



## **Swab Tensile Testing Procedures**

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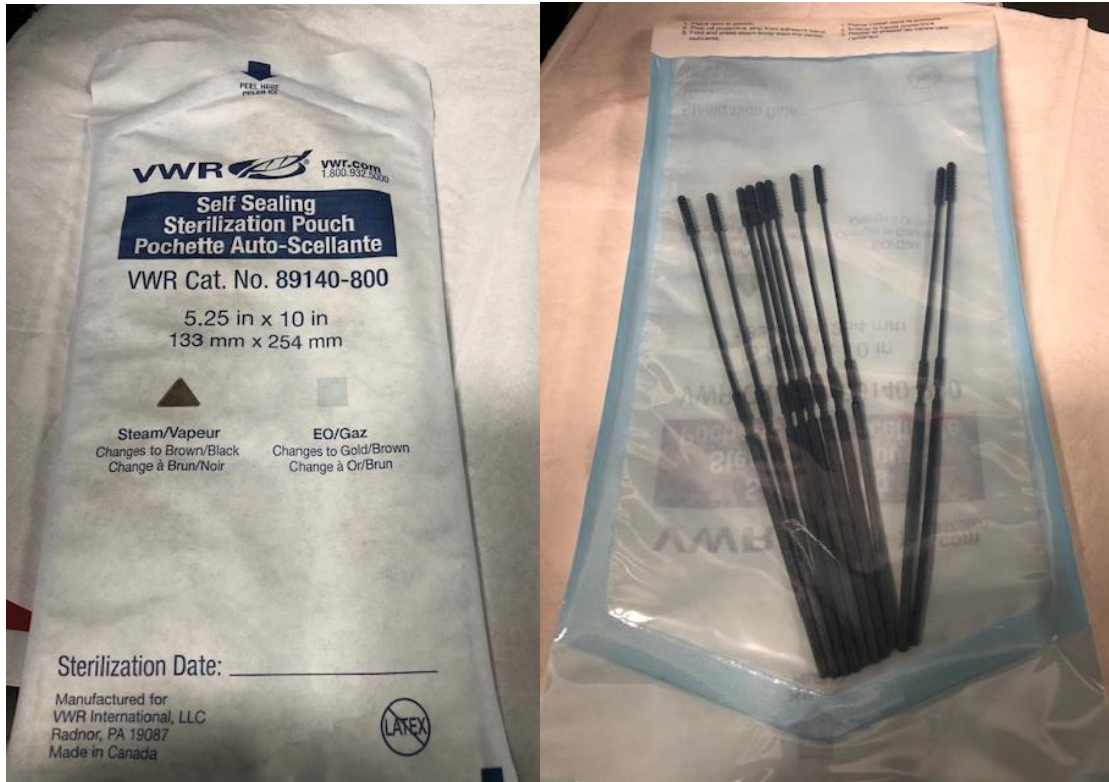
**Tensile Testing Procedure**

1. Pre-Treatment – Autoclave
  - a. Note: Pre-treatment was performed on only a subset of the swabs tested.
  - b. Equipment
    - i. Tuttnauer EZ10 Automatic Autoclave (Figure 1)



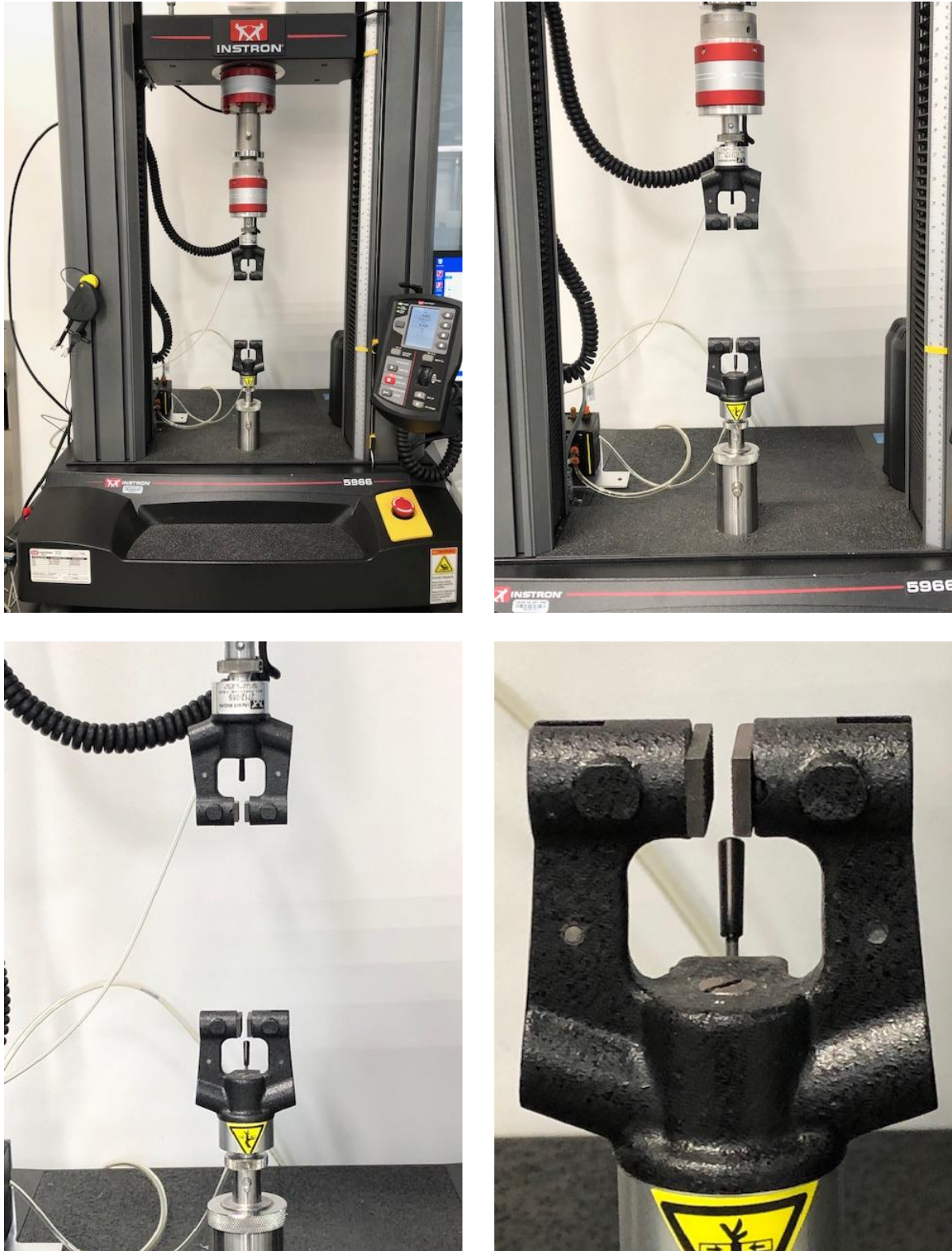
**Figure 1.** Autoclave used for pre-treatment of swabs.

- c. Materials
        - i. VWR Cat. NO. 89140-800 Self Sealing Sterilization Pouch (5.25in x 10in) (Figure 2)
      - d. Procedure
        - i. Swabs were placed inside the sterilization pouch. 10 swabs were placed in a single pouch (Figure 2).



**Figure 2.** Swabs were placed inside a self-sealing sterilization pouch.

- ii. Pouches were then placed inside the autoclave. Up to 4 pouches of swabs were autoclaved simultaneously.
  - iii. Swabs were autoclaved with the following settings:
    1. Temperature: 250°F
    2. Sterilization Time: 30 minutes
    3. Dry Time: 15 minutes
    4. (Note: The pressure during sterilization was 17psi.)
2. Tensile Testing
- a. Equipment
    - i. Instron Model 5966 (Figure 3) running Bluehill Universal Software
    - ii. 1kN Load Cell (Instron Model 2580-1KN) (Figure 3)
    - iii. Pneumatic Grips (Instron Model 2712-019) with serrated plates (0.5in height), controlled with 60psi of pressure (Figure 3)

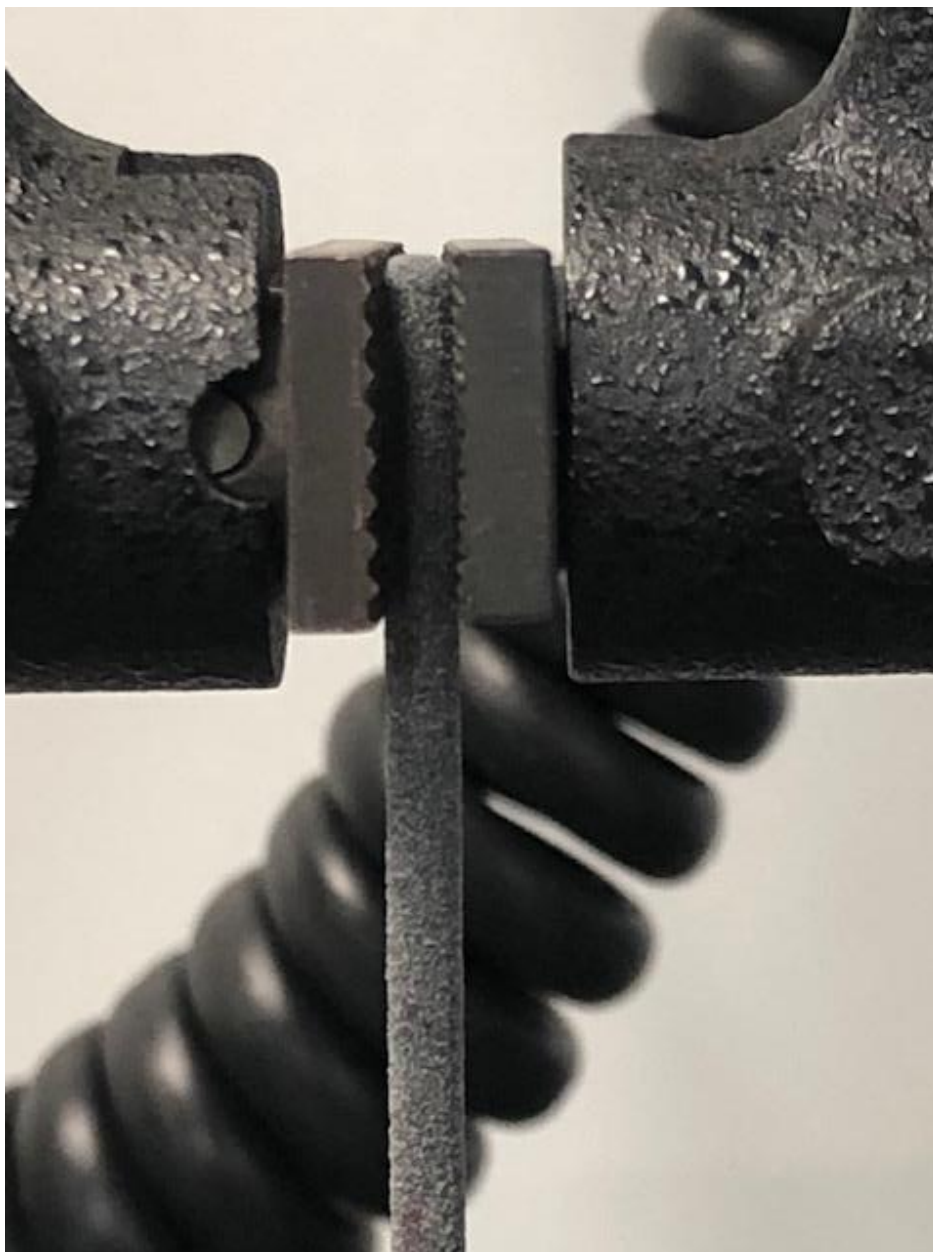


**Figure 3.** Test setup for the tensile tests.



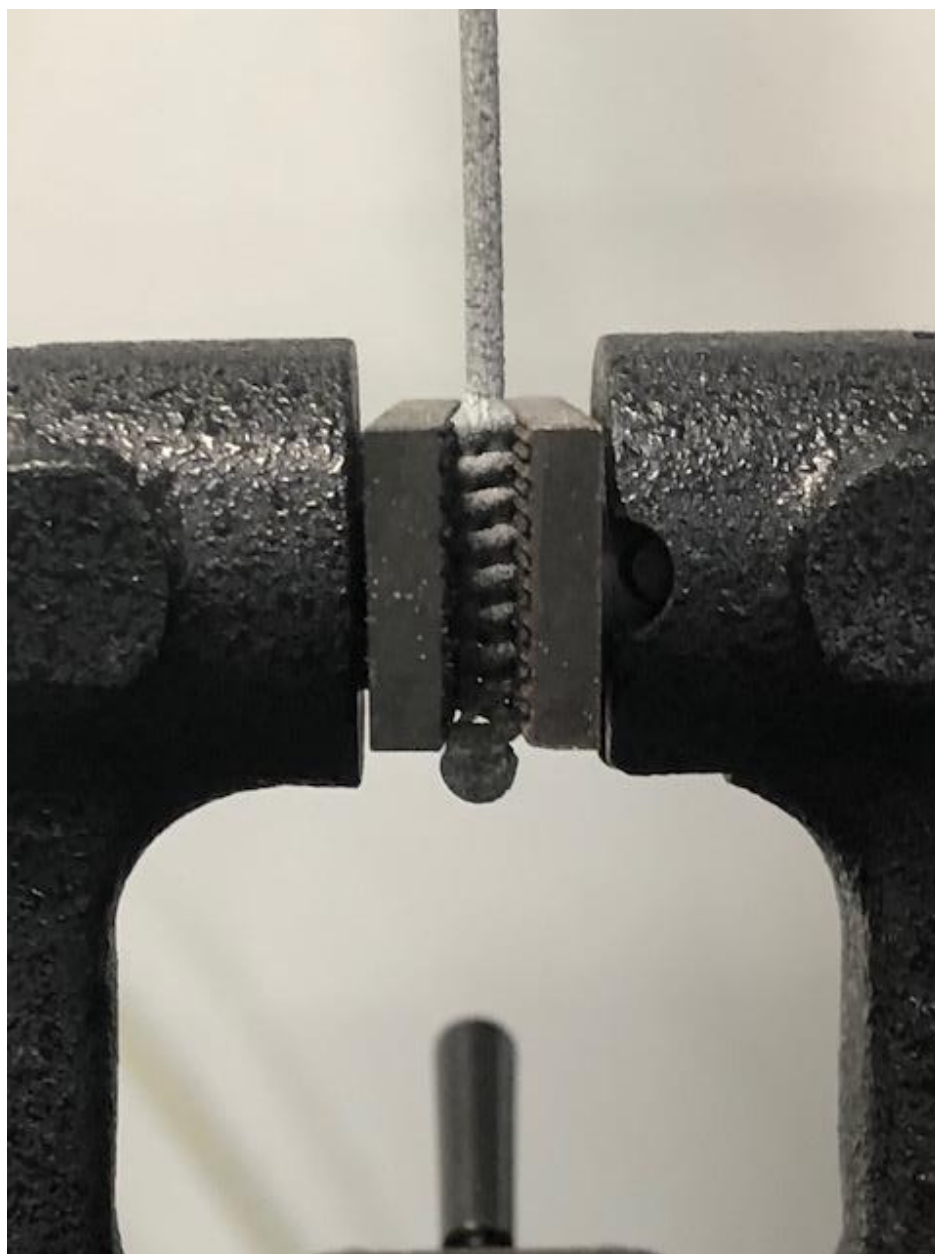
b. Procedure

- i. Place the handle of the swab in the upper grips and close. The swab should not protrude above the height of the plates (Figure 4).



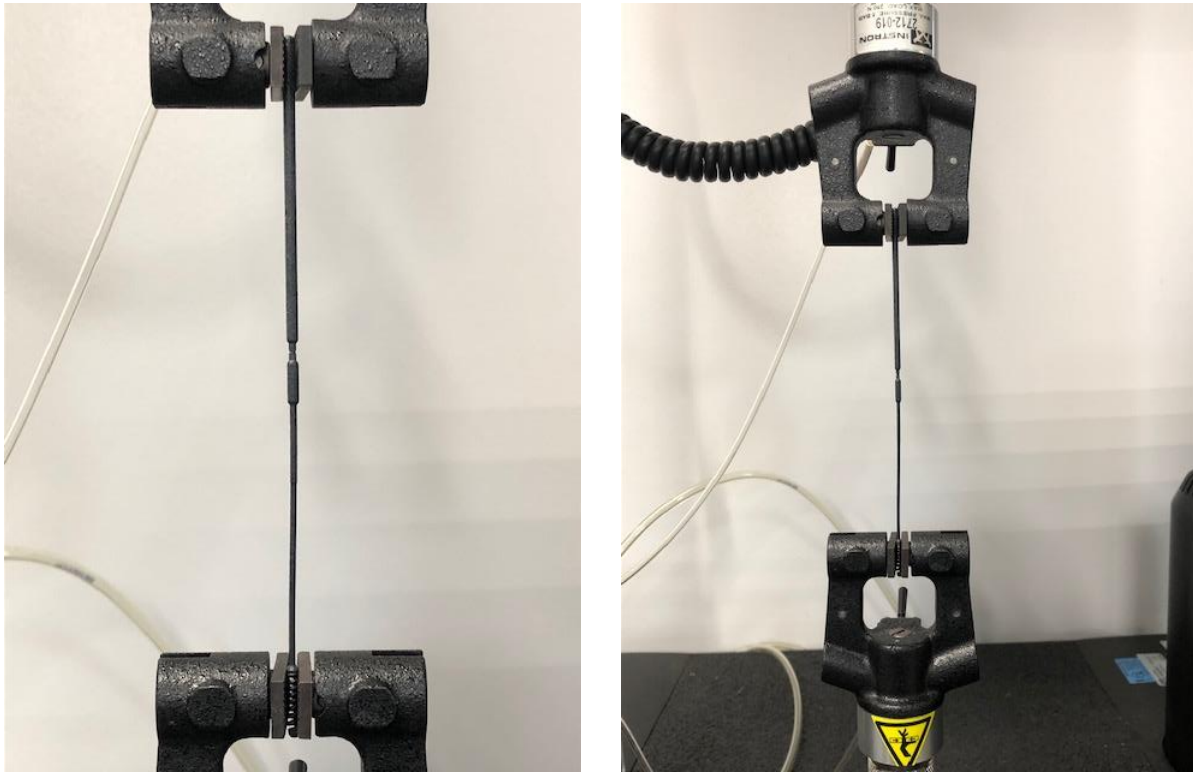
**Figure 4.** Image of the swab position inside the upper grips. The tip of the swab handle should be flush with the top of the grips.

- ii. Secure the tip of the swab in the lower grips and close. The tip of the swab will protrude slightly below the height of the plates. The swab head should be at the top of the plates (Figure 5).



**Figure 5.** Image of the swab inside the lower grips. The top of the swab head should be flush with the top of the grips. The tip of the swab head will protrude below the grips.

- iii. Adjust the height of the upper grip to remove any slack (Figure 6). Make sure not to pre-load the swab.



**Figure 6.** Image of the swab positioned in the grips. Prior to testing, any slack in the specimen should be removed by adjusting the height of the upper grips. Ensure that this slack-removal process does not pre-load the swab.

- iv. Balance both the force and displacement.
- v. Start the tensile test procedure:
  - 1. Rate of Test: 25mm/min
  - 2. Test End: 40% change in Force
- vi. The data is automatically collected for Time, Force, and Displacement. The test should automatically conclude when a 40% change in Force is detected (i.e. when the swab breaks). This data point is recorded as the “Break Point.”
- vii. The physical location of the break point was classified as:
  - 1. “Neck” (for swabs breaking in the neck region – Figure 7),
  - 2. “Head-Neck” (for swabs breaking at the joint between the head and the neck – Figure 8),
  - 3. “Head” (for swabs breaking in the head region – Figure 9), or
  - 4. “Breakpoint” (for swabs that broke at the desired breakpoint on the handle – Figure 10).



**Figure 7.** Representative images of the swabs classified as breaking at the “Neck.”



**Figure 8.** Representative image of a swab classified as breaking at the “Head-Neck.”





**Figure 9.** Representative image of a swab classified as breaking at the “Head.” The break location is shown circled in red in the bottom image. In many cases, though, the actual break location was not visually observable and the swabs were classified as having broken based on the force-elongation data.



**Figure 10.** Representative image of a swab classified as breaking at the “Breakpoint.”