BROOKHAVEN NATIONAL LABORATORY PHYSICS DEPARTMENT	Number: PO-P-ATF-0013 Effective: 8/21/2009	Revision: 4 Page 1 of 8
Subject: ATF Modulator Interlock Test Procedure	Prepared by: Marc Montemagno	
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ATF Modulator Interlock Test Procedure

Date _____ Start Time _____ Reason for test _____

Testers _____

This test procedure should be performed at the same interval as the ATF radiation interlock system tests, every 6 months. Inform the control room operator prior to starting the test. At least two "qualified" BNL employees are required to conduct these procedures, one of whom is authorized as an "ATF ***modulator*** operator" and one other from the interlock group or ES&H.

Note: There are components of the modulator system that may be air cooled and may need to be shut down in an orderly manner to avoid damage.

Note: Proper PPE (as labeled on each switch or breaker and defined by SBMS Electrical Safety subject area), shall be worn when operating the 208V modulator disconnect switches.

1.0 Gun Modulator (#1) Arc Detector test.

	√	Comments
Remove trigger BNC from arc detector circuit.		
Turn on Modulator #1 HV disconnect switch, reset interlock RIA&B.		
Reset arc interlock (leave key in RESET position). Should hear HV relay open.		
Confirm Maxwell HV power supply is ON (red light) but HV is OFF. Confirm Maxwell panel meters read zero.		
Open cabinet door (only a few inches, enough to toggle the door switch). Confirm Maxwell HV power supply drops out. Close door.		
Turn on HV on Maxwell unit. Confirm modulator pulsing sound.		
Turn arc interlock key to RUN position. Confirm modulator stops pulsing and Maxwell HV power supply drops out.		
Turn arc interlock key to RESET position. Confirm Maxwell HV power supply turns on but HV remains off (no pulsing heard and meters read zero).		
Turn arc interlock key to RUN position. Remove key.		
Restore trigger BNC to arc detector circuit.		

2.0 Linac Modulator (#2) Arc Detector test.

	√	Comments
Remove trigger BNC from arc detector circuit.		
Turn on Modulator #2 HV disconnect switch, reset interlock RIA&B.		
Reset arc interlock (leave key in RESET position). Should hear HV relay open.		
Confirm Maxwell HV power supply is ON (red light) but HV is OFF. Confirm Maxwell panel meters read zero.		
Open cabinet door (only a few inches, enough to toggle the door switch). Confirm Maxwell HV power supply drops out. Close door.		
Turn on HV on Maxwell unit. Confirm modulator pulsing sound.		
Turn arc interlock key to RUN position. Confirm modulator stops pulsing and Maxwell HV power supply drops out.		
Turn arc interlock key to RESET position. Confirm Maxwell HV power supply turns on but HV remains off (no pulsing heard and meters read zero).		
Turn arc interlock key to RUN position. Remove key.		
Restore trigger BNC to arc detector circuit.		

3.0 Turn on both modulators.

(Gun/Linac)

Modulator high voltage power supply is on. ____ ____

Reservoir power supply is on. ____ ____

Both filament power supplies are on. ____ ____

Core Bias supply is on. ____ ____

The Emergency Stop Contactor Closed indicator located on the junction box behind the Linac modulator is ON. ____

4.0 Press the Modulator Emergency Stop button located in the control room.

(Gun/Linac)

Modulator high voltage power supply turns off. ____ ____

Reservoir power supply turns off. ____ ____

Both filament power supplies turn off. ____ ____

Core Bias supply turns off. ____ ____

Both indicators located on the Emergency Stop System junction box behind the Linac modulator are OFF. ____

5.0 Pull out the Modulator Electrical Emergency Stop button located in the control room.

(Gun/Linac)

The E-STOP Contactor Open indicator turns on ____

Modulator high voltage power supply remains off. ____ ____

Reservoir power supply remains off. ____ ____

Both filament power supplies remain off. ____ ____

Core Bias supply remains off. ____ ____

6.0 Turn down the both filaments on both modulators to about 10% of original set point.

____ ____

7.0 Press the Emergency Stop Reset button on the junction box.

The E-STOP Contactor Closed indicator turns on. ____
The E-STOP Contactor Open indicator turns off. ____

8.0 Test the remainder of the Emergency Stop buttons by repeating steps 3.0 through 7.0

Under east stairs ____

East mezzanine door ____

Inside mezzanine ____

North mezzanine door ____

(Gun/Linac)

9.0 Restore AC power to the modulator. ____ ____

9.1 The following interlocks should show disabled on the interlock panel.

(Gun/Linac)

9.1.1 Capacitor failure detector ____ ____
9.1.2 Klystron filament voltage ____ ____
9.1.3 Klystron filament current ____ ____
9.1.4 Thyratron filament ____ ____
9.1.5 Filament time delay ____ ____

9.2 The following interlocks should show enabled on the interlock panel.

(Gun/Linac)

9.2.1 Vacuum ____ ____
9.2.2 Water flow ____ ____
9.2.3 Door ____ ____
9.2.4 Core Bias ____ ____

(Gun/Linac)

9.3 Slowly restore the Thyratron filament power. Clear the fault. ____ ____

9.4 Restore the Klystron filament power using the procedure attached to the power supply panel. Attempt to clear the 2 faults when approaching full power. ____ ____

9.4.1 Start timing the filament time delay once both klystron filament faults clear. ____ ____

9.4.2 Attempt to clear the filament time delay every five minutes. Attempt to clear the filament time delay every minute once it failed to clear after 20 minutes. The timer should not clear before 20 minutes.

(Gun/Linac)

____ ____

9.4.3 At this point all interlocks are clear except for the Klystron filament time delay and the Capacitor failure detector. (Gun/Linac)

____ ____

9.4.4 With the timer failing to clear after 20 minutes attempt to power the capacitor charging power supply by enabling the capacitor failure detector, and clearing it's fault.

(Gun/Linac)

9.4.4.1 The fault for the capacitor failure detector should clear. ____ ____

9.4.4.2 The fault for the filament time delay should not clear. ____ ____

9.4.4.3 The power supply should not be powered. ____ ____

9.4.5 Disable the capacitor failure detector. This will cause the capacitor failure detector interlock to show a fault. ____ ____

9.4.6 Continue to attempt to clear the Klystron filament time delay every minute. It should clear between 20 and 30 minutes. ____ ____

9.4.7 Remove the modulator trigger cable from the rear of the modulator.

____ ____

9.4.8 All interlocks should be clear except for the capacitor failure detector. The capacitor charging power supply should not have power.

____ ____

The remainder of the procedure will check for AC power to the capacitor charging power supply. Do not enable the high voltage output at any time for the remainder of this section of the test procedure.

9.4.9 Enable the capacitor failure detector and clear its fault. The capacitor charging power supply should be powered. ____ ____

9.4.10 Disable the capacitor failure detector. The capacitor charging power supply should shut down and the capacitor failure detector interlock should show a fault. ____ ____

9.4.11 Enable and clear the fault for the capacitor failure detector. The capacitor charging power supply should have power. ____ ____

9.4.12 Turn off the appropriate ion-gauge controller for the modulator. The vacuum interlock should trip. All other interlocks remain enabled. The capacitor charging power supply should shut down. ____ ____

9.4.13 Restore power to the ion-gauge controller. The vacuum fault should clear. The capacitor charging power supply should have power. (Gun/Linac)

____ ____

9.4.14 Turn off the Core Bias power supply. The Core Bias interlock should trip. All other interlocks remain enabled. The capacitor charging power supply should shut down.

(Gun/Linac)

____ ____

9.4.15 Restore power to the Core Bias power supply. The Core Bias fault should clear. The capacitor charging power supply should have power.

____ ____

9.4.16 Shut down the water flow by closing the valve by the water flow sensor. The water flow interlock should trip. All other interlocks remain enabled. The capacitor charging power supply should shut down. ____ ____

9.4.17 Restore water flow. The water flow fault should clear. The capacitor charging power supply should have power. ____ ____

9.4.18 Reduce power to the thyratron filament. The thyratron filament interlock should trip. Trip points are posted on the modulator. All other interlocks remain enabled. The capacitor charging power supply should shut down.

____ ____

9.4.19 Restore power to the thyratron filament. The thyratron filament interlock should clear. The capacitor charging power supply should have power.

____ ____

9.4.20 Reduce power to the klystron filament. The klystron filament interlock should trip. Trip points are posted on the modulator. All other interlocks remain enabled. The capacitor charging power supply should shut down.

____ ____

9.4.21 Restore power to the klystron filament. The klystron filament interlock should clear. The capacitor charging power supply should have power.

____ ____

9.4.22 Both filament power supplies on both modulators should be on and at operational settings. Restore the modulator trigger.

____ ____

9.4.23 Proceed to the next section once the klystron filament time delay clears.

____ ____

NOTE: The following devices are listed in the ATF "Response to Modulator Malfunction" procedure.

10.0 Smoke Detector Test Section

10.1 Remove the 1 ¾" panel from the rear of the PFN section, just below the thyratron exhaust grill

10.2 Have one person man the Modulator Smoke Detector Alarm Panel in the control room.

10.3 Turn on the modulator

10.4 Inject canned smoke into PFN section until the smoke detector sounds.

	(Gun/Linac)
10.4.1 The modulator shuts down	____ ____
10.4.2 The control room alarm panel sounds	____ ____
10.4.3 The correct LED flashes on the alarm panel	____ ____

10.5 Press Alarm Silence button in Control Room

10.5.1 Alarm panel is silent	____ ____
10.5.2 Correct LED is still flashing	____ ____

10.6 Open modulator door and allow smoke to dissipate	____ ____
10.6.1 Smoke detector LED is lit	____ ____

10.7 Reset the smoke detector (May need to repeat this section if the smoke has not dissipated enough)

	(Gun/Linac)
10.7.1 Open the Modulator Emergency Stop chassis	
10.7.2 Press the Smoke Detector Reset button for 5 seconds	____ ____
10.7.3 Smoke detector LED is off	____ ____
10.7.4 Control room panel remains silent	____ ____
10.7.5 Control room panel LED is off	____ ____

10.8 Secure the Modulator Emergency Stop chassis	____ ____
10.9 Secure the modulator door	____ ____
10.10 Replace the 1 3/4" panel	____ ____

11.0 Confirm that the video image of both modulators is properly displayed in the control room. Adjust camera as needed.

Video image in control room OK ____

12.0 Confirm that the PA microphone, located behind modulator #2, is connected and working. Adjust the input level on the PA amplifier in the control room as needed.

Microphone OK ____

Inform the control room operator that the test is complete and log it in the operations log.

Completion Time _____

Signatures & life numbers:

ATF modulator operator _____

Other _____ Title _____

Other _____ Title _____