

AD A094847

AFWAL-TR-80-4093

LEVEL 21

2



POLYMERIC MATERIAL TESTING PROCEDURES TO DETERMINE DAMPING
PROPERTIES AND THE RESULTS OF SELECTED COMMERCIAL MATERIAL

Michael L. Drake
Gary E. Terborg
University of Dayton Research Institute
300 College Park Avenue
Dayton, Ohio 45469

July 1980
TECHNICAL REPORT AFWAL-TR-80-4093
15 January 1976 - 31 December 1979

DTIC
SELECTED
SERIALS
10 1981
E

Approved for public release; distribution
unlimited.

DDC FILE COPY

MATERIALS LABORATORY
AIR FORCE WRIGHT AERONAUTICAL LABORATORIES
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

81 2 10 018

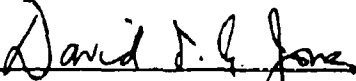
**Best
Available
Copy**

NOTICE

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture use, or sell any patented invention that may in any way be related thereto.

This report has been reviewed by the Office of Public Affairs (ASD/PA) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.


DR. D.I.G. JONES, Project Engineer
Metals Behavior Branch
Metals and Ceramics Division


DR. J.P. HENDERSON, Acting Chief
Metals Behavior Branch
Metals and Ceramics Division

"If your address has changed, if you wish to be removed from our mailing list, or if the addressee is no longer employed by your organization please notify _____, W-PAFB, OH 45433 to help us maintain a current mailing list".

Copies of this report should not be returned unless return is required by security considerations, contractual obligations, or notice on a specific document.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

19 REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM	
1. REPORT NUMBER AFWAL-TR-80-4093	2. GOVT ACCESSION NO. AD-A094	3. RECIPIENT'S CATALOG NUMBER 847	
4. TITLE (and Subtitle) POLYMERIC MATERIAL TESTING PROCEDURES TO DETERMINE DAMPING PROPERTIES AND THE RESULTS OF SELECTED COMMERCIAL MATERIALS		5. TYPE OF REPORT & PERIOD COVERED Technical 1-15-76 to 12-31-79	
6. AUTHOR(s) Michael J. Drake Gary E. Terborg		7. PERFORMING ORG. REPORT NUMBER UDR-TR-80-40	
8. PERFORMING ORGANIZATION NAME AND ADDRESS University of Dayton Research Institute 300 College Park Avenue Dayton, Ohio 45469		9. CONTRACT OR GRANT NUMBER(s) F33615-76-C-5137	
10. CONTROLLING OFFICE NAME AND ADDRESS Materials Laboratory, Air Force Wright Aeronautical Laboratories, Air Force Systems Command, W-PAFB, Ohio 45433		11. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 7351 06 88	
12. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) 7351-06-88 15-1-76-51-1-11		13. REPORT DATE July 1980	
		14. NUMBER OF PAGES 226	
		15. SECURITY CLASS. (of this report) Unclassified	
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE	
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.			
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)			
18. SUPPLEMENTARY NOTES			
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Damping materials, Polymers, Oberst Beam, sandwich beam, bare beam, loss factor, Loss Modulus, Young's Modulus, complex modulus, dynamic modulus, cantilever beam test, constrained layer, free layer.			
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report contains a detailed discussion of the methods and procedures used to determine the damping properties of commercial- ly available polymeric materials. The work was done by the University of Dayton Research Institute, Dayton, Ohio, in partial fulfillment of Air Force Contract Number F33615-76-C-5137 for the Materials Laboratory, Wright-Patterson Air Force Base, Ohio. The work described was conducted during the period January 1976			

DD FORM 1, JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. through December 1979 under the general supervision of Mr. D. H. Whitford, Supervisor of the Aerospace Mechanics Division, and Mr. M. L. Drake, Principal Investigator. The tests were conducted primarily by Mr. G. E. Terborg and Mr. J. Graham.

cont. All the data from the testing is contained in the Appendices which include the bare beam results, the coated beam results, and the temperature nomogram for each material tested.

PREFACE

This report contains a detailed discussion of the methods and procedures used to determine the damping properties of commercially available polymeric materials. The work was done by the University of Dayton Research Institute, Dayton, Ohio in partial fulfillment of Air Force Contract Number F33615-76-C-5137 for the Materials Laboratory, Wright-Patterson Air Force Base, Ohio. The project, task, and work unit numbers are 7351, 06, 88. The work described was conducted during the period January 1976 through December 1979 under the general supervision of Mr. D. H. Whitford, Supervisor of the Aerospace Mechanics Division, and Mr. M. L. Drake, Principal Investigator. The tests were conducted primarily by Mr. G. E. Terborg and Mr. J. Graham.

All the data from the testing is contained in the Appendices, which include the bare beam results, the coated beam results, and the temperature nomogram for each material tested.

Accession For	
NTIS GRA&I	X
DTIC TAB	
Unannounced	
Justification	
By	
Initials	
Approved for Release	
Authority	
1	
A	

TABLE OF CONTENTS

SECTION	PAGE
I INTRODUCTION	1
II VIBRATING BEAM TESTING TECHNIQUE	2
2.1 Set Up the Test	2
2.1.1 Select Test Instruments	2
2.1.2 Select Appropriate Specimen Beams	5
2.1.3 Review Solution Equations	5
2.1.4 Review Specimen Beam Criteria	8
2.2 Prepare and Test Bare Beams	10
2.2.1 Prepare Bare Beams	10
2.2.2 Test Bare Beams	12
2.3 Prepare Specimen Beams	15
2.3.1 Sandwich Beams	15
2.3.2 Free-Layer Beams	23
2.4 Testing the Specimen Beams	23
2.4.1 Carry Out Test Procedures	23
2.4.2 Check Possible Sources of Error	26
III PRESENTATION OF DATA	34
REFERENCES	37
APPENDIX A Bare Beam Test Data	38
APPENDIX B Polymeric Materials Test Data	67

LIST OF ILLUSTRATIONS

FIGURE		PAGE
1	Block Diagram of the Beam Test Fixture	3
2	Vibrating Beam Test Specimen	4
3	Sandwich Beam Specimen with Recommended Specimen Dimensions	9
4	Step Block Orientation	11
5	Test Fixture with Beam in Place	13
6	Response Spectra of a Bare Beam	14
7	Bare Beam Characteristic Modal Plot for Mode 3	16
8	Position of Beam on Glass Plate During Cleaning Procedure	18
9	Placement of Beam on Polymeric Material	19
10	Detailed Assembly Diagram of a Typical Sandwich Beam	20
11	Sandwich Beam Final Assembly Procedure	22
12	Response Spectra of a Coated Beam	24
13	Typical Graphs of η_n , f_n , and f_{on} Versus Temperature	28
14	Typical Temperature Nomogram of Polymeric Material Test Data	29
15	Curve Fit Parameters for Storage Modulus	31
16	Curve Fit Parameters for Loss Factor	33
17	Reduced Temperature Nomogram for Specific Damping Material with Hypothetical Acceptance Limits Superimposed	35

LIST OF SYMBOLS

A, B	nondimensional parameters
b	breadth of beam
C	parameter which defines the curvature of the damping peak
D	suffix denoting damping material
e	E_D/E ; the modulus ratio
E_1	Young's Modulus of beam material
E_D	real part of complex Young's Modulus of damping material
E'_D	material storage modulus
f	frequency (Hertz)
f_{on}	n^{th} natural frequency of bare beam
f_{cn}	n^{th} resonant frequency of coated beam
f_L	lower half-power bandwidth frequency
f_R	higher half-power bandwidth frequency
f_{red}	reduced frequency value of the damping peak
f_{rom}	reduced frequency value of inflection point
f_r	reduced frequency
$\Delta f = f_R - f_L$	total half-power bandwidth
G_D	real part of complex shear modulus of damping material
h	thickness of beam
h_D	thickness of polymeric material
h_r	thickness of root
L	length of beam
M_i	Young's Modulus value of the lower horizontal asymptote
M_{rom}	the inflection point of the storage modulus curve as read on the Young's Modulus scale
N	slope of the curve at the inflection point
S_h	slope of the asymptotic line for high values of reduced frequency
S_l	slope of asymptotic line for low values of reduced frequency
$n = h_p/h$	thickness ratio (also mode number)

LIST OF SYMBOLS (Concluded)

T	temperature
T_0	reference temperature
Z^2	nondimensional parameter
α_T	temperature shift factor
η	loss factor
η_D^1	shear loss factor
η_{frot}	loss factor value of the damping peak
η_n	loss factor of beam specimen in the n^{th} mode
η_D	extensional loss factor of damping material
l	length of beam root
λ_n	wavelength of n^{th} beam mode
ϵ_n	n^{th} eigen value for beam
ρ_n	density of beam; also density in general
ρ_1	density of damping material
ω_D	circular frequency
ω	n^{th} circular frequency of coated beam
ω_n	n^{th} circular frequency of bare beam

SECTION 1

INTRODUCTION

Vibratory energy is a source of acoustic and resonant fatigue failures in aerospace structures. The problem of how to dissipate this energy has long been an important consideration in aircraft design. It is well known that polymeric materials with high loss factors, when used in the form of a coating or in a constrained-layer damping treatment, can considerably reduce resonant vibration problems [1, 2]. This report describes the vibrating beam testing technique used by the University of Dayton Research Institute (UDRI) to determine the damping properties of commercially available materials. Accurate determination of these properties is an essential first step in using damping technology to control aircraft design problems.

This report has two main purposes. First the report explains the vibrating beam test technique. This step-by-step explanation (which appears as Section II) includes test instrumentation and set-up, specimen criteria, specimen preparation, and data collection procedures. Second, the report records the results of tests on twenty-eight polymeric materials. Section III of this report introduces these results. The data are included in the Appendices.

SECTION II

VIBRATING BEAM TESTING TECHNIQUE

The following information is a step-by-step explanation of how to set up and conduct vibrating beam tests.

2.1 SET UP THE TEST

2.1.1 Select Test Instruments

The instruments used in a typical UDRI vibrating beam test are shown in Figure 1. This set-up can be used to test four types of specimen beams: uniform; "Oberst;" "modified Oberst;" and, sandwich. Each of these beams is shown in Figure 2.

A continuous sine sweep oscillator is used to excite an Electro 3030HTB transducer (manufactured by Electro Corporation, Sarasota, Florida). The transducer excites the specimen beam. Responses are picked up by an Endevco B22 miniature accelerometer (manufactured by Endevco Corporation, San Juan Capistrano, California). An oscilloscope is used to monitor both excitation and response wave forms during the tests.

The UDRI test set-up incorporates an x-y plotter, used to plot response spectra graphs comprised of transverse acceleration versus frequency and to note resonant frequencies (f_n) and half-power bandwidths (Δf_n) for selected temperatures. These measurements are used to calculate the complex Young's modulus $E_D (1 + i\eta_D)$ for an applied layer of damping material, or the shear modulus $G_D (1 + i\eta'_D)$ for damping material in the core of a sandwich beam. The measurements must be taken carefully because small errors in measured quantities can lead to very large errors in the calculated values of G_D and η'_D or E_D and η_D .

Advantages of this test set-up method include: (a) the system is reasonably simple to use; (b) errors can be assessed and kept within limits; (c) a single specimen can be used to cover a wide band of frequencies and temperatures. A disadvantage of this method is that only low strain level data can be obtained.

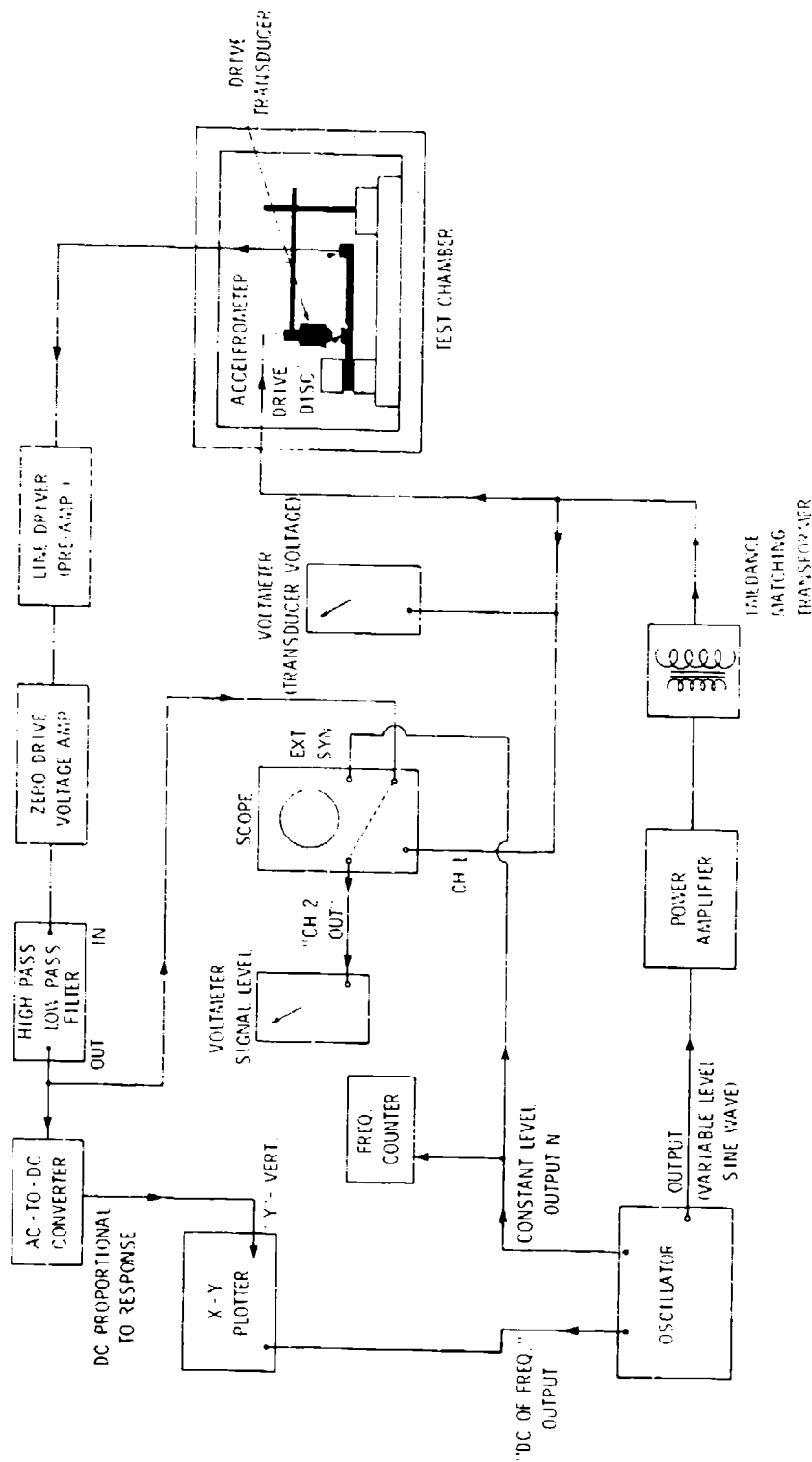


Figure 1. Block Diagram of the Beam Test Fixture.

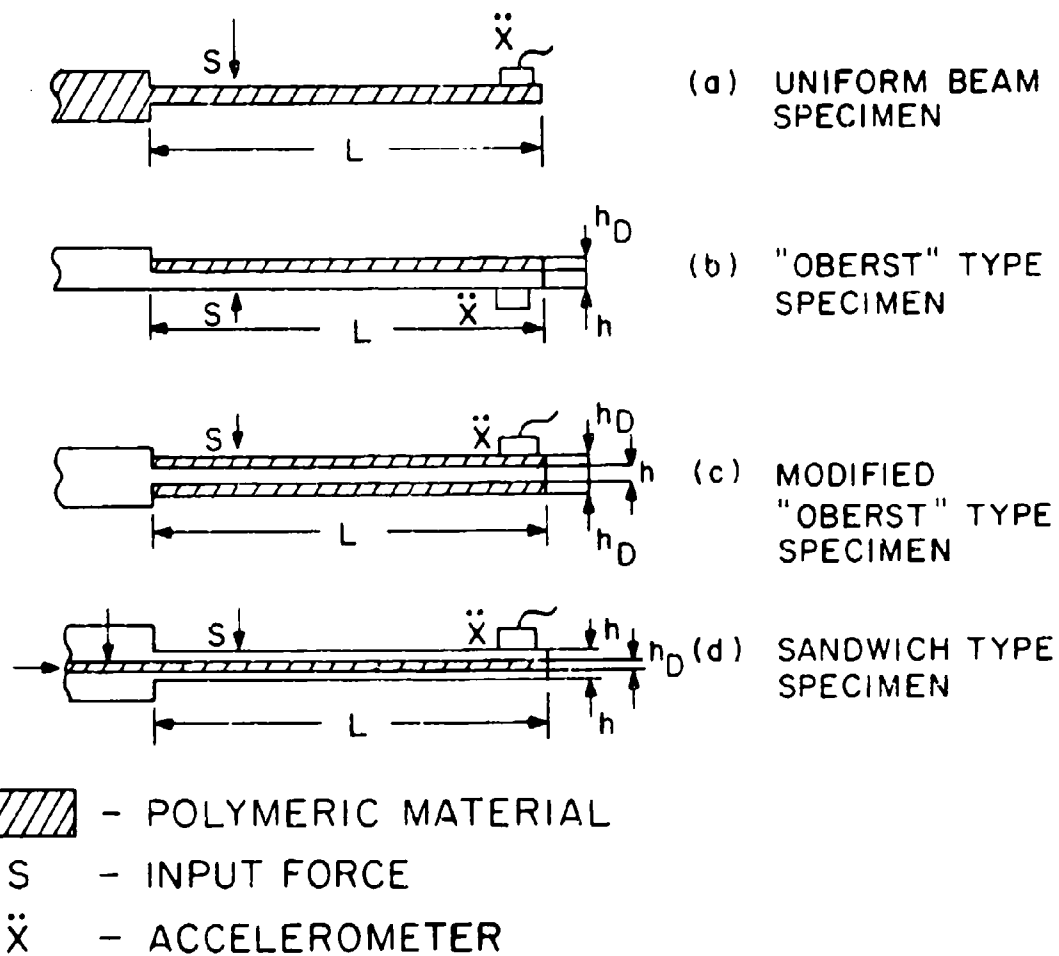


Figure 2. Vibrating Beam Test Specimens.

2.1.2 Select Appropriate Specimen Beams

Selecting the appropriate specimen beam for testing a particular material depends on the following criteria:

(a) The uniform beam is used for stiff materials, such as epoxies and plastics, which are self-supporting at ordinary temperatures, that is, have Young's moduli E_D greater than 10^6 psi (6.89×10^9 N/m²).

(b) The "Oberst" (nonsymmetrical) or modified Oberst (symmetric) beams are used for materials in which $|E_D|$ is between 10^4 lb/in² (6.89×10^7 N/m²) and 10^6 lb/in² (6.89×10^9 N/m²). As E_D falls toward the lower limit, h_D/h for these beams can increase.

(c) The symmetric sandwich beam is used for materials in which $|E_D|$ is between 10 lb/in² (6.89×10^4 N/m²) and 10^5 lb/in² (6.89×10^8 N/m²). Since the sandwich beam relies on shear of the damping material between two supporting beams, it yields better results for this range of values of E_D .

2.1.3 Review Solution Equations

The following equations are used to calculate the value of E_D or G_D for various materials, according to the specimen beam used:

(a) For an "Oberst" beam (with damping material coated on only one side of the beam), the complex Young's modulus is derived from formulae developed originally by Oberst [3]. These are:

$$Z^2 = 1 + \left[\frac{e D^2 h_D}{\rho h} \right] \left[\frac{f_n}{f_{on}} \right]^2 = \frac{1 + 2ne(2 + 3n + 2n^2) + e^2 n^4}{1 + ne} \quad (1)$$

$$\frac{\eta_n}{\eta_D} = \left[\frac{3 + 6n + 4n^2 + 2en^3 + e^2 n^4}{1 + 2ne(2 + 3n + 2n^2) + e^2 n^4} \right] \quad (2)$$

where $e = E_D/E$ and $n = h_D/h$. In these formulae, Z^2 is calculated from the measured resonance frequency (f_n) of the n^{th} mode of the damped beam and the measured frequency (f_{on}) of the undamped beam;

e is then deduced from equation (1) and η_D is calculated from equation (2), this value of e, and the measured value of the modal damping η_n . In fact, after some algebraic manipulation, the following equation for e in terms of Z^2 and n can be derived:

$$e = \left[-(4 + 6n + 4n^2 - Z^2)n + \sqrt{(4 + 6n + 4n^2 - Z^2)^2 n^2 + 4n^4 (Z^2 - 1)} \right] / 2n^4.$$

These equations give reasonably accurate results provided that $Z^2 - 1 \geq 0.1$. If $Z^2 < 1.0$, the error in e resulting from an error in Z^2 becomes prohibitively high.

(b) For a "modified Oberst" beam (with damping material coated symmetrically on both sides of the beam) the complex Young's modulus is derived from formulae (2):

$$E_D = E(Z^2 - 1) / [en^3 + 12n^2 + 6n] \quad (3)$$

$$\eta_D = \eta_n Z^2 / (Z^2 - 1) \quad (4)$$

where

$$Z^2 = (1 + 2\rho_D n/\rho) (f_n/f_{on})^2.$$

Again, the equations give reasonably accurate results whenever $Z^2 - 1 \leq 0.1$.

(c) For the symmetrical sandwich beam, calculation of values of the shear modulus (G_D) and the loss factor (η_h) for the damping material is based on a set of equations developed by Ross, Kerwin, and Ungar [4]. In current notation the now classical equations are:

$$(EI)_e^* = \frac{Eh^3}{6} + Eh(h + h_D)^2 \frac{g^*}{1 + 2g^*} \quad (5)$$

when $(EI)_e^*$ is the equivalent complex flexural rigidity of the three-layer sandwich [$(EI)_3 (1 + i\eta_n)$] and g^* is the shear parameter given by:

$$g^* = \frac{G_D^* L^2}{Ehh_D^2 \eta_n} \quad (6)$$

Equations (5) and (6) may be solved to give simple algebraic equations for G_D and η_D' , namely:

$$G_D = \frac{[(A - B) - 2(A - B)^2 - 2(A\eta_n)^2][Eh h_D \xi_n^2 / L^2]}{(1 - 2\Lambda + 2B)^2 + 4(\Lambda\eta_n)^2} \quad (7)$$

$$\eta_D' = A_n / [A - B - 2(A - B)^2 - 2(A\eta_n)^2], \quad (8)$$

where

$$\Lambda = (\xi_n / f_{on})^2 (2 + \rho_D h_D / \rho h) (B/2), \quad (9)$$

and

$$B = 1/6(1 + h_D/h)^2. \quad (10)$$

For most polymeric materials in the rubbery and transition regions, $E_D \sim 3G_D$ and $\eta_D \sim \eta_D'$ [5].

For tests covered by this report, the first seven eigen values of the system are given by:

$$\begin{aligned} \xi_1^2 &= 3.515 \\ \xi_2^2 &= 22.0345 \\ \xi_3^2 &= 61.6970 \\ \xi_4^2 &= 120.902 \\ \xi_5^2 &= 199.866 \\ \xi_6^2 &= 298.560 \\ \xi_7^2 &= 416.990 \end{aligned} \quad (11)$$

The eigen values define the relationship between the resonant frequencies of the uncoated individual beams and the modulus E by the classical relationship

$$\rho h \omega_{on}^2 L^4 / (Eh^3/12) = \xi_n^4. \quad (12)$$

2.1.4 Review Specimen Beam Criteria

To obtain satisfactory test results, specimen beams must be prepared carefully. Paying careful attention to specimen dimensions helps avoid machining difficulties and helps to insure accurate test results. Figure 3 shows a typical bare beam, with appropriate dimensions indicated.

Recommended materials for specimen beams depend on the test temperatures. For low temperature tests (below 300°F or 149°C), aluminum or steel beams can be used. It is important to note that if a stiffer beam is used, clamping conditions become more critical.

For high temperature tests (up to 2,000°F or 1,093°C), steel or superalloy beams must be used.

Recommended beam dimensions are as follows:

Length of beam	$L = 7 \text{ in} \pm 0.002 \text{ in} (177.8 \text{ mm} \pm 0.5 \text{ mm})$
Length of beam root	$\ell = 1.125 \text{ in} \pm 1/64 \text{ in} (28.58 \text{ mm} \pm 0.40 \text{ mm})$
Thickness of beam	$h \geq 0.05 \text{ in}; h \leq 0.08 \text{ in}; h \pm 0.0005 \text{ in}$ $(1.278 \text{ mm} \pm 0.018 \text{ mm})$
Thickness of root	$h_r = 0.25 \text{ in} \pm 0.005 \text{ in} (6.35 \text{ mm} \pm 0.12 \text{ mm})$
Breadth of beam	$b = 0.45 \text{ in} \pm 0.001 \text{ in} (11.43 \text{ mm} \pm 0.03 \text{ mm})$
Thickness of damping material layer	$h_D \geq 0.004 \text{ in} (0.127 \text{ mm})$

Tolerances are as stated. In sandwich beams, two dimensions are particularly important. The tolerances for the beam thickness (h) and the thickness of the damping material (h_D) should be carefully noted.

For sandwich beams, the thickness (h) should not be less than 0.05-inch (1.27 mm). Less thickness is likely to cause machining difficulties, and reduces the likelihood of well-matched beam pairs. For effective sandwich beam tests, the two beams that form the matched pair must have resonant frequencies (f_{on}) that match within ± 1.0 percent. Even small differences in thickness can lead to large differences in resonant frequency. For example, if a hypothetical Beam 1 had thickness $h_1 = 0.070\text{-inch} \pm 0.0005$,

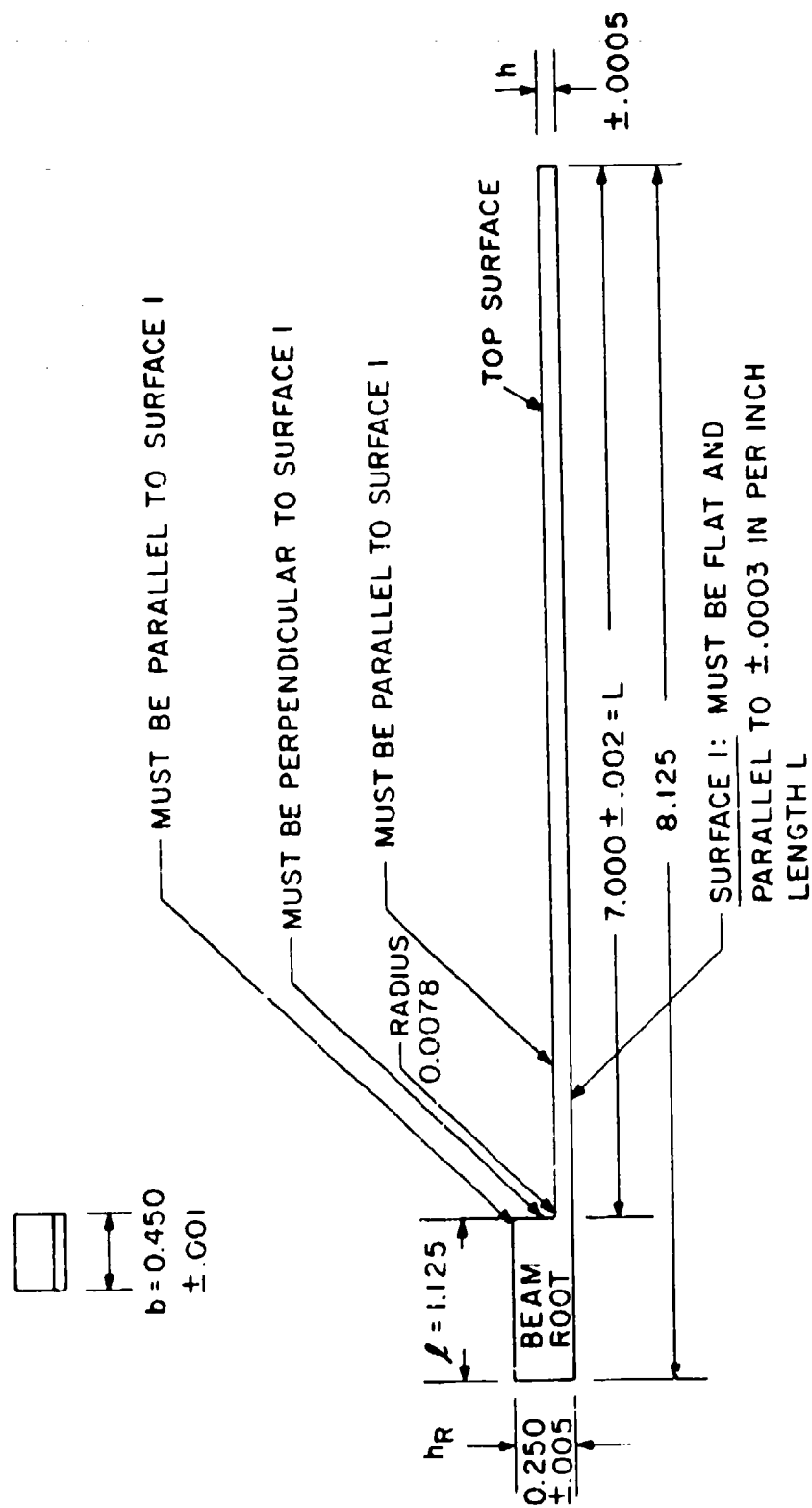


Figure 3. Sandwich Beam Specimen with Recommended Specimen Dimensions.

and a hypothetical Beam 2 had thickness $h_2 = 0.070\text{-inch} - 0.0005$, the n^{th} resonant frequency of each beam would differ by the ratio:

$$\frac{0.070 + 0.0005}{0.070 - 0.0005} = \frac{0.0705}{0.0695} = 1.0144$$

which represents a difference of over 1.4 percent. At a hypothetical frequency $f_n = 1,000$ Hz, the difference in this case could be as high as 14 Hz, which is unacceptable. Therefore, tolerances for each pair of beams must fall within the above stated limits at all points along each beam in the pair. Beams must be matched in pairs as they are made, and a vibration test must be used to verify this matching.

The thickness of the damping material (h_p) should not be less than 0.004-inch (0.127 mm). Preferably the damping material should be thicker; otherwise, it is difficult to control the dimensions of the composite specimen beam.

2.2 PREPARE AND TEST BARE BEAMS

2.2.1 Prepare Bare Beams

(a) Collect the batch of beams to be tested. It is best to test all beams in a particular machine shop batch (that is, beams of equal geometric dimensions and metallurgical composition) together, and to plot data from these tests on the same set of graphs. This makes it easier to select matched pairs of beams for sandwich beam specimens.

(b) Glue a rectangular step block to the bottom of the bare beam as shown in Figure 4. The step block should be made of the same metal as the bare beam. The step block should be the same width as the bare beam and the same length as the root of the bare beam.

Mount the step block on the flat side of the beam, directly above the step joint. The front surface of the step block must be in the same plane with the step joint, with the sides of the step block straight and parallel to the beam.

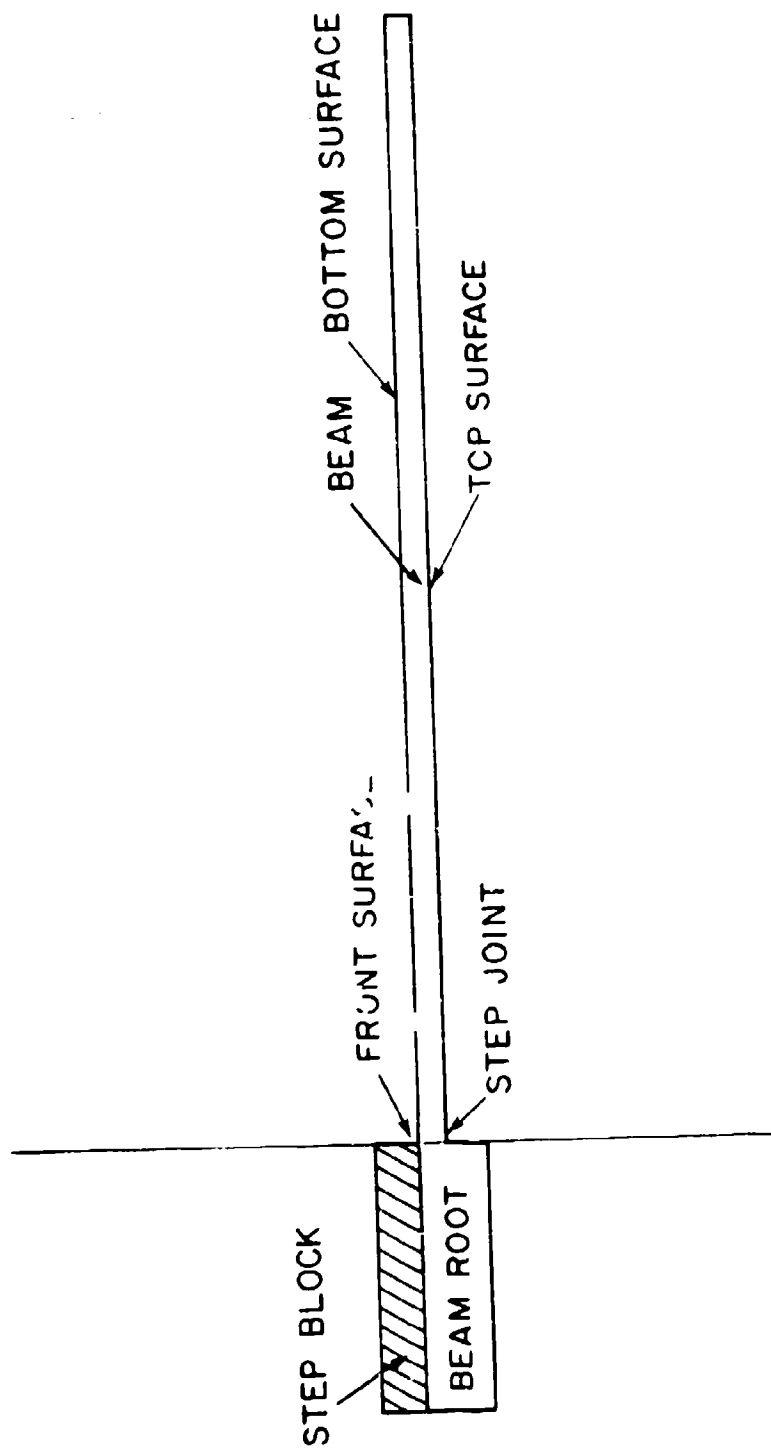


Figure 4. Step Block Orientation.

The glue used for all phases of the vibrating beam test should be a good, quick-drying cyanoacrylate epoxy, such as Loctite 404. This glue is effective for tests at temperatures ranging from -50°F to $+225^{\circ}\text{F}$ (-46°C to $+108^{\circ}\text{C}$). For testing at greater temperature ranges a higher temperature glue should be used, such as Loctite 306.

(c) Glue the magnetic drive disk to the beam. When non-magnetic beams are used, the high μ excitation disk is mounted near the root end of the beam to minimize the effect of mass loading on the beam being tested. The excitation disk mass is more than the accelerometer mass. Place the drive disk approximately 1.25-inch (3.175 cm) from the beam root. This step is not necessary if the test beam is made of a magnetic material which will maintain its magnetic properties over the temperature range of the test.

(d) Glue the accelerometer to the beam. Place the accelerometer approximately 0.125-inch (0.3175 cm) from the free end of the beam.

(e) Place thermocouple in root of the beam or on the base plate of the fixture. Either location is acceptable.

(f) Place the bare beam in the test fixture as shown in Figure 5. Make sure the front surface of the step joint or root is clamped securely within the test fixture, and does not protrude out of the fixture. Make sure the beam is perpendicular to the front edge of the clamping block.

(g) Check the system operation by taking frequency sweep and noting locations of resonant frequencies of the specimen beam. Figure 6 shows typical response spectra. For good results, each peak should be distinct, and should rise above the "background" by 10 db or more. If the "rising" is less than 10 db, it may be difficult to obtain satisfactory test data from a given mode.

2.2.2 Test Bare Beams

(a) Take frequency scans between 10 Hz and 10 KHz. Test at temperature ranging from -100°F to $+300^{\circ}\text{F}$ (-73°C to $+150^{\circ}\text{C}$). Take temperatures at intervals of 50°F (28°C).

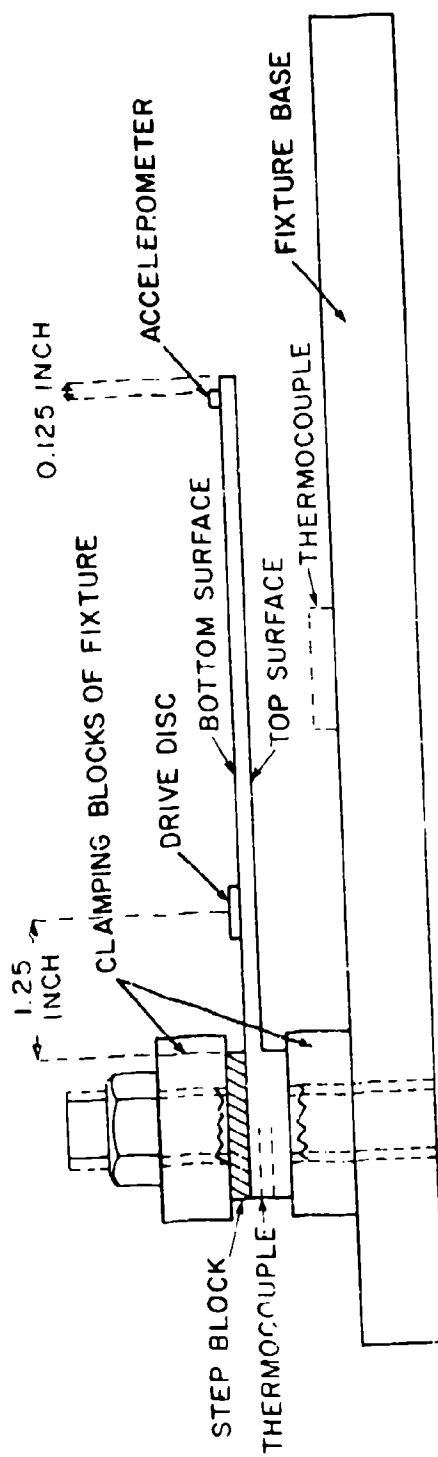


Figure 5. Test Fixture with Beam in place.

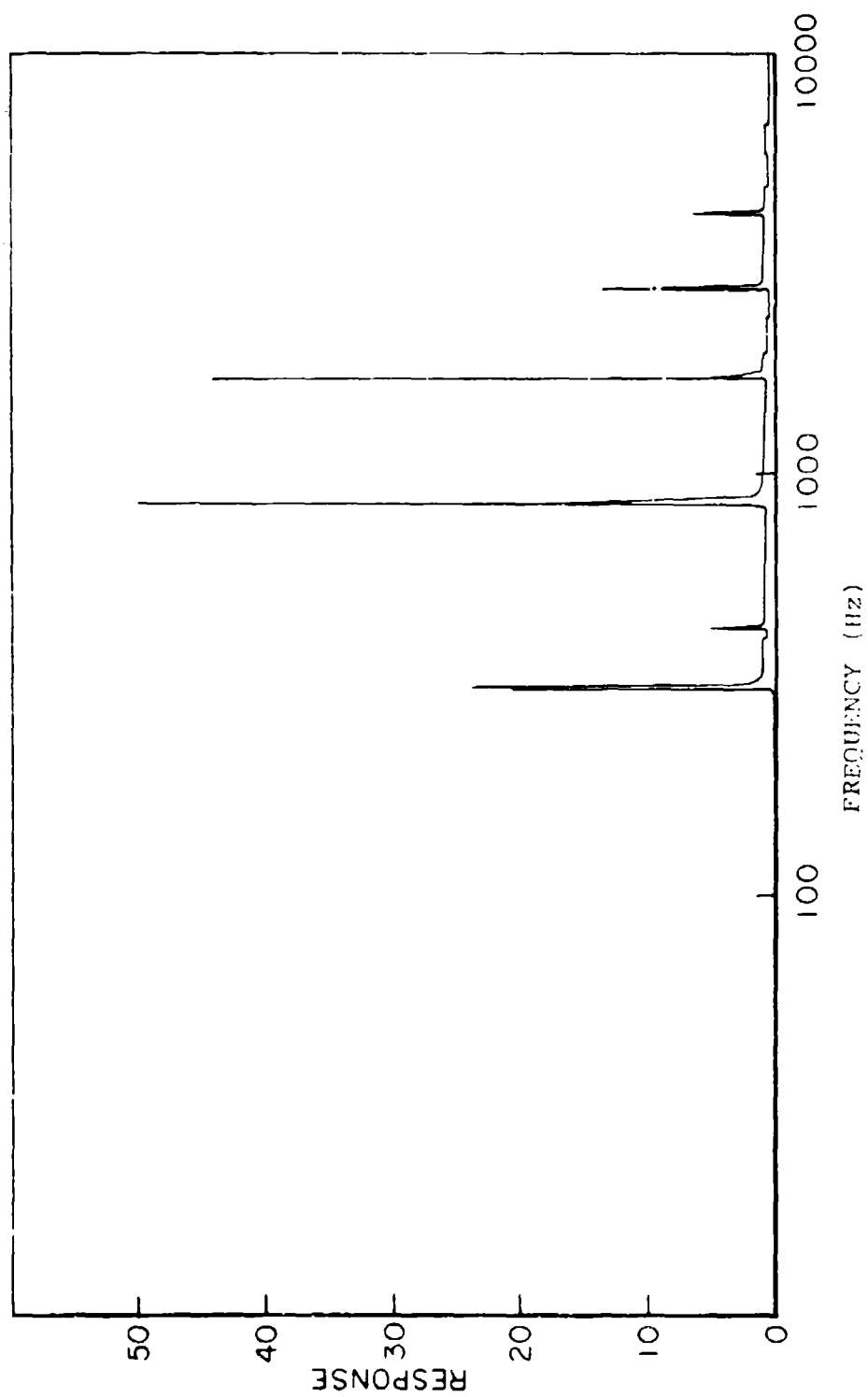


Figure 6. Response Spectra of a Bare Beam.

(b) Note resonant frequencies for each mode. If any interference modes, i.e., peaks in the response curve caused by 60 cycle noise, external excitation, or instrumentation noise, appear on the graph, verify the true resonance of the beam by comparing the respective frequency ratios to the respective ratios of the eigen values.

(c) Plot the modal data points. First divide the center frequencies of each mode (f_{on}) by their respective eigen values (Λ_n). Then plot the result versus temperature for each mode.

(d) Draw a line through all plotted data points. This helps determine frequencies for other unmeasured temperatures.

If sandwich beams are to be prepared, continue with the following steps:

(e) Select matched pairs of beams. Two beams whose characteristic curves lie very close together may be considered a matched pair. Figure 7 shows typical data for a matched pair of beams.

(f) Calculate the average natural frequency for the sandwich beam pair (refer to Figure 7). First draw an "average line" between the plots of the beams in the matched pair. Then read a value from this line, at a given temperature, and multiply this value by the respective eigen value. The result is the average natural frequency (f_n) for the sandwich beam.

2.3 PREPARE SPECIMEN BEAMS

2.3.1 Sandwich Beams

During all phases of beam preparation, make sure the beam dimensions are not distorted and make sure the beam surface stays clean and free of any contamination.

(a) Select a matched pair of beams using the process described above.

(b) Remove the step blocks from both the beams,

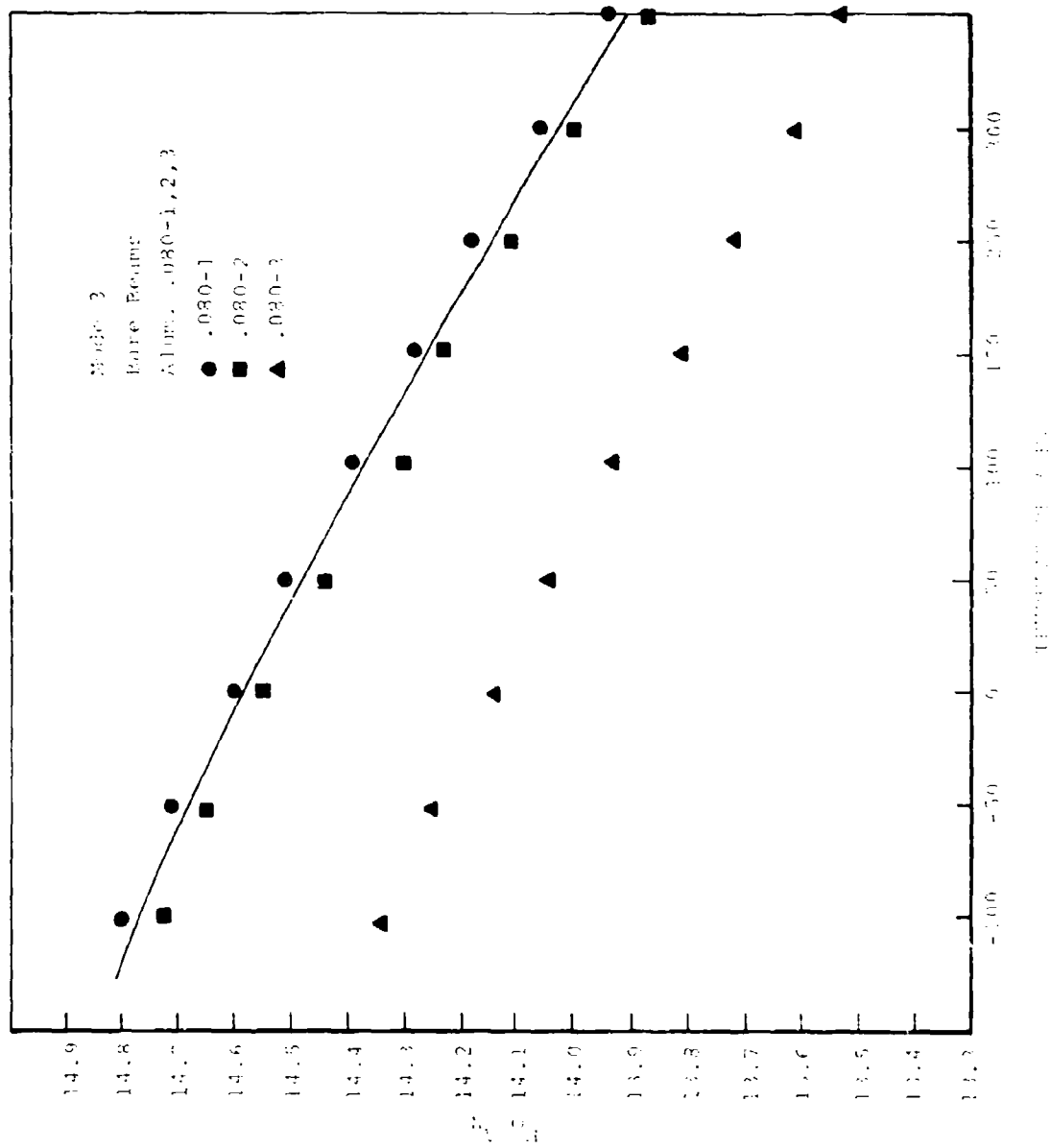


Figure 7. Bare Beam Characteristic Modal Plot for Mode 3.

and remove all adhesive from the beam root. Carefully scrape off the adhesive with the edge of a razor knife.

(c) Place the beams on a solid flat surface (a glass cleaning plate) as shown in Figure 8. Place the step joint over the edge of the cleaning plate to prevent the beam from bending and distorting during cleaning.

(d) Thoroughly clean both beams. Use a degreaser such as methanol, and an abrasive cloth such as Scotchbrite. Remove any surface oxidation and contamination. Then wipe the beams with a degreaser and a lint-free laboratory tissue. Continue wiping until the tissue shows no discoloration. Avoid contaminating the clean surfaces.

(e) Apply the polymeric material to one of the beams. Do this immediately after cleaning the beam to assure good adhesion. During this process make sure all air bubbles are removed from the material.

(1) Place the polymeric material on the glass cleaning plate. Then lay the beam down onto the material (see Figure 9). This process usually eliminates any entrapped air.

(2) Press the material on solidly with a rubber roller. If any air pockets are visible, use a sharp pointed object to break the bubbles, and then use the roller to work the air out. Use a razor knife to trim any excess material from around the beam.

(3) Remove excess material from the beam root. Use a razor knife and a straight edge to make sure the polymeric material is cut off on a line directly above the front edge of the step joint. If any material extends into the beam root, remove it and clean the root area thoroughly. Figure 10 is a detailed assembly diagram of a typical sandwich beam.

(f) Measure the polymeric material layer. If the layer is not thick enough, add material. (The thickness should be greater than 0.004-inch or 0.127 mm). To add material it is easiest to stack one layer on top of another on the same beam. It is also possible to adhere material to each beam in the matched pair.

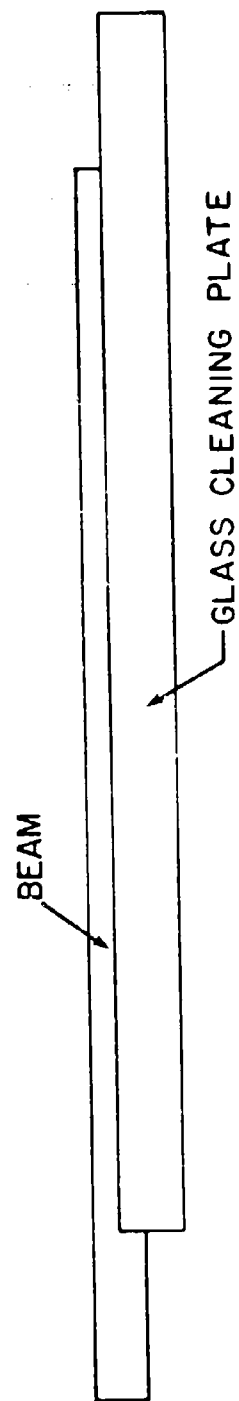


Figure 8. Position of Beam on Glass Plate During Cleaning Procedure.

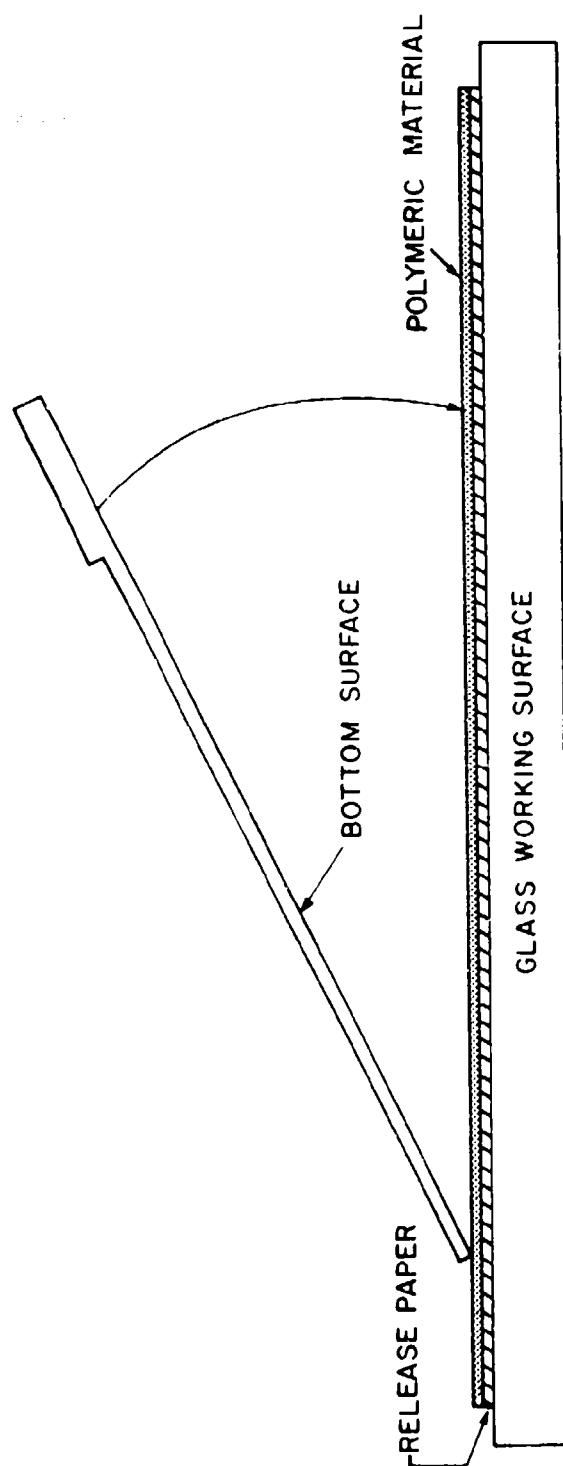
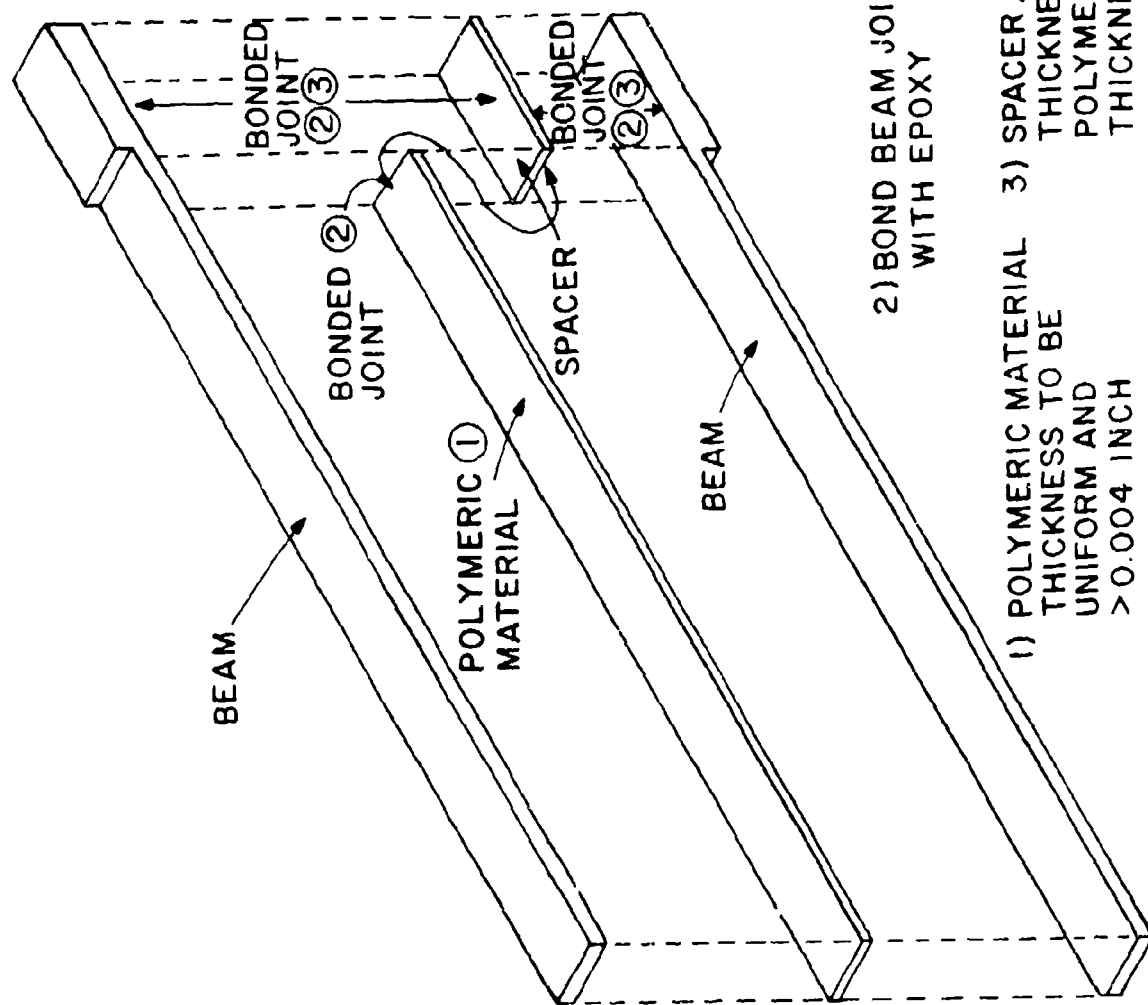


Figure 9. Placement of Beam on Polymeric Material.



2) BOND BEAM JOINTS
WITH EPOXY

1) POLYMERIC MATERIAL THICKNESS TO BE
UNIFORM AND > 0.004 INCH

3) SPACER / BEAM JOINT
THICKNESS TO EQUAL
POLYMERIC MATERIAL
THICKNESS

Figure 10. Detailed Assembly Diagram of a Typical Sandwich Beam.

Either method is acceptable as long as the resulting sandwich beam has an even layer of material that is free of air bubbles.

(g) Glue a metal spacer to the beam root as shown in Figure 10. The spacer must be the same thickness as the layer of material. The material should adhere to the leading edge of the spacer.

(h) Finish the sandwich beam assembly as shown in Figure 11.

- (1) Place both beams on a glass plate.
- (2) Peel the top layer of release paper off the material.
- (3) Spread a thin layer of glue on the exposed side of the spacer.
- (4) Place both beams on their sides.
- (5) Hold the beams by the step roots.
- (6) Place the free ends of the beams against a heavy square metal block.
- (7) Bring the free ends of the beams together, so the beams form a "V" with the free ends at the point of the "V".
- (8) Carefully close the "V", bringing the step roots of the beams towards each other so the beams come together with sides in parallel.

(i) Glue the magnetic drive disk to the completed sandwich beam. If the beams are non-magnetic in the temperature range of the material test, place the drive disk approximately 1.25-inch (3.2 cm) from the beam root (see Figure 5).

(j) Glue the accelerometer to the completed sandwich beam. Place the accelerometer approximately 0.125-inch (32 mm) from the free end of the beam (see Figure 5).

(k) Place the thermocouple in the root of the beam. If temperature measurements are made in this fashion, it is acceptable to have a thermocouple attached to the base plate.

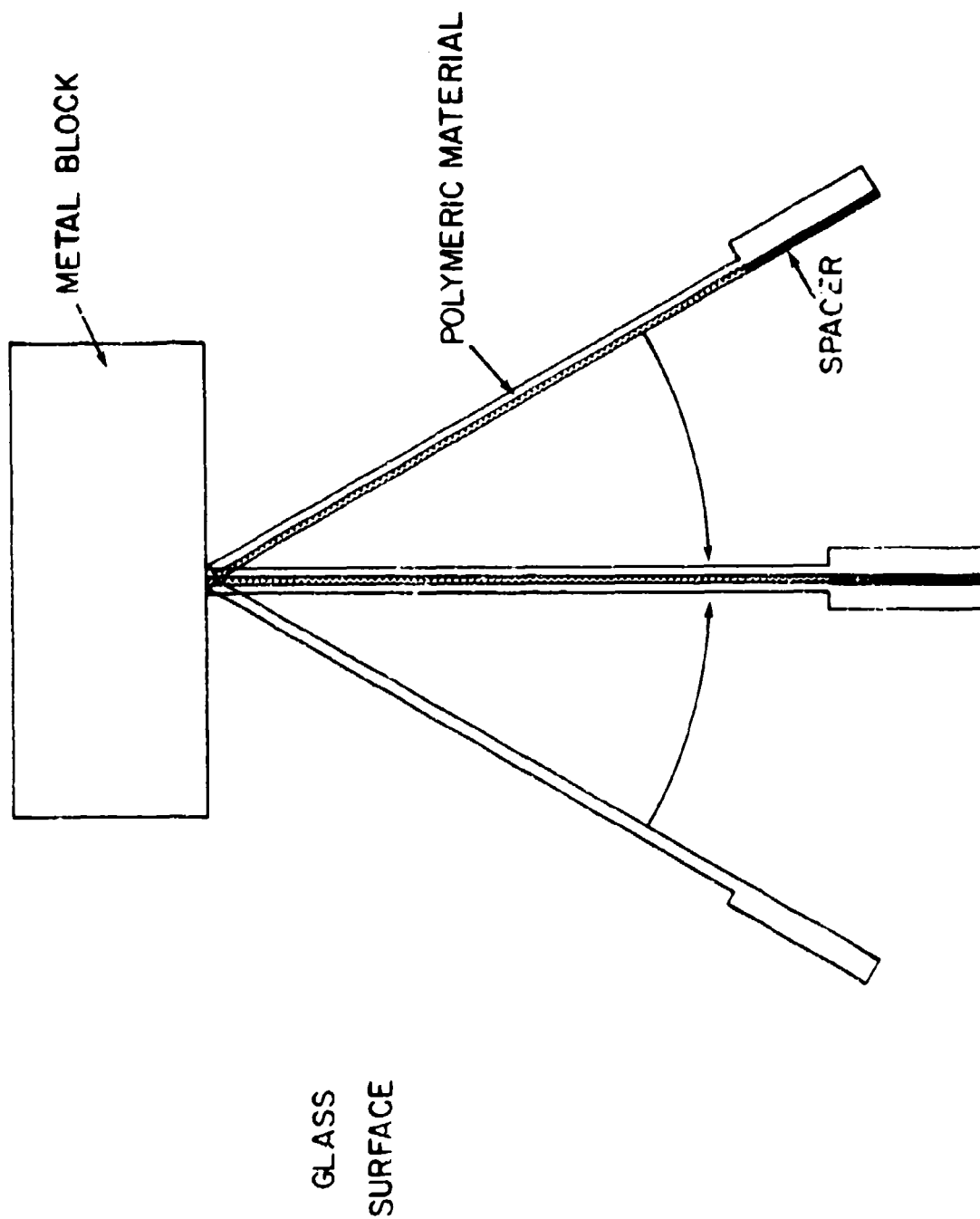


Figure 11. Sandwich Beam Final Assembly Procedure.

2.3.2 Free-Layer Beams

Prepare free-layer specimen beams using the procedure described previously, with these exceptions:

- (a) Do not remove the step block.
- (b) For an "Oberst" beam, adhere the polymeric material layer to the bottom of the beam (see Figure 2). Glue the drive disk and the accelerometer to the top of the beam.
- (c) For a "modified Oberst" beam, adhere the drive disk and the accelerometer directly to the top layer of material.

2.4 TESTING THE SPECIMEN BEAMS

Both "digital" and "analog" systems can be used to generate and handle data from vibrating beam tests. The tests reported here used the analog technique. The advantage of a digital system is that test results can be fed directly into a computer, and necessary mathematical operations can be performed at the time of the vibrating beam test.

2.4.1 Carry Out Test Procedures

(a) Place the specimen beam in the test fixture. Use the same process as was used for bare beam testing (see Section 2.2.1).

(b) Check the system operation by taking a frequency sweep and noting locations of resonant frequencies of the specimen beam. Figure 12 shows typical response spectra. For good results, each peak should be distinct and should rise above the "background" by 10 db or more. If the "rising" is less than 10 db, it may be difficult to obtain satisfactory test data from a given mode. This is especially true if the peak is highly "unsymmetrical." If "bad" points appear, attempt the following remedies:

- (1) Integrate the acceleration signal electronically. This procedure has the effect of looking at "velocity" instead of "accelerometer."
- (2) Try another pickup position on the beam.

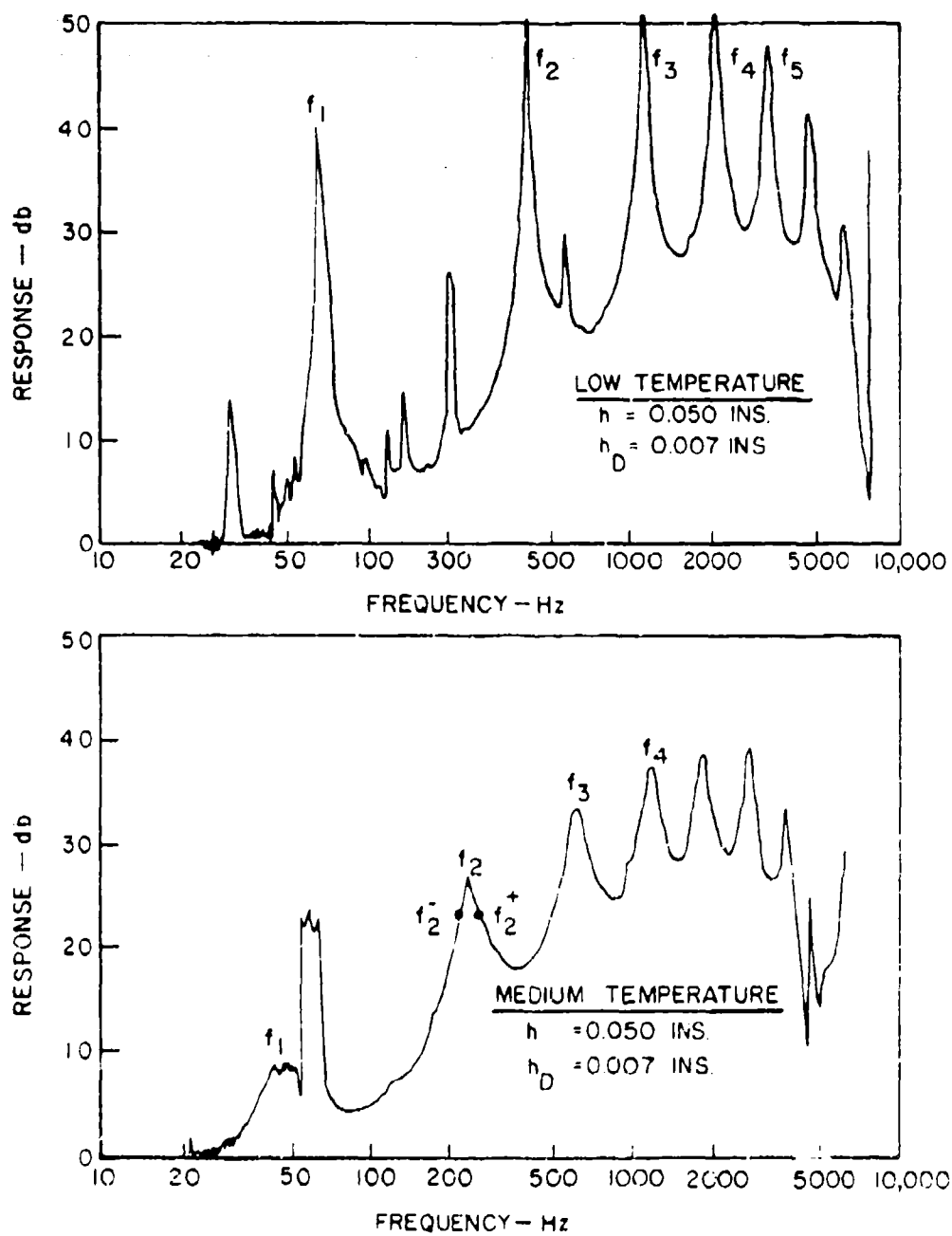


Figure 12. Response Spectra of a Coated Beam.

- (3) Try another thickness of damping material (generally smaller).
- (4) Try filtering the output signal. Use this procedure very carefully, to avoid obscuring a problem.

If no remedy is successful, the test data must be rejected.

(c) Conduct the tests. Measure the resonant frequency (f_c) and the half-power bandwidths [f_L (-3 db) and f_R (+3 db)] of modes 2, 3, 4, 5, 6, and 7. Measure frequencies to the second decimal point, and to a precision of ± 0.1 Hz. Observe at least two sample periods of the counter before writing down the frequency.

Conduct the tests in an ordered sequence of selected temperatures. Measure temperatures by using a thermocouple embedded in the root of the specimen beam, or in the base plate of the test fixture as described previously.

Begin testing at room temperature. Take measurements at test points above room temperature at intervals of 25°F (13.8°C). Continue until the composite loss factor for the majority of modes is below 0.02. For each test point monitor temperature until thermal equilibrium is reached; that is, until two successive temperature readings taken at one-minute intervals are within $\pm 2^\circ\text{F}$ of each other. After reaching thermal equilibrium, allow a fifteen-minute thermal soak before taking dynamic data.

If necessary (to test the maximum damping temperature), cool the specimen beam below room temperature. Continue measurements at decreasing temperatures until the loss factor drops below 0.02.

Use an oscilloscope to monitor the excitation and response waveforms. If a non-sinusoidal shape appears, reject the point and check the system. Response spectra should resemble the examples in Figure 12. Note any spurious peaks caused by stray voltages (usually multiples of 60 Hz) or by fixture resonances.

2.4.2 Check Possible Sources of Error

For vibrating beam testing, as for any measurement technique, errors can arise from several sources. Errors in the measured complex moduli of the polymeric material may be the result of:

- (a) Errors in specimen preparation, such as poor adhesion, voids (air bubbles), joint damping in clamping fixture, or non-uniform thicknesses.
- (b) Errors in temperature control. The thermocouple may not indicate the specimen temperature accurately because of thermal lag (insufficient time for reaching thermal equilibrium) or because of non-uniform temperature distribution within the specimen.
- (c) Errors in measuring resonant frequencies, as a result of too high frequency sweep rate, mechanical relaxation of the specimen, or low level signals (hence the need to always monitor "input" and "output").
- (d) Errors in measuring modal damping. Problems could include closely spaced modes, extraneous damping sources (such as damping in the clamp), or incorrect interpretation of non-linear response as apparent increased damping.
- (e) Error magnification, because of unstable regions in the equations. For example, in "Oberst" equations (1) and (2), and "modified Oberst" equations (3) and (4), the term $(Z^2 - 1)^{-1}$ acts to magnify errors in ρ_n or E . As $Z^2 \rightarrow 1$, this factor becomes infinite.

While conducting vibrating beam tests it is important to constantly be aware of these and other possible sources of erroneous data, and to apply every possible precaution while obtaining, interpreting, and utilizing the data.

2.4.3 Compile Test Data

For any beam specimen, each test "point" consists of a set of simultaneously measured values of temperature, mode, resonant frequency, and modal damping. The complete set of data

points for each test includes these measured values for the undamped beams and for the damped specimen beams. The raw test data for each damping material evaluated include the values of temperature, damped resonant frequency (f_c), the half-power frequency (f_L and f_R), bandwidth (Δf), and the modal loss factor (η). Appendix B contains examples of raw test data for each material tested.

It is important to evaluate the validity of raw test data being generated by a particular vibrating beam test. Such evaluation may indicate problems in a test system that need to be pinpointed and solved before too much effort is invested in the test. One way to evaluate the raw test data is to examine the plot of η_n , f_n , and f_{on} versus temperature. This plot may be generated manually as shown in Figure 13, or automatically as part of the test system [6, 7]. In either case, subjective evaluation of the test data at this point is an important step in the testing process.

The valid raw data can now be used in conjunction with the appropriate set of equations to produce a set of material properties for the specific temperatures and frequencies measured during the beam tests.

The final result of damping material analysis is a temperature nomogram, which expands the limited number of test results to a graph from which the designer can obtain the damping material's properties (modulus and loss factor) at any given combination of temperature and frequency. Appendix B contains temperature nomograms generated by the computer system used for UDRI vibrating beam tests.

The development of temperature nomograms is discussed in reference [10]. The computer program used by UDRI to generate nomograms is discussed in reference [7].

Figure 14 is a temperature nomogram with some grid lines removed. This nomogram can be read more easily. The procedure for reading this nomogram is as follows:

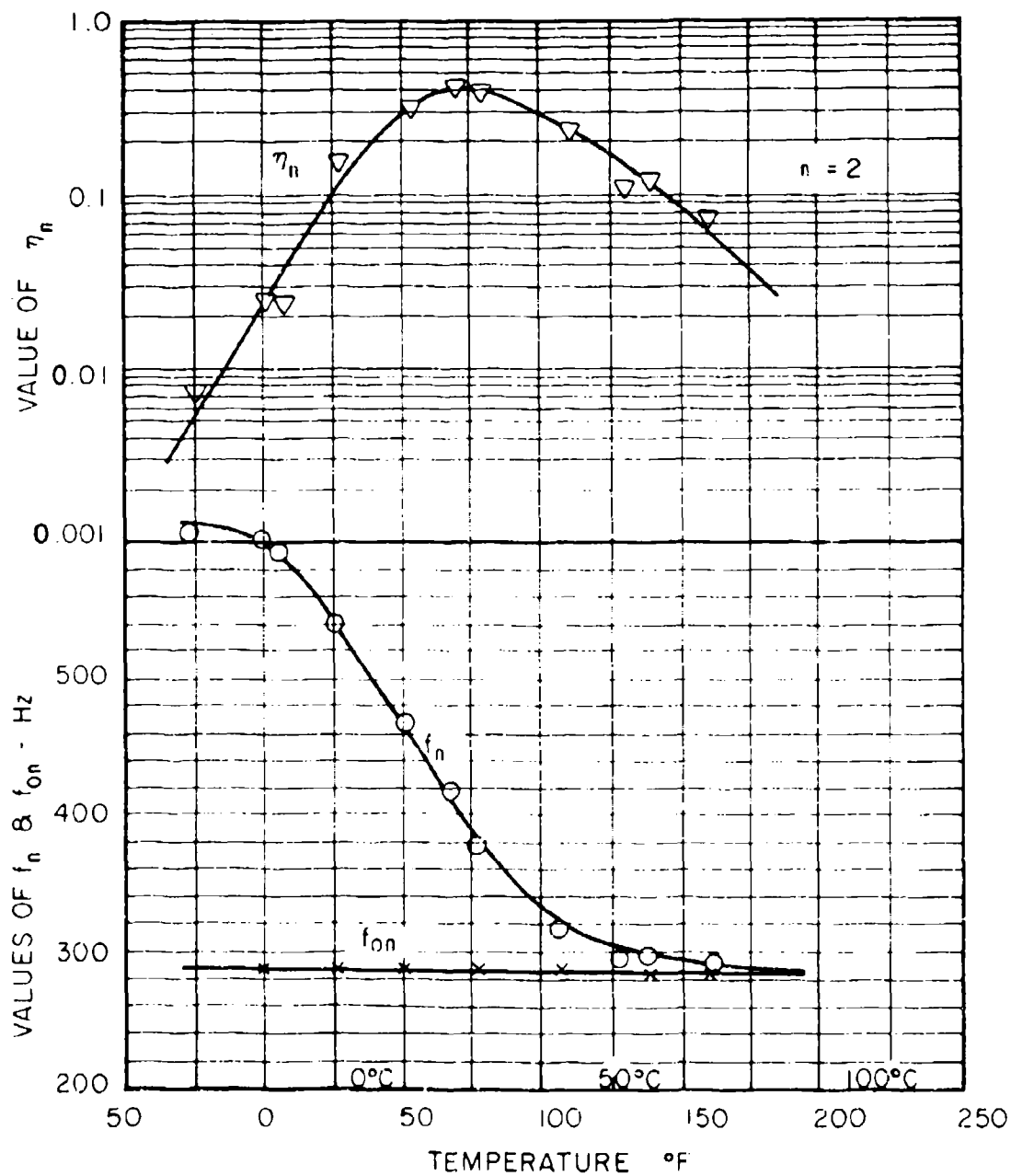


Figure 13. Typical Graphs of η_n , f_n , and f_{on} Versus Temperature.

Select a combination of temperature and frequency, for example 200 Hz and 59°F (15°C). Find the point for 200 Hz on the right-hand axis. Follow the point horizontally to the line for 59°F (15°C) temperature. At this intersection, draw a vertical line. Then read the modulus and loss factor values off the appropriate graph, at the point of intersection with the vertical line. In this example, modulus G (200 Hz, 59°F or 15°C) = 140 psi and loss factor n (200 Hz, 59°F or 15°C) = 0.89. This nomogram also shows a second example for the combination 40 Hz and 109°F (42.8°C). In this example, modulus G (40 Hz, 109°F or 42.8°C) = 20 psi and loss factor n (40 Hz, 109°F or 42.8°C) = 0.69.

Figure 15 illustrates another application of temperature nomograms - specifying tolerances for purchased polymeric materials. This nomogram has hypothetical acceptance limits superimposed. Details of this use of nomograms are discussed in reference [9].

It can easily be seen from the nomographs that the data in this format is amenable to the development of analytical equations which would represent the data. The equations used to fit the material properties are those suggested by Rogers in reference [6].

The ability to represent the dynamic material properties in equation form greatly facilitates the use of this data in analytical structural design. A short discussion of the equations and parameters used in the curve fitting routine follows. More detailed information can be obtained in references [6] and [7].

The curve fits to the data on the nomographs were calculated by the computer program mentioned previously in this Section. The basic form for these equations are as follows:

Storage Modulus

$$\log_{10}(E'_D) = \log_{10}(M_\ell) + \frac{2 \log_{10}\left(\frac{M_{rom}}{M_\ell}\right)}{1 + \left(\frac{f_{rom}}{f_r}\right)^N} \quad (13)$$

where:

E'_D is the material storage modulus;

f_r is the reduced frequency;

M_{rom} is the inflection point of the storage modulus curve as read on the Young's Modulus scale;

f_{rom} is the reduced frequency value of this inflection point;

N is the slope of the curve at the inflection point;

M_ℓ is the Young's Modulus value of the lower horizontal asymptote of this curve.

Figure 15 illustrates the curve fit parameters M_{rom} , f_{rom} , N , and M_ℓ .

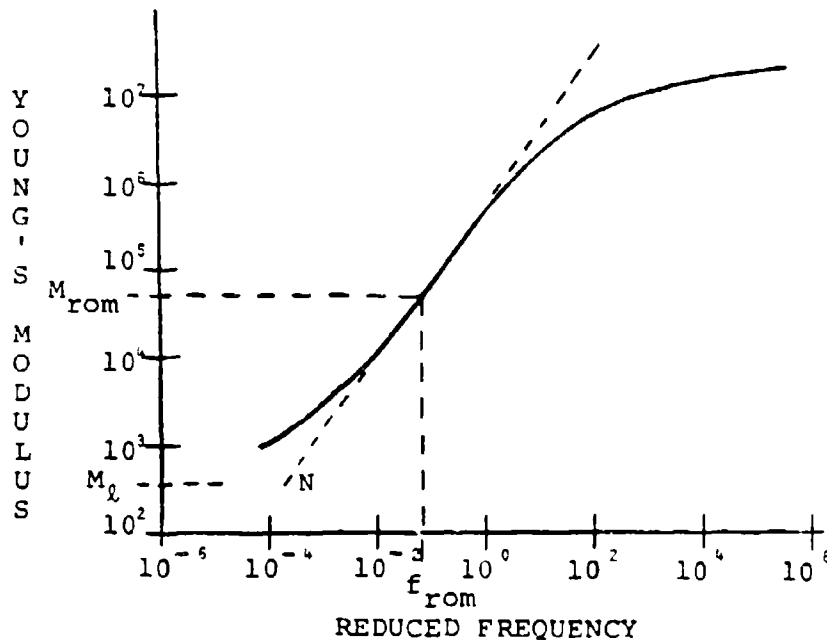


Figure 15. Curve Fit Parameters for Storage Modulus.

Loss Factor

$$\log_{10}(\eta) = \log_{10}(\eta_{f_{ro\ell}}) + \frac{C}{2} \left[\left(\frac{S_\ell + S_h}{C} \right) \log_{10} \left(\frac{f_\ell}{f_{ro\ell}} \right) + (S_\ell + S_h) \left(1 - \sqrt{1 + \left(\frac{\log_{10} \left(\frac{f_r}{f_{ro\ell}} \right)}{C} \right)^2} \right) \right] \quad (14)$$

where:

η is the loss factor;

f_r is the reduced frequency;

$\eta_{f_{ro\ell}}$ is the loss factor value of the damping peak;

$f_{ro\ell}$ is the reduced frequency value of the damping peak;

S_ℓ is the slope of asymptotic line for low values of reduced frequency;

S_h is the slope of asymptotic line for high values of reduced frequency;

C is a parameter which defines the curvature of the damping peak.

Figure 16 illustrates curve fit parameters $\eta_{f_{ro\ell}}$, $f_{ro\ell}$, S_ℓ , S_h , and C .

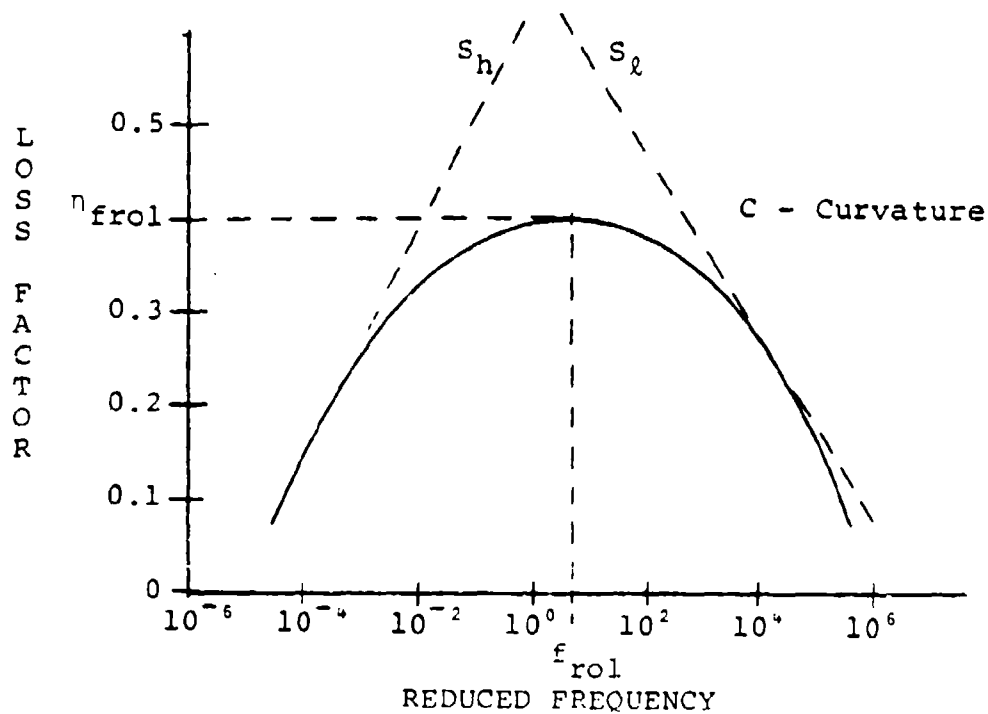


Figure 16. Curve Fit Parameters for Loss Factor.

The curve fit equations for each material tested are included in the materials damping properties evaluation in Appendix B.

SECTION III

PRESENTATION OF DATA

The raw test data from the bare beam characterization tests are presented in Appendix A. This data consists of the natural frequency (f_n) for modes two through seven at each temperature the beam was tested at, and the value of this frequency divided by its respective Eigen value (f_n/ξ_n). Each set of this bare beam data is plotted in a similar manner as Figure 17. From this graphical form of the data, matched pairs of beams are selected. This form of data is also used to obtain the natural frequencies of the beams at temperatures other than the test temperatures.

All of the polymeric materials that have been tested by UDRI are listed in Table 1. The raw and reduced data from these tests are presented in Appendix B in this order:

- (a) The geometric parameters of the beam and material, the temperature and frequency test range, the peak and range values of the loss factor, the computer file index numbers, the equations for the material's characteristic curve;
- (b) The raw test data;
- (c) The reduced test data;
- (d) The reduced temperature nomogram.

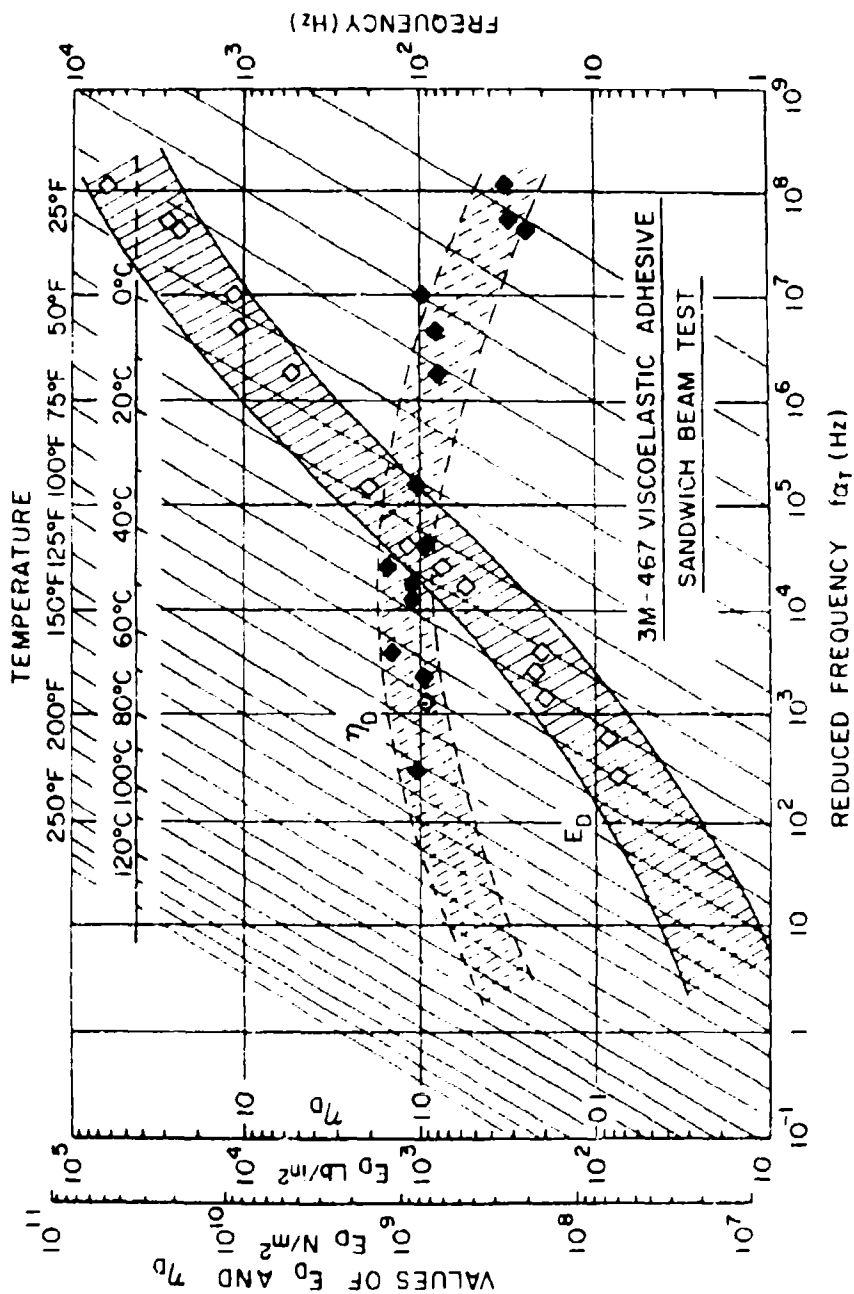


Figure 17. Reduced Temperature Nomogram for Specific Damping Material with Hypothetical Acceptance Limits Superimposed.

TABLE 1. POLYMERIC MATERIALS AND MANUFACTURERS

<u>Material</u>	<u>Manufacturer</u>
Exodamp C-2003	E. A. R. Corporation
Isodamp C-1002	E. A. R. Corporation
MacBond IB1120	MacBond (Morgan Adhesives Company)
MacBond IB1160	MacBond (Morgan Adhesives Company)
MacBond IB1200	MacBond (Morgan Adhesives Company)
MacBond IB1220	MacBond (Morgan Adhesives Company)
MacBond IB1248	MacBond (Morgan Adhesives Company)
MacBond IB1320	MacBond (Morgan Adhesives Company)
MacBond IB1400	MacBond (Morgan Adhesives Company)
MacBond IB1401	MacBond (Morgan Adhesives Company)
MacBond IB1622	MacBond (Morgan Adhesives Company)
MacBond IB2101	MacBond (Morgan Adhesives Company)
MacBond IB2107	MacBond (Morgan Adhesives Company)
MacBond IB2130	MacBond (Morgan Adhesives Company)
Soundcoat D	Soundcoat Company
Soundcoat M	Soundcoat Company
Soundcoat N	Soundcoat Company
Soundcoat R	Soundcoat Company
Soundcoat Diad 601	Soundcoat Company
Soundcoat Diad 606	Soundcoat Company
Soundcoat Diad 609	Soundcoat Company
Soundfoil LT12	Soundcoat Company
ISD 110	3M Company
ISD 112	3M Company
ISD 113	3M Company
ISD 113M	3M Company
ISD 330	3M Company
Enjoy Butyl	UDRI

REFERENCES

1. Oberst, H., "Reduction of Noise by the Use of Damping Materials," Royal Aero. Soc., Vol. 263, pp. 441 - 453, 1968.
2. Nashif, A. D., "A New Method for Determining the Damping Properties of Viscoelastic Materials," Shock and Vibration Bulletin 36, pp. 37 - 47, 1967.
3. Oberst, H., "Über die Dämpfung Biegeschwingungen Dünner Bleche Durch fest Haftende Beläge," Acustics (Akustische Beihefte) 4, pp. 181 - 194, 1952.
4. Ross, D., Ungar, E. E., and Kerwin, Jr., E. M., "Damping of Plate Flexural Vibrations by Means of Viscoelastic Laminac," Structural Damping, ed. J. E. Ruzicka, Proc. ASME Colloq., 1959.
5. Snowdon, J. C., Vibration and Shock in Damped Mechanical Systems. John Wiley and Sons, Inc., New York, 1968.
6. Rogers, L. C. and Nashif, A., "Computerized Processing and Empirical Representation of Viscoelastic Material Property Data and Preliminary Constrained Layer Damping Treatment Designs," Shock and Vibration Bulletin 48, 1978.
7. King, Jr., C. S., "Computerized Processing and Graphic Representation of Viscoelastic Material Property Data," University of Dayton, May, 1978, UDR-TR-78-49.
8. Jones, D. I. G., "A Reduced-Temperature Nomogram for Characterization of Damped Material Behavior," Shock and Vibration Bulletin 48, 1978.
9. Henderson, J. P. and Jones, D. I. G., "Specification of Damping Material Performance," Shock and Vibration Bulletin 48, 1978.

Beam No. 050A

[illegible]

05013

Temp.	Mode	f_n	f_n/A_n
°F		H ₂	H ₂
+ 86	2	197.9	8.83
	3	555.2	9.00
	4	1087.1	8.98
	5	1797.3	9.08
	6	2700.3	9.06
	7	3796.9	9.11
+ 25	2	199.1	8.89
	3	560.1	9.08
	4	1094.3	9.04
	5	1801.3	9.10
	6	2703.2	9.07
	7	3802.3	9.12
- 25	2	200.4	8.95
	3	563.7	9.14
	4	1101.6	9.10
	5	1815.4	9.17
	6	2722.6	9.14
	7	3829.2	9.18
+125	2	196.3	8.76
	3	552.6	8.96
	4	1078.8	8.92
	5	1774.2	8.96
	6	2659.3	8.92
	7	3743.0	8.98
+180	2	194.7	8.69
	3	547.9	8.88
	4	1069.5	8.84
	5	1758.7	8.88
	6	2635.3	8.84
	7	3708.3	8.89

[illegible]

Beam No. 060A

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 72	2	235.3	10.50
	3	658.8	10.68
	4	1290.8	10.67
	5	2122.2	10.61
+ 25	2	237.0	10.58
	3	663.7	10.76
	4	1300.2	10.75
	5	2138.6	10.69
- 25	2	239.0	10.67
	3	668.5	10.83
	4	1310.1	10.83
	5	2155.6	10.78
- 75	2	240.7	10.75
	3	673.4	10.91
	4	1319.3	10.90
	5	2176.8	10.88
+125	2	233.3	10.42
	3	653.0	10.58
	4	1278.3	10.56
	5	2102.6	10.51
+180	2	231.2	10.32
	3	647.1	10.49
	4	1266.9	10.47
	5	2080.3	10.40
+225	2	229.4	10.24
	3	642.3	10.41
	4	1257.1	10.39
	5	2063.6	10.32
+275	2	227.2	10.14
	3	636.5	10.32
	4	1245.3	10.29

[illegible]

Beam No. 060A

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 78	2	235.81	10.53
	3	662.95	10.74
	4	1301.1	10.75
	5	2150.5	10.75
	6	3200.0	10.74
	7	4466.3	10.71
+ 25	2	238.10	10.63
	3	668.54	10.84
	4	1312.0	10.84
	5	2166.8	10.83
	6	3223.7	10.82
	7	4496.4	10.78
- 25	2	240.05	10.72
	3	673.26	10.91
	4	1321.5	10.92
	5	2182.5	10.91
	6	3240.4	10.87
	7	4508.6	10.81
- 75	2	240.67	10.74
	3	676.82	10.97
	4	1327.0	10.97
	5	2183.41	10.92
	6	3206.2	10.76
	7	4683.8	11.23
+125	2	233.89	10.44
	3	657.46	10.66
	4	1298.03	10.73
	5	2148.69	10.74
	6	3204.10	10.75
	7	4484.30	10.75

[illegible]

Beam No. 060B

Temp.	Mode	f_n	f_n/λ_n
$^{\circ}\text{F}$		Hz	Hz
+275	2	230.2	10.28
	3	643.3	10.43
	4	1256.3	10.38
	5	2061.9	10.31
+225	2	233.4	10.42
	3	651.0	10.55
	4	1270.6	10.50
	5	2084.6	10.42
+175	2	234.4	10.46
	3	654.8	10.61
	4	1278.0	10.56
	5	2099.1	10.50
+125	2	236.6	10.57
	3	660.2	10.70
	4	1288.0	10.64
	5	2116.0	10.58
+ 75	2	238.1	10.63
	3	665.0	10.78
	4	1295.8	10.71
	5	2129.9	10.65
+ 25	2	240.0	10.71
	3	670.2	10.86
	4	1303.6	10.77
	5	2136.3	10.68
- 25	2	241.7	10.79
	3	673.5	10.92
	4	1313.2	10.85
	5	2167.3	10.84
- 75	2	243.5	10.87
	3	678.0	10.99
	4	1323.1	10.93

[illegible]

Beam No. 060B

Temp.	Mode	f_n	f_n/A_n
$^{\circ}\text{F}$		Hz	Hz
+ 80	2	238.44	10.64
	3	666.67	10.81
	4	1300.7	10.75
	5	2142.7	10.71
	6	3199.0	10.73
	7	4488.3	10.76
+125	1	38.066	10.81
	2	237.46	10.60
	3	662.60	10.74
	4	1294.50	10.70
	5	2138.1	10.69
	6	3198.0	10.73
	7	4488.3	10.76
+174	1	38.19	10.85
	2	236.98	10.58
	3	659.76	10.69
	4	1290.66	10.67
	5	2137.7	10.69
	6	3207.2	10.76
	7	4496.4	10.78
+225	1	37.910	10.77
	2	235.03	10.49
	3	654.11	10.60
	4	1279.5	10.57
	5	2120.8	10.60
	6	3182.6	10.68
	7	4464.1	10.71
+275	1	37.466	10.64
	2	232.77	10.39
	3	648.30	10.51
	4	1267.9	10.48

Temp.	Mode	f_n	f_n/A_n
$^{\circ}\text{F}$		Hz	Hz
	5	2099.9	10.50
	6	3150.1	10.57
	7	4412.0	10.60
+175	1	38.603	10.97
	2	237.38	10.60
	3	660.98	10.71
	4	1293.0	10.69
	5	2142.3	10.71
	6	3213.1	10.84
	7	4504.4	10.80
+125	1	38.72	11.00
	2	239.22	10.68
	3	666.18	10.80
	4	1303.1	10.77
	5	2158.7	10.79
	6	3237.7	10.86
	7	4538.6	10.88
+ 25	1	39.214	11.14
	2	243.29	10.86
	3	679.21	11.01
	4	1327.6	10.97
	5	2194.8	10.97
	6	3286.5	11.03
	7	4608.9	11.05
- 25	1	39.554	11.24
	2	244.70	10.92
	3	683.67	11.08
	4	1336.0	11.04
	5	2204.7	11.02
	6	3301.9	11.08
	7	4635.5	11.12

Beam No. 060B (cont'd)

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
- 80	1	39.760	11.30
	2	246.24	10.99
	3	688.04	11.15
	4	1344.9	11.11
	5	2220.8	11.10
	6	3324.5	11.16
	7	4665.0	11.19
+125	1	38.385	10.90
	2	238.93	10.67
	3	667.74	10.82
	4	1305.3	10.79
	5	2156.8	10.78
	6	3227.8	10.83
	7	4525.4	10.85
+181	1	37.58	10.68
	2	236.7	10.57
	3	661.7	10.72
	4	1293.9	10.69
	5	2137.8	10.69
	6	3201.3	10.74
	7	4489.3	10.77
+222	1	37.72	10.72
	2	235.24	10.50
	3	657.81	10.66
	4	1286.0	10.63
	5	2124.6	10.63
	6	3181.4	10.68
	7	4458.9	10.69
+270	2	232.8	10.39
	3	651.0	10.55
	4	1273.0	10.52

[illegible]

060C

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 68	2	241.9	10.80
	3	677.9	10.99
	4	1327.1	10.97
	5	2189.1	10.95
	6	3242.5	10.88
+ 25	2	243.6	10.88
	3	682.7	11.06
	4	1336.2	11.04
	5	2203.1	11.02
	6	3266.9	10.96
	7	4562.0	10.94
- 25	2	245.6	10.96
	3	688.2	11.15
	4	1346.3	11.13
	5	2226.2	11.13
	6	3292.7	11.05
	7	4591.4	11.01
- 75	2	247.0	11.03
	3	692.2	11.22
	4	1355.0	11.20
	5	2236.1	11.18
	6	3303.6	11.09
	7	4580.9	10.99
+125	2	239.8	10.71
	3	672.3	10.90
	4	1315.8	10.87
	5	2170.1	10.85
	6	3215.4	10.79
+175	2	238.1	10.63
	3	667.3	10.82
	4	1305.7	10.79

[illegible]

Beam No. 060C

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 72	2	242.16	10.987
	3	673.76	10.920
	4	1319.34	10.904
	5	2181.40	10.907
	6	3267.30	10.964
	7	4580.76	10.985
+ 25	2	243.47	11.047
	3	678.43	10.996
	4	1328.00	10.975
	5	2198.38	10.992
	6	3293.19	11.051
	7	4619.94	11.079
- 25	2	246.25	11.173
	3	685.37	11.108
	4	1342.15	11.092
	5	2221.46	11.107
	6	3329.31	11.172
	7	4667.05	11.192
- 75	2	247.60	11.234
	3	690.42	11.190
	4	1350.22	11.159
	5	2234.32	11.172
	6	3346.10	11.229
	7	4690.58	11.248
+125	2	240.60	10.917
	3	670.15	10.861
	4	1311.92	10.842
	5	2171.54	10.858
	6	3253.07	10.916
	7	4559.20	10.933

[illegible]

G E O D

Temp.	Mode	f_n	f_n/A_n
$^{\circ}\text{F}$		Hz	Hz
+ 72	3	674.2	10.93
	4	1319.2	10.90
	5	2166.9	10.83
	6	3212.5	10.78
	7	4486.1	10.76
+ 25	2	242.8	10.84
	3	679.3	11.01
	4	1327.5	10.97
	5	2182.9	10.91
	6	3238.1	10.87
	7	4520.8	10.84
- 25	2	244.5	10.92
	3	684.1	11.09
	4	1337.2	11.05
	5	2197.6	10.99
	6	3262.7	10.95
	7	4554.1	10.92
- 75	2	246.4	11.00
	3	688.8	11.16
	4	1349.1	11.13
	5	2216.5	11.08
	6	3284.5	11.02
	7	4588.2	11.00
+125	2	238.9	10.67
	3	668.6	10.34
	4	1307.3	10.80
	5	2149.7	10.75
	6	3187.1	10.69
	7	4450.6	10.67

[illegible]

060D

Temp.	Mode	f_n	f_n/A_n
$^{\circ}\text{F}$		Hz	Hz
+ 72	2	243.38	11.063
	3	678.55	10.998
	4	1328.76	10.981
	5	2202.46	11.012
	6	3302.25	11.081
	7	4633.06	11.110
+ 25	2	245.08	11.140
	3	682.68	11.065
	4	1337.60	11.055
	5	2217.60	11.088
	6	3326.60	11.163
	7	4667.35	11.193
- 25	2	246.81	11.219
	3	687.48	11.142
	4	1346.82	11.131
	5	2232.39	11.162
	6	3349.40	11.240
	7	4698.55	11.268
- 75	2	248.63	11.301
	3	692.51	11.224
	4	1357.58	11.220
	5	2249.64	11.248
	6	3374.35	11.323
	7	4731.86	11.347
+125	2	241.58	10.981
	3	673.28	10.912
	4	1319.75	10.907
	5	2185.48	10.927
	6	3277.12	10.997
	7	4592.10	11.012

[illegible]

Beam No. 060E

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 72	2	243.74	11.059
	3	679.01	11.005
	4	1328.8	10.982
	5	2199.8	10.999
	6	3291.2	11.044
	7	4620.3	11.080
+ 25	2	244.97	11.115
	3	683.31	11.075
	4	1337.8	11.056
	5	2213.9	11.070
	6	3310.6	11.109
	7	4641.7	11.131
- 25	2	245.56	11.142
	3	688.12	11.153
	4	1347.1	11.133
	5	2223.2	11.116
	6	3314.8	11.123
	7	4637.4	11.121
- 75	2	248.78	11.288
	3	694.11	11.250
	4	1359.1	11.232
	5	2249.4	11.247
	6	3363.0	11.285
	7	4715.5	11.308
+125	2	239.72	10.877
	3	672.57	10.901
	4	1316.9	10.883
	5	2172.7	10.864
	6	3235.1	10.856
	7	4523.3	10.847

[illegible]

060E

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 72	2	244.36	11.089
	3	679.96	11.020
	4	1332.5	11.012
	5	2213.0	11.065
	6	3321.7	11.146
	7	4658.6	11.172
+ 25	2	245.86	11.155
	3	684.79	11.098
	4	1341.3	11.085
	5	2226.6	11.133
	6	3338.0	11.201
	7	4680.0	11.223
- 25	2	247.60	11.234
	3	689.57	11.176
	4	1350.8	11.163
	5	2239.8	11.199
	6	3357.4	11.266
	7	4703.5	11.279
- 75	2	248.25	11.263
	3	693.05	11.232
	4	1356.4	11.209
	5	2242.1	11.210
	6	3346.7	11.230
	7	4686.0	11.237
+125	2	239.63	10.872
	3	674.75	10.935
	4	1318.3	10.895
	5	2175.3	10.876
	6	3243.8	10.885
	7	4548.9	10.908

[illegible]

070A

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 89	2	281.5	12.57
	3	783.5	12.70
	4	1540.2	12.73
	5	2549.9	12.88
	6	3824.8	12.83
	7	5353.9	12.84
+ 69	2	284.1	12.68
	3	791.1	12.82
	4	1546.0	12.78
	5	2564.2	12.95
	6	3845.2	12.90
	7	5385.0	12.91
+ 25	2	287.0	12.81
	3	794.7	12.88
	4	1555.5	12.86
	5	2579.0	13.03
	6	3866.3	12.97
	7	5410.9	12.98
- 25	2	288.9	12.90
	3	799.4	12.96
	4	1564.9	12.93
	5	2586.7	13.06
	6	3893.6	13.07
	7	5440.8	13.05
+125	2	281.7	12.58
	3	784.9	12.72
	4	1538.5	12.71
	5	2549.3	12.88
	6	3822.9	12.83
	7	5352.0	12.83

[illegible]

0700

Temp.	Mode	f_n	f_n/λ_n
°F		Hz	Hz
+ 74	2	283.9	12.67
	3	789.8	12.80
	4	1542.6	12.75
	5	2550.2	12.75
	6	3814.8	12.80
	7	5341.0	12.81
+ 25	2	285.8	12.76
	3	795.3	12.89
	4	1553.0	12.83
	5	2567.3	12.84
	6	3841.0	12.89
	7	5378.4	12.90
- 10	2	287.5	12.83
	3	799.4	12.96
	4	1561.3	12.90
	5	2581.2	12.91
	6	3863.0	12.96
	7	5408.9	12.97
+125	2	282.4	12.61
	3	786.0	12.74
	4	1535.5	12.69
	5	2538.1	12.82
	6	3797.5	12.74
	7	5316.8	12.75
+175	2	280.3	12.51
	3	781.3	12.66
	4	1527.0	12.62
	5	2524.4	12.75
	6	3777.0	12.67
	7	5287.2	12.68

[illegible]

Beam No. 0701D

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 69	1	44.534	12.65
	2	275.79	12.31
	3	779.42	12.63
	4	1525.2	12.60
	5	2518.3	12.59
	6	3757.6	12.61
	7	5257.2	12.61
+ 20	2	283.03	12.64
	3	785.73	12.73
	4	1537.0	12.70
	5	2538.7	12.69
	6	3787.6	12.71
	7	5302.6	12.72
- 25	2	285.99	12.77
	3	792.96	12.85
	4	1531.4	12.82
	5	2561.8	12.81
	6	3822.3	12.83
	7	5350.5	12.83
- 75	4	1552.5	12.83
	5	2563.7	12.82
	6	3824.8	12.83
	7	5354.2	12.84
+125	2	278.23	12.42
	3	773.81	12.54
	4	1515.5	12.52
	5	2502.4	12.51
	6	3731.7	12.52
	7	5217.2	12.51
+175	2	272.65	12.17
	3	769.35	12.47

[illegible]

Beam No. 070D

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 64	2	277.2	12.38
	3	772.7	12.52
	4	1502.7	12.42
	5	2481.5	12.53
+ 25	2	278.8	12.45
	3	777.3	12.60
	4	1512.0	12.50
	5	2498.0	12.62
- 24	2	280.5	12.52
	3	782.4	12.68
	4	1523.8	12.59
	5	2518.7	12.72
+122	2	274.8	12.27
	3	765.8	12.41
	4	1489.7	12.31
	5	2459.6	12.42
+172	2	272.6	12.17
	3	759.8	12.31
	4	1477.9	12.21
	5	2439.6	12.32
+224	2	270.4	12.07
	3	754.0	12.22
	4	1466.2	12.12
	5	2420.5	12.22
+271	2	268.2	11.97
	3	747.5	12.12
	4	1453.1	12.01
	5	2397.2	12.11
+ 71	2	173.1	
	3	481.4	
	4	946.8	

[illegible]

C70E

Temp.	Mode	f_n	f_n/A_n
$^{\circ}\text{F}$		Hz	Hz
+ 72	2	277.60	12.39
	3	776.28	12.58
	4	1518.1	12.55
	5	2503.2	12.52
	6	3726.0	12.50
	7	5203.0	12.48
+ 25	2	279.14	12.46
	3	780.58	12.65
	4	1526.8	12.62
	5	2518.1	12.59
	6	3748.3	12.58
	7	5228.3	12.54
- 25	2	281.37	12.56
	3	788.58	12.78
	4	1542.8	12.75
	5	2544.4	12.72
	6	3789.0	12.71
	7	5289.0	12.68
- 75	2	283.58	12.66
	3	793.02	12.85
	4	1551.9	12.83
	5	2559.2	12.80
	6	3812.0	12.79
	7	5325.8	12.77
+125	2	274.57	12.26
	3	769.41	12.47
	4	1508.3	12.47
	5	2490.6	12.45
	6	3707.7	12.44
	7	5173.4	12.41

[illegible]

Beam No. 070E

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 69	2	277.4	12.38
	3	774.6	12.55
	4	1508.3	12.47
	5	2493.7	12.59
+ 5	2	279.8	12.49
	3	781.8	12.67
	4	1522.4	12.58
	5	2497.7	12.61
- 50	2	281.9	12.58
	3	788.1	12.77
	4	1535.6	12.69
	5	2522.5	12.74
+100	2	275.8	12.31
	3	771.0	12.50
	4	1501.9	12.41
	5	2474.4	12.50
+150	2	273.8	12.22
	3	765.0	12.40
	4	1490.0	12.31
	5	2453.9	12.39
+199	2	271.8	12.13
	3	759.2	12.30
	4	1478.5	12.22
	5	2434.9	12.30
+250	2	269.5	12.03
	3	752.3	12.19
	4	1464.9	12.11
	5	2408.4	12.16

[illegible]

080B

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 72	1	50.932	14.47
	2	321.70	14.36
	3	903.18	14.64
	4	1768.3	14.61
	5	2920.3	14.60
	6	4333.4	14.61
	7	6045.0	14.50
+ 25	1	51.787	14.71
	2	325.58	14.53
	3	911.66	14.78
	4	1782.9	14.73
	5	2942.2	14.71
	6	4406.3	14.79
	7	6129.2	14.70
- 25	2	330.05	14.73
	3	922.34	14.95
	4	1800.3	14.88
	5	2971.2	14.86
	6	4427.4	14.86
	7	6202.4	14.87
+ 85	2	330.24	14.74
	3	925.07	14.99
	4	1809.2	14.95
	5	2986.8	14.93
	6	4449.8	14.93
	7	6221.5	14.92
+125	2	319.66	14.27
	3	896.30	14.53
	4	1755.5	14.51
	5	2898.1	14.49
	6	4325.7	14.52

[illegible]

Beam No. 080D

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 75	2	326.2	14.804
	3	912.1	14.783
	4	1785.1	14.765
	5	2952.2	14.771
	6	4409.5	14.769
	7	6159.7	14.772
- 72	2	333.7	15.145
	3	930.9	15.088
	4	1820.9	15.061
	5	3013.2	15.076
	6	4507.0	15.096
	7	6296.2	15.099
- 25	2	331.5	15.045
	3	925.8	15.005
	4	1810.1	14.972
	5	2995.2	14.986
	6	4479.7	15.004
	7	6259.3	15.011
+ 25	2	328.9	14.927
	3	918.9	14.894
	4	1798.1	14.872
	5	2975.1	14.886
	6	4447.4	14.896
	7	6213.3	14.900
+ 75	2	326.1	14.800
	3	912.0	14.782
	4	1785.3	14.766
	5	2952.4	14.772
	6	4410.2	14.772
	7	6160.6	14.774

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+125	2	323.4	14.677
	3	905.2	14.672
	4	1772.8	14.663
	5	2931.5	14.668
	6	4376.2	14.658
	7	6112.4	14.658
+175	2	322.0	14.614
	3	898.7	14.566
	4	1760.7	14.563
	5	2913.6	14.578
	6	4352.7	14.578
	7	6082.9	14.587
+225	2	319.5	14.500
	3	893.0	14.474
	4	1746.7	14.447
	5	2890.8	14.464
	6	4320.2	14.470
	7	6037.3	14.478
+275	2	317.0	14.387
	3	886.2	14.364
	4	1733.1	14.335
	5	2867.7	14.348
	6	4286.3	14.356
	7	5988.3	14.361

080F

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
- 75	2	333.0	15.1130
	3	927.7	15.0364
	4	1806.8	14.9443
	5	2979.5	14.9079
	6	4437.6	14.8635
	7	6184.1	14.8303
- 25	2	330.7	15.0086
	3	921.0	14.9278
	4	1793.8	14.8368
	5	2957.7	14.7989
	6	4399.5	14.7359
	7	6130.3	14.7013
+ 25	2	328.4	14.9042
	3	915.4	14.8370
	4	1783.6	14.7524
	5	2942.9	14.7248
	6	4385.0	14.6874
	7	6120.5	14.6771
+ 75	2	326.0	14.7953
	3	909.1	14.7349
	4	1772.5	14.6606
	5	2924.5	14.6327
	6	4360.5	14.6053
	7	6081.7	14.5847
+125	2	323.1	14.6637
	3	901.6	14.6134
	4	1758.9	14.5481
	5	2900.5	14.5127
	6	4318.2	14.4636
	7	6023.1	14.4442

[illegible]

080F'

Temp.	Mode	f_n	λ_n
°F		Hz	Hz
- 75	2	333.3	15.127
	3	927.0	15.025
	4	1819.3	15.047
	5	3017.5	15.098
	6	4518.0	15.133
	7	6306.8	15.124
+ 25	2	328.6	14.913
	3	913.0	14.798
	4	1791.9	14.821
	5	2972.3	14.872
	6	4446.8	14.894
	7	6214.5	14.903
+ 75	2	326.5	14.818
	3	908.0	14.717
	4	1782.5	14.743
	5	2956.9	14.795
	6	4442.4	14.879
	7	6182.3	14.826
+125	2	324.5	14.727
	3	903.0	14.636
	4	1772.8	14.663
	5	2940.3	14.712
	6	4417.0	14.794
	7	6149.7	14.745
+175	2	322.9	14.655
	3	898.6	14.565
	4	1762.6	14.579
	5	2922.3	14.622
	6	4371.2	14.641
	7	6112.4	14.658

[illegible]

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 69	2	326.0	14.795
	3	906.6	14.694
	4	1780.6	14.728
	5	2951.4	14.767
	6	4416.4	14.792
	7	6174.1	14.806
- 75	2	331.8	15.058
	3	906.1	14.686
	4	1811.6	14.728
	5	3003.1	15.026
	6	4501.6	14.792
	7	6287.1	14.806
- 25	2	330.8	15.013
	3	920.5	14.920
	4	1805.6	14.934
	5	2994.0	14.980
	6	4482.9	15.015
	7	6261.8	15.017
+ 25	2	328.6	14.913
	3	914.1	14.815
	4	1794.1	14.839
	5	2974.8	14.884
	6	4452.9	14.914
	7	6222.8	14.923
+ 75	2	326.5	14.818
	3	908.0	14.717
	4	1783.3	14.750
	5	2954.9	14.785
	6	4422.9	14.814
	7	6182.2	14.826

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+125	2	324.5	14.727
	3	902.5	14.628
	4	1772.8	14.663
	5	2936.4	14.692
	6	4396.2	14.724
	7	6145.0	14.736
+175	2	322.8	14.650
	3	897.7	14.550
	4	1763.3	14.534
	5	2919.9	14.610
	6	4369.1	14.634
	7	6109.4	14.651
+225	2	321.3	14.582
	3	894.7	14.501
	4	1755.0	14.515
	5	2906.9	14.545
	6	4366.5	14.625
	7	6082.2	14.586
+275	2	319.2	14.487
	3	889.4	14.415
	4	1743.5	14.421
	5	2890.3	14.461
	6	4338.9	14.533
	7	6040.1	14.485

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
- 75	2	331.6	15.0495
	3	924.7	14.9878
	4	1810.9	14.9782
	5	2993.7	14.9790
	6	4478.9	15.0019
	7	6255.9	15.0025
- 25	2	329.3	14.9451
	3	918.3	14.8840
	4	1798.0	14.8715
	5	2972.1	14.8709
	6	4443.8	14.8843
	7	6211.6	14.8962
+ 20	2	326.7	14.8271
	3	913.1	14.7997
	4	1786.6	14.7773
	5	2949.8	14.7593
	6	4406.0	14.7577
	7	6160.1	14.7727
+ 75	2	323.4	14.6773
	3	905.4	14.6749
	4	1769.3	14.6342
	5	2912.4	14.5722
	6	4339.1	14.5336
	7	6071.4	14.5600
+125	2	321.2	14.5775
	3	899.4	14.5777
	4	1757.5	14.5366
	5	2892.1	14.4706
	6	4307.8	14.4288
	7	6026.8	14.453

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+175	2	320.3	14.5366
	3	892.2	14.4610
	4	1739.5	14.3877
	5	2865.9	14.3395
	6	4264.8	14.2848
	7	5945.5	14.2581
+255	2	316.4	14.3596
	3	885.7	14.3556
	4	1731.0	14.3174
	5	2844.6	14.2330
	6	4240.8	14.2044
	7	5932.8	14.2276
+275	2	312.9	14.2462
	3	878.5	14.2389
	4	1718.2	14.2115
	5	2824.6	14.1329
	6	4208.5	14.0962
	7	5888.8	14.1221

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 77	2	323.8	14.69
	3	908.9	14.73
	4	1774.3	14.67
	5	2930.9	14.66
	6	4364.2	14.62
	7	6158.4	14.77
- 75	2	340.1	15.43
	3	927.3	15.03
	4	1812.2	14.99
	5	3003.2	15.06
	6	4499.2	15.07
	7	6282.4	15.07
- 25	2	328.6	14.91
	3	922.0	14.94
	4	1800.3	14.89
	5	2983.8	14.93
	6	4468.6	14.97
	7	6230.9	14.94
+ 25	2	325.2	14.76
	3	916.1	14.85
	4	1789.4	14.80
	5	2965.9	14.84
	6	4426.9	14.86
	7	6100.8	14.63
+125	2	321.5	14.59
	3	902.9	14.63
	4	1762.7	14.58
	5	2902.0	14.52
	6	4315.2	14.45
	7	6033.4	14.67

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+175	2	319.0	14.48
	3	896.6	14.53
	4	1749.3	14.47
	5	2880.2	14.41
	6	4293.9	14.38
	7	5994.0	14.37
+220	2	317.2	14.39
	3	891.0	14.44
	4	1737.6	14.37
	5	2863.0	14.32
	6	4260.9	14.27
	7	5976.2	14.33
+272	2	314.0	14.25
	3	882.4	14.30
	4	1725.4	14.27
	5	2837.1	14.20
	6	4223.4	14.15
	7	5845.5	14.02

Beam No. 080-1

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
-100	2	327.6	14.87
	3	913.3	14.80
	4	1799.8	14.89
	5	2985.8	14.94
	6	4480.7	15.01
	7	6256.9	15.00
- 50	2	325.4	14.77
	3	907.3	14.71
	4	1788.3	14.79
	5	2966.2	14.84
	6	4449.5	14.90
	7	6217.9	14.91
0	2	323.1	14.66
	3	900.7	14.60
	4	1773.2	14.67
	5	2940.4	14.71
	6	4410.3	14.77
	7	6163.5	14.78
+ 48	2	320.9	14.56
	3	895.2	14.51
	4	1762.1	14.57
	5	2922.5	14.62
	6	4354.6	14.58
	7	6126.0	14.69
+102	2	318.4	14.45
	3	888.0	14.39
	4	1747.6	14.45
	5	2896.9	14.49
	6	4345.2	14.55
	7	6076.5	14.57

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+152	2	315.9	14.34
	3	881.2	14.28
	4	1734.3	14.34
	5	2874.1	14.38
	6	4311.4	14.44
	7	6030.5	14.46
+200	2	313.6	14.23
	3	874.6	14.18
	4	1721.5	14.24
	5	2853.5	14.28
	6	4280.4	14.34
	7	5986.4	14.36
+250	2	311.3	14.12
	3	867.8	14.06
	4	1708.8	14.13
	5	2833.0	14.17
	6	4249.1	14.23
	7	5943.6	14.25
+303	2	308.4	14.00
	3	860.2	13.94
	4	1692.8	14.00
	5	2804.1	14.03
	6	4206.6	14.09
	7	5884.7	14.11

080-2

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
-100	2	324.0	14.70
	3	908.7	14.73
	4	1775.8	14.69
	5	2941.1	14.72
	6	4414.0	14.78
	7	6201.4	14.87
- 55	2	322.0	14.61
	3	903.8	14.65
	4	1765.5	14.60
	5	2922.4	14.62
	6	4389.4	14.70
	7	6176.1	14.81
- 1	2	319.8	14.51
	3	897.6	14.55
	4	1758.4	14.54
	5	2915.1	14.58
	6	4374.5	14.65
	7	6123.8	14.69
+ 48	2	317.3	14.40
	3	890.7	14.44
	4	1739.9	14.39
	5	2879.0	14.40
	6	4324.7	14.48
	7	6071.6	14.56
+101	2	314.8	14.29
	3	882.5	14.30
	4	1724.1	14.26
	5	2851.0	14.26
	6	4286.8	14.36
	7	6023.4	14.44

[illegible]

Beam No. 080-3

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 48	2	306.9	13.92
	3	866.4	14.04
	4	1705.8	14.11
	5	2830.3	14.16
	6	4244.3	14.22
	7	5959.4	14.29
- 2	2	309.1	14.03
	3	872.8	14.14
	4	1718.5	14.21
	5	2851.8	14.27
	6	4278.3	14.33
	7	6004.2	14.40
- 55	2	311.3	14.13
	3	879.4	14.25
	4	1731.6	14.32
	5	2873.5	14.38
	6	4311.0	14.44
	7	6047.9	14.50
-105	2	313.5	14.23
	3	885.0	14.34
	4	1741.9	14.41
	5	2882.3	14.42
	6	4343.6	14.55
	7	6081.2	14.58
+102	2	304.3	13.81
	3	859.4	13.93
	4	1688.9	13.97
	5	2798.2	14.00
	6	4201.2	14.07
	7	5898.8	14.17

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+158	2	301.9	13.70
	3	852.3	13.81
	4	1675.1	13.85
	5	2774.0	13.88
	6	4161.0	13.94
	7	5843.7	14.01
+200	2	299.8	13.61
	3	846.7	13.72
	4	1663.1	13.76
	5	2751.1	13.76
	6	4125.6	13.82
	7	5823.5	13.96
+246	2	297.4	13.50
	3	839.6	13.61
	4	1650.3	13.65
	5	2739.8	13.71
	6	4135.8	13.85
	7	5808.5	13.93
+301	2	294.6	13.37
	3	834.6	13.53
	4	1651.0	13.66
	5	2746.6	13.74
	6	4116.2	13.79
	7	5764.3	13.82

APPENDIX B
POLYMERIC MATERIALS TEST DATA
Polymeric Material Characterization Test

Test No. 79-8
Date 12/11/79

Beam Nos. 060D and _____
Damping Material E.A.R. Exodamp C-2003

Material Thickness 0.1204 cm Material Density 1.716 g/cc

Beam Thickness 0.1524 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -3.9 °C and 93.3 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 0.95 Temperature 44.4 °C

 1000 Hz η_D 0.95 Temperature 54.44 °C

Range 100 Hz 23.9 °C 63.3 °C

 1000 Hz 35.6 °C 77.8 °C

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
T0      FROM      MROM      N      ML
      A1      A2      A3      A4
140.0  4.0000E+08  4.0000E+08  .320  1.7000E+07
A=(LOG(FR)-LOG(FROL))/C
LOG(ETA)=LOG(ETAFROL)+((SL+SH)A+(SL-SH)(1-SQRT(1+A**2)))/C/2
T0      ETAFROL      SL      SH      FROL      C
      B1      B2      B3      B4      B5
140.0   .950   .325   -.325  8.0000E+07  3.000
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks: Material was tested as an Oberst type specimen.

Loctite 404 was used to adhere material to the beam.

Some problems occurred in acquisition of accurate data

between 120°C and 150°C. An attempt was made to acquire more

data in this range by going to a Modified Oberst type specimen,

but this did not help.

Beam No. 060D

Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	ldB
25	2	275.58	245.46	272.33	278.12	5.79	0.0210	
26	3	780.71	682.98	772.98	788.00	15.02	0.0192	
26	4	1552.10	1336.57	1538.67	1565.38	26.71	0.0172	
26	5	2593.13	2217.45	2571.76	2614.43	42.67	0.0165	
26	6	3897.54	3342.38	3867.15	3927.15	60.00	0.0154	
49	2	256.50	244.46	249.73	264.93	15.20	0.0593	
49	3	734.17	680.52	715.23	753.70	38.47	0.0524	
49	4	1464.66	1331.74	1431.52	1499.90	68.38	0.0467	
49	5	2456.91	2209.45	2397.13	2508.29	111.16	0.0452	
49	6	3694.95	3328.94	3608.78	3766.18	157.80	0.0426	
60	2	244.60	244.14	235.62	254.31	18.69	0.0764	
60	3	702.59	679.59	676.95	727.52	50.57	0.0720	
60	4	1401.60	1329.92	1357.92	1453.33	95.41	0.0681	
60	5	2355.73	2206.45	2278.74	2434.14	155.40	0.0660	
60	6	3556.31	3322.97	3436.14	3654.48	218.34	0.0614	
75	2	222.65	243.58	213.15	233.78	20.63	0.0927	
75	3	644.72	678.05	612.15	673.70	61.55	0.0955	
75	4	1293.32	1327.50	1229.80	1254.21	124.41	0.0962	
75	5	2181.63	2261.46	2063.29	2275.89	212.60	0.0974	
75	6	3291.03	3315.51	3101.11	3428.78	327.67	0.0996	

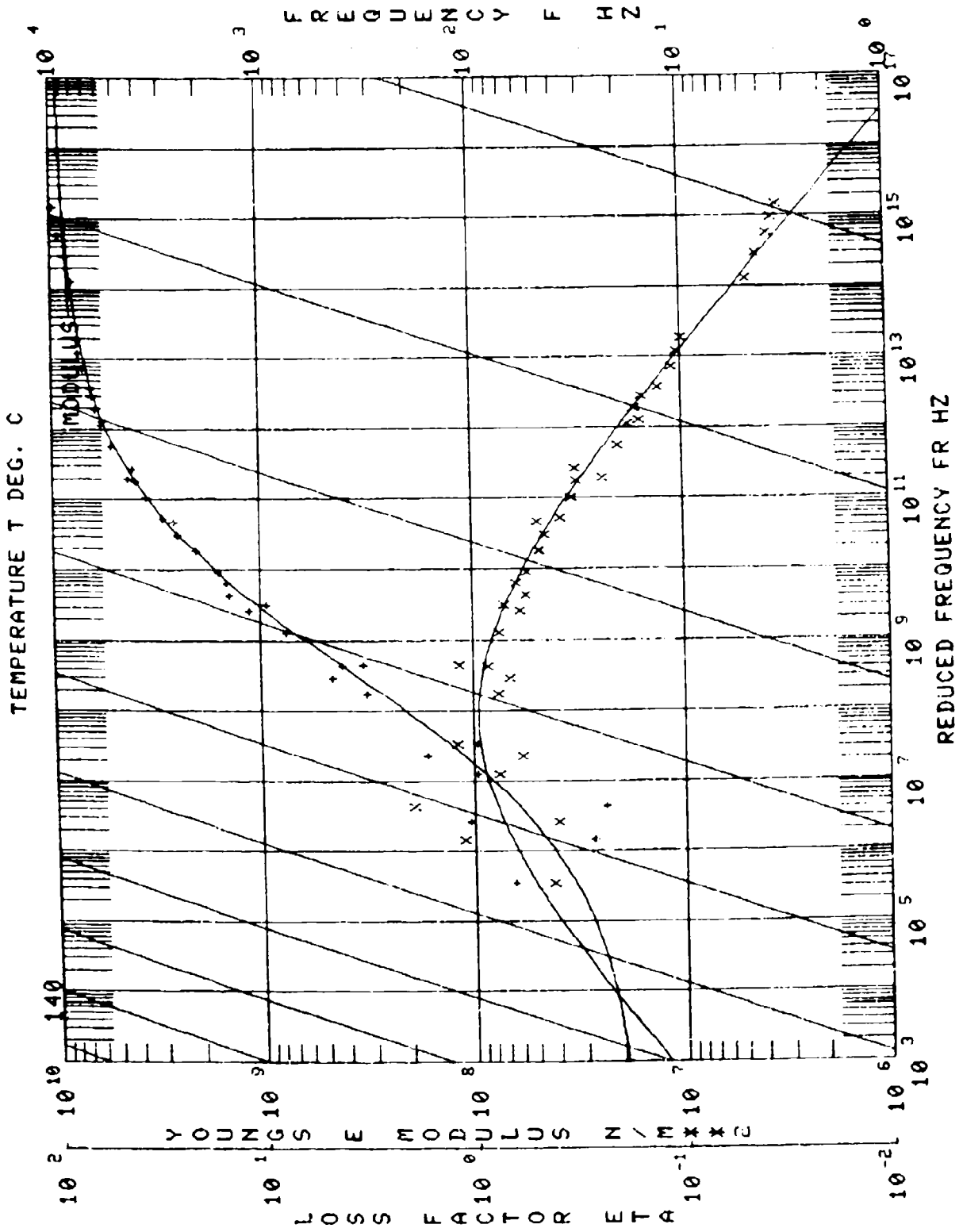
Page 1 of 4

°F	f _c	f _n	f _L	f _R	Δf	n _s	ldB
Temp. Mode							
76 2	216.52	244.14	200.84	235.42	34.58	0.1597	
76 3	637.72	678.05	586.06	692.54	106.48	0.1670	
76 4	1300.93	1327.50	1182.94	1407.05	224.11	0.1723	
76 5	2193.01	2201.46	1956.61	2364.87	408.26	0.1862	
76 6	3362.31	3315.51	3119.89	3432.05	613.71	0.1858	
87 2	210.29	243.14	203.48	218.62	15.14	0.0720	
87 3	605.99	677.12	578.62	632.16	53.54	0.0883	
87 4	1212.81	1325.09	1156.91	1272.40	115.49	0.0952	
87 5	2048.15	2197.46	1937.93	2143.71	205.78	0.1005	
87 6	3094.29	3308.04	2886.61	3234.61	348.00	0.1125	
102 2	203.37	243.05	198.97	208.04	9.07	0.0446	
102 3	579.25	675.58	559.92	597.30	37.32	0.0644	
102 4	1157.66	1323.27	1115.43	1199.05	83.57	0.0722	
102 5	1944.02	2192.46	1861.21	2018.61	157.40	0.0810	
102 6	2928.73	3300.58	2786.31	3052.97	266.66	0.0910	
102 7	5627.41		5378.51	5889.56	510.00	0.0906	
125 2	197.48	242.04	196.10	199.00	2.96	0.0147	
125 3	574.11	673.11	527.84	560.49	12.65	0.0228	
125 4	1102.95	1318.44	1086.80	1119.12	32.26	0.0292	
125 5	1841.35	2182.47	1805.47	1872.31	66.84	0.0309	

°F	f_c	f_n	f_L	f_R	Δf	η_s	ldB
Temp.	Mode						
125	6	2763.77	3287.15	2707.54	2820.44	112.90	0.0408
151	2	195.37	240.94	194.85	196.03	1.18	0.0060
151	3	546.98	670.65	544.87	548.91	4.04	0.0074
151	4	1085.13	1314.20	1079.56	1089.56	10.00	0.0092
150	5	1803.69	2175.48	1793.06	1814.69	21.63	0.0120
150	6	2702.73	3273.71	2684.73	2722.59	37.86	0.0140
176	2	194.06	239.95	193.77	194.51	0.74	0.0038
176	3	542.97	668.49	542.07	544.12	2.05	0.0038
175	4	1076.11	1308.76	1074.11	1078.26	4.15	0.0039
174	5	1788.97	2165.48	1784.52	1793.77	9.25	0.0052
173	6	2680.05	3260.27	2672.35	2687.53	15.18	0.0057
179	2	168.85	239.73	168.48	169.48	1.00	0.0059
177	3	473.24	668.18	471.92	474.86	2.94	0.0062
175	4	929.79	1308.76	926.69	933.31	6.62	0.0071
174	5	1541.10	2165.48	1534.71	1547.62	12.91	0.0084
173	6	2313.47	3260.27	2301.55	2325.13	23.58	0.0102
200	2	193.27	238.84	193.01	193.62	0.61	0.0032
199	3	540.19	665.71	539.45	541.27	1.82	0.0034
199	4	1068.17	1303.32	1066.64	1069.59	2.95	0.0027
198	5	1774.83	2153.49	1771.57	1777.87	6.30	0.0035

EXPERIMENTAL CODE 1140
 MATERIAL IE A R EXODAMP C-2003
 DATA SOURCES
 MANUFACTURER INHME
 AFRL IUDRI-GET
 OTHER INHME

NO.	MODULUS N/R112	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/R112	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/R112
1	3.36380E+08	1.1880	38.9	203.4	2.	6.92832E+10	.0446	243.0	3.99324E+08
2	7.75500E+08	1.7779	38.9	579.2	3.	6.82756E+10	.0644	675.6	6.03279E+08
3	1.16103E+09	.6110	38.9	1157.7	4.	6.82139E+10	.0722	1323.3	7.09367E+08
4	1.43697E+09	.5752	38.9	1944.0	5.	6.85259E+10	.0810	2192.5	8.25972E+08
5	1.47919E+09	.6406	38.9	2928.7	5.	6.98548E+10	.0910	3300.6	9.47632E+08
6	4.74766E+08	.6952	51.7	1841.9	5.	6.79651E+10	.0368	2183.5	3.30659E+08
7	4.23264E+08	.8744	51.7	2763.8	6.	6.92866E+10	.0408	3287.1	3.70092E+08
8	2.11225E+09	.4896	23.9	222.6	2.	6.95857E+10	.0927	243.6	1.03412E+09
9	3.00121E+09	.3870	23.9	644.7	3.	6.87758E+10	.0955	678.1	1.16132E+09
10	3.69465E+09	.3448	23.9	1293.3	4.	6.86507E+10	.0963	1327.5	1.24277E+09
11	4.07987E+09	.3238	23.9	2181.6	5.	6.90896E+10	.0974	2201.5	1.32106E+09
12	4.29779E+09	.3289	23.9	3291.4	6.	7.04873E+10	.0996	3315.5	1.38394E+09
13	5.8253E+09	.1622	9.4	256.1	2.	7.00894E+10	.0593	244.5	9.46013E+08
14	6.67494E+09	.1332	9.4	734.2	3.	6.92778E+10	.0624	680.5	8.89407E+08
15	7.32571E+09	.1136	9.4	1464.7	4.	6.90900E+10	.0467	1331.7	8.32430E+08
16	7.79082E+09	.1075	9.4	2456.9	5.	6.95921E+10	.0452	2209.5	8.36141E+08
17	7.87530E+09	.1017	9.4	3695.0	6.	7.10596E+10	.0426	3328.9	8.06637E+08
18	4.43240E+09	.2432	15.6	244.6	2.	6.90886E+10	.0720	244.1	1.07819E+09
19	5.29293E+09	.2058	15.6	702.6	3.	6.90886E+10	.0720	679.6	1.08920E+09
20	5.87309E+09	.1840	15.6	1491.6	4.	6.89013E+10	.0681	1329.9	1.08048E+09
21	6.37756E+09	.1722	15.6	2355.7	5.	6.94032E+10	.0660	2206.5	1.09158E+09
22	6.54686E+09	.1593	15.6	3556.3	6.	7.08049E+10	.0614	3323.0	1.04264E+09
23	9.54743E+08	.7226	30.6	210.3	2.	6.93345E+10	.0720	243.1	6.99423E+08
24	1.62886E+09	.5659	30.6	606.0	3.	6.85873E+10	.0883	677.1	9.21311E+08
25	2.10495E+09	.4975	30.6	1212.8	4.	6.84017E+10	.0952	1325.1	1.04730E+09
26	2.53000E+09	.4600	30.6	2048.1	5.	6.88388E+10	.1005	2197.5	1.16384E+09
27	2.65354E+09	.5030	30.6	3094.3	6.	7.01701E+10	.1125	3308.0	1.33933E+09
28	8.25547E+09	.0494	-3.3	275.6	2.	7.06640E+10	.0210	245.5	3.84803E+08
29	8.88439E+09	.0493	-3.3	780.7	3.	6.97795E+10	.0192	683.0	3.84803E+08
30	9.48347E+09	.0378	-3.3	1552.1	4.	6.95921E+10	.0172	1336.6	3.58965E+08
31	3.24971E+08	.7871	51.7	1102.9	4.	6.77169E+10	.0292	1318.4	2.55781E+08
32	9.84936E+09	.0359	-3.3	2397.1	5.	7.00959E+10	.0165	2217.5	3.53268E+08
33	9.84421E+07	.0336	-3.3	3387.5	6.	7.16345E+10	.0154	3342.4	3.34273E+08
34	9.88421E+07	.0367	66.1	1085.1	4.	6.72820E+10	.0092	1314.2	7.76215E+07
35	1.68993E+08	.6067	65.6	1893.7	5.	6.74686E+10	.0120	2175.5	1.02521E+08
36	9.87690E+07	1.2211	70.4	2702.7	6.	6.87212E+10	.0140	3273.7	1.20610E+08
37	2.81007E+07	1.1409	70.4	1076.1	4.	6.67265E+10	.0039	1308.8	3.23098E+07
38	1.07046E+08	.4077	78.9	1789.0	5.	6.68497E+10	.0052	2165.5	4.36456E+07
39	2.45310E+07	1.9651	78.3	2680.0	6.	6.81581E+10	.0057	3260.3	4.82072E+07
40	6.65220E+07	.4342	92.8	1774.8	5.	6.61115E+10	.0035	2153.5	2.88392E+07



Polymeric Material Characterization Test

Test No. 79-9
 Beam Nos. 080-3 and _____ Date 2/15/79
 Damping Material E.A.R. Isodamp C-1002

Material Thickness 0.3068 cm Material Density 1.271 g/cc

Beam Thickness 0.2032 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -31.7 °C and 51.7 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor n_D :

Peak 100 Hz n_D 0.900 Temperature 11.0 °C

1000 Hz n_D 0.900 Temperature 19.0 °C

Range 100 Hz -1.0 °C 25.0 °C

1000 Hz 7.0 °C 34.0 °C

$LOG(F) = LOG(ML) + (2LOG(MROM/ML)) / (1 + (FROM/FR) * SH)$
 $T0 = FROM MROM N ML$
 $A1 = 1.0000E+12 A2 = 1.7500E+08 A3 = .350 A4 = 1.5000E+07$
 $A = (LOG(FR) - LOG(FROL)) / C$
 $LOG(ETA) = LOG(ETAFROL) + ((SL + SH)A + (SL - SH)(1 - SQRT(1 + A^2))) / C / 2$
 $T0 = ETAFROL SL SH FROL C$
 $B1 = .000 B2 = .225 B3 = -.225 B4 = 3.0000E+11 B5 = 1.750$
 $LOG(FR) = LOG(F) - 12(T - T0) / (525 + 1.8 * T - T0)$

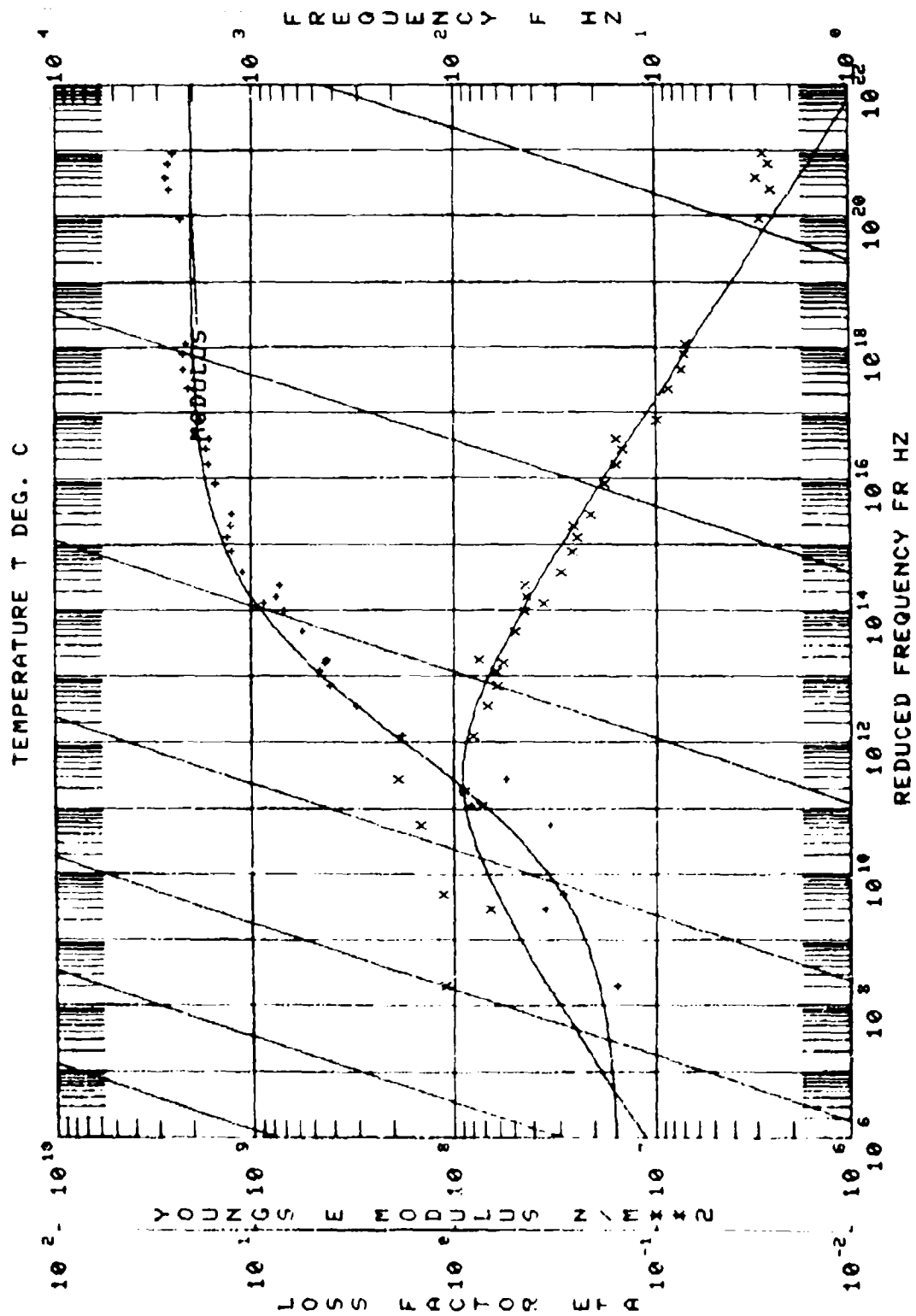
Remarks: Test specimen was an "Obersi"-type confil ion.

θ_F	f_C	f_n	f_L	f_R	Δf	η_S	ldB
0.0	348.24	310.04	345.58	350.78	5.20	0.0493	
0.1	1015.14	975.79	1007.90	1021.86	13.96	0.0137	
0.2	2010.11	1723.46	1997.65	2030.73	33.08	0.0164	
0.3	3311.11	2863.99	3286.39	3332.81	46.42	0.0140	
0.4	4994.97	4293.29	4847.31	4918.97	71.66	0.0147	
0.5	627.81	309.14	321.37	336.51	15.14	0.0462	
0.6	955.60	872.39	932.40	973.55	41.14	0.0431	
0.7	1899.01	1718.02	1862.90	1932.97	70.06	0.0369	
0.8	3150.21	2852.09	3094.19	3205.71	111.52	0.0354	
0.9	4680.65	4476.87	4583.27	4749.27	161.00	0.0344	
1.0	303.47	308.48	291.43	316.00	24.57	0.0819	
1.1	885.96	870.85	852.72	919.09	66.37	0.0749	
1.2	1774.67	1724.39	1713.49	1835.30	121.81	0.0686	
1.3	2952.29	2845.01	2841.37	3042.10	190.82	0.0646	
1.4	4379.47	4264.93	4207.18	4502.41	295.23	0.0674	
1.5	285.50	307.92	270.67	301.5	31.48	0.1103	
1.6	835.04	869.00	791.03	878.62	87.59	0.1049	
1.7	1678.22	1710.16	1592.11	1758.91	166.80	0.0994	
1.8	2808.86	2838.01	2657.89	2928.49	270.60	0.09634	
1.9	4164.71	4257.47	4049.37	4254.81	403.89	0.0970	x

Temp. Mode	f_c	f_n	f_L	f_R	Δf	n_s	1dB
35	262.1	307.37	246.47	274.44	27.97	0.1067	
35	759.31	867.77	717.04	803.48	86.44	0.1138	
35	1531.85	1707.74	1441.01	1620.65	179.64	0.1173	
35	2567.91	2833.02	2396.43	2706.27	309.84	0.1207	
35	3823.48	4250.00	3686.78	3917.41	453.42	0.1186	X
40	247.14	306.71	238.08	255.51	17.43	0.0705	
40	717.65	865.92	682.44	750.05	67.61	0.0942	
40	1442.46	1702.51	1363.21	1517.68	154.47	0.1070	
40	2417.35	2826.02	2261.29	2549.11	387.82	0.1190	
40	3592.51	4239.55	3450.91	3696.44	482.71	0.1341	X
45.2	233.06	305.50	233.47	237.27	3.80	0.0161	
45.2	669.98	862.52	661.20	678.25	17.05	0.0254	
45.2	1334.41	1606.96	1316.09	1356.26	40.17	0.0301	
45.2	2216.83	2833.03	2170.31	2263.53	93.22	0.0405	
45.2	3296.51	4221.64	3203.83	3376.58	172.75	0.0524	
400	233.38	304.29	222.53	234.00	1.47	0.0063	
400	661.00	859.13	658.11	663.80	5.69	0.0086	
400	1323.09	1689.60	1305.35	1321.33	15.98	0.0122	
400	2173.45	2800.04	2154.91	2192.31	37.40	0.0172	
400	3425.73	4229.74	3182.39	3267.39	81.09	0.0251	

EXPERIMENTAL CODE :147
 MATERIAL :E A R :ISODAMP C-1002
 DATA SOURCES
 NAME :AC :URER :NONE
 AFML :UDRI :GE
 OTHER :NONE

WC	MODULUS N/MHZ	LOSS FAC	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MHZ	COMPOSITE LOSS FAC	BEAM FREQ. HZ	COMPLEX MOD. N/MHZ
1	3.5893E+07	6.70	38.9	1313.1	4	6.2557E+10	.0122	1689.6	2.4337E+07
2	1.0437E+07	1.67	38.9	2172.5	5	6.2660E+10	.0172	2880.0	3.4368E+07
3	1.5839E+07	1.12	38.9	2181.8	4	6.2600E+10	.0091	1883.6	1.7828E+07
4	1.5839E+07	6.43	38.9	2149.0	5	6.2670E+10	.0183	2827.0	3.5759E+07
5	3.3655E+06	1.49	38.9	2670.3	3	6.2599E+10	.0254	1662.5	5.6552E+07
6	3.3655E+07	1.92	38.9	1334.3	4	6.3044E+10	.0301	1866.9	6.2130E+07
7	3.3655E+07	1.92	38.9	2216.8	5	6.3454E+10	.0405	4221.6	8.4474E+07
8	1.8453E+08	8.06	38.9	247.7	2	6.2665E+10	.0705	306.7	1.0853E+08
9	1.8453E+08	6.06	38.9	717.7	3	6.3043E+10	.0942	865.9	2.1811E+08
10	1.8453E+08	6.06	38.9	1443.5	4	6.3442E+10	.1078	1702.5	2.6217E+08
11	1.8453E+08	6.06	38.9	2412.5	5	6.4295E+10	.1190	2826.0	3.0909E+08
12	1.8453E+08	6.06	38.9	3599.5	6	6.4295E+10	.1341	4239.5	3.5645E+08
13	1.8453E+08	6.06	38.9	285.5	2	6.2511E+10	.1103	307.9	3.2483E+08
14	1.8453E+08	6.06	38.9	835.0	3	6.3440E+10	.1049	869.0	3.4019E+08
15	1.8453E+08	6.06	38.9	1678.2	4	6.4087E+10	.0994	1710.2	3.4101E+08
16	1.8453E+08	6.06	38.9	2808.0	5	6.4865E+10	.0963	2838.0	3.3948E+08
17	1.8453E+08	6.06	38.9	4164.7	6	6.5178E+10	.0970	4227.5	3.3703E+08
18	1.8453E+08	6.06	38.9	327.8	2	6.3078E+10	.0462	309.1	1.8637E+08
19	1.8453E+08	6.06	38.9	952.6	3	6.4047E+10	.0431	872.4	1.0053E+08
20	1.8453E+08	6.06	38.9	1899.0	4	6.4678E+10	.0369	1718.0	1.8830E+08
21	1.8453E+08	6.06	38.9	3150.2	5	6.5249E+10	.0354	2852.0	1.6255E+08
22	1.8453E+08	6.06	38.9	4680.7	6	6.5975E+10	.0344	4276.9	1.5634E+08
23	1.8453E+08	6.06	38.9	303.5	2	6.2778E+10	.0810	308.5	2.7375E+08
24	1.8453E+08	6.06	38.9	886.0	3	6.3814E+10	.0749	870.8	2.7787E+08
25	1.8453E+08	6.06	38.9	1774.7	4	6.4048E+10	.0686	1744.4	2.6734E+08
26	1.8453E+08	6.06	38.9	2952.3	5	6.4055E+10	.0646	2855.0	2.5515E+08
27	1.8453E+08	6.06	38.9	4279.5	6	6.5080E+10	.0674	4204.9	2.6264E+08
28	1.8453E+08	6.06	38.9	2622.0	2	6.2279E+10	.0671	307.4	2.6002E+08
29	1.8453E+08	6.06	38.9	759.3	3	6.3464E+10	.1108	867.8	3.5831E+08
30	1.8453E+08	6.06	38.9	2567.9	4	6.5195E+10	.1207	2823.0	3.4763E+08
31	1.8453E+08	6.06	38.9	3823.5	5	6.5195E+10	.1186	4203.0	3.4002E+08
32	1.8453E+08	6.06	38.9	348.2	2	6.3072E+10	.0573	310.2	6.9189E+07
33	1.8453E+08	6.06	38.9	1018.1	3	6.3088E+10	.0164	1233.0	1.5588E+07
34	1.8453E+08	6.06	38.9	2018.1	4	6.5081E+10	.0164	1233.0	1.5588E+07
35	1.8453E+08	6.06	38.9	331.1	2	6.5081E+10	.0164	1233.0	1.5588E+07
36	1.8453E+08	6.06	38.9	4885.0	5	6.6035E+10	.0147	2864.0	7.5809E+07
37	1.8453E+08	6.06	38.9	1531.0	4	6.6035E+10	.0173	4233.3	3.2723E+08
38	1.8453E+08	6.06	38.9	1015.1	3	6.4409E+10	.0137	107.7	6.5801E+07



Polymeric Material Characterization Test

Test No. 78-3

Beam Nos. Not and Recorded

Date 2/3/78

Damping Material MacBond IB1120

Material Thickness 0.0203 cm Material Density 0.950 g/cc

Beam Thickness 0.2032 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -3.9 °C and 79.4 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.5 Temperature 12.2 °C

1000 Hz η_D 1.5 Temperature 32.2 °C

Range 100 Hz -3.9 °C 29.4 °C

1000 Hz 15.6 °C 53.9 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MR0M/ML)) / (1 + (FROM/FR) \cdot IN)$$

T0	FROM	MR0M	N	ML
	A1	A2	A3	A4
40.0	2.0000E+03	3.3000E+06	.450	7.7500E+04

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL + SH)A + (SL - SH)(1 - \text{SORT}(1 + A \cdot 12))) / C / 2$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
40.0	1.500	1.000	-.900	1.3500E+03	2.250

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 / 1.8 + T - T0)$$

Remarks:

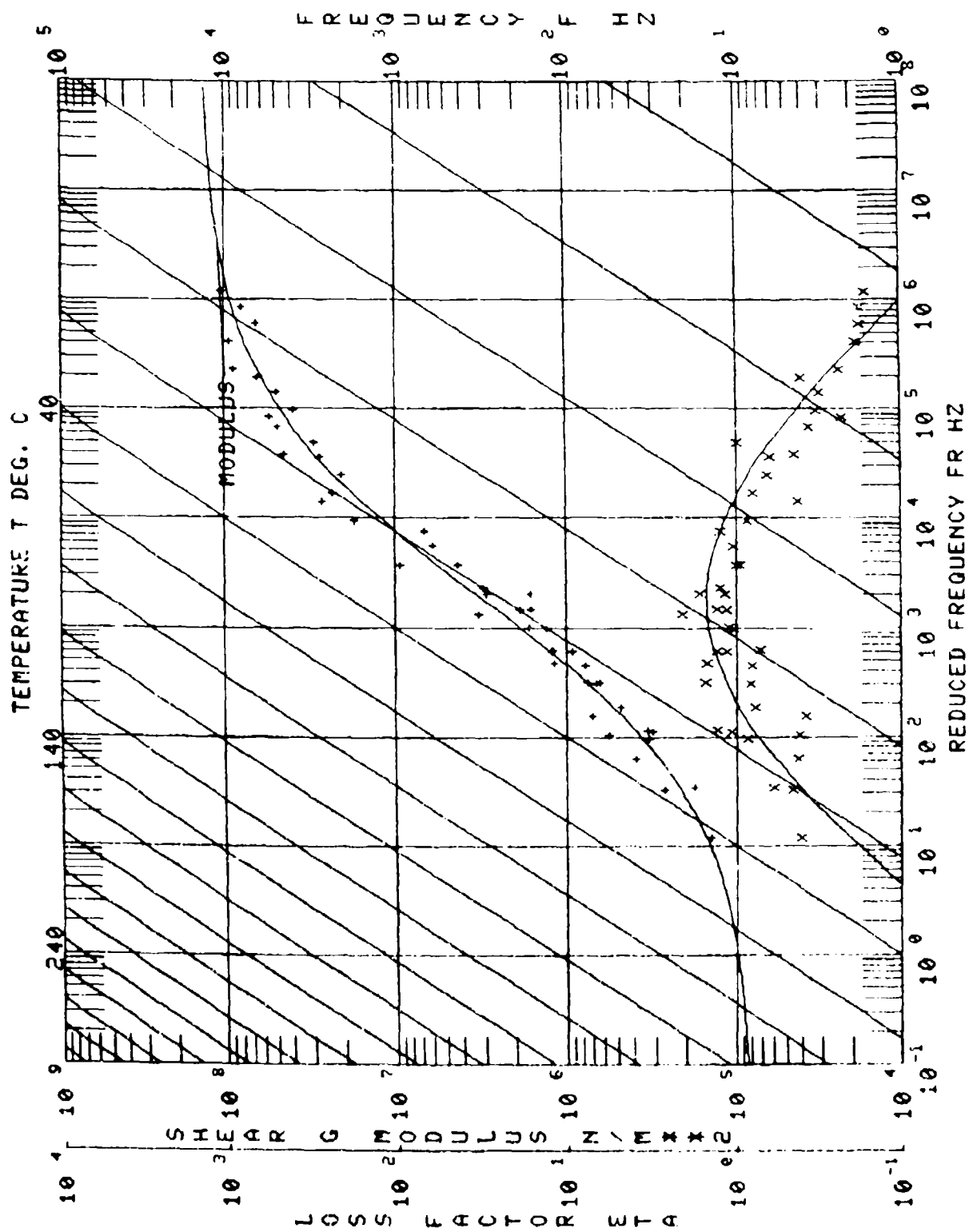
Test No. 78-3
Beam No. Not Recorded

Temp. Mode	f_c	f_n	f_L	f_R	Δf	η_s	lGB
25	2	656.7	327.3	648.4	665.5	17.1	0.0260
25	3	1763.0	912.2	1729.5	1800.6	71.1	0.0404
25	4	3222.9	1783.5	3142.5	3298.2	155.7	0.0484
25	5	4656.0	2942.5	4524.2	4819.2	295.0	0.0634
25	6	6712.6	4407.4	6505.5	6937.1	431.6	0.0643
25	7	9286.5	6140.3	9003.1		566.8	0.0611
50	2	624.3	325.9	601.6	648.9	47.3	0.0758
50	3	1649.4	908.8	1568.1	1746.0	177.9	0.1080
50	4	2942.9	1777.5	2804.7	3146.8	342.1	0.1160
50	5	4260.2	2932.0	3996.0	4497.6	501.6	0.1180
50	6	6169.7	4391.0	5811.9	6500.5	688.6	0.1130
50	7	8503.0	6121.6	7898.6		1208.8	0.1436
70	2	572.9	324.8	513.3	645.1	131.8	0.2364
70	3	1463.0	905.8	1323.1	1683.8	360.7	0.2544
70	4	2634.1	1772.6	2344.6	3003.0	658.4	0.2581
70	5	3816.0	2923.0	3586.9	3980.8	774.4	0.2072
70	6	5599.3	4377.6	5289.7	5835.2	1072.4	0.1951
70	7	7573.7	6100.7	7098.0	8120.9	2011.0	0.2753
100	2	389.8	323.1	337.7	468.1	130.4	0.3550
100	3	1115.2	902.1		1233.3	232.2	0.4578

°E	f _C	f _n	f _L	f _R	Δf	η _S	1dB
100	1920.2	1764.2	1763.1	2138.2	375.1	0.1982	
100	3130.9	2910.0	2917.1	3329.7	411.6	0.1326	
100	4670.3	4358.8	4363.8	5006.8	643.0	0.1390	
100	6425.6	6071.8	5978.0	6890.6	912.6	0.1435	
125	339.0	321.7	318.4	365.8	47.4	0.1412	
125	937.1	898.4	874.2	1003.8	129.6	0.1383	
125	1816.5	1758.1	1720.3	1903.2	182.9	0.1012	
125	2973.4	2899.0	2868.1	3081.6	213.5	0.0720	
125	4414.3	4337.4	4288.5	4579.0	290.5	0.0659	
125	6168.0	6042.3	5953.7	6357.7	404.0	0.0656	
125	337.4	321.7	320.8	347.8	37.0	0.1103	
125	929.7	898.4	876.2	985.8	109.6	0.1187	
125	1799.1	1758.1	1738.6	1862.5	123.9	0.0690	
125	2953.2	2899.0	2874.5	3034.1	159.6	0.0541	
125	4398.7	4337.4	4292.4	4513.1	220.7	0.0502	
125	6090.2	6042.3	5961.1	6278.6	317.5	0.0522	
125	328.0	320.1	321.8	334.2	12.4	0.0378	
125	907.4	895.3	900.0	916.9	33.22	0.0365	X
125	1764.3	1750.3	1742.9	1786.5	43.6	0.0247	
125	2904.1	2898.0	2873.9	2939.4	65.5	0.0226	

EXPERIMENTAL CODE :197
 MATERIAL :MACBOND 1120
 DATA SOURCES
 MANUFACTURER :NONE
 AFRL :UDRI
 OTHER :NONE

NO.	MODULUS N/MHz	LOSS FACTOR	TEMP. DEG. C	FREQ. MHz	MODE NO.	BEAM MOD. N/MHz	COMPOSITE LOSS FAC.	BEAM FREQ. Hz	COMPLEX MOD. N/MHz
1	5.6119E+07	.2347	-3.9	656.7	2.	7.0672E+10	.0260	327.3	1.3171E+07
2	9.0946E+07	.2420	-3.9	1763.6	3.	7.0018E+10	.0401	912.2	2.2004E+07
3	9.5324E+07	.1937	-3.9	3222.9	4.	6.9020E+10	.0484	1783.5	1.8468E+07
4	6.6232E+07	.1833	-3.9	4656.0	5.	6.9477E+10	.0634	2943.5	1.2139E+07
5	8.0639E+07	.1797	-3.9	6712.6	6.	7.0064E+10	.0643	4407.4	1.4499E+07
6	1.0775E+08	.1700	-3.9	9286.5	7.	6.9450E+10	.0611	6140.3	1.8316E+07
7	2.6998E+07	.4327	10.0	624.3	2.	7.0669E+10	.0753	325.9	1.1682E+07
8	4.5536E+07	.4565	10.0	1649.1	3.	6.9027E+10	.0800	608.8	2.0786E+07
9	4.9831E+07	.3681	10.0	2942.9	4.	6.9333E+10	.1160	1777.5	1.8343E+07
10	4.0216E+07	.3304	10.0	4260.2	5.	6.8935E+10	.1180	2932.0	1.3285E+07
11	5.0628E+07	.3178	10.0	6169.7	6.	6.9441E+10	.1130	4391.0	1.6091E+07
12	6.0979E+07	.4112	10.0	8502.0	7.	6.9277E+10	.1436	6121.6	2.6712E+07
13	5.6621E+06	1.0392	21.1	572.0	3.	6.9371E+10	.2364	384.8	1.0041E+07
14	2.3787E+07	.8712	21.1	1463.1	3.	6.9038E+10	.2544	905.8	1.5619E+07
15	2.0943E+07	.7587	21.1	2634.1	4.	6.8526E+10	.2581	172.6	1.9000E+07
16	2.8160E+07	.6534	21.1	3816.0	5.	6.8512E+10	.2072	2923.0	1.3684E+07
17	2.8160E+07	.6232	21.1	5599.3	6.	6.9120E+10	.1951	4777.6	1.7804E+07
18	3.0234E+07	1.0095	21.1	7573.7	7.	6.8572E+10	.2753	6400.7	3.0573E+07
19	1.2018E+06	1.5426	37.8	389.8	2.	6.8370E+10	.3550	323.1	1.8539E+06
20	3.3179E+06	2.1551	37.8	1115.2	3.	6.8769E+10	.4578	902.1	7.1505E+06
21	3.1257E+06	1.2870	37.8	1929.2	4.	6.8016E+10	.1325	1764.2	4.0229E+06
22	1.3610E+06	.9641	37.8	3130.9	5.	6.7904E+10	.1325	2910.2	4.2044E+06
23	1.4852E+06	1.0636	37.8	4670.3	6.	6.8375E+10	.1300	4358.8	6.5393E+06
24	6.9432E+06	1.2939	37.8	6425.6	7.	6.7909E+10	.1435	6071.8	8.9836E+06
25	3.4194E+05	1.3544	51.7	329.0	2.	6.8275E+10	.1412	321.7	4.6312E+05
26	7.7433E+05	1.5783	51.7	937.1	3.	6.7916E+10	.1383	998.4	1.2221E+06
27	1.2407E+06	1.3671	51.7	1816.5	4.	6.7306E+10	.1012	1758.1	1.6963E+06
28	1.6853E+06	1.1511	51.7	2973.4	5.	6.7323E+10	.0720	2999.0	1.9397E+06
29	1.5306E+06	1.3475	51.7	4414.8	6.	6.7356E+10	.0659	4337.4	2.6014E+06
30	2.5962E+06	1.2097	51.7	6168.0	7.	6.7350E+10	.0656	6042.3	3.6248E+06
31	3.1965E+05	1.1152	51.7	929.7	2.	6.8750E+10	.1103	321.7	3.5649E+05
32	6.5147E+05	1.5701	51.7	1799.1	3.	6.7516E+10	.1187	895.4	1.0229E+06
33	9.5220E+05	1.1753	51.7	2953.2	4.	6.7308E+10	.0690	1758.1	1.1219E+06
34	1.3408E+06	1.0639	51.7	4398.7	5.	6.7392E+10	.0541	2899.0	1.4264E+06
35	1.6654E+06	1.1763	51.7	6090.2	6.	6.7856E+10	.0502	4337.4	1.9591E+06
36	1.6490E+06	1.6795	51.7	8090.2	7.	6.7350E+10	.0522	6042.3	2.1707E+06
37	1.8400E+06	.8104	65.6	328.0	2.	6.7597E+10	.0378	320.1	1.1230E+05
38	3.3575E+05	.8715	65.6	907.4	3.	6.7448E+10	.0355	895.3	2.9268E+05
39	4.8900E+05	.7763	65.6	1764.3	4.	6.7311E+10	.0277	1750.3	3.7964E+05
40	6.8471E+05	.8232	65.6	2904.1	5.	6.6814E+10	.0266	2888.0	5.6775E+05
41	8.0011E+05	.8197	65.6	4328.9	6.	6.7551E+10	.0176	4318.0	8.9776E+05
42	1.2325E+06	.7284	65.6	6035.4	7.	6.6025E+10	.0173	6013.1	6.1504E+04
43	1.4790E+05	.4156	79.4	324.5	2.	6.6655E+10	.0213	318.6	1.3285E+05
44	2.7845E+05	.4771	79.4	900.4	3.	6.6821E+10	.0193	891.6	1.7379E+05
45	3.9832E+05	.4363	79.4	1752.4	4.	6.6518E+10	.0155	1743.6	2.5003E+05
46	5.8167E+05	.4230	79.4	2886.2	5.	6.6327E+10	.0101	2876.0	3.5003E+05
47	7.2145E+05	.3855	79.4	4303.7	6.	6.6046E+10	.0076	4297.2	2.7809E+05



Polymeric Material Characterization Test

Test No. 78-4

Beam Nos. Not and Recorded

Date 2/9/78

Damping Material MacBond IB1160

Material Thickness 0.0102 cm Material Density 0.965 g/cc

Beam Thickness 0.152 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -3.9 °C and 65.6 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 2.0 Temperature 7.2 °C

1000 Hz η_D 2.0 Temperature 29.4 °C

Range 100 Hz -6.7 °C 20.0 °C

1000 Hz 15.6 °C 46.1 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR) \times N)$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
30.0	4.0000E+03	4.0000E+06	.600	8.0000E+04

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL + SH)A + (SL - SH)(1 - \text{SQRT}(1 + A \times 2))) / C / 2$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
30.0	2.000	.750	-.750	10.0000E+02	1.000

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 / 1.8 + T - T0)$$

Remarks:

°E	f_c	f_n	f_L	f_R	Δf	η_s	ldB
25	493.4	240.7	488.1	499.1	11.0	0.0223	
25	1328.1	675.5	1307.8	1348.2	40.4	0.0304	
25	2530.4	1322.7	2473.5	2580.2	106.7	0.0422	
25	3958.4	2184.0	3853.0	4054.4	201.4	0.0509	
25	5745.9	3257.7	5580.0	5926.6	346.6	0.0604	
25	7408.2	4553.6	7111.5	7640.1	528.6	0.0715	
30	476.7	239.8	456.5	497.7	41.2	0.0868	
30	1252.4	673.0	1186.5	1322.8	136.3	0.1095	
30	2345.2	1318.7	2203.6	2509.1	305.5	0.1314	
30	3588.0	2177.6	3315.3	3867.0	551.7	0.1556	
30	5260.6	3249.7		5654.2	787.2	0.1513	
30	6709.6	4542.4		7470.2	1521.2	0.2328	
34	435.7	238.9	367.5	556.3	168.8	0.4202	
34	1056.3	670.5	848.9	1317.7	468.8	0.4953	
34	1983.4	1314.1	1776.2	2194.0	821.4	0.2155	X
34	3018.4	2170.4		3269.6	987.7	0.1688	X
38	281.4	237.9	242.2	338.2	96.0	0.3629	
38	726.5	667.6	638.9	838.6	199.7	0.2859	
38	1385.7	1309.0	1257.8	1517.4	259.6	0.1907	
38	2289.2	2162.4	2049.1	2483.4	434.3	0.1940	

°F	f _C	f _n	f _L	f _R	Δf	n _s	ldB
Temp. Mode							
25	2	493.4	240.7	488.1	499.1	11.0	0.0223
25	3	1328.1	675.5	1307.8	1348.2	40.4	0.0304
25	4	2530.4	1322.7	2473.5	2580.2	106.7	0.0422
25	5	3958.4	2184.0	3853.0	4054.4	201.4	0.0509
25	6	5745.9	3257.7	5580.0	5926.6	346.6	0.0604
25	7	7400.2	4553.6	7111.5	7640.1	528.6	0.0715
50	2	476.7	239.8	456.5	497.7	41.2	0.0868
50	3	1252.4	673.0	1186.5	1322.8	136.3	0.1095
50	4	2345.2	1318.7	2203.6	2509.1	305.5	0.1314
50	5	3588.0	2177.6	3315.3	3867.0	551.7	0.1556
50	6	5260.6	3249.7		5654.2	787.2	0.1513
50	7	6709.6	4542.4		7470.2	1521.2	0.2328
74	2	435.7	238.9	367.5	536.3	168.8	0.4202
74	3	1056.3	670.5	848.9	1317.7	468.8	0.4353
74	4	1983.4	1314.1	1776.2	2194.0	821.4	0.2155
74	5	3018.4	2170.4		3269.6	987.7	0.1688
100	2	281.4	237.9	242.2	338.2	96.0	0.3629
100	3	726.5	667.6	638.9	838.6	199.7	0.2859
100	4	1385.7	1309.0	1257.8	1517.4	259.6	0.1907
100	5	2280.1	2162.4	2049.1	2483.4	434.3	0.1940

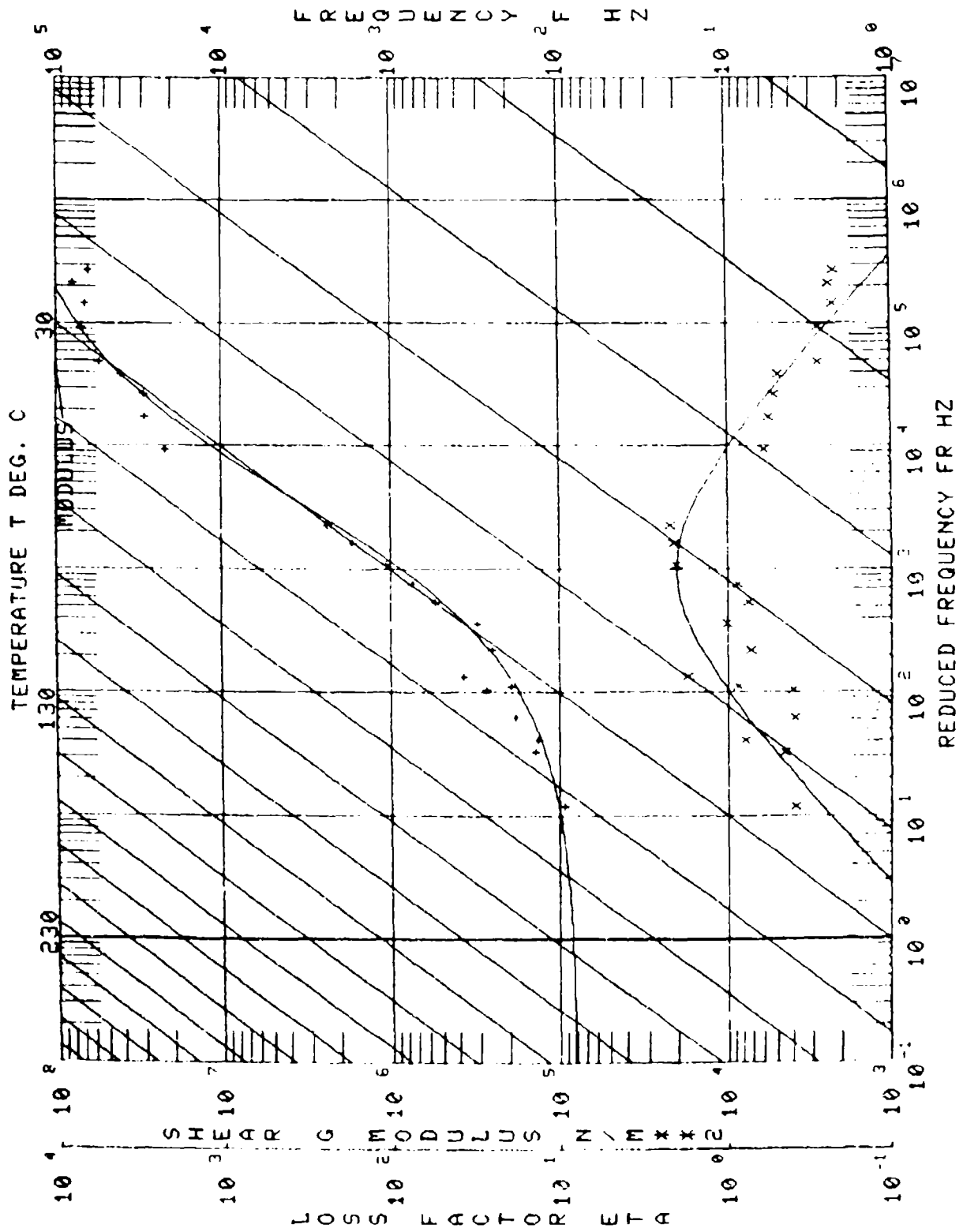
Test No. 78-4

Beam No. Not Recorded

f_c	f_n	f_L	f_R	Δf	n_s	ldB
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-100.00
0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	-98.67
0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	-97.34
0.0003	0.0003	0.0003	0.0003	0.0000	0.0000	-96.01
0.0004	0.0004	0.0004	0.0004	0.0000	0.0000	-94.68
0.0005	0.0005	0.0005	0.0005	0.0000	0.0000	-93.35
0.0006	0.0006	0.0006	0.0006	0.0000	0.0000	-92.02
0.0007	0.0007	0.0007	0.0007	0.0000	0.0000	-90.69
0.0008	0.0008	0.0008	0.0008	0.0000	0.0000	-89.36
0.0009	0.0009	0.0009	0.0009	0.0000	0.0000	-88.03
0.0010	0.0010	0.0010	0.0010	0.0000	0.0000	-86.70
0.0011	0.0011	0.0011	0.0011	0.0000	0.0000	-85.37
0.0012	0.0012	0.0012	0.0012	0.0000	0.0000	-84.04
0.0013	0.0013	0.0013	0.0013	0.0000	0.0000	-82.71
0.0014	0.0014	0.0014	0.0014	0.0000	0.0000	-81.38
0.0015	0.0015	0.0015	0.0015	0.0000	0.0000	-80.05
0.0016	0.0016	0.0016	0.0016	0.0000	0.0000	-78.72
0.0017	0.0017	0.0017	0.0017	0.0000	0.0000	-77.39
0.0018	0.0018	0.0018	0.0018	0.0000	0.0000	-76.06
0.0019	0.0019	0.0019	0.0019	0.0000	0.0000	-74.73
0.0020	0.0020	0.0020	0.0020	0.0000	0.0000	-73.40
0.0021	0.0021	0.0021	0.0021	0.0000	0.0000	-72.07
0.0022	0.0022	0.0022	0.0022	0.0000	0.0000	-70.74
0.0023	0.0023	0.0023	0.0023	0.0000	0.0000	-69.41
0.0024	0.0024	0.0024	0.0024	0.0000	0.0000	-68.08
0.0025	0.0025	0.0025	0.0025	0.0000	0.0000	-66.75
0.0026	0.0026	0.0026	0.0026	0.0000	0.0000	-65.42
0.0027	0.0027	0.0027	0.0027	0.0000	0.0000	-64.09
0.0028	0.0028	0.0028	0.0028	0.0000	0.0000	-62.76
0.0029	0.0029	0.0029	0.0029	0.0000	0.0000	-61.43
0.0030	0.0030	0.0030	0.0030	0.0000	0.0000	-60.10
0.0031	0.0031	0.0031	0.0031	0.0000	0.0000	-58.77
0.0032	0.0032	0.0032	0.0032	0.0000	0.0000	-57.44
0.0033	0.0033	0.0033	0.0033	0.0000	0.0000	-56.11
0.0034	0.0034	0.0034	0.0034	0.0000	0.0000	-54.78
0.0035	0.0035	0.0035	0.0035	0.0000	0.0000	-53.45
0.0036	0.0036	0.0036	0.0036	0.0000	0.0000	-52.12
0.0037	0.0037	0.0037	0.0037	0.0000	0.0000	-50.79
0.0038	0.0038	0.0038	0.0038	0.0000	0.0000	-49.46
0.0039	0.0039	0.0039	0.0039	0.0000	0.0000	-48.13
0.0040	0.0040	0.0040	0.0040	0.0000	0.0000	-46.80
0.0041	0.0041	0.0041	0.0041	0.0000	0.0000	-45.47
0.0042	0.0042	0.0042	0.0042	0.0000	0.0000	-44.14
0.0043	0.0043	0.0043	0.0043	0.0000	0.0000	-42.81
0.0044	0.0044	0.0044	0.0044	0.0000	0.0000	-41.48
0.0045	0.0045	0.0045	0.0045	0.0000	0.0000	-40.15
0.0046	0.0046	0.0046	0.0046	0.0000	0.0000	-38.82
0.0047	0.0047	0.0047	0.0047	0.0000	0.0000	-37.49
0.0048	0.0048	0.0048	0.0048	0.0000	0.0000	-36.16
0.0049	0.0049	0.0049	0.0049	0.0000	0.0000	-34.83
0.0050	0.0050	0.0050	0.0050	0.0000	0.0000	-33.50
0.0051	0.0051	0.0051	0.0051	0.0000	0.0000	-32.17
0.0052	0.0052	0.0052	0.0052	0.0000	0.0000	-30.84
0.0053	0.0053	0.0053	0.0053	0.0000	0.0000	-29.51
0.0054	0.0054	0.0054	0.0054	0.0000	0.0000	-28.18
0.0055	0.0055	0.0055	0.0055	0.0000	0.0000	-26.85
0.0056	0.0056	0.0056	0.0056	0.0000	0.0000	-25.52
0.0057	0.0057	0.0057	0.0057	0.0000	0.0000	-24.19
0.0058	0.0058	0.0058	0.0058	0.0000	0.0000	-22.86
0.0059	0.0059	0.0059	0.0059	0.0000	0.0000	-21.53
0.0060	0.0060	0.0060	0.0060	0.0000	0.0000	-20.20
0.0061	0.0061	0.0061	0.0061	0.0000	0.0000	-18.87
0.0062	0.0062	0.0062	0.0062	0.0000	0.0000	-17.54
0.0063	0.0063	0.0063	0.0063	0.0000	0.0000	-16.21
0.0064	0.0064	0.0064	0.0064	0.0000	0.0000	-14.88
0.0065	0.0065	0.0065	0.0065	0.0000	0.0000	-13.55
0.0066	0.0066	0.0066	0.0066	0.0000	0.0000	-12.22
0.0067	0.0067	0.0067	0.0067	0.0000	0.0000	-10.89
0.0068	0.0068	0.0068	0.0068	0.0000	0.0000	-9.56
0.0069	0.0069	0.0069	0.0069	0.0000	0.0000	-8.23
0.0070	0.0070	0.0070	0.0070	0.0000	0.0000	-6.90
0.0071	0.0071	0.0071	0.0071	0.0000	0.0000	-5.57
0.0072	0.0072	0.0072	0.0072	0.0000	0.0000	-4.24
0.0073	0.0073	0.0073	0.0073	0.0000	0.0000	-2.91
0.0074	0.0074	0.0074	0.0074	0.0000	0.0000	-1.58
0.0075	0.0075	0.0075	0.0075	0.0000	0.0000	-0.25
0.0076	0.0076	0.0076	0.0076	0.0000	0.0000	10.88
0.0077	0.0077	0.0077	0.0077	0.0000	0.0000	22.21
0.0078	0.0078	0.0078	0.0078	0.0000	0.0000	33.54
0.0079	0.0079	0.0079	0.0079	0.0000	0.0000	44.87
0.0080	0.0080	0.0080	0.0080	0.0000	0.0000	56.20
0.0081	0.0081	0.0081	0.0081	0.0000	0.0000	67.53
0.0082	0.0082	0.0082	0.0082	0.0000	0.0000	78.86
0.0083	0.0083	0.0083	0.0083	0.0000	0.0000	90.19
0.0084	0.0084	0.0084	0.0084	0.0000	0.0000	101.52
0.0085	0.0085	0.0085	0.0085	0.0000	0.0000	112.85
0.0086	0.0086	0.0086	0.0086	0.0000	0.0000	124.18
0.0087	0.0087	0.0087	0.0087	0.0000	0.0000	135.51
0.0088	0.0088	0.0088	0.0088	0.0000	0.0000	146.84
0.0089	0.0089	0.0089	0.0089	0.0000	0.0000	158.17
0.0090	0.0090	0.0090	0.0090	0.0000	0.0000	169.50
0.0091	0.0091	0.0091	0.0091	0.0000	0.0000	180.83
0.0092	0.0092	0.0092	0.0092	0.0000	0.0000	192.16
0.0093	0.0093	0.0093	0.0093	0.0000	0.0000	203.49
0.0094	0.0094	0.0094	0.0094	0.0000	0.0000	214.82
0.0095	0.0095	0.0095	0.0095	0.0000	0.0000	226.15
0.0096	0.0096	0.0096	0.0096	0.0000	0.0000	237.48
0.0097	0.0097	0.0097	0.0097	0.0000	0.0000	248.81
0.0098	0.0098	0.0098	0.0098	0.0000	0.0000	260.14
0.0099	0.0099	0.0099	0.0099	0.0000	0.0000	271.47
0.0100	0.0100	0.0100	0.0100	0.0000	0.0000	282.80

MATERIAL CODE : 8
 MATERIAL : MACBOND 18 1160 78-4
 LOG(FR)-LOG(F)-12(T-T0)/(525/1.8+T-T0)

NO.	MODULUS N/MI ^{1/2}	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.
1	5.59578E+07	.2890	-3.9	1328.1	3.
2	7.21881E+07	.2810	-3.9	2530.4	4.
3	8.12802E+07	.2420	-3.9	5745.9	6.
4	6.84512E+07	.2310	-3.9	3958.4	5.
5	6.53623E+07	.2270	-3.9	7408.2	7.
6	2.3597E+07	.6140	10.0	1252.4	3.
7	3.0256E+07	.5760	10.0	2345.2	4.
8	3.04817E+07	.5350	10.0	3588.0	5.
9	4.15754E+07	.4980	10.0	5260.6	6.
10	3.79001E+05	1.7879	37.8	281.4	2.
11	1.0868E+06	2.0550	37.8	2280.1	5.
12	1.7090E+06	2.1350	37.8	3416.7	6.
13	2.42351E+06	2.2720	37.8	4788.8	7.
14	1.37481E+05	.8000	50.0	250.4	2.
15	2.00017E+05	.8950	50.0	683.3	3.
16	2.56892E+05	.7370	50.0	1325.2	4.
17	3.14815E+05	1.0300	50.0	2178.4	5.
18	5.61233E+05	.7690	50.0	3265.9	6.
19	7.64628E+05	.8800	50.0	4564.5	7.
20	9.61819E+04	.4040	65.6	245.0	2.
21	1.45315E+05	.4640	65.6	673.9	3.
22	1.88041E+05	.4040	65.6	1311.9	4.
23	2.20134E+05	.4150	65.6	2165.2	5.



Polymeric Material Characterization Test

Test No. 78-5

Beam Nos. Not and Recorded

Date 2/13/78

Damping Material MacBond IB1200

Material Thickness 0.0279 cm Material Density 0.965 g/cc

Beam Thickness 0.2032 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -17.8 °C and 51.7 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.5 Temperature -4.4 °C

1000 Hz η_D 1.5 Temperature 16.1 °C

Range 100 Hz -17.8 °C 10.0 °C

1000 Hz 2.2 °C 31.1 °C

$$\text{LOG}(M) \cdot \text{LOG}(ML) \cdot (2 \text{LOG}(MROM/ML)) / (1 + (FROM/FR) \cdot XN)$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
30.0	4.2478E+03	7.0540E+06	.620	2.5097E+05

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL + SH)A + (SL - SH)((1 - \text{SQRT}(1 + A^2)))C / 2$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
30.0	1.500	.750	-.600	3.0000E+03	1.000

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 + 1.8(T - T0))$$

Remarks:

Test No. 78-5
Beam No. Not Recorded

°F	f _C	f _n	f _L	f _R	Δf	n _S	ldB
Temp. Mode							
0	2	688.5	328.4	679.4	697.4	18.0	0.0261
0	3	1845.6	915.3	1787.6	1888.8	101.2	0.0549
0	4	3410.8	1790.2	3340.7	3482.1	141.4	0.0415
0	5	5303.6	2954.0	5167.5	5446.3	278.8	0.0526
0	6	7438.9	4422.3	7210.6	5446.3	439.4	0.0592
0	7	9818.0	6173.7	9442.8		750.4	0.0767
25	2	656.6	327.3	634.2	680.5	46.3	0.0707
25	3	1729.5	912.2	1644.9	1809.0	164.1	0.0953
25	4	3141.5	1784.1	2980.7	3309.0	328.3	0.1051
25	5	4865.1	2943.0	4489.9	5294.2	804.3	0.1676
25	6	6750.4	4407.4	6234.0	7179.6	945.6	0.1415
25	7	8779.0	6148.7	8426.6	9072.5	1269.8	0.1461
50	2	584.8	325.9	524.4	666.4	142.0	0.2503
50	3	1458.5	908.8	1303.1	1716.5	413.4	0.2956
50	4	2733.4	1777.5	2372.9	3084.8	711.9	0.2698
50	5	4153.9	2932.0	3854.7	4401.1	1074.2	0.2676
50	6	5764.9	4391.0	5427.8	6118.6	1359.1	0.2423
70	2	445.6	324.8	388.3		114.6	0.2661
70	3	1215.1	906.1	976.0		478.2	0.3935
70	4	2225.2	1773.0	1796.2	2706.6	910.6	0.4485

Test No. 78-5

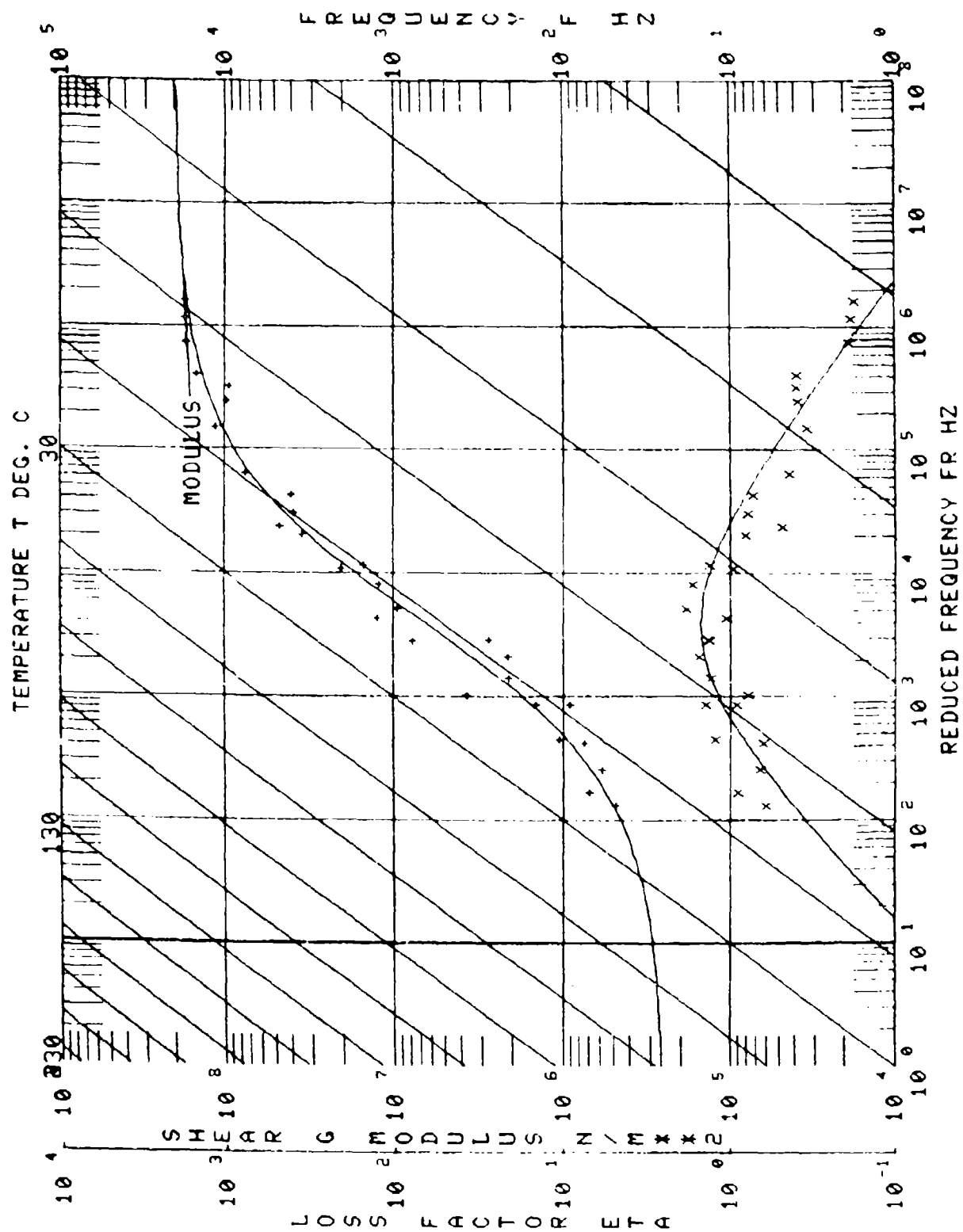
Beam No. Not Recorded

153

[illegible]

MATERIAL CODE 1 5
 MATERIAL : MACROBOND 1B 1200 78-5
 LOG(FR) = LOG(F) - 12(T-T0)/(525/1.8 + T - T0)

NO.	MODULUS N/MS ²	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.
1	3.79143E+06	.8040	21.1	445.6	2.
2	7.96344E+06	1.3840	21.1	1215.1	3.
3	9.89398E+06	1.8950	21.1	2225.2	4.
4	1.25485E+07	1.7560	21.1	3479.6	5.
5	1.54167E+07	1.3710	21.1	5004.5	6.
6	1.28518E+07	1.0820	10.0	584.8	2.
7	2.09118E+07	.9870	10.0	1458.5	3.
8	3.56845E+07	.8260	10.0	2733.4	4.
9	3.93758E+07	.7970	10.0	4153.9	5.
10	4.13754E+07	.7540	10.0	5764.9	6.
11	4.82081E+07	.4940	-3.9	656.6	2.
12	1.00526E+08	.3930	-3.9	6750.4	6.
13	9.71471E+07	.4020	-3.9	8779.0	7.
14	1.16728E+08	.3450	-17.8	688.5	2.
15	1.52443E+08	.3990	-17.8	1845.6	3.
16	1.73403E+08	.1910	-17.8	3410.8	4.
17	1.78988E+08	.1870	-17.8	5303.6	5.
18	1.75678E+08	.1780	-17.8	7438.9	6.
19	7.07402E+05	.9260	37.8	349.7	2.
20	1.09114E+06	1.2710	37.8	940.7	3.
21	1.50650E+06	1.4400	37.8	1812.4	4.
22	2.14772E+06	1.3620	37.8	2974.0	5.
23	2.1667E+06	1.6000	37.8	4405.7	6.
24	2.80065E+06	1.4010	37.8	6126.6	7.
25	4.99663E+05	.6240	51.7	910.3	3.
26	6.06601E+05	.6750	51.7	1755.0	4.
27	7.58423E+05	.6480	51.7	2899.0	5.
28	9.38376E+05	.9330	51.7	6014.6	7.
29	7.66697E+07	.4400	-3.9	1739.5	3.



Polymeric Material Characterization Test

Test No. 78-6

Beam Nos. Not and Recorded

Date 2/15/78

Damping Material MacIond 1B1220

Material Thickness 0.0254 cm Material Density 0.965 g/cc

Beam Thickness 0.2032 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -3.9 °C and 51.7 °C

Frequency Test Range: Between 10 Hz and 10 kHz

Loss Factor η_D :

Peak 100 Hz η_D 0.9 Temperature 12.2 °C

1000 Hz η_D 0.9 Temperature 32.2 °C

Range 100 Hz -6.7 °C 35.0 °C

1000 Hz 12.2 °C 60.0 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR) \times IN)$$

T0	FROM	MROM	N	ML
A1	A2	A3	A4	A5
40.0	4.0000E+03	4.5000E+06	.450	5.0000E+04

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL+SH)A + (SL-SH)(1-\text{SQRT}(1+A^2)))C/2$$

T0	ETA FROL	SL	SH	FROL	C
B1	B2	B3	B4	B5	B6
40.0	.900	.750	-.900	3.0000E+03	2.500

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T-T0) / (525/1.8 + T - T0)$$

Remarks:

1dB

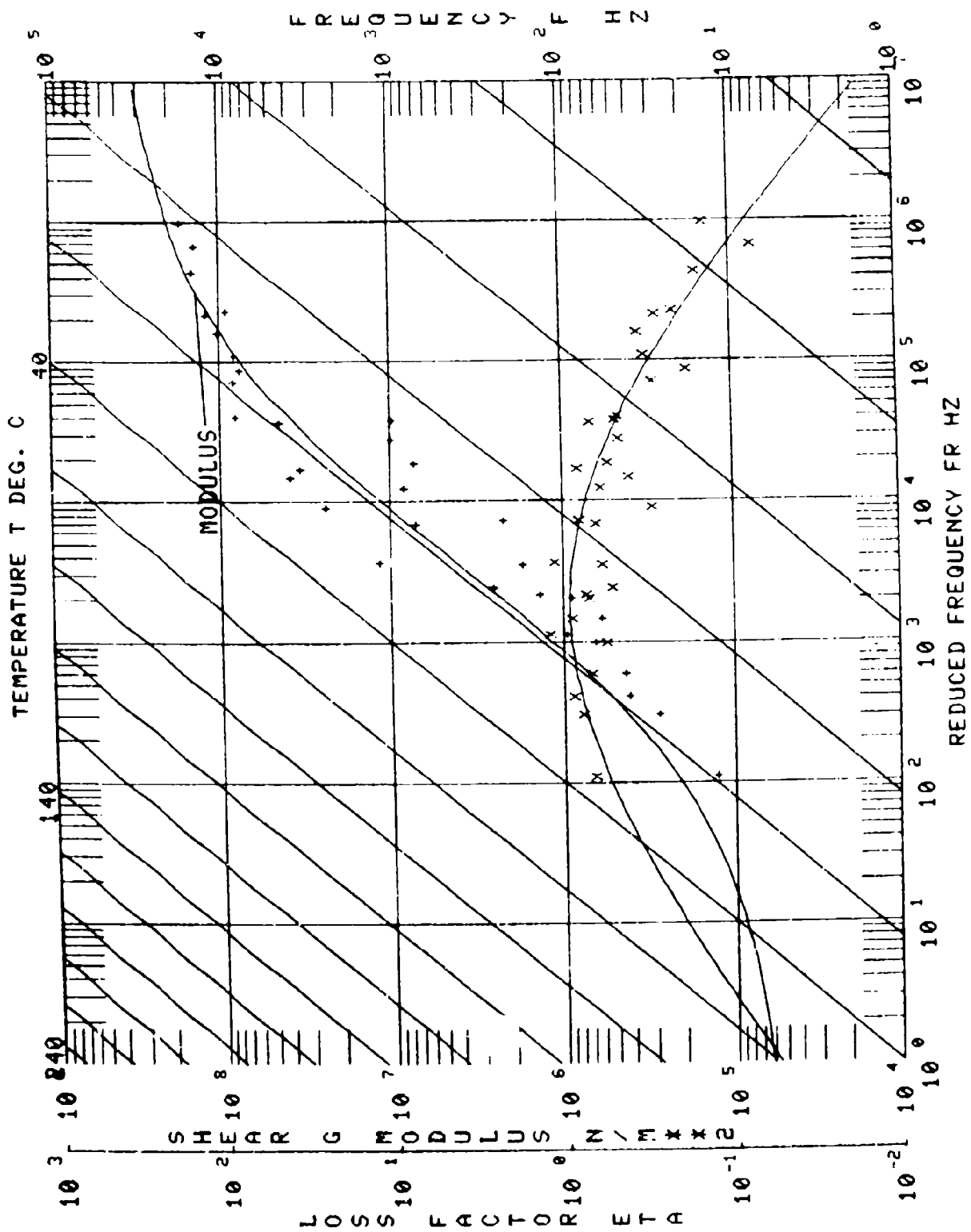
°F	f_c	f_n	f_L	f_R	Δf	η_s	
Temp.	Mode						
25	2	669.2	327.3	662.8	676.2	13.4	0.0200
25	3	1755.0	912.2	1716.3	1795.1	78.8	0.0449
25	4	3342.7	1783.5	3275.4	3403.0	127.6	0.0382
25	5	5132.5	2943.5	5067.3	5184.4	220.2	0.0228
25	6	7441.8	4407.4	7254.0	7567.9	413.9	0.0476
50	2	643.0	325.9	622.3	664.6	42.3	0.0659
50	3	1746.3	908.8		1827.5	162.4	0.0934
50	4	3117.9	1777.5	2987.1	3261.4	274.3	0.0863
50	5	4731.7	2932.0	4430.9	4972.4	541.5	0.1152
50	6	6860.6	4391.0	6378.8	7259.1	880.3	0.1294
50	7	9225.4	6121.6	9003.1	9500.9	968.8	0.1056
71	2	585.8	324.8	525.7	667.4	141.7	0.2493
71	3	1447.3	905.8	1313.9		256.8	0.1803
71	4	2761.8	1777.0	2423.7	3134.9	711.2	0.2665
71	5	5949.9	4377.6	5588.0	6288.6	1375.6	0.2375
72	2	416.6	324.8	385.3	455.7	76.4	0.1715
72	3	1171.9	905.8	1040.6	1282.1	241.5	0.2106
72	4	2103.7	1772.0	1938.5	2276.9	338.4	0.1630
72	5	3223.6	2923.0	3059.0	3383.6	324.6	0.1012
72	6	4780.0	4777.6	4954.3	4978.9	384.6	0.0807

Beam No. Not Recorded

[illegible]

MATERIAL CODE : 10
 MATERIAL : MACBOND 18 1220 78-6
 LOG(FR) = LOG(F) - 12(T-70)/(525/1.8+T-70)

NO.	MODULUS N/Hz ²	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.
1	1.1900E+07	1.1490	21.7	585.8	2.
2	2.4560E+07	.3120	21.7	1447.3	3.
3	3.5058E+07	.8390	21.7	2761.8	4.
4	4.6194E+07	.7150	21.7	5949.9	6.
5	4.0355E+07	.4200	10.0	643.0	2.
6	8.10134E+07	.4920	10.0	1746.3	3.
7	8.4255E+07	.3040	10.0	3117.9	4.
8	8.3426E+07	.3370	10.0	4731.7	5.
9	1.04387E+08	.3670	10.0	6860.6	6.
10	1.21761E+08	.2900	10.0	9225.4	7.
11	7.6738E+07	.1890	-3.9	669.2	2.
12	9.3013E+07	.2310	-3.9	1755.0	3.
13	1.4465E+08	.1670	-3.9	3342.7	4.
14	1.40791E+08	.0760	-3.9	5132.5	5.
15	4.2768E+05	.8990	37.8	339.8	2.
16	9.9146E+05	1.2350	37.8	940.5	3.
17	1.39343E+06	.7630	37.8	1812.1	4.
18	1.7638E+06	.6170	37.8	2963.9	5.
19	1.3065E+05	.6890	51.7	324.6	2.
20	2.9054E+05	.8040	51.7	903.0	3.
21	4.8366E+05	.7100	51.7	1761.3	4.
22	6.7279E+05	.5840	51.7	2901.1	5.
23	6.2101E+05	.9160	51.7	4321.7	6.
24	9.2045E+05	.7370	51.7	6023.3	7.
25	2.6052E+06	.5370	22.2	416.6	2.
26	7.4256E+06	.6630	22.2	1171.9	3.
27	8.5281E+06	.6270	22.2	2103.7	4.
28	7.4801E+06	.5640	22.2	3223.6	5.
29	1.0116E+07	.4840	22.2	4780.0	6.
30	9.9560E+06	.5050	-3.9	6492.0	7.
31	1.71197E+08	.1470	-3.9	7441.8	6.
32	2.2821E+06	.8330	37.8	6118.3	7.



Polymeric Material Characterization Test

Test No. 78-7

Beam Nos. Not and Recorded

Date 2/21/78

Damping Material MacBond IB1248

Material Thickness 0.0178 cm Material Density 0.965 g/cc

Beam Thickness 0.1524 cm Beam Density 2.975 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -31.7 °C and 51.7 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.403 Temperature -18.9 °C

1000 Hz η_D 1.403 Temperature -1.1 °C

Range 100 Hz -30.0 °C -6.7 °C

1000 Hz -8.9 °C 15.6 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR) \times IN)$$

T0	FROM	MROM	M	ML
	A1	A2	A3	A4
20.0	6.8243E+03	5.3055E+06	.845	3.0861E+05

$$A = ((\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
20.0	1.403	.336	-.584	7.4699E+03	.234

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA FROL}) + ((\text{SL} + \text{SH})A + (\text{SL} - \text{SH})(1 - \text{SQRT}(1 + A^2)))C/2$$

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525/1.8 + T - T0)$$

Remarks:

°F	f_c	f_n	f_L	f_R	Δf	η_s	ldB
-25	2	520.0	242.3	518.2	521.8	3.6	0.00692
-25	3	1386.7	679.9	1377.8	1395.4	17.6	0.0127
-25	4	2443.0	1330.4	2415.3	2468.9	52.6	0.0215
-25	5	3858.6	2195.0	3817.7	3899.1	81.4	0.0211
-25	6	5699.1	3272.0	5634.0	5769.7	135.7	0.0238
-25	7	7387.6	4572.4	7283.3	7400.0	176.7	0.0239
0	2	509.4	241.5	500.8	518.6	17.8	0.0352
0	3	1356.3	677.8	1322.2	1391.9	69.7	0.0515
0	4	2338.8	1326.8	2236.5	2422.6	186.1	0.0798
0	5	3695.7	2190.0	3558.1	3841.0	282.9	0.0768
0	6	5449.2	3264.6	5241.7	5677.5	435.8	0.0802
25	2	470.3	240.7	432.0	514.4	82.4	0.1780
25	3	1220.4	675.3	1098.2	1357.5	259.3	0.2174
25	4	2013.4	1322.5	1724.6	2210.3	485.7	0.2486
25	5	3117.6	2184.0	2919.2	3324.7	797.2	0.2644
25	6	4738.2	3257.1	4468.6	4965.8	977.5	0.2107
50	2	336.1	239.8	293.4	427.2	133.8	0.3962
50	3	876.4	672.8	664.0		414.8	0.5542
50	4	1492.4	1318.3	1313.1	1698.5	385.4	0.2673
50	5	2440.9	2178.0	2272.0	2559.5	565.2	0.2379

°F	f_c	f_n	f_L	f_R	Δf	n_s	l dB
Temp.	Mode						
50	6	3673.2	3249.7	3111.7	4173.6	1061.9	0.3020
70	2	278.8	239.1	256.8	310.5	53.7	0.1963
70	3	728.3	671.0	671.1	785.6	114.5	0.1592
70	4	1366.8	1314.7	1307.8	1426.7	118.9	0.0873
70	5	2229.1	2172.0	2145.7	2317.8	172.1	0.0799
70	6	3327.1	3242.2	3199.6	3482.3	282.7	0.0853
70	7	4643.1	4532.8	4464.6	4806.4	341.8	0.0738
100	2	257.9	237.9	250.7	266.1	15.4	0.0598
100	3	689.8	667.6	675.5	794.2	28.7	0.0415
100	4	1322.6	1309.2	1308.0	1339.0	31.0	0.0234
100	5	2177.5	2163.0	2156.9	2196.8	39.9	0.0183
100	6	3249.9	3231.8	3218.2	3284.6	66.4	0.0204
100	7	4534.1	4518.2	4491.5	4570.4	78.8	0.0174
125	2	253.0	236.9	248.7	257.7	9.0	0.0356
125	3	680.5	664.8	673.8	687.7	13.9	0.0204
125	4	1311.5	1303.8	1304.7	1318.8	14.1	0.0108
125	5	2160.7	2155.0	2151.4	2169.2	17.8	0.00824
125	6	3226.6	3219.9	3212.4	3240.5	28.1	0.00871
125	7	4498.5	4503.6	4479.6	4518.3	38.7	0.0086

MATERIAL CODE : 11
 MATERIAL : MACBOND 18 1248 78-7
 LOG(FR)-LOG(F)-12(T-T0)/(525/1.8+T-T0)

NO.	MODULUS N/MTI2	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.
1	6.84649E+05	.8320	21.1	278.8	2.
2	9.61129E+05	1.0560	21.1	728.3	3.
3	9.59750E+05	1.9890	21.1	1366.8	4.
4	1.13001E+06	1.2070	21.1	2223.1	5.
5	1.6959E+06	1.2080	21.1	3327.1	6.
6	2.25183E+06	1.1710	21.1	4543.1	7.
7	1.66095E+06	1.4030	10.0	336.1	2.
8	2.74963E+06	1.4000	10.0	1492.4	4.
9	4.22855E+06	1.2950	10.0	2440.9	5.
10	6.41626E+06	1.6580	10.0	3673.2	6.
11	1.05559E+07	1.3180	-3.9	470.3	2.
12	1.98431E+07	.9020	-3.9	1220.4	3.
13	1.70714E+07	.7590	-3.9	2013.4	4.
14	2.02598E+07	.8000	-3.9	3117.6	5.
15	3.52115E+07	.6110	-3.9	4738.2	6.
16	7.59113E+07	.3980	-17.8	1356.3	3.
17	4.69237E+07	.2830	-17.8	2338.8	4.
18	5.90536E+07	.2420	-17.8	3695.7	5.
19	8.22544E+07	.2470	-17.8	5449.2	6.
20	3.49426E+05	.3830	37.8	257.9	2.
21	4.27820E+05	.5240	37.8	689.8	3.
22	3.83831E+05	.6000	37.8	1322.6	4.
23	5.21519E+05	.5508	37.8	2177.5	5.
24	7.27397E+04	.6730	37.8	3249.9	6.
25	8.79881E+05	.6590	37.8	4534.1	7.
26	3.8374E+05	.2660	51.7	253.0	2.
27	3.27708E+05	.3230	51.7	680.5	3.
28	2.98543E+05	.3490	51.7	1311.5	4.
29	3.90726E+05	.3320	51.7	2160.7	5.
30	5.58406E+05	.3670	51.7	3226.6	6.
31	5.70196E+05	.4920	51.7	4498.5	7.
32	1.17762E+08	.1250	-31.7	1386.7	3.
33	6.66930E+07	.0870	-31.7	2443.0	4.
34	7.94955E+07	.0730	-31.7	3858.6	5.
35	9.77676E+07	.0690	-31.7	7387.6	6.

Polymeric Material Characterization Test

Test No. 78-8

Beam Nos. Not and Recorded

Date 2/27/78

Damping Material MacBond IB1320

Material Thickness 0.0381 cm Material Density 0.965 g/cc

Beam Thickness 0.2032 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -3.9 °C and 65.6 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.5 Temperature 12.2 °C

1000 Hz η_D 1.5 Temperature 32.2 °C

Range 100 Hz -1.7 °C 32.3 °C

1000 Hz 15.6 °C 57.2 °C

```

LOG(M)=LOG(NL)+(2LOG(MROM/NL))/(1+(FROM/FR)**N)
T0      FROM      MROM      N      NL
      A1      A2      A3      A4
40.0  2.0000E+03  6.0000E+06  1.00  1.2500E+05
A=(LOG(FR)-LOG(FROL))/C
LOG(ETA)=LOG(ETAFROL)+((SL+SH)*A*(CL-SH)/(1-SORT(1+A**2)))C/2
T0      ETAFROL  SL      SH      CL      C
      B1      B2      B3      B4      B5
40.0  1.500  1.000  -1.000  1.6000E+03  2.500
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
    
```

Remarks: _____

°F	f _C	f _n	f _L	f _R	Δf	η _s	ldB
Temp. Mode							
25	2	676.8	327.3	668.2	686.3	18.1	0.0267
25	3	1848.4	912.2	1817.9	1881.5	63.6	0.0344
25	4	3414.4	1783.5	3285.8	3496.6	210.8	0.0619
25	6	7346.8	4407.4	7089.5	7644.4	554.8	0.0757
25	7	9646.3	6140.3	9287.9	10155.6	867.7	0.0903
50	2	645.6	325.9	620.5	671.5	51.0	0.0791
50	3	1741.2	908.8	1661.4	1821.2	159.8	0.0922
50	4	3120.4	1777.5	2932.7	3301.0	368.3	0.1189
50	6	6579.1	4391.0	6400.4	6814.2	813.5	0.1246
50	7	8679.0	6121.6	7983.0	9318.1	1335.1	0.1557
70	2	584.5	324.8		672.9	176.2	0.3173
70	3	1554.1	905.1	1439.4	1696.0	504.5	0.3430
70	4	2712.8	1772.0	2277.3	3155.6	878.3	0.3422
70	6	5737.1	4377.6	5390.0	6105.5	1406.7	0.2528
70	7	7626.1	6100.7	7252.0	8119.3	1705.1	0.2293
100	2	387.5	323.1	356.8	428.0	140.0	0.3872
100	3	1038.3	902.1	954.5	115.6	395.4	0.4116
100	4	1957.2	1764.2	1810.9	2090.1	548.9	0.2921
100	5	3160.2	2910.0	2774.0	3486.0	712.0	0.2312
125	2	334.0	321.7	317.5	351.9	34.4	0.01035

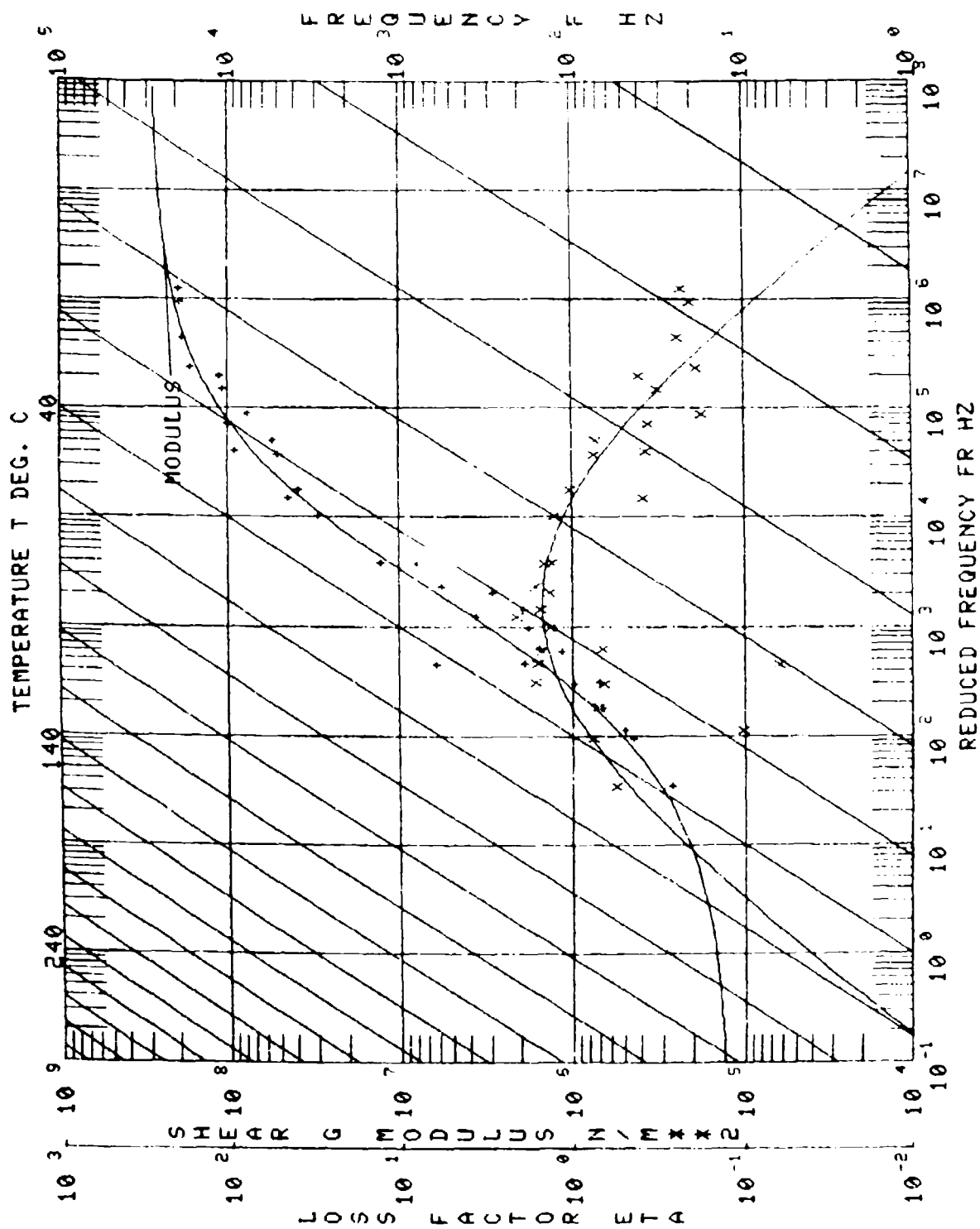
Test No. 78-8

Not Recorded

[illegible]

EXPERIMENTAL CODE 1172
 MATERIAL : MACBOND 181320 (78-8)
 MANUFACTURER : DATA SOURCES
 AFML 1UDRI
 OTHER : NONE

NO.	MODULUS N/MX2	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MX2	COMPOSITE LOSS	BEAM FREQ. HZ	COMPLEX MOD. N/MX2
1	7.78089E+07	-1.799	-3.9	676.8	2.	7.96726E+10	.0267	327.3	1.40006E+07
2	1.68092E+08	-1.934	-3.9	1848.4	3.	7.00189E+10	.0344	912.2	3.25165E+07
3	1.90922E+08	-2.095	-3.9	3414.4	4.	6.97020E+10	.0619	1783.5	4.76324E+07
4	1.98488E+08	-2.104	-3.9	7346.8	6.	7.00645E+10	.0757	4407.4	4.17651E+07
5	2.00593E+08	-2.374	-3.9	9646.3	7.	6.94501E+10	.0903	6140.3	4.76285E+07
6	4.48338E+07	-3.919	10.0	646.6	3.	7.00694E+10	.0791	325.9	1.75717E+07
7	9.31281E+07	-3.94	10.0	1741.2	2.	6.94979E+10	.0922	908.8	3.53303E+07
8	1.02186E+08	-3.699	10.0	3120.4	4.	6.92338E+10	.1189	1777.5	3.78003E+07
9	1.11234E+08	-3.254	10.0	6579.1	6.	6.95441E+10	.1246	4391.0	3.61927E+07
10	1.15226E+08	-4.157	10.0	8679.0	7.	6.90277E+10	.1557	6121.6	4.78991E+07
11	1.99489E+07	-1.3029	21.1	1554.1	3.	6.90855E+10	.3430	906.1	3.90192E+07
12	3.92134E+07	-1.0600	21.1	2712.8	4.	6.88060E+10	.3422	1772.0	4.15655E+07
13	1.13175E+07	-7.670	21.1	5737.1	6.	6.91203E+10	.2528	4377.6	3.93615E+07
14	5.51218E+07	-7.518	21.1	7626.1	7.	6.85572E+10	.2293	6100.7	4.14404E+07
15	1.92337E+06	-1.6368	37.8	387.5	2.	6.88705E+10	.3872	323.1	3.14819E+06
16	3.74731E+06	-2.1579	37.8	1038.3	3.	6.84750E+10	.4116	902.1	8.0821E+06
17	5.96411E+06	-1.6807	37.8	1957.2	4.	6.82016E+10	.2921	1764.2	1.00238E+07
18	8.15604E+06	-1.4996	37.8	3160.2	5.	6.79047E+10	.2312	2910.0	1.22309E+07
19	5.05175E+05	-1.048	51.7	334.0	2.	6.82750E+10	.0104	321.7	5.29480E+04
20	7.10795E+05	-1.6872	51.7	910.3	3.	6.79164E+10	.0907	898.4	1.19925E+06
21	1.19295E+06	-1.5509	51.7	1773.9	4.	6.77308E+10	.0725	1758.1	1.8501E+06
22	1.83171E+06	-1.3792	51.7	2919.9	5.	6.73923E+10	.0605	2899.0	2.52625E+06
23	1.95493E+06	-1.5692	51.7	4340.1	6.	6.78566E+10	.0499	4337.4	3.06759E+06
24	3.02104E+06	-1.3988	51.7	6057.0	7.	6.72509E+10	.0493	6042.3	4.22587E+06
25	2.7633E+05	-7.732	65.6	324.7	2.	6.75975E+10	.0330	320.1	1.55691E+05
26	7.08585E+05	-7.271	65.6	1748.0	4.	6.71311E+10	.0208	1750.3	5.10333E+05
27	1.00344E+06	-6.767	65.6	2878.7	5.	6.68819E+10	.0169	2888.0	6.79027E+05
28	3.0641E+06	-0.636	65.6	4300.5	6.	6.17610E+10	.0064	4138.0	4.01156E+05
29	1.59452E+06	-6.002	65.6	5976.0	7.	6.66025E+10	.0133	6013.1	1.10058E+06
30	1.32107E+07	-1.3616	21.1	584.5	2.	6.95971E+10	.3173	324.8	1.79871E+07
31	4.51327E+05	-7.777	65.6	897.4	3.	6.74485E+10	.0276	895.3	3.51004E+05



Polymeric Material Characterization Test

Test No. 78-9
 Beam Nos. Not and Recorded Date 3/11/78
 Damping Material MacBond IR1400

Material Thickness 0.0178 cm Material Density 0.965 g/cc
 Beam Thickness 0.1524 cm Beam Density 2.797 g/cc
 Beam Length 17.78 cm
 Temperature Test Range: Between -17.8 °C and 65.6 °C
 Frequency Test Range: Between 10 Hz and 10 KHz
 Loss Factor η_D :

Peak	100 Hz	η_D	<u>1.358</u>	Temperature	<u>2.2</u> °C
	1000 Hz	η_D	<u>1.358</u>	Temperature	<u>23.9</u> °C
Range	100 Hz		<u>-9.4</u> °C		<u>10.0</u> °C
	1000 Hz		<u>10.0</u> °C		<u>32.2</u> °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR) \times N)$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
30.0	3.2120E+03	5.9439E+06	.557	2.4589E+05

$$A = ((\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL + SH)A + (SL - SH)(1 - \text{SQRT}(1 + A^2)))C/2$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
30.0	1.358	.484	-.367	1.6138E+03	.215

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 + 1.8 \times T - T0)$$

Remarks: _____

Test No. 78-9
Beam No. Not Recorded

°F	f _C	f _n	f _L	f _R	Δf	n _s	ldb
Temp. Node							
0	2	504.8	241.5	500.7	509.0	8.3	0.0164
0	3	1354.7	677.6	1336.4	1373.2	36.8	0.0272
0	4	2546.1	1327.0	2508.8	2584.0	75.2	0.0295
0	5	4057.8	2190.0	3989.6	4127.2	137.6	0.0339
0	6	5937.0	3265.2	5833.0	6044.2	211.2	0.0356
25	2	487.3	240.7	474.8	501.1	26.3	0.0540
25	3	1279.5	675.5	1229.3	1335.5	106.2	0.0833
25	4	2360.6	1322.7	2243.4	2475.8	232.4	0.0989
25	5	3717.2	2184.0	3514.6	3920.9	406.3	0.1100
25	6	5446.9	3257.7	5148.6	5747.2	598.6	0.1106
50	2	456.7	239.8	423.6	494.5	70.9	0.1571
50	3	1177.6	673.0	1089.3	1297.5	208.2	0.1796
50	4	2112.0	1318.7	1921.1	2302.0	380.9	0.1834
50	5	3298.4	2177.6	2884.5	3646.3	761.8	0.2374
50	6	4862.0	3449.7	4332.0	5454.6	1122.6	0.2373
50	7	6326.4	4542.4	5715.2	6729.9	1994.9	0.3321
69	2	403.2	239.1	343.0	484.8	141.8	0.3757
69	3	1020.1	671.0		1301.8	563.4	0.6625
69	4	1786.5	1315.0	1419.6	2081.8	662.2	0.3991
69	5	2748.1	2172.0		3064.4	1243.7	0.5073
							X

°F	f _c	f _n	f _L	f _R	Δf	η _s	ldB
Temp.	Mode						
69	6	4164.5	3239.3	3891.2	4411.3	1022.5	0.02532
100	2	278.8	237.9	258.9	303.8	44.9	0.1632
100	3	742.0	667.6	670.7	819.3	148.6	0.2044
100	4	1377.5	1309.0	1292.3	1474.2	181.0	0.1332
100	5	2257.2	2162.4	2133.0	2387.4	254.4	0.1134
100	6	3381.2	3230.9	3177.0	3562.0	385.0	0.1146
100	7	4672.4	4516.9	4426.0	4922.4	496.4	0.1068
125	2	261.6	236.8	253.8	270.5	16.7	0.0640
125	3	700.7	664.7	677.2	724.7	47.5	0.0679
125	4	1334.2	1303.5	1308.0	1360.6	52.6	0.0395
125	5	2191.2	2154.6	2155.8	2226.8	71.0	0.0324
125	6	3266.4	3220.8	3210.1	3322.1	112.0	0.0343
125	7	4551.3	4503.6	4482.4	4617.2	134.8	0.0296
150	2	253.3	235.9	249.5	257.1	7.6	0.0300
150	3	683.6	661.9	676.0	691.2	15.2	0.0222
150	4	1312.0	1298.3	1305.0	1310.4	5.4	0.0102
150	5	2161.3	2146.2	2151.4	2171.3	19.9	0.0093
150	6	3222.9	3209.2	3206.6	3239.4	32.8	0.0102
150	7	4492.0	4488.2	4472.5	4520.9	48.4	0.0108

EXPERIMENTAL CODE : 10
MATERIAL : MACBOND 18 1400 JG 78-9

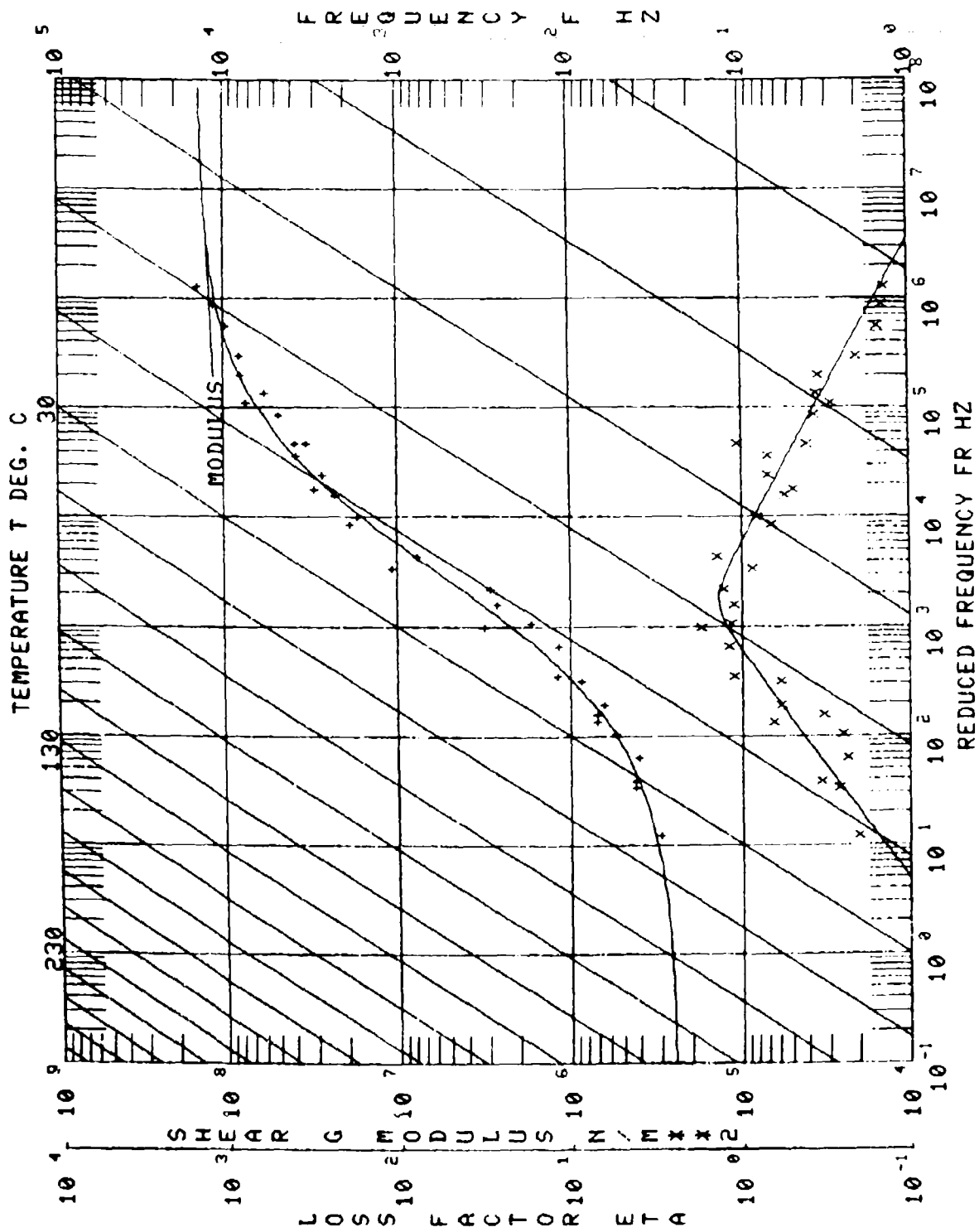
DATA SOURCES

MANUFACTURER : INOME

APRIL : SANDWICH BEAM (UDRI)

OTHER : INOME

NO.	MODULUS N/MR12	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO	BEAM MOD. N/MR12	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/MR12
1	3.28439E+06	1.7761	20.6	403.2	2.	6.70495E+10	.3757	239.1	5.68140E+06
2	7.88320E+06	1.4340	20.6	1786.5	4.	6.73640E+10	.3991	1315.0	1.13044E+07
3	1.74322E+07	.8324	20.6	4164.5	6.	6.72842E+10	.2532	3230.3	1.47110E+07
4	1.15065E+07	.8894	10.0	456.7	2.	6.74427E+10	.1795	239.8	9.91785E+06
5	1.92108E+07	.6760	10.0	1177.6	3.	6.77552E+10	.1834	673.0	1.29867E+07
6	2.38870E+07	.5615	10.0	2112.0	4.	6.77436E+10	.1834	1318.7	1.34142E+07
7	2.79400E+07	.7153	10.0	3298.4	5.	6.76001E+10	.2373	2177.6	1.90854E+07
8	3.93412E+07	.7032	10.0	4862.0	6.	6.77169E+10	.0540	3249.7	2.79023E+07
9	3.18222E+07	.4991	-3.0	487.3	2.	6.79495E+10	.0833	240.7	1.54845E+07
10	4.02820E+07	.4138	-3.9	1279.5	3.	6.82595E+10	.0889	673.5	1.66669E+07
11	4.97926E+07	.3717	-3.9	2360.6	4.	6.81552E+10	.0889	1322.7	1.85059E+07
12	6.03710E+07	.3685	-3.9	3717.3	5.	6.79981E+10	.1100	1324.0	2.17608E+07
13	8.16090E+07	.3482	-3.9	5446.9	6.	6.80507E+10	.1106	2184.0	2.82700E+07
14	7.67132E+07	.2937	-17.8	504.8	2.	6.84023E+10	.0164	241.5	2.25272E+07
15	8.31735E+07	.2080	-17.8	1354.7	3.	6.86845E+10	.0272	677.6	1.73026E+07
16	9.91614E+07	.1549	-17.8	2546.1	4.	6.85990E+10	.0295	1327.0	1.53600E+07
17	1.18124E+08	.1500	-17.8	4057.8	5.	6.83722E+10	.0339	2190.0	1.71274E+07
18	1.51262E+08	.1398	-17.8	5937.0	6.	6.83644E+10	.0356	3265.2	2.11489E+07
19	7.23234E+05	.6695	37.8	278.8	2.	6.63782E+10	.1632	237.9	4.80987E+05
20	1.23364E+06	1.1360	37.8	742.0	3.	6.66722E+10	.2044	667.6	1.40146E+06
21	1.21220E+06	1.2553	37.8	1377.5	4.	6.67507E+10	.1332	1309.0	1.49745E+06
22	1.73577E+06	1.1817	37.8	2257.2	5.	6.66597E+10	.1134	2162.4	2.05109E+06
23	2.97729E+06	1.3181	37.8	4672.4	7.	6.68116E+10	.1068	4516.9	3.92438E+06
24	4.38655E+05	.3459	51.7	261.6	2.	6.57658E+10	.0640	236.8	1.52152E+05
25	6.67097E+05	.5048	51.7	1334.3	4.	6.61900E+10	.0395	1303.5	4.03471E+05
26	3.10186E+05	.2074	65.6	255.3	2.	6.52688E+10	.0300	235.9	5.43276E+04
27	4.12197E+05	.2409	65.6	1312.0	4.	6.56638E+10	.0102	1298.3	9.92921E+04
28	5.69890E+05	.2598	65.6	2161.3	5.	6.56647E+10	.0093	2146.2	1.48035E+05
29	7.23715E+05	.3355	65.6	3222.9	6.	6.60396E+10	.0102	3209.2	2.41390E+05
30	3.46988E+07	1.0817	10.0	6326.4	7.	6.75681E+10	.3321	4542.4	3.70684E+07
31	2.73448E+06	1.1443	37.8	3381.2	6.	6.69357E+10	.1146	3230.9	3.12912E+06
32	8.90178E+05	.6021	51.7	2191.2	5.	6.61797E+10	.0324	2154.6	5.36009E+05
33	4.32675E+05	.2725	65.6	683.6	3.	6.55386E+10	.0222	661.9	1.17099E+05



Polymeric Material Characterization Test

Test No. 78-12

Beam Nos. Not and Recorded

Date 3/20/78

Damping Material MacBond IB1401

Material Thickness 0.01524 cm Material Density 1.103 g/cc

Beam Thickness 0.1524 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -20.0 °C and 51.7 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.25 Temperature -6.7 °C

1000 Hz η_D 1.25 Temperature 15.6 °C

Range 100 Hz -21.7 °C 12.8 °C

1000 Hz -3.9 °C 37.8 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR) * N)$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
20.0	2.5000E+03	8.0000E+06	.500	2.2500E+05

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL + SH)A + (SL - SH)(1 - \text{SORT}(1 + A**2)))C/2$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
20.0	1.250	1.000	-1.000	1.4000E+03	2.500

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 + 1.8 * T - T0)$$

Remarks:

Test No. 78-12
Beam No. Not Recorded

1dB

°F	f_C	f_n	f_L	f_R	Δf	η_s	1dB
Temp. Mode							
-4	2	508.6	241.6	505.4	512.2	6.8	0.0134
-4	3	1389.5	678.1	1378.0	1401.8	23.8	0.0171
-4	4	2504.7	1327.4	2471.2	2550.1	78.9	0.0315
-4	5	3895.9	2191.0	3826.7	3965.3	136.5	0.0356
-4	6	6002.5	3266.1	5889.8	6109.2	219.4	0.0366
-4	7	7811.6	4566.2	7652.8	7993.2	340.4	0.0436
21	2	492.5	240.8	481.6	504.2	22.6	0.0459
21	3	1333.1	675.6	1294.3	1374.3	80.0	0.0601
21	4	2347.7	1323.7	2235.6	2454.9	219.3	0.0938
21	5	3605.1	2185.0	3423.0	3800.1	377.1	0.1052
21	6	5547.0	3259.2	5196.0	5908.8	712.8	0.1296
21	7	7299.0	4555.7	6936.2	7755.5	819.3	0.1130
45	2	459.3	240.0	427.0	488.3	61.3	0.1347
45	3	1222.0	673.5	1129.8	1328.6	198.8	0.1649
45	5	3144.8	2179.0	2820.0	3454.3	634.3	0.2059
45	6	6338.8	3251.2	5782.1	7096.0	1313.9	0.2119
68	2	588.4	239.2	323.0		130.8	0.3577
68	3	959.7	671.1	780.1		359.2	0.4036
68	4	1596.1	1315.1	1279.0	1836.0	557.0	0.3724
68	5	2537.2	2172.2	2136.2	2869.3	743.1	0.3063

Beam No. Not Recorded

12B

EXPERIMENTAL CODE 1173
 MATERIAL : MACBOND 181401 (78-12)
 DATA SOURCES
 MANUFACTURER : NONE
 APPL : JDR1
 OTHER : NONE

NO.	MODULUS N/MS2	LOSS FACTOR	TEMP. DEG. C	FREQ. MHZ	MODE NO.	BEAM MOD. N/MS2	COMPOSITE LOSS FAC.	BEAM FREQ. MHZ	COMPLEX MOD. N/MS2
1	1.3433E+08	.5698	-20.0	508.6	2.	6.8459E+10	.0134	241.6	7.6545E+07
2	1.4013E+08	.2338	-20.0	1389.5	3.	6.8785E+10	.0171	678.1	3.2763E+07
3	7.3851E+07	.1588	-20.0	2504.7	4.	6.8640E+10	.0315	1327.4	1.2517E+07
4	7.8650E+07	.1338	-20.0	3895.9	5.	6.8434E+10	.0356	2191.0	1.0526E+07
5	1.5183E+08	.1588	-20.0	6002.5	6.	6.8402E+10	.0366	3266.1	2.4107E+07
6	1.2467E+08	.1454	-20.0	7811.2	7.	6.8278E+10	.0436	4566.2	1.8126E+07
7	3.7067E+07	.6177	-6.1	492.5	2.	6.8006E+10	.0459	240.8	2.2073E+07
8	5.9854E+07	.4555	-5.1	1333.1	3.	6.8279E+10	.0601	675.6	2.2664E+07
9	4.3751E+07	.3582	-6.1	2347.7	4.	6.8258E+10	.0938	1323.7	1.5671E+07
10	4.5506E+07	.3305	-6.1	3605.1	5.	6.8060E+10	.1052	2185.0	1.5041E+07
11	7.8922E+07	.4442	-6.1	5547.0	6.	6.8113E+10	.1296	3259.2	3.5059E+07
12	7.9729E+07	.3390	-6.1	7299.0	7.	6.7964E+10	.1130	4555.7	2.7025E+07
13	1.1384E+07	.8321	7.2	459.3	2.	6.7553E+10	.1347	240.0	9.4727E+06
14	2.1504E+07	.7460	7.2	1222.0	3.	6.7855E+10	.1649	673.5	1.0043E+07
15	2.0165E+07	.6847	7.2	3144.8	5.	6.7587E+10	.2059	2179.0	1.2193E+07
16	8.9136E+07	1.5977	7.2	6338.8	6.	6.7779E+10	.2119	3251.2	1.7806E+08
17	2.2349E+06	1.4836	20.0	388.4	2.	6.7105E+10	.3577	239.2	4.0404E+06
18	4.3655E+06	1.4878	20.0	959.7	3.	6.7373E+10	.4036	671.1	6.4952E+06
19	3.7277E+06	1.6145	20.0	1506.1	4.	6.7374E+10	.3724	1315.1	6.0183E+06
20	5.0247E+06	1.4248	20.0	2537.2	5.	6.7265E+10	.3063	2172.2	7.1594E+06
21	8.1463E+06	1.2307	20.0	3809.0	6.	6.7296E+10	.2799	3239.6	1.0025E+07
22	9.6604E+06	.9513	20.0	5183.0	7.	6.7306E+10	.2016	4533.6	9.1899E+06
23	6.7018E+05	.6596	37.8	280.7	2.	6.6378E+10	.1654	237.9	4.4204E+05
24	1.0451E+06	1.0105	37.8	738.9	3.	6.6672E+10	.1769	667.6	1.0560E+06
25	9.2863E+05	1.1808	37.8	1368.6	4.	6.6750E+10	.1131	1309.0	1.0966E+06
26	1.2788E+06	1.1330	37.8	2241.1	5.	6.6659E+10	.0931	2162.4	1.4489E+06
27	2.2567E+06	1.2450	37.8	3375.8	6.	6.6935E+10	.1175	3230.9	2.8095E+06
28	3.0094E+06	1.0304	37.8	4705.5	7.	6.6811E+10	.0937	4516.9	3.1003E+06
29	4.1906E+05	.3828	51.7	264.0	2.	6.5765E+10	.0741	236.8	1.6040E+05
30	5.2473E+05	.5096	51.7	697.8	3.	6.6094E+10	.0538	664.7	2.6738E+05
31	5.0032E+05	.5507	51.7	1329.6	4.	6.6190E+10	.0310	1303.5	2.7554E+05
32	6.9213E+05	.5333	51.7	2187.5	5.	6.6197E+10	.0255	2154.6	3.6910E+05
33	1.1285E+06	.5804	51.7	3277.0	6.	6.6517E+10	.0300	3220.8	6.5521E+05
34	1.3242E+06	.6367	51.7	4563.0	7.	6.6418E+10	.0280	4503.6	8.4316E+05

Polymeric Material Characterization Test

Test No. 78-13

Beam Nos. Not and Recorded

Date 3/22/78

Damping Material MacBond IB1622

Material Thickness 0.0203 cm Material Density 1.103 g/cc

Beam Thickness 0.2032 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -31.7 °C and 51.7 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.3 Temperature -15.0 °C

1000 Hz η_D 1.3 Temperature 6.1 °C

Range 100 Hz -28.9 °C -3.9 °C

1000 Hz -7.8 °C 20.0 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR) \times N)$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
20.0	7.2800E+03	8.2000E+06	.600	4.0000E+05

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL + SH)A + (SL - SH)(1 - \text{SQRT}(1 + A \times A)))C/2$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
20.0	1.300	1.000	-.750	3.0000E+03	1.000

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 + 1.8(T - T0))$$

Remarks:

°F	f _c	f _n	f _L	f _R	Δf	n _s	ldB
Temp. Node							
-25	2	671.3	329.5	667.6	675.5	7.9	0.0118
-25	3	1847.0	918.7	1837.6	1855.9	18.3	0.00991
-25	4	3440.0	1796.8	3414.9	3462.7	47.8	0.0139
-25	5	5133.3	2965.8	5083.6	5223.0	139.4	0.0272
-25	6	7142.6	4437.2	7061.9	7217.3	155.4	0.0218
0	2	650.2	328.4	637.2	672.8	35.6	0.0548
0	3	1774.9	915.3	1737.7	1812.1	74.4	0.0420
0	4	3264.2	1790.2	3173.2	3351.1	177.9	0.0546
0	5	4300.1	2954.0	4638.6	4964.1	325.5	0.0680
0	6	6636.2	4422.3	6416.3	6866.5	450.2	0.0680
0	7	9115.5	6173.7	8792.5	9408.5	616.0	0.0677
22	2	600.0	327.4	553.5	643.4	83.9	0.1412
22	3	1631.0	912.5	1517.5	1748.5	231.0	0.1431
22	4	2928.9	1784.8	2688.1	3232.7	544.6	0.1892
22	5	4240.1	2945.0	3816.0	4580.9	764.9	0.1834
22	6	5905.5	4407.4	5456.9	6374.6	917.7	0.1573
45	2	469.8	326.3	398.9	555.4	156.5	0.3533
45	3	1302.0	909.5	1079.3	1608.4	529.1	0.4448
45	4	2323.3	1778.7	2108.3	2564.3	896.5	0.4181
45	5	3471.5	2934.0	2969.3	3915.8	946.5	0.2834

ldB

η_s

Δf

f_R

f_L

f_n

f_C

$^{\circ}F$

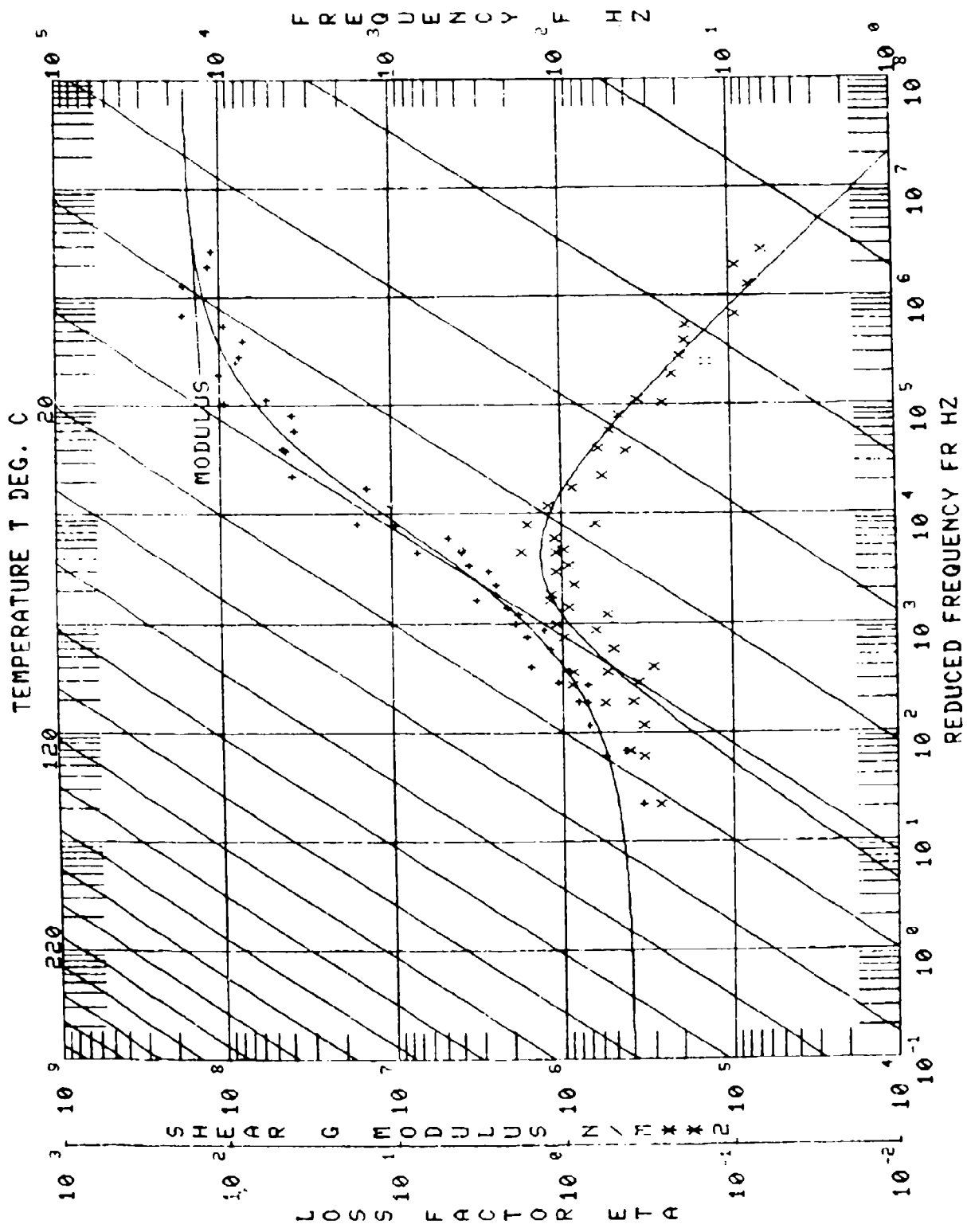
Temp.	Node	f_C	f_n	f_L	f_R	Δf	η_s	ldB
45	6	5088.5	4394.0	4827.1	5336.7	1001.9	0.2007	X
68	2	372.0	325.0	339.9	409.9	70.0	0.1916	
68	3	1094.2	906.4	910.7	1102.1	191.4	0.1942	
68	4	1897.8	1772.6	1752.8	2041.8	289.0	0.1540	
68	5	3053.7	2924.0	2908.4	3228.2	319.8	0.1053	
68	6	4566.6	4379.1	4317.7	4784.3	466.6	0.1027	
68	7	6316.9	6102.8	6031.7	6601.8	570.1	0.0906	
73	2	361.0	324.7	337.9	396.4	58.5	0.1642	
73	3	988/3	905.4	913.3	1068.5	155.2	0.1590	
73	4	1874.1	1771.4	1772.6	1972.6	200.0	0.1073	
73	5	3035.5	2922.0	2923.4	3155.6	232.2	0.0767	
73	6	4537.4	4374.6	4336.7	4695.1	358.4	0.0792	
73	7	6266.6	6098.7	6052.6	6481.4	428.8	0.0686	
100	2	343.8	323.1	334.6	353.0	18.4	0.0536	
100	3	934.6	902.1	911.9	957.4	45.5	0.0483	
100	4	1800.3	1764.2	1771.1	1829.0	57.9	0.0322	
100	5	2950.8	2910.0	2915.9	2985.4	69.5	0.0236	
100	6	4390.8	4356.8	4341.0	4438.7	97.7	0.0223	
100	7	6118.6	6069.4	6058.1	6177.0	118.9	0.0194	
125	2	338.3	321.7	333.4	343.7	10.3	0.0304	

Beam No. Not Recorded

[illegible]

MATERIAL CODE : 27
 MATERIAL : MACBOND 18 1622 78-13
 LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)

NO.	MODULUS N/1132	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.
1	9.5692E+05	.8920	20.0	372.0	2.
2	1.92157E+06	1.1150	20.0	1004.2	3.
3	2.50004E+06	1.1830	20.0	1897.8	4.
4	2.75446E+06	1.1140	20.0	3053.7	5.
5	4.02240E+06	1.1150	20.0	4566.6	6.
6	4.74152E+06	1.1310	20.0	6316.9	7.
7	3.20431E+06	1.2080	7.2	469.8	2.
8	7.30155E+06	1.7720	7.2	1302.0	3.
9	9.91456E+06	1.6410	7.2	2323.3	4.
10	1.04318E+07	1.2180	7.2	3471.6	5.
11	1.42101E+07	.8860	7.2	5088.5	6.
12	4.2373E+07	.4300	-17.8	650.0	2.
13	1.62234E+07	.6530	-5.6	600.0	3.
14	3.87278E+07	.5880	-5.6	1631.0	3.
15	4.35818E+07	.6250	-5.6	2928.9	4.
16	3.71558E+07	.5310	-5.6	4240.1	5.
17	3.86244E+07	.4660	-5.6	5905.5	6.
18	5.4893E+07	.3710	-5.6	8231.6	7.
19	9.61129E+07	.2620	-17.8	1774.9	3.
20	1.03421E+08	.2290	-17.8	3264.2	4.
21	7.8255E+07	.2050	-17.8	4800.1	5.
22	7.52908E+07	.1890	-17.8	6636.2	6.
23	9.60440E+07	.1870	-17.8	9115.5	7.
24	8.2613E+07	.1420	-31.7	1671.3	3.
25	1.74506E+08	.0940	-31.7	1847.0	3.
26	1.70645E+08	.0770	-31.7	3440.0	4.
27	1.19555E+08	.0930	-31.7	5133.3	5.
28	1.13970E+08	.0640	-31.7	7142.6	6.
29	4.37748E+05	.4210	37.8	343.8	3.
30	7.3223E+05	.5790	37.8	934.6	3.
31	9.30103E+05	.5640	37.8	1800.3	4.
32	1.19831E+06	.5180	37.8	2950.8	5.
33	1.3104E+06	.6550	37.8	4390.8	6.
34	1.86572E+06	.5600	37.8	6118.6	7.
35	3.57424E+05	.2790	51.7	338.3	2.
36	5.83296E+05	.3510	51.7	922.8	3.
37	7.9813E+05	.3500	51.7	1781.3	4.
38	8.3576E+05	.4040	51.7	2919.3	5.
39	1.68110E+06	.3730	51.7	4358.0	6.
40	1.57338E+06	.3080	51.7	6075.2	7.
41	7.33602E+05	.3000	22.8	361.0	2.
42	1.65612E+06	1.0060	22.8	988.3	3.
43	2.13255E+06	.9290	22.8	1874.1	4.
44	3.1245E+06	.8750	22.8	3036.5	5.
45	3.6040E+06	.9400	22.8	4527.4	6.
46	3.94656E+06	1.0040	22.8	6266.6	7.



Polymeric Material Characterization Test

Test No. 78-14
 Beam Nos. Not and Recorded Date 3/27/78
 Damping Material MacBond 2101

Material Thickness 0.0203 cm Material Density 1.049 g/cc
 Beam Thickness 0.1524 cm Beam Density 2.795 g/cc
 Beam Length 17.78 cm

Temperature Test Range: Between -17.8 °C and 93.3 °C

Frequency Test Range: Between 10 Hz and 10 kHz

Loss Factor η_D :

Peak 100 Hz η_D 1.470 Temperature -9.4 °C
 1000 Hz η_D 1.470 Temperature 10.0 °C
 Range 100 Hz -17.8 °C 8.9 °C
 1000 Hz 2.2 °C 31.1 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR) \times 1N)$$

T0	FROM	MROM	N	ML
A1	A2	A3	A4	
30.0	4.7887E+03	9.9865E+06	.412	2.2607E+05

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETAFROL}) + ((SL + SH)A + (SL - SH)(1 - \text{SQRT}(1 + A \times 2))) / C / 2$$

T0	ETAFROL	SL	SH	FROL	C
B1	B2	B3	B4	B5	
30.0	1.470	.182	-.355	6.2003E+03	.100

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 / 1.8 + T - T0)$$

Remarks: _____

°F	f_c	f_n	f_L	f_R	Δf	η_s	ldB
Temp. Mode							
0	2	520.3	241.5	516.3	524.5	8.2	0.0158
0	3	1426.5	677.6	1410.4	1443.0	32.6	0.0229
0	4	2659.2	1327.0	2611.7	2706.5	94.8	0.0357
0	5	4190.7	2190.0	4094.2	4291.9	197.7	0.0472
0	6	6132.8	3265.2	5982.2	6317.7	335.5	0.0548
0	7	8205.3	4563.6	7912.3	8498.5	586.2	0.0716
25	2	504.4	240.7	489.9	520.3	30.4	0.0604
25	3	1375.5	675.5	1329.5	1420.1	90.6	0.0660
25	4	2501.0	1322.7	2387.0	2632.4	245.4	0.0986
25	5	3890.3	2184.0	3669.2	4116.0	446.8	0.1156
25	6	5720.0	3257.7	5342.0	6131.9	789.9	0.1394
25	7	7567.7	4553.6	6992.8	8065.5	1072.7	0.1432
50	2	464.1	239.8	419.7	510.6	90.9	0.1997
50	3	1250.3	673.0	1114.3	1394.8	280.5	0.2302
50	4	2189.8	1318.7	2016.5	2359.7	674.7	X
50	5	3337.7	2177.6	3080.4	3568.5	959.6	X
50	7	6474.7	4542.4	6021.6	6861.1	1650.4	X
72	3	986.5	670.7	802.4	1233.2	430.8	0.4854
72	4	1710.2	1314.4		1990.0	1100.2	X
72	5	2644.9	2171.4	2436.2	2870.2	872.9	X

Test No. 78-14
Beam No. Not Recorded

°F	Temp. Mode	f_c	f_n	f_L	f_R	Δf	η_s	LdB
72	7	5308.5	4532.0	4359.6	6126.3	1766.6	0.3529	
100	3	759.9	667.6	676.5	865.5	189.0	0.2568	
100	4	1402.9	1309.0	1281.2	1527.4	246.2	0.1783	
100	5	2280.1	2162.4	2132.8	2450.0	317.2	0.1405	
100	6	3400.4	3230.9	3149.2	3657.1	507.9	0.1511	
100	7	4729.3	4516.9	4445.5	4995.4	549.9	0.1171	
125	2	264.6	236.8	242.1	289.6	47.5	0.1825	
125	3	707.2	664.7	666.2	752.5	86.3	0.1229	
125	4	1349.6	1303.6	1295.4	1402.8	107.4	0.0798	
125	5	2213.5	2154.6	2139.6	2279.8	140.2	0.0635	
125	6	3291.1	3220.8	2191.8		198.6	0.0605	
125	7	4593.3	4503.6	4463.0	4715.0	252.0	0.0549	
150	2	251.1	235.9	239.4	263.3	23.9	0.0956	
150	3	683.6	661.9	663.0	706.4	43.4	0.0636	
150	4	1320.7	1298.3	1293.5	1347.8	54.3	0.0411	
150	5	2172.0	2146.2	2138.7	2206.4	67.7	0.0312	
150	6	3242.2	3209.2	3193.9	3288.2	94.3	0.0291	
176	1	44.3		42.5	47.0	4.5	0.1021	
175	2	246.6	234.8	239.1	254.5	15.4	0.0626	
175	3	674.0	658.8	661.5	687.1	25.6	0.0380	

Test No. 78-14

Not Recorded

[illegible]

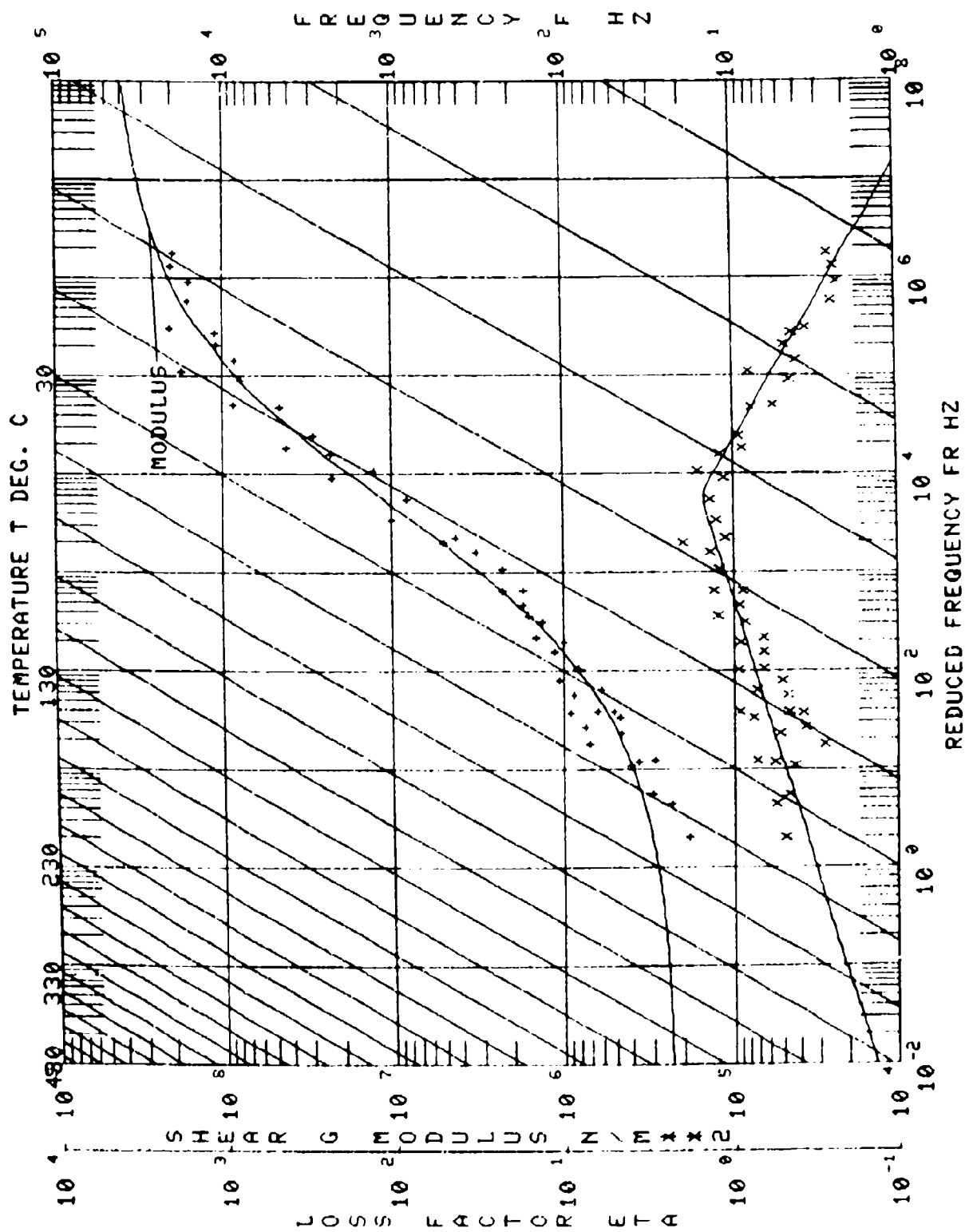
EXPERIMENTAL CODE : 1
MATERIAL : MACBOND 18 2101 78-14

MANUFACTURER : INONE

APPL : SANDWICH BEAM (UBRI)

OTHER : INONE

NO.	MODULUS N/MSZ	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MSZ	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/MSZ
1	5.1461E+06	2.8228	22.2	895.5	3.	6.7392E+10	.4854	579.7	1.0405E+07
2	8.3976E+06	1.4094	22.2	2644.9	5.	6.7315E+10	.3495	2171.4	1.1834E+07
3	1.3081E+07	1.6563	22.2	5308.6	7.	6.7259E+10	.3529	4532.0	2.1665E+07
4	1.0320E+07	1.2398	10.0	464.1	2.	6.7442E+10	.1997	239.8	1.3310E+07
5	2.2835E+07	1.1732	10.0	1259.3	3.	6.7755E+10	.2302	673.0	2.6847E+07
6	3.2428E+07	1.2307	10.0	2189.8	4.	6.7743E+10	.3237	1318.7	2.8605E+07
7	2.8738E+07	.9530	10.0	3337.7	5.	6.7600E+10	.3000	2177.6	2.8339E+07
8	4.6833E+07	.7836	10.0	6474.4	7.	6.7568E+10	.2635	4542.4	3.8581E+07
9	4.2952E+07	.9047	3.0	504.4	2.	6.7949E+10	.0604	240.7	3.8859E+07
10	8.7741E+07	.5746	3.0	1375.5	3.	6.8259E+10	.0660	675.5	5.0420E+07
11	7.9427E+07	.4586	-3.0	2501.0	4.	6.8152E+10	.0986	1322.7	3.6423E+07
12	8.5285E+07	.4182	-3.0	3890.3	5.	6.7998E+10	.1156	2184.0	3.5655E+07
13	1.1240E+08	.4901	-3.0	5720.0	6.	6.8050E+10	.1394	3257.7	5.5094E+07
14	1.1538E+08	.8223	-3.0	7567.7	7.	6.7901E+10	.1432	4553.6	5.0941E+07
15	1.7663E+08	.4415	-17.8	520.3	2.	6.8402E+10	.0158	241.5	1.4524E+08
16	2.1105E+08	.3684	-17.8	1426.5	3.	6.8684E+10	.0229	677.6	7.7730E+07
17	1.6367E+08	.2489	-17.8	2659.2	4.	6.8590E+10	.0357	1327.0	4.0739E+07
18	1.1645E+08	.2278	-17.8	4190.7	5.	6.8372E+10	.0472	2190.0	3.6822E+07
19	2.0874E+08	.2430	-17.8	6152.8	6.	6.8364E+10	.0548	3265.2	5.0713E+07
20	2.0127E+08	.2608	-17.8	8205.3	7.	6.8200E+10	.0716	4563.6	5.2489E+07
21	1.6711E+08	.2632	37.8	759.9	3.	6.5672E+10	.2568	667.6	2.1109E+06
22	1.7731E+06	1.3302	37.8	1482.9	4.	6.5707E+10	.1783	1309.0	2.3587E+06
23	3.2925E+06	1.2511	37.8	2280.1	5.	6.6559E+10	.1405	2162.4	2.9141E+06
24	3.3445E+06	1.3942	37.8	3400.4	6.	6.6935E+10	.1511	3230.9	4.6628E+06
25	4.3526E+06	1.1414	37.8	4729.3	7.	6.6811E+10	.1171	4516.9	4.9683E+06
26	5.2381E+05	.9518	51.7	264.6	2.	6.5765E+10	.1825	236.8	4.9816E+05
27	8.3624E+05	.9689	51.7	707.2	3.	6.6094E+10	.1229	684.7	8.0357E+05
28	1.0102E+06	.9295	51.7	1349.6	4.	6.6190E+10	.0798	1303.5	9.3007E+05
29	1.3847E+06	.8704	51.7	2213.5	5.	6.6197E+10	.0635	2154.6	1.2053E+06
30	1.7575E+06	.9530	51.7	3291.1	6.	6.6178E+10	.0605	3220.8	1.6922E+06
31	2.3428E+06	.9105	51.7	4593.3	7.	6.6418E+10	.0549	4583.6	2.1325E+06
32	3.0137E+05	.7330	65.6	251.1	2.	6.5668E+10	.0956	235.9	2.2007E+05
33	4.8502E+05	.7737	65.6	683.6	3.	6.5386E+10	.0636	661.9	3.7526E+05
34	6.1773E+05	.7351	65.6	1320.7	4.	6.5663E+10	.0411	1259.3	4.5489E+05
35	8.3007E+05	.6691	65.6	2172.0	5.	6.5664E+10	.0312	2146.2	5.6006E+05
36	1.1534E+06	.6695	65.6	3243.2	6.	6.5647E+10	.0291	3209.2	7.8019E+05
37	1.4002E+06	.6648	65.6	4525.9	7.	6.5853E+10	.0256	4488.2	9.9110E+05
38	2.4402E+05	.5664	79.4	246.6	2.	6.4650E+10	.0626	234.8	1.3729E+05
39	3.7617E+05	.5733	79.4	674.0	3.	6.4926E+10	.0380	658.8	2.1565E+05
40	4.7835E+05	.5387	79.4	1346.5	4.	6.5078E+10	.0240	1292.5	2.5760E+05
41	6.5426E+05	.4748	79.4	2152.1	5.	6.5127E+10	.0177	2137.4	3.1062E+05
42	8.9423E+05	.4864	79.4	3214.1	6.	6.5580E+10	.0166	3137.5	4.3489E+05
43	1.0789E+06	.5189	79.4	4485.9	7.	6.5525E+10	.0154	4473.2	5.6034E+05
44	1.0361E+05	.5036	90.6	242.9	2.	6.4744E+10	.0457	234.1	9.5610E+04
45	3.1050E+05	.4750	90.6	667.0	3.	6.4473E+10	.0267	666.5	1.4780E+05
46	4.1271E+05	.4426	90.6	1207.6	4.	6.4575E+10	.0173	1287.5	1.8254E+05
47	7.3022E+05	.3857	90.6	2140.4	5.	6.4101E+10	.0120	2120.6	2.0877E+05
48	7.6405E+05	.3823	90.6	3106.3	6.	6.4101E+10	.0113	3187.5	2.9307E+05
49	9.4170E+05	.3936	90.6	4464.9	7.	6.5163E+10	.0103	4460.6	3.7053E+05



Polymeric Material Characterization Test

Test No. 78-15

Beam Nos. Not and Recorded

Date 3/30/78

Damping Material MacBond IB2107

Material Thickness 0.0178 cm Material Density 1.049 g/cc

Beam Thickness 0.2032 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -17.8 °C and 93.3 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.321 Temperature 8.3 °C

1000 Hz η_D 1.321 Temperature 26.7 °C

Range 100 Hz -3.9 °C 26.7 °C

1000 Hz 12.8 °C 50.0 °C

$$\begin{aligned} & \text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR) * N) \\ & \begin{array}{cccccc} T0 & FROM & MROM & N & ML & \\ & A1 & A2 & A3 & A4 & \\ 50.0 & 2.6973E+04 & 9.9986E+06 & .280 & 1.0127E+05 & \\ A = & (\text{LOG}(FR) - \text{LOG}(FROL)) / C & & & & \\ \text{LOG}(\text{ETA}) = & \text{LOG}(\text{ETAFROL}) + ((SL+SH)A + (SL-SH)(1-\text{SQRT}(1+A^2))) / C/2 & & & & \\ & \begin{array}{cccccc} T0 & ETAFROL & SL & SH & FROL & C \\ & B1 & B2 & B3 & B4 & B5 \end{array} & & & & \\ 50.0 & 1.321 & .169 & -.325 & 1.5063E+04 & .300 & \\ \text{LOG}(FR) = & \text{LOG}(F) - 12(T-T0) / (525/1.8 + T-T0) & & & & \end{array} \end{aligned}$$

Remarks:

Test No. 78-15
Beam No. Not Recorded

°S	f_c	f_n	f_L	f_R	Δf	η_s	ldb
Temp. Note							
0 1	109.1		108.7	109.4	0.7	0.00642	
0 2	711.7	328.4	705.7	717.9	12.2	0.0171	
0 3	2045.6	915.3	2020.6	2092.6	71.7	0.0351	
0 4	3621.4	1790.2	3775.7	3879.2	103.5	0.0271	
0 5	6009.4	2954.0	5896.4	6112.1	215.7	0.0359	
0 6	8679.4	4422.3	8545.9	8842.3	296.4	0.0342	
25 1	108.1		107.3	108.9	1.6	0.0148	
25 2	653.6	327.3	641.3	666.5	25.2	0.0386	
25 3	1765.1	912.2	1721.8	1810.1	88.3	0.0501	
25 4	3302.5	1783.5	3199.6	3410.5	210.9	0.0640	
25 5	5206.1	2943.5	5003.4	5406.2	402.8	0.0776	
25 6	7553.2	4407.4	7248.8	7875.8	627.0	0.0833	
50 1	105.9		102.7	109.2	6.5	0.0615	
50 2	619.9	325.9	581.0	662.8	81.8	0.1331	
50 3	1650.2	908.8	1527.1	1778.4	251.3	0.1541	
50 4	3027.8	1777.5	2764.9	3309.4	544.5	0.1828	
50 6	6921.1	4391.0	6474.5	7232.3	757.8	0.2203	X
71 1	97.1		89.5	108.0	18.5	0.1941	
71 2	542.0	324.8		649.0	214.0	0.4298	
71 3	1426.0	905.8	1213.1	1649.2	431.1	0.3170	

Test No. 78-15
Beam No. Not Recorded

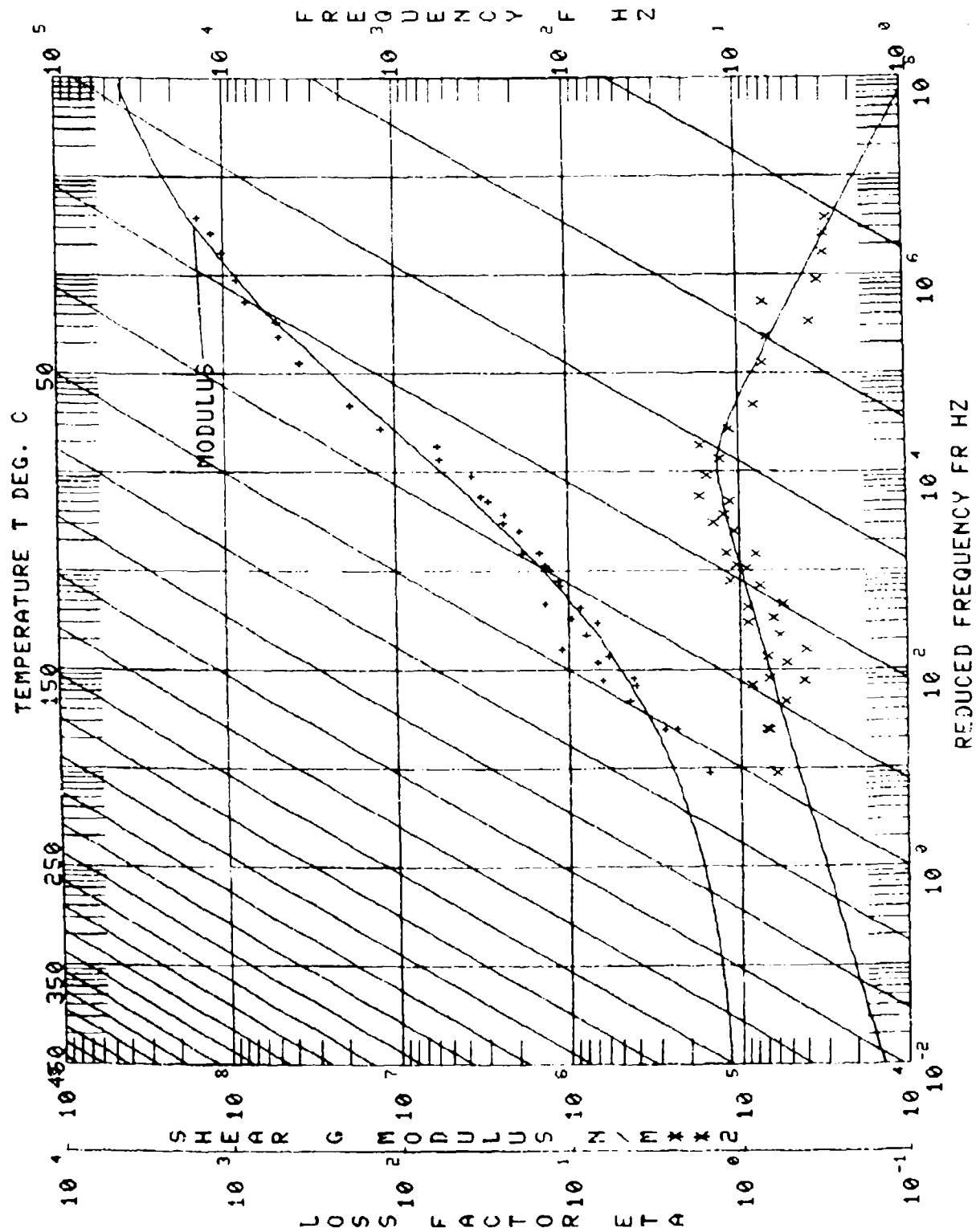
Temp.	Mode	f_c	f_n	f_L	f_R	Δf	τ_s	IGB
71	5	3091.3	2023.0	3492.8	4261.2	768.4	0.2009	X
102	2	400.3	323.1	354.2	463.9	109.7	0.2850	
102	3	1049.6	902.1	924.2	1227.5	303.3	0.3018	
102	4	1973.4	1764.2	1709.1	2262.4	553.3	0.2921	
102	5	3133.1	2910.0	2835.9	3467.1	631.2	0.2057	
102	6	4693.0	4358.8	4476.7	4894.1	820.6	0.1775	X
102	7	6419.6	6071.8	5761.0	6901.3	1140.3	0.1805	
125	1	79.3		62.1		16.4	0.2399	
125	2	361.3	321.7	332.2	395.0	62.8	0.1765	
125	3	966.0	898.4	898.1	1046.6	148.5	0.1556	
125	4	1842.3	1758.1	1736.9	1953.7	216.8	0.1185	
125	5	3003.4	2899.0	2873.3	3134.0	260.7	0.0871	
125	6	4456.5	4337.4	4289.5	4652.1	362.6	0.0816	
125	7	6188.5	6042.3	5975.8	6405.6	429.8	0.0696	
150	2	344.1	320.1	326.0	358.6	32.6	0.0952	
150	3	931.2	895.3	839.9	969.0	129.1	0.1400	
150	4	1793.0	1750.3	1743.4	1842.6	99.2	0.0554	
150	5	2938.7	2888.0	2879.5	2990.7	111.2	0.0379	
150	6	4370.7	4318.0	4292.0	4451.2	158.5	0.0363	
150	7	6089.6	6013.1	5989.2	6187.9	198.7	0.0326	

°F	Temp. Node	f_c	f_n	f_L	f_R	Δf	η_s	ldB
150	8	5079.6		7955.5	8205.1	249.6	0.0309	
175	1	58.1		54.8	62.2	7.4	0.1284	
175	2	331.4	318.64	321.6	342.0	20.4	0.0617	
175	3	811.6	891.6	889.8	935.2	45.4	0.0500	
175	4	1768.6	1743.6	1741.9	1795.7	53.8	0.0302	
175	5	2906.5	2876.0	2875.7	2938.0	62.3	0.0214	
175	6	4326.6	4297.2	4284.8	4366.5	81.7	0.0189	
175	7	6032.6	5988.1	5979.4	6082.6	103.2	0.0171	
175	8	8006.0		7939.7	8070.8	131.1	0.0164	
200	1	54.7		52.5	58.7	6.2	0.1141	
200	2	324.8	317.1	318.9	331.1	12.2	0.0376	
200	3	899.5	887.9	887.0	912.3	25.3	0.0281	
200	4	1751.8	1736.4	1736.7	1767.9	31.2	0.0178	
200	5	2884.2	2864.0	2866.2	2902.0	35.8	0.0124	
200	6	4292.2	4280.8	4267.6	4316.6	49.0	0.0114	
200	7	5984.8	5958.9	5954.8	6014.8	60.0	0.0100	
200	8	7941.6		7898.9	7983.8	84.9	0.0107	

EXPERIMENTAL CODE : 2
MATERIAL : INACBOND 18 2107 JG78-15

DATA SOURCES
MANUFACTURER : INONE
AFRL : SANDWICH BEAM (UDRI)
OTHER : INONE

NO.	MODULUS N/MS2	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MS2	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/MS2
1	1.25161E+07	1.1591	21.7	1426.0	3.	6.90398E+10	.3170	305.8	1.45080E+07
2	1.21417E+07	.6185	21.7	3901.3	5.	6.85128E+10	.2009	2923.0	1.32446E+07
3	1.89004E+07	.8206	10.0	619.0	2.	7.00694E+10	.1331	325.9	1.53661E+07
4	3.47406E+07	.7194	10.0	1650.2	7.	6.94970E+10	.1511	908.8	2.64330E+07
5	7.44849E+07	.6770	10.0	3627.8	4.	6.52330E+10	.1828	1777.5	3.21454E+07
6	7.45946E+07	.7111	10.0	6821.1	6.	6.95441E+10	.2203	4391.0	5.31163E+07
7	4.91330E+07	.3737	-3.9	653.6	2.	7.06726E+10	.0386	327.3	1.83600E+07
8	8.68213E+07	.3206	-3.9	1755.1	3.	7.00189E+10	.0591	912.2	2.84429E+07
9	1.05826E+08	.3054	-3.9	3302.5	4.	6.97828E+10	.0640	183.5	3.2180E+07
10	1.19923E+08	.2997	-3.9	5206.1	5.	6.94772E+10	.0716	2943.5	3.5354E+07
11	1.44887E+08	.2002	-3.9	7553.2	6.	7.00645E+10	.0833	4407.4	4.20428E+07
12	6.14724E+08	.4899	-17.8	6009.4	5.	6.99737E+10	.0359	2954.0	3.07303E+08
13	5.24685E+08	.2601	-17.8	8679.4	6.	7.05391E+10	.0342	4422.3	1.36491E+08
14	1.40284E+06	1.0688	38.9	409.3	2.	6.88795E+10	.2850	323.1	1.49372E+06
15	2.40694E+06	1.4441	38.9	1049.6	3.	6.84769E+10	.3018	902.1	3.47592E+06
16	3.26155E+06	1.7516	38.9	1973.4	4.	6.82016E+10	.2921	1764.2	5.71281E+06
17	3.68300E+06	1.5865	38.9	3133.1	5.	6.79047E+10	.2057	2910.0	5.84301E+06
18	5.70326E+06	1.3320	38.9	4693.0	6.	6.85278E+10	.1775	4358.8	7.59693E+06
19	5.85612E+06	.9227	38.9	6419.6	7.	6.79032E+10	.1895	6071.8	1.00795E+07
20	6.97954E+05	1.1639	51.7	361.3	2.	6.82750E+10	.1765	321.7	6.44020E+05
21	1.15984E+06	1.1639	51.7	966.0	3.	6.79164E+10	.1556	898.4	1.36158E+06
22	1.51201E+06	1.2313	51.7	1842.3	4.	6.77398E+10	.1185	1758.1	1.86171E+06
23	1.96613E+06	1.1035	51.7	3003.4	5.	6.73923E+10	.0871	2899.0	2.18968E+06
24	2.35418E+06	1.2620	51.7	4456.5	6.	6.73566E+10	.0816	4337.4	2.97004E+06
25	2.97470E+06	1.1695	51.7	6188.5	7.	6.72509E+10	.0636	6042.3	3.47901E+06
26	4.30694E+05	1.6882	65.6	344.1	2.	6.75975E+10	.0952	320.1	2.96412E+05
27	6.38230E+05	1.7079	65.6	931.2	3.	6.74485E+10	.1400	895.3	1.09008E+06
28	8.74445E+05	.9173	65.6	1793.0	4.	6.71311E+10	.0554	1750.3	8.06093E+05
29	1.13630E+06	.7785	65.6	2938.7	5.	6.68819E+10	.0379	2888.0	8.4596E+05
30	1.33937E+06	.9326	65.6	4370.7	6.	6.72510E+10	.0363	4318.0	1.24005E+06
31	1.98849E+06	.8159	65.6	6089.6	7.	6.65055E+10	.0326	6013.1	1.55712E+06
32	2.40618E+05	.7093	79.4	331.4	2.	6.69635E+10	.0617	318.6	1.70661E+05
33	4.17817E+05	.8756	79.4	911.6	3.	6.68921E+10	.0500	891.6	3.65852E+05
34	5.98335E+05	.7027	79.4	1768.6	4.	6.66182E+10	.0302	1743.6	4.20461E+05
35	8.19945E+05	.5911	79.4	2906.5	5.	6.63272E+10	.0214	2876.0	4.84659E+05
36	9.77214E+05	.6481	79.4	4328.6	6.	6.66045E+10	.0189	4397.2	6.33348E+05
37	1.41147E+06	.5644	79.4	6032.6	7.	6.60498E+10	.0171	5988.1	7.86660E+05
38	1.58220E+05	.6195	93.3	324.8	2.	6.63364E+10	.0376	317.1	9.00197E+04
39	2.06575E+05	.6910	93.3	899.5	3.	6.63381E+10	.0231	887.9	1.98011E+05
40	4.47861E+05	.5384	93.3	1751.8	4.	6.60691E+10	.0178	1736.4	2.41594E+05
41	6.57881E+05	.4186	93.3	2884.2	5.	6.57749E+10	.0124	2864.0	2.75400E+05
42	6.97232E+05	.5366	93.3	4202.2	6.	6.60972E+10	.0114	4280.8	3.74158E+05
43	1.11872E+06	.4084	93.3	5984.8	7.	6.54072E+10	.0100	5958.9	4.56806E+05



Polymeric Material Characterization Test

Test No. 78-17
 Beam Nos. Not and Recorded Date 4/11/78
 Damping Material MacBond IB2130

Material Thickness 0.0203 cm Material Density 1.103 g/cc

Beam Thickness 0.1524 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -31.7 °C and 93.3 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.408 Temperature -9.4 °C

1000 Hz η_D 1.408 Temperature 8.9 °C

Range 100 Hz -20.6 °C 4.4 °C

1000 Hz -1.1 °C 30.0 °C

LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
 T0 FROM MROM N ML
 A1 A2 A3 A4
 30.0 1.0317E+04 8.7144E+06 .390 2.1115E+05
 A=(LOG(FR)-LOG(FROL))/C
 LOG(ETA)=LOG(ETAFROL)+((SL+SH)A+(SL-SH)(1-SQRT(1+A**2)))/2
 T0 ETAFROL SL SH FROL C
 B1 B2 B3 B4 B5
 30.0 1.408 .192 -.358 8.5782E+03 .100
 LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)

Remarks: _____

°F	f_c	f_n	f_L	f_R	Δf	η_3	1dB
Temp. Mode							
-25	519.0	242.2	516.9	521.3	4.4	0.00848	
-25	1406.7	679.9	1397.6	1416.9	19.3	0.0137	
-25	2678.1	1330.0	2650.9	2704.1	53.3	0.0199	
-25	4168.1	2195.4	4113.2	4224.8	111.6	0.0268	
-25	6218.2	3272.0	6129.2	6303.4	174.2	0.0280	
-25	8009.7	4572.0	7878.5	8137.0	258.5	0.0348	
0	511.9	241.5	505.2	517.7	12.5	0.0244	
0	1364.4	677.6	1336.5	1391.3	54.8	0.0402	
0	2557.4	1327.0	2495.4	2639.1	143.7	0.0563	
0	3945.5	2190.0	3815.3	4067.5	252.0	0.0641	
0	5899.0	3265.2	5687.0	6097.4	410.4	0.0697	
0	7519.2	4563.6	7159.2	7095.6	746.4	0.0998	
25	481.0	240.7	452.8	516.8	64.0	0.1342	
25	1260.8	675.5	118.3	1369.9	201.6	0.1620	
25	2342.1	1322.7	2115.4	2541.4	426.0	0.1850	
25	3495.3	2184.0	3115.2	3824.1	708.9	0.2071	
25	5264.7	3257.7	4744.2		1041.0	0.2017	
25	6179.0	4553.6		7266.5	1095.0	0.1652	
50	395.0	239.8	330.7		128.5	0.3443	
50	988.2	673.0	835.6	1194.2	368.6	0.4020	

Test No. 78-17
Beam No. Not Recorded

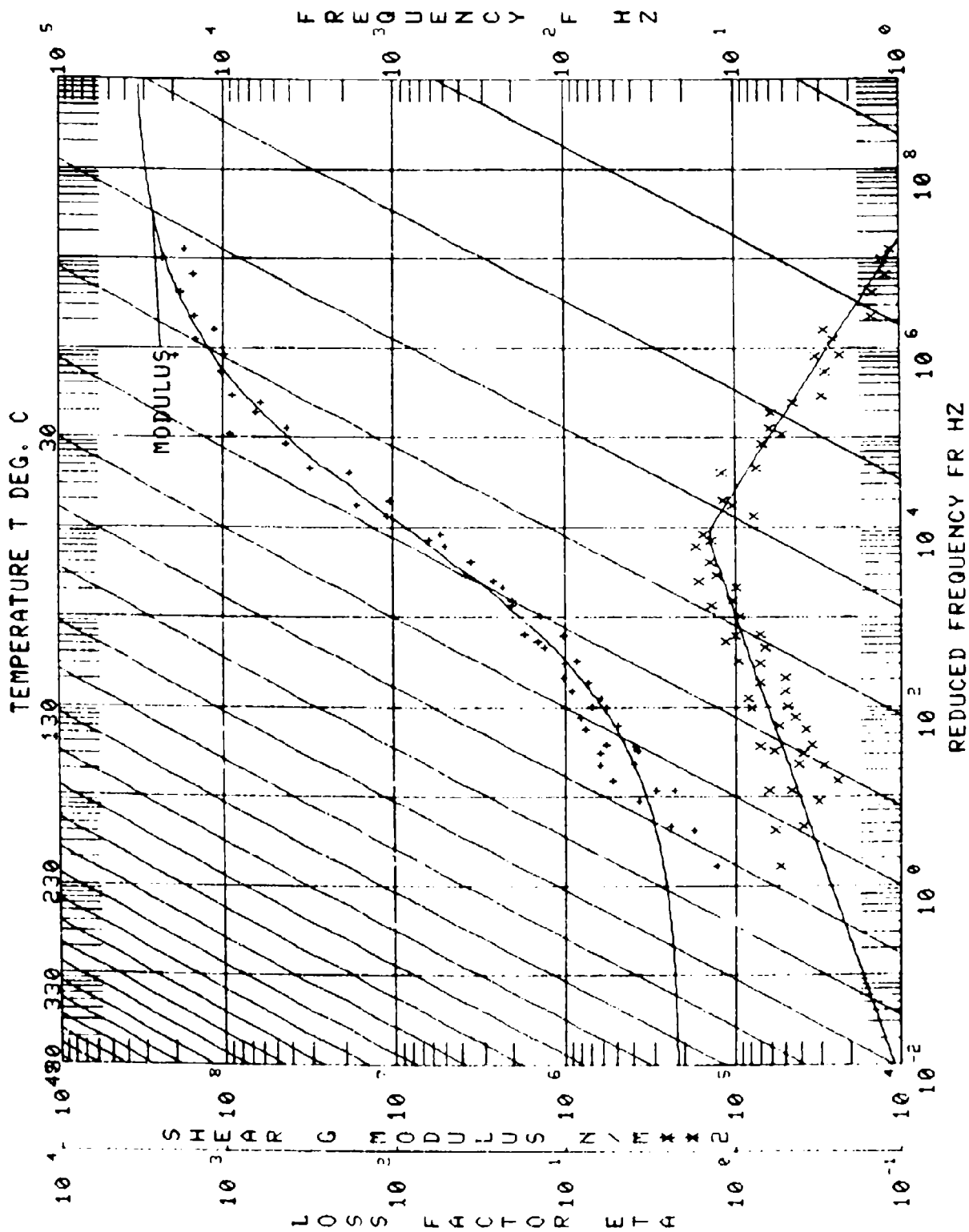
°F	Temp.	Mode	f_c	f_n	f_L	f_R	Δf	n_s	ldB
50	4		1796.8	1318.7	1585.4	2036.4	886.7	0.2593	X
50	5		2742.8	2177.6	2558.7	3007.5	882.3	0.3396	X
50	7		5556.8	4542.4	5020.6	5892.5	1714.2	0.3241	X
75	2		314.3	238.9	268.3	371.2	102.9	0.3465	
75	3		786.4	670.4	685.2	926.1	240.9	0.3218	
75	4		1469.5	1313.8	1280.3	1699.2	418.9	0.2974	
75	5		2364.9	2170.2	2114.2	2635.0	520.8	0.2258	
75	6		3520.5	3236.9	3293.6	876.2	876.2	0.2569	X
75	7		4811.6	4530.7	4351.0	5259.0	908.0	0.1922	
100	2		270.1	237.9	248.6	297.1	48.5	0.1825	
100	3		710.3	667.6	668.3	758.6	90.3	0.1282	
100	4		1354.8	1309.0	1297.2	1420.7	123.5	0.0915	
100	5		2218.8	2162.4	2141.7	2300.8	159.1	0.0719	
100	6		3311.2	3230.9	3178.7	3433.9	255.2	0.0773	
100	7		4598.8	4516.9	4452.9	4737.4	284.5	0.0620	
125	2		257.2	236.8	242.0	272.1	30.1	0.1178	
125	3		691.3	664.7	665.3	719.7	54.4	0.0789	
125	4		1330.4	1303.5	1299.1	1362.6	63.5	0.0478	
125	5		2187.6	2154.6	2141.2	2231.4	90.2	0.0413	
125	6		3257.9	3220.8	3205.2	3315.3	110.1	0.0338	

°F	Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	ldB
125	7		4546.5	4503.6	4462.1	4614.9	152.8	0.0336	
150	2		246.9	235.9	238.9	256.2	17.3	0.0702	
150	3		676.3	661.9	662.3	690.1	27.8	0.0411	
150	4		1311.0	1298.3	1293.3	1327.7	34.4	0.0262	
150	5		2159.3	2146.2	2137.7	2180.8	43.1	0.0200	
150	6		3220.8	3209.2	3190.1	3249.3	59.2	0.0184	
150	7		4488.8	4488.2	4452.2	4519.1	66.9	0.0149	
175	2		242.5	234.8	236.8	249.2	12.4	0.0511	
175	3		668.3	658.8	659.3	676.8	17.5	0.0262	
175	4		1299.3	1292.5	1289.0	1310.6	21.6	0.0166	
175	5		2143.5	2137.4	2131.0	2157.1	26.1	0.0122	
175	6		3199.4	3197.5	3180.2	3217.2	37.0	0.0116	
175	7		4460.2	4473.2	4437.1	4483.3	46.2	0.0104	
200	2		238.6	233.7	234.5	243.3	8.8	0.0369	
200	3		661.8	655.7	655.7	667.9	12.2	0.0184	
200	4		1291.3	1286.2	1288.7	1298.8	15.1	0.0117	
200	5		2131.2	2128.0	2122.7	2139.5	16.8	0.00788	
200	6		3179.0	3185.0	3167.7	3191.4	23.7	0.00746	
200	7		4433.1	4457.3	4417.1	4449.0	31.9	0.0072	

EXPERIMENTAL CODE : 4
 MATERIAL : MACBOND 182130 JG 78-17
 DATA SOURCES
 MANUFACTURER : INOME
 AFIL : SANDWICH BEAM (UDRI)
 OTHER : INOME

NO.	MODULUS N/MS2	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MS2	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/MS2
1	1.48782E+06	1.1775	23.9	314.3	2.	6.69374E+10	.3465	238.9	1.75185E+06
2	2.07053E+06	1.1346	23.9	786.4	3.	6.72321E+10	.3218	670.4	2.37038E+06
3	2.67185E+06	1.6781	23.9	1469.5	4.	6.72411E+10	.2974	1313.8	4.57216E+06
4	3.53130E+06	1.4524	23.9	2364.9	5.	6.71415E+10	.2258	2170.2	5.27440E+06
5	5.11710E+06	1.7356	23.9	3520.5	6.	6.71415E+10	.2569	3236.9	8.88134E+06
6	5.47788E+06	1.5557	23.9	4811.6	7.	6.72205E+10	.1922	4530.7	8.63171E+06
7	3.00105E+06	1.3386	10.0	395.0	2.	6.74427E+10	.3443	239.8	5.22185E+06
8	6.39978E+06	1.4233	10.0	988.2	3.	6.77552E+10	.4020	673.0	9.10859E+06
9	1.09821E+07	1.7841	10.0	1796.8	4.	6.77436E+10	.2593	1318.7	8.51067E+06
10	1.87388E+07	1.2341	10.0	2742.8	5.	6.76001E+10	.3396	2177.6	1.32522E+07
11	1.89695E+07	1.2477	10.0	5556.8	7.	6.75681E+10	.3241	4542.4	2.36678E+07
12	1.19130E+07	1.0618	-3.9	481.0	3.	6.72490E+10	.1342	240.7	1.82566E+07
13	3.12258E+07	1.7622	-3.9	1260.8	3.	6.82595E+10	.1620	675.5	2.37990E+07
14	4.39605E+07	1.7051	-3.9	2342.1	4.	6.81552E+10	.1850	1222.7	3.09951E+07
15	4.25554E+07	1.6320	-3.9	3495.7	5.	6.79981E+10	.2071	2184.0	2.68967E+07
16	6.70804E+07	1.6218	-3.9	5264.7	6.	6.85070E+10	.2017	3257.7	4.17106E+07
17	6.19171E+07	1.4595	-3.9	6719.0	7.	6.79017E+10	.1552	4553.6	2.8495E+07
18	9.31171E+07	1.5370	-17.8	511.9	7.	6.80235E+10	.0544	241.5	5.00033E+07
19	9.03363E+07	1.3042	-17.8	1364.4	3.	6.80845E+10	.0402	677.6	2.74832E+07
20	1.05130E+08	1.2901	-17.8	2557.4	4.	6.85990E+10	.0541	1327.0	3.05913E+07
21	1.04372E+08	1.2363	-17.8	3945.5	5.	6.83722E+10	.0637	2190.0	2.37178E+07
22	1.51647E+08	1.2602	-17.8	5899.2	6.	6.86444E+10	.0653	3265.2	3.4631E+07
23	1.18816E+08	1.2972	-17.8	7519.2	7.	6.82003E+10	.0998	4563.6	3.47186E+07
24	1.99966E+08	1.3324	-31.7	519.0	2.	6.87994E+10	.0085	242.2	6.64661E+07
25	1.56587E+08	1.1536	-31.7	1496.7	3.	6.91516E+10	.0137	679.0	2.40576E+07
26	1.87589E+08	1.1491	-31.7	2678.1	4.	6.89995E+10	.0199	1330.9	2.79766E+07
27	1.50032E+08	1.1242	-31.7	4168.1	5.	6.87098E+10	.0268	2195.4	1.96280E+07
28	2.73070E+08	1.1305	-31.7	6218.2	6.	6.86495E+10	.0380	3272.0	3.09796E+07
29	6.28218E+05	1.163	-31.7	8009.7	7.	6.84516E+10	.0318	4572.0	2.05843E+07
30	8.70438E+05	1.9785	37.8	270.1	2.	6.63782E+10	.1825	237.9	5.3503E+05
31	1.06642E+06	1.0339	37.8	710.3	3.	6.66722E+10	.1282	607.6	8.5106E+05
32	1.42773E+06	1.0650	37.8	1354.8	4.	6.66597E+10	.0650	1309.0	1.09218E+06
33	2.06264E+06	1.0720	37.8	2218.8	5.	6.6957E+10	.0719	2162.4	1.37398E+06
34	3.05270E+06	1.0171	37.8	3311.2	6.	6.68116E+10	.0660	3233.0	2.2120E+06
35	4.07321E+05	1.7246	51.7	4598.8	7.	6.66932E+10	.0773	4566.9	2.42599E+06
36	5.86265E+05	1.8106	51.7	631.3	2.	6.5758E+10	.1178	236.8	2.95160E+05
37	7.45757E+05	1.7263	51.7	1390.4	3.	6.6190E+10	.0479	664.7	4.83358E+05
38	1.04160E+06	1.7306	51.7	2187.0	4.	6.61797E+10	.0413	1343.5	5.4180E+05
39	1.75093E+06	1.6784	51.7	3257.0	5.	6.65178E+10	.0336	2154.6	7.61039E+05
40	1.75041E+06	1.7277	51.7	4546.5	6.	6.5268E+10	.0732	3220.9	9.22634E+05
41	2.30677E+05	1.6485	65.6	276.3	2.	6.5538E+10	.0411	4503.6	1.27369E+06
42	3.00330E+05	1.6050	65.6	710.3	3.	6.5667E+10	.0240	661.9	2.36157E+05
43	3.00330E+05	1.4995	65.6	2159.3	4.	6.5667E+10	.0262	2158.3	3.55501E+05
44	5.00574E+05	1.5602	65.6	3220.9	5.	6.6039E+10	.0184	4488.2	4.86708E+05
45	9.30167E+05	1.5199	65.6	4488.2	6.	6.50537E+10	.0149	5488.2	5.45030E+05
46	1.06420E+06	1.5907	65.6	5907.4	7.	6.4658E+10	.0511	7234.8	1.97012E+05
47	1.81169E+05	1.5070	79.4	242.5	2.	6.4658E+10	.0511	234.8	1.45825E+05
48	3.07230E+05	1.4746	79.4	669.3	3.	6.48201E+10	.0262	669.3	1.45825E+05

50	4.0225E+05	79.4	1299.3	4.	6.5078E+10	.0166	1292.5	1.7644E+05
51	5.93594E+05	79.4	2143.5	5.	6.5127E+10	.0122	2137.4	2.1294E+05
52	7.7326E+05	79.4	3199.4	6.	6.5558E+10	.0116	3197.5	3.0179E+05
53	8.2811E+05	79.4	4469.2	7.	6.5525E+10	.0104	4473.2	3.7437E+05
54	1.3334E+06	93.3	238.6	2.	6.4055E+10	.0369	233.7	7.3831E+04
55	2.49574E+05	93.3	661.8	3.	6.4316E+10	.0184	655.7	9.8895E+04
56	3.78543E+05	93.3	1291.3	4.	6.4445E+10	.0117	1286.2	1.22664E+05
57	5.4228E+05	93.3	2131.2	5.	6.4555E+10	.0079	2128.0	1.35771E+05
58	6.4025E+05	93.3	3179.0	6.	6.5047E+10	.0075	3185.0	1.91107E+05
59	6.42367E+05	93.3	4433.1	7.	6.5060E+10	.0072	4457.3	2.5534E+05



Polymeric Material Characterization Test

Test No. 79-4

Beam Nos. 060C and 060D

Date 5/79

Damping Material Soundcoat D

Material Thickness 0.0102 cm Material Density 0.965 g/cc

Beam Thickness 0.1524 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -17.8 °C and 148.9 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 0.9 Temperature 79.4 °C

1000 Hz η_D 0.9 Temperature 107.22 °C

Range 100 Hz 40.6 °C 116.67 °C

1000 Hz 62.8 °C 150.00 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR) \times 2N)$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
75.0	4.0000E+02	1.4000E+06	.200	5.5000E+04

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL + SH)A + (SL - SH)(1 - \text{SQRT}(1 + A \times 2))) / C / 2$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
75.0	.900	.400	-.200	1.8000E+01	1.500

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 / 1.8 + T - T0)$$

Remarks: _____

°F f_C f_n f_L f_R Δf n_s ldB

Temp.	Mode	f _C	f _n	f _L	f _R	Δf	n _s	l dB
0	2	472.20	246.00	467.90	476.40	8.5	0.0180	
0	3	1220.80	683.60	1204.90	1238.40	33.5	0.0274	
0	4	2244.00	1337.78	2206.70	2280.20	73.5	0.0327	
0	5	3591.90	2217.45	3515.90	3658.50	142.6	0.0397	
25	2	462.80	246.90	456.80	469.20	12.4	0.0268	
25	3	1181.20	686.38	1162.10	1210.70	48.6	0.0411	
25	4	2173.60	1343.83	2125.90	2222.60	96.7	0.0445	
25	5	3461.40	2226.44	3367.00	3534.70	176.7	0.0510	
50	2	452.10	244.03	442.30	462.70	20.4	0.0451	
50	3	1152.80	678.36	1119.90	1186.10	66.2	0.0574	
50	4	2078.90	1327.50	2006.80	2167.60	160.8	0.0773	
50	5	3298.30	2198.46	3166.20	3421.10	254.9	0.0773	
75	2	431.80	243.14	415.70	448.30	32.6	0.0755	
75	3	2090.20	676.20	1043.10	1138.20	95.1	0.0872	
75	4	2954.60	1323.27	1861.80	0252.20	190.40	0.0974	
75	5	3078.40	2189.47	2911.30	3245.40	334.1	0.1085	
100	2	407.20	242.15	384.70	432.40	47.7	0.1171	
100	3	1028.90	673.73	965.60	1088.20	122.6	0.1192	
100	4	1837.10	1319.04	1718.80	1951.50	232.7	0.1267	
100	5	2875.90	2192.47	2688.50	3068.90	380.3	0.1322	

1dB

 η_s Δf f_R f_L f_n f_c $^{\circ}F$

Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	
100	6	4603.30		4603.60	4608.50	4.9	0.0011	
125	2	376.90	211.27	348.30	412.70	64.4	0.1709	
125	3	952.60	671.57	878.50	1030.30	151.8	0.1593	
125	4	1717.60	1314.20	1568.70	1837.30	268.6	0.1564	
125	5	2678.70	2175.48	2484.70	2887.70	403.0	0.1504	
135	2	366.40	241.05	334.20	402.70	68.5	0.1869	
135	3	922.20	670.65	847.50	1000.70	153.2	0.1661	
135	4	1664.90	1313.60	1520.30	1784.50	264.2	0.1587	
135	5	2623.30	2173.48	2414.00	2807.10	393.1	0.1498	
150	2	347.30	240.39	313.50	389.20	75.7	0.2180	
150	3	883.10	669.10	802.90	969.90	167.0	0.1891	
150	4	1593.40	1310.58	1458.40	1723.60	265.2	0.1664	
150	5	2521.90	2168.48	2336.20	2709.00	370.8	0.1470	
165	2	330.60	239.73	298.50	372.40	73.9	0.2235	
165	3	845.30	667.56	767.30	931.90	164.5	0.1947	
175	4	1536.70	1307.55	1410.20	1659.90	249.7	0.1625	
175	5	2458.00	2162.48	2284.00	2619.80	335.8	0.1366	
175	2	315.20	239.51	283.90	359.00	75.1	0.2383	
175	3	818.00	671.57	738.30	900.50	162.2	0.1983	
175	4	1495.50	1305.14	1377.30	1608.60	231.3	0.1547	

Temp.	Mode	f_C	f_n	f_L	f_R	Δf	η_s	1dB
175	5	2393.00	2158.49	2244.80	2538.50	293.7	0.1227	
185	2	307.30	239.07	277.00	345.60	68.6	0.2232	
185	3	792.20	665.71	720.90	873.60	152.7	0.1927	
185	4	1469.10	1302.72	1357.20	1570.60	213.4	0.1453	
185	5	2366.60	2154.49	2226.60	2498.20	271.6	0.1148	
200	2	291.00	238.30	263.80	325.40	61.6	0.2117	
200	3	756.10	664.48	703.30	826.90	123.6	0.1635	
200	4	1416.10	1299.70	1329.30	1506.50	177.6	0.1251	
200	5	2316.80	2148.49	2195.70	2419.50	223.6	0.0966	
225	2	273.40	236.20	250.30	298.40	48.1	0.1760	
225	3	723.80	662.32	669.80	774.20	104.4	0.1442	
225	4	1374.10	1299.09	1311.10	1442.10	131.0	0.0953	
225	5	2254.30	2143.50	2169.80	2343.60	173.8	0.0771	
250	2	257.50	235.65	242.50	275.90	33.4	0.1297	
250	3	688.60	658.92	660.20	726.40	66.2	0.0961	
250	4	1338.10	1287.61	1296.80	1376.80	80.0	0.0598	
250	5	2203.40	2122.51	2150.20	2254.70	104.50	0.0474	
275	2	252.20	234.44	240.00	265.60	25.6	0.1015	
275	3	681.10	655.53	657.60	699.70	42.1	0.0618	
275	4	1320.90	1282.16	1291.10	1351.40	60.3	0.0456	

EXPERIMENTAL CODE : 64
 MATERIAL : SOUND COAT D-2
 DATA SOURCES
 MANUFACTURER : SOUND COAT INC.
 AFML TUDRI-GET
 OTHER : NONE

NO.	MODULUS N/MS ²	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MS ²	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/MS ²
1	1.5097E+07	.1227	-18.3	472.2	2	7.00752E+10	.0180	246.0	1.84471E+06
2	1.06367E+07	.1145	-18.3	1220.8	3	6.90633E+10	.0274	683.6	2.24833E+06
3	2.41002E+07	.1101	-18.3	2244.0	4	6.97111E+10	.0327	1337.8	2.66078E+06
4	3.20234E+07	.1241	-18.3	3591.3	5	7.00903E+10	.0397	2217.5	3.97313E+06
5	1.12825E+07	.1488	-5.6	462.8	2	7.14955E+10	.0268	246.9	1.87845E+06
6	1.47997E+07	.1493	-5.6	1181.2	3	7.04790E+10	.0411	686.4	2.21033E+06
7	1.92312E+07	.1388	-5.6	2173.6	4	7.03551E+10	.0445	1343.8	2.67008E+06
8	2.51505E+07	.1505	-5.6	3461.4	5	7.06655E+10	.0510	2226.4	3.78432E+06
9	9.52833E+06	.2321	10.0	452.1	2	6.98430E+10	.0451	244.0	2.21172E+06
10	1.30168E+07	.2016	10.0	1152.8	3	6.88387E+10	.0574	678.4	2.64082E+06
11	1.52345E+07	.2317	10.0	2078.9	4	6.85507E+10	.0773	1327.5	3.52763E+06
12	1.87913E+07	.2227	10.0	3298.3	5	6.89015E+10	.0773	2198.5	4.40844E+06
13	6.31103E+06	.3137	23.9	431.8	2	6.93345E+10	.0755	243.1	1.97992E+06
14	9.11801E+06	.2742	23.9	1090.2	3	6.82100E+10	.0872	676.2	2.50015E+06
15	1.07556E+07	.2804	23.9	1954.6	4	6.82139E+10	.0974	1323.3	3.01578E+06
16	1.34745E+07	.3130	23.9	3078.4	5	6.83391E+10	.1085	2189.5	4.21797E+06
17	4.08330E+06	.4117	37.8	407.2	2	6.87770E+10	.1171	242.1	1.68127E+06
18	6.47499E+06	.3538	37.8	1028.9	3	6.79022E+10	.1192	673.7	2.89106E+06
19	7.59303E+06	.3695	37.8	1837.1	4	6.77785E+10	.1267	1319.0	2.80553E+06
20	9.13044E+06	.4052	37.8	2875.9	5	6.70088E+10	.1322	2182.5	3.70341E+06
21	2.49122E+06	.5377	51.7	376.9	2	6.82721E+10	.1299	241.3	1.33953E+06
22	4.17098E+06	.4696	51.7	952.6	3	6.74675E+10	.1593	671.6	1.95852E+06
23	5.14557E+06	.4902	51.7	1717.6	4	6.72809E+10	.1564	1314.3	2.52247E+06
24	5.87007E+06	.5107	51.7	2678.7	5	6.74636E+10	.1594	2175.5	3.11529E+06
25	1.55723E+06	.6656	55.6	347.3	2	6.77750E+10	.2180	240.4	1.04264E+06
26	2.70608E+06	.5956	55.6	883.1	3	6.69721E+10	.1891	669.1	1.61188E+06
27	3.19504E+06	.6140	55.6	1593.4	4	6.69119E+10	.1664	1310.6	1.96164E+06
28	3.80690E+06	.6353	55.6	2521.9	5	6.70351E+10	.1470	2168.5	2.41838E+06
29	9.13095E+05	.7800	70.4	315.2	2	6.72737E+10	.2383	239.5	7.12861E+05
30	1.87869E+06	.6850	70.4	818.0	3	6.35038E+10	.1893	651.6	1.28688E+06
31	1.99378E+06	.7229	79.4	1495.5	4	6.63576E+10	.1547	1305.5	1.44125E+06
32	2.41409E+06	.6962	79.4	2393.0	5	6.64139E+10	.1227	2158.5	1.68060E+06
33	5.78611E+05	.7927	93.3	291.0	2	6.66016E+10	.2117	238.3	4.58689E+05
34	9.4367E+05	.7885	93.3	756.1	3	6.60595E+10	.1635	664.5	7.53723E+05
35	1.17302E+06	.8235	93.3	1416.1	4	6.58055E+10	.1651	1299.7	9.65909E+05
36	1.71182E+06	.6955	93.3	2316.8	5	6.58049E+10	.0966	2148.5	1.19064E+06
37	2.03787E+06	.7483	95.0	307.3	2	6.70337E+10	.2232	239.1	6.01463E+05
38	1.35462E+06	.7722	95.0	782.2	3	6.63115E+10	.1927	666.8	1.05285E+06
39	1.71705E+06	.7413	95.0	1469.1	4	6.61117E+10	.1453	1302.4	1.27278E+06
40	2.19566E+06	.6807	95.0	2366.6	5	6.61759E+10	.1148	2154.5	1.51563E+06
41	2.20515E+06	.6939	93.3	330.6	2	6.74034E+10	.2235	239.7	8.36291E+05
42	2.00851E+06	.6537	73.9	845.3	3	6.66642E+10	.1947	667.6	1.37577E+06
43	3.10875E+06	.5612	73.9	2458.0	4	6.66646E+10	.1366	2162.5	2.06536E+06
44	2.11809E+06	.5071	57.8	365.4	2	6.81472E+10	.1869	241.0	1.21805E+06
45	3.40062E+06	.5071	57.8	922.2	3	6.72808E+10	.1661	670.7	1.73408E+06
46	4.25412E+06	.5252	57.2	1664.9	4	6.72246E+10	.1587	2173.5	2.23413E+06
47	5.00638E+06	.5608	57.2	2623.3	5	6.73446E+10	.1488	2173.5	2.85767E+06
48	3.85266E+05	.7908	107.2	273.4	2	6.54330E+10	.1760	236.2	3.06544E+05
49	8.12831E+05	.9341	107.2	723.8	3	6.56218E+10	.1442	662.3	5.72165E+05

50	7.59602E+05	.8751	107.2	1374.1	4.	6.57738E+10	.0953	1299.1	6.64740E+05
51	2.18950E+05	.8333	121.1	257.5	2.	6.51286E+10	.1297	235.6	1.82455E+05
52	3.00287E+05	1.0809	121.1	688.6	3.	6.49430E+10	.0961	658.0	3.24227E+05
53	5.24692E+05	7.366	121.1	1338.1	4.	6.45870E+10	.0508	1887.6	3.86510E+05
54	8.35408E+05	.6073	121.1	2803.4	5.	6.42836E+10	.0474	2123.5	5.01586E+05
55	1.78112E+05	.7522	135.0	252.2	2.	6.44615E+10	.1015	234.4	1.3382E+05
56	2.64930E+05	.7652	135.0	681.1	3.	6.42832E+10	.0618	655.5	2.84920E+05
57	4.13720E+05	.6865	135.0	1320.9	4.	6.40414E+10	.0456	1882.2	2.02730E+05
58	7.50113E+05	.5087	135.0	2183.6	5.	6.36190E+10	.0369	2112.5	3.81612E+05
59	1.36932E+05	.6723	148.9	246.6	2.	6.36775E+10	.0476	233.0	9.20630E+04
60	1.84072E+05	.8664	148.9	670.9	3.	6.39815E+10	.0474	654.0	1.48330E+05
61	3.00580E+05	.6350	148.9	1302.1	4.	6.37080E+10	.0319	1275.5	1.0866E+05
62	5.62382E+05	.4552	148.9	2140.8	5.	6.27800E+10	.0264	2098.5	2.61634E+05
63	2.4710E+06	.6760	73.9	1536.7	4.	6.6020E+10	.1625	1307.6	1.67043E+05
64	1.13350E+06	.7667	107.2	2254.3	5.	6.54906E+10	.0771	2143.5	8.60098E+05

Polymeric Material Characterization Test

Test No. 80-1

Beam Nos. 080-1 and 080-2

Date 1/80

Damping Material Soundcoat M

Material Thickness 0.0127 cm Material Density 1.049 g/cc

Beam Thickness 0.2032 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -45.6 °C and 65.6 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.5 Temperature 32.2 °C

1000 Hz η_D 1.5 Temperature 65.6 °C

Range 100 Hz 7.2 °C 57.2 °C

1000 Hz 44.4 °C 101.1 °C

$$\text{LOG}(N) \cdot \text{LOG}(ML) + (2 \text{LOG}(MROM/ML)) / (1 + (FROM/FR) \cdot 2N)$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
-10.0	6.0000E+02	8.5000E+06	.600	3.5000E+05

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL + SH)A + (SL - SH)(1 - \text{SQRT}(1 + A^2)))C/2$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
-10.0	1.500	.800	-.850	3.0000E+02	1.250

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 / 1.8 + T - T0)$$

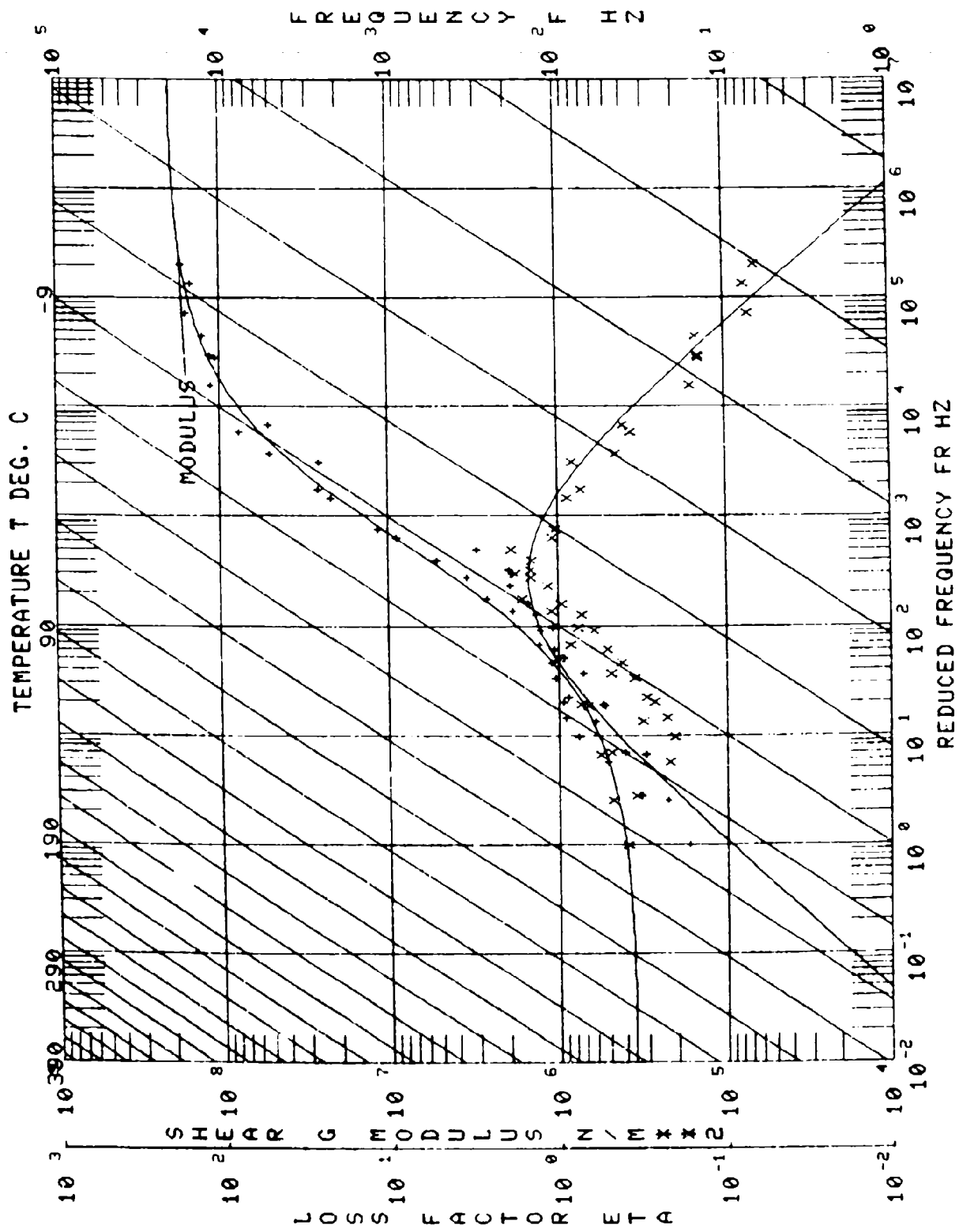
Remarks: _____

°F	f_c	f_n	f_L	f_R	Δf	η_s	
Temp. Mode							
-50	661.13	323.68	659.16	662.82	3.66	0.0055	
-48	1815.33	905.40	1811.21	1820.61	9.40	0.0052	
-48	3434.38	1776.05	3415.58	3450.17	34.59	0.0101	
-47	5528.86	2941.94	5495.36	5559.61	64.25	0.0116	
-25	654.67	322.58	648.71	660.61	11.9	0.0182	
-25	1785.49	902.63	1770.71	1797.80	28.09	0.0157	
-24	335.61	1770.00	3291.29	3374.68	83.39	0.0250	
-24	5359.96	2930.95	5266.16	5436.46	170.30	0.0318	
-2	632.04	321.70	602.32	657.33	55.01	0.0870	
-1	1704.31	899.54	1646.00	1767.99	121.99	0.0716	
-1	3110.53	1764.56	2952.09	3263.57	311.48	0.1001	
12	591.72	320.92	543.70	650.92	107.22	0.1812	
12	1619.13	898.00	1503.10	1750.01	246.91	0.1525	
12	2885.86	1761.54	2496.63	3150.58	653.95	0.2266	
26	528.17	320.37	454.71	628.82	174.11	0.3296	
26	1467.97	896.46	1270.55	1669.75	399.23	0.2720	
37	449.16	319.82	383.4	529.86	146.43	0.3260	
37	1288.32	894.91	1056.48	1553.32	496.84	0.3856	
50	411.075	319.27	362.36	466.79	104.43	0.2540	
51	1130.39	893.06	915.33	1366.13	450.80	0.3988	

°F	Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	ldB
51	4		1924.22	1751.26	1638.91	2152.39	513.48	0.2668	
51	5		3178.65	2897.97	2928.41	3373.44	874.93	0.2752	X
76	2		361.09	317.95	336.59	392.71	56.12	0.1554	
76	3		965.52	889.98	895.86	1038.21	142.35	0.1474	
76	4		1829.92	1744.62	1761.35	1900.65	139.30	0.0761	
76	5		3005.58	2887.98	2884.06	3127.87	243.81	0.0811	
76	6		4484.91	4335.09	4259.61	4646.51	386.90	0.0863	
76	7		6221.91	6075.54	5942.46	6450.56	508.10	0.0817	
101	2		341.88	316.85	328.13	355.55	27.42	0.0803	
100	3		927.94	886.59	897.25	957.05	59.80	0.0644	
99	4		1792.20	1738.57	1762.60	1823.95	61.35	0.0342	
99	5		2954.75	2876.98	2907.18	3022.11	94.93	0.0321	
99	6		4408.84	4320.16	4336.91	4476.18	139.27	0.0316	
99	7		6141.31	6054.69	6049.31	6226.51	177.20	0.0288	
126	2		333.85	315.64	324.80	343.00	18.20	0.0545	
126	3		913.93	883.19	896.65	930.56	33.91	0.0371	
126	4		1774.47	1730.71	1757.37	1791.28	33.91	0.0191	
126	5		2926.79	2863.99	2903.13	2951.06	47.93	0.0164	
126	6		4371.31	4302.25	4336.51	4403.41	66.90	0.0153	
126	7		6093.01	6029.67	6049.41	6132.41	83.00	0.0136	

EXPERIMENTAL CODE :166
 MATERIAL :SOUND COAT M-5
 DATA SOURCES
 MANUFACTURER :NONE
 AFRL :UDRI-GET
 OTHER :NONE

NO.	MODULUS N/MHz	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MHz	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/MHz
1	5.6500E+05	1.7643	24.4	361.1	2.	6.6625E+10	.1554	398.0	4.31847E+05
2	9.4833E+05	1.0269	24.4	965.5	3.	6.6610E+10	.1474	890.0	9.73839E+05
3	1.1141E+06	1.7903	24.4	1829.9	4.	6.6606E+10	.0761	1744.6	8.80449E+05
4	1.5473E+06	.9792	24.4	3005.6	5.	6.6609E+10	.0811	2888.0	1.51510E+06
5	2.0003E+06	1.1941	24.4	4484.3	6.	6.7784E+10	.0863	4335.1	2.38866E+06
6	3.0448E+06	1.5013	24.4	6221.9	7.	6.7992E+10	.0817	6075.5	3.06991E+06
7	3.1805E+06	.5792	38.3	341.4	2.	6.6231E+10	.0803	316.8	1.84217E+05
8	5.4267E+05	.6007	37.8	927.9	3.	6.6142E+10	.0644	886.6	3.74427E+05
9	7.3717E+05	.5034	37.2	1792.2	4.	6.6234E+10	.0342	1738.6	3.71086E+05
10	1.0895E+06	.5231	37.2	2954.7	5.	6.6372E+10	.0321	2877.0	5.69976E+05
11	1.3106E+06	.6341	37.2	4408.8	6.	6.7318E+10	.0316	4320.2	8.31073E+05
12	1.3949E+06	.7472	37.2	6141.3	7.	6.7537E+10	.0288	6054.7	1.04226E+06
13	2.3721E+06	.4971	52.2	333.9	3.	6.5727E+10	.0545	315.6	1.6523E+05
14	4.1469E+05	.4971	52.2	913.9	3.	6.5636E+10	.0371	883.3	2.06161E+05
15	6.1802E+05	.3265	52.2	1774.5	4.	6.5636E+10	.0191	1730.7	2.01769E+05
16	9.1018E+05	.3119	52.2	2926.8	5.	6.5774E+10	.0164	2864.0	3.83927E+05
17	1.0785E+06	.3648	52.2	4371.3	6.	6.5774E+10	.0153	4302.2	3.93416E+05
18	1.1228E+06	.4295	52.2	6093.0	7.	6.6970E+10	.0136	6023.7	4.82250E+05
19	1.7535E+05	.4027	66.7	327.6	3.	6.5174E+10	.0350	314.3	7.06144E+04
20	3.3784E+05	.3554	66.7	903.6	3.	6.5041E+10	.0223	870.2	1.20059E+05
21	5.2855E+05	.2309	65.6	1760.4	4.	6.5137E+10	.0118	1724.1	1.22049E+05
22	7.9131E+05	.2128	65.6	2906.0	5.	6.5364E+10	.0099	2854.0	1.58371E+05
23	9.3464E+05	.2382	65.6	4342.9	6.	6.6232E+10	.0088	4285.8	2.22603E+05
24	1.3292E+06	.2789	65.6	6056.8	7.	6.6461E+10	.0077	6006.7	2.59095E+05
25	1.6491E+06	.8726	10.0	411.1	2.	6.7247E+10	.2540	319.3	1.15992E+06
26	1.9479E+06	1.8558	10.6	1924.2	4.	6.7204E+10	.2668	1751.3	3.61493E+06
27	3.1162E+06	1.9689	10.6	3178.6	5.	6.7345E+10	.2752	2898.0	6.13533E+06
28	3.5534E+06	1.5026	18.3	528.2	3.	6.7716E+10	.3296	320.4	5.33950E+06
29	1.1820E+07	1.0760	-3.3	1468.0	3.	6.7623E+10	.0720	896.5	1.27185E+07
30	2.2693E+07	.8966	-18.9	632.0	2.	6.8250E+10	.0870	321.7	2.03480E+07
31	5.1615E+07	.4580	-18.3	1704.3	3.	6.8038E+10	.0716	1899.5	2.36848E+07
32	5.2548E+07	.4154	-18.3	3110.5	4.	6.8229E+10	.1001	1764.6	2.18303E+07
33	8.1369E+06	1.0981	-11.1	591.7	2.	6.7944E+10	.1812	320.9	1.00331E+07
34	2.6528E+07	.7513	-11.1	1619.1	3.	6.7855E+10	.1525	898.0	1.90309E+07
35	2.6322E+07	.8374	-11.1	2885.9	4.	6.7961E+10	.2266	1761.5	2.20437E+07
36	9.9342E+06	1.1256	2.8	445.2	2.	6.7493E+10	.3260	319.8	2.17728E+06
37	5.7460E+06	1.4739	2.8	1288.7	3.	6.7307E+10	.3855	894.9	7.8935E+06
38	7.8886E+07	.3723	-31.7	654.7	2.	6.8650E+10	.0182	322.6	2.9735E+07
39	1.1653E+08	.1667	-31.7	1785.5	3.	6.8574E+10	.0157	982.6	1.94315E+07
40	1.0886E+08	.1484	-31.1	3335.6	4.	6.8608E+10	.0250	1770.0	1.61557E+07
41	1.3135E+08	.1531	-31.1	5360.0	5.	6.8860E+10	.0318	2931.0	2.01154E+07
42	1.1836E+08	.1474	-45.6	661.1	2.	6.91180E+10	.0055	323.7	1.74334E+07
43	1.6735E+08	.0736	-44.4	1815.8	3.	6.89380E+10	.0052	965.4	1.23102E+07
44	1.5659E+08	.0771	-44.4	3434.4	4.	6.91200E+10	.0101	1776.1	1.26655E+07
45	1.7849E+08	.0671	-43.9	5528.9	5.	6.9403E+10	.0116	2941.9	1.18003E+07
46	2.7221E+06	1.6847	10.6	1130.4	3.	6.71114E+10	.3988	893.1	4.58612E+06



Polymeric Material Characterization Test

Test No. 79-7

Beam Nos. 080-1 and 080-2

Date 11/27/79

Damping Material Soundcoat N

Material Thickness 0.0127 cm Material Density 1.049 g/cc

Beam Thickness 0.2032 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -31.7 °C and 93.3 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.3 Temperature -11.1 °C

1000 Hz η_D 1.3 Temperature 4.4 °C

Range 100 Hz -28.9 °C 8.9 °C

1000 Hz -17.8 °C 26.7 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR) \times N)$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
75.0	1.4000E+06	9.0000E+06	.325	2.0000E+05

$$A = ((\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

T0	ETAFROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
75.0	1.250	.350	-.350	4.3000E+05	2.250

$$\text{LOG}(ETA) = \text{LOG}(ETAFROL) + ((SL + SH)A + (SL - SH)(1 - \text{SQRT}(1 + A^2))) / C / 2$$

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 / 1.8 + T - T0)$$

Remarks:

$^{\circ}\text{F}$	f_c	f_n	f_L	f_R	Δf	η_s	ldB
Temp.	Mode						
-26	2	669.32	322.69	667.53	671.05	3.52	0.0053
-26	3	1841.90	902.63	1835.93	1847.05	11.12	0.0060
-26	4	3532.91	1770.00	3516.34	3550.34	34.00	0.0096
-26	5	5751.01	2925.95	5718.01	5784.46	66.45	0.0115
-4	2	662.83	321.70	659.09	666.16	7.07	0.0107
-4	3	1814.03	900.16	1802.40	1826.00	23.60	0.0130
-4	4	3446.11	1765.17	3408.08	3493.71	85.63	0.0249
-4	5	5599.26	2917.96	5525.26	5668.16	142.90	0.0255
25	2	643.99	320.37	629.52	658.15	28.63	0.0445
25	3	1737.76	896.46	1697.21	1787.89	90.68	0.0522
25	4	3254.06	1757.92	3129.41	3363.74	234.33	0.0720
25	5	5232.06	2905.96	5016.31	5443.16	426.85	0.0816
25	6	7413.71	4367.93	7228.61	7574.76	346.15	0.0467
47	2	572.92	319.27	528.74	640.81	112.07	0.1956
47	3	1564.92	893.68	1414.16	1710.75	296.59	0.1895
47	4	2831.74	1751.87	2445.41	3126.68	681.27	0.2406
47	5	4547.35	2895.97	4232.11	4776.05	1069.39	0.2352
47	6	529.60	318.72	450.69	597.41	146.81	0.2820
61	3	1393.61	864.37	1198.49	1610.81	412.32	0.2959
61	4	2176.47	1749.24	2161.73	2661.77	938.08	0.3970

°F	f_c	f_n	f_L	f_R	Δf	n_s	ldB
Temp. Node							
75 2	456.07	318.01	392.83	533.08	140.25	0.3075	
75 3	1233.98	889.98	1018.34	1439.97	421.63	0.3417	
75 4	2113.19	1744.62	1911.85	2303.83	770.63	0.3647	X
75 5	3470.18	2882.98	3085.99	3748.44	1302.38	0.3753	X
88 2	405.57	317.40	358.92	465.67	106.75	0.2631	
88 3	1067.59	888.44	917.66	1258.91	341.25	0.3196	
88 4	1962.83	1740.99	1699.29	2172.59	473.30	0.2411	
88 5	3199.91	2877.98	3027.25	3375.41	684.48	0.2139	X
101 2	386.81	316.85	346.30	428.09	91.79	0.2373	
101 3	1028.40	886.58	896.93	1155.78	258.85	0.2517	
101 4	1887.89	1737.36	1722.13	2066.13	344.00	0.1822	
101 5	3121.78	2871.99	2816.23	3376.47	560.24	0.1795	
101 6	4589.21	4318.67	4118.44	4910.31	791.87	0.1725	
101 7	6317.56	6052.61	6032.46	6521.31	961.08	0.1521	X
115 2	364.07	316.19	335.01	400.66	65.65	0.1803	
115 3	964.94	884.43	888.22	1048.12	159.90	0.1657	
115 4	1337.71	1733.73	1737.59	1935.55	197.96	0.1077	
114 5	3046.34	2866.99		3184.49	276.30	0.0907	
114 6	4480.31	4308.22	4257.81	4679.41	421.60	0.0939	
114 7	6214.41	6040.10	5891.91	6452.91	561.00	0.0903	

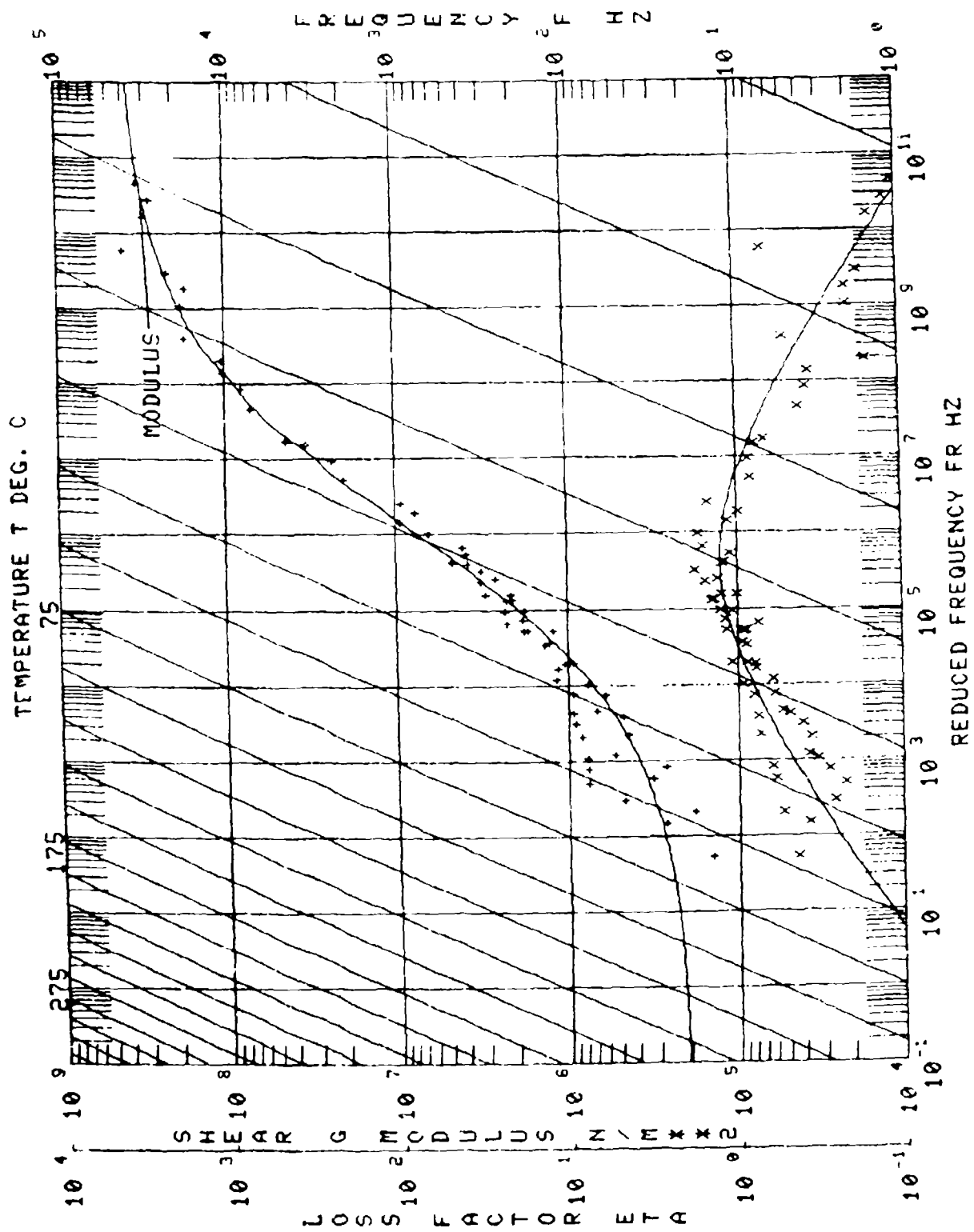
°F f_c f_n f_L f_R Δf η_s 1dB

Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
125	2	354.04	315.64	329.83	382.76	52.93	0.1495	
125	3	945.46	883.19	887.35	1002.92	115.57	0.1222	
124	4	1813.97	1731.32	1741.89	1882.35	140.46	0.0074	
124	5	2968.27	2861.99	2862.85		210.84	0.0710	
123	6	4438.55	4302.25	4282.54	4577.41	294.87	0.0664	
123	7	6160.36	6029.67	5958.36	6338.61	380.25	0.0617	
150	2	336.35	314.42	322.45	350.08	27.63	0.0821	
150	3	914.40	879.80	885.99	842.55	56.56	0.0618	
149	4	1775.24	1724.06	1742.73	1807.29	64.56	0.0364	
149	5	2978.51	2850.00	2873.53	2975.21	101.68	0.0348	
148	6	4357.11	4287.32	4300.07	4427.41	127.34	0.0292	
148	7	6076.86	6008.83	5998.91	6158.56	159.65	0.0263	
175	2	327.77	313.21	319.40	336.39	16.99	0.0518	
175	3	900.36	876.10	884.97	916.34	31.37	0.0384	
174	4	1755.33	1716.81	1738.18	1774.31	36.13	0.0206	
173	5	2899.61	2840.01	2871.11	2926.25	55.14	0.0190	
173	6	4327.11	4269.41	4293.17	4361.44	68.27	0.0158	
173	7	6033.96	5983.81	5992.20	6075.71	83.51	0.0138	
203	2	322.81	311.78	317.35	328.47	11.12	0.0344	
203	3	892.16	872.39	882.96	901.49	18.53	0.0208	

EXPERIMENTAL CODE 1148
 MATERIAL : SOUNDCOAT M-5
 DATA SOURCES
 MANUFACTURER : UDRI-GET
 OTHER : NONE

NO.	MODULUS N/M ²	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/M ²	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/M ²
1	9.44136E+05	.9084	38.3	385.8	3.	6.62318E+10	.2373	315.8	8.57675E+05
2	1.75202E+06	1.1894	38.3	1088.4	3.	6.61410E+10	.2517	885.6	2.08485E+06
3	1.82995E+06	1.2844	38.3	1887.9	4.	6.61422E+10	.1822	1737.4	2.35043E+06
4	3.64541E+06	1.2584	38.3	3121.8	5.	6.61424E+10	.1795	2872.0	3.83246E+06
5	3.27885E+06	1.5757	38.3	4580.2	6.	6.61718E+10	.1725	4318.7	5.16962E+06
6	3.26748E+06	1.8453	38.3	6317.6	7.	6.61804E+10	.1521	6052.6	6.02935E+06
7	4.94086E+05	.7923	51.7	354.0	2.	6.62729E+10	.1495	315.6	3.91444E+05
8	7.83121E+05	.9705	51.7	945.5	3.	6.63632E+10	.1222	883.2	7.60011E+05
9	1.07148E+06	.8200	51.7	1814.0	4.	6.65831E+10	.0774	1731.3	8.78615E+05
10	1.40358E+06	.9177	51.7	2568.3	5.	6.65826E+10	.0710	2852.0	1.28802E+06
11	1.24659E+06	.9716	50.6	4438.5	6.	6.67513E+10	.0654	4302.2	1.79412E+06
12	1.37418E+06	1.2094	50.6	6160.4	7.	6.68701E+10	.0617	6029.7	2.26661E+06
13	6.23517E+05	.8349	46.1	364.1	2.	6.69562E+10	.1803	316.2	5.20582E+05
14	9.95021E+05	1.1073	46.1	964.9	3.	6.68206E+10	.1657	884.4	1.10175E+06
15	1.31683E+06	.9572	46.1	1837.5	4.	6.68661E+10	.1077	1733.7	1.27361E+06
16	2.30052E+06	.7783	45.6	3046.3	5.	6.69123E+10	.0907	2857.0	1.79042E+06
17	2.35849E+06	1.1145	45.6	4489.3	6.	6.69467E+10	.0939	4308.2	2.62857E+06
18	2.34866E+06	1.4496	45.6	6214.4	7.	6.72019E+10	.0903	6040.1	3.40454E+06
19	2.18255E+06	1.0404	23.9	456.1	2.	6.67177E+10	.3475	318.0	2.27074E+06
20	4.89001E+06	1.2054	23.9	124.0	3.	6.66493E+10	.3417	89.0	5.89338E+06
21	4.20147E+06	1.5477	24.4	2113.2	4.	6.68961E+10	.3547	1744.6	6.92255E+06
22	6.71114E+06	1.7610	25.0	3470.2	5.	6.66496E+10	.3753	2883.0	7.14665E+07
23	7.1213E+06	1.0072	8.3	572.9	2.	6.67247E+10	.1956	319.3	7.76772E+06
24	1.93711E+07	.8456	8.3	1564.9	3.	6.72046E+10	.1895	893.7	1.68869E+07
25	2.37124E+07	.8754	8.3	2831.7	4.	6.72515E+10	.2406	1751.9	2.07585E+07
26	3.47193E+07	.8000	8.3	4547.3	5.	6.72515E+10	.2352	2896.0	2.77766E+07
27	1.24246E+06	.9235	31.1	405.6	2.	6.64620E+10	.2631	317.4	1.14736E+06
28	2.15393E+06	1.3987	31.1	1067.6	3.	6.64188E+10	.3196	882.4	3.01281E+06
29	2.66866E+06	1.3281	31.1	1962.8	4.	6.64189E+10	.2411	1741.0	3.54403E+06
30	3.00913E+06	1.2677	31.1	3193.9	5.	6.64189E+10	.2130	2878.0	4.07564E+06
31	4.02424E+06	1.1267	16.1	520.6	2.	6.60159E+10	.2820	318.7	1.55130E+06
32	9.68241E+06	1.1532	16.1	1393.6	3.	6.62867E+10	.3370	864.4	1.13021E+07
33	2.47336E+06	1.673	65.6	2476.5	4.	6.59733E+10	.2959	1748.2	1.45433E+07
34	2.81295E+05	.6433	65.6	335.3	2.	6.52198E+10	.0821	314.4	1.80954E+05
35	7.00396E+05	.7591	65.6	914.4	3.	6.51333E+10	.0618	870.8	3.45558E+05
36	9.67108E+05	.5525	65.0	1775.2	4.	6.51334E+10	.0364	1724.1	3.80946E+05
37	1.19498E+06	.6210	65.0	2918.5	5.	6.51334E+10	.0348	2850.0	6.00593E+05
38	1.15652E+06	.6291	64.4	4367.1	6.	6.62987E+10	.0292	4287.3	7.51713E+05
39	1.6652E+06	.7060	64.4	6076.9	7.	6.65084E+10	.0263	6008.8	9.28520E+05
40	1.89843E+05	.5542	79.4	327.8	2.	6.47185E+10	.0518	313.2	1.05210E+05
41	3.33383E+05	.6156	79.4	900.1	3.	6.45865E+10	.0384	876.1	2.05245E+05
42	5.0404E+05	.3855	78.9	1755.3	4.	6.45865E+10	.0296	1716.8	3.12190E+05
43	8.63177E+05	.3736	78.3	2899.6	5.	6.46776E+10	.0190	2840.0	3.22479E+05
44	9.5838E+05	.4240	78.3	4327.1	6.	6.51459E+10	.0158	4269.4	3.90860E+05
45	9.58303E+05	.4900	78.3	6034.0	7.	6.59552E+10	.0138	5983.8	4.78663E+05
46	1.69665E+05	.4547	95.0	322.8	2.	6.41203E+10	.0344	311.8	6.62505E+04
47	2.80781E+05	.3864	95.0	892.5	3.	6.40407E+10	.0200	872.4	1.08487E+05
48	4.83763E+05	.2675	94.4	1742.5	4.	6.40417E+10	.0128	1709.6	1.20424E+05
49	7.87225E+05	.2311	94.4	2879.4	5.	6.40420E+10	.0109	2825.0	1.81965E+05

50	7.94040E+05	2892	93.9	4297.2	6.	6.51982E+10	.0093	4251.5	2.29605E+05
51	7.92995E+05	3460	93.9	5997.4	7.	6.54505E+10	.0081	5960.9	2.76808E+05
52	7.92995E+05	6039	-3.9	644.0	8.	6.77116E+10	.0445	320.4	3.06814E+07
53	7.13843E+07	4202	-3.9	1737.8	3.	6.76234E+10	.0522	896.5	2.99930E+07
54	8.11614E+07	3838	-3.9	3854.1	4.	6.77169E+10	.0720	1757.9	3.10851E+07
55	1.04420E+08	3696	-3.9	5232.1	5.	6.77163E+10	.0816	2906.0	3.85944E+07
56	1.07232E+08	1646	-3.9	7413.7	6.	6.88152E+10	.0467	4367.9	1.76542E+07
57	1.76116E+08	5187	-20.9	662.8	2.	6.82750E+10	.0107	321.7	9.08392E+07
58	1.84506E+08	2181	-20.9	1814.0	3.	6.81827E+10	.0130	900.2	3.87750E+07
59	1.70640E+08	2116	-19.4	3441.1	4.	6.82765E+10	.0249	1765.2	3.60887E+07
60	2.23744E+08	1794	-19.4	5699.3	5.	6.82767E+10	.0255	2018.0	4.01370E+07
61	4.15185E+08	6884	-32.2	669.3	2.	6.89558E+10	.0053	322.7	2.85818E+08
62	3.12055E+08	1534	-32.2	1841.9	3.	6.85574E+10	.0060	902.6	4.78752E+07
63	2.84639E+08	1216	-31.7	3632.9	4.	6.85508E+10	.0096	1770.0	3.46198E+07
64	3.37114E+08	1096	-31.7	5751.0	5.	6.89512E+10	.0115	2026.0	3.69612E+07



Polymeric Material Characterization Test

Test No. 79-1

Beam Nos. 060C and 060D

Date 5/79

Damping Material Soundcoat R

Material Thickness 0.0254 cm. Material Density 0.950 g/cc

Beam Thickness 0.1524 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -59.4 °C and 65.6 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 2.4 Temperature -12.2 °C

1000 Hz η_D 2.4 Temperature 10.0 °C

Range 100 Hz -23.3 °C -1.1 °C

1000 Hz -3.9 °C 21.1 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR)^{1.5})$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
15.0	3.6568E+03	7.7910E+06	.621	1.2588E+05

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\eta_D) = \text{LOG}(\eta_{DAFROL}) + ((SL + SH)A + (SL - SH)(1 - \text{SQRT}(1 + A^2))) / C / 2$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
15.0	2.298	.429	-.507	1.7768E+03	.253

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 + 1.8(T - T0))$$

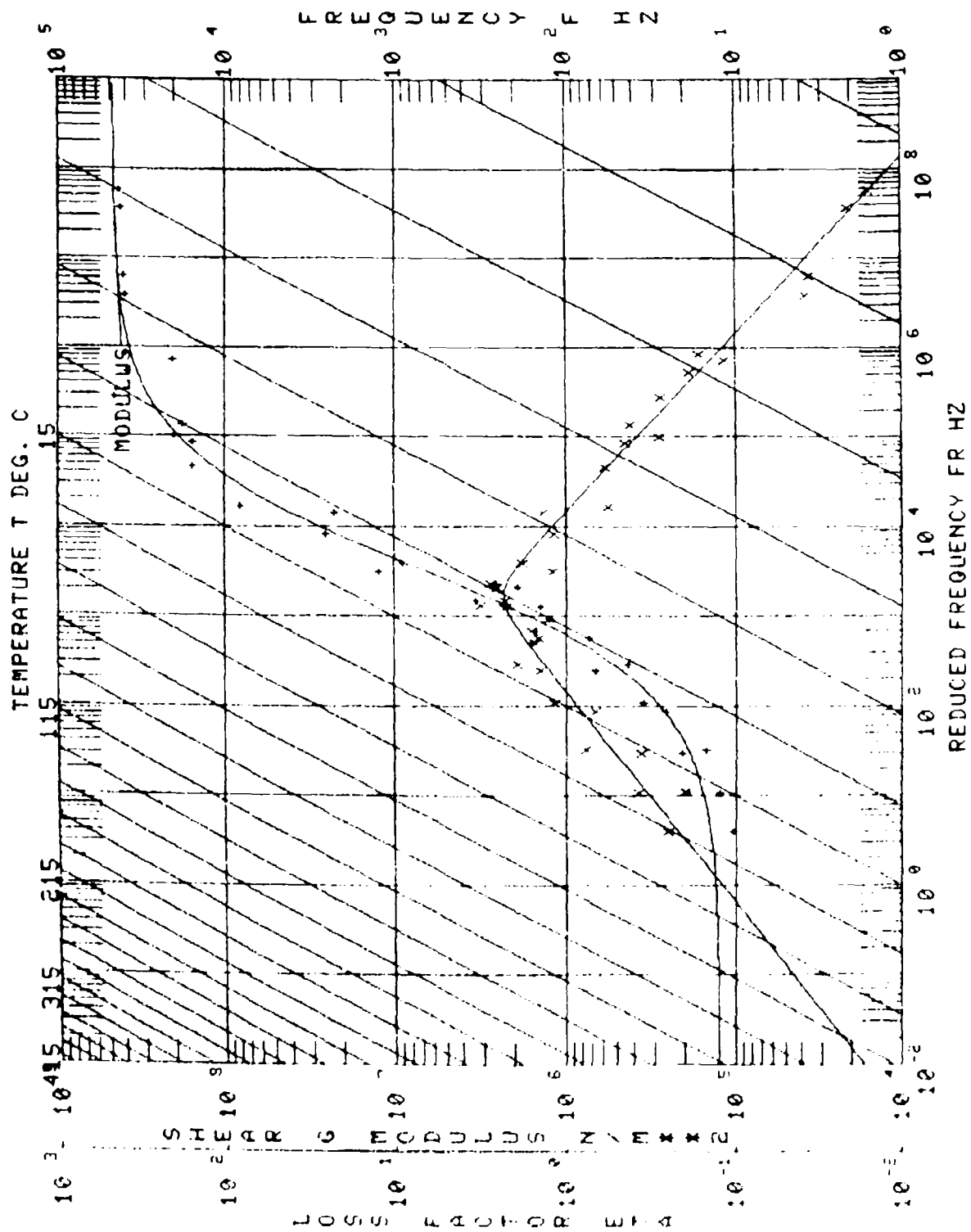
Remarks: _____

ϕ	f_c	f_r	f_L	f_R	Δf	η_s	ldb
0	544.30	248.54	544.60	546.40	1.80	0.0033	
1	1464.60	691.62	1505.10	1506.00	0.90	.0006	
2	2877.50	1353.49	2875.30	2880.50	5.20	0.0018	
3	4652.00	2241.43	4647.90	4657.50	9.60	0.0020	
4	542.10	247.77	540.00	542.30	2.30	0.0042	
5	1499.80	689.15	1498.70	1500.90	2.20	0.0015	
6	2860.40	1348.66	2855.20	2864.90	9.70	0.0034	
7	4616.70	2234.43	4605.60	4627.90	22.30	0.0048	
8	539.70	246.89	537.00	542.20	5.20	0.0096	
9	1496.10	686.38	1487.60	1504.10	16.50	0.0110	
10	2850.10	1343.83	2825.10	2873.60	48.50	0.0170	
11	4596.20	2226.44	4545.90	4648.30	102.40	0.0223	
12	528.70	246.00	519.10	538.10	19.00	0.0359	
13	1440.90	683.60	1413.70	1487.30	73.60	0.0508	
14	2702.70	1337.78	2605.30	2805.00	199.70	0.0739	
15	4312.50	2217.45	4091.90	4480.60	388.70	0.0901	
16	478.00	244.91	431.40	531.80	100.40	0.2100	
17	1272.90	683.60	1102.50	1426.40	323.90	0.2544	
18	2176.00	120	1936.80	2360.70	833.39	0.3830	X
19	421.00	4.25	335.80	525.30	189.50	0.4601	

Temp.	Mode	f_C	f_L	f_L	f_R	Δf	η_S	ldB
35	3	1085.00	679.59	849.20	1335.50	486.30	0.4482	
50	2	320.60	244.03	268.90	405.80	136.90	0.4270	
50	3	843.40	678.36	587.60	1082.90	495.30	0.5873	
50	4	1475.80	1327.50	1323.10	1630.10	606.71	0.4111	x
60	2	5.30	243.48	245.00	323.30	78.30	0.2844	
60	3	5.30	677.12	636.00	848.20	212.20	0.2824	
60	4	1390.10	1325.86	1207.80	1516.90	309.10	0.2224	
60	5	2277.60	2194.46	1982.60	2468.20	485.60	0.2132	
75	2	258.30	243.14	240.70	279.70	39.00	0.1510	
75	3	690.80	676.20	654.70	740.80	86.10	0.1246	
75	4	1344.80	1323.27	1290.20	1401.50	111.30	0.0828	
75	5	2226.7	2189.47	2136.70	2300.40	163.70	0.0735	
100	2	246.80	242.15	240.10	252.30	12.20	0.0494	
100	3	678.30	673.73	670.10	688.90	18.80	0.0277	
100	4	1324.00	1319.04	1310.20	1338.60	27.80	0.0210	
100	5	2192.60	2182.47	2173.30	2215.20	41.90	0.0191	
125	2	244.50	241.57	242.00	247.00	5.00	0.0204	
125	3	673.50	671.57	669.40	7.70	8.30	0.0123	
125	4	1316.50	1314.20	1311.00	21.70	10.70	0.0081	
125	5	2179.50	2175.48	2171.20	2187.50	16.30	0.0075	

EXPERIMENTAL CODE : 56
 MATERIAL : SOUND/COMAT
 DATA SOURCES
 NAME/AF/URER : NONE
 AFPL : UDRI-GET
 OTHER : NONE

NO.	MODULUS N/MRZ2	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MRZ2	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/MRZ2
1	2.8331E+08	.1282	-59.4	545.3	3.	7.2452E+10	.0033	248.5	3.6949E+07
2	4.9782E+08	.0147	-59.4	1505.6	3.	7.1562E+10	.0006	501.6	7.2389E+06
3	4.4217E+08	.0215	-59.4	2877.5	4.	7.1353E+10	.0018	153.5	9.5658E+06
4	4.1128E+08	.0162	-59.4	4653.0	5.	7.1621E+10	.0020	2241.4	2.5156E+07
5	2.8893E+08	.1284	-45.6	541.1	3.	7.2008E+10	.0042	247.8	2.1762E+07
6	4.1765E+08	.0362	-45.6	1499.8	3.	7.1045E+10	.0015	689.2	1.7625E+07
7	4.1489E+08	.0387	-45.6	2864.4	4.	7.0856E+10	.0034	1318.7	1.6957E+07
8	4.2524E+08	.0356	-45.6	4616.7	5.	7.1174E+10	.0048	2234.4	1.5567E+07
9	2.6595E+08	.2911	-31.7	539.7	2.	7.1489E+10	.0096	246.9	5.9990E+07
10	4.8516E+08	.2856	-31.7	1496.1	3.	7.0478E+10	.0110	686.4	1.3904E+08
11	3.9688E+08	.1941	-31.7	2854.1	4.	7.0301E+10	.0170	1343.8	7.7456E+07
12	4.6755E+08	.1690	-31.7	4596.2	5.	7.0655E+10	.0233	2226.4	6.8602E+07
13	8.3345E+07	.5698	-17.8	528.7	2.	7.0952E+10	.0358	226.0	4.7937E+07
14	1.6082E+08	.4527	-17.8	1449.9	3.	6.9906E+10	.0508	683.6	9.5792E+07
15	1.6021E+08	.4301	-17.8	2792.7	4.	6.9718E+10	.0739	1337.8	7.4132E+07
16	1.8428E+08	.4301	-17.8	4312.5	5.	7.0063E+10	.0901	2217.5	7.9572E+07
17	1.2688E+07	1.2324	-3.9	478.0	2.	7.0377E+10	.2100	244.0	1.5650E+07
18	2.5937E+07	1.2053	-3.9	1272.9	3.	6.9906E+10	.2544	683.6	3.1277E+07
19	2.2776E+07	1.1913	-3.9	2176.0	4.	7.1429E+10	.3830	1354.1	3.1689E+07
20	3.1939E+06	2.3437	1.7	411.0	2.	6.9698E+10	.4601	244.2	8.0137E+06
21	1.5435E+06	1.8259	10.0	1085.0	3.	6.9830E+10	.4482	679.6	1.6820E+07
22	1.6269E+06	1.5557	10.0	329.6	2.	6.8838E+10	.4270	244.0	2.5396E+06
23	2.3624E+06	3.2081	10.0	843.4	3.	6.8650E+10	.5873	678.4	7.5701E+06
24	2.6073E+06	2.8370	10.0	1475.8	4.	6.8507E+10	.4111	1357.5	7.3212E+06
25	8.4937E+05	1.4508	15.6	275.3	2.	6.9528E+10	.2844	243.5	9.9840E+05
26	1.5640E+06	2.2705	15.6	751.3	3.	6.8573E+10	.2824	677.1	2.5727E+06
27	1.4687E+06	2.2705	15.6	1390.1	4.	6.8491E+10	.2224	1325.0	3.1662E+06
28	1.9721E+06	2.5896	15.6	2277.6	5.	6.8651E+10	.2132	2194.5	5.1071E+06
29	3.6337E+05	1.1948	23.9	258.3	2.	6.9334E+10	.1510	670.2	8.7630E+05
30	4.4231E+05	1.0812	23.9	690.8	3.	6.8491E+10	.1246	1323.3	1.1206E+06
31	1.5441E+05	1.4855	23.9	1344.8	4.	6.8239E+10	.0828	219.5	1.6512E+05
32	1.2004E+05	1.2706	23.9	2225.7	5.	6.8385E+10	.0735	219.5	1.6512E+05
33	1.5589E+05	.7953	37.8	246.8	2.	6.8771E+10	.0494	673.7	1.8516E+05
34	2.6715E+05	.6931	37.8	678.3	3.	6.7902E+10	.0277	1319.0	2.7209E+05
35	4.4530E+05	.6100	37.8	1324.8	4.	6.7778E+10	.0210	2182.5	4.1094E+05
36	7.7571E+05	.5207	37.8	2192.6	5.	6.7902E+10	.0191	2182.5	4.1094E+05
37	1.2784E+05	.3987	51.7	244.5	2.	6.8272E+10	.0204	671.6	8.0740E+04
38	2.1512E+05	.3753	51.7	673.5	3.	6.7467E+10	.0123	1314.2	1.8355E+05
39	3.0104E+05	.2642	51.7	1316.5	4.	6.7282E+10	.0081	2175.5	1.5893E+05
40	6.5392E+05	.2431	51.7	2179.5	5.	6.7468E+10	.0115	246.4	2.7893E+04
41	1.0705E+05	.2578	65.6	242.6	2.	6.7750E+10	.0061	669.1	3.9583E+04
42	1.9532E+05	.2031	65.6	670.1	3.	6.6972E+10	.0042	1310.6	5.3061E+04
43	3.3633E+05	.1578	65.6	1310.1	4.	6.6911E+10	.0041	2168.5	8.6047E+04
44	6.9982E+05	.1436	65.6	2169.9	5.	6.7035E+10			



Polymeric Material Characterization Test

Test No. 7-11

Beam Nos. 050A and 050B

Date 1/26/77

Damping Material Soundcoat Diad 601

Material Thickness 0.0381 cm Material Density 0.965 g/cc

Beam Thickness 0.127 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -3.9 °C and 65.6 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.01 Temperature 10.0 °C

1000 Hz η_D 1.01 Temperature 29.4 °C

Range 100 Hz -9.4 °C 32.2 °C

1000 Hz 29.4 °C 57.2 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR)^{1/2})$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
40.0	7.3251E+03	1.6863E+07	.400	2.9765E+05

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\eta_D) = \text{LOG}(\eta_D FROL) + ((SL + SH)A + (SL - SH)(1 - \text{SQRT}(1 + A^2)))C/2$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
40.0	1.010	.700	-.700	2.0000E+03	2.500

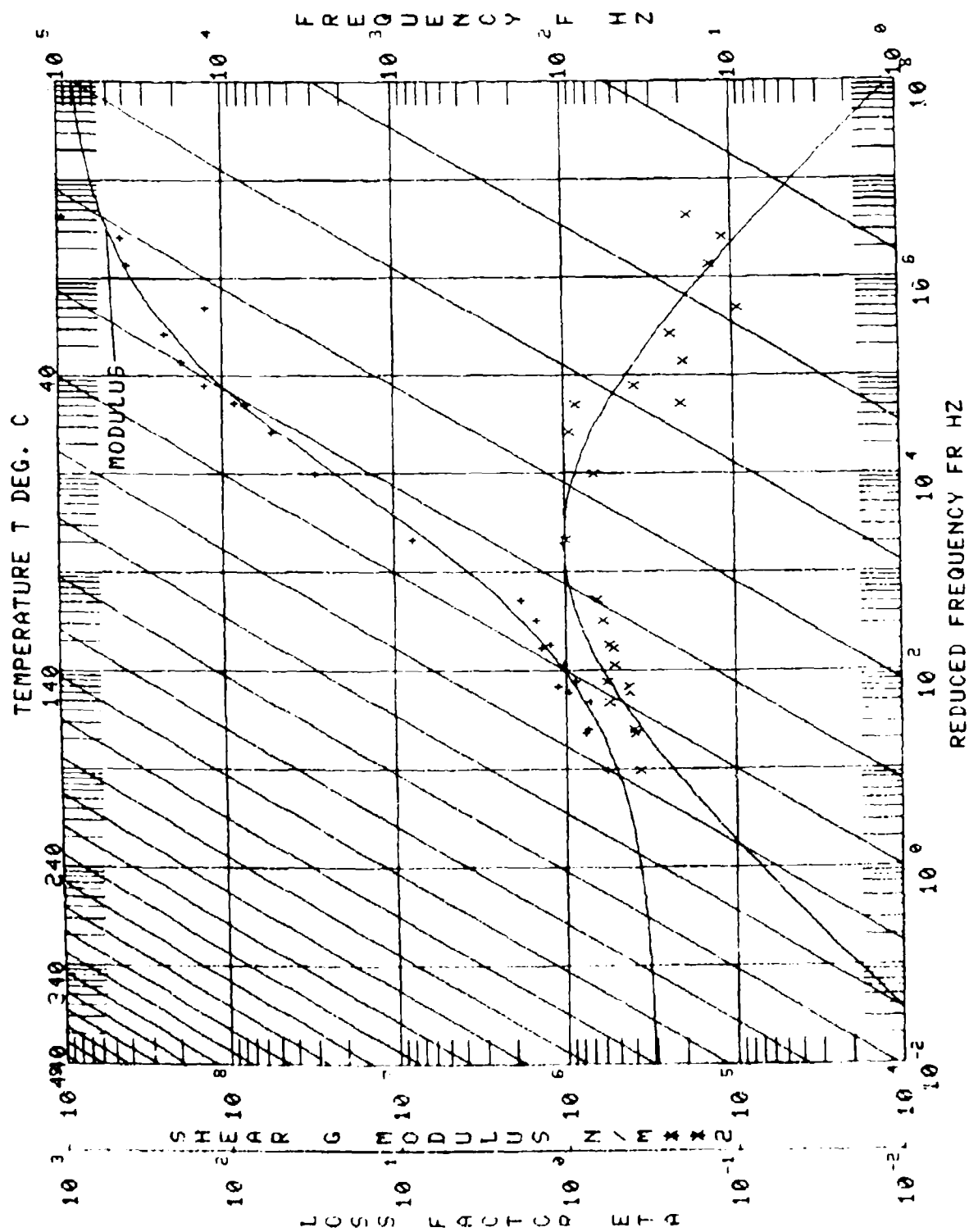
$$\text{LOG}(FR) = \text{LOG}(F) - 12(Y - T0) / (525 + 1.8 \cdot Y - T0)$$

Remarks: _____

°F	f_C	f_n	f_L	f_R	Δf	η_s	ldB
Temp.	Mode						
-2	2	468.0	201.8	467.0	470.0	3.0	0.0064
-2	3	1294.0	555.9	1289.0	1300.0	11.0	0.0085
-2	4	2479.0	1090.0	2463.0	2492.0	29.0	0.0117
-2	5	4118.0	1784.0	4081.0	4139.0	58.0	0.0141
27	2	461.0	201.7	456.0	465.0	9.0	0.0195
27	3	1254.0	555.6	1239.0	1268.0	29.0	0.0231
27	4	2392.0	1090.0	2349.0	2440.0	91.0	0.0381
50	2	437.0	201.6	416.0	465.0	49.0	0.1128
50	3	1171.0	555.3	1094.0	1299.0	205.0	0.1778
50	4	2188.0	1089.0	1993.0	2441.0	448.0	0.2092
50	5	3468.0	1782.0	3056.0		824.0	0.1196
72	2	368.0	201.2	315.0		106.0	0.3008
128	2	236.0	199.4	222.0	252.0	30.0	0.1282
128	3	594.0	549.4	568.0	625.0	57.0	0.0964
135	4	1115.0	1077.0	1080.0	1156.0	76.0	0.0683
128	5	1800.0	1763.0	1749.0	1854.0	105.0	0.0584
130	2	224.0	198.8	215.0	236.0	21.0	0.0942
130	3	575.0	547.6	560.0	592.0	33.0	0.0575
130	4	1092.0	1074.0	1068.0	1114.0	46.0	0.0422
130	5	1768.0	1757.0	1736.0	1797.0	61.0	0.0345

EXPERIMENTAL CODE :169
 MATERIAL :SOUNDCOAT 601
 DATA SOURCES
 MANUFACTURER :NONE
 AFML :UDRZ
 OTHER :NONE

NO.	MODULUS N/M112	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/M112	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/M112
1	1.30004E+08	.0957	-18.9	468.0	2.	5.87568E+10	.0064	201.8	1.24431E+07
2	3.92124E+08	.1415	-18.9	1294.0	3.	6.65684E+10	.0085	555.9	5.54798E+07
3	4.30640E+08	.1158	-18.9	2479.0	4.	6.66687E+10	.0117	1090.0	4.58575E+07
4	9.59471E+08	.1877	-18.9	4118.0	5.	6.53347E+10	.0141	1784.0	1.80134E+08
5	8.72072E+07	.2113	-2.8	461.0	2.	6.87086E+10	.0195	201.7	1.84238E+07
6	1.85887E+08	.2035	-2.8	1254.0	3.	6.64956E+10	.0231	555.6	3.78277E+07
7	2.38582E+08	.2420	-2.8	2392.0	4.	6.66487E+10	.0381	1090.0	5.77504E+07
8	3.02574E+07	.6840	10.0	437.0	2.	6.64248E+10	.1128	201.6	2.06958E+07
9	5.28175E+07	.5524	10.0	1171.0	3.	6.64248E+10	.1778	555.3	5.03031E+07
10	5.67673E+07	.8779	10.0	2188.0	4.	6.65655E+10	.2092	1089.0	6.73955E+07
11	1.30661E+08	.4028	10.0	3468.0	5.	6.51833E+10	.1196	1782.0	5.26275E+07
12	8.01902E+06	1.0716	22.2	368.0	2.	6.83584E+10	.3008	201.2	8.11280E+06
13	1.14577E+06	.4473	53.3	236.0	3.	6.71506E+10	.1282	199.4	5.12505E+05
14	1.43774E+06	.5475	53.3	594.0	4.	6.50084E+10	.0964	549.4	7.87115E+05
15	1.53842E+06	.6254	53.3	1115.0	5.	6.50084E+10	.0683	1077.0	9.62053E+05
16	1.87908E+06	.6877	53.3	1800.0	2.	6.38556E+10	.0584	1763.0	1.28088E+06
17	1.99313E+05	.4355	65.6	224.0	3.	6.67471E+10	.0942	198.8	3.20082E+05
18	1.04671E+06	.5332	65.6	575.0	4.	6.45954E+10	.0575	547.6	4.27693E+05
19	1.25733E+06	.5361	65.6	1092.0	5.	6.47044E+10	.0422	1074.0	5.61120E+05
20	1.25733E+06	.5734	65.6	1768.0	2.	6.33120E+10	.0345	1757.0	7.20968E+05
21	5.95365E+05	.3832	76.7	217.0	3.	6.65458E+10	.0739	198.5	2.28119E+05
22	1.56307E+05	.4145	76.7	565.0	4.	6.43833E+10	.0443	546.7	3.13521E+05
23	1.56307E+05	.5079	76.7	1077.0	5.	6.44677E+10	.0325	1072.0	4.16061E+05
24	3.04591E+05	.5910	76.7	1750.0	2.	6.31556E+10	.0263	1754.0	5.34633E+05



Polymeric Material Characterization Test

Test No. 77-18

Beam Nos. Not and Recorded

Date 2/10/77

Damping Material Soundcoat Diad 606

Material Thickness 0.0381 cm Material Density 0.965 g/cc

Beam Thickness 0.1778 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between 10.0 °C and 93.3 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.01 Temperature 38.7 °C

1000 Hz η_D 1.01 Temperature 57.2 °C

Range 100 Hz 15.6 °C 68.3 °C

1000 Hz 29.4 °C 93.9 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR) \times N)$$

T0	FROM	MROM	N	ML
A1	A2	A3	A4	
80.0	2.2000E+04	2.0000E+07	.350	3.5000E+05

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETAFROL}) + ((SL + SH)A + (SL - SH)(1 - \text{SQRT}(1 + A^2))) / C2$$

T0	ETAFROL	SL	SH	FROL	C
B1	B2	B3	B4	B5	
20.0	1.010	.400	-.600	3.0000E+04	2.500

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 / 1.8 + T - T0)$$

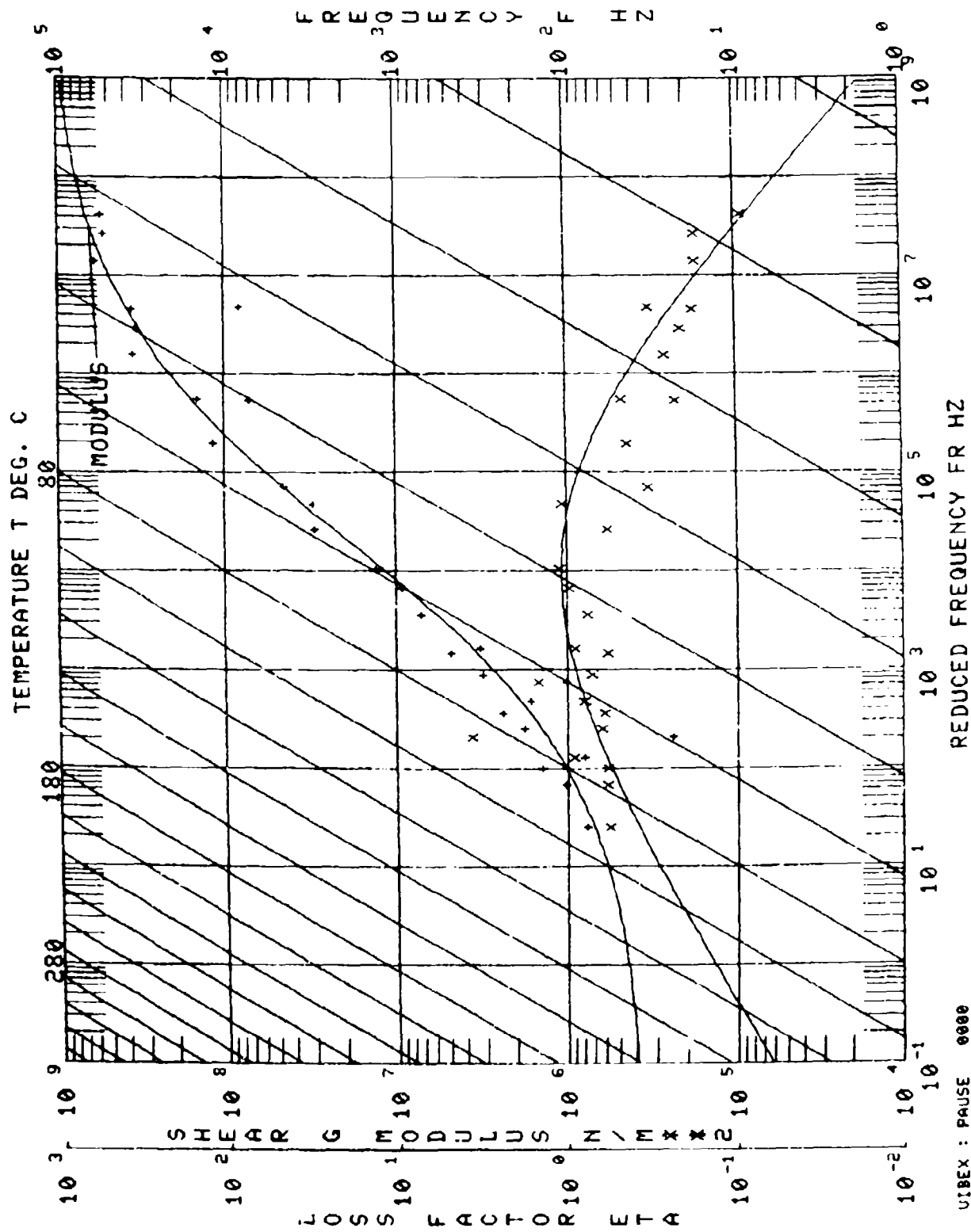
Remarks: _____

Test No. 77-18
Beam No. Not Recorded

Temp.	Note	f_c	f_n	f_L	f_R	Δf	η_s	ldB
47	2	614.0	287.6	600.0	625.0	25.0	0.0408	
47	3	1761.0	792.2	1752.0	1769.0	17.0	0.0097	
47	4	3346.0	1554.0	3312.0	3377.0	65.0	0.0194	
47	5	5311.0	2542.0	5273.0	5351.0	78.0	0.0147	
47	2	605.0	286.7	595.0	615.0	20.0	0.0331	
47	3	1728.0	789.7	1712.0	1750.0	38.0	0.0220	
47	4	3248.0	1549.0	3197.0	3304.0	107.0	0.0330	
47	5	5106.0	2534.0	5005.0	5201.0	196.0	0.0384	
93	2	584.0	286.0	566.0	603.0	37.0	0.0635	
93	3	1610.0	787.9	1543.0	1675.0	132.0	0.0823	
93	5	4576.0	2528.0	4285.0	4958.0	673.0	0.1487	
124	2	524.0	285.4	457.0	600.0	43.0	0.2837	
124	3	1323.0	786.1	1191.0		264.0	0.2036	
124	4	2346.0	1542.0	1950.0		792.0	0.3587	
132	2	404.0	284.5	361.0		8.6	0.2179	
132	3	995.0	783.6	876.0		238.0	0.2463	
132	4	1830.0	1537.0	1597.0		466.0	0.2633	
133	2	352.0	283.6	324.0	391.0	67.0	0.1939	
133	3	877.0	781.1	816.0	952.0	136.0	0.1570	
133	4	1626.0	1532.0	1539.0	1740.0	201.0	0.1246	

EXPERIMENTAL CODE :170
 MATERIAL :SOUND COAT 606
 DATA SOURCES
 MANUFACTURER :NONE
 APPL :UDRI
 OTHER :NONE

NC.	MODULUS N/M ²	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/M ²	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/M ²
1	3.24385E+07	.3335	8.3	614.0	2.	7.12722E+10	.0408	287.6	2.74907E+07
2	1.1666E+08	.1789	8.3	1761.0	3.	6.89745E+10	.0097	792.2	1.09406E+08
3	5.30697E+08	.1765	8.3	3346.0	4.	6.91176E+10	.0194	154.0	5.33952E+07
4	5.66448E+08	.0933	8.3	5311.0	5.	6.76782E+10	.0147	2542.0	5.28239E+07
5	1.9519E+07	.2340	22.2	605.0	2.	7.08279E+10	.0331	286.7	1.68365E+07
6	1.69053E+08	.2681	22.2	1728.0	3.	6.85398E+10	.0220	789.7	9.82274E+07
7	3.53314E+08	.2181	22.2	3248.0	4.	6.86729E+10	.0330	1549.0	7.70728E+07
8	3.72122E+08	.1850	22.2	5106.0	5.	6.72529E+10	.0384	2534.0	6.88412E+07
9	4.63956E+07	.3355	36.7	584.0	2.	7.04815E+10	.0635	286.0	1.57492E+07
10	1.19594E+08	.4488	36.7	1610.0	3.	6.82278E+10	.0823	787.9	5.38049E+07
11	1.51339E+08	.4857	51.1	524.0	2.	7.01861E+10	.1487	2228.0	7.35321E+07
12	1.34970E+07	1.1464	51.1	1323.0	3.	6.69348E+10	.2837	285.4	1.54730E+07
13	3.06227E+07	.5933	51.1	2346.0	4.	6.79164E+10	.2036	786.1	1.81699E+07
14	5.11633E+07	1.6907	66.7	404.0	2.	6.80537E+10	.3587	1542.0	3.39891E+07
15	4.99163E+06	.5879	66.7	995.0	3.	6.97442E+10	.2179	284.5	2.93455E+06
16	1.36738E+06	.1740	66.7	1830.0	4.	6.74851E+10	.2463	783.6	5.70683E+06
17	5.48734E+06	1.0019	79.4	352.0	2.	6.76138E+10	.2633	1537.0	9.50558E+06
18	4.3369E+06	.6255	79.4	877.0	3.	6.93036E+10	.1939	283.6	1.52193E+06
19	1.9293E+06	.7423	79.4	1626.0	4.	6.70551E+10	.1570	781.1	2.36976E+06
20	3.33600E+06	.9265	92.8	325.0	2.	8.71732E+10	.1246	1532.0	3.09096E+06
21	1.46732E+06	.5873	92.8	829.0	3.	6.86211E+10	.1430	282.2	8.58274E+05
22	1.82539E+06	.6411	92.8	1561.0	4.	6.54214E+10	.0921	777.4	1.17046E+06
23	1.0002E+06	.8225	92.8	2490.0	5.	6.55615E+10	.0635	1525.0	1.39896E+06
24	1.03111E+06	1.5212	108.3	303.0	2.	6.51982E+10	.0474	2495.0	1.56848E+06
25	1.94217E+05	.5849	108.3	797.0	3.	6.76519E+10	.0962	280.2	4.64543E+05
26	1.05055E+06	.5977	108.3	1518.0	4.	6.54849E+10	.0553	771.9	6.23876E+05
27	5.19822E+05	.9366	108.3	303.0	5.	6.56046E+10	.0376	1514.0	7.57811E+05
28	2.44063E+05	3.7523	108.3	2442.0	5.	6.42614E+10	.0291	2477.0	9.15797E+05



Polymeric Material Characterization Test

Test No. 77-20

Beam Nos. 070D and 070E

Date 2/17/77

Damping Material Soundcoat Diad 609

Material Thickness 0.0406 cm Material Density 0.965 g/cc

Beam Thickness 0.1778 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between 19.4 °C and 121.5 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 0.610 Temperature 37.8 °C

1000 Hz η_D 0.610 Temperature 60.0 °C

Range 100 Hz 10.0 °C 73.9 °C

1000 Hz 29.4 °C 101.7 °C

$LOG(M) = LOG(NL) + (2LOG(MROM/NL)) / (1 + (FROM/FR) * N)$
 $T0 \quad FROM \quad MROM \quad N \quad NL$
 $A1 \quad A2 \quad A3 \quad A4$
70.0 2.0000E+04 5.0000E+07 .300 8.5000E+05
 $A = (LOG(FR) - LOG(FROL)) / C$
 $LOG(ETA) = LOG(ETAFROL) + ((SL+SH)A + (SL-SH)(1-SORT(1+A**2)))C/2$
 $T0 \quad ETAFROL \quad SL \quad SH \quad FROL \quad C$
 $B1 \quad B2 \quad B3 \quad B4 \quad B5$
70.0 .610 .400 -.400 2.2500E+03 2.500
 $LOG(FR) = LOG(F) - 12(T-T0) / (525/1.8 + T - T0)$

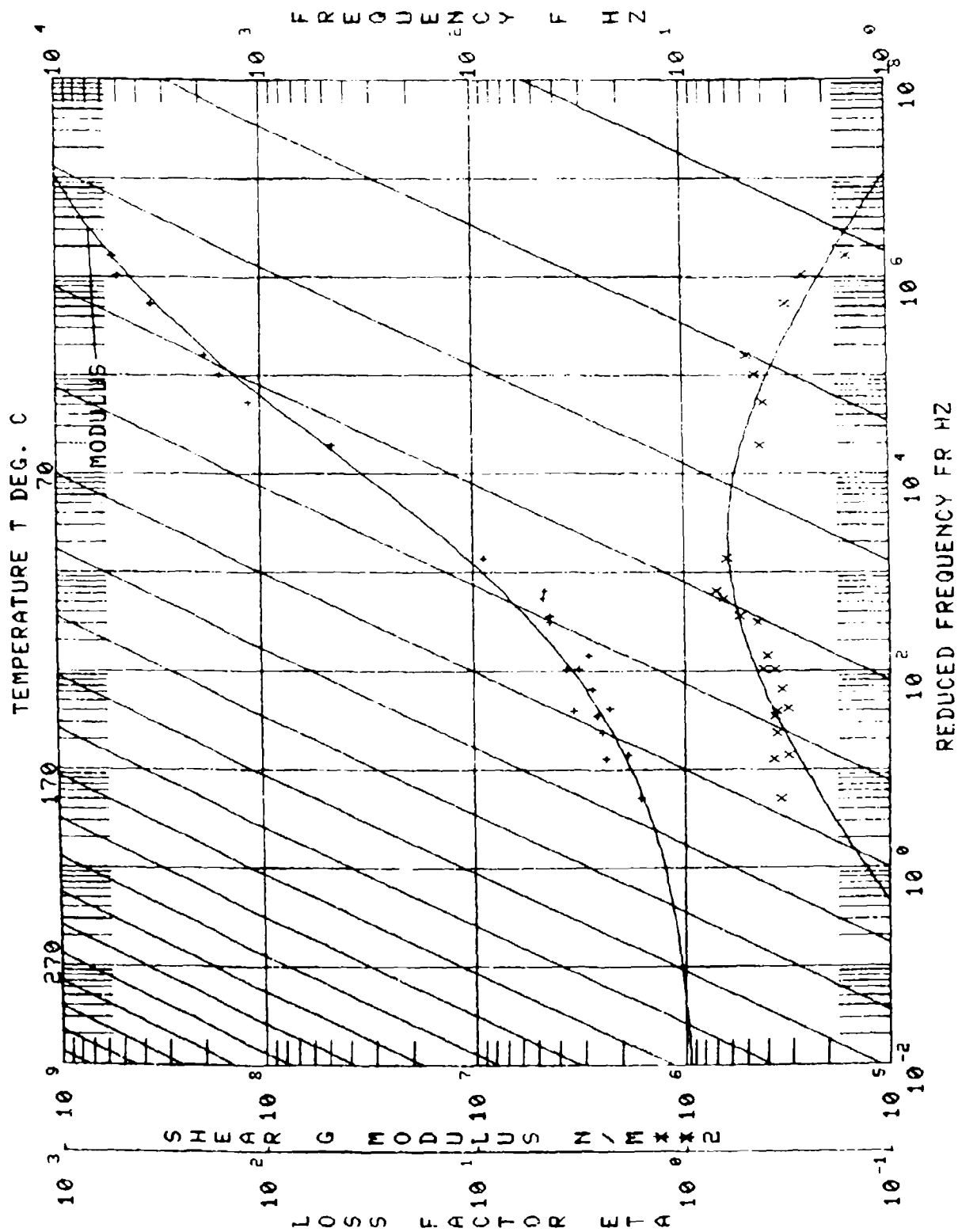
Remarks:

°S f_c f_n f_L f_R Δf η_s ldB

Temp. Mode								
67	2	643.0	279.3	631.0	657.0	26.0	0.6405	
67	3	1695.0	769.4	1669.0	1715.0	46.0	0.0271	
67	4	3271.0	1509.0	3224.0	3321.0	97.0	0.0297	
67	5	5186.0	2469.0	5119.0	5253.0	134.0	0.0258	
68	2	576.0	278.2	556.0	600.0	44.0	0.0766	
68	3	1568.0	766.3	1505.0		126.0	0.0896	
68	4	2363.0	1593.0	2766.0	3086.0	320.0	0.1086	
68	5	4653.0	2459.0	4345.0	4983.0	638.0	0.1384	
127	2	496.0	276.9		583.0	87.0	0.3746	
127	3	1300.0	762.6	1217.0		183.0	0.2924	
127	4	2367.0	1496.0	1989.0		378.0	0.3370	
151	2	391.0	276.0	357.0	443.0	92.0	0.2421	
151	3	1001.0	760.1	894.0		107.0	0.2188	
175	2	351.0	274.8	331.0	279.0	48.0	0.1380	
175	3	886.0	757.1	831.0	958.0	127.0	0.1448	
175	4	1620.0	1485.0		1721.0	202.0	0.1257	
200	2	337.0	274.0	321.0	355.0	34.0	0.1014	
200	3	849.0	764.6	814.0	894.0	80.0	0.0946	
227	5	2536.0	2122.0	2462.0	2592.0	134.0	0.0529	
227	2	326.0	272.8	312.0	342.0	30.0	0.0724	

EXPERIMENTAL CODE :168
 MATERIAL :SOUNDSCAT 609
 DATA SOURCES
 MANUFACTURER :NONE
 AFRL TUDRI
 OTHER :NONE

NO.	MODULUS N/MHz	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MHz	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/MHz
1	3.52527E+08	.3201	19.4	1695.0	3.	6.5061E+10	.0271	763.4	1.12959E+08
2	5.13116E+08	.2651	19.4	3271.0	4.	6.51728E+10	.0297	1509.0	1.36025E+08
3	5.4460E+08	.1593	19.4	5186.0	5.	6.38469E+10	.0258	2469.0	8.67731E+07
4	4.76318E+07	.4309	36.7	576.0	2.	6.66899E+10	.0766	278.2	2.05233E+07
5	1.15461E+08	.4161	36.7	1568.0	3.	6.45381E+10	.0806	766.3	4.80443E+07
6	1.60795E+08	.4587	36.7	2983.0	4.	6.46548E+10	.1086	1503.0	7.3764E+07
7	1.90774E+08	.5016	36.7	4653.0	5.	6.33308E+10	.1384	2459.0	9.56930E+07
8	9.29949E+06	1.5896	52.8	496.0	2.	6.60677E+10	.3746	276.9	1.47320E+07
9	2.72871E+07	1.9375	52.8	1300.0	3.	6.39164E+10	.2934	762.6	2.5521E+07
10	3.71848E+07	1.0133	52.8	2367.0	4.	6.40540E+10	.3310	1496.0	3.76807E+07
11	4.75916E+06	.6565	66.1	391.0	2.	6.56389E+10	.2421	276.0	3.12440E+06
12	9.04769E+06	.6300	66.1	1001.0	3.	6.34981E+10	.2188	760.1	5.63963E+06
13	2.90451E+06	.4057	79.4	886.0	2.	6.5069E+10	.1380	274.8	1.17825E+06
14	4.46256E+06	.7087	79.4	351.0	2.	6.29978E+10	.1488	757.1	2.45529E+06
15	4.70040E+06	.5502	79.4	1620.0	4.	6.31155E+10	.1257	1485.0	3.33109E+06
16	2.32809E+06	.3224	93.3	337.0	2.	6.46911E+10	.1014	274.0	7.50604E+05
17	3.26887E+06	.4285	93.3	849.0	3.	6.25824E+10	.0946	754.6	1.40081E+06
18	4.44239E+06	.4478	93.3	2536.0	5.	6.4393E+10	.0529	2422.0	1.08915E+06
19	1.91458E+06	.3201	107.2	326.0	2.	6.41257E+10	.0924	272.8	6.12789E+05
20	2.66680E+06	.3734	107.2	828.0	3.	6.20699E+10	.0725	751.5	9.95257E+05
21	2.80465E+06	.3416	107.2	1546.0	4.	6.21833E+10	.0414	1474.0	9.5812E+05
22	3.73088E+06	.3731	107.2	2502.0	5.	6.09330E+10	.0384	2412.0	1.39213E+06
23	1.67468E+06	.3494	121.1	319.0	2.	6.36096E+10	.0945	271.7	5.8511E+05
24	2.39977E+06	.3788	121.1	817.0	3.	6.1558E+10	.0687	748.4	9.08340E+05
25	2.49531E+06	.3601	121.1	1530.0	4.	6.1678E+10	.0399	1468.0	8.98508E+05
26	3.42593E+06	.3600	121.1	2482.0	5.	6.04288E+10	.0347	2402.0	1.23317E+06



Polymeric Material Characterization Test

Test No. 80-2

Beam Nos. 080-1 and 080-2

Date 3/20/80

Damping Material Soundfoil LT12 (Soundcoat)

Material Thickness 0.0259 cm Material Density 1.095 g/cc

Beam Thickness 0.2032 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -59.4 °C and 65.6 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor n_D :

Peak 100 Hz n_D 1.010 Temperature -48.33 °C

1000 Hz n_D 1.010 Temperature -26.1 °C

Range 100 Hz -65.0 °C -27.8 °C

1000 Hz -42.8 °C 1.1 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR) * N)$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
-30.0	10.0000E+03	10.0000E+07	.275	1.2500E+05

$$P = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL + SH)A + (SL - SH)(1 - \text{SQRT}(1 + A^2)))C/2$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
-30.0	1.010	.700	-1.250	2.0000E+03	1.500

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 + 1.8(T - T0))$$

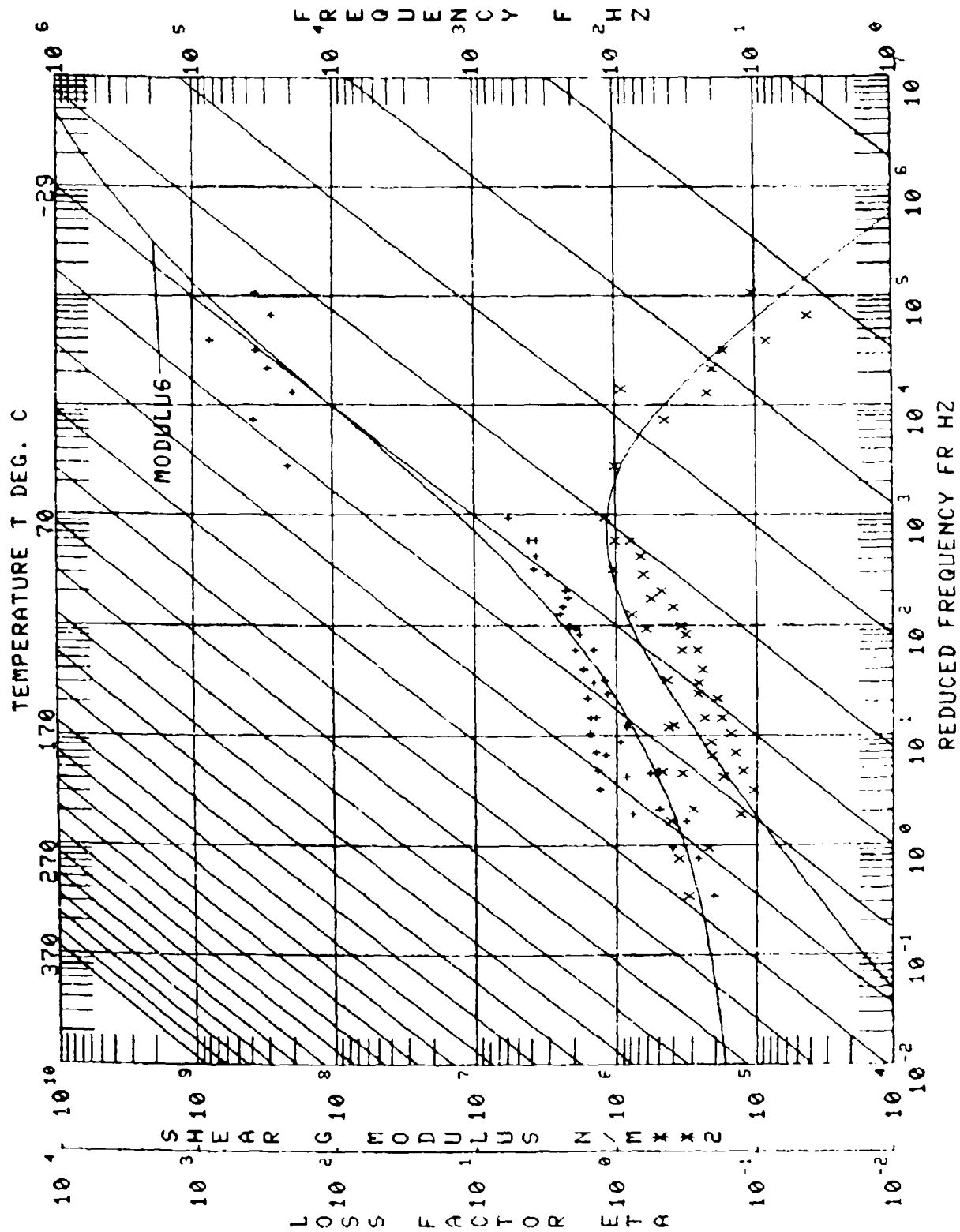
Remarks:

RF	Mode	f_c		f_n		f_L		f_R		Δf		η_s		ldB	
-71	1	111.92				111.34		112.04		0.20		0.0018			
-73	2	704.35	325.55			703.35		705.45		2.10		0.00298			
-74	3	1933.95	908.18			1930.82		1936.48		5.66		0.0029			
-73	4	3540.18	1782.09			3528.08		3550.81		22.73		0.0064			
-73	5	5756.66	2952.93			5695.06		5807.51		111.45		0.0194			
-73	1	112.16				111.34		112.91		1.57		0.0140			
-78	2	696.94	325.33			689.09		705.12		16.03		0.0230			
-77	3	1903.81	905.09			1879.45		1928.91		49.46		0.0260			
-77	4	3444.88	1776.05			3371.64		3515.61		143.97		0.0418			
-77	5	5641.51	2941.94			5520.66		5759.81		239.15		0.0424			
-77	6	8265.01	4412.72			8187.51		8356.91		323.04		0.0403		X	
-23	1	102.89				96.29		113.52		16.81		0.1618			
-24	2	536.16	324.23			504.94		703.97		199.03		0.3395			
-23	3	1536.39	902.32			1196.77				779.24		0.4912			
1	1	34.05				76.72		93.58		16.86		0.2006			
1	2	416.39	323.02			374.05		476.23		102.23		0.2455			
1	3	899.54	1059.55			928.13		1203.42		275.29		0.2598			
1	4	1936.75	1763.96			1757.49		2097.91		340.42		0.1758			
1	5	2162.41	2319.95			2844.99		3427.94		582.95		0.1843			
26	1	73.90				69.50		82.14		12.64		0.1710			

ω	f_c	f_n	f_L	f_R	Δf	η_S	ldb
26	975.96	286.46	922.85	1024.44	101.59	0.1041	
27	1239.97	1757.91	1783.53	1896.34	112.81	0.0613	
28	3020.09	2959.96	2931.65	3110.69	179.04	0.0593	
29	4490.84	4367.93	4371.07	4602.71	231.64	0.0516	
30	6220.46	6119.33	6066.76	6342.46	275.70	0.0443	
31	65.20		66.21	74.26	14.05	0.2152	
32	353.22	319.27	339.02	368.51	29.49	0.0835	
33	929.85	893.06	914.88	963.35	48.47	0.0516	
34	1261.03	1751.26	1776.38	1825.12	48.74	0.0271	
35	2966.09	2897.97	2929.05	3091.41	72.36	0.0244	
36	4416.44	4353.00	4370.55	4464.35	93.80	0.0212	
37	6334.66	6298.48	6681.26	6187.91	106.65	0.0174	
38	339.33	319.71	328.88	350.29	21.32	0.0628	
39	926.30	890.28	903.55	935.71	32.16	0.0349	
40	1780.42	1744.62	1765.04	1795.62	30.58	0.0172	
41	2936.99	2887.98	2915.94	2957.66	41.72	0.0142	
42	4379.11	4336.58	4354.31	4497.28	51.57	0.0118	
43	6192.41	6077.63	6061.96	6131.61	59.65	0.0098	
44	328.85	316.95	322.52	335.56	12.93	0.0395	
45	903.21	886.38	894.12	913.76	19.41	0.0215	

°F	f_G	f_n	f_L	f_R	Δf	η_s	$10R$
102	1752.34	1737.26	1751.28	1771.24	19.96	0.0113	
102	2911.25	2871.99	2898.26	2924.84	26.59	0.0091	
102	4245.85	4186.67	4231.15	4262.61	31.46	0.0072	
102	6051.46	6052.61	6032.51	6071.26	38.75	0.0064	
105	324.80	315.64	320.11	329.51	9.40	0.0289	
104	896.80	883.19	889.80	903.80	14.00	0.0156	
104	1752.92	1731.32	1744.75	1759.48	14.73	0.0084	
104	2897.03	2861.99	2887.27	2907.16	19.89	0.0069	
104	4227.11	4202.75	4214.87	4239.08	24.21	0.0056	
104	6025.36	6029.67	6009.66	6043.46	33.80	0.0036	
107	226.72	314.42	317.59	323.91	6.32	0.0127	
107	889.41	879.96	884.96	894.94	9.98	0.0102	
109	1721.92	1724.96	1736.11	1746.37	10.26	0.0078	
109	2880.46	2850.60	2873.69	2887.61	13.91	0.0048	
107	4397.25	4371.32	4295.07	4312.37	17.30	0.0061	

MODE NO.	MODULUS	LOSS FAC	TEMP DEG	FREQ MZ	MODE NO.	BEAM MOD- N, M12	COMPOSITE LOSS FAC	BEAM FREQ. MZ	COMPLEX MOD- N, M12
1	1.000000	0.000000	0.000000	320.7	1	521938+10	0.97	314.4	6.8834E+04
2	1.000000	0.000000	0.000000	389.4	2	651333+10	0.102	379.8	9.6130E+03
3	1.000000	0.000000	0.000000	1074.1	3	651333+10	0.058	1274.1	1.0676E+05
4	1.000000	0.000000	0.000000	2826.0	4	652338+10	0.048	2850.0	1.4643E+05
5	1.000000	0.000000	0.000000	3394.5	5	652338+10	0.043	4267.3	1.8583E+05
6	1.000000	0.000000	0.000000	5394.5	6	655080+10	0.043	6008.3	2.6220E+05
7	1.000000	0.000000	0.000000	324.8	7	652700+10	0.239	315.3	1.0377E+05
8	1.000000	0.000000	0.000000	326.6	8	656362+10	0.156	823.3	1.5021E+05
9	1.000000	0.000000	0.000000	1752.0	9	655683+10	0.084	1731.0	1.5694E+05
10	1.000000	0.000000	0.000000	2826.0	10	656826+10	0.059	2862.0	2.1329E+05
11	1.000000	0.000000	0.000000	3394.5	11	667613+10	0.056	4702.3	3.5738E+05
12	1.000000	0.000000	0.000000	5394.5	12	663701+10	0.035	6023.3	5.5388E+05
13	1.000000	0.000000	0.000000	324.8	13	662331E+10	0.035	316.3	1.4686E+05
14	1.000000	0.000000	0.000000	326.6	14	651410E+10	0.215	886.4	2.1121E+05
15	1.000000	0.000000	0.000000	1752.0	15	651410E+10	0.113	1737.4	2.1439E+05
16	1.000000	0.000000	0.000000	2826.0	16	651424+10	0.093	2872.9	2.8452E+05
17	1.000000	0.000000	0.000000	3394.5	17	651727+10	0.072	4318.7	3.3732E+05
18	1.000000	0.000000	0.000000	5394.5	18	651406E+10	0.064	6052.6	4.0815E+05
19	1.000000	0.000000	0.000000	324.8	19	653292+10	0.068	319.0	3.5546E+05
20	1.000000	0.000000	0.000000	326.6	20	66042+10	0.349	890.0	3.5123E+05
21	1.000000	0.000000	0.000000	1752.0	21	66061+10	0.172	1744.6	3.5505E+05
22	1.000000	0.000000	0.000000	2826.0	22	66800+10	0.112	2898.4	5.5515E+05
23	1.000000	0.000000	0.000000	3394.5	23	66800+10	0.118	4336.6	5.5527E+05
24	1.000000	0.000000	0.000000	5394.5	24	667810E+10	0.058	6077.9	6.7547E+05
25	1.000000	0.000000	0.000000	324.8	25	660197+10	0.035	319.0	3.8919E+05
26	1.000000	0.000000	0.000000	326.6	26	671247E+10	0.514	893.1	5.1909E+05
27	1.000000	0.000000	0.000000	1752.0	27	67114E+10	0.271	1751.3	5.4494E+05
28	1.000000	0.000000	0.000000	2826.0	28	672048E+10	0.254	2898.0	8.0059E+05
29	1.000000	0.000000	0.000000	3394.5	29	673445E+10	0.214	4353.0	1.0240E+06
30	1.000000	0.000000	0.000000	5394.5	30	673458E+10	0.174	6098.8	1.1479E+06
31	1.000000	0.000000	0.000000	324.8	31	682733+10	0.043	319.0	1.2921E+06
32	1.000000	0.000000	0.000000	326.6	32	671622+10	0.043	896.5	1.3339E+06
33	1.000000	0.000000	0.000000	1752.0	33	688152E+10	0.0516	1751.0	2.0497E+06
34	1.000000	0.000000	0.000000	2826.0	34	688152E+10			



Polymeric Material Characterization Test

Test No. 79-2

Beam Nos. 060C and 060D

Date 5/79

Damping Material 3M ISD 110

Material Thickness 0.0127 cm Material Density 0.965 g/cc

Beam Thickness 0.1524 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -17.8 °C and 121.1 °C

Frequency Test Range: Between 10 Hz and 10 kHz

Loss Factor η_D :

Peak 100 Hz η_D 1.14 Temperature 43.3 °C

1000 Hz η_D 1.14 Temperature 60.0 °C

Range 100 Hz 18.3 °C 82.2 °C

1000 Hz 29.4 °C 110.0 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR) \times N)$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
70.0	5.0000E+03	2.0000E+06	.350	5.5000E+04

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL+SH)A + (SL-SH)(1-\text{SQRT}(1+A \times A2))) / C2$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
70.0	1.300	.350	-.400	2.0000E+03	2.000

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T-T0) / (525/1.8 + T-T0)$$

Remarks: Composite structures made with this material should be
heat-soaked between 51.9°C and 65.6°C for at least one hours to
insure good adhesion.

Thermogravitalational analysis (TGA) revealed significant
decomposition beginning at 240°C.

°F f_c f_n f_L f_R Δf η_s 1d3

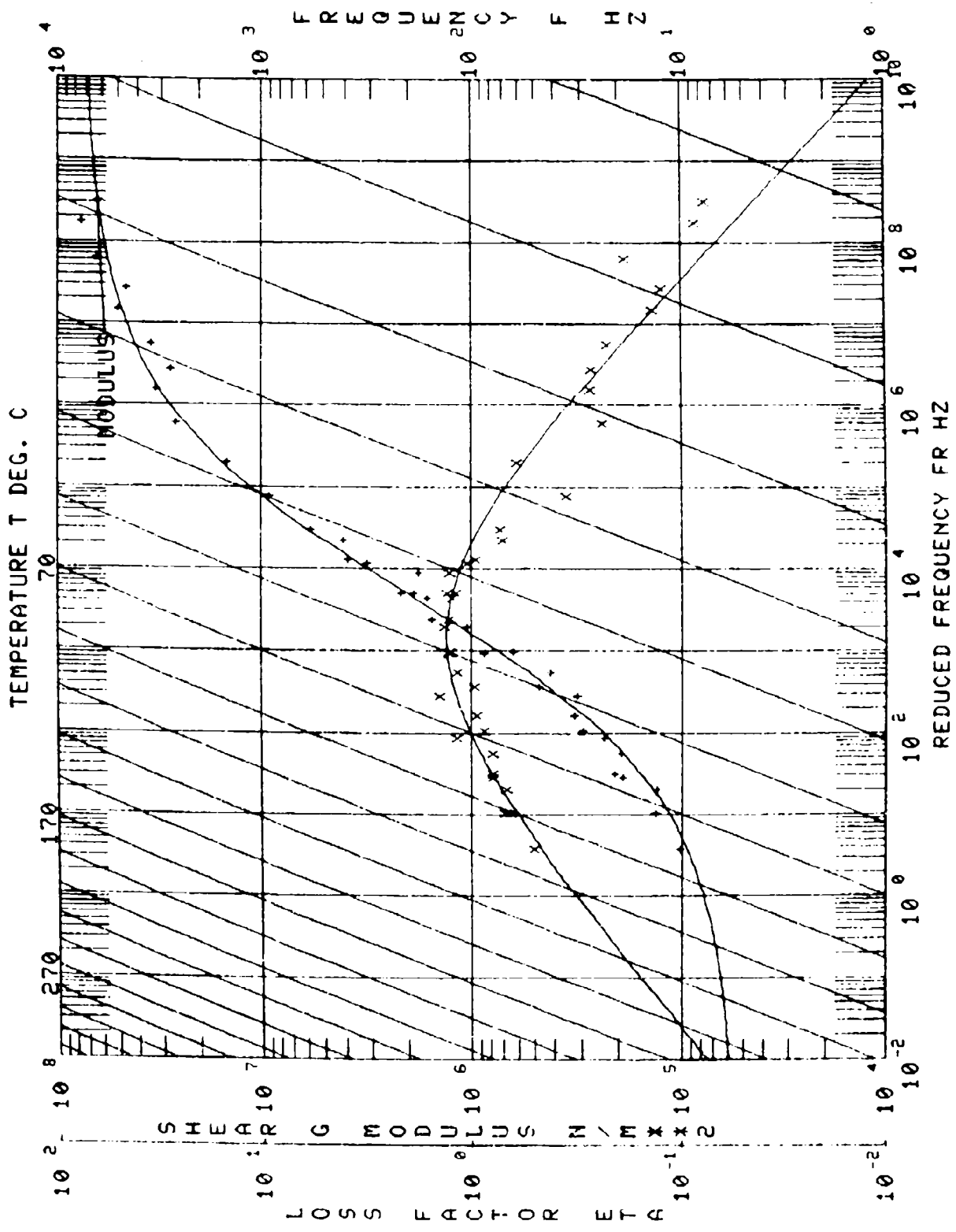
Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	
1	2	505.60	246.00	502.90	507.80	4.90	0.0097	
1	3	1058.80	682.00	1351.90	1364.90	13.00	0.0096	
1	4	2489.20	1337.80	2368.10	2503.30	40.20	0.0161	
25	2	496.80	246.90	492.00	502.20	10.20	0.0205	
25	3	1330.10	686.40	1316.90	1344.50	27.60	0.0208	
25	4	2413.30	1343.80	2375.00	2451.00	76.00	0.0315	
50	2	485.20	244.03	479.50	492.30	12.80	0.0264	
50	3	1271.90	678.35	1234.90	1302.30	68.40	0.0538	
50	4	2234.80	1327.50	2158.50	2342.60	184.10	0.0824	
75	2	445.90	243.14	426.60	461.30	34.70	0.0778	
75	3	1172.50	676.20	1064.90	1254.20	189.30	0.1615	
100	2	399.90	242.15	351.50	461.70	110.20	0.2756	
100	3	1000.60	673.73	862.20	1101.40	239.20	0.2391	
112	2	377.20	241.82	324.20	448.10	123.90	0.3285	
112	3	938.90	673.11	802.90	1093.20	280.30	0.2985	
112	4	1620.10	1315.40	1437.00	1762.00	325.00	0.2006	
137	2	311.30	241.05	271.40	379.60	108.20	0.3476	
137	3	861.60	670.95	688.80	922.30	243.40	0.3036	
137	4	1449.00	1311.80	1287.00	1589.10	302.10	0.2084	
152	2	279.20	240.30	249.80	310.80	61.00	0.2185	

°F f_c f_n f_L f_R Δf η_s 1dB

Temp.	Node	f_c	f_n	f_L	f_R	Δf	η_s	1dB
152	3	723.00	669.10	663.90	792.10	128.20	0.1773	
152	4	1362.60	1310.58	1287.40	1435.90	148.50	0.0190	
175	2	263.80	239.51	245.10	284.30	39.20	0.1486	
175	3	696.50	671.57	661.30	739.60	78.30	0.1124	
175	4	1334.90	1305.14	1290.90	1379.20	88.30	0.0661	
200	2	255.30	238.30	243.20	270.10	26.90	0.1054	
200	3	686.90	664.48	662.20	711.80	49.60	0.0722	
200	4	1320.60	1299.70	1291.60	1347.30	55.70	0.0422	
225	2	247.40	236.86	240.10	255.30	15.20	0.0614	
225	3	674.70	661.70	660.60	686.10	27.50	0.0408	
225	4	1304.00	1294.90	1288.70	1317.80	29.10	0.0223	
250	2	243.50	235.76	238.80	248.10	9.30	0.0382	
250	3	666.60	658.61	657.90	675.20	17.30	0.0260	
250	4	1292.10	1288.30	1284.00	1301.20	17.20	0.0133	

EXPERIMENTAL CODE : 71
 MATERIAL : 13A 15D 110
 DATA SOURCES
 MANUFACTURER : IN
 AFMIL TUDRI-GET,NJ
 OTHER : IN

NO.	MODULUS N/MHz	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MHz	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/MHz
1	6.45844E+07	.1895	-17.2	505.6	3	7.09752E+10	.0097	245.0	1.23367E+07
2	7.69432E+07	.0879	-17.2	1358.8	3	6.99063E+10	.0096	683.6	6.76421E+06
3	6.39763E+07	.0787	-17.2	2489.2	4	6.91620E+10	.0161	1337.8	5.0246E+06
4	3.45945E+07	.2319	-3.9	496.8	3	7.14955E+10	.0205	246.9	8.02381E+06
5	5.17461E+07	.1400	-3.9	1330.1	2	7.04801E+10	.0208	686.4	7.24399E+06
6	4.68559E+07	.1284	-3.9	2413.3	4	7.03472E+10	.0315	1343.8	6.01416E+06
7	2.64409E+07	.2443	10.0	485.2	2	6.9830E+10	.0264	244.0	6.46071E+06
8	3.30003E+07	.2800	10.0	1271.9	3	6.88387E+10	.0538	678.4	9.26408E+06
9	2.78420E+07	.2753	10.0	2234.8	1	6.86507E+10	.0824	1327.5	7.66462E+06
10	9.36550E+06	.3589	23.9	441.9	2	6.93345E+10	.0778	243.1	3.36129E+06
11	1.48874E+07	.6255	23.9	1172.5	3	6.84010E+10	.1615	676.2	9.31227E+06
12	3.19227E+06	1.0663	37.8	399.9	2	6.87710E+10	.2756	232.1	3.4802E+06
13	5.92187E+06	.7418	37.8	1000.6	3	6.79022E+10	.2391	673.7	4.38256E+06
14	1.07409E+06	1.3736	51.7	325.5	2	6.82721E+10	.3763	241.3	1.47540E+06
15	1.90726E+06	1.3339	51.7	829.6	3	6.74675E+10	.3335	671.6	2.54415E+06
16	1.82078E+06	1.2863	51.7	1457.5	4	6.72320E+10	.2256	1314.2	2.34207E+06
17	4.88776E+05	.9820	66.7	279.2	2	6.7750E+10	.2185	240.4	4.79973E+05
18	6.46653E+05	1.2942	66.7	723.0	3	6.69721E+10	.1773	663.1	8.36879E+05
19	6.97447E+05	1.221	66.7	1362.6	4	6.69119E+10	.0190	1310.6	1.54923E+05
20	3.23901E+05	1.2115	44.4	377.2	2	6.85837E+10	.3285	241.8	2.71145E+06
21	3.95318E+06	.9725	44.4	938.0	3	6.77773E+10	.2085	673.1	3.89513E+06
22	4.19561E+06	.7190	44.4	1620.1	4	6.74449E+10	.2006	1315.4	3.01682E+06
23	8.87233E+05	1.2849	58.3	311.3	1	6.81477E+10	.3476	241.0	1.14604E+06
24	1.56360E+06	1.3076	58.3	801.6	3	6.73330E+10	.3036	670.9	2.04331E+06
25	1.64519E+06	1.2652	58.3	1449.9	4	6.70365E+10	.2084	1311.8	2.08213E+06
26	3.03156E+05	.8876	79.4	263.8	3	6.7297E+10	.1486	239.5	2.6086E+05
27	3.21960E+05	1.4511	79.4	696.5	2	6.74675E+10	.1124	671.6	4.62187E+05
28	4.24389E+05	1.1937	79.4	1334.9	4	6.6576E+10	.0661	1305.1	5.06575E+05
29	2.13666E+05	.8053	93.3	255.3	2	6.66016E+10	.1054	238.3	1.72067E+05
30	2.42640E+05	1.1877	93.3	686.0	3	6.70482E+10	.0722	669.5	2.88191E+05
31	2.27847E+05	.9580	93.3	1200.6	4	6.58955E+10	.0422	1299.7	3.14969E+05
32	1.36936E+05	.6650	107.2	247.4	2	6.57991E+10	.0614	236.9	9.19644E+04
33	1.83255E+05	.8071	107.2	674.7	3	6.54989E+10	.0408	661.7	1.58979E+05
34	1.97962E+05	.8088	107.2	1304.0	4	6.53003E+10	.0223	1294.9	1.60121E+05
35	1.04386E+05	.5184	121.1	243.5	2	6.51894E+10	.0382	235.8	5.41151E+04
36	1.37245E+05	.7007	121.1	666.6	3	6.48887E+10	.0260	658.6	9.61737E+04
37	1.33982E+05	.6062	121.1	1202.1	4	6.47064E+10	.0133	1288.8	9.32785E+04



Polymeric Material Characterization Test

Test No. 79-3

Beam Nos. 060C and 060D

Date 5/79

Damping Material 3M ISD 112

Material Thickness 0.0127 cm Material Density 0.965 g/cc

Beam Thickness 0.1524 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -31.7 °C and 93.3 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.08 Temperature 7.2 °C

1000 Hz η_D 1.08 Temperature 29.4 °C

Range 100 Hz -12.2 °C 35.0 °C

1000 Hz 4.4 °C 76.7 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR)^{2N})$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
40.0	2.0000E+04	4.7500E+06	.275	6.0000E+04

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL + SH)A + (SL - SH)(1 - \text{SQRT}(1 + A^2))) / C$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
40.0	1.080	.450	-.550	5.0000E+03	2.500

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 + 1.8(T - T0))$$

Remarks: Thermogravitational (TGA) analysis

revealed significant decomposition of this material beginning
at 250°C.

°F f_c f_n f_L f_R Δf η_s 1dB

Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-25	2	503.50	247.00	501.00	505.80	4.80	0.00953	
-25	3	1362.00	668.38	1353.50	1370.20	16.70	0.01226	
-25	4	2560.90	1343.20	2538.80	2581.90	43.10	0.01683	
-2	2	494.70	246.00	488.10	501.50	13.40	0.0271	
-2	3	1323.30	683.60	1296.20	1348.40	52.20	0.0394	
-2	4	2463.70	1337.80	2404.00	2522.90	118.90	0.0483	
22	2	469.70	246.90	444.90	496.60	51.70	0.1101	
22	3	1223.20	686.40	1173.90	1305.10	131.30	0.1073	
22	4	2251.20	1343.80	2085.60	2405.80	320.20	0.1422	
40	2	426.90	244.36	387.00	480.80	93.80	0.2197	
40	3	1092.20	679.90	957.80	1215.40	257.60	0.2358	
50	2	401.60	244.03	350.80	465.80	115.00	0.2863	
50	3	1005.80	678.36	844.90	1161.00	316.10	0.3143	
65	2	352.40	243.48	307.39	420.30	113.00	0.3207	
65	3	894.30	676.82	750.00	1031.90	281.90	0.3152	
76	2	315.10	243.14	273.20	372.80	99.60	0.3161	
76	3	797.40	676.20	696.30	909.30	213.00	0.2671	
76	4	1488.20	1323.80	1274.40	1642.80	368.40	0.2475	
85	2	304.40	243.03	268.40	353.00	84.60	0.2779	
85	3	782.10	674.96	692.00	976.50	184.50	0.2359	

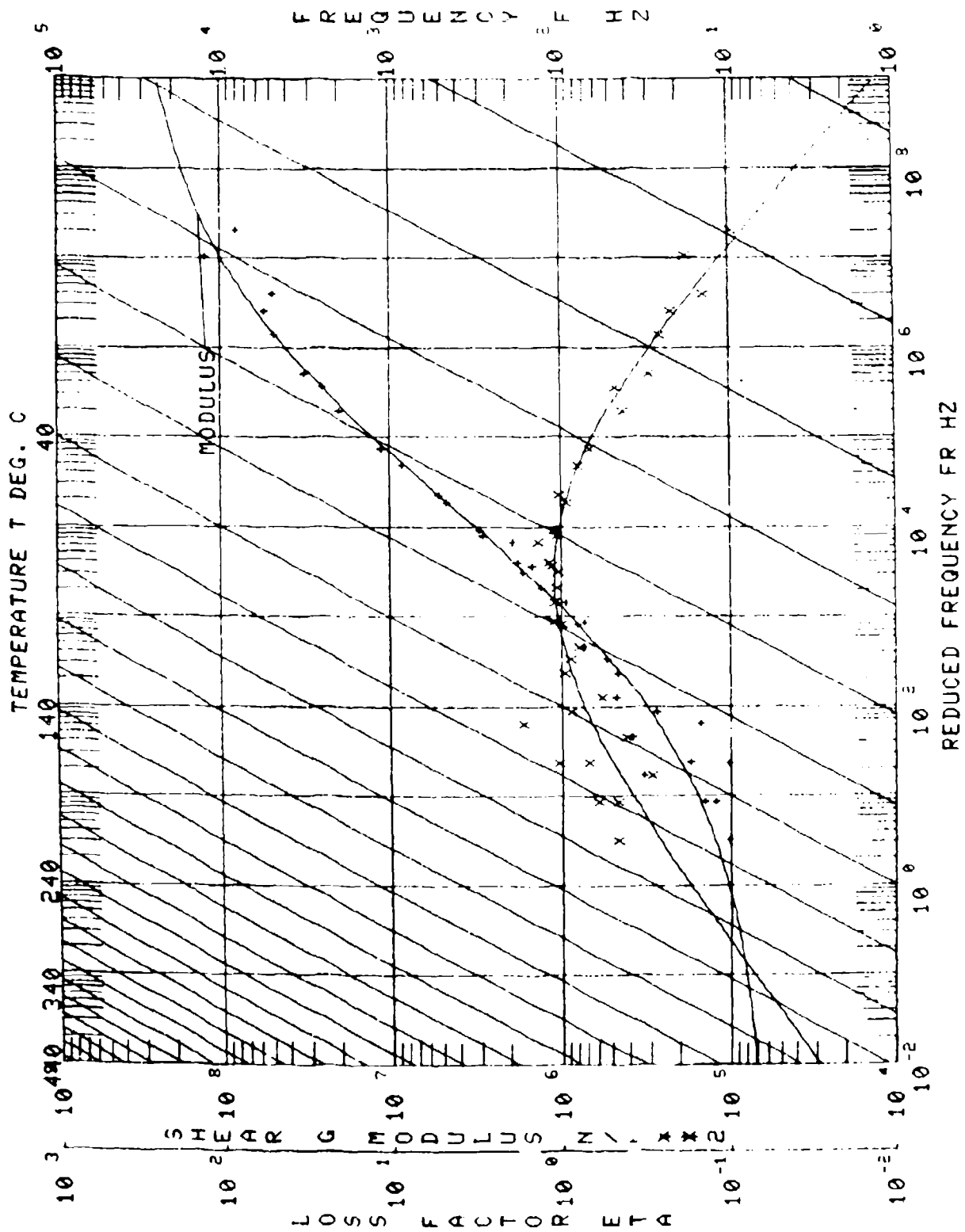
°F

 f_c f_n f_L f_R Δf η_s

Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	
85	4	1471.10	1321.50	1296.80	1603.60	306.80	0.2058	
100	2	284.30	242.15	254.90	314.90	60.00	0.2110	
100	3	733.90	673.73	671.50	796.10	124.60	0.1698	
100	4	1404.10	319.04	1314.00	1489.80	175.80	0.1252	
125	2	263.50	241.27	247.90	285.30	37.40	0.1419	
125	3	708.90	671.57	669.50	744.40	74.90	0.1057	
125	4	1369.90	1314.20	1319.40	1416.60	97.20	0.0709	
152	2	254.30	240.39	244.20	264.40	20.20	0.0794	
152	3	678.80	669.10	665.50	712.10	46.60	0.0686	
152	4	1344.80	1310.58	1319.20	1369.00	48.80	0.0363	
176	2	249.00	233.51	234.00	255.70	12.90	0.0518	
176	3	676.40	71.57	667.00	687.00	20.00	0.0296	
176	4	1331.50	1305.14	1316.40	1345.70	29.30	0.0220	
201	2	246.00	238.30	241.80	250.30	8.50	0.0345	
201	3	673.30	664.48	666.80	679.30	12.50	0.0186	
201	4	1321.40	1299.70	1312.40	1330.70	18.30	0.0138	

EXPERIMENTAL CODE 172
 MATERIAL 13M ISD 112
 DATA SOURCES
 MANUFACTURER IN
 AFML INJR
 OTHER 1M

NO.	MODULUS N/MHz	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MHz	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/MHz
1	3.10450E+06	1.1166	10.0	401.6	2.	6.98430E+10	-2863	244.0	3.46659E+06
2	5.27104E+06	1.0667	10.0	1005.8	3.	6.88387E+10	-3143	678.4	5.59116E+06
3	1.14751E+07	.6758	-5.6	460.7	2.	7.14955E+10	-1101	246.9	7.75496E+06
4	2.57761E+07	.4359	-5.6	1223.2	3.	7.04801E+10	-1073	686.4	8.96264E+06
5	3.57024E+07	.4869	-5.6	2251.2	4.	7.03470E+10	-1422	1743.8	1.25136E+07
6	3.28407E+07	.3044	-18.9	494.7	2.	7.09752E+10	-0271	246.0	9.99797E+06
7	4.87240E+07	.2646	-18.9	1223.3	3.	6.99063E+10	-0334	683.6	1.26913E+07
8	5.63468E+07	.2243	-18.9	2463.7	4.	6.97202E+10	-0483	1337.8	1.26361E+07
9	4.98507E+07	.1442	-31.7	503.5	2.	7.15534E+10	-0095	247.0	7.18963E+06
10	1.27545E+08	.1840	-31.7	1362.0	3.	6.58281E+10	-0123	568.4	2.34724E+07
11	8.32845E+07	.0976	-31.7	2560.9	4.	7.02842E+10	-0168	1343.2	8.12493E+06
12	9.62263E+05	1.1203	24.4	315.1	2.	6.93345E+10	-3161	243.1	1.07806E+06
13	1.49432E+06	1.1685	24.4	797.4	3.	6.84010E+10	-2671	676.2	1.74614E+06
14	1.93920E+06	1.3745	24.4	1488.2	4.	6.82686E+10	-2475	1323.8	2.66530E+06
15	5.45475E+05	.8981	37.8	284.3	2.	6.87710E+10	-2110	242.1	4.89866E+05
16	7.36162E+05	1.1351	37.8	733.9	3.	6.79022E+10	-1698	673.7	8.35586E+05
17	8.18662E+05	1.0131	29.4	304.4	2.	6.92718E+10	-2779	243.0	8.28955E+05
18	1.32839E+06	1.0873	29.4	782.1	3.	6.81504E+10	-2359	675.0	1.44440E+06
19	1.80955E+06	1.1978	29.4	1471.1	4.	6.80316E+10	-2035	1321.5	2.16745E+06
20	1.68426E+06	1.0755	18.3	362.4	2.	6.95286E+10	-3207	243.5	1.81331E+06
21	2.97348E+06	1.0867	18.3	834.3	3.	6.95266E+10	-3152	676.8	3.23190E+06
22	4.78922E+06	.9490	4.4	426.9	2.	7.00321E+10	-2197	244.4	4.53894E+06
23	8.0090E+06	.8056	4.4	1092.2	3.	6.91516E+10	-2358	679.9	7.09189E+06
24	2.78340E+05	.9080	51.7	283.5	2.	6.82721E+10	-1419	241.3	2.5323E+05
25	7.31422E+05	.8011	51.7	708.9	3.	6.74675E+10	-1077	671.6	4.65722E+05
26	1.79441E+05	.7057	51.7	1309.9	4.	6.72820E+10	-0794	1314.2	5.85977E+05
27	1.54883E+05	1.7030	66.7	254.3	2.	6.77750E+10	-0686	240.4	1.26486E+05
28	1.26498E+05	.6116	66.7	628.8	3.	6.69721E+10	-0518	669.1	2.63765E+05
29	1.05156E+05	1.0658	80.0	249.0	2.	6.72797E+10	-0266	239.5	7.73647E+04
30	3.94595E+05	.4239	80.0	566.4	3.	6.74675E+10	-0266	571.6	1.12070E+05
31	1.05320E+05	.4733	80.0	1331.5	4.	6.73576E+10	-0268	1305.1	1.67284E+05
32	1.48579E+05	.4731	93.9	246.0	2.	6.66016E+10	-0345	238.3	4.98521E+04
33	3.40437E+05	.3023	93.9	673.3	3.	6.60505E+10	-0186	664.5	7.02879E+04
34	4.85304E+05	.5043	93.9	1321.4	4.	6.58055E+10	-0138	1299.7	1.02919E+05
35			96.7	1344.8	4.	6.59116E+10	-0363	1310.6	2.83543E+05



Polymeric Material Characterization Test

Test No. 77-61

Beam Nos. 070D and 070E

Date 5/4/77

Damping Material ISD 113

Material Thickness 0.013 cm. Material Density 0.969 g/cc

Beam Thickness 0.178 cm. Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -36.1 °C and 65.6 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor r_D :

Peak 100 Hz r_D 1.25 Temperature -15 °C

1000 Hz r_D 1.25 Temperature 10 °C

Range 100 Hz -35 °C 12 °C

1000 Hz 35 °C -15 °C

$$\text{LOG}(N) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR)^{2N})$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
10.0	2.0000E+04	2.0000E+07	.300	7.5000E+04

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETAFROL}) + ((SL+SH)A + (SL-SH)(1-\text{SQRT}(1+A^2)))C/2$$

T0	ETAFROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
10.0	1.250	.800	-1.000	2.5000E+03	3.000

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T-T0) / (525/1.8 + T-T0)$$

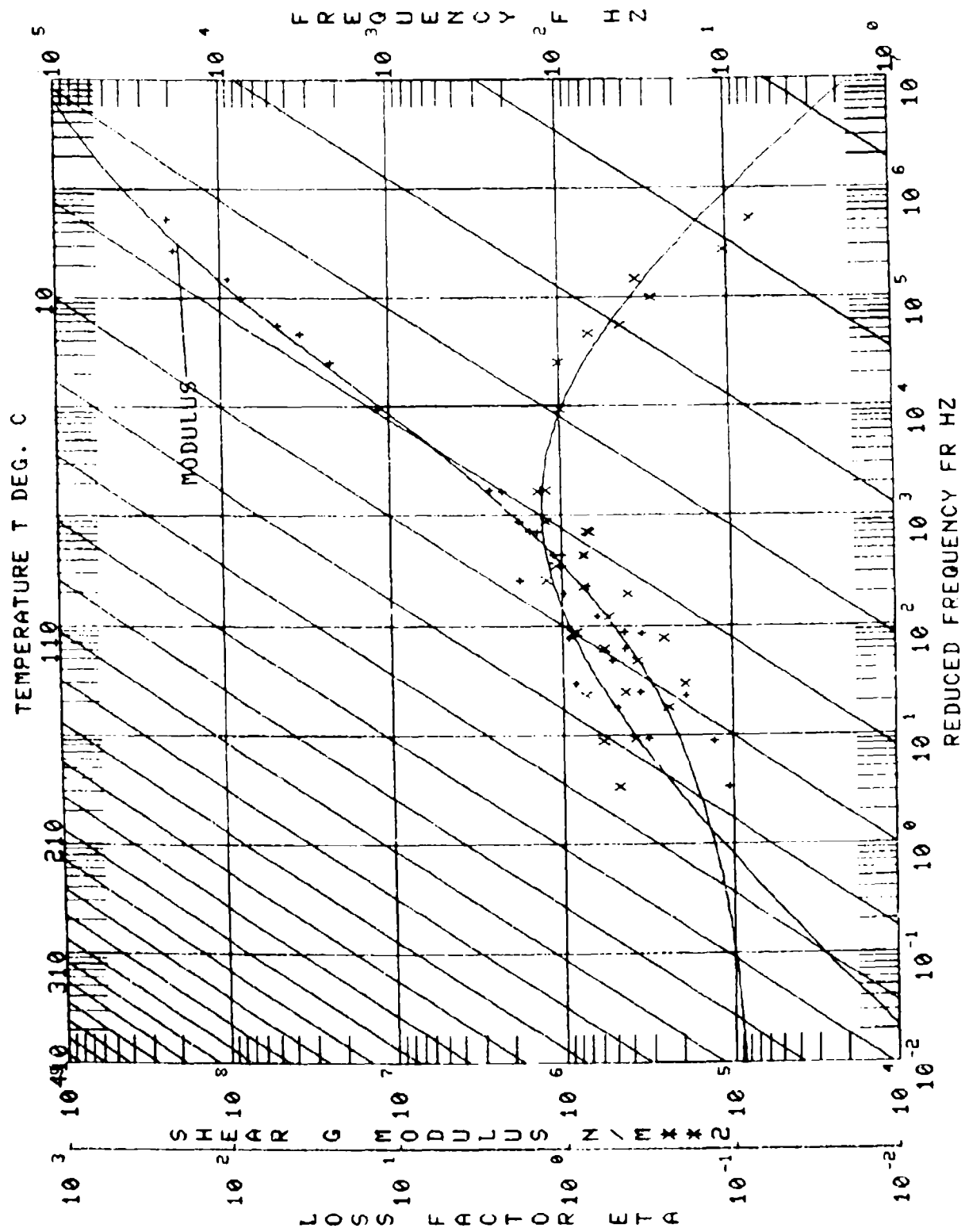
Remarks:

°F f_c f_n f_L f_R Δf η_g 1dB

Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_g	1dB
-53	2	531.0	284.3	578.0	586.0	8.0	0.0138	
-53	3	1596.0	783.0	1591.0	1600.0	9.0	0.00564	
-53	4	3064.0	1535.0	3054.0	3074.0	20.0	0.00653	
-53	5	4900.0	2173.0	4874.0	4926.0	52.0	0.0106	
-25	2	572.0	283.1	564.0	581.0	17.0	0.0297	
-25	3	1552.0	780.0	1526.0	1578.0	52.0	0.0335	
-25	5	4692.0	2503.0	4575.0	2799.0	224.0	0.0478	
0	2	542.0	283.1	564.0	581.0	17.0	0.0297	
0	3	1441.0	777.1	1337.0	1585.0	248.0	0.1747	
0	4	2653.0	1524.0	2465.0	2898.0	433.0	0.1654	
25	2	441.0	281.1	377.0		128.0	0.3303	
50	2	356.0	280.0	314.0	417.0	103.0	0.3023	
50	3	920.0	771.3	812.0	1069.0	257.0	0.2909	
50	4	1707.0	1513.0	1566.0	1957.0	391.0	0.2353	
50	5	2782.0	2475.0	2520.0	3111.0	591.0	0.2174	
75	2	514.0	270.1	290.0	340.0	50.0	0.1613	
75	3	831.0	768.8	789.0	883.0	94.0	0.1138	
75	4	1599.0	1508.0	1526.0	1663.0	137.0	0.0860	
75	5	2392.0	2467.0	2507.0	2693.0	186.0	0.0719	
75	2	307.0	279.1	289.0	333.0	44.0	0.1448	

EXPERIMENTAL CODE : 15
 MATERIAL : 15D 113
 DATA SOURCES
 MANUFACTURER : NONE
 AFML : SANDWICH BEAM
 OTHER : NONE

NO.	MODULUS N/MX12	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MX12	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/MX12
1	5.12643E+05	.7873	23.9	827.0	3.	3.12032E+10	.1840	768.8	4.03656E+05
2	7.98489E+05	.7902	23.9	1588.0	4.	3.12636E+10	.0790	1508.0	5.59221E+05
3	9.90544E+05	.7335	23.9	2579.0	5.	3.06189E+10	.0649	2467.0	7.26590E+05
4	1.35252E+06	.7716	35.4	293.0	2.	3.1969E+10	.0787	277.9	1.04354E+05
5	3.09158E+05	.6072	39.4	800.0	3.	3.09278E+10	.0538	765.4	1.87725E+05
6	4.31228E+05	.5695	39.4	1548.0	4.	3.09740E+10	.0775	1501.0	2.45579E+05
7	6.84503E+05	.4467	39.4	2531.0	5.	3.03455E+10	.0289	2456.0	3.05775E+05
8	9.00647E+04	.6244	51.7	287.0	2.	3.18041E+10	.0453	277.2	5.62327E+04
9	2.49334E+05	.4624	51.7	791.0	3.	3.07744E+10	.0342	763.5	1.15296E+05
10	3.56546E+05	.3979	51.7	1535.0	4.	3.08091E+10	.0222	1497.0	1.41884E+05
11	4.74731E+05	.2745	51.7	2519.0	5.	3.01944E+10	.0167	2450.0	1.74800E+05
12	2.46984E+04	.5117	65.6	284.0	2.	3.15293E+10	.0258	276.2	3.32855E+04
13	2.18285E+05	.4042	65.6	784.0	3.	3.05012E+10	.0130	760.1	6.05079E+04
14	3.36652E+05	.2629	65.6	1526.0	4.	3.05657E+10	.0110	2439.0	1.19255E+05
15	5.93652E+05	.2046	65.6	2503.0	5.	3.09278E+10	.0093	277.1	3.70435E+05
16	3.16071E+05	1.12873	33.0	314.0	3.	3.22410E+10	.0335	271.0	6.03039E+04
17	3.5521E+05	1.0763	33.0	593.0	4.	3.17030E+10	.0093	593.0	6.03039E+04
18	3.5521E+05	1.2444	33.0	850.0	5.	3.04435E+10	.0093	850.0	6.03039E+04
19	3.5521E+05	1.0333	10.0	350.0	3.	3.13030E+10	.0093	350.0	6.03039E+04
20	3.5521E+05	1.0333	10.0	550.0	4.	3.13030E+10	.0093	550.0	6.03039E+04
21	3.5521E+05	1.0333	10.0	850.0	5.	3.13030E+10	.0093	850.0	6.03039E+04
22	3.5521E+05	1.0333	10.0	1150.0	6.	3.13030E+10	.0093	1150.0	6.03039E+04
23	3.5521E+05	1.0333	10.0	1450.0	7.	3.13030E+10	.0093	1450.0	6.03039E+04
24	3.5521E+05	1.0333	10.0	1750.0	8.	3.13030E+10	.0093	1750.0	6.03039E+04
25	3.5521E+05	1.0333	10.0	2050.0	9.	3.13030E+10	.0093	2050.0	6.03039E+04
26	3.5521E+05	1.0333	10.0	2350.0	10.	3.13030E+10	.0093	2350.0	6.03039E+04
27	3.5521E+05	1.0333	10.0	2650.0	11.	3.13030E+10	.0093	2650.0	6.03039E+04
28	3.5521E+05	1.0333	10.0	2950.0	12.	3.13030E+10	.0093	2950.0	6.03039E+04
29	3.5521E+05	1.0333	10.0	3250.0	13.	3.13030E+10	.0093	3250.0	6.03039E+04
30	3.5521E+05	1.0333	10.0	3550.0	14.	3.13030E+10	.0093	3550.0	6.03039E+04
31	3.5521E+05	1.0333	10.0	3850.0	15.	3.13030E+10	.0093	3850.0	6.03039E+04
32	3.5521E+05	1.0333	10.0	4150.0	16.	3.13030E+10	.0093	4150.0	6.03039E+04
33	3.5521E+05	1.0333	10.0	4450.0	17.	3.13030E+10	.0093	4450.0	6.03039E+04
34	3.5521E+05	1.0333	10.0	4750.0	18.	3.13030E+10	.0093	4750.0	6.03039E+04
35	3.5521E+05	1.0333	10.0	5050.0	19.	3.13030E+10	.0093	5050.0	6.03039E+04
36	3.5521E+05	1.0333	10.0	5350.0	20.	3.13030E+10	.0093	5350.0	6.03039E+04
37	3.5521E+05	1.0333	10.0	5650.0	21.	3.13030E+10	.0093	5650.0	6.03039E+04
38	3.5521E+05	1.0333	10.0	5950.0	22.	3.13030E+10	.0093	5950.0	6.03039E+04
39	3.5521E+05	1.0333	10.0	6250.0	23.	3.13030E+10	.0093	6250.0	6.03039E+04
40	3.5521E+05	1.0333	10.0	6550.0	24.	3.13030E+10	.0093	6550.0	6.03039E+04
41	3.5521E+05	1.0333	10.0	6850.0	25.	3.13030E+10	.0093	6850.0	6.03039E+04
42	3.5521E+05	1.0333	10.0	7150.0	26.	3.13030E+10	.0093	7150.0	6.03039E+04
43	3.5521E+05	1.0333	10.0	7450.0	27.	3.13030E+10	.0093	7450.0	6.03039E+04
44	3.5521E+05	1.0333	10.0	7750.0	28.	3.13030E+10	.0093	7750.0	6.03039E+04
45	3.5521E+05	1.0333	10.0	8050.0	29.	3.13030E+10	.0093	8050.0	6.03039E+04
46	3.5521E+05	1.0333	10.0	8350.0	30.	3.13030E+10	.0093	8350.0	6.03039E+04
47	3.5521E+05	1.0333	10.0	8650.0	31.	3.13030E+10	.0093	8650.0	6.03039E+04
48	3.5521E+05	1.0333	10.0	8950.0	32.	3.13030E+10	.0093	8950.0	6.03039E+04
49	3.5521E+05	1.0333	10.0	9250.0	33.	3.13030E+10	.0093	9250.0	6.03039E+04
50	3.5521E+05	1.0333	10.0	9550.0	34.	3.13030E+10	.0093	9550.0	6.03039E+04



Polymeric Material Characterization Test

Test No. 79-5

Beam Nos. 060C and 060D

Date 6/79

Damping Material 3M ISD 113 (Modified)

Material Thickness 0.0127 cm Material Density 0.965 g/cc

Beam Thickness 0.1524 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -45.6 °C and 65.6 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor n_D :

Peak 100 Hz n_D 1.5 Temperature -7.0 °C

1000 Hz n_D 1.5 Temperature -1.1 °C

Range 100 Hz -31.7 °C -6.7 °C

1000 Hz -12.2 °C -1.1 °C

MATERIAL MOD. ISD 113
 $\text{LOG}(N) = \text{LOG}(NL) + (2\text{LOG}(NRON/NL)) / (1 + (FRON/FR) \times 2N)$

T0	FROM	NRON	N	NL
	A1	A2	A3	A4
10.0	7.5000E+03	5.5000E+06	.385	8.0000E+04

 $A = ((\text{LOG}(FR) - \text{LOG}(FROL)) / C$
 $\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETAFROL}) + ((SL + SH)A + (SL - SH)(1 - \text{SORT}(1 + A \times 2)))C/2$

T0	ETAFROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
10.0	1.500	.300	-.500	3.5000E+03	.300

 $\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 / 1.8 + T - T0)$

Remarks:

Beam No. 060C, 060D

°F	Temp.	Mode	f _c	f _n	f _L	f _R	Δf	η _s	ldB
-51	2		513.60	247.77	512.10	515.00	2.90	0.0056	
-51	3		1394.40	689.15	1388.50	1399.50	11.00	0.0079	
-51	4		2668.00	1348.66	2652.20	2682.50	30.30	0.0114	
-51	5		4309.10	2234.43	4277.80	4334.50	56.70	0.0132	
-26	2		496.30	246.89	490.10	510.60	20.50	0.0413	
-26	3		1340.80	686.38	1308.80	1369.90	61.10	0.0456	
-26	4		2541.80	1343.83	2472.10	2608.10	136.10	0.0535	
-4	2		458.90	246.00	431.60	499.80	68.20	0.1486	
-4	3		1215.30	683.60	1116.40	1307.40	191.00	0.1572	
-4	4		2297.40	1337.78	2027.90	2453.50	425.60	0.1852	
15	2		391.40	244.69	333.00	467.10	134.10	0.3426	
15	3		997.80	682.06	795.60	1167.70	372.10	0.3729	
24	2		349.50	244.91	299.20	427.20	128.00	0.3662	
24	3		914.00	683.60	680.80	1066.70	385.90	0.4222	
35	2		314.50	244.25	278.40	370.50	92.10	0.2928	
35	3		816.30	679.59	670.90	942.30	271.40	0.3325	
35	4		1492.10	1329.90	1326.80	1597.30	531.80	0.3564	X
50	2		289.80	244.03	259.90	326.00	66.10	0.2281	
50	3		749.60	678.36	671.50	827.20	155.70	0.2077	
50	4		1427.30	1327.50	1285.00	1534.20	249.20	0.1939	

°F	f_c	f_n	f_L	f_R	Δf	n_s	ldB
Temp. Mode							
50	5	2324.30	2198.46	1987.50	2474.70	487.20	0.2096
75	2	263.30	243.14	248.40	282.20	33.80	0.1284
75	3	705.80	676.20	674.10	739.80	65.70	0.0931
74	4	1369.60	1277.27	1321.40	1416.00	94.60	0.0691
74	5	2259.40	2189.47	2185.70	2318.60	132.90	0.0588
102	2	252.90	242.15	244.50	261.90	17.40	0.0688
102	3	689.60	673.73	674.00	704.60	30.60	0.0444
102	4	1346.20	1319.04	1324.30	1366.60	42.30	0.0314
102	5	2225.50	2182.47	2194.50	2252.00	57.50	0.0258
124	2	248.60	251.27	243.30	253.80	10.50	0.0422
124	3	681.70	671.57	673.10	690.70	17.60	0.0253
124	4	1334.30	1314.20	1322.00	1346.80	24.80	0.0186
124	5	2208.90	2175.48	2191.30	2224.90	33.60	0.0152
153	2	244.90	240.39	242.10	248.40	6.30	0.0257
152	3	675.90	669.10	670.90	681.10	10.20	0.0151
152	4	1323.90	1310.58	1317.20	1331.60	14.40	0.0109
152	5	2194.00	2168.48	2184.00	2203.40	19.40	0.0088

EXPERIMENTAL CODE :118
 MATERIAL MOD. ISD 113
 DATA SOURCES
 MANUFACTURER INONE
 AFRL HURI GET
 OTHER INONE

NO.	MODULUS N/MSI2	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MSI2	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/MSI2
1	1.1402E+08	.0097	-46.1	1394.4	3.	7.1046E+10	.0079	689.2	1.1372E+07
2	1.4021E+08	.0075	-46.1	2658.0	4.	7.0857E+10	.0114	1348.7	1.3681E+07
3	1.6051E+08	.0846	-46.1	4368.1	5.	7.1176E+10	.0132	2234.4	1.3585E+07
4	2.9858E+07	.4655	-32.2	486.3	2.	7.1487E+10	.0413	246.9	1.3922E+07
5	5.3853E+07	.3388	-32.2	1340.8	3.	7.0476E+10	.0456	686.4	1.8244E+07
6	7.2126E+07	.2964	-32.2	2541.8	4.	7.0350E+10	.0535	1343.8	2.1379E+07
7	8.5009E+06	.8277	-20.0	458.9	2.	7.0975E+10	.1486	246.0	7.0363E+06
8	1.7657E+07	.6706	-20.0	1215.3	3.	6.9843E+10	.1572	683.6	1.1819E+07
9	2.6715E+07	.7124	-20.0	2297.4	4.	6.9718E+10	.1852	1337.8	1.0031E+07
10	1.4700E+06	1.3029	-4.4	349.5	2.	7.0347E+10	.3682	244.9	1.9153E+06
11	2.6852E+06	1.6680	-4.4	914.0	3.	6.9963E+10	.4222	683.6	4.4962E+06
12	5.9735E+05	.0385	10.0	289.8	2.	6.9843E+10	.2281	244.0	5.6059E+05
13	8.6036E+05	1.2629	10.0	749.6	3.	6.8833E+10	.2077	678.4	1.0859E+06
14	1.1879E+06	1.5205	10.0	1427.3	4.	6.8650E+10	.1939	1327.5	1.8062E+06
15	1.4517E+05	2.1077	10.0	2324.3	5.	6.8901E+10	.2096	2198.5	3.0593E+06
16	1.6242E+05	1.0239	1.7	314.5	2.	6.9963E+10	.3325	244.2	9.8566E+05
17	1.8074E+06	1.4514	1.7	816.3	3.	6.9086E+10	.3564	679.6	2.3382E+06
18	4.4606E+06	2.3178	1.7	1493.1	4.	6.8992E+10	.3729	1329.9	3.8082E+06
19	2.5586E+05	.8840	-9.4	987.8	3.	6.9591E+10	.1284	682.1	6.0656E+06
20	3.8580E+05	1.0389	23.9	263.3	2.	6.9333E+10	.0931	273.1	2.2618E+05
21	6.2514E+05	.9049	23.9	705.8	3.	6.8213E+10	.0691	676.2	4.0079E+05
22	9.6942E+05	.8218	23.3	1359.6	4.	6.8771E+10	.0688	1323.3	5.6572E+05
23	1.4232E+05	.7490	23.9	2259.4	5.	6.8771E+10	.0688	242.1	1.0660E+05
24	2.3044E+05	.7731	38.9	252.9	2.	6.7902E+10	.0314	673.7	1.7810E+05
25	4.0784E+05	.5987	38.9	689.6	3.	6.7775E+10	.0258	1319.0	2.4416E+05
26	6.5456E+05	.5061	38.9	1346.2	4.	6.7008E+10	.0422	2182.5	3.3134E+05
27	1.0216E+05	.6081	51.1	225.6	5.	6.8273E+10	.0422	241.3	6.2124E+04
28	1.6520E+05	.6062	51.1	481.7	3.	6.7467E+10	.0258	671.6	1.0015E+05
29	3.2672E+05	.4322	51.1	1334.3	4.	6.7280E+10	.0186	1314.2	1.4120E+05
30	5.4316E+05	.3510	51.1	2288.9	5.	6.7456E+10	.0152	2175.5	1.9132E+05
31	6.9394E+04	.5218	67.2	244.9	3.	6.7770E+10	.0257	240.4	3.6210E+04
32	1.2734E+05	.4499	66.7	675.9	4.	6.6972E+10	.0151	669.1	5.7293E+04
33	2.4956E+05	.3245	66.7	1323.9	5.	6.6911E+10	.0109	1310.6	8.0922E+04
34	4.5263E+05	.1582	-46.1	2194.0	2.	7.2003E+10	.0056	247.8	1.5566E+07
35	2.4050E+06	1.2404	-46.1	391.4	3.	7.0331E+10	.0088	2168.5	1.0881E+05
36	2.4050E+06	1.3725	-9.4	391.4	4.	7.0221E+10	.3426	244.7	3.2974E+06



Polymeric Material Characterization Test

Test No. 78-2

Beam Nos. Not and Recorded

Date 1/3/78

Damping Material 3M ISD 830

Material Thickness 0.152 cm Material Density 0.965 g/cc

Beam Thickness 0.1524 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -59.4 °C and 40.6 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor η_D :

Peak 100 Hz η_D 1.6 Temperature -61.1 °C

1000 Hz η_D 1.6 Temperature -33.33 °C

Range 100 Hz -62.2 °C -48.33 °C

1000 Hz -42.78 °C -17.78 °C

$$\text{LOG}(M) = \text{LOG}(ML) + (2\text{LOG}(MROM/ML)) / (1 + (FROM/FR)^{2N})$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
-15.0	1.2000E+04	2.0000E+07	.500	4.0000E+05

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL+SH)A + (SL-SH)(1-\text{SQRT}(1+A^2))) / C / 2$$

T0	ETA FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5
-15.0	1.660	.450	-.900	8.0000E+03	.500

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T-T0) / (525 + 1.8(T-T0))$$

Remarks: Heat soak - ten minutes at 350°F (180°C)

Test No. 78-2
Beam No. Not Recorded

°F	f _C	f _n	f _L	f _R	Δf	η _s	ldb
Temp. Node							
-75	2	525.0	243.6	524.0	526.0	2.00	0.00381
-75	3	1457.0	683.3	1455.0	1458.0	3.00	0.00206
-75	4	2779.0	1336.7	2772.0	2784.0	12.00	0.00432
-75	5	4431.0	2204.4	4421.0	4443.0	22.00	0.00497
-75	6	6621.0	3282.8	6598.0	6642.0	44.00	0.00665
-75	7	8860.0	4586.6		8895.0	70.00	0.00790
-55	2	519.0	243.0	516.0	522.0	6.00	0.0116
-55	3	1436.0	711.4	1427.0	1445.0	8.00	0.0125
-55	4	2718.0	1363.7	2689.0	2745.0	56.00	0.0206
-55	5	4294.0	2201.0	4242.0	4347.0	105.00	0.0245
-55	6	6416.0	3278.6	6341.0	6502.0	161.00	0.0251
-55	7	8525.0	4581.6		8657.0	264.00	0.0310
-29	2	478.0	242.4	439.0	524.0	85.00	0.1807
-29	3	1329.0	680.2	1225.0	1451.0	226.00	0.1726
-29	4	2423.0	1331.0	2129.0	2719.0	590.00	0.2511
-29	5	3713.0	2196.2	3479.0	3948.0	922.05	0.2480 X
-29	6	5596.0	3272.6	5316.0	6209.0	1755.64	0.3137 X
-29	7	7107.0	4573.7	6689.0	7686.0	1960.10	0.2758 X
-4	2	351.0	241.7	313.0		76.00	0.2219
-4	3	959.0	678.1	803.0		212.00	0.3441

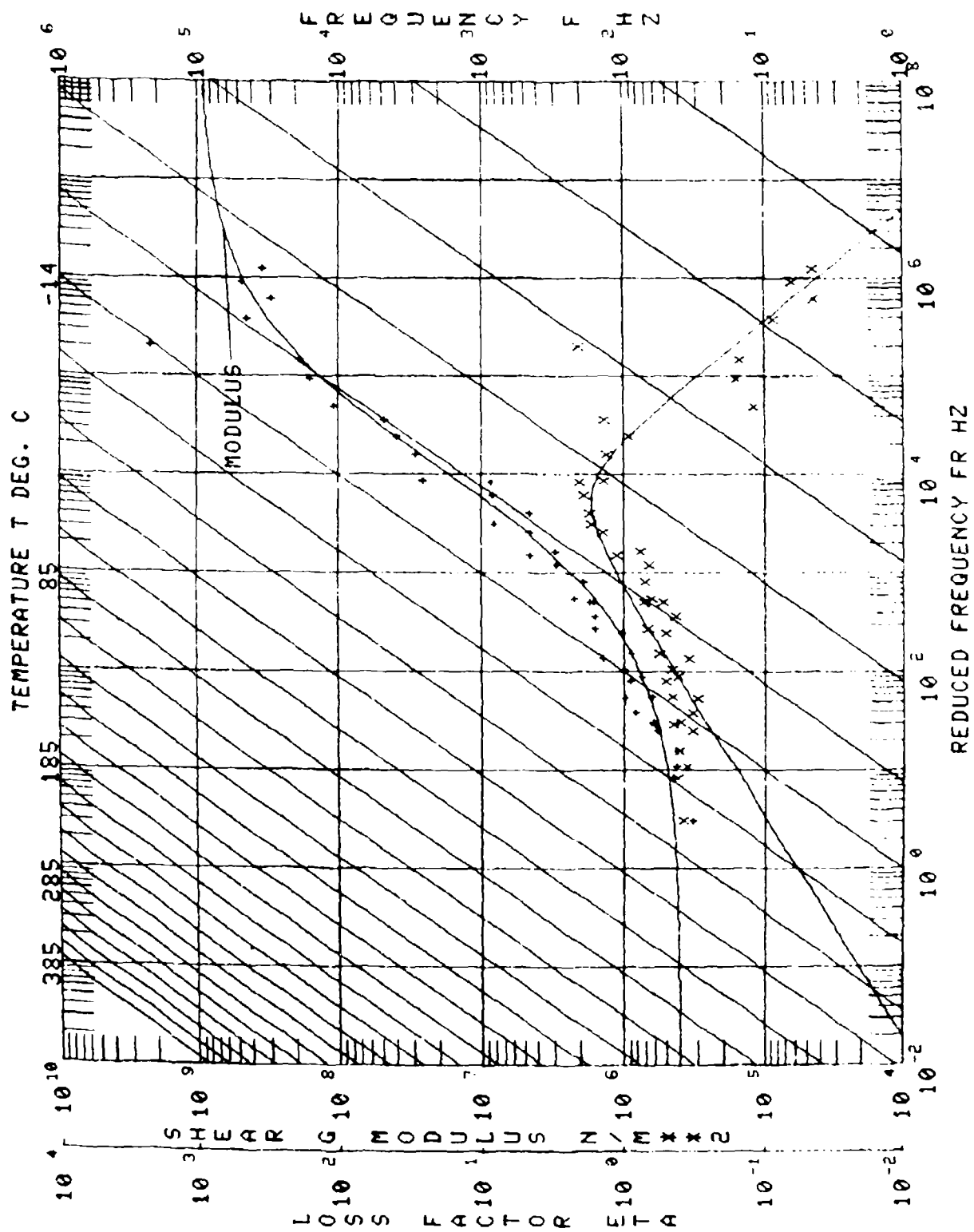
°F	Temp. Node	f_c	f_n	f_L	f_R	Δf	η_s	ldb
-4	4	1667.0	1327.4	1519.0	1831.0	613.39	0.3680	X
-4	5	2556.0	2191.0	2322.0	2785.0	910.26	0.3561	X
-4	6	3972.0	3266.1	3538.0	4395.0	1684.86	0.4242	X
-4	7	5296.0	4565.7	4735.0	5774.0	2042.67	0.3857	X
25	2	301.0	240.7	281.0	324.0	43.00	0.1443	
25	3	782.0	675.5	722.0	845.0	123.00	0.1593	
25	4	1434.0	1322.7	1357.0	1515.0	158.00	0.1109	
25	5	2311.0	2184.0	2211.0	2405.0	194.00	0.0842	
25	6	3454.0	3257.7	3327.0	3607.0	280.00	0.0813	
25	7	4750.0	4553.6	4579.0	4923.0	344.00	0.0726	
50	2	280.0	230.8	266.0	294.0	28.00	0.1005	
50	3	734.0	673.0	702.0	764.0	62.00	0.0848	
50	4	1376.0	1318.7	1339.0	1414.0	75.00	0.0546	
50	5	2241.0	2177.6	2199.0	2282.0	83.00	0.0371	
50	6	3357.0	3249.7	3313.0	3420.0	107.00	0.0319	
50	7	4640.0	4542.4	4566.0	4711.0	145.00	0.0313	
73	2	268.0	239.0	259.0	279.0	20.00	0.0748	
73	3	712.0	670.6	692.0	732.0	36.00	0.0563	
73	4	1353.0	1314.2	1329.0	1374.0	45.00	0.0333	
73	5	2212.0	2171.0	2187.0	2236.0	49.00	0.0222	

Beam No. Not Recorded

05

EXPERIMENTAL CODE : 23
 MATERIAL : ISD 830
 DATA SOURCES
 MANUFACTURER : NONE
 AFML SANDWICH BLOCK
 OTHER : NONE

NO.	MODULUS N/MM2	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.	BEAM MOD. N/MM2	COMPOSITE LOSS	BEAM FREQ. HZ	COMPLEX MOD. N/MM2
1	4.4702E+05	.3749	22.8	268.0	2.	6.5933E+10	.0748	239.0	1.6761E+05
2	6.55513E+05	.4710	22.8	135.0	4.	6.7282E+10	.0333	1314.2	3.08725E+05
3	7.72306E+05	.4255	22.8	2212.0	5.	6.71910E+10	.0222	2171.0	3.28688E+05
4	1.44522E+05	.3574	22.8	3321.0	6.	6.72343E+10	.0229	3238.1	5.16587E+05
5	6.40188E+05	.4095	10.0	200.0	2.	6.74427E+10	.0848	239.8	2.62163E+05
6	9.28755E+05	.5261	10.0	774.0	3.	6.75522E+10	.0546	673.0	4.88674E+05
7	1.04444E+06	.5846	10.0	1316.0	4.	6.77436E+10	.0371	1318.7	5.32250E+05
8	1.07526E+06	.5306	10.0	2241.0	5.	6.76091E+10	.0319	2259.7	5.70588E+05
9	1.65145E+06	.4475	10.0	3337.0	6.	6.81343E+10	.0313	3259.7	7.38947E+05
10	1.77506E+06	.5522	10.0	4640.0	7.	6.75681E+10	.1443	4542.4	9.80223E+05
11	1.03211E+06	.4781	-3.9	301.0	2.	6.79449E+10	.1593	240.7	4.93424E+05
12	1.64539E+06	.6916	-3.9	782.0	3.	6.85955E+10	.1109	675.5	1.13800E+06
13	1.67761E+06	.7353	-3.9	1434.0	4.	6.85552E+10	.0842	1322.7	1.23359E+06
14	1.94983E+06	.7309	-3.9	2311.0	5.	6.79581E+10	.0813	2184.0	1.42517E+06
15	3.1372E+06	.6859	-3.9	3447.0	6.	6.86507E+10	.0726	3257.7	2.06704E+06
16	3.10267E+06	.7876	-3.9	4750.0	7.	6.79017E+10	.219	4553.6	2.44353E+06
17	2.26988E+06	.6598	-20.0	351.0	2.	6.81570E+10	.1741	241.7	1.49763E+06
18	4.73631E+06	1.1578	-30.0	959.0	3.	6.8050E+10	.1807	678.1	5.48367E+06
19	8.56034E+06	1.7516	-33.9	1478.0	3.	6.89131E+10	.1726	1336.7	1.49940E+07
20	2.65435E+07	1.4288	-33.9	1329.0	3.	6.92127E+10	.2511	680.2	3.79265E+07
21	3.02145E+07	1.3550	-33.9	2423.0	4.	6.90132E+10	.0125	1331.0	4.09395E+07
22	1.08855E+08	1.236	-48.3	1460.0	3.	7.5077E+10	.0206	711.4	1.35743E+07
23	1.62337E+08	1.694	-48.3	2780.0	4.	7.24450E+10	.0021	1363.7	2.75009E+07
24	2.31966E+09	2.1221	-59.4	1470.0	3.	6.98450E+10	.0043	1336.7	4.92524E+07
25	4.47595E+08	.0872	-59.4	1479.0	4.	6.96056E+10	.0050	1336.7	3.90502E+07
26	2.39309E+08	.0459	-59.4	2779.0	5.	6.92743E+10	.0066	2204.4	3.11550E+07
27	4.81044E+08	.0648	-59.4	6621.0	6.	6.91034E+10	.0079	3282.8	1.65019E+07
28	5.5328E+08	.0467	-59.4	8800.0	7.	6.88954E+10	.0655	4586.0	1.33200E+05
29	3.70190E+05	.3939	40.6	200.0	2.	6.65627E+10	.0416	237.7	2.0420E+05
30	7.5323E+05	.4334	40.6	697.0	3.	6.65024E+10	.0210	667.1	1.86666E+05
31	4.38828E+05	.4240	40.6	1332.0	4.	6.6710E+10	.0142	1309.2	2.04789E+05
32	8.55319E+05	.3357	40.6	2100.0	5.	6.65734E+10	.0135	2161.0	2.90304E+05
33	1.00162E+06	.3117	40.6	3280.0	6.	6.6611E+10	.0105	3229.1	3.1216E+05
34	6.3710E+05	.4621	22.8	454.0	7.	6.6777E+10	.0563	4514.4	2.9434E+05
35	1.88300E+08	1.589	-48.3	4240.0	7.	6.72228E+10	.0245	670.6	2.9925E+07
36	4.68500E+06	1.7810	-20.0	2550.0	5.	6.9608E+10	.1561	2201.0	8.3428E+06
37	8.60761E+06	1.5807	-20.0	3972.0	5.	6.87347E+10	.1242	3191.0	3.7428E+06
38	8.85295E+06	2.0740	-20.0	5260.0	6.	6.84021E+10	.2857	3266.1	1.7040E+07
39	4.02658E+07	1.9506	-20.0	3718.0	7.	6.8631E+10	.2480	4565.7	1.83615E+07
40	4.99233E+07	1.4125	-20.0	5556.0	5.	6.85599E+10	.3137	2196.2	7.8278E+07
41	4.7485E+06	1.4480	-20.0	1667.0	6.	6.8646E+10	.3680	3272.6	7.0510E+07
42					4.	6.85604E+10		1327.4	6.8755E+06



Polymeric Material Characterization Test

Test No. 79-6

Beam Nos. 080E and 080G

Date 8/79

Damping Material Enjay Butyl 268

Material Thickness 0.0381 cm Material Density 1.187 g/cc

Beam Thickness 0.2032 cm Beam Density 2.795 g/cc

Beam Length 17.78 cm

Temperature Test Range: Between -45.6 °C and 65.6 °C

Frequency Test Range: Between 10 Hz and 10 KHz

Loss Factor r_D :

Peak 100 Hz r_D 1.7 Temperature -20.6 °C

1000 Hz r_D 1.7 Temperature -1.1 °C

Range 100 Hz -37.2 °C -6.7 °C

1000 Hz -17.8 °C 15.6 °C

$$\text{LOG}(N) \cdot \text{LOG}(ML) + (2 \text{LOG}(MROM/ML)) / (1 + (FROM/FR) \cdot 2N)$$

T0	FROM	MROM	N	ML
	A1	A2	A3	A4
10.0	9.1000E+03	3.2000E+07	.320	4.4000E+05

$$A = (\text{LOG}(FR) - \text{LOG}(FROL)) / C$$

$$\text{LOG}(\text{ETA}) = \text{LOG}(\text{ETA}FROL) + ((SL + SH)A + (SL - SH)(1 - \text{SQRT}(1 + A^2))) / C / 2$$

T0	ETA	FROL	SL	SH	FROL	C
	B1	B2	B3	B4	B5	B6
10.0	1.700	.560	-.510	2.8000E+03	1.050	

$$\text{LOG}(FR) = \text{LOG}(F) - 12(T - T0) / (525 / 1.8 + T - T0)$$

Remarks: Loctite 404 was the only adhesive found that adequately
adhered the material to the beam.

1dB

°F	Temp. Mode	f _C	f _n	f _L	f _R	Δf	η _S	
-52	2	742.40	331.17	739.90	745.00	5.10	0.0069	
-51	3	2017.50	922.99	2009.30	2025.90	16.60	0.0082	
-50	4	3864.70	1801.44	3839.40	3887.60	48.20	0.0125	
-24	2	718.40	329.85	700.60	741.30	40.70	0.0566	
-24	3	1947.90	919.28	1865.10	2021.30	156.20	0.0802	
-23	4	3690.50	1795.39	3525.90	3841.60	315.70	0.0855	
0	2	672.00	328.53	630.50	722.90	92.40	0.1373	
0	3	1770.50	916.82	1598.60	1921.20	322.60	0.1822	
0	4	3267.70	1789.35	3041.90	3455.00	812.10	0.2485	X
25	2	586.30	327.43	487.30	694.50	207.20	0.3534	
25	2	586.30		534.80	636.70	200.30	0.3416	X
25	3	1483.00	913.73	1181.80	1746.60	564.80	0.3808	
25	3	1483.00		1340.50	1614.80	539.30	0.3636	X
35	2	511.10	326.98	429.00	659.50	230.50	0.4510	
35	3	1350.10	911.88	1007.60	1624.60	617.00	0.4570	
40	2	455.90	326.10	381.40	566.40	185.00	0.4058	
49	3	1170.40	910.02	870.20	1408.90	538.70	0.4603	
62	2	414.40	325.66	356.80	493.00	136.20	0.3287	
62	3	1063.90	908.80	879.10	1250.30	371.20	0.3489	
62	4	1966.90	1774.84	1787.60	2107.50	628.90	0.3197	X

°F f_c f_n f_L f_R Δf n_s l_{dB}

Temp.	Mode	f_c	f_n	f_L	f_R	Δf	n_s	l_{dB}
62	5	3154.30	2929.95	2876.70	3365.90	961.80	0.3049	X
74	2	387.60	324.78	343.70	442.60	98.90	0.2552	
74	3	1003.80	906.95	885.00	1121.30	236.30	0.2354	
74	4	1857.50	1771.21	1799.50	1987.50	369.60	0.1948	X
74	5	3092.60	2923.95	2718.80	3320.80	602.00	0.1946	
100	2	356.90	323.46	333.00	384.20	51.20	0.1434	
100	3	946.10	903.24	893.60	998.50	104.90	0.1109	
100	4	1824.00	1764.56	1743.00	1900.00	157.00	0.0861	
100	5	2989.20	2911.96	2871.50	3093.70	222.20	0.0744	
99	6	4414.50	4332.10	4180.00	4530.40	350.40	0.0794	
99	7	6229.00	6046.35	6070.60	6467.30	396.70	0.0637	
124	2	342.90	322.14	330.50	355.60	25.10	0.0732	
124	3	924.20	900.16	897.60	947.00	49.40	0.0534	
124	4	1790.30	1757.91	1752.50	1827.50	75.00	0.0419	
124	5	2948.60	2897.97	2889.50	2996.90	107.40	0.0364	
123	6	4572.80	4314.19	4545.90	4587.80	41.90	0.0092	
123	7	6103.20	6021.35	6036.90	6211.60	174.17	0.0286	
149	2	336.70	320.81	329.60	345.60	16.00	0.0475	
149	3	911.50	899.07	897.40	926.50	29.10	0.0319	
149	4	1772.70	1750.66	1752.30	1793.10	40.80	0.0230	

[illegible]

EXPERIMENTAL CODE 1135
 MATERIAL BUTYL 268
 DATA SOURCES
 MANUFACTURER IENJAY BUTYL
 APRIL 1971 SANDWICH BEAM
 OTHER NONE

NO.	MODULUS N/MI12	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO	BEAM MOD. N/MI12	COMPOSITE LOSS FAC.	BEAM FREQ. HZ	COMPLEX MOD. N/MI12
1	6.49055E+05	.3893	65.0	336.7	2.	6.78977E+10	.0475	339.8	2.5263E+05
2	9.02717E+05	.4752	65.0	911.5	3.	6.7154E+10	.0319	897.1	4.2835E+05
3	1.57857E+06	.3768	65.0	1772.7	4.	6.71587E+10	.0230	1750.7	5.9482E+05
4	2.47842E+06	.3063	65.0	2918.3	5.	6.67883E+10	.0232	2886.0	9.82287E+05
5	3.76675E+06	.2645	64.4	4347.1	6.	6.65761E+10	.0158	4206.3	9.96187E+05
6	4.98001E+06	.2597	64.4	6058.1	7.	6.62313E+10	.0148	5986.3	1.29310E+06
7	8.03875E+06	.5104	51.1	924.9	2.	6.84619E+10	.0732	322.1	4.10270E+05
8	1.18842E+06	.6281	51.1	1790.3	4.	6.77162E+10	.0419	1757.9	1.1173E+06
9	3.02293E+06	.5896	51.1	2948.6	5.	6.73445E+10	.0364	2898.0	1.58330E+06
10	1.01488E+07	.0655	50.6	4572.8	6.	6.71324E+10	.0092	4314.2	6.75038E+05
11	5.58509E+06	.4556	50.6	6103.2	7.	6.67843E+10	.0286	6021.3	2.54454E+06
12	1.20819E+06	.7517	37.8	356.9	2.	6.96241E+10	.1474	323.5	9.08188E+05
13	1.73617E+06	.9552	37.8	946.1	3.	6.86591E+10	.1109	903.2	1.65839E+06
14	2.66864E+06	.9020	37.8	1824.0	4.	6.82294E+10	.0861	1764.6	2.40792E+06
15	3.78995E+06	.8855	37.8	2989.2	5.	6.78962E+10	.0744	2912.0	3.35595E+06
16	4.64444E+06	1.1193	37.2	4414.5	6.	6.76909E+10	.0794	4332.1	5.19832E+06
17	8.53320E+06	.7035	37.2	6229.0	7.	6.73444E+10	.0637	6046.9	6.00325E+06
18	3.30814E+06	1.2767	23.3	1003.8	3.	6.93152E+10	.2354	906.9	4.21318E+06
19	4.52543E+06	1.3527	23.3	1897.5	4.	6.87447E+10	.1948	1771.2	6.12175E+06
20	6.18889E+06	1.5622	23.3	3092.6	5.	6.85573E+10	.1946	2924.0	9.68391E+06
21	4.54971E+06	1.3309	9.4	455.9	2.	7.01554E+10	.4058	326.1	6.05540E+06
22	7.72821E+06	1.7620	3.4	1170.4	3.	6.95861E+10	.4693	910.0	1.36174E+07
23	1.16313E+07	1.6410	-3.9	586.3	2.	7.07288E+10	.3534	327.4	1.90956E+07
24	2.36110E+07	1.3600	-3.9	1483.0	3.	7.05539E+10	.3808	913.7	3.21114E+07
25	3.10466E+06	1.1050	16.7	414.4	2.	6.95662E+10	.3287	325.7	3.43058E+06
26	4.88618E+06	1.5348	16.7	1063.9	3.	6.94979E+10	.3489	908.8	7.49911E+06
27	6.00999E+06	1.8594	16.7	1966.9	4.	6.90267E+10	.3197	1774.8	1.11750E+07
28	7.12742E+06	2.2492	16.7	3154.3	5.	6.88390E+10	.3049	2930.0	1.60311E+07
29	6.30353E+06	1.7123	1.7	511.1	2.	7.05345E+10	.4510	327.0	1.07932E+07
30	1.45232E+07	1.6380	1.7	1350.1	3.	6.9697E+10	.4570	911.9	2.37887E+07
31	4.42215E+07	.9901	-17.8	672.9	2.	7.12048E+10	.1373	328.5	4.3780E+07
32	7.78744E+07	.8810	-17.8	1770.5	3.	7.07299E+10	.1822	916.8	6.86080E+07
33	9.73455E+07	1.0108	-17.8	3267.7	4.	7.01600E+10	.2485	1789.4	9.83943E+07
34	1.27056E+08	1.0811	-31.1	718.4	2.	7.17782E+10	.0566	329.8	1.37356E+08
35	2.26460E+08	.8253	-31.1	1947.9	3.	7.11100E+10	.0802	919.3	1.86902E+08
36	3.35533E+08	.5892	-30.6	3690.5	4.	7.06313E+10	.0855	1795.4	1.97689E+08
37	3.75466E+08	.5739	-30.6	5856.8	5.	7.05296E+10	.1069	2065.9	2.00415E+08
38	2.58671E+08	8.7214	-46.7	742.4	2.	7.25396E+10	.0069	331.2	2.25588E+09
39	7.99939E+08	1.661	-46.1	2017.5	3.	7.16851E+10	.0062	923.0	1.32806E+08
40	8.79209E+08	.1508	-45.6	3964.7	4.	7.11113E+10	.0125	1891.4	1.32582E+08
41	8.48503E+08	.1146	-45.6	6202.7	5.	7.19156E+10	.0150	2975.9	9.71962E+07
42	2.19610E+06	.5027	23.3	387.6	2.	6.95886E+10	.2552	324.8	2.11420E+06

