1.0 Title
VLSI msink6 Operation (MOS clean)

2.0 Purpose
Msink6 is the dedicated wet sink for MOS clean and pre-furnace clean processes. This sink provides two sets of piranha baths, HF tanks and quick dump rinse stations (QDR). There are the two 8" size piranha baths on the far left and far right sides of the sink. Next to them a 6-inch 10:1 HF (49%) tank on the left and an 8-inch 25:1 HF (49%) on the right between these two piranha baths. There are also two quick dump rinse stations (6" and 8") available at this sink.

3.0 Scope
This manual covers the operation of msink6 and rules applied to our VLSI operation. Msink6 is a furnace pre-clean sink. This is the last cleaning step applied to wafers prior to entering furnaces. Any wafer that goes into a furnace should go through this cleaning procedure regardless of MOS and Non-MOS clean category applied to it. Non-MOS processed wafers will get an additional clean in msink8 first, before going into msink6 for their pre-furnace clean step. MOS processed wafers, which have gone through the photo-resist stripping step, will also need to receive the additional msink8 clean prior to their pre-furnace clean steps in msink6. Additional information are available in Chapter 2.01- General Cleaning Procedures.

IMPORTANT NOTE: ABSOLUTELY NO METAL (ANY METAL) LAYER WAFERS OR PHOTORESIST COATED WAFER CAN BE PUT IN THIS SINK.

4.0 Applicable Documents
Revision History
Chapter 2.01 General Cleaning Procedures, which explains about pre-furnace cleaning the wafers, cleaning empty acid/solvent bottles, wafer boxes, tweezers, and cleaning of other tools prior to use in VLSI sinks. It also covers transferring chemical bottle within the Marvell Nanofabrication lab.

5.0 Definitions & Process Terminology
5.1 Exhaust Alarm: This alarm shuts off the power to the sink, when sink exhaust level falls below a certain limit (currently set at 0.8 inches of water; full scale is 1).
5.2 Fire sprinkler: There is one fire sprinkler mounted in the headcase designed to activate at 286 ºF.
5.3 DI: de-ionized (DI) water used for clean processes with resistivity of ~ 18 Mega Ohm-cm.
5.4 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 or contaminants. Therefore it is very important to make sure cassettes and wafers go through full QDR cycles, as any remaining acid can easily ruin and/or contaminate the consequent spin rinse dryer equipment or other equipment in the lab, particularly the furnaces.
5.5 Spin Rinse Dryer (SRD): DI water rinse followed by a spin dry cycle.
5.6 Clear (white) Fluoroware Teflon cassettes: These cassettes are stenciled “MSINK-6” for the MOS clean processing (electronic device fabrication) at msink6. These cassettes are designated for use in the msink6 spin rinse/dryer only.

6.0 Safe

Follow general safety guidelines for the lab; the safety rules outlined in Chapter 1.01 - Chemical Hygiene Plan and the following:

6.1 This sink contains HF 49% acid and Piranha (heated sulfuric acid); therefore, appropriate safety attire must 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 msink6.

Important Note: Do not use metal tweezers at this sink; only clean Teflon® tweezers are allowed at this MOS clean sink.

6.2 Do not adjust the heater controllers as they have been preset to produce proper temperatures for the piranha baths (120 °C).

6.3 Only use the clear (white) Teflon® chemically resistant cassettes and handles provided for this sink. They are stenciled “MSINK-6”. Failure to do so can cause damage to the station and compromise the operator’s safety.

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

Pre furnace clean processes (Piranha clean and HF dip) are available at this sink, as well as the quick dump rinse process to an acceptable resistivity level on all available wafer sizes: 4”, 6” and 8” wafers. Clear (white) Fluoroware Teflon cassettes and handles in 4” and 6” sizes and stenciled “MSINK-6” are available by the station. Use the same cassette coming out of the acid baths to go into the quick dump rinse/s (QDR), and finally the spin rinse/dryer unit (SRD) for the final rinse/dry steps at this station. Afterwards place these same cassettes into the red transfer box to carry over to the furnace banks. Make sure you are wearing a clean pair of the opaque poly gloves when handling the msink6 cassettes and handles. These gloves are available in a basket next to the techni-cloth holder at the msink6 worktable.

DEDICATED RED TRANSFER BOXES (4" and 6") MUST BE USED FOR TRANSPORTING PRE-FURNACE CLEANED WAFERS TO THE FURNACE STATION. BRING THE BOX/CASSETTE BACK TO MSINK6, IMMEDIATELY AFTER WAFERS ARE LOADED INTO THE FURNACE/S.
8.2 Chemical Location

All the chemicals needed for this sink are stored in the chemical/gas vaults (one on each floor of the Marvell lab: Chem Rm. 399 and the third floor and Chem Rm. 599 on the fifth floor.) Staff and/or student chemical stockers will stock these chemicals in the designated storage bins under the sink for members to use. Notify staff if the msink6 chemical bins need to be restocked.

8.3 Glove and Safety Attire Policy - msink6 Protocol

Whenever you are handling chemicals or placing wafers into the chemical baths, you must wear appropriate safety attire: chemical-resistant gloves on top of nitrile gloves; clear (opaque) poly gloves on top; apron and face shield. Whenever handling any cassettes or handles from VLSI msink6, the poly gloves (clear/opaque 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, except the outside of the waiver transfer boxes, should not be touched without poly gloves.

Do not wear the same pair of poly gloves that you have worn at msink8; get a fresh pair for this station.

In addition: Never use the red curly-corded clean vacuum wand to transfer wafers that have not 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 clear/white cassette using the black curly-corded vacuum wand.

If you suspect that either the cassettes or handles have been contaminated, investigate which part/s may be contaminated and take them out of circulation immediately by placing them in the blue contaminated cassette bin which is on the msink6 worktable in MNL bay 386. Only place contaminated parts in this bin. You can find the contaminated part by process of elimination, first take your wafers out and place the cassette plus handle in the QDR, and rinse to maximum possible resistivity value. If still out of spec (<10 Mega Ohm-cm), then remove the handle and repeat the QRD for the cassette/s. Only place contaminated part/s in the bin and keep in mind that cleaning procedure (RCA1 and RCA2) requires some staff time/work!

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.

Never touch any surface/s while wearing chemical-resistant gloves, such as table tops, door handles, computer keyboards, face shields, aprons, etc. Your gloves may have acid residues on them, hence presentencing hazard to other members that may come into contact with such surfaces/items in the lab. If you need to step away from the sink at anytime, rinse off your chemical resistant gloves with the DI deck hose, dry with techni-cloths and put them away in your drawer or cubbie until you are ready to resume your work at the sink.

8.4 Process Notes

The VLSI msink6 tanks are maintained for MOS-clean processes, as well as pre-furnace cleaning of Non-MOS and MOS clean wafers. See Chapter 2.01 - General Cleaning Procedures for more detail. There is a fire sprinkler mounted right above the sink top, underneath the head case. Be careful not to hit this sprinkler, while moving cassettes (handles) from one tank to another. Special care must also be taken not to contaminate the sink. Do not put any wafer with photoresist or metal layer(s) in this sink. Make sure to clean your wafers (msink8 clean, if
needed), before using this sink, and be careful not to touch piranha with your gloves, while grabbing cassette handles in the Piranha sinks, as this acid will stains the gloves black, also this black stained material may drip onto the sink top, staining it for life. In case of contamination they could cause lab wide problem or at the minimum furnace ramification. Staff changes the chemicals in msink6 regularly (as per portions defined in Table 1, below). If it appears that any of the solutions have been contaminated, notify a staff member immediately (or e-mail processtaff at eecs.berkeley.edu) to change it, and post the problem report on Mercury via FAULTS at once.

**CAUTION!** Techni-cloths left on the sink deck after you have finished working at the sink must be immediately disposed in the trash bin as they can float into the piranha bath! These cloths quickly melt in the hot sulphuric acid and contaminate the bath. The bath must then be shutdown to cool down to be drained and then an RCA-1 clean must follow. This shuts down one of the piranha baths for almost an entire working day! So again: once you have wiped down and dried the sink deck after use, dispose the techni-cloths at once.

**Hint:** If there is a ring around any of the acid tanks or QDR after you remove your wafers, you have contaminated the tank, cassette and the 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 msink6 process worktable in bay 386.

### Table 1 - Chemical Mix in msink6 Tanks (1 liter = 1000 ml)

<table>
<thead>
<tr>
<th>Bath</th>
<th>Chemicals</th>
<th>Portions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heated Baths</td>
<td>Sulfuric Acid (Piranha*)</td>
<td>17 liters (~5 gal) - partially filled tank</td>
</tr>
<tr>
<td>Right Non-Heated Tank (8&quot;)</td>
<td>25:1 HF* (49%)</td>
<td>16 liters DI- H₂O; 640ml HF** (49%)</td>
</tr>
<tr>
<td>Left Non-Heated Tank (6&quot;)</td>
<td>10:1 HF* (49%)</td>
<td>7 liters DI- H₂O; 700ml HF** (49%)</td>
</tr>
</tbody>
</table>

► Piranha is made by adding 250 ml of hydrogen peroxide to the sulfuric acid bath (partially filled with about 17 liters of sulfuric acid in it). Use the 500 ml beaker which is kept next to the hydrogen peroxide bottle on the table adjacent to the sink. You must add some hydrogen peroxide just before immersing every batch of wafers (spike the solution). After cleaning your wafers, as per defined in Chapter 2.01, VLSI clean steps (10 minutes in piranha followed by a short 1 minute HF dip), wafers must then get rinsed 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 report the problem on FAULTS for staff to schedule an acid change that will enable them to retrieve your samples.

### 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 three 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 MPC-301. This is the control pad for the quick dump (QDR) station, which is currently set for three dump rinse cycles. Wafers are initially
showered with DI water followed by three 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 8850-2 RESISTIVITY MONITOR control panel. Piranha bath temperature can also be read on the MPC-100 TEMPERATURE CONTROLLER display for each piranha bath. Each QDR station performs a self-clean every 60 minutes by running one QD cycle automatically.

**8850-2 RESISTIVITY MONITOR** (Figure 1)

- **UP/DOWN** Toggles between resistivity/temperature readings, loop output and last calibration date.

**MPC-301 DUMP RINSER (QDR) KEYS/FUNCTIONS** (Figure 2)

- **START** - Activates the dump rinse cycle/ Reactivates dump rinse cycle.
- **STOP/RESET** - Deactivates the Dump Rinser.
- - Silences alarm.
- - Automatically reset itself in preparation for another run.
- - Exits program mode.
- **OPEN** When the system is running, it halts the operation temporarily. When it is in STANDBY mode, it dumps the tank manually. This will allow you dump the water from the last QDR cycle. Leave the tank empty, after you are done with your process (manually dump the water).
- **SETUP** Parameters to be written in the EEPROM memory.

**MPC-100 TEMPERATURE CONTROLLER KEY/FUNCTION** (Figure 3)

- **POWER (ON/OFF)** PWR key Turns on/off the master power for the temperature controller.
- **HEATER ON/OFF** HOLD key turns on/off the heated piranha bath.
- **TIMER RUN** Stop/RESET key starts the timer.
- **TIMER STOP/RESET** Stop/RESET stops or resets the timer in operation mode.
- **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** Drain Key can be pressed twice to empty the baths/tanks. Make sure chemical baths are sufficiently cooled down (80ºC) before draining, to protect drain line/s. You can drain a small amount of chemical/s by pressing the DRAIN button twice, then once again when you want to stop draining.
- **PROGRAM** PROG key access to change or step through various setup parameters. Note: Staff are only allowed to edit/change the program.
- **SAVE** Save key permanently save the system setup parameters.
- **RESET** Stop/RESET this key is utilized to exit the PROGRAM mode.

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 12.3.
The parameter codes for the programs on the MPC-100 temperature controllers and MPC-301 quick dump rinsers are listed in Tables 3 and 4 in Appendix 12.2. The parameter codes are not to be altered by the Marvell Nanolab 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 250 ml of hydrogen peroxide to the heated sulfuric acid bath, which is kept at 120 °C to activate 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: Carefully lift the cassette out of the piranha bath, holding it above the bath until it stops dripping, and then place the cassette 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. Press START button on the QDR controller.

9.4.5 HF dip is required next, unless you have a gate oxide or other oxides that may get removed by HF, in which case you can skip the HF dip or shorten the process time. 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 msink6 (piranha or HF).

9.5 Quick Dump Rinse (QDR) Operation

This is a three 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 the clear(white) cassette/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 2 for keypad schematics).

9.5.3 Monitor the resistivity by selecting proper resistivity channel on the RESISTIVITY MONITOR control pad (Figure 1). Water temperature and resistivity can be monitored on the same LED display. Note, relay1 and relay2 light on the display shows which QDR is selected/monitored.

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 three 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 OPEN button, then RESET button, as soon as the water is drained. Leave the QDR with no water in it (press OPEN button to dump the water out), 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 MSINK6SRD during its rinse cycles.

9.6 Msink6 Chemicals

Chemicals used at msink6 can be found in Chem Rm. 399 or in the bins under the sink.

No empty bottles may be left in the bins underneath msink6, or on the floor in the vicinity of the sink. All empty bottles MUST be taken to the bottlewash2 in the rear chase 397, directly outside
the entrance to the Chem Rm. 399 to get rinsed and disposed properly. Operating instructions for the bottlewash2 are posted on the wall at the bottlewash2.

Face shields, nitrile gloves, chemical resistant 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 with the black curly cord to load incoming wafers (not cleaned at this sink yet). Use the vacuum wand with the red curly cord to unload cleaned wafers (post msink6 clean). The spin/rinse dryer next to msink6 can only be used with the cassettes from msink6 - each sink has its own set of Teflon 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 in 386 bay. If any particles are found on the wafers, post it as problem on FAULTS.

Msink6 cassettes and handles for msink6 are stored in the white bin labeled cassettes for msink6; located on the worktable in bay 386 (next to msink6). If an cassette and/or white handle appears to be contaminated, please observe the following procedure:

9.7.1 Remove the contaminated piece from msink6 immediately; transfer your wafers into a clean cassette from the worktable next to msink6.

9.7.2 Place the contaminated cassette into the blue bin on the process worktable in bay 386 labeled contaminated cassettes, see Section 8.3 for additional information.

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.

9.8 Transferring Cleaned Wafers to Furnace Stations

9.8.1 Always use the red transfer boxes at the station with the MOS clean clear(white) Teflon® cassettes to transfer pre-furnace cleaned wafers to the furnace station. There are 4” and 6” boxes available, labeled wafer transfer box to furnace.

9.8.2 Do not use these transfer boxes for any other application. These boxes have been cleaned for the sink-to-furnace transfer, and should immediately be returned back to msink6 once wafers are loaded into the furnace.

10.0 Troubleshooting Guidelines

10.1 Rinse cycle stopped in the middle QDR cycles: Press OPEN button to dump the water out, then press START to restart the quick dump rinse cycles.

10.2 Cannot reach resistivity above 10 M Ohm-cm in QDR: Go through another rinse program (3 cycles). If resistivity is still below specification limit, then change the cassette, handle and try the rinse cycle again. If it still cannot make the resistivity, then there may be other issues involved (dirty cassettes may need to be RCA cleaned by staff). See Section 8.3 as to how to put away dirty cassettes, and handles. Stop and report the problem on Mercury.

10.3 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.

10.4 Sink exhaust- Photohelic Gauge: Power will shuts off to the sink, if the exhaust drops below the minimum set limit (0.5 inch of water) or exceeds the maximum set limits (1.0 inch of water) shown on Photohelic gauge. Turn the power on, and if it stays on then use the sink, perhaps a
temporary excursion of air flow caused this issue. Otherwise, if the sink persists with shutting down and/or power does not come on/stays on, then report the problem on faults. Do not use sink until condition is checked by staff (Figure 5).

10.5 Status Indicators on Temperature Control Panel (Figure 3):
Red LED will light up to indicate a problem:

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HGH TEMP</td>
<td>High Temperature</td>
</tr>
<tr>
<td>OVER TEMP</td>
<td>Over Temperature</td>
</tr>
<tr>
<td>DEFFECTIVE SENSOR</td>
<td>Defective Sensor</td>
</tr>
<tr>
<td>SYSTEM FAULT</td>
<td>System Fault</td>
</tr>
<tr>
<td>LOW TEMP</td>
<td>Low Temperature</td>
</tr>
<tr>
<td>LOW LIQUID</td>
<td>Low Liquid</td>
</tr>
<tr>
<td>POWER FAILURE</td>
<td>Power Failure</td>
</tr>
<tr>
<td>DRAIN</td>
<td>Drain</td>
</tr>
</tbody>
</table>

Red indicator light will come on when acid is draining.

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

- **RED INDICATOR**: Red indicator light will come on when power goes off on the sink.
- **YELLOW INDICATOR**: Yellow indicator light will come on when an alarm is activated, pressing the alarm will shut the alarm off.
- **GREEN INDICATOR**: Green indicator light on, shows the sink is enabled.

10.7 If EPO is pushed, follow instructions:

10.7.1 Pull out EPO button (red).
10.7.2 Push PWR button on the Sink power controller, just below EPO.
10.7.3 Push power button on heater controller.
10.7.4 Push heat button on controller.
10.7.5 push power button on QDR controller.

10.8 Spin Rinse/Dryer Help Messages

<table>
<thead>
<tr>
<th>HELP-0 Power Failure</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HELP-1 Bladder Pressure</td>
<td>There is inadequate nitrogen pressure to inflate the door seal. Check the door bladder, the nitrogen 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.</td>
</tr>
<tr>
<td>HELP-2 Nitrogen Pres</td>
<td>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.</td>
</tr>
<tr>
<td>HELP-3 Door Open</td>
<td>The door is not completely closed. Check the door. If the door is properly aligned, check the micro-switch actuating arm.</td>
</tr>
<tr>
<td>HELP-4 Index Failure</td>
<td>The unit is not able to index the rotor. Check the rotor positioner.</td>
</tr>
<tr>
<td>HELP-5 Excessive Speed</td>
<td>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</td>
</tr>
</tbody>
</table>
assistance.
11.0 Figures & Schematics

Figure 1 - Resistivity Gauge

Figure 2 - QDR Controller

Figure 3 - Heated Bath Temperature Controller
Figure 4 - Main Sink Control Panel

Figure 5 - Photohelic Gauge
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 RCA1 and RCA2 Clean Tanks

The heated baths and rinse tanks in sink 6 and sink 8 in the VLSI area are periodically RCA1 and RCA2 cleaned. These are different size tanks, therefore will need different amount of RCA1 and RCA2 to fill up the tank. Use the following table to calculate correct amount per size of the tank to get RCA cleaned:

<table>
<thead>
<tr>
<th>Chemical Mix Ratio</th>
<th>Heated Piranha Tank (~25 liters)</th>
<th>6-inch HF Tank (8.5 liters)</th>
<th>8-inch HF Tank (21 liters)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DI water</td>
<td>5 parts</td>
<td>19 L</td>
<td>6 liters</td>
</tr>
<tr>
<td>NH₄OH</td>
<td>&lt; 1 part</td>
<td>2.5 liters (1 bottle)</td>
<td>1 liters</td>
</tr>
<tr>
<td>H₂O₂</td>
<td>1 part</td>
<td>3.75 liters (1 bottle)</td>
<td>1.5 liters</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15.5 liters</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.5 liters (1 bottle)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3 liters</td>
</tr>
<tr>
<td>a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DI water</td>
<td>6 parts</td>
<td>18 liters</td>
<td>6.5 liters</td>
</tr>
<tr>
<td>HCl</td>
<td>~1 part</td>
<td>2.5 liters (1 bottle)</td>
<td>1 liters</td>
</tr>
<tr>
<td>H₂O₂</td>
<td>~1 part</td>
<td>4.5 liters</td>
<td>1.5 liters</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>15 liters</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.5 liters (1 bottle)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.5 liters</td>
</tr>
</tbody>
</table>

Table 2 - RCA Mix

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 H₂SO₄

► 1 part H₂O₂

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

<table>
<thead>
<tr>
<th>MPC-100 Temperature Controller for Heated Piranha Baths</th>
<th>MPC-301 Dump Rinsers</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR</td>
<td>10</td>
</tr>
<tr>
<td>PB</td>
<td>10.0</td>
</tr>
<tr>
<td>RE</td>
<td>1.0</td>
</tr>
<tr>
<td>RA</td>
<td>1.0</td>
</tr>
<tr>
<td>OF</td>
<td>0.0</td>
</tr>
<tr>
<td>AC1</td>
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*Table 3*

*Table 4*
12.4 Msink6 Top View
Msinks 6 & 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. Changing the temperature.
6. Troubleshooting OVER TEMP, alarm and power shut off to the sink.
7. Disposing of empty bottles.
8. Required hand protection.
9. Other required protective gear.
10. How to recognize and deal with contamination.
11. What to do if you break a wafer in the piranha bath.
12. Wafers that are allowed in msink6.
13. Moving wafers from piranha to HF.
14. Which tweezers, cassettes and wands are allowed at each sink.
15. What to do if you find particles on your wafer after cleaning and drying.
16. Loading a cassette in the spin dryer.
17. Problems due to incorrect loading of cassettes in spin dryer.
18. How you know when resistivity is reached.
19. Why/when \( \text{N}_2 \) flows in the dryer chamber.
20. When to remove wafers from dryer.
22. Storing cassettes.
23. Troubleshooting a broken wafer in the spin dryer.
24. Meaning of error messages (e.g. HELP-1) at the spin dryer.
25. Making piranha mix.
27. Overheating piranha bath.
28. Preventing piranha overflow.
29. Using the aspirator.
30. Safety features of the sinks.

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