Performance Maintenance Protocol

Sample Manager-Fixed Loop

(SM-FL, SM-FL PLUS, µSM-FL, Trap Valve Manager, Sample Manager, AutoSampler, and nanoACQUITY Sample Manager)

For ACQUITY UPLC® (IVD and non-IVD), I-Class (IVD and non-IVD), nanoACQUITY UPLC®, and M-Class Systems

System name:	E10NPS733M
PM date:	05-Oct-2020

Guidelines

This performance maintenance (PM) protocol outlines maintenance tasks you should regularly perform on Waters systems. Regular maintenance ensures optimum performance and uninterrupted trouble-free operation.

Schedule

Waters recommends that performance maintenance visits be performed once a year. Systems under heavy use or using aggressive solvents need more frequent maintenance. For detailed maintenance schedules, refer to the appropriate user guide located on Waters.com. Failure to follow the maintenance schedules as described in the user guide might result in unreliable operation and inaccurate laboratory results.

Safety considerations

Some protocols might involve removing instrument covers, exposing the performer to high voltages, high currents, and moving parts. This presents risks of electric shock or damage to the instrument. To reduce these risks, Waters recommends that these protocols be conducted by certified Waters field service engineers with access to the latest information on Waters products. Waters is not responsible for actions initiated by an unqualified performer. If you are unsure, have a Waters certified field service engineer conduct the performance maintenance activity.

Waters Quality Parts

Waters designs and manufactures Waters Quality Parts® to the same strict regulatory standards it uses for its high-performance Waters systems. Waters recommends using Waters Quality Parts for all maintenance activities. Failure to use Waters Quality Parts might compromise laboratory results and reliability.

Customer education

Waters offers courses on operating and maintaining its high-performance systems, as well as courses designed to help you maintain professional competency and further your knowledge in chromatography, mass spectrometry, and Waters data systems. For more information on available training courses, visit Waters Educational Services on Waters.com.

Qualification/compliance services

Waters Compliance Services help you achieve and maintain the regulatory compliance of your LC and MS instruments and software with a combination of expertise, compliant-ready systems and software, and a portfolio of services to ensure that you consistently obtain quality data. To learn more, visit Qualification/Compliance Services on Waters.com.

PM task overview

Tables 1, 2, and 3 are an overview of the PM tasks performed.

Note: For instructions on performing these procedures, refer to the online Help or the appropriate user manual on Waters.com.

Note: References to the BSM and SM-FL also pertain to the BSM PLUS and the SM-FL PLUS, respectively.

Note: Calibration of the air sensor volume detection device is not required because it is not changed during performance maintenance.

Table 1 – PM tasks (ACQUITY UPLC and I-Class)

Inspect	Replace/rebuild	Verify
Firmware version	Sample needle assembly	Initialization diagnostics
Fan	Wash syringes	Calibrations and characterizations
Needle wash system	Sample syringe	Leak tests[4]
Column heater/cooler or column manager	Injector valve cartridge[1]	Reset injection count
Error logs	Sample loop[1]	
	Needle-wash housing O-ring	
	Tubing and fittings[2]	
	Chassis air filter	

Table 2 – PM tasks (nanoACQUITY)

Inspect	Replace/rebuild	Verify
Firmware version	Sample needle assembly	Initialization diagnostics
Fan	Wash syringes	Calibrations and characterizations
Needle wash system	Sample syringe	Leak tests[4]
Column heater/cooler or column manager	Injector valve cartridge[1]	Set pressure diagnostic[5]
Error logs	Sample loop[1]	Reset injection count
	Needle-wash housing O-ring	
	Chassis air filter	
	Trap valve cartridge[3]	

Table 3 – PM tasks (µSM-FL)

Inspect	Replace/rebuild	Verify
Firmware version	Sample needle assembly	Initialization diagnostics
Fan	Wash syringes	Calibrations and characterizations
Needle wash system	Sample syringe	Leak tests[4]
Column heater/cooler or column manager	Needle-wash housing O-ring	Set pressure diagnostic[5]
Error logs	Chassis air filter	Reset injection count

[1] The injector valve cartridge and sample loop are not replaced as part of the µSM-FL performance maintenance.

[2] From the sample manager to the column (ACQUITY UPLC only); and from the SM and SM-FL to the Binary Solvent Manager.

[3] nanoACQUITY UPLC only.

[4] For ACQUITY UPLC and I-Class (non-IVD/IVD), perform the dynamic leak test (system) when using ICS version 1.50 or higher.

For nanoACQUITY UPLC, perform the dynamic leak test (system) when using ICS version 1.30 or higher.

For the µSM-FL, perform the dynamic leak test (system).

When performing the dynamic leak test, choose **Column** as the End Point. Evaluate the fluid-handling integrity of the Binary Solvent Manager up to and including the inject valve of the sample manager (pin plug at port 6 of the inject valve).

[5] nanoACQUITY UPLC and µSM-FL only.

PM task descriptions

Performance maintenance consists of three task categories:

- Inspect
- Replace or rebuild parts
- Verify

Note: If the instrument fails pre- or post-performance maintenance inspections or verifications, it might need additional service beyond the scope of this protocol. Such service might incur additional parts and labor charges.

Inspect

1. If the instrument is off, power it on and allow it to complete software checks.
2. Inspect the firmware and, if appropriate, update it.
3. Ensure that the fan grate on the rear of the instrument is clear of debris and dust; clean if necessary.
4. Prime the needle wash and wash the needle.
5. Inspect the column trays for solvent residue and clean if necessary.
6. Review error logs for any errors and troubleshoot as necessary.

Replace or rebuild parts

Using the parts in the PM kit, replace or rebuild parts as necessary.

Note: For instructions on replacing parts, see the appropriate user manual on Waters.com.

Verify

After completing the maintenance tasks, verify instrument performance:

1. Power-on the instrument and allow it to complete on-board software checks.
2. Perform the calibrations and characterizations:
   - Calibrate the X, Y, and Zp axes (ACQUITY UPLC and nanoACQUITY UPLC only)
   - Calibrate R axis (I-Class and µSM-FL only)
   - Calibrate the rotary tray (I-Class and µSM-FL only)
   - Calibrate the needle *z*-axis
   - Characterize the needle seal
   - Characterize the needle and loop volumes
3. Perform the leak tests:
   - Sample syringe leak test
   - Wash syringe leak test
   - Needle seal leak test
   - Back-pressure regulator test
   - Dynamic leak test (refer to footnote 4 on page 4)

4. Perform the ‘Set pressure diagnostic’ (nanoACQUITY UPLC and μSM-FL only).
5. Record the current injection count, and then reset the injection count.

Results/checklist

A Waters field service engineer completes the test results, checklist, and confirmation sections.

Test results

Table 2 – Firmware version ☒ Yes ☐ No ☐ N/A

Firmware revision	1.42
Firmware revision for Trap Valve Manager (if applicable)	n/a

Table 3 – Calibrate X, Y, and Zp axes (ACQUITY UPLC and nanoACQUITY) ☒ Yes ☐ No ☐ N/A

X offset (mm)	Y offset (mm)	Zp offset (mm)
0.88	-1.36	2.39

Table 4 – Calibrate R axis (I-Class and µSM-FL) ☐ Yes ☐ No ☒ N/A

R offset (mm)	

Table 5 – Calibrate rotary tray (I-Class and µSM-FL) ☐ Yes ☐ No ☒ N/A

Offset (degrees)	

Table 6 – Calibrate needle *z*-axis ☒ Yes ☐ No ☐ N/A

Z offset (mm)	3.69

Table 7 – Characterize needle seal ☒ Yes ☐ No ☐ N/A

Pass or fail	Pressure (psi)	Offset (mm)
☒ Pass ☐ Fail	122	61.00

Table 8 – Characterize needle and loop volume ☒ Yes ☐ No ☐ N/A

System volume with loop (µL)	System volume without loop (µL)	Loop (µL)	Needle (µL)
29.3	23.6	5.3	15.3

Table 9 – Sample syringe leak test ☒ Yes ☐ No ☐ N/A

Pass or fail	Test pressure (psi)	Compressed volume (µL)	Decompressed volume (µL)	Start pressure (psi)	End pressure (psi)	Pressure change (psi)	Average pressure leak (psi/sec)
☒ Pass ☐ Fail	150	2.0	0.9	152	114	-37	-2

Table 10 – Wash syringe leak test ☒ Yes ☐ No ☐ N/A

Syringe	Pass or fail	Test pressure (psi)	Compressed volume (µL)	Decompressed volume (µL)	Start pressure (psi)	End pressure (psi)	Pressure change (psi)	Average pressure leak (psi/sec)
Weak	☒ Pass ☐ Fail	190	28.2	28.0	195	183	-12	0
Strong	☒ Pass ☐ Fail	190	23.5	24.0	193	178	-13	-1

Table 11 – Needle seal leak test ☒ Yes ☐ No ☐ N/A

Pass or fail	Compressed volume (µL)	Decompressed volume (µL)	Start pressure (psi)	End pressure (psi)	Pressure change (psi)	Average pressure leak (psi/sec)
☒ Pass ☐ Fail	45.1	28.0	120	100	-19	-1

Table 12 – Back-pressure regulator test ☒ Yes ☐ No ☐ N/A

Pass or fail	Start pressure (psi)	End pressure (psi)	Average pressure (psi)	Standard deviation (psi)
☒ Pass ☐ Fail	131	127	127	0

Table 13 – Dynamic leak test (Firmware dependent) ☐ Yes ☐ No ☒ N/A

End point column (choose one)		Leak rate (nL/min)	Pass or fail
Inject valve	Outlet of column		
☐	☐		☐ Pass ☐ Fail

Table 14 – Set pressure diagnostic (nanoACQUITY and µSM-FL) ☒ Yes ☐ No ☐ N/A

Solvent	Pre-sensor flow rate (µL/min)	Post-sensor flow rate (µL/min)	Pass or fail
A1	4.238	0.015	☒ Pass ☐ Fail
B1	6.057	0.001	☒ Pass ☐ Fail
A potential leak is indicated if the A1 solvent post-sensor flow rate is greater than 0.020 µL/min, or a difference between the pre-sensor and post-sensor flow rates is greater than 0.15 µL/min for the A1 and B1 solvents.			

Table 15 – Injection count ☒ **Yes** ☐ **No** ☐ **N/A**

Injection count	442

Checklist

Note: Select N/A if the task does not apply.

Inspect

All inspect tasks completed	☒ Yes ☐ No ☐ N/A
	Comments:

Replace/Rebuild

Sample needle assembly	☒ Yes ☐ No ☐ N/A
Wash syringes	☒ Yes ☐ No ☐ N/A
Sample syringe	☒ Yes ☐ No ☐ N/A
Injector valve cartridge	☒ Yes ☐ No ☐ N/A
Sample loop	☒ Yes ☐ No ☐ N/A
Needle wash housing O-ring	☒ Yes ☐ No ☐ N/A
Tubing and fittings	☒ Yes ☐ No ☐ N/A
Chassis air filter	☒ Yes ☐ No ☐ N/A
Trap valve cartridge	☒ Yes ☐ No ☐ N/A
	Comments:

Verify

All verify tasks completed	☒ Yes ☐ No ☐ N/A
	Comments: