

**CTI****CTI Inc.**

RADIATION SAFETY PROGRAM  
PART I  
PERIODIC INSPECTION AND MAINTENANCE

Section 5.0Page 30 of 31Rev. 17Date 4-15-88Appr. Shaw

### 13.0 TECHNICAL OPERATION "GAMMA RAY PROJECTOR" MODEL 865

#### 13.1 General

- 13.1.1 Inspection and maintenance of the Model 865 exposure device and Model 86550 control unit must be performed at intervals not to exceed three months (SEE 13.3.2 NOTE).
- 13.1.2 To properly service the Model 865 exposure device and control unit, the following tools and equipment are required:

- a) Master Key (AT865-11)
- b) Cleaning Solvent (chloroethene)
- c) Vibratite
- d) Piston Limit Tool (AT865-7)
- e) Socket wrench set with sockets: 1/2 inch, 10 mm
- f) Source holdown cap (AT865-8)
- g) Replacement O Rings and Seals
- h) Lock Seal Removal Tool (AT865-9)
- i) 1/32 Dia. stainless steel safety wire
- j) Grease MIL-G-23827 A

#### 13.2 Control Unit

- 13.2.1 Inspect the entire length of each control hose to assure that each section is free from cuts and damage.
- 13.2.2 Inspect the end fittings to assure that they are tightly connected. Check the threads on the fittings for damage.
- 13.2.3 With the control switch in the OFF position, close off the expose hose. Pressurize the control to approximately 30psig. Observe that the pressure gauge functions properly. Turn the control switch to the EXPOSE position. Observe that the indicated pressure reduces by approximately 4psi. Open the expose hose. Assure that air flows through the exposing hose and the pressure returns to atmospheric.
- 13.2.4 With the control switch in the OFF position, close off the retract hose. Pressurize the control to approximately (30psig). Turn the control switch to the RETRACT position. Observe that the indicated pressure reduces by approximately 4psi. Open the retract hose. Assure that air flows through the retracting hose and the pressure returns to atmospheric.

#### 13.3 Exposure Device

9611220235 961105

PDR RC

SSD

\*

PDR

CTI

**CTI****CTI Inc.**

## RADIATION SAFETY PROGRAM

## PART I

## PERIODIC INSPECTION AND MAINTENANCE

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13.3.1 Check the operation of the survey meter and check to assure that the source is properly stored by measuring the radiation intensity at the surface of the exposure device and at one meter from the surface. The radiation level should not exceed 200 mR/hr at the surface nor 10 mR/hr at one meter from the surface.

13.3.2 Inspect the exposure device for any signs of damage or excessive wear. Check to assure that there are no loose fasteners or broken safety wire. Assure that the exposure device is properly labeled.

NOTE

The manufacturer recommends that maintenance of the actuator assembly not be performed at quarterly intervals but performed during normal source replacement intervals at the manufacturers facility. ~~In cases where the user must perform maintenance of the actuator assembly, the procedure of steps 13.3.3 through 29 should be followed. Individuals performing this operation should wear a direct reading pocket dosimeter and either a film badge or a thermoluminescent dosimeter. All operations should be monitored with a properly calibrated and operable radiation survey instrument.~~

13.3.3 Assure that the key operated lock is engaged and the key is removed.

13.3.4 Remove the actuator cover by removing the four attachment screws.

13.3.5 Install the piston limit tool by threading it into the source position indicator rod.

13.3.6 Cut and remove the safety wire from the four actuator tie bolts. Remove the actuator tie bolts.

13.3.7 Carefully monitor this operation with the survey meter. Remove the actuator assembly by lifting the assembly and moving it in a circular motion until it disengages from the source assembly.

13.3.8 Install the source holddown cap to the exposure device using the four bolts.

*This Recommendation is  
Heavily Accepted by  
CTI, Inc.*

**CTI****CTI Inc.**RADIATION SAFETY PROGRAM  
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13.3.9 Disassemble the actuator assembly by carefully removing the piston limit tool. The piston is under spring force. Take care while removing the piston limit tool to assure that no damage or injury can occur.

13.3.10 Remove the piston, spring and top flange from the actuator assembly.

NOTE

If removal of the lock assembly is necessary, the procedure of steps 11 through 19 should be followed. Otherwise proceed to step 13.3.20. Assure that the source holddown cap is properly installed.

13.3.11 Remove the end cap of the locking rod and the cap screw which holds the lock body in the lock housing.

13.3.12 Insert the key into the lock. Rotate the key 90 and pull the lock and locking rod assembly from the lock housing. The locking rod has two seals. One seal should remain with the locking rod and one seal should remain in the lock housing. This seal can be removed using the lock seal removal tool.

13.3.13 Inspect the lock and locking rod. Replace shaft seal.

NOTE

To replace shaft seal located near the lock body, it is necessary to remove the pin nearest the seal. When reassembling the lock and locking end assembly, the end cap and its associated shaft seal must be assembled last.

13.3.14 Lightly grease the shaft seal, insert the return springs and spring guide pins into the lock body.

13.3.15 Depress the plunger on the side of the lock body so it clears the hole in the lock housing and insert the locking assembly into the housing.

13.3.16 Align the screw hole in the lock body with the slot in the housing and secure the lock with its cap screw.

13.3.17 Lightly grease the second shaft seal and place it on the

**CTI Inc.**

**CTI****CTI Inc.**RADIATION SAFETY PROGRAM  
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locking rod.

- 13.3.18 Attach end cap to locking rod so that the cap is flush with the end of the rod.
- 13.3.19 Insert key in lock and check that lock works freely.
- 13.3.20 Replace shaft seal and "O" ring on the rear flange, lightly grease the seal and "O" ring and insert the flange into the actuator housing.
- 13.3.21 Replace piston seal and install the piston and return spring in the actuator housing.
- 13.3.22 Thread piston limit tool into end of source position indicator shaft.
- 13.3.23 Assure that the key operated lock is engaged and the key is removed. Remove the source holddown cap.
- 13.3.24 Replace and lightly grease the base "O" ring seal.
- 13.3.25 Connect the source rod to the keyhole slot in the actuator piston. Assemble the actuator to the base being sure to align the air line connectors.
- 13.3.26 Fasten actuator assembly to base with the four tie rod bolts.
- 13.3.27 Safety wire the tie rod bolts.
- 13.3.28 Remove the piston limit screw.
- 13.3.29 Attach the actuator guard.
- 13.3.30 Assure that the exposure device operates properly by performing the operation of Section 9.0 of Part II.

**CTI Inc.**

*from Arctic  
Slope application  
of 1/26/96*

## Section VII

### MAINTENANCE

It is recommended that inspection and maintenance of the Model 865 exposure device and Model 86550 control unit be performed at intervals not to exceed three months.

To properly service the Model 865 exposure device and control unit, the following tools and equipment are required.

Master Key (A66021-11)  
Cleaning Solvent (chloroethene)  
Vibratite  
Piston Limit Tool (AT865-7)  
Socket wrench set with sockets: 1/2 inch, 18 mm  
Source holddown cap (AT865-8)  
Replacement O Rings and Seals  
Lock Seal Removal Tool (AT865-9)  
1/32 dia. stainless steel safety wire  
Grease MIL-G-23827 A

#### Control Unit

1. Inspect the entire length of each control hose to assure that each section is free from cuts and damage.
2. Inspect the end fittings to assure that they are tightly connected. Check the threads on the fittings for damage.
3. With the control switch in the OFF position, close off the expose hose. Pressurize the control to approximately 30 psig. Observe that the pressure gauge functions properly. Turn the control switch to the EXPOSE position. Observe that the indicated pressure reduces by approximately 4psi. Open the expose hose. Assure that air flows through the exposing hose and the pressure returns to atmospheric.
4. With the control switch in the OFF position, close off the retract hose. Pressurize the control to approximately (30 psig). Turn the control switch to the RETRACT position. Observe that the indicated pressure reduces by approximately 4psi. Open the retract hose. Assure that air flows through the retracting hose and the pressure returns to atmospheric.



### EXPOSURE DEVICE

1. Check the operation of the survey meter and check to assure that the source is properly stored by measuring the radiation intensity at the surface of the exposure device and at one meter from the surface. The radiation level should not exceed 200 mR/hr at the surface nor 10 mR/hr at one meter from the surface.
2. Inspect the exposure device for any signs of damage or excessive wear. Check to assure that there are no loose fasteners or broken safety wire. Assure that the exposure device is properly labeled.

### NOTE

The manufacturer recommends that maintenance of the actuator assembly not be performed at quarterly intervals but performed during normal source replacement intervals at the manufacturer's facility. In cases where the user must perform maintenance of the actuator assembly, the procedure of steps 3 through 29 should be followed. Individuals performing this operation should wear a direct reading pocket dosimeter and either a film badge or a thermoluminescent dosimeter. All operations should be monitored with a properly calibrated and operable radiation survey instrument.

3. Assure that the key operated lock is engaged and the key is removed.
4. Remove the actuator cover by removing the four attachment screws.
5. Install the piston limit tool by threading it into the source position indicator rod.
6. Cut and remove the safety wire from the four actuator tie bolts. Remove the actuator tie bolts.
7. Carefully monitor this operation with the survey meter. Remove the actuator assembly by lifting the assembly and moving it in a circular motion until it disengages from the source assembly.

8. Install the source holddown cap to the exposure device using the four bolts.
9. Disassemble the actuator assembly by carefully removing the piston limit tool. The piston is under spring force. Take care while removing the piston limit tool to assure that no damage or injury can occur.
10. Remove the piston, spring and top flange from the actuator assembly.

#### NOTE

If removal of the lock assembly is necessary, the procedure of steps 11 through 19 should be followed. Otherwise proceed to step 20. Assure that the source holddown cap is properly installed.

11. Remove the end cap of the locking rod and the cap screw which holds the lock body in the lock housing.
12. Insert the key into the lock. Rotate the key 90° and pull the lock and locking rod assembly from the lock housing. The locking rod has two seals. One seal should remain with the locking rod and one seal should remain in the lock housing. This seal can be removed using the lock seal removal tool.
13. Inspect the lock and locking rod. Replace shaft seal.

#### NOTE

To replace shaft seal located near the lock body, it is necessary to remove the pin nearest the seal. When reassembling the lock and locking end assembly, the end cap and its associated shaft seal must be assembled last.

14. Lightly grease the shaft seal, insert the return springs and spring guide pins into the lock body.
15. Depress the plunger on the side of the lock body so it clears the hole in the lock housing and insert the locking assembly into the housing.
16. Align the screw hole in the lock body with the slot in the housing and secure the lock with its cap screw.

17. Lightly grease the second shaft seal and place it on the locking rod.
18. Attach end cap to locking rod so that the cap is flush with the end of the rod.
19. Insert key in lock and check that lock works freely.
20. Replace shaft seal and "O" ring on the rear flange, lightly grease the seal and "O" ring and insert the flange into the actuator housing.
21. Replace piston seal and install the piston and return spring in the actuator housing.
22. Thread piston limit tool into end of source position indicator shaft.
23. Assure that the key operated lock is engaged and the key is removed. Remove the source holddown cap.
24. Replace and lightly grease the base "O" ring seal.
25. Connect the source rod to the keyhole slot in the actuator piston. Assemble the actuator to the base being sure to align the air line connectors.
26. Fasten actuator assembly to base with the four tie rod bolts.
27. Safety wire the tie rod bolts
28. Remove the piston limit screw
29. Attach the actuator guard
30. Assure that the exposure device operates properly by performing the operation of Section V.



# Section VII

## MAINTENANCE

It is recommended  
exposure  
intervals

To properly  
the following

11/17/83

3/14

Operation and Maintenance  
Instruction Manual

del 865  
med at

1 unit,

Sect VII Maintenance  
Sect VIII Leak Testing — looks OK  
+ any other changed pages.

Kafe  
Roughon 617-272-2000

### Control Unit

1. Inspect that each
2. Inspect connections
3. With the exposure psig. Turn the that the Open the exposure
4. With the retract (30 ps tion.

need:

- ① Copies of any changes to the manual, Sections VII Maintenance and VIII Leak Testing
- ② Diagrams which show:
  - where the 4 hex bolts hold in to
  - what part is removed from the device
  - drawing of A & ? at A
  - the same hold-down cap & show it fits onto the device
  - piston limit tool & how it fits into the same position indicated on
  - ~~if you removed the 4 bolts~~

96-10

3/14  
9AM

approximately 4psi. Open the retract hose. Assure that air flows through the retracting hose and the pressure returns to atmospheric.

## Section VII

### MAINTENANCE

It is recommended that inspection and maintenance of the Model 865 exposure device and Model 86550 control unit be performed at intervals not to exceed three months.

To properly service the Model 865 exposure device and control unit, the following tools and equipment are required.

Master Key (A66001-11)  
Cleaning Solvent (chlorothene)  
Vibratite  
Piston Limit Tool (AT865-7)  
Socket wrench set with sockets: 1/2 inch, 10 mm  
Source holddown cap (AT865-8)  
Replacement O Rings and Seals  
Lock Seal Removal Tool (AT865-9)  
1/32 dia. stainless steel safety wire  
Unitemp Grease

#### Control Unit

1. Inspect the entire length of each control hose to assure that each section is free from cuts and damage.
2. Inspect the end fittings to assure that they are tightly connected. Check the threads on the fittings for damage.
3. With the control switch in the OFF position, close off the expose hose. Pressurize the control to approximately 30 psig. Observe that the pressure gauge functions properly. Turn the control switch to the EXPOSE position. Observe that the indicated pressure reduces by approximately 4psi. Open the expose hose. Assure that air flows through the exposing hose and the pressure returns to atmospheric.
4. With the control switch in the OFF position, close off the retract hose. Pressurize the control to approximately (30 psig). Turn the control switch to the RETRACT position. Observe that the indicated pressure reduces by approximately 4psi. Open the retract hose. Assure that air flows through the retracting hose and the pressure returns to atmospheric.

## Exposure Device

1. Check the operation of the survey meter and check to assure that the source is properly stored by measuring the radiation intensity at the surface of the exposure device and at one meter from the surface. The radiation level should not exceed 200 mR/hr at the surface nor 10 mR/hr at one meter from the surface.
2. Inspect the exposure device for any signs of damage or excessive wear. Check to assure that there are no loose fasteners or broken safety wire. Assure that the exposure device is properly labeled.

### NOTE

The manufacturer recommends that maintenance of the actuator assembly not be performed at quarterly intervals but performed during normal source replacement intervals at the manufacturers facility. In cases where the user must perform maintenance of the actuator assembly, the procedure of steps 3 through 29 should be followed. Individuals performing this operation should wear a direct reading pocket dosimeter and either a film badge or a thermoluminescent dosimeter. All operations should be monitored with a properly calibrated and operable radiation survey instrument.

3. Assure that the key operated lock is engaged and the key is removed.
4. Remove the actuator cover by removing the four attachment screws.
5. Install the piston limit tool by threading it into the source position indicator rod.
6. Cut and remove the safety wire from the four actuator tie bolts. Remove the actuator tie bolts.
7. Carefully monitor this operation with the survey meter. Remove the actuator assembly by lifting the assembly and moving it in a circular motion until it disengages from the source assembly.
8. Install the source holddown cap to the exposure device using the four bolts.

*The source holddown cap is  
the lock key the source is*

9. Disassemble the actuator assembly by carefully removing the piston limit tool. The piston is under spring force. Take care while removing the piston limit tool to assure that no damage or injury can occur.
10. Remove the piston, spring and top flange from the actuator assembly.

NOTE

If removal of the lock assembly is necessary, the procedure of steps 11 through 19 should be followed. Otherwise proceed to step 20. Assure that the source holddown cap is properly installed.

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NOTE

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16. Align the screw hole in the lock body with the slot in the housing and secure the lock with its cap screw.
17. Lightly grease the second shaft seal and place it on the locking rod.

18. Attach end cap to locking rod so that the cap is flush with the end of the rod.
19. Insert key in lock and check that lock works freely.
20. Replace shaft seal and "O" ring on the rear flange, lightly grease the seal and "O" ring and insert the flange into the actuator housing.
21. Replace piston seal and install the piston and return spring in the actuator housing.
22. Thread piston limit tool into end of source position indicator shaft.
23. Assure that the key operated lock is engaged and the key is removed. Remove the source holddown cap.
24. Replace and lightly grease the base "O" ring seal.
25. Connect the source rod to the keyhole slot in the actuator piston. Assemble the actuator to the base being sure to align the air line connectors.
26. Fasten actuator assembly to base with the four tie rod bolts.
27. Safety wire the tie rod bolts
28. Remove the piston limit screw
29. Attach the actuator guard
30. Assure that the exposure device operates properly by performing the operation of Section V.

? from drawing -

Have you the end of the source

holddown assembly come loose from  
the actuator? ✓ don't



## Section VIII

### LEAK TESTING

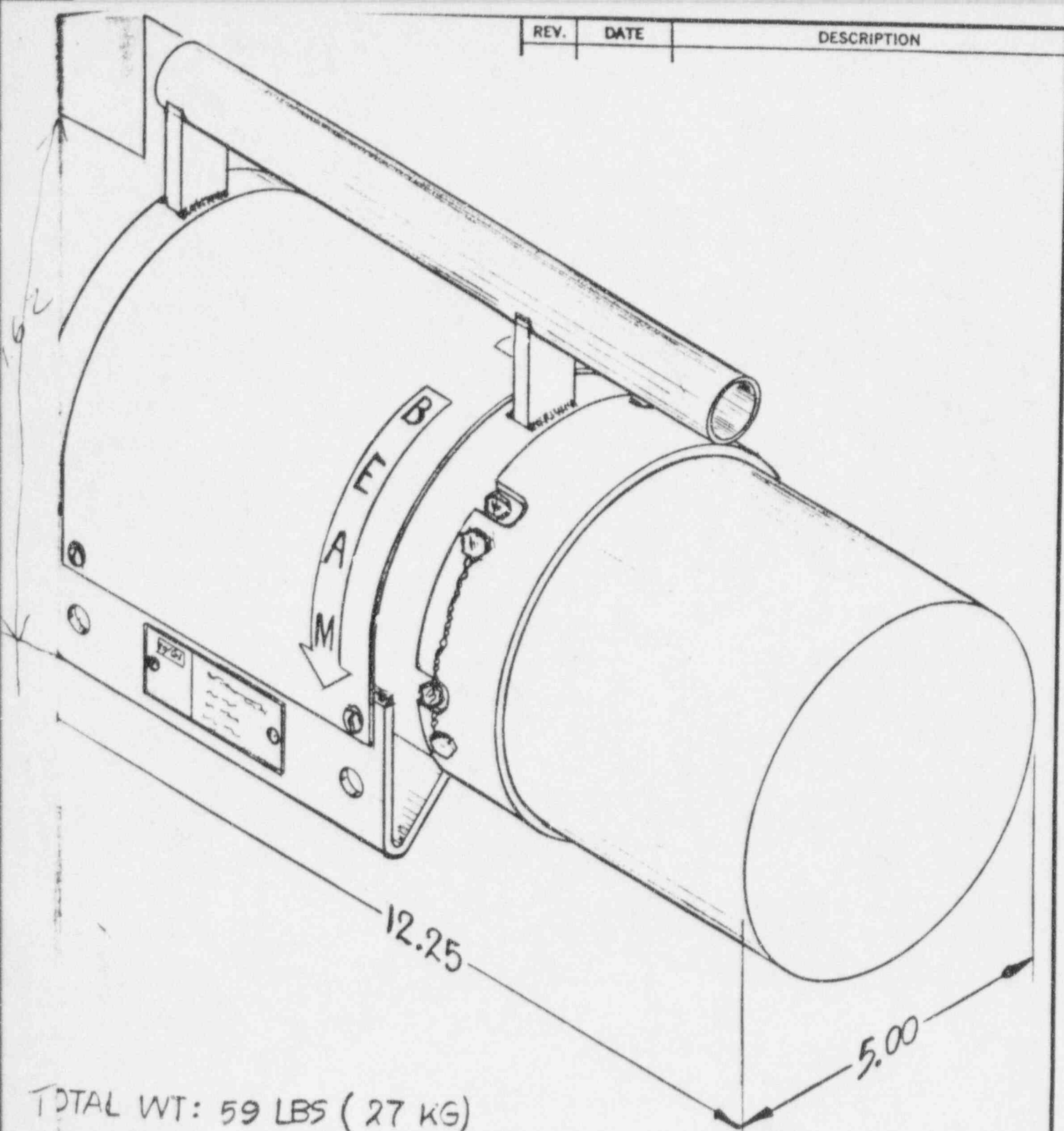
The source assembly used in the Model 865 should be leak tested for removable radioactive contamination at intervals not to exceed six months. This can be accomplished using Tech/Ops Model 518 Leak Test Kit.

This test must be performed in a properly secured Restricted Area. The individual performing this test should wear a direct reading pocket dosimeter and either a film badge or thermoluminescent dosimeter. The individual should also use a properly calibrated and operable radiation survey instrument.

1. Assure that the exposure device is locked. Assure that the source assembly is in the proper shielded storage position by surveying the exposure device at the surface and at one meter from the surface. The radiation levels should not exceed 200 mR/hr at the surface nor 10 mR/hr at one meter from the surface when the device is loaded to its capacity.
2. Moisten the wipe test swab with EDTA solution. Wipe the point on the device where the source position indicator emerges. Wipe the air inlets on the actuator assembly. Wipe the areas near each end of the locking rod. Wipe the end fittings of the control hoses.
3. Place the wipe test swab in the plastic envelope.
4. Set the survey meter on its most sensitive range and place the meter in a low background area. Move the wipe test swab towards the meter and observe the radiation level indication.
5. If there was no indicated increase in the background radiation level, place the plastic envelope in the mailing box and send to Tech/Ops, Inc. Be sure to complete and return the identification sheet.
6. If the meter indicates an increase in the background radiation level, DO NOT MAIL THE WIPE TEST PATCH. Contact Tech/Ops for further instructions.

REV. DATE

DESCRIPTION



TOTAL WT: 59 LBS (27 KG)

SEE SHEETS 2 THRU 5

**Tech Ops**

**Tech/Ops, Inc.**

RADIATION PRODUCTS DIVISION  
BURLINGTON, MA 01803

DWG TITLE

MOD 865 TYPE B PROJECTOR  
DESCRIPTIVE ASSEMBLY

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE	
.X	±
.XX	±
.XXX	±
ANGLES	±
FRACTIONS	±

CLASSIFICATION

SIZE

DWG. NO.

REV.

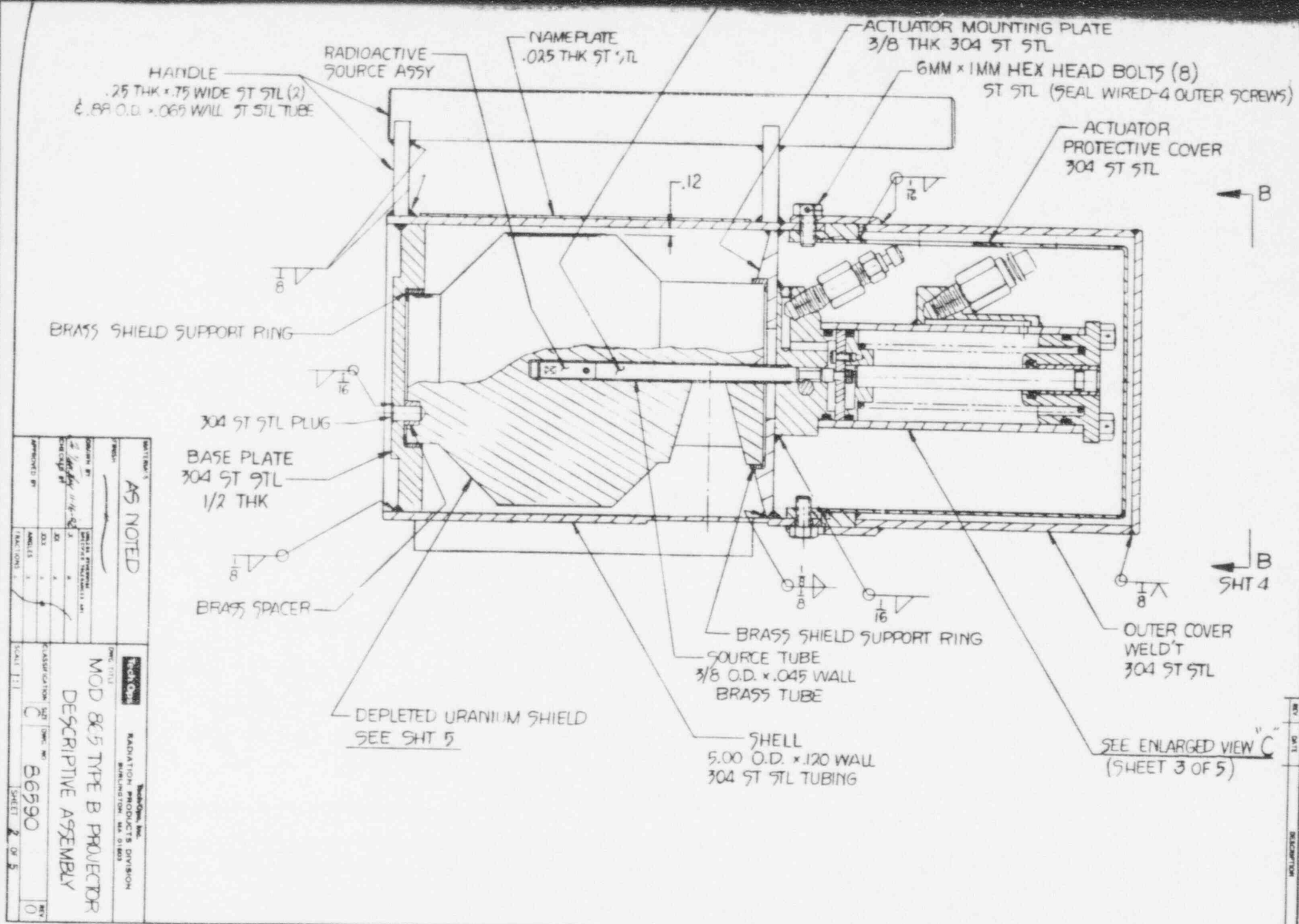
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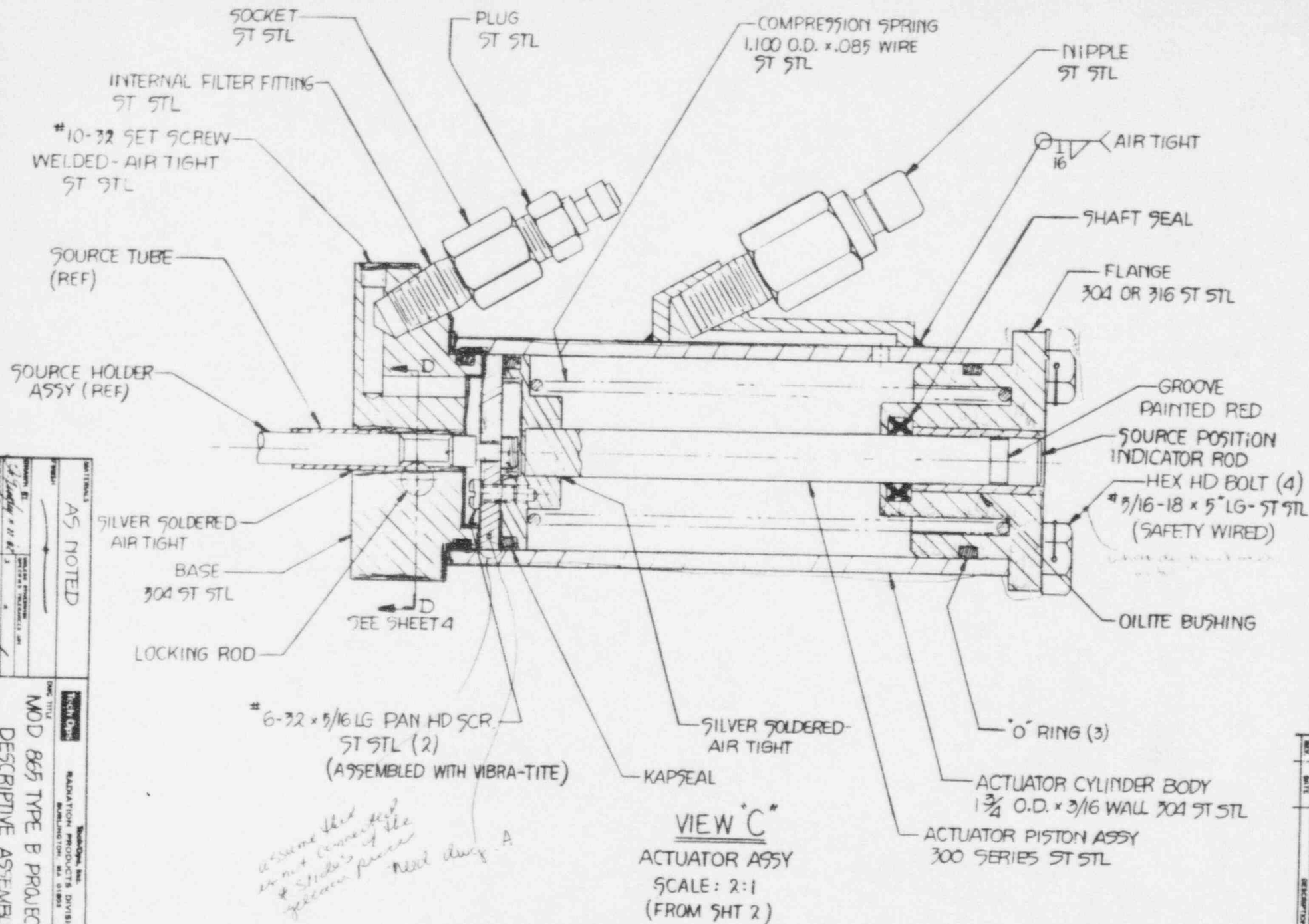
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SHEET 1 OF 5

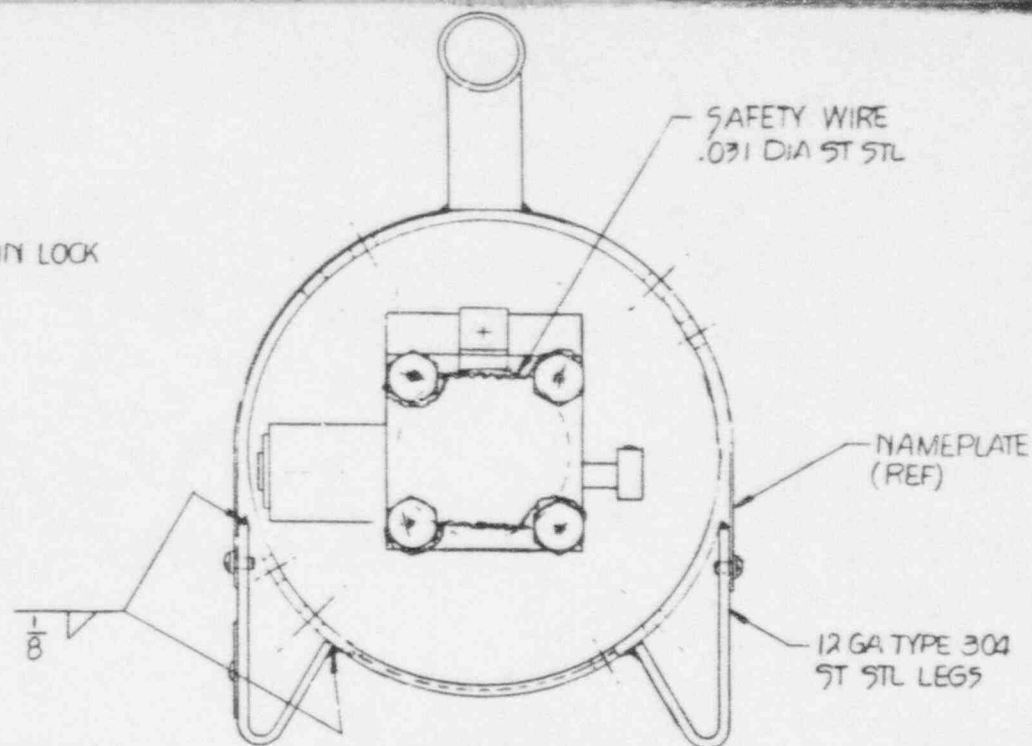
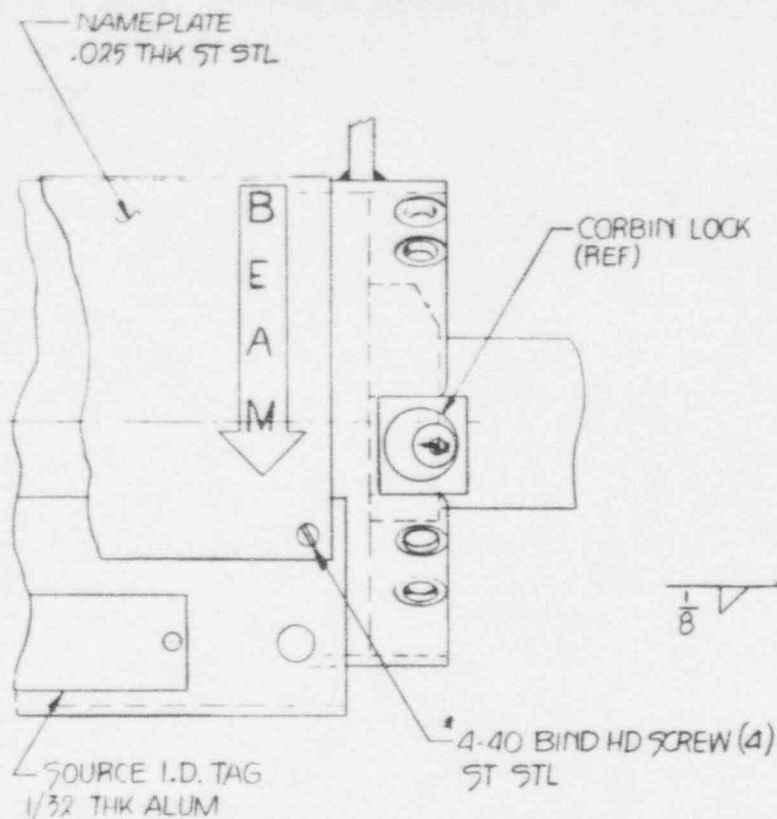


AS NOTED		Tech Ops		RADIATION PRODUCTS DIVISION BIRMINGHAM, AL 35203	
DESIGNED BY	DATE	APPROVED BY	DATE	CLASSIFICATION	REV
11-16-63	11-16-63			C	0
MOD 865 TYPE B PROJECTOR DESCRIPTIVE ASSEMBLY			B6590		
SHEET 2 OF 5					

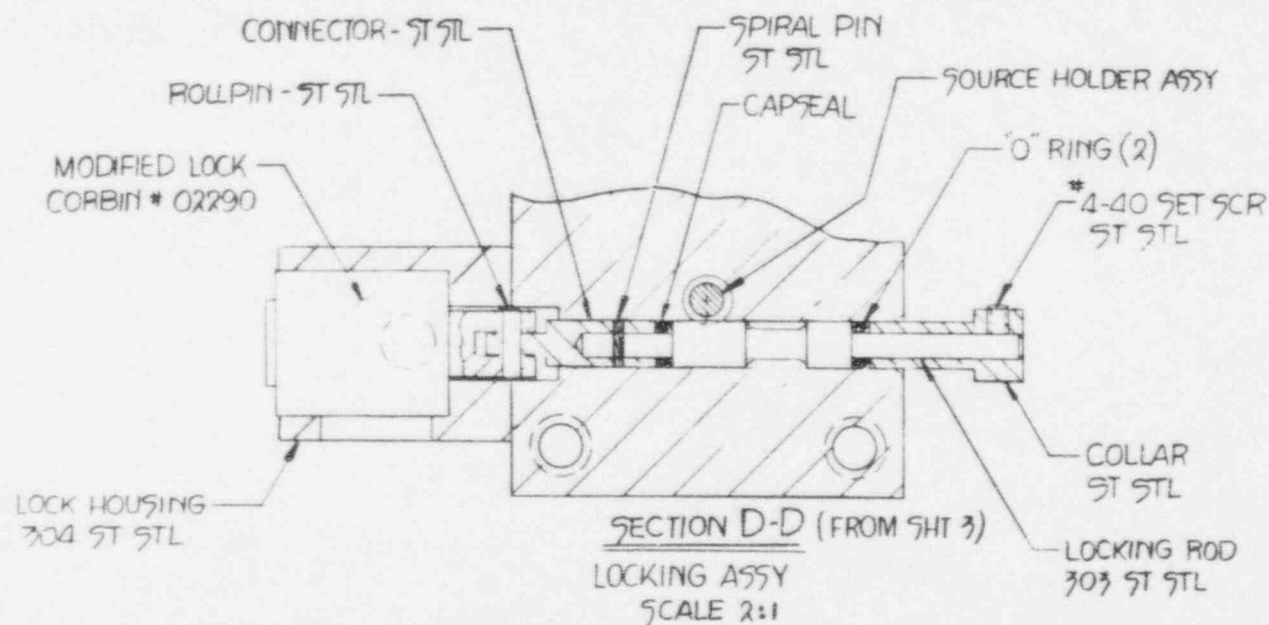
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REV DATE DESCRIPTION



VIEW B-B  
(OUTER COVER & ACTUATOR PROTECTIVE COVER REMOVED)



AS NOTED

MOD 865 TYPE B PROJECTOR

TECH DATA  
RADIATION PRODUCTS DIVISION  
BURLINGTON, MA 01803

REV DATE DESCRIPTION



April 22, 1996

Ms. Cathleen Roughan  
Regulatory Affairs Manager  
Sentinel  
Amersham Corporation  
40 North Avenue  
Burlington, MA 01803

Dear Ms. Roughan:

This letter is in response to your application dated February 19, 1996, requesting an amendment to the registration of the Model 86520 radiography source assembly and our telephone conversation on March 14, 1996, requesting additional information in order to continue our evaluation of your request. To date, the requested information has not been received. If we do not receive the requested information within forty-five (45) days of the date of this letter we will have considered your application as having been abandoned by you. This is without prejudice to the resubmission of a complete application.

If you have any questions, please contact me at (301) 415-5868 or Mr. Thomas Rich at (301) 415-7893.

Sincerely,

**Original Signed by**

Michele L. Burgess, Mechanical Engineer  
Sealed Source Safety Section  
Medical, Academic, and Commercial  
Use Safety Branch  
Division of Industrial and  
Medical Nuclear Safety  
Office of Nuclear Material Safety  
and Safeguards

cc ~~w/enc1~~: SKimberley, LFDCB

Distribution:

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SSD-96-10

NE01

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NAME	MBurgess/mb		TRich					
DATE	04/ /96		04/ 22 /96					

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9604240245

April 22, 1996

Ms. Cathleen Roughan  
Regulatory Affairs Manager  
Sentinel  
Amersham Corporation  
40 North Avenue  
Burlington, MA 01803

*4/24/96 called Kate - she  
will give me a status  
by end of today. Her  
estimate was that  
they will have response  
to us by middle of May  
We need to  
send in the 86520  
requesting  
processing  
fee price.*

Dear Ms. Roughan:

This letter is in response to your application dated February 19, 1996, requesting an amendment to the registration of the Model 86520 radiography source assembly and our telephone conversation on March 14, 1996, requesting additional information in order to continue our evaluation of your request. To date, the requested information has not been received. If we do not receive the requested information within forty-five (45) days of the date of this letter we will have considered your application as having been abandoned by you. This is without prejudice to the resubmission of a complete application.

If you have any questions, please contact me at (301) 415-5868 or Mr. Thomas Rich at (301) 415-7893.

Sincerely,

Original Signed by

Michele L. Burgess, Mechanical Engineer  
Sealed Source Safety Section  
Medical, Academic, and Commercial  
Use Safety Branch  
Division of Industrial and  
Medical Nuclear Safety  
Office of Nuclear Material Safety  
and Safeguards

cc ~~W/enc~~: SKimberley, LFDCB

Distribution:

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SSD-96-10

NE01

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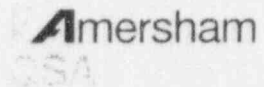
## SENTINEL

24 May 1996

Ms. Michele Burgess  
Sealed Source Safety Section  
Source Containment and Devices Branch  
Division of Industrial of Medical Nuclear Safety, NMSS  
U. S. Nuclear Regulatory Commission  
Washington, DC 20555

Amersham Corporation  
40 North Avenue  
Burlington, MA 01803  
tel (617) 272-2000  
tel (800) 225-1383  
fax (617) 273-2216

RE: NR-628-D-118-S



Dear Ms. Burgess:

Enclosed please find the information you requested concerning the model 865 device.

I have enclosed the most recent version of the operations manual for the 865. We recommend that maintenance be performed at the time of reloading at our facility, but provide instructions for users to perform their own when necessary. We have several users that perform this maintenance in the field.

The tools referenced for the performance of maintenance include a piston limiter tool, source holddown cap and a lock seal removal tool. The piston limiter tool is a screw that secures the source rod in the stored position while removing the actuator assembly. The piston limiter tool is a knurled thumb screw with 10/32 thread approximately 3/4 inch long.

The lock seal removal tool facilitates the removal of the lock seal while disassembling the lock housing, but is not required for removal. This tool is a steel rod approximately 3 inches long and 3/16 inch diameter.

The source holddown cap is installed over the source rod once the actuator assembly is removed from the device. The cap is approximately a 2 inch square and has holes to allow for the installation of screws through the cap and into the body of the device into the threaded holes for the actuator assembly. This keeps the source rod in the stored position while maintenance is performed.

Should you have any questions regarding this information, please contact me at (617) 272-2000, extension \*210.

Sincerely,

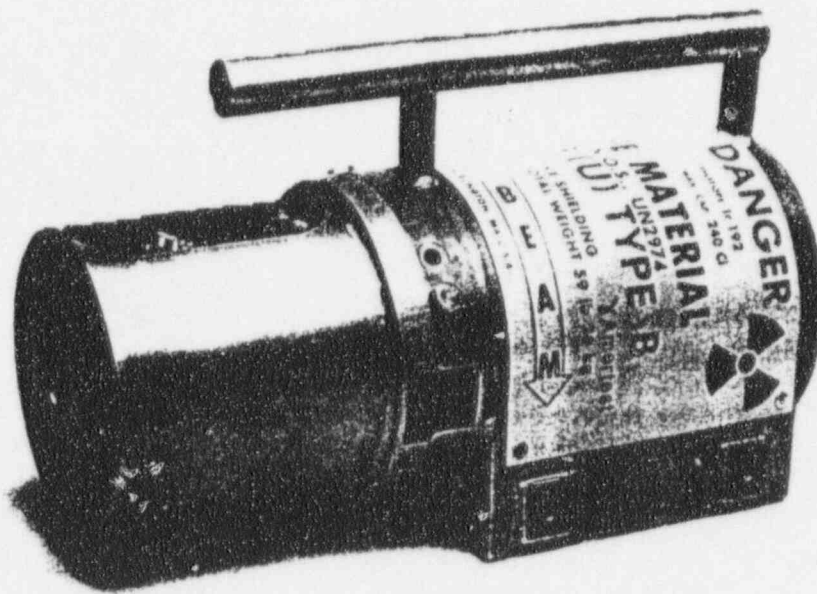
Cathleen Roughan  
Regulatory Affairs Manager

Enclosure

9607110264

# SENTINEL

## MODEL 865 RADIOGRAPHIC EXPOSURE DEVICE AND TYPE B(U) PACKAGE



## OPERATIONAL AND MAINTENANCE INSTRUCTION MANUAL

# SENTINEL

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## Section I

### I. General

The Model 865 is used as a radiographic exposure device and Type B(U) transport package for Amersham Corporation radioactive sources. **The user should become thoroughly familiar with the instruction manual before attempting operation of the equipment.**

In order to use this equipment, the user in the United States must be specifically licensed to do so. Applications for a license should be filed with the appropriate Regional Office of the U.S. Nuclear Regulatory Commission or with the appropriate Agreement State office.

Prior to the initial use of the exposure device as a transport package in the United States, the user must:

- a. If performing transportation activities with an NRC Regulated State, you must have an approved Quality Assurance Program and comply with its conditions. This must be applied for with an application fee to the:

Transportation Branch  
Division of Safeguards and Transportation  
Nuclear Material Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555

- b. Register as a user of the Type B package with the Transportation Branch of the U.S. Nuclear Regulatory Commission.
- c. Maintain on file a copy of the Certificate of Compliance Number 9187, issued by the Nuclear Regulatory Commission, including all copies of all applicable drawings referenced on this certificate and the operational and Maintenance Manual for the package.
- d. Maintain on file a copy of the U.S. Department of Transportation Certificate of Competent Authority for the special form source transported in the radiographic exposure device.
- e. Prepare this package for transport, as shown in the applicable drawings and as described in the Operational and Maintenance Manual.

Prior to the first shipment of this radiographic exposure device from the United States, the user must also register with:

Office of Hazardous Materials Technology  
Research and Special Programs Administration  
400 Seventh Street SW  
U.S. Department of Transportation  
Washington, DC 20590

The user must have in his possession a copy of IAEA Certificate of Competent Authority Number USA/9187/B(U) issued for this radiographic exposure device. Users of this equipment outside of the United States must comply with the regulatory, licensing and transportation rules and regulations of their respective countries.

### 2. Warranty and Limitation of Liability

Amersham Corporation, warrants its products which it manufactures and sells to be free of defects in material and workmanship for a period of one year from the date of shipment. This warranty shall not apply to any product or parts which have been subjected to misuse, improper installation, repair, alteration, neglect, accident, abnormal conditions of operation, or use in any manner contrary to instructions.

The manufacturer's liability under such warranty shall be limited to replacing or repairing, at its option, any parts found to be defective in such respects, which are returned to it transportation prepaid; or, at its option, to returning the purchase price thereof.

The exposure device is equipped with a key operated lock to prevent operation of the device by unauthorized personnel. The unit can only be locked when the source assembly is in the shielded storage position.

The exposure device incorporates a positive visual indication of source position. A rod emerges from the actuating cylinder as the source is exposed. The emergent length of the rod indicates the position of the source. When the source is in its fully shielded storage position, the rod is no longer visible.

#### **b. Model 86550 Control Unit**

The Model 86550 Control Unit is a pneumatic control designed for use with the Model 865 Exposure Device. The control unit is designed to pressurize the actuating mechanism of the exposure device through the use of a hand pump or through the use of an auxiliary air supply.

The control unit is equipped with a pressure gauge to monitor operating pressure.

The standard control unit is equipped with a 7.5 meter (25 feet) long control hose for attachment to the exposing side of the actuator and a similar control hose for attachment to the storing side of the actuator. Control units with longer hoses are available on an optional basis.

The control unit is equipped with a lock which prevents operation of the unit by unauthorized personnel.

### **3.4 Radioactive Source Assembly**

The Model 865 Exposure Device is used in conjunction with Amersham Model 86520 Source Assembly. This source assembly contains either Amersham Model 90004 or Amersham Model 90005 source capsule. These source capsules are fabricated from stainless steel and are seal welded.

Each of these source capsules have been designed and tested to comply with the criteria for classification C43515 in accordance with International Standard ISO 2919 - 1980 and American National Standard N542 -1977. Additionally, these source capsules have been certified as special form radioactive material in accordance with IAEA Safety Series No. 6, 1985, (as amended 1990).

The Model 865 exposure device will contain a maximum of 240 curies of Iridium-192.

The source in the Model 865 may only be changed by a user licensed to do so. Source changing of this device requires the use of a shielded cell and specially designed tools. Because of this, Amersham recommends that all devices be returned to the manufacturer for source replacement. During this source replacement the device will be completely inspected and maintained.

## **4. Technical Data**

### **4.1 Exposure Device**

<b>Length:</b>	310 mm (12.25 inches)
<b>Diameter:</b>	127 mm (5.0 inches)
<b>Shipping Weight:</b>	27 kg (59 pounds)
<b>Capacity:</b>	240 Ci, Ir-192
<b>Shielding:</b>	Depleted Uranium 18 kg (40 pounds)
<b>Transport Status:</b>	Type B(U) Package USA/9187/B(U) Special Form Certification USA/0179/S
<b>Sources approved for Use with Model 865:</b>	86520

The radiographer or radiographer's assistant must guard against unauthorized entrance into these areas at all times. No personnel should be allowed into the restricted area without a direct reading pocket dosimeter and either film badge or TLD.

---

## Section III

### 1. Receiving Radioactive Material

The consignee of a package of radioactive material must make arrangements to receive the package when it is delivered. If the package is to be picked up at the carrier's terminal, 10 CFR Part 20.1906 requires that this be done expeditiously upon notification of its arrival.

Amersham Model 865 portable gamma radiography system is normally shipped in one crate. Inspect the crate for signs of external damage. If damage is evident, the carrier's agent should be present while unpacking. Survey the exposure device with a survey meter as soon as possible, preferably at the time of pickup and no more than three hours later if it was received during working hours, or no more than 18 hours later if it was received after normal working hours. Radiation level should not exceed 200 milliroentgens per hour at the surface of the exposure device nor 10 milliroentgens per hour at a distance of 1 meter (40 inches) from the surface. Actual radiation levels should be recorded on the receiving report. If the radiation levels exceed these limits, the container should be secured in a Restricted Area, and the appropriate personnel notified. Visually inspect the 865 for signs of damage and assure that the seal wire has not been tampered with.

The radioisotope, activity, model number and serial number of the source and the package model number and serial number should be recorded in the receiving report.

---

## Section IV

### 1. Principles of Operation

The source holder assembly, which contains the radioactive source capsule, is positioned such that the source capsule is located in the shielded storage position in the exposure device. This source assembly is attached to the piston in the actuating cylinder. When the cylinder is pressurized, the piston moves the source from its shielded storage position to the beam port. In this exposing position, the emergent beam is 60° wide and 30° high. The radiation intensity in all directions outside the primary beam is reduced by a factor of 10,000 by the built in beam limiter. The radioactive source assembly never leaves the exposure device during normal operation.

When the air pressure is reduced on the exposing side of the piston, a spring causes the source assembly to move to the shielded position. An additional optional air line is available to pressurize the storing side of the piston to assist the spring return. This additional air line is mandatory for underwater and underwater habitat applications.

### 2. Safety Precautions

This system may be operated only by a qualified radiographer. The radiographer must be physically present and in direct surveillance at all times when the exposure device is being used.

Since the source emits high levels of radiation, it is good practice to operate the system from as great a distance as practicable and, if possible, from behind a radiation shield such as a heavy steel or concrete object or the corner of a building.

Radiography must only be performed in a Restricted Area which is marked with the appropriate radiation signs, and secured against unauthorized entrance. While assembling the system, it is important to keep the exposure device locked at all times except when operating. The radiographer and radiographer's assistant must at all times have a pocket dosimeter, either a film badge or TLD, and a survey meter capable of measuring from 2 mR/hr to at least 1000 mR/hr.

## 6. Disassembly

- a. Assure that the exposure device is locked. Remove the key.
- b. Disconnect the control hoses from the exposure device.
- c. Install the outer protective cover and install the four 6 mm x 1 mm bolts.
- d. Survey the external surfaces of the device to assure that the radiation levels do not exceed 200 mR/hr. Survey at one meter from the external surfaces of the device to assure that the radiation levels do not exceed 10 mR/hr.

## 7. Source Changing

The source in the Model 865 may only be changed by a user licensed to do so. Source changing of this device requires the use of a shielded cell and specially designed tools.

Therefore, we recommend that all devices be returned to Amersham for source replacement. During this source replacement, the device will be completely inspected and maintained.

---

## Section V

### 1. Shipment of Radioactive Material

The Model 865 meets the requirement for a Type B(U) shipping container under the regulations of the U.S. Nuclear Regulatory Commission, the U.S. Department of Transportation and the International Atomic Energy Agency. The container has been assigned USNRC Certificate of Compliance Number USA/9187/B(U) for domestic shipments and IAEA Certificate of Competent Authority Number USA/9187/B(U) for international shipments.

### 2. Shipment of Radioactive Source

Prior to shipment assure the package and its contents meet the following requirements:

- a. The contents are authorized for use in the package.
- b. The package is in good physical condition for transport.
- c. All locks are secured.
- d. All conditions of the certificate of compliance are met.

Assure that the source is locked into place in its proper shielded storage position. To check this, the source position indicator rod should be in the down position, and the key operated lock should be engaged. Install the outer cover using four, 6 mm x 1 mm bolts. Seal wire two of these bolts and attach a tamperproof seal with an identification mark.

If the exposure device is to be shipped inside outer packaging or barrel, mark the outside package "INSIDE PACKAGE COMPLIES WITH PRESCRIBED SPECIFICATIONS USA/9187/B(U) Type B." If an outer barrel is used as an over pack, it must be fastened with seal wire.

Survey all exterior surfaces of the package to assure that the radiation level does not exceed 200 mR/hr at the surface.

Measure the radiation level at one meter from all exterior surfaces to assure that the radiation level is less than 10 mR/hr. The maximum radiation level measured one meter from any exterior surface is the Transport Index. Example: with a maximum radiation level of 2.2 mR/hr, the transport index (T.I. is 2.2).

**NOTE:** If the device is to be shipped without an overpack, the radiation survey should be made of the outer surfaces of the device. If the device will be shipped inside of an overpack, the radiation survey should be from the outer surfaces of both the device and the overpack with the device packaged for shipment inside the overpack.

- e. Category of label applied to container (Radioactive Yellow II or Radioactive Yellow III).
- f. Transport Index.
- g. Type B identification number - USA/9187/B(U) Type B(U)
- h. Shippers certification stating:

"This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transport according to the applicable regulations of the Department of Transportation."

**NOTE:**

1. For air shipments, the following shipper's certification may be used:

"I hereby certify that the contents of this consignment are fully and accurately described by proper shipping name and are classified, packed, marked and labeled and are in proper condition for carriage by air according to applicable national governmental regulations."

2. For air shipments, the package must be labeled with a "CARGO AIRCRAFT ONLY" label and the shipping papers must state: "THIS SHIPMENT IS WITHIN THE LIMITATIONS PRESCRIBED FOR CARGO AIRCRAFT ONLY."

- i. The shipping papers must indicate an emergency phone number for the shipper. This phone number must have 24 hour coverage in case of an emergency during transport of your package. The emergency phone number must be clearly visible on the shipping papers.

Return the container to Amersham Corporation according to proper procedures for transporting Radioactive material as established in Title 49 Code of Federal Regulation parts 172-178.

**NOTE:** The U.S. Department of Transportation, in 49 CFR 173.22(c) requires each shipper of Type B quantities of radioactive material to provide prior notification to the consignee of the dates of shipment and expected arrival.

### 3. Shipment of an Empty Package

Perform a radioactive contamination wipe test of the outer shipping package. This consist of rubbing filter paper or other absorbent material, using heavy finger pressure, over an area of 300 cm<sup>2</sup> (46.5 in<sup>2</sup>) of the package surface. The activity on the filter paper should not exceed 0.00001 uCi/cm<sup>2</sup> of removable contamination.

**NOTE:** If the device is to be shipped without an overpack, the radioactive contamination wipe should be made of the outer surfaces of the device. If the device will be shipped inside of an overpack, the radioactive contamination wipe test should be made of both the outer surfaces of the device and the overpack with the device packaged for shipment inside the overpack.

Survey the container and prepare the package depending upon the radiation levels obtained, as given below.

- a. If the radiation level is below 0.5 mR/hr at the surface and there is no measurable radiation level at one meter from the container, no label is required. Mark the outside of the package with the proper shipping name (Radioactive Material, articles manufactured from depleted uranium UN 2910). Mark the outside of the package:

"Exempt from specification packaging, shipping paper and certification, marking and labeling and exempt from the requirements of part 175 per 49 CFR 173.421 and 49 CFR 173.426."

Additionally, a notice must be enclosed in or on the package included with the packing list, otherwise forwarded with the package. This notice must include the name of the consignor or consignee and the statement:

"This package conforms to the conditions and limitations specified in 49 CFR 173.426 for excepted radioactive materials, articles manufactured from depleted uranium, UN 2910."



If the vehicle is transporting a package bearing a "Radioactive Yellow III" label, 49 CFR Part 172.504 requires that the vehicle be posted on all four sides with a "Radioactive" placard. It should be noted that operation of a vehicle which is required to be placarded requires compliance with the Federal Motor Carrier Safety Regulations, 49 CFR Parts 390 to 397.

## 5. Hand Carrying

In order to minimize radiation exposure, it is recommended that care be taken when hand carrying the unit. A direct reading pocket dosimeter and film badge or TLD should be worn on the side of the body closest to the exposure device. If more than one person is present, it is good practice to alternate the hand carrying between them to minimize radiation doses to any one individual. Likewise, no person should be permitted to sit on or lounge against the exposure device.

## 6. Storage

When storing the system, the exposure device must be kept physically secure to prevent tampering or removal by unauthorized personnel. The storage area must be secured such that no unauthorized personnel are allowed entrance where radiation exposure levels exceed 2 millirem in any one hour. 10 CFR Part 34.22 and 34.23 require that the exposure device be kept locked and secured during storage.

---

# Section VI

## 1. Leak Testing

The source assembly used in the Model 865 should be leak tested for removable radioactive contamination at intervals not to exceed six months. This can be accomplished using Amersham Model 518 Leak Test Kit.

This test must be performed in a properly secured Restricted Area. The individual performing this test should wear a direct reading pocket dosimeter and either a film badge or thermoluminescent dosimeter (TLD). The individual should also use a properly calibrated and operable radiation survey instrument.

- a. Assure that the exposure device is locked. Assure that the source assembly is in the proper shielded storage position by surveying the exposure device at the surface and at one meter (40 inches) from the surface. The radiation levels should not exceed 200 mR/hr at the surface nor 10 mR/hr at one meter (40 inches) from the surface when the device is loaded to its capacity.
- b. Moisten the wipe test swab with EDTA solution. Wipe the point on the device where the source position indicator emerges. Wipe the air inlets on the actuator assembly. Wipe the areas near each end of the locking rod. Wipe the end fittings of the control hoses.
- c. Place the wipe test swab in the plastic envelope.
- d. Set the survey meter on its most sensitive range and place the meter in a low background area. Move the wipe test swab towards the meter and observe the radiation level indication.
- e. If there was no indicated increase in the background radiation level, place the plastic envelope in the mailing box and send to Amersham. Be sure to complete and return the identification sheet.
- f. If the meter indicates an increase in the background radiation level, **DO NOT MAIL THE WIPE TEST PATCH**. Contact Amersham for further instructions.

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# Section VII

## 1. Maintenance

It is recommended that inspection and maintenance of the Model 865 exposure device and Model 86550 control unit be performed at intervals not to exceed three months.

10. Remove the piston, spring and top flange from the actuator assembly.

**NOTE:** If removal of the lock assembly is necessary, the procedure of steps 11 through 19 should be followed. Otherwise proceed to step 20. Assure that the source holddown cap is properly installed.

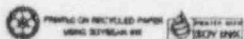
11. Remove the end cap of the locking rod and the cap screw which holds the lock body in the lock housing.
12. Insert the key into the lock. Rotate the key 90° and pull the lock and locking rod assembly from the lock housing. The locking rod has two seals. One seal should remain with the locking rod and one seal should remain in the lock housing. This seal can be removed using the lock seal removal tool.
13. Inspect the lock and locking rod. Replace shaft seal.

**NOTE:** To replace shaft seal located near the lock body, it is necessary to remove the pin nearest the seal. When reassembling the lock and locking end assembly, the end cap and its associated shaft seal must be assembled last.

14. Lightly grease the shaft seal, insert the return springs and spring guide pins into the lock body.
15. Depress the plunger on the side of the lock body so it clears the hole in the lock housing and insert the locking assembly into the housing.
16. Align the screw hole in the lock body with the slot in the housing and secure the lock with its cap screw.
17. Lightly grease the second shaft seal and place it on the locking rod.
18. Attach end cap to locking rod so that the cap is flush with the end of the rod.
19. Insert key in lock and check that lock works freely.
20. Replace shaft seal and "O" ring on the rear flange, lightly grease the seal and "O" ring and insert the flange into the actuator housing.
21. Replace and lightly grease the piston seal and install the piston and return spring in the actuator housing.
22. Thread piston limit tool into end of source position indicator shaft.
23. Assure that the key operated lock is engaged and the key is removed. Remove the source holddown cap.
24. Replace and lightly grease the base "O" ring seal.
25. Connect the source rod to the keyhole slot in the actuator piston. Assemble the actuator to the base being sure to align the air line connectors.
26. Fasten actuator assembly to base with the four tie rod bolts.
27. Safety wire the tie rod bolts.
28. Remove the piston limit screw.
29. Attach the actuator guard.
30. Assure that the exposure device operates properly by performing the operation in Section IV.

Figure 2

## SHIPPER'S DECLARATION FOR DANGEROUS GOODS



AMERICAN LABELMARK CO. — CHICAGO, IL 60646

290675-DH

## SHIPPER'S DECLARATION FOR DANGEROUS GOODS

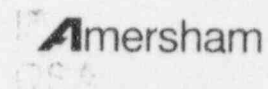
(Provide at least two copies to the airline.)

Shipper <b>SENTINEL AMERSHAM CORPORATION 40 NORTH AVENUE BURLINGTON, MA 01803 USA</b>		Air Waybill No.  Page <b>1</b> of <b>1</b> Page Shipper's Reference Number <small>(optional)</small>					
Consignee <b>SENTINEL AMERSHAM CORPORATION 40 NORTH AVENUE BURLINGTON, MA 01803</b>							
Two completed and signed copies of this Declaration must be handed to the operator		<b>WARNING</b>  Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.					
<b>TRANSPORT DETAILS</b> This shipment is within the limitations prescribed for: <small>(delete non-applicable)</small> <table border="1"> <tr> <td><input checked="" type="checkbox"/> PASSENGER</td> <td><input type="checkbox"/> CARGO</td> </tr> <tr> <td><input checked="" type="checkbox"/> AIRCRAFT</td> <td><input type="checkbox"/> AIRCRAFT ONLY</td> </tr> </table>				<input checked="" type="checkbox"/> PASSENGER	<input type="checkbox"/> CARGO	<input checked="" type="checkbox"/> AIRCRAFT	<input type="checkbox"/> AIRCRAFT ONLY
<input checked="" type="checkbox"/> PASSENGER	<input type="checkbox"/> CARGO						
<input checked="" type="checkbox"/> AIRCRAFT	<input type="checkbox"/> AIRCRAFT ONLY						
Airport of Departure:		Shipment type: <small>(delete non-applicable)</small> <input checked="" type="checkbox"/> DANGEROUS <input type="checkbox"/> FLAMMABLE <input type="checkbox"/> TOXIC <input type="checkbox"/> RADIOACTIVE					
Airport of Destination:							
<b>NATURE AND QUANTITY OF DANGEROUS GOODS</b> <small>(see Subsections 6.6 and 8.1 of IATA Dangerous Goods Regulations)</small>							
<b>Dangerous Goods Identification</b>							
Proper Shipping Name	Class or Division	UN or ID No.	Packing Group	Subsidiary Risk	Quantity and Type of packing	Packing Inst.	Authorization
<b>RG RADIOACTIVE MATERIAL SPECIAL FORM MOS</b>	<b>7</b>	<b>UN2974</b>			<b>SOLID METAL IRIDIUM-192 74.0 Curies 2738.0 GBq</b>	<b>II YELLOW</b>	<b>SPECIAL FORM CERT. USA/ 0179/S ***** TYPE B(U) T.I. PACKAGE 0.6 CERT. USA/ 9187/B(U)</b>
					<b>1 TYPE B(U) PACKAGES</b>		
					<b>13 X 20 X 31 CMS</b>		

rec'd 7/15

## SENTINEL

Amersham Corporation  
40 North Avenue  
Burlington, MA 01803  
tel (617) 272-2000  
tel (800) 225-1383  
fax (617) 273-2216



11 July 1996

Ms. Michele Burgess  
Sealed Source Safety Section  
Source Containment and Devices Branch  
Division of Industrial of Medical Nuclear Safety, NMSS  
U. S. Nuclear Regulatory Commission  
Washington, DC 20555

RE: NR-628-D-118-S  
NR-628-S-121-S

Dear Ms. Burgess:

Enclosed please find the information you requested concerning the model 865 device and the 86520 source rod.

The plating on the model 86520 source rod will not add any appreciable thickness to the rod, it is done through an electroplating process and will be less than 0.0005 inches thick. In addition the drawing has been updated to reflect the appropriate number of significant digits in the dimensions, based on importance to safety. This has resulted in some rounding off of dimensions, however no actual dimensions have been modified.

I have enclosed some sketches that show the view of the 865 during maintenance, depicting the removal of the actuator head, the method of securing the source and the specific tools used as described in our last letter. These depict the information given in the 865 manual, steps 3-29.

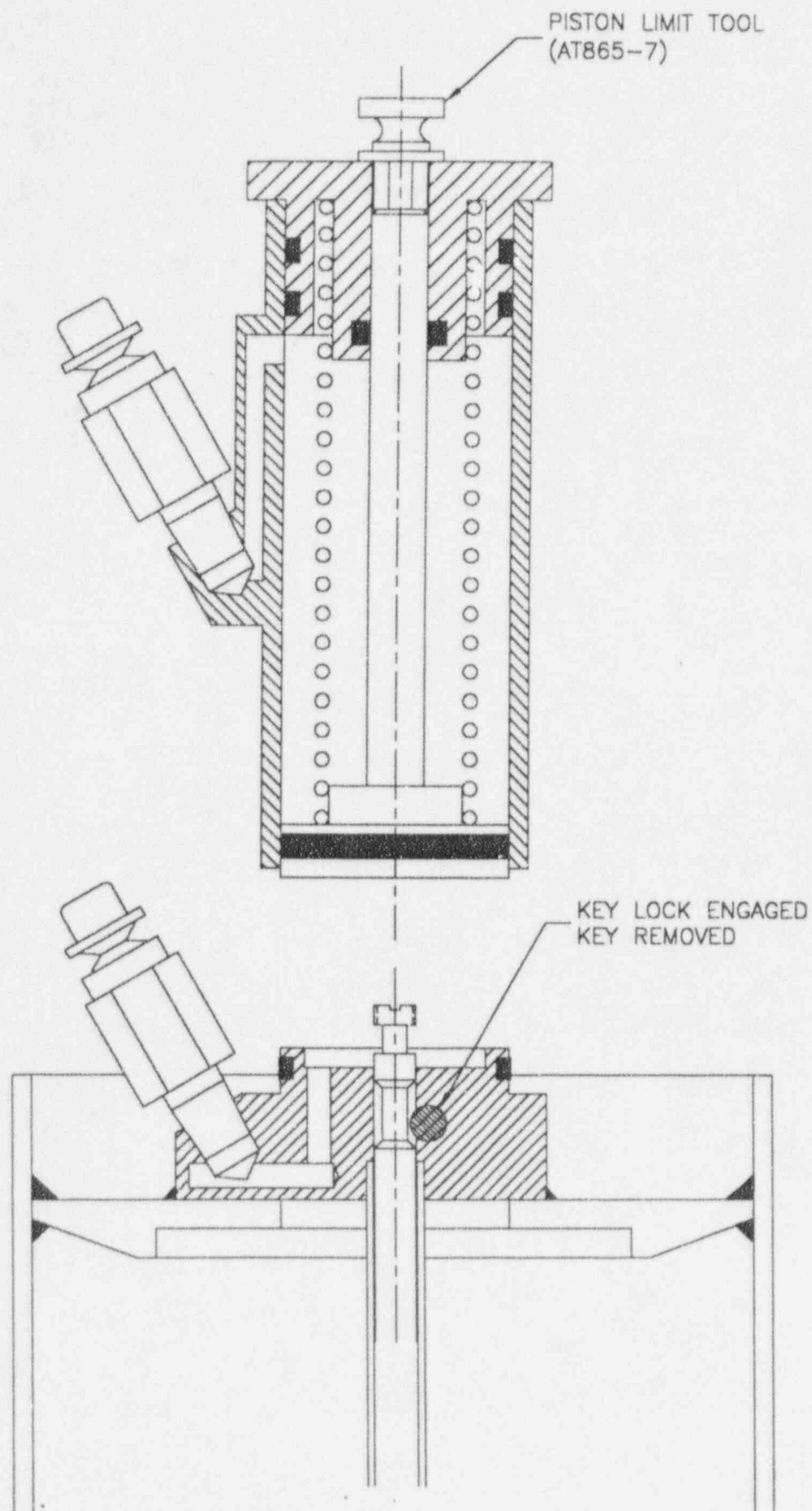
Should you have any questions regarding this information, please contact me at (617) 272-2000, extension \*210.

Sincerely,

Cathleen Roughan  
Regulatory Affairs Manager

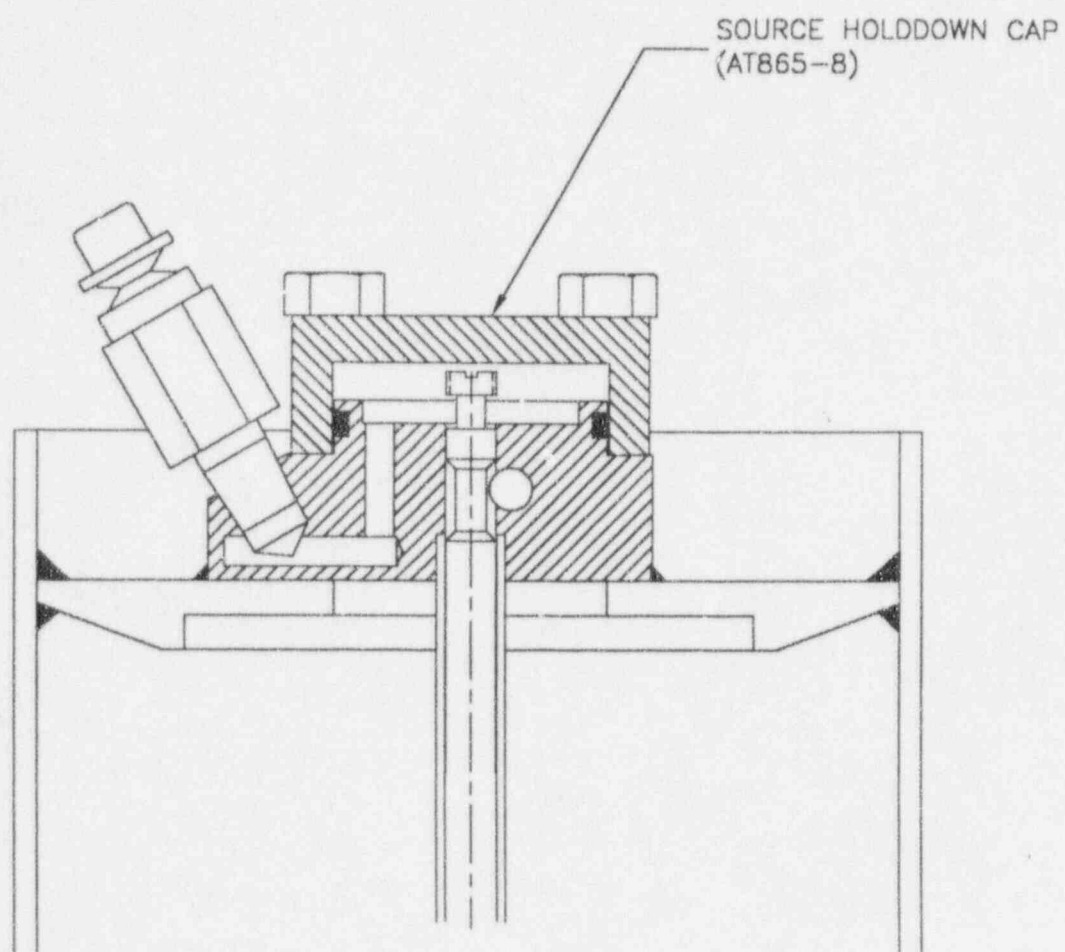
Enclosure

9608260462



ACTUATOR MAINTENANCE





LOCK REMOVAL