

*If you are using a printed copy of this procedure, and not the on-screen version, then you **MUST** make sure the dates at the bottom of the printed copy and the on-screen version match. The on-screen version of the Collider-Accelerator Department Procedure is the Official Version. Hard copies of all signed, official, C-A Operating Procedures are kept on file in the C-A ESHQ Training Office, Bldg. 911A.*

C-A OPERATIONS PROCEDURES MANUAL

2.6.1 Procedure for Lockout/Tagout for the AGS and Booster Rings,  
During Accelerator Operations

Text Pages 2 through 10

Attachments

Hand Processed Changes

<u>HPC No.</u>	<u>Date</u>	<u>Page Nos.</u>	<u>Initials</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Approved: \_\_\_\_\_ *Signature on File* \_\_\_\_\_  
 Collider-Accelerator Department Chairman Date

P. Ingrassia/P. Sampson

## 2.6.1 Lockout-Tagout Procedure for the AGS and Booster Rings, During Accelerator Operations

### 1. Purpose

- 1.1 This procedure provides instructions to Operations Coordinators, MCR Operators, Collider-Accelerator Support Technicians (CAS), and AGS Main Magnet Operators for locking out the AGS and/or Booster Accelerator Rings, during particle beam operations (including maintenance periods), under Controlled or Restricted access conditions, so that personnel can enter with the assurance that electrical hazards have been secured or are properly barriered.
- 1.2 C-A Policy states that the preferred method to protect workers from energy sources is Lockout/Tagout. See [C-A-OPM 2.6.2](#) for situations where LOTO cannot be performed.

**Note:**

This procedure is to be applied only to the AGS and Booster Rings.

### 2. Responsibilities

- 2.1 Responsibilities of the Operations Coordinator
  - 2.1.1 The Operations Coordinator (OC), the Head of the MCR Group, or the Deputy Accelerator Division Head, shall inform the MCR Operators or CAS Personnel, whether access to the accelerator is to be "Controlled" or "Restricted", and which lockout/tagout checklist (see attachments) shall be used.
  - 2.1.2 If alternate energy control devices are used to achieve an equivalent level of safety, the OC shall note this on the appropriate checklist and the equivalent checklist.
  - 2.1.3 The OC shall designate two individuals (Operators or CAS Technicians), with lockout/tagout training, one as the Responsible Authorized Person (RAP), and the other as the Safety Watch Verifier (SWV).
  - 2.1.4 If Operational LOTO is in effect during an operator shift change the OC shall:
    - Designate a new RAP and SWV,
    - Follow the provisions of paragraph 5.1.4.

2.2 Responsibilities of the MCR Operators, CAS Technicians.

2.2.1 One individual (MCR Operator or CAS Technician), shall act as the RAP and one as the SWV. They shall perform Lockout/Tagout (LOTO) for the AGS and/or Booster Rings.

**3. Prerequisites**

3.1 Prerequisites of importance for the Operations Coordinator.

3.1.1 LOTO must precede an HP survey as described in [C-A-OPM 4.1](#).

3.1.2 The following systems have been reviewed and are properly barriered, or are in a range A category, as defined in reference 7.1:

3.1.2.1 Vacuum systems: all vacuum pumps and gauges,

3.1.2.2 Ring general services: i.e., 120 V, 208 V, 480 V power receptacles, fire detection and protection equipment, lighting and ventilation equipment.

3.1.3 If a device cannot be locked out, but an equivalent lockout achieves the same level of safety, then [C-A-OPM-ATT 2.6.1.e](#) shall be used in conjunction with the appropriate checklist.

3.1.3.1 The OC shall determine, with the help of the systems specialist, whether a lockout is equivalent.

3.2 Prerequisites of importance for the MCR Operators and CAS Technicians.

3.2.1 Only qualified and trained MCR Operators, Operations Coordinator, and CAS Technicians, may perform the LOTO steps outlined in this procedure.

3.2.2 The appropriate attachment, listed in Section 8.0 of this procedure, is filled out prior to allowing entry to an accelerator.

**Note:**

The Booster and the AGS each have their respective TOKENS, TOKEN BOXES, and lock boxes.

## 4. **Precautions**

### 4.1 Precautions of interest to the Operations Coordinator

4.1.1 All of the energy disconnect switches on the appropriate Lockout-Tagout Checklist shall be opened, locked, and tagged, according to this procedure.

4.1.1.1 If any apparatus on the appropriate checklist, or an equivalent checklist, cannot be locked out for operational reasons, use procedure C-A-OPM 2.6.2.

4.1.2 Depending on the Physics Program that the accelerator is serving, the Head of the MCR Group may designate a RAP and SWV, to perform the LOTO for items not in operation but listed on the checklists.

For example, if SBE, and/or FEB, and/or Polarized Protons, is not running, then the lockout/tagout shall already have been performed, and the keys shall be in the MCR key locker. The RAP and SWV shall verify, record the lock number, and initial the checklist and the tag on the energy control device.

### 4.2 Precautions of interest to MCR Operators, CAS Technicians.

4.2.1 The RAP and SWV shall wear safety glasses when opening energy control devices.

4.2.2 MCR personnel that enter an accelerator ring are subject to the requirements of workers as described in [C-A-OPM 2.6](#).

#### **Warning:**

To avoid damaging the AGS MMPS 95 switches, LOTO \*'d items before executing the MMPS LOTO procedure.

4.3 Ring equipment testing shall be allowed under Restricted Access if the restrictions in [C-A-OPM 2.6.2](#) or [C-A-OPM 2.6.8](#) are followed.

## 5. **Procedure**

### 5.1 Procedures for the Operations Coordinator:

#### 5.1.1 RESTRICTED ACCESS

5.1.1.1 With the accelerator on Controlled Access, the OC shall instruct the Operators, and /or CAS Technicians, to perform LOTO using the Standard (Restricted Access) Checklists ([C-A-OPM-ATT 2.6.1.b](#) and/or [2.6.1.d](#)).

5.1.1.2 When LOTO is completed, and an HP survey completed (where required), the accelerator may be switched to the Restricted Access state.

#### 5.1.2 CONTROLLED ACCESS

5.1.2.1 With the accelerator on Controlled Access, the OC shall instruct the MCR Operators, or CAS Technicians, to perform LOTO using either the Standard Checklists ([C-A-OPM-ATT 2.6.1.a](#) and/or [2.6.1.c](#)), an Equivalent Checklist, or a Special Checklist.

5.1.2.2 After LOTO is implemented and HP is available to enter the enclosure with the first work team, then the ring may be opened for entry.

**Note:**

The OC may order the state of the Radiation Access Control System to be changed from Controlled Access to Restricted Access after a LOTO, using the appropriate checklist of Attachments 2.6.1.a-e has been executed, and Health Physics survey.

#### 5.1.3 CHECKLISTS

5.1.3.1 Standard Checklist (Attachments 2.6.1.a through 2.6.1.d) is a list of energy control devices, which when opened, locked, and tagged, shall produce a condition of minimal electrical hazard in the ring enclosure.

5.1.3.2 Equivalent Checklist, [C-A-OPM-ATT 2.6.1.e](#), provides the same level of safety as the Standard Checklist.

It may be employed, with Safety Section concurrence, when authorized by the Deputy Division Head, the Head of the MCR Group, the Chief Electrical Engineer, or the Work Coordinator. This checklist is used in conjunction with the Standard Checklist by:

- Referencing the item(s) on the Standard Checklist that are not locked out and,
- Listing the Energy Isolation Devices that are locked out instead, or
- Listing the devices whose circuits entering the ring, have been disconnected, locked and tagged.

5.1.3.3 Use [C-A-OPM-ATT 2.6.1.e](#) to document partial LOTO.

5.1.3.3.1 When being used for partial LOTO, Strike through the word "equivalent" at top of the form.

5.1.4 INSTRUCTING OPERATORS, AND CAS TECHNICIANS

5.1.4.1 During Accelerator Operations, the Operations Coordinator shall designate a RAP and SWV to perform the lockout.

5.1.4.2 During shutdown periods, the RAP and SWV may be selected from qualified personnel, by the Head of the MCR Group or the C-A Work Coordinator.

5.2 Procedures for MCR Operators, CAS Technicians to perform LOTO.

5.2.1 The RAP and the SWV shall utilize Operational LOTO Red Tags. A sample of which is shown below.



5.2.2 The RAP and SWV shall lockout and tagout the appropriate energy control devices for the accelerator rings, using the checklist(s) designated by the OC.

5.2.2.1 The RAP and SWV shall enter the appropriate information on the checklist, as each energy control device on the checklist is opened, locked, and tagged.

5.2.2.2 The RAP shall note, on the back of the checklist, any special instructions or hazards.

5.2.3 The RAP shall turn each switch to the open/off position, then:

5.2.3.1 Open the door of the switch to visually check that all poles of the switch have opened.

5.2.3.2 The SWV shall confirm that the proper switch has been operated and that the poles are open.

**Caution:**

UNDER NO CIRCUMSTANCES SHALL COMPONENTS OR WIRING INSIDE THE SWITCH BE TOUCHED, SINCE THEY MAY BE ENERGIZED.

5.2.4 If the switch blades are not visible, the RAP shall check if there are fuses installed in the switch. If there are none, the switch is to be considered open.

5.2.5 If the fuses are installed, the RAP shall use a Wiggins or "Wiggy" voltage detector to determine if the switch is open by checking the voltage on the load side of the fuses.

**Caution:**

DUE TO THE ELECTRICAL HAZARD, ALL LINE-TO-LINE VOLTAGES (A-B, B-C, C-A) AND/OR ALL LINE-TO-GROUND VOLTAGES SHALL BE ZERO FOR THE SWITCH TO BE CONSIDERED OPEN.

**Note:**

Instead of using a Wiggins to measure voltages, operators may verify that apparatus is de-energized by attempting to turn on the power supply locally.

5.2.6 The RAP shall then close the door and apply the lock and tag to the switch handle.

5.2.6.1 Both the RAP and the SWV shall initial the entry in the column marked RAP on and SWV on, respectively.

5.2.6.2 If ES&F apparatus is LOTO, then place the kirk keys to the apparatus into the ESF lock box in the ESF Tech Shop, and apply one MCR lock and tag to the lock box, and place this key in the MCR/AGS Lockbox.

5.2.7 After all switches for the AGS have been locked and tagged open, the RAP shall:

5.2.7.1 Place the set of keys into the AGS lock box located in the MCR and apply a lock to this box. The key to this lock is the AGS TOKEN.

5.2.7.2 The RAP shall place the AGS TOKEN in the AGS TOKEN BOX.

**Note:**

The AGS Token Box can be mobile and may be placed at an AGS gate chosen by the OC or the Maintenance Coordinator.

5.2.7.3 Lock and tag the TOKEN BOX using a lock multiplier.

5.2.7.3.1 Store this key in the captured key locker above MCR\_2.

5.2.7.4 When not in use, the AGS token shall be stored in the captured key locker on top of MCR\_2.

5.2.8 After all switches for the Booster have been locked and tagged open, the RAP shall:

5.2.8.1 Place the set of keys into the Booster lock box located in building 914, and apply a lock to this box. The key to this lock now becomes the BOOSTER TOKEN.

5.2.8.2 The RAP shall place the BOOSTER TOKEN in the BOOSTER TOKEN BOX, located in building 914, next to the "Man gate", and

5.2.8.3 Lock and tag the TOKEN BOX, using a lock multiplier.

5.2.8.4 When not in use, the BOOSTER TOKEN shall be stored in the captured key locker on top of MCR\_2.

5.2.9 The RAP shall store the key(s) to the TOKEN boxes in the MCR Captured Key Box.

5.2.10 The RAP shall affix the checklists (one to each side of the page) in the MCR LOTO Logbook, which shall consist of a bound volume.

- 5.3 Procedures for MCR Operators, CAS Technicians to remove LOTO.
  - 5.3.1 When in Restricted Access, the OC shall have an announcement made to exit the ring and remove locks from the TOKEN box.
  - 5.3.2 The OC shall then have the accelerator placed into the Controlled Access state, and the enclosure shall be swept free of personnel ([C-A-OPM-ATT 4.56.a](#) and [OPM-ATT 4.56.f](#))
  - 5.3.3 The RAP shall open the appropriate TOKEN BOX and then use the TOKEN to open the appropriate Lock Box.

**Note:**  
Only the designated RAP on a shift may remove Operational LOTO.

- 5.3.4 Using the keys from the Lock Box, the RAP accompanied by the SWV, shall unlock and re-close the required energy control devices, and make the apparatus ready for operations.
- 5.3.5 The RAP and SWV shall use the SAME checklist(s) that was used to install the LOTO, and initial RAP off and SWV off columns, as each item is unlocked and re-closed.
  - 5.3.5.1 The RAP shall note any special instructions or hazards written on the back of the checklist.
- 5.3.6 The RAP shall return all red tags, locks and multipliers to the appropriate MCR LOTO station and placethe TOKEN(S) in the MCR Captured Key Locker above MCR\_2.

**6. Documentation**

- 6.1 MCR LOTO Logbook
- 6.2 Appropriate Checklist (see attachments)

**7. References**

- 7.1 [BNL ES&H Standard section 1.5.0.](#)
- 7.2 [BNL ES&H Standard section 1-5-1.](#)

- 7.3 [C-A-OPM 2.6.3 "LOTO for Booster MMPS".](#)
- 7.4 [C-A-OPM 2.6.2 "Procedure for Partial Lockout for the AGS and Booster Rings, During Accelerator Operations, Under Controlled Access Conditions".](#)
- 7.5 [C-A-OPM 2.6 "Personnel Entry to AGS and Booster".](#)

**8. Attachments**

- 8.1 [C-A-OPM-ATT 2.6.1.a, "AGS Ring Lockout-Tagout Checklist--Controlled Access".](#)
- 8.2 [C-A-OPM-ATT 2.6.1.b, "AGS Ring Lockout-Tagout Checklist--Restricted Access".](#)
- 8.3 [C-A-OPM-ATT 2.6.1.c, "Booster Ring Lockout-Tagout Checklist--Controlled Access".](#)
- 8.4 [C-A-OPM-ATT 2.6.1.d, "Booster Ring Lockout-Tagout Checklist-- Restricted Access".](#)
- 8.5 [C-A-OPM-ATT 2.6.1.e, "Equivalent Checklist -- Controlled Access".](#)