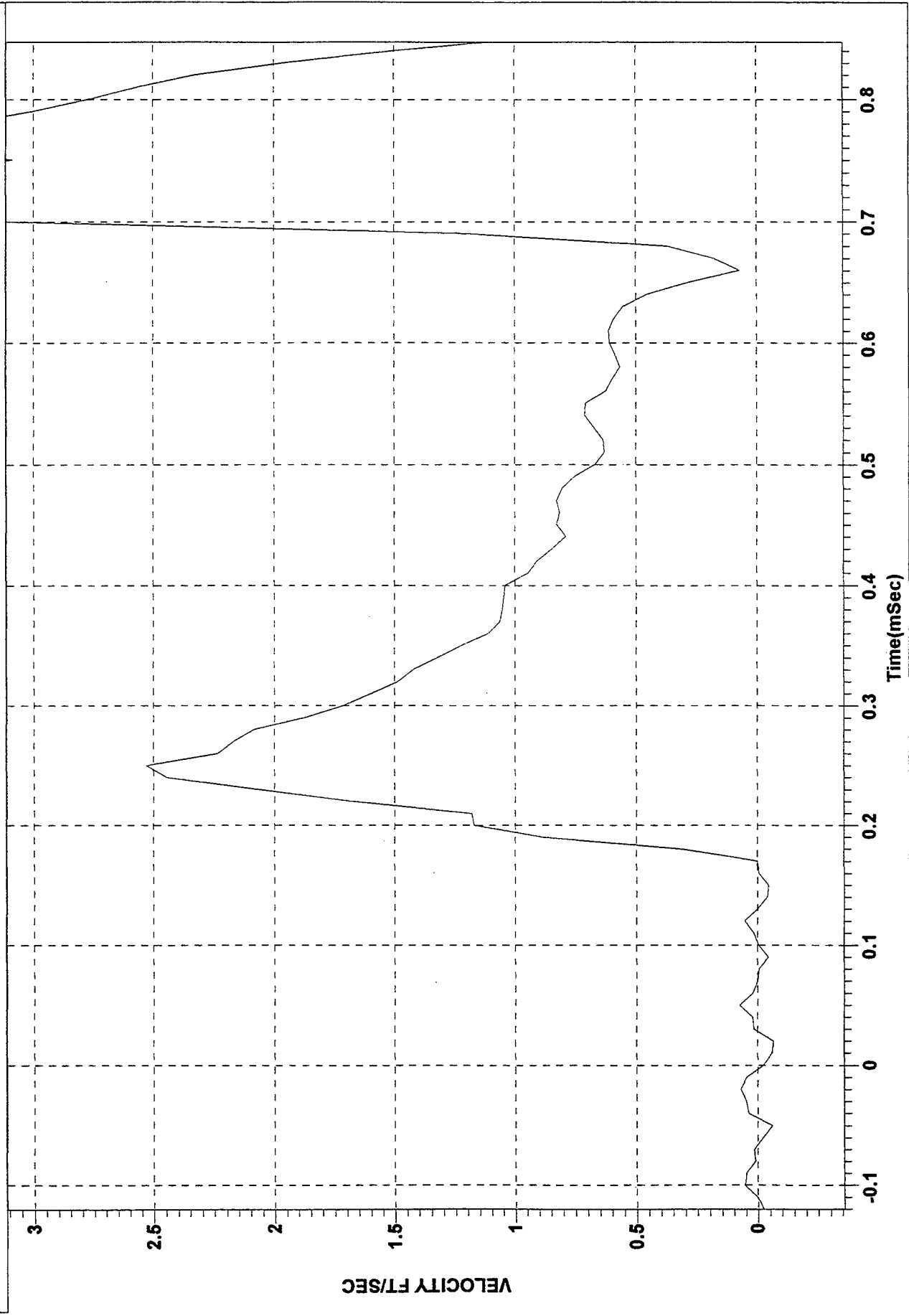
Test Title: EPW FOAM EVALUATION Test No. 045 Service Order No: 6254AK3475 Test Date: 09-27-95 23:02
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 10000.000
Transducer Serial No: STEELHBAR4 SR: 1.000000E+005 Transducer Location: .501"PINK HS-II TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 3.1698 fps TT: 0.2300 ms TR: 0.1500 ms TF: 0.0600 ms TP: 0.1600 ms



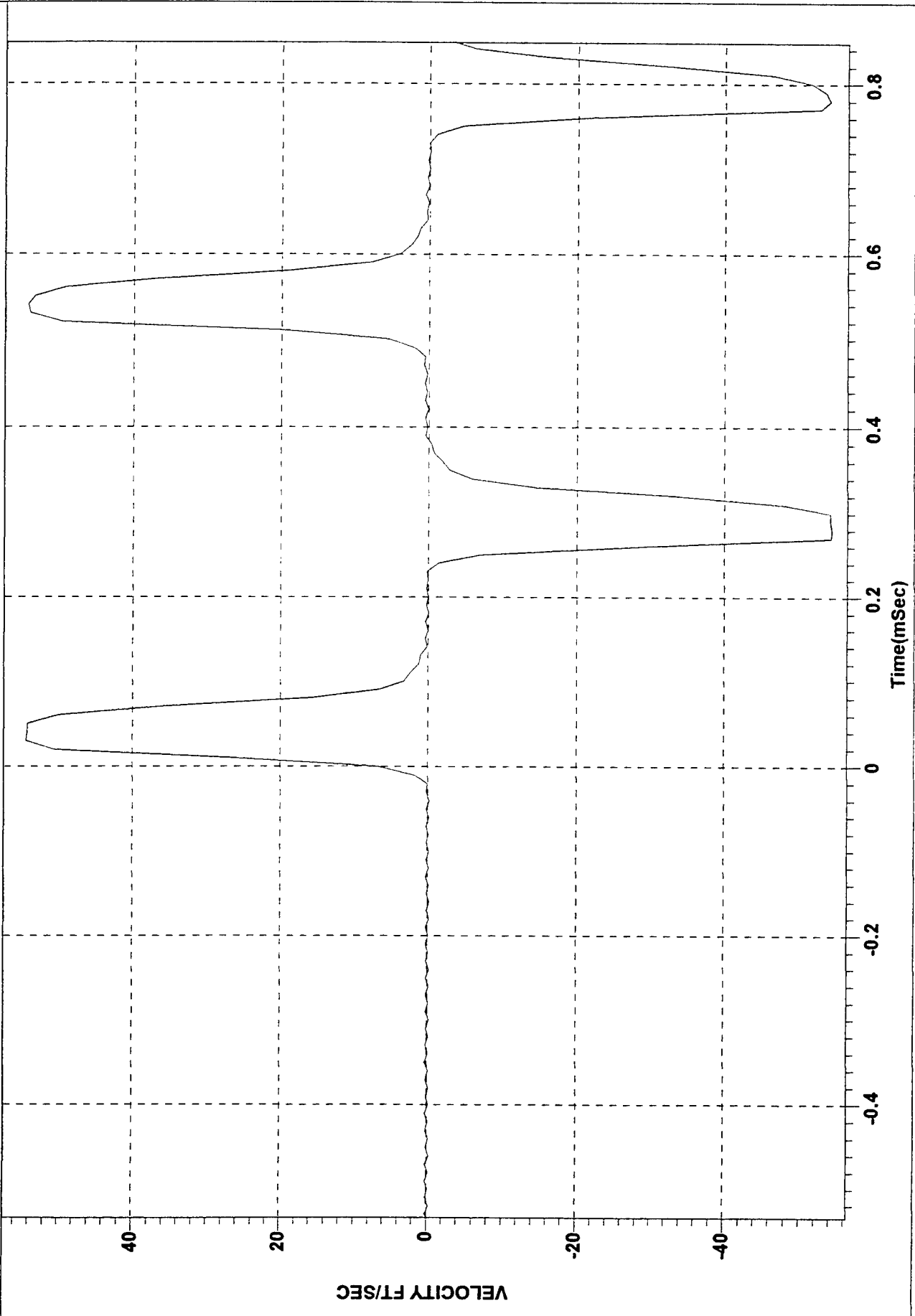
Test Title: EPW FOAM EVALUATION Test No. 047 Service Order No: 6254AK3475 Test Date: 09-28-95 01:43
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR3 SR: 1.000000E+005 Transducer Location: .121"184w/GMB INPUT VELOCITY
Pulse Parameters: M.F.A. 52.0697 fps TT: 0.1100 ms TR: 0.0400 ms TF: 0.0400 ms TP: 0.0500 ms



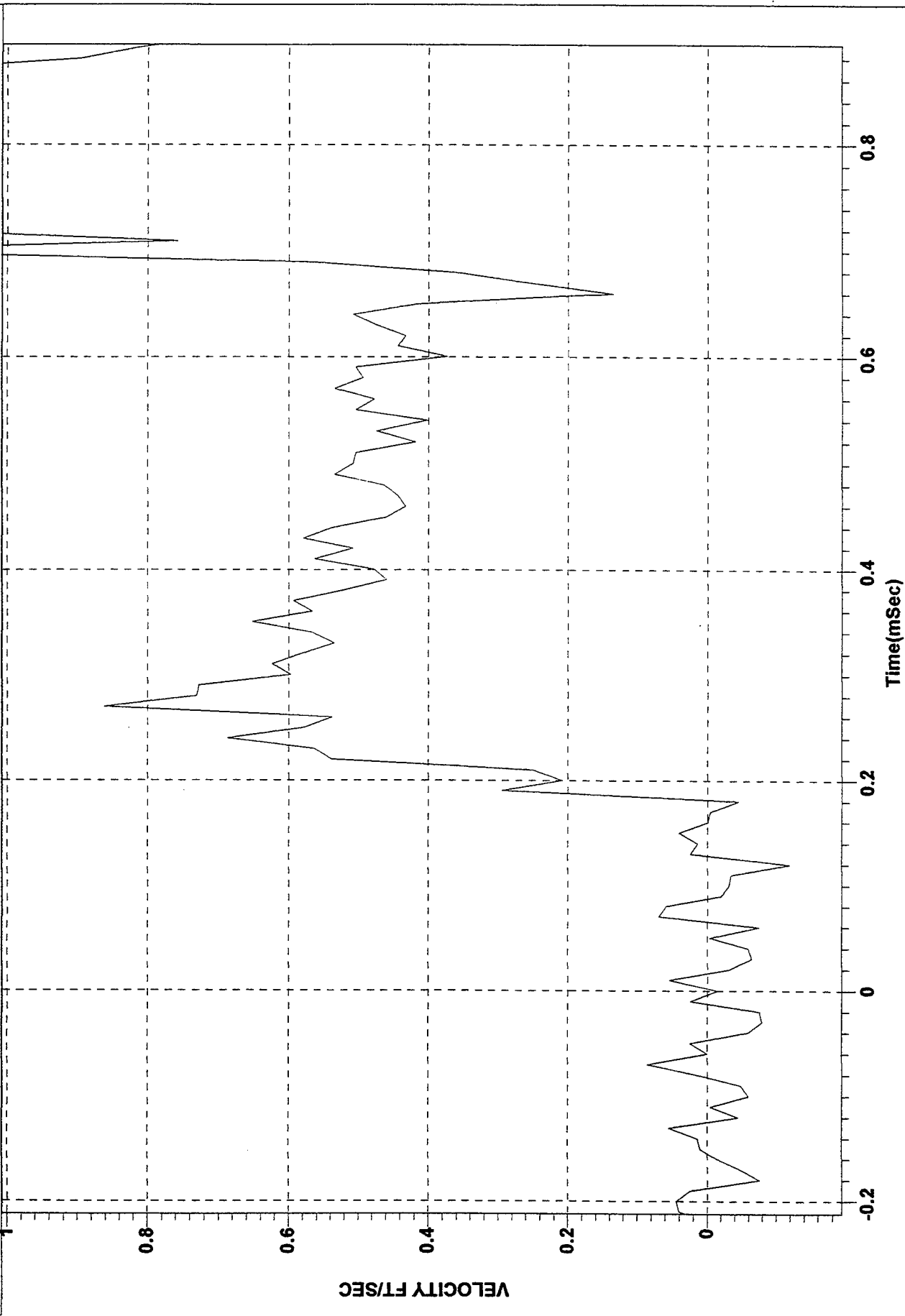
Test Title: EPW FOAM EVALUATION Test No. 047 Service Order No: 6254AK3475 Test Date: 09-28-95 01:43
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR4 SR: 1.000000E+005 Transducer Location: .121"184w/GMB TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 11.6407 fps TT: 0.1200 ms TR: 0.0300 ms TF: 0.0900 ms TP: 0.0300 ms



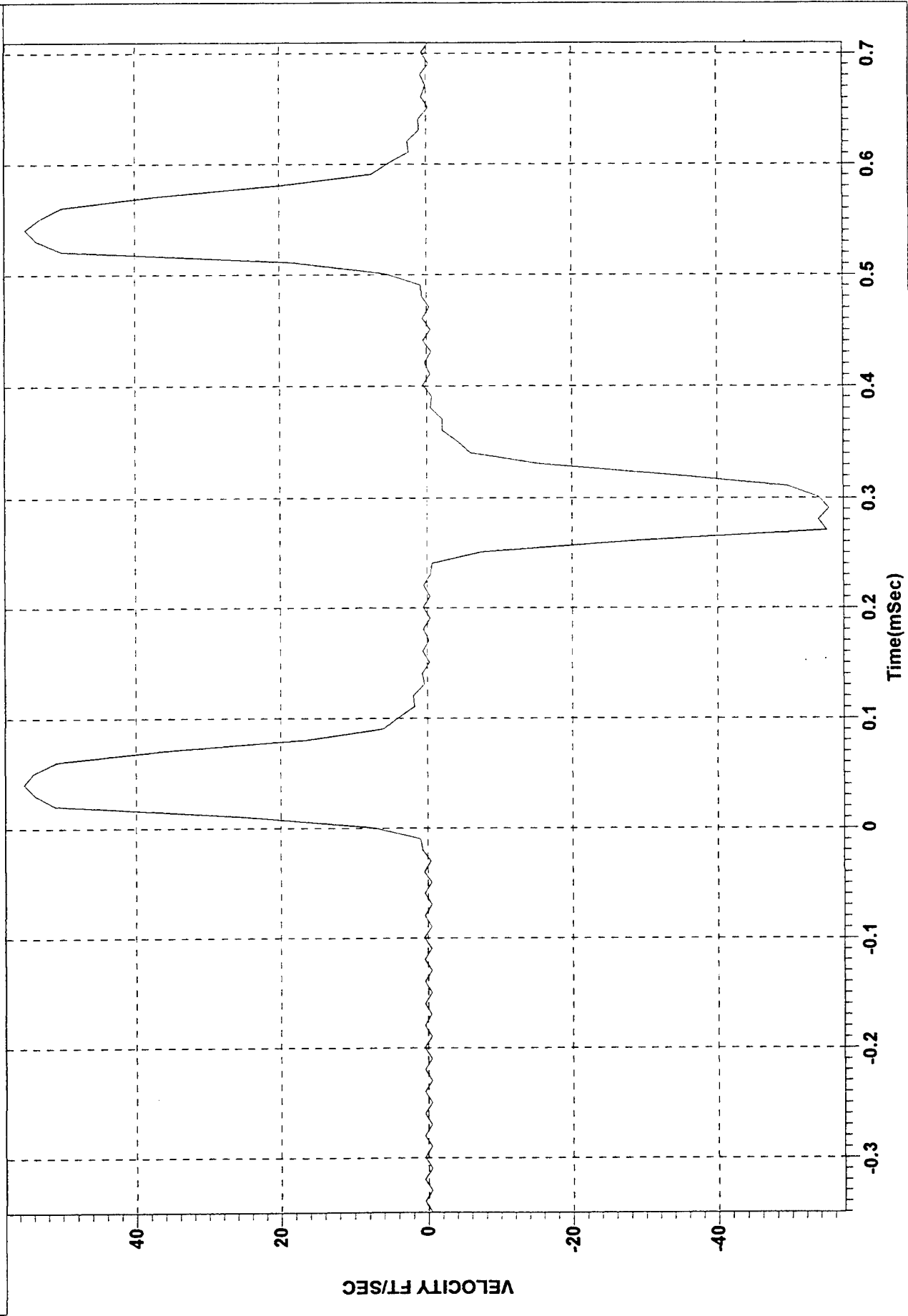
Test Title: EPW FOAM EVALUATION Test No. 050 Service Order No: 6254AK3475 Test Date: 09-28-95 01:56
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBR3 SR: 1.000000E+005 Transducer Location: .249"184w/GMB INPUT VELOCITY
Pulse Parameters: M.F.A. -59.3492 fps TT: 0.0900 ms TR: 0.0300 ms TF: 0.0600 ms TP: 0.0300 ms



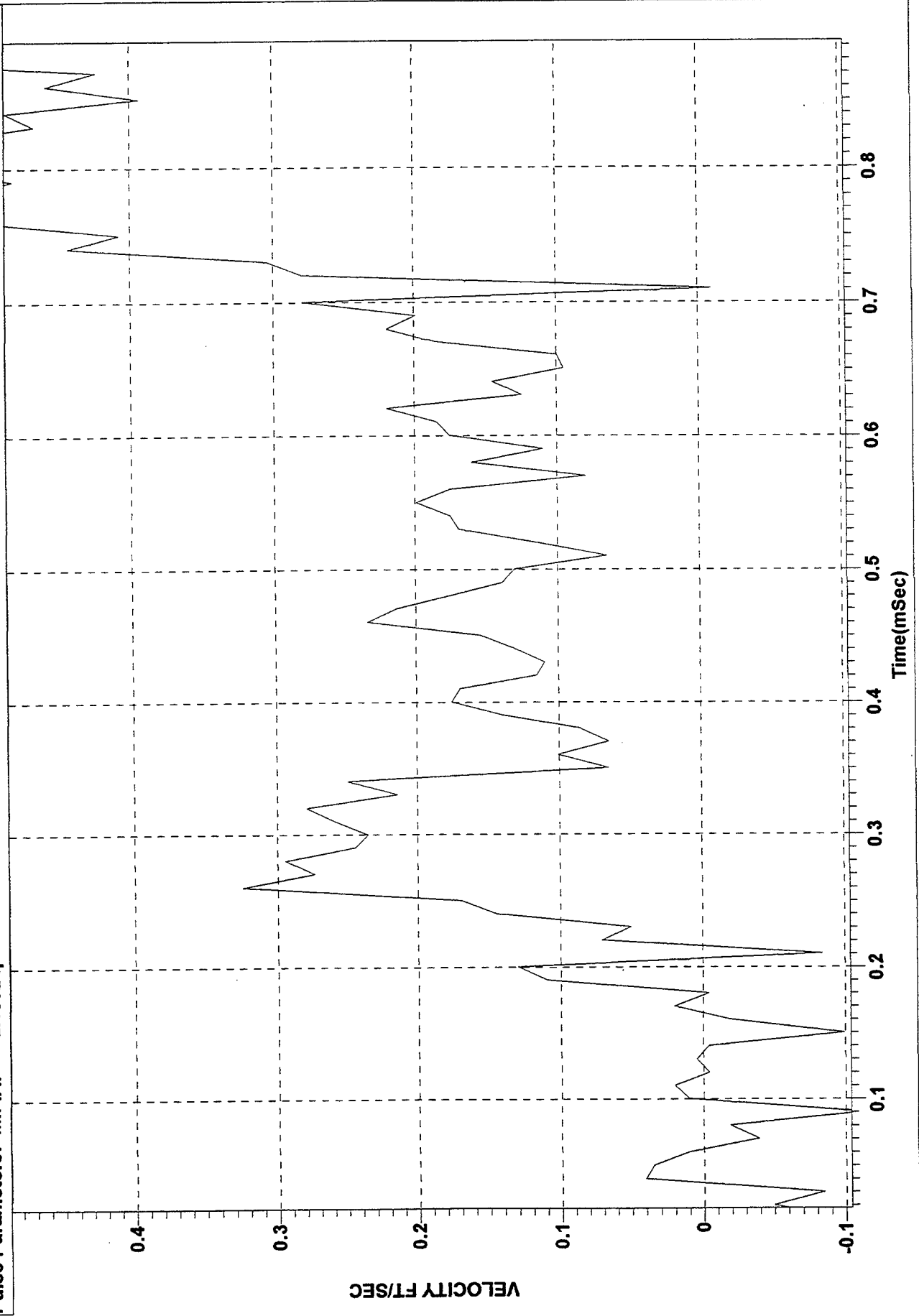
Test Title: EPW FOAM EVALUATION Test No. 050 Service Order No: 6254AK3475 Test Date: 09-28-95 01:56
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR4 SR: 1.000000E+005 Transducer Location: .249"184w/GMB TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 4.2301 fps TT: 0.1600 ms TR: 0.0700 ms TF: 0.0600 ms TP: 0.0700 ms



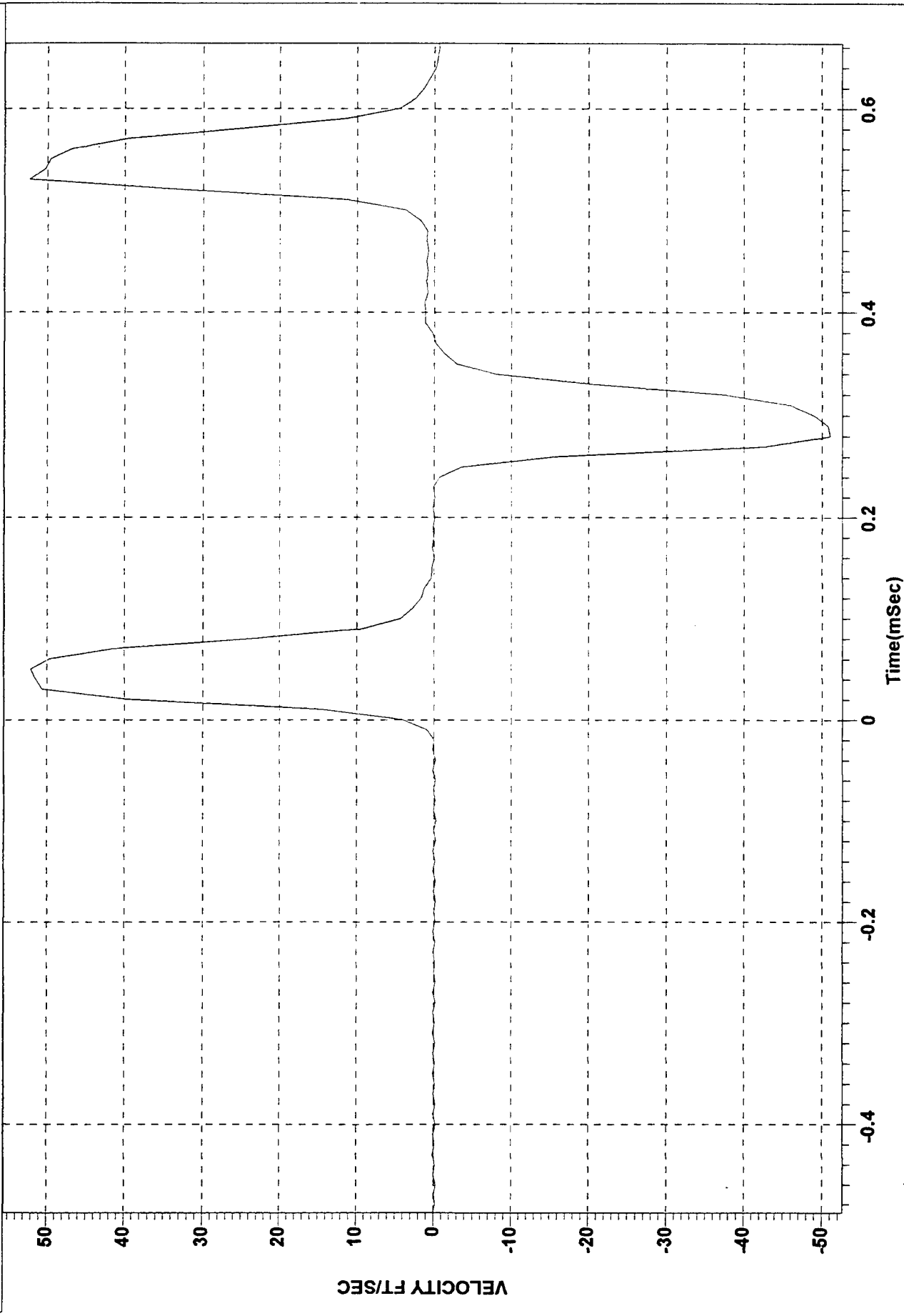
Test Title: EPW FOAM EVALUATION Test No. 051 Service Order No: 6254AK3475 Test Date: 09-28-95 02:00
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR3 SR: 1.000000E+005 Transducer Location: .497"184w/GMB INPUT VELOCITY
Pulse Parameters: M.F.A. -64.8449 fps TT: 0.1000 ms TR: 0.0300 ms TF: 0.0700 ms TP: 0.0300 ms



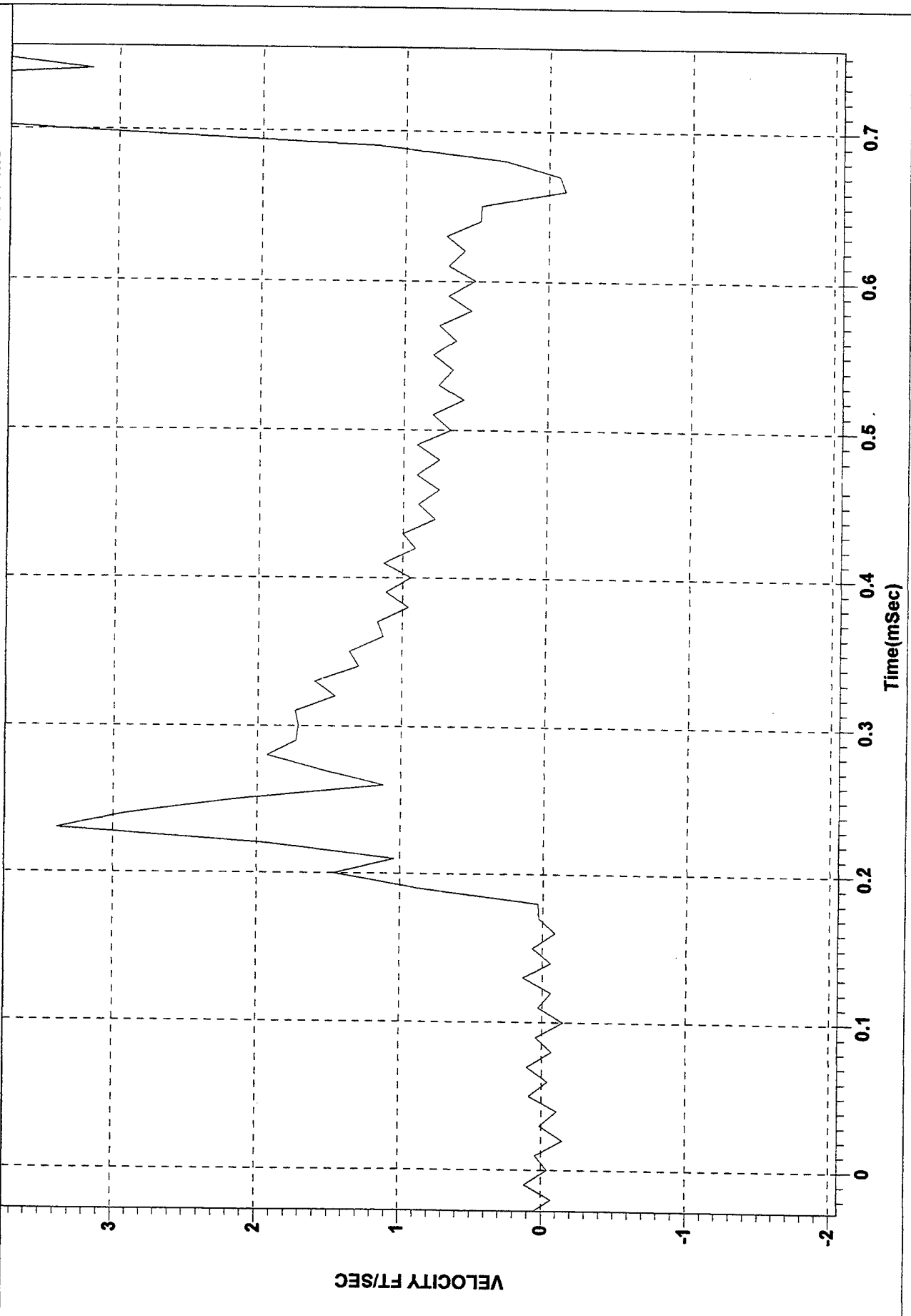
Test Title: EPW FOAM EVALUATION Test No. 051 Service Order No: 6254AK3475 Test Date: 09-28-95 02:00
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR4 SR: 1.000000E+005 Transducer Location: .497"184w/GMB TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 2.1882 fps TT: 0.4500 ms TR: 0.0600 ms TF: 0.3500 ms TP: 0.0600 ms



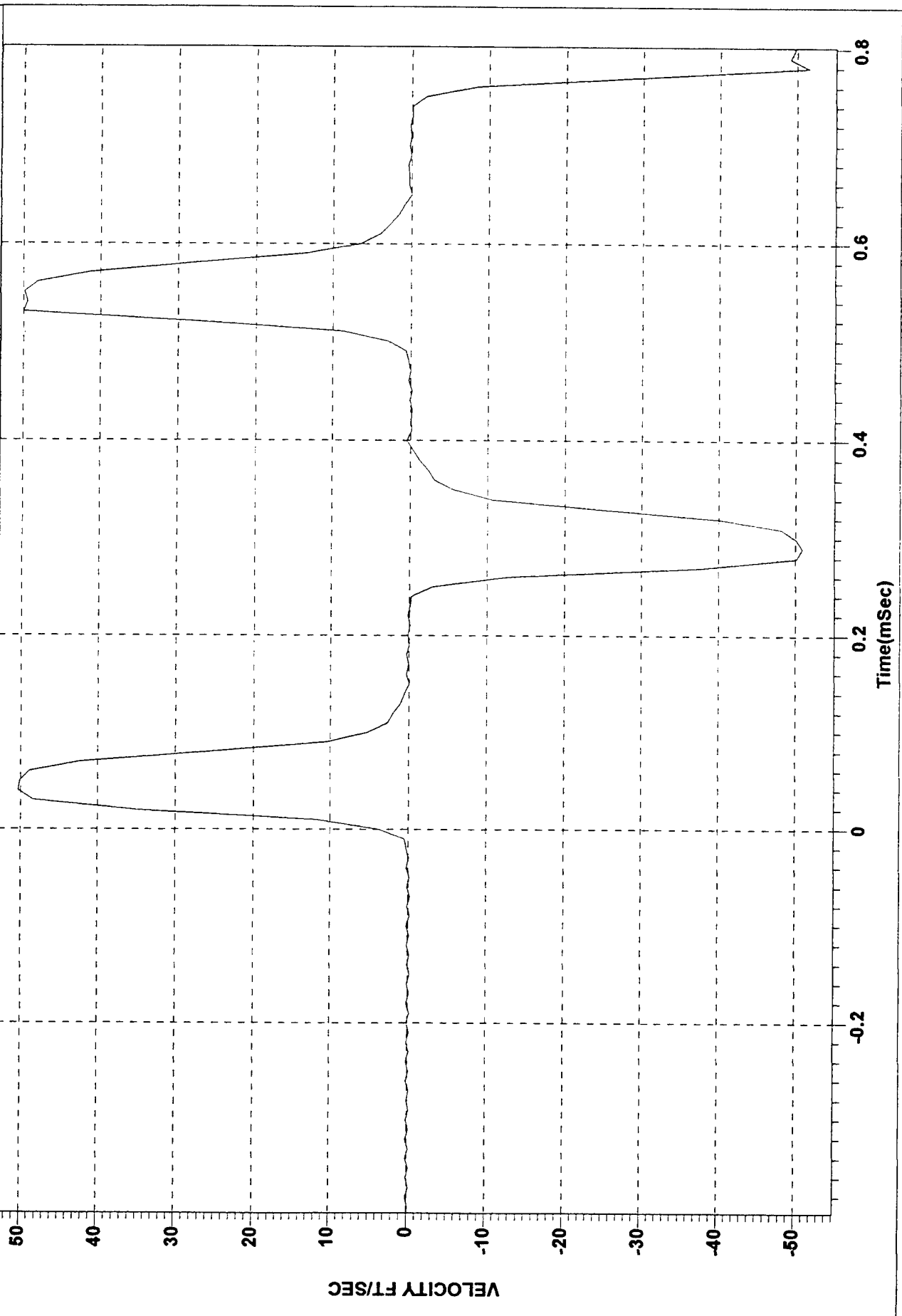
Test Title: EPW FOAM EVALUATION Test No. 054 Service Order No: 6254AK3475 Test Date: 09-28-95 02:14
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR3 SR: 1.000000E+005 Transducer Location: .121" RTV630 INPUT VELOCITY
Pulse Parameters: M.F.A. 52.3605 fps TT: 0.1000 ms TR: 0.0300 ms TF: 0.0500 ms TP: 0.0300 ms



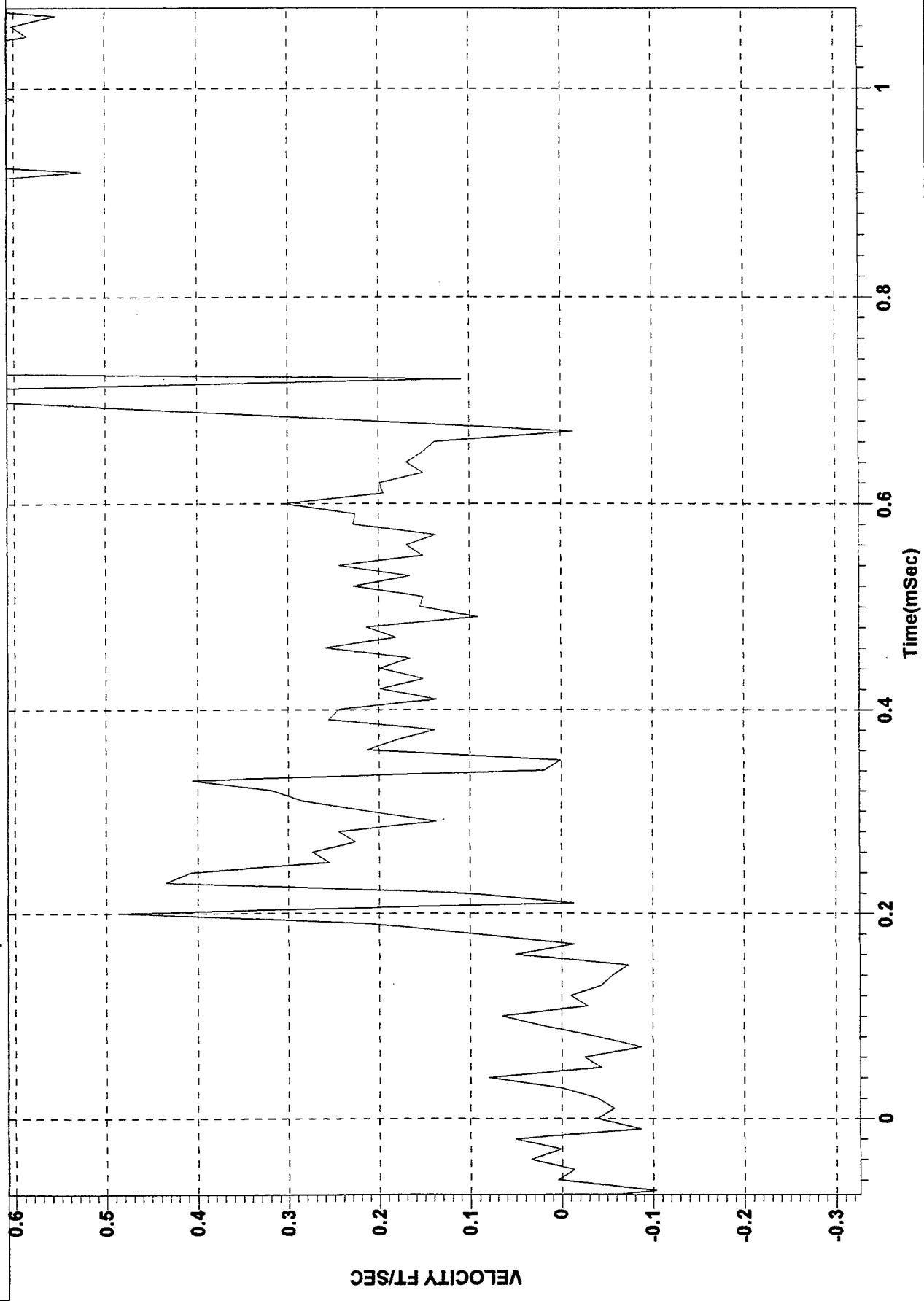
Test Title: EPW FOAM EVALUATION Test No. 054 Service Order No: 6254AK3475 Test Date: 09-28-95 02:14
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR4 SR: 1.000000E+005 Transducer Location: .121" RTV630 TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 13.8861 fps TT: 0.1300 ms TR: 0.0300 ms TF: 0.1000 ms TP: 0.0300 ms



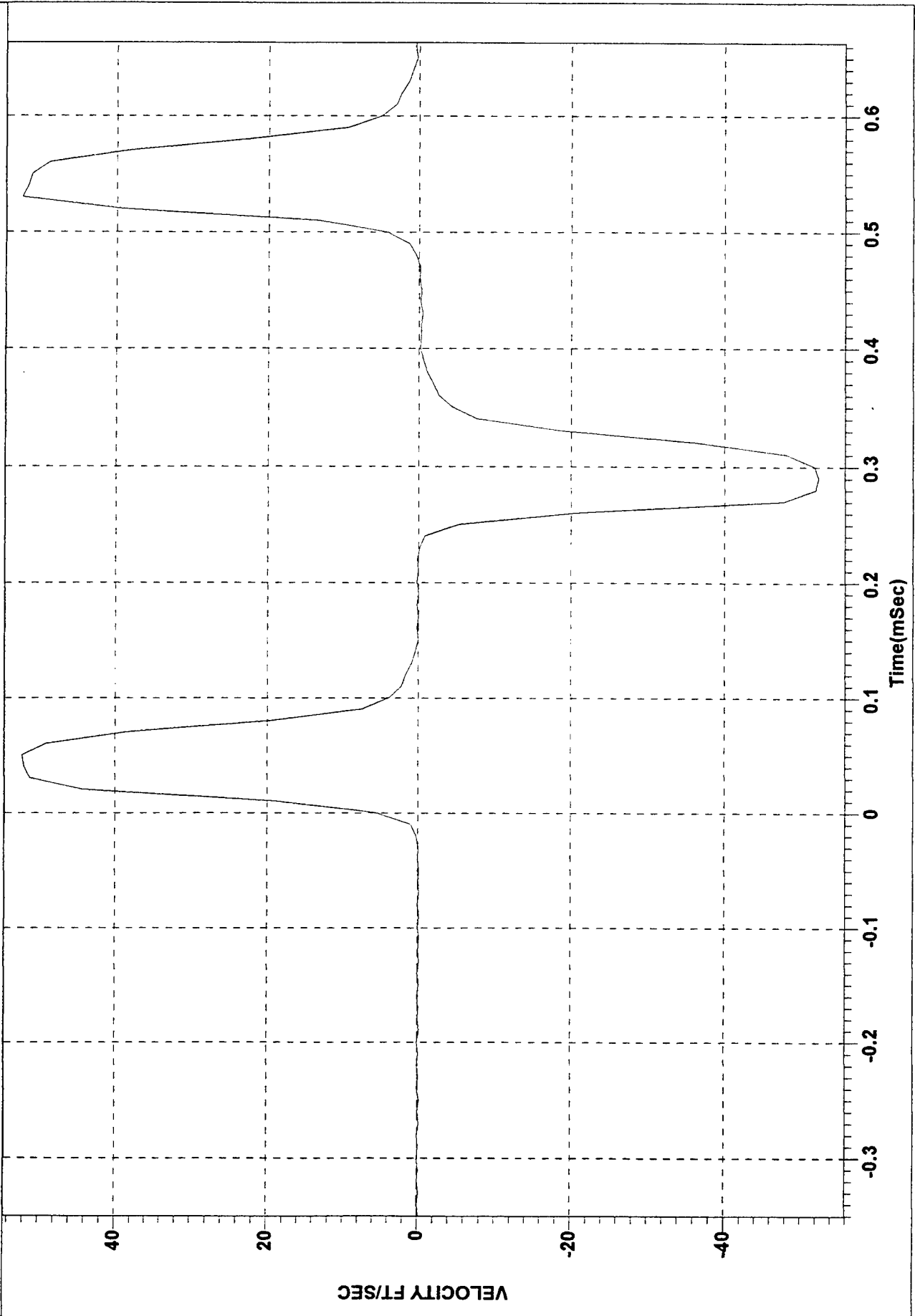
Test Title: EPW FOAM EVALUATION Test No. 055 Service Order No: 6254AK3475 Test Date: 09-28-95 02:18
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBR3 SR: 1.000000E+005 Transducer Location: .250" RTV630 INPUT VELOCITY
Pulse Parameters: M.F.A. 53.6414 fps TT: 0.1000 ms TR: 0.0300 ms TF: 0.0700 ms TP: 0.0300 ms



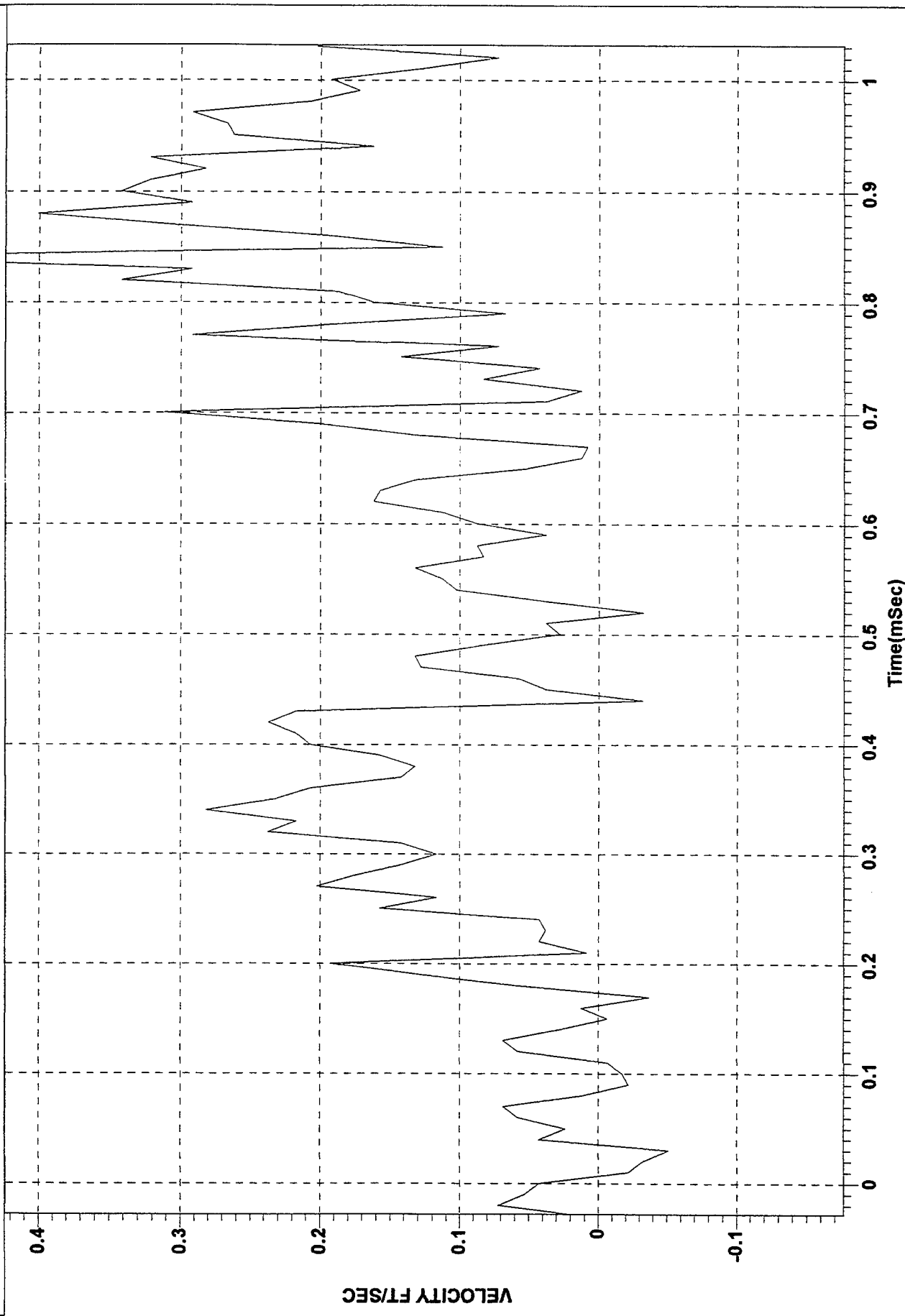
Test Title: EPW FOAM EVALUATION Test No. 055 Service Order No: 6254AK3475 Test Date: 09-28-95 02:18
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR4 SR: 1.000000E+005 Transducer Location: .250" RTV630 TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 4.1885 fps TT: 0.1300 ms TR: 0.0800 ms TF: 0.0400 ms TP: 0.0900 ms



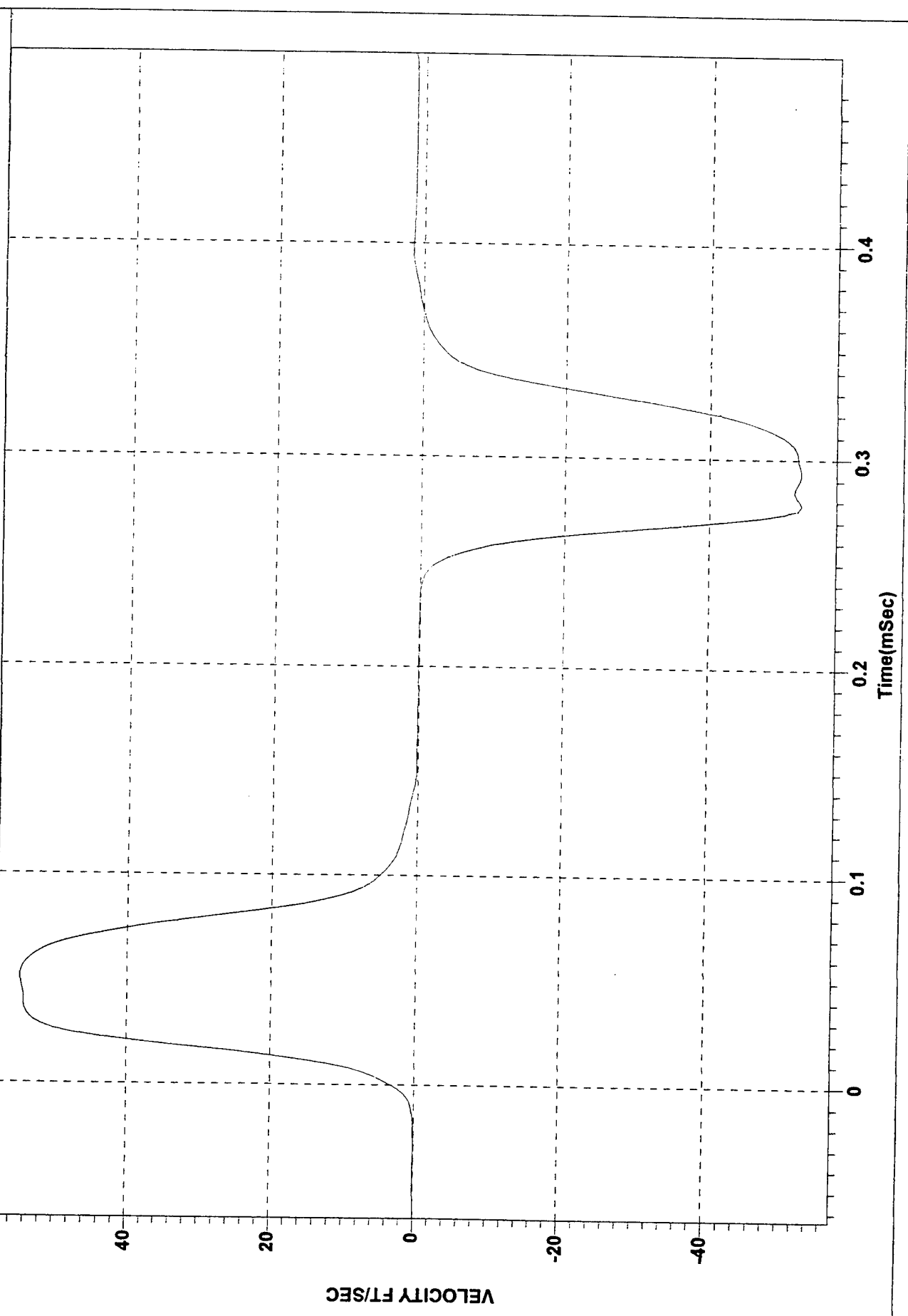
Test Title: EPW FOAM EVALUATION Test No. 057 Service Order No: 6254AK3475 Test Date: 09-28-95 02:30
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBR3 SR: 1.000000E+005 Transducer Location: .497" RTV630 INPUT VELOCITY
Pulse Parameters: M.F.A. 59.8351 fps TT: 0.1100 ms TR: 0.0300 ms TF: 0.0800 ms TP: 0.0300 ms



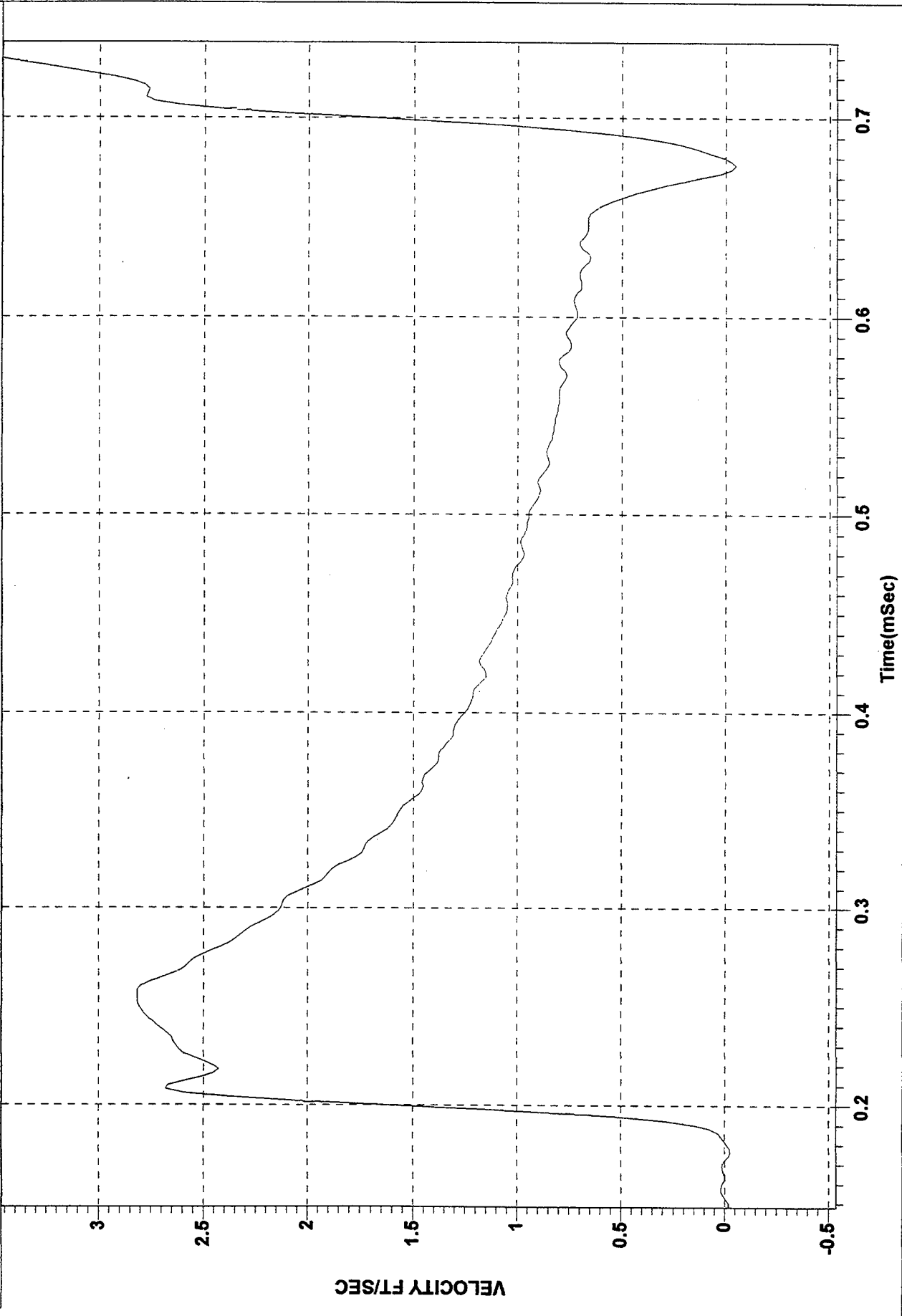
Test Title: EPW FOAM EVALUATION Test No. 057 Service Order No: 6254AK3475 Test Date: 09-28-95 02:30
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR4 SR: 1.000000E+005 Transducer Location: .497" RTV630 TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 2.2560 fps TT: 0.4500 ms TR: 0.0600 ms TF: 0.3600 ms TP: 0.0900 ms



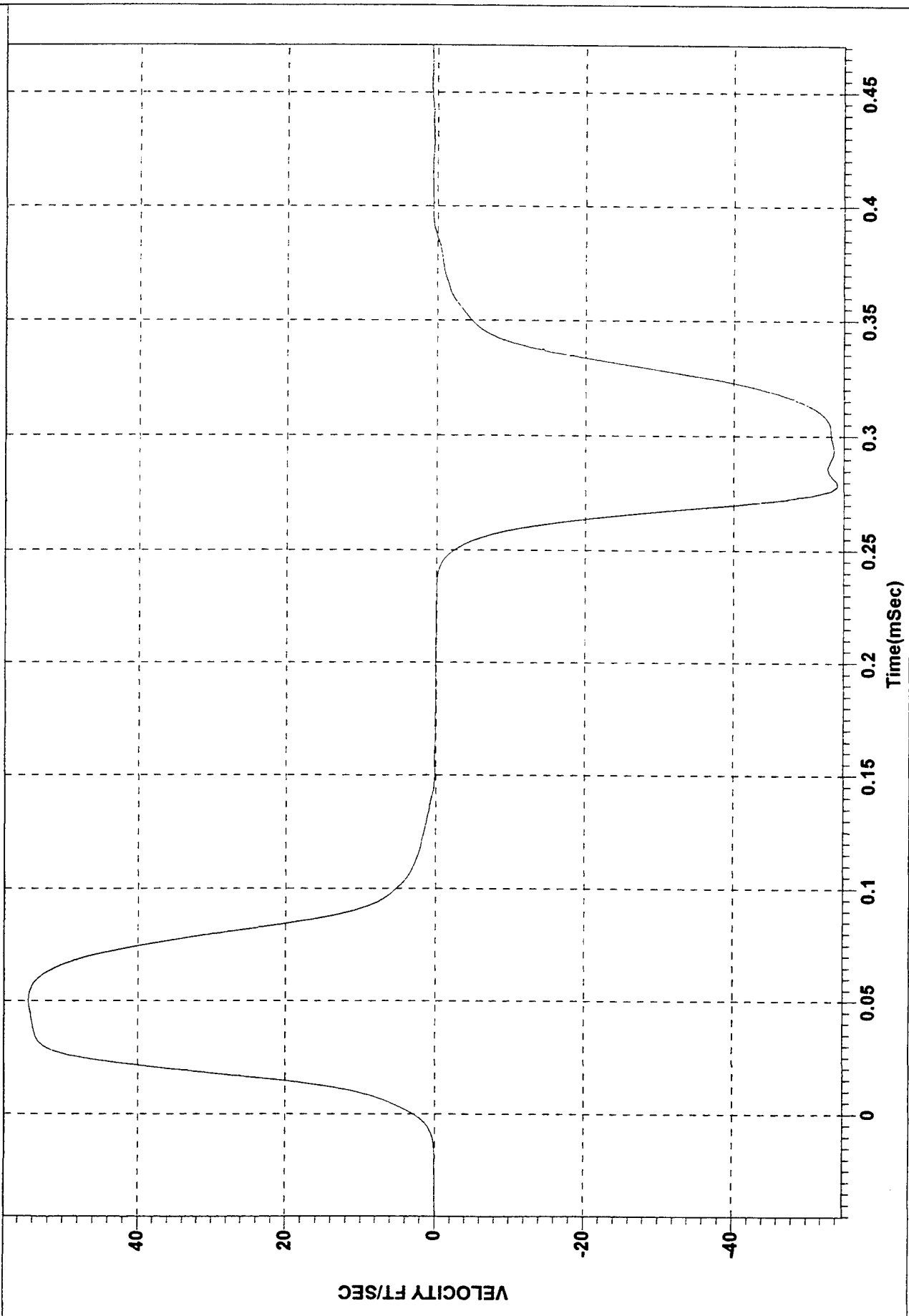
Test Title: EPW FOAM EVALUATION Test No. 061 Service Order No: 6254AK3475 Test Date: 09-28-95 03:20
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .121"20LB FOAM INPUT VELOCITY
Pulse Parameters: M.F.A. 54.7484 fps TT: 0.0980 ms TR: 0.0240 ms TF: 0.0340 ms TP: 0.0480 ms



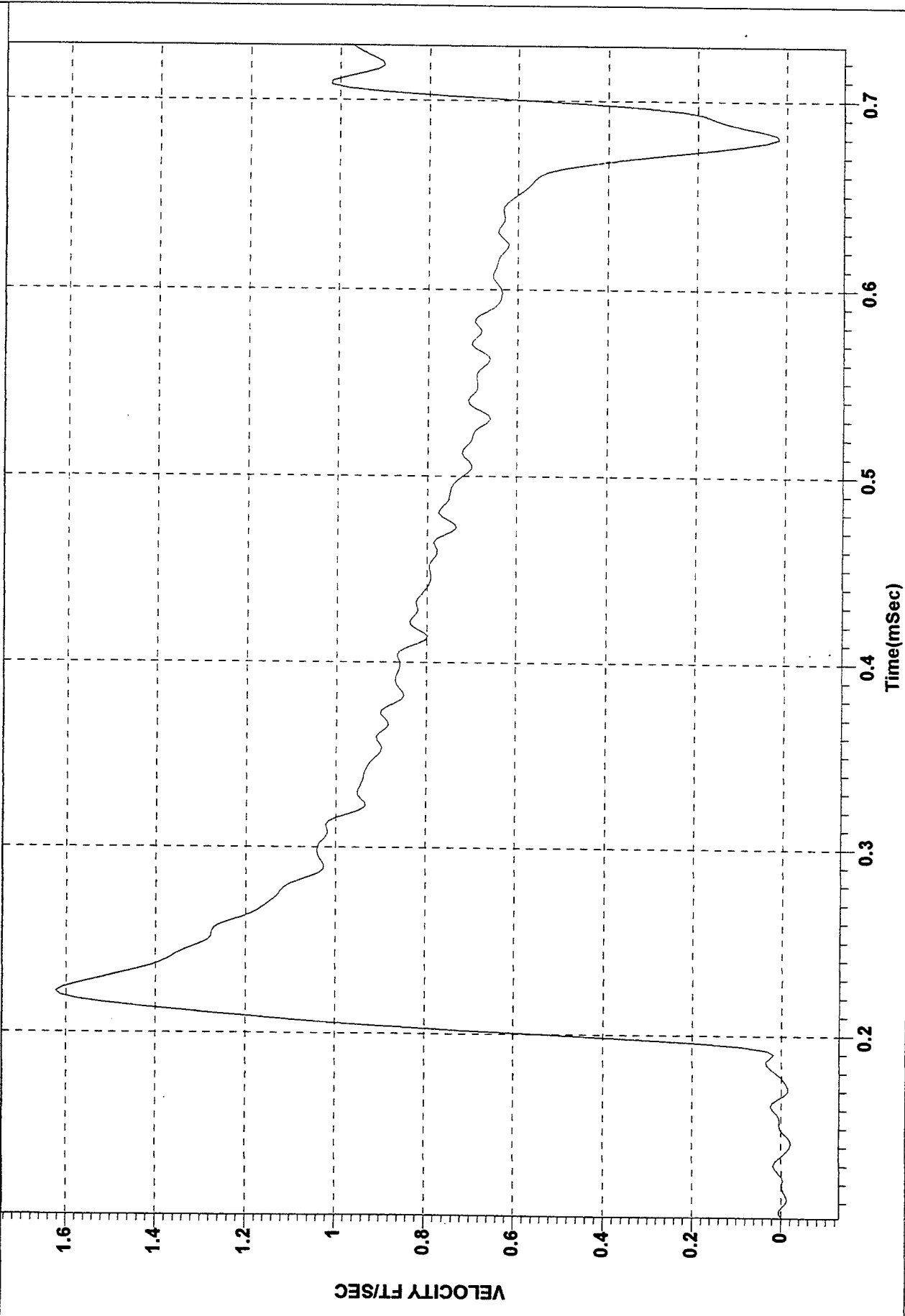
Test Title: EPW FOAM EVALUATION Test No. 061 Service Order No: 6254AK3475 Test Date: 09-28-95 03:20
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .121"20LB FOAM TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 13.6308 fps TT: 0.1060 ms TR: 0.0240 ms TF: 0.0760 ms TP: 0.0260 ms



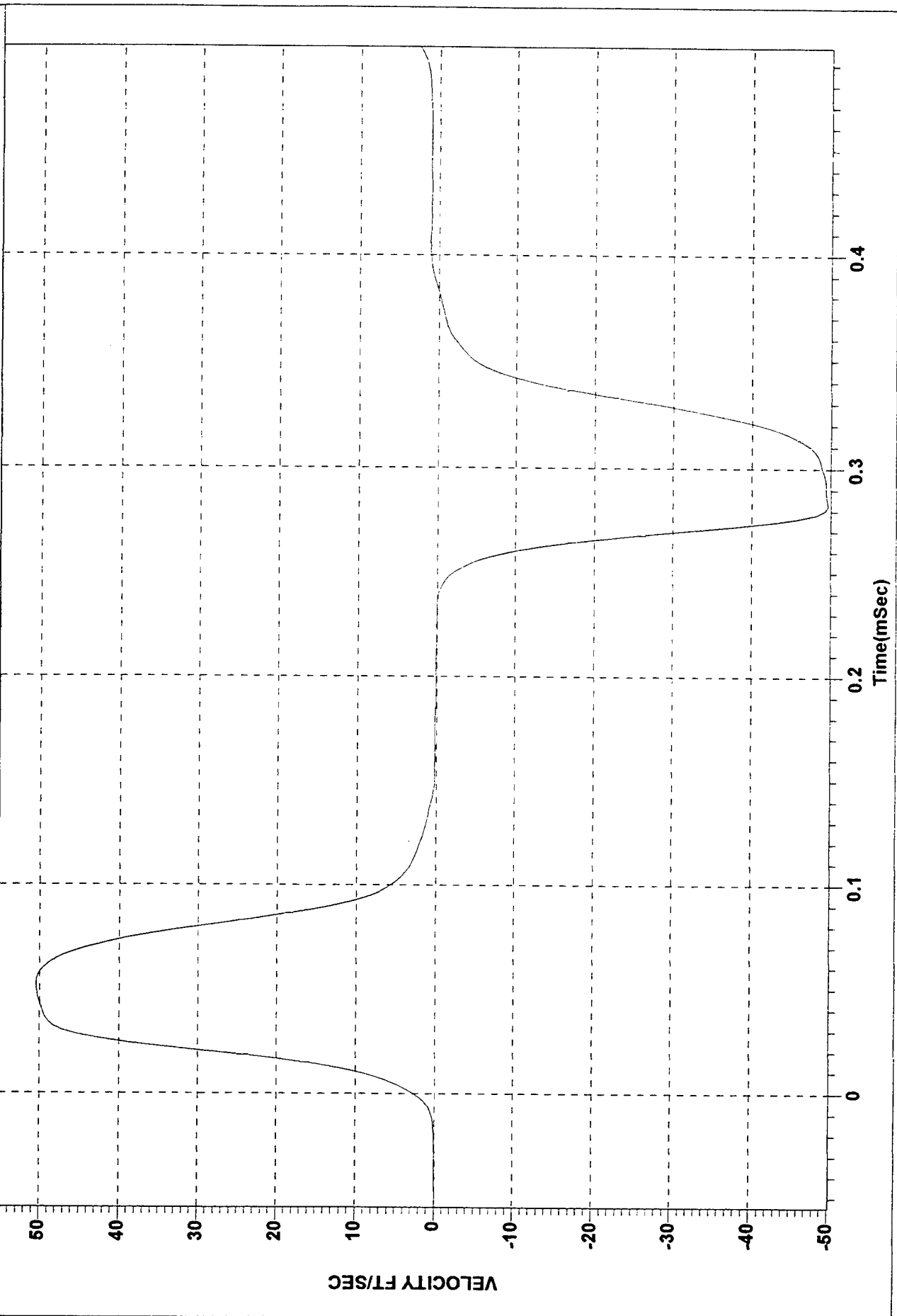
Test Title: EPW FOAM EVALUATION Test No. 062 Service Order No: 6254AK3475 Test Date: 09-28-95 03:24
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .250"20LB FOAM INPUT VELOCITY
Pulse Parameters: M.F.A. -61.1438 fps TT: 0.0840 ms TR: 0.0200 ms TF: 0.0580 ms TP: 0.0220 ms



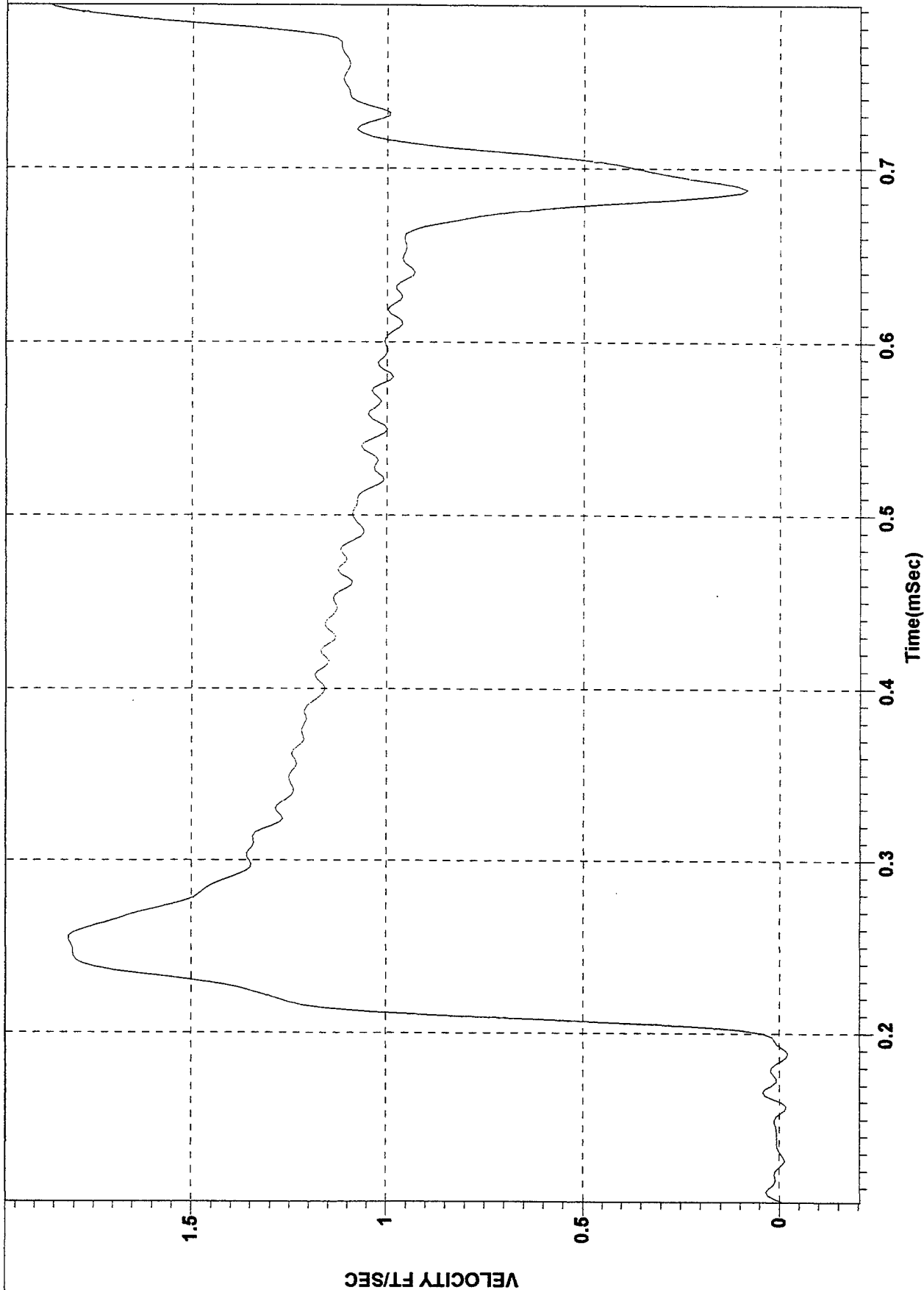
Test Title: EPW FOAM EVALUATION Test No. 062 Service Order No: 6254AK3475 Test Date: 09-28-95 03:24
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .250"20LB FOAM TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 1.9448 fps TT: 0.3000 ms TR: 0.0720 ms TF: 0.2160 ms TP: 0.0800 ms



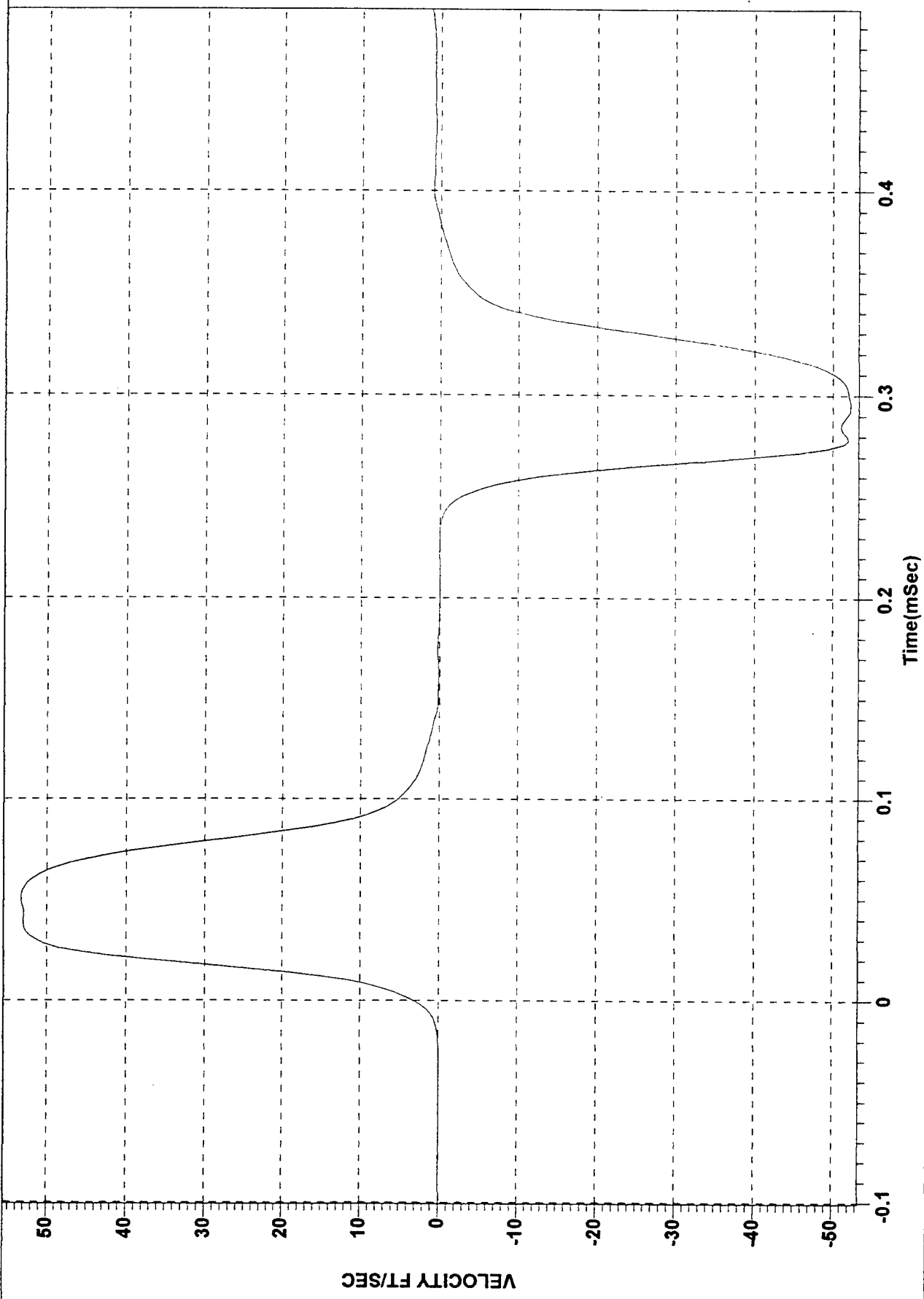
Test Title: EPW FOAM EVALUATION Test No. 067 Service Order No: 6254AK3475 Test Date: 09-28-95 03:42
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .500"20LB FOAM INPUT VELOCITY
Pulse Parameters: M.F.A. -56.5845 fps TT: 0.0920 ms TR: 0.0220 ms TF: 0.0620 ms TP: 0.0260 ms



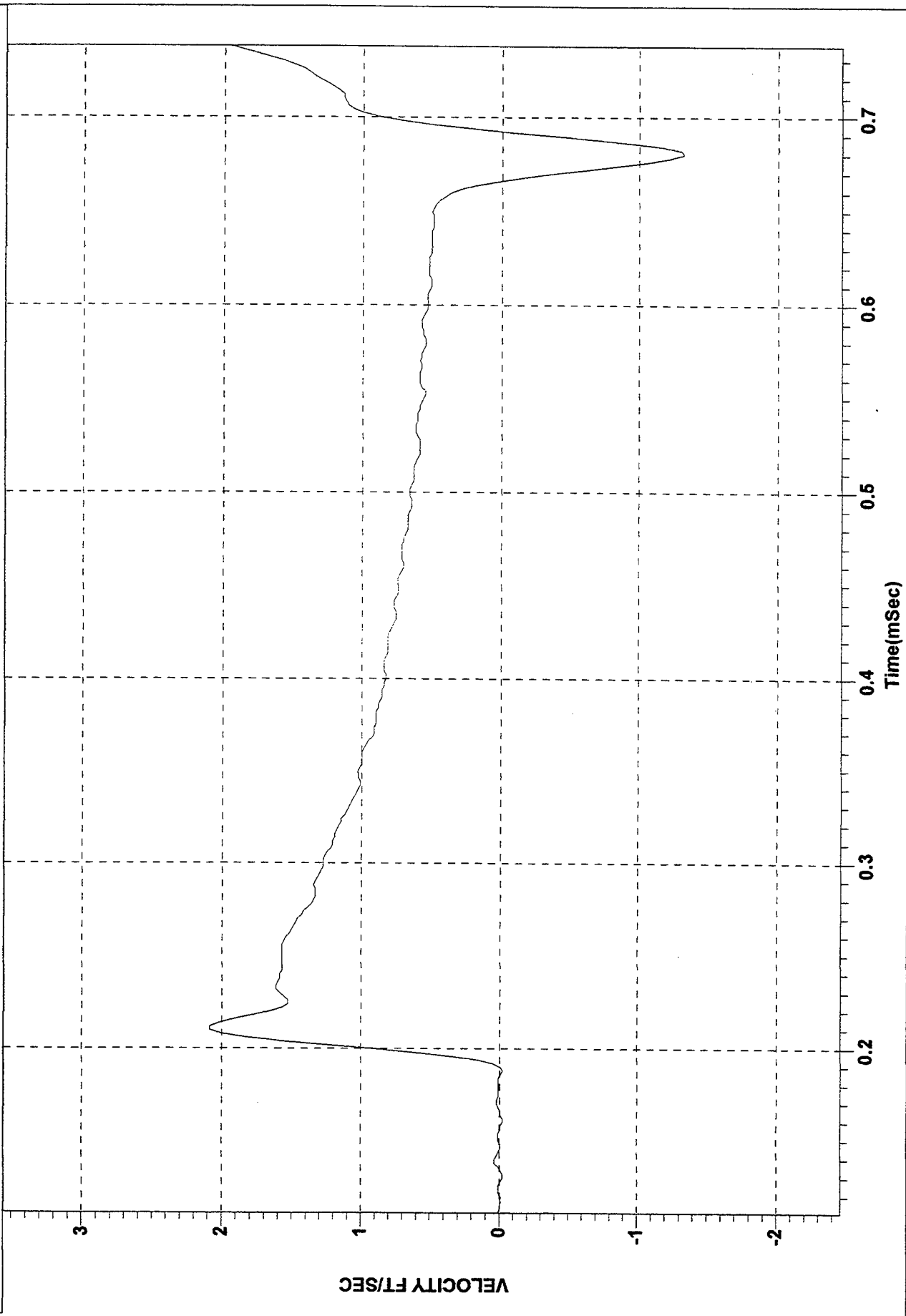
Test Title: EPW FOAM EVALUATION Test No. 067 Service Order No: 6254AK3475 Test Date: 09-28-95 03:42
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .500"20LB FOAM TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 1.8701 fps TT: 0.2060 ms TR: 0.0960 ms TF: 0.0840 ms TP: 0.1020 ms



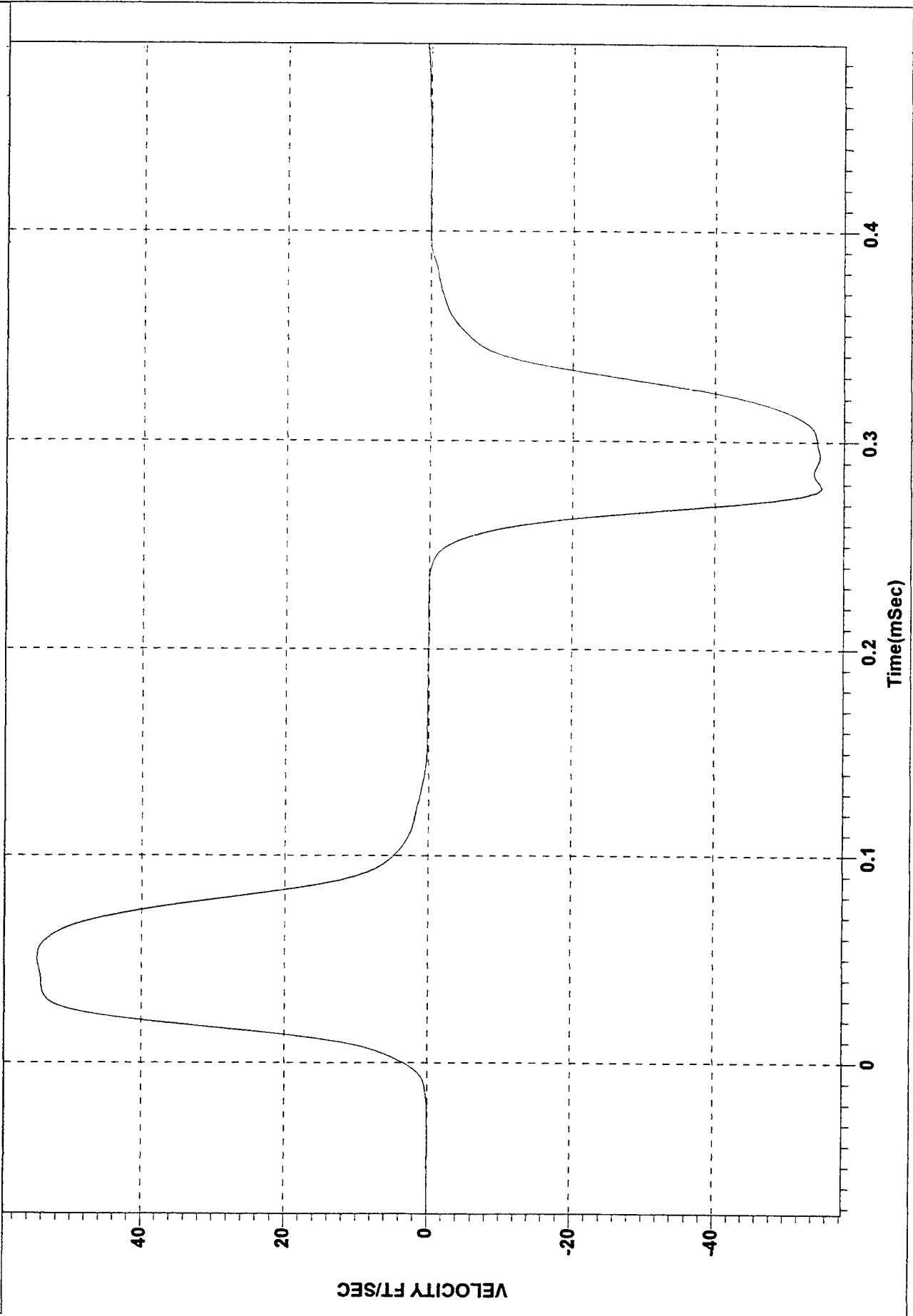
Test Title: EPW FOAM EVALUATION Test No. 070 Service Order No: 6254AK3475 Test Date: 09-28-95 03:57
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .126"10LB FOAM INPUT VELOCITY
Pulse Parameters: M.F.A. 54.4290 fps TT: 0.0900 ms TR: 0.0220 ms TF: 0.0400 ms TP: 0.0260 ms



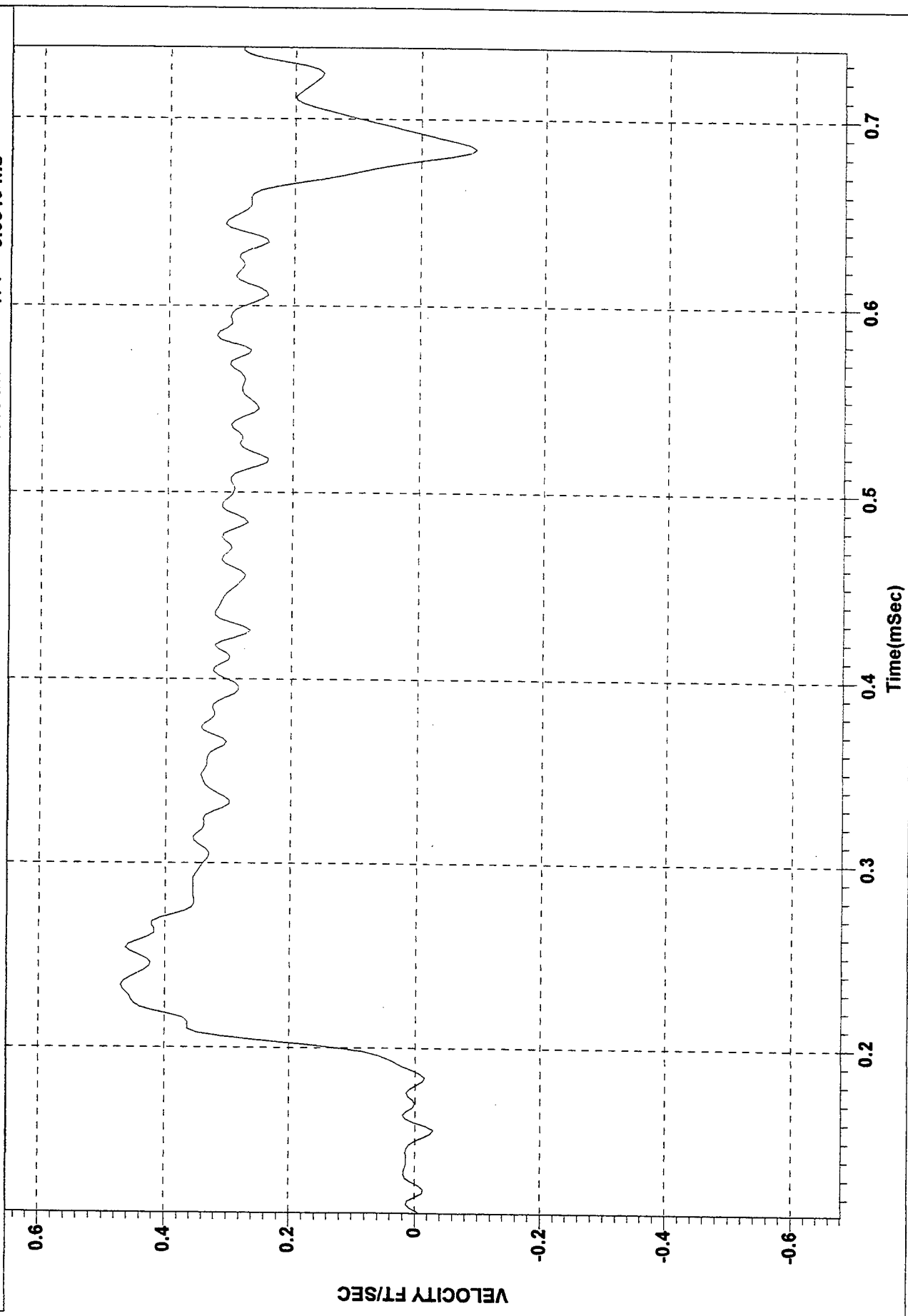
Test Title: EPW FOAM EVALUATION Test No. 070 Service Order No: 6254AK3475 Test Date: 09-28-95 03:57
 DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
 Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .126"10LB FOAM TRANSMITTED VELO. 10"
 Pulse Parameters: M.F.A. 29.6323 fps TT: 0.0640 ms TR: 0.0160 ms TF: 0.0400 ms TP: 0.0200 ms



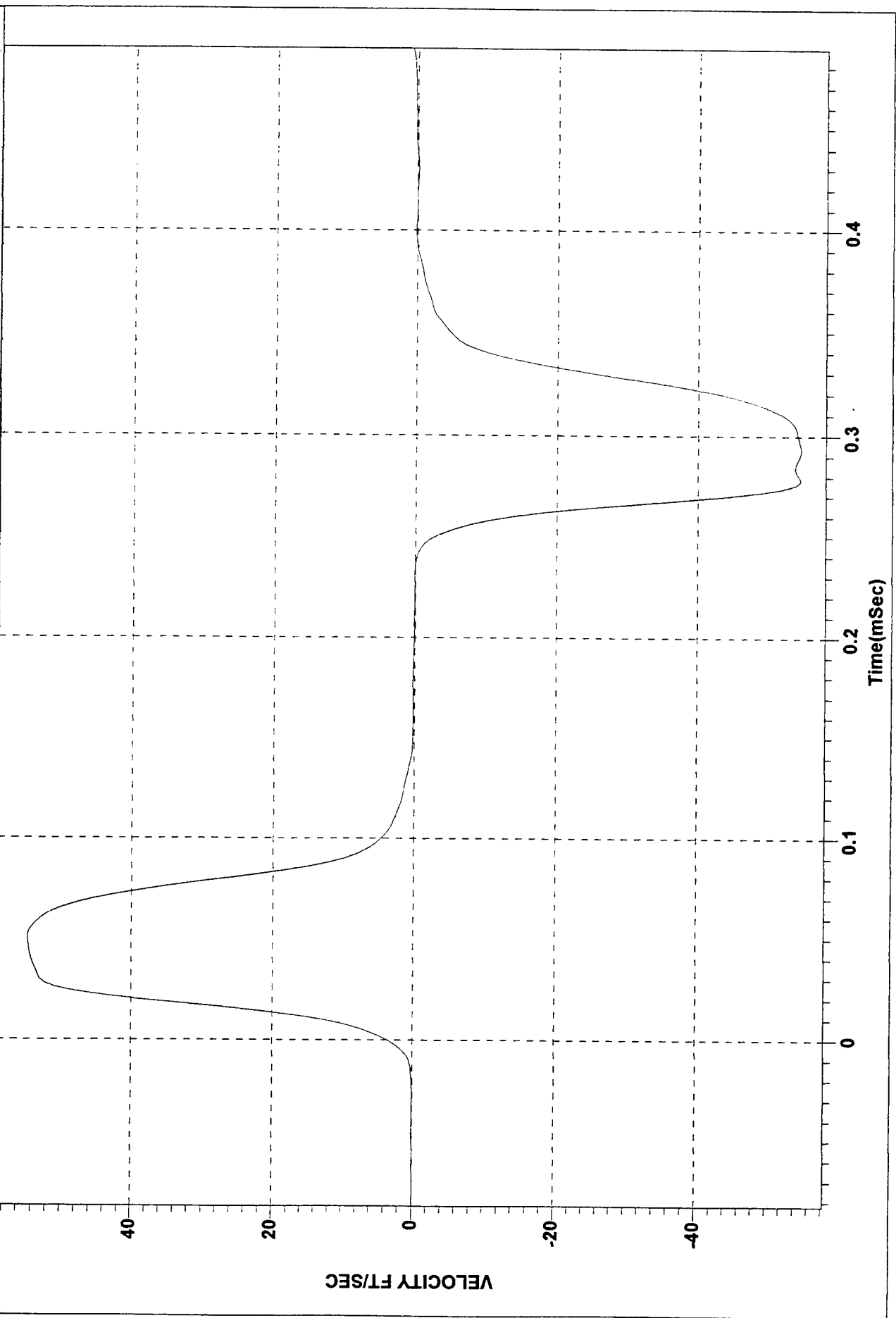
Test Title: EPW FOAM EVALUATION Test No. 071 Service Order No: 6254AK3475 Test Date: 09-28-95 04:01
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR3 SR: 5.000000E+005 Transducer Location: .251"10LB FOAM INPUT VELOCITY
Pulse Parameters: M.F.A. -64.0712 fps TT: 0.0800 ms TR: 0.0200 ms TF: 0.0540 ms TP: 0.0220 ms



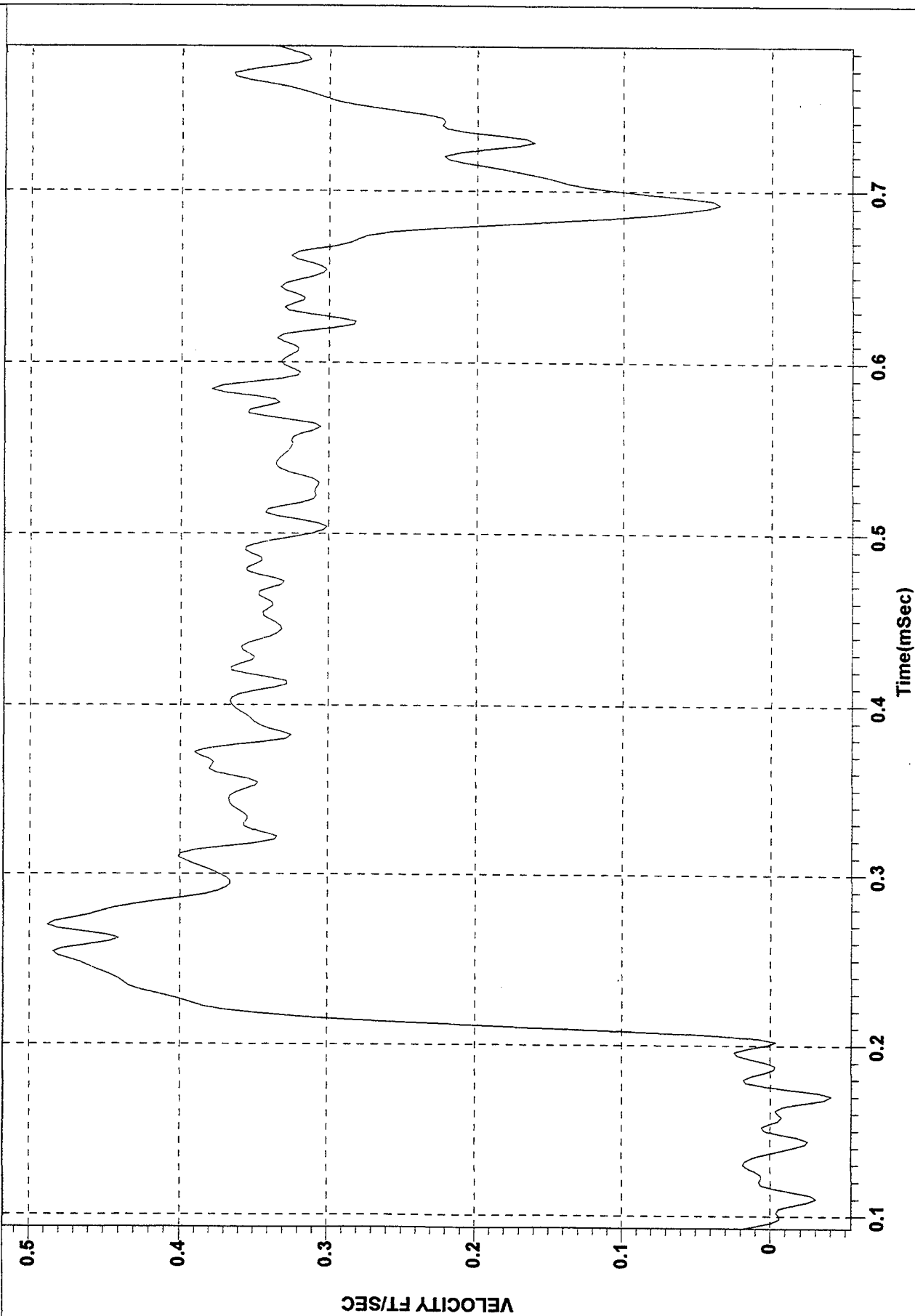
Test Title: EPW FOAM EVALUATION Test No. 071 Service Order No: 6254AK3475 Test Date: 09-28-95 04:01
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .251"10LB FOAM TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 7.5308 fps TT: 0.1780 ms TR: 0.0480 ms TF: 0.1160 ms TP: 0.0540 ms



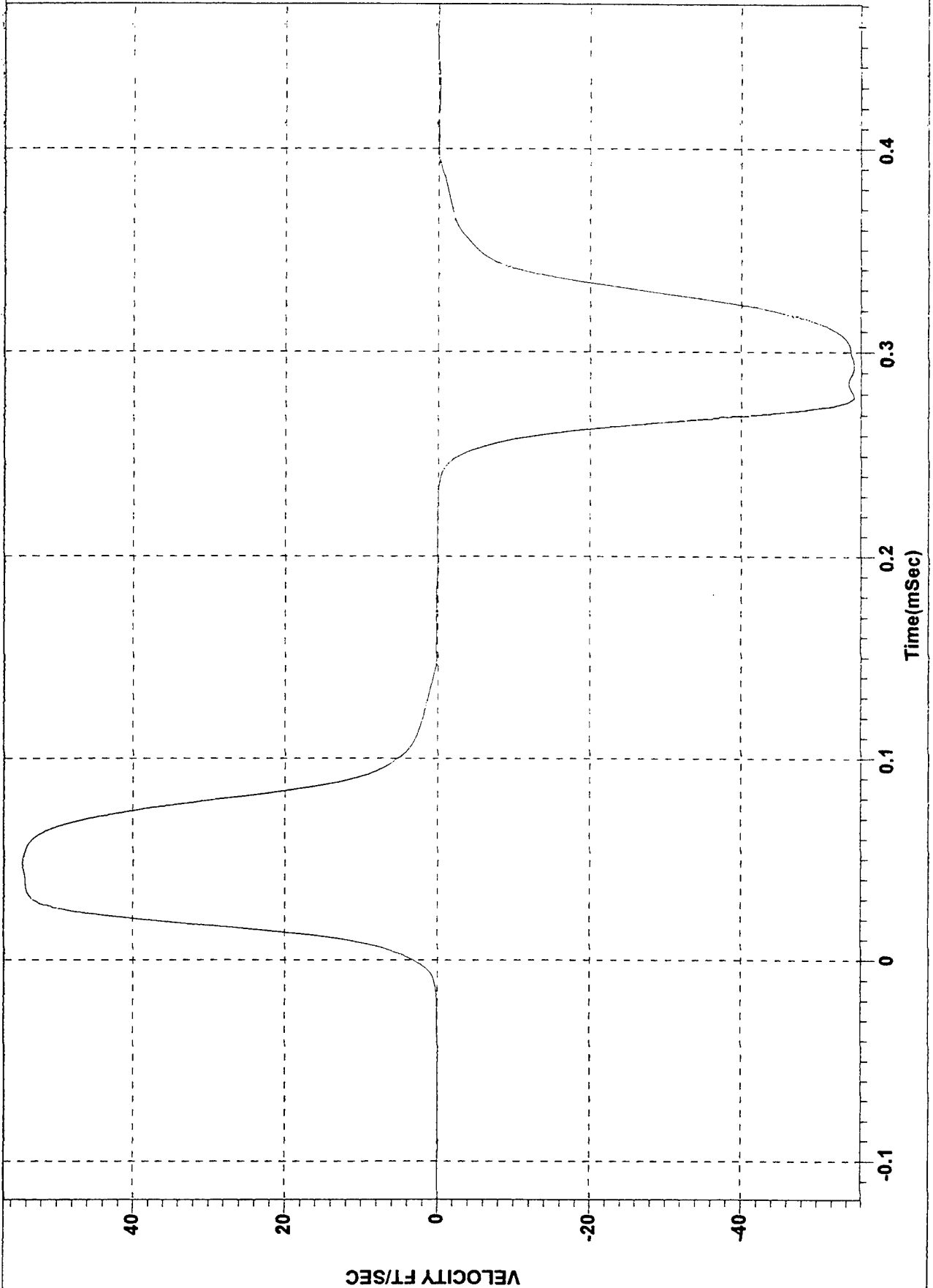
Test Title: EPW FOAM EVALUATION Test No. 075 Service Order No: 6254AK3475 Test Date: 09-28-95 04:14
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBR3 SR: 5.000000E+005 Transducer Location: .500"10LB FOAM INPUT VELOCITY
Pulse Parameters: M.F.A. -65.2081 fps TT: 0.0940 ms TR: 0.0200 ms TF: 0.0680 ms TP: 0.0220 ms



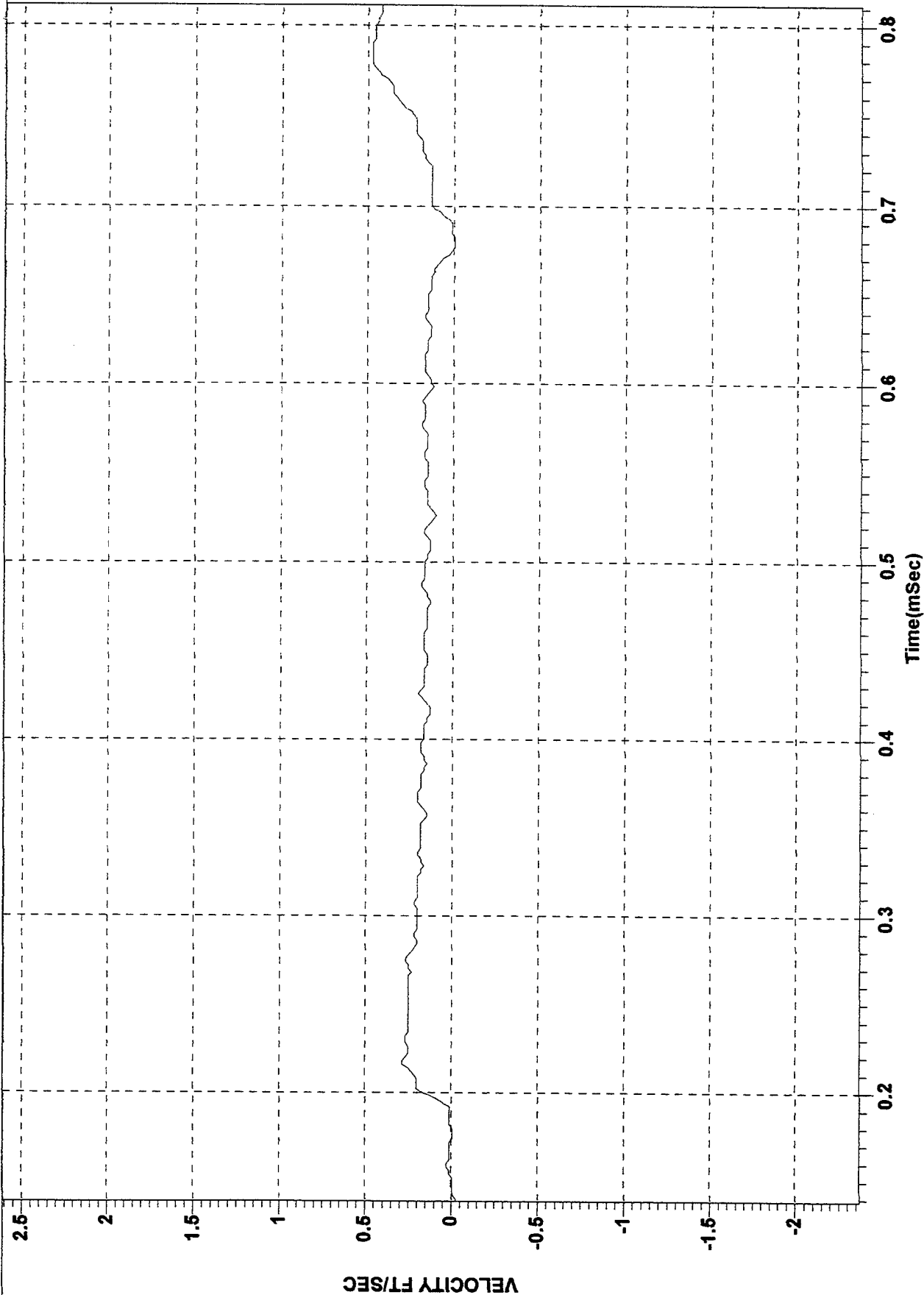
Test Title: EPW FOAM EVALUATION Test No. 075 Service Order No: 6254AK3475 Test Date: 09-28-95 04:14
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .500"10LB FOAM TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 0.5664 fps TT: 0.9880 ms TR: 0.1020 ms TF: 0.3040 ms TP: 0.1180 ms



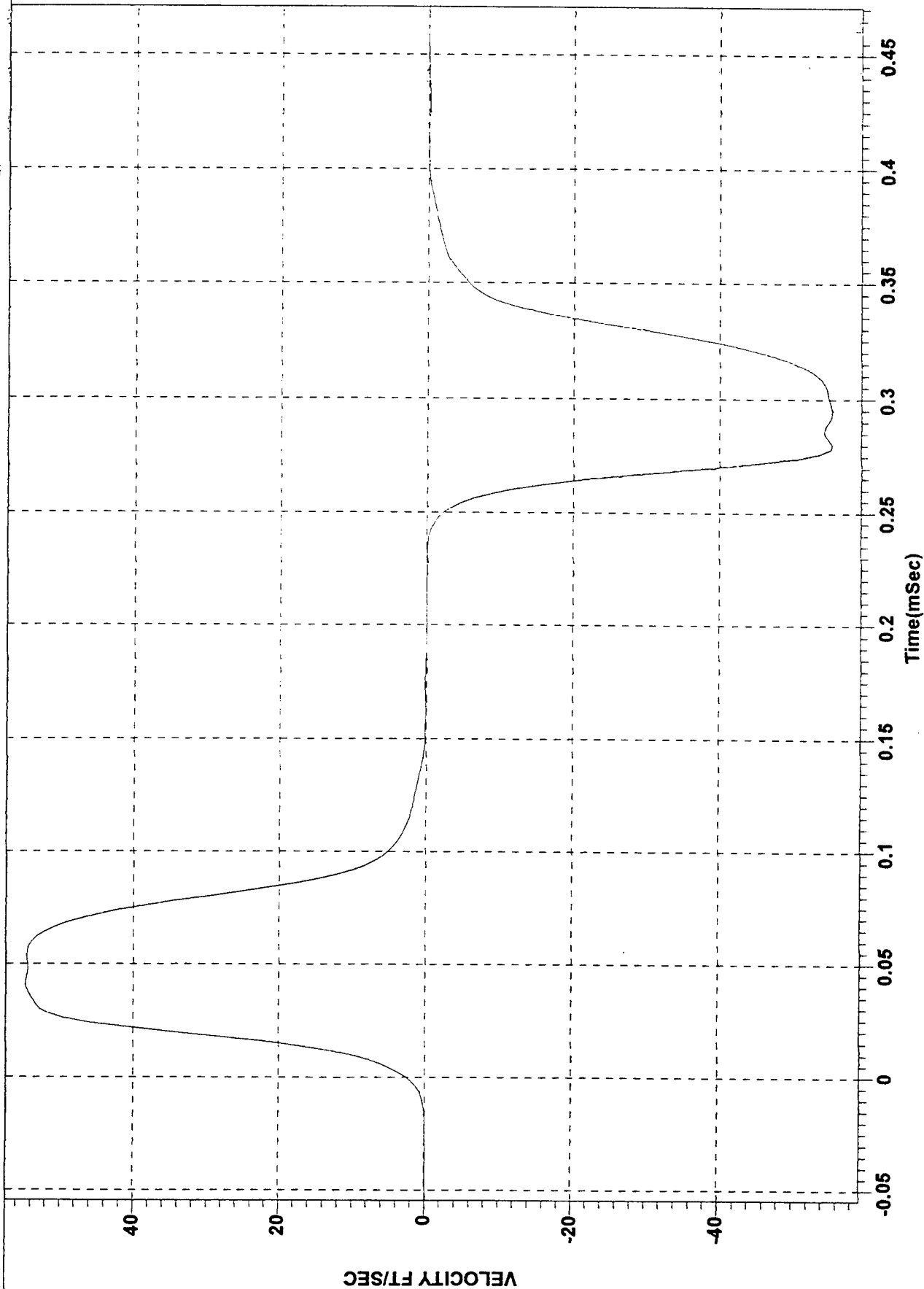
Test Title: EPW FOAM EVALUATION Test No. 079 Service Order No: 6254AK3475 Test Date: 09-28-95 04:32
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR3 SR: 5.000000E+005 Transducer Location: .127" 6LB FOAM INPUT VELOCITY
Pulse Parameters: M.F.A. 60.2332 fps TT: 0.0720 ms TR: 0.0220 ms TF: 0.0420 ms TP: 0.0260 ms



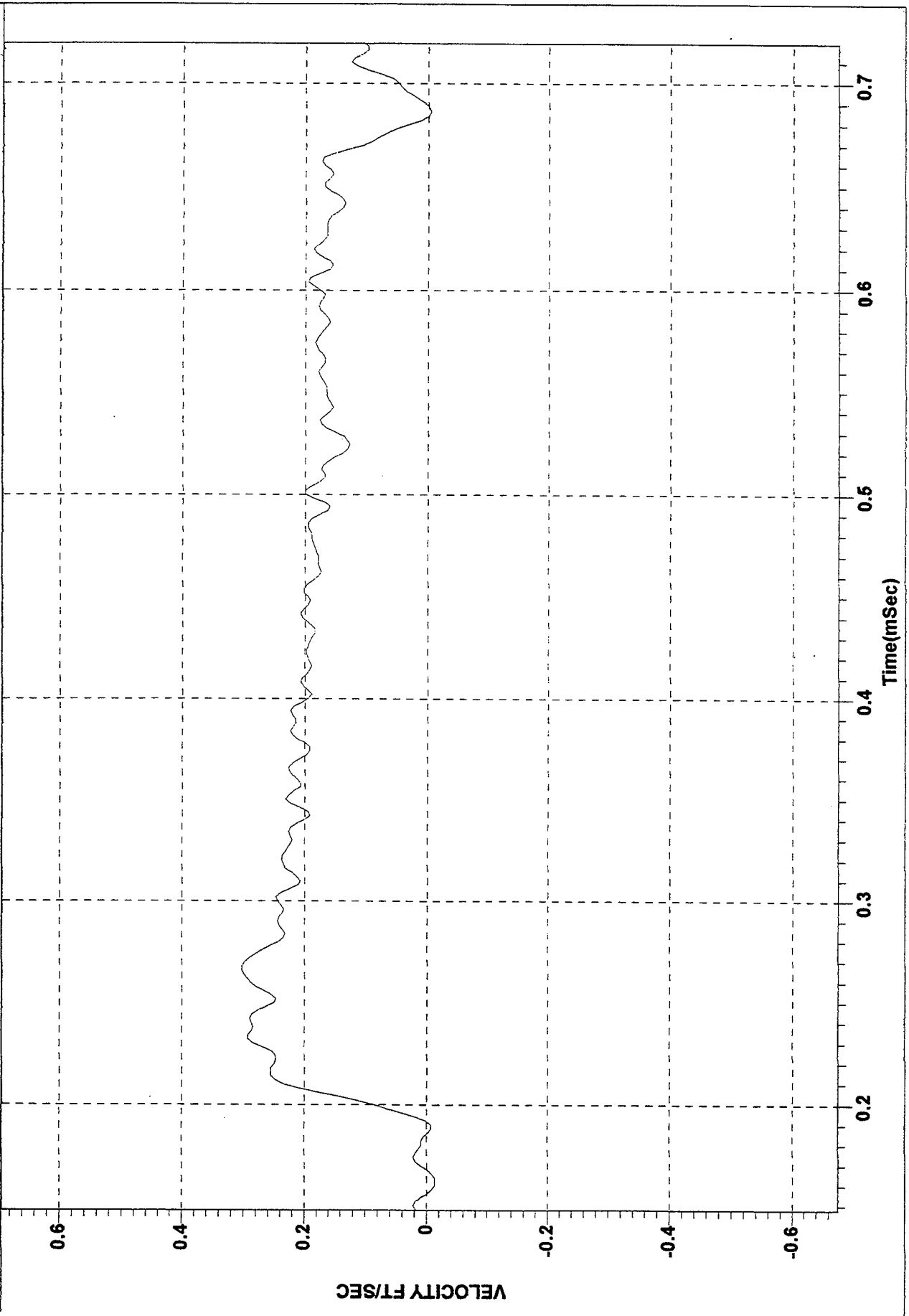
Test Title: EPW FOAM EVALUATION Test No. 079 Service Order No: 6254AK3476 Test Date: 09-28-95 04:32
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+005 Transducer Location: .127" 6LB FOAM TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. -37.1674 fps TT: 0.0520 ms TR: 0.0160 ms TF: 0.0140 ms TP: 0.0180 ms



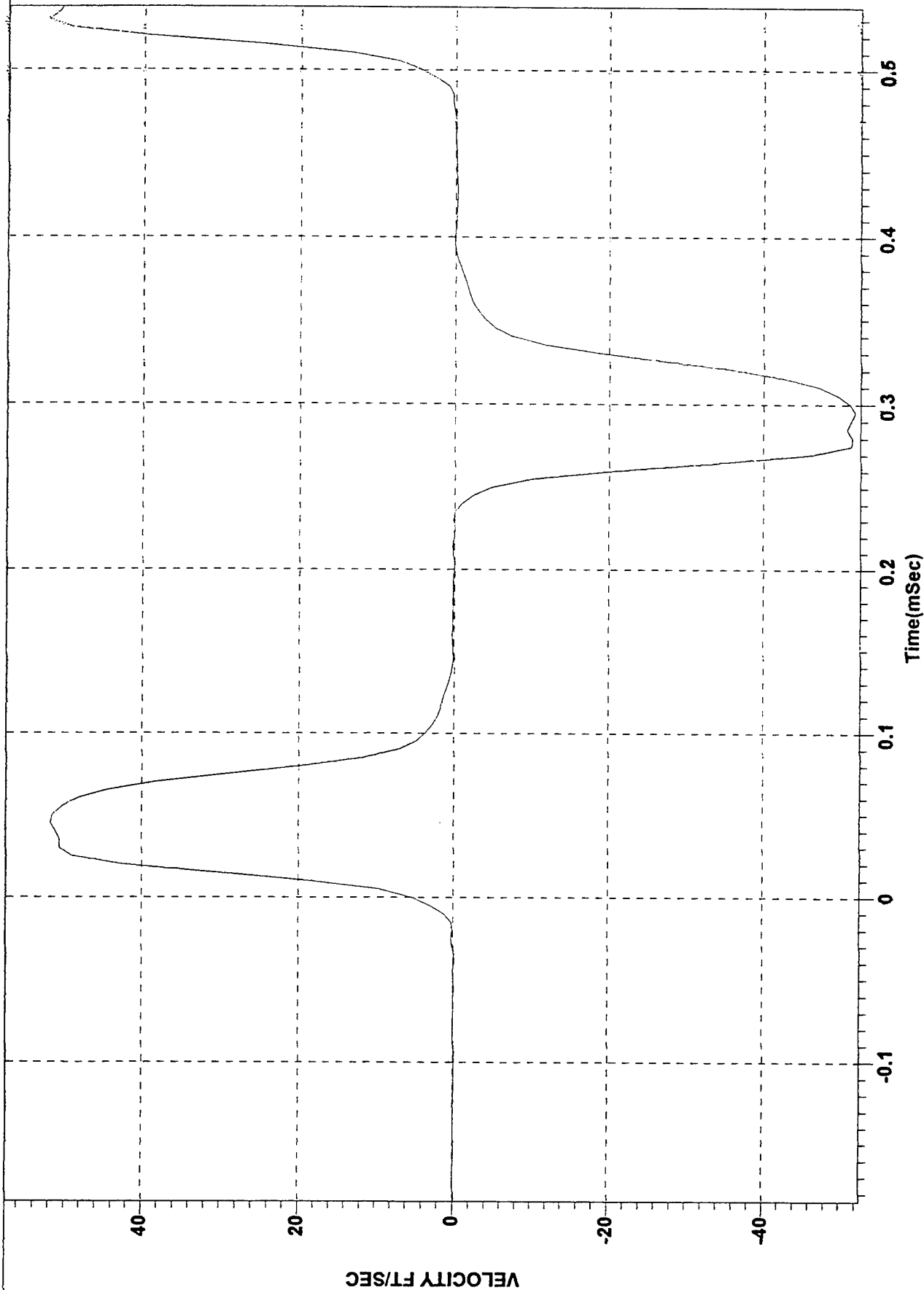
Test Title: EPW FOAM EVALUATION Test No. 081 Service Order No: 6254AK3475 Test Date: 09-28-95 04:41
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR3 SR: 5.000000E+005 Transducer Location: .253" 6LB FOAM INPUT VELOCITY
Pulse Parameters: M.F.A. -65.0067 fps TT: 0.0760 ms TR: 0.0180 ms TF: 0.0520 ms TP: 0.0220 ms



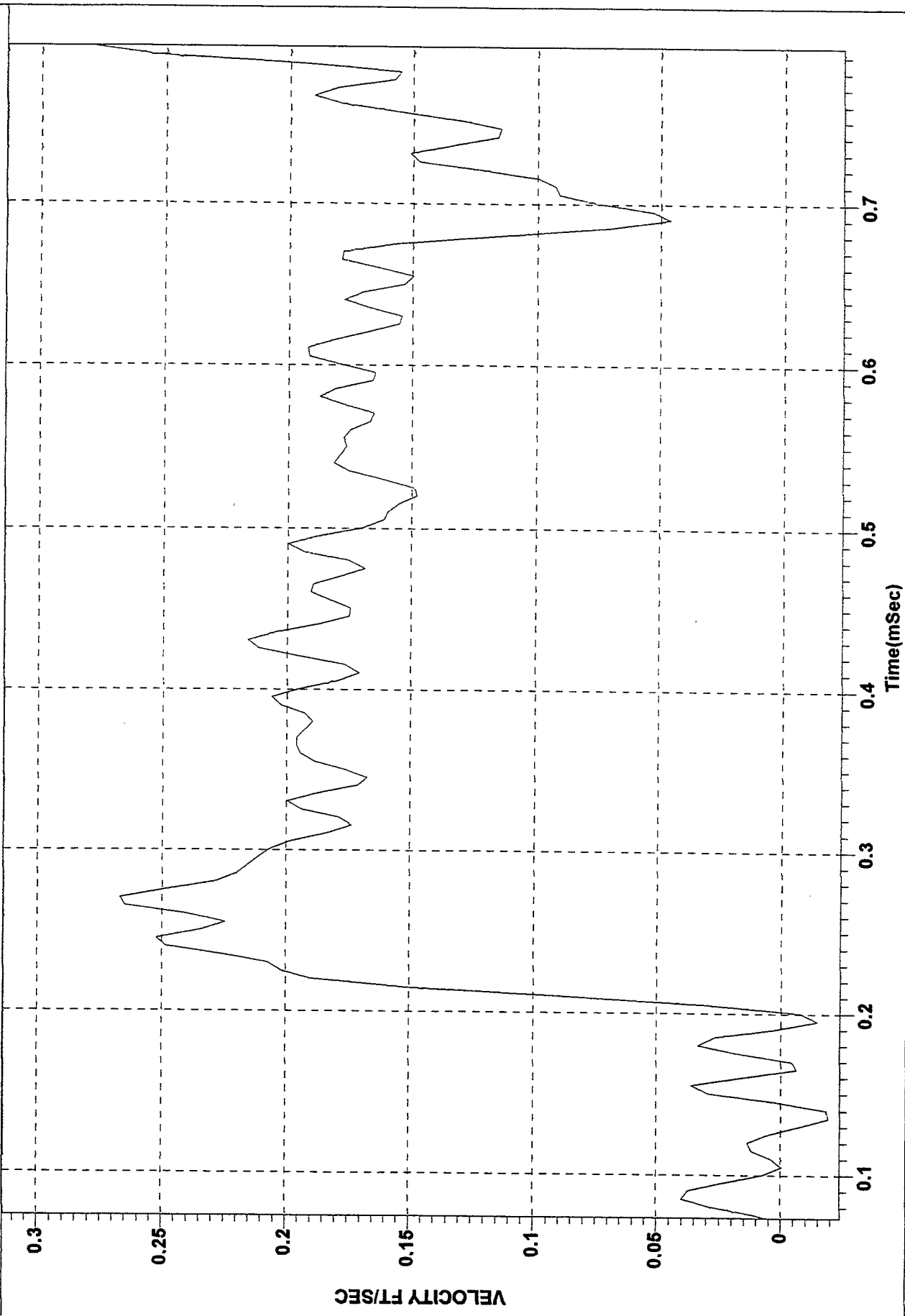
Test Title: EPW FOAM EVALUATION Test No. 081 Service Order No: 6254AK3475 Test Date: 09-28-95 04:41
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 75000.000
Transducer Serial No: STEELHBAR4 SR: 5.000000E+006 Transducer Location: .253" 6LB FOAM TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 10.6792 fps TT: 0.1440 ms TR: 0.0480 ms TF: 0.0840 ms TP: 0.0540 ms



Test Title: EPW FOAM EVALUATION Test No. 085 Service Order No: 6254AK3475 Test Date: 09-28-95 04:56
DAS Channel: CH01 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR3 SR: 2.000000E+005 Transducer Location: .503" 6LB FOAM INPUT VELOCITY
Pulse Parameters: M.F.A. -63.3238 fps TT: 0.0950 ms TR: 0.0250 ms TF: 0.0700 ms TP: 0.0250 ms

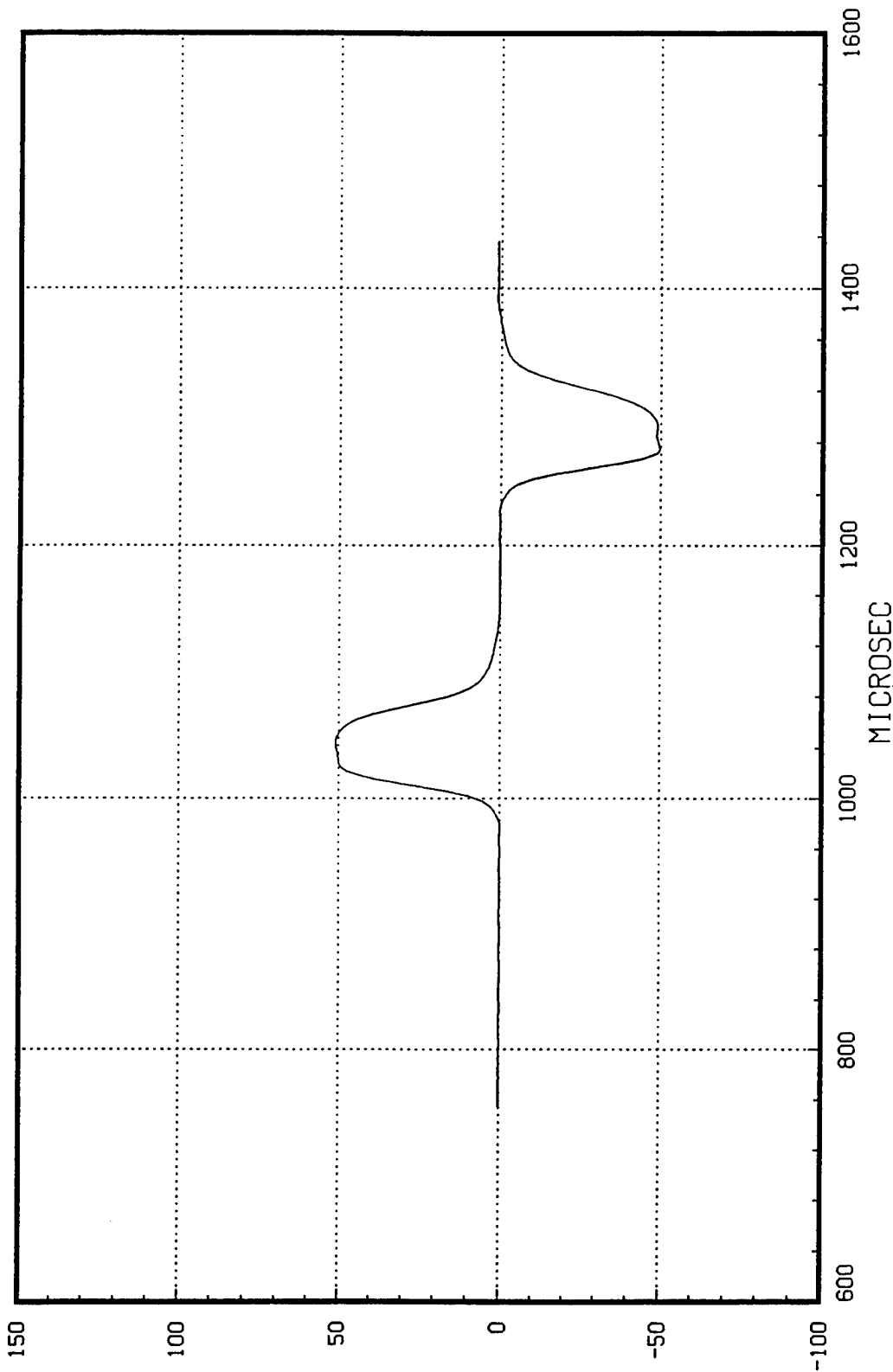


Test Title: EPW FOAM EVALUATION Test No. 085 Service Order No: 6254AK3475 Test Date: 09-28-95 04:56
DAS Channel: CH02 LP FILTERS: Analog (Hz) = 100KHZ Digital (Hz) = 50000.000
Transducer Serial No: STEELHBAR4 SR: 2.000000E+006 Transducer Location: .503" 6LB FOAM TRANSMITTED VELO. 10"
Pulse Parameters: M.F.A. 1.5689 fps TT: 0.3450 ms TR: 0.0300 ms TF: 0.2450 ms TP: 0.0500 ms



A-98

VEL FT/SEC



EPW PSR SAMPLES

05/01/96
.125 PSR

AK4275
FILTER 50000.00HZ

data verified by
date

TEST 01-03

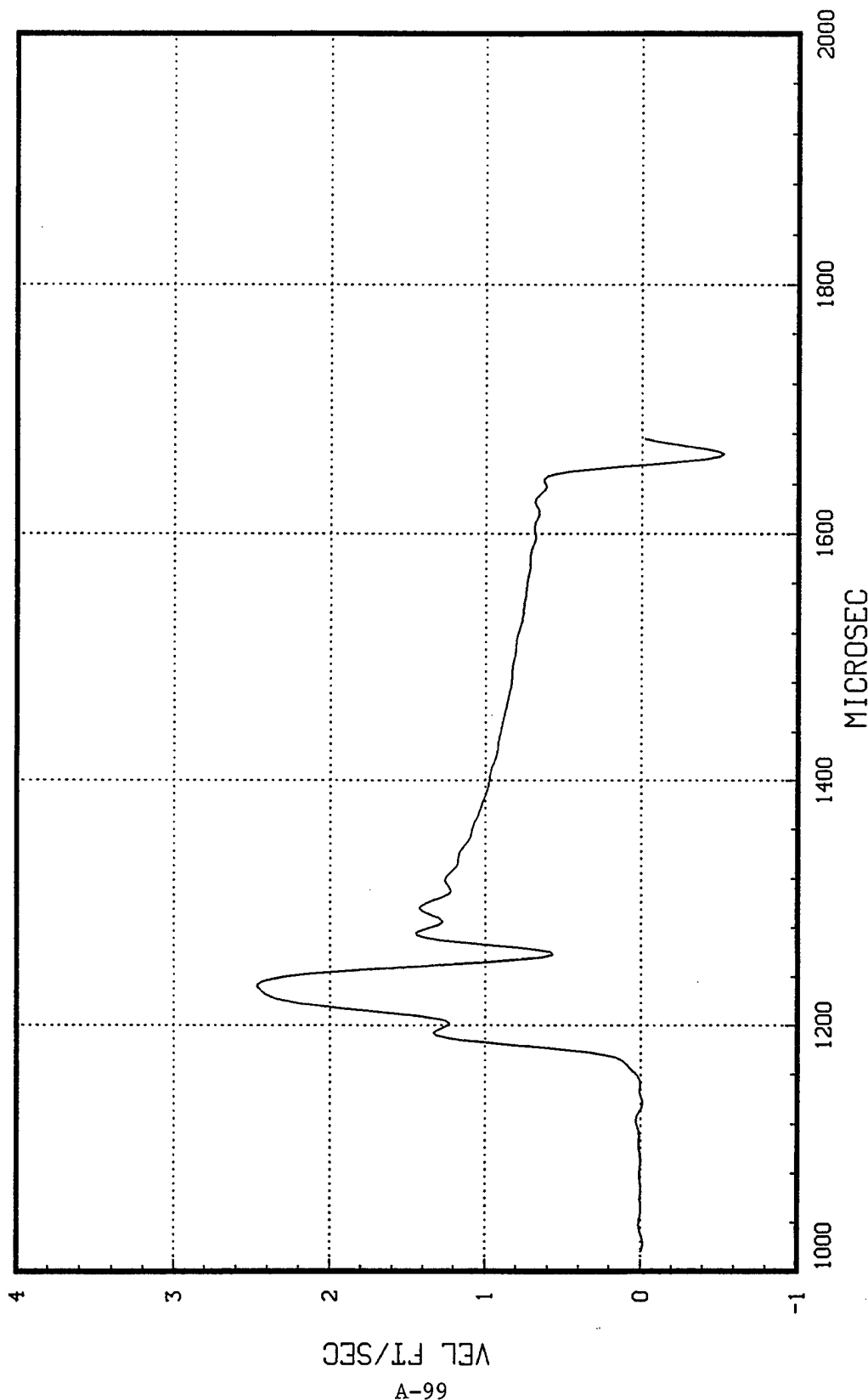
TT=	0.098 MS.	M.F.A:	54.219	INPUT BAR
TF=	0.044 MS.	TR=	0.032 MS.	
		TP=	0.040 MS.	

data verified by
date

EPW PSR SAMPLES

05/01/96
.125 PSR

AK4275
FILTER 50000.00HZ



TEST 01-03

M.F.A. 2.462

TT= 0.482 MS.

TR= 0.052 MS.

TF= 0.414 MS.

TP= 0.060 MS.

TRANSMITTED BAR

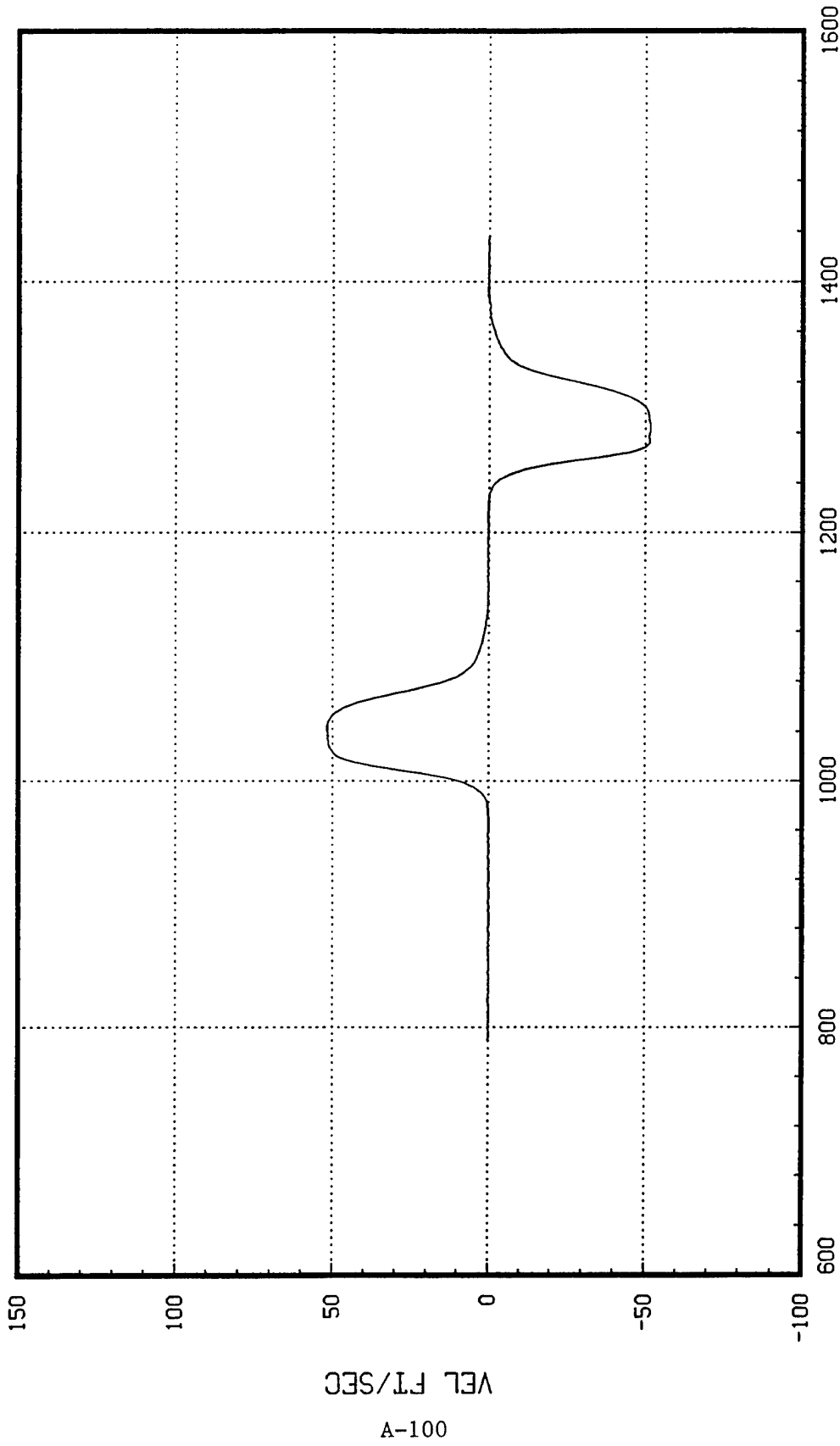
EPW PSR SAMPLES

05/01/96
.250 PSR

AK4275

FILTER 0.00HZ

data verified by
date

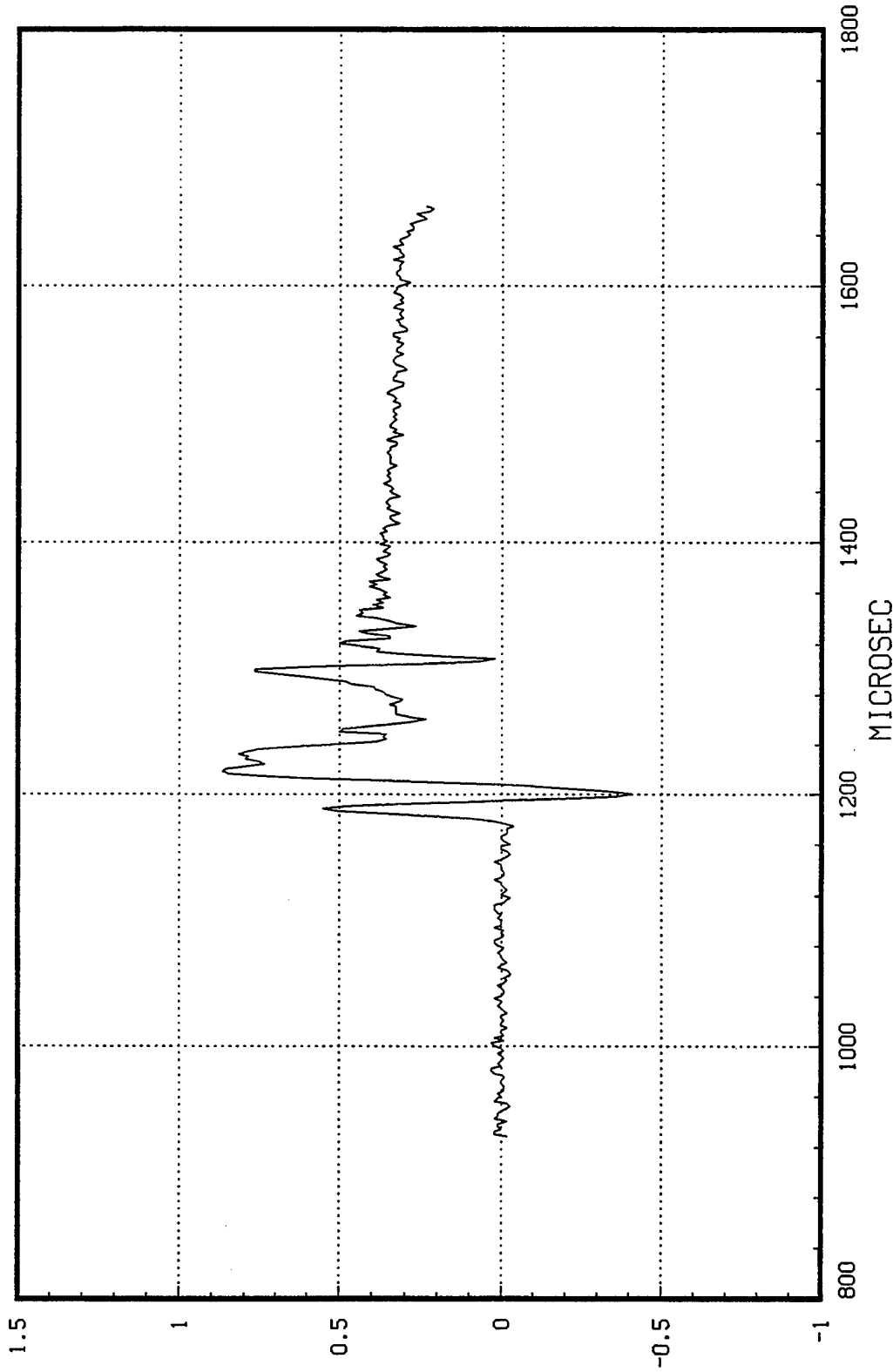


TEST 04-06

INPUT BAR

A-101

VEL FT/SEC



TEST 04-06

TRANSMITTED BAR

M.F.A. 0.931

TT= 0.270 MS. TR= 0.018 MS.

TF= 0.244 MS. TP= 0.022 MS.

EPW PSR SAMPLES

05/01/96
.250 PSR

AK4275

FILTER 0.00HZ

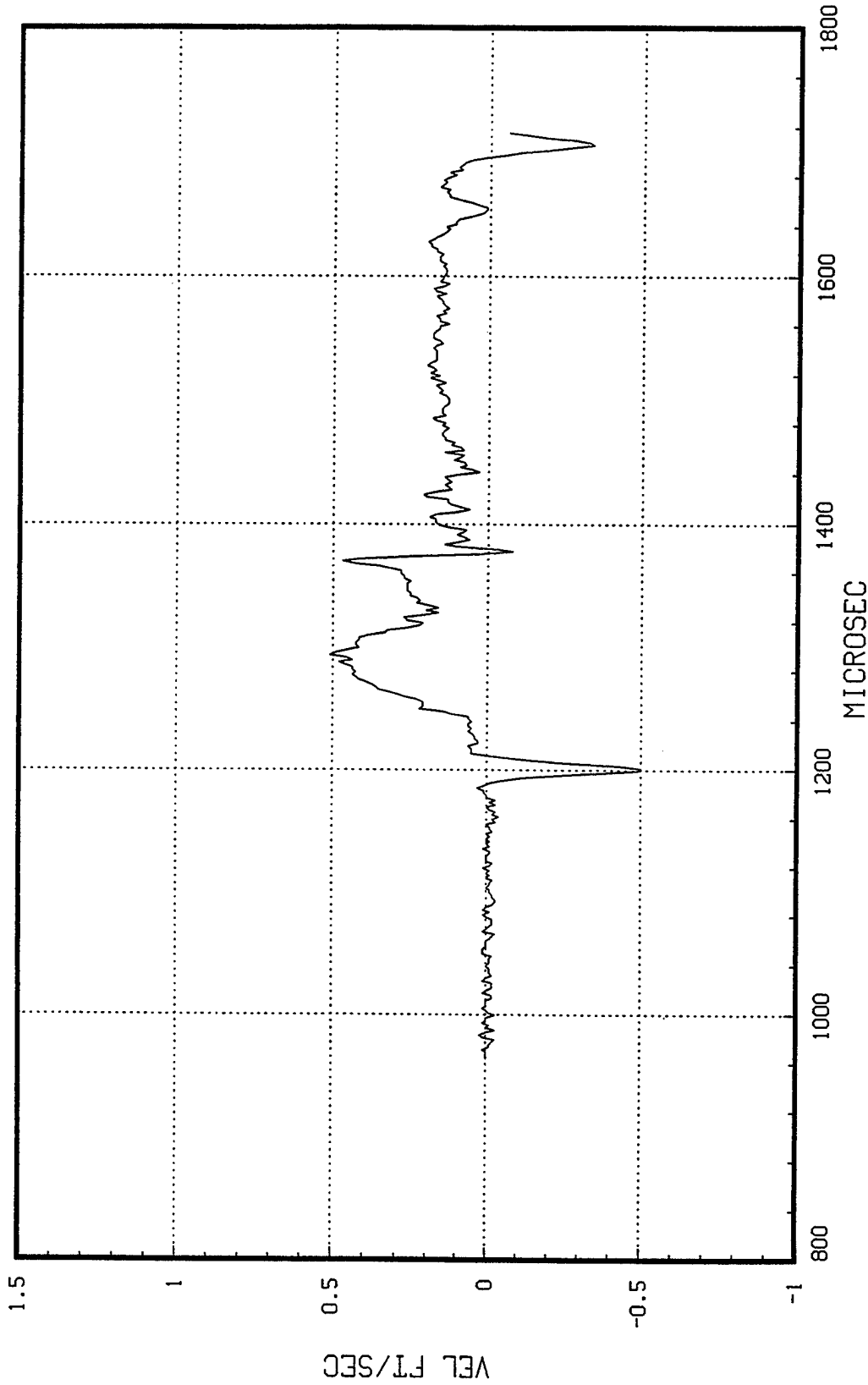
data verified by
date

EPW PSR SAMPLES

05/01/96
.500 PSR

AK4275
FILTER 0.00HZ

data verified by
date



TEST 07-09

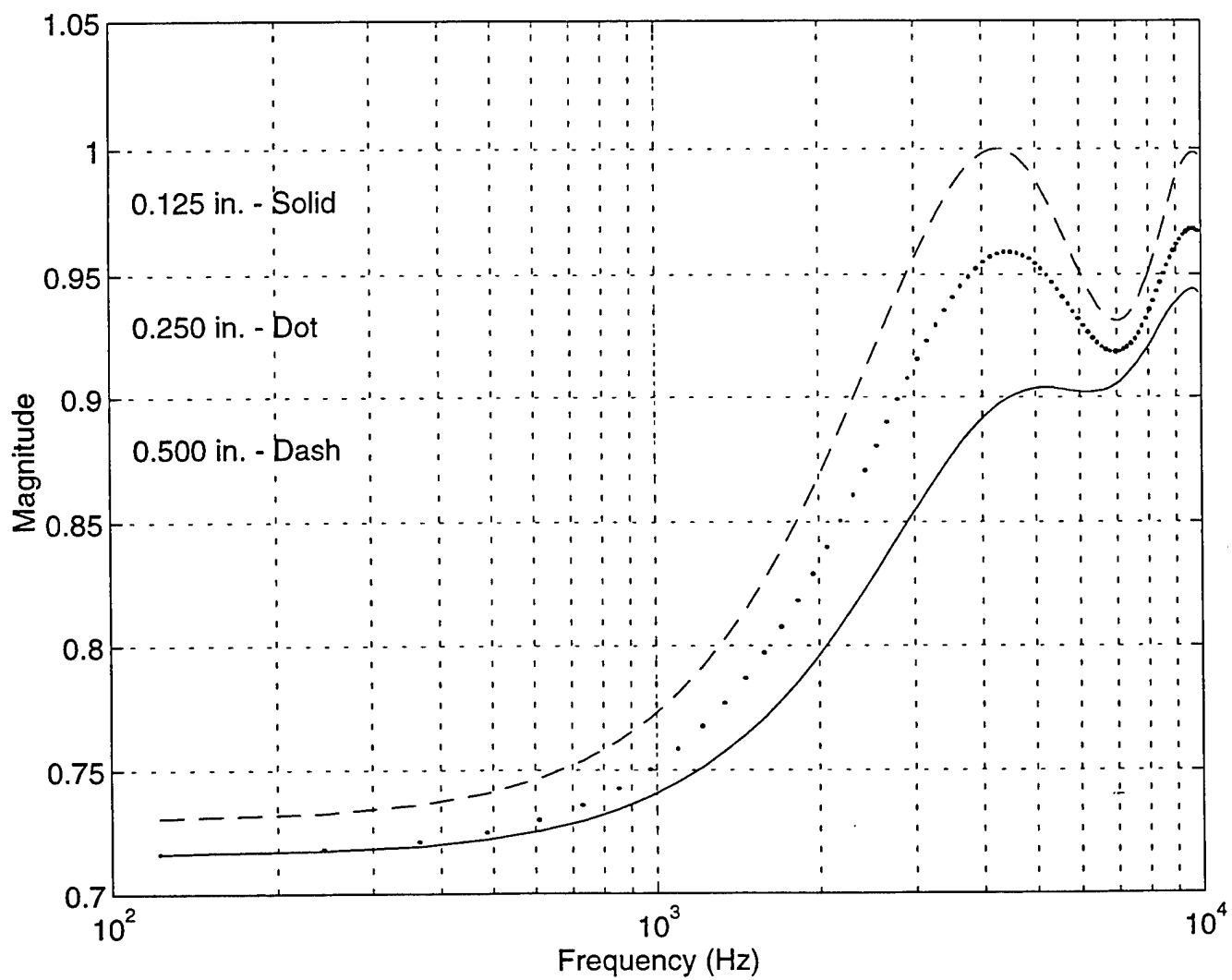
TT=	0.472 MS.	M.F.A.	0.460	TRANSMITTED BAR
TF=	0.390 MS.	TR=	0.050 MS.	
		TP=	0.062 MS.	

A-103

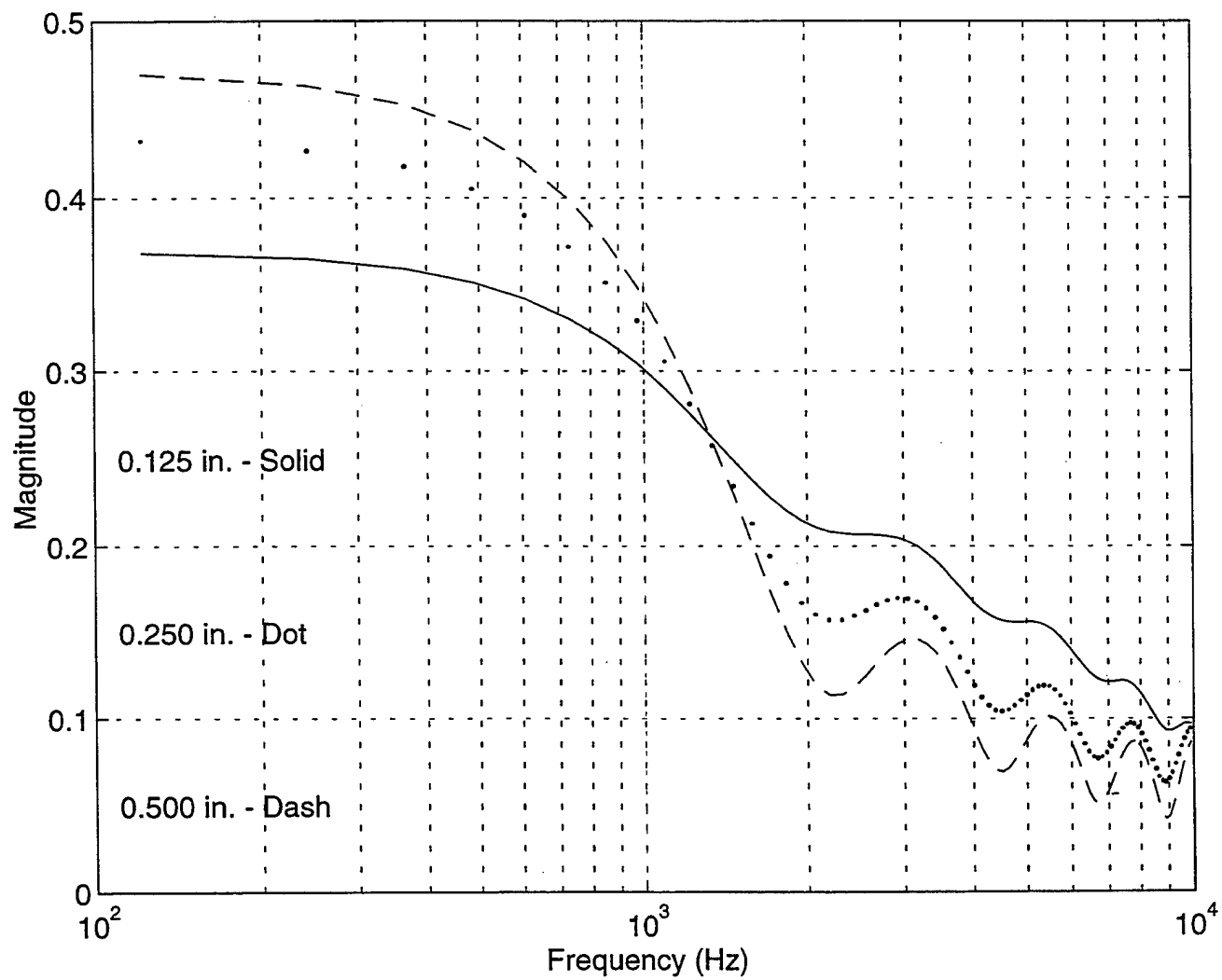
Appendix B

A Reflected Frequency Response Function Magnitude and A Transmitted Frequency Response Function Magnitude for Seventeen Shock Mitigating Materials

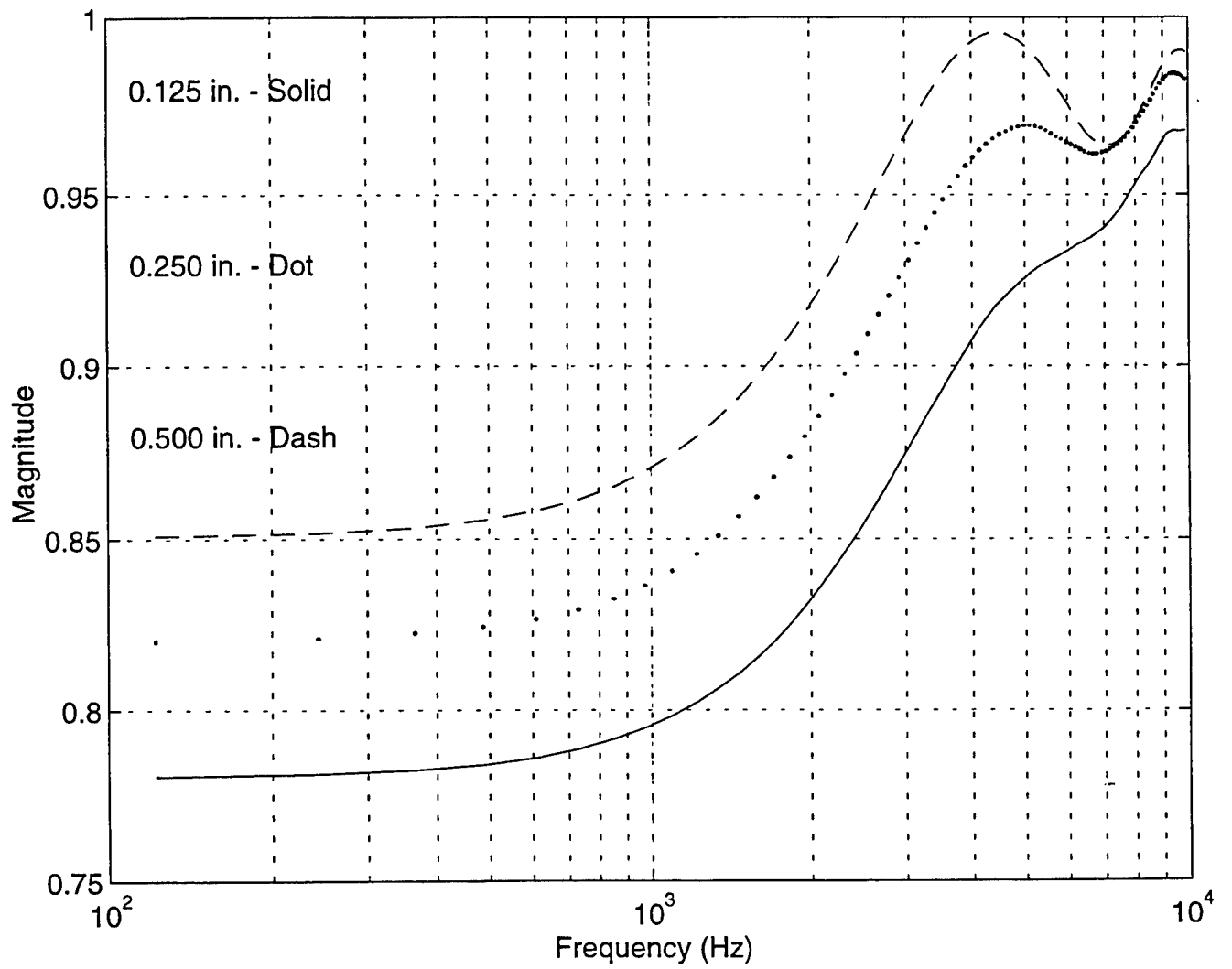
HIGH DENSITY POLYETHYLENE ROD REFLECTED FRF



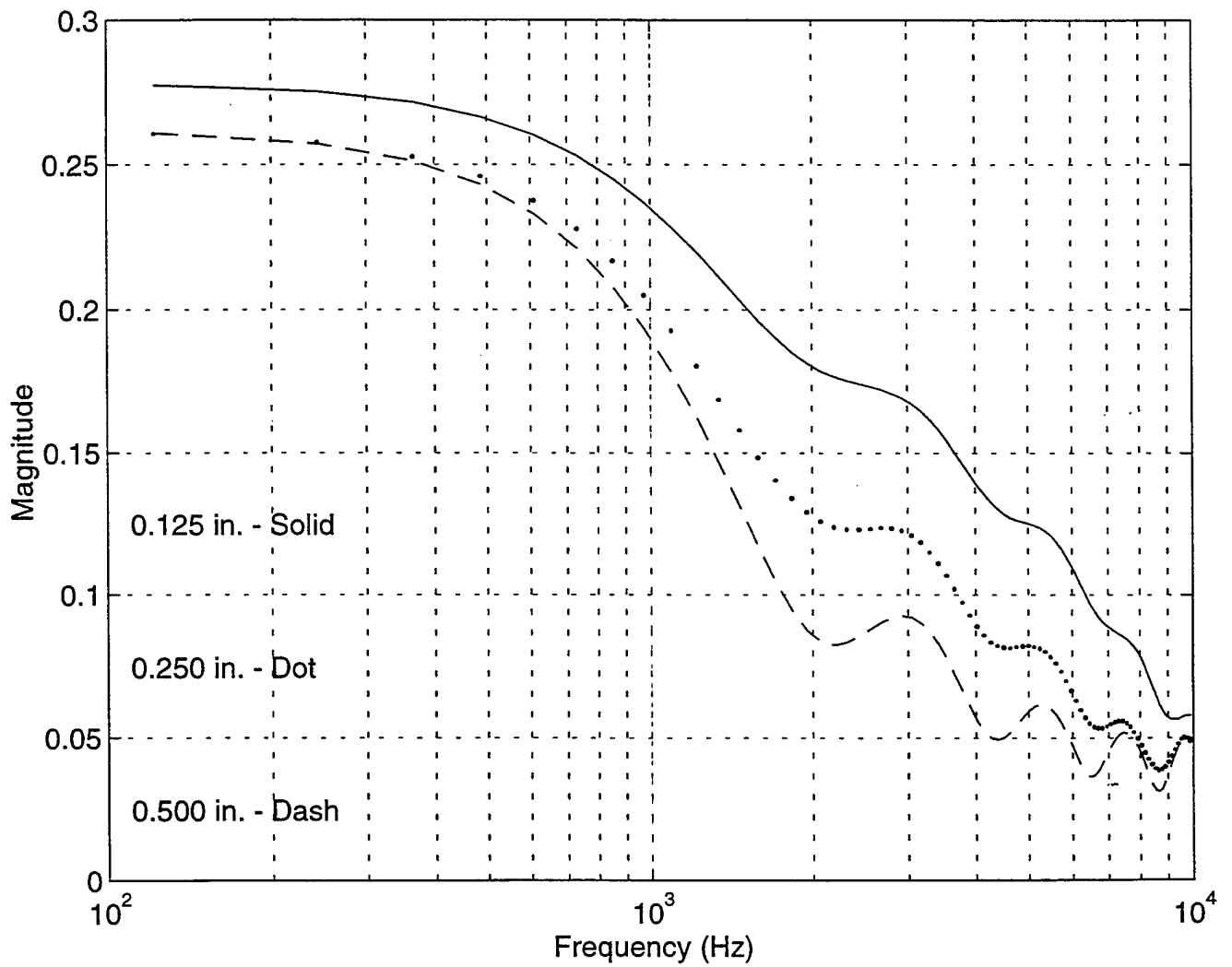
HIGH DENSITY POLYETHYLENE ROD TRANSMITTED FRF



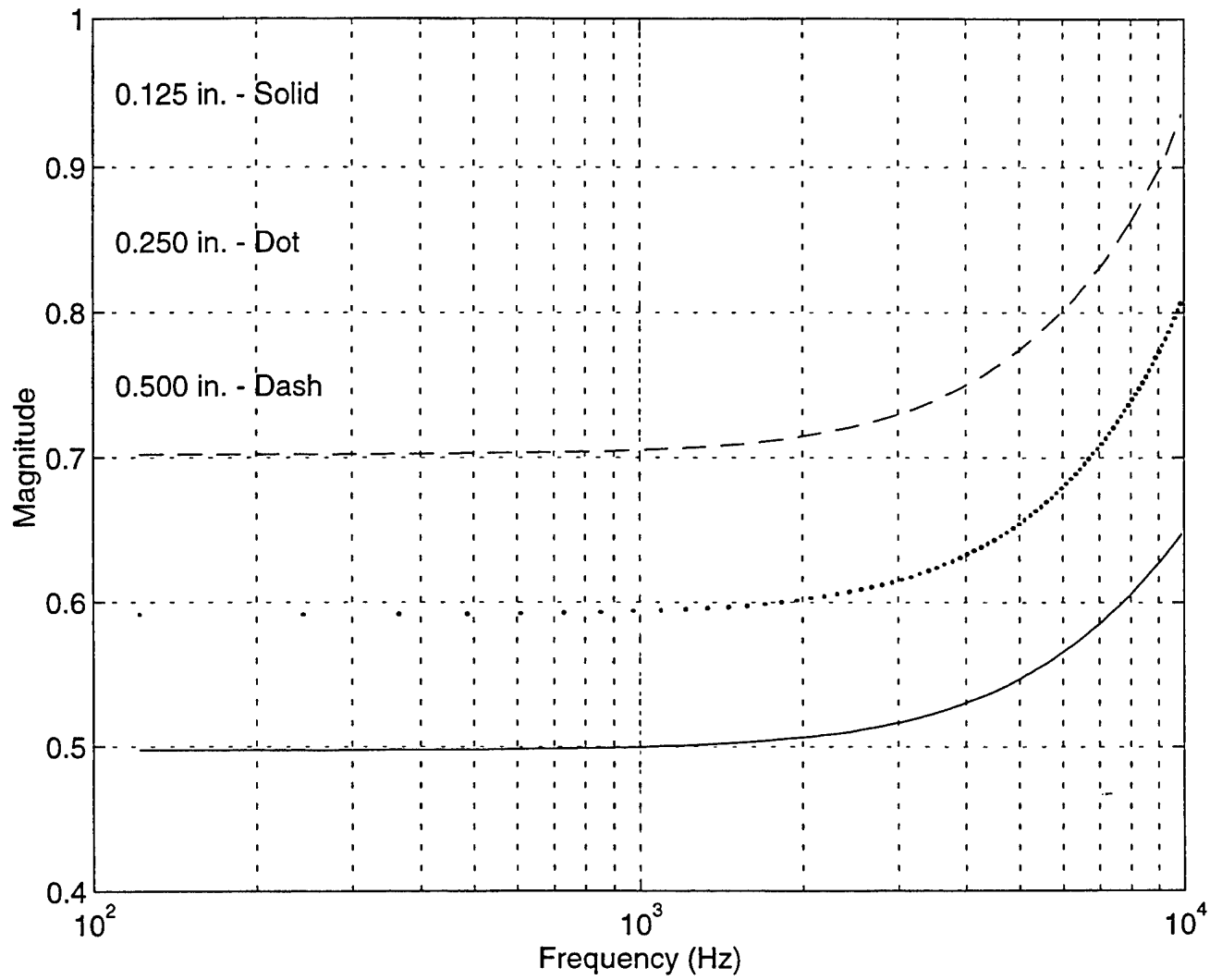
TEFLON ROD REFLECTED FRF



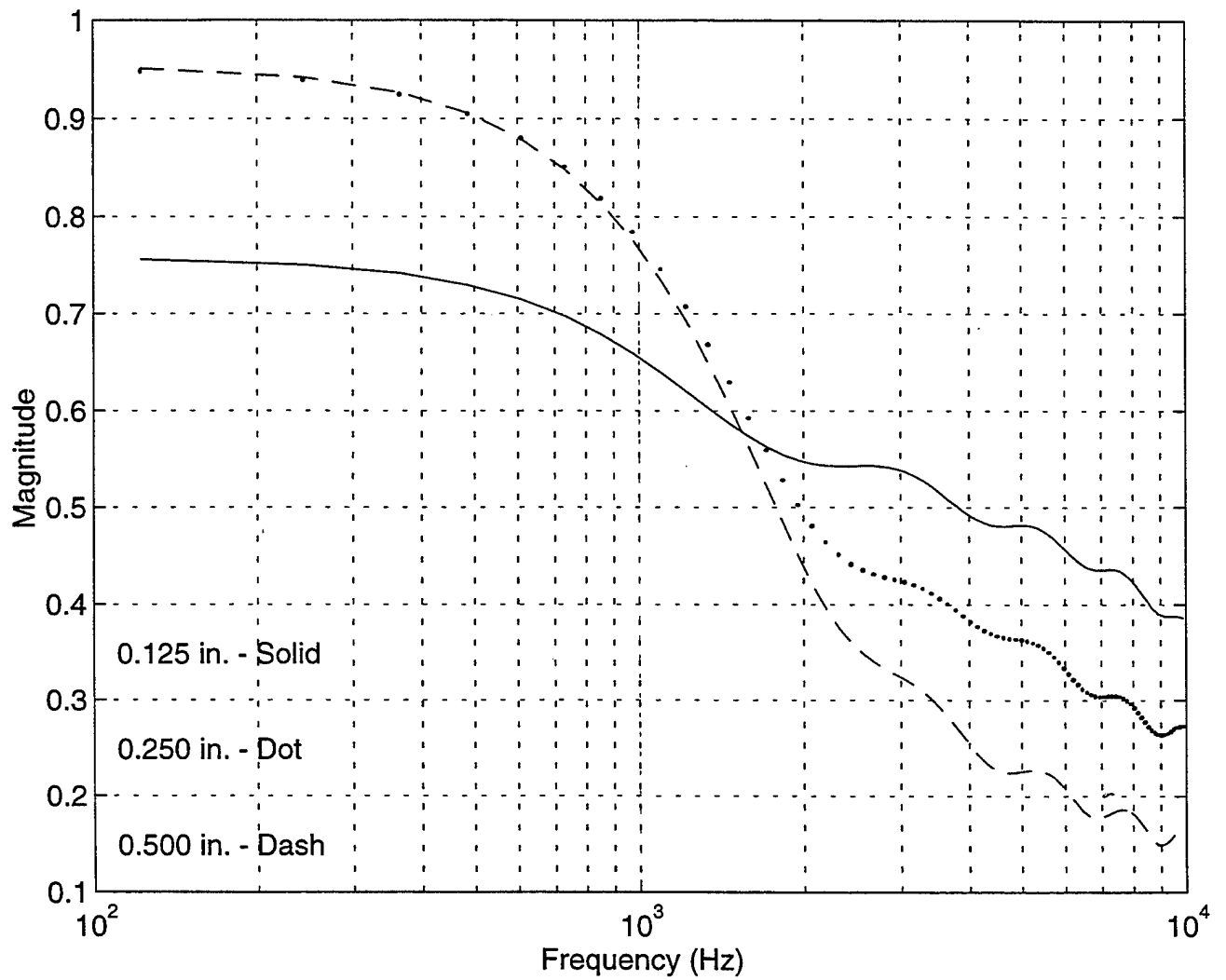
TEFLON ROD TRANSMITTED FRF



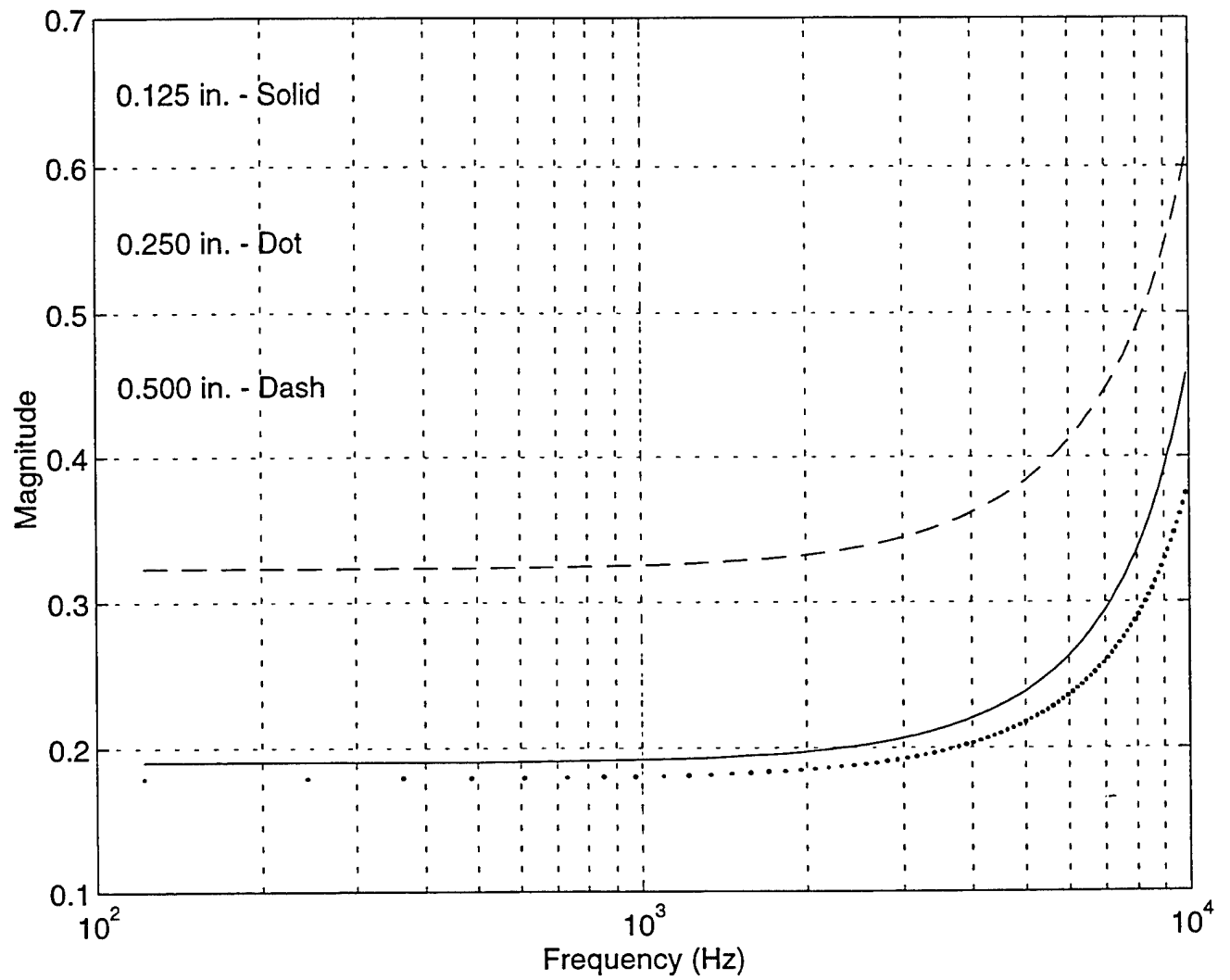
LEXAN ROD REFLECTED FRF



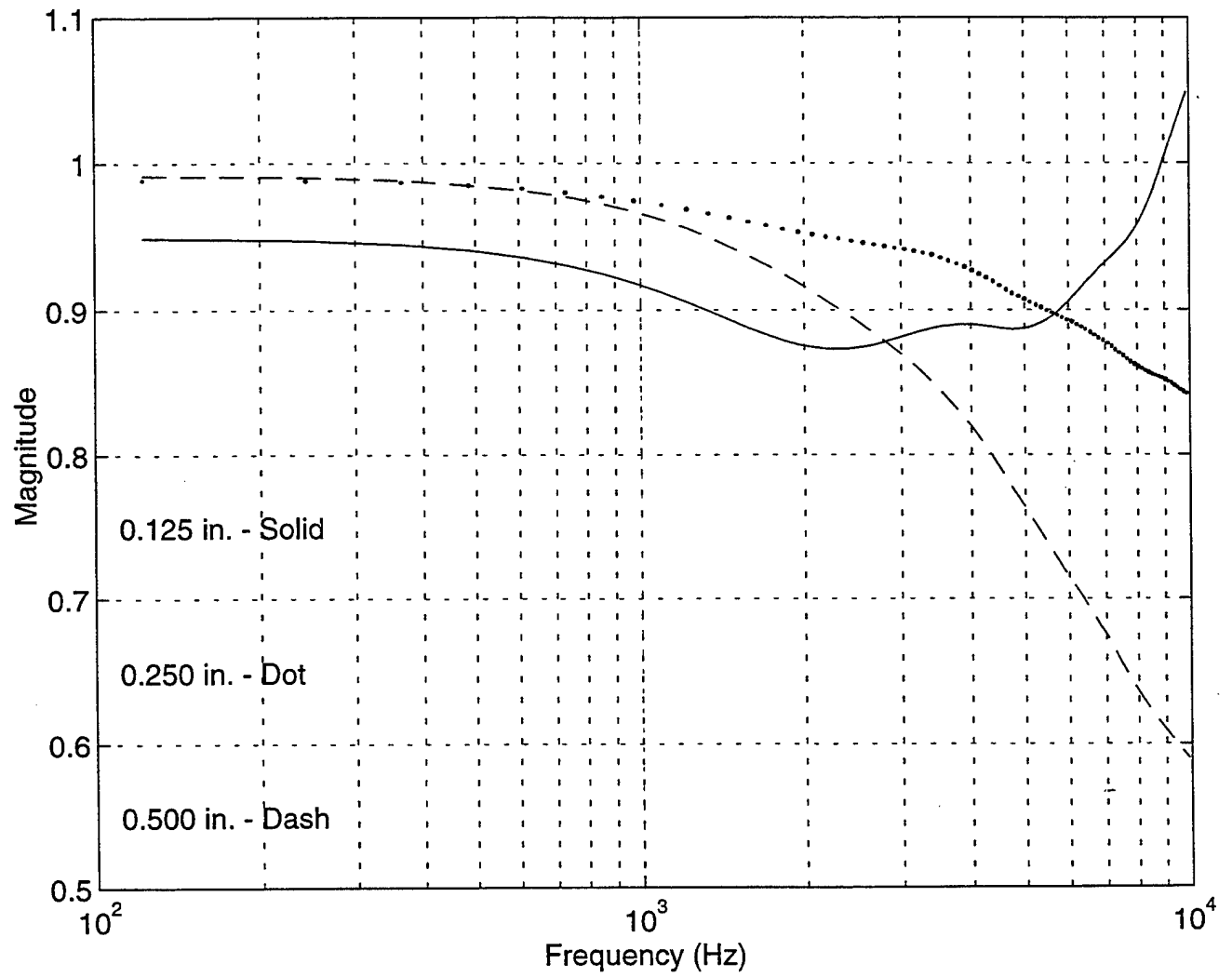
LEXAN ROD TRANSMITTED FRF



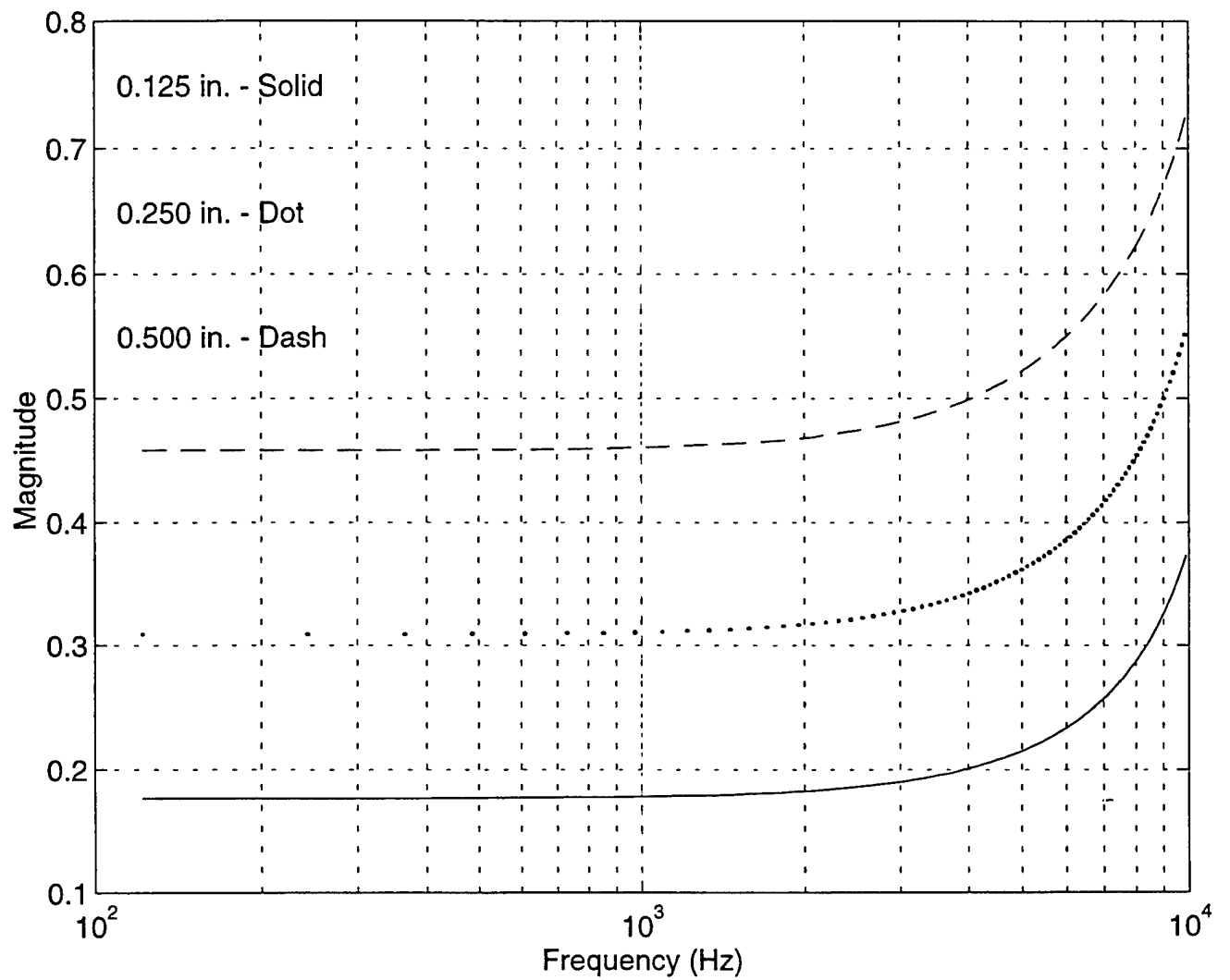
G-10 EPOXY & FIBERGLASS CLOTH REFLECTED FRF

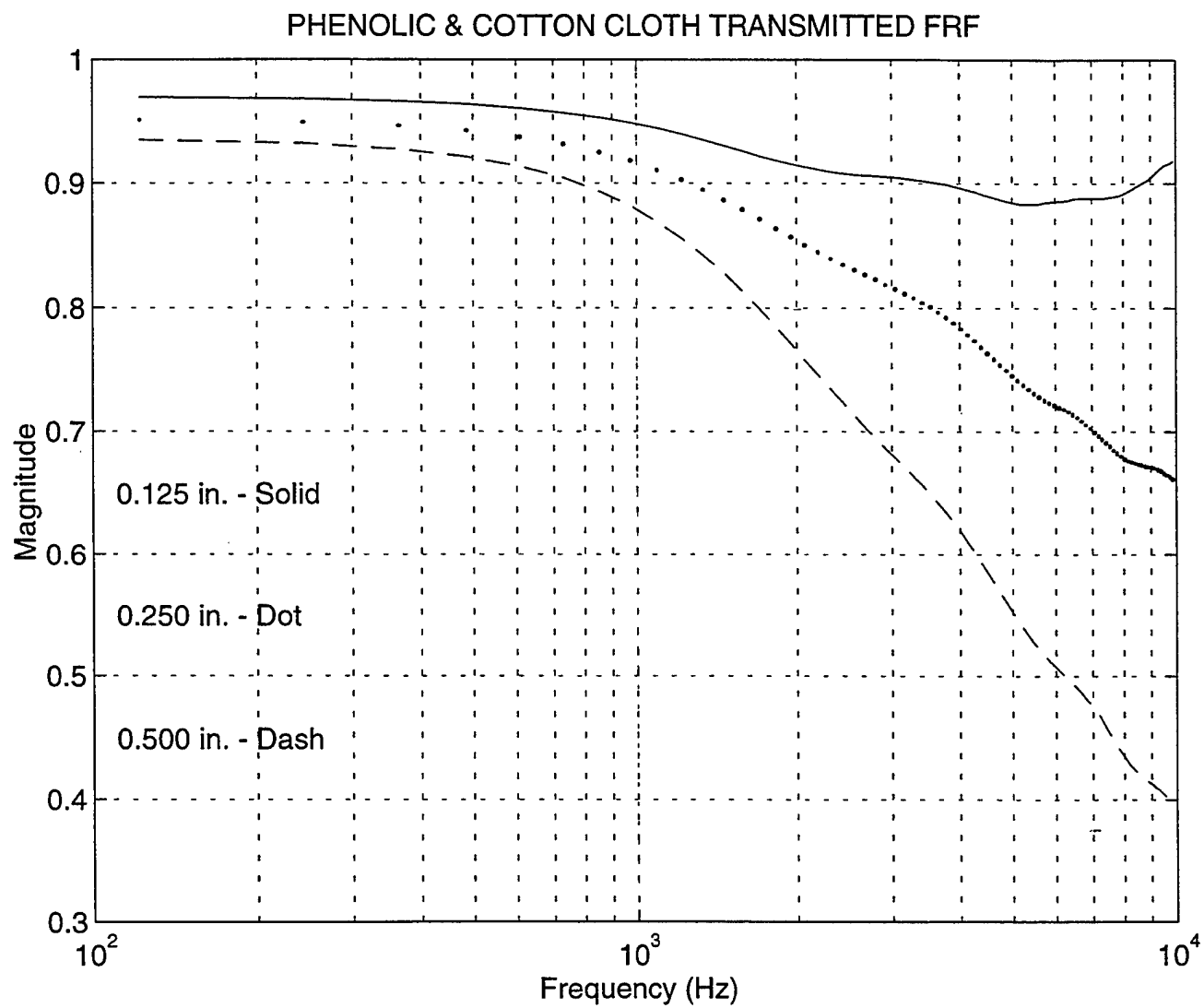


G-10 EPOXY & FIBERGLASS CLOTH TRANSMITTED FRF

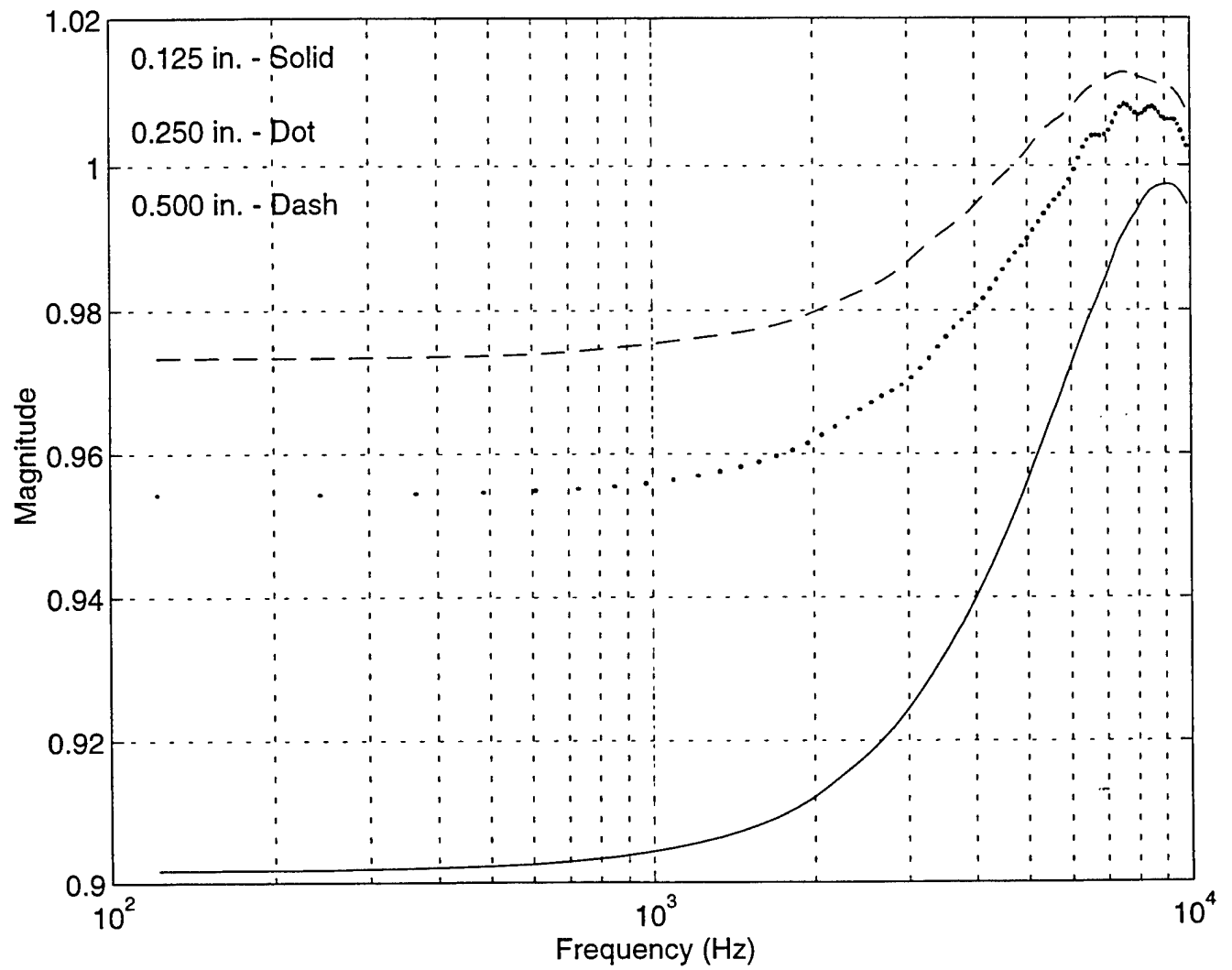


PHENOLIC & COTTON CLOTH REFLECTED FRF

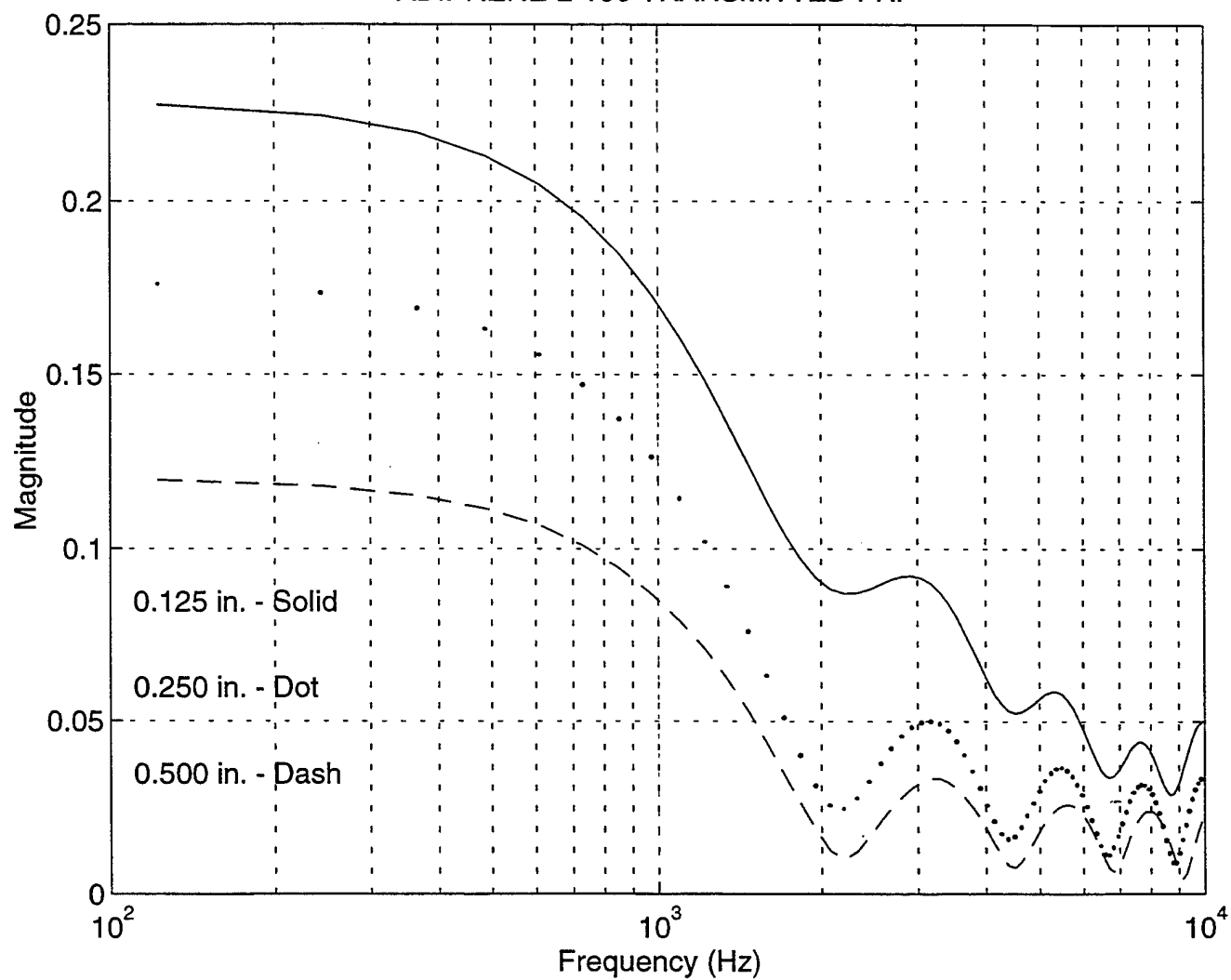




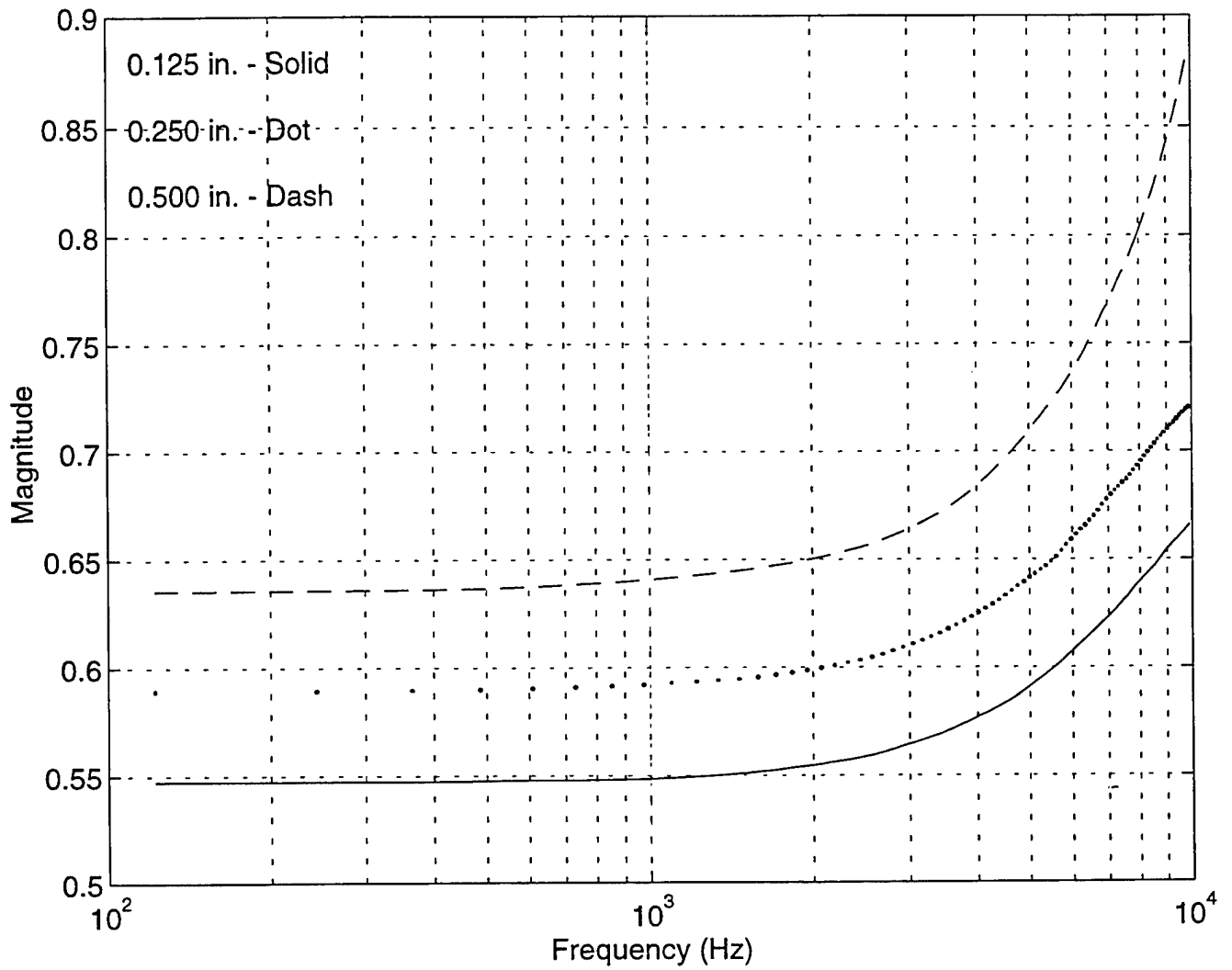
ADIPRENE L-100 REFLECTED FRF



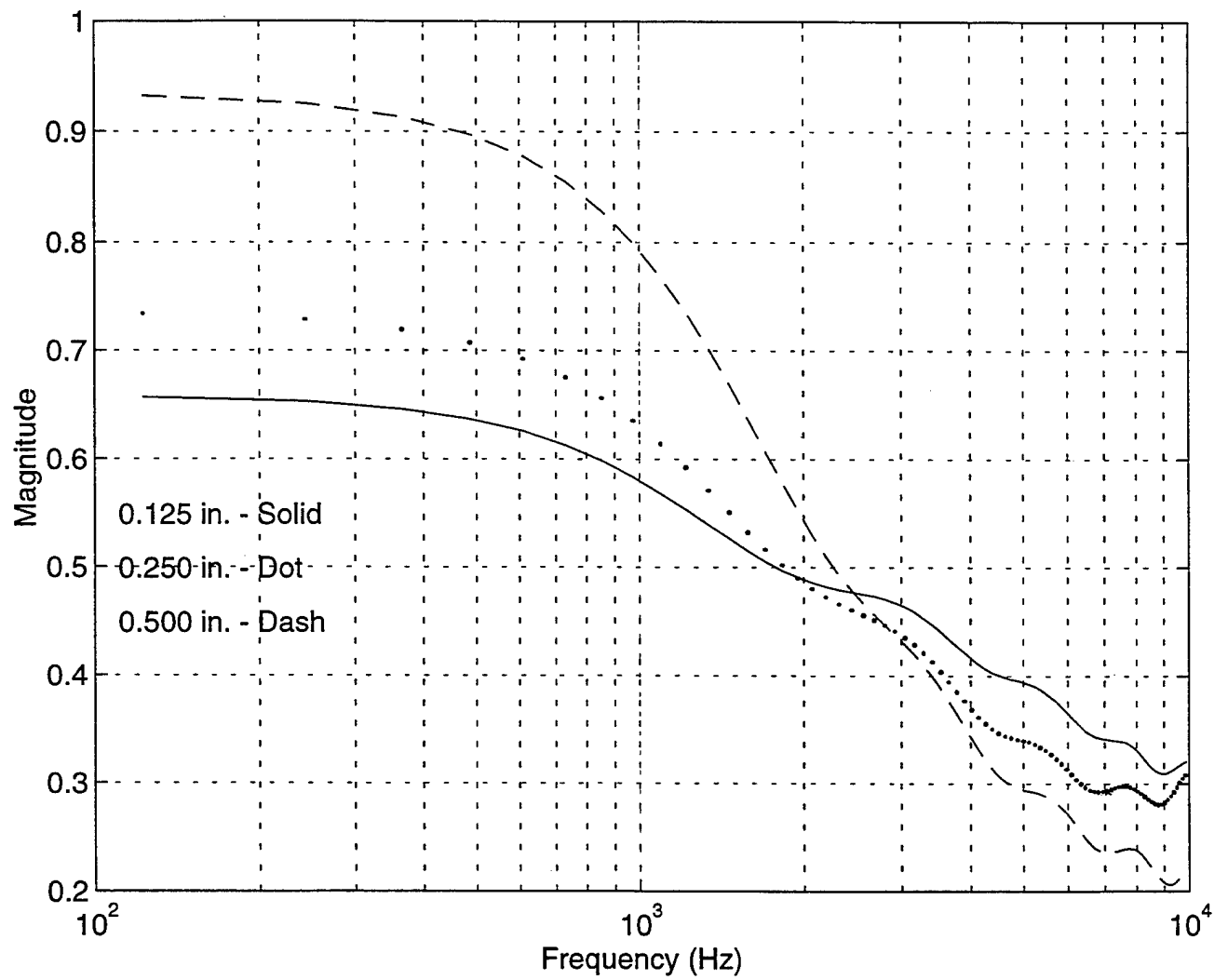
ADIPRENE L-100 TRANSMITTED FRF



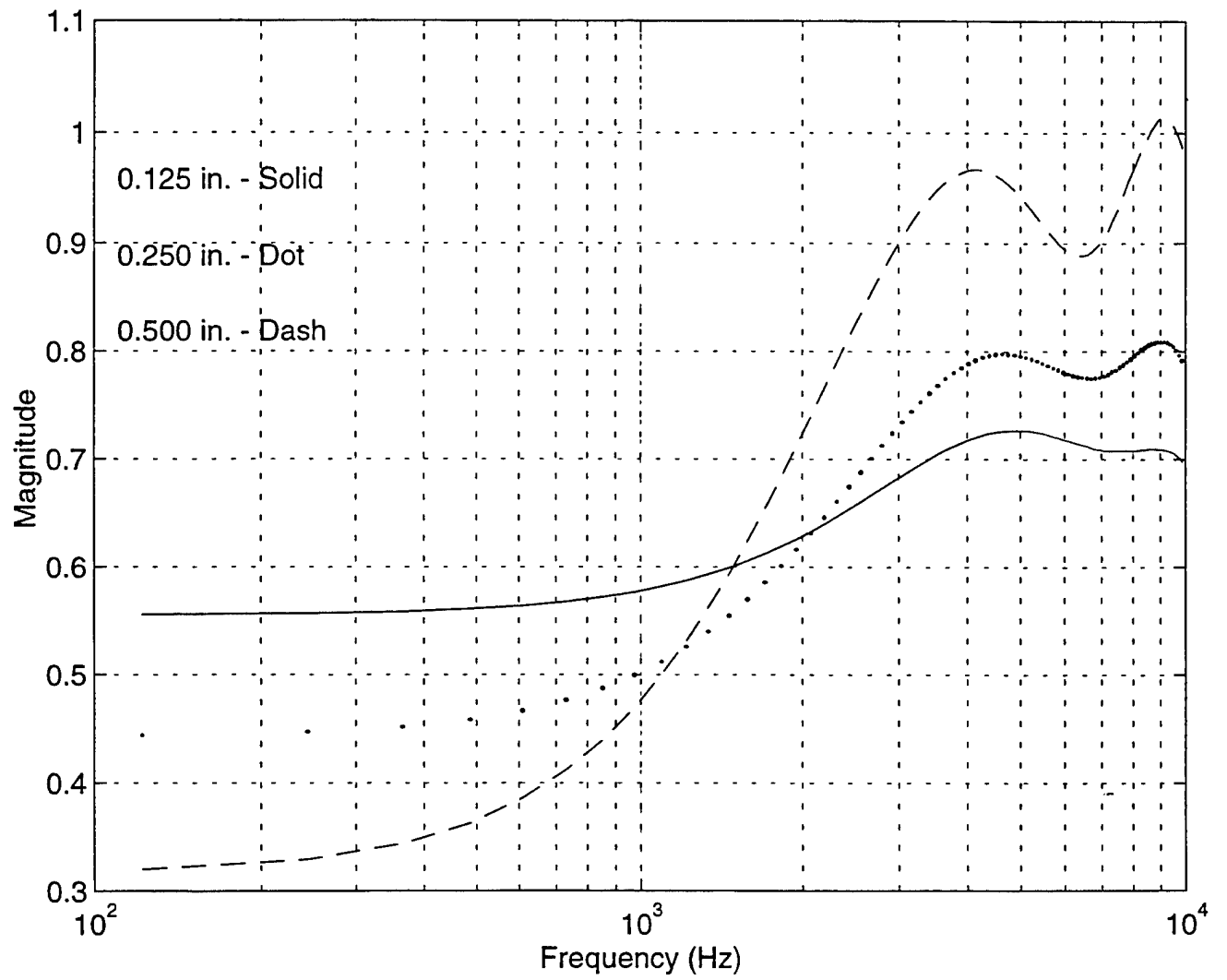
828/DEA/GMB REFLECTED FRF



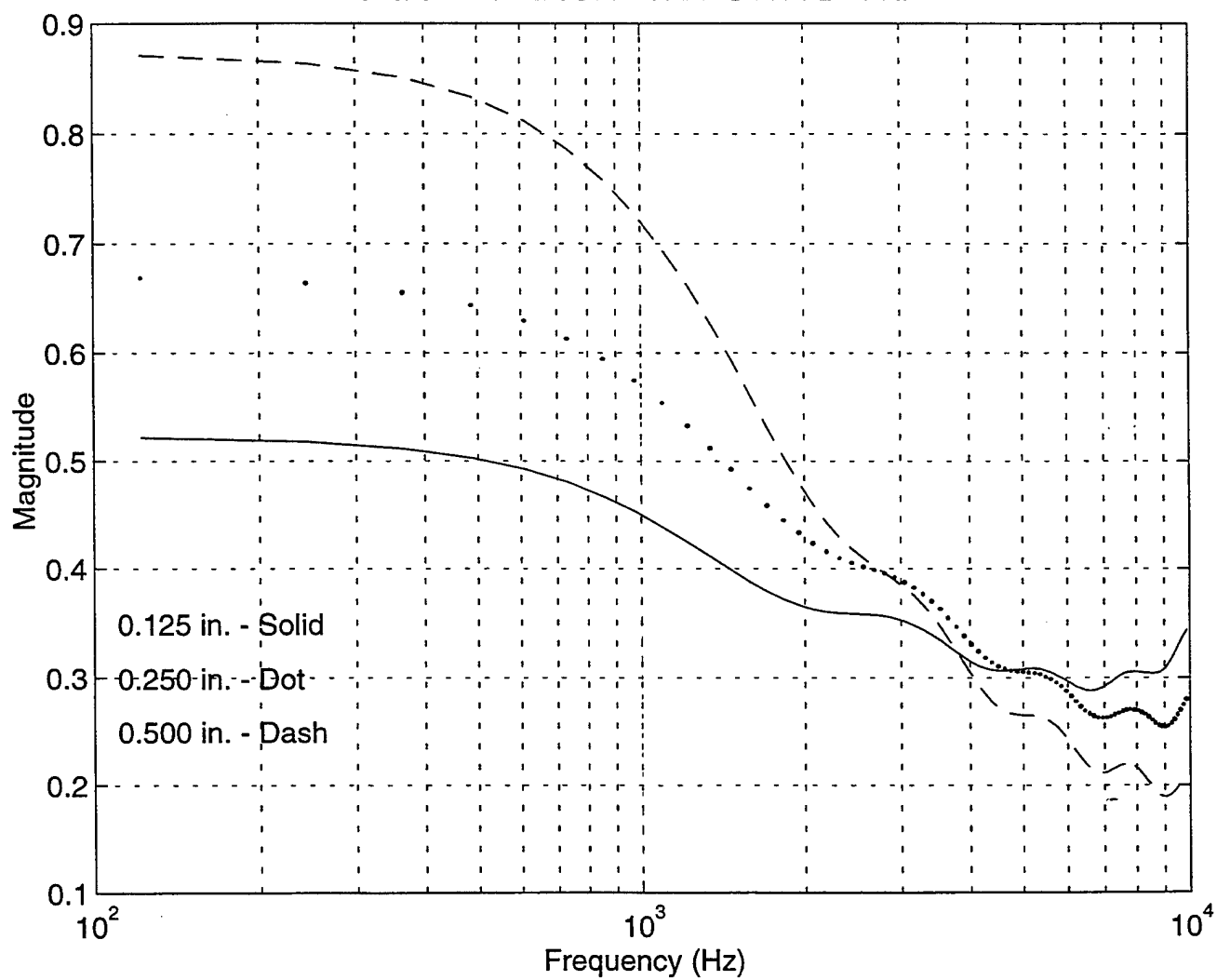
828/DEA/GMB TRANSMITTED FRF



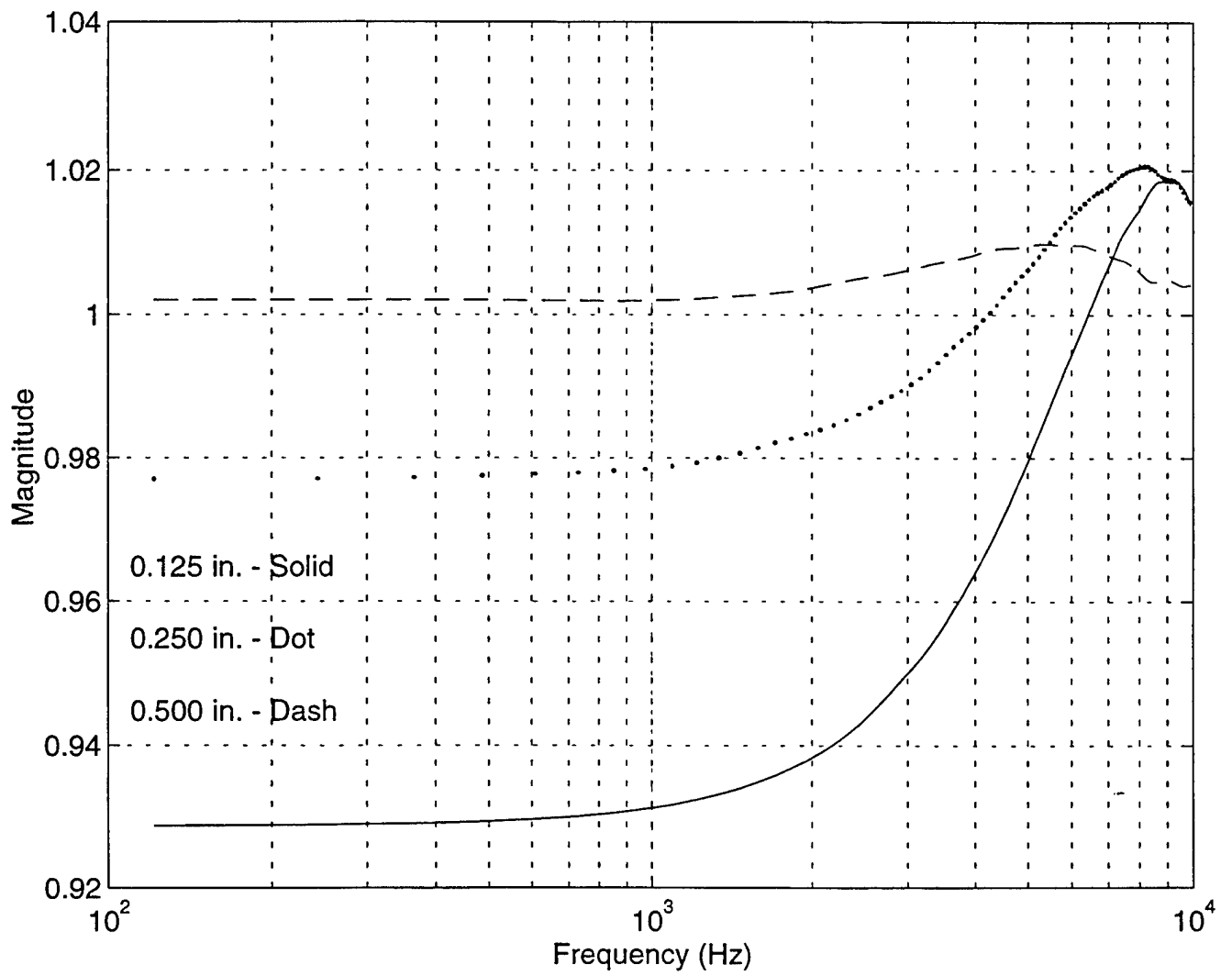
828/CTBN/DEA/GMB REFLECTED FRF



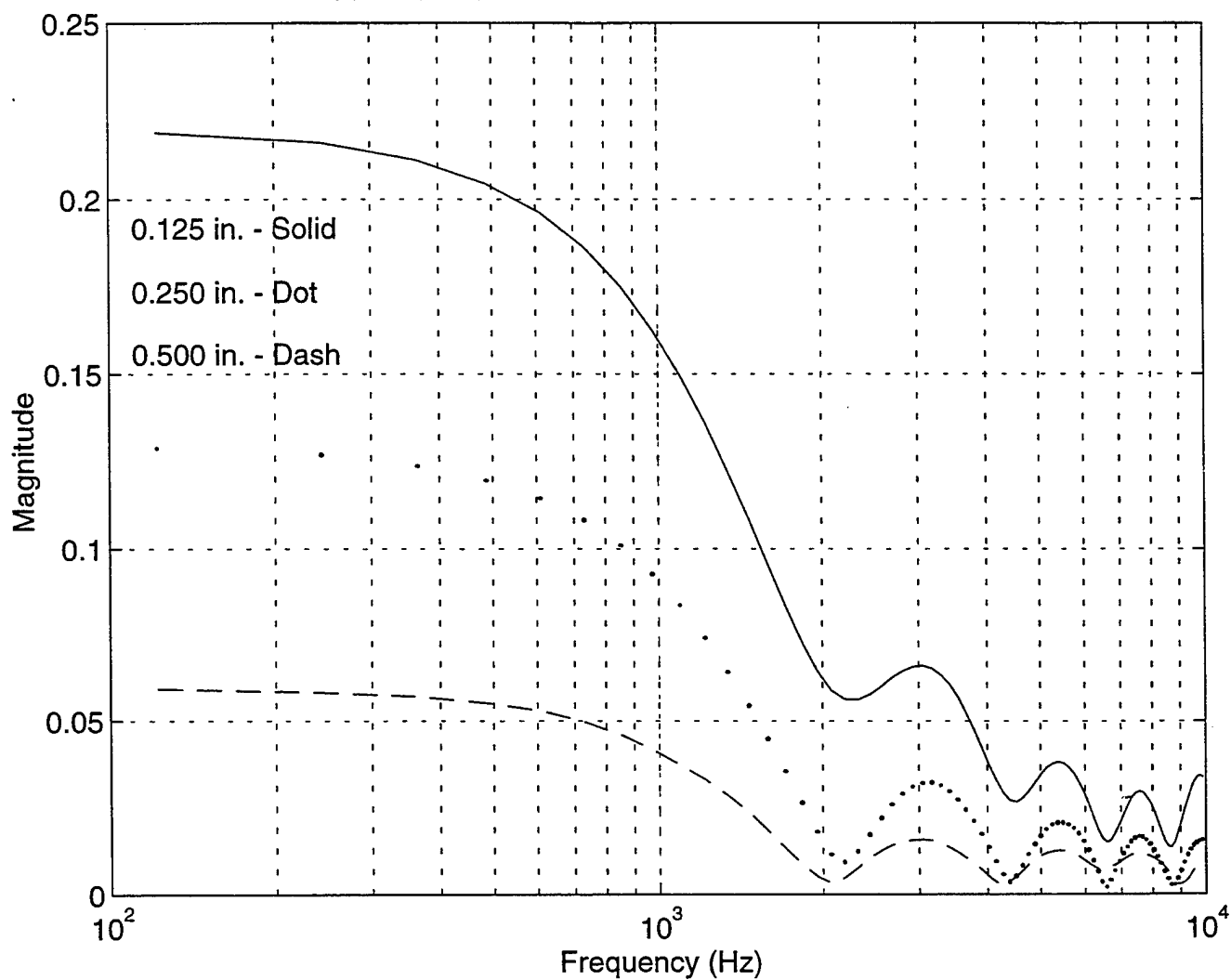
828/CTBN/DEA/GMB TRANSMITTED FRF



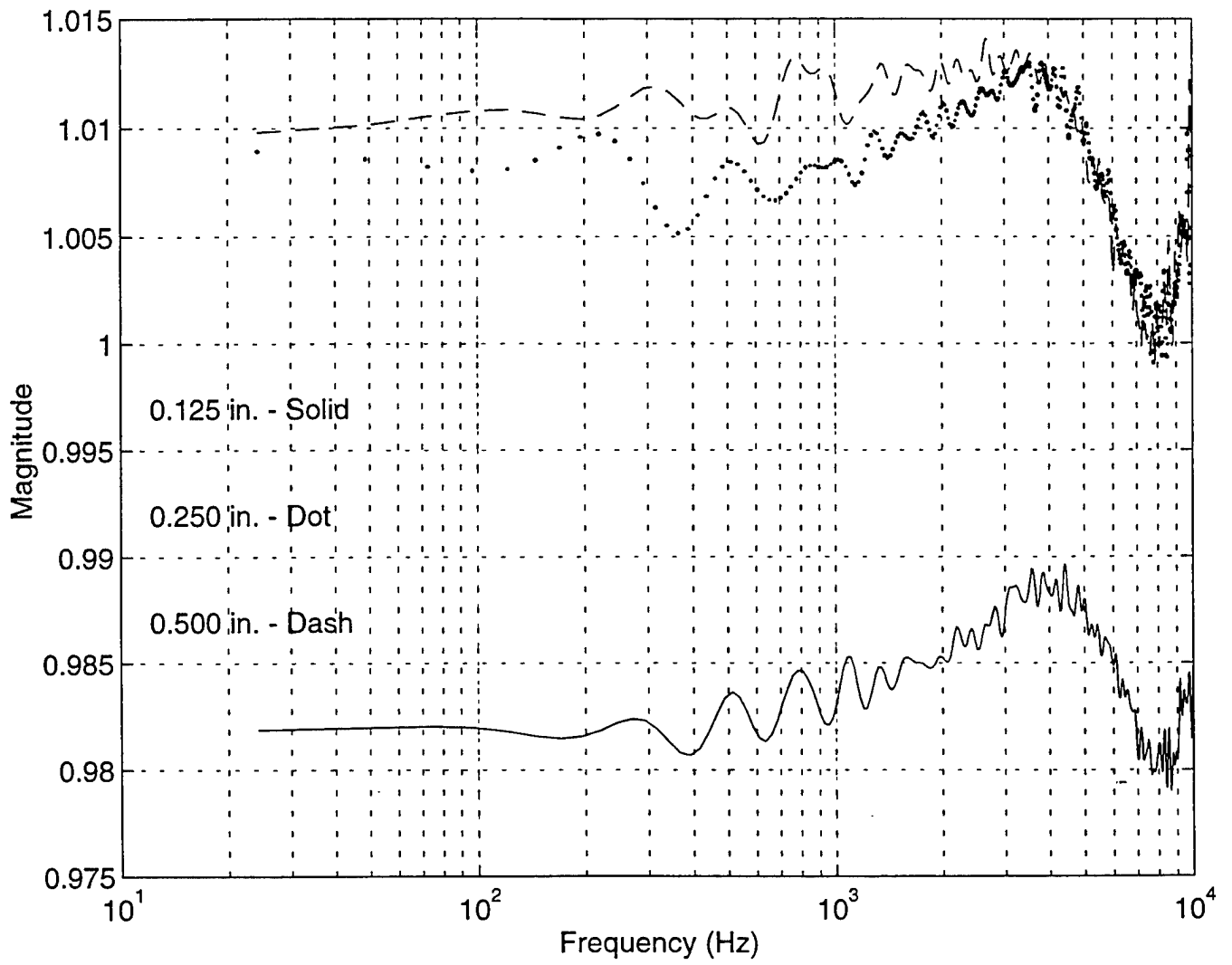
PET 90A POLYURETHANE RUBBER REFLECTED FRF



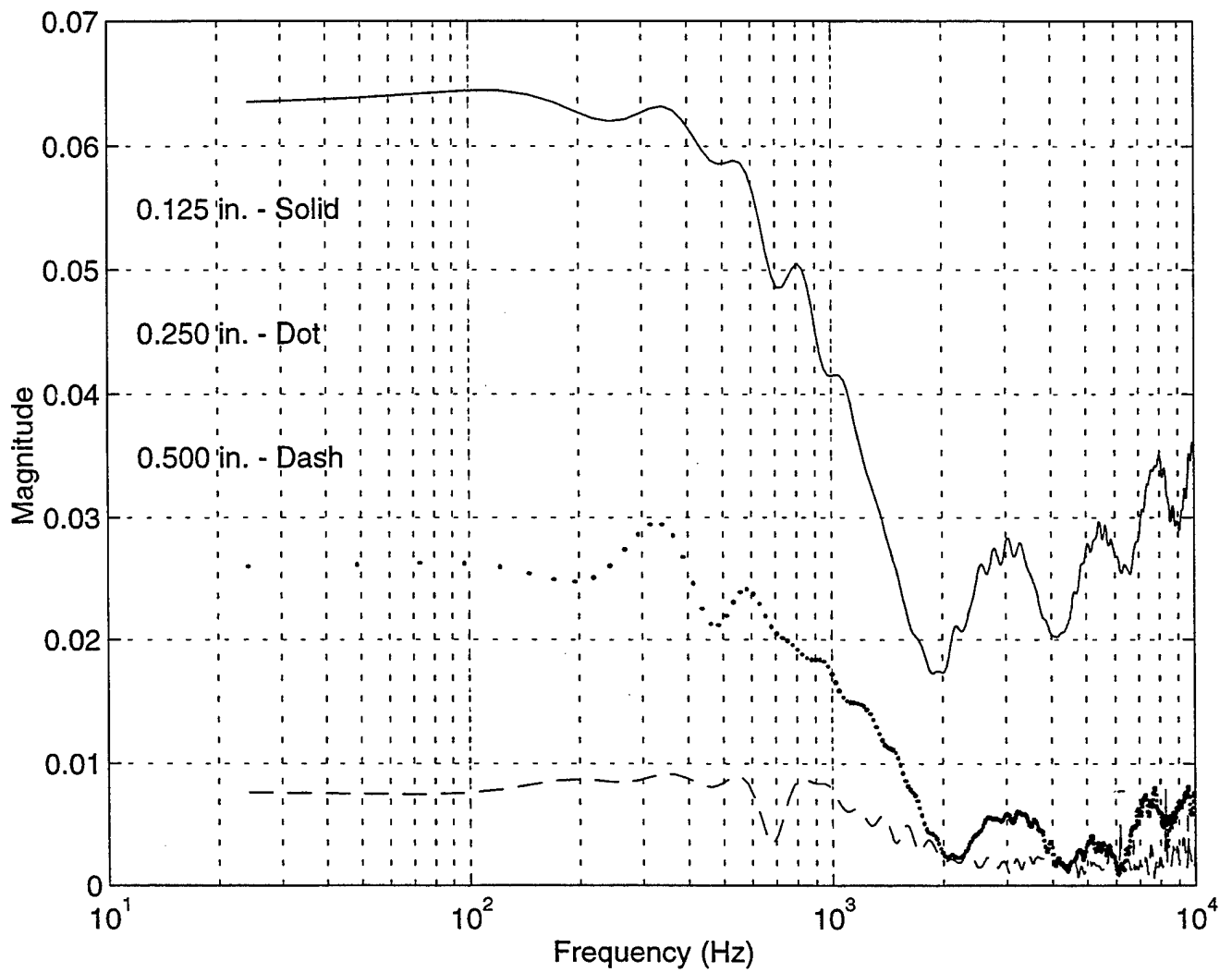
PET 90A POLYURETHANE RUBBER TRANSMITTED FRF



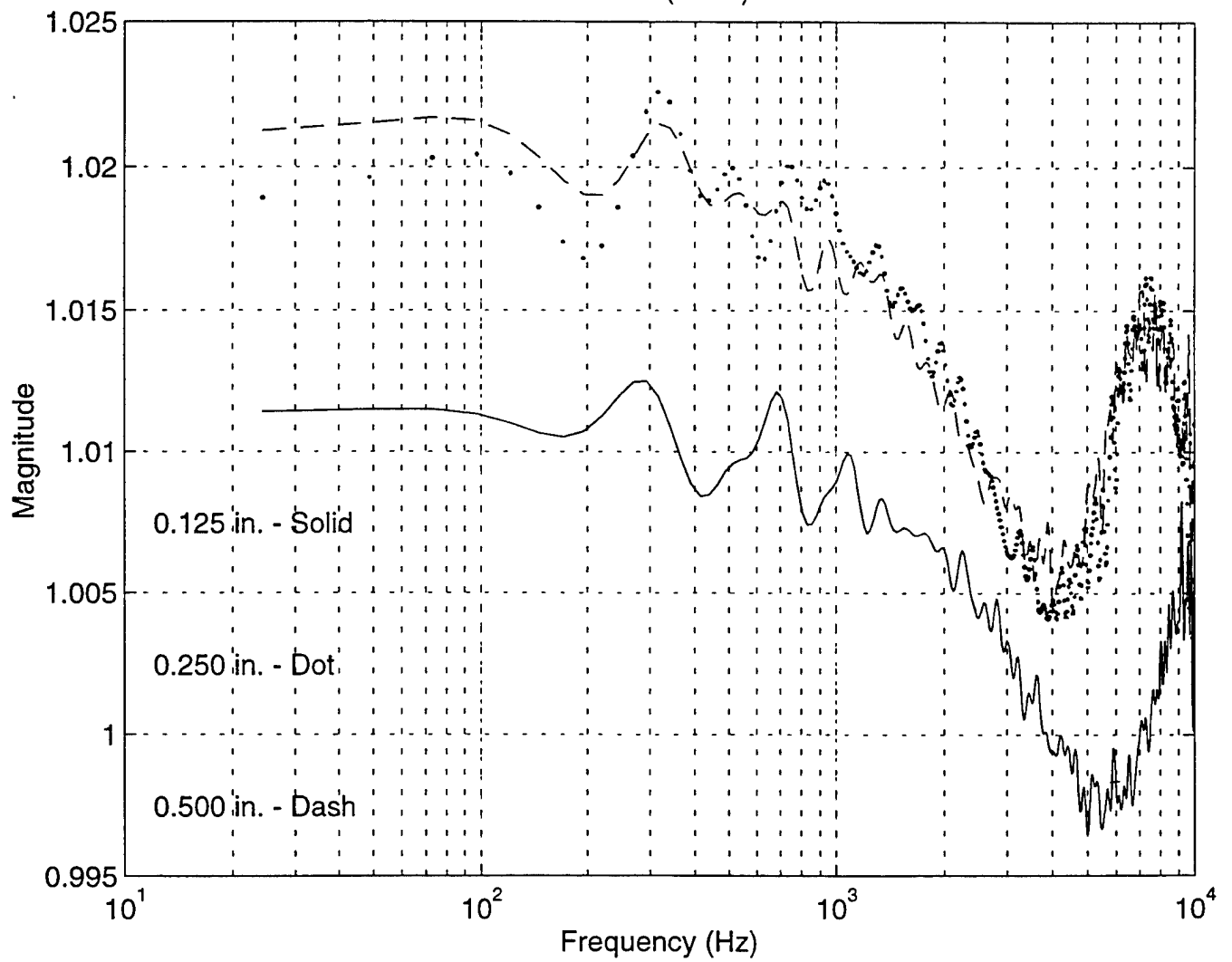
SYLGARD 184 REFLECTED FRF



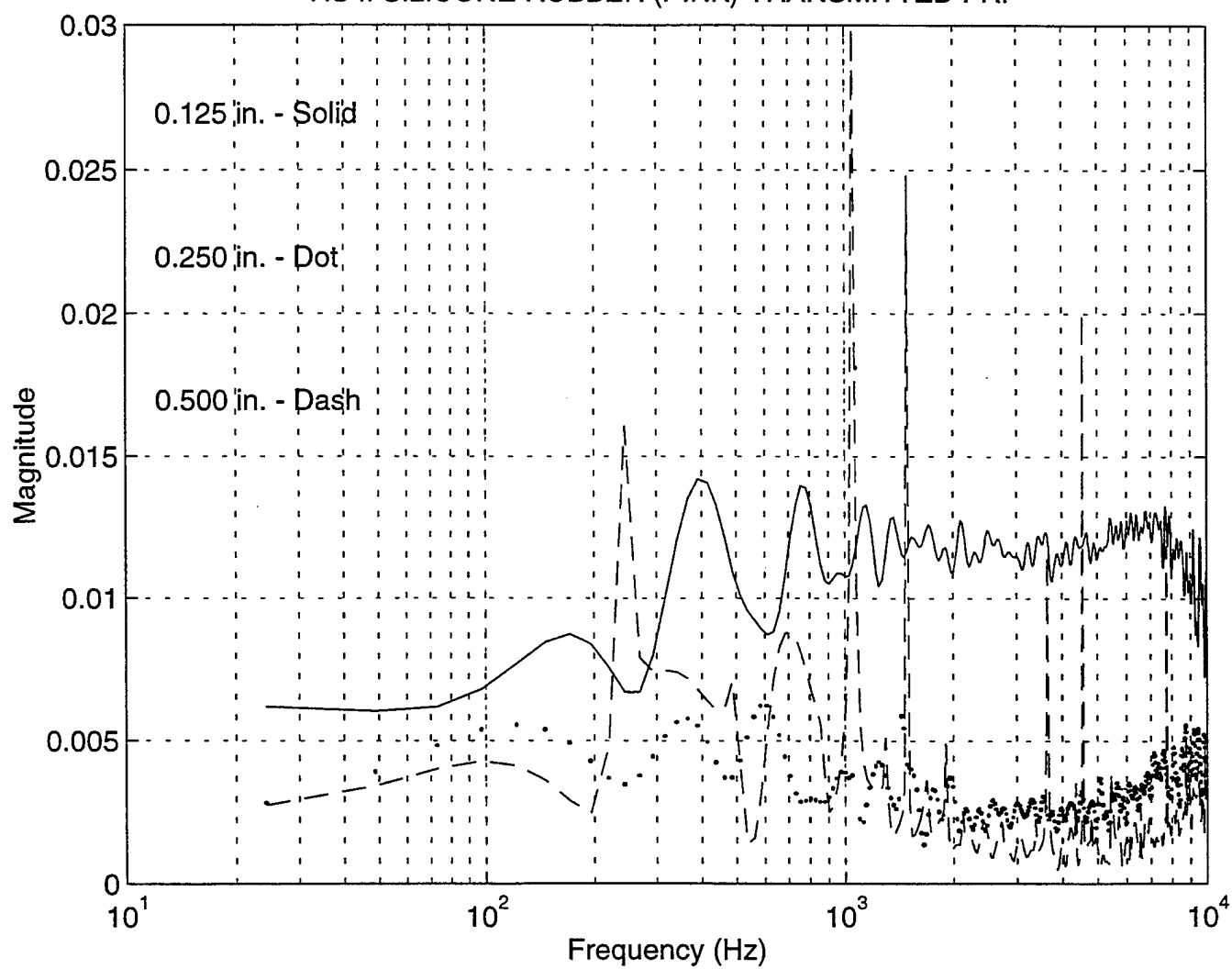
SYLGARD 184 TRANSMITTED FRF



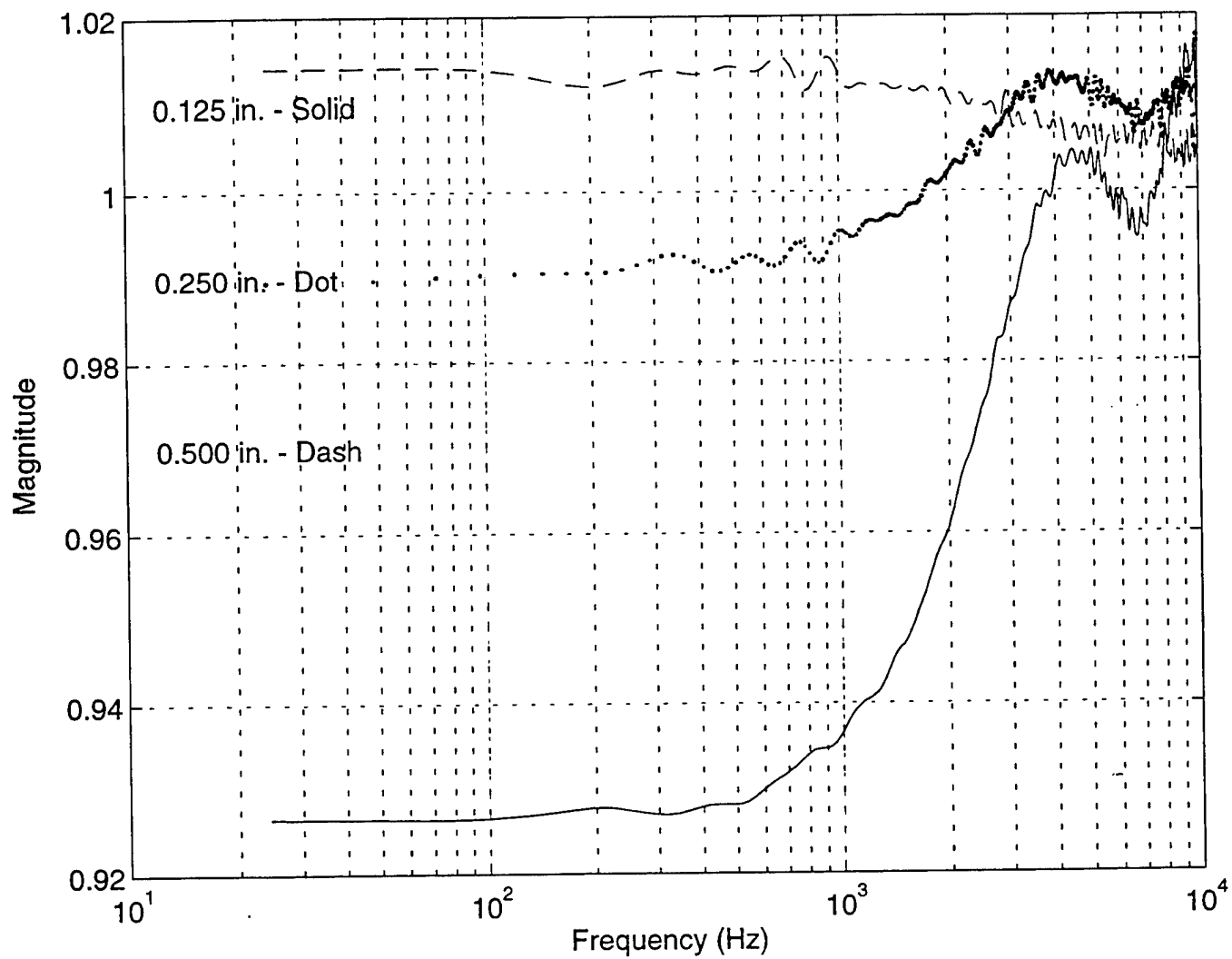
HS II SILICONE RUBBER (PINK) REFLECTED FRF



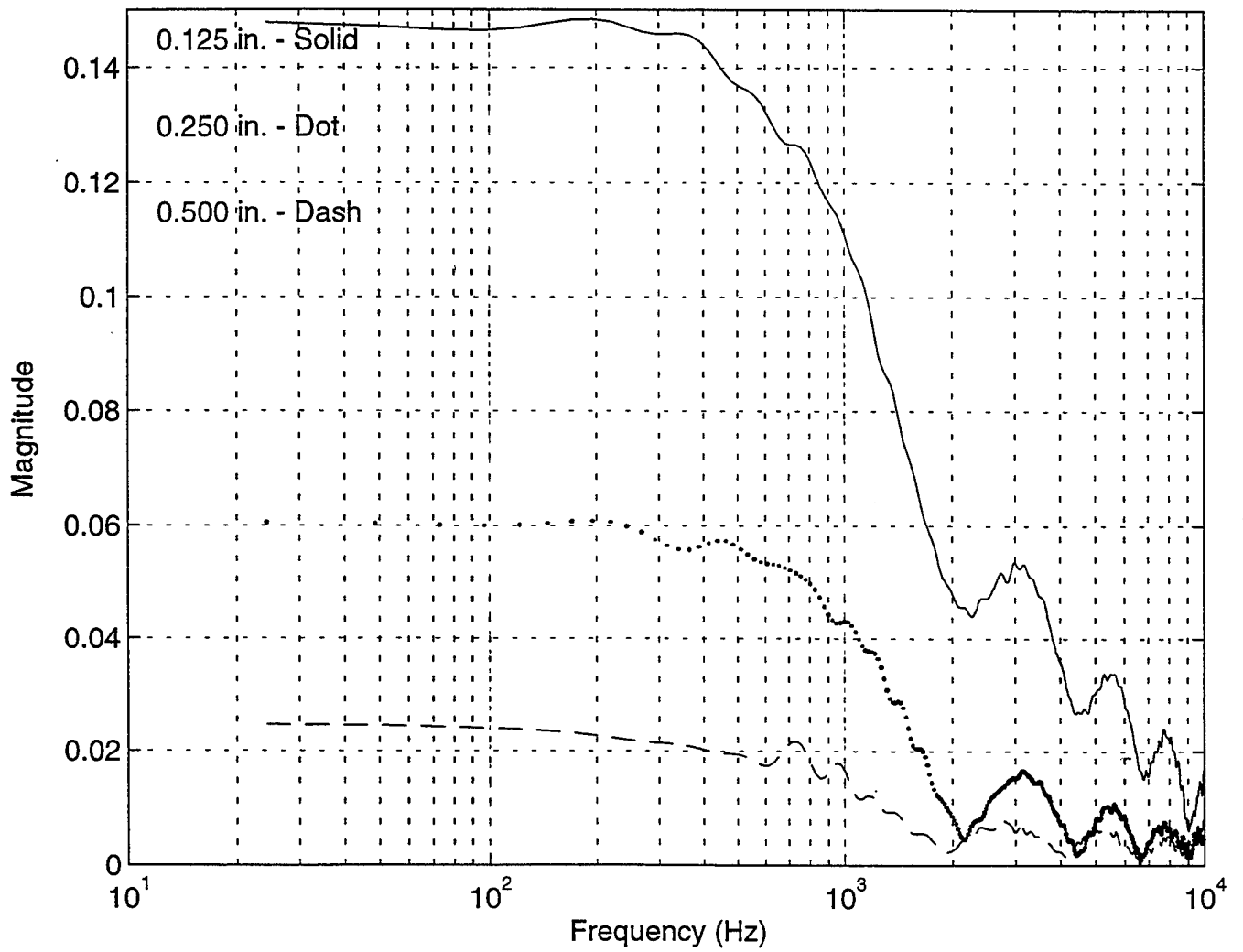
HS II SILICONE RUBBER (PINK) TRANSMITTED FRF



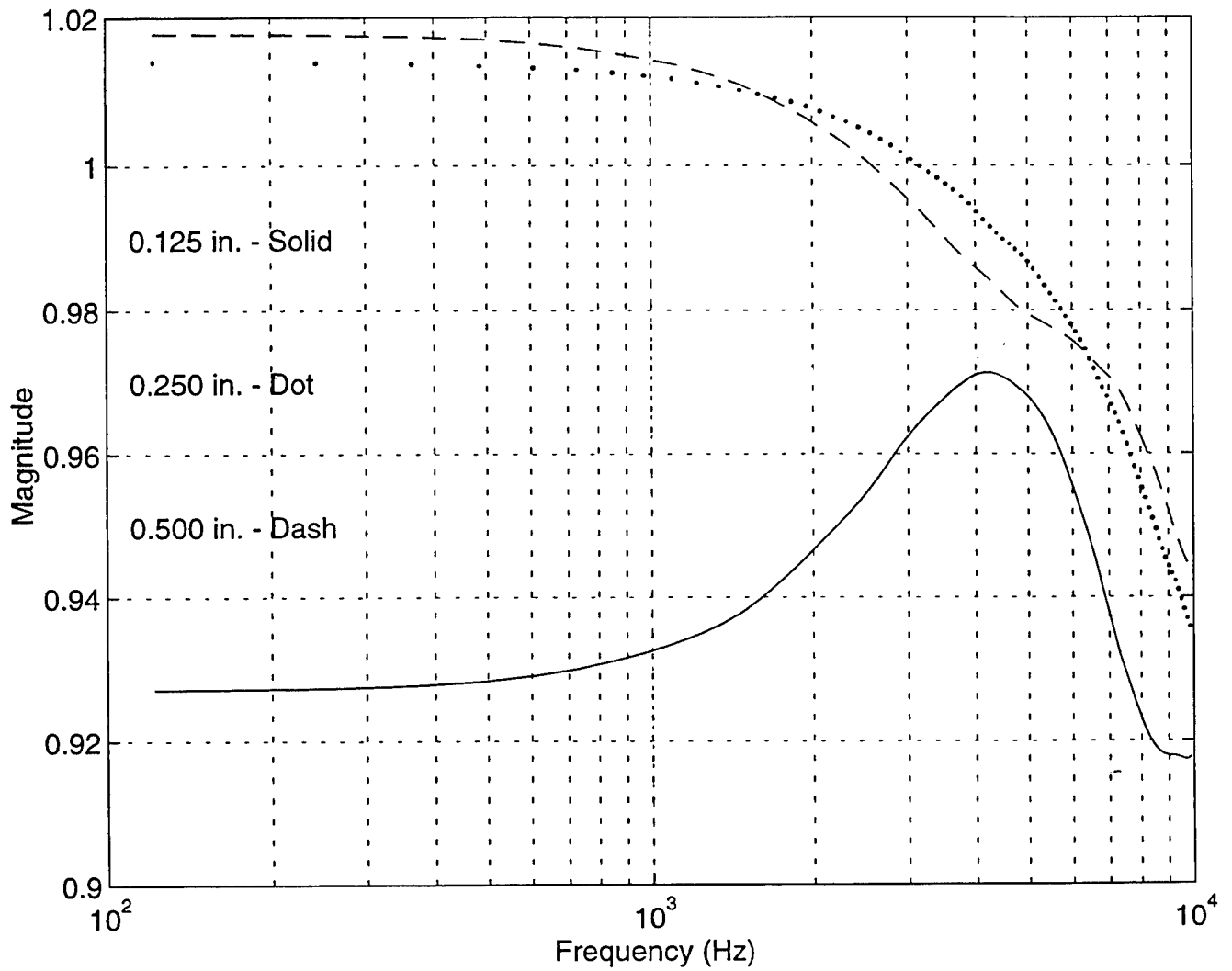
SYLGARD 184 & GMB REFLECTED FRF



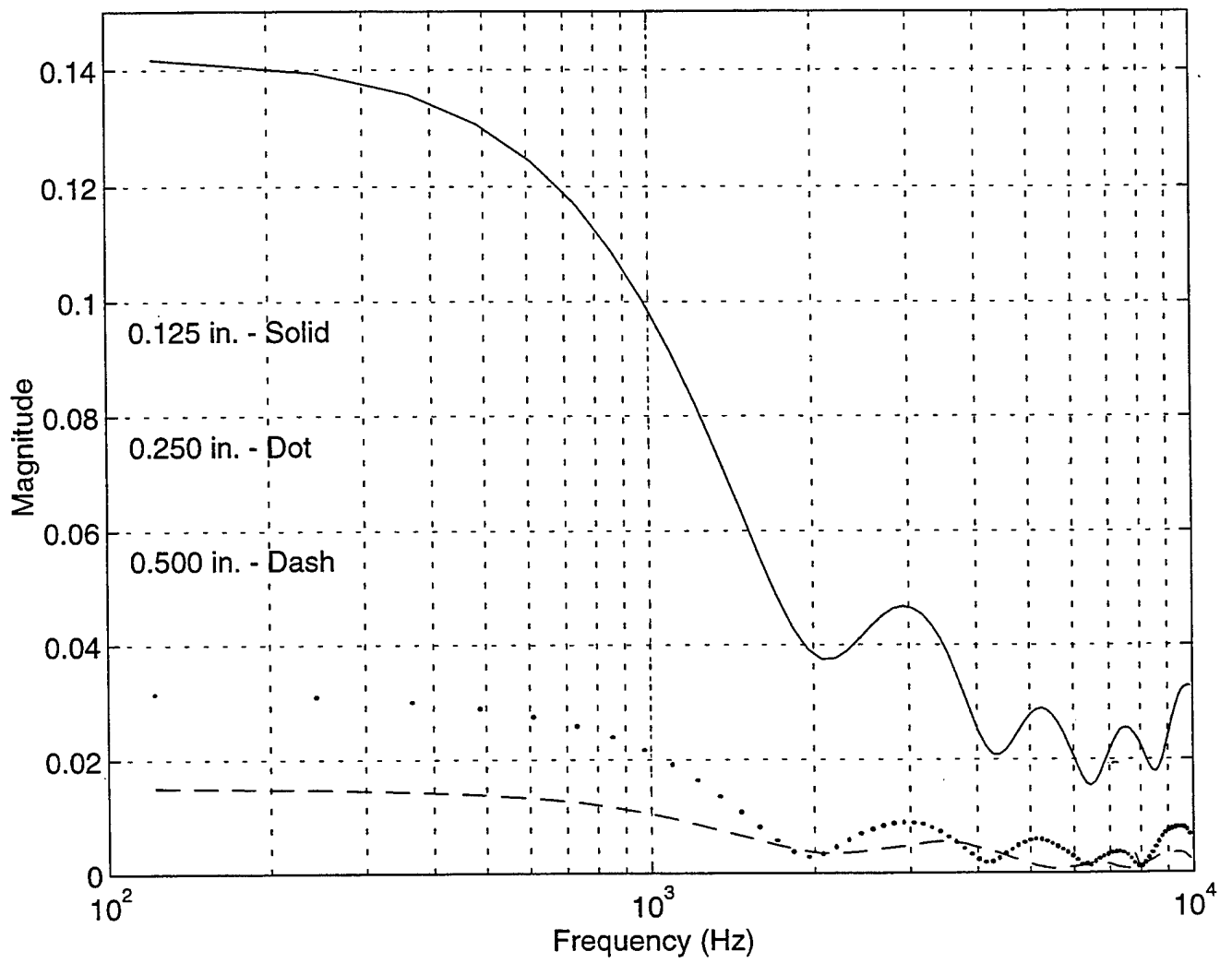
SYLGARD 184 & GMB TRANSMITTED FRF



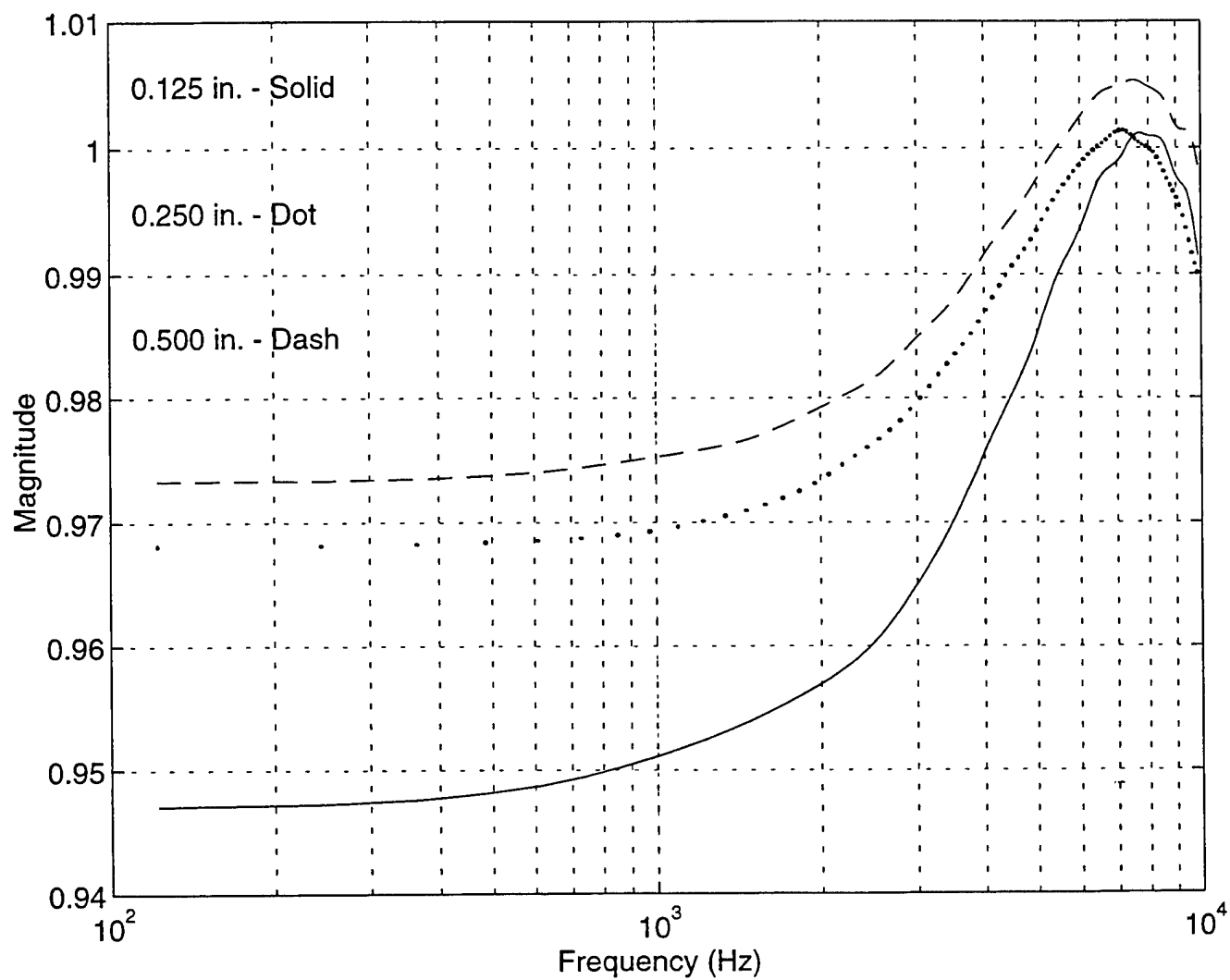
GE RTV 630 REFLECTED FRF



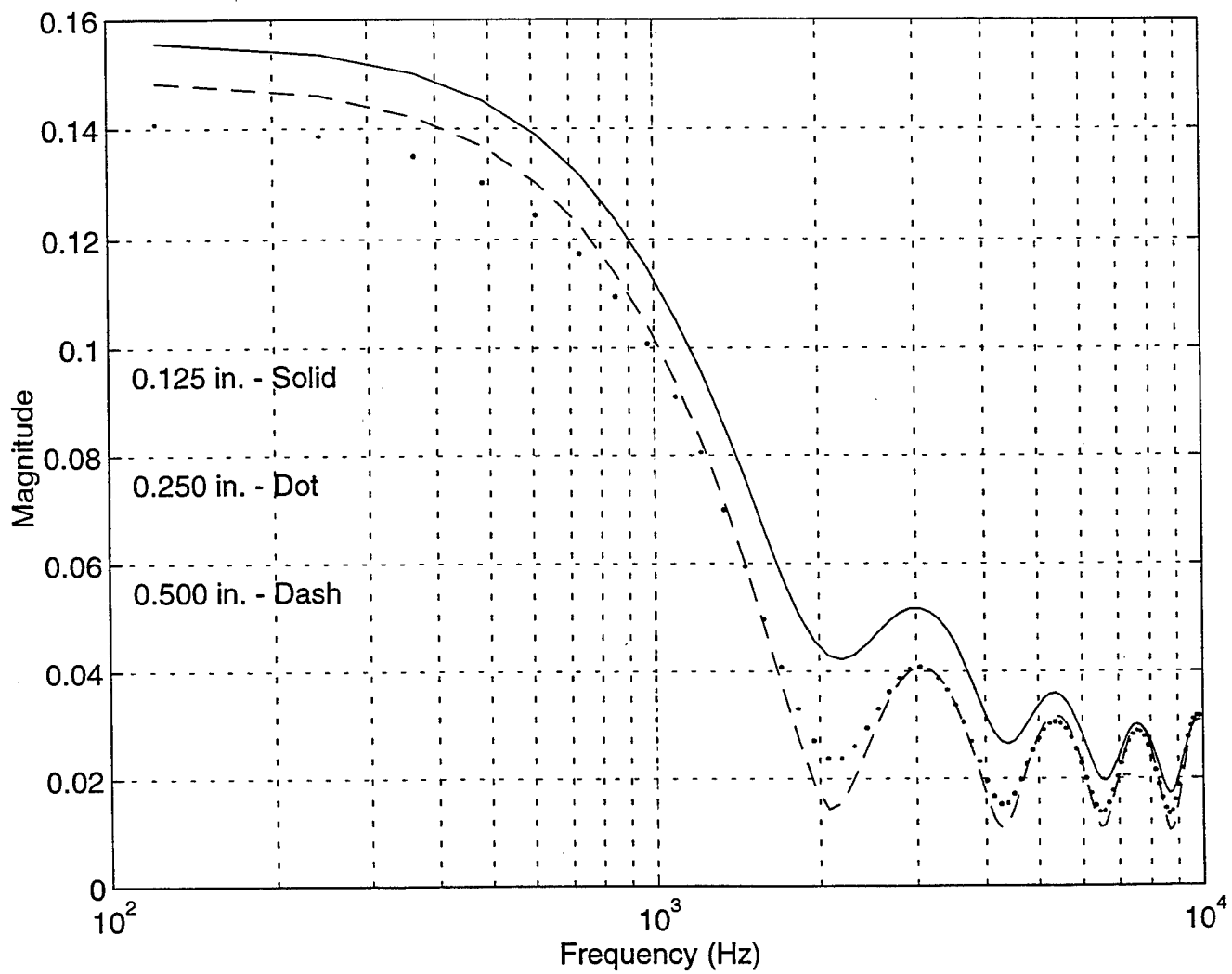
GE RTV 630 TRANSMITTED FRF



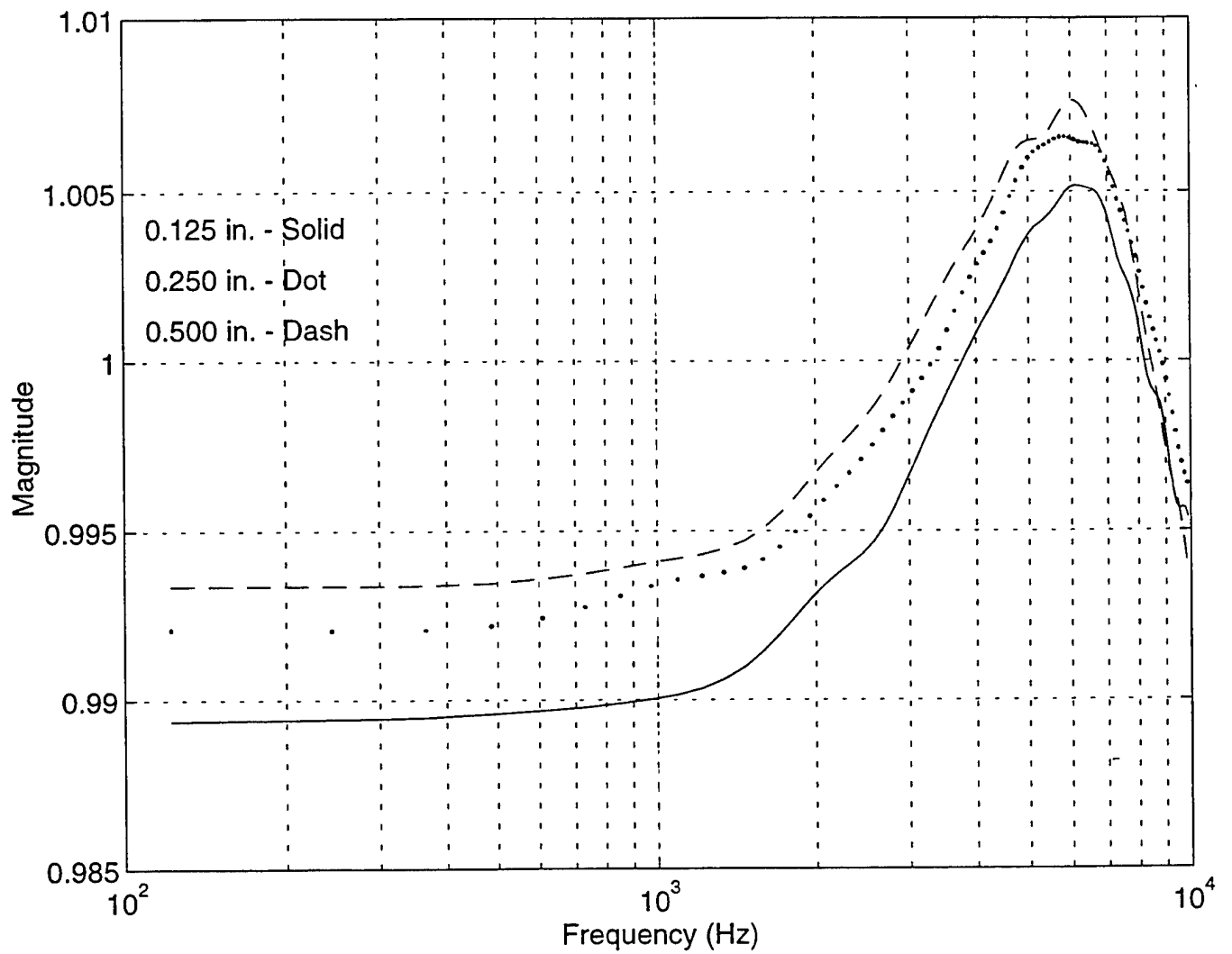
20 LB POLYURETHANE FOAM REFLECTED FRF

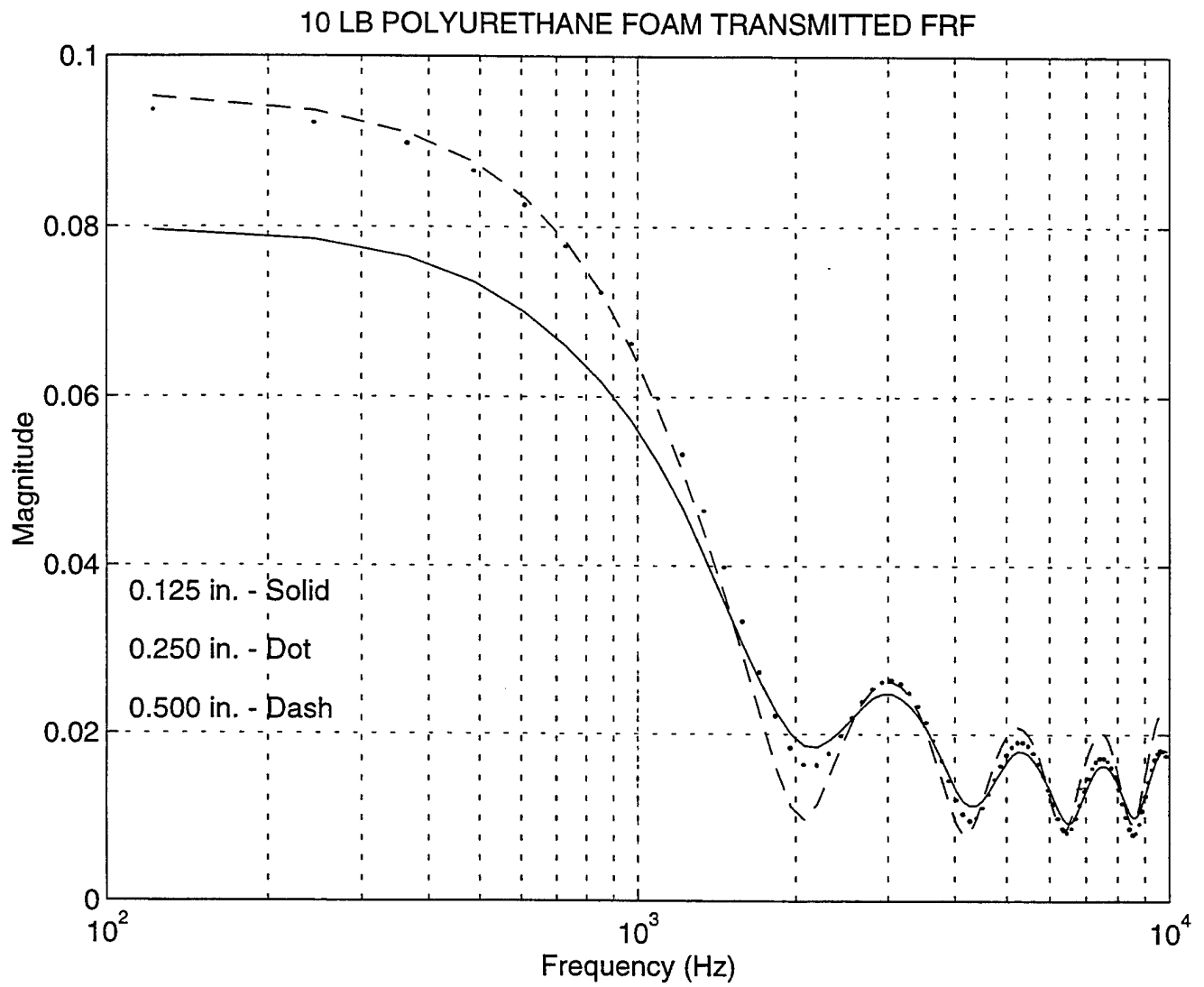


20 LB POLYURETHANE FOAM TRANSMITTED FRF

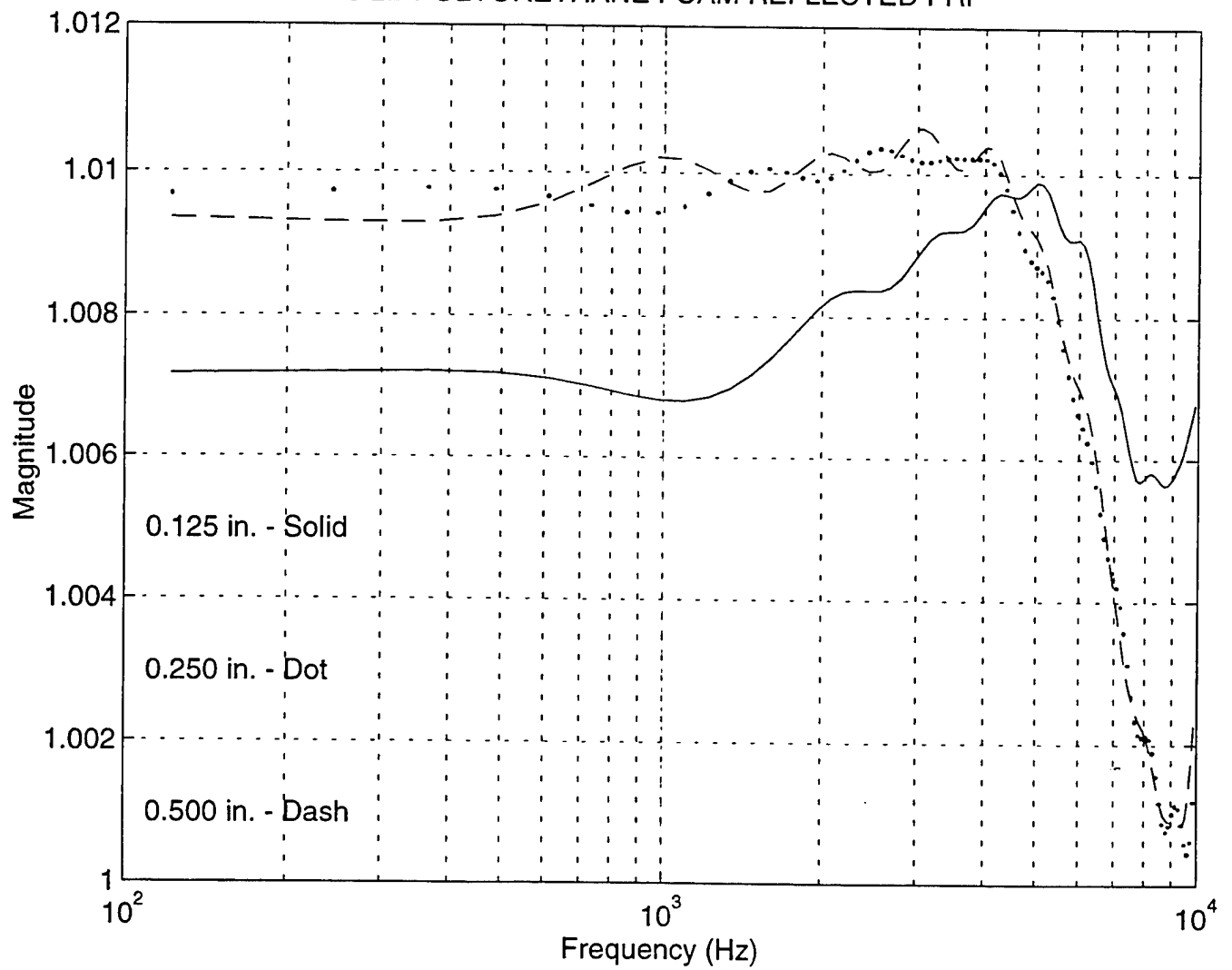


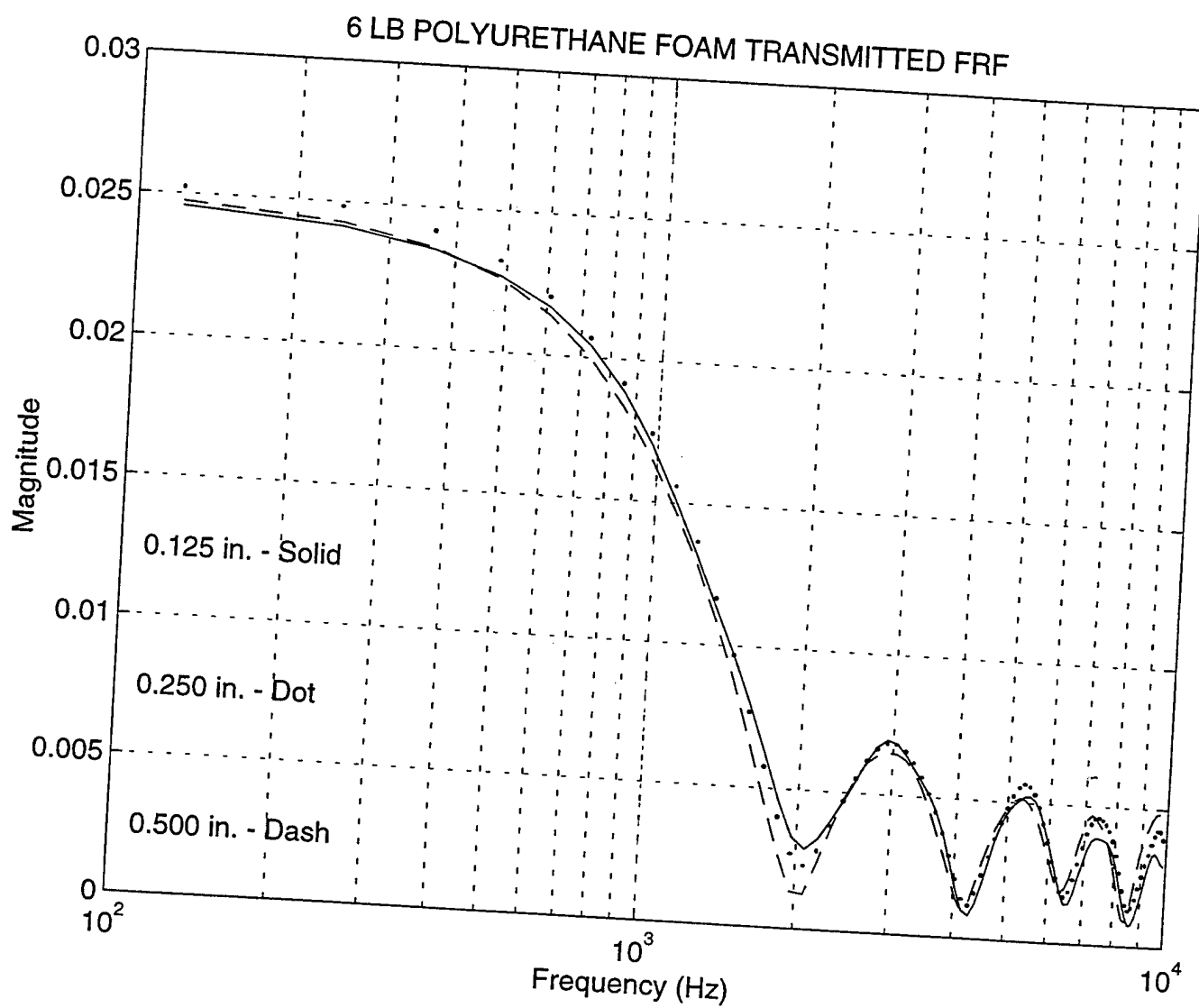
10 LB POLYURETHANE FOAM REFLECTED FRF



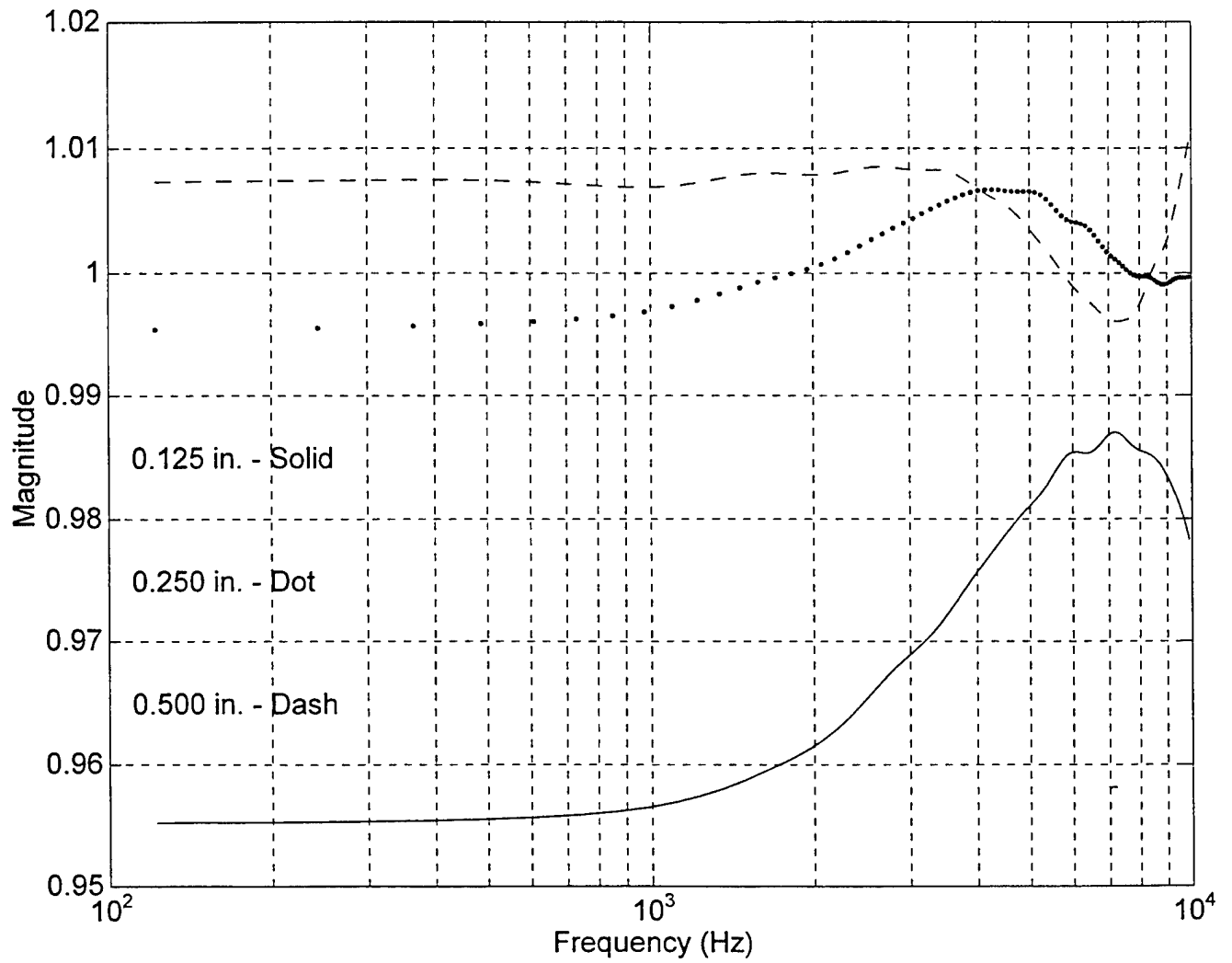


6 LB POLYURETHANE FOAM REFLECTED FRF

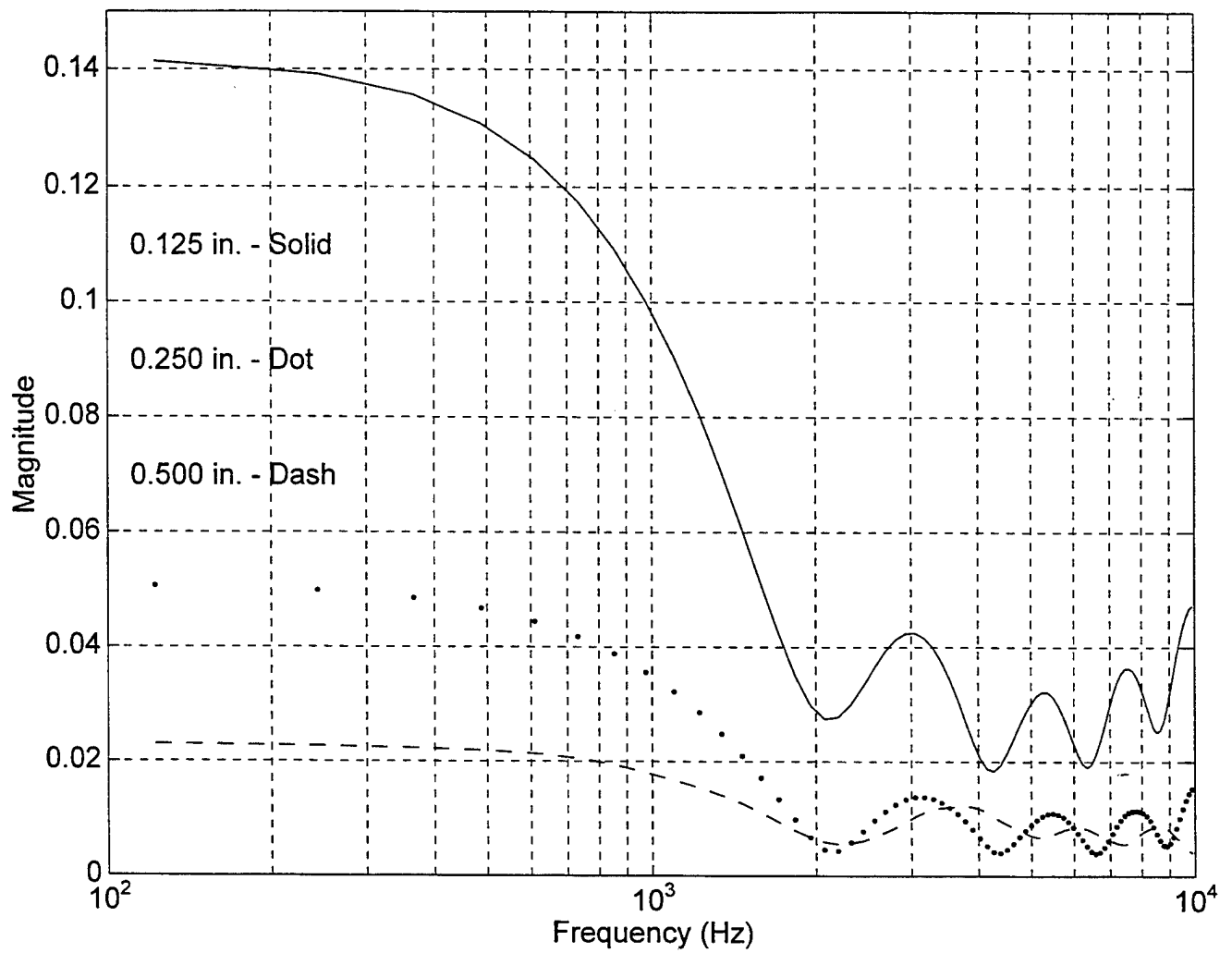




POLYSULFIDE RUBBER 1422 REFLECTED FRF



POLYSULFIDE RUBBER 1422 TRANSMITTED FRF



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