

## Sure Torque ST-LAB Automatic torque testers



### Theory of closure release testing without breaking the seal integrity with the release>application test

Twist closures in the PET industry are usually having warranty rings. When releasing the closure, the followings will happen with the rotation increment:

1. First (initial) torque peak is measured at a minor rotation, usually under 10°
2. After passing the first release torque peak the torque starts to drop
3. The seal integrity breaks (product loses carbonation, or air gets into the aseptic product). Seal integrity breaks when:
  - a. The release rotation angle exceeds a certain value (closure specific, provided by the closure manufacturer). This values is usually 60-90° at normal 1 start closures, and 45-60° at 2 and 3-start closures. This value is provided by the closure manufacturer.
  - b. The torque decreases under the "secure seal torque" value, which is a closure specific constant value, related to the release angle, and provided by the closure manufacturer.
4. Warranty ring bridges start to break
5. Maximum of the warranty ring bridge breaking torque
6. Last warranty ring bridge breaks
7. The closure is removable

The following figure shows the most important parts of a release torque – angle graph:

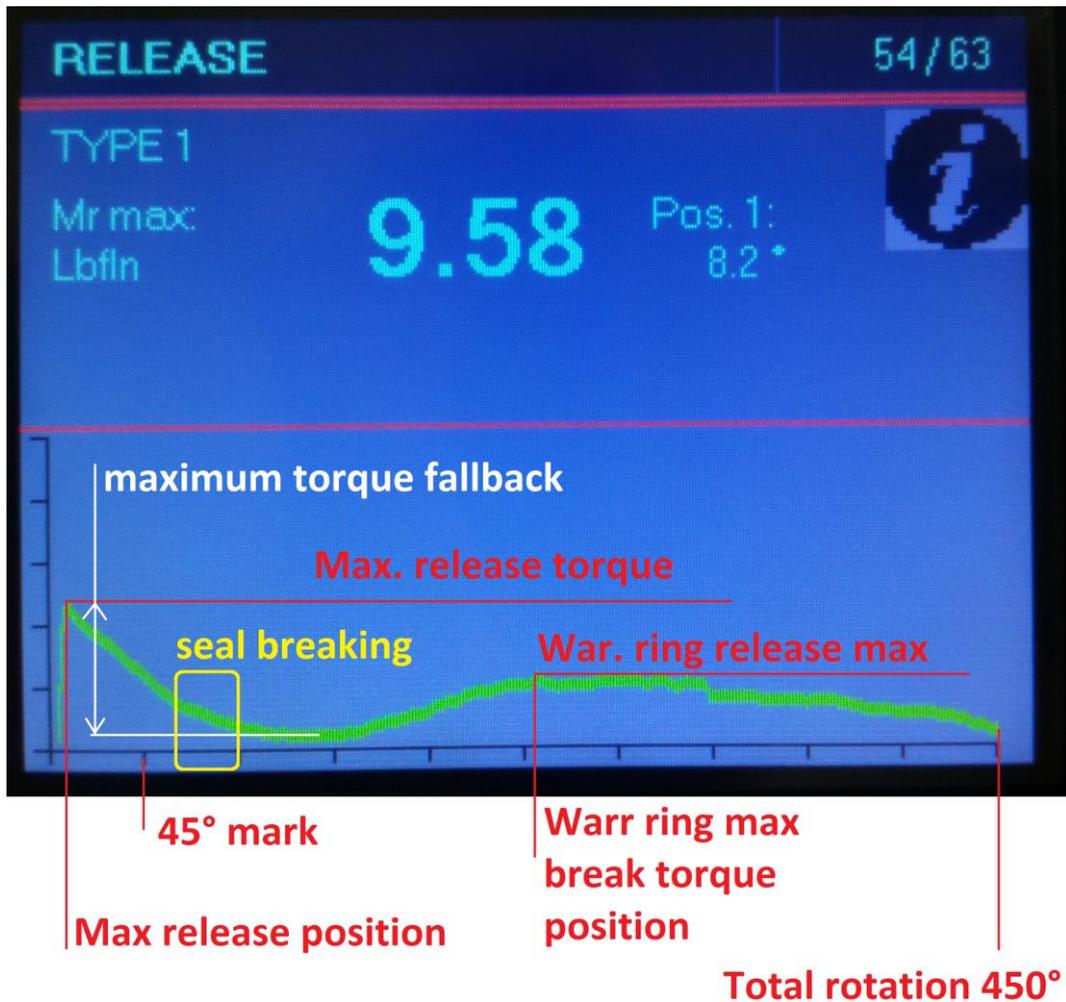


Figure 1 - Complete release process on a Torque-angle graph

Figure 1 shows the most important parts of a release torque – angle graph. It is conspicuous that the maximum release torque is followed by a steep fallback section. The seal is broken at the end of this descending torque section. After the maximum fallback the torque starts increasing again when the warranty rings' bridges start to break.

For measuring the maximum release torque **without breaking the seal integrity** the ST-LAB automatic torque tester provides 2 options with Release>Application testing. In both cases the closure will be reapplied with an accurate torque that is specified in the setup menu of the torque tester. The difference between the 2 options is the trigger of the stop of the release rotation:

### 1 - Stop release on fallback

Torque fallback is the difference between the actual measured torque and the torque maximum (since the start of the test). The torque tester always calculates the actual fallback and can compare it to the Release fallback value that is specified in the setup menu.

Figure 2 shows the graph of a release-application test with 2 LbfIn release fallback and 15 LbfIn re-application torque. The smaller the fallback, the less rotation is made.

Important is, that the difference of the max torque and the fallback should exceed the minimum sealing torque

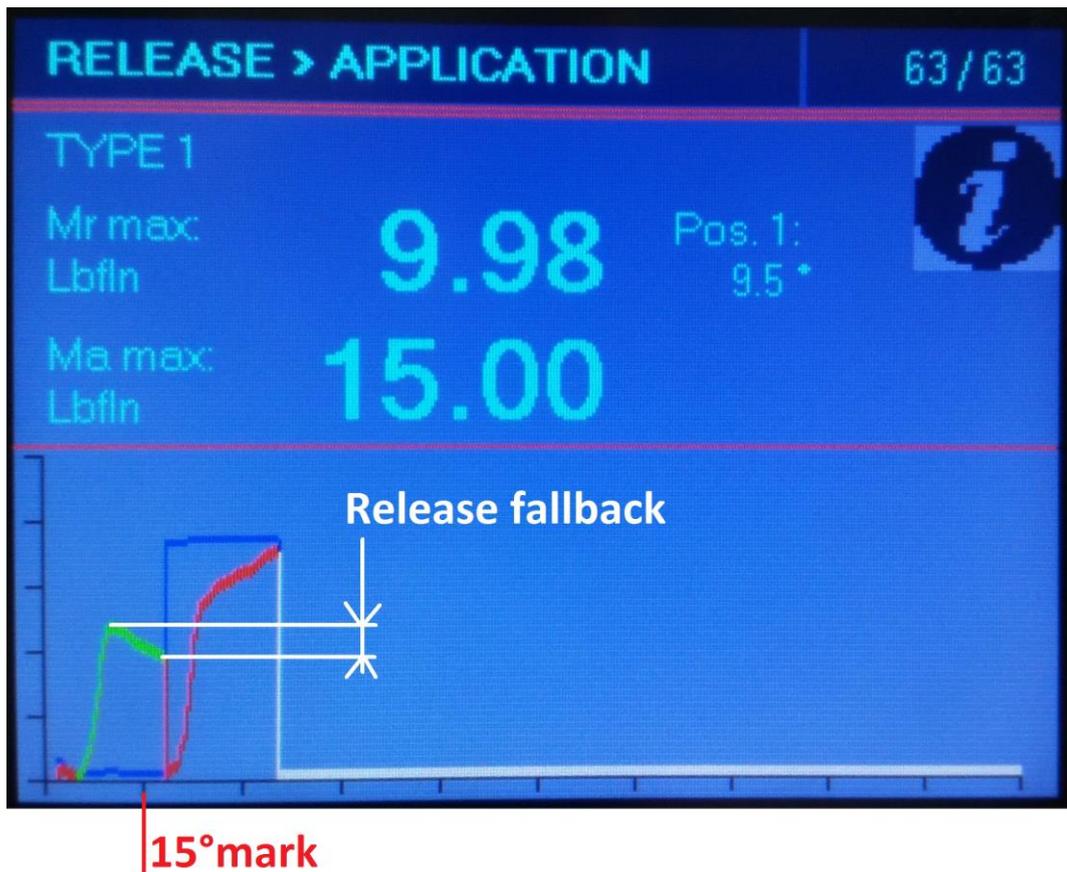


Figure 2 – Release>Application test with stop release on fallback

### 2 - Stop release on rotation

Release can be controlled by rotation angle too. In this case release is stopped when rotation angle reaches the Maximum rotation specified in the setup menu.

Figure 3 shows the graph of a release-application test with 30 degrees Maximum rotation and 15 LbfIn re-application torque. The smaller the Maximum rotation is, the safer the test is.

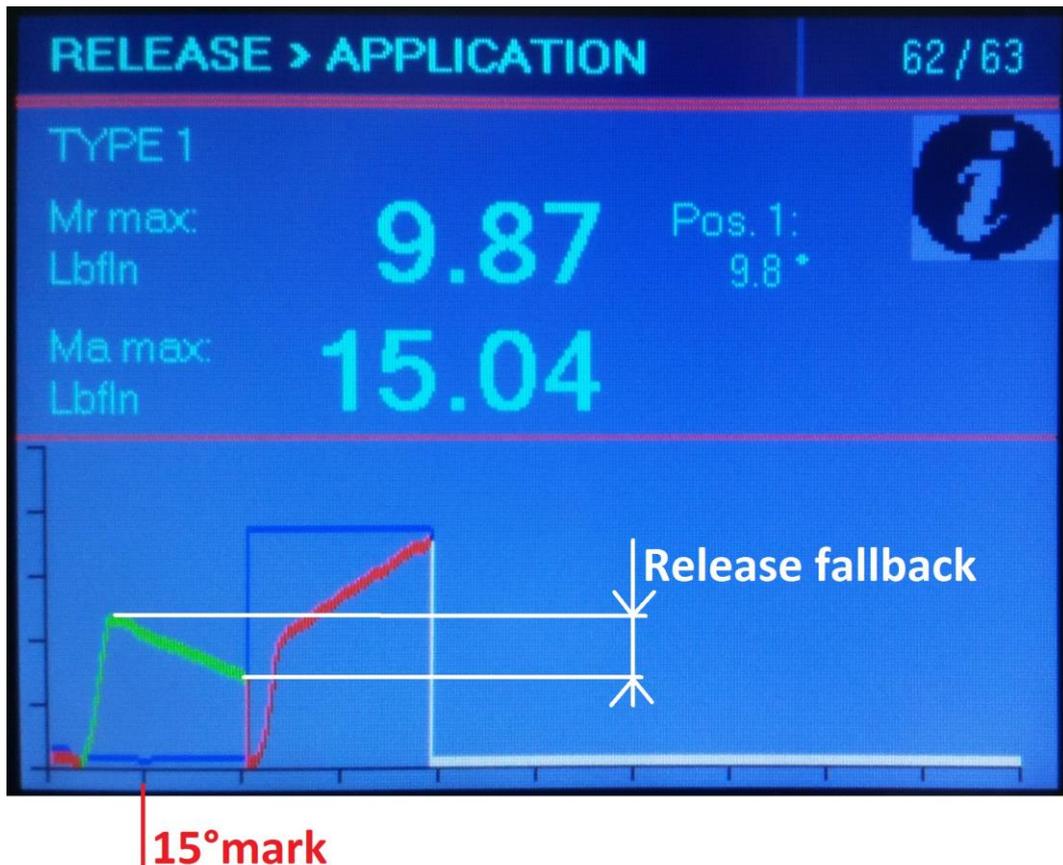


Figure 3 – Release>Application test with stop release on rotation

Both tests are bringing the same performance at most closures. Most customers use the test with "Release stop on fallback", but by certain closures it is possible that finishing test on rotation may bring better results (for example if the initial fallback section of the graph is very flat).

Important is that for every kind of closure and container all test parameters has to be specified, and this parameters should not be changed. This is ensured by the multi-level password protection of the ST-LAB. Any change of the test parameters is possible only with the password of the setup level.