TECHNICAL MANUAL

OPERATOR AND ORGANIZATIONAL MAINTENANCE MANUAL

DRILL, PNEUMATIC, DRIFTER: SELF PROPELLED

JOY MODEL RAM-MS-5/450A-DR

FSN 3820-445-3766

HEADQUARTERS, DEPARTMENT OF THE ARMY

19 JULY 1974

CHANGE
No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., 11 May 1992

Operator and Organizational
Maintenance Manual

DRILL, PNEUMATIC, DRIFTER: BOOM-TYPE;
CRAWLER-MOUNTED, SELF-PROPELLED
JOY MODEL RAM-MS-5/450A DR
NSN 3820-00-445-3766

NOTE

The equipment/system described herein is non-metric and does not require metric common or special tools: therefore, metric units are not supplied. For clarity, operator and maintenance instructions will also remain non-metric.

PURPOSE

The purpose of this change is to incorporate operation and maintenance data for the 220-lb class crawler-mounted drifter drill retrofit kit.

HOW TO USE THIS CHANGE

To determine if your crawler-mounted drill is equipped with the retrofit kit. check the part number stamped on the gearbox mounting plate. If the part number is "20010", your unit is equipped with the retrofit kit. Follow the instructions included in this change package for operation, preventive maintenance, and maintenance of the feedshell assembly and drifter drill.

TM 5-3820-241-12, 19 July 1974, is changed as follows:

Page i.

Add the following to the Table of Contents immediately before Appendix A:

.CHAPTER 5. MAINTENANCE INSTRUCTIONS FOR UNITS EQUIPPED WITH RETROFIT KIT

Section I. Maintenance of Pneumatic System, paragraphs 5-1 5-7

Section II. Maintenance of the Boom Frame and Drill Guide Assembly, paragraphs 5-8 5-12

Section III. Maintenance of the Feed and Leveling Mechanism, paragraphs 5-13 5-16

Add the following to the Table of Contents immediately after Appendix B:

.APPENDIX C. COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

.APPENDIX D. EXPENDABLE AND DURABLE ITEMS LIST

Page 1-1.

Paragraph 1-2 is superseded as follows:

1-2. Maintenance Forms, Records, and Reports

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750, The Army Maintenance Management System (TAMMS).

Paragraph 1-3 is superseded as follows:

1-3. Reporting Errors and Recommending Improvements

You can help improve this manual. If you find any mistakes or know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander. U.S. Army lank-Automotive Command,

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***This change supersedes Change 1, 23 April 1990.**

Approved for public release; distribution is unlimited.

ATTN: AMSTA-MB, Warren, MI 48397-5000. A reply will be furnished to you.

Page 1-4. Add the following data to the paragraph indicated:

Paragraph 1-9b(2).

Manufacturer .....Cannon Industries. Inc.
Model.....CVR-250
Type.....Dual rotation, percussion type
Bore.....4 1/2 in.
Stroke .....3 1/4 in.
Drill Steel Size .....1 1/4 In.
Hole Size Range .....1 1/2 to 3 1/2 in.
Air Pressure Used .....90 psi
Air Drill Capacity .....330 cfm
Hose Sizes:
Drill.....11/2 in.
Blow .....3/4 in.
Rotation .....3/4 in.

Paragraph 1-9b(10).

Manufacturer .....Gast Manufacturing Corporation
Model 16AM-FRV-13

Page 1-6. Figure 1-3.1 Is added as follows:

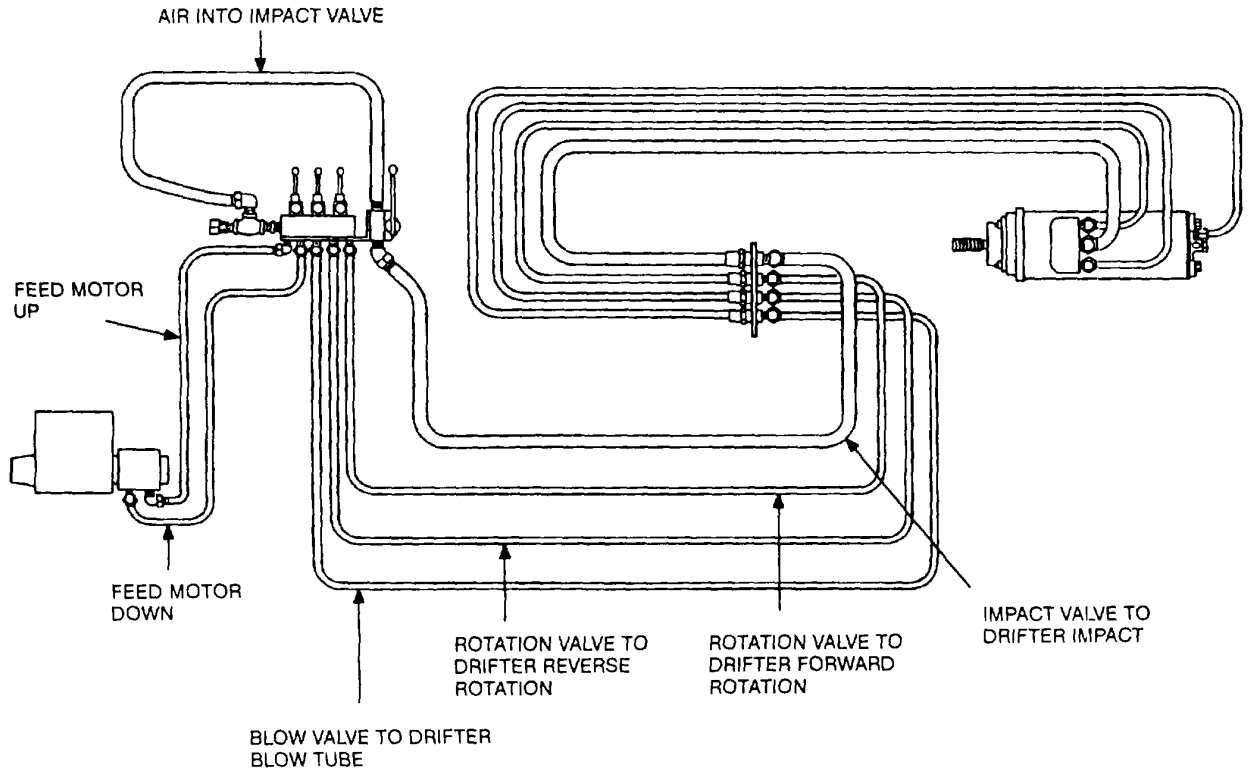


Figure 1-3.1. Drill control air piping diagram (for units equipped with retrofit kit).

Page 2-3. Figure 2-1, sheet 2.1 of 3, is added after sheet 2 of 3:

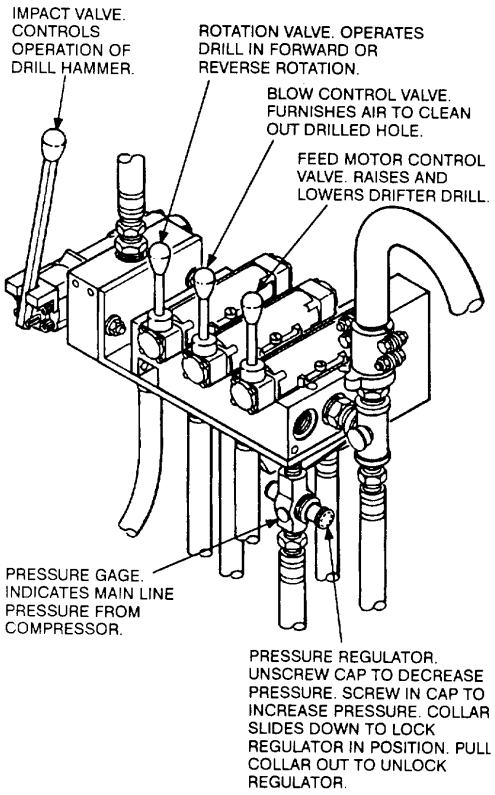


Figure 2-1. Controls and instruments (for units equipped with retrofit kit) (sheet 2.1 of 3).

Page 2-11. Figure 2-8.1 is added as follows:

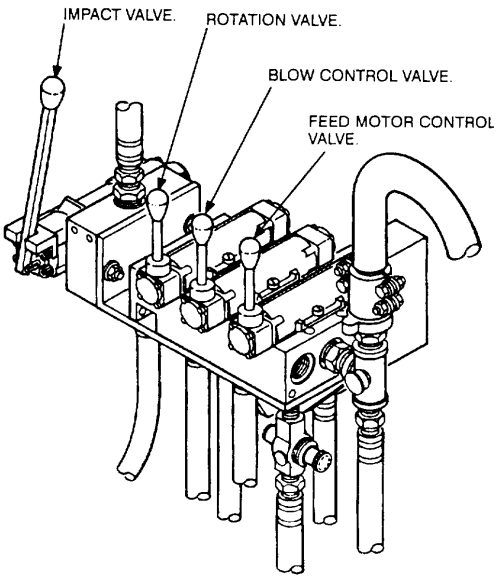


Figure 2-8.1. Drilling operation (for units equipped with retrofit kit).

Page 3-1. Chapter 3, Section II is superseded as follows:

Section II. OPERATOR'S PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-3. Introduction

a. General. Table 3-1 (PMCS Table) has been provided so you can keep your equipment in good operating condition and ready for its primary mission.

b. Warnings and Cautions. Always observe the WARNINGS and CAUTIONS appearing in your PMCS table. Warnings and cautions appear before applicable procedures. You must observe these WARNINGS and CAUTIONS to prevent serious injury to yourself and others or to prevent your equipment from being damaged.

c. Explanation of Table Entries.

(1) Item Number Column. Numbers in this column are for reference. When completing DA Form 2404 (Equipment Maintenance and Inspection ,Worksheet), include the item number for the check/service indicating a fault. Item numbers also appear in the order that you must do checks and services.

(2) Interval Column. This column tells you when you must do the procedure in the procedure column. BEFORE procedures must be done before you operate or use the equipment. DURING procedures must be done during the time you are operating or using the equipment for its intended mission. AFTER procedures must be done immediately after you have operated or used the equipment.

(3) Location, Item to Check/Service Column. This column provides the location and the item to be checked or serviced. The item location is underlined.

(4) Procedure Column. This column gives the procedures you must do to check or service the item listed in the Check/Service column to know if the equipment is ready or available for its intended mission or for operation. You must do the procedure at the time stated in the interval column.

(5) Not Fully Mission Capable If. Column. Information in this column tells you what faults will keep your equipment from being able to perform its primary mission. If you make check and service procedures that show faults listed in this column, do not operate the equipment. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.

d. Other Table Entries. Be sure to observe all special information and notes that appear in you table.

3-4. Leakage Definitions

The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your equipment.

CLASSIFICATION	DEFINITION
Class I	Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
Class II	Leakage of fluid great enough to form drops but not enough to cause drops to drip from the item being inspected.
Class III	Leakage of fluid great enough to cause drops to drip from the item being inspected.

NOTE

Fluid levels of items with Class I and Class II leaks must be checked often so proper levels can be kept.

Class III leaks must be reported to supervisors or to Organizational Level Maintenance for corrective action.

Table 3-1. Operator Preventive Maintenance Checks and Services for Crawler-Mounted Rock Drill

Item No.	Interval	Item to Check/ Service	Procedure	Not Fully Mission Capable If:
		Crawler and Carrier		
1	Before	Hydraulic Hoses and Cylinders	Inspect hydraulic hoses and cylinders for leaks or damaged condition.	Class III leaks are found.
2	Before	Boom Drill Carriage	Inspect all drill motor to boom bolts. If loose, report to organizational maintenance.	
3	Before	Tramming Motors	a. Remove drain plug and drain off water. Install drain plug. b. Check oil level. If level is low, notify organizational maintenance.	
4	Before	Rock Drill Reservoir	Check for proper oil level. If level is low, notify organizational maintenance.	
5	During	Hydraulic Control Valves	Visually inspect hydraulic control valve for leaks.	Class III leaks are found.
6	During	Air Motor and Hydraulic Pump	a. Inspect air motor and hydraulic pump for proper operation. Listen for unusual noises. Check for sluggish Motor or erratic performance.	There are unusual noises, motor is sluggish, or equipment is operating erratically.
	During		b. Check motor exhaust for atomized oil.	Oil is present in exhaust.

Table 3-1. Operator Preventive Maintenance Checks and Services for Crawler-Mounted Rock Drill Location

Item No.	Interval	Location Item to Check/ Service	Procedure	Not Fully Mission Capable If:
		Feed System		
7	Before	Mounting Hardware	Check for missing bolts or signs of looseness. Notify organizational maintenance if any nuts or bolts are loose or missing	Missing or loose bolts.
8	Before	Striker Bar	Check striker bar for damage and excessive wear. Both ends of striking bar must be flat and square, not chipped. Replace if necessary.	Striker bar is excessively worn or damaged.
9	Before	Drifter Drill	Check front cap for tightness. Do not run drill with a loose front cap.	Front cap is loose.
10	Before	Feed Chain	Visually check feed chain for breaks or damage.	Feed chain broken or damaged.
11	Before	Feed Chain Sprockets	Visually check sprocket alinement. If sprockets are not aligned, notify organizational maintenance.	
12	Before	Feedshell	Visually check feedshell for damage. Visually check for wear that would interfere with operation.	
13	Before	Sprockets, Feed Chain, and Centralizer	Visually check for excessive accumulation of dust and debris that will interfere with operation.	
14	Before	Centralizer	Inspect centralizer bushing for wear by looking for grooves in bushing or metal filings around or below centralizer (not applicable to units equipped with retrofit kit).	Excessive wear is apparent.
15	During	Sprockets, Feed Chain, and Centralizer	Visually check for excessive accumulation of dust and debris that will interfere with operation.	
16	During	Air Hoses	Inspect air hoses for leaks, damage, or frays.	Leakage causes poor performance.
17	During	Drifter Drill	Inspect drifter drill for proper operation. Drill should travel freely on boom feed mechanism.	

Page 4-9. Chapter 4, Section IV, is superseded as follows:

Section IV. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-10. Introduction

a. General. Table 4-l (PMCS Table) has been provided so you can keep your equipment in good operating condition and ready for its primary mission.

b. Warnings and Cautions. Always observe the WARNINGS and CAUTIONS appearing in your PMCS table. Warnings and cautions appear before applicable procedures. You must observe these WARNINGS and CAUTIONS to prevent serious injury to yourself and others or to prevent your equipment from being damaged.

c. Explanation of Table Entries.

(1) Item Number Column. Numbers in this column are for reference. When completing DA Form 2404 (Equipment Maintenance and Inspection Worksheet), include the item number for the check/service indicating a fault. Item numbers also appear in the order that you must do checks and services.

(2) Interval Column. This column tells you when you must do the procedure in the procedure column. QUARTERLY procedures must be done every three months. SEMIANNUALLY procedures must be done ever, six months.

(3) Item to be Checked/Serviced Column. This column provides the item to be checked or serviced.

(4) Procedure Column. This column gives the procedures you must do to check or service the item listed in the Item to be Checked/Serviced column to know if the equipment is ready or available for its intended mission or for operation. You must do the procedure at the time stated in the interval column.

(5) Not Fully Mission Capable lf Column. Information in this column tells you what faults will keep your equipment from being able to perform its primary mission. If you make check and service procedures that show faults listed in this column, do not operate the equipment. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.

d. Other Table Entries. Be sure to observe all special information and notes that appear in you table.

4-11. Leakage Definitions

The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your equipment.

CLASSIFICATION	DEFINITION
Class I	Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
Class II	Leakage of fluid great enough to form drops but rot enough to cause drops to drip from the item being inspected.
Class III	Leakage of fluid great enough to cause drops to drip from the item being inspected.

NOTE

Fluid levels of items with Class I and Class II leaks must be checked often so proper levels can be kept.

Class III leaks must corrected before releasing the equipment for operation.

Table 4-1. Organizational Preventive Maintenance Checks and Services for Crawler-mounted Rock Drill

Item No.	Interval	Item to Check/ Service	Procedure	Not Fully Mission Capable If:
			NOTE Checks 1 through 6 are for units equipped with retrofit kit.	
1	Weekly	Feedshell	Check all bolts and nuts on feedshell for tightness. Pay particular attention to drifter drill mounting bolts and feed-shell slide mounting bolts.	Any bolts loose or missing.
2	Weekly	Feed Chain	Check chain deflection weekly. Ensure that chain is not so tight that no deflec-tion occurs not so loose that is sags. Ad-just if necessary (see paragraph 5-13).	Chain cannot be ad-justed.

Table 4-1. Organizational Preventive Maintenance Checks and Services for Crawler-mounted Rock Drill

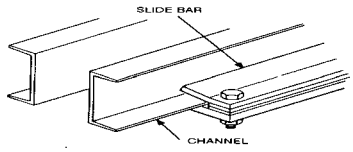
Item No.	Interval	Item to Check/ Service	Procedure	Not Fully Mission Capable If:
3	Weekly	Air Hose Connections	Check all air hose connections and tighten if necessary.	
4	Weekly	Track Suspension System	Check track suspension for proper adjustment. Track should sag approx.-mately 1 in. at a point midway between the two sprockets. Adjust if needed (see paragraph 3-27).	
				
5	Monthly	Slide Bar Shims	Measure clearance between slide bar and feedshell channel. If clearance is greater that 1/8 in., remove slide bar and adjust shims until clearance is less than 1/8 in. (see paragraph 5-12). Repeat for all four slide bars.	
6	Monthly	Centralizer	Close centralizer and measure inside di-ameter of bore. Replace centralizer blocks when inside diameter is greater than 2 in.	
7	Monthly	Drifter Drill	Check torque on side rod mounting nuts. Gradually tighten to 150 lb-ft.	
8	Quarterly	Boom Drill Carriage	Inspect feed chain for proper tension. Adjust if necessary (see paragraph 4-23 or 5-13).	
9	Quarterly	Drifter Drill Cradle	Inspect wear plates and shims for appar-ent wear. Replace if needed.	
10	Quarterly	Hydraulic Hoses	Inspect hydraulic hoses for leaks or oth-er damage. Replace defective hoses.	
11	Semiannually	Centralizer	Inspect centralizer bushings for appar-ent wear (not applicable to units equipped with retrofit kit). Replace if defective.	

Table 4-1. Organizational Preventive Maintenance Checks and Services for Crawler-mounted Rock Drill (Cont.)

Item No.	Interval	Item to Check/ Service	Procedure	Not Fully Mission Capable If:
12	Quarterly	Air Hoses	Inspect air hoses for leaks. Tighten loose fittings or replace defective hoses (see paragraph 4-18 or 5-2 through 5-6).	
13	Quarterly	Hydraulic Pump	Inspect hydraulic pump for proper operation and leaks. Tighten any loose fittings.	
14	Quarterly	Air Motor	a. Inspect air motor for proper operatlon and leaks. If leaking, tighten fittings or replace (see paragraph 4-21). b. (’heck the air motor exhaust for presence of atomized oil. If oil is present, adjust air line lubricator (see paragraph 3-20).	
15	Quarterly	Drill Motor	Inspect drill motor for proper operation by making sure it travels freely on boom.	
16	Quarterly	Feed Chain	Inspect feed chain gear case for leaks. If leaking, report to direct support maintenance.	
17	Quarterly	Final Drive	Inspect final drive and drive sprockets for insecure mounting. Tighten or replace hardware if necessary.	
18	Quarterly	Transmission Breather	Refer to 1O 5-3820-241-12 and service the transmission breather.	

Page 4-11. Add the following references to Table 4-2:

Malfunction 1, Step 1, Corrective Action statement. Add reference to paragraphs 5-3 through 5-6.

Malfunction 4.

Step 1, Corrective Action statement. Add reference to paragraphs 5-3 through 5-6.

Step 4. Add reference to paragraph 5-13 for chain adjustment. Add the following sentence to end of corrective action statement: "If unit is equipped with retrofit kit, have direct support maintenance replace the feed chain.

Malfunction 6, Step 2, Corrective Action statement. Add reference to paragraphs 5-3 through 5-6.

Malfunction 7, Step 1, Corrective Action Statement. Add reference to paragraphs 5-3 through 5-6.

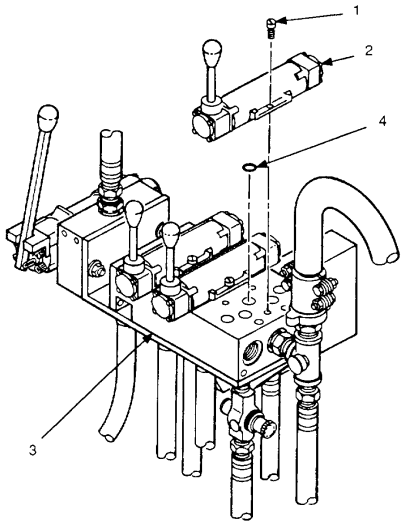
Page A-1. Chapter 5 is added before Appendix A as follows:

CHAPTER 5

MAINTENANCE INSTRUCTIONS FOR UNITS EQUIPPED WITH RETROFIT KIT

Section I. MAINTENANCE OF THE PNEUMATIC SYSTEM

5-1. Control Valves and Manifold Replacement

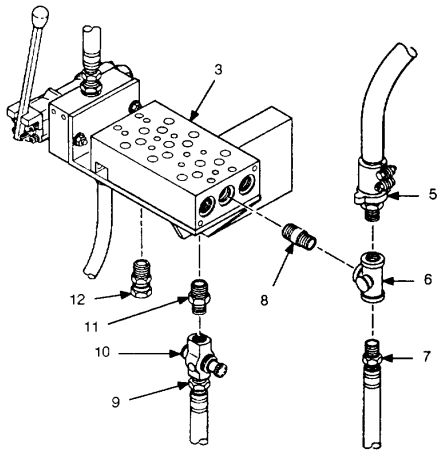


a Removal.

(1) Remove three screws (1). Remove valve (2) from manifold (3).

(2) Remove five O-rings (4) from valve (2) or manifold (3). Discard O-rings.

(3) Repeat steps (1) and (2) for remaining valves.

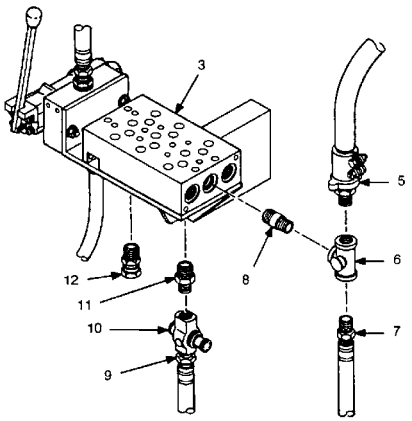


(4) Disconnect crawler air hose (5) from tee (6).

(5) Disconnect impact valve air hose (7) from tee (6).

(6) Remove tee (6) and nipple (8) from manifold (3).

(7) Tag and disconnect five hoses (9).

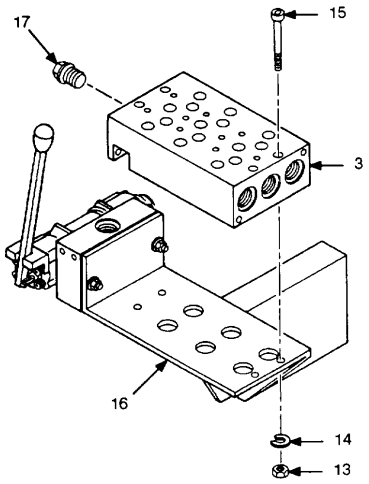


NOTE

Use a thin-walled wrench (NSN 5120-00-288-8714) to remove swivels from valve manifold.

(8) Remove pressure regulator (10) and swivel (11) from manifold (3).

(9) Remove remaining four swivels (12) from manifold (3).



(10) Remove four nuts (13), lockwashers (14), and bolts (15). Remove manifold (3) from bracket (16). Discard lockwashers.

(11) Remove seven pipe plugs (17) from manifold (3).

b. Installation.

(1) Wrap pipe plug threads with antiseize tape. Install seven pipe plugs (17) in manifold (3).

(2) Install manifold (3) on bracket (16) using four bolts (15), new lockwashers (14), and nuts (13).

NOTE

Use a thin-walled wrench (NSN 5120-00-288-8714) to install swivels in valve manifold.

(3) Wrap male threads on four swivels (12) with antiseize tape. Install four swivels in manifold (3).

(4) Wrap threads on swivel (11) with antiseize tape.

Install swivel in manifold (3) then install pressure regulator (10) on swivel.

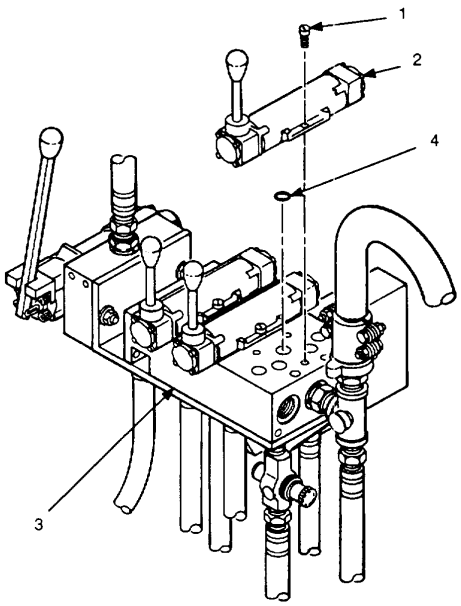
(5) Connect five hoses (9) to swivels (12 and 11). Remove tags.

(6) Wrap threads on nipple (8) with antiseize tape.

Install nipple in manifold (3) then install tee (6) on nipple.

(7) Connect impact valve air hose (7) to tee (6).

(8) Connect crawler air hose (5) to tee (6).

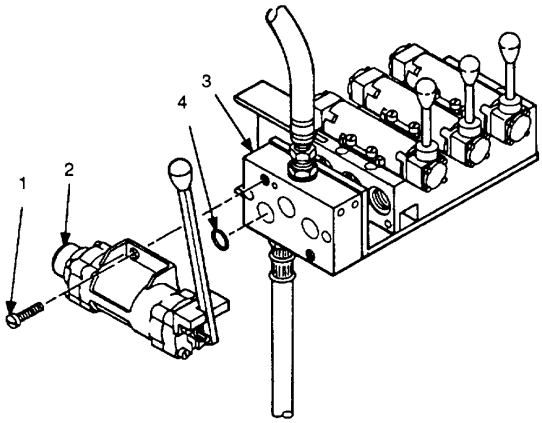


(9) Install five new O-rings (4) in valve (2).

(10) Install valve (2) on manifold (3) using three screws (1).

(11) Repeat steps (9) and (10) for remaining valves.

5-2. Impact Valve and Manifold Replacement



a. Removal.

(1) Remove two screws (1). Remove impact valve (2) from manifold (3).

(2) Remove two O-rings (4) from impact valve (2) or manifold (3). Discard O-rings.

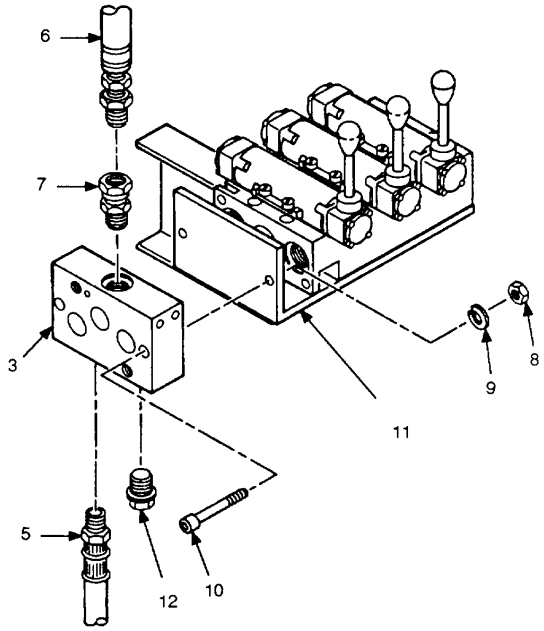
(3) Tag and disconnect hose (5) from manifold (3).

(4) Tag and disconnect hose (6) from swivel (7).

(5) Remove swivel (7) from manifold (3).

(6) Remove two nuts (8), lockwashers (9), and bolts (10). Remove manifold (3) from bracket (11). Discard lockwashers.

(7) Remove plug (12) from manifold (3).



b. Installation.

(1) Wrap threads on plug (12) with antiseize tape. Install plug in manifold (3).

(2) Install manifold (3) on bracket (11) using two bolts (10), new lockwashers (9), and nuts (8).

(3) Wrap male threads on swivel (7) with antiseize tape. Install swivel in manifold (3).

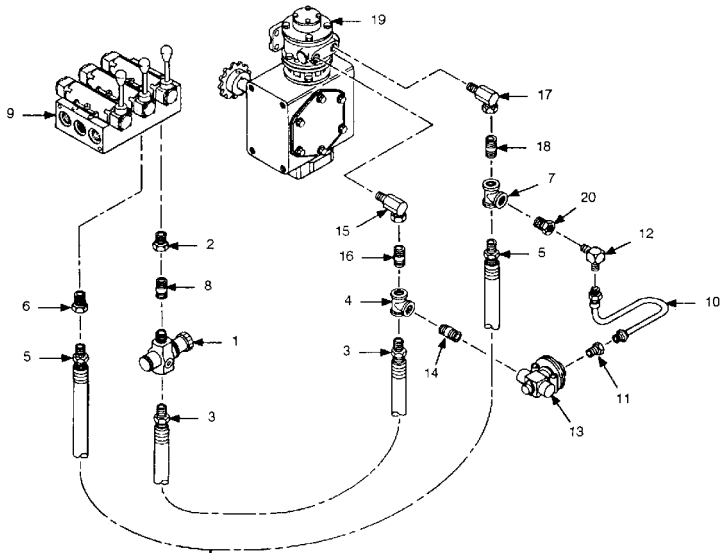
(4) Connect hose (6) to swivel (7). Remove tag.

(5) Connect hose (5) to manifold (3). Remove tag.

(6) Install two new O-rings (4) in impact valve (2).

(7) Install impact valve (2) on manifold (3) using two screws (1).

5-3. Feed Motor Hoses and Fittings Replacement



a. Removal.

(1) Disconnect pressure regulator (1) from swivel (2). Remove hose (3) from pressure regulator and tee (4).

(2) Disconnect hose (5) from swivel (6) and tee (7). Remove hose.

(3) Remove nipple (8) from pressure regulator (1) or swivel (2).

NOTE

Use a thin-walled wrench (NSN 5120-00-288-8714) to remove swivels from valve manifold

(4) Remove two swivels (2 and 6) from valve manifold (9).

(5) Remove hose (10) from straight fitting (11) and 90 degree fitting (12).

(6) Remove quick-exhaust valve (13) from nipple (14).

(7) Remove tee (4) from elbow (15). Remove nipple (16) from tee.

(8) Remove tee (7) from elbow (17). Remove nipple (18) from tee.

(9) Remove nipple (14) from tee (4) or quick-exhaust valve (13).

(10) Remove two elbows (15 and 17i') from feed motor (19).

(11) Remove straight fitting (11) from quick-exhaust valve (13).

(12) Remove 90 degree fitting (1I.) from bushing (20), then remove bushing from tee (7).

b. Installation.

(1) Wrap male threads on elbows (15 and 17) with antiseize tape. Install two elbows in feed motor (19). Elbows must face down.

(2) Wrap two nipples (14 and 16) with antiseize tape. Install two nipples in tee (4).

(3) Install quick-exhaust valve (13) on nipple (14).

(4) Install straight fitting (11) ill quick-exhaust valve (13).

(5) Connect assembled quick-exhaust valve (13) and tee (4) to elbow (15) on control valve side of feed motor (19).

(6) Wrap threads on nipple (18) with antiseize tape. Install nipple in tee (7).

(7) Wrap male threads on bushing (20) with antiseize tape. Install bushing in tee (7).

(8) Install 90 degree fitting (12) in bushing (20).

(9) Install tee (7) on elbow (17).

(10) Connect hose (10) to straight fitting (11) and 90 degree fitting (12).

NOTE

Use a thin-walled wrench (NSN 5120-00-288-8714) to install swivels in valve manifold.

(11) Install two swivels (2 and 6) in valve manifold (9).

(12) Wrap threads on one end of hose (5) with antiseize tape. Connect that end to tee (7).

(13) Connect other end of hose (5) to swivel (6).

(14) Wrap threads on one end of hose (3) with antiseize tape. Connect that end to pressure regulator (1).

(15) Connect other end of hose (3) to tee (4).

(16) Wrap nipple (8) with antiseize tape. Install nipple in pressure regulator (1).

(17) Connect nipple (8) to swivel (2).

5-4. Rotation and Blow Hoses and Fittings Replacement

a. Removal.

(1) Tag and disconnect hose (1) from swivel (2) at valve manifold (3) and elbow (4) at hose bulkhead (5). Remove hose.

NOTE

Use a thin-walled wrench (NSN 5120-00-288-8714) to remove swivels from valve manifold.

(2) Remove swivel (2) from valve manifold (3).

NOTE

First and third hoses in bulkhead have elbow and swivel. Second and fourth hoses only have elbows.

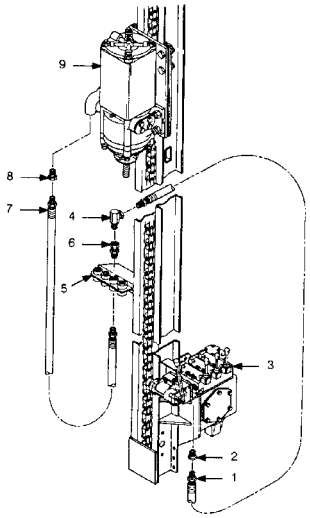
(3) Remove elbow (4) and swivel (6) from hose bulkhead (5).

NOTE

Blow hose at rear of drifter connects to elbow. All other hoses connect to swivels

(4) Tag and disconnect hose (7) from swivel (8) in drifter (9) and hose bulkhead (5).

(5) Remove swivel (8) from drifter (9).



b. Installation.

(1) Wrap male threads on swivel (8) with antiseize tape. Install swivel in drifter (9). If installing elbow for blow hose, ensure that elbow points toward striker bar end of drifter.

(2) Connect hose (7) to hose bulkhead (5) and swivel (8) in drifter (9). Remove tag.

(3) Wrap male threads on swivel (6) and elbow (4) with antiseize tape. Install swivel and elbow in hose bulkhead (5).

NOTE

Use a thin-walled wrench (NSN 5120-00-288-8714) to install swivels in valve manifold.

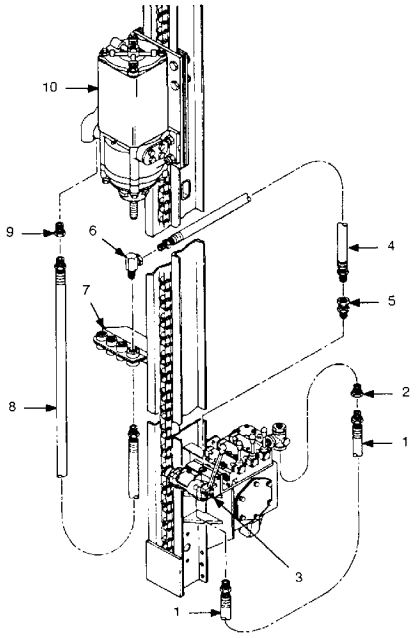
(4) Wrap male threads on swivel (2) with antiseize tape. Install swivel in valve manifold (3).

NOTE

Route all hoses behind feedshell so that they will not interfere with drifter movement. Ensure that hoses are not twisted or kinked after installation.

(5) Connect hose (1) to elbow (4) in hose bulkhead (5) and swivel (2) in valve manifold (3). Remove tag.

5-5. Impact Valve Hoses and Fittings Replacement



a. Removal.

(1) Disconnect hose (1) from swivel (2) and impact valve manifold (3). Remove hose.

(2) Disconnect hose (4) from swivel (5) on impact valve manifold (3) and elbow (6) on hose bulkhead (7). Remove hose.

(3) Remove swivel (5) from impact valve manifold (3).

(4) Remove elbow (6) from hose bulkhead (7).

(5) Disconnect hose (8) from swivel (9) on drifter (10) and hose bulkhead (7). Remove hose.

(6) Remove swivel (9) from drifter (10).

b. Installation.

(1) Wrap male threads of swivel (9) with antiseize tape. Install swivel in drifter (10).

NOTE

Ensure that ho4se is not twisted or kinked after installation.

(2) Wrap threads on hose (8) (where it connects to hose bulkhead) with antiseize tape. Connect hose to hose bulkhead (7) and swivel (9) on drifter (10).

(3) Wrap male threads of elbow (6) with antiseize tape. Install elbow in hose bulkhead (7).

(4) Wrap male threads of swivel (5) with antisei7e tape. Install swivel in impact valve manifold (3).

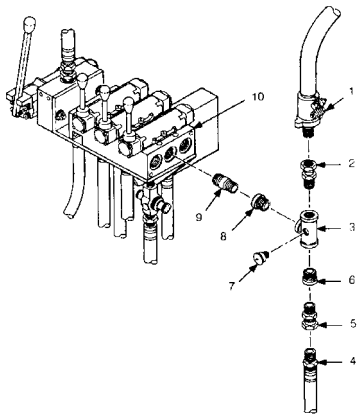
NOTE

Route hose behind feedshell so that it will not interfere with drifter movement. Ensure that hose Is not twisted or kinked after installation.

(5) Connect hose (4) to swivel (5) on impact valve manifold (3) and elbow (6) on hose bulkhead (7).

(6) Connect hose (1) to impact valve manifold (3) and swivel (2).

5-6. Air Inlet Tee and Fittings Replacement



a. Removal.

(1) Disconnect crawler air hose (1) from swivel (2).

(2) Remove swivel (2) from tee (3)

(3) Disconnect impact valve hose (4) from swivel (5)

(4) Remove swivel (5) and bushing (6) from tee (3).

(5) Unscrew and remove gage (7) from tee (3).

(6) Remove tee (3) from bushing (:).

(7) Remove bushing (8) from nipple (9).

(8) Remove nipple (9) from valve manifold (10).

b. Installation.

(1) Wrap threads on nipple (9) with antiseize tape. Install nipple in valve manifold (10).

(2) Wrap male threads on bushing (8) with antiseize tape. Install bushing on nipple (9).

(3) Install tee (3) on bushing (8). Ensure that mounting hole for gage (7) faces out.

(4) Wrap male threads on bushing (6) with antiseize tape. Install bushing in tee (3).

(5) Wrap male threads on swivel (5) with antiseize tape. Install swivel in bushing (6).

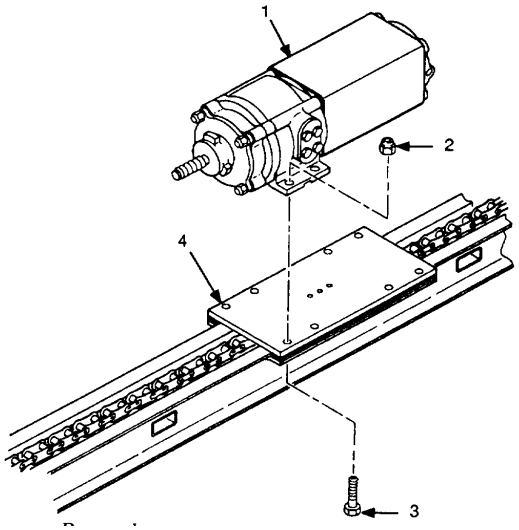
(6) Connect impact valve hose (4) to swivel (5).

(7) Wrap male threads on swivel (2) with antiseize tape. Install swivel in tee (3).

(8) Connect crawler air hose (1) to swivel (2).

(9) Wrap threads on gage (7) with antiseize tape. Screw gage (7) into tee (3).

5-7. Drifter Drill Replacement



a. Removal.

(1) Tag and disconnect air hoses from drifter drill (1).

WARNING

Drifter drill is heavy (approx 288 lb). Use an overhead hoist to remove drifter drill. Secure drifter drill to overhead hoist before removing mounting hardware. Failure to follow this warning could result in personnel injury and equipment damage.

(2) Remove four locknuts (2) and bolts (3). Remove drifter drill from slabback (4). Discard locknuts.

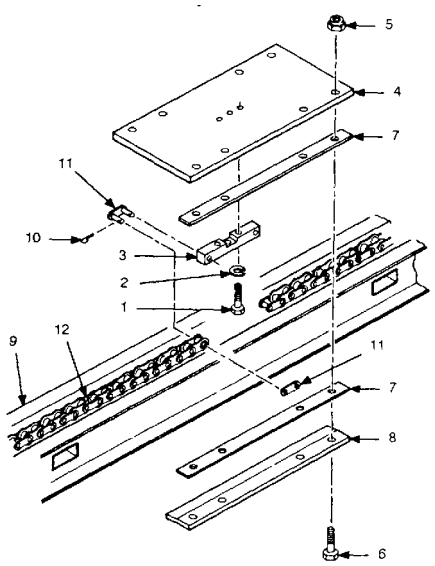
b. Installation.

(1) Install drifter drill (1) on slabback (4) using four bolts (3) and new locknuts (2).

(2) Connect air hoses to drifter drill (1) and remove tags.

Section II. MAINTENANCE OF THE BOOM FRAME AND DRILL GUIDE ASSEMBLY

5-8. Slabback Replacement



a. Removal.

(1) Remove drifter drill (see paragraph 5-7).

(2) Fully loosen chain (see paragraph 5-13).

(3) Remove three screws (1) and lockwashers (2). Remove chain mounting block (3) from slabback (4). Discard lockwashers.

(4) Remove four locknuts (5) and bolts (6) securing slabback (4), four shims (7), and two side rails (8) to feedshell (9). Remove slabback. shims, and side rails. Discard locknuts.

(5) Remove two cotter pins (10) from each master link (11). Separate master links and remove from chain mounting block (3). Discard cotter pins.

b. Installation.

(1) Connect two master links (11) on feed chain (12) to chain mounting block (3). Secure using four new cotter pins (10).

(2) Install slabback (4), four shims (7). and two side rails (8) on feedshell (9) using four bolts (6) and new locknuts (5).

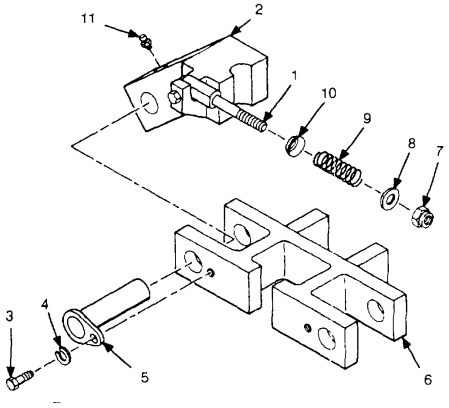
(3) Measure clearance between side rails (8) and flange on feedshell (9). If clearance is greater than 1/8 in.16 remove thinner shim and remeasure. Adjust shims until clearance is 1/8 in. or less.

(4) Install chain mounting block (3) on slabback (4) using three bolts (1) and new lockwashers (2).

(5) Install drifter drill (see paragraph 5-7).

(6) Adjust chain (see paragraph 5-11:).

5-9. Centralizer Replacement and Repair



a. Removal.

(1) Release latch bolt (1) from two centralizer blocks (2).

(2) Remove bolt (3), lockwasher (4), and pin (5) securing each centralizer block (2) to mount (6). Remove two blocks from mount. Discard lockwashers.

b. Disassembly.

(1) Remove locknut (7), flatwasher (8), spring (9), and beveled washer (10) from latch bolt (1',. Discard locknut.

(2) Remove lubrication fitting (11) from each centralizer block (2).

c. Assembly.

(1) Install lubrication fitting (11) in each centralizer block (2).

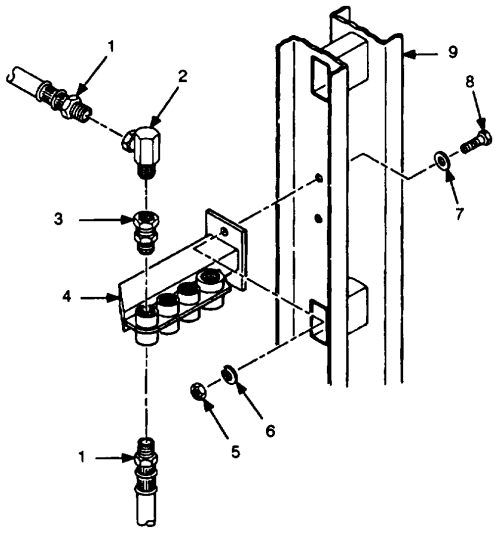
(2) Install beveled washer(10), spring (9), and flatwasher (8) on latch bolt (1). Secure with new locknut (7). Do not fully tighten locknut.

d. Installation.

(1) Install each block (2) on mount (6) using pin (5), new lockwasher (4), and bolt (3).

(2) Lubricate centralizer (LO 5-3820-241-12).

5-10. Hose Bulkhead Replacement



a. Removal.

(1) Tag and disconnect hoses (1).

(2) Remove elbows (2) and swivels (3) from hose bulkhead (4).

(3) Remove two nuts (5), lockwashers (6), flatwashers (7), and bolts (8) securing hose bulkhead (4) to feedshell (9). Remove hose bulkhead. Discard lockwashers.

b. Installation.

(1) Install hose bulkhead (4) on feedshell (9) using two bolts (8), flatwashers (7), new lockwashers (6), and two nuts (5).

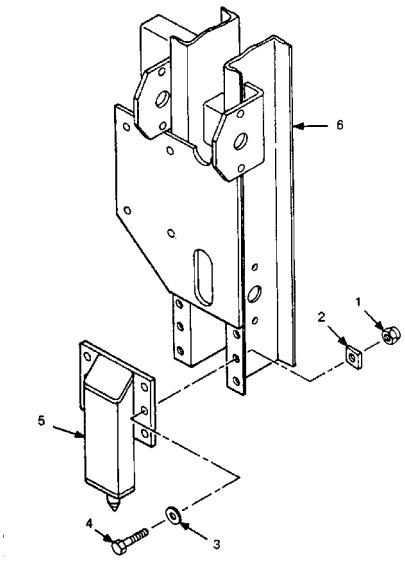
NOTE

First and third hoses have swivels and elbows. Second and fourth hoses have elbows only.

(2) Wrap male threads on swivels (3) and elbows (2) with antiseize tape. Install swivels and elbows in hose bulkhead (4).

(3) Connect hoses (1) and remove tags.

5-11. Foot Replacement



a. Removal. Remove six locknuts (1), bevel washers (2), flatwashers (3), and bolts (4) securing foot (5) to feedshell (6). Remove foot. Discard locknuts.

b. Installation. Install foot (5) on feedshell (6) using six bolts (4), flatwashers (3), bevel washers (2), and new locknuts (1).

5-12. Feedshell Slide Bars Replacement

a. Removal.

NOTE

Replace slide bars one at a time so that feedshell is never completely disconnected.

The following procedure is the same **for all four slide bars.**

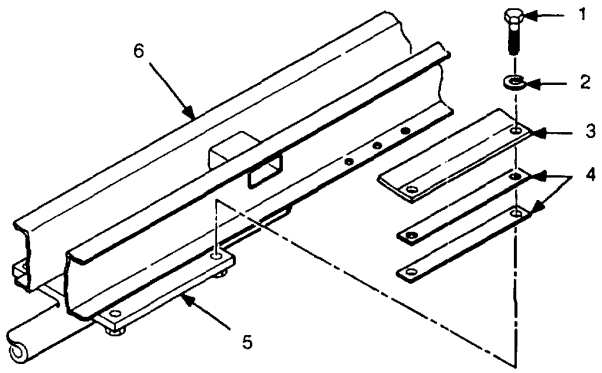
(1) Position feedshell horizontally.

(2) Remove two bolts (1) and lockwashers (2) securing slide bar (3) and two shims (4) to guide plate (5). Remove slide bar and shims. Discard lockwashers.

b. Installation.

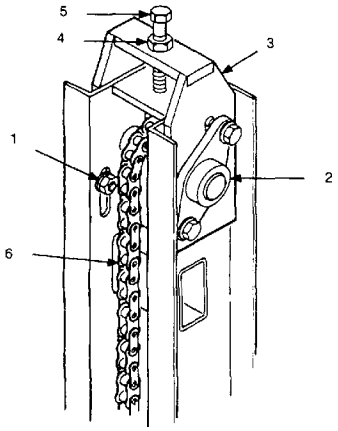
(1) Install slide bar (3) and two shims (4) on guide plate (5) using two bolts (1) and new lockwashers (2).

(2) Measure clearance between slide bar (3) and flange on feedshell (6). If clearance is greater than 1/8 in., remove thinner shim and remeasure. Adjust shims until clearance is 1/8 in. or less.



Section III. MAINTENANCE OF THE FEED AND LEVELING MECHANISM

5-13. Feed Chain Adjustment



a. Loosen four locknuts (1) securing flange bearings (2) to chain adjuster (3).

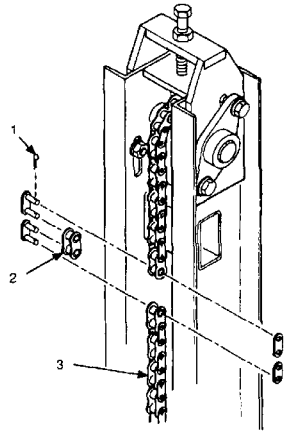
b. Loosen jam nut (4).

c. Tighten bolt (5) to tighten chain (6) or loosen bolt to loosen chain.

d. When chain (6) is properly adjusted, tighten jam nut (4) against top of chain adjuster (3).

e. Tighten four locknuts (1).

5-14. Chain Adjuster and Upper Sprocket, Shaft, and Bearings Replacement



a. Removal.

(1) Fully loosen chain (see paragraph 5-13).

(2) Remove four cotter pins (1) from one of the master links (2) on feed chain (3). Remove master link. Discard cotter pins.

(3) Remove two locknuts (4), flatwashers (5), and bolts (6) securing each bearing (7) to chain adjuster (8) and feedshell (9). Discard locknuts.

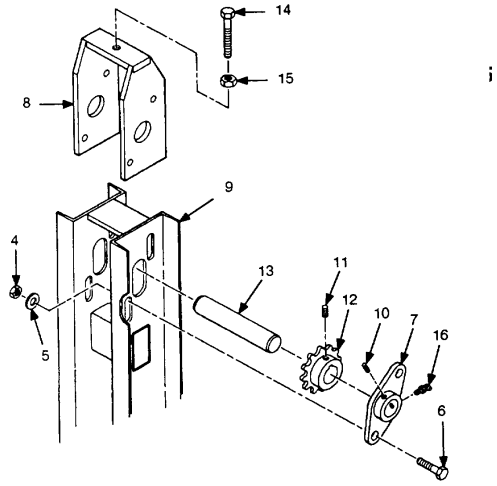
(4) Loosen two setscrews (10) in each bearing (7).

(5) Loosen setscrew (11) in sprocket (12).

(6) Drive out shaft (13) and remove sprocket (12), chain adjuster (8), and two bearings (7).

(7) Remove bolt (14) and jam nut (15) from chain adjuster (8).

(8) Remove lubrication fitting (16) from each bearing (7).



b. Installation.

(1) Install lubrication fitting (16) in each bearing (7).

(2) Screw jam nut (15) onto bolt (14) and install bolt in chain adjuster (8). Do not tighten jam nut against chain adjuster.

NOTE

Ensure that chain adjuster is installed correctly. Chain adjuster should be installed so that holes for shaft are closer to front (drifter side) of feedshell.

(3) Slide chain adjuster (8) over top of feedshell (9).

(4) Position sprocket (12) in feedshell (9) and install shaft (13) through chain adjuster (8), feedshell, and sprocket. Ensure that sprocket is centered on shaft.

(5) Tighten setscrew (11) in sprocket (12).

NOTE

Bearing on control valve side of feedshell must be installed with lubrication fitting to rear.

(6) Install bearing (7) on each end of shaft (13).

(7) Secure each bearing (7) to chain adjuster (8) and feedshell (9) using two bolts (6), flatwashers (5), and new locknuts (4). Do not fully tighten locknuts.

(8) Tighten two setscrews (10) in each bearing (7).

(9) Ensure that drive chain (3) properly engages all sprockets. Install master link (2) and secure with four new cotter pins (1).

(10) Lubricate bearings (LO 5-3820-241-12).

(11) Adjust chain (see paragraph 5-13).

5-15. Feed Chain Sprockets, Bearings, and Shafts Replacement

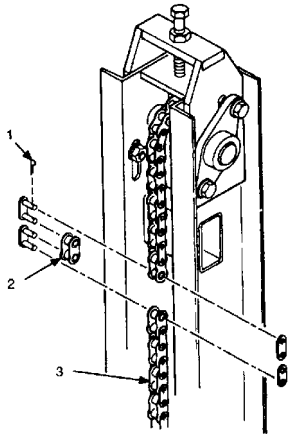
NOTE

This procedure is for the lower and middle sprockets, bearings, and shafts. If the upper sprocket, bearings, or shafts require replacement, see paragraph 5-14.

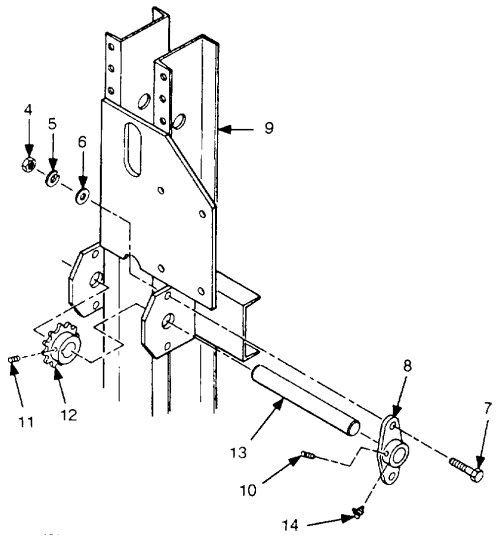
Middle sprocket is illustrated. Procedure is identical for lower sprocket.

a. Removal.

(1) Fully loosen chain (see paragraph 5-13).



(2) Remove four cotter pins (1) from one of the master links (2) on drive chain (3). Remove master link. Discard cotter pins.



(3) Remove two nuts (4), lockwashers (5). flatwashers (6) (lower sprocket only), and bolts (7) securing each bearing (8) to feedshell (9). Discard lockwashers.

(4) Loosen two setscrews (10) in each bearing (8).

(5) Loosen setscrew (11) in sprocket (12).

(6) Drive out shaft (13) and remove sprocket (12) and two bearings (8).

(7) Remove lubrication fitting (14) from each bearing (8).

b. Installation.

(1) Install lubrication fitting (14) in each bearing (8).

(2) Position sprocket (12) in feedshell (9) and install shaft (13). Ensure that sprocket is centered on shaft.

(3) Tighten setscrew (11) in sprocket (12).

(4) Install bearing (8) on each end of shaft (13).

(5) Secure each bearing (8) to feedshell (9) using two bolts (7). flatwashers (6), new lockwashers (5). and nuts (4).

(6) Tighten two setscrews (10) in each bearing (8).

(7) Ensure that drive chain (3) properly engages all sprockets. Install master link (2) and secure with four new cotter pins (1).

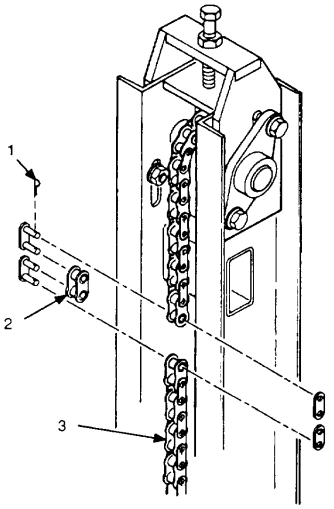
(8) Lubricate bearings (LO 5-3820-241-12).

(9) Adjust chain (see paragraph 5-13).

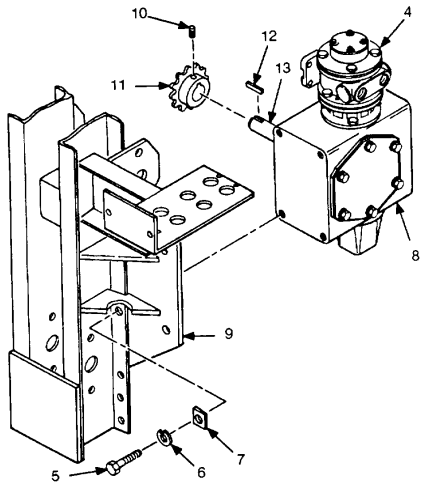
5-16. Feed Motor and Gearbox Assembly Replacement

a. Removal.

(1) Fully loosen chain (see paragraph 5-13).



(2) Remove four cotter pins (1) from one of the master links (2) on drive chain (3). Remove master link. Discard cotter pins.



(3) Remove air hoses and fittings from feed motor (4) (see paragraph 5-3).

WARNING

Feed motor and gearbox assembly is heavy.
Use an overhead hoist to remove assembly. Secure assembly to overhead hoist before removing mounting hardware. Failure to follow this warning could result in personnel injury and equipment damage.

(4) Remove four bolts(5), lockwashers (6), and two square washers (7) securing gearbox (8) to mount (9). Remove feed motor (4) and gearbox. Discard lockwashers.

(5) Loosen setscrew (10) and remove sprocket (11) and key (12) from gearbox shaft (13).

b. Installation.

(1) Install key (12) and sprocket (11) on gearbox shaft (13). Tighten setscrew (10).

NOTE

Square washers are used on Inner mounting bolts only.

(2) Install feed motor (4) and gearbox (8) on mount (9) using four bolts (5), new lockwashers (6), and two square washers (7).

(3) Ensure that sprocket (11) is aligned with other sprockets. Adjust position if necessary.

(4) Install air hoses and fittings on feed motor (4) (see paragraph 5-3).

(5) Ensure that drive chain (3) properly engages all sprockets. Install master link (2) and secure with four new cotter pins (1).

(6) Service gearbox (LO 5-3820-241-12).

(7) Adjust chain (see paragraph 5-13). Page B-1. Appendix B is superseded as follows:

APPENDIX B
MAINTENANCE ALLOCATION CHART (MAC)

Section I. INTRODUCTION

B-1. The Army Maintenance System MAC

a. This introduction (Section I) provides a general explanation of all maintenance and repair functions authorized at various maintenance levels under the standard Army Maintenance System concept.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels, which are shown on the MAC in Column (4) as:

Unit-includes two subcolumns, C (operator/crew) and O (unit) maintenance.

Direct Support-includes an F subcolumn.

General Support-includes an H subcolumn.

Depot-includes a D subcolumn.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. Maintenance Functions. Maintenance functions are limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition; e.g., to clean (includes decontaminate, when required), to preserve, to drain. to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Removal/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and assigned maintenance level is shown as the 3d position code of the SMR code.

i. Repair. The application of maintenance services including fault location/troubleshooting, removal/installation, and disassembly/assembly procedures, and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure In a part. subassembly, module (component or assembly). end item, or system.

j. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/ operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurement (e.g.. hours/miles) considered in classifying Army equipment/components.

B-3. Explanation of Columns in the MAC, Section II

a. Column I. Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies. and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance/Function. Column 3 lists the functions to be performed on the Item listed in Column 2. (For detailed explanation of these functions, see paragraph 13-2.)

d. Column 4, Maintenance Level. Column 4 specifies each level of maintenance authorized to perform each function listed in Column 3, by indicating a work time required (expressed as man-hours in whole hours or decimals) In the appropriate subcolumn. This work-time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance levels, appropriate work-time figures are shown for each level. 'The work-time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance levels are as follows:

C Operator or crew maintenance
O Organizational maintenance
F Direct support maintenance
L Specialized Repair Activity (SRA)
H General support maintenance
D Depot maintenance

e. Column 5, Tools and Test Equipment Reference Code. Column 5 specifies, by code, those common tool sets (not individual tools), common TMDE, special tools, special TMDE, and special support equipment required to perform the designated function. Codes are keyed to tools and test equipment in Section III.

f. Column 6, Remarks. When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks contained in .Section IV.

B-4. Explanation of Columns in Tool and Test Equipment Requirements, Section III

a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The National Stock Number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number, model number, or type number.

B-5. Explanation of columns in Remarks, Section IV

a. Column 1, Remarks Code. The code recorded in Column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

Section II. MAINTENANCE ALLOCATION CHART FOR RAM-MS-5/450A DR

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level UNIT C	UNIT O	DS F	GS H	DEPOT D	(5) Tools and Equipment	(6) Remarks
13	WHEELS AND TRACKS								
1302	TRACK SUPPORT	SERVICE		0.3					
	ROLLERS AND	REPLACE			3.0				
	BRACKETS	REPAIR			3.0				
1303	TRACK IDLER AND	SERVICE		0.5					
	BRACKETS	ADJUST		1.0					
		REPLACE			3.0				
		REPAIR			3.0				
1304	TRACK DRIVE	SERVICE		0.3					
	SPROCKETS	INSPECT	0.5						
		REPLACE			3.0				
1305	TRACK ASSEMBLY	INSPECT		0.5					
		ADJUST		1.0					
		REPLACE			16.0				
		REPAIR			16.0				
15	FRAME, TOWING ATTACHMENTS AND DRAWBARS								
1501	FRAME ASSEMBLY	SERVICE		0 5					
		REPLACE			24.0				
		REPAIR			10.5				
1503	PINTLES AND TOWING ATTACHMENTS								
	TOW HITCH	SERVICE		0.1					
		REPLACE		1 5					
		REPAIR		1.5					
18	BODY, CAB, HOOD AND HULL								
1808	STOWAGE BOXES	REPLACE		1.0					
		REPAIR		1.0					
22	BODY CHASSIS AND ACCESSORY ITEMS								
	DATA PLATES	REPLACE			0.5				

Section II. MAINTENANCE ALLOCATION CHART FOR RAM-MS-5/450A DR

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			UNIT		DS	GS	DEPOT		
Group Number	Component/Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
24	HYDRAULIC AND FLUID SYSTEMS								
2401	HYDRAULIC PUMP AND	SERVICE		0.3					
	PNEUMATIC DRIVE	REPLACE		3.0					
	MOTOR ASSEMBLY	REPAIR			5.0				
2403	HYDRAULIC CONTROL	REPLACE		2.0					
	VALVES	REPAIR			3.0				
2406	HYDRAULIC FILTERS,	SERVICE		0.3					
	STRAINERS, LINES AND	INSPECT		0.3					
	FITTINGS	REPLACE		0.5					
		REPAIR		1.0					
2407	HYDRAULIC CYLINDERS	REPLACE		1.0					
		REPAIR			4.0				
2408	LIQUID TANKS AND	INSPECT	0.2						
	RESERVOIRS	SERVICE	0.3						
50	PNEUMATIC EQUIPMENT								
5006	LUBRICATION SYSTEM								
	MANIFOLD	REPLACE		1.5					
	LUBRICATOR	REPAIR			1.5				
	HOSES	INSPECT	0.5						
		REPLACE		1.0					
		REPAIR		1.0					
5008	AIR INTAKES								
	VALVE, MAIN AIR INLET	REPLACE		0.5					
		REPAIR			0.5				
5015	AIR DISCHARGE SYSTEM								
	REMOTE CONTROL	INSPECT			0.5				
	MANIFOLD AND	REPLACE		1.0					
	THROTTLE VALVES	REPAIR			3.0				
	AIR LINES AND FITTINGS	INSPECT	0.3	0.5				1,2	A
		REPLACE		0.5					

Section II. MAINTENANCE ALLOCATION CHART FOR RAM-MS-5/450A DR

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			UNIT		DS	GS	DEPOT		
Group Number	Component/Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
5019	PNEUMATIC MOTOR ASSEMBLIES								
	TRACTION DRIVE	SERVICE		0.5					
	PROPELLING MOTORS	REPLACE			4.0				
		REPAIR			5.0				
	PROPELLING MOTOR	REPLACE		2.0					
	CONTROL ASSEMBLY	REPAIR			2.5				
	PNEUMATIC DRIFTER	SERVICE		0.5					
	DRILL MOTOR	INSPECT	0.3	0.5					
		REPLACE		2.5					
		REPAIR			4.5				
74	CRANES, SHOVELS AND EARTH MOVING EQUIPMENT								
7473	LIFT AND SWING MECHANISM								
	BOOM FRAME AND	SERVICE	0.5	0.3					
	DRILL GUIDE	INSPECT	0.2	0.5					
	ASSEMBLY	REPLACE			3.0				
		REPAIR		2.0	4.0				B
	DRILL MOUNTING	SERVICE		0.3					
	CENTRALIZER	INSPECT	0.2	0.2					
		REPLACE		1.0					
		REPAIR		1.0					
7476	FEED AND LEVELING MECHANISM								
	CHAIN AND GUIDE	SERVICE		0.3					
	ASSEMBLY	INSPECT	0.3						
		ADJUST		0.5					
		REPLACE			3.0				
		REPAIR			3.0				
	FEED MOTOR GEARBOX	SERVICE		0.5					
	ASSEMBLY	REPLACE		1.0					
		REPAIR			2.0				
	FEED MOTOR	INSPECT		0.5					
		REPLACE		1.0					
		REPAIR			1.0				

Section III. TOOLS AND TEST EQUIPMENT FOR RAM-MS-5/450A DR

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	O	TOOL KIT, GENERAL MECHANIC'S AUTOMOTIVE	5180-00-177-7033	SC 5180-90-CL-N26
2	O	SHOP EQUIPMENT, AUTOMOTIVE MAINTENANCE AND REPAIR, ORGANIZATIONAL MAINTENANCE, COMMON NO.2	4910-00-754-0650	SC 4910-95-CL-A72

Section IV. REMARKS FOR RAM-MS-5/450A DR

Remarks Code	Remarks
A	TOOL REQUIREMENT IS FOR RETROFIT KIT ONLY
B	FOR REPAIR, REFER TO TM 9-237

Page B-3. Appendix C is added after Appendix B:

APPENDIX C
COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

Section I. INTRODUCTION

C-1. Scope

This appendix lists components of the end item and basic issue items for the rock drill to help you inventory the items for safe and efficient operation of the equipment.

C-2. General

The Components of End Item and Basic Issue Items (BII) Lists are divided into the following sections:

a. Section II, Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. There items arc part of the rock drill, but they are to be removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to help you find and identify the items.

b. Section III, Basic Issue Items. These essential items are required to place the rock drill in operation, operate It, and to do emergency repairs. Although shipped separately packaged, BII must be with the rock drill during operation and when it is transferred between property accounts. Listing these items is your authority to request/requisition them for replacement based on authorization of the end item by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

C-3. Explanation of Columns.

a. Column (1), Illus Number, gives you the number of the item illustrated.

b. Column (2), National Stock Number, identifies the stock number of the item to be used for requisitioning purposes.

c. Column (3), Description and Usable On Code, identifies the Federal item name (in all capital letters)followed by a minimum description when needed. The last line below the description is the CA(GEC (commercial and Government entity code) (in parentheses) and the part number.

d. Column (4), U/I (unit of issue), indicates how the item is issued for the National Stock Number shown in Column (2).

e. Column (5), Qty Rqd, indicates the quantity required.

Section II. COMPONENTS OF END ITEM

Not applicable.

Section III. BASIC ISSUE ITEMS

(1) Illus Number	(2) National Stock Number	(3) Description CAGEC and Part Number	Usable On Code	(4) U/I	(5) Qty rqr
1	3820-00-118-1273	SHANK, ROD, ROCK DRILL (81349) MIL-D-22233		ea	10

Appendix D is added as follows:

APPENDIX D
EXPENDABLE AND DURABLE ITEMS LIST

Section I. INTRODUCTION

D-1. Scope

This appendix lists expendable and durable items that you will need to operate and maintain the rock drill. This listing Is for information only and is not authority to requisition the listed items. These Items are authorized to you by C-TA 50-790, Expendable/Durable Items (except medical, class V, repair parts, and heraldic items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

D-2. Explanation of Columns

a. Column 1, Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the item (e.g., "Use cleaning compound, item 5, Appendix D".)

b. Column 2, Level. This column identifies the lowest level of maintenance that requires the item.

c. Column 3, National Stock Number. This is the national stock number assigned to the item which you can use to requisition it.

d. Column 4, Item Name, Description, Commercial and Government Entity Code (CA GEC). and Part Number. This provides the other information you need to identify the item.

e. Column 5, Unit of Measure. This codes shows the physical measure or count of an item, such as gallon, dozen. gross, etc.

SECTION II. EXPENDABLE AND DURABLE ITEMS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION CAGE, Part Number	(5) U/M
1	O	9150-01-035-5391	Lubricating oil, gear (81349) MIL-L-2105	cn
2	O	9150-00-754-2595	Grease, molybdenum disulfide (54527) AEROSHELLL17	cn
3	O	9150-00-186-6668	Lubricating oil, engine (81349) MIL-L-2104	cn
4	O	8030-00-889-3535	Tape, antiseize, 1/2 in. width, 260-in. roll (81349) MIL-T-27730	in

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

PATRICIA P. HICKERSON
Colonel, United States Army
The Adjutant General

Distribution:

WARNING

Operation of this equipment presents a noise hazard to personnel in the area. The noise level exceeds the allowable limits for unprotected personnel. Wear ear muffs or ear plugs which were fitted by a trained professional. Failure to do so could cause serious injury to hearing.

WARNING

Should a break occur in the feed chain, the drill engine will slide down the feed and strike the centralizer, which could cause serious injury to operator. While operating the drill controls, the operator must always stand in a position away from the drill.

WARNING

The spring return mechanism on the tram controls must operate freely at all times. Frequent and proper lubrication and cleaning of these components is an absolute necessity to insure that they will always return the valves to a completely off position. Malfunctioning spring return mechanism can cause unexpected tram activity resulting in death or serious injury.

WARNING

Always make sure that the safety wire line is secured to the main air supply line before turning on the air supply. Death or serious injury could result if the hose should come loose.

WARNING

Under normal operation, the line oiler system is pressurized to 90 p.s.i. Do not open filler cap until all air pressure has been completely eliminated from the air system. The cap could blow off under pressure and cause serious injury to personnel.

WARNING

Dry cleaning solvent, P-D-680, used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. The flash point of solvent is 100°F. (38°C) to 138°F (59°C

TECHNICAL MANUAL
No. 5-3820-241-12

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *19 July 1974*

OPERATOR AND ORGANIZATIONAL MAINTENANCE MANUAL

DRILL, PNEUMATIC, DRIFTER: SELF PROPELLED
JOY MODEL RAM-MS-5/450A-DR
FSN 3820-445-3766

***This manual supersedes TM 5-3820-241-12, 29 September 1971 including all changes**

LIST OF ILLUSTRATIONS

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope
This manual contains instructions for use by operator and organizational maintenance personnel to whom the pneumatic rock drill is issued. It provides information on the operation and organizational maintenance of the equipment. Also included are descriptions of main units and their functions in relation to other components.

1-2. Maintenance Forms and Records
Maintenance forms and records that you are required to use are explained in TM 38-750 (The Army Maintenance Management System).

1-3. Reporting of Errors
You can improve this manual by calling attention to errors and by recommending improvements, using DA Form 2028 (Recommended Changes to Publications) or by a letter and mailing directly to Commander, U.S. Army Troop Support Command, ATTN: AMSTS-MPP, 4300 Goodfellow Blvd., St. Louis, Missouri 63120. A reply will be furnished directly to you.

1-4. Equipment Serviceability Criteria
This equipment is not covered by an equipment serviceability criteria.

1-5. Destruction of Army Material to Prevent Enemy Use
Refer to TM 750-244-3 (Procedures for Destruction of Equipment to Prevent Enemy Use) for information and instructions on destruction of equipment to prevent enemy use.

1-6. Administrative Storage
Refer to TM 740-90-1 (Administrative Storage of Equipment) for information and instructions pertaining to organizational maintenance administrative storage.

Section II. DESCRIPTION AND DATA

1-7. Description
a. General. The pneumatic drifter drill (figs. 1-1 and 1-2) is a heavy duty, self-propelled crawler drill. The ram mounts a hydraulically operated swing boom jib that permits positioning of the feed and drill. The hydraulically operated boom also permits power positioning of the feed for vertical and horizontal drilling. The drill also can be positioned over the side of the crawler track for drilling in confined areas.

b. The pneumatic rock drill assembly is equipped with the following major components:

(1) A heavy duty precision type drill engine (fig. 1-1), designed for deep hole drilling in hard rock.

(2) A drill feed and control valve (fig. 1-1) to control the drill, blow, feed, and rotation functions.

(3) A feed assembly (fig. 1-1) used as a track for the drill engine to slide back and forth during the drilling operation.

(4) A hydraulic feed extension cylinder (fig. 1-2) to provide a four foot extension for the feed mechanism and to maintain pressure on the stinger.

(5) A stinger (fig. 1-1) mounted on the front end of feed to provide a pressure point for drilling.

(6) A centralizer (fig.1-1) used to maintain drilling alignment.

(7) A feed motor and transmission (fig. 1-1), used to pull the drill slab back, forward or backward along the feed.

(8) A boom (fig. 1-1), which is a connecting assembly between the feed mechanism and the tractor.

(9) A boom lift cylinder (fig.1-2) used to raise and lower the boom assembly.

(10) A boom swing cylinder (fig.1-2) used to move the boom assembly from left to right.

(11) A feed tilt cylinder (fig. 1-2) to control the horizontal and vertical position of the feed.

(12) A feed swing cylinder (fig.1-2) used to move the forward end of the feed from left to right.

(13) An upper main frame assembly or pedestal (fig. 1-1) is a steel weldment which mounts the boom controls, tramming controls, pump motor shut-off and lubricator.

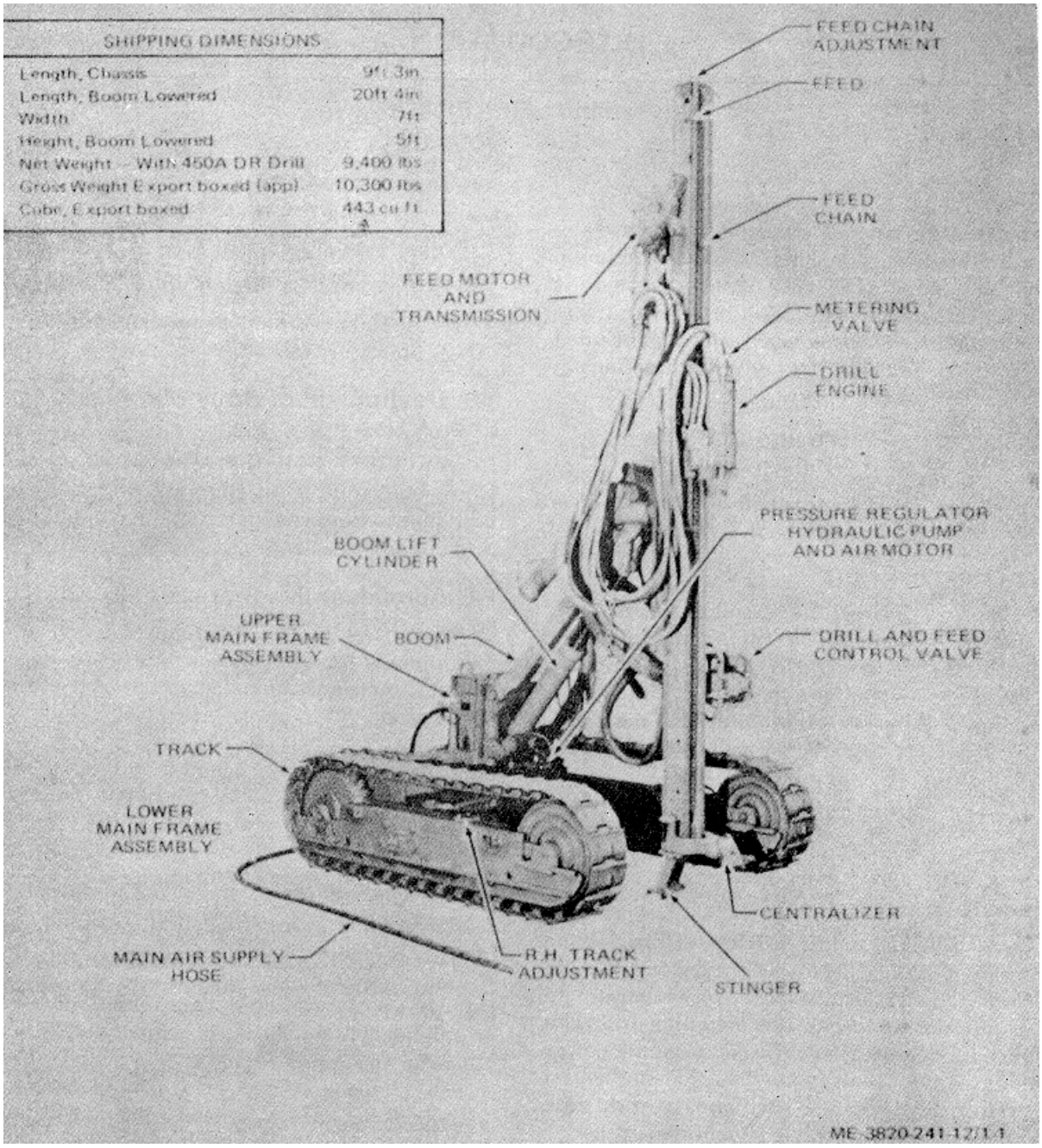


Figure 1-1. Rock drill assembly, right front, 3/4 view with shipping dimensions.

(14) A hydraulic boom control valve (fig. 1-2) which controls the feed tilt, boom lift, feed swing and feed extension, and boom swing functions.

(15) Two air operated tram control valves (fig. 1-2) to operate the left and right hand tram motors.

(16) A pump motor shut-off valve (fig. 1-2) to maintain hydraulic pressure for the hydraulic functions.

(17) A lubricator fitting (fig.1-2) which is used to 1-2 introduce oil into the air stream.

(18) A lower main frame assembly (fig.1-1) which is the tractor section of the drill carrier.

(19) A track oscillating system which permits each track to move separately to conform with terrain.

(20) Two tramming motors and transmissions to power the drill carrier.

(21) A hydraulic pump and air motor pressure

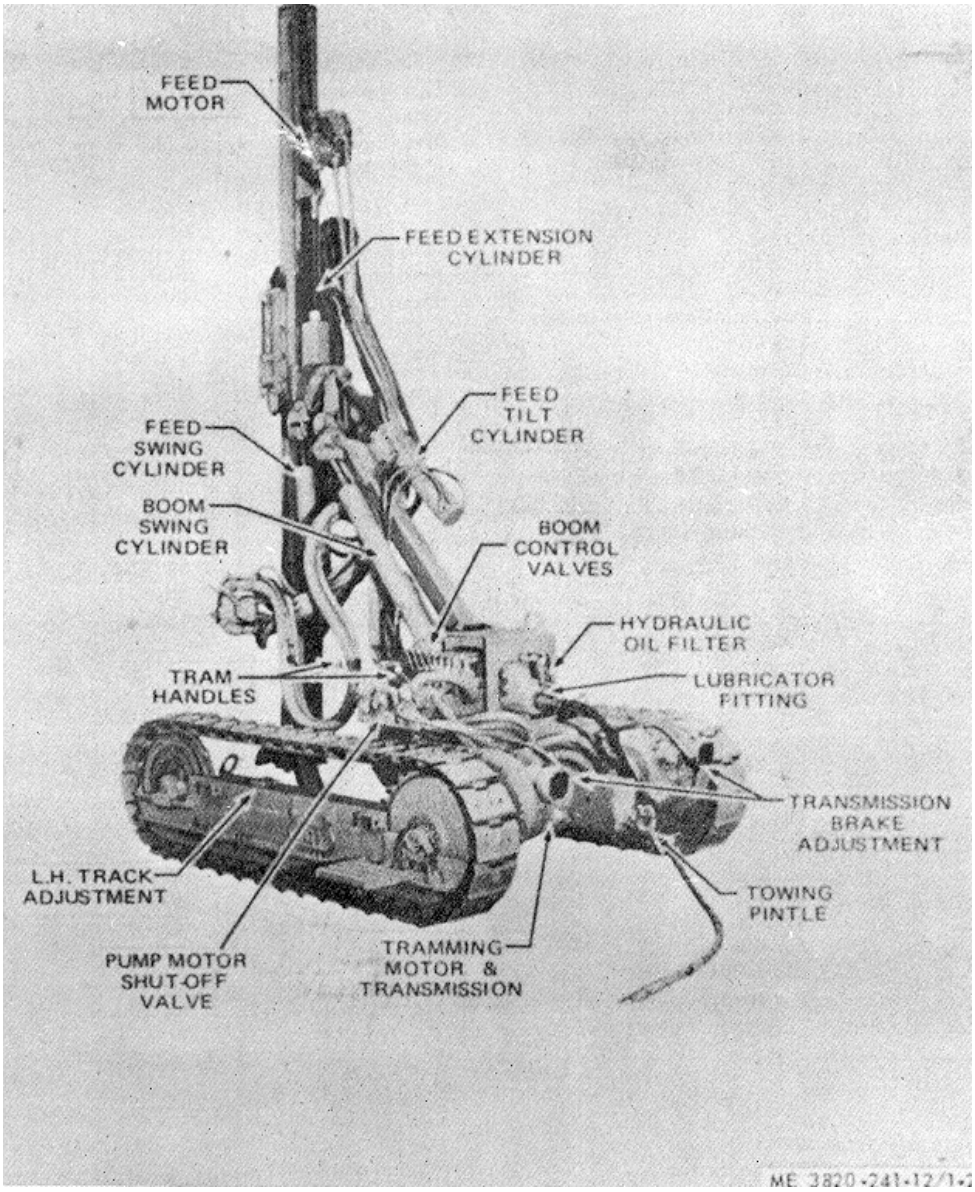


Figure 1-2. Rock drill assembly, left rear, 34 view.

regulator to regulate the air and hydraulic pressure.

(22) Two tracks (fig.1-1) used as the drill carrier.

1-8. Differences Between Models

This manual covers only the Joy Model RAM-MS-5/450A-DR crawler mounted rock drill. No known unit differences exist for models covered in this manual.

1-9. Data Plates

a. Identification Plates. The pneumatic rock drill has two major identification plates.

(1) Army data plate located on the rear section of the pedestal. It lists the equipment manufacturer, model number, serial number, Federal Stock Number and contract number.

(2) Lifting data plate located on the top section of the pedestal. It illustrates proper lifting instructions.

b. Tabulated Data.

(1) *End Item.*

Manufacturer ..... Joy Mfg. Co.
Model RAM-MS-5/450A-DR
Type ..... Track mounted, percussion drill
Serial Numbers.....
Total Horsepower ..... 23 HP (horsepower)

(2) *Percussion Drill Engine.*

Manufacturer ..... Joy Mfg. Co.
Model 450 ..... 450A-DR
Type ..... Dual rotation, percussion type
Bore ..... 4 1/2in. (inch)
Stroke ..... 3 3/8 in.
Striking Bar ..... Two lug
Drill Steel Size ..... 1 1/2 in.
Hole Size Range..... 2 1/2 to 3 1/2 in.
Air Pressure Used ..... 90 P.s.i. (pounds per square inch)
Air Drill only (Capacity) ..... 320 c.f.m. (cubic feet per minute)
Air Drill and Blow (Capacity) 580 c.f.m.
Rifle Bar Rotation ..... 40, upstroke
Hose Sizes:
Drill ..... 1 1/2 in.
Blow 1 in.
Rev. Rotation..... 3/4 in.

(3) Transmission.

Manufacturer ..... Joy Mfg. Co.
Part No. 700310-1116
Type ..... Planetary Gear
Gear Reduction 35:1

(4) *Tramming Motors.*

Manufacturer ..... Joy Mfg. Co.
Part Number 502020-60
Type ..... Piston air, 5 cylinder
Horsepower ..... 11 HP (horsepower)
Speed ..... 150 f.p.m. (feet per minute)

(5) *Hydraulic Cylinders.*

(a) Boom Lift Cylinder.

Manufacturer ..... Benton Harbor
Part Number 501002-329

(b) Boom Swing Cylinder.

Manufacturer ..... Benton Harbor
Part Number 501002-340

(c) Feed Tilt Cylinder.

Manufacturer ..... Benton Harbor
Part Number 501002-316

(d) Feed Swing Cylinder.

Manufacturer ..... Benton Harbor
Part Number 501002-312

(e) Feed Extension

Manufacturer ..... Benton Harbor
Part Number 501002-257

(6) *Hydraulic Valve.*

Manufacturer ..... Vickers, Inc.
Part Number 501029-77
Type ..... Closed Center, 5 spool
Main Relief Valve Setting .2,700 p.s.i.

(7) *Hydraulic Pump.*

Manufacturer ..... Vickers, Inc.
Part Number 501083-29
Type ..... Vane

(8) *Hydraulic Oil Filter.*

Manufacturer ..... Vickers, Inc.
Part Number 501072-20
Type ..... Spin on (10 micron)

(9) *Air Motor (Pump Drive).*

Manufacturer ..... Joy Mfg. Co.
Part Number 501023-12
Type ..... Vane

(10) *Air Motor (Feed Drive).*

Manufacturer ..... Joy Mfg. Co.
Part Number 501015
Type ..... Piston air.

(11) *Pressure Regulator.*

Manufacturer ..... Norgens, Inc.
Part Number 501046-5
Type ..... Relieving

(12) *Feed Transmission.*

Manufacturer ..... Joy Mfg. Co.
Part Number 501005-50
Type ..... Spur Gear

(13) *Air Control Valve.*

Manufacturer ..... Joy Mfg. Co.
Part Number 501052-42
Type ..... Plug

(14) *Injection Oiler.*

Manufacturer ..... Joy Mfg. Co.
Part Number 501003-26
Type ..... Venturi

(15) *Capacities.*

Rock Drill Oil ..... 5 gal. (gallons)
Hydraulic Oil ..... 13 gal.
Tram Transmissions (2)..... 1 qt.(quart) each section, each transmission
Tram Motors (2) ..... 2 qt. Each motor

(16) *Adjustment Data.*

Feed Chain ..... Slight sag in chain at all times
Crawler Tracks ..... 1 in. Depression at midpoint
Injector Oiler ..... Light film of oil striking bar shank
Pressure Regulator ..... 65 p.s.i.

(17) *Dimensions and Weights*

	English	*Metric*
Net weight with 450-DR drill	9,400 lb. (pound)	4267.6kg (kilogram)
Gross weight, export boxed	10,300 lb.	4676.2 kg
Cube, export boxed	443 cu. ft. (cubic feet)	12.537 cu m (cubic meters)
Width	ft. (feet)	2.134 m (meters)
Chassis length	9 ft., 3 in.	2.819 m
Length, boom lowered	20 ft., 4 in.	6.198 m
Height, boom lowered	ft., 0 in.	1.524 m
Height, max horizontal hole	10 ft., 10 in.	3.255 m
Ground clearance	1 in.	279 mm (millimeters)
Height to pintle hook	5 in.	381 mm
Width, track tread	1 in.	279 mm
Ground contact length	4 In.	1.880 mm
Track, center to center	72 in.	1.829 mm

(18) *Torque Data.* Table 1-1 lists the specific nut and bolt torque data.

Table 1-1. SPECIFIC TORQUE DATA

	Size	Torque, ft-lb
Rotary valve to motor	3/8-16	18-21
Centralizer arm	1-8	140-150
Centralizer bushings	5/8-11	75-85
Chain take up	1-8	140-150
Lube fitting to frame	1/2-13	45-50
Control bracket to frame	5/8-11	75-85
Air motor mounting	3/8-16	18-21
Cradle to feed	7/8-14	105-115

(19) Air System Schematic Diagram.

(a) Refer to figure 1-3 for the rock drill feed ram air system schematic diagram.

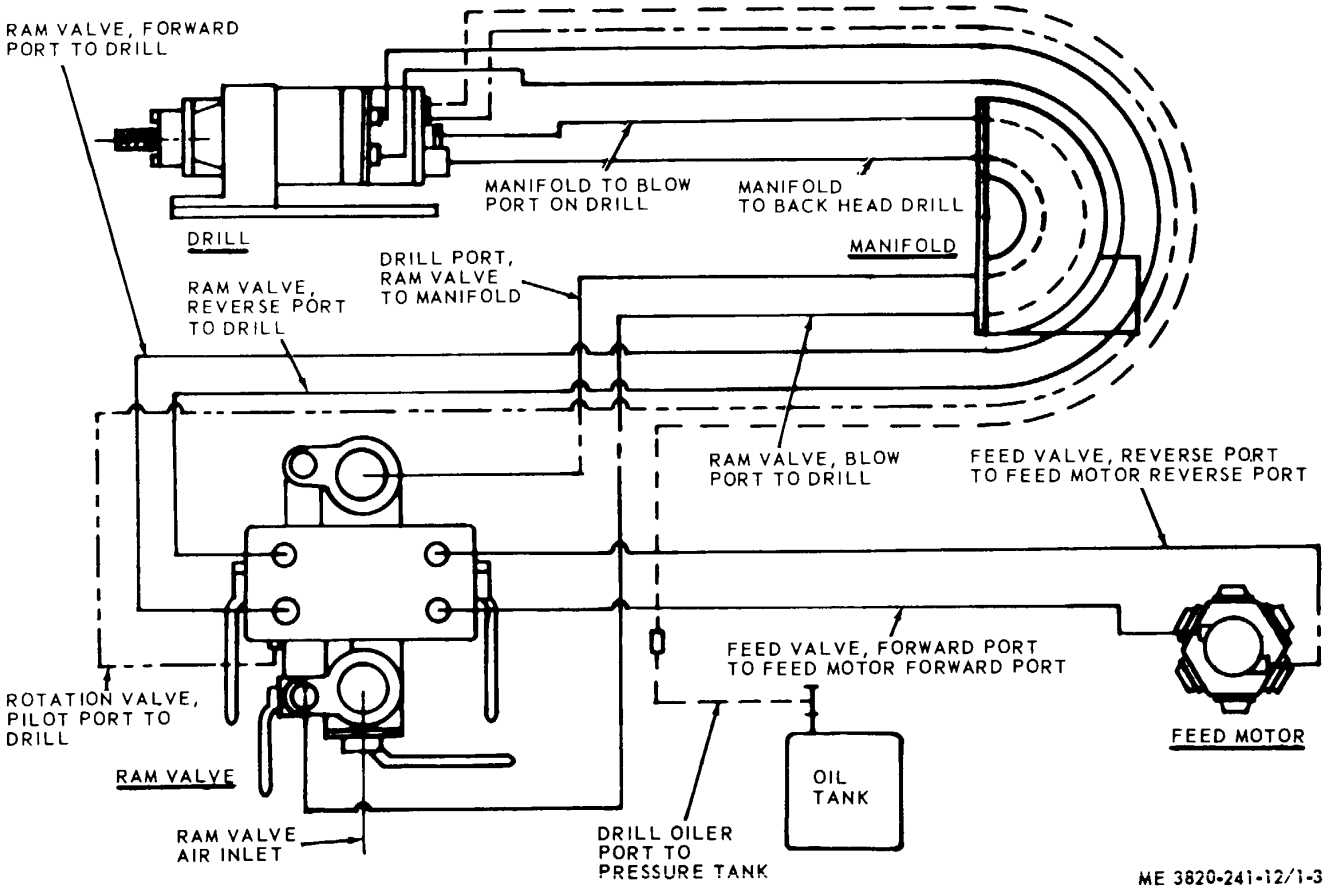


Figure 1-3. Rock drill feed, ram, air system schematic diagram.

(b) Refer to figure 1-4 for the rock drill, ram and side tram, air system schematic diagram.

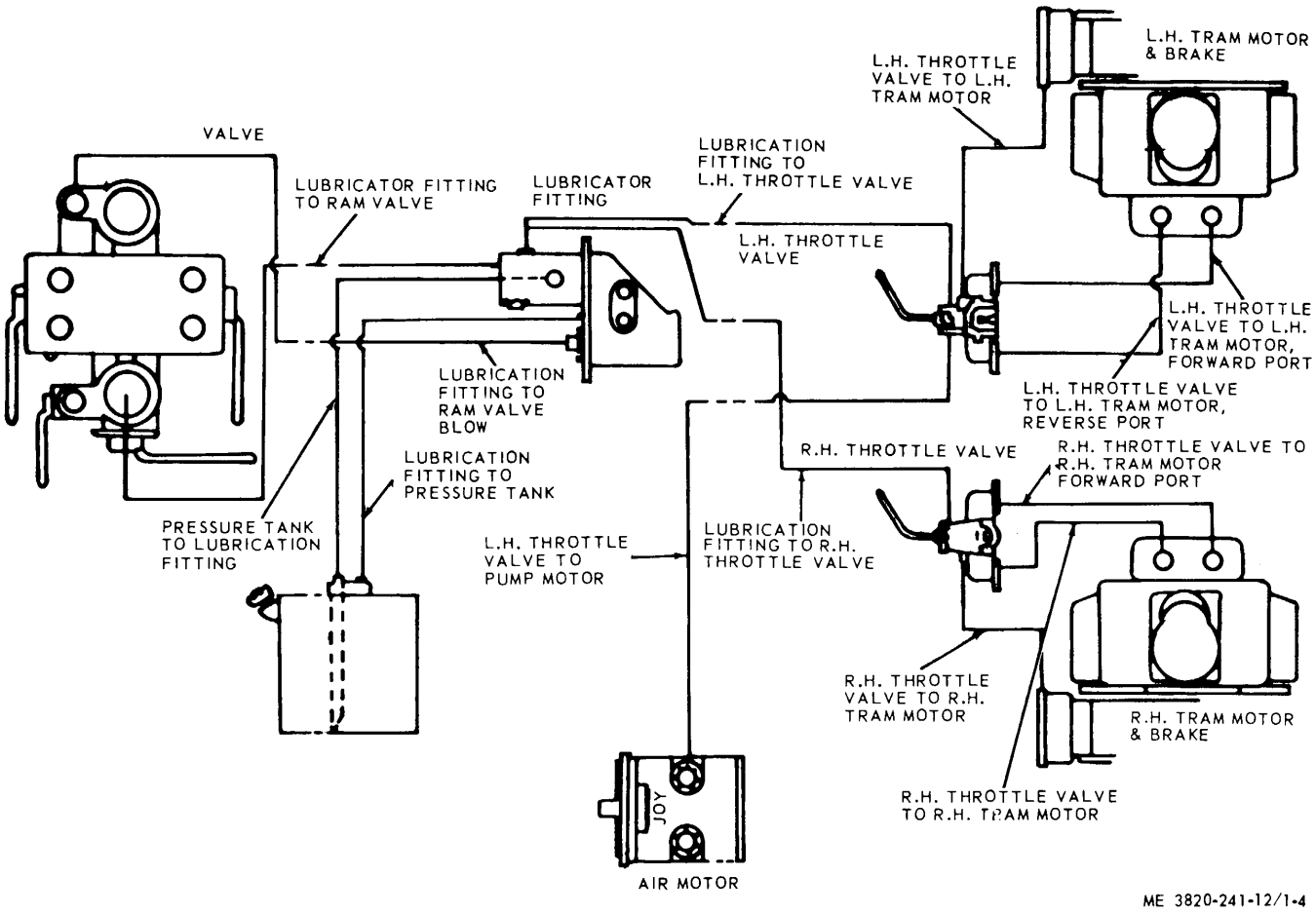


Figure 1-4. Rock drill, ram and side tram, air system schematic diagram.

(c) Refer to figure 1-5 for the rock drill, ram system, hydraulic schematic diagram.

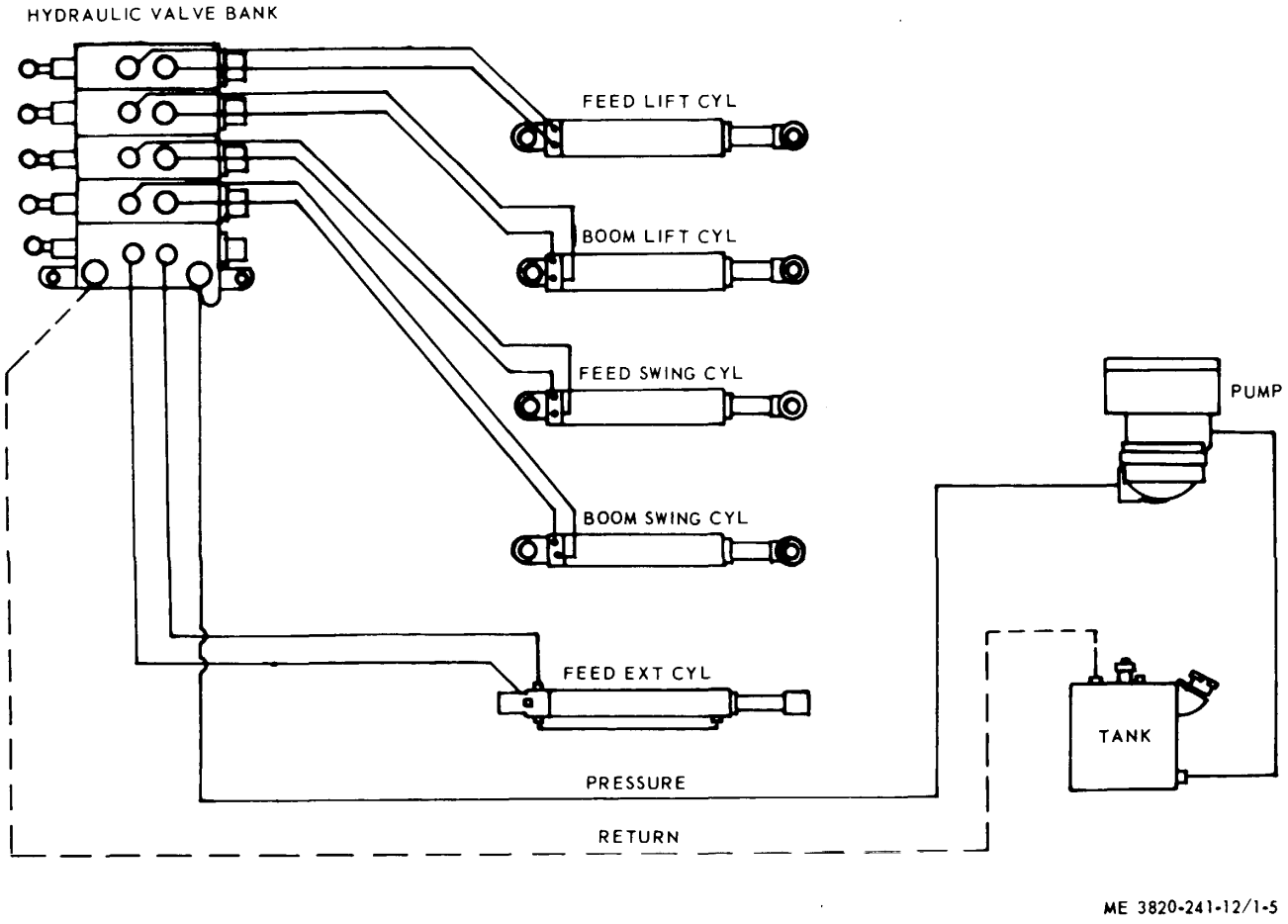


Figure 1-5. Rock, drill, ram system, hydraulic schematic diagram.

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. OPERATING PROCEDURES

WARNING

If equipment fails to operate, refer to the troubleshooting procedures in Chapter 3.

2-1. Controls and Instruments

a. This paragraph describes, illustrates, locates and furnishes the operator/crew sufficient information to insure proper operation of the pneumatic drifter drill.

b. The purpose of the controls and instruments and their normal maximum reading or position is illustrated in figure 2-1.

2-2. Operation Under Usual Conditions

a. The instructions in paragraph 2-2 through paragraph 2-5 are for the information and guidance of personnel responsible for the operation of the pneumatic rock drill.

b. The operator must know how to perform every operation of which the pneumatic rock drill is capable. Paragraphs 2-3 through 2-5 contain instructions on starting, stopping, and operation of the rock drill and coordinating the basic motions to perform the specific tasks for which the equipment is designed. Since nearly every job presents a different problem, the operator may have to vary given procedures to fit the individual job.

c. Refer to paragraphs 4-1 and 4-2 for installation and setting up instructions for the rock drill.

2-3. Starting

a. Preparation for Starting.

(1) Perform the before operation preventive maintenance services (para 3-4).

(2) Connect the main air supply hose and attach the safety wire as illustrated in figure 2-2.

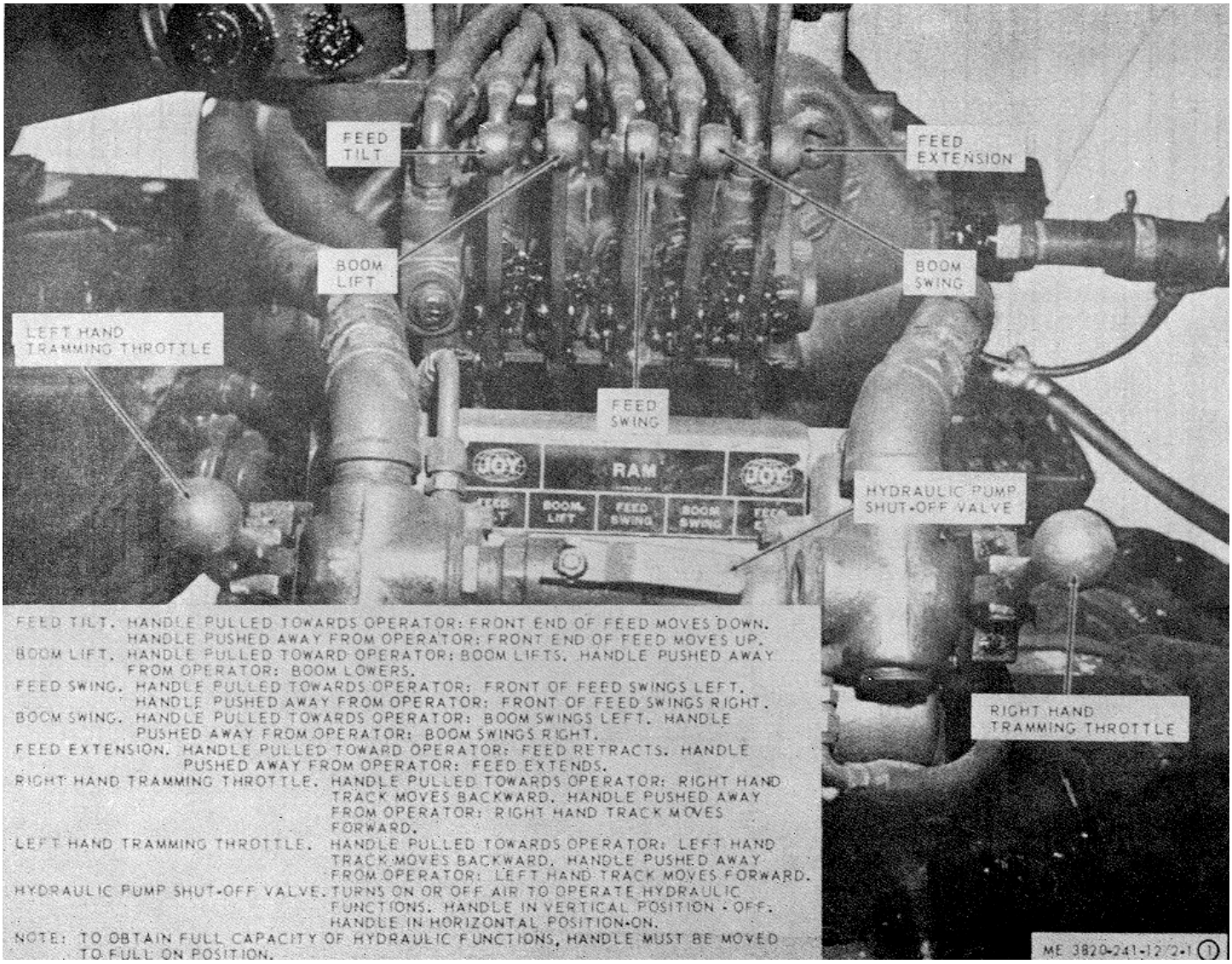


Figure 2-1. Controls and instruments (sheet 1 of 3).

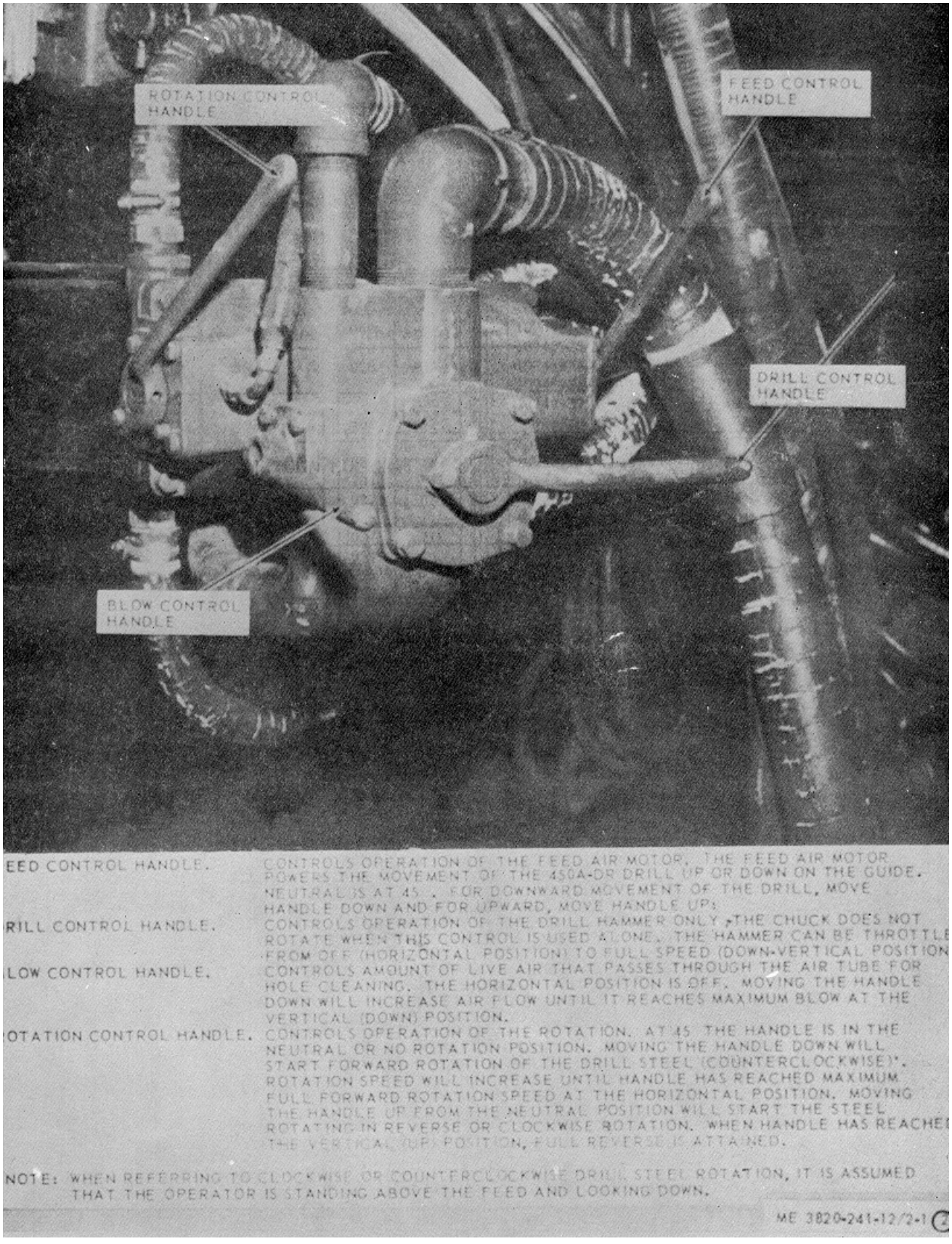


Figure 2-1. Controls and instruments (sheet 2 of 3).

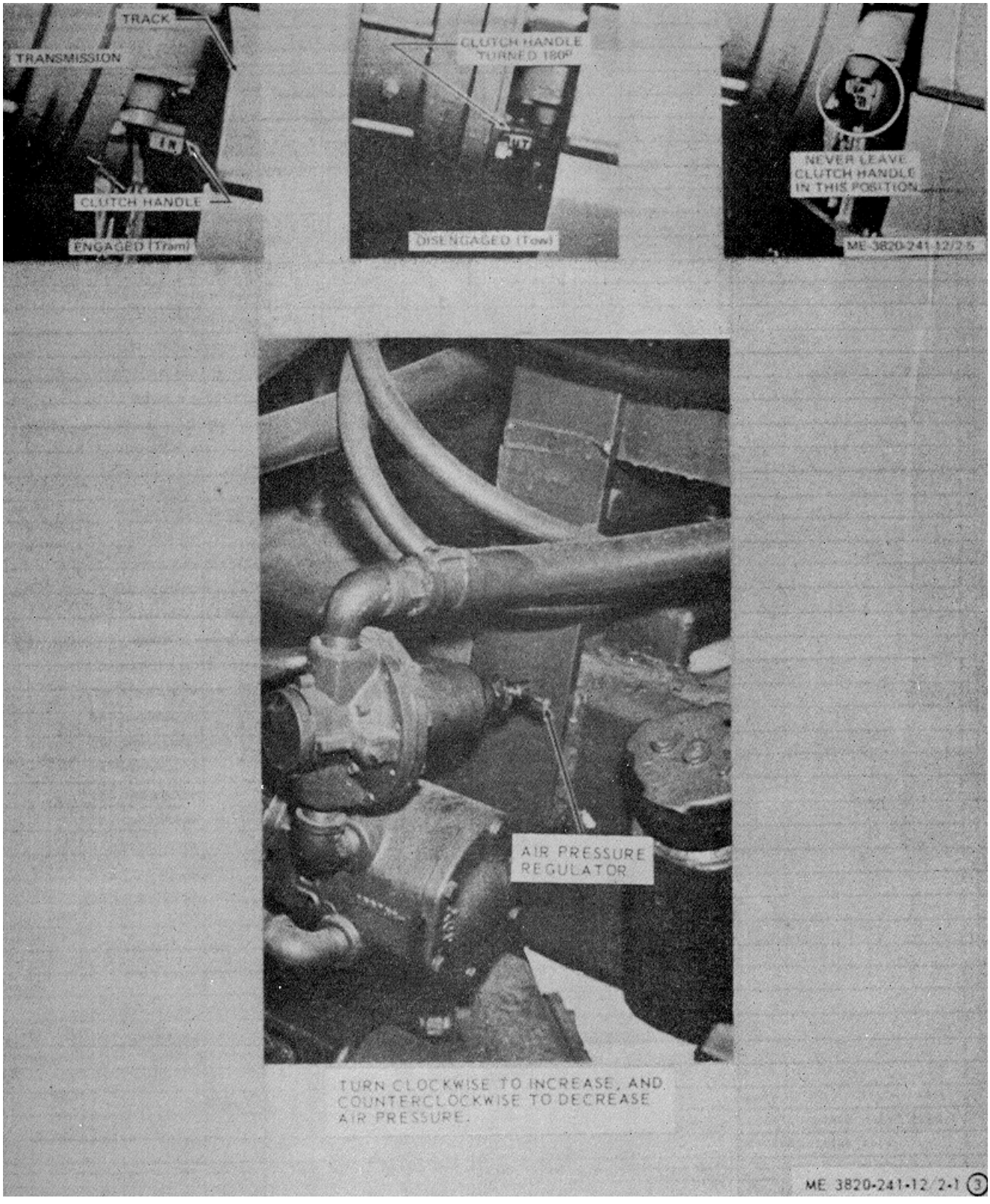


Figure 2-1. Controls and instruments (sheet 3 of 3).

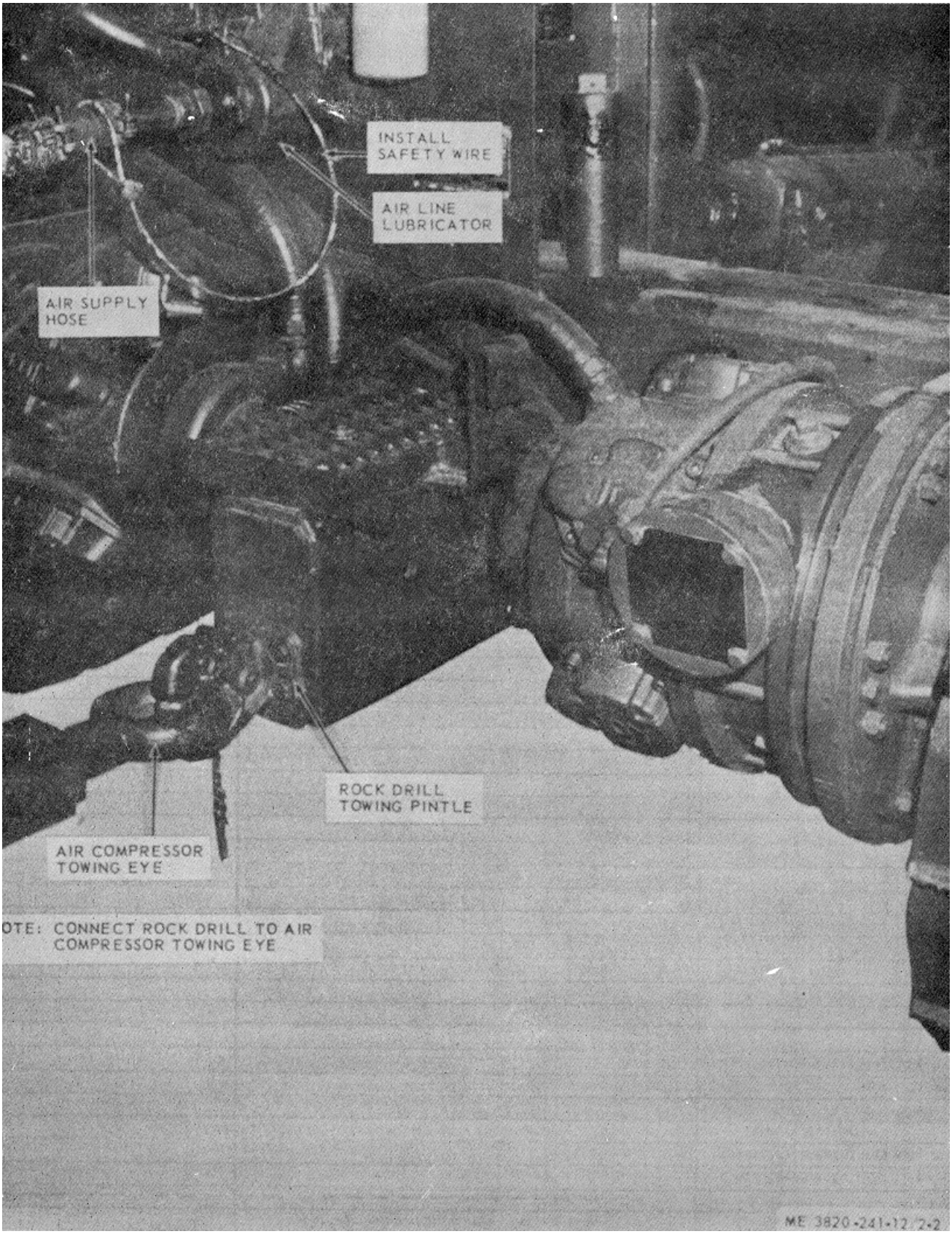


Figure 2-2. Main air supply hose, removal and installation.

b. Starting.

(1) Refer to the applicable technical manual, and start the air compressor. Open the main air supply valve at the compressor to supply air pressure to the rock drill. All air-only functions, tramming, drill hammer, drill rotation, drill feed and blow can now be operated.

(2) To operate the hydraulic functions, feed tilt, boom lift, feed swing, boom swing, and feed extension, move the hydraulic pump shut-off valve (fig. 2-1) to the (on) horizontal position.

2-4. Stopping

a. Stop the rock drill as illustrated in figure 2-3.

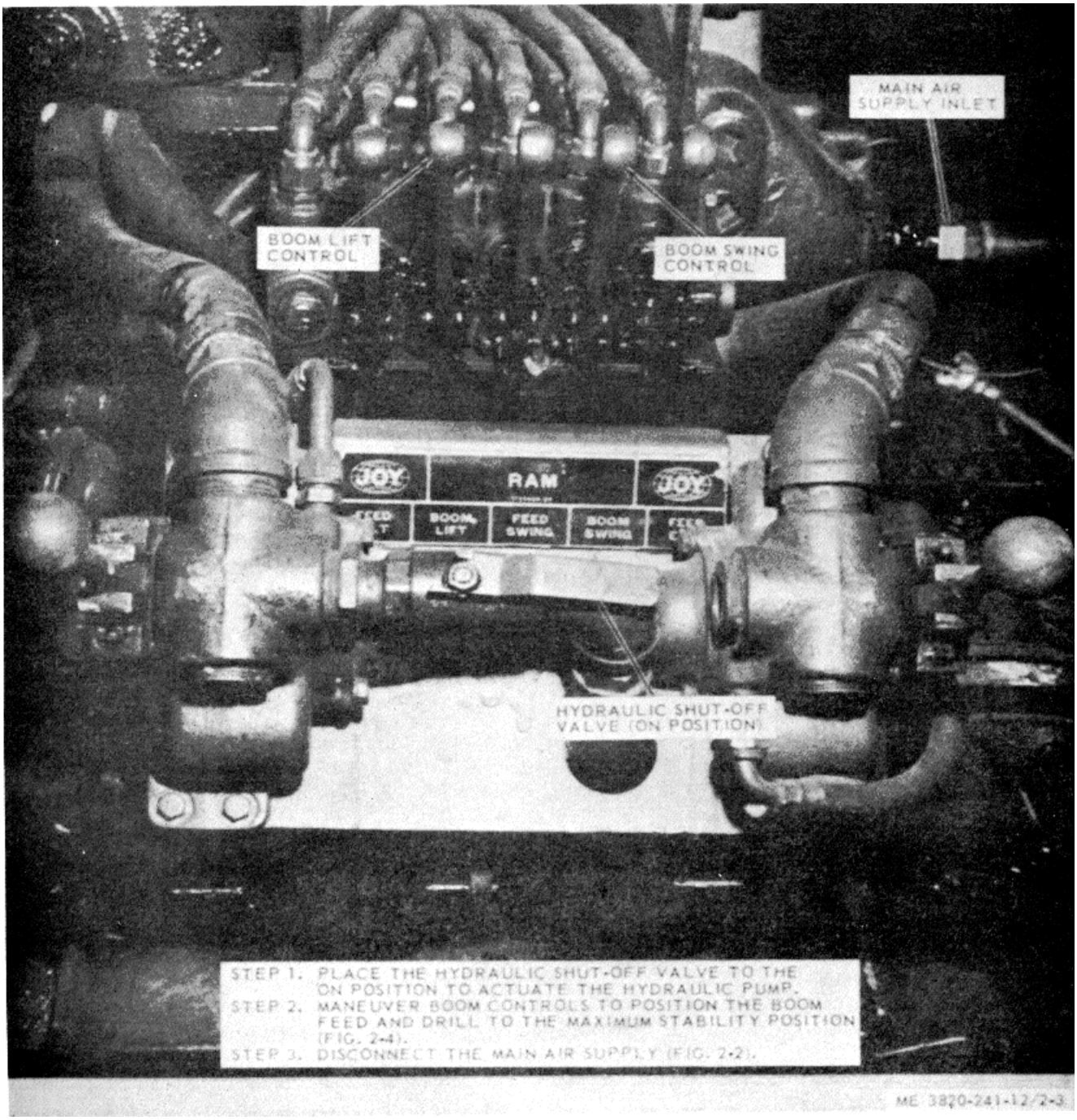


Figure 2-3. Stopping the rock drill.

b. Store the pneumatic rock drill in the maximum stability position as shown in figure 24, when not in operation.

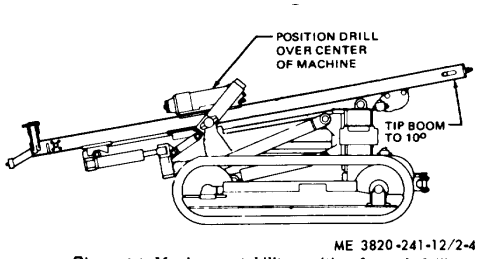


Figure 2-4. Maximum stability position for rock drill tramming and storage.

2-5. Operation of Equipment

a. Tramming the Rock Drill.

(1) *Operation of Tram Clutch*. The internal clutch mechanism for each tram motor operates by a sliding, splined coupling that couples two splined shafts. When the coupling is all on one shaft, the tram motor is disengaged from the drive sprocket (towing position). When the coupling is half over each of the male splines, the gear train is in tramming position. There are no intermediate positions that are satisfactory. Figure 2-5 shows the proper engaged position, disengaged position, and the wrong position of the clutch handles.

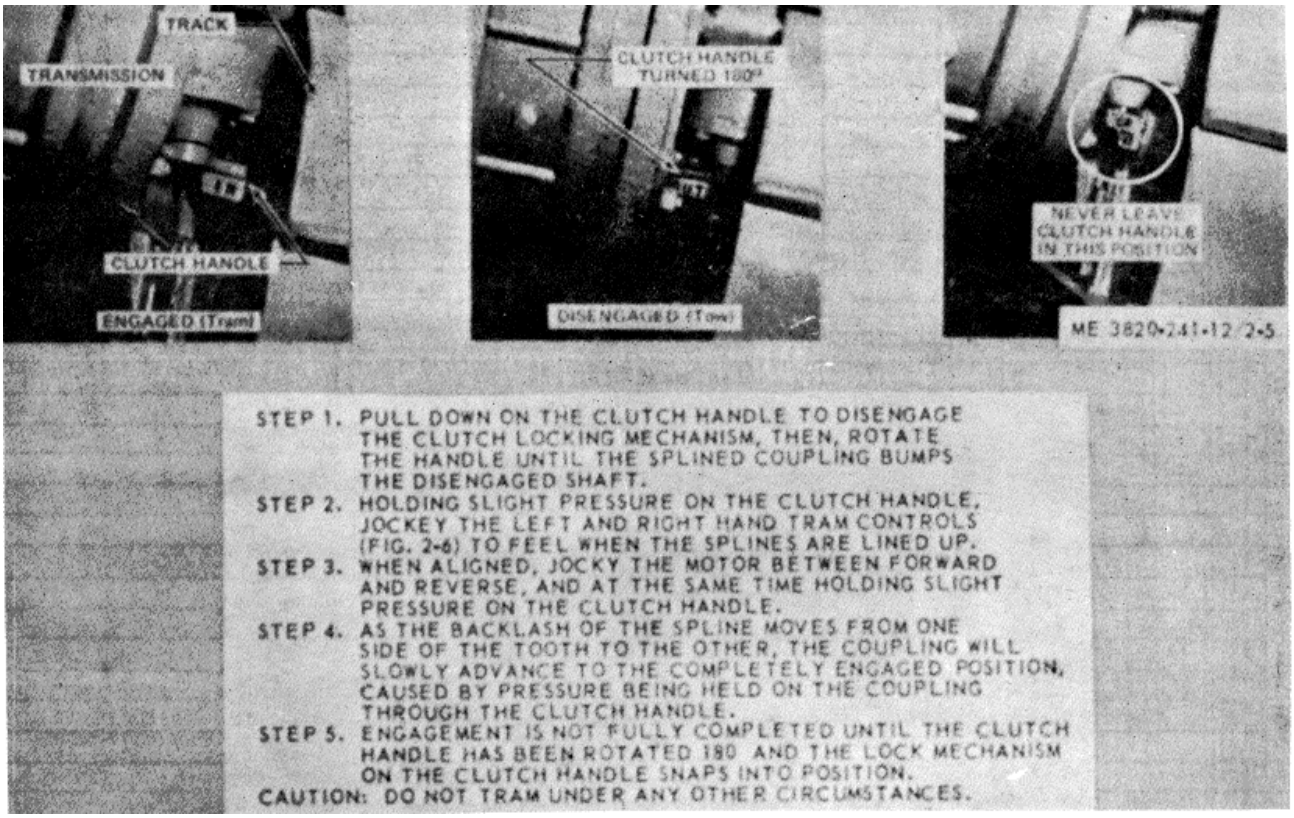


Figure 2-5. Engaging the rock drill for tramming.

(2) *Connecting Air Supply*. Secure the air compressor to the rock drill and connect the main air supply hose as illustrated in figure 2-2.

(3) *Engaging for Tramming.*

(a) Start the air compressor (para 2-3) and operate the tram motors to make sure they rotate freely.

(b) Engage the rock drill for tramming as illustrated in figure 2-5.

(4) *Disengaging for Towing.*

CAUTION

Disengage the clutch only when rock drill is parked on terrain that will not allow the rock drill to run free. When disengaging, it may be necessary to jog the tram motor back and forth so the backlash will relieve any external pressure that may be opposing engagement.

WARNING

It is possible to tram the rock drill with the clutch partially disengaged as shown in circled view of figure 2-5. In this position, it is also possible for the clutch mechanism to slip out of engagement, allowing the drill to run away.

(a) To tow the rock drill, the internal clutch on each transmission must be released.

(b) Pull down the clutch "T" handle to clear the lock mechanism, then turn the handle 180° as shown in figure 2-5.

(c) When the disengaged position has been reached, the spring loaded lock mechanism will snap the clutch handle into place and disengage for towing.

(5) *Tramming the Rock Drill.*

CAUTION

When tramming, always position the main supply hose properly, to make sure the rock drill does not run over the hose.

(1) Refer to figure 2-6 for tramming the rock drill

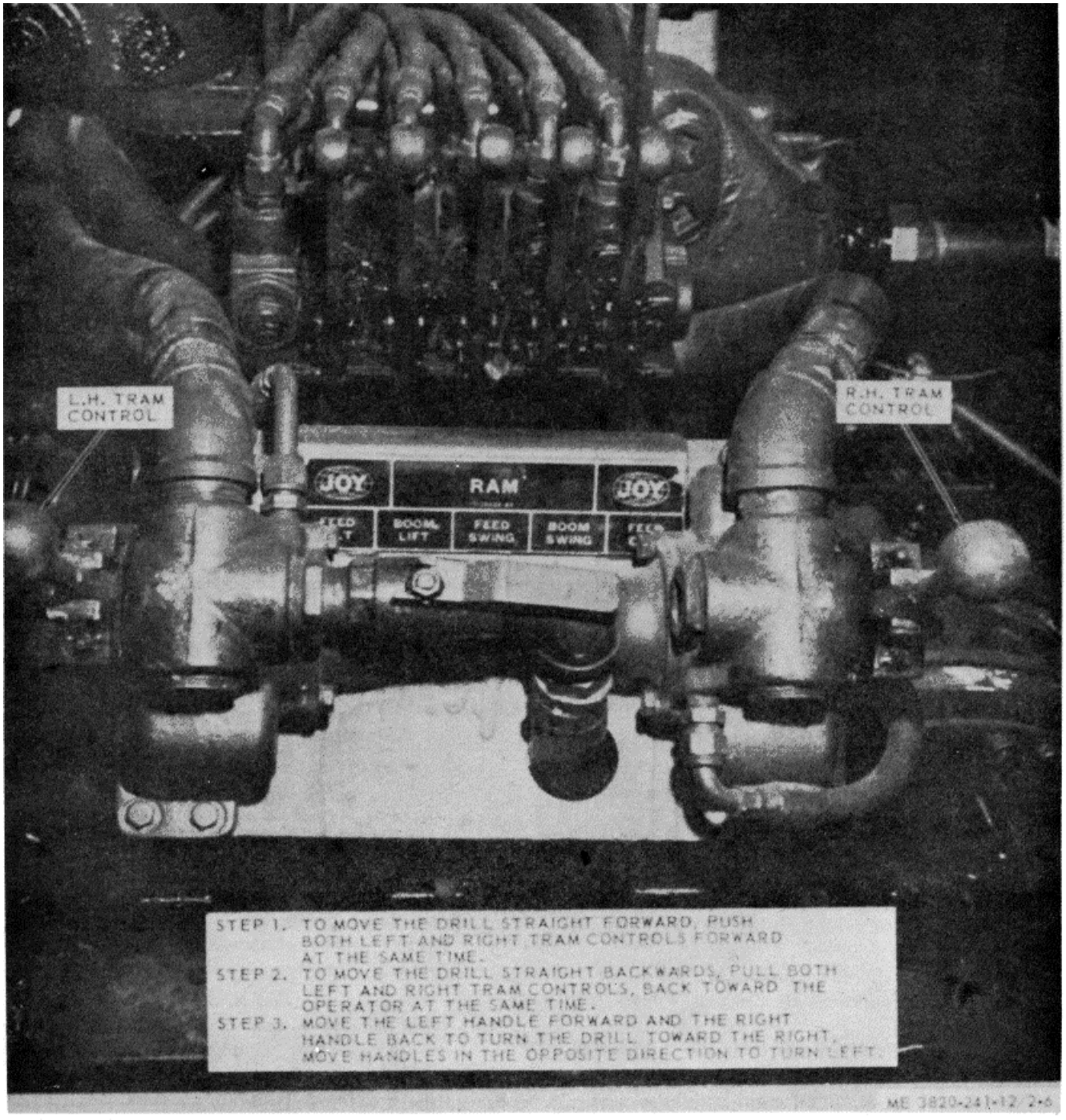


Figure 2-6. Tramming the rock drill.

(2) Position the rock drill in the maximum stability position for tramming or towing illustrated in figure 2-4.

NOTE

Since there are several variations in the manner which the tramming controls can be used, it Is recommended that the operator familiarize himself with their feel before attempting to negotiate the rock drill in confined quarters.

b. Positioning Boom and Feed. After rock drill has been trammed to the desired location, refer to figure 2-1 and position the boom as follows: (1) Place the hydraulic shut-off valve in the horizontal position to activate the hydraulic pump.

(2) Maneuver the boom controls to obtain the desired altitude of the boom and feed.

c. Preparing to Drill. Prepare the drill for operation as illustrated in figure 2-7.

d. Drilling.

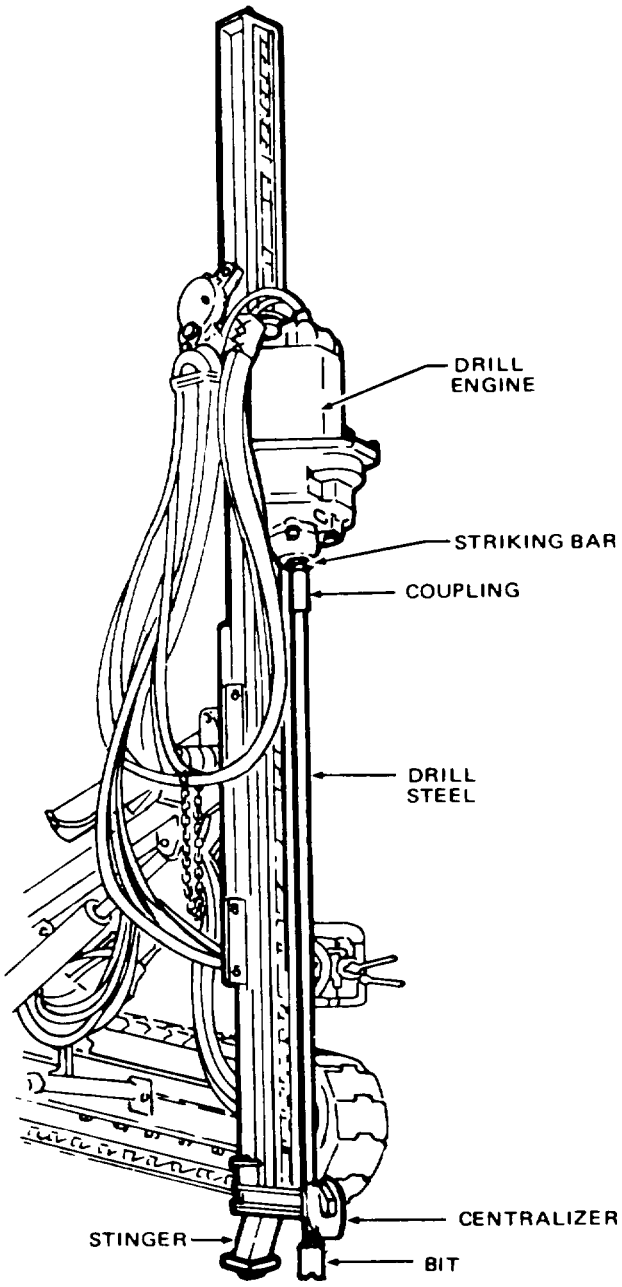
(1) Spot the drill bit at the desired location of the hole.

(2) Perform the drilling operation as illustrated in figure 2-8.

NOTE

The type and density of the material to be drilled will determine the setting of the blow and feed controls. Advance blow controls only to the point where the air is cleaning the hole of all loose material. Apply steady pressure to the drill bit with feed controls. When feed pressure is too great, the drill will attempt to stall out.

e. Adding Steel. Refer to figure 2-9 for addition of multiple steel lengths if required.



STEP 1. REMOVE THE STRIKING BAR RETAINNER FROM THE DRILL ENGINE, INSTALL STRIKING BAR, AND REINSTALL RETAINER.

STEP 2. MOVE DRILL HANDLE (FIG. 2-1) TO THE VERTICAL POSITION UNTIL DRILL ENGINE HAS REACHED BACK OF FED.

STEP 3. COAT THREADS OF STRIKING BAR, COUPLING, AND STEEL WITH THREAD COMPOUND AND ASSEMBLE.

STEP 4. OPEN THE CENTRALIZER AND HAND TURN THE ASSEMBLED BIT, STEEL, AND COUPLING INTO STRIKING BAR. CLOSE CENTRALIZER.

STEP 5. TO MAINTAIN HOLE ALIGHNMENT AND PREVENT STEEL FROM STICKING, IN THE HOLE, NEVER CHANGE THE POSITION OF THE BOOM OR TRAM AFTER DRILLING IS STARTED.

Figure 2-7. Rock drill steel system installed.

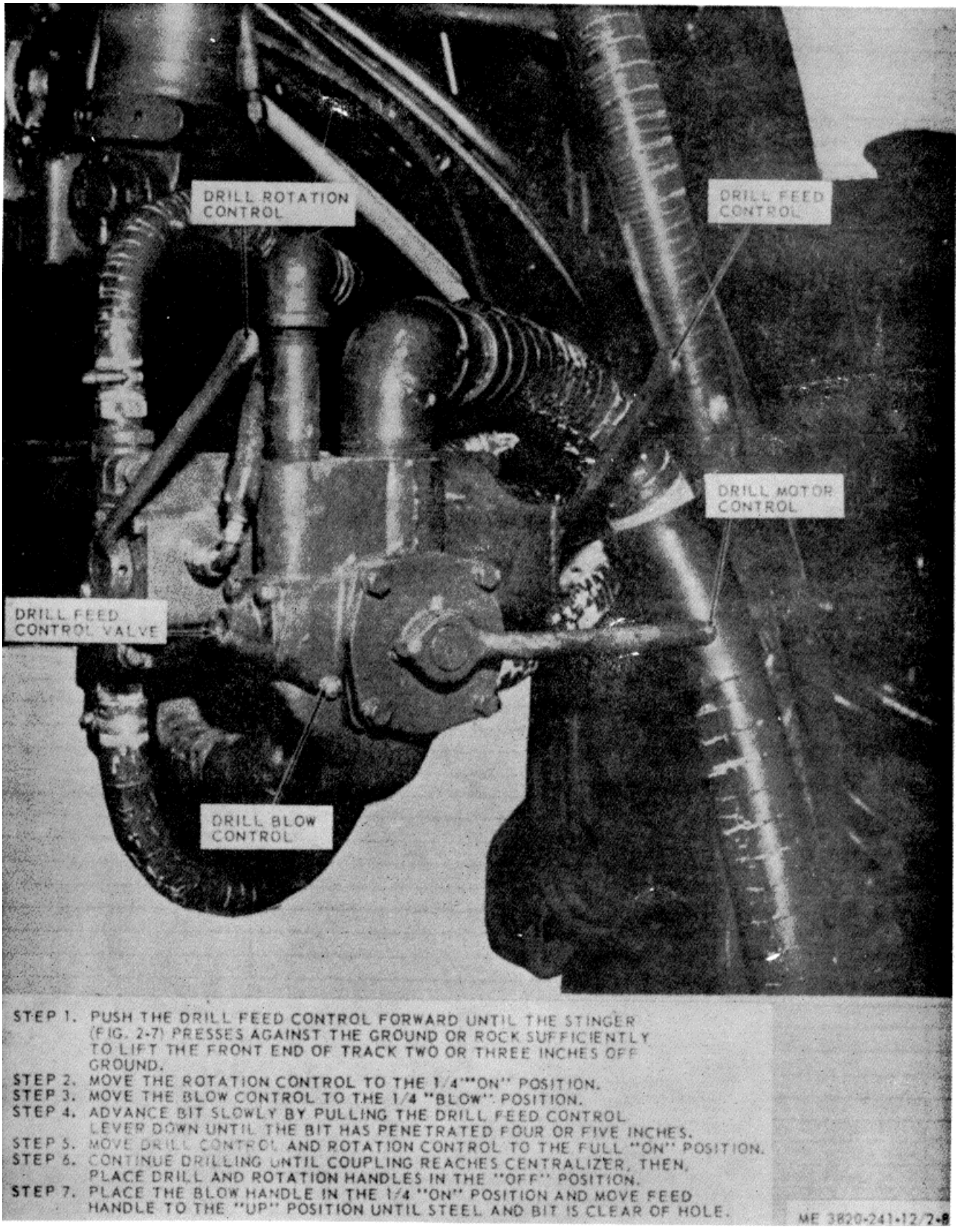


Figure 2-8. Drilling operation.

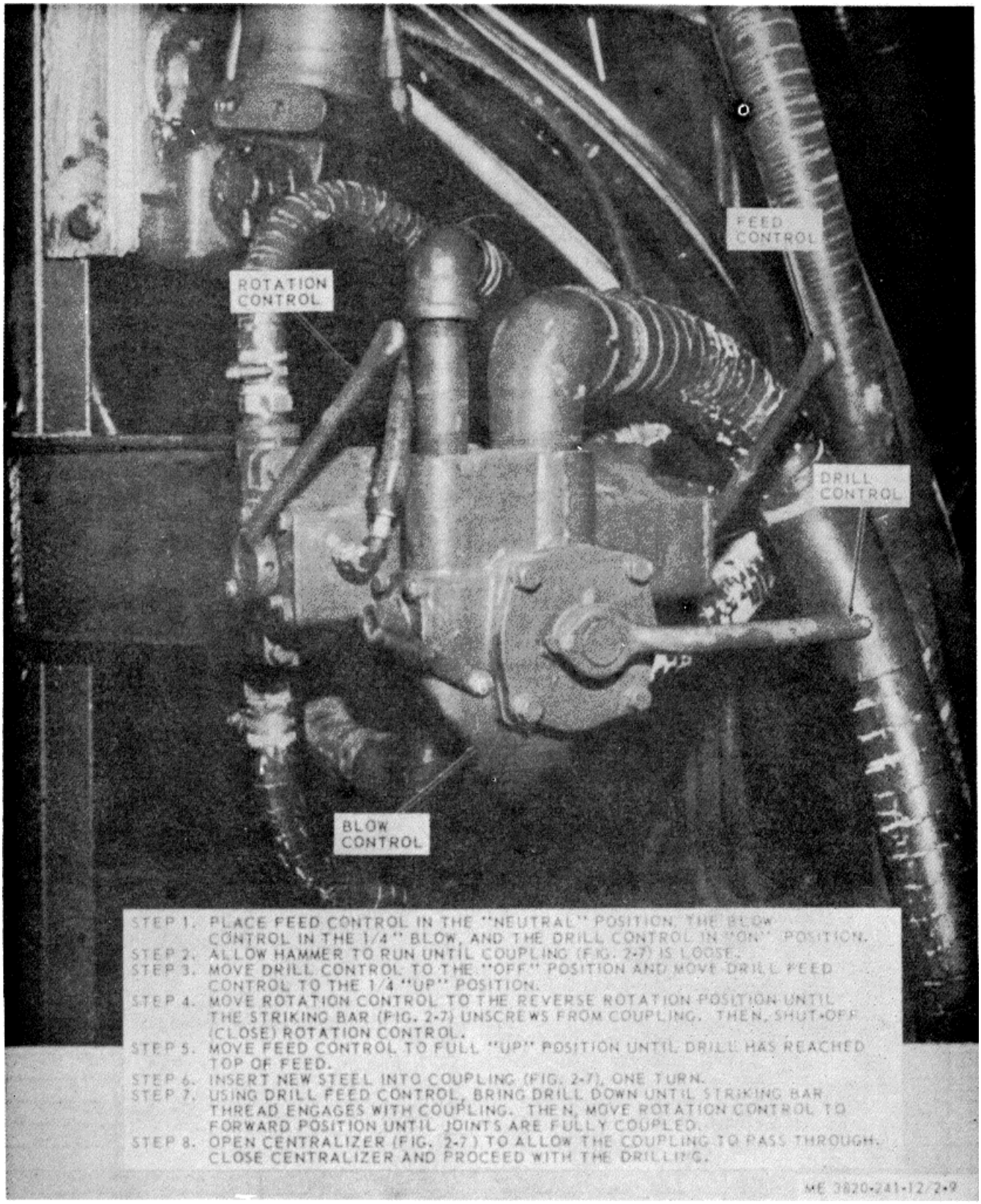


Figure 2-9. Adding multiple steel lengths.

f. Removing Steel. verse the procedure used in adding steel (e above) to dismantle the string of steel with the following exceptions:

(1) Move the blow handle (fig. 2-1) to 1/4 "ON" position only when raising the bottom steel.

(2) Before removing steel, always make sure the steel coupling is above the centralizer and that the centralizer is in the closed position. Neglecting to do this could result in loss of the remaining steels, coupling and bit in the hole.

Section II. OPERATION OF AUXILIARY EQUIPMENT

2-6. General

The pneumatic rock drill can be operated with any trailer mounted air compressor with a capacity of 600 c.f.m. (cubic feet per minute).

2-7. Compressor Operation

For operation of the air compressor, refer to the applicable technical manual for compressor to be used for power.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

2-8. Operation in Extreme Cold (Below 32°F.) (0°C.)

a. General. If the rock drill is to be operated in below freezing temperatures, certain precautions must be taken to assure continued normal operation.

b. Oil Reservoir Service. Service the oil reservoir in accordance with LO 5-3820-241-12. Use the grade of lubricant specified for the expected temperature.

c. Hydraulic Oil Reservoir. Service the hydraulic oil reservoir in accordance with LO 53820-241-12.

d. Tramming Motors (2 ea used). Open level plugs and drain off water until oil appears; close drain plug.

e. Air and Hydraulic Systems. If operating in sever cold (below 0°f.) (-18°C.), complete the following:

(1) Before terminating the shift, introduce one to two quarts of permanent type antifreeze into the main air supply line.

(2) Operate all air functions briefly, allowing the antifreeze to mix with any water that may be present in the air lines.

f. Control Station. If control station handles are iced up, apply heat to thaw the moving parts before attempting to operate.

2-9. Operation in Extreme Heat

a. Refer to LO 5-3820-241-12 and lubricate the equipment more frequently.

b. Adjust the drop rate of the airline lubricator according to the characteristics of the oil, the temperature, and the air consumption of the equipment. Always blow out the air supply line before connecting it to the rock drill inlet.

2-10. Operation in Dusty Areas

a. Always keep hydraulic oil reservoirs tightly capped.

b. Service the hydraulic oil filter at more frequent intervals.

c. Cover all ports immediately as soon as a line is disconnected.

d. Refer to LO 53820-241-12 and lubricate the equipment at more frequent intervals as required.

e. Keep the equipment clean. Pay special attention to the condition of the feed chain and sprockets, machined surfaces of the hydraulic cylinder rod, and the sliding surfaces of the drill carriage.

f. Take all necessary precautions to prevent dirt, dust, or sand from entering the pneumatic system. Service the air strainer daily. Cover the air inlet when not in use.

g. Provide maximum protection for the rock drill when not in use by storing it in a shelter or covering with a canvas cover.

2-11. Operation Under Rainy or Humid Conditions

a. Keep all exposed surfaces with preservative oil. Pay special attention to damaged painted surfaces. Cover all paint cracks and chip marks as soon as possible to prevent corrosion.

b. Take all necessary precautions to prevent moisture from entering the pneumatic system.

c. Service the air lubricator (para 4-19). Cover the air inlet when equipment is not in use.

d. Provide maximum protection for the equipment when not in use.

2-12. Operation in Salt Water Areas

The corrosive effect of salt water and salt water spray is very extensive. When operating in salt water areas, observe the following:

a. When exposed to salt water, rinse the track drill with fresh water as soon as possible and dry thoroughly.

b. Keep all machined surfaces coated with preservative lubricating oil.

c. Refer to LO 5-3820-241-12 and lubricate the rock at more frequent intervals.

2-13. Operation in Snow

a. Remove all ice and snow from the controls to assure proper operation of controls.

b. Preserve the equipment in a similar manner as outlined in paragraph 2-11.

2-14. Operation in Mud

a. Keep crawler tracks free of mud.

b. Preserve the equipment in a similar manner as outlined in paragraph 2-11.

CHAPTER 3
MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

3-1. Detailed Lubrication Information

a. General. Lubrication of the pneumatic rock drill is covered in LO 5-3820-241-12. Keep all lubricants in closed containers and store in a clean, dry place away from external heat. Allow no dust, dirt or other foreign material to mix with the lubricants. Keep all lubrication equipment clean and ready for use.

b. Cleaning. Keep all external parts not requiring lubrication clean of lubricants. Before lubricating the equipment, wipe all lubrication points free of dirt and grease. Clean all lubrication points after lubricating to prevent accumulation of foreign matter.

3-2. Points of Lubrication

Service all lubrication points at proper intervals as specified on LO 5-3820-241-12.

Section II. OPERATOR'S PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-3. General

To insure that the pneumatic rock drill is ready for operation at all times, it must be inspected systematically so that defects may be discovered and inspected before they result in serious damage or failure. The necessary preventive maintenance checks and services to be performed are listed in Table 3-1. The item numbers indicate sequence of minimum inspection requirements. Defects discovered during operation of the unit will be noted for future corrections to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with the corrective action taken on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

3-4. Operators Preventive Maintenance

The operator's periodic (daily and weekly) preventive maintenance checks and services are listed in Table 3-1.

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services

B - Before Operation D - During -A- After Operation

Time required: 2 7 Time required:

Interval and Sequence No.			ITEM TO BE INSPECTED	WORK TIME
B	D	A	PROCEDURE	(M/H)
1			DRIFTER DRILL Inspect the drifter drill for proper operation and see that it travels freely on the boom feed mechanism. If travel is slow, adjust the backhead metering valve (para 3-19).	0.2
2			HYDRAULIC HOSES AND CYLINDERS Inspect hydraulic hoses and cylinders for leaks. If defective, refer to organizational maintenance.	0.2
3			AIR HOSES Inspect the air hoses for leaks. Tighten fittings. If hoses are defective, refer to organizational maintenance personnel.	0.2
4			HYDRAULIC CONTROL VALVE Inspect the hydraulic control valve for leaks. If defective, refer to organizational maintenance.	0.2
5			AIR MOTOR AND HYDRAULIC PUMP Inspect the air motor and hydraulic pump for proper operation and leaks. Check the motor exhaust air for presence of atomized oil.	0.1
			Adjust air line lubricator as required (para 3-20).	0.5

B - Before Operation D - During A- After Operation
Time required: 2 7 Time required:

Interval and Sequence No.			ITEM TO BE INSPECTED	WORK TIME
B	D	A	PROCEDURE	(M/H)
6			BOOM DRILL, CARRIAGE Tighten all drill motor to boom bolts daily. Refer to LO 5-3820-241-12 and lubricate the feed chain.	0.2
7			TRAMMING MOTORS Remove drain plug and drain off excess water. Refer to LO 5-3820-241-12 and check oil level. Add oil as required	0.3
8			TRACK SUSPENSION SYSTEM Check the suspension system for proper adjustment or other damage. Adjust track suspension as required (para 3-27).	0.5
9			ROCK DRILL RESERVOIR Refer to LO .3820-241-12 and service the reservoir.	0.2
10			CENTRALIZER Inspect the centralizer bushing for excessive wear. If defective, refer to organizational maintenance.	0.1
11			DRILL BIT AND STRIKING BAR Inspect the drill bit and striking bar for excessive wear or damage. Replace If damaged (para 2-3).	

Section III. OPERATOR/CREW TROUBLESHOOTING

3-5. General

a. This section provides information useful to the operator and crew in diagnosing and correcting unsatisfactory operation or failure of the rock drill and its components. Each malfunction for an individual component, unit or system is followed by a list of tests or inspections which will help you determine the probable cause and the corrective action to take. Perform the tests, inspections, and corrective action in the order listed.

b. This table does not list all functions that may occur, nor all tests, inspections and corrective actions. If a malfunction is not listed or is not corrected by recommended corrective action notify organizational maintenance personnel.

3-6. Troubleshooting Table

Table 3-2 lists the operator/crew troubleshooting malfunctions, tests or inspection and the recommended corrective actions.

Table 3-2. OPERATOR/CREW TROUBLESHOOTING

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. ROCK DRILL AIR PRESSURE IS LOW.
   - Step 1. Check for insufficient air from main air supply source.
     Build up pressure in air supply source to 110 to 120 p.s.i.
   - Step 2. Check for loose fittings or hoses.
     Tighten hose and pipe fittings.
   - Step 3. Check for plugged or defective air hose.
     Notify organizational maintenance.
   - Step4. Check air pressure regulator adjustment.
     Adjust the air pressure regulator (para 3-13).
2. LOW HYDRAULIC PRESSURE
   - Step 1. Check for low hydraulic oil reservoir.
     Refer to LO 5.3820-241-12 and service the hydraulic oil reservoir.
   - Step 2. Check for loose hydraulic fittings.
     Tighten hydraulic fittings.
   - Step 3. Check for ruptured hydraulic hose.
     Notify organizational maintenance.
   - Step 4. Check adjustment of pressure regulator.
     Adjust pressure regulator (para 3-13).

MALFUNCTION TEST CORRECTIVE ACTION

3. TRAMMING MOTOR OPERATES UNEVEN OR SLUGGISH

Step 1. Check tramming motor brake adjustment.
Adjust tramming motor brake (para 3-9).

Step 2. Check for improper track tension.
Adjust track tension (para 3-27).

Step 3. Check to make sure transmission is fully engaged.
Check clutch handle position for proper engagement (para 2-3).

4. DRILL ENGINE IS SLUGGISH OR OPERATES ERRATICALLY

Step 1. Check for incorrect grade of oil.
Refer to LO .5-3820-241-12 and service reservoir with proper grade of oil.

Step 2. Check for inadequate main air supply.
Build up air supply to 110 to 120 p.s.i.

Step 3. Check for lack of oil in rock drill engine.
Service the lubricator fitting (para 3-20) or adjust fitting (para 3-20).

5. DRILL ENGINE LACKS POWER

Step 1. Check for plugged air strainer in lubricator.
Service the air line lubricator, or adjust the lubricator (para 3-20).

Step 2. Check for restricted air line.
Remove restriction or notify organizational maintenance.

Step 3. Check for inadequate air supply.
Build up air supply to 110 to 120 p.s.i.

Step 4. Check for lack of oil at rock drill engine.
Adjust the lubricator fitting (para 3-7).

6. DRILL ENGINE DRILLING SPEED IS LOW

Step 1. Check for accumulation of excessive rock and dust in drill hole.
Adjust blow control valve (para 2-3).

Step 2. Check for plugged bit or drill steel.
Clean out passage in drill steel and bit.

7. ICE OR FROST ON EXHAUST PORT

Step 1. Check for rapid feed advance.
Advance feed slower (para 2-3).

Step 2. Check for excessive moisture in air supply.
Blow out main air supply line and drain off excess water.

8. DRILL ENGINE OVERHEATS.

Step 1. Check for proper lubricator fitting adjustment.
Adjust lubricator fitting (para 3-20).

Step 2. Check for proper type drill oil.
Refer to LO 53820-241-12 and service oil reservoir.

Step 3. Check for clogged hydraulic oil filter.
Service the hydraulic oil filter (para 3-17).

Step 4. Check for insufficient feed pressure.
Adjust bulkhead metering valve (para 3-19).

9. DRILL STEEL STICKS IN HOLE.

Step 1. Check for worn or dull bit.
Sharpen or replace bit para 2-3).

Step 2. Check for improper drilling procedure.
Review drilling procedure (para 2-3).

Section IV. MAINTENANCE OF THE FINAL DRIVE

3-7. General

This section contains operator/crew instructions for inspection and adjustment of the final drive (transmission and tramming motors).

3-8. Final Drive Inspection

Inspect the transmission and tramming motors for loose plugs and bolts. Inspect all surfaces for oil leaks. Check air hoses for sharp bends, cracks or ruptures. Tighten all loose plugs, bolts and hose clamps. Refer defective or damaged hoses to organizational maintenance.

3-9. Transmission Tramming Brake

a. General. Each of the two tramming transmissions is equipped with a brake. If improperly adjusted, the brake can cause slow or uneven tramming and will result in a loss of tramming power. The tramming brake adjustments are located at the top rear of each transmission.

b. Brake Adjustment. Adjust the transmission tramming brake as illustrated in figure 3-1.

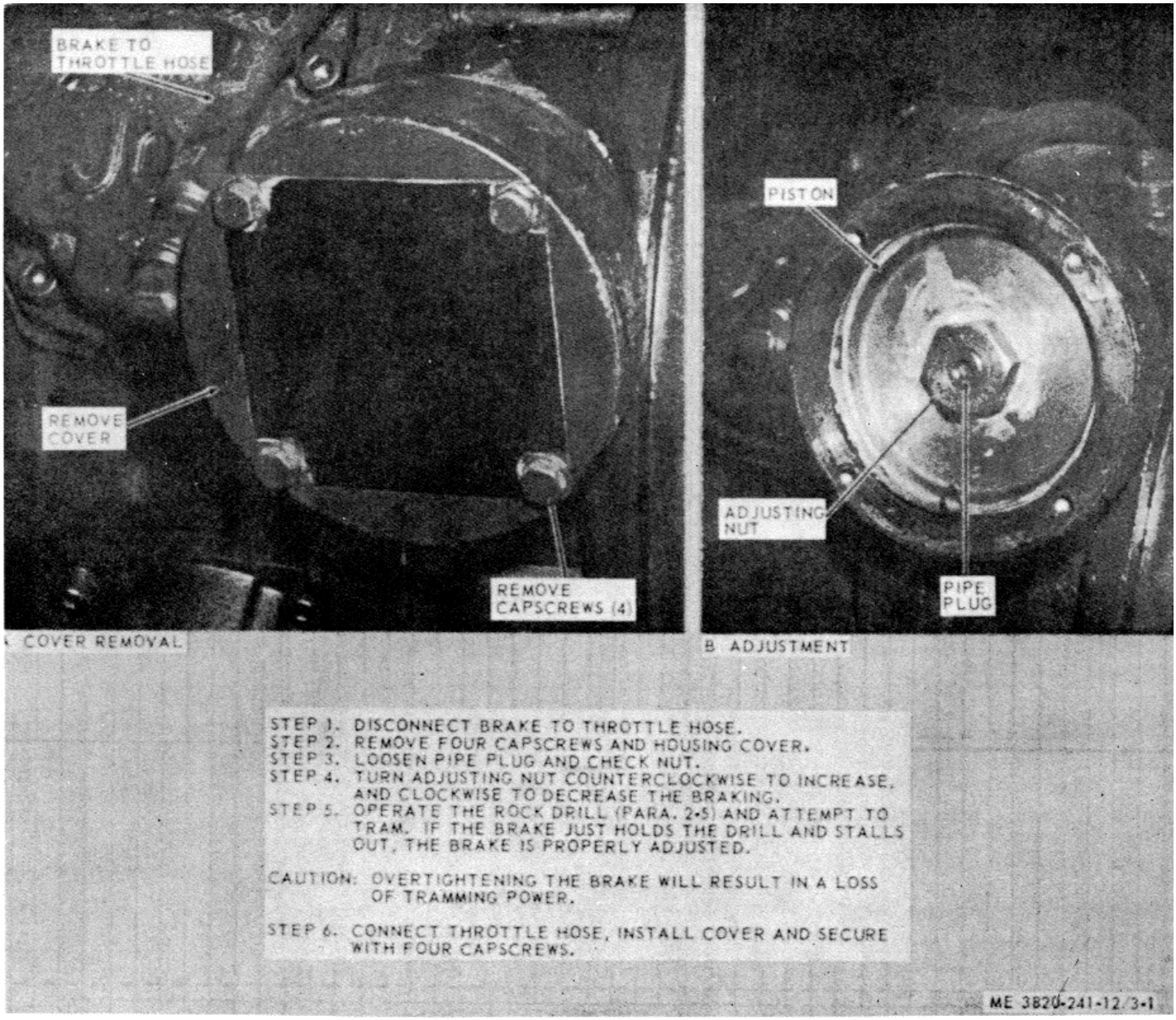


Figure 3-1. Transmission tramming brake adjustment

Section V. MAINTENANCE OF HYDRAULIC SYSTEM

3-10. General

The rock drill hydraulic system consists of a hydraulic pump, pump drive motor, pressure regulator, control valve, reservoir, lift boom, swing, tilt, and extension cylinders, and the necessary hoses and fittings. Refer to figure 1-5 for a hydraulic system schematic diagram.

3-11. Hydraulic Hoses

a. Inspect the hydraulic hoses and fittings for cracks, breaks or leaks. Presence of hydraulic fluid on any of components or under the crawler indicates loose fittings or damaged hoses.

b. Check and tighten loose hydraulic fittings or hose.

c. Report defective hoses to organizational maintenance.

3-12. Hydraulic Pump and Drive Motor

a. Inspect the hydraulic pump and drive motor for secure mounting and leaks at the inlet and outlet fittings.

b. Tighten all loose mounting hardware and fittings.

3-13. Hydraulic Air Pressure Regulator

a. Inspection. Inspect the pressure regulator for secure mounting. Inspect the hydraulic and air hoses to the regulator for secure mounting. Tighten all loose mounting hardware of hoses.

b. Adjustment. Adjust the air pressure regulator as illustrated in figure 3-2.

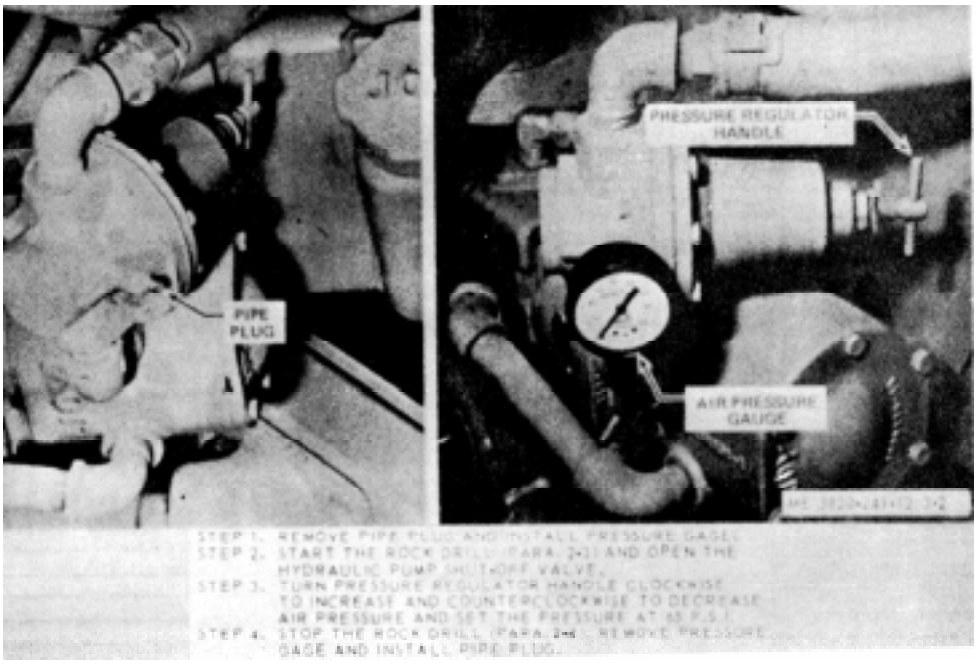


Figure 3-2. Air pressure regulator adjustment

3-14. Hydraulic Control Valve

Make a periodic inspection of the hydraulic control valve to see that all hose connections and mounting hardware are secure. Inspect hoses for ruptures or other damage.

3-15. Hydraulic Cylinders

a. The rock drill is equipped with {5 cylinders consisting of lift, swing, tilt, extension and boom cylinders.

b. Check to make sure that all cylinders extend and

retract smoothly. Inspect pipe fittings to make sure they are secure. Inspect the cylinders for excessive leakage which generally indicates O-ring or packing failure. Report this condition to direct and general support maintenance.

3-16. Rock Drill Oil Reservoir Service

a. Pressurized Reservoir. Service the pressurized rock drill reservoir as illustrated in figure 3-3.

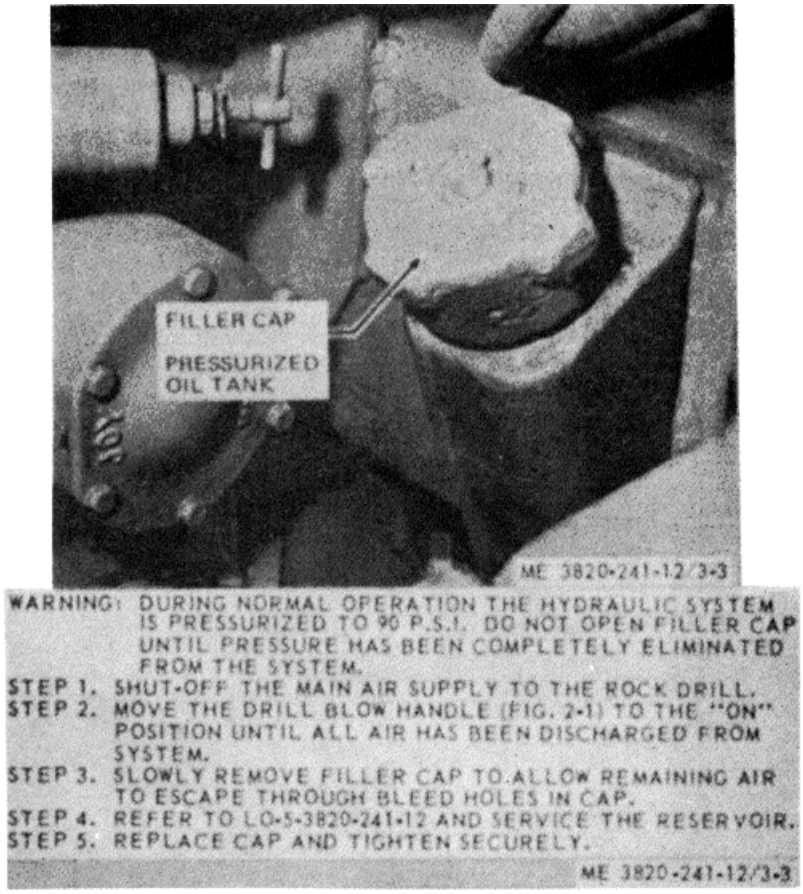


Figure 3-3. Rock drill pressurized reservoir service.

b. Oil Reservoir. Refer to LO 5-3820-241-12 and service the hydraulic oil reservoir as illustrated in figure 3-4.

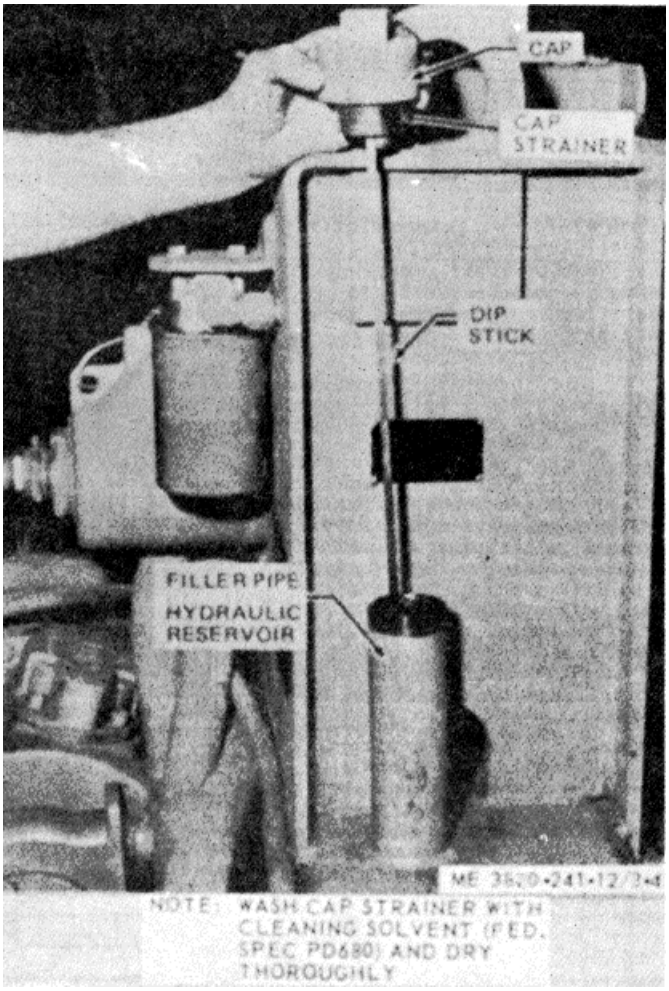


Figure 3-4. Hydraulic oil reservoir service.

3-17. Hydraulic Oil Filter Service

Service the hydraulic oil filter as illustrated in figure 3-5.

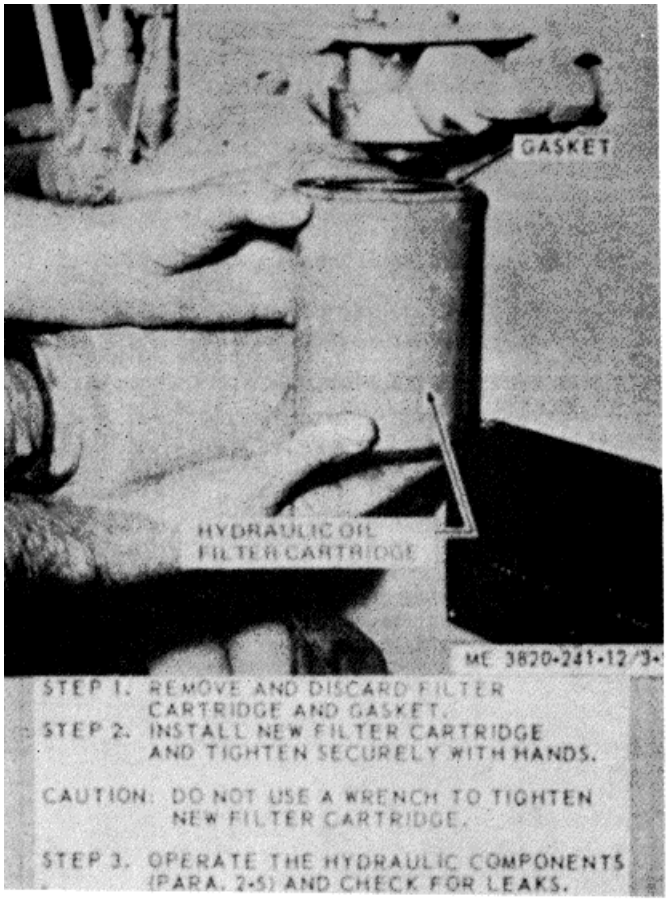


Figure 3-5. Hydraulic oil filter service.

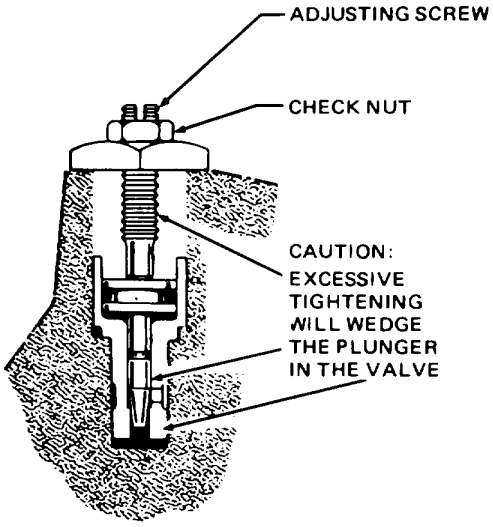
Section VI. MAINTENANCE OF PNEUMATIC SYSTEM

3-18. General

The rock drill pneumatic system consists of the air inlet lubricator fitting, ram and feed control valve, air motor, drifter drill engine, and the backhead air metering valve. The operator's maintenance is limited to servicing the lubricator and adjusting the backhead air metering valve. Refer to figures 1-3 and 1-4 for an air system schematic diagram.

3-19. Bulkhead Metering Valve Adjustment

Adjust the bulkhead metering valve as illustrated in figure 3-6.



STEP 1. BACK OFF CHECK NUT FROM ADJUSTING SCREW.
STEP 2. TURN THE ADJUSTING SCREW COUNTERCLOCKWISE TO INCREASE THE FLOW OF OIL AND CLOCKWISE TO DECREASE THE FLOW.
NOTE: WHEN PROPERLY ADJUSTED, A LIGHT FILM OF OIL WILL BE EXHAUSTED FROM THE CYLINDER EXHAUST PORT.

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Figure 3-6. Bulkhead metering valve adjustment.

3-20. Lubricator Fitting Adjustment

a. Back off check nut on the metering valve (fig.3-6) and turn the adjusting screw in until it bottoms in the valve seat to shut off the oil supply.

CAUTION

Excessive tightening of the adjusting screw will wedge the plunger into the metering valve and damage the plunger.

b. Activate the rock drill (para 2-5) until the drill engine has warmed up sufficiently to produce an oil film at drill engine exhaust port and on the shank of the striking bar.

c. With the drill engine thoroughly warmed up, quickly retract the drill to force the hammer to operate on cushion. If the lubricator fitting adjustment is correct, the drill will diesel one or two cycles. This indicates that oil is reaching the front end. If instead, the drill continues to sputter for many cycles when retracted, the drill is receiving too much oil and is dieseling heavily. Too much oil may cause the drill to overheat and force of combustion may even drive the piston against the valve seat. If the drill is not receiving sufficient oil, no dieseling will occur when the drill is retracted. There will be no occasional sputter when hot and no random dieseling or very little show of oil at exhaust and striking bar.

d. Adjust the lubricator fitting as illustrated in figure 3-7.

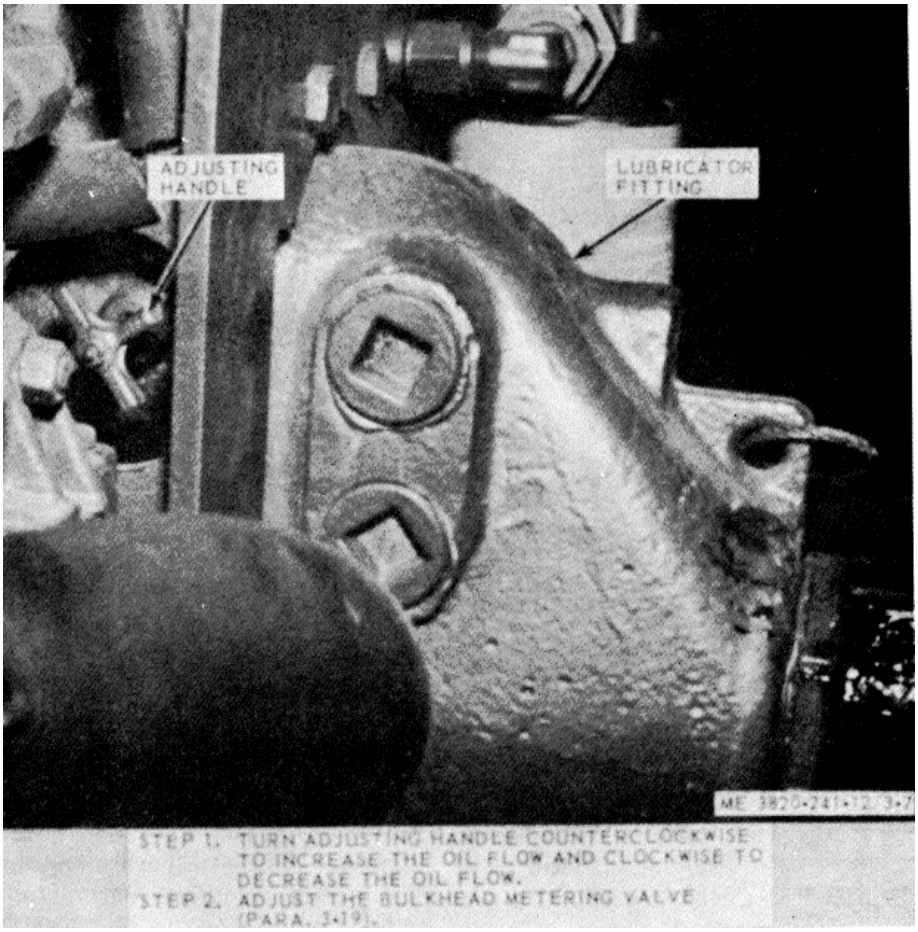


Figure 3-7. Air line lubricator fitting adjustment.

3-21. Pneumatic Hoses

Inspect the pneumatic hoses and fittings for loose. connections or ruptured hoses. Tighten loose connections. Report defective hoses to organizational maintenance.

Section VII. MAINTENANCE OF LIFT, SWING, FEED AND LEVELING MECHANISM

3-22. General

a. The lift and swing mechanism consists of a pivot, boom assembly and dump assembly.

b. The feed and leveling mechanism consists of the feed assembly, centralizer, feed chain, drill trunnion and sprockets.

3-23. Lift and Swing Components

Inspect all pivot points, bushings and pins on the lift and swing mechanism for damage or excessive wear. Report all defects to organizational maintenance.

3-24. Feed and Leveling Components

a. Inspect the feed assembly for damaged components.

b. Inspect the centralizer to make sure the arms operate freely. Keep arm pivot areas free of dirt and stones.

c. Inspect the feed chain for proper adjustment. The chain should have a slight sag at all times. If adjustment is required, report the condition to organizational maintenance.

d. Inspect the drill trunnion for proper operation.

It should move smoothly along the feed at all times.

e. Keep the feed chain sprocket areas free of dirt and stones.

3-25. Drill and Feed Control Valve

Keep the drill and feed control valve clean at all times. Keep all hose connections tight.

Section VIII. MAINTENANCE OF CRAWLER TRACKS

3-26. General

The pneumatic rock drill is equipped with two carrier tracks. Each track consists of 38 individual pads that are connected together with drive pins. Operator's maintenance of the track is limited to adjustment of the track tension.

3-27. Track Tension Adjustment

a. Each track has its own adjustment located on the track frame midway between the track sprockets. The tension in the track is maintained by a grease cylinder mounted in each frame.

b. Adjust the track tension as illustrated in figure 3-8.

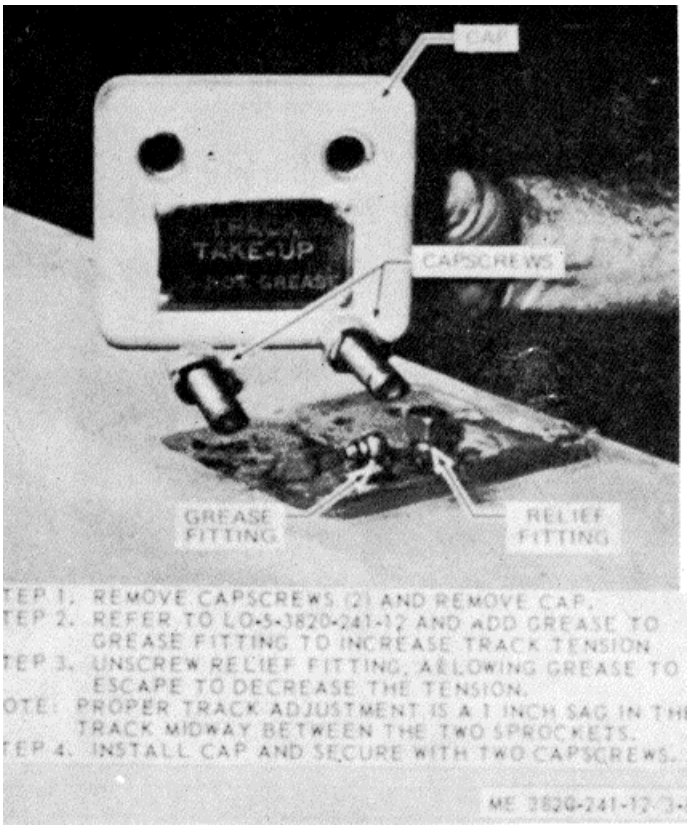


Figure 3-8. Crawler track tension adjustment

CHAPTER 4
ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

4-1. Unpacking the Equipment

a. General. The pneumatic rock drill assembly is shipped in two crates. The boom assembly is removed and crated separately.

b. Uncrating.

(1) Uncrate the rock drill crawler assembly as illustrated in figure 4-1.

(2) Use a suitable hoist with a capacity of at least 24,000 pounds and remove the rock drill crawler assembly from the crate base as illustrated in figure 4-2.

(3) Remove the steel bands securing the drill and feed control valve to the crate base and remove the valve.

(4) Remove the rock drill feed assembly from the shipping crate as illustrated in figure 4-3.

(5) Remove the preservative tape from the rock drill cylinder rods and the feed control valve.

4-2. Inspection and Servicing.

a. Inspection.

(1) Make a complete inspection of the rock drill for any damage that may have occurred during shipment.

(2) Inspect the drill feed, deck, frame and crawler for damage and loose or missing hardware.

(3) Inspect the air motor, hydraulic pump, tramming motors, hydraulic valves, drill motor and centralizer for secure mounting.

(4) Check the hydraulic pump, hydraulic and air control valves, hydraulic cylinders, final drives and drill motor for damage.

(5) Inspect all hydraulic and pneumatic lines and hoses for damage and loose connections.

(6) Check all operating controls for damage and proper operation.

b. Servicing.

(1) Refer to LO 5-3820-241-12 and lubricate the rock drill.

(2) Perform the before operation preventive maintenance services (para 3-4).

(3) Inspect and adjust the lubricator fitting (para 3-20).

(4) Check the feed chain for proper tension. Adjust the feed chain if necessary (para 4-23).

(5) Check the crawler tracks for proper adjustment. Adjust the tracks if necessary (para 3-27),

4-3. Installation

a. Feed Assembly Installation.

(1) Connect the air supply to the rock drill as outlined in paragraph 2-3. Refer to paragraph 2-5 and position the tilt and swing mechanism in the horizontal position.

(2) Connect a suitable hoise to the feed assembly as outlined in paragraph 4-1.

(3) Lift the feed assembly and install it on the tilt and swing mechanism frame as illustrated in figure 4-4.

(4) Install the drill and feed control valve and connect the hoses as illustrated in figure 4-5.

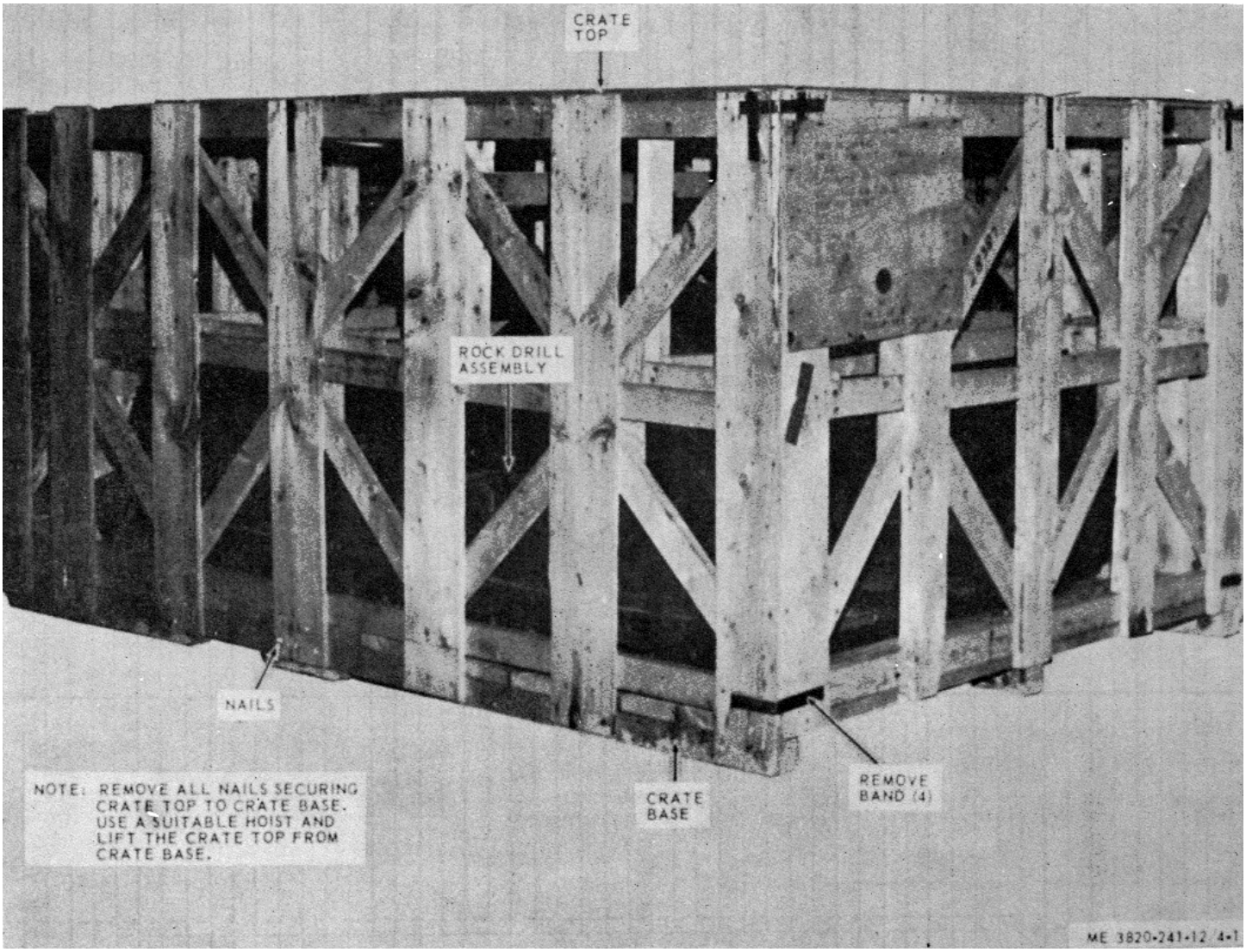


Figure 4-1. Uncrating the rock drill crawler assembly.

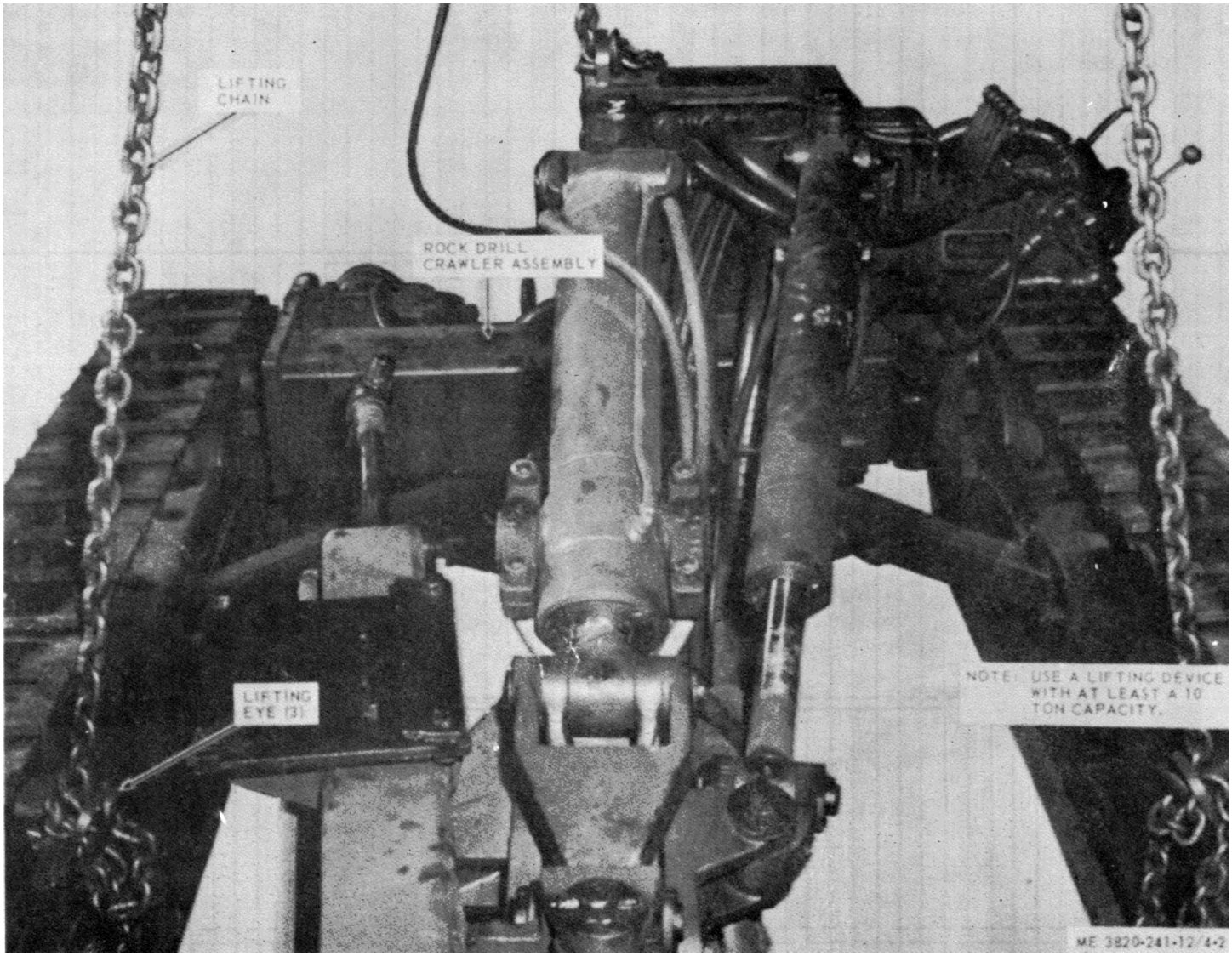


Figure 4-2. Lifting the rock drill crawler assembly.

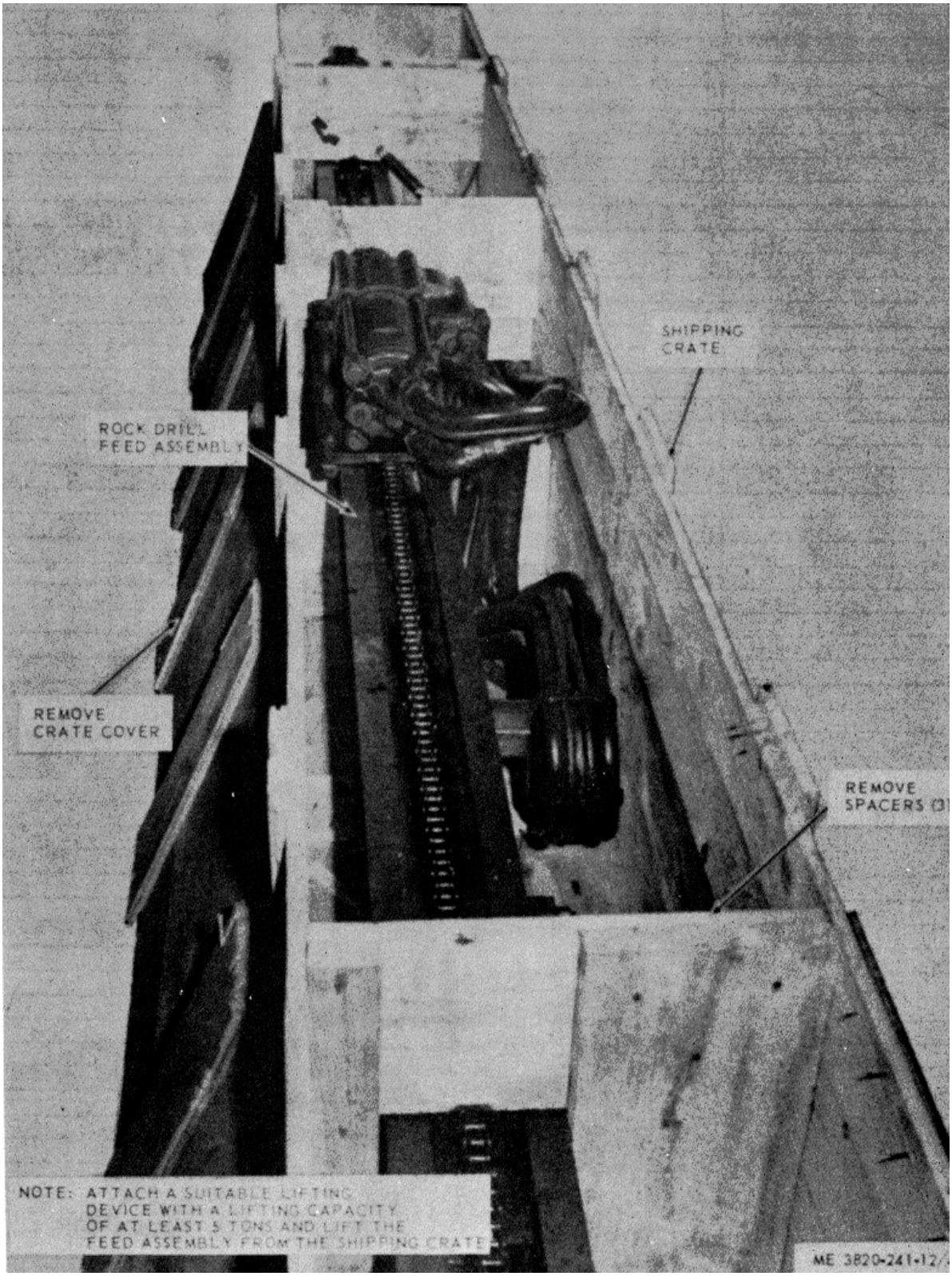


Figure 4-3. Removing the rock drill feed assembly from shipping crate.

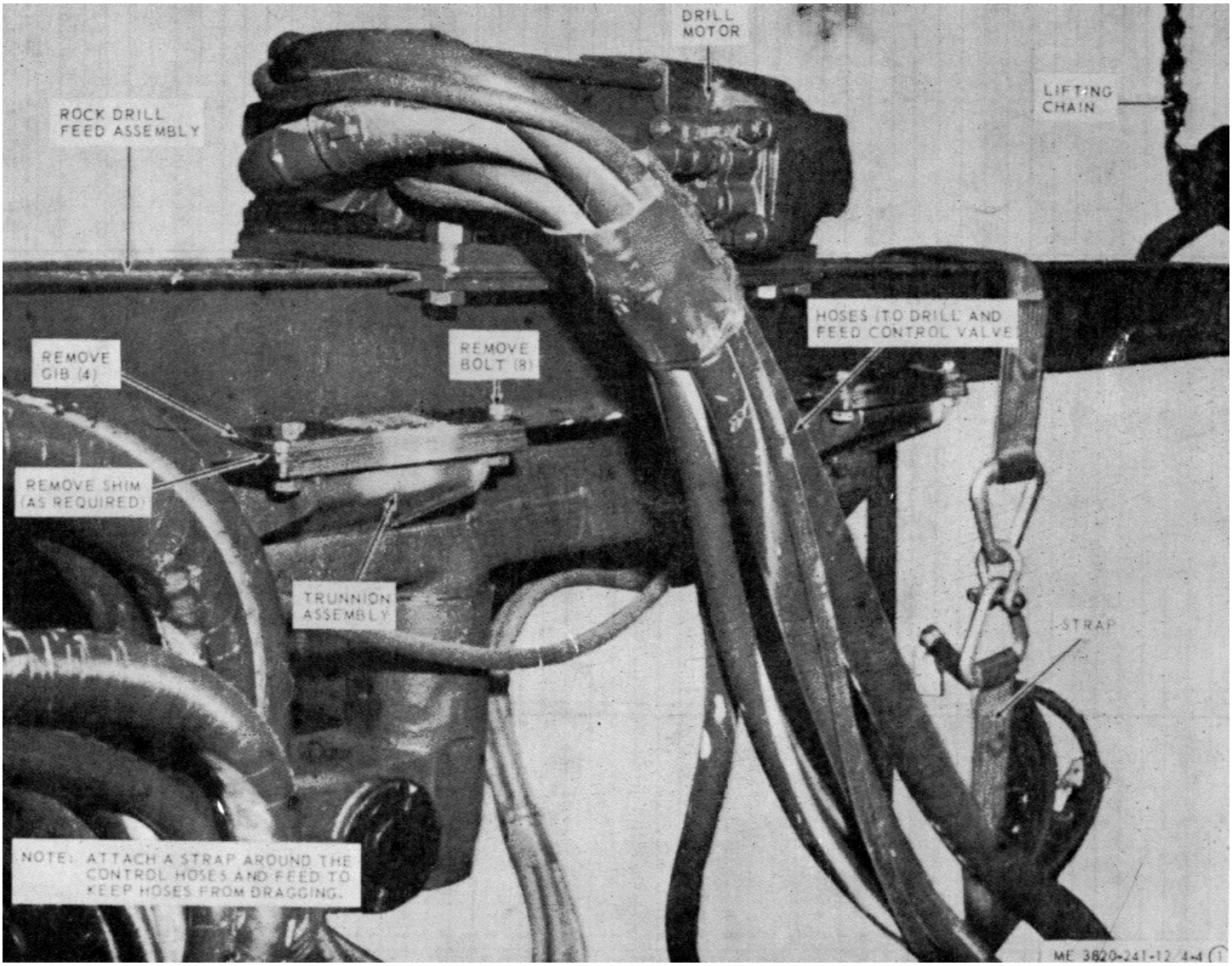


Figure 4-4. Rock drill feed assembly, removal and installation (sheet 1 of 2).

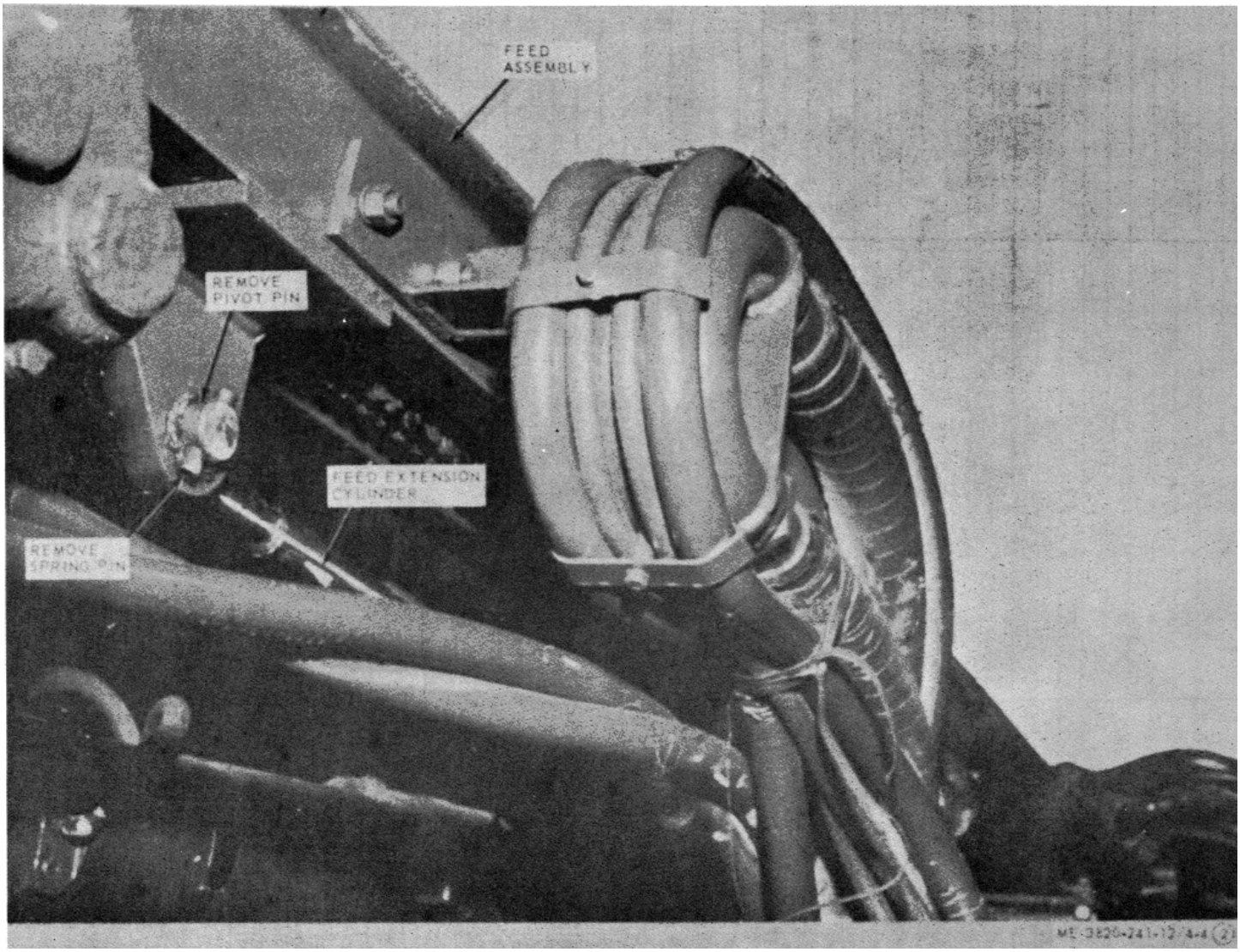


Figure 4-4. Rock drill feed assembly, removal and installation (sheet 2 of 2).

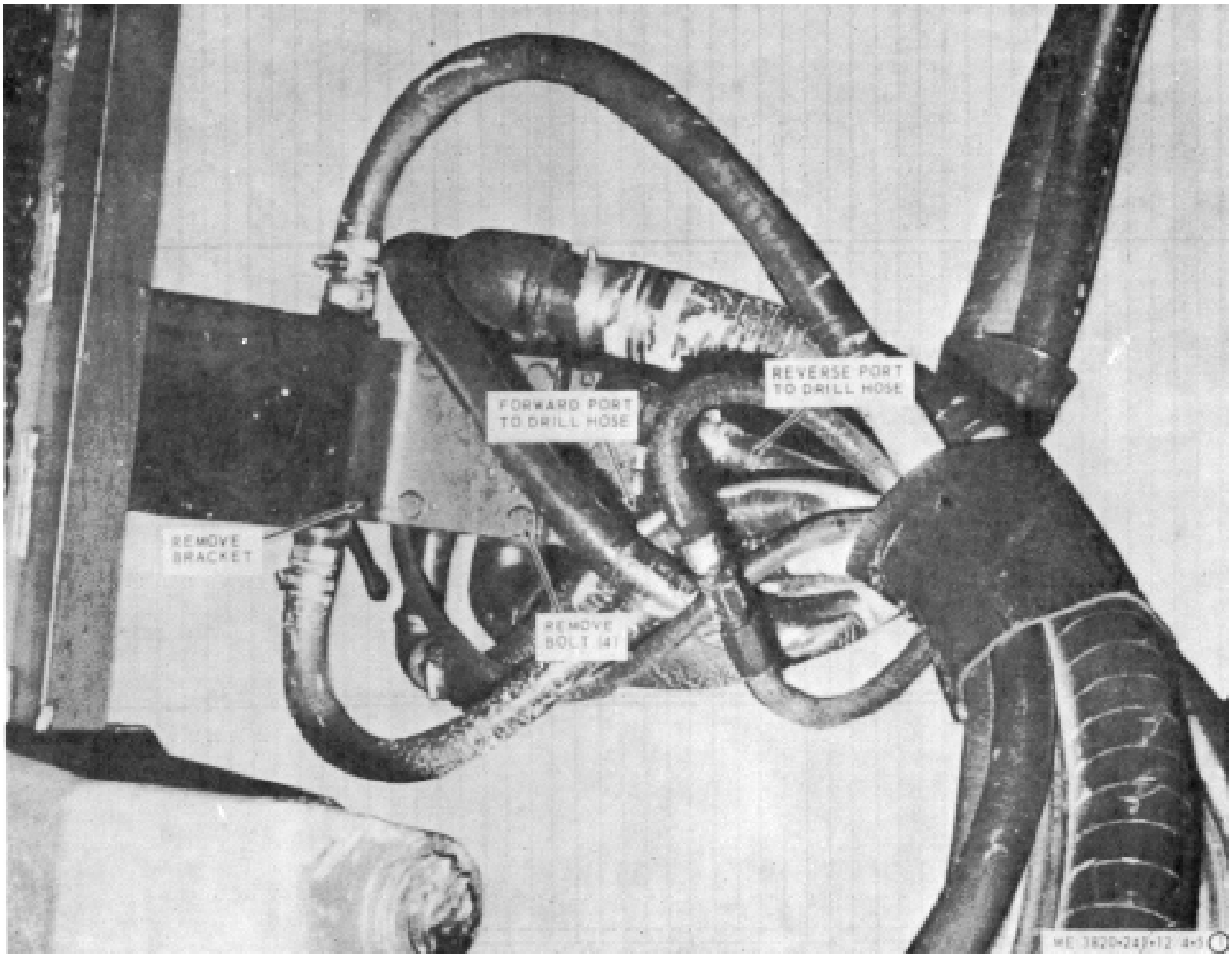


Figure 4-5. Drill and feed control valve, removal and installation (sheet 1 of 2).

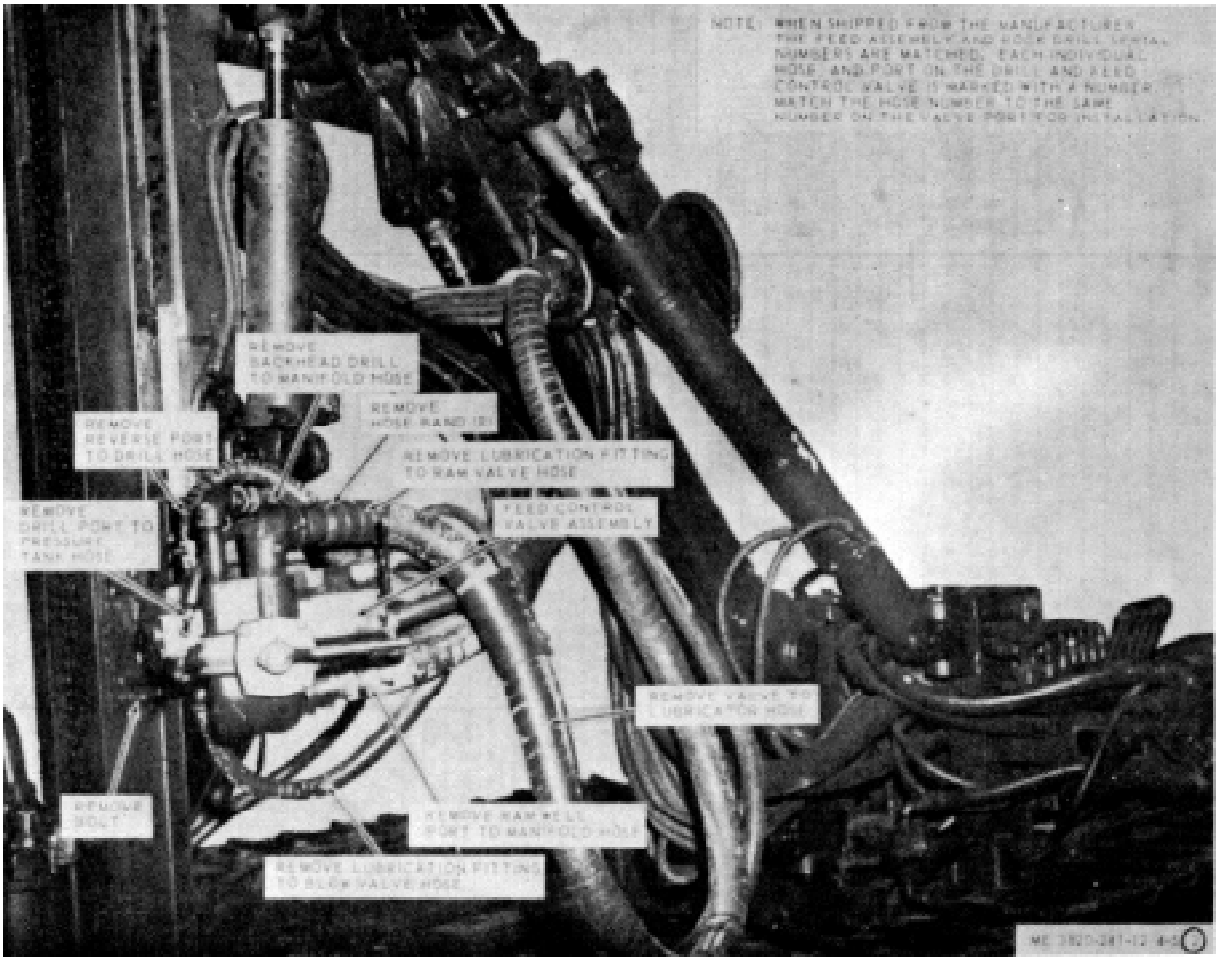


Figure 4-5. Drill and feel control valve, removal and installation (sheet 2 of 2).

b. Locating the Drill. Refer to paragraph 2-5 and tow or tram the assembled drill to the worksite, and prepare the drill for operation.

c. Remove the operator's platform from transmission housing and install in position as shown in figure 1-1.

Section II. MOVEMENT TO A NEW WORKSITE

4-4. Dismantling for Movement

a. The pneumatic rock drill does not require dismantling for movement, to a new worksite.

b. The rock drill can be moved by carrier or tramming. Tramming will be used only when the new location is reasonably close.

4-5. Rock Drill Movement

a. Short Distance Movement

(1) When the rock drill is to be moved a short distance, it will be moved by tramming (self-propelled) as outlined in paragraph 2-5.

(2) Position the drill feed and boom as illustrated in figure 2-4 to allow maximum stability while moving. The terrain over which the drill is to be moved will determine the tramming speed. Full speed can be used if tramming on a flat level surface.

(3) When the rock drill is to be towed to the new worksite, disengage the clutch as outlined in paragraph 2-5 and tow the rock drill to the new worksite.

b. Long Distance Movement.

(1) Position the feed assembly in the horizontal position.

(2) Use a suitable hoist with at least a 12,000 pound capacity, attach lifting chain to lifting eyes, as illustrated in figure 4-2, and lift the rock drill on the carrier bed.

(3) Refer to TB 740-97-2 and prepare the rock drill for shipment to the new worksite.

4-6. Reinstallation After Movement

a. Remove the necessary blocking and tie down cables securing the rock drill to the carrier bed.

b. Use a suitable lifting device with at least 12,000 pounds capacity and lift the rock drill from the carrier bed as illustrated in figure 4-2.

c. Inspect and service the equipment (para 4-2).

d. Prepare the rock drill for operation (para 4-3).

Section III. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

4-7. Tools and Equipment

Tools, equipment and repair parts issued with or authorized for the pneumatic rock drill are listed in TM 5-3820-241-20P.

4-8. Special Tools and Equipment

No special tools and equipment are required by organizational maintenance personnel for performing maintenance on the pneumatic rock drill.

4-9. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in TM 5-3820-241-20P, Repair Parts and Special Tools List, covering organizational maintenance for this equipment.

Section IV. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-10. General

For a general description and purpose of the preventive maintenance checks and services, refer to paragraph 3-3.

4-11. Organizational Preventive Maintenance

Organizational maintenance monthly and quarterly preventive maintenance checks and services are listed in Table 4-1.

Table 4-1 Organizational Preventive Maintenance Checks and Services

Q - Quarterly
Total man-hours required 7 5

Sequence Number	ITEM TO BE INSPECTED PROCEDURE	WORK TIME (M H)
1	BOOM DRILL CARRIAGE Inspect the feed chain for proper tension. Adjust if necessary (para 4-23).	0.5
2	DRIFTER DRILL CRADLE Inspect the wear plates and shims for excessive wear.	0.5
3	CENTRALIZER Inspect the centralize bushings for excessive wear. Replace defective bushings (para 4-24).	0.3
4	HYDRAULIC HOSES Inspect hydraulic hoses for leaks or other damage. Replace defective hoses (para 4-15).	0.5
5	AIR HOSES Inspect the air hoses for leaks. Tighten loose fittings or replace defective hoses (para 4-18).	0.5
6	HYDRAULIC CONTROL VALVE Inspect the hydraulic control valve for leaks and proper operation.	0.2
7	HYDRAULIC PUMP Inspect hydraulic pump for proper operation and leaks Tighten loose fittings, replace a defective pump (para 4-15)	0.5
8	AIR MOTOR Inspect the air motor for proper operation and leaks. Check the motor exhaust air for presence of atomized oil. Adjust airline lubricator (para 3-20). Replace a defective air motor (para 4-21).	1.3
9	DRILL AND FEED CONTROL VALVE Inspect the drill and feed control valve for leaks and proper operation. Tighten loose connections, replace a defective valve (para 4-18).	0.5
10	DRILL MOTOR Inspect the drill motor for proper operation. Make sure it travels freely on the boom.	0.5
11	FEED CHAIN Check the feed chain for proper tension. Proper tension is a 2 inch deflection between the front and rear sprockets. Adjust as required (para 4-23).	1.2
12	FEED MOTOR Check the feed motor for proper operation. Inspect the gear case for leaks. Report a defective feed motor to direct and general support maintenance.	0.5
13 .	TRAMMING MOTORS Inspect the tramming motors for proper operation and leaks. Report a defective tramming motor to direct support maintenance	0.5
14	FINAL DRIVE Inspect the final drive and drive sprockets for insecure mounting. Tighten or replace hardware as required.	0.5
15	TRANSMISSION BREATHER Refer to LO .53820-241-12 and service the transmission breather.	0.5

Section V. ORGANIZATIONAL MAINTENANCE TROUBLESHOOTING

4-12. General

Refer to paragraph 3-5 introductory information and the purpose of troubleshooting.

4-13. Troubleshooting Table

Table 4-2 lists the organizational maintenance troubleshooting malfunctions, tests or inspection and the recommended corrective action.

Table 4-2. ORGANIZATIONAL MAINTENANCE TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. AIR PRESSURE IS LOW
Step 1. Check for plugged or defective air hose. Replace air hoses (para 4-18).
Step 2. Check for defective air motor. Replace air motor (para 4-21).
2. HYDRALIC PRESSURE IS LOW
Step) 1. Check for defective hydraulic hoses. Replace defective hose (para 4-15).
Step 2. Check for defective hydraulic air pressure regulator. Adjust or replace air regulator (para 4-20).
Step3. Check for defective air motor. Replace air motor (para 4-21).
3. TRAMMING MOTOR FAILS TO OPERATE
Step 1. Check for defective hose leading to tramming controls. Replace a defective hose (para 4-18).
Step2. Check for leak in air lines. Tighten connection or replace hose (para 4-18).
4. DRILL MOTOR IS SLUGGISH OR OPERATES ERRATICALLY
Step 1. Check for broken or ruptured air hose. Replace air hoses (para 4-18).
Step 2. Check for(defective air motor. Replace air motor (para 4-21).
Step 3. Check for proper air regulator adjustment. Adjust the air regulator (para 4-20).
Step 4 Check for defective or binding feed chain. Adjust the feed chain (para 4-23). Replace defective feed chain (para 4-23).
5. HYDRAULIC SYSTEM INOPERATIVE OR HYDRAULIC ACTION IS ERRATIC
Step 1. Check for defective air motor. Replace defective air motor (para 4-21).
Step 2. Check for defective air pressure regulator adjustment. Adjust or replace air pressure regulator (para 4-20).
Step 3 Check for broken or ruptured hydraulic hose. Replace a defective hydraulic hose (para 4-15).
6. BOOM TILT AND SWING ACTION INOPERATIVE
Step 1. Check for defective air motor. Replace defective air motor (para 4-21).
Step 2. Check for ruptured or broken air hose. Replace defective air hoses (para 4-18).
7. DRILL MOTOR FAILS TO TRAVEL ON CARRIAGE OR TRAVELS TOO SLOW'
Step 1 Check for defective air hose. Replace defective air hose (para 4-18).
Step 2 Check for defective air pressure regulator. Adjust or replace air pressure regulator (para 4-20).

Section VI. MAINTENANCE OF THE HYDRAULIC SYSTEM

4-14. General

a. The pneumatic rock (hill is equipped with a close circuit hydraulic system that operates only when hydraulic power is needled. A pressure regulated, vane-type air motor powers a high capacity van type hydraulic pump to supply hydraulic pressure, as required for operating the feed tilt cylinder, boom lift cylinder, feed swing cylinder, boom swing cylinder and feed extension cylinder. The hydraulic cylinders are double acting and self locking when not in use.

b. Individual control levers operate each cylinder independently.

4-15. Hydraulic Hoses and Fittings

CAUTION

Before disconnecting hydraulic hoses, lower the boom and rest it on the ground. When disconnecting hydraulic hoses, loosen the connection and allow the oil to bleed down,

because the hydraulic system is under pressure at all times.

a. General. For identification of the hydraulic lines that connect to the various components of the hydraulic system, refer to figure 1-5.

b. Removal.

(1) Loosen or remove the hydraulic hose boot or support.

(2) If more than one hose is to be removed, tag the hoses so they can be reinstalled in the correct position.

(3) Refer to figure 4-6 for identification and removal of the hydraulic hoses and fittings.

c. Cleaning, Inspection and Repair.

(1) Wipe all parts clean with a cloth dampened with cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

(2) Inspect all fittings and hoses for damaged threads.

(3) Inspect the hoses for cracks, breaks or other damage.

(4) Repair by replacement of defective parts.

d. Installation.

(1) Refer to figure 4-6 and install the hydraulic hoses.

(2) Install the boot (30) and hose supports and remove identification tags.

(3) Refer to LO 5-3820-241-12 and service the hydraulic system.

(5) Operate the rock drill (para 2-5) and check for leaks.

4-16. Hydraulic Pump Shut Off Valve

a. Removal.

(1) Refer to figure 3-4 and release the air pressure from the hydraulic system.

(2) Remove the hydraulic pump shut-off valve as illustrated in figure 4-7.

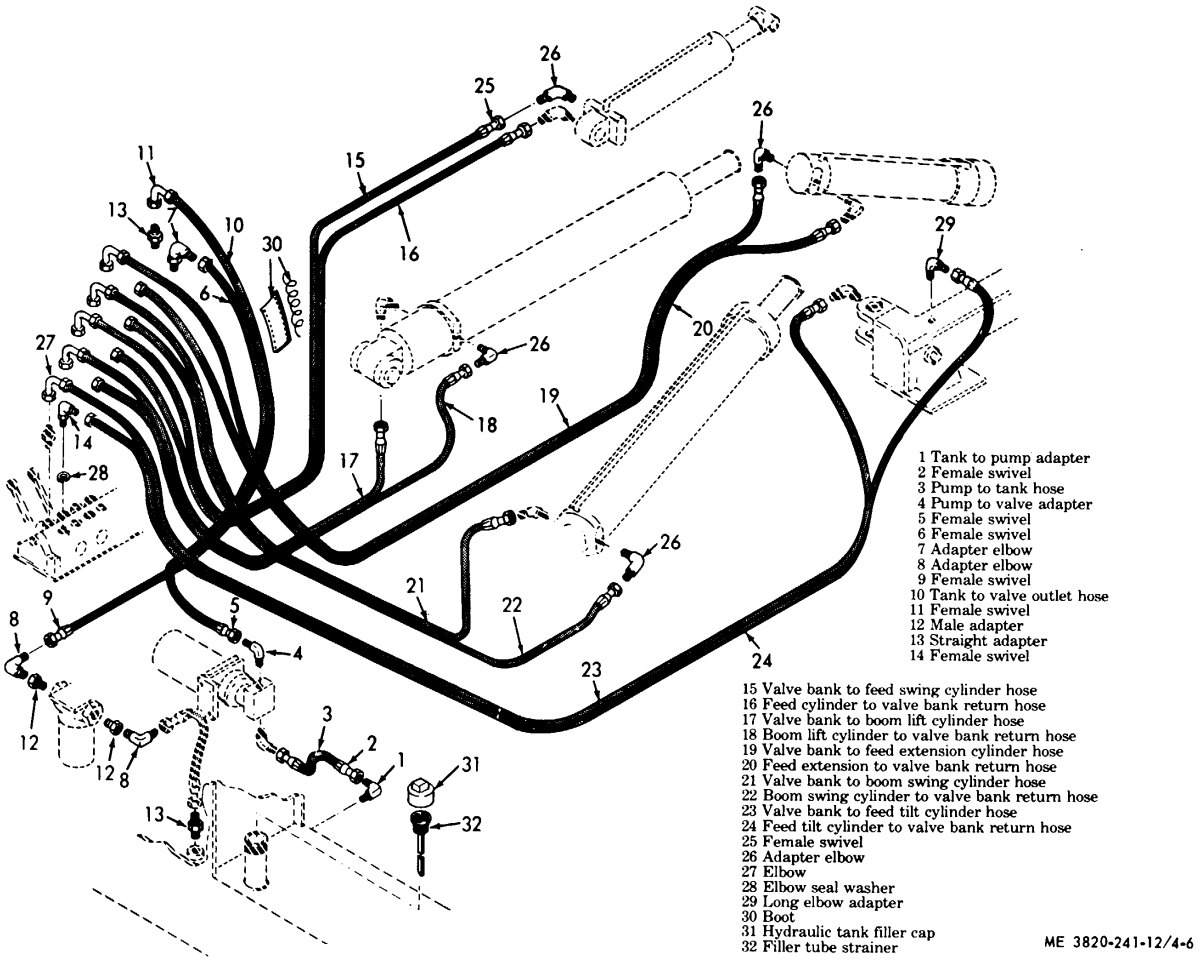


Figure 4-6. Hydraulic hoses and fittings, removal and installation.

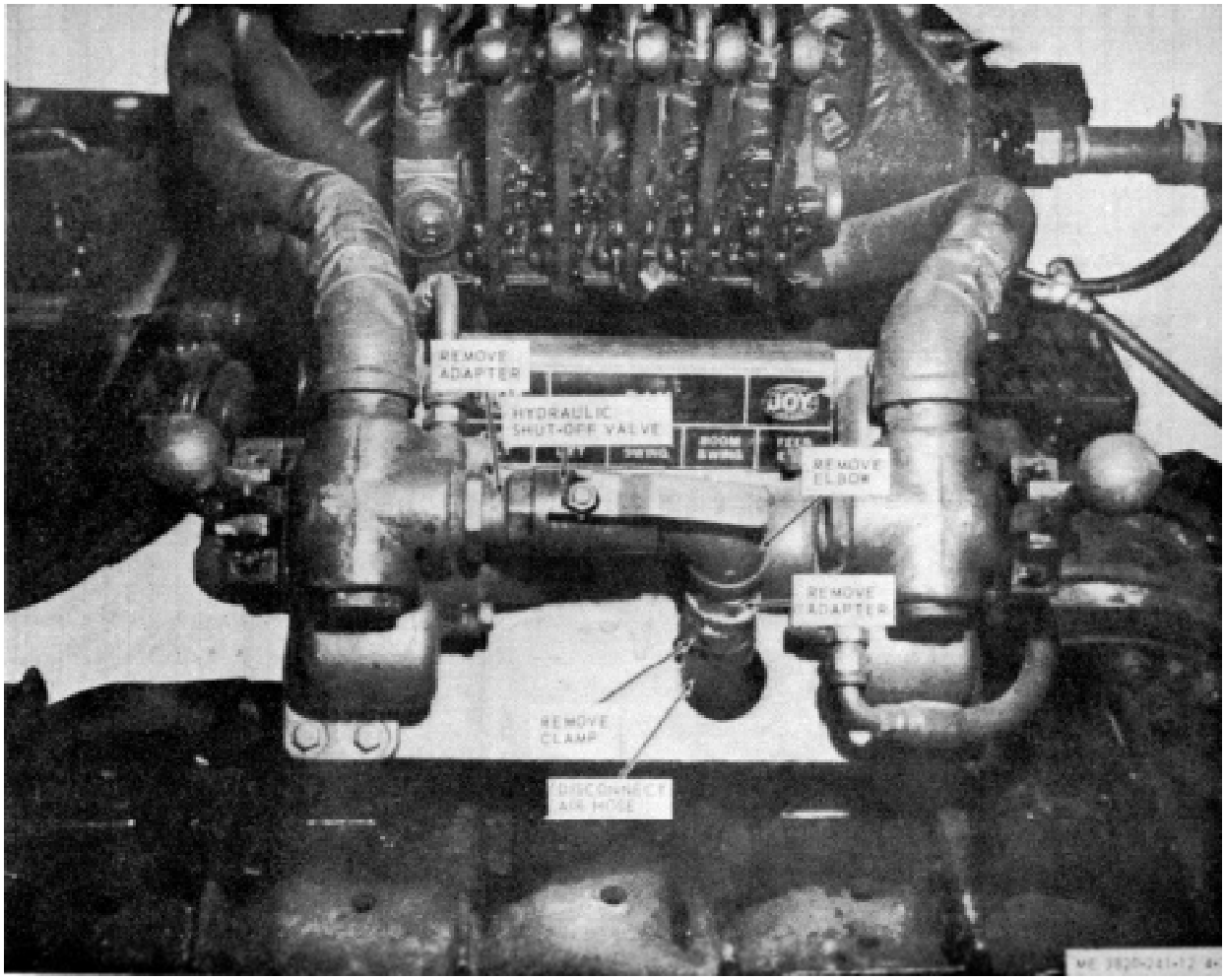


Figure 4-7. Hydraulic pump shut-off valve, removal and installation

b. Cleaning and Inspection.

(1) Clean all parts with cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

(2) Inspect the fittings and valve for thread damage or other defects.

c. Installation.

(1) Install the hydraulic pump shut-off valve as illustrated in figure 4-7.

(2) Operate the rock drill (para 2-5) and check for leaks.

Section VII. MAINTENANCE OF THE PNEUMATIC SYSTEM

4-17. General

The rock drill pneumatic system consists of an air line lubricator, hydraulic pump drive air motor, pressure regulator, two tramming motors, feed motor, drill motor, feed control valve and the necessary hoses and fittings. Refer to figure 1-3 and figure 1-4 for the air system schematic diagram.

4-18. Air Line Hoses and Fittings

a. Removal.

(1) Position the rock drill feed assembly in the horizontal position and block the end of the feed.

(2) Disconnect the main air supply at the lubricator, open the blow handle (fig. 2-1) and release all the air from the system.

(3) Remove the hose manifold as illustrated in figure 4-8.

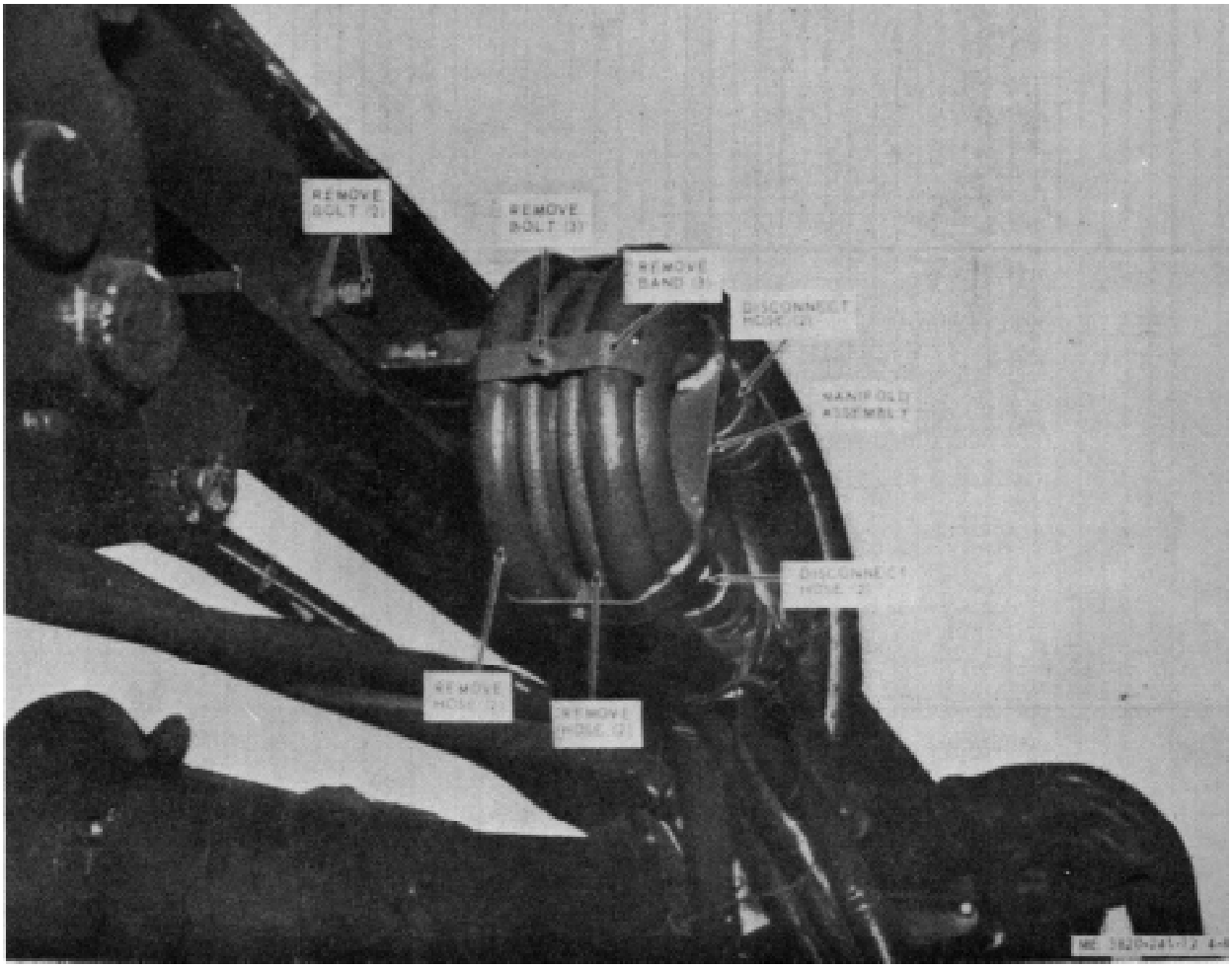


Figure 4-8. Air hose manifold, removal and installation

(4) Refer to figure 4-9, sheets 1 through 4, for air hose identification. Tag and disconnect hoses and fittings as required and remove defective hoses.

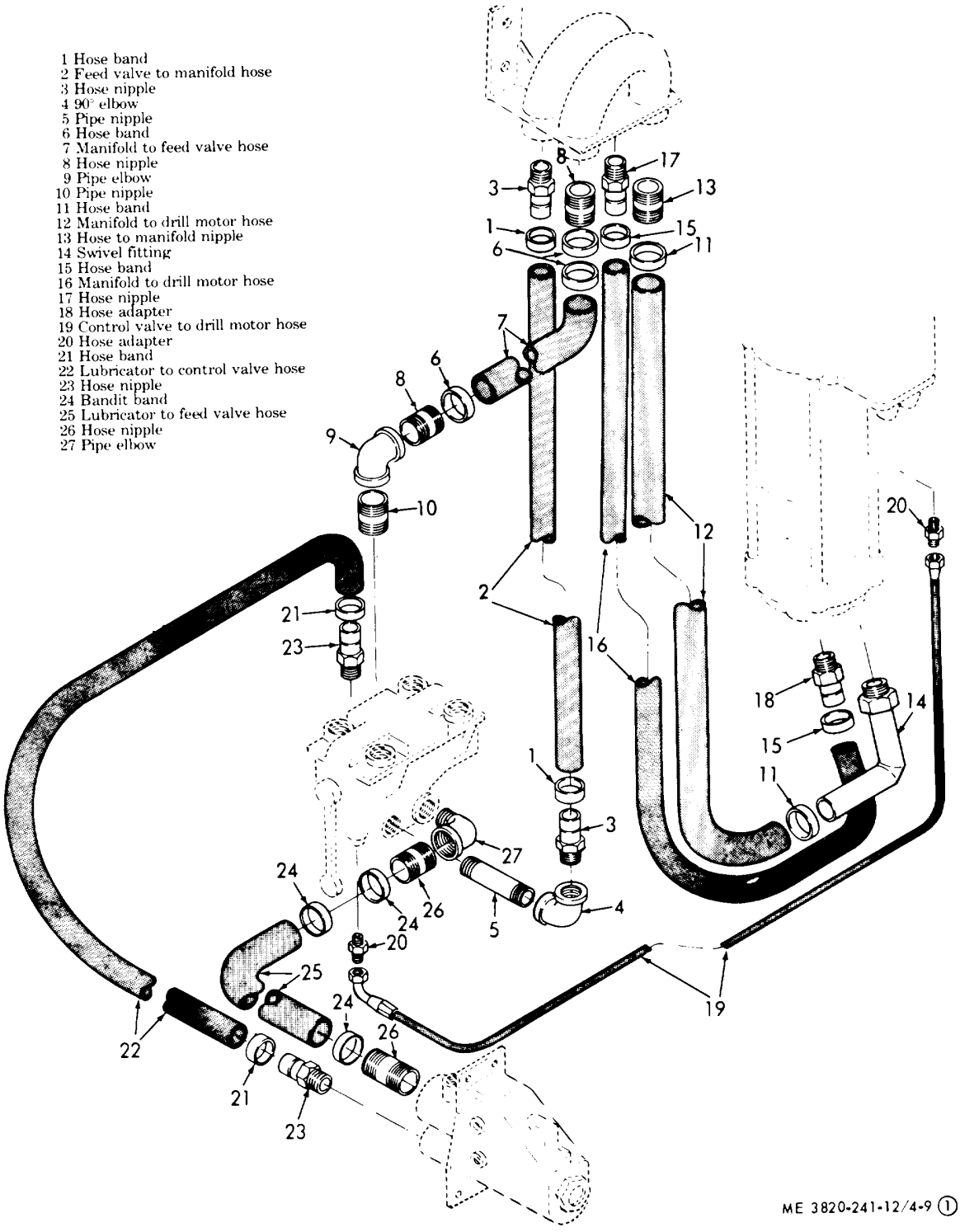


Figure 4-9. Rock drill pneumatic hoses and fittings, removal and installation (sheet 1 of 4).

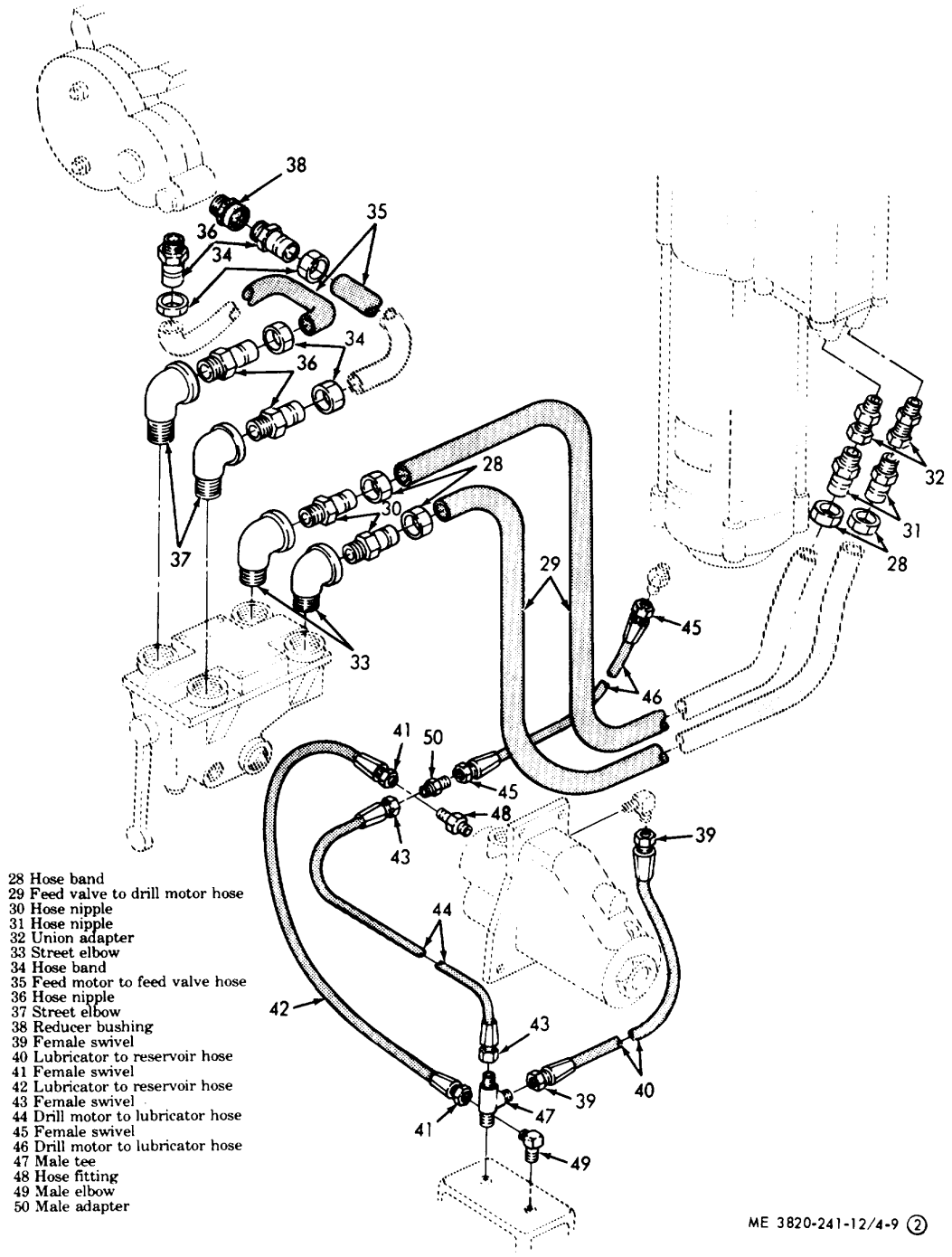


Figure 4-9. Rock drill pneumatic hoses and fittings, removal and installation (sheet 2 of 4).

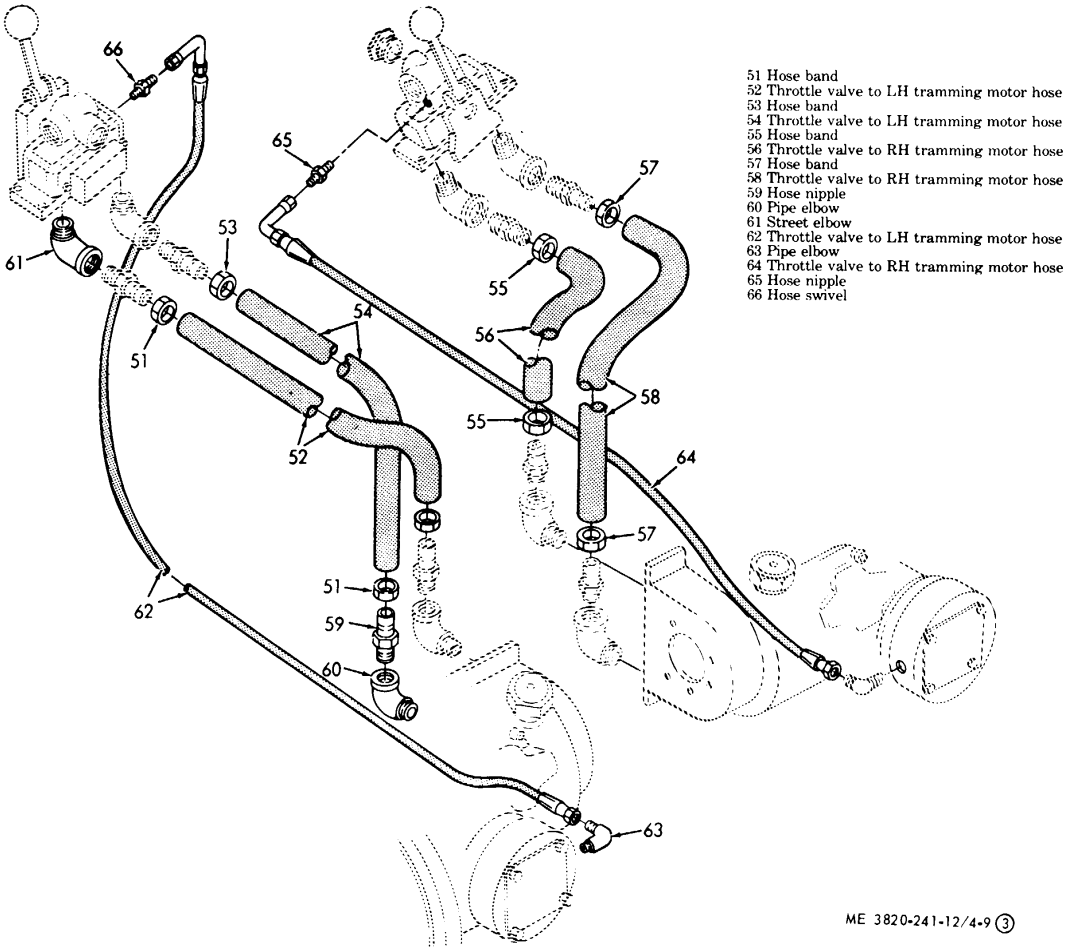


Figure 4-9. Rock drill pneumatic hoses and fittings, removal and installation (sheet 3 of 4).

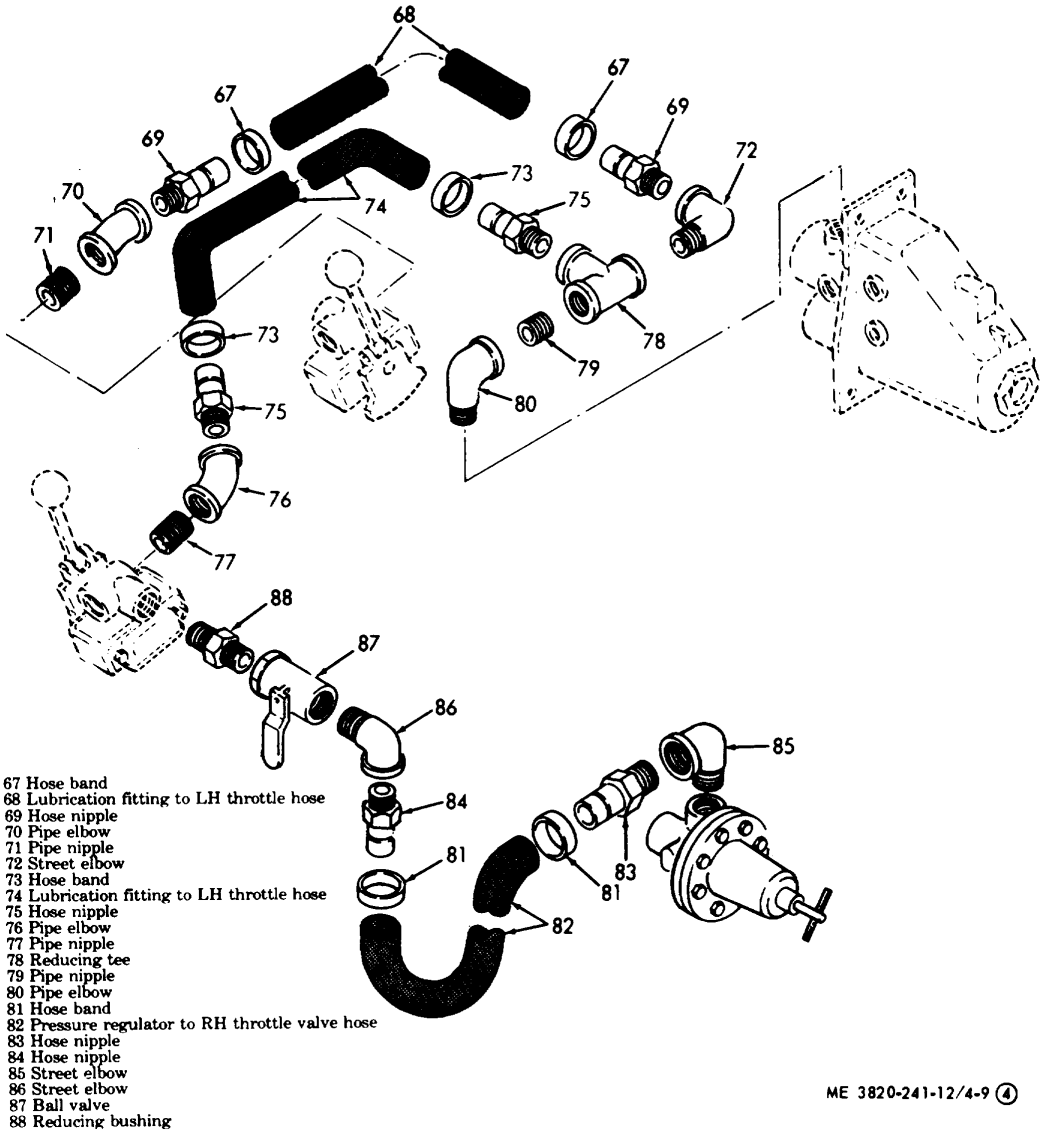


Figure 4-9. Rock drill pneumatic hoses and fittings, removal and installation (sheet 4 of 4).

b. Cleaning and Inspection.

(1) Wipe all hoses clean with a cloth dampened with cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

(2) Wash remaining metal parts in same solvent and dry thoroughly.

(3) Inspect all fittings for damaged threads.

(4) Discard and replace all hose clamps.

(5) Inspect hoses for cracks, breaks or other damage.

(6) Replace all defective parts.

c. Installation.

(1) Refer to figures 1-3 and 1-4 for hose identification and install the pneumatic hoses as illustrated in figure 4-9.

(2) Install the hose manifold as illustrated in figure 4-8.

(3) Operate the equipment (para 2-5) and check for leaks.

4-19. Air Line Lubricator

a. Service.

(1) Reach under the upper main frame assembly and remove band (21, fig. 4-9), disconnect hose (22) and remove nipple (23).

(2) Service the air line lubricator as illustrated in figure 4-10.

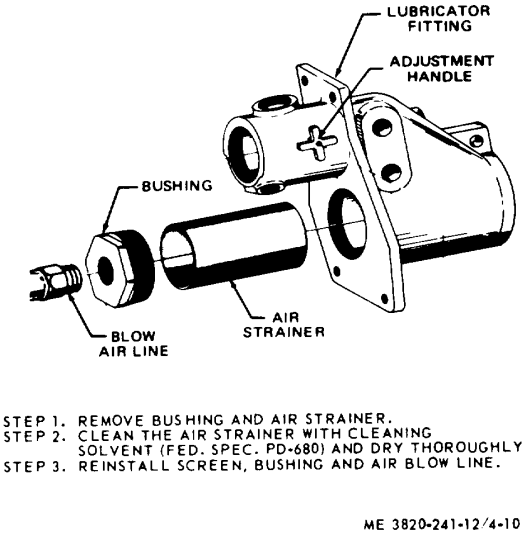


Figure 4-10. Air line lubricator fitting service.

(3) Reinstall nipple (23, fig. 4-9), hose (22) and secure with band (23).

b. Removal.

(1) Reach under the upper main frame assembly, remove hose bands (21, 24, 67, and 63, fig. 4-9) and disconnect hoses (22, 25, 39 and 41).

(2) Remove nipple (69), elbow (72), nipple (75), tee (78), nipple (79) and elbow (80).

(3) Remove the air line lubricator as illustrated in figure 4-11.

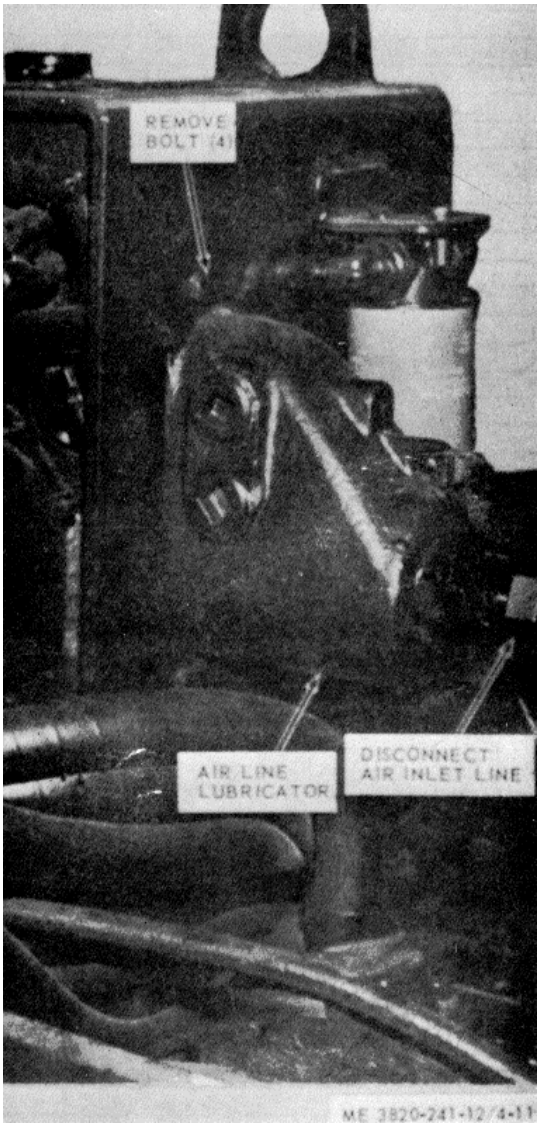


Figure 4-11. Air line lubricator, removal and installation

c. Cleaning and Inspection.

(1) Wash all parts with cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

(2) Inspect all pipe fittings for damaged threads.

(3) Inspect the air strainer for tears or other damage.

(4) Replace all defective parts.

d. Installation.

(1) Install the air line lubricator as illustrated in figure 4-11.

(2) Install elbow (80, fig. 4-9), nipple (79), tee (78), nipple (75), elbow (72), and nipple (69).

(3) Connect hoses (22, 25, 34 and 41) and secure with clamps (21, 24, 63 and 67).

4-20. Air Pressure Regulator

a. Removal

(1) Disconnect the main air supply at the lubricator, open the blow handle (fig. 2-1) an(l release all the air from the system.

(2) Remove the air pressure regulator as illustrated in figure 4-12.

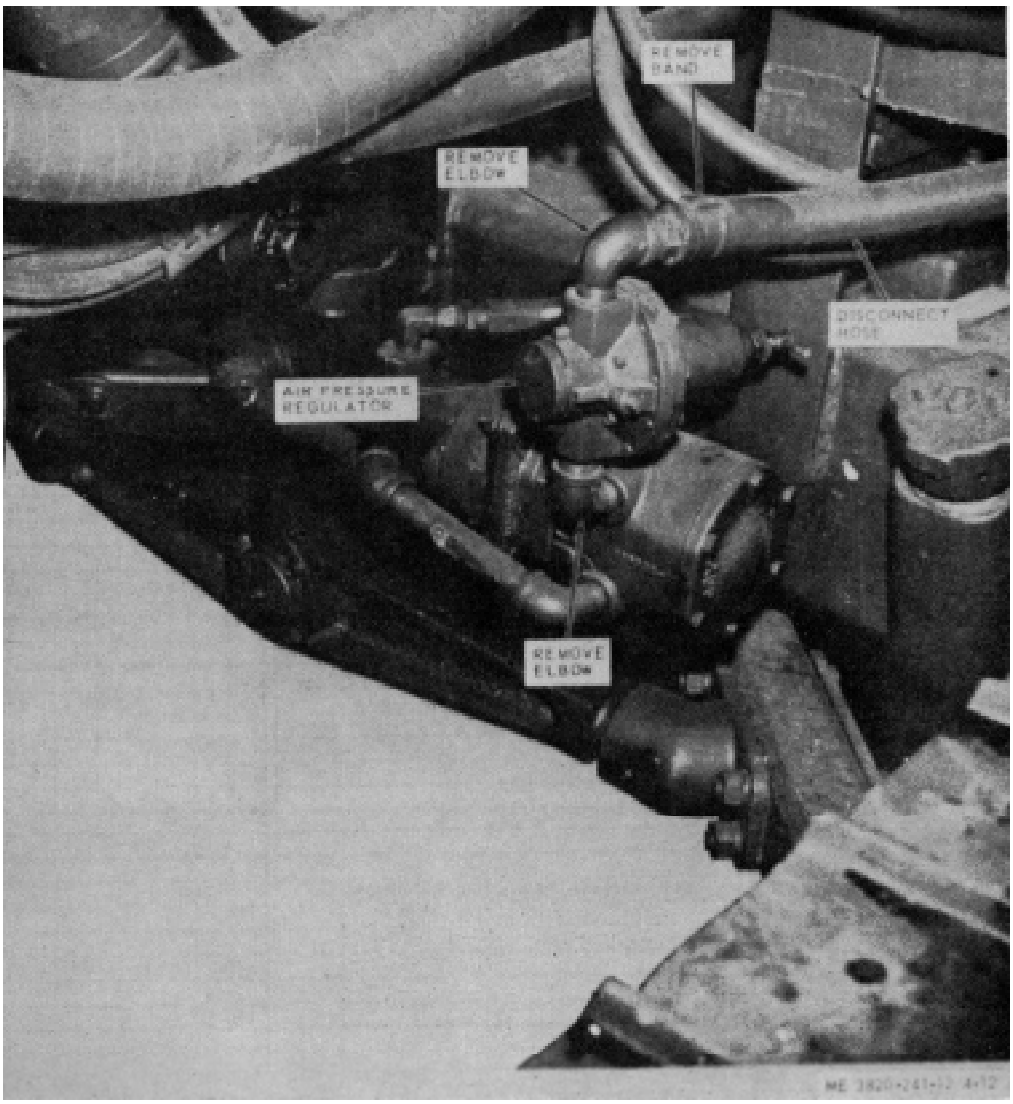


Figure 4-12. Air pressure regulator, removal and installation.

b. Cleaning and Inspection.

(1) Wash all parts with cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

(2) Inspect all pipe fittings and threaded areas for damage.

(3) Replace a defective air regulator.

c. Installation.

(1) Install the air regulator as illustrated in figure 4-12.

(2) Operate the rock drill (para 2-5) and check for leaks.

(3) Adjust the air regulator (para 3-13).

4-21. Air Motor

a. Removal. Remove the air motor as illustrated in figure 4-13.

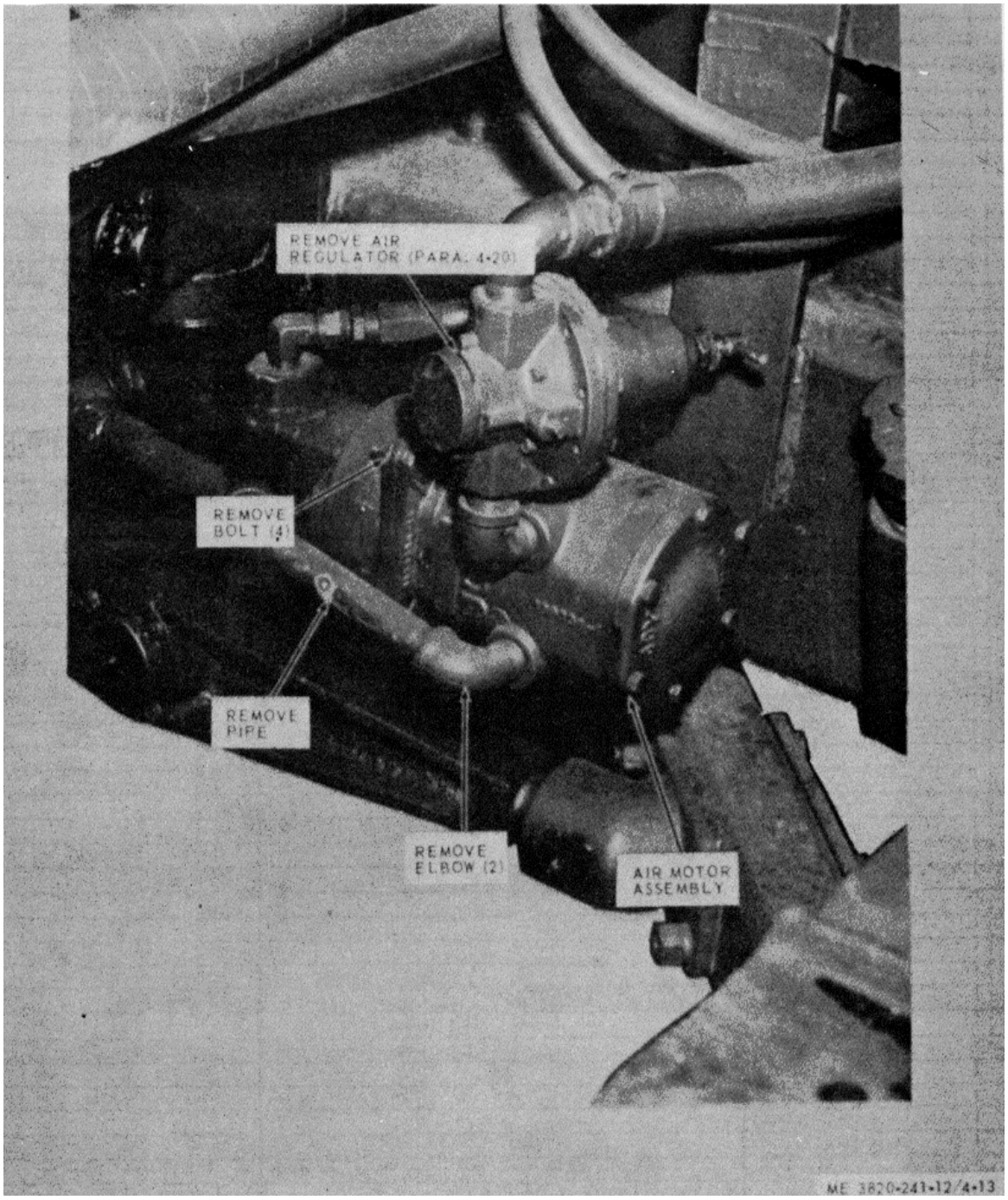


Figure 4-13. Air motor, removal and installation.

b. Cleaning and Inspection.

(1) Wash the exterior of the air motor with cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

(2) Replace a defective air motor.

c. installation.

(1) Install the air motor as illustrated in figure 4-13.

(2) Operate the rock drill (para 2-5) and check for leaks.

Section VIII. MAINTENANCE OF THE FEED MECHANISM AND CENTRALIZER

4-22. General

a. Feed Chain. The feed chain assembly built as part of the tower is operated by a high torque Pistonair motor-, driven by a worm gear transmission. A single bolt chain adjuster is provided for tightening the feed chain.

b. Centralizer. The centralizer is a ruggedly built cast steel construction which locks and holds the drill steel securely while drilling and pulling steel. Horizontally hinged centralizer arms open and close around the drill steel to pass couplings through the centralizer.

4-23. Feed Chain

a. Removal.

(1) Place the boom assembly in the horizontal position.

(2) Remove the feed chain as illustrated in figure 4-14.

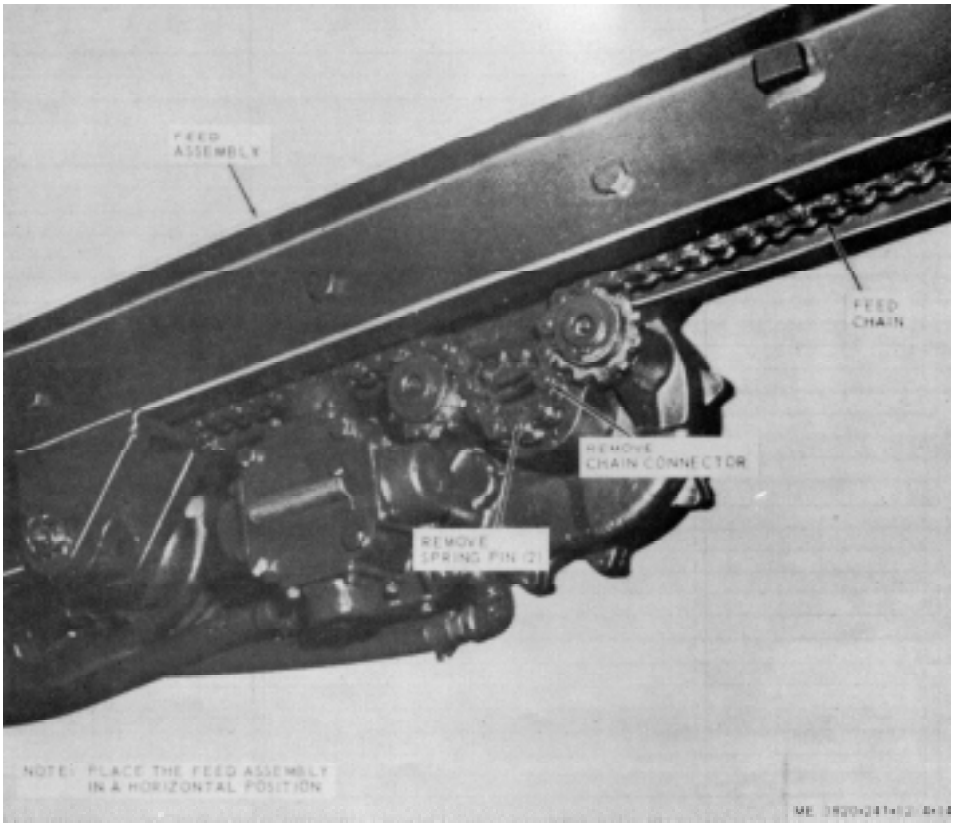


Figure 4-14. Feed chain, removal and installation.

b. Cleaning and Inspection.

(1) Wash the feed chain with cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

(2) Inspect each link for excessive wear or other damage.

(3) Replace defective links. Replace the feed chain assembly if all links show excessive wear.

c. Installation.

(1) Loop the feed chain around the upper and lower sprockets, over and around the sprockets on the feed transmission and install the feed chain as illustrated in figure 4-14.

(2) Refer to LO 5-3820-241-12 and lubricate the feed chain and sprockets.

(3) Adjust the feed chain, paragraph d below.

d. Feed Chain Adjustment.

(1) Refer to paragraph 2-9 and position the feed mechanism in the horizontal position.

(2) Adjust the feed chain as illustrated in figure 4-15.

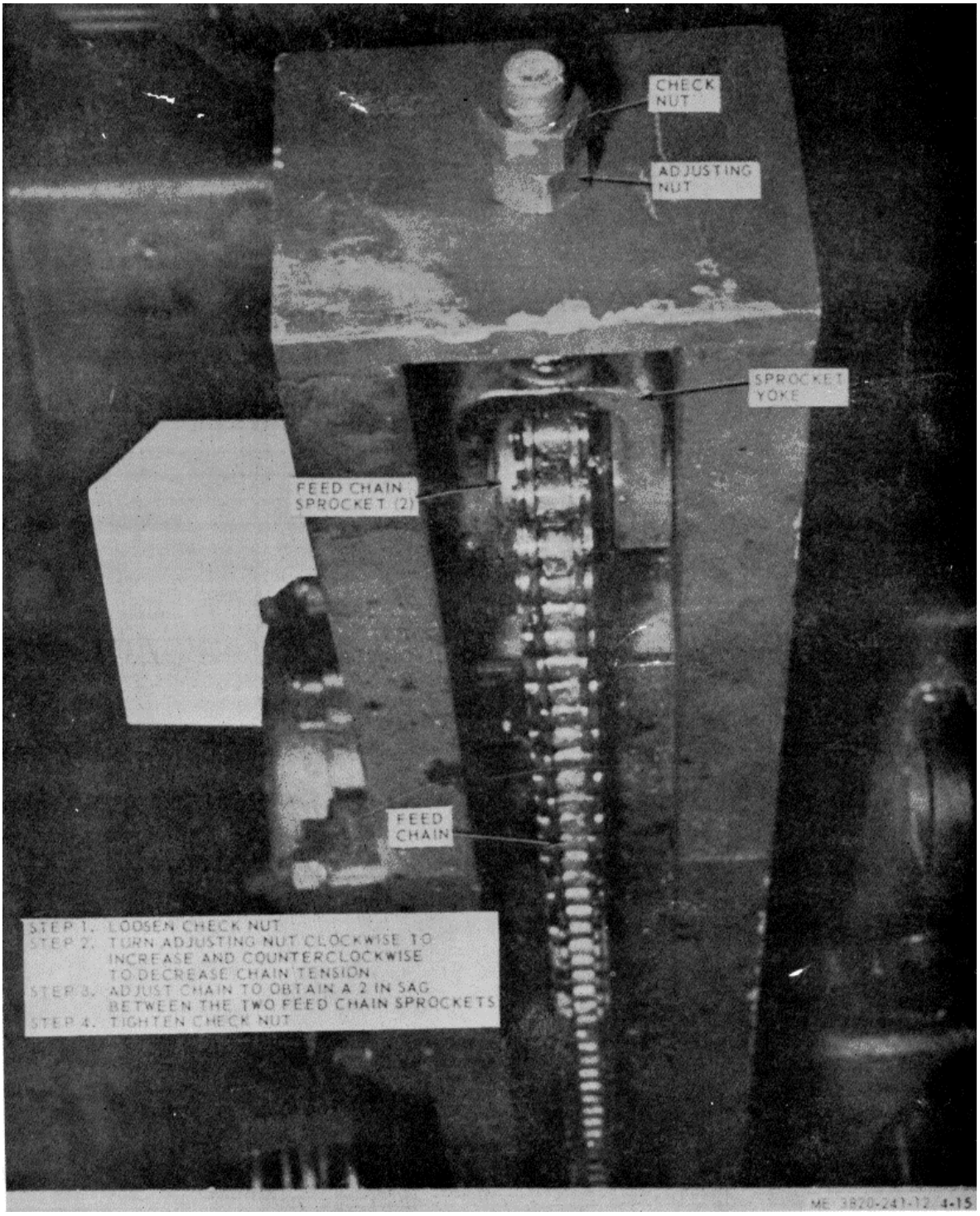


Figure 4-15. Feed chain adjustment.

4-24. Centralizer

a. Removal. Remove the centralizer as illustrated in figure 4-16.

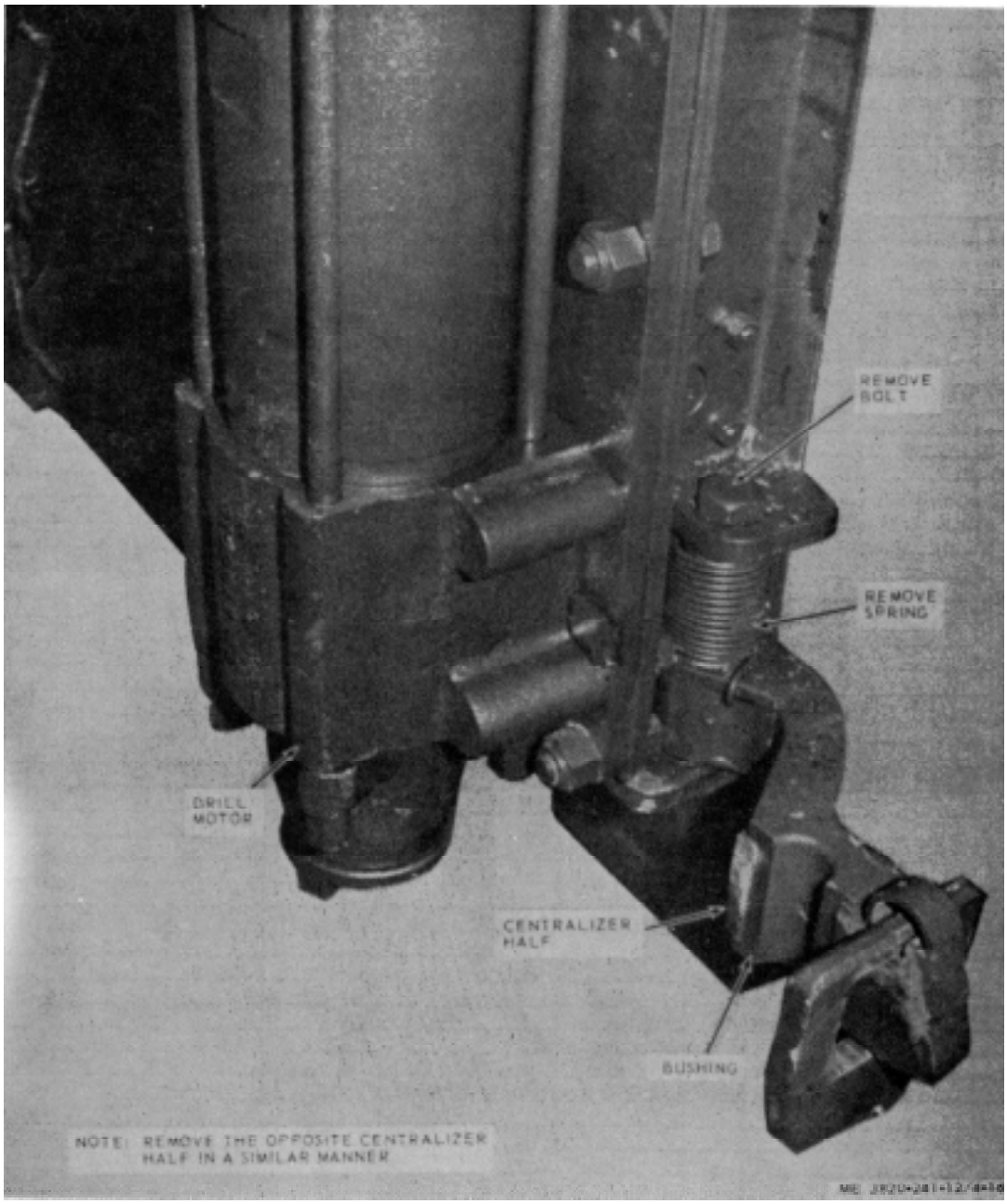


Figure 4-16. Centralizer, removal and installation.

b. Cleaning and Inspection.

(1) Wash all parts with cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

(2) Inspect the centralizer for cracks, breaks or excessive wear.

(3) Replace a defective centralizer.

c. Installation. Install the centralizer as illustrated in figure 4-16.

Section IX. MAINTENANCE OF THE ROCK DRILL FRAME

4-25. General

The heavy weight rock drill is designed and built to move easily over the roughest terrain while towing its power unit, the air compressor. Organizational maintenance of the frame is limited to removal and installation of the towing pintle.

4-26. Towing Pintle

a. Removal. Remove the towing pintle as illustrated in figure 4-17.

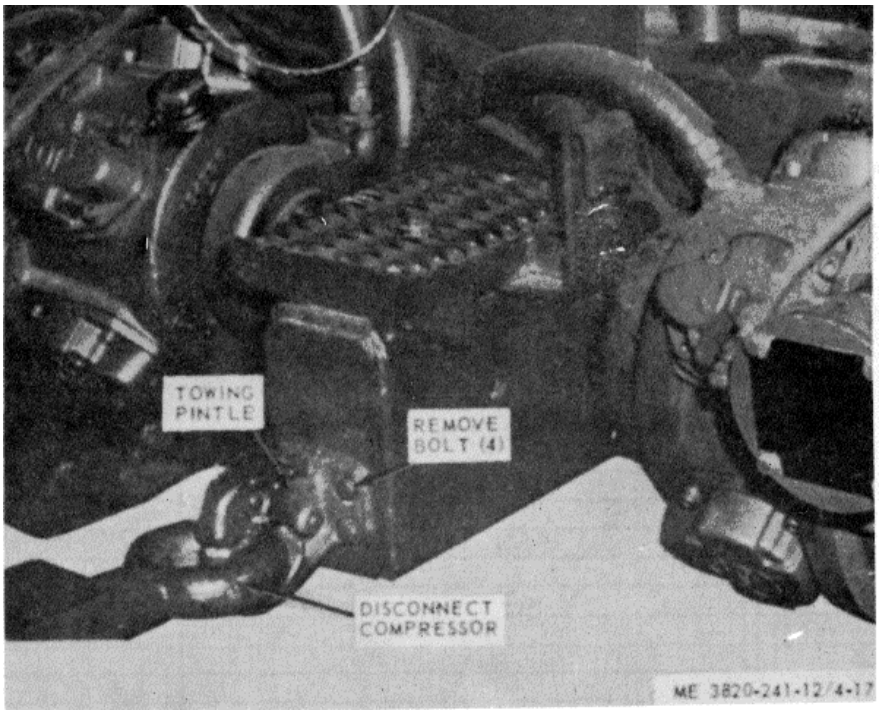


Figure 4-17. Towing pintle, removal and installation.

b. Cleaning and Inspection.

(1) Wash all parts with cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

(2) Inspect the towing pintle for cracks, breaks or excessive wear.

(3) Replace a defective towing pintle.

c. Installation. Install the towing pintle as illustrated in figure 4-17.

APPENDIX A
REFERENCES

A-1. Fire Protection

TB 5420()-200-1()	Hand Portable Fire Extinguishers Approved for Army Use

A-2. Lubrication

C9100-IL	Fuels, Lubricants, Oils and Waxes
LO 5-3820-241-12	Lubricants, Order, Drill, Pneumatic, Drifter: Self-Propelled, Joy Model RAM-MS-5/450 A-DR

A-3. Painting

TM 9-213	Painting Instructions for Field Use

A-4. Maintenance

TM 38-750	The Army Maintenance Management System
TM 5-3820-241-20P	Organizational Maintenance Repair Parts and Special Tools List, Drill, Pneumatic, Drifter: Boom-Type: Crawler Mounted; Self-Propelled, Joy Model RAM-MS-5/450A-DR

A-5. Shipment and Storage

TB 740-97-2	Preservation of USAMECOM Mechanical Equipment for Storage
TM 740-90-1	Administrative Storage of Equipment

A-6. Demolition

TM 750-244-3	Destruction of Equipment to Prevent Enemy Use

APPENDIX B
MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component and the work measurement time required to perform the functions by the designated maintenance level. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III (Not applicable).

d. Section IV (Not applicable).

B-2. Explanation of Columns in Section II

a. Column (1), Group Number. A number is assigned to each group in a top down breakdown sequence. The applicable groups are listed in the MAC in disassembly sequence beginning with the first group removed.

b. Column (2), Assembly Group. This column contains a brief description of the components of each numerical group.

c. Column (3), Maintenance Functions. This column lists the various maintenance functions (A through K).The lowest maintenance level authorized to perform these functions is indicated by a symbol in the appropriate column. Work measurement time standards (the active repair time required to perform the maintenance function) are shown directly below the symbol identifying the maintenance level. The symbol designations for the various maintenance levels as follows:

C - Operator or crew
O - Organizational maintenance
F - Direct support maintenance
H - General support maintenance
D - Depot maintenance

The maintenance functions are defined as follows:

A- Inspect: To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards through examination.

B-Test: To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

C - Service: Operations required periodically to keep an item in proper operating condition, i.e., to clean, to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

D - Adjust: To maintain within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

E - Aline: To adjust specified variable elements of an item to bring about optimum or desired performance.

F--Calibrate: To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipment's used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

G--Install: The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

H - Replace: The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

I - Repair: The application of maintenance services (inspect, test, service, adjust, align, calibrate, or replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

J - Overhaul: That maintenance effort (service/ action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publication. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

K - Rebuild: Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurement (hours/miles, etc.) considered in classifying Army

equipment/components.

d. Column (4), Tools and Equipment. This column is provided for referencing by code the special tools and test equipment (sec III) required to perform the maintenance functions (sec II).

e. Colul4nRl (5) Remarks. This column is provided for referencing by code the remarks (sec IV) pertinent to the maintenance functions.

SECTION II. MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Functional Group	(3) Maintenance functions A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	(4) Tools and equipment	(5) Remarks
01	DRIFTER,DRILL MOTOR	..	C	..	..	..	..	..	F	F	F			
			05	..	..	..	..	..	2.0	3.0	3.5			
	Metering Valve	..	..	..	C									
					0.5									
02	HYDRAULIC LINES, HOSES,	C	..	..	..	..	..	..	O	F				
	AND FITTINGS	.01	..	..	..	..	..	..	.03	.05				
03	AIR HOSE,LINES,AND	O	..	..	..	..	..	..	O	F				
	FITTINGS	.01	..	..	..	..	..	..	.02	.05				
04	HYDRAULIC CYLINDERS													
	Boom Swing Cylinder	C	..	..	..	..	..	..	F	..	.	F		
		.01	..	..	..	..	..	..	5.0	..	..	4.0		
	Lift Cylinder	C	..	..	..	..	..	..	F	..	..	F		
		.01	..	..	..	..	..	..	5.0	..	..	4.0		
	Feed Swing Cylinder	C	..	..	..	..	..	..	F	..	..	F		
		.01	..	..	..	..	..	..	5.0	..	..	4.0		
	Tilt Cylinder	C	..	..	..	...	..	..	F	,.	..	F		
		.01	..	..	..	..	..	..	5.0	..	..	4.0		
	Extension Cylinder	C	..	..	..	..	..	..	F	..	..	F		
		.01	..	..	..	..	..	..	5.0	..	..	4.0		
05	ROTATION AND CONTROL VALVES													
	Drill and Feed Control	C	O	..	.	..	..	F	F	F				
	Valve Assembly	0.5	0.3	..	..	..	..	1.0	2.0	4.0				
	Hydraulic Control Valve	C	O	..	..	..	.	F	F	F				
	Assembly	0.5	0.3	..	..	..	.	1.0	2.0	4.0				
	Tramming Motor Throttle	C	o	..	..	..	..	F	F	F				
	Valve Assembly	0.5	0.3	..	..	..	..	1.0	2.0	4.0				
06	HYDRAULIC PUMP AND MOTOR AND OIL INJECTOR													
	Pump, Hydraulic	O	F	..	..	..	..	F	F	F				
		0.2	.01	..	..	..	..	1.0	3.0	3.5				
	Coupling Hydraulic Pump	O	F	..	..	..	..	F	F	F				
		0.2	.01	.	..	..	..	1.0	3.0	3.5				
	Motor, Air Hydraulic	F	..	..	..	..	..	..	O	F	F			
	Pump	.01	..	..	..	..	..	..	1.0	2.0	2.5			
	Injector, Oiler	O	..	O	C	..	..	..	O					
		.01	,.	.02	.01	..	..	..	.02					
	Hydraulic Pressure Regulator	..	..	C	..	..	..	..	F					
		..	..	0.5	..	..	..	..	1.0					
07	FEED TRANSMISSION AND MOTOR													
	Feed Transmission Assembly	F	..	C	..	..	..	..	F	F				
		0.1	..	.01	..	..	..	..	2.0	3.0				
	Feed Motor	F	..	..	..	..	..	..	F	F	F			
		0.1	..	..	..	..	..	..	2.0	3.0	4.0			
08	CRADLE,CHAIN,GUIDE AND RELATED PARTS													
	Manifold, Air Hose	..	..	..	..	..	..	O						
						1.0								
	Cradle Assembly	..	..	..	..	..	..	F	F					
							16.0	24.0						
	Chain	C	..	..	O	..	..	..	O	O				
		0.1	..	..	0.5	.	..	..	1.5	2.0				
	Chain, Guide and Related	O	..	O	O	..	..	..	F	F				
	Parts	0.1	..	0.1	0.2	..	..	..	1.0	.05				

SECTION II. MAINTENANCE ALLOCATION CHART

(1) Group No.	(2) Functional Group	(3) Maintenance functions A Inspect	B Test	C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	(4) Tools and equipment	(5) Remarks
08	CRADLE,CHAIN GUIDE AND RELATED PARTS (Con'd)													
	Centralizer	O 0.1	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	O 1.5					
09	BOOM TILT AND SWING COMPONENTS													
	Tilt and Swing Components	F .02	O .02	O .02	.. ..	.. ..	.. ..	.. .	F 6.0	F 8.0				
	Boom and Components	F 0.1	.. ..	O ..	.. ..	.. ..	.. 3.0	.. 8.0	f	h				
10	TRAMMING MOTOR FRAME AND CRAWLER COMPONENTS													
	Tramming Motor	F 0.3	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	F ..	F 8.0	F 12.0	16.0		
	Brake	.. ..	.. ..	.. ..	C 1.0									
	Crawler Drive	C .02	.. ..	O .05	.. ..	.. ..	.. ..	. ..	F 5.0	F 6.0	F 8.0			
	Frame Components	C .01	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	F 3.0	F 4.0				
	Crawler Track Assembly	C .01	.. ..	C .03	C .05	.. ..	.. ..	.. ..	F 1.5	F 2.0	F 16.0			
	Side Frame Assembly	C .02	.. .	.. ..	.. ..	.. ..	.. ..	.. .	F .	F 3.0	 4.0			
	Reservoir	.. .02	.. ..	C ..										
	Oil Filter	.. ..	.. ..	C 0.5	.. .	.. ..	.. ..	.. ..	O 1.0					
	Hitch, Towing	..	..	..	..	..	..	..	O 0.5					

Section III. SPECIAL TOOL AND SPECIAL TEST EQUIPMENT REQUIREMENTS

Reference Code	Maintenance level	Nomenclature	Tool number
		No special tools or test equipment required.	

Section IV. REMARKS

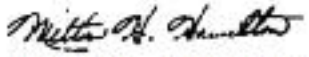
Reference code	Remarks
	Not Applicable

ALPHABETICAL INDEX

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:



MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
01889

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TEAR ALONG PERFORATED LINE

THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'VEIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

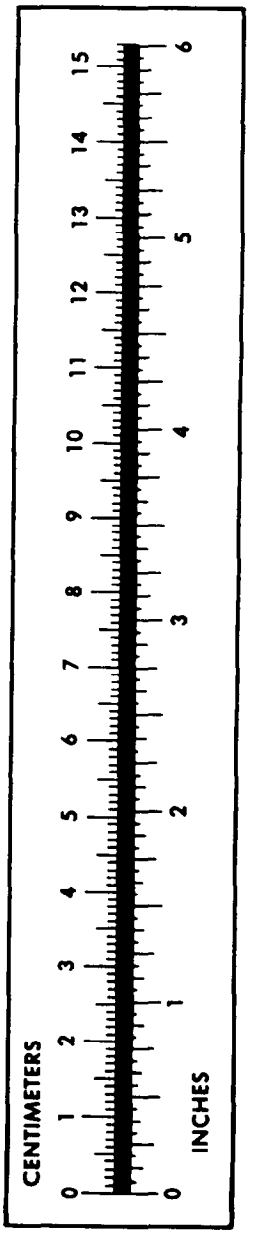
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
lometers per Liter	Miles per Gallon	2.354
meters per Hour	Miles per Hour	0.621



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