SPOTLIGHT feature

Sample Preparation & Processing

How safe are your samples?

Part III: Sample integrity through secure capping

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When using sample tubes, secure capping is paramount to protect sample integrity during the storage and handling process for a range of applications. These applications could include; Biobanking, Compound Management, Cell Therapy, Benchtop Research or applied industry.

Two major hazards that can be mitigated through safe and secure sample tube capping are:

- Evaporation
- Cross contamination

Evaporation and Cross Contamination

Evaporation and cross contamination can occur either directly through the tube and cap or through a mechanical failure or flaw. During long-term storage or handling, aqueous samples can evaporate or cross contaminate each other potentially causing irreplaceable samples to be lost or compromised, rendering them unusable for future research or treatment. In closed customer testing Azenta Sample Tubes have shown to provide higher sample integrity through lower levels of evaporation.

To ensure sample integrity, Azenta Sample Tubes have been leak tested and have been through rigorous testing methods both under vacuum (to test the mechanical seal of the tube and cap) and under pressure (to simulate an increase of internal tube pressure).

Figure 1: Azenta Life Sciences sample tubes undergo rigorous testing to ensure sample integrity.

Under Pressure:

- Product samples are taken from each cavity of the tool, at the start, end, and during batch production
- The tube is connected to a silicone pressure tubing manifold via a hole drilled in the tube base
- The cap is applied with the minimum recommended torque for the tube and cap
- The manifold is then attached to a test rig and a pressure of 2Bar is applied
- The pressure must be maintained for 10 seconds without any reduction in pressure observed.

Under Vacuum:

- Product samples are taken from each cavity of the tool, at the start, end, and during batch production
- Tubes are filled with 0.15ml of with blue pigment. (Ethanol is used due to its low surface tension which will accelerate and exaggerate any leaks)
- The tubes are then capped, just below the minimum recommended torque level, and independently weighed
- The tubes are then placed on their sides in a tray lined with filter paper and placed in a vacuum chamber. A vacuum of -0.03Mpa (-19psi) is applied
- Tubes are left for 24 hours
- The sample is re-weighed and the weight compared with the original recorded
- Tubes and caps pass QC when there is no evidence of sample loss

Quality control processes ensure that every batch of Azenta Sample Tubes are above industry standard to provide safe and secure long-term storage for precious samples. If any of the tubes tested fail then the entire batch fails quality control and is inspected to mitigate any issues in future.

The rationale for these two tests is to maintain sample integrity during periods of increased internal pressure and to assure reliability of seal from the cap.

Internal vs. external thread

As aqueous samples expand when frozen, internal pressure is increased and burst pressure is paramount to calculate the safe working volume of each tube (see: How Safe Are Your Samples? Part II: Working Volume). When freezing samples, it is imperative to know the maximum fill volume of the tube being used as, when water-based samples are frozen, they expand by approximately 9%. This is an important factor when selecting an internal or external thread tube & cap, *Figure 2* shows the results of comparative testing with 0.7ml Azenta sample tubes.

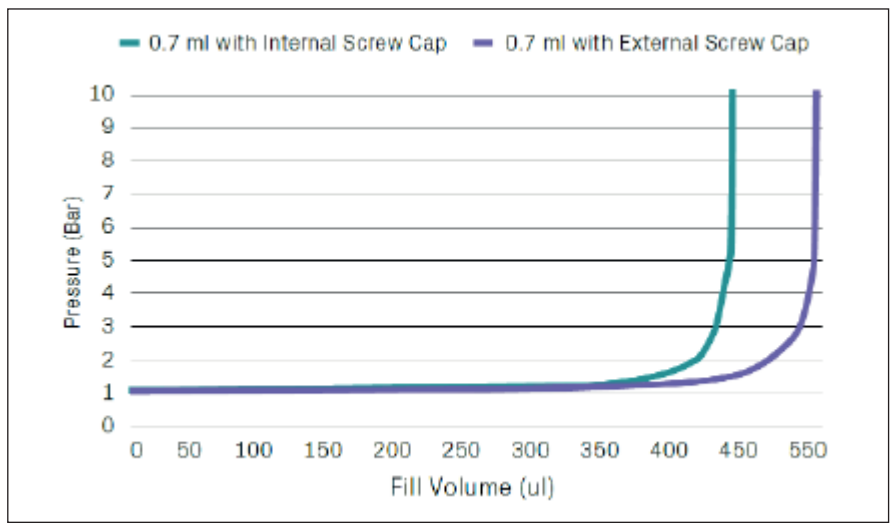

Figure 2: Graph showing the pressure generated with increasing fill volumes in both an internal and external thread 0.7ml sample storage tube

The results show that due to the higher headspace volume in the Azenta External Thread Sample Tube, the internal pressure is lower and therefore a greater volume of sample can be stored with a lower risk of sample loss through bursting when sealed with an external cap. Furthermore, results show that the Azenta External Thread Sample Tube offers more protection from evaporation.

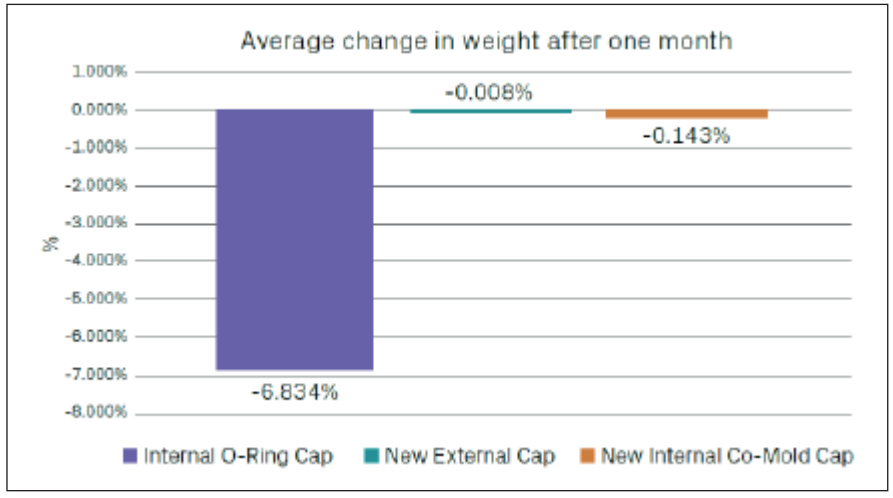

Figure 3: The results of testing on average change in weight over one month with three capping options.

Figure 3 shows the results of testing on average change in weight over one month with three capping options; traditional Internal O-Ring Cap, New Azenta External Cap and the New Azenta Internal Co-Mold Cap. Both the New External Cap and New Internal cap demonstrate excellent sealing, whilst the traditional Internal O-Ring Cap showed significant evaporation after one month.

The Azenta External Thread Sample Tube was designed for a greatly increased burst pressure for enhanced sample integrity, it also has a range of other benefits including:

- Increased working volume allowing users to store more sample
- Reduced tube height enabling a higher density of storage
- Prevention of cross-threading and 'jumping' if the tube is over-torqued
- Improved robustness of automated capping and decapping processes

These improvements are only possible with highly advanced manufacturing techniques, and therefore a rigorous quality control process. Details of the tolerances can be seen in *Figure 4*.

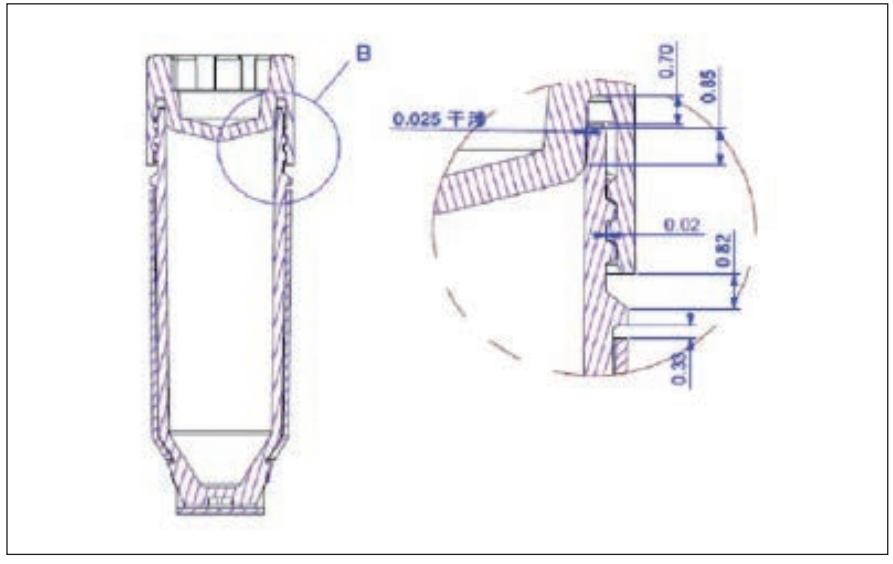

Figure 4: Compression seal on external thread sample storage tube

Summary

Due to the advanced manufacturing techniques used when Azenta tubes and caps are manufactured the results demonstrate the superiority of the New Internal Co-Mold Cap and New External Cap over the traditional Internal O-Ring Cap. This shows how two of the major hazards to compromising sample integrity; evaporation and cross contamination can be mitigated with the use of an effective capping method.

Reliable and robust capping can be assured through high quality manufacturing processes including a rigorous quality control process, simulating the expansion of aqueous samples during freezing and testing mechanical leaks.

The results all indicate that the new Azenta External Thread Cap provides an assured level of quality to maintain sample integrity whilst offering a range of other benefits including; higher density of storage, enabling automation, manual handling and increased working volume vs. internal thread tubes of the same size.