

Princeton Plasma Physics Laboratory Procedure			
Procedure Title: MGI Capacitor Box Safing and Access Procedure			
Number: AP-MGI-01	Revision: 0	Effective Date: 05/27/2016	
		Expiration Date: <i>(2 yr. unless otherwise stipulated)</i>	
Procedure Approvals			
Author	Frank Hoffmann	Date 05/27/2016	
ATI	Frank Hoffmann	Date 05/27/2016	
RLM	Al von Halle	Date	
Responsible Division: Electrical Engineering			
Procedure Requirements designated by RLM			
LABWIDE:			
	Work Planning Form # _____ (ENG-032)		Lockout/Tagout (ESH-016)
	Confined Space Permit (5008, Sec. 8, Chap 5)		Lift Procedure (ENG-021)
	Master Equip. List Mod (GEN-005)		ES&H Review (NEPA, IH, etc.)
	RWP (HP-OP-20)		Independent Review
	ATI Walkdown		Pre-job Brief
	Post-job Brief		Hazard Analysis
	Run Copy Required (performance of procedure must be documented and archived per ENG-030 page 10)		Special archiving requested for completed Run Copies: _____ _____ _____
D-SITE SPECIFIC:			
	D-Site Work Permit (OP-AD-09)		Door Permit (OP-G-93)
	Work on Tritium Contaminated Sys. (OP-AD-77)		Activity Certification Committee Review
	Pre-job brief (ENG-030)		T-MOD (ENG-036)

REVIEWERS (designated by RLM)	
Accountable Technical Individual	Frank Hoffmann
Test Director	
Independent Reviewer	Roger Raman, Doug Westover
D-Site Shift Supervisor	
NSTX	
D-Site Caretaking	
Vacuum	
Computer	
Tritium	
Quality Assurance/Quality Control	
AC Power	
Maintenance and Operations Division	
Energy Conversion Systems	
Engineering	
Materials and Environmental Services	
Water Systems	
Neutral Beam (Heating Systems Branch of Electrical Engineering)	
Radiofrequency (Heating Systems Branch of Electrical Engineering)	
Diagnostics	
Environmental, Safety, & Health	Glenn Anderson

TRAINING (designated by RLM)			
No training required _____		Instructor _____	
Personnel (group, job title or individual name)	Read Only*	Instruction	Hands-On
MGI Engineer and Designee(s)		✓	
RLM _____			

* “Read Only” training for Administrative, Alarm Response, and Emergency Operations procedures must be documented on a Record of Training form (attachment 6). The completed Run Copy will serve as the documentation of “Read Only” training for all other types of procedures.

1. PURPOSE

- 1.1 This procedure ensures that the Massive Gas Injector (MGI) Capacitor Boxes are safe for maintenance, repairs, testing, and adjustments.

2. SCOPE

- 2.1 The MGI systems are located in rack CTC-EE-401 on the NSTX 100' level and rack CTC-EE-451 on the NSTX 119' level and are connected to valves mounted on the NSTX-U vacuum vessel. This procedure details the steps required to safely transition each of the separate systems between the normal operating state of the MGI systems and a safe state for maintenance and other purposes.

3. REFERENCES

3.1 Drawings

B-AE3528	MGI Grounding Diagram
B-AE3526	MGI Power Supply Schematic Diagram
B-AE3527	MGI NI CRIO Schematic Diagram

Documents

ES&HD 5008, S2, C5	Personnel Safety Interlock (PSI) Systems
ES&HD 5008, S2, C6	Capacitors and Capacitor Banks
ESH-016	Control of Hazardous Energy (Lockout/Tagout)
ENG-011	Interlock Key Control
ENG-036	Control of Temporary Modifications

4. PRECAUTIONS

- 4.1 The equipment delineated in this procedure shall be considered energized until the Accessor has:
- 4.1.1 Personally and positively DE-ENERGIZED and GROUNDED the equipment; or,
 - 4.1.2 CONFIRMED that the equipment has positively been DE-ENERGIZED and GROUNDED by others.

5. PREREQUISITES

- 5.1 All Accessors assigned to secure this capacitor bank and render it safe for general access shall have completed Basic Electrical Safety training, Lockout/Tagout training, General Capacitor Bank Access training, and training in the execution of this procedure.
- 5.2 Equipment and Personal Protective Equipment (PPE):
- 5.2.1 At each equipment rack, a tested low Impedance Grounding Stick – with its connection to GND attached to the grounding lug of the equipment rack – is present.
 - 5.2.2 One set of high voltage PPE is located at locker in the CHI Tools Cabinet (CHI Cap Bank, Mechanical Equipment Room Mezzanine).
The PPE consists of:
 - a. Arc flash face shield HRC 2,
 - b. Arc rated jacket,
 - c. One pair tested insulating gloves, Class 0-5kV
- 5.3 Accessors are required to bring the following equipment:
- a. One Class III or IV listed multimeter,
 - b. One shorting jumper per capacitor to be safed.

6. PROCEDURE

6.1 MGI Capacitor Box Safing; requires Accessor only.

- 6.1.1 Remote login into the MGI control unit (compactRIO) for the MGI system to be safed.
- 6.1.2 If the 'Enabled' button indicates that the system is enabled (green indicator), press the 'Enabled button to disable the system (red indicator).
- 6.1.3 Using the Graphical User Interface (GUI) ensure that the control unit is in the 'Ready' State with the power supply disabled and the control signals set as follows:
 - DISCHARGE RELAY OPEN = 0
 - CHARGE_ENABLE = 0
 - VC1 = 0V
 - HV_ENABLE = 0
 - PS_ON = 0

If the GUI does NOT show the given status contact Frank Hoffmann (ext 3914).

- 6.1.4 Click on the "GUI Lock" button of the GUI to disable the GUI and visually alert personnel that this MGI system must not be operated.
- 6.1.5 Collect PPE from locker listed in 5.2.2
- 6.1.6 Walk to the equipment rack containing the MGI capacitor box to be safed.
- 6.1.7 Put on PPE as listed in 5.2.2
- 6.1.8 Unlock the combination lock. The combination for the lock can be obtained from Frank Hoffmann (ext. 3914), or Doug Westover (ext. 3045).
- 6.1.9 Open the door of the equipment rack. This will open the corresponding door switch, thereby disabling power flow to the charging power supply and forcing the capacitor discharge relay ("RR1") to its default Normally-Closed position.
- 6.1.10 Wait at least 10 seconds.

6.1.11 Looking through the capacitor box cover, **visually verify that RR1 is in its closed position** see Figure 1 below.

If RR1 is NOT in its closed position contact Frank Hoffmann (ext. 3914), or Doug Westover (ext. 3045).

6.1.12 Looking through the capacitor box cover, visually verify that the GND cable connecting the negative terminal of the capacitor to the GND point in the enclosure is intact.

If the GND cable is NOT intact, contact Frank Hoffmann (ext 3914), or Doug Westover (ext. 3045).

6.1.13 Use multimeter to measure the resistance on BNC connector "RR1 Status" (see Figure 4).

The measured value must be above 1M Ω (or showing 'INF'. or 'OL').

If resistance measured is not above the threshold, contact Frank Hoffmann (ext 3914), or Doug Westover (ext. 3045).

6.1.14 Use multimeter to measure the DC voltage on BNC connector "CAP VOLTS VD2" (see Figure 5).

The measured voltage must be below 50 Vdc.

If voltage measured is not below the threshold, contact Frank Hoffmann (ext 3914), or Doug Westover (ext. 3045).

6.1.15 Manually slide the access hole cover into its open position, allowing access to the capacitor terminals.

6.1.16 Touch the capacitor 'hot' terminal with the tip of the grounding stick and hold for at least 10 seconds.

6.1.17 Attach shorting jumper cable between the two terminals of the capacitor in the capacitor box (see Figure 3 for reference).

6.1.18 Remove PPE and store in locker listed in 5.2.2.

6.2 MGI Capacitor Box Ready for operation; requires Accessor only.

6.2.1 Looking through the capacitor box cover, visually verify that RR1 is in its closed position; see Figure 1 below.

If RR1 is NOT in its closed position contact Frank Hoffmann (ext 3914), or Doug Westover (ext. 3045).

6.2.2 Manually remove shorting jumper from the capacitor terminals.

- 6.2.3 Manually slide the access hole cover into its closed position so that it covers the access hole.
- 6.2.4 Close equipment rack door and lock it with combination lock to prevent unauthorized access.
- 6.2.5 Remote login into the MGI control unit (CompactRIO) for the MGI system to be readied for operation.
- 6.2.6 Click on the “GUI Lock” button of the GUI to enable the GUI for normal operation.

7. FIGURES

7.1 Discharge Relay – Closed Position

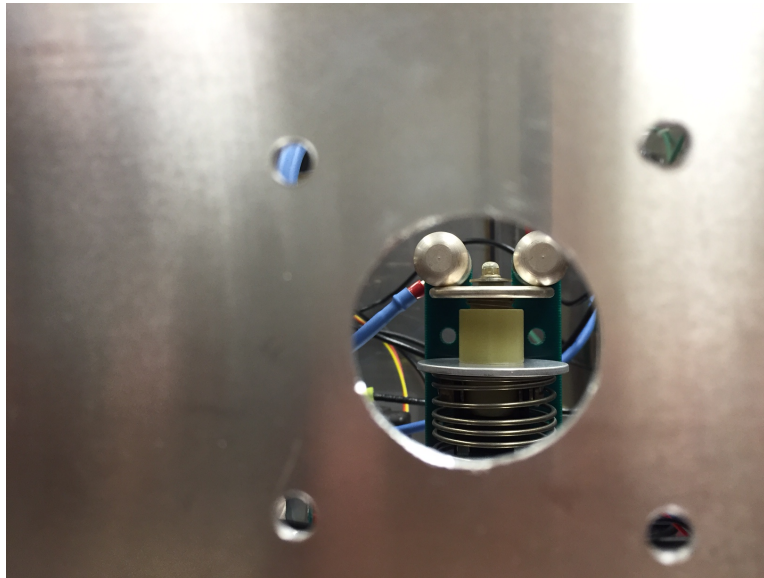


Figure 1: Discharge Relay in Closed Position

7.2 Discharge Relay – Open Position

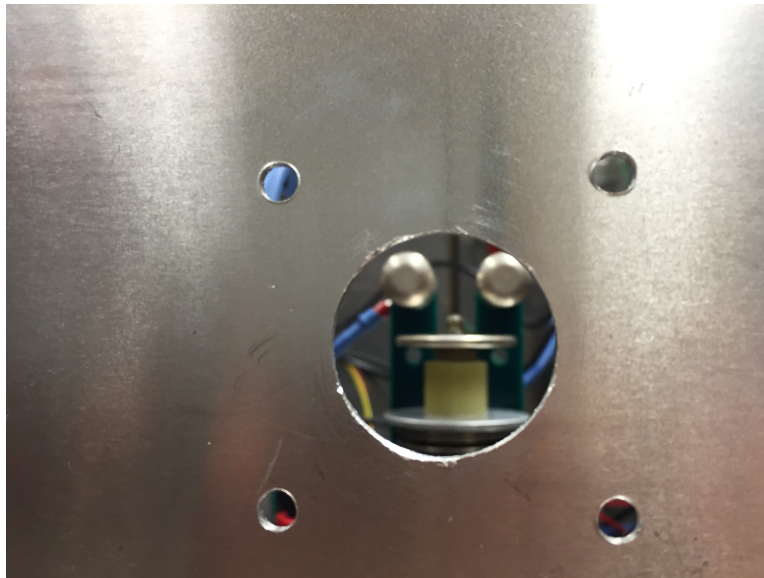


Figure 2: Discharge Relay in Open Position

7.3 Capacitor Jumper

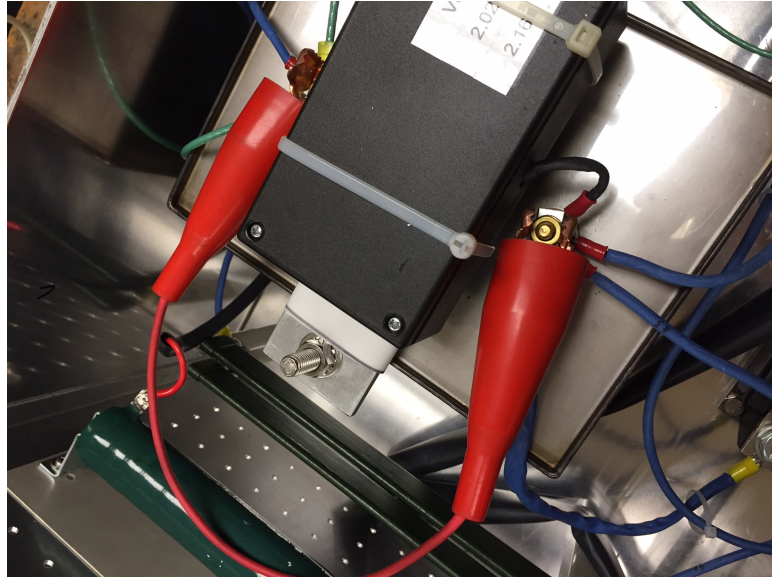


Figure 3: Capacitor with Jumper

7.4 Connectors – Front

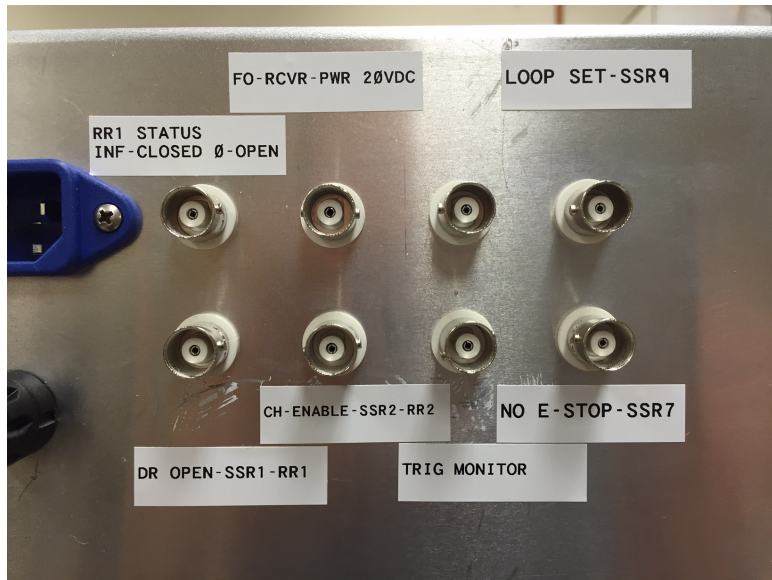


Figure 4: Connectors - Front

7.5 Connectors - Back

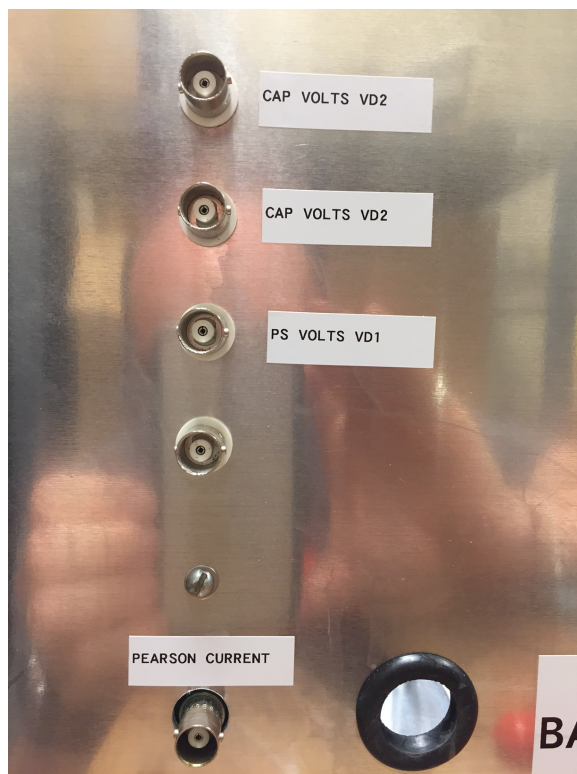


Figure 5: Connectors - Back