Person: Hannon, Fay (<u>fhannon@jlab.org</u>) Org: SRFR&D Status: PROCESSED Saved: 11/13/2019 7:46:24 AM Submitted: 11/8/2019 10:48:00 AM

Jefferson Lab		Operational Safety Procedure Review and Approval Form # 94703 (See ES&H Manual Chapter 3310 Appendix T1 Operational Safety Procedure (OSP) and Temporary OSP Procedure for Instructions)					
Туре:	OSP Click for OSP/TOSP Procedure Form Click for LOSP Procedure Form Click for LTT-Individual Information Click for LTT-Group Information						
Serial Number:	AC	C-19-94703-OSP					
Issue Date:	12/4	1/2019					
Expiration Date:	11/4,	/2020					
Title:	The	mionic Electron Source (TES)					
Location: (where work is being performed)	18 - Low Energy Recirculator Facility (LERF) - 109A						
Building Floor Plans							
Risk Classification: (See <u>ES&H Manual Chapt</u> e	<u>er 321(</u>	Without mitigation measures (3 or 4):3Appendix T3 Risk Code Assignment)With mitigation measures in place (N, 1, or 2):1					
Reason:	This Dete	document is written to mitigate hazard issues that are : rmined to have an unmitigated Risk code of 3 or 4					
Owning Organization:	ACC	CCIS					
Document Owner(s):	Han	non, Fay (<u>fhannon@jlab.org</u>) <u>Primary</u>					
		Supplemental Technical Validations 🗳					
Lock, Tag, Try (Bill	Rain	ey, Tim Fitzgerald)					
		Document History 🛛					
Revis	Revision Reason for revision or updates Serial number of superseded documents						
Lessons Learned		Lessons Learned relating to the hazard issues noted above have been reviewed.					
Comments for reviewers/approvers: I	3	11.13.19 - From: Harry W. Fanning Sent: Wednesday, November 13, 2019 7:07 AM To: Mary Jo Bailey Cc: Fay Hannon ; Harry Fanning Subject: OSP 94703 Needs Minor Edit I added the risk code to match the THA and cover sheet and changed their color to black.					
		Attachments N					

Procedure: *Thermionic Electron Source (TES) OSP - rev2RC.pdf* THA: *GTS_TES_THA (003).pdf*

Additional Files:

Auditional Tries.		
Rev	iew Signatures	
Subject Matter Expert : Lock-> Tag->Signed orTry(tfitzger@)	n 11/8/2019 11:14:56 AM by Tim Fitzgerald <u>Djlab.org</u>)	
Арр	roval Signatures	
Division Safety Officer : ACCCIS	Signed on 11/11/2019 7:48:22 AM by Harry Fanning (fanning@jlab.org)	
Org Manager : ACCCIS	Signed on 11/11/2019 12:25:03 PM by Matthew Poelker (poelker@jlab.org)	
Person : Lock, Tag, Try Coordinator	Signed on 11/19/2019 9:00:57 AM by Fay Hannon (fhannon@jlab.org)	
Safety Warden : Low Energy Recirculator Facility (LERF) - 109A	Signed on 12/4/2019 9:34:56 AM by Kevin Banks (<u>banks@jlab.org</u>)	



Operational Safety Procedure Form

(See <u>ES&H Manual Chapter 3310 Appendix T1 Operational</u> <u>Safety Procedure (OSP) and Temporary OSP Procedure</u> for Click For Word Doc

instructions.)

Title:	Th	ermionic	nic Electron Source (TES)							
Lesstian	LERF (Bld 18) Gun Test Stand (GTS)						Ø OSP			
						I ype:	TOSP			
Risk Classification				Highest Risk Code Before Mitigation 3		3				
(See <u>ESH&Q Manual Chapter 3210 Appendix T3 Risk Code Assignment</u> .) Highest Ri Mitigatio				ighest Ris Mitigatior	k Code after 1 (N, 1, or 2):	1				
Owning Organization: Accelerator Center for Injectors and Sources				Data	Deta 4 Nov 2010					
Document Owner(s): Fay Hannon and Mark Stefani					4-1100-2015	/				

DEFINE THE SCOPE OF WORK

1. Purpose of the Procedure – Describe in detail the reason for the procedure (what is being done and why).

This OSP is to be used for the safe operation of 100 kV gridded Thermionic Electron Source (TES)

2. Scope – include all operations, people, and/or areas that the procedure will affect.

This OSP identifies risk mitigation measures and operational procedures related to the safe use of the TES.

This OSP does NOT cover operation, maintenance or troubleshooting of hot deck components or their specific functions.

3. Description of the Facility – include building, floor plans and layout of the experiment or operation.

The TES resides in the Gun Test Stand (GTS), which is located on the west side of the LERF (Building 18) and consists of a control room (Bldg. 18, room 217) and an enclosure (Bldg. 18, room 109A) with concrete shield walls that is under room 217 and is adjacent to the LERF vault.

ANALYZE THE HAZARDS and IMPLEMENT CONTROLS

- 4. Hazards identified on written Task Hazard Analysis
 - Electrical shock Electrical heating Prompt radiation

5. Authority and Responsibility:

4. 5.

5.1 Who has authority to implement/terminate

Fay Hannon, Mark Stefani, Riad Suleiman, Md Mamun, Matt Poelker

5.2 Who is responsible for key tasks

For questions or comments regarding this form contact the Technical Point-of-Contact Harry Fanning

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	Fay Hannon and Mark Stefani
5.3	Who analyzes the special or unusual hazards including elevated work, chemicals, gases, fire or sparks (See ES&H Manual Chapter 3210 Appendix T1 Work Planning, Control, and Authorization Procedure)
	ES&H Electrical Safety reviews Electrical issues ES&H Industrial Hygiene reviews magnetic field issues Radiation Control Division reviews radiation issues
Person	al and Environmental Hazard Controls Including:
5 6 6.1	Shielding
	Concrete enclosure for radiation RF cage over TES for electromagnetic protection during operation
6.2	Barriers (magnetic, hearing, elevated or crane work, etc.)
	Concrete enclosure and door Flashing beacon and postings RF cage
6.3	Interlocks
	Personnel Safety System (PSS)
6.4	Monitoring systems
	EPICS control system Spellman PS software Hot Deck control rack controls
6.5	Ventilation
	Air exchange
6.6	Other (Electrical, ODH, Trip, Ladder) (Attach related Temporary Work Permits or Safety Reviews as appropriate.)
	Area ODH monitoring for SF6 and other oxygen depleting gases
List of	Safety Equipment:
7.1	List of Safety Equipment:
	Specialized grounding rod for TES electrical discharge safe-out
7.2	Special Tools:
	none
Associa	ated Administrative Controls
	Standing GTS OSP for normal operation
	Area postings for specific hazards within the GTS enclosure
Traini	ng
6. 7. 8. 9. 9.1	What are the Training Requirements (See <u>List of Training Skills</u>)

SAF103 Oxygen Deficiency Hazards SAF104 Lock, Tag and Try SAF603A Electrical Safety Hazard Awareness SAF143 LERF Safety Awareness Orientation Equipment specific straining Read, understand and comply with this OSP

ccelerator Facility

DEVELOP THE PROCEDURE

10. Operating Guidelines

Jefferson Lab

Background:

The 'hot deck', which is at high voltage (100kV provided by the high voltage power supply) during normal operation, sits atop an isolation transformer which provides local floating 110V AC electrical power to the electron source control components. The hot deck is also isolated from the beamline via a ceramic insulator. An aluminum table and isolation transformer supports the TES. The hot deck controls are operated remotely via fiber optic link. The high voltage power supply is located in the vault with the TES and is also operated remotely. A mesh cover on the hot deck prevents touching the control components during normal operation. An RF cage attaches to the table and fully encloses the TES.

For Safe Operation:

- In general the GTS should be clean and organized before operation.
- The TES hot deck must be powered and fully assembled. The hot deck is powered via a standard 110V AC plug to the isolation transformer. A red light indicates there is live power to the hot deck. At the hot deck, check that the local AC power connections to all components are not exposed. Hot deck 'fully assembled' means that all electronics are secured to the structure and that the structure is firmly attached to the ceramic. Additionally, the perforated shield and back plate should be in place.



• Operator should check the cathode heating power supply voltage is set to 6.5 V and that the current is no more than 1.8A, after a trained individual has followed heating procedure. This power supply is not remotely operated.





Note: when full assembled there is no exposed power.

- The TES and table should be wiped down with alcohol to remove organic residue and dust using appropriate PPE.
- Place RF cage over powered TES so that the front face of the RF cage neatly matches and encloses the TES. This is secured to the front plate with screws.
- Wipe the high voltage (HV) cable with alcohol (using appropriate PPE) and feed it through the insulating G-10 plate on the back of the RF cage. It attaches to the back of the hot deck via a banana plug. Ensure this connection is firmly made.
- There are 2 nitrogen feeds to the RF cage. One is connected to the top vent hole, the other is to a Vortex chiller on the back of the cage. Turn on the flow of nitrogen to ³/₄ open on both feeds. This provides cooling to the hot deck and mitigates corona discharge.



Operational Safety Procedure Form



• Ensure the RF cage is grounded via a thick wire to the grounding strip on the GTS wall.





- Ensure the grounding to the beamline side of the TES is connected to the 10" flange. This grounding cable should be wrapped around the high voltage power supply cable and connected to the supply chassis.
- Perform PSS sweep.

Operation is now remote from the control room:

Following the PSS sweep of the GTS enclosure, the interlock to the high voltage power supply means that HV can then be applied.

• The Spellman power supply software is used to bring the TES to an operating voltage of 100 kV. **DO NOT EXCEED THIS LIMIT.**



• The hot deck control rack's RF generator and grid bias controls are set to produce desired electron current.



Operational Safety Procedure Form



• All other beamline controls are handled through EPICS.

After Operation:

- Radiation monitors will indicate if any hazardous radiation sources are present after operating the TES
- Opening the GTS enclosure sets the PSS interlock to a safe condition preventing any HV to the TES



- Entering the enclosure, turn off nitrogen flow and unplug the power to the hot deck.
- Touch the RF cage with the grounding rod before removing HV cable and nitrogen lines. Remove RF



cage and contact hot deck with grounding rod. This will ensure any stored charge is dissipated.



Note: there are no components that are expected to store charge.

Now all systems are safe.

Hazards and mitigations:

Electrical shock: Grounding rod, red indicator light, hazardous voltage warning sticker, RF cage Heating: Vortex chiller cools electronics Radiation: PSS, Radiation monitors

11. Notification of Affected Personnel (who, how, and when include building man	ager, safety warden, and area coordinator)

Posting of GTS specific hazards Notification during PSS sweep procedure

12. List the Steps Required to Execute the Procedure: from start to finish.

- 1. Hot deck powered at appropriate settings
- 2. RF cage in place
- 3. Nitrogen lines, HV cable in place
- 4. Nitrogen flow on
- 5. PSS sweep
- 6. Operate TES
- 7. PSS open
- 8. Power down hot deck
- 9. Nitrogen flow off
- 10. Grounding rod to RF cage
- 11. Grounding rod to hot deck

13. Back Out Procedure(s) i.e. steps necessary to restore the equipment/area to a safe level.

Steps 7 - 11 in section 12 of this procedure.

14. Special environmental control requirements:

 14.1
 List materials, chemicals, gasses that could impact the environment (ensure these are considered when choosing Subject Mater Experts) and explore EMP-04 Project/Activity/Experiment Environmental Review below

n/a

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l 4.2	Environmental impacts	(See	EMP-04 Pro	ject/Activity	<u>/Experimer//Experimer//</u>	<u>nt Environmenta</u>	<u>l Review</u>)	

n/a

14.3 Abatement steps (secondary containment or special packaging requirements)

n/a

15. Unusual/Emergency Procedures (e.g., loss of power, spills, fire, etc.)

In the event of injury, call 911 and also notify:

- Guards (x5822)
- Crew Chief (x7045) (if inside the fence)
- Occupational Medicine (x7539)

In case of an injury follow standard JLAB procedures. Initial response cards are located with each phone for appropriate emergency phone numbers. Additional information can be found at https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-24400/*.pdf. If an immediate emergency exists, call 911.

16. Instrument Calibration Requirements (e.g., safety system/device recertification, RF probe calibration)

n/a

17. Inspection Schedules

Before locking up GTS for TES operation, inspect all cables and terminals for mechanical wear or abnormal conditions.

18. References/Associated/Relevant Documentation

OSP – LERF Gun Test Stand (GTS) ACC-16-63923-OSP or its successor

19. List of Records Generated (Include Location / Review and Approved procedure)

n/a

Submit Procedure for Review and Approval (See <u>ES&H Manual Chapter 3310 Appendix T1 OSP &</u> TOSP Instructions – Section 4.2 Submit Draft Procedure for Initial Review):

- Convert this document to .pdf
- Open electronic cover sheet: <u>https://mis.jlab.org/mis/apps/mis_forms/operational_safety_procedure_form.cfm</u>
- Complete the form
- Upload the pdf document and associated Task Hazard Analysis (also in .pdf format)

Distribution: Copies to Affected Area, Authors, Division Safety Officer **Expiration:** Forward to ESH&Q Document Control

Form Revision Summary

Revision 1.5 - 04/11/18 – Training section moved from section 5 Authority and Responsibility to section 9 Training Revision 1.4 - 06/20/16 – Repositioned "Scope of Work" to clarify processes Qualifying Periodic Review – 02/19/14 – No substantive changes required Revision 1.3 - 11/27/13 – Added "Owning Organization" to more accurately reflect laboratory operations. Revision 1.2 - 09/15/12 – Update form to conform to electronic review.

For questions or comments regarding this form contact the Technical Point-of-Contact <u>Harry Fanning</u>

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	Revision 1.1 – 04/03/12 – Risk Code 0 switched to N to be consistent with 3210 T3 Risk Code Assignment. Revision 1.0 – 12/01/11 – Added reasoning for OSP to aid in appropriate review determination. Revision 0.0 – 10/05/09 – Updated to reflect current laboratory operations									
	ISSUING AUTHORITY FORM TECHNICAL POINT-OF-CONTACT APPROVAL DATE REVIEW DATE REV.									
	ESH&Q Division Harry Fanning 04/11/18 04/11/21 1.5									
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Task Hazard Analysis (THA) Worksheet (See ES&H Manual Chapter 3210 Appendix T1

Work Planning, Control, and Authorization Procedure)

Author:	Marl	x Stefani		Date:	November 5, 2019		Task #: If applicable	
	Complete all information. Use as many sheets as necessary							
Task Title:	Thermionic Electron Source					Task Location:	LERF Gun Test Stan	d (GTS)
Division:	Accelerator			Department:	Center for Injectors	and Sources	Frequency of use:	Daily
Lead Work	er:	Mark Stefani						
Mitigation already in place: Standard Protecting Measures Work Control DocumentsSee OSP, "Thermion Electron				ron Source".				

Sequence of Task Steps	Task Steps/Potential Hazards	<u>Consequence</u> Level	<u>Probability</u> Level	Risk Code (before mitigation)	Proposed Mitigation (Required for <u>Risk Code</u> >2)	Safety Procedures/ Practices/Controls/Training	Risk Code (after mitigation
1	Electrical Hazard	М	М	3	Electric Hazard warning labels, All electrical leads covered, Grounding rod	 Read and Adhere to this OSP Training: SAF603 Electrical Hazard Awareness SAF104 Lock, Tag and Try 	1
2	Electrical heating	L	L	2	Nitrogen Vortex Chiller	Read and Adhere to this OSP	1
3	Radiation	М	М	3	Interlocked concrete door, flashing beacons	Read and Adhere to this OSP ESH Manual Chapter 6420	1

When completed, if the analysis indicates that the <u>Risk Code</u> before mitigation for any steps is "medium" or higher (RC \geq 3), then a formal <u>Work Control Document</u> (WCD) is developed for the task. Attach this completed Task Hazard Analysis Worksheet. Have the package reviewed and approved prior to beginning work. (See <u>ES&H Manual Chapter 3310 Operational</u> Safety Procedure Program.)

For questions or comments regarding this form contact the Technical Point-of-Contact Harry Fanning

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By signing this page, you testify that you have read, understand, and agree to abide by the procedure specified in the above referenced work control document:

Title:	Thermionic Electron Source (TES)	
Name	Signature	Date

Serial Number: ACC-19-94703-OSP