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| **Desk Top Instruction for Dry Turbo Pump hook-up prior to Removing a Cryomodule and Removal/Replacement of Girder/Beam Line Component.** |
| **Document Number:** | <SRF-##-XX-###> | **Effective Date:** | DD Mmm YYYY |
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| **Document Owner:** | <First Last Name> | **Department Owner:** | SRF Operations |

# Purpose

The purpose of this document is to <enter text>.

This procedure supports the Quality Management System as described in SRF-01-ML-001 Quality Manual.

# Scope

These instructions define the process for setting up Dry Turbo Pump Station prior to a Cryomodule/Girder Beam line component replacement. This Procedure assumes the Cryomodule is Warm.

# Terms and Definitions

The following terms have specific meanings within this procedure.

|  |  |
| --- | --- |
| **Term** | **Definition** |
| <Term 1> | <Definition> |
| <Term 2> | <Definition> |
|  |  |

# 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

## Setup

The initial setup ensures a clean delivery system for the nitrogen/helium purge.

* + Remove or relocate all exterior components, wiring and magnets associated with girder that can be removed to accommodate the installation of the laminar flow hood.
	+ Use water and clean rags to pre-clean all of the non-beam line components associated with the girder i.e. girder stand and floor area in work zone.
	+ The flow hood will encompass the entire girder and connections points for both ends of the cryomodule.
	+ Perform a preliminary wipe down of the flange(s) that are coming apart with isopropyl alcohol and clean room wipes. Flush the joint area with isopropyl and blow down using ionized N2 gun.
	+ Use large clean room nylon bagging material to cover the entire girder and beamline up to connection points. The bagging material will drape down to the floor and cover entire floor area out to ~ 1ft perimeter outside of the laminar flow hood floor footprint.
	+ The edges of the nylon bagging shall be taped down around girder and components in such a manner as to protect the “clean” surface/space from being contaminated with new dust or dirt particles.
	+ After the bagging is complete, the only exposed area shall be the area immediately around the connection at the cryomodule isolation gate valve.
	+ Immediately position a Laminar Flow Hood over the Girder, turn flow hood on and let flow.
	+ Roll turbo vacuum cart to outside left of (section 2) work zone and slide vacuum pump manifold/hose through pre-cut hole in (section 2) curtain. Note: Vacuum pump manifold/hose will be nylonasized during cleaning and set-up of (section 2) work zone.
	+ Place Sticky mats outside of flow hood entrance. Step on outside sticky mat then don shoe covers, and then step into (section 1) gowning room and don clean room attire. This will include suit, hair net, face mask and gloves.
	+ Wipe down (section 1) interior gowning room plastic curtains with isopropyl pre-moistened wipes; then continue tape in of (section 2) work zone and also a wipe down of (section 2) interior curtain with isopropyl pre-moistened wipes + add nylon bagging to turbo manifold/hose and clean end of hose exterior 2 ¾” CF flange connection point.
	+ Clean all accessible beam line components, bagged surfaces and tools (within the laminar flow hood) with lint free isopropyl pre-moistened wipes. Then blow out area with clean Ionized N2. Wait a couple of minute’s for airborne particles to be evacuated from the flow hood.
	+ Set-up Particle Counter inside the (section 2) work zone and turn on and leave running for the entire work process.
	+ Flow hood can now continually run until the work is complete.

## Prepare to enter flow hood

* + Step on sticky mat outside of the gowning section of the laminar flow station. Place booty over shoes and immediately place that leg into the gowning area of the flow hood.
	+ Repeat for other foot.
	+ Place face mask over face and hairnet on head.
	+ Don a pair of class 100 gloves.
	+ Put on clean room hood.
	+ Step into clean room suit, ensuring that the hood is fully tucked in on the back side of the neck.
	+ Don a second pair of gloves (class 10) over the top of the cuff on the clean room suit.
	+ You are now ready to enter the work zone of the laminar flow hood.

## Dry Turbo/Manifold hook-up/particle counter/ Ionized N2 set up/ N2 slow purge manifold

* + Blank removal from right angle ion pump isolation valve shall be performed as follows:
	+ Set Particle counter nozzle under component being disconnected
	+ Remove four bolts leaving two bolts tight. Spray bolt hole’s with High Pressure N2 (bottle) though filtered ionizer (N2) gun until you get alara < 20 (.3 micron particle’s)
	+ Spray the entire flange again for a minute or so. Watch the portable particle counter and wait until the counts are as low as reasonably possible. Record the counts of 0.03 micron particles that was achieved before spray stopped.
	+ Remove the last two bolts while holding the flange in place so as to avoid any movement of the flange.
	+ Carefully slide the blank flange away from the valve.
	+ Wipe out open flange of right angle isolation valve located on the ion pump. Purge with alcohol if necessary to help clean any visible dirt. Spray into open end of valve with ionized N2 while monitoring the back-spray with a particle counter. Again, keep spraying until the particle counts are alara.
	+ Record the counts of 0.03 micron particles at the time the spray was stopped.
	+ Purge/bleed-up manifold shall be pre-assembled in Class 10 clean room and transported in clean room bag to the work zone. Spray the purge/bleed-up manifold exterior with ionized N2.
	+ Record the 0.03 micron particle count at the time the spray is stopped.
	+ Connect purge/bleed-up manifold to the open end of the right angle isolation valve.
	+ Remove the turbo vacuum pump manifold/hose CF blank and connect the vacuum pump manifold/hose to the “C” side of the 2 3/4” tee using the same cautions as used in the previous steps.
	+ Isolate the manifold with the manifold’s needle valve and the ion pump isolation valve. Pump down the manifold with the pump cart.
	+ Perform a leak check on the manifold and connection at the right angle ion pump isolation valve. Repair any leaks.
	+ Perform an analog scan of the manifold up to 65 AMU and record the data.
	+ **Note: If Beamline Isolation VBV’s leak through (associated Cryomodule’s) or are known to leak through a decision will be made to either Open or Keep Closed VBV’s during the slow bleed-up process.**
	+ Close the internal cold isolation gate valves on both ends (VCV1Lxx1 & VCV1Lxx8). Ensure the warm cryomodule (VBV1LxxA and VBV1LxxB) isolation valves are also closed.
	+ Ensure the internal cold isolation valve VCV1Lxx8 on cryomodule just upstream and VCV1Lxx1 on cryomodule just downstream to be closed and also the most downstream VBV1LxxB to be open; this will allow VIP1LxxB and VIP1LxxA to monitor vacuum level of these cryomodule’s during the slow bleed up process.
	+ Slowly open the right angle ion pump isolation valve, allowing the purge/bleed-up manifold pressure to equalize with the beam-line pressure in the girder and cryomodule.
	+ Girder manifold is now ready to be bled up.

## Slow Bleed-Up procedure

* + Connect the available N2 line to the bleed up manifold and purge up to the needle valve (the other side of the valve is under vacuum).
	+ Open the needle valve approximately 10 microns past the “click” while watching the convectron gauge readout. This valve will probably not be opened at this point. Slowly increase the amount the valve is open until there is a response on the convectron gauge. The bleed-up rate shall be less than 7.6 Torr/min throughout the entire process.
	+ The needle valve can slowly be opened further to allow the bleed up process to move along while staying under the max rate of 7.6 Torr/min.
	+ Shortly after the convectron gauge reaches 760 Torr, the relief valve will pop and the nitrogen will be flowing through this “pop off” valve.
	+ The girder is ready for disconnection at this point.

## Disconnecting the Girder

* + Remove the nuts from 4 of the six studs (leaving the two nuts on the sides of the flange tight) located at the connection between the girder bellows and the cryomodule isolation valve (VBV’s).
	+ Spray the entire flange area around the exposed studs with ionized N2 gun. Watch the portable particle counter and wait until the counts are as low as reasonably achievable. Record the counts of 0.03 micron particles that was achieved before spray stopped.
	+ Prepare the blank flanges (blank flanges should be pre-cleaned and bagged) that will be placed on the valve and bellows. This includes blowing these parts down until the counts are at zero on the particle counter.
	+ Remove the last two nuts while holding the bellows flange to keep it from moving.
	+ Slowly and carefully back the flange off the studs. Place a blank on the bellows flange.
	+ Allow for the collection of samples (Only if needed) from the open gate valve and place a blank on when collection is complete.
	+ Repeat these steps to the girder connection other side.
	+ Once complete leave girder at static N2 valve out equipment, breakdown equipment, remove cleanroom to allow Installation crew to remove girder and relocate to Test Lab.
	+ Move to 2nd Girder and perform same process.
	+ Once complete leave girder at static N2 valve out equipment, breakdown equipment, remove cleanroom to allow Installation crew to remove girder and relocate to Test Lab.
	+ Girder removal complete, SRF Cryomodule removal process can start.

## Equipment needed

* + 2 Technician’s
	+ Rags, Bucket, H2O
	+ Portable 2pc Cleanroom
	+ Cleanroom Lg. Nylon Bagging Material
* Tape
	+ Cleanroom (Full) Attire
	+ Cleanroom Pre-moistened Isopropyl Wipes
	+ Tacky Mat
	+ Sm. Wire Rack Rollaround
	+ High Pressure N2 Bottle
	+ N2 Ionizer Spray Gun
	+ Solair 3100E Particle Counter
* Slow Bleed/Pumpdown Manifold
* Dry Vacuum Pump Cart w/RGA
* Fluorescent Lighting
	+ Clean 2 ¾” CF Blanks
* Clean 2 ¾” CF Gaskets
* Clean 2 ¾” CF Hardware
* Misc Tools: Scissor, Driver’s, Particle Collection Tools if needed.

# Process Flow

<Related Process Outside this Procedure>

<Starting Condition>

<Step 2>

<Related Step 1>

<Step 4>

<Decision>

<Related Step 2>

<Related Step 4>

<Ending Condition>

<Step 1>

YES

NO

<Related Decision>

<Related Step 3>

YES

NO

<Step 3>

# References

|  |  |
| --- | --- |
| **Document No.** | **Title** |
| SRF-01-ML-001 | SRF Quality Manual |
| <SRF-FM-###> | <Document Title> |
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| <2> | <brief description of major changes> | DD Mmm YYY |
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# Form Release and Revision History

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