



Chapter [2.16 and 2.18]

msink16 and msink18

General Purpose Sink

(msink16 and msink18 - 582A)

1.0 Equipment Purpose

- 1.1 Msink16 and msink18 are identical general purpose sinks. They have large deck spaces for members to handle wafers and perform beaker-level work.
- 1.2 Any material and any chemical except 25% TMAH is allowed in these sinks.
- 1.3 Once wafers or materials are processed at msink16 or 18, they are considered metal contaminated and may not continue processing at msink1, 6, 7, or 8.

2.0 Material Controls & Compatibility

- 2.1 Any material is allowed at these sinks, and therefore wafers and samples processed here are considered contaminated and have significant restrictions on where they may go after.
 - 2.1.1 Photoresist is allowed at these sinks.
- 2.2 Any chemical - acid, base, or solvent - except for TMAH is allowed at these sinks, and therefore the user must evaluate their surroundings for safety concerns before starting their work.
 - 2.2.1 If you need to work with TMAH, please get qualified on msink4-tmah.
- 2.3 Lift-off and electroplating are allowed at these sinks.
 - 2.3.1 Lift-off waste must be poured into the right side organic waste bottles.
 - 2.3.2 If you are doing electroplating, take care to keep the surrounding space neat by covering the sink deck during the process and cleaning up after yourself immediately.

3.0 Training Procedure & Applicable Documents

- 3.1 Exam Tool
 - 3.1.1 This tool includes an online exam before qualification. Exams before qualification are to ensure a minimum amount of training has been received. Staff and superuser time is limited, and members need to demonstrate readiness before meeting with staff or a superuser for qualification.
 - 3.1.2 Timeline:
 - 3.1.2.1 Get trained by any qualified member.
 - 3.1.2.2 Take the online test.
 - 3.1.2.3 Arrange a qualification session with a superuser to show competency on the tool.
 - 3.1.2.4 Note that sinkclass is a prerequisite for qualification on all sinks.

3.1.3 Estimated time to completion: 1 week.

3.1.4 msink16 and 18 are grouped together for the test, training, and qualification.

4.0 Please see [Chapter 2.0](#) for general lab cleaning information:

5.0 [Process Chapter 2.1](#) - Chemical/Labwear Guidelines

6.0 **Definitions & Process Terminology**

6.1 **Organic waste disposal bottle:** This is the disposal bottle for organic waste and water-immiscible solvents.

6.1.1 The *right* side of each sink has a bottle for liftoff processes, and the *left* side of each sink has metal-free bottles.

6.2 **Aspirator:** Suction hose used to dispose of water-miscible, acids, bases, and solvents. These get neutralized with the NanoLab's acid waste neutralization (AWN) system. The sink must be enabled for this to work.

6.2.1 Most metals may NOT be disposed of in this way. If you have metal + acid waste, please see process staff before beginning your work to discuss the best way to dispose of your waste.

6.3 **Gooseneck:** The basin opening within the sinks with a faucet attached. The sink must be enabled for this to work.

6.4 **Glove Wash** – Automatically wash the chemical gloves when you put your hands in.

6.5 **Exhaust Alarm** – This alarm shuts off the power to the sink when sink exhaust level falls outside the allotted exhaust band.

6.6 **IPA:** 2-propanol, or isopropyl alcohol. Available at certain sinks and around the lab in yellow-topped squeeze bottles.

7.0 **Safety**

7.1 The following safety gear must be worn at all times while operating this sink:
Chemical-resistant apron, face shield, and chemical-resistant gloves.

7.1.1 Chem gloves must always be the last thing on, and first thing off, so you do not accidentally leave residue chemical anywhere that another lab member may touch without proper safety gear (i.e. phones, doorknobs, table tops, etc.).

7.1.2 Tan chem gloves can be purchased at the Nanolab Office (open 8A-12P, 1P-5P). During off hours, you may checkout gloves from the plastic box in the gowning room. Please only do this if the office is closed, or the supply may not last through the weekend. Green gloves are available near sinks throughout the lab.

7.1.3 Chem gloves should be inspected for holes before each use, and multi-use gloves replaced regularly even if they appear to be in acceptable condition.

7.1.4 Lab members may purchase their own chemical aprons and faceshields. These can be stored in ziploc bags on the designated storage areas of the gowning room (shelves 12-4 and 12-5) or the metal rack in 391.

7.2 This is a general sink where many chemicals are allowed. Take precautions when setting up your chemicals, and note what chemicals that others nearby are working with.

7.3 There is an automatic sprinkler system at this sink, activated at 286 °F.

7.4 The de-ionized (DI) water deck hose is always on, in case of emergency.

- 7.5 Take note of the closest safety station prior to working at this sink (which is located in 582A near the entrance to the gowning room).
- 7.6 In the event of chemical exposure, follow all guidelines found in section 5.3 of the CHP, namely:
 - 7.6.1 Rinse the affected area for 15 minutes either with a safety shower, eye wash, or deck hose. Take care to scrub around fingernails and cuticles.
 - 7.6.2 If you are exposed to HF, apply calcium gluconate gel after 15 minutes of rinsing.
- 7.7 The use of 25% TMAH (Tetramethylammonium hydroxide) is not allowed at msink16/18.
- 7.8 Dwyer Photohelic Exhaust Flow Meter: Monitors the sink exhaust flow and will shut down all electricity and water to the sink if there is too much or too little flow. An alarm will sound; press the SILENCE button and attempt to power back on. If continued alarm, promptly report on Mercury.
- 7.9 MPC-901 Emergency Alarm: Cuts power to the sink in emergencies. Push the big red STOP button to cut the power to this sink. Report on faults if safe to do so. Evacuate others around you if there is an emergency.
- 7.10 Never mix acids with solvents, which is potentially an explosive combination. Therefore, never put an acid in the organic waste bottle.
- 7.11 Rinse the aspirator hose before and after using it, to ensure there's no residue chemical on it which could dangerously mix with the chemical that you are aspirating.
- 7.12 Do not plate flammable solvents directly onto a hotplate - instead, use a secondary water bath.



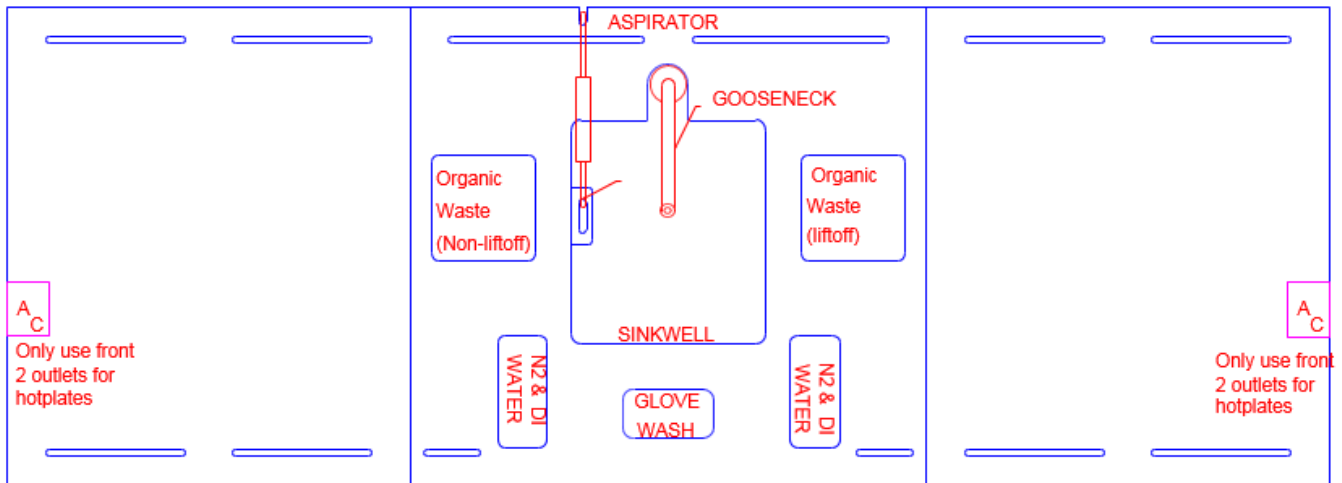
8.0 **Process Data**

- 8.1 Etch rates will vary significantly based on both chemicals, dilution, and temperature, as well as material quality (for example, a material with many pinholes will etch faster than a single crystal of the same material). If precision matters, it is recommended that you etch a dummy wafer with the same material immediately prior to your target wafer to determine an etch rate.
- 8.2 Here are some useful references to give you approximate etch rates:

- 8.2.1 Etch Rates for Micromachining Processing (by K. Williams and R. Muller)
<https://inst.eecs.berkeley.edu/~n245/fa01/hw/etchrate.pdf>
- 8.2.2 Etch Rates for Micromachining, Part II (by K. Williams, K. Gupta, and M. Wasilik)
[https://nanolab.berkeley.edu/labmanual/chap1/JMEMSEtchRates2\(2003\).pdf](https://nanolab.berkeley.edu/labmanual/chap1/JMEMSEtchRates2(2003).pdf)
- 8.2.3 <http://www.smfl.rit.edu/Process%20Information/Film%20Etch%20Rates.htm>

9.0 **Available Processes, Gases, Process Notes**

- 9.1 Each sink (msink16 and msink18) consist of a wet bench work space for two people at a time (one on each side), a gooseneck, aspirator, two organic waste bottles (right side: for lift-off processes, left side: not for lift-off), NanoLab supplied hotplates, and DI H₂O and N₂ guns.



- 9.2 Any material may be processed here, and therefore there are significant restrictions where a sample may go after using this sink. Even if that sample only contains materials that are allowed in other tools of the lab, it is considered contaminated by using these sinks.
- 9.3 Any lab-supplied chemical except 25% TMAH (Tetramethylammonium hydroxide) is allowed at these sinks. 25% TMAH is only allowed at msink4.
- 9.4 You must enable msink16/18 when working at the sink, and disable when you are done. If another person is working at the sink, please communicate with them before disabling.
- 9.5 Work should always be done at least 6" from the front of the sink. If you need to leave a sample in a beaker for an extended period, place it at the back of the sink with a filled out process ID blue label, including the following information: name, member name, date, return time, chemical (even if it is water).
- 9.6 **WARNING:** The cassettes that wafers are delivered in are usually polypropylene and have very limited chemical resistance. Never use the cassettes from your wafer purchase for chemical processing of your wafers. If you are unsure what cassette or part holder to use for your chemical processing - always review with staff.
- 9.7 NanoLab supplied hotplates are allowed here. See section 10.4 for guidelines you **MUST** follow if using hotplates.
- 9.8 The following chemicals are stored in the bins under the sinks. These bins are secondary containment and well labeled. Always place a chemical back in its designated spot to ensure that it is stored with compatible chemicals.

- 9.8.1** Acids: Acetic Acid, Aluminum Etchant, Buffered Oxide Etch (5:1 and 10:1), Hydrochloric Acid, Hydrogen Fluoride, Hydrogen Peroxide, Nitric Acid, Phosphoric Acid, Silicon Etchant, Sulfuric Acid
 - 9.8.2** Bases: Potassium Hydroxide, Ammonium Hydroxide, Ammonium Fluoride
 - 9.8.3** Solvents: Acetone, IPA, Methanol, 1165, NMP, PRS-3000
- 9.9** The following cabinets are for lab stocked chemicals, and available for members to use AFTER confirming that there is not already an open bottle of the desired chemical under the sink. These cabinets are secondary containment and well labeled. Always place a chemical back in it's designated spot to ensure that it is stored with compatible chemicals.
 - 9.9.1** 582A-C1: Acetone, PRS-3000, SVC-14, 1165 Remover, Methanol, IPA, Ethylene Glycol
 - 9.9.2** 582A-C2: Buffered Oxide Etch (10:1 and 5:1), 49% HF, Sulfuric Acid, Hydrochloric Acid, Nitric Acid, Phosphoric Acid, Cr etchant, Al etchant, H₂O₂
 - 9.9.3** 591-C3: SU-8 Developer, Ammonium Hydroxide, Ammonium Fluoride
 - 9.9.4** 591-C4: Si etchant, FeO etchant, Au etchant,
 - 9.9.5** Msink20, lower left: NMP
 - 9.9.6** Acetic Acid has to be stored in staff only storage in room 599. Please email staff when you need to use Acetic Acid
- 9.10** After opening a new bottle, it should be placed under the sink, not back in the cabinet. Exceptions are the following chemicals, which are only stored in the cabinet, not under the sink:
 - 9.10.1** Au etchant, FeO etchant, Cr Etchant
- 9.11** Special Chemicals: Special chemicals are ones that the NanoLab does not stock, but a member brings in for their own research. Special chemicals must be approved by staff before bringing into the lab. During the approval process, you will find out how to safely store, and dispose of your chemical. Bottles in the special chemical cabinets must have an up-to-date approved special chemical label.
- 9.12** When you finish a bottle, it must be washed in the bottlewash in 582A (see section 8.2 for bottlewash instructions). Never start a new bottle if one is already open (finish a bottle before starting a new one). Never leave an empty bottle for the next person to rinse out.
- 9.13** Waste disposal:
 - 9.13.1** Acids, bases, and water-miscible solvents (unless specified) without metal ions can be aspirated. The acid waste neutralization system in the NanoLab will safely treat these chemicals before going into the general system.
 - 9.13.1.1** If you have metal ions mixed in, please consult process staff before starting your process for disposal instructions.
 - 9.13.2** Water-immiscible solvents, photoresist, and anything with photoresist mixed in gets disposed in the organic waste bottles.
 - 9.13.2.1** Be sure to open the funnel lid before pouring.
 - 9.13.2.2** If there is metal liftoff, it goes in the right side bottle, waste without metal liftoff goes into the left side bottle.

- 9.13.2.3** Every pour must be recorded! Record your name, date, chemical(s) and lift-off metal used, and approximate quantity. This allows EH&S to know how to most safely dispose of the bottle.
- 9.13.2.4** When a bottle is 75-80% full and you reach the blue line, or close to it, you are responsible for changing the bottle and leaving a new bottle for the next person. See section 8.1 for full instructions.
- 9.13.2.5** Acids are never allowed in this bottle.
- 9.13.3** EKC265 and EKC270, which are special chemicals used by multiple groups, contain hydroxylamine which reacts with acetone and other solvents in the general use organic waste bottles. Therefore, they must have their own separate waste container. This should be stored in 591-C3. Please contact process staff when this bottle is full for EH&S preparation.
- 9.13.4** Full EH&S guidelines for waste disposal is found here:
<https://ehs.berkeley.edu/sites/default/files/lines-of-services/environmental-protection/2014draindisposal.pdf>
- 9.13.5** Aluminum foil must be disposed of every 48 hours. Otherwise, it may corrode due to the metal fumes in the sink, and stain the sink deck. This applies to any foil used in the sink, such as for hotplates or to cover beakers.

10.0 Equipment Operation

- 10.1 To change organic waste bottle:** Bring a new (empty) bottle from 591-C7 to msink16/18. Swap that bottle's cap onto the full bottle, and put the funnel onto the new bottle. Fold the filled out organic waste manifest into the full bottle. Write the number from the new bottle onto the next sheet on the clipboard. Take the full bottle to 591-C8.
- 10.2 To rinse empty bottle in bottle wash:** Carry the empty bottle to the bottlewash in 582A using a secondary containment carrier. Wear the safety gear supplied there. Take off the cap to the empty bottle, and place the bottle upside down on the water spout. Close the lid. Press the green button which cycles water for one minute. Draw an X on the label, and place in the blue recycle bin (either glass or plastic).
- 10.3 To use gooseneck/aspirator:** Press green "start" button for either apparatus. Press "stop" to end. The times are set to 3 minutes. The aspirator may be used for acids, bases, and water-miscible solvents.
- 10.4 Hotplates:** The following guidelines must be followed when working with hotplates at msink16/18:
 - 10.4.1** Only NanoLab supplied hotplates are allowed here.
 - 10.4.2** Hotplates may only be used in the FRONT two outlets on each the left and right sides of the sinks. These outlets are activated by pressing the large green buttons on each side labeled "4 hour time" for either side.
 - 10.4.2.1** If you have a process longer than 4 hours, you simply press the button again and it will be reactivated for another 4 hours.
 - 10.4.2.2** This is an important safety measure to prevent hotplates from accidentally getting turned and left on, or from being left on unattended.
 - 10.4.3** If you are heating flammable solvents, this must be done in a secondary water bath. Solvents may not be placed directly on a hotplate.

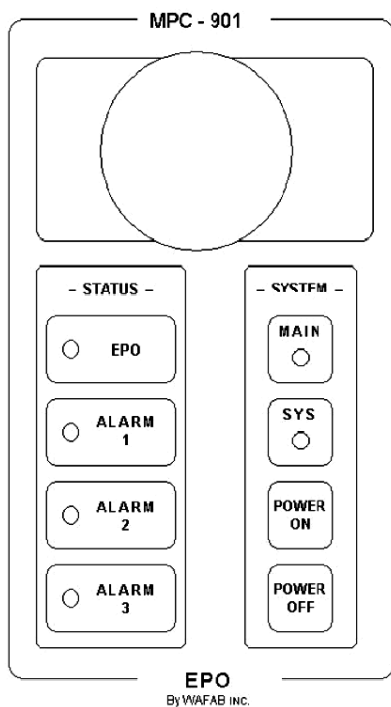
10.4.4 As noted in the CHP, section 10.1, hotplates may be left unattended when performing well understood, stable processes, during regular MNL Staff hours (8AM – 5PM) if labeled with a blue process identification tag. Hotplates should be periodically monitored. Hotplates must be secured before finishing laboratory activities for the day. In the event a process requires hotplate use outside of regular Staff hours, members are responsible for conducting routine inspections that maintain a safe, well controlled process. Any hotplate above 200 °C requires full supervision until processing is done.

10.5 Spills: You are responsible for cleaning up any spill or mess. Do not leave a mess for the next person. Water can be wiped up. If it is not water, use the deck hose to neutralize the spill, and if possible point the water towards the gooseneck. Once neutralized, wipe up using technicloths.

11.0 Troubleshooting Guidelines

11.1 I arrive at the sink and power is off. Why and what should I do?

11.1.1 Power is likely off because the exhaust flow went out of spec (less than 0.5" of water, or greater than 1" of water). You may try to turn the power back on. If it stays on, then there was a temporary issue to the flow. If it shuts off again, there is a more permanent airflow issue and the sink may not be used. Report the fault on Mercury.



12.0 Study Guide

12.1 If there is a written test, add study guide to help prepare for written test.

13.0 Appendices

- 13.1** Glassware (and teflon beakers) can be stored in the communal glassware cabinets. On the third floor, this is at the window area between bays 380 and 382, and on the 5th floor it is in 591 near 591-C1. Cabinets must never overflow- the doors must always be able to fully close. Glassware must have a current member's name on it - not a former member or a group name. Otherwise, it may be purged.