Important Notice

In August 1, 2013, PABCO® Gypsum, a division of PABCO® building products, LLC acquired the QuietRock® business and operations from Serious Energy, Inc. Serious Energy, Inc. corporate structure and legal name changed through the years from Quiet Solution, Inc. to Serious Materials, Inc to Serious Energy, Inc. The acquisition of the QuietRock® business by PABCO® Gypsum includes the products, technical data, test reports and other intellectual property. For the avoidance of confusion, references to “Quiet Solution”, “Serious Materials”, or “Serious Energy” used within test reports, in general, should be understood as references to PABCO® Gypsum as of August 1, 2013.
INTRODUCTION

Quiet Solution provided CTC with a pair of brass cymbals for testing their NoiseKiller™ product. The purpose of the test was to determine the effectiveness of the coating over a range of temperatures. A set of brass cymbals was chosen as the test object to demonstrate the product. An untreated cymbal was compared to one that had the Quiet Solution treatment applied to the bottom surface. Impact vibration response analysis was used as the basis for the evaluation. A baseline test of the standard cymbal was conducted at ambient followed by identical tests between –50°F and +150°F on the treated cymbal.

CONCLUSION

The Quiet Solution NoiseKiller™ product provided very effective damping from -50°F to +150°F. The mean vibration levels were reduced by 15 db to 30 db over the test temperature range.

RESULTS

Vibration damping was evaluated by measuring acceleration levels of the cymbal at the same location for treated and untreated cases. Baseline untreated response was taken for one brass cymbal at 65°F. This was used as a comparison point for the treated cymbal at various temperatures. The treated cymbal response spectra were compared to give a relative evaluation of the overall efficiency of the material in providing damping over a wide temperature range. The average or mean value of each spectra from 10 Hz to 10 KHz was used as the overall basis of comparison. The treated cymbal provided damping over the entire range. The impact response window results are presented in acceleration units of db g per lb force. This normalizes impact force that was measured for each strike of the cymbal.

The mean value results as a function of temperature are plotted with a reference line for the room temperature response of an un-damped untreated cymbal in Figure 2. For the purposes of this test the untreated cymbal was not tested at all temperatures since it has relatively small
inherent damping. Figure 3 shows the db difference measured between the treated and the baseline untreated case as a function of temperature. Figure 4 shows a time history comparison plot of treated and untreated g response levels.

Figure 2 – Mean Vibration Response of Cymbal Treated with NoiseKiller™ versus Untreated Cymbal at Ambient 65°F.
Quiet Solution Cymbal Vibration Damping Comparison
Untreated at 65 F versus Treated -50 F to +150 F

Reduction in Level Compared to Baseline
Untreated Response at +65 F

Maximum Performance at 110 F

*Treated Values taken from mean response from 10 Hz to 10 KHz
Untreated Response Value taken at +65 F

Figure 3 – Mean Vibration Amplitude Reduction Between Untreated and Treated Cymbals
Figure 4 – Example Time History of Cymbal Treated with NoiseKiller™ versus Un-Treated Cymbal
DISCUSSION

Testing was conducted at CTC’s Mechanical Test Lab in Santa Clara California.

The test procedure was as follows:

1) A very small *Endevco* 2250-A accelerometer with response to 10 Khz was attached to the top surface of the cymbal approximately ½ way between the center and the outside.

2) A type K thermocouple was installed near the center hole of the cymbal to monitor temperature. Each run was conducted when the cymbal was stabilized at the correct temperature.

3) The cymbal exposed to temperature was installed on a short stand in an environmental chamber that was programmed to achieve the correct test temperatures.

4) A 2 channel *Data Physics* spectrum analyzer connected to a PC laptop acquired data between 10 Hz and 10 KHz. (actual sample rate higher to achieve FFT bandwidth).

5) The analyzer was programmed for force response window. A modal impact hammer with a piezoelectric PCB force sensor was connected to the first channel of the spectrum analyzer, the response accelerometer to the second.

6) An impact response FFT window was chosen to evaluate the response of the cymbal to impact. This window normalizes the response in terms of g per lb impact force for ease of comparison since each strike from the modal hammer does not have the same impact force. The analyzer was triggered off the impact hammer and acquired spectral averages for each impact. For each run 10 impacts were averaged together. Incorrect looking or double hit impacts were rejected and not included in the averaged window.

7) The spectral data was plotted in the g/lb versus frequency format. Time history and spectral output data was exported in ASCII format to MS Excel files for further plotting and calculation.

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APPENDIX A

SPECTRAL DATA PLOTS

General Plot Notes:

Y axis units – Magnitude values for g per lbf are plotted on a db scale referenced to zero db = 1 g per lbf. The g response values were normalized for impact force since 10 impact spectra were averaged together.

db units - $db = 20 \log \left( \frac{x}{x_{ref}} \right)$ In this case $x = g/lbf$ measured and $x_{ref} = 1 g/lbf$, This is the calculation typically used for sound or vibration levels.

Note that electrical db measurement related to power are calculated $db = 10 \log \left( \frac{x}{x_{ref}} \right)$.

The mean value of the db reading is shown for each plot and is used as the relative basis of comparing vibration levels for this test.
Untreated Cymbal Response @ +65 F

Mean: 91.5095
Quiet Solution Treated Cymbal, Response @- 50 F

Mean: 71.7617
Quiet Solution Treated Cymbal, Response @ -30 F

Mean: 73.4613
Quiet Solution Treated Cymbal, Response @- 10 F

Mean: 70.1858
Quiet Solution Treated Cymbal, Response @ +10F

Mean: 71.2201

Hz

dBMag. g / lbf
Quiet Solution Treated Cymbal, Response @ +30 F

Mean: 76.522
Quiet Solution Treated Cymbal, Response @ +50 F

Mean: 67.355
Quiet Solution Treated Cymbal, Response @ +70 F

Mean: 67.1472
Quiet Solution Treated Cymbal, Response @ +90 F

Mean: 65.2494
Quiet Solution Treated Cymbal, Response @ +110 F

Mean: 62.4465
Quiet Solution Treated Cymbal, Response @ +130°F

Mean: 65.4805
Quiet Solution Treated Cymbal, Response @ +150°F

Mean: 72.3188