



QUALITY TESTING SOLUTIONS *T.O.P Industries Inc.*

VIBRATION EFFECTS WHILE STACKING BOXES DURING TRUCK AND AIR PROFILES

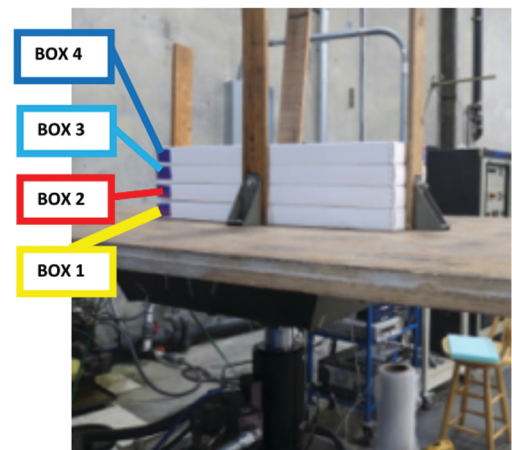
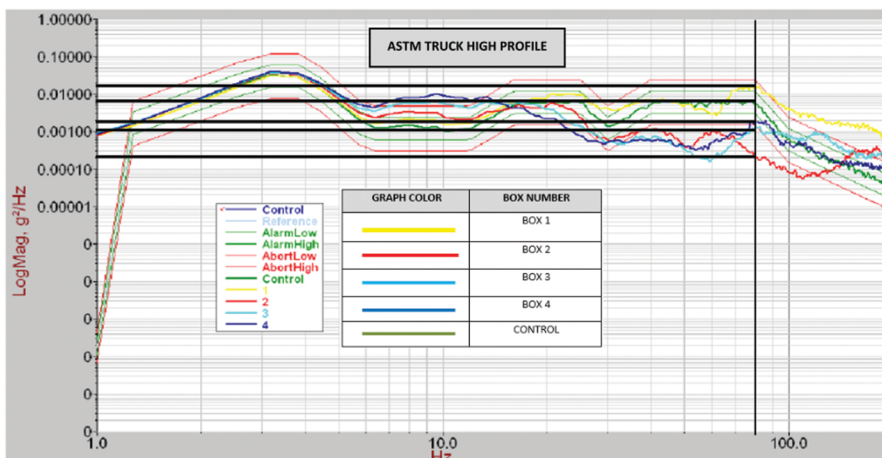
Random Vibration is used to assess the performance of a container which incorporates interior packaging and determines the overall packaging design's ability to protect the product and maintain its sterility. Various test methods (ASTM D4169 method D4728 and ISTA Vibration) are used to demonstrate the vibration effects on the packaging and the product.

ASTM D4169 truck profiles use 3 density levels for vibration to assure your packaging meets the safety criteria to maintain the products sterility. Each profile and time are carefully selected by the ASTM test method to simulate real world occurrences. High Density at .70 grms for 5 minutes, Medium Density at .54 grms for 15 minutes, and Low Density at .40 for 40 minutes.

Test-O-Pac has faced some scenarios where customers running a group of 60 Shippers during vibration are stacking the shippers on top of each other. This led us to conduct a white paper study that will share the effect of vibration when shippers are stacked on top of each other. Stacking will mitigate failure, and inhibit the 95% confidence level.

During this study, the High Density Profile at .70 grms was performed on the vibration table and 4 shippers were stacked on top of each other to provide a quick study on the stacking scenerio. The study clearly demonstrates that when packages are stacked on top of each other, only the bottom shipper is experiencing the vibration of .70 grms (yellow plot on Figure 1). Also in Figure 1, you can find Box#2 in Red, Box#3 in Light Blue, Box#4 in Dark Blue and how their values are below the required .70 grms value.

In conclusion, the single packaged products should never be stacked on top of each other during the vibration cycle while conducting packaging validation. This will result in inaccurate test data.



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