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| **Girder Clean Assembly and Leak Check Procedure** | | | |
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| **Revision Number:** | R1 | **Periodic Review Date:** | 25 Jan 2024 |
| **Document Owner:** | Tiffany Ganey | **Department Owner:** | SRF Operations |

# Purpose

This procedure covers the clean assembly of a CEBAF girder. The tasks take place in the SRF Production Cleanroom. Parts will be received from SRF personnel after cleaning in the SRF main cleanroom.

# 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.

During the girder re-work process, there will be some items labeled as “Radioactive Material”. **Radioactive Material (RAM)** is defined in the RadCon manual as any activated material, equipment or system component with radiation levels distinguishable from background. The following guidelines are to be adhered to when handling RAM in order to follow Radcon requirements:

* There are no requirements for dosimetry for Radioactive Material Areas unless otherwise notified by a member of the RCD.
* Persons must be Radiation Worker I qualified to handle RAM.
* The RAM tag must accompany the item at all times with the following exceptions. Cleaning, heating or any process in which the tag will impede that process or the tag could be potentially damaged or destroyed.
* When performing processes listed above, the tag is to be removed by personnel performing the task and placed on the RAM tag board located in the area.
* Each component removed from the cavity pair needs to be tagged with a Radcon coupon, recorded on the dedicated list.
* Once task is complete, the tag is to be placed back on the material/equipment.
* Eating, drinking or smoking is not permitted in Radioactive Material Areas.
* Remove all tags prior to installation of cryomodule in the Accelerator
* Tasks associated with this procedure will be performed in the designated area of the clean room.
* Each re-location of the assembly or its components requires Radcon authorization.

**CAUTION:**

**Take great care of the items disassembled. Some are extremely sensitive and/or delicate. Limited or no spares may be available for replacement.**

# 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** |
| Nitrogen (N2) | Filtered Nitrogen |
| Project Manager (PM) | Someone in charge of the project or item in question. A supervisor may also be referred to if needed. |
| Spec 1 | Particle counts are to be one count per second or less on the 1 µm scale. |
| Spec 2 | Particle counts are to be one count or less on the 0.3 µm scale in 10 seconds. |

# 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

Level 1 text.

## Prep Work Prior to Assembly

### Several girder types are used at CEBAF and are documented in separate drawings. Before proceeding with the girder assembly, determine and review the appropriate drawings for the girder to be assembled. Note that it may take multiple drawings to fully represent the exact configuration of the girder being assembled. A collection of girder drawings is saved in [Docushare](https://jlabdoc.jlab.org/docushare/dsweb/View/Collection-49642); however, the latest drawing revision should be verified in Document Control.

### Print the Girder Drawing(s) or picture with parts identified. Print the parts list and record all existing component data. Any component that has been tagged as RAM shall be noted in the last column.

#### Girder assemblies have slight variations. It is critical for post-analysis to maintain the nomenclature as consistent as possible form one assembly to another.

### Bag the drawings / lists in cleanroom bag(s) and transfer to the cleanroom pass-thru.

### All associated hardware and flanges should already be UHV cleaned, bagged, and ready for assembly.

### Ensure the workspace is clean and tidy.

### Don appropriate PPE.

* Gloves should be worn whenever handling items and changed after cleaning and as needed to maintain cleanliness.
* TLD badge may be required. Check tags and posted signs.

### Wipe down a cleanroom cart with a cleanroom wipe.

### Pre-clean all tools necessary for assembly and place pre-cleaned tools on the wiped down cleanroom cart.

### Lay out the hardware on a table to ensure all the parts are ready for assembly.

### Remove copper gaskets from their packages and clean until they reach Spec 1.

### Clean transportation covers / blanks for the girder beamline ends.

### Open and pre-clean all parts and bolts, nuts, and washers for each flange until they reach Spec 1.

* BPM
* Bellows
* Pump drop
* Exterior of Ion pump/ valve assembly
* View window (if viewer to be installed) or blank (if viewer not to be installed)
* Pre-cleaned and assembled Viewer assembly or blank

### Inspect parts and hardware for damage (dents, scratches, dings, etc.).

* Examine knife edges of all flanges to verify that there are no nicks or scratches.
* Examine flex bellows to verify that there are no dents or distortions.
* If an item has pre-existing impairment, notify the PI/PM/SOTR.
* Do not proceed until written acknowledgement of previous damage presence has been received.
* Take pictures.

## Component Assembly

### If a viewer will be installed on the girder, contact the Electrical Engineering Systems Instrumentation & Controls Systems (EES I&C) to obtain the assembled viewer. The viewer will be installed on the girder later in this procedure with the EES I&C team.

### Assemble all top components on the rail with new gaskets and two bolts, nuts, and washers in accordance with the applicable drawing except the viewer or blank at the viewer port. Turn wrench ½ turn only.

* Verify orientation of flanges, valves, pumps, etc. according to the appropriate drawing.
* Use clean scratch-free copper gaskets and clean bolts, washers, and nuts.
* Place the two bolts through the flange 180 degrees from each other.
* Remaining hardware will be installed later in this procedure.

## Nitrogen Purge

### Nitrogen purge from the pump drop side with a cleanroom nitrogen gun while monitoring through the spool side until Spec 2 is achieved.

### Install blank on spool end.

### Nitrogen purge from the pump drop side while monitoring through the viewport until spec 2 is achieved.

### If a viewport will be installed on the girder, install the viewport. If a viewport will not be installed on the girder, install a blank.

### Nitrogen purge from the pump drop side while monitoring through the viewer port until spec 2 is achieved.

### Nitrogen purge from the pump drop side while monitoring through the pump drop bottom until spec 2 is achieved.

### Install blank on pump drop end.

### If a viewer will be installed on the girder, install viewer. If a viewer will not be installed on the girder, install a blank.

## Ion Pump / NEG Assembly

### Cleanly remove top blank from the ion pump / NEG flange.

* Remove all but 4 bolts and clean out all bolt holes with cleanroom swabs soaked in isopropyl. Allow component to dry completely before continuing.
* Once the component is 100% dry, Nitrogen clean each hole to spec 1.
* Remove the remaining bolts and clean out the 4 bolt holes with cleanroom swabs soaked in isopropyl. Do not nitrogen spray.
* Remove the top flange.
* Remove and discard the used copper gasket.
* Wipe sealing surface with pre-wet cleanroom wipe.

### Open / verify open the angle valve.

### Cleanly remove the blank from the angle valve.

* Remove all bolts and blank from the valves.
* Remove and discard used copper gasket.
* Clean out all bolt holes with cleanroom swabs soaked in isopropyl. Do not nitrogen spray.
* Wipe sealing surface with pre-wet cleanroom wipe.

### Purge the angle valve and ion pump / NEG assembly with a cleanroom nitrogen gun both directions until spec 2 is achieved inside and out.

* Cycle the angle valve open and close during the purge.

### Close right angle valve.

### Cleanly remove the blank on the girder assembly pump drop end.

* Remove all bolts and blank from the pump drop end.
* Remove and discard used copper gasket.
* Clean out all bolt holes with cleanroom swabs soaked in isopropyl. Do not nitrogen spray.
* Wipe sealing surface with pre-wet cleanroom wipe.

### Install ion pump / NEG and right angle valve assembly on the pump drop using clean scratch-free copper gasket(s) and two sets clean bolts, washers, and nuts in accordance with the applicable drawing. Torque flanges metal to metal.

* Ensure that gaskets seal properly when bolted together.
* Flanges are to be torqued in a star pattern.

## Leak Test Preparation

### In accordance with the applicable drawing(s), install all remaining hardware on all flanges using clean scratch-free copper gaskets and clean bolts, washers, and nuts. Torque flanges metal to metal.

* Ensure that gaskets seal properly when bolted together.
* Flanges are to be torqued in a star pattern.

### Install assembly on pump cart.

## Assembly Leak Test

### Open the right angle valve.

### Slow pump until pressure reaches 2E-7 mbar.

### Leak check the entire assembly in accordance with SRF-MSPR-CLNRM-LEAK.

### Install magnets on the ion pump.

### Turn on ion pump / NEG and verify that the pressure goes below the leak check pressure of 2E-7 mbar.

### Turn off ion pump / NEG.

### Close the angle valve.

### Vent pumping system.

### Disconnect pump system from girder.

# References

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| **Document No.** | **Title** |
| EES-PR-02-002 | BPM Cavity Acceptance Test (Pete Francis) |
| [SRF-MSPR-CLNRM-CST-ION](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-251185/SRF-MSPR-CLNRM-CST-ION-R1.pdf) | Ionized Nitrogen Parts Cleaning |
| [SRF-MSPR-CLNRM-LEAK](https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-251183/SRF-MSPR-CLNRM-LEAK-R1.pdf) | Leak Testing with a RGA |
| [Collection of Girder Drawings](https://jlabdoc.jlab.org/docushare/dsweb/View/Collection-49642) |  |

# Release and Revision History

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| --- | --- | --- |
| **Rev #** | **Major Changes** | **Effective Date:** |
| 1 | Initial version | 28 Jan 2022 |
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# Approvals

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