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| **<Procedure Title>** | | | |
| **Document Number:** | WMGRDR-PR-VAC-IPON | **Effective Date:** | DD Mmm YYYY |
| **Revision Number:** | R2 | **Periodic Review Date:** | DD Mmm YYYY |
| **Document Owner:** | M. Menia | **Department Owner:** | SRF Operations |

# Purpose

This procedure covers the turn-on of any ion pump used in SRF applications.

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

# Scope

**STP- Standard Traveler/Procedure:**

This Standard Procedure can be generalized such that it could apply to most cavities and cryomodules 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. In general, a paper and digital log of turn-on is only needed, not a specific traveler.

**SAFETY:**

Properly review the manufactures ion pump controller and installation manual and fully understand the operation before starting. These controllers can produce deadly high voltage shock and proper installation of the cables and connectors is mandatory.

# Terms and Definitions

The following terms have specific meanings within this procedure.

|  |  |
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| **Term** | **Definition** |
| Current | Floating current produced by a ion pump inherent in its applications |
| Voltage | Applied voltage to the ion pump by the controller |
| Trip | Voltage shutoff which may or may not restart automatically |
| Processing | allowing the controller to continuously trip and auto-restart |
| 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 referred to if needed |

# 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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# Hardware

## Gamma Vacuum SPCe (small pump controller)

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## Gamma Vacuum SPCe power supply – 24V (4A) power brick.

### Ion pump cable (10KV). - CAUTION is you do not know how to identity this cable seek help from an expert as there are 5KV versions which require voltage restrictions.

# Activation Details

## Prior to turn-on

1. Verify the vacuum system pressure is below 2x10-7 Torr at the gauge closest to item being pumped, the system has been pumping for a minimum of 12 hours, is leak checked to a leak rate no greater than 2 x 10-10 Torr L/s, and the ratio between 28 and 32 mass on a RGA is greater than 8. If there is no gauge on the system the pressure of the cart can be used, but the pumping time must increase to 24 hours before turn-on.
2. Verify the ion pump and associated vacuum system is at room temperature, high temperature turn-on is prohibited.
3. Verify the ion pump controller is disconnected from the wall outlet and power is off.
4. Manually inspect the ion pump high voltage cable to ensure it is in good condition. Connect high voltage cable between the pump and the controller. Verify both connectors are fully engaged.
5. Note the pressure of the pumping system attached to the vacuum system. Generally, a turbo pumping cart.

## Ion pump Controller beginning setting

1. Plug in the controller and turn on to the 24V (4A) power brick.



24V power in

Power on - Blue

1. Set the controller to the pumping size of the pump; most CEBAF beamline pumps are 40 or 45 L/Sec pumps.
2. Set the maximum current to 1mA trip setting.
3. Set the voltage to its lowest setting, generally 3kV.

## Turn-on and ramp

1. Turn on the high voltage on the ion pump power supply (at 3kV) by holding down the HV red bottom for 2 seconds.



HV on - Red

* 1. If the ion pump voltage rises smoothly to 3 kV, wait 30 seconds and proceed to step 2.
  2. If the ion pump voltage is limited due to the 1mA current limit, wait up to 20 minutes for the voltage to get to 3 kV (this is referred to as processing). The controller will turn off after a minute and then restart; allow the controller to keep running
     1. If the voltage does not reach 3 kV after 20 minutes, increase current limit to 3 mA and turn on high voltage.
     2. If the ion pump voltage is limited due to the 3 mA current limit, wait up to 20 minutes to reach 3 kV (process). If the pump will not turn on at a 3 mA current limit, contact PI/PM/SOTR.
     3. Once voltage reaches 3 kV, wait until current falls below 1 mA
     4. Reduce the controller current limit to 1 mA and proceed to step 2.

1. Increase the voltage to 3.5kV and verify the system is stable and does not trip for a minimum of 30 seconds. Do not turn off the high voltage – just increase the setpoint by 500V. The system must be stable before increasing the voltage.
   1. If processing occurs, wait up to 20 minutes.
   2. If controller does not reach set voltage within 20 minutes, reduce voltage to prior level and wait an hour before ramping up as long as current is falling.
2. Increase the voltage to 4kV and verify the system is stable and does not trip for a minimum of 30 seconds. Do not turn off the high voltage – just increase the setpoint by 500V. The system must be stable before increasing the voltage.
   1. If processing occurs, wait up to 20 minutes.
3. Increase the voltage to 4.5kV and verify the system is stable and does not trip for a minimum of 30 seconds. Do not turn off the high voltage – just increase the setpoint by 500V. The system must be stable before increasing the voltage.
   1. If processing occurs, wait up to 20 minutes.
4. Increase the voltage to 5kV and verify the system is stable and does not trip for a minimum of 30 seconds. Do not turn off the high voltage – just increase the setpoint by 500V. The system must be stable before increasing the voltage.
   1. If processing occurs, wait up to 20 minutes.

## Back-out and isolation

1. Track the ion pump current and/or pressure for 10 minutes.
   1. If it is rising, turn off the pump and re-evaluate the situation as the pump is most likely faulty.
   2. If the pressure is stable or goes down after 10 minutes, move on.
2. Using pump cart gauges, verify that the pressure is lower that the beginning of this procedure.
3. Close the valve between the pump cart and the vacuum system.
4. Vent the external pump cart and verify the ion pump pressure continues to drop at the same rate as before the disconnection. If this is not the case, the isolation valve is leaking through and must be replaced. See the PI/PM/SOTR for a back-out procedure to remove and replace the ion pump or valve.
5. Return at least 4 hours after disconnect to verify the pressure continues to drop, automatic data logging is preferred to ease analysis and data fitting to verify the pumps performance.

# 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 |
| SPC\_User ManualREV\_J.pdf | Ion Pump Controller Manual |
|  | Ion Pump Manual |

# Release and Revision History

|  |  |  |
| --- | --- | --- |
| **Rev #** | **Major Changes** | **Effective Date:** |
| 1 | Initial version | 25 Jun 2021 |
| 2 | Updated to latest Procedure ID and Template | DD Mmm YYY |
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# Approvals

|  |  |  |  |
| --- | --- | --- | --- |
| **Approved by:** | **Name:** | **Signature:** | **Date:** |
| Document Owner | <First Last Name> |  | DD Mmm YYY |
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| SRF Department Head | Tony Reilly |  | DD Mmm YYY |