GE Healthcare

Technical Publications

Direction 2166913-1EN

Revision 15

AMX-4+ Operation (Model 2169360, 2236420 & 2275938 Series)

CE 0459

Operating Documentation

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Direction 2166913-1EN

Revision 15

AMX-4+ Operation (Model 2169360, 2236420 & 2275938 Series)

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 by everyone who will use the equipment 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 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 adequate steps to protect against injury.

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 improper use of the equipment.

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

CAUTION: United States Federal law restricts this device to use by or on the order of a physician.

If you have any comments, suggestions or corrections to the information in this document, please write them down, include the document title and document number, and send them to:

GENERAL ELECTRIC COMPANY MEDICAL SYSTEMS
MANAGER - INFORMATION INTEGRATION,
AMERICAS W-622
P.O. BOX 414
MILWAUKEE, WI 53201-0414

CERTIFIED ELECTRICAL CONTRACTOR STATEMENT

All electrical installations that are preliminary to positioning of the equipment at the site prepared for the equipment shall be performed by licensed electrical contractors. In addition, electrical feeds into the Power Distribution Unit shall be performed by licensed electrical contractors. Other connections between pieces of electrical equipment, calibrations, and testing shall be performed by qualified GE Medical personnel. The products involved (and the accompanying electrical installations) are highly sophisticated, and special engineering competence is required. In performing all electrical work on these products, GE will use its own specially trained field engineers. All of GE's electrical work on these products will comply with the requirements of the applicable electrical codes.

The purchaser of GE equipment shall only utilize qualified personnel (i.e., GE's field engineers, personnel of third-party service companies with equivalent training, or licensed electricians) to perform electrical servicing on the equipment.

DAMAGE IN TRANSPORTATION

All packages should be closely examined at time of delivery. If damage is apparent, have notation "**damage in shipment**" written on **all** copies of the freight or express bill **before** delivery is accepted or "signed for" by a General Electric representative or a hospital receiving agent. Whether noted or concealed, damage **MUST** be reported to the carrier **immediately** upon discovery, or in any event, within **14** days after receipt, and the contents and containers held for inspection by the carrier. A transportation company will not pay a claim for damage if an inspection is not requested within this **14** day period.

Call Traffic and Transportation, Milwaukee, WI (414) 827-3449/ 8*285-3449 **immediately** after damage is found. At this time be ready to supply name of carrier, delivery date, consignee name, freight or express bill number, item damaged and extent of damage.

Complete instructions regarding claim procedure are found in Section "S" of the Policy & Procedure Bulletins.

REGULATORY REQUIREMENTS

This product conforms with the requirements of Council Directive 93/42/EEC concerning medical devices when it bears the following CE marking of conformity:

CE 0459

Note: This equipment generates, uses, and can radiate radio frequency energy. The equipment may cause radio frequency interference to other medical and non-medical devices and radio communications. To provide reasonable protection against such interference, the AMX4+ Mobile X-Ray Unit complies with emissions limits for a Group 1, Class A Medical Devices as stated in EN 60601-1-2.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment is found to cause interference (which may be determined by switching the equipment on and off), the user (or qualified service personnel) should attempt to correct the problem by one or more of the following measure(s):

- Reorient or relocate the affected device(s).
- Increase the separating space between the equipment and the affected device.
- Power the equipment from a source different from that of the affected device.
- Consult the point of purchase or service representative for further suggestions.

The manufacturer is not responsible for any interference caused either by the use of interconnect cables other than those recommended, or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

To comply with the regulations applicable to an electromagnetic interface for a Group 1, Class A Medical Device, all interconnect cables to peripheral devices must be shielded and properly grounded. Use of cables not properly shielded and grounded may result in the equipment causing radio frequency interference in violation of the European Union Medical Device directive and FCC regulations.

Setting for Mobile AID

Under certain Electro Static Discharge (ESD) conditions, the optional Automatic Exposure Control for the AMX 4+ may self-modify its settings. The operator will need to adjust the settings to their original condition. If the problem cannot be corrected, please call service.

Medical Device Directive

This product complies with the following requirements:

Council Directive 93/42/EEC concerning medical devices when it bears the following CE marking of conformity:

CE 0459

The location of the CE mark label on the equipment is in the service system manual.

European registered place of business:

GE Medical Systems SCS
Quality Assurance Manager
283 rue de la Minière
78530 BUC France

Green QSD 1990 Standard issued by MDD (Medical Devices Directorate, Department of Health, UK).

Medical Device Good Manufacturing Practice Manual issued by the FDA (Food and Drug Administration, Department of Health, USA).

Underwriters' Laboratories, Inc. (UL), an independent testing laboratory.

Canadian Standards Association (CSA).

International Electrotechnical Commission (IEC), international standards organization, when applicable.

GE Healthcare reserves the right to make changes in specifications and features shown herein, or discontinue the product described at any time without notice or obligation.

The original language of this manual is English.

Technical Manual Updates

When operating or servicing GE Healthcare products, please contact your GE representative for the latest revision of product documentation. Product documentation may also be available on-line at the GE Healthcare support documentation library.

Contact Information

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REVISION HISTORY

REV	DATE	REASON FOR CHANGE
0	Dec. 13, 1996	Initial release.
1	Aug. 22, 1997	Changed Periodic Maintenance Schedule to yearly for all checks.
2	Dec. 1, 1998	Added CE regulatory requirements.
3	Apr. 5, 1999	Added Warning in Section 4.
4	Apr. 12, 1999	Added AMX4+ model 2236420.
5	May 6, 1999	Added yoke mounting screws tighten and replace requirements to Table 7-1. Add model numbers to charging specs in section 6.
6	July 14, 1999	Removed “yoke mounting screws tighten and replace requirements” from Table7-1.
7	Feb. 29, 2000	Updated first periodic maintenance visit from 12 months to 13 months after installation to agree with Information Service Letter.
8	Mar. 27, 2002	Added section 10, Options.
9	Sept. 17, 2003	Added circuit breaker notes to section 7. Added new model numbers. Added caution to section 2.
10	June 24, 2005	Added WEEE symbol definition.
11	May 5, 2008	Created new part number to comply with new international standard. Incremented all operator manuals to the same revision.
12	May 5, 2008	Created new part number to comply with new international standard. Incremented all operator manuals to the same revision.
13	Sept. 7, 2010	Added Section 11, Environmental Conditions
14	Feb. 9, 2011	Added Manufactured By statement
15	Sept. 1, 2012	Revised cleaning instructions. Refer to CAPA 5970812. Revised Periodic Maintenance Schedule for hand switch replacement. Refer to CAPA 5970812. Added text to front matter on how to obtain most recent revisions of technical manuals. Related to resolution of CAPA 5970812.

TABLE OF CONTENTS

SECTION 1
BEFORE YOU BEGIN

The instructions in this operation manual are for use with the AMX-4+ Mobile X-ray Unit,

Models	2169360	2169360-2	2169360-3	2169360-4
	2169360-5	2169360-6	2169360-7	2169360-8
	2169360-9	2169360-10	2169360-11	2169360-12
	2169360-13	2169360-14	2169360-15	2169360-16
Models	2236420	2236420-2	2236420-3	2236420-4
	2236420-5	2236420-6	2236420-7	2236420-8
	2236420-9	2236420-10		
Models	2275938	2275938-2	2275938-3	2275938-4
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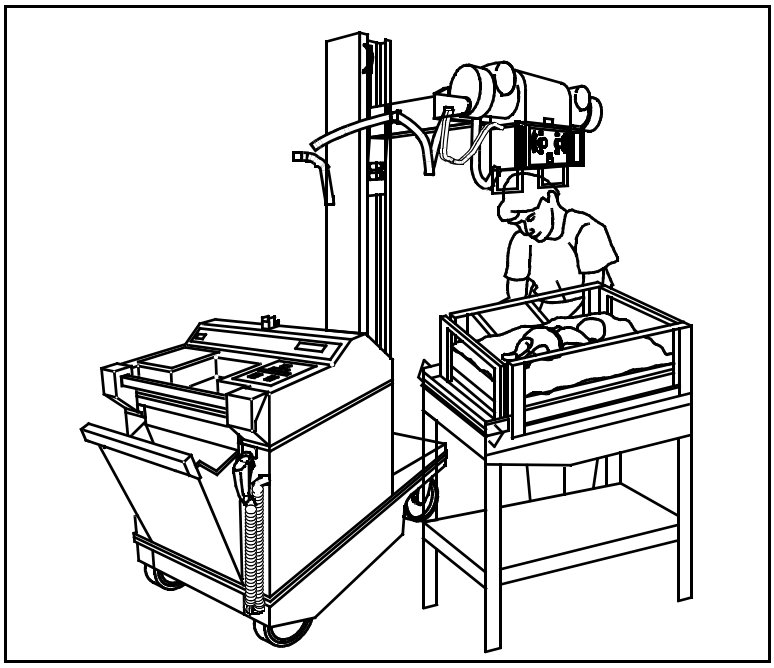
Your AMX-4+ is designed for ease of operation and years of reliable service. Each time you push a button, you can depend on the same consistent radiographic quality - quality comparable to radiographs made in a full scale X-ray room.

ILLUSTRATION 1-1



Since the AMX-4+ is battery operated, there's no need to plug in your mobile X-ray unit before taking exposures. Battery operation makes the AMX-4+ easily adapted to operating, intensive care, and emergency room applications.

Because of a dual-motor drive, driving and positioning the AMX-4+ requires a minimum of effort. And the control panel's cut-away design permits optimum visibility for steering down crowded corridors.

The self-stopping bumper, one of many built-in safety devices, helps prevent unwanted mobility - the motors stop and the brakes activate upon impact with another object.

Operator controls are microprocessor based, combining the latest technology with simplicity of design.

The control panel includes three illuminated displays: a kVp and mAs display to reflect the technique selected, a battery display for at-a-glance battery status, and a message display to provide helpful information on the operating status of the AMX-4+ .

1-1 Available Options

Mobil-Aid Automatic Exposure Control.

For operating instructions, refer to Mobil-Aid Owner's Manual, Number 69198.

1-2 How to Use This Book

Most sections of your operator manual (see *Contents*) are organized using two headings:

1. Overview, and

2 Steps

Overview

Overview, as the name implies, presents general information on a particular operation. Introductory in nature, the overview is intended to help give you an overall understanding of a procedure or capability, quickly and easily.

The word *overview* is flagged in **bold text,** like this ...

Overview

and appears in the left margin of the page.

Steps

For specific, detailed information in step-by-step sequence, you'll refer to the actual procedure. In this manual, we refer to procedures as *steps*.

The word steps is flagged in bold text, like this ...

Steps

and also appears in the left margin of the page.

Steps are listed numerically. Any supplemental information (that is, additional information you should know, but information that isn't really necessary to perform the procedure) is listed under the step in a bulleted • format.

- *supplemental information is placed next to a bullet*

We think you'll find the AMX-4+ portable design performs so easily that it seems to nearly run itself.

To promote optimum operation of this or any radiographic equipment, however, be sure to read your operator's manual carefully.

And, when not in use, store your manual in the cassette tray so that all new users can easily refer to it when needed.

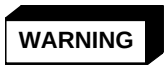
SECTION 2
SAFETY FIRST

This equipment is to be used by authorized medical personnel only.

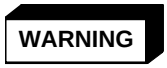
Your AMX-4+ is engineered for years of reliable service. To promote optimum safety, be sure to read this manual carefully, before operating the unit.

Keep the manual with the equipment at all times. When not in use, store it in the AMX-4+ cassette tray.

Always be alert to safety when you operate this equipment. You must be familiar enough with the equipment to recognize any malfunctions that can be a hazard. If a malfunction occurs or a safety problem is known to exist, isolate the unit to avoid unauthorized operation, and do not use this equipment until qualified personnel correct the problem.



THIS X-RAY UNIT MAY BE DANGEROUS TO PATIENT AND OPERATOR UNLESS CORRECT EXPOSURE FACTORS AND OPERATING INSTRUCTIONS ARE OBSERVED.



ALWAYS PROVIDE NECESSARY RADIATION PROTECTION FOR YOUR PATIENT AND YOURSELF WHEN OPERATING ANY X-RAY SYSTEM.

2-1 Good Operating Practices

- Wear a lead apron while performing an X-ray exam.
- Step back at least 6 feet (1.8 meters) from the tube 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.
- Check the digital display carefully before making an exposure: verify that the selected technique is the intended technique. Pay particular attention to the placement of the decimal point in the mAs setting to insure that whole numbers are not mistaken for an intended mAs fractional number.
- When X-raying bed patients, move them as far as possible from nearby patients.
- Ask visitors to step outside the room during an exposure.
- Use gonadal shields for patients whenever possible.
- Be sure to read and follow the maintenance schedule outlined in the *Maintenance and Service* section of this manual.
- 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.

CAUTION

While driving the AMX-4+, keep the film bin closed. A loaded bin may close without warning possibly causing injury.

SECTION 3
OPERATING CONTROLS

ILLUSTRATION 3-1
AMX-4+ MOBILE X-RAY UNIT (RIGHT REAR VIEW)

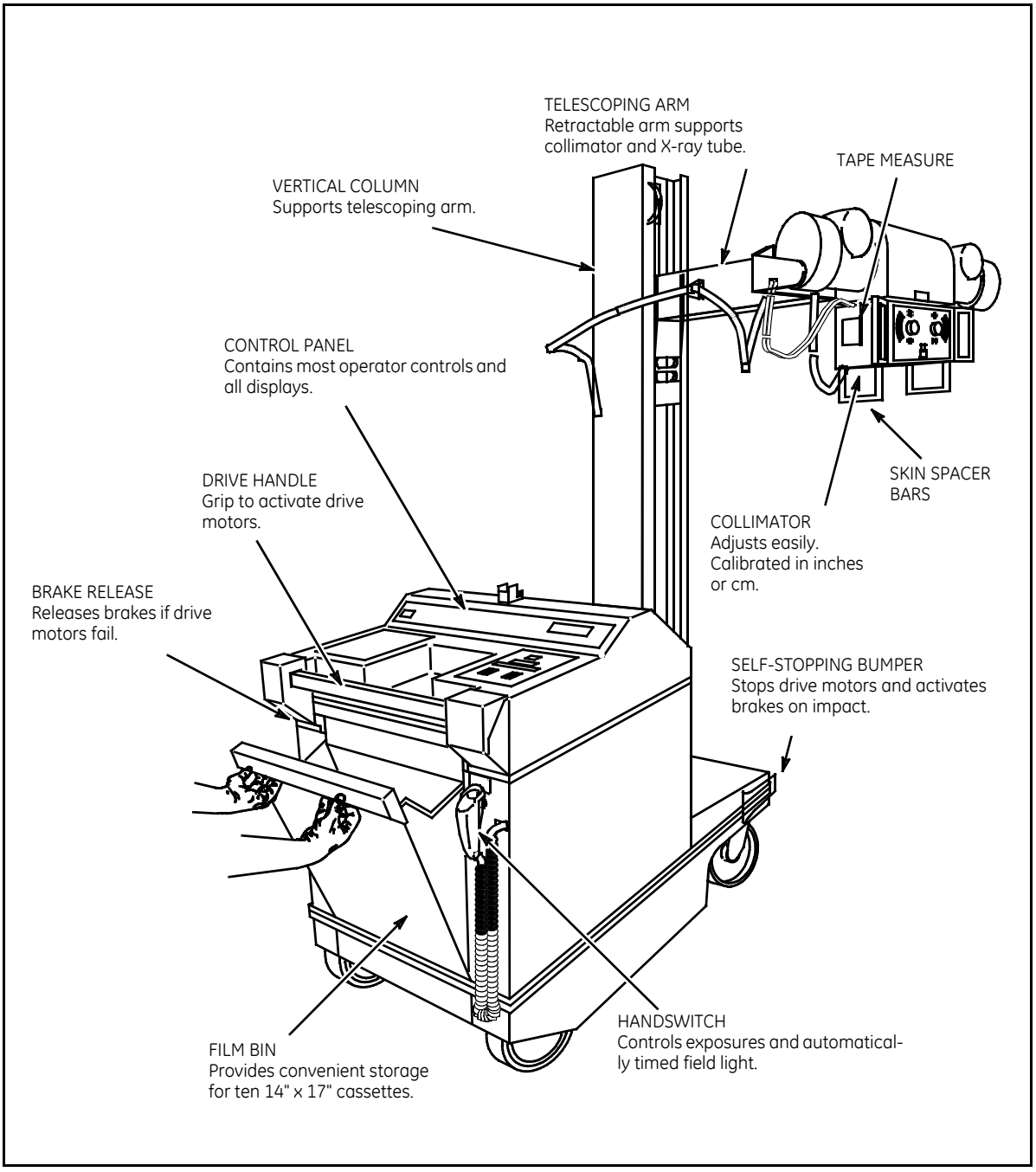
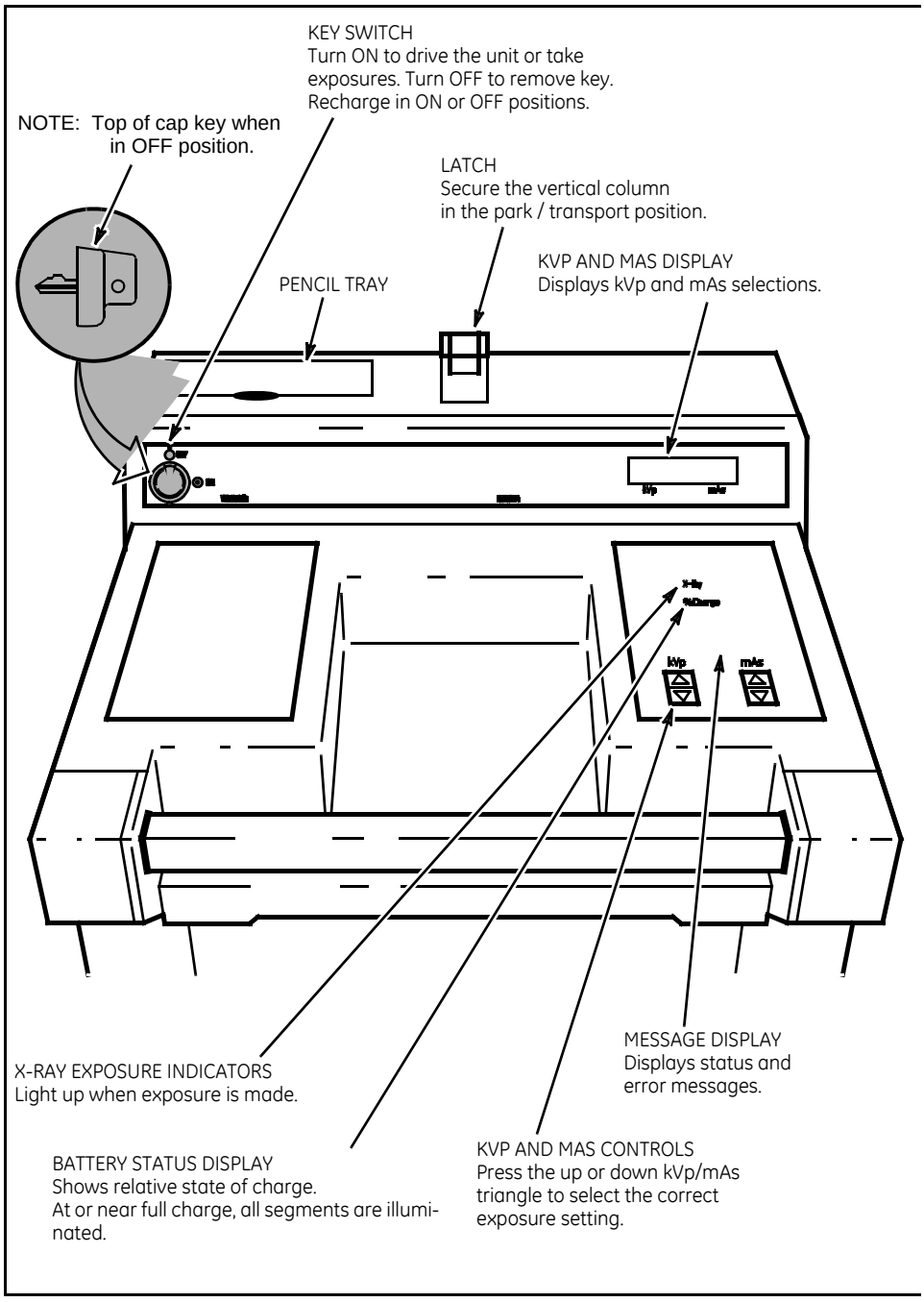


ILLUSTRATION 3-2
AMX-4+ OPERATOR CONSOLE



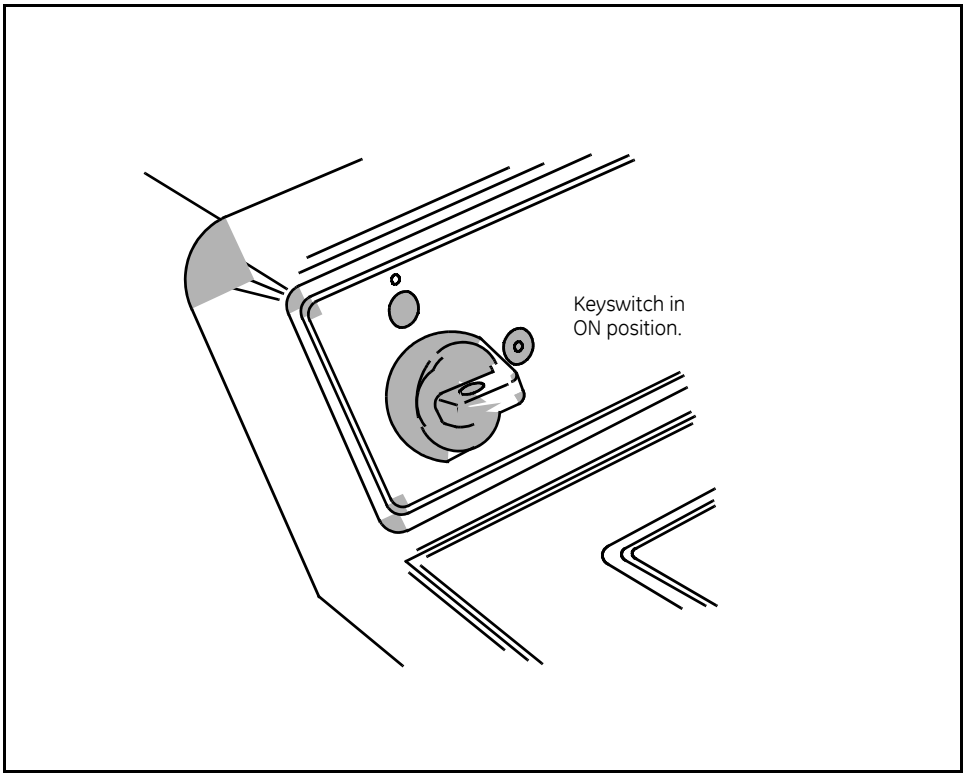
3-1 Turning the AMX-4+ On

Steps

Be sure to refer to Maintenance and Service in this manual for important information on the circuit breaker.

1. Turn the keyswitch to the ON position.

ILLUSTRATION 3-3
KEYSWITCH



- The unit performs *diagnostics* (self-tests to make sure everything is working correctly). This process takes a few seconds.

2 When the technique and battery status displays light up, the unit is ready for operation. *TESTING COMPLETE* will also briefly appear on the message display.

3 If *TEST -- XX FAILED* is displayed, turn the unit **OFF** then **ON** again. If *TEST -- XX FAILED* displays again, write down the alphanumeric code (*XX* represents the code) and contact your service representative.

SECTION 4
DRIVING THE AMX-4+

Overview

A compact design and dual motor assembly makes driving and maneuvering the AMX-4+ an easy process.

If moving down hallways or just traveling from one room to another, you'll first make sure the telescoping arm is properly positioned and securely latched so maximum speed can be reached.

Then simply grip the drive handle and steer the unit to your destination. (See Illustration 4-1.)

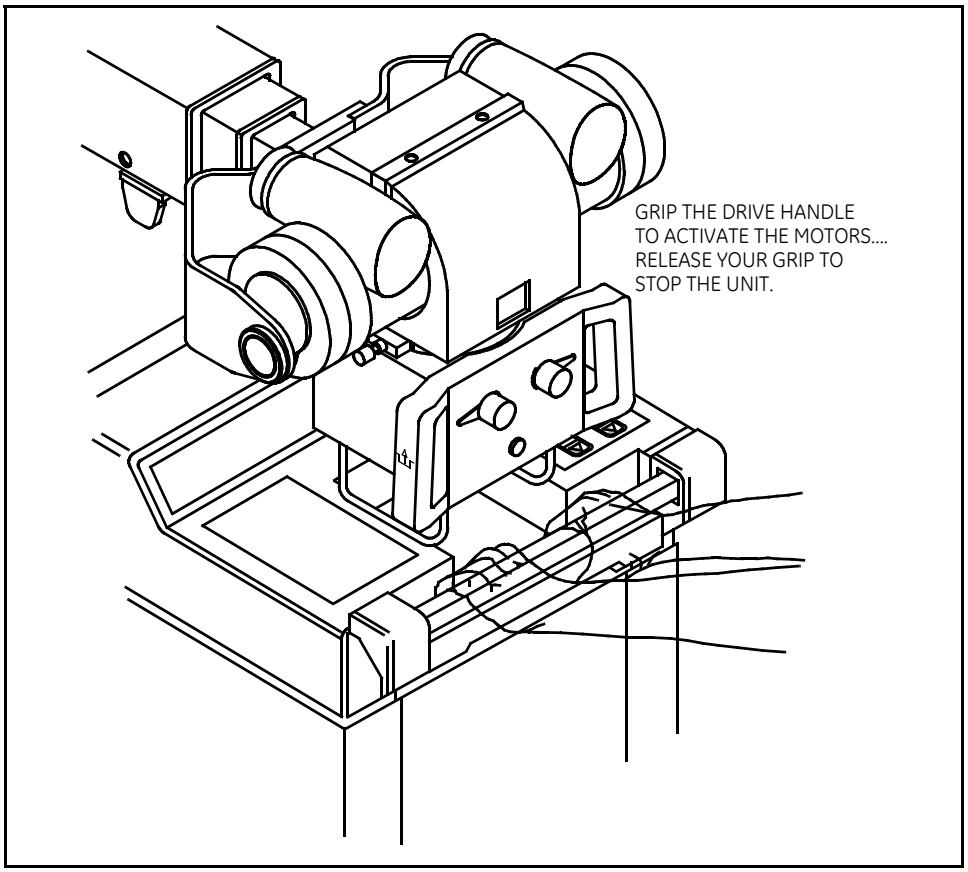
WARNING

MOVEMENT OF THE AMX-4+ X-RAY UNIT COULD CAUSE THE HORIZONTAL ARM TO SLIDE AND STRIKE AN OPERATOR OR PATIENT IF NOT LATCHED PROPERLY. LATCH TELESCOPING ARM PROPERLY BEFORE MOVING THE UNIT.

WARNING

DO NOT DRIVE OR POSITION THE AMX-4+ UNIT UNLESS STANDING DIRECTLY BEHIND IT (SEE ILLUSTRATION 4-1). FAILURE TO DO THIS MAY RESULT IN LOSS OF CONTROL CAUSING SERIOUS INJURY AND EQUIPMENT DAMAGE.

ILLUSTRATION 4-1
DRIVE HANDLE



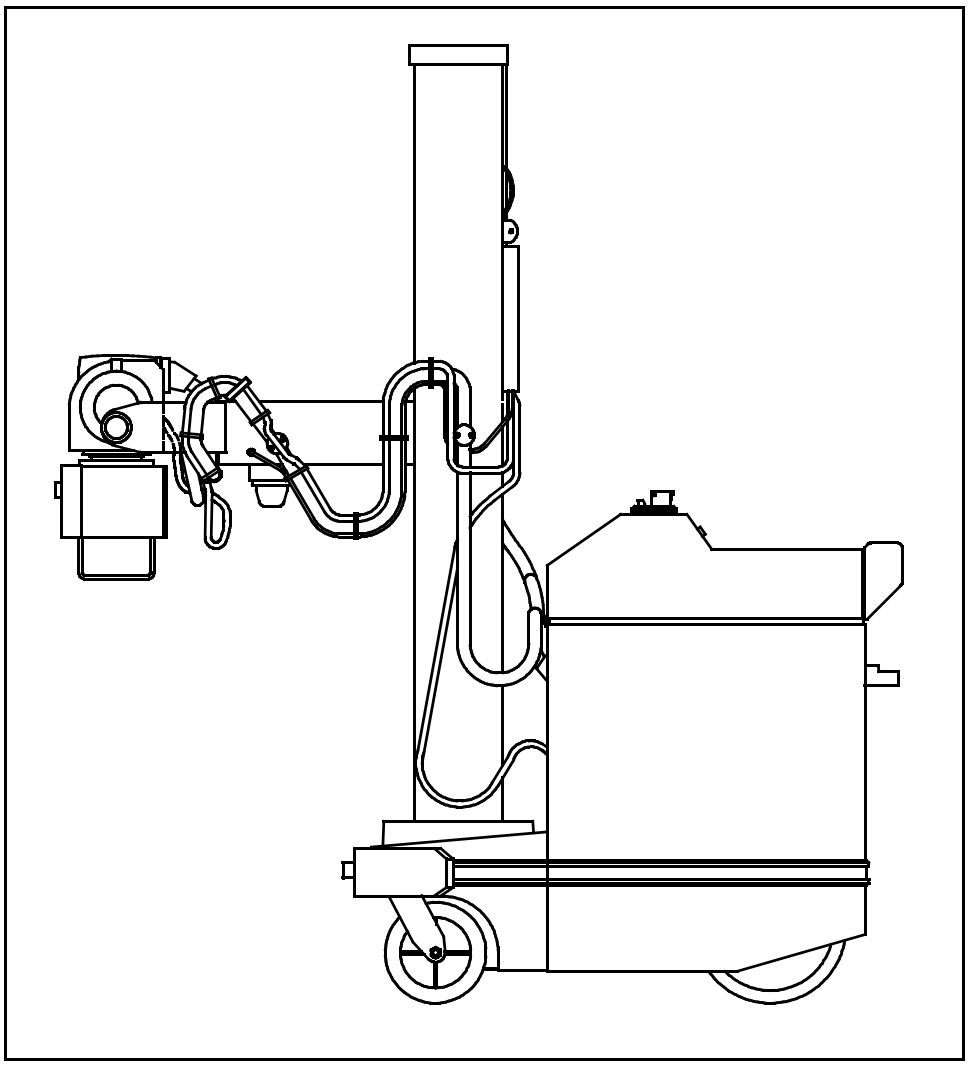
The drive automatically adjusts to your pace, and can be pushed forward, turned or pulled in reverse at speeds of up to 3 mph (4.8 km per hour).

A self-stopping bumper at the front of the unit automatically activates the brakes and turns off the drive motors upon impact, to help prevent accidents. If the bumper is engaged, simply grip the drive handle and pull the unit in reverse. (As with any mobile equipment, however, when driving the unit be sure to exercise reasonable care.)

With the telescoping arm extended for a patient exam, the AMX-4+ pivots on the spot, rotating and maneuvering easily for exact positioning. Again, grip the drive handle and turn the unit to the desired position.

AMX-4+ maneuvering speed is automatically reduced by 50 percent when the telescoping arm is extended.

ILLUSTRATION 4-2
ARM EXTENDED



Steps

To drive the AMX-4+, follow these steps:

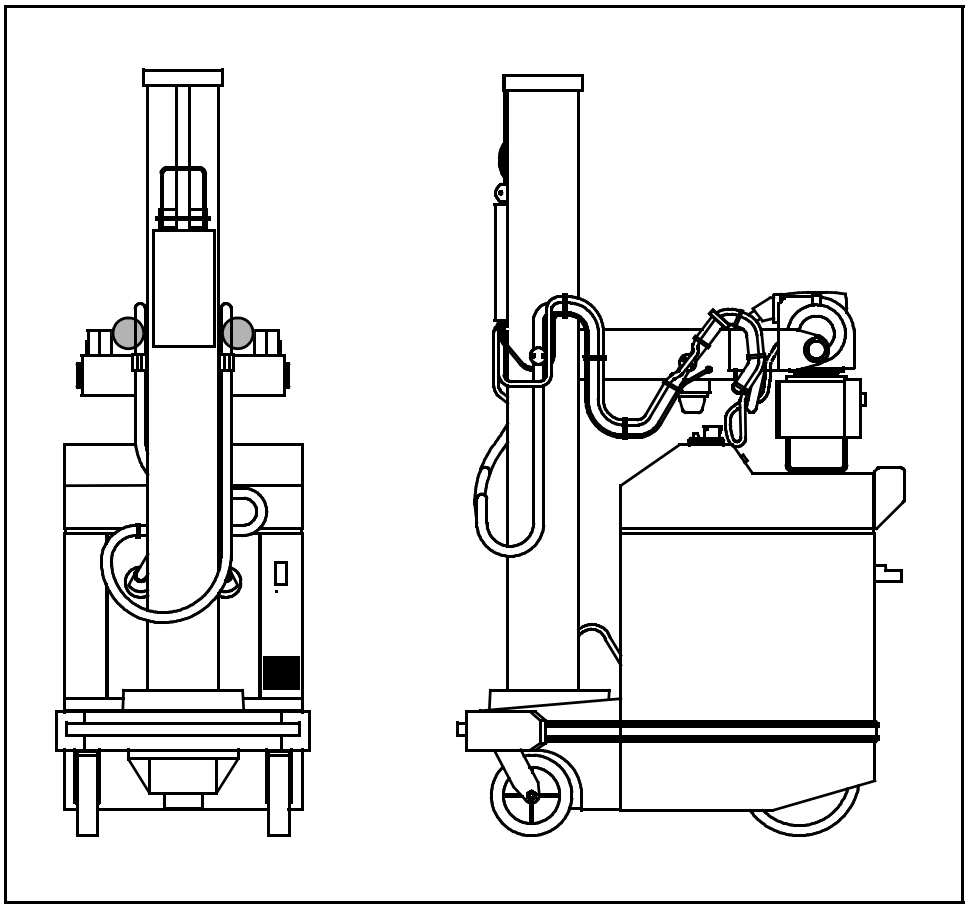
1. Make sure that the telescoping arm is in the *park/transport* position and that the battery charging cord is unplugged and fully retracted.
   - In the park/transport position the telescoping arm is:

     a.)*completely* pushed in;

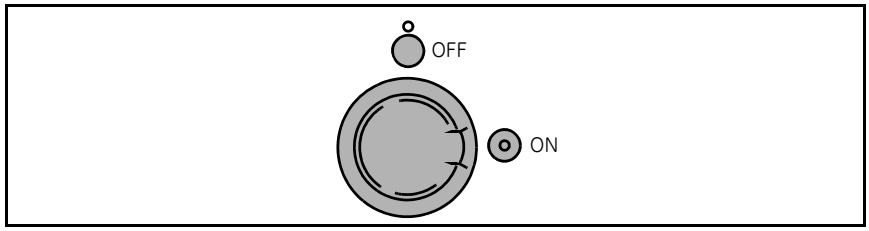
     b.)centered over the control panel (collimator skin spacers within well); and

     c.)securely latched. See Illustration 4-3.

ILLUSTRATION 4-3
PARK/TRANSPORT POSITION



2 Turn the keyswitch to **ON**, if necessary.

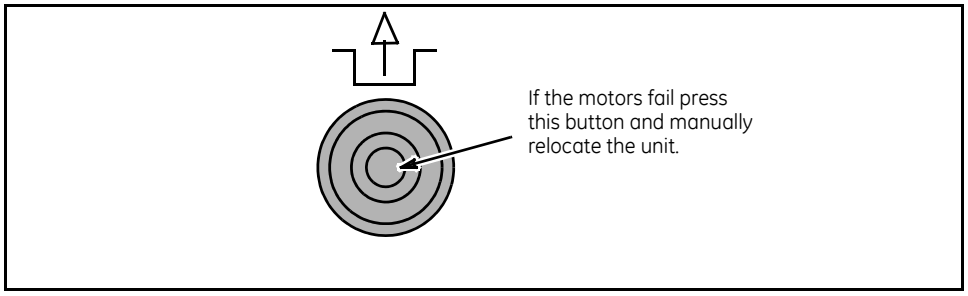


3 Grip the drive handle to activate the motors and disengage the brakes. Now simply steer the unit, like a shopping cart, to your destination.

- When climbing inclines or moving over carpeting or other rough surfaces the drive motors will automatically adjust to the floor surface.
- When descending inclines or pushing the AMX-4+ to make it go faster, it may stop and display the message **RELEASE HANDLE**. If this happens, release the handle to clear the message and then continue with normal operation.

4 To *stop* the unit and activate the brakes, release your grip on the drive handle. Remember that the self-stopping bumper, upon impact, will turn off the drive motors and activate the brakes.

- To reverse the unit, grip the drive handle and pull backwards. If the self-stopping bumper is engaged, after a brief pause reverse the unit.
- To turn a sharp corner or rotate the unit, push one side of the drive handle (to the right or left) and pull on the other. The unit will turn or pivot easily.



5 If the drive motors should fail, press and hold the **BRAKE RELEASE** button, located just below the **DRIVE HANDLE** on the left bracket. Manually relocate the unit, and call service.

SECTION 5
X-RAY PROCEDURE

Overview

In this section you'll learn how to setup and position mechanical components of the AMX-4+. Steps for mechanical positioning are organized in the following way.

- Adjustment of column and telescoping arm
- Rotation of X-ray tube unit, and
- Adjustment of collimator

You'll also learn how to select patient parameters (technique selection) and, finally, how to take an X-ray exposure.

5-1 Mechanical Setup

Steps

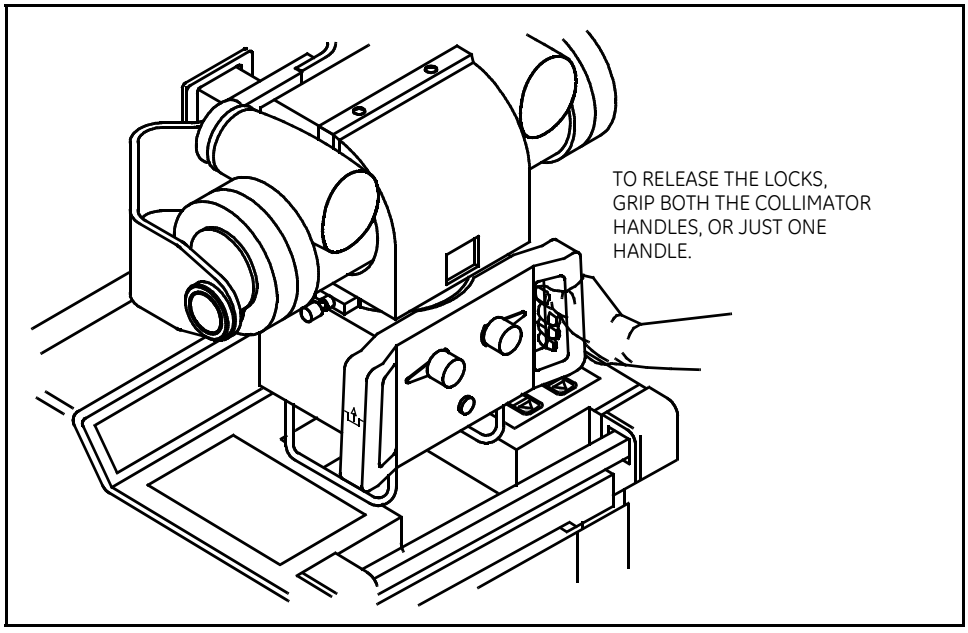
Follow these steps to release the latch, vertical column and telescoping arm locks from the park/transport position.

Make sure that the unit is turned **ON.**

5-2 Latch Lock Release

1. Grip the collimator handles to activate the switch. (You should hear a clicking sound.) With *slight* force, push the telescoping arm down to release latch and then raise up.
   - Note that you only need to grip *one* of the collimator handles to activate the lock release system. See Illustration 5-1.

ILLUSTRATION 5-1
LOCK RELEASE MECHANISM



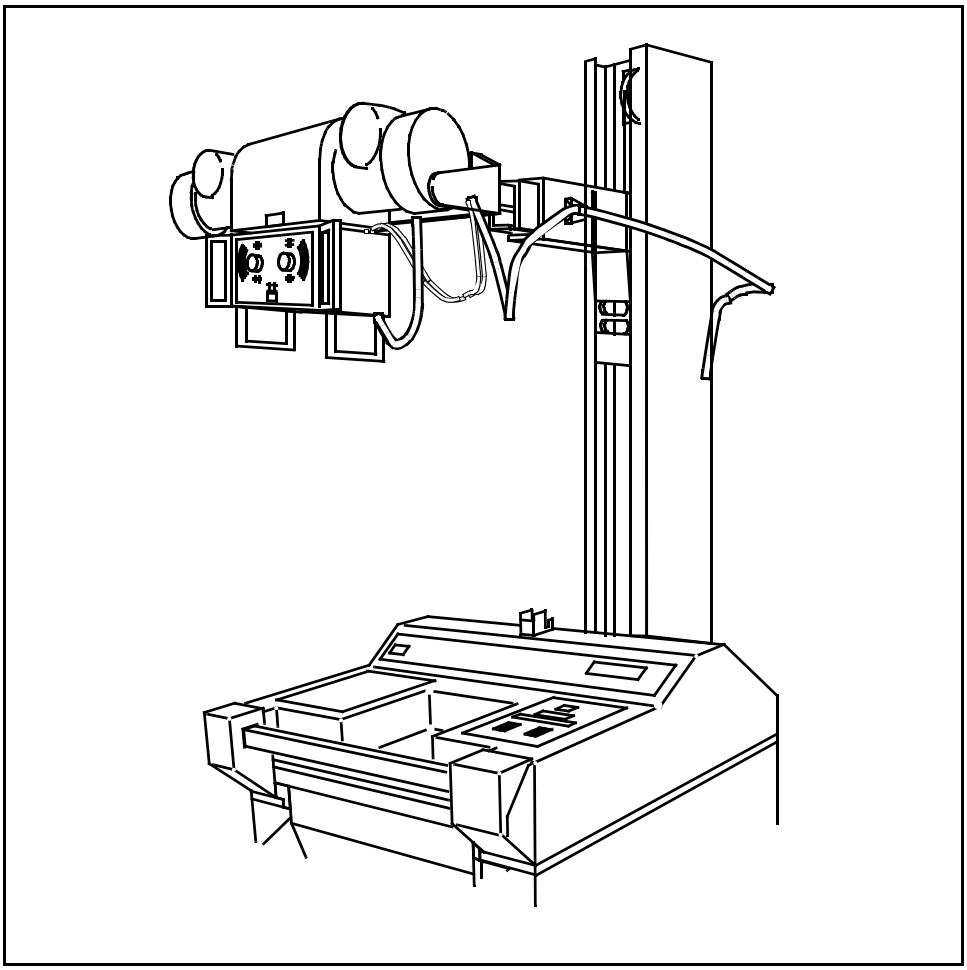
5-3 Adjustment of Column and Telescoping Arm

In the following steps you can free the AMX-4+ components for positioning in one of two ways: by gripping the collimator handle(s) to keep the lock system released or, whenever necessary, overriding the lock system with slight force.

When possible, we recommend that you use the lock release system.

1. Rotate the arm and vertical column assembly to *horizontally* position the telescoping arm. The vertical column can be rotated 270 degrees clockwise or counterclockwise (detent at 0 degree park location). See Illustration 5-2.
2. Raise the arm on the vertical column to the desired height.
3. Extend the retractable arm to the desired length and release. See Illustration 5-2.

ILLUSTRATION 5-2 |

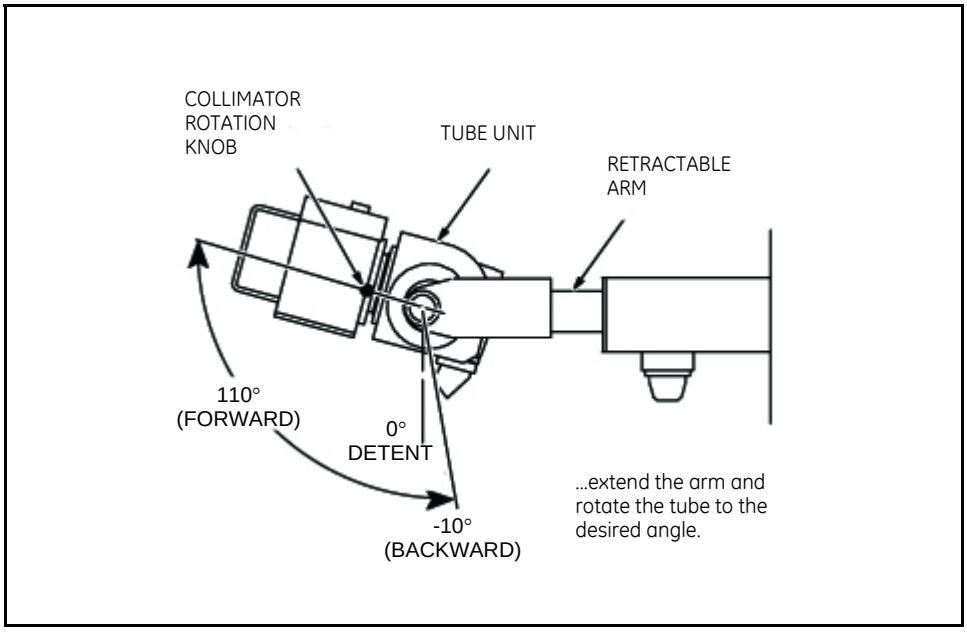


5-4 Tube Unit Rotation

Because the tube assembly is *counterbalanced*, no active lock is required. And little effort is needed to override friction and rotate the tube.

1. Use the collimator handles to position the tube to the desired angle.
   - You may rotate the tube in two directions:
     a.) clockwise and counterclockwise ±180 degrees (detents at every 90 degrees), or
     b.) backwards -10 degrees and forwards +100 degrees (detent at 0 degree). See Illustration 5-3.

ILLUSTRATION 5-3
TUBE ROTATION

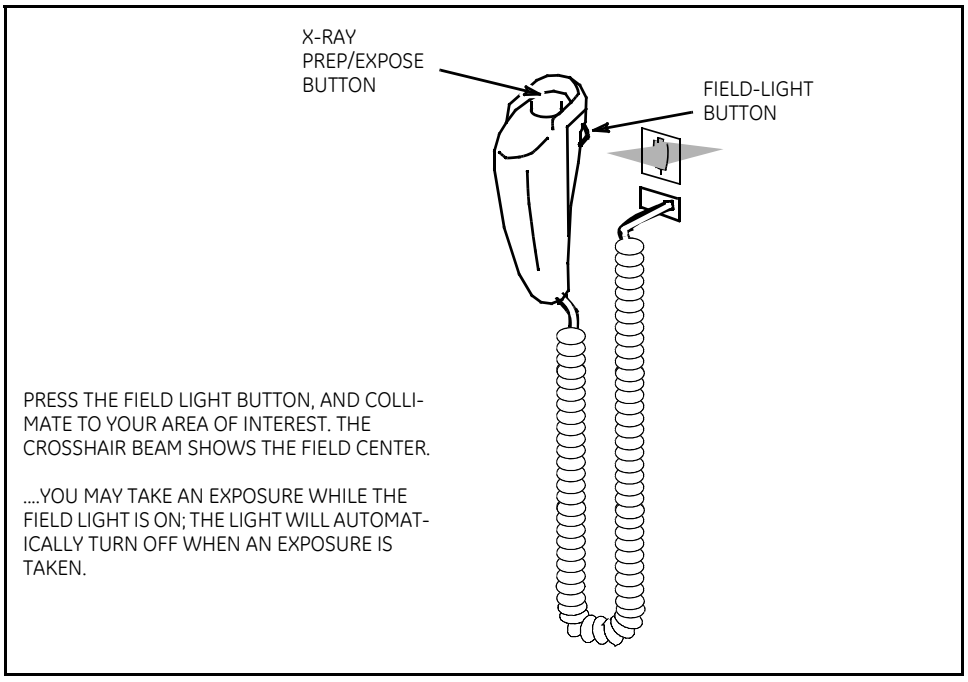


5-5 Adjustment of Collimator

The AMX-4+ manual collimator limits patient radiation exposure to a desired area at a given distance from the X-ray tube focal spot.

1. Press the field light button (on either the collimator face or handswitch) to activate the high-intensity field lamp. See Illustration 5-4.
   - The field light is timed and automatically turns off 30 seconds after you release the switch. To adjust the field light timer, contact your service representative.
   - To activate the field light for another 30 seconds, press the button again when the light goes out. (You may keep the field light on for up to 4 minutes. After 4 minutes, the field light will turn off for cooling and remain inactive for 5 minutes.)

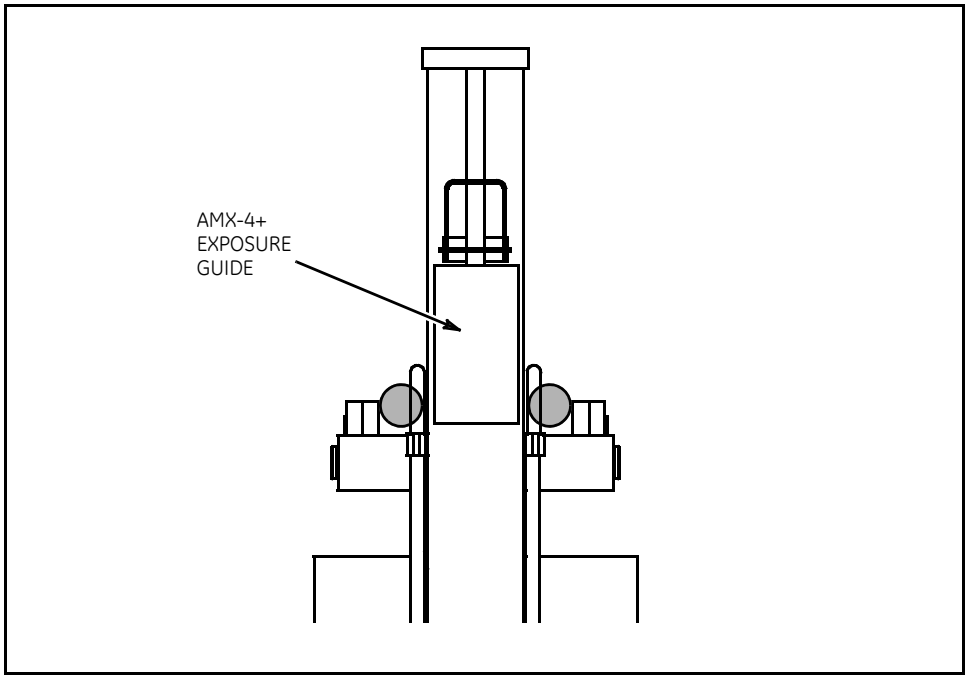
ILLUSTRATION 5-4



2 Position the collimator and tube using the field light and crosshair shadow as guides. The crosshair shows the field center. For fine positioning of the collimator, see Step 4.

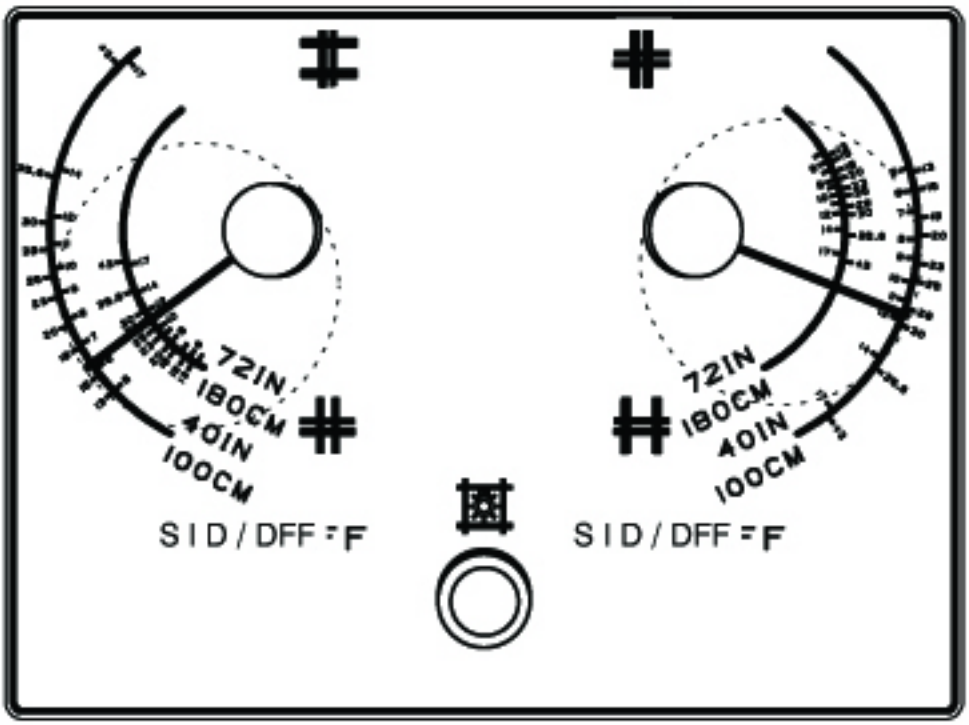
- Use the tape measure on the side of the collimator to measure the SID (source-to-image distance).
- Refer to the AMX-4+ Exposure Guide in the holder on the front of the column for suggested SID and exposure techniques. See Illustration 5-5.

ILLUSTRATION 5-5 |



3 Collimate by adjusting the size of the field with the two control knobs located on the front of the collimator. See Illustration 5-6.
- For fine positioning of the collimator, see Step 4
- The left knob controls the *transverse* dimension of the blades, and the right blade knob controls the *longitudinal* dimension of the blades. (A diagram on the face of the collimator shows which knob controls which dimension.) See Illustration 5-6.
- Field sizes from 0x 0 inches up to 17x17 inches (43x43 cm) at a 40 inch (102 cm) SID can be obtained. The knob selectors indicate the field size for a selected SID.
- Dial numbers on the calibrated scale are for 40 inch/100 cm and 72 inch/180 cm scale SIDs.

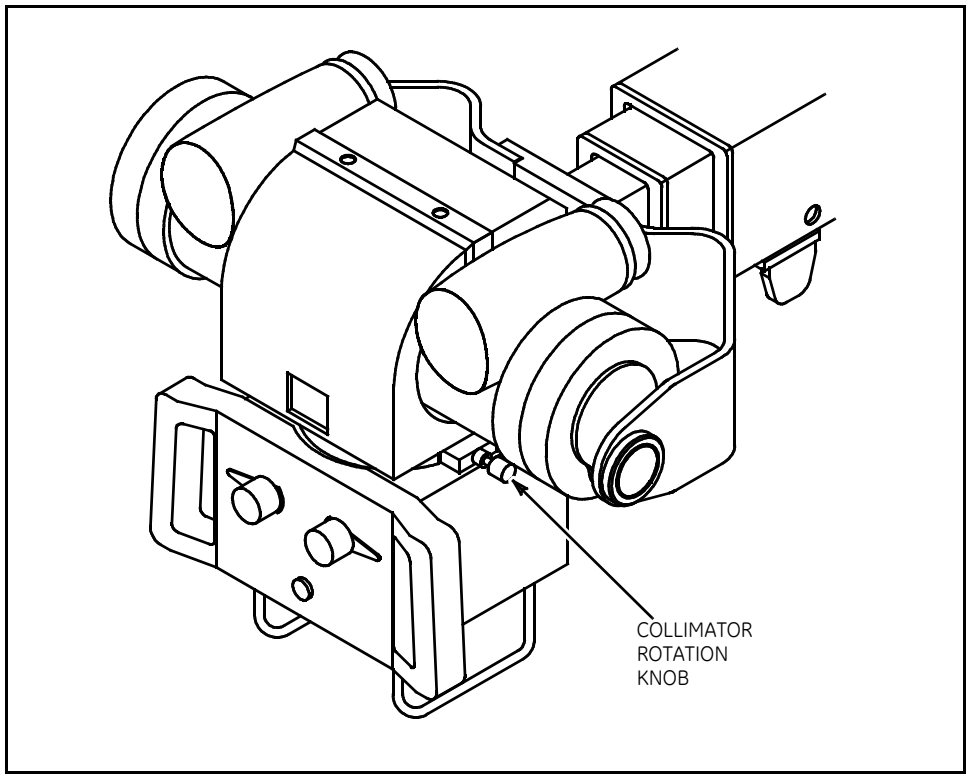
ILLUSTRATION 5-6



4 You may rotate the collimator about its vertical axis (that is, to the right or left) in two ways: by a simple 90× detent method or by a manual lock method for an angle other than 90×.
   - *90-degree detent method*: Pull out the knob (see Illustration 5-7) and rotate the collimator to the desired 90× detent position. The detent will snap in place and lock.
   - *Manual lock method:* Pull out the knob, position the collimator to the desired angle (other than 90× detent), and turn the knob clockwise to secure. (Turn the knob counterclockwise to unlock the collimator and reposition.)

5 Continue with *Technique Selection* in Section 5-6.

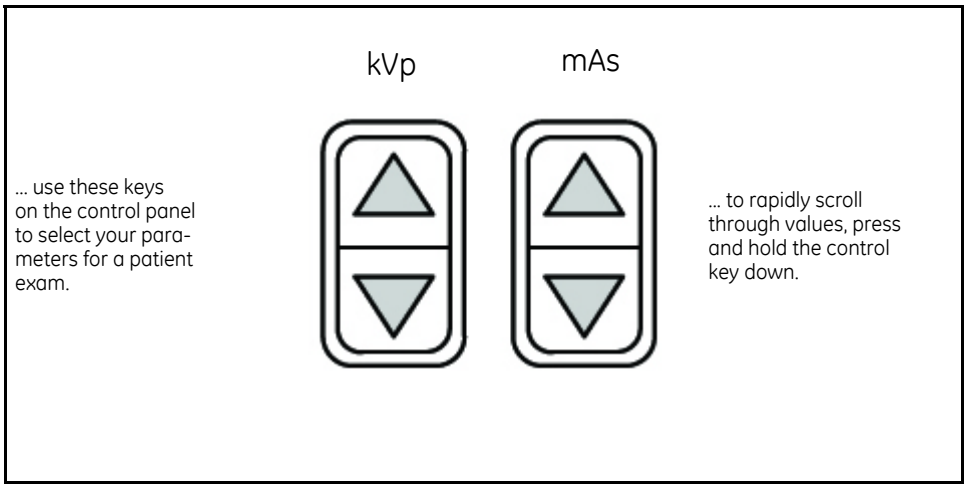
ILLUSTRATION 5-7



5-6 Technique Selection

Be sure to refer to the AMX-4+ Exposure Guide (found in the card holder attached to the vertical column) for suggested techniques.

ILLUSTRATION 5-8

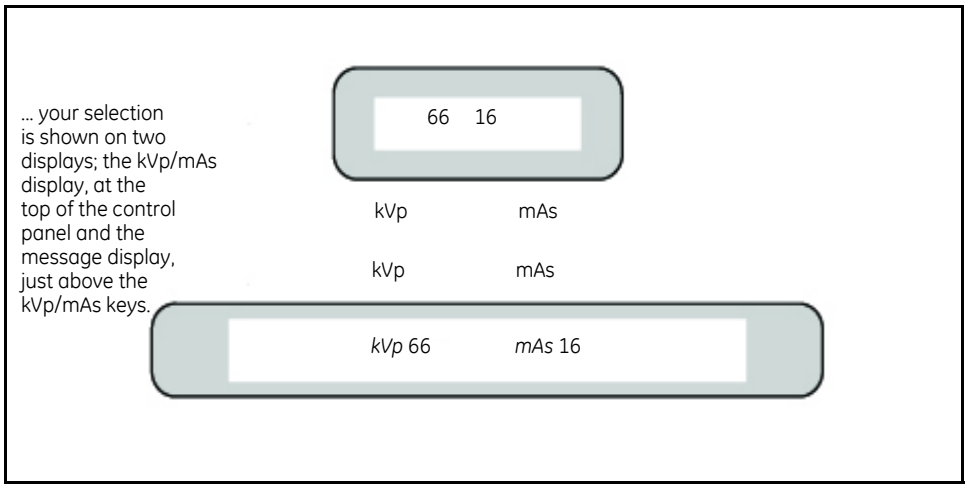


Steps

1 If you'd like to increase the kVp, press the **UP** kVp arrow. To decrease the kVp value, press the **DOWN** kVp arrow. See Illustration 5-8.

2 If you'd like to increase the mAs, press the **UP** mAs arrow. Press the **DOWN** mAs arrow to decrease the value.

ILLUSTRATION 5-9
TECHNIQUE CONSOLE DISPLAY



- Should you reach a maximum or minimum value, *kVp / mAs MAX or kVp / mAs MIN* will briefly appear on the message display to alert you.

IMPORTANT!: Carefully check the digital display (see Illustration 5-9) before making an exposure to ensure that the factors selected are those that are intended. Pay particular attention to the placement of the decimal point in the mAs setting to ensure that whole numbers are not mistaken for an intended mAs fractional number.

- The kVp ranges from 50 to 125 kVp, in 24 steps:

  50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 80, 85, 90, 95, 100, 105, 110, 115, 120 and 125.
- The mAs ranges from 0.40 to 320 mAs, in 30 steps:

  0.4, 0.5, 0.64, 0.8, 1, 1.25, 1.6, 2, 2.5, 3.2, 4, 5, 6.40, 8, 10, 12.5, 16, 20, 25, 32, 40, 50, 64, 80, 100, 125, 160, 200, 250 and 320. Refer to the chart below for maximum technique ratings.
-

Maximum kVp and mAs Ratings

kVp	mAs
110 to 125	200
95 to 105	250
50 to 90	320

- It's important to note that *the kVp setting takes precedence over your mAs setting.* That is, if your technique would generate too much heat for the X-ray tube anode, the mAs setting will automatically decrease to permit the selected kVp.

  For instance, if kVp is set at 110 then your maximum mAs will not exceed 200.

Note: The maximum allowable kVp and mAs ratings stated within this operation manual and as allowed by the equipment, may appear to exceed the tube ratings. (Reference Direction 46-017226, *Tube Ratings HRT X-ray Tube 50 & 60 Hz or* 2236721-100, *Product Data Sheet Maxiray 75 TH 11 X-ray Tube).* The reason for this apparent discrepancy is that the tube rating charts in Direction 46-017226 or Product Data Sheet 2236721-100 are based upon a 25% heated tube assembly (75% heat units remaining), while the actual maximum allowable kVp and mAs ratings are based upon a cold tube assembly. The AMX-4+ generator contains a proprietary heat loading algorithm which protects the tube assembly for all heat loading conditions.

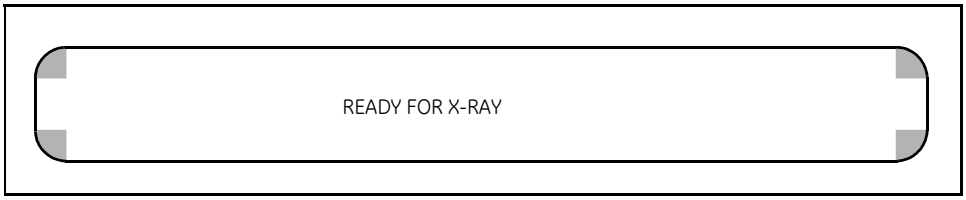
5-7 Taking Exposures

Check the battery status and message displays for battery condition. *It's important to note that you do not have to raise your kVp or mAs value to compensate for low battery voltage.*

Steps

Once you've positioned patient and cassette, selected technique and the proper safety precautions are taken, follow these steps.

1 Remove handswitch from saddle. Press the handswitch button half way to the **PREP** position. Accelerating the rotor to proper speed takes about 2.5 seconds.



- *READY FOR X-RAY* will appear on the message display.

Note: You may, if you wish, press the button all the way down to take an exposure. The 2.5 second prep cycle is automatic. (If **PREP/EXPOSE** positions are pressed simultaneously, *READY FOR X-RAY* will not display.)

2 Press the **PREP/EXPOSE** button all the way down to take an exposure. (An audible tone will sound, and the **X-RAY** indicator will light up.)
- If an exposure isn't taken within 30 seconds of pressing **PREP**, release and repeat the prep cycle. (Release the **PREP/EXPOSE** button, and press to prep position again.)
- If the message *WAIT* appears, you may still take another exposure. Although, because of insufficient recovery time, the selected technique may be inaccurate. (Refer to *Messages On Display* in this manual for a complete description of all X-ray messages.)
- *HEAT WAIT* displays when the tube anode is cooling. No exposures can be taken while this message appears. (The length of the delay will vary with the selected technique.) If an exposure is attempted while *HEAT WAIT* is active *X-RAY DISABLED* will be displayed.
- The kVp/mAs Numeric Display will flash for about 6 seconds after the release of the handswitch from the **PREP** position, if an exposure has occurred.

3 Secure the unit for transport when the exam is complete.

SECTION 6
CHARGING THE BATTERIES/CAPACITY GAUGE OPERATION

Overview

Battery charging is as easy as driving the AMX-4+ to a correctly rated wall outlet and plugging the unit in. Ratings are as follows:

- For Models 2169360-7,-8,-9,-10, 2236420-7,-8,-9,-10, 2275938-7,-8,-9,-10: 120 Volts AC, 60 Hz at 6A.
- For Models 2169360, 2169360-2,-3,-4, 2236420, 2236420-2,-3,-4, 2275938, 2285938-2,-3,-4,-12,-13,-14,-15: 220/240 Volts AC, 50 Hz at 3.15A.
- For Models 2169360-5,-6, 2236420-5,-6, 2275938-5,-6: 100 Volts AC, 50/60 Hz at 6A.

The time required to fully recharge the AMX-4+ batteries will vary according to battery charge level as indicated on the battery status display.

During recharge the AMX-4+ capacity gauge increases as the unit is charged. To recharge from 10% to 100% typically requires 4-5 hours.

Occasionally the AMX-4+ automatically performs an extended charge to make sure that all portions of the battery's internal plates get fully charged. This extended charge occurs every twentieth time the battery is charged.

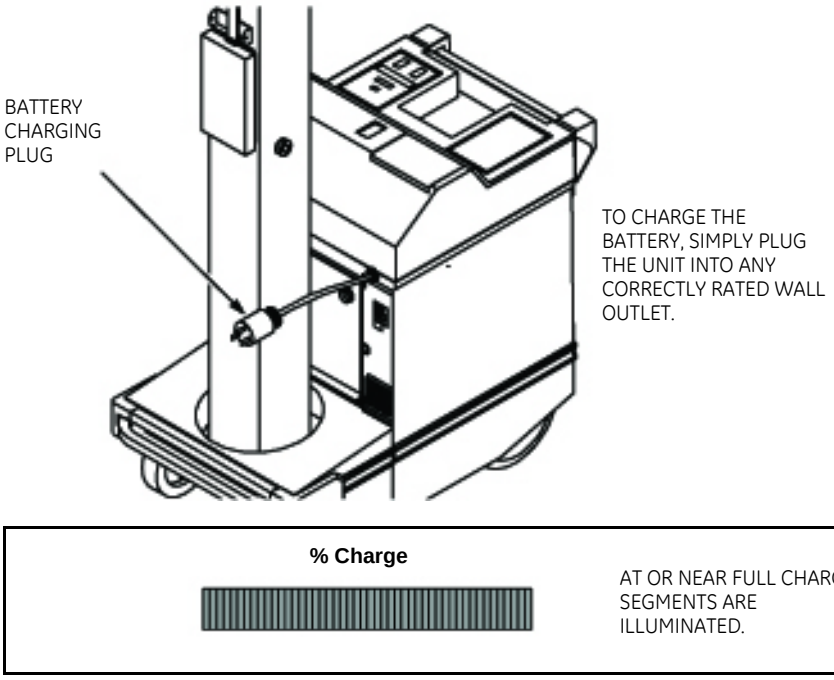
To recharge from 10% to 100% during an extended charge typically requires 10 hours. The AMX-4+ will continue to attempt extended charges until at least half of the extended charge time is complete.

Note: The extended charge will be transparent to the operator. The only indication that it is in progress is the longer charge time.

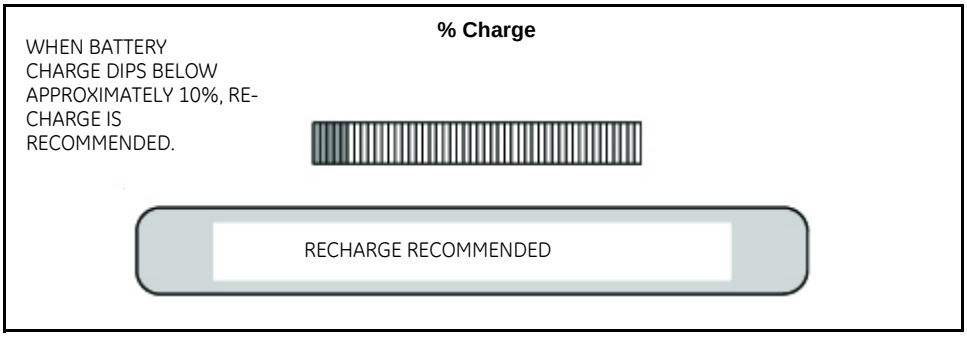
Although portable application will vary site to site, under most operating conditions, a fully charged AMX-4+ is designed to supply enough charge for a typical 8-hour shift.

The AMX-4+ capacity gauge visually displays the remaining capacity using a 48 segment bargraph display.

ILLUSTRATION 6-1



The blue battery status display approximates remaining battery charge, and should only be used to gather information as to the relative state of charge.



As the AMX-4+ is used in its various modes of operation, the number of segments lit will slowly decrease.

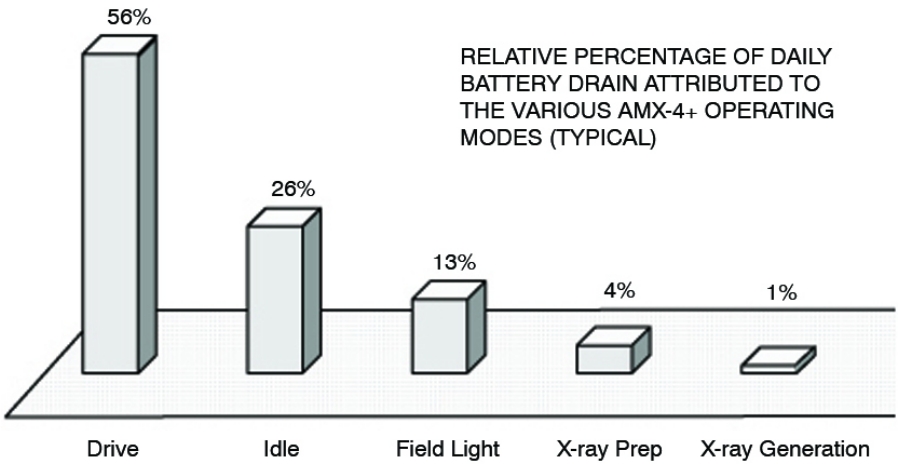
It's important to note that you *do not have to raise your kVp and mAs value* to compensate for low battery voltage.

Should the battery charge dip below approximately 10% of full capacity, *RECHARGE RECOMMENDED* will flash on the message display. (If *all* segments are extinguished, the message *RECHARGE IMMEDIATELY -- X-RAY INHIBITED* displays.)

To ensure maximum battery life, the AMX-4+ should not be recharged until at least one-half of the bar graph segments have extinguished.

Illustration 6-1 shows how much of the battery's capacity is used for the various AMX-4+ operating modes on a relative basis.

ILLUSTRATION 6-2



As Illustration 6-2 demonstrates, the majority of the battery pack's capacity is used for drive and idle. Thus, reducing the amount of drive time by parking the AMX-4+ in a central location and turning the system OFF when not in use will make more capacity available for X-ray generation and will increase the service life of the batteries.

Note: See the Ratings and Specification Section, 9-7 for more detail on how total AMX-4+ battery capacity is determined.

Bar Graph Display vs Battery Loading

Table 6-1 details the various battery loads and how they affect the bar graph display.

TABLE 6-1

LOAD MODE	APPROXIMATE DISCHARGE RATE	TYPICAL DAILY USAGE*
Idle (AMX-4+ on but not in use)	0.04 segments/minute	6 segments
Drive (Drive handle engaged)	0.4 segments/minute	13 segments
Field Light (Any time light is ON)	0.3 segments/minute	3 segments
X-Ray Prep (PREP switch depressed)	0.4 segments/minute	1 segment
X-Ray (High voltage generation)	0.0005 to 0.8 segments/exposure	0 segments
TOTAL DAILY SEGMENTS TURNED OFF:		23 segments (48%)
* - Based on data from a number of actual AMX-4 sites.		

Capacity Gauge Features

"STUCK AT FULL" FEATURE

After the AMX-4+ charges to 100% (i.e. "CHARGE COMPLETE"), the capacity gauge will remain "stuck-at-full" for a pre-programmed amount of usage before the number of lit segments begins to decrease. This usage is equivalent to approximately 10 minutes of drive or 100 minutes of idle. Once this "stuck-at-full" capacity is used, the capacity gauge will update according to Table 1.

EMERGENCY CAPACITY FEATURE

When the AMX-4+ capacity gauge drops to 0%, inhibiting X-ray exposures, it is possible to access some emergency capacity to **finish** an exam by turning the AMX-4+ off and then back on. After it has completed its power-up tests, the AMX-4+ will provide enough capacity for approximately 45 seconds of usage before X-ray exposures are again inhibited.

CAUTION

In some cases the AMX-4+ battery may not provide sufficient voltage for proper operation when EMERGENCY CAPACITY is used. Therefore this feature should only be used when absolutely necessary.

6-1 Application Tip

To insure the greatest reliability, you may decide to establish a battery charging schedule at your particular site, based on past experience and anticipated needs.

Steps

Follow these steps to recharge the batteries.

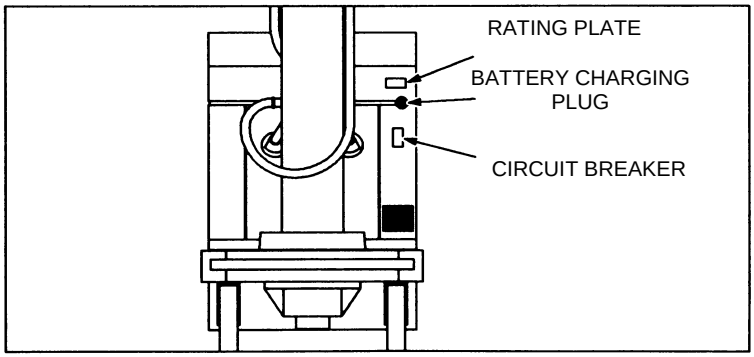
CAUTION

When recharging the batteries, always locate the unit in a well ventilated area.

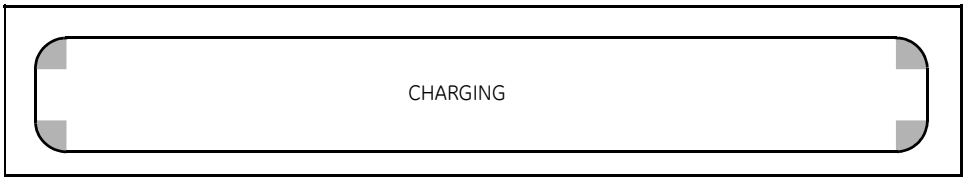
1 Drive the AMX-4+ to a designated battery charging station or to a correctly rated wall outlet. A rating plate is located on the front of the unit, above the battery plug. (See Illustration 6-3.) Position the unit to within 10 feet of the outlet.

2 To plug in, firmly grip the plug located on the front of the unit, and pull the retractable cord straight out until it is fully extended. Set the cord by a slow pull-release action. Plug into the battery charging station.

ILLUSTRATION 6-3



3 Check the message display to confirm the charging status: the message *CHARGING* should appear on the display.



- During charging all other controls, driving and X-ray exposures, for instance, are disabled. Note that you may charge the batteries with the **KEYSWITCH** in either the **ON** or **OFF** position.

4 When *CHARGE COMPLETE* appears on the message display, and all blue segments are illuminated, the batteries are fully charged (at 100% of capacity).

5 Unplug the unit from the outlet, giving the plug a slight tug to release from take-up reel.

Important: After unplugging the unit, turn the unit on and wait approximately 15 minutes before taking your first exposure to ensure technique accuracy.

- You may leave the unit in the charge position indefinitely, if you wish, without damaging the equipment.
- The prompt **BATTERY TOO HIGH** may display when the first exposure is attempted after charging. If this occurs, run the rotor for 15 to 20 seconds and then make the exposure. This prompt is caused by a normal battery voltage rise after charging.

SECTION 7
MAINTENANCE AND SERVICE

7-1 Cleaning the Unit

We recommend that you clean the AMX-4+ regularly with a soft cloth and a mild, non-abrasive cleaner. Apply the cleaner to the cloth, not directly to the unit, to safeguard against damage to the circuitry. If a corrosive chemical is spilled or splashed on the unit surface, be sure to clean it off immediately.

7-2 Hand Switch Cleaning and Disinfecting Instructions

SAFETY PRECAUTIONS - Before you begin:

- Disconnect the hand switch cord from the body of the hand switch before performing the maintenance/cleaning procedures.
- Never use solvents or flammable solutions to clean the hand switch.
- Never use dripping cloth (or) immerse hand switch in water or cleaning solutions.

Approved Cleaners

The cleaners listed below are approved to clean the hand switch:

- Bleach 50% mix with water (5–8% household Bleach)
- Glutaraldehyde <5%, Polyethylene Glycol <20% (tested as Cidex Plus 28)
- Isopropyl Alcohol 70% concentration
- Hydrogen Peroxide 15–40% concentration

CAUTION: **Never use cleaners or solvents of any kind if you are uncertain of the nature of the cleaning agent. The hand switch should be cleaned using EPA cleared and EPA registered high-level disinfecting agents.**

7-3 Main Power Circuit Breaker

The main power circuit breaker is located on the front right side of the unit. Refer to Illustration 6-3.

If the battery charge is too low, or in the event of an overload in the high-voltage system, the circuit breaker will *trip* (interrupt power to the X-ray unit).

Should the circuit breaker trip, the control panel lights will go out and you'll be prevented from operating the unit. To resume operation, flip the circuit breaker up to the **ON** position.If necessary, recharge the unit or (if the battery is adequately charged) try the procedure again.

If the battery is within operating condition (as indicated by the battery status and message displays) and power interruptions are frequent, there may be a fault in the high voltage system. If a fault is indicated, have the unit checked by a qualified service representative.

If the unit does not turn off when the keyswitch is turned off, isolate the unit to prevent unauthorized operation, use the circuit breaker to remove power from the unit, and have the unit checked by a qualified service representative.

7-4 Periodic Maintenance by Service Personnel

To insure the continued safe performance of your AMX-4+ portable X-ray unit, establish a periodic maintenance program with a qualified service representative.

Periodic maintenance checks are required thirteen months after installation and every year thereafter. A periodic maintenance schedule and a sample mAs/kVp accuracy chart are provided on the following pages.

7-5 Qualified Service Available

GE Medical Systems, and its associates maintain a worldwide organization of service personnel specially trained on medical X-ray equipment. Consult your GE representative to find out more about all the available service programs.

Table 7-1
PERIODIC MAINTENANCE SCHEDULE

Maintenance/Checks	Frequency
Replace counterweight cable	Every 5 years
Inspect counterweight cable	Every year (Refer to Appendix 6 of 2173227-100, *AMX-4+ Periodic Maintenance*)
Replace hand switch	Every 3 years
Verify no movement between collimator and tube unit	Every 12 months, verify that there is no movement between the collimator and X-ray tube. If any movement is detected, you **MUST** remove the collimator and inspect all related fasteners. Refer to Direction 2173225-100, *AMX-4+ Service* for additional information.
Extension arm inspection	Every year (Refer to Section 3-3 in Direction 2173224-100, *AMX-4+ Functional Check*)
Collimator general inspection and adjustment	Every year (Refer to Section 3-4 in Direction 2173224-100, *AMX-4+ Functional Check*)
Filament and rotor interlocks	Every year (Refer to Section 3-5, Direction 2173224-100, *AMX-4+ Functional Check*)
X-ray tube anode rotation	Every year (Refer to Section 3-5, Direction 2173224-100, *AMX-4+ Functional Check*)
Column and carriage assembly inspection	Every year (Refer to Section 3-3 in Direction 2173224-100, *AMX-4+ Functional Checks*)
mAs accuracy	Every year (Refer to Appendix 4, Direction 2173227-100, *AMX-4+ Periodic Maintenance*)
kVp accuracy	Every year (Refer to "kVp Accuracy and Indirect Linearity" (Test 3-3) in Tab 3 of Direction 46-013894, *System Field Test for HHS)*
Operator displays	Every year (Refer to "Generator Operator Indicators" (Test 3-1) in Tab 3 of Direction 46-013894, *System Field Test for HHS)*
Cross hair	Every year (Refer to Appendix 3, Direction 2173227-100, *AMX-4+ Periodic Maintenance*)
Collimator alignment	Every year (Refer to Appendix 3, Direction 2173227-100, *AMX-4+ Periodic Maintenance*)
Equipment and Serial Number: Date of Inspection: _ Maintenance Check Performed By:	

Maintenance/Checks	Frequency
Field size indicator	Every year (Refer to Appendix 3, Direction 2173227-100, *AMX-4+ Periodic Maintenance*)
Rotational detent	Every year (Refer to Section 3-4, Direction 2173224-100, *AMX-4+ Functional Check*)
Exposure tone is audible and X-ray on indicators light up when handswitch depressed to expose position	Every year
Auxiliary items (battery charger, HV cables, etc.)	Every year
Equipment and Serial Number: Date of Inspection: _ Maintenance Check Performed By:	

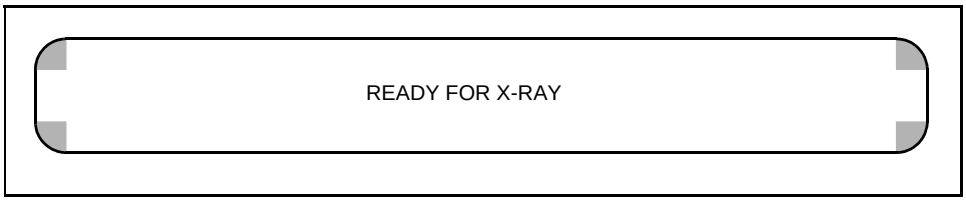
Table 7-2
SAMPLE CHART FOR TECHNIQUE ACCURACY TESTS

Technique Selected				
mAs	**kVp**	**Primary Volts**	**kVp**	**Time (Sec.)**

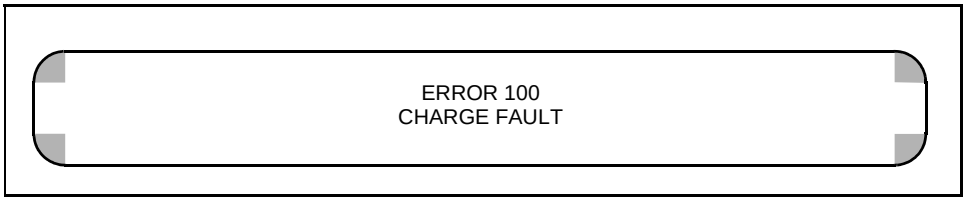
SECTION 8
MESSAGES ON DISPLAY

Two kinds of messages can appear on the message display on the control cover: *status* messages and *error* messages.

Status messages simply inform you of the operating condition of the AMX-4+, and look something like this.



Another type of message, called an error message, may appear should a problem occur with the equipment. An error message looks something like this.



Note that an error message includes an alphanumeric code, and will display one line at a time.

If an error message appears, follow these steps.

1 Try the function again. If the problem is corrected, and no error message is displayed, proceed as usual.

2 If the error message still displays, turn the unit **OFF** then back **ON**.

- Diagnostics or self-tests are quickly performed when the unit is turned back on.
- When diagnostics are complete, the following message displays:
  ERROR XXX
  OCCURRED WHEN
  THE UNIT WAS
  LAST OPERATED --
  PROCEED WITH
  --- CAUTION ---

3 Now try the function once more. If the problem is corrected, and no error message is displayed, proceed as usual.

4 If the problem persists, call your service representative, and report the code and message shown on the display. This will prepare service for the type of problem encountered and the service required.

On the following pages, we'll list the status messages and include a brief explanation of each one.

Status Messages	Description
AUTO CAL LIMIT	If this message displays, the unit is at its automatic calibration limit. A service call is recommended to ensure accurate technique and radiographic results. Exposures are not inhibited.
BATTERY TOO HIGH VOLTAGE RECOVERY IS REQUIRED	This message may appear when attempting to take a high technique exposure immediately after removing the unit from charge. Exposure is prevented. Operating the field lamp or driving the AMX-4+ will assist in stabilizing the battery voltage so that the exposure may be made.
BATTERY TOO LOW CHARGE REQUIRED	This message may appear when attempting to expose while only a few segments remain on the battery charge indicator. Exposure is prevented. Recharging the batteries will eliminate the message and allow exposures.
CHARGE COMPLETE	The charge process is complete, and the battery is fully recharged.
CHARGING	The unit is charging.
DRIVES ONLY	All modes are disabled except drive. Service is required.
HEAT WAIT	No exposures can be taken while this message appears (The length of the delay will vary with the selected technique). This message displays while the tube anode is cooling.
kVp MAX	Displayed on the alphanumeric display any time an attempt is made to increase the kVp above 125.
kVp MIN	Displayed on the alphanumeric display any time an attempt is made to decrease the kVp below 50.
LIGHT DISABLED FOR COOLING	If the field light is on for over 4 minutes, the light will be automatically turned off to prevent the collimator from overheating. You may activate the field light in about 5 minutes.
mAs MAX	Displayed on the alphanumeric display any time an attempt is made to increase the mAs above 320 or above the acceptable energy limit for the X-ray tube anode. The acceptable heat limit is based on the kVp you selected. Note that the kVp setting will always take precedence over the mAs setting. That is, if the technique selected would generate too much X-ray tube heat, the maximum mAs will automatically decrease to permit the selected kVp.
mAs MIN	Displayed on the alphanumeric display any time an attempt is made to decrease the mAs below 0.40.

Status Messages Description

READY FOR X-RAY	The prep cycle has successfully completed, and an exposure may be taken within the next 30 seconds. (If an exposure is attempted after 30 seconds, the prep cycle must be repeated.)
RECHARGE IMMEDIATELY - X-RAY INHIBITED	The estimated usable battery capacity is near 0%. No more exposures may be taken. Although charge is too low to complete an x-ray exam, you'll have enough energy to drive the unit to a correctly rated wall outlet for recharge.
RECHARGE RECOMMENDED	The remaining battery capacity is approximately 10% or less.
RELEASE HANDLE	The AMX-4+ was moving faster than the drive motors allow. Release the Drive Handle to clear the message, and then continue with normal operation. This may happen if you push the AMX-4+ too hard when driving down a ramp.
RELEASE PREP SW	The prep switch is still depressed (five seconds after an exposure or beyond the 30-second timeout). If taking an exposure, repeat the prep cycle: 1) release the prep switch, and 2) when the message WAIT is no longer displayed, press to prep position again.
RESET AEC CNTROL	Reset the AEC controller. AEC is on, but not enabled. For Example: The (**ON**) light is flashing on the Automatic Exposure Control (AEC) unit. This indicates the paddle is not connected. Reset the AEC controller. The red reset (**GEN**) on the Automatic Exposure Control (AEC) unit is lit. This indicates the back-up time is too short. Reset the AEC controller.
REVERSE ONLY	Forward drive is prevented because the safety bumper is in contact with another object. Reverse the unit before proceeding.
TESTING COMPLETE	Power-up diagnostic testing is finished.
WAIT	Wait before taking another exposure. (Displayed when the tube anode has cooled, but before the battery has recovered from the previous exposure.) Although radiographs can be taken, because of low battery voltage they may not achieve the desired kVp technique accuracy.
WAIT/ACT-XX.X	After an AEC exposure the XX.X field will display the actual exposure mAs.
X-RAY DISABLED	This message appears if an attempt to make an exposure occurs while **HEAT WAIT** is displayed.
X-RAY TUBE PARKED	No exposures can be taken with the X-ray tube in the park/transport position.

SECTION 9
SYMBOLS

9-1 IEC Classification

In accordance with International Safety Standard IEC 601, the AMX-4+ Mobile X-ray Unit is classified as Type B Equipment, Class I Equipment, Internally Powered Equipment, Ordinary Equipment and continuous operation.

Type B Equipment provides an adequate degree of protection against electric shock, in particular regarding:

- allowable leakage current,
- reliability of the protective earth connection.

In accordance with International Safety Standard IEC 601, the manufacturer is not responsible for any consequences caused by unauthorized modification of this equipment.

This equipment is not suitable for use in the presence of flammable gas.

There are no user replaceable parts in this unit. This would include the cord reel, as well as any other mains or secondary part.

9-2 Earth Leakage Current

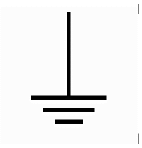
The AMX-4+ Mobile X-ray Unit complies with (Class I - Type B) standards.

9-3 Applicable IEC Symbols

Protective earth (ground). Identifies any terminal which is intended for connection of an external protective conductor to protect against electrical shock in case of a fault.

This symbol on the equipment means that the accompanying operating instructions **should be consulted** to assure safe operation.

Dangerous voltage. Indicates an avoidable dangerous high voltage hazard.



Functional Earth (ground) Terminal. Terminal directly connected to a point of a measuring supply or control circuit or to a screening part which is intended to be earthed for functional purposes.

Indicates **non-ionizing radiation** is present.

Indicates **radiographic control**.

Indicates **ionizing radiation** is present.

X-ray emission. X-ray tube head is emitting X-rays. Take adequate precautions to prevent the possibility of any persons carelessly, unwisely, or unknowingly exposing themselves or others to radiation.

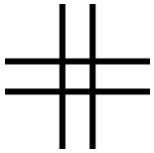
Battery power on. This does not apply mains voltage.

Battery power off. This does not remove mains voltage.

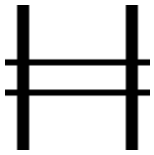
Indicates positioning lock or brake release.

Indicates terminal and receptacle location for hand-held radiographic and light field control.

Control for indicating radiation field by using light.



Collimator blades closed. The controlled blades are shown in thicker lines.



Collimator blades open. The controlled blades are shown in thicker lines.

Alternating Current. Indicates equipment that is suitable for alternating current only.

This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.

SECTION 10
OPTIONS

10-1 Dose Area Product (DAP) Meter

Full field ion chamber with an integral display unit. The display unit contains electronics controlling total dose area product, system reset and system test.

- Provides easy to read real time information on patient dose.
- Allows for simple manual transcription of this information into patient records.

10-2 Mobil-AIDTM Automatic Exposure Control (AEC)

A fully integrated automatic exposure control option is available with the AMX-4+. Mobil-AID™ further simplifies use by automatically controlling radiographic exposures.

10-3 Remote Control Handswitch

AMX-4+ is available with TechSwitch™, a cordless handswitch option that enables even greater procedural flexibility and radiation protection to the Technologist.

SECTION 11
ENVIRONMENTAL CONDITIONS

Table 11-1
ENVIRONMENTAL CONDITIONS

System operating environmental temperature	15°C to 38°C / 59°F to 100°F
Storage environmental temperature	-40°C to 60°C / -40°F to 140°F
Operating ambient humidity	10% to 80% relative humidity, non-condensing
Non-operating ambient humidity	5% to 95% relative humidity, non-condensing
Operating ambient atmospheric pressure	106.2 kPa down to 70.0 kPa (maximum rate of change of atmospheric pressure less than 1.8 kPa/hour)
Non-operating ambient atmospheric pressure	106.2 kPa down to 50 kPa (maximum rate of change of atmospheric pressure less than 76 kPa/hour)

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