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| **L2HE Cavity Assembly Part 1** |
| **Document Number:** | L2HE-PR-CLNRM-CAV-ASSY1 | **Effective Date:** | DD Mmm YYYY |
| **Revision Number:** | R1 | **Periodic Review Date:** | DD Mmm YYYY |
| **Document Owner:** | T. Ganey | **Department Owner:** | SRF Operations |

# Purpose

This procedure describes the proper assembly steps for the first assembly of 9-cell L2 cavities, including the assembly one beamline flange, the FPC feedthrough, the FP feedthrough, and both of the HOM feedthroughs on a 9-cell L2 cavity after high pressure rinse (HPR). At the end of this procedure, the cavity is ready for final HPR.

# Scope

This procedure applies to <enter text>.

This procedure does not apply to <enter text>.

# Terms and Definitions

The following terms have specific meanings within this procedure.

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| **Term** | **Definition** |
| <Term 1> | <Definition> |
| <Term 2> | <Definition> |
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# Roles and Responsibilities

The following roles have responsibilities described in this document.

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| **Role** | **Responsibility** |
| <Job Title> | <Very short summary of activities this job title performs in this procedure.> |
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# Procedure

Before proceeding with this activity, ensure that the cavity was high pressure rinsed and has been drying with the flange covers removed (do not approach open cavity at this time). Cavity will be assembled in the cage using a cage lifting fixture to hold the cavity and cage in place. The cavity will be drying with the FPC end facing down; however, this end of the cavity shall be in the upper position for the assembly.

## Assembly Preparation

* Spray the FPC feed-through flange and the copper probe tip with ionized nitrogen in accordance with the Ionized Nitrogen Cleaning Procedure.
* Attach the copper probe tip to the FPC feed-through flange until the bottom of the probe is engaged solidly with the feed-through.
* This sub-assembly can now be sprayed again in accordance with the Ionized Nitrogen Cleaning Procedure and placed on cart.
* All other flanges, associated fasteners, gaskets, temporary blanks and spring clamps for the first assembly shall be cleaned in accordance with the Ionized Nitrogen Cleaning Procedure.
* Items shall be placed on the cart in such a manner that they can be picked up during assembly in the correct order without having to reach your arm over other parts on the cart.
* Clean/replace outer gloves prior to covering cavity. Starting at the bottom of the cavity cover the beam-line flange and clamp in place. Cover the FPC flange and the HOM flange on the same end. Clamp the covers in place. Cover the HOM and field probe flanges and clamp in place. Cover the top beam-line flange and clamp in place.
	+ **NOTE:** *Attach flange covers with one motion as to not rotate or vibrate flanges once together. Never position your body or clothing over an opening. Replace and clean new gloves if they are damaged prior to, or during an operation. Only one person shall be within a few feet of the cavity during this blanking operation. Inspect cavity sealing surfaces of cavity flanges during cover installation.*
* Slowly flip the cavity moving the FPC end to the upper position and raise the cavity to the correct working height.

## Cavity Assembly

* Cavity is lifted with lift cart to eye level during assembly, either in the seated or standing position-depending on the assembler’s preference. The cage shall be attached to the lifting fixture such that the FPC and FP flanges are 90 degrees from side of the cage which is being picked up.
* At this time the cleanliness of the assembler’s glove should be verified, either by blowing off with nitrogen and verifying counts, or by replacing.
* The technician’s gloves shall be sprayed with ionized nitrogen in between each flange assembly.
* Carefully remove the spring clamps and cover from the bottom flange.
* Place two of the four N2 cleaned M8 washers and nuts on the matching studs.
* These studs are now placed through the beam-line blank flange. They should be located 180 degrees from each other.
* Place an aluminum gasket in the seal groove.
* The flange will be held in a manner that will keep the studs secure. Slowly and carefully bring the flange flush with the bottom cavity flange while the studs are moving through the bolt holes on the cavity.
* Place the remaining two N2 cleaned M8 washers and nuts on the studs and tighten by hand. These nuts can now be snugged with a wrench. They should be turned approximately 1/8 to 1/4 of a turn.
* Attach the remaining studs, washers and nuts to the flange using the fasteners that have not been cleaned with N2.
* Snug all fasteners with a wrench in the same manner as the first two. This shall be done in a star pattern, starting with one of the bolts that are ninety degrees from the original two that are already snugged.
* The cavity can now be flipped in the fixture. Pull the pin on the lifting fixture and spin the cavity 90 degrees in the direction that will leave the FPC flange facing down.
* Change gloves after touching pin on lift cart. If you have a partner that spins the cavity, you can check your gloves with ionized nitrogen and only change if necessary.
* Before starting the FPC flange, leave the cavity alone for two minutes after flipping before removing cover.
* Carefully remove the spring clamps and cover from the FPC flange.
* Place two of the four M5 N2 cleaned M6 nuts and washers on the matching studs.
* These studs are now placed through the FPC feed-through sub-assembly. They shall be located 180 degrees from each other.
* Place an aluminum gasket in the seal groove.
* The feed-through flange will be held in a manner that will keep the studs secure. Slowly and carefully bring the feed-through flange flush with the FPC flange while the studs are moving through the bolt holes.
* Place the remaining two N2 sprayed nuts and washers on the studs and tighten by hand. These bolts can now be snugged with a wrench. They should be turned approximately 1/8 to 1/4 of a turn.
* Attach the remaining studs, washers and nuts to the flange using the fasteners that have not been cleaned with N2.
* Snug all fasteners with a wrench in the same manner as the first two. This shall be done in a star pattern, starting with one of the bolts that are ninety degrees from the original two that are already snugged.
* The cavity can now be flipped in the fixture. Pull the pin on the lifting fixture and spin the cavity 180 degrees in the direction that will leave the field-probe flange facing down.
* Change gloves after touching pin on lift cart. If you have a partner that spins the cavity, you can check your gloves with ionized nitrogen and only change if necessary.
* Before starting the field-probe flange, leave the cavity alone for two minutes after flipping before removing cover.
* Carefully remove the spring clamps and cover from the field-probe flange.
* Place a gasket onto the field-probe feed-through flange.
* While holding one of the backing straps in place on the back side of the cavity field-probe flange, carefully bring feed-through flange into place.
* Hold the backing plate and feed-through flange tight against the seal-groove with one hand. Use the other hand to move the bolts through the bolt hole and snug hand tight.
* While keeping the feed-through flange tight against the cavity flange, pick up the other backing strap. After this is in place, use the same hand to hold both the feed-through and the backing strap. This frees up the other hand to place the bolt through the bolt hole that is 180 degrees from the first bolt. Snug the bolt by hand.
* Carefully move the backing straps such that all the bolt holes line up and finish putting all the bolts in hand tight.
* Snug all the bolts approximately 1/8 to 1/4 turn.
* The bellows stiffening fixture that remains installed is directly in the way of torqueing the field probe bolts. These bolts can all be tightened at this time using a standard Allen wrench.
* Both HOM feed-throughs shall be assembled in the same manner as the field probe flange. Technician shall take extra care while bringing the flanges together because the orientation of the cavity flanges is not in the horizontal position. This makes keeping the gasket in place a bit more difficult. Other than the orientation the assemblies are to be done exactly the same.
* The HOM flange bolts will all be torqued as follows in the next section.

## Final Torque Sequence

* Using a star pattern, torque all beam-line flange nuts to 12 ft/lbs.
* Using same star pattern, increase to 23 ft/lbs.
* Tighten all nuts again by walking the wrench around the flange at least two times while still having the toque wrench still set at 23 ft/lbs. If there is no movement on any of the nuts, you are finished.
* If necessary, keep walking the wrench around the flange until there is no movement of any nut.
* Using a star pattern, torque all FPC flange nuts to 5 ft/lbs.
* Using same star pattern, increase to 10 ft/lbs.
* Tighten all nuts again by walking the wrench around the flange at least two times while still having the torque wrench still set at 10 ft/lbs. If there is no movement on any of the nuts, you are finished.
* If necessary, keep walking the wrench around the flange until there is no movement of any nut.
* Using a star pattern, torque both HOM flange bolts to 20 in/lbs.
* Using same star pattern, increase to 40 in/lbs.
* Tighten all bolts again by walking the wrench around the flange at least two times while still having the torque wrench still set at 40 in/lbs. If there is no movement on any of the bolts, you are finished.
* If necessary, keep walking the wrench around the flange until there is no movement of any bolt.

## Final Preparation

* The cavity can now be flipped in the lifting fixture until the covered FPC flange is facing down.
* Using the lifting fixture, lower the cage into a roll cart.
* The cavity is now ready to be moved back to the chemistry department for final rinsing.

# References

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| **Document No.** | **Title** |
| [F10023864](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-248683/Cavity%20Drawing%20Package%20F10023864_rev_M_drawing_package.pdf) | Production Cavity Assembly Drawing |
| SRF-MSPR-CLNRM-CST-ION | Ionized Nitrogen Cleaning Procedure |
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# Release and Revision History

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| --- | --- | --- |
| **Rev #** | **Major Changes** | **Effective Date:** |
| 1 | Initial version, based on CP-L2PRO-CAV-FRST-R1 | DD Mmm YYY |
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# Approvals

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| --- | --- | --- | --- |
| **Approved by:** | **Name:** | **Signature:** | **Date:** |
| Document Owner | Tiffany Ganey |  | DD Mmm YYY |
| Reviewer | Chris Dreyfuss |  | DD Mmm YYY |
| Cleanroom Lead | Danny Forehand |  | DD Mmm YYY |