

Ames Laboratory	Procedure	46200.005
Office Engineering Services Group	Revision	5
Title Maintenance Procedures for Engineered X-ray Barrier Safety Systems	Effective Date	8/15/01
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MAINTENANCE PROCEDURES FOR ENGINEERED X-RAY BARRIER SAFETY SYSTEMS

This procedure shall be used for routine preventive maintenance and repair of the engineered x-ray barrier safety systems designed and installed on x-ray equipment by Engineering Services Group.

Comments and questions regarding this procedure should be directed to the X-ray Contact Person listed below:

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Sign-off Record:

Approved by: John Hjortshoj Date: 8-20-01
X-ray Contact Person

Approved by: T. Neuman Date: 8/20/01
Program/Department

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Radiation Safety Officer

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1.0 Revision/Review Log

This document will be reviewed once every 3 years as a minimum.

Revision Number	Effective Date	Contact Person	Pages Affected	Description of Revision
0	01/01/95	B. Thomas	All	Initial issue
1	06/01/97	B. Thomas	All	Change in procedure
2	10/01/99	G. Sleege	All	General update
3	11/11/99	G. Sleege	All	Change in procedure
4	12/09/99	J. Hjortshoj	All	Change in procedure
5	08/15/01	J. Hjortshoj		Reference Revision Description Summary PROC462_005revdesc.doc

2.0 Purpose and Scope

This procedure shall be used to direct the inspection, preventive maintenance and/or repair activities for the engineered x-ray barrier safety systems which have been installed on x-ray equipment located in Ames Laboratory spaces or owned by Ames Laboratory Programs in ISU spaces. As a safety system, these barriers require routine preventive maintenance checks and/or repair as needed to assure their operational integrity. Scheduled preventive maintenance shall routinely occur on a *semi-annual* basis for those x-ray barriers in Ames Laboratory spaces or owned by Ames Laboratory Programs in ISU spaces.

3.0 Prerequisite Actions and Requirements

3.1 Definitions:

Designated escort

An individual assigned by the facility group to accompany and remain with the preventive maintenance technician while working in the area to safeguard ESG personnel.

Engineered X-ray barrier safety system

Physical barriers specifically designed by ESG-Mechanical and Electronics Work Groups to provide protected operating environments possessing particular features designed to guard all personnel from exposure to the x-ray beam.

ESG

Engineering Services Group, Technical & Administrative Services Division, Ames Laboratory

ISU

Iowa State University

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IPRT

Institute for Physical Research and Technology

Interlock switches

Mechanical devices that provide electrically open or closed conditions.

By-pass key

A mechanical device that energizes an electronic circuit which overrides an interlock function.

Beam shutter

A mechanical device, when deactivated, places a beam barrier in the x-ray beam path.

RSO

Radiation Safety Officer

3.2 Authorized Maintenance Personnel

Inspection, preventive maintenance checks and/or repair shall be performed only by trained ESG-Electronics personnel (reference item 3.5). Engineered safety systems or factory installed safety systems, particularly those designed for personnel protection may not be tampered with or otherwise modified without specific approval of the program directors or the laboratory administration. Failure to recognize and adhere to these rules seriously jeopardizes the lives and/or safety of personnel using such systems, in addition to exposing Ames Laboratory to serious liability.

3.3 Assignment of Designated Escort at Location of X-ray Equipment

Each group having protected x-ray equipment shall assign a designated escort to be present whenever ESG-Electronics personnel perform inspection, preventive maintenance checks and/or repair on the engineered x-ray barrier safety system on x-ray equipment.

3.4 Group Training/Administrative Controls

Upon installation of the engineered x-ray barrier safety system, the designated escort will receive initial safety training from ESG-Electronics personnel on the operation of the system. It will then become the group's responsibility to train all other cognizant personnel within their group. In addition, each group must develop appropriate administrative controls to prevent unauthorized access, misuse, or modification of the engineered safety system. Appropriate lock-out/tag-out measures will be used whenever repair is needed.

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3.5 ESG-Electronics Personnel Training

All technicians and engineers within ESG-Electronics prior to performing this procedure are Qualified Electrical Workers (reference Ames Laboratory Electrical Safety Manual 46200.001) and will complete required radiological training. Additionally, technicians will receive job activity specific training. The job activity specific training includes hands-on training utilizing the performance steps listed in Item 4.0.

4.0 Performance (Semi-annual)

Responsibility

Inspection, preventive maintenance and/or repair activities will be performed in accordance with the Ames Laboratory Analytical X-ray Safety Policy 10202.003 by ESG-Electronics personnel utilizing the specified training identified in Item 3.5 of this procedure. The interval between inspections shall not exceed six months. The *Preventive Maintenance Activity Checklist for X-ray Barriers* Form 46200.014 will be utilized to document the results of Actions 1 - 10. ESG will obtain the current inventory list from the Radiation Safety Officer before starting inspections.

Action

- 1) Contact the group Safety Coordinator or Safety Representative to arrange for an escort and a date and time for the preventive maintenance activity.
- 2) With help from the escort, perform a safety hazard awareness of the location prior to initiation of the inspection, and/or repair maintenance work. Document any hazards on the *ESG Hazard Awareness* Form 46200.047.
- 3) With an escort present, make a visual inspection of the x-ray barrier noting the condition of barrier door hardware, interlock switches and wiring.
- 4) Verify that all warning lamps are working properly by energizing the x-ray unit including opening the shutters. De-energize the unit. Remove fail safe warning lamp and verify the x-ray unit will not start.

Actions 5 and 6 are for systems with by-pass

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capability only.

- 5) With the x-ray unit energized and the beam shutter open, (by-pass deactivated), verify that opening each barrier access closes the beam shutter.
- 6) With the x-ray unit energized and the beam shutter open, activate the interlock by-pass using escort's key. Verify that opening each barrier access **does not** close the beam shutter.
- 7) Affix a dated and signed inspection sticker (Form 46200.012) on the front of the x-ray barrier.
- 8) Return x-ray unit to its original conditions.
- 9) Complete all documentation needed on the *Preventive Maintenance Activity Checklist for X-ray Barriers*, Form 46200.014.
- 10) Enter preventive maintenance activity data into preventive maintenance schedule database with copies provided to ESH&A and ESG-Administrative office. The original form is to be kept on file in the ESG-Electronics Tech Shop.

5.0 Post Performance Activity

5.1 Repairs (other than normally scheduled preventive maintenance)

X-ray facility group personnel suspecting any malfunction of the engineered x-ray barrier safety system should call ESG-Electronics, 4-4823 or factory representative for immediate repair. The cognizant group should initiate lockout/tagout of the facility until repairs can be scheduled and completed by ESG-Electronics or factory representative.

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5.2 Documentation of X-ray Barriers

The location and PM schedule of all installed engineered x-ray barrier safety systems shall be documented by ESG-Electronics personnel using the PM software database and by using and completing the forms listed hereinafter.

- 5.2.1 Follow and perform the *Preventative Maintenance Activity Checklist for X-ray Barriers*, Form 46200.014. This checklist will be kept on file in the ESG-Electronics Tech Shop as long as the equipment is property of Ames Laboratory/IPRT.
- 5.2.2 Date and sign an *Ames Laboratory X-ray Barrier Inspection* sticker, Form 46200.012, and affix to the front of the x-ray barrier.
- 5.2.3 Complete the *X-ray Barriers Preventive Maintenance Schedule*, Form 46200.016 with copies provided to ESH&A and ESG-Administrative office. The original form is to be kept on file in the ESG-Electronics Tech Shop.
- 5.2.4 Provide revised and/or corrected data to the Radiation Safety Officer, ESH&A. All deficiencies shall be documented on Form 46200.016.

6.0 Materials Required for Maintenance Activity

6.1 Form 46200.014, Rev. 1, 12/01/99, *Preventative Maintenance Activity Checklist for X-ray Barriers*.

6.2 Inspection Sticker (sample)

Ames Laboratory X-ray Barrier Inspection	
Last Inspected (M/D/Y)	_____
BY	_____
<small>Form 46200.012</small>	<small>Rev. 1 1/1/95 LH/X-ray Insp.</small>

6.3 Form 46200.016, Rev. 2, 12/01/99, *X-ray Barrier Preventive Maintenance Schedule*.

6.4 Form 46200.047, Rev. 0, 8/4/99, *Hazard Awareness Form for ESG In-house or Out-of-area Service Tasks*.

PREVENTIVE MAINTENANCE ACTIVITY CHECKLIST FOR X-RAY BARRIERS

USER GROUP: _____ LOCATION: _____
(Building and Room #)

DESIGNATED ESCORT: _____

DATE: _____ PM PERFORMED BY: _____

PERFORMANCE CHECKLIST: S - Satisfactory; U - Unsatisfactory; NA - Not Applicable

- 1) **Visual inspection:**
- | | | | | |
|--------------------------|---|--------------------------|---|--------------------------|
| a) barrier door hardware | S | <input type="checkbox"/> | U | <input type="checkbox"/> |
| b) interlock switches | S | <input type="checkbox"/> | U | <input type="checkbox"/> |
| c) wiring | S | <input type="checkbox"/> | U | <input type="checkbox"/> |

Corrective actions needed: _____

Corrective actions taken: _____

- 2) **Test operation of warning lamps:** S U

Corrective actions needed: _____

Corrective actions taken: _____

- 3) **Test fail safe warning lamp circuit:** S U

Corrective actions needed: _____

Corrective actions taken: _____

- 4) **In activated state, barrier access closes beam shutter:** S U

Corrective actions needed: _____

Corrective actions taken: _____

- 5) **In by-pass mode, barrier access does not close beam shutter:** S U NA

Corrective actions needed: _____

Corrective actions taken: _____

6) Affix a dated and signed inspection sticker (Form No. 46200.012) to the front of the x-ray barrier.

7) X-ray unit returned to normal operation conditions.

8) PM activity data entered in PM database.

Hazard Awareness Form for ESG In-house or Out-of-area Service Tasks

Equip. Location: _____ **Requester:** _____ **Phone:** _____ **W/J/Daysheet #:** _____

DIRECTIONS: FOR SERVICE REPAIR AND TROUBLESHOOTING TASKS, THE SUPERVISOR OR ASSIGNED WORKER WITH THE HELP OF THE REQUESTER, SHALL PERFORM A SAFETY ASSESSMENT AND COMPLETE THE ITEMS BELOW FOR THE EQUIPMENT/WORK AREA BEFORE WORK BEGINS. THE WORKER SHALL NOT PERFORM THE REPAIR UNTIL CONCERNS ARE ADDRESSED AND NEEDED SAFETY PRECAUTIONS ARE TAKEN. PLEASE COMMENT ON PRECAUTIONS NEEDED FOR ANY 'YES' ANSWERS. IF ANY OF THE ANSWERS BELOW ARE MARKED 'YES' SEND A COPY OF THIS SHEET TO ESH&A.

1) Work Area Concerns:

- a. Confined space/limited egress Yes/No
- b. Temperature/humidity extremes Yes/No

3) Chemical, Biological, & Radiation Concerns:

- a. Suspected carcinogens/biological agents Yes/No
- b. MSDS needed & available Yes/No
- c. Radioactive matrl./sources (laser/x-ray) Yes/No
- d. PPE needed Yes/No

2) Electrical Concerns:

- a. High Voltage Yes/No
- b. Exposed wiring Yes/No
- c. LOTO needed Yes/No
- d. Non-NRTL equipment Yes/No
- e. PPE needed Yes/No

4) Mechanical Concerns:

- a. Rotating parts or pinch points Yes/No
- b. Stored energy systems Yes/No
- c. LOTO needed Yes/No
- d. Pressurized system/pressure vessel Yes/No
- e. PPE needed Yes/No

Hazard assessment performed by (please print): _____ **Date (m/d/y):** _____

Item # _____ **Comments:** _____

Item # _____ **Comments:** _____

Item # _____ **Comments:** _____