



GE Medical Systems

Technical Publications

Service Manual SM A0654E
Revision 3-1684

810 lbs
WITH BATS

AMX-II X-Ray Unit

Product

Operating Documentation

DAMAGE IN TRANSPORTATION

All packages should be closely examined at time of delivery. If damage is apparent, have notation of "bad order" placed by the delivering driver on all copies of the freight or express bill. If damage is of a concealed nature, notify transportation agent as soon as possible to make an "inspection report of damage" but in any event not later than 15 days after delivery. A transportation company usually will not pay a claim for concealed damage if an inspection is not requested within this 15 day period. Complete instructions regarding claim procedure are found in section "S" of the Policy & Procedure Bulletins.

If shipment was handled by moving van service - uncrated - call Traffic - Milwaukee immediately when any damage is found. Do not attempt to call any local agent. At this time be ready to describe type of damage, type of equipment, serial numbers and if possible the order number.

The above paragraph is in regard to equipment requiring installation only, and does not apply to supply items. The F.O.B. point for these items is as shown in the Price Book.



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**AMX-II
X-Ray Unit**

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AMX-II X-Ray Unit

IMPORTANT!... X-RAY PROTECTION

X-ray equipment if not properly used may cause injury. Accordingly, the instructions herein contained should be thoroughly read and understood before you attempt to place this equipment in operation. The General Electric Company, Medical Systems Group, will be glad to assist and cooperate in placing this equipment in use.

Although this apparatus incorporates a high degree of protection against x-radiation other than the useful beam, no practical design of equipment can provide complete protection. Nor can any practical design compel the operator to take adequate

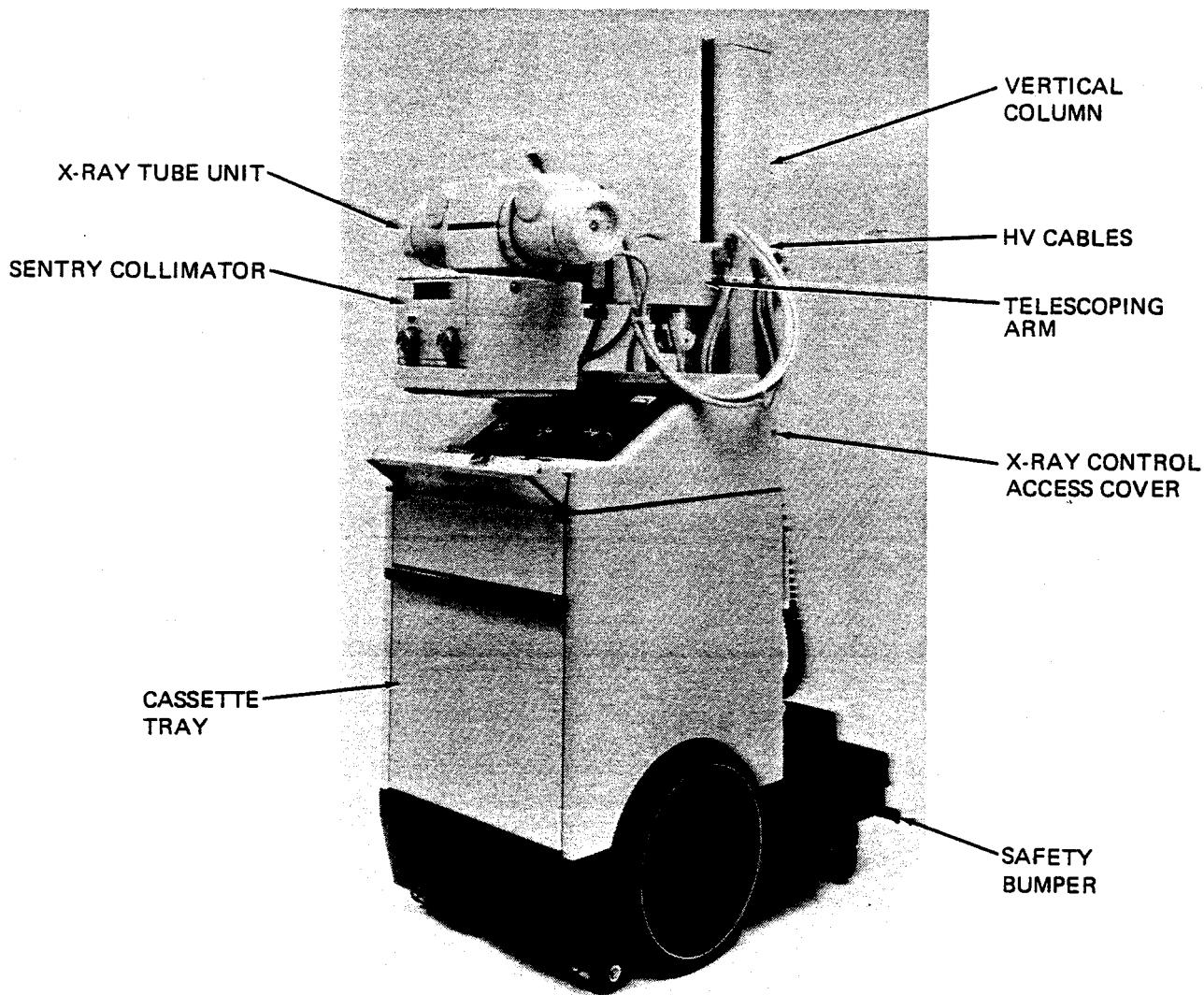
precautions to prevent the possibility of any persons carelessly, unwisely, or unknowingly exposing themselves or others to radiation.

It is important that everyone having anything to do with x-radiation be properly trained and fully acquainted with the recommendations of the National Council on Radiation Protection and Measurements as published in NCRP Reports available from NCRP Publications, 7910 Woodmont Avenue, Room 1016, Bethesda, Maryland 20814, and of the International Commission on Radiation Protection, and take ade-

quate steps to insure protection against injury.

All persons authorized to use the equipment must be cognizant of the danger of excessive exposure to x-radiation and the equipment is sold with the understanding that the General Electric Company, Medical Systems Group, its agents, and representatives have no responsibility for injury or damage which may result from exposure to x-radiation.

Various protective material and devices are available. It is urged that such materials or devices be used.



23561-P10

AMX-II X-RAY WITH
TUBE UNIT AND SENTRY COLLIMATOR

ILLUSTRATION 1-1

AMX-II X-RAY UNIT

FOREWORD

The AMX-II X-Ray Unit consists of a full wave 500 Hz single phase x-ray generator control and transformer, rechargeable battery, tube support column with x-ray tube unit and collimator, all mounted on a self-propelled mobile base.

Operation of the AMX-II X-Ray Unit consists of driving the mobile unit, positioning and making an x-ray exposure, and recharging the battery. An understanding of the specific operative steps and various switch, signaling, and lockout devices is essential. Therefore, these directions should be read carefully and thoroughly understood before attempting to operate the AMX-II X-Ray Unit.

COMPONENT	MODEL NUMBERS	NAMEPLATE LOCATIONS
Basic Unit, Control Mobile Base, Support Column 115V 50/60 Hz	46-165600G10, G12, G14, G15	Beneath exposure control Handswitch bracket on front of unit.
230V 50/60 Hz	46-165600G11	
X-Ray Tube Unit	46-155750G2, G3, G4	Cathode trim cap housing Rear Trim Cover
Collimator	46-177399G1-G2 or 46-194759G1	Bottom - Rear of Trim Cover
HV Transformer	46-150625G1	On side of transformer beneath terminal strip
Battery (cell group)	46-152812P1	End of cell group case
Extension Cylinder (optional)	46-138573G1	On body of cylinder

WARNING

Explosion Hazard - Do not use in the presence of flammable anesthetics. This X-ray equipment is dangerous to both patient and operator unless safe exposure factors are observed. Sold only to be used by or on the prescription of a licensed physician.

SAFETY PRECAUTIONS

RADIATION: Always consider providing radiation protection for your patient and yourself when operating the AMX-II.

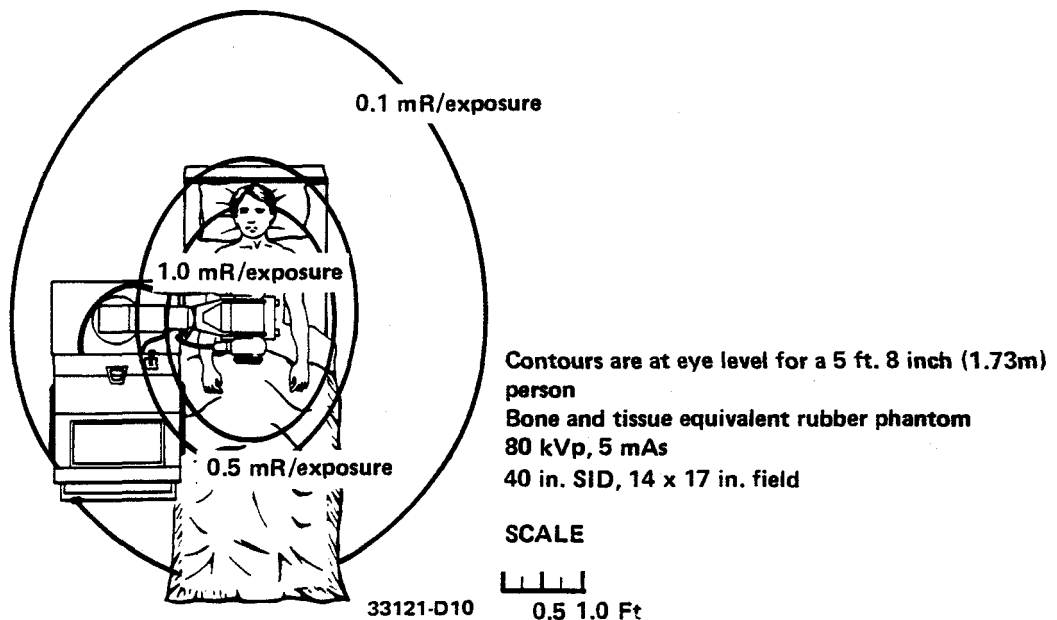
GOOD OPERATING PRACTICES

- Wear a lead apron while operating the x-ray controls of the AMX-II.
- Step back at least 6 ft. (1.8m) from the AMX-II or to the full extension of the handswitch cord before making an exposure.
- Always use the proper field sizes and technic factors for each procedure to minimize x-ray exposure and produce the best diagnostic results.
- When x-raying bed patients, move them as far as possible from nearby beds.
- Ask visitors to step outside the room during an exposure.
- Use gonadal shields for patients whenever possible.

EXPOSURE PROFILE

Illustration 1-1A shows the iso-exposure profile of the AMX-II. This profile shows the typical scattered radiation levels around an AMX-II using chest radiography technics.

NOTE: This profile is only an indication of typical scattered radiation levels. Variations in equipment performance, patient size, technic, geometry, and radiation measuring devices may cause the profile to vary slightly from the one shown here.



AMX-II ISO-EXPOSURE PROFILE
ILLUSTRATION 1-1A

Under most conditions, cumulative radiation dose to the operator will not exceed recommended maximum permissible levels. However, as with all radiation-producing devices, a qualified radiation expert should evaluate situations involving frequent exposures using high kVp and mAs technics to determine if extra protective devices are necessary.

NOTE: Recommended maximum permissible dose to the eyes is 100 mrem/week (NCRP no. 39, p. 89), where a dose of 1 mrem is produced by an exposure to 1 mR of x-radiation.

An audible tone and/or red X-RAY light indicates presence of radiation. If either indicator is on at any time other than during the expected X-RAY exposure interval, immediately release the handswitch ROTOR and/or X-RAY button and turn off main circuit breaker. Do not energize the unit again until it has been checked by a qualified x-ray serviceman.

**ELECTRICAL SHOCK
WARNING:**

This unit contains a 120 volt rechargeable battery inside the cabinet. It can cause electrical shock even when the unit is not connected to a power outlet.

The x-ray control access door, shown in Illustration 1-1, can be opened only by removing the cover. Because of the possible electrical shock and other hazards present when this cover is removed, it should be removed only by a trained x-ray serviceman when the unit requires servicing.

**BATTERY
WARNING:**

Unauthorized persons should not remove the cassette tray shown in Illustration 1-1.

The cassette tray should not be removed except by or in the presence of a person thoroughly familiar with safe nickel-cadmium battery service procedures given in Chapter 8 of the AMX-II X-Ray Unit Service Manual.

Should a metallic object come in contact with the battery terminals, a small one would vaporize and a large one would become very hot. If the object is, for example, a ring or a wrist watch, it may weld to a terminal and the wearer could be severely burned or injured by molten metal.

The Electrolyte used in nickel-cadmium batteries is a caustic solution of potassium hydroxide. Serious burns will result if it comes in contact with any part of the body.

If Electrolyte gets on the skin, wash the affected areas with large quantities of water; then neutralize skin with vinegar, lemon juice, or 3% acetic acid.

If Electrolyte gets into the eyes, flush with water and GET IMMEDIATE MEDICAL ATTENTION.

When recharging the battery, the x-ray unit must be located in a large ventilated room. During normal charging conditions and when all batteries are functioning properly, there is little or no gas emitted. Should abnormal conditions develop, there could be an accumulation of hydrogen gas which if confined in a small space would be explosive in the presence of a flame or electrical spark. Whenever the batteries are being charged, a fan ventilates the battery compartment. A hazardous situation will not develop where the overflow from this compartment is into a large room or a well ventilated small room.

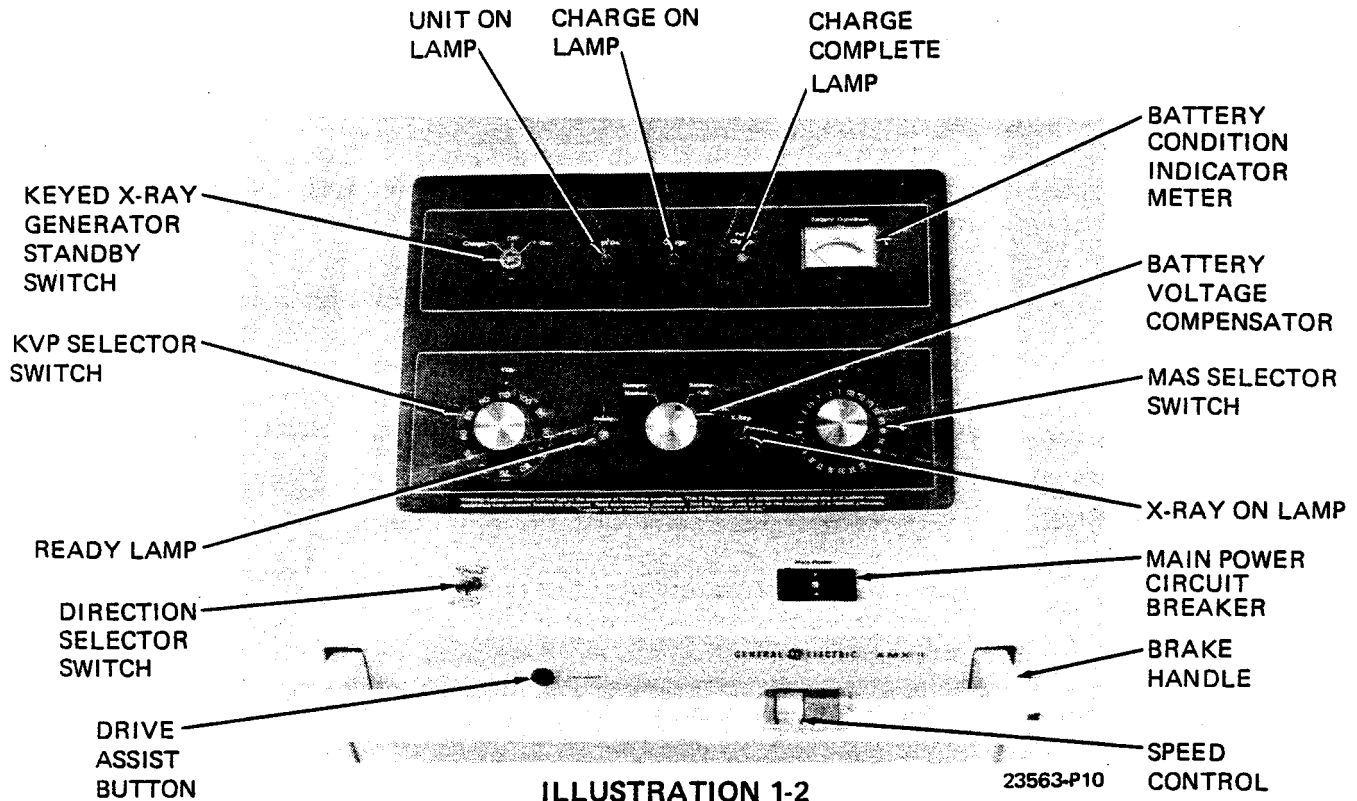


ILLUSTRATION 1-2
FUNCTIONAL DESCRIPTION

The MAIN POWER CIRCUIT BREAKER disconnects the Battery. It must be ON in order to charge the unit, drive it from one location to another, and make exposures.

The keyed X-RAY GENERATOR STANDBY SWITCH is turned to OFF when the AMX-II is being driven or is not in use, to ON for exposures, and to CHARGE when charging the batteries. A key is provided for this switch to assure that only authorized personnel operate the unit. The key should be taken out of the socket and retained by the designated operator immediately after a scheduled period of x-ray operation.

The BATTERY CHARGER recharges the internal battery from any 115v or 230v, 50-60 Hz power outlet receptacle. The unit may not be driven or an x-ray exposure cannot be made when the battery charger plug is in a power outlet receptacle.

The x-ray unit battery should be charged (as described under OPERATION) whenever the BATTERY CONDITION needle enters the red band. It should be allowed to charge until the amber CHARGE COMPLETE lamp glows, and the BATTERY CONDITION indicator needle is in the green band. Typically, the battery will charge from too low (red band) to full charge in less than 10 hours. Since the charger is self-regulating, it is permissible to have it connected to power indefinitely.

CAUTION: ALWAYS LOCATE THE UNIT IN A WELL VENTILATED ROOM WHEN CHARGING IT.

The SPEED CONTROL will vary the speed of the unit in forward or reverse. When released, it will return to the zero speed position.

The SAFETY BUMPER, located on the front of the unit, will disconnect the drive motor and stop the unit upon impact with any object.

The DRIVE ASSIST BUTTON, when pressed, will increase the low speed torque of the drive motor. It is a spring loaded button which should be used when climbing an incline or when moving over the edge of carpeting or other small floor discontinuities.

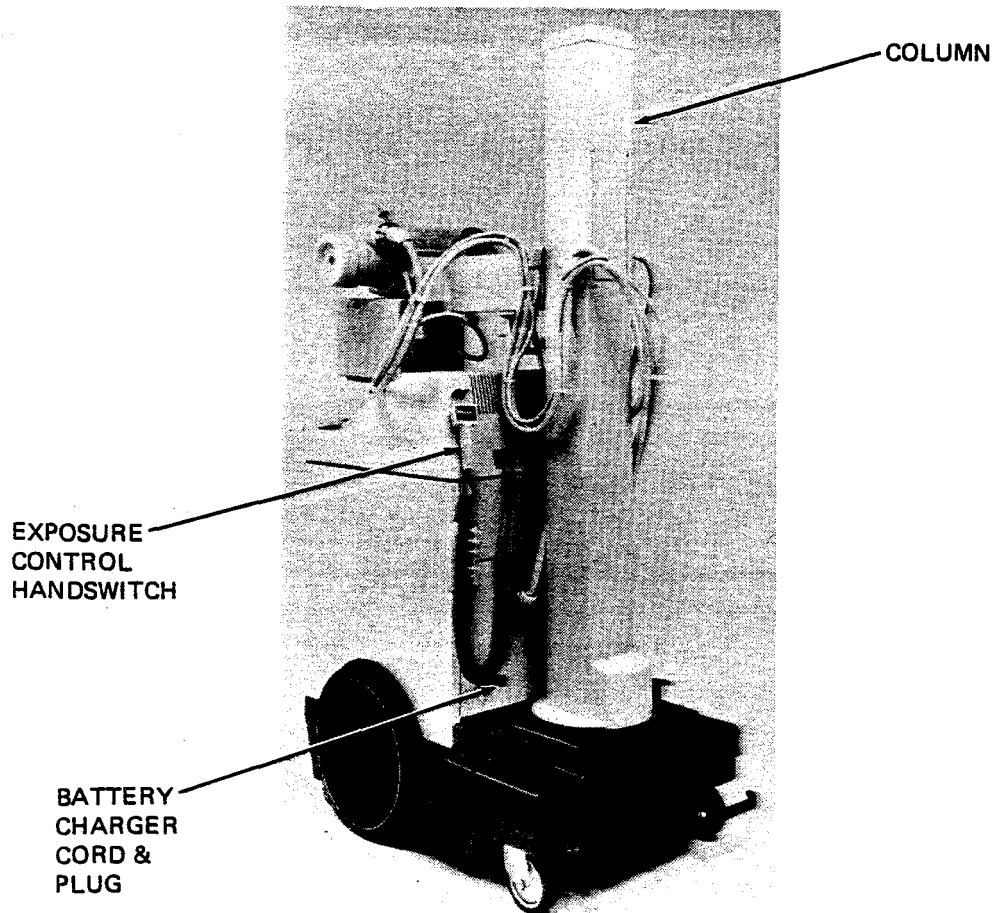


ILLUSTRATION 1-3 23564-P10

The BRAKE HANDLE is used to steer the unit, and automatically engages the brakes and disconnects the drive motor when released.

The BATTERY VOLTAGE COMPENSATOR SWITCH adjusts for variations in battery charge. When the battery meter is in the HIGH region, the switch should be in the HIGH position. As the battery charge is reduced to the LOW region, the switch should be in the LOW position. After battery charging is completed, allow the following condition for at least 15 minutes before making exposures: Keep the MAIN POWER BREAKER at ON. If the line cord is left connected, set the KEY SWITCH at CHARGE. However, if the line cord is disconnected, set the KEY SWITCH at ON.

The Remote Exposure Control Handswitch (Illustration 1-3) has ROTOR and X-RAY buttons. Provided that the red UNIT ON light is glowing, depressing the rotor button will cause x-ray tube anode rotation and filament preheating. There will be a 2.5 second delay for these functions to reach the operating point. After that delay, the white READY lamp will glow. Then the x-ray exposure will occur immediately after the handswitch X-RAY button is depressed.

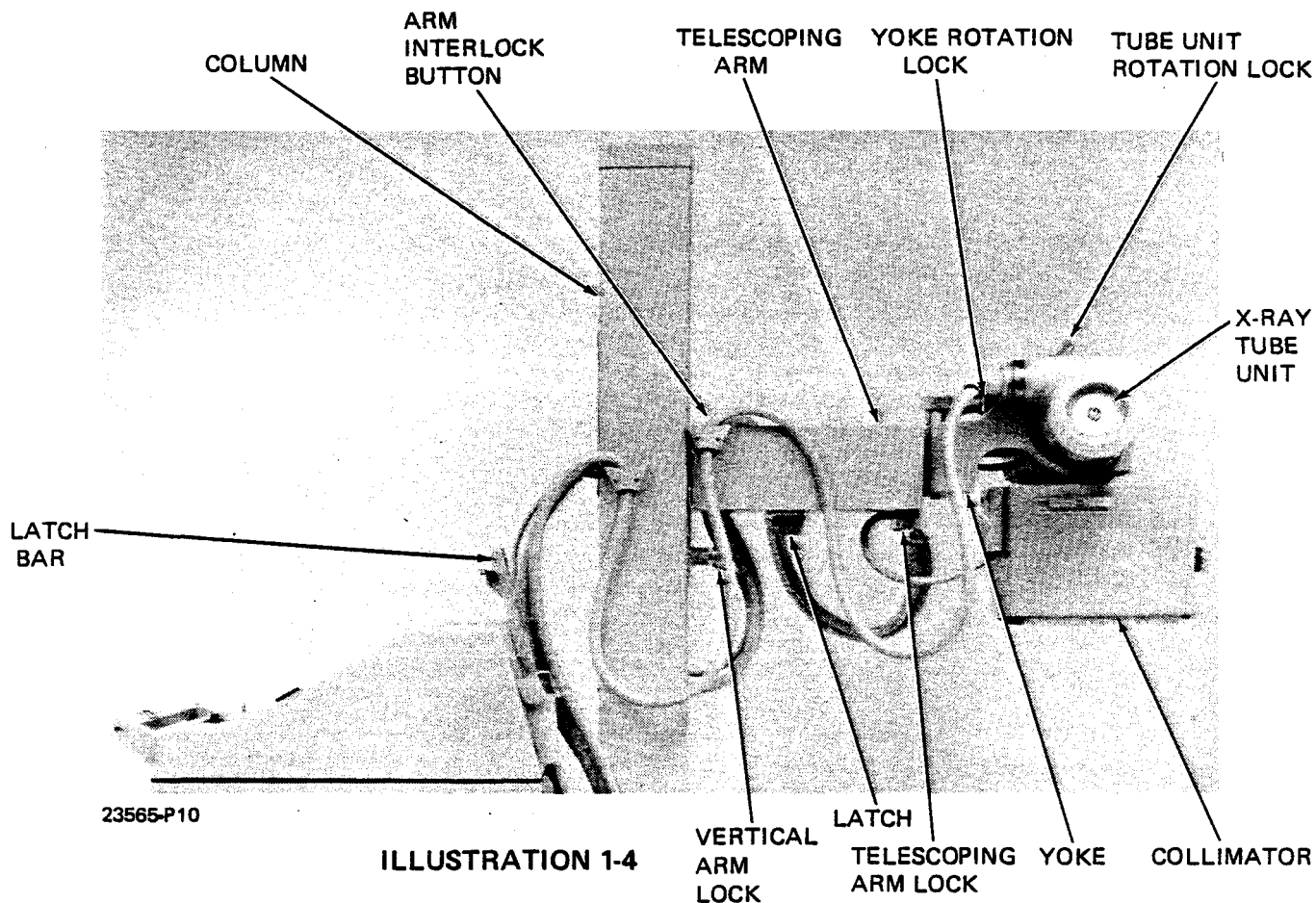
If the ROTOR and X-RAY buttons are depressed simultaneously, the x-ray exposure will occur after the 2.5 second delay and as the READY lamp flashes on.

In order to obtain an exposure, the MAIN POWER CIRCUIT BREAKER must be ON, the X-RAY GENERATOR STANDBY SWITCH must be ON, and the charger cord disconnected from the power outlet.

Glow of the red X-RAY lamp indicates that x-rays are being emitted. When the READY lamp is glowing, the X-RAY lamp will glow immediately after the handswitch X-RAY button is depressed and it will remain

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on for the time interval equal to the MAS selected divided by 100. All exposures with the AMX II will be at 100 milliamperes. Therefore, exposure time may be determined by dividing the MAS selection by 100. For example, if 300 MAS is selected, the lamp will glow for three seconds or if 2.0 MAS is selected it will glow for 0.02 seconds.

During the time that the X-Ray lamp glows, there will also be an audible tone signal to indicate that x-rays are being produced. At the low MAS selections, this signal will be a short beep. For longer exposures there will be a sustained tone.

WARNING: If either the X-RAY lamp glow or the tone signal continues longer than 3 seconds under any circumstances, immediately release handswitch ROTOR and X-RAY buttons and turn the main power circuit breaker OFF.

In such a case, another exposure should not be attempted until the unit has been examined by a qualified x-ray serviceman.

The Vertical Column supports the telescoping arm, x-ray tube unit and collimator. It rotates in a bearing structure in the base of the unit.

To rotate the vertical column, move the telescoping arm to the desired position. 360° of movement is possible. A friction brake holds the vertical column in place. If the column drifts after positioning, call for service.

The VERTICAL ARM LOCK, Illustration 1-4, will secure the telescoping arm in any position. If the arm drifts when the lock is released, call for service. If the counterbalance system should fail, a safety device locks the arm in position, and the unit must be serviced before it can be used again.

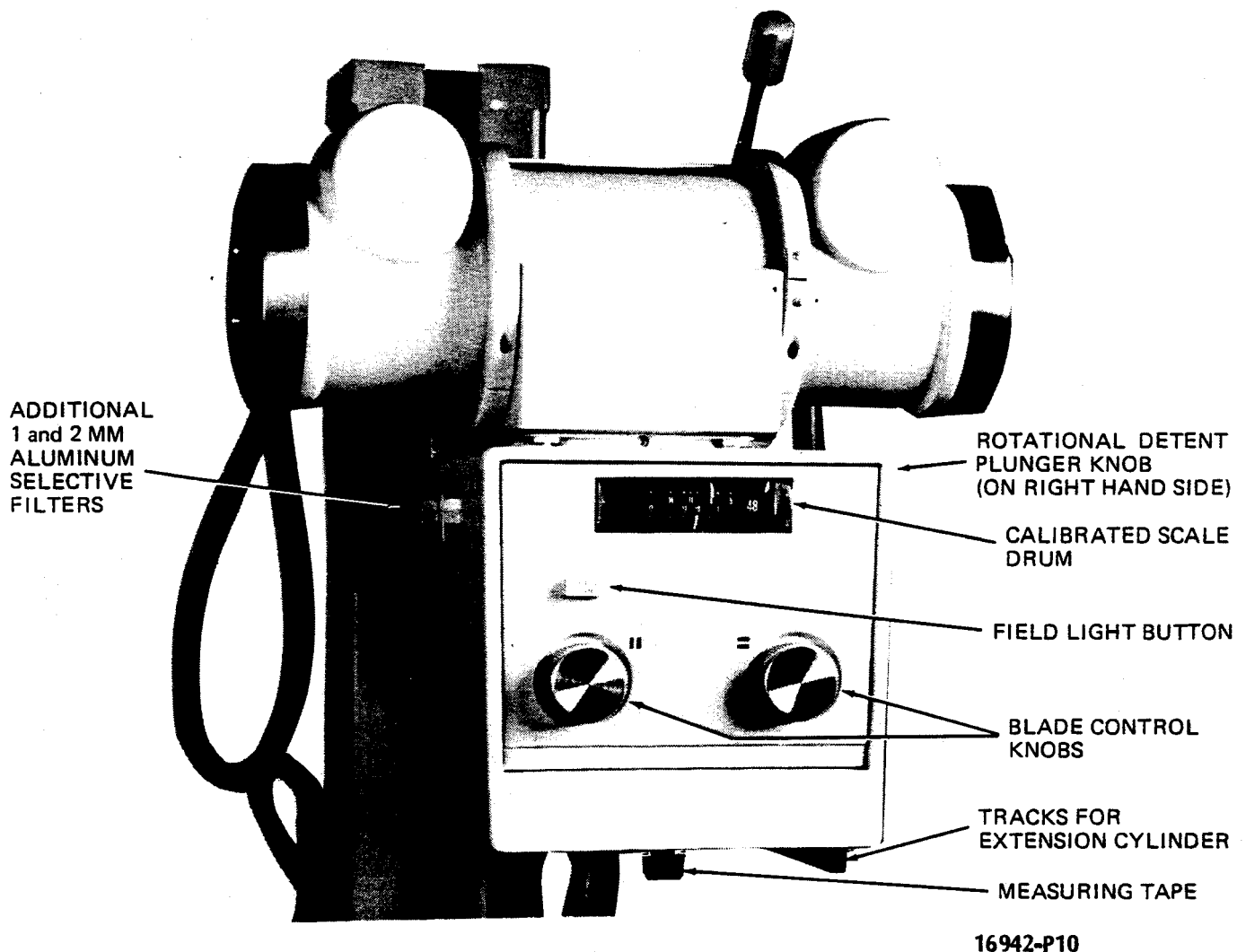


ILLUSTRATION 1-5

The **Telescoping Arm** consists of two movable sections and one stationary section. The sections extend and retract equally as the arm is repositioned.

The **TELESCOPING ARM LOCK**, located beneath the middle section, will secure the telescoping arm in any position.

The **YOKE ROTATION LOCK** allows the tube to be rotated $\pm 180^\circ$ about the horizontal axis and locked in any position.

The **ARM INTERLOCK BUTTON** will maintain the telescoping arm in the maximum retracted position.

When driving the AMX-II from room to room, the telescoping arm is secured by means of the **LATCH** and **LATCH BAR**. The telescoping arm must be in the position shown in Illustration 1-1. The **LATCH** at the bottom of the telescoping arm automatically latches to the **LATCH BAR** when they are joined. To release, rotate the latch clockwise and raise the telescoping arm.

The yoke supporting the Tube Unit can be rotated 180 degrees about the horizontal axis in either direction of the central position (x-ray port pointing straight downward). It can be positively retained in any intermediate position by the YOKE ROTATION LOCK.

The TUBE UNIT ROTATION LOCK, located on the yoke clamp, locks or releases the Tube Unit for rotation in the yoke clamps toward or away from the column. Two index lines, one on the Tube Unit and one on the yoke clamp, may be used to place the central x-ray beam axis in the vertical plane.

The X-Ray Tube Unit is an HRT - 09N with a 1.0 mm focal spot.

The Sentry Manual Collimator is used with the AMX-II X-Ray Unit. The collimator limits patient radiation exposure to a desired area at a given distance from the x-ray tube focal spot.

Minimum Source-to-Skin distance is limited to more than 30 centimeters by the tracks on the bottom of the collimator for mounting the accessory Extension Cylinder.

Area of coverage is indicated by light from a GE Quartzline® high-intensity lamp. Distinct shadow cross-hairs, which indicate the field center, aid in accurate radiographic positioning.

The collimator has a fixed minimum filtration equivalent to 1.5mm of aluminum measured at 150 kvp, so that a total filtration of 2.5mm of aluminum equivalent results from the tube-collimator combination. By inserting the 1mm and/or 2mm filter in the slot on the left side of the collimator, additional selective filtration of 1, 2, or 3mm of aluminum equivalent may be obtained.

Dial numbers on the **Calibrated Scale Drum**, Illustration 1-5, are for 40, 48, 60, and 72 inch source-to-image distances and standard film sizes of 5 through 17 inches (13 cm through 43 cm). To select the scale for one of the four source-to-image distances, rotate the drum by turning the **SCALE SELECTION KNOB** until the desired detent position is reached. Two moving pointers sweep across the scale upon actuation of the **BLADE CONTROL KNOBS** permitting easy selection of the field size. The upper pointer indicates the transverse dimension while the lower pointer indicates the longitudinal dimension.

Independent adjustment is provided by the **BLADE CONTROL KNOBS** on the face of the collimator. They allow collimating to any desired rectangular field size up to 17" x 17" (43 cm x 43 cm) at a 40" source-to-image distance. The right-hand knob controls the transverse dimension, while the left-hand knob controls the longitudinal dimension, while the left-hand knob controls the longitudinal dimension.

Depressing the **FIELD LITE BUTTON** energizes the high-intensity lamp. A timer automatically switches the light off in approximately 15 to 20 seconds to keep lamp operation at a minimum. This time interval can be adjusted by the serviceman if the user so desires.

NOTE: An interlock allows exposures and turns off the field light when x-ray rotor handswitch is energized.

The collimator can be rotated and locked positively at 0°, +/- 15°, +/-45°, and +/- 90° from the front position by detent. Depress the **ROTATIONAL DETENT PLUNGER KNOB** on the right side of the collimator to move it from a detent position. Keep the plunger knob depressed until the approximate position desired is reached. Then release the button and rotate the collimator slightly about this position until the lock snaps in place.

A **Measuring Tape** is provided on the center line of the bottom of the collimator housing. It is calibrated in inches and centimeters for measuring source-to-image distances. The correct source-to-image distance is indicated by having the bottom of the collimator housing even with the marking on the tape which corresponds to the desired source-to-image distance. For accurate measurements, have the tape tab on the end of the tape straight down, not perpendicular to the tape.

Parallel tracks on the bottom of the collimator housing accept an optional extension cylinder. Slide the extension cylinder into the tracks from the front of the collimator until the cylinder latch snaps into the slot on the right track. Press the latch to release the cylinder for removal. The added weight of the extension cylinder will affect the counterbalance of the vertical column. Lock the vertical arm when installing or removing the extension cylinder and apply extra caution when positioning the unit with the extension cylinder installed.

OPERATION

Before operating the unit read the **Warning** on page 1 and the **Safety Precautions** on page 2.

Driving the Mobile Unit

1. Loosen the Telescoping Arm Lock and withdraw the arm until the interlock button is heard to click. Tighten the Telescoping Arm Lock.
2. Remove the Extension Cylinder, if used.
3. Rotate the column until the arm is facing the operator.
4. Loosen the Vertical Arm Lock and slowly lower the arm until the latch and latch bar are seen to engage. Secure the Carriage Lock.
5. Check that the Yoke Rotation Lock and Tube Rotation Lock are secure.
6. Be sure the charger cable plug is removed from a power outlet and retracted.

CAUTION: WHEN DRIVING THE UNIT THROUGH DOORS, BE SURE TO PARK THE TUBE UNIT AS SHOWN ON ILLUSTRATION 1-1 TO PREVENT STRIKING DOOR CASINGS AND DAMAGING THE TELESCOPING ARM.

7. Turn the Main Circuit Breaker to ON.
8. Move the Direction Switch to FORWARD or REVERSE as desired.
9. Depress the Brake Handle.
10. Rotate the Speed Control toward the x-ray control to increase speed.
11. Steer the unit with the Brake Handle.
12. To aid in climbing ramps or moving the unit onto thick carpeting, press the Drive Assist Button with the left thumb while keeping the Brake Handle depressed.

CAUTION: DRIVE ASSIST OPERATION IS NOT RECOMMENDED WHILE POSITIONING THE UNIT FOR RADIOGRAPHS OR WHILE MANEUVERING THE UNIT THROUGH DOORWAYS OR CONGESTED CORRIDORS.

13. If the Bumper contacts any object when moving forward, the unit will stop. To regain drive control, the unit must be manually pushed back.


CAUTION: DO NOT DEPRESS THE BRAKE HANDLE WHEN THE SPEED CONTROL IS SET TO FULL SPEED. ALWAYS START AT ZERO SPEED.

Positioning and Making an Exposure

This operative procedure presupposes that preliminary steps have been completed. These include positioning the patient, placing the cassette in position, selecting KVP, MAS, etc.

1. Check that charger cable plug is removed from the power outlet.
2. Release the LATCH and raise the telescoping arm.
3. Rotate the column so the arm points in the desired position.
4. Loosen the Telescoping Arm Lock, push the interlock button, extend the arm and lock it into position.
5. Adjust the Telescoping Arm to the desired source-to-image distance. Use the measuring tape in the collimator.

NOTE: As an aid in positioning the unit, it may be driven with Telescoping Arm unlatched from the Latch Bar. Use of the Drive Assist Button is not recommended with the Telescoping Arm unlatched.

6. Turn the keyed X-Ray Generator Standby Switch to the ON position. The UNIT ON light will glow red. The BATTERY CONDITION indicator needle must swing into the green band. If it does not, the batteries must be recharged. Check to see that the battery voltage compensator switch is in the position indicated by the battery condition indicator.
7. Rotate the collimator until the crosshairs from the Field Light align in the desired position.
8. Collimate to the desired film size with the Field Light.
9. Depress the handswitch ROTOR button. There will be a 2.5 second delay before the white READY light will glow.
-  10. After ready lite glows, depress the handswitch X-Ray button. An audible tone signal will sound and the red X-RAY light will glow during the time that x-rays are emitted.

WARNING: IF EITHER THE LAMP GLOWS OR THE AUDIBLE SIGNAL CONTINUES FOR MORE THAN 3 SECONDS, RELEASE THE ROTOR AND X-RAY BUTTONS AND TURN THE MAIN POWER CIRCUIT BREAKER OFF. IN THIS CASE, DO NOT ATTEMPT ANOTHER EXPOSURE UNTIL THE UNIT HAS BEEN CHECKED BY A QUALIFIED SERVICEMAN.

11. Check the Battery Condition Meter between exposures. If the meter reads in the red region after one minute rest, the batteries must be recharged as described below.
12. Turn the X-RAY Generator Standby switch to OFF when completed.
13. The unit may be driven to a new location. Prepare the unit for transport as described previously. Only the MAIN POWER CIRCUIT BREAKER should be ON while driving.

Recharging the Battery

Battery recharging is required only when the BATTERY CONDITION METER reads in the RED band after a one minute rest. Charging is recommended only when the battery condition meter indicates a need. The battery should not be routinely charged between patients. When charging is necessary, the battery is automatically protected from overcharging.

1. With the unit prepared for transport as described previously, drive the entire mobile unit to within 15' of a 115 or 230V, 50-60 Hz power outlet in a ventilated area. Check that the power outlet matches the nameplate rating of the basic unit. The nameplate is located beneath the exposure hand-switch bracket.

CAUTION: ALWAYS LOCATE THE UNIT IN A WELL VENTILATED ROOM WHEN RECHARGING THE BATTERY.

2. Move the Main Power Circuit Breaker to ON. Insert the extension cord into the power outlet. The cord is stored on a reel inside the mobile unit cabinet. Upon pull and slow release, the cord remains extended the desired length.
3. Turn the Standby Switch to CHARGE. The BATTERY CONDITION indicator needle will swing toward the green band and the fan will run. The CHARGE ON lamp will glow red. The battery is now charging.

4. The BATTERY CONDITION indicator will show battery charge level. When the white CHARGE COMPLETE Lamp comes on the battery charge has been completed. The unit may be left with the charger connected without damage to the equipment.
5. To disconnect the charger, turn the Standby Switch and the Main Power Circuit Breaker to OFF. Remove the plug from the power outlet. Pull the extension cord and release it quickly. The take-up reel will coil the cord into the cabinet.
6. Allow a minimum interval of 15 minutes after charge completion, with key switch in "ON" or "CHARGE" position and main power circuit breaker "ON", before making an exposure.

RATINGS AND SPECIFICATIONS

Power Requirements

Power for this unit is obtained from a rechargeable 120 v battery housed inside the mobile base cabinet.

Capacity of the battery when fully charged is approximately 10,000 MAS at 100 KVP. However, actual MAS capacity will depend on battery condition, use of collimator lamp, time rotor is held on, and distance motor drive is used.

Power requirements for recharging the battery: 110 to 120VAC 50/60 Hz 6.0 Amps
210 to 240VAC 50/60 Hz 3.0 Amps

Battery Charge

The minimum battery charge for operation of the unit is that the Battery Condition Meter read in either of the two green bands prior to the initiation of the x-ray exposure.

Motor Drive Ratings

The AMX-II may be driven at speeds up to a maximum of 180 feet per minute (54.9 meter per minute) on a smooth, hard surfaced, level floor. Attainable speed will be reduced by inclines, carpeted, or soft surfaced floors. The Drive Assist feature primarily increases the low speed torque and has little effect on maximum speed. With Drive Assist the unit is capable of climbing a 6 degree incline on a tiled or similar surface. Battery drain varies according to the speed, distance, type of surface, and incline.

X-Ray Generator Ratings and Duty Cycle

Maximum Ratings

All radiographic exposures with this unit are at 100 milliamperes.

<u>KVP (MAXIMUM)</u>	<u>MAS (MAXIMUM)</u>
110	200
100	250
50 to 90	300

All ratings and duty cycles are subject to limitations of the x-ray tube rating and apply at altitudes up to 8000 feet, (24.38 kilo meters) average relative humidity not exceeding 80%, and ambient temperature between 60°F (15.6°C) and 100°F (37.8°C).

Technic Factor Deviations

The maximum deviation from the selected setting during radiographic exposure is as follows:

SELECTION AND RANGE	ACCURACY AS STATED IN (MEDIAN*) + VARIATION**
MAS	
1 MAS	(+/- 40% + .35MAS) +/- .27 MAS
1.5 MAS	(+/- 33% + .30MAS) +/- .27 MAS
2 MAS	(+/- 21% + .32 MAS) +/- .28 MAS
2.5 MAS to 4 MAS	(+/- 14% + .39 MAS) +/- .30 MAS
5 MAS to 8 MAS	(+/- 8% + .40 MAS) +/- .32 MAS
10 MAS	(+/- 7% + .40 MAS) +/- .32 MAS
12 MAS to 300 MAS	-7% to +10%

* Represents the range of possible median values for any given machine.

** Represents the range of possible variation between exposures at fixed technic for any given machine.

KVP	
50 KVP to 110 KVP	(+ (10 KVP +7%)) (- (5 KVP + 7%)) of dial reading after first 20 milliseconds of exposure
50 KVP to 95 KVP	(+ (20 KVP +7%)) (- (5 KVP +7%)) of dial reading during first 20 milliseconds of exposure.
100 KVP to 110 KVP	(+ (25 KVP +7%)) (- (5 KVP + 7%)) of dial reading during first 20 milliseconds of exposure.

Conditions required to achieve the above accuracies:

1. The Battery Condition Meter must be in either of the two green bands.
2. Allow a minimum interval of 15 minutes after charge completion with key switch in "ON" or "CHARGE" position, and main power circuit breaker "ON", before making an exposure.

Measurement Criteria:

Kilovoltage: Generated high voltages at anode and cathode are reduced by a precision voltage divider, Catalog C1515A. Resulting peak values are observed on a calibrated dual channel oscilloscope using algebraic addition. For procedure, see Chapter 5 of Service Manual SM A0654E.

MAS is within stated accuracy when:

1. The tube current (MA), measured with a DC milliammeter (1% accuracy) inserted into the tube current line, is adjusted to within accuracies described in Chapter 4 of Service Manual SM A0654E.
2. Time, measured as the duration of the peak kilovoltage applied to the x-ray tube using the voltage divider and oscilloscope for kilovoltage measurement, is adjusted to within accuracies described in Chapter 4 of Service Manual SM A0654E.

MAS can be measured directly with a DC MAS Meter (Fluke 8000A/W MAS option or equivalent) inserted into the tube current line as described in Chapter 4 of Service Manual SM A0654E.

Tube Unit Ratings

The tube unit meets federal regulations of leakage radiation when operated continuously at leakage technic factors of 130 kvp, 1.5 ma.

Minimum inherent filtration of the tube unit is 1.0 mm Aluminum equivalent, measured at 130 kvp.

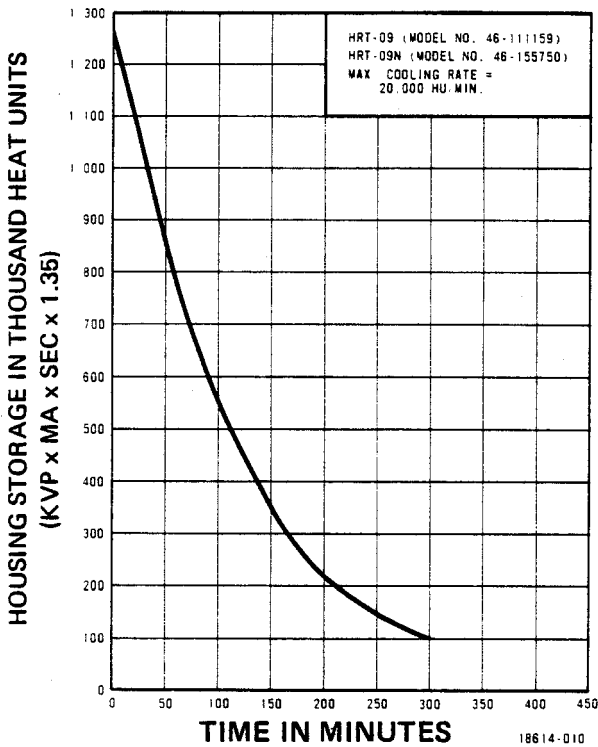
The tube ratings for this unit are given in the Rating Chart that follows. They are based on operation with a 1-mm focal spot, 15 degree target angle, 3400 RPM, at 500 Hz, the frequency at which the AMX-II operates. When calculating heat input to the anode or tube unit, use the following:

$$\text{HEAT UNITS} = \text{KVP} \times \text{MAS} \times 1.35$$

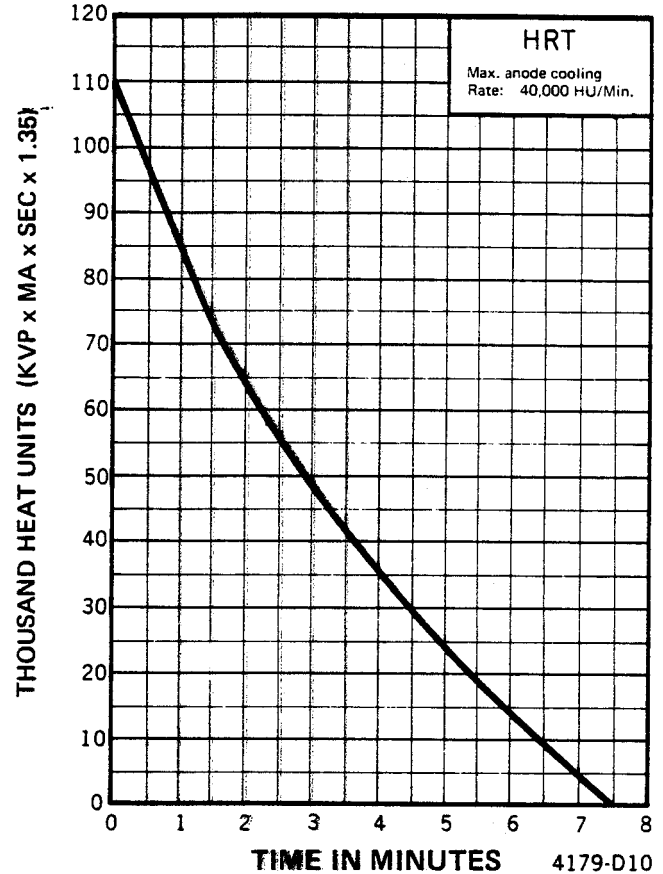
**HRT TUBE RATINGS
FOR AMX-II**

<u>KVP</u>	<u>MA</u>	<u>MAX. TIME (SECONDS)</u>	<u>MIN. INTERVAL BETWEEN EXPO.</u>
50	100	15	6.5 Min.
60	100	12	6.5 Min.
70	100	9.5	5.5 Min.
80	100	7	4.0 Min.
90	100	5	3.0 Min.
100	100	4	2.5 Min.
110	100	3	2.0 Min.
120	100	2.5	2.0 Min.
125	100	2.5	2.0 Min.

TUBE HOUSING COOLING CURVE



ANODE COOLING CURVE



Collimator Specifications

Maximum rating is 150 KVP.

Minimum inherent filtration of the collimator is 1.5mm aluminum equivalent at 150 KVP. Additional filtration may be obtained by inserting the 1mm and/or 2mm aluminum filters.

Minimum source-to-skin distance is limited to more than 30 centimeters by the tracks on the bottom of the collimator for mounting the accessory Extension Cylinder.

Full 17" x 17" (.43 m x .43 m) radiographic coverage at a 40" (1.02 m) source-to-image distance (SID) is provided for tubes with a 15 degree target angle as specified on page 1.

A high intensity GE Quartzline® Lamp with provision for long life is used for field illumination. Distinct shadow crosshairs indicate the field center. A Bucky centering light pattern is provided to aid in longitudinal focal spot-Bucky alignment.

The collimator can be rotated and locked positively at 0°, +/-15°, +/-30°, +/-45°, and +/-90° from the front position.

DIAGNOSTIC SOURCE ASSEMBLY MINIMUM INHERANT FILTRATION

COMPONENT	MM'S AL. EQUIV.	KVP MEASURED
Tube Insert	0.7	130 KVP
Tube Housing	0.3	130 KVP
Collimator	1.5	150 KVP
Additional Collimator Filters	1.0	—
	2.0	—

SERVICING

Periodic Maintenance

In order to obtain continued safe performance of this x-ray equipment, a periodic maintenance program must be established. It is the owner's responsibility to supply or arrange for this service.

Maintenance procedures for the AMX-II X-Ray Unit are required one month and three months after completion of installation, and every 6 months thereafter. These maintenance procedures are described in Chapters 5 and 8 of Service Manual A0654D and outlined on PMS Data Record - Mobile Generator 1 - form F3316.

Qualified Service Available

Safe equipment performance also requires the use of service personnel specially trained on medical X-ray apparatus. General Electric Company, Medical Systems, and its associates maintain a world-wide organization of stations from which one may obtain skilled X-ray service. If desired, arrangements can usually be made to furnish preventive and/or emergency service on a contract basis. A GE representative will be glad to discuss this plan.

User Service and Maintenance

General Electric x-ray equipment contains operating safeguards to provide maximum safety. Before calling for service, be certain proper operating procedures are being used.

This equipment should be cleaned frequently, particularly if corroding chemicals are present. Use a cloth **moistened slightly** in warm soapy water (use mild soap) to clean the trim and nameplate of the Operator's Panel. Wipe with a cloth moistened in clean water. Do not use cleaners or solvents of any kind as they may dull the finish or blur the lettering. Polish with PURE liquid or paste wax. Do not use a wax containing a cleaning substance. Do not use wax on the meter front. Other surfaces of the unit can be cleaned using a clean cloth **moistened slightly** with a good mild cleaner and polish acceptable for use on enameled metal surfaces.

Excessive water and cleaning solution may leak into the AMX-II and damage the electronics. Clean the unit only with a **slightly moistened** cloth.

The Main Power Circuit Breaker interrupts power to the X-Ray unit in the event of overload in the high voltage system. When this occurs, the control panel lights will go out. To resume operation, place the main power circuit breaker to the ON position. Repeated power interruptions indicates a fault in the high voltage system. Have the unit checked by a qualified GE Medical Systems serviceman.

TECHNIC SELECTED		PRIMARY - VOLTS	MA	KVP	TIME (Sec.)
MAS	KVP				



GE Medical Systems

*GE Medical Systems: Telex 3797371
P.O. Box 4M, Milwaukee, Wisconsin 53201 U.S.A.
(Asia, Pacific, Latin America, North America)*

*GE Medical Systems—Europe: Telex 261794
Shortlands, Hammersmith, London W6 8BX U.K.*

CHAPTER 3

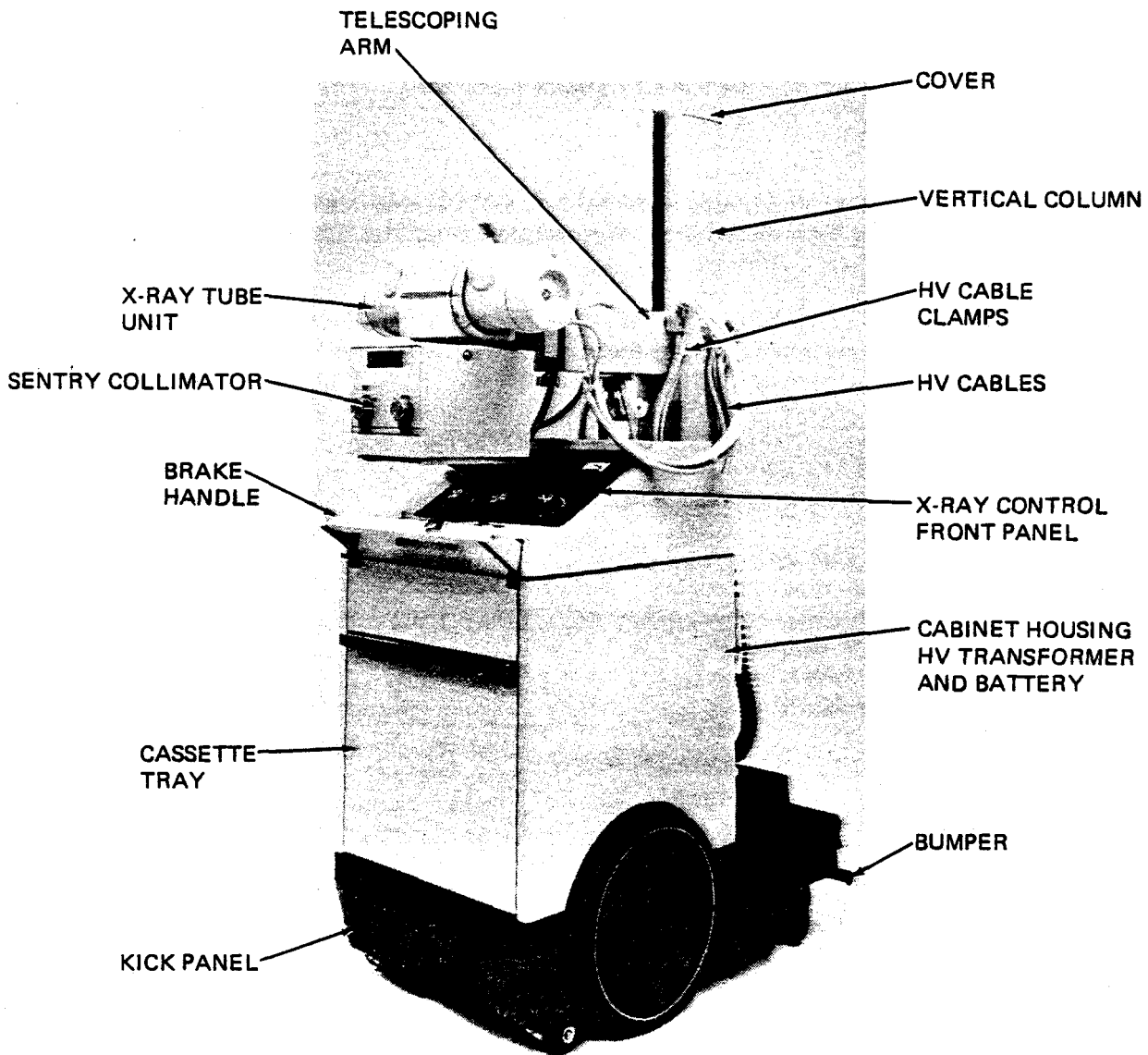
INSTALLATION

NOTE: This Chapter and Chapter 4, Part I apply only to AMX-II units packed for export with vertical column removed, or for domestic units without the horizontal telescoping arm assembled to the vertical column.

For domestic AMX units with high level assembly, refer to Chapter 4, Part II. Units with high level assembly have the horizontal telescoping arm assembled and tied down with straps for shipment.

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ILLUSTRATION 3-1

COMPONENT

NAMEPLATE LOCATION

AMX-II X-Ray Unit
 Transformer
 Tube Unit
 Collimator

Beneath the Handswitch Bracket
 Beneath terminal strip 7TB1
 On the back trim cover
 Bottom rear of the trim cover

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▲ Indicates Change

SEC. 1 PREINSTALLATION

1-1 Introduction

The AMX-II is identified by the following model numbers:

▲ X-Ray Control	46-165600G10, G11, G12, G14, G15
HV Transformer	46-150625G1
Collimator	46-177399G1, G2 or 46-194759-G1
Tube Unit	46-155750G2, G3, G4
Battery (cell group)	46-152812P1
Extension Cylinder (optional)	46-138573G1

Assembly of the unit consists of installation of the HV Transformer in the cabinet, installation of the telescoping arm and fork on the vertical column, mounting the x-ray tube on the fork, connecting HV cables between the HV Transformer and the x-ray tube unit, and installation of the battery in the cabinet. In addition, for export units, the vertical column must be installed to the mobile base assembly. Then the unit must be checked and adjusted for proper operation.

NOTE: Two men are required to install the vertical column, the telescoping arm, the HV transformer, the x-ray tube unit and the collimator.

1-2 Compatibility Requirements for H.E.W. Certification:

To meet H.E.W. regulations regarding beam quality, exposure MAS, minimum filtration, and beam collimation, the AMX-II X-Ray unit must consist of the following model number components. Nameplates for these components include the statement "this product conforms to all applicable standards under 21CFR Sub. Chap. J."

▲ Basic Unit	46-165600G10, G11, G12, G14, G15
H-V-Transformer	46-150625G1
X-Ray Tube Unit	46-155750G2, G3, G4
Collimator	46-177399G1, G2 or 46-194759-G1
Extension Cylinder (optional)	46-138573G1

1-3 Safety Precautions

Any person providing installation, maintenance or service on this unit must follow safe procedures to avoid needless accidental injury.

Work on any electrical apparatus involves the risk of electric shock. On a battery operated unit such as this, additional precautions are required because of the following conditions:

1. This x-ray unit contains a 120 v rechargeable battery inside the cabinet. It is possible to disconnect the battery from the x-ray unit circuits. However, the battery is a source of power when contacted directly even with all the switches off.
2. If a conductive metallic object comes in contact with the battery terminals, high currents may cause damage to the object, to the battery and severe burns to the serviceman.

WARNING: THE ELECTROLYTE USED IN NICKEL-CADIUM BATTERIES IS A CAUSTIC SOLUTION OF POTASSIUM HYDROXIDE. SERIOUS BURNS WILL RESULT IF IT COMES IN CONTACT WITH ANY PART OF THE BODY. IF ELECTROLYTE GETS ON THE SKIN, WASH THE AFFECTED AREAS WITH LARGE QUANTITIES OF WATER, NEUTRALIZE WITH VINEGAR, LEMON JUICE, OR 3

PERCENT ACETIC ACID: IF ELECTROLYTE GETS INTO THE EYES, FLUSH WITH WATER AND GET IMMEDIATE MEDICAL ATTENTION.

3. Because of the potential hazards mentioned above, the serviceman must remove rings, wrist watch, etc. and WEAR SAFETY GOGGLES when working on or near the battery. He must follow battery installation and maintenance procedures given in Chapters 3 and 8. Furthermore, the serviceman should not leave the x-ray unit unattended with the battery compartment cover and the cassette tray removed, unless adequate warning signs and safety measures to limit access to the area are made.
4. The x-ray control access door, shown in Illustration 3-1, can be opened only with a key. Because of the possible electrical shock and other hazards present when this door is opened, the key should not be left in the lock but should be retained by the serviceman or by the customer. The serviceman should not leave this unit unattended with the door unlocked and open, unless adequate warning signs and safety measures to limit access to the area are made.
5. When recharging the battery, the x-ray unit must be located in a large ventilated room. During normal charging conditions and when all batteries are functioning properly, there is little or no gas emitted. Should abnormal conditions develop, there could be an accumulation of hydrogen gas which, if confined in a small space, would be explosive in the presence of flame or electrical spark. Whenever the extension cord plug is inserted in a wall outlet, a fan ventilates the battery compartment. A hazardous situation will not develop where the outflow from this compartment is into a large or a well ventilated small room.
6. An audible tone and/or red x-ray light indicated presence of radiation. If either indicator is on at any time other than the expected x-ray exposure interval, immediately release the handwith X-RAY and ROTOR buttons and move the Main Power Circuit Breaker to OFF. Perform the procedure for disconnecting the HV Transformer before attempting to determine the malfunction.

THIS UNIT IS NOT DESIGNED FOR USE IN HAZARDOUS AREAS.

1-4 Tools and Materials

The following will be required in addition to the standard serviceman's tool kit:

- (1) Voltmeter, 0/150/300 VAC, 25 to 500 Hz, accuracy 3/4 of 1% of full scale, Weston Instruments Inc., Cat. No. 433-1903010. Where this meter is not readily available, use the following instruments with lower response on the square wave 60 Hz and the higher frequency (500 Hz) voltage. Voltmeter, 0/150/300 VAC, 25-125 Hz, accuracy 3/4 of 1% of full scale, GE type AP-9, Cat. No. 50-20102RHRH or Weston Instruments Inc., Cat. No. 433-1903009.
- (2) Multimeter, Simpson Model 260, Triplett Model 630 or equivalent (20,000 ohm/volt dc, 5,000 ohm/volt ac).
- (3) Standard wrench (507A935G1) for GE type II cable terminals.
- (4) Oscilloscope, Tektronix 564 or equivalent, dual trace, memory tape with algebraic addition feature and X10 probes. (A Tektronix type 422 scope is satisfactory where troubleshooting is not required.)
- (5) 1 gallon (3.8 litres) Diala AX for adding to HV transformer, if required.
- (6) Can of 75-25 cleaning solvent and rags for cleaning. (Do not use for cleaning covers)
- (7) Spintite or socket wrench, 11/32" hex
Spintite or socket wrench, 3/8" hex
Medium screw holding screw driver
Spintite or socket wrench 1-1/16" hex
- (7) Clamp on Ammeter, GE Model AK-4.

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- (8) Level (Machinist)
- (9) HEW Field Test Kit including receptor alignment tool (RAT) 46-177371P1 and Standard Test Absorber 46-173632G1.
- (10) Digital multimeter, Fluke Model 8000A or equivalent.
- (11) DC Milliammeter 1.5/16/150, accuracy 1/2 of 1% of full scale, Weston Instructions, Inc., Model 931 or equivalent.
- (12) Collimator alignment fixture, 46-166390G1.
- (13) 14 x 17 (35.5 x 43.2 cm) cassette and x-ray film.
- (14) DC ammeter; 0-5 amp. 4" scale, +/- 2% F.S. accuracy: GE Cat. 50-250400 LSLS, or equivalent.
- (15) Lampload device, 1200 watt, consisting of 8-150W, 120 V lamps in parallel.
- (16) Non-metallic case flashlight.
- (17) Variable autotransformer, 5 amp., 120 VAC input, 0-140 VAC output, with ground GE Cat. 9T92A91, or equivalent.
- (18) Safety Tape: and warning signs.
- (19) 0.5K, 2-w potentiometer wired as variable resistor.
- (20) Torque wrench 0-4 ft.-lb. or 0-50 in.-lb. with 9/64" hex drive. Snap-on Tools Model TSO-4 torque wrench with TMA-4-1/2-9/64" hex drive or equivalent. This tool required to give proper tightening of components in assembly of the unit.
- ▲ (21) 10 Ω 100W adjustable resistor and shorting switch.

1-5 Delivery Data

The x-ray unit is shipped in the following parts for domestic delivery.

Item or Box No.	Drawing No.	Description
(1)	46-165600	X-Ray Control and mobile stand
(2)	46-150625G1	HV Transformer
(3)	46-165850G2	Telescoping Arm
	46-165897G2	Yoke Asm.
	46-165775G1	Cover
	46-125388G2	HV Cables
(4)	46-155750	HRT-09N Tube Unit
(5), (6), (7)	46-152812	Batteries
(8)	46-177399G1, G2 or 46-194759-G1	Collimator

Remove the plastic cover from the x-ray control mobile stand. Remove the HV Transformer from crate. Remove HRT tube unit from the box. Place these items in the assembly area.

Do not discard any crates, boxes of packing materials until all parts have been accounted for.

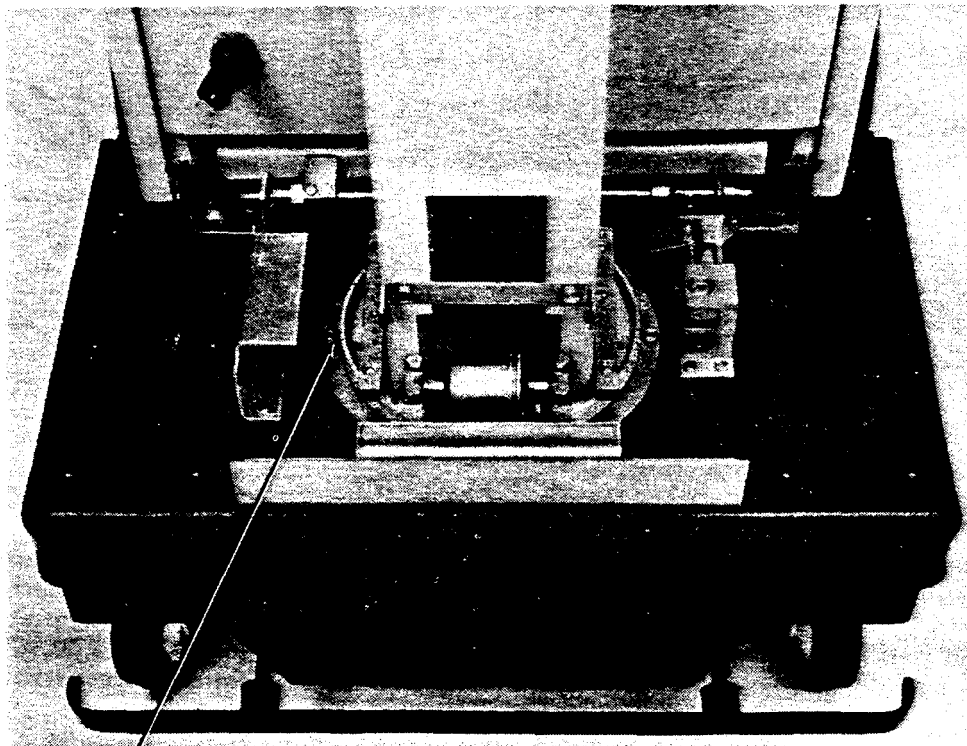
SEC. 2 INSTALL TUBE SUPPORT ASSEMBLY**2-1 Install Vertical Column (not required for domestic units)**

1. Clean the base of the Mounting Support with CDX 75-25 to remove dirt or grease.
2. Apply a small amount of Way-Mat oil to the center alignment hole in the base mounting support.

NOTE: Two men are required to mount the vertical column to the AMX Base Assembly.

3. Place the column in the support assembly checking that the center pivot engages the hole in the bottom of the support plate and the column rotates freely 180° each side of center.
4. Install six 5/16-18 unc x 3/4" hex socket cap screws in the bearing retainer ring at the base of the column. Refer to Illustration 3-1A.
5. Mount the two semi-circular braked discs to the lower column casting with eight 8-32 unc x 3/8" bind head screws. Mount (2) splice plates to brake disc using four 8-32 unc x 3/8" bind head screws.

NOTE: The cable inspection cover (square cover at base of column) will be installed after completion of mechanical assembly and counterbalancing of the vertical column. It is mounted using two 10-32 unc x 3/8" bind head mounting screws.



SIX 5/16 - 18 X 3/4"

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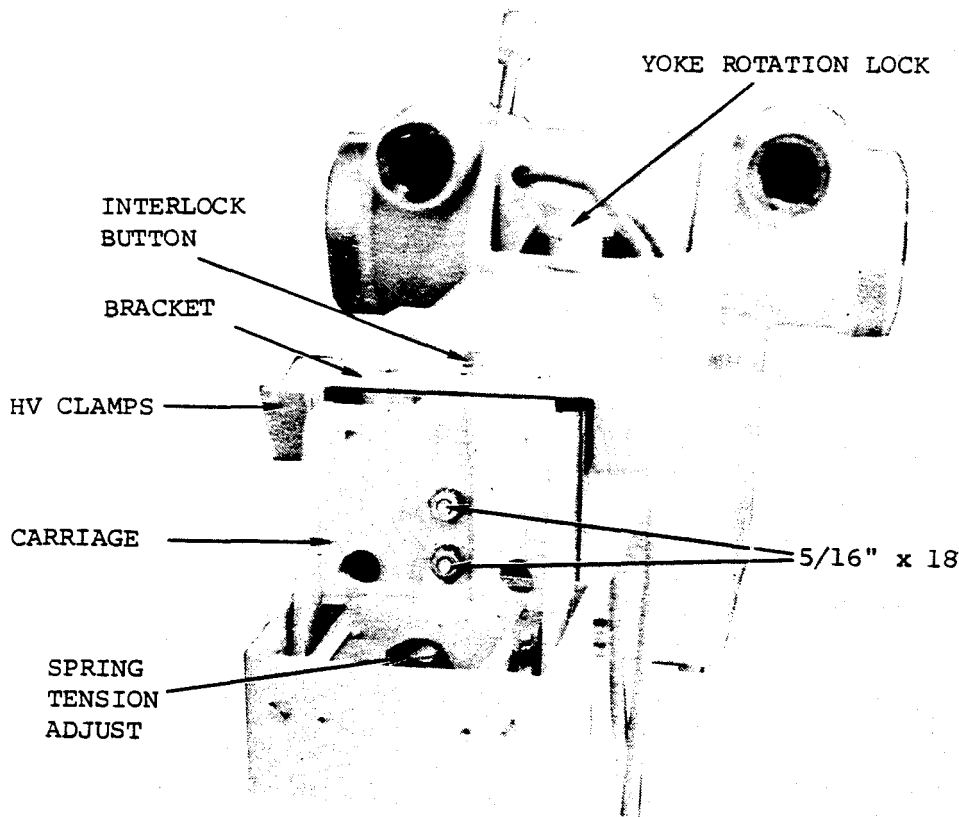
ILLUSTRATION 3-1A

SEC. 2A INSTALL HORIZONTAL EXTENSION ASSEMBLY

2-2 Install Telescoping Arm

The unit as shipped has the carriage loaded against the top stops of the vertical column.

1. Remove the telescoping arm, spacers and bracket out of its shipping container.
2. One man must hold the arm and insert the two studs into the carriage. See Illustration 3-2.



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ILLUSTRATION 3-2

3. A second man must place the bracket over the top of the arm and fasten but do not tighten, with three 5/16- 18 unc x 1/2 hex soc. hd. screws.
4. Insert enough "UU" shaped spacers (four are furnished in bag no 2) between the carriage and the telescoping arm to maintain the arm in a horizontal position. Check with a level with unit on a level floor.
5. Tighten the three screws securing the bracket.
6. Secure the two carriage studs located at the rear of the carriage with two 5/16-18 unc hex hd nuts and flat washers.
7. Loosen the carriage lock while manually holding the arm.

8. Carefully release the arm.
9. Lower the arm until it is three feet (.9 m) above the floor. Secure the Carriage Lock.
10. Check that the cable is riding in the cable guide. If the cable is too slack, it may jump off the guide. If this occurs, the cable will be severed after two or three movements of the carriage.

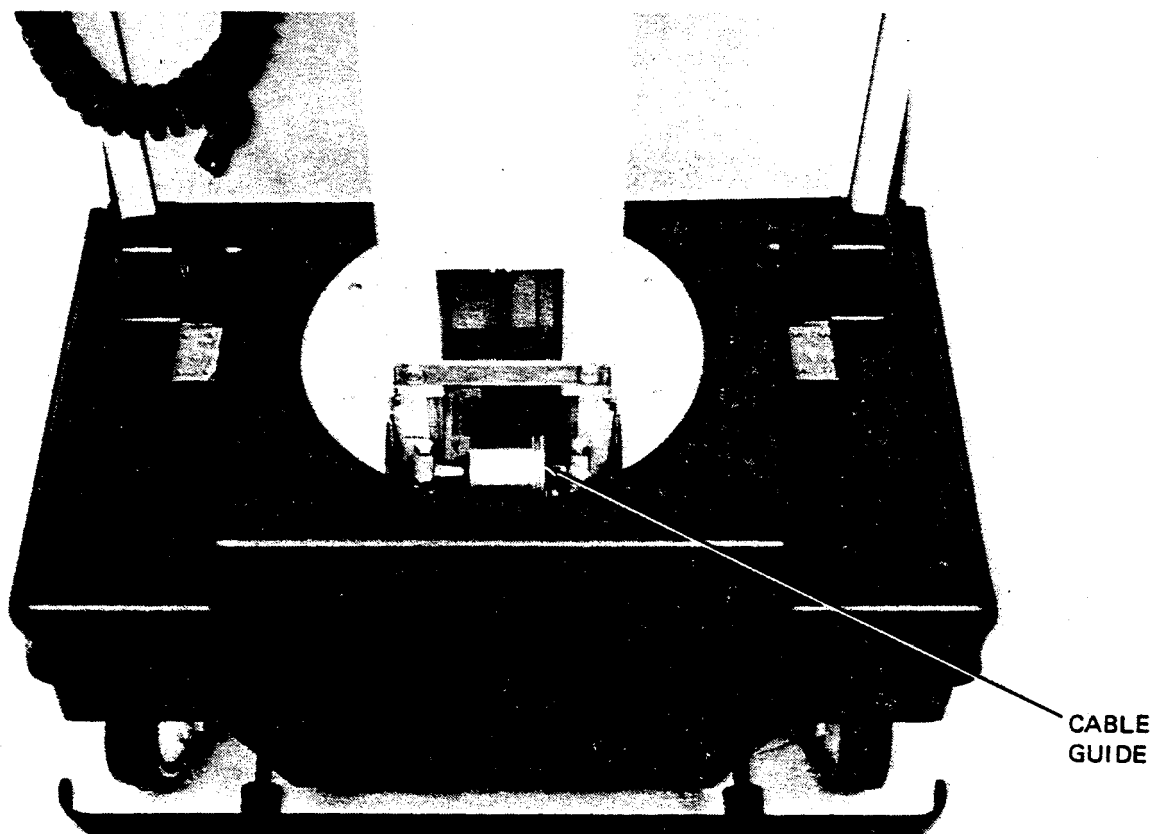


ILLUSTRATION 3-2A

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Continue to check on the cable until the x-ray tube unit is mounted and the counterbalance system is properly adjusted.

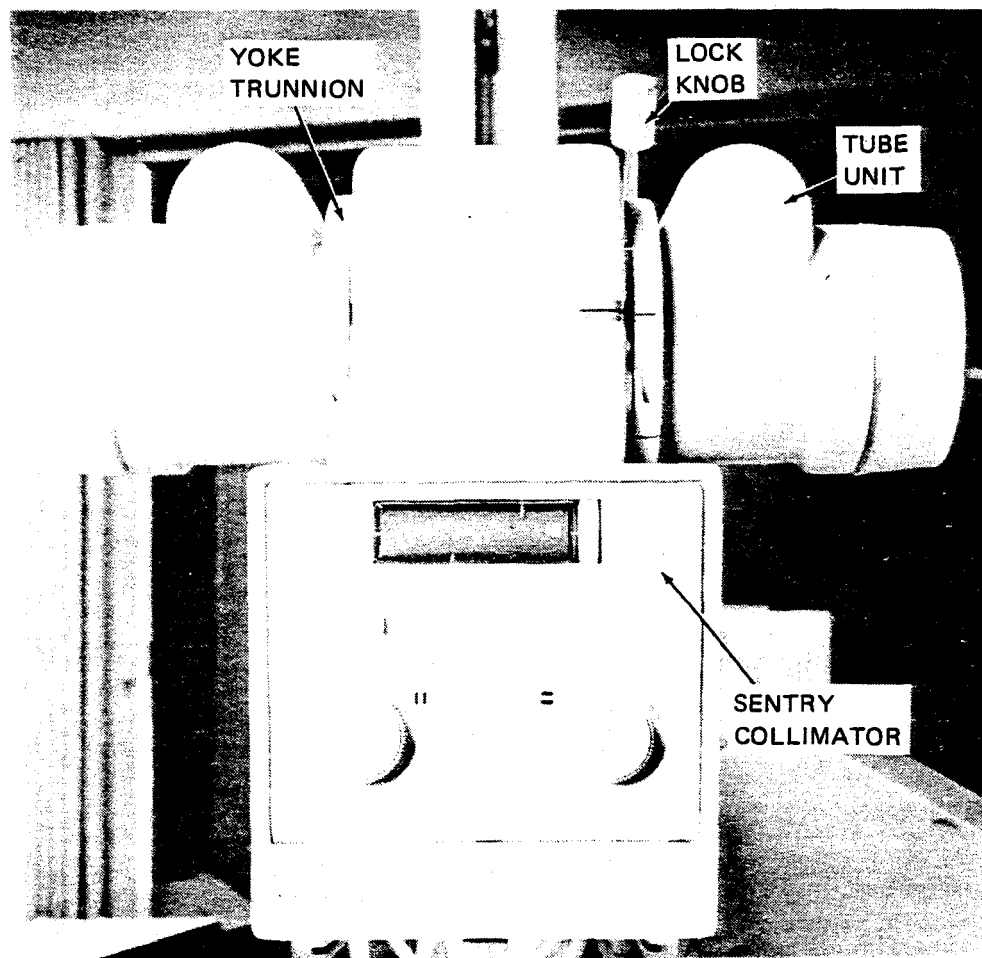
2-3 Install X-Ray Tube Unit

1. Remove upper halves of the yoke trunnion. See Illustration 3-3. Be careful not to lose any spacer washers. **Note:** Collimator installed in Chapter 4, Section 2, Unpack the X-Ray Tube Unit.
2. Apply a film of Way-Mat oil (furnished plastic bottle) to the bearing surfaces of the yoke trunnion halves.

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▲ Indicates Change

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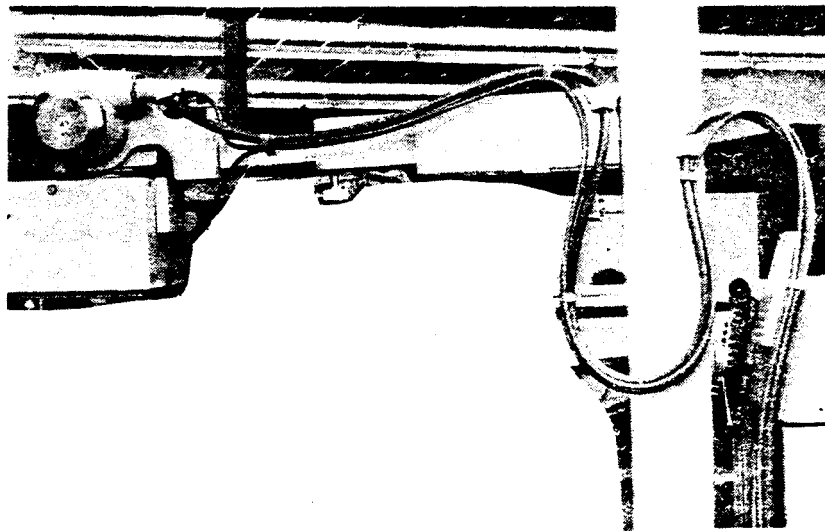
ILLUSTRATION 3-3

- ▲ 3. Set the tube unit on the yoke trunnions with tube port down and the HV cable receptacles pointing to the rear.
- ▲ 4. Install the upper halves of the yoke trunnion.
 - a. Use (3) or (4) of the 3/8" (9.53 mm) O.D. flat washers at the lower joints and (3) or (4) of the 1/2" (12.7 mm) O.D. washers at the upper joints as spacers.
 - b. Tighten the lower screws.
 - c. Tighten the upper screw of the left half.
 - d. If there is excessive drag as the tube unit is rotated, install another spacer washer.
 - e. Install the lock knob at the upper joint of the right trunnion.
- ▲ 5. Adjust the counterbalance system to support the arm and tube, if necessary.

The counterbalance system is properly adjusted when it requires the same force (2.3 kg to 5.9 kg) (about 5 to 13 lbs.) to move the arm up and down. It is adjusted by turning the 1-1/16-inch nut at the top of the column. Clockwise rotation increases force in the up direction and counterclockwise rotation decreases force in the up direction.

SEC. 3 CABLES**3-1 Install High Voltage Cables**

1. Remove bag containing silicone grease, grounding rings and rubber gaskets from each HV cable.
2. Take the cardboard protector boxes off one end of the cables.
3. Uncoil the HV cables.
4. Move the vertical carriage until the x-ray tube unit port is about 4 feet (1.2 m) from the floor.
5. Locate the four HV cable clamps. See Illustration 3-4.



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ILLUSTRATION 3-4

6. Install the HV cable plugs into the x-ray tube unit, without using grounding rings, gaskets or petroleum jelly at this time.
7. Extend the telescoping arm to its maximum distance.
8. Route the HV cables through the cable clamps on the telescoping arm as shown in Illustration 3-4.
9. Locate the telescoping arm in its lowest position.

10. Route the HV Cables through the column cable clamps as shown in Illustration 3-5.

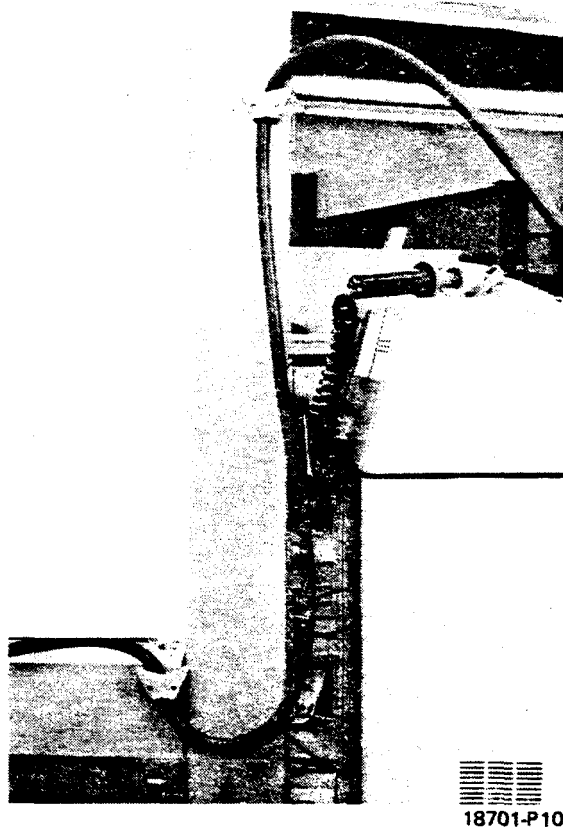


ILLUSTRATION 3-5

11. Secure each clamp with two 6-32 unc x 1" screws.
12. Lay the protected ends of the HV cables on the mobile base until the HV Transformer is installed.

3-2 Install Stator and Collimator Cables

1. Open the Cassette Tray, Illustration 3-6.

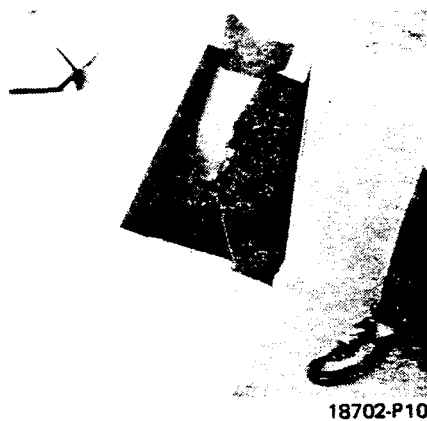


ILLUSTRATION 3-6

2. Remove the rubber liner covering the bottom of the drawer.
3. Loosen the four screws (two in each corner) in the bottom of the tray.
4. Slide the screws toward the center of the tray and remove it.
5. Uncoil the stator cable attached to the tube unit.
6. Locate the Collimator cable.
7. Route both the stator cable and the collimator cable along the cathode HV cable. Use rubber straps to fasten the stator and collimator cable to the HV cable and hold it in the properly draped position.
8. Leave enough excess collimator cable to make connection to the back of the collimator.
9. Remove the two panels on the cabinet located behind the vertical column.

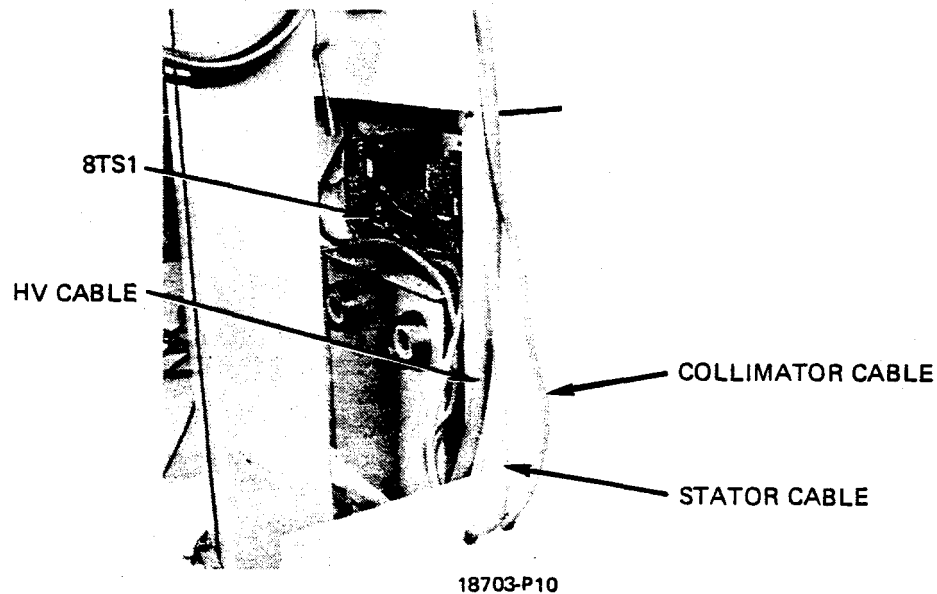
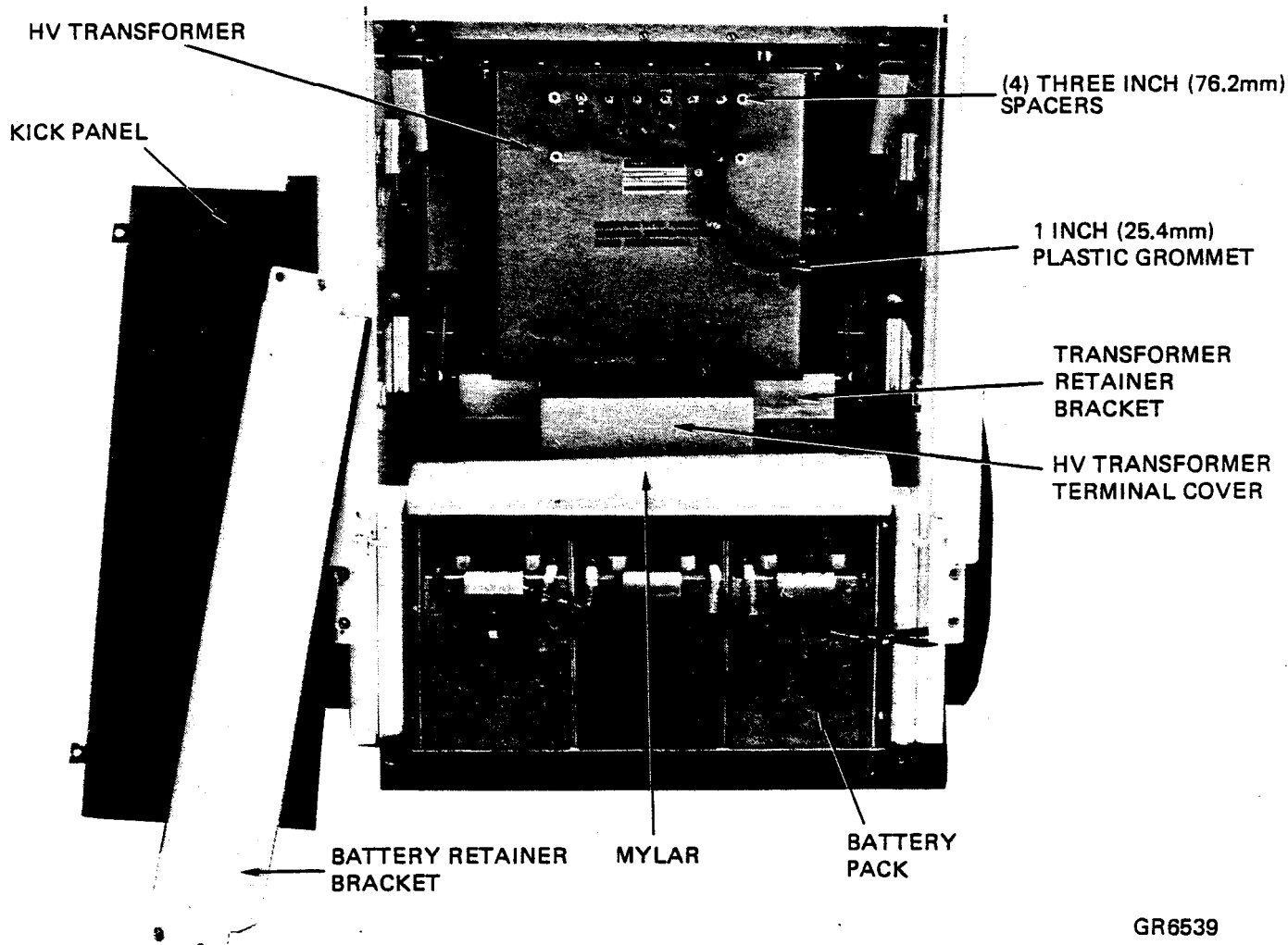


ILLUSTRATION 3-7

10. Run the stator cable through the top 7/8" (22.23 mm) hole in the larger panel, Illustration 3-7.
11. Run the collimator cable through the lower 7/8" (22.23 mm) hole.
12. Lay both cables on the mobile base until the HV transformer is installed.

SEC. 4 INSTALL HIGH VOLTAGE TRANSFORMER

1. Remove the five pan hd bolts securing the transformer retainer bracket. See Illustration 3-8.



GR6539

ILLUSTRATION 3-8

2. Remove the HV transformer oil filler cap shown in Illustration 3-9.
3. Insert point of punch into holes in cap and tap with hammer to rotate CCW to loosen, if necessary.
4. Turn a #10-32 unf screw into the cover under the cap and lift it out. Discard the rubber o-ring that is on that cover.
5. The transformer oil level should be within 1/4" (6.25 mm) +/- 1/16" (1.59 mm) of the top. Add more oil if necessary.
6. Replace cover and cap.

- Carefully push the HV transformer into the cabinet with the HV receptacles facing the column.

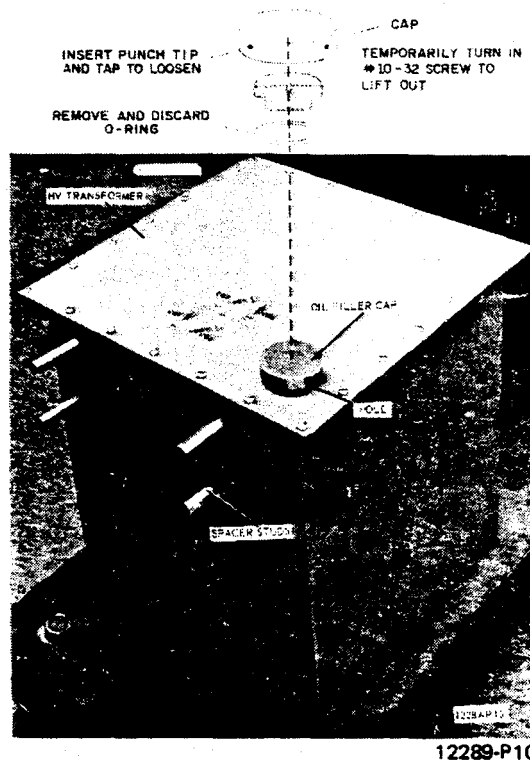


ILLUSTRATION 3-9

- Replace the HV Transformer retainer bracket shown in Illustration 3-8.
- Locate the HV transformer terminal cover and a plastic bag containing four 3" (76.2 mm) long spacer studs. Install the spacers on the four screws protruding out of the HV transformer. Connect the six wires to the HV transformer terminals as follows: (Check that there is a 1" (25.4 mm) I.D. plastic grommet around the six wires before connecting.)

LEAD LABELS

CONNECT TO HV TRANSFORMER TERMINAL

P1
P2
G
XC
XS
MA

P1
P2
G
XC
XS
MA

- The terminal cover will be installed later, after tests are completed. Set aside the cover and the four 8-32 unc x 1/2" machine screws furnished.

SEC. 5 CONNECTING CABLES

5-1 Stator Cable

1. Route the stator cable over the top of the transformer and to the left end of the 8TS1. See Illustration 3-10.

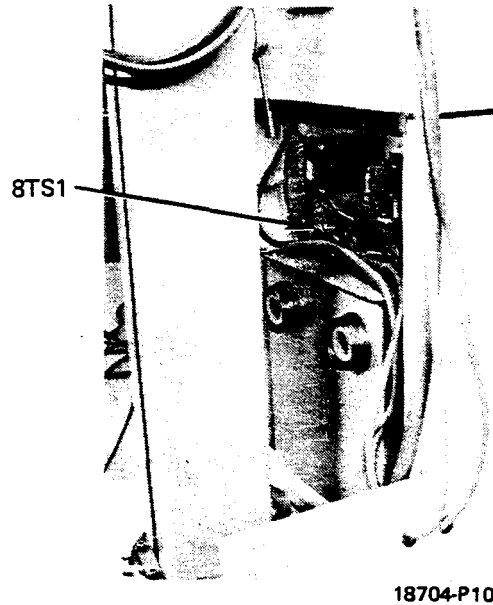


ILLUSTRATION 3-10

2. Then route the stator cable along the main harness to the other side of the HV Transformer. Pull the cable through to take up the slack. Remove rear cover and remove screws holding x-ray control cover and remove cover.
3. Route the stator cable to the 3TB1 panel as shown in Illustration 3-11.

CAUTION: Route stator cable at least 2 inches (50.8 mm) away from 1R4 and 1R7. They become hot and may damage the cable.



ILLUSTRATION 3-11

4. Cut the wires as required and install solderless push-on terminals.

5. Connect the leads as indicated below:

Lead Color	Terminal No.	
White	3TB1-39	Red/Wht lead with in-line connector located in main harness
Green	3TB1-29	
Black	3TB1-28	
Red	Tape up ends	
Blue		

5-2 Collimator Cable

- Route the collimator cable to the 8TS1 terminal strip located above the HV transformer. See Illustration 3-10.
- Connect the collimator light cable as follows for Collimator 46-177399-G1

Lead Color	Lead Mark	Control End Terminal No.	Collimator End	
Black	14	8TS1-14	4P2 -C	
White	13	8TS1-13	-A	
Red	5	8TS1-5	-K	
Blue	6	8TS1-6	-H	
Green	13	8TS1-13	-A	Additional leads added to 6 conductor cables
Orange	14	8TS1-14	-C	

NOTE: For Collimator 46-177399G2 or 46-194759-G1

Lead Color	Lead Mark	Control End Terminal No.	Collimator End
Black	14	8TS1-14	4P2 C
White	13	8TS1-13	A
Red	15	8TS1-15 in-line Gry	K
Blue	16	8TS1-16 in-line Blu	H
Green	13	8TS1-13	A
Orange	14	8TS1-14	C
Blk/Wht	11	8TS1-11	M

5-3 HV Cables

- Replace large panel on the cabinet as shown in Illustration 3-12.



- Install a strain relief on the collimator cable and the stator cable.

23572-P10

ILLUSTRATION 3-12

3. Remove the cardboard covers from the HV cable ends near the HV Transformer.
4. Make a trial installation of the cable terminals into the transformer receptacles without using grounding rings, rubber gaskets. Orient the strain reliefs upward and slightly outward so that the cables clear the vertical column.
 - a. Place a little silicon compound on the threads of the rings.
 - b. Insert the terminal into the receptacle and tighten the ring until the cable strain relief is no longer free to run. Check that only two or three threads remain exposed on the ring.
5. An HV transient may occur from arcing at the HV receptacles due to improper grounding and/or air in receptacles. Any time these conditions exist, they can cause HV cable punctures, x-ray failures or damage to an HV transformer. Therefore, remove the HV cable terminal from the receptacle at each of the four connection points (two anode and two cathode connections) and carefully follow the procedure below to make the proper connection.
 - a. Inspect each receptacle. Use CDX 75-25 cleaning solvent, if necessary, to clean out dirt and moisture. Dry it with a clean, lintless cloth.
 - b. Clean each HV cable terminal using CDX 75-25. Dry it with a clean lintless cloth. Inspect for correct spread of pin ends. Remove excess solder, if any, on the pins that would prevent full insertion into the receptacles.
 - c. Place the tapered rubber gasket over the HV terminal and against the ground shield with small diameter toward the pins and a notch over the boss.
 - d. Place a 514A727P1 grounding ring on the cable terminal. When layed on a flat surface, the grounding ring should have corrugations measuring 3/16" (4.76 mm) minimum to the highest point. If necessary, bend it to increase the height, otherwise, the contact pressure may be inadequate to ground.
 - e. Coat the end of HV cable plug with silicon compound* to make a round mound equal to the height of the pins. Use a clean dry wood stick such as a tongue depressor to spread a thin layer of silicon compound over the side of the plug. It need not cover the surfaces covered by the grounding ring.
 - f. Insert the HV cable terminal into the receptacle guiding the boss of the terminal into the slot of the receptacle. Press down on the terminal. If the correct quantity of silicon compound was used, it should ooze up into the space around the grounding ring. Otherwise, remove the cable terminal and repeat the procedure.
 - g. Hold the plastic strain relief in the desired position and tighten the threaded ring with a spanner wrench. Wipe off the excess silicon compound that has oozed out.

*Use only the silicon compound furnished with HV cables or procured from National Parts Service or factory equivalent.

SEC. 6 BATTERY

It is assumed that all preceding installation steps have been completed so that there are no unconnected electrical circuits such as stator or HV cables. The collimator lamp circuit wires remain unconnected as the collimator is not to be installed until after the x-ray filament check.

Initial charge of battery will be done with battery located on floor next to unit and with operator's panel open for voltage and current checks. The procedure will typically take 10-12 hours and require monitoring every half hour. The total time however, need not be continuous, but may be split over two or more working days.

6-1 Unpacking and Preparation

1. Review the safety precautions in Section 1-3 before installing the batteries.

Remove rings, metal watch bands and identification bracelets. Metal articles will, if allowed to contact intercell connectors, fuse themselves to the connectors and cause severe burning. Check pockets for loose metal objects that could fall across battery intercell connectors. Wear safety glasses and do not smoke or use an open flame while working near the battery.

2. Locate the unit in a well-ventilated area or room where access can be restricted during the initial charge procedure. Setup safety tape to define limited access, hazard area. Post appropriate warning and caution signs. Obtain and prepare three Battery Service logs F3560.
3. Unpack the three 30-cell groups that comprise the battery and place them on the floor. The battery does not have a charge. However, a DC meter placed across the input and output terminals of each cell group will show about 10 to 30 V which may disappear if loaded.
4. Some white powdery potassium carbonate may be found on the battery cells. Excessive accumulation can cause electrical leakage between cells. Therefore, remove any powdery deposits with a non-metallic brush or compressed air.
5. The electrolyte in a cell will not be visible above the baffle when the battery has little or no charge. Therefore, do not check electrolyte level until after the battery is charged. Do not add any distilled water to the electrolyte of an uncharged battery.
- ▲ 6. Battery is shipped with vented caps regardless of color of cap.
7. Wrap tape on a 9/64" hex drive of torque wrench so only the tip is exposed (to avoid shorting the battery cells if it falls across the terminals). Use it to check tightness of screws fastening the inter-cell connecting links. Torque value for cell terminals is 3.7 ft. lb. DO NOT OVERTIGHTEN. Use tool #20 as described at 3-2 of this chapter.
8. Remove the kick panel from the unit shown in Illustration 3-8. The panel is anchored by three screws on top and two on the bottom.
9. Remove the battery retainer plate for access to battery leads.
10. Double check to make certain that the Main Power Circuit Breaker is OFF.
11. Arrange the three cell groups on floor in front of unit. Space the cell groups several inches (150 mm) apart for air circulation. Keep heat sources such as the lamp load away from the battery.

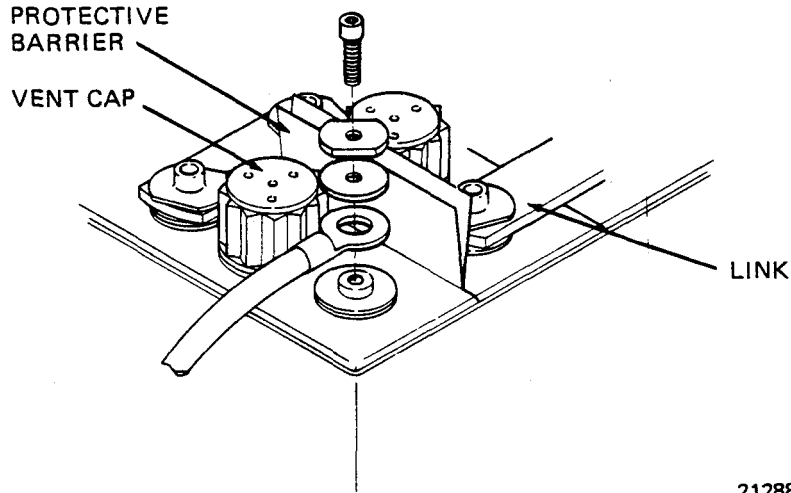


ILLUSTRATION 3-13

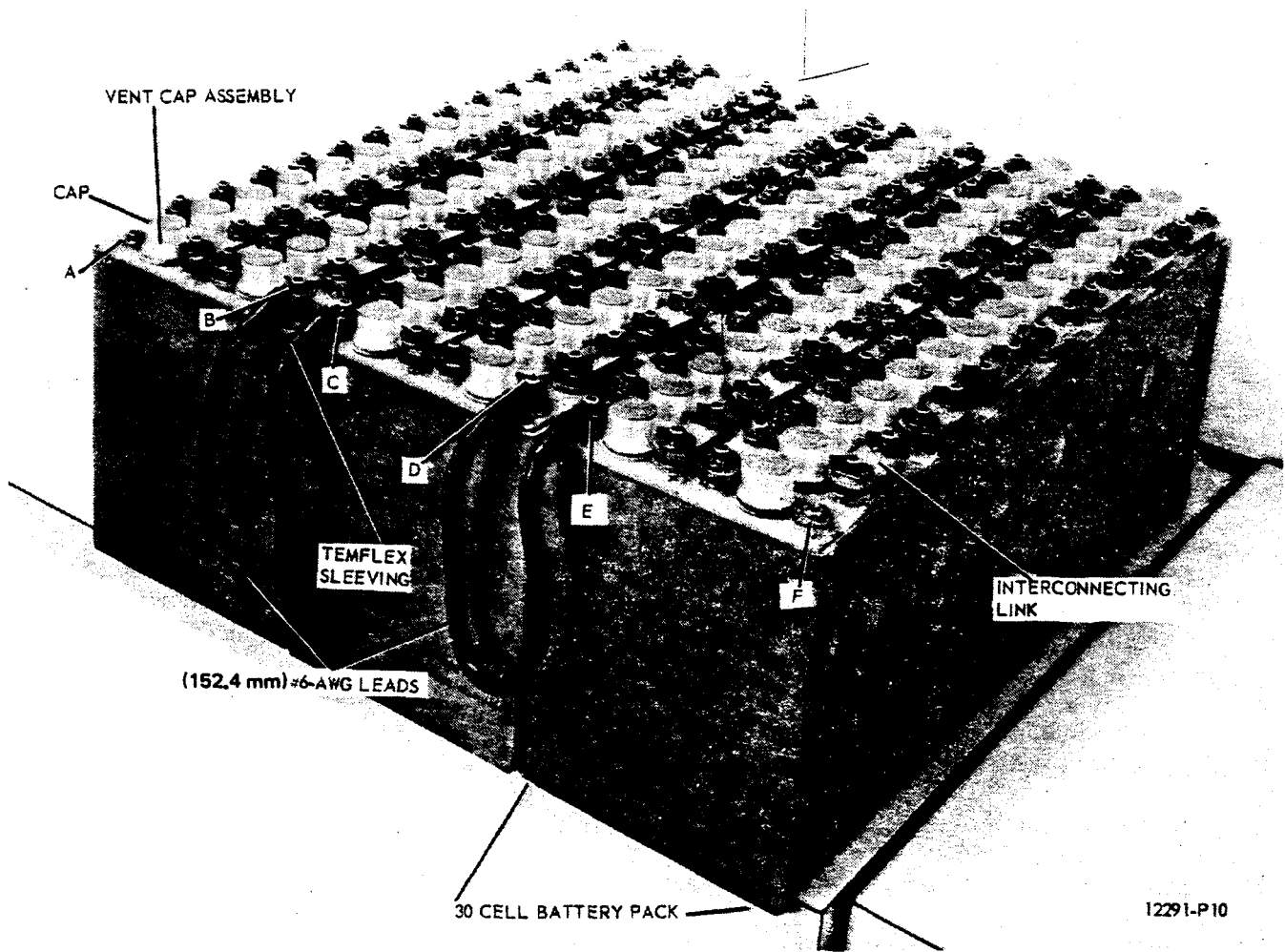


ILLUSTRATION 3-14

12. Before connecting battery leads, cut six (6) 1-1/2" x 3" (38.1 mm x 76.2 mm) strips of insulation paper. Bend in half and wedge between the first and second as well as last and second last cell in each group; as shown in Illustration 3-13. This will prevent damage to battery if a washer or screw slips on connection of battery leads.
13. Connect the battery lead labelled (-) from the Main Power Circuit Breaker to the negative terminal of the left hand cell group. (A in Ill. 3-14). Use two No. 6 AWG leads 6" (152.4 mm) long to interconnect the cell groups (B to C and D to E in Ill. 3-14). Connect the battery lead labelled (+) from the Main Power Circuit Breaker to the positive terminal of the right hand cell group (F in Ill. 3-14).
14. The battery terminals have flat sided washers as part of the terminal hardware. The flat side serves as a visual indicator during torquing. During initial screw engagement the washer rotates, and upon tightening, rotation stops. This indicates that the screw is tightened in the terminal and not binding or bottoming when proper torque is reached. Tighten all six terminal to 3.7 ft. lbs. torque. Push Temflex sleeving over solderless terminal lug.

6-2 Initial Charge of New Battery

1. Check that the OPERATOR'S KEY switch and Main Power Circuit Breaker are OFF.
2. Remove the x-ray control (Operator's panel), cover Ill. 3-1. The panel is to remain open only during this initial battery charging operation to release heat from components inside the cabinet. User charging in the working range does not generate as much heat and the cabinet is to remain closed.
3. Connect a digital voltmeter across the battery plus to minus terminals. The voltage for an uncharged battery may be less than 30 V. During charge it will rise rapidly to about 110 volts and then slowly rise to 130 volts during the charge period and to over 135 volts during the overcharge period.
4. Locate a lead to 8TS1-2 or 8TS1-3 from the cord reel assembly. Place the clamp on ammeter around this lead. During the first minute of charging from a 115v, 60 Hz power supply, the current will be 4 to 5 amperes. Thereafter, it will be about 3 amps. Higher currents may indicate a fault in the system.
5. Connect a 0-5 DC ammeter in series with a lamp load device consisting of 750 Watt, 5-150 Watt, 120 Volt lamps in parallel. Remove the white lead at 4A1-2 which connects to 5S1-16. Connect (-) terminal of ammeter-resistor combination to this lead and (+) terminal to 4TB1-2. Remove jumper from 4A1-2 to 4A1-19.

Turn the charge complete adjustment 4A1R30 maximum counterclockwise.

6. Connect Battery charger line and to the output of a variable autotransformer in the AC line. Set autotransformer output to 115 VAC.
7. Turn Main Power Circuit Breaker ON. Turn OPERATOR KEY switch to charge. Monitor charge current, Line Current, and Battery voltage.

Line Current will initially be about 5 amperes and fall rapidly. Higher currents may indicate a fault in the charger.

Charger Current will initially be about 5 amperes and drop rapidly as battery voltage increases.

Battery Voltage will rise rapidly (in a few minutes) during this initial procedure to the order of 90-110 volts.

8. Turn the charger off when battery voltage reaches 110 volts. Turn circuit breaker OFF, remove the lamp load in series with DC ammeter and reconnect ammeter. Be sure meter polarity is correct.
9. During the remainder of the charge it will be necessary to monitor and record the charge current at 1/2 hour intervals so as to calculate the total ampere-hour charge input to the battery. Prepare a table as shown below to record the data.

The table shows typical data during the initial charge of a new battery.

DATE & TIME	HOUR INTERVAL FROM STEP 10	BATTERY VOLTAGE	CHARGE CURRENT END OF INTERVAL	CHANGE INPUT TO BATTERY	
				INTERVAL AMP-HOURS	ACCRUED AMP-HOURS
6/27 12:07	0.0	117.4	2.5	---	---
12:37	0.5	122.1	2.1	1.05	1.05
13:07	1.0	122.6	2.5	1.25	2.30
13:37	1.5	123.0	2.4	1.2	3.50
14:07	2.0	123.4	2.5	1.25	4.75
14:37	2.5	123.8	2.4	1.2	5.95
15:07	3.0	124.2	2.4	1.2	7.15
15:37	3.5	124.5	2.4	1.2	8.35
16:07	4.0	124.8	2.3	1.15	9.50
16:37	4.5	125.1	2.3	1.15	10.65
17:07	5.0	125.3	2.3	1.15	11.80
Overnight Shutdown					
6/28 08:00	5.0	119.4	2.7	---	---
08:30	5.5	125.3	2.3	1.15	12.95
09:00	6.0	125.7	2.2	1.1	14.05
09:30	6.5	126.1	2.3	1.15	15.20
10:00	7.0	126.3	2.2	1.1	16.30
10:30	7.5	127.1	2.2	1.1	17.40
11:00	8.0	127.6	2.1	1.05	18.45
C/10 Charge Rate					
11:15	8.0	126.2	1.3	0.65	19.10
11:45	8.5	129.1	1.3	0.65	19.75
12:00	8.75	131.5	1.3	0.325	20.075
Charger Cut-off; Overcharge					
12:15	8.75	130.5	1.3	---	---
12:30	9.0	133.5	1.3	0.325	20.40
13:00	9.5	139.8	1.3	0.65	21.05

10. Re-energize charger. Adjust AC input voltage for a charger current no more than 3.0 DC amps.
11. After 10 minutes into charging period check voltage of each cell using digital voltmeter. Voltage should be between 1.2 and 1.55 volts. If any cell is outside this range stop charging procedure and replace the cell group under terms of warranty. If a cell group is replaced, start over at Step 1 of this section.
12. For protection, place the furnished red insulating boards over the top of the battery. Temporarily secure with masking tape.
13. Record charge input current at 1/2 hour intervals. Adjust AC input up to a maximum of 125 volts to maintain DC charge current between 2.0 and 3.0 amps.

NOTE: This charge procedure may be discontinued overnight without having to begin at Step 1 the following day. Turn charger ON and continue with readings as per Step 13.

14. Continue charging and recording on 1/2 hour intervals for a maximum of 8.0 hours from the initiation of Step 10 - or until a battery voltage of 131 to 132 V is achieved - whichever comes first. If 8.0 hours, continue with Step 15. If 131 volts, skip to Step 16.
15. At the end of 8.0 hours from Step 10 with battery voltage less than 131 V; adjust line voltage for a reduced charge current of 1.3 amperes. Continue at this rate, recording on 1/2 hour intervals, until a battery voltage of 131 to 132 is realized.
16. When battery voltage reaches 131 to 132 V, slowly adjust 4A1R30 clockwise until the charger stops and the charge complete lamp lights.
17. Turn OPERATOR'S KEY switch and Main Power Circuit Breaker OFF. Disconnect charger plug from wall outlet. Move the white lead from 4A1-2 to 4A1-17 and the black lead that goes to 4 CR5 bridge from 4A1-8 to 4A1-18. If the charger board does not have terminals 4A1-17 and 4A1-18 connect a jumper (No. 16 AWG wire or larger capable of carrying 3 amps) across terminal 4A1-2. This by-passes 4CR6 to allow battery charging even though the automatic cut-off has shut off 4CR6.
18. Connect the battery charger plug to variable autotransformer in AC line. Turn OPERATOR'S KEY switch to CHARGE and main power circuit breaker on ON.

Adjust variable autotransformer in AC line for a charge current of 1.3 amperes.
19. Continue charging and recording charge current on 1/2 hour intervals until a total of 21.0 ampere-hours is accrued. During this overcharge interval battery voltage should rise from 131 to a minimum of 135 volts. Adjust AC line input to maintain 1.3 ampere charging current.
20. When 21.0 ampere hours is accrued, and with battery still on charge, measure voltage of each cell with digital voltmeter. All cells shall read at least 1.50 volts. Record individually all voltages in Battery Service Log F3560. If any cell reads less than 1.50 volts that cell group should be replaced following established warranty procedures. Use F3560 for record information.

21.
 - a. If a cell group is to be replaced after the 21.0 ampere-hour charge, turn unit circuit breaker and OPERATOR'S KEY switch OFF.
 - b. Disconnect Battery lead terminals to unit and connect 1200 Watt lamp load - consisting of 8-150 Watt 120 V lamps in parallel - across battery. This will discharge entire battery (3 cell group) in approximately the 1 hour at rate of 13 amperes.
 - c. When individual cell voltages discharge to a level of 0.5V or less, place a shorting clip across the cell terminals. Continue until all cells are shorted, then remove lamp load. Allow the battery to discharge for a total of 16 hours with each cell shorted.
 - d. Remove the faulty cell group from the battery and replace with a new cell group, repeat the initial charge from Step 1 of Section 6-2.
 - e. Put white lead back on 4A1-2.
 - f. Put black lead back on 4A1-8.
22. **Turn OPERATOR'S KEY switch and Main Power Circuit Breaker OFF. Disconnect charger plug from wall outlet. Turn battery protector adjustment 4A1-R11 completely counterclockwise. Reconnect jumper from 4A1-2 to 4A1-19. Connect DVM across the battery plus to minus terminals. Connect charger cord to wall outlet. Turn Operator's Key to charge position and main power circuit breaker on. When battery voltage reaches 135.5 +/- .5V slow turn 4A1-R11 clockwise until 4A1-K16 energizes and blower turns off.**

PMS DATA RECORD – MOBILE GENERATOR I

Date of Inspection _____

Mobile Generator Name _____

MAINTENANCE AND/OR CHECKS	FREQUENCY	RECORD INFORMATION, NOTES, ETC.
1. Counterweight cable Inspection	Every 6 Months	
2. Counterweight Cable Replacement and Carriage Lubrication	Every 3 Years	
3. Yoke Rotation Bearing Lubrication	Every 3 Years	
4. Extension Arm Inspection	Every 3 Years	
5. Extension Arm Lubrication	Every Year	
6. Brake, Chain, and Linkage Lubrication	Every 3 Years	
7. Battery Servicing	Every 6 Months	
8. Equalization Cycle	Every Year	
9. Sentry Collimator Lubrication	Every 3 Years	
10. Sentry Collimator Cable Inspection And Adjustment	Every Year	
11. Sentry Collimator General Inspection	Every Year	

List the equipment and serial numbers of same used on this work.

PMS Performed By _____

This record is used in conjunction with X-Ray Room log form No. F3219

Form No. F3316 3/16/73

PRINTED IN U.S.A.

FUNCTIONAL CHECK

MAINTENANCE AND/OR CHECKS	FREQUENCY	RECORD INFORMATION, NOTES, ETC.
1. X-Ray Tube Filaments	Every 6 Months	
2. X-Ray Tube Anode Rotation	Every 6 Months	
3. X-Ray Tube MA	Every 6 Months	MA=
4. X-Ray Contactor (Mech.)	Every 6 Months	
5. Rad, Timer	Every 6 Months	T=
6. HV. Transformer Primary Voltages	Every 6 Months	Fill out Primary Load Volts Record
7. Line Voltage Compensation	Every 6 Months	
8. Rad. KVP Output	Every 6 Months	Fill IN KVP Record
9. Battery Circuit Calibration	Every 6 Months	
10. Tube Current Overload	Every 6 Months	
11. Battery or Line Current Overload	Every 6 Months	
12. Low Filament Voltage Check	Every 6 Months	
13. Three Second Back-up	Every 6 Months	
14. Indicating Lights	Every 6 Months	
15. Extension Arm Assembly	Every 6 Months	
16. Column And Carriage Assembly	Every 6 Months	
17. Brake And Motor Drive	Every 6 Months	
18. Collimator Field Lamp Voltage	Every 6 Months	V=
19. Collimator Alignment	Every 6 Months	
20. Crosshair Position	Every 6 Months	
21. Bucky Centering Light	Every 6 Months	
22. Field Size Pointer	Every 6 Months	
23. Extension Cylinder Alignment	Every 6 Months	
24. Rotational Detent	Every 6 Months	
25. Time Interval	Every 6 Months	
26. Inherent Filtration	Every 6 Months	()mm of Al. Equiv.
27. Phototimer	Every 6 Months	
28. Auxiliary Items	Every 6 Months	

6-3 Check Electrolyte Level

Electrolyte level of a discharged cell will be below the baffle. Electrolyte level can only be checked after a cell has been fully charged and gas bubbles from overcharging have been allowed to escape.

WARNING: BATTERY ELECTROLYTE IS CAUSTIC POTASSIUM HYDROXIDE WHICH WILL BURN SKIN OR CLOTHING. IF SPILLED, NEUTRALIZE WITH VINEGAR OR MILD BORIC ACID SOLUTION OR, IF THESE ARE NOT AVAILABLE, WASH THOROUGHLY WITH WATER. IMMEDIATE MEDICAL ATTENTION IS REQUIRED IF ELECTROLYTE COMES IN CONTACT WITH EYES.

CAUTION: Do not use hydrometers, containers or syringes that have been used for servicing lead-acid batteries.

Do not spill water or electrolyte into the battery container. Resultant electrolytic corrosion may cause battery failure.

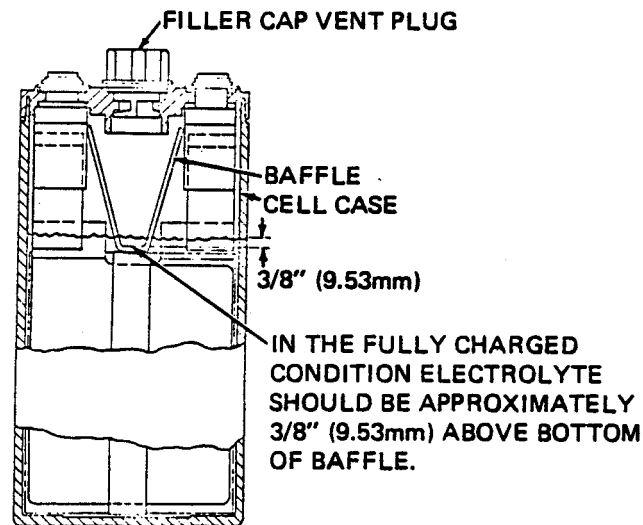
1. Allow the battery to rest a minimum of 2 hours after step 20 of Section 6-2 before proceeding with this check.
2. Use the furnished wrench to remove the caps. Turn each cap 1/4 turn counterclockwise only, then lift it out.
3. Using a bright light (flash light with non-metallic case) examine the inside of each cell for electrolyte level. The level should be 1/4 to 3/8" (6.35 mm to 9.53 mm) above the bottom of the baffle. Refer to Illustration 3-15.

NOTE: 3/8" (9.53 mm) is approximately at the top edge of the second set of holes in the side of the baffle as counted from bottom of baffle.

4. If electrolyte level is too low use a squeeze bottle with pipette tip or syringe to add distilled water to the 3/8" (9.53 mm) level.

CAUTION: DO NOT overfill when adding water as the resulting expulsion during charging or overcharging will cause additional clean-up operations. If too much water is added, do not remove electrolyte because resulting dilution will adversely affect battery performance.

5. Reinstall the filler cap vent plug.
6. Note and record the average water (c.c.) added per cell on F3560. Make individual notations of water required per cell if variations exceed 3 cc per cell.



LEVEL OF ELECTROLYTE IN TYPICAL CELL

16948-R11

LEVEL OF ELECTROLYTE IN TYPICAL CELL
ILLUSTRATION 3-15**6-4 Battery Installation in Unit**

1. Disconnect the battery leads and jumpers from each cell group. (Be sure to use the protective barriers per Section 6-1, Step 12.)
2. Fold back the Mylar covering the battery compartment.
3. Slide one 30-cell group in the right side of the battery compartment. Before pushing it all the way in, check that protective barriers are installed. Connect the lead out of the top main circuit breaker that is labelled (+) to the right front corner terminal (shown as F in Illustration 3-14) of the battery pack.
4. Slide another 30-cell group into the left side of the battery compartment. Before pushing it all the way in, install the protective barriers, then connect the lead on the side of the main power circuit breaker that is labelled (-) to the front left corner terminal (A in Illustration 3-14) of the battery pack.
5. Slide the remaining 30-cell group into the center of the battery compartment. Insert two 7-3/4" x 16-1/4" (2.12 m x 4.91 m) red insulator boards (furnished) between the right and center and two others between the left and center cell group. These are to prevent the battery from sliding around.
6. Two No. 6 AWG leads 6" (152.4 mm) long are furnished. Use them to interconnect the left, right and center battery packs. Install the protective barriers, Illustration 3-13. Connect B to C and D to E as shown in Illustration 3-14. After the connection, push the Temflex sleeving over the solderless terminal lug of each end of each jumper. See Illustration 3-14.
7. Place the Mylar cover over the battery compartment and reinstall the battery retainer plate and the kick panel.

CHAPTER 4

PART I

ADJUSTMENT AND CALIBRATION

NOTE: Chapter 4, Part I as well as Chapter 3 apply only to AMX-II units packed for export with the Vertical Column removed, or for domestic units without the horizontal telescoping arm assembled to the Vertical Column. For domestic AMX-II units with high level assembly refer to Chapter 4, Part II. Units with high level assembly have the horizontal telescoping arm assembled and tied down with straps for shipment.

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SEC 1. HEW FIELD TESTS

The tests and adjustments of this chapter must be followed by the "Functional Checks" of Chapter 5 before the unit is turned over to the user. Do not repeat a Functional Check that has already been covered in this chapter.

Field Tests for HEW compliance are included in Tests performed in this chapter as well as Chapter 5 "Functional Checks." These are an elaboration of the generalized procedures given in Direction 13894 "Field Tests for HEW Compliance." The table below lists all pertinent HEW Field Tests for the AMX-II Reference is given to the appropriate test in Direction 13894, and the corresponding chapter and section of this Service Manual. For a new installation, follow the procedures given in the tables and record data on Form F3382 "System Field Tests for HEW Compliance" and/or Form 3316 "PMS Data Record—Mobile Generator I."

Test Name	Dir. 13894 Reference	Reference SM A0654E	Test Requirement	Application	Record Data
Application and Function	Test 5; Test Set W	Chapter 3 Section 1-2	Manual Collimator used on Mobile Unit.	On installation and replacement of Collimator.	F-3382
X-Ray Control	Test 6	Chapter 4 Sec 2-6 Chapter 5 Sec 5-1	Audible tone required for x-ray exposure.	On installation and preventive maintenance calls.	F-3382
Tube Current—Exposure Time Product	Test 23	Chapter 4 Sec 2-5 Chapter 5 Sec 3-4	<p>MAS Accuracy</p> <p>MAS (MEDIAN) + VARIATION</p> <p>1 (+/-40% + .35 mas) +/- .27 mas</p> <p>1.5 (+/-33% + .30 mas) +/- .27 mas</p> <p>2 (+/-21% + .32 mas) +/- .28 mas</p> <p>2.5 to 4 (+/-14% + .39 mas) +/- .30 mas</p> <p>5 to 8 (+/-8% + .40 mas) +/- .32 mas</p> <p>10 (+/-7% + .40 mas) +/- .32 mas</p> <p>12 to 300 .7% to 10%</p>	On installation, preventive maintenance calls, and whenever repairing or replacing x-ray tube, MA control circuits, timer circuits or H.V. components.	F-3316
Peak Tube Potential (KVP)	Test 21	Chapter 5 Sec 3-5	<p>KVP Accuracy</p> <p>KVP</p> <p>50 to 110 (+10 KVP +7%) (-5 KVP +7%) of dial reading after first 20 milliseconds of exposure.</p> <p>50 to 95 (+20 KVP +7%) (-5 KVP +7%) of dial reading during first 20 milliseconds of exposure.</p> <p>100 to 110 (+25 KVP +7%) (-5 KVP +7%) of dial reading during first 20 milliseconds of exposure.</p>	On installation, preventive maintenance calls, and whenever repairing or replacing battery, KVP control circuits, or H.V. components.	F-3316 F-3382
Indirect Test of Collimator Illumination Level	Test 27-33 Test Set F	Chapter 4 Sec 5-5 Chapter 5 Sec 4-1	19 V (RMS) at minimum battery voltage of 110 VDC.	On installation, preventive maintenance calls, and whenever replacing collimator or collimator lamp.	F-3382

8-3179

SM A0654E

Collimator Alignment; Light Field to X-Ray Field	Test 27-33 Test Set F	Chapter 4 Sec 5-6 Chapter 5	Misalignment of edges of Light Field and X-Ray Field shall not exceed 1.8% of SID.	On installation, preventive maintenance calls, and whenever repairing or replacing collimator or x-ray tube unit.	F-3382
Collimator Alignment; Actual vs Indicated X-Ray Field	Test 27-33 Test Set F	Chapter 4 Sec 5-6 Chapter 5 Sec 4-4	Field size indicators shall agree with actual field size within 1.8% of SID.	On installation, preventive maintenance calls, or whenever repairing or replacing collimator.	F-3382
Inherent Filtration; Diagnostic Source Assembly	Test 13	Chapter 4 Sec 6-1	Half value layer of useful x-ray beam shall not be less than 2.3 mm at 80 KVP.	On installation, and whenever replacing tube unit, insert, collimator mirror, or other absorption between source and patient.	F-3316 F-3381

SEC. 2 TESTS AND ADJUSTMENTS

CAUTION: ON AMX-II Units it is necessary to remove x-ray control cover. To gain access to the six screws retaining the cover, the front and rear panel covers must be removed first. With x-ray control cover removed, extreme safety should be exercised to prevent the possibility of electrical shock.

2-1 Adjust Battery Condition Meter, 5M1

1. If battery was recently charged, the 4A1 Board shall be allowed to cool before starting this procedure. Remove cover and open Operator's Panel and cool for a minimum of 15 minutes. Leave cover off for remainder of tests and adjustments.
- ▲ 2. With 6CB1 and 5S1 off, connect 0.5K, 2 Watt potentiometer in series with Gray lead from 3TB1-26.
3. Connect the digital voltmeter across 4A1-2 (+) and 4A1-11 (-). Set on 200-vdc scale.
4. Arrange test leads so that Operator's Panel can be closed without causing shorts. Close Operator's panel and mechanically Zero 5M1.
5. Open Operator's Panel. Turn 6CB1 and 5S1 ON. Adjust 0.5K potentiometer for 110+/- .1 V on Digital Voltmeter.
- ▲ 6. Adjust 4A2R10 for 5M1 reading on black mark between red and green bands.
7. Close Operator's Panel and allow unit to thermally stabilize for 5 minutes.
8. Repeat steps 5 and 6 if Digital Voltmeter on 5M1 readings shift during the 5-minute interval. Always check 5M1 reading with Operator's panel closed.
- ▲ 9. Turn 6CB1 and 5S1 OFF. Disconnect leads and 0.5K potentiometer. Reconnect Gray lead from 3TB1-26.

2-2 Check X-Ray Tube Filament

1. Disconnect 7TB1-P1 and 7TB1-P2 at the HV transformer and tape the ends (230 v will appear at these ends).

1-1880

SM A0654E

2. Turn the circuit breaker and standby switch to ON.
3. Depress the handswitch ROTOR button while looking into the x-ray tube window. Only the small filament is connected, the large filament is not used in this unit. If the filament does not glow, check for improper filament circuit or HV cable connection. The small filament is the one to the left when viewed from the anode through the x-ray tube window.




2-3 Check X-Ray Tube Anode Rotation

1. Check that 7TB1-P1 and 7TB1-P2 are disconnected at the HV transformer, and the leads taped.
2. Depress the handswitch ROTOR button while looking into the x-ray tube window.
3. When the ROTOR button is released the anode should coast for at least 10 seconds.

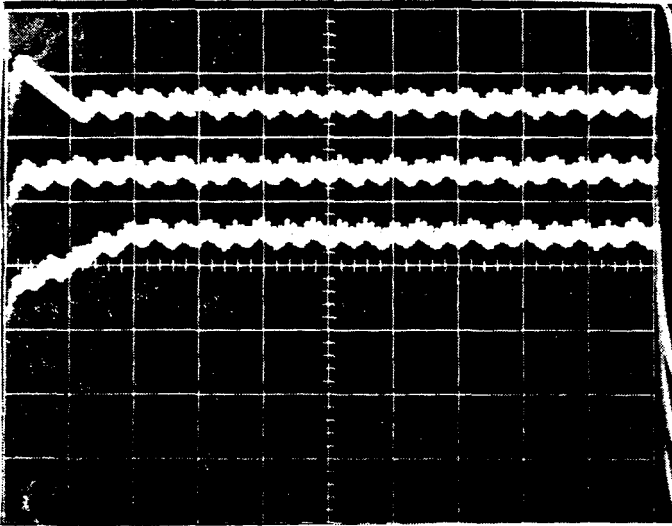
The x-ray tube anode should accelerate to operating speed (3400 rpm) within the 2-1/2-second interval before the READY light glows. If rotation does not occur, check for improper connection of the stator cable. If there is any doubt that the rotor is at proper speed, check voltages across the stator as shown in Chapter 7, waveforms W7 and W8.

2-4 Adjust X-Ray Tube Current (MA)

The filament power and ma regulator circuits were initially adjusted during factory test. Readjustment on installation is required because of tolerance variations between individual controls, transformers, and tube units.

1. Remove the jumper (with banana plugs) from terminals MA+ and MA-on panel 3.
2. Install 0 to 150 ma, DC milliammeter +/-1/2% accuracy with plus lead in the MA+ end and the minus lead in the MA-.
3. Connect the 7TB1-P1 and 7TB1-P2 leads at the HV transformer.
4. Turn the x-ray tube port up and cover with a 1/8" (3.175 mm) thick lead sheet.
5. Cover the x-ray tube unit with a lead apron or place it behind a lead screen for additional radiation protection.
-  6. Select 50 kvp and 10 mas. Make an exposure and observe that the ma meter "kicks" up scale.
7. Connect a 0 to 150 v, iron vane type, AC voltmeter across 7TB1-XS and 7TB1-XC.
8. Select 80 kvp, 200 mas.
-  9. Take an exposure and read the ma meter. Do not make more than one exposure per minute.
10. If ma is not 100, adjust 3A2R34 to obtain ma x-ray tube current +/-5%.
11. Make another exposure and read the voltage across 7TB1-XS and 7TB1-XC. Record this voltage.
-  12. For this next check and adjustment, battery must be at full charge.
With power off, locate leads at main power circuit breaker 6CB1-B (heavy lead). Remove leads from 6CB1-B and connect a 10 ohm, 100 watt adjustable resistor and shorting switch as shown in Ill. 4-11-32A between the leads and 6CB1-B. Turn power on but **DO NOT MAKE EXPOSURES**. Press rotor button only. Depress switch on device shown in Ill. 4-11-32A and read voltage on DVM and adjust resistor tap to obtain 90 VDC \pm 5V. With rotor depressed, adjust 3A2R30 to obtain the filament voltage recorded earlier. Recheck this voltage with the 10 ohm resistor shorted (switch released). If difference in voltage is more than \pm 1 volt, adjust 3A2R27. Repeat checks and adjustments until change in voltage is less than \pm 1V with resistor in or out. Remove switch and resistor and replace leads on 6CB1-B.

13. To verify that filament voltage and ma regulator is optimum, refer to Illustration 4-1. Adjustments of 3A2R30 and 3A2R34 is correct if the center scope trace is obtained when the temporarily installed ma meter reads 100 ma during an exposure. If more or less than 100 ma is obtained with the trace as shown at the center of Illustration 4-1, readjust 3A2R34, then readjust 3A2R30 to obtain the center trace. Repeat this procedure until the center trace is obtained when the x-ray tube current is 100 ma +/-5%. Record in F3382, Test 22 and F3316.



18775-P10

PROBE: Top of 3A2C55
 GND: Bottom of 3A2C55
 H: 20 ms/div
 V: 0.2v/div x 10 (Probe)
 TRIG: INT,DC,+,Set Point

Upper Trace: Filament voltage too high and regulator pulling down or filament voltage normal but regulator pulling down improperly.

Center Trace: Filament voltage correct and ma regulator adjusted correctly.

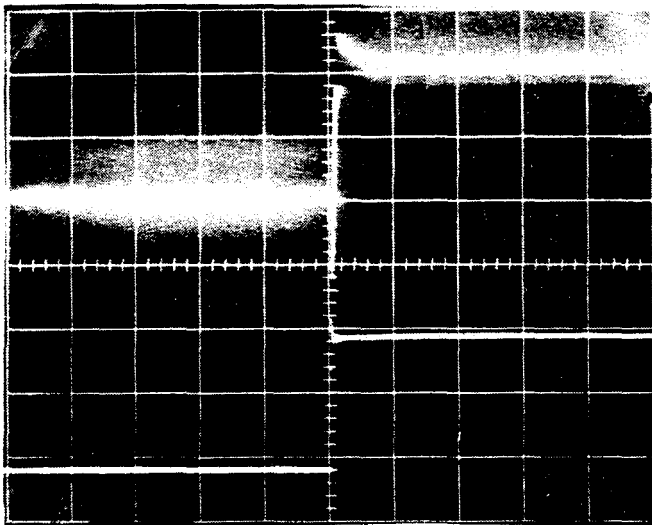
Lower Trace: Filament voltage too low and ma regulator pulling up or filament voltage normal but regulator pulling up improperly.

ILLUSTRATION 4-1

2-5 Test the Timer

The timer was calibrated at the factory and should not require readjustment at installation. This is a function check to verify operation before proceeding further.

1. Check that the scope horizontal sweep calibration is correct.
2. Connect the scope as shown in Illustration 4-2. Make x-ray exposures at 10 mas and 100 mas, 80 kvp.
3. If the trace does not correspond with Illustration 4-2, adjust 3A1R7 to obtain correct interval timing for the 100 mas selection as shown in the lower waveform of Illustration 4-2.
4. Check the interval timing for the 100 mas exposure. Time should be correct within +/-2%. Record in F3316.
5. Select 80 kVp, 1 mAs. Make another exposure and only if necessary, adjust 3A1R9 for exposure interval of 10 MS.
6. If the timer adjustment fails to provide proper exposure timing, check for proper operation of the control SCR (2CR2) and the turnoff SCR (2CR1).



PROBE: 2TB1-1
 GND: 2TB1-3
 UPPER H: 20 ms/div
 LOWER H: 0.2 sec/div
 V: 5.0-v/div x 10 (Probe)
 TRIG: INT, DC, +/- Set Point

18724-P10

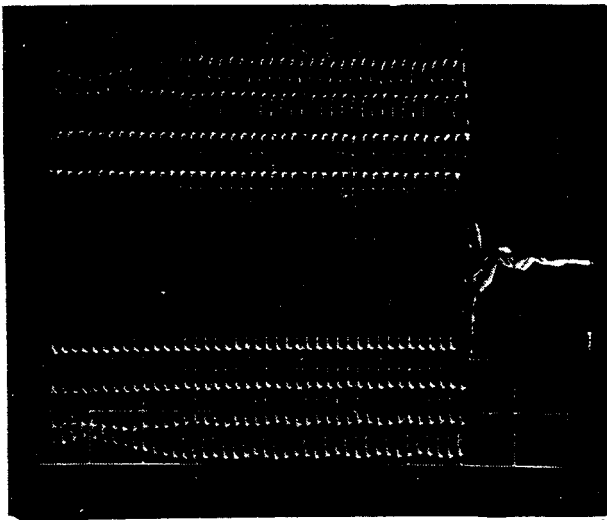
ILLUSTRATION 4-2

2-6 Check High Voltage Transformer Primary and Battery Voltage Under Load

1. The HV transformer primary voltages will vary depending upon the level of charge in the battery. It is assumed that the battery is at 118 to 120 v (full charge with 30 minutes rest) at this time. Make several exposures as indicated for Illustration 4-3 and 4-4 to determine that the output of the x-ray unit is correct. Do not make more than one exposure per minute. This is a function check to verify operation before proceeding further.

It is impractical to use an AC voltmeter to read HV transformer primary voltages because of the differences in response of the various meters to the square wave voltages and because of poor damping which results in needle oscillation during even a 2-1/2-second exposure. Use a scope to observe these voltages.

2. Verify the SON-A-LERT "Beep" and Flash of the X-RAY on Lamp during the exposure. Record in F3382, Test 6.
3. Connect a Digital Voltmeter (2 - 200 vdc) across 4A1-2(+) and 4A1-11(-) to measure battery voltage under load.
4. Make an exposure at 80 kvp, 200 mas and note battery voltage drop between standby, stator load, and x-ray load.
5. Voltage drop from standby to stator load should be from 1 to 1.5 volts and from standby to x-ray load from 22 to 24 volts. If voltage drop is in excess of 25 volts check tightness of primary terminal and jumper lead connections to battery. If necessary, check each cell group voltage under x-ray load to locate and correct cause of excessive voltage drop.

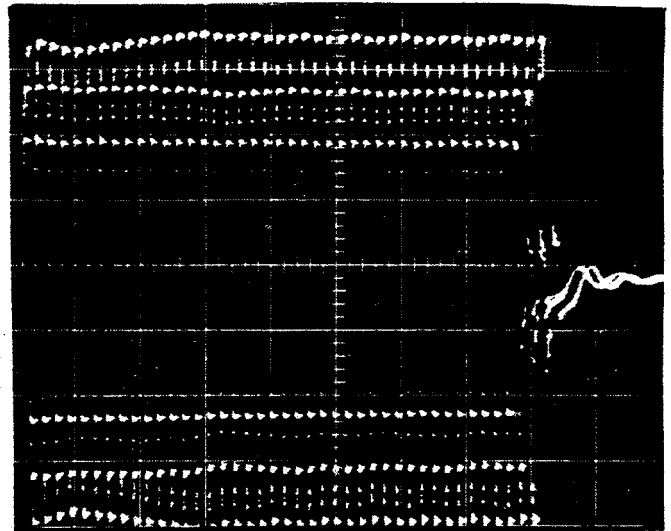


18726-P10

Technic for A - 110 kvp, 8 mas
 B - 90 kvp, 8 mas
 C - 70 kvp, 8 mas
 D - 50 kvp, 8 mas

PROBE: 2TB1-P1L
 GND: 2TB1-P2L
 H: 10 ms/div
 V: 5v/div x 10 (Probe)
 TRIG: INT,DC,+,Set Point

ILLUSTRATION 4-3



18727-P10

Technic for E - 100 kvp, 8 mas
 F - 80 kvp, 8 mas
 G - 60 kvp, 8 mas

PROBE: 2TB1-P1L
 GND: 2TB1-P2L
 H: 10 ms/div
 V: 5v/div x 10 (Probe)
 TRIG: INT,DC,+,Set Point

ILLUSTRATION 4-4

2-7 Motor Drive Speed Control Check and Adjustment

1. Check that the battery voltage is in the range of 110 to 120 vdc.
2. Pry a wood block 2" x 4" x 24" (50.8 mm x 101.6 mm x 0.6 m) under the unit until the 16" (0.4 m) wheels are just off the ground.
3. Connect a DC voltmeter (Simpson Model 260 or equivalent, 20,000 ohms/volt) as follows:
 - + lead to 8A1-5
 - lead to 8A1-6
4. Place a piece of light colored tape on the edge of the tread of one drive wheel.
5. Fully depress the brake handle.

6. Rotate the speed control knob, located on the brake handle, to maximum speed. Check voltmeter reading and wheel RPM.
7. If necessary, adjust 8A1R15 on the motor drive board for 54 ± 2 RPM at a voltmeter reading of 75 ± 5 vdc. The reading should be steady. Variation indicates binding in the drive train or braking system. Do not exceed 80 vdc average.

TABLE 1

(Wheels blocked off of floor)

Test Condition	Adjustment	Voltage	RPM
Full Speed FWD	8A1R15	** 76 \pm 5	54 \pm 2

** Do not exceed 80 vdc average under any conditions.

8. If voltage and RPM values of Table 1 do not agree, remove the voltmeter and take the unit off the wooden block. Connect a pull scale to a rigid member of the AMX. Set 6S2, the Forward-Reverse Switch, to OFF.

With the brake handle depressed measure the force required to move the unit in a straight line on a smooth, level, hard surfaced floor such as tile. The force needed to move the unit should not exceed 25 lbs. (11.34 kg) in either the forward or reverse directions. Note, this is not starting force. If the moving force is greater than 25 lbs. (11.34 kg) the drive train should be examined for a malfunction.

▲ Indicates Change

SEC. 3 INSTALL SENTRY COLLIMATOR

3-1 Prepare Collimator (Required only for collimators shipped with finger guard as shown in III. 4-5).

For collimators shipped with cardboard cover to protect lead fingers and with interface plate prealigned and assembled to HRT-09N tube unit, skip to Section 3-4.

Illustration 4-5 depicts the unit as shipped. Prepare the collimator for attachment as follows:

- ▲ 1. Detach the interface plate adapter plate and finger guard from the collimator by removing three 10-24 unc x 3/4" hex soc hms. See Illustration 4-6. Use the 9/64 T-handle Allen wrench furnished (46-165137P1). Lift off carefully to avoid hitting the projecting lead fingers.
2. Remove the nuts holding the finger guard in place. Discard the nuts, finger guard and adapter plate.
3. Remove and discard the other two 1/4" nuts.
4. Detach the interface plate from the adapter plate by removing the four 10-32 unf x 1/2" hex hms.

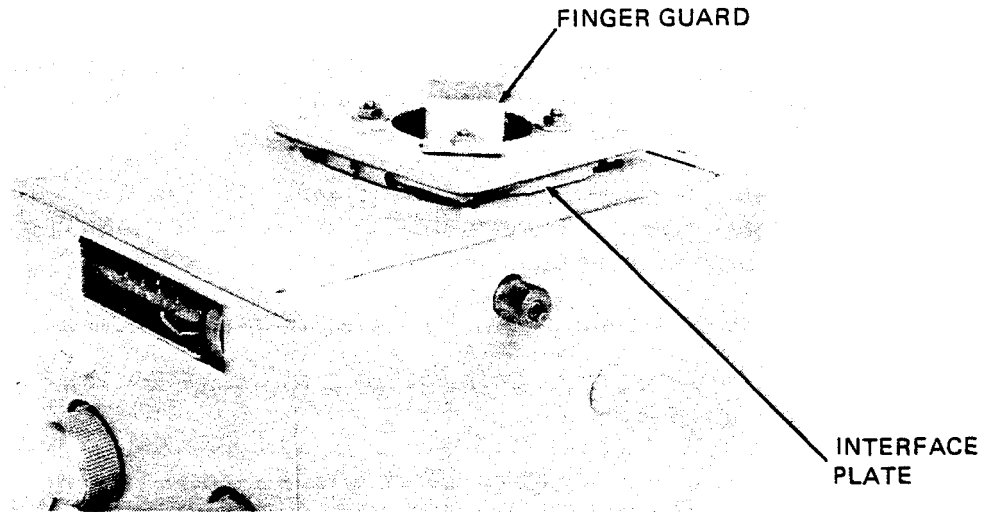
3-2 Tube Unit—Collimator Interface Alignment (Required only if interface plate is not prealigned and assembled to HRT-09N tube unit. For tube units with prealigned interface plate, skip to Section 3-3.

The following procedure will result in alignment of the central axis of the x-ray beam and the center of the collimator blade and shutter arrangement. It requires use of the collimator alignment fixture (part No. 46-166390G1). Incorrect alignment could result in lack of uniform radiation field density.

1-981

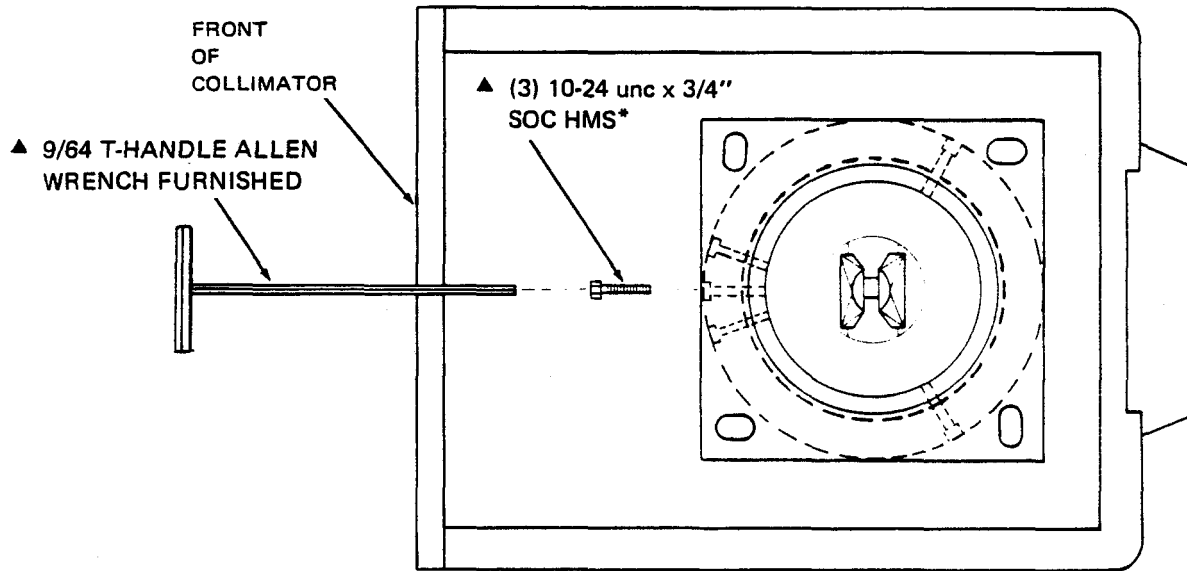
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▲ Indicates Change



21049-P10

ILLUSTRATION 4-5



21371-D11

▲ * WITH SIZE 8 HEAD

ILLUSTRATION 4-6

1. New Style HRT-09N Tube Units (focal spot to accessory mounting surface distance of 2-5/16"): (58.74 mm)


Refer to Illustration 4-7. Discard the adapter plate and the 10-32 unf x 3/4" hex hms. Fasten the interface plate directly to the tube unit with the 9/16" hex eccentrics and the 10-32 unf x 1/2" hex hms furnished. Do not tighten the machine screws at this time.

2. Remove the protective plastic cap from the collimator alignment fixture. Attach the alignment fixture to the interface plate with the three 8-32 unf x 3/4" hex soc hms. Use the 7" (177.8 mm) shank Allen wrench furnished with the collimator. See Illustration 4-8.
3. Rotate the tube unit and alignment fixture for a horizontal x-ray beam.

WARNING: FOR PROPER APPLICATION DURING ALIGNMENT, USE THE FOLLOWING X-RAY TECHNIQUES

60 KVP, 200 MAS (2 seconds)

THE ALIGNMENT FIXTURE IS DESIGNED TO PROVIDE SUFFICIENT RADIATION PROTECTION WHEN THE TUBE UNIT IS OPERATED AT OR BELOW THESE TECHNIQUES. A PIECE OF LEAD GLASS (MINIMUM LEAD CONTENT-2.3MM LEAD EQUIVALENT AT 150 KVP) ALREADY MOUNTED AT THE BOTTOM OF THE FIXTURE MAKES IT SAFE TO LOOK INTO THE FIXTURE WITH THE NAKED EYE. HOWEVER, AS WITH ANY X-RAY EXPOSURE, A LEAD PROTECTIVE SCREEN, LEAD APRON, OR OTHER PROTECTIVE MEDIUM SHOULD BE USED. IF AVAILABLE, TO AVOID UNNECESSARY RADIATION EXPOSURE.

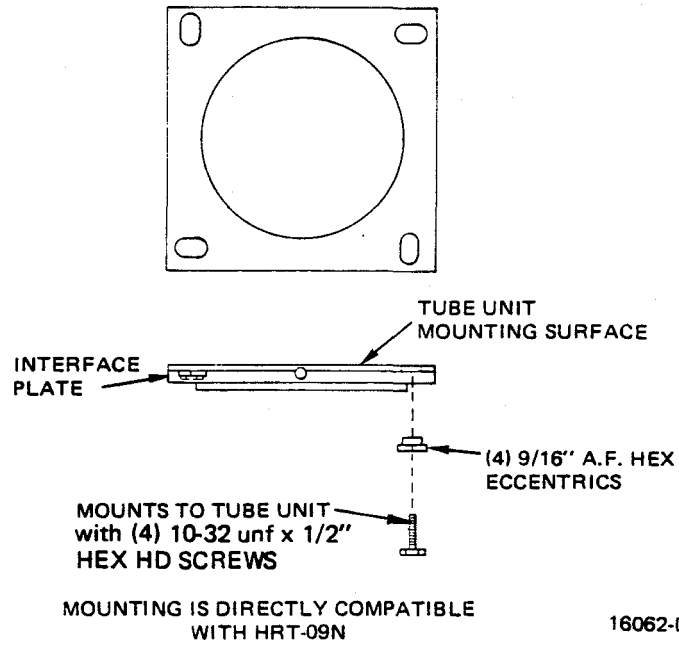
-  4. Darken the room and have an assistant make 60 KVP, 100S ma, 2 sec. exposure. Looking into the bottom of the alignment fixture, observe correlation of the x-ray pattern with the crosshairs on the screen.

Observe the image of the small focal spot. When properly aligned, the crosshairs and focal spot image should coincide.

5. Using the 9/16" hex eccentrics, shift the interface plate in the direction needed for correct alignment. (Using the open end wrenches furnished with the collimator, rotate opposite eccentrics in opposite directions to shift the interface plate position.)

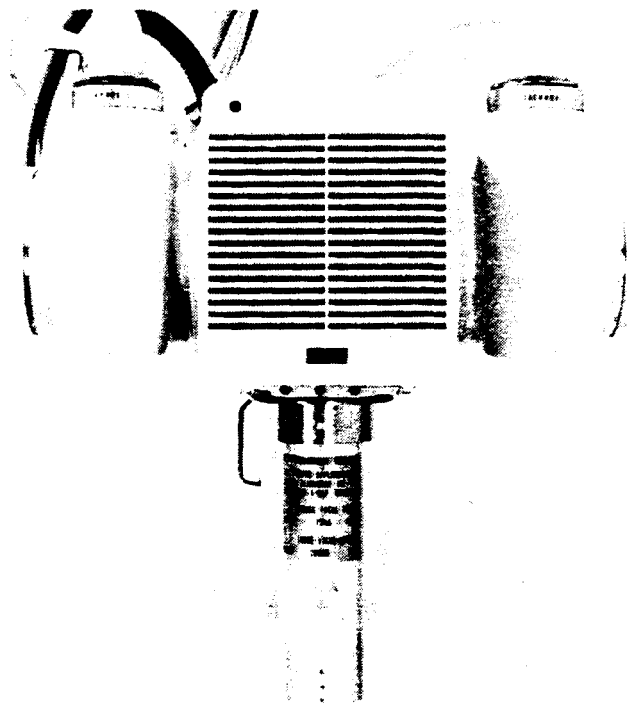
Repeat Steps 4 and 5 until alignment is satisfactory, then tighten the four 10-32 unf hex hms. After tightening the screws, recheck the alignment to make certain it has not changed.

6. Rotate the tube unit and alignment fixture back to a vertical position. Remove the alignment fixture and replace the protective cap.



16062-D11

ILLUSTRATION 4-7



21049-P10

ILLUSTRATION 4-8

1-1582

SM A0654E

▲ Indicates Change

3-3 Collimator Installation

- ▲ 1. Apply Loctite 242 to the three 10-24 x 3/4" hex soc hms and attach the collimator to the interface plate using these screws. Use the 7" (17.8 mm) T-handle shank allen wrench to install screws. Turn the screws until they stop. Then, twist the wrench an additional 1/8 turn. This will apply 35 in/lb of torque to each screw.

NOTE: BE CAREFUL! Bumping the fingers projecting from the top of the collimator could bend them out of alignment.

2. Turn the 1-1/16" inch nut at the top of the column in the clockwise direction until the telescoping arm is properly balanced. Be sure the carriage lock is not secured when making the adjustment.
3. With a level, recheck that the telescoping arm is level with the floor. If not, additional shims must be installed between the arm and the carriage. Refer to Chapter 3, Sec. 2-1, Step 4.
4. Detach the connector housing cover on the back of the collimator by removing the two screws in the top corner.
5. Connect the collimator cable to the receptacle on the right side of the connector.
6. Check that the collimator can be rotated and locked positively at 0°, +/-15°, +/-30°, +/-45°, and +/-90°, from the front position by detents.
7. Check that the measuring tape in the bottom of the collimator housing extends smoothly and freely.
8. Install connector housing on collimator.

SEC. 4 COLLIMATOR MODIFICATIONS (OPTIONAL)

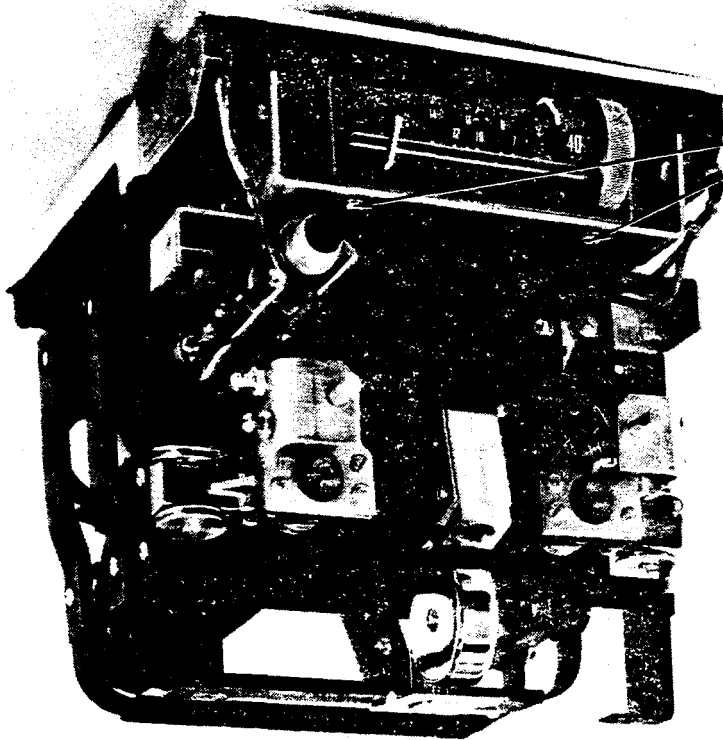
4-1 Metric Scale Label

Attaching the metric scale label does not require recalibration of the pointers.

1. Close the blades (pointers at the right side of the drum).
2. Remove the blade control knobs by loosening the two 8-32 unc x 1/4" hex ss.
3. Remove the nameplate as follows:
 - a. Loosen the two 6-32 unc x 1/4" hex soc set screws at the top of the frame.
 - b. Tilt the nameplate forward enough to clear the control knobs shafts and lift out.
 - c. Lift out.
4. Using a right-angle screwdriver, remove the two screws holding the scale bracket. See Illustration 4-9.
5. Carefully remove the dial assembly.

NOTE: The pointers may have to be spread and held to the right slightly to accommodate removal of the dial assembly.

6. Loosen the 4-40 unc x 3/16" hex soc ss in the left side of the scale drum.
7. Separate the scale drum assembly from the scale bracket by removing the steel shaft that goes through the bracket and the assembly.
8. Place a straightedge along the TOP row of dots at any scale drum to correspond to the dot positions.
9. Expose the adhesive backing behind the "100" scale position by removing the 1/2" strip of liner.



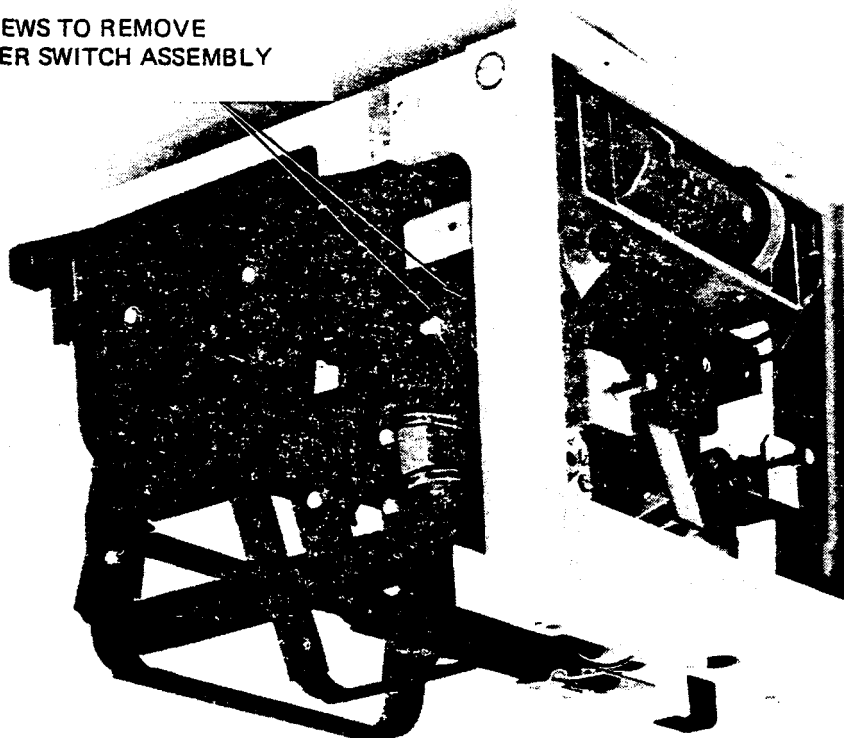
SCREWS TO REMOVE
SCALE BRACKET

18728-P10

NOTE: Trim Cover And Frame Removed For Clarity.

ILLUSTRATION 4-9

SCREWS TO REMOVE
TIMER SWITCH ASSEMBLY



NOTE: Trim Cover Removed For Clarity

18729-P10

ILLUSTRATION 4-10

10. Press the exposed portion of the label around onto the scale drum with the TOP row of dots at the "100" position corresponding to the marks on the ends of the drum.
11. Roll the covered portion of the label around the scale drum to check that the label is attached straight. Realign the attached portion of the label if necessary.
12. Remove the remainder of the liner while carefully pressing the label firmly onto the scale drum.
13. Trim off any excess.
14. Hold the scale drum assembly in the scale bracket and pass the steel shaft back through the bracket and the assembly.
15. Center the shaft on the bracket and align the scale drum with one of the scales indexed in the detent position.
16. Re-tighten the set screw. Check for free rotation and proper index of the scale drum.
17. Replace the dial assembly, nameplate, and knobs.

4-2 Time Interval Adjustment

The field light timer is for 15 to 20 seconds. If the user desires a different time interval, proceed as follows:

For G1 collimators w/old style dashpot timer:

1. Remove the knobs and nameplate per instructions in Sec. 4-1.
2. Detach the connector housing cover.
3. Remove the collimator light cable.
4. Remove the trim cover as follows:
 - a. Remove the two screws in the top corners of the back of the collimator.
 - b. Remove the two front screws in each cone track on the bottom of the collimator.
 - c. Remove the filters and set aside.
 - d. Remove the rotational detent button by turning it CCW. Also remove the spring. Then fully depress the plunger shaft.
 - e. Rotate the collimator approximately 90° from the front position.
 - f. With the measuring tape fully retracted, slide the cover rearward and off.

NOTE: Make sure the cover does not get caught on the measuring tape.

5. Remove the timer switch assembly. See Illustration 4-10.
 - a. Remove the two screws, spacers, and nuts holding the assembly to the mounting plate.
 - b. Pull the assembly out from the side.

NOTE: SEE CAUTION. The dashpot is glass.

6. Remove the plastic cap from the back of the assembly.
7. Turn the socket head set screw on the back of the assembly CCW to shorten the interval (turn the screw only small increments at a time).
8. Depress the button and check the time interval. Listen for the audible click in the snap action switch. Replace the plastic cap when the adjustment is satisfactory.
9. Replace the timer-switch assembly, trim cover, light cable, connector housing cover, nameplate and knobs. Also replace the spring and the plunger knob.

For G2 collimators w/electronics timer:

1. Remove the knobs and nameplate per instructions in Sec. 4-1.
2. Adjust potentiometer on timer circuit board located below timer button for desired timing.
3. Replace nameplate and knobs.

SEC. 5 COLLIMATOR CHECKS AND ADJUSTMENTS

General

The collimator blade and shutter assemblies were factory aligned. Realignment in the field is not recommended. The following adjustments, however, should be checked and readjusted if necessary. Where instructed record data on Form F3382, "System Field Tests for HEW Compliance," or Form F3316, "PMS Data Record-Mobile Generator I."

NOTE: The mirror should NEVER be moved.

5-1 Crosshair Position Check and Adjustment

1. Position the tube unit and collimator perpendicularly over a smooth surface such as a tile floor. Using the collimator measuring tape, set the SID at 40". (1.016 m).
2. Darken the room and energize the field light.

The illuminated area on the cassette should show equal rectangles of light on either side of the crosshair shadows as each set of blades is moved toward the closed position.

3. If adjustment is necessary, proceed as follows:
 - a. Slightly loosen the two rear screws in each cone track.
 - b. Slide the plastic window with the fingertips or tap the frame with a screwdriver until alignment is satisfactory.
 - c. Re-tighten the cone track screws.

5-2 Bucky Centering Light Check and Adjustment

The Bucky centering light is factory adjusted to provide a projected crosshair image in front of the collimator in line with the transverse centerline of the right field. If the Bucky centering light is to be used, check the settings.

1. Adjust the blades to yield an approximate 12" x 12" (304.8 mm x 304.8 mm) field size.
2. Establish a transverse guide line—approximately 20" (0.5 m) length on a surface of 40" (1.016 m) SID.
3. Energize the field light. Position the tube unit and collimator so the shadow of the transverse crosshair falls on the transverse guide line.

If the Bucky light crosshair shadow does not center within 1/4" (6.35 mm) of the guide line and is not reasonably parallel to the line, adjust per the following steps.

4. Remove the blade control knobs and the nameplate per instruction in Sec. 4-1 of this chapter.

CAUTION: BECAUSE OF THE HIGH ENERGY LAMP, THE LIGHT HOUSING MAY BE HOT.

5. Slightly loosen the two socket head screws on the bottom of the light housing.
6. Slide the entire Bucky light lens assembly until the proper position is obtained.
7. Re-tighten the screws.
8. If necessary, rotate the light housing to move the Bucky light field. If this is done, recheck the position of the light field and the shadow crosshairs per instructions in Sections 4-1 and 6.
9. Replace the nameplate and the blade control knobs and repeat steps 1 through 3.

5-3 Extension Cylinder Alignment Check (Optional Accessory)

1. Position the tube unit and collimator perpendicularly over a smooth surface such as a tile floor. Using the collimator measuring tape, set the SID at 40" (1.016 m).
2. Slide the extension cylinder into the tracks at the bottom of the collimator until the cylinder latch snaps into the slot on the right-hand track.
3. Darken the room and energize the field light.

The illuminated area on the cassette should show equal sectors of light on either side of the crosshair shadows.

4. If adjustment is necessary, proceed as follows:
 - a. Loosen the eight cone track screws.
 - b. Shift and/or shim the tracks as necessary.
 - c. Re-tighten the screws.
 - d. Re-check the alignment.

5. Remove the cylinder by pressing the latch.

5-4 Large Field Size Check

1. Position a loaded 14" x 17" (35.5 cm x 43.2 cm) cassette under the collimator (17" (43.2 cm) dimension transverse to the axis of the tube unit). Using the collimator measuring tape set the source-to-image distance at 40". (1.016 m).
2. Adjust the blades to yield a field size of 14" x 17" (35.5 cm x 43.2 cm). Place a coin on the cassette to identify the anode end of the x-ray tube.

CAUTION: THE FOLLOWING PROCEDURE REQUIRES THE PRODUCTION OF X-RAYS. OBSERVE RADIATION SAFETY RULES. A LEAD PROTECTIVE SCREEN, LEAD APRON UNIT OR OTHER PROTECTIVE MEDIUM SHOULD BE USED TO AVOID UNNECESSARY EXPOSURE. X-RAY REQUIREMENT INDICATED BY

3. Make a 50 KVP, 1 mas exposure and develop the film.

If cutoff in the transverse direction is observed, correct lead finger spacing should be verified. Refer to Section 2-2. This should be done as follows:

4. Remove collimator lamp cable.
5. Remove the (5) 8-32 unc x 3/4" soc hms holding the collimator to the interface plate.

NOTE: Be careful not to loosen any of the 10-32 unf hex hms securing the interface plate to the tube unit.

6. Place the collimator upright on a table (use soft material between the collimator and table top to protect the finish). Fully close the transverse set of blades.

With this set of blades full closed, the lead finger spacing (measured at the top edge) should be between 5/32" (3.96 mm) and 3/16" (4.76 mm) and centered. If the spacing is greater, gently bend the fingers toward each other until the gap is within this range. If the spacing is less, bend the fingers apart until the gap is within these limits (preferably toward the 3/16" (4.76 mm) dimension). If the latter is done, visually check that the lower portion (heel) of each finger will not cause cutoff of the primary x-ray beam at large field sizes.

Replace the collimator and make another exposure at the field size specified in Step 2. If cutoff is still observed, alignment of the blade and/or shutter assemblies is faulty and the collimator must be replaced.

5-5 Field Lamp Voltage Check

The voltage at the collimator lamp socket must be at least 19.0 VAC RMS at a minimum battery voltage of 110 vdc. This is an indirect test of illumination level to meet HEW requirements.

Because the lamp voltage is a square rather than sine wave, the voltage measured with a Fluke 8000A Digital Meter will be greater than the true RMS value. Lamp voltage can be measured with a True RMS calculating digital meter such as a Weston/Schlumberger, model 4445. Do not use an iron-vane AC voltmeter because it will load the lamp circuit.

1. Remove the Blade Control knobs and collimator nameplate per Section 4.
2. Measure No Load Battery Voltage using a digital voltmeter.

3. Connect Digital Voltmeter (Fluke 8000A) to read the ac lamp voltage at the collimator lamp socket terminals.
4. Depress the FIELD LIGHT Button and read Lamp Voltage.
5. Compare Lamp Voltage to no-load battery voltage as listed in the table below. If necessary, extrapolate between values. The lamp voltage must be equal or greater than the values given, however too high a lamp voltage will reduce lamp life.

No Load Battery Voltage	Minimum Lamp Voltage (VAC)	
	RMS Ref.	Fluke 8000A
128	22.2	24.3
126	22.0	24.1
124	21.7	23.8
122	21.4	23.5
120	21.1	23.1
118	20.7	22.7
116	20.3	22.3
114	19.9	21.9
112	19.5	21.5
110	19.0	21.0

6. The secondary of 8T1 is factory connected to the Blue Tap. A shift to an adjacent 8T1 tap will change lamp voltage by approximately 0.5 v rms. If necessary, select the lowest voltage tap of 8T1 that provides at least the minimum voltage listed in the Table above.


8T1 Transformer Taps. (AMX— Model 46-165600G10, G11, G12)

Common	Brown	—	Factory connection to 8TS1-13
	Red		Factory connection to 8TS1-14
TAPS listed in order of increase voltage ↓	Orange		
	Green		
	Black		
	Blue	—	
	Yellow		
	Black/White		
	BRN/WHT		

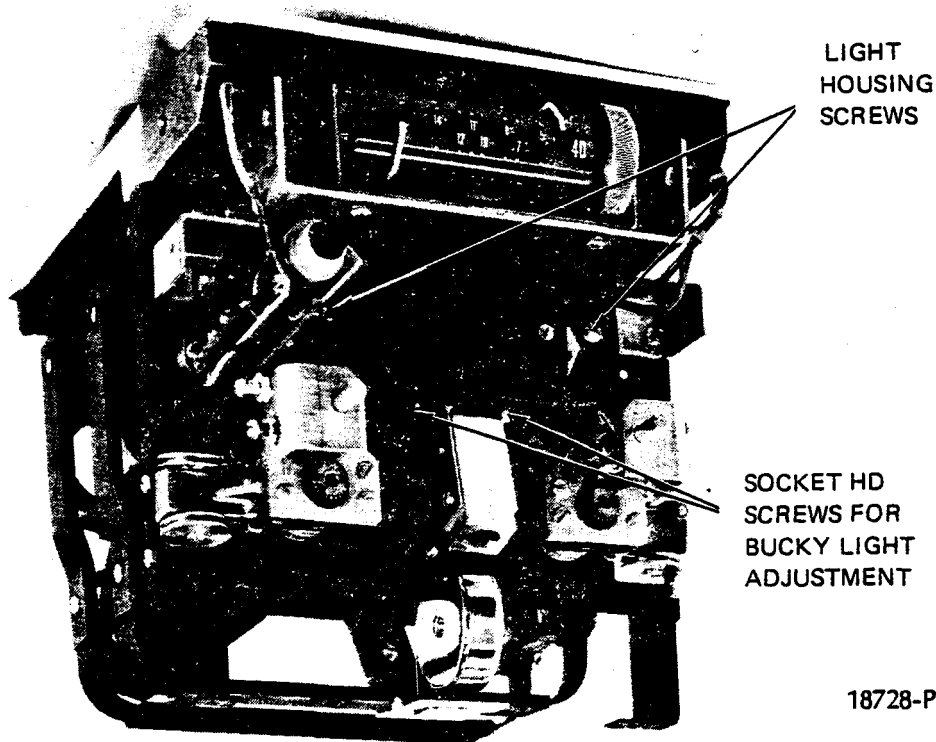
7. Replace nameplate and knobs after verifying that the collimator lamp is operating in the proper voltage range.
8. Record Collimator Lamp Voltage and battery voltage on F-3382, Test 27-33, Set F.

5-6 Collimator Beam Alignment Tests

1. To meet HEW requirements:
 - a. The misalignment of the edges of the light field with the respective edges of the x-ray field along either the length or width shall not exceed 2% of SID when the field is perpendicular to the x-ray beam.

- b. Field size indicators of length and width on collimator shall each agree with actual x-ray field size at the receptor to within 1.8% of SID when beam axis is perpendicular to the plane of the film.
2. Establish test variables using single cassette size (14" x 17") (35.5 cm x 43.2 cm) for a vertical x-ray beam at SID distances of 40" (1.016 m) and 72" (1.83 m).
3. Procedure
 - a. Load a large cassette and place on floor (14" x 17" (35.5 cm x 43.2 cm) preferred size).
 - b. Position Diagnostic Source assembly for vertical x-ray beam and a SID of 40" (1.016 m). Using collimator light to carefully center x-ray beam on cassette.
 - c. Carefully adjust collimator field size indicators to a common field size smaller than the image receptor—use 12" x 12" (30.48 cm x 30.48 cm) field size for a 14" x 17" (35.5 cm x 43.2 cm) cassette.
 - d. Assemble and attach RAT to collimator using RAT holding fixture.
 - e. Use Collimator Lamp, note and record where edges of light field appear on RAT grid pattern.
 -  f. Exposure and develop film (recommend 4 MAS at 50 KVP for par speed film with medium screens at 40" (1.016 m) and 16 MAS at 72") (1.83 m).
 - g. Measure x-ray image length and width. Each must agree with numerical indicator settings (step c) within 1.8% of SID.
 - h. Mark light field (step e) on x-ray field. Total misalignment of either length or width edges must not exceed 1.8% of SID.
 - i. Repeat steps a thru h for a SID distance of 72" (1.83 m).
4. If edge to edge light field and x-ray field alignment exceeds 1.8% of SID adjust as follows:
 - a. Remove the knobs and nameplate per instructions in Section 4-1.
 - b. With nameplate removed, temporarily reinstall knobs and adjust field size to same setting as in 3C.
 - c. Slightly loosen the two light housing mounting screws. See Illustration 4-12.
 - d. With RAT in holding fixture beneath collimator, shift light housing so that light field aligns with the grid pattern of the x-ray field from step 3h.

Shift the light housing vertically to move the field forward or back and horizontally to move the field right or left. Do not rotate the housing.



NOTE: Trim Cover and Frame Removed for Clarity



ILLUSTRATION 4-12

- e. Retighten the two screws.
- f. Replace the nameplate and the blade control knobs and repeat the alignment procedure.
5. If the indicated versus actual field size does not fall within specifications, adjust the appropriate pointer or pointers as follows:
 - a. Remove the blade control knobs and the nameplate per instructions in Sec. 4-1 of this chapter.
 - b. Gently bend the pointer sideways to make the necessary adjustment.
 - c. Replace the nameplate and the knobs and repeat the alignment procedure.
6. If any test is not in compliance the collimator must be realigned and all tests of Section 5-6 repeated.
7. Record Data in Set F, "Manual Collimator Light Field," sheet 10, F-3382. Omit "SID" and "center-to-center" rows in Set F Data Table.

SEC. 6 DIAGNOSTIC SOURCE ASSEMBLY; INHERENT FILTRATION

To meet HEW requirements, the half-value layer of the useful beam at 80 KVP shall be not less than 2.3mm aluminum. This test must be made of the diagnostic source assembly, at installation and whenever replacing tube unit, insert, window, collimator mirror, or other absorption between source and patient.

NOTE: REFER TO DIRECTION 13894, PART II, SEC. 2 "RADIATION INSTRUMENTS" FOR SPECIFIC INFORMATION ON DIFFERENT TYPES OF INSTRUMENTS.

1. Position radiation probe of a Dose measuring instrument so that the center of the active probe area is 12 inches (304.8 mm) from the end of the collimator and centered in the useful beam.
2. Collimate down to area of probe using the light beam. Keep other equipment at least 4" (101.6 mm) away from probe to prevent radiation scatter errors.
3. Use technic factors of 80 KVP; 20 to 48 MAS. MAS should be adjusted so that reading in step 5 is approximately 3/4 scale.
4. Remove the 1.0 and 2.0MM selective filters from the collimator.
-  5. Make an exposure and measure radiation (total R for integrating meters) with no added filters. This represents 100% transmission level. Record readings and terminate exposure.
-  6. Place standard absorber 46-173632G1 in beam. Absorber must be in collimator accessory rails. Repeat exposure and record reading.
7. Divide reading in step 6 by reading in step 5.

IF RATIO IS

THEN FIXED FILTRATION MUST BE

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Greater than 0.5 2. Less than 0.5 | <ol style="list-style-type: none"> Left as is. Added (mandatory) |
|---|--|
8. Filtration may only be removed if additional filtration was previously added. The amount of filtration to be changed may be estimated as 0.5mm for each desired 0.05 change in ratio. For example, if ratio is 0.48, a change of approximately .05, is desired, so add 0.5mm aluminum.
 9. Fixed filters must be 1100 aluminum and should be mounted to the back of the mirror. Use a good quality adhesive such as contact cement or epoxy. Since the filter will be at about 45° angle to the beam use only about 0.7 of the thickness of aluminum that is calculated. Recheck before mounting permanently (use tape for temporary mounting).
 10. The 0.5 minimum ratio is mandatory, but above 0.5 ratio is not. However, above 0.57 there will be a noticeable reduction in radiation, requiring higher technics to obtain the desired image density.
 11. Record Data on F-3382, Test 13.


SEC. 7 COMPLETING THE INSTALLATION

This section should not be done until the remaining checks of Chapter 5 "Functional Check" listed below are completed.

Chapter 5, Section	Functional Check
2-1	Mechanical; Tube Unit and Collimator
2-2	Mechanical; Extension Arm Assembly
2-3	Mechanical; Column and Vertical Carriage
2-4	Mechanical; Base, Cabinet and Brakes
2-5-1	Mechanical; Motor Drive Controls and Interlocks
3-2	Electrical; Tube Rotation Check
3-3-2	Electrical; Tube Filament Sensor Interlock
3-4-2	Electrical; Backup Timer
3-5	Electrical; H.V. Divider, KVP Calibration and MA
4-1-1	Collimator; Uniform Light Pattern
5-1	System; Film and Indicator Checks
5-3-1	System; Battery Capacity Check

1. Disconnect the trickle charger circuit. This circuit was designed to trickle charge after the CHARGE COMPLETE lamp indicates that the battery is at full charge. As recommended use is to leave the unit on charge when not in service, this trickle charge feature should not be used as it will result in excessive water use by the battery. Check that there is no jumper between 4A1-7 and 4A1-8. If a jumper is present, remove it.
2. Complete battery service log forms, F3560, and place in holder on back of cassette drawer.
3. Install the cover over the HV transformer terminals. Be sure the plastic grommet is placed in the cover notch when positioning the cover over the terminal studs.
4. Install cassette drawer.
5. Install X-Ray control cover, front and rear panel covers.
6. Install wheel covers using the furnished eight F.H.M.S.
7. Demonstrate and explain unit functions as follows:
 - a. Demonstrate how to position the vertical column and x-ray tube before the mobile unit is moved to a new location. Particularly point out that the latch must be connected to the latch bar to prevent the collimator from striking the x-ray control during transport. Install two white bumpers over the slots for adjusting the latch.
 - b. Demonstrate the proper operation of the motor drive feature. Emphasize that the motor will automatically stop.
 - c. Explain that the unit must be manually pulled back to regain drive control if the bumper comes in contact with any object. If the bumper is bent so it remains recessed, it must be manually straightened.
 - d. Explain that the unit may be transported manually if the user desires to or if the drive feature fails.

- e. Explain that if the motor drive is used very extensively, the batteries will require more frequent charging.
- f. Explain that the unit does not require charging when the meter reads in the green regions. Recharging is required only when the meter reads in the red "RECHARGE" or "LOW" region. It is not recommended that the unit be put on charge after every use.

-  8. Make several x-ray exposures to check that the unit is functioning properly. Particularly check lamp and tone signal exposure indicators.
- 9. Give the two x-ray control panel door keys and the six stand-by on/off switch keys to the customer. Advise that the former should be given only to a qualified serviceman and the latter should be given only to a qualified operator. The keys should not be left on the x-ray unit.
- 10. Insert the technic chart (Direction 13777) furnished, into the card holder on vertical column of the mobile stand. Call the customers attention to the location of the chart.
- 11. Provide a copy of the AMX-II Operating Manual, OM A0654E, and NCRP Report No. 33 to the customer on his representative. Obtain the signed acknowledgement card for NCRP Report No. 33.
- 12. Complete F3382 "System Field Tests for HEW Compliance" and F3316 "PMS Data Record—Mobile Generator I."

CHAPTER 4

PART II

NOTE: CHAPTER 4, PART II, APPLIES ONLY TO DOMESTIC AMX-II UNITS WITH HIGH LEVEL ASSEMBLY IN WHICH THE HORIZONTAL TELESCOPING ARM IS CONNECTED TO THE VERTICAL COLUMN AND TIED DOWN WITH STRAPS FOR SHIPMENT. REFER TO CHAPTER 3 AND CHAPTER 4, PART I, FOR EXPORT AMX-II UNITS PACKED WITH VERTICAL COLUMN REMOVED OR FOR DOMESTIC UNITS WITHOUT THE HORIZONTAL TELESCOPING ARM ASSEMBLED TO THE VERTICAL COLUMN.

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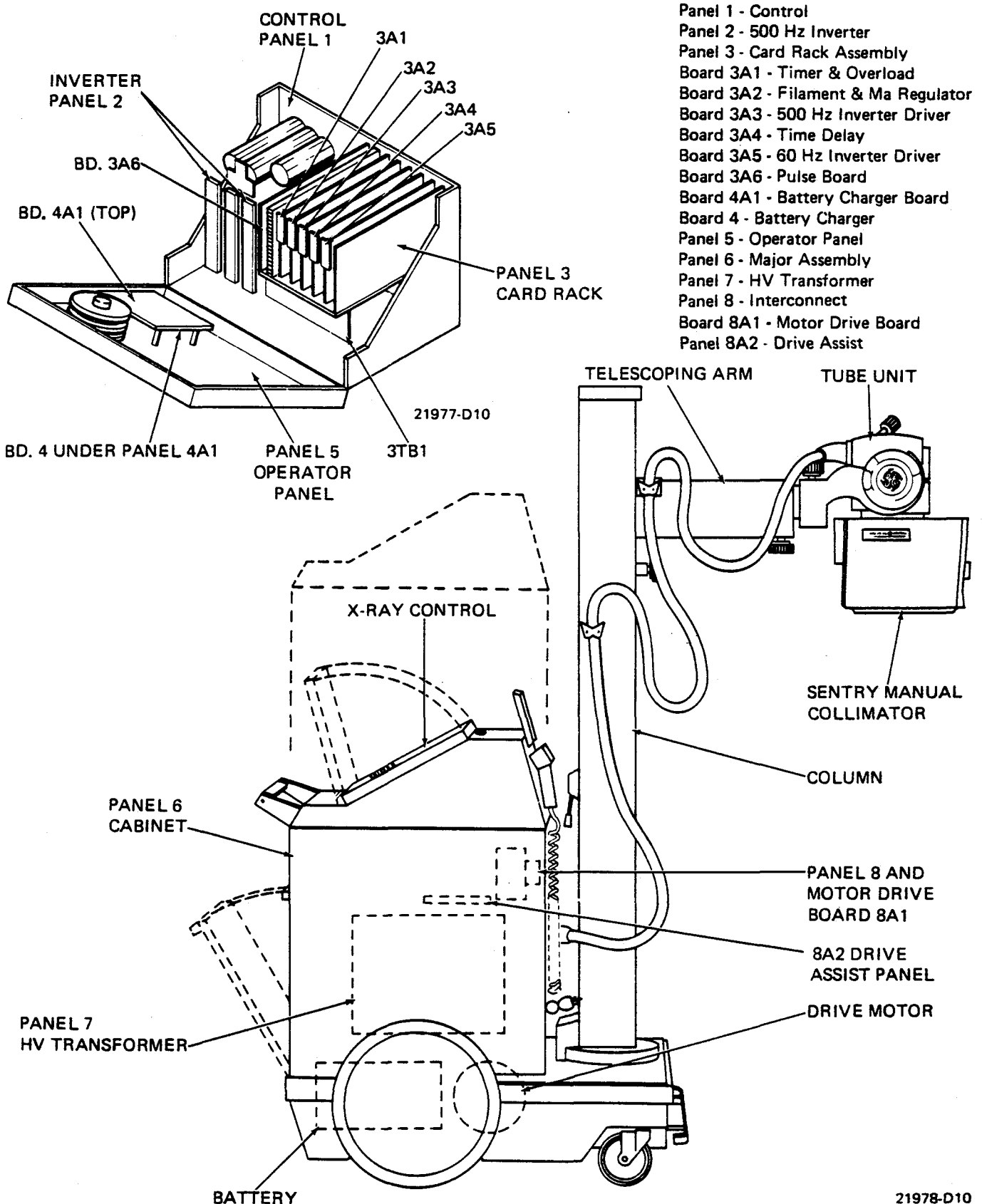


ILLUSTRATION 4-II-1

1-1582

SM A0654E

▲ Indicates Change

SEC. 1 PRE-INSTALLATION

1-1 Introduction:

This AMX-II installation procedure is organized to minimize the time required to install and check-out the unit. It takes advantage of the assembly and tests performed in the factory. Also, System Functional Checks and Field Tests for HEW compliance are included in the installation procedure to eliminate duplication.

Users of this publication are encouraged to report errors, omissions and their recommendations for improving the publication (use direction form 13861A).

1-2 Product Identification and Compatibility Requirements for HEW Certification:

The AMX-II is identified by the following component model numbers. To meet HEW requirements regarding beam quality, exposure MAS, minimum filtration, beam collimation, and source to skin distance, the sensitive components making up the AMX are identified with the nameplate statement "this product conforms to all applicable standards under 21 CFR part 1020", or "complies with DHEW radiation performance standards, 21 CFR Subchapter J".

COMPONENT	MODEL NUMBER	NAMEPLACE LOCATION	NAMEPLATE HEW STATEMENT
Basic AMX-II Unit includes control, mobile base, vertical column, and horizontal telescoping arm.	▲ 46-165600G10, G14, G15	On front of Unit beneath handswitch bracket.	yes
H.V. Transformer	46-150625G1	Beneath terminal strip	yes
X-Ray Tube Housing X-Ray Tube insert	46-155750G3 46-125686G6	On back trim cover of Tube Housing	yes
Sentry Collimator	46-177399G1 or G2 or 46-194759-G1	On rear trim cover	yes
Extension Cylinder (optional item)	46-138573G1	On support plate	yes
Battery Cell Group (3 used per unit)	46-152812-P1	End of cell group case	no

1-3 Safety Precautions

Any person providing installation, maintenance or service on this unit must follow safe procedures to avoid needless accidental injury.

Work on any electrical apparatus involves the risk of electric shock. On a battery operated unit such as this, additional precautions are required because of the following conditions:

1. This x-ray unit contains a 120 v rechargeable battery inside the cabinet. It is possible to disconnect the battery from the x-ray unit circuits. However, the battery is a source of power when contacted directly even with all the switches off.
2. If a conductive metallic object comes in contact with the battery terminals, high currents may cause damage to the object, to the battery and severe burns to the serviceman.

WARNING: THE ELECTROLYTE USED IN NICKEL-CADIUM BATTERIES IS A CAUSTIC SOLUTION OF POTASSIUM HYDROXIDE. SERIOUS BURNS WILL RESULT IF IT COMES IN CONTACT WITH ANY PART OF THE BODY. IF ELECTROLYTE GETS ON THE SKIN, WASH THE AFFECTED AREAS WITH LARGE QUANTITIES OF WATER, NEUTRALIZE WITH VINEGAR, LEMON JUICE, OR 3 PERCENT ACETIC ACID. IF ELECTROLYTE GETS INTO THE EYES, FLUSH WITH WATER AND GET IMMEDIATE MEDICAL ATTENTION.

3. Because of the potential hazards mentioned above, the serviceman must remove rings, wrist watch, etc. and WEAR SAFETY GOGGLES when working on or near the battery. He must follow battery installation and maintenance procedures given in Chapters 3 and 8. Furthermore, the serviceman should not leave the x-ray unit unattended with the battery compartment cover and the cassette tray removed, unless adequate warning signs and safety measures to limit access to the area are made.
4. The x-ray control access door can be opened only by first, removing the x-ray control cover as described in Part I, Sec. 2 of this Chapter. Because of the possible electrical shock and other hazards present when this door is opened, the serviceman should not leave this unit unattended with the cover removed and the door open, unless adequate warning signs and safety measures to limit access to the area are made.
5. When recharging the battery, the x-ray unit must be located in a large ventilated room. During normal charging conditions and when all batteries are functioning properly, there is little or no gas emitted. Should abnormal conditions develop, there could be an accumulation of hydrogen gas which, if confined in a small space, would be explosive in the presence of flame or electrical spark. Whenever the extension cord plug is inserted in a wall outlet, a fan ventilates the battery compartment. A hazardous situation will not develop where the outflow from this compartment is into a large or a well ventilated small room.
6. An audible tone and/or red x-ray light indicated presence of radiation. If either indicator is on at any time other than the expected x-ray exposure interval, immediately release the handswitch X-RAY and ROTOR buttons and move the Main Power Circuit Breaker to OFF. Perform the procedure for disconnecting the HV Transformer before attempting to determine the malfunction.

CAUTION: THIS UNIT IS NOT DESIGNED FOR USE IN HAZARDOUS AREAS.

1-4 Delivery Data:

The unit is shipped partially assembled as shown in Illustration 4-II-2. Copies of the Product Delivery Instructions are included with the basic unit. These should be used to inventory furnished parts on receipt of shipment.

**Item or Box
Marked ..**

Description

A0654E; Item A

AMX-II with vertical column horizontal Telescoping Arm, tube yoke, H. V. Transformer, H. V. cables, Tube Stator and Collimator cables assembled to the basic unit.

CAUTION: The Telescoping arm is strapped down and locked to prevent damage in shipment. **DO NOT CUT THE STRAP OR RELEASE THE VERTICAL LOCK UNTIL INSTRUCTED TO DO SO IN THE INSTALLATION PROCEDURE. THE VERTICAL COLUMN HAS BEEN COUNTERBALANCED FOR WEIGHT OF TUBE UNIT AND COLLIMATOR WHICH HAVE BEEN REMOVED FOR SHIPMENT!**

Furnished Parts; (packed in the cassette drawer).

- | | | |
|-----------|-----------------------|---|
| Bag No. 1 | (6)
(1)
(2) | T8014B Operator Keys
81645 Waymat Oil, 1 oz. (28.4g)
46-165626P1 Shims for Telescoping Arm. |
| Bag No. 5 | (2)
(2) | 46-152662P1 Tube Unit Wear Strips.
No. 6 Awg x 6" (152.4 mm) Black leads for battery Interconnection. |
| Bag No. 7 | (8)

(2)
(4) | 6-32 unc x 1/4" F.H.M.S. for hub caps.

46-165618P1 Hub Caps.
46-154021P1 Battery Section Insulator Boards |

Envelope for H. V. Cables, containing:

- | | | |
|-----|--|--------------------|
| (2) | 507A936P1 | Rubber gasket. |
| (2) | 514A727P1 | Brass ground ring. |
| (1) | GE Silicone Dielectric Compound G-635, 2 oz. (56.7g) | |
| (1) | Direction 13871A, Application of Compound. | |

Item or Box Marked . . .	Description
A0654E; Box B	Sentry Collimator for AMX Unit with mailing tube used to protect projecting lead fingers on top of collimator. Furnished Parts: (Located in Box B) Bag No. 1 (1) 46-165737P1 Allen Wrench (5) 8-32 unf x 1" Hex-Soc Cap Screw Bag No. 2 (1) 46-165149P1 Metric Label
A0654E; Box C	X-Ray Tube Unit for AMX with collimator interface plate pre-aligned and mounted to Tube Unit face plate. Furnished Parts: (Located in Box C) (2) 46-155519G2 Plastic End Caps Bag (12) 8-32 x 1/4" Hex-Soc Cap Screw
A8104A	Battery Pack for AMX-II consisting of: (3) 46-152812P1 Cell group, Model 43B011TB01
D5312BC	Extension Cylinder (Optional accessory to AMX-II)

1-5 Battery:

The installation procedure is written on the basis that the battery pack for this AMX-II has been previously charged and electrolyte level adjusted at a GE District Office or other suitable facility. The charged battery is then to be transported to the installation site of the AMX-II in the recommended shipping container.

If these pre-requisite steps have not been taken, the battery must be initially charged using the charger in the AMX-II unit. Follow the procedure given in Chapter 3, Section 6, "Battery". This should be done just prior to Section 4 "Installing the Battery" of Chapter 4, Part II.

- ▲ All battery information contained in this manual refers both to G.E. and Marathon NiCad cells.

1-6 Tools and Test Equipment

The following will be required for installation in addition to the standard serviceman's tool kit. The following list does not include additional tools or test equipment required if difficulty is encountered during the installation which requires trouble shooting or repair to the equipment.

- (1) Voltmeter, -/150/300 VAC, 25 to 500 Hz, accuracy 3/4 of 1% of full scale, Weston Instruments, Inc., Cat. No. 433-1903010. Where this meter is not readily available, use the following instruments with lower response on the square wave 60 Hz and the higher frequency (500 Hz) voltage. Voltmeter, 0/150/300 VAC, 25-125 Hz, accuracy 3/4 of 1% of full scale, GE type AP-9, Cat. No. 50-20102RHRH or Weston Instruments, Inc., Cat. No. 433-1903009.
- (2) Multimeter, Simpson Model 260, Triplett Model 630, or equivalent (20,000 ohm/volt dc, 5,000 ohm/volt ac).
- (3) Standard wrench (507A935G1) for GE type II cable terminals.
- (4) Oscilloscope, Tektronix 564 or equivalent, dual trace, memory tape with algebraic addition feature and X10 probes. (A Tektronix type 422 scope is satisfactory where troubleshooting is not required.)
- (5) 1 gallon (3.8 litres) Diala AX transformer oil for H. V. Transformer or H. V. Divider.
- (6) Can of 75-25 cleaning solvent and rags for cleaning. (Do not use for cleaning covers).
- (7) Socket or open end wrench 1-1/16" hex for counterbalance adjustment.
- (8) Calibrated H. V. Divider (C1515A) with two 5 ft. (1.5 m) H. V. Cables.
- (9) Torpedo level.
- (10) HEW Field Test Kit including Receptor Alignment Tool (RAT) 46-177371P1 and Standard Test Absorber, 46-173632G1.
- (11) Digital multimeter, Fluke Model 8000A, or equivalent.
- (12) DC milliammeter 1.5/15/150, accuracy 1/2 of 1% of full scale, Weston Instruments, Inc., Model 931, or equivalent.
- (13) 14 x 17 (35.5 cm x 43.2 cm) cassette and x-ray film.
- (14) 500 ohm, 2 w potentiometer wired as variable resistor for set-up of battery condition meter.
- (15) Torque wrench 0-4 ft.-lb. or 0-50 in.-lb. with 9/64" hex drive. Snap-on Tools Model TSQ-4 torque wrench with TMA-4-1/2 9/64" hex drive or equivalent.
- (16) Radiation meter (integrating dose type): Capintec Model 192, or equivalent.
- (17) Fluoricon Test Pattern for demonstration radiographs.
- (18) Oscilloscope Trigger Circuit consisting of: (Refer to Illustration 4-11-31).
 - (1) 46-134441P1 Transformer 1:1.7 ratio
 - (1) Capacitor 33 ufd, 50v Electrolyte
 - (1) Resistor, 100K, 1/2-w comp.
- ▲ (19) 10 ohm, 100W adjustable resistor and shorting switch.

1-7 HEW Field Tests

Field Tests for HEW Compliance are included in the installation procedures of Chapter 4, Part II. These are an elaboration of the generalized procedures given in Direction 13894 "Field Tests for HEW Compliance." The table below lists all pertinent HEW Field Tests for the AMX-II. Reference is given to the appropriate test in Direction 13894, and the corresponding section in this Chapter. For a new installation, follow the procedures given in the tables and record data on Form F3382 "System Field Tests for HEW Compliance" and/or Form 3316 "PMS Data Record—Mobile Generator I."

Test Name	Dir. 13894 Reference	Reference SM A0654E Chapter 4, Part II	Test Requirement	Application	Record Data
Application and Function	Test 5; Test Set W	Sections 1,2	Manual Collimator used on Mobile Unit.	On installation and replacement of Collimator.	F-3382
X-Ray Control	Test 6	Section 11	Audible tone required for x-ray exposure.	On installation and preventive maintenance calls.	F-3382
Tube Current—Exposure Time Product	Test 23	Sections 11, 12	MAS Accuracy MAS (MEDIAN) + VARIATION 1 (+/-40% + .35 mas) +/- .27 mas 1.5 (+/-33% +.30 mas)+/- .27 mas 2 (+/-21% + .32 mas) .28 mas 2.5 to 4 (+/-14% + .39 mas) +/- .30 mas 5 to 8 (+/-8% + .40 mas) +/- .32 mas 10 (+/-7% + .40 mas)+/- .32 mas 12 to 300 -7% to 10%	On installation, preventive maintenance calls, and whenever repairing or replacing x-ray tube, MA control circuits, timer circuits or H.V. components.	F-3316
Peak Tube Potential (KVP)	Test 21	Section 13	KVP Accuracy KVP 50 to 110 (+ (10 KVP +7%)) (- (5 KVP +7%)) of dial reading after first 20 milliseconds of exposure. 50 to 95 (+ (20 KVP +7%)) (- (5 KVP +7%)) of dial reading during first 20 milliseconds of exposure. 100 to 110 (+ (25 KVP +7%)) (- (5 KVP +7%)) of dial reading during first 20 milliseconds of exposure.	On installation, preventive maintenance calls, and whenever repairing or replacing battery, KVP control circuits, or H.V. components.	F-3316 F-3382
Indirect Test of Collimator Illumination	Test 27-33 Test Set F	Section 14	19.6 V (RMS) at minimum battery voltage of 110 VDC.	On installation, preventive maintenance calls, and whenever replacing collimator or collimator lamp.	F- 3382
Collimator Alignment; Light Field to X-Ray Field	Test 27-33 Test Set F	Section 14	Misalignment of edges of Light Field and X-Ray Field shall not exceed 1.8% of SID.	On installation, preventive maintenance calls, and whenever repairing or replacing collimator or x-ray tube unit.	F-3382
Collimator Alignment; Actual vs Indicated X-Ray Field	Test 27-33 Test Set F	Section 14	Field size indicators shall agree with actual field size within 1.8% of SID.	On installation, preventive maintenance calls, or whenever repairing or replacing collimator.	F-3382
Inherent Filtration; Diagnostic Source Assembly	Test 13	Section 16	Half value layer of useful x-ray beam shall not be less than 2.3 mm at 80 KVP.	On installation, and whenever replacing tube unit, insert, collimator mirror, or other absorption between source and patient.	F-3316 F-3381

1-8 Documents and Forms:

The following manuals, documents, and forms are required or referred to during the installation of the AMX-II.

Reference No.	Description	Source
SM A0654E	Service Manual AMX-II	Furnished with Unit
OM A0654E	Operating Manual AMX-II	Furnished with Unit
Direction 13871A	Application of G635 Silicone grease	Furnished with Unit
Product Delivery Instructions	46-165600G10 Basic AMX-II 46-155750G3, Tube Unit 46-177399G1 or 46-194759G1 Collimator	Furnished with Unit
Product Locator Cards Set of 2 cards	Set of cards for each of the following components:	Furnished with Unit
Red Stripe & Green Stripe in Salmon envelope	46-165600G1 AMX-II Basic 46-155750G3 Tube Housing 46-125686G6 Tube Insert 46-150625G1 H.V. Transformer 46-177399G1 Sentry Collimator 46-138573G1 Extension Cylinder (Optional)	
Direction 13440B	NCRP Report 33 with acknowledgment card.	Furnished with Unit
Direction 13777	AMX-II Technic Chart	Furnished with Unit
Form, F3560	(3) Battery Service Log Form	Furnished with Unit
Form, F3316	PMS Data Record, Mobile I	Furnished with Unit
Direction 13894	System tests for HEW Compliance	District
Form, F3382	System tests for HEW Compliance	District
Form, F3382	System Field Tests for HEW Compliance	District
Direction 13861A	Technical Publications Error Report	District
Federal Form FD 2579	Installers Report, "Report of Assembly of a Diagnostic X-Ray System."	District
Direction 13788D	"High Voltage Bleeder"	District
SM-D1154A (Microfiche Card BL-9-1 C1 & C2)	Maxiray 75, HRT, ORN-18 Tube Units	District

SECTION 2 INSPECTION AND UNPACKING

The unit as shipped is shown in Illustration 4-11-2. The Telescoping Arm is strapped down and locked to prevent damage in shipment. The counterpoise spring in the vertical column has been adjusted to the assembled weight of the Tube Unit and Collimator.

CAUTION: DO NOT CUT THE TIE DOWN STRAPS, RELEASE THE TRANSPORT LATCH, OR THE VERTICAL LOCK UNTIL SECTION 4. DAMAGE TO EQUIPMENT OR INJURY TO PERSONNEL COULD OCCUR IF THE TELESCOPING ARM IS RELEASED PREMATURELY.

DAMAGE IN TRANSPORTATION

All packages should be closely examined at time of delivery. If damage is apparent, have notation of "bad order" placed by the delivering driver on all copies of the freight or express bill. If damage is of a concealed nature, notify transportation agent as soon as possible to make an "inspection report of damage" but in any event not later than 15 days after delivery. A transportation company usually will not pay a claim for concealed damage if an inspection is not requested within this 15 day period. Complete instructions regarding claim procedure are found in section "S" of the Policy & Procedure Bulletins.

If shipment was handled by moving van service - uncrated - call Traffic - Milwaukee immediately when any damage is found. Do not attempt to call any local agent. At this time be ready to describe type of damage, type of equipment, serial numbers and if possible the order number.

1. Remove the plastic cover from the AMX Unit. Unwrap the cables tied to the horizontal Telescoping Arm, but do not release or unstrap the Telescoping Arm. Open the cassette drawer and inventory the furnished parts referring to Section 1-4 and copies of the Product Delivery Instructions.
2. Unpack the boxes containing Tube Unit, Collimator, and accessory extension cylinder assembly. Inventory furnished parts referring to Section 1-4 and Copies of the Product Delivery Instructions.

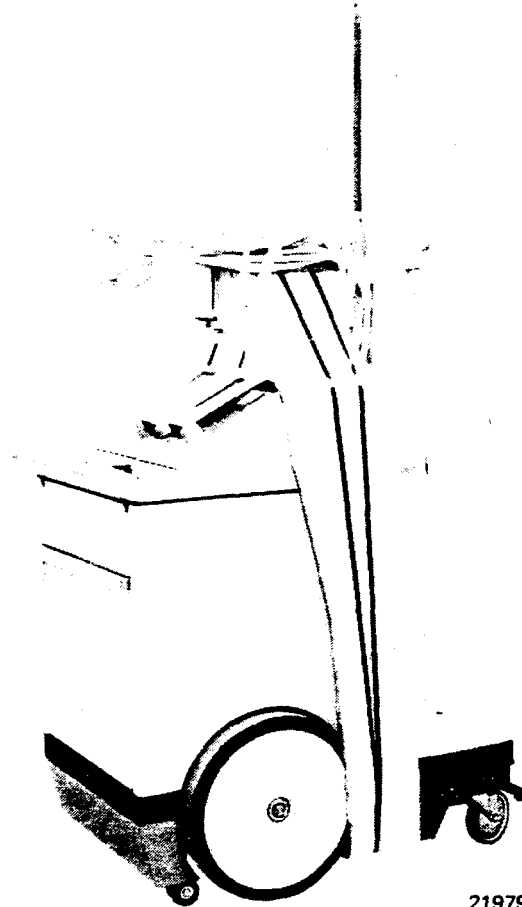
Do not remove the two wooden shipping braces fastened to the ends of the Tube Unit. They will be removed after the Tube Unit is mounted to the trunnion fork.

3. Check the Tube Unit for an oil leak or a broken insert.

Look for tell-tale oil slick on the housing indicating an oil leak. In the event an oil slick is found at any of the "O" ring seals, tighten the seal. Make sure the leakage is stopped.

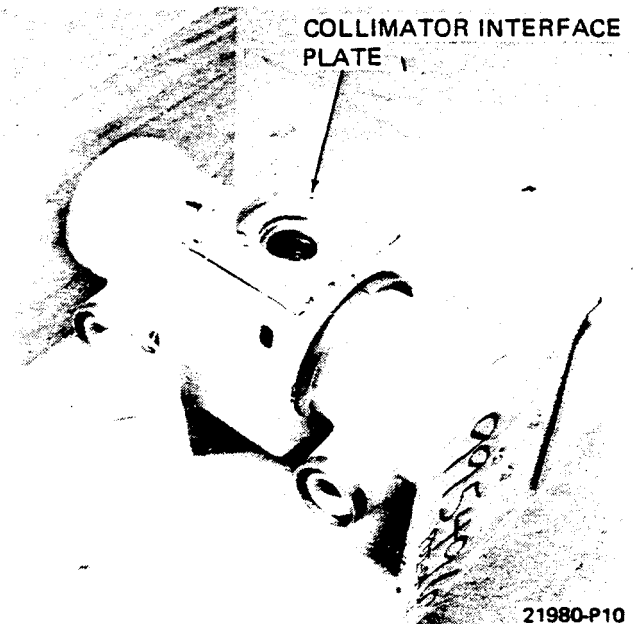
Rotate and angulate the Tube Unit and listen for any noise which would indicate a broken insert. Using a flashlight examine the insert through the Lexan Window.

NOTE: The Tube Unit is shipped with the collimator interface plate pre-aligned and secured to the Tube Unit faceplate. Do not loosen any of the (4) 10-32 unf Hex-HD screws or move any of the excentrics which secure the interface plate. If the plate is shifted it must be realigned following the procedure of Chapter 4 part 1, section 3-3.



21979-P10

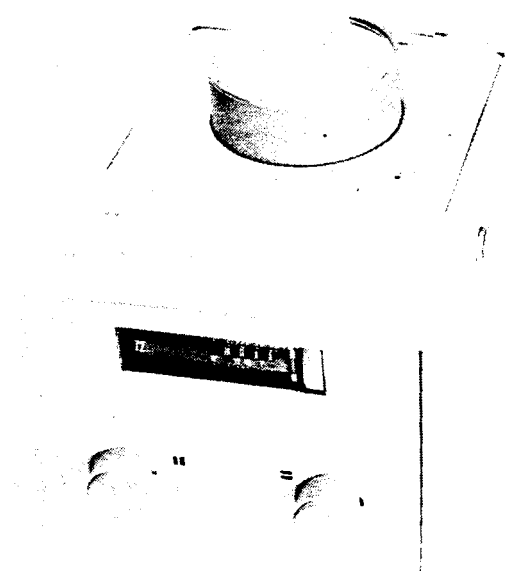
ILLUSTRATION 4-II-2



21980-P10

ILLUSTRATION 4-II-3

- 4. Do not unpack the battery cell groups at this time. From a safety standpoint they should be unpacked only when ready for installation in the unit.
- 5. Save all packing materials until the installation is completed and all parts accounted for.



21981-P10

ILLUSTRATION 4-II-4

▲ Indicates Change

SEC. 3 TUBE UNIT INSTALLATION

- ▲ 1. Disassemble the two halves of the fork trunnions. Remove (2) 6-32 unc screws at the bottom of the fork halves. Remove a 1/4-20 unc screw from the top of the left fork and the fork lock from the top of the right fork.

NOTE: Save the 4 washers under each of the three screws.

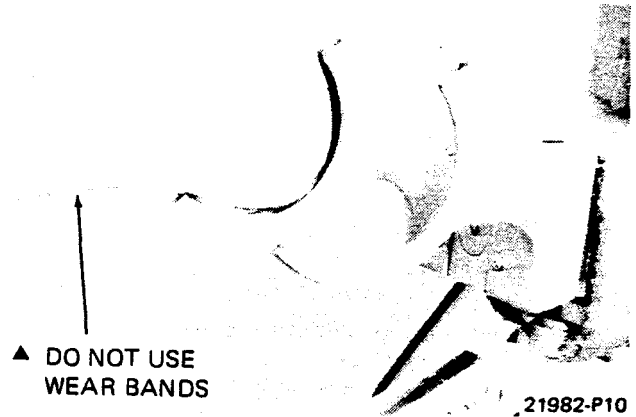


ILLUSTRATION 4-II-5

- 2. Check that the trunnion contact surfaces of the fork and Tube Unit are smooth, and free of paint.

- ▲ 3. Apply a light coat of Waymat oil to the inside surfaces of the lower trunnion halves and to the external trunnion surfaces of the Tube Unit.



ILLUSTRATION 4-II-6

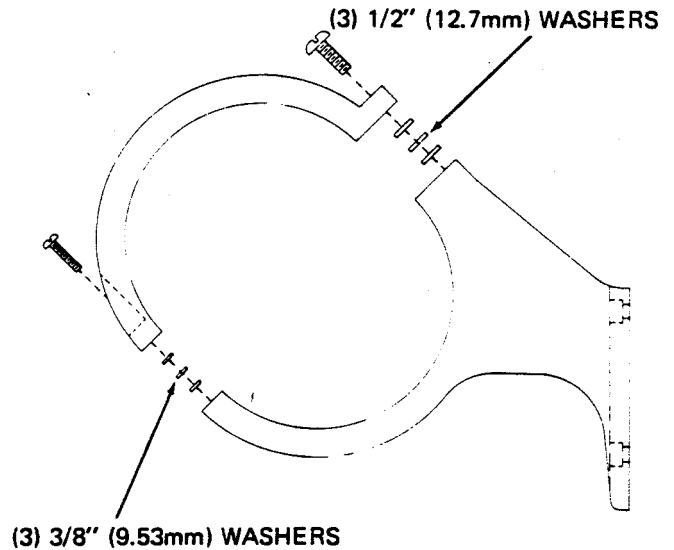
- ▲ 4. Carefully place the Tube Unit, x-ray port down, in the lower trunnion halves.

1-981

SM A0654E

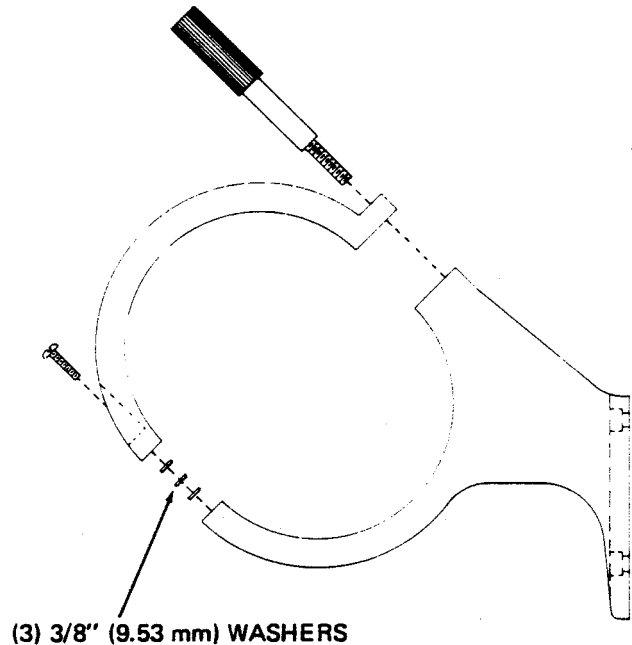
▲ Indicates Change

- ▲ 5. Install the left trunnion using one 6-32 unc and 1/4-20 unc screws removed in Step 1. Install (3) of the (4) flat washers between the trunnion halves. Tighten the two screws.
- ▲ 6. Install the right trunnion using (3) of the (4) flat washers and the second 6-32 screw in the lower hole. Install 1/4-20 unc Rotation Lock in the upper hole.
- 7. Check adjustment of the Fork Lock. With the (3) trunnion screws tight and the Rotation Lock released, the Tube Unit should rotate smoothly in the trunnion. When the Fork Lock is tightened the Tube Unit should be held securely. If there is excessive drag when the Rotation Lock is released add a fourth spacer washer, first to both 8-32 unc screws, and if required to the 1/4-20 unc screw on the left trunnion. If trunnion is too loose with the rotation lock tightened, remove spacer washers.
- 8. Remove and discard the two wooden shipping braces and hardware from the ends of the Tube Unit.
- 9. Locate the (2) Tube Unit plastic end caps and bag with (12) 8-32 unc x 1/4" Hex S.H.C.S. Position the end caps so that the G.E. Trade-mark is upright when x-ray port is down. Install each with (6) 8-32 unc x 1/4" Hex S.H.C.S.
- 10. Rotate the Tube Unit so that its rear trim cover is down, (high voltage cable horns project down). Remove the rear fiberglass trim cover from the Tube Unit. Remove (2) No. 10-32 unf 1/2" B.H.M.S. at the edge of the x-ray port surface, and (2) No. 10-32 unf P.H.M.S. in center of the cover. Loosen the cable clamp located at the end of the terminal strap beneath the trim cover.



LEFT FORK
▲ ILLUSTRATION 4-II-7

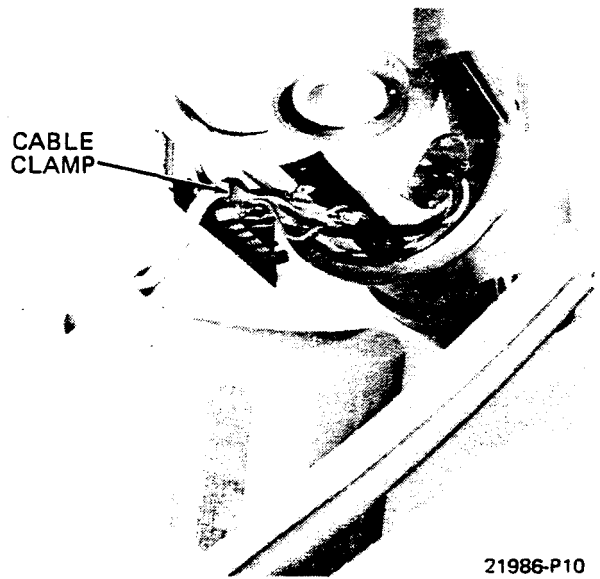
21984-D11



RIGHT FORK
▲ ILLUSTRATION 4-II-8

21985-D11

11. Locate the Tube Unit rotor cable. It is the 5 conductor cable with push-on terminals bundled with the cathode H.V. cable and collimator cable. Route the rotor cable underneath the fork, through the hole in the Tube Unit cover, and through the cable clamp. Connect the leads at the terminal strip to match the black, green and white stator leads. Place the red and blue leads on unused terminals. Tighten the cable clamp and reinstall the rear trim cover on the Tube Unit.
12. Rotate the Tube Unit so that the x-ray port is down. Make a temporary dry installation of the cathode H.V. cable to the Tube Unit. Do not use silicone dielectric compound because this cable installation is for preliminary checks without high voltage. The Anode H.V. cable and collimator cable are not to be connected at this time.



21986-P10

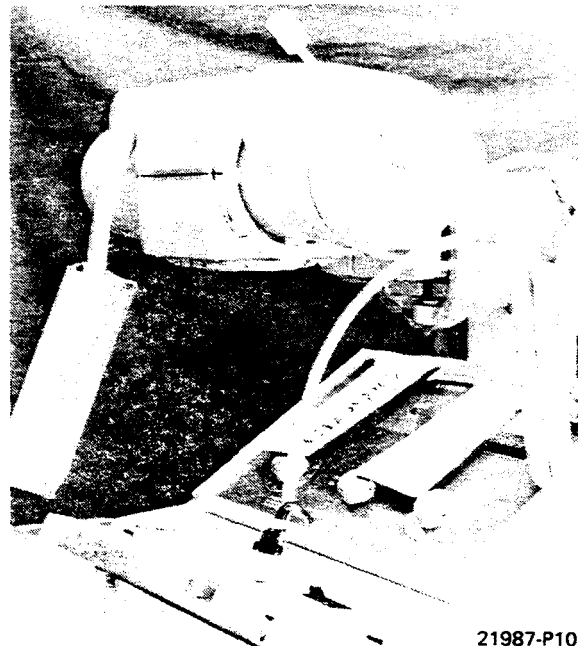
ILLUSTRATION 4-II-9

SEC. 4 RELEASE OF HORIZONTAL ARM

CAUTION: THE VERTICAL COLUMN IS NOT PROPERLY COUNTERBALANCED AT THIS TIME. IT WILL BE RELEASED IN THIS SECTION AND WILL BE ABOUT 30 LBS. (13.61 Kg) LIGHT.

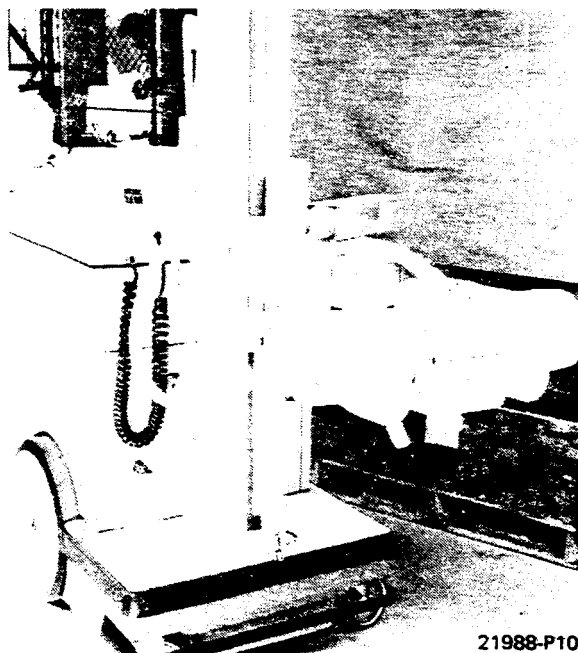
1. Check that the Vertical Arm Lock is tight and that the transport latch is engaged.
2. Carefully cut the two tie down straps around the Telescoping Arm.
3. While holding the Telescoping Arm against rising, release the lock and latch.
4. Relock the Telescoping Arm tightly once the transport latch is released.
5. Release the Column Rotation Lock and rotate the column 180°. Relock the column with the Telescoping Arm projecting in front of the unit.
6. Again while holding the Telescoping Arm against rising, release the vertical arm lock and lower the Tube Unit so that it is approximately 3 ft. (0.9 m) off the floor. Relock the arm tightly.
7. Release the Telescoping Arm Lock and press the arm interlock button to extend the Telescoping Arm. Pull out and discard the (4) rubber wedges between the inner two sections of the Telescoping Arm. Check smooth functioning of the Telescoping Arm and then lock it extended a few inches (150 mm).
8. Release the Yoke Rotation Lock and rotate the yoke about the Telescoping Arm. Check for functioning and detents every 90° of rotation. Relock the Tube Unit with x-ray port up.
9. Record functional check No. 15 on F3316.
10. Carefully examine Tube Unit for air bubbles. With port up look through x-ray window with the aid of a flashlight, and gently rock Tube Unit either side of horizontal. If an air bubble is observed, Tube Unit must be removed and de-aired following procedure given in SM D1154A before proceeding.

NOTE: Leave the Tube Unit, port-up, for filament and stator checks in section 8-2.



21987-P10

ILLUSTRATION 4-II-10



21988-P10

ILLUSTRATION 4-II-11

3-1684

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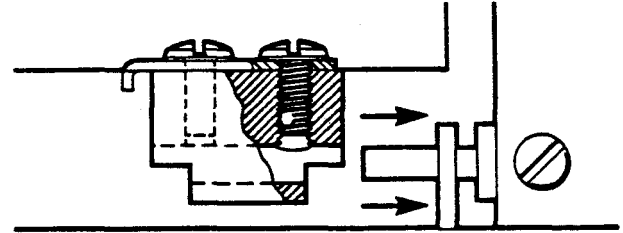
▲ Indicates Change

SECTION 5 CASSETTE DRAWER REMOVAL

1. Lift out rubber bottom liner of cassette drawer.
2. Loosen (4) screws, two in each front bottom corner of drawer.
3. Slide each pivot block toward center of drawer to disengage the pivot.
4. Remove drawer and set aside for later reinstallation.

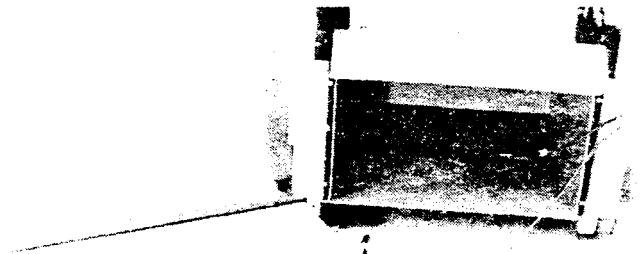
NOTE: Do not lose the spacers on each pivot shaft.

5. Remove (3) 7/16 HHCS on top skirt of kick panel and (2) 7/16 HHCS, one at each support for the rear casters. Remove the kick panel.
6. Remove the battery retainer plate. It is secured by (4) 7/16 HHCS to the two side frame members. Set aside with its hardware for later reinstallation.
7. Pry off the cover over the 8 panel. The panel is held with (4) friction fasteners. Use a padded screwdriver so as not to mar the finish.



21989-D12

▲ ILLUSTRATION 4-II-12



21990-P10

ILLUSTRATION 4-II-13

SEC. 6 BATTERY INSTALLATION

CAUTION: CHARGED BATTERIES: REVIEW THE SAFETY PRECAUTIONS OF SECTION 1-3. REMOVE RINGS, WATCHES, AND METALLIC OBJECTS FROM POCKETS. WEAR SAFETY GLASSES.

NOTE: This procedure assumes that the battery has been precharged and electrolyte level adjusted prior to the AMX-II installation. If the battery requires charging it should be done following the procedure of Chapter 3, Section 6.

1. Unpack the battery cell groups from their transport containers and set in front of the AMX unit. If Vent Cap Wrench is furnished with each cell group, save the wrenches as they will be required for servicing the battery.
2. As shipped, each cell may have a yellow plastic cap inserted in the top of the Vent Cap assembly. Replace all the yellow caps with the red spray caps furnished in a bag with the battery. The red caps have three small holes for venting. Yellow caps are for shipping only.
3. Check that the Main Power Circuit Breaker on the AMX, (6CV1) is OFF. Locate the two No. 6 Awg x 6" (152.4 mm) black leads in Bag No. 5, and the four 46-154021P1 7-3/4" x 16-3/4" (220 mm x 413 mm) red insulator boards furnished with the AMX.
4. Fold back the mylar cover over the battery compartment. Check that the loose insulating boards are correctly positioned in the battery compartment, and that the primary leads are clear of the compartment.
5. Cut six (6) 1-1/2" x 3" (38.1 mm x 76.2 mm) strips of insulation paper. Bend in half and wedge between the first and second as well as last and second last cell in each group, as shown in Illustration 4-II-15. This will prevent damage to battery if a washer or screw slips on connection of battery leads.

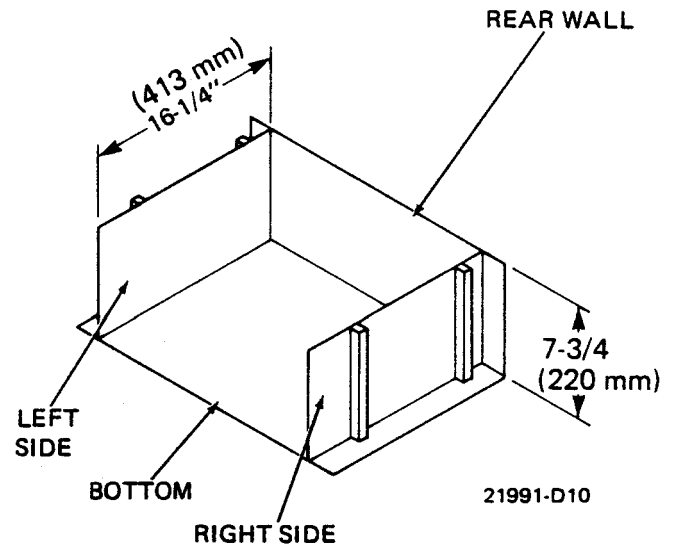


ILLUSTRATION 4-II-14

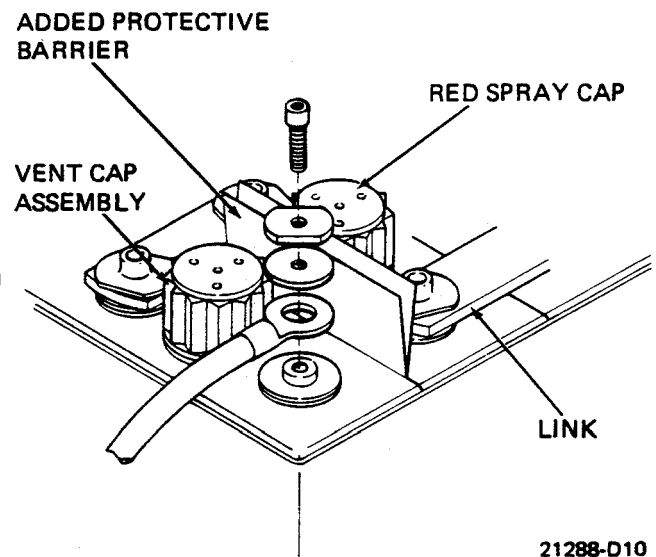
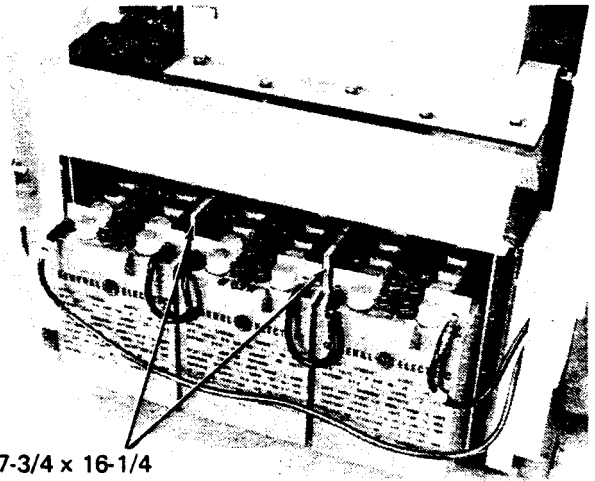


ILLUSTRATION 4-II-15

6. Slide one 30-cell group in the right side of the battery compartment. Slide it tight against the right hand wall of the compartment to hold the insulator board in place. Do not push it all the way in. Connect the lead out of the top main circuit breaker that is labeled (+) to the right front corner terminal of the cell group.
7. Slide another 30-cell group into the left side of the battery compartment. Do not push it all the way in. Connect the lead on the side of the main power circuit breaker that is labeled (-) to the front left corner terminal of the cell group.
8. Slide the remaining 30-cell group into the center of the battery compartment. Insert two 7-3/4" x 16-1/4" (220 mm x 413 mm) red insulator boards (furnished) between the right and center and two others between the left and center cell groups. These are to prevent the battery from sliding around.
9. Two No. 6 Awg leads 6" (152.4 mm) long are furnished. Use them to interconnect the left, right and center battery packs.
10. The battery terminals have flat sided washers as part of the terminal hardware. Refer to Ill. 4-II-15. The flat side serves as a visual indicator during torquing. During initial screw engagement the washer rotates, and upon tightening, rotation stops. This indicates that the screw is tightened in the terminal and not binding or bottoming when proper torque is reached. Tighten all six terminals to **44 in/ lbs. (4.97 Nm)** torque. Push Temflex sleeving over solderless terminal lug.
11. Place the Mylar cover over the battery compartment and reinstall the battery retainer plate.



(4) 7-3/4 x 16-1/4
(220mm x 413mm)
RED INSULATOR BOARDS

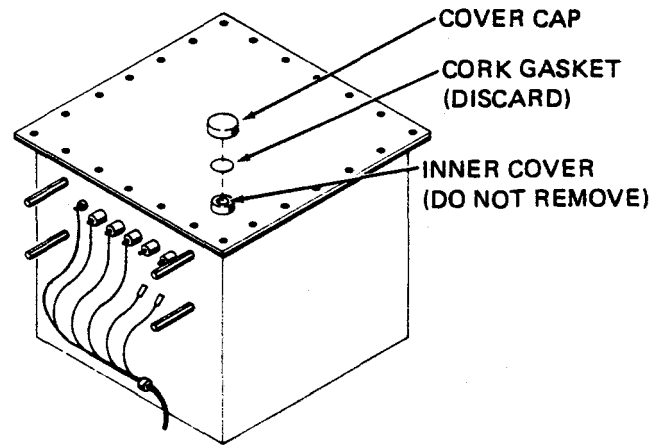
21992-P10

ILLUSTRATION 4-II-16

SECTION 7 H. V. TRANSFORMER

The H. V. Transformer has been shipped installed. The oil level has been checked and a cork gasket used to seal the unit for shipment.

1. If there is evidence that the transformer has leaked oil it will have to be removed from the unit in order to locate and repair the leak and to reset the oil level. Otherwise proceed to Step 2.
2. Remove the terminal cover over the H. V. Transformer primary leads. It is mounted with (4) No. 10-32 unc x 1/2" B.H.M.S. Set the cover and hardware aside for later installation.
3. Check that the leads to 7P1 and 7P2 are disconnected and taped.
4. Remove the threaded cover cap from the oil filler hole. Do not attempt to remove the inner cover. Discard the cork gasket located inside the cover cap and reinstall the cover cap.

**ILLUSTRATION 4-II-17**

1-981

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▲ Indicates Change

SEC. 8 PRELIMINARY ELECTRICAL CHECKS

The purpose of this section is to make preliminary non x-ray checks of Control Transformer and Tube Unit before installing collimator.

NOTE: The battery which was precharged before installation should have a terminal voltage of at least 120 volts. If the battery voltage falls into the RED "LOW" region during the installation procedure, temporarily charge the battery per Section 18 for approximately one hour before proceeding.

8-1 Calibrate Battery Condition Meter, 5M1

NOTE: If battery was recently charged, the 4A1 Board should be allowed to cool before starting this procedure. Remove cover and open Operators Panel and cool for a minimum of 15 minutes.

Initial Condition:

- Main Circuit Breaker and Keyed Switch—OFF
- Battery installed and charged
- Remove x-ray control cover. Leave cover off for remainder of tests.

Instrumentation:

- ▲ a. Connect 0.5K, 2 watt potentiometer in series with Gray lead, to 3TB1-26. See III. 4-11-18.
 - b. Connect the digital voltmeter across 4A1-2 (+) and 4A1-11 (-). Set on 200 VDC scale.
 - c. Arrange test leads so that Operator's Panel can be closed without causing shorts.
1. Close Operator's Panel and mechanically zero 5M1.
 2. Open Operator's Panel. Turn main circuit breaker and keyed switch ON. Adjust 0.5K potentiometer for 110+/-1V on Digital Voltmeter. Allow warm-up for 15 minutes.
 3. Open Operator's Panel and adjust 4A2R10 for 5M1 reading on black mark between red and green bands.
 4. Carefully close Operator's Panel and check 5M1.
 5. Turn main circuit breaker and keyed switch OFF. Disconnect D.V.M. and 0.5K potentiometer leads. Reconnect Gray lead to 3TB1-26.
 6. Record Battery Circuit calibration on PMS Form 3316, Functional Check No. 9.

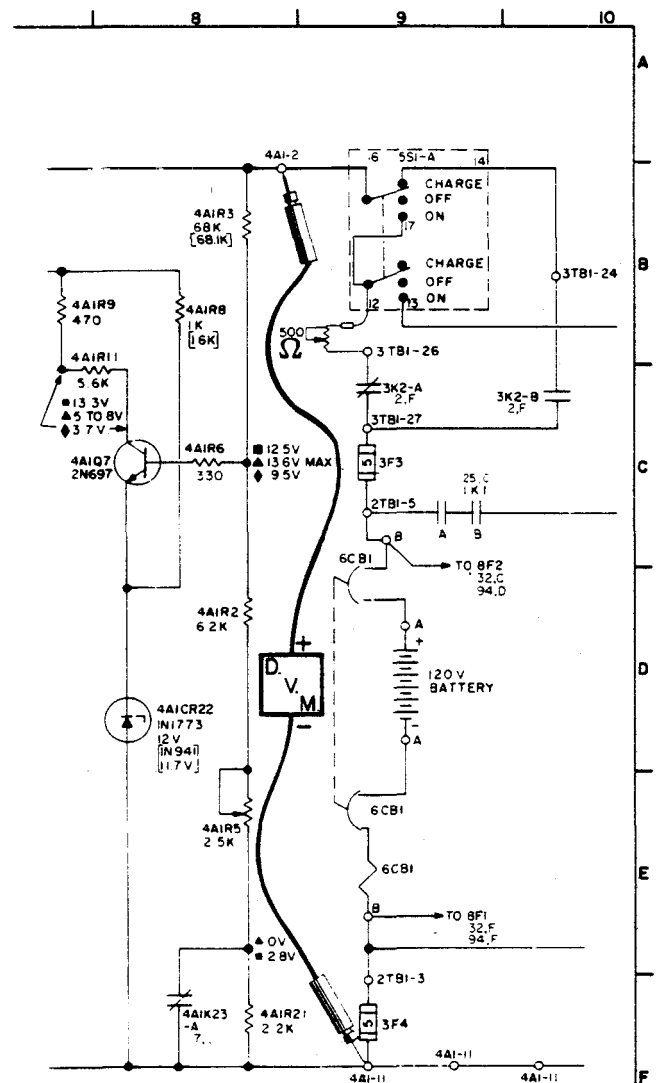


ILLUSTRATION 4-11-18

8-2 Check X-Ray Tube Filament and Stator**Initial Conditions:**

- Check that 7TB1-P1 and 7TB1-P2 are disconnected at the HV Transformer and the ends taped (230 V may appear at these ends).
1. Turn main circuit breaker and keyed switch ON.
 2. Depress the handswitch Rotor Button while looking into the x-ray tube window. Only the small filament is connected, the large filament is not used in this unit. If the filament does not glow, check for improper filament circuit or HV cable connection. The small filament is the one to the left when viewed from the anode end through the x-ray window.
 3. Again depress the handswitch Rotor Button while looking into the x-ray tube window. The x-ray tube anode should accelerate to a stable speed within the 2-1/2 second interval before the READY light glows. If rotation does not occur, check for improper connection of the stator cable.
 4. Release the Rotor Button. The anode should coast for at least 10 seconds before stopping. If not, the bearings in the x-ray tube are likely to seize and the tube should be replaced.
 5. With the Operator's Panel open, again depress the Rotor Button. Note that after 2-1/2 seconds the ready light lights and that the neon bulb on the 3A1 board (3A1161) lights during the 2-1/2 second interval. This indicates that the shut-off capacitor for the 500 Hz inverter switch is charged.
 6. Turn main circuit breaker and keyed switch OFF.

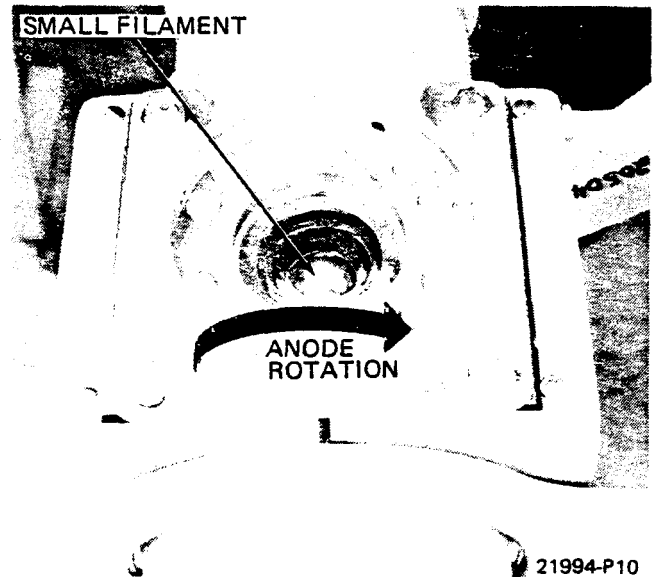


ILLUSTRATION 4-II-19

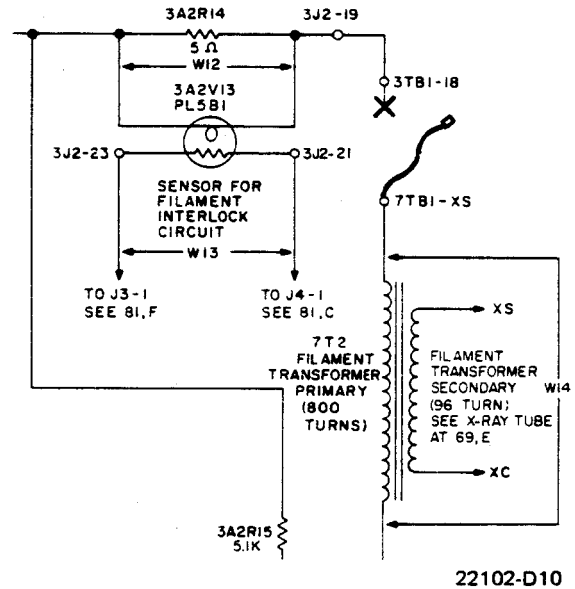


ILLUSTRATION 4-II-20

8-3 Check Filament and Rotor Interlocks

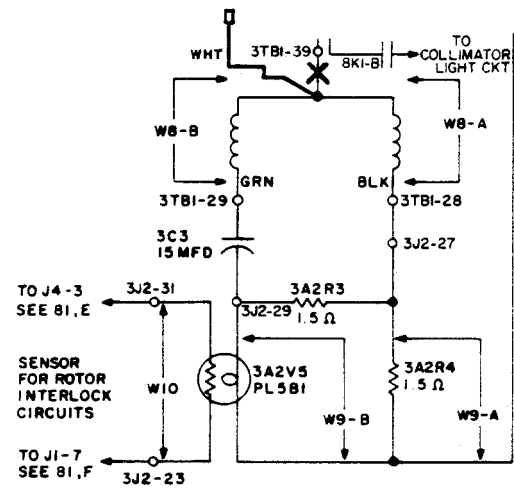
1. Disconnect filament transformer primary lead at 3TB1-18 and tape end of lead.
2. Turn main circuit breaker and keyed switch ON.
3. Press Rotor Button. Ready Lamp should not light at end of 2-1/2 second interval. If it does light, check functioning of 3A2V13, Schematic Reference 27,B.
4. Turn circuit breaker and keyed switch OFF.
5. Reconnect filament lead to 3TB1-18.
6. Disconnect and tape white stator lead at 3TB1-39.
7. Repeat Steps 2, 3 and press Rotor Button. If Ready Lamp lights, check functioning of 3A2V5, Schematic Reference 24,F.
8. Turn circuit breaker and keyed switch OFF. Reconnect Stator lead to 3TB1-39.
9. Record on F3316. Functional Check No. 1 and No. 2.

NOTE: Leave the Tube Unit, port up, for installation of the collimator in the next section.



22102-D10

ILLUSTRATION 4-II-21



22103-D10

ILLUSTRATION 4-II-22

1-981

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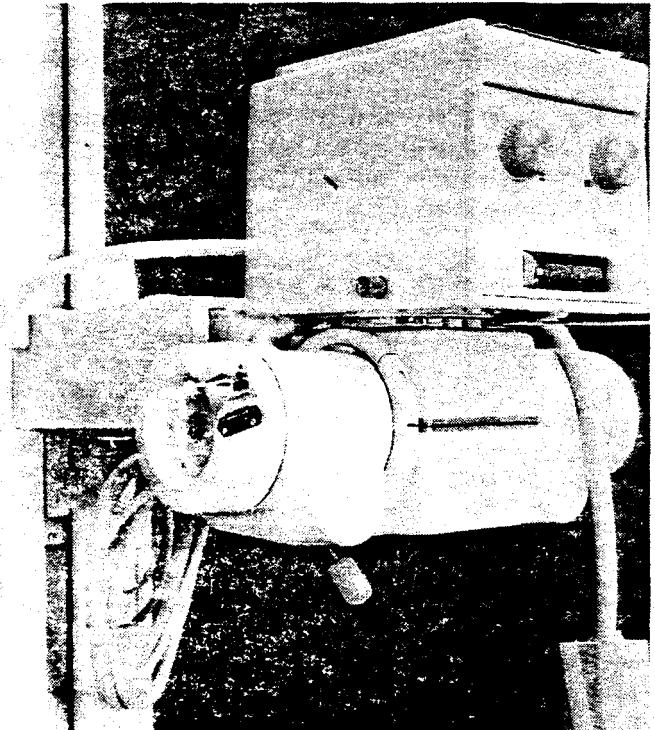
▲ Indicates Change

SECTION 9 COLLIMATOR INSTALLATION

NOTE: BE CAREFUL! Bumping the fingers projecting from the top of the collimator could bend them out of alignment.

9-1 Mounting Collimator

- ▲ 1. With the tube unit, port up, carefully place the collimator into the interface plate. Position so that the mounting screw holes line up. Attach the collimator to the interface plate with the (3) 10-24 unc x 3/4" hex soc hms. Use the 9/64 T-handle Allen wrench furnished with the collimator (46-165137P1).
- 2. Rotate the tube unit and collimator for port down x-ray beam and raise the horizontal telescoping arm for a suitable working height.



21996-P10

9-2 Connect Collimator Cable

- 1. Unscrew and push the Rotational Detent Button on the right side of the collimator. Rotate the collimator 90° to the left for access to the connector housing.
- 2. Remove the connector housing cover at the rear of the Collimator. It is held by two screws.
- 3. Route the collimator cable under the fork trunnion and connect the plug to the collimator jack.

NOTE: The jack screws must be alternately taken up a few turns at a time until the plug is drawn up tightly and evenly to the socket.

- 4. Reinstall the connector housing on the rear of the collimator.

ILLUSTRATION 4-II-23

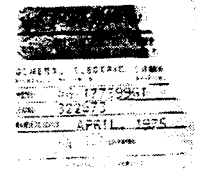
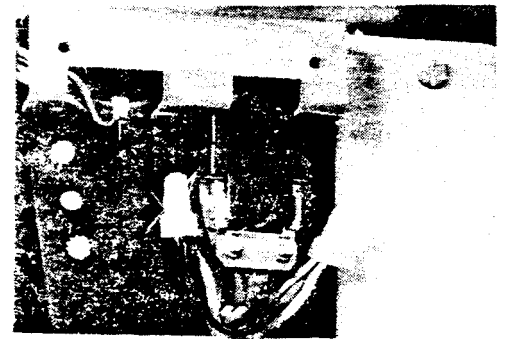


ILLUSTRATION 4-II-24

21997-P10

9-3 Collimator Functional Checks and Modifications

1. If an extension cone is part of the system check that it slides into the tracks on bottom of the collimator and locks securely in place.
2. If installation requires metric field size scale, perform the scale label modification of Chapter 4, Part I, Section 4-1.
3. The field light timer is factory set for 15 to 20 seconds. If the user desires a shorter time setting, refer to Adjustment Procedure of Chapter 4, Part I, Section 4-2.

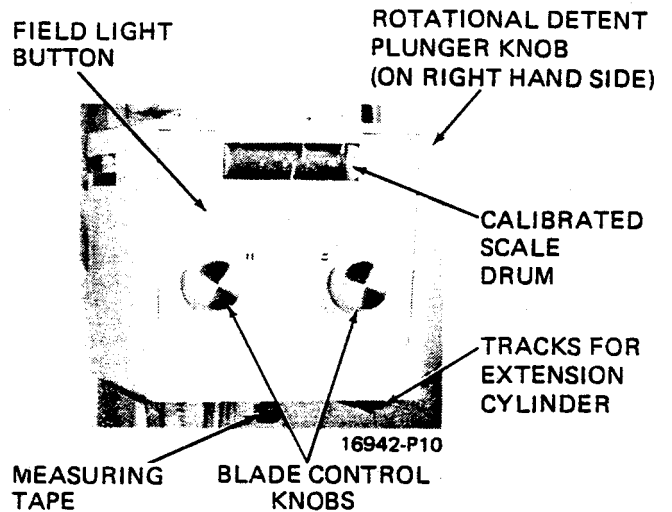
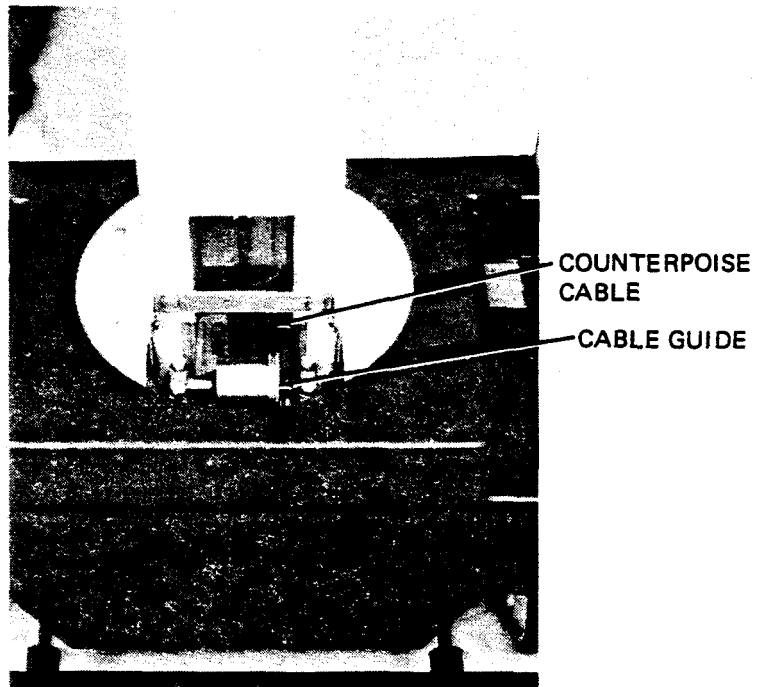


ILLUSTRATION 4-II-25

9-4 Vertical Column and Horizontal Arm Balance

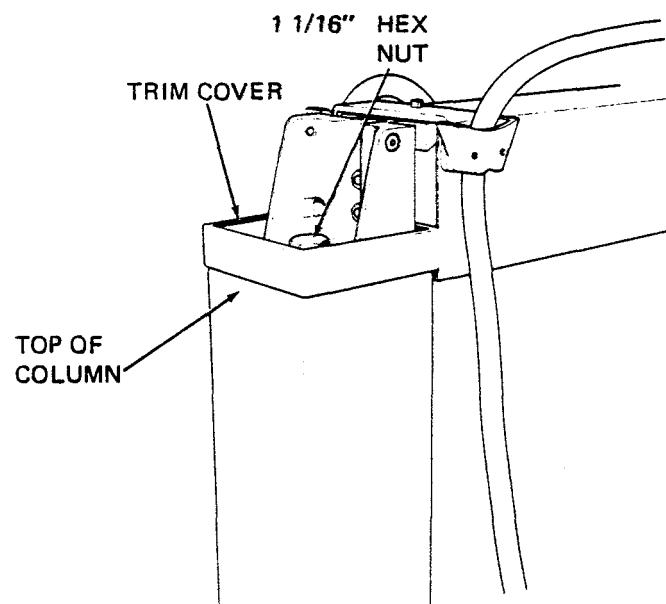
NOTE: As all components are now mounted on the vertical column, the counterbalancing should be checked. If an extension cylinder is included with the system, counterbalancing should be checked with the extension cylinder off the unit.

1. Remove the rectangular cover at the rear base of the column. It is held with two screws on the sides.
2. Check that the counterpoise cable is riding in the cable guide. If not, raise the vertical carriage to the top of its travel and use a smooth surfaced tool, so as not to damage the cable, to place the cable in the groove of the guide.
3. Check the counterbalance. It is properly adjusted when it requires the same force (about 5 to 13 lbs) (2.3 to 5.9 kg) to move the arm up or down. The Telescoping Arm should balance at any point except the top most 2" (50.8 mm) and bottom most 10" (254 mm) of vertical travel.
4. Counterbalancing adjustment maybe required. Use a socket wrench to turn the 1-1/16" inch nut at the top of the column. Earlier units require that the trim cover be removed from the top of the column. It is secured with four 4-40 unx c 1/4" FMS.
5. Turn the 1-1/16" nut in the clockwise direction to increase the upward counterbalancing force. Typically, about 40 turns will be required to counterbalance the column.
6. After counterbalancing the column re-install the trim cover at the top of the column, if removed, and the access cover over the cable guide at the bottom of the column.



23570-P10

ILLUSTRATION 4-II-26



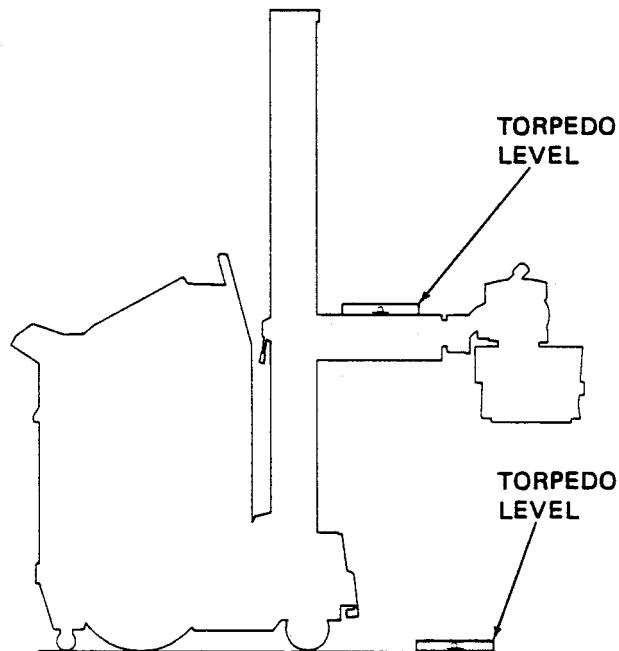
21999-D10

ILLUSTRATION 4-II-27

7. Place a torpedo level on the large section of the horizontal Telescoping Arm. Then compare level of the arm with level of the floor. With the Telescoping Arm projecting in front of the unit the arm should be level reasonably with the floor so that the arm does not coast in or out. If not, shims must be added or removed between the telescoping Arm and the vertical carriage.

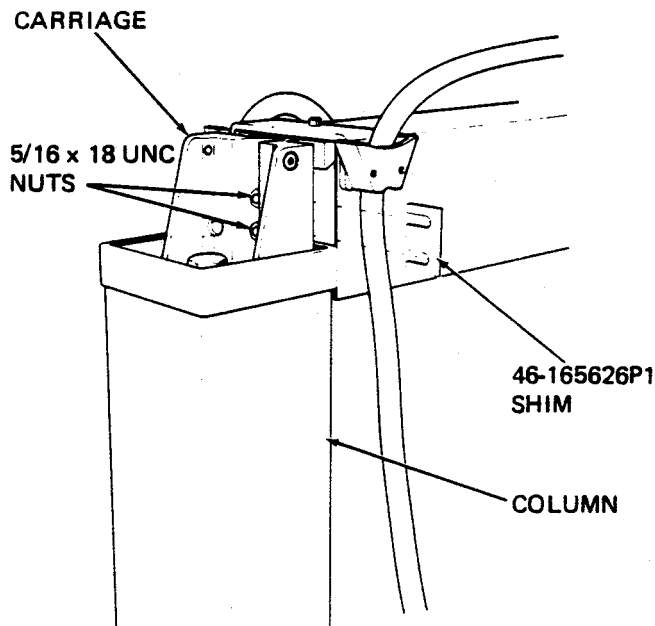
Two 46-165626P1 shims are furnished in Bag No. 1.

8. If adjustment is required, raise the vertical carriage to the top of its travel and securely lock the carriage.
9. Loosen the two 5/16 x 18 unc nuts at the back of the carriage.
10. Have an assistant lift on the end of the horizontal Telescoping Arm to overcome the weight of the tube unit and collimator.
11. Insert or remove 46-165626P1 shims as required to make the arm horizontal.
12. Retighten the two 5/16" x 18 unc nuts and recheck that the Telescoping Arm is level with the floor.



22000-D10

ILLUSTRATION 4-II-28

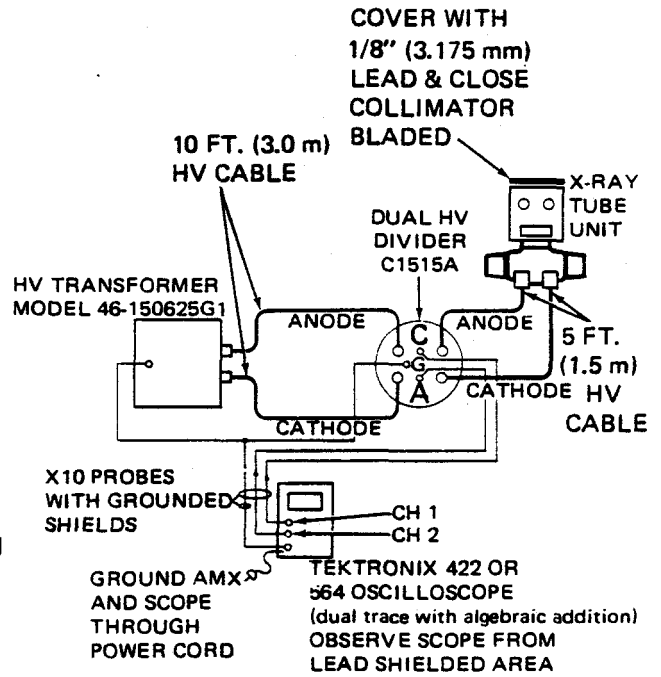


22001-D10

ILLUSTRATION 4-II-29

SEC. 10 CONNECT H. V. DIVIDER

1. Check that the main circuit breaker and keyed switch are OFF.
2. Position the tube unit, port up, with the horizontal column about 2 feet (0.6 m) off the floor.
3. Remove the Cathode H. V. Cable from the Tube Unit (Installed dry in Section 3). If necessary, remove the last cable tie around the cathode H. V. cable, stator cable, and collimator cable.
4. Connect the unit H. V. cables to the H. V. Divider and Tube Unit. Use transformer oil in the cable recepticals of the H. V. Divider and silicone insulating compound, G635, at the tube unit. Apply silicone compound per Direction 13871A. Follow standard procedures for installing the grounding wave washer, and rubber gasket at each H. V. cable connection.
5. Do not connect the scope to the H. V. Divider at this time.
6. Reconnect transformer primary leads at 7P1 and 7P2. Install cover over primary leads on transformer. Be sure that plastic grommet is snapped in place in cover cutout.
7. Close collimator blades and tape a sheet of 1/8" (3.175 mm) lead over collimator window. Cover tube unit (primarily cathode end) with a lead apron or place lead screens for additional radiation protection.



18738-D12

ILLUSTRATION 4-II-30

1. Turn circuit breaker and keyed switch to ON.
2. Check battery voltage. It should be greater than 110 VDC with the control ON.
3. Select 50 KVP and 10 MAS. Make an exposure and observe that the x-ray tube MA meter "kicks" up scale.

NOTE: Tone "beep" and x-ray on light during exposure.

4. Select 80 KVP, 200 MAS.

5. ▲ Take an exposure and read the MA meter. If it is not 100, adjust 3A2R34 to obtain an x-ray tube current of 100 MA +/- 1.0 MA (CW to increase MA).

NOTE: Do not make more than one exposure per minute to stay within tube ratings.

6. Make another exposure and read the filament transformer primary voltage across 3TB1-12 and 3TB1-18. Record this voltage.

7. For the next check and adjustment, battery must be at full charge.

With power off, locate leads at main power circuit breaker 6CB1-B (heavy lead). Remove leads from 6CB1-B and connect a 10 ohm, 100 Watt adjustable resistor and shorting switch as shown in Illustration 4-II-32A between the leads and 6CB1-B. Turn power on but **DO NOT MAKE EXPOSURES**. Press rotor button only. Depress switch on device shown in Illustration 4-II-32A and read voltage on DVM and adjust resistor tap to obtain 90 VDC ± 5V. With rotor depressed, adjust 3A2R30 to obtain the filament voltage recorded earlier. Recheck this voltage with the 10 ohm resistor shorted (switch released). If difference in voltage is more than ± 1 volt, adjust 3A2R27. Repeat checks and adjustments until change in voltage is less than ± 1V with resistor in or out. Remove switch and resistor and replace leads on 6CB1-B.

8. Observe MA stabilizer signal on scope to verify that filament voltage and adjustments in MA regulator are optimum. Use 80 KVP, 16 MAS. Settings of 3A2R30 and 3A2R34 are correct if the A scope trace is obtained when the x-ray tube MA meter reads 100 MA during an exposure of step 5. If more or less than 100 MA

is obtained with the trace, readjust 3A2R34, per step 5, then readjust 3A2R30 to obtain the A trace. Repeat procedure until the center trace is obtained when the x-ray tube current is 100 MA with battery voltage above 110 VDC.

9. Turn keyed switch and circuit breaker OFF.
10. Disconnect only the following instrumentation.
 - a. Scope connections across 3A2C55
 - b. Filament transformer primary voltage at 3TB1-12 and 3TB1-18.
 - c. Replace 3A2 Board in card rack.
11. Check off F3316 Functional Checks No. 12 and No. 14.

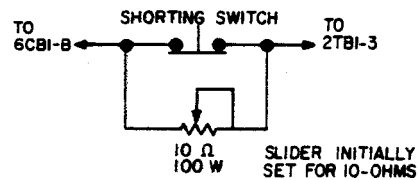


ILLUSTRATION 4-II-32A

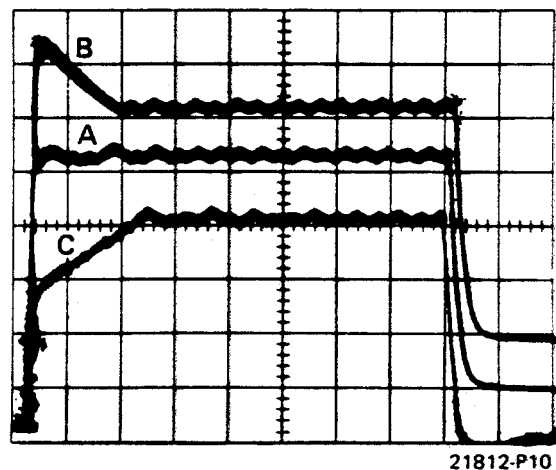


ILLUSTRATION 4-II-32

B Trace: Filament voltage too high and MA regulator pulling down or filament voltage normal but regulator pulling down improperly: Adjust 3A2R30 CCW.

A Trace: Filament voltage correct and MA regulator adjusted correctly.

C Trace: Filament voltage too low and MA regulator pulling up or filament voltage normal but regulator pulling up improperly. Adjust 3A2R30 CW.

SECTION 12 PRELIMINARY KVP, TIMER, AND LOAD CHECKS

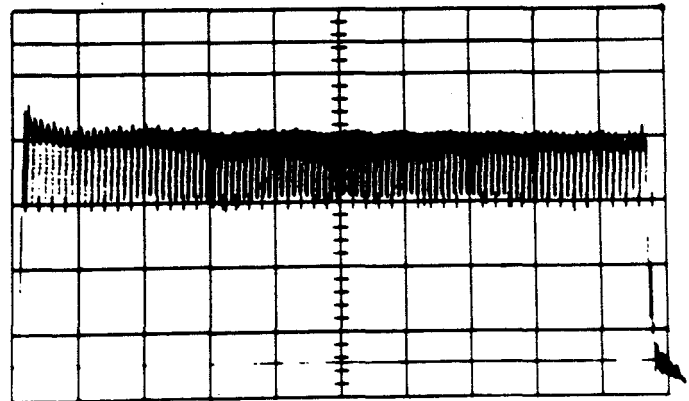
Initial Conditions:

- a. Circuit breaker and keyed switch OFF.
- b. Tube unit shielded and x-ray port blocked (from Section 10).
- c. H. V. Divider connected (from Section 10).

Instrumentation:

- a. Connect scope to H. V. Divider, refer to Illustration 4-II-30.

Scope to be grounded through line cord and scope ground connected to AMX-110 chassis. Use external trigger circuit per Illustration 4-II-31. Or INT, DC, +.
- b. Digital voltmeter across battery voltage (from Section 11).
- c. X-ray tube current monitored by 0-150 DCMA meter (from Section 11).



25282-P10

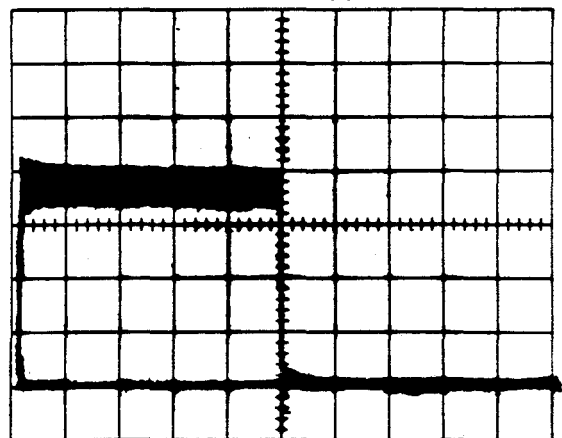
ILLUSTRATION 4-II-33

Timer: 80 KVP, 10 MAS
 V = 20 KV/DIV
 H = 10 MS/DIV
 TRIG = Ext. Trigger Circuit or Int, DC, T

NOTE: Deep discharge pulses as shown above appear on scopes with faster writing rates. Older scopes will appear as in Ill. 4-II-34.

12-1 Timer Check And Adjustment

- 1. Turn circuit breaker and keyed switch ON.
- ▲ 2. Select 80 KVP, 10 MAS. Make an exposure and record exposure duration from scope waveform - measure time interval at 75% of maximum KVP (60 KVP for a selected 80 KVP). See Ill. 4-II-33.
- ▲ 3. Select 80 KVP, 100 MAS. Make another exposure and note exposure duration on scope. See Ill. 4-II-34.
- 4. If necessary adjust 3A1R7 for exposure interval within +/-2% of .10 second at 10 mAs and 1.0 seconds at 100 mAs.
- ▲ 5. Select 80 kVp, 1 mAs. Make another exposure and only if necessary, adjust 3A1R9 for exposure interval of 10 MS.
- ▲ 6. Turn keyed switch and circuit breaker OFF.




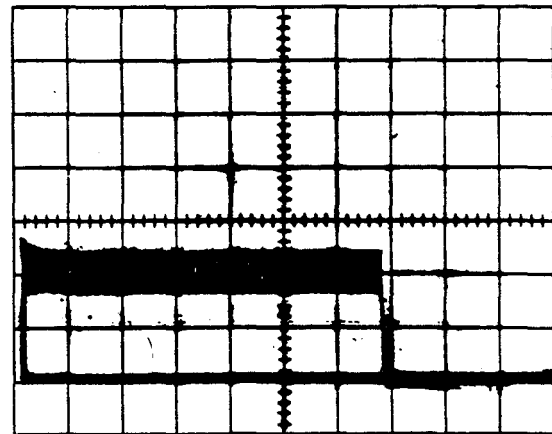
21814-P10

ILLUSTRATION 4-II-34

Timer: 80 KVP, 100 MAS
 V = 20 KV/DIV
 H = 200 MS/DIV
 TRIG = Ext. Trigger Circuit

12-2 Back-Up Timer Check

1. Temporarily disconnect the MAS selector lead at 3TB1-21 and tape the lead.
2. Turn circuit breaker and keyed switch ON.
3.  Select 50 KVP, and MAS, and make an exposure. Measure exposure duration with watch or on scope KVP waveform with horizontal time of 0.5 sec/div.
4. Exposure should be terminated within 3-1/2 seconds by back-up time delay relay, 3K3.
5. Turn keyed switch and circuit breaker OFF. Reconnect MAS switch lead to 3TB1-21.
6. Record Data
 - a. F3382 HEW Test No. 25.
 - b. F3316 Functional Check No. 5 and 13.





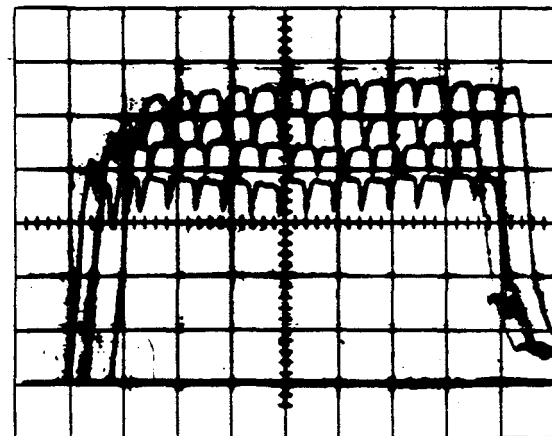
21815-P10

ILLUSTRATION 4-II-35

Back-up Timer: 50 KVP
 V = 20 KVP/DIV
 H = 500 MS/DIV
 TRIG = Ext. Trigger Circuit

12-3 Battery Load Voltage Check

1. Turn circuit breaker and keyed switch ON.
2.  Make an exposure at 80 KVP, 200 MAS and note battery voltage drop between standby, stator load, and x-ray load.
3. Voltage drop from standby to stator load should be from 1 to 1.5 volts and from standby to x-ray load up to 20.6 to 24 volts. If voltage drop is in excess of 25 volts check tightness of primary terminal and connections to battery. If necessary check each cell group voltage under x-ray load to locate and correct cause of excessive voltage drop.
4.  Make a series of exposures at 2 MAS, from 80 to 110 KVP. Observe scope waveform for signs of arcing or transients.
5. Turn keyed switch and circuit breaker OFF. Do not disconnect any test equipment.



21816-P10

ILLUSTRATION 4-II-36

80/90/100/110 KVP; 2 MAS
 V = 20 KVP/DIV
 H = 2 MS/DIV
 TRIG = Ext. Trigger Circuit

SEC. 13 X-RAY KVP AND MAS ACCURACY

NOTE: The tests of Sections 13, 14, 15 and 16 may be done in any order, except that the check of KVP and MA accuracy (Section 13) must be done at a battery voltage between 110 and 120 VDC. Battery voltage is measured with the main circuit breaker, 6CB1, and operator's keyed switch, 5S1, ON and after the battery has recovered for at least one minute after completion of the last x-ray exposure.


Initial Conditions:


- a. Battery voltage between 110 and 120 VDC.
- b. MA adjusted for 100 MA with H. V. Divider and 5 ft. H. V. Cables connected (Section 11).

Instrumentation:

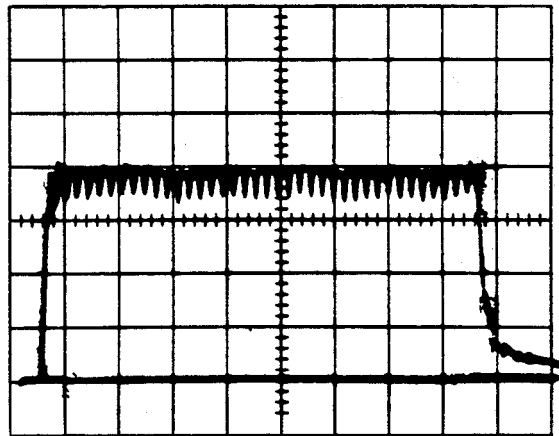
- a. Measure battery voltage with D.V.M. (Section 11).
- b. Measure x-ray tube current with DCMA Meter (Section 11).
- c. Scope connected to H. V. Divider (Sec. 12).
V:20KV/DIV; H:5MS/DIV TRIG: EXT. CKT.

1. Turn circuit breaker and keyed switch ON. Measure battery voltage. Battery voltage will depend on state of charge. For this test it must be between 110 and 120 volts.

 2. Make an x-ray exposure at 80 KVP, 4 MAS. Measure KVP. Compare scope waveform with illustration at right. KVP should be 80 (+10 KVP +5%) (-5 KVP +5%). Check during last 20 milliseconds of exposure as MA stabilizer does affect KVP during first 20 milliseconds.

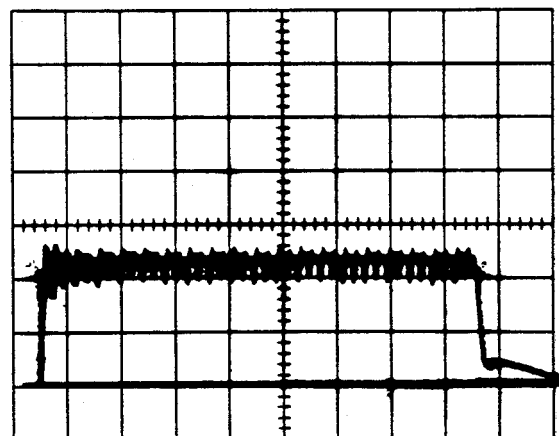
 3. Wait one minute from step 2. Measure battery voltage, then make a second exposure at 80 KVP, 200 MAS. Measure MA and record. Battery voltage should be between 110 and 120 volts. MA should be 100 MA +/- 1.

4. Wait one minute between exposures then repeat steps 2 and 3 at 50 KVP and 110 KVP. KVP should be within (+10 KVP +5%) (-5 KVP + 5%) of selected value. MA should be within 95 and 105 MA at a battery voltage between 110 and 120 volts.



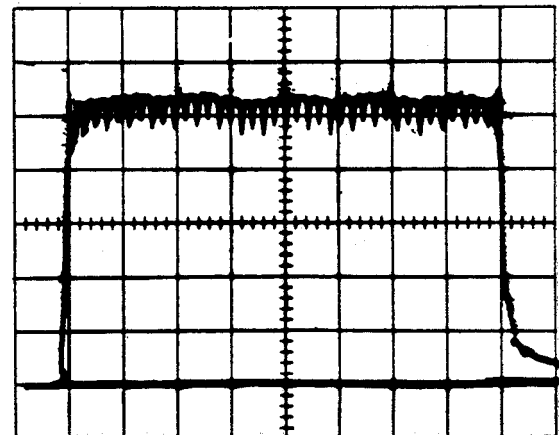
21817-P10

ILLUSTRATION 4-II-37 80 KVP; 4 MAS



21818-P10

ILLUSTRATION 4-II-38 50 KVP; 4 MAS



21819-P10

ILLUSTRATION 4-II-39 110 KVP; 4 MAS

1-1880

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5. Calculate KVP (MIN) and KVP (MAX) for 50, 80 and 110 KVP based on measured KVP and battery voltage.

$$KVP (MIN) = KVP (measured) \times \frac{110}{Bat. Volt (Measured)}$$

$$KVP (MAX) = KVP (measured) \times \frac{120}{Bat. Volt (Measured)}$$

6. Record data on F3382, Test 19. Refer to Ill. 4-II-40. Calculate KVP deviation. KVP (MIN) and KVP (MAX) must be within (+)10 KVP (+5%) (-)5 KVP (+5%) of each selected value. If KVP is too low, disconnect tap 4 of 1T1 from 2TB1-P1L and replace it with tap 3 of 1T1. Repeat accuracy test.
7. Turn keyed switch and circuit breaker OFF. Remove H.V. Divider and scope. Connect 10 ft. H.V. cables to tube unit using standard procedure. Replace the cable tie-wrap on the cathode H.V. cable. Do not disconnect tube current test meter.
8. Turn circuit breaker and keyed switch ON. Make an exposure at 80 KVP, 200 MAS. Readjust 3A2R34, if required for MA value of Step 3. Readjustment of 3A2R30 may be required to compensate for removal of H. V. Divider and 5 foot cables.
9. Turn keyed switch and circuit breaker OFF. Remove the tube current test meters and reinstall the MA (+) to MA (-) jumper. Do not disconnect the battery voltage DVM.
10. Optional MAS test. (Not required for field installation) may be performed by inserted MAS meter (FLUKE 8000A/W MAS option) into the MA + MA - terminals of panel 3. With battery voltage in the green band, record 10 consecutive exposures. Compare dial selection of MAS to reading on calibrated MAS meter. Readings should be within accuracies as stated in Chapter 4, Section 1.

TEST 19 INDIRECT TEST FOR ASSURANCE OF LINEARITY

TUBE UNIT 46-165750G4
 Serial No. 48725

- YES NO Requirements of Sec. 19-2 (KVP Accuracy) have been met.
 YES NO Requirements of Sec. 19-2 (Linearity) have been met.
 NOT APPLICABLE

The following data table substantiates the above:

~~%MA Error/KVP Error~~

SELECTED KVP	BATT VOLTS	MA		KVP MEAS	KVP (MIN)		KVP (Max)	
		MEAS	ERROR		CALC	Δ.	CALC	Δ.
80	116	101	+1	81.5	77.3	-2.7	84.3	+4.3
50	114	98	-2	48.0	46.3	-3.7	50.5	+0.5
110	113.5	102	+2	108.0	105.0	-3.0	114.2	+4.2

SECTION 14 COLLIMATOR FUNCTIONAL CHECKS AND ADJUSTMENTS

General

The collimator blade and shutter assemblies have been factory aligned. The following adjustments, however, should be checked and readjusted if necessary. **Note: The mirror should NEVER be moved.**

14-1 Cross Hair Position Check and Adjustment

Initial Conditions:

- Main power circuit breaker - ON
 - X-ray generator standby switch - ON
 - Battery charge indicator green band
 - Charger cord disconnected
1. Position tube unit and collimator to project light field on smooth surface such as a tile floor at 40" (1.016 m) SID. Darken the room and open the collimator blades.
 2. Press the Field Light button on the collimator. Field Light should energize and remain on for 15 to 20 seconds unless modified per Chapter 4, Part I, Section 3-2. Light pattern should be of uniform brightness (no shadows or blotches) with sharply defined edges, and approximately squarely with the floor.
 3. Slowly move each blade set toward the closed position while observing the light pattern. The illuminated area on the floor should show equal rectangles of light on either side of the cross-hair shadows as each set of blades is moved toward the closed position.
 4. If adjustment is necessary, proceed as follows:
 - a. Slightly loosen the two rear screws in each cone track.
 - b. Slide the plastic window with the fingertips or tap the frame with a screwdriver until alignment is satisfactory.
 - c. Retighten the cone track screws.

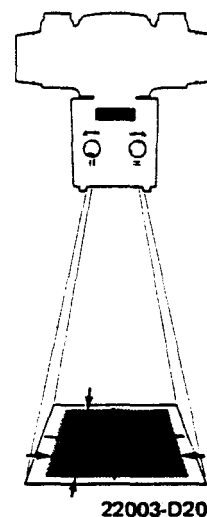


ILLUSTRATION 4-II-41

14-2 Extension Cylinder (Optional Accessory) Alignment Check

Initial Conditions:

Same as Section 14-1.

1. Slide the Extension Cylinder into the tracks at the bottom of the collimator until the cylinder latch snaps into the slot on the righthand track.
2. Darken the room and energize the field light. The illuminated area on the cassette should show equal sectors of light on either side of the cross-hair shadows.
3. If adjustment is necessary, proceed as follows:
 - a. Loosen the eight cone track screws.
 - b. Shift and/or shim the tracks as necessary.
 - c. Retighten the screws.
 - d. Recheck the alignment.
4. Remove the Extension Cylinder by pressing the latch.

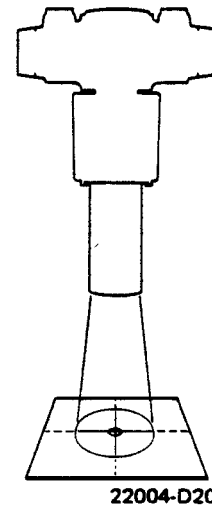


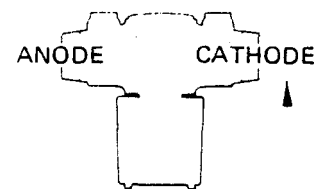
ILLUSTRATION 4-II-42

CAUTION: SOME OF THE FOLLOWING PROCEDURE REQUIRE THAT RADIOGRAPHS BE TAKEN. OBSERVE RADIATION SAFETY RULES. A LEAD PROTECTIVE SCREEN, LEAD APRON UNIT OR OTHER PROTECTIVE MEDIUM SHOULD BE USED TO AVOID UNNECESSARY EXPOSURE.

14-3 Large Field Size Check

Initial Conditions:

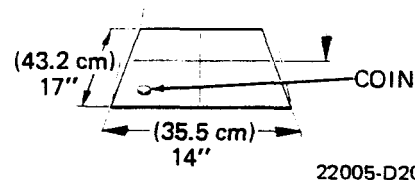
Same as Section 14-1.



(1.016 m)
40"

1. Position a loaded 14" x 17" (35.5 cm x 43.2 cm) cassette under the collimator (17" (43.2 cm) dimension transverse to the axis of the tube unit). Using the collimator measuring tape set the source-to-image distance at 40" (1.016 m).

2. Adjust the blades to yield a field size of 14" x 17" (35.5 cm x 43.2 cm). Place a coin on the cassette to identify the anode front corner of the x-ray field.



22005-D20

ILLUSTRATION 4-II-43

3. Make a 50 KVP, 1 MAS exposure and develop the film.

4. If cutoff in the transverse direction is observed, lead finger spacing of the collimator should be checked. Refer to Chapter 4, Part I, Section 5-4.

14-4 Field Lamp Voltage Check

To meet HEW requirements, the voltage at the collimator lamp socket must be at least 19.6 VAC (RMS) at a minimum battery voltage of 110 VDC. This is an indirect test of illumination level.

NOTE: Because the lamp voltage is a square rather than sine wave, the voltage measured with a Fluke 8000A Digital Meter will be greater than the true RMS value. Lamp voltage can be measured with a true RMS calculating digital meter such as a Weston/Schlumberger, Model 4445. However, do not use an iron-vane AC voltmeter because it will overload the lamp circuit.

Initial Conditions:

Same as Section 14-1.

Instrumentation:

Battery Voltage: digital voltmeter from section 13.

1. Remove the Blade Control Knobs and the collimator front nameplate.
 - a. Loosen two 6-32 unc x 1/4" hex soc. set screws at the top front of the collimator frame.
 - b. Tilt the nameplate forward enough to clear the knob shafts and lift out.

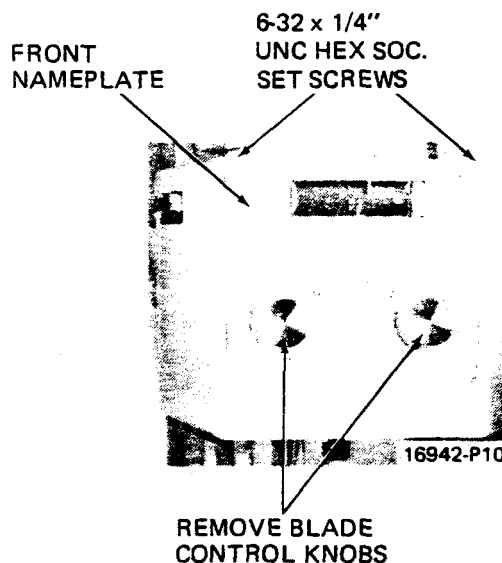


ILLUSTRATION 4-II-44

2. Turn circuit breaker and keyed switch ON. Measure and record no-load battery voltage using the digital voltmeter across 3TB1-27 (+) and 3TB1-5 (-)
3. Turn circuit breaker and keyed switch OFF. Disconnect digital voltmeter from 3TB1-27 and 3TB1-5. Turn circuit breaker and keyed switch ON.
4. With the field light energized measure and record the voltage across the lamp socket terminals using the digital voltmeter on the 200 VAC scale.
5. Compare no-load battery voltage with collimator lamp voltage. To provide required illumination, lamp voltage must be no less than value listed in the table. Too high a voltage will reduce lamp life.
6. If necessary, shift secondary taps on 8TB1 to provide required collimator lamp voltage. Carefully pry off cover over the 8 panel.

No Load Batt. Volt.	Min. Collimator Lamp Voltage (VAC)	
	RMS	Fluke 8000A
128	22.2	24.3
126	22.0	24.1
124	21.7	23.8
122	21.4	23.5
120	21.1	23.1
118	20.7	22.7
116	20.3	22.3
114	19.9	21.9
112	19.5	21.5
110	19.0	21.0

The secondary of 8T1 is factory connected to the Red Tap. A shift to an adjacent tap will change lamp voltage by approximately 0.5 v rms. Select the lowest voltage tap of 8T1 that provides at least the minimum voltage required. BUT NOT MORE THAN 1 V OVER.

7. Replace nameplate and knobs after verifying that the collimator lamp is operating in the proper voltage range.
8. Record collimator lamp voltage and battery voltage on F-3382, Test 27-33, Set F.

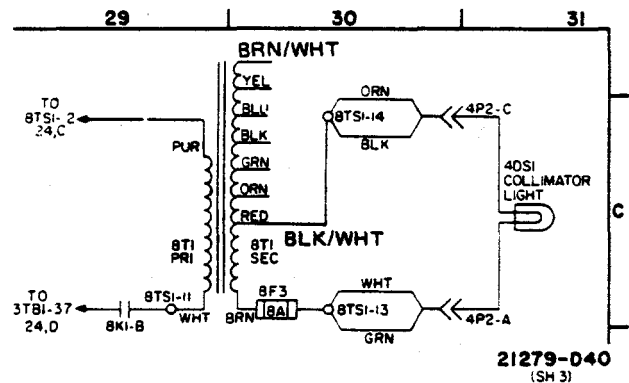


ILLUSTRATION 4-II-45

SEC. 15 COLLIMATOR BEAM ALIGNMENT CHECKS

To meet HEW Requirements:

- The total misalignment of the edges of the light field with the respective edges of the x-ray field along either the length or width shall not exceed 1.8% of SID when the field is perpendicular to the x-ray beam.
- Field size indicators of length and width on collimator shall each agree with actual x-ray field size at the receptor to within 1.8% of SID when beam axis is perpendicular to the plane of the film.

Initial Conditions:

- Main power circuit breaker - ON
- X-ray generator keyed switch - ON
- Battery charge indicator - Green band
- Charger cord retractor

Test Conditions:

- 14" x 17" (35.5 cm x 43.2 cm)
- Vertical x-ray beam
- 40" (1.016 m) and 72" (1.83 m) SID

- Load a 14" x 17" (35.5 cm x 43.2 cm) cassette and place on floor. Position tube unit and collimator for a vertical x-ray beam at a SID of 40" (1.016 m). Use collimator light to carefully center x-ray beam perpendicularly on Cassette.
- Carefully adjust collimator field indicators to a common field side smaller than the cassette-use 12" x 12" (304.8 x 304.8 mm) for a 14" x 17" (35.5 cm x 43.2 cm) cassette. Place a coin on the cassette in the anode-front corner of the light field for reference.

NOTE: The measuring tape built into the collimator housing is used to measure source-to-image distance (SID). The correct SID is indicated by having the bottom of the collimator housing even with the marking on the tape which corresponds to the desired source-to-image distance. For accurate measurements, have the tape tab on the end of the tape straight down, not perpendicular to the tape.

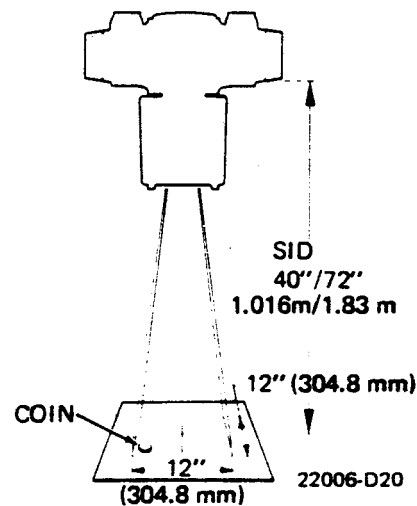

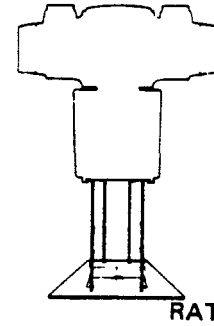


ILLUSTRATION 4-II-46

3. Assemble and attach Receptor Alignment Tool (RAT) to collimator using RAT holding fixture.
4. Using collimator light, note and record where edges of light field appear on RAT grid pattern.
5.  Expose and develop film (recommend 4 MAS at 50 KVP for par speed film with medium screens at 40" (1.016 m) and 16 MAS at 72" (1.83 m)).
6. Measure x-ray image length and width. Each must agree with numerical indicator settings (step 2) within 1.8% of SID. (.72" at 40" SID, (18.3 mm at 1.016 m) on 1.3" at 72" SID) (33 mm at 1.83 m).
7. Mark light field (step 4) in relation to x-ray field on film. Measure misalignment at each of the four edges. Total misalignment of either the two length of two width edges must not exceed 1.8% of SID.
8. Repeat Steps 1 through 7 for a SID of 72" (1.83 m).
9. If edge to edge light field and x-ray field alignment exceeds 1.8% of SID adjust as follows:
 - a. Remove the Blade Control Knobs and collimator front nameplate. Refer to Section 14-1.
 - b. With nameplate removed, temporarily reinstall knobs and adjust field size to same setting as in step 2.
 - c. Slightly loosen the two light housing mounting screws. See Illustration
 - d. With RAT in holding fixture beneath collimator, shift light housing so that light field aligns with the grid pattern of the x-ray field from Step 5.

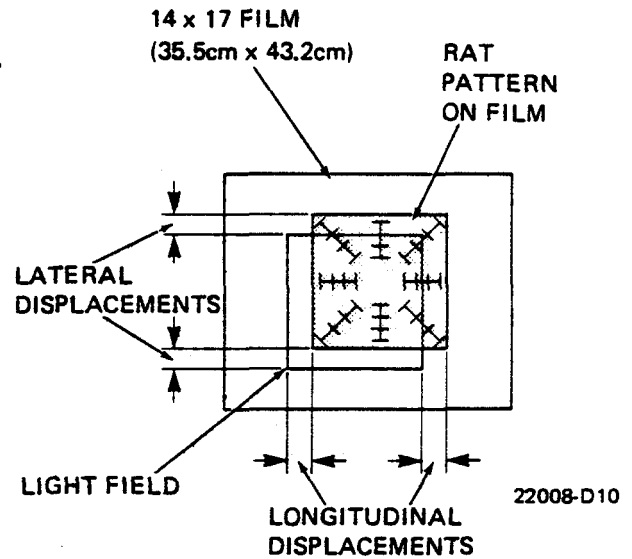


RAT



22007-D20

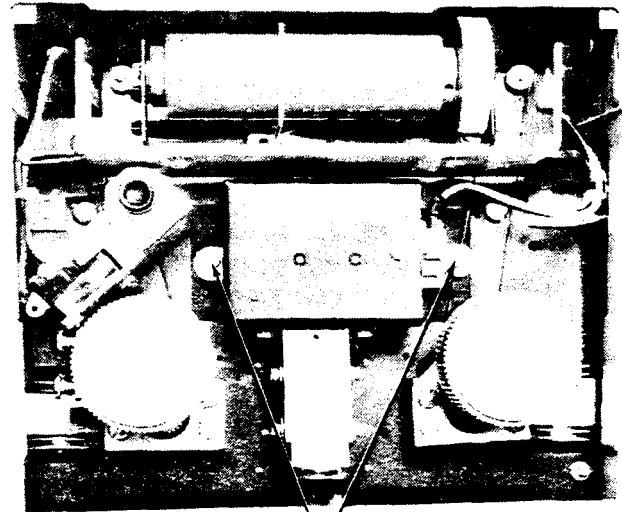
ILLUSTRATION 4-II-47



22008-D10

ILLUSTRATION 4-II-48

- e. Retighten the two light housing mounting screws and replace the nameplate and control knobs.
 - f. Repeat the alignment check from Step 1.
10. If the indicated versus actual field size does not fall within specifications, adjust the appropriate pointer or pointers as follows:
- a. Remove the Blade Control Knobs and the nameplate. Refer to Section 14-1.
 - b. Gently bend the pointer sideways to make the necessary adjustment.
 - c. Replace the nameplate and the knobs.
 - d. Repeat the alignment check from Step 1.
11. Record collimator Beam Alignment on F-3382, Sec. 7 Test SET-F.



LIGHT
HOUSING
SCREWS

22009-P10



ILLUSTRATION 4-II-49

SECTION 16 DIAGNOSTIC SOURCE ASSEMBLY; INHERENT FILTRATION

To meet HEW requirements:

The half-value layer of the useful beam at 80 KVP shall be not less than 2.3mm aluminum.

NOTE: Refer to Direction 13894, Part II, Section 2 "Radiation Instruments" for specific information on different types of instruments.

1. Position radiation probe of an integrating radiation measuring instrument so that the center of the active probe area is 12 inches (304.8 mm) from the end of the collimator and centered in the useful beam. Collimate down to area of probe using light beam.
2. Keep other equipment at least 4" (101.6 mm) away from probe to prevent radiation scatter errors. Remove the 1.0 and 2.0 mm selective filters from collimator.
3. Use technic factors of 80 KVP; 20 to 48 MAS. MAS should be adjusted so that reading in step 4 is approximately 3/4 scale.
4.  Make an exposure and measure radiation (total R) with no added filters. This represents 100% transmission level. Record readings.
5.  Place standard absorber 46-173632G1 in beam. Absorber must be in collimator accessory rails. Repeat exposure and record reading.
6. Divide reading in step 5 by reading in step 4.
 - a. If Ratio is greater than 0.5, then fixed filtration must be left as is.
 - b. If Ratio is less than 0.5, then fixed filtration must be added (mandatory).
7. The 0.5 minimum ratio is mandatory. If fixed filtration must be added, refer to Direction 13894, Test 13, Beam Quality.
8. Record Data on F-3382, Test 13.

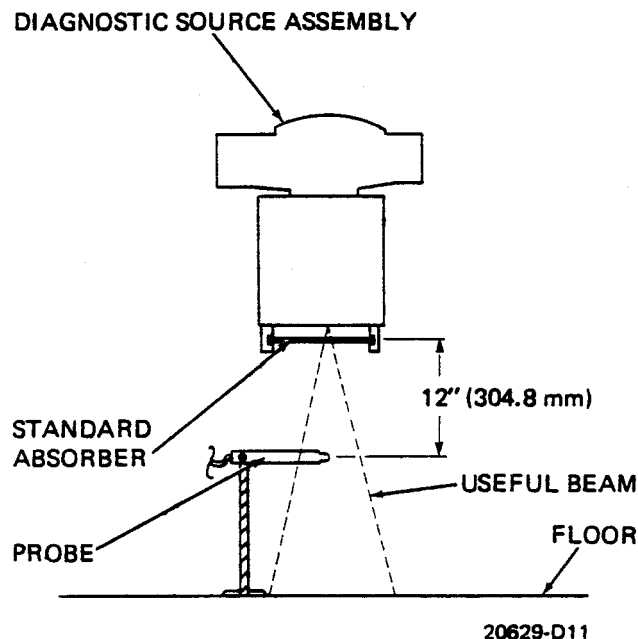


ILLUSTRATION 4-II-50

$$\text{RATIO} = \frac{\text{Reading with Standard Absorber}}{\text{Reading without Standard Absorber}}$$

SEC. 17 MOTOR DRIVE SYSTEM

Initial Conditions:

- Main power circuit breaker - ON
- X-ray generator keyed switch - OFF
- Charger cord disconnected.

17-1 Motor Drive Controls and Safety Interlocks

1. Check Speed Control Knob. The Drive Motor Speed Control Knob should rotate freely and spring return.
2. Place Direction Selector in FORWARD position. Depress Brake Handle and advance Speed Control Knob. The slow speed should begin with some pre-travel of the speed lever.
3. Check Brake Handle. The brake handle limit switch should be actuated when the Brake Handle is depressed within 3/8" (9.53 mm) of its bottom, brake released, position.
4. Check front safety bumper. The bumper should depress completely without binding and spring return. The drive power should be de-energized when the bumper is depressed approximately 1/4 inch. (6.35 mm).
5. Plug the charger cord into a convenience outlet. Check that the motor drive system is disabled when the charger cord is plugged into a convenience outlet.
6. Turn circuit breaker - OFF.

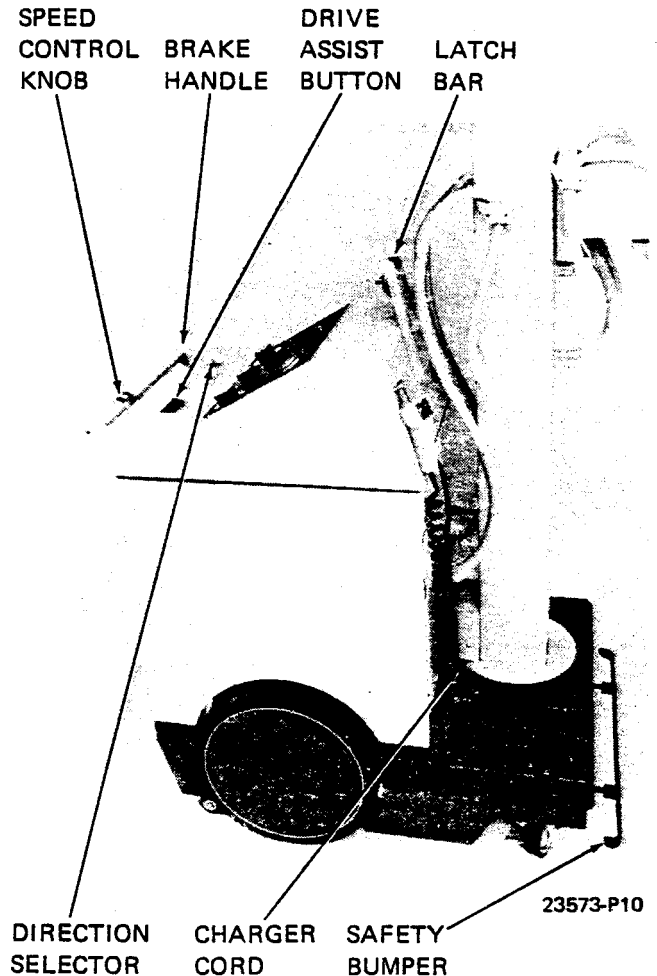


ILLUSTRATION 4-II-51

17-2 Motor Drive Speed Checks and Adjustments

Instrumentation:

- Connect DVM (200 VDC scale) to 8A1-5 (+) and 8A1-6(-)
 - Block 16" (0.4 m) wheels just off floor with wooded blocks
 - Place piece of tape on edge of wheel to count RPM
1. Turn main circuit breaker ON and operate drive system.
 2. Check wheel RPM and drive motor voltage for conditions listed at the right. Adjust 8A1R15, if required.
 3. If voltage and RPM values do not agree with table, remove the voltmeter and take the unit off the wooden block.
 - a. Connect a pull scale to a rigid member of the AMX. Set 6S2, the Forward Reverse switch, to OFF.
 - b. With the brake handle depressed, measure the force required to move the unit in a straight line on a smooth, level, hard surfaced floor such as tile.
 - c. The force needed to move the unit should not exceed 25 lbs. (11.34 kg), excluding starting force, in either the forward or reverse directions. If the moving force is greater than 25 lbs, (11.34 kg) the drive train should be examined for a malfunction.

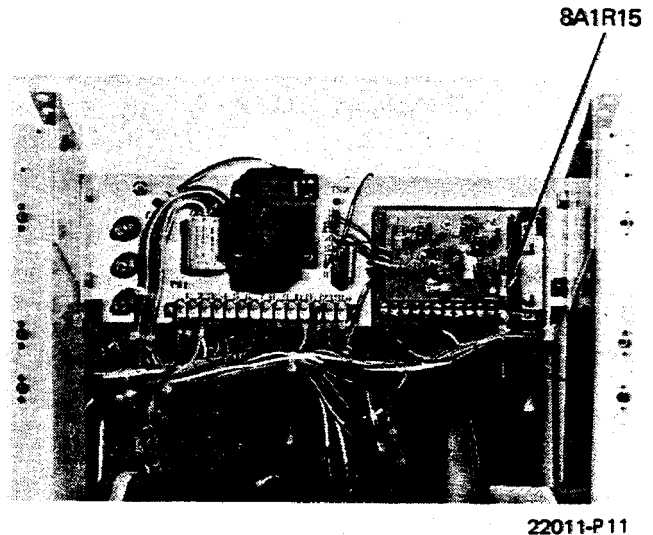


ILLUSTRATION 4-II-52

**UNITS WITH DRIVE ASSIST
TEST CONDITIONS: FORWARD ONLY,
DRIVE ASSIST NOT DEPRESSED**

Adjustment	8A1R15
Wheel RPM	54 +/- 2
D.C. Volts 8A1-5 to 8A1-6	≤ 80 VDC

SECTION 18 CHARGE BATTERY

Initial Conditions:

- a. All prior sections completed, or battery voltage too low (Red Band) to continue checkout of unit.
- b. Circuit breaker and keyed switch - OFF.
- c. Preset charger cutoff adjustment. Turn 4A1R30 maximum counterclockwise.
- d. Check that trickle charge circuit is disconnected. Pull and discard jumper from 4A1-7 to 4A1-8.

Instrumentation:

- Battery voltage: Connect digital voltmeter (200 VDC scale) to 3TB1-27 (+) and 3TB1-11 (-).

18-1 Charge Battery and Check Cutoff Setting.

1. Plug charger cord into convenience outlet.
2. Turn circuit breaker to ON and keyed switch to CHARGE. Charge Light should come ON and blower should run.
3. Check that motor drive system is disabled; and that x-ray control will not go into READY condition when Rotor Button is pressed.
4. Monitor battery voltage on D V M. While waiting for battery voltage to rise to 131 volts, proceed with Sections 18-2 and 18-3.
5. At a battery voltage of 131 volts, slowly adjust 4A1R30 clockwise until the Charger Complete Lamp lights.
6. Check 4A1R30 setting.
 - a. Turn keyed switch OFF and wait for battery voltage to drop below 130 volts.
 - b. Turn keyed switch to CHARGE and note voltage when Charge Complete Lamp lights.
 - c. Charge Complete Lamp should light between 131 and 132 volts. If not, re-adjust 4A1R30 and recheck.
7. Turn keyed switch and circuit breaker OFF. Do not disconnect digital voltmeter. Remove charger cord from convenience outlet.
8. Disconnect lead from 4A1-4. Temporarily connect jumper across 4A1-8 to 4A1-2. Turn 4A1-R11 fully counterclockwise. Plug charger cord into convenience outlet. Turn keyed switch to the CHARGE position and circuit breaker to the ON position. Allow batteries to charge to 135.5 +/- .5V. At this point, slowly adjust 4A1-R11 clockwise until 4A1-K16 energizes (indicated by the blower cutout). To check adjustment, turn off keyed switch and unplug charger cord. Turn keyed switch to the ON position. Depress rotor button and allow batteries to drain down to approximately 127V. Turn keyed switch to the CHARGE position and plug-in charger cord. Allow batteries to again charge to 135.5 +/- .5V and check operation of 4A1-K16. If necessary, readjust 4A1-R11. When adjustment complete, turn off charger, disconnect charger cord, remove jumper from 4A1-8 to 4A1-2 and replace connection to 4A1-4.

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▲ Indicates Change

18-2 While Waiting for Battery to Charge, Complete Paper Work

1. PMS Data Record, F3316
2. HEW Field Tests, F3382
3. Battery Service Logs, 3 ea; F3560
4. Assemblers Report, Federal Form FD 2579
5. Collect and complete Product Locator Cards

▲ 18-3 While Waiting for Battery to Charge, Complete Mechanical Assembly

1. Install the kick panel over the battery retainer plate.

NOTE: It may be necessary to loosen the battery retainer plate and shift it laterally so that the mounting holes of the kick panel line up.


2. Place the three completed Battery Service Logs, F3560, in the plastic envelope on the rear surface of the cassette drawer. Re-install the cassette drawer and replace the rubber liner in the bottom of the drawer. Refer to Illustration 4-II-12.
3. Reinstall the cover over the 8 panel and motor drive board.
4. Check the cassette drawer and cover panels for proper fit.
5. Remove all shipping tags and labels. Then clean the exterior surfaces of the unit. Touch up paint as required. For clean up, use mild soap and water or mild commercial cleaners.
6. Place the AMX-II technic chart, Direction 13777, in the holder on the side of the vertical column.
7. Check tightness of the H. V. Cable terminations at the transformer and tube unit.

SECTION 19 BATTERY CAPACITY CHECK


Initial Conditions:

- Main power circuit breaker - ON
- X-ray generator keyed switch - ON
- Battery charged and allowed to rest 15 minutes before this test

Instrumentation:

- Battery voltage: digital voltmeter connected across 3TB1-27 (+) and 3TB1-5 (-).
1. Select 100 KVP, 100 MAS. Close collimator blades and shield with lead.
 -  2. Take one exposure every minute for 10 minutes. Do not run rotor more than 6 seconds per exposure.
 3. Record battery voltage after each exposure.
 4. After the series of 10 exposures, allow batteries to rest for one minute with no power being drawn. If battery voltage is less than 112 VDC after one minute, battery should be reconditioned as described in Chapter 8, Section 5-4.
 5. Turn keyed switch and circuit breaker OFF. Disconnect digital voltmeter, and secure close operator's panel. Replace x-ray control cover, installing 6-screws holding it. Replace front and rear covers.

SECTION 20 COMPLETING THE INSTALLATION

1. Demonstrate and explain unit functions to salesman as follows:
 - a. Demonstrate how to position the vertical column and x-ray tube before the mobile unit is moved to a new location. Emphasize that the latch must be connected to the latch bar to prevent the collimator from striking the x-ray control during transport.
 - b. Demonstrate the proper operation of the motor drive feature. Emphasize that the motor will automatically stop when the brake handle is released, or if the bumper is depressed from striking an object.
 - c. Explain that the unit must be manually pulled back to regain drive control if the bumper comes in contact with any object. If the bumper is bent so it remains recessed, it must be manually straightened.
 - d. Explain that the unit may be transported manually if the user desires to or if the drive feature fails.
 - e. Explain that if the motor drive is used very extensively, the batteries will require more frequent charging.
 - f. Explain that the unit does not require charging when the meter reads in the green regions. Recharging is required only when the meter reads in the red "LOW" region. It is not recommended that the unit be left on charge when not in use.
-  2. Make several x-ray exposures using a phantom or fluoricon test pattern at different settings of KVP and MAS to check that the unit is functioning properly. Particularly check lamp and tone signal exposure indicators.
3. Turn over the six Standby/On/Off Switch keys. Advise that the keys should be given only to a qualified operator. The keys should not be left on the x-ray unit.
4. Provide copies of the following documents.
 - a. OM A0654E, AMX-II Operating Manual.
 - b. Tube Warranty Form; F2995
 - c. Tube Unit Data Sheet with X-Ray Warning Notice; Catalog D1022-27
 - d. NCRP Report No. 33, (Obtain signed acknowledgement card, Direction 13440B).

5. Service follow-up with timely submission of the following documents.

a. Installation Job sheets.

b. Sets of Product Locator Cards.

File: District set, green stripe

Mail: Installation Set, red stripe, in salmon envelope

c. Complete and file

PMS Data Record, F3316

HEW Data Record, F3382

d. Complete Assemblers Report, Federal Form FD2579

File: Blue Installers copy

Mail: { White Federal Copy

Yellow State Copy

{ Pink Purchasers Copy

SEC. 1 PURPOSE AND REQUIREMENTS

1-1 Instructions

1. Perform these checks after completing installation adjustments or preventive maintenance in Chapter 8. These tests are recommended when trouble shooting the system.
2. Omit a function if that check has just been made during an installation or repair procedure.
3. Unless otherwise instructed remove test jumpers and/or test equipment after completing the section in which they are connected.
4. When a test result is unsatisfactory, refer to service reference column.

1-2 HEW Field Tests

Field tests for HEW compliance are included in Chapter 4 and this chapter. These tests are an elaboration of the generalized procedures given in Direction 13894 "Field Tests for HEW Compliance." The table below lists all pertinent Field Tests for the AMX-II. Reference is given to the appropriate test in Direction 13894, and the corresponding chapter and section of this service manual.

Data is to be recorded on Form F3382 "Systems Field Tests for HEW Compliance" and/or on Form F 3316 "PMS Data Record—Mobile Generator I."

Note that all HEW Field Tests except Test 5, Test Set W, "Application and Function," and Test 13, Inherent Filtration Diagnostic Source Assembly," should be performed during a functional check. These two tests would also be required if the collimator were replaced as explained by notes in the "Application" column.

Test Name	Dir. 13894 Reference	Reference SM A0654E	Test Requirement	Application	Record Data
Application and function	Test 5: Set W	Chapter 3 Section 1.2	Manual Collimator used on Mobile Unit.	On installation and replacement of Collimator	F 3382
X-Ray Control	Test 6	Chapter 4 Sec 2-6 Chapter 5 Sec 3-1	Audible tone required for X-ray exposure	On installation and preventive maintenance calls.	F-3382
Tube Current Exposure Time Product	Test 23	Chapter 4 Sec. 2-5 Chapter 5 Sec 3-4	MAS Accuracy MAS (MEDIAN) + VARIATION 1 (+/-40% +.35 mas)/- .27 mas 1.5 (+/- 33% + .30 mas)/- .27 mas 2 (+/-21% + .32 mas)/- .28 mas 2.5 to 4 (+/- 14% + .39 mas) +/- .30 mas 5 to 8 (+/-8% + .40 mas)/- .32 mas 10 (+/-7% + .40 mas)/- .32 mas 12 to 300 -7% to +10%	On installation, preventive maintenance calls, and whenever repairing or replacing x-ray tube, MA control circuits, timer circuits, or H.V. components.	F-3316

Peak Tube Potential (KVP)	Test 21	Chapter 5 Sec 3-5	KVP Accuracy KVP 50 to 110 (+(10 KVP +7%)) (-(5 KVP +7%)) of dial reading after first 20 milliseconds of exposure. 50 to 95 (+(20 kvp +7%)) (-(5 KVP +7%)) of dial reading during first 20 milliseconds of exposure. 100 to 110 (+(25 KVP +7%)) (-(5 KVP +7%)) of dial reading during first 20 milliseconds of exposure.	On installation, preventive maintenance calls, and whenever repairing or replacing battery, KVP control circuits, or H.V. components.	F-3316 F-3382
Indirect Test of Collimator Illumination Level	Test 27-33 Test Set F	Chapter 4 Sec 5-5 Chapter 5 Sec 4-1	19.6 V (RMS) at minimum battery voltage of 110 VDC.	On installation, preventive maintenance calls, and whenever replacing collimator or collimator lamp.	F-3382
Collimator Alignment; Light Field to X-Ray Field	Test 27-33 Test Set F	Chapter 4 Sec 5-6 Chapter 5 Sec 4-5	Misalignment of edges of Light Field and X-Ray Field shall not exceed 1.8% of SID.	On installation, preventive maintenance calls, and whenever repairing or replacing collimator or x-ray tube unit.	F-3382
Collimator Alignment; Actual vs Indicated X-Ray Field	Test 27-33 Test Set F	Chapter 4 Sec 5-6 Chapter 5 Sec 4-4	Field size indicators shall agree with actual field size within 1.8% of SID.	On installation, preventive maintenance calls, and whenever repairing or replacing collimator	F-3382
Inherent Filtration; Diagnostic Source Assembly	Test 13	Chapter 4 Sec 6-1	Half value layer of useful x-ray beam shall not be less than 2.3 mm at 80 KVP	On installation, and whenever replacing tube unit, insert, collimator mirror, or other absorption between source and patient.	F-3316 F-3382

1-3 Tools and Materials

1. Voltmeter, 0/150/300 vac, 25 to 500-Hz, accuracy 3/4 of 1% of full scale, Weston Instruments Inc. Cat. No. 433-1903010. Where this meter is not readily available, use the following instruments with lower response on the square wave 60 Hz and the higher frequency (500 Hz) voltage. Voltmeter, 0/150/300 vac, 25 to 125 Hz accuracy 3/4 of 1% of full scale, GE type AP-9, Cat. No. 50-20102RHRH or Weston Instruments Inc. Cat. No. 433-1903009.
2. Multimeter, Simpson Model 260, Triplet Model 630 or equivalent (20,000-ohm/volt dc, 5,000-ohm volt/ac).
3. Standard wrench (507A935G1) for GE type II cable terminals.
4. Oscilloscope, Tektronix 564 or equivalent, dual trace, memroy type with algebraic addition feature and X10 probes. (A Tektronix type 422 scope is satisfactory where trouble shooting is not required.
5. 1-gallon (3.8 litres) Diala AX for adding the HV transformer, if required.
6. Socket wrench 1-1/16" hex.

7. Level (Machinist).
8. Digital Multimeter, Fluke Model 8000A, or equivalent.
9. 14" x 17" (35.5 cm x 43.2 cm) Cassette and suitable x-ray film.
10. DC milliammeter, 1.5/15/150, accuracy 1/2 of 1% full scale, Weston Instruments Inc. Model 931 or equivalent.
11. HV Divider (C1515A) with Direction 13788.
12. HEW Field Test Kit including Receptor Alignment tool 46-177371P1 and Standard test absorber 46-173632G1.
13. Radiation Meter (integrating dose type): Capintec Model 192; Berthold LB 1310 (Nuclear Associates 05-640) or equivalent.
14. Fluoricon Test Pattern.
15. Resistor, 100 ohms, 1 watt with a banana plug at each end.
16. 0.5-k, 2-w Potentiometer wired as a variable Resistor.

SEC. 2 MOBILE UNIT MECHANICAL CHECKS

2-1 Tube Unit and Collimator

Initial conditions: Main power circuit breaker—OFF
 X-ray generator "Standby" switch—OFF
 Charger cord disconnected

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
1. Unscrew and depress the rotational detent button on the right side of the collimator. Rotate the collimator about the tube unit.	The collimator should rotate smoothly and lock positively at 0°, +/- 15° +/-45° and +/-90° from the front position. Play between the rotating body of the collimator and the stationary brass flange is not permissible.	Chapter 8, Section 6-1
2. Release the tube unit rotation lock and rotate the x-ray tube unit through its range of travel.	Look for free movement when the lock is released and no slippage when the lock is tightened.	Chapter 3, Section 2-3

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▲ Indicates Change

2-2 Extension Arm Assembly

Initial conditions: Same as Section 2-1

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p>1. Release the yoke rotation lock and rotate the yoke 180° each side of the vertical position.</p>	<p>The yoke should turn freely and index at 90° and 180° positions either direction from the vertical position.</p> <p>The yoke rotation lock should hold the yoke at any position.</p>	<p>Chapter 8, Section 3-1</p>
<p>2. Release the telescoping arm lock and depress the arm interlock button. Extend the telescoping arm.</p>	<p>The telescoping sections should extend and retract freely with x-ray tube and collimator attached. Tube sections should extend and retract equally. Check that the link chain located in the extension arm is adjusted to remove backlash in the tube sections and permit easy section extension and retraction.</p> <p>The telescoping arm lock should hold the sections together and lock the sections in any position.</p> <p>The arm latch should latch and unlatch freely and hold the section firmly together when retracted.</p>	<p>The chain is adjusted by loosening the four Allen head screws securing the telescoping arm lock and moving the lock forward or backwards to tighten or loosen the chain. respectively. See Chapter 8, Section 3-2.</p>

2-3 Column and Vertical Carriage Assembly

Initial conditions: Same as Section 2-1.

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p>▲ 1. Rotate column through its range of travel.</p>	<p>The column should turn smoothly and freely for 360°. Torque should be adjusted between 4.5 ft-lb (6.1N-m) and 9.0 ft-lb (12.2N-m).</p>	<p>Chapter 8, Section 2 for AMX-II with column rotational lock. For AMX-II without column rotational lock (46-165600G14, G15), remove covers at base of column and adjust friction pad spring tension with a 3/32 hex wrench. Adjust all four pads equally; and turn each set screw only 1/4 turn at a time. Rotate column and repeat adjustment as needed. Replace covers.</p>
<p>2. Release the vertical arm lock and move the vertical carriage over its full range of travel.</p>	<p>The carriage should travel freely. The moving effort should not exceed 13 pounds (5.9 kg) in either direction except for 2 inches (50.8 mm) on top most travel and 10 inches (254 mm) on the bottom.</p> <p>The carriage when counterbalanced should not drop more than 2 inches (50.8 mm) from the top stop and not rise more than 10 inches (254 mm) from the bottom stop. The carriage should be capable of being stopped and remain balanced in any other position.</p>	<p>Chapter 8, Section 2 for AMX-II with column rotational lock. For AMX-II without column rotational lock (46-165600G14, G15), remove covers at base of column and adjust friction pad spring tension with a 3/32 hex wrench. Adjust all four pads equally; and turn each set screw only 1/4 turn at a time. Rotate column and repeat adjustment as needed. Replace covers.</p>

	The carriage should be capable of being locked in all positions. The lock should hold a 15-pound (6.8 kg) load. Locks should turn freely, lock positively, and release fully.	
3. Retract the telescoping arm, rotate the column and lower the vertical carriage to engage the transport latch to the latch bar.	The latch should automatically engage the latch bar. Check for easy release by rotating the latch CW and raising the telescoping arm.	Chapter 8, Section 3-3

2-4 Base, Cabinet and Brakes

Initial conditions: Same as Section 2-1.

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
1. Open the cassette drawer. Check cover panels.	Covers and doors should fit properly. The cassette door should be properly aligned and open and close without mechanical interference. The magnetic latches should be engaged and have equal holding forces. The control cabinet door should fit well without mechanical interference.	
2. With the motor drive de-energized, release the brake, and move the unit on a smooth, hard level floor.	The forward push or pull required to move the unit, with the brakes released, should not exceed 25 pounds. (11.34 kg). The brakes should be actuated when the brake handle is in the free position and released when the handle is depressed. The brake handle and linkage should move freely without interference when released. Each wheel brake should hold a minimum of 320 inch pounds (36.1 Nm) torque with the brake linkage and handle properly adjusted.	Binding in Drive Train Chapter 8, Section 4.

2-5 Motor Drive System

Initial conditions: Main power circuit breaker—ON
 X-ray generator "standby" switch—OFF
 Charger cord disconnected.

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p>1. Check motor drive system controls and safety interlocks.</p> <p>a. Speed Control Knob</p> <p>b. Brake Release Handle</p> <p>c. Front Safety Bumper</p> <p>d. Latch Bar</p> <p>e. Charger Cord</p>	<p>The drive motor speed control knob should rotate freely and spring return.</p> <p>The brake handle limit switch should be actuated when the brake handle is depressed within 3/8" (9.53 mm) of its bottom, brake released, position.</p> <p>The front safety bumper should depress completely without binding and spring return. The drive power should be de-energized when the bumper is depressed approximately 1/4 inch (6.35 mm).</p> <p>The Latch Bar should depress and spring return. With the arm latched, the unit should be capable of high forward speed.</p> <p>The motor drive should be disabled when the charger cord is plugged into a convenience outlet.</p>	
<p>2a. Block 16" (0.4 m) wheels just off floor. Connect 0-100 vdc meter to 8A1-5(+) and 8A1-6(-).</p> <p>2b. Operate drive system, check RPM and voltage. Readings at: MAX: Full Speed Forward</p>	<p>RPM 54 +/-2</p> <p>VOLTAGE 75 +/-%*</p>	<p>Chapter 4 Section 2-7 ADJUST 8A1R15</p>

*Not to exceed 80 vdc, average.

<p>3. Drive the mobile unit at full speed forward into a chair or other light object to make contact with the bumper. Be sure the unit will not be damaged or anyone injured by this test.</p>	<p>Observe that the unit stops within 3 inches (76.2 mm) of the impact point. Also check that the drive belt does not jump or make any unusual noise as the unit stops.</p>	<p>Chapter 8, Section 4-1</p>
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SEC. 3 ELECTRICAL CHECKS

3-1 Battery Circuit Calibration Check

Initial conditions: Main power circuit breaker—OFF
 X-Ray generator standby switch—OFF
 Charger cord disconnected
 Unit cooled for 15 minutes with Operator's Panel Cover removed after charging.
 See Chapter 4, Sec. 2.

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p>▲ a. Connect 0.5K 2-watt potentiometer in series with Gray lead from 3TB1-26.</p> <p>Connect Digital Voltmeter (0-200 vdc scale) to 4A1-2(+) and 4A1-11(-).</p> <p>b. Close Operator's Panel (don't short test leads). Mechanically zero 5M1.</p> <p>c. Open Operator's Panel 6CB1 and 5S1 ON. Adjust 0.5K Potentiometer for 110 +/- 0.1-v on Digital Voltmeter.</p> <p>d. Close Ops. Panel, allow to thermally stabilize for 5 minutes and recheck Step c.</p> <p>▲ e. Turn 6CB1 and 5S1 OFF. Disconnect test leads and reconnect Gray lead from 3TB1-26.</p>	<p>Battery Voltage depends on state of charge.</p> <p>When digital voltmeter reads 110 +/- 0.1-v 5M1 should read on BLACK mark between Red and Green Bands.</p>	<p>5M1 Reference Points</p> <p>Less than 110 vdc; RED "Recharge" or "Low" Band.</p> <p>110 vdc; Black mark between Red and Green Bands.</p> <p>Adjustment Procedure 1, Chapter 7, Schematic Reference (2,C).</p>

<p>f. Plug charger cord into convenience outlet. Turn 6CB1 ON. Turn keyed x-ray generator switch to CHARGE.</p> <p>g. Attempt to drive unit and press rotor button with charger cord connected.</p> <p>h. Turn power OFF and disconnect voltmeter.</p>	<p>When digital voltmeter reads 131 to 132 vdc the charge complete lamp should light.</p> <p>Exhaust blower for battery compartment should run whenever charger cord is plugged into outlet, and Generator Switch to CHARGE.</p> <p>Drive motor should not run and the generator should not go into "READY" with the charger cord connected.</p>	<p>Adjustment procedure 2, Chapter 7, Schematic Reference is 2,c.</p> <p>NOTE: Battery capacity check will be made in Section 5.</p>
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3-2 Tube Rotation Check

Initial conditions: Main power circuit breaker—ON
 X-ray generator standby switch—ON
 Battery charge indicator—Green band
 Charger cord disconnected.

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p>1a. Depress the hand-switch ROTOR button. Do not press X-ray button.</p> <p>b. Release Rotor button and note coasting time (time rotor noise is still audible).</p>	<p>READY light should light about 3 seconds after ROTOR button is depressed. The x-ray tube anode should accelerate to operating speed (3400 rpm) within the 3 second interval before the READY light glows.</p> <p>If less than 10 seconds, x-ray tube should be replaced to prevent rotor freeze up during use.</p>	<p>5DS4, Schematic Ref. 77,C.</p> <p>SM-D1154A for X-ray tube replacement.</p>
<p>2a. Turn circuit breaker and "standby" switch OFF.</p> <p>b. Disconnect and tape white stator lead at 3TB1-39.</p> <p>c. Turn circuit breaker and standby switch ON.</p> <p>d. Depress handswitch rotor button—do press x-ray button.</p> <p>e. Turn power OFF and restore connections.</p>	<p>Check that READY does not light at end of 3-second acceleration interval.</p>	<p>Rotor interlock sensor 3A2V5, Schematic, Ref. 24,F.</p>

3-3 MA and Filament Protection



Initial conditions: Main power circuit breaker—OFF
 X-ray generator standby switch—OFF
 Charger cord disconnected

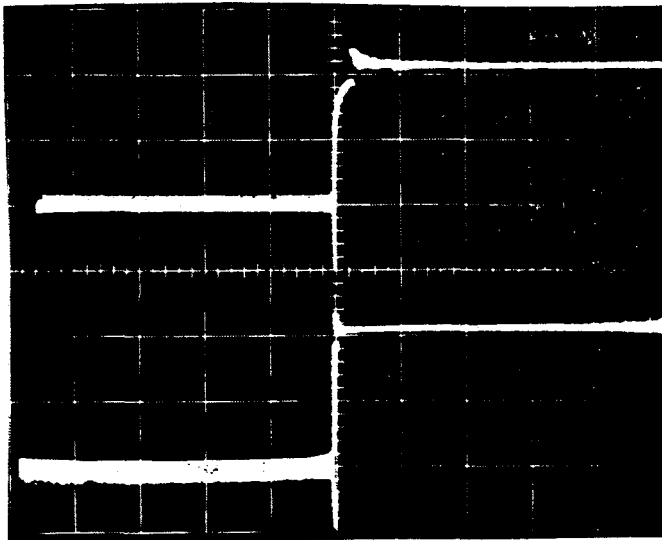
OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p>1a. Remove the jumper (with banana plugs) from terminals MA+ & MA- on panel 3. Install an accurate 0 to 150 ma, DC millimeter with plus lead in the MA+ end and the minus lead in the MA-.</p> <p>b. Connect a 0 to 150 v, iron vane type, AC voltmeter across 3TB1-18 and 3TB1-12 to read XS-XC Filament Primary Voltage.</p> <p>c. Turn the x-ray tube port up, close collimator blades and cover collimator port with a 1/8" (3.175 mm) thick lead sheet.</p> <p>d. Turn circuit breaker and standby switch ON. Select 80 KVP, 200 MAS, (2-second exposure).</p> <p> e. Take an exposure and read the ma meter. Do not make more than one exposure per min.</p> <p> f. Make another exposure and read the voltage across 3TB1-18 and 3TB1-12. At the end of the exposure.</p> <p>g. Press the Rotor button only and read voltage across 3TB1-18 and 3TB1-12.</p>	<p>MA should be between 95 and 105 MA.</p> <p>AC Filament Primary Voltage on 3TB1-18 and 3TB1-12 should not change more than 1.0-v. RMS between steps f and g.</p>	<p>If MA is not 100, adjust 3A2R34 to obtain 100 MA X-ray tube current. Refer to Chapter 4, Sec. 1-3 or Chapter 4, Part II, Sec. II.</p> <p>Adjust 3A2R30 to obtain the same reading as in step f. Refer to Chapter 4, Sec. 1-3 or 4-II-28.</p>

<p>2a. Turn circuit breaker and standby switch OFF. Disconnect filament transformer primary lead at 3TB1-18 and tape.</p>	<p>Check that READY lamp does not light at end of 2-1/2 second rotor acceleration interval.</p>	<p>Filament interlock sensor 3A2Y13, Schematic Ref. 27B.</p>
<p>2b. Turn power ON and press rotor button only.</p>		

3-4 MAS (Time) and Overload Check


Initial conditions: Same as Section 3-3.

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p>1a. Connect a scope with accurately calibrated horizontal sweep as shown in Illustration 5-1.</p>		
<p> 1b. Make an exposure at 10 MAS at 80 KVP measure exposure duration from scope waveform.</p>	<p>Measure x-ray exposure duration from 98 to 102 milliseconds.</p>	
<p> 1c. Make a second exposure at 100 MAS, 80 KVP. Measure exposure duration from scope waveform.</p>	<p>Measure x-ray exposure duration from 0.98 to 1.02 seconds.</p>	<p>If the trace does not correspond with Illustration 5-1, adjust 3A1R4 to obtain correct interval timing for the 100 MAS selection as shown in the lower waveform of Illustration 5-1. Refer to Chapter 4, Part II Sec. 12-1.</p>





PROBE: 2TB1-1
 GND: 2TB1-3
 UPPER H: 20 ms/div (10 mas)
 LOWER H: 0.2 sec/div (100 mas)
 V: 5.0-v/div x 10 (Probe)
 TRIG: INT, DC, +/-, Set Point

ILLUSTRATION 5-1

<p>2a. Turn circuit breaker and standby switch OFF.</p> <p>2b. Disconnect MAS Select-or lead at 3TB1-21 and tape.</p> <p>2c. Set KVP selector at 50.</p> <p> 2d. Make an exposure and time exposure duration with sweep second hand of watch.</p> <p>2e. Turn power OFF and reconnect MAS selector lead at 3TB1-21.</p>	<p>Exposure should terminate within 3 to 3.4 ± .2 seconds by safety back-up timer.</p>	<p>3K3 Time delay relay. Schematic reference 78,D.</p>
--	--	--

3-5 H.V. Divider Check of KVP Calibration and MA.

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p>a. Connect calibrated H.V. Divider and dual trace scope as shown in Ill. 5-2. Connect 0-150 DCMA meter in MA+ and MA- Jacks on Panel 3. Connect 0-200 DCV Digital Voltmeter to 3TB1-27(+) and 3TB1-5(-).</p> <p>b. Turn circuit breaker and stand-by switch ON. Note battery voltage.</p> <p> c. Discharge or charge battery for a voltage between 110 and 120 volts. If necessary, make exposures at 80 KVP, 200 MAS. Rest one minute between exposures.</p> <p> d. Make an x-ray exposure at 80 KVP, 4 MAS. Measure KVP.</p>	<p>Battery voltage will depend on state of charge. For this test must be between 110 and 120 volts.</p> <p>Addition of H.V. Divider and 5 feet (1.5 m) H.V. cables will alter MA setting. Adjust 3A2R34 if necessary for 100 MA +/- 1.</p> <p>Compare scope waveform will Ill. 5-3. KVP should be 80 (+10 KVP +5%)(-5 KVP +5%). Check during last 20 milliseconds of exposure as MA stabilizer does affect KVP during first 20 milliseconds.</p>	<p>Refer to Direction 13288A for use and calibration of H.V. Divider with oscilloscope.</p> <p>X-ray tube current; Chapter 4, Sec. 2-4.</p>

▲ Indicates Change

<p>▲ e. Wait one minute from step d. Measure and record battery voltage, then make a second exposure at 80 KVP, 200 MAS. Measure MA and record.</p> <p>▲ f. Wait one minute between exposures then repeat steps d and e at 50 KVP and 110 KVP.</p> <p>g. Calculate KVP (MIN) and KVP (MAX) for 50, 80, and 110 KVP based on measured KVP and battery voltage.</p> <p>h. Record data on F3382. Calculate KVP and MA deviation. Refer to III. 5-4 for sample record.</p> <p>i. Remove H.V. Divider and scope. Do not disconnect tube current test meter.</p> <p>▲ j. Make an exposure at 80 KVP, 200 MAS. Readjust 3A2R34, if required for MA value of step e.</p>	<p>Battery voltage should be between 110 and 120 volts. MA should be 100 MA.</p> <p>▲ KVP should be within +(10 KVP + 5%)/-(5 KVP + 5%) of selected value. MA should be within 95 and 105 MA at a battery voltage between 110 and 120 volts.</p> $KVP_{(MIN)} = KVP \text{ (measured)} \times \frac{110}{\text{Batt. Volt}}$ $KVP_{(MAX)} = KVP \text{ (measured)} \times \frac{120}{\text{Batt. Volt}}$ <p>KVP (MIN) and KVP (MAX) must be within +/-5 KVP of each selected value. MAS must be within 5% of 100 MA at each selected value.</p> <p>▲ Readjustment of 3A2R34 will be required to compensate for removal of H.V. Divider and (1.5 m) cables.</p>	<p>If KVP is outside tolerance refer to primary waveform check. Chapter 4, Sec. 2-6.</p> <p>There are no usable autotransformer taps on the AMX-II. The H.V. transformer, X-ray tube unit, or H.V. cables may have to be replaced.</p> <p>X-ray tube current; Chapter 4, Sec. 2-4.</p>
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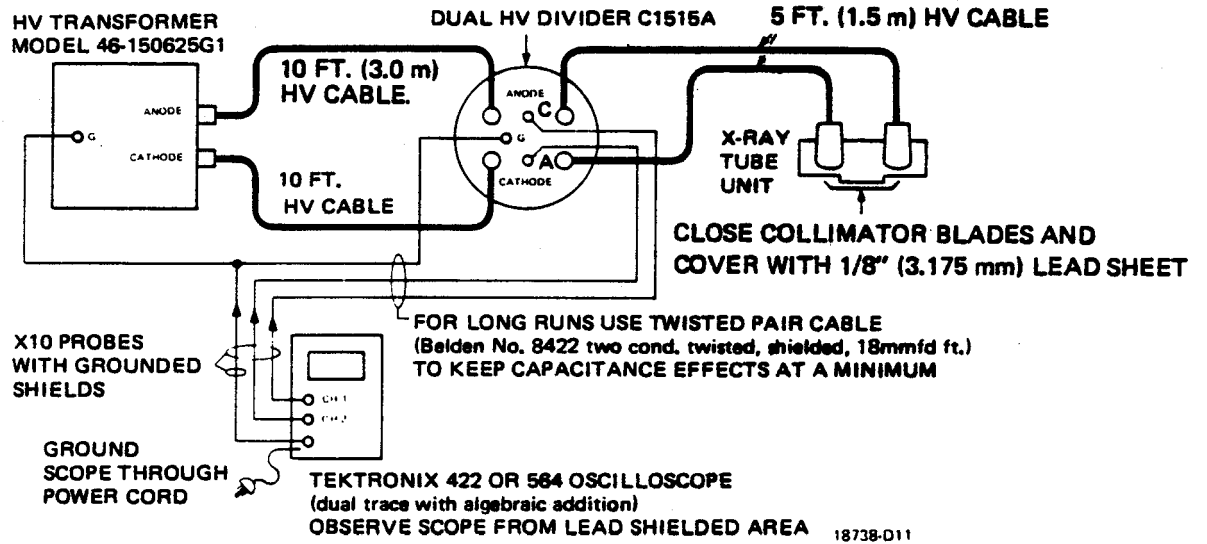


ILLUSTRATION 5-2

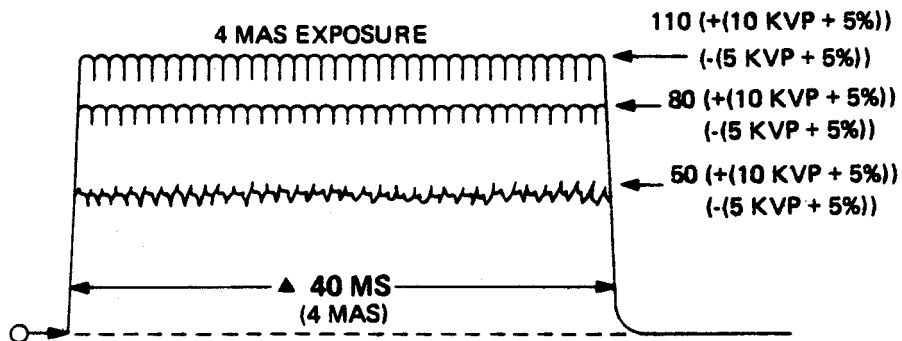


ILLUSTRATION 5-3

SEC. 4 COLLIMATOR CHECKS

4-1 Field Light Check

Initial conditions: Main power circuit breaker—ON
 X-ray generator standby switch—ON
 Battery charge indicator green band
 Charger cord disconnected.

OPERATOR	RESULTS EXPECTED	SERVICE REFERENCE																																	
<p>1a. Position tube unit and collimator to project light field on smooth, surface such as a tile floor at 40" SID. (1.016 m)</p> <p>b. Darken room and press lite button on collimator. Open collimator blades.</p>	<p>Field light should energize and remain on for 15 to 20 seconds unless modified per Chapter 4, Sec. 4-2. Light pattern should be of uniform brightness (no shadows or blotches) with sharply defined edges approx. square with floor.</p>	<p>Chapter 8, Section 8</p>																																	
<p>2a. Remove the blade control knobs and the nameplate from the front of the collimator.</p> <p>b. Measure No-Load battery voltage at 3TB1-27(+) to 3TB1-5(-).</p> <p>c. With the field light energized measure the voltage across the lamp socket terminals.</p> <p>d. Replace nameplate and blade control knobs.</p>	<p>To provide required illumination, lamp voltage must be no less than value listed.</p> <table border="1" data-bbox="565 1188 1149 1604"> <thead> <tr> <th>No Load Battery Voltage</th> <th>Min. Lamp Voltage (VAC) RMS Ref.</th> <th>Fluke 8000A</th> </tr> </thead> <tbody> <tr><td>128</td><td>22.2</td><td>24.3</td></tr> <tr><td>126</td><td>22.0</td><td>24.1</td></tr> <tr><td>124</td><td>21.7</td><td>23.8</td></tr> <tr><td>122</td><td>21.4</td><td>23.5</td></tr> <tr><td>120</td><td>21.1</td><td>23.1</td></tr> <tr><td>118</td><td>20.7</td><td>22.7</td></tr> <tr><td>116</td><td>20.3</td><td>22.3</td></tr> <tr><td>114</td><td>19.9</td><td>21.9</td></tr> <tr><td>112</td><td>19.5</td><td>21.5</td></tr> <tr><td>110</td><td>19.0</td><td>21.0</td></tr> </tbody> </table>	No Load Battery Voltage	Min. Lamp Voltage (VAC) RMS Ref.	Fluke 8000A	128	22.2	24.3	126	22.0	24.1	124	21.7	23.8	122	21.4	23.5	120	21.1	23.1	118	20.7	22.7	116	20.3	22.3	114	19.9	21.9	112	19.5	21.5	110	19.0	21.0	<p>Step down transformer 8T1. Tap selection Chapter 4, Section 4-5.</p>
No Load Battery Voltage	Min. Lamp Voltage (VAC) RMS Ref.	Fluke 8000A																																	
128	22.2	24.3																																	
126	22.0	24.1																																	
124	21.7	23.8																																	
122	21.4	23.5																																	
120	21.1	23.1																																	
118	20.7	22.7																																	
116	20.3	22.3																																	
114	19.9	21.9																																	
112	19.5	21.5																																	
110	19.0	21.0																																	

4-2 Crosshair Position Check

Initial conditions: Same as Section 4-1.

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p>1a. Position tube unit and collimator to project light field on a smooth light surface such as a wall at 40" SID.(1.016 m)</p> <p>b. Darken the room and energize the field light. Slowly move each blade set toward the closed position while observing the light pattern.</p>	<p>The illuminated area on the wall should show equal rectangles of light on either side of the crosshair shadows as each set of blades is moved toward the closed position.</p>	<p>Chapter 4, Section 4-1.</p>

4-3 Extension Cylinder Alignment Check (Optional Accessory)


Initial conditions: Same as Section 4-1.

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p>1a. Position the tube unit and collimator to project the light field on a smooth reflective surface such as a wall at 40" SID. (1.016m)</p> <p>b. Slide the extension cylinder into the tracks at the bottom of the collimator.</p> <p>c. Darken the room and energize the field light.</p>	<p>The illuminated area on the cassette should show equal sectors of light on either side of the crosshair shadows.</p>	<p>Chapter 4, Section 4-3.</p>

4-4 Alignment Checks

Initial conditions: Main power circuit breaker—ON
 X-ray generator standby switch—ON
 Battery charge indicator—Green band
 Charger cord retracted


OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p>1a. Position a loaded 14" x 17" (35.5 cm x 43.2 cm) cassette under the collimator. Using the collimator measuring tape, set SID at 48" (1.2 m).</p>		

<p>b. Adjust blade knobs to yield an indicated x-ray field size of 12" x 12" (304.8 mm x 304.8 mm) at 48" SID (1.2 m).</p> <p>c. Energize the field light and center light field on cassette.</p> <p>d. Assemble and attach RAT to collimator using RAT holding fixture. Use collimator lamp, note and record where edges of light field intersect RAT.</p> <p> e. Make an exposure at 50 K.V.P, 6 MAS. Develop film.</p>		
<p>2. Measure x-ray field size on film.</p>	<p>X-Ray field size as measured on film must be within 1.8% of SID, that is 11.04 to 12.86 (302.6 mm to 306.9 mm) inches for a 12" (304.8 mm) field size at 48" SID (1.2 m).</p>	<p>Chapter 4, Section 5-6.</p>
<p>3. Mark light field (step 1c) on x-ray film and measure total misalignment light to x-ray field.</p>	<p>Total misalignment of either length or width edges must not exceed 0.86 (21.6 mm) inches (1.8% of 48 inches). (1.22 m).</p>	<p>Chapter 4, Section 5-6.</p>

SEC. 5 SYSTEM CHECKS

5-1 Film and Indicator Checks

Initial conditions: Main power circuit breaker—ON
 X-ray generator standby switch—ON
 Battery condition indicator—Green band
 Charger cord disconnected

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p> 1a. Make several exposures using a phantom at different settings of KVP and MAS to insure the unit operational.</p> <p>b. Develop and check the resulting films.</p>	<p>Check lamp and tone signal exposure indicators. Do not exceed tube or generator ratings.</p>	


5-2 Battery Electrolyte Level Check (Do not repeat on installations.)

Initial conditions: Main power circuit breaker—OFF
 X-ray generator standby switch—OFF
 Charger cord disconnected

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p>1a. Charge battery until charge complete lamp lights. Allow battery to rest minimum of 2 hours.</p> <p>b. Review battery safety precautions.</p> <p>c. Remove cassette drawer, kick panel and battery retaining plate. Fold back Mylar cover.</p> <p>d. Use insulated tools, disconnect battery and remove the three cell groups.</p> <p>e. Use furnished wrench remove vent caps and check electrolyte level in each cell using syringe.</p> <p>f. Replace vent caps, reinstall battery and cover panels.</p> <p>g. Clean off white powder deposits with non-metallic brush.</p>	<p>Electrolyte level in each cell should not be below baffle.</p> <p>Add water if level is less than 1/4" (6.35 mm) above baffle.</p> <p>Record cc of water added to each cell. Note: Water reserve of cell is 16cc.</p>	<p>Chapter 3, Section 1-3.</p> <p>Chapter 3, Section 6-3.</p> <p>Add distilled or deionized water to raise electrolyte level to 3/8" (9.53 mm) above baffle.</p> <p>If more than 16cc water required per cell, electrolyte check interval is too long or battery charger is not cutting off at 131-132v. Chapter 8, Section 5.</p>

5-3 Battery Capacity Check

Initial conditions: Main power circuit breaker—ON
 X-ray generator standby switch—CHARGE
 Charger cord connected

OPERATION	RESULTS EXPECTED	SERVICE REFERENCE
<p>1a. Charge battery until charge complete lamp lights.</p> <p>b. Allow battery to rest 30 minutes before test.</p> <p>c. Connect digital volt-meter, 3TB1-27(+) and 3TB1-5(-). Record battery voltage.</p> <p>d. Select 100 KVP, 100 MAS. Close collimator blades and shield with lead.</p> <p> e. Take one exposure every minute for 10 min. Do not run rotor more than 6 seconds per exposure. Record battery voltage after each exposure.</p>	<p>Battery voltage should be at least 112 vdc after 10 exposures with a 1 minute rest.</p>	<p>If battery voltage is less than 112 vdc the battery should be reconditioned as described in Chapter 8, Section 5.</p>
<p>2a. Select 80 KVP 200 MAS. Record Battery Voltage.</p> <p>b. Take an exposure and note battery voltage during the exposure.</p>	<p>Battery voltage drop during the exposure should be approximately 22 to 24 volts.</p>	<p>If voltage drop is excessive, Battery may require reconditioning or may have high resistance terminal connection.</p>



CHAPTER 6

THEORY AND SERVICE

SECTION	TITLE	PAGE
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2	BATTERY CHARGER	6-1
2-1	Turning On Battery Charger	6-1
2-2	Turning Off Battery Charger	6-4
3	INVERTER DRIVERS	6-5
4	INVERTER DRIVER OUTPUT COUPLERS	6-8
4-1	60 Hz Inverter Driver Output Couplers	6-8
4-2	500 Hz Inverter Driver Output Couplers	6-9
5	INVERTERS	6-10
6	X-RAY TUBE FILAMENT SUPPLY AND CONTROL CIRCUITS	6-13
7	X-RAY EXPOSURE CONTROL	6-17
7-1	Off To Ready	6-17
7-2	Ready To Exposure Start	6-17
8	EXPOSURE TERMINATION	6-18
8-1	Radiographic Timer Termination By Forced Commutation	6-18
8-2	Termination Due To Tube MA Overload	6-19
8-3	Termination Due to Release of the Handswitch X-Ray or Rotor Button	6-19
9	COLLIMATOR LAMP CIRCUIT	6-20
10	MOTOR CONTROL	6-21
11	OSCILLOSCOPE WAVEFORMS	6-22

SEC. 1 FUNCTIONAL DESCRIPTION

NOTE: Waveform (Ex: W31-A) will be found in Sec. 11 of this chapter.

The AMX-II is a battery powered X-ray unit rated to provide up to 110 kvp at 100 ma (fixed ma) for radiography. The unit cannot be operated with the charge cord plugged into a wall outlet. Power is obtained from the batteries for the collimator lamp, motor drive and X-ray exposures. If fully charged the batteries will provide up to 10,000 mas at 100 kvp for X-ray exposures provided the rotor on-time is limited to 10 seconds per exposure.

Refer to the simplified block diagram of the AMX-II in Illustration 6-1. The battery charger is energized when the charge cord is inserted into a suitable wall outlet. Incoming AC power is rectified and fed to the battery. The battery charger includes a circuit to sense the battery charge level and automatically turn off the charger when the battery voltage reaches a predetermined level.

Battery power is connected to the 60 Hz and 500 Hz inverter drivers and the 60 Hz and 500 Hz inverter circuits. Both inverters change the DC battery power into 60 Hz and 500 Hz. square wave power to permit circuit isolation and transformation to higher and lower voltages.

The output of the 60 Hz inverter is fed to an isolation transformer. One secondary of this transformer supplies power to the X-ray tube stator. Another secondary winding provides power to a transformer which steps voltage down to supply the X-ray tube filament.

The 500 Hz inverter output feeds on autotransformer which is controlled by the knob on the kvp selector. The autotransformer feeds the primary of the HV Transformer where it is stepped up and applied to the X-ray tube during an exposure.

SEC. 2 BATTERY CHARGER

Schematic reference sheet 1, Chapter 7.

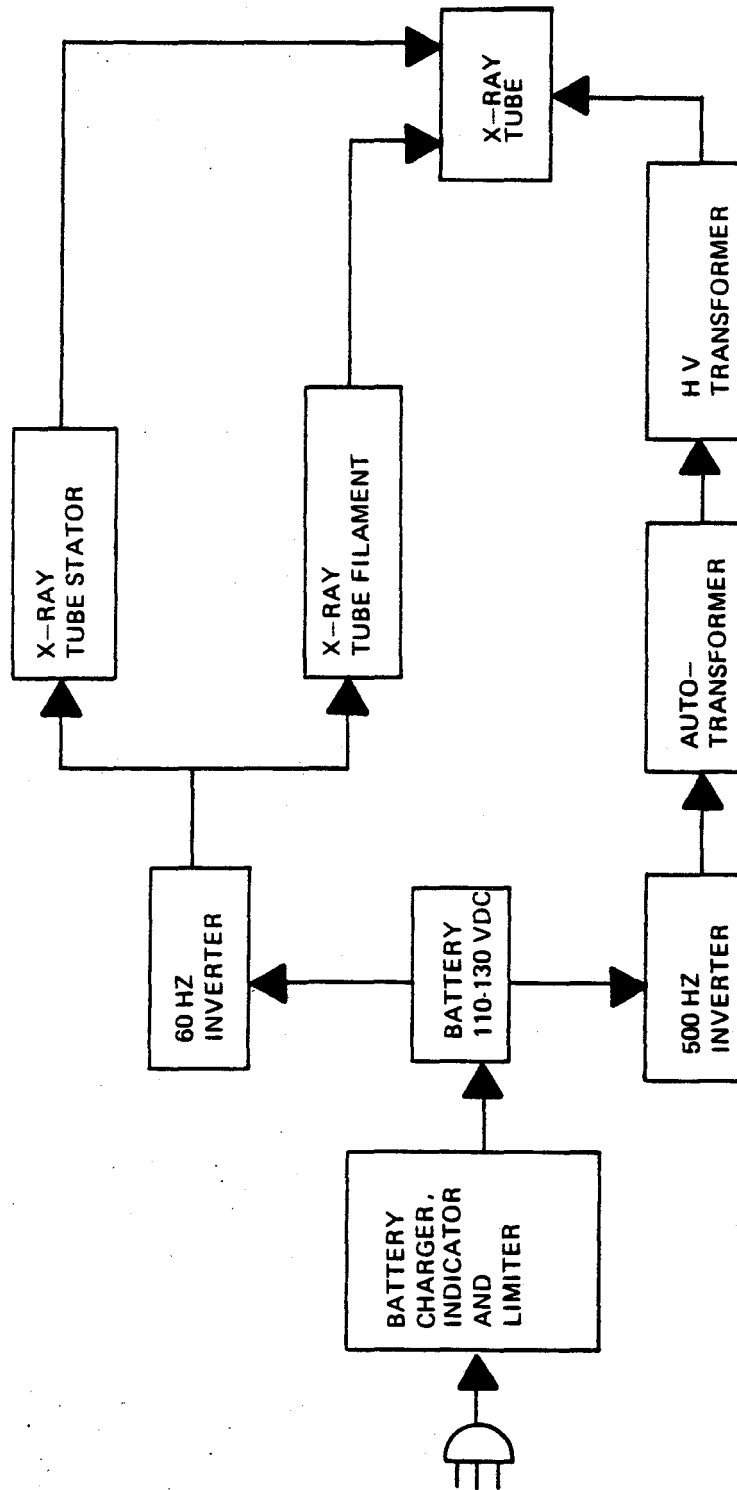
The battery charger (a) provides pulsating DC voltage at about 140 V to the battery, (b) turns off the charging voltage when the battery reaches 130 V, (c) energizes signal lamps to indicate "charge on" and "charge complete", and (d) actuates meter to indicate battery charge.

Refer to Illustration 6-2. When the line cord is inserted into a power outlet, AC voltage is supplied to the bridge rectifier. If battery voltage is below 128 V as measured by the battery level sensor, the charger will supply current to the battery. The battery level sensor also activates the "Charge On" indicator to show that the battery is being charged. When battery voltage reaches 130, the battery level sensor will turn off the charger and "Charge On" indicator, and activates the "Charge Complete" lamp.

2-1 Turning On Battery Charger

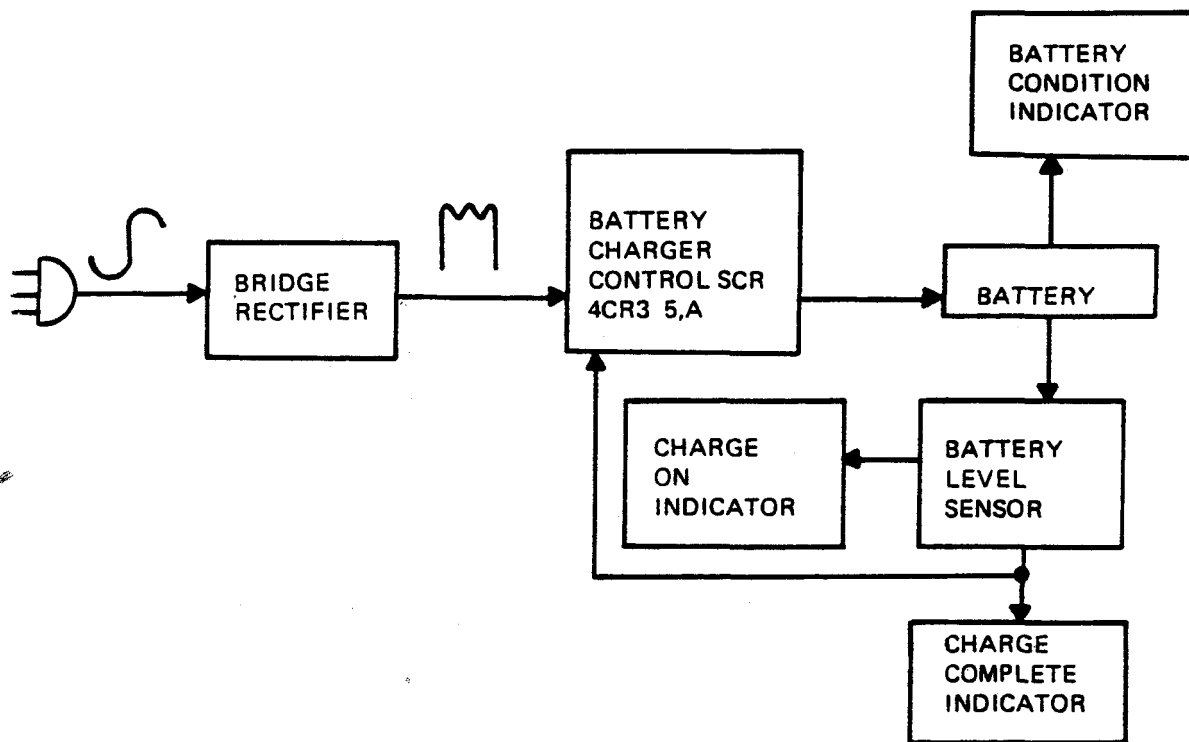
Schematic reference, sheet 1, Chapter 7.

When battery voltage drops below 128 V the bias voltage to the level sensor 4A1Q7 (8,C) will cause it to turn off (see W-41B). The bias voltage resulting across 4A1R9 will cause 4A1Q10 to turn off and de-energize 4A1K23 (7,D). This opens contact 4A1K23-B (5,E) and places the gate of control SCR 4CR3 (5,A) at a positive potential with respect to the cathode (see W-42) turning it on. Control SCR 4SCR 4CR3 will charge the battery until it is turned off as described in Sec. 2-2.



18794-D10

SIMPLIFIED BLOCK DIAGRAM OF AMX-II X-RAY UNIT
ILLUSTRATION 6-1



18793-D10

BLOCK DIAGRAM OF BATTERY CHARGER
ILLUSTRATION 6-2

2-2 Turning Off Battery Charger

When battery voltage is 130 the base emitter voltage for 4A1Q7 (8,C) will turn it on. The voltage across 4A1R9 will turn on 4A1Q10 and pick up relay 4A1K23 (7,D). Contact 4A1K23-B (5,E) will close, reducing current to the gate of control SCR 4CR3 (5,B) and stopping the charging operation. Contact 4A1K23-A (8,F) opens to increase the emitter base voltage of 4A1Q7. Consequently the battery will not charge again until it has discharged about 3 volts below the charge complete point.

SUMMARY OF CIRCUIT CONDITIONS

CHARGING

1. 4A1Q7 is off
2. 4A1Q10 is off.
3. 4A1K23 is de-energized.
4. 4CR3 is ON.
5. "Charge On" light is on.
6. "Charge Complete" lamp is off

CHARGE TERMINATION

1. 4A1Q7 turns on.
2. 4A1Q10 turns on.
3. 4A1K23 is energized.
4. 4CR3 is OFF.
5. "Charge On" light is off.
6. "Charge Complete" lamp is on.

SEC. 3 INVERTER DRIVERS

From III. 6-2B it can be seen that the DC battery voltage is fed to the 60 Hz inverter (Sec. 5) where it is "inverted" into square wave AC power. The inverter driver controls the frequency at which the inverter operates. The inverter driver output coupler (Sec. 4) provides a peak pulse at the gate of the SCR for reliable triggering.

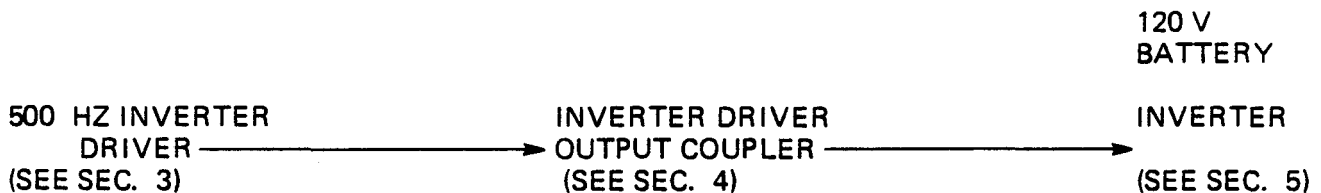


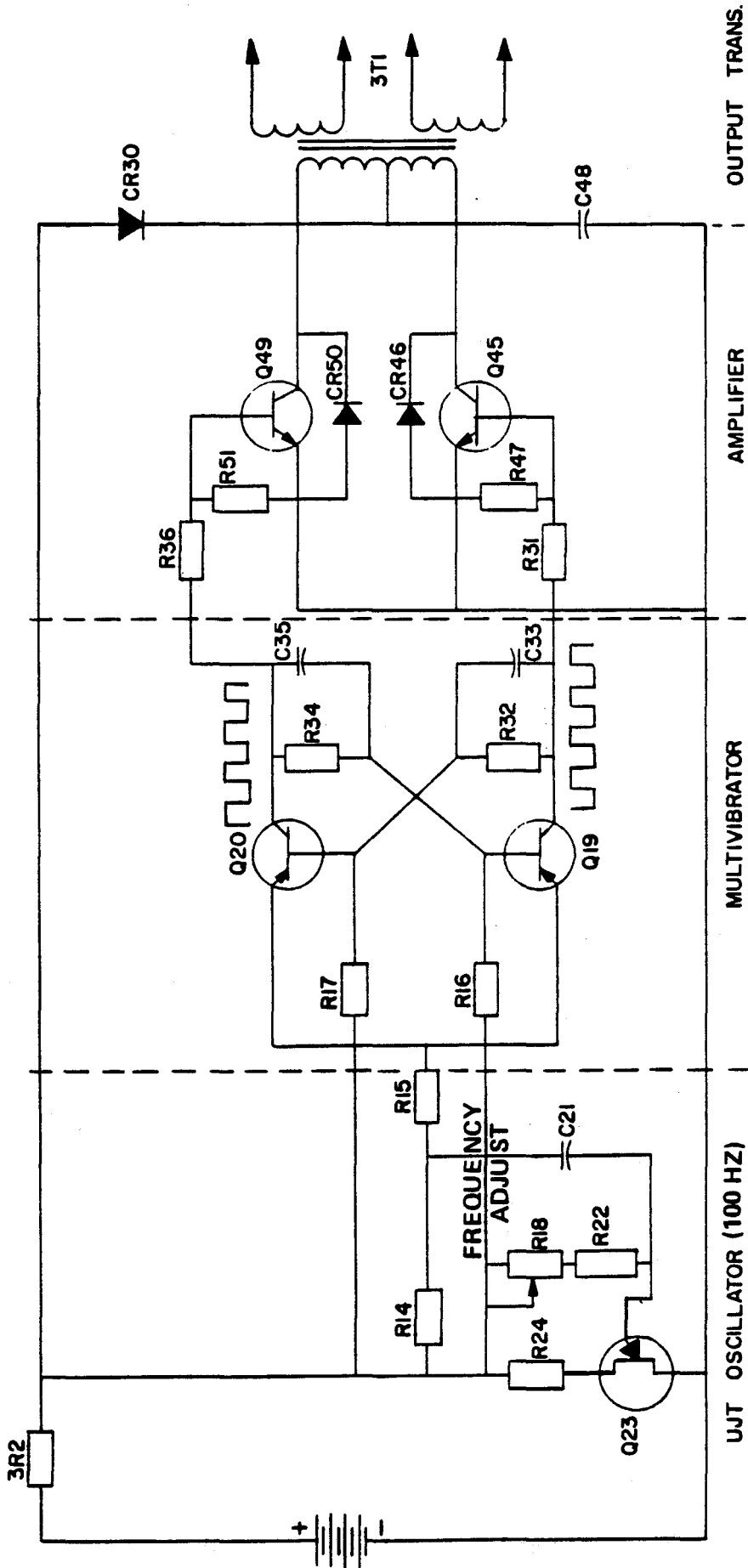
ILLUSTRATION 6-2B

The inverter driver consists of a flip-flop multivibrator triggered by a UJT oscillator. The 60 Hz inverter driver is the same as the 500 Hz inverter driver except the resistor and capacitor in the oscillator has been changed to provide the different frequency.

The schematic reference for the 500 Hz inverter is sheet 5, Chapter 7. A simplified circuit is shown in Illustration 6-3. The UJT oscillator provides a source of short precisely timed negative pulses with a period determined by C21 and R18 plus R22. R18 is adjusted to obtain 500 Hz. The pulses are coupled to the common emitter resistor (R15) of a transistor flip-flop circuit (Q19 and Q20). Details of flip-flop circuit operation may be found in the GE Transistor Manual, Sixth Edition under Square Wave Inverter Drive Circuits. The output of the flip-flop circuit is amplified by Q49 and Q45 and coupled to the inverter by transformer 3T1.

In inverter circuits it is important that one SCR be allowed sufficient time to turn off before the other is placed in conduction. Therefore, the inverter driver circuits are designed to have a slight delay between the termination of one pulse and the start of the next as specified below.

The 500 Hz inverter SCR gate voltages are shown in W-24. The delay can be seen by observing that one pulse in W-24A terminates on the left side of the centerline graticule and the next pulse in W-24B starts to the right of the centerline graticule. An expanded view would appear as shown in Illustration 6-4.



500-HZ INVERTER DRIVER
ILLUSTRATION 6-3

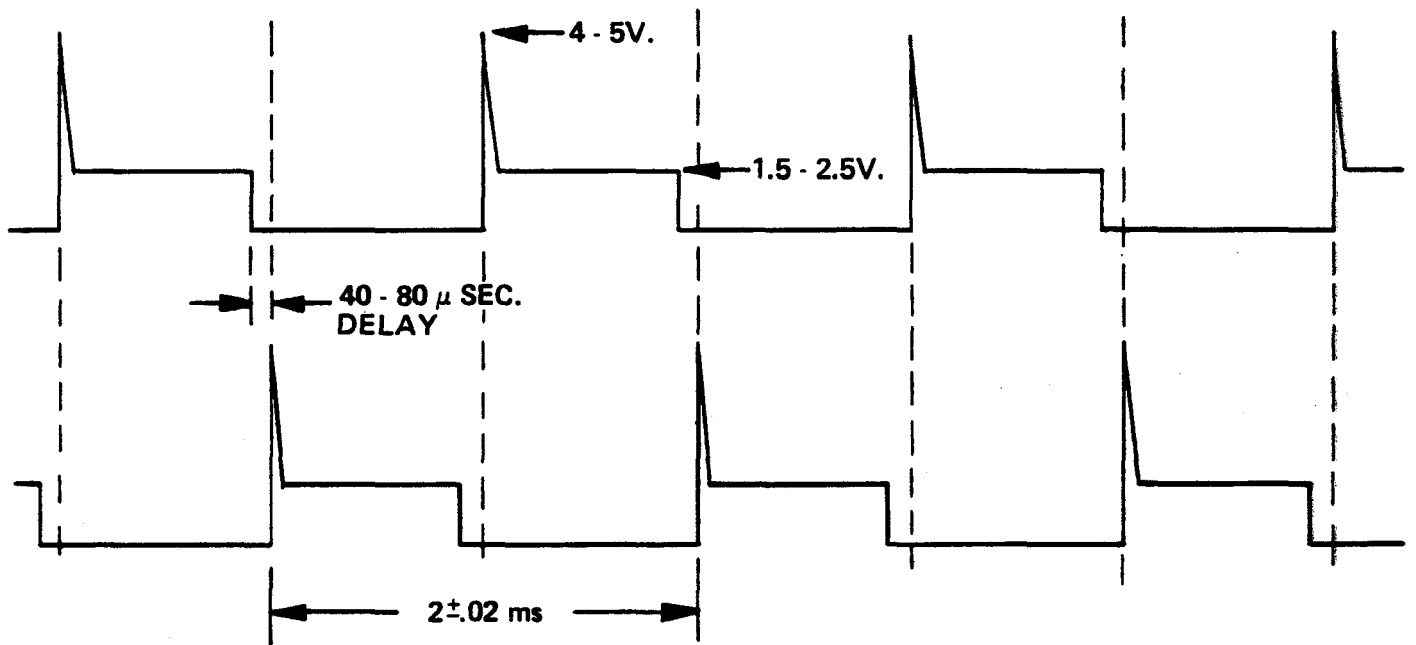


ILLUSTRATION 6-4

SEC. 4 INVERTER DRIVER OUTPUT COUPLERS

4-1 60 Hz Inverter Driver Output Couplers.

Schematic reference sheet 2, Chapter 7.

The output of the 60 Hz inverter driver is coupled to the inverter as shown in Illustration 6-5. This voltage charges capacitor C through diode CR. The voltage developed across C is transferred to the SCR gate through the Silicon Unilateral Switch (SUS). The SUS is a miniature SCR having an anode gate (instead of the usual cathode gate) and a built-in avalanche diode, between the gate and cathode. As voltage across the SUS rises to the switching voltage point (7-9 volts for a 2N4990) the avalanche diode conducts and triggers the SUS into conduction. The capacitor C discharges through the SUS and R2. The voltage across R2 provides a peak pulse at the gate of the SCR for reliable triggering. Note the normal and abnormal waveforms. The leading spikes may not be visible unless the scope is properly adjusted.

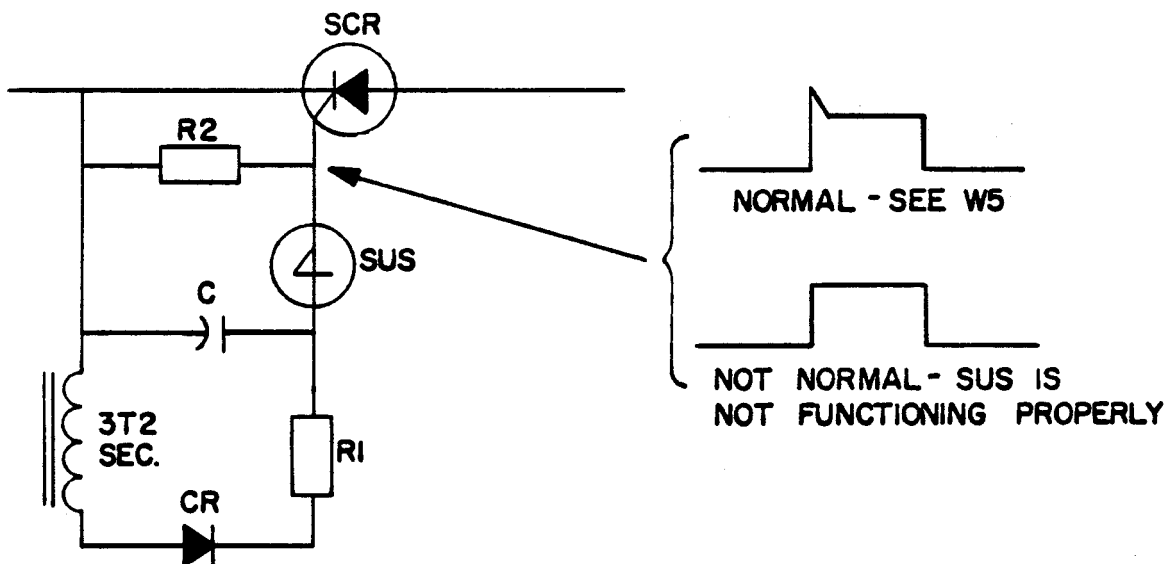


ILLUSTRATION 6-5

SEC. 5 INVERTERS

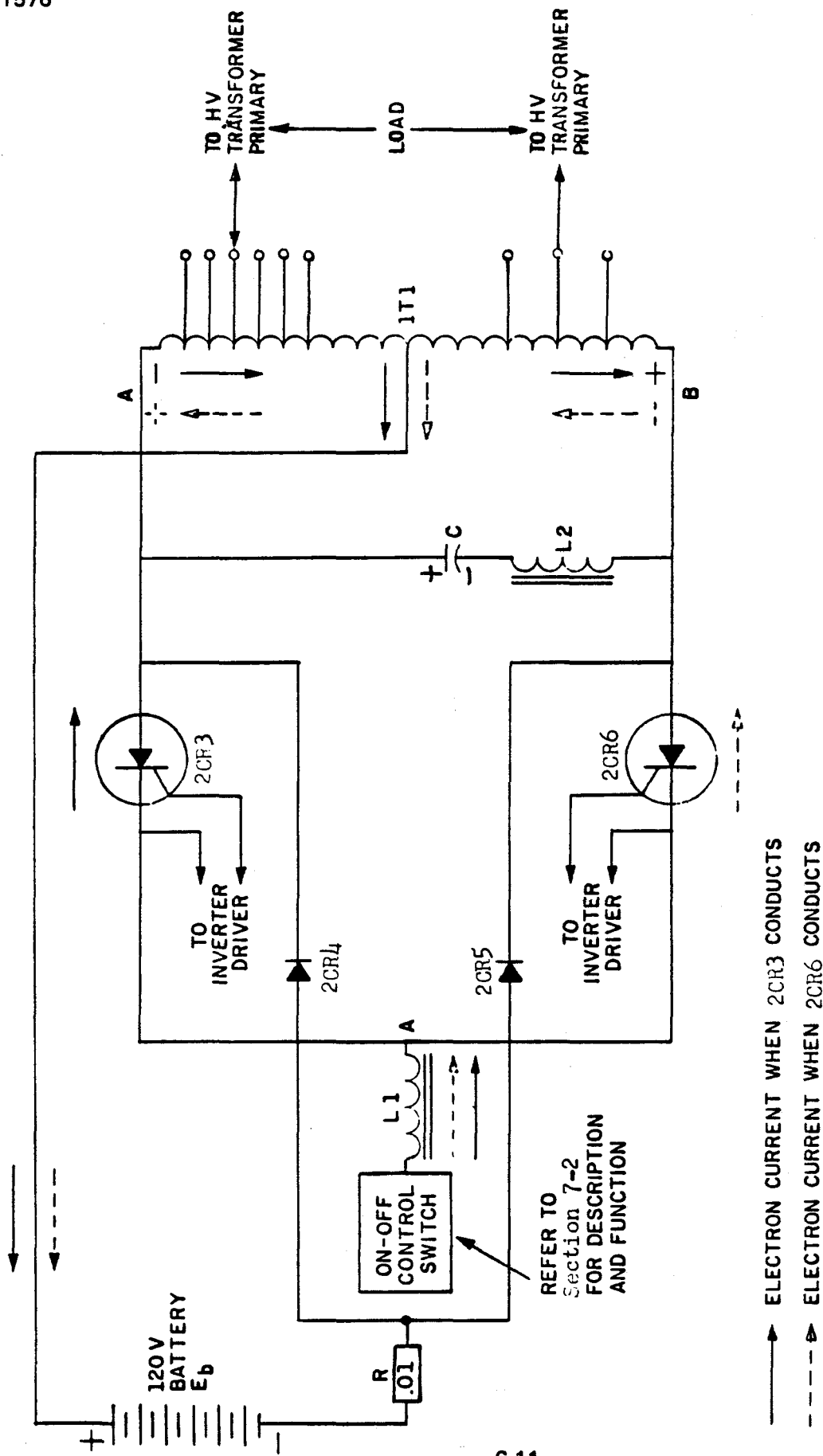
Schematic reference, 60 Hz, sheet 2, 500 Hz, sheet 5, Chapter 7.

For additional description of inverter circuits see the General Electric SCR Manual, Fifth Edition, Chapter 13.2.

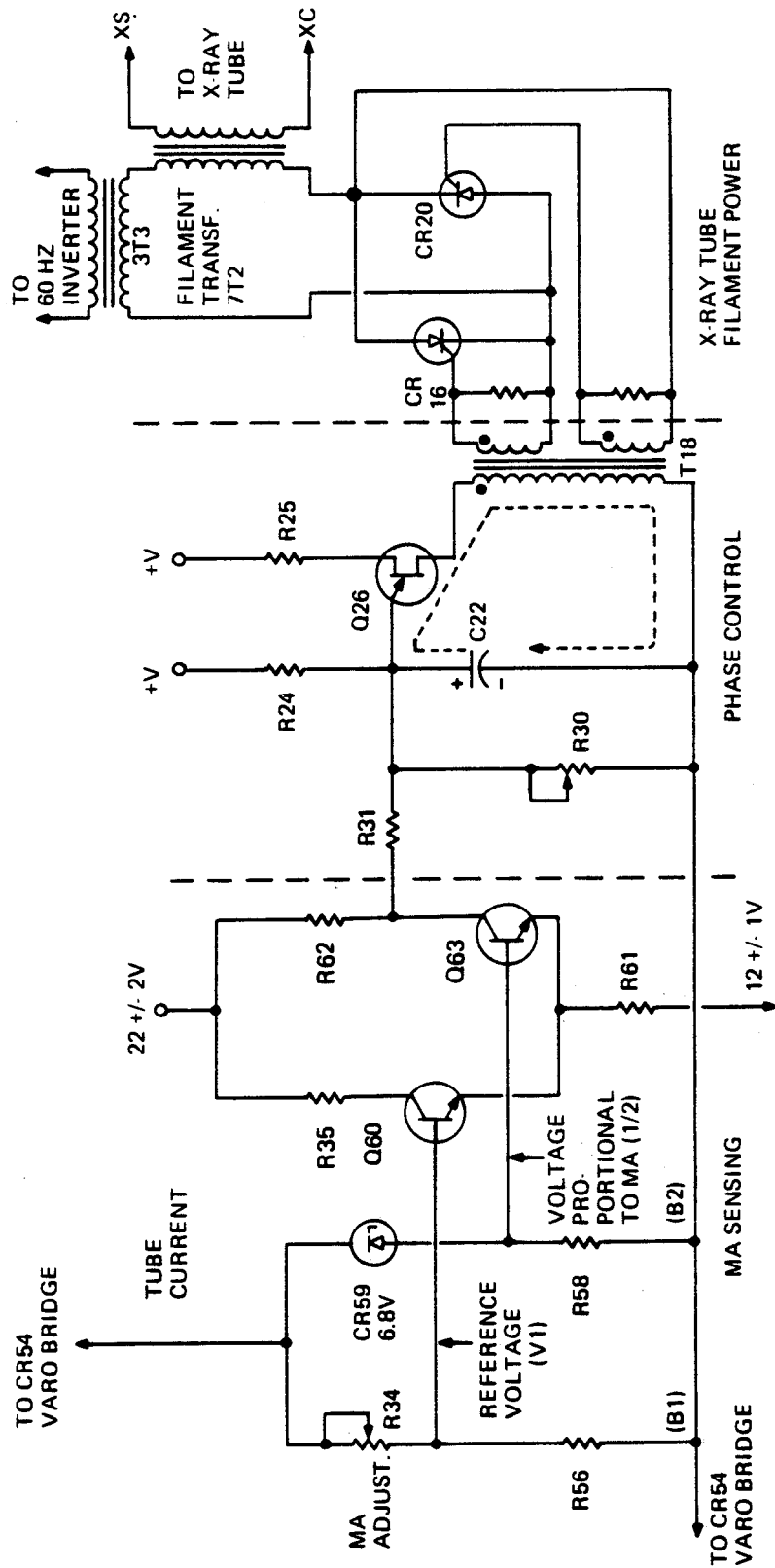
The 60 Hz and 500 Hz inverters are alike except for the method of turning each off and on and the power handled. The 60 Hz inverter is turned on and off by relay contacts actuated when the handswitch ROTOR button is pressed. The 500 Hz inverter is turned on by proper gate signal to a control SCR when the hand switch X-RAY button is pressed, and turned off by forced commutation with another SCR when the interval timer signals the end of an exposure.

The principle of operation for both inverters is as follows. Refer to the simplified circuit in Illustration 6-7. The inverter driver is providing a square wave AC signal alternately to 2CR3 and 2CR6. Therefore, one or the other SCR gate will be positive when the inverter is turned on. Assume that 2CR3 turns on first. Then 2CR6 will remain in a blocking condition. The current from the 120 -v supply will flow through the upper side of transformer T1. Transformer action will produce a voltage of approximately $2 \times 120 = 240$ v at the anode of 2CR6 and across capacitor C. When a positive trigger pulse is applied to the gate of SCR2, it will turn on and apply reverse bias to 2CR3 because of the action of commutating capacitor C. Capacitor C will maintain a reverse bias across 2CR3 long enough for 2CR3 to turn off. The next positive trigger pulse at the gate of 2CR3 will cause the circuit to revert to the original state. In this manner the current from the DC supply will flow alternately through the two sides of the transformer primary and produce an AC voltage in the secondary.

Rectifiers 2CR4 and 2CR5 feedback to the battery reactive power stored in the load at the end of a half cycle of AC voltage.



CLASS C INVERTER CIRCUIT
 AS USED TO POWER THE 500-HZ HV TRANSFORMER OF THE AMX-II
 ILLUSTRATION 6-7



23603-D10

ILLUSTRATION 6-8

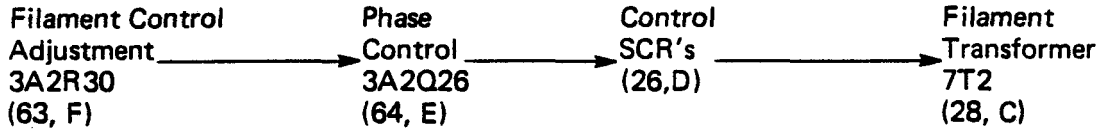


ILLUSTRATION 6-10

The filament control voltage during warm-up is adjusted as close as possible to that required to give a tube current of 100 ma during exposure.

- The X-ray tube filament transformer receives power form the 60 Hz inverter as shown in Illustration 6-11.

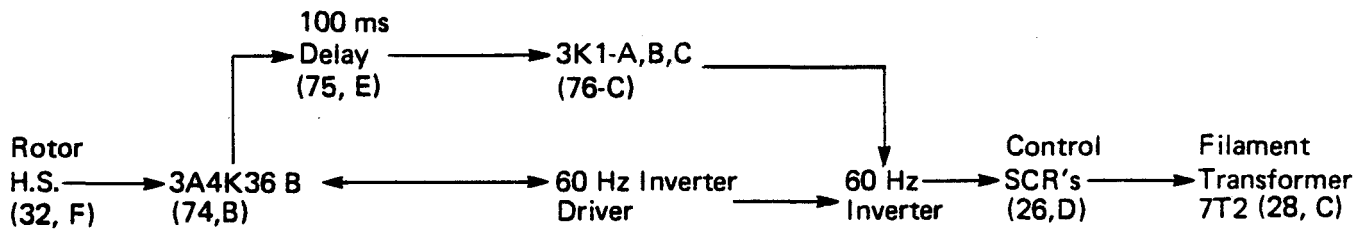


ILLUSTRATION 6-11

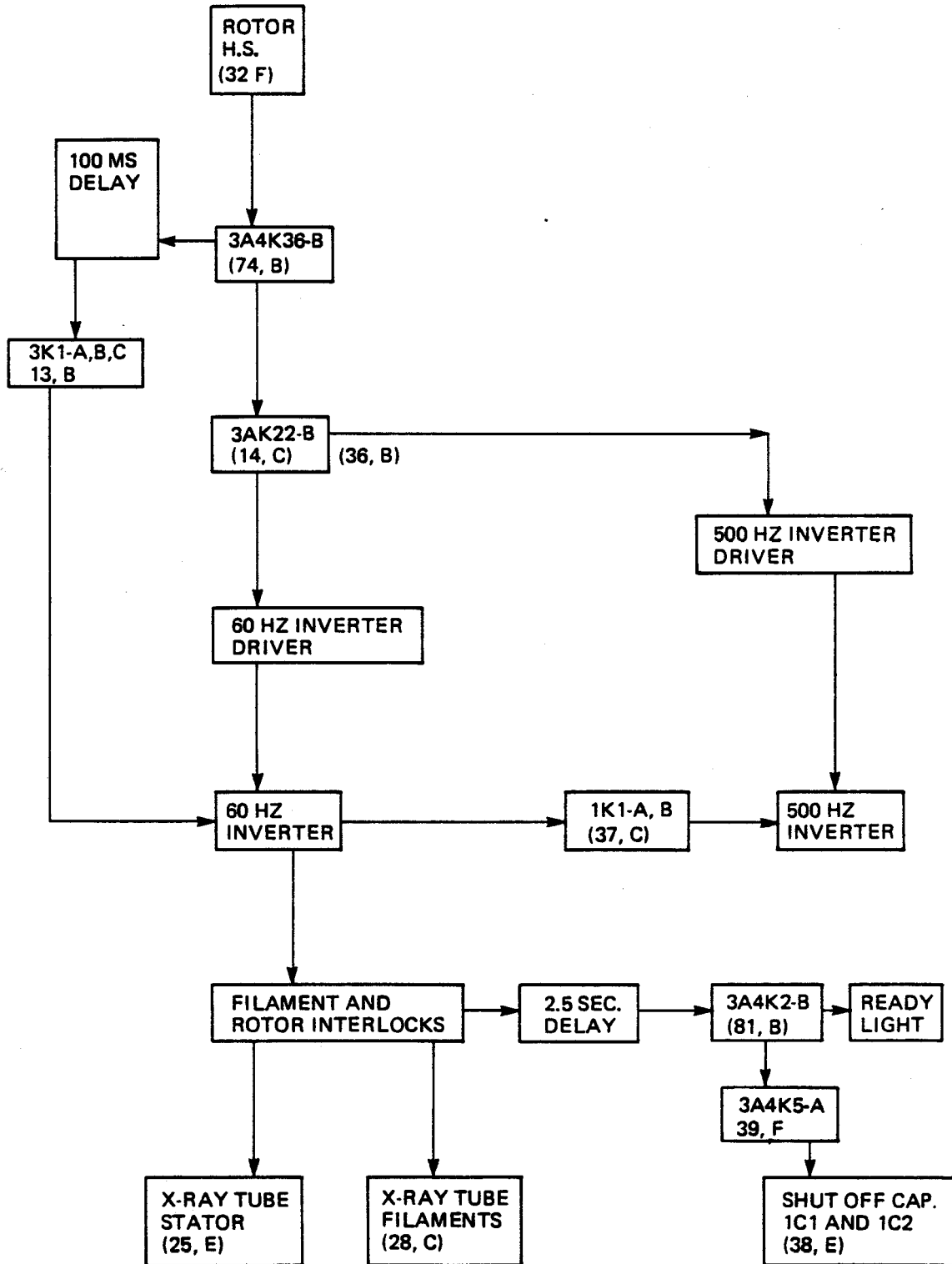


ILLUSTRATION 6-12

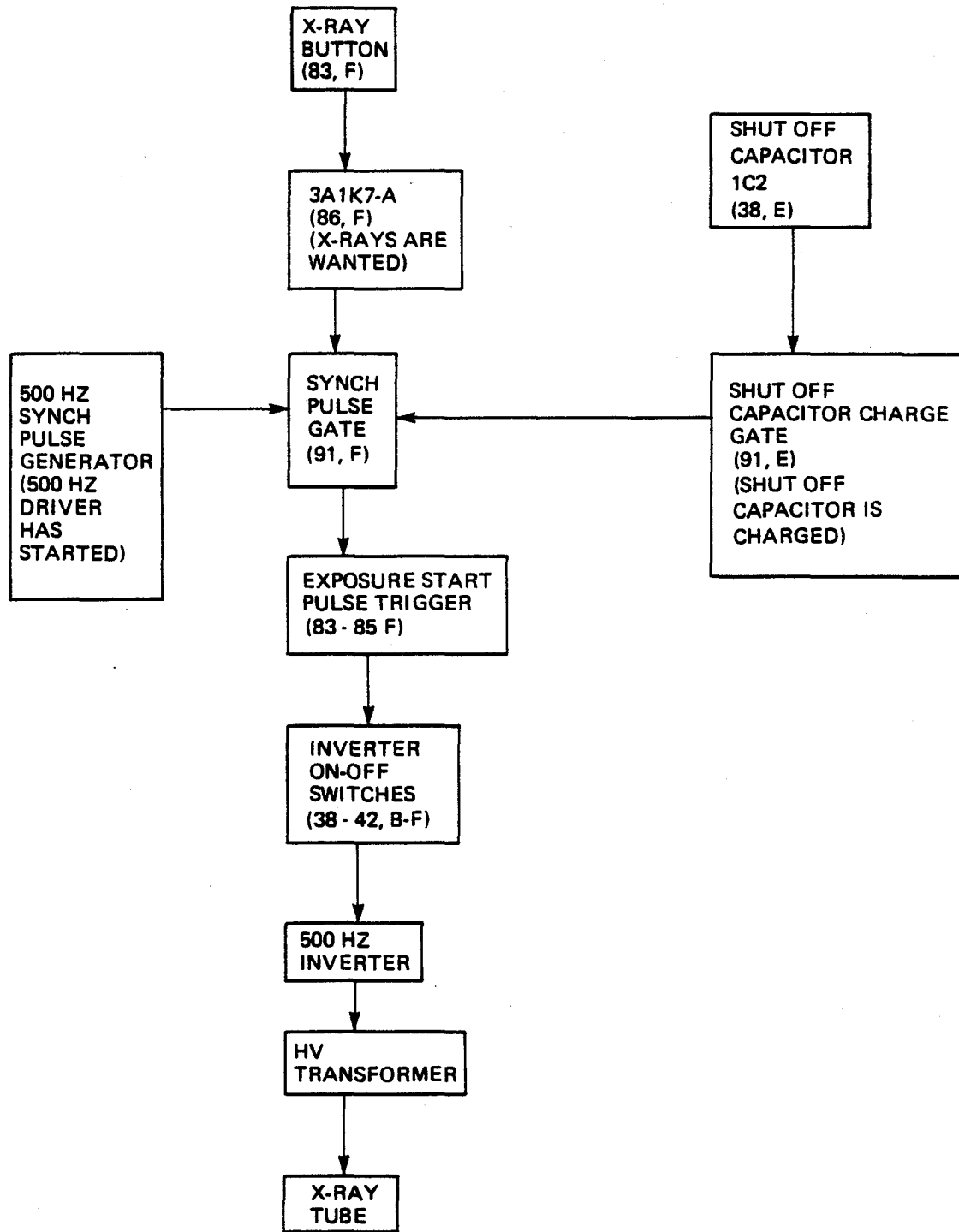


ILLUSTRATION 6-13

SEC. 7 X-RAY EXPOSURE CONTROL

7-1 Off to Ready

The sequence of events leading up to the READY state are described below.

The X-ray unit is energized by turning on the circuit breaker 6CB1 and the x-ray control switch. The "power on" lamp will glow. The battery change cord should not be plugged in. The "power on" lamp and either the "charge on" lamp or the "charge complete" lamp will glow.

Depressing the hand switch ROTOR button energizes relay 3A4K36-B, Illustration 6-12. The 60 Hz Inverter Power Delay (76, G) will ensure that the inverter driver is functioning 100 ms before battery power is applied to the 60 Hz Inverter.

The 2.5 sec. delay (79, G) allows the filament to reach operating temperature and the rotor to reach operating speed.

7-2 Ready to Exposure Start

The sequence of events that occur to produce an exposure are shown in Illustration 6-13. These events presume the unit is in the READY state as described in Sec. 7-1. When 3A1CR28 (85,E) fires capacitor 3A1C3 (84,D) discharges through 3A1CR13, 3A1CR28, 3A1CR63 and 3A6T3. The resulting exposure start pulse is transmitted to the gate of 2CR2 (39,D) in the inverter ON-OFF circuit. 2CR2 conducts to complete the 500 Hz inverter circuit and start the exposure.

Note on Illustration 6-13 that three inputs are required to the Synch Pulse Gate before 3A1CR28 fires-Contact 3A1K7-A, (86, F) activated by X-ray handswitch, removes a ground path from the collector of 3A1Q56 (90,F) which is biased on. When the shut off capacitors 1C1 and 1C2 are not charged, 3A1Q60 will conduct, by-passing the Synch pulse signal and preventing an exposure. A signal from the 500 Hz Synch pulse generator (49, D) is applied to the base of 3A1Q56. This signal provides turn-on of 3A1CR28 to step with the 500 Hz inverter pulses.

SEC. 8 EXPOSURE TERMINATION

There are several means for terminating an exposure. These are individually described below.

8-1 Radiographic Timer Termination by Forced Commutation

Schematic reference sheet 4 & 9, Chapter 7.

After the rotor button is depressed 1C2 (38,E) is charged to a -80 volts as shown in Illustration 6-14. 1C1 does not charge due to 1CR2.

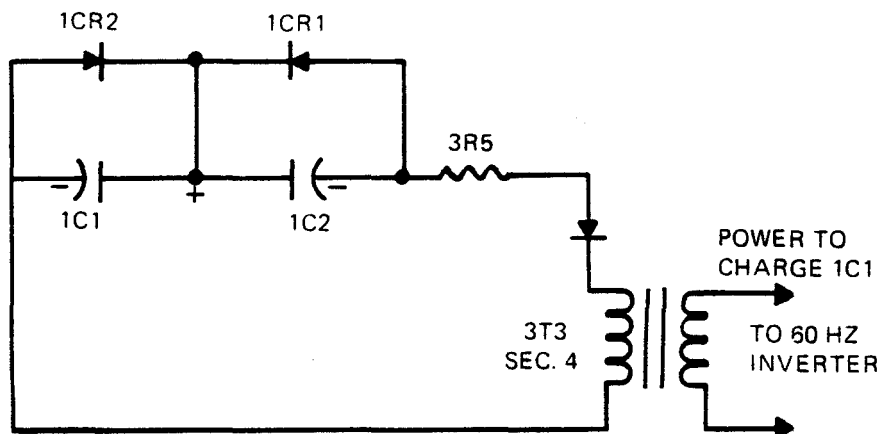


ILLUSTRATION 6-14

18796-D10

During an exposure 2CR2 (38,D) is conducting and 2CR1 is off. When the exposure is to be terminated, a signal is applied to the gate of 2CR1 (39,D) turning it on, Illustration 6-15. Capacitor 1C2 will discharge through 1C1, 2CR2 and 2CR1. This forces more current through 2CR2 in the reverse direction than was flowing in the forward, shutting it off. The reverse current charges 1C1 until 2CR2 shuts off.

The Timer consists of an RC timing circuit and UJT 2A1Q17 (86-87,D) which is turned on at a time period of mas/100.

At the end of the selected time period the UJT conducts producing a signal through pulse transformer 3A1T18 (89,E) and 3A1CR44 to turn on 3A1CR47 (88,D). The turning on of 3A1CR47 provides a discharge path for 3A1C38 (87,E) through 3A1CR39 (87,C), 3A1CR47, 3A1CR68 and 3A6T5. The pulse generated by the discharge of 3A1C38 is coupled by 3A6T5 to the gate of 2CR1 (39,D). When 2CR1 conducts, it applies the full negative voltage (-80 v) of 1C2 to the anode of 2CR2 turning it off as described earlier.

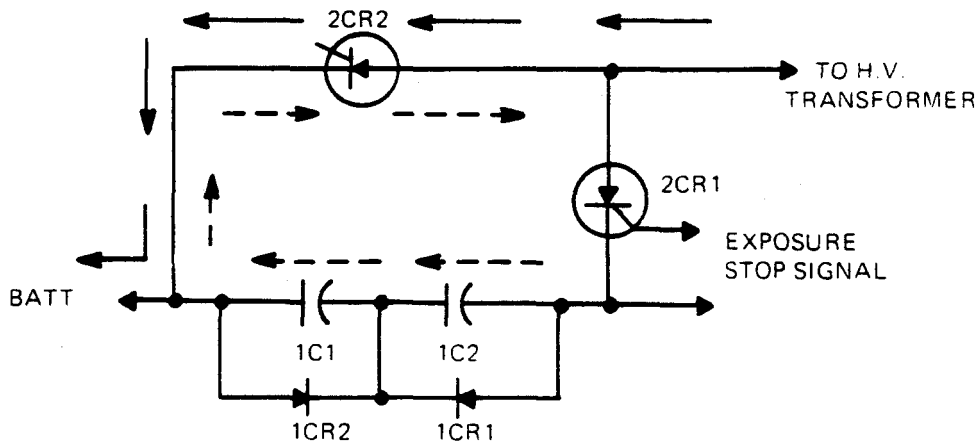


ILLUSTRATION 6-15

18787-D10

8-2 Termination Due to Tube MA Overload

Schematic reference, sheet 6, Chapter 7.

If tube current reaches 200 +/- 40 MA, the trip coil of 6CB shown at 60,D will trip the main power circuit breaker, 6CB1, and disconnect the battery from all circuits.

8-3 Termination Due to Release of the Handswitch X-Ray or Rotor Button

Schematic reference, sheet 9, Chapter 7.

Release of the X-ray button closes the 3A1K7-A contact (86,F) and provides a discharge path for 3A1C38. The pulse generated by the discharge of 3A1C38 stops the exposure by forced commutation as described in Section 8-1.

Release of the rotor button causes 3A4K36-B contacts to open and remove power from the inverter driver, and timing circuits. This terminates the exposure.

SEC. 9 COLLIMATOR LAMP CIRCUIT

Schematic reference Page 9, Chapter 7.

1. The collimator lamp circuit is initiated by pushing the collimator field light switch 4S1.
2. The collimator light receives its power in the sequence shown in Illustration 6-16.

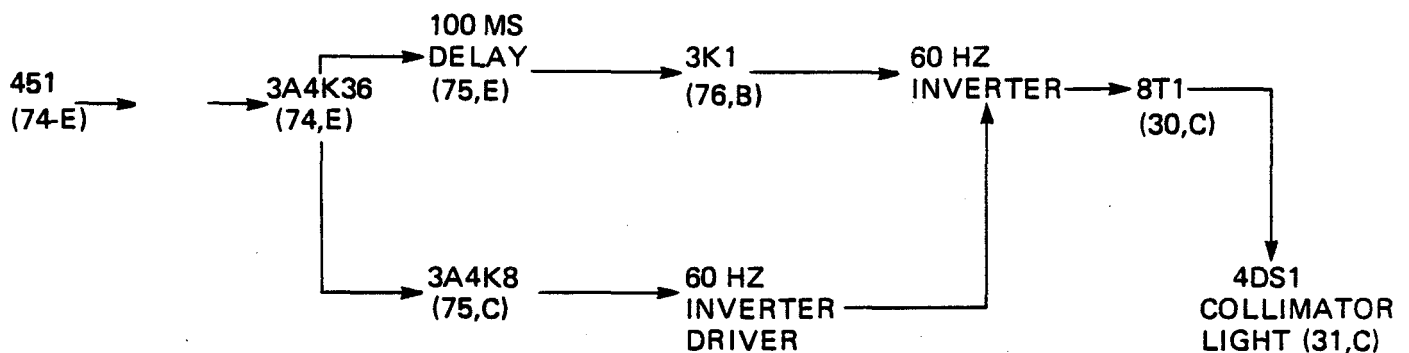


ILLUSTRATION 6-16

3. Relay 8K1 (32,F) has four contacts functioning in the circuit.
 - a. 8K1-4,5 (29-C) completes the circuit for the collimator transformer primary (8T1).
 - b. 8K1-4,6 (25,D) allows exposure by closing the circuit for relay 1K1. Relay 1K1 applies battery power to the 500 Hz inverter.
 - d. 8K1-7,9 (25,D) allows rotation of the tube rotor when collimator light switch is on by closing the stator circuit and opening the field lite circuit.
 - e. 8K1-5,6 (74,E) energizes 3A4K36 in the sequence shown in Illustration 6-16.
4. 4S1 is a dashpot type switch. When the switch is pushed, a piston forces air out of the cylinder through a one-way valve. The piston is slowly returned by a spring and by air re-entering the cylinder through an adjustable orifice. The time required to return determines the duration of 4DS1. 4S1 on G2 style collimators is an electronic type switch. When the switch is pushed, an electronic timer controls internal contacts which control light duration.

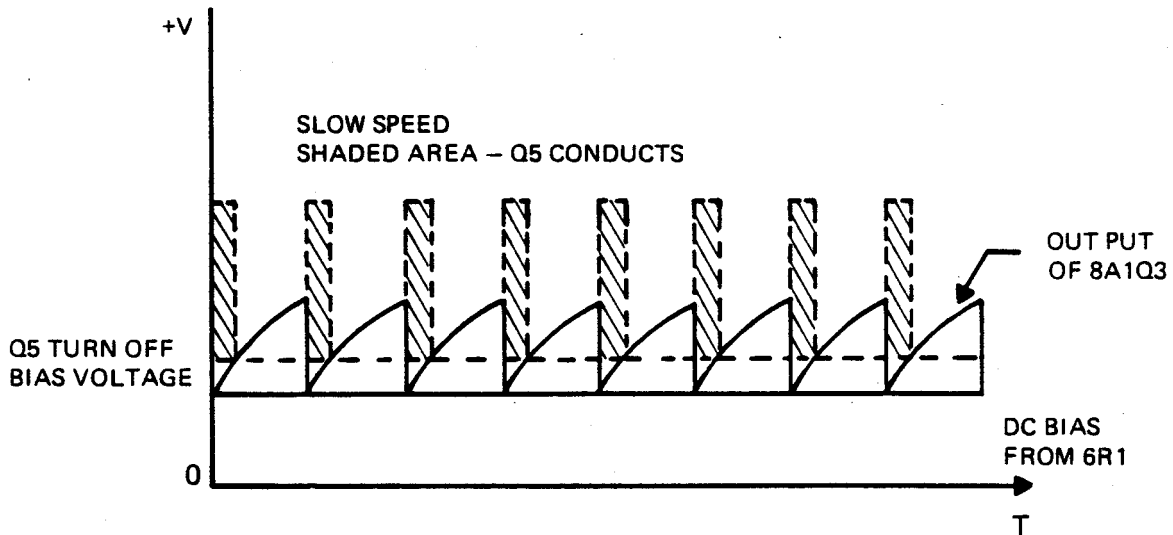
SEC. 10 MOTOR CONTROL

The operator controls the motor speed by rotating a potentiometer (6R1 96,D) on the brake handle, Illustration 1-2, Chapter 1. The potentiometer (6R1) voltage is combined with a sawtooth voltage to control the conduction of 8A1Q9 and Q10(101,F) which regulate motor current and hence motor speed.

Power transistors 8A1Q9 and 8A1Q10 are controlled by a pulse width modulated signal applied to the base of 8A1Q9. The period of the transistors remains constant but the on and off times are adjusted to give a desired average current. As the on pulses become wider and the off pulses shorter more current flows through the motor resulting in a higher speed. See W59.

When the brake handle is depressed 6LS1 (95,F) closes to apply power to the motor drive system and start 8A1Q2 (96,F) oscillating (W-51). The sawtooth output of 8A1Q3 (w-52) is combined with the DC voltage from 6R1 (Speed Control) and 8A1R15 (max. speed adjust) to provide pulse width modulation bias for 8A1Q5.

Pulse width modulation of 8A1Q5 is achieved in the following manner.



18790-D10

ILLUSTRATION 6-17

The frequency and amplitude of the output of 8A1Q3 remains constant but the DC bias from 6R1 is changed by the operator. At a slow speed 6R1 applies high DC bias causing 8A1Q5 to conduct for a short time (shaded area) and remain off for a long time; Illustration 6-17.

When the operator applies less DC bias, 8A1Q5 conducts for a longer period of time (shaded area, Illustration 6-18). In this manner the operation controls the conduction time of 8A1Q5 resulting in a pulse modulated output. Examples of the pulse modulated output of 8A1Q5 are shown in W-53 and W-54.

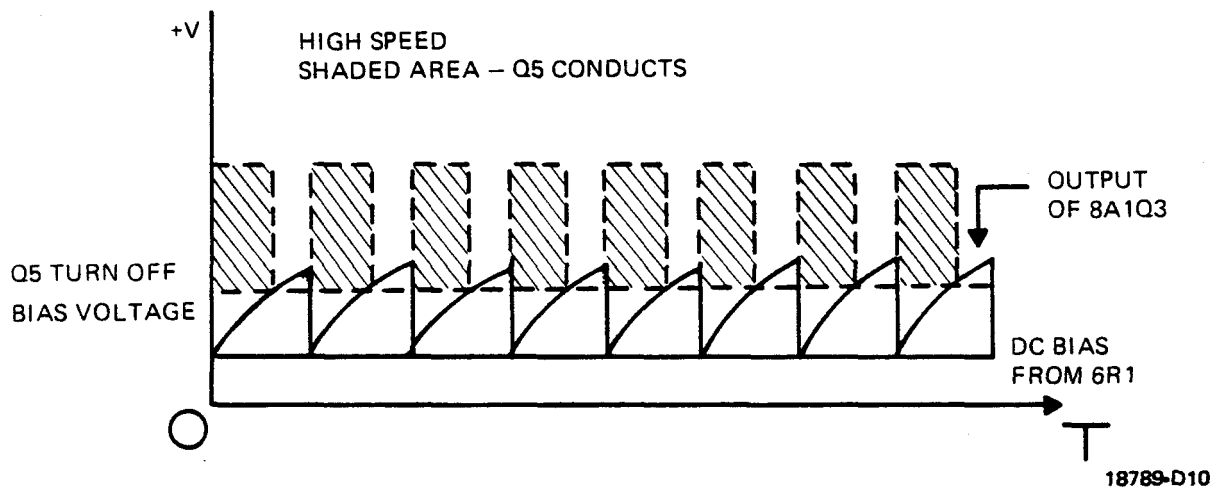


ILLUSTRATION 6-18

8A1Q6, 7 and 8 amplify the power of the signal from 8A1Q5 before it is applied to the base of 8A1Q9. Therefore, the conduction of 8A1Q10 determines the current through the motor and the speed of the motor.

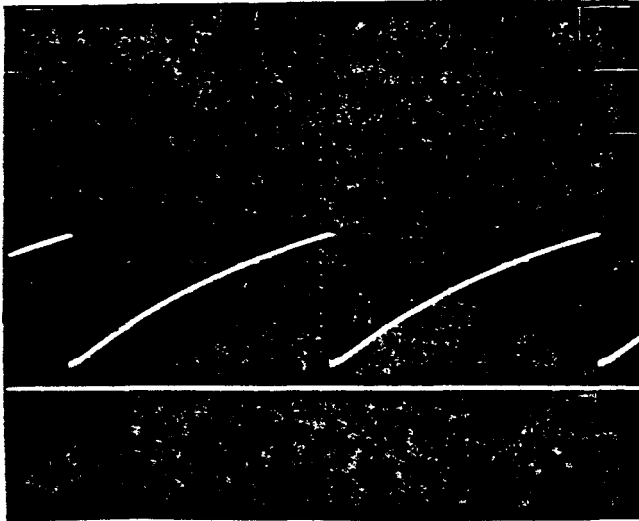
Normal operation at full speed requires a peak motor currents of about 3 amps. If a fault in the drive system occurs 8A2, R2, R3, R4 prevent excessive motor current and limit the amount of torque developed.

When the operator selects reverse, 6S2 switches in an additional 10Ω resistor, 8A2R1 which further limits the torque developed in reverse.

SEC. 11 OSCILLOSCOPE WAVEFORMS

The oscillograms that follow were made with a Tektronix 422 oscilloscope and a C-30 camera.

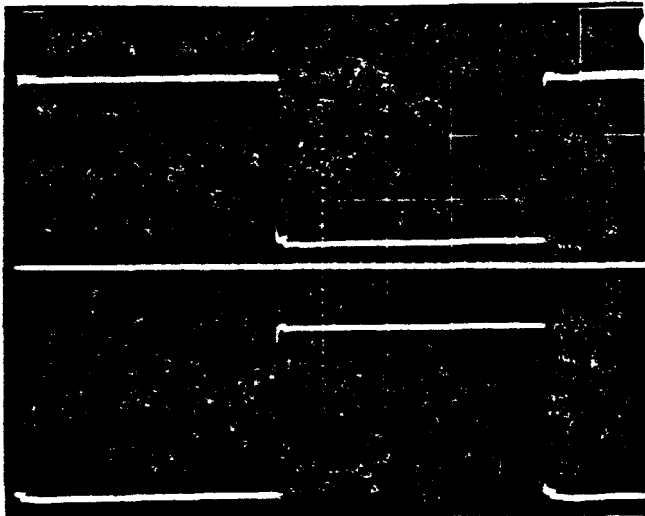
For the waveforms, the letter w followed by a number identifies the point in the circuit where the voltage appears. Using that number and the coordinates given with it, the waveforms may be located on the schematics in Chapter 7. Traces were taken in standby conditions unless specified otherwise.



UJT oscillator providing trigger signals to 60-Hz inverter driver.

PROBE: Emitter of 3A5Q23
 GND: 3TB1-5
 H: 2-ms/div
 V: .5-v/div x 10 (probe)
 TRIG: INT, DC, +, AUTO

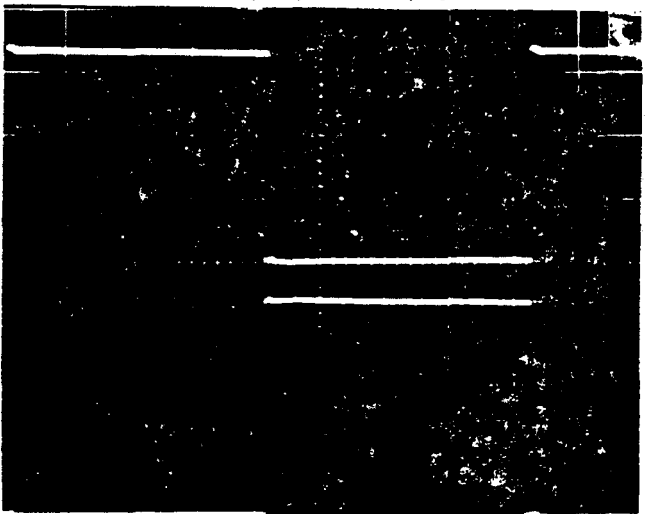
W1 (17,F)



Voltage across 60-Hz inverter driver pilot SCR's

CH1-PROBE: Collector of 3A5Q19
 CH2-PROBE: Collector of 3A5Q20
 GND: 3TB1-5
 H: 2-ms/div
 V: .5-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Trig.

W2 (18,E & 18,D)

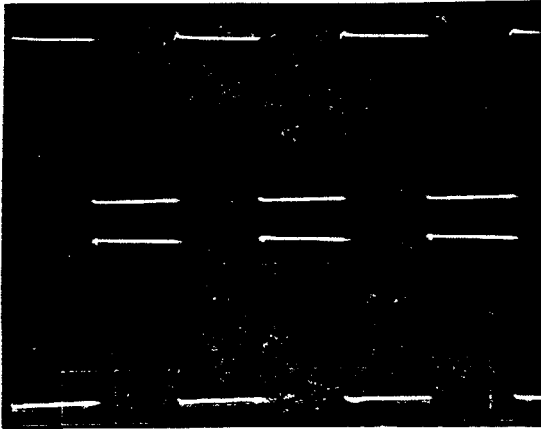


Voltage across 60-Hz inverter driver transistors (use to check frequency also)

CH1-PROBE: Cathode of 3A5CR46
 CH2-PROBE: Cathode of 3A5CR50
 GND: 3TB1-5
 H: 2-ms/div
 V: .5-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point

Frequency is correct if period of one one cycle is 16-ms to 16.5-ms.

W3 (18,F & 18,C)



W4-A (Upper) W4-B (Lower) (19,E)

60-Hz inverter driver output

CH1-PROBE: Cathode of 3A5CR46

CH2-PROBE: Cathode of 3A5CR50

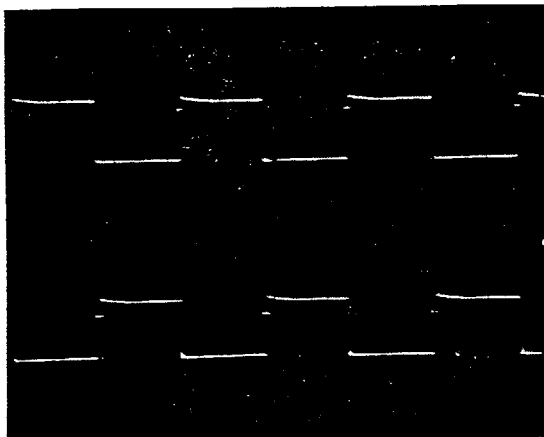
GND: Cathode of 3A5CR30

H: 5-ms/div

V: 1-v/div x 10 (probe)

TRIG: INT, DC, +, Set Point

Voltage across J5-7 and J5-21 is the sum of two shown above, varying 40-v above and below 0-v.



W5-A (Upper) W5-B (Lower) (20,C-G)

60-Hz inverter SCR gate signals

CH1-PROBE: 3TS1-3

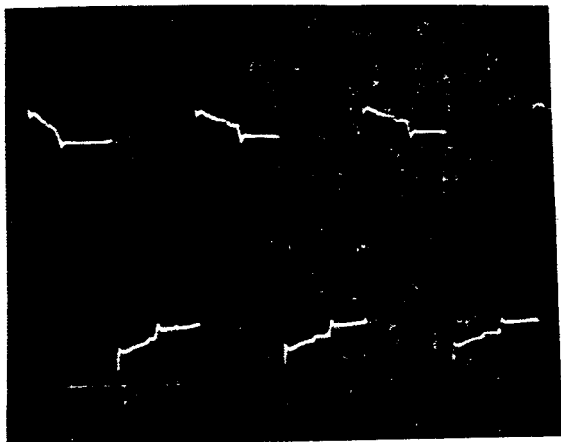
CH2-PROBE: 3TS1-1

GND: 3TS1-2

H: 5-ms/div

V: 1-v/div x 10 (probe)

TRIG: INT, DC, +, Set Point



W6 (22,E)

60-Hz inverter output, press ROTOR button to obtain trace

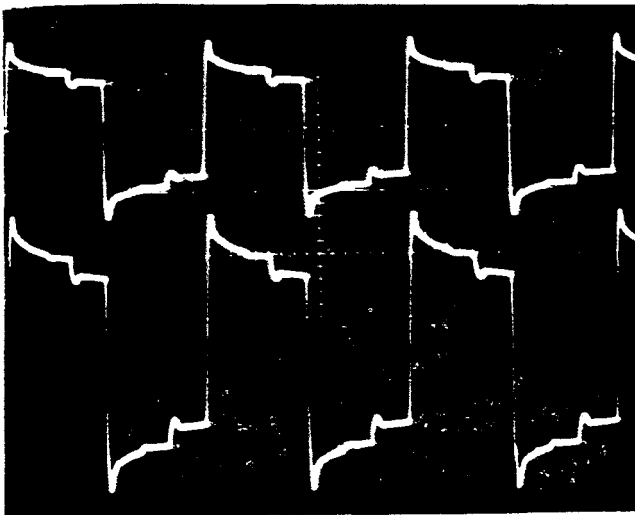
CH1-PROBE: Cathode (Black lead) of 3CR4-A

GND: Cathode (Brown lead) of 3CR4-B

H: 5-ms/div.

V: 10-v/div x 10 (probe)

TRIG: INT, DC, +, AUTO



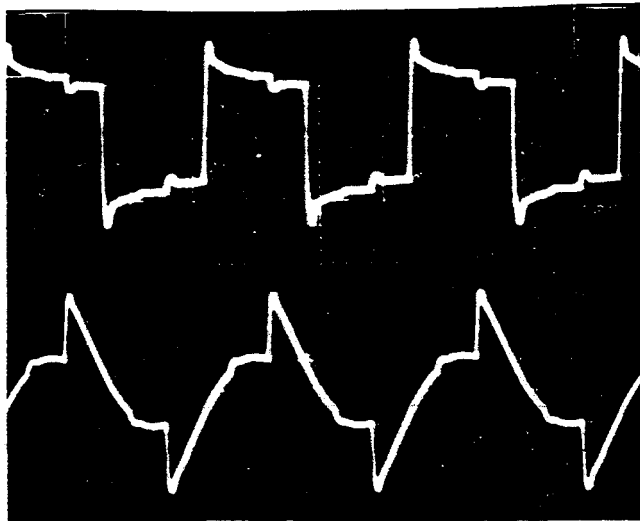
W7-A (Upper) W7-B (Lower) 24,D)

W7-A: Power to X-Ray Tube Stator. Press ROTOR button to operate.

PROBE: 3TB1-30 } CH1
 GND: 3TB1-14 }
 H: 5-ms/div
 V: 10-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point.

W7-B: Power to x-ray tube filament transformer. Press ROTOR button to operate.

PROBE: 3TB1-8 } CH1
 GND: 3TB1-14 }
 Set up scope as for W7-A



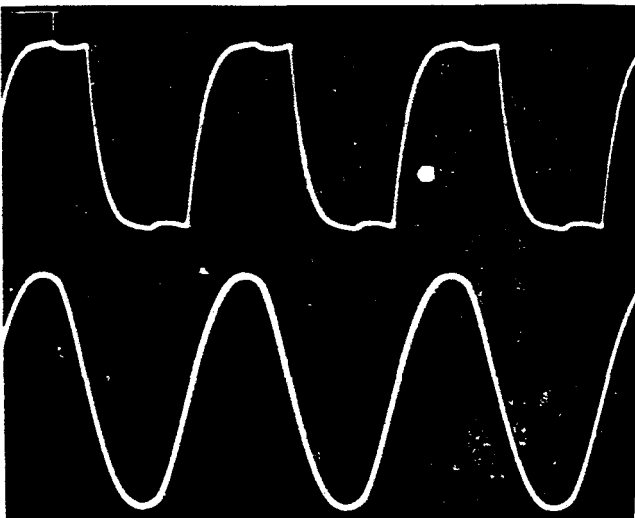
W8-A (Upper) W8-B (Lower) (24,E)

W8-A: Power to main winding of x-ray tube stator. Press ROTOR button to operate.

PROBE: 3TB1-30 } CH1
 GND: 3TB1-28 }
 H: 5-ms/div
 V: 10-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point

W8-B: Power to phase shifted winding of x-ray tube stator. Press ROTOR button to operate

PROBE: 3TB1-30 } CH1
 GND: 3TB1-29 }
 Set up scope as for W8-A.



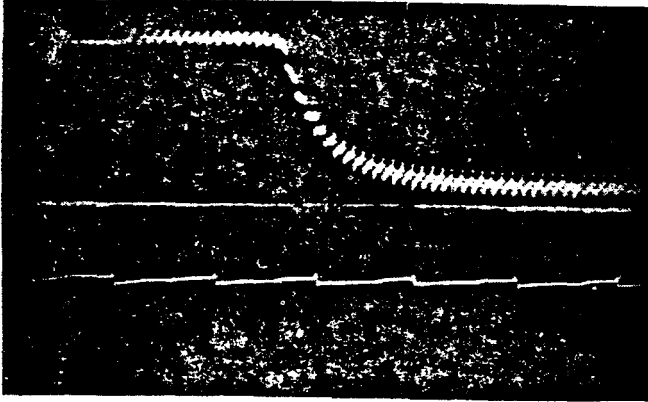
W9-A (Upper) W9-B (Lower) (25,F)

W9-A: Voltage proportional to current in x-ray tube stator main winding. Press ROTOR button to operate

PROBE: 3TB1-28 } CH1
 GND: 3TB1-14 }
 H: 5-ms/div
 V: 0.2-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point

W9-B: Voltage across ROTOR interlock sensor. Press ROTOR button to operate.

PROBE: J2-29 } CH1
 GND: 3TB1-14 }
 Set up scope as for W9-A.

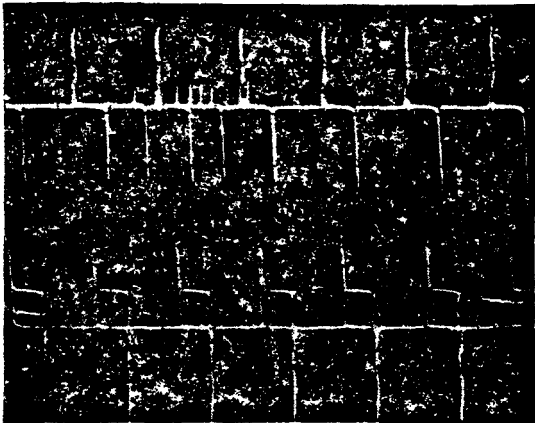


W10-A (Upper) W10-B Lower (24,F)

W10-A: Signal indicating that 3A2V5 has been actuated. This closes an interlock in the exposure start circuit. Press ROTOR button to operate.

PROBE: Left side of 3A4R63 } CH1
 GND: 3TB1-5
 H: 50-ms/div
 V: 0.2-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point.

W10-B: Same as W10-A except H is 5-ms/div to show waveform during run conditions.



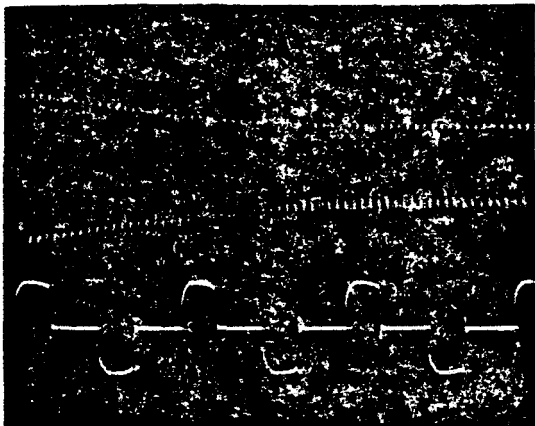
W11-A & B (Upper)
 W11-C & D (Lower) (26,E-C)

W11-A: Trigger voltage for gates of filament power control SCR. Press ROTOR button to operate. W11-B is same except 180° out of phase.

PROBE: Cathode of 3A2CR23 } CH1
 GND: Anode of 3A2CR23
 H: 5-ms/div
 V: .05-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point.

W11-C: Trigger voltage at gates of filament power control SCR, Press ROTOR button to operate. W11-D is same except 180° out of phase.

PROBE: Upper end of 3A2R19 } CH1
 GND: Lower end of 3A2R19
 Set scope up as for W10-A.

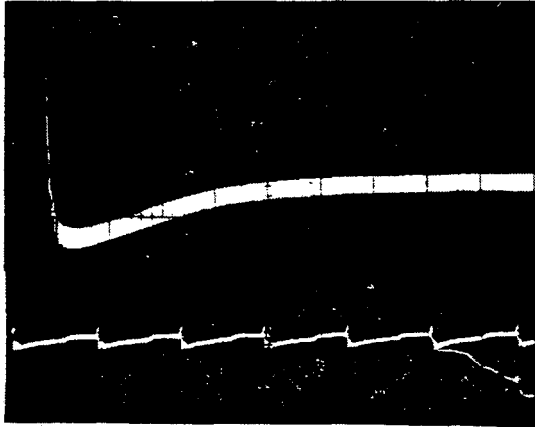


W12-A (Upper) W12-B (Lower) (27,A)

W12-A: Signal indicating that 3A2V13 has been actuated. This closes an interlock in the exposure start circuit. Press ROTOR button to operate.

PROBE: Top of 3A2R14 } CH1
 GND: Bottom of 3A2R14
 H: 0.1-sec/div
 V: 0.5-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point

W12-B: Same as W12-A except H is 5-ms/div to show waveform during run conditions.

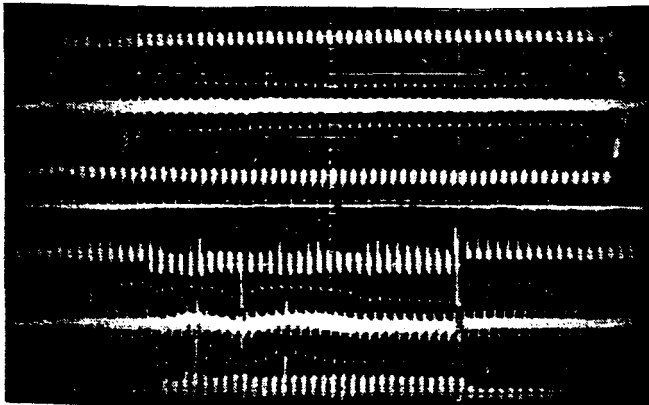


W13-A (Upper) W13-B (Lower) (27,B)

W13-A: Signal indicating current in 7T2 filament transformer primary. This actuates 3A2V13. Press ROTOR button to operate.

PROBE: Left side of 3A4R50 } CH1
 GND: 3TB1-5
 H: 0.2-sec/div
 V: 0.2-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point

W13-B: Same as W13-A except H is 5-ms/div to show waveform during run conditions.

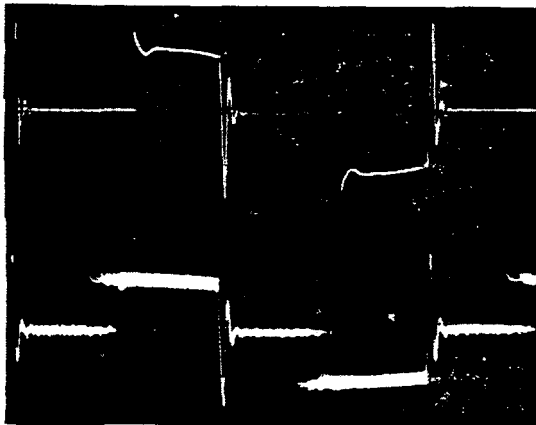


W14-A (Upper) W14-B (Lower) 28,B)

W14-A: X-Ray tube filament transformer 7T2 primary voltage. Press ROTOR button to operate.

PROBE: 7TB1-XS } CH1
 GND: 7TB1-XC
 H: 0.2-sec/div
 V: 10-v/div x 10 (probe)
 TRIG: INT, DC, +, AUTO

W14-B: Same as W14-A except center portion of trace shows change in voltage during an 80-kvp, 100-mas exposure.



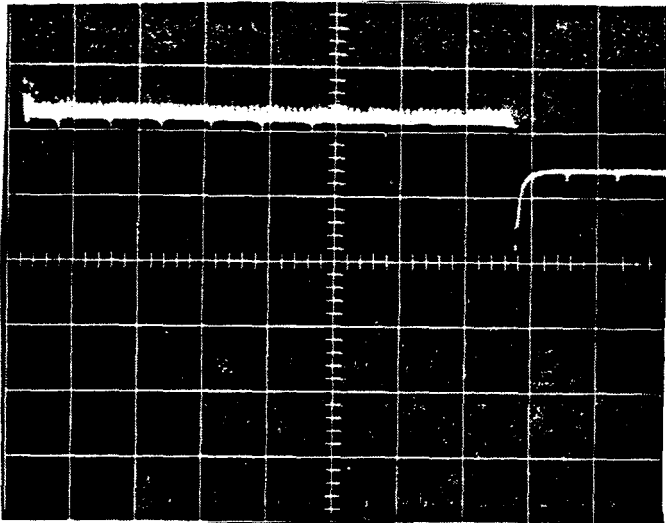
W14-C (Upper) W14-D (Lower) (28,B)

W14-C: Same as W14-A except H is 2-ms/div to show expanded waveform under warm-up conditions prior to the exposure (during rotor start).

W14-D: Same as W14-C except trace was made during an exposure. Note that conduction time per pulse has increased

7-1576

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W15 (34,C)

W15: X-Ray exposure turn-on signal at gate of 2CR2. Depress Rotor and X-Ray buttons.

X-Ray Control

70KVP

8MAS

Probe: 3A6-1

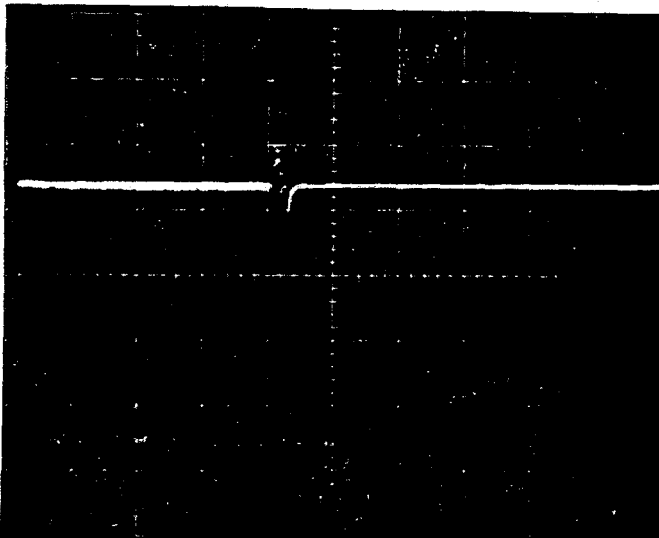
Gnd: 3A6=2

H: 10-mx/div.

V: .02 V/div. x 10 (probe)

Trig: INT, DC, +, Set Point

2CR2 is turned on by first spike of volt voltage 0.5V or more.



W16 (35,D)

W16: X-Ray exposure turn-off signal at gate of 2CR1. Depress ROTOR and X-RAY buttons to operate.

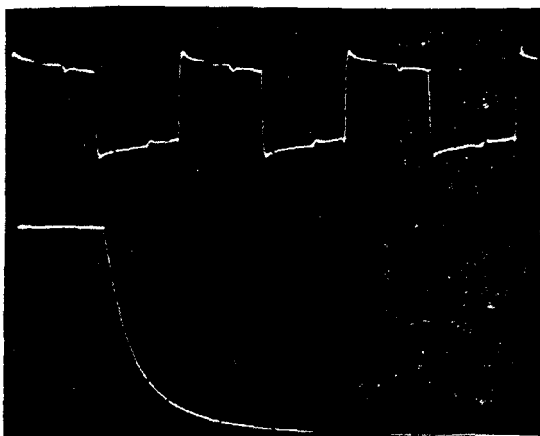
PROBE: 3A6-5

GND: 3A6-6 CH1

H: 5-ms/div

V: 0.1-v/div x 10 (probe)

Only the end of the 40-ms exposure of W15 is shown here. A 0.5-v or larger spike of voltage will turn off the exposure.



W17-A (Upper) W17-B (Lower) (35.F)

W17-A: Power for shut-off capacitor charge circuit. Absence of this voltage locks out the exposure circuit. Depress ROTOR button to operate.

PROBE: 3TB1-15

GND: 3TB1-5 CH1

H: 5-ms/div

V: 10-v/div x 10 (probe)

TRIG: INT, DC, +, Set Point

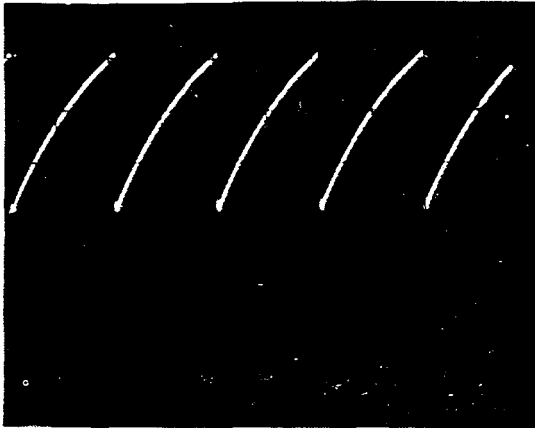
W17-B: Capacitor 1C2 charges to -80-v prior to an exposure. Depress ROTOR button to obtain this.

PROBE: 3TB1-1

GND: 2TB1-6 CH1

H: 0.5-sec/div

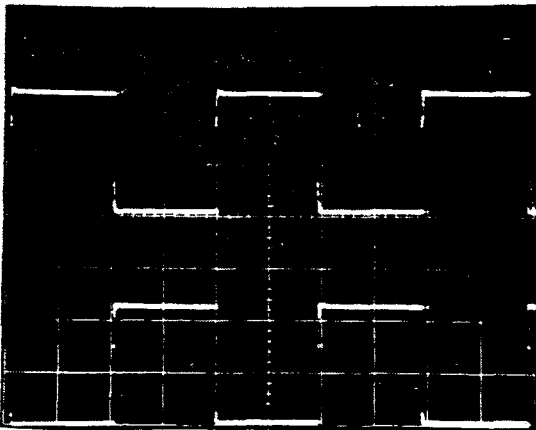
V: 2-v/div x 10 (probe)



W18 (40,F)

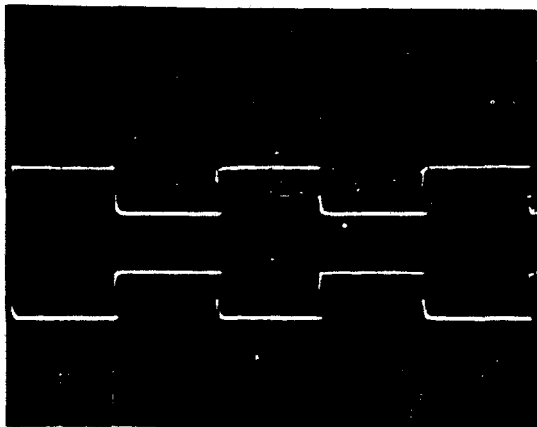
W18: UJT oscillator providing trigger signals to the 500-Hz inverter driver. Press ROTOR button to operate.
 PROBE: Emitter of 3A3Q23
 GND: 3TB1-5
 H: .5-ms/div
 V: .5-v/div x 10 (probe)
 INT, DC, +, Set Point

Period for two pulses must be 1.95-ms to 2.05-ms



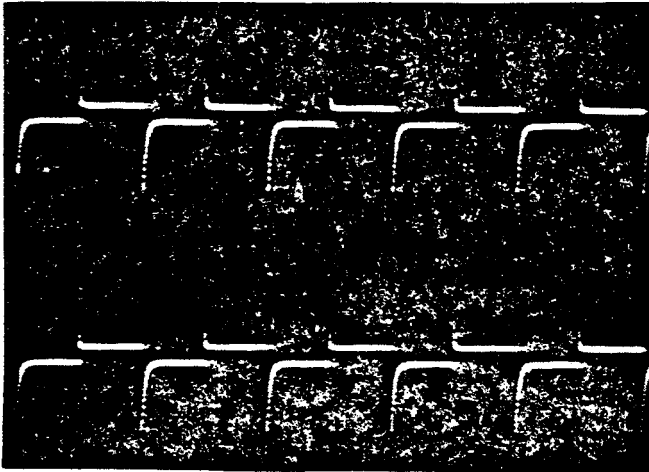
W19-A (Upper) W19-B (Lower) (41,C-E)

W19: Signal provided by pilot SCR's to the inverter driver SCR's. Depress ROTOR button to operate.
 CH1-PROBE: Collector of 3A3Q45
 CH2-PROBE: Collector of 3A3Q49
 GND: 3TB1-5
 -OV H: .5-ms/div
 V: 2-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point
 Waveforms A and B must be 180° out of phase as shown and with the time per cycle shown.
 P-P voltage must be 42 + 4V.
 Period for one cycle must be 1.95-ms -OV to 2.05-ms.



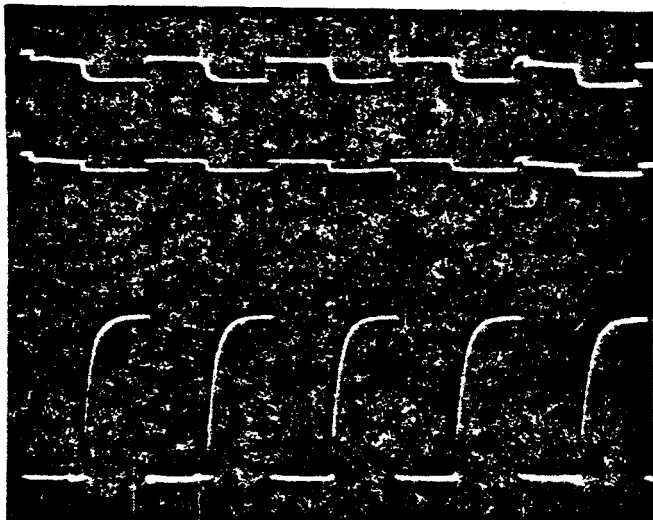
W20-A (Upper) W20-B (Lower) (42,B-F)

W20: Voltage across inverter driver. Depress ROTOR button to operate.
 CH1-PROBE: Collector of 3A3Q19
 CH2-PROBE: Collector of 3A3Q20
 GND: 3TB1-5
 H: .5-ms/div
 V: 2-v/div x 10 (probe)
 TRIG: INT, DC, +, AUTO
 Peak voltage must be 20 + 3V.
 Period for one cycle must be 1.95-ms to 2.05-ms



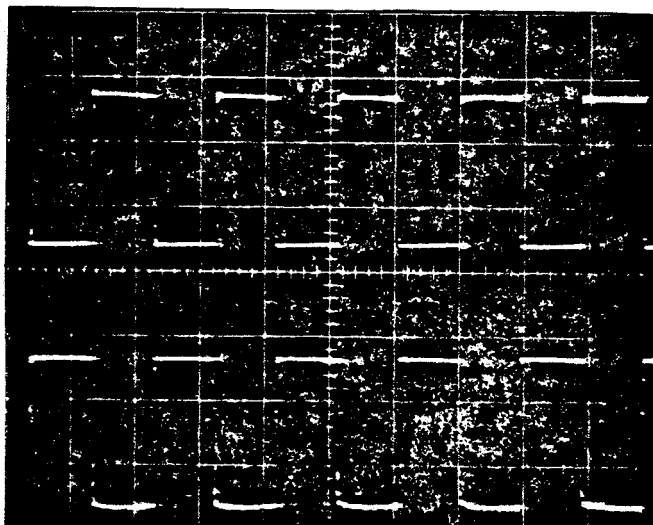
W21-A (Upper) W21-B (Lower) (41,D)

W-21: Voltage proportional to base current of 3A3Q19 and 20. Press ROTOR button to operate.
 CH1-PROBE: Top of 3A3R16
 CH2-PROBE: Top of 3A3R17
 GND: Bottom of 3A3R16 or 17
 H: 1-ms/div
 V: 1.0-v/div x 10 (probe)
 TRIG: CH1, INT, DC, +, Set Point



W22-A (Top) W22-B (Center)
 W22-C (Bottom) (43,E)

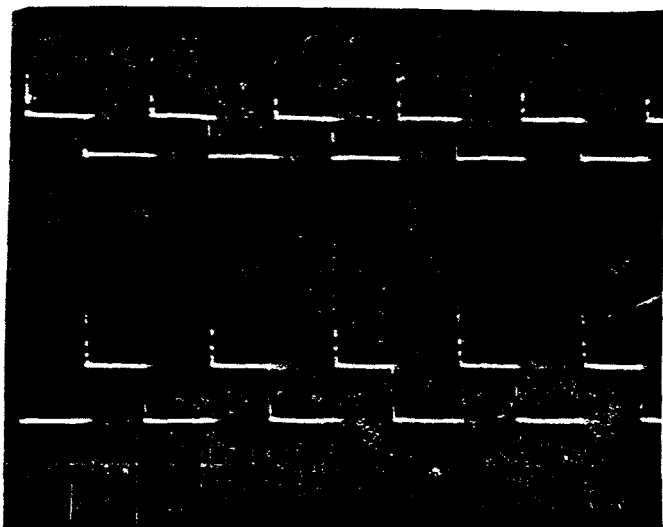
W22-A: Voltage for base of 3A3Q55. Press ROTOR Button to operate.
 PROBE: Top of 3A3R57
 GND: 3TB1-11
 H: 1-ms/div
 V: 0.5-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point
 W22-B: Voltage for base of 3A3Q55.
 PROBE: Top of 3A3R60
 GND: 3TB1-11
 H: 1-ms/div
 V: 0.2-v/div x 10 (probe)
 W22-C: Output signal from 3A3Q55.
 PROBE: Bottom of 3A3R56
 GND: 3TB1-11
 H: 1-ms/div
 V: 1.0-v/div x 10 (probe)



W23-A (Upper) W23-B (Lower) (45,C-E)

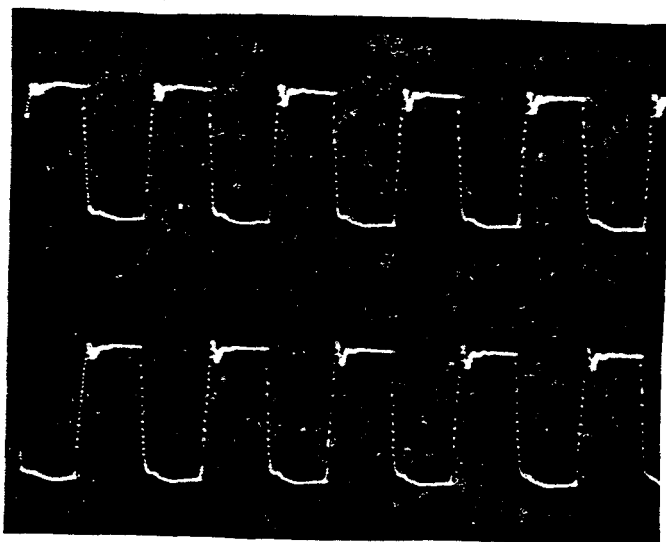
W23-A & B: Output of 500-Hz inverter driver. Press ROTOR button to operate.
 CH1-PROBE: Cathode of 3A3CR50
 CH2-PROBE: Cathode of 3A3CR46
 GND: Cathode of 3A3CR30
 H: 1-ms/div
 V: 2.0-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point

NOTE: 3T1 has 1 to 1 ratio. So voltages of 3T1 Sec 1 and 3T1 Sec 2 are similar to W23-A and B except for slight drop in transformation.



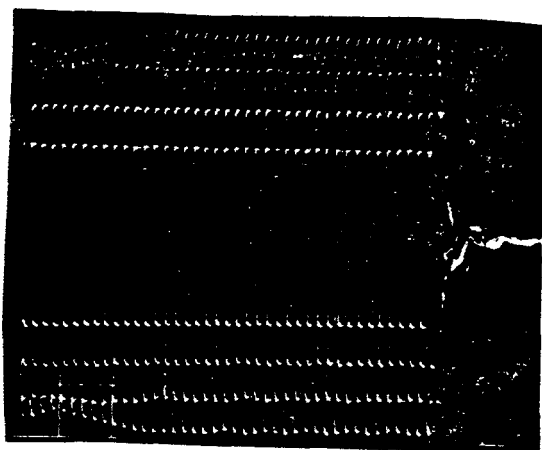
W24-A (Upper) W24-B (Lower) (47,B-F)

W24: Gate trigger voltages for 500-Hz inverter SCR's, 2CR3 and 2CR6. Press ROTOR and X-RAY buttons to operate.
 CH1-PROBE: Top of 3A3R8
 CH2-PROBE: Bottom of 3A3R28
 GND: 2TB1-4
 H: 1-ms/div
 V: 0.2-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point



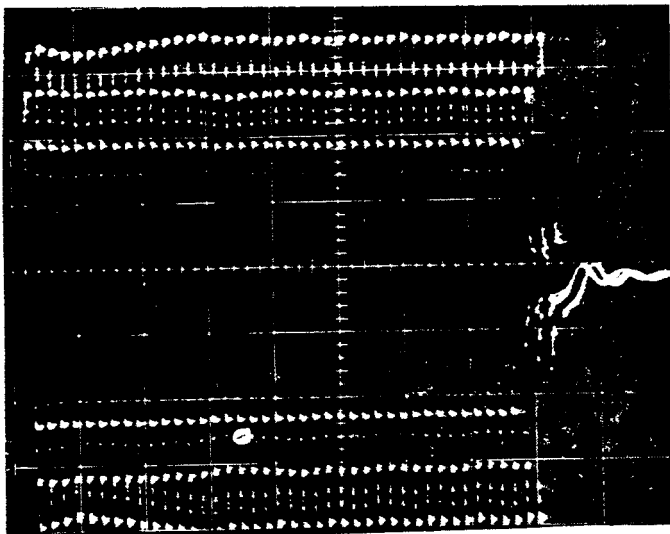
W25-A (Upper) W25-B (Lower) (48,C-F)

W25: Output of 500-Hz inverter. Select 80 kvp, 10-mas. Depress ROTOR and X-RAY button to operate.
 CH1-PROBE: 2TB1-7
 CH2-PROBE: 2TB1-9
 GND: 2TB1-2
 H: 1-ms/div
 V: 5-v/div x 10 (probe)
 TRIG: INT, DC, +, AUTO



W26-A-D (50,A-G)

W26: High Voltage Transformer primary voltages. Select technics listed. Depress ROTOR and X-RAY buttons to operate.
 TECHNIC FOR A: 110-kvp, 8-mas
 B: 90-kvp, 8-mas
 C: 70-kvp, 8-mas
 D: 50-kvp, 8-mas
 PROBE: 2TB1-P1L
 GND: 2TB1-P2L
 H: 10-ms/div
 V: 5-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point

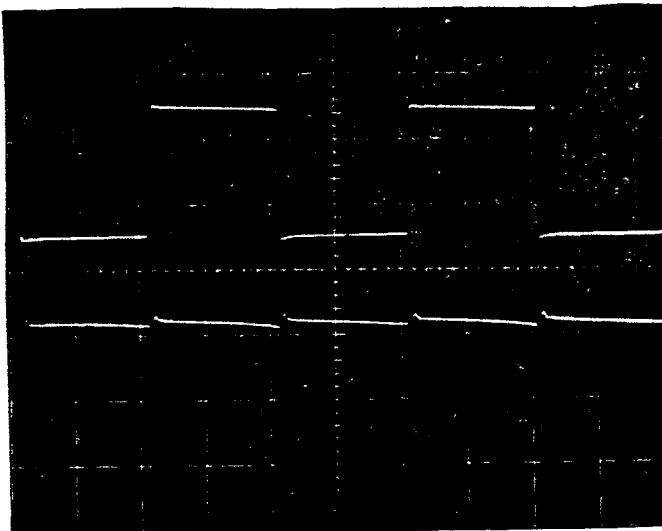


W26-E to G (50,A-G)

W26: High Voltage Transformer primary voltages. Select technics listed. Depress ROTOR and X-RAY buttons to operate

TECHNIC FOR E - 100-kvp, 8-mas
 F - 80-kvp, 8-mas
 G - 60-kvp, 8-mas

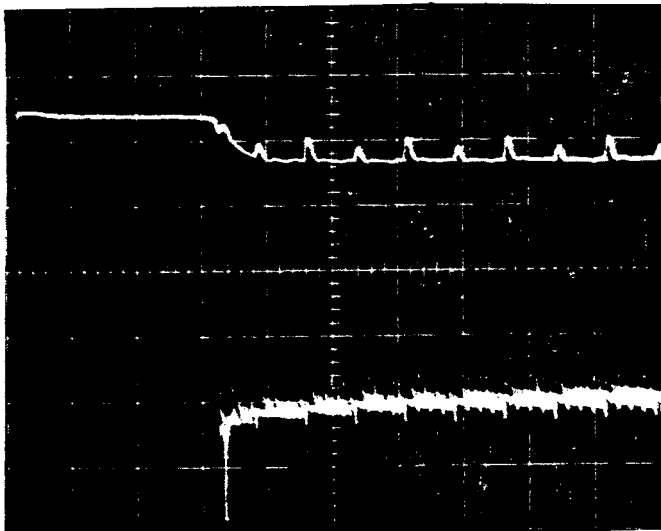
PROBE: 2TB1-P1L
 GND: 2TB1-P2L
 H: 10-ms/div
 V: 5-v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point



W27A (UPPER) W27A (LOWER) (59-B)

W27: Power Supply for x-ray ON light circuit. Press ROTOR button to operate.

CH1-PROBE: Anode of 3A2CR37
 CH2-PROBE: Cathode of 3A2CR38
 GND: Cathode of 3A2CR50
 H: 0.5-ms/div
 CH1-V: 2.0 v/div x 10 (probe)
 CH2-V: 1.0 v/div x 10 (probe)
 TRIG: INT, DC, +, Set Point.

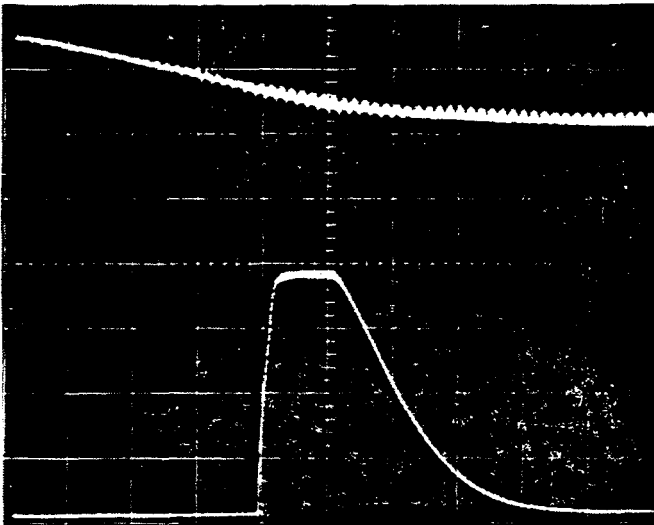


W28-A (Upper) W28-B (Lower) (55,B)

W28A: Voltage at base of 3A2Q46 before and during 80-kvp, 2.5-mas x-ray exposure. Press ROTOR and X-RAY buttons to operate

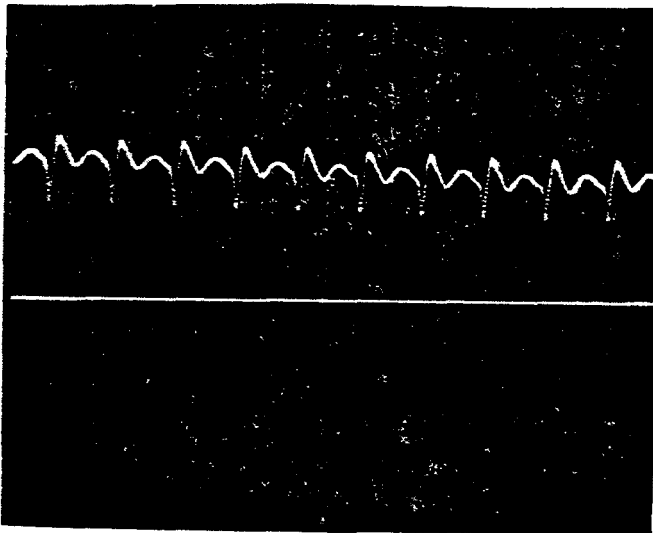
CH1-PROBE: Top of 3A2R48
 CH2-PROBE: Top of 3A2R44
 GND: Cathode of 3A2CR50
 H: 10-ms/div
 CH1-V: 0.1-v/div x 10 (probe)
 CH2-V: 1.0-v/div x 10 (probe)
 TRIG: CH1, INT, DC, +, Set Point

W28B: Voltage across 3A2Q46 before and during 80-kvp, 2.5-mas x-ray exposure.



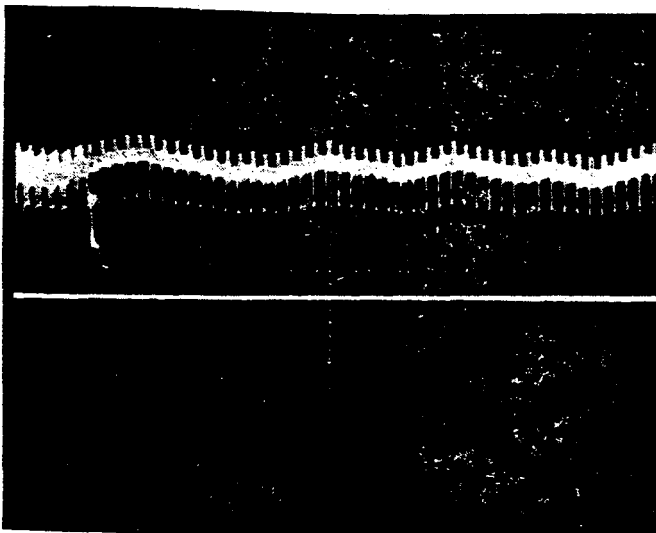
W29-A (Upper) W29-B (Lower) (57,B)

- W29-A: Voltage at base of 3A2Q39 (X-Ray ON light switch) during exposure. Press ROTOR and X-RAY buttons to operate.
- CHI-PROBE: Bottom of 3A2R40
- GND: Base of 3A2Q39
- H: .1 sec/div
- V: 0.02 v/div x 10(probe)
- TRIG:
- W29-B: Voltage across 5DS5 x-ray ON light.
- PROBE: 3TB1-25
- GND: 3TB1-9
- H: .1-sec/div
- V: .5-v/div x 10(probe)



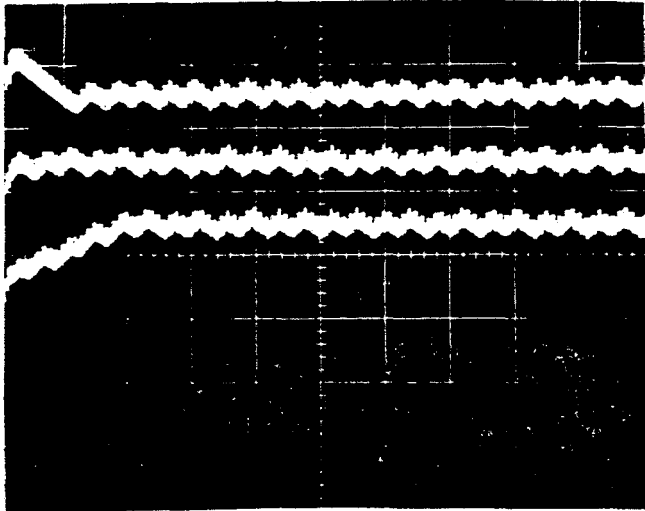
W30-A (54,C)

- W30-A: Voltage proportional to MA in the HV transformer secondary and x-ray tube. Press ROTOR and X-RAY buttons to operate.
- PROBE: Across 100-ohm resistor in the MA terminal sockets.
- GND: }
- H: 2-ms/div
- V: 0.2-v/div x 10(probe)
- TRIG: INT, DC, +, Set Point



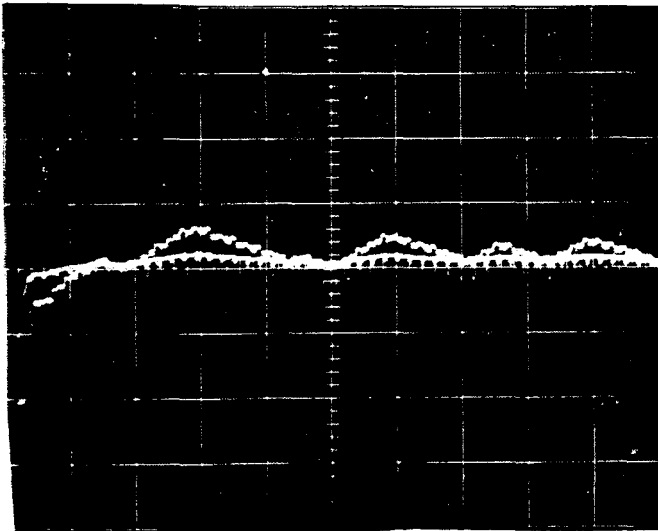
W30-B (54,C)

- W30-B: Same as W30-A except H is 10-ms/div



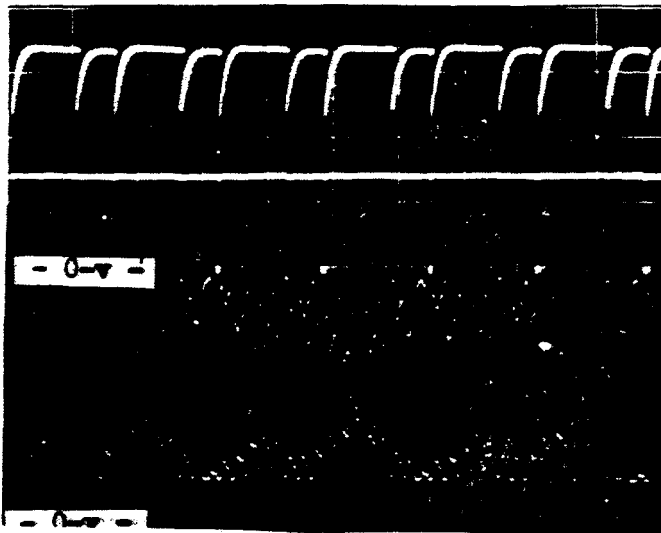
W31-A (54,E)

W31-A: Signal voltage proportional to MA for ma regulator actuation. Press ROTOR and X-RAY buttons to operate.
 PROBE: Top of 3A2C55
 GND: Bottom of 3A2C55
 H: 20-ms/div
 V: 0.2-v/div x 10(probe)
 UPPER TRACE: Filament voltage too high and regulator pulling down or filament voltage normal but regulator pulling down improperly.
 CENTER TRACE: Filament voltage correct and ma regulator adjusted correctly.
 BOTTOM TRACE: Filament voltage too low and ma regulator pulling up or filament voltage normal but regulator pulling up improperly.



W31-B (Upper) W31-C (Lower) (55,E)

W31-B: Signal proportional to ma for ma regulator. Press ROTOR and X-Ray buttons to operate.
 W31-C: Reference voltage for ma regulator
 CH1-PROBE: Base of 3A2Q63
 CH2-PROBE: Base of 3A2Q60
 GND: Common of 3A2R56 and 58
 H: 10-ms/div
 V: 0.1-v/div x 10(probe)
 TRIG: INT, DC, +, set point
 EXP: 50-kvp, 10-mas
 Traces superimpose sooner at best adjustment

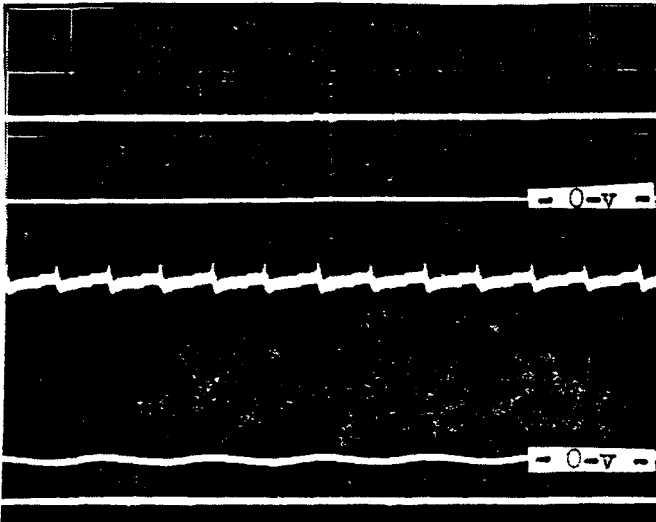


W32-A (Upper) W32-B (Lower) (58,E)

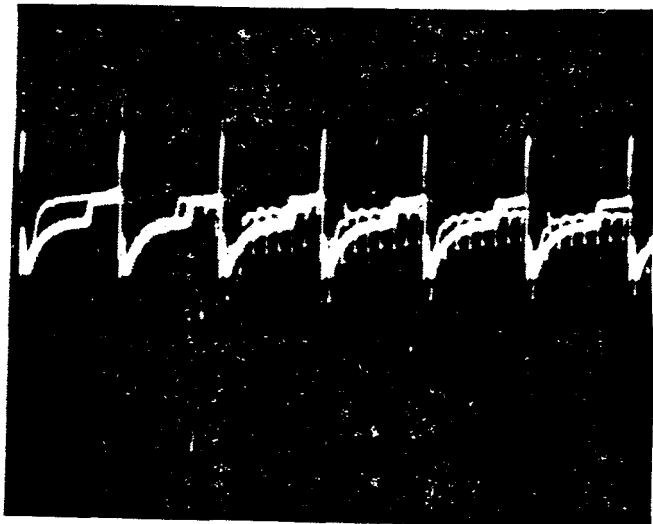
W32: Typical balance adjustment voltages of 3A2Q60 and 3A2Q63.
 CH1-PROBE: Collector of 3A2Q60
 CH2-PROBE: Collector of 3A2Q63
 GND: Between 3A2R56 and 58
 H: 5-ms/div
 CH1-V: 0.5-v/div x 10(probe)
 CH2-V: 1.0-v/div x 10(probe)
 TRIG: INT, DC, +, Set Point
 UPPER: Depress ROTOR button only
 LOWER: Depress ROTOR and X-RAY buttons.
 Note that the V settings of CH1 and CH2 were different to keep traces from superimposing on the photo.

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W33-A (Upper) W33-B (Lower) (85,F)



W35 (79,F)

W33A: Signal that 500-Hz inverter is functioning. Press ROTOR (and X-RAY optional) buttons to operate.

PROBE: Base of 3A1Q56

GND: Emitter of 3A1Q56

H: 10-ms/div

V: 0.1-v/div x 10(probe)

TRIG: INT, DC, +, AUTO

W33B: Signal that shut off capacitors are charged. Press ROTOR and X-RAY buttons. Square top pulses show voltage during ROTOR run up. Bottom line is voltage after exposure.

PROBE: Base of 3A1Q60

GND: Emitter of 3A1Q60

H: 10-ms/div

V: 0.1-v/div x 10(probe)

W35: Signal for exposure start.

Depress ROTOR and X-RAY buttons to operate.

PROBE: 3A64

GND: 3TB1-5

H: 5-ms/div

V: .05 v/div x 10 (probe)

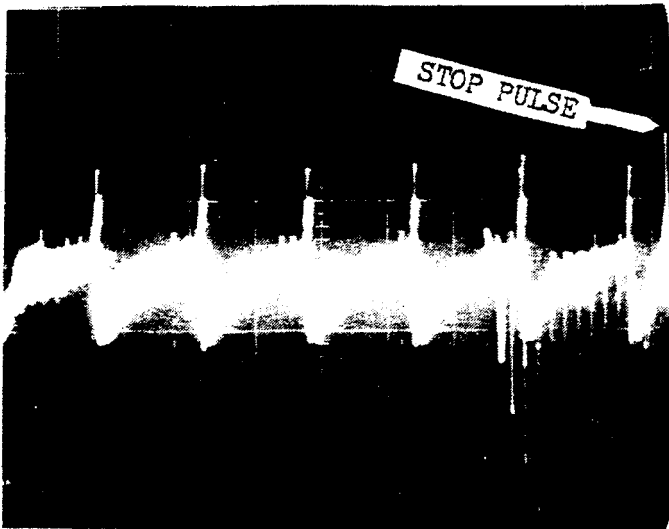
TRIG: INT, DC, +, Set Point

Only the high negative spike starts the exposure. Remainder is pickup from the inverters.

CAUTION: DO NOT REVERSE SCOPE CONNECTIONS. EXPOSURE MAY FAIL TO TERMINATE.

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W36-A (82,F)

W35: Exposure stop signal to turn-off SCR (2CR1) gate.

PROBE: 3A6-7

GND: 3TB1-11

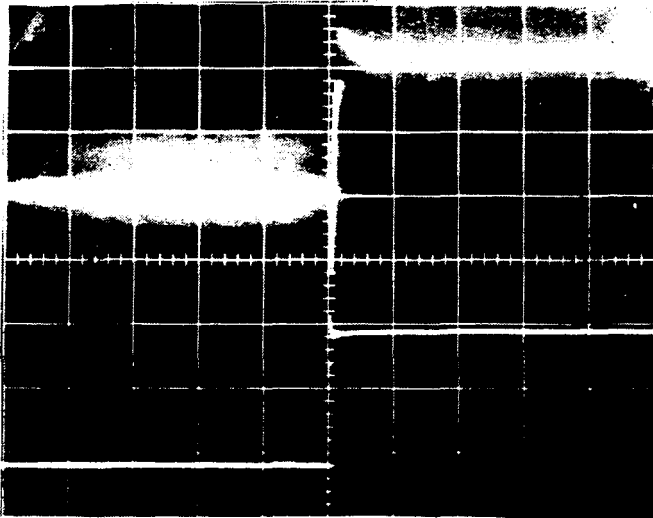
H: 5-ms/div

V: 0.5 v/div x 10

TRIG: INT, DC, +, AUTO

Stop pulse signal is highest peak at extreme right. Remainder of waveforms are 60-Hz and 500-Hz inverter pick up voltages.

CAUTION: DO NOT REVERSE SCOPE CONNECTIONS. EXPOSURE MAY NOT TERMINATE.



W37-A (34,D-30,F)

W37: Interval Timer adjustment

W37-A: Exposure interval for 50-kvp 10-MAS selection

W37-B: Exposure interval for 50-kvp 100-mas selection.

PROBE: 2TB1-1

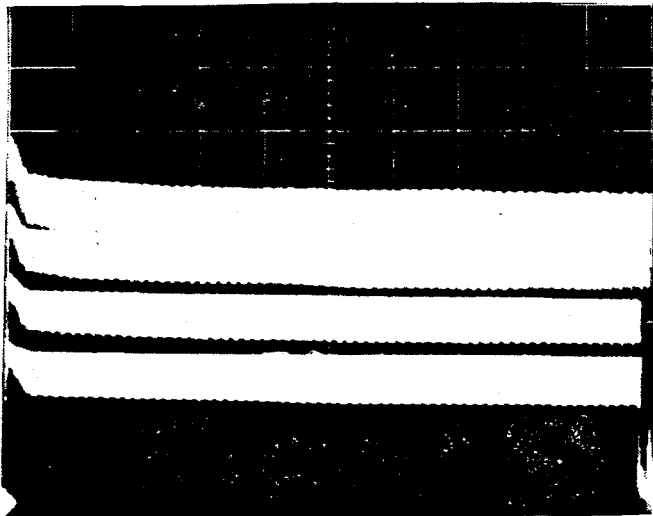
GND: 2TB1-3

H: (for upper trace) 20-ms/div

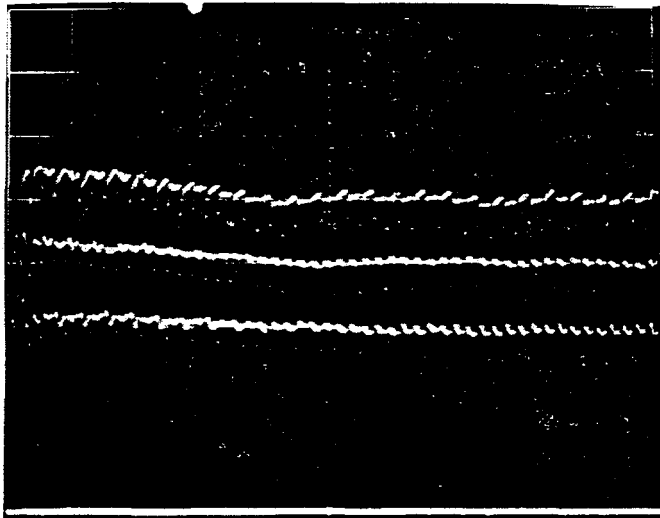
H: (for lower trace) 0.2 sec/div

V: 5-v/div x 10(probe)

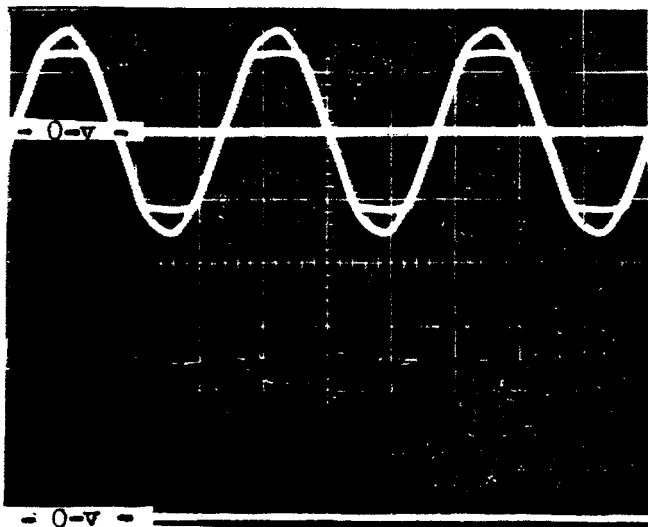
Note that with increased intensity (upper trace) it is possible to see the turn off spike. Adjustment could be for slightly shorter interval than shown.



W39-A (Upper) W39-B,C,D



W39-E (Upper) W39-B,C,D



W40-A

W39: Kvp across x-ray tube as shown by HV bleeder and scope.

CH1-PROBE: Anode }
 CH2-PROBE: Cathode } Terminals on HV bleeder
 GND: Ground }

H: 0.1 sec/div and 5-ms/div
 V: 2-v/div x 10(probe) x 1000 (bleeder)

MODE: Algebraic addition

TRIG: INT, DC, +, Set Point

Press ROTOR and X-RAY buttons to operate.

TECHNICS SELECTED:

W39-A	110 kvp,	100 mas
W39-B	90 kvp,	100 mas
W39-C	70 kvp,	100 mas
W39-D	50 kvp,	100 mas
W39-E	100 kvp,	5 mas
W39-F	80 kvp,	5 mas
W39-G	60 kvp,	5 mas

W40-A: No load and load voltages at input of battery charger.

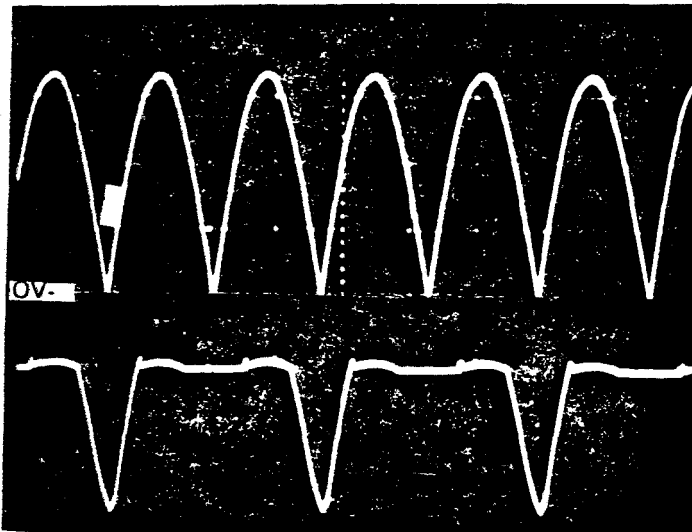
PROBE: 4A1-9 }
 GND: 4A1-10 } CH1

H: 5-ms/div

V: 10-v/div x 10(probe)

TRIG: INT, DC, +, AUTO

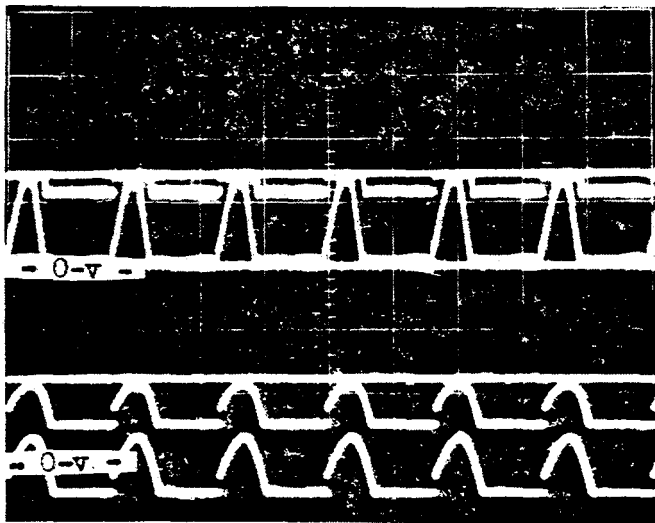
Sine wave is no-load-clipped sine wave is load voltage.



OV- W40-B (Upper) W40-C (lower) (4,F)

W40-B: Charge complete voltages at output of rectifier 4CR1
 CH1 PROBE: 4A1-8
 CH2 PROBE: 4A1-8 MODE: Added Invert CHI
 H: 5-ms/div
 V: 5-v/div x 10 (probe)
 TRIG: INT, DC, +, AUTO

W40-BC Charger "on" load voltage at output of Rectifier 4CR1
 Setup same as W40-A



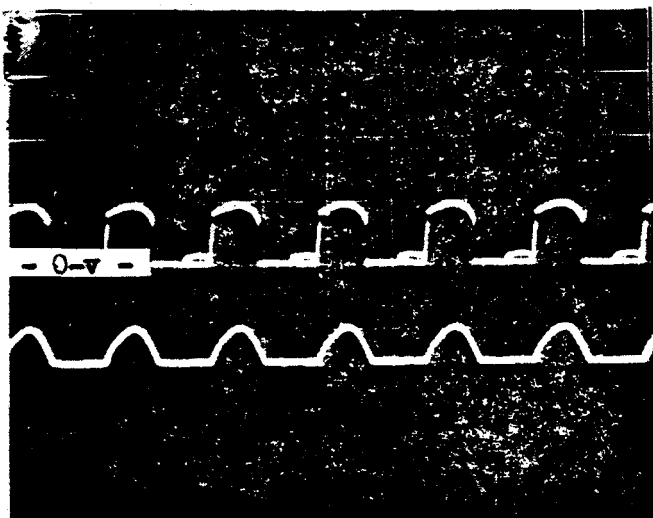
W41-A (Upper) W41-B (Lower) (7,C)

W41-A: Base voltages of 4A1Q10
 PROBE: Between 4A1R9 and 4A1R4
 GND: Base of 4A1Q10
 H: 5-ms/div
 V: .05-v/div x 10 (probe)
 TRIG: INT, DC, +, AUTO

High pulses appear as battery charges. Small square wave appears just before the solid top line indicates charge complete.

W41-B: Base voltages of 4A1Q7
 PROBE: Base of 4A1Q7
 GND: Cathode of 4A1CR22

H and V as for W41-A
 Lower trace of pulses appear (up to 12-v below 0 line) as battery charges. Higher pulse trace is just before battery charge complete. Top line is voltage as charge complete lamp comes on.



W42-A (Upper) W42-B (Lower) (5,B)

W42: Gate voltages of battery charge control SCR (4CR3)

PROBE: 4A1-4
 GND: 4A1-2
 H: 5-ms/div x 10
 V for A: 0.1-v/div x 10 (probe)
 V for B: 0.5-v/div x 10 (probe)

Zero is centerline of graticule for both traces.

W42-A: Shows turn-on voltage while Battery is charging.

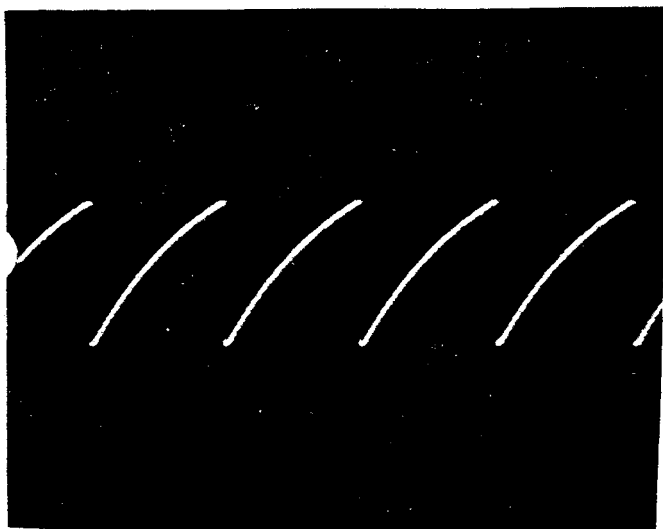
W41-B: Shows negative bias when CHARGE COMPLETE LAMP IS ON.

CHAPTER 6

AMX-IIMOTOR CONTROL WAVEFORMS

The oscillograms that follow were made with a Tektronix 422 oscilloscope and a C-30 Camera. Probe connections, scope setting and operating conditions are given for each.

For the waveforms, the letter W followed by a number identifies the point in the circuit at which the voltage appears on page 10 of the schematics in Chapter 6.

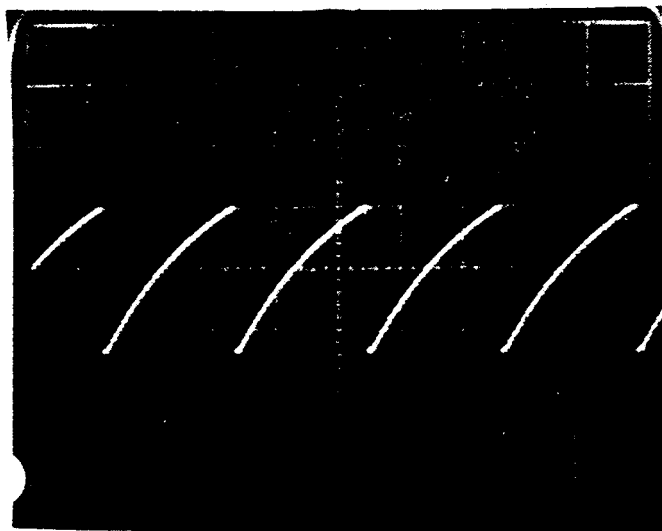


W-51

W-51

1K Hz sawtooth from UJT oscillator
8A1-Q2

Ch 1 probe: Plus side of 8A1-C2
GND: 8A1-1
H: 0.5 ms/div
V: 0.5-V/div x 10 probe
Trig: Int, AC, +, Set Point
Speed Control - zero
Brake Handle - down

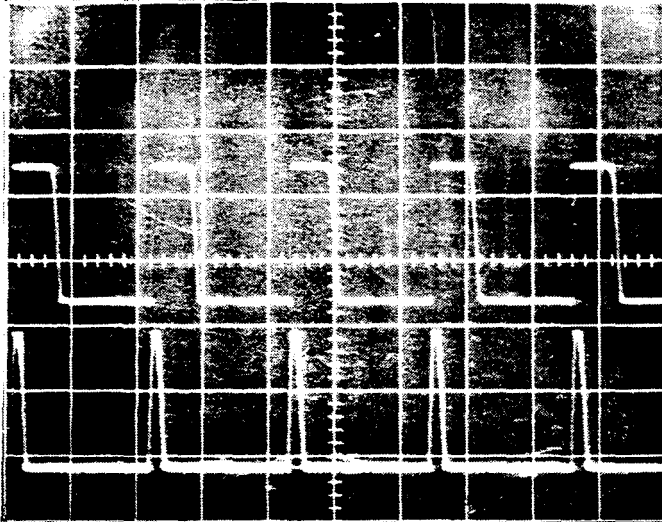


W-52

W-52

Output of emitter follower 8A1-Q3

Ch 1 probe: Emitter of 8A1-Q3
GND: 8A1-1
H: 0.5 ms/div
V: 0.5 V/div x 10 probe
Trig: Int, AC, +, Set Point
Speed Control - zero
Brake Handle - down



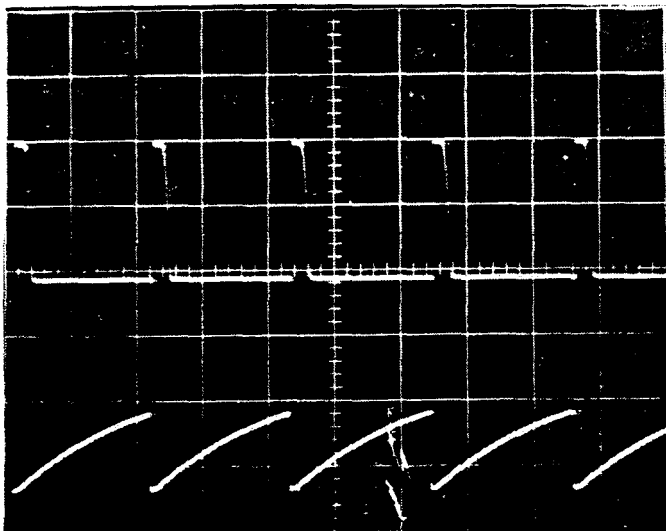
W-53A (Upper) W-53B (Lower)
max. speed slow speed

W-53

Output of Q5 at low and max. speeds.

Ch 1 Probe: Collector of 8A1-5
 GND: 8A1-1
 H: 0.5 mx/div
 V: 0.5 V/div x 10 probe
 Trig: Int, AC, +, Set Point
 Speed Control ; 53-A, max
 53-B, slow

Spikes should expand to the right as speed is increased

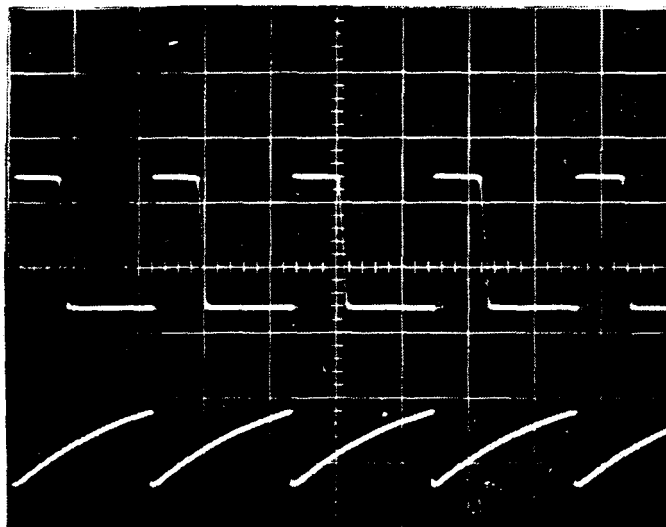


W-54A (Upper) W-54B (Lower)
Output of Q5 Input of Q5

W-54

Comparing the input and output of Q5 at slow speed.

W-54A: Same as W-53
 W-54B: Same as W-52 except -
 V: 1.0 V/div x 10 probe
 Speed Control - slow
 Brake Handle - down

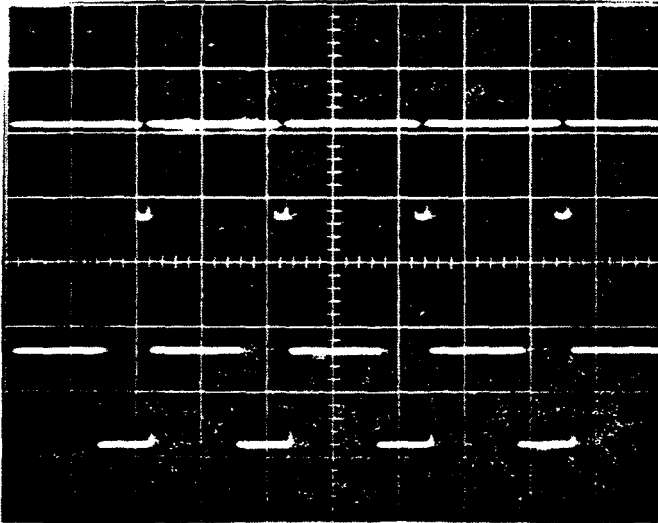


W-54C (Upper) W-54D (Lower)
Output of Q5 Input of Q5

W-54

Comparing the input and output of 8A1-Q5 at max. speed.

W-54C: Same as W-54A
 W-54D: Same as W-54B
 Speed Control - max.
 Brake Handle - down

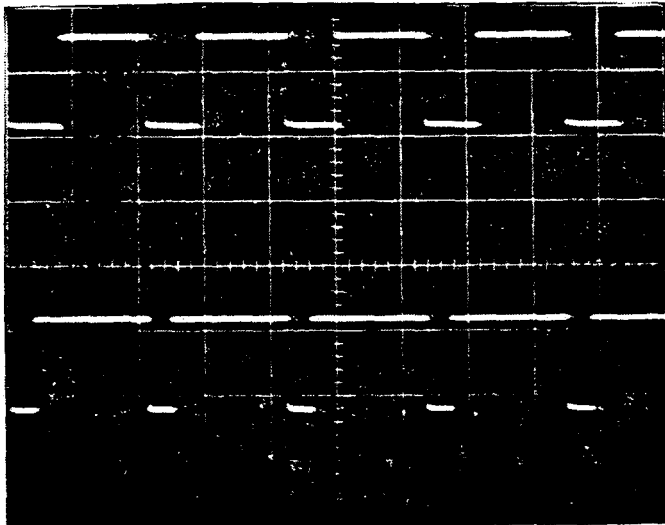


W-55A (Upper) slow speed
W-55B (Lower) max. speed

W-55
Output of 8A1-Q6 at low and high speed.

Ch 1 Probe: Collector of 8A1-Q6
GND: 8A1-1
H: 0.5 ms/div
V: 0.5 V/div x 10 probe
Trig: Int, AC, + Set Point

Brake Handle -- down

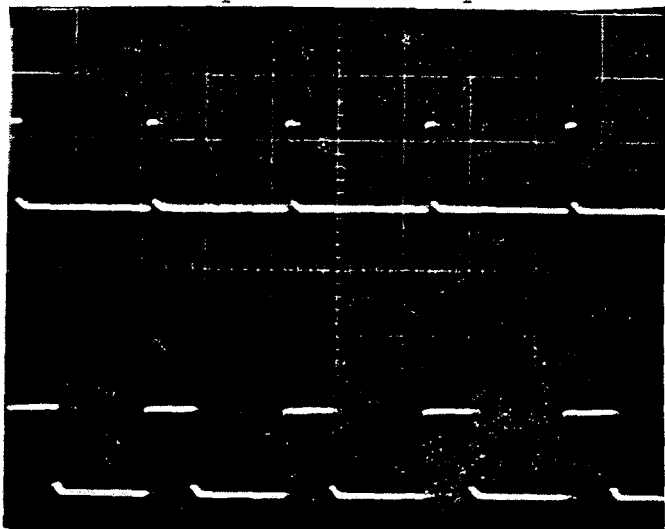


W-56A (Upper) max. speed
W-56B (Lower) slow speed

W-56
Voltage across load resistor 8A1-R23 for different speeds.

Ch 1 Probe: Junction of R21 and R23
GND: Collector of Q7
H: 0.5 ms/div
V: 0.5 V/div x 10 probe
Trig: Int, AC, +, Set Point

Brake Handle - down

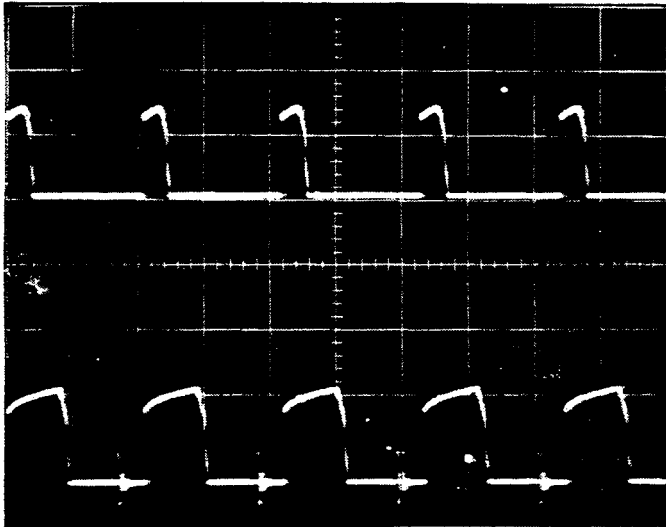


W-57A (Upper) slow speed
W-57B (Lower) max. speed

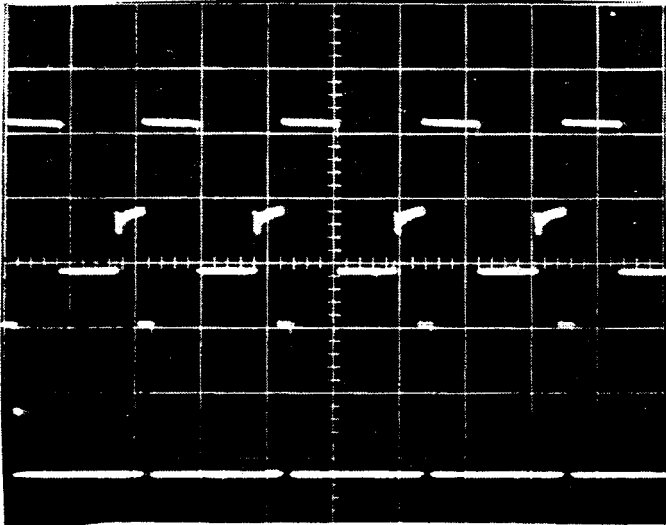
W-57
Output of 8A1-Q8 for different speeds.

Ch 1 Probe: Emitter of Q8
GND: 8A1-1
H: 0.5 ms/div
V: 0.5 V/div x 10 probe
Trig: Int, AC, +, Set Point

Brake Handle - down



W-59A (Upper) W-59B (Lower)
low speed max. speed



W-60A (Upper) W-60B (Lower)
max. speed slow speed

W-59

Output of 8A1-Q9 during run conditions.

Ch 1 Probe: Base of Q10
 GND: 8A1-1
 H: 0.5 ms/div
 V: .05 V/div x 10 probe
 Trig: Int, AC, +, Set Point

Brake Handle - down

W-60

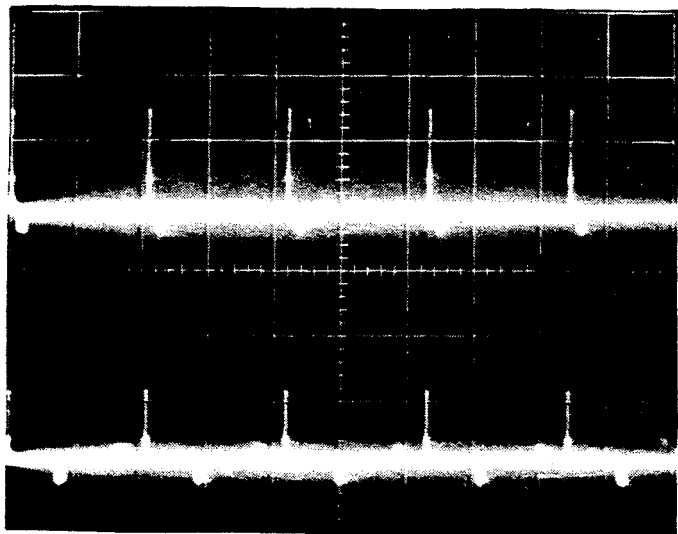
Output voltage to drive motor 6B2.

Ch 1 Probe: 8A1-5
 GND: 8A1-6
 H: 0.5 ms/div
 V: 5. V/div x 10 probe
 Trig: Int, AC, +, Set Point

Brake Handle - down

7-1576

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W-61A (Upper) W-61B (Lower)
slow speed max. speed

W-61

Overload protection circuit. Wave form shows circuit during normal operating condition.

Ch 1 Probe: Base of 8A1-Q1
GND: Collector of 8A1-Q4
H: 0.5 ms/div
V: 1.0 V/div x 10 probe
Trig: Int, AC, + Set Point

Brake Handle - down

CHAPTER 7 SCHEMATICS

TABLE OF CONTENTS

PANEL IDENTIFICATION TABLE

RELAY FUNCTION CHART

SCHEMATICS	SHEET NO.
BATTERY CHARGER (ALL MODELS) WITH NEW FUSE LOCATION . . .	1
BATTERY CHARGER (ALL MODELS) WITH NEW CHARGER ASM. . . .	1A
60 Hz INVERTER CIRCUIT Models 46-165600G10 Thru G12	2
TUBE STATOR & FILAMENT: COLLIMATOR LIGHT (ALL MODELS)..	3
500 Hz INVERTER ON-OFF SWITCHES (ALL MODELS)	4
500 Hz INVERTER CIRCUITS (ALL MODELS)	5
MA CIRCUITS (ALL MODELS)	6
H. V. RECTIFIERS AND TUBE UNIT (ALL MODELS)	7
DELAY AND INTERLOCK CIRCUITS Models 46-165600G10 Thru G12	8
TRIGGER, TIMER AND OVERLOAD CIRCUITS Units Below Ser. No. 346320	9
TRIGGER, TIMER AND OVERLOAD CIRCUITS Units 346320 and Above	9A
MOTOR DRIVE CIRCUITS (ALL MODELS)	10

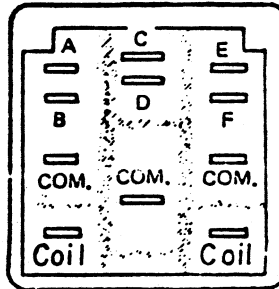
AMX-110 PANEL IDENTIFICATION TABLE

PANEL	COMPONENT PREFIX
X-RAY CONTROL CABINET	1-
INVERTER ASSEMBLY	2-
CARD RACK ASSEMBLY	3-
Timer and Overload Board	3A1-
Filament & MA, Regulator Board	3A2-
500 Hz Inverter Driver Board	3A3-
Time Delay Board	3A4-
60 Hz Inverter Driver Board	3A5-
Pulse Board	3A6-
BATTERY CHARGER ASSEMBLY	4-
Battery Charger CKT. Board	4A1-
OPERATOR'S PANEL	5-
AMX CHASSIS	6-
H.V. TRANSFORMER	7-
INTERCONNECTION PANEL	8-
MOTOR DRIVE ASSEMBLY & BOARD	8A1-
DRIVE ASSIST PANEL	8A2-
X-RAY TUBE UNIT	None
BATTERY ASSEMBLY	None
COLLIMATOR ASSEMBLY	4-

RELAY COIL	RELAY NAME AND LOCATION	ENERGIZED BY	CONTACT	CONTACT FUNCTION	SCHEMATIC LOCATION
1K1 (115 VAC) (25C)	500 Hz Inverter safety turn-off	Output of 60 Hz inverter when handswitch ROTOR is pressed	A B	Connect 500 Hz inverter to battery power	9,C 13,D 37,C
3K1 (24 VDC) (77,C)	60 Hz inverter control	Closing 3A4K32-A by depressing handswitch ROTOR button	A B C	Connect 60 Hz inverter to battery power	14,B 36,B 73,B
3K2 (115 VAC) (2,F)	Battery charger interlock	Connecting charger to 115-VAC power	A B C	Disconnect battery power from X-ray control circuits when battery is being charged Connect battery to charger when 5S1-A is charge only Disconnect motor drive when charge cord is plugged in.	13,C 9,C 36,C 73,C 13,C 10,C 36,C 73,B 95,D
3K3 (83,D)	500 Hz inverter 3 sec. safety turn-off	Depressing handswitch X-ray button	A	Opens supply voltage to 1K1 after 3 seconds	25,C
3A1K7 (24 VDC) (83,C)	X-Ray exposure start	Depressing handswitch X-RAY button	A	Remove the short across gate to cathode of 3A1CR28 and allow it to be triggered on	86,F
3A4K2 (24 VDC) (79,B)	Inverter function sensor and exposure start time delay	Proper response to sensors in inverter and filament and rotor circuits and completion of time delay	B	Close circuit to ready light and prepare exposure start circuits	81,B
3A4K5 (24 VDC) (82, C)	Turn-off capacitor power disconnect	Closure of 3A4K2 and Exposure switch 3A1CR28 "ON"	A	Opens power supply used to charge exposure stop capacitors 1C2 during exposure.	39,C
3A4K22 (24 VDC) (76,C)	60 Hz and 500 Hz Inverter driver turn on	Time delayed circuit after depressing handswitch rotor.	B	Connects battery power to inverter driver circuits	10,C,14,C 37,B,74,B
3A4K36 (24 VDC) (74,E)	Preparation	Depressing handswitch ROTOR button or COLL. FIELD LITE	B	Connect inverter driver and exposure control circuits	10,C 69,B

RELAY COIL	RELAY NAME AND LOCATION	ENERGIZED BY	CONTACT	CONTACT FUNCTION	SCHEMATIC LOCATION
4A1K23 (24 VDC) (7,C)	Charge complete shut-off	Charging battery to 131-132V	A	Change charger turn on point so the battery must discharge awhile before the charger turns on again Turn on CHARGE COMPLETE lamp turn off 4CR3	8,F
			B		5,D
6CB1 9,E 60,E 12,F 72,E 35,F 94,F 32,E	Circuit breaker	Current overload	-	Disconnects battery when battery current drain is excessive or Charge Rate Excessive	12,E 32,D 9.D 35,D 72,D 94, D
8K1 (32, F)	Collimator light	Depressing handswitch ROTOR BUTTON	D	Prevents exposures when Collimator light is on by opening Circuit for 1K1	25,D
			C	Complete Primary transformer (8T1) Collimator light circuit	29, C
			F	Picks up relay 3A4K36 to apply power to 60 Hz inverter	75, E
			B	Prevent power to stator when Collimator light is on	25, D
8A2K1 95, C	Drive Assist	Drive Assist Push Button 6S5	B	Shorts 8A2R2 to increased motor torque	103, C

8K1 RELAY CONTACTS



15863-R11

GENERAL ELECTRIC

30466-D20

CONT ON SHEET - SHT NO. 1

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING:-

REV A B

TITLE

APPLIED PRACTICES

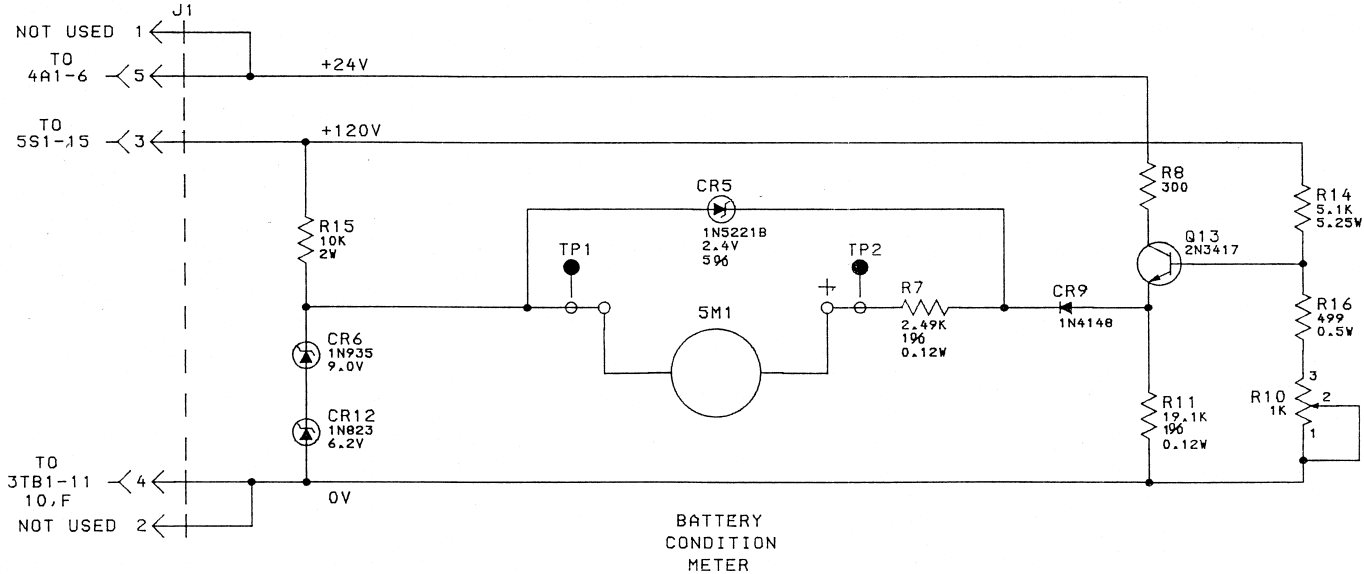
SCHEMATIC DIAGRAM

METER BOARD

FIRST MADE FOR AMX GENERATOR

CONT ON SHEET - SHT NO. 1

46-18849461-A
4A2



BATTERY
CONDITION
METER

NOTES

UNLESS OTHERWISE SPECIFIED,
ALL RESISTORS ARE 1/4W, 5%
AND ARE IN OHMS.

ALL DEVICES SHOWN TOP VIEW



2N3417

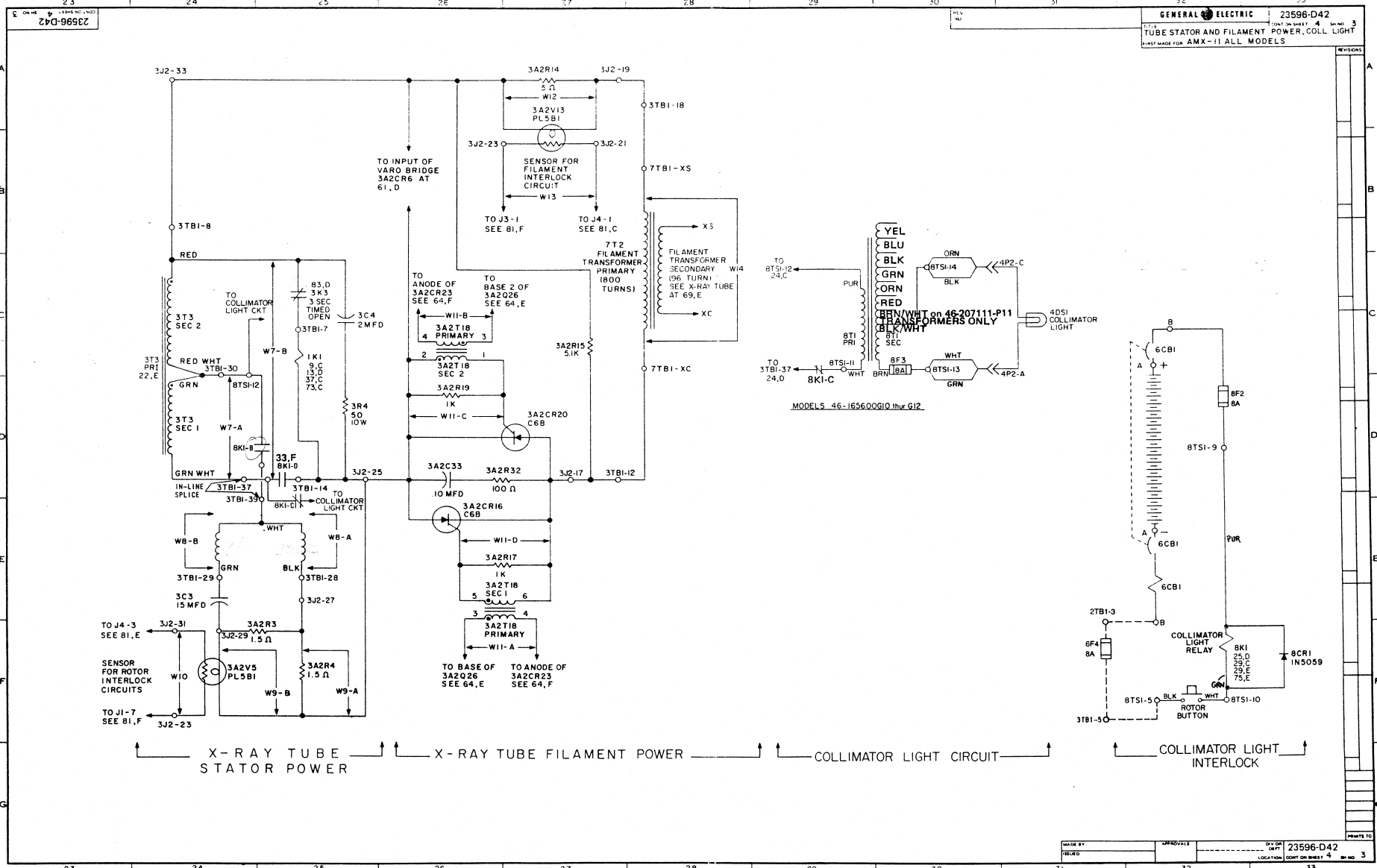
REVISIONS		PRINTS TO	
B	DUS 9/MAY/79	407	
GENERAL CHANGES			

MADE BY
ISSUED *Ray Doo 6 June 79*

APPROVALS

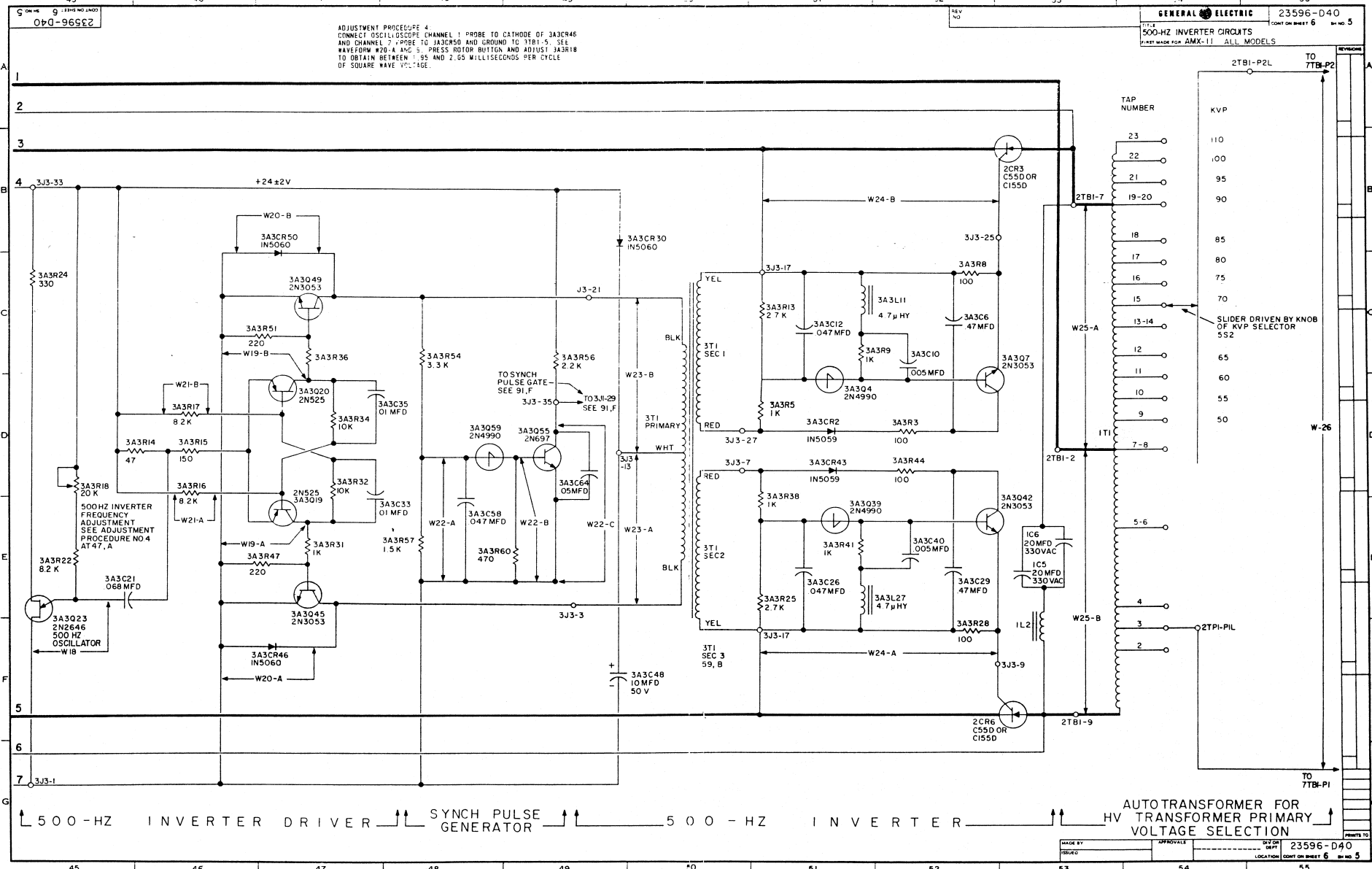
MEDICAL SYSTEMS DIV OR
DEPT
MILWAUKEE, WI LOCATION

CONT ON SHEET - SHT NO. 1



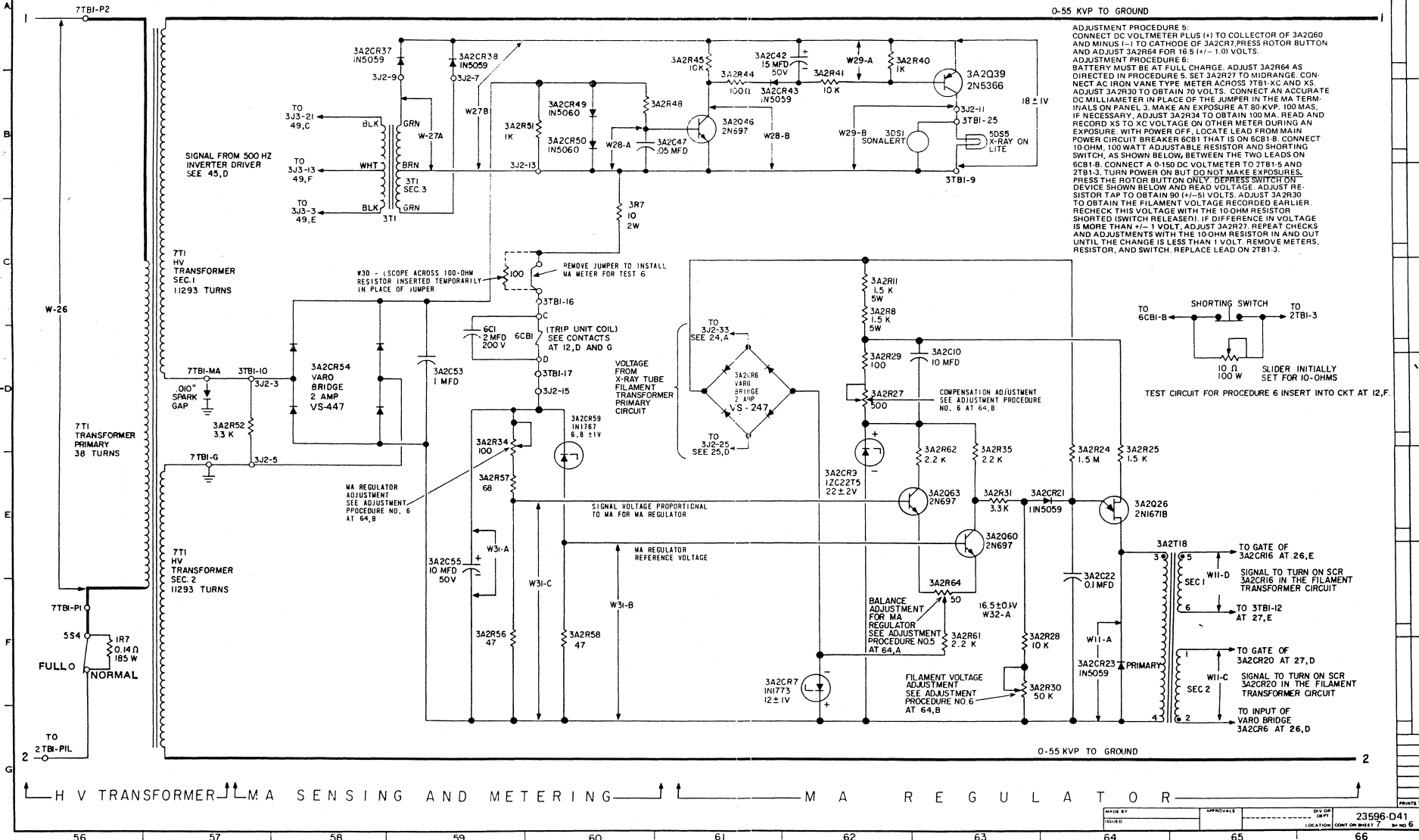
REV NO. 23596-D40
 GENERAL ELECTRIC 23596-D40
 500-HZ INVERTER CIRCUITS
 COUNT ON SHEET 6 OF NO. 5
 PART MADE FOR AMX-II ALL MODELS

ADJUSTMENT PROCEDURE 4
 CONNECT OSCILLOSCOPE CHANNEL 1 PROBE TO CATHODE OF 3A3CR46
 AND CHANNEL 7 PROBE TO 3A3CR50 AND GROUND TO 17B1-5. SEE
 WAVEFORM W20-A AND 3. PRESS ROTOR BUTTON AND ADJUST 3A3R18
 TO OBTAIN BETWEEN 1.95 AND 2.05 MILLISECONDS PER CYCLE
 OF SQUARE WAVE VOLTAGE.



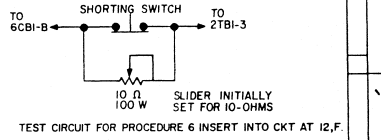
MADE BY: []
 DESIGNED BY: []
 CHECKED BY: []
 APPROVED BY: []
 DATE: []
 LOCATION: []
 23596-D40
 COUNT ON SHEET 6 OF NO. 5

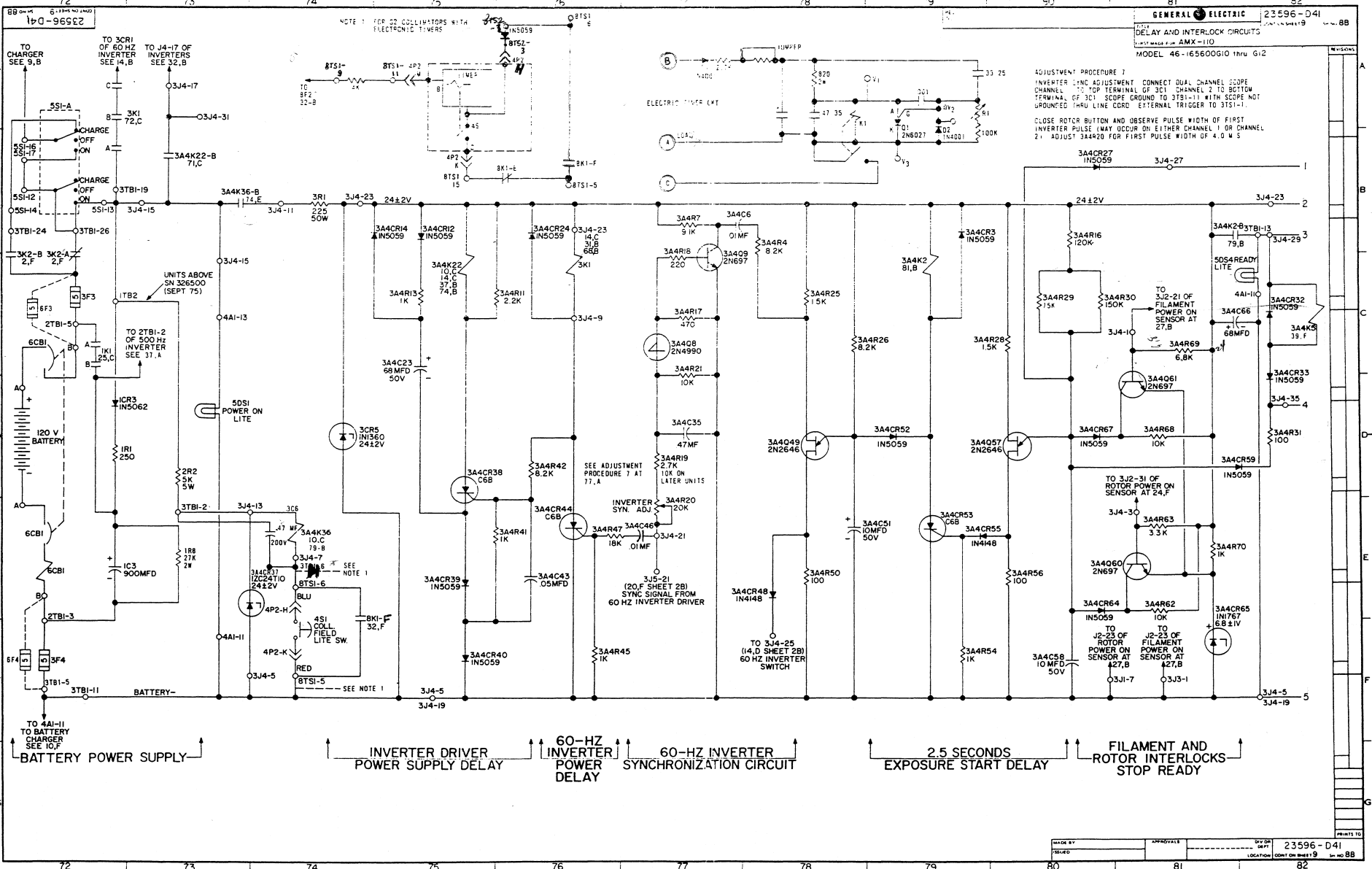
X-RAY ON INDICATOR



ADJUSTMENT PROCEDURE 5:
CONNECT DC VOLT METER PLUS (+) TO COLLECTOR OF 3A2Q60 AND MINUS (-) TO CATHODE OF 3A2CR7, PRESS ROTOR BUTTON AND ADJUST 3A2R64 FOR 16.5 (+/- 1.0) VOLTS.

ADJUSTMENT PROCEDURE 6:
BATTERY MUST BE AT FULL CHARGE. ADJUST 3A2R64 AS DIRECTED IN PROCEDURE 5. SET 3A2R27 TO MIDRANGE. CONNECT AC IRON VANE TYPE METER ACROSS 7T1-XC AND XS. ADJUST 3A2R30 TO OBTAIN 70 VOLTS. CONNECT AN ACCURATE DC MILLIAMMETER IN PLACE OF THE JUMPER IN THE MA TERMINALS ON PANEL 3. MAKE AN EXPOSURE AT 80 KVP, 100 MAS. IF NECESSARY, ADJUST 3A2R34 TO OBTAIN 100 MA. READ AND RECORD XS TO XC VOLTAGE ON OTHER METER DURING AN EXPOSURE. WITH POWER OFF, LOCATE LEAD FROM MAIN POWER CIRCUIT BREAKER 6CB1 THAT IS ON 6CB1-B. CONNECT 10 OHM, 100 WATT ADJUSTABLE RESISTOR AND SHORTING SWITCH, AS SHOWN BELOW, BETWEEN THE TWO LEADS ON 6CB1-B. CONNECT A 0-150 DC VOLT METER TO 2T81-5 AND 2T81-3. TURN POWER ON BUT DO NOT MAKE EXPOSURES. PRESS THE ROTOR BUTTON ONLY. DEPRESS SWITCH ON DEVICE SHOWN BELOW AND READ VOLTAGE. ADJUST RESISTOR TAP TO OBTAIN 90 (+/- 5) VOLTS. ADJUST 3A2R30 TO OBTAIN THE FILAMENT VOLTAGE RECORDED EARLIER. RECHECK THIS VOLTAGE WITH THE 10-OHM RESISTOR SHORTED (SWITCH RELEASED). IF DIFFERENCE IN VOLTAGE IS MORE THAN +/- 1 VOLT, ADJUST 3A2R27. REPEAT CHECKS AND ADJUSTMENTS WITH THE 10-OHM RESISTOR IN AND OUT UNTIL THE CHANGE IS LESS THAN 1 VOLT. REMOVE METERS, RESISTOR, AND SWITCH. REPLACE LEAD ON 2T81-3.





GENERAL ELECTRIC 23596-D41
 DELAY AND INTERLOCK CIRCUITS
 MODEL 46-165600G10 thru G12

ADJUSTMENT PROCEDURE 1
 INVERTER SYNC ADJUSTMENT: CONNECT DUAL CHANNEL SCOPE CHANNEL 1 TO TOP TERMINAL OF 3C1 CHANNEL 2 TO BOTTOM TERMINAL OF 3C1 SCOPE GROUND TO 3TBI-11 WITH SCOPE NOT GROUNDED THRU LINE GND. EXTERNAL TRIGGER TO 3TBI-1.
 CLOSE ROTOR BUTTON AND OBSERVE PULSE WIDTH OF FIRST INVERTER PULSE (MAX OCCUR ON EITHER CHANNEL 1 OR CHANNEL 2). ADJUST 3A4R20 FOR FIRST PULSE WIDTH OF 4.0 μS

DESIGNED BY	APPROVED BY	DATE	23596-D41
ISSUED	LOCATIONS	CONTROL SHEET NO.	REV. NO. 88

