GenieClip™

Technical Note #2

Importance of Rubber Properties in Performance of the Resilient Clip Technology

Rubber is a superior vibration isolator. In almost every significant application, rubber is chosen to isolate vibrations because of its compression ratio, dynamic and static properties. The dynamic properties of the rubber element of a vibration isolator are affected by its compression ratio, and thus the dynamic characteristics of a vibration isolator depend on the static load.

Stiffness

The stiffness measures the " spring rate" of the rubber. Higher spring rate means a stiffer material and lower overall performance.

Static Stiffness

Under a static or constant load, the stiffness is measured.

<u>Result</u>

KINETICS 16.74 N/MM
PAC 15.85 N/MM
PLITEQ 9.53 N/MM

Dynmatic Stiffness

Tested under a variable load due to the effect of vibration. It is a forced frequency test for resonance at specific frequencies. Natural rubber has the lowest dynamic stiffness of common material.

<u>Result</u>
KINETICS 21.6 N/MM
PAC 21.2 N/MM
PLITEQ 11.3 N/MM

Dynamic / Static Stiffness Ratio

The ratio is a measure of the resiliency of the material. For example, for completely resilient material, the ratio is 1.In order to achieve isolation at lower frequencies, it is important that this ratio be as low as possible.
Therefore, ratio closer to 1 means better vibration isolation performance. Most acousticians will specify isolators that have a maximum dynamic to static ratio of 1.4.

<u>Result</u>
KINETICS 1.29
PAC 1.34
PLITEQ 1.19

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Force / Deflection Curve

If the isolator is more resilient, typically the acoustical performance will be better. A measure of force versus deflection gives a direct link to resilience at a static loading.

Result

KINTETICS 19.79 N/MM
PAC 23.88 N/MM
PLITEQ 8.95 N/MM

Durometer of Rubber

Durometer is a term for hardness as indicated by the Shore A durometer number. The normal range for isolation materials is 40 to 60+ / -5 as limited by dynamic stiffness. Steel springs for example have a ratio of 1. Dynamic stiffness increases with hardness and in broad terms, the filler ratio of the materials to the rubber content as well as the carbon black reinforcement, plasticizers etc.

Results

KINETICS 56
PAC 57
PLITEQ 37

Conclusion

Based on these results, the rubber stiffness of the Pliteq GenieClip is about 2 times better than the other two materials. Since the dynamic stiffness and dynamic to static ratio control the performance of the clp, especially at low frequencies, it is clear that the performance of the GenieClip will be superior to the other two products.

July 31, 2008

▪ TEST REPORT ▪

PN 80164

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July 31, 2008

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Subject: Dynamic Stiffness, Static Stiffness, Resonant Frequency, Force vs. Deflection and Hardness.

Received: Three (3) samples identified as Kinetics Iso Max (Sample 1), Pac International RS-1 (Sample 2), and Genie Clip Pliteq (Sample 3).

Dynamic Characterization (Dynamic Stiffness, Static Stiffness, Resonant Frequency)**:**

Test Parameters:

Specimen:	6.0 mm Diameter x 6.6 mm thk.
Mean Level:	7.5% strain (Compression)
Amplitude:	5.0% strain (p-p)
Frequency:	1-40 Hz, 1 Hz increments
Equipment:	MTS 831.20 Elastomer Test System
Test Fixture:	Compression Platens
Temperature:	23°C

Procedure: Each specimen was stabilized at test temperature for at least 24 hours prior to being tested on the MTS machine. Before starting the test, a frequency sweep was conducted to narrow down the resonant frequency search of the material from 1-200Hz at 5 Hz increments. Once the Resonant Frequency was located the actual test was conducted at that specified frequency range at 1Hz increments.

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Test Results:

Dynamic Stiffness:

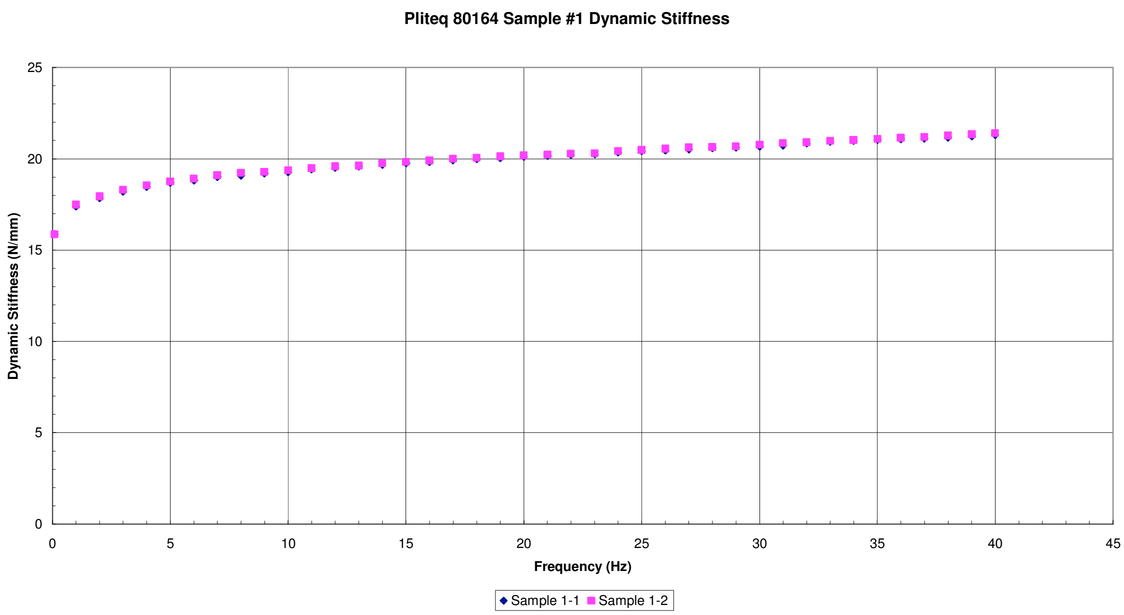

Figure 1: Dynamic Stiffness Sample 1

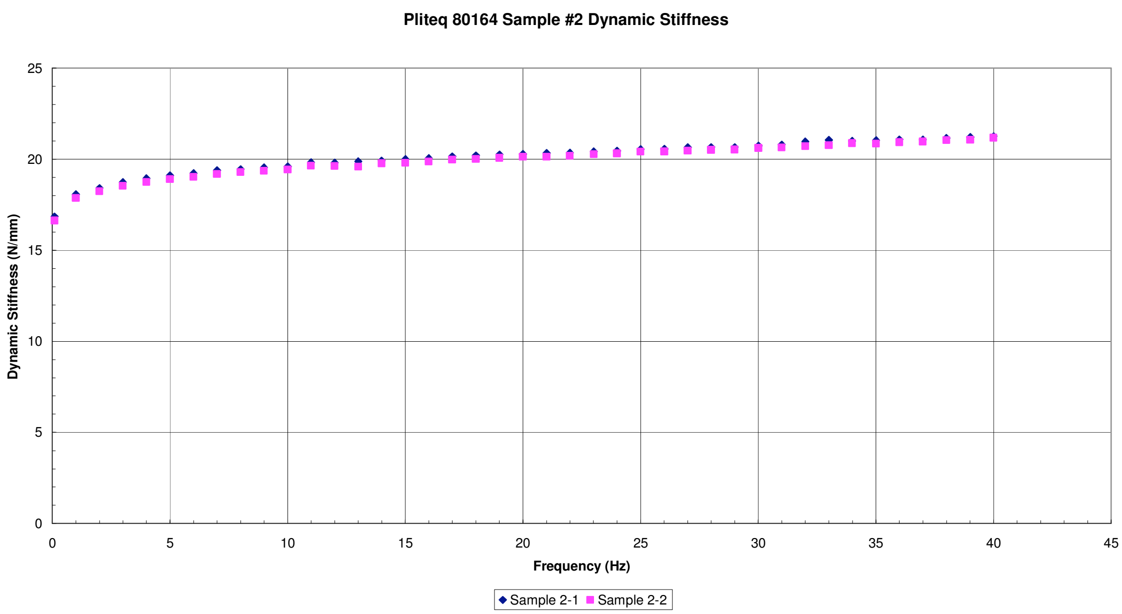

Figure 2: Dynamic Stiffness Sample 2

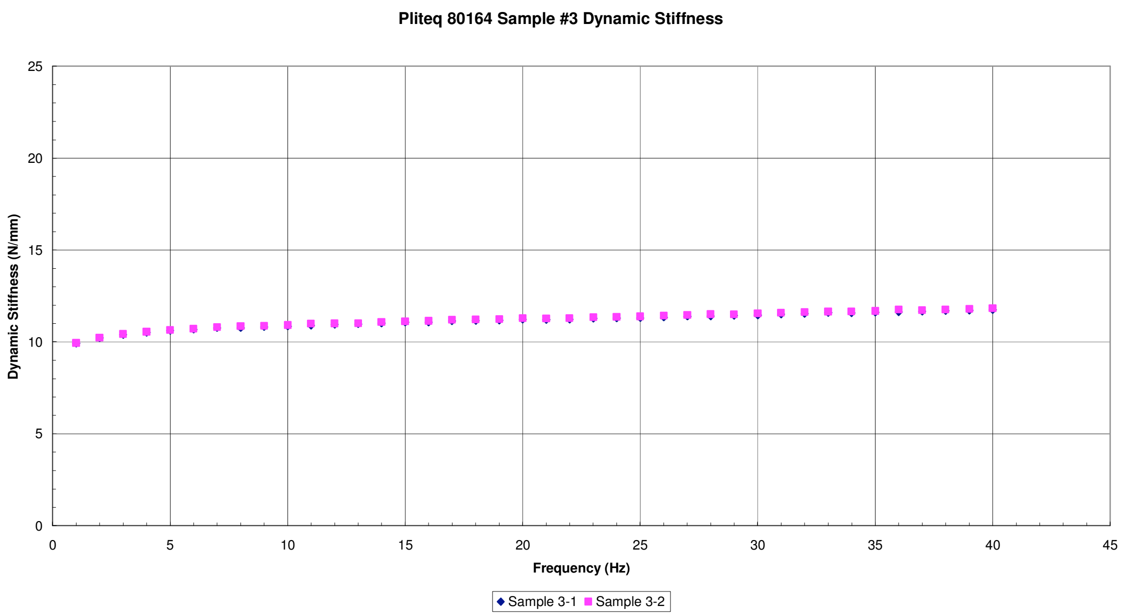

Figure 3: Dynamic Stiffness Sample 3

Static Stiffness:

Sample	Static Stiffness (N/mm) @ 0.1Hz
Sample 1	*16.74
Sample 2	*15.85
Sample 3	*9.53

* Average from two specimens

Resonant Frequency:

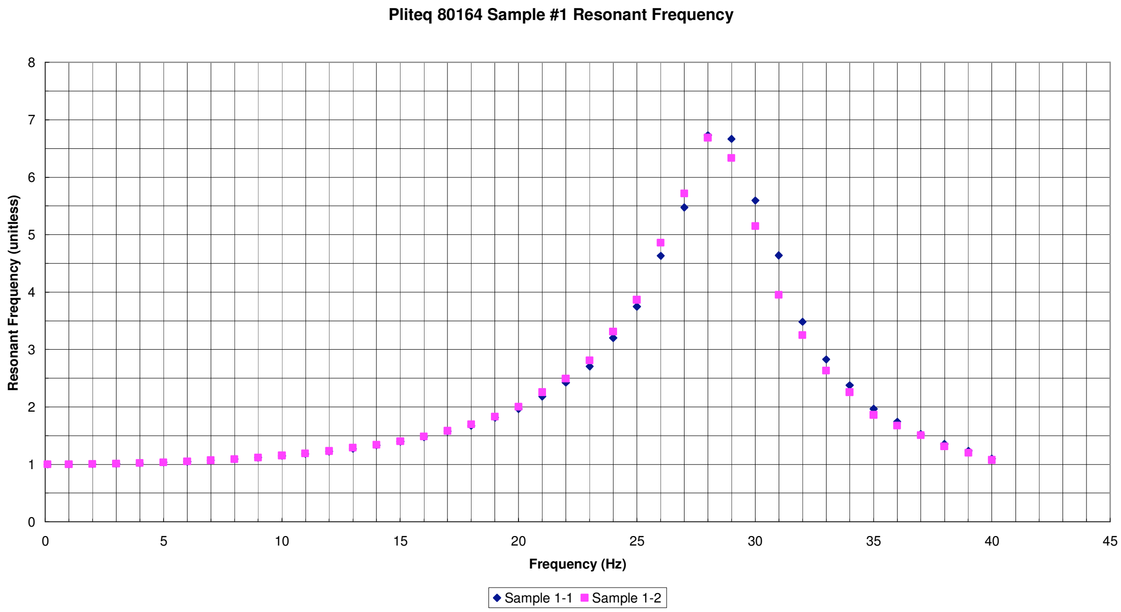

Figure 4: Resonant Frequency Sample 1

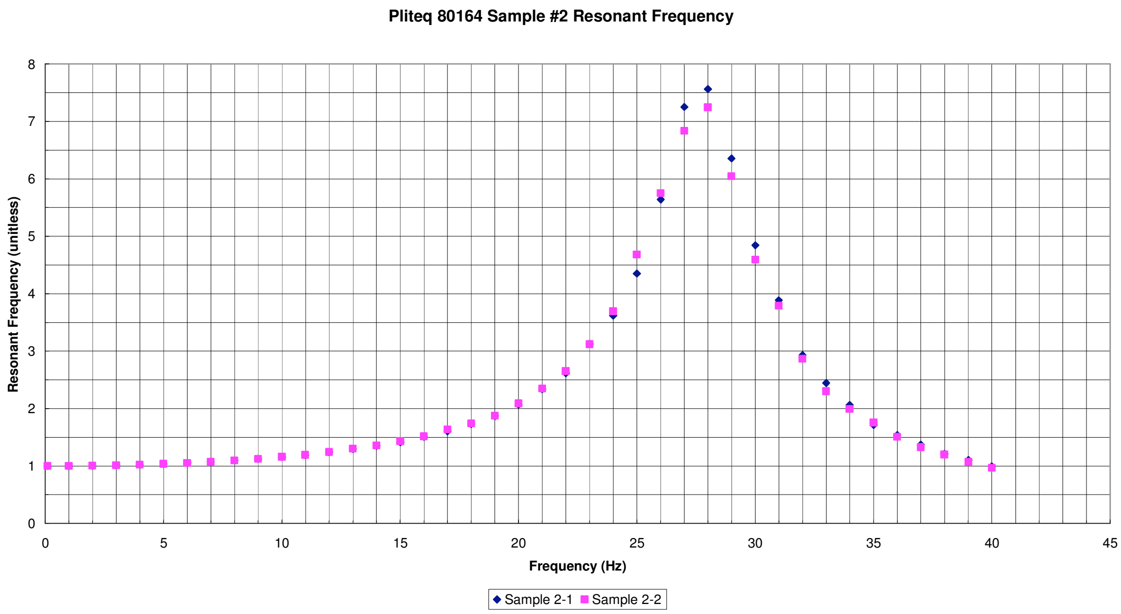

Figure 5: Resonant Frequency Sample 2

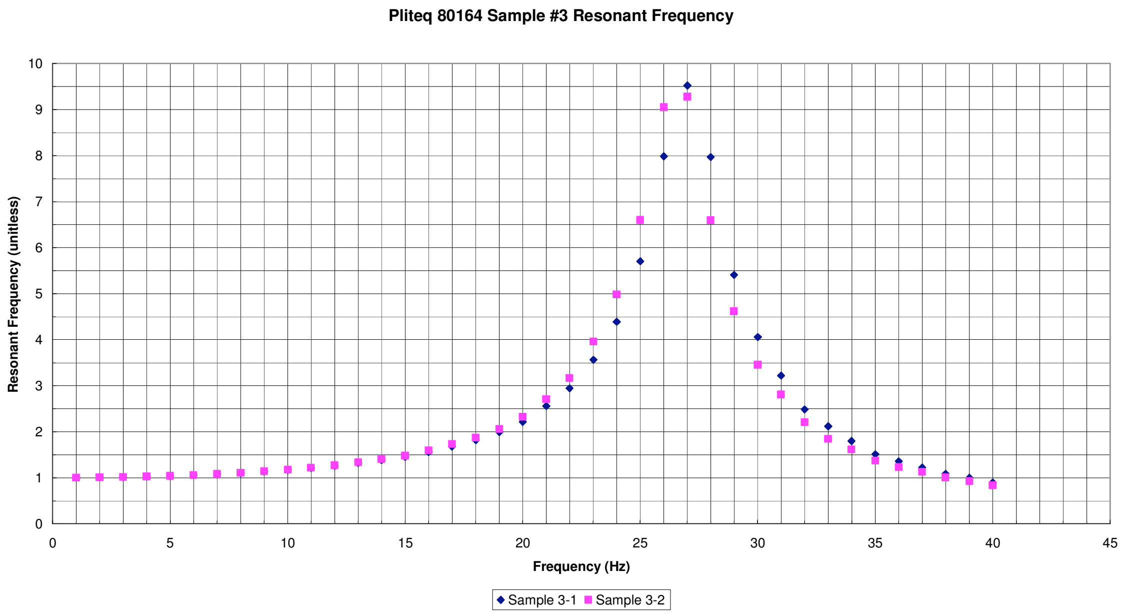

Figure 6: Resonant Frequency Sample 3

Sample	Resonant Frequency (Hz)
Sample 1	*28
Sample 2	*28
Sample 3	*27

* Average from two specimens

Force vs. Deflection:

Test Parameters:

Specimen:	6.0 mm Diameter x 6.6 mm thk.
Rate:	0.2 in/min
Equipment:	MTS 831.20 Elastomer Test System
Test Fixture:	Compression Platens
Temperature:	23℃

Procedure: Each specimen was stabilized at test temperature for at least 24 hours prior to being tested on the MTS machine. Each specimen was loaded at the rate indicated above and both the load and displacement were recorded.

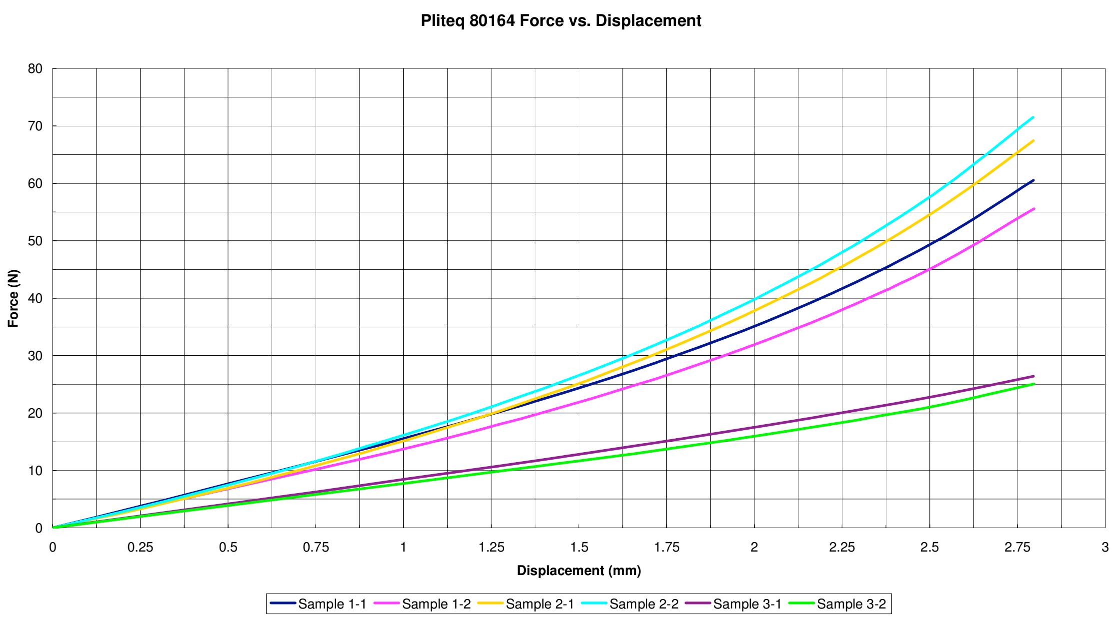

Figure 7: Force vs. Displacement

Sample	**Slope (N/mm)**
Sample 1	*19.79
Sample 2	*23.88
Sample 3	*8.95

* Average from two specimens

<u>Hardness:</u>
ASTM D2240 Shore A

Sample	Shore A
Sample 1	*56
Sample 2	*57
Sample 3	*37

* Mean of five measurements

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