

DOCUMENT TITLE: **ACQUITY UBSM & AUX FINAL INSTRUMENT TEST**

SYSTEM/ASSEMBLY NAME: **ACQUITY M-CLASS UBSM & AUX PUMP**

PART NUMBER AFFECTED **186016003, 800000444, 186016022, 800000445**

TEST EQUIPMENT NAME: **ACQUITY SDS FINAL TEST STATION**

TEST EQUIPMENT NUMBER: **TE83081 WITH TE82943**

TEST SOFTWARE:



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DATE: **01-Feb-2017**

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DATE: **21-Mar-2019**

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EQUIPMENT REQUIRED

Quantity	Part Number	Description
1	TE83081	ACQUITY M-Class Flow Controller Box
1	TE82943	ACQUITY BSM Automated Rear Panel Test Box
1	N/A	5/16 open ended wrench
1	N/A	5/8 open ended wrench
1	N/A	1/4 open ended wrench
1	N/A	3/16 open ended wrench
1	410001941	NUT EXTENDER, FLANGELESS, RIGHT ANGLE
1	410001522	FLANGELESS NUT EXTENDER, ALUMINUM
2	430002275	Tube, 316SS, 1/32 OD X 0.005 16 Roughness Avg. roughly 8.5" length required – (order as required)
8	410000651	Valco Valve Nut, compression screw
8	410000652	Valco Valve Ferrule
2	430000233	1/8" tubes from startup kit with added ball valve
1	405005067	PLUG, PEEK, KNURLED, M-DETAIL
1	430001150	Tube, 316L, SS, 1/16 OD X .020, 16 Roughness Avg. (roughly 36" required – order as required)
1	PI0406S	John Guest Acetal Copolymer Tube Fitting, Union Straight Connector, 3/16" Tube OD (for seal wash line connection)

DISPOSABLES REQUIRED

Quantity	Part Number	Description
As Required	N/A	100% Virgin Methanol
As Required	N/A	100% IPA

REFERENCE DOCUMENTATION

Document Number	Description
721002340	FS Micro BSM and ASM
730000710	Creating and Maintaining Technical Files
WAT000050MP	Waters Record Retention Corporate Policy
WAT046538	GENERIC Electrical SafetyTest PROC.
735002528	FLUIDICS DIAGRAM, MICRO PUMPS, M-CLASS
735002010	TSP for BSM Final Functional Test
735002626	ASSY, BSM, ASM, MICRO-CLASS, INERT
810000422	PERF SPEC, PCB, VISTA PUMP ROHS
735001225	PERF. SPEC, MASS FLOW SENSOR, 15KPSI,5ul
710000422	SCHEM, PCB, VISTA PUMP ROHS
710000274	SCHEM, PCB, NANOACQUITY TEMP SENSOR
279002603	ASSY, HI-PSI FCM, NANO BSM, INERT
N/A	Autozero Testing for the M-Class Pumps Firmware Output.txt
N/A	Dynamic Leak Testing for the M-Class Pumps Firmware Output.doc
N/A	Prime Pump Testing for the M-Class Pumps Memo V02.doc
N/A	Seal Wash Testing for the M-Class Pumps Memo V01.doc
N/A	VV to Output Testing for the M-Class AUX Pump A Memo V01.doc

DEFINITIONS AND ABBREVIATIONS

Term	Definition / Abbreviation
AC	Alternating Current
ASP	Assembly Procedure
AUX	Auxiliary Solvent Manager Pump
BSM	Binary Solvent Manager Pump
CM	Contract Manufacturer
FSD	Functional Specification Document
IO	Input Output
IPA	Isopropyl Alcohol
LED	Light Emitting Diode
MeOH	Methanol
PC	Personal Computer
PCI	Peripheral Component Interconnect
PS	Performance Specification
PSC	Product Support Check
PSI	Pound per square inch
SAP	Systems Applications and Products
SDS	Solvent Delivery System
SN	Serial Number
Tempco	Temperature Coefficient ml/°C
TSP	Test and Specification Procedure
uBSM	Micro Binary Solvent Manager Pump
USB	Universal Serial Bus
UUT	Unit Under Test

I. The ACQUITY uBSM & AUX Final Test

The ACQUITY uBSM & AUX Final Test is performed consecutively on two separate test stations. The first test station provides the initial pretest power-up checks and electrical safety testing. The second station provides all of the remaining functional testing.

II. The Pre-Test Power-up Electrical Safety Test Station

The pretest power-up test station is used to perform an electrical safety test per Waters procedure WAT046538. All Test Units must pass this test in order to move to the Final Test Station.

III. The ACQUITY uBSM & AUX Automated Final Test Station

The ACQUITY uBSM & AUX Automated Final Test Station is designed to functionally test the Water's Corporation ACQUITY uBSM & AUX Pumps. Tests include: Software Download, Rear Panel Tests, Prime Pump, Degasser Tests, Dynamic Leak Decay, Flow Rate Accuracy/Ripple, Manifold to Filter Tubing, Dynamic Leak, Xducer Autozero, Xducer Pre/Post Leak, Fans, LEDs, IPA Fill and Drain.

The test strategy for this assembly is to test the functions that the unit as a whole must be able to provide.

The internal circuit boards will have been through an In-Circuit and a Functional Test, prior to installing into this assembly. The Check Valves and Vent Valve Assembly will also have been tested and inspected.

The ACQUITY uBSM & AUX Automated Testing will verify that these assemblies, boards and all other assemblies, when assembled together correctly, will produce the expected performance.

For clarity, please note the following information and equivalent descriptions.

Part Number	Class	Description(s)
186016003	M-CLASS	uBSM (micro Binary Solvent Manager)
186016022	M-CLASS	AUX (Auxiliary Solvent Manager)

Prior to executing this test procedure on any uBSM or AUX, the operator must check the Calibration Due label on the AnD Balance and the Preventative Maintenance Due label on the TE82943 & TE83081 test boxes, to confirm these devices are within their valid date window.

IV. Functional Test System Features

The system uses a PC with added serial ports to communicate with the UUT, the test boxes TE82943 & TE83081, and the AnD balance. An added Ethernet card to the PC, communicates with the UUT for faster firmware downloading.

TE82943 includes a USB digital IO and an analog input module for rear panel testing. A Valco valve controls the direction of the pump's output flow to either one of three restrictors or a dead end plug. The restrictors flow to waste or to the AnD analytical balance, for flow rate testing. The UUT seal wash output can be connected to a vacuum pump for priming or diverted to the balance for flow

rate testing. TE82943 and TE83081 front panel controls are under 'remote control' when the automated program is running.

TE83081 includes a Valco Valve to direct the UUT low flow rate outputs to either a flow to waste, restrictor to waste, or dead end plug. It also contains a restrictor for use in testing the AUX Pump A higher flow rate output.

The Test is controlled through an Operator Interface Test Program written in LabVIEW.

The Test Program has the following controls:

New Test – this button starts the testing on a newly assembled UUT.

Retest – this button will begin testing at a point determined appropriately close to where the last test run failure occurred.

Stop/Pause – this button, when active, will pause the program at the end of the current test step and prompt the operator with a choice to either stop or continue the testing.

Diagnostics – this button will launch the diagnostics page. In Diagnostics, the operator can select any test and verify the result.

Reprint Report – this button, when active, will send another hard copy of the test record to the printer.

The program will prompt the operator for information as required. Examples of inquiries include: UUT Serial Number, Factory Order Number, Operator Name, Part Number, etc... This will mainly occur during the initial launch of the test sequence.

Once the firmware has been loaded, the test runs without operator interaction, until it is time to pull lines from the MeOH and IPA bottles at the end of the test.

Operator Prompts can be easily identified from a distance by a yellow background popup window.

All data collected is sent to the SigmaQuest server.

V. Test Fixture Setup (Initial)

Connect the monitor, keyboard, and mouse to the PC.

Connect the PC RS232, AC lines, serial ports, USB, and Ethernet port (PCI card) to the proper locations as shown in Appendix 1 of 735002010.

Connect the PC RS232 serial port COM 5, and an AC line, to the TE83081 test box.

Connect the PC "main board" Ethernet port to the Waters assigned facility network.

Connect the fluidic lines from TE82943 test box to the AnD scale and to waste as labeled on TE82943 rear panel. Refer to Appendix 2 Fluidic Connections in 735002010 for details.

TE83081 electrical and fluidic connections are shown in Appendix 1 of this document.

Turn on TE82943 via the rear panel AC core module switch.

Turn on TE83081 via the rear panel AC core module switch.

Turn on the AnD balance via the front panel power button.

Turn on the monitor and PC.

Enter the appropriate Login Name and Password.

Launch the Test Program by double clicking on the icon “TE82943 ACQUITY uBSM & AUX Final Functional Test.exe”.

VI. Test Setup/Connections and Test Procedure with Automated Test Program

1. CONNECTIONS

- 1.1. Connect the “remote controlled” AC line from the rear panel of TE82943 to the rear of the UUT.
- 1.2. Verify that the AC power is off. (Press the UUT front panel switch to off if necessary).
- 1.3. Connect the Ethernet cable from the PC to the rear of the UUT.
- 1.4. Connect the RS232 serial cable from the PC to the UUT.
- 1.5. Connect the two cables with green Phoenix connectors from the TE82943 box to the rear of the UUT. Be sure to connect BLOCK I and BLOCK II to the corresponding connection.
- 1.6. Connect the cable with the 3-pin c-grid connector from the TE82943 box to the UUT front panel Leak Detector connector. (Located just behind the mixer).
- 1.7. Place the TE83081 test box on top front of the UUT. The TE83081 Waste output tube should be placed into the UUT top front drain reservoir.
- 1.8. **For the uBSM**, connect the fluidic OUT port to the To: OUT or B-OUT inlet of the TE83081 side panel using the interface tube part number 430002275.
- 1.9. **For the AUX**, connect the fluidic B-OUT port to the To: OUT or B-OUT inlet of the TE83081 side panel using the interface tube part number 430002275. Connect the A-OUT port to the To: A-OUT inlet of the TE83081 side panel using the interface tube part number 430002275. Connect the fluidic output from TE83081 front panel to the input filter port on the TE82943 front panel using the interface tube part number 430001150.
- 1.10. On the UUT, pull the Seal Wash output line from the drip tray’s barbed fitting. Connect the line to the quick connect fitting on the seal wash line input located on the front panel of TE82943.
- 1.11. Connect the large waste tubing to the UUT drip tray barb fitting, located just under the front of the UUT.
- 1.12. Place the UUT A1, B1, and Seal Wash Inlet tubes with sinkers into the MeOH bottle.
- 1.13. Connect the two test station supplied 1/8 inch inlet tubes (PN43000233) to the UUT A2 and B2 degasser input ports. Ensure the supplied inlet tube ball valve is in the flow position.
- 1.14. Place the A2 and B2 Inlet tubes with sinkers into the IPA bottle.

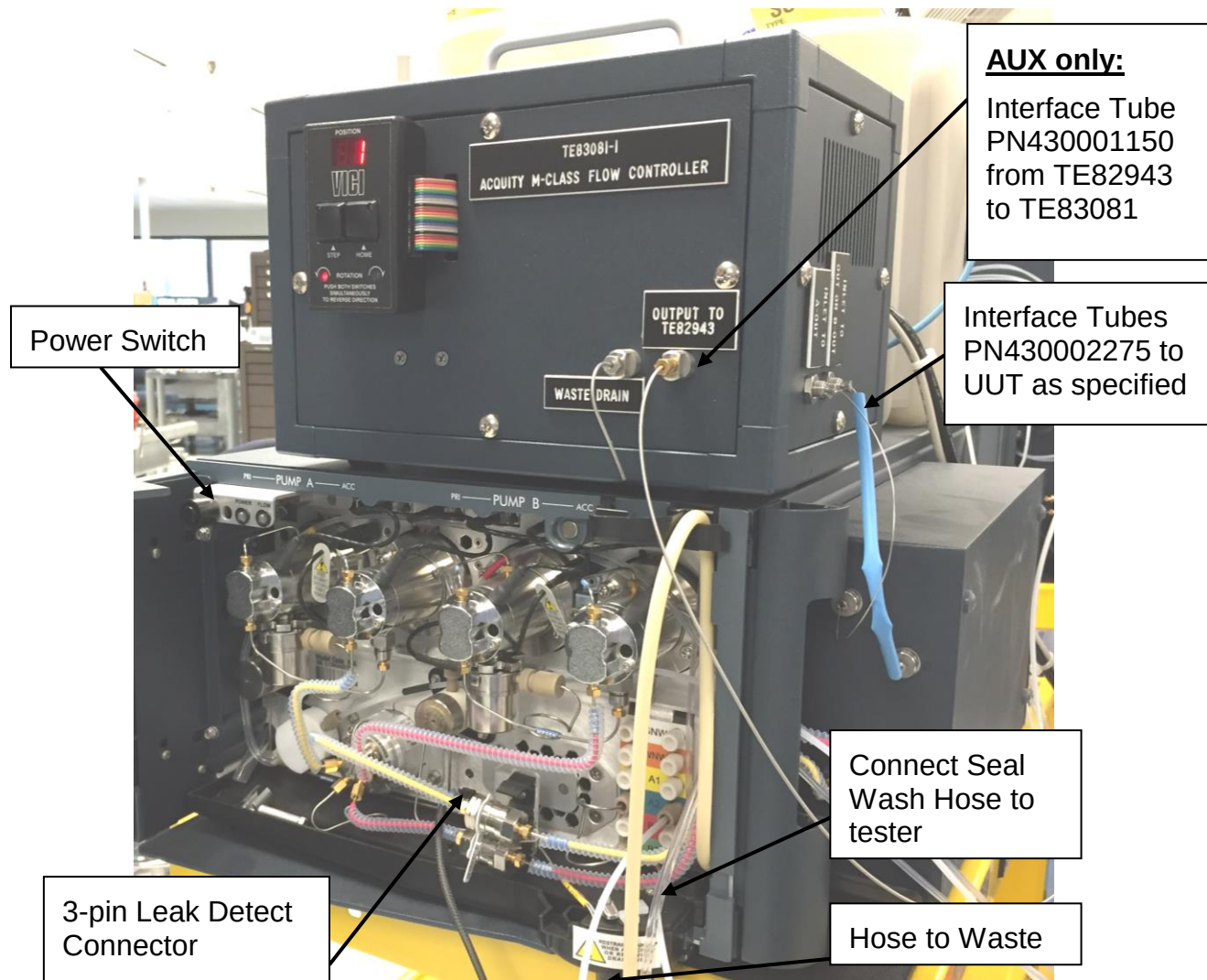
2. TEST PROGRAM

- 2.1. Prepare and install the UUT to the test system following the Test Setup procedure above.
- 2.2. Ensure the test program screen is shown on the PC.

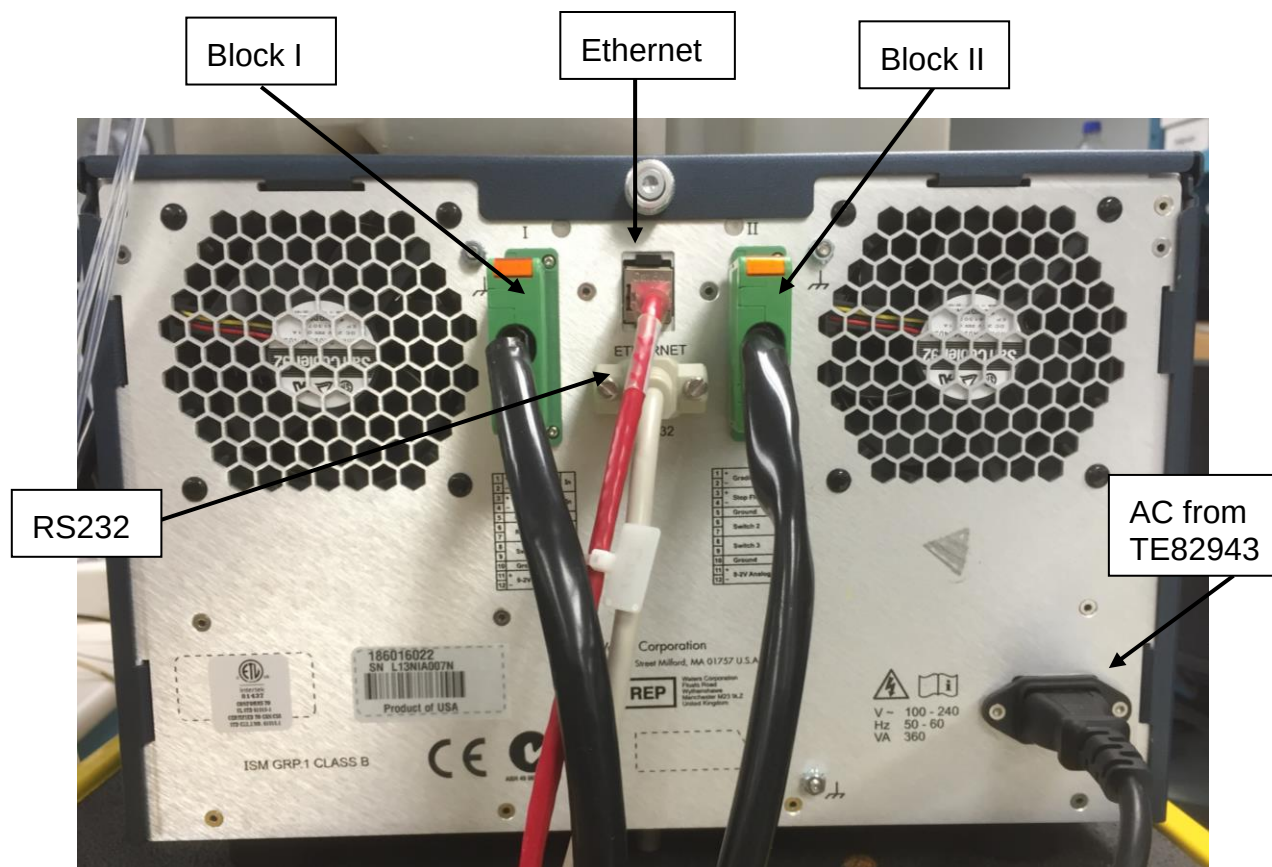
- 2.3. On the Test Program, press the **New Test** button to start the test.
- 2.4. An Input Information window will appear. Enter in all the requested data. The bar code scanner may be used to expedite the data entry. The program will reject any data input that is considered invalid. Press the **OK** button at the end when all data has been entered.
For Operator Name entry, an Operators.txt file resides on the PC desktop that must contain the operators name and ID. For Waters employees, use your SAP ID, for CM employees use employee number. The Operators.txt file can be easily edited by any operator or supervisor.
- 2.5. **Note For Repairs Department:** Enter **REPAIR** for the **Operator Name**. This will provide two special options in the test program. First, it will allow any version of firmware to pass. Second, it will prompt the operator if the BSM has Leak Detect Circuitry. If not, in the case of older BSMs, it will skip Leak Detect Testing.
- 2.6. The Test Program will prompt the operator for data entry for the Electrical Safety test. Enter the response necessary.
- 2.7. Next, the Test Program will load the latest firmware. Depending on if the UUT has already been loaded or not, the program will prompt the operator to either **Continue** testing or to **Reload** the firmware. Enter the response necessary.
- 2.8. From this point until just before the IPA Prep., the testing can be run unattended.
- 2.9. Any failures can be observed by a yellow popup window prompting the operator for attention.
- 2.10. Enter the response necessary for the popup. (See 2.18 below for operator failure options from here).
- 2.11. The Test Program will prompt the operator for proper operations of the fans. Enter the response necessary.
- 2.12. The Test Program will prompt the operator for proper operations for the Front Panel LEDs. Enter the response necessary.
- 2.13. If the testing is successful, a popup window will now appear at the start of IPA Prep.
- 2.14. The operator will be requested to pull the A1, B1 and Seal Wash lines from the MeOH bottle and to disconnect the interface tube(s) from the UUT. Press **OK** when complete.
- 2.15. The Test Program will continue on until the operator is prompted to pull the A2 and B2 lines from the IPA bottle. Press OK when complete.
- 2.16. Once the Test Program completes, a PASS window will appear. Press the **OK** button.
- 2.17. Disconnect all electrical and tubing connections from the UUT as referenced in the Test Setup/Connections section above. Test Complete.
- 2.18. In the case of a test failure, the operator has two choices, Diagnostics or Retest.
- 2.19. Diagnostics can be entered by pressing the **Diagnostics** button. The UUT will power up and then a pull down selection will be available to the operator.
- 2.20. This Diagnostic selection can be used as an aid to verify any test the operator chooses to run.

- 2.21. The Diagnostic routine can be exited, repairs made to the UUT, and re-entered again as many times as necessary.
- 2.22. It is recommended that the operator run the failed test in the diagnostics menu and verify a passing result before returning to the testing program.
- 2.23. Note that some repairs, fluidic assembly replacements for example, may require re-priming the UUT before rerunning the failed test. All tests and actions are available in the Diagnostic routine to accommodate the operator's needs.
- 2.24. Once the operator feels the UUT will pass the failed test, the UUT can now be retested. Press the **Retest** button.
- 2.25. The Test Program will power-up the UUT. A popup window will prompt the operator for failure information. From the pull down, select the fail note that most closely corresponds with the repair made to the UUT to correct the failure. Press **OK** to continue.
- 2.26. The Test Program will now pickup in the test sequence at a point appropriate to the place of the last failure. It is usually at the same test, but in some cases may be at a point just before the failure.
- 2.27. Other Test Program features:
- 2.28. If necessary, the Final Test Record that prints at the end of a passing UUT, can be reprinted by pressing the **Reprint Report** button. This button is only active until another UUT is started.
- 2.29. The **Stop/Pause** button on the main Test Program window, when active, can be used to pause the testing at the end of the current test. The operator then has the option to **Continue** with the test or to **Stop** testing.
- 2.30. During some tests, a new window will be present with buttons providing the options of **Abort** or **Stop/Pause at end of test**.
- 2.31. In this case, the **Abort** button will Stop the testing as quickly as it can.
- 2.32. The **Stop/Pause at end of test** button will finish testing the particular test, and then pause. The operator then has the option to **Continue** with the test or to **Stop** testing.
- 2.33. The **Exit** button will exit out of the Test Program.

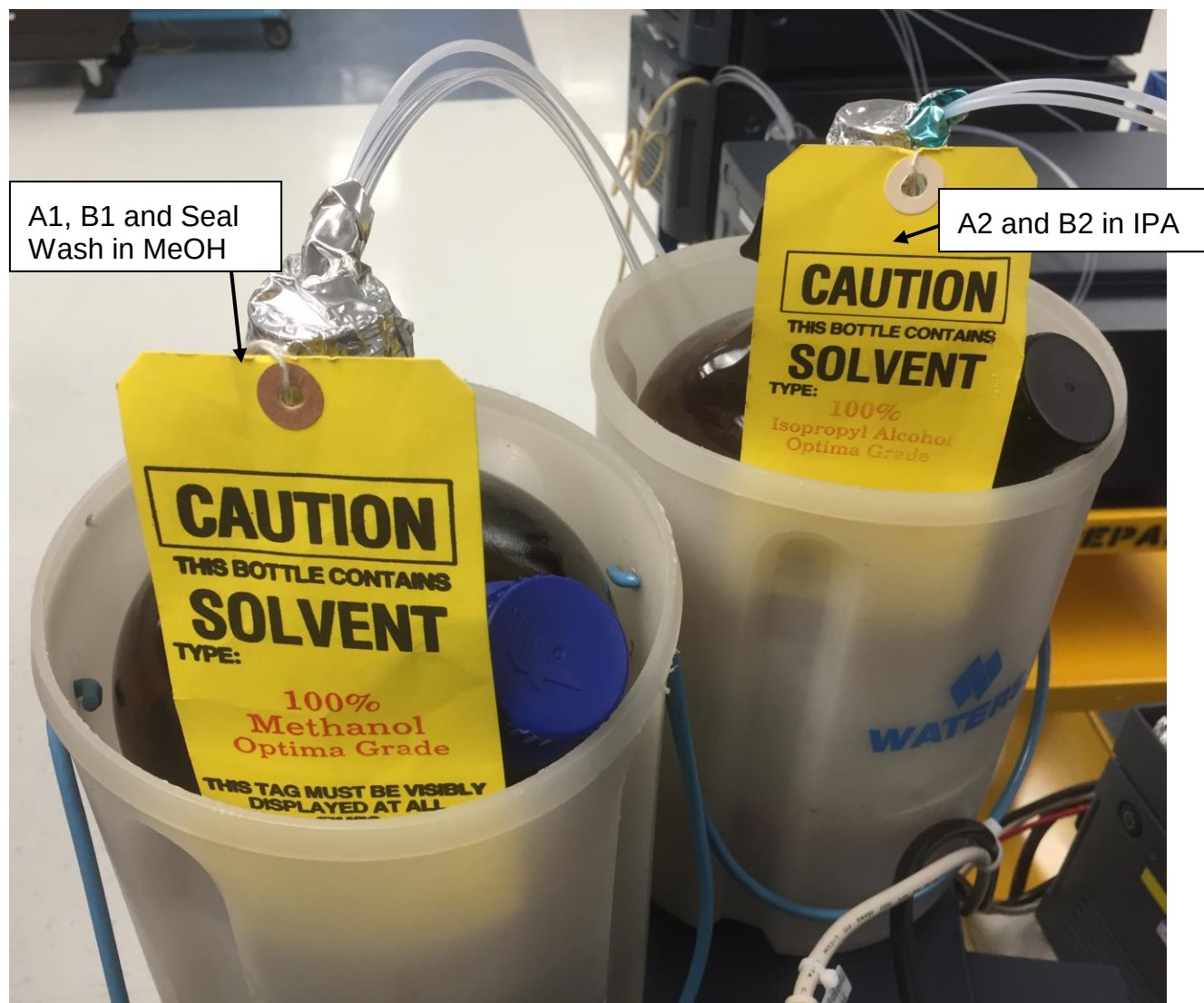
VII. Figures



AUX Front View (similar for uBSM)



AUX Rear View (same for uBSM)



Input Lines in MeOH and IPA Bottles

Note: 4 liter bottles shown just for fluidic reference

VIII. Test Specifications & Traceability Matrix

Test #			Description of Test	Test		Acceptance Criteria				Reference
Procedure	Report			Operator	Automated Test Fixture	PASS / FAIL	LSL	USL	Unit	FSD, ASP, PS, PSCs, schematics, SAP, etc..
	Aux	uBSM								
			Test Fixture Calibrated and Preventative Maintenance Performed	X		X				TSP 735003807 sec.III
1	1	1	Test Electrical Safety		X	X				PSC – Note 1 FSD 721002340 sec. 5.7
2	2	2	Test Loader Download		X	X				PSC – Note 1
3	3	3	Test Reboot Firmware for Pump B Download		X	X				PSC – Note 1
4	4	4	Test Firmware Version		X	X				PSC – Note 1 SAP (CS03)
5	5	5	Test Instrument Type		X	X				PSC – Note 3 ASP 735002626 p.27
6	6	6	Test Serial Number		X	X				PSC – Note 2
7	7	7	Test Alarms at Bootup		X	X				PSC – Note 2
8	8	8	Test Switch2 Output ON		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
9	9	9	Test Switch2 Output OFF		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18

10	10	10	Test Switch3 Output ON		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
11	11	11	Test Switch3 Output OFF		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
12	12	12	Test Run Stopped Output ON		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
13	13	13	Test Run Stopped Output OFF		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
14	14	14	Test Switch1 Output ON		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
15	15	15	Test Switch1 Output OFF		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
16	16	16	Test Gradient Start Input SHORT		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18

17	17	17	Test Gradient Start Input OPEN		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
18	18	18	Test Stop Flow Input SHORT		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
19	19	19	Test Stop Flow Input OPEN		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
20	20	20	Test Auxiliary1 Input SHORT		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
21	21	21	Test Auxiliary1 Input OPEN		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
22	22	22	Test Auxiliary2 Input SHORT		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
23	23	23	Test Auxiliary2 Input OPEN		X	X				PSC – Note 3 FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
24	24	24	Test Analog Output2 set to 2.0 VDC		X	X	1.900	2.100	VDC	FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18

25	25	25	Test Analog Output2 set to 0.0 VDC		X	X	-0.100	0.100	VDC	FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
26	26	26	Test Analog Output1 set to 2.0 VDC		X	X	1.900	2.100	VDC	FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
27	27	27	Test Analog Output1 set to 0.0 VDC		X	X	-0.100	0.100	VDC	FSD 721002340 sec.5.2.2.3, PS 810000422 sec.2.10.18
28	28	28	Test Leak Detect Connected		X	X				PSC – Note 3 PS 810000422 sec.2.10.3, 710000422 p.19
29	29	29	Test Leak Detect Disconnected		X	X				PSC – Note 3 PS 810000422 sec.2.10.3, 710000422 p.19
30	30	30	Test Leak Detect Input Low		X	X				PSC – Note 3 PS 810000422 sec.2.10.3, 710000422 p.19
31	31	31	Test Leak Detect Input High		X	X				PSC – Note 3 PS 810000422 sec.2.10.3, 710000422 p.19
34		32	Test Flow Xducer Temperature (uBSM)		X	X	17.000	35.000	Deg.C	PSC – Note 3 710000274
35			Test Pump B Flow Xducer Tempco (AUX)		X	X	-10.000	10.000	Tcoef	PSC – Note 3 PS 735001225 sec.8.1
36		33	Test Pump B Flow Xducer Tempco (uBSM)		X	X	-6.000	6.000	Tcoef	PSC – Note 3 PS 735001225 sec.8.1

37		34	Test Pump A Flow Xducer Tempco (uBSM)		X	X	-6.000	6.000	Tcoef	PSC – Note 3 PS 735001225 sec.8.1
38		35	Test Smallest Tempco Location (uBSM)		X	X				PSC – Note 3 ASP 279002603 p.8
39	33	36	Test Alarms Recheck		X	X				PSC – Note 2
40	34	37	Test Seal Wash Pump Prime/Flow		X	X	2.000	5.000	ml/min	PSC – Note 4
41	35	38	Test Pump A Input 2 Prime with IPA		X	X	570.000	2800.000	PSI	FSD 721002340 sec.5.3.3 PSC – Note 5
41	36	39	Test Pump B Input 2 Prime with IPA		X	X	570.000	2800.000	PSI	FSD 721002340 sec.5.3.3 PSC – Note 5
42	37	40	Test Pump A Input 1 Prime with MeOH		X	X	2.000	5.000	rel	FSD 721002340 sec.5.3.3 PSC – Note 5
42	38	41	Test Pump B Input 1 Prime with MeOH		X	X	2.000	5.000	rel	FSD 721002340 sec.5.3.3 PSC – Note 5
43	39	42	Test Degasser Pressure		X	X	0.000	1.300	PSI	FSD 721002340 sec.5.14.2
44	40	43	Test Degasser Switch Setting		X	X				PSC – Note 3 ASP 735002626 Sec. 3.8 p.15
46	41	44	Test Pump A Dynamic Leak - Accum. Leak Rate		X	X	1.000	150.000	nl/min	FSD 721002340 sec.5.14.4 PSC – Note 6
47	42	45	Test Pump A Dynamic Leak - Accum. Percent of Stroke		X	X	0.000	30.000	%	PSC – Note 6
48	43	46	Test Pump A Dynamic Leak - Accum. Max Pressure		X	X	14000.000	15000.000	PSI	FSD 721002340 sec.5.14.4 PSC – Note 6
49	44	47	Test Pump A Dynamic Leak - Primary Leak Rate		X	X	-50.000	150.000	nl/min	FSD 721002340 sec.5.14.3 PSC – Note 6
50	45	48	Test Pump A Dynamic Leak - Primary Percent of Stroke		X	X	0.000	50.000	%	PSC – Note 6

51	46	49	Test Pump A Dynamic Leak - Primary Max Pressure		X	X	12000.000	13000.000	PSI	FSD 721002340 sec.5.14.3 PSC – Note 6
52	47	50	Test Pump B Dynamic Leak - Accum. Leak Rate		X	X	1.000	150.000	nl/min	FSD 721002340 sec.5.14.4 PSC – Note 6
53	48	51	Test Pump B Dynamic Leak - Accum. Percent of Stroke		X	X	0.000	30.000	%	PSC – Note 6
54	49	52	Test Pump B Dynamic Leak - Accum. Max Pressure		X	X	14000.000	15000.000	PSI	FSD 721002340 sec.5.14.4 PSC – Note 6
55	50	53	Test Pump B Dynamic Leak - Primary Leak Rate		X	X	-50.000	150.000	nl/min	FSD 721002340 sec.5.14.3 PSC – Note 6
56	51	54	Test Pump B Dynamic Leak - Primary Percent of Stroke		X	X	0.000	50.000	%	PSC – Note 6
57	52	55	Test Pump B Dynamic Leak - Primary Max Pressure		X	X	12000.000	13000.000	PSI	FSD 721002340 sec.5.14.3 PSC – Note 6
58	53		Test Flow Rate Accuracy Pump A 1ml/min (AUX)		X	X	0.990	1.010	ml/min	FSD 721002340 sec.5.3.14
59	54		Test Pump A Pressure Ripple (AUX)		X	X	0.000	15.000	PSI	FSD 721002340 sec.5.14.5
60	55		Test Pump B Pressure Ripple (AUX)		X	X	0.000	22.000	PSI	FSD 721002340 sec.5.14.5
61		56	Test Pump A Pressure Ripple (uBSM)		X	X	0.000	22.000	PSI	FSD 721002340 sec.5.14.5
62		57	Test Pump B Pressure Ripple (uBSM)		X	X	0.000	22.000	PSI	FSD 721002340 sec.5.14.5
63		58	Test Pump A Avg. Zero Flow (uBSM)		X	X	-5.000	5.000	nl/min	PSC – Note 7
64		59	Test Pump B Avg. Zero Flow (uBSM)		X	X	-5.000	5.000	nl/min	PSC – Note 7
65	56		Test Pump B Avg. Zero Flow (AUX)		X	X	-5.000	5.000	nl/min	PSC – Note 7
66		60	Test uBSM Flow Xducer Leak – Pump A Pre-Sensor		X	X	-300.000	300.000	nl/min	PSC – Note 8
67		61	Test uBSM Flow Xducer Leak – Pump A Post-Sensor		X	X	-15.000	15.000	nl/min	FSD 721002340 sec.5.14.6

68		62	Test uBSM Flow Xducer Leak – Pump B Pre-Sensor		X	X	-300.000	300.000	nl/min	PSC – Note 8
69		63	Test uBSM Flow Xducer Leak – Pump B Post-Sensor		X	X	-15.000	15.000	nl/min	FSD 721002340 sec.5.14.6
70	57		Test AUX Flow Xducer Leak – Pump B Pre-Sensor		X	X	-300.000	300.000	nl/min	PSC – Note 8
71	58		Test AUX Flow Xducer Leak – Pump B Post-Sensor		X	X	-15.000	15.000	nl/min	FSD 721002340 sec.5.14.6
72	59		Test Pump A Dynamic Leak VV to Output (AUX)		X	X	0.000	5.000	ul/min	PSC – Note 9
73	60	64	Test Serial Number Re-verification		X	X				PSC – Note 2
74	61	65	Test Fans	X	X	X				PSC – Note 3
75	62	66	Test LEDs	X	X	X				PSC – Note 3
	63	67	Acquity AUX / uBSM Final Test Overall Result		X	X				

PSC Notes:

1. Pre-test condition.
2. Internal function of instrument firmware.
3. Verify invalidated assembly process.
4. Reference *Seal Wash Testing for the M-Class Pumps Memo V01.doc* for system test limit calculations.
5. Reference *Prime Pump Testing for the M-Class Pumps Memo V02.doc* for system test limit calculations.
6. Reference *Dynamic Leak Testing for the M-Class Pumps Firmware Output.doc*. Internal function of instrument firmware.
7. Reference *Autozero Testing for the M-Class Pumps Firmware Output.txt*. Internal function of instrument firmware.
8. Reference TSP 735002691 Rev.C section 11.7 – Verify invalidated assembly process.
9. Reference *VV to Output Testing for the M-Class AUX Pump A Memo V01.doc* – Verify invalidated assembly process.

1. ELECTRICAL SAFETY

The operator is prompted to enter the Electrical Safety Test result.

2. LOADER DOWNLOAD

The UUT is powered up. During this time, the serial communications is being monitored. It is then determined what version firmware, if any, is loaded on the UUT. If there is no firmware previously loaded, the test program will load the latest version of firmware. Otherwise it will prompt the operator to continue on testing or reload the latest version.

The “Loader” program is called from the test program to load the firmware via the UUT’s Ethernet port. Once loaded, the UUT is rebooted.

3. REBOOT FIRMWARE FOR PUMP B DOWNLOAD

Upon rebooting, the serial communications is monitored. The UUT is expected to begin loading packets of data onto the pump B CPU 2000 at this time. Once pump B has been fully loaded, the UUT is rebooted.

4. FIRMWARE VERSION

The serial command **version** and **b version** is sent to the UUT. Both pump A and B responses are compared against the latest version name located in the file *TestStringsFile.txt*.

5. INSTRUMENT TYPE

The serial command **bsmtype** is sent to the UUT. The string *BSM* or *ASM* is returned and is expected to match the instrument type being tested. J3 Jumpers on the personality board are used to tell the firmware the instrument type.

6. SERIAL NUMBER

The scanned serial number from the Input Information Window is loaded into the UUT via the serial command **setserial** *serialnumber*. The serial number is then read back out of the UUT via the command **showserial**. The response is then compared back to the scanned serial number. The UUT is then rebooted to clear Alarms associated with the serial number update.

7. ALARMS AT BOOTUP

Once the UUT reboots, the serial command **printalarm** is sent to the UUT. Any alarms present will be displayed to the operator and the testing will be halted.

8. SWITCH2 OUTPUT ON

The UUT is sent the serial command **swon relay1**. The UUT rear panel output pins labeled **Switch2 Out** are measured and expected to be shorted.

9. SWITCH2 OUTPUT OFF

The UUT is sent the serial command **swoff relay1**. The UUT rear panel output pins labeled **Switch2 Out** are measured and expected to be open.

10. SWITCH3 OUTPUT ON

The UUT is sent the serial command **swon relay2**. The UUT rear panel output pins labeled **Switch3 Out** are measured and expected to be shorted.

11. SWITCH3 OUTPUT OFF

The UUT is sent the serial command **swoff relay2**. The UUT rear panel output pins labeled **Switch3 Out** are measured and expected to be open.

12. RUN STOPPED OUTPUT ON

The UUT is sent the serial command **b swon relay1**. The UUT rear panel output pins labeled **Run Stopped Out** are measured and expected to be shorted.

13. RUN STOPPED OUTPUT OFF

The UUT is sent the serial command **b swoff relay1**. The UUT rear panel output pins labeled **Run Stopped Out** are measured and expected to be open.

14. SWITCH1 OUTPUT ON

The UUT is sent the serial command **b swon relay2**. The UUT rear panel output pins labeled **Switch1 Out** are measured and expected to be shorted.

15. SWITCH1 OUTPUT OFF

The UUT is sent the serial command **b swoff relay2**. The UUT rear panel output pins labeled **Switch1 Out** are measured and expected to be open.

16. GRADIENT START INPUT SHORT

The UUT rear panel input pins labeled **Gradient Start** are shorted together. The UUT is then sent the serial command **show eventin**. The expected serial response is **Eventin.Event1 = True**.

Note: For the AUX only, this event creates an expected alarm condition. The AUX is rebooted at the end of this test to clear the alarm state.

17. GRADIENT START INPUT OPEN

The UUT rear panel input pins labeled **Gradient Start** are left open. The UUT is then sent the serial command **show eventin**. The expected serial response is **Eventin.Event1 = False**.

18. STOP FLOW INPUT SHORT

The UUT rear panel input pins labeled **Stop Flow** are shorted together. The UUT is then sent the serial command **show eventin**. The expected serial response is **Eventin.Event2 = True**.

19. STOP FLOW INPUT OPEN

The UUT rear panel input pins labeled **Stop Flow** are left open. The UUT is then sent the serial command **show eventin**. The expected serial response is **Eventin.Event2 = False**.

20. AUXILIARY1 INPUT SHORT

The UUT rear panel input pins labeled **Auxiliary1** are shorted together. The UUT is then sent the serial command **b show eventin**. The expected serial response is **Eventin.Event1 = True**.

21. AUXILIARY1 INPUT OPEN

The UUT rear panel input pins labeled **Auxiliary1** are left open. The UUT is then sent the serial command **b show eventin**. The expected serial response is **Eventin.Event1 = False**.

22. AUXILIARY2 INPUT SHORT

The UUT rear panel input pins labeled **Auxiliary2** are shorted together. The UUT is then sent the serial command **b show eventin**. The expected serial response is **Eventin.Event2 = True**.

23. AUXILIARY2 INPUT OPEN

The UUT rear panel input pins labeled **Auxiliary2** are left open. The UUT is then sent the serial command **b show eventin**. The expected serial response is **Eventin.Event2 = False**.

24. ANALOG OUTPUT2 SET TO 2.0 VDC

The UUT is sent the serial command **analogoutput 2**. The UUT's rear panel output labeled **Analog Out2** is measured and expected to read 2.0 VDC +/- 0.1 VDC.

25. ANALOG OUTPUT2 SET TO 0.0 VDC

The UUT is sent the serial command **analogoutput 0**. The UUT's rear panel output labeled **Analog Out2** is measured and expected to read 0.0 VDC +/- 0.1 VDC.

26. ANALOG OUTPUT1 SET TO 2.0 VDC

The UUT is sent the serial command **b analogoutput 2**. The UUT's rear panel output labeled **Analog Out1** is measured and expected to read 2.0 VDC +/- 0.1 VDC.

27. ANALOG OUTPUT1 SET TO 0.0 VDC

The UUT is sent the serial command **b analogoutput 0**. The UUT's rear panel output labeled **Analog Out1** is measured and expected to read 0.0 VDC +/- 0.1 VDC.

28. LEAK DETECT CONNECTED

The UUT front panel Leak Detect input pins 1-2 are shorted. The UUT is then sent the serial command **peek 0x50001c**. The expected serial response is **01**.

29. LEAK DETECT DISCONNECTED

The UUT front panel Leak Detect input pins 1-2 are left open. The UUT is then sent the serial command **peek 0x50001c**. The expected serial response is **00**.

30. LEAK DETECT INPUT LOW

The UUT front panel Leak Detect input pin 3 is shorted to GND. The UUT is then sent the serial command **dump adc**. The expected serial response for Channel 1: is less than 0.5 VDC.

31. LEAK DETECT INPUT HIGH

The UUT front panel Leak Detect input pin 3 is pulled up via a 1K ohm resistor to pin 2. The UUT is then sent the serial command **dump adc**. The expected serial response for Channel 1: is greater than 3.5 VDC.

32. FLOW XDUCER TEMPERATURE (UBSM)

The serial command **tsgettemp** is sent to the UUT. The Xducer Temperature board returns the temperature as a response.

33. PUMP B FLOW XDUCER TEMPCO (AUX)

The serial command **b dump flowxducer** is sent to the UUT. The returned parameter P178 is compared to the allowed TempCo range for that position. Note: A value returned of 0.000000 is considered an invalid value and will fail the test.

34. PUMP B FLOW XDUCER TEMPCO (UBSM)

The serial command **b dump flowxducer** is sent to the UUT. The returned parameter P178 is compared to the allowed TempCo range for that position. Note: A value returned of 0.000000 is considered an invalid value and will fail the test.

35. PUMP A FLOW XDUCER TEMPCO (UBSM)

The serial command **dump flowxducer** is sent to the UUT. The returned parameter P178 is compared to the allowed TempCo range for that position. Note: A value returned of 0.000000 is considered an invalid value and will fail the test.

36. SMALLEST TEMPCO LOCATION (UBSM)

The absolute value of the Pump A TempCo and the Pump B TempCo is compared. Pump B TempCo must be less than Pump A TempCo.

37. ALARMS RECHECK

The serial command **printalarm** is sent to the UUT. Any alarms present will be displayed to the operator and the testing will be halted.

38. SEAL WASH PUMP PRIME/FLOW

The serial command **swpprime** is sent to the UUT to start the seal wash pump. The UUT's seal wash pump can be heard running by a clicking sound. The vacuum pump located inside TE82943 is activated. The vacuum pump helps the seal wash pump prime by pulling MeOH through the seal wash line. After enough time has elapsed to draw the MeOH through the system, the test program then switches from Priming to Establishing Flow. The test waits for a period of time to allow the MeOH to be pumped by the seal wash pump through TE82943 and out into the AnD balance. Next, the Flow Rate Testing begins.

The AnD scale is monitored for 2 minutes. Balance readings are taken at the beginning and end of this time. The measured flow rate is then calculated.

39. A2 B2 PRIME WITH IPA

The serial commands **selectsolvent 2** and **b selectsolvent 2** are sent to the UUT to activate the UUT's Biochem valves. A2 and B2 IPA solvent inputs are selected. The serial commands **setprimeflow 4** and **b setprimeflow 4** are sent to the UUT to start pumps A and B priming IPA to waste. The four pressure transducers are monitored and displayed at approximately 1 second intervals.

The priming will run for 6 minutes to allow enough time to draw IPA through the system.

For each pump, the last 60 seconds of accumulator pressure data readings are collected and averaged to provide a test measurement. Also, a counter is set to count any number of accumulator pressure readings, during the last 60 seconds, that fall outside of the test limits. Greater than two readings outside the PSI limit range of 350 to 2800 constitute a failure.

Note: In the case of a slight intermittent check valve failure, the reading value may not contain enough bad data points to cause a failure consistently with this test. However, the UUT will fail other tests further on in the test program. Consistent failures such as select valves not switching to IPA, bad check valves, gross leaks, etc.. will generally be shown as a low pressure measurement.

40. A1 B1 PRIME WITH MEOH

The serial commands **selectsolvent 1** and **b selectsolvent 1** are sent to the UUT to activate the BSM's Biochem valves. A1 and B1 MeOH solvent inputs are selected. The serial commands **setprimeflow 4** and **b setprimeflow 4** are sent to the UUT to start pumps A and B priming MeOH to waste. The four pressure transducers are monitored and displayed at approximately 1 second intervals.

The priming will run for 6 minutes to allow enough time to draw MeOH through the system. For each pump, the last 60 seconds of accumulator pressure data readings are collected and averaged to provide a test measurement. This measurement is compared to the Prime with IPA measurement in the equation (IPA Test result)/(MeOH Test Result). The relationship value will reflect the priming dynamic viscosity differences for the two fluids. This change is used to determine the functional operation of the solvent select valve. Also, a counter is set to count any number of accumulator pressure readings, during the last 60 seconds, that fall outside of the test limits. Greater than two reading outside the PSI limit range of 100 to 700 constitutes a failure.

Note: In the case of a slight intermittent check valve failure, the reading value may not contain enough bad data points to cause a failure consistently with this test. However, the BSM will fail other tests further on in the test program.

41. DEGASSER PRESSURE

The serial command **degasstatus** is sent to the UUT. The UUT's degasser pressure reading is returned in response.

42. DEGASSER SWITCH SETTING

The serial command **dump degasser** is sent to the UUT. The serial response should state **ACQUITY Degasser found**.

43. VALVE CONDITIONING ACTION STEP

This routine is used to run-in the pump seals at pressure. This will allow the valve seals to seat. The file *SealConditioningFile.txt* is used to control this action. Parameters for time, pump A flow rate, pump B flow rate, and restrictor number are stored. The routine will set up the specified restrictor. Then a serial command will send the **setflow x** command, where **x** is the desired flow rate. The pressure is displayed and the routine will run for the specified time. Test Engineering will determine the parameters to use for this action based on seal reliability data. Parameters used at this time are as follows:

UBM: 240 sec., 90.0 ul/min., 24.0 ul/min., TE83081 – no restrictor pos. 1)

AUX: 240 sec., 1.0 ml/min., 24 ul/min., Pump A - TE83081 fixed restrictor & TE82943 pos. 2, Pump B - TE83081 restrictor pos. 2.

44. DYNAMIC LEAK PUMP A – ACCUMULATOR LEAK RATE

The serial command **newleaktest 1 14000 0 0 0** is sent to the UUT. This launches a UUT internal test which does the following:

The UUT will fill and empty the Accumulator and Primary cylinders several times to obtain a good solvent intake. The vent valve is set to a mid point state between the vent and system outputs.

This closes off the output of the pump. The Accumulator is pressured to 14K PSI. The Accumulator pressure is displayed on the graph while the Accumulator motor is stepped 'dynamically' to maintain the set pressure. The Leak Rate is calculated and displayed on the graph. Next the Primary is pressured to 12K PSI. The Primary pressure is displayed on the graph while the Primary motor is stepped 'dynamically' to maintain the set pressure. The Leak Rate is calculated and displayed on the graph.

The results are available for display at the completion of the test.

This test is currently called up to three times by the Test Program to give ample opportunity to pass. Consistent failures are an indication of a fitting leak, bad seals, faulty check valve, etc..

Clues to the exact failure can be derived from the data results. Diagnosis information is sometimes given by the internal test. This will be displayed to the operator when available.

45.DYNAMIC LEAK PUMP A – ACCUMULATOR PERCENT OF STROKE

Refer above for test description.

46.DYNAMIC LEAK PUMP A – ACCUMULATOR MAXIMUM PRESSURE

Refer above for test description.

47.DYNAMIC LEAK PUMP A – PRIMARY LEAK RATE

Refer above for test description.

48.DYNAMIC LEAK PUMP A – PRIMARY PERCENT OF STROKE

Refer above for test description.

49.DYNAMIC LEAK PUMP A – PRIMARY MAXIMUM PRESSURE

Refer above for test description.

50.DYNAMIC LEAK PUMP B – ACCUMULATOR LEAK RATE

The serial command **newleaktest 2 14000 0 0 0** is sent to the UUT. This launches a UUT internal test which does the following:

The UUT will fill and empty the Accumulator and Primary cylinders several times to obtain a good solvent intake. The vent valve is set to a mid point state between the vent and system outputs.

This closes off the output of the pump. The Accumulator is pressured to 14K PSI. The Accumulator pressure is displayed on the graph while the Accumulator motor is stepped 'dynamically' to maintain the set pressure. The Leak Rate is calculated and displayed on the graph. Next the Primary is pressured to 12K PSI. The Primary pressure is displayed on the graph while the Primary motor is stepped 'dynamically' to maintain the set pressure. The Leak Rate is calculated and displayed on the graph.

The results are available for display at the completion of the test.

This test is currently called up to three times by the Test Program to give ample opportunity to pass. Consistent failures are an indication of a fitting leak, bad seals, faulty check valve, etc..

Clues to the exact failure can be derived from the data results. Diagnosis information is sometimes given by the internal test. This will be displayed to the operator when available.

51.DYNAMIC LEAK PUMP B – ACCUMULATOR PERCENT OF STROKE

Refer above for test description.

52.DYNAMIC LEAK PUMP B – ACCUMULATOR MAXIMUM PRESSURE

Refer above for test description.

53.DYNAMIC LEAK PUMP B – PRIMARY LEAK RATE

Refer above for test description.

54.DYNAMIC LEAK PUMP B – PRIMARY PERCENT OF STROKE

Refer above for test description.

55.DYNAMIC LEAK PUMP B – PRIMARY MAXIMUM PRESSURE

Refer above for test description.

56.FLOW RATE ACCURACY PUMP A 1ML/MIN (AUX)

The serial command **setsysflow 1000 0** is sent to the UUT. The output of the pump is routed through a restrictor inside TE83081 and then to TE82943 through another restrictor which in total will provide approximately 1500 PSI pressure. The flow is then routed out to the AnD Balance. The pump will run for 210 seconds to initialize the flow to the balance. Then the Flow Rate Testing will begin and run for 180 seconds. Readings are taken from the balance at the beginning and end of this time. The measured flow rate is then calculated.

57.PUMP A PRESSURE RIPPLE (AUX)

During the above 1.0ml/min flow rate accuracy testing, the pressure ripple is being recorded. The serial command **getp** is sent to the UUT to retrieve the results.

58.PUMP B PRESSURE RIPPLE (AUX)

The serial command **setsysflow 19 100** (approximately 19 ul/min) is sent to the UUT. After 120 seconds, the back pressure is measured and the flow rate is readjusted slightly to provide a back pressure of approximate 2000 to 2300 PSI. TE83081 valve selector pos.2 restrictor provides this back pressure. Another 90 seconds of initializing is performed to stabilize the pressure. Then the

flow testing will run for 120 seconds while the pressure ripple is being recorded. The serial command **getp** is sent to the UUT to retrieve the results.

59. PUMP A PRESSURE RIPPLE (UBSM)

The serial command **setflow 90** (approximately 90 ul/min) is sent to the UUT. After 120 seconds, the back pressure is measured and the flow rate is readjusted slightly to provide a back pressure of approximate 2000 to 2300 PSI. The UUT's internal output restrictor provides this back pressure. Another 90 seconds of initializing is performed to stabilize the pressure. Then the flow testing will run for 120 seconds while the pressure ripple is being recorded. The serial command **getp** is sent to the UUT to retrieve the results.

60. PUMP B PRESSURE RIPPLE (UBSM)

The serial command **setflow 24** (approximately 24 ul/min) is sent to the UUT. After 120 seconds, the back pressure is measured and the flow rate is readjusted slightly to provide a back pressure of approximate 2000 to 2300 PSI. The UUT's internal output restrictor provides this back pressure. Another 90 seconds of initializing is performed to stabilize the pressure. Then the flow testing will run for 120 seconds while the pressure ripple is being recorded. The serial command **getp** is sent to the UUT to retrieve the results.

61. PUMP A AVG. ZERO FLOW (UBSM)

The operator is prompted to insert the Peek pin plug P/N 405005067 into UUT OUT port and hand tighten. The serial command **autozero** is sent to the UUT. The Autozero test is an internal test performed by the UUT firmware on the Bronkhorst xducers. The "zero" flow rate is displayed as the UUT makes internal adjustments and calculations. Both A & B Pumps are being autozeroed simultaneously. This test will take upwards of ten minutes to run. When complete, the average zero flow rate is returned from the UUT and displayed.

62. PUMP B AVG. ZERO FLOW (UBSM)

Refer above for test description.

63. PUMP B AVG. ZERO FLOW (AUX)

The operator is prompted to insert the Peek pin plug P/N 405005067 into UUT B-OUT port and hand tighten. The serial command **autozero pumpB** is sent to the UUT. The Autozero test is an internal test performed by the UUT firmware on the Bronkhorst xducer. The "zero" flow rate is displayed as the UUT makes internal adjustments and calculations. This test will take upwards of ten minutes to run. When complete, the average zero flow rate is returned from the UUT and displayed.

64. UBSM FLOW XDUCER LEAK – PUMP A PRE-SENSOR

The operator is prompted to insert the Peek pin plug P/N 405005067 into UUT OUT port and hand tighten. The serial command **testdiag s 14500 A** is sent to the UUT. The Flow Xducer Leak test is an internal diagnostic test performed by the UUT firmware. The pump is ramped to 14500 PSI against a dead ended output. The pump output pressure is displayed. The pre and post sensor (Bronkhorst Transducers) readings are displayed and graphed over several minutes. The pre-sensor reading is the leak rate detected before the xducer and the post-sensor reading is the leak rate detected after the xducer. Detected leaks are generally attributed to leaks surrounding the tubing connections. The last 60 seconds of data is averaged and displayed. The overall test will run for more than 5 minutes.

Note : This test is intended to test the connections from the vent valve to the OUT port. In the event of a test failure, retesting will automatically repeat the Zero Flow Test prior to this test.

65.UBSM FLOW XDUCER LEAK – PUMP A POST-SENSOR

Refer above for test description.

66.UBSM FLOW XDUCER LEAK – PUMP B PRE-SENSOR

Refer above for test description.

67.UBSM FLOW XDUCER LEAK – PUMP B POST-SENSOR

Refer above for test description.

68.AUX FLOW XDUCER LEAK – PUMP B PRE-SENSOR

The operator is prompted to insert the Peek pin plug P/N 405005067 into UUT B-OUT port and hand tighten. The serial command **testdiag s 14500 B** is sent to the UUT. The Flow Xducer Leak test is an internal diagnostic test performed by the UUT firmware. The pump is ramped to 14500 PSI against a dead ended output. The pump output pressure is displayed. The pre and post sensor (Bronkhorst Transducers) readings are displayed and graphed over several minutes. The pre-sensor reading is the leak rate detected before the xducer and the post-sensor reading is the leak rate detected after the xducer. Detected leaks are generally attributed to leaks surrounding the tubing connections. The last 60 seconds of data is averaged and displayed. The overall test will run for more than 5 minutes.

Note : This test is intended to test the connections from the vent valve to the B-OUT port. In the event of a test failure, retesting will automatically repeat the Zero Flow Test prior to this test.

69.AUX FLOW XDUCER LEAK – PUMP B POST-SENSOR

Refer above for test description.

70.PUMP A DYNAMIC LEAK VV TO OUTPUT (AUX)

The serial command **setpress 10000** is sent to the UUT. A-OUT output is dead ended inside TE82943. The test begins by ramping the pressure to a set point of 10000 PSI. The serial

command **getstatus** is sent and returns the dynamic leak rate. The last 60 seconds of data is averaged and displayed.

Note : This test is intended to test the connections from the vent valve to the A-OUT port. It includes the TE83081 side panel connections and the front connection of TE82943, because the dead end plug is located inside the TE82943 tester. Any tester leaks have been attributed to a worn out UUT interface tubing assembly. Replace the interface tubing assembly part number 430001150 or 430002275 if necessary.

71. SERIAL NUMBER RE-VERIFICATION

The serial number is read back out of the BSM via the command **showserial**. The response is then compared back to the scanned serial number from the beginning of the test.

72. FANS

The operator is prompted to verify that both fans are on and blowing outward.

73. LEDS

The operator is prompted to verify that the Front Panel Power and Flow LEDS are working properly. The Power LED will be lit Green. Using a serial **poke address** command, the Flow LED will be verified in the Off, Green, and Red states.

IX. Test Program IPA Prep. Action Descriptions

The following list describes the actions performed for the IPA preparation before the UUT can ship. Manual power-off of the UUT is also accomplished, to ensure the power switch is in the OFF state at the end of testing. During the test program run, this procedure must be completed in order for the UUT to be considered a passing unit. The final test record is generated at the end of this process.

74. PURGE A1, B1 & SEAL WASH OF MEOH

The operator is instructed to pull the A1, B1 and Seal Wash input lines out of the MeOH bottle and to disconnect the output interface tubing(s).

The serial commands **selectsolvent 1** and **b selectsolvent 1** are sent to the UUT to activate the UUT's Biochem valves. A1 and B1 (removed) MeOH solvent inputs are selected. The serial commands **setprimeflow 4** and **b setprimeflow 4** are sent to the UUT to start pumps A and B priming the residual internal MeOH to waste. The four pressure transducers are monitored and displayed at approximately 1 second intervals.

The priming will run for 100 seconds to allow enough time to purge the MeOH throughout the system. The operator may observe the transducer pressures dropping to near zero when the last of the MeOH is purged.

75. PRIME USING A2 & B2 WITH IPA

The serial commands **selectsolvent 2** and **b selectsolvent 2** are sent to the UUT to activate the BSM's Biochem valves. A2 and B2 IPA solvent inputs are selected. The serial commands

setprimeflow 4 and **b setprimeflow 4** are sent to the UUT to start pumps A and B priming the IPA to waste. The four pressure transducers are monitored and displayed at approximately 1 second intervals.

The priming will run for 3 minutes to allow enough time to prime the IPA throughout the system.

76. PURGE A2 & B2 OF IPA

The operator is instructed to pull the A2 and B2 input lines out of the IPA bottle.

The serial commands **selectsolvent 2** and **b selectsolvent 2** are sent to the UUT to activate the UUT's Biochem valves. A2 and B2 (removed) IPA solvent inputs are selected. The serial commands **setprimeflow 4** and **b setprimeflow 4** are sent to the UUT to start pumps A and B priming the residual internal IPA to waste. The four pressure transducers are monitored and displayed at approximately 1 second intervals.

The priming will run for 100 seconds to allow enough time to purge the IPA throughout the system.

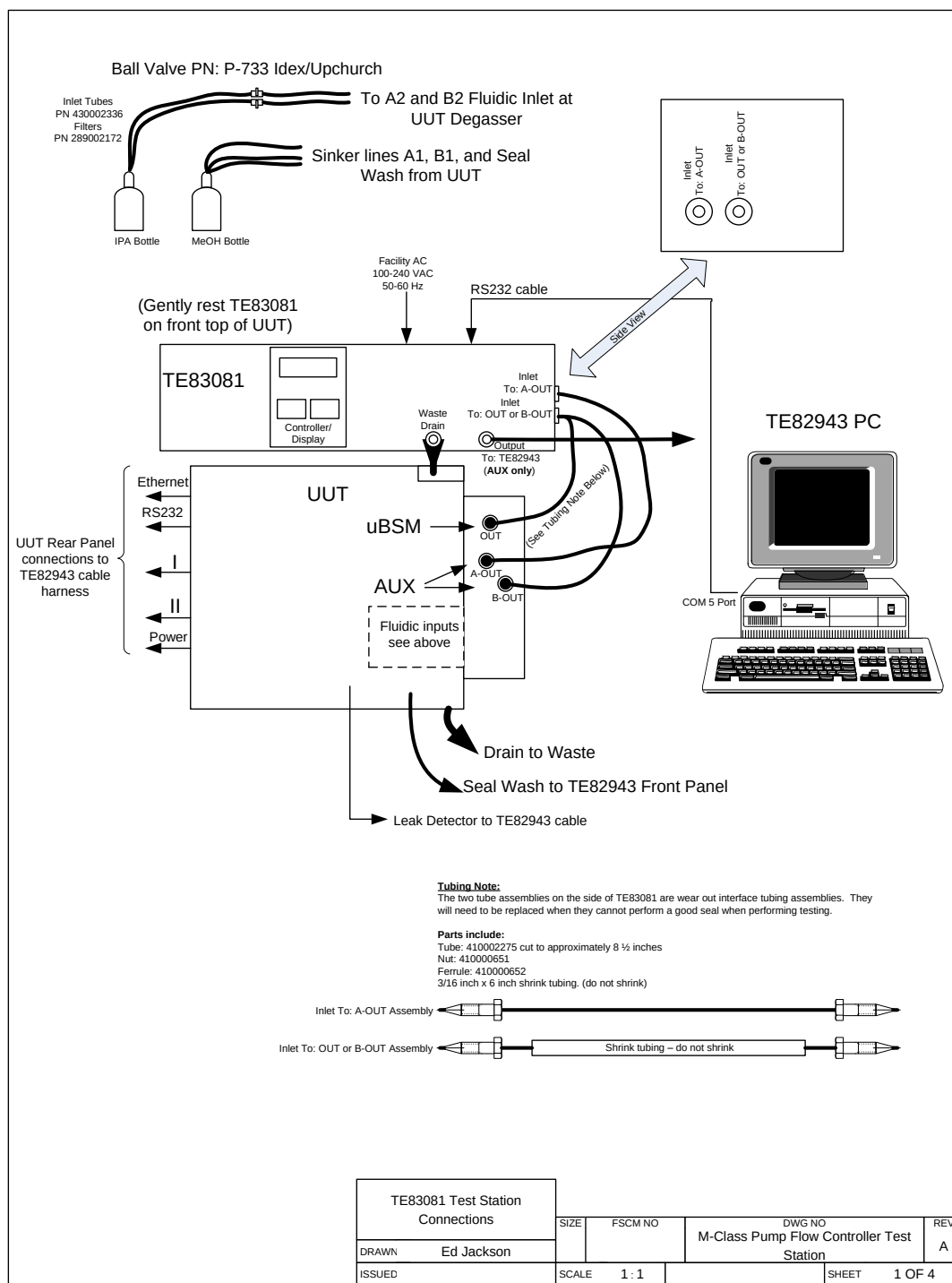
The operator may observe the transducer pressures dropping to near zero when the last of the IPA is purged.

77. MANUAL POWER OFF THE UBSM/AUX

The operator is instructed to press the uBSM/AUX front panel power switch to power off the UUT.

The power state of the uBSM/AUX is monitored by the test program. The test program will continue to the end of testing when power off is detected.

X. Appendix 1



TE83081 & UUT Connections