

Waters Corporation

Waters 2690/5 USER
&
TROUBLESHOOTING GUIDE



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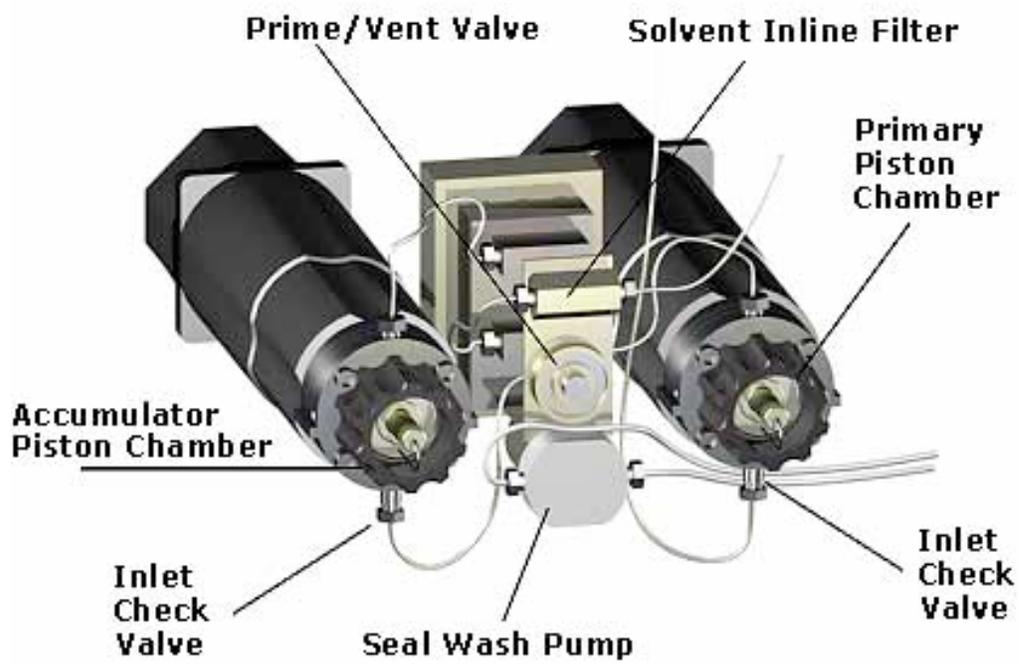
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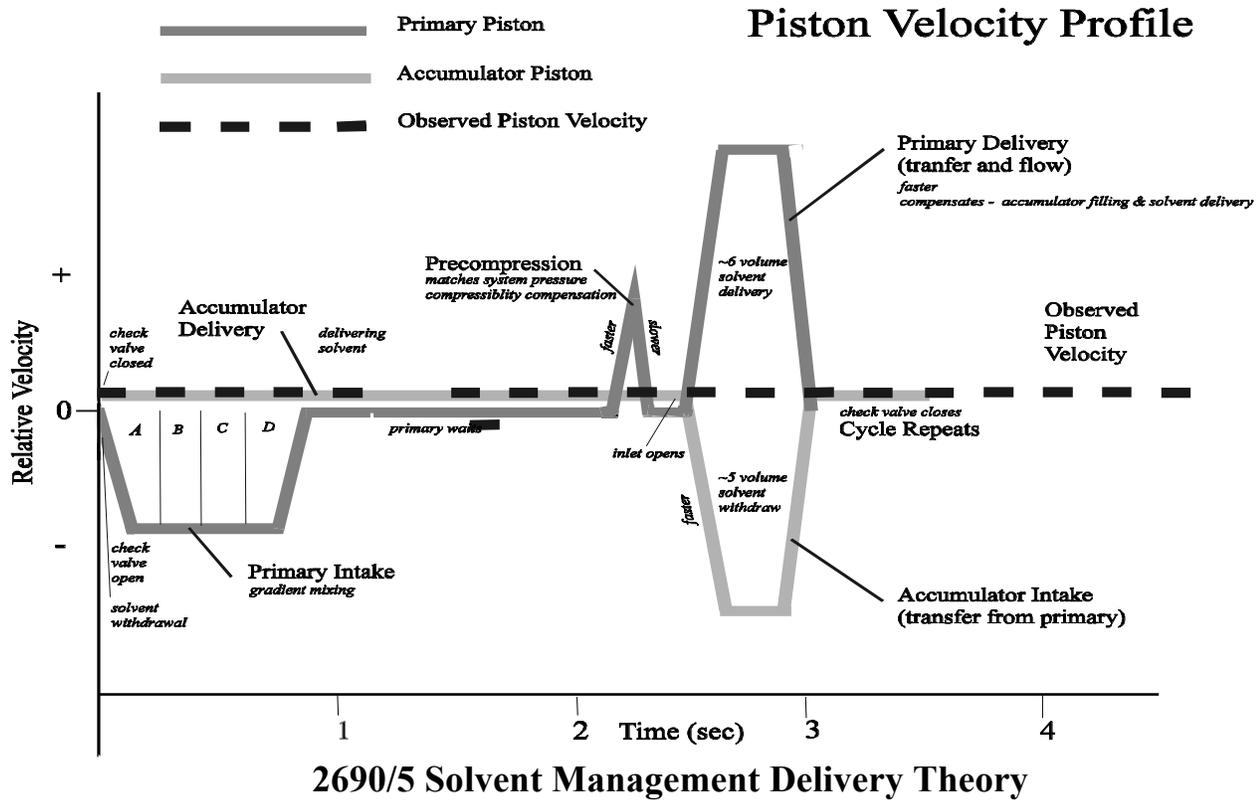
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2690/5 Solvent Management Flow Path



2690/5 Theory



The solvent management system components work together to deliver solvent in the following sequence.

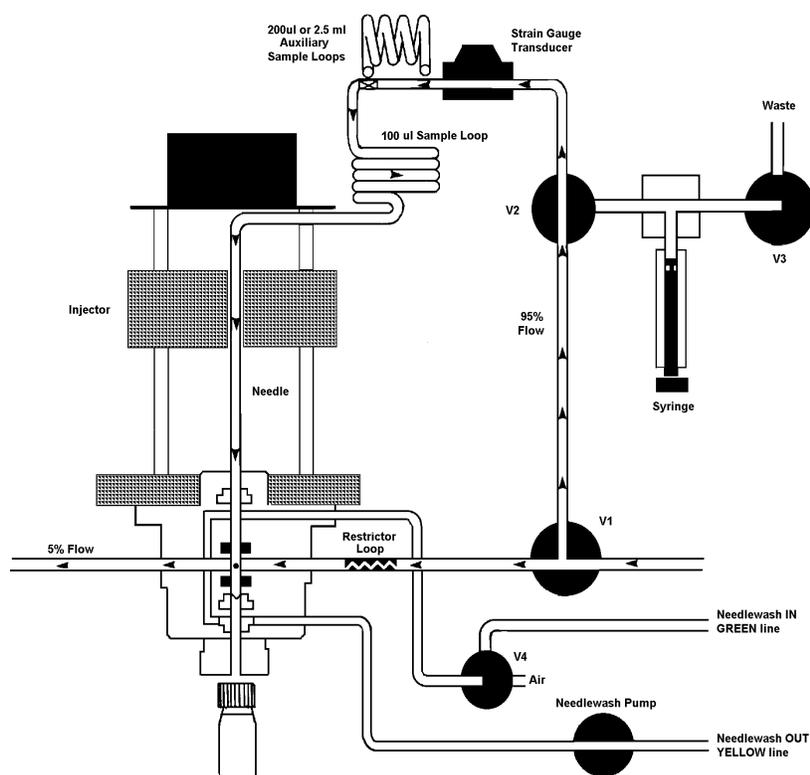
1. The accumulator plunger (left plunger) moves forward delivering solvent, while the primary plunger (right plunger) moves backwards filling with solvent.
2. While the accumulator continues to deliver solvent, the primary plunger waits. The primary pressure transducer then measures the pressure and matches it to the system pressure by moving the primary plunger forward, pre-compressing the solvent.
3. When the accumulator plunger reaches the end of its stroke, it slows down and reverses direction. Simultaneously, the primary plunger moves forward delivering solvent.
4. While the accumulator plunger moves backwards, the primary plunger moves forward slightly faster which allows the primary plunger stroke to both fill the accumulator piston chamber and to deliver solvent to the rest of the system

This sequence enables the solvent management system to maintain a consistent and pulse-free manner.

2690/5 Theory

2690/5 Sample Management System Theory

2690/5 Injection Cycle



The injection cycle is completed in three steps.

1. Isolation of the loop.

Valve 1 closes.
Needle wash pump turns on.
Valve 4 opens.
Needle moves into the bottom seal.
Valve 3,2 open venting the loop to atmospheric pressure.

2. Sample withdrawal.

Valve 3 closes
Needle wash pump turns off. Valve 4 closes.
Needle moves into the vial.
Syringe moves withdrawing sample.
Needle moves to the bottom seal.

3. Sample injection.

Valve 3 opens. Valve 2 closes.
Needle moves into the stream.
Valve 1 opens. Sample is injected.
Syringe moves home. Valve 3 closes

2690/5 Theory

2690/5 Sample Management System Purge & Compression Check

The purge cycle consists of three parts.

1. Purge: Fills the sample loop with new composition of mobile phase replacing the previous mobile phase and any air bubbles.
2. Flush syringe: Fills the syringe with new composition of mobile phase replacing the previous mobile phase and any air bubbles.
3. Compression check: The mobile phase in the injector assembly is compressed to check for leaks, the presence of air bubbles and undegassed mobile phase.

SETUP PROCEDURES

Priming a New or Dry system using undegassed solvents

1. Fill the solvent bottles with Mobile Phase.
2. From the **Status Page** turn the degasser **on**. *
3. Perform a dry prime until solvent flows from each of the four lines.
4. Starting with the organic solvent, perform a 3 minute **Wet Prime** on each line separately at a flow rate of 7.5 mL/min **
5. Once all lines are primed, set the flow rate to 0mL/min with the degasser on for 2 minutes.
6. Start the flow with the initial conditions of your chromatographic method. Equilibrate with 10 column volumes of solvent.
7. Check the **Pressure Ripple** on page two of the **Status Page**. The ripple should be less than 2% of the system pressure. (For system pressures above 1000psi, repeat **Wet Prime** if the ripple is too high)
8. After the column is equilibrated, **Purge** the autosampler. (initial conditions)
9. Run samples.

Priming an idle system using existing mobile phase

1. From the Status Page turn the degasser **on**. *
2. For each line that will be used, starting with the organic solvent, perform a 1.0 minute **Wet Prime** at a flow rate of 7.5 mL/min. **
3. Once all lines are primed, set flow rate to 0mL/min with degasser on for 2 minutes.
4. Start the flow with the initial conditions of your chromatographic method. Equilibrate with 10 column volumes of solvent.
5. Check the **Pressure Ripple** on page two of the **Status Page**. The ripple should be less than 2% of the system pressure. (for system pressures above 1000psi, repeat **Wet Prime** if the ripple is too high)
6. After the column is equilibrated, **Purge** the autosampler. (initial conditions)
7. Run Samples.

SETUP PROCEDURES

Priming an idle system changing the mobile phase

1. Fill all of the solvent bottles with mobile phase.
2. For each line that will be used, starting with the organic solvent, perform a 3 minute **Wet Prime** at a flow rate of 7.5 mL/min. ******
3. Once all of the lines are primed, set the flow rate to 0 mL/min with the degasser **on** for 2 minutes.
4. Start the flow with the initial conditions of your chromatographic method. Equilibrate with 10 column volumes of solvent.
5. Check the **Pressure Ripple** on page two of the **Status Page**. The ripple should be less than 2% of the system pressure. (for system pressures above 1000psi, repeat wet prime if the pressure is too high)
6. After the column is equilibrated, **Purge** the autosampler. (initial conditions)
7. Run Samples.

Replacing the Needle Wash Frit (as needed or 6 months)

Remove all carousels and power off the 2690/5. Reach into the sample compartment and unscrew the lower frit retainer which located under the injector assembly. Remove the frit with a small diameter pick and discard. Wet the replacement frit with methanol and seat it completely within the retainer. Reinstall the lower retainer using a clockwise motion. Screw the retainer in by hand until it is firmly seated.

*** The degasser should never be left on with no flow for long periods of time. (i.e. overnight)**

**** Caution: To avoid precipitating salts in the Separations Module use an intermediate solvent such as water when you change from buffers to high-organic content solvents.**

The volume of each solvent line including the vacuum degasser chamber is 7.5 mL. This volume must be considered when priming the system and changing to a different mobile phase.

The degasser can be turned off, the flow rate stopped and the lamp turned off (if controlling the detector through the Alliance) in a Shutdown Method.

SETUP PROCEDURES

Priming the Seal Wash Pump (when needed)

1. Press the **Diag** screen key in the Main screen. The Diagnostic screen appears.
2. Attach the syringe adapter (from the Startup Kit) to the syringe.
3. Remove the solvent filter from the plunger seal wash inlet line or remove the plunger seal wash waste line from the waste container. (Either pushing solvent through it or drawing solvent through it can be used to prime the plunger seal wash pump.)
4. Fill the syringe with the plunger seal wash solvent* and attach the syringe adapter to the end of the plunger seal wash line or attach the syringe to the end of the plunger seal wash waste line.
5. Press the **Prime Sealwash** Screen key and then press the **Start** screen key. The plunger seal wash procedure begins. Push on the syringe to push seal wash solution through the system or draw on the syringe to pull solvent through the plunger seal wash pump.
6. When solvent flows out of the plunger seal wash line or into the syringe (the pump will run quieter when it is primed) press the **Halt** screen key.
7. Reinstall the solvent filter and place the seal wash inlet line back into the plunger seal wash reservoir or place the plunger seal wash waste line back into the waste container. To finish the priming push the **Start** screen key again.
8. Press **Close** to return to the diagnostics screen.

* Choose a Seal Wash solution that has high solubility with salts and/or buffers used in the mobile phase. (Usually a solution of 80-90% aqueous, 20-10% methanol.)

Priming the Needle Wash Pump (daily or weekly)

1. Make sure Needle Wash line (Green Line) is in its appropriate bottle.
2. Press the **Diag** screen key in the Main screen. The Diagnostics screen appears.
3. Press the **Prime NdlWsh** screen key. The 30-second needle wash procedure begins. If solvent does not flow out of the waste line (the yellow line) press the **Start Again** screen key.

* Choose a Needle Wash solution that your sample is soluble in. Buffered solutions or a mobile phase modifier such as TFA are not recommended. If these solutions are necessary they must be flushed from the instrument.

TROUBLE SHOOTING THE 2690/5

2690/5 System Error Messages

| MESSAGE | ACTION STEPS |
|--|---|
| Accumulator over pressure | Locate restriction... guard column / column / inline filter / blocked tubing. |
| Bubble found on intake | Wet prime and allow system to sit at zero flow with the degasser in continuous mode for approx. 10 min. prior to starting the run. If the flow rate is greater than 1 mL/min. install extended flow inlet tube. |
| Carousel malfunction | Cycle power. If message persists call Waters Service Representative. |
| Carousel Z axis malfunction | Cycle power. If message persists call Waters Service Representative. |
| Compression check failed | Solvent not degassed properly. Check for bubble on syringe plunger. Test seal pack and valve 3. Perform appropriate maintenance. |
| Degasser pressure fault | Replace faulty degasser chamber or vacuum pump. Call Waters Service Representative. |
| Lost prime | Solvent not degassed properly. Change check valves. If the flow rate is greater than 1 ml/min. install extended flow inlet tube. |
| Missing vial | The missing vial should be placed in the correct location in the tray. Disable the vial sensor [Main>>Config>>Highlight] "Verify vial presence" press clear. Call Waters Service Representative. |
| Needle malfunction | Check needle wash reservoir. Prime needle wash. Cycle power. If message persists call Waters Service Representative. |
| Plunger homing fault | Cycle power. Change inline filter. If message persists call Waters Service Representative. |
| Primary transducer range (volts) Sample | Call Waters Service Representative. |

TROUBLE SHOOTING THE 2690/5

2690/5 System Error Messages

| MESSAGE | ACTION STEPS |
|----------------------------------|--|
| Solvent delivery h/w fault | Cycle power. If message persists call Waters Service Representative. |
| Solvent delivery motor lost sync | Cycle power. Change inline filter. If message persists call Waters Service Representative. |
| Syringe Movement malfunction | Cycle power. If message persists call Waters Service Representative. |
| System over pressure | Locate restriction... guard column / column / inline filter / blocked tubing. |
| System under pressure | Connect column. Locate leak. 50 psi is needed to run the system. |

Chromatographic Errors

| SYMPTOMS | POSSIBLE CAUSES | CORRECTIVE ACTION |
|---------------------------|-----------------------------|---|
| Erratic retention times | Air bubble | Wet prime the unit. Degas all solvents. |
| | Malfunctioning check valves | Clean/ replace check valves. |
| | Solvent leak | Check all fittings. Replace seals. |
| | Chemistry | Check mobile phase, column, Gradient Proportioning Valve. |
| | Clogged solvent filters | Replace filters. |
| | Temperature | Use column oven. |
| Increased retention times | Incorrect flow rate | Malfunctioning check valve. Solvent leak. |
| | Incorrect Mobile Phase | Change solvent. |
| | Column Contaminated. | Clean/ replace the column. |

TROUBLE SHOOTING THE 2690/5

Chromatographic Errors

| SYMPTOMS | POSSIBLE CAUSES | CORRECTIVE ACTION |
|--------------------------------|-------------------------------|--|
| Reduced retention times | Incorrect flow rate | Change flow rate. |
| | Incorrect solvent composition | Change composition. Check gradient proportioning valve. |
| | High column temp. | Change column temp. |
| | Column contamination | Clean/replace column. |
| | Solvent not degassed | Degas solvent. |
| Reproducibility errors | Solvent not degassed | Degas solvent. |
| | Air in syringe | Purge solvent management system. |
| | Incompatible vial septa | Switch to approved vial and septa. |
| | Sample management system | Contact Waters Service Representative. |
| Baseline drift | Column not equilibrated | Equilibrate column. |
| | Detector not equilibrated | Allow detector to warm up. Time will vary with wavelength and sensitivity. |
| | Solvent contaminated | Use fresh solvent. |
| | Solvent not properly degassed | Degas solvent. |
| | Flow/ Pressure fluctuations | Prime system. Replace check valves, pump seals. |
| | Temperature fluctuations | Stabilize operating environment. |
| | Leaking flow cell | Repair leak. |
| | Dirty flow cell | Clean flow cell. |
| Baseline noise | Flow fluctuations | Malfunctioning check valve. Leaks, Seals, fittings. |
| | Radio frequency noise | Eliminate interference. |
| | Air in detector | Purge detector. |
| | Solvent not degassed | Degas solvent. |

TROUBLE SHOOTING THE 2690/5

Chromatographic Errors

| SYMPTOMS | POSSIBLE CAUSES | CORRECTIVE ACTION |
|-------------------------|--|--|
| Baseline noise | Solvents contaminated | Use fresh solvents. |
| | Column contaminated | Clean/ replace column. |
| | Dirty flow cell | Clean flow cell. |
| | Electronic | Call Waters Service Representative. |
| Sensitivity loss | Solvent leak | Check all fittings |
| | Degraded, contaminated, or improperly prepared sample. | Use fresh sample. |
| | Column contaminated | Clean/ replace column. |
| | Loss of column efficiency | Clean/ replace column. |
| | Leak in flow cell | Repair leak. |
| | Change in mobile phase | Correct mobile phase. (i.e. pH or ionic composition) |
| | Contaminated solvents | Use fresh mobile phase. |
| | Dirty flow cell | Clean flow cell. |
| Split peaks | Old Lamp | Replace lamp |
| | Needle wash solvent | Prime needle wash solvent. Solvent not appropriate for samples. |
| | Column | Clean/ Replace column. |

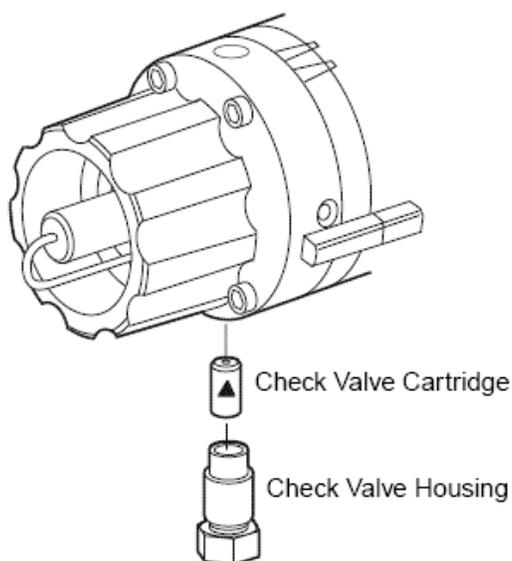
User maintenance of the 2690/5

The power on the 2690/5 should be cycled once a week to perform self-diagnostic and calibration routine.

Replacing an Inlet Check Valve Cartridge

1. From the Menu screen select [Diagnostics > Other Tests>Turn GPV off].
2. Remove the compression fitting from the check valve housing using a 5/16" wrench.
3. Using a 1/2" wrench to remove the check valve housing from the manifold.
4. Tip the check valve housing upside down to remove the old check valve cartridge.
5. Insert the new check valve cartridge into the check valve housing with the arrow or the two holes facing up.
6. Using a 1/2" wrench to reinstall the check valve housing to the manifold. (do not over-tighten)
7. Using a 5/16" wrench reconnect the compression tubing to the check valve housing. (to prevent over-tightening of the check valve housing, use a 1/2" wrench to prevent the housing from moving)
8. Exit out of diagnostics.
9. Prime and degas the system.

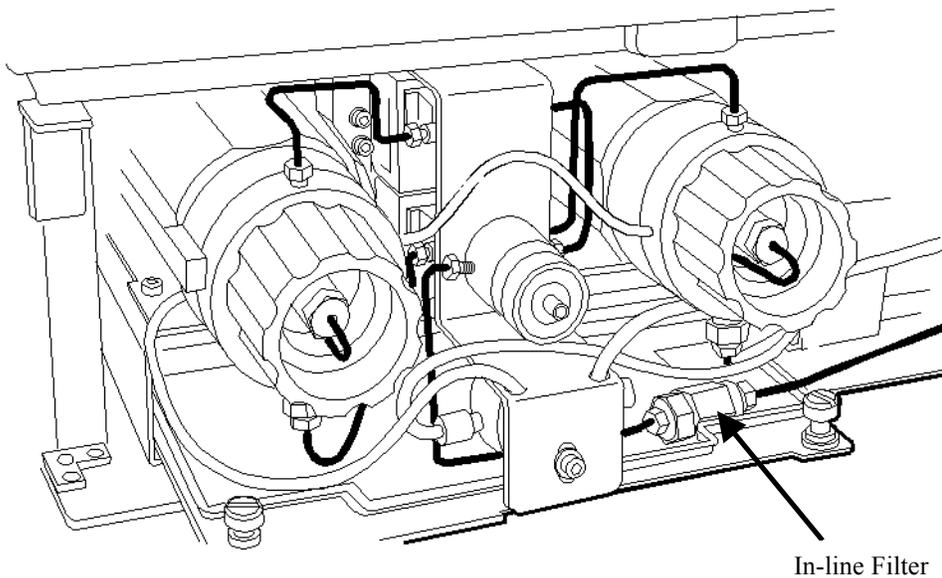
NOTE: Check valve cartridges may be cleaned. Sonicate check valve cartridges in water for 15 minutes and in an appropriate organic solvent for an additional 15 minutes.



User maintenance of the 2690/5

Replacing the In-Line Filter

1. Use a 5/8" wrench and a 5/16" wrench to separate the compression screw on the left side of the in-line filter from the in-line filter inlet housing.
2. Use a 5/8" wrench to hold the filter outlet housing while you loosen the inlet housing with another 5/8" wrench.
3. Tip the housing upside down to remove the in-line filter element.
4. Insert the replacement in-line filter element.
5. Reconnect the in-line filter inlet and outlet housing using two 5/8" wrenches.
6. Reconnect the compression screw into the inlet housing.
7. Inspect connections for leaks.



ATTENTION: The in-line filter insert should be replaced every 6 months or whenever a significant increase in back pressure is seen on the system transducer.

User maintenance of the 2690/5

Replacing Plunger Seals and Face Seals

Plunger Seal Replacement

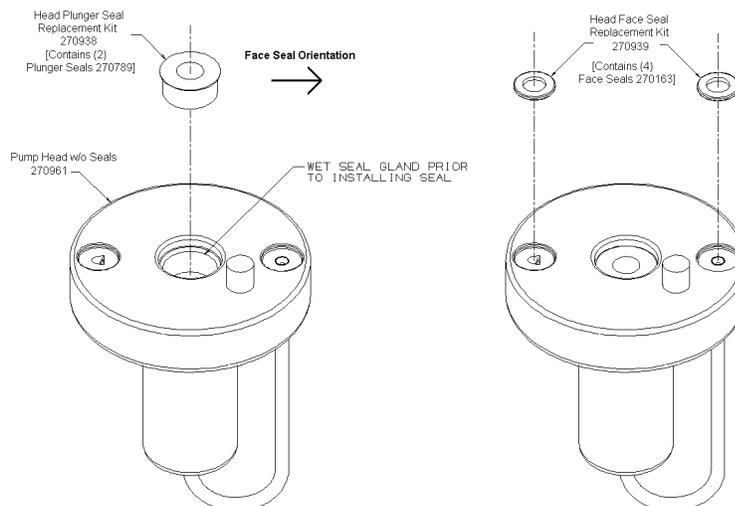
1. Press the **Diagnostic** screen from the Main screen.
2. Press the **Other Test** screen key in the Diagnostics screen.
3. Select **Head Removal and Replacement** from the list.
4. Follow the directions that appear in the Head Removal and Replacement screen.
5. Remove the plunger seal using the Seal removal tool (P/N WAT039803).
6. Wet the seals and the seal opening with methanol.
7. Insert the plunger seal using the seal insertion tool (P/N WAT270969).

Face Seal Replacement

1. Follow directions 1-4 from the plunger seal replacement directions.
2. Remove face seals using plastic tweezers.
3. Wet the seals and the seal opening with methanol.
4. Replace the face seals in the seal openings using a clean flat object.
5. Follow the directions that appear in the Head Removal and Replacement screen.
6. Prime the system and allow 10 minutes to degas the mobile phase before running the system.

NOTE: Plunger seals and face seals should be replaced at the same time.

ATTENTION: To avoid damage to the sealing surfaces do not use sharp tools.



2690/5 SPARE PARTS

| Description | Part Number |
|---|--------------------|
| 2500 µL Syringe | WAT077342 |
| 250 µL Syringe | WAT073109 |
| 25 µL Syringe | WAT077343 |
| Plunger Seals (kit) | WAT270938 |
| Face Seals (kit) | WAT270939 |
| Check Valve Cartridge (2) | WAT270941 |
| High Flow Inlet Tubing | WAT270968 |
| 2 mL Loop | WAT096106 |
| 200 µL Loop | WAT045584 |
| Vials with Preslit Septa | 186000307 |
| Total Recovery Vials with Preslit Septa | 186000385 |
| In-Line Filter Insert | WAT088084 |
| Needle Wash Frit (5) | 700001318 |
| PerformancePLUS Needle | 700001326 |
| Optional Solvent Tray | 205000329 |
| Alliance Interactive System Support CD | 715000116 |