



GE Medical Systems

Technical Publications

Direction 2115681-100

Revision 3

AMX-4 Service (Model 2115090 Series)

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Operating Documentation

WARNING

- THIS SERVICE MANUAL IS AVAILABLE IN ENGLISH ONLY.
- IF A CUSTOMER'S SERVICE PROVIDER REQUIRES A LANGUAGE OTHER THAN ENGLISH, IT IS THE CUSTOMER'S RESPONSIBILITY TO PROVIDE TRANSLATION SERVICES.
- DO NOT ATTEMPT TO SERVICE THE EQUIPMENT UNLESS THIS SERVICE MANUAL HAS BEEN CONSULTED AND IS UNDERSTOOD.
- FAILURE TO HEED THIS WARNING MAY RESULT IN INJURY TO THE SERVICE PROVIDER, OPERATOR OR PATIENT FROM ELECTRIC SHOCK, MECHANICAL OR OTHER HAZARDS.

AVERTISSEMENT

- CE MANUEL DE MAINTENANCE N'EST DISPONIBLE QU'EN ANGLAIS.
- SI LE TECHNICIEN DU CLIENT A BESOIN DE CE MANUEL DANS UNE AUTRE LANGUE QUE L'ANGLAIS, C'EST AU CLIENT QU'IL INCOMBE DE LE FAIRE TRADUIRE.
- NE PAS TENTER D'INTERVENTION SUR LES ÉQUIPEMENTS TANT QUE LE MANUEL SERVICE N'A PAS ÉTÉ CONSULTÉ ET COMPRIS.
- LE NON-RESPECT DE CET AVERTISSEMENT PEUT ENTRAÎNER CHEZ LE TECHNICIEN, L'OPÉRATEUR OU LE PATIENT DES BLESSURES DUES À DES DANGERS ÉLECTRIQUES, MÉCANIQUES OU AUTRES.

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- DIESES KUNDENDIENST-HANDBUCH EXISTIERT NUR IN ENGLISCHER SPRACHE.
- FALLS EIN FREMDER KUNDENDIENST EINE ANDERE SPRACHE BENÖTIGT, IST ES AUFGABE DES KUNDEN FÜR EINE ENTSPRECHENDE ÜBERSETZUNG ZU SORGEN.
- VERSUCHEN SIE NICHT, DAS GERÄT ZU REPARIEREN, BEVOR DIESES KUNDENDIENST-HANDBUCH NICHT ZU RATE GEZOGEN UND VERSTANDEN WURDE.
- WIRD DIESE WARNUNG NICHT BEACHTET, SO KANN ES ZU VERLETZUNGEN DES KUNDENDIENSTTECHNIKERS, DES BEDIENERS ODER DES PATIENTEN DURCH ELEKTRISCHE SCHLÄGE, MECHANISCHE ODER SONSTIGE GEFAHREN KOMMEN.

AVISO

- ESTE MANUAL DE SERVICIO SÓLO EXISTE EN INGLÉS.
- SI ALGÚN PROVEEDOR DE SERVICIOS AJENO A GEMS SOLICITA UN IDIOMA QUE NO SEA EL INGLÉS, ES RESPONSABILIDAD DEL CLIENTE OFRECER UN SERVICIO DE TRADUCCIÓN.
- NO SE DEBERÁ DAR SERVICIO TÉCNICO AL EQUIPO, SIN HABER CONSULTADO Y COMPRENDIDO ESTE MANUAL DE SERVICIO.
- LA NO OBSERVANCIA DEL PRESENTE AVISO PUEDE DAR LUGAR A QUE EL PROVEEDOR DE SERVICIOS, EL OPERADOR O EL PACIENTE SUFRAN LESIONES PROVOCADAS POR CAUSAS ELÉCTRICAS, MECÁNICAS O DE OTRA NATURALEZA.

ATENÇÃO

- ESTE MANUAL DE ASSISTÊNCIA TÉCNICA SÓ SE ENCONTRA DISPONÍVEL EM INGLÊS.
- SE QUALQUER OUTRO SERVIÇO DE ASSISTÊNCIA TÉCNICA, QUE NÃO A GEMS, SOLICITAR ESTES MANUAIS NOUTRO IDIOMA, É DA RESPONSABILIDADE DO CLIENTE FORNECER OS SERVIÇOS DE TRADUÇÃO.
- NÃO TENHA TENTADO REPARAR O EQUIPAMENTO SEM TER CONSULTADO E COMPREENDIDO ESTE MANUAL DE ASSISTÊNCIA TÉCNICA.
- O NÃO CUMPRIMENTO DESTA AVISO PODE POR EM PERIGO A SEGURANÇA DO TÉCNICO, OPERADOR OU PACIENTE DEVIDO A CHOQUES ELÉTRICOS, MECÂNICOS OU OUTROS.

AVVERTENZA

- IL PRESENTE MANUALE DI MANUTENZIONE È DISPONIBILE SOLTANTO IN INGLESE.
- SE UN ADDETTO ALLA MANUTENZIONE ESTERNO ALLA GEMS RICHIEDE IL MANUALE IN UNA LINGUA DIVERSA, IL CLIENTE È TENUTO A PROVVEDERE DIRETTAMENTE ALLA TRADUZIONE.
- SI PROCEDA ALLA MANUTENZIONE DELL'APPARECCHIATURA SOLO DOPO AVER CONSULTATO IL PRESENTE MANUALE ED AVERNE COMPRESO IL CONTENUTO.
- NON TENERE CONTO DELLA PRESENTE AVVERTENZA POTREBBE FAR COMPIERE OPERAZIONI DA CUI DERIVINO LESIONI ALL'ADDETTO ALLA MANUTENZIONE, ALL'UTILIZZATORE ED AL PAZIENTE PER FOLGORAZIONE ELETTRICA, PER URTI MECCANICI OD ALTRI RISCHI.

警告

- ・ このサービスマニュアルには英語版しかありません。
- ・ GEMS以外でサービスを担当される業者が英語以外の言語を要求される場合、翻訳作業はその業者の責任で行うものとさせていただきます。
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- ・ この警告に従わない場合、サービスを担当される方、操作員あるいは患者さんが、感電や機械的又はその他の危険により負傷する可能性があります。

注意:

- 本维修手册仅存有英文本。
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- 未详细阅读和完全了解本手册之前，不得进行维修。
- 忽略本注意事项会对维修员，操作员或病人造成触电，机械伤害或其他伤害。

Direction 2115681-100

Revision 3

AMX-4 Service (Model 2115090 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 Protec-

tion, 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.

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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**

ENGINEERING, X-RAY W-702
MANAGER - FIELD SERVICE DEVELOPMENT
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.

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TABLE OF CONTENTS

SECTION	TITLE	PAGE
	AMX-4 SERVICE	xi
	REVISION HISTORY	xiii
1	SERVICING THE COLLIMATOR	1-1
1-1	Collimator Removal	1-1
1-1-1	Collimator Interface & Port Plates Check	1-2
1-2	Collimator Installation	1-3
1-3	Field Lamp Replacement	1-4
1-4	Light Field Adjustment	1-5
1-4-1	Adjustment Method 1	1-5
1-4-2	Adjustment Method 2	1-8
1-5	Crosshair Window Adjustment	1-10
1-6	Field Light Switch Replacement	1-11
1-7	Brake Switch Replacement	1-11
2	SERVICING THE X-RAY TUBE	2-1
2-1	X-Ray Tube Removal	2-1
2-2	X-Ray Tube Installation	2-2
3	SERVICING THE HORIZONTAL ARM	3-1
3-1	Yoke Assembly Removal	3-1
3-2	Yoke Assembly Installation	3-2
3-3	Yoke Mounting Plate Assembly Removal	3-3
3-4	Yoke Mounting Plate Assembly Installation	3-5
3-5	Horizontal Arm Assembly Removal	3-6
3-6	Horizontal Arm Assembly Installation	3-8
3-7	Horizontal Arm Brake and Cable Assembly Removal	3-9
3-8	Horizontal Arm Brake and Cable Assembly Installation	3-11
3-9	Horizontal Arm Brake Cable Removal	3-12
3-10	Horizontal Arm Brake Cable Installation	3-13
3-11	Horizontal Arm Brake Removal	3-13
3-12	Horizontal Arm Brake Installation	3-13
4	SERVICING THE VERTICAL COLUMN	4-1
4-1	Vertical Column Assembly Removal	4-1
4-2	Vertical Column Assembly Installation	4-3
4-3	Main, Safety and Follower Cable Removal	4-4
4-4	Main, Safety and Follower Cable Installation	4-6
4-5	Upper Pulley and Brake Assembly Removal	4-7
4-6	Upper Pulley and Brake Assembly Installation	4-8
4-7	Counterweight Removal	4-9
4-8	Counterweight Installation	4-10
4-9	Upper Brake Removal	4-11
4-10	Upper Brake Installation	4-12
4-11	Upper Pulley and Bearings Removal	4-13

TABLE OF CONTENTS

SECTION	TITLE	PAGE
	4-12 Upper Pulley and Bearings Installation	4-13
	4-13 Carriage Assembly Removal	4-14
	4-14 Carriage Assembly Installation	4-14
	4-15 Carriage Assembly Bearings Removal	4-15
	4-16 Carriage Assembly Bearings Installation	4-16
	4-17 Lower Brake and Bearings Removal	4-16
	4-18 Lower Brake and Bearings Installation	4-17
	4-19 Column Base Removal	4-17
	4-20 Column Base Installation	4-18
	4-21 Lower Pulley and Bearings Removal	4-18
	4-22 Lower Pulley and Bearings Installation	4-19
	4-23 Column Support Assembly Removal	4-19
	4-24 Column Support Assembly Installation	4-20
5	SERVICING THE TRIM COVERS AND CASSETTE DRAWER	5-1
	5-1 Cassette Drawer Removal	5-1
	5-2 Cassette Drawer Installation	5-1
	5-3 Side Covers Removal	5-2
	5-4 Side Cover Installation	5-3
	5-5 Top Cover Removal	5-4
	5-6 Top Cover Installation	5-5
6	SERVICING THE BASE ASSEMBLY	6-1
	6-1 Gates Battery Removal	6-1
	6-2 Gates Battery Installation	6-5
	6-3 Bumper Removal	6-9
	6-4 Bumper Installation	6-10
	6-5 Bumper Switch Removal	6-11
	6-6 Bumper Switch Installation	6-11
	6-7 Bumper Bearings Removal	6-12
	6-8 Bumper Bearings Installation	6-12
	6-9 Motor and Brake Assembly Removal	6-13
	6-10 Motor and Brake Assembly Installation	6-14
	6-11 Drive Wheel Removal	6-15
	6-12 Drive Wheel Installation	6-17
	6-13 Caster Wheel Removal	6-18
	6-14 Caster Wheel Installation	6-22
7	SERVICING THE DRIVE HANDLE ASSEMBLY	7-1
	7-1 Handle Sensor Removal	7-1
	7-2 Handle Sensor Installation	7-3
	7-3 Handle Drive Enable Switch Removal	7-4
	7-4 Handle Drive Enable Switch Installation	7-4
8	SERVICING THE HIGH VOLTAGE TRANSFORMER	8-1
	8-1 High Voltage Transformer Removal	8-1
	8-2 High Voltage Transformer Installation	8-3

TABLE OF CONTENTS

SECTION	TITLE	PAGE
9	SERVICING THE LATCH ASSEMBLY, CORD REEL ASSEMBLY AND CABLE ROUTING	9-1
9-1	Latch Assembly and Components Removal (Hall Effect Switch)	9-1
9-2	Latch Assembly and Components Installation (Hall Effect Switch)	9-3
9-3	Cord/Cord Reel Removal	9-4
9-3-1	Cord Reel Removal (Model 2115090, 2115090-4, 2115090-5, 2115090-7, 2115090-9 & 2115090-10 Only)	9-4
9-3-2	Cord Reel Removal (Model 2115090-2, 2115090-6, 2115090-8 & 2115090-11 Only)	9-5
9-4	Cord/Cord Reel Installation	9-6
9-4-1	Cord Reel Installation (Model 2115090, 2115090-4, 2115090-5, 2115090-7, 2115090-9 & 2115090-10 Only)	9-6
9-4-2	Cord Reel Installation (Model 2115090-2, 2115090-6, 2115090-8 & 2115090-11 Only)	9-6
9-5	Cable Routing	9-7
9-5-1	Cathode Cable Routing	9-8
9-5-2	Anode Cable Routing	9-10
9-5-3	Collimator Cable	9-11
9-5-4	Stator Cable Routing	9-13
9-5-5	Horizontal Arm Brake Cable	9-14
9-5-6	Control Cable	9-15
9-5-7	Vertical Column Brake Cable	9-15
10	COUNTERWEIGHT BALANCING	10-1

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AMX-4 SERVICE

Introduction	This direction contains instructions for performing mechanical maintenance on the following AMX-4, Mobile X-ray Unit, model numbers: 2115090, 2115090-2, 2115090-4, 2115090-5, 2115090-6, 2115090-7, 2115090-8, 2115090-9, 2115090-10, 2115090-11. The instructions cover the removal, installation, and adjustment of the field serviceable assemblies and parts comprising the unit. Illustrations are provided as a supplement to the procedures to assist the service technician in understanding the relationship of the parts involved.
Definition of Terms	The front end of the unit is defined as the end containing the vertical column and bumper assembly. Left and right sides are determined by standing at the rear (handle end) of the unit, facing the unit.
Tools and Materials	<p>A list of tools required to perform the service adjustment procedures is given below. With the exception of the vertical column lifting tool and floor jack, the tools listed are part of the standard complement of tools supplied in the service technician's tool kit.</p> <p>Tools</p> <ol style="list-style-type: none"> 1. Socket head wrench set 2. Hex socket wrench set 3. Snap-ring pliers – internal and external 4. Open end wrench set 5. Flat blade screwdriver set 6. Phillips head screwdriver set 7. Flashlight 8. Vertical column lifting tool 9. Floor Jack <p>Materials</p> <ol style="list-style-type: none"> 1. Loctite sealant 2. Bearing grease – Lithium 3. Silicone grease 4. Oil 5. Cotton rags 6. Cotton swabs
Periodic Inspection	Periodic inspection instructions for various assemblies of the AMX-4 are listed in the maintenance schedule given in Direction 2115682-100, AMX-4, <i>Periodic Maintenance (Model 2115090 Series.)</i> . All deficiencies uncovered during inspection should be corrected before further use of the equipment.
Removal and Installation Procedure Index	A list of AMX-4 assemblies for which removal and installation procedures are provided is given in the following index. The index lists the section in which the procedure is presented, the name of the assembly, and the number of the paragraph that contains the removal or installation procedure.

SECTION TITLE	ASSEMBLY NAME	REMOVAL PARAGRAPH	INSTALLATION PARAGRAPH
Section 1 Servicing the Collimator Assembly	Collimator Assembly	1-1	1-2
Section 2 Servicing the X-ray Tube Assembly	X-Ray Tube Assembly	2-1	2-2
Section 3 Servicing the Horizontal Arm Assembly	Yoke Assembly Yoke Mounting Plate Assembly Horizontal Arm Assembly Brake - Cable Assembly Cable Assembly Brake Assembly	3-1 3-3 3-5 3-7 3-9 3-11	3-2 3-4 3-6 3-8 3-10 3-12
Section 4 Servicing the Vertical Column Assembly	Vertical Column Cables Upper Pulley and Brake Assembly Counterweights Upper Brake Assembly Upper Pulley and Bearings Carriage Assembly Carriage Bearings Lower Brake and Bearings Column Base Lower Pulley and Bearings Column Support	4-1 4-3 4-5 4-7 4-9 4-11 4-13 4-15 4-17 4-19 4-21 4-23	4-2 4-4 4-6 4-8 4-10 4-12 4-14 4-16 4-18 4-20 4-22 4-24
Section 5 Servicing the Trim Covers	Cassette Drawer Side Covers Top Cover	5-1 5-3 5-5	5-2 5-4 5-6
Section 6 Servicing the Base Assembly	Gates Battery Bumper Assembly Bumper Switch Bumper Bearings Motor and Brake Drive Wheel Caster Wheel	6-1 6-3 6-5 6-7 6-9 6-11 6-13	6-2 6-4 6-6 6-8 6-10 6-12 6-14
Section 7 Servicing the Handle Assembly	Sensor Assembly Drive Enable Switch	7-1 7-3	7-2 7-4
Section 8 Servicing the High Voltage Transformer	Transformer	8-1	8-2
Section 9 Servicing the Latch Assembly and Cable Routing	Latch Assembly (Hall Effect Switch) Cord/Cord Reel Cord Reel (Model 2115090, 2115090-4, 2115090-5, 2115090-7, 2115090-9, 2115090-10 Only) Cord Reel (Model 2115090-2, 2115090-6, 2115090-8, 2115090-11 Only) Cable Routing Cathode Cable Anode Cable Collimator Cable Stator Cable Horizontal Arm Brake Cable Control Cable Vertical Column Brake Cable	9-1 9-3 9-3-1 9-3-2	9-2 9-4 9-4-1 9-4-2 9-5 9-5-1 9-5-2 9-5-3 9-5-4 9-5-5 9-5-6 9-5-7

REVISION HISTORY

REV	DATE	REASON FOR CHANGE
0	Sept. 2, 1994	Initial product release.
1	Jul. 18, 1996	Added G3 carriage and columns in Section 4.
2	Sept. 17, 1996	Changed reference to caster support plates in Section 6.
3	22APR2015	Page 1-3, updated Step 4 to remove Loctite reference. Refer to ECO 2181356.

LIST OF EFFECTIVE PAGES

PAGE NUMBER	REVISION NUMBER	PAGE NUMBER	REVISION NUMBER	PAGE NUMBER	REVISION NUMBER
All pages	3				

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SECTION 1

SERVICING THE COLLIMATOR

This section provides procedures covering the removal and installation of the collimator. It also provides procedures for replacing and aligning the field lamp, aligning the crosshairs, and replacing the brake and field lamp switches.

1-1 Collimator Removal

1. Close collimator blades.
2. Rotate X-ray tube and collimator assembly so collimator crosshair window is facing upward.
3. Place the horizontal arm assembly in park position on top cover of unit.

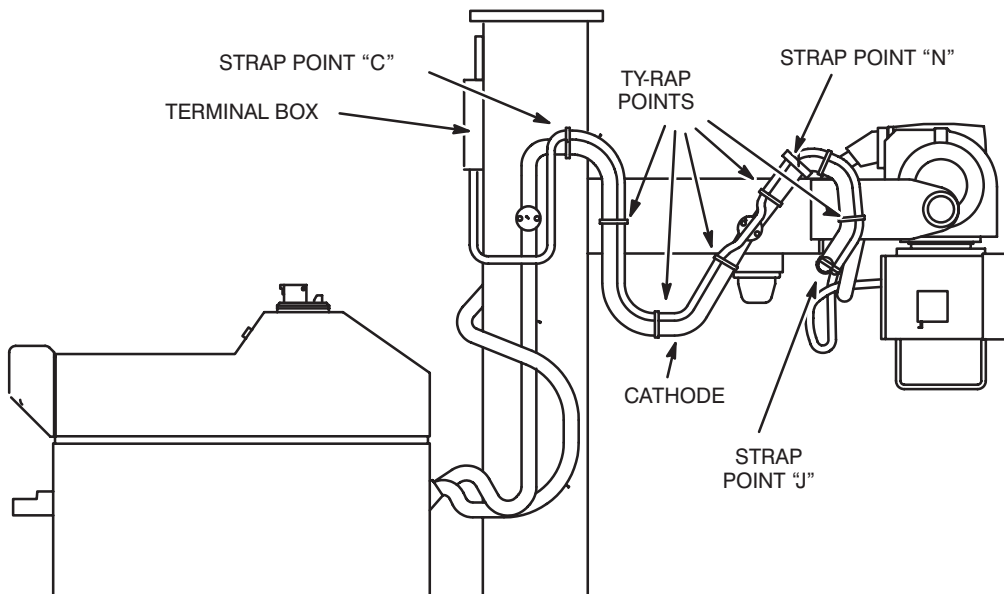


Equipment Damage!

Secure the horizontal arm before removing components from the arm. Removing weight allows the counterweight to descend rapidly and the arm to ascend rapidly possibly causing damage to the unit and personal injury. Use Counterweight Lift Tool 46-303491G1.

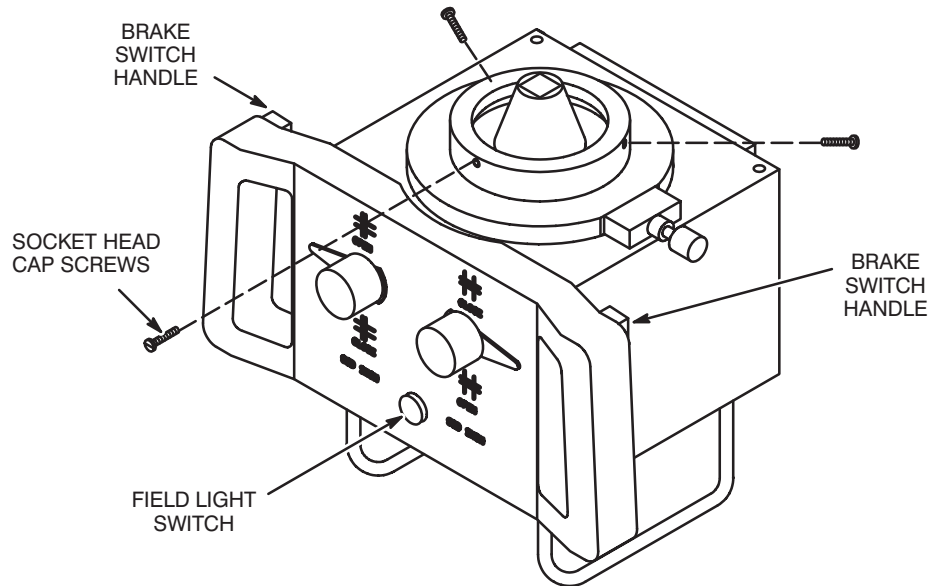
4. Shut off power by turning circuit breaker OFF.
5. Remove two screws in bottom of terminal box located on back of vertical column and lift off cover. See Illustration 1-1.
6. Disconnect collimator cable leads from terminal block. Record and tag leads.
7. Remove Heyco bushing and cable through bottom of terminal box.

ILLUSTRATION 1-1
TERMINAL BOX AND
COLLIMATOR CABLE ROUTING



8. Cut ty-raps securing collimator cable to cathode cable and remove from Strap Points "J, C & N".
9. Remove three 10-24 \times .75 hex socket head cap screws securing collimator assembly to x-ray tube. See Illustration 1-2.
10. Remove collimator from interface plate.

ILLUSTRATION 1-2
COLLIMATOR



1-1-1 Collimator Interface & Port Plates Check

1. Close collimator blades.
2. Rotate X-ray tube and collimator assembly so collimator crosshair window is facing upward.
3. Place the horizontal arm assembly in park position on top cover of unit.

Equipment Damage!

Secure the horizontal arm before removing components from the arm. Removing weight allows the counterweight to descend rapidly and the arm to ascend rapidly possibly causing damage to the unit and personal injury. Use Counterweight Lift Tool 46-303491G1.



4. Shut off power by turning circuit breaker OFF.
5. Remove three 10-24 \times .75 hex socket head cap screws securing collimator assembly to x-ray tube. See Illustration 1-2.
6. Remove collimator from interface plate.
7. Carefully place collimator and cables on horizontal arm.

8. Check that each X-ray port plate screw is securely fastened in place.
9. If any port plate screw is loose, unscrew it until it touches the interface plate.

Note:

Do not remove collimator interface plate. This plate is factory aligned and should not be disturbed. (However, if any of the interface plate screws are loose, re-torque them to 32–40 inch pounds (3.6–4.5 N-m)).

10. Apply Loctite 290 to the port plate screw and tighten to 45–50 inch pounds (5.1–5.6 N-m). Loctite 290 is thin and, like a wick, will draw down around the screw threads. Clean the area of any residue solution.
11. Turn collimator upside down and insert cone into the tube port interface plate. Align mounting screw holes.
12. Attach collimator assembly to tube port interface plate with three 10–24 × .75 hex socket head cap screws using Loctite 242. Torque to 50–60 inch pounds (5.6–6.8 N-m).

1-2 Collimator Installation

1. Horizontal arm assembly is in parked position on top cover of unit (or counter-weight is secured) Check that power is off.
2. X-ray tube is facing upward.

**Equipment Damage!**

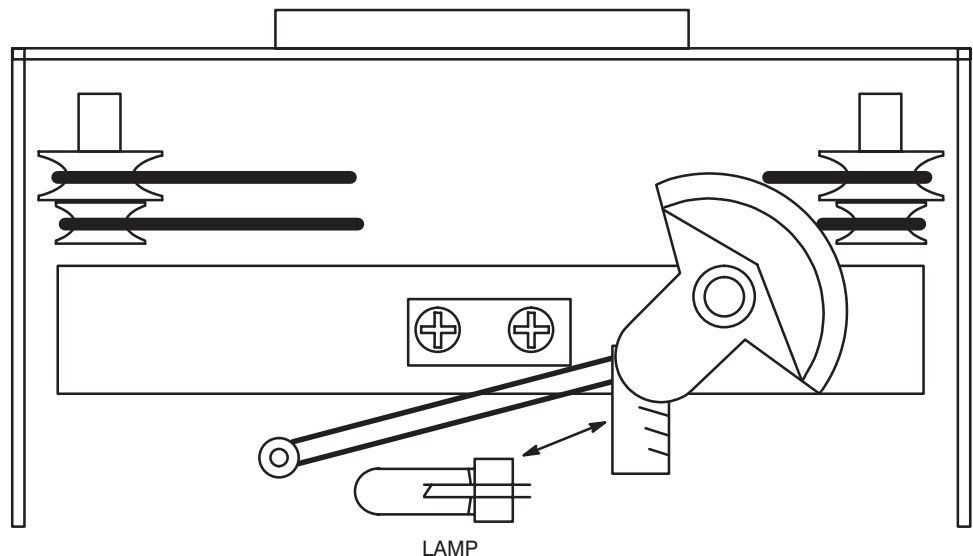
Do not bump the cone when handling the collimator, especially when mounting it on the tube. It is made of lead and damages easily.

3. Turn collimator upside down and insert cone into the tube port interface plate. Align mounting screw holes.
4. Attach collimator assembly to tube port interface plate with three 10-24 x .75 hex socket head cap screws and torque to 50-60 inch-pounds (5.6-6.8 N-m).
5. Route collimator cable along the cathode cable to strap point on side of the column. Secure collimator cable in place with ty-raps to the cathode cable. See Illustration 1-1.
6. Drape the cable from the side of the column to the terminal box on the back of the column. Insert the cable with a Heyco bushing up through the bottom of the terminal box.
7. Connect collimator cable leads to terminal block in accordance with connection data recorded and tagged on leads.
8. Position back cover on terminal box and secure with two screws.
9. Rotate x-ray tube and collimator assembly to a port down position.

1-3 Field Lamp Replacement

1. Remove the rear cover on the collimator by removing four metric Phillips head screws holding it in place. Remove the cover. See Illustration 1-3.

ILLUSTRATION 1-3
FIELD LAMP REPLACEMENT



2. Close the collimator blades. This makes it easier to reach the lamp for removal and replacement.

Field Lamp Damage!

Field lamp should never be touched with bare fingers since chemicals on skin will damage lamp and reduce its useful life. Always use gloves, tissue or soft cloth when handling lamp. If outside of the lamp becomes contaminated, clean with a soft cloth dampened in water. Wipe dry after cleaning.



3. Carefully remove the lamp by pulling it straight back and out of its receptacle. Replace it with a new lamp. Refer to renewal parts listing for correct lamp.
4. Whenever a lamp is replaced the light field and x-ray field sizes must be checked to be certain the difference between them does not exceed a specified maximum tolerance. Refer to Section 1-4, *Adjusting the Field Lamp*, to make these measurements and any necessary adjustments.

1-4 Light Field Adjustment

The x-ray field and light field must be properly aligned to meet HHS requirements. Two methods for accomplishing this are given below.

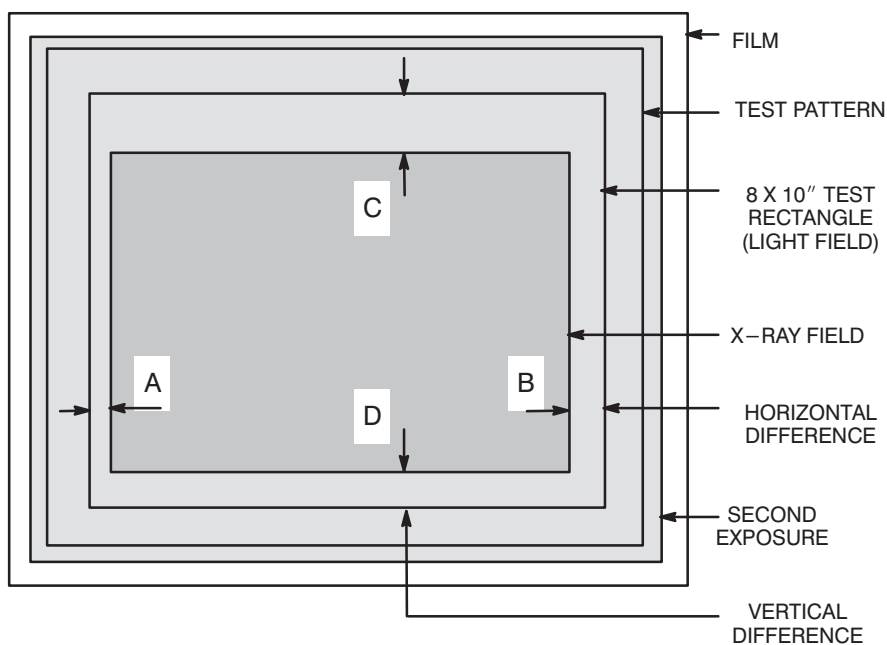
Method 1, Section 1-4-1, is only used if the "Light Field to X-Ray Field Test Pattern," 46-198466P1, from an HHS Field Test Kit, 46-177372G1, is available.

Method 2, Section 1-4-2, uses lead strips to indicate the light field areas.

1-4-1 Adjustment Method 1

1. Place loaded cassette (14 × 17 inches suggested) on floor directly beneath collimator.
2. Adjust the collimator so that it is parallel to the cassette.
3. Set SID to 40 inches.
4. Place light field to x-ray field test pattern on top of cassette.
5. Turn on field lamp.
6. Adjust collimator blades so light field exactly covers the 8 × 10 inch rectangle on the test pattern. See Illustration 1-4.

ILLUSTRATION 1-4
APPEARANCE OF X-RAY
FIELD AND LIGHT FIELD
ALIGNMENT ON EXPOSED
FILM USING TEST PATTERN



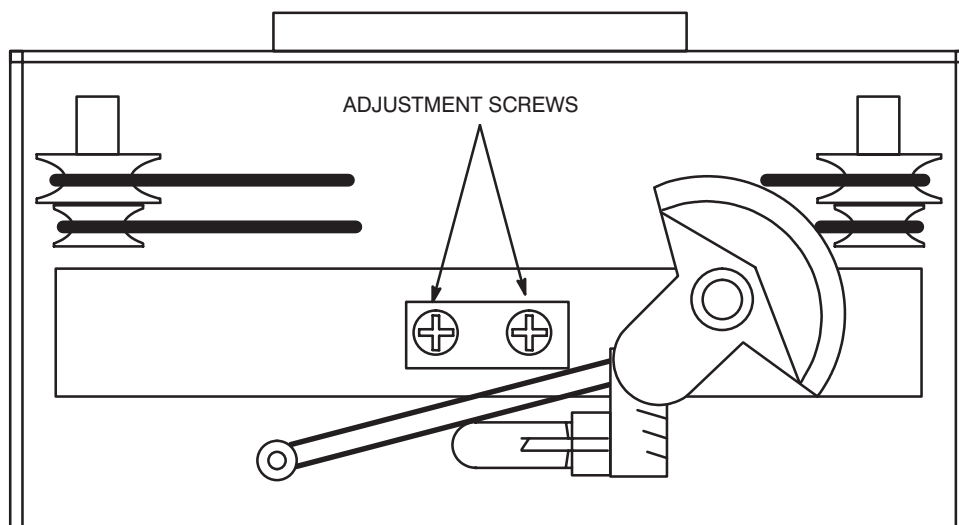
7. Expose film.
 - 60 kVp, 2 mAs.
 - Do not disturb the cassette and pattern because a second exposure is to be made.
8. Open collimator blades wide enough to include test pattern.
9. Expose film a second time and develop the film.
 - 60 kVp, 2 mAs.
 - This exposure should include the 8 × 10 inches rectangle. Refer to Illustration 1-4. If the rectangle does not show, reload the cassette and repeat steps 1 through 8 but open the collimator blades in step 7 wider than last time.
10. Measure and record the horizontal A & B distances, in inches, between the x-ray field and the light field. See Illustration 1-4.
11. Measure and record the vertical C & D distances, in inches, between the x-ray field and the light field. See Illustration 1-4.
12. The total of the horizontal differences as well as the total of the vertical differences must each be less than 1.8% of the SID:
 - $A + B < 1.8\% \text{ SID} = A + B < .018 \times 40 \text{ inches} = \underline{A + B < .72 \text{ inches}}$
 - $C + D < 1.8\% \text{ SID} = C + D < .018 \times 40 \text{ inches} = \underline{C + D < .72 \text{ inches}}$

If the above requirements are met, go to step 18. If they are not met, proceed with the following steps.

Note:

Ideally, the x-ray field and the light field should coincide but this is rarely the case. The best compromise is to move the light field so the x-ray field is centered within it. Usually the light field area will be larger than the x-ray area. The size and location of the light field can be adjusted by moving the bulb.

13. To place the two fields as close to coincidence as possible, only the light field area is moved. The light field area adjustment is made by repositioning the field lamp housing.
14. Loosen the two Phillips head adjustment screws located in the back of the collimator. See Illustration 1-5.

ILLUSTRATION 1-5
FIELD LAMP ADJUSTMENT

15. Examine the last exposure and determine which direction to move the field lamp to best position it around the x-ray field.
16. Turn on the field lamp.

**High Temperature and Brightness!**

Components are hot in the high energy field lamp adjustment area. Do not look directly at the field lamp. Its brightness is blinding.

17. The field lamp adjustment area will be hot so use a metal tool to move the bracket when repositioning the light field area on the film cassette.
18. When the light field area has been repositioned equidistant around the x-ray field, tighten the adjustment screws. Alternately tightening the two screws will help prevent the bracket from slipping out of place.
19. Repeat steps 1 through 16 until the “percentage of SID” requirements are obtained.

Note;

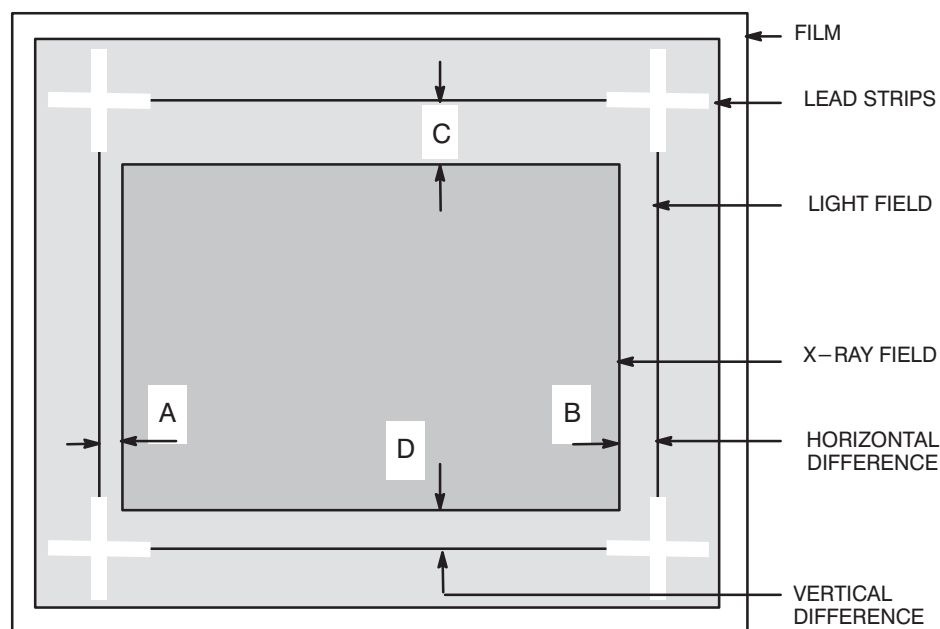
If the percentage of SID requirement cannot be obtained, the light field is either too large or in rare instances too small. In this case the collimator will have to be returned to the factory.

20. Replace the back cover and fasten it in place with four metric Phillips head screws. See Illustration 1-3.
21. After any adjustment to the field light area, the collimator crosshair window position should be checked and corrected if necessary. Refer to Section 1-5.

1-4-2 Adjustment Method 2

1. Place loaded cassette (14×17 inches suggested) on floor directly beneath collimator.
2. Set SID to 40 inches.
3. Set collimator for 8×10 inches.
4. Turn on field lamp.
5. Place lead strips at each corner of light field to demarcate size of field. See Illustration 1-6.

ILLUSTRATION 1-6
APPEARANCE OF X-RAY
FIELD AND LIGHT FIELD
ALIGNMENT ON EXPOSED
FILM USING LEAD STRIPS



6. Expose film. Do not move film cassette.
 - 60 kVp, 2 mAs.
7. Open collimator blades.
8. Expose film a second time and develop the film.
 - 60 kVp, 2 mAs.

Note:

This exposure should include the lead strips marking the corners of the light field. See Illustration 1-6. If the lead strips do not show, reload the cassette and repeat steps 1 through 8 but open the collimator blades in step 7 far enough to include the lead strips.

9. Measure and record the horizontal A & B distances, in inches, between the x-ray field and the light field. See Illustration 1-6.
10. Measure and record the vertical C & D distances, in inches, between the x-ray field and the light field. See Illustration 1-5.
11. The total of the horizontal differences as well as the total of the vertical differences must each be less than 1.8% of the SID:
 - $A + B < 1.8\% \text{ SID} = A + B < .018 \times 40 \text{ inches} = \underline{A + B < .72 \text{ inches}}$
 - $C + D < 1.8\% \text{ SID} = C + D < .018 \times 40 \text{ inches} = \underline{C + D < .72 \text{ inches}}$

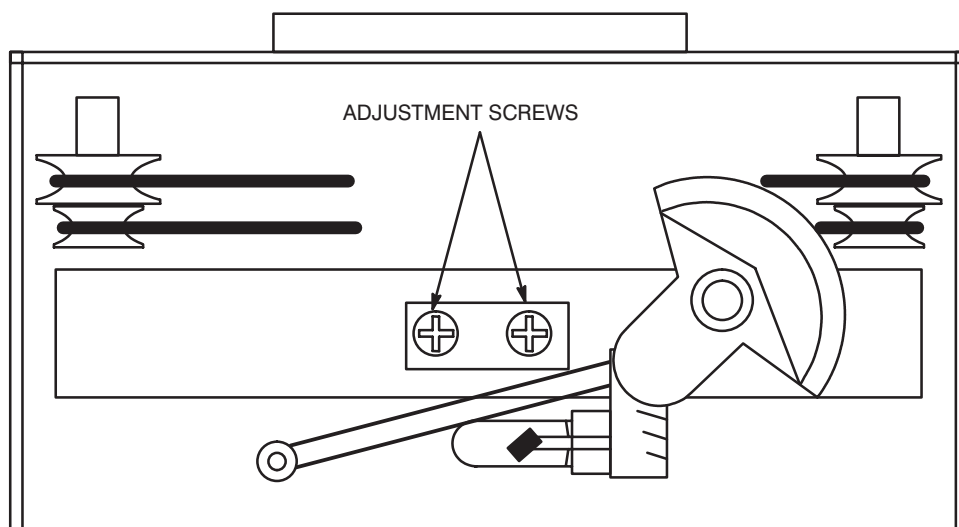
If the above requirements are met, go to step 18. If they are not met, proceed with the following steps.

Note:

Ideally, the x-ray field and the light field should coincide but this is rarely the case. The best compromise is to move the light field so the x-ray field is centered within it. Usually the light field area will be larger than the x-ray area.

12. To place the two fields as close to coincidence as possible, only the light field area is moved. The light field area adjustment is made by repositioning the field lamp housing.
13. Loosen the two Phillips head adjustment screws located in the back of the collimator. See Illustration 1-7.
14. Examine the last exposure and determine which direction to move the field lamp to best position light field around the x-ray field.
15. Turn on the field lamp.

ILLUSTRATION 1-7
FIELD LAMP ADJUSTMENT



**High Temperature and Brightness!**

Components are hot in the high energy field lamp adjustment area. Do not look directly at the field lamp. Its brightness is blinding.

16. The field lamp adjustment area will be hot so use a metal tool to move the bracket when repositioning the light field area on the film cassette.
17. When the light field area has been repositioned equidistant around the x-ray field, tighten the adjustment screws. Alternately tightening the two screws will help prevent the bracket from slipping out of place.
18. Repeat steps 1 through 16 until the percentage of SID requirements are obtained.

Note;

If the percentage of SID requirement cannot be obtained, the light field is either too large or in rare instances too small. In this case the collimator will have to be returned to the factory.

19. Replace the back cover and fasten it in place with four metric Phillips head screws. See Illustration 1-6.
20. After any adjustment to the field light area, the collimator crosshair window position should be checked and corrected if necessary. Refer to Section 1-5.

1-5 Crosshair Window Adjustment

1. After any adjustment to the field light area the collimator crosshair window position should be checked and corrected if necessary.
2. Place Light Field to X-Ray Field Test Pattern, 46-198466P1, directly under the collimator. If the test pattern is not available use a sheet of rectangular paper and draw a cross extending from exact center to each edge and parallel to the sides of the sheet.
3. Turn on field lamp and adjust collimator blades so edges of light field are coincident with the rectangle on the test pattern or the sides of the paper sheet. This may involve moving the test pattern or paper sheet.
4. Check the window crosshairs. The crosshairs must be within 1/4 inch of the pattern centerlines or cross (including the width of the crosshair shadow) over the entire length of the crosshairs.
5. If the window crosshairs are not properly aligned, go to step 7. If the window crosshairs are properly aligned, do not perform steps 7 through 9.
6. Loosen the four screws retaining the crosshair window in the bottom or exit side of the collimator.
7. Gently slide the window until the crosshairs are aligned with the test pattern centerlines or the cross on the paper.
8. Tighten the four screws retaining the crosshair window.

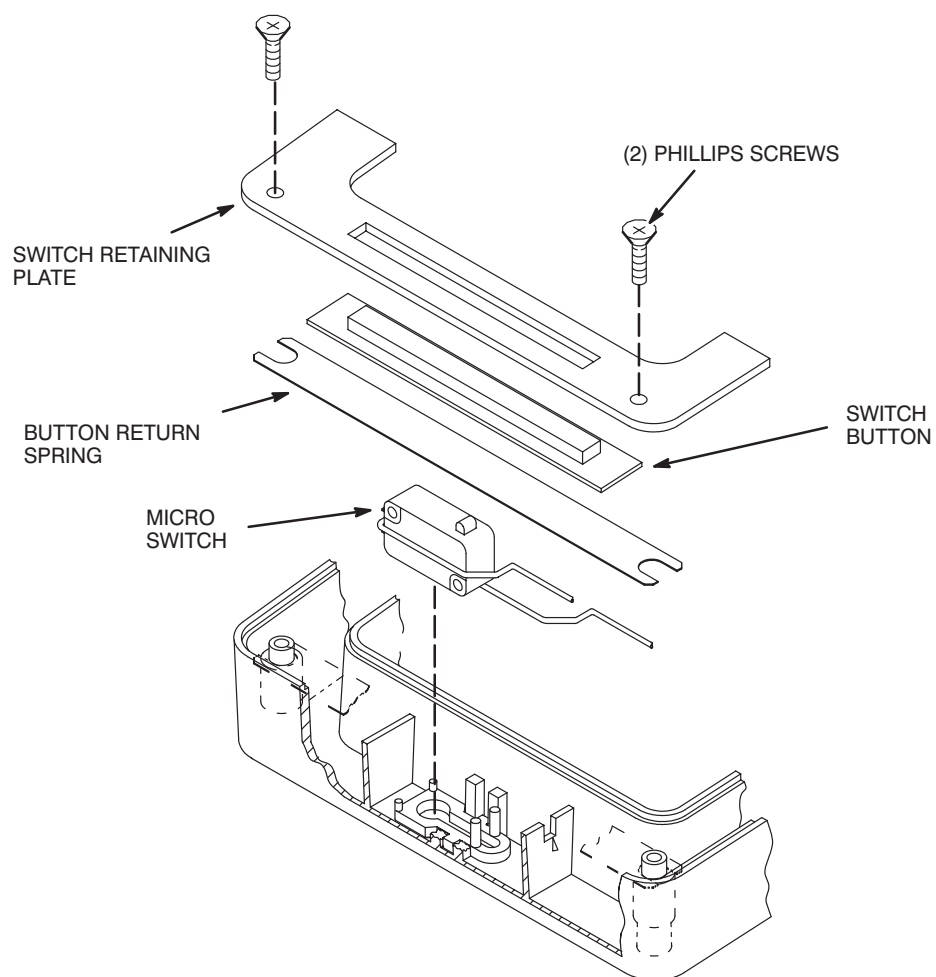
1-6 Field Light Switch Replacement

1. Place horizontal arm in lock position.
2. Shut power off.
3. Use a small screwdriver and very carefully pry the field light switch out of the collimator control panel. The switch press fits into the panel and will easily snap out of the panel. A short length of two wires will be attached to the switch. Use care not to scratch the panel during this procedure. See Illustration 1-2.
4. Unsolder the two wires.
5. Resolder two wires to the terminals on new replacement switch.
6. Carefully insert the switch and wires into the panel and press into place.

1-7 Brake Switch Replacement

1. Place horizontal arm in lock position.
2. Shut power off by turning circuit breaker OFF.
3. To prevent parts from falling out of the collimator handles when opening them, rotate the x-ray tube to position the back side of the collimator handles pointing upward.
4. Select the switch to be replaced and remove the two Phillips head screws from the switch retaining plate. Remove the plate.
5. Lift off the switch button and button return spring.
6. Pull the switch from the handle.
7. Unsolder the two wires.
8. Solder the two wires onto the new replacement switch.
9. Place the new switch in the same position as the switch which was replaced.
10. Replace the button return spring and the switch button.
11. Replace the switch retaining plate. Install and tighten the (2) Phillips head screws.
12. Test the switch to be sure that it activates/deactivates, and does not stick in the ON position.

ILLUSTRATION 1-8
BRAKE SWITCH REPLACEMENT



SECTION 2

SERVICING THE X-RAY TUBE

This section provides procedures covering the removal and installation of the x-ray tube.

2-1 X-Ray Tube Removal

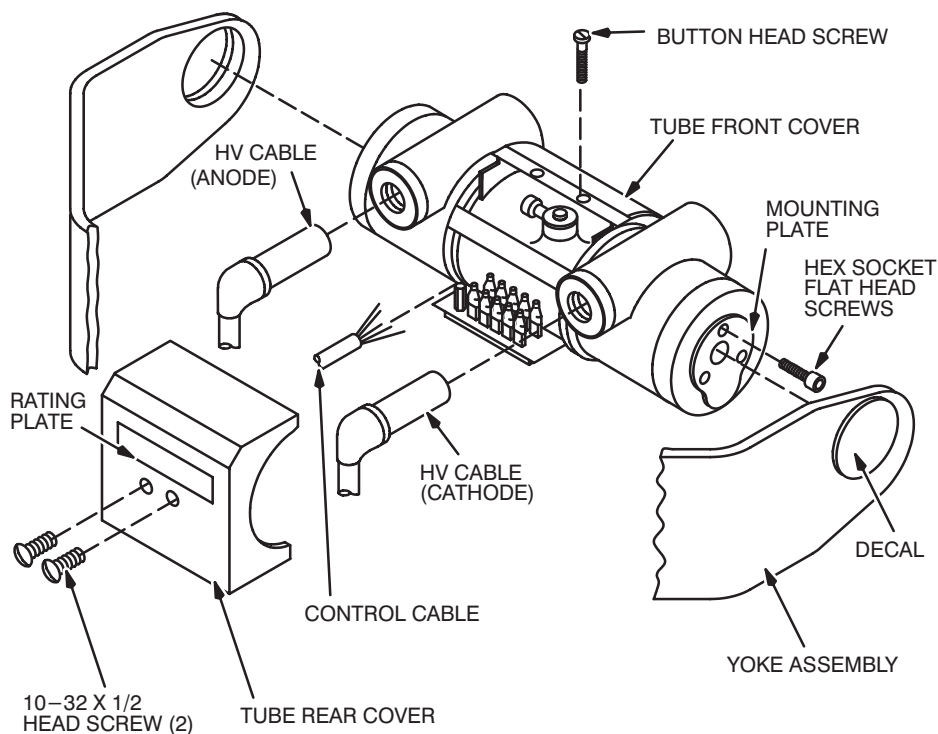


Equipment Damage!

Secure the horizontal arm before removing components from the arm. Removing weight allows the counterweight to descend rapidly and the arm to ascend rapidly possibly causing damage to the unit and personal injury. Use the Counterweight Lift Tool 46-303491G1.

1. Remove collimator from x-ray tube. Refer to Section 1-1, steps 1 through 10 for removal instructions.
2. Disconnect anode and cathode High Voltage cable connectors from x-ray tube. See Illustration 2-1.

ILLUSTRATION 2-1
X-RAY TUBE ASSEMBLY



3. Remove four button head screws securing top and rear of back cover to x-ray tube and lift off cover.
4. Disconnect control cable leads from terminal block on tube cable bracket. Record and tag lead connections.
5. Remove cable clamp securing control cable to cable bracket by removing three socket head cap screws.
6. Support the x-ray tube and remove the three hex socket flat head screws securing each end of the tube to mounting plates on the yoke assembly.
7. Remove x-ray tube assembly from yoke assembly

2-2 X-Ray Tube Installation

1. Support x-ray tube assembly in a position between mounting plates on yoke assembly. See Illustration 2-1.
2. Attach each end of tube to mounting plates with three hex socket flat head screws. Torque to 50 inch pounds (5.6 N-m).
3. Position control cable in tube cable bracket. Replace cable clamp and secure in place using three socket head cap screws.
4. Connect control cable leads to terminal block on tube cable bracket in accordance with connection data recorded and tagged on leads.

Note:

If installing a new tube, use color code and match leads.

5. Position back cover on x-ray tube assembly and secure to tube with four 10-32 \times 1/2 button head screws.
6. Cover anode and cathode HV connectors with Silicone Insulating Compound, 46-125224P3. Refer to Direction 46-013871.
7. Insert anode and cathode connectors into x-ray tube and secure firmly in place.
8. Check that tube rotates smoothly in yoke assembly when rotated forward and backward between detent positions on yoke mounting plates.
9. Install collimator on x-ray tube. Refer to Section 1-2, steps 1 through 9.
10. If a new tube is installed, the field light must be checked for proper positioning. Refer to Section 1-4, *Adjusting the Field Light*, for this procedure.

SECTION 3

SERVICING THE HORIZONTAL ARM

This section provides procedures covering the removal and installation of the field serviceable assemblies and parts comprising the horizontal arm assembly.

3-1 Yoke Assembly Removal



Equipment Damage!

Secure the horizontal arm before removing components from the arm. Removing weight allows the counterweight to descend rapidly and the arm to ascend rapidly possibly causing damage to the unit and personal injury. Use Counterweight Lift Tool 46-303491G1.

1. Remove the collimator. Refer to Section 1.
2. Remove the X-ray tube. Refer to Section 2.

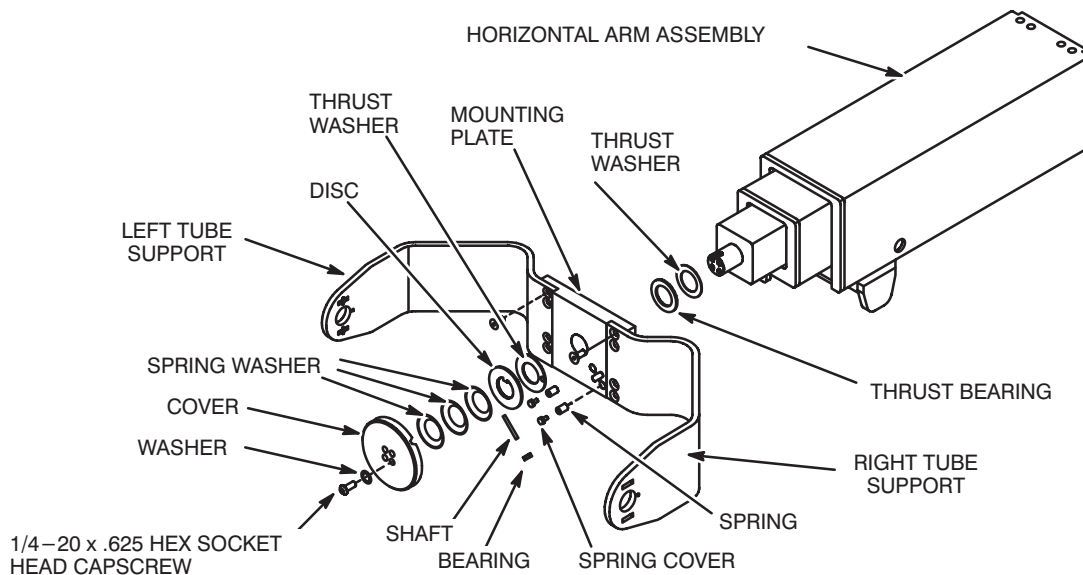


EYE INJURY!

WEAR EYE PROTECTION WHEN REMOVING THE YOKE ASSEMBLY, SOME PARTS ARE SPRING LOADED AND MAY CAUSE INJURY.

3. Holding cover in place, remove four capscrews securing cover to end of horizontal arm shaft. A spring loaded detent positioning assembly is retained by the cover. Reach behind the cover, hold the detent assembly in place and carefully remove cover. See Illustration 3-1.

ILLUSTRATION 3-1
YOKE ASSEMBLY



4. Carefully remove the detent assembly consisting of two spring covers, two springs and one shaft with one bearing from recessed location in yoke mounting plate.
5. Slide three spring washers, disk, thrust washer and yoke mounting plate from the shaft on horizontal arm.
6. Remove thrust bearing and thrust washer from horizontal arm shaft.

3-2 Yoke Assembly Installation



EYE INJURY!

**WEAR EYE PROTECTION WHEN REMOVING THE YOKE ASSEMBLY,
SOME PARTS ARE SPRING LOADED AND MAY CAUSE INJURY.**

1. Lubricate thrust bearing with small amount of grease.
2. Install thrust washer and thrust bearing on horizontal arm shaft. See Illustration 3-1.
3. Place yoke mounting plate with tube supports on horizontal arm shaft.
4. Slide thrust washer, disk, and three spring washers onto horizontal arm. (Concave side of spring washer facing you)
5. Place two springs and spring covers into recessed position in face of mounting plate.
6. Place shaft with bearing on the two springs and carefully install cover over end of horizontal arm shaft.
7. Hold cover in place on horizontal arm shaft to prevent detent assembly from springing loose and secure with four capscrews.
8. Install the x-ray tube. Refer to Section 2.
9. Install the collimator. Refer to Section 1.

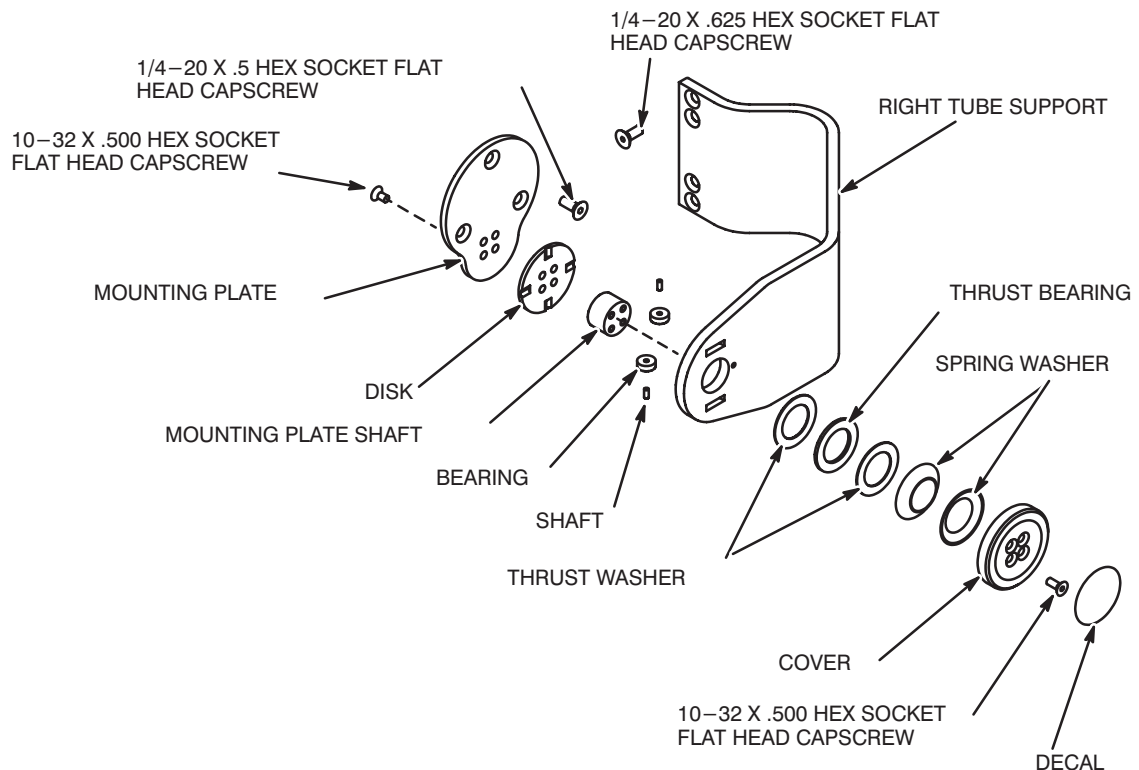
3-3 Yoke Mounting Plate Assembly Removal

1. Remove collimator. Refer to Section 1.
2. Remove the x-ray tube. Refer to Section 2.

Right Mounting Plate Assembly

3. Remove decal from cover on end of right tube support to access the cover mounting screws.
4. Remove four screws holding cover to mounting plate shaft.
5. Remove cover, two spring washers, two thrust washers and thrust bearing from mounting plate shaft.
6. Slide shaft, disk, and mounting plate from right tube support.
7. Remove two small bearings and their shaft from right tube support.
8. Remove four screws holding shaft and disk to mounting plate.
9. Remove shaft and disk from mounting plate.

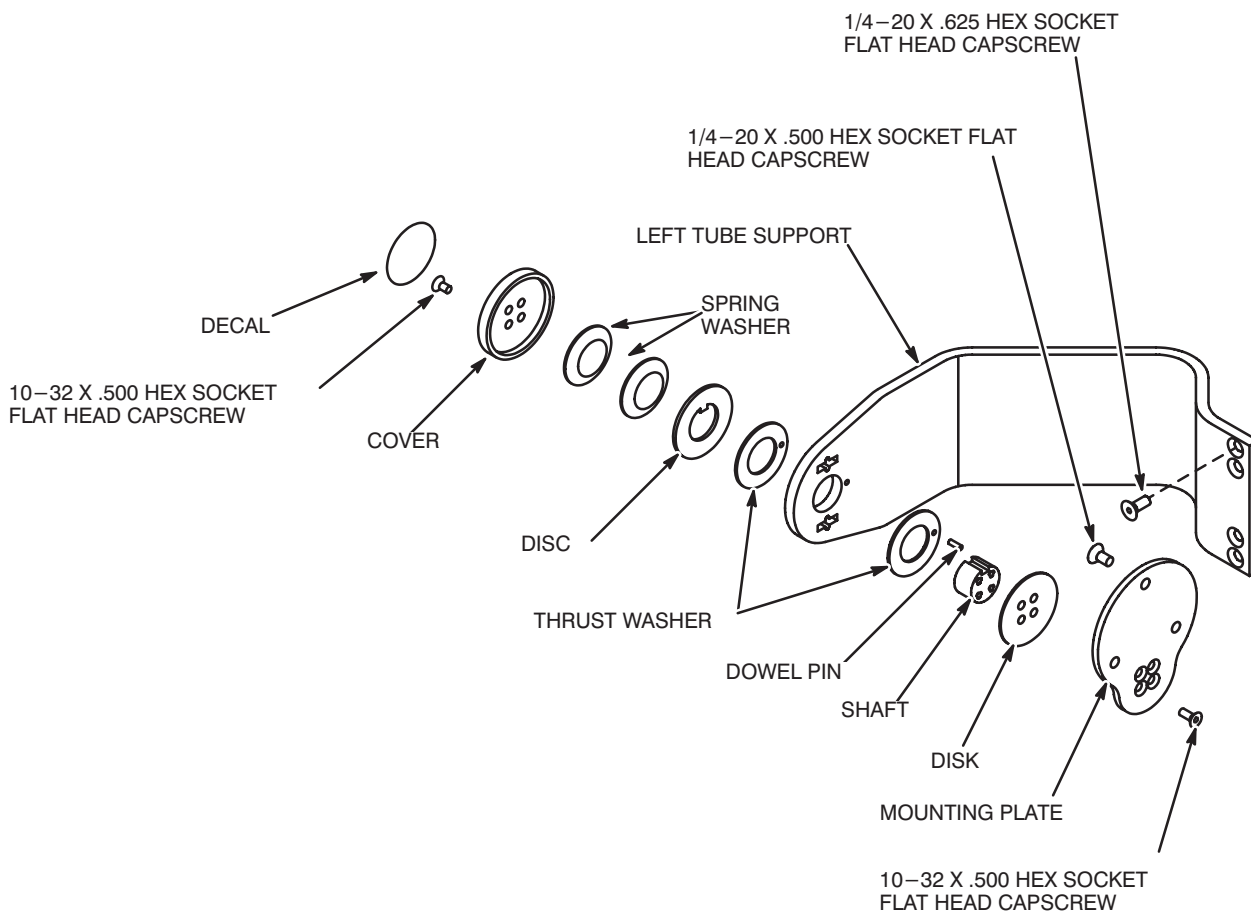
ILLUSTRATION 3-2
RIGHT MOUNTING PLATE ASSEMBLY



Left Mounting Plate Assembly

10. Remove decal from cover on end of left tube support to access the cover mounting screws.
11. Remove four screws holding cover to mounting plate shaft.
12. Remove two spring washers, disk and thrust washer from mounting plate shaft.
13. Slide shaft, thrust washer, dowel pin, disk, and mounting plate from left tube support.
14. Remove thrust washer and dowel pin from shaft.
15. Remove four screws holding shaft and disk to mounting plate.
16. Remove shaft and disk from mounting plate.
17. Remove eight hex socket flat head capscrews holding right and left tube support arms to mounting plate.
18. Remove tube supports.

ILLUSTRATION 3-3
LEFT MOUNTING PLATE ASSEMBLY



**3-4 Yoke Mounting Plate
Assembly Installation***Right Mounting Plate Assembly*

1. See Illustration 3-2. Place mounting plate shaft and disk on mounting plate.
2. Secure shaft and disk to mounting plate with four capscrews.
3. Replace two small bearings and their shaft in right tube support.
4. Slide mounting plate shaft with disk and mounting plate into right tube support.
5. Replace two thrust washers and thrust bearing, two spring washers and cover on mounting plate shaft. (Spring washers, concave side facing out)
6. Secure cover to mounting plate shaft with four capscrews.
7. Replace decal on cover.

Left Mounting Plate

8. See Illustration 3-3. Place mounting plate shaft and disk on mounting plate.
9. Secure shaft and disc to mounting plate with four capscrews.
10. Replace washer and dowel pin on mounting plate shaft.
11. Slide mounting plate shaft with washer, dowel pin, disk and mounting plate into left tube support.
12. Replace washer, disk and two spring washers on mounting plate shaft. (Spring washers, concave side facing out)
13. Secure cover to mounting plate shaft with four capscrews.
14. Replace decal on cover.
15. Install the x-ray tube. Refer to Section 2.
16. Install the collimator. Refer to Section 1.

3-5 Horizontal Arm Assembly Removal



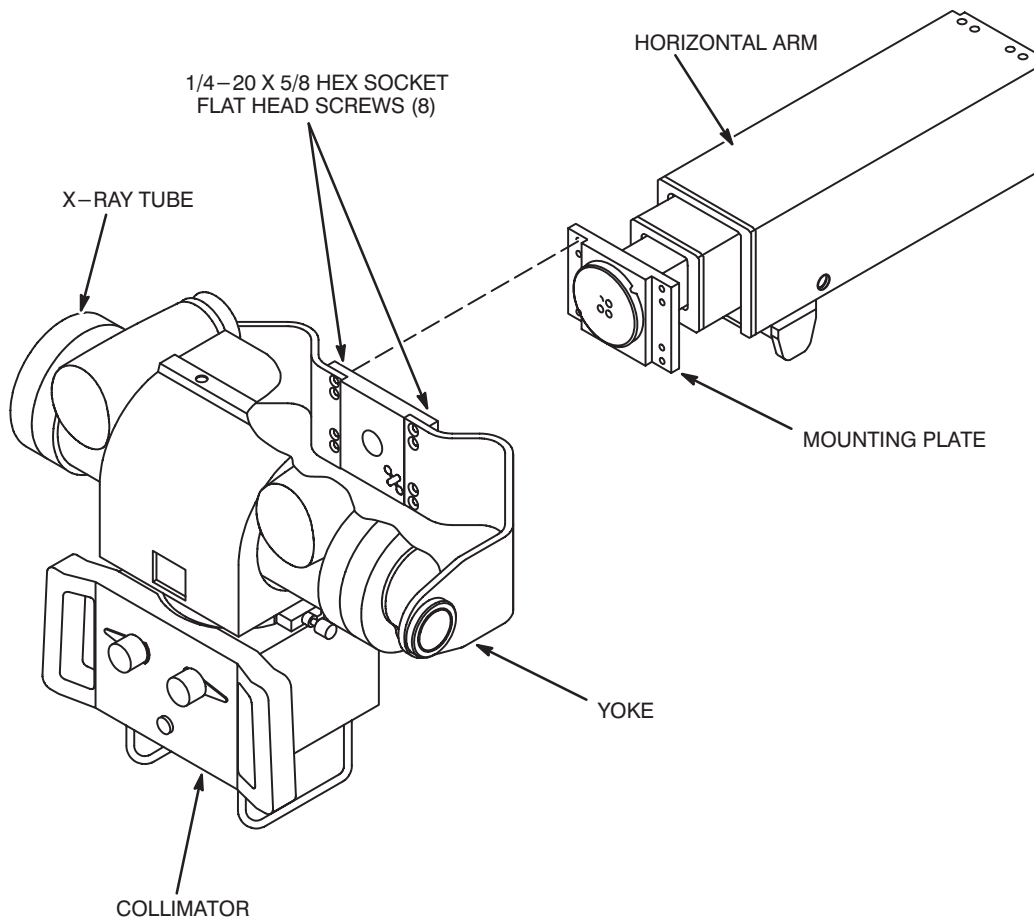
1. Rotate the x-ray tube and collimator to a horizontal position.
2. Check that the horizontal arm is securely held in place by means other than the latch alone.

Equipment Damage!

Secure the horizontal arm before removing components from the arm. Do not rely on the latch alone to hold it in place. Removing weight allows the counterweight to descend rapidly and the arm to ascend rapidly possibly causing damage to the unit and personal injury. Use Counterweight Lift Tool 46-303491G1.

3. Support the x-ray tube and collimator.
4. Remove the eight hex socket flat head screws that hold the yoke with tube head and collimator to the mounting plate on the horizontal arm. See Illustration 3-4.
5. Lower tube and collimator gently to the floor.

ILLUSTRATION 3-4
REMOVAL AND RE-MOUNTING OF X-RAY
TUBE AND COLLIMATOR ASSEMBLY

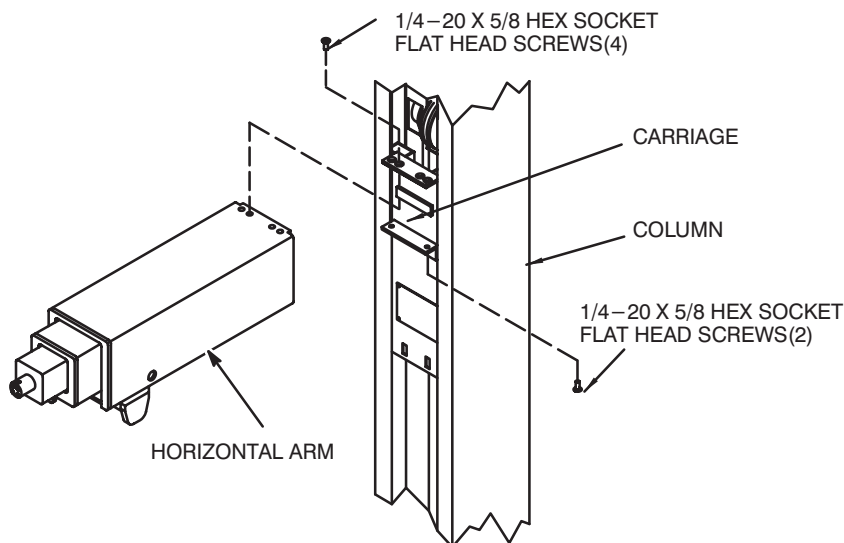


Note:

The horizontal arm cannot be removed while in the parked position or until the counterweight is at the bottom of the column.

6. Firmly grasp the horizontal arm and using your weight to counterbalance the counterweight, approximately 75 pounds (34 kg), carefully unlock the arm from parked position and slowly move it to the top of the column.
7. Remove two screws in bottom of terminal box located on back of vertical column and lift off cover.
8. Disconnect brake cable leads from terminal block. Record and tag leads.
9. Remove Heyco bushing and cable through bottom of terminal box.
10. Cut ty-raps holding brake cable to anode cable.
11. Remove six screws securing horizontal arm assembly to carriage in vertical column. See Illustration 3-5.
12. Remove horizontal arm from carriage.

ILLUSTRATION 3-5
HORIZONTAL ARM MOUNTING



**3-6 Horizontal Arm
Assembly Installation****Note:**

The counterweight must be at the bottom of the column or otherwise immobilized.

1. Mount horizontal arm assembly on carriage assembly flanges. See Illustration 3-5.
2. While supporting the arm, secure it firmly in place with six mounting screws. Torque to 110 inch pounds (12.3 N-m).
3. Route brake cable along the anode cable to strap point on side of the column. Secure brake cable to the anode cable with ty-raps.
4. Drape the cable from the side of the column to the terminal box on the back of the column. Insert the brake cable with a Heyco bushing up through the bottom of the terminal box.
5. Connect brake cable leads to terminal block in accordance with connection data recorded and tagged on leads.
6. Position back cover on terminal box and secure with two screws.

**Equipment Damage!**

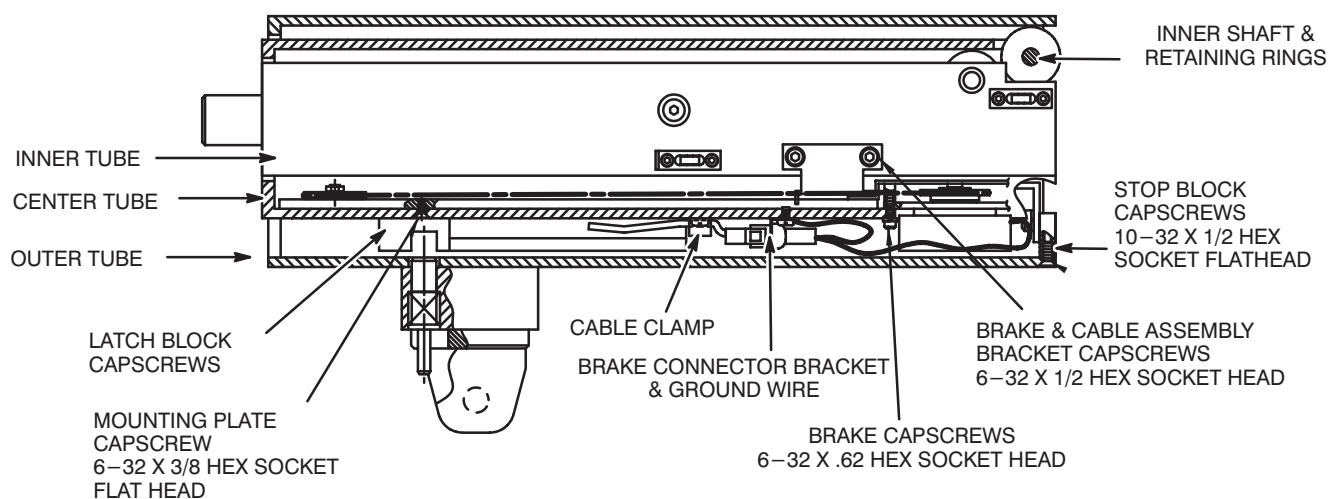
The horizontal arm must be secured before installing components on the arm. Do not rely on latch alone to hold it in place. With weight removed from the arm, the counterweight can descend rapidly and the arm ascend rapidly possibly causing damage to the unit and personal injury. Use Counterweight Lift Tool 46-303491G1.

7. Firmly grasp the horizontal arm and using your weight to counterbalance the counterweight, approximately 75 pounds (34 kg), carefully move it down to the top of the unit and into parked position. Do not rely on latch alone to hold the arm in place. Check that the arm is locked down before slowly removing your weight and releasing it.
8. Re-mount the x-ray tube and collimator assembly per Illustration 3-4.
9. Check that the arm moves freely up and down the column.

**3-7 Horizontal Arm Brake and
Cable Assembly Removal**

1. Remove horizontal arm assembly. Refer to Section 3-5.
2. Position horizontal arm assembly with latch block up.
3. Extend Horizontal Arm until clearance hole on underside is exposed.
4. Remove cable clamp. See Illustration 3-6.
5. Disconnect Brake Cable connection.
6. Remove the two stop block capscrews securing the brake and cable assembly to the end of the outer tube. See Illustration 3-6.

ILLUSTRATION 3-6
HORIZONTAL ARM OUTER,
CENTER AND INNER TUBES



7. Return arm to upright position.
8. Slide the center and inner tubes from the outer tube.
9. Place center and inner tubes in upside down position.
10. Remove four screws holding latch block to center tube. Remove block. This provides access to the mounting plate holding screw. See Illustration 3-6.
11. Remove mounting plate capscREW holding brake and cable assembly to the center tube.
12. Remove the two brake capscREWS holding the brake & cable assembly to the rear of the center tube.
13. Remove two or three screws (depends on unit you have) holding the connector bracket and ground wire to the center tube.
14. Remove two retaining rings from inner shaft on center tube. Slide shaft out permitting removal of two spacers and two bearings.
15. Carefully slide the brake and cable assembly, and the inner tube from the center tube.
16. Remove two capscREWS holding the brake and cable assembly bracket to the inner tube.
17. Remove brake and cable assembly from inner tube.

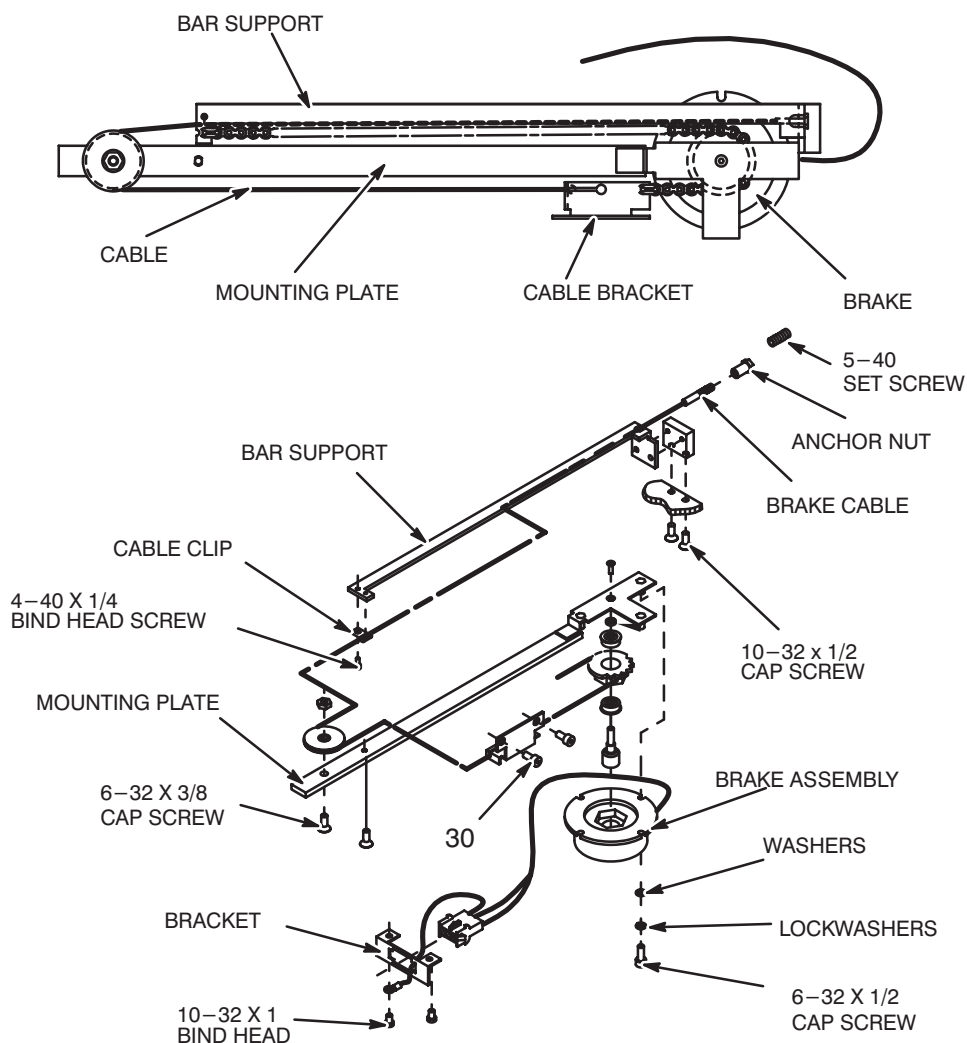
**3-8 Horizontal Arm Brake and
Cable Assembly Installation**

1. Mount the brake and cable assembly on the inner tube.
2. Secure the brake and cable assembly bracket to the inner tube with two capscrews. See Illustration 3-6.
3. Carefully slide the brake and cable assembly, and the inner tube into the center tube.
4. Replace the inner shaft, two spacers and two bearings. Secure with two retaining rings.
5. Place center and inner tubes in an upside down position.
6. Replace the two brake capscrews securing the brake & cable assembly to the rear of the center tube.
7. Secure the connector bracket and ground wire to the center tube with two or three screws (depends on unit you have).
8. Replace mounting plate capscrew holding brake and cable assembly to the center tube.
9. Replace the latch block and secure it with four screws to center tube.
10. Place the outer tube in an upside down position.
11. Slide the center and inner tubes into the outer tube.
12. Replace the two stop block capscrews and secure the brake and cable assembly to the end of the outer tube.
13. Connect Brake Cable.
14. Extend Horizontal Arm until clearance hole on underside is exposed.
15. Replace cable clamp.
16. Return arm to upright position.
17. Replace horizontal arm assembly. Refer to Section 3-6.

3-9 Horizontal Arm Brake Cable Removal

1. Remove horizontal arm brake and cable assembly. Refer to Section 3-7.
2. Remove cable clip from bar support assembly by removing one machine screw. See Illustration 3-7.
3. Remove anchor nut from brake cable by turning counterclockwise. This nut has been secured with set screws and Loctite.
4. Remove cable anchor end from bar support.
5. Slide ball end of cable from slot in cable bracket and remove from path around pulley end on mounting plate.
6. Remove the brake cable from brake and cable assembly.

ILLUSTRATION 3-7
BRAKE AND CABLE ASSEMBLY



**3-10 Horizontal Arm
Brake Cable Installation**

1. Slide ball end of brake cable into slot in cable bracket on end of chain on brake and cable assembly. See Illustration 3-7.
2. Route anchor end of cable around pulley on end of mounting plate to opposite end of support bar and insert in slot.
3. Replace anchor nut on cable end and take up slack by turning nut clockwise. Do not overtighten.
4. Replace cable clip, with brake cable in place, on bar support assembly and secure with one machine screw.
5. Check that the cable and chain move freely.
6. Loctite the anchor nut.
7. Install horizontal arm brake and cable assembly. Refer to Section 3-8.

**3-11 Horizontal Arm
Brake Removal**

1. Remove horizontal arm brake and cable assembly. Refer to Section 3-7.
2. Disconnect brake electrical cable connectors to remove from connector bracket.
3. Loosen remaining capscrew holding brake to mounting plate. See Illustration 3-7.
4. Slide brake off brake sprocket shaft.

**3-12 Horizontal Arm
Brake Installation**

1. Slide brake onto brake sprocket shaft.
2. Secure brake with single capscrew in end of mounting plate. See Illustration 3-7.
3. Position brake electrical cable connectors in connector bracket and reconnect.
4. Install horizontal arm brake and cable assembly. Refer to Section 3-8.

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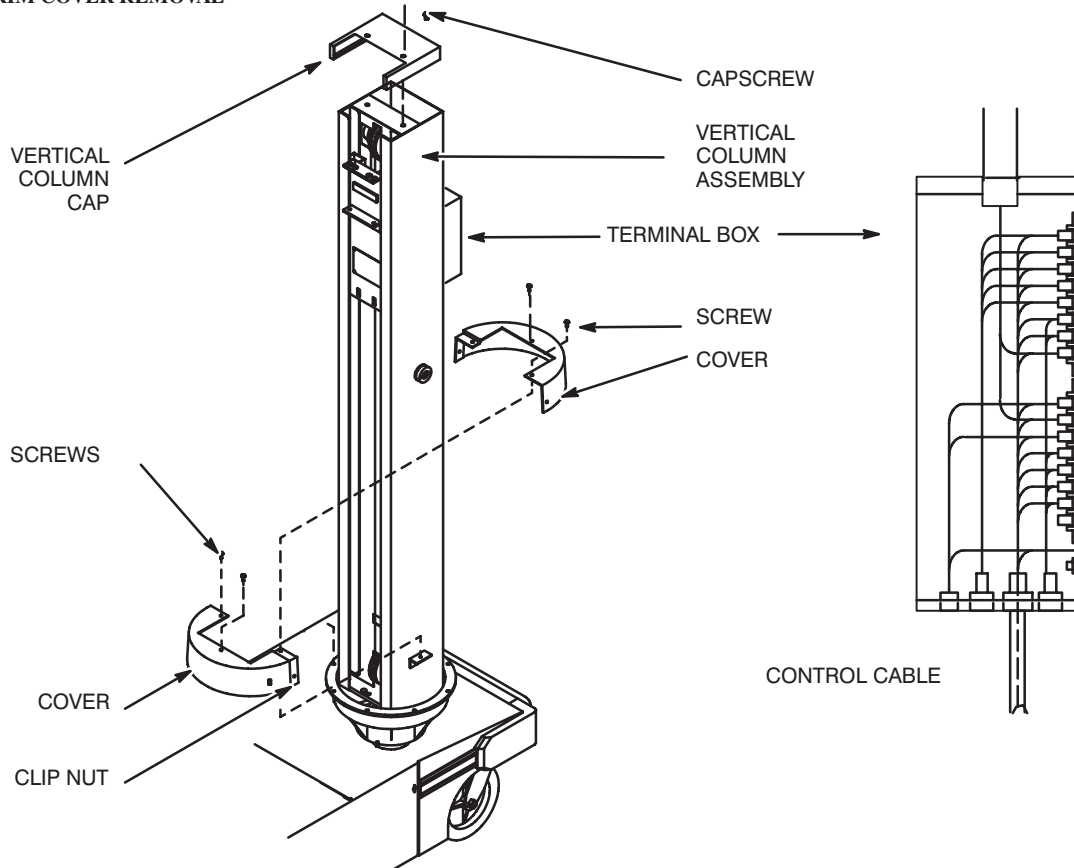
SECTION 4**SERVICING THE VERTICAL COLUMN**

This section provides procedures covering the removal and installation of the field serviceable assemblies subassemblies and parts comprising the vertical column assembly.

4-1 Vertical Column Assembly Removal

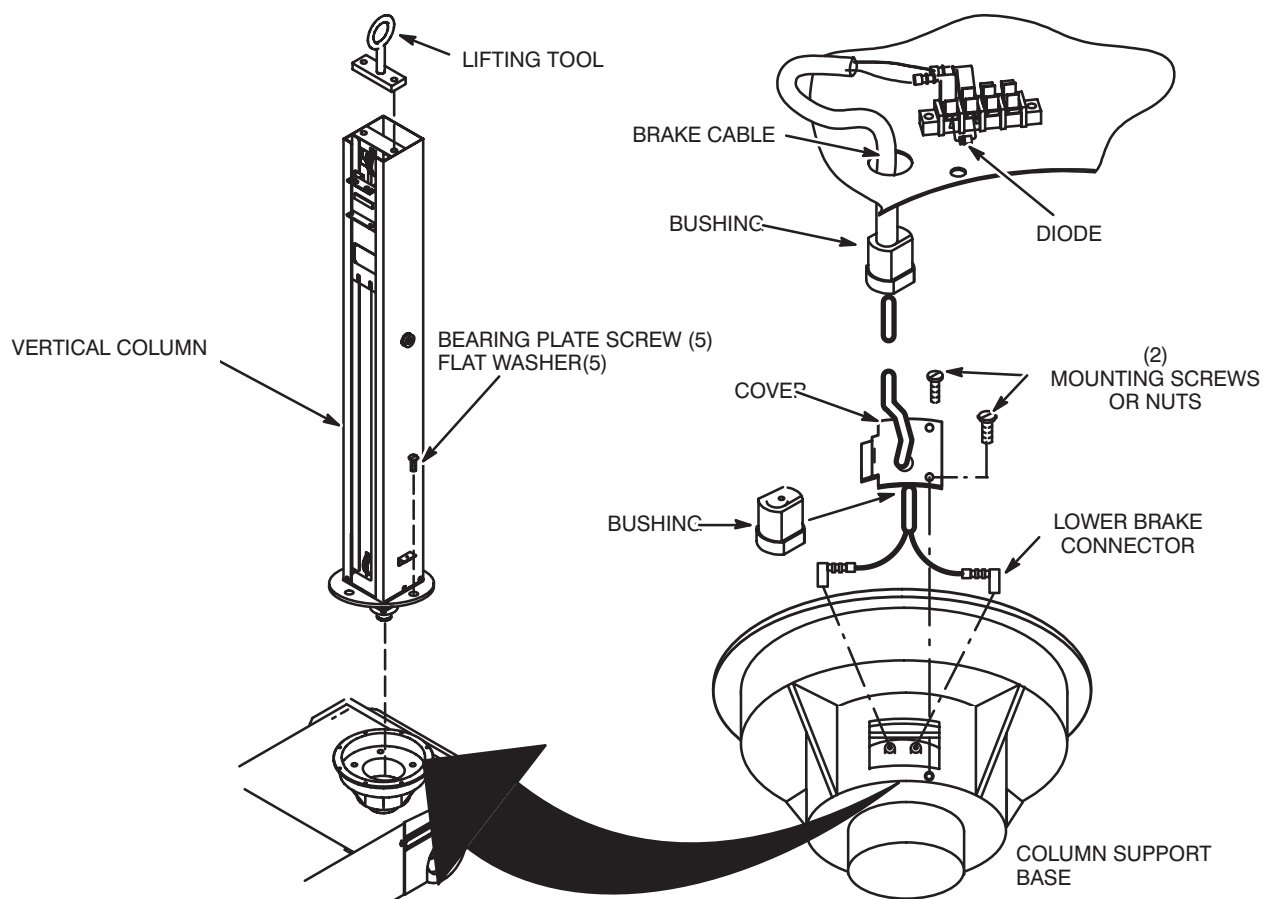
1. Remove x-ray tube and collimator assembly per Section 3-5. Then continue in Section 3-5 to remove horizontal arm.
2. Disconnect control cable leads from terminal block. Record and tag leads. See Illustration 4-1.
3. Remove Heyco bushing and cable through bottom of terminal box.
4. Clear all cables and wires from the column area.
5. Remove vertical column cap by removing two hex socket button head capscrews. See Illustration 4-1.
6. Attach lifting tool (46-303362P1) to top of column with 2 screws.
7. Attach chain hoist to lifting tool (46-303362P1) and take up slack. The chain hoist must be capable of lifting a seven foot, 175 lb. (80 kg) column a minimum of two feet (61 cm).

ILLUSTRATION 4-1
COLUMN TRIM COVER REMOVAL



8. Remove trim cover from bottom of vertical column by removing three screws, two clip nuts and two binding head screws. See Illustration 4-1.
9. Remove 5 bearing plate screws and washers securing column to the column support base.
10. Remove two screws securing brake cable cover and disconnect the lower brake connectors. See Illustration 4-2.
11. Move brake cable connectors and cover away from column support base.
12. Break loose the column support bearing from the column support base by jacking the column out using three 1/4-20 screws thru the base plate and against the support base.
13. Lift the column and bearing plate out of the base.
14. Lower the column onto the floor or a table capable of supporting its weight. Carriage side must be upwards.
15. Remove the chain hoist and lifting tool.

ILLUSTRATION 4-2
VERTICAL COLUMN REMOVAL



**4-2 Vertical Column
Assembly Installation**

1. Attach lifting tool (46-303362P1) to top of pulley and brake assembly with two capscrews. See Illustration 4-2.
2. Attach chain hoist to lifting tool.

Note:

The chain hoist must be capable of lifting a seven foot column weighing 175 lbs. (80 kg) a minimum of two feet (61 cm), preferably 4 feet (122 cm).

3. Lower the column into the base. Carefully seat the bearing plate in the base with the mounting holes lined up and the lower brake connectors opposite the opening in the base. See Illustration 4-2.
4. Replace five capscrews and five flat washers and secure bearing plate to the column support base. See Illustration 4-2. Torque to 50 to 70 inch pounds (5.6 to 7.8 N-m).
5. Connect brake connectors to brake. See Illustration 4-2.
6. Secure cover on column support base with two screws.
7. Replace trim cover at base of column. Refer to Section 5.
8. Insert control cable with Heyco bushing through bottom of terminal box located on back of vertical column. See Illustration 4-1.
9. Connect control cable leads to terminal block as recorded on tags.
10. Remove the chain hoist and lifting tool.
11. Replace trim cover on top of vertical column and secure with two hex socket button head capscrews. Refer to Section 5.
12. Replace horizontal arm. Refer to Section 3-6.
13. Then continue in Section 3-6 to remount x-ray tube and collimator assembly.
14. Check counterweight balancing. Refer to Section 10.

**4-3 Main, Safety and
Follower Cable Removal**

1. Remove vertical column from unit. Refer to Section 4-1. Vertical Column removal is necessary in order to replace a main, safety or follower cable.

Note:

When replacement of either the main, safety or follower cable is required, all three cables must be replaced to ensure that the periodic maintenance time interval specified for replacement of the cables remains the same. A mix of new and used cables may result in multiple cable failure and damage to the unit.

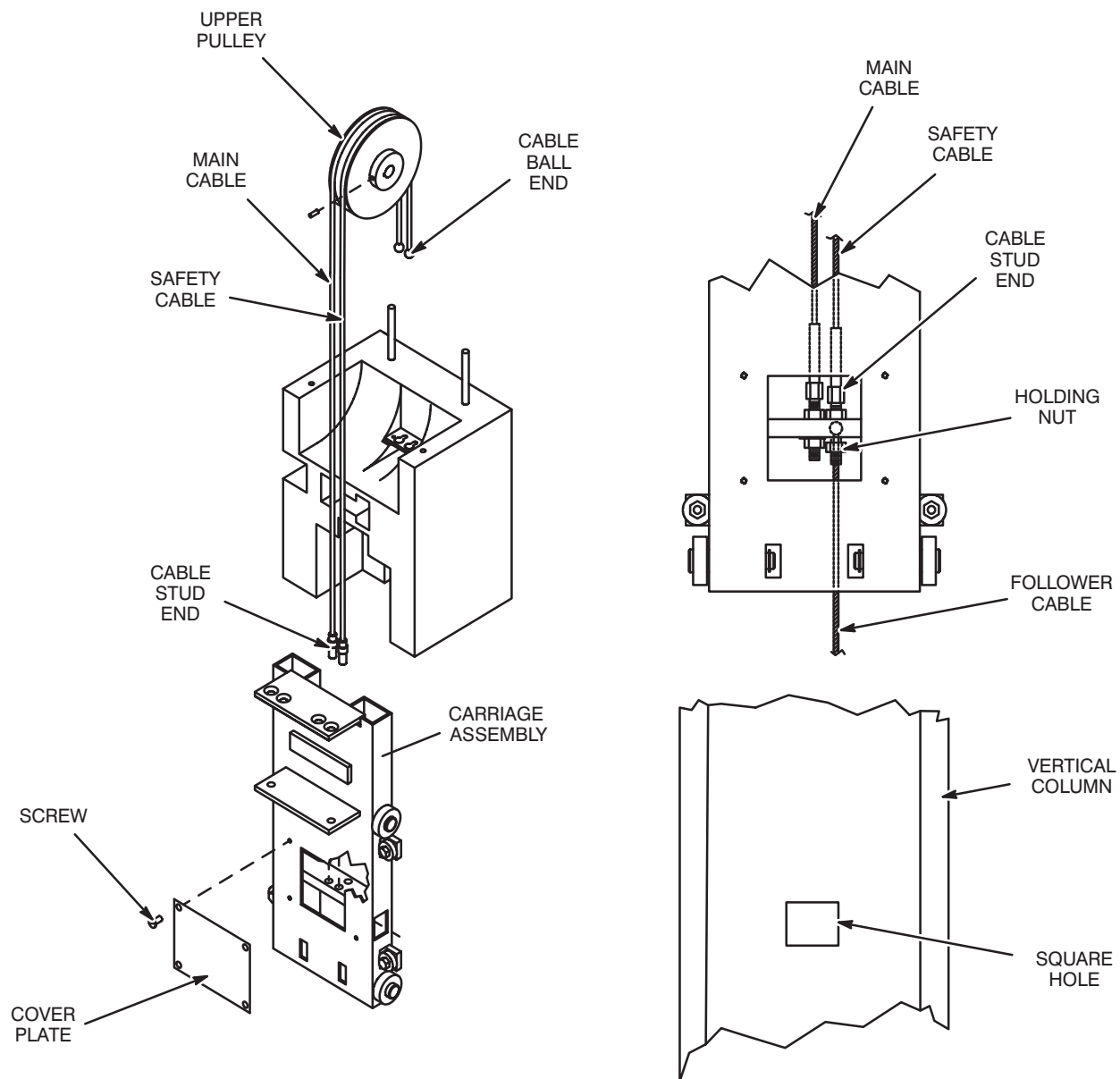
2. Remove cover plate from the carriage assembly by removing four binding head screws holding it in place. See Illustration 4-3.
3. Move carriage near to bottom of column. Line the carriage cable mounting strut over the small square hole in the column. This also brings counterweight to top of column where it can be removed.
4. Loosen locking nuts on top of stud ends of main and safety cables.
5. Remove holding nuts on bottom of stud ends of main and safety cables.
6. Remove cable studs from carriage cable mounting strut.
7. Push ball end of follower cable out of slot in carriage cable mounting strut into square hole in column.
8. Move carriage toward top of column until ball end of follower cable is exposed. Move ball end of cable to bottom of column.
9. Remove follower cable from lower pulley and leave inside bottom of column.
10. Remove pulley and brake assembly. Refer to Section 4-5.
11. Remove counterweight from top end of column. Refer to Section 4-7.

Note:

At this point all three cables are detached from the counterweight and can be removed from the vertical column assembly.

12. Remove main, safety and follower cables.

ILLUSTRATION 4-3
CABLE REPLACEMENT



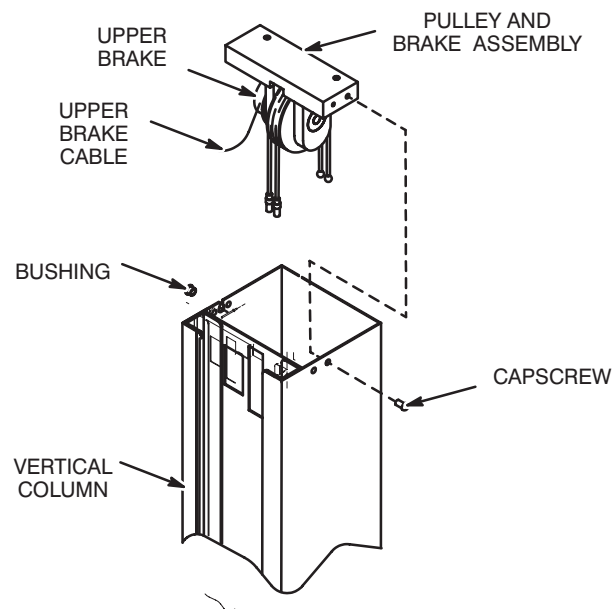
**4-4 Main, Safety and
Follower Cable Installation**

1. Install counterweight assembly. Refer to Section 4-8.
2. Install upper pulley and brake assembly. Refer to Section 4-6.
3. Reach in the bottom of the column, retrieve the follower cable and position it around the lower pulley. See Illustration 4-3.
4. Place the ball end of the follower cable in the small square cut-out in the column.
5. Align the carriage cable mounting strut over the base end of the follower cable.
6. Place ball end of follower cable in slot on carriage cable mounting strut.
7. Replace top locking nuts on stud ends of main and safety cables.
8. Insert main safety cable studs into carriage cable mounting strut holes.
9. Replace holding nuts on bottom of stud ends of main and safety cables. Do not tighten at this time.
10. Make certain all the cables are still in their pulley grooves. (Follower cable is on right side as you look at it.)
11. Tighten the main cable until there is no slack in the follower cable.
12. Tighten the safety cable holding nut. It should have approximately 5 to 10 pounds of tension.
13. Apply Loctite and tighten the locking nuts.
14. Check that the carriage moves freely up and down the column.
15. Replace cover plate on the carriage assembly and secure with four binding head screws. See Illustration 4-2.
16. Move carriage to top of column. This moves counterweight to bottom of column.
17. Install vertical column. Refer to Section 4-2.

4-5 Upper Pulley and Brake Assembly Removal

1. Remove the vertical column. Refer to Section 4-1.
2. Detach the main and safety cables from the carriage cable mounting strut. Refer to Section 4-3.
3. Remove two screws in the bottom of terminal box located on back of vertical column and lift off cover.
4. Disconnect upper brake cable leads from terminal block. (It is important to tag and record terminal points, otherwise there is a possibility of blowing internal diode in brake if leads are improperly installed.)
5. Remove brake cable from terminal box and channel on back of column.
6. Remove capscrews securing pulley and brake assembly to top of column. See Illustration 4-4.

ILLUSTRATION 4-4
UPPER PULLEY AND
BRAKE ASSEMBLY



7. Remove Heyco bushing from column where brake cable enters pulley and brake assembly. Bushing extends into pulley and brake casting.
8. Slowly withdraw pulley and brake assembly from top of column while sliding the brake cable through slot in top of column. These must be done together or the brake cable will be severed.
9. Pull main and safety cables from the column.
10. Remove the nuts from the stud ends of both cables.

11. Remove each cable from the pulley and brake assembly by first lifting it from its pulley groove, moving it to the side of the pulley and then pulling it free. The ball ends of these cables still remain attached to counterweight.
12. Remove the pulley and brake assembly.

4-6 Upper Pulley and Brake Assembly Installation

1. Place pulley and brake assembly near upper end of vertical column. See Illustration 4-4.
2. Remove the nuts from the stud ends of main and safety cables.
3. Insert each cable into pulley and brake assembly along the side of the pulley then lift it into its assigned pulley groove. The ball ends of these cables are attached to the counterweight.
4. Tag either the main or safety cable. This will eliminate confusion when securing them in their correct positions on the carriage mounting strut.
5. Insert main and safety cables into the column through slot provided.
6. Check that the brake cable is exiting pulley and brake assembly through hole in casting.
7. Replace pulley and brake assembly in top of column while sliding the brake cable through slot in top of column. This must be done together or the brake cable may be damaged.
8. Replace the Heyco bushing in column where brake cable passes through column and enters pulley and brake assembly. Bushing extends into pulley and brake casting.
9. Apply Loctite and replace four capscrews securing pulley and brake assembly to top of column. Torque to 50-70 inch pounds (5.6 to 7.8 N-m).
10. Insert brake cable through top of channel on back of column and down into terminal box.
11. Connect upper brake cable leads to terminal block. See Illustration 1-1.
12. Replace terminal box cover located on back of vertical column and secure with two screws.
13. Install main and safety cables on the carriage cable mounting strut. Refer to Section 4-4.
14. Install vertical column. Refer to Section 4-2.

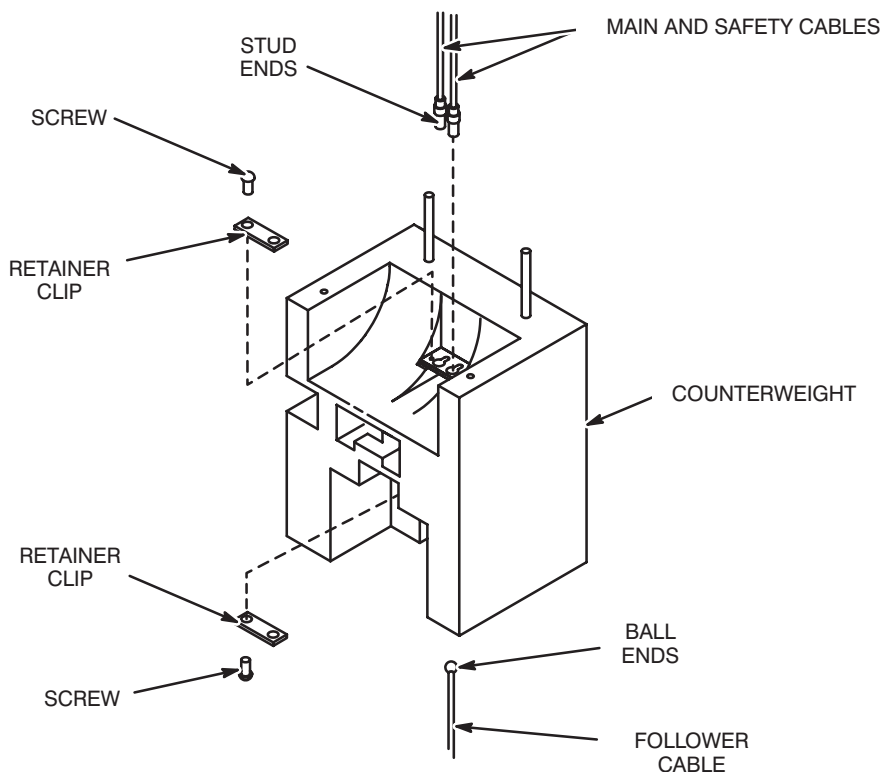
4-7 Counterweight Removal

1. Remove vertical column. Refer to Section 4-1.
2. Remove the main, safety and follower cables. Refer to Section 4-3.
3. Remove upper pulley and brake assembly. Refer to Section 4-5.

**WARNING****PERSONAL INJURY!**

THE COUNTERWEIGHT WEIGHS APPROXIMATELY 100 POUNDS (45 KG). USE THE PROPER SAFETY PRECAUTIONS WHEN HANDLING THE COUNTERWEIGHTS.

4. Slide counterweight from vertical column.
5. Remove top cable retainer clip from counterweight assembly by removing two slotted hex washer head screws. See Illustration 4-5.
6. Remove main and safety cables from counterweight assembly by dislodging ball ends of cables from retaining notch in counterweight.
7. Remove bottom follower cable retainer clip from counterweight assembly by removing two slotted hex washer head capscrews.
8. Remove follower cable from counterweight assembly by dislodging ball end of cable from retaining notch in counterweight.

ILLUSTRATION 4-5
COUNTERWEIGHT

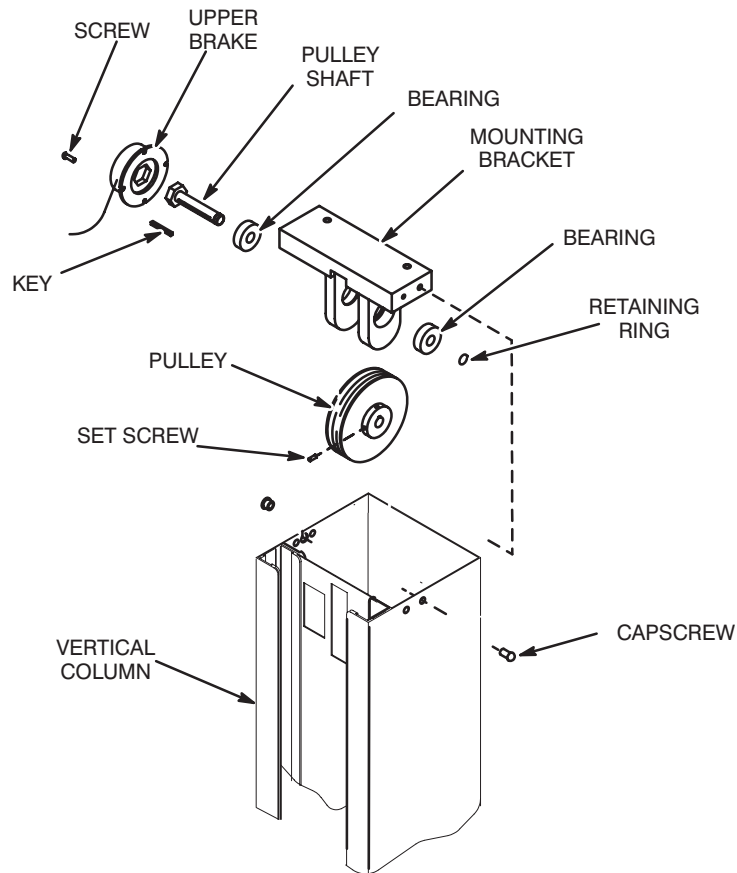
4-8 Counterweight Installation

1. Replace main and safety cables in counterweight assembly by inserting ball ends of cables into retaining notch in top of counterweight. See Illustration 4-5.
2. Replace cable retainer clip in top of counterweight assembly and secure with two slotted hex washer capscrews.
3. Place follower cable ball end into retaining notch in bottom of counterweight. The follower cable must be installed on the right side to function properly.
4. Replace follower cable retainer clip in bottom of counterweight assembly and secure with two slotted hex washer head capscrews.
5. Slide follower cable down inside of vertical column as far as possible.
6. Slide counterweight assembly into vertical column.
7. Check counterweight balancing. Refer to Section 10.

4-9 Upper Brake Removal

1. Remove collimator. Refer to Section 1-1.
2. Remove tube. Refer to Section 2-1.
3. Remove horizontal arm. Refer to Section 3-5. It is not necessary to remove yoke from arm.
4. Remove two screws in the bottom of terminal box located on back of vertical column and lift off cover.
5. Disconnect upper brake cable leads from terminal block.

(It is important to tag and record terminal points, otherwise there is a possibility of blowing internal diode in brake if leads are improperly installed.)
6. Remove brake cable from terminal box and channel on back of column.
7. Remove cover plate from the carriage assembly by removing four binding head screws holding it in place. See Illustration 4-3.
8. Move carriage as close as possible to top of column and disconnect the main and safety cables by removing the cable stud end nuts and holding nuts. See Illustration 4-7.
9. Move carriage to bottom of column.
10. Remove four capscrews securing pulley and brake assembly to top of column.
11. Remove the Heyco bushing in column where brake cable passes through column and enters pulley and brake assembly. Bushing extends into pulley and brake casting.
12. Remove pulley and brake assembly from top of column while sliding the brake cable through slot in top of column. This must be done together or the brake cable may be damaged.
13. Remove two slotted hex, washer head, thread-forming screws holding upper brake to the mounting bracket. See Illustration 4-6.
14. Remove brake from hex headed shaft. Note the orientation of the brake cable in relation to the mounting bracket. This is important when installing a brake.

ILLUSTRATION 4-6
UPPER BRAKE AND PULLEY**4-10 Upper Brake Installation**

1. Replace brake on hex headed pulley shaft. Note the orientation of the brake cable in relation to the mounting bracket. This is important for cable routing when installing a brake. Refer to Illustration 4-6.
2. Insert two slotted hex, washer head, thread-forming screws holding upper brake to the pulley and brake assembly casting and secure in place.
3. Check that the brake cable is exiting pulley and brake assembly through hole in casting.
4. Replace pulley and brake assembly in top of column while sliding the brake cable through slot in top of column. This must be done together or the brake cable may be damaged.
5. Replace the Heyco bushing in column where brake cable passes through column and enters pulley and brake assembly. Bushing extends into pulley and brake casting.
6. Apply Loctite and replace four cap screws securing pulley and brake assembly to top of column. Torque to 50-70 inch pounds (5.6 to 7.8 N-m).

7. Insert brake cable through top of channel on back of column and down into terminal box.
8. Connect upper brake cable leads to terminal block. See Illustration 4-1. Carefully check lead installation at terminal points. Otherwise possibility of blowing internal diode in brake if leads improperly reinstalled.
9. Move carriage to top of column and insert main and safety cables in carriage cable mounting strut. See Illustration 4-7.
10. Tighten the main and safety cable stud end nuts and lock in place with the holding nuts.

Tighten main cable to 60 pounds (27 kg) tension.

Set safety cable to 5 – 10 pounds (2.3 to 4.5 kg) tension after main cable tension is set.

11. Replace cover plate on the carriage assembly and secure with four binding head screws. See Illustration 4-3.
12. Replace horizontal arm with yoke. Refer to Section 3-6.
13. Replace tube. Refer to Section 2-2.
14. Replace collimator. Refer to Section 1-2.

4-11 Upper Pulley and Bearings Removal

1. Remove upper brake. Refer to Section 4-9.
2. Place a tag on either the main cable or safety cable. This will aid in re-installing them later in their correct positions.
3. Remove pulley set screws (2).
4. Remove retaining ring from end of pulley shaft.
5. Remove pulley shaft bearing, key, pulley and cables from mounting bracket.
6. Remove bearing from mounting bracket.

4-12 Upper Pulley and Bearings Installation

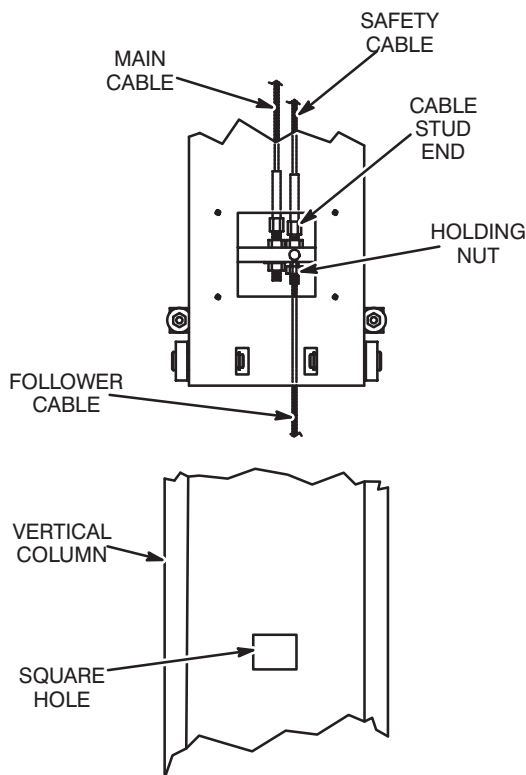
1. Place bearing on pulley shaft and insert key. See Illustration 4-6.
2. Place pulley with main and safety cables in position in the mounting bracket.
3. Insert pulley shaft, bearing and key into mounting bracket and through pulley.
4. Place bearing in mounting bracket on end of pulley shaft.
5. Place retaining ring on end of pulley shaft.

6. Replace pulley set screws (2) and secure firmly.
7. Install upper brake. Refer to Section 4-10.

4-13 Carriage Assembly Removal

1. Remove upper pulley and brake assembly. Refer to Section 4-5.
2. Lower carriage to position over square cut-out in column and remove follower cable end from carriage strut by loosening its holding nut. See Illustration 4-7.
3. Slide carriage to top of column and remove it.

ILLUSTRATION 4-7
CARRIAGE ASSEMBLY



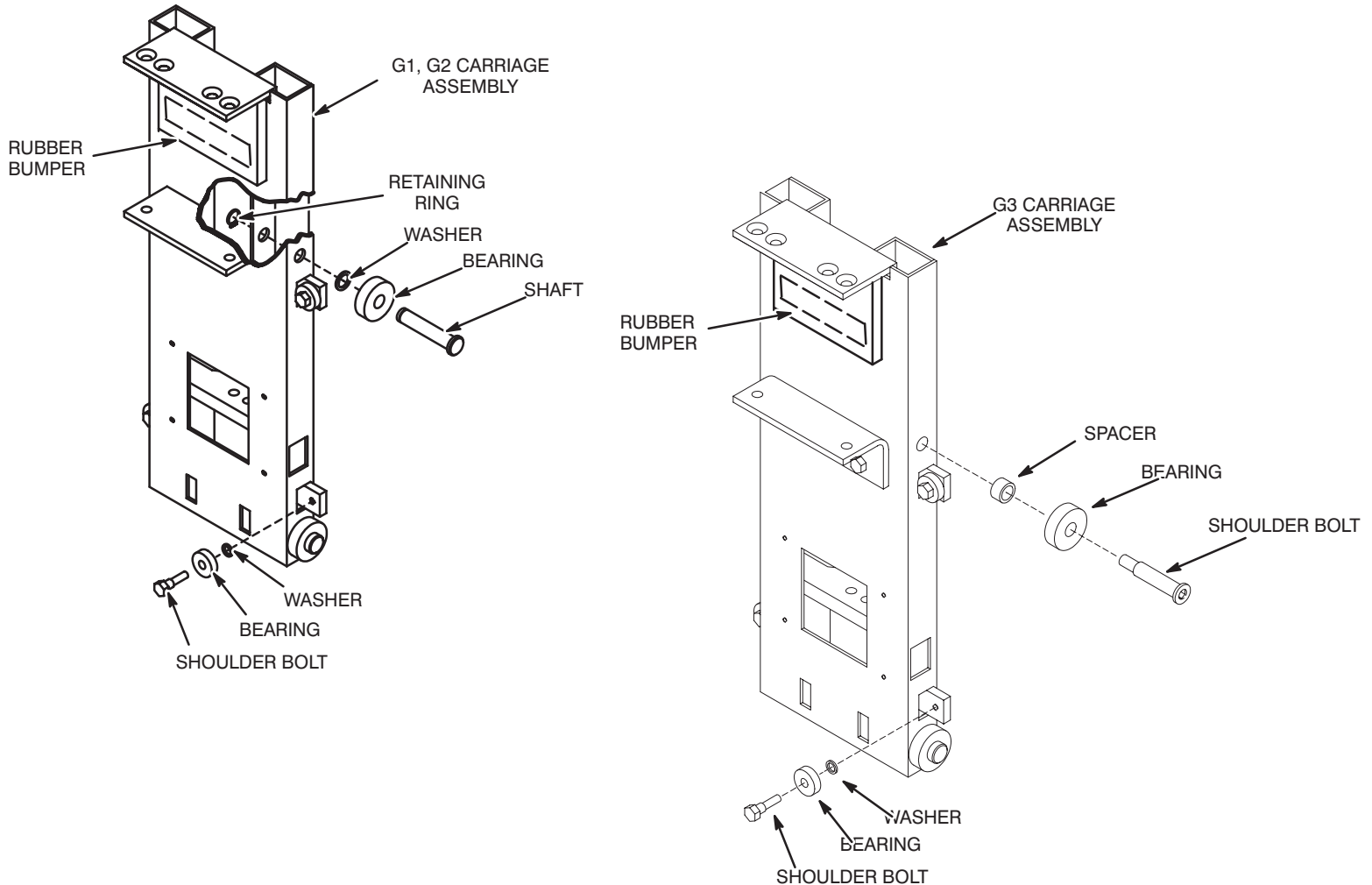
4-14 Carriage Assembly Installation

1. Slide carriage assembly into top of column. Check that horizontal arm mounting plate is at top of carriage.
2. Install pulley and brake assembly. Refer to Section 4-6.
3. Lower carriage to position over square cut-out in column. Place follower cable end into carriage strut and secure in place by tightening its holding nut. See Illustration 4-7.

4-15 Carriage Assembly Bearings Removal

1. Remove carriage assembly. Refer to Section 4-13.
2. Remove four hex head shoulder bolts securing four forward facing bearings to side flanges on carriage. See Illustration 4-8.

ILLUSTRATION 4-8
CARRIAGE BEARINGS



3. Remove carriage side facing bearings.

G1/G2 Models: Turn carriage assembly over and remove retaining rings from ends of side facing bearing shafts located at each side of carriage. Remove bearing shafts and bearings from carriage.

G3 Models: Remove bearing shoulder bolts and bearings from carriage.

**4-16 Carriage Assembly
Bearings Installation**

1. Lubricate bearings if necessary.
2. Attach four forward facing bearings to carriage mounting flanges with hex head shoulder bolts. See Illustration 4-8. Apply Loctite and torque to 40-60 pound inches (4.5 to 6.7 N-m)
3. Install side facing bearings.

G1/G2 Models: Secure bearing shafts to carriage each side of carriage with retaining rings in grooved ends of shafts.

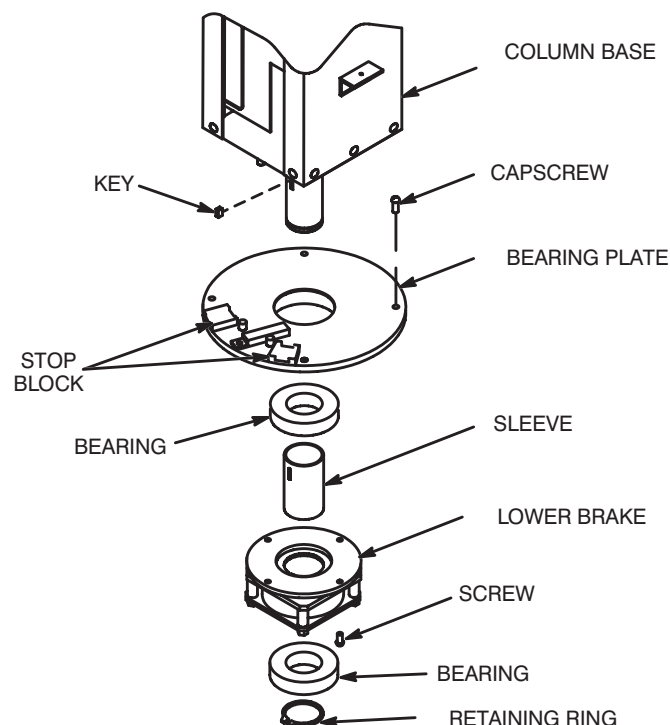
G3 Models: Install bearings at mounting locations on each side of carriage with shoulder bolts.

4. Install carriage assembly in vertical column assembly. Refer to Section 4-14.

**4-17 Lower Brake and
Bearings Removal**

1. Remove vertical column. Refer to Section 4-1.
2. Remove retaining ring and pull lower bearing from shaft on column base. See Illustration 4-9.

ILLUSTRATION 4-9
LOWER BRAKE AND BEARINGS



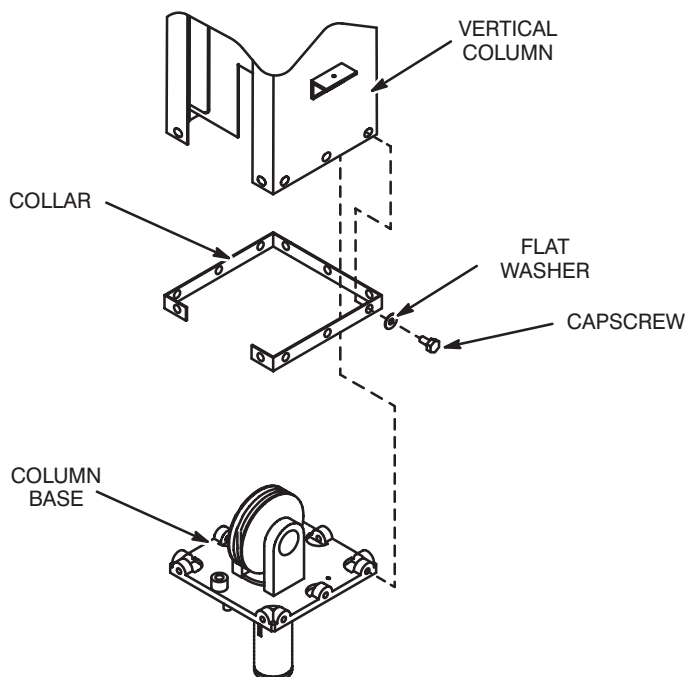
3. Remove four machine screws and star washers securing lower brake to bearing plate.
4. Remove lower brake from shaft on column base.
5. Remove sleeve and key from shaft on column base.
6. Remove bearing plate and bearing.
7. Remove bearing from bearing seat in bearing plate.

4-18 Lower Brake and Bearings Installation

1. Insert bearing in bearing seat in bearing plate. See Illustration 4-9.
2. Place bearing plate with bearing on column base shaft.
3. Place sleeve and key on column base shaft.
4. Place lower brake on column base shaft.
5. Secure lower brake to bearing plate with four machine screws and star washers. Torque to 40-60 inch pounds (4.5 to 6.7 N-m).
6. Slide lower bearing on column base shaft and secure with retaining ring.
7. Install vertical column assembly. Refer to Section 4-2.

4-19 Column Base Removal

1. Remove vertical column assembly. Refer to Section 4-1.
2. Remove follower cable. Refer to Section 4-3, Steps 2 through 9.
3. Remove lower brake and bearings. Refer to Section 4-17.
4. Remove eleven hex head capscrews and flat washers securing column base assembly to vertical column. See Illustration 4-10.
5. Remove collar from bottom of vertical column.
6. Pull column base assembly from vertical column.

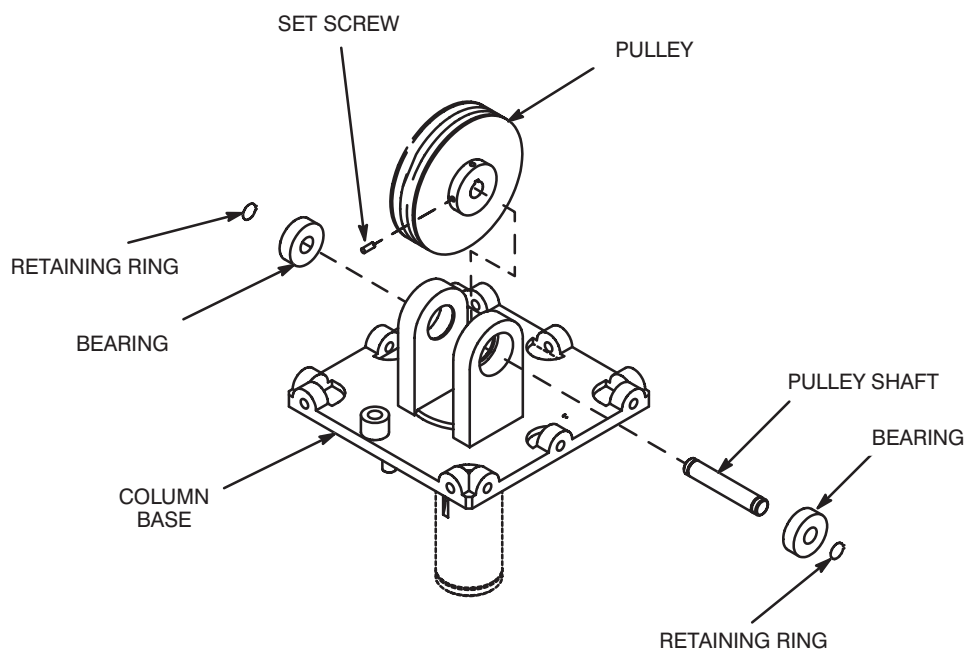
ILLUSTRATION 4-10
COLUMN BASE

4-20 Column Base Installation

1. Insert column base assembly into vertical column. Line-up holes with those in vertical column. See Illustration 4-10.
2. Place collar around bottom of vertical column. Align holes with vertical column and column base holes.
3. Secure column base assembly to vertical column with eleven hex head capscrews and flat washers. Apply Loctite to the capscrews. Torque to 30-35 foot pounds (41 to 47 N-m).
4. Install lower brake and bearings. Refer to Section 4-18.
5. Install follower cable. Refer to Section 4-3, Steps 3 through 14.
6. Install vertical column assembly. Refer to Section 4-2.

4-21 Lower Pulley and Bearings Removal

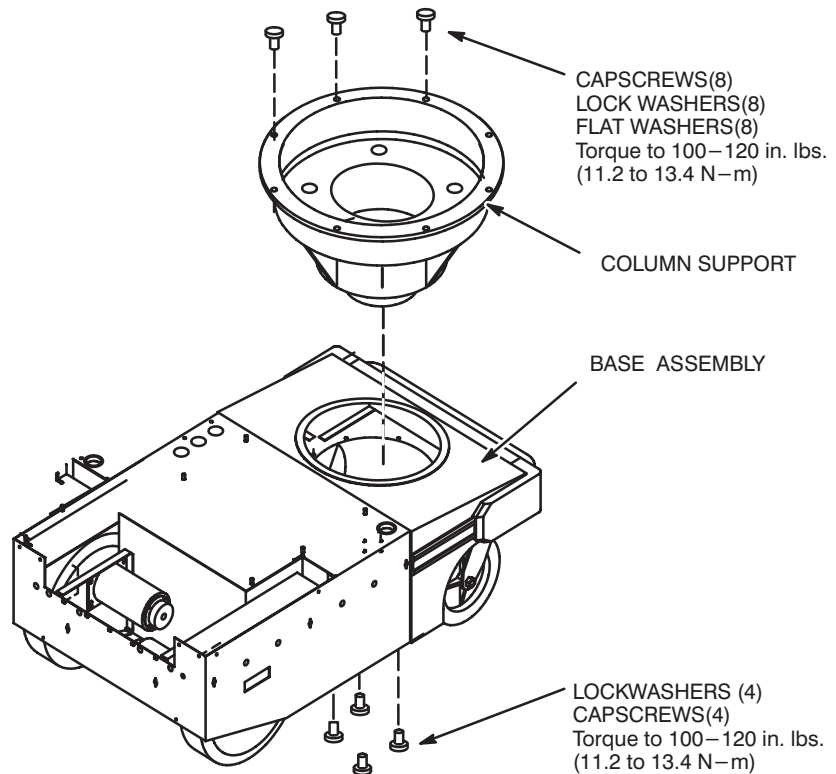
1. Remove column base. Refer to Section 4-19.
2. Loosen two set screws on pulley hub. See Illustration 4-11.
3. Remove external retaining rings from pulley ends of pulley shaft.
4. Pull out shaft and remove pulley.
5. Remove bearings from column base casting.

ILLUSTRATION 4-11
LOWER PULLEY AND BEARINGS**4-22 Lower Pulley and Bearings Installation**

1. Insert bearings in bearing seats in column base casting. See Illustration 4-11.
2. Push pulley shaft through left bearing. Slide pulley on shaft with pulley hub toward right bearing.
3. Insert pulley shaft in right bearing and secure shaft with one external retaining ring in groove on each end of shaft.
4. Tighten two set screws on pulley hub.
5. Install column base. Refer to Section 4-2.

4-23 Column Support Assembly Removal

1. Remove vertical column assembly. Refer to Section 4-1.
2. From beneath the bare assembly, remove four capscrews and washers securing column support to bottom of base assembly. See Illustration 4-12.
3. Remove eight hex head capscrews, eight lockwashers and eight flat washers securing the column support to the base assembly.
4. Remove column support from base assembly.

ILLUSTRATION 4-12
COLUMN SUPPORT ASSEMBLY

4-24 Column Support Assembly Installation

1. Place column support in base assembly. Orient opening in side of column support so it is opposite terminal board in base assembly. Line-up mounting holes. See Illustration 4-12.
2. Secure the column support to the base assembly with eight hex head cap screws, eight lock washers and eight flat washers. Torque to 100–120 inch pounds (11.2 to 13.4 N–m).
3. Secure bottom of column support to bottom of front tongue in base assembly with four cap screws and washers. Torque to 100–120 inch pounds (11.2 to 13.4 N–m).
4. Install vertical column assembly. Refer to Section 4-2.

SECTION 5

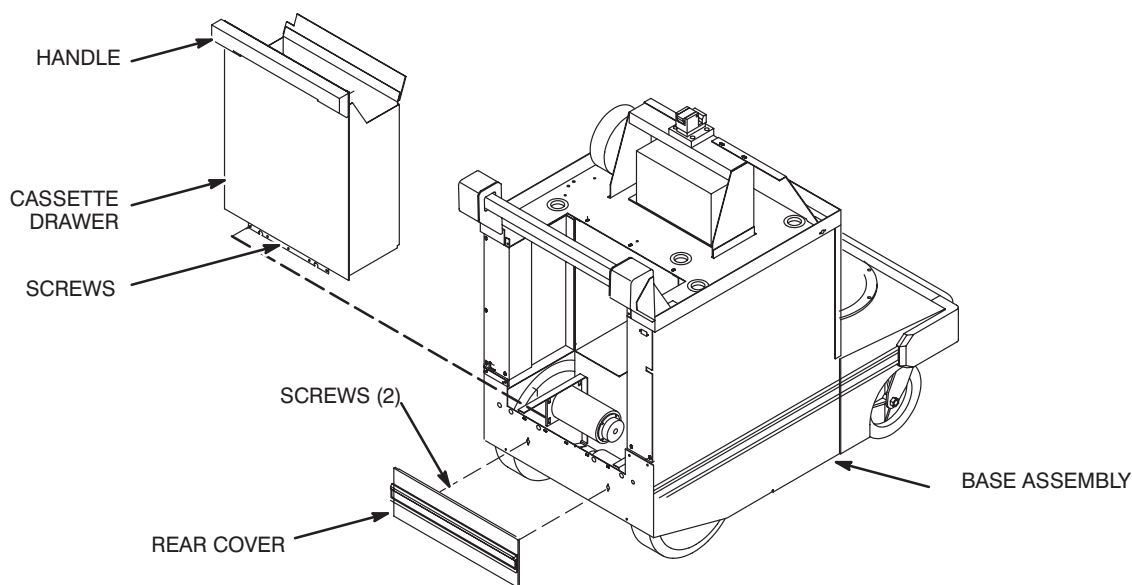
SERVICING THE TRIM COVERS AND CASSETTE DRAWER

This section provides procedures covering the removal and installation of trim covers.

5-1 Cassette Drawer Removal

1. Remove rear cover from unit by removing two screws securing it to base assembly. See Illustration 5-1.
2. Remove five binding head screws and flat washers securing cassette drawer hinge to base assembly.
3. Pull cassette drawer to open position. It is retained by magnetic catch. Lift drawer up and out of base assembly.

ILLUSTRATION 5-1
CASSETTE DRAWER



5-2 Cassette Drawer Installation

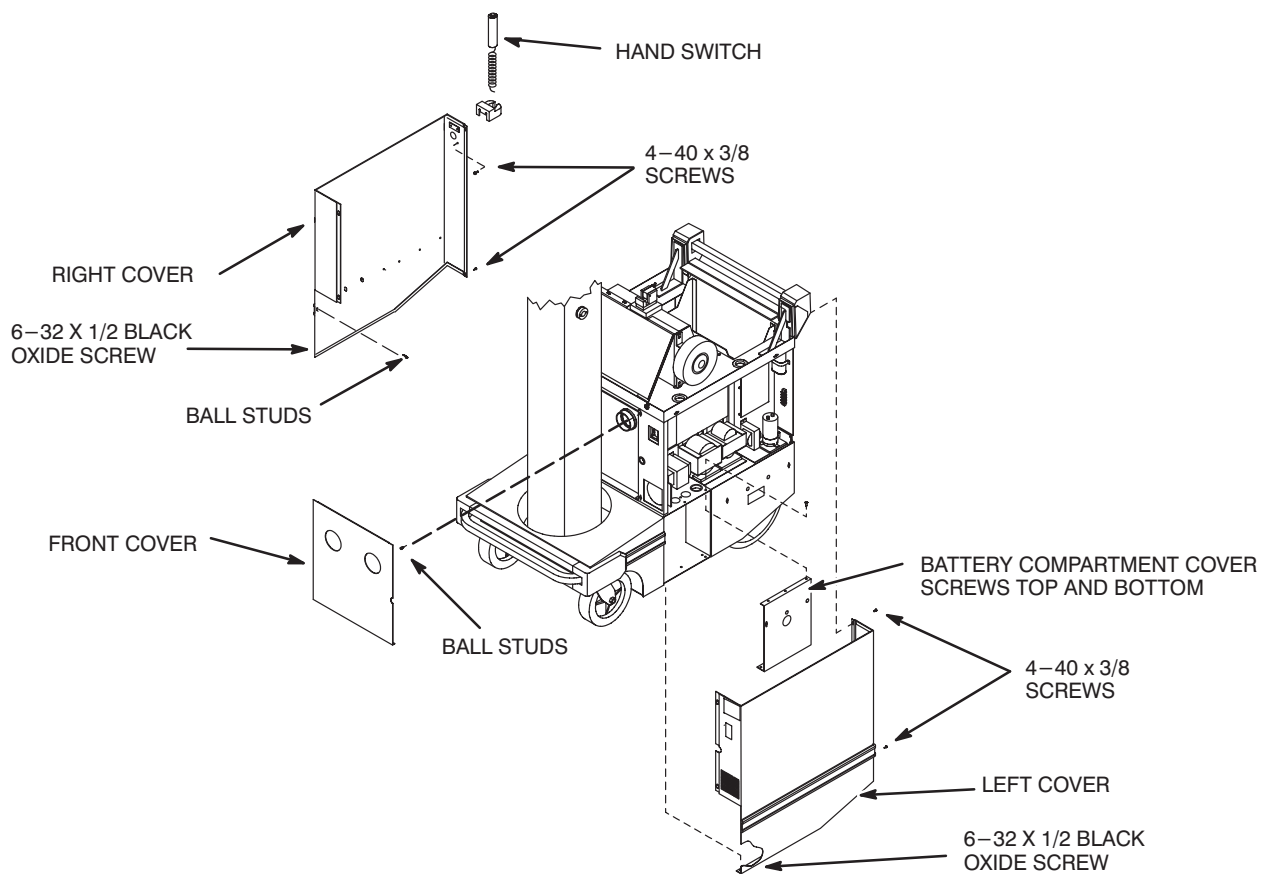
1. Place cassette drawer in position on base assembly.
2. Attach cassette drawer hinge to base with five binding head screws and flat washers.
3. Install rear cover to base assembly with two screws.
4. Close cassette drawer. Magnetic catch will hold it in its place.

5-3 Side Covers Removal

Note: This procedure covers the removal of both the right and left trim covers.

1. Turn power off by turning circuit breaker OFF.
2. Remove front cover from unit by pulling corners of cover from ball stud retainer sockets on mainframe. See Illustration 5-2.
3. Remove rear cover by removing two screws retaining it on base assembly.
4. Disconnect hand switch on right side trim cover.
5. Remove two 4-40 x 3/8 binding head screws and one 6-32 x 1/2 black oxide binding head screw holding each cover to base and mainframe assemblies.
6. Pull covers loose from five ball stud retaining sockets and carefully remove from unit.

ILLUSTRATION 5-2
SIDE COVERS



5-4 Side Cover Installation

1. Turn power off by turning circuit breaker OFF.

Note:

This procedure covers the installation of both the right and left trim covers.

2. Install side covers by first pressing the five ball studs into retainer sockets on base and mainframe assemblies. See Illustration 5-2.
3. Secure each side cover to base and mainframe assemblies with two 4-40 x 3/8 binding head screws and one 6-32 x 1/2 black oxide binding head screw.
4. Connect handswitch on right side trim cover.
5. Install rear cover with two screws.
6. Install front cover on unit by pressing ball studs on corners of cover into retainer sockets.

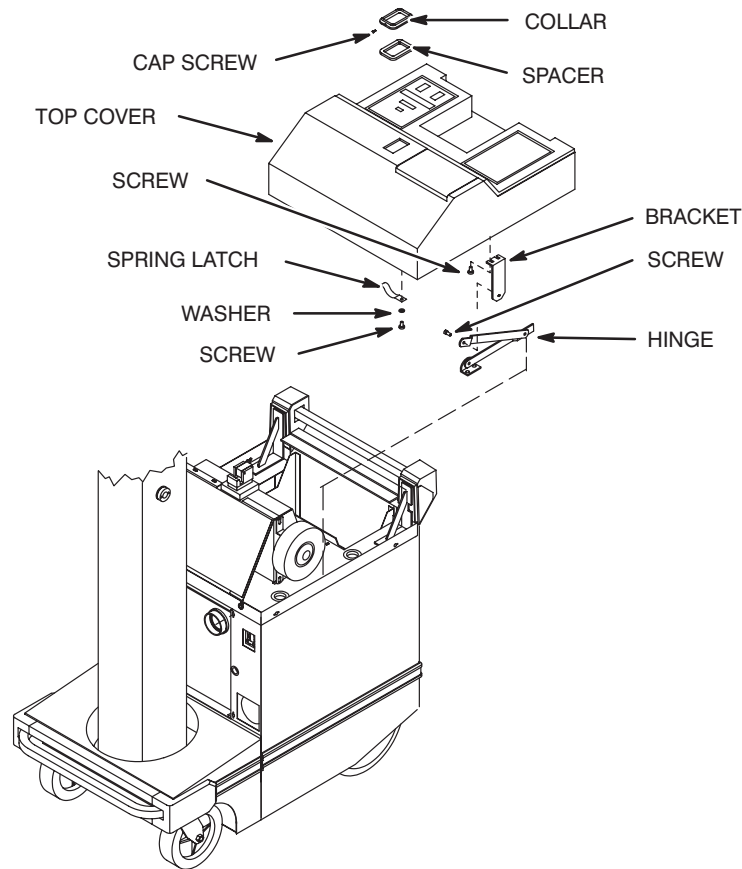
5-5 Top Cover Removal

1. Move horizontal arm to top of column.
2. Turn power off by turning circuit breaker OFF.
3. Open cassette drawer, reach up into top cover and rotate two spring latches to release cover from the mainframe.
4. Remove three hex socket capscrews holding collar to horizontal arm latch and lift off collar and spacer beneath it. See Illustration 5-3.
5. Lift top cover straight up until right and left hinges lock in vertical position.

Note:

With top cover extended on hinges, the cover can be tilted toward the front or rear of the unit to provide access to either area for servicing. If complete removal of the cover is necessary then continue with steps 5 through 9.

6. Disconnect wires from key switch assembly.
7. Disconnect ribbon cable from display at printed wire board.
8. Remove the shouldered screws holding the right and left hinges to the top cover brackets.
9. Remove the top cover.

ILLUSTRATION 5-3
TOP COVER

5-6 Top Cover Installation

1. Move horizontal arm to top of column.
2. Turn power off by turning circuit breaker OFF.
3. Extend right and left hinges from mainframe to vertical position. See Illustration 5-3.
4. Lift top cover and position brackets on hinges.
5. Secure top cover brackets to right and left hinges with two shouldered screws.
6. Connect ribbon cable from display to printed wire board.
7. Connect wires to key switch assembly.
8. Carefully lower cover into position on top of mainframe.
9. Open cassette drawer, reach up into top cover and rotate two spring latches to lock cover to mainframe.
10. Place spacer and collar on horizontal arm latch and secure collar in place with three hex socket capscrews.

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SECTION 6

SERVICING THE BASE ASSEMBLY

This section provides procedures covering the removal and installation of the field serviceable assemblies and parts comprising the base assembly.

6-1 Gates Battery Removal



PERSONAL INJURY !

REMOVE ALL JEWELRY AND RINGS WHEN HANDLING THE BATTERIES OR REACHING IN THE BATTERY COMPARTMENT. USE EXTREME CAUTION, HIGH AMPERAGE AND VOLTAGE IS PRESENT. USE INSULATED TOOLS FOR WORKING ON BATTERIES.

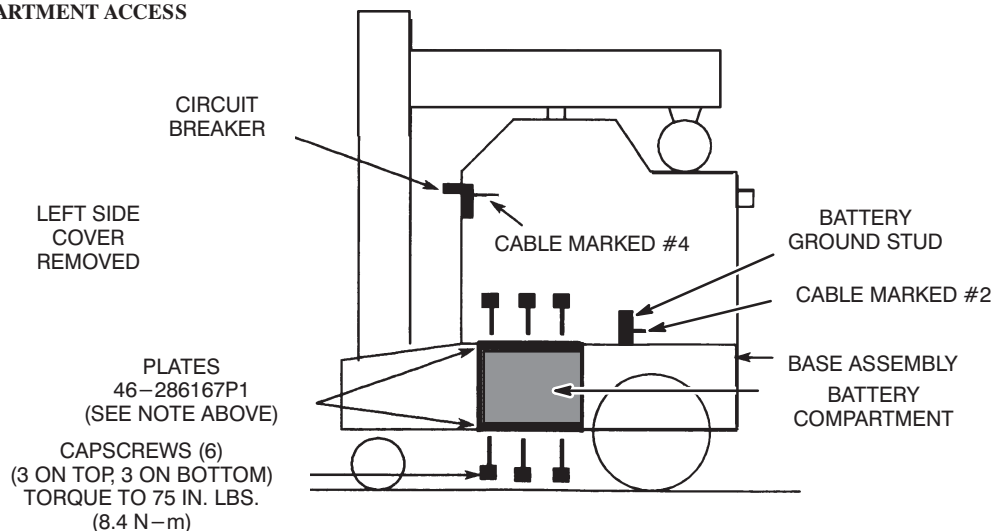
1. Verify that AMX key switch is in "OFF" position and that circuit breaker is "OFF".
2. Remove Left Side Cover, Refer to Section 5-3.
3. Remove battery cable marked #2 from battery ground stud. Refer to Illustration 6-1. Tape connector separately to assure that this cable will not short out to any other wiring.
4. Remove battery compartment cover by removing six internal-hex cap screws. Refer to Illustration 6-1.

Note:

Plates 46-286167P1 correct units with over-size holes where capscrews will not catch and properly secure the cover to the compartment opening.

It is important to torque capscrews to 75 inch pounds (8.4 N-m) to maintain overall strength of the base.

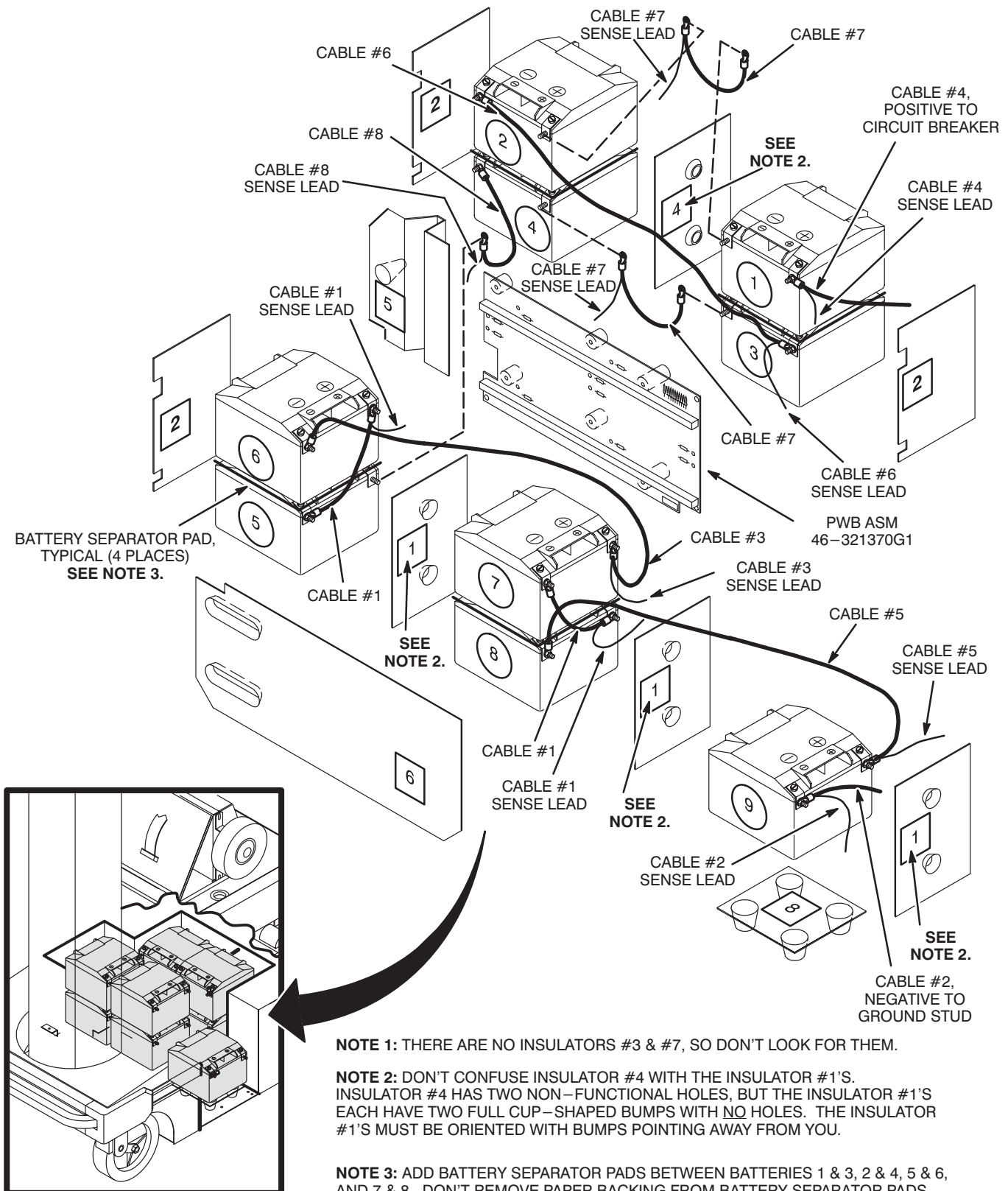
ILLUSTRATION 6-1
BATTERY COMPARTMENT ACCESS



Note: In following procedure, be sure to insulate all battery lead connectors to prevent electrical contact with battery terminals or AMX frame. Save all connecting hardware.

Note: Refer to Illustrations 6-2 and 6-3 for following procedure.

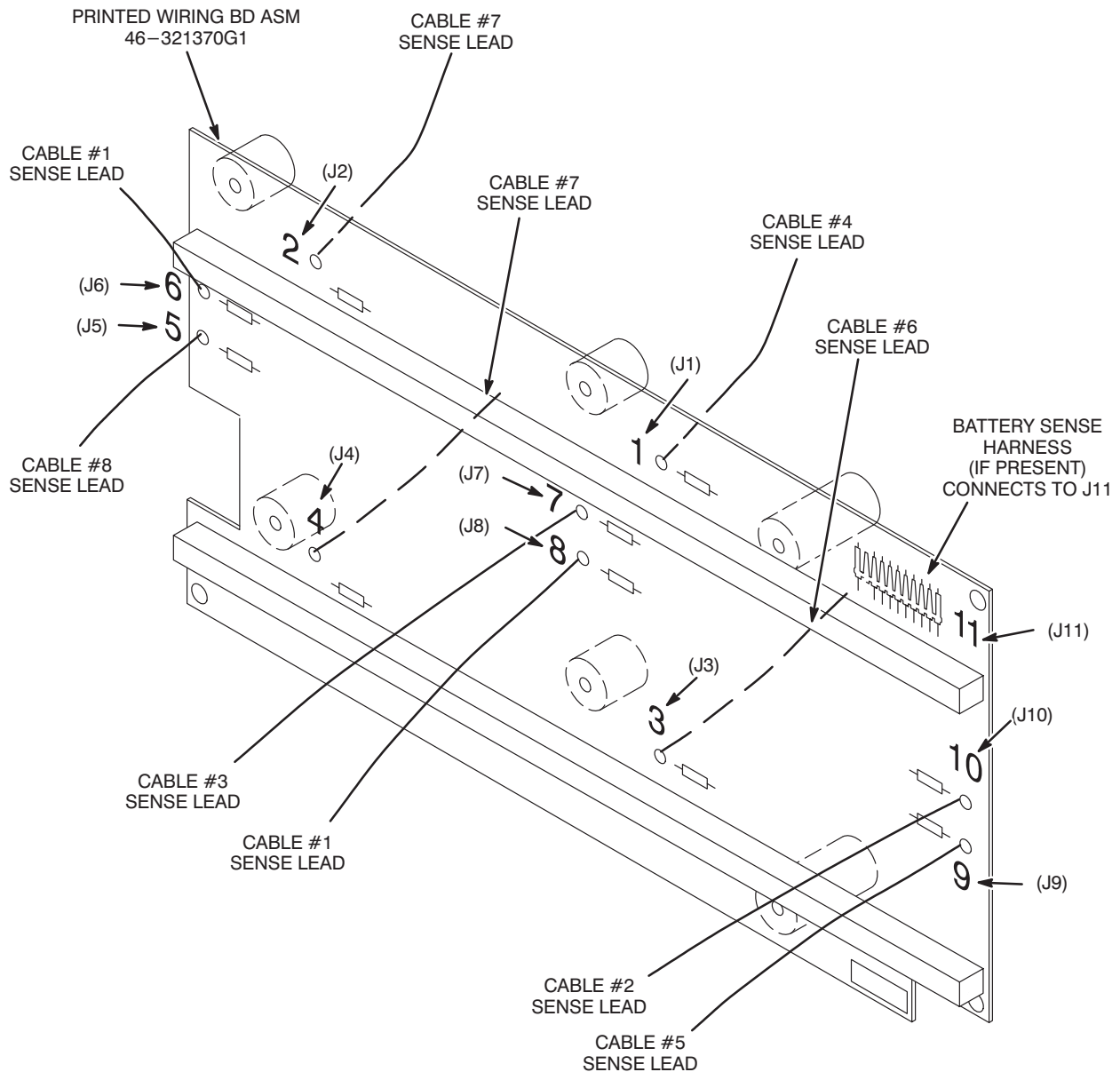
5. Remove the Insulator #1 that is at battery compartment entrance.
6. If unit has a battery sense harness, disconnect this harness from the 46-321270G1 Printed Wiring Board (PWB) J11.
7. Disconnect sense leads from J9 and J10 on left hand side of 46-321270G1 PWB.
8. Disconnect Cable #2 from Battery #9 (-), and slide boot over cable terminal.
9. Disconnect Cable #5 from Battery #9 (+), and slide boot over cable terminal.
10. Remove Battery #9, Insulator #8, and the Insulator #1 that is in front of Batteries #7 & #8.
11. Disconnect sense leads from J7 and J8 on left hand side of 46-321270G1 PWB.
12. Disconnect Cable #3 from Battery #7 (+), and slide boot over cable terminal.
13. Disconnect Cable #5 from Battery #8 (-), and slide boot over cable terminal.
14. Disconnect one of the Cable #1's from Battery #7 (-) and Battery #8 (+), and slide a boot over each cable terminal.
15. Remove Batteries #7 & #8 and the separator pad between them.
16. Remove the remaining Insulator #1.
17. Disconnect sense leads from J5 and J6 on left hand side of 46-321270G1 PWB, and J1, J2, J3 and J4 from right side of PWB.
18. Remove 46-321370G1 PWB from battery compartment.
19. Disconnect Cable #8 from Battery #5 (+), and slide boot over cable terminal.
20. Disconnect Cable #3 from Battery #6 (-). and slide boot over cable terminal.
21. Disconnect remaining Cable #1 from Battery #6(+) and Battery #5 (-), and slide boot over each cable terminal.
22. Remove Batteries #5 & #6 and the separator pad between them.
23. Remove Insulator #5, Insulator #6, and the Insulator #2 that was behind Batteries #5 & #6.
24. Disconnect Cable #4 from Terminal #4 of circuit breaker in AMX1 A3, and slide boot over cable terminal. Disconnect other end of Cable #4 from Battery #1 (+), and slide boot over cable terminal.
25. Disconnect Cable #8 from Battery #4 (-), and slide boot over cable terminal.

ILLUSTRATION 6-2
GATES BATTERY CONNECTIONS

26. Disconnect one of the Cable #7's from Battery #1 (–) and Battery #2 (+), and slide a boot over each cable terminal.
27. Disconnect the other Cable #7 from Battery #3 (–) and Battery #4 (+), and slide a boot over each cable terminal.
28. Disconnect Cable #6 from Battery #2 (–) and Battery #3 (+). Slide a boot over each cable terminal.
29. Remove Insulator #4 and the two remaining Insulator #2's.
30. Remove the four remaining batteries and the battery separator pads.

ILLUSTRATION 6-3

CONNECTION OF SENSE LEADS TO PRINTED WIRING BOARD ASM (PWB)



6-2 Gates Battery Installation

**PERSONAL INJURY !**

REMOVE ALL JEWELRY AND RINGS WHEN HANDLING THE BATTERIES OR REACHING IN THE BATTERY COMPARTMENT. USE EXTREME CAUTION, HIGH AMPERAGE AND VOLTAGE IS PRESENT. USE INSULATED TOOLS FOR WORKING ON BATTERIES.

Note:

Observe the following during installation procedure:

- Be sure that battery compartment top and bottom insulation is in place.
- Make all battery connections as shown in Illustration 6-4, using the hardware shown. Torque to 45-50 inch pounds (5.1-5.6 N-m) on ALL battery connections.
- Install batteries as shown in Illustration 6-2. Place insulation boots over ends of each cable.

Note:

Cable #'s indicated in Illustration 6-2 are physically marked on the parts. Insulator numbers are shown for convenience in description, but are not physically marked on the parts. (There are no Insulators #3 and #7, so don't look for them.) Battery #'s are not necessarily physically marked on batteries.

Note:

References to the right and left sides of battery compartment are relative to an observer looking into battery compartment from side of AMX.

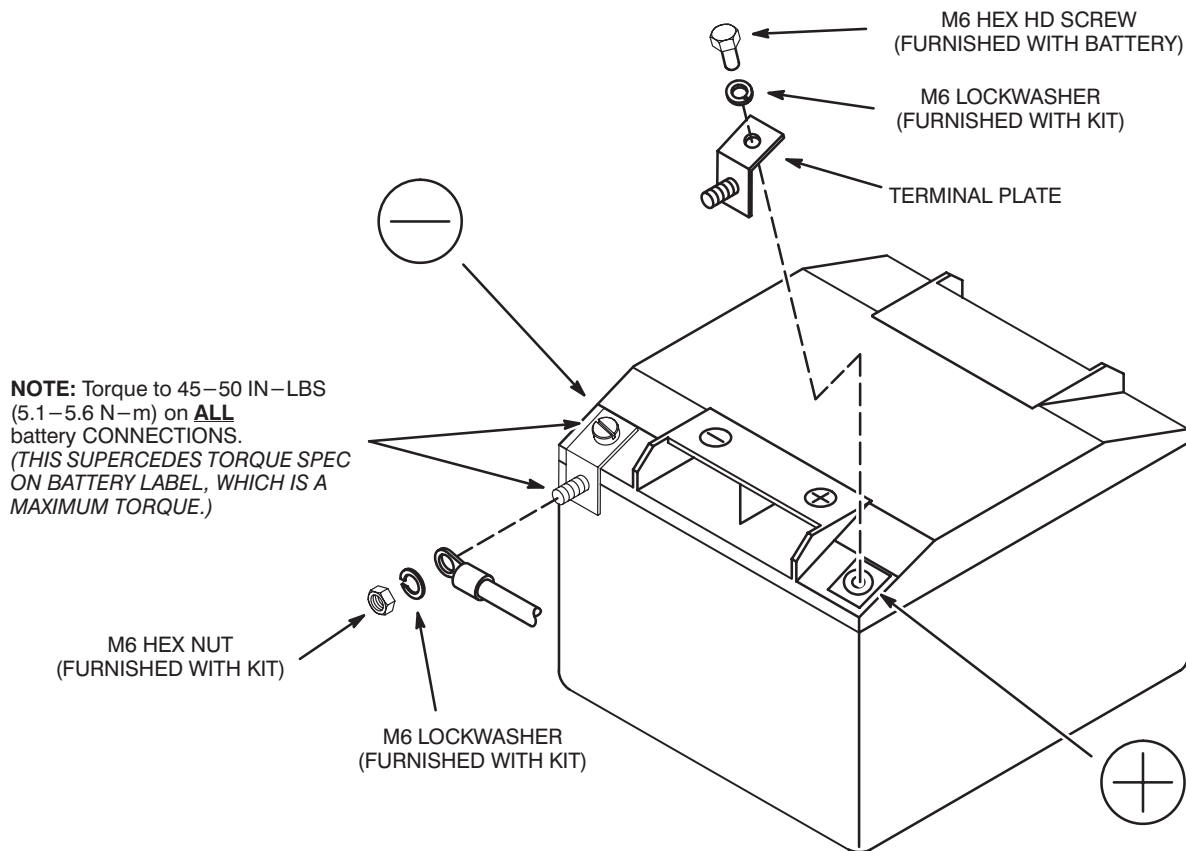
1. Verify that AMX key switch is in "OFF" position and that circuit breaker is "OFF".
2. Install terminal plates on each battery. (Refer to Illustration 6-4.) Discard flat washers supplied with batteries.
3. Position two batteries (shown as Batteries #2 & #4 in Illustration 6-2) in the battery compartment opening stacked one on top of the other, with a battery separator pad between them. Don't remove paper backing from separator pad. Orient pad with paper backing facing up. Put both batteries into position at back of recess on right side of compartment.
4. Position Batteries #1 & #3 in the compartment opening stacked one on top of the other, with a separator pad between them. (Refer to Illustration 6-2.) Don't remove paper backing from separator pad. Orient pad with paper backing facing up. Push both batteries into position on right side of compartment, along side Batteries #2 & #4.
5. Install Insulator #4 as shown between Batteries #2 & #4 and Batteries #1 & #3. Install one of the Insulator #2's next to Batteries #1 & #3, as shown, and another of the Insulator #2's next to Batteries #2 & #4.

Note:

Don't confuse Insulator #4 with the Insulator #1's. Insulator #4 has two non-functional holes, but the Insulator #1's each have two full cup-shaped bumps with no holes.

6. Connect end of Cable #6 with sense lead to Battery #3 (+) and connect other end to Battery #2 (-), as shown. Slide a boot over each terminal.

ILLUSTRATION 6-4
INSTALLATION OF TERMINALS
AND TERMINAL PLATES ON GATES BATTERIES



7. For one of the Cable #7's, connect end with sense lead to Battery #4 (+), and connect other end to Battery #3 (-). Slide a boot over each terminal. For remaining Cable #7, connect end with sense lead to Battery #2 (+) and connect other end to Battery #1 (-). Slide a boot over each terminal.
8. Connect end of Cable #8 without sense lead to Battery #4 (-), and slide a boot over this terminal. (Orient cable so that the terminal lug points down at 45° toward door opening.) Do not connect the other end of Cable #8 yet.
9. Connect end of Cable #4 with sense lead to Battery #1 (+) as shown, and slide a boot over this terminal. Route Cable #4 through grommet in hole in top of battery compartment, connect it to terminal #4 on circuit breaker in AMX1 A3, and slide boot over terminal.
10. Install Insulator #5, Insulator #6, and the remaining Insulator #2 as shown.
11. Position Batteries #5 & #6 in compartment opening stacked one on top of the other with a separator pad between them, as shown. Don't remove paper backing from separator pad. Orient pad with paper backing facing up.
12. For one of the Cable #1's, connect end with sense lead to Battery #6 (+), and connect other end to Battery #5 (-). Slide boots over each terminal.

13. Connect end of Cable #3 without the sense lead to Battery #6 (-), and slide a boot over terminal. Do not connect other end of Cable #3 yet.
14. Push Batteries #5 & #6 to rear of battery compartment.
15. Connect free end of Cable #8 (the cable which comes from battery #4 [-]) to Battery #5 (+), and slide a boot over terminal.
16. Place the furnished 46-321370G1 Printed Wiring Board Assembly (PWB) of Illustration 6-3 into battery compartment as shown in Illustration 6-2.
 - a. Connect Cable #7 Sense Lead (that comes from Battery #2) to Terminal J2 of PWB (RHS [right hand side]) as shown in Illustration 6-3.
 - b. Connect Cable #7 Sense Lead (from Battery #4 [+]) to Terminal J4 of PWB (RHS).
 - c. Connect Cable #6 Sense Lead (from Battery #3 [+]) to J3 of PWB (RHS).
 - d. Connect Cable #4 Sense Lead (from Battery #1 [+]) to J1 of PWB (RHS).
 - e. Connect Cable #1 Sense Lead (from Battery #6 [+]) to J6 (LHS [left hand side]).
 - f. Connect Cable #8 Sense Lead (from Battery #5 [+]) to J5 (LHS) of PWB.
17. Install one of the Insulator #1's (the one that goes between Batteries #5 & #6 and Batteries #7 & #8), as shown in Illustration 6-2, with cup-shaped bumps pointing away from you. Route free end of Cable #3 over top of Insulator #1.
18. Position Batteries #7 & #8 in compartment opening stacked one on top of the other with a separator pad between them, as shown. Don't remove paper backing from separator pad. Orient pad with paper backing facing up.
19. For remaining Cable #1, connect end with sense lead to Battery #8 (+) and connect other end to Battery #7 (-). Slide a boot over each terminal.
20. Connect end of Cable #5 without sense lead to Battery #8 (-), and slide a boot over terminal. Do not connect other end of Cable #5 yet.
21. Push Batteries #7 & #8 back into position, as shown, while holding Cable #3 above Insulator #1.
22. Connect free end of Cable #3 (the Cable that comes from Battery #6 [-]) vertically to Battery #7 (+), and slide a boot over terminal.
23. Connect the following sense leads at this time:
 - a. Connect Cable #1 Sense Lead (from Battery #8 [+]) to J8 of PWB (LHS).
 - b. Connect Cable #3 Sense Lead (from Battery #7 [+]) to J7 of PWB (LHS).

24. Install another of the Insulator #1's (the one that goes between Batteries #7 & #8 and Battery #9), as shown, with cup-shaped bumps pointing away from you. Route free end of Cable #5 over the top of this Insulator #1.
25. Install Insulator #8 as shown.
26. Position Battery #9 on top of Insulator #8 as shown.
27. Connect free end of Cable #5 (the Cable that comes from Battery #8 [-]) to Battery #9 (+), and slide a boot over terminal.
28. Cable #2 will be the ground. To prevent Cable #2 from shorting after it is connected to Battery #9, tape the end of Cable #2 that does not have the sense lead. Connect other end of Cable #2 to Battery #9 (-), and slide a boot over cable terminal. Route Cable #2 through grommet in hole in top of battery compartment.

Do NOT connect Cable #2 to ground stud yet.

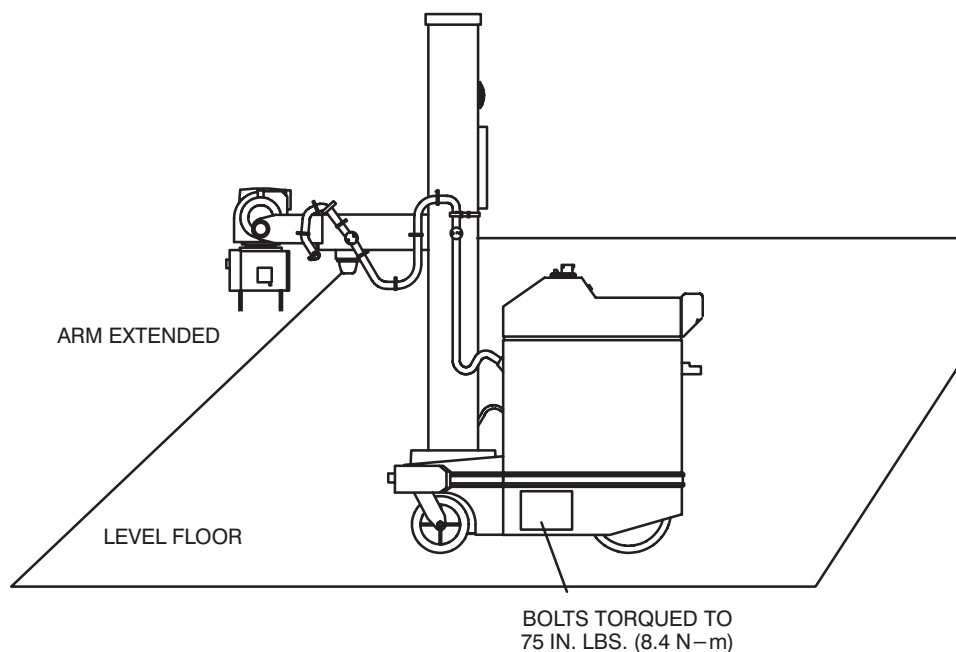
29. Connect the remaining sense leads:
 - a. Connect Cable #5 Sense Lead (from Battery #9 [+]) to J9 of PWB (LHS).
 - b. Connect Cable #2 Sense Lead (from Battery #9 [-]) to J10 of PWB (LHS).
30. Measure the battery voltage between circuit breaker lead marked #6 and the ground stud. It should measure between 111 and 118 volts DC, depending upon state of charge of the batteries. If it does not, determine the cause of the problem.
31. If unit has a battery sense harness, connect battery sense harness to the 46-321270G1 PWB connector J11. See Illustration 6-3.
32. Place the unit on a level floor. Extend the horizontal arm and rotate it to the front end of the AMX (vertical-column end). Distribution of weight is necessary in installing the battery-compartment cover. See Illustration 6-5.
33. Place the remaining Insulator #1 in the compartment opening with cup-shaped bumps pointing away from you, as shown in Illustration 6-2.



The battery compartment cover is an integral part of the Base Assembly. All six bolts must be in place and torqued to 75 inch pounds (8.4 Newton-meters) or the Base Assembly can be warped or cracked.

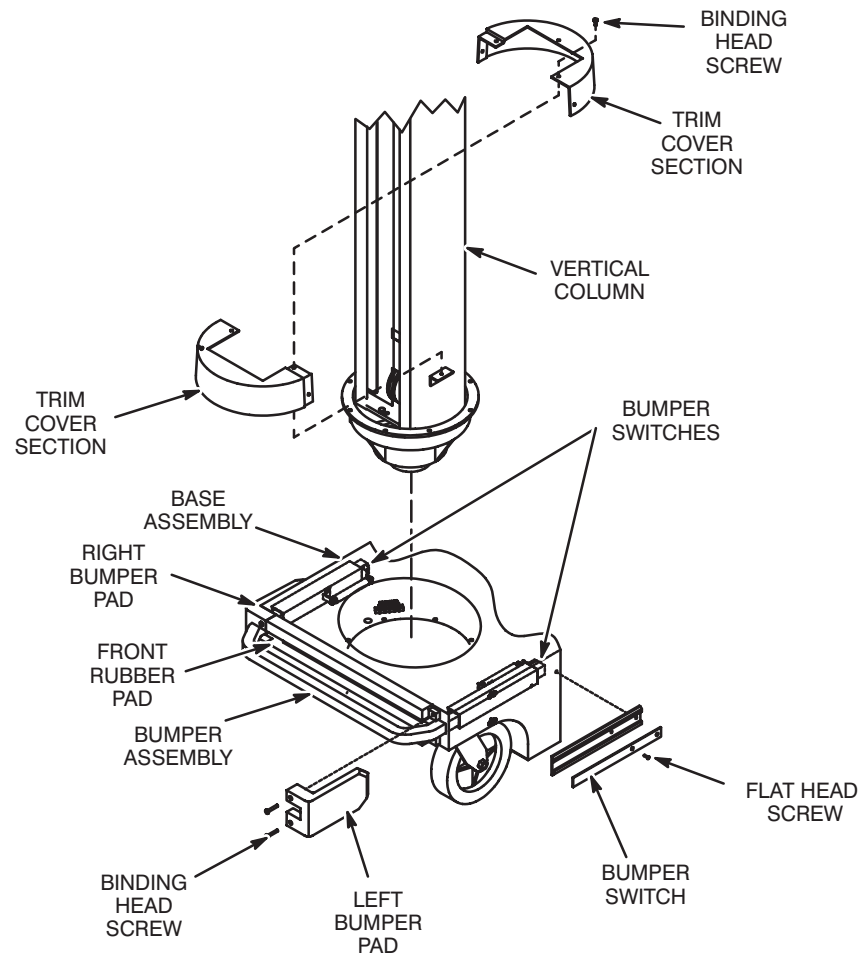
34. Install battery compartment cover. Torque six capscrews to 75 inch pounds (8.4 Newton-meters), as shown in Illustration 6-5.
35. Remove tape from free end of Cable #2, and connect Cable #2 to ground stud using Flat Washer and Nut.
36. Install Left Side Cover. Refer to Section 5-4.
37. This completes the battery installation.

ILLUSTRATION 6-5
AMX BATTERY COMPARTMENT
COVER INSTALLATION



6-3 Bumper Removal

1. Shut power OFF.
2. Remove trim cover from bottom of vertical column by removing two brass clip nuts and five binding head capscrews.
3. Reach through vertical column opening in base assembly and cut the Ty-raps holding the bumper harness in place. The wiring is long enough to allow removal of bumper with connectors still attached and ready for testing if necessary. See Illustration 6-6.
4. Remove the right and left corner pads by removing the four binding head screws holding each to the front of the base assembly. It is not necessary to remove the front rubber pad.
5. Remove wear strip from each side of base assembly by removing two black flat head screws securing each trim strip to base assembly.
6. Remove six binding head screws and flat washers securing bumper assembly to base assembly.
7. Pull bumper assembly from base assembly.

ILLUSTRATION 6-6
BUMPER ASSEMBLY

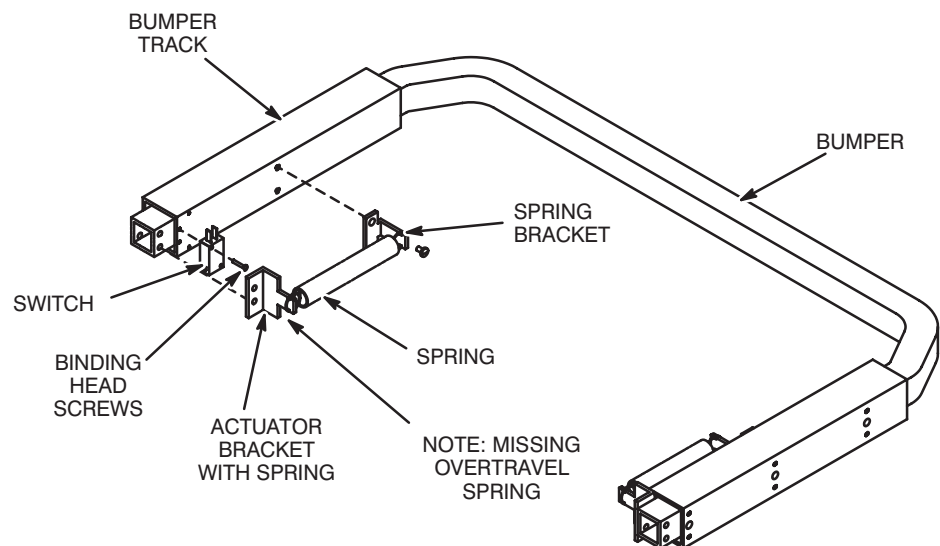
6-4 Bumper Installation

1. Shut power OFF.
2. If the connectors are removed, connect them and slide bumper assembly into base assembly. See Illustration 6-6.
3. Reach through vertical column opening in base assembly and dress the harness with Ty-raps to hold in place.
4. Align mounting holes in bumper assembly with holes in base assembly.
5. Attach bumper assembly to base assembly with six binding head screws and flat washers.
6. Secure wear strips to each side of base assembly with two black flat head screws.
7. Replace right and left corner pads on base assembly and secure each in place with four binding head screws.
8. Install trim covers on bottom of vertical column and secure with two brass clip nuts and five binding head capscrews.

6-5 Bumper Switch Removal

1. Remove bumper assembly. Refer to Section 6-3.
2. Remove actuator bracket to release tension on switch actuator. See Illustration 6-7.
3. Remove two binding head screws holding switch on end of bumper track.
4. Remove switch from bumper assembly.

ILLUSTRATION 6-7
BUMPER SWITCH



6-6 Bumper Switch Installation

1. Shut off power.
2. Install switch on end of bumper track and secure with two binding head screws. See Illustration 6-7.
3. Install actuator bracket to place tension on switch actuator.
4. Verify that bumper switch is activated by spring tension on switch actuator bracket.
5. Install bumper assembly. Refer to Section 6-4.

6-7 Bumper Bearings Removal

Note: This procedure covers the removal of any one or more of the eight bearings comprising the bumper assembly.

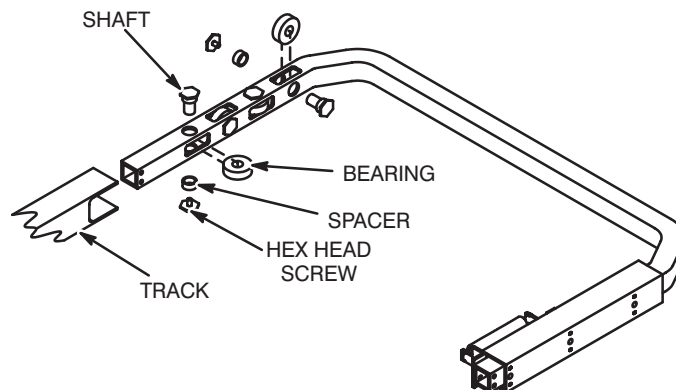
1. Remove the bumper assembly. Refer to Section 6-3.
2. Remove spring from between actuator bracket and spring bracket to release tension on switch actuator. See Illustration 6-7.
3. Remove switch actuator bracket by removing two binding head screws and hex nuts.
4. Slide track from end of bumper assembly to expose bearings.
5. Remove bearing from mounting slot in bumper by removing one hex head screw, spacer and shaft.

6-8 Bumper Bearings Installation

Note: This procedure covers the removal of any one or more of the eight bearings comprising the bumper assembly.

1. Install bearing in bumper assembly mounting slot and secure with one hex head screw, spacer and shaft. See Illustration 6-8.
2. Slide track into end of bumper assembly.
3. Install switch actuator bracket and secure with two binding head screws and hex nuts.
4. Install spring between actuator bracket and spring bracket.
5. Verify that bumper switch is activated by spring tension on switch actuator bracket.
6. Install the bumper assembly. Refer to Section 6-6.

ILLUSTRATION 6-8
BUMPER BEARINGS

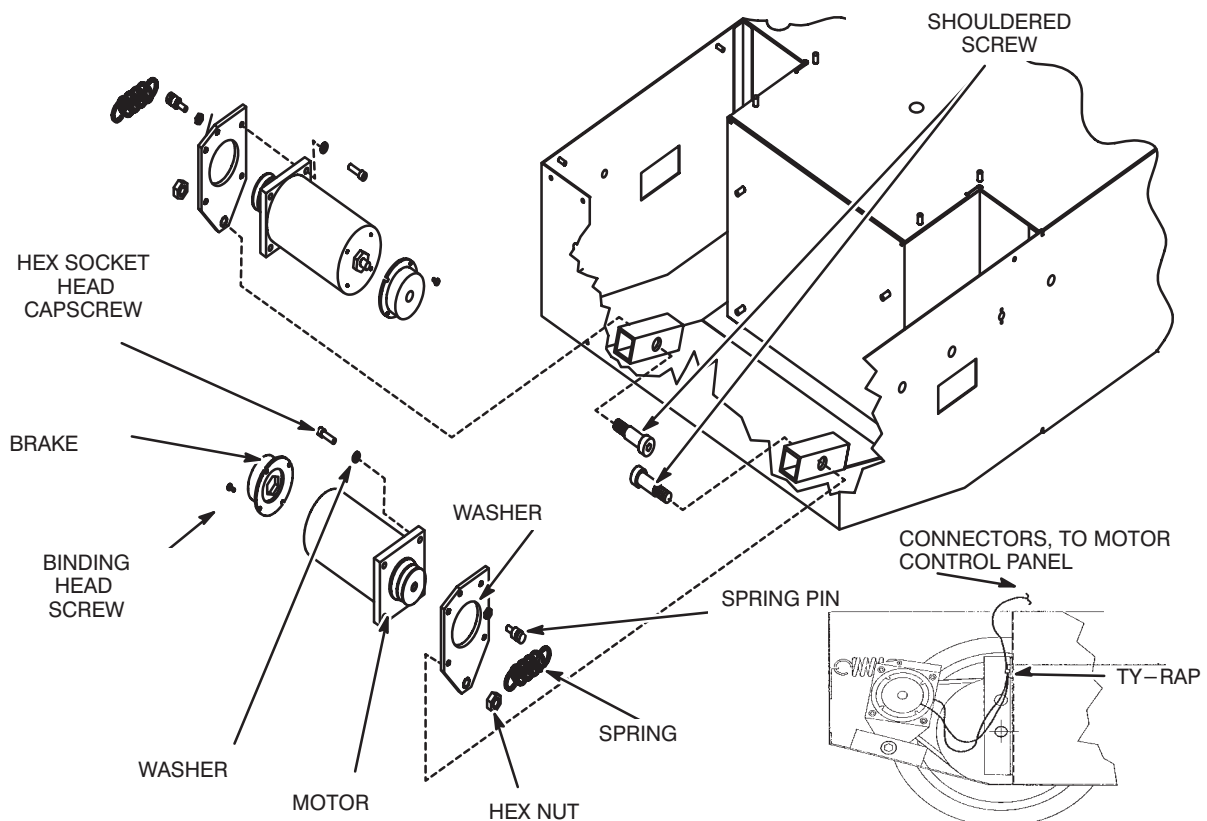


6-9 Motor and Brake Assembly Removal

Note: This procedure covers the removal of either the right or left motor and brake assembly.

1. Shut off power.
2. Remove cassette drawer from mainframe. Refer to Section 5-1.
3. Disconnect motor and brake wire connectors from motor control panel and remove ty-rap. See Illustration 6-9.
4. Carefully remove spring between base assembly and spring pin on motor mount plate. This removes tension from the drive belt.
5. Remove nut and shouldered screw holding motor mount to base.
6. Remove drive belt from motor pulley.
7. Remove motor and brake assembly.
8. Remove motor from motor mount plate by removing four capscrews and washers.
9. Remove brake by removing four binding head screws.

ILLUSTRATION 6-9
MOTOR & BRAKE ASSEMBLY



**6-10 Motor and Brake
Assembly Installation**

Note: This procedure covers the installation of either the right or left motor and brake assembly.

1. Shut off power.
2. Install Brake on Motor and secure with four binding head screws. Be certain brake is oriented properly on motor. (Wires in position to be connected to Motor Control Panel). See Illustration 6-9.
3. Install motor on Mounting Plate and attach with four hex socket head capscrews and washers.

Note: Motor Mounting Plate must be orientated with the plate corner bevel toward the rear. If the Spring Pin was removed from the mounting plate, replace it and check that it does not rub on the wheel. See Illustration 6-9.

4. Install motor and brake assembly in the base assembly.
5. Secure motor mount to base assembly with nut and shouldered screw. Torque to 40-60 inch pounds (4.5 to 6.7 N-m).
6. Place drive belt in position on motor pulley.
7. Carefully install spring between base assembly and motor and spring pin on motor mount plate. This places tension on the drive belt.
8. Connect motor and brake wire connectors to motor control panel and replace ty-rap.

J1 - Left Motor
J2 - Right Motor

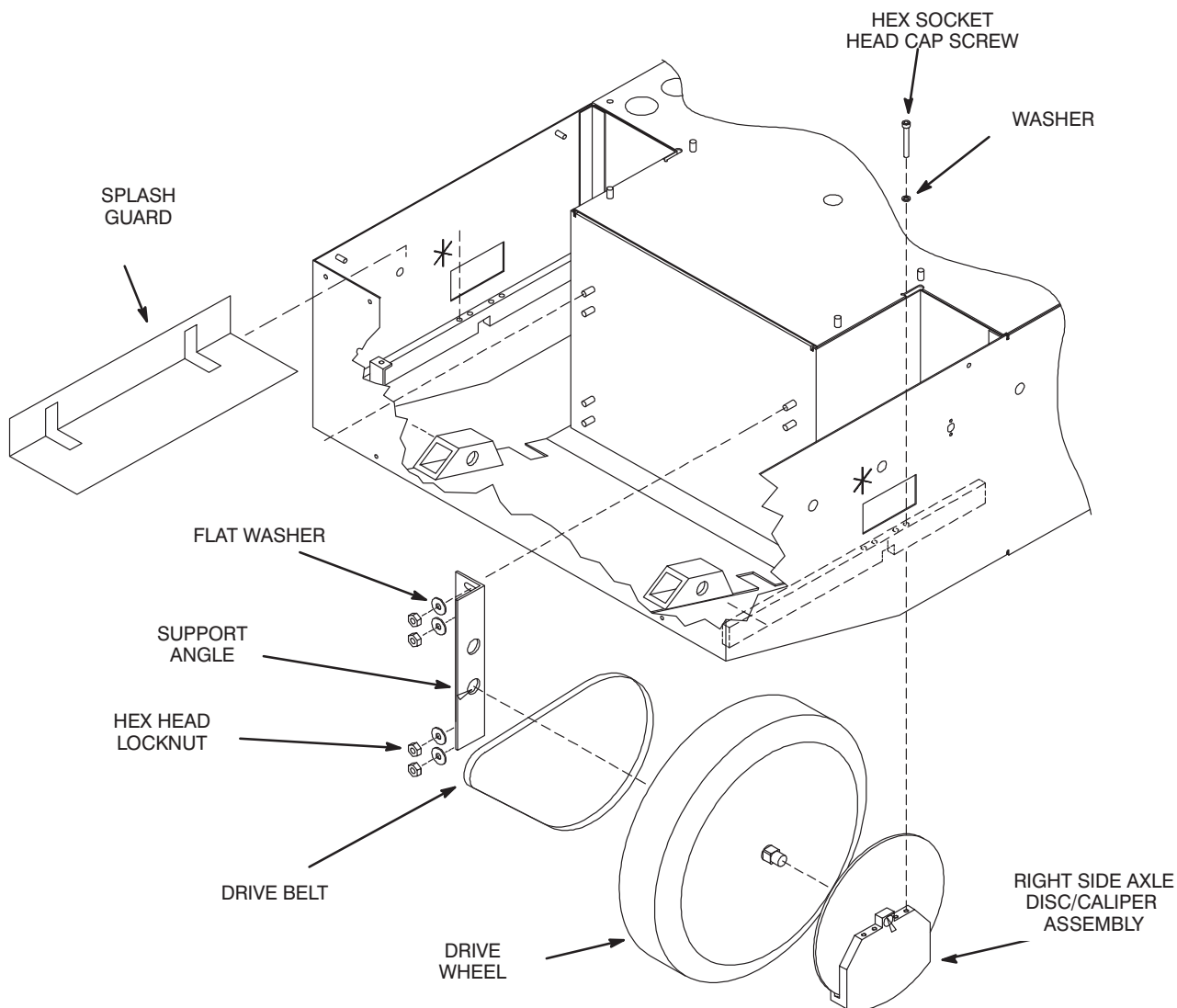
Note: Use caution when installing brake connector. Connector is keyed but can be forced on in reverse direction causing brake and possibly printed wire board damage.

9. Install cassette drawer in mainframe. Refer to Section 5-2.

6-11 Drive Wheel Removal

The following procedure covers removal of either the right or left drive wheel. The wheel mounting support is welded to the side of the base assembly with the notch in the lower surface of the support. All wheels have caliper assemblies. See Illustration 6-10.

ILLUSTRATION 6-10
DRIVE WHEEL ASSEMBLY



**WARNING****PERSONAL INJURY!**

WHEN LIFTING THE BACK OF THE UNIT IT CAN BECOME UNSTABLE AND TIP OVER. USE EXTREME CAUTION WHEN PERFORMING THIS OPERATION.

1. Place the horizontal arm in park position.
2. Remove trim covers. See Section 5.
3. Remove motor and brake assembly. Refer to Procedure 1.
4. Rotate front wheel caster toward rear, otherwise unit will be unstable when rear of unit is raised. Block the front wheel and lift drive wheel end of base assembly approximately 10 inches (25 cm) and place it on blocks.

Lifting can be done with

Jack (minimum 1200 lbs. (550 kg) capacity).

Lever (2 × 4 inches, palette lever) (5 cm × 10 cm).

Chain hoist.

Special tool, AMX-4 lifting jack, 46-302966P1.

5. Remove two locknuts securing splash guard and lift out of base assembly. Refer to Illustration 6-10.
6. Place blocks under wheel being removed to prevent it from falling when axle supports are removed.
7. Loosen the four locknuts and flat washers holding the wheel support angle to the base assembly.
8. Slide the support angle with its wheel block to the side and off of the wheel axle. The mounting holes in the support angle are slotted for this purpose.
9. Leave the drive belt on the axle pulley.
10. Remove the wheel and caliper through the bottom of the base assembly.
11. Remove the four hex socket head capscrews and lockwashers from the top of the wheel mounting support which secure the wheel and caliper assembly to the base assembly.
12. Carefully remove the wheel and caliper assembly through the bottom of the base assembly.

6-12 Drive Wheel Installation

Note: This procedure covers the installation of either the right or left drive wheel.

**PERSONAL INJURY!**

**THE UNIT CAN BE UNSTABLE WHEN ON BLOCKS AND TIP OVER.
USE EXTREME CAUTION WHEN PERFORMING THIS OPERATION.**

Note: Apply light coat of grease (Lubriplate Fiske 630-A-A) to each end of axle.

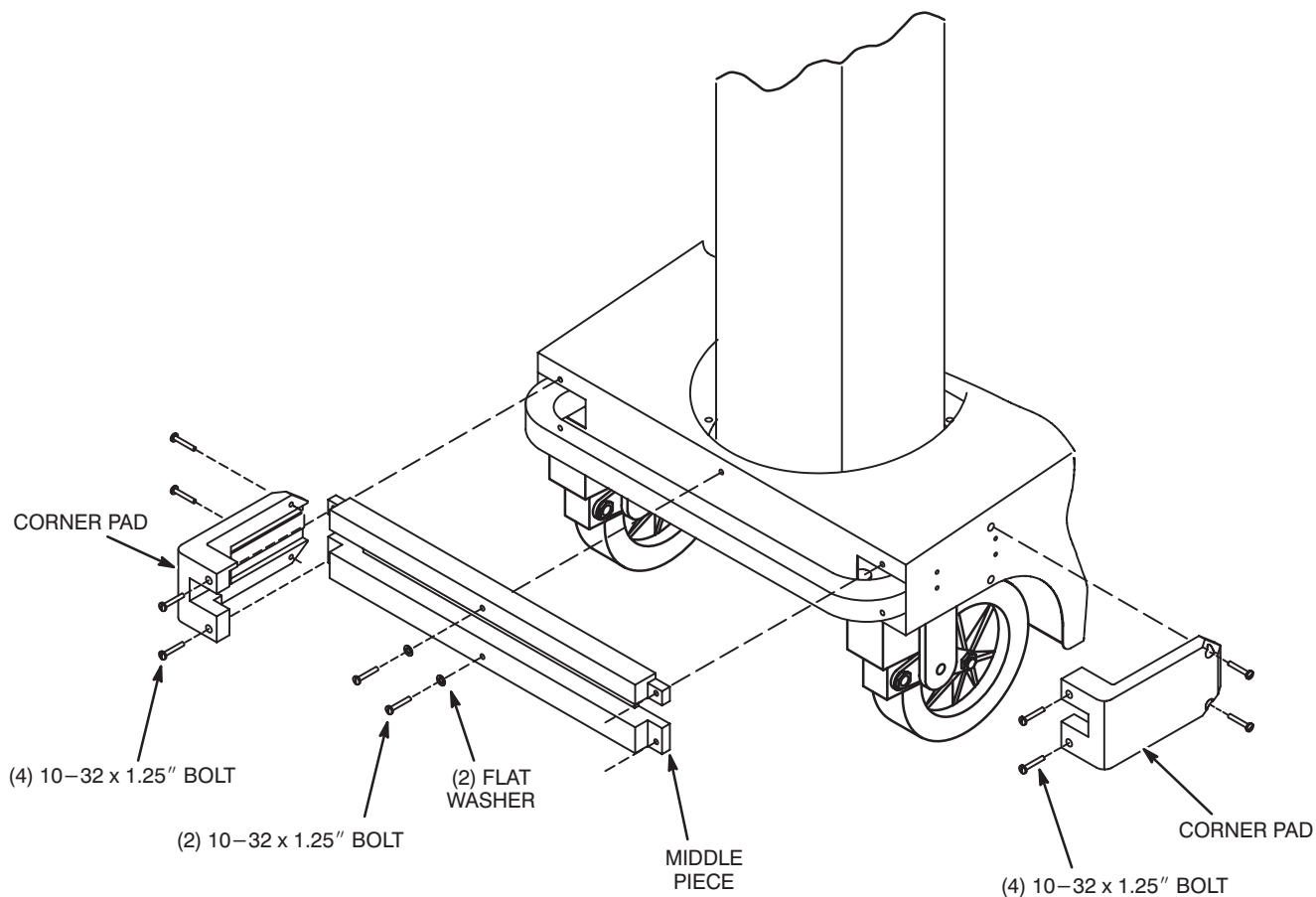
1. The unit is on blocks approximately 10 inches (25 cm) above the floor.
2. Place the caliper assembly on the wheel axle.
3. Install the drive belt on the drive wheel pulley.
4. Lift the drive wheel through the bottom of the base assembly and into position in the notch in the bottom of the wheel mounting support. See Illustration 6-10.
5. Attach the wheel and caliper assembly to the wheel mounting support with four hex socket head capscrews. Do not tighten in place.
6. Slide the support angle with its wheel block onto the wheel axle as far as it will go.
7. Tighten the four locknuts and flat washers holding the wheel support angle to the base assembly. Torque to 50-70 inch pounds (5.6 to 7.8 N-m).
8. Secure the wheel and caliper assembly to the wheel mounting support. Torque to 40-60 inch pounds (4.5 to 6.7 N-m).
9. Install splash guard and secure with two lock nuts.
10. Install the motor and brake assembly. Refer to Section 6-10.
11. Lower the unit to the floor.

6-13 Caster Wheel Removal

Note: This procedure covers the removal of either the right or left caster wheel.

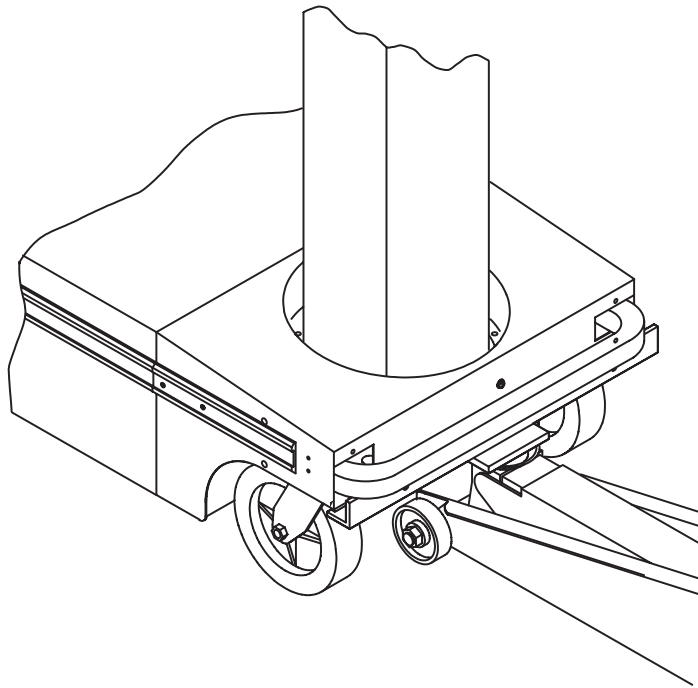
1. Latch the horizontal arm assembly in place.
2. Be sure that the AMX key switch is in the "OFF" position, and that the circuit breaker is "OFF."
3. Referring to Illustration 6-11, remove the three pieces of the front bumper assembly. (This must be done in order to avoid damage to the front bumper when jacking up the AMX unit.)
 - a. Remove each of the two corner pads by removing (4) 10-32 x 1.25" bolts from each pad.
 - b. Remove the middle piece of the front bumper by removing (2) 10-32 x 1.25" bolts and (2) flat washers.

ILLUSTRATION 6-11
REMOVAL/INSTALLATION OF CORNER PADS
AND MIDDLE PIECE OF BUMPER ASSEMBLY



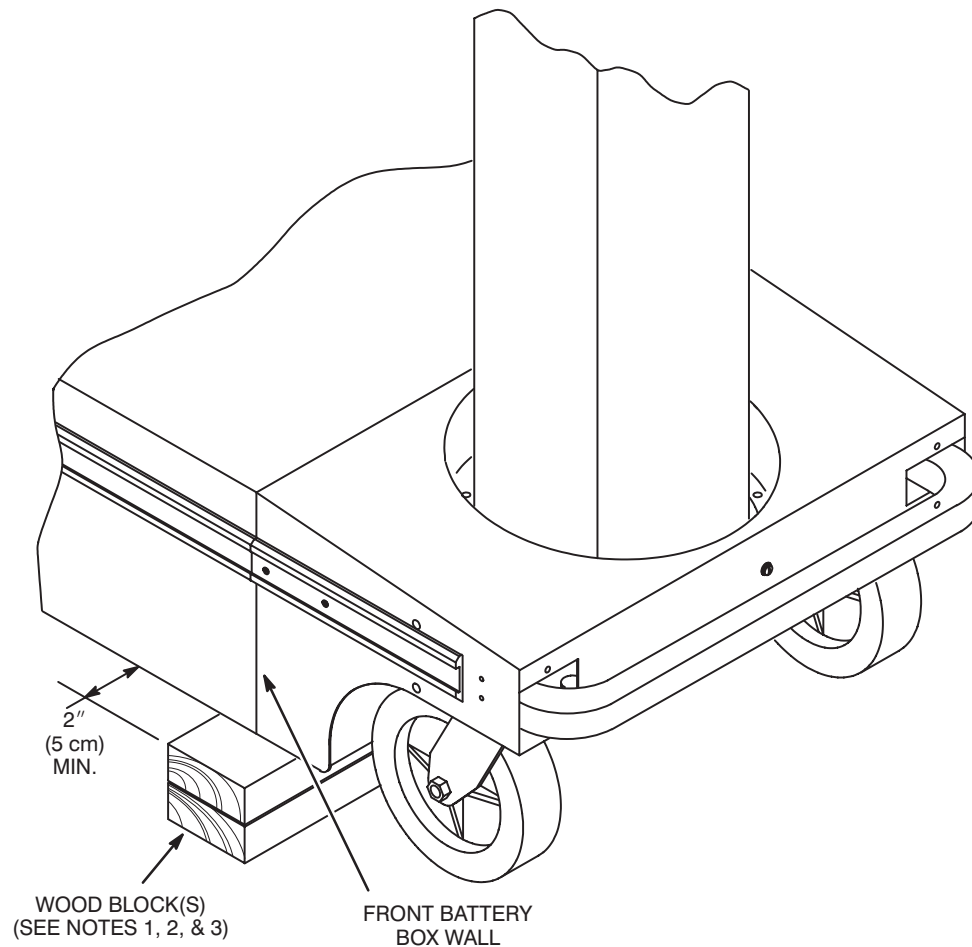
4. Referring to Illustration 6-12, put the 46-302966P1 AMX-4 lifting jack under the front of the AMX unit. ENSURE THAT THE TWO LIPS ON THE FRONT OF THE JACK RETAIN THE FRONT OF THE BASE IN ORDER TO PREVENT THE AMX UNIT FROM FALLING OFF OF THE JACK.

ILLUSTRATION 6-12
AMX-4 UNIT WITH JACK IN PLACE



5. Lift the AMX unit high enough to put an approximately 4" x 4" x at least 28" long (10 cm x 10 cm x at least 71 cm long) wood block (nominal 4" x 4" board or two nominal 2" x 4" boards suggested) under the AMX unit as shown in Illustration 6-13. Be sure that the block(s) is (are) centered under the front battery box wall, and be sure that the block(s) extend(s) out at least 2" (5 cm) on each side of AMX unit.
6. Lower the AMX unit and remove the jack.

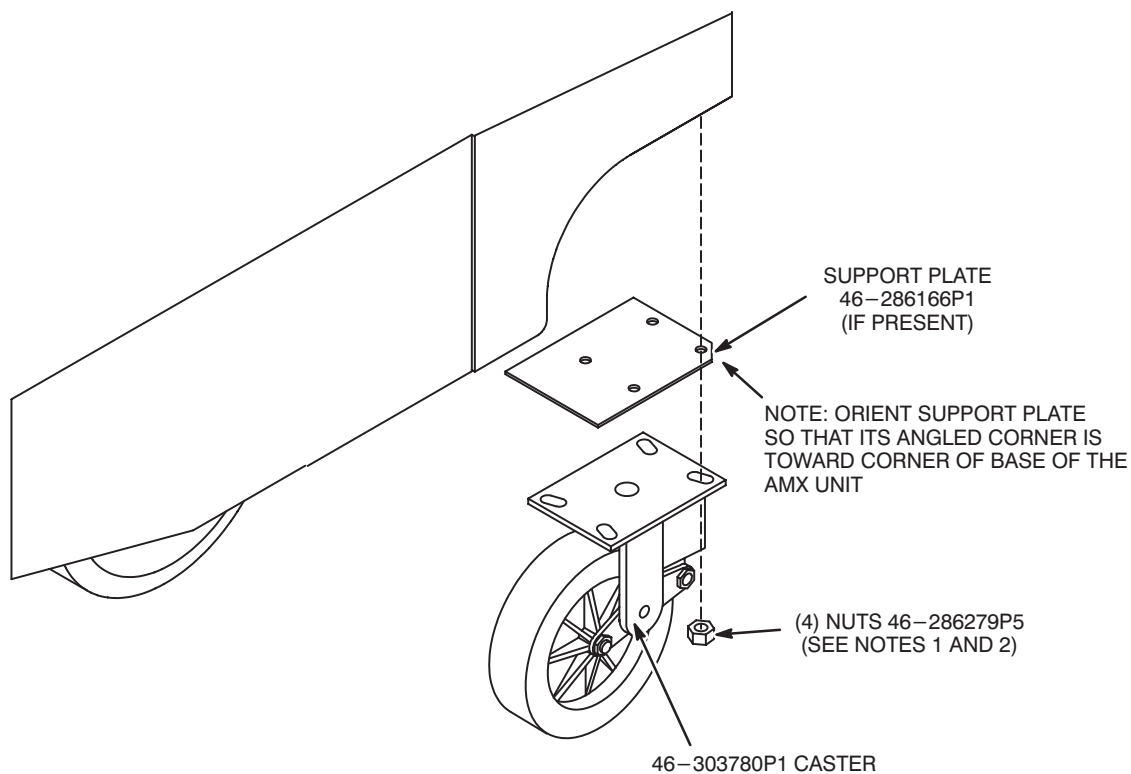
ILLUSTRATION 6-13
AMX-4 UNIT SUPPORTED BY WOOD BLOCK



- NOTE 1: IF TWO BLOCKS ARE USED, ORIENTATE BLOCKS AS SHOWN FOR MAXIMUM STABILITY.
- NOTE 2: CENTER BLOCK(S) WITH FRONT BATTERY BOX WALL.
- NOTE 3: LOCATE WOOD BLOCK(S) SO THAT BLOCK(S) STICKS OUT AT LEAST 2" (5 cm) BEYOND EACH SIDE OF THE AMX UNIT.

7. Referring to Illustration 6-14, remove the old caster by removing the four nuts.

ILLUSTRATION 6-14
REMOVAL/INSTALLATION OF CASTER
TYPICAL (RIGHT CASTER SHOWN)



NOTE 1: APPLY LOCTITE 242 TO (4) BOLTS

NOTE 2: TIGHTEN (4) NUTS TO RANGE OF 15 TO 25 FT. LB.
(20.5 TO 34 N-m)

6-14 Caster Wheel Installation

Note: This procedure covers the installation of either the right or left caster wheel.

1. Referring to Illustration 6-14, install the new caster as follows:
 - a. Install the new caster using the four nuts and Loctite 242. Note orientation of the support plate (if present).
 - b. Use the torque wrench to tighten the four nuts to within a range of 15 to 25 pound-feet (20.5 to 34 N-m).
2. Put the jack under the front of the AMX unit USING THE TWO LIPS ON THE FRONT OF THE JACK, and lift the AMX unit enough to remove the wood block(s).
3. Lower the AMX unit and remove the jack.
4. Referring to Illustration 6-11, reinstall the three pieces of the front bumper assembly.
 - a. Reinstall the middle piece of the front bumper by installing the (2) 10-32 x 1.25" bolts and (2) flat washers.
 - b. Reinstall each of the two corner pads by installing (4) 10-32 x 1.25" bolts for each pad.

SECTION 7
SERVICING THE DRIVE HANDLE ASSEMBLY

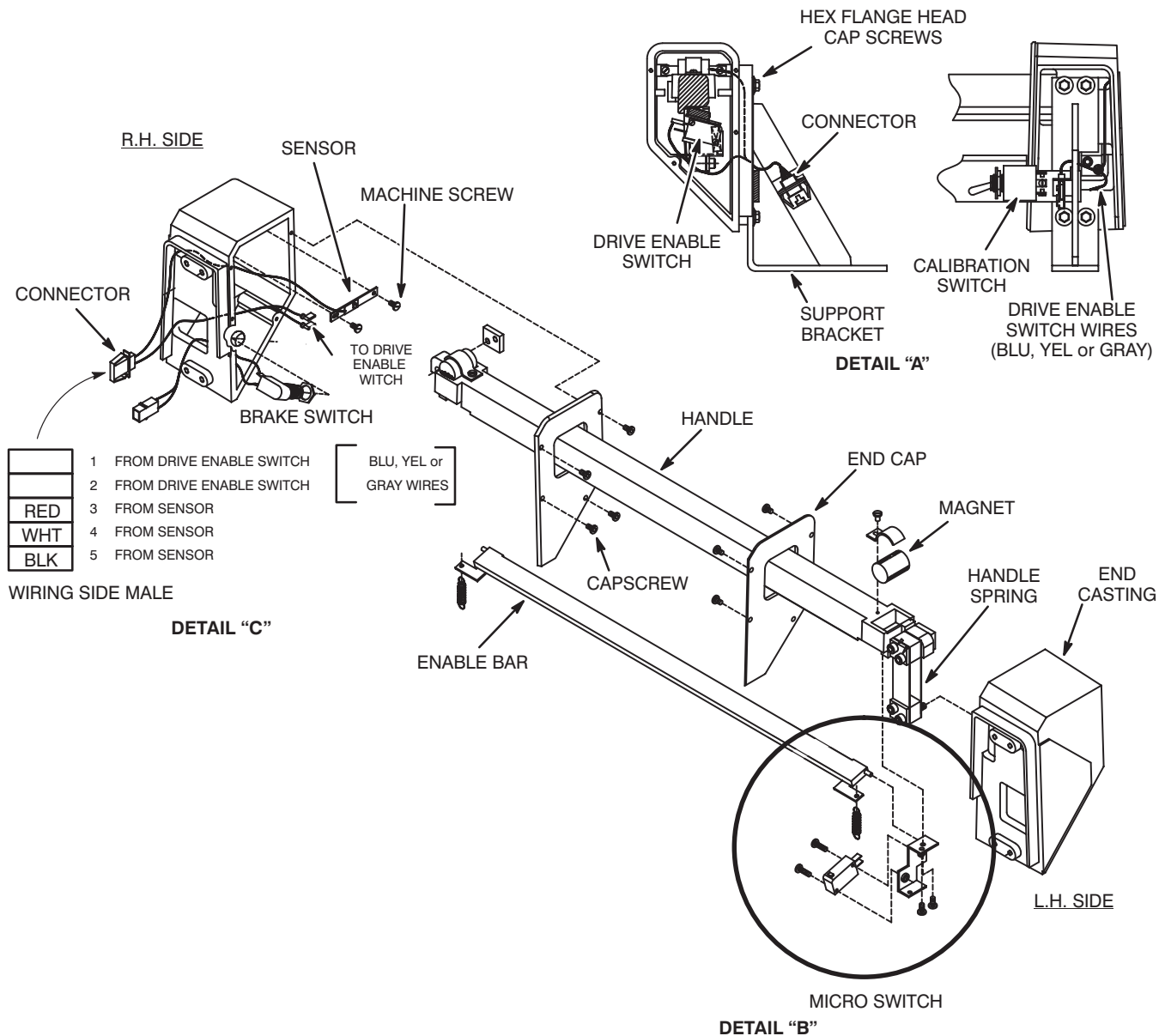
This section provides procedures covering the removal and installation of field serviceable parts in the handle assembly.

7-1 Handle Sensor Removal**Note:**

This procedure covers removal of either the right or left sensor from the handle assembly.

1. Open top cover and place in position to easily access the handle assembly. Refer to Section 5-5.
2. Disconnect connector at each end of handle assembly. See Illustration 7-1, Detail "A".
3. Disconnect ground wire, located at left end of handle, from mainframe.
4. Cut the two ty-raps holding wires to the angle support bracket at each end of the Handle Assembly.
5. Remove handle assembly by removing eight hex flange head capscrews securing it to the two support brackets. See Illustration 7-1, Detail "A".
6. Disconnect sensor leads (red, white and black – positions 3, 4 & 5 in connector) from connector. See Illustration 7-1, Detail "C".
7. Detach end cap from end casting by removing four hex socket button head capscrews. See Illustration 7-1.
8. Slide end cap along handle away from end casting.
9. Remove end casting from handle assembly by removing two hex socket head capscrews securing it to handle springs. Be careful not to damage sensor and drive enable switch leads.
10. Remove two binding head capscrews securing sensor to standoff posts inside the end casting.
11. Pull sensor leads through back of end casting and remove sensor.

ILLUSTRATION 7-1
HANDLE ASSEMBLY



7-2 Handle Sensor Installation**Note:**

This procedure covers installation of either the right or left sensor in the handle assembly.

1. Position sensor on standoff posts inside end casting and secure with two binding head capscrews. See Illustration 7-1.
2. Feed sensor leads through back end of casting to the connector.
3. Position handle assembly in end casting and secure handle springs to casting with two hex socket head capscrews. Be careful not to damage sensor and drive enable switch leads.
4. Slide end cap along handle and position on end casting.
5. Secure end cap on end casting with four hex socket button head capscrews.
6. Connect sensor leads (red, white and black – positions 3, 4 & 5 in connector to connector). See Illustration 7-1, Detail “C”.
7. Fasten handle assembly to two support brackets with eight hex flange head capscrews. See Illustration 7-1, Detail “A”.
8. Connect connectors at each end of handle assembly.
9. Connect ground wire, located at left end of handle, to mainframe.
10. Attach wires to the handle assembly angle support bracket with ty-raps.
11. Close top cover. Refer to Section 5-6.

**7-3 Handle Drive Enable
Switch Removal****Note:**

This procedure covers removal of either the right or left enable switch from the handle assembly.

1. Open top cover and place in position to easily access the handle assembly. Refer to Section 5-5.
2. Cut ty-raps holding drive enable switch leads to end casting angle support bracket. See Illustration 7-1, Detail "A".
3. Free the drive enable switch leads from the other wires. (blue, yellow or gray – positions 1 & 2 in connector) See Illustration 7-1, Detail "C".
4. Disconnect drive enable switch leads from connector.
5. Remove end cap from end casting by removing four hex socket button head capscrews. See Illustration 7-1.
6. Slide end cap along handle away from end casting to allow access to drive enable switch.
7. Pull switch leads through back of end casting.
8. See Illustration 7-1, Detail "B", for the drive enable microswitch.
9. Remove two screws securing drive enable microswitch to bracket, and remove this microswitch.

**7-4 Handle Drive Enable
Switch Installation****Note:**

This procedure covers installation of either the right or left drive enable switch in the handle assembly.

1. See Illustration 7-1, Detail "B", for the drive enable microswitch.
2. Place the drive enable microswitch on its bracket and secure it in place with two screws.
3. Feed drive enable switch leads through back of end casting to connector.
4. Slide end cap along handle into position on end casting.
5. Secure end cap to end casting with four hex socket button head capscrews.
6. Connect drive enable switch leads (blue, yellow or gray) to connector (positions 1 & 2 in connector). See Illustration 7-1, Detail "C".
7. Secure enable switch leads and other leads to end casting support bracket with a ty-rap. See Illustration 7-1, Detail "A".
8. Close top cover. Refer to Section 5-6.

SECTION 8

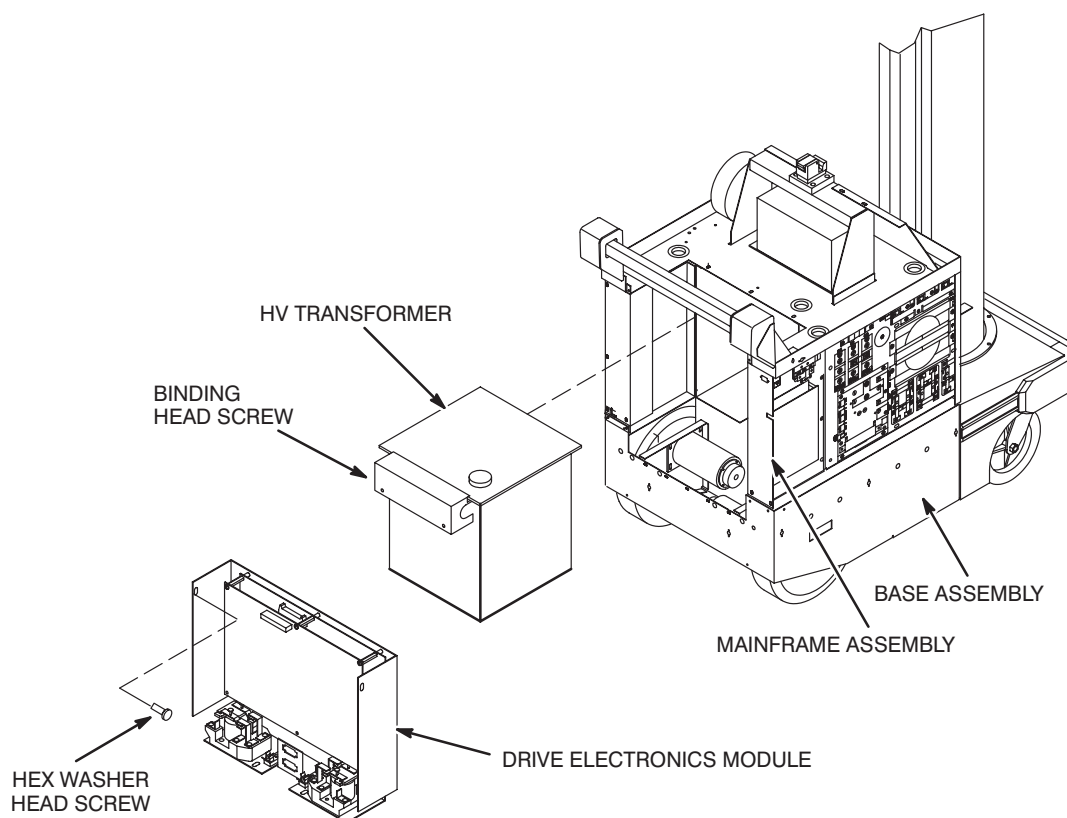
SERVICING THE HIGH VOLTAGE TRANSFORMER

This section provides procedures covering the removal and installation of the high voltage transformer.

8-1 High Voltage Transformer Removal

1. Shut power off by turning the circuit breaker OFF.
2. Remove front cover by carefully pulling cover from four ball stud retainer sockets.
3. Disconnect anode and cathode cables from high voltage transformer.
4. Remove two cap screws holding rear cover on base assembly and remove cover.
5. Remove cassette drawer. Refer to Section 5-1.
6. Remove cassette drawer magnetic strip lock by removing three binding head screws and flat washers.
7. Remove high voltage transformer terminal cover by removing two binding head screws and washers. See Illustration 8-1.

ILLUSTRATION 8-1
HIGH VOLTAGE TRANSFORMER



8. Tag and label all leads on terminal
9. Disconnect all leads from terminal.
10. Tag and label all connections to Drive Electronics Module Assembly.
11. Disconnect all connections to Drive Electronics Module Assembly.
12. Remove Drive Electronics Assembly by removing four hex washer head screws securing it to mainframe.

**PERSONAL INJURY!**

HIGH VOLTAGE TRANSFORMER WEIGHS APPROXIMATELY 100 LBS (45KG). USE CAUTION WHEN MOVING IT.

Note:

Before sliding high voltage transformer to rear of unit, move cable harness out of way of transformer cap.

13. Use two people to remove high voltage transformer.
14. While one person pushes transformer from front of unit, second person guides transformer out back of unit until it rests on rear edge of base assembly.
15. Use two people to lift transformer out of unit.

**8-2 High Voltage
Transformer Installation****WARNING**

1. Shut power off by turning circuit breaker OFF.
2. Use two people to install transformer.

PERSONAL INJURY!

HIGH VOLTAGE TRANSFORMER WEIGHS APPROXIMATELY 100 LBS (45KG). USE CAUTION WHEN MOVING IT.

3. Lift transformer and place front side on edge of opening into mainframe Rest the terminal side of transformer on rear edge of base assembly.

Note:

Before sliding high voltage transformer into unit:

Check oil level

Check vent is open

Set spark gap to 0.01 inches (.25 millimeters)

Move cable harness out of way of transformer cap.

4. While one person pushes transformer from back of unit, second person guides transformer into unit until it contacts transformer restraint plate.
5. Install Drive Electronics Module Assembly and secure it to mainframe with four hex washer head screws.
6. Connect all connections to Drive Electronics Module Assembly in accordance with tagged and labeled instructions on connectors.
7. Connect all leads to transformer terminal in accordance with tagged and labeled instructions on leads.
8. Remove all tags.
9. Install high voltage transformer terminal cover and secure in place with two binding head screws and washers.
10. Install cassette drawer magnetic strip lock and secure with three binding head screws and flat washers.
11. Install cassette drawer. Refer to Section 5-2.
12. Install rear cover and secure with two flat head cap screws.
13. Connect anode and cathode cables to high voltage transformer.
14. Install front cover with two flat head capscrews.

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SECTION 9

SERVICING THE LATCH ASSEMBLY, CORD REEL ASSEMBLY AND CABLE ROUTING

This section covers cable routing and the procedures necessary for the removal and installation of the latch and cord reel.

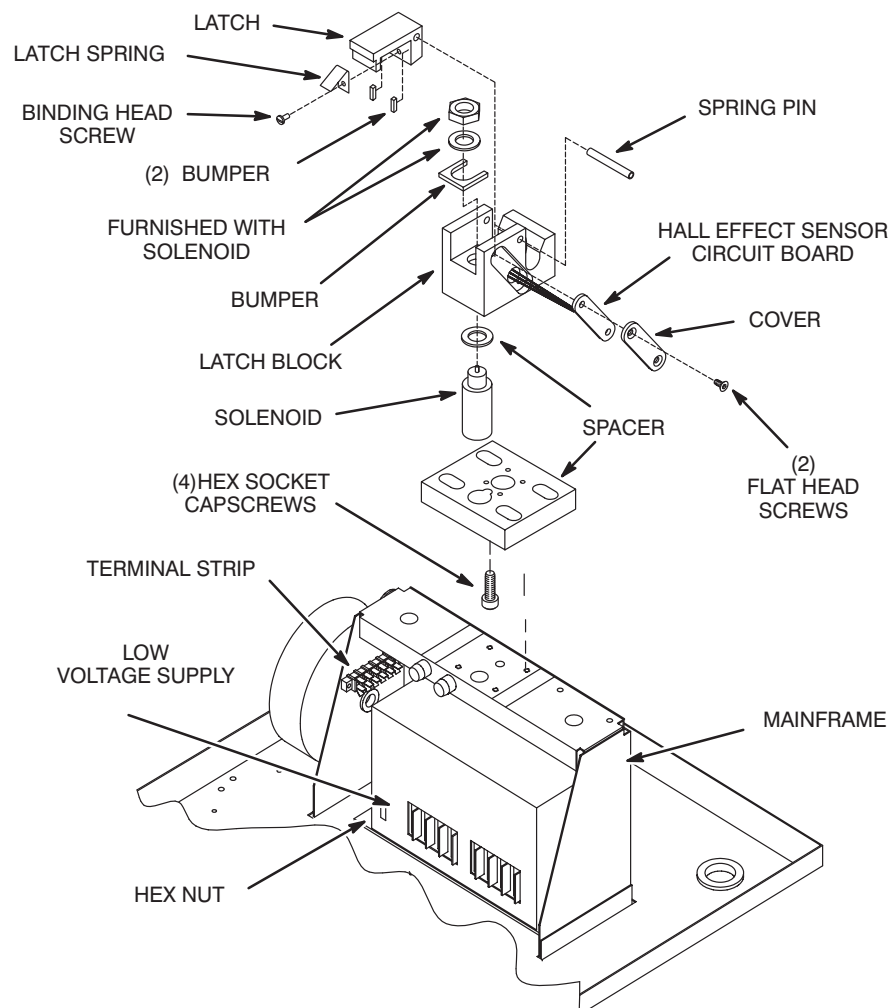
9-1 Latch Assembly and Components Removal (Hall Effect Switch)

1. Move horizontal arm out of the way.
2. Shut power off by turning circuit breaker OFF.
3. Open top cover. Refer to Section 5-5.

Note:

If you need more access to terminal strip, you may remove four hex nuts attaching low voltage power supply to mainframe and slide power supply backward out of mainframe housing. See Illustration 9-1.

ILLUSTRATION 9-1
LATCH ASSEMBLY (HALL EFFECT LATCH SWITCH)



4. Disconnect leads from terminal strip:
 - Sensor Board: three leads to quick disconnect connectors. (#1, #2 and #3).
 - Solenoid: two leads to terminal strip. Tag and label terminals. Must reconnect properly on #3 & #4 or will blow diode in solenoid.
5. Remove latch assembly from mainframe by removing four hex socket head capscrews.
6. Remove latch block from spacer by removing four hex socket head capscrews.
7. Push spring pin out of latch block.
8. Remove latch.
9. Remove latch spring by removing binding head screw.
10. Remove hex nut from top of solenoid.
11. Remove solenoid from recess in latch block.
12. Remove the two flat head screws in side of latch base.



Use care to avoid electrostatic discharge damage to the Hall effect sensor circuit board.

13. Remove the cover and the Hall effect sensor circuit board.

**9-2 Latch Assembly and Components Installation
(Hall Effect Switch)**

1. Shut off power by turning circuit breaker OFF.
2. Install solenoid in recess in latch block. See Illustration 9-1.
3. Install hex nut on top of solenoid.



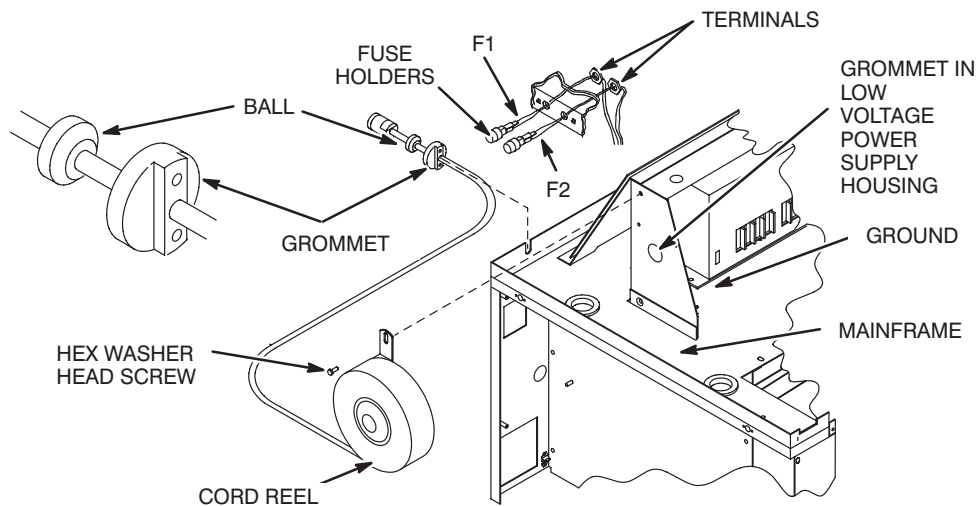
Use care to avoid electrostatic discharge damage to the Hall effect sensor circuit board.

4. Install Hall effect sensor circuit board and cover with two flat head screws.
5. Attach latch spring to latch with binding head screw.
6. Install latch in latch block.
7. Insert spring pin in latch block to retain latch in position.
8. Install latch block on spacer and fasten with four hex socket head capscrews.
9. Install latch assembly on mainframe and fasten with four hex socket head capscrews.
10. Connect leads from latch assembly:
 - Hall Effect Sensor Board: three leads to terminal strip #1, #2 and #3.
 - Solenoid: two leads to terminal strip in accordance with labels on terminals.
11. If you moved low voltage power supply out of the way in Section 9-1, slide power supply onto mainframe housing and fasten with four hex nuts.
12. Close top cover. Refer to Section 5-6.

9-3 Cord/Cord Reel Removal**9-3-1** Cord Reel Removal (Model 2115090, 2115090-4, 2115090-5, 2115090-7, 2115090-9 & 2115090-10 Only)

1. Shut power off by turning circuit breaker OFF.
2. Open top cover. Refer to Section 5-5.
3. Remove four hex nuts attaching low voltage power supply to mainframe and slide it backward out of mainframe housing. See Illustration 9-2.
4. Disconnect cord reel leads from F1, F2 and ground stud.
5. Remove two internal hex cap screws retaining grommet in cut-out in mainframe and remove cable and grommet.
6. Remove two hex washer head screws and lock nuts holding cord reel to side of low voltage power supply housing.
7. Lift off cord reel pulling leads through grommet in low voltage power supply housing.

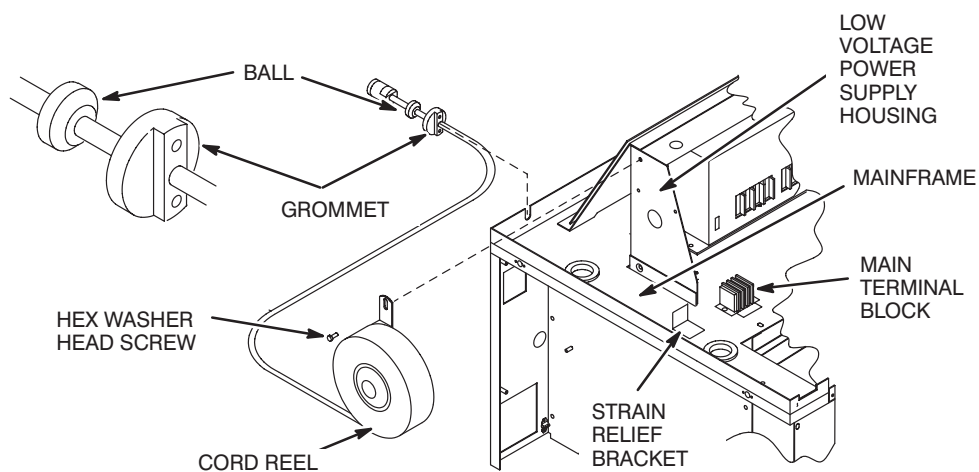
ILLUSTRATION 9-2
CORD REEL REMOVAL/INSTALLATION
(MODEL 2115090, 2115090-4, 2115090-5, 2115090-7, 2115090-9 & 2115090-10 ONLY)



**9-3-2 Cord Reel Removal (Model 2115090-2,
2115090-6, 2115090-8 & 2115090-11 Only)**

1. Shut power off by turning circuit breaker OFF.
2. Open top cover. Refer to Section 5-5.
3. Disconnect cord reel leads at main terminal block. See Illustration 9-3.
4. Remove two internal hex cap screws retaining grommet in cut-out in mainframe and remove cable and grommet.
5. Remove two hex washer head screws and lock nuts holding cord reel to side of low voltage power supply housing.
6. Loosen screw in strain relief bracket located behind cord reel.
7. Lift off cord reel pulling leads through strain relief bracket.

ILLUSTRATION 9-3
CORD REEL REMOVAL/INSTALLATION
(MODEL 2115090-2, 2115090-6, 2115090-8 & 2115090-11 ONLY)



9-4 Cord/Cord Reel Installation**9-4-1** Cord Reel Installation (Model 2115090,
2115090-4, 2115090-5, 2115090-7, 2115090-9
& 2115090-10 Only)

1. Shut power off by turning circuit breaker OFF.
2. Feed cord reel leads through grommet in low voltage power supply housing. See Illustration 9-2.
3. Install cord reel on side of low voltage power supply housing and secure with two hex washer head screws and lock nuts.
4. Install cable grommet in cut-out in mainframe with two cap screws.
5. Connect three leads from cord reel to F1 (Black), F2 (White) and ground stud (Green).
6. Slide low voltage power supply into mainframe housing and fasten with four hex nuts.
7. Close top cover. Refer to Section 5-6.

9-4-2 Cord Reel Installation (Model 2115090-2,
2115090-6, 2115090-8 & 2115090-11 Only)

1. Shut power off by turning circuit breaker OFF.
2. Feed cord reel leads through strain relief bracket and tighten bracket retaining screw. See Illustration 9-3.
3. Install cord reel on side of low voltage power supply housing and secure with two hex washer head screws and lock nuts.
4. Install cable grommet in cut-out in mainframe with two cap screws.
5. Connect three leads from cord reel to main terminal block.
 - Use color code as identified by tag adjacent to terminal block.
6. Close top cover. Refer to Section 5-6.

9-5 Cable Routing

There are seven cables mounted on the horizontal arm and column. These must be carefully routed and mounted in order for the equipment to be operated with maximum flexibility and to prevent binding or jamming of cables which would restrict positioning the X-ray tube.

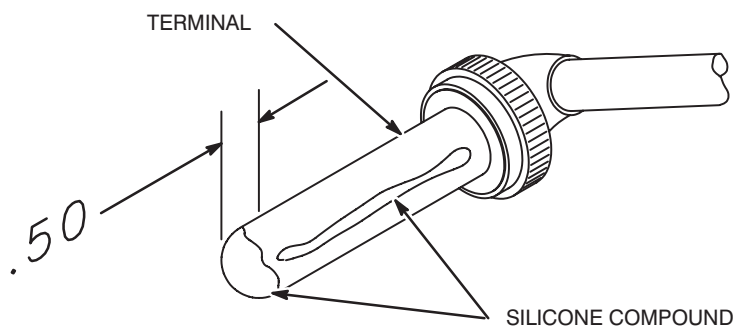
Cables:

- Cathode - X-ray tube to transformer located in base of unit.
- Anode - X-ray tube to transformer located in base of unit.
- Collimator - Collimator to terminal box located on vertical column assembly
- X-ray Control - X-ray tube to terminal box
- Horizontal Arm Brake - Horizontal arm to terminal box
- Control - Terminal box to base unit
- Upper Column Brake - Upper brake to terminal box

Note:

When connecting the anode or cathode cables to the tube or transformer use the following procedure. Apply a strip of silicone compound along the terminal. Use a clean dry stick to spread the compound uniformly over the terminal. Apply a 1/2 inch dome of compound over the end of the terminal. Insert the terminal into the connector. It must be positioned correctly Pointing down from the tube, pointing up from the transformer. See Illustration 9-4.

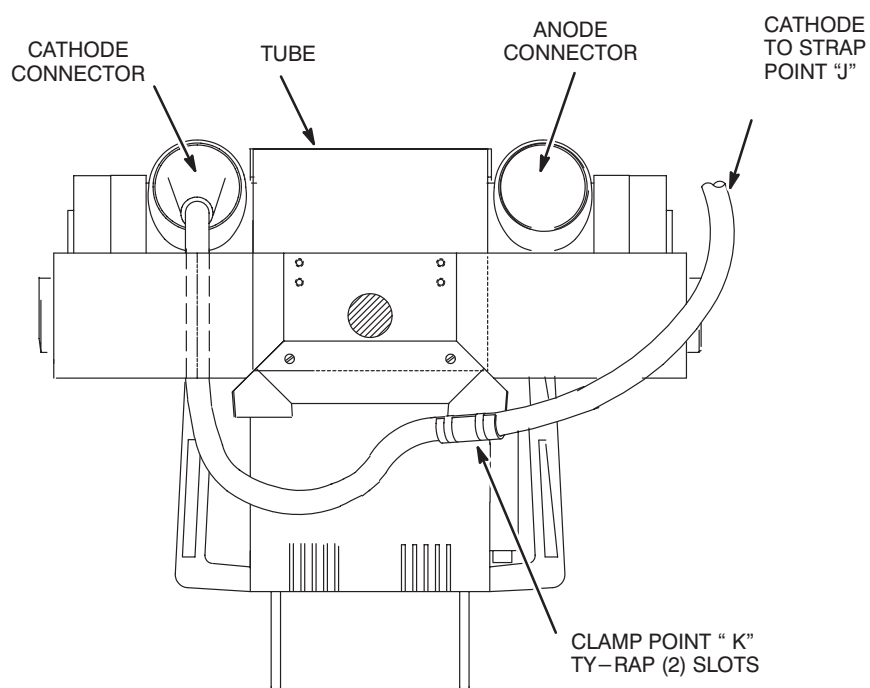
ILLUSTRATION 9-4
HV TERMINAL PREPARATION



9-5-1 Cathode Cable Routing

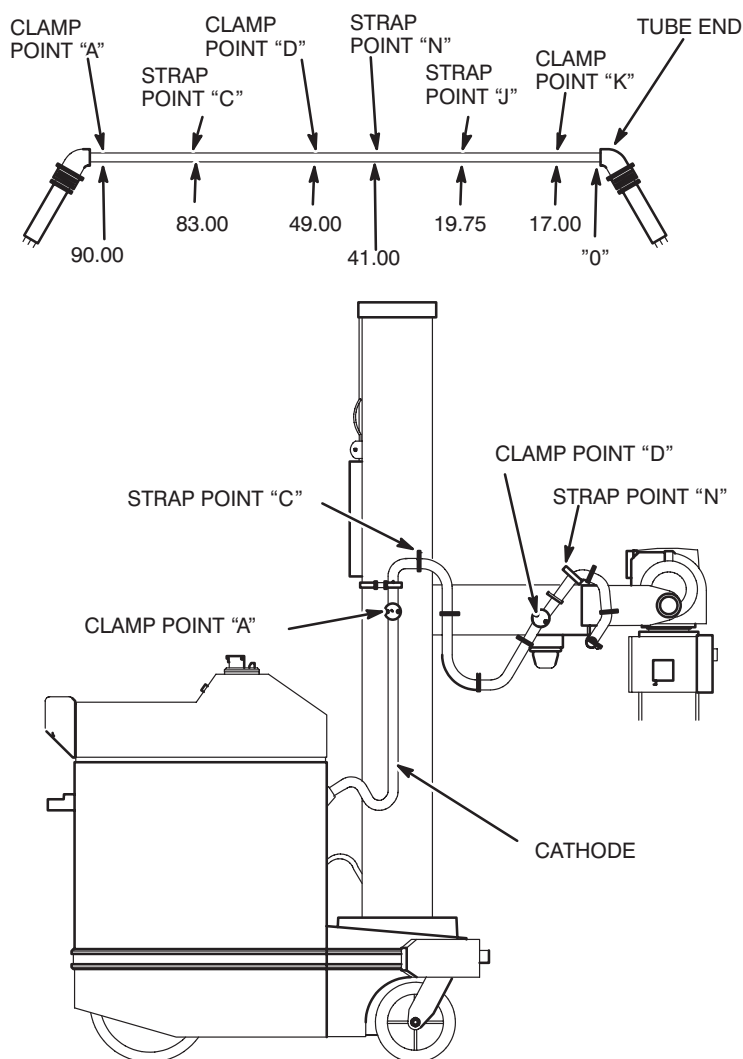
1. The cathode cable starts at the tube, runs through the yoke, crosses underneath the opposite side of the yoke to clamp point "K." See Illustration 9-5. The cable distance from the tube to the clamp is 17 inches. See Illustration 9-6.

ILLUSTRATION 9-5
CATHODE CABLE ROUTING
FROM TUBE TO FIRST CLAMP



2. From clamp "K" the cable continues to strap points "J and N" and then to clamp point "D." See Illustration 9-6. The distances are referenced in the illustration. Other ty-raps or straps are not used until the collimator is installed.
3. The cathode cable continues from clamp point "D" to strap point "C," clamp point "A" and then terminates at the transformer in the base of the unit.

ILLUSTRATION 9-6
CATHODE CABLE ROUTING
FROM TUBE TO FIRST CLAMP



9-5-2 Anode Cable Routing

1. The anode cable starts at the tube, runs through the yoke crosses underneath to the opposite side of the yoke to clamp point "L." See Illustration 9-7. The cable distance from the tube to the clamp is 17 inches. See Illustration 9-8.
2. From clamp point "L" the cable continues to strap point "M" and clamp point "H." See Illustration 9-8. The distance from the tube to each clamp and strap point is referenced in the illustration. Other ty-raps or straps are not used until the x-ray control and arm brake cables are installed.
3. The anode cable continues from clamp point "H" to strap point "G," to clamp point "E" and then to the transformer in the base of the unit.

ILLUSTRATION 9-7
ANODE CABLE ROUTING FROM TUBE TO FIRST CLAMP

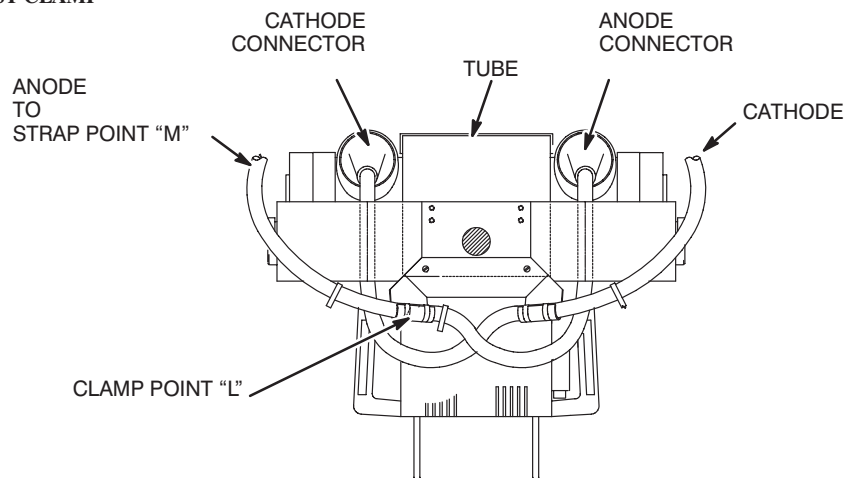
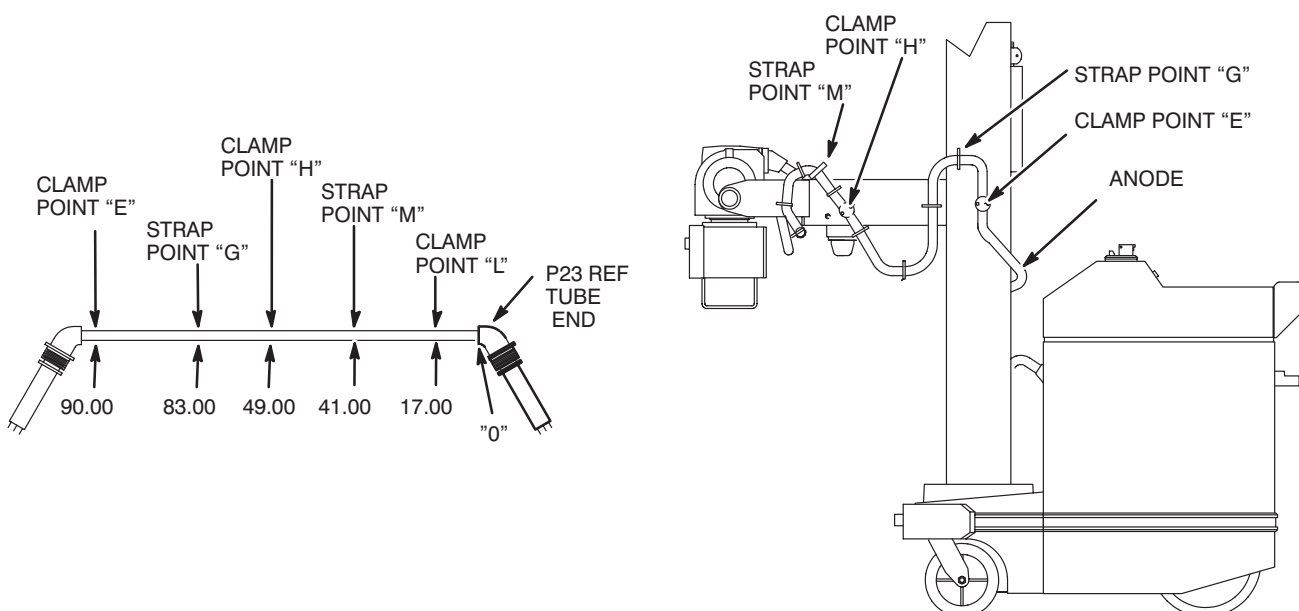


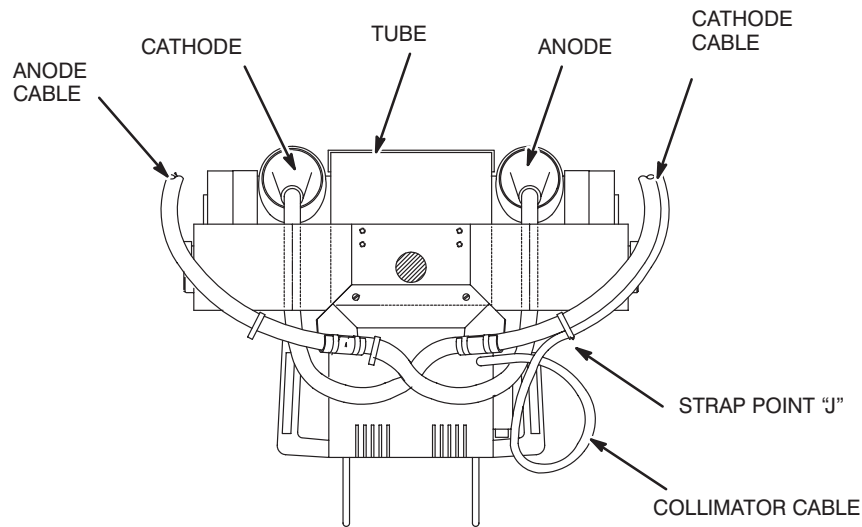
ILLUSTRATION 9-8
ANODE CABLE ROUTING FROM FIRST CLAMP TO TRANSFORMER



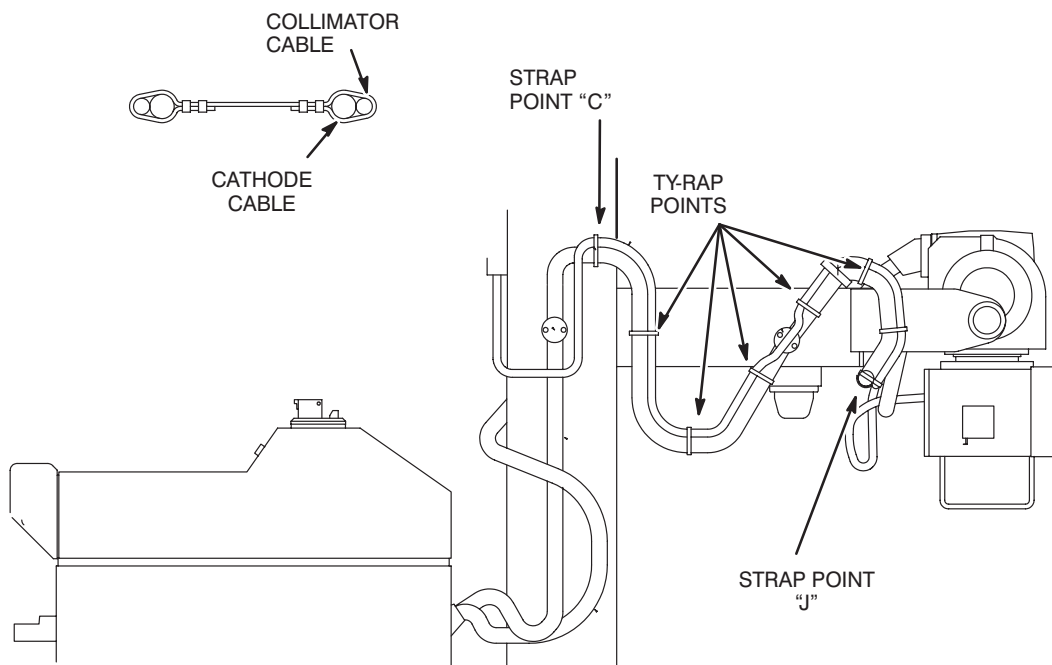
9-5-3 Collimator Cable

1. The collimator cable starts at the collimator, passes over the anode cable and goes to strap point "J" where it is joined to the cathode cable. There is a large loop of cable before reaching strap point "J" as shown in Illustration 9-9.
2. Continue routing and ty-rapping the collimator cable along the cathode cable to strap point "C." There is a large loop of collimator cable immediately after strap point "C." See Illustration 9-10.

**ILLUSTRATION 9-9
COLLIMATOR CABLE
ROUTE TO FIRST STRAP**



**ILLUSTRATION 9-10
COLLIMATOR CABLE
ROUTE ON CATHODE CABLE**



3. The collimator cable goes from strap point "C" directly into the vertical column assembly terminal box where it is connected to terminal strip AMX3 A1 TS1. See Illustration 9-11.

ILLUSTRATION 9-11
COLUMN TERMINAL STRIP AMX3 A1 TS1

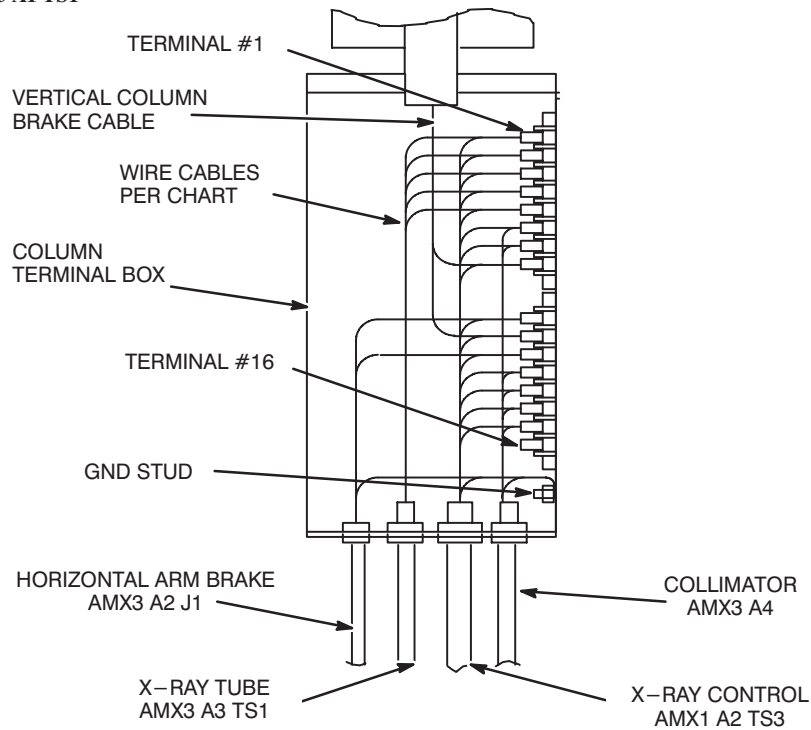


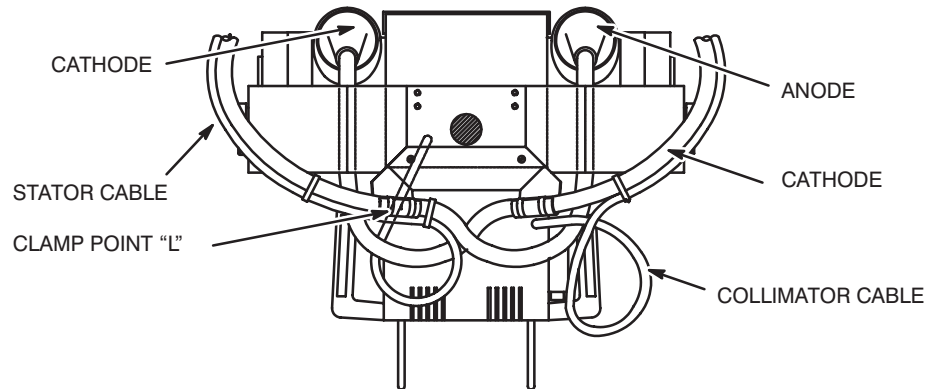
TABLE 9-1
AMX3 A1 TS1 CONNECTIONS

Terminal No.	Signal Name	FROM		TO		
		AMX1 A2 TS3	Color	Color	Terminal	
1	ROTOR PHASE2	3	BLK	BLK	AMX3 A3 TS1-5	X-RAY TUBE
2	ROTOR COMN	4	WHT	WHT	AMX3 A3 TS1-3	X-RAY TUBE
3	ROTOR PHASE 1	5	GRN	GRN	AMX3 A3 TS1-4	X-RAY TUBE
4	X-RAY PRES SW	6	WHT/ORN	BLU	AMX3 A3 TS1-1	X-RAY TUBE
5	X-RAY PRES SW RTN	7	GRY	RED	AMX3 A3 TS1-2	X-RAY TUBE
6	FIELD LIGHT SW	8	WHT/BRN	WHT	AMX3 A4	COLLIMATOR
7	FIELD LIGHT SW RTN	9	WHT/RED	YEL	AMX3 A4	COLLIMATOR
8	+12VDC LOCKS	10	WHT/BLK	RED	AMX3 BRK2	COLUMN LOCK
9	- JUMPER FROM 8 -			RED	AMX3 A2 J1	TUBE ARM LOCK
10	- BATT	11	VIO	BLK	AMX3 BRK2	COLUMN LOCK RTN
11	- JUMPER FROM 10 -			BLK	AMX3 A2 J1	TUBE ARM LOCK RTN
12	PWR GND	12	YEL	ORN	AMX3 A4	COLLIMATOR
13	+24VDC	13	BLU	GRN	AMX3 A4	COLLIMATOR
14	FIELD LIGHT	14	BRN	RED/BLK	AMX3 A4	COLLIMATOR
15	FIELD LIGHT RTN	15	ORN	BRN/BLU	AMX3 A4	COLLIMATOR
16	NOT USED					
GND STUD		BASE GND STUD	GRN/YEL	GRN/YEL	AMX3 A2 J1	TUBE ARM GND
				GRN/YEL	AMX3 A4	COLLIMATOR GND

9-5-4 Stator Cable Routing

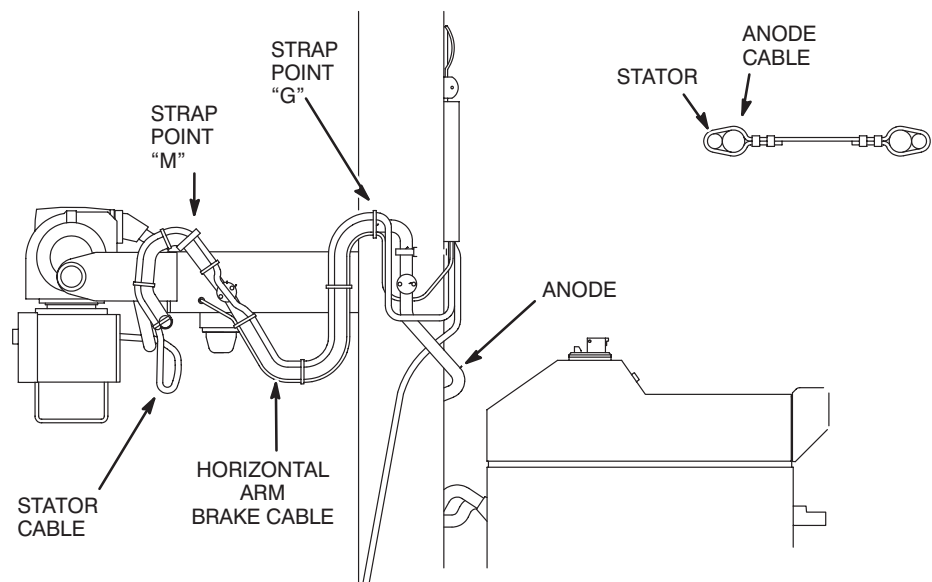
1. The stator cable starts at the tube, passes under the cathode cable and joins the anode cable just before clamp "L." There is a large loop of cable before reaching clamp point "L." The x-ray cable is ty-rapped on each side of clamp point "L" as shown in Illustration 9-12.

ILLUSTRATION 9-12
STATOR CABLE ROUTE
TO FIRST TY-RAP



2. The stator cable follows the anode cable from clamp point "L" to strap point "M" with two ty-raps in between. Continue routing and ty-rapping the collimator cable along the anode cable to strap point "G." The horizontal arm brake cable is also picked up and retained until strap point "G." See Illustration 9-13.
3. There is a large loop after strap point "G" before the cable enters the bottom of the vertical column assembly terminal box and is connected to the terminal strip AMX3 A1 TS1. See Illustration 9-11.

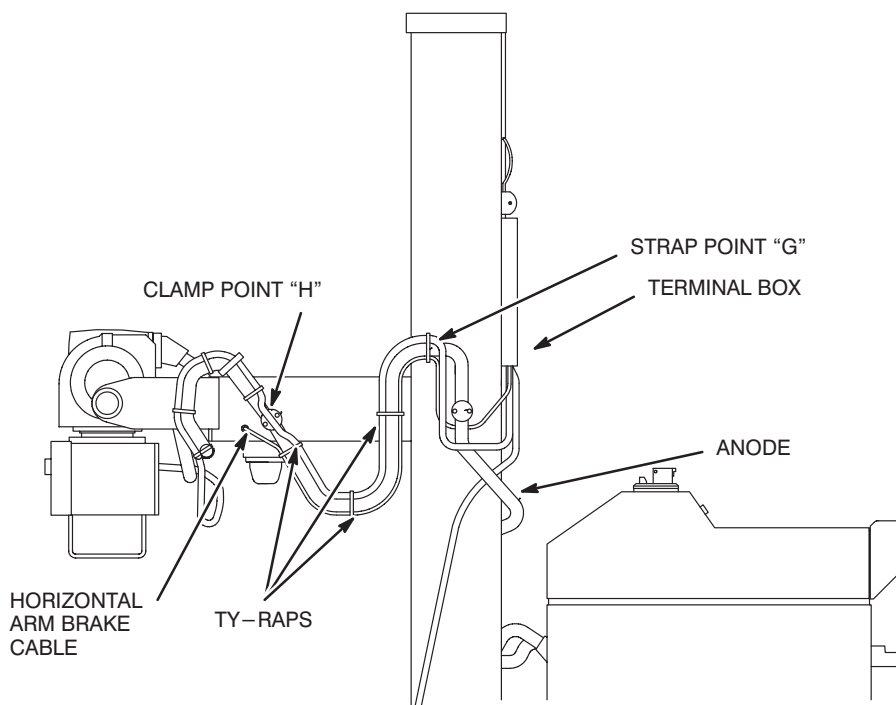
ILLUSTRATION 9-13
STATOR CABLE ROUTE
ON ANODE CABLE



9-5-5 Horizontal Arm Brake Cable

1. The horizontal arm brake cable exits the left side of the horizontal arm outer tube and is ty-rapped to the bottom of the anode cable just below clamp point "H." See Illustration 9-14.
2. The cable continues from near clamp point "H" and is ty-rapped to the anode and stator cables at the locations shown in Illustration 9-14 until reaching strap point "G".
3. The horizontal arm brake cable is looped and enters the bottom of the vertical column assembly terminal box. It is connected to terminal strip AMX3 A1 TS1. See Illustration 9-11.

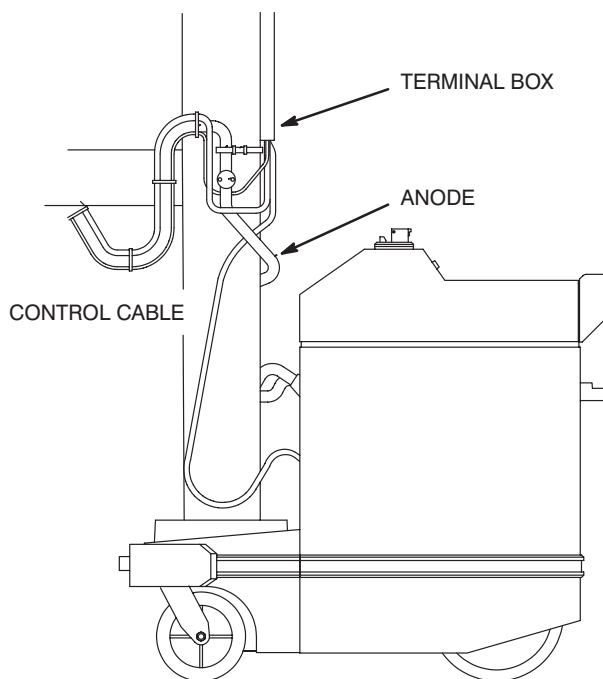
ILLUSTRATION 9-14
HORIZONTAL ARM
BRAKE ROUTING



9-5-6 Control Cable

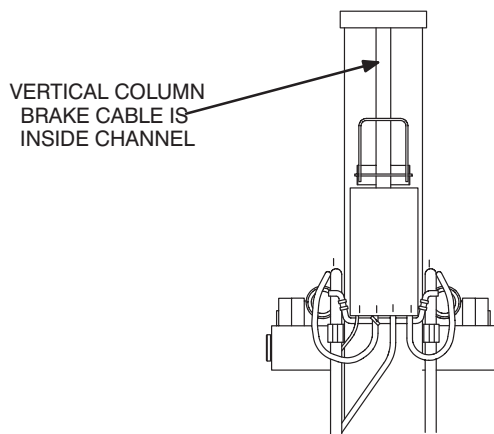
The control cable exits the bottom of the terminal box on the rear of the vertical column assembly, passes beneath the anode cable and connects directly into the unit just below the anode and cathode cables. The cable is loosely draped to accommodate arm and column movements. See Illustration 9-15.

ILLUSTRATION 9-15
CONTROL CABLE ROUTING

**9-5-7 Vertical Column Brake Cable**

1. The vertical column brake cable exits the side of the vertical column assembly and is routed to a channel on the rear of the column. See Illustration 9-16.
2. The brake cable enters the channel at the top of the vertical column assembly and continues down into the top of the terminal box and is connected to the terminal strip AMX3 A1 TS1. See Illustration 9-11.

ILLUSTRATION 9-16
UPPER BRAKE CABLE ROUTE ON COLUMN



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SECTION 10
COUNTERWEIGHT BALANCING

Note: The column assembly trim cover must be removed from top of column assembly as shown in Section 4-1.

1. Turn on AMX unit.
2. Secure the collimator hand switch closed (only one is necessary) to energize the vertical column brake (as well as all other brakes and latch solenoid). This is done best with an electrical ty-wrap or piece of tape.
3. With all hardware in place, check the forces required to move the tube/arm assembly upward and downward. If the force to move it up is equal to the force to move it down, then the vertical column system is balanced and no shims need to be added or removed from the counterweight. Replace trim cover on top of vertical column and secure with two hex socket button head capscrews and proceed no further.
4. If the vertical moving forces are unequal, then one or two shims (46-279784P1) need to be installed, or shims already installed on the counterweight need to be removed (there are approximately four shims installed at the factory). To do this, move the tube/arm to its lowest possible position. This will raise the counterweight to the top of the vertical column where the counterweight shims can be accessed.
5. Loosen and remove the two locknuts and washers that hold the counterweight shims. Add or remove shims as required, replace the washers and locknuts, and tighten locknuts.
6. Repeat step #3 and check the balancing of the vertical column system. If the moving forces are equal, replace trim cover on top of vertical column and secure with two hex socket button head capscrews. If they are unequal, repeat step #4.

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