Cavro® Syringe

Installation Success Guide.

Syringe replacement and installation tips for confidence and success with Cavro liquid handling pumps.

Syringe pumps are the heart of many life science liquid handling applications. Generally considered as consumable products, syringes require periodic maintenance due to wear and tear, which may vary in frequency and degree depending on the application. To maintain superior performance of Tecan's liquid handling syringe pump solutions, Cavro syringes must be maintained and replaced regularly.

HOW DOES A SYRINGE ACHIEVE A GOOD SEAL?

It is important to understand how a Cavro glass syringe achieves a complete seal. Sealing occurs at two points on glass syringes:

1. The borosilicate glass syringe is equipped with a stainless-steel knurled cap with a polytetrafluoro-ethylene (PTFE) insert at one end. This end-cap insert must make full contact against the bottom surface of the valve port to achieve a good seal. The threads of the valve do not provide any sealing capabilities, but they ensure that the syringe remains securely in place.

2. The plunger seal provides a secure fit and is located at the end of the plunger stem where it is inserted into the glass syringe barrel. This plunger seal material may be PTFE or ultra-high molecular weight polyethylene (UHMW-PE) and usually contains a thin film of 100% silicone oil lubricant, which provides the following benefits:
   - Ensures smooth, lower friction plunger operation within the syringe barrel
   - Prolongs the life of the syringe by reducing friction between the contact points
   - Compensates for (fills in) minor plunger seal wear to resist leakage

   The silicone lubricant may naturally wear away over time as a result of use and exposure to fluids. It is possible to prolong the life of the syringe by periodically re-lubricating the plunger seal with silicon oil, or the syringe may be used until it reaches the end of its useful life. Applications with solvents* or reagents that are more aggressive than water may wash away the lubricant more rapidly, resulting in a lower syringe lifespan than if operating with deionized (DI) water.

* **For more tips and information on chemical compatibility, see our blog: Six tips to help match your liquid handling components with chemical compatibility.**

INSTALLATION AND ALIGNMENT TIPS

When replacing a syringe, there are a few elements to consider. First and foremost, the syringe must be aligned with the frame face of the syringe pump. It is best that the syringe be handled from two locations: (1) at the knurled cap that sits at the top of the syringe; and (2) at the plunger button (on the opposite end). Avoid placing fingers around the glass body during installation, because this may cause misalignment.

While threading the syringe onto the valve, be careful to maintain the syringe body parallel to the pump frame face. Some valves are made of relatively soft polymeric materials. Therefore, to ensure proper installation do not use unnecessary force or install at an angle, as this can lead to cross-threading of the valve port threads. If an increase in resistance is felt during this step, it may be due to misalignment or cross threading. Cross threading can damage the valve.

TIPS TO TIGHTEN A SYRINGE SUCCESSFULLY

As best practice, and to ensure confidence in performance, Tecan recommends finger-tightening for all syringe installations. When the syringe is threaded onto the valve port, and the tip of the syringe makes contact with the bottom of the port, then make an additional ¼-turn. This applies to all plastic valves. For ceramic valves, use slightly more than an additional ¼-turn to provide a good seal. Customers commonly ask if a torque specification is available. Tecan does not recommend the use of any tools to apply torque during tightening, due to the softness of both the valve material and the syringe knurled cap PTFE insert. For this reason, no torque specification is necessary. The finger-tightening method can be used with confidence to achieve a good liquid seal with reliable operation.

Note: Over-tightening the syringe may result in valve port damage, valve leakage, and shortened syringe life. Avoid using tools to tighten and secure the syringe to the valve.

CAVRO PUMPS SYRINGE INSTALLATION INSTRUCTIONS:

It is always recommended to install a new syringe when the pump is upright. Following is an outline of the installation steps. More specifics are provided in the following table.

1. With no syringe installed, loosen the lock or thumbscrew.
2. Move the plunger drive to the recommended position.
3. Align the syringe barrel.
4. Thread the syringe into the valve.
5. Tighten the syringe for a liquid seal and reliable operation.
6. Secure the syringe in place.

<table>
<tr><th></th><th>CAVRO CENTRIS PUMP</th><th>CAVRO XE 1000 PUMP</th><th>CAVRO XCALIBUR PUMP</th><th>CAVRO XLP 6000 PUMP</th><th>CAVRO XMP 6000 PUMP</th></tr>
<tr><td>1. Position the plunger drive.</td><td>Initialize the pump.

Move plunger drive to mid stroke position.</td><td colspan="2">With power off, move plunger drive to lowest stroke position, by pushing down firmly on carriage.</td><td colspan="2">Initialize the pump.

Move plunger drive to mid stroke position.</td></tr>
<tr><td>2. Loosen the thumbscrew plunger drive.</td><td>Make 8 full turns, counterclockwise.</td><td>See next step.</td><td>Make 3 full turns, counterclockwise.</td><td colspan="2">Loosen and remove.</td></tr>
<tr><td>3. Align the syringe and barrel when installing syringe; handle by the knurled cap at top of syringe. Maintain syringe parallel to frame.</td><td colspan="2" rowspan="2">Slide plunger ball into capture assembly.

Pull syringe barrel up to the ¼-28 valve port.

Carefully screw the syringe into the valve by hand.

Do not cross-thread; this will damage the valve port.

Any resistance during this step indicates a probable misalignment.</td><td>Pull the syringe plunger button down until it aligns with the syringe plunger holder.

Loosely tighten the syringe plunger thumbscrew by hand to secure the syringe plunger button.</td><td>Pull the syringe plunger button down to align with the carriage insert hole. Install the syringe thumbscrew into the plunger button.</td><td>Pull the syringe plunger button down to position in line with the locking pin.</td></tr>
<tr><td colspan="3">Align the syringe with the valve port (make sure syringe barrel is parallel to the pump frame).

Carefully screw the syringe into the valve by hand.

Do not cross-thread; this will damage the valve port. Any resistance during this step indicates a probable misalignment.</td></tr>
<tr><td>4. Thread the syringe into place.</td><td colspan="5">Thread syringe into the valve until the knurled cap PTFE insert first makes contact with the valve port; when in place you will feel an increase in resistance.</td></tr>
<tr><td>5. Tighten the syringe.</td><td colspan="5">After the ¼-28 thread on the syringe is properly screwed into the valve port, secure the syringe with ⅛ to ¼ additional turn.

Caution: Over-tightening the syringe may result in compression of the PTFE seal and/or damage to the valve port, impacting the seal and allowing leakage.</td></tr>
<tr><td>6. Secure the syringe in place.</td><td>Tighten the knurled thumb-screw to secure the ball end of the syringe within the syringe capture mechanism.

Be sure that the ball is fully secured when tightened with no visible gap between the ball and capture pin.</td><td>No further steps needed.</td><td>Hand tighten the thumbscrew.</td><td colspan="2">Hand tighten the thumbscrew.

Do not use tools to tighten!</td></tr>
</table>

CHECK THAT YOUR SYRINGE AND VALVE ARE IN THE BEST SHAPE POSSIBLE

The PTFE insert at the end cap of the syringe is soft. Using excessive force may cause the PTFE insert to recede into the cavity of the syringe end cap, which may allow the threaded stainless-steel segment to make contact with the valve port. This scenario should be avoided. Contact between the steel tip and the valve may leave a groove in the valve material (Figure 1). This may not cause immediate leakage; it will, however, increase the risk that a good seal is not achieved during future syringe installations and may reduce valve life.

Normal "good" port **Damaged port due to overtightening**

Figure 1. Magnified images of valve ports. Grooves visible as dark rings on the center and right images reveal damage due to overtightening.

Syringe PTFE inserts should be checked periodically to evaluate their fitness for use. As a rule of thumb, if the exposed PTFE insert measures less than .02 inches (0.5 mm) (Figure 2), the syringe should be replaced immediately.

New syringe and end-cap PTFE insert **Insufficient amount of end-cap PTFE insert**

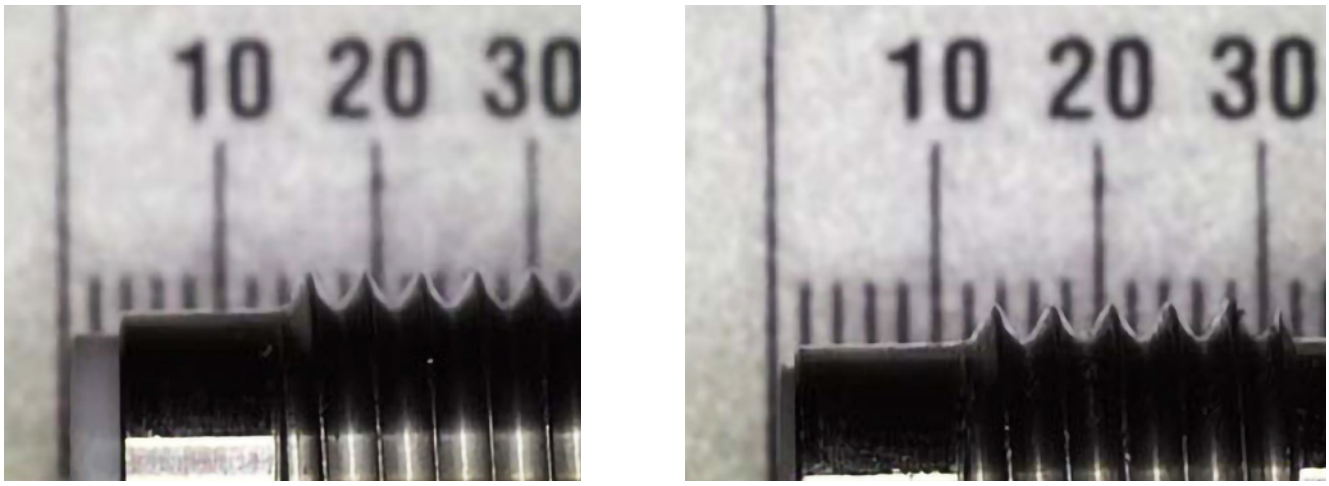

Figure 2. Magnified images of a new (left) and a worn (right) syringe. The thickness of the end cap is shown at the far left of the ruler.

Tecan offers a full range of glass and ceramic syringes specifically designed for Tecan Cavro syringe pumps, helping to ensure the superior performance that our customers have relied on for many years.

Standard syringes have a precision manufactured glass barrel and stainless-steel plunger rod, allowing accurate volume control. A wide range of sizes are available for each pump, with either PTFE or UHMW-PE plunger seals, offering excellent chemical resistance. UHMW-PE seals also provide extended service life for some applications, ensuring reliable performance and reducing maintenance requirements. Centris pumps are also available with precision-paired ceramic syringes which ensure minimal resistance or wear – and do not require a compliant O-ring seal on the plunger/barrel or an unswept dead volume – further reducing downtime and maintenance.

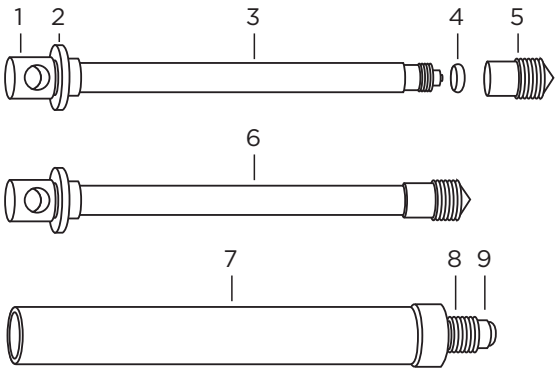

Image is representative only and may vary slightly depending on type of syringes

1. Plunger button
2. Plunger guide
3. Plunger stem
4. O-ring (where applicable)
5. Plunger seal
6. Plunger assembly
7. Syringe barrel
8. 1/4-28 thread
9. PTFE insert

A range of accessories is also available to complement Tecan Cavro syringes, including:

- Lubrication kits to increase the working life of plunger seals
- Plunger seal replacement kits to extend syringe life

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Tecan – Who we are

Tecan (www.tecan.com) is a leading global provider of laboratory instruments and solutions in biopharmaceuticals, forensics and clinical diagnostics. The company specializes in the development, production and distribution of automated workflow solutions for laboratories in the life sciences sector. Its clients include pharmaceutical and biotechnology companies, university research departments, forensic and diagnostic laboratories. As an original equipment manufacturer (OEM), Tecan is also a leader in developing and manufacturing OEM instruments and components that are then distributed by partner companies.

Founded in Switzerland in 1980, the company has manufacturing, research and development sites in both Europe and North America, and maintains a sales and service network in 52 countries.

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