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| Standard Cavity Components Degreasing Procedure | | | |
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# Purpose

This Standard Procedure is intended to be generalized such that it could apply to most cavity types at JLab. The PI/PM is encouraged to provide project specific instructions to supplement this procedure, which are to be attached to the applicable Traveler.

If at any time the project specific instructions change or modify the content of this procedure, then a new procedure will be required, to be approved through the normal processes at SRF and JLab.

**SAFETY:**

Individuals must keep safety as the first priority in the process; before beginning any job, the user must assure they have the correct PPE for the individual job. Maintaining the level of safety and secure nature of the work area is paramount. Assure personal safety by using caution in movement and taking necessary steps to avoid unnecessary personnel in the immediate area.

Refer to the work-center OSP for specifics.

# Scope

This procedure applies to all components degreased inside the SRFOPS Chemistry Room.

This procedure does not apply to component processing inside the R&D Chemistry Room.

# Terms and Definitions

The following terms have specific meanings within this procedure.

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| **Term** | **Definition** |
| **Component** | * For the simplicity of this procedure, the terms cavities, components, and/or parts are considered interchangeable and will be generally referred to as “component”. Components generally are used to seal a cavity and potentially see beam. They are to be kept as clean as possible and should never be put in the same water as hardware. * If a component is a mix of metals or an unusual size or shape, the PI/PM and/or a supervisor should be consulted on the appropriate method to use. |
| **Hardware** | * Also referred to as fasteners. Nuts, bolts, studs, washers and like items. These should not be degreased in the same water as components and other parts that potentially see beam or face the inside of a cavity. |
| **Item** | Either a component or hardware. |
| **DI/UPW** | Deionized (DI) and Ultra-Pure Water (UPW) are used interchangeably in this procedure and may also be referred to as simply water. |
| **Ultrasonic, USC, and sonic** | are used interchangeably in this procedure. The container or tank may also be referred to as a bath. |
| **N2 / Nitrogen** | filtered nitrogen is most commonly used. |
| **Quick Dump Rinser (QDR)** | Also called the triple rinser. A sink that fills and empties water to rinse components several times. |
| **PI/PM/SOTR** | * Principal Investigator, Project Manager, Subcontracting Officer Technical Representative. Someone otherwise in charge of the project or item in question. A supervisor may also be utilized if needed. |

# Roles and Responsibilities

The following roles have responsibilities described in this document.

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| **Role** | **Responsibility** |
| Chemistry Technician | A technician certified to do degreasing of components inside the SRFOPS chemistry room. |
| Chemistry Supervisor | Oversees the chemistry room and processing; and certifies Chemistry Technician. |
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# Procedure

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| * **Items used in this procedure:** | | |
| **Detergents:** | **Solvents:** | **Wipers:** |
| Micro90, Citranox, Liquinox | Acetone, Methanol, Clean Room Quality Isopropyl (Isopropanol) | TX1009B Alpha Wipes, TX2009 Beta Wipes |

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## Prior to Cleaning

1. Ensure the workspace is clean and tidy.
2. Don appropriate PPE.
   1. Gloves should be worn whenever handling items and changed after cleaning and as needed to maintain cleanliness.
3. Inspect item(s) for damage (chips, scratches, dings, damaged threads, etc).
   1. If an item has pre-existing impairment, notify the PI/PM or a supervisor.
   2. Do not proceed until written acknowledgement of previous damage presence has been received.
4. All items shall be completely disassembled and all gaskets removed prior to executing this procedure unless otherwise directed by the PI/PM.
5. When cleaning, it is critical to keep items separated by type and material in the bath. Only like materials items are to be cleaned together. Do not share the bath with other items.
6. Some items may be serialized or labeled and it may be necessary to keep them together or retain that information throughout the cleaning process. This can be done several ways including:
   1. Labeling the cleaning containers
   2. Using separate baths
   3. Color-coding the containers
7. Use only pre-approved detergents and solvents.
8. When using the smaller sonics in the hoods in 1043, the water must be filled to a minimum of 5 inches to prevent the motors from overheating. Failure to do so can cause permanent damage to the USC.
9. The item(s) must be completely submerged for proper ultrasonic cleaning action. Ensure there are no trapped air pockets under or within the item in the USC.
10. To prevent excessive exposure to particulate in air, the technician is to perform all actions within the laminar flow hood (when possible).

## Niobium, Stainless Steel, and Titanium

The following steps apply to stainless steel, titanium, or niobium components and hardware.

1. If the component(s) appears excessively soiled or greasy, perform the following:
   1. Wipe all oil and marker off with acetone.
   2. Measure a small amount of Micro90 into a small container (~4 oz.).
   3. Use a TX 1009B Alpha Wipe to apply detergent directly to the component’s exterior and/or interior. Additional wipers, brushes or other means may be necessary to pre-clean heavily soiled components.
   4. Alternatively, the components may be ultrasoniced in a secondary container.
   5. Thoroughly rinse component with DI water.
   6. Repeat until heavy soil, oil, etc. has been removed.
2. Ultrasonic the items:
   1. Position components in such a way as to prevent their surfaces from touching each other during the ultrasonic cleaning process. Baskets, sheets of plastic, or containers may be used as necessary to protect and contain the component(s). Failure to do so could result in damage to the component.
      1. If the components have sealing surfaces, place them face up whenever possible.
   2. Hardware (nuts, bolts, studs, and washers) does not need to avoid touching, but should be kept in a thin layer to ensure proper cleaning occurs.
      1. Hardware and components shall not share the same water.
   3. Close drain valve of USC.
   4. Fill USC with DI/UPW at least five inches or more to cover the component being cleaned.
   5. Add 1-2% detergent to the USC tank.
      1. Usually about 300 ml (small USC) or 600 ml (large USC) of Micro90 detergent is added to the USC. If using the 200gal large USC, add roughly 1 L of Liquinox. Citranox may also be used.
   6. Turn on the USC heater (the temperature is typically set to 130°F (54°C)).
   7. Turn on USC andallow the component(s) to clean for 50 minutes. This time may be adjusted if the water is preheated.
      1. The UPW/detergent temperature shall be at least 130°F (54°C) for a minimum of 15 minutes.
   8. Turn off the USC and heater.
   9. Don a new pair of nitrile gloves and inspect the items(s) for cleanliness.
      1. If the items do not appear to be clean, re-clean as necessary.
      2. If the components appear to be clean, proceed.
3. Rinse components in DI/UPW using one or all of the following methods:
   1. Transfer the parts (in perforated containers if small parts) to the QDR and allow to run for the standard 3 cycles.
   2. Rinse items using DI/UPW until no soap bubbles are visible (approximately 5 minutes).
      1. Extra rinsing may be necessary on blind holes as they may trap soap and particulates.
   3. Dip visibly clean items in the triple rinse sinks three times from left to right.
4. Once thoroughly clean, place items on clean room wipes in the laminar flow hood or appropriately clean area and allow to dry if there is no immediate need.
   1. If parts are needed urgently, they may be dried with a solvent such as acetone, methanol, or isopropyl and blown dry with filtered N2.
   2. If components are bellows, valves or otherwise difficult to dry, they may need to be dried in the oven.
      1. Follow CP-STP-CAV-CHEM-BAKE unless otherwise directed by the PI/PM.
5. Bag the items:
6. Ensure items have dried completely before bagging.
   1. If necessary, dry with filtered nitrogen.
7. Bag and seal each item separately.
8. Repeat process until all are bagged.
9. Transport to the next work center.

## Silver Plated Stainless Steel Fasteners and components

The following steps apply to silver plated stainless steel fasteners (nuts, bolts, washers). Only silver plated stainless steel fasteners are to be cleaned in the bath. Do not share the bath with other items. All fasteners shall be completely disassembled prior to executing this procedure. To prevent excessive exposure to particulate in air, the user is to perform all actions within the laminar flow hood (when possible).

1. Don a new pair of nitrile gloves and appropriate safety glasses;
2. Inspect fasteners for irregularities or damage (stripped heads, threads, flaking of silver plating, etc.). Report questionable items to your supervisor.
3. If the fasteners appear excessively soiled or greasy, perform the following:
4. Measure ~4 oz. of Micro90 into a small container.
5. Use TX 1009B Alpha Wipe or small brush to apply detergent directly to the component’s exterior. Additional wipers, brushes or other means may be necessary to pre-clean heavily soiled components.
6. Alternatively, the components may run through the ultrasonic in an secondary container
7. Thoroughly rinse component with UPW.
8. Repeat until heavy soil, oil, etc. has been removed.
9. All fasteners need to be cleaned in the Ultrasonic Cleaner (USC):
   1. Close drain valve of USC.
   2. Fill USC to the bottom of the plugged overflow port with UPW. Carefully load fasteners into containers or mesh baskets as needed. The fasteners must be completely submerged for proper ultrasonic cleaning action. Ensure there are no trapped air pockets.
   3. Add 1-2% detergent to the USC tank.
      1. ~300 ml (small USC) or ~600 ml (large USC) of Micro90 detergent to the USC.
   4. Turn on the USC heater (the temperature is typically set to 130°F (54°C)).
   5. Turn on USC andallow the component(s) to clean for 50 minutes. This time may be adjusted if the water is preheated.

***NOTE: The UPW/detergent temperature shall be at least 130°F (54°C) for a minimum of 15 minutes.***

* 1. Turn off the USC and heater. Don a new pair of nitrile gloves and inspect the fasteners for cleanliness. If the components do not appear to be clean, return the component(s) to the ultrasonic bath and re-clean. If the components appear to be clean, continue.

1. Rinse components in DI/UPW using one or all of the following methods:
   1. Transfer the parts (in perforated containers if small parts) to the Quick Dump Rinser (QDR). Start the QDR and allow to run for the standard 3 cycles.
   2. Rinse components using DI/UPW until no soap bubbles are visible (approximately five minutes) then dip visibly clean components in the triple rinse sink from left to right.
   3. Ensure the components are thoroughly rinsed and water surface is free of soap bubbles. Repeat if necessary.
   4. Once thoroughly clean, dry components on clean room wipe(s) in the laminar flow hood.
      1. If parts are needed urgently, they may be dried with a solvent such as acetone, methanol, or isopropyl and blown dry with filtered N2.
2. Bag fasteners:
3. Ensure all fasteners have dried completely before bagging
   1. If necessary, dry component with filtered nitrogen
4. Bag each type/size separately, in its own bag and seal.
5. Repeat process until all components are bagged.
6. Transport bagged components to the next work center.

## Copper & Silicon Bronze Components

The following steps apply to copper (probe tips, washers, etc.) and silicon bronze (nuts, etc.) parts. Only copper or silicon bronze items are to be cleaned in the bath. Do not share the bath with other items. All components shall be completely disassembled prior to executing this procedure. To prevent excessive exposure to particulate in air, the user is to perform all actions within the laminar flow hood (when possible).

***NOTE: Copper wastewater should be saved and disposed of appropriately.***

1. Don a new pair of nitrile gloves and appropriate safety glasses.
2. Inspect components for irregularities or damage (dings, nicks, scratches, etc.). Report questionable items to your supervisor.
3. Perform applicable oxide stripping step for the type of metal:

***NOTE: Position copper probe tips in such a way as to prevent their surfaces from touching each other during the oxide stripping process. Failure to do so could result in damage to the component.***

* 1. Copper Probe Tips (or similar components):
     1. It may be necessary to manually clean the copper before placing in the USC. Use a TX 1009B Alpha Wipe or small brush to apply detergent directly to the component until all visible oxides have been removed. Additional wipers, brushes or other means may be necessary to pre-clean heavily soiled components.
     2. Once oxides have been satisfactorily removed, immediately rinse in UPW.

***Note: Oxides form on the surface of copper very quickly. Do not allow probe tips to dry between steps.***

* 1. Silicon bronze nuts and copper washers:

***Note: Silicon bronze nuts and copper washers can be cleaned together.***

* + 1. Add an appropriate amount of Micro90 into an appropriately sized container or basket (container volume in ml x .2 = ml of Micro90 needed). Add components to the container and top off with UPW to achieve a 20% concentration.
  1. Close drain valve of USC.
  2. Fill USC roughly to the bottom of the plugged overflow port with UPW. Place container(s) with Micro90 and components into USC bath.
  3. Turn on the USC heater (temperature set typically to 130°F (54°C)).
  4. Turn on USC andallow the component(s) to clean for 50 minutes. This time may be shortened if water is preheated.

***NOTE: The UPW/detergent temperature shall be at least 130°F (54°C) for a minimum of 15 minutes.***

* 1. Turn off the USC and heater. Don a new pair of nitrile gloves and inspect the component(s) for cleanliness. If the components do not appear to have all the oxide removed, repeat the cleaning process. When the oxide layer is no longer visible, continue.

1. Perform final ultrasonic cleaning (particulate removal):

***NOTE: Position components in such a way as to prevent copper probe tips from touching each other during the ultrasonic cleaning process; failure to do so could result in damage to the component.***

* 1. Rinse components with UPW.
  2. Follow metal specific procedure:
     1. Copper probe tips: Place probe tips into a small plastic container with locking lid or other appropriate container. Add appropriate amounts of Micro90 or Citranox and UPW to container to achieve a ~2% concentration (UPW volume in ml x .02 = ml of detergent needed).
     2. Copper washers & silicon bronze nuts: Carefully load them into mesh basket or other container for use in USC.
  3. Add 1-2% detergent to the USC tank.
     1. ~300 ml (small USC) or ~600 ml (large USC) of Citranox or Micro90 detergent to the USC.
  4. Add components to USC.
  5. Turn on the USC heater (the temperature is typically set to 130°F (54°C)).
  6. Turn on USC andallow the component(s) to clean for 50 minutes. This time may be reduced if water has been preheated.

***NOTE: The UPW/detergent temperature shall be at least 130°F (54°C) for a minimum of 15 minutes.***

* 1. Turn off the USC and heater. Don a new pair of nitrile gloves and inspect the component(s) for cleanliness. If the components do not appear to be clean, return the component(s) to the ultrasonic bath and restart the cleaning process. If the components appear to be clean, continue.

1. After ultrasonically cleaning the components, rinse them in UPW as follows:
   1. Copper probe tips: Remove probe tip(s) from container and immediately rinse in UPW for at least five minutes.

***Note: Oxides form on the surface of copper very quickly. Do not allow probe tips to dry between steps.***

* + 1. Thoroughly dry with filtered ionized N2.
    2. Immediately bag probe tip(s) in its own bag filled with N2 and seal.
    3. Transport bagged components to the clean room pass-through or an appropriate location.
  1. Silicon bronze nuts and copper washers:
     1. Transfer container and components to the Quick Dump Rinser (QDR). Start the QDR.

***Note: A minimum of three rinse and dumps shall be performed in the QDR.***

* + 1. The components may also be cleaned by rinsing with UPW and/or dipping in the triple rinse sink.
    2. Ensure the components are thoroughly rinsed.

1. Place nuts and washers on new, dry, clean room wipes within the laminar flow hood and allow components to dry if there is no immediate need.
   1. If parts are needed urgently, they may be dried with a solvent such as acetone, methanol, or isopropyl and blown dry with filtered N2.
2. Bag components:
3. Ensure all components have dried completely before bagging
   1. If necessary, dry component with filtered nitrogen
4. Bag each item type separately and seal.
5. Repeat process until all components are bagged.
6. Transport bagged components to the next work center.

## Copper Gaskets/Seals (Still Under Development)

* 1. Put on fresh pair of vinyl gloves and safety glasses.
  2. If copper seals are tarnished, follow instructions for copper components.
  3. If copper seals are clean and tarnish free in a manufacturer’s bag, wipe bag with isopropanol on an Alpha Wipe.

Step 2:

* 1. Put on fresh pair of vinyl gloves and safety glasses.
  2. Material’s surface may be covered in tarnish from the oxidation of the copper. Impurity on surface should be removed by doing the following:
     1. Measure 4 oz. of Micro 90 detergent into a small container.
     2. Fill remainder of container with DI water at “rinse only” wet bench side.
     3. Use TX 2009 Beta Wipes to apply mixture directly onto part.
     4. Rinse with DI water.
  3. Parts need to be cleaned in ultrasonic (UHV) basin, accomplished as follows:
     1. Place seals in container.
     2. Place container in UHV.
     3. Close drain system of UHV.
     4. Fill container ¾ full of DI water (each part needs to be completely submerged for UHV cleaning to successfully be performed).
     5. Fill UHV with at least 3 inches of DI water to prevent motors from overheating (thereby causing permanent damage to the UHV).
     6. Disperse 4 oz. of Citranox into container.
     7. Set UHV timer for 15 minutes.
  4. Parts will need to be bagged in nylon material:
     1. Cut appropriate length/width nylon bag for each part.
     2. Seal one end of bag with sealing machine.
     3. Sets bags under hood in a dry place.
  5. Replace vinyl gloves with fresh pair of poly gloves, put on safety goggles.
  6. Parts will need to be dried in Acetone:
     1. Set up a compatible container with acetone for drying.
     2. Pour enough Acetone in container to adequately submerge parts.
     3. Label exterior of container with chemical label to insure safety.
  7. Seals need to be thoroughly rinsed of loose particulate once UHV timer expires:
     1. Remove container from UHV, transfer it to “rinse only” wet bench side.
     2. Rinse with DI water hose thoroughly.
     3. Agitate in first rinse basin 3 times.
     4. Agitate in second rinse basin 3 times.
     5. Agitate in third rinse basin 3 times.
     6. Rinse again with DI water hose.
  8. Don fresh pair of poly gloves.
  9. Copper seals will oxidize in a short period of time. To reduce any chances of tarnish follow these steps:
     1. Set parts into Acetone basin. Solvent will rapidly remove any moisture.
     2. Jostle basin if necessary.
     3. Remove seals one at a time.
     4. Dry parts with nitrogen (N2) gun *optional* use ear PPE to reduce high decibel exposure from N2 gun drying.
     5. Place dried parts on fresh TX 2009 Beta Wipes.
  10. Inspect for remaining tarnish or oxidation. If blemishes remain:
      1. Mix another batch of cleaner (see 2.b.i.-iv.)
      2. Use lightest grade Scotch-Bright (light gray) to scrub surface of copper with Micro mixture.
      3. Scour in one direction.
      4. Rinse with DI water.
      5. Repeat all previous steps from the beginning.
  11. NOTE: Copper seal bags will need to be purged of oxygen (O2), to do so follow these steps:
      1. Bag field probe components (see step 3); probe tips bags will need to be purged of oxygen, to do so follow these steps
      2. Only bag if part is COMPLETELY dry and no oxides appear on surface of part.
      3. Place part in its own bag.
      4. Seal opposite end of bag with sealing machine.
      5. Cut off corner of bag with scissors.
      6. Use N2 gun to purge bag of oxygen (O2); be careful not to bust bag with N2. There should be enough N2 trapped in bag to create “pillow” effect.
      7. Reseal bag on corner used to introduce N2.

## Copper Plated Bellows (Still Under Development)

The following steps apply to copper plated bellows and other items as appropriate. Only like material is to be cleaned in the bath. Do not share the bath with other items. To prevent excessive exposure to particulate in air, the user is to perform all actions within the laminar flow hood (when possible).

***Note: Oxides form on the surface of copper very quickly. Do not allow bellows to dry between steps.***

1. Don a new pair of nitrile gloves and appropriate safety glasses.
2. Remove any covers and inspect the bellows for excessive damage (chips/scratches/dents/bent parts). If a bellows has a pre-existing impairment, notify PI/PM. Do not proceed until PI/PM verifies through written acknowledgement of previous damage presence.
3. Pre-clean the bellows:
   1. Wipe all oil and marker off with acetone.
   2. Measure a small amount of Citranox into a small container.
   3. Use a soft bristled brush to apply detergent directly to the component’s exterior and interior to remove visible oxides. Additional wipers or other means may be necessary to pre-clean heavily soiled components.
   4. Thoroughly rinse component with DI water.
   5. Repeat until heavy soil, oil, etc. has been removed.
4. Bellows are usually cleaned in the Ultrasonic Cleaner (USC):

***NOTE: Position bellows in such a way as to prevent touching each other during the ultrasonic cleaning process; failure to do so could result in damage to the component. If the bellows contains a rotatable flange, it should be placed at the bottom of the tank or in such a way as to avoid damage to the bellows if movement occurs while in the USC.***

* 1. Close drain valve of USC.
  2. Fill USC with DI/UPW at least five inches or more to cover the bellows being cleaned. Carefully place the bellows into USC using baskets, sheets of plastic, or containers as necessary to protect and contain the bellows.
     1. Ensure there are no trapped air pockets under or within the bellows.
  3. Add 1-2% detergent to the USC tank.
     1. Usually about 300 ml (small USC) or 600 ml (large USC) of Citranox detergent is added to the USC.
  4. Turn on the USC andallow the component(s) to ultrasonically clean for 30 minutes.

***Do NOT use the USC heater.***

* 1. Turn off the ultrasonic. Don a new pair of nitrile gloves and inspect the bellows for cleanliness. If the bellows do not appear to be clean, return the bellows to the ultrasonic bath and re-clean as necessary. If the bellows appear to be clean, proceed.

***NOTE: Some dark spots may be persist and will usually bake off during heat treatment. If heat treatment is not the next step and the bellows are to be used in an assembly, contact the PI/PM.***

***NOTE: Copper wastewater should be saved and disposed of appropriately.***

1. Rinse bellows in DI/UPW using the following method:
2. Rinse bellows using DI/UPW until no soap bubbles are visible (approximately 5 minutes)
3. Dip visibly clean bellows in the triple rinse sink from left to right.
4. Ensure the components are thoroughly rinsed and water surface is free of soap bubbles. Repeat if necessary.
5. Prepare a container filled with enough solvent (“clean” isopropyl or methanol) to cover the bellows.
   1. Submerge the bellows in the solvent and agitate to remove excess water from the surface.
6. Dry the bellows with filtered nitrogen.
7. Bag the components:
8. Ensure components have dried completely before bagging.
9. Bag and seal each component separately.
10. Backfill the bag with filtered nitrogen.
11. Repeat process until all components are bagged.
12. Transport bagged components to the next work center.

## Field Probes (Still Under Development)

1. Put on fresh pair of vinyl gloves and appropriate safety glasses.
2. Inspect field probes for excessive damage (chips/scratches/bent stems).
   1. If part has pre-existing impairment, notify PI/PM.
   2. Do not proceed until PI/PM verifies through written acknowledgement of previous damage presence.
3. ***NOTE: Field probes maybe specifically labeled.*** Take care to segregate parts to insure no intermingling of serial numbers. Through the course of the whole degreasing process it is paramount the field probe assemblies be kept separate if serial numbers are present. This can be accomplished by:
   1. Place in separate small containers labeling the exterior of container with serial number (using a chemical sticker).
   2. Placing on TX 2009 Beta Wipes marked for each serial number.
   3. Placing in nylon bag system labeled with serial number.
4. Separate field probe and field probe tips by unscrewing tips. Use caution while doing so as parts are small and can easily fall into floor grate or break. The tip may contain two different parts. Remove both tip parts from probe.
5. Field probe tips are copper. Material’s surface may be covered in tarnish from the oxidation of the copper. Impurity on surface should be removed by doing the following:
   1. Measure 4 oz. of Micro 90 detergent into a small container.
   2. Fill remainder of container with DI water at “rinse only” wet bench side.
   3. Use TX 2009 Beta Wipes to apply mixture directly onto part.
   4. Metal polish may also be utilized for persistent or hard to remove oxidation.
   5. Rinse thoroughly with DI water.
6. Place parts in separate small containers if necessary (see step 3). Parts need to be cleaned in ultrasonic (UHV) basin, accomplished as follows:
   1. Place containers in UHV.
   2. Close drain system of UHV.
   3. Fill each container ¾ full of DI water (each part needs to be completely submerged for UHV cleaning to successfully be performed).
   4. Fill UHV with at least 3 inches of DI water to prevent motors from overheating (thereby causing permanent damage to the UHV).
   5. Disperse 4 oz. of Citranox between basins.
   6. Ultrasonic 15 minutes.
7. Set up a compatible container with isopropyl for drying the probe tips (see step 3). Pour enough acetone in container to adequately submerge parts. Label exterior of container with chemical label to insure safety.
8. Parts will need to be bagged in nylon material:
   1. Cut appropriate length/width nylon bag for each part (see step 3)
   2. Seal one end of bag with sealing machine.
   3. Sets bags under hood in a dry place.
9. Put on fresh pair of vinyl gloves.
10. Remove containers from UHV after timer expires. After UHV cleaning all particulate needs to be rinsed away from part via this method:
    1. Transfer them to “rinse only” wet bench side (see step 3).
    2. Rinse with DI water hose; Thoroughly rinse each part, taking care not to allow tips to fall down drain
    3. Agitate in first rinse basin 3 times.
    4. Agitate in second rinse basin 3 times.
    5. Agitate in third rinse basin 3 times.
    6. Rinse again with DI water hose.
11. Place field probe under hood on TX 2009 Beta Wipes (see step 3).
12. Don pair of poly gloves for solvent exposure and switch from glasses to safety goggles; *optional* use ear PPE to reduce high decibel exposure from nitrogen (N2) gun drying.
13. Probe tips will oxidize in a short period of time. To reduce any chances of tarnish follow these steps:
    1. Set field probe tips into acetone basin (see step 3). Solvent will rapidly remove any moisture captured in tip.
    2. Jostle basin if necessary.
    3. Remove tips on at a time.
    4. Completely dry each tip with the N2 gun prior to removing next tip.
    5. Place dried tips on TX 2009 Beta Wipes.
14. Don fresh pair of vinyl gloves, switch from goggles to glasses if desired.
15. Inspect for remaining tarnish or oxidation. If blemishes remain:
    1. Mix another batch of cleaner (see step 5.a.-b.)
    2. Use lightest grade Scotch-Bright (light gray) to scrub surface of copper with Micro mixture.
    3. Scour in one direction.
    4. Rinse with DI water
    5. Repeat all previous steps from the beginning.
16. Bag field probe components (see step 3); probe tips bags will need to be purged of oxygen, to do so follow these steps::
    1. Only bag if part is COMPLETELY dry and no oxides appear on surface of part.
    2. Place part in its own bag.
    3. Seal opposite end of bag with sealing machine.
    4. Cut off corner of bag with scissors.
    5. Use N2 gun to purge bag of oxygen (O2); be careful not to bust bag with N2. There should be enough N2 trapped in bag to create “pillow” effect.
    6. Reseal bag on corner used to introduce N2.

## Aluminum

The following steps apply to aluminum components. Only aluminum is to be cleaned in the bath. Do not share the bath with other items. All components shall be completely disassembled and all gaskets removed prior to executing this procedure. To prevent excessive exposure to particulate in air, the user is to perform all actions within the laminar flow hood (when possible).

***NOTE: Do NOT clean Aluminum with Micro90 and heat, as it will tarnish the components.***

1. Don a new pair of nitrile gloves and appropriate safety glasses.
2. Inspect component(s) for excessive damage (chips/scratches). If a component has pre-existing impairment, notify PI/PM. Do not proceed until PI/PM verifies through written acknowledgement of previous damage presence.
3. If the component(s) appears excessively soiled or greasy, perform the following:
4. Wipe all oil and marker off with acetone.
5. Measure a small amount of Citranox into a small container.
6. Use a TX 1009B Alpha Wipe to apply detergent directly to the component’s exterior and/or interior. Additional wipers, brushes or other means may be necessary to pre-clean heavily soiled components.
7. Thoroughly rinse component with DI water.
8. Repeat until heavy soil, oil, etc. has been removed.
9. Components are usually cleaned in the Ultrasonic Cleaner (USC):

***NOTE: Position components in such a way as to prevent their surfaces from touching each other during the ultrasonic cleaning process; failure to do so could result in damage to the component.***

* 1. Close drain valve of USC.
  2. Fill USC with DI/UPW at least five inches or more to cover the component being cleaned. Carefully place component(s) into USC using baskets, sheets of plastic, or containers as necessary to protect and contain the component(s). If the components have sealing surfaces, place them face up whenever possible. The component(s) must be completely submerged for proper ultrasonic cleaning action. Ensure there are no trapped air pockets under or within the component(s).
  3. Add 1-2% detergent to the USC tank.
     1. Usually about 300 ml (small USC) or ~600 ml (large USC) of Citranox detergent is added to the USC. If using the 200gal large USC, add roughly 1 L of Liquinox.
  4. Turn on the USC heater (the temperature is typically set to 130°F (54°C)).
  5. Turn on USC andallow the component(s) to clean for 50 minutes. This time may be adjusted if the water is preheated.

***NOTE: The UPW/detergent temperature shall be at least 130°F (54°C) for a minimum of 15 minutes.***

* 1. Turn off the USC and heater. Don a new pair of nitrile gloves and inspect the component(s) for cleanliness. If the components do not appear to be clean, return the component(s) to the ultrasonic bath and re-clean as necessary. If the components appear to be clean, proceed.

1. Rinse components in DI/UPW using one or all of the following methods:
2. Transfer the parts (in perforated containers if small parts) to the Quick Dump Rinser (QDR). Start the QDR and allow to run for the standard 3 cycles.
3. Rinse components using DI/UPW until no soap bubbles are visible (approximately 5 minutes)
4. Dip visibly clean component in the triple rinse sink from left to right.
5. Ensure the components are thoroughly rinsed and water surface is free of soap bubbles. Repeat if necessary.
6. Once thoroughly clean, dry parts on clean room wipe in the laminar flow hood or appropriately clean and allow components to dry if there is no immediate need. If parts are needed urgently, they may be dried with a solvent such as acetone, methanol, or isopropyl and blown dry with filtered N2.
   1. Dry all feedthroughs using filtered compressed nitrogen. Place feedthroughs on TX 1009B Alpha Wipes within the laminar flow hood.
7. If components are bellows, valves or otherwise difficult to dry, they may need to be dried in the oven. This is typically set for ~10+ hours at 100°C in the nitrogen oven.
   1. The nitrogen flow should be set to 50 PSI and 50 CFM.
8. Bag the components:
9. Ensure components have dried completely before bagging
   1. If necessary, dry component with filtered nitrogen
10. Bag and seal each component separately.
11. Repeat process until all components are bagged.
12. Transport bagged components to the next work center.

## Aluminum – anodized or coated

The following steps apply to anodized or coated aluminum components. Only aluminum is to be cleaned in the bath. Do not share the bath with other items. All components shall be completely disassembled and all gaskets removed prior to executing this procedure. To prevent excessive exposure to particulate in air, the user is to perform all actions within the laminar flow hood (when possible).

1. Don a new pair of nitrile gloves and appropriate safety glasses.
2. Inspect component(s) for excessive damage (chips/scratches). If a component has pre-existing impairment, notify PI/PM. Do not proceed until PI/PM verifies through written acknowledgement of previous damage presence.
3. If the component(s) appears excessively soiled or greasy, perform the following:
4. Wipe all oil and marker off with acetone.
5. Measure a small amount of Citranox into a small container.
6. Use a TX 1009B Alpha Wipe to apply detergent directly to the component’s exterior and/or interior. Additional wipers, brushes or other means may be necessary to pre-clean heavily soiled components.
7. Thoroughly rinse component with DI water.
8. Repeat until heavy soil, oil, etc. has been removed.
9. Rinse components in DI/UPW using one or all of the following methods:
10. Transfer the parts (in perforated containers if small parts) to the Quick Dump Rinser (QDR). Start the QDR and allow to run for the standard 3 cycles.
11. Rinse components using DI/UPW until no soap bubbles are visible (approximately 5 minutes)
12. Dip visibly clean component in the triple rinse sink from left to right.
13. Ensure the components are thoroughly rinsed and water surface is free of soap bubbles. Repeat if necessary.
14. Once thoroughly clean, dry parts on clean room wipe in the laminar flow hood or appropriately clean and allow components to dry if there is no immediate need. If parts are needed urgently, they may be dried with a solvent such as acetone, methanol, or isopropyl and blown dry with filtered N2.
    1. Dry all feedthroughs using filtered compressed nitrogen. Place feedthroughs on TX 1009B Alpha Wipes within the laminar flow hood.
    2. If components are bellows, valves or otherwise difficult to dry, they may need to be dried in the oven. This is typically set for ~10+ hours at 100°C in the nitrogen oven.
       1. The nitrogen flow should be set to 50 PSI and 50 CFM.
15. Bag the components:
16. Ensure components have dried completely before bagging
    1. If necessary, dry component with filtered nitrogen
17. Bag and seal each component separately.
18. Repeat process until all components are bagged.
19. Transport bagged components to the next work center.

## Aluminum-Magnesium Gasket/Seals

The following steps apply to aluminum-magnesium gaskets. Aluminum-magnesium gaskets do not need ultra-sonic cleaning. To prevent excessive exposure to particulate in air, the user is to perform all actions within the laminar flow hood (when possible).

1. Don a new pair of nitrile gloves and appropriate safety glasses;
2. Inspect gaskets for irregularities or damage (dings, nicks, scratches, etc.). Report questionable gaskets to your supervisor.
3. Wipe down gasket with acetone soaked TX 1009B Alpha Wipe.
4. Wipe down gasket with isopropyl alcohol soaked TX 1009B Alpha Wipe.
5. Bag components promptly:
6. Ensure all gaskets have dried completely before bagging.
   1. If necessary, dry component with filtered nitrogen.
7. Bag each item separately.
8. Repeat process until all gaskets are bagged.
9. Transport bagged components to the next work center.

## Rubber Gaskets/Seals

The following steps apply to rubber gaskets or seals. They do not need ultra-sonic cleaning. To prevent excessive exposure to particulate in air, the user is to perform all actions within the laminar flow hood (when possible).

1. Don fresh pair of poly gloves and appropriate safety goggles.
2. Wipe down rubber seals with isopropanol using TX 1009 Alpha Wipes.
3. Dry parts with the filtered nitrogen (N2) gun.
4. Place dried rubber seals on clean wipes under hood.
5. Bag seals in nylon bag:
   1. Only bag if part is COMPLETELY dry and no stains appear on surface.
   2. Place part in bag, seal.

## Burst Disks

The following steps apply to burst disks. They DO NOT get ultra-sonic cleaning. To prevent excessive exposure to particulate in air, the user is to perform all actions within the laminar flow hood (when possible).

1. Apply proper PPE before beginning process.
2. Inspect burst disk(s) for excessive damage (chips/scratches/dents). If a bust disk has a pre-existing impairment, notify PI/PM. Do not proceed until PI/PM verifies through written acknowledgement of previous damage presence.
3. If the burst disk(s) has tape/stickers/labels present, perform the following:
4. Wipe all residue off with acetone.
   * 1. A plastic or metal razor blade may be used on the outside of the burst disk(s) if necessary.
5. Place part in a container that is compatible with solvents (HDPE or glass); the container must also have a lid, or be capable of being covered by something.

***NOTE: Always use new solvents when degreasing burst disk.***

***NEVER place burst disk into USC, doing so will permanently damage the part.***

1. Submerge the disk completely in acetone, making sure to remove any trapped air bubbles.
2. Place lid on container to prevent solvent evaporation and unnecessary fume exposure.
3. Allow to soak for 2 hours.
4. Once time elapses, remove disk from solvent.
5. Place burst disk under hood on clean wipe and inspect part for any stains or residue.
6. If stains or residue are present, use a clean wipe soaked in acetone to remove the stain/residue. If the acetone clean wipe cannot remove stain, re-clean disk.
7. Once thoroughly clean, dry on clean room wipe in the laminar flow hood if there is no immediate need.
   1. If parts are needed urgently, Dry component at a distance with nitrogen gun (N2).

***NOTE: Do NOT blow into the burst plate with N2!***

1. Use nylon bagging material once part is dry:
2. Ensure components have dried completely before bagging.
3. Bag and seal each component separately.
4. Repeat process until all components are bagged.
5. Transport bagged components to the next work center.

## Ceramic Windows

The following steps apply to ceramic windows and like components. Only similar items are to be cleaned in the bath. Do not share the bath with other items. All components shall be completely disassembled and all gaskets removed prior to executing this procedure. To prevent excessive exposure to particulate in air, the user is to perform all actions within the laminar flow hood (when possible).

1. Put on fresh pair of vinyl gloves and appropriate safety glasses.
2. Inspect ceramic windows for excessive damage (chips/scratches). If a part has pre-existing impairment, notify PI/PM. Do not clean until PI/PM verifies through written acknowledgement of previous damage presence.
3. Ceramic windows are very fragile and delicate. User should always exercise a conscious effort to maintain the structural integrity of the window by being cautious and focused.

***NOTE: It is paramount they are placed on their side during both USC procedures and whenever placed on a flat surface (i.e. under the hood).*** ***Direct force from nitrogen (N2) gun or DI water hose is never acceptable.***

1. Material’s surface may be dirty. Impurities on surface should be removed by doing the following:
   1. Measure ~4 oz. of Micro90 detergent into a small container.
   2. Fill remainder of container with DI water.
   3. Use a TX 1009B Alpha Wipe to apply mixture directly onto part.
   4. Use Clean Room Swabs as necessary to clean bolt holes and crevices in and around the windows.
   5. Avoid direct contact of the wipe with ceramic window itself; if necessary do so with great vigilance.
   6. Rinse with DI water.
2. Place parts in container; typically, five can fit into a given container, making sure they are on their side. Parts need to be cleaned in ultrasonic cleaner (USC) basin, accomplished as follows:
   1. Place container in USC.
   2. Close drain system of USC.
   3. Fill container ¾ full of DI water (each part needs to be completely submerged for USC cleaning to successfully be performed).
   4. Fill USC with at least 5 inches of DI water to prevent motors from overheating (thereby causing permanent damage to the USC).
   5. Disperse ~4 oz. of Micro 90 into container.
   6. Set USC timer for 15 minutes.
3. Put on fresh pair of vinyl gloves.
4. Remove containers from USC after timer expires. After USC cleaning all particulate needs to be rinsed away from parts:
   1. Rinse with DI water hose thoroughly.
   2. Agitate in first rinse basin 3 times.
   3. Agitate in second rinse basin 3 times.
   4. Agitate in third rinse basin 3 times.
   5. Rinse again with DI water hose.
5. Place ceramic windows on their side under the laminar flow hood on clean wipes.
6. Dry ceramic windows:
7. Allow windows to air dry if enough time or no immediate need.
8. Ceramic windows can be manually dried using N2 gun without putting direct force on window itself from N2 gun.
9. Examine each part for water spots or other blemishes prior to bagging.
10. If water spots are found remove them with DI water and Alpha Wipes, then repeat the drying process.
11. Prepare ceramic windows for transport to R&D Chemroom by either:
    1. Bagging the windows individually.
       1. Only bag if part is COMPLETELY dry and no stains appear on surface.
       2. Place each part in its own bag and seal.
       3. Place bagged parts into a container that can sufficiently hold them without a chance of damage. Transport container to the R&D Chemroom, along with bag containing duplicate nylon baggies.
    2. Placing the windows in a clean container with a lid.
       1. Place bagged parts into a container that can sufficiently hold them without a chance of damage. Transport container to the R&D Chemroom, along with bag containing duplicate nylon baggies.

***NOTE: R&D Chemroom requires user to follow the OSP and record activity in the log book prior to beginning any work.***

1. Don fresh pair of gloves along with safety goggles.
2. Transport materials over to the solvent USC. To finalize the degreasing of the ceramic windows, they need to be USC cleaned in acetone followed by isopropyl:
   1. Remove ceramic windows from nylon bags or container, making sure to place them in a clean solvent compatible approved container on their side.
   2. Fill USC with a small amount of water in the basin area.

***DO NOT EMPTY WATER AT ANY POINT.***

* 1. Fill container with enough new acetone to completely cover the windows.
  2. Place acetone filled container into solvent USC basin.
  3. Fill USC with a sufficient amount of water.
  4. Set solvent USC timer for 5 minutes ***(NOTE: Do not run for more than 5 minutes at a time as this may cause volatile situation with the highly flammable solvent).***
  5. Repeat the above steps (a-f) with isopropyl to remove any acetone residue.

1. Don fresh pair of poly gloves.
2. Once USC timer expires, windows will need to be dried/bagged:
   1. Dry ceramic windows:
      1. Remove part from solvent.
      2. Dry each individual ceramic window carefully with N2 gun.
      3. Place component on a clean room wipe once completely dry.
   2. Bag ceramic windows:
      1. Ensure components have dried completely before bagging and no stains appear on surface.
      2. Place part in its own bag and seal.
      3. Wrap each individually bagged part additionally with aluminum foil.
      4. Repeat process until all components are bagged.
      5. Transport bagged components to the next work center.

## Right Angle Valves

The following steps apply to right angle valves and other valves as appropriate. Only like material is to be cleaned in the bath. Do not share the bath with other items. All valves shall be opened prior to executing this procedure. To prevent excessive exposure to particulate in air, the user is to perform all actions within the laminar flow hood (when possible).

1. Don a new pair of nitrile gloves and appropriate safety glasses.
2. Remove valve(s) from packaging and any covers.
3. Inspect valves(s) for excessive damage (chips/scratches/bent parts). If a valve has a pre-existing impairment, notify PI/PM. Do not proceed until PI/PM verifies through written acknowledgement of previous damage presence.
4. If the component(s) appears excessively soiled or greasy, or has tape/stickers/labels present, perform the following:
5. Wipe all oil, marker, stickers, and tape off with acetone.
   * 1. A plastic or metal razor blade may be used on the outside of the valve if necessary.
6. Use a TX 1009B Alpha Wipe and solvent to remove excess residue on the threads of the valve stem if necessary.
   * 1. The valve stem does not need to be completely free of residue, but the majority should be removed.
7. Measure a small amount of Micro90 into a small container.
8. Use a TX 1009B Alpha Wipe to apply detergent directly to the component’s exterior and/or interior. Additional wipers, brushes or other means may be necessary to pre-clean heavily soiled components.
9. Alternatively, the components may be ultrasoniced in a secondary container.
10. Thoroughly rinse component with DI water.
11. Repeat until heavy soil, oil, etc. has been removed.
12. Components are usually cleaned in the Ultrasonic Cleaner (USC):

***NOTE: Position components in such a way as to prevent touching each other during the ultrasonic cleaning process; failure to do so could result in damage to the component.***

* 1. Close drain valve of USC.
  2. Fill USC with DI/UPW at least five inches or more to cover the component being cleaned. Carefully place component(s) into USC using baskets, sheets of plastic, or containers as necessary to protect and contain the component(s).
     1. The valves(s) must ***NOT*** be completely submerged, the top of the valve and valve stem should remain above the water line. Ensure there are no trapped air pockets under or within the component(s).
  3. Add 1-2% detergent to the USC tank.
     1. Usually about 300 ml (small USC) or 600 ml (large USC) of Micro90 detergent is added to the USC. If using the 200gal large USC, add roughly 1 L of Liquinox.
  4. Turn on the USC heater (the temperature is typically set to 130°F (54°C)).
  5. Turn on the USC andallow the component(s) to ultrasonically clean for 50 minutes. This time may be adjusted if the water is preheated. ***NOTE: The UPW/detergent temperature shall be at least 130°F (54°C) for a minimum of 15 minutes.***
  6. Turn off the USC heater and ultrasonic. Don a new pair of nitrile gloves and inspect the valves(s) for cleanliness. If the valve(s) do not appear to be clean, return the valve(s) to the ultrasonic bath and re-clean as necessary. If the valve(s) appear to be clean, proceed.

1. Rinse valve(s) in DI/UPW using one or all of the following methods:
2. Rinse valve(s) using DI/UPW until no soap bubbles are visible (approximately 5 minutes)
3. Dip visibly clean valve(s) in the triple rinse sink from left to right.
4. Ensure the components are thoroughly rinsed and water surface is free of soap bubbles. Repeat if necessary.
5. Once thoroughly clean, dry parts in the nitrogen drying oven set to 100°C for ~ 10+ hours.
6. The nitrogen flow should be set to 50 PSI and 50 CFM.
7. Follow the STP baking procedure unless provided by the PI/PM
   1. CP-STP-CAV-CHEM-BAKE
8. Bag the components:
9. If the valve(s) are still hot from the oven, allow them to cool before handling.
10. Ensure components have dried completely before bagging.
11. Bag and seal each component separately.
12. Repeat process until all components are bagged.
13. Transport bagged components to the next work center.

## Uncoated / Stainless Steel Bellows (Still Under Development)

The following steps apply to stainless steel or uncoated bellows as appropriate. Only like material is to be cleaned in the bath. Do not share the bath with other items. To prevent excessive exposure to particulate in air, the user is to perform all actions within the laminar flow hood (when possible).

1. Don a new pair of nitrile gloves and appropriate safety glasses.
2. Remove any covers and inspect the bellows for excessive damage (chips/scratches/dents/bent parts). If a bellows has a pre-existing impairment, notify PI/PM. Do not proceed until PI/PM verifies through written acknowledgement of previous damage presence.
3. If the component(s) appears excessively soiled or greasy, or has tape/stickers/labels present, perform the following:
   1. Wipe all oil and marker off with acetone.
   2. Measure a small amount of Micro90 into a small container.
   3. Use a TX 1009B Alpha Wipe to apply detergent directly to the component’s exterior and/or interior. Additional wipers, brushes or other means may be necessary to pre-clean heavily soiled components.
   4. Alternatively, the components may be ultrasoniced in a secondary container.
   5. Thoroughly rinse component with DI water.
   6. Repeat until heavy soil, oil, etc. has been removed.
4. Pre-clean the bellows with a soft-bristled brush and Micro90 (alternatively Citranox may be used).
   1. Clean internally and externally focusing on the convolutions, bolt holes, and areas around the flange where particles may be trapped.
5. Bellows are usually cleaned in the Ultrasonic Cleaner (USC):

***NOTE: Position bellows in such a way as to prevent touching each other during the ultrasonic cleaning process; failure to do so could result in damage to the component. If the bellows contains a rotatable flange, it should be placed at the bottom of the tank or in such a way as to avoid damage to the bellows if movement occurs while in the USC.***

* 1. Close drain valve of USC.
  2. Fill USC with DI/UPW at least five inches or more to cover the bellows being cleaned. Carefully place the bellows into USC using baskets, sheets of plastic, or containers as necessary to protect and contain the bellows.
     1. Ensure there are no trapped air pockets under or within the bellows.
  3. Add 1-2% detergent to the USC tank.
     1. Usually about 300 ml (small USC) or 600 ml (large USC) of Micro90 detergent is added to the USC. If using the 200gal large USC, add roughly 1 L of Liquinox.
  4. Turn on the USC heater (the temperature is typically set to 130°F (54°C)).
  5. Turn on the USC andallow the component(s) to ultrasonically clean for 50 minutes. This time may be adjusted if the water is preheated.

***NOTE: The UPW/detergent temperature shall be at least 130°F (54°C) for a minimum of 15 minutes.***

* 1. Turn off the USC and heater. Don a new pair of nitrile gloves and inspect the bellows for cleanliness. If the bellows do not appear to be clean, return the bellows to the ultrasonic bath and re-clean as necessary. If the bellows appear to be clean, proceed.

1. Rinse bellows in DI/UPW using one or all of the following methods:
2. Transfer the bellows to the Quick Dump Rinser (QDR). Start the QDR and allow to run for its standard 3 cycles.
3. Rinse bellows using DI/UPW until no soap bubbles are visible (approximately 5 minutes)
4. Dip visibly clean bellows in the triple rinse sink from left to right.
5. Ensure the components are thoroughly rinsed and water surface is free of soap bubbles. Repeat if necessary.
6. Once thoroughly clean, dry the bellows depending on the urgency:
   1. If time allows, dry in the nitrogen drying oven set to 100°C for ~ 10+ hours.
      1. The nitrogen flow should be set to 50 PSI and 50 CFM.
   2. If bellows are needed urgently, dip into clean isopropyl
7. Bag the components:
   1. Ensure components have dried completely before bagging.
   2. If the valve(s) are still hot from the oven, allow them to cool before handling.
   3. Bag and seal each component separately.
   4. Repeat process until all components are bagged.
8. Transport bagged components to the next work center.

## Large Components - Pressure Washer

Occasionally, parts may be too large for the ultrasonic cleaners or otherwise need to be pressure washed.

1. Apply proper PPE before beginning process (eye and hearing protection).
2. Secure the part so that it will not move when hit with high-pressure water.
3. Attach the appropriate nozzle on the pressure washer.
4. Turn on the UPW then the pressure washer.
5. Rinse the part, getting closer or further away as necessary to clean without damaging the part.
6. Once finished, turn off the pressure washer and the water. Depress the handle on the handle to release any pressure, and return the hose to the hose reel.
7. Move the part to a clean location to air dry or manually dry as appropriate.
8. Bag as necessary to maintain cleanliness.

Proceed to next work center.

# References

|  |  |
| --- | --- |
| **Document No.** | **Title** |
|  | [Chemistry Cleaning Procedures](https://jlabdoc.jlab.org/docushare/dsweb/View/Collection-2654?sort=Date) |
|  | [LCLSII Component Cleaning Procedure](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-98727/LCLSII%20Component%20Cleaning%20Procedure_with%20hotplate.pdf) |
|  | [Alconox User’s Manual](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-73545/Alconox-UserManual.pdf)- User’s manual for Alconox detergents |
| [SRF-19-83800-OSP](https://mis.jlab.org/mis/apps/mis_forms/operational_safety_procedure_form.cfm?entry_id=83800) | OSP for Safe Operations in the Production Chemistry Room |
| CP-STP-CAV-CHEM-BAKE | Baking in Nitrogen Oven |

# Release and Revision History

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| --- | --- | --- |
| **Rev #** | **Major Changes** | **Effective Date:** |
| 1 | Initial version | DD Mmm YYY |
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# Approvals

|  |  |  |  |
| --- | --- | --- | --- |
| **Approved by:** | **Name:** | **Signature:** | **Date:** |
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