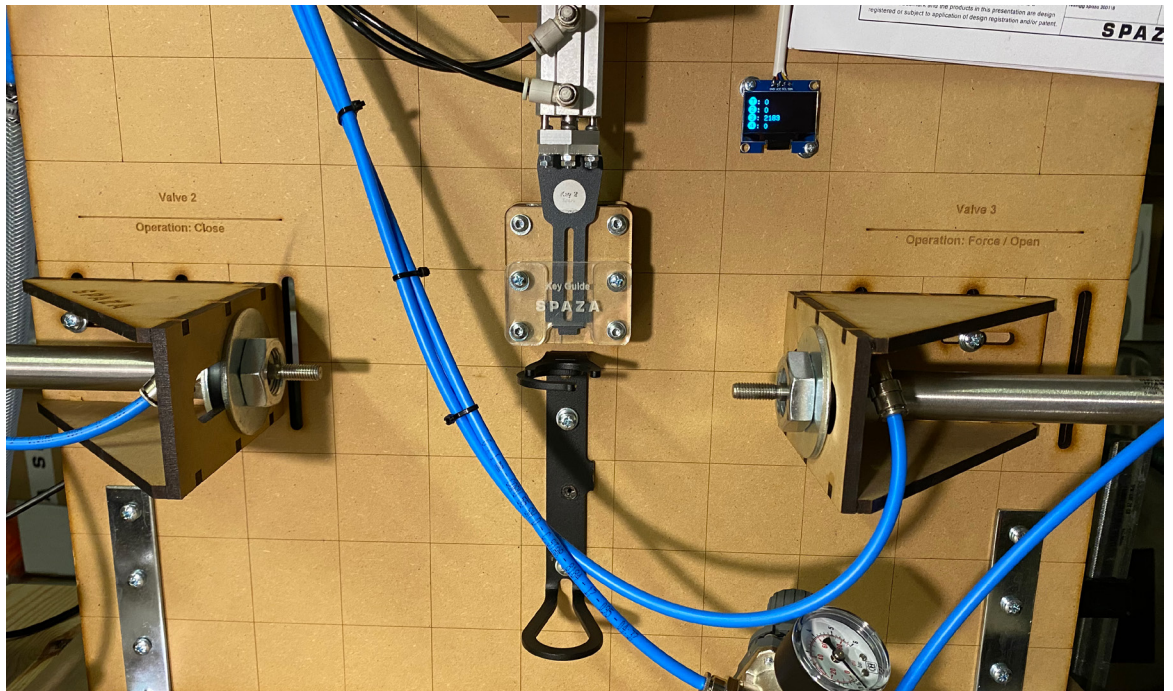


Mechanical Endurance Testing

Full cycle, force open and key



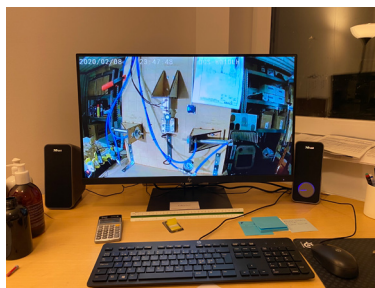
Testing our product's mechanical durability is essential to get insights in our product's potential weaknesses and to ensure ideal performance. When we decided for how many repetitions, or cycles, that our tests should run in our starting point was at least one action per day, 365 days a year in 10 years. That results in 3,650 cycles so we decided to run for minimum 5,000 cycles. Depending on functionality tested this might vary to larger amount of cycles.

Method

Using mecatronic and pneumatic cylinders we built a test rig where the bottle holder is mount absolute fix, meaning all forces are picked up by the mechanical features in the bottle holder. Metal rods are used to represent manual action. A gauge display system pressure (3 bar equals a load of 9 kg on the pneumatic cylinders). Test run was monitored and regularly seen over.



Pressure gauge



Monitoring test run



Metal rods

Full cycle test

This test simulates excessive load on the locking mechanism and its sub-steps in a full cycle. Reason we make this full cycle test is to make sure the different type of stress that the locking mechanism endures. A full cycle consists of following steps:

1. Push key three times

This is to make sure locking spring will endure many activations in combination with being tampered with, opened and closed.

2. Force locking mechanism to open

This is to make sure the spring mechanism will withstand excessive force as if someone decide to push on the locking arm and try to tamper with the locking mechanism.

3. Open mechanism

Locking mechanism is opened.

4. Close mechanism

Locking mechanism is opened.



1. Key is pushed down three times, pushing down the locking spring.



2. Force open by pushing on the locking arm when locked.



3. Open



4. Close

No. of Cycles: 6.578 cycles, 19.734 activations of locking spring (reason test was stopped it passed 5 000 cycles)

Load: 9 kg

Conclusion

Pushing the load 9 kg with your finger on the locking arm is nothing you do accidentally if you're not by intention want to tamper or damage the locking mechanism. As a reference, using a luggage scale you can push about 7-8 kg before your finger starts to hurt.

As the metal rods are sharp they did damage the surface finish on the locking arm. The powder coating was worn down, not completely through down to the stainless steel, on the locations where locking arm is in contact with wall mount.

Top of the key is worn down to the metal due to the locking spring that runs on the key at the start of the rotating operation. Fine powder of metal appears after 6.578 cycles as a result of worn down material from the key (steel) and on the underside of wall mount.



Worn down finish from the metal rod



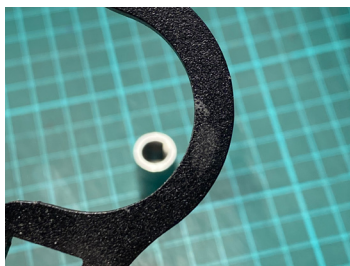
Worn down finish and material on the underside of wall mount from the locking spring



Worn down tip of key from the rotating locking spring



Worn down finish and material from the metal rod



Worn down finish from metal rod



Metal powder from worn down material of key and wall mount



Achieved load of 7-8 kg with a luggage scale