Joint Assessment of Capping Process Performance Using SmartSkin's Seal Tightness Drone

SmartSkin has developed a novel sensing device, the Seal Tightness drone to measure the sealing forces applied to the flange of a vial within capping and crimping operations (Fig. 1). It measures the external top load force and the force applied by a metal crimp. The drone is shaped like a production vial and able to run with regular vials through capping and crimping processes at production speeds.

A feasibility study for sealing force measurement using a 50 ml Seal Tightness drone was performed on a clinical line at Boehringer in Germany.

Figure 1. Seal Tightness drone with axial sensor integrated into flange.

All tests were performed on the same single-head capper to assess the capping forces applied. A stopper and cap were applied to the 50 ml Seal Tightness drone through the process and the initial top load force applied by the capping head and the seal tightness over time after capping were recorded by the drone.

With standard settings, the top load force and seal force after 10 s were found to be very consistent.

Figure 2. Seal Tightness drone in the capping process.

Table 1. Top load force (N) and seal tightness (N) measured by the Seal Tightness drone through the capping machine.

Top Load Force (N)	Seal Tightness (N) after 10s
148.5	90.0
152.6	89.9
152.2	92.0
152.6	94.0
154.8	96.8
150.0	92.0
153.4	92.5
148.9	92.5

From the data profile, it also became clear that the cap checker was applying a force to the vial after capping when it should not be.

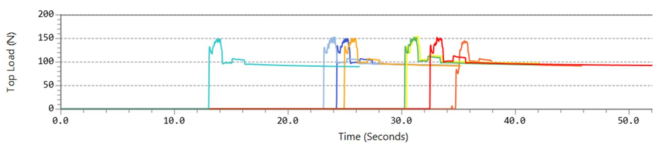

Figure 3. Top load pressure (N) measured with the Seal Tightness drone through capping and the cap checker.

The Effect of Capping Force

Increasing the applied capping force setting changed the top load force measured by the Seal Tightness drone during capping and resulted in a higher seal force measurement (Table 2).

Table 2. Top load force (N) and seal tightness (N) measurements based on the applied capping force setting

	Top Load Force (N)	Seal Tightness (N)
Capping force (1.5 bar)	148.5	90.0
Capping force (2.6 bar)	191.7	114.0

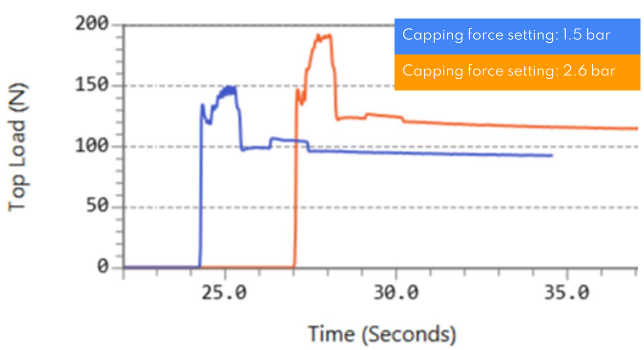

Figure 4. The effect of capping force setting on top load force (N) and seal tightness measurements (N) over time (s).

Seal Tightness Stability Over Time

Two Seal Tightness drones were left capped for 20 days to study the seal tightness profile over time (Fig. 5). The most significant decrease in seal tightness was seen within 1 day of capping after which sealing forces stabilized at roughly 50% of the initial capping force.

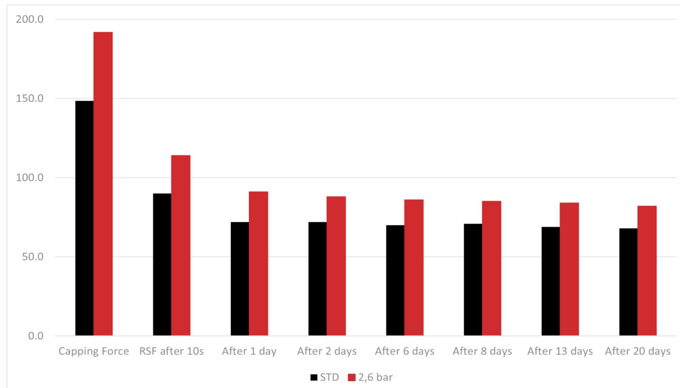

Figure 5. Seal tightness measurements (N) of two capped Seal Tightness drones over time for 20 days after capping.

Conclusion

Seal Tightness drone data indicated that a change in capping force resulted in a change in top load force and seal tightness. It also demonstrated that seal tightness degrades over time with the most significant decrease occurring within 1 day of capping after which measurements stabilized at roughly 50% of the initial capping force applied.

Repeating runs on the same capping head in the same conditions resulted in repeatable results demonstrating measurement consistency.

Boehringer Ingelheim