

Battery Box Shock Failure Case History

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Introduction

A colleague wrote me that a certain launch vehicle battery box failed its shock test which was performed on a drop table. The purpose was to simulate a stage separation pyrotechnic event. The failure mode was cracking in a plexi-glass type material encasing silver zinc battery cells.

Additional information regarding the box was not disclosed due to sensitive reasons. But I was given the acceleration time history as shown in Figure 1 for review.

The natural frequency of the battery box is unknown, but another battery box for which I have data had a natural frequency of 80 Hz due to the motion of the cells within the foam-lined housing.

The acceleration and pseudo velocity SRS plots are given in Figures 2 and 3, respectively.

The pseudo velocity level is approximately 200 in/sec over most of the frequency domain. So this level appears to be somewhere above the severity threshold for at least some types of battery boxes.

The normal severity threshold for equipment is 100 in/sec, which some references applying a 6 dB margin to reduce the level to 50 in/sec.

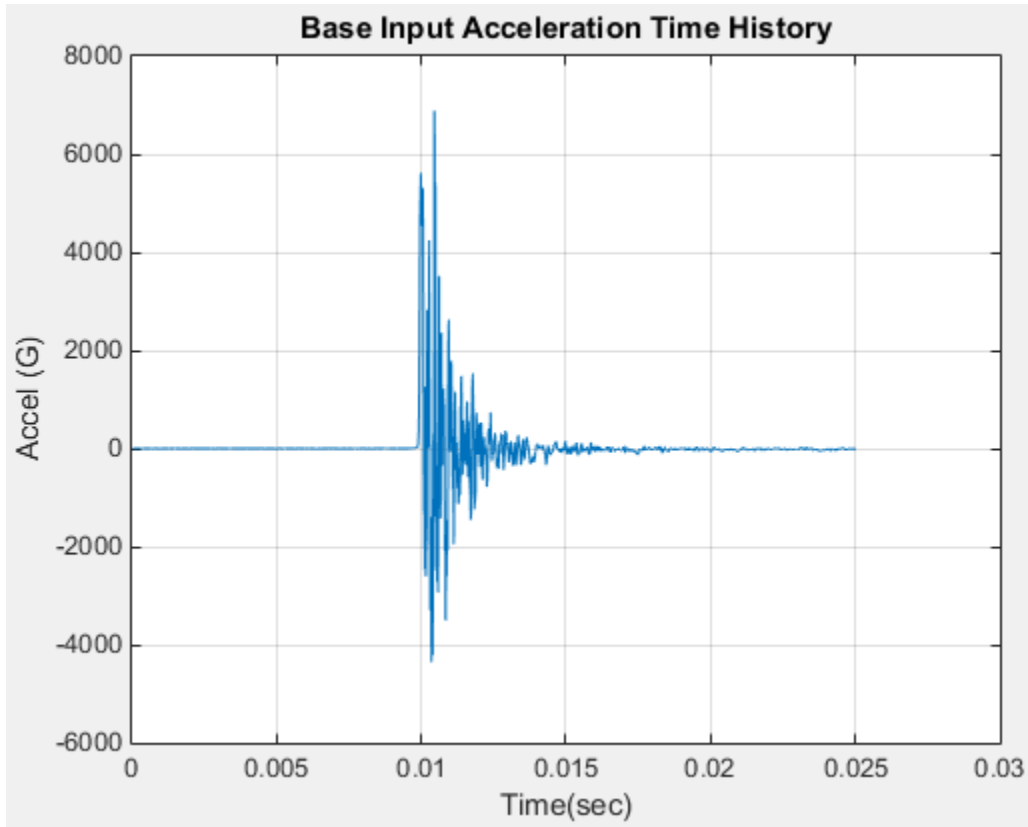


Figure 1.

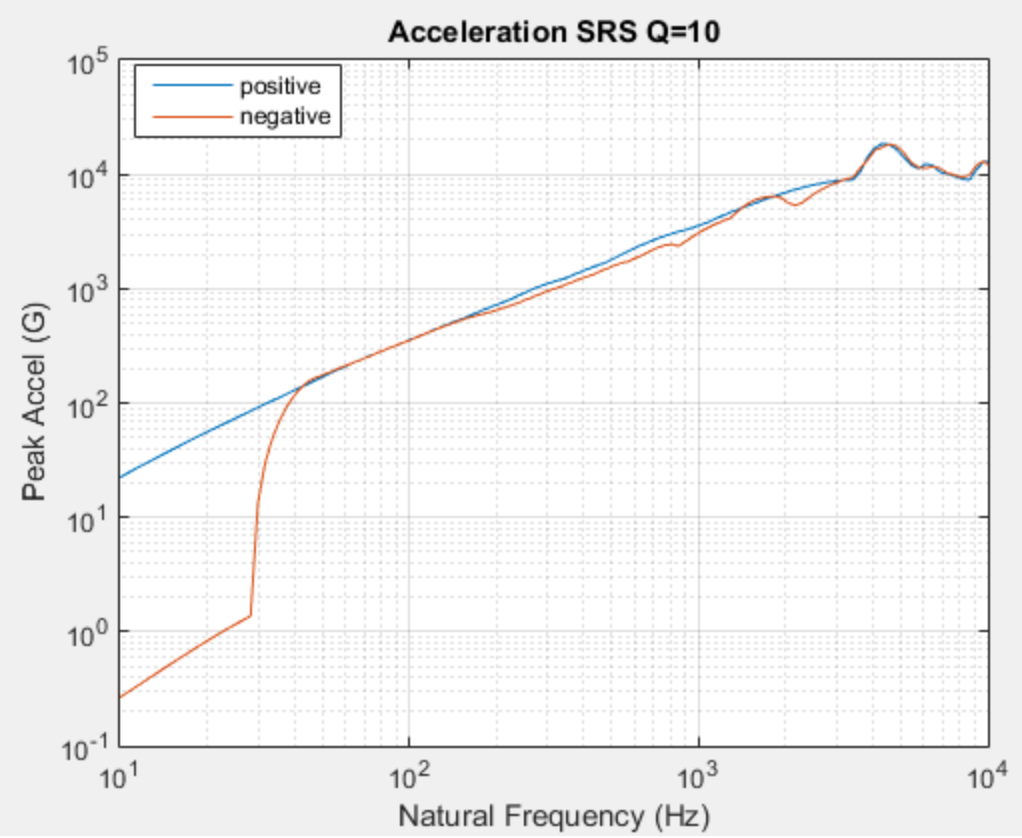


Figure 2.

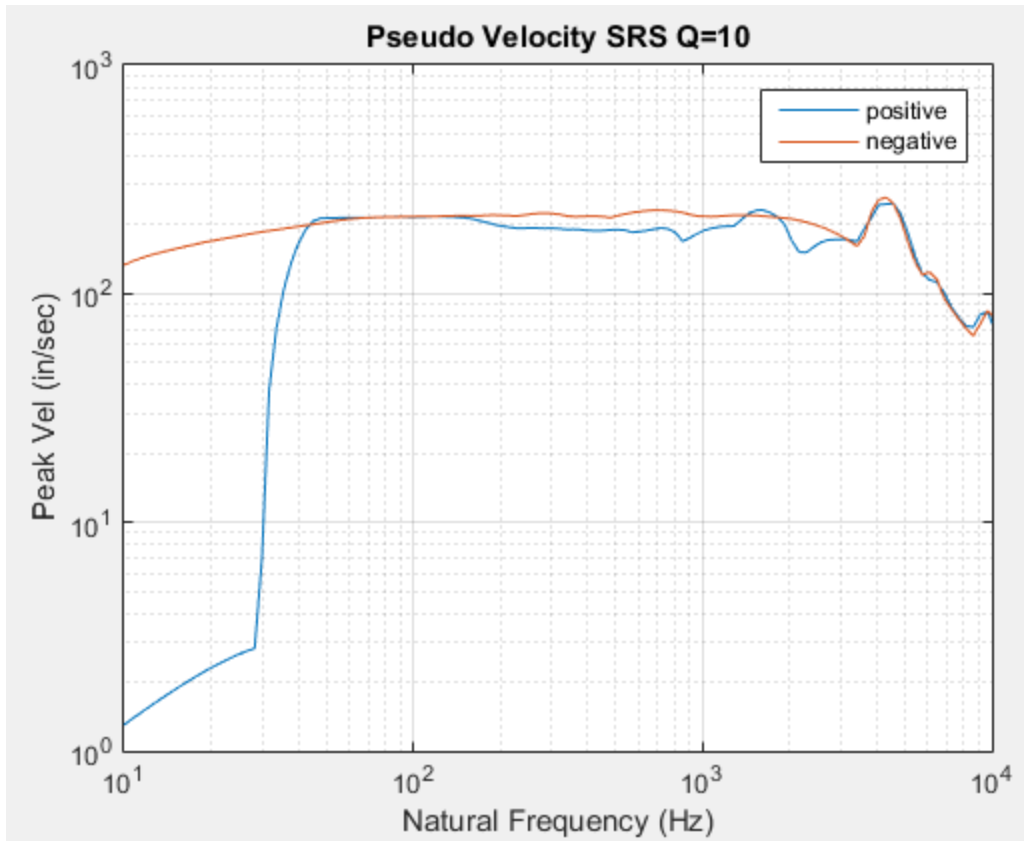


Figure 3.