

ACQUITY UPLC Systems WEEK 2 Workbook



FSE Training Workbook

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Section 2 : Installation



FSE Training Workbook

Installation

- ❑ The first thing the you should be familiar with before installing an Acquity UPLC system is the **System Prep Guide**.
- ❑ Locate the **Waters Acquity UPLC System Site Preparation Guide**, part number 715000878 on the portal. Always use the latest revision.
- ❑ Take the time read through this document. It is the responsibility of the customer to make sure all of these specifications are met before you arrive. If the specs are not meet the customer will be charged a rescheduling fee plus travel costs.
- ❑ Who does the customer return the completed System Prep Guide to?

Installation

- ❑ The next step will be the Installation Checklist.
- ❑ Locate the **Waters ACQUITY UPLC® System Installation Tips** (part number 715001907) on the portal. Then print a copy, make sure everyone in the group gets a copy.
- ❑ Locate the **Waters ACQUITY UPLC® Systems Installation Checklist** (part number 715000877) on the portal. Then print a copy, make sure everyone in the group gets a copy.
- ❑ Locate the **Installing System Leak Sensors** (part number 715001557) on the portal. Then print a copy, make sure everyone in the group gets a copy.
- ❑ These documents will be your responsibility to fill out.
- ❑ Read through and perform **Waters ACQUITY UPLC® Systems Installation Checklist** up to page 13. You may find extra information about plumbing the system by looking at the **Acquity UPLC Systems Operator's Guide 71500082502. DO NOT PRINT.** Download only from the portal.

Section 3 : System Verification Tests



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System Verification Exercise

Objectives

- ❑ By the end of this exercise you will:
 - ❑ Be proficient in running the ACQUITY Startup Verification tests and demonstrating proper system function.

Procedures

- ❑ Refer to the Masslynx 4.1 Software Foundational if necessary and/or to the **Tips and Techniques for Masslynx 4.1** in Annexe 1.
- ❑ Equipment necessary
 - ❑ ACQUITY UPLC BEH C18 (2.1 x 50 mm, 1.7 µm, P/N 186002350)
 - ❑ Waters ACQUITY UPLC System Absorbance Startup Solution (TUV and PDA) 700002669
 - ❑ Acetonitrile HPLC grade (1L)
 - ❑ MilliQ Water (1L)
 - ❑ Printer

System Verification Exercise

- ☐ Return to the Installation checklist, page 20, section « Acquity UPLC System Power-up, Visible Leak and Performance tests »
- ☐ Perform the System Verification tests as detailed in the **ACQUITY Start-up Verification test procedure**, P/N 715001134 available on the Knowledge Portal.
- ☐ Save the Inlet Method for the System Precision test as "**System Precision IM**"
- ☐ Save the Inlet Method for the Gradient Test as "**Gradient IM**"
- ☐ Create a Sample Set for the System Precision test and save it as "**System Precision SSM**"
- ☐ Create a Sample Set for the Gradient test and save it as "**Gradient SSM**"
- ☐ Fill the appropriate results tables of the installation checklist.

System Verification Exercise

- ☐ Do the Precision Test results meet the specifications for RT Area and Height Reproducibility?

- ☐ Do the results meet the specifications for RT Reproducibility ?

- ☐ As an extra step, calculate the Area and Height Reproducibility for the acetophenone peak of the gradient mixture.

- ☐ %RSD Area

- ☐ %RSD Height

- ☐ Are the results better or worse then the Caffeine Precision Results?

- ☐ This completes the Verification System exercise.

Section 4 : Binary Solvent Manager



FSE Training Workbook

BSM Exercise

Objectives

- ❑ The objective of this exercise is to:
 - Understand the design, components, maintenance practices and console diagnostics for the Binary Solvent Manager.
- ❑ Please refer to (document available on the Portal):
 - ❑ Acquity UPLC systems Operators Guide 715000082502
 - ❑ Performance Maintenance Protocol of the BSM, 715001008
 - ❑ Intelligent Intake Valve maintenance instruction

BSM Exercise

- The following Tables indicate those procedures that are performed most frequently including those procedures we can expect a customer to perform and therefore should be educated to perform. By the end of this lab session you should have either physically performed all of the identified tasks or familiarized yourself with the appropriate procedures.

BINARY SOLVENT MANAGER					
TASK / PROCEDURE	PM	Frequent Task	Customer Task	Video Exists	Doc. No.
Loading the Firmware		√		√	715001058
Intelligent Intake Valves Maintenance Instructions	√				Procedure in the Portal
Installing the Hexane/Tetrahydrofuran Adapter Kit		√			Procedure in the Portal
Upgrading to the Intelligent Intake Valve				√	Procedure in the Portal
Replacing the Actuator		√			Procedure in the Portal
Replacing the CPU 2000 / Personality Card				√	Procedure in the Portal
Replacing the Degasser Assembly		√			Procedure in the Portal
Replacing the Power Supply					Procedure in the Portal
Replacing the Solvent Select Valve					Procedure in the Portal

BSM Exercise

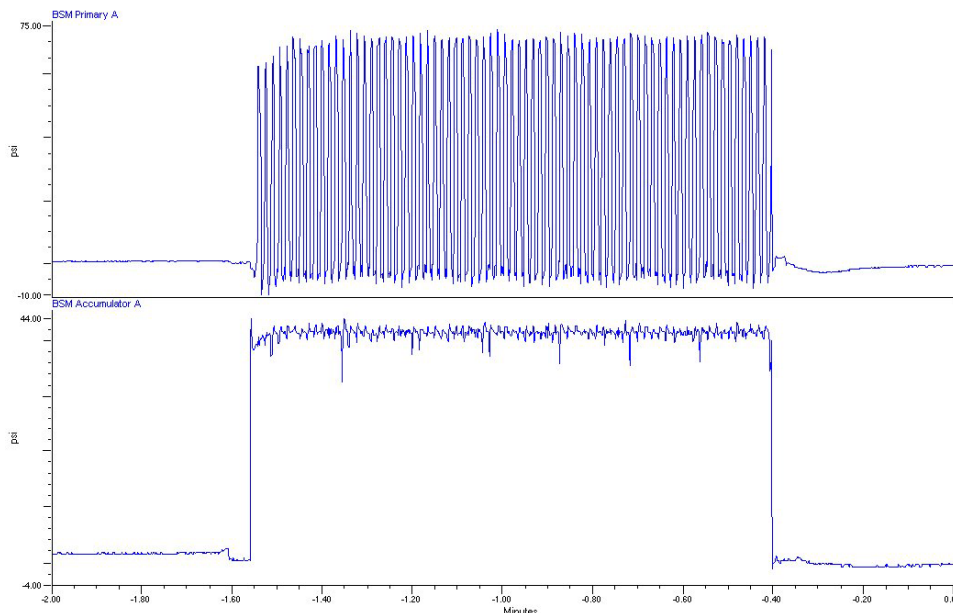
BINARY SOLVENT MANAGER					
TASK / PROCEDURE	PM	Frequent Task	Customer Task	Video Exists	Doc. No.
Replacing the Wash Pump					Procedure in the Portal
Replace the Plunger Seals	√		√	√	71500082502
Replace the Seal Wash Seals	√		√	√	71500082502
Replace the Plungers	√				71500082502
Replace The Solvent Filters	√		√		71500082502
Replace the Check Valves	√		√	√	71500082502
Replace the Inline Filter	√				716001783
Replace the Filter/Mixer	√		√		71500082502
Replace the PTFE O-Ring	√				71500082502
Replace/Clean the Air Filters	√		√		71500082502
Replace the Tubing and Fittings	√				71500082502
Inspect the Fan	√				
Inspect the Waste Management	√				
Replace the Vent Valve Cartridge	√		√	√	71500082502
Replace the I ² V Valve Cartridge	√				71500082502
Replace the inline filter cartridge on the I ² V valve Actuator		√	√		71500082502
Replace the Rear Panel Fuses		√	√		71500082502
Leak Sensor Maintenance Instructions	√	√	√		71500082506

BSM Exercise

Activities

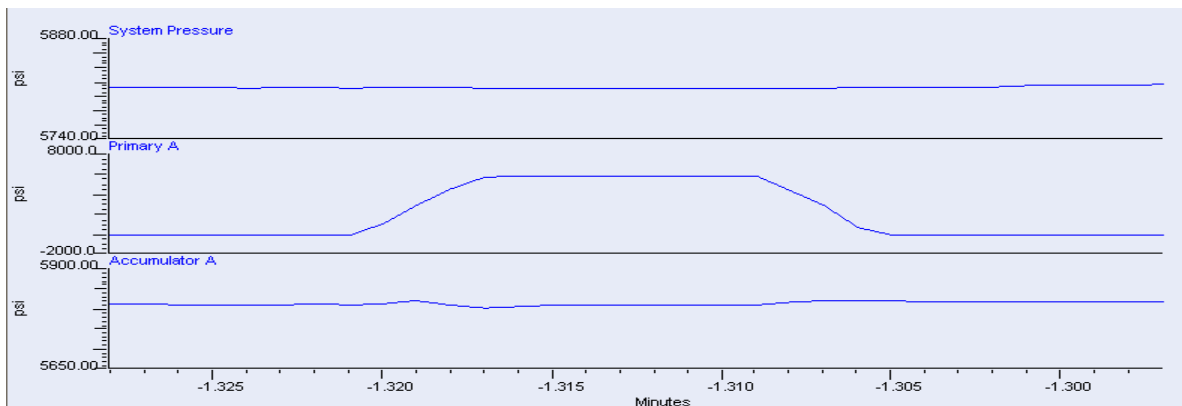
ACQUITY Console

- ❑ The ACQUITY Console serves as the front panel user interface, diagnostic menu and main source for testing and maintenance procedures for the Binary Solvent Manager as well as the other ACQUITY UPLC™ system modules.
- ❑ The following activity is a guideline to step you through the usage of the console diagnostics.
- ❑ Access the upper level console diagnostics for the Binary Solvent Manager.
- ❑ Access the Prime A/B Solvents menu from the Control menu. Prime the A1 solvent for 1.00 minutes.
- ❑ The plot should look similar to the figure below.



BSM Exercise

- ☐ Prime the B1 solvent for 1.00 minute.
- ☐ Observe the pressure traces for the priming sequence from the console menu.
- ☐ Right click on one of the pressure plots and choose Properties from the menu. Set the plot properties to show the Primary A, Accumulator A and System Pressure channels.
- ☐ Set the flow on Solvent Manager A for 0.2 ml/min. Allow the Solvent Manager to run for 3 minutes.
- ☐ Observe the Primary A and Accumulator A plots as well as the system pressure.
- ☐ Note that the pressure traces are all auto-scaled by default. Similar to a chromatogram real-time plot before the peaks elute, the system pressure in particular will show excessive detail. It is important to note the Y scale of the current display.
- ☐ Note the characteristic shape of the Primary A pressure trace.
- ☐ Stop the real time plot on the console menu and zoom in on just 1 Primary stroke of the plot. The plot should look like the figure below.



BSM Exercise

- ☐ How do you explain the difference in shape between the Primary A and Accumulator A?

- ☐ Check the Delta value for the Pressure Ripple from the console menu.
- ☐ Record this value in a **log entry** by choosing **Create Log Entry** from the **Maintain** menu. Record the name of your group in the description as well
- ☐ Set the plot properties to show the Primary B Accumulator B and System Pressure channels.
- ☐ Repeat the above steps for the B-side with solvent B1.
- ☐ Enter the **log entry** with the value for the Delta value for the Pressure Ripple as performed above.
- ☐ Access the BSM Interactive menu.
- ☐ Click the Control button on the right side of the menu to gain control of the menu
- ☐ What fields do you have access to once the control is enabled?

BSM Exercise

Static Decay Test

- ❑ The static decay test performs a pressure ramp-up. It also monitors the pressure decay in the solvent manager to determine whether the check valves, tubes, fittings, or plunger seals are faulty. Perform the static decay test whenever you
 - suspect leakage in the check valves or plunger seals.
 - perform maintenance on the binary solvent manager.
 - replace fittings in the fluid path.
- ❑ **Requirement:**
 - If you replaced the seals, run the solvent manager at 96527 kPa (965 bar, 14000 psi) for a half-hour before performing the static decay test.
 - Neglecting to properly break-in the seals may cause testing failure.
 - **Tip:** The static decay test is not recommended as a qualification test. You should perform this test only if you are experiencing performance problems with the binary solvent manager.

BSM Exercise

- ❑ **To perform the static decay test (read these information, the test will be performed later)**
 - Make sure that all the fittings on the solvent manager are tight.
 - In the ACQUITY UPLC Console, select Binary Solvent Manager from the system tree.
 - Click Maintain > Static decay test.
 - In the Static Decay Test dialog box, in the Test Parameters area, select a module (pump) to test.
 - In the Accumulator text box, specify your typical operating pressure:
 - **Range:** 34474 to 103421 kPa (345 to 1034 bar, 5000 to 15000 psi)
 - **Default:** 96527 kPa (965 bar, 14000 psi)
 - Click Start. The test time appears in the Run Time bar graph.
 - When the test ends, the Results pane appears.
- ❑ The main test criterion is the decay rate. A rate of 3447 kPa/min (34 bar, 500 psi) for each actuator indicates a successful, or “passed” test. Other aspects of the static decay that determine pass/fail status include percent of stroke and final pressure. For example, excessive primary pressure while the accumulator is compressed triggers an accumulator failure, the result of excessive valve leakage.

BSM Exercise

- ❑ Right click on one of the pressure plots and choose Properties from the menu. Set the plot properties to show the Primary B, Accumulator B and System Pressure channels.
- ❑ **Perform the Static Decay test for Solvent Manager B.** This test should take about 5 minutes to complete.
- ❑ Check the results for successful passing of the test. Observe the characteristics of the plot for a typical Static Decay Test (see figure below).



BSM Exercise

- ☐ Switch flow back to solvent A1.
- ☐ Set the plot properties to show the Primary A, Accumulator A and System Pressure channels.
- ☐ Repeat the above test Static Decay Test for Solvent Manager A.

BSM Exercise

Dynamic leak test

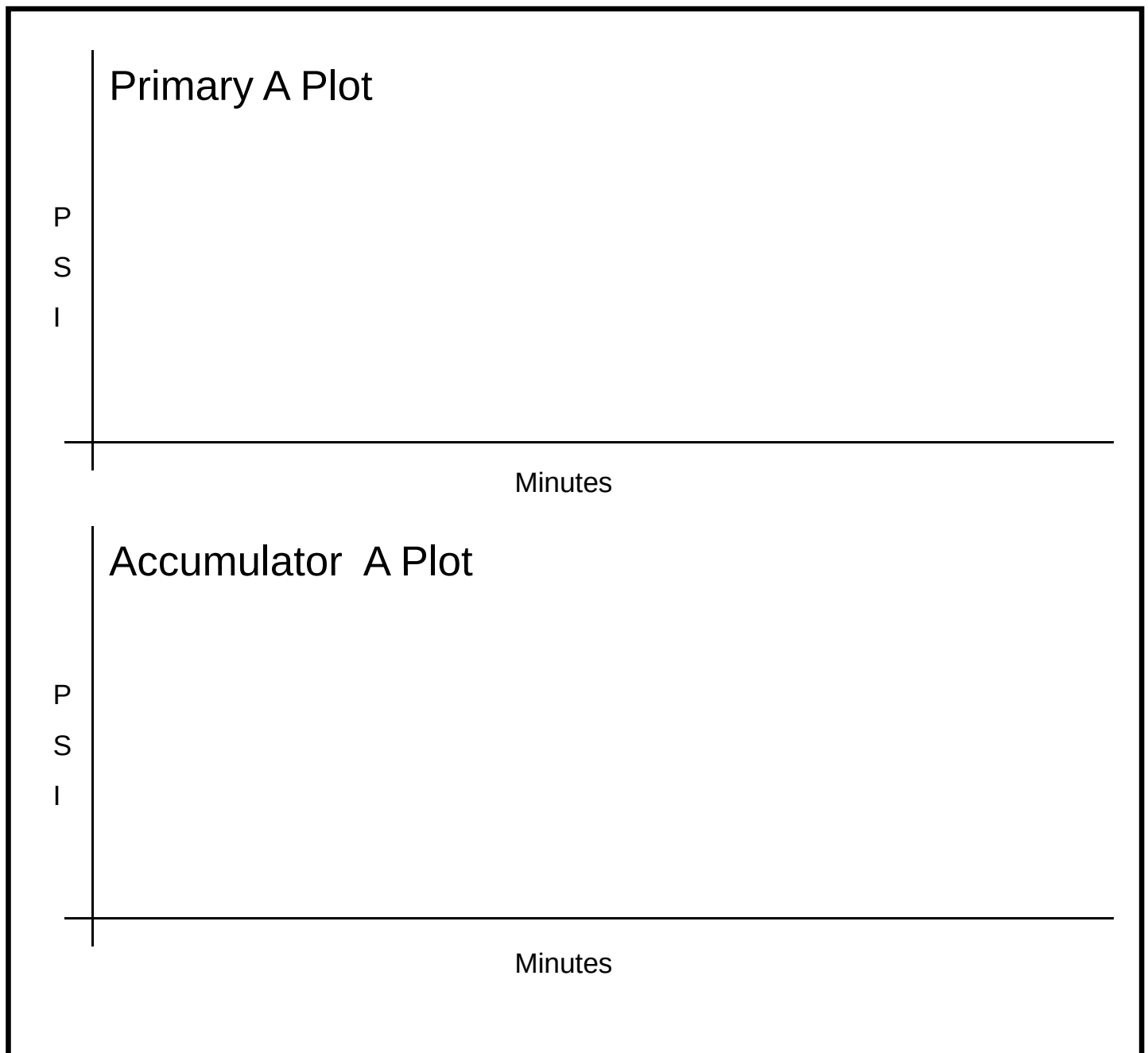
- The dynamic leak test performs a pressure ramp-up, and then employs feedback control to maintain constant pressure within the solvent manager. By monitoring plunger travel during the constant pressure phase, it calculates the leak rates of the Primary and Accumulator actuators. These leak rates can indicate whether the check valves, tubes, fittings, or plunger seals are faulty. Perform the dynamic leak test whenever you
 - suspect leakage in the check valves or plunger seals.
 - perform maintenance on the binary solvent manager.
 - replace fittings in the fluid path.
- **Requirement:**
 - If you replaced the seals, run the binary solvent manager at 96527 kPa (965 bar, 14000 psi) for 30 minutes before performing the dynamic leak test. Neglecting to properly break-in the seals may cause testing failure.
 - **Tip:** The dynamic leak test is not recommended as a qualification test. You should perform this test only if you are experiencing performance problems with the binary solvent manager.

BSM Exercise

- ❑ **To perform the dynamic leak test (read these information, the test will be performed later)**
 - Make sure that all the fittings on the solvent manager are tight.
 - In the ACQUITY UPLC Console, select Binary Solvent Manager from the system tree.
 - Click Maintain > Dynamic leak test. The Dynamic Leak Test dialog box appears.
 - In the Test Parameters area, select a module (pump) to test.
 - In the Accumulator text box, specify your typical operating pressure:
 - **Range:** 34474 to 103421 kPa (345 to 1034 bar, 5000 to 15000 psi)
 - **Default:** 96527 kPa (965 bar, 14000 psi)
 - Click Start. The test time appears in the Run Time bar graph.
 - When the test ends, the Results pane appears.
- ❑ The main test criterion is the leak rate. A rate below 150 nL/min for each actuator indicates a successful, or “passed” test. Other aspects of the test that determine pass/fail include percent of stroke to attain pressure and plunger travel limits.

BSM Exercise

- ❑ Perform Dynamic Leak Test for Solvent Manager A and B.
- ❑ Draw and compare the Static Decay and Dynamic Leak Test Plot for Pump A



BSM Exercise

Performance Maintenance Procedures

- ❑ Perform all the procedures detailed in the Performance Maintenance Protocol of the BSM, document number 715001008
- ❑ Refer to the maintenance procedures describe in the ACQUITY UPLC System Operators Guide document number 71500082502 and the Intelligent Intake Valve (i2Valve) maintenance instructions.
- ❑ For this exercise, **just perform the procedures on the 2 pump heads of 1 pump (A or B)** rather than all four as is done in the PM procedure.
- ❑ Just remove and replace the existing items rather than replacing each one with a new part. The only exception would be the high pressure seals as they are almost always destroyed as part of the removal process.
- ❑ Obviously during a true customer PM visit all parts would be replaced with new ones.

BSM Exercise

- ❑ After the PM procedure is done, on the pump you have worked with, set the flow rate for 0.5ml/min 100% of A or B line. After 3 minutes, note the pressure ripple delta value.
- ❑ Enter the log entry with the description of the service you performed as well as the value for the Delta Pressure Ripple as performed above.

BSM Exercise

- ☐ After completing the PM visit and check that the BSM is working properly :
 - ☐ Close the console and Masslynx Software
 - ☐ Power Off the Acquity UPLC system
 - ☐ Disconnect the BSM from the AutoSampler
 - ☐ Disconnect the UV detector from the Autosampler
 - ☐ Disconnect the power cordon
 - ☐ Remove the UV detector and the AutoSampler from the top of the BSM
 - ☐ Remove the top, right and left panels of the pump
 - ☐ Locate :
 - ☐ The Personnality A
 - ☐ The personnality B
 - ☐ The CPU 2000 A
 - ☐ The CPU 2000 B
 - ☐ Battery A
 - ☐ Battery B
 - ☐ The Degasser Chamber
 - ☐ The Degasser PCB Assy
 - ☐ 4 Pump Actuators
 - ☐ Transducer Board
 - ☐ Power Supply

BSM Exercise

- ☐ Referring to the procedures available in the Portal :
 - ☐ Replace one Actuator
 - ☐ Replace the Degasser chamber
 - ☐ Replace the CPU/Personnality card
- ☐ On the personnality board, locate the **Software Jumper**. Compare this Jumper settings from A to B.

- ☐ How are configured the dip switches of the degasser PCB assy ?

- ☐ After completing the tasks listed above, reconnect the BSM to the UPLC system and make appropriate tests to prove the proper functioning of the pump.
- ☐ **This concludes the Binary Solvent Manager – Console Diagnostics and Service Procedures exercise.**

Section 5 : AutoSampler



FSE Training Workbook

AutoSampler Exercise

Objectives

- ❑ By the end of this exercise you will:
 - ❑ Be familiar with the Sample Manager console menus
 - ❑ Have first hand knowledge of the most important Sample Manager Diagnostic tests and procedures
 - ❑ Know the characteristics of the Sample pressure trace during various operations
 - ❑ Have first knowledge of Injection Modes
- ❑ Please refer to (document available on the Portal):
 - ❑ Acquity UPLC systems Operators Guide 715000082502
 - ❑ Performance Maintenance Protocol of the AutoSampler, 715001007
- ❑ The following Tables indicate those procedures that are performed most frequently including those procedures we can expect a customer to perform and therefore should be educated to perform. By the end of this lab session you should have either physically performed all of the identified tasks or familiarized yourself with the appropriate procedures.

AutoSampler Exercise

SAMPLE MANAGER					
TASK / PROCEDURE	PM	Frequent Task	Customer Task	Video Exists	Doc. No
Calibrating the Volume Detection Device	✓	✓			Procedure in the Portal
Applying the Tubing Markers					715001336
Replacing the Y Carriage		✓			715001639
Assessing the Switching Valves or Outlet Tubing					715001708
Replacing/Adjusting the Wash Station O-ring	✓				Procedure in the Portal
Replacing the MSV Head					Procedure in the Portal
Installing a Drain Hole Sleeve					715001999
Replacing the XYZ Mechanism					715002000
Installing the Hexane/ Tetrahydrofuran Adapter Kit		✓			715001473
Replacing the CPU 2000/Personality/Barrier Card		✓		✓	Procedure in the Portal
Replace the Fluidics Drawer		✓			Procedure in the Portal
Replace the Needle Wash Housing		✓			Procedure in the Portal
Replacing the Power Supply					Procedure in the Portal
Replacing the Pressure Transducer					Procedure in the Portal
Replacing the Syringe Drive Assembly					Procedure in the Portal
Replacing the Valve Manifold					Procedure in the Portal
Replacing the Wash Syringe Drive					Procedure in the Portal
Replacing the XYZZ Belts					Procedure in the Portal

AutoSampler Exercise

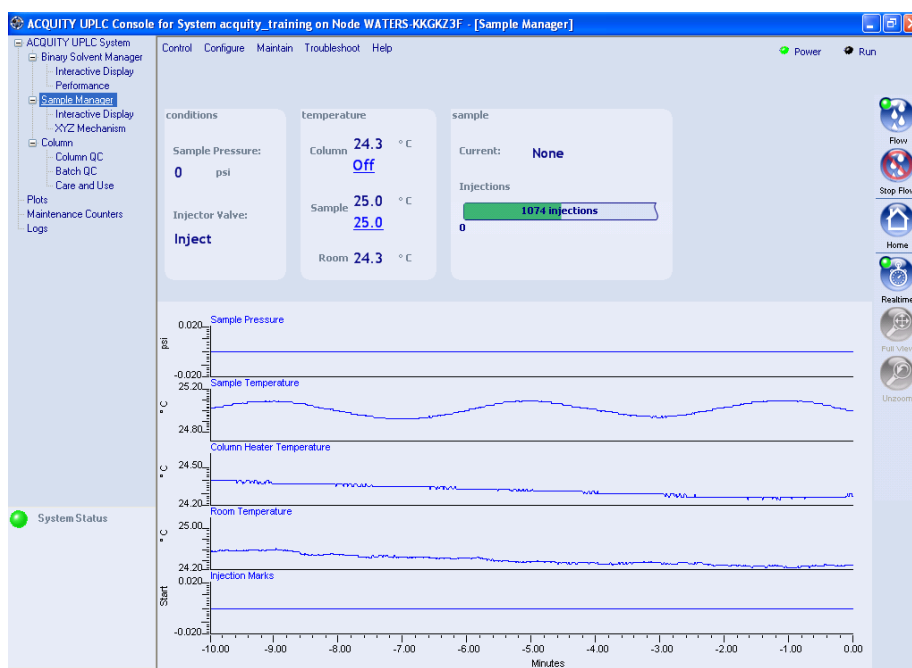
SAMPLE MANAGER					
TASK / PROCEDURE	PM	Frequent Task	Customer Task	Video Exists	Doc. No
Replacing the Sample Needle	✓	✓	✓	✓	71500082502
Replace the Wash Syringes	✓		✓	✓	71500082502
Replace the Sample Syringe	✓		✓	✓	71500082502
Replace the Sample Loop	✓	✓	✓	✓	71500082502
Replace the Inject Valve Cartridge	✓			✓	71500097502
Calibrate the XYZ Mechanism	✓		✓	✓	71500082502
Calibrate the Needle Z-axis	✓		✓	✓	71500082502
Characterize the Needle Seal	✓		✓	✓	71500082502
Characterize the Needle and Sample Loop Volume	✓		✓	✓	71500082502
Test the Sample Manager Back Pressure Regulator	✓				71500082502
Cleaning the Injection Valve					715002168
Replace Tubing and Fittings	✓				715001007
Inspect the Fan	✓				
Inspect the Needle wash Station	✓				
Defrost the Sample Compartment	✓		✓		71500082502
Upgrading the Firmware using an Ethernet Connection		✓		✓	715002089
Performing the Sample Syringe, Wash Syringe and Needle Seal Leak Tests	✓	✓	✓	✓	715002089
Resetting the Injection Counters		✓	✓		71500082502
Create Log Entries	✓	✓	✓		71500082502
Replace the Puncture Needle Holder			✓		71500082502

AutoSampler Exercise

Activities

Sample Manager Console Diagnostics

- ☐ Access the ACQUITY Console.
- ☐ Go to the Sample Manager main console menu. You should see the menu as shown in the figure below.



- ☐ Perform the Prime Syringes (wash and sample) operation from the Control menu. Choose 3 for the number of cycles.
 - ☐ What was the maximum sample pressure you saw during the priming sequence?
-

AutoSampler Exercise

- ☐ Right-click on the Sample Manager Plots in the center of the console and choose properties. Click the SM Channels tab of the plot properties menu
- ☐ Remove the check mark from all channels of the menu except the Sample Pressure channel. This will allow you to see the Sample pressure profiles of the various operations and tests better.
- ☐ Perform the Needle Wash procedure with 200ul of Strong solvent and 600ul of Weak solvent.
- ☐ Look at the Sample Pressure plot to check the characteristics of the Needle Wash operation.

AutoSampler Exercise

Performing the sample syringe leak test

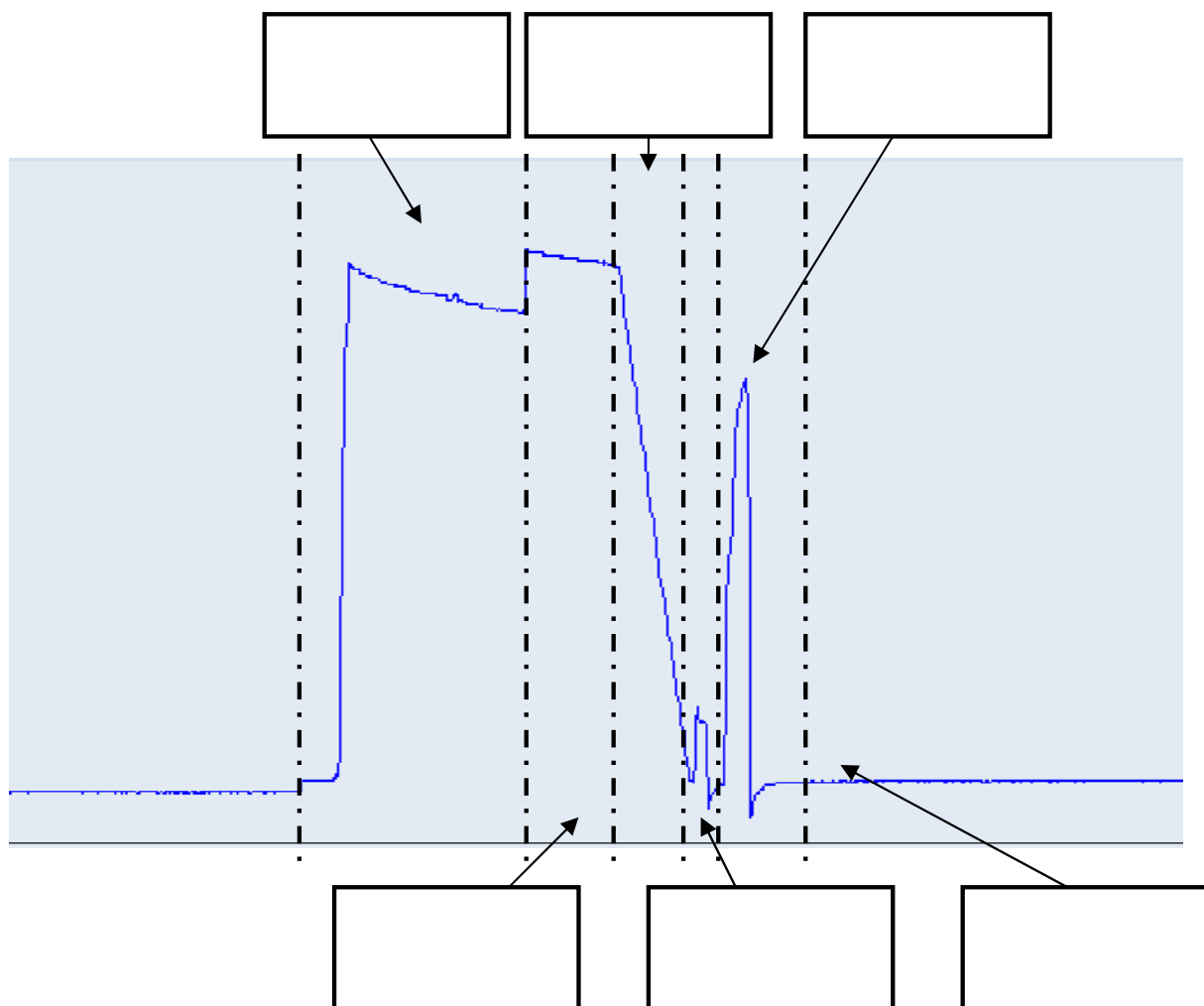
- ❑ The sample syringe leak test checks for leaks in the path between the sample syringe and the injection valve.
- ❑ **Tip:** The sample syringe leak test is not recommended as a qualification test. You should perform this test only if you are experiencing performance problems with the sample manager.

To perform the sample syringe leak test:

- ❑ Make sure that all the fittings on the sample manager are tight.
- ❑ **Recommendation:** Prime the sample syringe three times before starting the sample syringe leak test.
- ❑ In the ACQUITY UPLC Console, select Sample Manager from the system tree.
- ❑ Click **Maintain > Leak Test > Sample syringe**
- ❑ Click Start. The test time appears in the Run Time bar graph.
- ❑ When the test ends, the Results pane appears.

AutoSampler Exercise

- Look at the Sample Syringe Leak Test Plot below. To what action correspond each section (marked out by the dotted lines) and in what position is the Injector valve ?



AutoSampler Exercise

Performing the wash syringe leak test

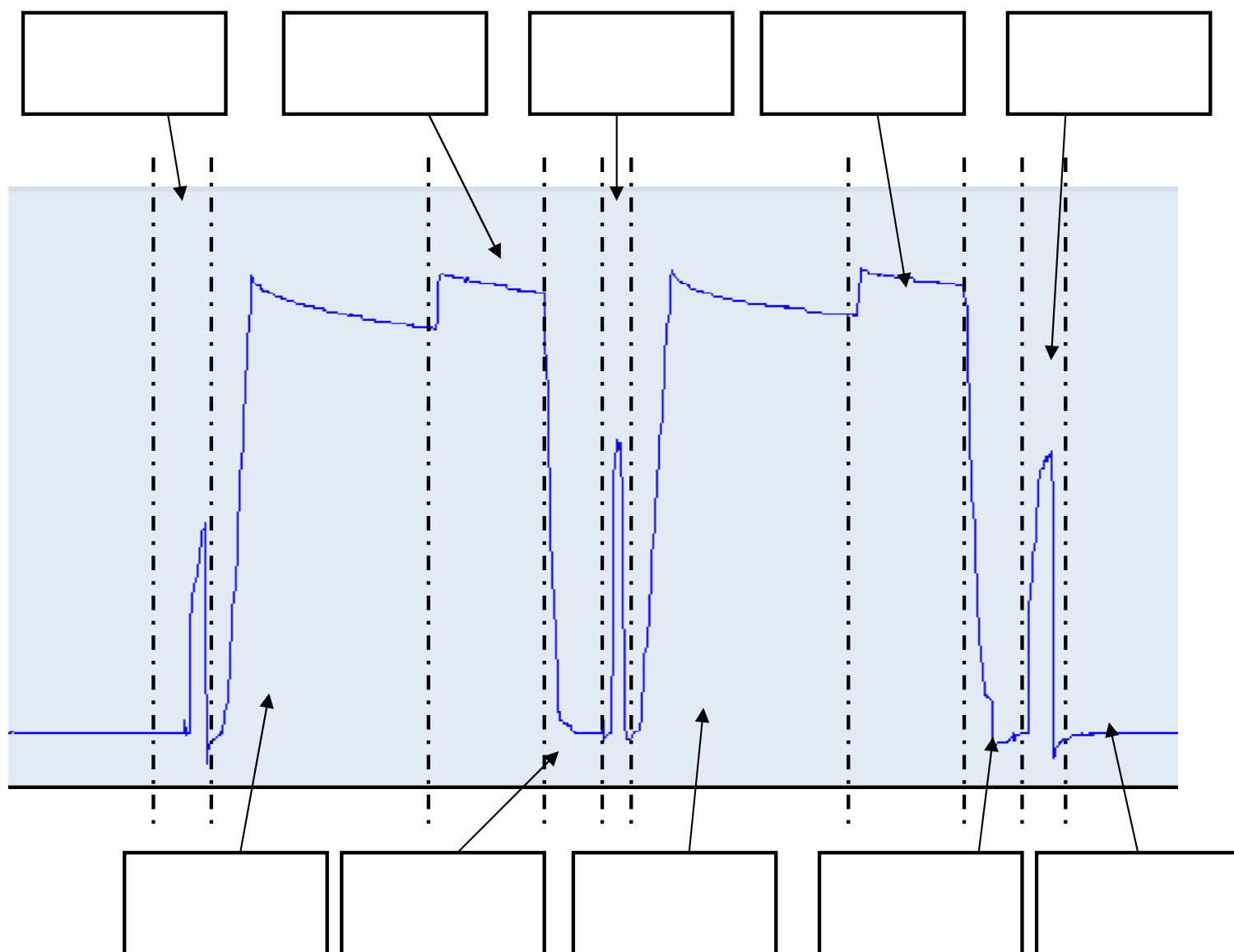
- ❑ The wash syringe leak test checks for leaks in the path between the weak and strong wash syringes and the injection valve.
- ❑ **Tip:** The wash syringe leak test is not recommended as a qualification test.
- ❑ You should perform this test only if you are experiencing performance problems with the sample manager.

To perform the wash syringe leak test:

- ❑ Make sure that all the fittings on the sample manager are tight.
- ❑ **Recommendation:** Perform a prime before starting the wash syringe leak test.
- ❑ In the ACQUITY UPLC Console, select Sample Manager from the system tree.
- ❑ Click **Maintain > Leak Test > Wash syringe**
- ❑ Click Start. The test time appears in the Run Time bar graph.
- ❑ When the test ends, the Results pane appears.

AutoSampler Exercise

- Look at the Wash Syringe Leak Test Plot below. To what action correspond each section and in what position is the Injector valve ?



AutoSampler Exercise

Performing the needle seal leak test

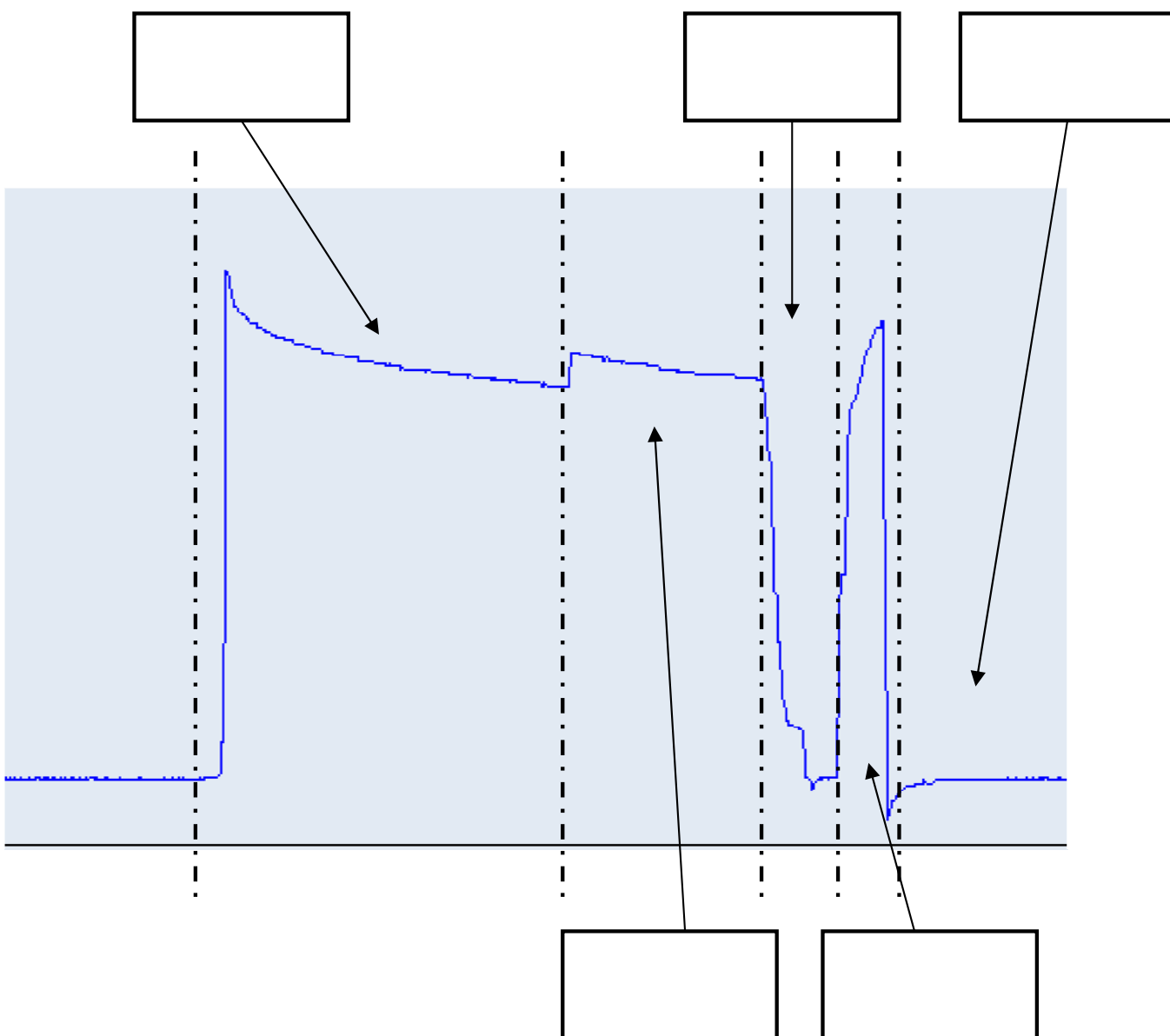
- ❑ The needle seal leak test determines whether seal leaks exist in the path between the weak wash and sample syringes.
- ❑ **Tip:** The needle seal leak test is not recommended as a qualification test. You should perform this test only if you are experiencing performance problems with the sample manager.

To perform the needle seal leak test:

- ❑ Make sure that all the fittings on the sample manager are tight.
- ❑ **Recommendation:** Perform a prime before starting the needle seal leak test.
- ❑ In the ACQUITY UPLC Console, select Sample Manager from the system tree.
- ❑ Click **Maintain > Leak Test > Needle seal**
- ❑ Click Start. The test time appears in the Run Time bar graph.
- ❑ When the test ends, the Results pane appears.

AutoSampler Exercise

- Look at the Needle Seal Leak Test Plot below. To what action correspond each section and in what position is the Injector valve ?



AutoSampler Exercise

- ❑ Perform the Back Pressure Regulator test and check the results. Draw the Sample pressure plot for the pressure profile for this test below.



- ❑ Check to see if you can find the results of these tests in the Logs Console tree menu by filtering for diagnostics in the Content menu. This will be a useful tool for checking results from previous service visits and comparing them with current results.

AutoSampler Exercise

Calibrating the XYZ Mechanism

- ☐ Perform the “Calibrating the XYZ Mechanism” procedure .
- ☐ It is important that each member of the group physically practices this procedure as it is an important one.
- ☐ If you are unsure that the needle is correctly aligned above the teach block, have one of the instructors check your answers before saving the calibration results. This is very important to avoid bent needles resulting from improper calibration of the XY and Zp axes. It is quite important that you learn to do these tests properly as they will need to be performed on a regular basis during service calls.
- ☐ The Sample Manager’s XY and Zp axes are calibrated.
 - ☐ X Offset: _____ mm
 - ☐ Y Offset: _____ mm
 - ☐ Zp Offset: _____ mm
- ☐ What is the offset limit for each axe ?

AutoSampler Exercise

Calibrate the Needle Z-axis

- ☐ Perform the "Calibrating the Needle-Z axis" procedure .
- ☐ It is important that each member of the group physically practices this procedure as it is an important one.
 - ☐ Z Offset: _____ mm

Characterize Needle Seal Test

- ☐ Perform the "Characterize Needle Seal" procedure.
 - ☐ Pressure: _____ psi
 - ☐ Offset: _____ mm

Characterize Needle and Loop volume test

- ☐ Perform the "Characterize Needle and Loop volume " procedure .
- ☐ Check and Note the results for
 - ☐ System Volume with Loop _____
 - ☐ System Volume without Loop _____
 - ☐ Loop _____
 - ☐ Needle _____

AutoSampler Exercise

Performance Maintenance Procedures

- ☐ Perform all the procedures detailed in the Performance Maintenance Protocol of the AutoSampler, document number 715001007.
- ☐ Fill all the PM Protocol.
- ☐ Refer to the maintenance procedures describe in the ACQUITY UPLC System Operators Guide document number 71500082502
- ☐ Just remove and replace the existing items rather than replacing each one with a new part.
- ☐ Obviously during a true customer PM visit all parts would be replaced with new ones.
- ☐ Note the results for the Post-Performance Maintenance Tests
 - ☐ X Offset: _____ mm
 - ☐ Y Offset: _____ mm
 - ☐ Zp Offset: _____ mm
 - ☐ Z Offset: _____ mm
 - ☐ Needle seal Pressure: _____ psi
 - ☐ Needle Offset: _____ mm
 - ☐ VDD Calibration _____ µl
 - ☐ Loop volume _____ µl
 - ☐ Needle volume _____ µl

AutoSampler Exercise

- ❑ After completing the PM visit and check that the AutoSampler is working properly :
 - ❑ In the Autosampler Console menu, select Contrôle > Reset SM. This will reset the Y-carriage position and place the Needle in his **Home** position.
 - ❑ Close the Console and Masslynx Software
 - ❑ Power Off the Acquity UPLC system
 - ❑ Disconnect the UV detector from the Autosampler
 - ❑ Disconnect the power cordon
 - ❑ Remove the UV detector
 - ❑ Remove the top, right and left panels of the AutoSampler
 - ❑ Locate :
 - ❑ The Personnality
 - ❑ The CPU 2000
 - ❑ The Barrier Board
 - ❑ The BOS pump assembly
 - ❑ Power Supply
 - ❑ Battery
 - ❑ XYZ mechanism assembly

AutoSampler Exercise

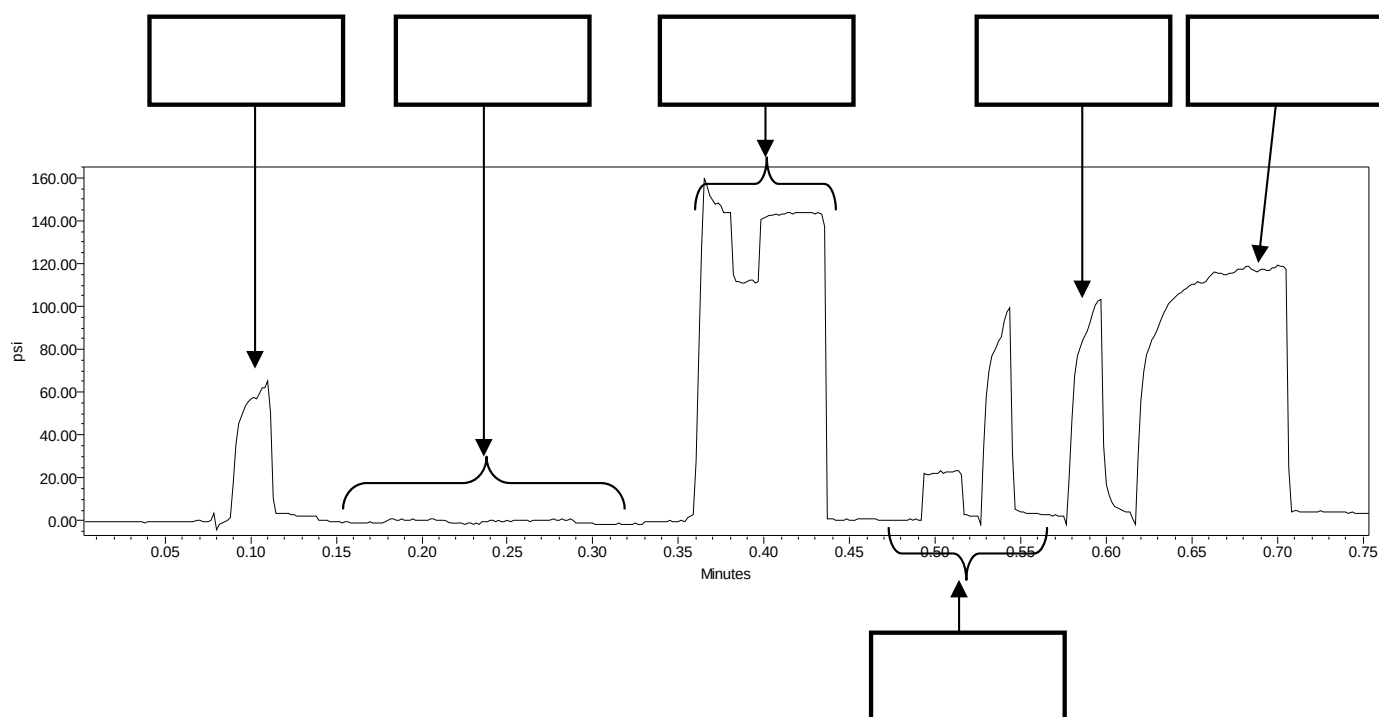
- ☐ Referring to the procedures available in the Portal :
 - ☐ Replace the CPU/Personnality card
 - ☐ Replace the y-carriage
 - ☐ Replace the Heater/Cooler
 - ☐ Be familiar on how replacing the XYZ mechanism, i.e read the procedure.
- ☐ What are the Barrier PCB functions ?

- ☐ On the Personnality PCB , measure and note the values of :
 - ☐ 5V _____
 - ☐ 12V _____
- ☐ On the CPU , measure and note the value of:
 - ☐ VCC _____
- ☐ After completing the tasks listed above, reconnect the AutoSampler to the UPLC system and make appropriate tests to prove the proper functioning of the injector.

AutoSampler Exercise

Injection Modes

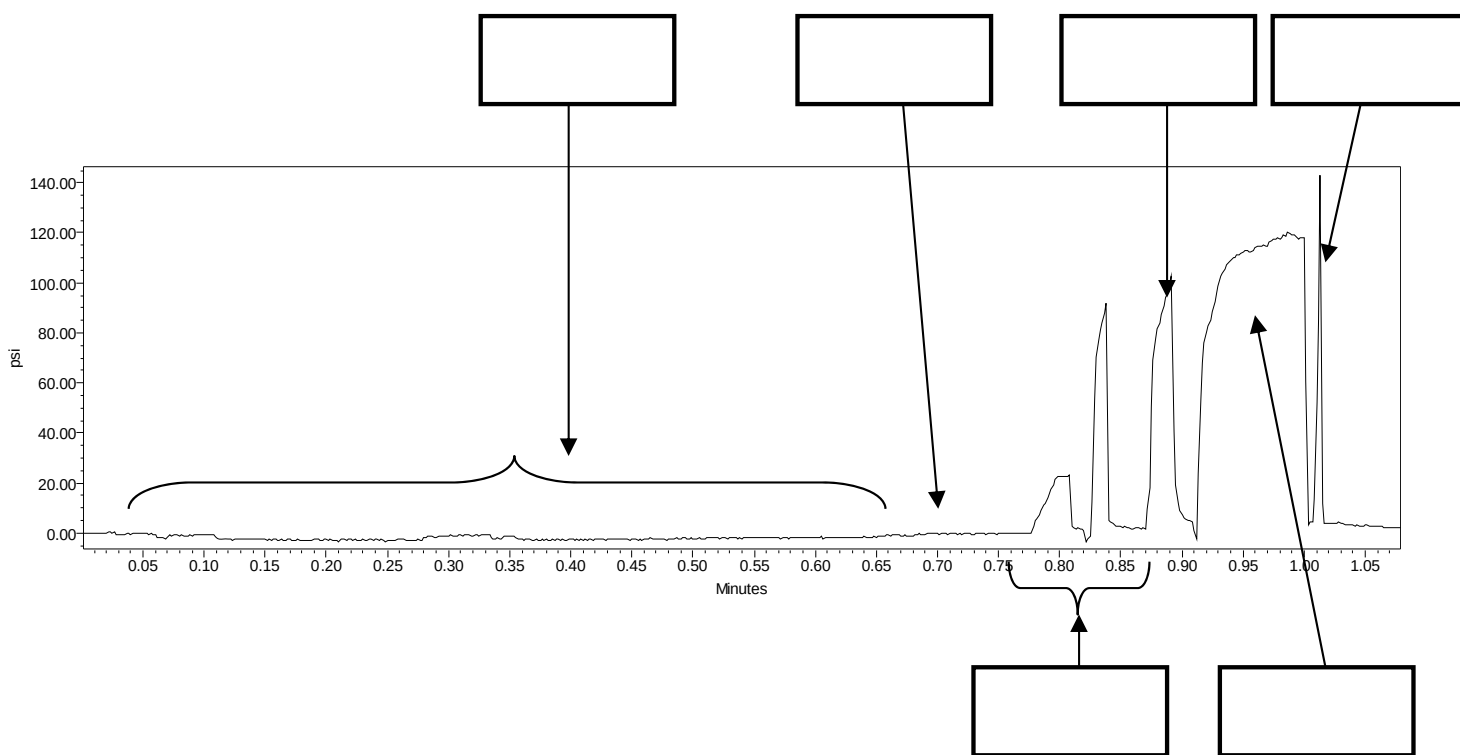
- ☐ Open the **Acquity Training *ddmmyyy*** Project from Masslynx
- ☐ Do run with a blank from the weak solvent wash or mobile phase using the following parameters:
 - ☐ 100% A @ 0.3ml/min
 - ☐ **Partial Loop** mode
 - ☐ Volume injected : 1µl
 - ☐ Wavelength : 254nm
 - ☐ Run time : 1 minute
- ☐ Look at the sample pressure trace in the console plot to check the injection profile. It should look similar to the figure below. To what action correspond each section and in what position is the Injector valve ?



AutoSampler Exercise

- When does injection occur ?

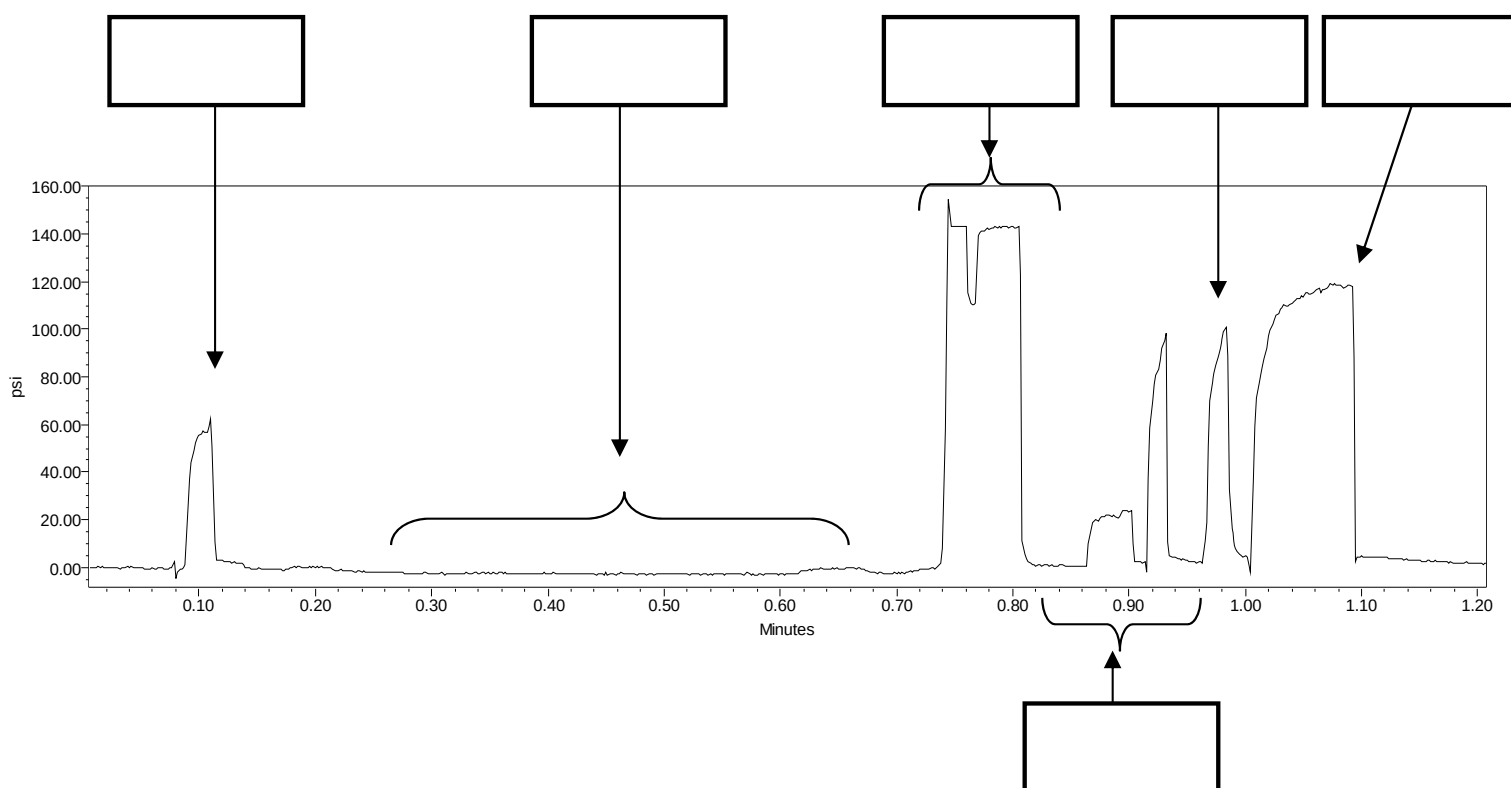
- Repeat the above blank injection test using the **Partial Loop with Needle Overfill** mode. It should look similar to the figure below. To what action correspond each section and in what position is the Injector valve ?



- When does injection occur ?

AutoSampler Exercise

- Repeat the above blank injection test using the **Full Loop** mode. It should look similar to the figure below. To what action correspond each section and in what position is the Injector valve?



AutoSampler Exercise

- ☐ Observe and compare the traces from the various injection modes to see the similarities and differences. Take notes of it.

- ☐ Go to the Portal.
- ☐ Select the **Knowledge Center – Services and support** Tab.
- ☐ Go to the **Quality Part Locator**
- ☐ Select **Acquity UPLC** in the **System** sub-menu
- ☐ Select **Reference Information > Sample Manager**.
- ☐ Look at the **Injection Mechanism animations**.
- ☐ Compare each injection mode animation with what you did above

AutoSampler Exercise

- ☐ Does this correspond to what you have observed?
- ☐ The injection mechanism will be discussed during classroom.
- ☐ **This concludes the Sample Manager Console exercise.**

Section 6 : Column Compartment



FSE Training Workbook

Column Compartment Exercise

Objectives

- ❑ By the end of this exercise you will:
 - ❑ Be familiar with the Column Compartment console menus
- ❑ Please refer to (document available on the Portal):
 - ❑ Acquity UPLC systems Operators Guide 715000082502
- ❑ The following Tables indicate those procedures that are performed most frequently including those procedures we can expect a customer to perform and therefore should be educated to perform. By the end of this lab session you should have either physically performed all of the identified tasks or familiarized yourself with the appropriate procedures.

Column Compartment Exercise

Column Manager					
TASK / PROCEDURE	PM	Frequent Task	Customer Task	Video Exists	Doc. No.
Installing Column Manager					715001355
Accessing the Switching Valves					715001708
Installing Figher Tight fitting					715001756
Installing the Column Manager Inlet Tube Extension Kit					715001706
Column Manager Fluidic Diagram					Portal

Column Heater Cooler					
TASK / PROCEDURE	PM	Frequent Task	Customer Task	Video Exists	Doc. No.
Installing Column Heater Cooler					715001355
Installing Column Stabilizer					715000926
Column Stabilizer otpions					Portal

30cm Column Heater/Cooler					
TASK / PROCEDURE	PM	Frequent Task	Customer Task	Video Exists	Doc. No.
Installing 30cm column heater/cooler					715001558
Installing the Y-cable kit					715001997

Column Compartment Exercise

High Temperature Column Heater					
TASK / PROCEDURE	PM	Common Task	Customer Task	Video Exists	Doc. No.
Installing the Column Heater					715001519 71500082502
Installing Column Stabilizer					715000926
Column Stabilizer options					Portal

- ☐ In front of every UPLC column (not needed in HPLC) is a solvent pre-heater called a column stabilizer. It MUST BE USED always. Why?

- ☐ Open the panel of each Column compartment available and familiarize yourself with the different configuration.

Column Manager Method editor

- ☐ Take a look at the Column manager method editor.
- ☐ What is the main difference between the Column Heater/cooler method editor ?

Column Compartment Exercise

eCord LED

- ☐ Off – The eCord is currently not connected
- ☐ On Green – The eCord is connected
- ☐ Flashing Green (2 Hz) – This indicates that the column corresponding to this eCord is the one that is currently selected
 - ☐ Only one of these four LEDs can be blinking green at any time
- ☐ On Red – This indicates that an error has occurred while reading or writing data to the eCord.
- ☐ Flashing Red (2 Hz) – This indicates that the column position has been selected, but the eCord is not plugged in.

Section 7 : Sample Organizer



FSE Training Workbook

Sample Organizer

- ❑ The Sample Organizer is an option for laboratory situations requiring the ACQUITY UPLC System to operate in an increased sample capacity. It stores microtiter or vial plates and transfers them to and from the sample manager. The sample organizer enables automation and increases sample processing throughput. It can service up to two stacked sample managers.
- ❑ The following Tables indicate those procedures that are performed most frequently including those procedures we can expect a customer to perform and therefore should be educated to perform. By the end of this lab session you should have either physically performed all of the identified tasks or familiarized yourself with the appropriate procedures.
- ❑ Please refer to (document available on the Portal):
 - ❑ Assembling the Sample Organizer 715000852
 - ❑ Performance Maintenance Protocol of the SO 715002077.

Sample Organizer

Sample Organizer					
TASK / PROCEDURE	PM	Frequent Task	Customer Task	Video Exists	Doc. No.
Performance Maintenance Technical Reference					715002078
Configuring Sample Plates in Empower					Portal
Configuring Sample Plates in MassLynx					Portal
Adjusting the Pressure Regulator					Portal
Adjusting the Z Initialization Sensors					715001502
Aligning the Optics				√	Portal
Assembling the Sample Organizer				√	715000852
Recoupling the Shuttle Magnet					715002025
Replacing the Carriage				√	Portal
Replacing the Compressor					Portal
Replacing the Exterior Pneumatic Source					715001716
Replacing the Heater/Cooler					Portal
Replacing the Heater/Cooler Fan Assembly					715002106
Replacing the IGUS Cable					715001311
Replacing the Motor					Portal
Replacing the Over-travel Cables and Lenses					Portal
Replacing the Over-travel Sensor					Portal
Replacing the PCBs					Portal
Replacing the Pneumatic Panel					Portal
Replacing the Power Supply					Portal

Sample Organizer

Sample Organizer					
TASK / PROCEDURE	PM	Frequent Task	Customer Task	Video Exists	Doc. No.
Replacing the Pressure Regulator Filter					Portal
Retrofitting the Pressure Sensor					Portal
Retrofitting the Stripper Bar					715001231
Replacing the Shelf Bearings					715001142
Replacing the YTS Carriage Bar					715001715
Setting the Threshold in the Over-travel Sensor				√	Portal
Verifying/Adjusting the Hard Stops				√	Portal
Transfer Subassemblies					Portal

Sample Organizer

- ☐ Performed the installation of the SO as per the procedure 715000852.
- ☐ Familiarize yourself with SO Maintenance Procedure.
- ☐ Service Procedure
 - ☐ Performed the "Setting the Threshold in the Over-travel Sensor"
 - ☐ Verifying/Adjusting the Hard Stops
 - ☐ Recoupling the Shuttle Magnet
- ☐ Read Services Notes :
 - ☐ Ghost Shelves causing " Configuration Modified Errors" - How to avoid and test
 - ☐ Changes to 48 Position - 2ml Microtiter Plates used in ACQUITY UPLC Sample Organizer- Sample Manager
 - ☐ Z Axis Jamming
 - ☐ Amplifier Settings and Modes for Shelf and Plate Over Travel Sensors
 - ☐ Initialization, Errors, Troubleshooting, and Repairing common issues

Final Tests

- Now that you have performed PM visits on every instruments of your UPLC systems, rerun the System Verification Tests (Precision and Gradient Tests) and fill the tables. Do not forget to include the SO.

Table 1: PDA and TUV Retention Time Reproducibility

(Six Replicates)			
Peak	Retention Time Mean Value	Std Dev	Acceptable Std Dev
Caffeine			≤ 1.0 second

Table 4: TUV and PDA Peak Area Reproducibility

(Six Replicates)			
Peak	Peak Area Mean Value	%RSD	Acceptable %RSD
Caffeine			$\leq 0.5\%$

Table 7: TUV and PDA Peak Height Reproducibility

(Six Replicates)			
Peak	Peak Height Mean Value	%RSD	Acceptable %RSD
Caffeine			$\leq 0.9\%$

Table 10: Retention Time Reproducibility

Three Replicates			
Peak	Peak Retention Time Mean Value	Std Dev	Acceptable Std Dev
2-acetylfuran			≤ 1.5 secs
acetanilide			≤ 1.5 secs
acetophenone			≤ 1.5 secs
propiophenone			≤ 1.5 secs
butylparaben			≤ 1.5 secs
benzophenone			≤ 1.5 secs
valerophenone			≤ 1.5 secs