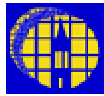

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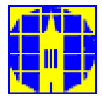

Sink6 (MOS Clean)

(sink6)

1.0 Title

VLSI Sink 6 Operation (MOS)

2.0 Purpose

Wet sink 6 provides two sets of piranha baths: HF tanks and quick dump rinse stations (QDR). There is one piranha bath on the left side. Next to it there are two HF tanks in the middle. These are 25:1 HF (49%), and 10:1 HF (49%) tanks followed by a piranha bath on the right side and two QDR stations in front of sink6 station.

3.0 Scope

Wet Sink6 is a furnace pre-clean sink. It is to be used for cleaning wafers prior to initial oxidation (wafers out of the vendor box). This is the last cleaning step before they go into any furnace. Any wafer that goes into a furnace should go through this cleaning procedure. 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 photo-resist stripping step, should also be cleaned in sink8 prior to their pre-clean steps in sink6. **ABSOLUTELY NO METAL WAFERS CAN BE PUT IN THIS SINK (ANY METAL).**

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 & 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 contaminants. Therefore, it is very important to make sure cassette/wafers go through a 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 STAT-PRO 1000 cassette: Black Teflon® cassette with name **STAT-PRO 1000** printed on their side. These cassettes will minimize static charge built up in the SRD, hence more appropriate for the device (MOS) processing. These cassettes are also properly balanced for the sink6 SRD.

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 HF 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 nitrile gloves, plus a face shield and apron must be worn at all times while working at or around sink6. Do not use metal tweezers in this sink. Only clean Teflon® tweezers can be used here.

6.2 Do not adjust the heater controllers as they have been preset to produce proper temperatures for the piranha baths.

6.3 Only use the black Teflon® chemically resistant cassettes provided for this sink. They are marked statpro1000 in black color. Failure to do so can cause damage to the station and/or compromise the operator's safety.

6.4 Glove Wash: Located in the front center right of this sink. Water spray is sensor activated.

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

7.0 Statistical Process Data

N/A

8.0 Available Processes, Glove Policy & Process Notes

8.1 Processing

Furnace pre-clean processes (Piranha clean and HF dip) are available at this sink as well as the quick dump rinse process to a desired resistivity for both 4" and 6" wafers. Black **STAT-PRO 1000** 4" cassettes, 6" cassettes and designated white Teflon® handles, marked as **MOS** 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 black STAT-PRO 1000 cassettes are properly balanced for the SRD by sink6.

DEDICATED BLUE TRANSFER BOXES (4" and 6" BOXES WITH BLACK STAT PRO CASSETTES IN IT) MUST BE USED FOR TRANSFERRING PRE-FURNACE CLEANED WAFERS TO THE FURNACE STATION. BRING THE BOX BACK TO SINK6 IMMEDIATELY AFTER WAFERS ARE LOADED IN THE FURNACE.

8.2 Chemical Location

All sink6 (and 9) chemicals are purchased premixed, except for diluted CMOS grade 49% HF. They are available in the chemical cabinets in the front lobby. Additional sink6 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 - Sink-6 Protocol

Whenever you are handling chemicals and/or placing wafers into the chemical baths, you must wear appropriate safety attire: chemical-resistant gloves on top of nitrile gloves; clear poly gloves on top; apron and face shield. Whenever handling any cassettes or handles from VLSI sinks 6 (or 9), the poly gloves (clear gloves) MUST be worn on top of whichever gloves you already have on.

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

To repeat: Wear poly gloves at all times when working at this sink; everything at this sink other than the outside of the wafer transfer boxes should not be touched without poly gloves.

Do not wear the same pair of poly gloves that you have worn at sink-8; get a fresh pair.

In addition: Never use the red curly-corded **clean** vacuum wand to transfer wafers that have not yet been cleaned in the piranha bath: Use the black curly-corded **dirty** vacuum wand instead.

To repeat: Wafers out of the vendor box should always be transferred to a black STAT-PRO cassette using the black curly-corded vacuum wand.

If you suspect that either the cassettes or handles have been contaminated, take them out of circulation immediately by placing them in the blue **contaminated cassette** bin which is on the process island table in V1.

Always piranha-clean your wafers before dipping them into the HF tanks.

Do not dump wafers cassette-to-cassette: Use the vacuum wands at the sink.

The black **X-FER** cassette belongs only in the blue sink-to-furnace transfer box. Do not put this cassette into the piranha bath.

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 6 (and 9) is maintained for MOS-clean processes. Special care must be taken when using them. Do not contaminate them. If they are contaminated, they could have a lab wide/furnace ramification. Staff changes the chemicals in Sink 6 regularly (as per portions defined in 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 and remove the cassette and handle from circulation by placing it in the **contaminated cassette** bin which is on the process island table in V1.

Bath	Chemicals	Portions
Heated Baths	Sulfuric Acid (Piranha*)	6000 ml (6 liters)
Left Non-Heated Tank	25:1 HF* (49%)	6000 ml H_2O:240 ml HF** (49%)
Right Non-Heated Tank	10:1 HF* (49%)	5500 ml H_2O:550 ml HF** (49%)

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.

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 sulphuric, 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 MOS clean station and subsequent processes. The quick/dump/rinse cycle (QDR) is invoked from a special keypad mounted on the face of the station (one for each station). 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). 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 UFT-820 TEMPERATURE CONTROLLER display for each piranha bath. Each station performs a self-clean every 60 minutes by running one QD cycle automatically.

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.
RETURN/SIL	Silence the alarm. Exit the set up mode.

UFT-48-8 DUMP RINSER (Figure 3)

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 2-4 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). Note: always have the poly gloves on when handling this beaker.

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 9.4.3 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 step 9.4.3 and 9.4.4.

Note: Repeat the rinse cycle as described above after each acid clean step done in sink6 (piranha or HF).

9.5 Quick Dump Rinse (QDR) 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 DI water in it.

9.5.2 Press RESET (if status light is blinking), then START button to activate the dump rinse cycle (see Figure 3 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 left station, or channel #2 for the QDR #2 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 and dry cycles. Make sure to place the cassette with the **H-bar** facing in. Dump the QDR water by pressing the HOLD button, then RESET button, as soon as the water is drained. Leave the QDR with no water in it, and close the lid before leaving the station.

9.5.6 Press start on the SRD station. SDR will go through rinse and dry cycles. Final resistivity should be greater than 12 M OHM-CM for the SRD during its rinse cycles.

9.6 Important Operational Notes

Metal tweezers are NOT to be used at this sink! Use the vacuum wand with the black curly cord to load dirty wafers. Use the vacuum wand with the red curly cord to unload cleaned wafers from the black STAT-PRO 1000 cassette. The spin/rinse dryer next to Sink 6 can only be used with the cassettes from Sink 6- 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 6 are stored in a blue bin labeled **extra cassettes for sink6** located on the worktable in V1 (next to Sink 6). If a black STAT-PRO cassette and/or white handle appears to be contaminated, please observe the following procedure:

9.6.1 Remove the contaminated piece from sink6 immediately; transfer your wafers into a clean cassette from the worktable next to Sink 6.

9.6.2 Place the contaminated cassette into the blue bin on the process island table in V1 labeled **contaminated** cassettes.

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 2 clean.

9.7 Transferring Properly Cleaned Wafers to Furnace Stations

9.7.1 Always use the blue boxes at the station with the MOS clean Teflon® cassettes to transfer pre-furnace cleaned wafers to the furnace station. There are one 4” and one 6” boxes available, labeled as **wafer transfer box to furnace**.

9.7.2 Do not use these boxes and their cassettes for any other application. These boxes have been cleaned for the sink-to-furnace transfer, and should immediately be returned back to sink6 once wafers are loaded into the furnace.

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**	**POWER FAILURE**	**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.

11.0 Figures & Schematics

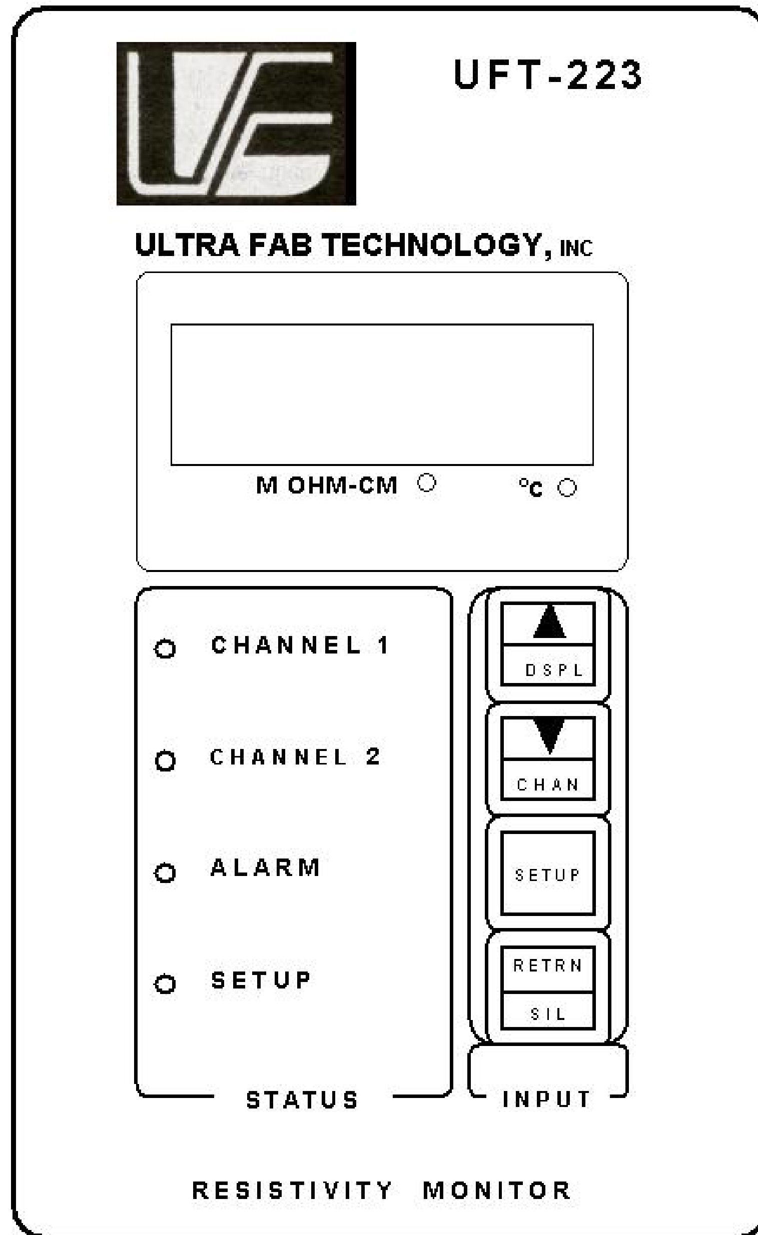

Figure 1

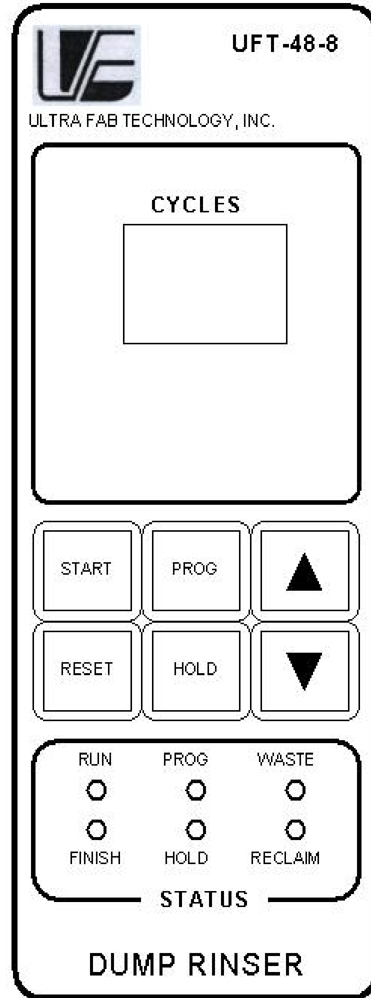

Figure 2

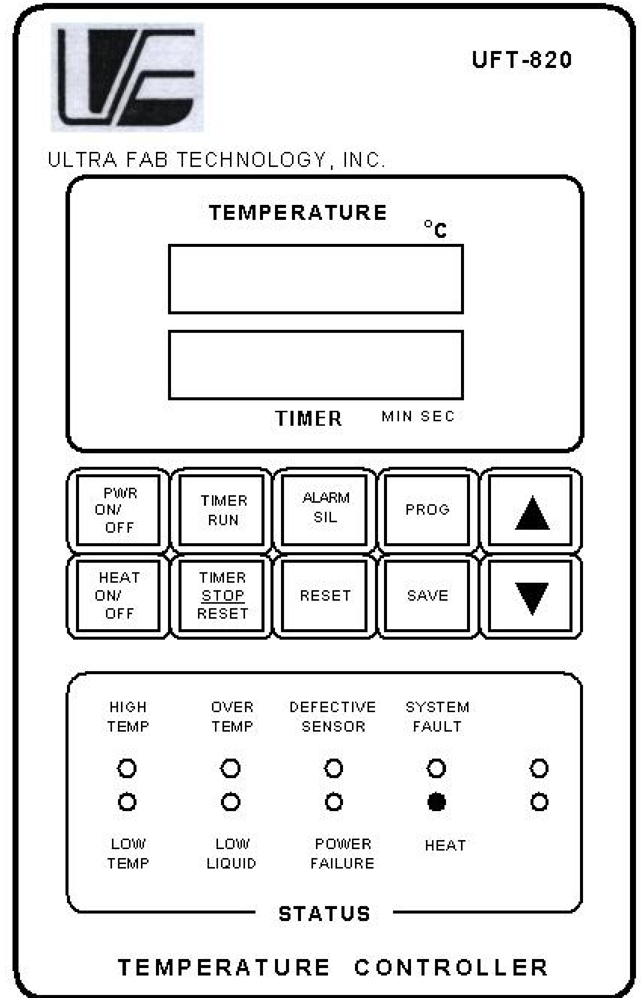

Figure 3

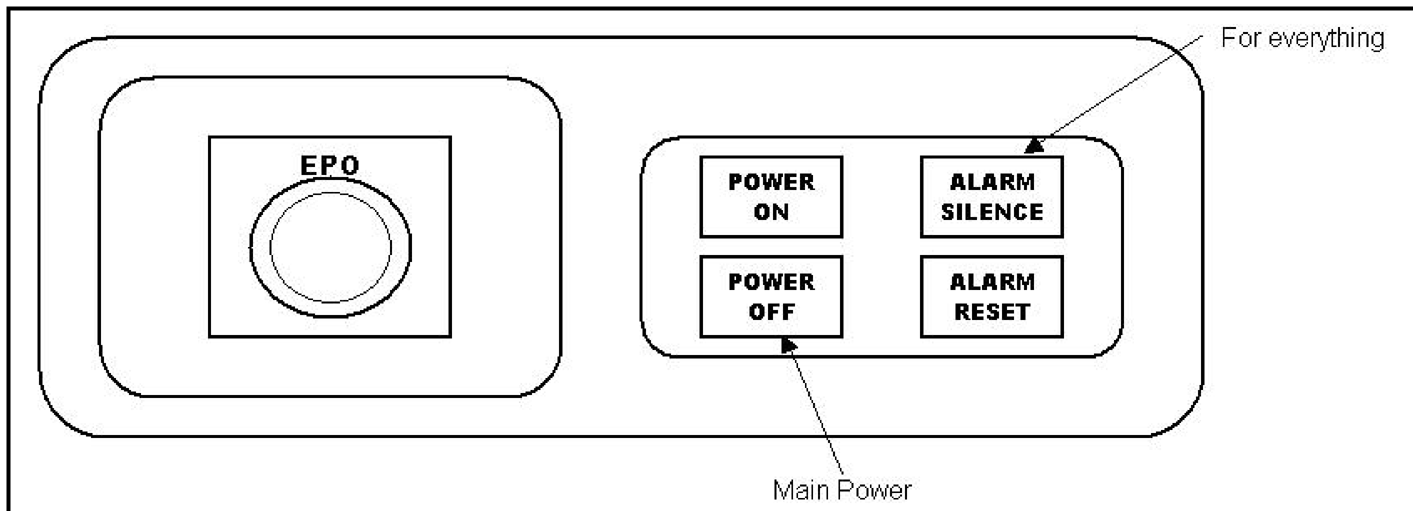

Figure 4

12.0 *Appendices*

12.1 Deck Hose Instructions

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.

12.2 Piranha Bath

UFT-223 Resistivity Monitor	
SP1	10.00
SS1	12.00
Hi1	.00
Lo1	.00
Cr1	1.00
Ce1	0.0
SP2	10.00
SS2	.00
Hi2	.00
Lo2	.00
Cr2	.00
Ce2	.00
AC	00
CC	01
rL1	05
rL2	06
AL1	07
AL2	08

Table 4

UFT-820 Temperature Controllers	
C5	10:00
PA	:20
P5	120.0ºC
Hi	125.0
Lo	12.9
dr	100.0
dl	2:00
Cr	10
Pb	10.0
rE	0.5
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	4
Ad	0
n2	n
Ac	0
PC	5
Pn	1
rP	L

Table 3

Teflon® is a registered trademark of DuPont.