Sink8 (Non-MOS Clean)

(sink8)

1.0 Title

Sink8 (Non-MOS Clean)

2.0 Purpose

This document has specific information about VLSI sink8. Wet sink 8 provides two sets of heated baths: one for aluminum etch and one for **dirty** piranha, one 5:1 HF tank and one quick dump rinse station (QDR). The aluminum etch bath is on the left; the 5:1 BHF tank is in the center; the **dirty** piranha bath is on the right.

3.0 Scope

Wet sink8 is the first piranha clean. It is to be used for cleaning wafers prior to sink6 piranha clean. NON-MOS processed wafers shall be cleaned in sink8 first, then go into sink6 as a furnace pre-clean step. MOS processed wafers, which went through the photoresist strip step, should also be cleaned in sink8 prior to their pre-clean steps in sink6.

4.0 Applicable Documents

Revision History

Chapter 2.1 of the lab manual, which explains wafer boxes, tweezers, and other tool cleaning prior to using VLSI sink.

5.0 Definitions and Process Terminology

5.1 Full Plenum Lockout Alarm: Early warning alarm indicating sink drain failure.

5.2 Quick dump Rinse (QDR): DI water station programmed to rinse wafers to an acceptable resistivity level (>10 Mega Ohm-cm), and to get rid of excess acid and/or contaminant. Therefore, it is very important to make sure cassette/wafers go through full QDR cycle/s, as any remaining acid can easily ruin the consequent SRD machine and/or contaminate other equipment in the lab, particularly the furnaces.

5.3 Spin Rinse Dryer (SRD): DI water rinse followed by a spin dry cycle.

5.4 Clear Teflon cassette: Clear Teflon® cassette with name **MEMS** drilled on their side. These cassettes are dedicated for NON-MOS processing.

6.0 Safety

Follow the general safety guidelines for the lab, the safety rules outlined in Chapter 1.2 and the following:

6.1 This sink contains heated aluminum etchant, BHF acid and Piranha (heated sulfuric acid); therefore, appropriate safety attire should be worn while working at this station. This means chemically resistant gloves should be worn on top of the surgical gloves, plus a face shield and apron must be worn at all times while working at or around sink8.

6.2 Do not adjust the heater controllers as they have been preset to produce proper temperatures for the piranha bath and aluminum etch.

6.3 Glove Wash: Rinse gloves with deck hose in utility sink.

6.4 **EPO** red button: Cuts power to the sink in emergencies. Report promptly on FAULTS.

6.5 The de-ionized (DI) water deck hose for the sinks is **ALWAYS** available for emergencies; it provides a good safety backup in the event of exposure to chemicals.

7.0 Statistical Process Data

N/A

8.0 Available Processes, Glove Policy, & Process Notes

8.1 Processing

Aluminum etch, Piranha clean and BHF dip are available at this sink as well as the quick dump rinse process to a desired resistivity for both 4**"** and 6" wafers. Clear **MEMS** Teflon 4" cassettes, 6" cassettes and designated **MEMS** Teflon® handles are available by the station. The same cassettes should be used in this sink, then put them into the SRD for the final rinse. The clear Teflon cassettes are properly balanced for the SRD by sink8.

8.2 Chemical location

All sink8 chemicals are purchased premixed. They are available in the C-lockers in the front lobby. Additional sink8 chemicals can be found in the C-locker in service chase CV2 also (located between sink 6 and 7 in the VLSI area of the lab).

8.3 Glove and Safety Attire Policy

Whenever you are handling chemicals and/or place wafers into the chemical baths, you must wear appropriate safety attire: chemical-resistant gloves on top of surgical gloves, apron and face shield. Whenever handling any cassettes or handles from VLSI sink8, the poly gloves (clear gloves) MUST be worn on top of whichever gloves you already have on.

Example 1: surgical gloves/poly gloves
Example 2: surgical gloves/chemical-resistant gloves/poly gloves

Never touch any surface while wearing chemical-resistant gloves that other lab members may come into contact with, such as table tops, door handles, computer keyboards, face shields, aprons, etc. If you need to step away from the sink at anytime, rinse off gloves at the glove wash, dry with techni-cloths and put away in your drawer until you are ready to resume your work at the sink.

8.4 Process Notes

The VLSI Sink 8 is maintained for NON-MOS clean processes. Staff changes the chemicals in sink8 regularly (as listed on Table 1, below). If it appears that any of the solutions have been contaminated, notify a staff member (or e-mail **processtaff at silicon.eecs.berkeley.edu**) to change it, and post the problem report on FAULTS.

Hint: If there is a ring around any of the rinse tanks after you remove your wafers, you have contaminated the tank, cassette and handle. Report the contamination on FAULTS immediately.

Bath	Chemicals	Portions
Right Heated Bath	**Dirty** Sulfuric Acid (Piranha*)	6000 ml (6 liters)
Center Non-Heated Tank	5:1 Buffered HF	6000 ml
Left Heated Bath	Aluminum Etch	6000 ml

Table 1

► Piranha is made by adding 100 ml of hydrogen peroxide to the sulfuric acid bath. Use the 100 ml beaker kept next to the hydrogen peroxide bottle on the table adjacent to the sink. You

must add the hydrogen peroxide just before immersing every batch of wafers. After cleaning your wafers in piranha, they must rinse in the QDR station. Rinse the wafers until the resistivity reading is 10 M OHM-CM or higher.

► Sink8 is for cleaning wafers after a photoresist plasma strip step; wafers can then be cleaned in sink6 in preparation for a furnace process.

8.5 Wafer Breakage in the Sink

If you accidentally break a wafer in either the piranha baths or the HF tanks, first try to retrieve the broken wafer pieces by using the 10" long Fluoroware tweezers located on the worktable next the sink. DO NOT PUT METAL TWEEZERS INTO THE BATHS OR TANKS.

If the wafer pieces cannot be retrieved by this method, you will need to turn off the heater and let bath cool to 100ºC. Next, drain the piranha. Thoroughly rinse the bath with DI water; then drain the DI. Retrieve all pieces of broken wafers; rinse; drain once more; refill the bath with fresh suphuric, then turn the heater back on. Report the chemical change on FAULTS.

If there is an issue with the solutions in these heated tanks, report a sink problem via the WAND. Microlab staff will respond, change baths, and clear the FAULT.

9.0 Sink Operation

The sink operation is relatively easy, however special care must be taken not to contaminate this MEMS clean station and subsequent processes. The piranha and HF sinks are set up much like sink6. QDR stations are programmed to run two complete DI fill/rinse cycles with wafers submerged in the water at the end of the program.

9.1 Control Key Description

There are three control/displays at this station (see Figures 1-3). Most of the time, members should only need to use the DUMP RINSER control pad marked as **UFT–48-8**. This is the control pad for the quick dump (QDR) station, which is currently set for two dump rinse cycles. Wafers are initially showered with DI water followed by two DI fill-dump cycles. These cycles end with wafers submerged in the water for operator to extract and place them in the SRD. During the QDR cycle, the resistivity can be monitored via the UFT-223 RESISTIVITY MONITOR control panel. Piranha bath temperature can also be read on the right UFT-820 TEMPERATURE CONTROLLER display.

UFT-820 TEMPERATURE CONTROLLER (Figure 3)

POWER ON/OFF	Turns on/off the master power for the temperature controller (Figure3).
HEATER ON/OFF	Turns on/off the heated piranha bath.
TIMER RUN	Starts the timer.
TIMER STOP/RESET	Stops or resets the timer.
ALARM SIL	- Silences the timer and other alarm conditions. - Cancels flashing alpha code in the displays. - Examines the process set point and the Time Preset.
DRAIN	Press twice to empty the baths/tanks. Make sure chemical baths are sufficiently cooled down before draining. To only drain a small amount, press the DRAIN button twice, then once again when you want to stop the draining.
PROG	Access to change or step through various setup parameters.
SAVE	Permanently save the system setup parameters.
RESET	This key is utilized to exit the PROGRAM mode.

UFT-223 RESISTIVITY MONITOR (Figure 1)

UP/DSPLY	Toggles between resistivity and temperature readings.
DOWN/CHAN	Toggles between the viewing of channel 1 and channel 2. Since there is only one QDR in sink8, UFT-223 Resistivity Monitor is locked to Channel 1.
RETURN/SIL	Silence the alarm. Exit the set up mode.

UFT-48-8 DUMP RINSER (Figure 2)

START	Activates the dump rinse cycle/ Reactivates dump rinse cycle.
RESET	- Deactivates the Dump Rinser. - Silences alarm. - Automatically reset itself in preparation for another run. - Exits program mode.
HOLD	When the system is running, it halts the operation temporarily. When it is in STANDBY mode, it dumps the tank manually.
PROG	Parameters to be written in the EEPROM memory.

9.2 Control Key Functions for Overall Sink Operations (Figure 4)

POWER ON	Main power on for top control panels.
EPO	Big red button for emergency stop on the entire sink operation.
SILENCE ALARM	Silence the plenum flush lockout alarm.
ALARM RESET	Reset the plenum flush system.

9.3 Control Panel Programs are shown in Appendix 12.2

The parameter codes for the programs on the UFT-223 resistivity monitors, UFT-820 temperature controllers and UFT-48-8 quick dump rinsers are listed in Tables 2-5 in Section 12.2. The parameter codes are not to be altered by the Microlab members. Please only use them as your reference check.

9.4 Basic Piranha Clean

Piranha is an excellent oxidant capable of removing most organic contaminants.

9.4.1 Add 100 ml hydrogen peroxide to the heated sulfuric acid bath, which is kept at 120ºC to activate (spike) the piranha (see Figure 3 for more details on the temperature controller display).

9.4.2 Piranha clean wafers for 10 minutes.

9.4.3 DI water rinse your wafers by carefully lifting the cassette out of the (piranha) bath, and holding it above the bath until it stops dripping before placing them in the quick dump rinse station.

9.4.4 Start the DI rinse in the QRD station per the instructions provided in Section 9.5.1 to 9.5.6 and make sure you reach proper resistivity level.

9.4.5 HF dip if desired; however, make sure to run another DI rinse in QDR by repeating Section 9.5.1 to 9.5.6.

Note: Repeat the rinse cycle as described above after each acid clean step done in sink8 (aluminum etch, piranha or BHF).

9.5 Quick Dump Rinse Operation

This is a two cycle DI dump/rinse process that is needed to bring wafers to above 10 M OHM-CM resistivity before one can proceed to next step in the spin rinse dryer. Proceed as follows:

9.5.1 Place wafers in the QDR tank: it should initially have no water in it.

9.5.2 Press RESET (if status light is blinking), and then START button to activate the dump rinse cycle (see Figure 2 for keypad schematic).

9.5.3 Monitor the resistivity by selecting the proper resistivity channel on the RESISTIVITY MONITOR control pad (Figure 1). Select proper channel by pressing CHAN button (channel 1 for the QDR #1 on the right station). Make sure M OHM-CM light is on when selecting this measurement mode. Water temperature or resistivity can be monitored on the same LED display by selecting/deselecting one or the other display mode via DSPLY button.

9.5.4 Make sure your resistivity reading is 10 M OHM-CM or greater than 10 M OHM-CM at the end of your dump rinse cycle before going into SRD. If not, repeat the rinse program.

9.5.5 Upon the completion of two rinse cycles in the QDR, remove wafers from the bath and place them in the spin rinse dryer (SRD) station for the final rinse dry cycle. 6" wafer cassette goes in the top SRD and 4" wafer cassette goes in the lower SRD. Make sure to place the cassette with H-bar facing in. Dump the QDR water by pressing the **HOLD** button, then the **RESET** button. As soon as the water is drained, close the lid. Leave the QDR with no water in it and with closed lid, before leaving the station.

9.5.6 Final resistivity should be greater than 12 M OHM-CM for the SRD during its rinse cycles.

9.6 Sink8 Chemicals

Chemicals used at sink 8 can be found in the C-locker in service chase CV2 (located between rooms V1 and V2).

Silicon etch bath had temporarily moved to sink 7. If you use the last of the silicon etch, return the empty bottle to the tall white acid cabinet next to sink 432C in the old lab, and bring a fresh bottle into the VLSI locker.

No empty bottles may be returned to this locker, left on the floor in the chase, on the floor in the vicinity of the sinks, or underneath the sinks. All empty bottles MUST be taken to sink 432C in the old lab to be rinsed and disposed of properly.

Face shields, surgical gloves, and aprons must be worn at all times when working with chemicals.

9.7 Important Operational Notes

Metal tweezers are NOT to be used at this sink! Use the vacuum wand to load and unload wafers. The spin/rinse dryer next to Sink 8 can only be used with the cassettes from Sink 8-each sink has its own set of cassettes! Transferring cassettes from one sink to another introduces contaminants.

After wafers have been piranha cleaned, DI water rinsed (QDR) and spun dry (SRD), inspect each wafer under the inspection light, which is mounted on the wall at each sink. If any particles are found on the wafers, post it as problem on FAULTS.

Extra cassettes and handles for Sink 8 are stored in a blue bin labeled **extra cassettes for sink8** located on the worktable in V2 (next to Sink 8). If a sink8 cassette and/or white handle appears to be contaminated, please observe the following procedure:

9.7.1 Remove the contaminated piece from sink8 immediately; transfer your wafers into a clean cassette from the worktable next to Sink 8.

9.7.2 Place the contaminated cassette into the blue bin on the process table against the wall in V2 labeled **contaminated cassettes**.

Note: If the cassette and/or handle have been dropped on the floor, label it as such. Contaminated cassette/handle will be removed from the VLSI area for the next scheduled RCA 1 and RCA2 clean.

Clean up: Always leave the working area of the VLSI sinks as you would like to find it. Wipe all work surfaces of the sink with Techno-cloth lint-free towels. If a solution is needed later, label it with name, date, time, contents, when you will return, and where you can be reached. Keep C-lockers closed.

10.0 Troubleshooting Guidelines

10.1 **Rinse cycle stopped in the middle QDR cycles:** Press RESET/HOLD buttons to dump the water out, then press RESET/START buttons to restart the quick dump rinse cycles.

10.2 **Cannot reach resistivity above 10 M Ohm-cm in QDR:** Go through another rinse program (2 cycles). If resistivity is still below specification limit, then change the cassette and try the rinse cycle again (dirty cassettes need to be RCA cleaned by staff). If it still cannot make the resistivity, then there may be other issues involved. Stop and report it on FAULTS.

10.3 **–LO-:** Display indicates that the resistivity reading is below the system minimum.

10.4 **Err:** Display indicates that the sensor reading is erroneous. The sensor has exceeded a reasonable value on the resistivity display or a malfunction in the sensor on the temperature display.

10.5 Status Indicators on Temperature Control Panel (Figure 3)**:**

Red LED will light up to indicate a problem:

HGH TEMP	**OVER TEMP**	**DEFFECTIVE SENSOR**	**SYSTEM FAULT**
LOW TEMP	**LOW LIQUID FAILURE**	**POWER**	**HEAT**

10.6 Sink System Status Indicators (located on top of the sink panel)

LOW PURGE Red indicator light will come on when there is low air purge to cool off electronics for the sink.

PLENUM L/L Red indicator light will come on when the plenum liquid level is too high.

ASPIRATOR Red indicator light will come on when aspirator is in use.

DRAIN Red indicator light will come on when acid is draining.

PLENUM L/L HIGH: If it sounds, push the **ALARM SILENCE** button on the sink, and notify the process staff and post the problem on FAULTS as a full plenum lockout is an early warning alarm indicating sink drain failure.

The area under the deck of a wet process station (sink) is known as the plenum. This area receives the water and chemicals when they drain from the tanks and the utility sink. When the level of water in the plenum reaches 3 inches, a float activated switch opens a valve and the waste is removed. Should the water rise too high in the plenum because of a failure of the system, all sources of water to the sink are shut off and the alarm will sound. This is to prevent an overflow. If the user silences the alarm, it will again sound when the problem is solved and the water level has returned to normal.

10.7 If EPO is pushed, follow instructions:

10.7.1 Pull out EPO button.

10.7.2 Open head case pull down breaker switch and then lift up.

10.7.3 Push button on front of sink that says on.

10.7.4 Push power button on heater controller.

10.7.5 Push heat button on controller.

SPIN RINSE/DRYER HELP MESSAGES

HELP-0 **Power Failure**	The power failed while the unit was operating. Check the electrical lines in the unit, and for a blown fuse. Press **START** to reset the microprocessor. The rinser/dryer indexes the rotor and resets to the beginning of the interrupted cycle.
HELP-1 **Bladder Pressure**	There is inadequate nitrogen pressure to inflate the door seal. Check the door bladder, the nitrogren pressure, and the pressure switch. Be sure there is 20-21 psi on RG2 and that the pressure switch turns off when the pressure reaches 17-18 psi.
HELP-2 **Nitrogen Pres**	There is insufficient pressure in the system nitrogen line. Check the nitrogen pressure switch (PSW1). It should be set to approximately 13 psi. Check the system line for leaks. Be sure that the pressure at RG1 is 23 psi dynamic. Check the Clean Coil thermostat and reset if necessary.
HELP-3 **Door Open**	The door is not completely closed. Check the door. If the door is properly aligned, check the micro-swtich actuating arm.
HELP-4 **Index Failure**	The unit is not able to index the rotor. Check the rotor positioner.
HELP-5 **Excessive Speed**	The rotor speed has exceeded 3400 RPM. Retry the cycle a few minutes. If the problem persists, there is a hardware problem. Call maintenance or VERTEQ for assistance.

11.0 Figures & Schematics

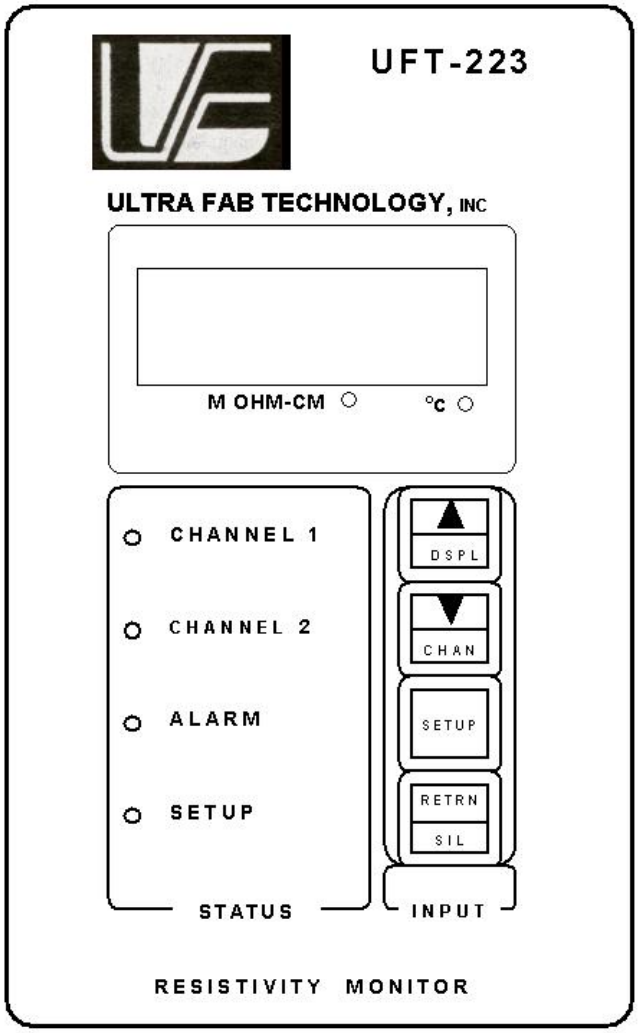


Figure 1

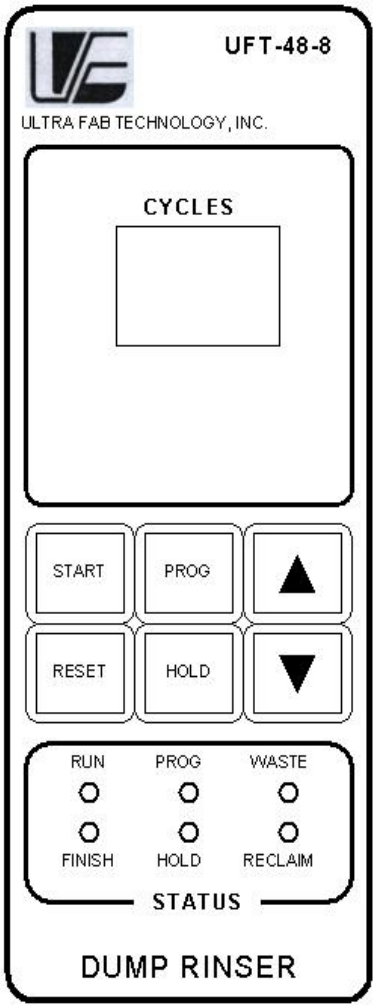


Figure 2

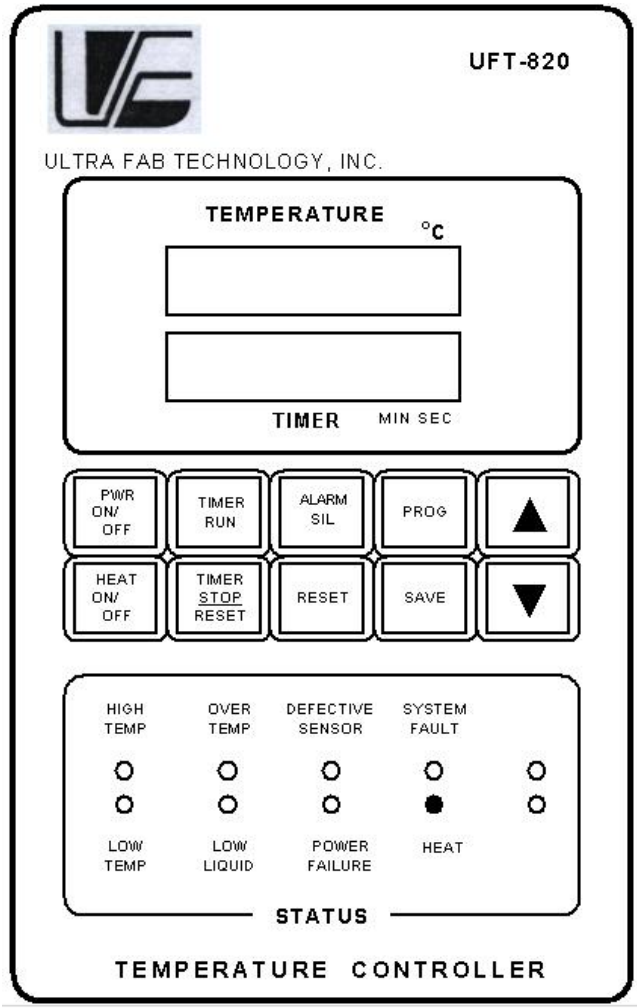


Figure 3

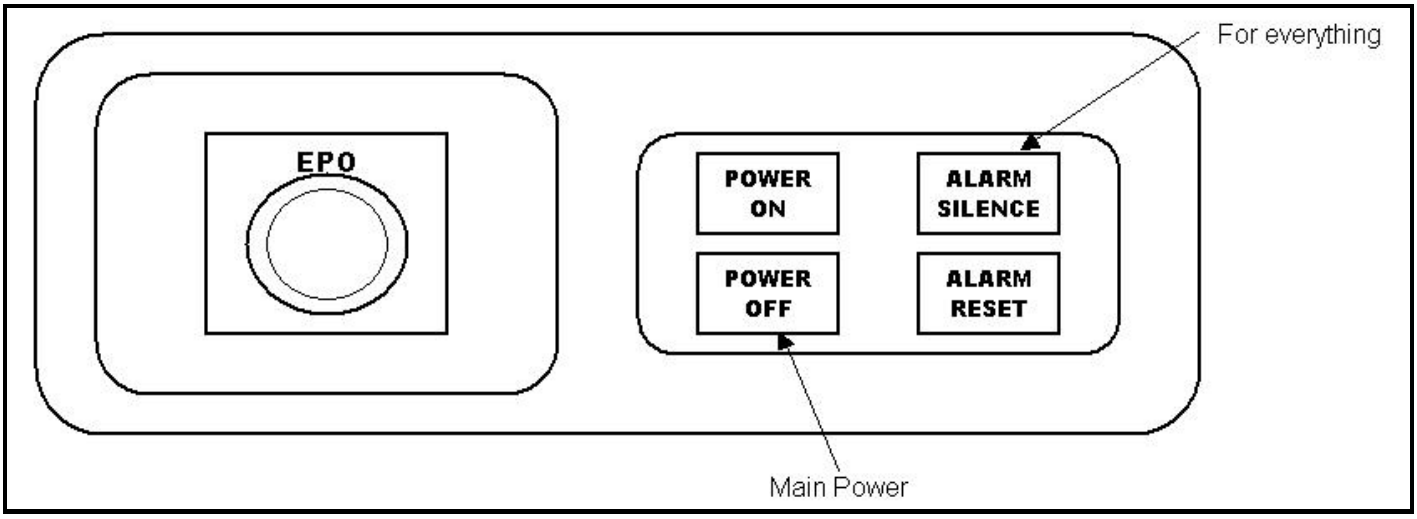


Figure 4

12.0 Appendices

12.1 RCA 1 and RCA 2 Clean Tanks

The heated baths and rinse tanks in sink 6 and sink 8 in the VLSI area are periodically RCA1 and RCA2 cleaned as follows:

RCA 1		
DI water	5 parts	4250 ml
NH_4OH	1 part	850 ml
H_2O_2	1 part	850 ml
RCA 2		
DI water	6 parts	4500 ml
HCl	1 part	750 ml
H_2O_2	1 part	750 ml

Piranha is a mixture of sulfuric acid and hydrogen peroxide and is used to remove organic residues. It can be made in small batches as follows:

- 5 parts H_2SO_4
- 1 part H_2O_2

Note: **Always add peroxide to sulfuric acid, never vice versa!** This is a self-heating solution.

12.2 Sink 8 Controller Programs

UFT-223 Resistivity Monitor	
SP1	10.00
SS1	12.00
Hi1	.00
Lo1	.00
Cr1	.01
Ce1	0.1
SP2	10.00
SS2	.00
Hi2	.00
Lo2	.00
Cr2	1.0
Ce2	.00
AC	00
CC	01
rL1	07
rL2	06
AL1	07
AL2	08

Table 4

UFT-820 Temperature Controller for Heated Piranha Bath	
C5	10:00
PA	:30
P5	120.0ºC
Hi	130.0ºC
Lo	8.0
dr	60.0ºC
dl	:05
Cr	10
Pb	10.0
rE	1.0
rA	0.0
CA	0.0
AC	00
rL	00
Cd	dn

Table 2

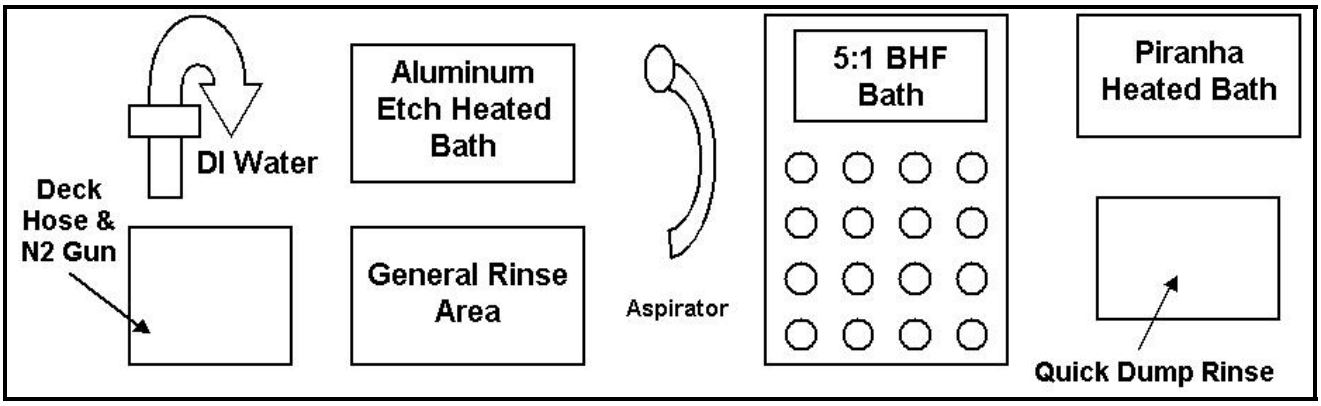
UFT-48-8 Dump Rinsers	
CY	2
rC	0
Fp	99
dp	5
SC	20
Ad	0
n2	n
Ac	0
PC	5
Pn	1
rP	L

Table 3

UFT-820 Temperature Controller for Heated Aluminum Etch Bath	
C5	30:00
PA	:30
P5	50.0ºC
Hi	60.0ºC
Lo	15.0
dr	60.0ºC
dl	1:00
Cr	10
Pb	10.0
rE	1.0
rA	1.0
CA	0.0
AC	00
rL	00
Cd	dn

Table 5

12.3 Sink Top Diagram



12.4 Revision 05 Comments

Sink operation process was updated from the old style to the new style. Sink top diagram had changed to implement the new sink. Spin dryer instruction was removed and study guide was revised.

Sinks 6 and 8 Study Guide

Be sure to know...

1. Position, contents and purpose of each tank and hose.
2. Purpose and timing of piranha clean.
3. Cleaning wafers with photoresist on them.
4. Range of resistivity for pure water and for wafers going into furnaces.
5. Glove wash.
6. Changing the temperature.
7. Troubleshooting OVER TEMP, FULL PLENUM LOCKOUT.
8. Disposing of empty bottles.
9. Required hand protection.
10. Other required protective gear.
11. How to recognize and deal with contamination.
12. What to do if you break a wafer in the piranha bath.
13. Wafers that are allowed in sink6.
14. Moving wafers from piranha to HF.
15. Which tweezers, cassettes and wands are allowed at each sink.
16. What to do if you find particles on your wafer after cleaning and drying.
17. Loading a cassette in the spin dryer.
18. Problems due to incorrect loading of cassettes in spin dryer.
19. How you know when resistivity is reached.
20. Why/when N_2 flows in the dryer chamber.
21. When to remove wafers from dryer.
22. Keeping the cassette clean.
23. Storing cassettes.
24. Troubleshooting a broken wafer in the spin dryer.
25. Meaning of error messages (e.g. HELP-1) at the spin dryer.
26. Making piranha.
27. Dealing with a leaky deck hose.
28. Overheating piranha bath.
29. Preventing piranha overflow.
30. Using the aspirator.
31. Safety features of the sinks.

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