TYCO Ball Clutch Project Recap

Tyco’s Retail Solution group produces the AMT42, a 5 kGauss tack tag used as an anti-theft device for clothing garments. The tag’s anti-slam function prevents it from failing or releasing when it is slammed against hard surfaces. The AMT42 tag’s anti-slam function is inadequate at high slamming forces. This is a problem because thieves are able to slam the clothing against the floor in order to remove the security tag and steal the clothing.

In order to improve the anti-slam function, the ball clutch mechanism inside the tag needed to be modified. The ball clutch mechanism was redesigned by manipulating the plunger mass, spring stiffness, and energy absorption. Several detailed designs have been developed to show how manipulation of these components affects the anti-slam function. Using both a theoretical and experimental analysis, several prototypes with varying characteristics were created.

These prototypes were tested using a test stand which was developed to mimic the tag being slammed against the floor of a department store. The test procedure utilizes a homemade stand that is composed of a long metal plate secured at one end while holding the prototype at the other end. Input variables of the testing procedure were the deflection and length of the beam while the output is simply if the pin releases or not. The prototypes were tested until failure. The original tag and prototypes were tested 10 times at each deflection. A line plot was used to compare the performance of each prototype and the original product.

All of customer requirements were met using the internal damper prototype. Only one part was added to the inside of the tag which was a small change to the BOM and did not change the size of the tag. The internal damper does not require machining, so there is also minimal change to production and assembly. The internal damper design requires a higher velocity in order to unlock, but it maintains the EAS function and can be removed with the current detacher. The final recommendation to Tyco Retail Solutions is to add a soft internal dampening element to the AMT42 security tag.

Further testing should be done using TYCO’s testing device to determine if adding an internal damper would increase the velocity required to make the tags fail. The current internal damper is a small piece of cotton pad. It is possible that over hundreds of tests, the cotton could jam the tag making it unable to be detached. Further testing on TYCO’s device could help determine if this is a possible problem.