ACCELERATOR DIVISION DEPARTMENTAL PROCEDURE

ELECTRICAL/ELECTRONIC SUPPORT DEPARTMENT

BDDP-EE-9920

EQUIPMENT SPECIFIC LOCKOUT/TAGOUT PROCEDURE

NUMI PROTON EXTRACTION KICKER POWER SUPPLY AND KICKER MAGNETS

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1.0 PURPOSE

The purpose of this document is to outline and detail the conduct of LOCKOUT/TAGOUT for the maintenance of the Numi Proton Extraction Kicker Power Supply and Magnets, I:KPS6N. The pulse power supply (PFN TANK, CHARGING TANK and THYRATRON ENCLOSURE) is located in the MI-60 South Power Supply Room. The controls are located in the MI-60 South Control Room and the magnets are located downstream of Main Injector Q602 (KM602A, KM602B and KM602C).

2.0 PERFORMANCE OF MAINTENANCE ACTIVITIES

2.1 This procedure is considered to be simple, and therefore authorized employees are not required to perform check off steps nor are they required to have this document with them while performing the necessary operations.

2.2 All personnel who replace, access or work within the described equipment shall comply with the specific instructions defined in this document. In cases where unusual circumstances may require deviation from these instructions, the Department Head or his designee and all participating personnel shall discuss and agree upon an appropriate course of action.

3.0 AUTHORIZED PERSONNEL

3.1 The EE Support Department Head maintains a list of department personnel authorized to perform this procedure. This list is accessible on the web via the department’s home page under "LOTO Compliance".

3.2 In times of emergency the Department Head or the Power Supply Group Leader may authorize other employees to perform this procedure. They shall assure themselves that the employee has read this procedure and can safely perform the necessary activities.

4.0 THE NECESSITY OF A WRITTEN LOTO PROCEDURE

4.1 The specific hazards that are involved with this kicker system are:

a. 208 VAC and 120 VAC (derived from 208 VAC) inside the controls relay rack
b. 60 kV, 6 kW, General Atomics power supply inside the controls relay rack
c. 30 kV pulsed voltage applied to the output cables and magnet
d. 2400 Joules of stored energy when the PFN capacitors inside the PFN TANK are charged to 60 kV

e. 72 Joules of stored energy when the filter capacitors inside the CHARGING TANK are charged to 60 kV
f. 120 VAC for safety switch inside the CHARGING TANK and relays inside the CHARGING TANK INTERFACE BOX
g. 1000 V, 4mA DC power for the thyratron trigger supply inside the THYRATRON TRIGGER UNIT (<1 Joule stored energy)
h. 150 VDC, 7A DC power for the thyratron filament inside the FILAMENT RESERVOIR DRIVER
i. 48 VDC, 15 ADC power for the thyratron reservoir inside the FILAMENT RESERVOIR DRIVER

4.2 The specific hazards of this system are controlled by:

a. Lockable 208 V, 3 phase disconnect mounted on the wall in the power supply room.
b. A discharge relay and resistor inside the CHARGING TANK.
c. A shorting stick and ground clip next to the CHARGING TANK.
d. A shorting stick at the thyratron enclosure and four grounding clips located around the PFN TANK.

5.0 THE STEPS OF LOCKOUT/TAGOUT PRIOR TO MAINTENANCE ACTIVITY

5.1 Prepare: The authorized employee shall understand hazards involved and the procedures to control them. If the authorized employee does not have this knowledge, he/she is not qualified to perform the LOTO procedure or maintenance activity.

Safety glasses must be worn when working on high voltage equipment

The two man rule is in effect while working on the Numi Proton Extraction Kicker Power Supply or Magnets.

5.2 Notify: Affected area personnel shall be notified as necessary. This includes the Main Control Room if this procedure is being used during operational periods of the Main Injector.

5.3 Shutdown

5.3.1 Locate the controls rack (labeled MI60127). Locate the Power Supply Status and Control NIM module. Turn the reference voltage to zero and pull the LOCAL REMOTE switch out and up to set it to LOCAL.

5.3.2 In the same NIM bin, locate the MANUAL TRIGGER button on the Trigger Interface module and press it to trigger the thyratron and discharge the PFN.

5.3.3 On the control rack (labeled MI60127), locate the ON–OFF switch on the Power Supply Status Control module and put in the OFF position. This closes the high voltage safety relay in the CHARGING TANK.

5.3.4 Turn OFF the General Atomics power supply with the front panel POWER toggle switch. NOTE THIS ONLY TURNS OFF CONTROL POWER AND DOES NOT INTERNALLY DISCONNECT 208 V.

5.3.5 Turn off the THYRATRON PULSER FIL/RES POWER circuit breaker at the bottom of the relay rack. Wait 10 minutes before proceeding to enter the thyratron enclosure so that the thyratron has been allowed to cool.

5.3.5 Turn off the CHARGING TANK AUX POWER circuit breaker at the bottom of the relay rack. This turns off all 120 VAC and 24 VAC power from the charging tank and CHARGING TANK INTERFACE BOX.

5.4 Isolate, Verify and Lock and Tag

5.4.1 Isolate the 208/120 VAC by moving the disconnect switch on wall in the power supply room marked I:KPS6N NUMI PROTON EXTRACTION KICKER to OFF (down).

5.4.2 Verify that 208/120 VAC is absent by opening the disconnect and seeing that all the knife blades are open. Note that one side of the disconnect is still energized.

5.4.3 Lock and Tag the disconnect

5.5 Relieve and Restrain Stored Hazardous Energy

Listed below are four separate procedures. Use only the procedure required to work on the device you need to access

5.5.1 Entering the CHARGING TANK:

a) Verify that the safety shorting switch is closed by looking through the viewing window on the side of the CHARGING TANK.

b) Remove the bolts that hold down the CHARGING TANK lid and carefully remove it. The oil level switch sticks into the oil from the bottom of this lid and can be easily broken.

c) Using the grounding stick short the copper tubing leading from the large black resistor assembly.

d) Apply the shorting clip while holding the ground stick on the resistor assembly.

5.5.2 Entering the PFN TANK or changing the tube in the THYRATRON ENCLOSURE:

a) Verify that the safety shorting switch is closed by looking through the viewing window on the side of the CHARGING TANK.

b) Remove the bolts that hold down the PFN TANK lid section that you need to enter and carefully slide it toward the middle of the PFN TANK. The oil level switch sticks into the oil from the bottom of this lid and can be easily broken.

c) Using the grounding stick short the copper tubing at the junction where it connects to the two PFN coils.

d) Apply the shorting clip to one of the PFN coils while holding the ground stick on the junction.

NOTE THERE ARE TWO GROUND CLIPS ON EACH END. IF YOU WILL BE DISCONNECTING ANY OF THE PFN COILS YOU SHOULD CONNECT A GROUND CLIP TO EACH COIL TO INSURE THE PFN CAPACITORS ARE GROUNDED.

5.5.3 Working inside the FILAMENT RESEROIR DRIVER or the THYRATRON TRIGGER UNIT

a) Remove the cover

b) Using a voltmeter measure across the local capacitor to verify zero voltage.

5.5.4 Working on the magnets in the tunnel enclosure or working in the THYRATRON ENCLOSURE when removing the THYRATRON CATHODE ACCESS COVER:

a) Verify that the safety shorting switch is closed by looking through the viewing window on the side of the CHARGING TANK.

b) Remove one of the output cables and carefully touch it to ground.

c) Insert the grounding stick into the empty connector and leave it in.

6.0 THE STEPS FOR RETURN TO SERVICE

The authorized employee must return all the following steps before returning the equipment to service after service or maintenance activity.

6.1 Check equipment to insure that everything is been put back together, that all connections are made tight, tools have been put away and that no metal filings are on the high voltage components. Make sure all components are in the same location to insure high voltage operation.

6.2 Check work area for personnel safety. Make sure all personnel are safely positioned or removed from the area as appropriate

6.3 Verify that all controls are in the off or neutral position.

6.4 Removal of ground clamps

REMOVE GROUND CLAMPS WHILE TOUCHING THE TERMINALS YOU ARE UNGROUNDING WITH THE GROUND STICK

6.5 Replace ground stick and close all covers and panels

6.6 Remove padlocks and tags from 208 VAC disconnect switch. The authorized employee who installed the locks and tags shall remove them and reconnect the equipment to the energy source from which it was isolated.

6.7 Notify affected personnel, as necessary, of completion of LOTO activity.

NOTE: If the crew chief in the control room was notified prior to the activity, s/he should be notified of completion of the activity.

7.0 PROCEDURE TRAINING REQUIREMENTS

Authorized employees are required to have had LOTO training (Level 1 and Level 2), and have read and understood this LOTO procedure.

Electrical/Electronic Department Personnel using this procedure shall be trained on the job. After reviewing this document, the employee shall perform the steps accompanied by an employee with previous experience. The authorized employee shall then complete a "Beams Division Electrical/Electronic Department Procedures Review Form" and turn it in to the department secretary.

Personnel from other departments shall be trained according to the requirements of their department.