



The Advantages of Motorized Cap Torque Testing

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In today's industrial packaging environments, the need to obtain accurate and repeatable cap torque testing data is greater than ever. While many low cost, easy-to-use manual torque testers are present in the market place; the use of motorized cap torque testers is becoming the industry standard in part to these machines ability to deliver measurable cap testing data by eliminating operator induced variables. These variables include inconsistent acceleration and force application through the use of manual torque tester.

When measuring torque there are two equations to remember which can account for variations that may be seen during testing. The equations are as follows:

$$F = M \times A$$

*Force = Mass multiplied by Acceleration

"Mass" is the amount of friction that is applied by the operator during the course of a normal testing cycle. "Acceleration" is related to the amount of speed that is applied by the operator when performing a removal test on a manual spring tester which has the effect to greatly alter the readings being produced.

$$T = F \times D$$

*Torque = Force multiplied by Distance

In this equation the "distance" is the distance from cap wall to the center point of rotation for the closure or bottle neck. The friction that is created during the movement of the cap as well as the acceleration applied by the operator during testing again can alter torque results being seen on a manual hand tester due to variables such as the ones mentioned above hindering constant, repeatable testing cycles.

Through using a manually operated torque testers, the acceleration is applied to the cap by the operator engaging their hand on the closure or using a hand-held "chuck." The issue that this variable creates during testing is that the operator typically cannot generate the same amount of acceleration each time they test a product. Having several different operators performing the torque tests on a manual device increases the variability of the results that will be seen from operator to operator. For example, if one operator is applying muscle and down force when performing tests and another operator gently but quickly rotates the cap, the results will vary dramatically on the same product due to the inconsistencies seen in performing the testing.

Another variable that can affect torque results is the amount of external pressure that can be applied by an operator which can cause the cap and neck finish of a product to become deformed. Motorized systems eliminate this variable by utilizing a customized gripping device



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manufactured out of stainless steel that conforms to the outside diameter and serration pattern of a closure whether it is for a carbonated beverage or a child resistant pharmaceutical product. This customized gripping tooling will last for many years and will ensure that the product is not being contorted in any manner which could cause inaccurate data fluctuations during testing.

The aim of a motorized cap torque testing system is to eliminate these human induced errors by providing a consistent, accurate and repeatable drive speed that does not create added pressure or unnecessary acceleration on a product during testing. Thus the results being yielded by the motorized system can be measured by the quality team in order to validate and confirm that caps are being applied to a specific torque to prevent leakage during transport and to ensure shelf life.

Depending on the product and testing application, certain motorized testing systems can have testing profiles and parameters created to perform non-destructive testing. Non-destructive testing will drive the closure in the opening direction and will measure the peak removal value of the cap without actually opening the product. Performing a non-destructive torque test will allow for the product to be returned to the production line after testing since the tamper evident band has not been broken or compromised and the product has not been exposed to the environment which can result in contamination.

The test is completed in two steps:

- 1) **Removal:** Testing is conducted in the opening direction up to the point the closure begins to slip on the neck of the bottle. Upon detection of rotational movement by the system, a peak removal torque will be measured and the system will stop rotating in the counter-clockwise direction
- 2) **Application:** The closure is then re-applied to the bottle after the removal torque is measured. The reapplication torque can be set to a specific value depending on the closure and product type.

Utilizing a motorized cap testing system in a production environment which eliminates the human influence during cap testing, will provide accurate and repeatable data that can be measured and evaluated by the production team. Having quantifiable data can help improve package and production quality as well operations and efficiency. Non-destructive torque testing allows for production facilities to save money by reducing the amount of wasted packaging and product over the course of large scale production.

Mesa Laboratories, Inc. manufactures the Torqo line of computerized cap torque testing systems. For further information please visit www.mesalabs.com or contact torqo@mesalabs.com.