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| **Princeton Plasma Physics Laboratory**  **Procedure** | | | | | | |
| Procedure Title:  **NSTX-U CHI Capacitor Bank Operation** | | | | | | |
| Number:  **D-NSTX-CHI-759** | | Revision:  **1** | | | Effective Date: 10/15/15  Expiration Date: 10/15/18  *(3 yrs. unless otherwise stipulated)* | |
| **Procedure Approvals** | | | | | | |
| Author: Doug Westover | | | | | | Date |
| ATI: | | | | | | Date |
| RLM: A. Von Halle | | | | | | Date |
| Responsible Division: Electrical Engineering | | | | | | |
| **Procedure Requirements**  Designated by RLM  LABWIDE: | | | | | | |
|  | Work Planning Form # 1149 (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 | | |
| D-SITE SPECIFIC: | | | | | | |
|  | D-Site Work Permit (OP-AD-09) | |  | Door Permit (OP-G-93) | | |
|  | Tritium Work Permit (OP-AD-49) | |  | USQD (OP-AD-63) | | |
|  | Pre-Job Brief (OP-AD-79) | |  | T-Mod (OP-AD-03) | | |
|  | DCA/DCN (OP-AD-104) \*\* | |  |  | | |

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| \*\* | OP-AD-04 was voided by procedure ENG-032. However, DCAs that were open at the time of adoption of  ENG-032 are still considered valid for work approval purposes. |

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| **REVIEWERS** (designated by RLM) | |
| Accountable Technical Individual |  |
| Test Director |  |
| Independent Reviewer |  |
| D-Site Shift Supervisor |  |
| NSTX |  |
| D-Site Caretaking |  |
| Vacuum |  |
| Computer |  |
| Tritium |  |
| Quality Assurance/Quality Control |  |
| AC Power |  |
| Maintenance and Operations Division |  |
| Energy Conversion System/Motor Control System |  |
| Engineering |  |
| Environmental Restoration & Waste Management Division |  |
| Water |  |
| Neutral Beam Heating (Heating Systems Branch of Electrical Engineering) |  |
| Radiofrequency (Heating Systems Branch of Electrical Engineering) |  |
| RF |  |
| Diagnostics |  |
| Environmental, Safety, & Health |  |

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| **TRAINING** (designated by RLM) | | | | |
| No training required \_\_\_\_\_\_\_\_\_\_\_ | Instructor \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | |
| Personnel (group, job title or individual name) | | Read Only\* | Instruction | Hands On |
| CHI Engineer and Designee(s) | | 🗸 |  |  |
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| Training Rep. | | | | |
| 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.

# PURPOSE

## This procedure describes the steps necessary for the safe operation of the NSTX-U Coaxial Helicity Injection (CHI) Capacitor Bank System.

# SCOPE

## Configuration of the NSTX-U Test Cell (NTC), Motorized Ground Switch, and CHI Capacitor Bank for operation.

## Configuration and Safing of the CHI Capacitor Bank and the NSTX-U Test Cell for access to the Test Cell.

## Configuration and operation of the CHI Cap Bank System during Glow Discharge Cleaning (GDC).

## Access to the CHI Capacitor Bank is covered under AP-NSTX-01, ‘CHI Capacitor Bank Safing and Access Procedure’.

# REFERENCES

## **Drawings**

B-4FD122 Sh 1 CHI Capacitor Bank Power Supply Elementary

D-4FD133 RWM Kirk Key Interlock System

6000-B52135-PL LP-304

B-4F1005 Sh 1575A PF1AU/CHI Control Wiring Diagram

B-AE2006 Sh 510 NTC Area Safety System & Motor Operated Grounding/Disconnecting Safety Switch

## **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

D-NSTX-AP-02 RWM, and NSTX Test Cell Kirk Key Operation

OP-NSTX-15 NSTX-U HPP Daily Operations

AP-NSTX-01 CHI Capacitor Bank Safing and Access Procedure

D-NSTX-OP-CHI-791 CHI Capacitor Bank Startup, Local Operation and Testing

# PROCEDURE

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| **WARNING:** | No one shall be allowed in the NSTX-U Test Cell until the CHI Capacitor Bank is declared safe by the ATI or his/her designee. |

## At the start and end of any NSTX-U CHI experimental run day, or when entering or leaving the NTC for Controlled Access on those run days, the COE, in coordination with the CHI Cap Bank Engineer or his/her designee, shall complete the checklist on page 5.

## At the end of each run day, the completed and signed checklist shall be filed with the completed OP-NSTX-15 checklist for that same day.

## During GDC Operations it is necessary to Disarm and Disable the CHI Capacitor Bank via EPICS page PC50. This will provide the appropriate ground for the GDC probes.

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| CHI CAP BANK STARTUP | Startup | CA | CA | CA | CA |
| Verify that CHI Operations are scheduled for today and the necessary prerequisites have been completed. |  |  |  |  |  |
| Verify that systems configurations (OH/PF1B/PF2L voltages; ACP settings; PF4 leads, etc.) given by the Project Engineer have been implemented and that the appropriate PSRTC files have been developed and loaded. |  |  |  |  |  |
| Prior to locking the NTC, instruct Machine Technicians to configure the Motorized Ground Switch for CHI Operation. |  |  |  |  |  |
| After Vacuum Vessel Hipots are complete, instruct the Machine Technicians to attach the CHI snubber circuits per Drawing B-4F1005, Sheet 1575A. |  |  |  |  |  |
| After all personnel are clear of the NTC, Search and Secure is complete and the HIS Loop has been set, instruct the CHI Cap Bank Engineer or his/her designee to configure and configure the system for *NSTX-U CHI Operations* in accordance with AP-NSTX-01. |  |  |  |  |  |
| Confirm with the CHI Cap Bank Engineer or his/her designee that the Manual Ground Switch (S2) is OPEN, the cage is clear, the door is locked and the Cap Bank is ready for operation. |  |  |  |  |  |
| Enable and arm the CHI Capacitor Bank system using EPICS page PC50. |  |  |  |  |  |

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| CHI CAP BANK SHUTDOWN | CA | CA | CA | CA | Shutdown |
| Disarm and Disable using EPICS page PC50. |  |  |  |  |  |
| Prior to unlocking the NTC, instruct the CHI Cap Bank Engineer or his/her designee to establish the *CHI System Secured* condition in accordance with AP-NSTX-01. |  |  |  |  |  |
| Confirm with the CHI Cap Bank Engineer or his/her designee that the manual ground switch (S2) is CLOSED, and the CHI Cap Bank HVPS Disconnect LD-104 is OPEN and LOCKED. |  |  |  |  |  |
| Proceed with NTC entry. |  |  |  |  |  |
| At the end of the day, instruct the Machine Technicians to disconnect the CHI snubber circuits. |  |  |  |  |  |
| At the completion of the CHI experiments, verify restoration of NSTX-U machine configuration and files per Project Engineer. |  |  |  |  |  |

Comments: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

COE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_