Technical Publications

Direction 46-014039
Revision 11

Sentry III Automatic Collimator
with XT RAD Suspension


Operating Documentation
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## REVISION HISTORY

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<td>6</td>
<td>Feb 23, 1987</td>
<td>Add modification for Mammography Collimator</td>
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<td>7</td>
<td>July 25, 1988</td>
<td>Added L500 installation instructions for electronics package</td>
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<td>8</td>
<td>Sept 29, 1989</td>
<td>Add Advanor references Revise procedure or installing electronics packages in L500 cabinet Add procedure for field size adjustment for non-tilt vertical Bucky</td>
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<td>9</td>
<td>Feb 1, 1991</td>
<td>Clarify Section 1-11, Interface Plate Alignment</td>
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<td>10</td>
<td>May 10, 1991</td>
<td>Add height Angle Adapter Kit D5304GB to Section 1-10</td>
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<td>11</td>
<td>Aug 21, 1991</td>
<td>Create electronic master for CD-ROM</td>
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SECTION 1
INSTALLATION

Introduction

The installation of the Sentry III Auto Collimator on 48 series hangers or on tube stands is covered in SM D5303C. The instructions you are now reading cover the installation, calibration, and functional testing of the Sentry III Auto Collimator with an XT Suspension. The model numbers of the collimators covered by these instructions are:

- 46–19475061 = Sentry III Auto
- 46–19475561 = Sentry III Auto Mammography

Compatibility requirements for meeting DHHS regulations are given in Section 2 of Direction 46–0 17158. Sentry III Automatic Collimator Planning.

Note

You should be aware that although this direction presents complete installation and functional test procedures, it is the installation steering direction that dictates the sequence of events. Refer to the appropriate installation steering direction before beginning any procedures called for in this direction. Procedures Number 1 through 4 in the sequence below are generally performed while the tube hanger is still on the lifting fixtures.

Tools

- Small medium and large cassettes
- Sentry Collimator Alignment Fixture 46–16639061
- Special wrenches furnished with collimator
- Two double ended, thin, open end wrenches 46–165136P1
- Allen wrench with "T" handle and 7' shank 9/64' 46–165137P1
- Digital Voltmeter Beckman 3030 RMS or Fluke Model 8030A or equivalent
- HHS field Test Kit 46–17737261 including new (April 1981) RAT pattern set, 46–216074P1

Recommended Installation Sequence

1. Unpacking
2. Attaching the interface plate to the x-ray tube
3. Mounting the collimator head
4. Adjusting the height sensing potentiometer
5. Routing cables up and around vertical column
6. Routing cables for SID switches
7. Routing cables through cable drape or through cable concealment
8. Installing the electronics package
9. Installing SID switches and actuators
10. Interface plate alignment
11. Calibration

There is some flexibility to the above schedule. Item 8 can be performed by a second person while the first person is busy with preceding items. Item 10 can be performed whenever convenient.
1-1 Unpacking

When unpacking, carefully examine the contents of each box. Do not discard packing materials, envelopes, boxes, etc., until all parts are accounted for. Check all items against the Product Delivery Instruction (PDI). A sample PDI is shown in Illustration 1-1.

Should damaged or missing parts be noticed, refer to the "Damage in Transportation" statement for instructions regarding transit damage or shortages.

When all parts are accounted for, you may find it helpful to gather all items into one box and discard all other containers. Do not leave parts lying about where they may become mixed with unrelated components.

[ILLUSTRATION 1-1 SAMPLE PDI]

<table>
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<th>PRODUCT</th>
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<tr>
<td>48-178132</td>
<td>2-20-75 MN</td>
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<td>MEDICAL</td>
<td>1 9/16/79 AFL</td>
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<td>ADAPTER KIT FOR XT SUSPENSION</td>
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<tr>
<td>(2) P7 HEX NUT 1/4-20</td>
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E- PART OF D63030DD

E-
1–2 Attaching the Interface Plate to the X-Ray Tube

Note

For staged systems, this adjustment is performed by SCA. Do not readjust.

Fasten the interface plate to the tube unit with the 9/16" hex eccentric and the 10–32 x 3/4" hex head screws (1/2" screws for MX 75 tube). Refer to Illustration 1–2. Center the plate and align the edges parallel to the edges of the port plate. Do not tighten the screws yet but adjust all eccentrics by rotating them clockwise until the interface plate just begins to move (this will simplify later adjustments). Tighten the screws.

ILLUSTRATION 1–2
ATTACHING INTERFACE PLATE TO X-RAY TUBE
1-3 Mounting the Collimator Head to the X-Ray Tube

1 Refer to Illustration 1-3 Remove the finger guard

**CAUTION**

Be careful! Bumping the fingers projecting from the top of the collimator could bend them

2 Attach the collimator to the interface using the three 10-24 x 3/4 hex screws

Refer to Illustration 1-4 Use the special T handle Allen wrench supplied

*Note*

Use of Loctite 242 and special torque specifications are required for final installation of the collimator. These are described in Section 1-11 of this direction steps 9, 10, and 11 after the alignment of the interface plate

**CAUTION**

There have been several modifications to the interface plate and brass collimator mounting ring. Make certain that the holes tapped in the collimator brass mounting ring are 10-24 and not 8-32. Likewise make sure that the screws are 10-24 and not 8-32. Reference FMI #10001

**ILLUSTRATION 1-3**

COLLIMATOR WITH FINGER GUARD
1–4 Adjusting the Height Sensing Potentiometer

Refer to Illustration 1–5

1. Move the column to its upper limit
2. Loosen the two screws on the potentiometer bracket and disengage the gears
3. Read the resistance between pins 2 and 3 and rotate the gear to obtain the correct resistance according to the chart following Illustration 1–5. Engage the gears and tighten the screws.
ILLUSTRATION 1-5
ADJUSTING THE HEIGHT SENSING POTENTIOMETER

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<td>680 OHMS</td>
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<tr>
<td>a 2</td>
<td>725</td>
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<td>a 4</td>
<td>745</td>
<td>720</td>
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<tr>
<td>a 6&quot;</td>
<td>765</td>
<td>740</td>
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<td>760</td>
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<td>8'10&quot;</td>
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<td>945</td>
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Note

For Sections 1–5, 1–6 and 1–7 following, refer to the XT Radiographic Suspension Manual, SM 82054 or to the XT Radiographic Suspension 12 Foot (3.7 m) Outboard Manual, SM B2054AF

1–5 Routing Cables Up and Around Vertical Columns (See Note Above)

1–6 Routing Cable for SID Switches (See Note Above)

1–7 Routing Cables Through Cable Drape or Through Cable Concealment (See Note Above)

1–8 Installing the Electronics Package in the MPX/SPX Master Control Cabinet

Note

This is applicable only on R&F MPX/SPX, not on Multiroom MPX Staged systems will have the collimator electronics mounted by SCA

This procedure requires the parts supplied in kit #46-01 4039
‘To be provided later

To install electronics package in a wall-mounted box, see Section 1–9

1 Remove all rails from the cabinet between the 10th and 22nd mounting holes See Illustration 1–6

2 Remove the fasteners from the rear lip of the cabinet and reposition them, as shown in Illustration 1–6 on cabinet holes #12

3 Install fasteners on the upper rail as shown in Illustration 1–7 and install this rail as shown in Illustration 1–6 to the rear surface of the cabinet flange

4 Elongate holes 7 and 14 as shown in Illustration 1–8 Lower Rail

5 Use the metal plate to attach the cable bracket to the lower rail as shown in Illustration 1–9

6 Attach spacers and nuts on the two 1/4–20 studs of the electronics package as shown in Illustration 1–10 If the chassis does not have keyhole slots as shown in Illustration 1–10 use this illustration to modify the chassis Mount the terminal strip and marker strip identified in Illustration 1–15 in the approximate position shown in Illustration 1–11 Remove Card #11 prior to Step 7

7 Make sure that the Sentry card rack is secured to the package via the little hook on the end, and then carefully lift the package and hang it on the two screws installed on the upper rails Illustration 1–11 shows the package mounted in the cabinet

8 Install the lower rail, capturing the two 1/4–20 studs in the holes on the rail This rail mounts in the normal fashion to the front surface of the cabinet flange
9 Check that the weight of the package is evenly distributed between the upper and lower rails. If necessary, add or remove spacers from the two 1/4-20 studs on the bottom of the electronics package. Tighten the two screws on the upper rail. Secure the package with two 1/4-20 nuts. REPLACE CARD #11.

10 Connect the wiring harness between the terminal strip and the plugs at the bottom of the electronics package and the plugs on the bracket mounted to the lower rail. Connect a ground wire between the electronics package chassis and a suitable ground stud on the MPX/SPX cabinet.
ILLUSTRATION 1-7
UPPER RAIL

INSERT 10-32 X 7/8" LONG HEX HEAD SCREWS INTO FASTENERS AT POSITIONS 8 AND 15 LEAVE HEADS PROTRUDING 1/4"

MOUNT RAIL TO THE REAR SURFACE OF THE REAR CABINET FLANGE IN HOLE POSITION #22
ILLUSTRATION 1-8
LOWER RAIL

TOP VIEW

#1 #7 #14
ELONGATE HOLES AS SHOWN

FRONT VIEW

ILLUSTRATION 1-9
METAL PLATE
MARK CENTER OF 25 φ HOLE THEN MARK CENTER OF 75 φ HOLE 62" BELOW FIRST MARK. DRILL BOTH 25 φ HOLE THEN ENLARGE LOWER HOLE TO 75 φ WITH CHASSIS PUNCH. FORM SLOT WITH RAT TAIL FILE.

THESE ARE THE SAME MOUNTING STUDS SHOWN IN ILLUSTRATION 1-11. ADJUST TOTAL THICKNESS WITH WASHERS SO THAT WEIGHT OF PACKAGE IS EVENLY DISTRIBUTED BETWEEN UPPER AND LOWER SUPPORTS.
ILLUSTRATION 1-11
PACKAGE MOUNTED IN CABINET

CABLE BRACKET (SEE ILLUSTRATION 1-9)

MOUNT TERMINAL STRIP HERE

HOLE #22

1/4-20 STUDS WITH SPACERS
SECURE PACKAGE WITH
1/4-20 NUTS ON BOTTOM SIDE OF RAIL

HOLE #12

MOUNT TERMINAL STRIP IN THIS AREA WITH #6-32 SCREWS

DETACH CONNECTOR COVER BY REMOVING THESE SCREWS
ALSO REMOVE (2) HEX SPACERS
AND DISCARD WITH COVER

DETACH THIS SHIELD AND DISCARD

MOUNTING STUDS

34528-D10
1–9 Installing Electronics Package in L500 Cabinet

The following procedure describes the steps required to mount the Sentry III Electronics Assembly in the L500 Image Intensifier Electronics Cabinet.

Designator
SE1 Sentry III Electronics Package

Furnished Pans Kit #46–273386G1 – L500/Sentry III Adapter Kit (Part of Catalog #D5303DF)

Application
Perform the following procedure on all XT Hanger/L500/SFX RFX or CFX Table Systems using MVP Generators

Procedure
1. Remove and discard the following items from the Sentry III Electronics package as shown in Illustration 1–12
   - (3) Power supply shields including mounting hardware
   - 1P1 through 1P9 connector cover
   - Mounting studs and screws behind 1P1 through 1P9 connectors
   - Front circuit board trim cover
2. Attach the 46–302076P1 mounting plate to the Sentry III Electronics package as shown in Illustration 1–13
   a. Slide the (2) bushings on the mounting studs of the electronics package
   b. Install the (2) hex extensions on the electronics package with the (2) 6–32 x 38 binding head external tooth screws
   c. Install the mounting plate and connect the 2–1/2’ #14 AWG green/yellow ground wire to the mounting plate
   d. Install the (2) 6–32 lock nuts and the (2) 1/4–20 lock nuts

ILLUSTRATION 1–12
SENTRY III ELECTRONICS MOUNTING MODIFICATIONS
3. Assemble external cable interface assembly using supplied hardware as shown in Illustration 1–13
   a. Mount 46–17613161 harness/plate assembly to the mounting plate using (2) 6–32 x 38 binding head external tooth screws
   b. Mount supplied 8 position terminal stnp and marker label to the mounting plate using (2) 6–32 x 63 binding head external tooth screws
   c. Connect the two green leads from the harness/plate assembly using the 6–32 lock nut as shown in detail “A” of Illustration 1–14

4. Connect individual leads of harness/plate assembly to terminal stnp (TS1) posts as shown in Illustration 1–15
ILLUSTRATION 1-14
EXTERNAL CABLE INTERFACE ASSEMBLY

GREEN LEADS FROM HARNES/PLATE ASSEMBLY

6-32 LOCKNUT

DETAIL A

MOUNTING PLATE 46-302076P1

HARNES/PLATE ASSEMBLY 46-176131G1

MOUNT HARNES/PLATE ASSEMBLY TO MOUNTING PLATE USING (2) 6-32 X 38 BD HD EXTERNAL TOOTH SCREWS

MOUNT TERMINAL STRIP AND MARKER STRIP TO MOUNTING PLATE USING (2) 6-32 X 63 BD HD EXTERNAL TOOTCHED SCREWS

SEE ILLUSTRATION 1-16 FOR CONNECTIONS

SEE DETAIL A
5 Connect P5, P6 and P8 harness connectors to associated plugs on electronics package (connectors are marked)

6 Install supplied white wire (46-177502G1) between TSI-5 and TSI-7 of terminal strip as shown in Illustration 1-15

7 Mount (2) supplied cabinet mounting brackets (46-263949P1) to Sentry III Electronics package using (4) 1/4-20 x 625 binding head external tooth screws as shown in Illustration 1-16

While mounting brackets, ensure that

- Mounting brackets keyhole slots (for easy cabinet rail mounting) are over power supply side of the Sentry III Electronics package (top)
- Mounting bracket holes (for 1/4-20 screws) face outside in reference to the mounting bracket slots (keyhole and standard)

Distance between keyhole slot on each mounting bracket should be 13-1/8'. If not, turn over one or both brackets and reattach to the Sentry III Electronics package

8 Mount (2) supplied horizontal mounting rails (46-182503P1) in L500 Electronics Cabinet as shown in Illustration 1-17

   a Place (4) supplied nut clips (46-220288P1) over the 25th and 36th mounting holes (from top) on the cabinet vertical mounting rails

   b Mount (2) supplied horizontal mounting rails (46-182503P1) on the installed nut clips using (4) supplied 10-32 x 75 hex head screws

ILLUSTRATION 1-15
HARNESS/PLATE ASSEMBLY CONNECTIONS
9 Mount Sentry III Electronics package (using attached brackets) in LS00 electronics cabinet as shown in Illustration 1-17

a. Place (4) supplied nut clips (46-220288P1) over the 15th and 30th mounting holes (from left) on the top (25th) and bottom (36th) horizontal mounting rails installed in Step 8.

b. Thread (2) supplied 10-32 x 75 hex head screws into nut clips installed on top (25th) horizontal mounting rail installed in Step 8. Leave approximately 1/2" between rail and screw head.

c. Lift Sentry III Electronics package over top (25th) horizontal mounting rail so that keyholes slots on mounting brackets fit over the (2) protruding 10-32 x 75 hex head screws installed in Step 9b.

d. Complete mounting Sentry III Electronics package by

- Tightening (2) 10-32 x 75 hex head screws on 25th horizontal rail and
- Installing (2) supplied 10-32 x 75 hex head screws through mounting bracket standard slots to nut clips on 36th horizontal rail.

ILLUSTRATION 1-16
ATTACHING MOUNTING BRACKETS TO SENTRY III ELECTRONICS
ILLUSTRATION 1-17
SENTRY III ELECTRONICS MOUNTING IN L500 ELECTRONICS CABINET

INSTALL RATING PLATE 46-273386G1 (NEXT TO EXISTING RATING PLATES)

- MOUNT SENTRY III ELECTRONICS PACKAGE TO HORIZONTAL MOUNTING RAILS WITH (4) NUT CLIPS AND (4) 10-32 X 75 HEX HEAD SCREWS
- HOLE 25
- HOLE 36
- HOLE 30
- MOUNT (2) 46-182503P1 HORIZONTAL MOUNTING RAILS EACH WITH (2) NUT CLIPS AND (2) 10-32 X 75 HEX HEAD SCREWS

L500 ELECTRONICS CABINET

MX1 A1
40VDC POWER SUPPLY

MX1 A3
240V-CONTACTOR

MX1 A4
MS-53/89 CAMERA

MX1 A5
L500 SINGLE PLANE ELECTRONICS INTERFACE

MX1 A1B
PHOTOSPOT POWER SUPPLY

MX1 A2
LVDC POWER SUPPLY

L500 ELECTRONICS/CABINET

HOLE 25

HOLE 36

HOLE 30

HOLE 15

WHT

BLK

HOLE (2) 46-182503P1 HORIZONTAL MOUNTING RAILS EACH WITH (2) NUT CLIPS AND (2) 10-32 X 75 HEX HEAD SCREWS

DIRECTION 46-014039
10 Make power and ground connections from Sentry III Electronics package to L500 cabinet as shown in Illustration 1–18
   a. Connect free end of the 2–1/2' #14 AWG green/yellow ground wire to the L500 cabinet ground stnp as shown.
   b. Connect a 2 two conductor (black & white) #14 AWG cable as follows:
      - Connect one end to 8 position terminal stnp white to 7 and black to 8 as shown in Detail “A” of Illustration 1–18
      - Connect the other end to SC1 A2 cabinet power panel, white to 3 and black to 4.

ILLUSTRATION 1–18
POWER AND GROUND CONNECTIONS TO L500 CABINET
11 Connect external cables to cable interface assembly and electronics package as shown in your system MIS map.

12 Secure cables to Sentry III Collimator 4P1 and 4P2 using supplied cable clamps. Refer to Illustration 1–19 for removal of cover from rear of collimator to install (2) cable clamps and (2) screws.

13 Install L500/Sentry III Adapter Kit Model #46-27386G1 rating plate on top of L500 cabinet next to existing rating plates as shown in Illustration 1–19.
1–10 Installing Electronics Package In Wall Mounted Box

1. Remove wall box cover and set aside.
2. Attach wall box mounting plate to wall in desired location. Depending upon the particular structure involved, use lag screws, toggle bolts, or anchors for mounting.
3. Prepare electronics package according to Illustration 1–20 and 1–21.
4. Use Illustration 1–22 and Table 1–1 for interfacing the electronics.

ILLUSTRATION 1–20
ELECTRONICS PACKAGE
ILLUSTRATION 1-21
INSTALLING ELECTRONICS PACKAGE

1-3/8 HEX STANDOFF
#6 LOCKWASHER
6-32 X 3/8" PAN HEMS
6-32 HEX NUT

1/4-20 HEX NUT
1/4" LOCKWASHER
1-3/8 ROUND STANDOFF

DETAIL "A"
TYP 2 PLACES

ELECTRONICS PACKAGE MOUNTING STUD

DETAIL "B"
TYP 2 PLACES

INSTALL PLASTIC GUARD STRIP
(IF REAR CABLE EXIT IS TO BE USED)

LOOSEN ELECTRONICS PACKAGE COVER BY REMOVING THIS SCREW AND MOUNT ELECTRONICS PACKAGE PER DETAIL A AND B

SEE DETAIL B
SEE DETAIL A
ILLUSTRATION 1-22
CABLE ROUTING IN WALL BOX

CONNECTOR J8 DISPLACED FOR CLARITY

UL REQUIRES REMOVAL OF THIS CONNECTION IF CONTROL IS ENERGIZED BY AN UNGROUNDED NEUTRAL SUPPLY
ALSO REMOVE JUMPER ACROSS 6F11 ON THE HANGER COLUMN
Installing the SID Switches and Actuators

Note

Although four situations relating to SID switches and actuators are outlined below, you should give serious consideration to #4 below if there is even the most remote possibility that the room may be upgraded at some future date. It is much more difficult to add a few switches and actuators at a later date.

Switches and actuators must be installed to signal collimator control circuitry when the tube unit is positioned at specific SID s for vertical table or chest unit work. Three SID’s are permitted for vertical table work and another three for vertical chest unit work. Normally these distances are those on the collimator field size scale selector, namely 40 or 44 48 and 60, or 72’ (1016 1118 1219 1524 1829 mm). Four situations governing switch and actuator requirements exist. These are:

1. Stationary table and no chest unit — no switches required. Proceed to Section 1-12 Interface Plate Alignment.

2. Stationary table and chest unit — 4 switches and 4 actuators (8 actuators for Advantx) required. Install switches first (Illustrations 1-23 1-24 1-25 or 1-26), then refer to Illustration 1-27 or 1-28 for actuator positions. For non-Advantx systems see Table 1-2 for jumper arrangement on Card A5, logic board.

Note

The chest unit may be mounted on any wall if it is mounted on either the front of rear wall, a right angle adapter kit D5304GB, will be required.
3 Angulating table and no chest unit — 4 switches and 4 actuators (8 actuators for Advantx) required. However if a chest unit is to be added at a future date, it is more practical to use Paragraph 4 below. Install switches first (Illustrations 1–23, 1–24, 1–25 or 1–26), then refer to Illustrations 1–29 or 1–30 for actuator positions. For non-Advantx systems, see Table 1–2 for jumper arrangement on Card A5 logic board.

4 Angulating table and chest unit — 5 switches and 11 actuators (16 actuators for Advantx) required (number of actuators required may be reduced if a table and chest unit SID position happens to coincide — see Illustration 1–33 and the discussion below it). Install switches first (Illustrations 1–23, 1–24, 1–25 and 1–26) then refer to Illustrations 1–31 or 1–32 for actuator positions. For non-Advantx systems, see Table 1–2 for jumper arrangements on Card A5 logic board.

**Note**

The chest unit may be mounted on any wall. If it is mounted on either the front of rear wall a right angle adapter kit, D5304GB, will be required. The system will not accommodate Bucky work at both table vertical and Trendelenberg positions. If it is necessary to use the table in the 90° Trendelenberg position, for Bucky work you must reverse the order of the actuators from that shown. You must also reverse the vertical/Trendelenberg logic signals for both the collimator head and the table. This is done as follows:

**Collimator Servo Cable**

- Remove WHT lead from 4P1–T and WHT/ORN lead from 4P1–D
- Insert WHT lead in 4P1–D and WHT/ORN lead in 4P1–T

**RFX/SFX Table Electronics Cabinet** (Described here for non-Advantx. For Advantx see appropriate Advantx R&F System MIS manuals)

- Remove PUR lead from SF1A5J7–9 (8835/8535) or ML1A1–J3–(88/85) and GRA lead from SF1A5J7–10 (8835/8535) or ML1A1–J3–10 (88/85)
- Place PUR lead in SF1A5J7–10 or ML1A1–J3–10 and GRA lead in SF1A5J7–9 or ML1A1–J3–9
ILLUSTRATION 1-23
MOUNTING OF SWITCH ASSEMBLY - OUTBOARD XT RAD SUSPENSION

OUTBOARD (WITHOUT RIGHT ANGLE ADAPTER KIT)

SIDE VIEW

FRONT VIEW
ILLUSTRATION 1–24
MOUNTING OF SWITCH ASSEMBLY - INBOARD XT RAD SUSPENSION

INBOARD (WITHOUT RIGHT ANGLE ADAPTER KIT)

REAR STATIONARY RAIL

6-32 X 3/8" BINDER HD SCREW

TRIM COVER

SIDE VIEW

(32 MM) 1/8"

10-32 X 3/8" HEX SOC HD SCREW AND LOCKWASHER

RIGHT HAND BRIDGE MEMBER

BRN  B"  RED  MOUNTING BRACKET

A  C  E  BUSHING

(4) BLK LEADS FURNISHED WITH CABLE 46-177033

C  D  YEL  ORN

BLK  ORN  BLU

REAR VIEW

ROUTE CABLE (46-177033) TO 1P9 OF SENTRY ELECTRONICS PACKAGE
ILLUSTRATION 1-25
MOUNTING OF SWITCH ASSEMBLY - OUTBOARD XT RAD SUSPENSION

OUTBOARD (WITH RIGHT ANGLE ADAPTER KIT D5304GB)

SIDE VIEW

FRONT VIEW

REAR STATIONARY RAIL

10-32 X 3/8"

1/8"

ACTUATOR MOUNTING ANGLE

SWITCH MOUNTING BRACKET

10-32 HEX NUT AND LOCK WASHER

REAR END CAP TRIM COVER

MOUNTING BRACKET

RED

4 BLK LEADS FURNISHED WITH CABLE 46-177033

SWITCH A

CABLE 46-273813G1 (PART OF D5304GB) FROM 6J1

SWITCH B

YEL

SWITCH D

SWITCH C

ORN

BLK

SWITCH E

BRN

BLU

1-28
ILLUSTRATION 1-26
MOUNTING OF SWITCH ASSEMBLY - INBOARD, XT RAD SUSPENSION

INBOARD (WITH RIGHT ANGLE ADAPTER KIT)

SIDE VIEW

REAR STATIONARY RAIL
6-32 X 3/8 BIND HD SCREW
TRIM COVER
10-32 X 3/8 HEX SOC HD SCREW AND LOCKWASHER

RIGHT HAND BRIDGE MEMBER

(3.2 MM) 1/8"

(4) BLK LEADS FURNISHED WITH CABLE 46-177033

CABLE 46-273813G1 (PART OF D5304GB) [M 6]
NOTE FOR ADVANTX Actuators must be used in pairs for Advantx. Each pair of actuators must be a unique combination.

NOTE FOR ADVANTX, MODEL PERIODS 1 THROUGH 5 ONLY* Do not use actuator A.

1. Mount actuator mounting angle to rear station rail as per Illustration 1-23.

2. Determine position of actuator A. Then use bottom drawing to locate other actuators.

NOTE. Actuator A is to be positioned so that switch A disengages when SID reaches 35.5'. When measuring SID, use the collimator tape with the tab extended. Measure to the film plane. This is 20" beyond the front surface of the film cassette.

3. Route SID Interlock switch cable through the XT Rad Suspension per instructions in Chapter 3 of the appropriate XT Rad Suspension Service Manual SM 82054 or SM 82054AF. Replace the end cap trim cover.

4. Reference the SID positions selected by affixing the furnished pointer to the bottom of the rear end cap and the circular markers to the longitudinal cable concealment cover or other suitable surface. Use one color for vertical table SID's and the other for chest unit SID's.

5. Position card A5 jumpers as per Figure A in Table 1-2 (N/A for Advantx).

*USE52 FORA40 SID OR 92 FORA44 SID
**USE252 FORA60 SID OR 372 FOR A 72 SID
NOTE FOR ALL ADVANTX. Actuators must be used in pairs for Advantx. Each pair of actuators must be a unique combination.

NOTE FOR ADVANTX, MODEL PERIODS 1 THROUGH 5 ONLY. Do not use actuator A.

1. Determine position of actuator A. Then use bottom drawing to locate other actuators.

   - Actuator A is to be positioned so that switch A disengages when SID reaches 35.5". When measuring SID, use the collimator tape with the tab extended. Measure to the film plane. This is 20" beyond the front surface of the film cassette.

2. Route SID interlock switch cable through the XT Rad Suspension per instructions in Chapter 3 of the appropriate XT Rad Suspension Service Manual SM 52054 or SM 52054AF. Replace the end cap trim cover.

3. Reference the SID positions selected by affixing the furnished pointer to the bottom of the rear end cap and the circular markers to the longitudinal cable concealment cover or other suitable surface. Use one color for vertical table SID's and the other for chest unit SID's.

4. Position card A5 jumpers as per Figure A in Table 1-2 (N/A for Advantx).

'SUE52 FOR A40 SID OR 92 FOR A44 SID
**USE 252 FOR A60' SID OR 372' FOR A72 SID

1-31
ILLUSTRATION 1-29
OUTBOARD - ANGULATING TABLE

NOTE FOR ALL ADVANTX
Actuators must be used in pairs for Advantar. Each pair of actuators must be a unique combination.

NOTE FOR ADVANTX, MODEL PERIODS 1 THROUGH 5 ONLY
Do not use actuator B

1. Mount actuator mounting angle to rear stationary rail as per Illustration 1-23.

2. Determine position of actuator B. Then use bottom drawing to locate other actuators.

NOTE. Actuator B is to be positioned so that switch B disengages when SID reaches 35 5". When measuring SID, use the collimator tape with the tab extended. Measure to the film plane. This is 20" beyond the front surface of the film cassette.

3. Route SID Interlock switch cable through the XT Rad Suspension per instructions in Chapter 3 of the appropriate XT Rad Suspension Service Manual SM B2054 or SM B2054AF. Replace the end cap trim cover.

4. Reference the SID positions selected by affixing the furnished pointer to the bottom of the rear end cap and the circular markers to the X T Rad Suspension Service Manual SM B2054 or SM B2054AF. Replace the end cap trim cover. Use one color for vertical table SID and the other for chest unit SID.

5. Position card A5 jumpers as per Figure B in Table 1-2 (N/A for Advantx).

*USE 8 3" FOR A 40 SID OR 12 3" FOR A 44 SID
**USE 28 3" FOR A 60 SID OR 40 3" FOR A 72 SID
NOTE FOR ALL ADVANTX Actuators must be used in pairs for Advantx. Each pair of actuators must be a unique combination.

NOTE FOR ADVANTX, MODEL PERIODS 1 THROUGH 5 ONLY Do not use actuator B*

1. Determine position of actuator B. Then use bottom drawing to locate other actuators.

NOTE. Actuator B is to be positioned so that switch B disengages when SID reaches 35.5". When measuring SID use the collimator tape with the tab extended. Measure to the film plane. This is 20" beyond the front surface of the film cassette.

2. Route SID Interlock switch cable through the XT Rad Suspension per instructions in Chapter 3 of the appropriate XT Rad Suspension Service Manual SM 8205 or SM 8205 AF. Replace the end cap trim cover.

3. Reference the SID positions selected by affixing the furnished pointer to the bottom of the rear end cap and the circular markers to the longitudinal cable concealment cover or other suitable surface. Use one color for vertical table SID's and the other for chest unit SID's.

4. Position card A5 jumpers as per Figure B in Table 1-2 (N/A for Advantx).

*USE 7.5' FOR A 40 SID OR 11.5' FOR A 44' SID
**USE 27.5' FOR A 60 SID OR 39.5' FOR A 72' SID
ILLUSTRATION 1-31
OUTBOARD "ANGULATING TABLE AND CHEST UNIT

NOTE. ACTUATORS FOR TABLE AND CHEST UNIT
ARE SHOWN SEPARATED FOR CLARITY BUT MAY BE MINGLED IF NECESSARY SEE ILLUSTRATION 1-33

FILM PLANE

NOTE FOR ALL ADVANTX. Actuators must be used in pairs for Advantx. Each pair of actuators must be a unique combination.

NOTE FOR ADVANTX, MODEL PERIODS 1 THROUGH 5 ONLY: Do not use actuator A and B

1. Mount actuator mounting angle to rear stationary rail as per Illustration 1-23

NOTE. Actuator A and B are to be mounted so that switches disengage when the SID reaches 35.5". When measuring SID use the collimator tape with the tab extended. Measure to the film plane. This is 20" beyond the front surface of the film cassette.

2. Determine position of actuators A and B. Use bottom drawing to locate other actuators for table. Then use Illustration 1-27 to locate actuators for chest unit.

3. Route SID Interlock switch cable through XT Rad Suspension per instructions in Chapter 3 of the applicable XT Rad Suspension Service Manual. SM B2054 or SM B2054AF. Replace the end cap trim cover.

4. Reference the SID positions selected by affixing the furnished pointer to the bottom of the rear end cap and the circular markers to the longitudinal cable concealment cover or other suitable surface. Use one color for vertical table SID's and the other for chest unit SID's.

5. See Table 1-2 and Illustration 1-33 for location of jumpers on card A5 (N/A for Advantx).

USE 83 FORA40 SID OR 123 FORA44 SID

*USE 283 FOR A 40 SID OR 403 FOR A 72 SID
ILUSTRATION 1-32
INBOARD "ANGULATING TABLE AND CHEST UNIT

NOTE FOR ALL ADVANTX Actuators must be used in pairs for Advantx Each pair of actuators must be a unique combination.

NOTE FOR ADVANTX, MODEL PERIODS 1 THROUGH 5 ONLY Do not use actuator A and B.

1. Determine position of actuators A and B. Use bottom drawing to locate other actuators for table. Then use Illustration 1-28 to locate actuators for chest unit.

2. Route SID Interlock switch cable through the XT Rad Suspension per instructions in Chapter 3 of the appropriate XT Rad Suspension Service Manual. Replace the end cap trim cover.

3. Reference the SID positions selected by affixing the furnished pointer to the bottom of the rear end cap and the circular markers to the longitudinal cable concealment cover or other suitable surface. Use one color for vertical table SID s and the other for chest und SID s.

4. See Table 1-2 and Illustration 1-33 for location of jumpers on card A5. (N/A for Advantx)

"USE 7.5 FOR A 40" SID OR 11.5" FOR A 44" SID
"USE 27.5 FOR A 60" SID OR 39.5" FOR A 72" SID.
### TABLE 1-2

**N14 FOR ADVANTX**

<table>
<thead>
<tr>
<th>JUMPER ARRANGEMENT</th>
<th>ROOM CONFIGURATION</th>
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<tbody>
<tr>
<td>FIGURE A</td>
<td>4-T 4-Y 4-T AND CHEST UNIT</td>
</tr>
<tr>
<td>FIGURE B</td>
<td>ANGULATING TABLE AND NO CHEST UNIT</td>
</tr>
<tr>
<td>FIGURE A</td>
<td>ANGULATING TABLE AND CHEST UNIT (WHEN ACTUATOR</td>
</tr>
<tr>
<td></td>
<td>POSITIONS DON'T CONFLICT)</td>
</tr>
<tr>
<td>FIGURE A MODIFIED</td>
<td>ANGULATING TABLE AND CHEST UNIT (WHEN ACTUATOR</td>
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<tr>
<td>ACCORDING TO</td>
<td>POSITIONS CONFLICT)</td>
</tr>
<tr>
<td>TABLE 1-3</td>
<td>READ SECTION BELOW ILLUSTRATION 1-33</td>
</tr>
</tbody>
</table>

**Note**

JB4 is shown in the −90 position which is used when the chest unit is off the foot end of the table. Should the chest unit be off the head end of the table, move the jumper to the +90 position. If the chest unit is mounted transversely, note that the +90 position is used when the beam is angulated clockwise for chest work and conversely.
ILLUSTRATION 1-33
EXACT OR PARTIAL COINCIDENCE, OR ADJACENT ACTUATOR POSITIONS FOR TABLE AND CHEST UNITS

(N/A for Advanor)

With both angulating table and chest units, the 2 sets of required actuators may be separated or they may be mingled depending on equipment layout and room size. Collimator logic discriminates between the 2 sets of actuators since 2 switches must close for vertical table SID's while only one switch must close for the chest unit SID's.

There is a chance that there will be an occasional conflict between actuator positions for the table and chest unit. Illustration 1-33 shows what should be done in case of a conflict. If there is more than 3/4" (19 mm) overlap, move the chest unit so that the two locations are exactly coincident as in Illustration 1-33(A). For coincident positions, a jumper change MUST be made on card A5 per Table 1-3 to maintain proper collimator logic signals. If, for example, an actuator for table SID No 1 happens to coincide exactly with the actuator for chest unit SID No 2, JB1 must be inserted between X1 and Z1. If there is less than 3/4" (19 mm) overlap move the chest unit so that the positions are adjacent as in Illustration 1-33(B). Obviously, if the chest unit is already against the wall, it can be moved only in one direction.

<table>
<thead>
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<th>TO CONNECT</th>
<th>TO CONNECT</th>
<th>INSERT</th>
<th>BETWEEN</th>
<th>AND</th>
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<td>CHEST UNIT SID NO 1</td>
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<td>Z1</td>
<td>X1</td>
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<td>CHEST UNIT SID NO 2</td>
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<td>Z2</td>
<td>X2</td>
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<td>Z3</td>
<td>X3</td>
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<td>Y1</td>
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<td>CHEST UNIT SID NO 2</td>
<td>JB2</td>
<td>W2</td>
<td>Y2</td>
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<tr>
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<td>X2</td>
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<td>CHEST UNIT SID NO 3</td>
<td>JB3</td>
<td>V3</td>
<td>X3</td>
</tr>
</tbody>
</table>
1-12 Interface Plate Alignment

Note

This adjustment is performed by SCA for staged systems. Do not readjust unless testing indicates that distance “X” in Illustration 1-35 differ by more than 6 mm. For example, if “X” for small spot is 8 mm and “X” for large spot is 13 mm this is OK, and indicates a plate position error of about 5 mm. See Service Note 2770, Page 4.

1. Lock up the counterpoise as shown in Illustration 1-34.
2. Disconnect the collimator cables and remove the collimator. This is easiest to do if the tube is angulated beam up.
3. Remove the protective cap from the collimator alignment fixture (46-16639061). Angulate the tube beam up and attach the fixture (this allows the fixture to rest on the port plate rather than hang on the screws).

Note

Fixtures manufactured after June 1981 have two sets of mounting holes, 8-32 and 10-24 to accommodate both old and new style collimator mounts. The older fixtures have only 8-32 screw holes. Be careful to use the proper screws.

4. Position the x-ray tube so that the lead glass screen of the alignment fixture can be viewed by the person operating the x-ray control if possible.
5. Using exposures of 60 kVp, 25 mA 4 seconds and 200 mA large 2 seconds, look at the images on the lead glass screen. When the interface plate is properly aligned, the images will appear as in Illustration 1-35.
6. Using the end wrenches furnished with the collimator, rotate diagonally opposite eccentrics in the same direction to shift the interface plate as needed. The images will move in the direction the plate is shifted. Be sure to keep the interface plate square with the mounting plate on the x-ray tube.
7. When alignment is satisfactory tighten the four hex head machine screws. Use two wrenches — hold the eccentric while tightening the screw. Recheck the alignment.
8. Remove the alignment fixture (don’t forget the protective cap).
9. Replace the collimator. Use Locktite 242 when replacing the three #10-24 socket head cap screws (Refer to Illustration 1-4).

CAUTION

Bumping the fingers projecting from the top of the collimator can bend them.
10 Using the supplied T-handle Allen wrench, tighten each screw.

**CAUTION**

**WHAT IS MEANT BY TIGHTEN** - You must keep an eye on the T-handle wrench and stop applying torque when you begin to see the T-handle shaft just start to twist. Now the screws are considered to be tight.

11 After each screw is tight, go back to each screw and apply 2 additional 1/4 or 90° twisting turns.

**CAUTION**

**WHAT IS MEANT BY TWISTING TURN** - You will actually be seeing the T-handle shaft twisting during the entire 1/4 or 90° additional turn.

With this procedure, you can be assured of acquiring the required 40–50 in/oz of torque to each screw.

You can assist the turning of the T-handle wrench with a screwdriver or wrench, as long as you follow the above procedure step by step.

Damage to the T-handle wrench will not occur after being used in the above procedure. You can continue to use the wrench during other collimator installations.

12 Unlock the counterpoise assembly.
TURN LOCK UP SCREW INTO ONE OF THE NOTCHES ON THE PERIPHERY OF THE COUNTERPOISE ASSEMBLY THEN BACK OFF SO THERE IS A LITTLE CLEARANCE. DO NOT LEAVE THE SCREW BOTTOMED IN THE NOTCH.

CENTERS OF SMALL AND LARGE FIELD ARE EQUIDISTANT FROM THE CROSSHAIRS.
1-13 Modification for Mammography Collimator

Install relay K11 (furnished with the mammography collimator) on the XT hanger interface circuit board, 46-174410G1. See Illustration 1-36 for location of this board.

ILLUSTRATION 1-36
INTERFACE CIRCUIT BOARD LOCATION
SECTION 2
CALIBRATION (SECTIONS 2-1 THROUGH 2-12 N/A FOR ADVANTX)

The bulk of the adjustments deal with establishing three reference voltages for use in controlling field sizes. The first voltage is proportional to the height of the receptor above the floor. The second voltage is proportional to the height of the focal spot above the floor. It is provided by the height sensing potentiometer at the top of the vertical column. The third voltage is proportional to the size of the film cassette. The Sentry electronics combine the first two voltages to produce a fourth reference which is proportional to the SID. This reference and the cassette size reference are then combined to produce a signal which maintains the x-ray field at the proper size under all conditions of SID, tube height, and film size.

CAUTION

Always turn off the Sentry power when removing or reinserting cards. The power switch is identified in Illustration 2-1.

Unless otherwise specified, all voltages are measured with respect to ground (the chassis). All voltages are to be measured with a Fluke Model 8030 or equivalent DMM.
2-1 Source–To-Floor Reference Voltage

1. Adjust the x-ray tube so that the focal spot is 75" above the floor. Use the collimator measuring tape with the tab extended.

2. Record the voltage at TP3 card 9, it should be $7.5\pm0.5\text{VDC}$ Make no adjustments yet.

3. Reposition the tube so that the focal spot is 50" above the floor. The voltage at TP3 card 9 should be 2 50 volts less than before corresponding to a ratio of 1 volt per inch of travel. If the voltage change is between 2 46 volts and 2 54 volts, proceed to Step 4. Otherwise, see (a) below.

   a. If the voltage change with a 25" travel is not within the limits specified above, the supply voltage to the potentiometer may be in error. Look for $10\pm1\text{ volts}$ at TP4 on card 11. If necessary, adjust with A11R103.

4. If the voltage recorded in Step 2 was $7.5\pm0.5\text{VDC}$, proceed to Section 2-2. Otherwise, see (a) below.

   a. The height sensing potentiometer should be readjusted to provide $7.5\pm0.5\text{ volts}$ at a focal spot–to–floor distance of 75". Go directly to Step (e) if the height sensing potentiometer is not accessible.

   b. Turn off the power to the hanger.

   c. Loosen the two screws holding the potentiometer in place. Reference II Illustration 2-2.

   d. Rotate the potentiometer body until a meter reading of $7.5\pm0.5\text{ volts}$ is obtained at TP3 card 9. Then secure the potentiometer in place. Skip the rest of the section and go directly to 2-2.
If you complete Steps 1, 2, and 3 but the voltage in Step 2 is out of the ±0.05 V tolerance and there is no easy access to the height sensing pot, you may skip to Section 2-2 provided the voltage in Step 2 is between 7.0 and 8.0 volts. Outside of this range there is danger of destroying the pot, so you must gain access and make the adjustments of a, b, c, and d.

If the conditions above permit you to skip to Section 2-2, you should note that the voltage at TP3, Card 9 (focal spot-to-floor proportional voltage), will not correspond to the real focal spot-to-floor distance, and the voltage at TP1, Card 9 (film-to-floor reference) will not correspond to the real film-to-floor distance. Record these facts in the room log.

2-2 ***SID Adjustment - Table Horizontal***

1. Monitor the voltage at TP2 on Card 9.
2. Adjust the x-ray tube to place the focal spot 40" above the Bucky film plane (measure accurately) use the collimator tape with the tab extended and note that the film plane is 2" beyond the front surface of the film cassette.
3. Adjust A9R103 to obtain a meter reading of -4.00 ± 0.02 VDC (-3.98 to -4.02).

Verify that the height sensing potentiometer is tracking properly by moving the x-ray tube through its range of vertical travel several times and then noting that the voltage at TP2, Card 9, corresponds to the SID. This is a negative voltage and is 10 volt per inch of SID.

Test at 40" and at 50" above the Bucky film plane. If the readings are erratic, check the potentiometer mounting gears, and the belt.

As a matter of interest the voltage at TP1 of Card 9 should now correspond to the film-to-floor distance within 0.5 volts. For the 31.5" distance of the Moptrol, RFX, and SFX tables, this voltage should be 3.15 VDC (not counting the thickness of grout pads). If Step 4 (e) above was performed, however, the preceding statement may not be true.

Make no further adjustments to A9R103.
Adaptments for Vertical Buckys when Receptor is Positioned Horizontally

X-ray exposures are permitted only when the receptor is positioned at one of two preselected heights and a cassette is in place (Refer to the chest unit installation manual for information on installing the two height switches)

1 Rotate the image receptor 180° clockwise or counterclockwise, and angulate it backward to horizontal. Release the legs and lower the unit until the legs touch the floor (the lower height switch should now be actuated)

2 Insert a cassette

3 Position the x-ray tube so that the focal spot is 40" above the film plane (measure accurately)

4 Monitor the voltage at TP2 of Card 9. Adjust A9R102 (Bucky height #2 adjust) so that this voltage equals -4.00 ± 0.02VDC. This voltage is proportional to the SID at negative 10 volt per inch.

5 Reposition the image receptor to the second pre-selected height. Reposition the x-ray tube so as to maintain the 40" SID (measure accurately)

6 Monitor the voltage at TP2 of Card 9. Adjust A9R101 (Bucky height #1 adjust) so that this voltage equals -4.00 ± 0.02VDC.

As a matter of interest, the voltage at TP1 of Card 9 should now be equal to the scaled film-to-floor distance within 0.5 volt. If Step 4(e) of Section 2–1 was performed, however, the preceding statement may not be true.

SID Adjustments for Chest Unit when Receptor is Positioned Vertically (VT Buckys Included)

1 If applicable, angulate the image receptor to the vertical position

2 Insert a cassette or transport a film as applicable

3 Position the x-ray tube as for a chest exam at the SID #1 position 40 or 44"

4 Monitor the voltage at TP2 of Card 9

5 Adjust A9R95 (Wall SID #1) so that the voltage equals the negative of the SID scaled at 1 volt per inch (e.g., if the SID is 44", the voltage at TP2 should be adjusted to -4.40 ± 0.02VDC)

Note: The LED indicator to the immediate left of the pot should be on, indicating that the proper signal is being switched into the SID calculator circuit. If it is not on, an interlock is open. Recheck equipment positioning.

6 Repeat Step 5 for SID #2 and for SID #3 utilizing, respectively A9R97 (Wall SID #2) and A9R99 (Wall SID #3)

7 Remove the cassette or eject the film as applicable
2-5 **SID Adjustments for Table Vertical**

1. Angulate the table to 90° vertical
2. Insert a cassette
3. Position the x-ray tube as for an exam at the SID #1 position (40 or 44")
4. Monitor the voltage at TP2 of Card 9
5. Adjust A9R89 (Table SID #1) so that the voltage at TP2 is equal to the negative of the SID, scaled at 10 volt per inch (e.g., for a 44" SID the voltage should be \(-4.40 \pm 0.2 \text{VDC}\))

**Note**

The LED indicator to the immediate left of the pot should be on, indicating that the proper signal is being switched into the SID calculator circuit. If it is not on, an interlock is open. Recheck equipment positioning.

6. Repeat Step 5 for SID #2 and SID #3 positions, if they are provided, utilizing A9R91 (Table SID #2) and A9R93 (Table SID #3) respectively.

2-6 **PBL Crossover Adjustment**

The range of vertical SIDs from 36" down to zero is considered to be a bypass region where PBL is not required. When SID passes into this region, conversion to manual operation may be automatic. Upon return to SID greater than 36", return to PBL must be automatic.

**Note**

- This adjustment is factory set but a field check is a good practice.

1. The table should be in the horizontal position.
2. Position the tube unit and collimator so the x-ray beam is vertical.
3. Slowly lower the tube unit and collimator until the SID is less than 36". Results are manual mode and non-auto lite on.
4. Slowly raise the tube unit and collimator until the SID is 36". Results are that it should return back to automatic mode and non-auto lite off. If not adjust A9R108 so that collimator returns to auto-mode at 35 to 35.5 SID.

**Note**

This will give more margin for PBL crossover and is intended to prevent incidents on non-compliance.
2-7 Damping Adjustment

This adjustment cannot be made by observing blade motion at the mylar mask or by observing the projected light field. In the first case, the eye cannot detect possible small rapid oscillations, and in the second case, although the edges of the film might oscillate 1/4" or more, the edges are fuzzy and difficult to evaluate.

1. Turn off the Sentry electronics while you place Card 6 on an extender.
2. Position the tube over the horizontal table at maximum SID (provided you can still reach the thumbwheels).
3. Insert a 14" x 17" cassette into the table Bucky. The collimator must be in the automatic mode.
4. Depress the "REDUCT" button and adjust for a field size roughly 2" square. Depress the button a second time to return the collimator to auto.
5. Monitor the signal on Pin 10 of Card 6 (follow the foil path and pick up signal at R6). See Illustration 2-3.

Scope Settings
- Probe: See above
- Ground: Chassis
- Trigger: DC Int
- Vert: 1V/div (with 10X probe)
- Hoz: 0 1 sec/div

ILLUSTRATION 2-3
CARD 6
6 Operate "manual set switch S28, on Card 5 to cycle the blades. Press to close blades, release to open.

7 Adjust A6R102 (GAIN) and recycle blades until waveform appears as in Illustration 2–4. Adjust for minimum rise and fall times with no overshoot or adjust for blade oscillation and then back off. If blade oscillation occurs when collimator is rotated to beam horizontal (collimator in auto mode) you will have to back off on the adjustment slightly.

![Waveform Image]

**Note**

Overdamping will result in a system that does not respond to small changes in SID. This will cause inaccurate field size control. When adjustments are complete, the blades should respond smoothly to changes in SID.

8 You have completed the damping adjustment for the lateral blades. Repeat steps 5, 6, and 7 for the longitudinal blades. Connect probe to pin 10 of Card 8 (follow the foil path and pick up signal at R6) and use A8R102 (GAIN) to make the adjustment. Leave Card 6 on the extender for the next test.
Motor Stall Adjustment

The objective is to ensure that the blades do not slam together when they are driven to the fully closed position. There should be no audible blade knock upon closure. A very slight gap (less than a millimeter) is permissible.

1. Depress the "REDUCT" button on the collimator and use the thumbwheel to bring the lateral blades to the fully closed position. The lateral blades are the ones that control the lateral field dimension.

2. Connect the DMM to the junction of R7 and R43 on Card 6 (see Illustration 2-3). The voltage should be between 0.0 and -0.03 VDC. Make no adjustments yet.

3. Check that the lateral blades do not bump when the thumbwheel is rotated to the fully closed position. If the blades make an audible knock, adjust R78 (Offset) on Card 6.

If the voltage from Step 2 does not remain within the specified range when the blades are closed, the physical position of the blade-driven potentiometer within the collimator head will have to be readjusted. Refer to Step 4 for the adjustment procedure. If the voltage is within the specified limits, go directly to Step 5.

4. If it is necessary to readjust the blade-driven potentiometer (Illustration 2-5), proceed as follows:
   a. Remove the nameplate by removing the two screws from the top front of the collimator.
   b. Tilt nameplate forward and unplug leads to keyswitch and indicator lights.
   c. Loosen the clamp holding the pot.
   d. Rotate the body of the pot until the voltmeter reading is between 0.0 and -0.03 VDC.

Note: If this range cannot be achieved, make sure that R78 is set near mid-range.

   e. Tighten the clamp. Leave nameplate off until longitudinal blades have been checked.

5. Connect the DMM to TP1. The voltage must not exceed 3 volts. If it does, readjust R78 to bring the voltage closer to zero.

6. Repeat Steps 1 through 5 for the longitudinal blades. Use Card 8 for the adjustments. When finished, replace the nameplate on the collimator.
ILLUSTRATION 2-5
RE-ADJUSTING THE BLADE-DRIVEN POTENTIOMETER

LOosen POT CLAMPS BY BACKING SCREWS OUT SLIGHTLY

LONGITUDINAL BLADE-DRIVEN POT

TRANSVERSE BLADE-DRIVEN POT
2-9  Field Size Adjustment for Table with Cassette Size Sensing

Note: If there is a light mask between the collimator cover and the mylar window remove it temporarily. The mask should not be replaced if the x-ray tube has a 15” or larger target angle.

1. Position the table horizontal and align the x-ray tube with the table Bucky at a SID of 40” or 44” depending on whether the collimator field size indicator drum has a 40” or a 44” scale (measure accurately). Use the collimator tape with the tab extended and note that the film plane is 20” beyond the front surface of the cassette. Insert a 5” x 7” cassette at this time if you have one. Any size will do, however for measuring the SID with the collimator tape.

2. Assemble the RAT fixture according to Illustration 2-6 and slide the fixture onto the cone tracks of the collimator, taking care not to change the vertical position of the x-ray tube.

3. Place the 40” (or 44”) SID RAT pattern onto the fixture with the north/south axis of the pattern parallel to the longitudinal axis of the table. Centering in not important.

4. Initial sizing will be done by observing the position of the pointers on the collimator. Fine tuning will be done via the light field. If necessary, the tube can be repositioned laterally and longitudinally so as to place it near the person making adjustments at the electronics package. Be extremely careful not to change the vertical position of the tube.

ILLUSTRATION 2-6
RAT FIXTURE
At this point there are numerous options for setting up the field sizes, depending on the sizes of cassettes available. One thing that is not optional is that the small field sizes must be set before the large field sizes.

Also, the adjustments are interactive between small and large sizes so you must go back and check small sizes again after large sizes are set up.

The following steps are convenient if 5” x 7” and 14” x 17” cassettes are available.

**Note**

If a 5” x 7” cassette is not available, use the smallest size you can get and change the instructions accordingly.

5. Insert a 5’ x 7’ cassette into the Bucky tray with the 5” dimension along the table lateral axis. See Illustration 2-7.

6. With the x-ray tube in a position where the pointers are easily visible and with the collimator field size indicator drum rotated to the 40 (or 44”) SID scale, make the adjustments indicated in the following diagrams.
7. Observe pointer **R115** must set 5'' dimension **R112** must set 7'' dimension

8. Observe pointer **R91** must set 17'' dimension **R97** must set 14'' dimension

9. Observe light field **R115** must set 7'' dimension **R112** must set 5'' dimension

10. Observe light field **R91** must set 14'' dimension **R97** must set 17'' dimension
Since the small and large field size adjustments are interactive, you may find it necessary to repeat Steps 9 and 10 one or more times before the system will track the various cassette sizes properly. Verify proper operation by testing with a variety of cassette sizes. Verify repeatability by cycling between large and small fields via the REDUCT button. Proper operation is achieved when the system maintains field dimensions within 1/2" of the cassette size (preferable not oversized).

11 Angulate the table to 90° vertical. Position the x-ray tube as for an exam at the SID #1 position. It may be necessary to secure the RAT pattern with a paper clip or alligator clip to prevent it falling off the RAT fixture.

12 Energize the collimator lamp and, if necessary, adjust A9R89 (Table SID #1) so that the light field covers 14 by 17 units corresponding to the 14 by 17 cassette which should still be in place in the table Bucky tray. Right LED lit?

13 Likewise adjust A9R91 (Table SID #2) and A9R93 (Table SID #3) if these SID's have been provided for the vertical table. Position the x-ray tube accordingly. Be sure to change RAT patterns according to the selected SID. Remove the cassette when finished.
Field Size Adjustments for Tilting Vertical Buckys

1. Rotate the image receptor 180° clockwise or counterclockwise, and angulate it backward to horizontal. Release the legs and lower the unit until the legs touch the floor (the lower height switch should now be actuated).

2. Insert a 5" x 7" cassette. See Illustration 2-8. If a 5" x 7" cassette is not available, use the smallest size you can get and change the instructions accordingly. If you are absolutely certain about how the equipment will be oriented for these procedures, you may proceed. Otherwise, ask the chief x-ray technician to come in and align the equipment as desired. Techniques requiring use of the vertical Bucky with the receptor horizontal sometimes also require that the gooseneck be rotated to one side or the other or that the collimator be rotated with respect to the x-ray tube. The conventional "lateral" and "longitudinal" directions may become reversed. It would be embarrassing to discover that you had adjusted the system to produce 14" x 17" fields that are rotated 90° with respect to the film.

3. Having positioned the x-ray tube in the appropriate orientation, adjust the SID to 40" or 44" depending on which scale is installed on the collimator field size indicator drum. Measure accurately. Use the collimator tape with the tab extended and note that the film plane is 20" beyond the front surface of the cassette.

4. Assemble the RAT fixture according to Illustration 2-6 and slide the fixture onto the cone tracks of the collimator, taking care not to change the vertical position of the x-ray tube.

5. Place the 40' (or 44') SID RAT pattern on the fixture. Centering is not important.

6. Initial sizing will be done by observing the position of the pointers on the collimator. Fine tuning will be done via the light field. If necessary, the x-ray tube can be repositioned laterally and longitudinally (do not rotate gooseneck) so as to place it near the person making adjustments at the electronics package. Be extremely careful not to change the vertical position of the x-ray tube.

At this point, there are numerous options for setting up the field sizes, depending on the sizes of cassettes available. One thing that is not optional is that the small field sizes must be set before the large field sizes. Also, the adjustments are interactive between small and large sizes so you must go back and check small sizes again after large sizes are set up.

The following steps are convenient if 5" x 7" and 14" x 17" cassettes are available.

7. Follow the instructions in the following diagrams. The indicated pot must control the indicated dimension. Otherwise, the cassette orientation is wrong.
8 Observe pointer \textbf{R109 must} set 5" dimension \textbf{R106 must} set 7" dimension

9 Observe pointer \textbf{R89 must} set 17" dimension \textbf{R95 must} set the 14" dimension

10 Observe field light \textbf{R109 must} set 7" dimension \textbf{R106 must} set the 5" dimension

11 Observe field light \textbf{R89 must} set 14" dimension \textbf{R95 must} set the 17" dimension
12 Since the small and large field size adjustments are interactive you may find it necessary to repeat Steps 10 and 11 one or more times before the system will track the various cassette sizes properly. Verify proper operation by testing with a variety of different size cassettes. Verify repeatability by cycling between large and small fields via the REDUCT button. Proper operation is achieved when the system maintains field dimensions within 1/2" of the cassette size (preferably not over size).

13 Move the image receptor up to the second SID (upper height switch should be actuated). Maintain the 40" (or 44") SID. The 14" x 17" cassette should still be in place.

14 Energize the collimator lamp, and, if necessary, adjust A9R101 (Bucky height #2) so that the size of the light field corresponds to the size of the film cassette. Right LED lit?

15 Reposition the Bucky and x-ray tube as for a chest exam at the first horizontal SID.

16 If necessary adjust A9R95 (Wall SID #1) so that the light field corresponds to the size of the cassette. Be sure the RAT pattern corresponds to the selected SID. Right LED lit?

17 Likewise adjust the field sizes for the second and third SID's (if so equipped), using A9R97 (Wall SID #2) and A9R99 (Wall SID #3), respectively. Be sure to change the RAT pattern according to the selected SID.
2-11 Field Size Adjustments for Non–Tilting Vertical Buckys

1. Position the Bucky and x-ray tube as for a chest exam at the first horizontal SID.

2. Insert a 5’ x 7’ cassette. See Illustration 2-9. If a 5” x 7” cassette is not available, use the smallest size you can get and change the instructions accordingly.

3. Having positioned the x-ray tube in the appropriate orientation, adjust the SID to 40” or 44” depending on which scale is installed on the collimator field size indicator drum. Measure accurately. Use the collimator tape with the tab extended and note that the film plane is 20” beyond the front surface of the cassette.

4. Assemble the RAT fixture according to Illustration 2-6 and slide the fixture onto the cone tracks of the collimator, taking care not to change the horizontal position of the x-ray tube.

5. Place the 40” (or 44”) SID RAT pattern on the fixture. Centering is not important.

6. Initial sizing will be done by observing the position of the pointers on the collimator. Fine tuning will be done via the light field. If necessary, the x-ray tube can be repositioned laterally and vertically so as to place it near the person making adjustments at the electronics package. Be extremely careful not to change the longitudinal position of the x-ray tube.

At this point, there are numerous options for setting up the field sizes, depending on the sizes of cassettes available. One thing that is not optional is that the small field sizes must be set before the large field sizes. Also, the adjustments are interactive between small and large sizes, so you must go back and check small sizes again after large sizes are set up.

The following steps are convenient if 5” x 7” and 14” x 17” cassettes are available.

7. Follow the instructions in the following diagrams. The indicated pot must control the indicated dimension. Otherwise, the cassette orientation is wrong.
8. Observe pointer $R_{109}$ must set 5" dimension $R_{106}$ must set 7' dimension

9. Observe pointer $R_{89}$ must set 17" dimension $R_{95}$ must set the 14' dimension

10. Observe field light $R_{109}$ must set 7" dimension $R_{106}$ must set the 5" dimension

11. Observe field light $R_{89}$ must set 14" dimension $R_{95}$ must set the 17" dimension
12 Since the small and large field size adjustments are interactive, you may find it necessary to repeat Steps 10 and 11 one or more times before the system will track the various cassette sizes properly. Verify proper operation by testing with a variety of different size cassettes. Verify repeatability by cycling between large and small fields via the REDUCT button. Proper operation is achieved when the system maintains field dimensions within 1/2" of the cassette size (preferably not over size).

13 Reposition the Bucky and x-ray tube as for a chest exam at the second horizontal SID.

14 If necessary, adjust A9R97 (Wall SID #2) so that the light field corresponds to the size of the cassette. Be sure the RAT pattern corresponds to the selected SID light LED lit?

15 Likewise, adjust the field sizes for the third SID (if so equipped), using A9R99 (Wall SID #3). Be sure to change the RAT pattern according to the selected SID.

2-12 Field Size Adjustments for Chest Units Using a Fixed Size (14 x 17) Image Receptor

1 Position the equipment as for a chest exam at the largest SID position (SID #3) light LED lit?

2 Insert a cassette or transport a film.

3 Assemble the RAT fixture as per Illustration 2–6 and slide it onto the collimator cone tracks.

4 Select a RAT pattern of the appropriate SID and attach it to the fixture. A single paper clip or alligator clip may be required if the vinyl surfaces will not stick to each other.

5 Turn on the collimator lamp and adjust A10R88 (Lat Fixed) and A10R94 (Long Fixed) as required so that the light field size is 14 by 17 units.

6 Reposition the tube to SID #2, change the RAT pattern as appropriate, and adjust A9R97 to maintain a 14 unit by 17 unit light field light LED lit?

7 Repeat Step 6 for SID #1 using A9R95 for the adjustment.
2–13  Field Size Adjustments for Chest Units with Multiple Size Cassette Capability

Note

Direction 46–014138 "Interface Kit for Positive Beam Limiting on Chest Stands", contains information for interfacing the chest unit and the collimator.

1. Place Card 11 on an extender.
2. Position the equipment as for a chest exam at the largest SID position (SID #3) with LED lit?
3. Assemble the RAT fixture as per Illustration 2–6 and slide it onto the collimator cone tracks.
4. Select a RAT pattern of the appropriate SID designation and attach it to the fixture. A single paper clip or alligator clip may be required if the vinyl surfaces will not stick to each other.
5. Monitor the voltage at Pin 10 of Card 11 (point A in Illustration 2–9).
6. Insert a 14” x 17” cassette.
7. Adjust the potentiometer in the chest unit so as to produce the voltage listed in Table 2–1. You will be adjusting the pots for the transverse (horizontal) dimension.
8. Continue in the same manner for each size of cassette that can be used with the chest unit.
10. Repeat Steps 6 through 8 for the longitudinal (vertical) dimension.
11. Monitor the voltage at TP6 Card 11 and adjust A11R109 to produce 0.5 volt per inch for the film's transverse dimension.

TABLE 2-1
ADJUSTING THE POTENTIOMETER

<table>
<thead>
<tr>
<th>FILM LENGTH (VERTICAL) OR WIDTH (HORIZONTAL)</th>
<th>*DC VOLTAGE, POT WIPER TO SIGNAL GROUND **(6 84VDC ACROSS POTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5”</td>
<td>040</td>
</tr>
<tr>
<td>7”</td>
<td>140</td>
</tr>
<tr>
<td>8”</td>
<td>1 90</td>
</tr>
<tr>
<td>10”</td>
<td>290</td>
</tr>
<tr>
<td>11”</td>
<td>340</td>
</tr>
<tr>
<td>12”</td>
<td>390</td>
</tr>
<tr>
<td>14”</td>
<td>490</td>
</tr>
<tr>
<td>17”</td>
<td>640</td>
</tr>
</tbody>
</table>

Note

Be sure points C and C are at ground within a few millivolts. See Schematic IC.

Note

This table may be interpolated for other film sizes.

'Measure from 1P3–C (or A11R18) to A11TP11 for LAT (transverse or horizontal dimension (point A to TP11)) and 1P3–B (or A11R30) for LONG (vertical dimension (point B to TP11)).

**A11TP2 to signal ground (A11TP11)
12 Likewise, monitor the voltage at TP5 and adjust A11R106 to produce 0.5 volt per inch for the film's longitudinal dimension.

13 Energize the collimator lamp and observe that the light field size, as indicated by the PAT pattern scale corresponds to the film size. If necessary, readjust A11R109 and A11R106 slightly to obtain proper sizing.

Note: If both dimensions are in error by about the same amount, the readjustment can be made in one shot with A9R99.

14 Reposition the equipment to the second SID position, change the RAT pattern accordingly, and if necessary, adjust A9R97 to obtain the proper field size.

15 Repeat Step 14 for SID #1 using A9R95 to make the adjustment.
ILLUSTRATION 2-10
PARTIAL SCHEMATIC OF CARD A11, SENTRY III

NOTE: FOR COMPLETE INTERCONNECTION INFORMATION SEE APPROPRIATE INTERFACE DIAGRAM

ILUSTRATION 2-11
COMPONENT LOCATIONS FOR A11 CARD
ILLUSTRATION 2-12
HHS DEFINITION OF FIELD EDGES

X"  CENTER OF FILM

25% OF MAX DENSITY

ANODE CUTOFF

LEAD FINGER CUTOFF

CONSTRUCT THESE LINES AT POINTS WHERE THE DENSITY IS 25% OF MAX
2-14 Adjustment of Quantamat Film Area
Switching for Systems with Ion Chambers

Note

Place Card 11 on an extender. The adjustment is only performed once regardless of the number of ion chambers. The tube need not be aligned to the receptor with the ion chamber - any receptor will do.

1. Insert a 14’ x 17” cassette or transport a film.
2. Set the SID to 40’ or 44”, if possible.
3. Use the REDUCT button to establish a 13’ square field (pointer reading will suffice).
4. Measure the voltage at the junction of R45 and R93 (See Illustration 2-10).
5. Move the voltmeter to TP9 on Card 11 and adjust R121 to obtain the same voltage measured in Step 4.
6. Measure the voltage at the junction of R42 and R94.
7. Move the voltmeter to TP10 on Card 11 and adjust R118 to obtain the same voltage measured in Step 6.
2-15 Large Field Size Check

The following procedures require the production of \textit{x-rays}. Observe radiation safety rules. A lead protective screen, lead apron, or other protective medium should be used to avoid unnecessary exposure.

The x-ray tube and collimator (diagnostic source assembly) should be capable of providing a 17” transverse field at a 40” SID.

1. Position a loaded 14” x 17” cassette under the collimator (17” dimension along the transverse axis).
2. Set the focal spot 40” above the cassette (Use collimator tape).
3. Use the field light to align the tube and cassette.
4. Fully open the collimator blades in the transverse direction (Use Overnde 1 setting).
5. Install RAT fixture per Illustration 2-13 using the 40” pattern.

ILLUSTRATION 2-13
RAT FIXTURE
6 Install a loaded paper or vinyl cassette, with lead backing removed, in the RAT fixture

7 Expose both films simultaneously using 60 kV and technic settings which yielded film densities of approximately 1

8 Process films

9 Verify full transverse coverage on the 14" x 17" film. See Illustration 2-11

10 Use film in the RAT fixture as a reference only. Both films should have the same portion of the pattern exposed if the 40" SID setting is correct. If not correct the SID setting and verify that the RAT fixture contains the 40" pattern.

11 If no cutoff is observed, proceed to Section 2-16

12 If cutoff due to the lead fingers is observed, as evidenced by a very fuzzy transverse border (Illustration 2-12) proceed as follows:

13 STOP! The lead fingers affect only the front and rear of the film not the anode or cathode ends. OK, now go ahead.

14 Remove the collimator. Turn the x-ray tube beam up and remove the three 10-24 socket head cap screws. Carefully lift off the collimator and lay it down on a towel on the table. It may be necessary to tie the suspension down.

**CAUTION** Be careful! Bumping the fingers projecting from the top of the collimator could bend them.

15 Energize the system and using the thumbwheel on the upper left front of the collimator fully close the transverse blade set.

16 When the collimator blades are completely closed, the spacing of the lead fingers should be 11/64 ± 1/64" (170 ± 0.16' or 4.4 ± 4 mm). If the spacing is too little, very carefully bend the fingers apart. Some people have been surprised as how easily lead can be broken. Don't be one of them.

17 Remount the collimator per Section 1-11 of this direction, Steps 9, 10, and 11 observe torque requirements.

18 Repeat the x-ray test. If cutoff is still observed, alignment of the blade and/or shutter assemblies may be faulty in which case the collimator must be replaced.
2-16 Tube and Cutoff Check and Adjustment

Note

A mask plate is installed in the cover assembly to mask the light field, at the anode end of the tube, to agree with actual x-ray field. If 15° tube target this check and adjustment is not necessary.

In the longitudinal direction, 10° and 11° target angle tubes will exhibit anode cutoff at less than a 17° field with a SID of 40". This may also occur to some extent with a 12-1/2° tube. A light mask is provided to trim the light field on the anode end so that it conforms to the x-ray field.

The following procedures require the production of x-rays. Observe radiation safety rules. A lead protective screen, lead apron or other protective medium should be used to avoid unnecessary exposure.

1. Position a loaded 14" x 17" cassette under the collimator (17" dimension along the longitudinal axis).

2. Set the focal spot 40" or 44" above the cassette depending on which scale has been installed on the field size indicator drum (use collimator tape).

3. Use the field light to align the tube and cassette.

4. Fully open the collimator blades in the longitudinal direction (Use Override setting).

5. Install RAT fixture per Illustration 2-13 using the 40" or 44" pattern per Step 2.

6. Install a loaded paper or vinyl cassette with lead backing removed in RAT fixture.

7. Expose both films simultaneously using 60 kV and technic settings which yield film densities of approximately 1.


9. Verify full longitudinal coverage on the 14" x 17" film. See Illustration 2-12.

10. Use film in the RAT fixture as a reference only. Both films should have the same portion of the pattern exposed if the 40" or 44" SID setting is correct. If not, correct the SID setting and verify that the RAT fixture contains the proper pattern.

11. If no anode cutoff is observed, proceed to Section 2-17.

12. If anode cutoff is observed, as evidenced by a very fuzzy border on the anode side of the exposure (see illustration 2-12) proceed as follows.
13 The light field must correspond to the x-ray field. A light mask has been provided to trim the light field on the anode side, if necessary. Since anode cutoff will create a fuzzy edge, it may not be obvious where to set this mask. HHS defines the field edges as the locus of points where the intensity is 25% of maximum. The mask can be moved by loosening the two rear collimator rail mounting screws slightly while taking care not to shift the mylar target (tape the mylar target to the collimator cover while shifting the light mask). Edge of the mask projection should be located within ± 1/8” and parallel within ± 1/8” of the x-ray field pattern. Retighten two screws.

14 To determine the film size where anode cutoff occurs, measure the distance from the center of the film to the point where the film density is 25% of the maximum film density. See Illustration 2-12.

Center of film can be found by making anode cassette exposure at the same geometry as the test film but with the blades collimated down to a position less than the anode cutoff. The intersection of pencil lines drawn diagonally from each corner will indicate the center of the films. Superimpose this film with the test film to locate the center. Double this dimension to get the maximum film size allowable at 40” or 44” before anode cutoff occurs.

15 Attach the anode cutoff warning label to the collimator nameplate as shown in Illustration 2-14.

ILLUSTRATION 2-14
COLLIMATOR NAMEPLATE AND LABEL

2-17 Performance of Functional Check

To assure complete and proper operation of the collimator, perform the checks outlined in Chapter 6, Sections 1 through 3 of SM D5303C, and then Chapter 4 of SM D5303C.