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This report contains a detailed discussion of the methods and procedures used to determine the damping properties of commerially 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

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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

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LIST OF ILLUSTRATIONS

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
$f_{ro\ell}$	reduced frequency value of the damping peak
f_{rom}	reduced frequency value of inlfection 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_ℓ	Young's Modulus value of the lower horizontal assymptope
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 assymptotic line for high values of reduced frequency
S_ℓ	slope of assymptotic line for low values of reduced frequency
$n = h_D/h$	thickness ratio (also mode number)

LIST OF SYMBOLS (Concluded)

T	temperature
T_o	reference temperature
Z^2	nondimensional parameter
α_T	temperature shift factor
η	loss factor
η'_D	shear loss factor
$\eta_{fro\ell}$	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
ξ_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 I

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 commerically 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 quantitites 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.

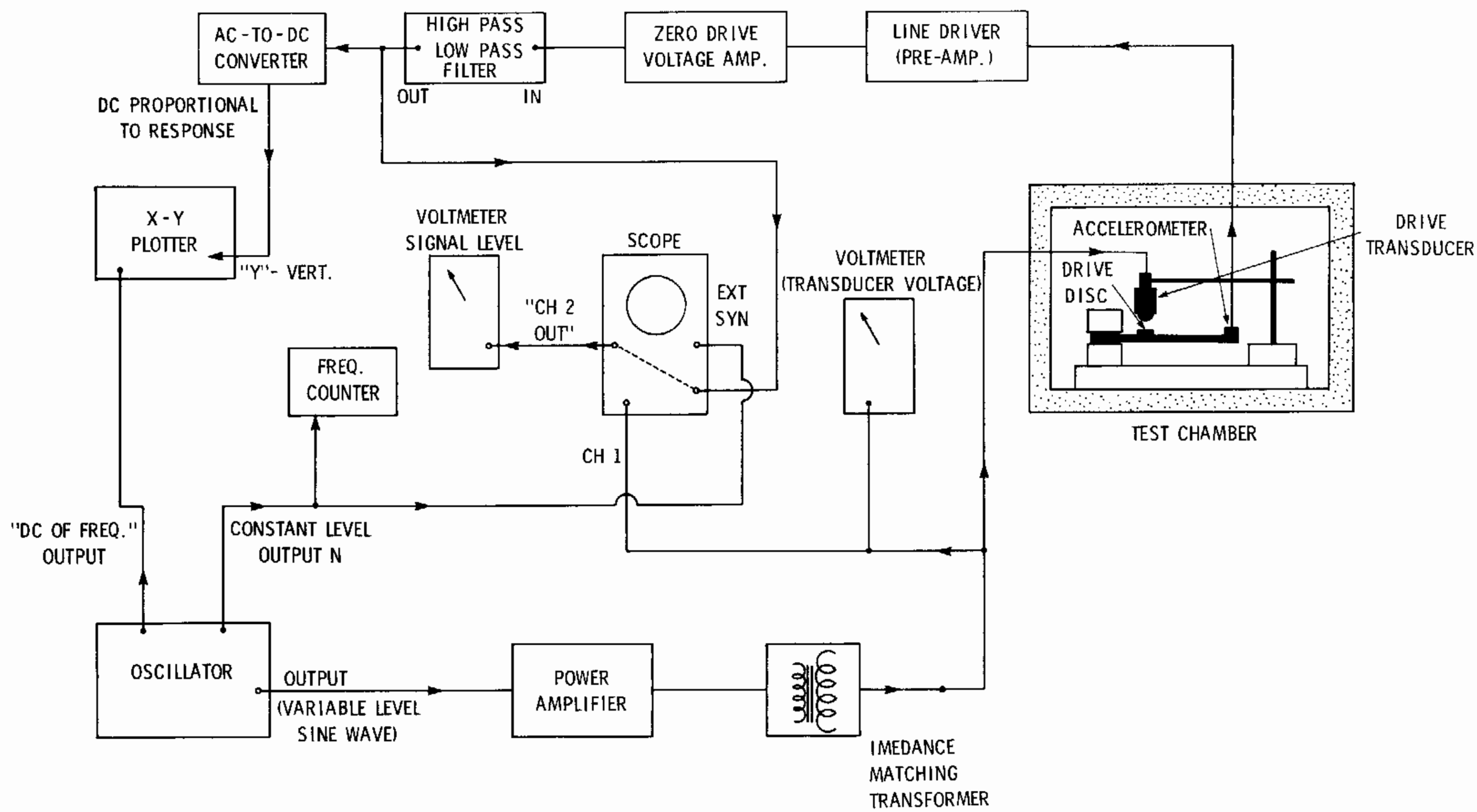

Figure 1. Block Diagram of the Beam Test Fixture.

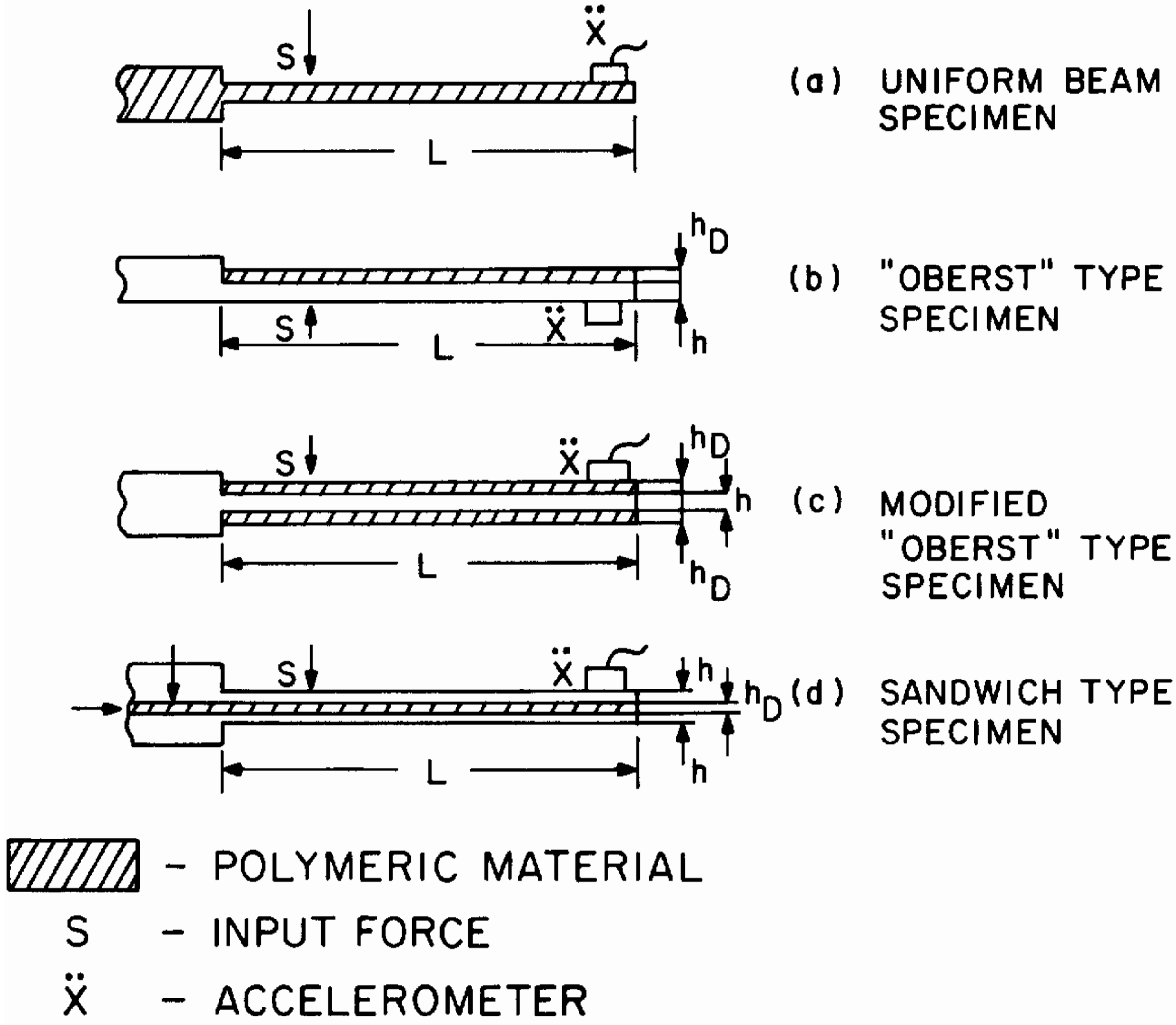

Figure 2. Vibrating Beam Test Specimens.

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/m^2).

(b) The "Oberst" (nonsymmetrical) or modified Oberst (symmetric) beams are used for materials in which $|E_D|$ is between 10^4 lb/in^2 (6.89×10^7 N/m^2) and 10^6 lb/in^2 (6.89×10^9 N/m^2). 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/in^2 (6.89×10^4 N/m^2) and 10^5 lb/in^2 (6.89×10^8 N/m^2). 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:

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

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

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):

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

$$\eta_D = \eta_n Z^2 \ / \ (Z^2 - 1) \tag{4}$$

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:

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

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

$$g^* = \frac{G^*_D \ L^2}{Ehh_D \xi^2_n} \tag{6}$$

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

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

$$\eta'_D = A\,_n/[A - B - 2(A-B)^2 - 2(A\eta_n)^2], \tag{8}$$

where

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

and

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

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:

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

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

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

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	$L = 7$ in $\pm$ 0.002 in (177.8 mm $\pm$ 0.5 mm)
Length of beam root	$\ell = 1.125$ in $\pm$ 1/64 in (28.58 mm $\pm$ 0.40 mm)
Thickness of beam	$h \geq 0.05$ in; $h \leq 0.08$ in; $h \pm 0.0005$ in (1.778 mm $\pm$ 0.018 mm)
Thickness of root	$h_r = 0.25$ in $\pm$ 0.005 in (6.35 mm $\pm$ 0.12 mm)
Breadth of beam	$b = 0.45$ in $\pm$ 0.001 in (11.43 mm $\pm$ 0.03 mm)
Thickness of damping material layer	$h_D > 0.004$ in (0.127 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-inch + 0.0005,

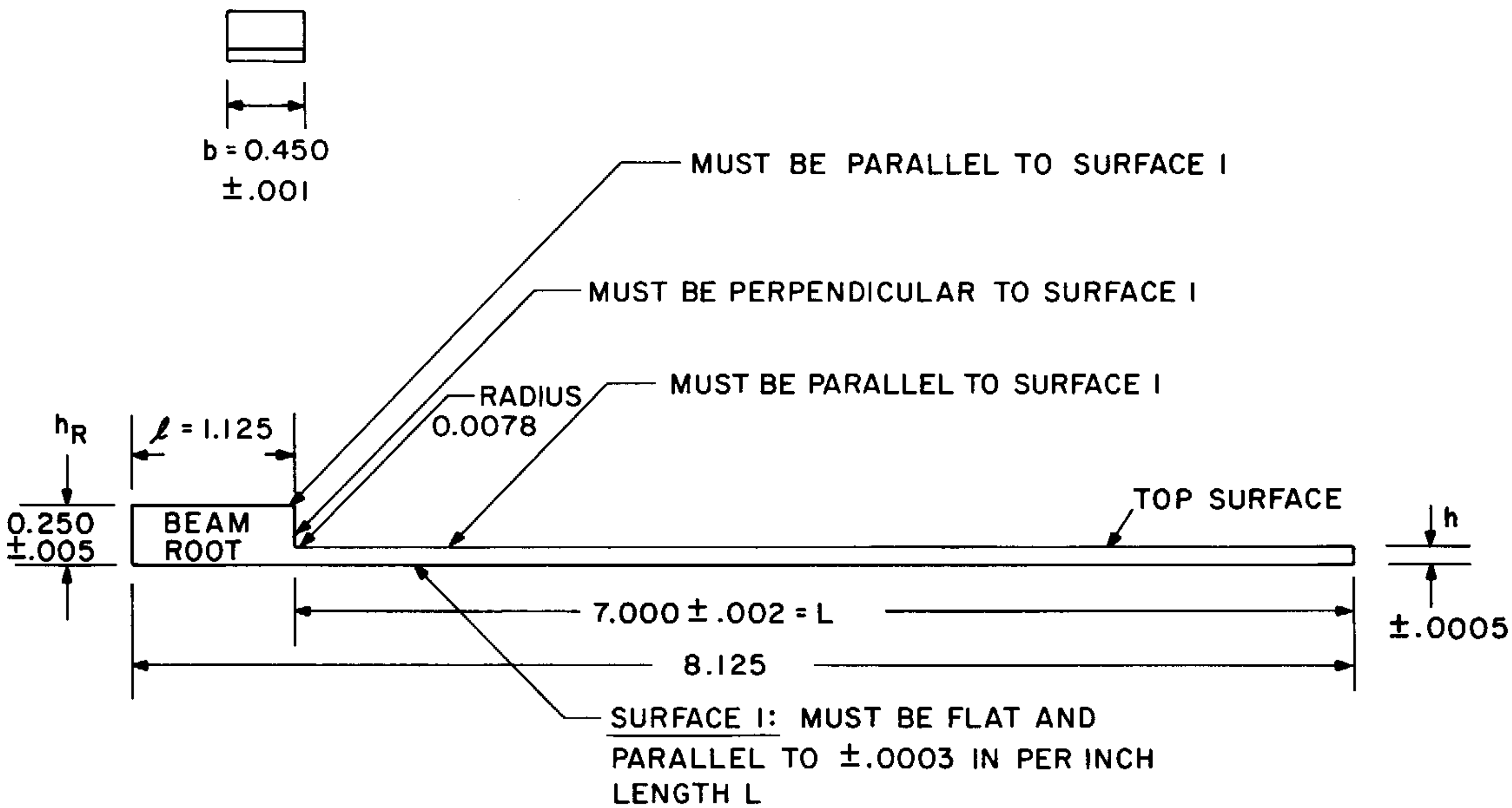

Figure 3. Sandwich Beam Specimen with Recommended Specimen Dimensions.

and a hypothetical Beam 2 had thickness h_2 = 0.070-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_D) 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.

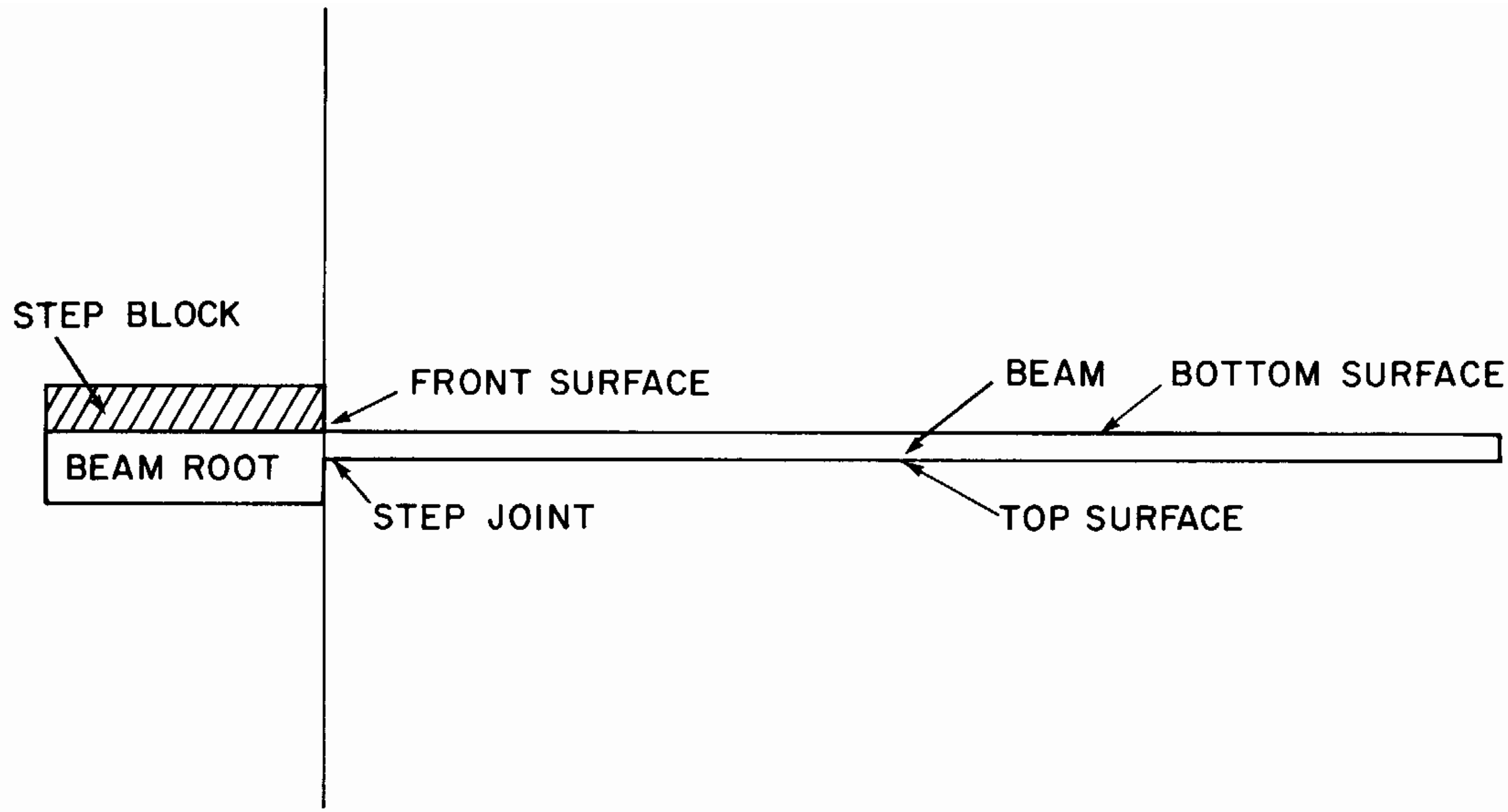

Figure 4. Step Block Orientation.

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°F (-46°C to +108°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 frequecies 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°F (-73°C to +150°C). Take temperatures at intervals of 50°F (28°C).

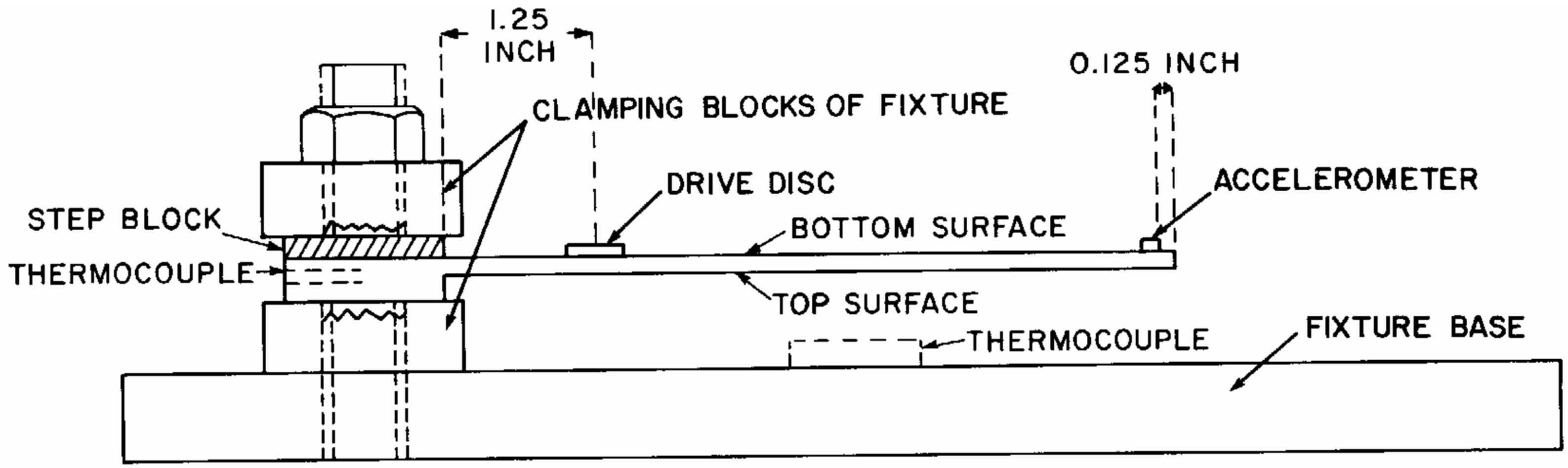

Figure 5. Test Fixture with Beam in Place.

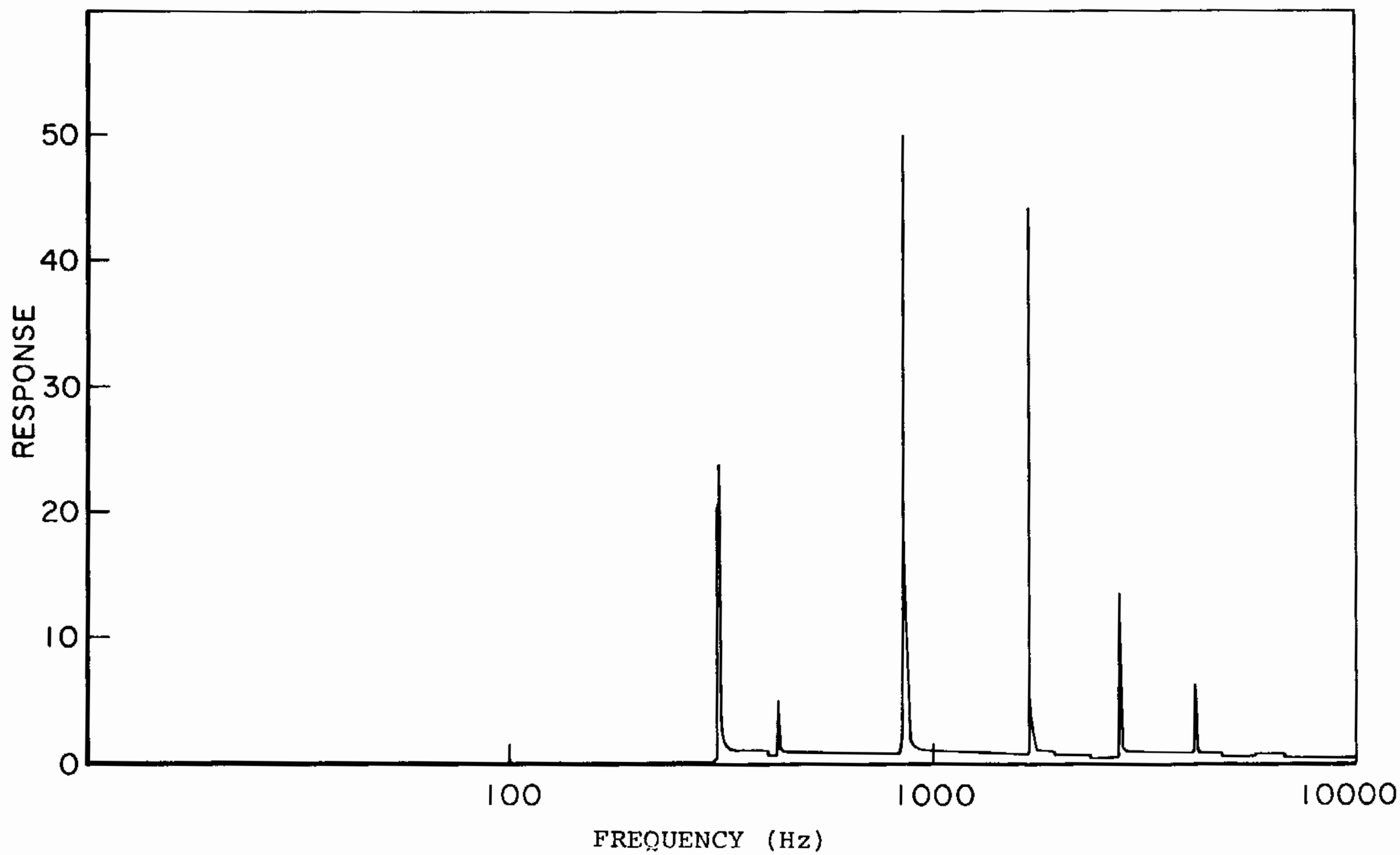

Figure 6. Response Spectra of a Bare Beam.

(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 (A_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,

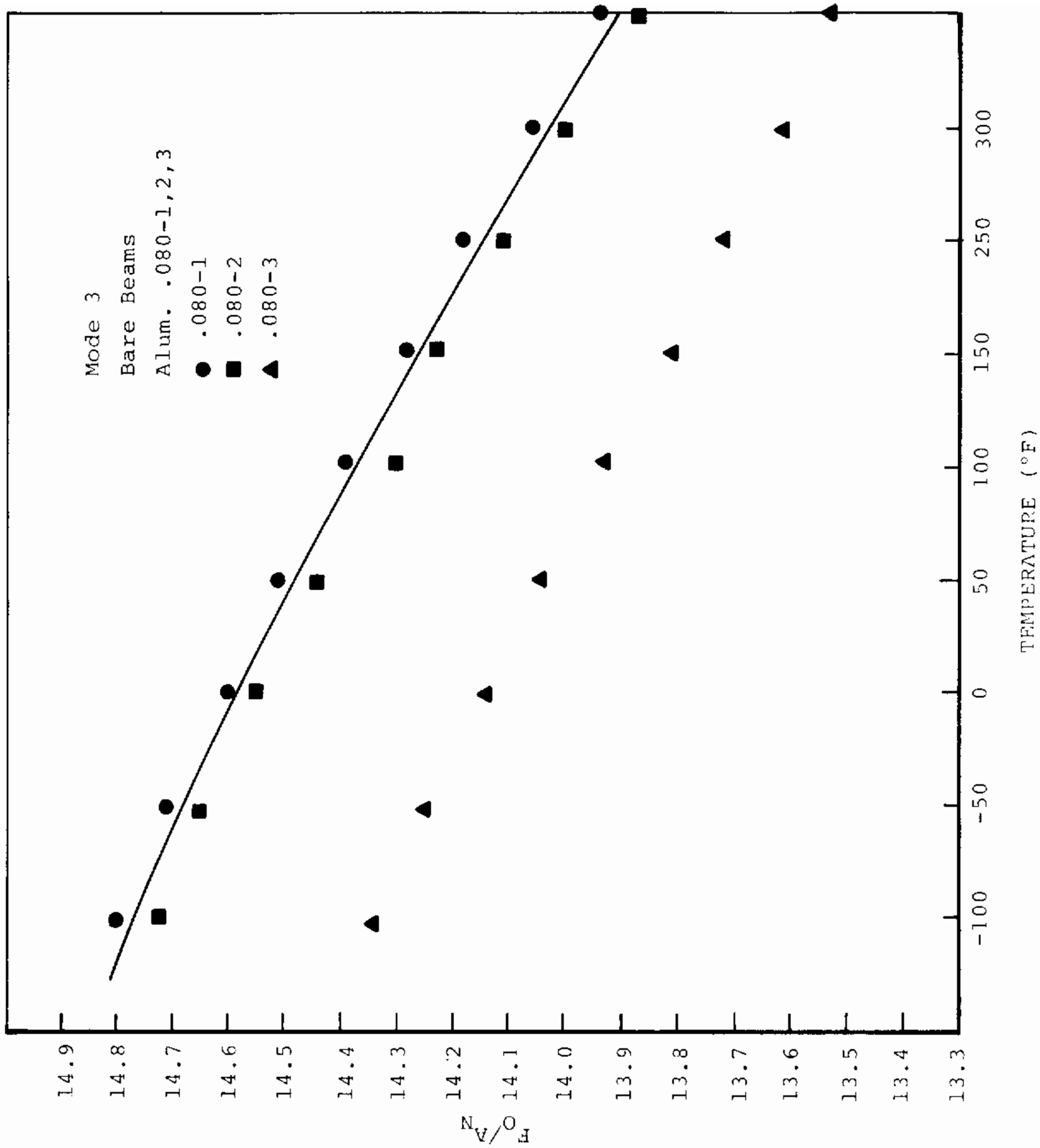

Figure 7. Bare Beam Characteristic Modal Plot for Mode 3.

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.

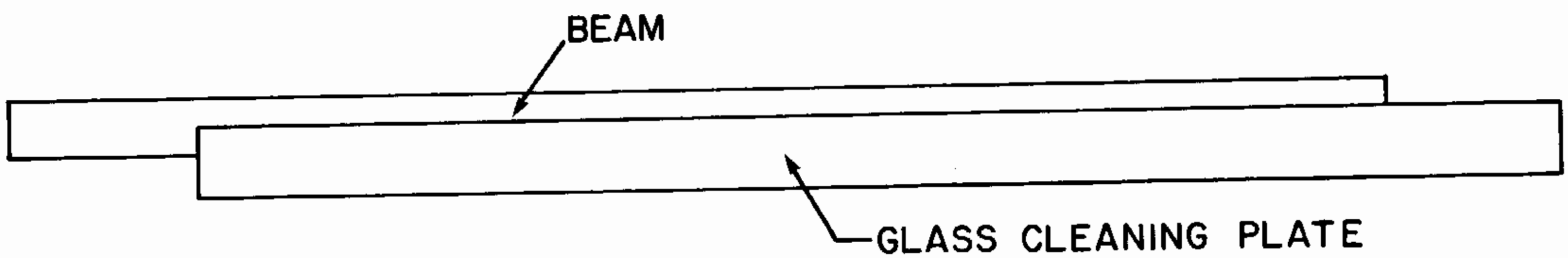

Figure 8. Position of Beam on Glass Plate During Cleaning Procedure.

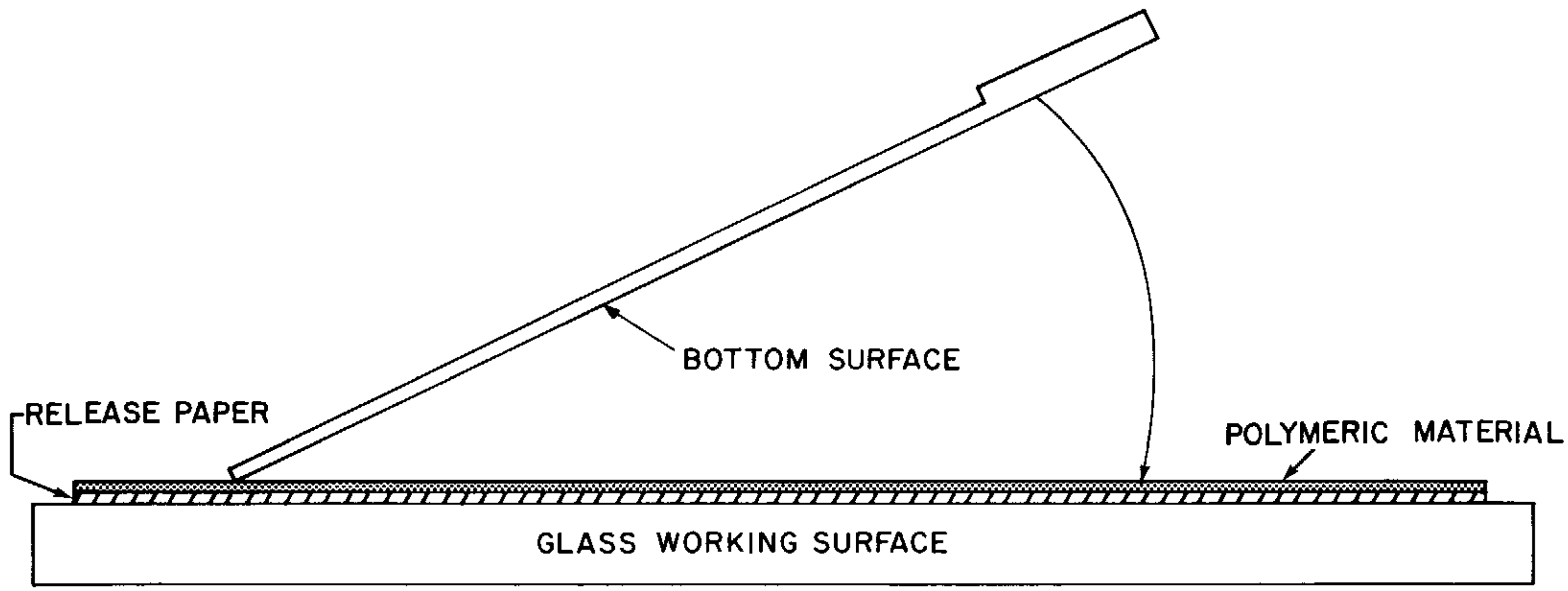

Figure 9. Placement of Beam on Polymeric Material.

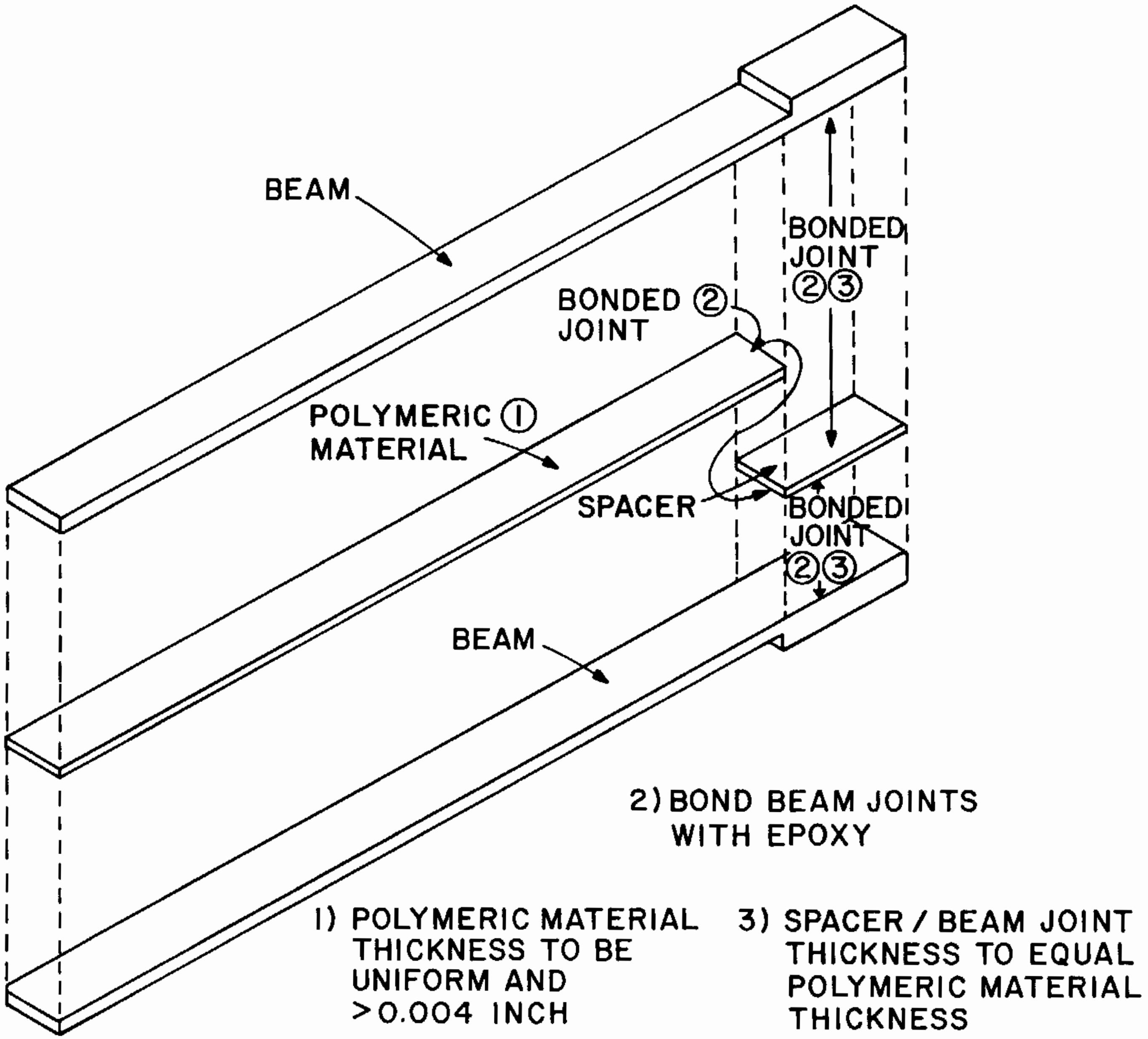

Figure 10. Detailed Assembly Diagram of a Typical Sandwich Beam.

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 papaer 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.

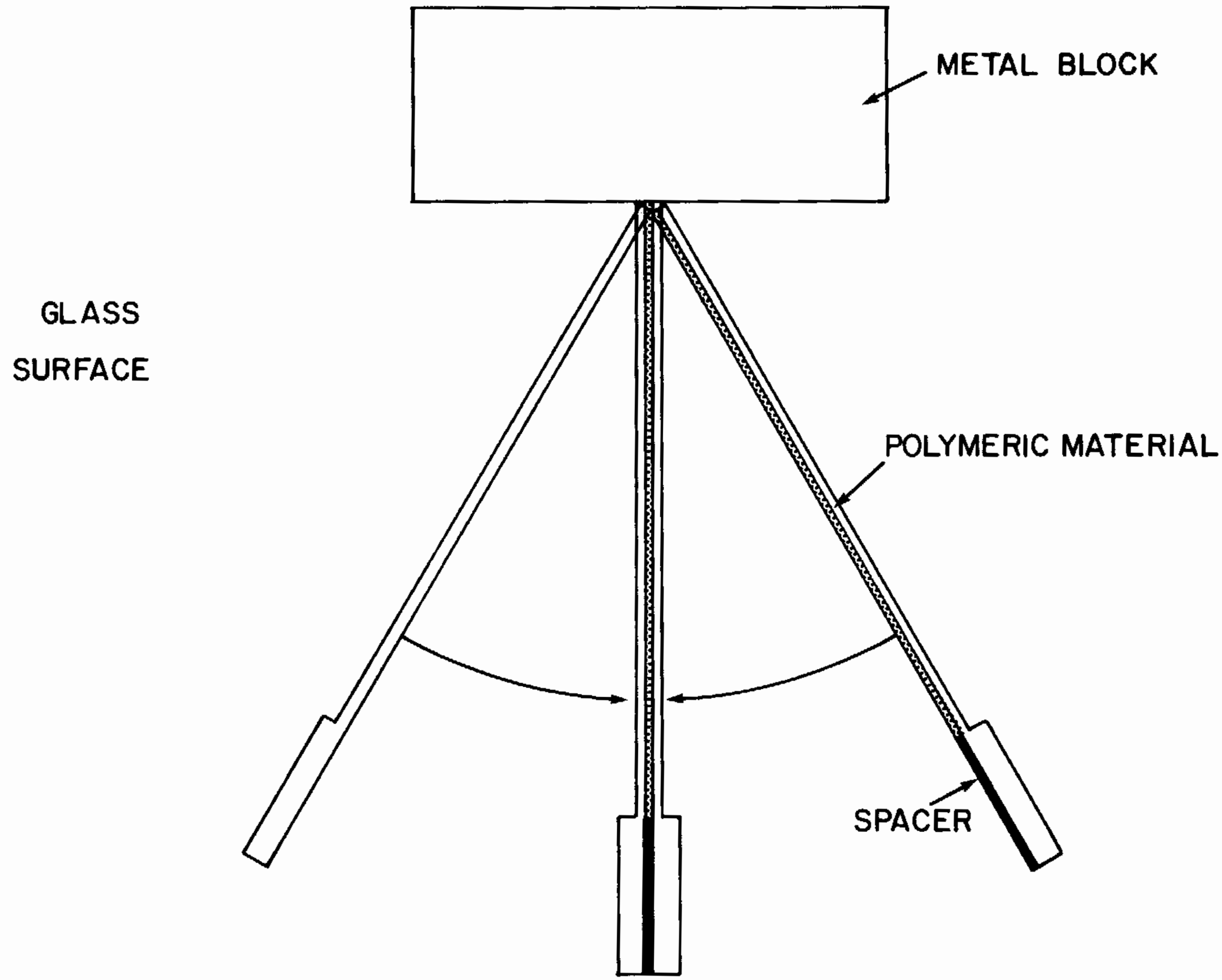

Figure 11. Sandwich Beam Final Assembly Procedure.

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.

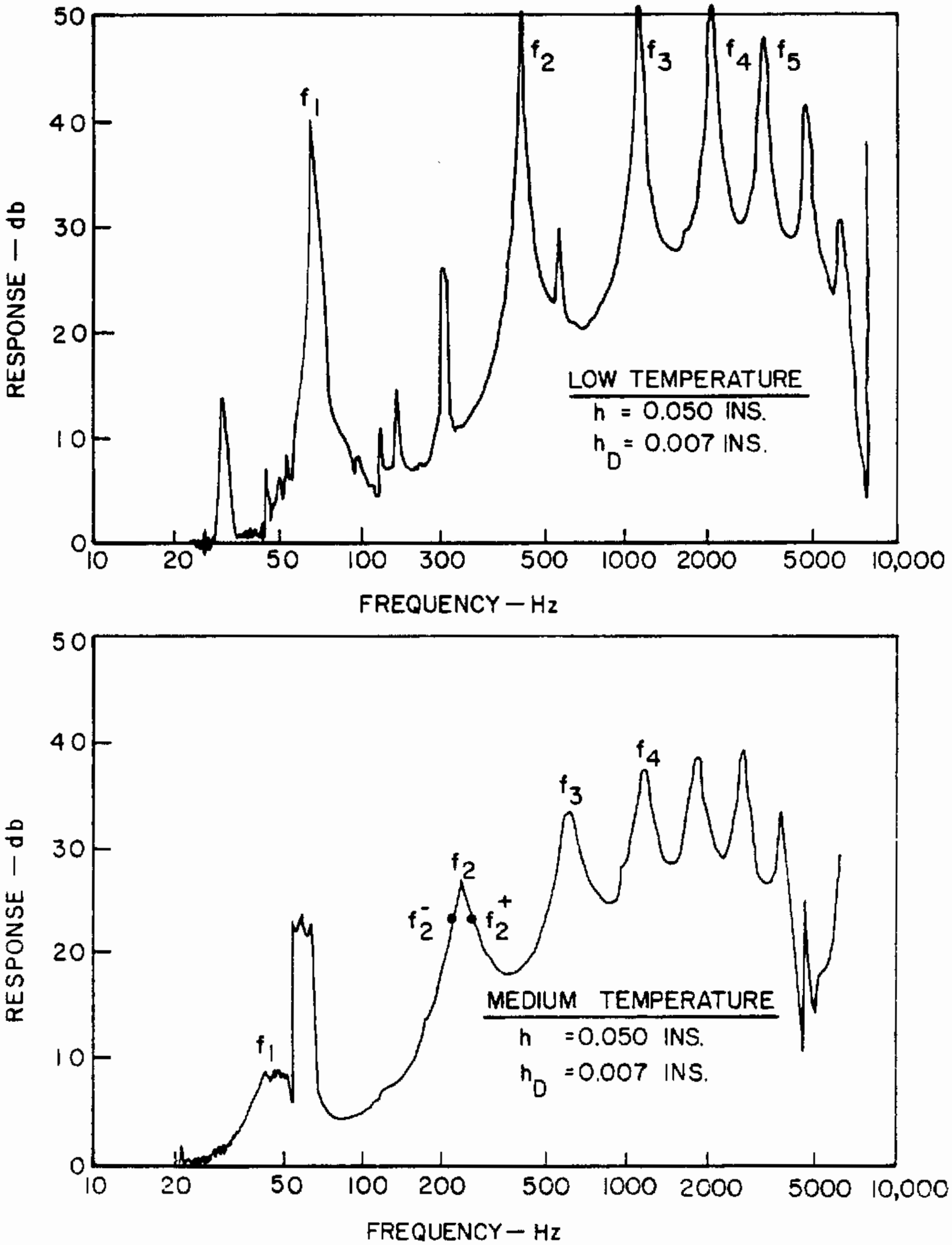

Figure 12. Response Spectra of a Coated Beam.

(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 ± 2°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 η_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:

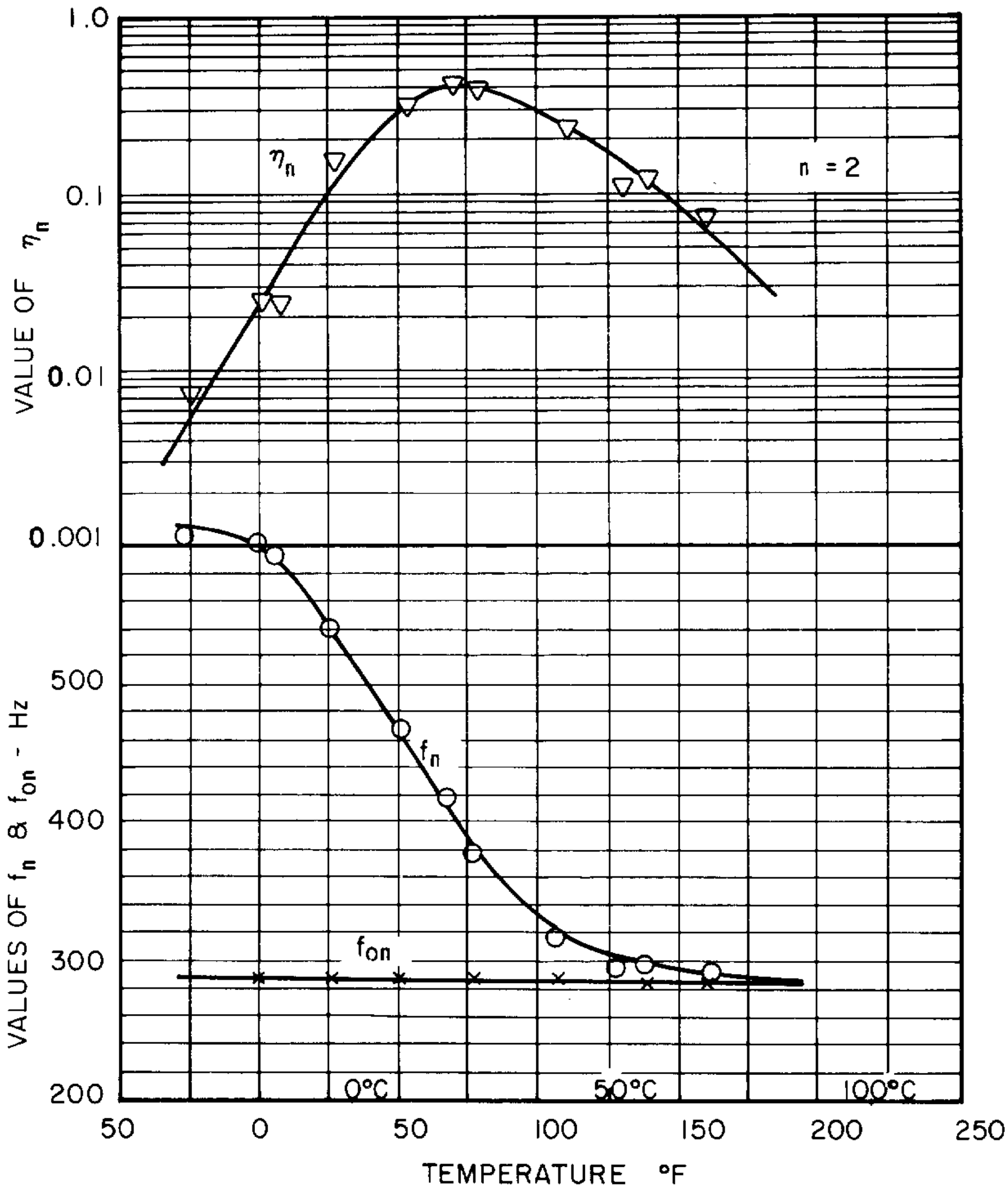

Figure 13. Typical Graphs of η_n, f_n, and f_{on} Versus Temperature.

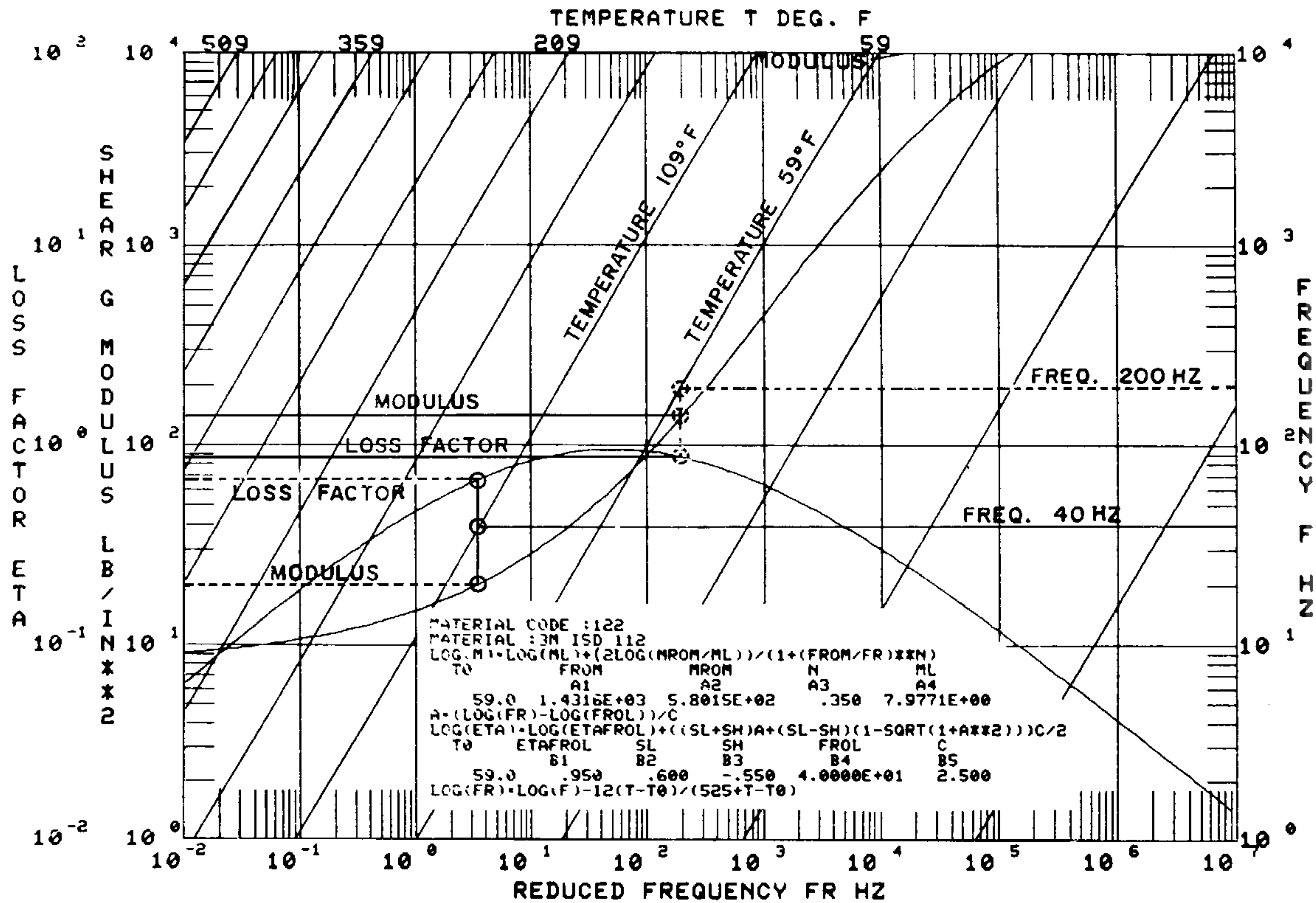

Figure 14. Typical Temperature Nomogram of Polymeric Material Test Data.

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 η (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 η (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

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

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 asymptope of this curve.

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

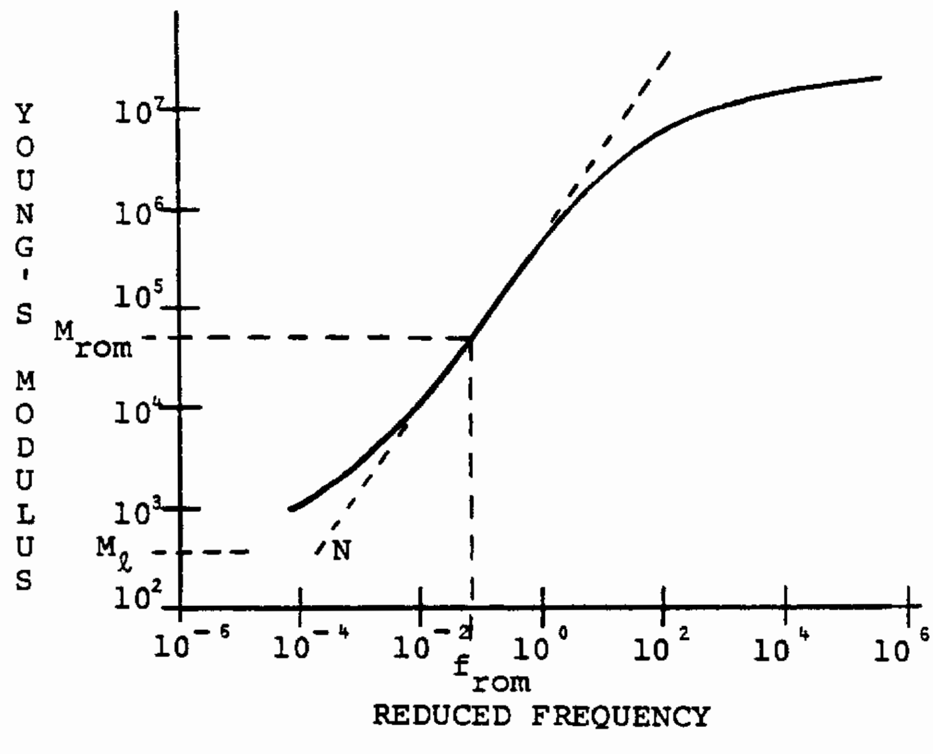

Figure 15. Curve Fit Parameters for Storage Modulus.

Loss Factor

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

where:

η is the loss factor;

f_r is the reduced frequency;

$\eta_{fro\ell}$ 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 $\eta_{fro\ell}$, $f_{ro\ell}$, S_ℓ, S_h, and C.

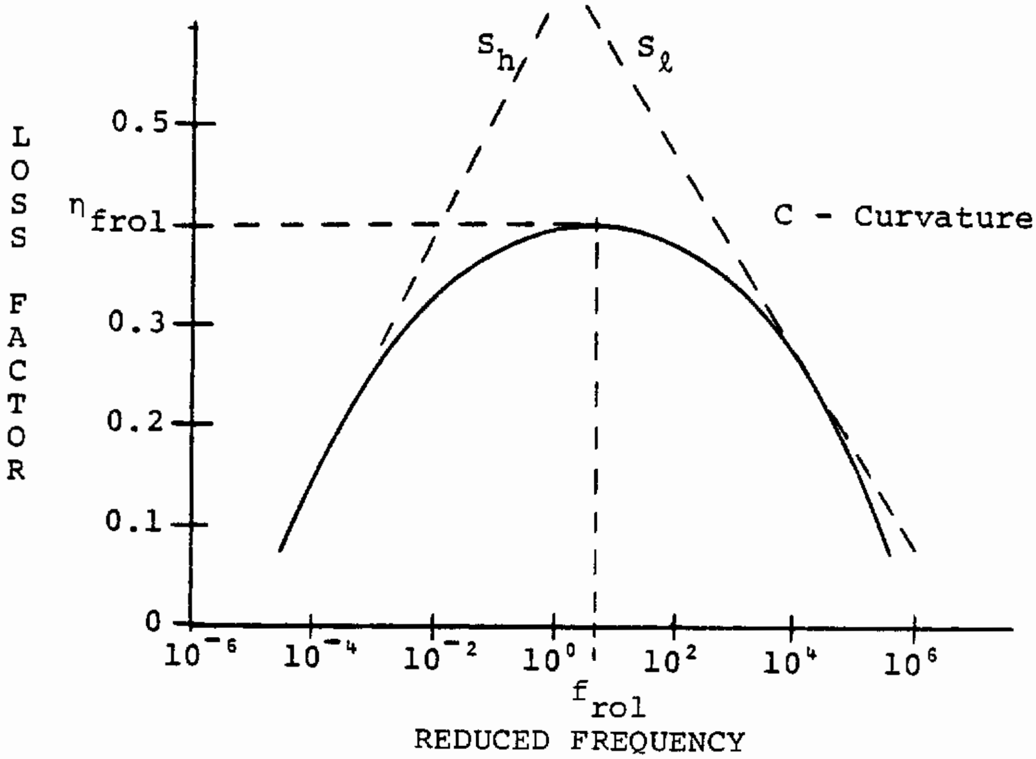

Figure 16. Curve Fit Parameters for Loss Factor.

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.

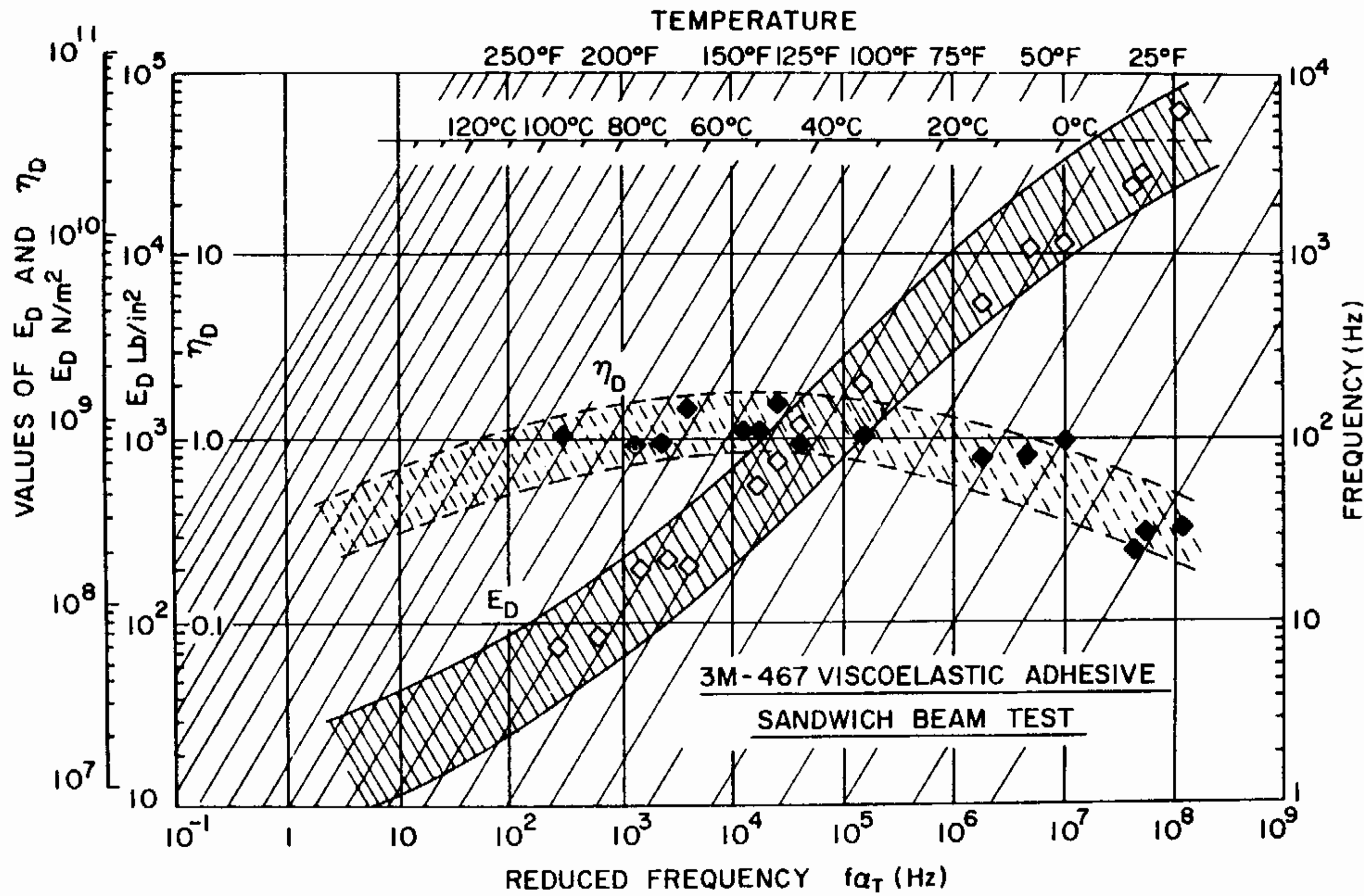

Figure 17. Reduced Temperature Nomogram for Specific Damping Material with Hypothetical Acceptance Limits Superimposed.

TABLE 1. POLYMERIC MATERIALS AND MANUFACTURERS

Material	Manufacturer
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 830	3M Company
Enjay Butyl	UDRI

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APPENDIX A
BARE BEAM TEST DATA

Beam No. 050A

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 75	2	196.6	8.78
	3	548.5	8.89
	4	1076.4	8.90
	5	1784.5	9.01
	6	2681.1	9.00
	7	3770.2	9.04
+ 25	2	197.9	8.83
	3	551.8	8.94
	4	1084.2	8.96
	5	1798.2	9.08
	6	2702.1	9.07
	7	3793.6	9.10
- 25	2	199.3	8.90
	3	555.7	9.01
	4	1092.9	9.03
	5	1813.6	9.16
	6	2724.5	9.14
	7	3826.2	9.18
+125	2	194.8	8.70
	3	543.7	8.81
	4	1068.2	8.83
	5	1772.2	8.95
	6	2663.0	8.94
	7	3743.0	8.98
+175	2	193.4	8.63
	3	540.2	8.76
	4	1060.6	8.77
	5	1760.3	8.89
	6	2644.6	8.87
	7	3778.0	9.06
+225	2	191.6	8.55
	3	534.5	8.66
	4	1044.6	8.63
	5	1723.9	8.71
	6	2593.2	8.70
	7	3667.0	8.79
+275	2	189.9	8.48
	3	530.3	8.59
	4	1036.5	8.57
	5	1709.7	8.63
	6	2572.2	8.63
	7	3637.9	8.72

Beam No. 050B

Temp. °F	Mode	f_n Hz	f_n/A_n Hz
+ 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
+225	2	193.5	8.64
	3	544.6	8.83
	4	1063.6	8.79
	5	1748.9	8.83
	6	2619.8	8.79
	7	3687.0	8.84
+275	2	192.3	8.58
	3	540.1	8.75
	4	1053.0	8.70
	5	1738.6	8.78
	6	2621.3	8.80
	7	3705.9	8.89

Beam No. 060A

Temp. °F	Mode	f_n Hz	f_n/A_n 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

Temp. °F	Mode	f_n Hz	f_n/A_n Hz

Beam No. 060A

Temp. °F	Mode	f_n Hz	f_n/A_n 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

Temp. °F	Mode	f_n Hz	f_n/A_n Hz
+175	2	232.26	10.37
	3	654.92	10.62
	4	1287.7	10.64
	5	2133.1	10.67
	6	3186.7	10.69
	7	4454.3	10.68
+225	2	231.54	10.34
	3	647.84	10.50
	4	1276.0	10.55
	5	2117.7	10.59
	6	3162.6	10.61
	7	4434.6	10.63
+290	2	227.74	10.17
	3	639.06	10.36
	4	1253.9	10.36
	5	2067.8	10.34
	6	3073.1	10.31
	7	4280.8	10.27

Beam No. 060B

Temp. °F	Mode	f_n Hz	f_n/A_n 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

Temp. °F	Mode	f_n Hz	f_n/A_n Hz
	5	2184.8	10.92

Beam No. 060B

Temp. °F	Mode	f_n Hz	f_n/A_n 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. °F	Mode	f_n Hz	f_n/A_n Hz
	5	2099.9	10.50
	6	3150.1	10.57
	7	4419.0	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. °F	Mode	f_n Hz	f_n/A_n 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

Temp. °F	Mode	f_n Hz	f_n/A_n Hz
	5	2103.8	10.52
	6	3145.3	10.55
	7	4414.9	10.59

Beam No. 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

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
	5	2152.4	10.76
	6	3183.7	10.68
+225	2	236.2	10.54
	3	661.8	10.73
	4	1294.8	10.70
	5	2134.2	10.67
	6	3152.8	10.58
+275	2	233.9	10.44
	3	655.9	10.63
	4	1286.1	10.63
	5	2124.1	10.62
	6	3177.9	10.66

Beam No. 060C

Temp. °F	Mode	f_n Hz	f_n/A_n 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	4667.06	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

Temp. °F	Mode	f_n Hz	f_n/A_n Hz
+173	2	238.51	10.822
	3	665.40	10.784
	4	1302.82	10.767
	5	2153.48	10.767
	6	3223.68	10.818
	7	4517.40	10.833
+225	2	235.05	10.665
	3	661.62	10.723
	4	1302.38	10.763
	5	2158.40	10.792
	6	3229.28	10.837
	7	4515.20	10.828
+270	2	233.81	10.608
	3	653.62	10.594
	4	1279.40	10.574
	5	2113.74	10.569
	6	3164.35	10.619
	7	4446.80	10.664

Beam No. 060D

Temp.	Mode	f_n	f_n/A_n
°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	10.84
	4	1307.3	10.80
	5	2149.7	10.75
	6	3187.1	10.69
	7	4450.6	10.67

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+ 175	2	237.0	10.58
	3	663.6	10.76
	4	1296.8	10.72
	5	2132.4	10.66
	6	3164.7	10.62
	7	4411.9	10.58
+225	2	235.1	10.50
	3	658.2	10.67
	4	1286.7	10.63
	5	2115.8	10.58
	6	3135.1	10.52
	7	4374.6	10.49
+275	2	233.0	10.40
	3	652.2	10.57
	4	1275.3	10.54
	5	2096.4	10.48
	6	3106.5	10.42
	7	4325.8	10.37

Beam No. 060D

Temp. °F	Mode	f_n Hz	f_n/A_n 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

Temp. °F	Mode	f_n Hz	f_n/A_n Hz
+175	2	239.60	10.891
	3	668.55	10.835
	4	1310.01	10.827
	5	2167.14	10.836
	6	3248.12	10.900
	7	4554.75	10.923
+225	2	236.53	10.751
	3	663.00	10.746
	4	1297.92	10.727
	5	2137.98	10.690
	6	3194.32	10.719
	7	4476.98	10.736
+275	2	234.37	10.653
	3	657.75	10.660
	4	1287.33	10.639
	5	2113.84	10.569
	6	3150.38	10.572
	7	4390.50	10.529

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

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+175	2	237.90	10.794
	3	667.96	10.826
	4	1307.4	10.805
	5	2157.5	10.788
	6	3212.0	10.779
	7	4490.7	10.769
+225	2	236.30	10.721
	3	662.92	10.744
	4	1297.6	10.724
	5	2140.0	10.700
	6	3183.5	10.683
	7	4449.0	10.669
+275	2	234.40	10.635
	3	657.06	10.649
	4	1288.4	10.648
	5	2125.6	10.628
	6	3163.0	10.614
	7	4423.2	10.607

Beam No. 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

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
+175	2	238.81	10.835
	3	669.95	10.858
	4	1309.1	10.819
	5	2160.3	10.801
	6	3221.9	10.811
	7	4516.7	10.831
+222	2	237.63	10.781
	3	665.20	10.781
	4	1301.4	10.755
	5	2152.2	10.761
	6	3215.4	10.789
	7	4509.9	10.815
+275	2	235.4	10.680
	3	659.0	10.680
	4	1289.7	10.658
	5	2133.2	10.666
	6	3185.6	10.689
	7	4471.0	10.721

Beam No. 070A

Temp. °F	Mode	f_n Hz	f_n/A_n 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

Temp. °F	Mode	f_n Hz	f_n/A_n Hz
+175	2	280.1	12.50
	3	781.3	12.66
	4	1534.5	12.68
	5	2540.0	12.83
	6	3805.3	12.77
	7	5326.0	12.77
+225	2	276.5	12.34
	3	774.1	12.55
	4	1511.8	12.49
	5	2493.3	12.59
	6	3725.2	12.50
	7	5222.9	12.52
+275	2	274.6	12.26
	3	769.6	12.47
	4	1502.5	12.42
	5	2476.1	12.51
	6	3696.2	12.40
	7	5179.5	12.42

Beam No. 070C

Temp. °F	Mode	f_n Hz	f_n/A_n 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

Temp. °F	Mode	f_n Hz	f_n/A_n Hz
+225	2	278.1	12.42
	3	775.8	12.57
	4	1515.7	12.53
	5	2500.6	12.63
	6	3734.0	12.53
	7	5226.6	12.53
+275	2	275.0	12.28
	3	768.7	12.46
	4	1502.7	12.42
	5	2474.4	12.50
	6	3684.2	12.36
	7	5146.3	12.34

Beam No. 070D

Temp. °F	Mode	f_n Hz	f_n/A_n 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

Temp. °F	Mode	f_n Hz	f_n/A_n Hz
	4	1507.1	12.46
	5	2488.7	12.44
	6	3710.3	12.45
	7	5187.1	12.44
+225		275.69	12.31
		764.99	12.40
		1497.7	12.38
		2473.5	12.37
		3689.8	12.38
		5161.3	12.38
+275		269.71	12.041
		759.76	12.31
		1486.2	12.28
		2452.8	12.26
		3655.0	12.27
		5112.3	12.26

Beam No. 070D

Temp. °F	Mode	f_n Hz	f_n/A_n 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	

Temp. °F	Mode	f_n Hz	f_n/A_n Hz
	5	1553.6	
+138	2	171.8	
	3	477.4	
	4	939.5	
	5	1541.1	
+202	2	170.5	
	3	473.6	
	4	932.0	
	5	1529.6	

Beam No. 070E

Temp. °F	Mode	f_n Hz	f_n/A_n 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

Temp. °F	Mode	f_n Hz	f_n/A_n Hz
+175	2	272.71	12.17
	3	764.41	12.39
	4	1489.9	12.31
	5	2476.4	12.38
	6	3687.1	12.37
	7	5143.3	12.33
+225	2	270.91	12.09
	3	759.19	12.30
	4	1489.2	12.31
	5	2461.2	12.31
	6	3663.9	12.29
	7	5113.2	12.26
+275	2	268.42	11.98
	3	753.13	12.21
	4	1477.6	12.21
	5	2441.3	12.21
	6	3632.1	12.19
	7	5068.4	12.15

Beam No. 070E

Temp. °F	Mode	f_n Hz	f_n/A_n 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

Temp. °F	Mode	f_n Hz	f_n/A_n Hz

Beam No. 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

Temp.	Mode	f_n	f_n/A_n
°F		Hz	Hz
	7	6021.2	14.44
+175	2	318.01	14.20
	3	892.14	14.46
	4	1745.8	14.43
	5	2882.3	14.41
	6	4304.5	14.44
	7	5989.2	14.36
+225	2	315.28	14.08
	3	885.58	14.35
	4	1733.8	14.33
	5	2862.5	14.31
	6	4269.1	14.33
	7	5945.2	14.26
+272	2	313.1	13.98
	3	877.8	14.23
	4	1719.3	14.21
	5	2838.1	14.19
	6	4227.4	14.19
	7	4889.7	14.12

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

Beam No. 080E

Temp. °F	Mode	f_n Hz	f_n/A_n 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
+175	2	320.8	14.5593
	3	894.7	14.5015
	4	1744.9	14.4324
	5	2878.1	14.4006
	6	4285.4	14.3538
	7	5975.7	14.3305
+225	2	317.4	14.4050
	3	886.5	14.3686
	4	1730.1	14.3099
	5	2849.9	14.2595
	6	4240.1	14.2020
	7	5902.8	14.1557
+275	2	314.5	14.2734
	3	879.9	14.2616
	4	1717.9	14.2090
	5	2830.5	14.1624
	6	4200.6	14.0697
	7	5847.2	14.0224

Beam No. 080F

Temp.	Mode	f_n	f_n/A_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
+225	2	321.1	14.573
	3	893.8	14.487
	4	1753.2	14.501
	5	2905.7	14.539
	6	4344.6	14.552
	7	6076.6	14.572
+275	2	319.5	14.500
	3	888.8	14.406
	4	1741.3	14.403
	5	2889.5	14.458
	6	4335.4	14.521
	7	6042.7	14.491

Beam No. 080F

Temp. °F	Mode	f_n Hz	f_n/A_n 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. °F	Mode	f_n Hz	f_n/A_n 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	14.584
	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

Beam No. 080G

Temp. °F	Mode	f_n Hz	f_n/A_n 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. °F	Mode	f_n Hz	f_n/A_n 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	313.9	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

Beam No. 080H

Temp. °F	Mode	f_n Hz	f_n/A_n 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. °F	Mode	f_n Hz	f_n/A_n 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. °F	Mode	f_n Hz	f_n/A_n 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. °F	Mode	f_n Hz	f_n/A_n 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

Beam No. 080-2

Temp. °F	Mode	f_n Hz	f_n/A_n 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

Temp. °F	Mode	f_n Hz	f_n/A_n Hz
+154	2	312.5	14.18
	3	877.8	14.23
	4	1710.4	14.15
	5	2829.6	14.16
	6	4256.4	14.26
	7	5980.7	14.34
+199	2	310.3	14.08
	3	870.8	14.11
	4	1698.2	14.05
	5	2808.7	14.05
	6	4226.1	14.15
	7	5936.5	14.24
+248	2	307.9	13.97
	3	864.0	14.00
	4	1684.9	13.94
	5	2786.9	13.94
	6	4193.2	14.04
	7	5896.1	14.14
+299	2	305.2	13.86
	3	856.2	13.87
	4	1670.2	13.81
	5	2762.6	13.82
	6	4157.1	13.92
	7	5839.3	14.00

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

Beam Nos. 060D and ______ Date 12/11/79

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      .300    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)
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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 acuqire more data in this range by going to a Modified Oberst type specimen, but this did not help.

Beam No. 060D

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	1354.21	124.41	0.0962	
75	5	2181.63	2201.46	2063.29	2275.89	212.60	0.0974	
75	6	3291.03	3315.51	3101.11	3428.78	327.67	0.0996	

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Beam No. 060D

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	3302.31	3315.51	3119.89	3432.05	613.71	0.1858	X
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	559.98	597.30	37.32	0.0644	
102	4	1157.66	1323.27	1115.48	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	5888.56	510.00	0.0906	
125	2	197.48	242.04	196.10	199.00	2.90	0.0147	
125	3	554.11	673.11	547.84	560.49	12.65	0.0228	
125	4	1102.95	1318.44	1086.86	1119.12	32.26	0.0292	
125	5	1841.95	2183.47	1805.47	1873.31	67.84	0.0368	

Page 2 of 4

Beam No. 060D

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	

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Beam No. 060D

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
198	6	2661.43	3245.35	2656.46	2665.53	9.07	0.0034	

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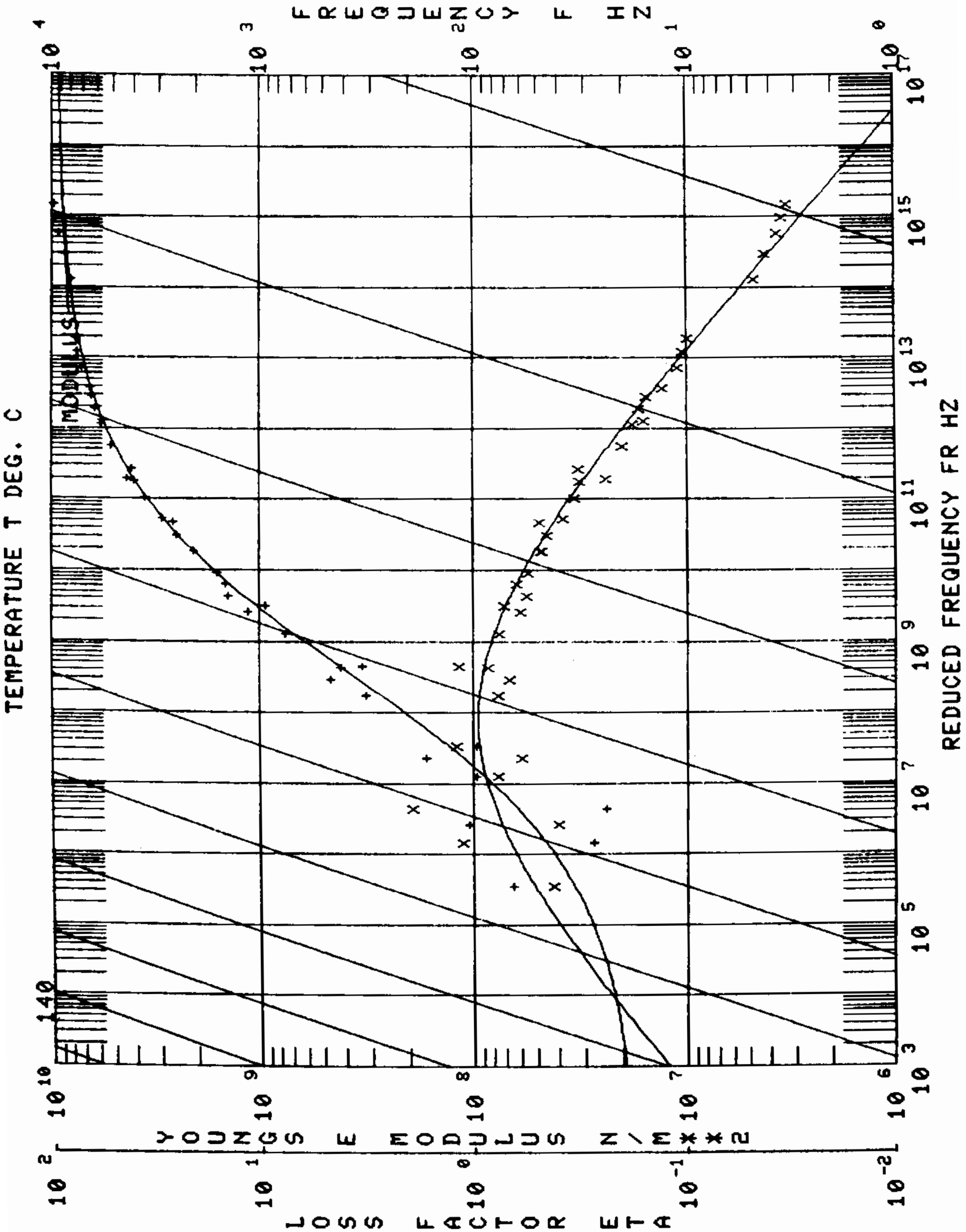
EXPERIMENTAL CODE :140
MATERIAL :E A R EXODAMP C-2003
DATA SOURCES
MANUFACTURER :NONE
AFML :UDRI-GET
OTHER :NONE

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	3.36389E+08	1.1889	38.9	203.4	2.	6.92832E+10	.0446	243.0	3.99924E+08
2	7.75500E+08	.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	1.43597E+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	6.	6.98540E+10	.0910	3300.6	9.47632E+08
6	4.74766E+08	.6952	51.7	1841.9	5.	6.79651E+10	.0368	2183.5	3.30059E+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	3.60465E+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	1.32100E+09
12	4.20779E+09	.3289	23.9	3291.0	6.	7.04873E+10	.0996	3315.5	1.38394E+09
13	5.83253E+09	.1622	9.4	256.5	2.	7.00894E+10	.0593	244.5	9.46013E+08
14	6.67494E+09	.1332	9.4	734.2	3.	6.92778E+10	.0524	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	7.78082E+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	8.00637E+08
18	4.43240E+09	.2433	15.6	244.6	2.	6.99060E+10	.0764	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	1401.6	4.	6.89013E+10	.0681	1329.9	1.08048E+09
21	6.33756E+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	.7326	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	9.21841E+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	2.66354E+09	.5030	30.6	3094.3	6.	7.01701E+10	.1125	3308.0	1.33983E+09
28	8.26547E+09	.0490	-3.9	275.6	2.	7.06640E+10	.0210	245.5	4.04893E+08
29	8.86439E+09	.0433	-3.3	780.7	3.	6.97795E+10	.0192	683.0	3.84083E+08
30	9.48347E+09	.0378	-3.3	1552.1	4.	6.95921E+10	.0172	1336.6	3.58505E+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	2593.1	5.	7.00969E+10	.0165	2217.5	3.53268E+08
33	9.94140E+09	.0336	-3.3	3897.5	6.	7.16345E+10	.0154	3342.4	3.34273E+08
34	9.88421E+07	.7853	66.1	1085.1	4.	6.72820E+10	.0092	1314.2	7.76215E+07
35	1.68993E+08	.6067	65.6	1803.7	5.	6.74686E+10	.0120	2175.5	1.02521E+08
36	9.87690E+07	1.2211	65.6	2702.7	6.	6.87212E+10	.0140	3273.7	1.20610E+08
37	2.81007E+07	1.1498	79.4	1076.1	4.	6.67262E+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	2.45316E+07	1.9651	78.3	2680.0	6.	6.81581E+10	.0057	3260.3	4.82072E+07
40	6.65290E+07	.4342	92.8	1774.8	5.	6.61115E+10	.0035	2153.5	2.88892E+07


TEMPERATURE T DEG. C
140
MODULUS
FREQUENCY F HZ
REDUCED FREQUENCY FR HZ
YOUNGS E MODULUS N/M**2
LOSS FACTOR ETA

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 η_D:

Peak	100 Hz	η_D 0.900	Temperature	11.0 °C	
	1000 Hz	η_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(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0          FROM          MROM         N          ML
               A1            A2          A3         A4
   140.0  1.0000E+12  1.7500E+08     .350  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       B2         B3          B4         B5
   140.0     .900     .225     -.225  3.0000E+11    1.750
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks: Test specimen was an "Oberst"-type configuration.

Beam No. 080-3

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-27	2	348.24	310.24	345.58	350.78	5.20	0.0493	
-27	3	1015.14	875.79	1007.90	1021.86	13.96	0.0137	
-26	4	2010.49	1723.46	1997.65	2030.73	33.08	0.0164	
-26	5	3311.09	2863.99	3286.39	3332.81	46.42	0.0140	
-26	6	4884.97	4293.29	4847.31	4918.97	71.66	0.0147	
-2.5	2	327.81	309.14	321.37	336.51	15.14	0.0462	
-2.5	3	955.60	872.39	932.40	973.55	41.14	0.0431	
-2.5	4	1899.01	1718.02	1862.90	1932.97	70.06	0.0369	
-2.5	5	3150.21	2852.00	3094.19	3205.71	111.52	0.0354	
-2.5	6	4680.65	4276.87	4588.27	4749.27	161.00	0.0344	
11	2	303.47	308.48	291.43	316.00	24.57	0.0810	
11	3	885.96	870.85	852.72	919.09	66.37	0.0749	
11	4	1774.67	1714.39	1713.49	1835.30	121.81	0.0686	
11	5	2952.29	2845.01	2841.37	3042.19	190.82	0.0646	
11	6	4379.47	4264.93	4207.18	4502.41	295.23	0.0674	
25	2	285.50	307.92	270.67	302.15	31.48	0.1103	
25	3	835.04	869.00	791.03	878.62	87.59	0.1049	
25	4	1678.22	1710.16	1592.11	1758.91	166.80	0.0994	
25	5	2808.86	2838.01	2657.89	2928.49	270.60	0.09634	
25	6	4164.71	4257.47	4049.37	4254.81	403.89	0.0970	X

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Beam No. 080-3

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
35	2	262.18	307.37	246.47	274.44	27.97	0.1067	
35	3	759.31	867.77	717.04	803.48	86.44	0.1138	
35	4	1531.85	1707.74	1441.01	1620.65	179.64	0.1173	
35	5	2567.91	2833.02	2396.43	2706.27	309.84	0.1207	
35	6	3823.48	4250.00	3686.78	3917.41	453.42	0.1186	X
49	2	247.14	306.71	238.08	255.51	17.43	0.0705	
49	3	717.65	865.92	682.44	750.05	67.61	0.0942	
49	4	1443.46	1703.51	1363.21	1517.68	154.47	0.1070	
49	5	2417.55	2826.02	2261.29	2549.11	387.82	0.1190	
49	6	3599.51	4239.55	3450.91	3696.44	482.71	0.1341	X
75.2	2	235.36	305.50	233.47	237.27	3.80	0.0161	
75.2	3	669.98	862.52	661.20	678.25	17.05	0.0254	
75.2	4	1334.41	1696.86	1316.09	1356.26	40.17	0.0301	
75.2	5	2216.83	2813.03	2170.31	2263.53	93.22	0.0405	
75.2	6	3296.51	4221.64	3203.83	3376.58	172.75	0.0524	
102	2	233.38	304.29	232.53	234.00	1.47	0.0063	
102	3	661.00	859.13	658.11	663.80	5.69	0.0086	
102	4	1313.08	1689.60	1305.35	1321.33	15.98	0.0122	
102	5	2172.45	2800.04	2154.91	2192.31	37.40	0.0172	
102	6	3226.53	4200.74	3182.39	3263.39	81.00	0.0251	

Page 2 of 3

Beam No. 080-3

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
102	7	4511.61		4441.31	4633.71	192.40	0.0426	
126	2	323.19	303.19	231.61	232.69	1.08	0.0046	
126	3	656.73	856.04	655.00	658.49	3.49	0.0053	
125	4	1301.83	1683.56	1295.95	1307.79	11.84	0.0091	
125	5	2149.43	2787.05	2129.51	2168.77	39.26	0.0183	
125	6	3174.81	4184.32	3105.53	3231.11	125.58	0.0396	

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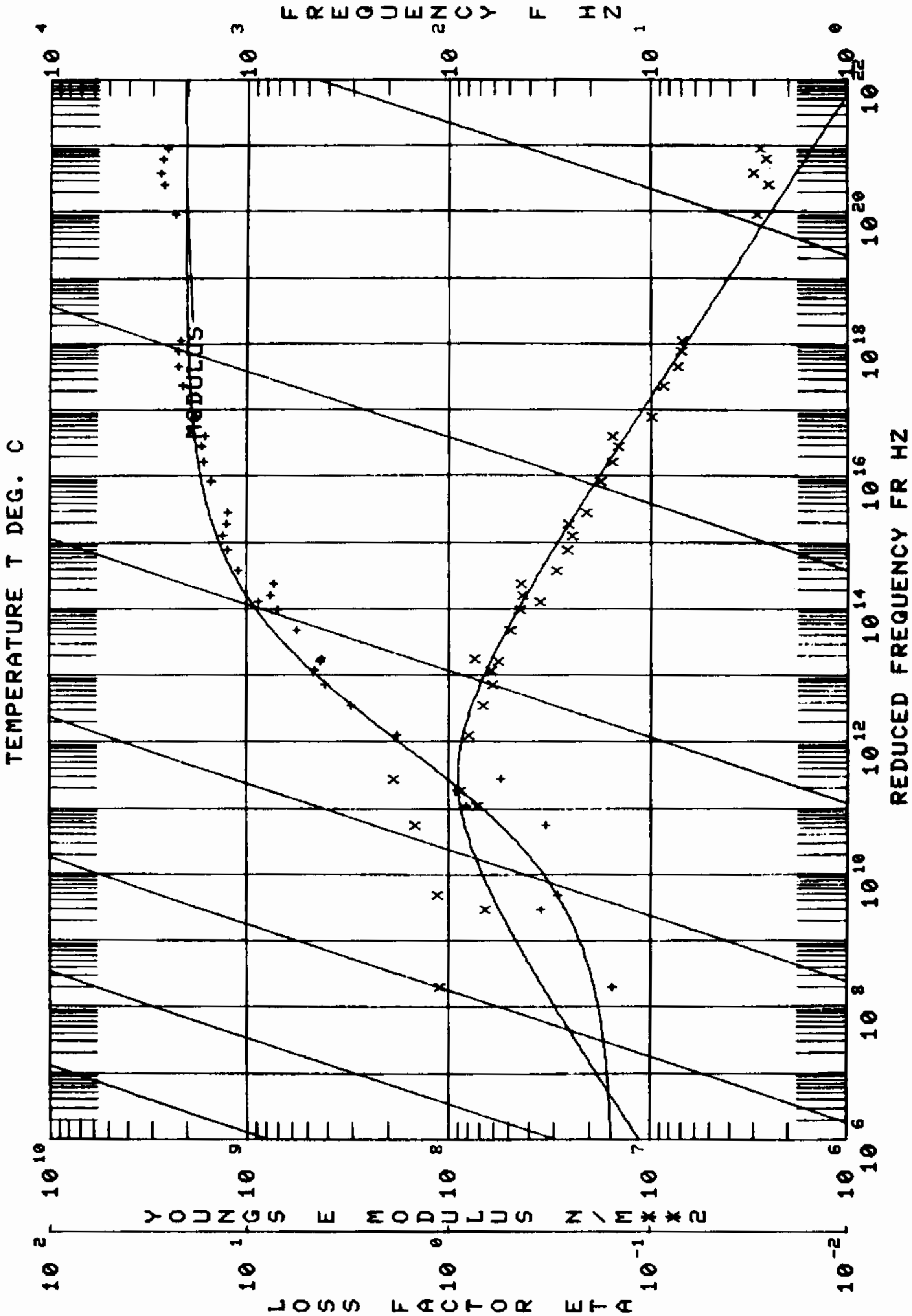
EXPERIMENTAL CODE :147
MATERIAL :E A R ISODAMP C-1002
DATA SOURCES
MANUFACTURER :NONE
AFML :UDRI-GET
OTHER :NONE

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	3.58943E+07	.6780	38.9	1313.1	4.	6.25557E+10	.0122	1689.6	2.43376E+07
2	2.94317E+07	1.1675	38.9	2172.5	5.	6.28699E+10	.0172	2800.0	3.43604E+07
3	1.58594E+07	1.1242	51.7	1301.8	4.	6.21092E+10	.0091	1683.6	1.78286E+07
4	5.55306E+06	6.4380	51.7	2149.4	5.	6.22879E+10	.0183	2787.0	3.57507E+07
5	3.39675E+07	1.4912	23.9	670.0	3.	6.25999E+10	.0254	862.5	5.06521E+07
6	8.41198E+07	.7386	23.9	1334.3	4.	6.30944E+10	.0301	1696.9	6.21309E+07
7	9.36559E+07	.9020	23.9	2216.8	5.	6.34545E+10	.0405	2813.0	8.44743E+07
8	5.65073E+07	1.9207	23.9	3296.5	6.	6.42829E+10	.0524	4221.6	1.08535E+08
9	1.84563E+08	.8180	9.4	247.1	2.	6.20605E+10	.0705	306.7	1.50964E+08
10	3.14002E+08	.6946	9.4	717.7	3.	6.30943E+10	.0942	865.9	2.18111E+08
11	4.22479E+08	.6206	9.4	1443.5	4.	6.35899E+10	.1070	1703.5	2.62175E+08
12	4.73014E+08	.6340	9.4	2417.5	5.	6.40420E+10	.1190	2826.0	2.99892E+08
13	4.40657E+08	.7635	9.4	3599.5	6.	6.48295E+10	.1341	4239.5	3.36451E+08
14	8.96054E+08	.3625	-3.9	285.5	2.	6.25511E+10	.1103	307.9	3.24837E+08
15	1.13291E+09	.3003	-3.9	835.0	3.	6.35440E+10	.1049	869.0	3.40190E+08
16	1.28339E+09	.2657	-3.9	1678.2	4.	6.40874E+10	.0994	1710.2	3.41010E+08
17	1.35291E+09	.2509	-3.9	2808.9	5.	6.45865E+10	.0963	2838.0	3.39485E+08
18	1.28709E+09	.2619	-3.9	4164.7	6.	6.53787E+10	.0970	4257.5	3.37034E+08
19	1.83502E+09	.1016	-19.2	327.8	2.	6.30478E+10	.0462	309.1	1.86377E+08
20	2.14029E+09	.0890	-19.2	955.6	3.	6.40407E+10	.0431	872.4	1.90538E+08
21	2.24335E+09	.0750	-19.2	1899.0	4.	6.46778E+10	.0369	1718.0	1.68303E+08
22	2.25577E+09	.0721	-19.2	3150.2	5.	6.52249E+10	.0354	2852.0	1.62553E+08
23	2.19691E+09	.0712	-19.2	4680.7	6.	6.59759E+10	.0344	4276.9	1.56347E+08
24	1.27389E+09	.2149	-11.7	303.5	2.	6.27788E+10	.0810	308.5	2.73753E+08
25	1.53470E+09	.1811	-11.7	886.0	3.	6.38148E+10	.0749	870.8	2.77877E+08
26	1.68149E+09	.1590	-11.7	1774.7	4.	6.44048E+10	.0686	1714.4	2.67343E+08
27	1.71390E+09	.1489	-11.7	2952.3	5.	6.49055E+10	.0646	2845.0	2.55156E+08
28	1.64953E+09	.1592	-11.7	4379.5	6.	6.56080E+10	.0674	4264.9	2.62644E+08
29	4.46153E+08	.5828	1.7	262.2	2.	6.23279E+10	.1067	307.4	2.60025E+08
30	5.83569E+08	.5112	1.7	759.3	3.	6.33642E+10	.1138	867.8	2.98313E+08
31	7.88103E+08	.4411	1.7	2567.9	5.	6.43596E+10	.1207	2833.0	3.47634E+08
32	7.54346E+08	.4508	1.7	3823.5	6.	6.51495E+10	.1186	4250.0	3.40025E+08
33	2.34272E+09	.0295	-32.8	348.2	2.	6.34972E+10	.0149	310.2	6.91892E+07
34	3.45891E+10	.4362	-32.8	1015.1	3.	1.39723E+09	.3573	128.9	1.50883E+10
35	2.78522E+09	.0307	-32.2	2010.5	4.	6.50881E+10	.0164	1723.5	8.55670E+07
36	2.72087E+09	.0266	-32.2	3311.1	5.	6.57744E+10	.0140	2864.0	7.22432E+07
37	2.58692E+09	.0285	-32.2	4885.0	6.	6.64835E+10	.0147	4293.3	7.38096E+07
38	7.23490E+08	.4530	1.7	1531.9	4.	6.39061E+10	.1173	1707.7	3.27725E+08
39	2.69620E+09	.0259	-32.8	1015.1	3.	6.45409E+10	.0137	875.8	6.98014E+07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FREQUENCY F HZ
REDUCED FREQUENCY FR HZ
YOUNGS E MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

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 K Hz

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

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0        FROM         MROM        N          ML
             A1           A2         A3         A4
  40.0   2.0000E+03   3.3000E+06    .450    7.7500E+04
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
  40.0    1.500     1.000     -.900    1.3500E+03    2.250
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Test No. 78-3
Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	2943.5	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	X
70	6	5599.3	4377.6	5289.7	5835.2	1072.4	0.1951	X
70	7	7573.7	6100.7	7098.0	8120.9	2011.0	0.2753	X
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	X

Page 1 of 3

Test No. 78-3
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
100	4	1929.2	1764.2	1763.1	2138.2	375.1	0.1982	
100	5	3130.9	2910.0	2917.1	3329.7	411.6	0.1326	
100	6	4670.3	4358.8	4363.8	5006.8	643.0	0.1390	
100	7	6425.6	6071.8	5978.0	6890.6	912.6	0.1435	
125	2	339.0	321.7	318.4	365.8	47.4	0.1412	
125	3	937.1	898.4	874.2	1003.8	129.6	0.1383	
125	4	1816.5	1758.1	1720.3	1903.2	182.9	0.1012	
125	5	2973.4	2899.0	2868.1	3081.6	213.5	0.0720	
125	6	4414.8	4337.4	4288.5	4579.0	290.5	0.0659	
125	7	6168.0	6042.3	5953.7	6357.7	404.0	0.0656	
125	2	337.4	321.7	320.8	347.8	37.0	0.1103	
125	3	929.7	898.4	876.2	985.8	109.6	0.1187	
125	4	1799.1	1758.1	1738.6	1862.5	123.9	0.0690	
125	5	2953.2	2899.0	2874.5	3034.1	159.6	0.0541	
125	6	4398.7	4337.4	4292.4	4513.1	220.7	0.0502	
125	7	6090.2	6042.3	5961.1	6278.6	317.5	0.0522	
150	2	328.0	320:1	321.8	334.2	12.4	0.0378	
150	3	907.4	895.3	900.0	916.9	33.22	0.0365	X
150	4	1764.3	1750.3	1742.9	1786.5	43.6	0.0247	
150	5	2904.1	2888.0	2873.9	2939.4	65.5	0.0226	

Page 2 of 3

Test No. 78-3
Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
150	6	4328.9	4318.0	4292.4	4368.7	76.3	0.0176	
150	7	6035.4	6013.1	5985.3	6090.0	104.7	0.0173	
175	2	324.5	318.6	321.3	328.2	6.9	0.0213	
175	3	900.4	891.6	892.8	908.0	15.2	0.0169	
175	4	1752.4	1743.6	1742.0	1762.1	20.1	0.0115	
175	5	2886.2	2876.0	2871.8	2901.0	29.2	0.0101	
175	6	4303.7	4297.2	4287.7	6024.0	45.3	0.00755	

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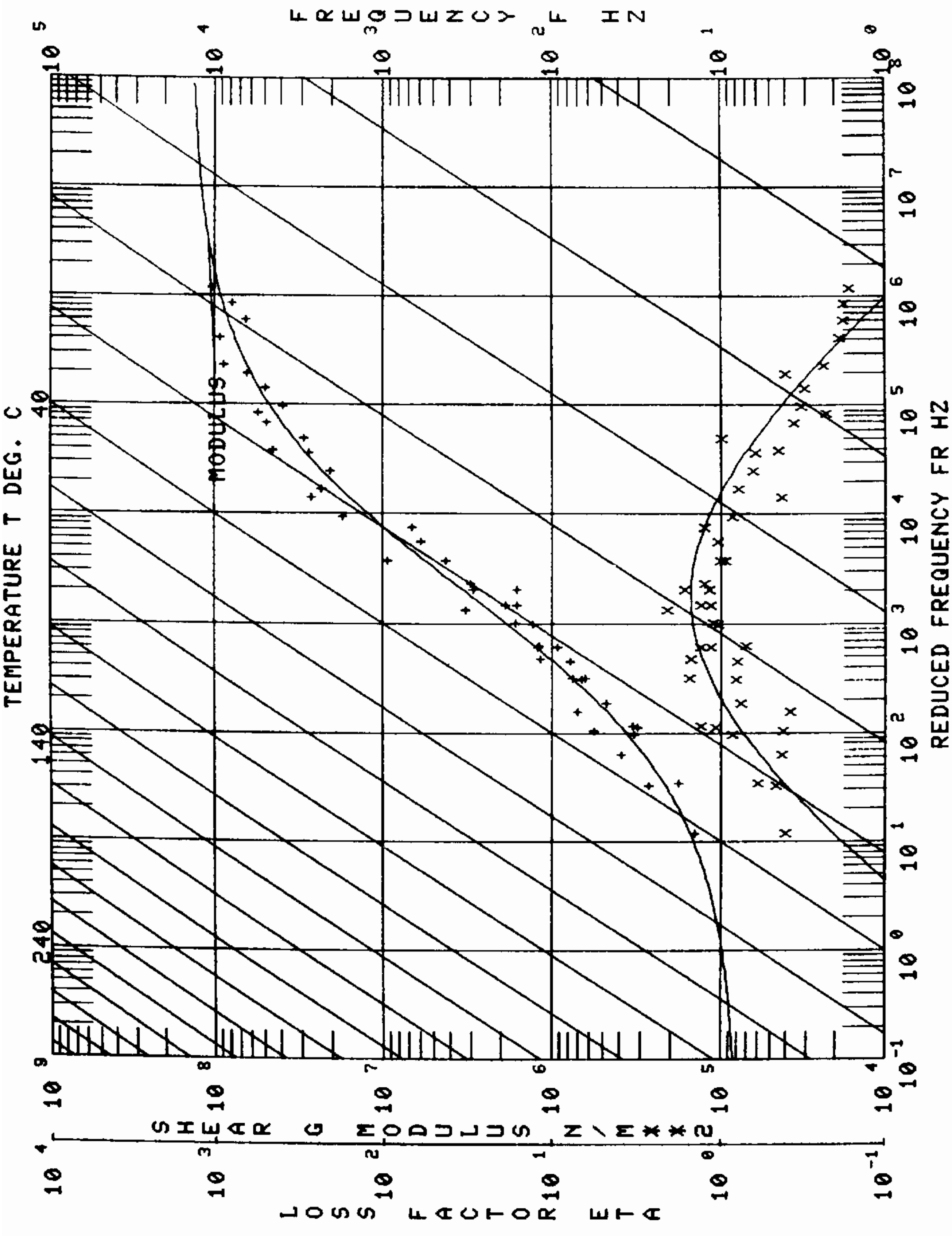
EXPERIMENTAL CODE :197
MATERIAL :MACBOND 1120
DATA SOURCES
MANUFACTURER :NONE
AFML :UDRI
OTHER :NONE

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	5.61199E+07	.2347	-3.9	656.7	2.	7.06726E+10	.0260	327.3	1.31717E+07
2	9.09467E+07	.2420	-3.9	1763.0	3.	7.00189E+10	.0404	912.2	2.20046E+07
3	9.53249E+07	.1937	-3.9	3222.9	4.	6.97020E+10	.0484	1783.5	1.84649E+07
4	6.62320E+07	.1833	-3.9	4656.0	5.	6.94772E+10	.0634	2943.5	1.21397E+07
5	8.06397E+07	.1797	-3.9	6712.6	6.	7.00645E+10	.0643	4407.4	1.44949E+07
6	1.07753E+08	.1700	-3.9	9286.5	7.	6.94501E+10	.0611	6140.3	1.83169E+07
7	2.69985E+07	.4327	10.0	624.3	2.	7.00694E+10	.0758	325.9	1.16827E+07
8	4.55364E+07	.4565	10.0	1649.4	3.	6.94979E+10	.1080	908.8	2.07869E+07
9	4.98315E+07	.3681	10.0	2942.9	4.	6.92338E+10	.1160	1777.5	1.83439E+07
10	4.02162E+07	.3304	10.0	4260.2	5.	6.89353E+10	.1180	2932.0	1.32856E+07
11	5.06286E+07	.3178	10.0	6169.7	6.	6.95441E+10	.1130	4391.0	1.60917E+07
12	6.49794E+07	.4112	10.0	8503.0	7.	6.90277E+10	.1436	6121.6	2.67181E+07
13	9.66217E+06	1.0392	21.1	572.9	2.	6.95971E+10	.2364	324.8	1.00412E+07
14	1.79292E+07	.8712	21.1	1463.0	3.	6.90398E+10	.2544	905.8	1.56191E+07
15	2.37878E+07	.7987	21.1	2634.1	4.	6.88526E+10	.2581	1772.6	1.90004E+07
16	2.09437E+07	.6534	21.1	3816.0	5.	6.85128E+10	.2072	2923.0	1.36845E+07
17	2.81605E+07	.6322	21.1	5599.3	6.	6.91203E+10	.1951	4377.6	1.78044E+07
18	3.02843E+07	1.0095	21.1	7573.7	7.	6.85572E+10	.2753	6100.7	3.05731E+07
19	1.20185E+06	1.5426	37.8	389.8	2.	6.88705E+10	.3550	323.1	1.85396E+06
20	3.31795E+06	2.1551	37.8	1115.2	3.	6.84769E+10	.4578	902.1	7.15056E+06
21	3.12572E+06	1.2870	37.8	1929.2	4.	6.82016E+10	.1982	1764.2	4.02291E+06
22	4.36106E+06	.9641	37.8	3130.9	5.	6.79047E+10	.1326	2910.0	4.20446E+06
23	6.14852E+06	1.0636	37.8	4670.3	6.	6.85278E+10	.1390	4358.8	6.53939E+06
24	6.94321E+06	1.2939	37.8	6425.6	7.	6.79092E+10	.1435	6071.8	8.98367E+06
25	3.41946E+05	1.3544	51.7	339.0	2.	6.82750E+10	.1412	321.7	4.63121E+05
26	7.74336E+05	1.5783	51.7	937.1	3.	6.79164E+10	.1383	898.4	1.22217E+06
27	1.24078E+06	1.3671	51.7	1816.5	4.	6.77308E+10	.1012	1758.1	1.69631E+06
28	1.68513E+06	1.1511	51.7	2973.4	5.	6.73923E+10	.0720	2899.0	1.93975E+06
29	1.93056E+06	1.3475	51.7	4414.8	6.	6.78566E+10	.0659	4337.4	2.60140E+06
30	2.99624E+06	1.2097	51.7	6168.0	7.	6.72509E+10	.0656	6042.3	3.62462E+06
31	3.19657E+05	1.1152	51.7	337.4	2.	6.82750E+10	.1103	321.7	3.56497E+05
32	6.51478E+05	1.5701	51.7	929.7	3.	6.79164E+10	.1187	898.4	1.02290E+06
33	9.52205E+05	1.1783	51.7	1799.1	4.	6.77308E+10	.0690	1758.1	1.12199E+06
34	1.34081E+06	1.0639	51.7	2953.2	5.	6.73923E+10	.0541	2899.0	1.42644E+06
35	1.66547E+06	1.1763	51.7	4398.7	6.	6.78566E+10	.0502	4337.4	1.95912E+06
36	1.64989E+06	1.6795	51.7	6090.2	7.	6.72509E+10	.0522	6042.3	2.77097E+06
37	1.84005E+05	.6104	65.6	328.0	2.	6.75975E+10	.0378	320.1	1.12309E+05
38	3.35757E+05	.8715	65.6	907.4	3.	6.74485E+10	.0365	895.3	2.92608E+05
39	4.89006E+05	.7763	65.6	1764.3	4.	6.71311E+10	.0247	1750.3	3.79624E+05
40	6.84716E+05	.8292	65.6	2904.1	5.	6.68819E+10	.0226	2888.0	5.67750E+05
41	8.01011E+05	.8197	65.6	4328.9	6.	6.72510E+10	.0176	4318.0	6.56612E+05
42	1.23250E+06	.7284	65.6	6035.4	7.	6.66025E+10	.0173	6013.1	8.97763E+05
43	1.47990E+05	.4156	79.4	324.5	2.	6.69655E+10	.0213	318.6	6.15046E+04
44	2.78456E+05	.4771	79.4	900.4	3.	6.68921E+10	.0169	891.6	1.32855E+05
45	3.98322E+05	.4363	79.4	1752.4	4.	6.66182E+10	.0115	1743.6	1.73794E+05
46	5.81670E+05	.4299	79.4	2886.2	5.	6.63272E+10	.0101	2876.0	2.50043E+05
47	7.21453E+05	.3855	79.4	4303.7	6.	6.66046E+10	.0076	4297.2	2.78089E+05


TEMPERATURE T DEG. C
MODULUS
REDUCED FREQUENCY FR HZ
FREQUENCY F HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA

Polymeric Material Characterization Test

Test No. 78-4

Date 2/9/78

Beam Nos. Not and Recorded

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 K Hz

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	

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0         FROM          MROM         N          ML
              A1            A2          A3         A4
    30.0  4.0000E+03  4.0000E+06      .600   8.0000E+04
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
    30.0   2.000     .750     -.750  10.0000E+02    1.000
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Test No. 78-4
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	7408.2	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	0.4953	
74	4	1983.4	1314.1	1776.2	2194.0	821.4	0.2155	X
74	5	3018.4	2170.4		3269.6	987.7	0.1688	X
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	

Page 1 of 2

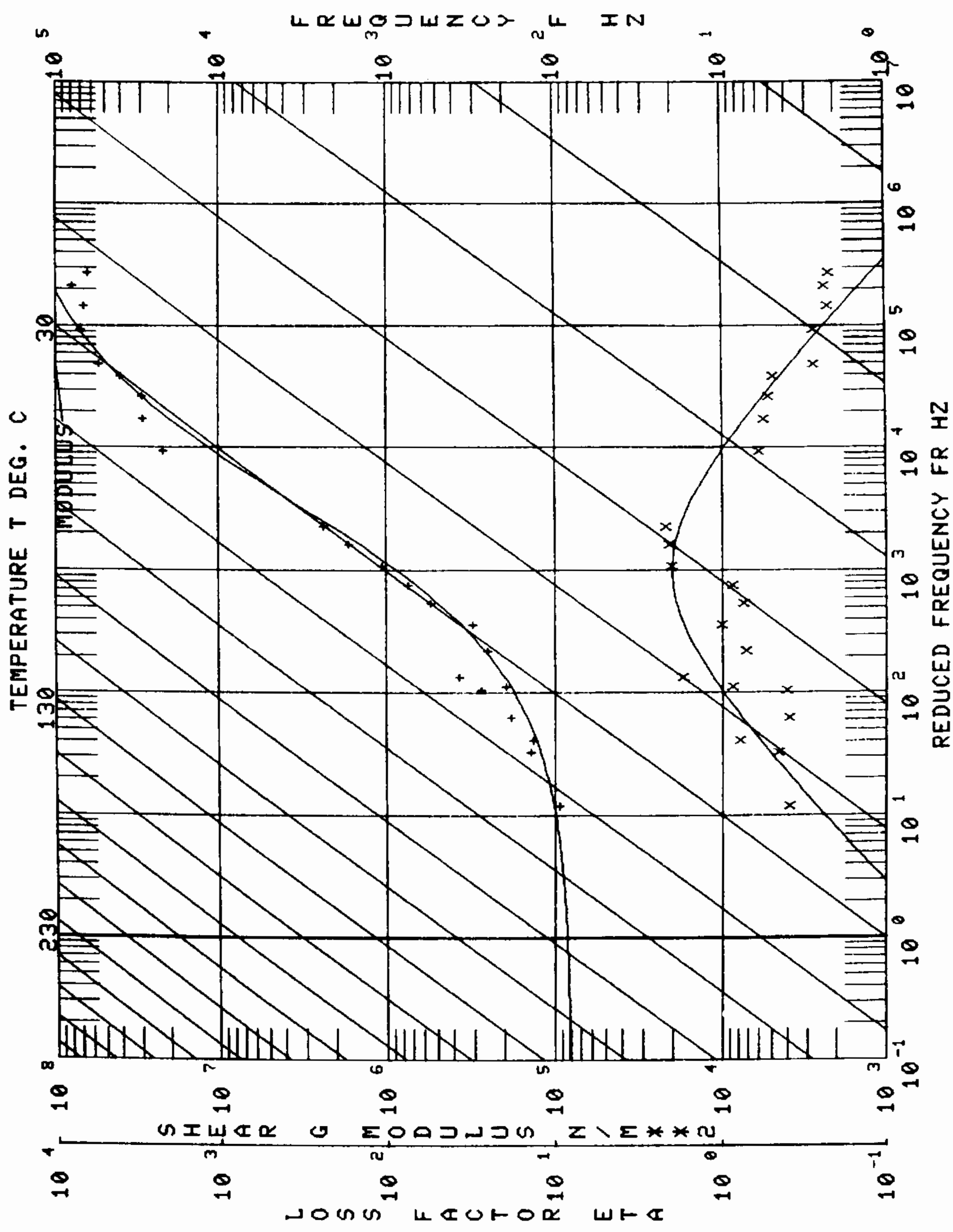
Test No. 78-4
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
100	6	3418.7	3230.0	3042.7	3742.7	700.0	0.2092	
100	7	4788.8	4516.9	4173.8	5223.4	1049.6	0.2246	
122	2	250.4	236.9	240.1	261.7	21.6	0.0866	
122	3	683.3	665.0	663.7	701.2	37.5	0.0550	
122	4	1325.2	1304.2	1304.3	1345.0	40.7	0.0307	
122	5	2178.4	2155.5	2145.8	2216.4	70.6	0.0324	
122	6	3265.9	3222.1	3218.8	3311.8	93.0	0.0285	
122	7	4564.5	4505.2	4481.1	4628.1	147.0	0.0332	
150	2	245.0	235.9	241.0	249.0	8.0	0.0327	
150	3	673.9	661.9	666.5	680.7	14.2	0.0211	
150	4	1311.9	1298.3	1303.7	1320.4	16.7	0.0127	
150	5	2165.2	2146.2	2151.9	2177.5	25.6	0.0118	
150	6	3237.1	3209.2	3219.3	3253.8	34.5	0.0107	
150	7	4501.4	4488.2	4476.7	4555.2	78.5	0.0174	

Page 2 of 2

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

NO.	MODULUS N/M**2	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.
1	5.59578E+07	.2800	-3.9	1328.1	3.
2	7.21881E+07	.2810	-3.9	2530.4	4.
3	8.12202E+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	2.23597E+07	.6140	10.0	1252.4	3.
7	3.02956E+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	3.79901E+05	1.7870	37.8	281.4	2.
11	1.08868E+06	2.0550	37.8	2280.1	5.
12	1.70990E+06	2.1350	37.8	3418.7	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	2.56692E+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	.8890	50.0	4564.5	7.
20	9.61819E+04	.4040	65.6	245.0	2.
21	1.42515E+05	.4640	65.6	673.9	3.
22	1.88641E+05	.4040	65.6	1311.9	4.
23	2.80134E+05	.4150	65.6	2165.2	5.


TEMPERATURE T DEG. C
FREQUENCY F HZ
REDUCED FREQUENCY FR HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS
30
130
230

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		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0          FROM         MROM         N          ML
               A1           A2          A3         A4
    30.0   4.2478E+03  7.0540E+06     .620    2.5097E+05
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
    30.0    1.500      .750       -.600    3.0000E+03    1.000
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Test No. 78-5
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	X
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	X
50	6	5764.9	4391:0	5427.8	6118.6	1358.1	0.2423	X
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	1772.0	1796.2	2706.8	910.6	0.4485	

Page 1 of 2

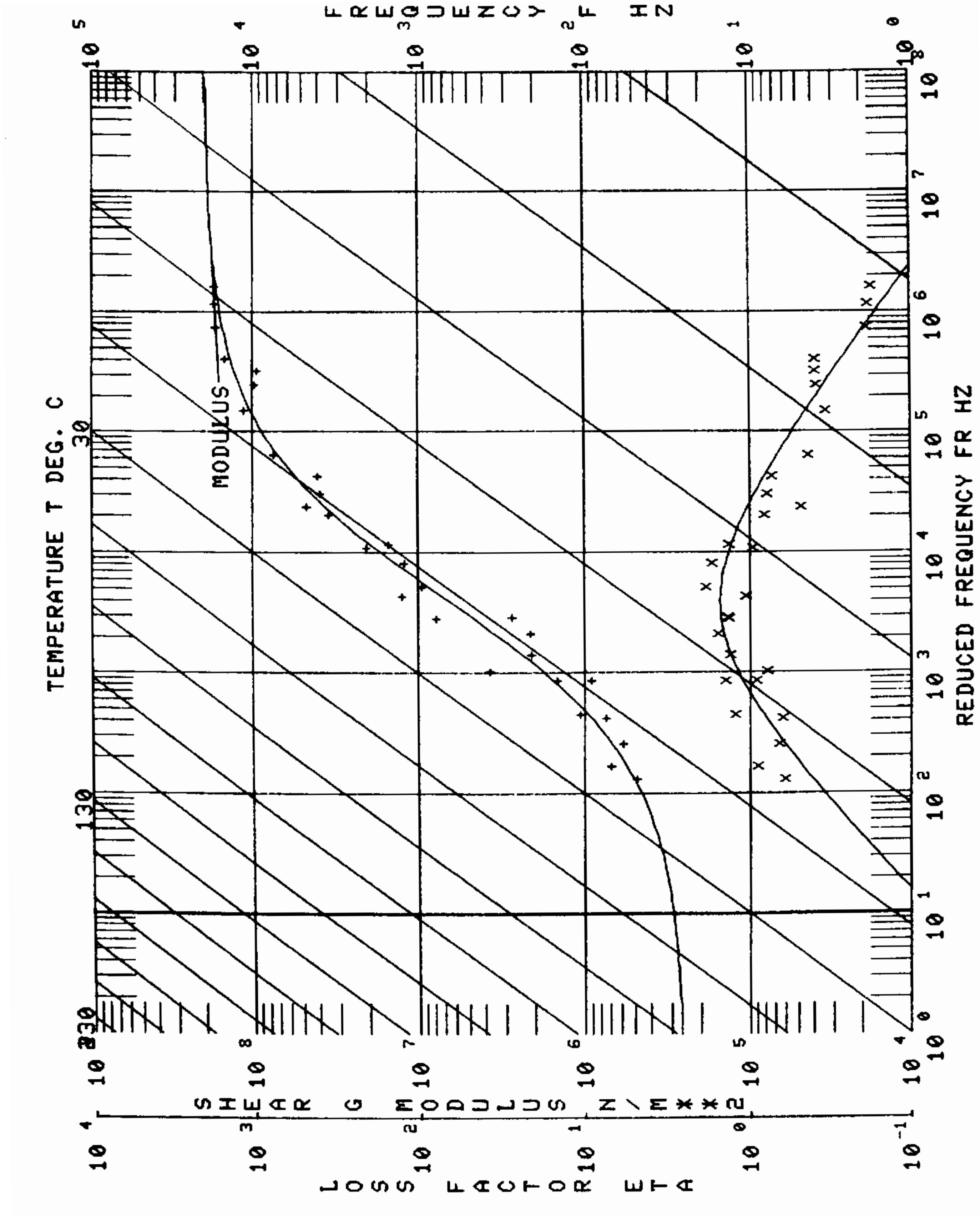
Test No. 78-5
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
70	5	3479.6	2924.0	3127.3	3763.1	1250.0	0.3847	X
70	6	5004.5	4377.6	4274.1	5620.2	1346.1	0.2793	
100	2	349.7	323.1	327.0	375.6	48.6	0.1403	
100	3	940.7	902.1	883.5	996.0	112.4	0.1203	
100	4	1812.4	1764.2	1725.2	1907.3	182.1	0.1010	
100	5	2974.0	2710.0	2851.2	3100.3	249.1	0.0841	
100	6	4405.7	4356.8	4258.9	4561.2	302.3	0.0688	
100	7	6126.6	6069.4	5961.2	6304.8	343.6	0.0562	
125	2	330.6	321.7	325.3	336.4	11.1	0.0336	
125	3	910.3	898.4	896.5	923.6	27.1	0.0298	
125	4	1765.0	1758.13	1747.1	1783.5	36.4	0.0206	
125	5	2899.6	2899.0	2878.5	2922.5	44.0	0.0152	
125	6	4316.0	4337.4	4286.9	4342.6	55.7	0.0129	
125	7	6014.6	6042.3	5983.4	6052.6	69.2	0.0132	

Page 2 of 2

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

NO.	MODULUS N/M**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	3.56045E+07	.8260	10.0	2733.4	4.
9	3.99758E+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	1.77678E+08	.1780	-17.8	7438.9	6.
19	7.07402E+05	.9260	37.8	349.7	2.
20	1.09144E+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	2.17667E+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	1765.0	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	1729.5	3.


TEMPERATURE T DEG. C
MODULUS
REDUCED FREQUENCY FR HZ
FREQUENCY F HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA

Polymeric Material Characterization Test

Test No. 78-6

Beam Nos. Not and Recorded

Date 2/15/78

Damping Material MacBond IB1220

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 K Hz

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		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0         FROM        MROM         N          ML
              A1          A2          A3         A4
    40.0  4.0000E+03  4.5000E+06    .450   5.0000E+04
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
    40.0    .900     .750    -.900   3.0000E+03    2.500
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Test No. 78-6

Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	230.2	0.0228	X
25	6	7441.8	4407.4	7254.0	7667.9	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	0.0883	
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	9008.1	9500.9	968.8	0.1056	X
71	2	585.8	324.8	525.7	667.4	141.7	0.2493	
71	3	1447.3	905.8	1318.9		256.8	0.1803	
71	4	2761.8	1777.0	2423.7	3134.9	711.2	0.2665	
71	6	5949.9	4377.6	5588.0	6288.6	1375.6	0.2375	X
72	2	416.6	324.8	385.3	455.7	70.4	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	4377.6	4954.3	4978.9	384.6	0.0807	

Page 1 of 2

Test No. 78-6
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
72	7	6492.0	6100.7	6282.4	6703.2	420.8	0.0650	
100	2	339.8	323.1	324.4	357.3	32.9	0.0973	
100	3	940.5	902.1	886.1	993.2	108.1	0.1146	
100	4	1812.1	1764.2	1763.3	1860.0	96.7	0.0534	
100	5	2963.9	2910.0	2915.1	3016.2	101.1	0.0341	
100	6	4401.8	4558.8	4323.8	4503.2	179.4	0.0408	
100	7	6118.3	6071.8	6031.4	6212.0	180.6	0.0295	
125	2	324.6	321.7	320.7	329.2	8.5	0.0262	
125	3	903.0	898.4	891.6	913.9	22.3	0.0247	
125	4	1761.3	1758.1	1745.8	1776.4	30.6	0.0174	
125	5	2901.1	2899.0	2882.1	2920.2	38.1	0.0131	
125	6	4321.7	4337.4	4293.1	4348.3	55.2	0.0128	
125	7	6023.3	6042.3	5983.7	6050.0	66.3	0.0110	

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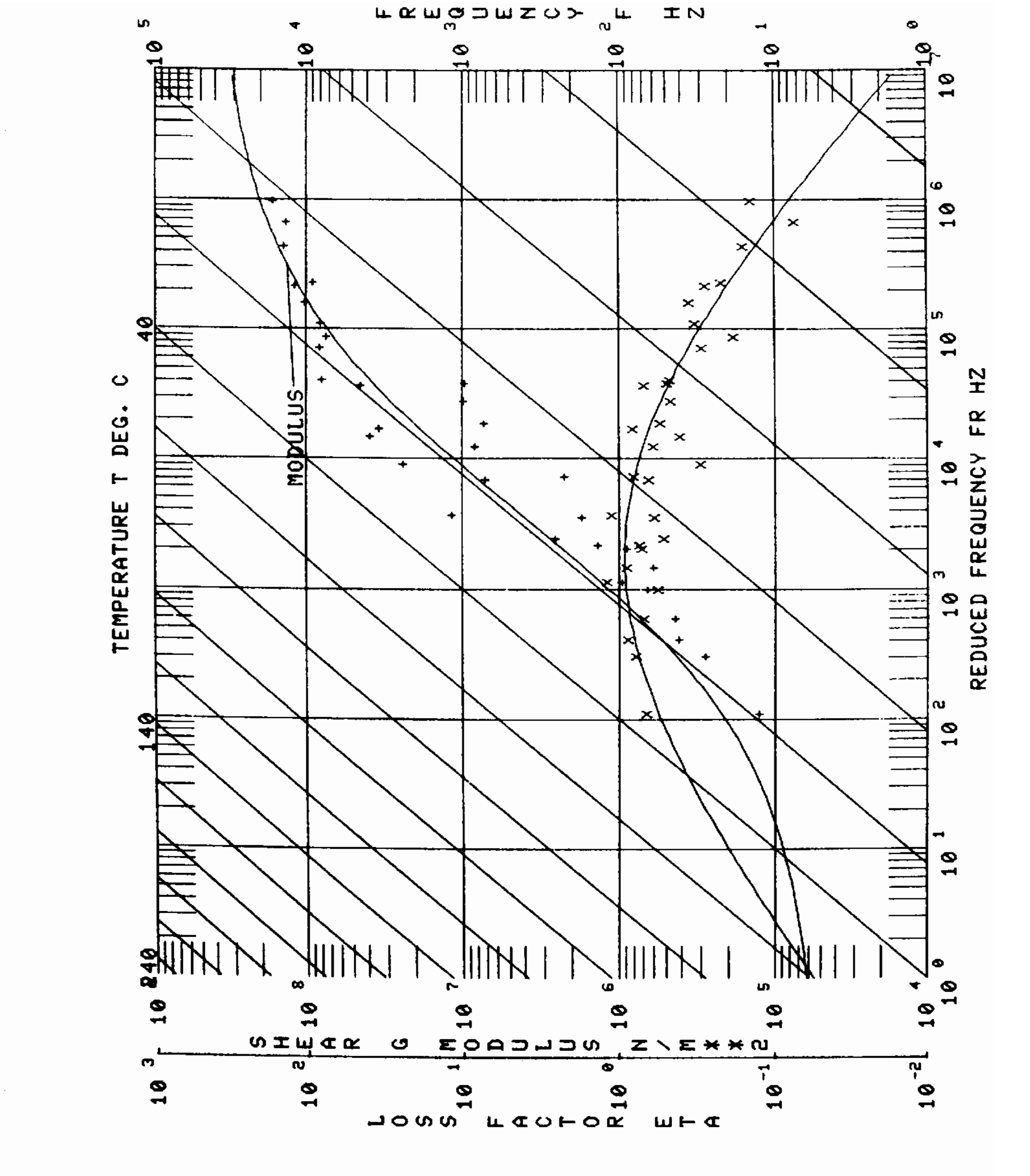
MATERIAL CODE : 10
MATERIAL :MACBOND IB 1220 78-6
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)

NO.	MODULUS N/M**2	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.
1	1.19900E+07	1.1490	21.7	585.8	2.
2	2.45660E+07	.3120	21.7	1447.3	3.
3	3.50598E+07	.8390	21.7	2761.8	4.
4	4.61949E+07	.7150	21.7	5949.9	6.
5	4.03550E+07	.4200	10.0	643.0	2.
6	8.10134E+07	.4920	10.0	1746.3	3.
7	8.42539E+07	.3040	10.0	3117.9	4.
8	8.34266E+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	7.67386E+07	.1890	-3.9	669.2	2.
12	9.30103E+07	.2310	-3.9	1755.0	3.
13	1.44652E+08	.1670	-3.9	3342.7	4.
14	1.40791E+08	.0760	-3.9	5132.5	5.
15	4.27682E+05	.8990	37.8	339.8	2.
16	9.91466E+05	1.2350	37.8	940.5	3.
17	1.39343E+06	.7630	37.8	1812.1	4.
18	1.76368E+06	.6170	37.8	2963.9	5.
19	1.30656E+05	.6890	51.7	324.6	2.
20	2.90545E+05	.8040	51.7	903.0	3.
21	4.48366E+05	.7100	51.7	1761.3	4.
22	6.72790E+05	.5840	51.7	2901.1	5.
23	6.21011E+05	.9160	51.7	4321.7	6.
24	9.20450E+05	.7370	51.7	6023.3	7.
25	2.60553E+06	.5370	22.2	416.6	2.
26	7.42565E+06	.6630	22.2	1171.9	3.
27	8.52881E+06	.6270	22.2	2103.7	4.
28	7.48081E+06	.5640	22.2	3223.6	5.
29	1.01146E+07	.4840	22.2	4780.0	6.
30	9.95603E+06	.5050	22.2	6492.0	7.
31	1.71197E+08	.1470	-3.9	7441.8	6.
32	2.28216E+06	.8330	37.8	6118.3	7.


TEMPERATURE T DEG. C
REDUCED FREQUENCY FR HZ
FREQUENCY F HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

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		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0         FROM         MROM         N          ML
              A1           A2          A3          A4
    20.0  6.8243E+03  5.3055E+06     .845   3.0861E+05
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
    20.0     1.403    .336     -.584   7.4699E+03      .234
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Test No. 78-7
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-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	2416.3	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	7460.0	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	X
25	6	4738.2	3257.1	4468.6	4965.8	977.5	0.2107	X
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	X

Page 1 of 2

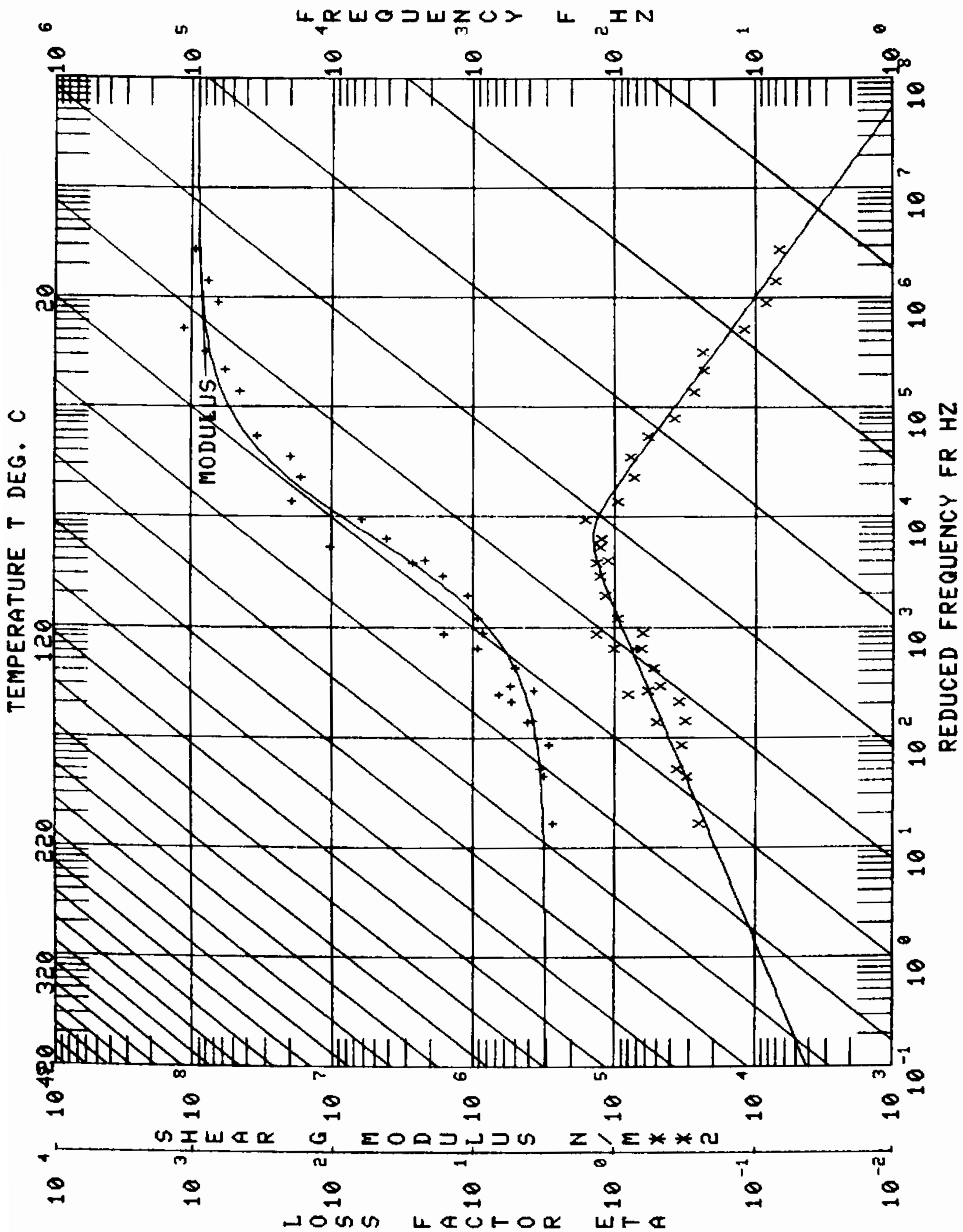
Test No. 78-7
Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	704.2	28.7	0.0416	
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	

Page 2 of 2

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

NO.	MODULUS N/M**2	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	.9890	21.1	1366.8	4.
4	1.13901E+06	1.2070	21.1	2229.1	5.
5	1.69059E+06	1.2980	21.1	3327.1	6.
6	2.25183E+06	1.1710	21.1	4643.1	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	.9820	-3.9	1220.4	3.
13	1.70714E+07	.7590	-3.9	2013.4	4.
14	2.02568E+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	4.69533E+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	8.79081E+05	.6590	37.8	4534.1	7.
26	2.83374E+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	7.94965E+07	.0730	-31.7	3858.6	5.
35	9.77676E+07	.0690	-31.7	7387.6	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REDUCED FREQUENCY FR HZ
FREQUENCY F HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

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 K Hz

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(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0          FROM          MROM          N          ML
               A1            A2           A3         A4
    40.0  2.0000E+03  6.0000E+06        .500  1.2500E+05
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
    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:

Test No. 78-8
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	646.6	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	X
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	906.1	1439.4	1696.0	504.5	0.3430	X
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	X
70	7	7626.1	6100.7	7252.0	8119.3	1705.1	0.2293	X
100	2	387.5	323.1	356.8	428.0	140.0	0.3872	X
100	3	1038.3	902:1	954.5	115.6	395.4	0.4116	X
100	4	1957.2	1764.2	1810.9	2090.1	548.9	0.2921	X
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	

Page 1 of 2

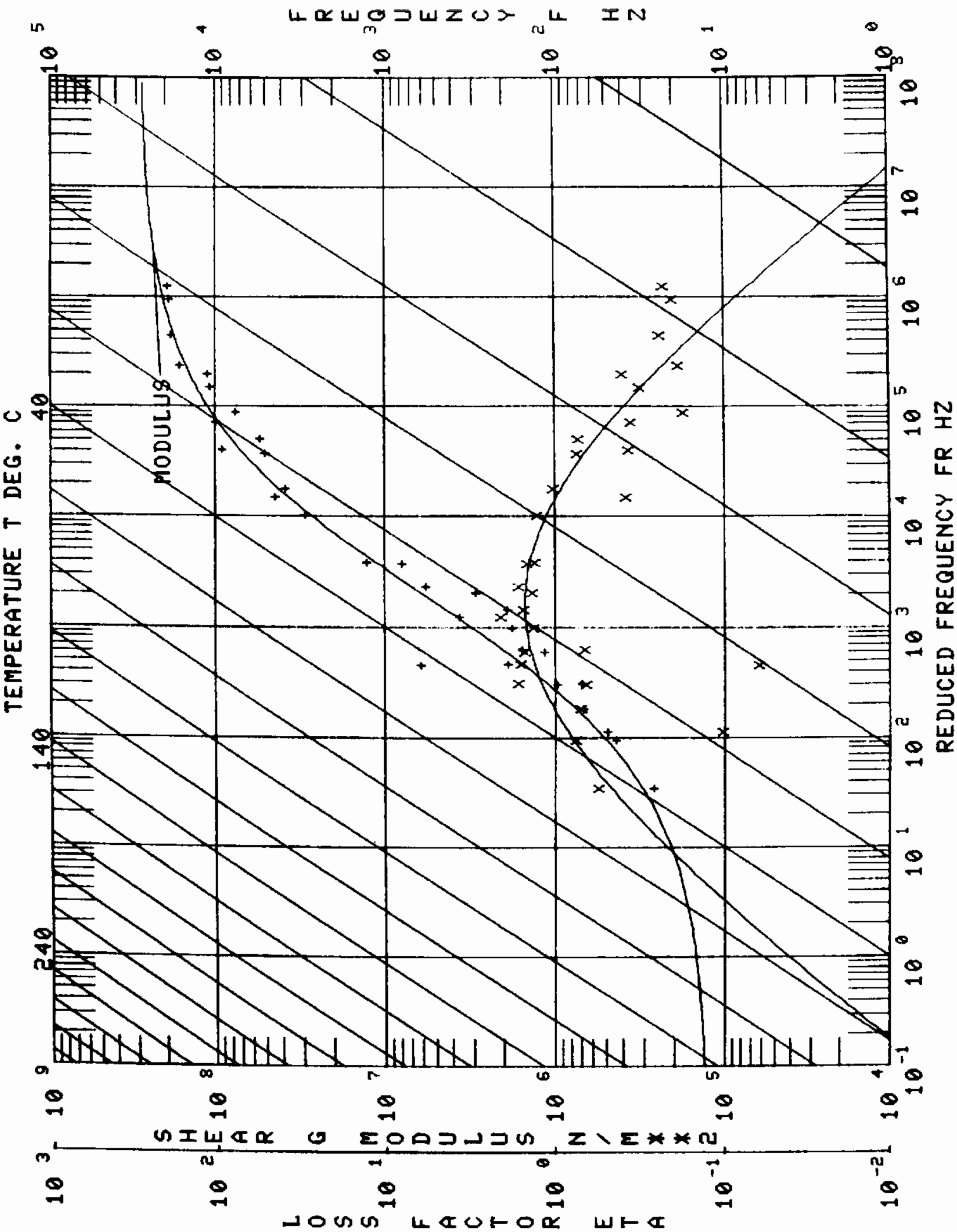
Test No. 78-8
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
125	3	910.3	898.4	870.6	952.8	82.2	0.0907	
125	4	1773.9	1758.1	1712.9	1841.1	128.2	0.0725	
125	5	2919.9	2899.0	2835.6	3012.0	176.4	0.0605	
125	6	4340.1	4337.4	4296.5	4406.6	216.5	0.0499	X
125	7	6057.0	6042.3	5904.4	6202.4	298.0	0.0493	
150	2	324.7	320.1	319.5	330.2	10.7	0.0330	
150	3	897.4	895.3	884.6	909.4	24.8	0.0276	
150	4	1748.0	1750.3	1729.6	1766.0	36.4	0.0208	
150	5	2878.7	2888.0	2853.4	2902.1	48.7	0.0169	
150	6	4300.5	4138.0	4286.9	4314.4	54.1	0.00639	X
150	7	5976.0	6013.1	5936.1	6015.5	79.4	0.0133	

Page 2 of 2

EXPERIMENTAL CODE :172
MATERIAL :MACBOND IB1320 (78-8)
DATA SOURCES
MANUFACTURER :NONE
AFML :UDRI
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	7.78089E+07	.1799	-3.9	676.8	2.	7.06726E+10	.0267	327.3	1.40006E+07
2	1.68099E+08	.1934	-3.9	1848.4	3.	7.00189E+10	.0344	912.2	3.25165E+07
3	1.90922E+08	.2495	-3.9	3414.4	4.	6.97020E+10	.0619	1783.5	4.76324E+07
4	1.98488E+08	.2104	-3.9	7346.8	6.	7.00645E+10	.0757	4407.4	4.17651E+07
5	2.00593E+08	.2374	-3.9	9646.3	7.	6.94501E+10	.0903	6140.3	4.76285E+07
6	4.48338E+07	.3919	10.0	646.6	2.	7.00694E+10	.0791	325.9	1.75717E+07
7	9.31281E+07	.3794	10.0	1741.2	3.	6.94979E+10	.0922	908.8	3.53302E+07
8	1.02186E+08	.3699	10.0	3120.4	4.	6.92338E+10	.1189	1777.5	3.78003E+07
9	1.11234E+08	.3254	10.0	6579.1	6.	6.95441E+10	.1246	4391.0	3.61927E+07
10	1.15226E+08	.4157	10.0	8679.0	7.	6.90277E+10	.1557	6121.6	4.78991E+07
11	2.99489E+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	4.15650E+07
13	5.13175E+07	.7670	21.1	5737.1	6.	6.91203E+10	.2528	4377.6	3.93615E+07
14	5.51218E+07	.7518	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.	6.84769E+10	.4116	902.1	8.08621E+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	.1048	51.7	334.0	2.	6.82750E+10	.0104	321.7	5.29480E+04
20	7.10796E+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	1.85011E+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	2.71632E+05	.5732	65.6	324.7	2.	6.75975E+10	.0330	320.1	1.55691E+05
26	7.01858E+05	.7271	65.6	1748.0	4.	6.71311E+10	.0208	1750.3	5.10333E+05
27	1.00344E+06	.6767	65.6	2878.7	5.	6.68819E+10	.0169	2888.0	6.79027E+05
28	6.30641E+06	.0636	65.6	4300.5	6.	6.17610E+10	.0064	4138.0	4.01156E+05
29	1.59452E+06	.6902	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	.7777	65.6	897.4	3.	6.74485E+10	.0276	895.3	3.51004E+05


TEMPERATURE T DEG. C
40
140
240
FREQUENCY F HZ
REDUCED FREQUENCY FR HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

Polymeric Material Characterization Test

Test No. 78-9

Beam Nos. Not and Recorded

Date 3/11/78

Damping Material MacBond IB1400

Material Thickness 0.0178 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 65.6 °C

Frequency Test Range: Between 10 Hz and 10 K Hz

Loss Factor η_D:

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

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0         FROM         MROM         N          ML
              A1           A2          A3          A4
    30.0  3.2120E+03  5.9439E+06     .557   2.4589E+05
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
    30.0   1.358      .484     -.367   1.6138E+03     .215
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Test No. 78-9
Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	X
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

Page 1 of 2

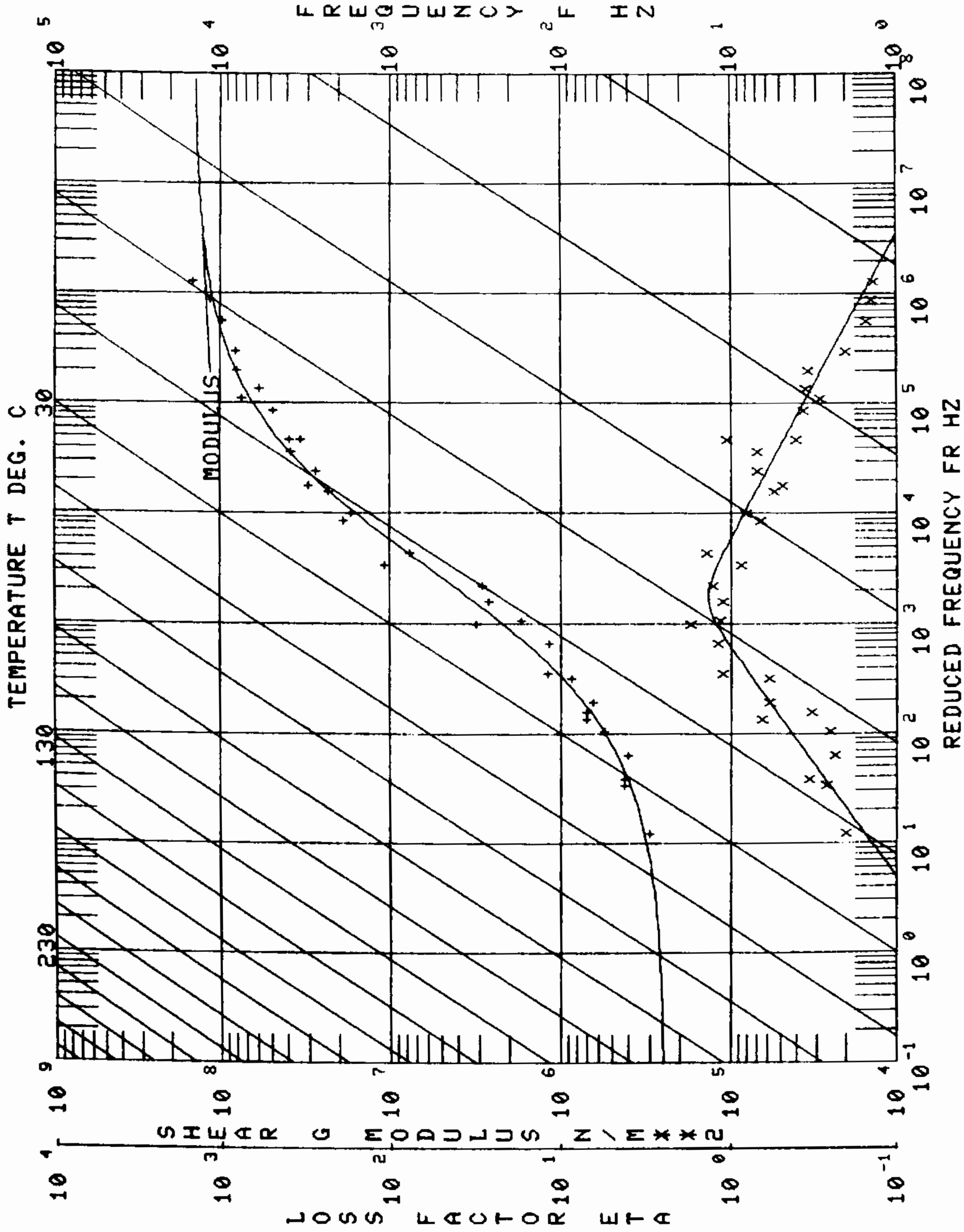
Test No. 78-9
Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
69	6	4164.5	3239.3	3891.2	4411.3	1022.5	0.02532	X
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	

Page 2 of 2

EXPERIMENTAL CODE : 10
MATERIAL :MACBOND IB 1400 JG 78-9
DATA SOURCES
MANUFACTURER :NONE
AFML :SANDWICH BEAM (UDRI)
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	3.20439E+06	1.7761	20.6	403.2	2.	6.70496E+10	.3757	239.1	5.69140E+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	3239.3	1.45110E+07
4	1.11506E+07	.8894	10.0	456.7	2.	6.74427E+10	.1571	239.8	9.91705E+06
5	1.92108E+07	.6760	10.0	1177.6	3.	6.77552E+10	.1796	673.0	1.29863E+07
6	2.38879E+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	.2374	2177.6	1.99854E+07
8	3.93413E+07	.7092	10.0	4862.0	6.	6.77169E+10	.2373	3249.7	2.79023E+07
9	3.10222E+07	.4991	-3.9	487.3	2.	6.79499E+10	.0540	240.7	1.54845E+07
10	4.02820E+07	.4138	-3.9	1279.5	3.	6.82595E+10	.0833	675.5	1.66669E+07
11	4.97926E+07	.3717	-3.9	2360.6	4.	6.81552E+10	.0989	1322.7	1.85059E+07
12	6.03710E+07	.3605	-3.9	3717.2	5.	6.79981E+10	.1100	2184.0	2.17608E+07
13	8.12090E+07	.3482	-3.9	5446.9	6.	6.80507E+10	.1106	3257.7	2.82790E+07
14	7.67132E+07	.2937	-17.8	504.8	2.	6.84023E+10	.0164	241.5	2.25272E+07
15	8.31736E+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	.1450	-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	7.28234E+05	.6605	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	1.2353	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	4.38665E+05	.3469	51.7	261.6	2.	6.57658E+10	.0640	236.8	1.52152E+05
25	6.67097E+05	.6048	51.7	1334.2	4.	6.61909E+10	.0395	1303.5	4.03471E+05
26	3.10186E+05	.2074	65.6	253.3	2.	6.52668E+10	.0300	235.9	6.43276E+04
27	4.12197E+05	.2409	65.6	1312.0	4.	6.56638E+10	.0102	1298.3	9.92921E+04
28	5.69899E+05	.2598	65.6	2161.3	5.	6.56647E+10	.0093	2146.2	1.48035E+05
29	7.23716E+05	.3335	65.6	3222.9	6.	6.60396E+10	.0102	3209.2	2.41390E+05
30	3.42698E+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	1.17909E+05


TEMPERATURE T DEG. C
REDUCED FREQUENCY FR HZ
FREQUENCY F HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

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		

```
LOG(M)=LOG(ML)+(2LOG(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=(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
    20.0   1.250    1.000   -1.000   1.4000E+03   2.500
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Test No. 78-12
Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-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	388.4	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	

Page 1 of 2

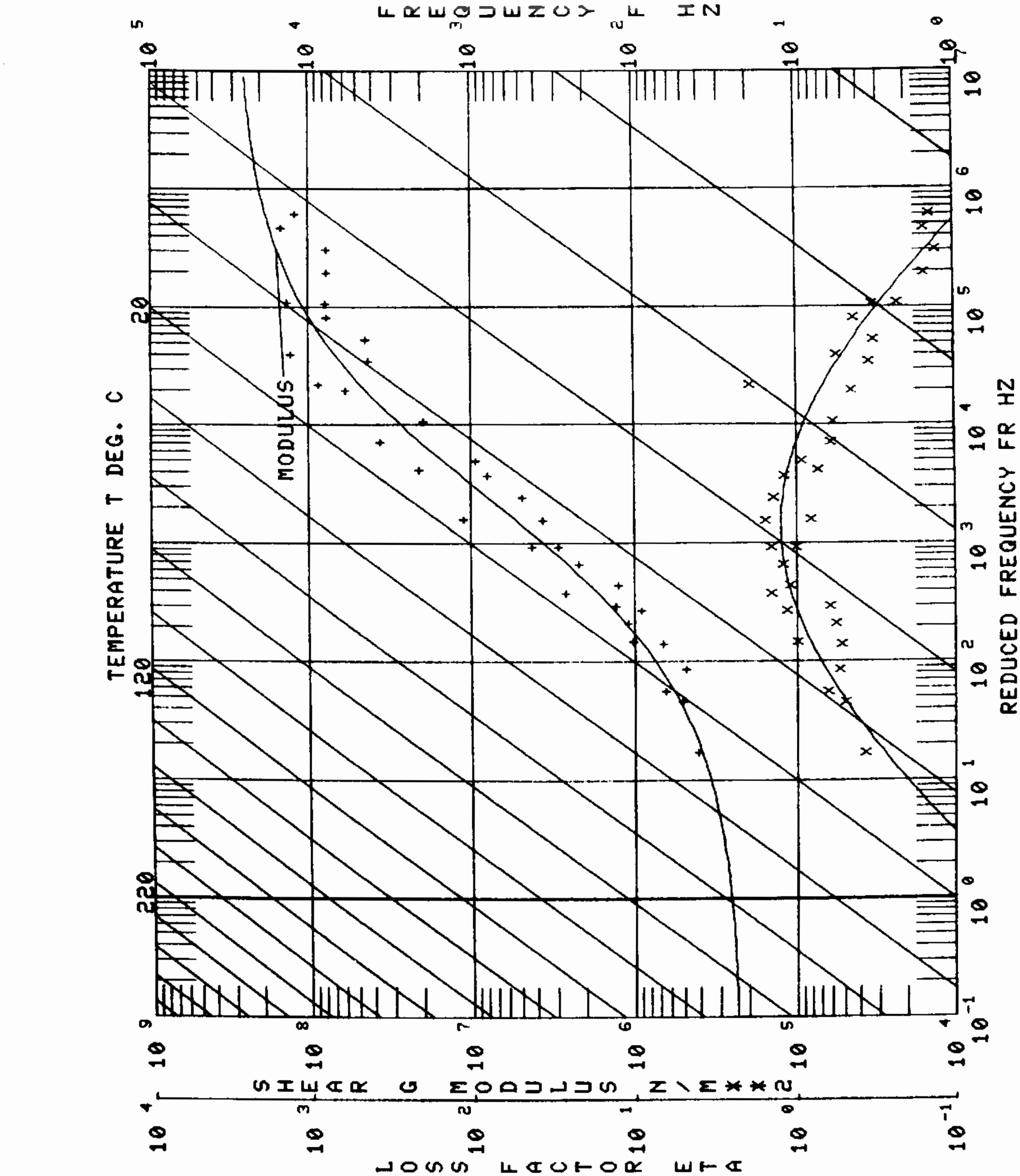
Test No. 78-12
Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
68	6	3809.0	3239.6	3592.6	4115.1	1027.2	0.2799	X
68	7	5183.0	4533.6	4946.0	5467.1	1024.5	0.2016	X
100	2	280.7	237.9	257.3	303.1	45.8	0.1654	
100	3	738.9	667.6	679.0	807.7	128.7	0.1769	
100	4	1368.6	1309.0	1298.7	1452.5	153.8	0.1131	
100	5	2241.1	2162.4	2141.5	2349.3	207.8	0.0931	
100	6	3375.8	3230.9	3177.9	3571.8	393.9	0.1175	
100	7	4705.5	4516.9	4469.5	4908.3	438.8	0.0937	
125	2	264.0	236.8	254.5	274.0	19.5	0.0741	
125	3	697.8	664.7	678.9	716.4	37.5	0.0538	
125	4	1329.6	1303.5	1309.8	1351.0	41.2	0.0310	
125	5	2187.5	2154.6	2158.8	2214.6	55.8	0.0255	
125	6	3277.0	3220.8	3226.2	3324.5	98.3	0.0300	
125	7	4563.0	4503.6	4499.8	4627.7	127.9	0.0280	

Page 2 of 2

EXPERIMENTAL CODE :173
MATERIAL :MACBOND IB1401 (78-12)
DATA SOURCES
MANUFACTURER :NONE
AFML :UDRI
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	1.34335E+08	.5698	-20.0	508.6	2.	6.84590E+10	.0134	241.6	7.65450E+07
2	1.40130E+08	.2338	-20.0	1389.5	3.	6.87859E+10	.0171	678.1	3.27638E+07
3	7.88515E+07	.1588	-20.0	2504.7	4.	6.86404E+10	.0315	1327.4	1.25177E+07
4	7.86503E+07	.1338	-20.0	3895.9	5.	6.84347E+10	.0356	2191.0	1.05260E+07
5	1.51830E+08	.1588	-20.0	6002.5	6.	6.84021E+10	.0366	3266.1	2.41077E+07
6	1.24676E+08	.1454	-20.0	7811.2	7.	6.82780E+10	.0436	4566.2	1.81266E+07
7	3.70671E+07	.6177	-6.1	492.5	2.	6.80064E+10	.0459	240.8	2.28973E+07
8	5.98548E+07	.4555	-6.1	1333.1	3.	6.82797E+10	.0601	675.6	2.72641E+07
9	4.37513E+07	.3582	-6.1	2347.7	4.	6.82583E+10	.0938	1323.7	1.56719E+07
10	4.55062E+07	.3305	-6.1	3605.1	5.	6.80604E+10	.1052	2185.0	1.50413E+07
11	7.89226E+07	.4442	-6.1	5547.0	6.	6.81134E+10	.1296	3259.2	3.50598E+07
12	7.97290E+07	.3390	-6.1	7299.0	7.	6.79644E+10	.1130	4555.7	2.70254E+07
13	1.13843E+07	.8321	7.2	459.3	2.	6.75553E+10	.1347	240.0	9.47275E+06
14	2.15049E+07	.7460	7.2	1222.0	3.	6.78559E+10	.1649	673.5	1.60434E+07
15	2.01656E+07	.6047	7.2	3144.8	5.	6.76871E+10	.2059	2179.0	1.21933E+07
16	8.91362E+07	1.9977	7.2	6338.8	6.	6.77794E+10	.2119	3251.2	1.78066E+08
17	2.72349E+06	1.4836	20.0	388.4	2.	6.71056E+10	.3577	239.2	4.04043E+06
18	4.36558E+06	1.4878	20.0	959.7	3.	6.73731E+10	.4036	671.1	6.49529E+06
19	3.72770E+06	1.6145	20.0	1596.1	4.	6.73742E+10	.3724	1315.1	6.01835E+06
20	5.02487E+06	1.4248	20.0	2537.2	5.	6.72653E+10	.3063	2172.2	7.15946E+06
21	8.14635E+06	1.2307	20.0	3809.0	6.	6.72966E+10	.2799	3239.6	1.00256E+07
22	9.66045E+06	.9513	20.0	5183.0	7.	6.73065E+10	.2016	4533.6	9.18999E+06
23	6.70182E+05	.6596	37.8	280.7	2.	6.63782E+10	.1654	237.9	4.42042E+05
24	1.04510E+06	1.0105	37.8	738.9	3.	6.66722E+10	.1769	667.6	1.05609E+06
25	9.28687E+05	1.1808	37.8	1368.6	4.	6.67507E+10	.1131	1309.0	1.09663E+06
26	1.27888E+06	1.1330	37.8	2241.1	5.	6.66597E+10	.0931	2162.4	1.44891E+06
27	2.25676E+06	1.2450	37.8	3375.8	6.	6.69357E+10	.1175	3230.9	2.80965E+06
28	3.00940E+06	1.0304	37.8	4705.5	7.	6.68116E+10	.0937	4516.9	3.10093E+06
29	4.19069E+05	.3828	51.7	264.0	2.	6.57658E+10	.0741	236.8	1.60402E+05
30	5.24738E+05	.5096	51.7	697.8	3.	6.60942E+10	.0538	664.7	2.67388E+05
31	5.00329E+05	.5507	51.7	1329.6	4.	6.61909E+10	.0310	1303.5	2.75546E+05
32	6.92131E+05	.5333	51.7	2187.5	5.	6.61797E+10	.0255	2154.6	3.69104E+05
33	1.12897E+06	.5804	51.7	3277.0	6.	6.65178E+10	.0300	3220.8	6.55216E+05
34	1.32428E+06	.6367	51.7	4563.0	7.	6.64187E+10	.0280	4503.6	8.43166E+05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REDUCED FREQUENCY FR HZ
FREQUENCY F HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

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 K Hz

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		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0          FROM         MROM         N          ML
               A1           A2          A3         A4
    20.0  7.2800E+03  8.2000E+06     .600   4.0000E+05
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
    20.0    1.300    1.000     -.750   3.0000E+03    1.000
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Test No. 78-13
Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-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	4800.1	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	559.5	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	X
45	5	3471.6	2934.0	2969.3	3915.8	946.5	0.2834	

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Test No. 78-13
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	1004.2	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	3036.5	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	

Page 2 of 3

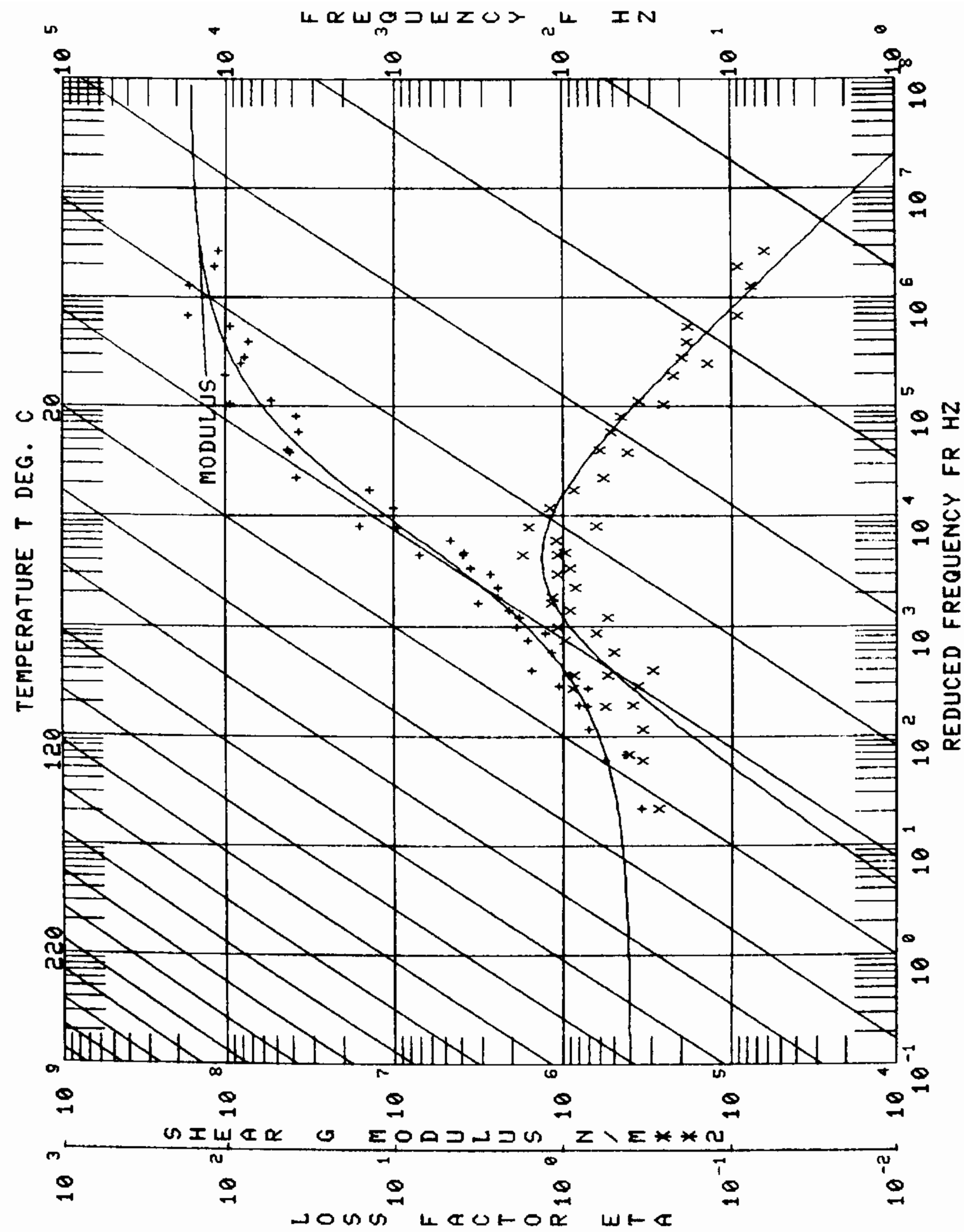
Test No. 78-13
Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
125	3	922.8	898.4	911.5	933.8	22.3	0.0242	
125	4	1781.9	1757.5	1768.1	1796.4	28.3	0.0159	
125	5	2919.3	2899.0	2906.7	2945.2	38.5	0.0132	
125	6	4358.0	4337.4	4334.6	4380.7	46.1	0.0106	
125	7	6075.2	6042.3	6046.9	6102.5	55.6	0.00915	

Page 3 of 3

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

NO.	MODULUS N/M**2	LOSS FACTOR	TEMP. DEG. C	FREQ. HZ	MODE NO.
1	9.56992E+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	3.29431E+06	1.2080	7.2	469.8	2.
8	7.30155E+06	1.7720	7.2	1302.0	3.
9	9.91466E+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	4.22373E+07	.4300	-17.8	650.2	2.
13	1.62234E+07	.6530	-5.6	600.0	2.
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	5.42893E+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	7.82555E+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	8.24613E+07	.1420	-31.7	671.3	2.
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	2.
30	7.32223E+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	1.32104E+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	7.19813E+05	.3500	51.7	1781.9	4.
38	8.33576E+05	.4040	51.7	2919.3	5.
39	1.08110E+06	.3730	51.7	4358.0	6.
40	1.57338E+06	.3080	51.7	6075.2	7.
41	7.33602E+05	.9000	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	2.51245E+06	.8750	22.8	3036.5	5.
45	3.60940E+06	.9400	22.8	4537.4	6.
46	3.94656E+06	1.0040	22.8	6266.6	7.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20
120
220
MODULUS
REDUCED FREQUENCY FR HZ
FREQUENCY F HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA

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		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0          FROM          MROM          N          ML
               A1            A2          A3          A4
    30.0   4.7887E+03   9.9865E+06     .412    2.2607E+05
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
    30.0    1.470     .182     -.355    6.2003E+03     .100
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Test No. 78-14

Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	0.3237	X
50	5	3337.7	2177.6	3080.4	3568.5	959.6	0.3000	X
50	7	6474.7	4542.4	6021.6	6861.1	1650.4	0.2635	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	0.8397	X
72	5	2644.9	2171.4	2436.2	2870.2	872.9	0.3495	X

Page 1 of 3

Test No. 78-14
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	

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Test No. 78-14
Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
175	4	1306.5	1292.5	1291.0	1322.4	31.4	0.0240	
174	5	2152.1	2137.4	2133.7	2171.8	38.1	0.0177	
174	6	3214.1	3197.5	3187.8	3241.1	53.3	0.0166	
174	7	4485.9	4473.2	4454.8	4523.8	69.0	0.0154	
195	1	43.3		41.9	45.7	3.8	0.0881	
195	2	242.9	234.1	237.5	248.6	11.1	0.0457	
195	3	667.8	656.5	658.8	676.6	17.8	0.0267	
195	4	1297.6	1287.5	1287.1	1309.6	22.5	0.0173	
195	5	2140.4	2120.5	2128.0	2153.7	25.7	0.0120	
195	6	3196.3	3187.5	3178.8	3214.9	36.1	0.0113	
195	7	4464.9	4460.5	4440.1	4486.0	45.9	0.0103	

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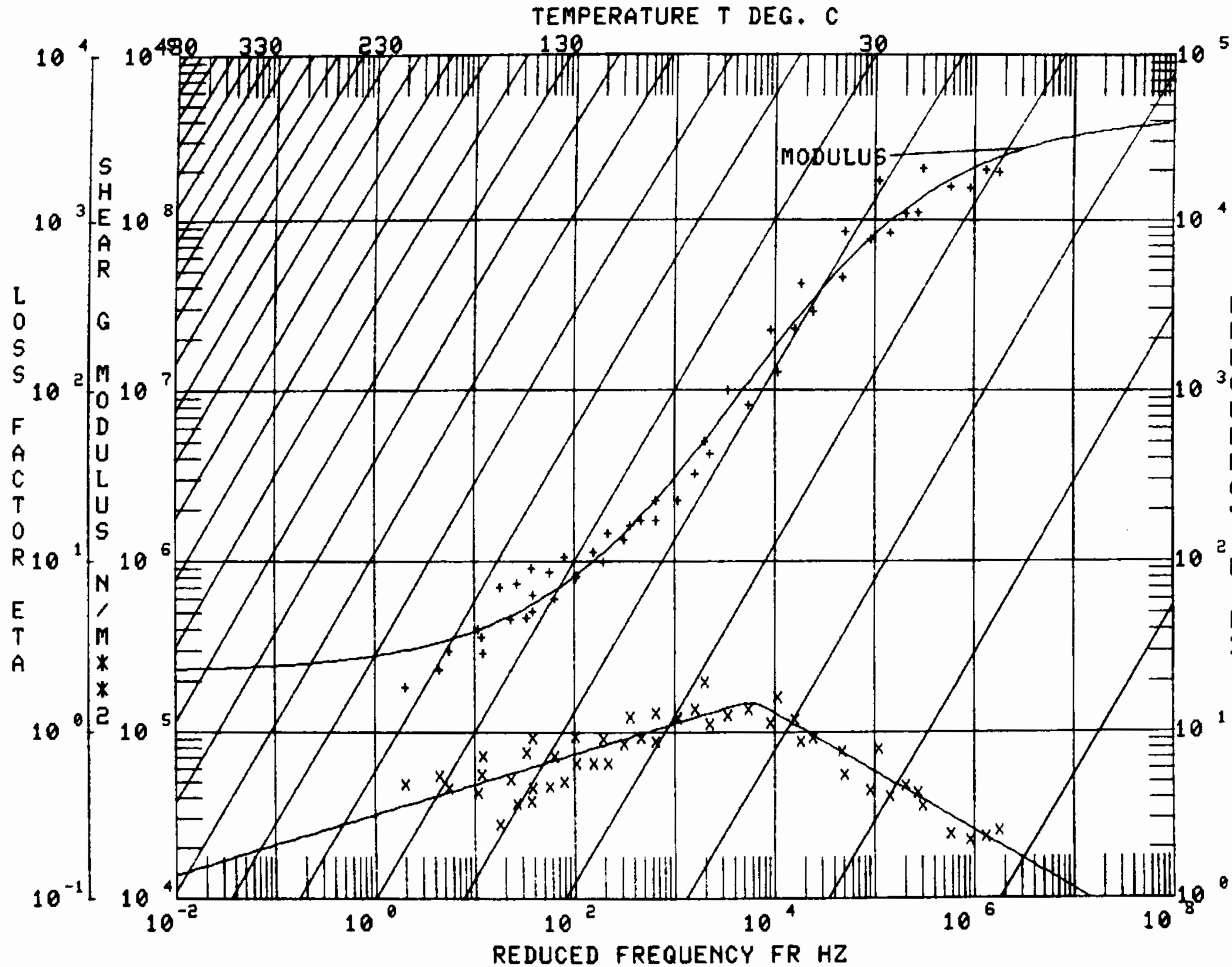
EXPERIMENTAL CODE : 1
MATERIAL :MACBOND IB 2101 78-14
DATA SOURCES
MANUFACTURER :NONE
AFML :SANDWICH BEAM (UDRI)
OTHER :NONE

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	5.14461E+06	2.0228	22.2	986.5	3.	6.72928E+10	.4854	670.7	1.04065E+07
2	8.39705E+06	1.4094	22.2	2644.9	5.	6.72158E+10	.3495	2171.4	1.18347E+07
3	1.30810E+07	1.6563	22.2	5308.6	7.	6.72591E+10	.3529	4532.0	2.16658E+07
4	1.03201E+07	1.2898	10.0	464.1	2.	6.74427E+10	.1997	239.8	1.33110E+07
5	2.28836E+07	1.1732	10.0	1250.3	3.	6.77552E+10	.2302	673.0	2.68472E+07
6	2.32428E+07	1.2307	10.0	2189.8	4.	6.77436E+10	.3237	1318.7	2.86051E+07
7	2.97384E+07	.9530	10.0	3337.7	5.	6.76001E+10	.3000	2177.6	2.83397E+07
8	4.66832E+07	.7836	10.0	6474.7	7.	6.75681E+10	.2635	4542.4	3.65819E+07
9	4.29527E+07	.9047	-3.9	504.4	2.	6.79499E+10	.0604	240.7	3.88596E+07
10	8.77415E+07	.5746	-3.9	1375.5	3.	6.82595E+10	.0660	675.5	5.04202E+07
11	7.94271E+07	.4586	-3.9	2501.0	4.	6.81552E+10	.0986	1322.7	3.64232E+07
12	8.52853E+07	.4182	-3.9	3890.3	5.	6.79981E+10	.1156	2184.0	3.56655E+07
13	1.12404E+08	.4901	-3.9	5720.0	6.	6.80507E+10	.1394	3257.7	5.50945E+07
14	1.15382E+08	.4415	-3.9	7567.7	7.	6.79017E+10	.1432	4553.6	5.09412E+07
15	1.76634E+08	.8223	-17.8	520.3	2.	6.84023E+10	.0158	241.5	1.45240E+08
16	2.11005E+08	.3684	-17.8	1426.5	3.	6.86845E+10	.0229	677.6	7.77305E+07
17	1.63667E+08	.2489	-17.8	2659.2	4.	6.85990E+10	.0357	1327.0	4.07392E+07
18	1.61645E+08	.2278	-17.8	4190.7	5.	6.83722E+10	.0472	2190.0	3.68224E+07
19	2.08740E+08	.2430	-17.8	6152.8	6.	6.83644E+10	.0548	3265.2	5.07135E+07
20	2.01271E+08	.2608	-17.8	8205.3	7.	6.82003E+10	.0716	4563.6	5.24895E+07
21	1.67111E+06	1.2632	37.8	759.9	3.	6.66722E+10	.2568	667.6	2.11096E+06
22	1.77318E+06	1.3302	37.8	1402.9	4.	6.67507E+10	.1783	1309.0	2.35875E+06
23	2.32925E+06	1.2511	37.8	2280.1	5.	6.66597E+10	.1405	2162.4	2.91413E+06
24	3.34445E+06	1.3942	37.8	3400.4	6.	6.69357E+10	.1511	3230.9	4.66282E+06
25	4.35269E+06	1.1414	37.8	4729.3	7.	6.68116E+10	.1171	4516.9	4.96830E+06
26	5.23381E+05	.9518	51.7	264.6	2.	6.57658E+10	.1825	236.8	4.98160E+05
27	8.36246E+05	.9609	51.7	707.2	3.	6.60942E+10	.1229	664.7	8.03571E+05
28	1.01028E+06	.9295	51.7	1349.6	4.	6.61909E+10	.0798	1303.5	9.39076E+05
29	1.38476E+06	.8704	51.7	2213.5	5.	6.61797E+10	.0635	2154.6	1.20532E+06
30	1.77575E+06	.9530	51.7	3291.1	6.	6.65178E+10	.0605	3220.8	1.69228E+06
31	2.34284E+06	.9105	51.7	4593.3	7.	6.64187E+10	.0549	4503.6	2.13325E+06
32	3.01370E+05	.7330	65.6	251.1	2.	6.52668E+10	.0956	235.9	2.20907E+05
33	4.85021E+05	.7737	65.6	683.6	3.	6.55386E+10	.0636	661.9	3.75266E+05
34	6.17736E+05	.7351	65.6	1320.7	4.	6.56638E+10	.0411	1298.3	4.54093E+05
35	8.38087E+05	.6691	65.6	2172.0	5.	6.56647E+10	.0312	2146.2	5.60806E+05
36	1.16534E+06	.6695	65.6	3242.2	6.	6.60396E+10	.0291	3209.2	7.80193E+05
37	1.49092E+06	.6648	65.6	4525.9	7.	6.59653E+10	.0266	4488.2	9.91100E+05
38	2.42402E+05	.5664	79.4	246.6	2.	6.46596E+10	.0626	234.8	1.37295E+05
39	3.76178E+05	.5733	79.4	674.0	3.	6.49261E+10	.0380	658.8	2.15658E+05
40	4.78356E+05	.5387	79.4	1306.5	4.	6.50785E+10	.0240	1292.5	2.57698E+05
41	6.54260E+05	.4748	79.4	2152.1	5.	6.51273E+10	.0177	2137.4	3.10621E+05
42	8.94223E+05	.4864	79.4	3214.1	6.	6.55589E+10	.0166	3197.5	4.34990E+05
43	1.07995E+06	.5189	79.4	4485.9	7.	6.55251E+10	.0154	4473.2	5.60341E+05
44	1.90361E+05	.5036	90.6	242.9	2.	6.42746E+10	.0457	234.1	9.58610E+04
45	3.10590E+05	.4759	90.6	667.8	3.	6.44736E+10	.0267	656.5	1.47802E+05
46	4.12710E+05	.4426	90.6	1297.6	4.	6.45759E+10	.0173	1287.5	1.82645E+05
47	7.30982E+05	.2857	90.6	2140.4	5.	6.41014E+10	.0120	2120.5	2.08877E+05
48	7.64061E+05	.3823	90.6	3196.3	6.	6.51495E+10	.0113	3187.5	2.92074E+05
49	9.41705E+05	.3935	90.6	4464.9	7.	6.51535E+10	.0103	4460.5	3.70538E+05


TEMPERATURE T DEG. C
430
330
230
130
30
MODULUS
LOSS FACTOR ETA
SHEAR G MODULUS N/M**2
FREQUENCY F HZ
REDUCED FREQUENCY FR HZ
10^{-2}
10^{0}
10^{2}
10^{4}
10^{6}
10^{8}

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		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0        FROM        MROM         N          ML
             A1          A2          A3         A4
    50.0  2.6973E+04  9.9986E+06    .280   1.0127E+05
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
    50.0   1.321    .169     -.325   1.5063E+04     .300
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Test No. 78-15
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	3821.4	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	1218.1	1649.2	431.1	0.3170	

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Test No. 78-15
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
71	5	3091.3	2923.0	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	70.3		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	

Page 2 of 3

Test No. 78-15
Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
150	8	8079.6		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	

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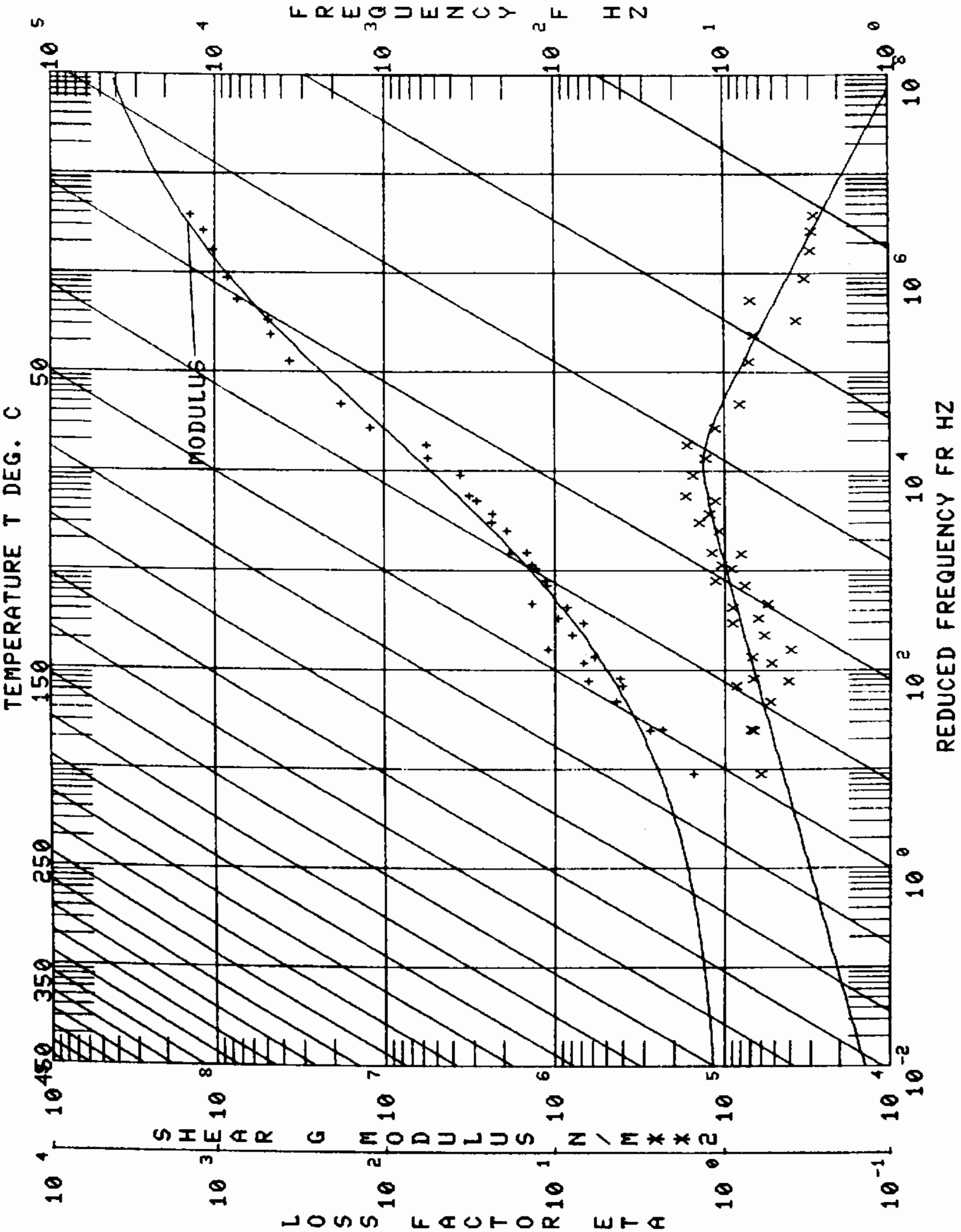
EXPERIMENTAL CODE : 2
MATERIAL :MACBOND IB 2107 JG78-15
DATA SOURCES
MANUFACTURER :NONE
AFML :SANDWICH BEAM (UDRI)
OTHER :NONE

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	1.25161E+07	1.1591	21.7	1426.0	3.	6.90398E+10	.3170	905.8	1.45080E+07
2	2.14147E+07	.6185	21.7	3901.3	5.	6.85128E+10	.2009	2923.0	1.32446E+07
3	1.85000E+07	.8306	10.0	619.9	2.	7.00694E+10	.1331	325.9	1.53661E+07
4	3.67406E+07	.7194	10.0	1650.2	3.	6.94979E+10	.1541	908.8	2.64330E+07
5	4.74840E+07	.6770	10.0	3027.8	4.	6.92338E+10	.1828	1777.5	3.21454E+07
6	7.46946E+07	.7111	10.0	6921.1	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	8.60213E+07	.3306	-3.9	1765.1	3.	7.00189E+10	.0501	912.2	2.84429E+07
9	1.05826E+08	.3054	-3.9	3302.5	4.	6.97020E+10	.0640	1783.5	3.23180E+07
10	1.19923E+08	.2997	-3.9	5206.1	5.	6.94772E+10	.0776	2943.5	3.59354E+07
11	1.44887E+08	.2902	-3.9	7553.2	6.	7.00645E+10	.0833	4407.4	4.20428E+07
12	6.14724E+08	.4999	-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	400.3	2.	6.88765E+10	.2850	323.1	1.49937E+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	1.7212	38.9	6419.6	7.	6.79092E+10	.1805	6071.8	1.00795E+07
20	6.97954E+05	.9227	51.7	361.3	2.	6.82750E+10	.1765	321.7	6.44020E+05
21	1.16984E+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.	6.77308E+10	.1185	1758.1	1.86171E+06
23	1.96613E+06	1.1035	51.7	3003.4	5.	6.73923E+10	.0871	2899.0	2.16968E+06
24	2.35418E+06	1.2620	51.7	4456.5	6.	6.73566E+10	.0816	4337.4	2.97094E+06
25	2.97479E+06	1.1695	51.7	6188.5	7.	6.72509E+10	.0696	6042.3	3.47901E+06
26	4.30694E+05	.6882	65.6	344.1	2.	6.75975E+10	.0952	320.1	2.96412E+05
27	6.38239E+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	8.02093E+05
29	1.13630E+06	.7785	65.6	2938.7	5.	6.68819E+10	.0379	2888.0	8.84596E+05
30	1.33937E+06	.9326	65.6	4370.7	6.	6.72510E+10	.0363	4318.0	1.24905E+06
31	1.90849E+06	.8159	65.6	6089.6	7.	6.66025E+10	.0326	6013.1	1.55712E+06
32	2.40618E+05	.7093	79.4	331.4	2.	6.69655E+10	.0617	318.6	1.70661E+05
33	4.17813E+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	4326.6	6.	6.66046E+10	.0189	4297.2	6.33348E+05
37	1.41147E+06	.5644	79.4	6032.6	7.	6.60498E+10	.0171	5988.1	7.96660E+05
38	1.58229E+05	.6195	93.3	324.8	2.	6.63364E+10	.0376	317.1	9.80197E+04
39	2.86575E+05	.6910	93.3	899.5	3.	6.63381E+10	.0281	887.9	1.98011E+05
40	4.47861E+05	.5394	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	4292.2	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	4.56896E+05


TEMPERATURE T DEG. C
FREQUENCY F HZ
REDUCED FREQUENCY FR HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

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)))C/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:

Test No. 78-17
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-25	2	519.0	242.2	516.9	521.3	4.4	0.00848	
-25	3	1406.7	679.9	1397.6	1416.9	19.3	0.0137	
-25	4	2678.1	1330.0	2650.9	2704.1	53.3	0.0199	
-25	5	4168.1	2195.4	4113.2	4224.8	111.6	0.0268	
-25	6	6218.2	3272.0	6129.2	6303.4	174.2	0.0280	
-25	7	8009.7	4572.0	7878.5	8137.0	258.5	0.0348	
0	2	511.9	241.5	505.2	517.7	12.5	0.0244	
0	3	1364.4	677.6	1336.5	1391.3	54.8	0.0402	
0	4	2557.4	1327.0	2495.4	2639.1	143.7	0.0563	
0	5	3945.5	2190.0	3815.3	4067.5	252.0	0.0641	
0	6	5899.0	3265.2	5687.0	6097.4	410.4	0.0697	
0	7	7519.2	4563.6	7159.2	7095.6	746.4	0.0998	
25	2	481.0	240.7	452.8	516.8	64.0	0.1342	
25	3	1260.8	675.5	118.3	1369.9	201.6	0.1620	
25	4	2342.1	1322.7	2115.4	2541.4	426.0	0.1850	
25	5	3495.3	2184.0	3115.2	3824.1	708.9	0.2071	
25	6	5264.7	3257.7	4744.2		1041.0	0.2017	
25	7	6179.0	4553.6		7266.5	1095.0	0.1652	
50	2	395.0	239.8	330.7		128.6	0.3443	
50	3	988.2	673.0	835.6	1194.2	368.6	0.4020	

Page 1 of 3

Test No. 78-17
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	

Page 2 of 3

Test No. 78-17
Beam No. Not Recorded

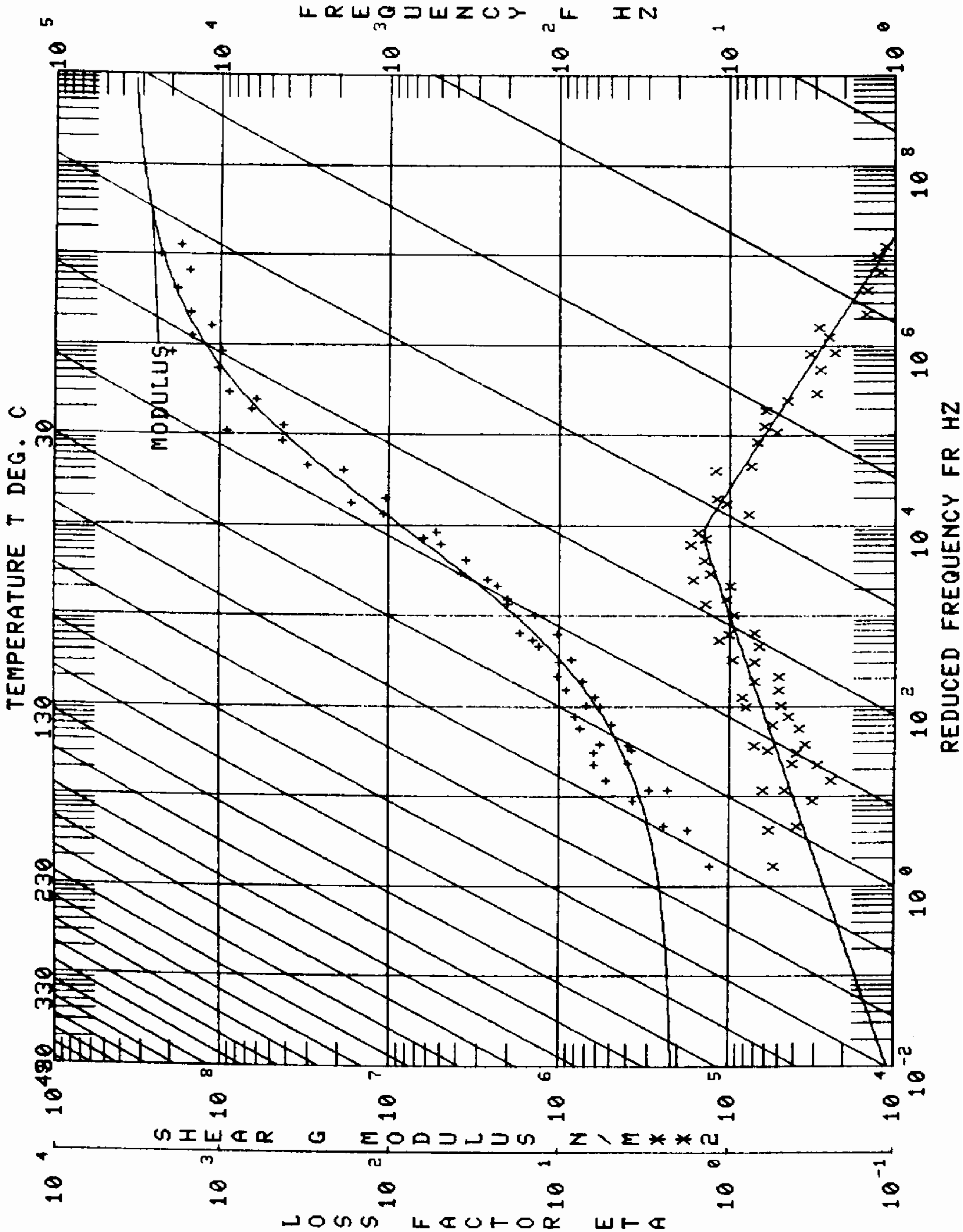
Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
125	7	4546.5	4503.6	4462.1	4614.9	152.8	0.0336	
150	2	246.9	235.9	238.9	256.2	17.3	0.0702	
150	3	676.3	661.9	662.3	690.1	27.8	0.0411	
150	4	1311.0	1298.3	1293.3	1327.7	34.4	0.0262	
150	5	2159.3	2146.2	2137.7	2180.8	43.1	0.0200	
150	6	3220.8	3209.2	3190.1	3249.3	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	

Page 3 of 3

EXPERIMENTAL CODE : 4
MATERIAL :MACBOND IB2130 JG 78-17
DATA SOURCES
MANUFACTURER :NONE
AFML :SANDWICH BEAM (UDRI)
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	1.48782E+06	1.1775	23.9	314.3	2.	6.69374E+10	.3465	238.9	1.75185E+06
2	2.07053E+06	1.4346	23.9	786.4	3.	6.72326E+10	.3218	670.4	2.97038E+06
3	2.72785E+06	1.6761	23.9	1469.5	4.	6.72411E+10	.2974	1313.8	4.57216E+06
4	3.63139E+06	1.4524	23.9	2364.9	5.	6.71415E+10	.2258	2170.2	5.27440E+06
5	5.11719E+06	1.7356	23.9	3520.5	6.	6.71845E+10	.2569	3236.9	8.88134E+06
6	5.47798E+06	1.5757	23.9	4811.6	7.	6.72205E+10	.1922	4530.7	8.63171E+06
7	3.90105E+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	.7841	10.0	1796.8	4.	6.77436E+10	.2593	1318.7	8.61067E+06
10	1.07386E+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	1.71939E+07	1.0618	-3.9	481.0	2.	6.79499E+10	.1342	240.7	1.82566E+07
13	3.12258E+07	.7622	-3.9	1260.8	3.	6.82595E+10	.1620	675.5	2.37990E+07
14	4.39605E+07	.7051	-3.9	2342.1	4.	6.81552E+10	.1850	1322.7	3.09951E+07
15	4.25554E+07	.6320	-3.9	3495.3	5.	6.79981E+10	.2071	2184.0	2.68967E+07
16	6.70804E+07	.6218	-3.9	5264.7	6.	6.80507E+10	.2017	3257.7	4.17106E+07
17	6.19171E+07	.4595	-3.9	6719.0	7.	6.79017E+10	.1652	4553.6	2.84495E+07
18	9.31171E+07	.5370	-17.8	511.9	2.	6.84023E+10	.0244	241.5	5.00033E+07
19	9.03368E+07	.3042	-17.8	1364.4	3.	6.86845E+10	.0402	677.6	2.74832E+07
20	1.05130E+08	.2901	-17.8	2557.4	4.	6.85990E+10	.0563	1327.0	3.05013E+07
21	1.00372E+08	.2363	-17.8	3945.5	5.	6.83722E+10	.0641	2190.0	2.37178E+07
22	1.51647E+08	.2602	-17.8	5899.0	6.	6.83644E+10	.0697	3265.2	3.94631E+07
23	1.16816E+08	.2972	-17.8	7519.2	7.	6.82003E+10	.0998	4563.6	3.47186E+07
24	1.99966E+08	.3324	-31.7	519.0	2.	6.87994E+10	.0085	242.2	6.64661E+07
25	1.56587E+08	.1536	-31.7	1406.7	3.	6.91516E+10	.0137	679.9	2.40576E+07
26	1.87589E+08	.1491	-31.7	2678.1	4.	6.89095E+10	.0199	1330.0	2.79766E+07
27	1.58032E+08	.1242	-31.7	4168.1	5.	6.87098E+10	.0268	2195.4	1.96280E+07
28	2.37307E+08	.1305	-31.7	6218.2	6.	6.86495E+10	.0280	3272.0	3.09796E+07
29	1.77063E+08	.1163	-31.7	8009.7	7.	6.84516E+10	.0348	4572.0	2.05843E+07
30	6.28218E+05	.8521	37.8	270.1	2.	6.63782E+10	.1825	237.9	5.35303E+05
31	8.70438E+05	.9785	37.8	710.3	3.	6.66722E+10	.1282	667.6	8.51706E+05
32	1.05642E+06	1.0339	37.8	1354.8	4.	6.67507E+10	.0915	1309.0	1.09218E+06
33	1.42773E+06	.9659	37.8	2218.8	5.	6.66597E+10	.0719	2162.4	1.37898E+06
34	2.06264E+06	1.0720	37.8	3311.2	6.	6.69357E+10	.0773	3230.9	2.21120E+06
35	2.38627E+06	1.0171	37.8	4598.8	7.	6.68116E+10	.0620	4516.9	2.42699E+06
36	4.07321E+05	.7246	51.7	257.2	2.	6.57658E+10	.1178	236.8	2.95160E+05
37	5.96265E+05	.8106	51.7	691.3	3.	6.60942E+10	.0789	664.7	4.83358E+05
38	7.45757E+05	.7263	51.7	1330.4	4.	6.61909E+10	.0478	1303.5	5.41680E+05
39	1.04169E+06	.7306	51.7	2187.6	5.	6.61797E+10	.0413	2154.6	7.61039E+05
40	1.35993E+06	.6784	51.7	3257.9	6.	6.65178E+10	.0338	3220.8	9.22634E+05
41	1.75041E+06	.7277	51.7	4546.5	7.	6.64187E+10	.0336	4503.6	1.27369E+06
42	2.38677E+05	.6485	65.6	246.9	2.	6.52668E+10	.0702	235.9	1.54792E+05
43	3.90338E+05	.6050	65.6	676.3	3.	6.55386E+10	.0411	661.9	2.36157E+05
44	7.11701E+05	.4995	65.6	2159.3	5.	6.56647E+10	.0200	2146.2	3.55501E+05
45	5.08574E+05	.5602	65.6	1311.0	4.	6.56638E+10	.0262	1298.3	2.84916E+05
46	9.36167E+05	.5199	65.6	3220.8	6.	6.60396E+10	.0184	3209.2	4.86708E+05
47	1.05420E+06	.5170	65.6	4488.8	7.	6.59653E+10	.0149	4488.2	5.45030E+05
48	1.81169E+05	.5907	79.4	242.5	2.	6.46596E+10	.0511	234.8	1.07012E+05
49	3.07238E+05	.4746	79.4	668.3	3.	6.49261E+10	.0262	658.8	1.45825E+05

50	4.09225E+05	.4312	79.4	1299.3	4.	6.50785E+10	.0166	1292.5	1.76445E+05
51	5.93694E+05	.3587	79.4	2143.5	5.	6.51273E+10	.0122	2137.4	2.12946E+05
52	7.73266E+05	.3903	79.4	3199.4	6.	6.55589E+10	.0116	3197.5	3.01792E+05
53	8.28119E+05	.4521	79.4	4460.2	7.	6.55251E+10	.0104	4473.2	3.74370E+05
54	1.33346E+05	.5537	93.3	238.6	2.	6.40552E+10	.0369	233.7	7.38312E+04
55	2.49574E+05	.4002	93.3	661.8	3.	6.43165E+10	.0184	655.7	9.98695E+04
56	3.78543E+05	.3240	93.3	1291.3	4.	6.44456E+10	.0117	1286.2	1.22664E+05
57	5.42283E+05	.2504	93.3	2131.2	5.	6.45557E+10	.0079	2128.0	1.35771E+05
58	6.40262E+05	.2985	93.3	3179.0	6.	6.50473E+10	.0075	3185.0	1.91107E+05
59	6.42367E+05	.3975	93.3	4433.1	7.	6.50601E+10	.0072	4457.3	2.55349E+05


TEMPERATURE T DEG. C
FREQUENCY F HZ
REDUCED FREQUENCY FR HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

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 K Hz

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		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0         FROM         MROM        N          ML
              A1           A2         A3         A4
    75.0  4.0000E+02  1.4000E+06    .200   5.5000E+04
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
    75.0    .900     .400      -.200   1.8000E+01    1.500
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Beam No. 060C, 060D

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	1090.20	676.20	1043.10	1138.20	95.1	0.0872	
75	4	1954.60	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	2182.47	2688.50	3068.80	380.3	0.1322	

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Beam No. 060C, 060D

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
100	6	4605.30		4603.60	4608.50	4.9	0.0011	
125	2	376.90	241.27	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	2338.20	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	
165	4	1536.70	1307.55	1410.20	1659.90	249.7	0.1625	
165	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	

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Beam No. 060C, 060D

°F 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	2123.51	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	

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Beam No. 060C, 060D

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
275	5	2183.60	2112.52	2140.30	2220.80	80.5	0.0369	
300	2	246.60	233.01	237.80	256.20	18.4	0.0746	
300	3	670.90	653.99	654.50	686.30	31.8	0.0474	
300	4	1302.10	1275.52	1281.00	1322.50	41.5	0.0319	
300	5	2149.80	2098.53	2121.60	2178.30	56.7	0.0264	

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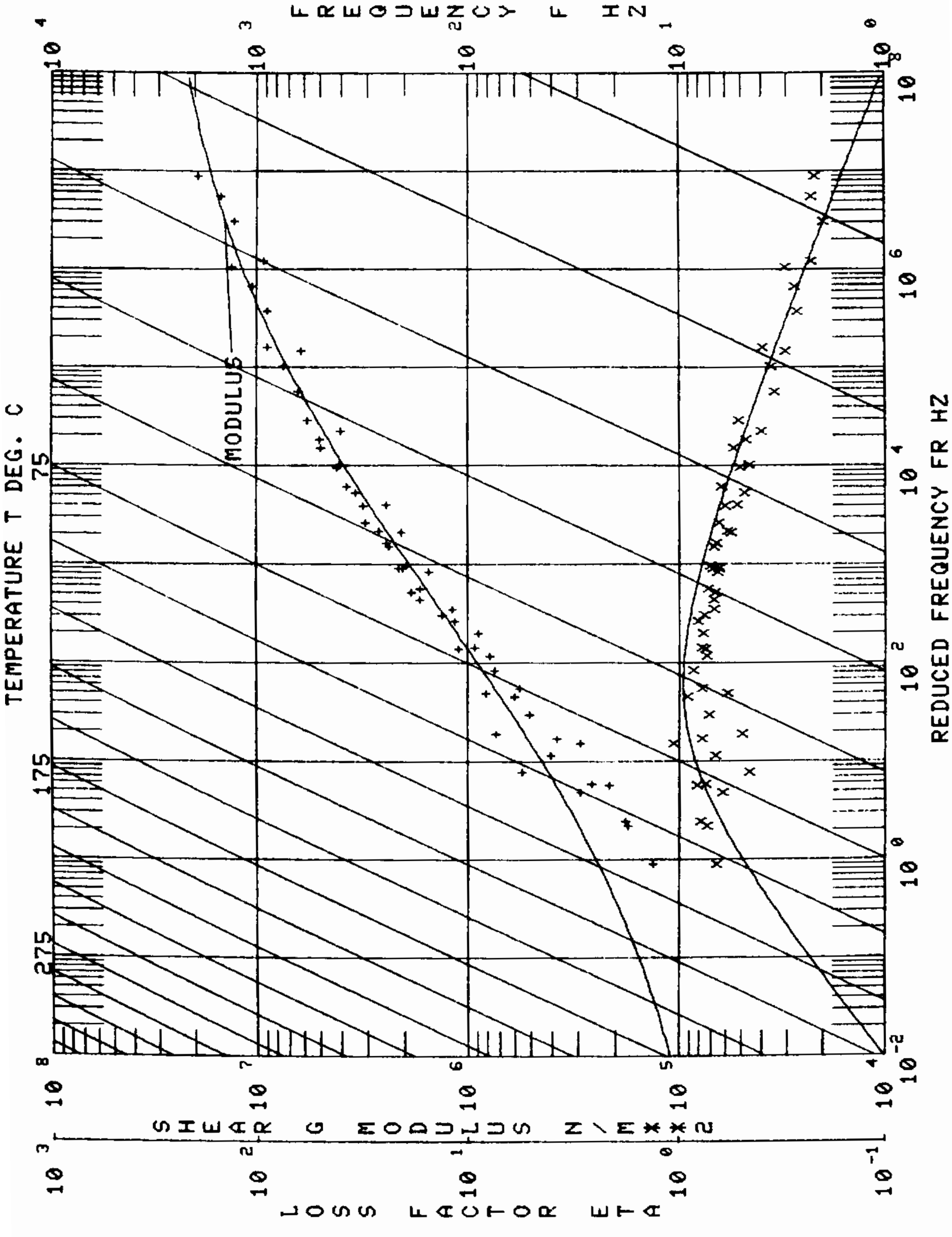
EXPERIMENTAL CODE : 64
MATERIAL :SOUNDCOAT D-2
DATA SOURCES
MANUFACTURER :SOUNDCOAT INC.
AFML :UDRI-GET
OTHER :NONE

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	1.50397E+07	.1227	-18.3	472.2	2.	7.09752E+10	.0180	246.0	1.84471E+06
2	1.96367E+07	.1145	-18.3	1220.8	3.	6.99063E+10	.0274	683.6	2.24838E+06
3	2.41602E+07	.1101	-18.3	2244.0	4.	6.97181E+10	.0327	1337.8	2.66078E+06
4	3.20234E+07	.1241	-18.3	3591.9	5.	7.00969E+10	.0397	2217.5	3.97319E+06
5	1.12825E+07	.1488	-5.6	462.8	2.	7.14955E+10	.0268	246.9	1.67845E+06
6	1.47997E+07	.1493	-5.6	1181.2	3.	7.04760E+10	.0411	686.4	2.21033E+06
7	1.92312E+07	.1388	-5.6	2173.6	4.	7.03501E+10	.0445	1343.8	2.67008E+06
8	2.51505E+07	.1505	-5.6	3461.4	5.	7.06665E+10	.0510	2226.4	3.78428E+06
9	9.52833E+06	.2321	10.0	452.1	2.	6.98430E+10	.0451	244.0	2.21172E+06
10	1.30968E+07	.2016	10.0	1152.8	3.	6.88387E+10	.0574	678.4	2.64082E+06
11	1.52245E+07	.2317	10.0	2078.9	4.	6.86507E+10	.0773	1327.5	3.52763E+06
12	1.97913E+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	1.97990E+06
14	9.11801E+06	.2742	23.9	1090.2	3.	6.84010E+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	4.08339E+06	.4117	37.8	407.2	2.	6.87710E+10	.1171	242.1	1.68127E+06
18	6.47499E+06	.3538	37.8	1028.9	3.	6.79022E+10	.1192	673.7	2.29100E+06
19	7.59303E+06	.3695	37.8	1837.1	4.	6.77785E+10	.1267	1319.0	2.80553E+06
20	9.13904E+06	.4052	37.8	2875.9	5.	6.79028E+10	.1322	2182.5	3.70341E+06
21	2.49122E+06	.5377	51.7	376.9	2.	6.82721E+10	.1709	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.	6.72820E+10	.1564	1314.2	2.52247E+06
24	5.87007E+06	.5307	51.7	2678.7	5.	6.74686E+10	.1504	2175.5	3.11529E+06
25	1.55723E+06	.6696	65.6	347.3	2.	6.77750E+10	.2180	240.4	1.04264E+06
26	2.70608E+06	.5956	65.6	883.1	3.	6.69721E+10	.1891	669.1	1.61188E+06
27	3.19504E+06	.6140	65.6	1593.4	4.	6.69119E+10	.1664	1310.6	1.96164E+06
28	3.80690E+06	.6353	65.6	2521.9	5.	6.70351E+10	.1470	2168.5	2.41838E+06
29	9.13895E+05	.7800	79.4	315.2	2.	6.72797E+10	.2383	239.5	7.12861E+05
30	1.87869E+06	.6850	79.4	818.0	3.	6.35088E+10	.1983	651.6	1.28686E+06
31	1.99378E+06	.7229	79.4	1495.5	4.	6.63576E+10	.1547	1305.1	1.44125E+06
32	2.41409E+06	.6962	79.4	2393.0	5.	6.64189E+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	9.43967E+05	.7985	93.3	756.1	3.	6.60505E+10	.1635	664.5	7.53722E+05
35	1.17302E+06	.8235	93.3	1416.1	4.	6.58055E+10	.1251	1299.7	9.65999E+05
36	1.71182E+06	.6955	93.3	2316.8	5.	6.58049E+10	.0966	2148.5	1.19064E+06
37	8.03787E+05	.7483	85.0	307.3	2.	6.70327E+10	.2232	239.1	6.01465E+05
38	1.35462E+06	.7772	85.0	792.2	3.	6.63152E+10	.1927	665.8	1.05285E+06
39	1.71705E+06	.7413	85.0	1469.1	4.	6.61117E+10	.1453	1302.7	1.27278E+06
40	2.17055E+06	.6987	85.0	2366.6	5.	6.61729E+10	.1148	2154.5	1.51663E+06
41	1.20515E+06	.6939	73.9	330.6	2.	6.74034E+10	.2235	239.7	8.36291E+05
42	2.08851E+06	.6587	73.9	845.3	3.	6.66642E+10	.1947	667.6	1.37577E+06
43	3.10575E+06	.6612	73.9	2458.0	5.	6.66646E+10	.1366	2162.5	2.05367E+06
44	2.11209E+06	.5767	57.2	366.4	2.	6.81477E+10	.1869	241.0	1.21805E+06
46	3.49006E+06	.4971	57.2	922.2	3.	6.72828E+10	.1661	670.7	1.73498E+06
46	4.25418E+06	.5252	57.2	1664.9	4.	6.72206E+10	.1587	1313.6	2.23413E+06
47	5.09638E+06	.5608	57.2	2623.3	5.	6.73446E+10	.1498	2173.5	2.85767E+06
48	3.86366E+05	.7908	107.2	273.4	2.	6.54330E+10	.1760	236.2	3.05544E+05
49	6.12521E+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.	6.57438E+10	.0953	1299.1	6.64740E+05
51	2.18950E+05	.8333	121.1	257.5	2.	6.51286E+10	.1297	235.6	1.82456E+05
52	3.00227E+05	1.0809	121.1	688.6	3.	6.49498E+10	.0961	658.9	3.24527E+05
53	5.24692E+05	.7366	121.1	1338.1	4.	6.45870E+10	.0598	1287.6	3.86510E+05
54	8.35498E+05	.6003	121.1	2203.4	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	1.33982E+05
56	2.64938E+05	.7652	135.0	681.1	3.	6.42832E+10	.0618	655.5	2.02739E+05
57	4.13720E+05	.6865	135.0	1320.9	4.	6.40414E+10	.0456	1282.2	2.84020E+05
58	7.50113E+05	.5087	135.0	2183.6	5.	6.36199E+10	.0369	2112.5	3.81612E+05
59	1.36932E+05	.6723	148.9	246.6	2.	6.36775E+10	.0746	233.0	9.20638E+04
60	1.84072E+05	.8064	148.9	670.9	3.	6.39815E+10	.0474	654.0	1.48439E+05
61	3.00588E+05	.6350	148.9	1302.1	4.	6.33798E+10	.0319	1275.5	1.90866E+05
62	5.62382E+05	.4652	148.9	2149.8	5.	6.27800E+10	.0264	2098.5	2.61634E+05
63	2.47103E+06	.6760	73.9	1536.7	4.	6.66029E+10	.1625	1307.6	1.67043E+06
64	1.13359E+06	.7667	107.2	2254.3	5.	6.54996E+10	.0771	2143.5	8.69098E+05


TEMPERATURE T DEG. C
FREQUENCY F HZ
REDUCED FREQUENCY FR HZ
MODULUS
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA

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	

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0         FROM        MROM        N          ML
              A1          A2         A3          A4
  -10.0   6.0000E+02  8.5000E+06   .600   3.5000E+05
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
  -10.0    1.500     .800     -.850   3.0000E+02   1.250
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Beam No. 080-1, 080-2

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-50	2	661.13	323.68	659.16	662.82	3.66	0.0055	
-48	3	1815.83	905.40	1811.21	1820.61	9.40	0.0052	
-48	4	3434.38	1776.05	3415.58	3450.17	34.59	0.0101	
-47	5	5528.86	2941.94	5495.36	5559.61	64.25	0.0116	
-25	2	654.67	322.58	648.71	660.61	11.9	0.0182	
-25	3	1785.49	902.63	1770.71	1797.80	28.09	0.0157	
-24	4	335.61	1770.00	3291.29	3374.68	83.39	0.0250	
-24	5	5359.96	2930.95	5266.16	5436.46	170.30	0.0318	
- 2	2	632.04	321.70	602.32	657.33	55.01	0.0870	
- 1	3	1704.31	899.54	1646.00	1767.99	121.99	0.0716	
- 1	4	3110.53	1764.56	2952.09	3263.57	311.48	0.1001	
12	2	591.72	320.92	543.70	650.92	107.22	0.1812	
12	3	1619.13	898.00	1503.10	1750.01	246.91	0.1525	
12	4	2885.86	1761.54	2496.63	3150.58	653.95	0.2266	
26	2	528.17	320.37	454.71	628.82	174.11	0.3296	
26	3	1467.97	896.46	1270.52	1669.75	399.23	0.2720	
37	2	449.16	319.82	383.43	529.86	146.43	0.3260	
37	3	1288.32	894.91	1056.48	1553.32	496.84	0.3856	
50	2	411.075	319.27	362.36	466.79	104.43	0.2540	
51	3	1130.39	893.06	915.33	1366.13	450.80	0.3988	

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Beam No. 080-1, 080-2

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	

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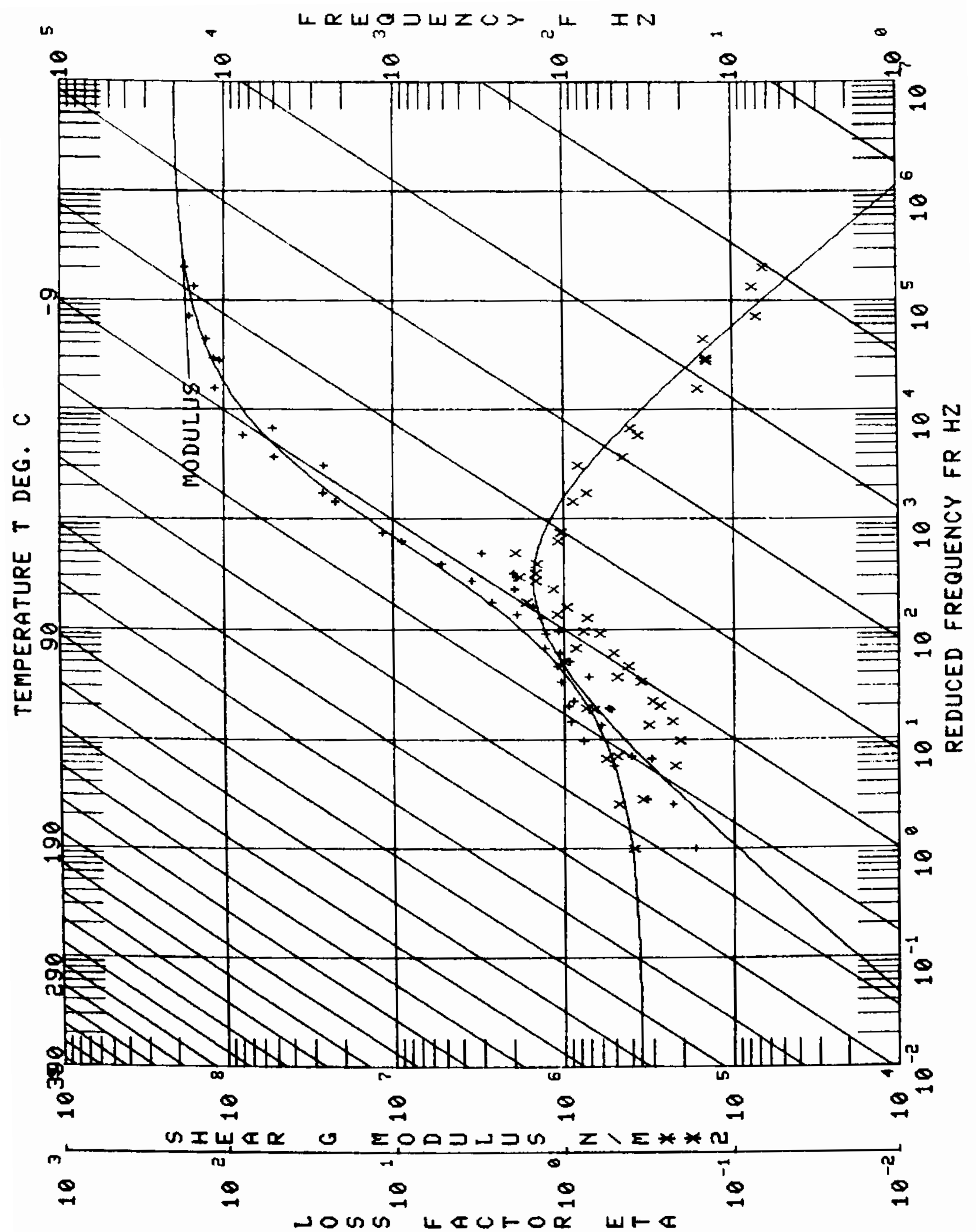
Beam No. 080-1, 080-2

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
153	2	327.56	314.31	322.00	333.47	11.47	0.0350	
152	3	903.56	879.18	893.45	913.59	20.14	0.0223	
151	4	1760.41	1724.06	1750.15	1770.97	20.82	0.0118	
150	5	2906.91	2854.00	2893.28	2921.99	28.71	0.0099	
150	6	4342.91	4285.83	4324.07	4362.21	38.14	0.0088	
150	7	6056.81	6006.74	6033.51	6080.21	46.70	0.0077	

Page 3 of 3

EXPERIMENTAL CODE :166
MATERIAL :SOUNDCOAT M-5
DATA SOURCES
MANUFACTURER :NONE
AFML :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	5.65003E+05	.7643	24.4	361.1	2.	6.66925E+10	.1554	318.0	4.31847E+05
2	9.48333E+05	1.0269	24.4	965.5	3.	6.66493E+10	.1474	890.0	9.73839E+05
3	1.11410E+06	.7903	24.4	1829.9	4.	6.66961E+10	.0761	1744.6	8.80449E+05
4	1.54730E+06	.9792	24.4	3005.6	5.	6.68809E+10	.0811	2888.0	1.51510E+06
5	2.00034E+06	1.1941	24.4	4484.9	6.	6.77844E+10	.0863	4335.1	2.38866E+06
6	2.04482E+06	1.5013	24.4	6221.9	7.	6.79929E+10	.0817	6075.5	3.06991E+06
7	3.18069E+05	.5792	38.3	341.4	2.	6.62318E+10	.0803	316.8	1.84217E+05
8	5.42077E+05	.6907	37.8	927.9	3.	6.61425E+10	.0644	886.6	3.74427E+05
9	7.37172E+05	.5034	37.2	1792.2	4.	6.62344E+10	.0342	1738.6	3.71086E+05
10	1.08959E+06	.5231	37.2	2954.7	5.	6.63724E+10	.0321	2877.0	5.69976E+05
11	1.31062E+06	.6341	37.2	4408.8	6.	6.73183E+10	.0316	4320.2	8.31073E+05
12	1.39497E+06	.7472	37.2	6141.3	7.	6.75270E+10	.0288	6054.7	1.04226E+06
13	2.37214E+05	.4912	52.2	333.8	2.	6.57270E+10	.0545	315.6	1.16523E+05
14	4.14697E+05	.4971	52.2	913.9	3.	6.56362E+10	.0371	883.2	2.06161E+05
15	6.18029E+05	.3265	52.2	1774.5	4.	6.56368E+10	.0191	1730.7	2.01769E+05
16	9.10182E+05	.3119	52.2	2926.8	5.	6.57744E+10	.0164	2864.0	2.83927E+05
17	1.07851E+06	.3648	52.2	4371.3	6.	6.67613E+10	.0153	4302.2	3.93416E+05
18	1.12281E+06	.4295	52.2	6093.0	7.	6.69701E+10	.0136	6029.7	4.82250E+05
19	1.75355E+05	.4027	67.2	327.6	2.	6.51742E+10	.0350	314.3	7.06144E+04
20	3.37844E+05	.3554	66.7	903.6	3.	6.50415E+10	.0223	879.2	1.20059E+05
21	5.28555E+05	.2309	66.1	1760.4	4.	6.51334E+10	.0118	1724.1	1.22049E+05
22	7.91311E+05	.2128	65.6	2906.9	5.	6.53164E+10	.0099	2854.0	1.68371E+05
23	9.34648E+05	.2382	65.6	4342.9	6.	6.62526E+10	.0088	4285.8	2.22603E+05
24	9.64919E+05	.2789	65.6	6056.8	7.	6.64617E+10	.0077	6006.7	2.69095E+05
25	1.32927E+06	.8726	10.0	411.1	2.	6.72474E+10	.2540	319.3	1.15992E+06
26	1.94793E+06	1.8558	10.6	1924.2	4.	6.72048E+10	.2668	1751.3	3.61493E+06
27	3.11620E+06	1.9689	10.6	3178.6	5.	6.73445E+10	.2752	2898.0	6.13533E+06
28	3.55349E+06	1.5026	-3.3	528.2	2.	6.77116E+10	.3296	320.4	5.33950E+06
29	1.18201E+07	1.0760	-3.3	1468.0	3.	6.76234E+10	.2720	896.5	1.27185E+07
30	2.26939E+07	.8966	-18.9	632.0	2.	6.82750E+10	.0870	321.7	2.03480E+07
31	5.16158E+07	.4589	-18.3	1704.3	3.	6.80838E+10	.0716	899.5	2.36848E+07
32	5.25486E+07	.4154	-18.3	3110.5	4.	6.82294E+10	.1001	1764.6	2.18303E+07
33	9.13696E+06	1.0981	-11.1	591.7	2.	6.79443E+10	.1812	320.9	1.00331E+07
34	2.65280E+07	.7513	-11.1	1619.1	3.	6.78559E+10	.1525	898.0	1.99309E+07
35	2.63229E+07	.8374	-11.1	2885.9	4.	6.79961E+10	.2266	1761.5	2.20437E+07
36	1.93426E+06	1.1256	2.8	449.2	2.	6.74793E+10	.3260	319.8	2.17728E+06
37	5.34606E+06	1.4739	2.8	1288.3	3.	6.73897E+10	.3856	894.9	7.87935E+06
38	7.88886E+07	.3723	-31.7	654.7	2.	6.86490E+10	.0182	322.6	2.93735E+07
39	1.16536E+08	.1667	-31.7	1785.5	3.	6.85574E+10	.0157	902.6	1.94315E+07
40	1.08861E+08	.1484	-31.1	3335.6	4.	6.86508E+10	.0250	1770.0	1.61557E+07
41	1.31356E+08	.1531	-31.1	5360.0	5.	6.88860E+10	.0318	2931.0	2.01154E+07
42	1.18306E+08	.1474	-45.6	661.1	2.	6.91180E+10	.0055	323.7	1.74334E+07
43	1.67215E+08	.0736	-44.4	1815.8	3.	6.89789E+10	.0052	905.4	1.23102E+07
44	1.56509E+08	.0771	-44.4	3434.4	4.	6.91209E+10	.0101	1776.1	1.20665E+07
45	1.78492E+08	.0671	-43.9	5528.9	5.	6.94035E+10	.0116	2941.9	1.19803E+07
46	2.72217E+06	1.6847	10.6	1130.4	3.	6.71114E+10	.3988	893.1	4.58612E+06


TEMPERATURE T DEG. C
REDUCED FREQUENCY FR HZ
FREQUENCY F HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

Polymeric Material Characterization Test

Test No. 79-7

Date 11/27/79

Beam Nos. 080-1 and 080-2

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		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0         FROM          MROM        N          ML
              A1            A2         A3         A4
    75.0  1.4000E+06  9.0000E+06    .325   2.0000E+05
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
    75.0   1.250      .350     -.350   4.3000E+05    2.250
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Beam No. 080-1, 080-2

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-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	
-25	4	3532.91	1770.00	3516.34	3550.34	34.00	0.0096	
-25	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	
- 3	4	3446.11	1765.17	3408.08	3493.71	85.63	0.0249	
- 3	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	X
61	2	520.60	318.72	450.60	597.41	146.81	0.2820	
61	3	1393.61	864.37	1198.49	1610.81	412.32	0.2959	
61	4	2476.47	1748.24	2161.73	2661.77	938.08	0.3970	X

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Beam No. 080-1, 080-2

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	1837.51	1733.73	1737.59	1935.55	197.96	0.1077	
114	5	3046.34	2866.99		3184.49	276.30	0.0907	
114	6	4489.31	4308.22	4257.81	4679.41	421.60	0.0939	
114	7	6214.41	6040.10	5891.91	6452.91	561.00	0.0903	

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Beam No. 080-1, 080-2

Temp. °F	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	4367.11	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	

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Beam No. 080-1, 080-2

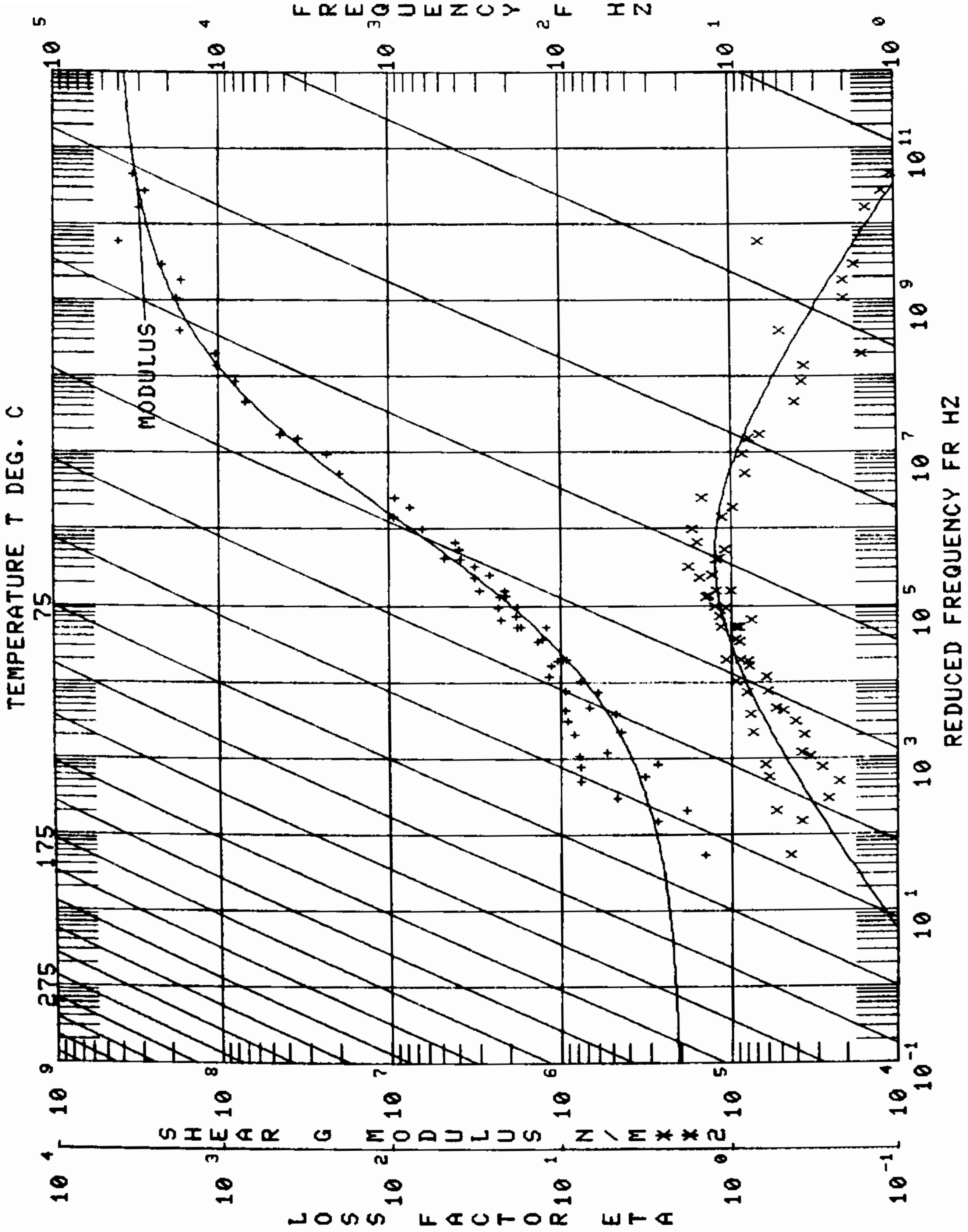
Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
202	4	1742.51	1709.55	1731.42	1753.74	22.32	0.0128	
202	5	2879.41	2826.02	2863.41	2894.79	31.28	0.0109	
201	6	4297.21	4251.49	4278.41	4318.47	40.06	0.0093	
201	7	5997.41	5960.87	5972.31	6020.91	48.60	0.0081	

Page 4 of 4

EXPERIMENTAL CODE :148
MATERIAL :SOUNDCOAT N-5
DATA SOURCES
MANUFACTURER :NONE
AFML :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	386.8	2.	6.62318E+10	.2373	316.8	8.57676E+05
2	1.75292E+06	1.1894	38.3	1028.4	3.	6.61410E+10	.2517	886.6	2.08485E+06
3	1.82995E+06	1.2844	38.3	1887.9	4.	6.61422E+10	.1822	1737.4	2.35043E+06
4	3.04541E+06	1.2584	38.3	3121.8	5.	6.61424E+10	.1795	2872.0	3.83246E+06
5	3.27885E+06	1.5767	38.3	4589.2	6.	6.72718E+10	.1725	4318.7	5.16962E+06
6	3.26748E+06	1.8453	38.3	6317.6	7.	6.74806E+10	.1521	6052.6	6.02935E+06
7	4.94086E+05	.7923	51.7	354.0	2.	6.57270E+10	.1495	315.6	3.91444E+05
8	7.83121E+05	.9705	51.7	945.5	3.	6.56362E+10	.1222	883.2	7.60011E+05
9	1.07148E+06	.8200	51.7	1814.0	4.	6.56831E+10	.0774	1731.3	8.78615E+05
10	1.40358E+06	.9177	51.1	2968.3	5.	6.55826E+10	.0710	2862.0	1.28802E+06
11	1.84659E+06	.9716	50.6	4438.5	6.	6.67613E+10	.0664	4302.2	1.79412E+06
12	1.87418E+06	1.2094	50.6	6160.4	7.	6.69701E+10	.0617	6029.7	2.26661E+06
13	6.23517E+05	.8349	46.1	364.1	2.	6.59562E+10	.1803	316.2	5.20582E+05
14	9.95021E+05	1.1073	46.1	964.9	3.	6.58206E+10	.1657	884.4	1.10175E+06
15	1.31682E+06	.9672	46.1	1837.5	4.	6.58661E+10	.1077	1733.7	1.27361E+06
16	2.30052E+06	.7783	45.6	3046.3	5.	6.59123E+10	.0907	2867.0	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	.3075	318.0	2.27074E+06
20	4.89001E+06	1.2064	23.9	1234.0	3.	6.66493E+10	.3417	890.0	5.89938E+06
21	4.20147E+06	1.6477	24.4	2113.2	4.	6.66961E+10	.3647	1744.6	6.92255E+06
22	6.51140E+06	1.7610	25.0	3470.2	5.	6.66496E+10	.3753	2883.0	1.14665E+07
23	7.71213E+06	1.0072	8.3	572.9	2.	6.72474E+10	.1956	319.3	7.76772E+06
24	1.99711E+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.	6.72516E+10	.2406	1751.9	2.07586E+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	888.4	3.01281E+06
29	2.66860E+06	1.3281	31.1	1962.8	4.	6.64189E+10	.2411	1741.0	3.54423E+06
30	3.90913E+06	1.2677	31.1	3199.9	5.	6.64186E+10	.2139	2878.0	4.95568E+06
31	4.02424E+06	1.1267	16.1	520.6	2.	6.70159E+10	.2820	318.7	4.53430E+06
32	9.68241E+06	1.1673	16.1	1393.6	3.	6.28687E+10	.2959	864.4	1.13021E+07
33	9.47336E+06	1.5352	16.1	2476.5	4.	6.69732E+10	.3970	1748.2	1.45433E+07
34	2.81292E+05	.6433	65.6	336.3	2.	6.52198E+10	.0821	314.4	1.80954E+05
35	4.55361E+05	.7591	65.6	914.4	3.	6.51333E+10	.0618	879.8	3.45658E+05
36	7.00396E+05	.5525	65.0	1775.2	4.	6.51334E+10	.0364	1724.1	3.86946E+05
37	9.67108E+05	.6210	65.0	2918.5	5.	6.51334E+10	.0348	2850.0	6.00593E+05
38	1.19498E+06	.6291	64.4	4367.1	6.	6.62987E+10	.0292	4287.3	7.51713E+05
39	1.16652E+06	.7960	64.4	6076.9	7.	6.65080E+10	.0263	6008.8	9.28529E+05
40	1.89843E+05	.5542	79.4	327.8	2.	6.47188E+10	.0518	313.2	1.05210E+05
41	3.33388E+05	.6156	79.4	900.4	3.	6.45866E+10	.0384	876.1	2.05245E+05
42	5.50404E+05	.3855	78.9	1755.3	4.	6.45867E+10	.0206	1716.8	2.12190E+05
43	8.63177E+05	.3736	78.3	2899.6	5.	6.46776E+10	.0190	2840.0	3.22479E+05
44	9.35888E+05	.4240	78.3	4327.1	6.	6.57459E+10	.0158	4269.4	3.96860E+05
45	9.59303E+05	.4990	78.3	6034.0	7.	6.59552E+10	.0138	5983.8	4.78663E+05
46	1.46969E+05	.4547	95.0	322.8	2.	6.41292E+10	.0344	311.8	6.68258E+04
47	2.80781E+05	.3864	95.0	892.2	3.	6.40407E+10	.0208	872.4	1.08487E+05
48	4.83763E+05	.2675	94.4	1742.5	4.	6.40417E+10	.0128	1709.6	1.29424E+05
49	7.87225E+05	.2311	94.4	2879.4	5.	6.40420E+10	.0109	2826.0	1.81965E+05

50	7.94040E+05	.2898	93.9	4297.2	6.	6.51952E+10	.0093	4251.5	2.29605E+05
51	7.99996E+05	.3460	93.9	5997.4	7.	6.54505E+10	.0081	5960.9	2.76808E+05
52	4.42790E+07	.6929	-3.9	644.0	2.	6.77116E+10	.0445	320.4	3.06810E+07
53	7.13843E+07	.4208	-3.9	1737.8	3.	6.76234E+10	.0522	896.5	2.99930E+07
54	8.11614E+07	.3830	-3.9	3254.1	4.	6.77160E+10	.0720	1757.9	3.10851E+07
55	1.04420E+08	.3696	-3.9	5232.1	5.	6.77163E+10	.0816	2906.0	3.85964E+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	-20.0	662.8	2.	6.82750E+10	.0107	321.7	9.08392E+07
58	1.84596E+08	.2101	-20.0	1814.0	3.	6.81827E+10	.0130	900.2	3.87750E+07
59	1.70540E+08	.2116	-19.4	3441.1	4.	6.82766E+10	.0249	1765.2	3.60887E+07
60	2.23744E+08	.1794	-19.4	5599.3	5.	6.82767E+10	.0255	2918.0	4.01370E+07
61	4.15185E+08	.6884	-32.2	669.3	2.	6.86958E+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	3532.9	4.	6.86508E+10	.0096	1770.0	3.46198E+07
64	3.37184E+08	.1096	-31.7	5751.0	5.	6.86512E+10	.0115	2926.0	3.69612E+07


TEMPERATURE T DEG. C
75
175
275
MODULUS
REDUCED FREQUENCY FR HZ
FREQUENCY F HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA

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

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0         FROM        MROM        N        ML
              A1          A2         A3       A4
    15.0  3.6568E+03  7.7910E+06   .621  1.2588E+05
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
    15.0   2.298     .429    -.507  1.7768E+03    .253
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Beam No. 060C, 060D

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-75	2	545.30	248.54	544.60	546.40	1.80	0.0033	
-75	3	1404.60	691.62	1505.10	1506.00	0.90	0.0006	
-75	4	2877.50	1353.49	2875.30	2880.50	5.20	0.0018	
-75	5	4653.00	2241.43	4647.90	4657.50	9.60	0.0020	
-50	2	541.10	247.77	540.00	542.30	2.30	0.0042	
-50	3	1499.80	689.15	1498.70	1500.90	2.20	0.0015	
-50	4	2860.40	1348.66	2855.20	2864.90	9.70	0.0034	
-50	5	4616.70	2234.43	4605.60	4627.90	22.30	0.0048	
-25	2	539.70	246.89	537.00	542.20	5.20	0.0096	
-25	3	1496.10	686.38	1487.60	1504.10	16.50	0.0110	
-25	4	2850.10	1343.83	2825.10	2873.60	48.50	0.0170	
-25	5	4596.20	2226.44	4545.90	4648.30	102.40	0.0223	
0	2	528.70	246.00	519.10	538.10	19.00	0.0359	
0	3	1449.90	683.60	1413.70	1487.30	73.60	0.0508	
0	4	2702.70	1337.78	2605.30	2805.00	199.70	0.0739	
0	5	4312.50	2217.45	4091.90	4480.60	388.70	0.0901	
25	2	478.00	244.91	431.40	531.80	100.40	0.2100	
25	3	1272.90	683.60	1102.50	1426.40	323.90	0.2544	
25	4	2176.00	1354.10	1936.80	2360.70	833.39	0.3830	X
35	2	411.90	244.25	335.80	525.30	189.50	0.4601	

Page 1 of 3

Beam No. 060C, 060D

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	275.30	243.48	245.00	323.30	78.30	0.2844	
60	3	751.30	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	2226.70	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	1338.00	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	677.70	8.30	0.0123	
125	4	1316.50	1314.20	1311.00	1321.70	10.70	0.0081	
125	5	2179.50	2175.48	2171.20	2187.50	16.30	0.0075	

Page 2 of 3

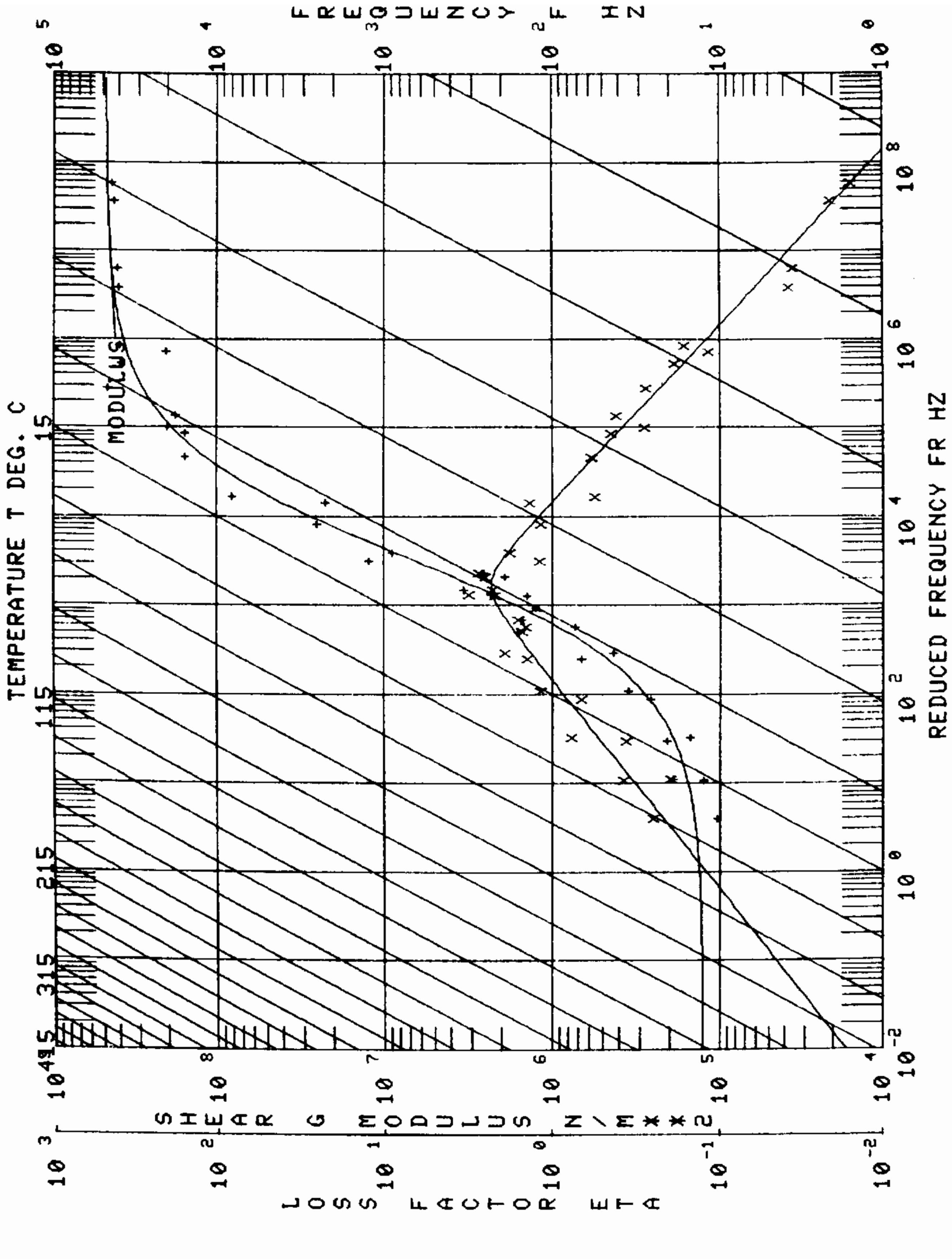
Beam No. 060C, 060D

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
150	2	242.60	240.39	241.30	244.10	2.80	0.0115	
150	3	670.10	669.10	668.10	672.20	4.10	0.0061	
150	4	1310.10	1310.58	1307.60	1313.10	5.50	0.0042	
150	5	2169.90	2168.48	2165.70	2174.60	8.90	0.0041	

Page 3 of 3

EXPERIMENTAL CODE : 56
MATERIAL :SOUNDCOAT
DATA SOURCES
MANUFACTURER :NONE
AFML :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	2.88311E+08	.1282	-59.4	545.3	2.	7.24252E+10	.0033	248.5	3.69498E+07
2	4.97824E+08	.0147	-59.4	1505.6	3.	7.15562E+10	.0006	691.6	7.29898E+06
3	4.42173E+08	.0215	-59.4	2877.5	4.	7.13652E+10	.0018	1353.5	9.50650E+06
4	4.61129E+08	.0162	-59.4	4653.0	5.	7.16212E+10	.0020	2241.4	7.45958E+06
5	2.08936E+08	.1204	-45.6	541.1	2.	7.20003E+10	.0042	247.8	2.51568E+07
6	4.87050E+08	.0362	-45.6	1499.8	3.	7.10460E+10	.0015	689.2	1.76259E+07
7	4.14893E+08	.0387	-45.6	2860.4	4.	7.08567E+10	.0034	1348.7	1.60574E+07
8	4.25244E+08	.0366	-45.6	4616.7	5.	7.11746E+10	.0048	2234.4	1.55672E+07
9	2.05955E+08	.2913	-31.7	539.7	2.	7.14897E+10	.0096	246.9	5.99903E+07
10	4.85166E+08	.2866	-31.7	1496.1	3.	7.04760E+10	.0110	686.4	1.39048E+08
11	3.98988E+08	.1941	-31.7	2850.1	4.	7.03501E+10	.0170	1343.8	7.74561E+07
12	4.07550E+08	.1690	-31.7	4596.2	5.	7.06665E+10	.0223	2226.4	6.88602E+07
13	8.33455E+07	.5698	-17.8	528.7	2.	7.09752E+10	.0359	246.0	4.74934E+07
14	1.60082E+08	.5984	-17.8	1449.9	3.	6.99063E+10	.0508	623.6	9.57928E+07
15	1.60219E+08	.4627	-17.8	2702.7	4.	6.97181E+10	.0739	1337.8	7.41322E+07
16	1.84289E+08	.4301	-17.8	4312.5	5.	7.00969E+10	.0901	2217.5	7.92572E+07
17	1.26988E+07	1.2324	-3.9	478.0	2.	7.03477E+10	.2100	244.9	1.56505E+07
18	2.59377E+07	1.2059	-3.9	1272.9	3.	6.99063E+10	.2544	683.6	3.12771E+07
19	2.27766E+07	1.3913	-3.9	2176.0	4.	7.14295E+10	.3830	1354.1	3.16894E+07
20	3.41929E+06	2.3437	1.7	411.9	2.	6.99690E+10	.4601	244.2	8.01371E+06
21	9.15685E+06	1.8369	1.7	1085.0	3.	6.90886E+10	.4482	679.6	1.68206E+07
22	1.62691E+06	1.5557	10.0	320.6	2.	6.98430E+10	.4270	244.0	2.53096E+06
23	2.36248E+06	3.2081	10.0	843.4	3.	6.88387E+10	.5873	678.4	7.57910E+06
24	2.60733E+06	2.8079	10.0	1475.8	4.	6.86507E+10	.4111	1327.5	7.32122E+06
25	6.84037E+05	1.4596	15.6	275.3	2.	6.95286E+10	.2844	243.5	9.98403E+05
26	1.56400E+06	1.6450	15.6	751.3	3.	6.85873E+10	.2824	677.1	2.57279E+06
27	1.46075E+06	2.2705	15.6	1390.1	4.	6.84812E+10	.2224	1325.9	3.31662E+06
28	1.97214E+06	2.5896	15.6	2277.6	5.	6.86510E+10	.2132	2194.5	5.10711E+06
29	3.63375E+05	1.1946	23.9	258.3	2.	6.93345E+10	.1510	243.1	4.34076E+05
30	4.42312E+05	1.9812	23.9	690.8	3.	6.84010E+10	.1246	676.2	8.76308E+05
31	7.54418E+05	1.4855	23.9	1344.8	4.	6.82139E+10	.0828	1323.3	1.12066E+06
32	1.29047E+06	1.2796	23.9	2226.7	5.	6.83385E+10	.0735	2189.5	1.65129E+06
33	1.55892E+05	.7953	37.8	246.8	2.	6.87710E+10	.0494	242.1	1.23976E+05
34	2.67151E+05	.6931	37.8	678.3	3.	6.79022E+10	.0277	673.7	1.85163E+05
35	4.45396E+05	.6109	37.8	1324.0	4.	6.77785E+10	.0210	1319.0	2.72097E+05
36	7.75741E+05	.5297	37.8	2192.6	5.	6.79028E+10	.0191	2182.5	4.10943E+05
37	1.27841E+05	.3907	51.7	244.5	2.	6.82721E+10	.0204	241.3	4.99510E+04
38	2.15121E+05	.3753	51.7	673.5	3.	6.74675E+10	.0123	671.6	8.07409E+04
39	3.91964E+05	.2642	51.7	1316.5	4.	6.72820E+10	.0081	1314.2	1.03557E+05
40	6.53921E+05	.2431	51.7	2179.5	5.	6.74686E+10	.0075	2175.5	1.58993E+05
41	1.07058E+05	.2578	65.6	242.6	2.	6.77750E+10	.0115	240.4	2.76035E+04
42	1.96834E+05	.2021	65.6	670.1	3.	6.69721E+10	.0061	669.1	3.95836E+04
43	3.36351E+05	.1578	65.6	1310.1	4.	6.69119E+10	.0042	1310.6	5.30612E+04
44	5.99821E+05	.1436	65.6	2169.9	5.	6.70351E+10	.0041	2168.5	8.60477E+04


TEMPERATURE T DEG. C
FREQUENCY F HZ
MODULUS
REDUCED FREQUENCY FR HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA

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 K Hz

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		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0          FROM          MROM         N          ML
               A1            A2          A3         A4
    40.0  7.3251E+03  1.6863E+07    .400   2.9765E+05
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
    40.0   1.010     .700     -.700   2.0000E+03    2.500
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Beam No. 050A, 050B

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-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	
128	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	
150	2	224.0	198.8	215.0	236.0	21.0	0.0942	
150	3	575.0	547.6	560.0	593.0	33.0	0.0575	
150	4	1092.0	1074.0	1068.0	1114.0	46.0	0.0422	
150	5	1768.0	1757.0	1736.0	1797.0	61.0	0.0345	

Page 1 of 2

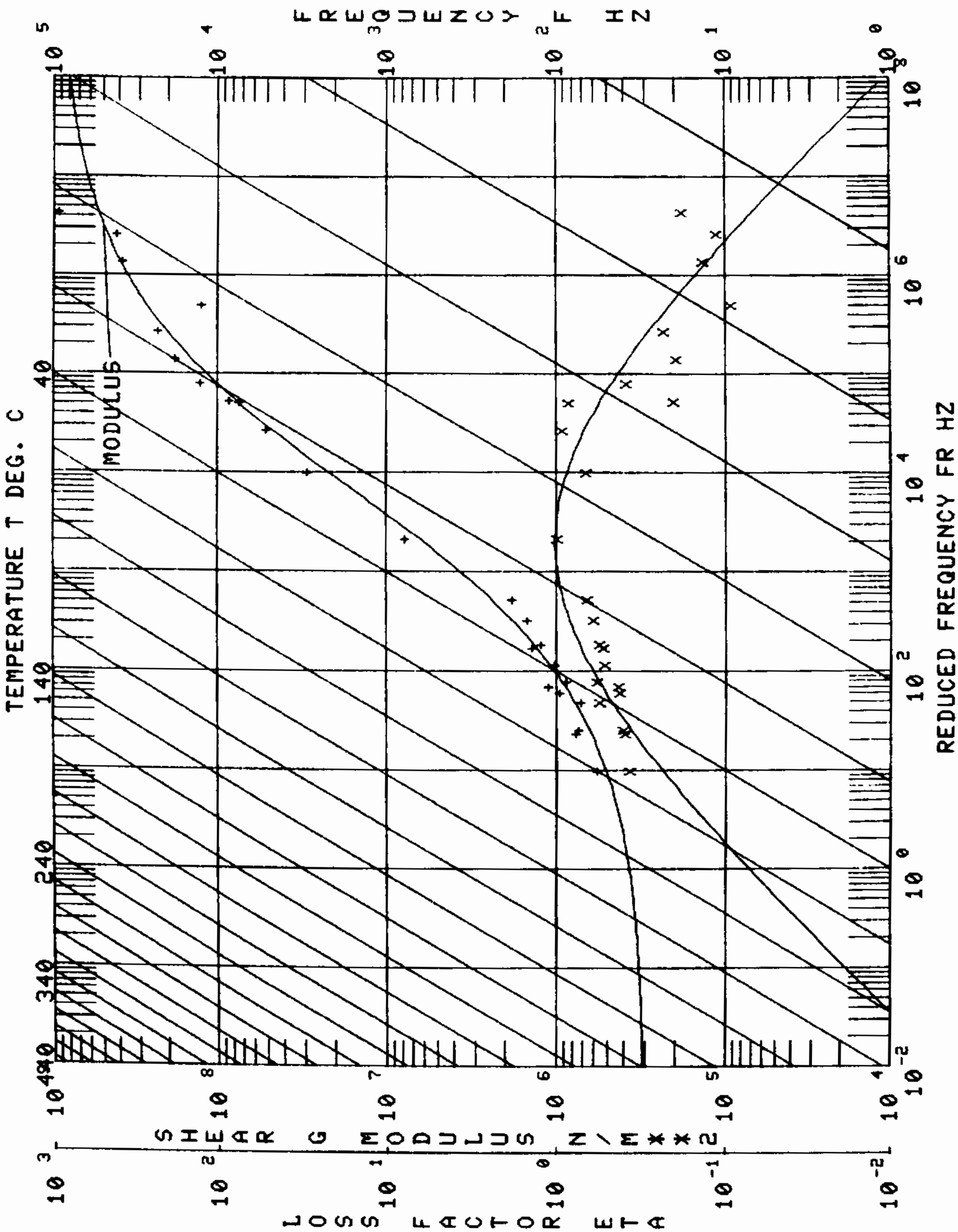
Beam No. 050A, 050B

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
170	2	217.0	198.5	210.0	226.0	16.0	0.0739	
170	3	565.0	546.7	553.0	578.0	25.0	0.0443	
170	4	1077.0	1072.0	1060.0	1095.0	35.0	0.0325	
170	5	1750.0	1754.0	1727.0	1773.0	46.0	0.0263	

Page 2 of 2

EXPERIMENTAL CODE :169
MATERIAL :SOUNDCOAT 601
DATA SOURCES
MANUFACTURER :NONE
AFML :UDRI
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	1.30004E+08	.0957	-18.9	468.0	2.	6.87768E+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.	6.66487E+10	.0117	1090.0	4.98575E+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.	6.64966E+10	.0231	555.6	3.78277E+07
7	2.38682E+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.	6.86405E+10	.1128	201.6	2.06958E+07
9	5.28175E+07	.9524	10.0	1171.0	3.	6.64248E+10	.1778	555.3	5.03031E+07
10	7.67673E+07	.8779	10.0	2188.0	4.	6.65265E+10	.2092	1089.0	6.73955E+07
11	1.30641E+08	.4028	10.0	3468.0	5.	6.51883E+10	.1196	1782.0	5.26275E+07
12	8.01962E+06	1.0116	22.2	368.0	2.	6.83684E+10	.3008	201.2	8.11280E+06
13	1.14571E+06	.4473	53.3	236.0	2.	6.71506E+10	.1282	199.4	5.12505E+05
14	1.43774E+06	.5475	53.3	594.0	3.	6.50208E+10	.0964	549.4	7.87115E+05
15	1.53842E+06	.6254	53.3	1115.0	4.	6.50684E+10	.0683	1077.0	9.62053E+05
16	1.87908E+06	.6817	53.3	1800.0	5.	6.38056E+10	.0584	1763.0	1.28088E+06
17	7.89313E+05	.4055	65.6	224.0	2.	6.67471E+10	.0942	198.8	3.20082E+05
18	9.87376E+05	.4332	65.6	575.0	3.	6.45954E+10	.0575	547.6	4.27693E+05
19	1.04671E+06	.5361	65.6	1092.0	4.	6.47064E+10	.0422	1074.0	5.61120E+05
20	1.25733E+06	.5734	65.6	1768.0	5.	6.33720E+10	.0345	1757.0	7.20968E+05
21	5.95305E+05	.3832	76.7	217.0	2.	6.65458E+10	.0739	198.5	2.28119E+05
22	7.56391E+05	.4145	76.7	565.0	3.	6.43833E+10	.0443	546.7	3.13521E+05
23	7.33373E+05	.5673	76.7	1077.0	4.	6.44657E+10	.0325	1072.0	4.16061E+05
24	9.04591E+05	.5910	76.7	1750.0	5.	6.31558E+10	.0263	1754.0	5.34633E+05


TEMPERATURE T DEG. C
FREQUENCY F HZ
REDUCED FREQUENCY FR HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

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	38.3	°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		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0          FROM         MROM        N        ML
               A1           A2         A3       A4
     80.0  2.2000E+04  2.0000E+07     .350  3.5000E+05
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
     80.0   1.010     .400    -.600   3.0000E+04   2.500
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Test No. 77-18
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	
72	2	605.0	286.7	595.0	615.0	20.0	0.0331	
72	3	1728.0	789.7	1712.0	1750.0	38.0	0.0220	
72	4	3248.0	1549.0	3197.0	3304.0	107.0	0.0330	
72	5	5106.0	2534.0	5005.0	5201.0	196.0	0.0384	
98	2	584.0	286.0	566.0	603.0	37.0	0.0635	
98	3	1610.0	787.9	1543.0	1675.0	132.0	0.0823	
98	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	
152	2	404.0	284.5	361.0		8.6	0.2179	
152	3	995.0	783.6	876.0		238.0	0.2463	
152	4	1830.0	1537:0	1597.0		466.0	0.2633	
175	2	352.0	283.6	324.0	391.0	67.0	0.1939	
175	3	877.0	781.1	816.0	952.0	136.0	0.1570	
175	4	1626.0	1532.0	1539.0	1740.0	201.0	0.1246	

Page 1 of 2

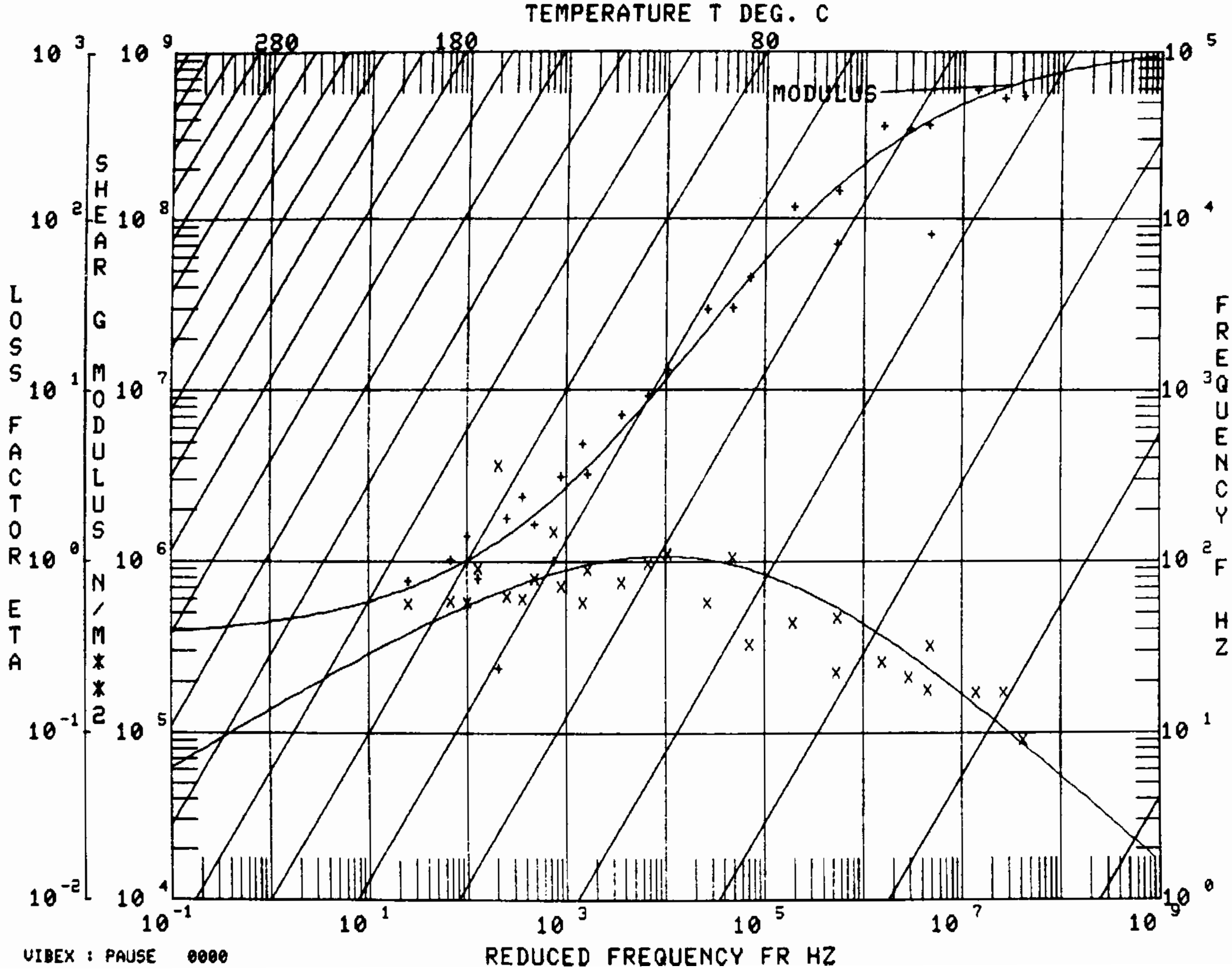
Test No. 77-18
Beam No. Not Recorded

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
199	2	325.0	282.2	305.0	351.0	46.0	0.1430	
199	3	829.0	777.4	793.0	869.0	76.0	0.0921	
199	4	1561.0	1525.0	1515.0	1614.0	99.0	0.0635	
199	5	2490.0	2495.0	2431.0		118.0	0.0474	
227	2	303.0	280.2	290.0	319.0	29.0	0.0962	
227	3	797.0	771.9	776.0	820.0	44.0	0.0553	
227	4	1518.0	1514.0	1491.0	1548.0	57.0	0.0376	
227	5	2442.0	2477.0	2407.0	2478.0	71.0	0.0291	

Page 2 of 2

EXPERIMENTAL CODE :170
MATERIAL :SOUNDCOAT 606
DATA SOURCES
MANUFACTURER :NONE
AFML :UDRI
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	8.24385E+07	.3335	8.3	614.0	2.	7.12723E+10	.0408	287.6	2.74907E+07
2	6.11606E+08	.1789	8.3	1761.0	3.	6.89745E+10	.0097	792.2	1.09406E+08
3	5.39697E+08	.1768	8.3	3346.0	4.	6.91170E+10	.0194	1554.0	9.53952E+07
4	5.66448E+08	.0933	8.3	5311.0	5.	6.76782E+10	.0147	2542.0	5.28239E+07
5	7.19519E+07	.2340	22.2	605.0	2.	7.08270E+10	.0331	286.7	1.68365E+07
6	3.69053E+08	.2681	22.2	1728.0	3.	6.85398E+10	.0220	789.7	9.89274E+07
7	3.53314E+08	.2181	22.2	3248.0	4.	6.86729E+10	.0330	1549.0	7.70728E+07
8	3.72192E+08	.1850	22.2	5106.0	5.	6.72529E+10	.0384	2534.0	6.88412E+07
9	4.63956E+07	.3395	36.7	584.0	2.	7.04815E+10	.0635	286.0	1.57492E+07
10	1.19894E+08	.4488	36.7	1610.0	3.	6.82278E+10	.0823	787.9	5.38049E+07
11	1.51379E+08	.4857	36.7	4576.0	5.	6.69348E+10	.1487	2528.0	7.35321E+07
12	1.34970E+07	1.1464	51.1	524.0	2.	7.01861E+10	.2837	285.4	1.54730E+07
13	3.06227E+07	.5933	51.1	1323.0	3.	6.79164E+10	.2036	786.1	1.81699E+07
14	3.11633E+07	1.0907	51.1	2346.0	4.	6.80537E+10	.3587	1542.0	3.39891E+07
15	4.99163E+06	.5879	66.7	404.0	2.	6.97442E+10	.2179	284.5	2.93455E+06
16	7.36738E+06	.7746	66.7	995.0	3.	6.74851E+10	.2463	783.6	5.70683E+06
17	9.48734E+06	1.0019	66.7	1830.0	4.	6.76130E+10	.2633	1537.0	9.50558E+06
18	2.43309E+06	.6255	79.4	352.0	2.	6.93036E+10	.1939	283.6	1.52195E+06
19	3.19258E+06	.7423	79.4	877.0	3.	6.70551E+10	.1570	781.1	2.36976E+06
20	3.33600E+06	.9265	79.4	1626.0	4.	6.71739E+10	.1246	1532.0	3.09096E+06
21	1.46142E+06	.5873	92.8	325.0	2.	6.86211E+10	.1430	282.2	8.58274E+05
22	1.82579E+06	.6411	92.8	829.0	3.	6.64214E+10	.0921	777.4	1.17046E+06
23	1.70092E+06	.8225	92.8	1561.0	4.	6.65614E+10	.0635	1525.0	1.39896E+06
24	1.03111E+06	1.5212	92.8	2490.0	5.	6.51987E+10	.0474	2495.0	1.56348E+06
25	7.94217E+05	.5849	108.3	303.0	2.	6.76518E+10	.0962	280.2	4.64543E+05
26	1.05055E+06	.5977	108.3	797.0	3.	6.54849E+10	.0553	771.9	6.27876E+05
27	8.19822E+05	.9366	108.3	1518.0	4.	6.56046E+10	.0376	1514.0	7.67811E+05
28	2.44063E+05	3.7523	108.3	2442.0	5.	6.42614E+10	.0291	2477.0	9.15797E+05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280
180
80
MODULUS
LOSS FACTOR ETA
SHEAR G MODULUS N/M**2
FREQUENCY F HZ
REDUCED FREQUENCY FR HZ
VIBEX : PAUSE 0000

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 K Hz

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(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0         FROM        MROM        N          ML
              A1          A2         A3         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-SQRT(1+A**2)))C/2
  T0     ETAFROL     SL       SH         FROL         C
            B1       B2       B3          B4          B5
    70.0    .610    .400    -.400   2.2500E+03   2.500
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Beam No. 070D, 070E

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
67	2	643.0	279.3	631.0	657.0	26.0	0.0405	
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	
98	2	576.0	278.2	556.0	600.0	44.0	0.0766	
98	3	1568.0	766.3	1505.0		126.0	0.0806	
98	4	2963.0	1503.0	2766.0	3086.0	320.0	0.1086	
98	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	1117.0		183.0	0.2934	
127	4	2367.0	1496.0	1989.0		378.0	0.3370	
151	2	391.0	276.0	357.0	449.0	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	754.6	814.0	894.0	80.0	0.0946	
200	5	2536.0	2422.0	2462.0	2592.0	134.0	0.0529	
225	2	326.0	272.8	312.0	342.0	30.0	0.0924	

Page 1 of 2

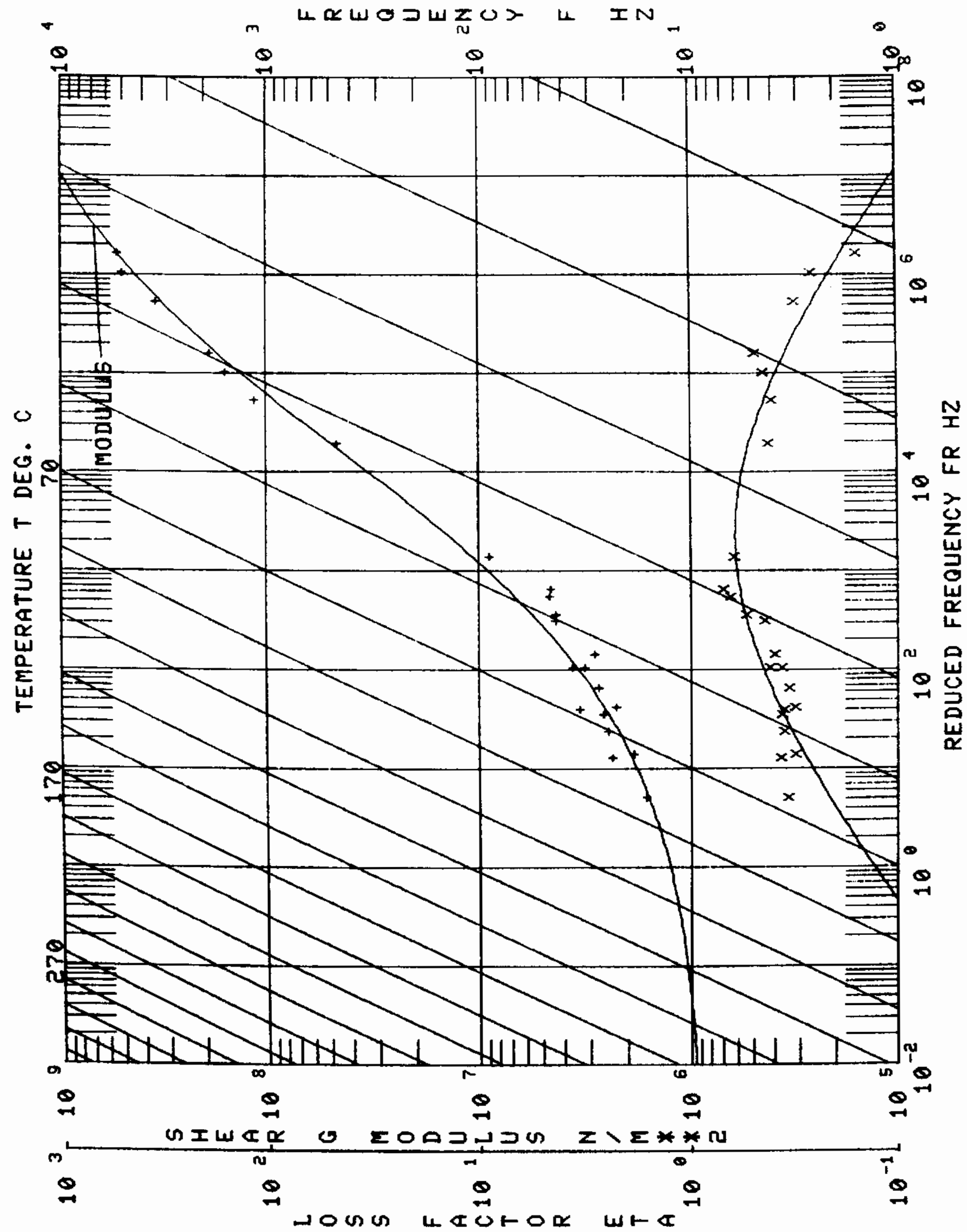
Beam No. 070D, 070E

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
225	3	828.0	751.5	803.0	863.0	60.0	0.0725	
225	4	1546.0	1474.0	1509.0	1573.0	64.0	0.0414	
225	5	2502.0	2412.0	2453.0	2549.0	96.0	0.0384	
250	2	319.0	271.7	306.0	336.0	30.0	0.0945	
250	3	817.0	748.4	792.0	848.0	56.0	0.0687	
250	4	1530.0	1468.0	1498.0	1559.0	61.0	0.0399	
250	5	2482.0	2402.0	2438.0	2524.0	86.0	0.0347	

Page 2 of 2

EXPERIMENTAL CODE :168
MATERIAL :SOUNDCOAT 609
DATA SOURCES
MANUFACTURER :NONE
AFML :UDRI
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	3.52527E+08	.3201	19.4	1695.0	3.	6.50614E+10	.0271	769.4	1.12859E+08
2	5.13116E+08	.2651	19.4	3271.0	4.	6.51720E+10	.0297	1509.0	1.36025E+08
3	5.44604E+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.	6.66895E+10	.0766	278.2	2.05233E+07
5	1.15461E+08	.4161	36.7	1568.0	3.	6.45381E+10	.0806	766.3	4.80442E+07
6	1.60795E+08	.4587	36.7	2963.0	4.	6.46548E+10	.1086	1503.0	7.37644E+07
7	1.90774E+08	.5016	36.7	4653.0	5.	6.33308E+10	.1384	2459.0	9.56930E+07
8	9.29944E+06	1.5896	52.8	496.0	2.	6.60677E+10	.3746	276.9	1.47820E+07
9	2.72871E+07	.9375	52.8	1300.0	3.	6.39164E+10	.2934	762.6	2.55812E+07
10	3.71848E+07	1.0133	52.8	2367.0	4.	6.40540E+10	.3370	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	5.69963E+06
13	2.90451E+06	.4057	79.4	351.0	2.	6.50694E+10	.1380	274.8	1.17825E+06
14	4.46256E+06	.5502	79.4	886.0	3.	6.29978E+10	.1448	757.1	2.45529E+06
15	4.70040E+06	.7087	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.	6.14393E+10	.0529	2422.0	1.98915E+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.	6.20693E+10	.0725	751.5	9.95857E+05
21	2.80465E+06	.3416	107.2	1546.0	4.	6.21839E+10	.0414	1474.0	9.58128E+05
22	3.73088E+06	.3731	107.2	2502.0	5.	6.09330E+10	.0384	2412.0	1.39215E+06
23	1.67468E+06	.3494	121.1	319.0	2.	6.36096E+10	.0945	271.7	5.85115E+05
24	2.39977E+06	.3788	121.1	817.0	3.	6.15583E+10	.0687	748.4	9.08940E+05
25	2.49531E+06	.3601	121.1	1530.0	4.	6.16787E+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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FREQUENCY F HZ
REDUCED FREQUENCY FR HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

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 K Hz

Loss Factor η_D:

Peak	100 Hz	η_D 1.010	Temperature	-48.33 °C	
	1000 Hz	η_D 1.010	Temperature	-26.1 °C	
Range	100 Hz	-65.0 °C	-27.8 °C		
	1000 Hz	-42.8 °C	1.1 °C		

```
LOG(M)=LOG(ML)+(2LOG(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
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
  -30.0    1.010    .700    -1.250   2.0000E+03    1.500
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Beam No. 080-1, 080-2

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-74	1	111.92		111.84	112.04	0.20	0.0018	
-74	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	
-48	1	112.16		111.34	112.91	1.57	0.0140	
-48	2	696.94	325.33	689.09	705.12	16.03	0.0230	
-47	3	1903.81	905.09	1879.45	1928.91	49.46	0.0260	
-47	4	3444.88	1776.05	3371.64	3515.61	143.97	0.0418	
-47	5	5641.51	2941.94	5520.66	5759.81	239.15	0.0424	
-47	6	8265.01	4412.72	8187.51	8356.91	333.04	0.0403	X
-23	1	103.89		96.89	113.52	16.81	0.1618	
-24	2	586.16	324.23	504.94	703.97	199.03	0.3395	
-23	3	1586.39	902.32	1196.77		779.24	0.4912	
1	1	84.05		76.72	93.58	16.86	0.2006	
1	2	416.39	323.02	374.05	476.28	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	3162.41	2919.95	2844.99	3427.94	582.95	0.1843	
26	1	73.90		69.50	82.14	12.64	0.1710	

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Beam No. 080-1, 080-2

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
26	3	975.96	896.46	922.85	1024.44	101.59	0.1041	
26	4	1839.97	1757.91	1783.53	1896.34	112.81	0.0613	
26	5	3020.09	2909.96	2931.65	3110.69	179.04	0.0593	
26	6	4490.84	4367.93	4371.07	4602.71	231.64	0.0516	
26	7	6220.46	6119.33	6066.76	6342.46	275.70	0.0443	
51	1	65.30		60.21	74.26	14.05	0.2152	
51	2	353.32	319.27	339.02	368.51	29.49	0.0835	
51	3	939.85	893.06	914.88	963.35	48.47	0.0516	
51	4	1801.03	1751.26	1776.38	1825.12	48.74	0.0271	
51	5	2966.09	2897.97	2929.05	3001.41	72.36	0.0244	
51	6	4416.44	4353.00	4370.55	4464.35	93.80	0.0212	
51	7	6134.66	6098.48	6081.26	6187.91	106.65	0.0174	
74	2	339.33	319.71	328.88	350.20	21.32	0.0628	
74	3	920.30	890.28	903.55	935.71	32.16	0.0349	
74	4	1780.48	1744.62	1765.04	1795.62	30.58	0.0172	
74	5	2936.99	2887.98	2915.94	2957.66	41.72	0.0142	
74	6	4379.11	4336.58	4354.31	4405.88	51.57	0.0118	
74	7	6092.41	6077.63	6061.96	6121.61	59.65	0.0098	
102	2	328.85	316.85	322.58	335.56	12.98	0.0395	
102	3	903.81	886.58	894.18	913.56	19.41	0.0215	

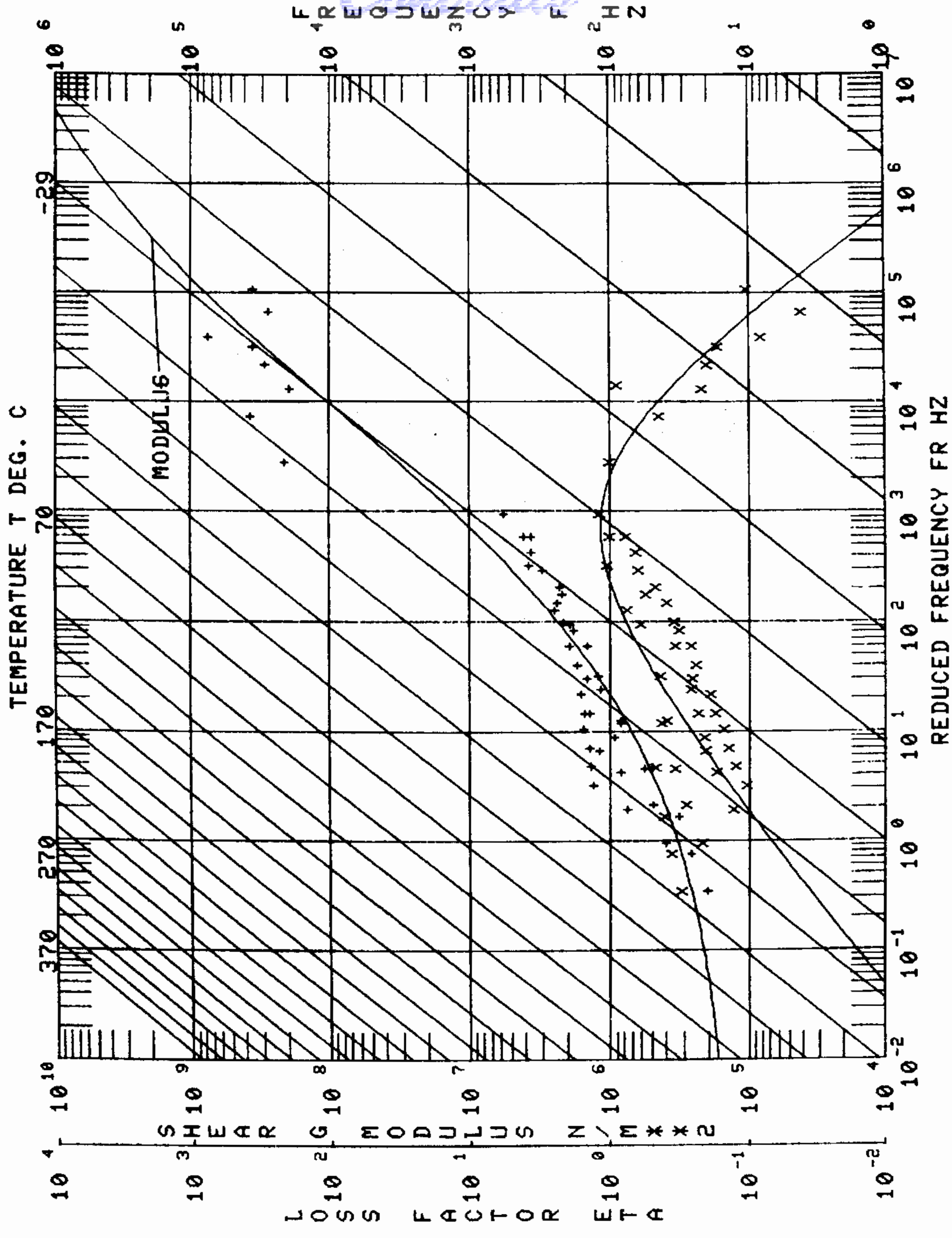
Page 2 of 3

Beam No. 080-1, 080-2

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
102	4	1762.34	1737.36	1751.88	1771.84	19.96	0.0113	
102	5	2911.25	2871.99	2898.26	2924.84	26.58	0.0091	
102	6	4345.85	4318.67	4331.15	4362.61	31.46	0.0072	
102	7	6051.46	6052.61	6032.51	6071.26	38.75	0.0064	
125	2	324.80	315.64	320.11	329.51	9.40	0.0289	
124	3	896.80	883.19	889.80	903.80	14.00	0.0156	
124	4	1752.02	1731.32	1744.75	1759.45	14.70	0.0084	
124	5	2897.03	2861.99	2887.27	2907.16	19.89	0.0069	
124	6	4327.11	4302.75	4314.87	4339.08	24.21	0.0056	
124	7	6025.36	6029.67	6009.66	6043.46	33.80	0.0056	
150	2	320.72	314.42	317.59	323.91	6.32	0.0197	
150	3	889.41	879.90	884.96	894.04	9.08	0.0102	
149	4	1741.03	1724.06	1736.11	1746.26	10.15	0.0058	
149	5	2880.46	2850.00	2873.69	2887.61	13.92	0.0048	
149	6	4303.35	4287.32	4295.05	4312.77	17.72	0.0041	

EXPERIMENTAL CODE :178
MATERIAL :SOUNDCOAT LT12
DATA SOURCES
MANUFACTURER :NONE
AFML :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	2.12123E+05	.3219	65.6	320.7	2.	6.52198E+10	.0197	314.4	6.82834E+04
2	4.22394E+05	.2276	65.6	889.4	3.	6.51333E+10	.0102	879.8	9.61308E+04
3	7.88677E+05	.1354	65.0	1741.0	4.	6.51334E+10	.0058	1724.1	1.06762E+05
4	1.35477E+06	.1081	65.0	2880.5	5.	6.51334E+10	.0048	2850.0	1.46438E+05
5	1.42414E+06	.1305	65.0	4303.3	6.	6.62987E+10	.0041	4287.3	1.85820E+05
6	1.22697E+06	.2137	65.0	5994.5	7.	6.65080E+10	.0042	6008.8	2.62205E+05
7	2.75398E+05	.3768	51.7	324.8	2.	6.57270E+10	.0289	315.6	1.03775E+05
8	5.09981E+05	.2946	51.1	896.8	3.	6.56362E+10	.0156	883.2	1.50218E+05
9	8.72999E+05	.1798	51.1	1752.0	4.	6.56831E+10	.0084	1731.3	1.56943E+05
10	1.46082E+06	.1460	51.1	2897.0	5.	6.56826E+10	.0069	2862.0	2.13298E+05
11	1.61979E+06	.1588	51.1	4327.1	6.	6.67613E+10	.0056	4302.2	2.57184E+05
12	1.44694E+06	.2446	51.1	6025.4	7.	6.69701E+10	.0056	6029.7	3.53860E+05
13	3.39513E+05	.4326	38.9	328.8	2.	6.62318E+10	.0395	316.8	1.46862E+05
14	5.90517E+05	.3577	38.9	903.8	3.	6.61410E+10	.0215	886.6	2.11219E+05
15	9.69073E+05	.2210	38.9	1762.3	4.	6.61422E+10	.0113	1737.4	2.14192E+05
16	1.55864E+06	.1825	38.9	2911.2	5.	6.61424E+10	.0091	2872.0	2.84521E+05
17	1.67933E+06	.1987	38.9	4345.8	6.	6.72718E+10	.0072	4318.7	3.33723E+05
18	1.52471E+06	.2677	38.9	6051.5	7.	6.74806E+10	.0064	6052.6	4.08153E+05
19	5.18113E+05	.4931	23.3	339.3	2.	6.74329E+10	.0628	319.7	2.55464E+05
20	8.74896E+05	.4129	23.3	920.3	3.	6.66942E+10	.0349	890.3	3.61235E+05
21	1.21051E+06	.2768	23.3	1780.5	4.	6.66961E+10	.0172	1744.6	3.35061E+05
22	1.78154E+06	.2546	23.3	2937.0	5.	6.68809E+10	.0142	2888.0	4.53515E+05
23	2.01971E+06	.2760	23.3	4379.1	6.	6.78310E+10	.0118	4336.6	5.57477E+05
24	1.87455E+06	.3389	23.3	6092.4	7.	6.80397E+10	.0098	6077.6	6.35273E+05
25	8.73940E+05	.4453	10.6	353.3	2.	6.72474E+10	.0835	319.3	3.89192E+05
26	1.25888E+06	.4521	10.6	939.8	3.	6.71114E+10	.0516	893.1	5.69096E+05
27	1.52217E+06	.3580	10.6	1801.0	4.	6.72048E+10	.0271	1751.3	5.44947E+05
28	2.20629E+06	.3629	10.6	2966.1	5.	6.73445E+10	.0244	2898.0	8.00592E+05
29	2.48244E+06	.4125	10.6	4416.4	6.	6.83456E+10	.0212	4353.0	1.02406E+06
30	2.34119E+06	.4903	10.6	6134.7	7.	6.85073E+10	.0174	6098.5	1.14798E+06
31	2.02930E+06	.6368	-3.3	976.0	3.	6.76234E+10	.1041	896.5	1.29217E+06
32	2.24719E+06	.5845	-3.3	1840.0	4.	6.77162E+10	.0613	1757.9	1.31339E+06
33	3.13527E+06	.6538	-3.3	3020.1	5.	6.79028E+10	.0593	2910.0	2.04974E+06
34	3.78570E+06	.6911	-3.3	4490.8	6.	6.88152E+10	.0516	4367.9	2.61612E+06
35	3.73952E+06	.8129	-3.3	6220.5	7.	6.89765E+10	.0443	6119.3	3.03992E+06
36	2.58071E+06	.7923	-17.2	416.4	2.	6.88364E+10	.2455	323.0	2.04480E+06
37	3.89264E+06	1.0879	-17.2	1059.6	3.	6.80888E+10	.2598	899.5	4.23463E+06
38	4.25312E+06	1.0406	-17.2	1936.7	4.	6.81830E+10	.1758	1764.0	4.42561E+06
39	5.92461E+06	1.2397	-17.2	3162.4	5.	6.83699E+10	.1843	2920.0	7.34485E+06
40	2.12950E+08	1.0474	-44.4	696.9	2.	6.98245E+10	.0230	325.3	2.23051E+08
41	3.75894E+08	.4635	-43.9	1903.8	3.	6.89316E+10	.0260	905.1	1.74211E+08
42	1.99977E+08	.2270	-43.9	3444.9	4.	6.91209E+10	.0418	1776.1	4.53898E+07
43	2.96616E+08	.2126	-43.9	5641.5	5.	6.94035E+10	.0424	2941.9	6.30665E+07
44	3.63895E+08	.1760	-43.9	8265.0	6.	7.02338E+10	.0403	4412.7	6.40454E+07
45	1.69288E+09	.9333	-58.9	704.3	2.	6.99189E+10	.0030	325.5	1.57988E+09
46	7.80739E+08	.0852	-58.9	1933.9	3.	6.94031E+10	.0029	908.2	6.65124E+07
47	2.77186E+08	.0422	-58.3	3540.2	4.	6.95918E+10	.0064	1782.1	1.16969E+07
48	3.63755E+08	.1087	-58.3	5756.7	5.	6.99231E+10	.0194	2952.9	3.95228E+07


TEMPERATURE T DEG. C
REDUCED FREQUENCY FR HZ
FREQUENCY F HZ
MODULUS
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA

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		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0         FROM         MROM         N          ML
              A1           A2          A3         A4
    70.0  5.0000E+03  2.0000E+06     .350   5.5000E+04
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
    70.0    1.300     .350     -.400   2.0000E+03   2.000
LOG(FR)=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.

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

Beam No. 060C, 060D

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
1	2	505.60	246.00	502.90	507.80	4.90	0.0097	
1	3	1358.80	683.00	1351.90	1364.90	13.00	0.0096	
1	4	2489.20	1337.80	2368.10	2508.30	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	1303.30	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	1083.20	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	801.60	670.95	688.80	932.20	243.40	0.3036	
137	4	1449.90	1311.80	1287.00	1589.10	302.10	0.2084	
152	2	279.20	240.39	249.80	310.80	61.00	0.2185	

Page 1 of 2

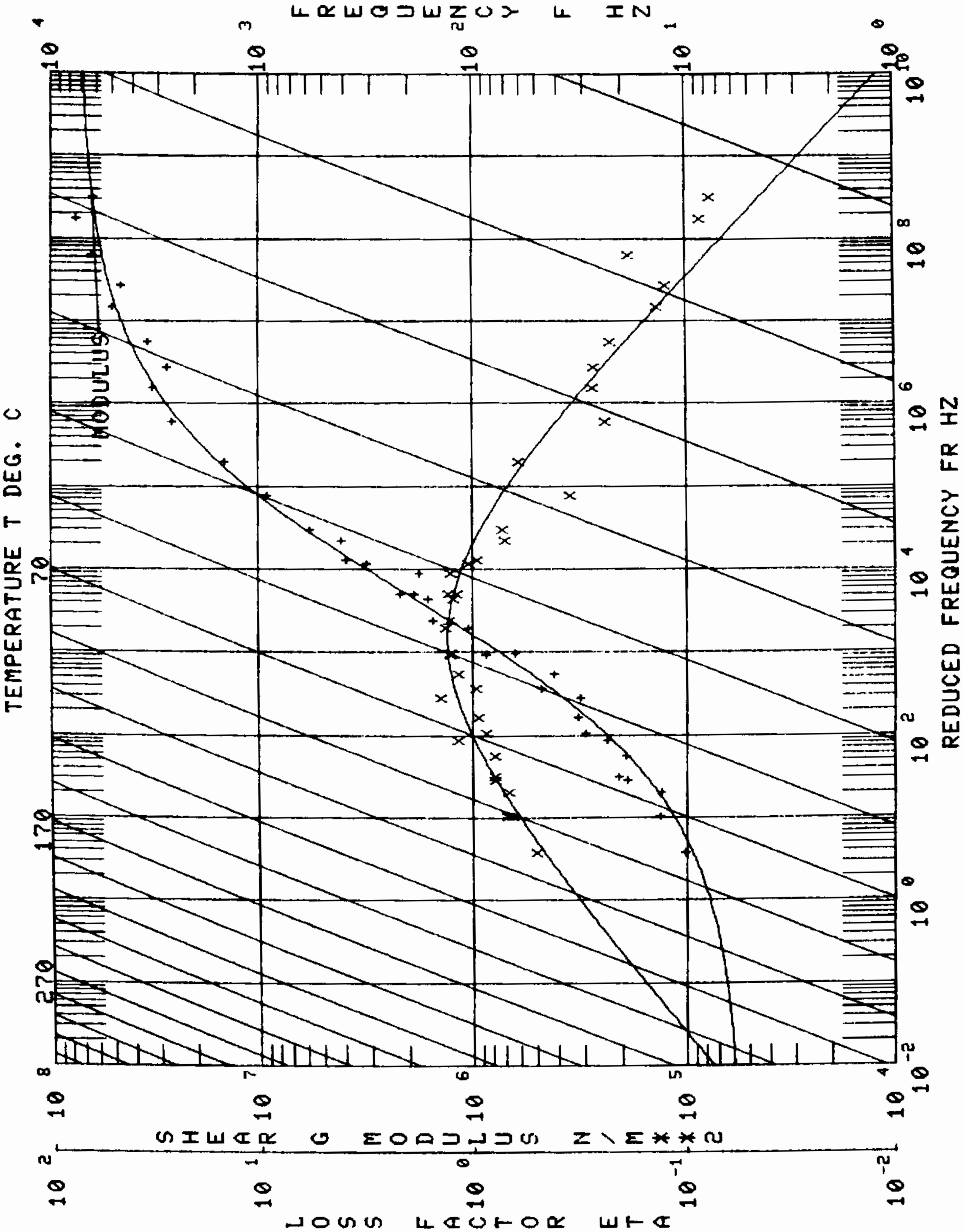
Beam No. 060C, 060D

°F Temp.	Mode	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	688.10	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	1288.80	1284.00	1301.20	17.20	0.0133	

Page 2 of 2

EXPERIMENTAL CODE : 71
MATERIAL :3M ISD 110
DATA SOURCES
MANUFACTURER :N
AFML :UDRI-GET,MJR
OTHER :N

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	6.45844E+07	.1895	-17.2	505.6	2.	7.09752E+10	.0097	246.0	1.22367E+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.	6.97202E+10	.0161	1337.8	5.03246E+06
4	3.45945E+07	.2319	-3.9	496.8	2.	7.14955E+10	.0205	246.9	8.02381E+06
5	5.17461E+07	.1400	-3.9	1330.1	3.	7.04801E+10	.0208	686.4	7.24399E+06
6	4.68559E+07	.1284	-3.9	2413.3	4.	7.03470E+10	.0315	1343.8	6.01416E+06
7	2.64409E+07	.2443	10.0	485.2	2.	6.98430E+10	.0264	244.0	6.46071E+06
8	3.30903E+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	4.	6.86507E+10	.0824	1327.5	7.66462E+06
10	9.36650E+06	.3589	23.9	445.9	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	242.1	3.40402E+06
13	5.92187E+06	.7418	37.8	1000.6	3.	6.79022E+10	.2391	673.7	4.39256E+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	1467.5	4.	6.72820E+10	.2256	1314.2	2.34207E+06
17	4.88776E+05	.9820	66.7	279.2	2.	6.77750E+10	.2185	240.4	4.79973E+05
18	6.46653E+05	1.2942	66.7	723.0	3.	6.69721E+10	.1773	669.1	8.36879E+05
19	6.97447E+05	.2221	66.7	1362.6	4.	6.69119E+10	.0190	1310.6	1.54923E+05
20	2.23801E+06	1.2115	44.4	377.2	2.	6.85837E+10	.3285	241.8	2.71145E+06
21	3.99518E+06	.9725	44.4	938.9	3.	6.77773E+10	.2985	673.1	3.88513E+06
22	4.19561E+06	.7190	44.4	1620.1	4.	6.74049E+10	.2006	1315.4	3.01682E+06
23	8.87233E+05	1.2849	58.3	311.3	2.	6.81477E+10	.3476	241.0	1.14004E+06
24	1.56260E+06	1.3076	58.3	801.6	3.	6.73330E+10	.3036	670.9	2.04331E+06
25	1.64519E+06	1.2656	58.3	1449.9	4.	6.70365E+10	.2084	1311.8	2.08213E+06
26	3.03156E+05	.8876	79.4	263.8	2.	6.72797E+10	.1486	239.5	2.69086E+05
27	3.21960E+05	1.4511	79.4	696.5	3.	6.74675E+10	.1124	671.6	4.67187E+05
28	4.24389E+05	1.1937	79.4	1334.9	4.	6.63576E+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	2.42649E+05	1.1877	93.3	686.9	3.	6.70482E+10	.0722	669.5	2.88191E+05
31	3.27847E+05	.9580	93.3	1320.6	4.	6.58055E+10	.0422	1299.7	3.14069E+05
32	1.36936E+05	.6650	107.2	247.4	2.	6.57991E+10	.0614	236.9	9.10644E+04
33	1.93255E+05	.8071	107.2	674.7	3.	6.54989E+10	.0408	661.7	1.55979E+05
34	1.97962E+05	.8088	107.2	1304.0	4.	6.53203E+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	.6962	121.1	1292.1	4.	6.47064E+10	.0133	1288.8	9.32785E+04


TEMPERATURE T DEG. C
REDUCED FREQUENCY FR HZ
FREQUENCY F HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

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		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
 T0        FROM        MROM        N         ML
           A1          A2          A3        A4
   40.0  2.0000E+04  4.7500E+06   .275   6.0000E+04
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
   40.0  1.080     .450    -.550  5.0000E+03    2.500
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks: Thermogravitational (TGA) analysis revealed significant decomposition of this material beginning at 250°C.

Beam No. 060C, 060D

°F 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	1173.80	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	876.50	184.50	0.2359	

Page 1 of 2

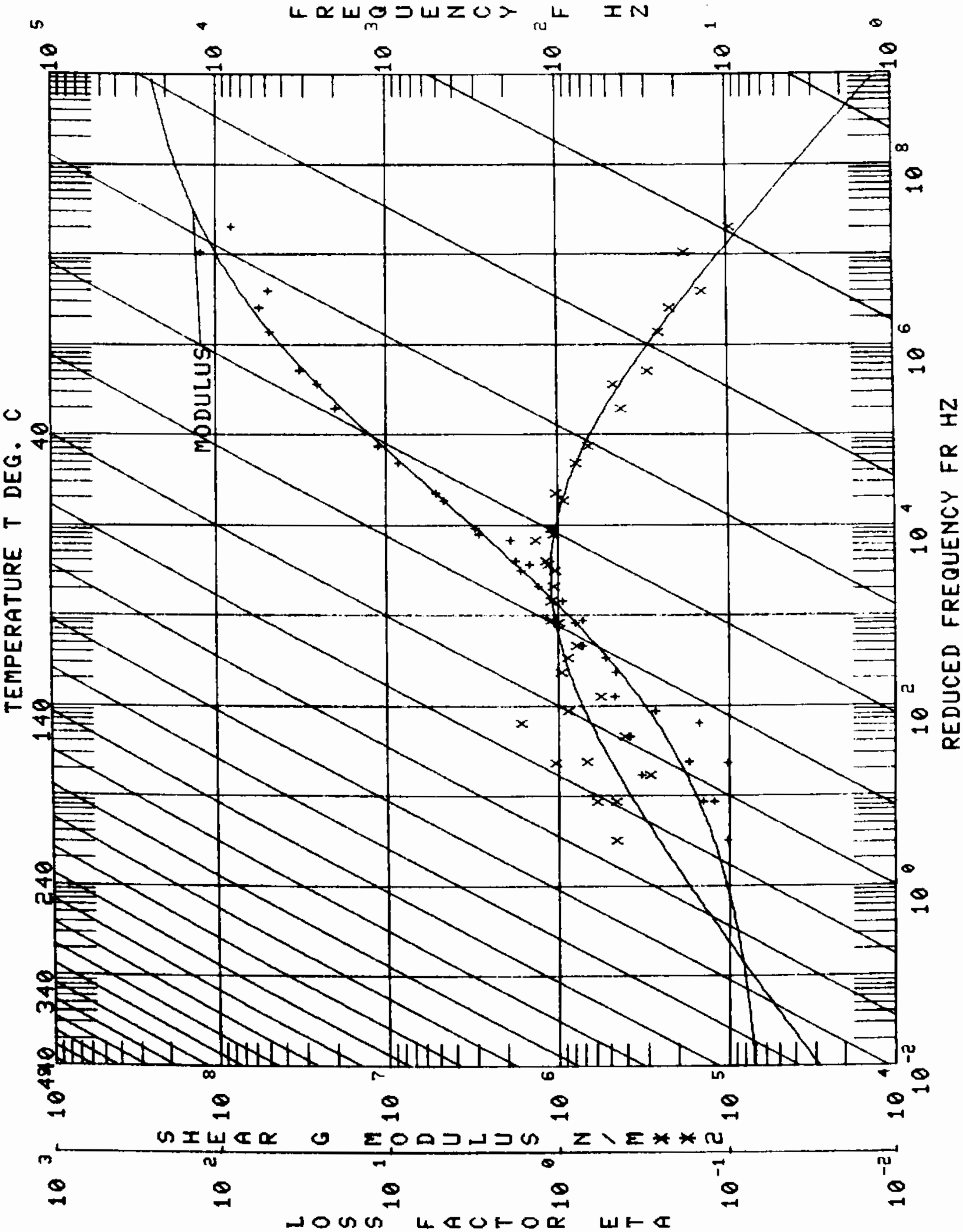
Beam No. 060C, 060D

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	1368.00	48.80	0.0363	
176	2	249.00	239.51	242.80	255.70	12.90	0.0518	
176	3	676.40	671.57	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	

Page 2 of 2

EXPERIMENTAL CODE : 72
MATERIAL :3M ISD 112
DATA SOURCES
MANUFACTURER :N
AFML :MJR
OTHER :N

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	3.10450E+06	1.1166	10.0	401.6	2.	6.98430E+10	.2863	244.0	3.46659E+06
2	5.27104E+06	1.0607	10.0	1005.8	3.	6.88387E+10	.3143	678.4	5.59116E+06
3	1.14751E+07	.6758	-5.6	469.7	2.	7.14955E+10	.1101	246.9	7.75496E+06
4	2.03761E+07	.4399	-5.6	1223.2	3.	7.04801E+10	.1073	686.4	8.96264E+06
5	2.57024E+07	.4869	-5.6	2251.2	4.	7.03470E+10	.1422	1343.8	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	1323.3	3.	6.99063E+10	.0394	683.6	1.28913E+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.	6.68281E+10	.0123	668.4	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	2.66539E+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	8.18262E+05	1.0131	29.4	304.4	2.	6.92718E+10	.2779	243.0	8.28985E+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	.2085	1321.5	2.16745E+06
20	1.68642E+06	1.0755	18.3	352.4	2.	6.95286E+10	.3207	243.5	1.81381E+06
21	2.97348E+06	1.0867	18.3	894.3	3.	6.85265E+10	.3152	676.8	3.23130E+06
22	4.78292E+06	.9490	4.4	426.9	2.	7.00321E+10	.2197	244.4	4.53894E+06
23	8.80290E+06	.8056	4.4	1092.2	3.	6.91516E+10	.2358	679.9	7.09189E+06
24	2.78940E+05	.9080	51.7	263.5	2.	6.82721E+10	.1419	241.3	2.53283E+05
25	4.73490E+05	.9836	51.7	708.9	3.	6.74675E+10	.1057	671.6	4.65722E+05
26	7.31422E+05	.8011	51.7	1369.9	4.	6.72820E+10	.0709	1314.2	5.85977E+05
27	1.79241E+05	.7057	66.7	254.3	2.	6.77750E+10	.0794	240.4	1.26486E+05
28	1.54883E+05	1.7030	66.7	678.8	3.	6.69721E+10	.0686	669.1	2.63765E+05
29	1.26498E+05	.6116	80.0	249.0	2.	6.72797E+10	.0518	239.5	7.73647E+04
30	1.05156E+05	1.0658	80.0	676.4	3.	6.74675E+10	.0296	671.6	1.12079E+05
31	3.94595E+05	.4239	80.0	1331.5	4.	6.63576E+10	.0220	1305.1	1.67284E+05
32	1.05320E+05	.4733	93.9	246.0	2.	6.66016E+10	.0345	238.3	4.98521E+04
33	1.48579E+05	.4731	93.9	673.3	3.	6.60505E+10	.0186	664.5	7.02879E+04
34	3.40437E+05	.3023	93.9	1321.4	4.	6.58055E+10	.0138	1299.7	1.02919E+05
35	4.85304E+05	.5843	66.7	1344.8	4.	6.69119E+10	.0363	1310.6	2.83543E+05



FREQUENCY F HZ
TEMPERATURE T DEG. C
REDUCED FREQUENCY FR HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

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 K Hz

Loss Factor η_D:

Peak	100 Hz	η_D 1.25		Temperature	-15 °C
	1000 Hz	η_D 1.25		Temperature	10 °C
Range	100 Hz	-35 °C	12 °C		
	1000 Hz	35 °C	-15 °C		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0          FROM          MROM          N          ML
               A1            A2           A3         A4
    10.0  2.0000E+04  2.0000E+07        .300    7.5000E+04
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
    10.0    1.250     .800    -1.000   2.5000E+03     3.000
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Beam No. 070D, 070E

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-53	2	581.0	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	314.0	279.1	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	

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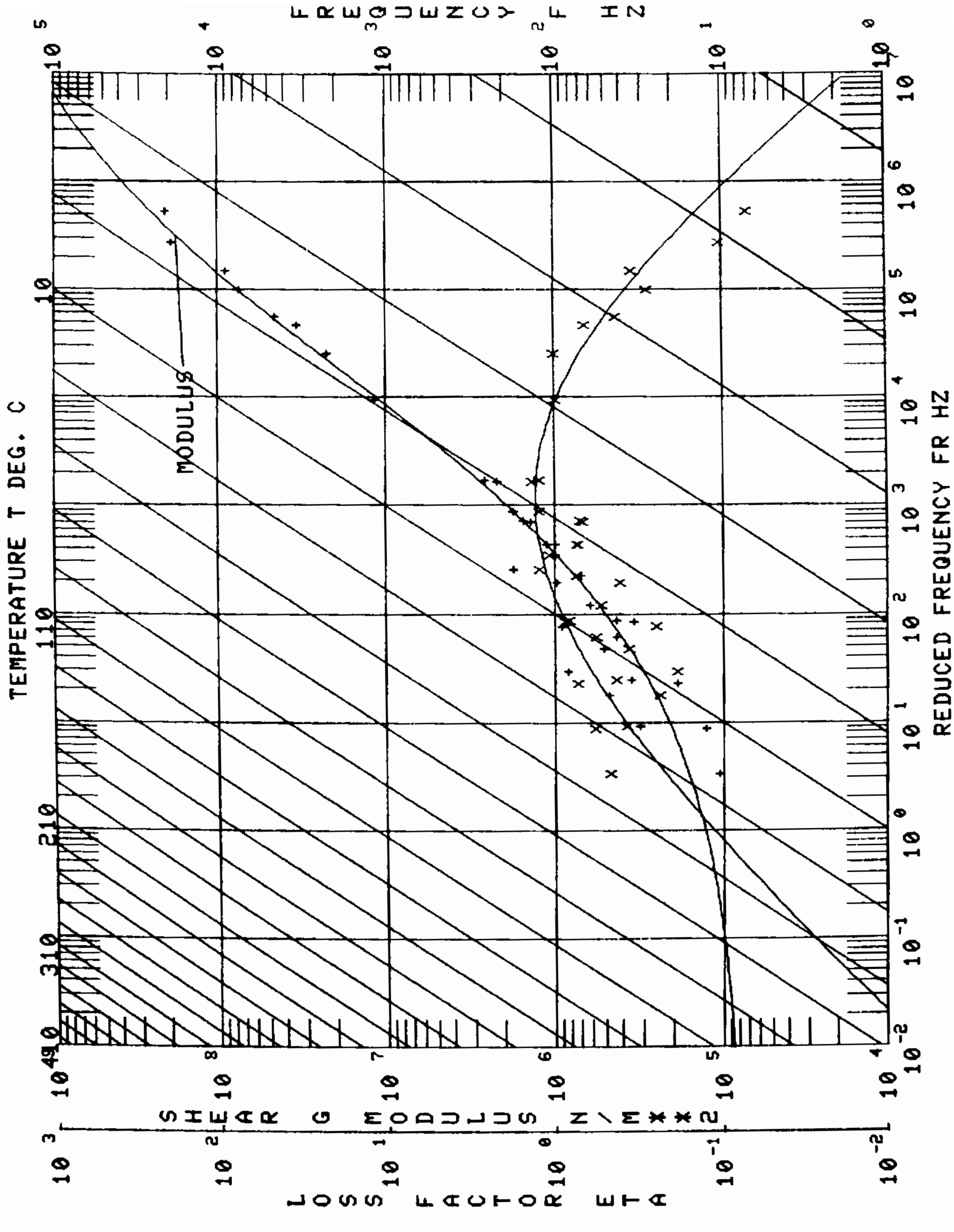
Beam No. 070D, 070E

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
75	3	827.0	768.8	787.0	873.0	86.0	0.1040	
75	4	1588.0	1508.0	1526.0	1651.0	125.0	0.0790	
75	5	2579.0	2467.0	2502.0	2669.0	167.0	0.0649	
103	2	293.0	277.9	282.0	305.0	23.0	0.0787	
103	3	800.0	765.4	779.0	822.0	42.0	0.0538	
103	4	1548.0	1501.0	1522.0	1580.0	58.0	0.0375	
103	5	2531.0	2456.0	2500.0	2573.0	73.0	0.0289	
125	2	287.0	277.2	282.0	295.0	13.0	0.0453	
125	3	791.0	763.5	778.0	805.0	27.0	0.0342	
125	4	1535.0	1497.0	1520.0	1554.0	34.0	0.0222	
125	5	2519.0	2450.0	2496.0	2538.0	42.0	0.0167	
150	2	284.0	276.0	280.0	289.0	9.0	0.0317	
150	3	784.0	760.1	774.0	795.0	21.0	0.0268	
150	4	1526.0	1491.0	1515.0	1663.0	137.0	0.0860	
150	5	2502.0	2439.0	2488.0	2517.0	29.0	0.0116	

Page 2 of 2

EXPERIMENTAL CODE : 15
MATERIAL :ISD 113
DATA SOURCES
MANUFACTURER :NONE
AFML :SANDWICH BEAM
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	5.12643E+05	.7873	23.9	827.0	3.	3.12032E+10	.1040	768.8	4.03626E+05
2	7.08489E+05	.7902	23.9	1588.0	4.	3.12636E+10	.0790	1508.0	5.59821E+05
3	9.90544E+05	.7335	23.9	2579.0	5.	3.06189E+10	.0649	2467.0	7.26590E+05
4	1.35252E+05	.7716	39.4	293.0	2.	3.19649E+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	.0375	1501.0	2.45579E+05
7	6.84503E+05	.4467	39.4	2531.0	5.	3.03465E+10	.0289	2456.0	3.05775E+05
8	9.00647E+04	.6244	51.7	287.0	2.	3.18041E+10	.0453	277.2	5.62397E+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	6.34731E+05	.2749	51.7	2519.0	5.	3.01984E+10	.0167	2450.0	1.74500E+05
12	7.46994E+04	.5117	65.6	284.0	2.	3.15293E+10	.0317	276.0	3.82265E+04
13	2.18286E+05	.4042	65.6	784.0	3.	3.05010E+10	.0268	760.1	8.82386E+04
14	3.30753E+05	.2629	65.6	1526.0	4.	3.05627E+10	.0138	1491.0	8.69579E+04
15	5.82669E+05	.2046	65.6	2502.0	5.	2.99278E+10	.0116	2439.0	1.19225E+05
16	3.16019E+05	.8558	23.9	314.0	2.	3.22416E+10	.1613	279.1	2.70458E+05
17	1.27526E+06	1.2845	23.9	920.0	3.	3.14065E+10	.2909	771.3	1.63808E+06
18	8.03901E+05	.7760	23.9	1599.0	4.	3.12636E+10	.0860	1508.0	6.23863E+05
19	1.09984E+06	.7444	23.9	2592.0	5.	3.06189E+10	.0719	2467.0	8.18675E+05
20	7.19026E+05	1.1288	10.0	356.0	2.	3.24498E+10	.3023	280.0	8.11661E+05
21	-6.44715E+06	-.8224	10.0	920.0	3.	3.13820E+10	3.0000	771.0	5.30225E+06
22	1.88709E+06	1.3356	-3.9	441.0	2.	3.27053E+10	.3303	281.1	2.52032E+06
23	8.50246E+06	1.2357	-17.8	542.0	2.	3.29384E+10	.1340	282.1	1.05068E+07
24	1.61277E+07	1.1797	-17.8	1441.0	3.	3.18806E+10	.1747	777.1	1.90258E+07
25	2.53555E+07	.7229	-17.8	2653.0	4.	3.19305E+10	.1654	1524.0	1.83298E+07
26	4.28544E+07	.7114	-31.7	572.0	2.	3.31723E+10	.0297	283.1	3.04822E+07
27	8.12783E+07	.4836	-31.7	1552.0	3.	3.21189E+10	.0335	780.0	3.93081E+07
28	9.36208E+07	.6561	-36.1	581.0	2.	3.34543E+10	.0138	284.3	6.14232E+07
29	2.75646E+08	.2150	-36.1	1596.0	3.	3.23665E+10	.2056	783.0	5.92687E+07
30	2.11182E+08	.1006	-36.1	3064.0	4.	3.23931E+10	.2065	1535.0	2.12411E+07
31	-1.22151E+08	-.0528	-36.1	4900.0	5.	2.37559E+10	.2106	2173.0	6.44435E+06
32	2.48666E+05	.9008	23.9	307.0	2.	3.22416E+10	.1448	279.1	2.23993E+05
33	1.59261E+06	1.4444	10.0	1707.0	4.	3.14712E+10	.2553	1513.0	2.30032E+06
34	1.27526E+06	1.2845	10.0	920.0	3.	3.14065E+10	.2909	771.3	1.63808E+06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REDUCED FREQUENCY FR HZ
FREQUENCY F HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

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 K Hz

Loss Factor η_D:

Peak	100 Hz	η_D 1.5		Temperature	-7.0 °C
	1000 Hz	η_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
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0          FROM          MROM         N          ML
              A1            A2           A3         A4
    10.0  7.5000E+03  5.5000E+06      .385  8.0000E+04
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
    10.0   1.500     .300      -.500  3.5000E+03     .300
LOG(FR)=LOG(F)-12(T-T0)/(525/1.8+T-T0)
```

Remarks:

Beam No. 060C, 060D

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-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	

Page 1 of 2

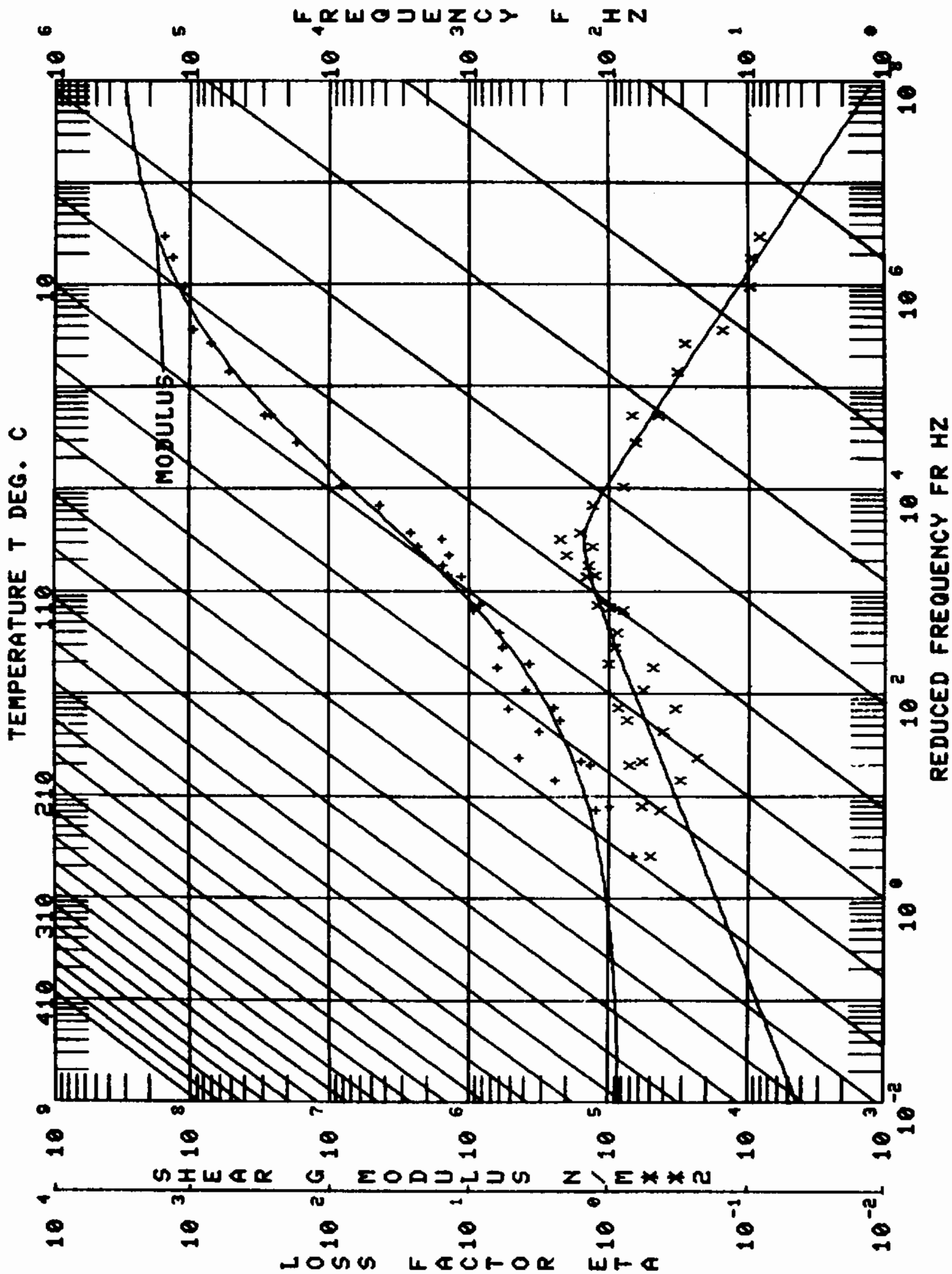
Beam No. 060C, 060D

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
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	1323.27	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	0.0258	
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	

Page 2 of 2

EXPERIMENTAL CODE :118
MATERIAL :MOD. ISD 113
DATA SOURCES
MANUFACTURER :NONE
AFML :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	1.14042E+08	.0997	-46.1	1394.4	3.	7.10460E+10	.0079	689.2	1.13723E+07
2	1.40281E+08	.0975	-46.1	2668.0	4.	7.08567E+10	.0114	1348.7	1.36811E+07
3	1.60514E+08	.0846	-46.1	4309.1	5.	7.11746E+10	.0132	2234.4	1.35858E+07
4	2.98589E+07	.4665	-32.2	496.3	2.	7.14897E+10	.0413	246.9	1.39282E+07
5	5.38531E+07	.3388	-32.2	1340.8	3.	7.04760E+10	.0456	686.4	1.82445E+07
6	7.21296E+07	.2964	-32.2	2541.8	4.	7.03501E+10	.0535	1343.8	2.13791E+07
7	8.50096E+06	.8277	-20.0	458.9	2.	7.09752E+10	.1486	246.0	7.03631E+06
8	1.76257E+07	.6706	-20.0	1215.3	3.	6.99063E+10	.1572	683.6	1.18192E+07
9	2.67157E+07	.7124	-20.0	2297.4	4.	6.97181E+10	.1852	1337.8	1.90311E+07
10	1.47002E+06	1.3029	-4.4	349.5	2.	7.03477E+10	.3662	244.9	1.91530E+06
11	2.69562E+06	1.6680	-4.4	914.0	3.	6.99063E+10	.4222	683.6	4.49626E+06
12	5.97356E+05	.9385	10.0	289.8	2.	6.98430E+10	.2281	244.0	5.60591E+05
13	8.60367E+05	1.2629	10.0	749.6	3.	6.88387E+10	.2077	678.4	1.08659E+06
14	1.18792E+06	1.5205	10.0	1427.3	4.	6.86507E+10	.1939	1327.5	1.80626E+06
15	1.45179E+06	2.1077	10.0	2324.3	5.	6.89015E+10	.2096	2198.5	3.05993E+06
16	9.62629E+05	1.0239	1.7	314.5	2.	6.99690E+10	.2928	244.2	9.85667E+05
17	1.60748E+06	1.4514	1.7	816.3	3.	6.90886E+10	.3325	679.6	2.33302E+06
18	1.64306E+06	2.3178	1.7	1492.1	4.	6.88992E+10	.3564	1329.9	3.80821E+06
19	4.46060E+06	1.3597	-9.4	997.8	3.	6.95917E+10	.3729	682.1	6.06526E+06
20	2.55867E+05	.8840	23.9	263.3	2.	6.93345E+10	.1284	243.1	2.26183E+05
21	3.85802E+05	1.0389	23.9	705.8	3.	6.84010E+10	.0931	676.2	4.00793E+05
22	6.25144E+05	.9049	23.3	1369.6	4.	6.82139E+10	.0691	1323.3	5.65723E+05
23	9.60942E+05	.8218	23.3	2259.4	5.	6.83391E+10	.0588	2189.5	7.89662E+05
24	1.42327E+05	.7490	38.9	252.9	2.	6.87710E+10	.0688	242.1	1.06602E+05
25	2.30446E+05	.7731	38.9	689.6	3.	6.79022E+10	.0444	673.7	1.78148E+05
26	4.07845E+05	.5987	38.9	1346.2	4.	6.77785E+10	.0314	1319.0	2.44164E+05
27	6.54656E+05	.5061	38.9	2225.5	5.	6.79028E+10	.0258	2182.5	3.31341E+05
28	1.02165E+05	.6081	51.1	248.6	2.	6.82721E+10	.0422	241.3	6.21248E+04
29	1.65209E+05	.6062	51.1	681.7	3.	6.74675E+10	.0258	671.6	1.00155E+05
30	3.26732E+05	.4322	51.1	1334.3	4.	6.72820E+10	.0186	1314.2	1.41202E+05
31	5.43716E+05	.3519	51.1	2208.9	5.	6.74686E+10	.0152	2175.5	1.91321E+05
32	6.93994E+04	.5218	67.2	244.9	2.	6.77750E+10	.0257	240.4	3.62109E+04
33	1.27345E+05	.4499	66.7	675.9	3.	6.69721E+10	.0151	669.1	5.72934E+04
34	2.49565E+05	.3245	66.7	1323.9	4.	6.69119E+10	.0109	1310.6	8.09722E+04
35	9.84018E+07	.1582	-46.1	513.6	2.	7.20003E+10	.0056	247.8	1.55668E+07
36	4.52630E+05	.2404	66.7	2194.0	5.	6.70351E+10	.0088	2168.5	1.08814E+05
37	2.40250E+06	1.3725	-9.4	391.4	2.	7.02213E+10	.3426	244.7	3.29746E+06


TEMPERATURE T DEG. C
MODULUS
REDUCED FREQUENCY FR HZ
FREQUENCY F HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA

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		

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0          FROM        MROM        N          ML
               A1          A2         A3         A4
   -15.0   1.2000E+04  2.0000E+07    .500    4.0000E+05
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
   -15.0   1.600      .450    -.900    8.0000E+03    .500
LOG(FR)=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

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-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	3718.0	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		312.00	0.3441	

Page 1 of 3

Test No. 78-2
Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-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	239.8	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	

Page 2 of 3

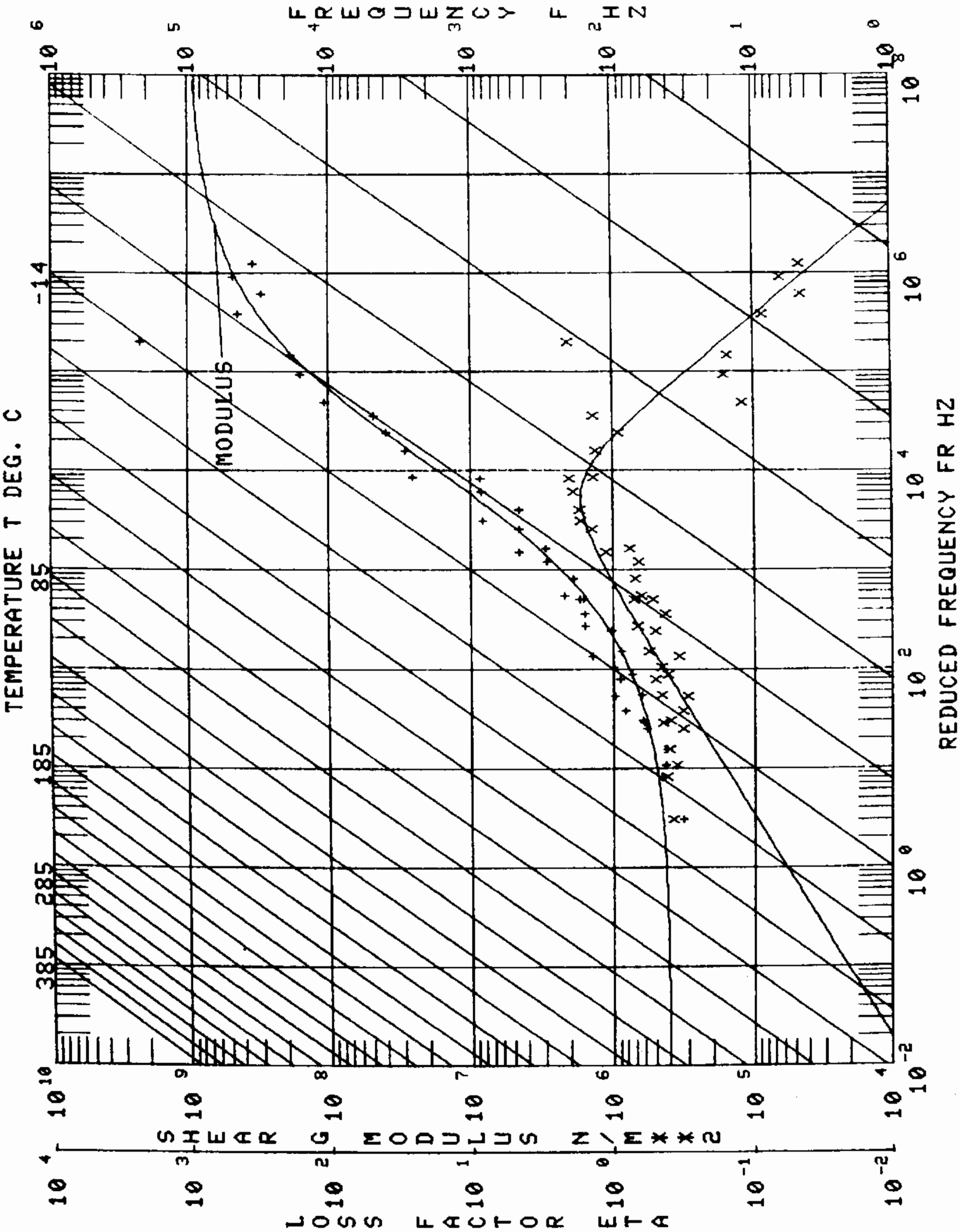
Test No. 78-2
Beam No. Not Recorded

Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
73	6	3321.0	3238.1		3359.0	76.00	0.0229	
105	2	260.0	237.7	252.0	269.0	17.00	0.0655	
105	3	697.0	667.1	683.0	712.0	29.00	0.0416	
105	4	1332.0	1309.2	1319.0	1347.0	28.00	0.0210	
105	5	2190.0	2161.0	2175.0	2206.0	31.00	0.0142	
105	6	3268.0	3229.1	3247.0	3291.0	44.00	0.0135	
105	7	4554.0	4514.4	4530.0	4578.0	48.00	0.0105	

Page 3 of 3

EXPERIMENTAL CODE : 23
MATERIAL :ISD 830
DATA SOURCES
MANUFACTURER :NONE
AFML :SANDWICH BLOCK
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	4.47026E+05	.3749	22.8	268.0	2.	6.69935E+10	.0748	239.0	1.67610E+05
2	6.55513E+05	.4710	22.8	1353.0	4.	6.72820E+10	.0333	1314.2	3.08725E+05
3	7.72396E+05	.4255	22.8	2212.0	5.	6.71910E+10	.0222	2171.0	3.28688E+05
4	1.44542E+06	.3574	22.8	3321.0	6.	6.72343E+10	.0229	3238.1	5.16587E+05
5	6.40188E+05	.4095	10.0	280.0	2.	6.74427E+10	.1005	239.8	2.62163E+05
6	9.28755E+05	.5261	10.0	734.0	3.	6.77552E+10	.0848	673.0	4.88644E+05
7	9.10444E+05	.5846	10.0	1376.0	4.	6.77436E+10	.0546	1318.7	5.32220E+05
8	1.07526E+06	.5306	10.0	2241.0	5.	6.76001E+10	.0371	2177.6	5.70528E+05
9	1.65145E+06	.4475	10.0	3357.0	6.	6.81343E+10	.0319	3259.7	7.38947E+05
10	1.77506E+06	.5522	10.0	4640.0	7.	6.75681E+10	.0313	4542.4	9.80223E+05
11	1.03211E+06	.4781	-3.9	301.0	2.	6.79499E+10	.1443	240.7	4.93424E+05
12	1.64539E+06	.6916	-3.9	782.0	3.	6.82595E+10	.1593	675.5	1.13800E+06
13	1.67761E+06	.7353	-3.9	1434.0	4.	6.81552E+10	.1109	1322.7	1.23359E+06
14	1.94983E+06	.7309	-3.9	2311.0	5.	6.79981E+10	.0842	2184.0	1.42517E+06
15	3.01372E+06	.6859	-3.9	3454.0	6.	6.80507E+10	.0813	3257.7	2.06704E+06
16	3.10263E+06	.7876	-3.9	4750.0	7.	6.79017E+10	.0726	4553.6	2.44353E+06
17	2.26988E+06	.6598	-20.0	351.0	2.	6.85157E+10	.2219	241.7	1.49763E+06
18	4.73637E+06	1.1578	-20.0	959.0	3.	6.87859E+10	.3441	678.1	5.48367E+06
19	8.56034E+06	1.7516	-33.9	478.0	2.	6.89131E+10	.1807	242.4	1.49940E+07
20	2.65435E+07	1.4288	-33.9	1329.0	3.	6.92127E+10	.1726	680.2	3.79265E+07
21	3.02145E+07	1.3550	-33.9	2423.0	4.	6.90132E+10	.2511	1331.0	4.09395E+07
22	1.09858E+08	.1236	-48.3	1436.0	3.	7.57077E+10	.0125	711.4	1.35743E+07
23	1.62334E+08	.1694	-48.3	2718.0	4.	7.24459E+10	.0206	1363.7	2.75069E+07
24	2.31960E+09	2.1221	-59.4	1457.0	3.	6.98450E+10	.0021	683.3	4.92246E+09
25	4.47799E+08	.0872	-59.4	2779.0	4.	6.96056E+10	.0043	1336.7	3.90502E+07
26	3.03900E+08	.0459	-59.4	4431.0	5.	6.92743E+10	.0050	2204.4	1.39476E+07
27	4.81044E+08	.0648	-59.4	6621.0	6.	6.91034E+10	.0066	3282.8	3.11550E+07
28	3.53286E+08	.0467	-59.4	8860.0	7.	6.88894E+10	.0079	4586.6	1.65019E+07
29	3.38195E+05	.3939	40.6	260.0	2.	6.62667E+10	.0655	237.7	1.33200E+05
30	4.71323E+05	.4334	40.6	697.0	3.	6.65724E+10	.0416	667.1	2.04249E+05
31	4.38828E+05	.4240	40.6	1332.0	4.	6.67710E+10	.0210	1309.2	1.86056E+05
32	6.10106E+05	.3357	40.6	2190.0	5.	6.65734E+10	.0142	2161.0	2.04789E+05
33	8.55319E+05	.3394	40.6	3268.0	6.	6.68611E+10	.0135	3229.1	2.90304E+05
34	1.00162E+06	.3117	40.6	4554.0	7.	6.67377E+10	.0105	4514.4	3.12166E+05
35	6.37194E+05	.4621	22.8	712.0	3.	6.72728E+10	.0563	670.6	2.94434E+05
36	1.88390E+08	.1589	-48.3	4294.0	5.	6.90608E+10	.0245	2201.0	2.99264E+07
37	4.68508E+06	1.7810	-20.0	2556.0	5.	6.84347E+10	.3561	2191.0	8.34424E+06
38	8.60761E+06	1.9807	-20.0	3972.0	6.	6.84021E+10	.4242	3266.1	1.70492E+07
39	8.85298E+06	2.0740	-20.0	5296.0	7.	6.82631E+10	.3857	4565.7	1.83615E+07
40	4.02658E+07	.9506	-33.9	3718.0	5.	6.87599E+10	.2480	2196.2	3.82758E+07
41	4.99235E+07	1.4125	-33.9	5596.0	6.	6.86746E+10	.3137	3272.6	7.05190E+07
42	4.74863E+06	1.4480	-20.0	1667.0	4.	6.86404E+10	.3680	1327.4	6.87595E+06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285
385
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REDUCED FREQUENCY FR HZ
SHEAR G MODULUS N/M**2
LOSS FACTOR ETA
MODULUS

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 η_D:

Peak	100 Hz	η_D 1.7	Temperature	-20.6 °C
	1000 Hz	η_D 1.7	Temperature	-1.1 °C
Range	100 Hz	-37.2 °C	-6.7 °C	
	1000 Hz	-17.8 °C	15.6 °C	

```
LOG(M)=LOG(ML)+(2LOG(MROM/ML))/(1+(FROM/FR)**N)
  T0          FROM          MROM          N          ML
               A1            A2           A3         A4
   10.0   9.1000E+03   3.2000E+07     .320   4.4000E+05
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
   10.0    1.700      .560    -.510    2.8000E+03    1.050
LOG(FR)=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.

Beam No. 080E, 080G

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
-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	672.90	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	
49	2	455.90	326.10	381.40	566.40	185.00	0.4058	
49	3	1170.40	910.03	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

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Beam No. 080E, 080G

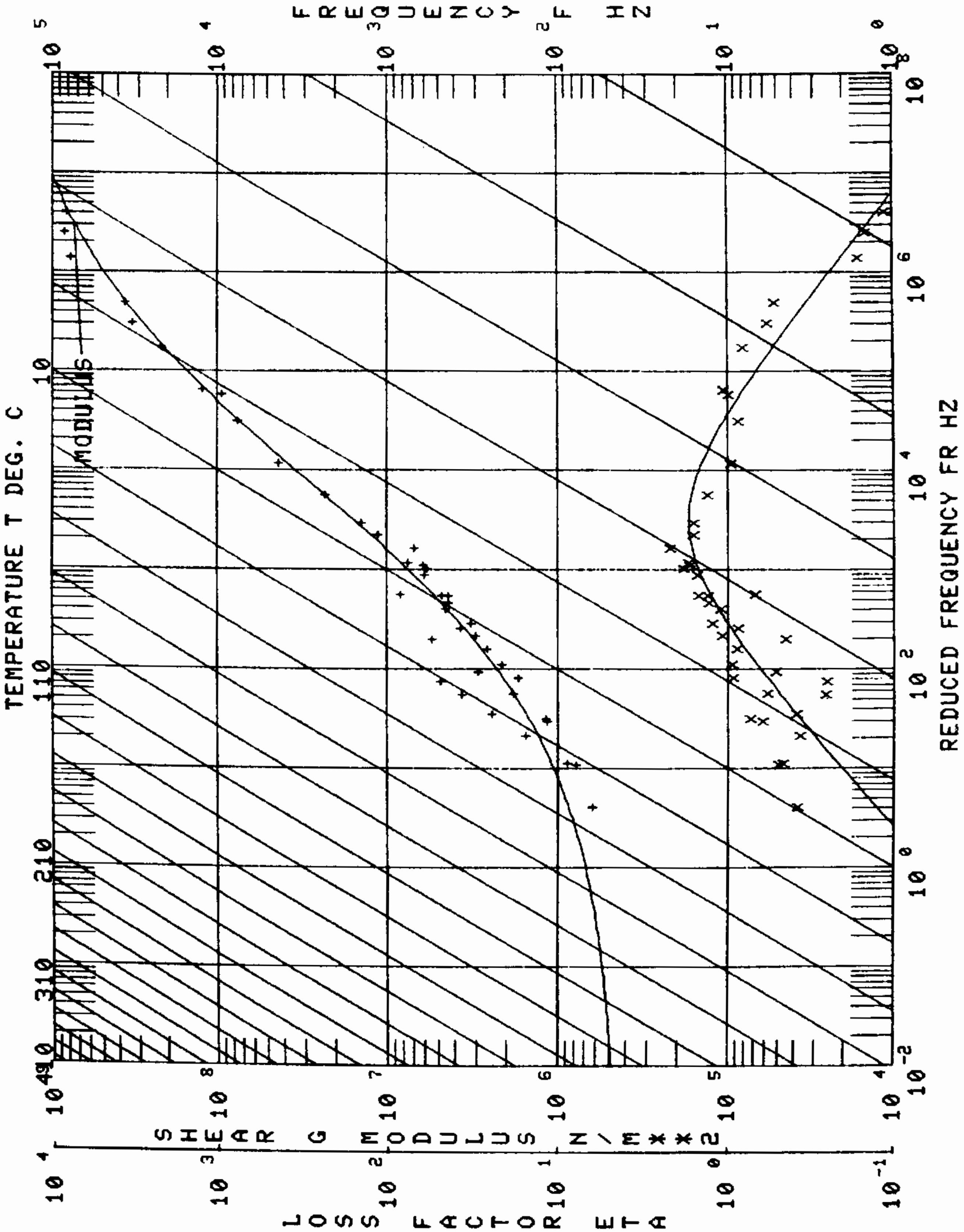
Temp. °F	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
62	5	3154.30	2929.95	2876.70	3365.90	961.80	0.3049	X
74	2	387.60	324.78	343.70	442.60	98.90	0.2552	
74	3	1003.80	906.95	885.00	1121.30	236.30	0.2354	
74	4	1897.50	1771.21	1799.50	1987.50	369.60	0.1948	X
74	5	3092.60	2923.95	2718.80	3320.80	602.00	0.1946	
100	2	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	6021.33	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	

Beam No. 080E, 080G

°F Temp.	Mode	f_c	f_n	f_L	f_R	Δf	η_s	1dB
149	5	2918.30	2885.98	2885.80	2953.50	67.70	0.0232	
148	6	4347.10	4296.28	4310.50	4379.20	68.70	0.0158	
148	7	6058.10	5996.32	6020.90	6110.50	89.60	0.0148	

EXPERIMENTAL CODE :135
MATERIAL :BUTYL 268
DATA SOURCES
MANUFACTURER :ENJAY BUTYL
AFML :UDRI SANDWICH BEAM
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	6.49055E+05	.3893	65.0	336.7	2.	6.78977E+10	.0475	320.8	2.52653E+05
2	9.02717E+05	.4752	65.0	911.5	3.	6.77154E+10	.0319	897.1	4.28935E+05
3	1.57857E+06	.3768	65.0	1772.7	4.	6.71587E+10	.0230	1750.7	5.94829E+05
4	2.47842E+06	.3963	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	4296.3	9.96187E+05
6	4.98001E+06	.2597	64.4	6058.1	7.	6.62313E+10	.0148	5996.3	1.29310E+06
7	8.03875E+05	.5104	51.1	342.9	2.	6.84619E+10	.0732	322.1	4.10270E+05
8	1.18802E+06	.6281	51.1	924.2	3.	6.81827E+10	.0534	900.2	7.46156E+05
9	1.88545E+06	.5896	51.1	1790.3	4.	6.77162E+10	.0419	1757.9	1.11173E+06
10	3.02293E+06	.5238	51.1	2948.6	5.	6.73445E+10	.0364	2898.0	1.58330E+06
11	1.01488E+07	.0665	50.6	4572.8	6.	6.71324E+10	.0092	4314.2	6.75038E+05
12	5.58509E+06	.4556	50.6	6103.2	7.	6.67843E+10	.0286	6021.3	2.54454E+06
13	1.20819E+06	.7517	37.8	356.9	2.	6.90241E+10	.1434	323.5	9.08188E+05
14	1.73617E+06	.9552	37.8	946.1	3.	6.86501E+10	.1109	903.2	1.65839E+06
15	2.66964E+06	.9020	37.8	1824.0	4.	6.82294E+10	.0861	1764.6	2.40792E+06
16	3.78995E+06	.8855	37.8	2989.2	5.	6.79962E+10	.0744	2912.0	3.35595E+06
17	4.64444E+06	1.1193	37.2	4414.5	6.	6.76909E+10	.0794	4332.1	5.19832E+06
18	8.53320E+06	.7035	37.2	6229.0	7.	6.73444E+10	.0637	6046.5	6.00325E+06
19	3.30014E+06	1.2767	23.3	1003.8	3.	6.92152E+10	.2354	906.9	4.21318E+06
20	4.52543E+06	1.3527	23.3	1897.5	4.	6.87447E+10	.1948	1771.2	6.12175E+06
21	6.19889E+06	1.5622	23.3	3092.6	5.	6.85573E+10	.1946	2924.0	9.68391E+06
22	4.54971E+06	1.3309	9.4	455.9	2.	7.01554E+10	.4058	326.1	6.05540E+06
23	7.72821E+06	1.7620	9.4	1170.4	3.	6.96861E+10	.4603	910.0	1.36174E+07
24	1.16313E+07	1.6410	-3.9	586.3	2.	7.07288E+10	.3534	327.4	1.90866E+07
25	2.36110E+07	1.3600	-3.9	1483.0	3.	7.02539E+10	.3808	913.7	3.21114E+07
26	3.10466E+06	1.1050	16.7	414.4	2.	6.99662E+10	.3287	325.7	3.43058E+06
27	4.88618E+06	1.5348	16.7	1063.9	3.	6.94979E+10	.3489	908.8	7.49911E+06
28	6.00999E+06	1.8594	16.7	1966.9	4.	6.90267E+10	.3197	1774.8	1.11750E+07
29	7.12742E+06	2.2492	16.7	3154.3	5.	6.88390E+10	.3049	2930.0	1.60311E+07
30	6.30353E+06	1.7123	1.7	511.1	2.	7.05345E+10	.4510	327.0	1.07932E+07
31	1.45232E+07	1.6380	1.7	1350.1	3.	6.99697E+10	.4570	911.9	2.37887E+07
32	4.42215E+07	.9901	-17.8	672.9	2.	7.12048E+10	.1373	328.5	4.37820E+07
33	7.78744E+07	.8810	-17.8	1770.5	3.	7.07299E+10	.1822	916.8	6.86080E+07
34	9.73435E+07	1.0108	-17.8	3267.7	4.	7.01600E+10	.2485	1789.4	9.83943E+07
35	1.27056E+08	1.0811	-31.1	718.4	2.	7.17782E+10	.0566	329.8	1.37356E+08
36	2.26460E+08	.8253	-31.1	1947.9	3.	7.11100E+10	.0802	919.3	1.86902E+08
37	3.35533E+08	.5892	-30.6	3690.5	4.	7.06313E+10	.0855	1795.4	1.97689E+08
38	3.75406E+08	.5339	-30.6	5856.8	5.	7.05396E+10	.1060	2965.9	2.00415E+08
39	2.58671E+08	8.7214	-46.7	742.4	2.	7.23538E+10	.0069	331.2	2.25598E+09
40	7.99929E+08	.1661	-46.1	2017.5	3.	7.16851E+10	.0082	923.0	1.32860E+08
41	8.79298E+08	.1508	-45.6	3864.7	4.	7.11113E+10	.0125	1801.4	1.32582E+08
42	8.48503E+08	.1146	-45.6	6202.7	5.	7.10156E+10	.0150	2975.9	9.71962E+07
43	2.19610E+06	.9627	23.3	387.6	2.	6.95886E+10	.2552	324.8	2.11420E+06



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