DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

COMPRESSOR, ROTARY AIR; DIESEL ENGINE DRIVEN; 250 CFM, 100 PSI; TRAILER MOUNTED, TWO WHEEL (DAVEY MODEL 14M250RPV)

FSN 4310-256-9319

COMPONENT OF PNEUMATIC TOOL AND COMPRESSOR OUTFIT,

FSN 3820-950-8584

HEADQUARTERS, DEPARTMENT OF THE ARMY

JUNE 1972

WARNING

The lifting device used must be capable of lifting a minimum of 6 tons.

To prevent serious burns when filling batteries, take precautions against spilling electrolyte on clothing or allowing electrolyte to come in contact with skin or eyes. Use rubber gloves.

Do not operate air compressor unit in a building or any enclosed area unless exhaust gases are piped outside.

Do not operate cold weather starting aid at temperatures above 40° F. Do not puncture or mishandle fuel cylinder. The cylinder contains an ether base mixture which is extremely toxic, volatile, and combustible.
Use extreme care when handling fuel. Do not allow an open flame or smoking near fuel.

Disconnect battery terminals before removing cables and leads.

Always place injector in the proper position in relation to the spray deflector before it is tested to prevent the fuel spray from penetrating the skin. Fuel oil which enters the blood stream can cause serious infection.

Do not remove oil level gage or oil fill plug with air pressure in separator. Open service valves or actuate separator safety valve to relieve separator air pressure.

CHANGE

NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *24 August 1991*

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

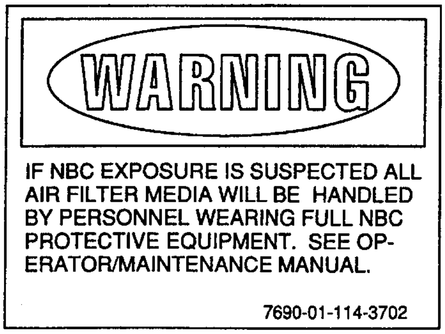
COMPRESSOR, ROTARY, AIR; DIESEL ENGINE DRIVEN; 250 CFM, 100 PSI; TRAILER MOUNTED, TWO WHEEL (DAVEY MODEL 14M250RPV) NSN 4310-00-256-9319 COMPONENT OF PNEUMATIC TOOL AND COMPRESSOR OUTFIT, NSN 3820-00-950-8584

TM 5-4310-345-14, 5 June 1972, is changed as follows:

The *title* and *cover* are changed to read as shown above.

Page 2-12, the following paragraph is added after **Section IV. "OPERATION UNDER USUAL CONDITIONS."**

A decal has been developed that warns of NBC exposure. It is to be positioned in a noticeable place on or near the air cleaner or air filter housing. You may order the decal using part number 12296626, CAGEC 19207. Refer to TB 43-0219 for further information. Add the decal to the air cleaner *(page 3-14, figure 3-11 ,page 4-14, figure 4-8, page 4-60, figure 4-28, page 4-61, figure 4-29* and on *page 4-77, figure* 4-43).



Add the following WARNING to the following locations;

inside front cover, after the list of WARNINGS;

page 1-5, preceding *(g), "Engine air cleaner";*

page 2-17, preceding paragraph 2-14 and preceding paragraph 2-15;

page 3-14, after paragraph 3-15, "Air Cleaner Service":

page 3-20, Table 3-2, after malfunction 2, preceding g,"Engine air cleaner dirty or clogged" and after malfunction 4, preceding *a,* "Engine air cleaner clogged";

page 3-21, after malfunction 9, "Engine exhaust excessively black or gray";

page 3-22, after malfunction 17, preceding *a,* "Defective engine air cleaner";

page 3-23, after malfunction 20, preceding *a,* "Compressor air cleaner dirty or clogged";

page 4-14, after paragraph 4-18, "Air Cleaner Service";

page 4-19, table 4-2, after malfunction 4, preceding e, "Restricted air cleaner";

page 4-20, table 4-2, after malfunction 6, preceding *g,* "Restricted air cleaner" and after malfunction 8, preceding *i,* "Restricted air cleaner";

page 4-60, figure 4-28, preceding step 1 of removal;

page 4-61, figure 4-29, preceding step 1 of removal and preceding step 1 of installation;

page 4-65, preceding (7), "Install engine and compressor air cleaner assemblies";

page 4-75, after Section XIV. MAINTENANCE OF AIR COMPRESSOR SYSTEM;

page 4-76, after paragraph 4-71, "Compressor Air Cleaner Assembly";

page 5-12, paragraph 5-8 *a.* preceding (6) "Remove engine and compressor air cleaner assemblies";

page 6-12, paragraph 6-10 c. *Reassembly,* preceding (4);

page B-3, preceding 0304, "Air Cleaner":

WARNING

If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal instructions.

By Order of the Secretary of the Army:

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

Official:

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

Distribution:

*** U.S. GOVERNMENT PRINTING OFFICE 1991 – 5 4 3- 0 2 5 4 0 0 9 3**

PIN: 026843-0

Change No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C., 11 *May* 1973

Operator, Organizational, Direct Support and General Support Maintenance Manual COMPRESSOR, ROTARY, AIR; DIESEL ENGINE DRIVEN; 250 CFM, 100 PSI: TRAILER MOUNTED, TWO WHEEL (DAVEY MODEL 14 M250RPV) FSN 4310-256-9319 COMPONENT OF PNEUMATIC TOOL AND COMPRESSOR OUTFIT, FSN 3820-950-8584

TM 5-4310-345-14, 5 June 1972, is changed as follows:

Inside cover page, WARNING, add WARNING as follows:

Change oil separator element every four thousand hours. Destroy used element to prevent accidental re-use. Over pollution of metal salts collecting on the separator element can become a hazardous condition by lowering the flash point and causing a fire in the separator.

Page iv. Add to List of ILLUSTRATIONS as follows:

Page 1-4.. Add to paragraph 1-8. b.(1) serial numbers as follows

Serial numbers . . . . . . .9 P155-18891 through 9P155-19040

Page 1-4. Add to paragraph 1-8b. (3) (a) part number and type as follows:

Part Number . . . .-...1114717
(Applicable to units with serial numbers 9P1 55-18891 through 9P155-19040)

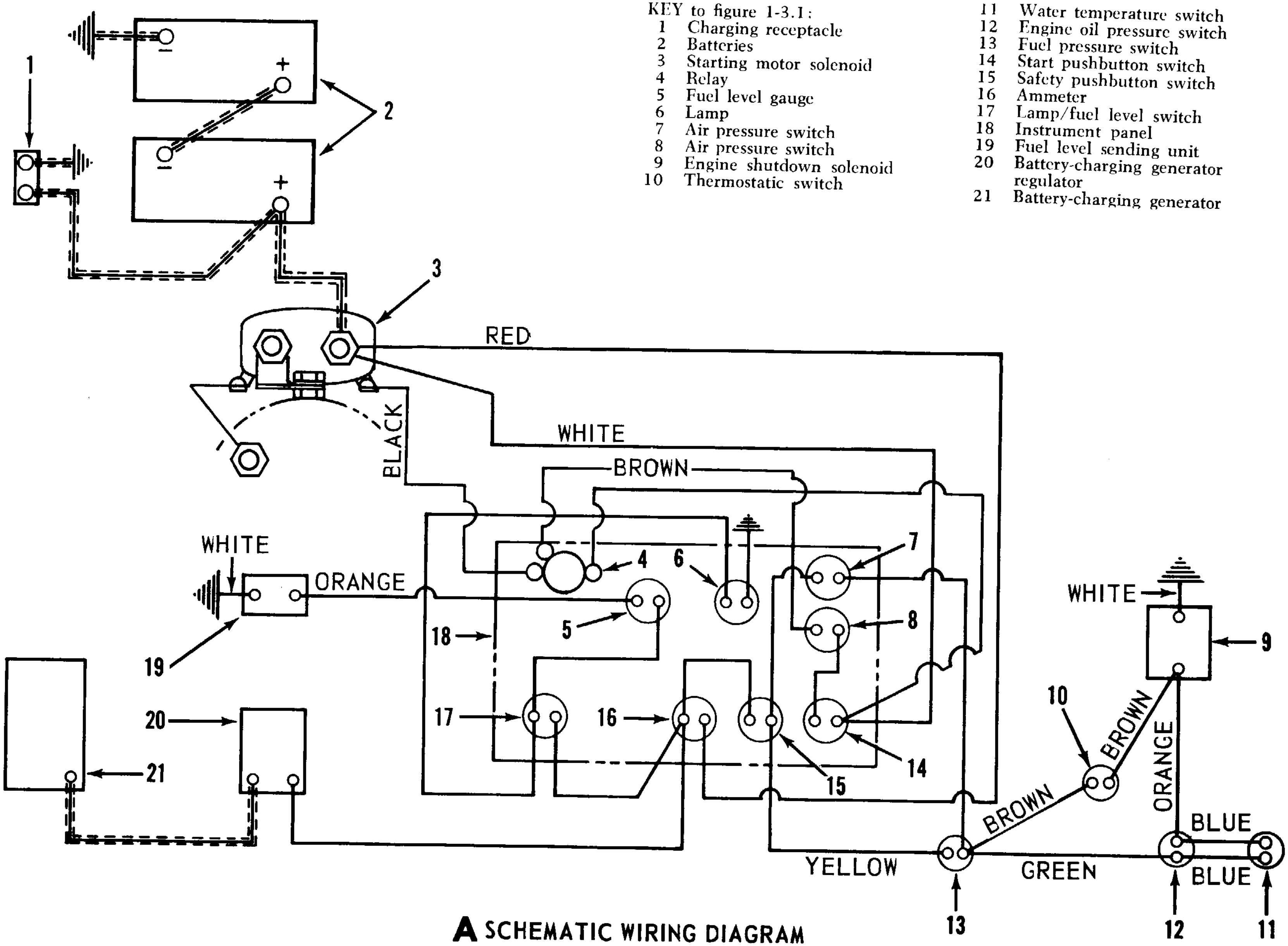
Type . . . . Heavy duty, corrosion proof

Page 1-6.1 and Figure 1-3.1 is added as follows:

Page 1-7.1 and Key to figure 1-3.1 is added as follows:

KEY to figure 1-3.1:

1	Charging receptacle
2	Batteries
3	Starting motor solenoid
4	Relay
5	Fuel level gauge
6	Lamp
7	Air pressure switch
8	Air pressure switch
9	Engine shutdown solenoid
10	Thermostatic switch
11	Water temperature switch
12	Engine oil pressure switch
13	Fuel pressure switch
14	Start pushbutton switch
15	Safety pushbutton switch
16	Ammeter
17	Lamp/fuel level switch
18	Instrument panel
19	Fuel level sending unit
20	Battery-charging generator regulator
21	Battery-charging generator



A SCHEMATIC WIRING DIAGRAM

ME 4310-345/1-3.1 C1

Figure 1-3.1 Wiring diagram.

Page 2-7. Add paragraph 2-7.b. (4) as follows:
Air pressure switch. (Applicable to units with serial numbers 9P155-18891 through 9P155-19040), This switch is connected in series between starting motor, relay, and starting push-button switch. The air pressure switch prevents the engine from being started when air pressure in the system exceeds 10 PSI.

Page 4-16.1 and Figure 4-9.1 is added as follows:
Applicable to units with serial numbers 9P155-18891 through 9P115-19040.

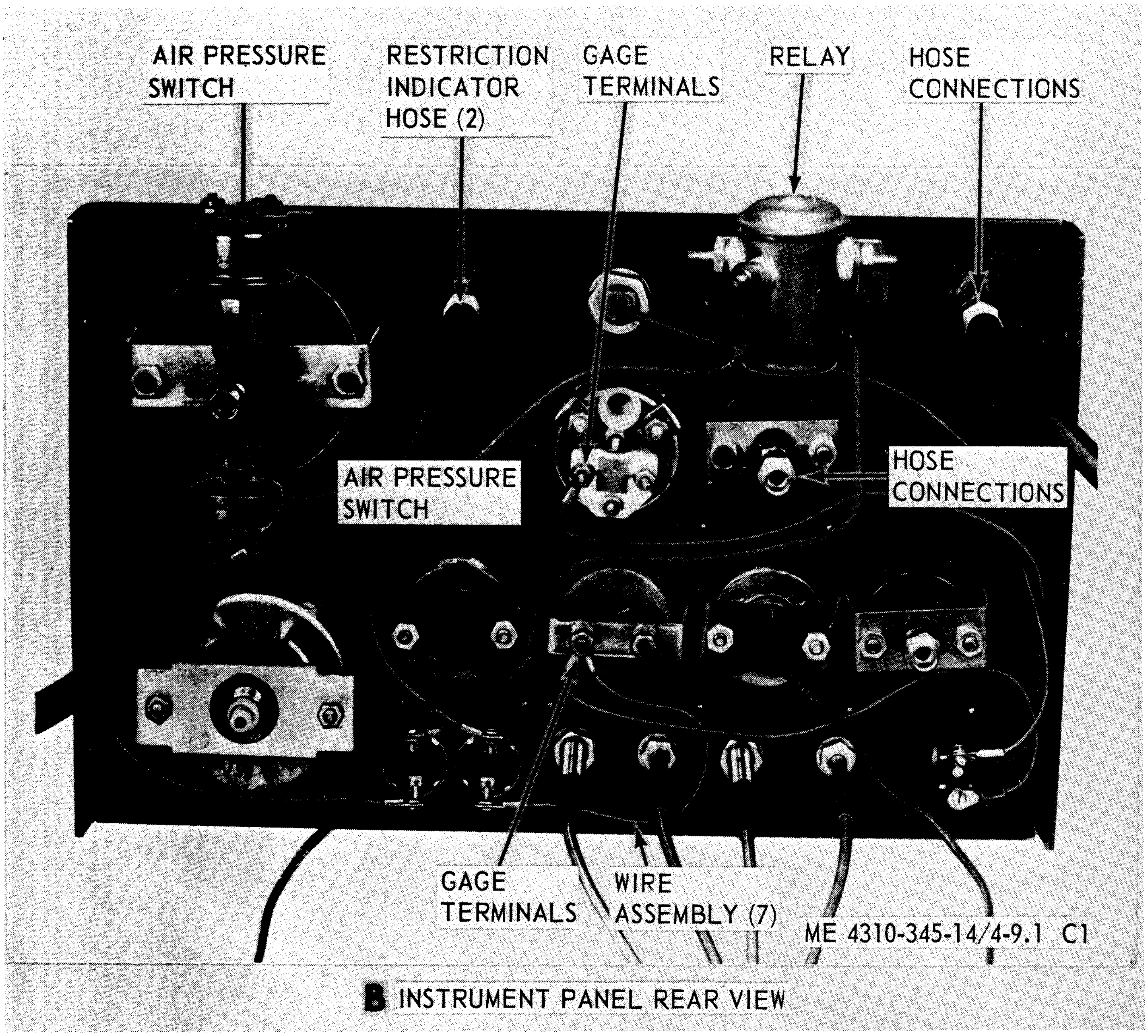


Figure 4-9.1. Controls and instruments service.

Page 4-40.1 and Figure 4-21.1 is added as follows :

Applicable to units with serial numbers 9P155-18891 through 9P155-19040.

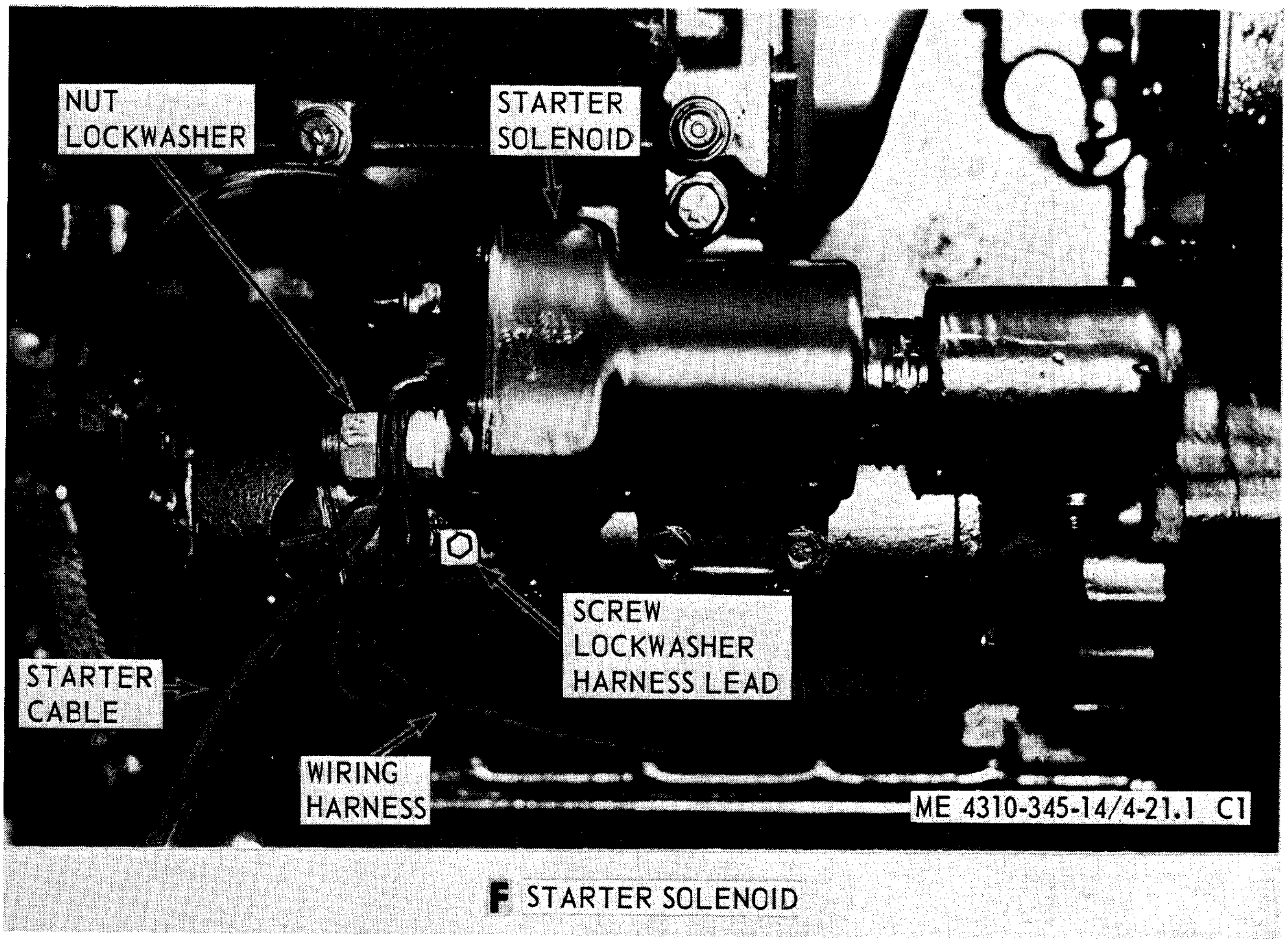
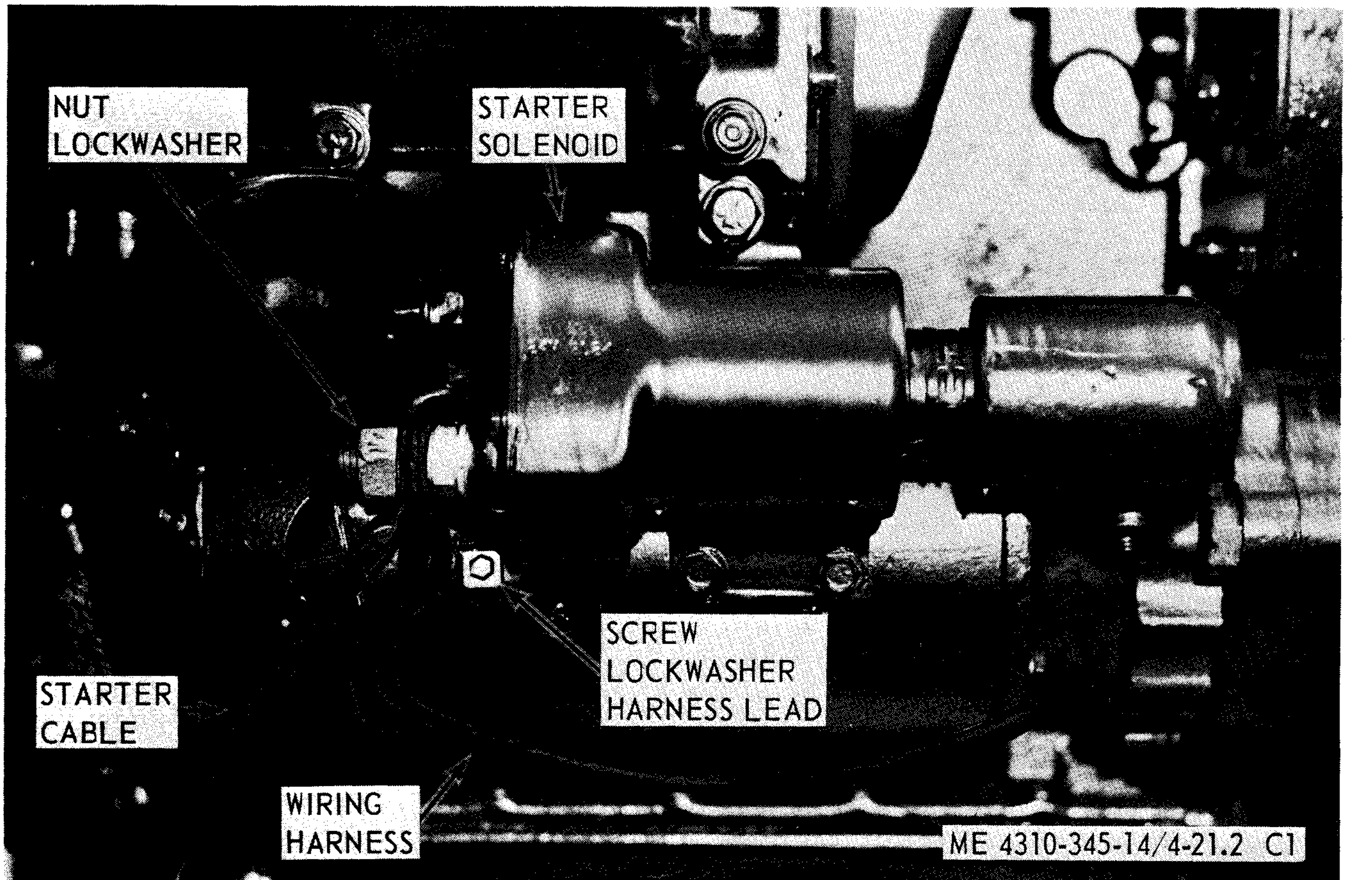


Figure 4-21.1. Shutdown solenoid wiring harness, removal and installation.

Page 4-40.2 and Figure 4-21.2 is added as follows:

Applicable to units with serial numbers 9P155-18891 through 9P155-19040.



G STARTER SOLENOID

INSTALLATION

NOTE

REFER TO FIGURE 1-3.1 FOR WIRING DIAGRAM.

STEP 1. INSTALL BLACK HARNESS LEAD TO STARTER SOLENOID TERMINAL AND SECURE WITH SCREW AND LOCKWASHER. INSTALL WHITE AND RED HARNESS LEADS AND STARTER CABLE ON SOLENOID TERMINAL. SECURE WITH LOCKWASHER AND NUT.

Figure 4-21.2, Shutdown solenoid wiring harness, removal and installation.

Page 4-52.1 and Figure 4-25.1 is added as follows:

Applicable to units with serial numbers 9P155-18891 through 9P155-19040.

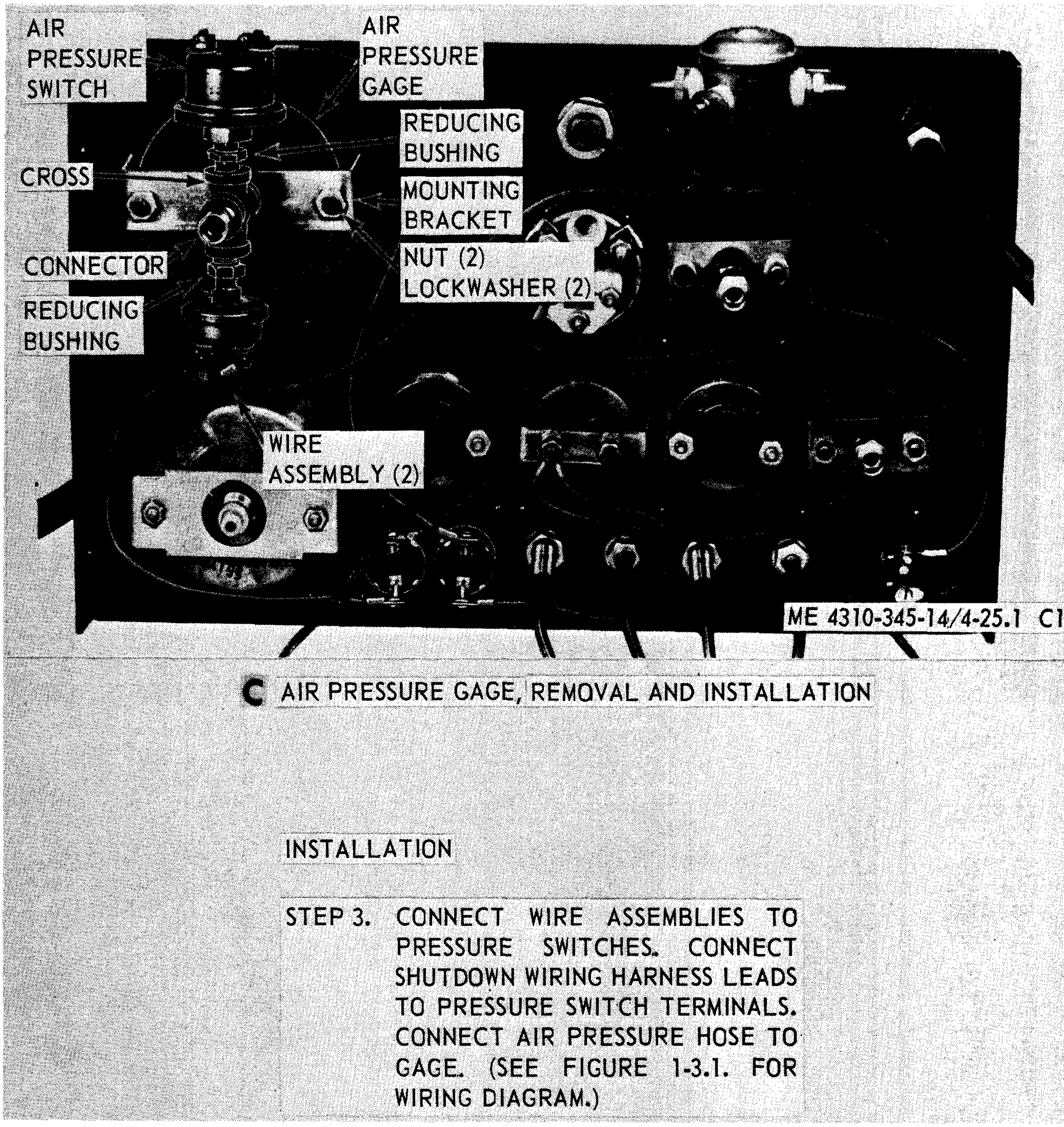
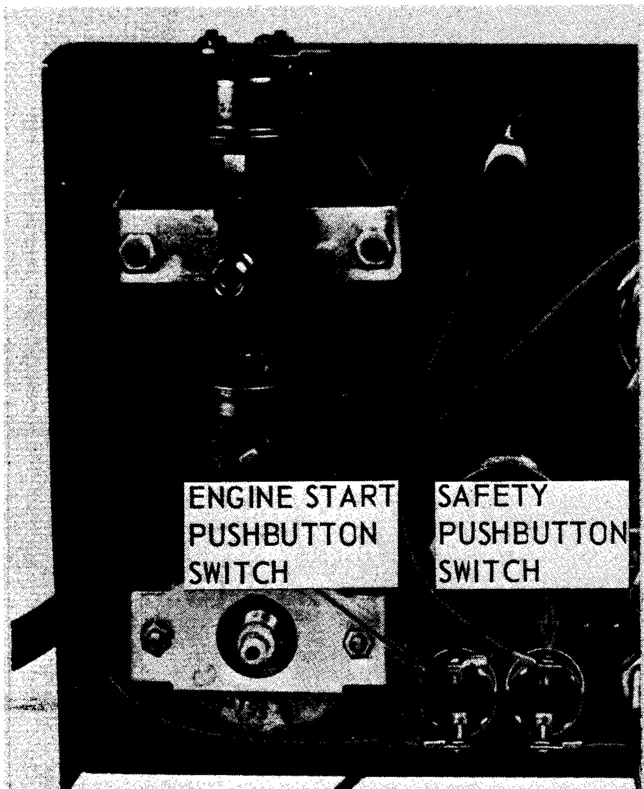


Figure 4-25.1. Instrument panel controls and instruments, removal and installation.

Page 4-52.2 and Figure 4-25.2 is added as follows:

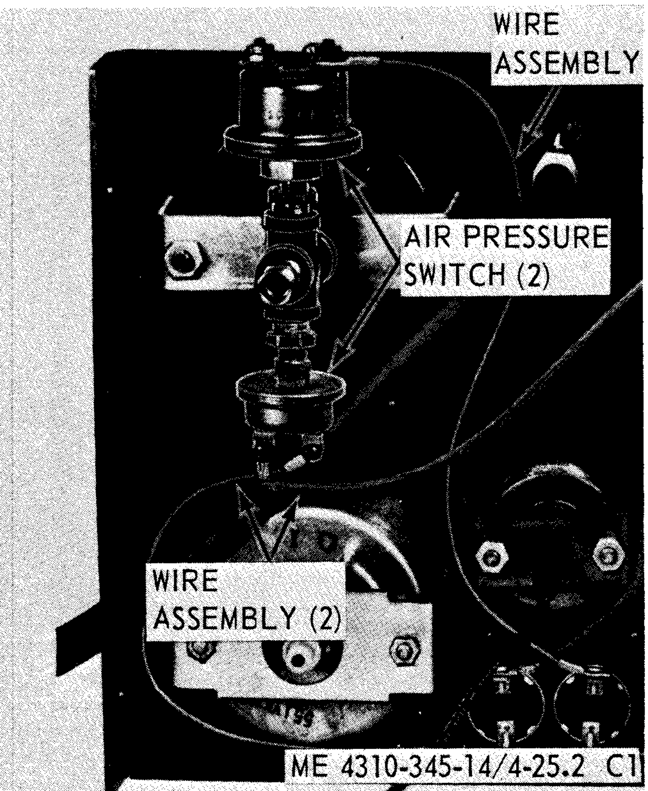
Applicable to units with serial numbers 9P155-18891 through 9P155-19040.



L START AND SAFETY PUSHBUTTON SWITCHES, REMOVAL AND INSTALLATION

INSTALLATION

STEP 2. CONNECT WIRE ASSEMBLIES. (REFER TO FIGURE 1-3.1. FOR WIRING DIAGRAM.)



M AIR PRESSURE SWITCH, REMOVAL AND INSTALLATION

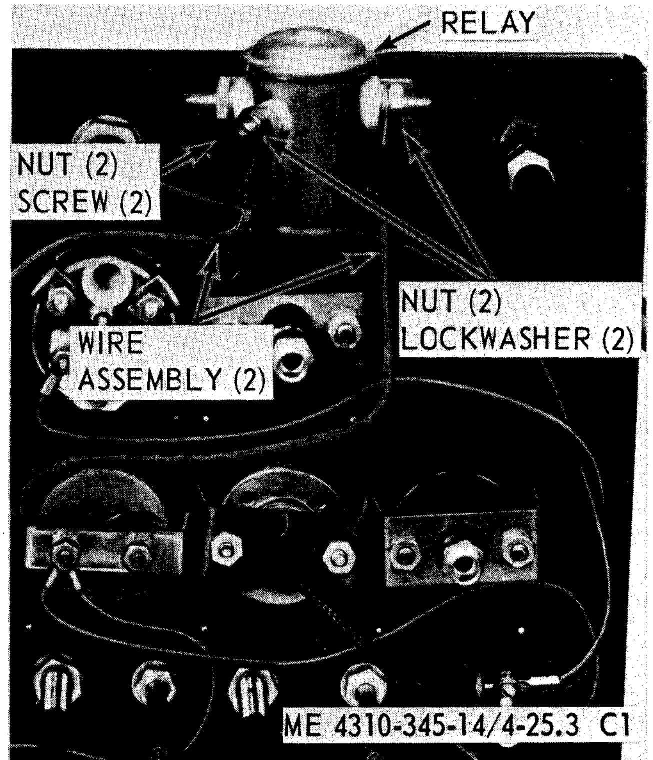
INSTALLATION

STEP 2. CONNECT WIRE ASSEMBLIES. (REFER TO FIGURE 1-3.1. FOR WIRING DIAGRAM.)

Figure 4-25.2. Instrument panel controls and instruments, removal and installation.

Page 4-52.3 and Figure 4-25.3 is added as follows:

Appicable to units with serial numbers 9P155-18891 through 9P155-19040.



N RELAY
REMOVAL AND INSTALLATION

REMOVAL

STEP 1. REMOVE NUTS, LOCKWASHERS, AND WIRE ASSEMBLIES.

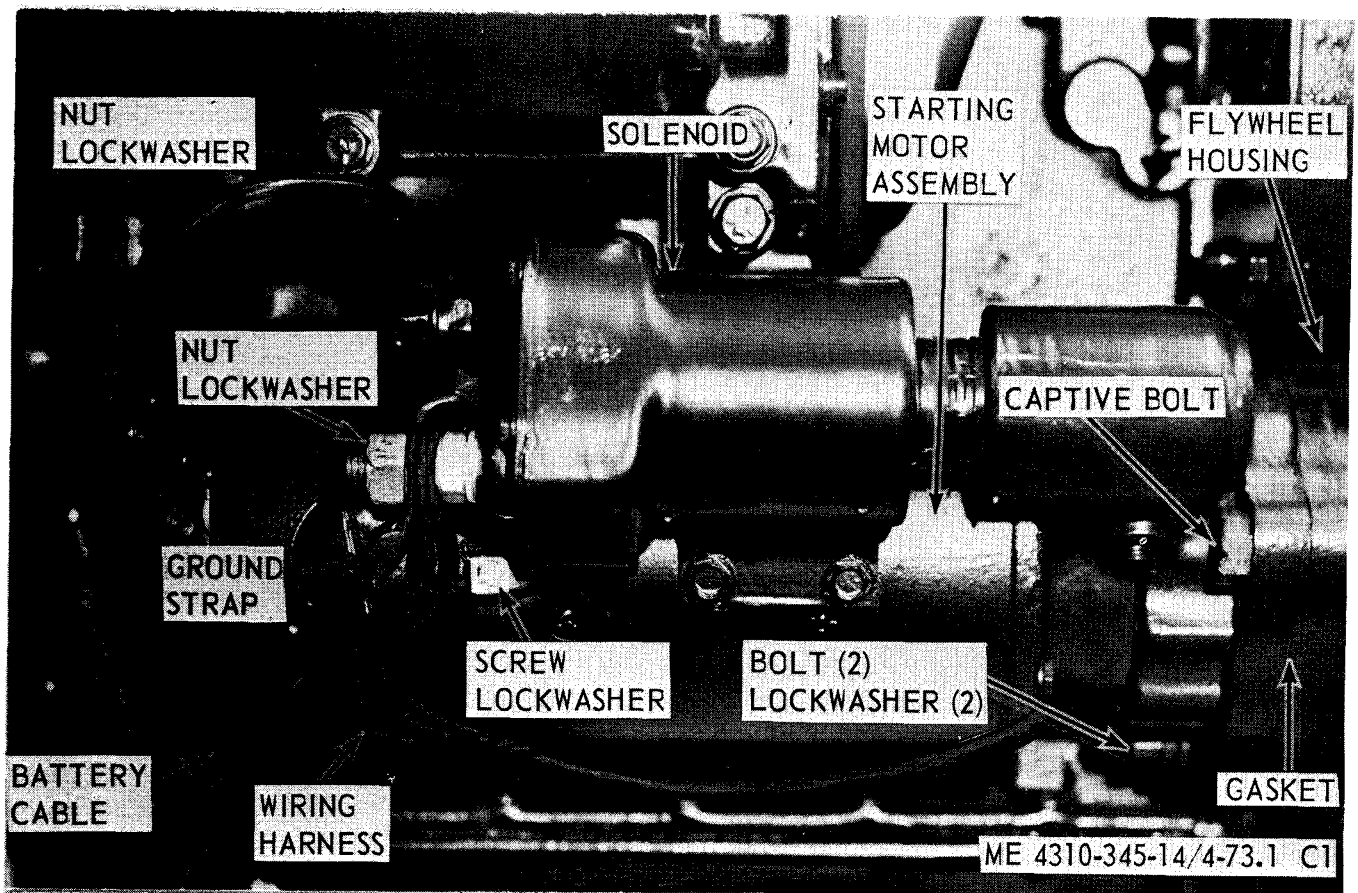
STEP 2. REMOVE SCREWS, NUTS, AND REMOVE RELAY.

INSTALLATION

STEP 1. INSTALL RELAY AND SECURE WITH SCREWS AND NUTS.

STEP 2. INSTALL WIRE ASSEMBLIES AND SECURE WITH LOCKWASHERS AND NUTS. (REFER TO FIGURE 1-3.1 FOR WIRING DIAGRAM.)

Figure 4-25.3. Instrument panel control and instruments, removal and installation.



REMOVAL		INSTALLATION	
STEP 1.	REMOVE SOLENOID TERMINALS NUT, SCREW, AND LOCKWASHERS. REMOVE BATTERY CABLE AND WIRING HARNESS LEADS. REMOVE NUT AND LOCKWASHER FROM STARTER GROUND TERMINAL AND REMOVE GROUND STRAP.	STEP 1.	INSTALL NEW GASKET. POSITION STARTING MOTOR ON FLYWHEEL HOUSING. SECURE WITH TWO BOLTS AND LOCKWASHERS. TIGHTEN CAPTIVE BOLT.
STEP 2.	REMOVE TWO BOLTS AND LOCKWASHERS. LOOSEN CAPTIVE BOLT AND REMOVE STARTER. DISCARD STARTER.	STEP 2.	INSTALL GROUND STRAP AND SECURE WITH LOCKWASHER AND NUT. INSTALL WIRING HARNESS AND BATTERY CABLE ON SOLENOID TERMINALS WITH LOCKWASHERS, NUTS, AND SCREW. REFER TO FIGURE 1-3.1. FOR WIRING DIAGRAM.

4-73.1. Starting motor assembly, removal and installation.

Page .4-111.1. Add Figure 4-73.1 as follows: Applicable to units with serial numbers 9P155-18891 through 9P155-19040.

Page 6-3. Add the following WARNING to paragraph 6-3 between paragraph title 6-3. Oil Separator Element and subparagraph *a.* as follows:

WARNING

Change oil separator element every four thousand hours. Destroy used element to prevent accidental re-use. Over pollution of metal salts collecting on the separator element can become a hazardous condition by lowering the flash point and causing a fire in the separator.

Page 7-7.1 and Key to figure 7-3.1 is added as follows:
Applicable to units with serial numbers 9P155-18891 through 9P155-19040.

KEY to figure 7-3.1:

1 Plug
2 Gasket
3 Nut
4 Guide
5 Nut
6 Washer
7 Connector
8 Screw
9 Solenoid
10 Retaining ring
11 Retainer
12 Spring
13 Retainer
14 Bellows
15 Washer
16 Plunger
17 Screw (5)
18 Screw
19 Housing
20 Plug
21 Bearing
22 Bolt
23 Gasket
24 Motor drive
25 Retaining ring
26 Shaft
27 Packing preformed
28 Packing preformed
29 Lever
30 Washer
31 Screw (5)
32 Screw (5)
33 Housing
34 Bearing
35 Packing preformed
36 Oil seal
37 Washer
38 Screw (4)
39 Washer (4)
40 Plate
41 Nut
42 Washer
43 Nut
44 Washer
45 Washer
46 Insulator
47 Bushing
48 Screw (3)
49 Washer (3)
50 Washer (3)
51 Holder assembly
52 Bushing
53 Washer
54 Screw (8)
55 Washer (8)
56 Brush (8)
57 Pipe plug
58 Wick
59 Plug
60 Bearing
61 Packing preformed
62 Washer
63 Armature
64 Nut
65 Washer
66 Washer (2)
67 Support
68 Washer
69 Plug
70 Gasket
71 Frame

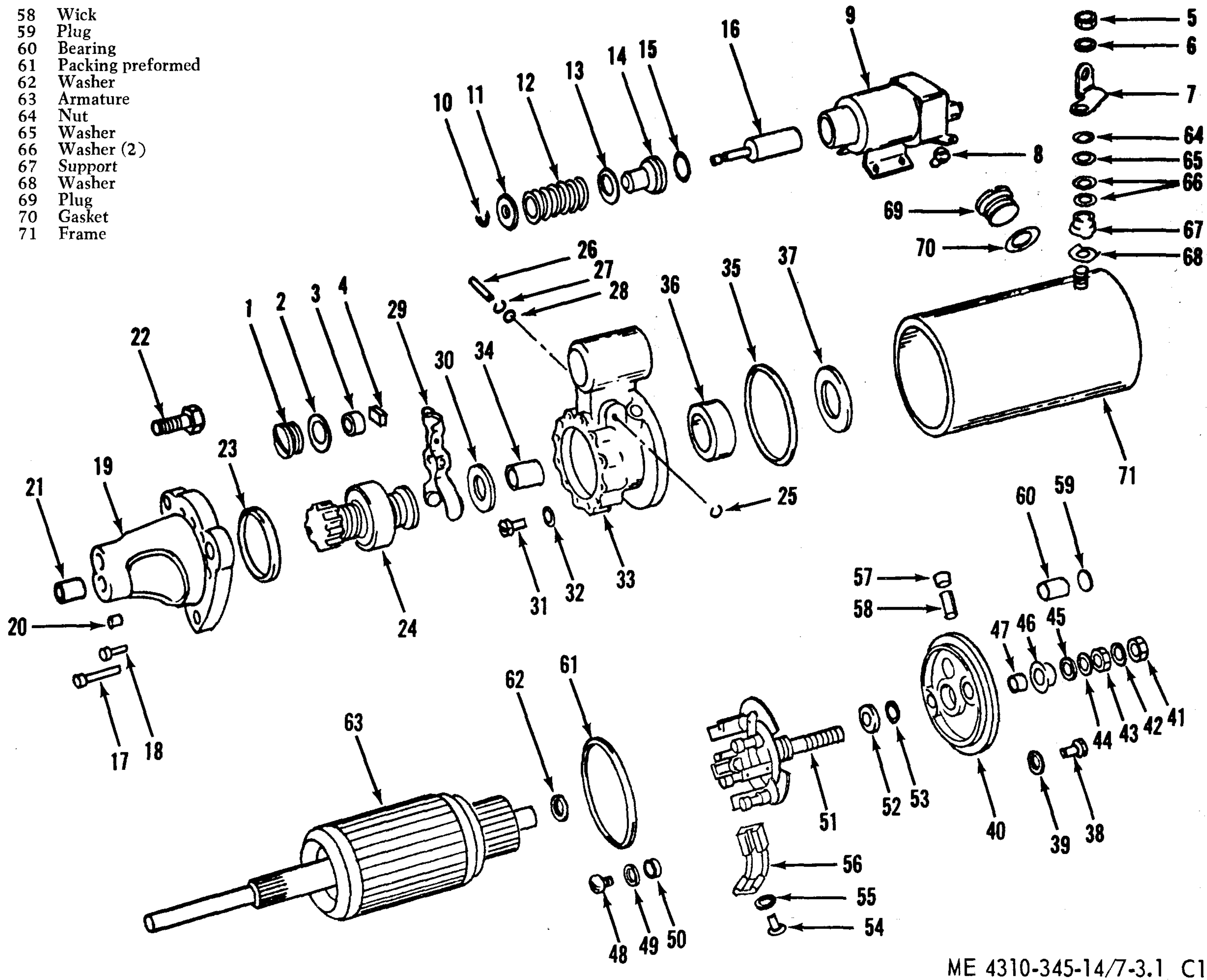


Figure 7-3.1. Starting motor assembly disassembly and reassembly.

Page 7-7.2 and Figure 7-3.1 is added as follows:

Applicable to units with serial numbers 9P155-18891 through 9P155-19040.

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-25A (qty rqr block No. 38), Organizational maintenance requirements for Air Compressors 250 CFM.

*U.S. GOVERNMENT PRINTING OFFICE: 1973-769751/521

TECHNICAL MANUAL
No. 5-4310-345-14

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON. D. C., 5 *June 1972*

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

COMPRESSOR, ROTARY, AIR; DIESEL ENGINE DRIVEN; 250 CFM, 100 PSI; TRAILER MOUNTED, TWO WHEEL (DAVEY MODEL 14M250RPV)

FSN 4310-256-9319

COMPONENT OF PNEUMATIC TOOL AND COMPRESSOR OUTFIT,

FSN 3820-950-8584

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS—Continued

LIST OF ILLUSTRATIONS - Continued

LIST OF ILLUSTRATIONS - Continued

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Section i. GENERAL

1-1. Scope

a. This manual is published for the use of the personnel to whom the Rotary Air Compressor is issued. Chapters 1 through 4 provide information on the operation, operator's maintenance, and organizational maintenance instructions of the equipment, accessories, components, and attachments. Chapter 5 provides direct support and general support maintenance instructions beyond authorized operator and organizational levels. Chapter 6 provides repair of the Rotary Air Compressor. Chapter 7 provides maintenance of materiel used in conjunction with the Rotary Air Compressor, as applicable.

b. Refer to TM 740-90-1 for Administrative Storage.

1-2. Forms and Records

Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

1-3. Equipment Serviceability Criteria (ESC)

This equipment is not covered by an ESC.

1-4. Reporting of Errors

Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028, (Recommended Changes to Publications) and forwarded direct to Commanding General, U. S. Army Mobility Equipment Command, ATTN: AM AMSME-MPP, 4300 Goodfellow Blvd., St. Louis, Missouri 63120.

1-5. Destruction of Army Materiel to Prevent Enemy Use

Instructions for the destruction of Army materiel to prevent enemy use are provided in TM750-244-3.

Section ii. DESCRIPTION AND DATA

1-6. Description

a. The air compressor unit is a trailer mounted, two-wheel pneumatic tired, diesel engine driven, sliding blade type, rotary air compressor. The unit supplies 250 cubic feet of air per minute (CFM) at a discharge pressure of 100 pounds per square inch (PSI). (fig. 1-1 and 1-2).

b. The compressor unit is enclosed in a sheet metal housing fastened to a welded frame. This unit is then fastened to the two-wheel trailer. The trailer has an air brake system operated from the towing vehicle. When the unit is parked, the brakes are set manually using the hand lever provided. The compressor unit is self-contained and capable of continuous operation, under normal conditions, for a period of eight hours without refueling. The unit is employed for general construction work in conjunction with pneumatic tools and other equipment.

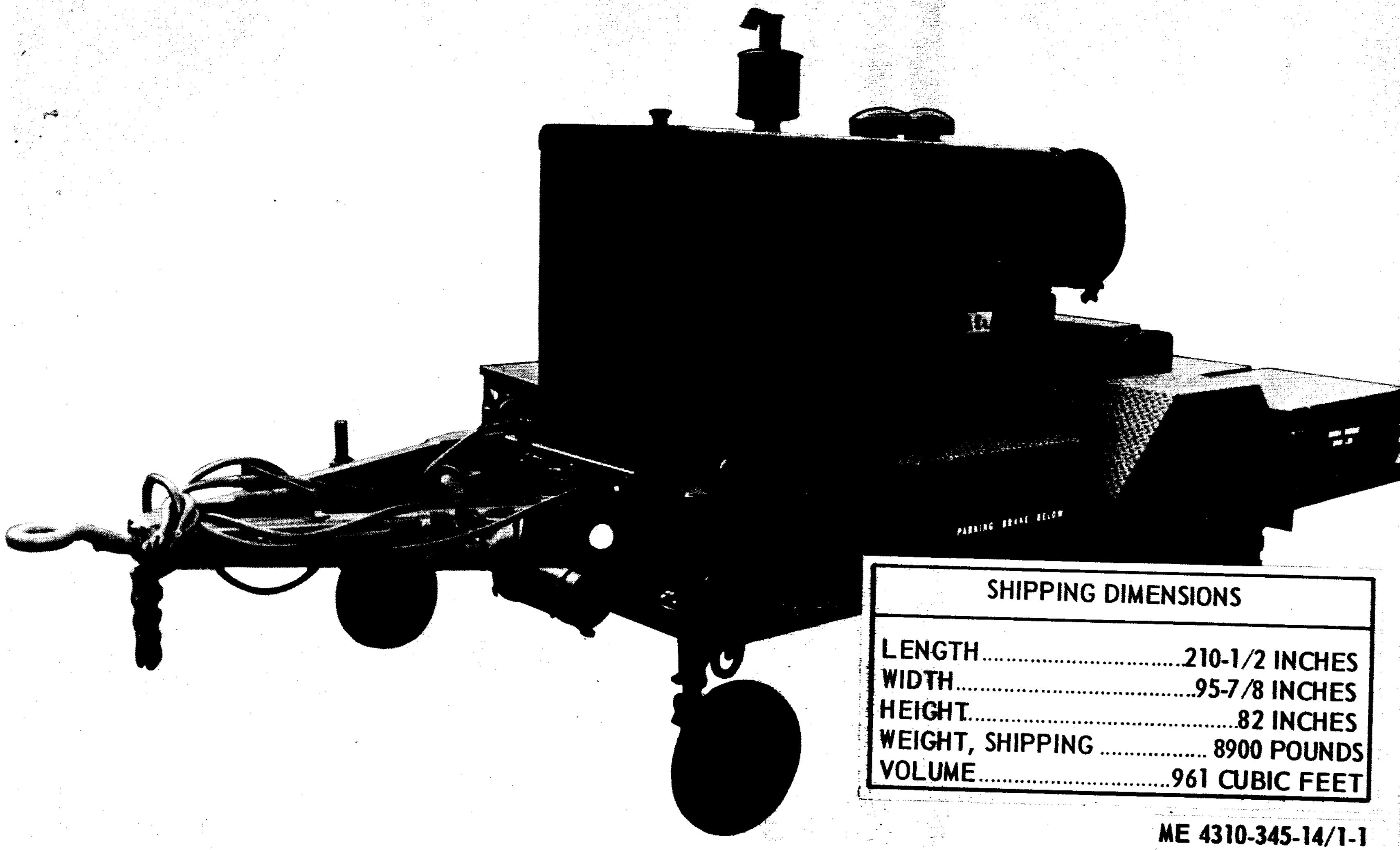
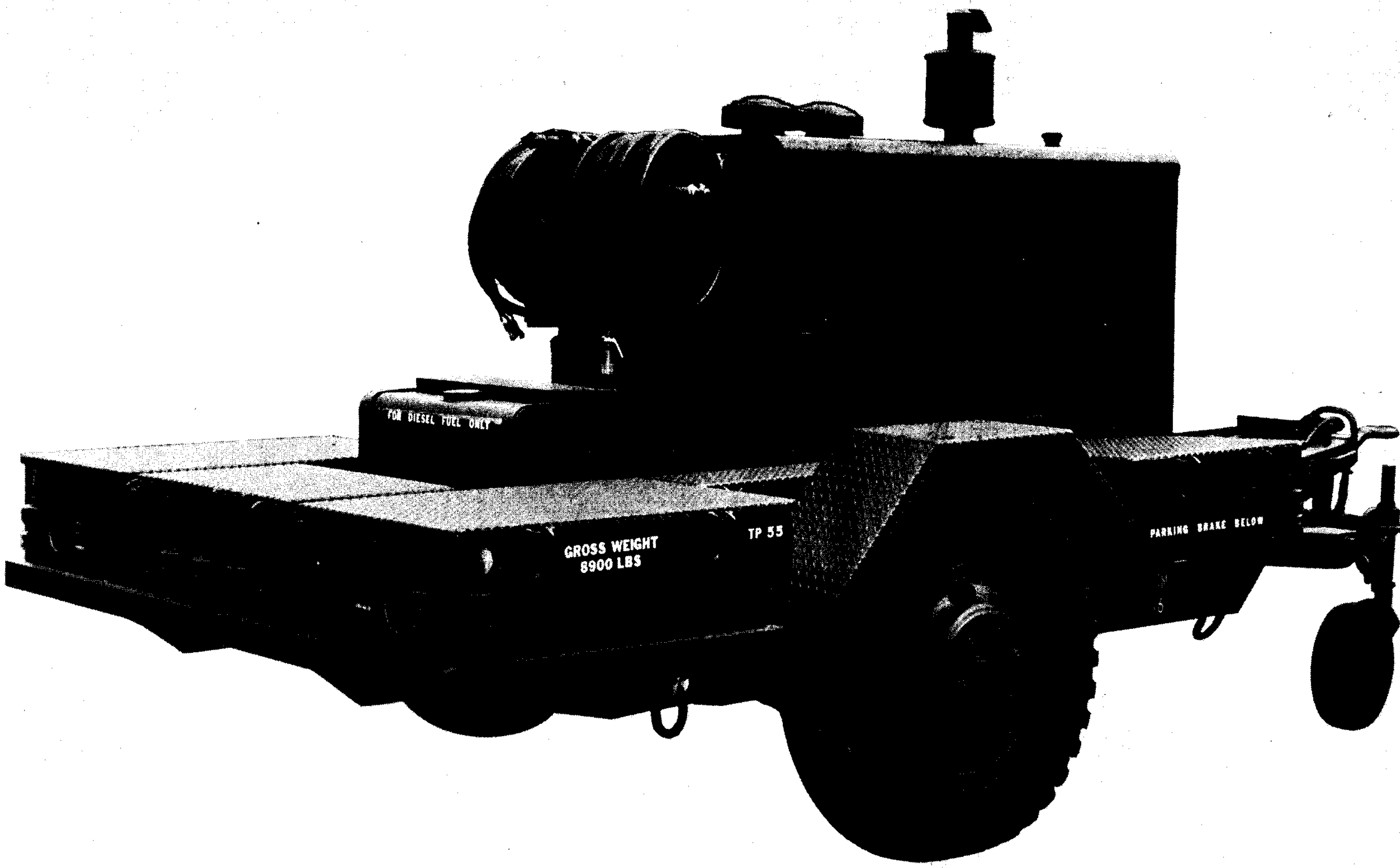


Figure 1-1. Model 14M250RPV Rotary Air Compressor, left front, three-quarter view.



ME 4310-345-14/1-2

Figure 1-2. Model 14M250RPV Rotary Air Compressor, right rear, three-quarter view.

1-7. Differences Between Models

This manual covers only the Davey Compressor Company Model 14M250RPV Rotary Air Compressor. No known differences exist for the model covered by this manual.

1-8. Identification and Tabulated Data

a. Identification. The air compressor unit has six major identification and data plates. The information contained on these plates is listed below.

(1) *U. S. Army data plate.* Located on the left rear housing door panel. Specifies unit nomenclature, model, contract number, serial number, capacity, registration number, weights, dimensions, Federal Stock Number, date of manufacture, engine serial number, warranty data, date shipped, inspection information, and manufacturer.

(2) *Transportation data plate.* Located on the left rear portion of the door panel. Illustrates prescribed lifting method, location of lifting and tie-down eyes, and center of gravity. Specifies dimensions, shipping weight and cubage, towing speeds, and tire pressure.

(3) *Operating instruction plate.* Located on the left front housing side panel Specifies before starting, starting, and stopping instructions with cautions to be observed. Also includes lubrication specifications.

(4) *Rotary compressor plate.* Located on the top of compressor drive end cover. Specifies the compressor model and serial number.

(5) *Engine data plate.* Located on the left side of the engine valve rocker cover, Specifies engine unit number, engine model number, maximum RPM-no load, and lists optional equipment used on the engine.

(6) *Tool disposition plate.* Located on the under side of the lid of each toolbox. Illustrates the location of all tools and contents of each toolbox. Also lists the index item number, Federal Stock Number, description, quantity of tools and securing straps.

b. Tabulated Data.

(1) *Rotary air compressor unit.*

Manufacturer . . . . Davey Compressor Company
Model 14M25ORPV
Type . . . . Sliding Blade, Air, Rotary, DED
Part Number 62963
Serial Numbers . . . . 9P155-17213 through 9P155-17248 and 9P155-17583 through 9P155-17587
Air Volume, ...25O CFM
Air Pressure . . . .100 PSI
Stages . . . . One
Prime Mover . . . . Diesel Engine
Oil Filter . . . . AC Spark Plug Division of General Motors Corporation No. 5578294 Type PM13-11
Air Cleaner Assembly . . . . . Donaldson Company, Inc. No. KAXOO-0155
Air Cleaner Element Donaldson Company, Inc. No. P10-6000
Mounting . . . . Trailer mounted, 2-wheel, pneumatic tires
Trailer Chassis . . . . .3 1 / 2 Ton, 2-wheel, M353 (FSN 2330-542-2831) (Ref. TM 9-2330-247-14)
Electrical System . . . . .24 Volts. D. C.
Federal Stock Number 3820-950-8584

(2) *Engine.*

Manufacturer . . . Detroit Diesel Engine Division of General Motors Corporation
Model 5043-5l98
Type, ...2-Cycle Diesel
Number of Cylinders 4
Bore and Stroke ., ...3.875 In. x 4.5 In.
Displacement . ., ., 212.4 Cu. In.
Compression Ratio . . . . 17 to 1
Oil Pressure Normal at 1800 RPM . . . . .40-60 PSI
Oil Pressure Minimum at Idle . . . . .30 PSI
Firing Order 1-3-4-2
Fuel Oil . . . . No. 2-D (ASTM D-975)
Governed Speed . . . .1800 RPM
Idle Speed . . . .1000 RPM
Horsepower 80Hp

(3) *Engine accessories.*

(a) Starting motor.

Manufacturer . . . . .Delco-Remy Division of General Motors Corporation
Part Number 1113208
Type . . . . Corrosion proof

(b) Generator.

Manufacturer . . . . . . .Delco-Remy Division of General Motors Corporation
Part Number 1105993
Type . . . . Corrosion proof

(c) Generator regulator.

Manufacturer . . . . Delco-Remy Division of General Motors Corporation
Part Number 1118644
Type . . . . Fungus and Corrosion Proof

(d) Oil filter assembly.

Manufacturer . . . . . Detroit Diesel Engine Division of General Motors Corporation
Part Number 5134392
Type . .. Full Flow . . . . Full Flow
Element ... ...5573014 ..55730l4

(e) Fuel strainer assembly (primary).

Manufacturer . . . . AC Spark Plug Division of General Motors Corporation
Part Number 5577342
Type TL-7O
Element . . . . 1595655 Type TL-12

(f) Fuel filter assembly (secondary).

Manufacturer ., ... AC Spark plug Division of General Motors Corporation
Part Number 5578475
Type T-7 1MS
E1ement 5578188

(g) Engine air cleaner.

Manufacturer . . . . Donaldson Company, Inc.
Part Number KAXOO-0l55
Type . . . .Dry
Element Assembly P10-6600

(4) *Capacities.*

Fuel Tank . . . .46 Gallons
Engine Lubrication System (with Filter) . . . .15 Quarts
Compressor Oil System . . ...32 Quarts
Engine Cooling System 36 Quarts

(5) *Overall dimensions, weights and maximum speeds (fig. 1-2).*

Overall Length . . . .210 1/2 Inches
overall Height . . . . 8 2 Inches
Overall Width 95 7/81nches
Shipping Volume . . . . .961 Cubic Feet
Shipping Weight . . . . 8900 Lbs. Approx.
Maximum Highway Speed . . . . . . .60 MPH
Maximum Off-Road Speed .. . . 20 MPH
Bridge Weight Classification . . . . . . Refer to FM5-36)

(6) *Nut and bolt torque data.*

(a) Torque screws, bolts, and nuts on air compressor unit assembly as indicated in table 1-1.

(b) Torque screws, bolts, and nuts on engine assembly as indicated in table 1-2.

(7) *Wiring diagram. See* figure 1-3.

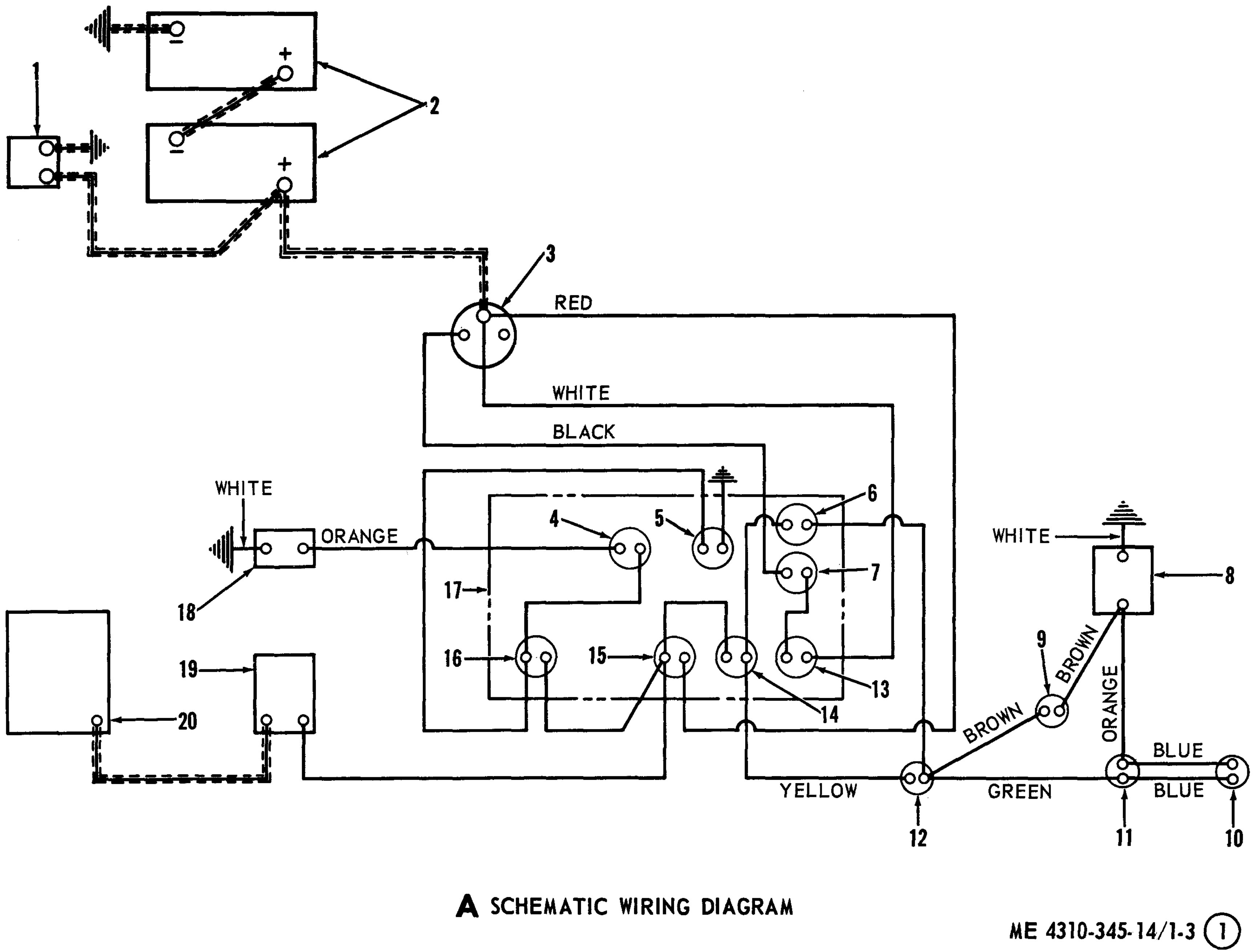
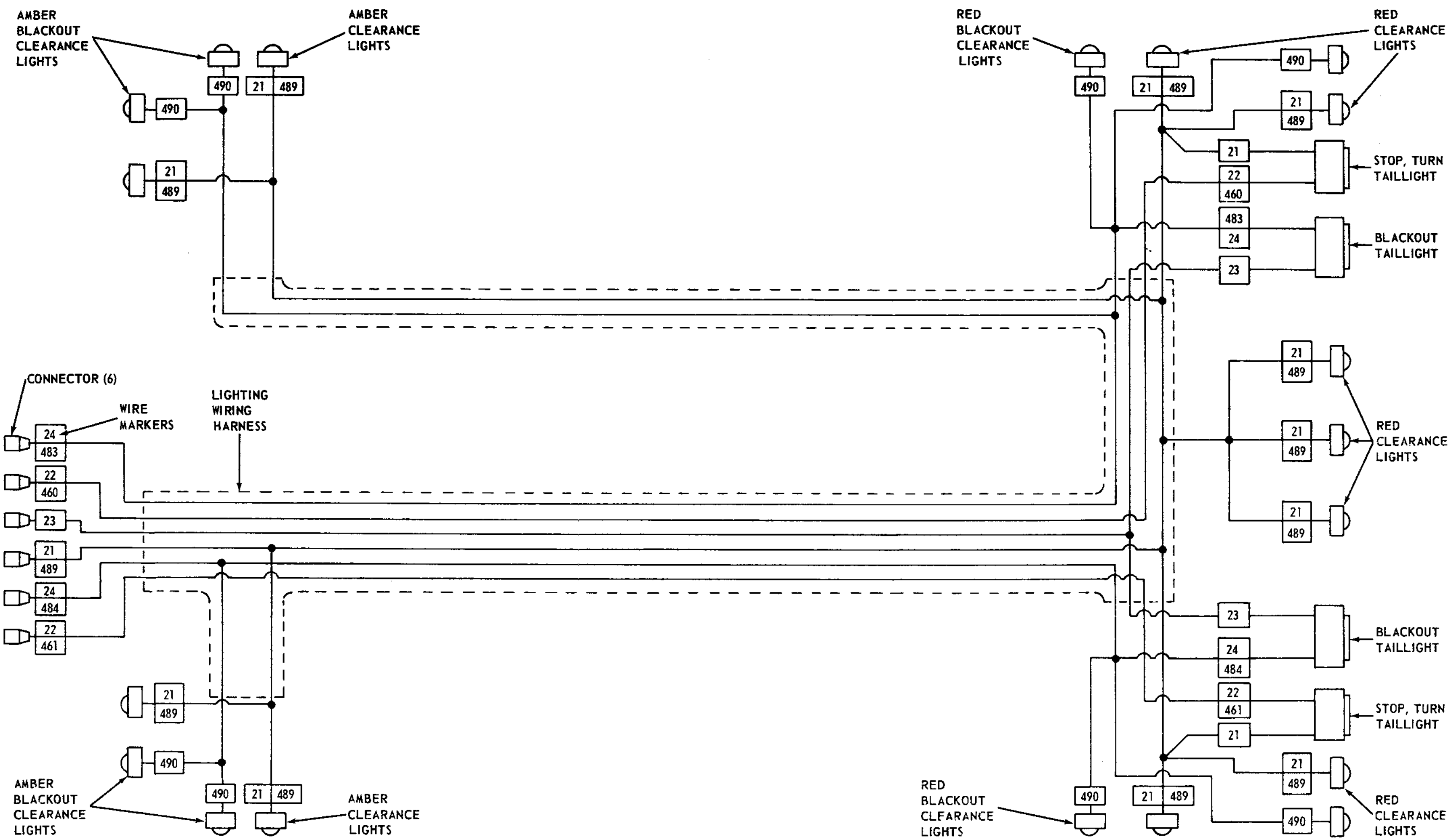


Figure 1-3. Wiring diagram (sheet 1 of 2).

KEY to figure 1-3 (sheet 1 of 2):
1. Charging receptacle
2. Batteries
3. Starting motor solenoid
4. Fuel level gage
5. Lamp
6. Air pressure switch
7. Air pressure switch
8. Engine shutdown solenoid
9. Thermostatic switch
10. Water temperature switch
11. Engine oil pressure switch
12. Fuel pressure switch
13. Start pushbutton switch
14. Safety pushbutton switch
15. Ammeter
16. Lamp / fuel level switch
17. Instrument panel
18. Fuel level sending unit
19. Battery-charging generator regulator
20. Battery-charging generator



B UNIT LIGHTING WIRING HARNESS

ME 4310-345-14/1-3 (2)

Figure 1-3. Wiring diagram (sheet 2 of 2).

Table 1-1. Air Compressor Unit Torque Table

Size	Foot-pounds	Size	Foot-pounds	Size	Foot-pounds
1/4-20	6	7/16-20	35	3/4-10	143
1/4-28	8	1/2-13	45	3/4-16	150
5/16-18	11	1/2-20	47	7/8-9	218
5/16-24	12	9/16-12	60	7/8-14	217
3/8-16	20	9/16-18	66	1-8	291
3/8-24	22	5/8-11	104	1-14	322
7/16-14	33	5/8-18	116		

Table 1-2. Engine Assembly Torque Table

Standard nut and bolt torque specifications

Size nut or bolt	Foot-pounds	Size nut or bolt	Foot-pounds	Size nut or bolt	Foot-pounds
1/4-20	7-9	7/16-20	57-61	3/4-10	240-250
1/4-28	8-10	1/2-13	71-75	3/4-16	290-300
5/16-18	13-17	1/2-20	83-93	7/8-9	410-420
5/16-24	15-19	9/16-12	90-100	7/8-14	475-485
3/8-16	30-35	9/15-18	107-117	1-8	580-590
3/8-24	35-39	5/8-11	137-147	1-14	685-695
7/16-14	46-50	5/8-18	168-178		

Exceptions to standard nut and bolt torque

Application	Size nut or bolt	Foot-pounds
Injector control shaft bracket bolts	1/4-20	10-12
Cam follower guide bolts	1/4-20	12-15
Governor to flywheel housing bolts	5/16-18	10-12
Idler gear hub and spacer bolts	5/16-18	19-23
Idler gear hub and spacer bolts	3/8-16	40-45
Flywheel housing bolts	3/8-16	25-30
Injector clamps bolts	3/8-16	20-25
Air box cover bolts	3/8-16	12-16
Connecting rod bolts	3/8-24	40-45
Flywheel housing bolts	3/8-24	25-30
Fuel line nuts	3/8-24	12-15
Fuel connector	3/8-24	20-28
Rocker arm bracket bolts	7/16-14	50-55
*Flywheel bolts	1/2-20	110-120
* Main bearing cap bolts	9/16-12	120-130
*Cylinder head bolts	5/8-11	170-180
Blower drive assembly to flywheel housing	3/8-16	20-25
Governor drive gear retaining nut	5/8-18	125-135
Injector filter caps	5/8-24	65-75
Injector nut	15/16-24	55-65
Blower drive gear pilot bolt	5/16-24	25-30
Blower timing gear-to-rotor shaft bolts	5/16-24	25-30
Blower thrust washer retaining bolt	5/16-24	25-30
Front end plate cover bolts	3/8-16	20-25
Air inlet adapter-to-blower bolts	3/8-16	16-20
Blower housing bolts	3/8-16	16-20
Blower drive support to blower rear end plate bolts	3/8-16	20-24
Flywheel housing to blower drive support bolts	3/8-16	20-24
Blower thrust washer retaining bolt	3/8-24	54-59
Blower end plate-to-block bolts	7/16-14	55-60
Oil filter center studs		40-50
Oil pan drain plug		25-35
Water pump cover	5/16-18	6-7
Tachometer drive cover bolt	7/16-14	30-35
Tachometer drive cover bolt	1/2-13	30-35

• Lubricate at assembly with OE/HDO 30 engine oil

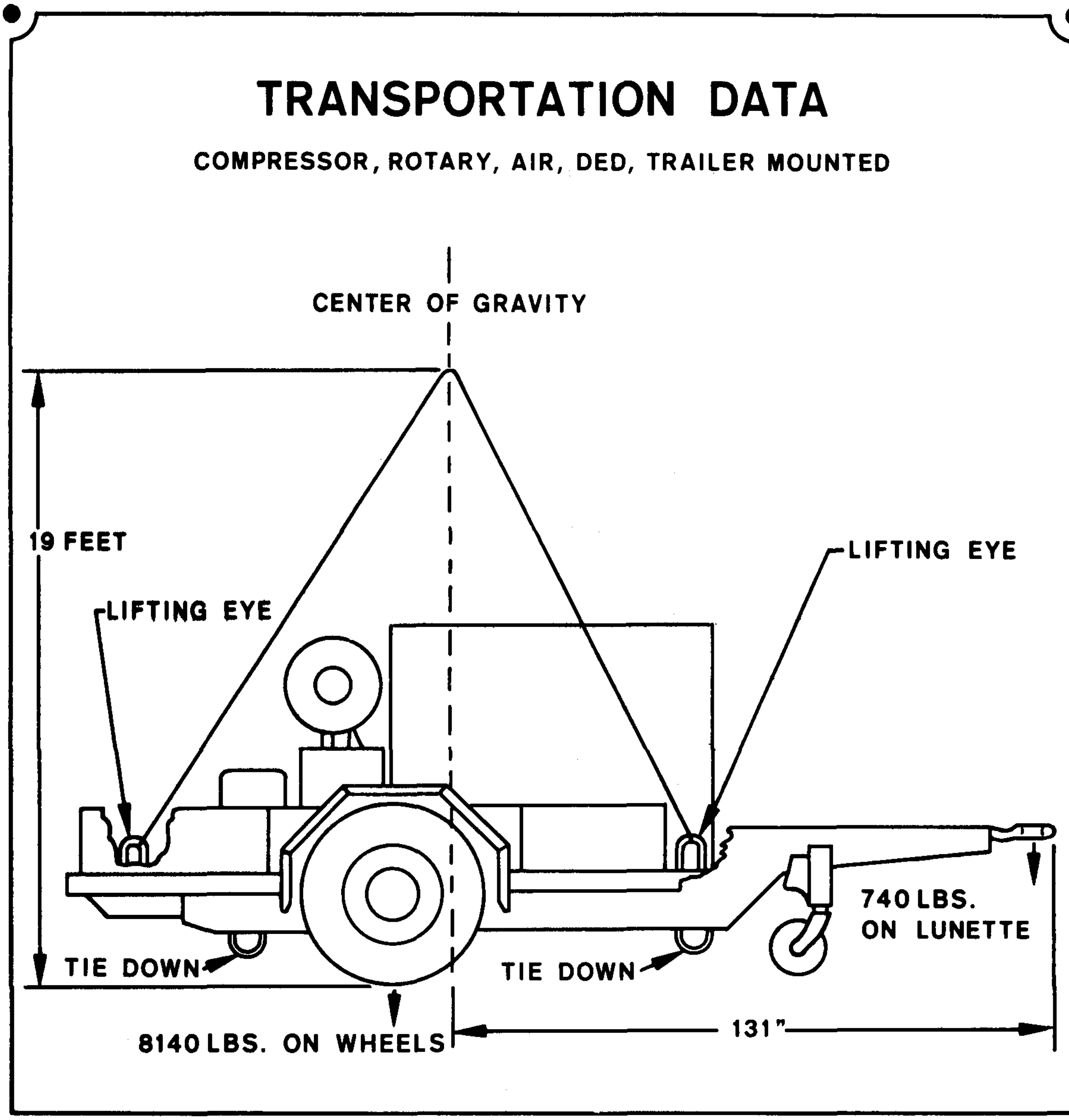
CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIEL

2-1. Inspecting and Servicing the Equipment

a. General. The model 14M250RPV Rotary Air Compressor is shipped by the manufacturer as a completely assembled two-wheeled, trailer mounted unit. Lifting provisions are incorporated on the trailer as shown in figure 2-1.



MAX ALLOWABLE SPEED

HIGHWAY	60	M.P.H.	OVER-ALL LENGTH	210 1/2	IN.
OFF ROAD	20	M.P.H.	OVER-ALL HEIGHT	82	IN.
TIRE INFLATION PRESSURE			OVER-ALL WIDTH	95 7/8	IN.
FRONT	55	P.S.I.	SHIPPING CUBAGE	961	FT.
REAR	55	P.S.I.	SHIPPING WEIGHT		LB.

ME 4310-345-14/2-1

Figure 2-1. Transportation data plate.

b. Unloading.

NOTE

The method of attachment of the air compressor trailer unit to the transportation equipment will be determined by the type of carrier used.

(1) The air compressor trailer unit can be unloaded by a lifting device or towed from the carrier. If a lifting device is to be used, connect the device to the unit as shown in figure 2-1.

WARNING

The lifting device used must be capable of lifting a minimum of 6 tons.

(2) Remove all blocks and tie downs that secure the air compressor trailer unit to the carrier. Release the parking brakes,

(3) Lift or tow air compressor unit off carrier.

CAUTION

After unloading and locating on desired sight, reset parking brakes.

c. *Unpacking and Reprocessing.*

(1) Remove all crating, blocking, and protective material.

(2) Remove separately packed components from air compressor unit.

(3) Carefully unpack components and inspect for damage. Refer to paragraph 2-2 for instructions on installing separately packed components.

(4) Refer to DA Form 2258 (Depreservation Guide for Vehicles and Equipment) furnished with unit and complete reprocessing before any servicing is attempted.

d. Inspecting Equipment.

(1) Check identification plates for positive identification of equipment.

(2) Check equipment against packing list.

(3) Inspect for and tighten any loose nuts, bolts, and screws.

(4) Inspect all controls, instruments, and gages for damage or loose mounting.

(5) Check all accessories for damage and loose or missing hardware.

(6) Inspect all electrical wiring for frayed insulation or other damage. See wiring diagram, figure 1-3.

(7) Check condition of fan drive belts. Check belt tension (fig. 3-8) Ensure that fan is securely mounted and that there is clearance between fan blades and radiator core and fan guard.

(8) Inspect all piping, air tubing, and hose assemblies for loose connections or damage.

(9) Check tires for slow leaks or damage. Correct pressure is 55 PSI.

(10) Check external lights for broken glass or other damage.

e. *Servicing Equipment.*

(1) Perform daily and before operation maintenance services (table 3-1).

(2) Lubricate equipment in accordance with LO 5-4310-345-12.

(3) Fill fuel tank and engine cooling system. Refer to tabulated data, paragraph 1-8 *b* (4), for capacities. Refer to table 2-1 for antifreeze data.

Table 2-1. Freezing Points, Composition, and Specific Gravities of Military Antifreeze Materials

Lowest expected ambient temp. °F	Pints of inhibited glycol per coolant [1]	Compound, antifreeze arctic [2]	Ethylene glycol solution specific gravity at 68 °F [3]
+20	1½	Issued full strength and ready mixed for 0° to —65° F temperatures for both initial installation and replenishment of losses.	1.022
+10	2		1.036
0	2¾		1.047
—10	3¼		1.055
—20	3½		1.062
—30	4		1.067
—40	4¼		1.073
—50	Arctic Antifreeze preferred	DO NOT DILUTE WITH WATER OR ANY OTHER SUBSTANCE	
—60			
—75			

[1] Maximum protection is obtained at 60 percent by volume (4.8 pints of ethylene glycol per gallon of solution).

[2] Military Specificaion MIL-C11755 Arctic type, nonvolatile antifreeze compound is intended for use in the cooling system of liquid-cooled internal combustion engine. It is used for protection against freezing primarily in Arctic regions where ambient temperature remains for extended periodsclose to 40 °F or drops below, to as low as -90°F.

[3] Use an accurate hydrometer. To test hydrometer, use 1 part ethylene glycol antifreese to 2 parts water. This should produce a hydrometer reading of 0°F .

NOTE

Fasten a tag near the radiator filler cap indicating the type antifreeze and temperature of protection.

WARNING

To prevent serious burns when filling batteries, take precautions against spilling electrolyte on clothing or allowing it to come in contact with skin or eyes. Use rubber gloves.

(4) Fill batteries with electrolyte to a level of approximately 3/8 inch above plates. Specific gravity must be a 1.250 or higher when checked with a hydrometer. (Refer to TM 9-6140-200-15)

(5) For cold weather operation. refer to LO 5-4310-345-12 and table 2-1.

2-2. Installation of Separately Packed Components

a. Remove air service hose assemblies from toolboxes and install on hose reels as shown in figure 2-2.

STEP 1. PLACE END OF HOSE ASSEMBLY THROUGH OPENING OF HOSE REEL FLANGE, FROM THE INSIDE. CONNECT HOSE END TO ELBOW.

STEP 2. LOOSEN HOSE REEL CLAMP AND ROLL HOSE ASSEMBLY ON HOSE REEL, TIGHTEN HOSE REEL CLAMP.

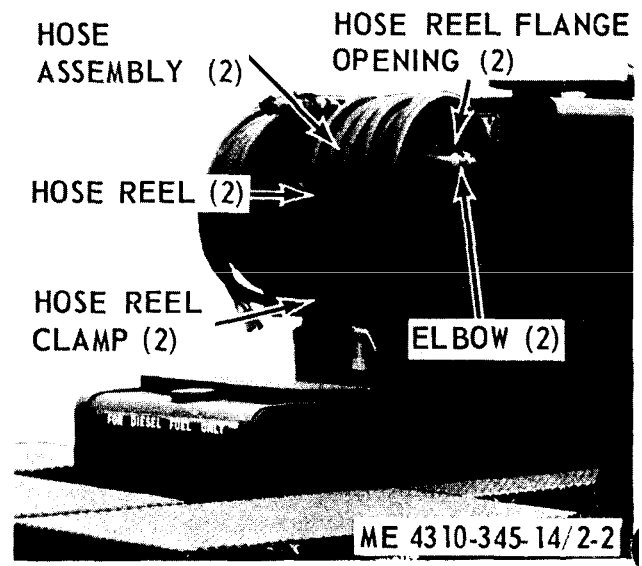


Figure 2-2. Air service hose assemblies, installation on hose reels.

b. Install fully charged fire extinguisher at a location convenient to operator access. (Refer to appendix C.)

c. Fill batteries with electrolyte as described in paragraph 2-1 e (4). Observe the warning.

2-3. Installation

CAUTION

Locate the air compressor unit in an area as free of dust and dirt as possible. A highly contaminated atmosphere places abnormal load on air cleaners, oil filters, and compressor, and can result in an increase in maintenance problems.

a. Tow the air compressor unit to the worksite and select a location as near level as possible. Out-of-level shall not exceed 15 degrees in any direction.

b. Set the parking brakes.

c. Disconnect air brake hoses, intervehicular wiring, safety chains, and towbar from towing vehicle. Secure air hoses to dummy couplings. Secure intervehicular electrical cable in hanger.

CAUTION

Ensure that side doors are fully secured when open.

d. Open and secure housing side doors.

e. Connect air hoses and tools to air discharge connections as required.

WARNING

Do not operate air compressor unit in a building or any enclosed area unless exhaust gases are piped outside.

f. Indoor installation procedure is the same as described in steps *a* through *e* above except observe above warning.

Section II. MOVEMENT TO A NEW WORKSITE

2-4. Dismantling for Movement

a. Stop air compressor unit (fig. 2-10).

b. Remove tools and air hoses from air discharge connections and stow in toolboxes.

c. Close and secure housing side doors.

NOTE

The air compresser unit is self-contained and requires no further dismantling for movement to new worksite.

d. Attach trailer tow bar to towing vehicle. Attach and secure safety chains to towing vehicle.

e. Connect air brake intervehicular hoses to towing vehicle.

f. Connect intervehicular electrical cable between air compressor trailer unit and towing vehicle.

g. Release parking brakes.

CAUTION

Maximum towing speed is 40 miles per hour over highways and 10 miles per hour off-road.

h. Test air brakes and lights to ensure proper operation,

2-5. Reinstallation After Movement

Refer to paragraph 2-3 for installation instructions after movement to new worksite.

Section III. CONTROLS AND INSTRUMENTS

2-6. General

This section describes the various controls and instruments and provides the operator/crew sufficient information to ensure proper operation of the Rotary Air Compressor Unit, Model 14 M250RPV.

2-7. Controls and Instruments

a. Instrument Panel Controls and Instruments (fig. 2-3).

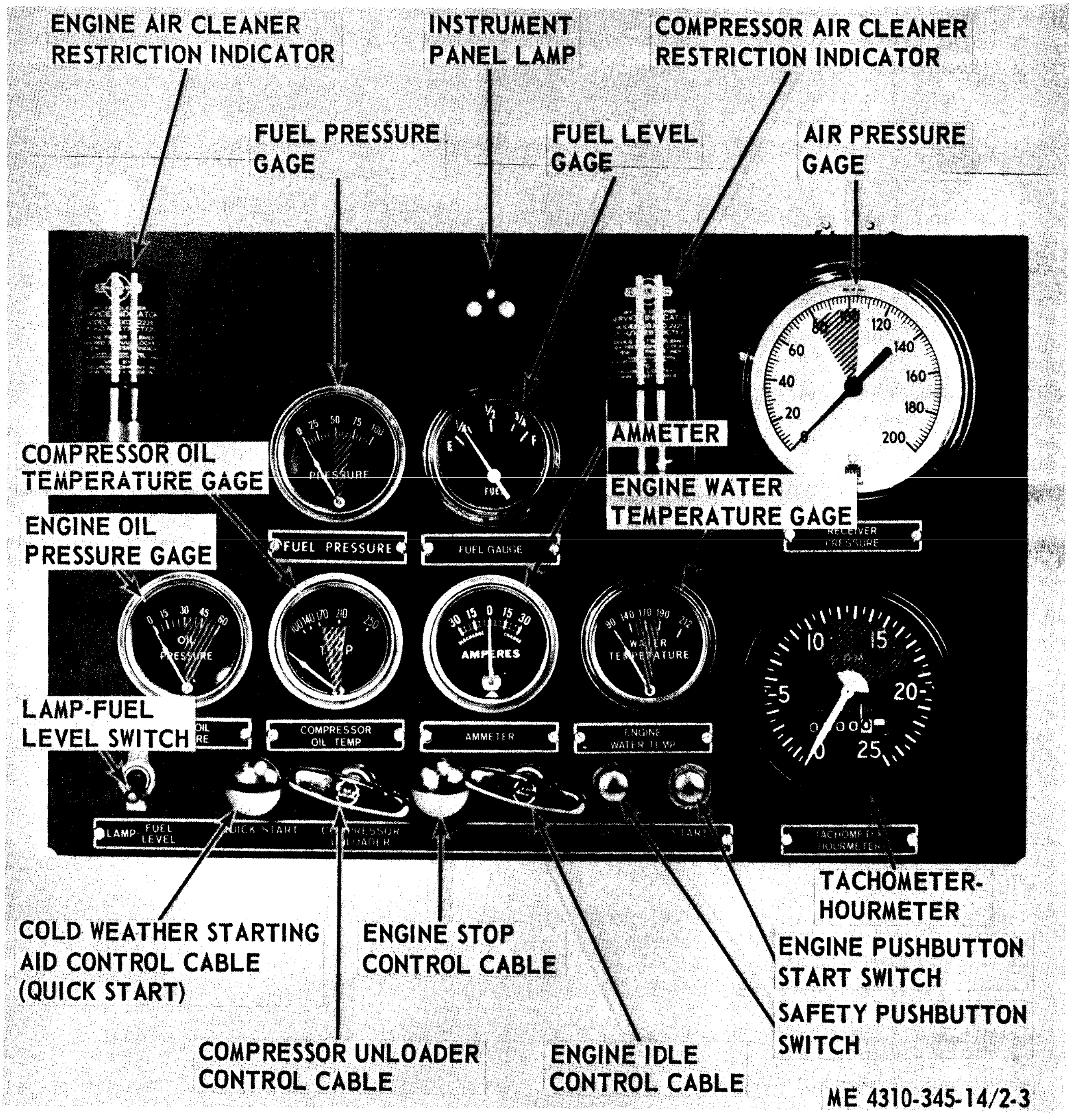


Figure 2-3. Instrument panel, controls and instruments.

(1) Air cleaner restriction indicators. These indicators monitor the air pressure drop through the air cleaners (engine and compressor intake). When the pressure drop is satisfactory, the indicators show green. When intake air is restricted by dirt or any other reason, the indicators show red. After the restriction is cleared, reset indicators by pressing down on top of cap until green is showing.

(2) Fuel pressure gage. This gage indicates engine fuel pressure. Normal fuel pressure is 70 PSI minimum at 1800 RPM.

(3) Fuel level gage. This gage indicates the level of fuel in the fuel tank.

(4) Air pressure gage. This gage indicates the air pressure in the oil separator tank. Normal operating range is 80 to 105 PSI.

(5) Lamp-fuel level switch. This toggle switch controls the illuminating and extinguishing of the

Instrument panel lamp. A switch plate indicates the ON and OFF positions. The switch also activates the fuel level gage.

(6) *Quick start control cable.* This control cable is used to inject cold weather starting aid fuel into the engine air intake.

NOTE

Do not actuate this control cable at temperatures above 40° F.

(7) *Compressor unloader.* This control cable is used when starting the unit in cold weather. Pull handle out and lock to permit unit to start with compressor unloaded. Unlock and push handle in when operating temperature is achieved.

(8) *Engine stop control cable.* This control cable, when pulled all the way out, shuts down the engine by mechanically moving the fuel rack to the extreme “fuel off” position.

(9) *Engine idle control cable.* This control cable, when pulled all the way out, mechanically sets the engine control linkage in idle position for starting. When operating temperature is achieved, push in control cable.

(10) *Safety pushbutton switch.* This pushbutton type switch overrides the engine oil pressure safety switch to allow starting of the engine. This pushbutton must be pressed along with the engine pushbutton start switch when starting and hold in until oil pressure is in excess of 10 PSI.

(11) *Engine pushbutton start switch.* This pushbutton type switch energizes the starting motor solenoid for cranking the engine. This pushbutton must be pressed along with the safety pushbutton switch when starting.

(12) *Oil Pressure gage.* This gage indicates engine lubricating oil pressure. Normal oil pressure is 40 to 60 PSI at 1800 RPM and 30 PSI minimum at idle.

(13) *Oil temperature* gage. This gage indicates compressor oil temperature. Normal operating temperature range is 170° to 220° F after warm-up.

(14) *Ammeter.* This gage indicates rate of battery charge or discharge.

(15) *Water temperature gage.* This gage indicates the engine water temperature. Normal operating range after warm-up is 160° to 185° F.

(16) *Tachometer-hourmeter.* This gage indicates the speed of the engine in revolutions per minute (RPM). Normal operating range is from 1000 RPM idle to 1800 RPM full speed. The gage also records elapsed engine running time in hours and tenths of hours.

b. Safety Circuit Switches (fig. 2-4).

(1) *Air pressure switch.* This switch is connected in series between starting motor and starting pushbutton switch. The air pressure switch prevents the engine from being started when air pressure in the system exceeds 10 PSI.

(2) *Engine water temperature safety switch.* This switch is a normally open temperature sensing device which shuts down the engine if engine coolant reaches an unsafe high temperature. The switch is wired to the engine shutdown solenoid and actuates at 220° ± 5° F.

(3) *Engine oil pressure safety switch.* This switch is a normally closed pressure sensing device which shuts down the engine if engine oil pressure drops to an unsafe operating pressure. The switch is wired to the engine shutdown solenoid. The safety switch actuates at 10 PSI.

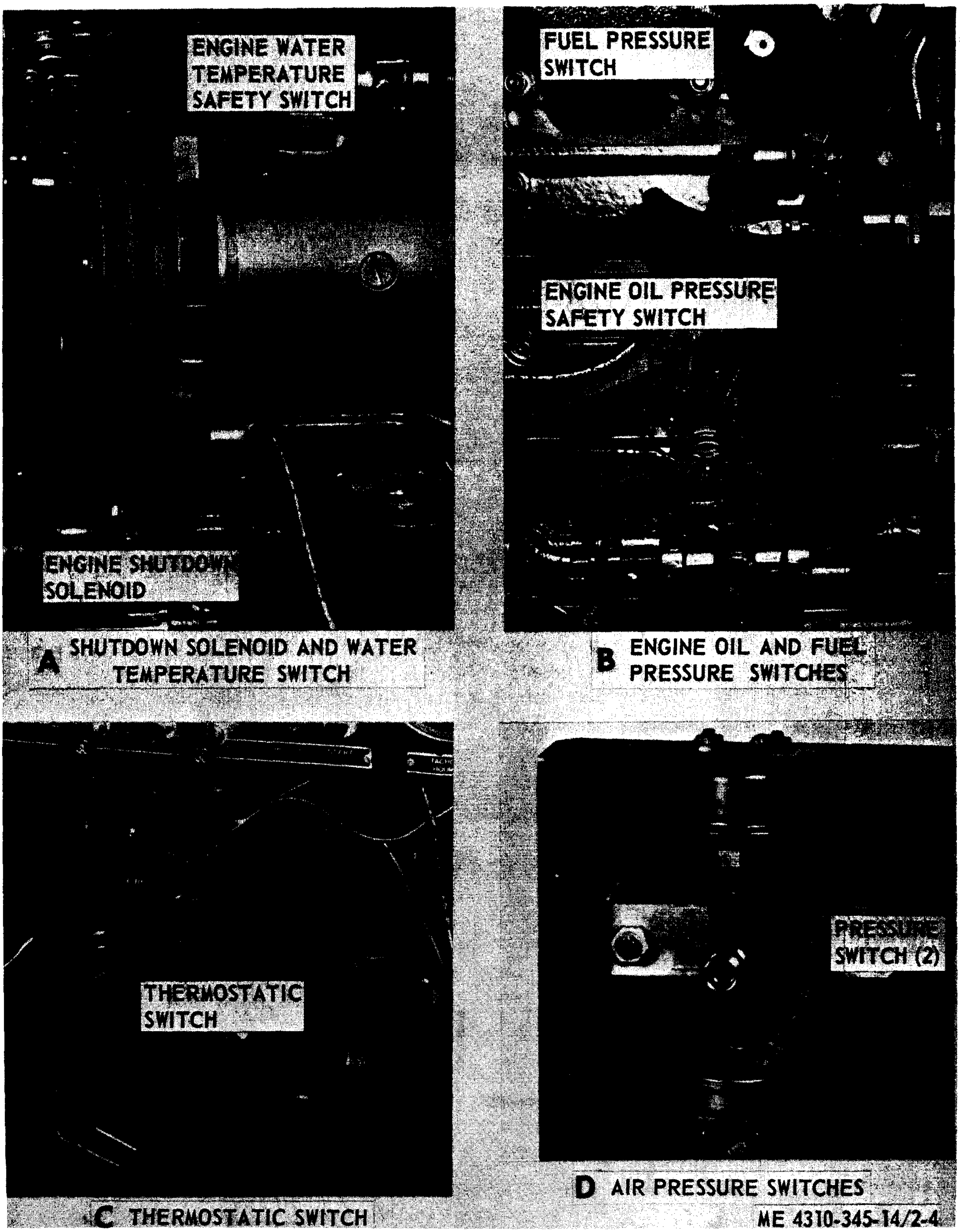


Figure 2-4. Safety circuit switches.

(4) *Thermostatic switch.* This switch is a normally open temperature sensing device which shuts down the engine if the compressor oil reaches an unsafe high temperature. The switch is wired to the engine shutdown solenoid.

(5) *Fuel pressure switch.* This normally open switch energizes when fuel pressure reaches 20 PSI, and actuates the engine shutdown safety citcuit.

(6) *Engine shutdown solenoid.* This solenoid is energized to shut down the engine if engine coolant or compressor oil reaches an unsafe high temperature. The solenoid is also energized if engine oil pressure drops below safe operating pressure. The solenoid releases the air shutdown latch which closes off the engine intake air thereby stopping the engine.

NOTE

The air shutdown latch must be manually reset before starting the engine.

(7) *Air pressure switch (safety circuit).* This norm ally open switch is connected in parallel with the fuel pressure switch. It energizes when air pressure reaches 20 PSI and actuates the engine shutdown safety circuit.

c. Fuel Tank Sending Unit (fig. 2-5). This sending unit transmits an electrical signal to the fuel level gage which interprets the signal and indicates a reading corresponding to the level of the fuel in the tank.

Figure 2-5. Fuel tank sending unit.

d. Compressor Oil Level Gage (fig. 2-6). This gage is a dipstick type and indicates the level of compressor oil in the oil separator tank. Oil level in separator must be maintained at FULL level mark on gage.

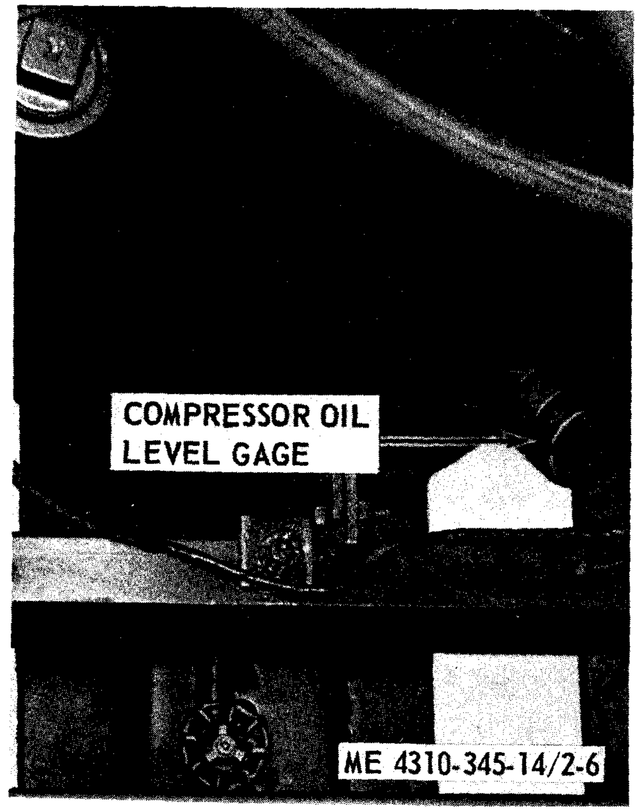


Figure 2-6. Compressor oil level gage.

e. Engine Oil Level Gage (fig. 2-7). This gage is a bayonet type dipstick which indicates the oil level within the engine. The gage is graduated with an "L" for low and "F" for full. Oil level should be maintained at the "F" level. When level reaches the "L" mark, oil shall be added.

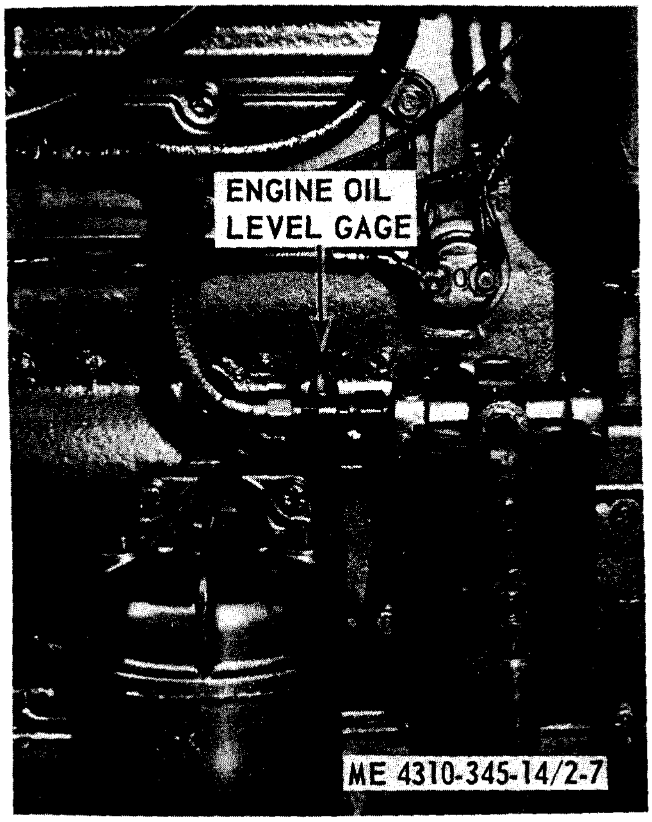


Figure 2-7. Engine oil level gage.

f. Air Discharge Service Valves (fig. 2-8). These service valves control the output of air from the minimum pressure valve assembly which is located on top of the oil separator assembly.

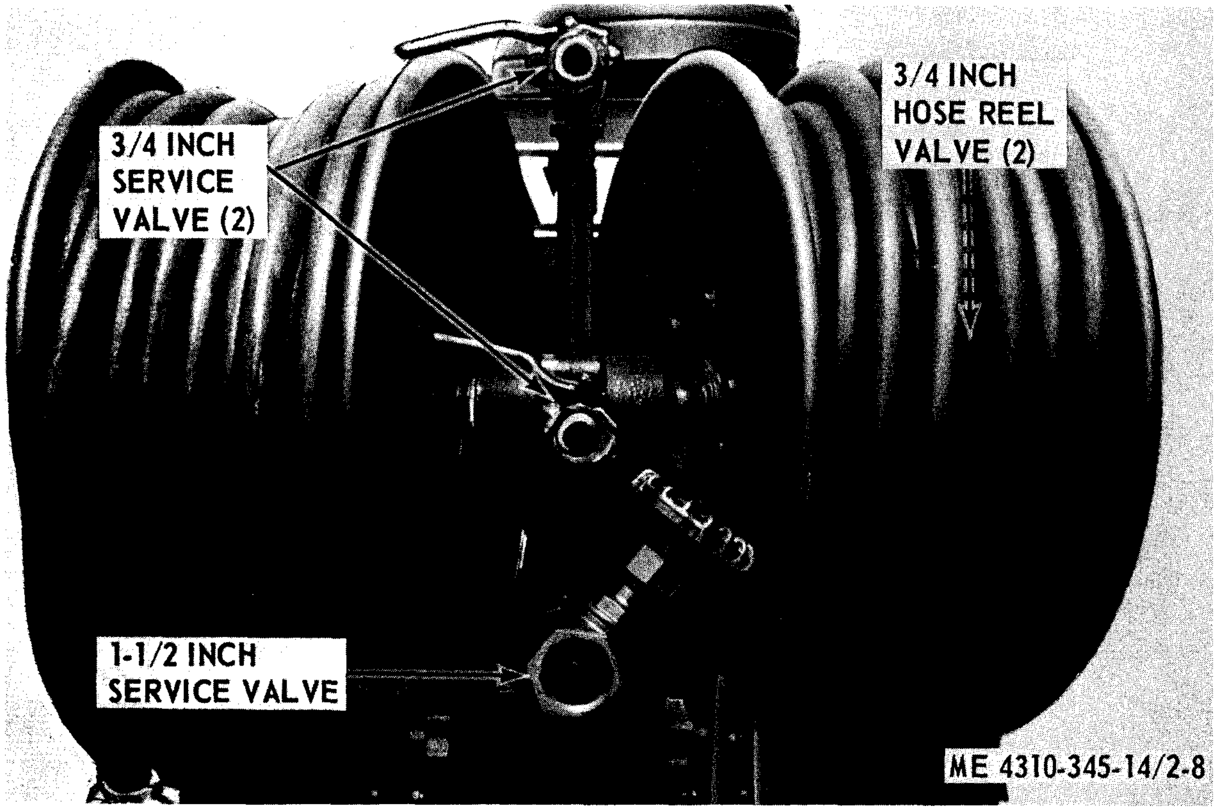


Figure 2-8. Air discharge service values.

g. Oil Separator Safety Valve (fig. 2-9). This valve is a pressure relief type device, normally closed. Lever may be manually operated to relieve oil separator air pressure. The safety valve opens automatically when oil separator air pressure exceeds 125 PSI.

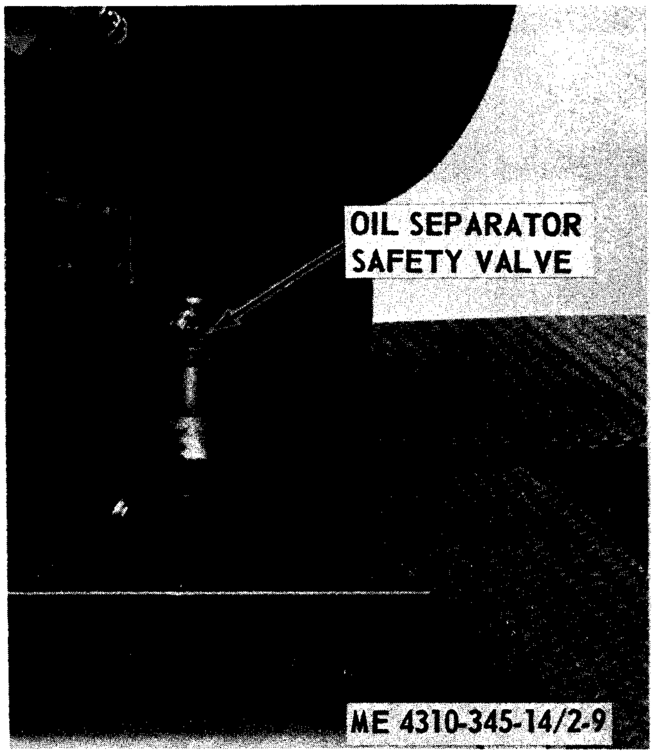


Figure 2-9. Oil separator safety valve.

Section IV. OPERATION UNDER USUAL CONDITIONS

2-8. General

a. The instructions in the information and guidance of personnel responsible for operation of the Rotary Air Compressor, Model 14M250RPV.

b. The operator must know how to perform every operation of which the Rotary Air Compressor, Model 14 M250RPV, is capable. This section contains instructions on starting and stopping the air compressor unit, on operation of the air compressor unit, and on 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.

2-9. Starting

a. Preparation for Starting.

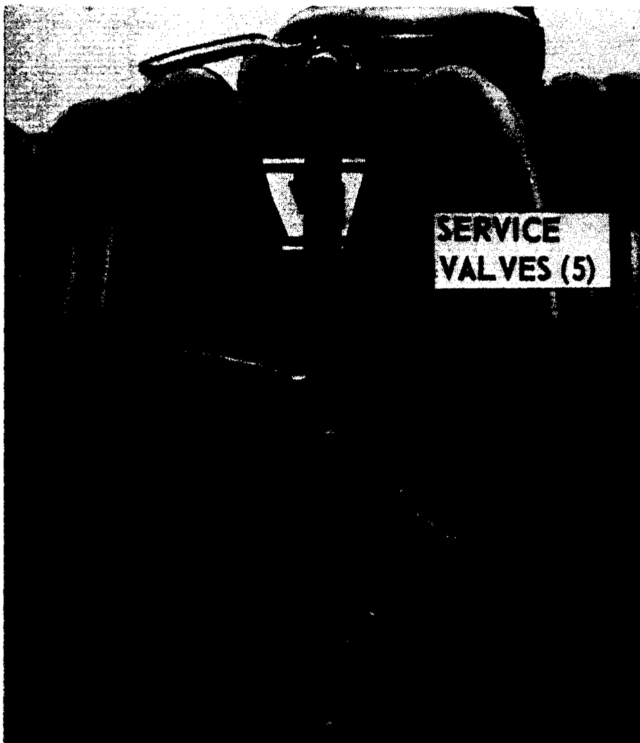
(1) Perform the necessary daily preventive maintenance services (table 3-1).

(2) Check air demand requirements.

b. Starting. Refer to figure 2-10 and start the air compressor unit.

CAUTION

Operating compressor unit below 80 PSI causes overheating of compressor and excessive oil consumption.

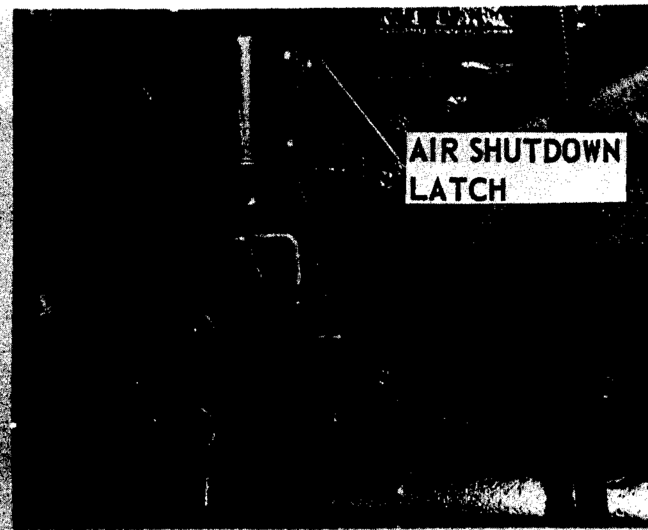


A AIR DISCHARGE SERVICE VALVES

STEP 1. CLOSE ALL AIR DISCHARGE SERVICE VALVES.

STEP 2. SWITCH LAMP-FUEL LEVEL SWITCH TO ON POSITION.

STEP 3. PULL ENGINE STOP CABLE OUT TO STOP POSITION.



B ENGINE AIR SHUTDOWN LATCH

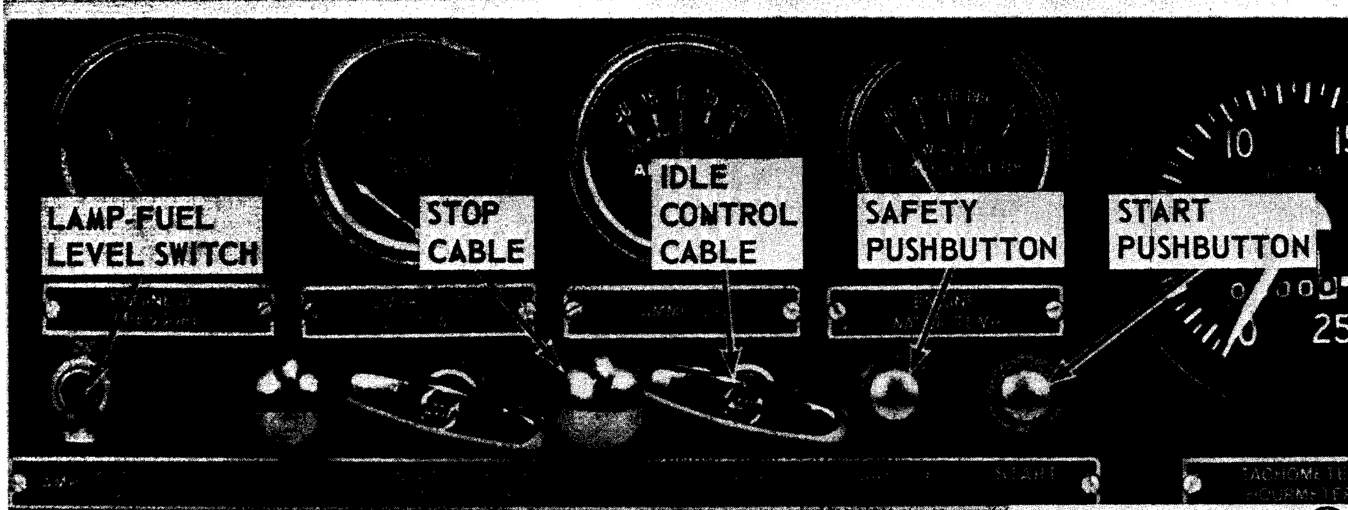
STEP 4. RESET ENGINE AIR SHUTDOWN LATCH.

STEP 5. PULL ENGINE IDLE CONTROL CABLE OUT TO STOP POSITION.

STEP 6. PRESS START PUSHBUTTON FOR 3 SECONDS TO CRANK OVER ENGINE.

STEP 7. PUSH ENGINE STOP CABLE ALL THE WAY IN.

STEP 8. PRESS START PUSHBUTTON AND SAFETY PUSHBUTTON SIMULTANEOUSLY.



C INSTRUMENT PANEL

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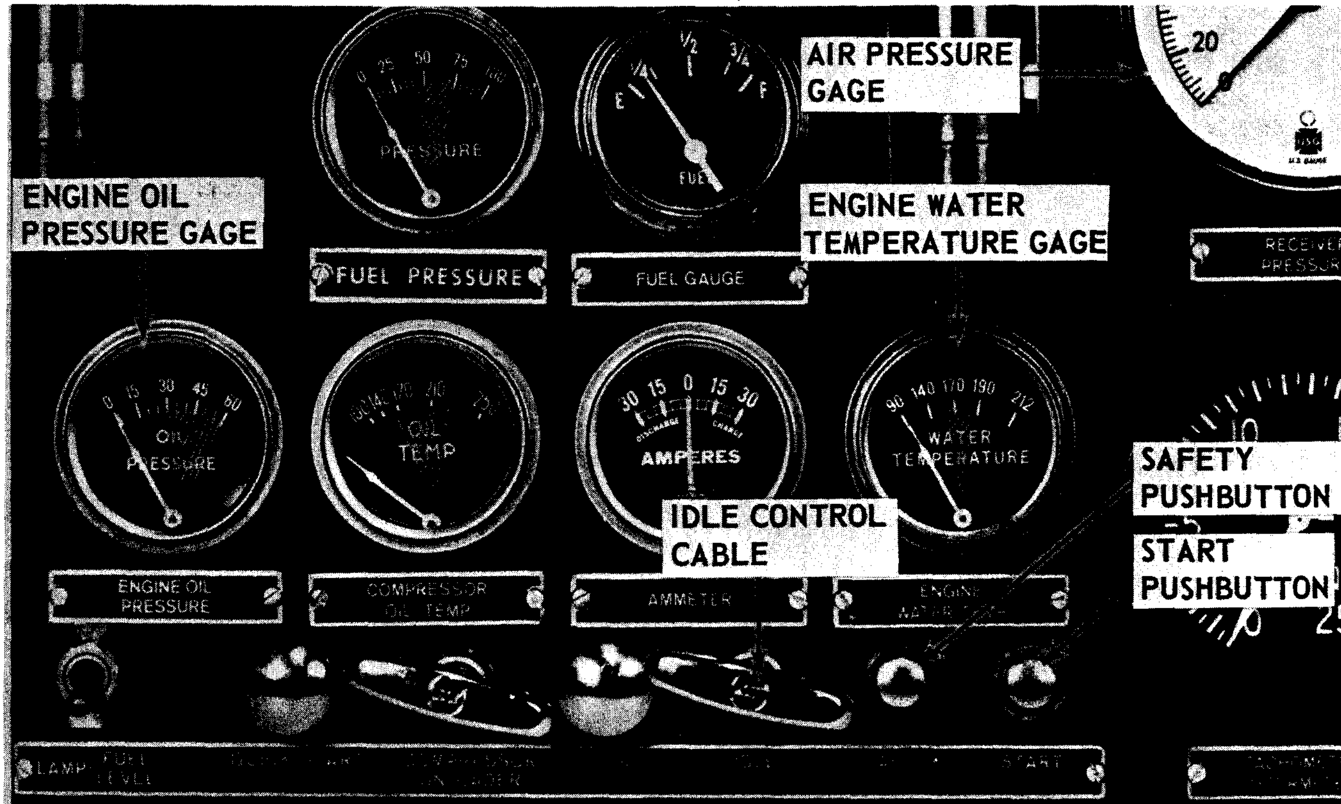
Figure 2-10. Air compressor unit starting procedures (sheet 1 of 3).



CAUTION

DO NOT CRANK ENGINE FOR MORE THAN 30 SECONDS CONTINUOUSLY WITHOUT ALLOWING A 2 MINUTE COOLING OFF PERIOD. IF ENGINE DOES NOT START AFTER A FEW TRIES, STOP CRANKING AND DETERMINE CAUSE OR REPORT CONDITION TO ORGANIZATIONAL MAINTENANCE.

STEP 9. RELEASE START PUSHBUTTON AS SOON AS ENGINE STARTS. RELEASE SAFETY PUSHBUTTON WHEN ENGINE OIL PRESSURE GAGE INDICATES PRESSURE IS ACHIEVED.

STEP 10. ALLOW ENGINE TO RUN AT IDLE UNTIL ENGINE WATER TEMPERATURE GAGE REACHES 140°F, THEN PUSH IDLE CONTROL CABLE ALL THE WAY IN TO INCREASE ENGINE SPEED TO OPERATING LEVEL.

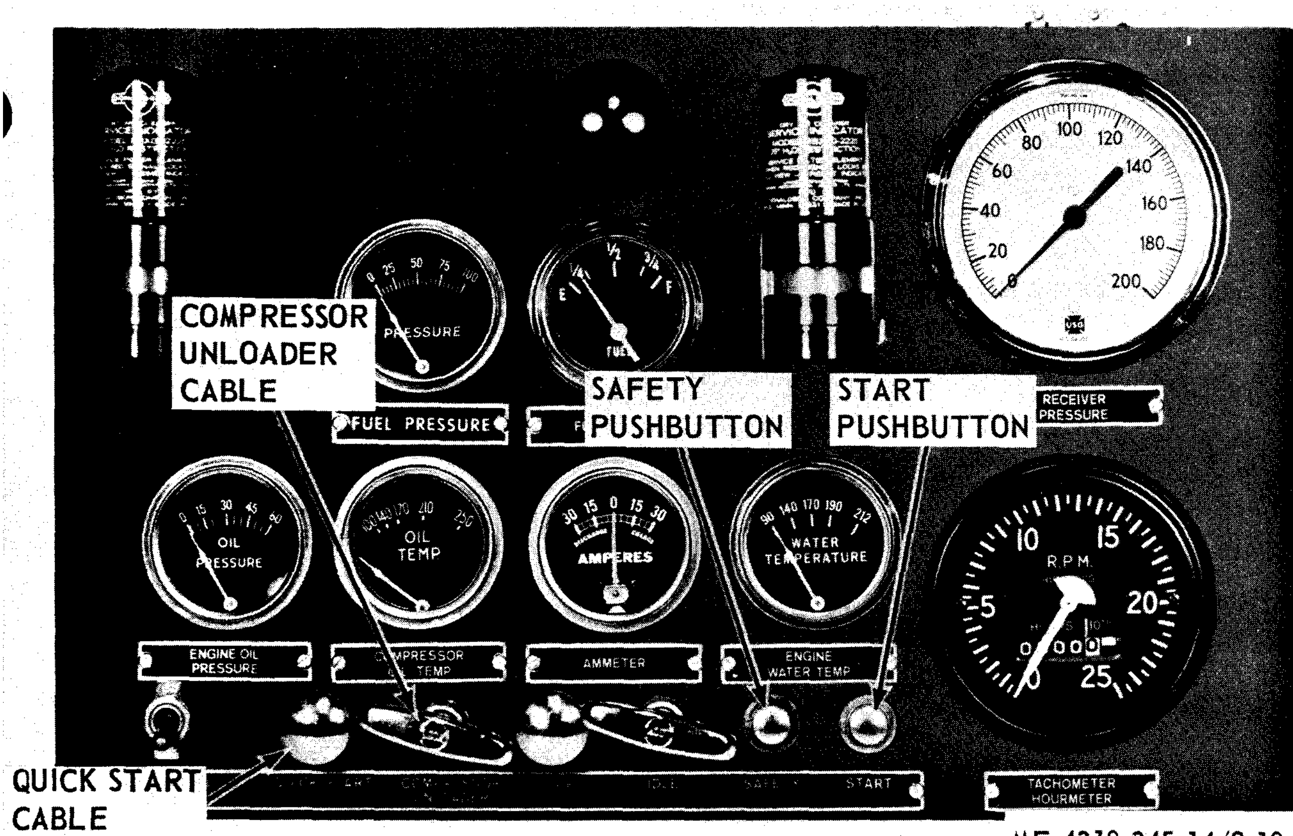
STEP 11. CHECK READINGS OF ALL ENGINE AND COMPRESSOR GAGES.

STEP 12. UNIT IS NOW READY FOR USE. NORMAL OPERATING PRESSURE RANGE IS 80 PSI TO 105 PSI.

CAUTION

DO NOT OPERATE THE COMPRESSOR UNIT WITH LESS THAN 80 PSI IN THE OIL SEPARATOR TANK. IF AIR DEMAND CAUSES PRESSURE TO FALL BELOW 80 PSI, PARTIALLY CLOSE AIR DISCHARGE SERVICE VALVE.

Figure 2-10. Air compressor unit starting procedures (sheet 2 of 3).



E INSTRUMENT PANEL

ME 4310-345-14/2-10 (3)

NOTE

IF WEATHER IS COLD, PERFORM STEPS 1 THRU 7. PULL COMPRESSOR UNLOADER CABLE OUT AND LOCK. PULL QUICK-START CONTROL CABLE OUT FOR 1 TO 2 SECONDS; THEN, WHILE PERFORMING STEP 8, PUSH IN QUICK-START CABLE. DO NOT OPERATE QUICK-START UNTIL START AND SAFETY PUSHBUTTONS ARE PRESSED. IF ENGINE DOES NOT START IMMEDIATELY, ACTUATE QUICK-START AGAIN. WHEN ENGINE IS RUNNING SMOOTHLY, UNLOCK AND PUSH IN COMPRESSOR UNLOADER CABLE. IF ENGINE FALTERS AFTER STARTING, ACTUATE QUICK-START CABLE TO KEEP ENGINE RUNNING.

NOTE

DO NOT ACTUATE QUICK-START IF TEMPERATURE IS ABOVE 40°F.

Figure 2-10. Air compressor unit starting procedures (sheet 3 of 3).

2-10. Stopping

a. Refer to figure 2-11 and stop the air compresser unit.

b. Perform the necessary daily preventive maintenance services (table 3-1).

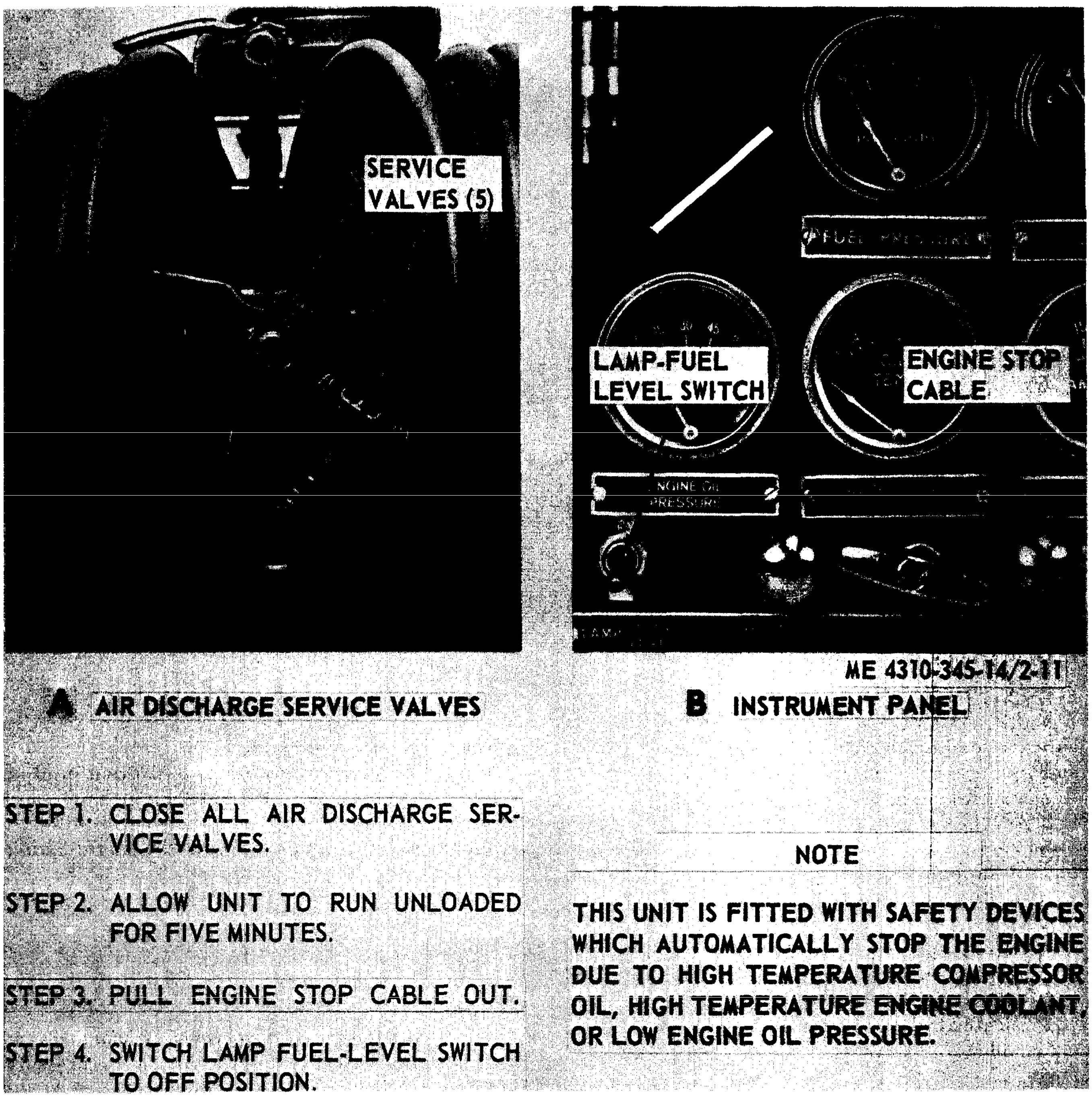


Figure 2-11. Air compressor unit stopping procedures.

2-11. Operation of Equipment

a. General. The air compressor unit is used in general construction work for operation of pneumatic tools. Five discharge connections are provided for attaching pneumatic tools and accessories. Two of these connections are on the hose reels (one on each reel) and three connections located on the minimum pressure valve assembly on top of the oil separator.

b. Operating Air Compressor Unit. The air compressor unit operates automatically after initial starting and warm-up. Only periodic inspection and servicing is required during operating cycle. As the air demand increases, the compressor output automatically increases to meet the demand and maintains a continuous supply of compressed air. Make certain that demand does not exceed unit capability of 250 CFM at 100 PSI. The operator should observe the various gages periodically to ensure that no malfunction exists and that the unit is operating properly. The air supply to each pneumatic tool is controlled by the air discharge service valves.

Section V. OPERATION UNDER UNUSUAL CONDITIONS

2-12. Operation in Extreme Cold (Below 0° F)

a. Ensure that antifreeze solution is correct for lowest temperature anticipated. Refer to table 2-1 for antifreeze data.

b. Inspect cooling system for leaks and circulation. Correct or report any defect to organizational maintenance.

c. Keep batteries fully charged. After adding water to batteries, run engine for at least one hour.

d. Keep fuel tank full when unit is not in operation. Refer to tabulated data, paragraph 1-8 *b,* for fuel type and tank capacity.

e. Drain and service fuel filter (fig. 3-7).

f. Lubricate air compressor unit in accordance with LO 5-4310-345-12.

g. Allow engine to reach operating temperature before applying load.

2-13. Operation in Extreme Heat

a. Keep engine cooling system clean and full of coolant. Inspect cooling system often and correct or report any leaks or other malfunction to organizational maintenance.

b. Locate the air compressor unit in a well ventilated area. Keep side doors open during operation to promote good air circulation.

c. Keep air compressor unit lubricated in accordance with LO 5-4310-345-12.

2-14. Operation in Dusty or Sandy Areas

A highly contaminated dusty or sandy area places an extra load on the air cleaners, oil filters, engine and compressor with the possibility of increased wear and maintenance. Therefore, servicing of the unit must be performed at much shorter intervals as inspection reveals the presence of contamination in the oil supplies and air cleaners. The following steps outline the operating procedures.

WARNING

Do not operate air compressor unit in an enclosed or sheltered area unless the exhaust gases are piped outside.

a. Locate air compressor unit in a sheltered area, if possible. Pipe exhaust gases outside of sheltered area.

b. Keep entire unit as clean as possible.

c. Lubricate unit in accordance with LO 5-4310-345-12 except intervals shall be more frequent when inspections indicate service should be performed.

d. Repeatedly check air cleaner restriction indicators and service air cleaners as required (fig. 3-11).

e. Periodically wet down surrounding area to help reduce dust.

2-15. Operation Under Rainy or Humid Conditions

a. Wipe all exposed areas frequently.

b. Cover air compressor unit when not in operation.

c. Keep electrical components clean and dry.

d. Inspect air cleaners and oil supplies frequently for contamination. Service in accordance with LO 5-4310-345-12.

2-16. Operation in Salt Water Areas

Follow same procedures described in paragraph 2-15.

2-17. Operation in Snow

Follow same procedures described in paragraph 2-15.

2-18. Operation in Mud

a. Position air compressor unit as level as possible. Out-of-level shall not exceed 15° in any directional plane.

b. If ground is very soft or miry, place blocks, boards, or the equivalent under each wheel to prevent unit from settling.

c. Take necessary precautions to prevent mud or water from getting inside air discharge hoses and fittings.

d. Clean air compressor unit thoroughly after use.

2-19. Operation in High Altitudes

CAUTION

Check unit frequently for overheating of engine during high-altitude operation.

This air compressor unit operates satisfactorily at high altitudes. However, since barometric pressure (air density) decreases as altitude increases, a slight loss of compressor efficiency may be noticed at higher altitudes. This is a normal condition and cannot be prevented.

Section Vi. OPERATION OF MATERIEL USED IN CONJUNCTION WITH THE EQUIPMENT

2-20. Diesel Engine Cold Weather Starting Aid

a. Description. The diesel engine cold weather starting aid (Quick-Start) is a measured-shot system which contains an ether base fuel mixture. This fuel mixture, which is highly combustible, is manually injected into the engine air intake. The cold weather starting aid consists of the measured-shot valve, cylinder mounting clamps. atomizer. control cable, and replaceable fuel cylinder.

b. Operation.

WARNING

Do not operate cold weather starting aid at temperatures above 40° F. Do not puncture or mishandle fuel cylinder. The cylinder contains an ether base mixture which is extremely toxic, volatile, and combustible.

(1) Pull out (Quick-Start) control cable (fig, 2-3) for one to two seconds to fill chamber in valve body.

CAUTION

Use only one shot of starting aid fuel for each engine start. Excessive use of starting aid fuel can seriously damage engine.

(2) When engine is cranking, push in control cable to release starting aid fuel into engine air intake.

c. Replacement.

(1) Weigh cylinder to determine remaining fuel capacity, A full cylinder weighs 37 ounces; an empty cylinder weighs 17 ounces. To determine approximately how many starts are left in a cylinder, allow 5 cc's per shot (39 cc's per ounce).

(2) To replace an empty fuel cylinder, loosen clamps that attach cylinder to housing and unscrew cylinder from valve. Place new cylinder in valve, screw cylinder into valve in clockwise direction and secure cylinder in place with attaching clamps.

d. Maintenance. Refer to figure 3-16 for maintenance instructions.

2-21. Fire Extinguisher (Monobromotrifluoromethane Type)

The monobromotrifluoromethane type fire extinguisher is generally suitable for all types of fire, except fires involved with LOX (liquid oxygen) generating equipment. Refer to TB 5-4200-200-10 for operation and maintenance of the fire extinguisher.

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I. BASIC ISSUE ITEMS

3-1. Basic Issue Items

Items issued with or authorized for the Rotary Air Compressor Unit, Model 14M250RPV, are listed in the basic issue items list, appendix C.

Section II. LUBRICATION INSTRUCTIONS

3-2. Detailed Lubrication Information

a. General. Keep all lubricants in closed containers and store in a clean, dry place away from external heat. Allow no dust, dirt, or other foreign matter 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 lubrication to prevent accumulation of foreign matter.

c. *Points of Lubrication.* Service the lubrication points at proper intervals specified on LO 5-4310-345-12.

CAUTION

Over lubrication may cause equipment failure or damage to working parts.

d. Operation Immediately After Lubrication. Inspect all oil lines, fittings, and filters for leaks immediately after lubrication and during operation.

e. OE/ HDO and OES Oil.

(1) The crankcase oil level must be checked frequently since oil consumption may increase at any time.

(2) The oil may require changing more frequently than usual during cold weather operating conditions. These extreme conditions cause oil contamination by dilution and an increase in sludge formation.

(3) The oil must be changed at least every 50 hours of operation if the fuel used has a sulphur content of more than 0.4 percent. The oil filter change period can remain at the normal specified time.

f. Oil Filter Service. Service engine oil filter and compressor oil filter as illustrated in figure 3-5 and 3-6 at intervals specified in table 3-1.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-3. General

To ensure that the rotary air compressor unit is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance checks and services to be performed are described in table 3-1. The item numbers indicate the sequence of minimum inspection requirements, Defects discovered during operation of the unit will be noted for future correction to be made as soon as operation has ceased, Stop operation immediately if a deficiency is noted during operation which would dam age 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. Preventive Maintenance Checks and Services

Operator's periodic (daily and weekly) preventive maintenance checks and services are listed in table 3-1.

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Table 3-1. Preventive Maintenance Checks and Services

Item No.	Operator Interval — Daily — B	D	A	W	Item to be inspected (B–Before operation; D—During operation)	Procedure	Reference
1	Y			X	Radiator assembly	Check engine coolant level. Proper level is 2 inches below filler neck.	para 3-5
	x			X		Check radiator, hoses, clamps, and connections for leaks or other defects.	para 4-13
	x			X		Check antifreeze level when operating in temperatures below +32°F.	Table 2-1; para 2-12
2	x		X	X	Fuel tank	Check fuel level. Use gage on instrument panel.	para 3-6
	x			X		Check tank for leaks or other defects.	fig. 3-2
	x			X		Check cap gasket for damage.	fig. 3-2
				X		Check fuel lines and fittings for leaks or other damage.	fig. 3-2
3	x			X	Engine crankcase	Check oil level. Use dipstick gage.	para 3-7; fig. 3-3
				X		Change oil.	LO 5-4310-345-12
4	x		X	X	Oil separator	Check oil level. Use oil level gage on tank.	para 3-8; fig. 3-4
5				X	Engine oil filter	Change filter element.	para 3-9; fig. 3-5
6				X	Compressor oil filter	Change filter element.	para 3-10; fig. 3-6
7	x			X	Primary fuel filter	Drain approx. 1/4 pint of fuel to drain off sediment. Change element every 300 hours.	para 3-11; fig. 3-7
8	x			X	Secondary fuel filter	Drain approx. 1/4 pint of fuel to drain off sediment. Change element every 300 hours. Drain every 50 hours when operating in temperatures of +32°F and above. Drain every 10 hours when operating temperatures below + 32 °F.	para 3-11; fig. 3-7
9	x			X	Drive belts	Check for worn, frayed, or cracked belts.	para 3-12; fig. 3-8
10				X	Batteries	Check battery mounting and cable connections.	para 3-13; fig. 3-9
				X		Check electrolyte level. Correct level is 3/8 in. above plates.	fig. 3-9
				X		Remove corrosion from battery terminals and lubricate.	
				X		Clean filler cap vent holes.	
	x					Check general condition of batteries.	
				X		Make hydrometer test.	
11	x	x			Engine speed control linkage	Check linkage for freedom of movement.	para 3-14; fig. 3-10
				X		Lubricate linkage.	
12	x	x	X	X	Air cleaners	Check restriction indicators.	para 3-15; fig. 3-11
				X		Clean element and body.	fig. 3-11
						Inspect element.	
13	x		X		Controls and instruments	Check for damaged control cables and instruments.	fig. 2-3
	x					Check for loose mountings.	
		x				Check instruments for proper operation. Normal readings are: Engine oil pressure: 40 to 60 PSI at 1800 RPM; Tachometer-hourmeter: Idle, 1000 RPM governed speed 1800 RPM; Water temperature: 160°—185 °F	

Table 3-1. Preventive Maintenance Checks and Services

Item No.	operator Interval Daily B	D	A	W	B-Before operation D–During operation A-After operation W-Weekly Item to be inspected	Procedure	Referance
					Controls and instruments-continued	Oil Temperature: 170°—220°F Air pressure: 80-105 PSI fuel pressure: 70 PSI minimum at 1800 RPM	
14		x			Engine assembly	Check for even running and exhaust smoke for improper combustion.	table 3-2
15	x			X	Tires	Check inflation pressure for missing valve caps and wear,	para 3-16; fig. 3-12 TM 9-2330-247-14
16	x			X	Brake system	Check all air lines and connections.	para 3-17; fig. 3-13 TM 9-2330-247-14
				X		Check parking brake position.	
17				X	Springs	Check for broken mounting hardware or spring leafs.	para 3-18; fig. 3-14 TM 9-2330-247-14
18	x		X	X	Lighting system	Check operation of all taillights, stoplights, clearance lights, and panel light.	para 3-19; fig. 3-15
19	x			X	Cold weather starting aid	Weigh cylinder. Full cylinder weighs 37 ounces. Fuel consumption is 5 cc's per shot.	para 3-20; fig. 3-16
				X		Clean atomizer.	para 4-21
	x		X	X		Check cylinder for hand tightness in valve.	
20				X	Wiring harness	Check wiring for damaged connections and frayed insulation.	para 4-34
21				X	Oil separator safety valve	Check for proper operation. Safety valve may be manually operated by lifting lever. Valve open at 125 PSI automatically to relieve oil separator air pressure.	para 3-21; fig. 3-17
22				X	Fire extinguisher	Check weight.	Refer to TB 5-4200-200.10 for maintenance.

3-5. Radiator Service

Service radiator as shown in figure 3-1.

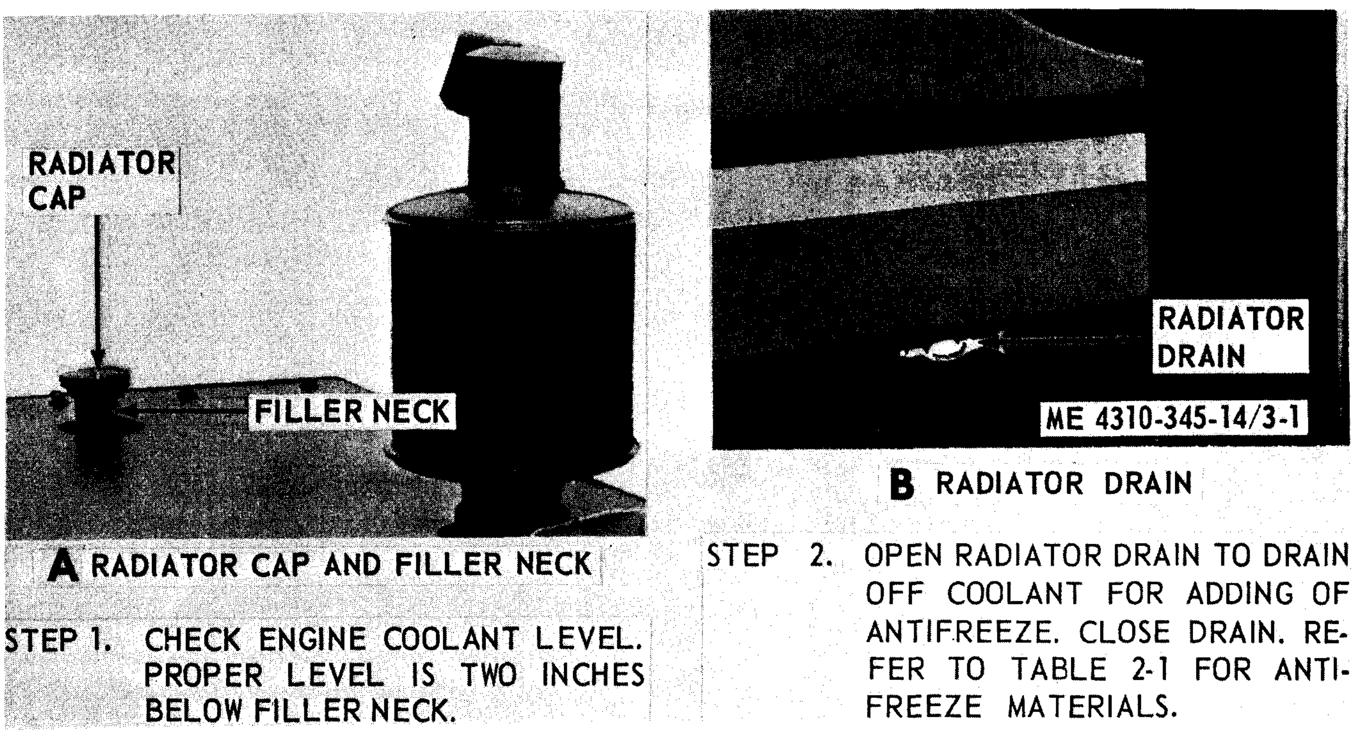


Figure 3-1. Radiator service.

3-6. Fuel Tank Service

Service fuel tank as shown in figure 3-2.

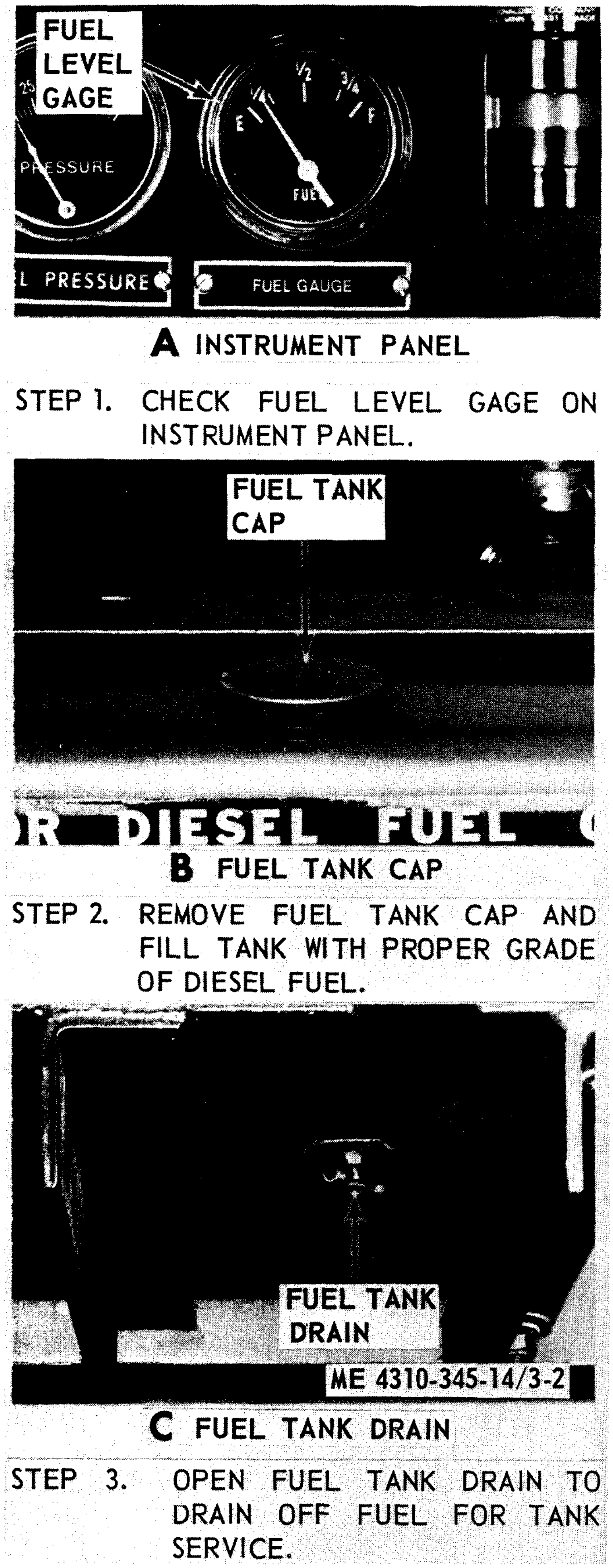
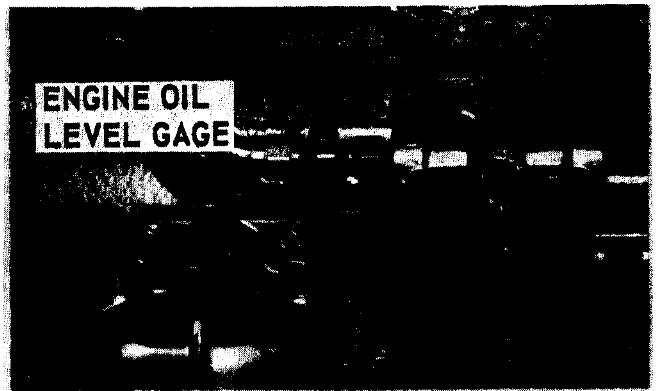


Figure 3-2. Fuel tank service.

3-7. Engine Crankcase Service

Service engine crankcase as shown in figure 3-3.

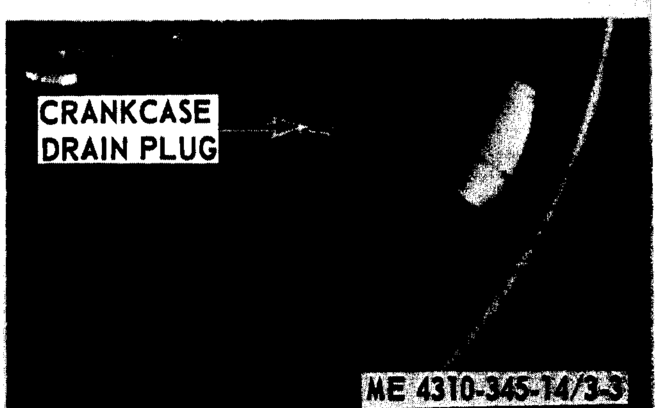


A OIL LEVEL GAGE

STEP 1. CHECK ENGINE OIL LEVEL GAGE FOR PROPER CRANKCASE OIL LEVEL.

B OIL FILL CAP

STEP 2. FILL CRANKCASE TO PROPER LEVEL. SEE LO5-4310-345-12.



C CRANKCASE DRAIN PLUG

STEP 3. REMOVE CRANKCASE DRAIN PLUG TO DRAIN OIL FOR OIL CHANGE. INSTALL DRAIN PLUG.

Figure 3-3. Engine crankcase service.

3-8. Oil Separator Service

Service the oil separator as shown in figure 3-4.

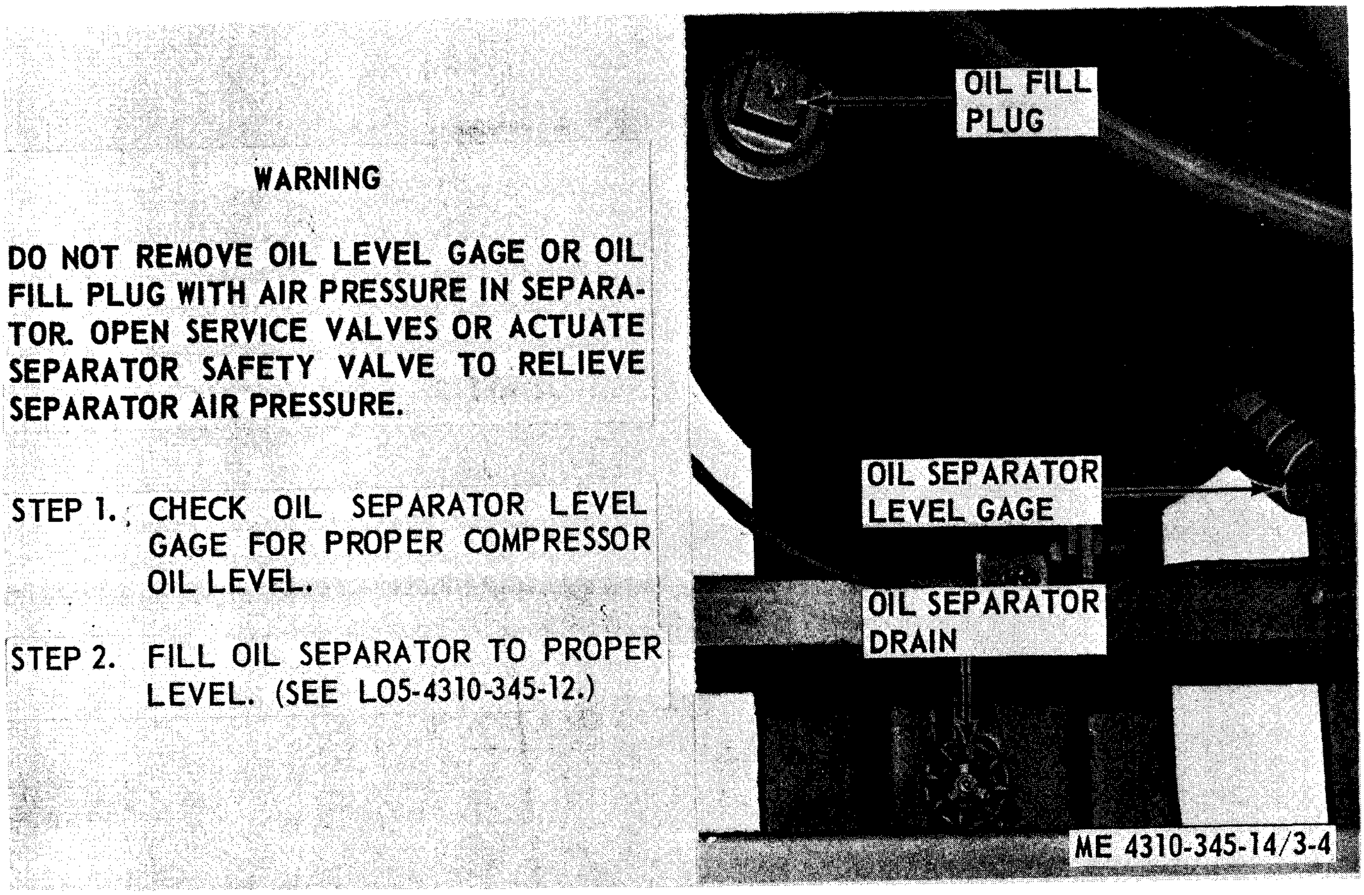
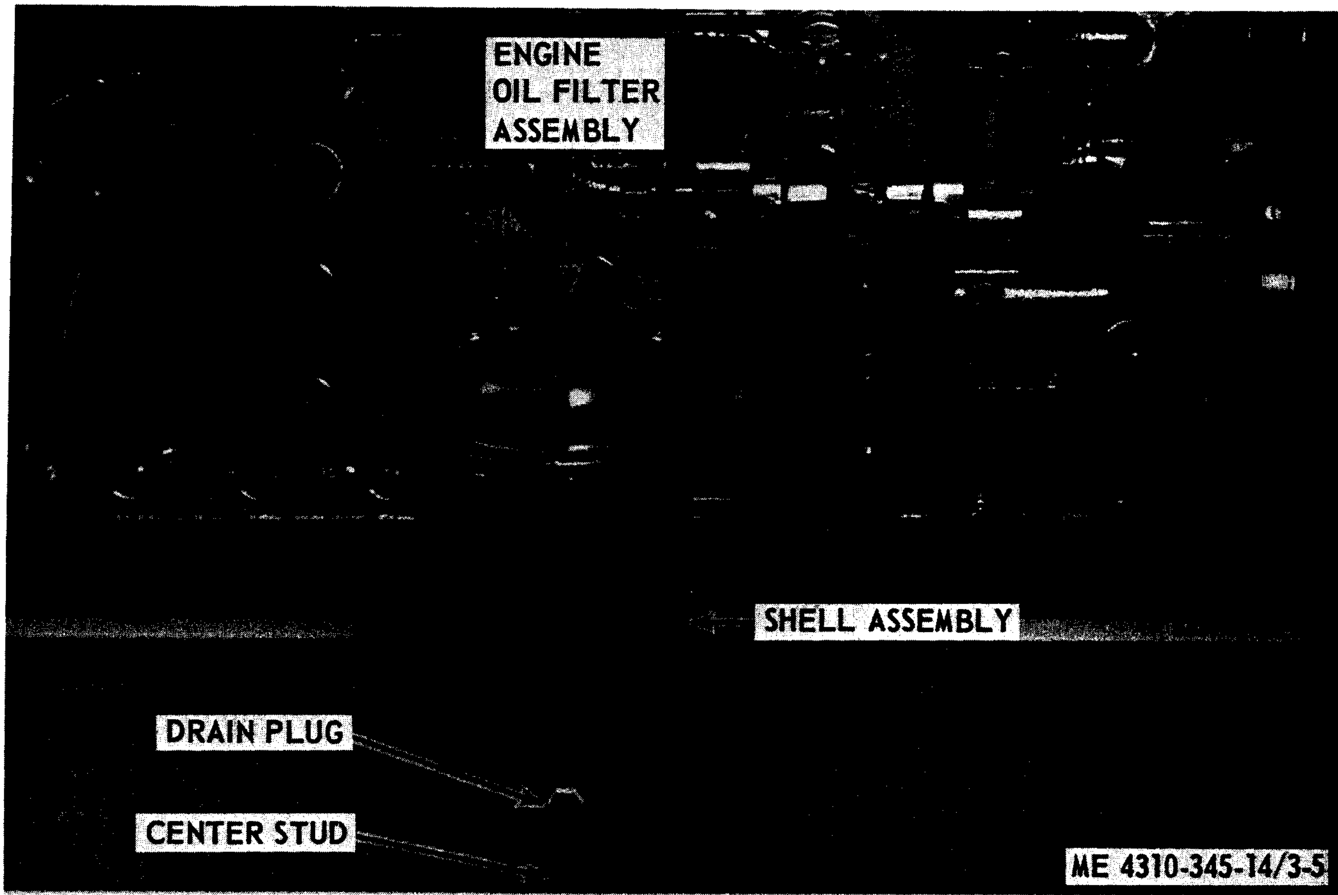


Figure 3-4. Oil separator service.

3-9. Engine oil Filter Service

Service the engine oil filter as shown in figure 3-5.



NOTE

STOP ENGINE BEFORE SERVICING ENGINE OIL FILTER. SERVICE AFTER EACH 100 HOURS OF OPERATION.

STEP 1. REMOVE DRAIN PLUG AND DRAIN OIL FROM SHELL ASSEMBLY. REPLACE DRAIN PLUG.

STEP 2. UNSCREW CENTER STUD AND REMOVE SHELL ASSEMBLY AND ELEMENT.

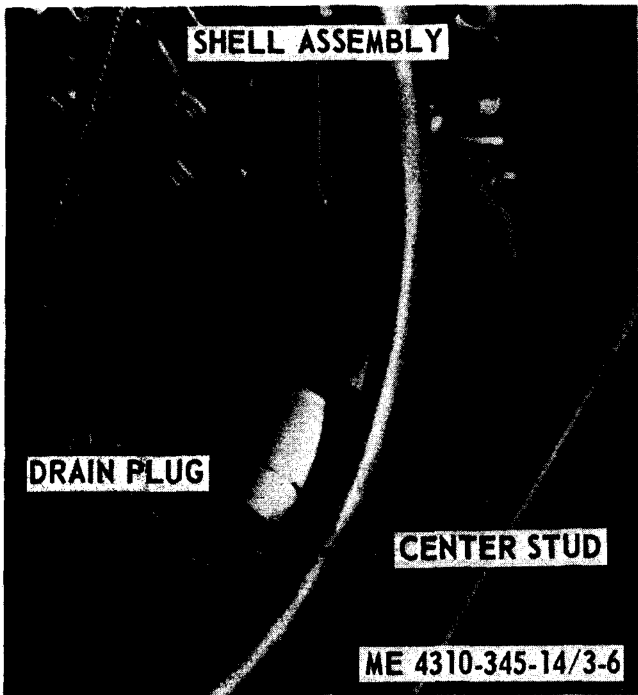
STEP 3. CLEAN SHELL ASSEMBLY AND HEAD USING A CLEANING SOLVENT CONFORMING TO FEDERAL SPECIFICATION P-D-680.

STEP 4. INSTALL NEW ELEMENT AND GASKET. INSTALL SHELL ASSEMBLY. TIGHTEN CENTER STUD TO 45-55 LB/FT TORQUE.

Figure 3-5. Engine oil-filter service.

3-10. Compressor Oil Filter Service

Service the compressor oil filter as shown in figure 3-6.



NOTE

STOP ENGINE BEFORE SERVICING COMPRESSOR OIL FILTER. SERVICE AFTER EACH 100 HOURS OF OPERATION.

STEP 1. PLACE CONTAINER OF APPROXIMATELY THREE QUART CAPACITY UNDER COMPRESSOR OIL FILTER. REMOVE DRAIN PLUG FROM SHELL ASSEMBLY AND DRAIN OIL. REPLACE DRAIN PLUG.

STEP 2. UNSCREW CENTER STUD AND REMOVE SHELL ASSEMBLY AND ELEMENT.

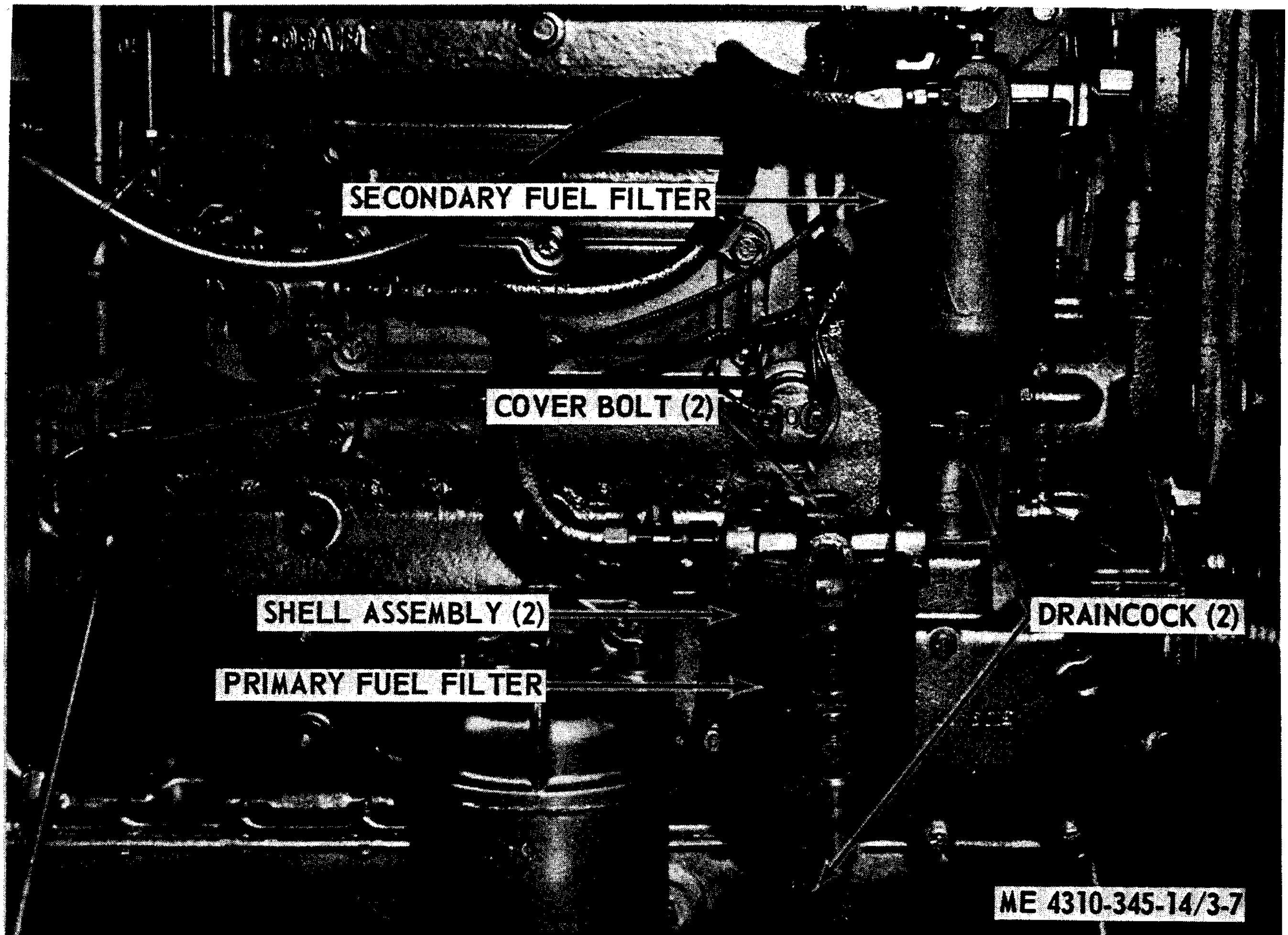
STEP 3. CLEAN SHELL ASSEMBLY AND HEAD USING A CLEANING SOLVENT CONFORMING TO FEDERAL SPECIFICATION P-D-680.

STEP 4. INSTALL NEW ELEMENT AND GASKET. INSTALL SHELL ASSEMBLY, TIGHTEN CENTER STUD TO 45-55 LB/FT TORQUE.

Figure 3-6. Compressor oil filter service.

3-11. Primary and Secondary Fuel Filter Service

Service the engine primary and secondary fuel filters as shown in figure 3-7.



NOTE

STOP ENGINE BEFORE SERVICING PRIMARY OR SECONDARY FUEL FILTER. SERVICE EACH 300 HOURS OF OPERATION.

STEP 1. PLACE A CONTAINER OF APPROXIMATELY TWO QUART CAPACITY UNDER FUEL FILTERS AND OPEN DRAINCOCKS TO DRAIN OFF FUEL IN SHELL ASSEMBLY. CLOSE DRAINCOCKS.

STEP 2. UNSCREW AND REMOVE COVER BOLT. REMOVE SHELL ASSEMBLY AND ELEMENT.

STEP 3. CLEAN SHELL ASSEMBLY AND HEAD WITH A CLEANING SOLVENT CONFORMING TO FEDERAL SPECIFICATION P-D-680 OR CLEAN DIESEL FUEL.

STEP 4. INSTALL NEW ELEMENT AND GASKETS. FILL SHELL WITH FUEL AND INSTALL SHELL ASSEMBLY. SECURE WITH COVER BOLT.

Figure 3-7. Primary and secondary fuel filter service.

3-12. Drive Belt Service

Service the drive belts as shown in figure 3-8.

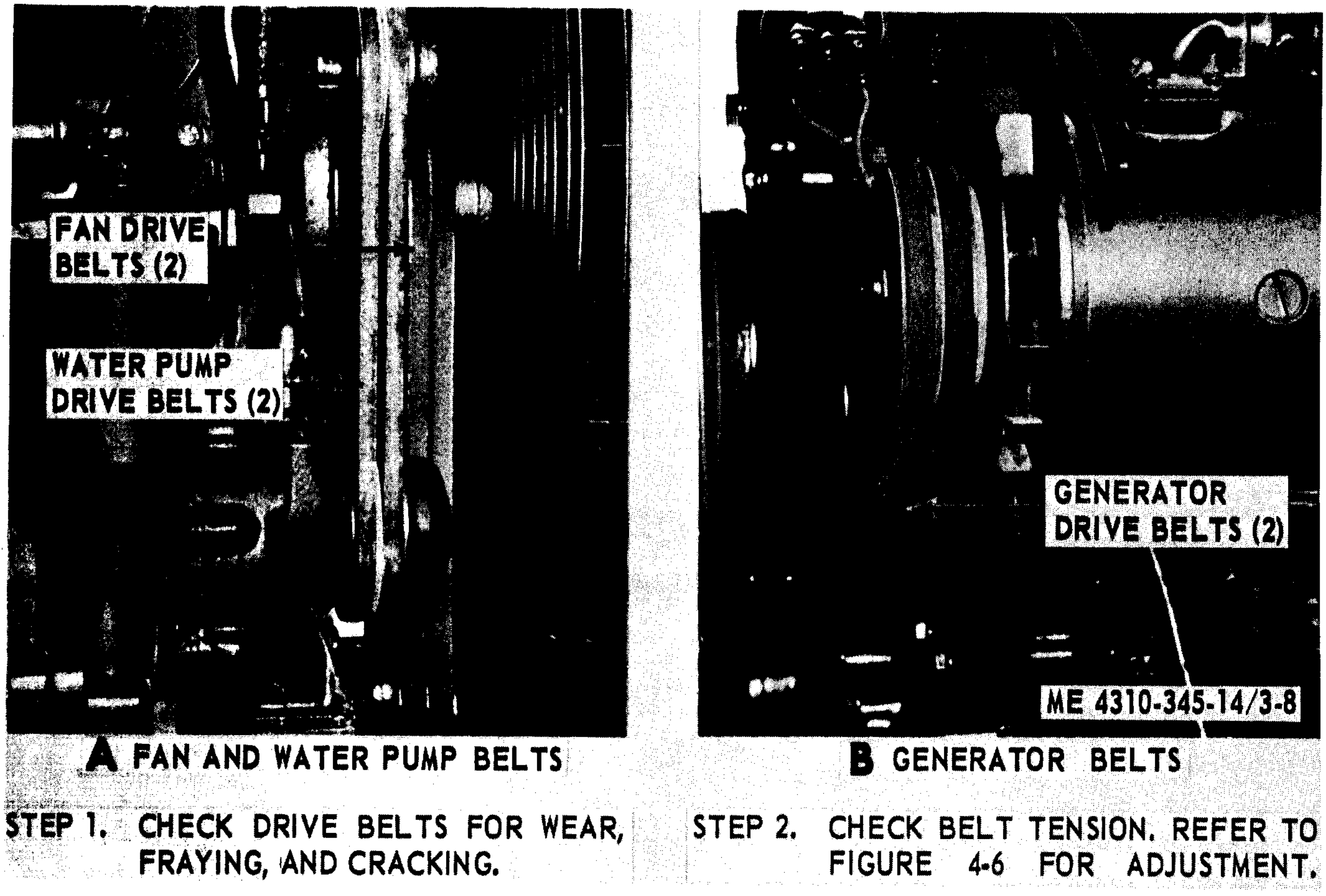
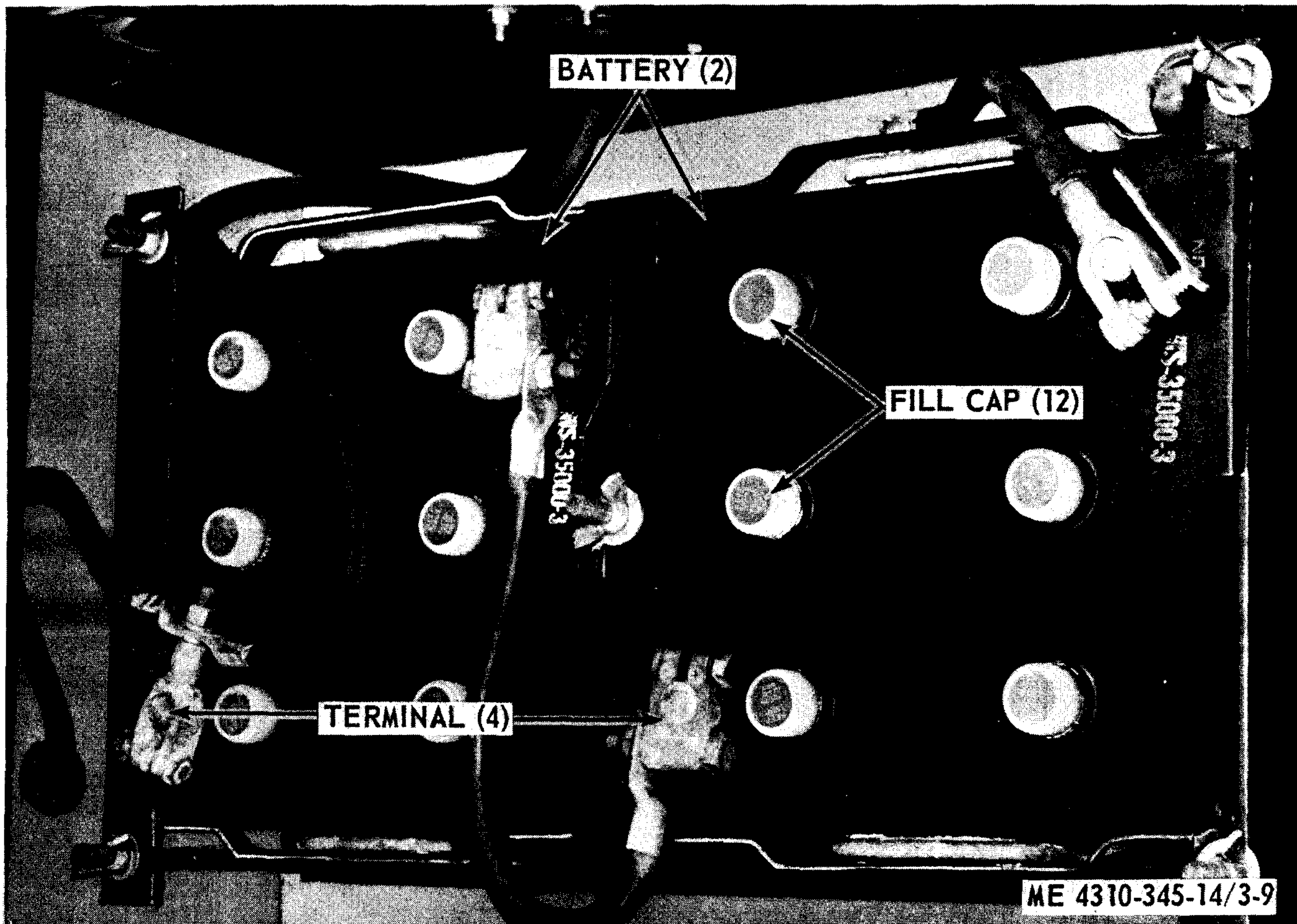


Figure 3-8. Drive belt service.

3-13. Battery Service

Service the batteries as shown in figure 3-9.

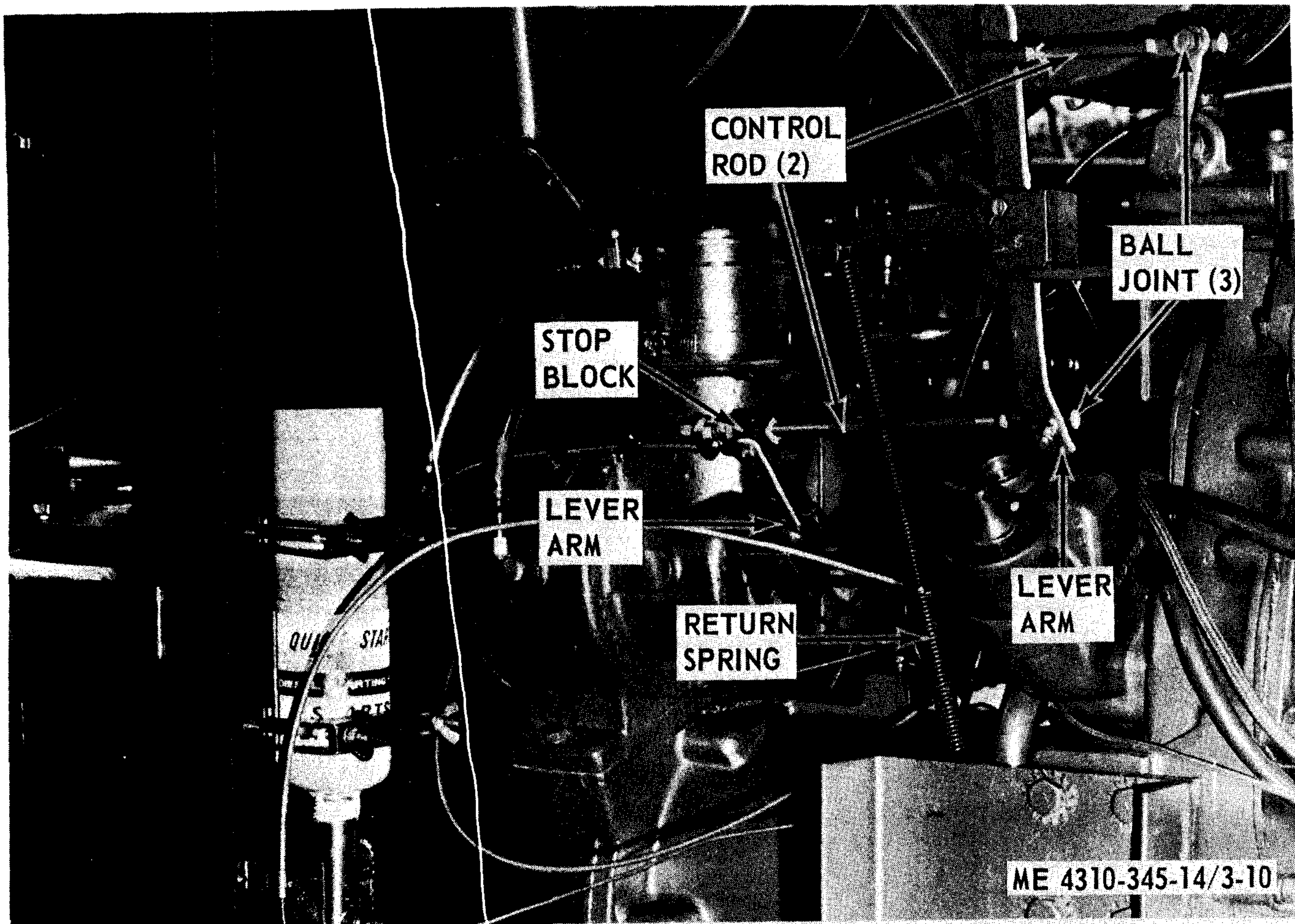


STEP 1.	REMOVE FILL CAP (12). CLEAN VENT HOLE.
STEP 2.	FILL BATTERY CELLS WITH DISTILLED WATER TO A LEVEL OF 3/8 INCH ABOVE PLATES. (FILL TO LEDGE ONLY.)
STEP 3.	CLEAN TERMINALS (4) AND COAT LIGHTLY WITH LUBRICANT. CLEAN BATTERIES (2) WITH WATER OR A SOLUTION OF SODIUM BICARBONATE. DO NOT ALLOW THE BICARBONATE SOLUTION TO ENTER OR MIX WITH THE ELECTROLYTE IN THE CELLS.

Figure 3-9. Battery service.

3-14. Speed Control Linkage Service

Service the speed control link age as shown in figure 3-10.



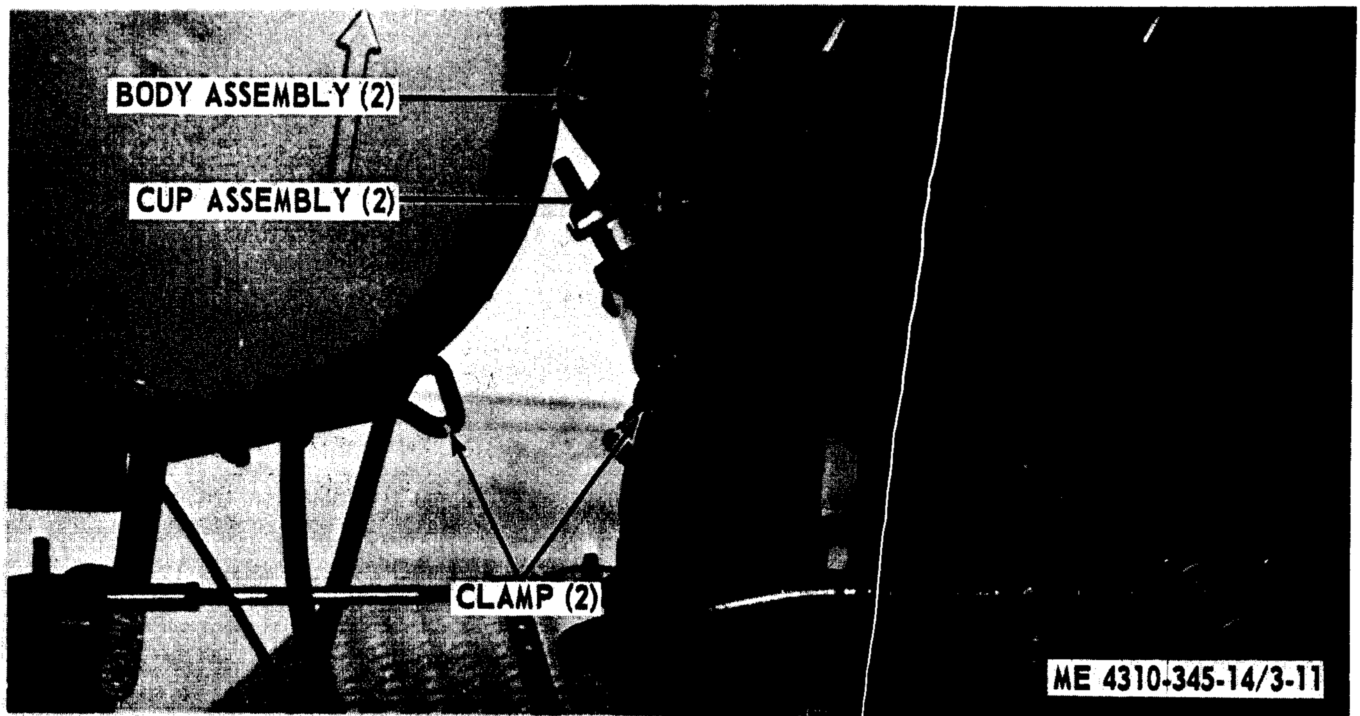
STEP 1. WIPE CLEAN ALL LEVER ARMS, PIVOT POINTS, RETURN SPRING, AND CONTROL RODS USING A CLEANING SOLVENT CONFORMING TO FEDERAL SPECIFICATION P-D-680. DRY THOROUGHLY.

STEP 2. LUBRICATE ARMS, BALL JOINTS, STOP BLOCK, SPRING, AND PIVOT POINTS. SEE LO5-4310-345-12.

Figure 3-10. Speed control linkage service.

3-15. Air Cleaner Service

Service the engine and compressor air cleaners as shown in figure 3-11..



NOTE

THE FOLLOWING SERVICE INSTRUCTIONS ARE APPLICABLE TO BOTH THE ENGINE AND COMPRESSOR AIR CLEANERS. DO NOT SERVICE THE AIR CLEANERS WHILE ENGINE IS OPERATING.

STEP 1. LOOSEN CLAMP SECURING CUP ASSEMBLY TO BODY ASSEMBLY.

STEP 2. PULL OUTWARD ON CUP ASSEMBLY AND REMOVE ELEMENT.

NOTE

DO NOT CLEAN BODY WITH COMPRESSED AIR.

STEP 3. CLEAN CUP ASSEMBLY WITH A CLEANING SOLVENT CONFORMING TO FEDERAL SPECIFICATION P-D-680. DRY THOROUGHLY.

STEP 4. REFER TO PARA 4-18 FOR ELEMENT CLEANING.

STEP 5. INSTALL ELEMENT INTO BODY ASSEMBLY. INSTALL NEW GASKETS.

STEP 6. INSTALL CUP ASSEMBLY AND SECURE WITH CLAMP.

NOTE

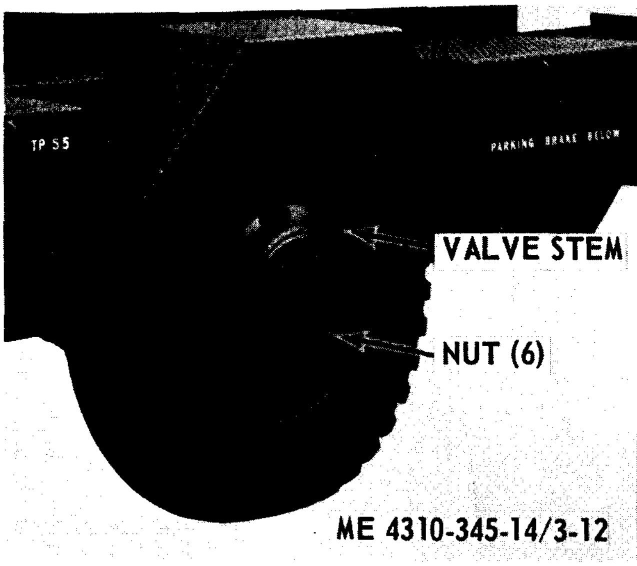
INSTALL CUP ASSEMBLY WITH ARROWS POINTING UPWARD.

STEP 7. RESET RESTRICTION INDICATORS ON INSTRUMENT PANEL BY DEPRESSING TOP RESET. (FIG. 2-2.)

Figure 3-11. Air cleaner service.

3-16. Tire Service

Service tires as shown in figure 3-12.



STEP 1. CHECK FOR AND TIGHTEN ANY LOOSE NUTS.

NOTE

DO NOT CHECK AIR PRESSURE JUST AFTER UNIT HAS BEEN TOWED FOR A LONG DISTANCE AND TIRES ARE WARM.

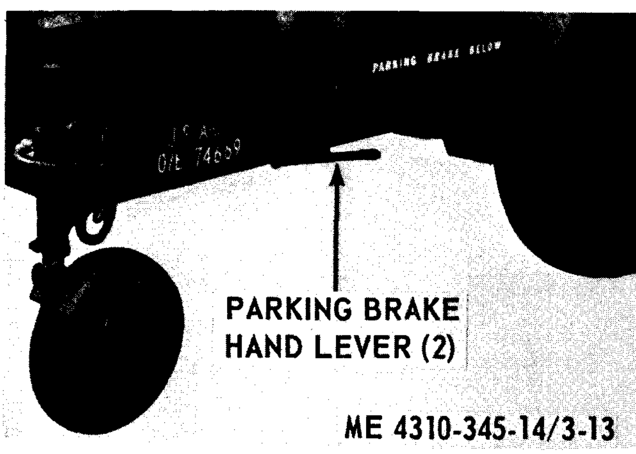
STEP 2. CHECK EACH TIRE FOR PROPER INFLATION. AIR PRESSURE IN EACH TIRE SHALL BE 55 PSI.

STEP 3. FOR TRAILER CHASSIS MAINTENANCE REFER TO TM 9-2330-247-14

Figure 3-12. Tire service.

3-17. Parking Brake Service

Service the parking brake as shown in figure 3-13.



STEP 1. CHECK PARKING BRAKE HAND LEVER FOR PROPER OPERATION.

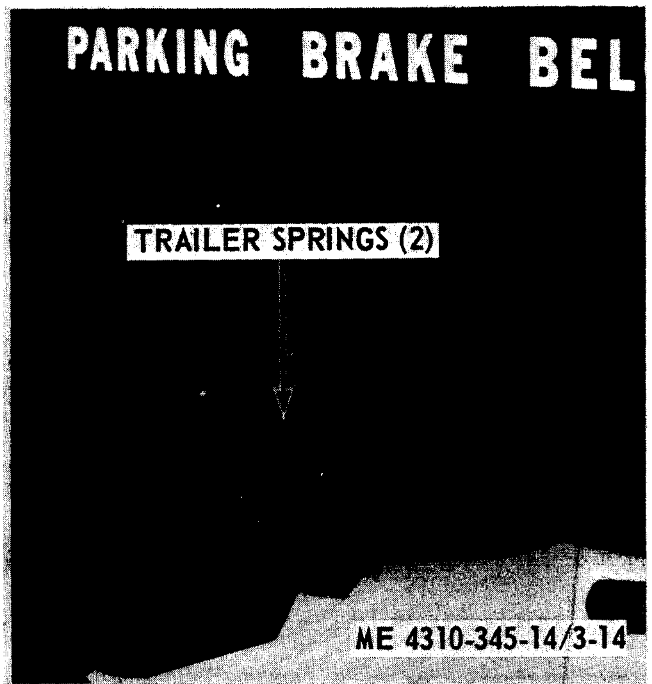
STEP 2. WIPE HAND LEVER CLEAN WITH A CLOTH SOAKED WITH A CLEANING SOLVENT CONFORMING TO FEDERAL SPECIFICATION P-D-680.

STEP 3. FOR TRAILER CHASSIS MAINTENANCE REFER TO TM 9-2330-247-14

Figure 3-13. Parking brake service.

3-18. Trailer Spring Service

Service the trailer springs as shown in figure 3-14.



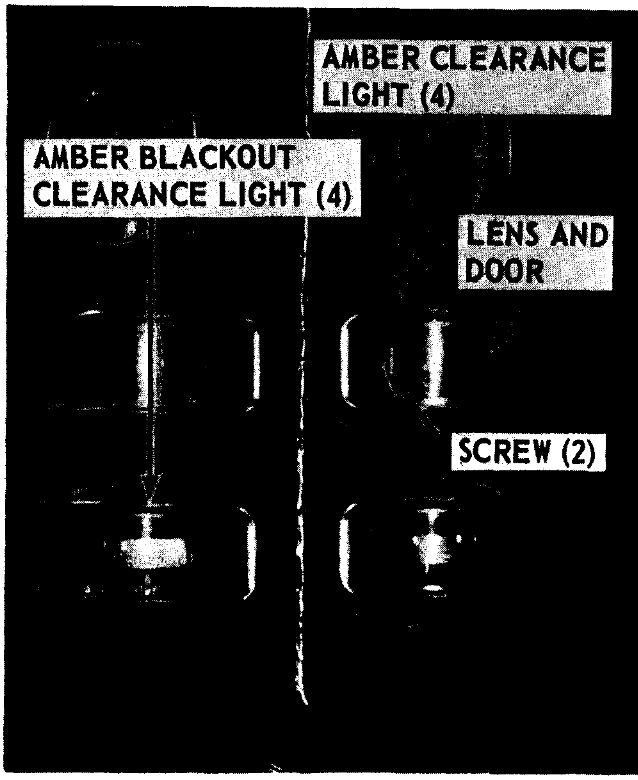
STEP 1. CHECK TRAILER SPRINGS FOR BROKEN LEAVES, SHACKLES, AND BRACKETS.

STEP 2. FOR TRAILER CHASSIS MAINTENANCE REFER TO TM 9-2330-247-14

Figure 3-14. Trailer spring service.

3-19. Lighting System Service

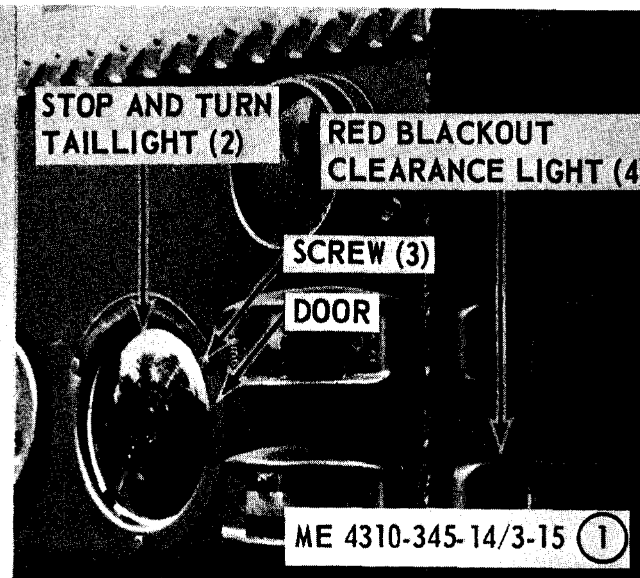
Service the lighting system as shown in figure 3-15.



A CLEARANCE LIGHTS (TYP)

STEP 1. REMOVE SCREWS. REMOVE LENS AND DOOR AS A UNIT.

STEP 2. REPLACE BULB AND INSTALL LENS AND DOOR. INSTALL SCREWS.



B STOP AND TURN TAILLIGHT ASSEMBLIES

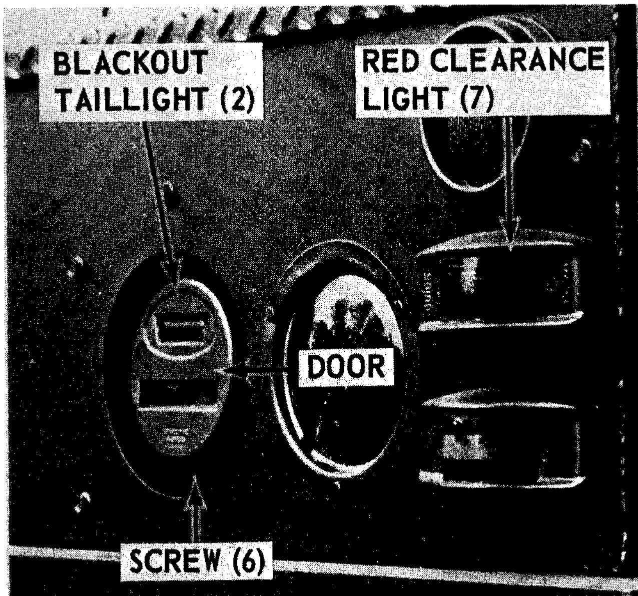
STEP 1. REMOVE SCREWS AND DOOR FROM STOP AND TURN TAILLIGHT BEING SERVICED. REPLACE BULBS AS REQUIRED.

NOTE

MAKE CERTAIN THAT GASKET IS SEATED PROPERLY WHEN DOOR IS INSTALLED.

STEP 2. INSTALL DOOR AND SECURE WITH SCREWS.

Figure 3-15. Lighting system service (sheet 1 of 2).



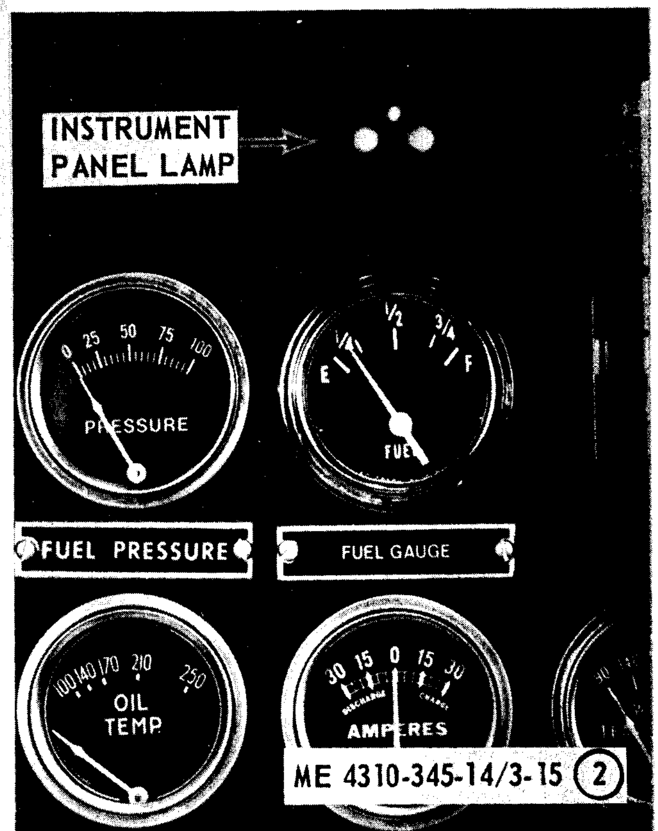
C BLACKOUT TAILLIGHT ASSEMBLIES

STEP 1. REMOVE SCREWS AND DOOR FROM BLACKOUT TAILLIGHT BEING SERVICED. REPLACE BULBS AS REQUIRED.

NOTE

MAKE CERTAIN THAT GASKET IS SEATED PROPERLY WHEN DOOR IS INSTALLED.

STEP 2. INSTALL DOOR AND SECURE WITH SCREWS.



D INSTRUMENT PANEL LAMP

STEP 1. TURN PANEL LAMP CAP COUNTER-CLOCKWISE AND REMOVE.

STEP 2. REPLACE BULB AND INSTALL PANEL LAMP CAP.

Figure 3-15. Lighting system service (sheet 2 of 2).

Table 3-2. Trouble-Shooting-Continued

Malfunction	Probable Cause	Corrective Action
5. Engine knocks, develops excessive noise, or vibration.	*a.* Engine oil level low.	*a.* Fill crankcase in accordance with LO 5-4310-345-12.
	b. Improper fuel grade.	*b.* Drain fuel tank. Fill tank with proper grade of fuel (para 1-8).
	c. Engine mounting boks loose.	*c.* Tighten engine mounting bolts (see torque data, table 1-2).
	d. compressor vibrating.	*d. See* noisy compressor operation, trouble number 19.
	e. Other causes.	*e.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
6. Engine stops suddenly.	*a.* Out of fuel.	*a.* Fill fuel tank with proper grade of fuel (para 1-8).
	b. Fuel filters dirty or clogged.	*b.* Service fuel filters (fig. 3-7).
	c. Water or dirt in fuel system.	*c.* Drain fuel tank. Fill tank with uncontaminated fuel. Clean fuel lines. Service fuel filters (fig. 3-7).
	d. Engine overheating (safety switch shutoff).	*d.* Check engine coolant level (fig. 3-1). Inspect radiator hoses for leaks. Check water pump drive belt adjustment (fig. 3-8).
	e. Low oil pressure (safety switch shutoff).	*e.* Check crankcase oil level. Fill in accordance with LO 5-4310-345-12.
	f. Air in fuel lines.	*f.* Purge fuel filters and fuel lines. Tighten connections.
	g. Air compressor overheating (safety switch shutoff).	*g.* Low compressor oil level. Fill in accordance with LO 5-4310-345-12. Dirty air compressor oil filter. Service compressor oil filter (fig. 3-6). Dust or dirt collected on oil cooler core external surface. Blow off all dirt and dust.
	h. Defective safety switch or defective air shut down valve.	*h.* Replace safety switch and/or shut down valve. Refer to Organizational Support Maintenance personnel.
	i. Other causes.	*i.* Refer other causes to Organizational, Direct Support, *or* General Support Maintenance personnel.
7. Engine has low or no oil pressure	*a.* Oil level in crankcase too low.	*a.* Fill crankcase in accordance with LO 5-4310-345-12.
	b. Improper lubricating oil.	*b.* Drain crankcase. Fill with proper Lubricating oil in accordance with LO 5-4310-345-12 (fig. 3-3).
	c. Defective oil pressure gauge.	*c.* Replace oil pressure gauge (para 4-44).
	d. Other causes.	*d.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
8. Engine overheats.	*a.* Engine coolant level too low.	*a.* Service radiator (fig. 3-1).
	b. Dust or dirt collected on radiator core external surfaces.	*b.* Blow off all dust and dirt.
	c. Oil supply in crankcase too low	*c.* Fill crankcase in accordance with LO 5-4310-345-12 (fig. 3-3).
	d. Fan drive belts slipping or broken	*d.* Service drive belts (fig. 3-8).
	e. Other causes.	*e.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
9. Engine exhaust excessively black or gray.	Air cleaner clogged.	Service air cleaner (fig. 3-11).

Table 3-2. Troubleshooting—Continued

Malfunction	Probable Cause	Corrective Action
10. Engine exhaust excessively white or blue.	*a.* Crankcase oil level too high.	*a.* Avoid overfilling. Determine cause and drain excess oil.
	b. Improper fuel grade.	*b.* Drain fuel tank. Fill tank with proper grade of fuel (para 1-8).
	c. Air in fuel system.	*c.* Purge fuel filters and fuel lines. Tighten connections.
	d. Fuel filters dirty or clogged.	*d.* Service fuel filters (fig. 3-7).
	e. Other causes.	*e.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
11. Excessive engine oil consumption.	*a.* Crankcase oil level too high.	*g.* Avoid overfilling. Determine cause and drain excess oil.
	b. Other causes.	*b.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
12. Engine fails to stop.	*a.* Engine stop cable broken or out of adjustment.	*g.* To stop engine, manually actuate air shutdown latch (fig. 2-11). Refer malfunction to proper maintenance pereonnel.
	b. Other causes.	*b.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
13. Excessive fuel consumption.	*a.* Leak in fuel system.	*a.* Check fuel filters, fuel lines, and fuel tank for leaks. Tighten connections.
	b. Improper fuel grade.	*b.* Drain fuel tank. Fill tank with proper grade of fuel (para 1-8).
	c. Other causes.	*c.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
14. Engine stalls at low speed.	*a.* Air in fuel system.	*a.* Purge fuel filters and fuel lines. Tighten connections.
	b. Fuel filters dirty or clogged.	*b.* Service fuel filters (fig. 3-7).
	c. Other causes.	*c.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
15. Valve train clicking noise.	a. Engine oil level low.	a. Fill crankcase in accordance with LO 5-4310-345-12.
	b. Other causes.	*b.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
16. Engine oil in coolant or coolant in engine oil.	Defective engine oil cooler or other causes.	Refer this trouble to Organizational, Direct Support or General Support Maintenance personnel.
17. Premature engine wear.	*a.* Defective engine air cleaner.	*a.* Service air cleaner (fig. 3-11).
	b. Dirt in lubricating oil.	*b.* Locate and correct source of dirt entry. Change oil. Service oil filter (fig. 3-5).
	c. Other causes.	*c.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
18. Compressor overheats.	*a.* Dirty compressor oil filter element.	*a.* Service compressor oil filter (fig. 3-6).
	b. Dust or dirt collected on oil cooler core external surfaces.	*b.* Blow off all dirt and dust.
	c. Compressor oil level low.	*c.* Fill oil separator to proper level in accordance with LO 5-4310-345-12.

Malfunction	Probable Cause	Corrective Action
18. Compressor overheats—continued	*d.* Other causes.	*d.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
19. Noisy compressor operation.	*a.* Compressor oil level low.	*a.* Fill oil separator to proper level in accordance with LO 5-4310-345-12.
	b. Other causes.	*b.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
20. Compressor not operating to full capacity or pressure.	*a.* Compressor air cleaner dirty or clogged.	*a.* Service compressor air cleaner (fig. 3-11).
	b. Other causes.	*b.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
21. Condensate and / or emulsion in oil separator.	*a.* Unusually low oil temperature and high humidity.	*a.* If this is a climatic condition, replace oil with a non-detergent oil. Refer to LO 5-4310-345-12.
	b. Other causes.	*b.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.
22. Excessive compressor oil consumption.	*a.* Compressor oil system overfilled.	*a.* Drain oil separator to proper level.
	b. Other causes.	*b.* Refer other causes to Organizational, Direct Support, or General Support Maintenance personnel.

Section V. MAINTENANCE OF ENGINE OIL FILTER

3-23. General

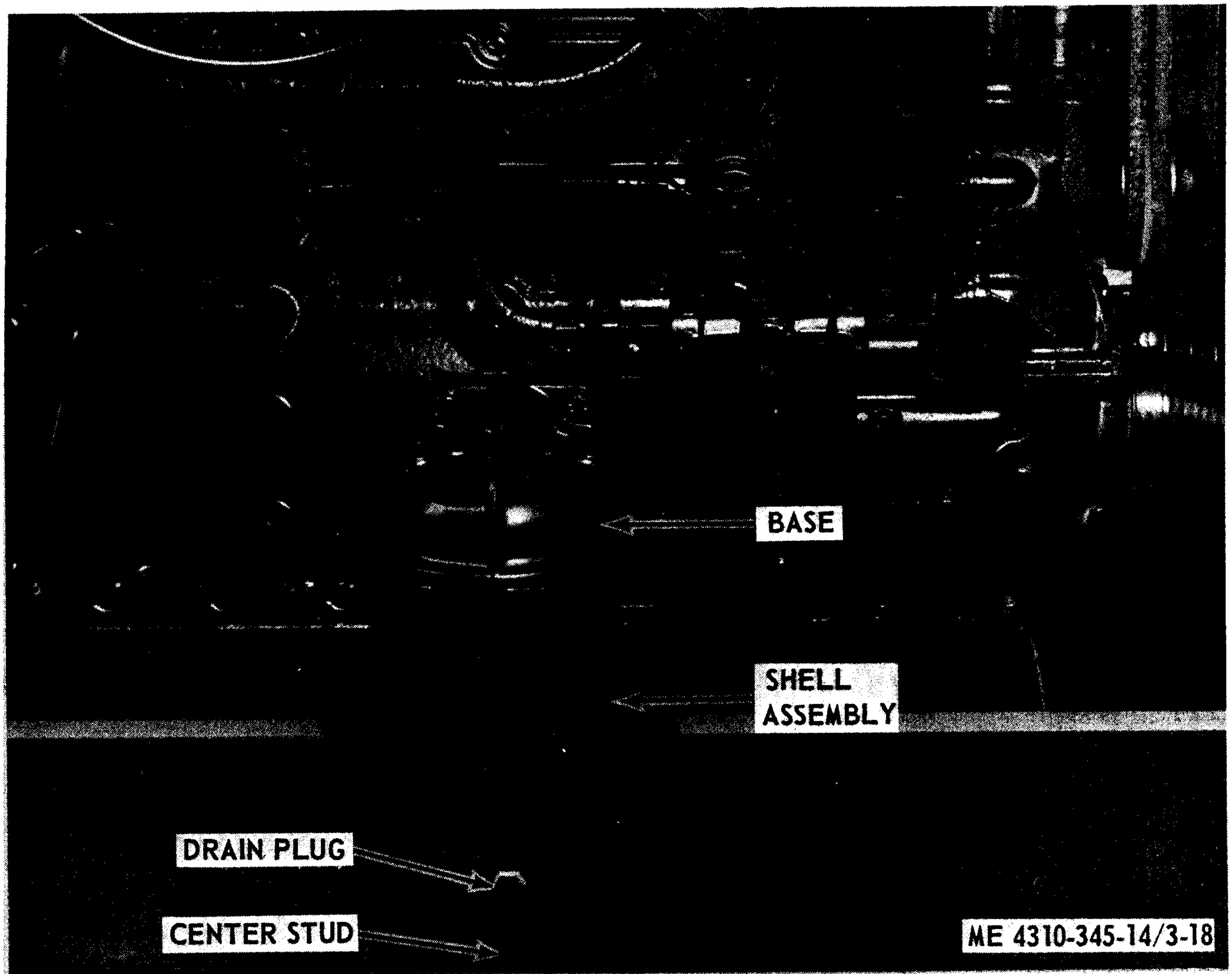
The engine oil filter is a full-flow, replaceable element type. All of the oil supplied to the engine passes through this filter. The larger foreign particles are removed without restricting the normal flow of oil. The full-flow filter element shall be changed as specified in LO 5-4310-345-12.

3-24. Engine Oil Filter

a. Removal. Remove the engine oil filter from the engine as shown in figure 3-18.

b. Cleaning. Clean the engine oil filter components as specified in figure 3-18.

c. Installation. Install the engine oil filter on the engine as shown in figure 3-18.



REMOVAL

STEP 1. REMOVE DRAIN PLUG AND DRAIN THE OIL.

STEP 2. REMOVE CENTER STUD, FILTER SHELL, AND FILTER ELEMENT FROM BASE. DISCARD GASKET AND ELEMENT.

STEP 3. CLEAN BASE AND SHELL WITH SOLVENT CONFORMING TO FEDERAL SPECIFICATION P-D-680 OR EQUIVALENT.

INSTALLATION

STEP 1. INSTALL NEW FILTER ELEMENT ON CENTER STUD.

STEP 2. PLACE NEW GASKET IN FILTER BASE.

STEP 3. POSITION THE SHELL AND ELEMENT ON THE GASKET AND TIGHTEN CENTER STUD CAREFULLY TO PREVENT DAMAGE TO GASKET OR STUD THREADS.

STEP 4. INSTALL DRAIN PLUG.

NOTE

AFTER ENGINE IS STARTED, CHECK FOR OIL LEAKS.

Figure 3-18. Engine oil filter, removal and installation.

Section VI. MAINTENANCE OF COMPRESSOR OIL FILTER

3-25. General

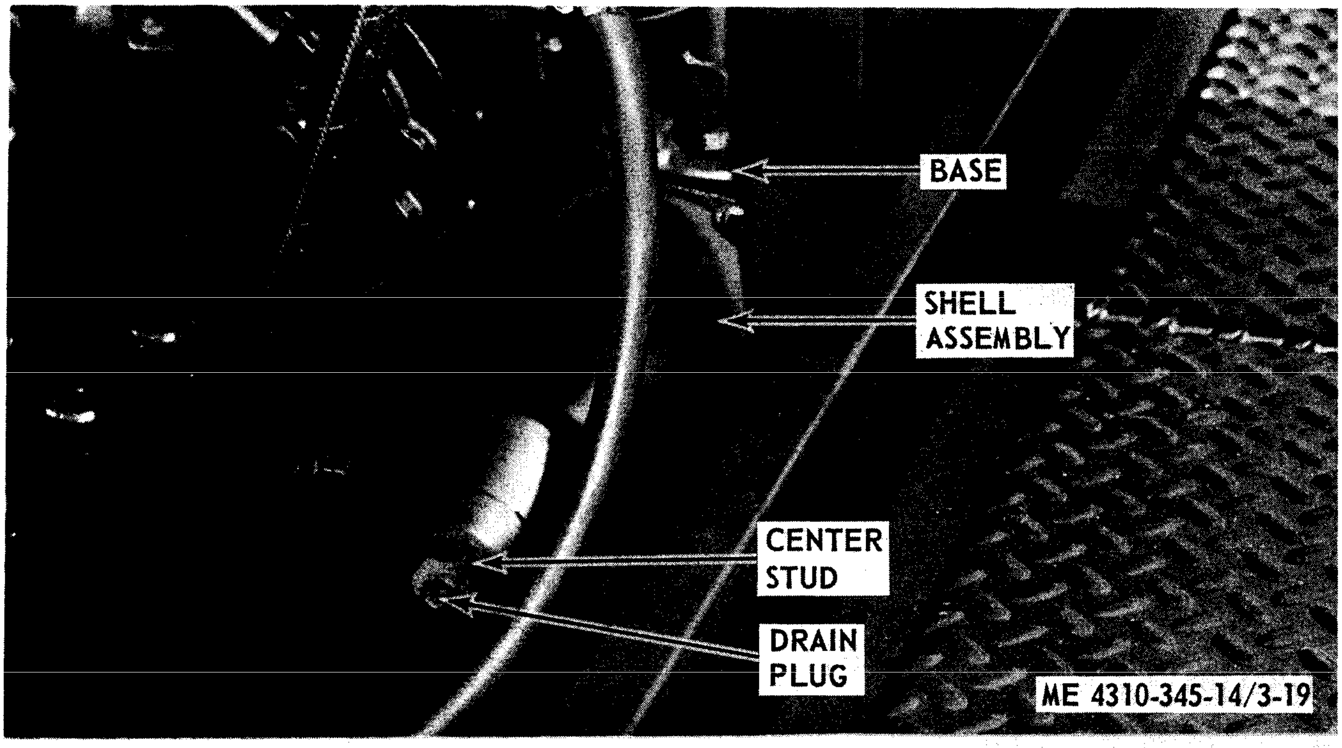
The compressor oil filter is a full-flow, replaceable element type. All of the oil in the compressor oil system passes through this filter. Foreign particles are removed from the oil without restricting the normal flow. The filter element shall be changed as specified in LO5-4310-345-12.

3-26. Compressor Oil Filter

a. Removal. Remove the compressor oil filter as shown in figure 3-19.

b. Cleaning. Clean the compressor oil filter as specified in figure 3-19.

c. Installation. Install the compressor oil filter as shown in figure 3-19.



REMOVAL

STEP 1. REMOVE DRAIN PLUG FROM CENTER STUD AND DRAIN OIL.

STEP 2. REMOVE CENTER STUD, FILTER SHELL, AND FILTER ELEMENT FROM BASE. DISCARD GASKET AND ELEMENT.

STEP 3. CLEAN BASE AND SHELL WITH SOLVENT CONFORMING TO FEDERAL SPECIFICATION P-D-680 OR EQUIVALENT.

INSTALLATION

STEP 1. INSTALL NEW FILTER ELEMENT ON CENTER STUD.

STEP 2. PLACE NEW GASKET IN FILTER BASE.

STEP 3. POSITION THE SHELL AND ELEMENT ON THE GASKET AND TIGHTEN CENTER STUD CAREFULLY TO PREVENT DAMAGE TO GASKET OR CENTER STUD THREADS.

STEP 4. INSTALL DRAIN PLUG.

NOTE

AFTER COMPRESSOR IS OPERATING, CHECK FOR OIL LEAKS.

Figure 3-19. Compressor oil filter, removal and installation.

Section VII. MAINTENANCE OF ENGINE FUEL FILTERS

3-27. General

The engine fuel system contains two fuel filters. The primary filter is located in the system between the fuel tank and the fuel pump inlet port. The secondary filter is located between the fuel pump and the fuel manifold (integral with the cylinder head). A check valve is installed on the inlet side of the primary filter to prevent fuel drain-back to the tank when the engine is not running. Both filters are replaceable element type and are basically the same in construction. The primary filter functions under suction and the secondary under pressure. The primary filter removes the larger fuel impurity particles; the secondary removes small foreign particles.

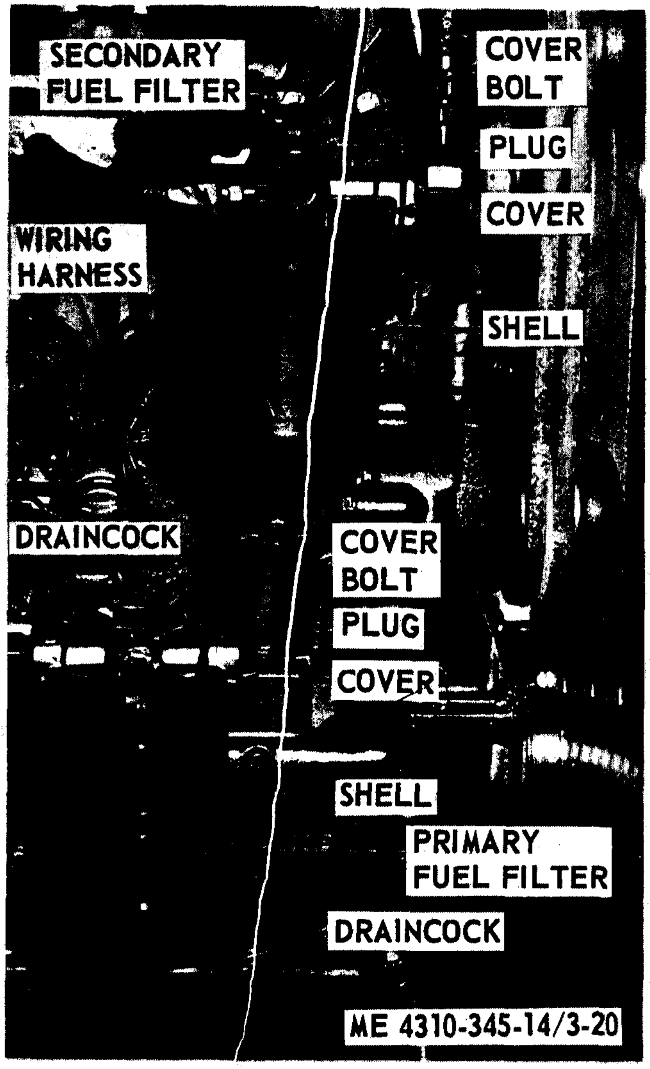
3-28. Engine Fuel Filters

a. Removal. Remove fuel filter, either primary or secondary, as shown in figure 3-20.

b. Cleaning. Clean fuel filters as specified in figure 3-20.

c. Installation. Install fuel filter, either primary or secondary, as shown in figure 3-20.

d. Checking for Leaks. Remove the fuel return line at the restricted fitting on the fuel manifold (fig. 4-4). Attach a test hose assembly to the restricted elbow fitting and place the opposite end of the hose assembly in a container of fuel. Start the engine and if bubbles appear coming from the end of the hose in the container, the primary fuel filter is leaking. Inspect the shell gasket and tighten all connections.



REMOVAL

CAUTION

PROVIDE SHIELDING FOR WIRING HARNESS DURING FILTER CHANGE. FUEL OIL CAN PERMANENTLY DAMAGE ELECTRICAL INSULATION.

STEP 1. WITH ENGINE STOPPED, PLACE A CONTAINER UNDER FILTER AND OPEN DRAINCOCK. LOOSEN COVER BOLT JUST ENOUGH TO ALLOW FUEL OIL TO DRAIN FREELY. WHEN DRAINING STOPS, CLOSE DRAINCOCK.

STEP 2. HOLD THE SHELL, UNSCREW COVER BOLT, REMOVE SHELL AND ELEMENT. REMOVE AND DISCARD ELEMENT, SHELL GASKET, AND COVER BOLT GASKET.

STEP 3. WASH SHELL THOROUGHLY WITH CLEAN FUEL OIL AND DRY WITH COMPRESSED AIR.

INSTALLATION

NOTE

THOROUGHLY SOAK THE FUEL FILTER ELEMENT IN CLEAN FUEL OIL BEFORE INSTALLATION. THIS WILL EXPEL ANY AIR ENTRAPPED IN ELEMENT AND IS CONDUCIVE TO FASTER INITIAL ENGINE START.

STEP 1. INSTALL NEW FILTER ELEMENT OVER SHELL STUD AND PUSH DOWN AGAINST ELEMENT SEAL.

STEP 2. FILL SHELL ABOUT TWO-THIRDS FULL WITH CLEAN FUEL OIL. PLACE NEW SHELL GASKET ON TOP OF SHELL. PLACE NEW COVER BOLT GASKET ON COVER BOLT.

STEP 3. PLACE SHELL AND ELEMENT INTO POSITION UNDER COVER. START COVER BOLT INTO SHELL STUD. WITH SHELL AND ELEMENT PROPERLY POSITIONED, TIGHTEN COVER BOLT JUST TIGHT ENOUGH TO PREVENT FUEL LEAKAGE.

STEP 4. REMOVE PIPE PLUG FROM TOP OF COVER AND FILL SHELL WITH CLEAN FUEL OIL. REPLACE PIPE PLUG.

STEP 5. START THE ENGINE (PARA 2-9) AND CHECK FOR FUEL LEAKS (PARA 3-28d).

Figure 3-20. Fuel filters, removal and installation,

Section VIII. MAINTENANCE OF STORAGE BATTERIES

3-29. General

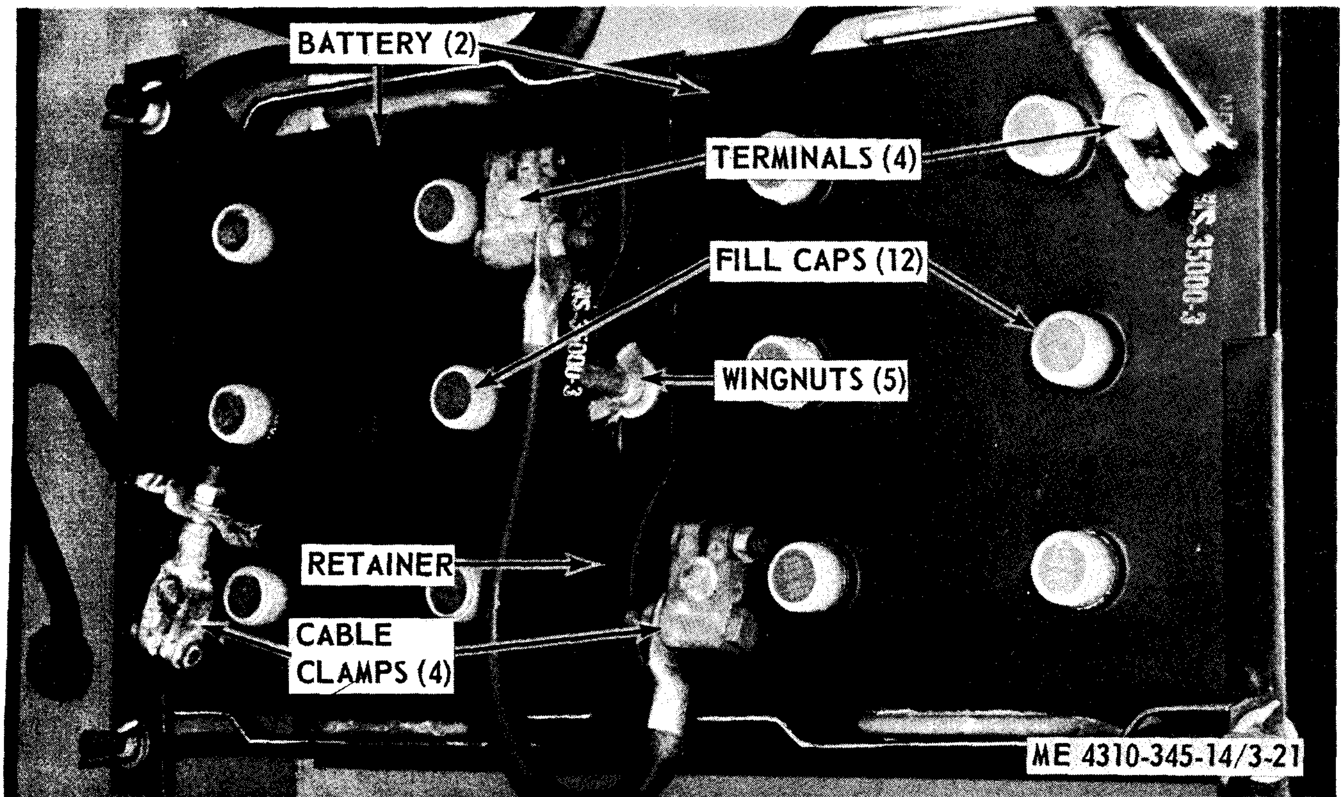
The two storage batteries supplied are each 12 volt type connected in series to provide a 24 volt electric starting source. They are located in the right front toolbox. A 24 volt charging receptacle is also provided in the front side of this toolbox for connection of a battery charging cable.

3-30. Storage Batteries TM 9-6140-200-15)

a. Inspection. Inspect the storage batteries as shown in figure 3-21.

b. Cleaning. Clean battery terminals as specified in figure 3-21.

c. Filling. Fill batteries as specified in figure 3-21.



INSPECTION

WARNING

AVOID CONTACT WITH BATTERY ELECTROLYTE ON CLOTHING AND FLESH. USE PROTECTIVE CLOTHING.

STEP 1. INSPECT BATTERIES FOR GENERAL CONDITION SUCH AS EVIDENCE OF CRACKS IN CASE, BROKEN TERMINALS, AND PLUGGED OR MISSION FILL CAPS.

STEP 2. INSPECT TERMINALS AND BATTERY CABLE CLAMPS FOR CORROSION.

STEP 3. CHECK CABLE CLAMPS FOR TIGHT CONNECTION ON TERMINALS.

STEP 4. INSPECT BATTERY MOUNTING. WINGNUTS ARE TO BE SECURED AND BATTERY RETAINER TIGHT.

STEP 5. CLEAN TERMINALS AND CABLE CLAMPS AND LUBRICATE IN ACCORDANCE WITH LO5-4310-345-12. CLEAN BATTERIES WITH WATER OR A SOLUTION OF SODIUM BICARBONATE. DO NOT ALLOW THE BICARBONATE SOLUTION TO ENTER OR MIX WITH THE ELECTROLYTE IN THE CELLS.

STEP 6. CHECK SPECIFIC GRAVITY OF ELECTROLYTE WITH HYDROMETER. SPECIFIC GRAVITY SHALL BE 1.250 OR HIGHER.

FILLING

STEP 1. REMOVE FILL CAPS (24). MAKE CERTAIN VENT HOLES ARE NOT PLUGGED.

STEP 2. FILL CELLS WITH DISTILLED WATER, AS NECESSARY, TO A LEVEL 3/8 INCH ABOVE PLATES.

STEP 3. START ENGINE (PARA 2-9) AND ALLOW TO RUN FOR APPROX. ONE HOUR AFTER FILLING BATTERIES.

Figure 3-21. Storage batteries, inspection and filling.

Section IX. MAINTENANCE OF COLD WEATHER STARTING AID

3-31. General

The cold weather starting aid provides a means of injecting a highly combustible fuel mixture into the engine air intake to aid in starting the engine when ambient temperatures are below +32°F. The fuel, an ether base mixture, is stored in a metal cylinder that has a capacity of 790 cubic centimeters. The cylinder is approximately 95 percent expendable. The fuel cylinder mounts to a valve assembly which is actuated by the control cable (Quick-Start) mounted on the instrument panel. Each actuation of the valve lever injects a measured shot of 5 cubic centimeters of fuel into the engine intake air stream, The fuel mixture travels via copper tubing from the valve to an atomizer on the intake manifold,

3-32. Fuel Cylinder

a. Removal. Remove the cold weather starting aid fuel cylinder as shown in figure 3-22.

b. Installation, Install the cold weather starting aid fuel cylinder as shown in figure 3-22.

REMOVAL

STEP 1. LOOSEN AND REMOVE WINGNUTS, LOCKWASHERS, AND CLAMPS.

WARNING

DO NOT PUNCTURE OR MISHANDLE FUEL CYLINDER. THIS CYLINDER CONTAINS AN ETHER MIXTURE WHICH IS EXTREMELY TOXIC, VOLATILE, AND COMBUSTIBLE.

STEP 2. UNSCREW AND REMOVE FUEL CYLINDER FROM VALVE ASSEMBLY. DISCARD GASKET.

STEP 3. SCREW VALVE CAP ON VALVE ASSEMBLY UNTIL NEW FUEL CYLINDER IS TO BE INSTALLED.

INSTALLATION

STEP 1. REMOVE VALVE CAP FROM VALVE ASSEMBLY.

NOTE

DO NOT OVERTIGHTEN FUEL CYLINDER IN VALVE ASSEMBLY.

STEP 2. INSTALL NEW VALVE GASKET AND FUEL CYLINDER IN VALVE ASSEMBLY. SCREW IN UNTIL HAND TIGHT.

STEP 3. INSTALL CLAMPS AND SECURE WITH LOCKWASHERS AND WINGNUTS.

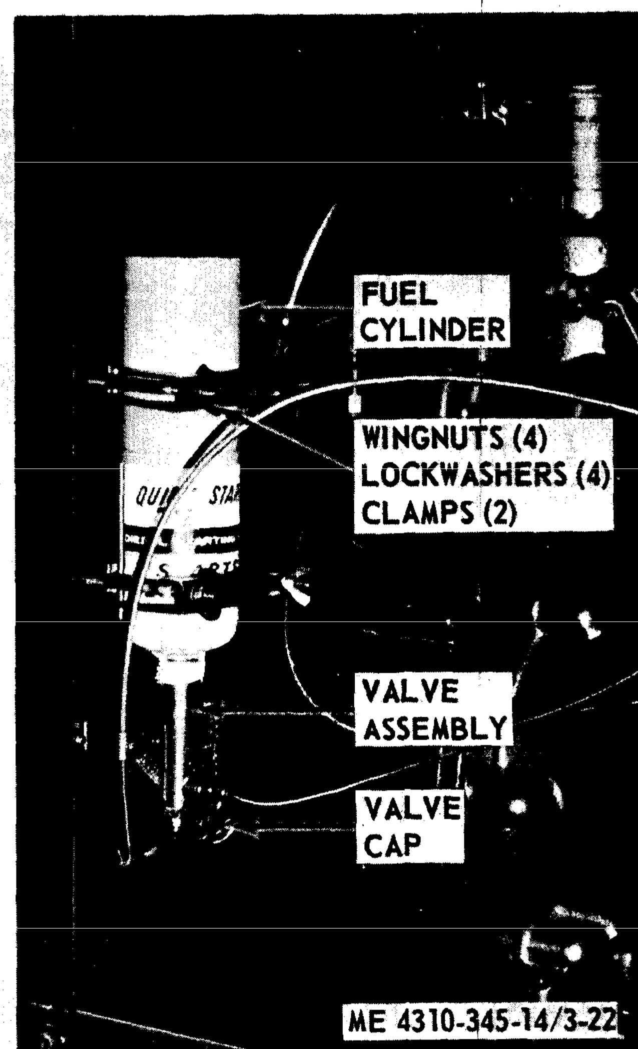


Figure 3-22. Cold weather starting aid fuel cylinder, removal and installation.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF MATERIAL

4-1. Inspecting and Servicing the Equipment

Refer to paragraph 2-1 for inspecting and servicing the rotary air compressor unit.

4-2. Installation of Separately Packed Components

Refer to paragraph 2-2 for installation of separately packed components.

4-3. Installation

Refer to paragraph 2-3 for installation of rotary air compressor unit.

Section II. MOVEMENT TO A NEW WORKSITE

4-4. Dismantling for Movement

Refer to paragraph 2-4 for dismantling for movement to a new worksite.

4-5. Reinstallation After Movement

Refer to paragraph 2-3 for installation instructions after movement to a new worksite.

Section III. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

4-6. Tools and Equipment

Items issued with or authorized for the rotary air compressor unit are listed in the basic issue items list, appendix C.

4-7. Special Tools and Equipment

There are no special tools and equipment required for organizational maintenance of the rotary air compressor unit.

4-8. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in TM 5-4310-345-24P for the pneumatic outfit and TM 9-2330-247-14 for the trailer.

Section IV. LUBRICATION INSTRUCTIONS

4-9. General

a. This section contains lubrication instructions which are supplemental to, and not specifically covered in, the lubrication order.

b. In addition to detailed instructions below, refer to LO 5-4310-345-12.

4-10. Detailed Lubrication Information

a. General. Keep all lubricants in closed containers and store in a clean, dry place away from external heat. Allow no dust, dirt, or other foreign matter 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 lubrication to prevent accumulation of foreign matter.

c. Points of Lubrication.

CAUTION

Overlubrication may cause equipment failure or damage to working parts.

(1) Service the lubrication points at proper intervals specified on LO 5-4310-345-12.

(2) Lubricate engine speed control linkage as shown in figure 4-1.

STEP 1. WIPE CLEAN ALL ARMS, PIVOT POINTS, AND RODS WITH SOLVENT CONFORMING TO FEDERAL SPECIFICATION P-D-680 OR EQUIVALENT. DRY THOROUGHLY.

STEP 2. USING OIL CAN, APPLY 3 TO 5 DROPS OF ENGINE OIL TO PIVOT ARM, BALL JOINTS, STOP BLOCK, SPRING, AND OTHER PIVOT POINTS.

NOTE

REFERENCE L05-4310-345-12 FOR LUBRICANTS.

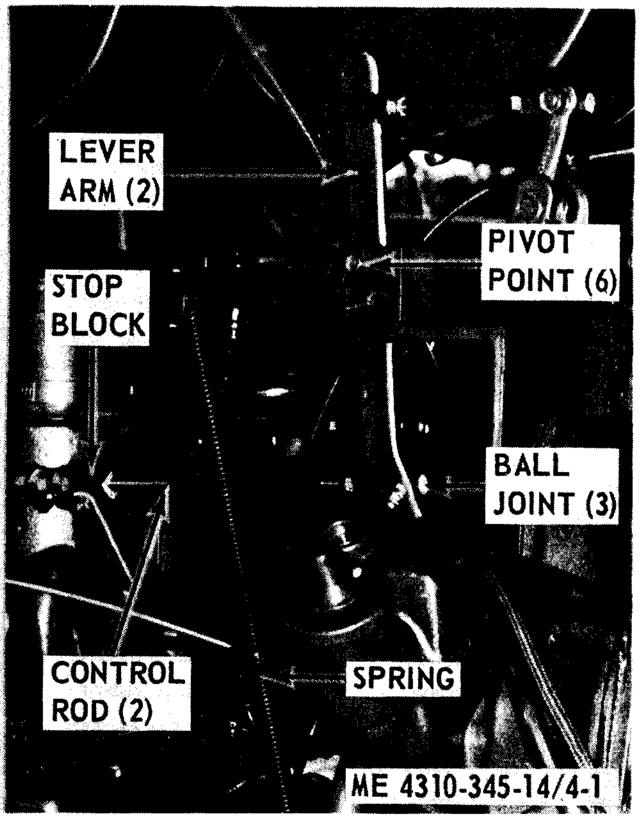
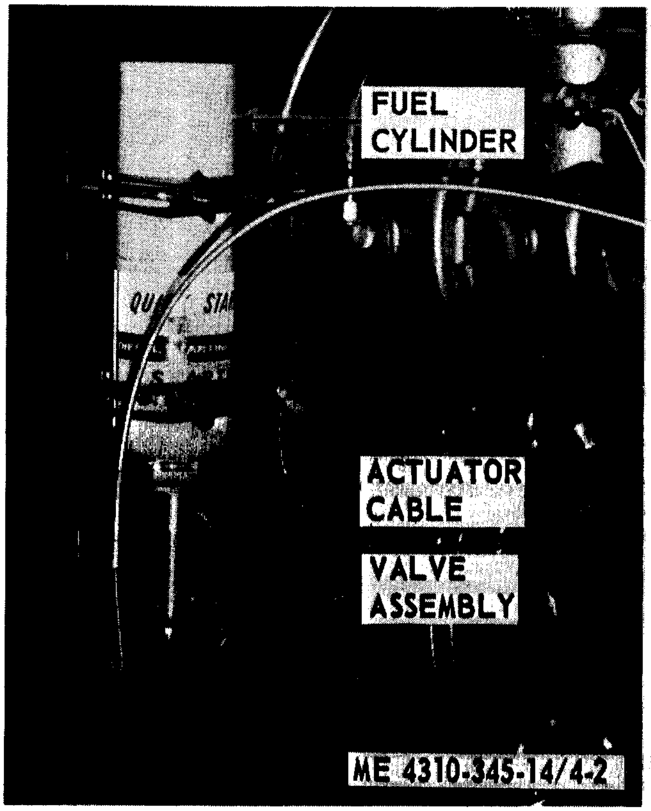


Figure 4-1. Speed control linkage lubrication.

shown in figure 4-2.



STEP 1. REMOVE FUEL CYLINDER. REFER TO FIGURE 3-22. USING OIL CAN, APPLY 3 TO 5 DROPS OF ENGINE OIL AROUND THE PUSHER PIN UNDER THE GASKET.

STEP 2. APPLY A FEW DROPS OF ENGINE OIL TO ACTUATOR CABLE.

STEP 3. ACTUATE THE VALVE WITH THE CABLE TO DISTRIBUTE OIL ON CABLE AND ALLOW OIL TO RUN DOWN THROUGH VALVE. WIPE EXCESS OIL OFF CABLE AND VALVE ASSEMBLY.

STEP 4. INSTALL FUEL CYLINDER. REFER TO FIGURE 3-22.

NOTE

REFERENCE L05-4310-345-12 FOR LUBRICANTS.

Figure 4-2. Cold weather starting aid lubrication.

(4) Starting motor, generator, water pump, and fan hub. These engine components have sealed bearings and require no lubrication.

Section V. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-11. General

This section contains preventive maintenance checks and services for organizational level. Operator preventive maintenance checks and services are listed in table 3-1.

4-12. Preventive Maintenance Checks and Services

Organizational periodic preventive maintenance checks and services are listed in table 4-1.

Table 4-1. Preventive Maintenance Checks and Services

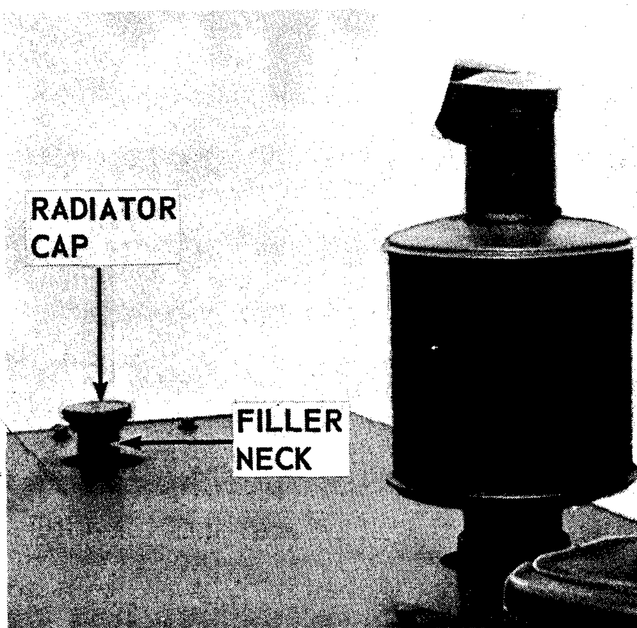
Item No.	Interval org. M	Q	Item to reinspected	Procedure	Reference
	M—Monthly	Q-Quarterly			
1	X	X	**Radiator assembly**	Check engine coolant level. Proper level is 2 inches below filler neck.	fig. 3-1
	X	X		Check radiator, hoses, and connections for leaks or defects.	fig. 4-3
	X	X		Check antifreeze level when operating in temperatures below +32°F.	table 2-1
2	X	X	**Fuel tank**	Check fuel level. Use gage instrument panel.	fig. 3-2
	X	X		Check tank for leaks or other defects.	fig. 4-4
	X	X		Check cap gasket for damage.	
	X	X		Check fuel lines and fittings for leaks or other damage.	fig. 4-4
3	X	X	**Engine crankcase**	Check oil level. Use dipstick gage. Fill or change oil as necessary.	LO 5-4310-345-12 fig. 3-3
	X	X		Clean crankcase breather. Wash with clean diesel fuel.	fig. 4-5
4	X	X	**Oil separator**	Check oil level. Use oil level gage on tank.	fig. 3-4
	X			Change oil (every 500 hours).	
5		X	**Engine oil filter**	Change filter element.	fig. 3-5
6		X	**Compressor oil filter**	Change filter element.	fig. 3-6
7	X	X	**Primary fuel filter**	Change filter element every 300 hours.	fig. 3-7
8	X	X	**Secondary** fuel filter	Change filter element every 300 hours. Drain every 50 hours when operating in temperatures of +32°F and above.	fig. 3-7
	X	X		Drain every 10 hours when operating in temperatures below +32°F.	
9	X	X	**Drive belts**	Check for worn, frayed, or cracked belts.	fig. 4-6
	X	X		Check for proper belt adjustment.	
10	X	X	**Batteries**	Check battery mountings and cable connections.	fig. 3-9
	X	X		Check electrolyte level. Correct level is 3/8 in. above plates.	fig. 3-21
	X	X		Remove corrosion from battery terminals and lubricate.	fig. 3-21
11		X	**Speed control linkage**	Check linkage for freedom of movement.	fig. 3-10
	X	X		Lubricate linkage.	fig. 4-1
	X	X		Check linkage for proper adjustment.	fig. 4-7
12	X	X	**Air cleaners**	Check restriction indicators.	fig. 3-11
	X	X		Clean element and body. Inspect element.	
	X	X		Replace element as necessary. Clean air cleaner.	fig. 4-8
13	X	X	**Controls and instruments**	Check for damaged instruments.	fig. 4-9
	X	X		Check for loose mountings.	
	X	X		Check instruments for proper operation. Normal readings are: ‘Engine oil pressure: 40 to 60 PSI at 1800 RPM. Tachometer-hourmeter: Idle 1000 RPM, Governed speed 1800 RPM. Water temperature: 160°-185°F. Oil temperature: 170°-220° F. Air pressure: 80—105 PSI. Fuel pressure: 70 PSI minimum at 1800 RPM.	
14	X	X	**Engine assembly**	Check fuel pump for proper operation.	fig. 4-61
	X	X		Check fuel rack setting.	Refer to Direct and General Support Maintenance personnel.
	X	X		Check fuel injectors for operation	
	X	X		Check for even running and exhaust smoke for improper combustion.	Refer to Direct and General Support Maintenance personnel.
	X	X		Check engine mounting.	

Table 4-1. Preventive Maintenance Checks and Services

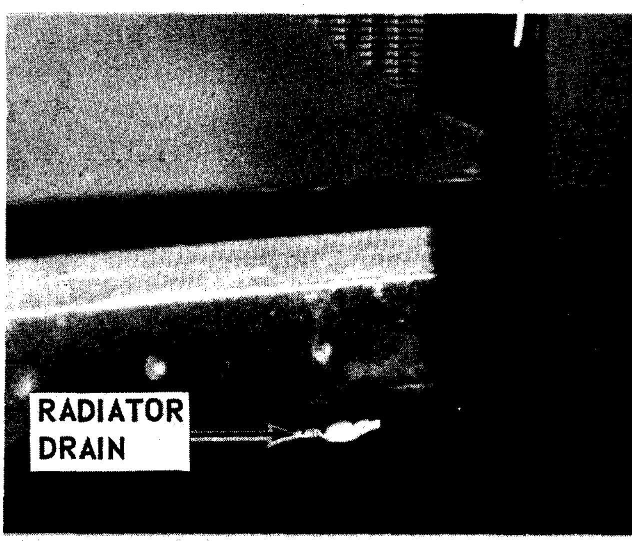
Item No.	Interval Org. M	Interval Org. Q	Item to be Inspected	Procedure	Reference
			M-Monthly	Q-Quarterly	
15	X	X	Tires	Check inflation, for missing valve caps, and wear.	fig. 3-12
16	X	X	Brake system	Check all air lines and connections.	TM 9-2330-247-14
	X	X		Check parking brake operation and adjustment.	
		X		Lubricate parking brake mechanism.	
17	X	X	Springs	Check for broken mounting hardware or spring leafs.	fig. 3-14
	X	X		Lubricate springs.	TM 9-2330-247-14
18	X	X	Lighting system	Check operation of all taillights, stoplights, clearance lights, and panel light.	fig. 4-10
19	X	X	Cold weather starting aid	Weigh cylinder. Full cylinder weighs 37 ounces. Fuel consumption is 5 cc per shot.	fig. 3-10 fig. 4-11
	X	X		Clean orifice and tubing.	fig. 4-11
	X	X		Check cylinder for hand tightness.	fig. 3-16
20	X	X	Fire extinguisher	Check weight.	Refer to TM 5-4200.200-10 for maintenance.

4-13. Radiator Hose Service

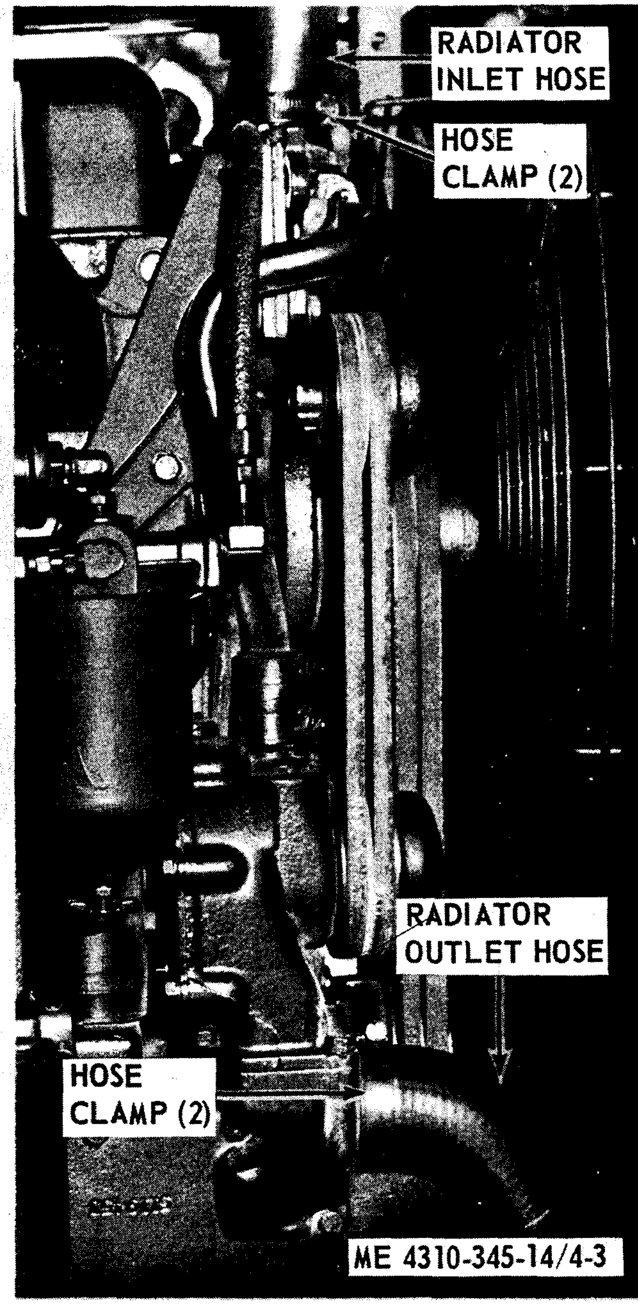
Service radiator hoses as shown in figure 4-3.



A RADIATOR CAP AND FILLER NECK



B RADIATOR DRAIN



C RADIATOR HOSES

STEP 1. REMOVE RADIATOR CAP AND OPEN RADIATOR DRAIN TO REMOVE COOLANT FROM RADIATOR. CLOSE RADIATOR DRAIN.

STEP 2. REMOVE HOSE CLAMPS AND RADIATOR HOSE TO BE SERVICED.

STEP 3. INSTALL RADIATOR HOSE AND SECURE WITH HOSE CLAMPS.

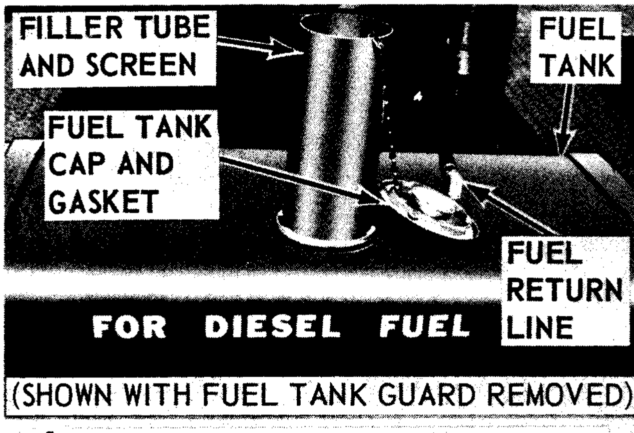
STEP 4. FILL RADIATOR WITH COOLANT TO A LEVEL TWO INCHES BELOW FILLER NECK. REFER TO TABLE 2-1.

STEP 5. INSTALL RADIATOR CAP AND CHECK HOSE CONNECTIONS FOR LEAKS.

Figure 4-3. Radiator hose service.

4-14. Fuel Tank and Fuel Lines Service

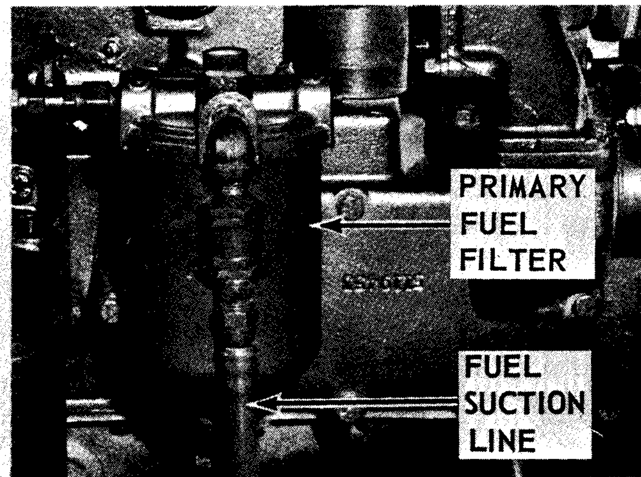
Service the fuel tank and fuel lines as shown in figure 4-4.



A FUEL TANK CAP AND FILLER TUBE

STEP 1. CLEAN EXTERIOR OF FUEL TANK WITH A CLEAN CLOTH SOAKED WITH CLEANING SOLVENT CONFORMING TO FEDERAL SPECIFICATION P-D-680. DRY THOROUGHLY.

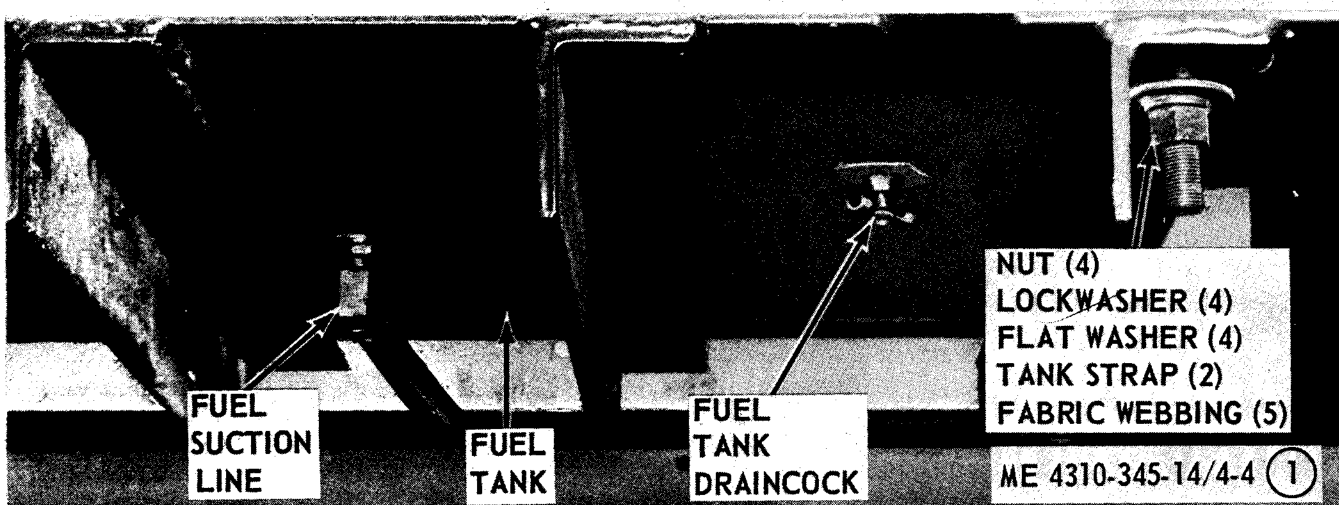
STEP 2. UNSCREW FUEL TANK CAP AND LIFT FILLER TUBE. CHECK CONDITION OF CAP GASKET AND FILLER TUBE SCREEN.



B PRIMARY FILTER AND SUCTION LINE

STEP 3. OPEN FUEL TANK DRAINCOCK AND DRAIN FUEL FROM TANK. CLOSE DRAINCOCK.

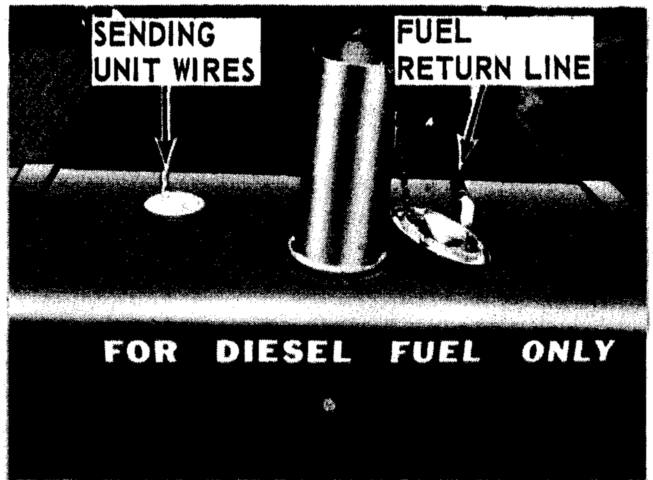
STEP 4. REMOVE FUEL SUCTION LINE AS NECESSARY FOR SERVICE.



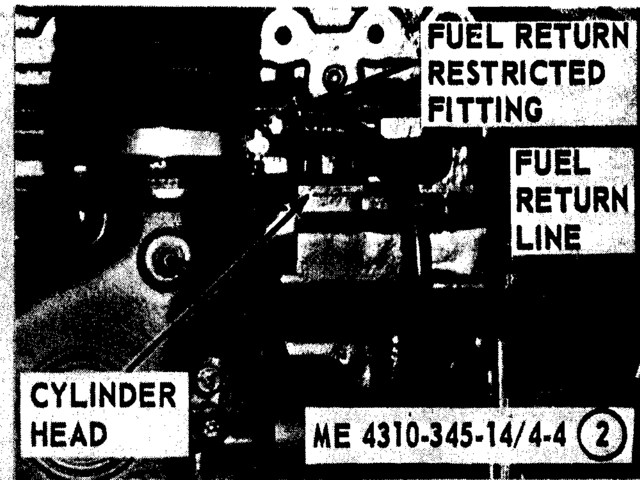
C FUEL TANK DRAIN AND SUCTION LINE

STEP 5. REMOVE NUTS, LOCKWASHERS, FLAT WASHERS, AND TANK STRAPS. REMOVE FABRIC WEBBING FROM STRAPS AS NECESSARY FOR SERVICE. REMOVE FUEL TANK GUARD FROM TOP OF TANK.

Figure 4-4. Fuel tank and fuel lines service (sheet 1 of 2).



D SENDING UNIT WIRES



E FUEL RETURN LINE

STEP 6. REMOVE FUEL RETURN LINE AS NECESSARY FOR SERVICE.

STEP 7. REMOVE FUEL TANK SENDING UNIT WIRES AS NECESSARY.

STEP 8. INSTALL FUEL SUCTION AND RETURN LINES AS NECESSARY.

STEP 9. INSTALL FUEL TANK SENDING UNIT WIRES AS NECESSARY.

STEP 10. INSTALL FUEL TANK GUARD AND SECURE GUARD TO FUEL TANK AND TANK TO FRAME WITH TANK STRAPS, FLAT WASHERS, LOCKWASHERS, AND NUTS.

STEP 11. FILL FUEL TANK WITH PROPER GRADE OF DIESEL FUEL; INSTALL FUEL TANK CAP. START ENGINE AND CHECK FOR LEAKS.

Figure 4-4. Fuel tank and fuel lines service (sheet 2 of 2).

4-15. Crankcase Breather Service

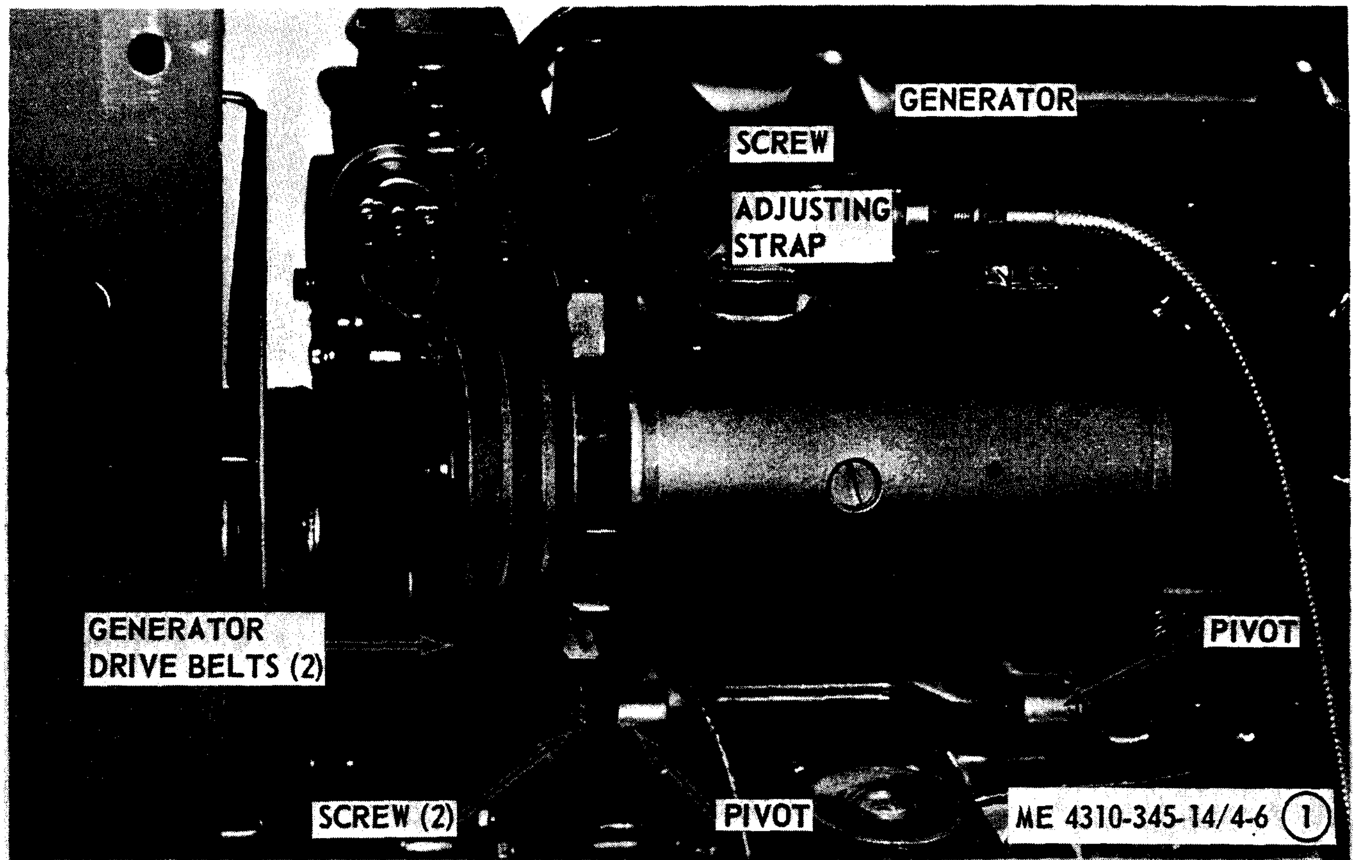
Service the crankcase breather as shown in figure 4-5.

STEP 1.	REMOVE THE OIL FILLER CAP, OIL FILLER TUBE, AND SCREEN.
STEP 2.	CLEAN THE CAP, FILLER TUBE, AND SCREEN USING A SOLVENT CONFORMING TO FEDERAL SPECIFICATION P-D-680, OR CLEAN DIESEL FUEL. DRY THOROUGHLY. INSPECT CAP GASKET FOR DAMAGE. REPLACE PARTS AS NECESSARY.
STEP 3.	INSTALL SCREEN, FILLER TUBE, AND FILLER CAP.

Figure 4-5. Crankcase breather service.

4-16. Drive Belts Service and Adjustment

Service and adjust drive belts as shown in figure 4-6.



A GENERATOR DRIVE BELT SERVICE AND ADJUSTMENT

STEP 1. INSPECT ALL DRIVE BELTS FOR CRACKS, BREAKS, FRAYING, AND EXCESSIVE WEAR. (REFER TO PARA 4-65 FOR REMOVAL AND INSTALLATION.)

STEP 2. LOOSEN TWO SCREWS SECURING GENERATOR TO PIVOT.

STEP 3. LOOSEN SCREW SECURING GENERATOR TO ADJUSTING STRAP.

STEP 4. MOVE GENERATOR IN DIRECTION TO OBTAIN PROPER ADJUSTMENT OF FROM 1/2 TO 3/4 INCH BELT DEFLECTION AT A POINT MIDWAY BETWEEN THE PULLEYS.

STEP 5. WHEN PROPER ADJUSTMENT IS OBTAINED, TIGHTEN SCREW SECURING GENERATOR TO ADJUSTING STRAP.

STEP 6. TIGHTEN TWO SCREWS SECURING GENERATOR TO PIVOT.

Figure 4-6. Drive belt service and adjustment (sheet 1 of 4).

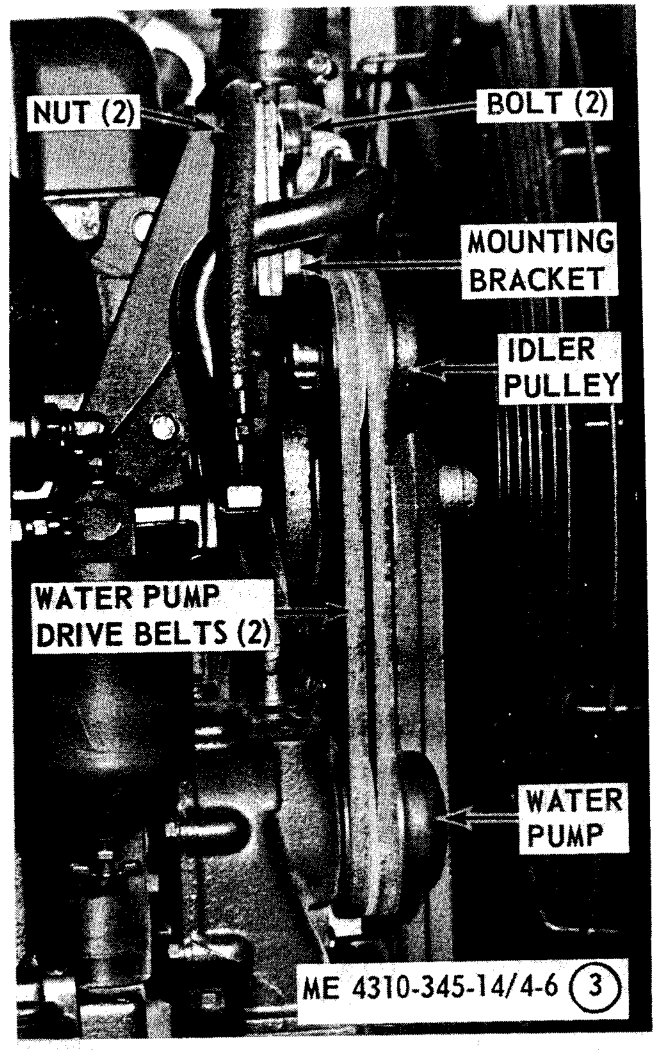
B FAN DRIVE BELT ADJUSTMENT

STEP 1. LOOSEN THREE SCREWS SECURING ADJUSTING BRACKET TO FAN MOUNTING SUPPORT.

STEP 2. MOVE FAN DRIVE AND ADJUSTING BRACKET IN DIRECTION TO OBTAIN PROPER ADJUSTMENT OF FROM 1/2 TO 3/4 INCH BELT DEFLECTION AT A POINT MIDWAY BETWEEN THE PULLEYS.

STEP 3. WHEN PROPER ADJUSTMENT IS OBTAINED, TIGHTEN THREE SCREWS SECURING ADJUSTING BRACKET TO FAN MOUNTING SUPPORT.

Figure 4-6. Drive belt service and adjustment (sheet 2 of 4).



C WATER PUMP DRIVE BELT ADJUSTMENT

STEP 1. LOOSEN TWO NUTS SECURING IDLER PULLEY ASSEMBLY TO MOUNTING BRACKET.

STEP 2. MOVE IDLER PULLEY ASSEMBLY IN DIRECTION TO OBTAIN PROPER ADJUSTMENT OF FROM 1/2 TO 3/4 INCH BELT DEFLECTION AT A POINT MIDWAY BETWEEN IDLER PULLEY AND WATER PUMP DRIVE PULLEY.

STEP 3. WHEN PROPER ADJUSTMENT IS OBTAINED, TIGHTEN TWO NUTS SECURING IDLER PULLEY ASSEMBLY TO MOUNTING BRACKET.

Figure 4-6. Drive belt service and adjustment (sheet 3 of 4).

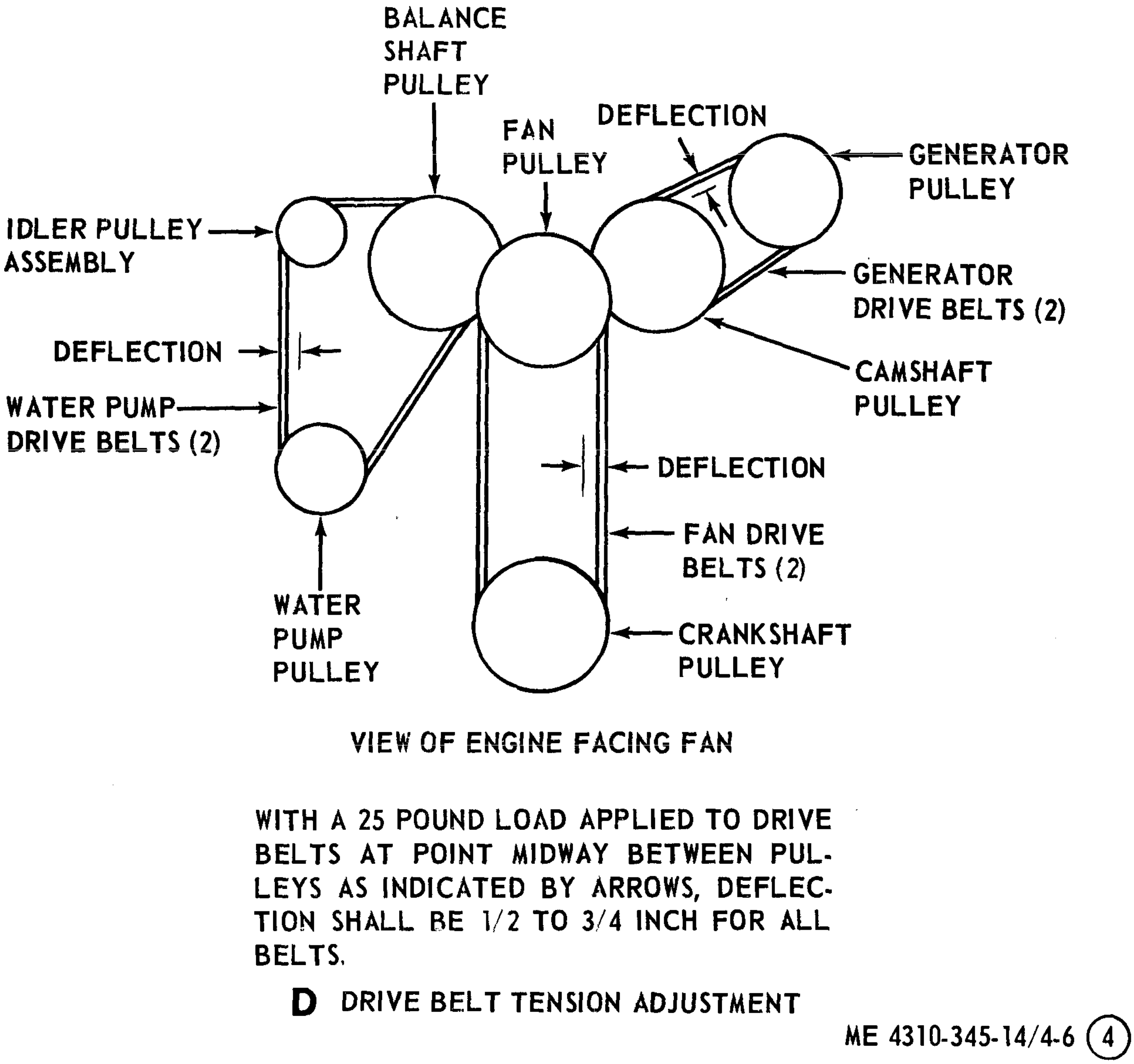
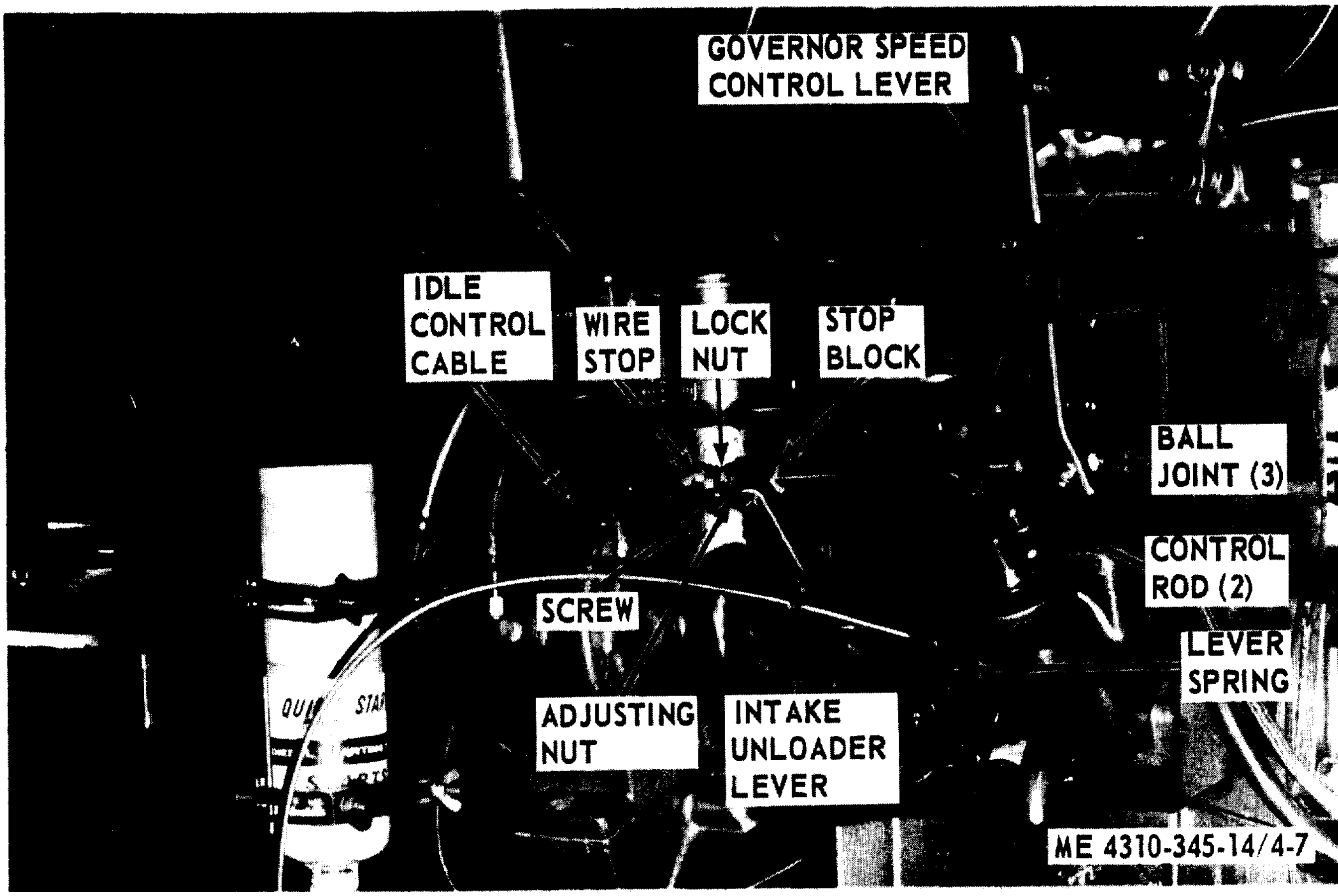


Figure 4-6. Drive belt service and adjustment (sheet 4 of 4).

4.17. Speed Control linkage Adjustment

Adjust the engine speed control linkage as shown in figure 4-7.



NOTE

FULL OPERATING SPEED OF 1800 RPM IS SET AND CONTROLLED BY THE GOVERNOR. REFER TO PARA 7-26b FOR GOVERNOR **ADJUSTMENT.**

STEP 1. WITH ENGINE OPERATING, LOOSEN LOCK NUT SECURING INTAKE UNLOADER LEVER STOP BLOCK. TURN ADJUSTING NUT IN DIRECTION TO MOVE STOP BLOCK TO POSITION WHERE 1000 RPM IDLE SPEED IS OBTAINED. TIGHTEN LOCK NUT AGAINST ADJUSTING NUT. (ALL AIR SERVICE VALVES MUST BE CLOSED,)

STEP 2. PULL IDLE CONTROL CABLE HANDLE ON INSTRUMENT PANEL OUTWARD. (REFER TO FIGURE (2.2)

STEP 3. LOOSEN SCREW SECURING WIRE STOP TO END OF IDLE CONTROL CABLE. MOVE WIRE STOP AGAINST THE STOP BLOCK WHICH IS SECURED TO END OF CONTROL ROD. TIGHTEN SCREW TO SECURE WIRE STOP.

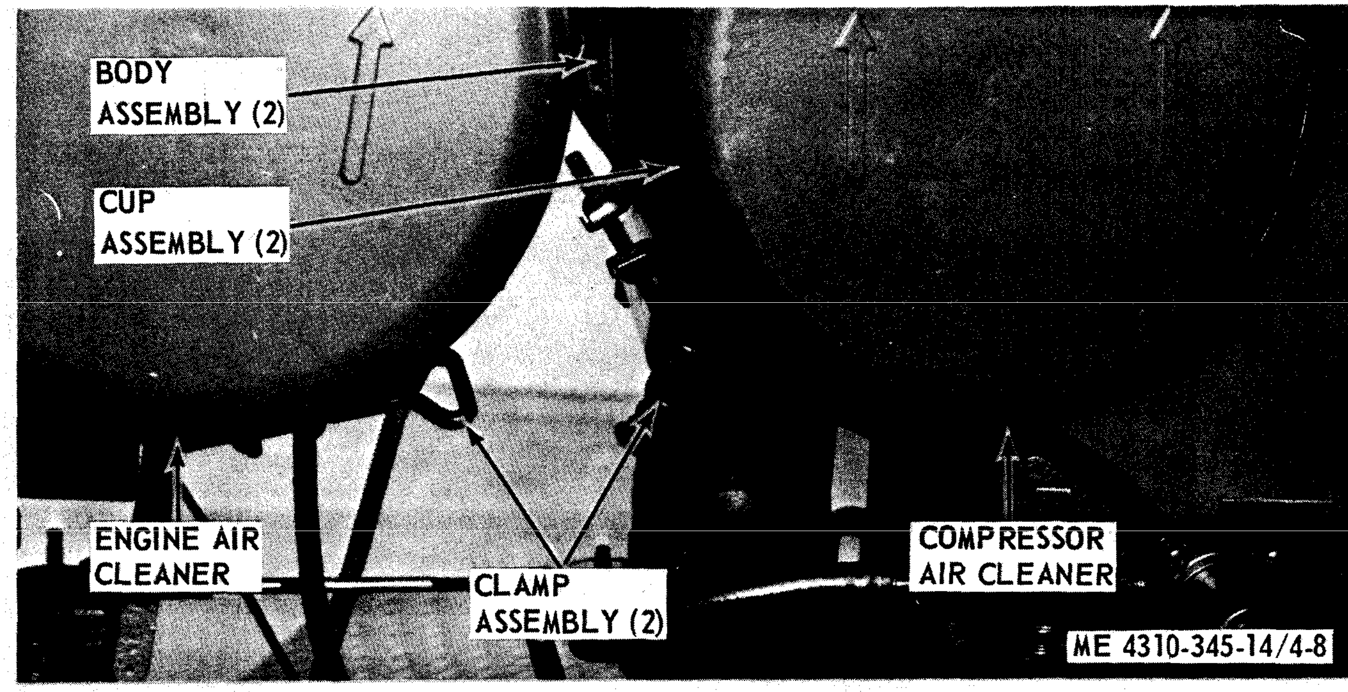
STEP 4. PUSH IDLE CONTROL CABLE HANDLE ON INSTRUMENT PANEL IN. CYCLE AIR COMPRESSOR UNIT SEVERAL TIMES BY OPENING AND CLOSING AIR SERVICE VALVE. OBSERVE TACHOMETER EACH TIME TO ENSURE ENGINE IDLE REMAINS AT 1000 RPM.

STEP 5. STOP ENGINE.

Figure 4-7. .Speed control linkage adjustment.

4-18. Air Cleaner Service

Service the engine and compressor air cleaner as shown in figure 4-8.



NOTE

THE FOLLOWING SERVICE INSTRUCTIONS ARE APPLICABLE TO BOTH THE ENGINE AND COMPRESSOR AIR CLEANER.

STEP 1. REFER TO FIGURE 3-11 AND REMOVE THE AIR CLEANER ELEMENTS.

STEP 2. CLEAN ELEMENTS AS FOLLOWS: DRY OR DUSTY ELEMENT: USE COMPRESSED AIR HOSE TO BLOW CLEAN, DRY AIR (100 PSI OR LESS) THROUGH THE ELEMENT IN DIRECTION OPPOSITE OF ARROW ON END OF ELEMENT.

OILY OR SOOTY ELEMENT: USE GARDEN TYPE WATER HOSE (40 PSI OR LESS) AND NON-SUDSING HOUSEHOLD TYPE DETERGENT TO WASH THE ELEMENT. DRY THOROUGHLY WITH COMPRESSED AIR.

CAUTION

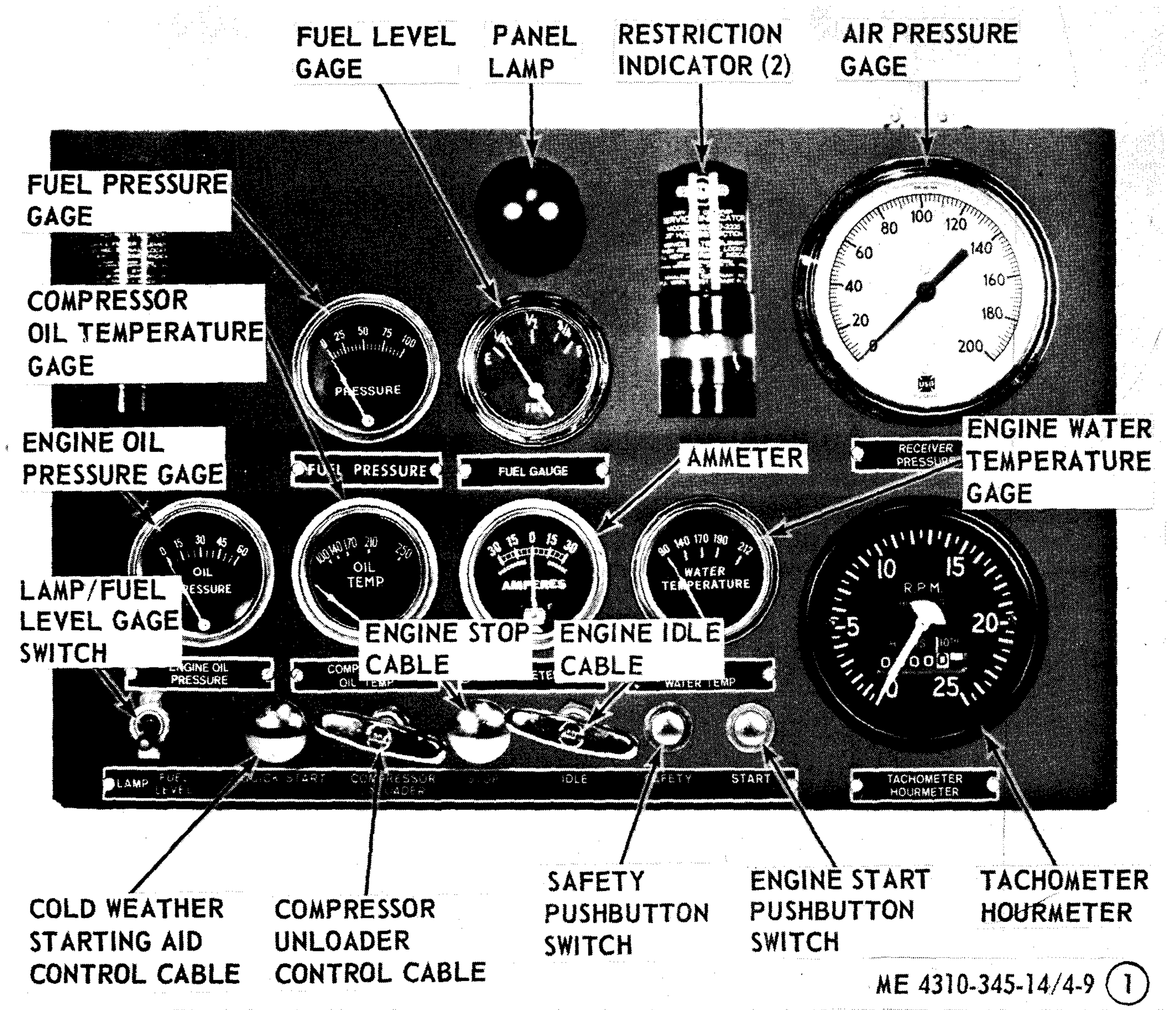
DO NOT RUPTURE ELEMENT, DAMAGE FINS OR SEALING SURFACES, NOR ALLOW DUST TO DEPOSITE ON CLEAN AIR SIDE OF ELEMENT.

STEP 3. REFER TO FIGURE 3-11 AND INSTALL AIR CLEANER ELEMENTS.

Figure 4-8. Air cleaner service.

4-19. Controls and Instruments Service

Service the controls and instruments as shown in figure 4-9.



A INSTRUMENT PANEL FRONT VIEW

STEP 1. CLEAN ALL CONTROLS AND INSTRUMENTS WITH A CLEAN CLOTH SOAKED WITH CLEANING SOLVENT CONFORMING TO FEDERAL SPECIFICATION P-D-680. DRY THOROUGHLY.

STEP 2. INSPECT ALL GAGE FACES FOR CRACKS AND BREAKS.

STEP 3. INSPECT ALL CONTROLS AND INSTRUMENTS FOR LOOSE MOUNTING, SECURE HOSE CONNECTIONS, AND TIGHTEN WIRE TERMINAL CONNECTIONS.

STEP 4. INSPECT HOSES AND CONTROL CABLES FOR KINKS, CRACKS, OR ANY OTHER DEFECT.

STEP 5. REFER TO SECTION XI, THIS CHAPTER, FOR MAINTENANCE OF CONTROLS AND INSTRUMENTS.

Figure 4-9. Controls and instruments service (sheet 1 of 2).

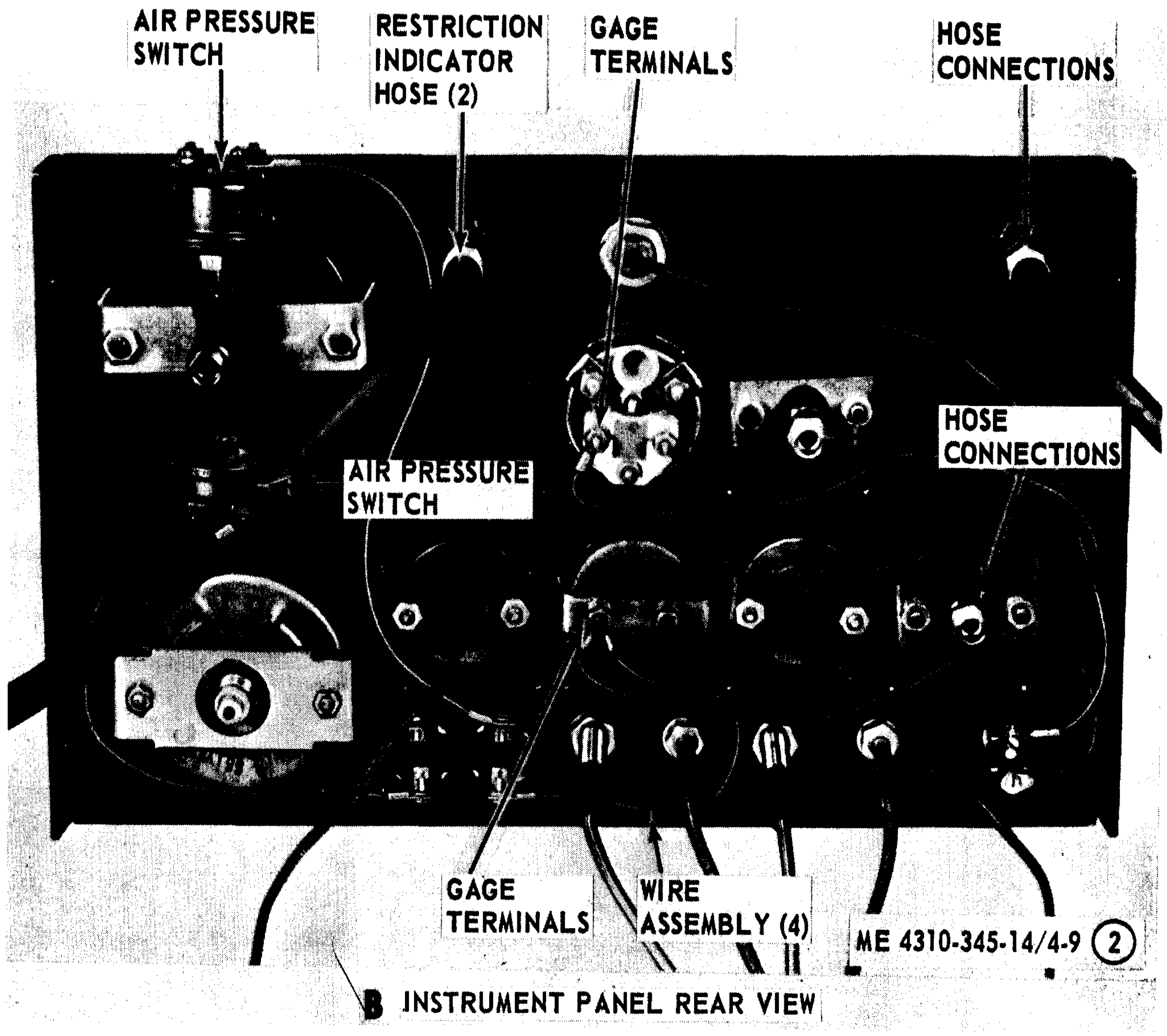
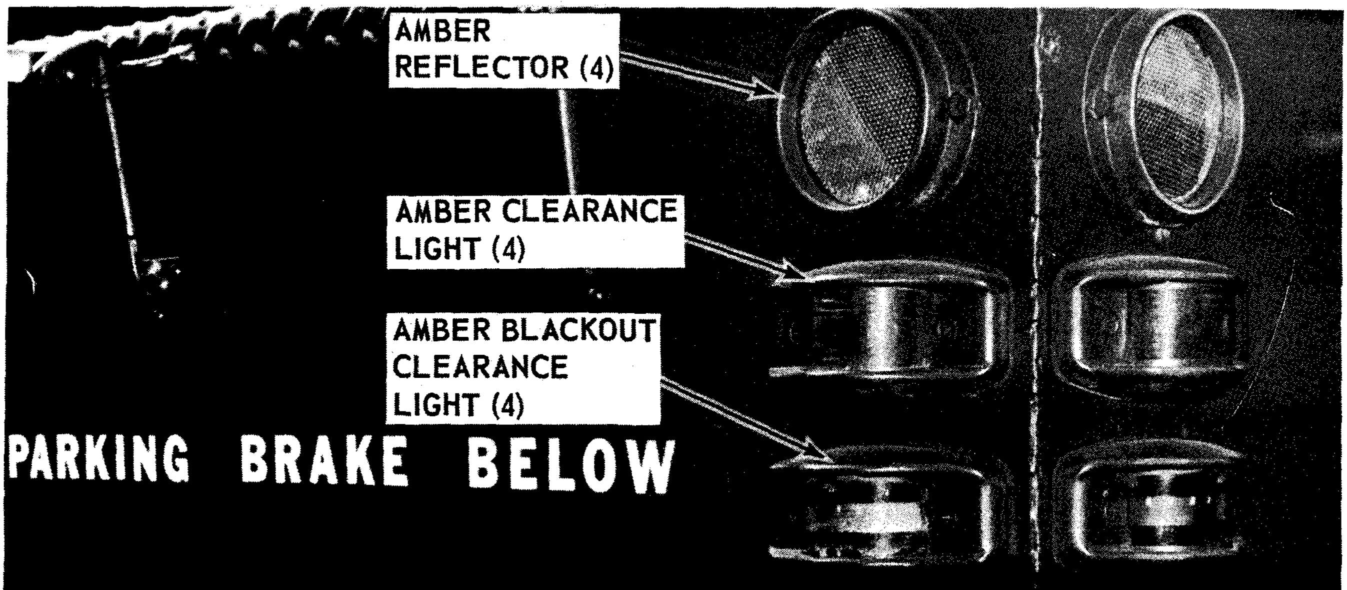


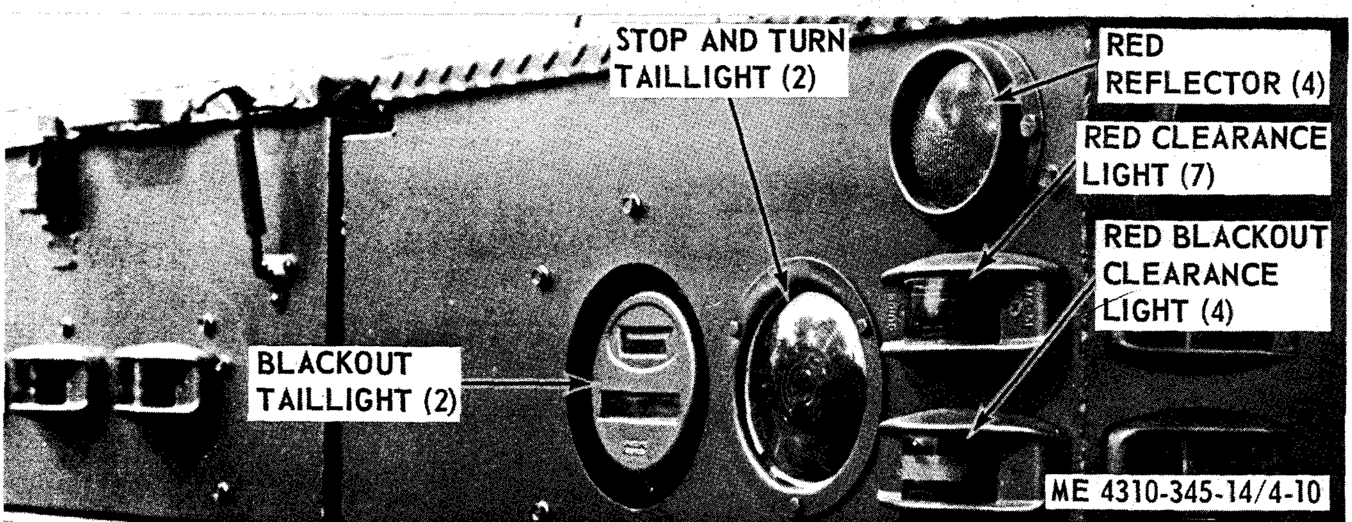
Figure 4-9. Controls and instruments service (sheet 2 of 2).

4-20. Lighting System Service

Service the lighting system as shown in figure 4-10.



A FRONT CLEARANCE LIGHTS AND REFLECTORS



B TAILLIGHTS, CLEARANCE LIGHTS AND REFLECTORS

STEP 1. CLEAN ALL CLEARANCE LIGHTS, TAILLIGHTS, AND REFLECTORS WITH A CLEAN CLOTH SOAKED WITH A CLEANING SOLVENT CONFORMING TO FEDERAL SPECIFICATION P-D-680. DRY THOROUGHLY.

STEP 2. INSPECT ALL CLEARANCE LIGHTS, TAILLIGHTS, AND REFLECTORS FOR CRACKED OR BROKEN LENSES. REFER TO FIGURE 3-15 FOR BULB REPLACEMENT.

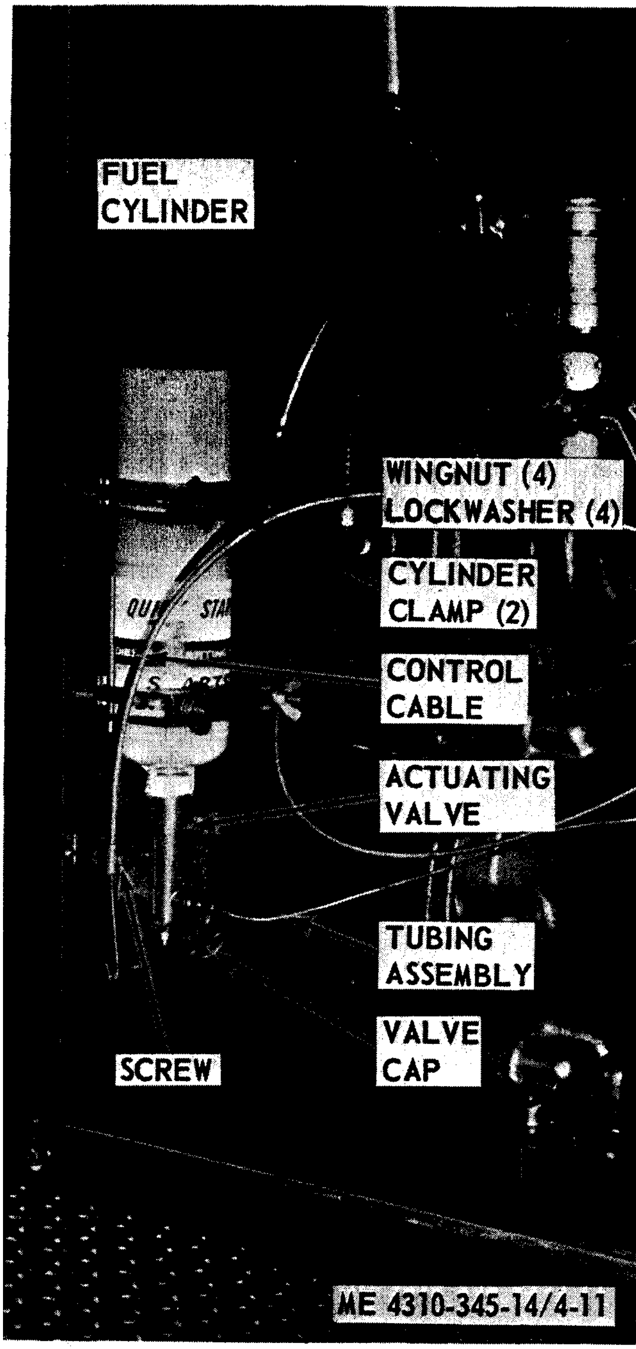
STEP 3. REFER TO FIGURES 4-17, 4-18, AND 4-19 FOR DISASSEMBLY FOR PARTS REPLACEMENT.

STEP 4. INSPECT ALL WIRING CONNECTIONS FOR CORROSION AND TIGHTNESS.

Figure 4-10. Lighting system service.

4-21. Cold Weather Starting Aid Service

Service the cold weather starting aid as shown in figure 4-11.



WARNING

DO NOT PUNCTURE OR MISHANDLE FUEL CYLINDER. THE CYLINDER CONTAINS AN ETHER BASE MIXTURE WHICH IS EXTREMELY TOXIC, VOLATILE, AND COMBUSTIBLE.

STEP 1. REFER TO FIGURE 3-16 AND REMOVE THE FUEL CYLINDER.

STEP 2. LOOSEN SCREW ON ACTUATING VALVE AND DISCONNECT CONTROL CABLE. APPLY A FEW DROPS OF LUBRICATING OIL ON CONTROL CABLE AND CHECK OPERATION BY PULLING AND PUSHING COLD WEATHER STARTING AID CONTROL ON INSTRUMENT PANEL. CHECK CABLE FOR KINKS OR BREAKS.

STEP 3. APPLY A FEW DROPS OF OIL IN ACTUATING VALVE INLET. DISCONNECT TUBING ASSEMBLY FROM ACTUATING VALVE. OPERATE ACTUATING LEVER A FEW TIMES TO DISTRIBUTE OIL THROUGH VALVE. REINSTALL TUBING ASSEMBLY.

STEP 4. INSTALL CONTROL CABLE, CONNECT WIRE END TO ACTUATING VALVE LEVER, AND TIGHTEN SCREW.

STEP 5. REFER TO FIGURE 3-16 AND INSTALL FUEL CYLINDER.

Figure 4-11. Cold weather starting aid service.

4-22. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the Model 14M250RPV Rotary Air Compressor Unit. Malfunctions which may occur are listed in table 4-2. Each malfunction stated is followed by a list of probable causes of the trouble. The corrective action, within the scope of organizational maintenance, recommended is described next to the probable cause. References to applicable procedural paragraphs or illustrations are also included in the corrective action column. For troubleshooting within the scope of the operator, refer to table 3-2. Any trouble encountered beyond the scope of organizational maintenance shall be reported to Direct Support or General Support Maintenance personnel as indicated by the Maintenance Allocation Chart, appendix B.

Table 4-2. Troubleshooting

Malfunction	Probable Cause	Corrective Action
1. Engine will not turn over.	*a.* Weak or dead batteries.	*a.* Charge or replace batteries (fig. 3-9). Refer to TM 9-6140-200-15
	b. Defective start pushbutton.	*b.* Replace pushbutton (para 4-52).
	c. Corroded battery terminals or loose wire connections.	*c.* Clean terminals and tighten all connections (fig. 3-21).
	d. Starting motor defective.	*d.* Replace starting motor (para 4-96).
	e. Other causes.	*e.* Refer other causes to Direct Support or General Support Maintenance personnel.
2. Engine turns over but will not start or is hard to start.	*a.* Primary fuel filter assembly defective.	*a.* Replace primary fuel filter (para 4-83).
	b. Secondary fuel filter assembly defective.	*b.* Replace secondary fuel filter (para 4-84).
	c. Defective fuel pump.	*c.* Replace fuel pump (para 4-85).
	d. Shutoff solenoid sticking.	*d.* Replace shutoff solenoid (para 4-58).
	e. Other causes.	*e.* Refer other causes to Direct Support or General Support Maintenance personnel.
	f. Defective safety switch or shut down valve.	*f.* Repair or replace defective safety switch and / or shut down valve.
	g. Defective safety switch push-button.	g. Replace safety switch pushbutton.
	h. Incorrect crankcase oil.	*h.* Drain engine crankcase and refill with correct oil.
	i. Improper injector timing.	*i.* Time the injectors correctly.
3. Engine misses or runs erratically.	*a.* Fuel pump defective.	*a.* Replace fuel pump (para 4-85).
	b. Fuel lines leaking or restricted.	*b.* Replace fuel lines or clean (para 4-82).
	c. Defective fuel injector.	*c.* Replace defective fuel injector (para 4-86).
	d. Defective governor controls.	*d.* Repair or replace controls.
	e. Restricted fuel filters.	*e.* Clean or replace filter element.
	f. Other causes.	*f.* Refer other causes to Direct Support or General Support Maintenance personnel.
4. Engine lacks power.	*a.* Defective fuel injector.	*a.* Replace defective fuel injectors (para 4-86).
	b. Defective fuel pump.	*b.* Replace fuel pump (para 4-85).
	c. Speed control linkage out of adjustment.	c. Adjust speed control linkage (fig. 4-7).
	d. Restricted fuel filters.	*d.* Clean or replace fuel filter elements.
	e. Restricted air cleaner.	e. Clean or replace air cleaner element.
	f. Incorrect type of fuel.	*f.* Drain fuel tank and refill with correct fuel.
	g. other causes,	*g.* Refer other causes to Direct Support or General Support Maintenance personnel.

	Probable Cause	Corrective Action
5. Engine knocks, develops excessive noise or vibration.	*a.* Low engine operating temperature.	*a.* Replace engine water thermostat (para 4-67).
	b. Cooling fan out of balance.	*b.* Replace cooling fan (para 4-66).
	c. Defective fuel injector.	*c.* Replace defective fuel injectors (para 4-86).
	d. Defective fuel pump.	*d.* Replace defective fuel pump (para 4-85).
	e. Other causes.	*e.* Refer other causes to Direct Support or General Support Maintenance personnel.
6. Engine stops suddenly.	*a.* Engine overheating (safety switch shutoff).	*a.* Check radiator hoses for leaks or obstruction. Replace defective hoses and clamps (para 4-64). Check fan drive belt adjustment and adjust as necessary (fig. 4-6). Replace a defective water pump (para 4-68). Replace a defective safety switch (fig. 4-26). Replace defective thermostat (para 4-67).
	b. Low oil pressure (safety switch shutoff).	*b.* Replace defective safety switch (fig. 4-26).
	c. Shutoff solenoid defective.	*c.* Replace shutoff solenoid (para 4-58).
	d. Defective air shut down valve.	*d.* Repair or replace shut down valve.
	e. Out of fuel.	*e.* Refill fuel tank.
	f. Restricted fuel filters.	*f.* Clean or replace fuel filter elements.
	g. Restricted air cleaner.	*g.* Clean or replace air cleaner element.
	h. Improper weight oil.	*h.* Change oil.
	i. Other causes.	*i.* Refer other causes to Direct Support or General Support Maintenance personnel.
7. Engine has low or no oil pressure.	*a.* Defective oil pressure gage.	*a.* Replace engine oil pressure gage (para 4-44).
	b. Improper weight oil.	*b.* Change oil.
	c. Defective oil gauge hose.	*c.* Replace hose.
	d. Other causes.	*d.* Refer other causes to Direct Support or General Support Maintenance personnel.
8. Engine overheats.	*a.* Defective thermostat.	*a.* Replace defective thermostat (para 4-67).
	b. Water temperature gage defective.	*b.* Replace water temperature gage (para 4-47).
	c. Radiator hoses collapsed or deteriorated.	*c.* Replace radiator hoses and clamps (para 4-64).
	d. Radiator core blocked.	*d.* Flush radiator to remove obstruction.
	e. Fan drive belts slipping or broken.	*e.* Adjust or replace fan belts (para 4-65).
	f. Defective water pump.	*f.* Replace defective water pump (para 4-68).
	g. Low coolant level.	*g.* Fill radiator.
	h. Improper type fuel.	*h.* Drain fuel tank and refill with proper fuel.
	i. Restricted air cleaner.	*i.* Clean or replace air cleaner element.
	j. Other causes.	*j.* Refer other causes to Direct Support or General Support Maintenance personnel.
9. Engine exhaust excessively black or gray.	*a.* Fuel injector plugged or leaking.	*a.* Replace defective fuel injector (para 4-86).
	b. Other causes.	*b.* Refer other causes to Direct Support or Genera] Support Maintenance personnel.

Table 4-2. Troubleshooting—Continued

	Probable Cause	Corrective Action
10. Engine exhaust excessively white or blue.	*a.* Defective fuel injector.	*a.* Replace a defective fuel injector (para 4-86).
	b. Engine operating temperature too low.	*b.* Replace engine coolant thermostat (para 4-67).
	c. Fuel pump defective.	*c.* Replace fuel pump (para 4-85).
	d. Restricted fuel filter.	*d.* Clean or replace fuel filter element.
	a. Improper weight oil.	*e.* Drain crankcase and refill with proper weight oil.
	f. Other causes.	*f.* Refer other causes to Direct Support or General Support Maintenance personnel.
11. Excessive engine oil consumption.	*a.* High crankcase pressure.	*a.* Service crankcase breather (fig. 4-5).
	b. External oil leaks.	*b.* Inspect for visible evidence of leaks and repair accordingly.
	e. Other causes.	*c.* Refer other causes to Direct Support or General Support Maintenance personnel.
12. Engine fails to stop.	*a.* Engine speed control linkage out of adjustment.	*a.* Adjust engine speed control (fig. 4-7).
	b. Engine stop control defective.	*b.* Replace control.
	c. Other causes.	*c.* Refer other causes to Direct support or General Support Maintenance personnel.
13. Excessive fuel consumption.	*a.* Defective injectors.	*a.* Replace defective injectors (para 4-86).
	b. Leaks in fuel line.	*b.* Tighten or replace fuel lines.
	c. Other causes.	*c.* Refer other causes to Direct Support or General Support Maintenance personnel.
14. Engine stalls at low speed.	*a.* Defective injectors.	*a.* Replace defective injectors (para 4-86).
	b. Defective fuel restrictor fitting.	*b.* Replace restrictor fitting (para 4-82).
	c. Defective fuel pump.	*c.* Replace fuel pump (para 4-85).
	d. Other causes.	*d.* Refer other causes to Direct Support or General Support Maintenance personnel.
15. Valve train clicking noise.	*a.* Insufficient lubrication,	*a.* Remove valve rocker cover and check lubrication. Should be very wet at higher speed; damp at idle. Refer trouble to Direct Support or General Support Maintenance personnel.
	b. Other causes.	*b.* Refer other causes to Direct Support or General Support Maintenance personnel.
16. Engine oil in coolant or coolant in engine oil.	*a.* Defective engine oil cooler.	*a.* Replace engine oil cooler (para 4-90).
	b. Other causes.	*b.* Refer other causes to Direct Support or General Support Maintenance personnel.
17. Little rocker arm movement and excessive valve clearances.	*a.* Insufficient lubrication.	*a.* Remove valve rocker cover and check lubrication. Should be very wet at higher speeds; damp at idle. Refer trouble to Direct Support or General Support Maintenance personnel.
	b. Other causes.	*b.* Refer other causes to Direct Support or General Support Maintenance personnel.
18. Premature engine wear.	All causes.	Refer permature engine wear to Direct Support or General Support Maintenance personnel.
19. Compressor overheats.	*a.* Faulty thermal bypass valve.	*a.* Replace thermal bypass valve (para 4-78).

Table 4-2. Troubleshooting—Continued

Malfunction	Probable Cause	Corrective Action
19. Compressor overheats—continued	*b.* Defective thermostatic switch.	*b.* Replace defective thermostatic switch (para 4-57).
	c. Faulty compressor oil temperature gage.	*c.* Replace compressor oil temperature gage (para 4-45).
	d. Oil cooler restricted.	*d.* Clean or replace oil cooler.
	e. Low oil level.	*e.* Add oil to proper level in separator tank.
	f. Restricted oil filter.	*f.* Clean or replace oil filter element.
	g. Other causes.	*g.* Refer other causes to Direct Support or General Support Maintenance personnel.
20. Noisy compressor operation.	*a.* Air pressure regulator assembly defective.	*a.* Replace air pressure regulator assembly (fig. 4-30).
	b. Other causes.	*b.* Refer other causes to Direct Support or General Support Maintenance personnel.
21. Compressor not operating to full capacity or pressure.	*a.* Leak in air hoses, piping, or connections.	*a.* Check all air hoses, piping, and connections for leaks while unit is operating. Use soapy water solution on connections. Tighten or replace as required.
	b. Air pressure regulator assembly defective or out of adjustment.	*b.* Adjust or replace air pressure regulator assembly (fig. 4-30).
	c. Safety valve on oil separator leaking.	*c.* Replace safety valve (para 4-76).
	d. Other causes.	*d.* Refer other causes to Direct Support or General Support Maintenance personnel.
22. Compressor fails to load or unload.	*a.* Dirt build-up on intake-unloader valve seat.	*a.* Clean valve seat.
	b. Unloading pressure too high or too low.	*b.* Adjust air pressure regulator assembly (fig. 4-30).
	c. Air hose between intake-unloader and air pressure regulator assembly damaged or leaking.	*c.* Replace air hose (para 4-74).
	d. Other causes.	*d.* Refer other causes to Direct Support or General Support Maintenance personnel.
23. Compressor unloads but engine will not idle.	*a.* Speed control linkage defective.	*a.* Adjust or replace speed control linkage as necessary (fig. 4-7).
	b. Other causes.	*b.* Refer other causes to Direct Support or General Support Maintenance personnel.
24. Condensate and/or emulsion in oil separator.	*a.* Faulty thermal bypass valve.	*a.* Replace thermal bypass valve (para 4-78).
	b. Other causes.	*b.* Refer other causes to Direct Support or General Support Maintenance personnel.
25. Excessive compressor oil consumption.	*a.* Compressor oil system oil lines leaking.	*a.* Check oil lines for visible leakage and tightness of connections. Replace oil lines as necessary (para 4-79).
	b. Separator element damaged.	*b.* Replace separator element.
	c. Other causes.	*c.* Refer other causes to Direct Support or General Support Maintenance personnel.
26. Compressor unit hunts.	*a.* Air pressure regulator defective.	*a.* Replace air pressure regulator assembly (fig. 4-30).
	b. Other causes.	*b.* Refer other causes to Direct Support or General Support Maintenance personnel.
27. Ammeter indicates low or no charging rate when batteries are low or discharged.	*a.* Defective or loose wiring in charging circuit.	*a.* Repair or replace as required.
	b. Loose or broken generator drive belts.	*b.* Tighten or replace broken belts (fig. 4-6).
	c. Ammeter defective.	*c.* Replace ammeter (para 4-46).

Table 4-2. *Troubleshooting—Continued*

Malfunction	Probable Cause	Corrective Action
27. Ammeter indicates low or no charging rate when batteries are low or discharged-continued	*d.* Generator regulator assembly defective.	*d.* Replace generator regulator assembly (para 4-95).
	e. Generator assembly defective.	*e.* Replace generator assembly (para 4-93).
	f. Loose connections.	*f.* Tighten connections.
	g. Generator drive belts loose.	*g.* Adjust drive belts.
28. Ammeter indicates excessive charge rate when batteries are fully charged.	*a.* Defective wiring in charging circuit.	*a.* Repair or replace as required.
	b. Ammeter defective.	*b.* Replace ammeter (para 4-46).
	c. Generator regulator assembly defective.	*c.* Replace generator regulator assembly (para 4-95).
29. Generator overheats.	*a.* Defective wiring.	*a.* Repair or replace as necessary.
	b. Generator regulator assembly defective.	*b.* Replace generator regulator assembly (para 4-95).
	c. Generator assembly defective.	*c.* Replace generator assembly (para 4-93).
	d. Defective generator bearings.	*d.* Replace generator bearings.
30. Wheel and /or brake malfunction.	All causes.	Refer to TM 9-2330-247-14.

Section VII. RADIO INTERFERENCE SUPPRESSION

4-23. General Methods Used to Attain Proper Suppression

Essentially, suppression is attained by providing a low resistance path to ground for stray currents. The methods used include shielding the generator and generator regulator cables, and grounding the unit using a braided electrical lead and toothed lockwashers.

4-24. Interference Suppression Components

a. Primary Suppression Components. Primary suppression components are those whose primary function is to suppress radio interference. These components are the shielded cables on the generator and generator regulator, figure 4-12.

b. Secondary Suppression Components. These components have radio interference suppression functions which are incidental or secondary to their primary functions. These are the toothed lockwashers and braided electrical wire.

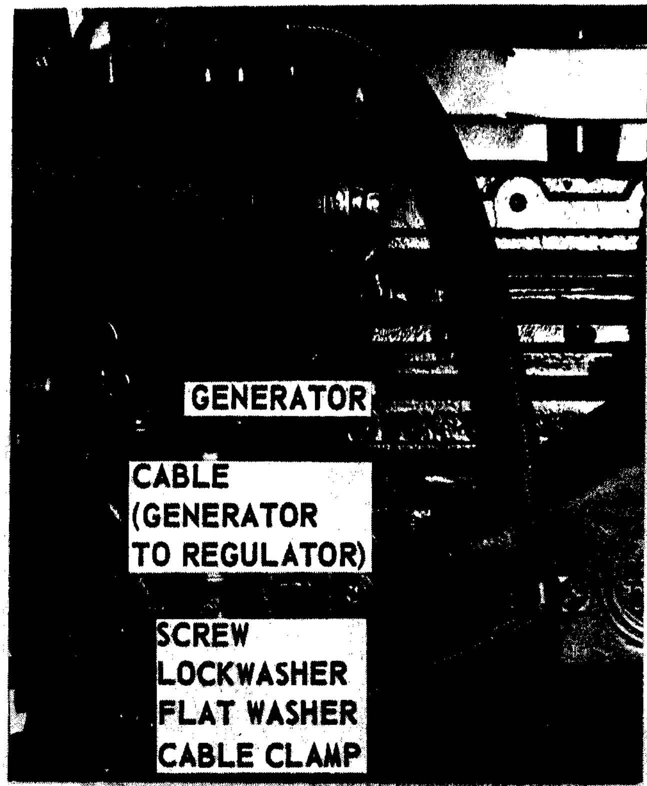
4-25. Replacement of Suppression Components

a. Refer to figure 4-12 for instructions on removing shielded cables from generator and generator regulator.

b. Removal instructions for secondary suppression components are included in the disassembly instructions for the individual assemblies on which they are used.

4-26. Testing of Radio Interference Suppression

Test the cables for proper grounding of the shielding. If test equipment is not available and interference is indicated, isolate the cause by replacing each cable, one at a time, until the interference is corrected.



A GENERATOR SHIELDED CABLE

REMOVAL

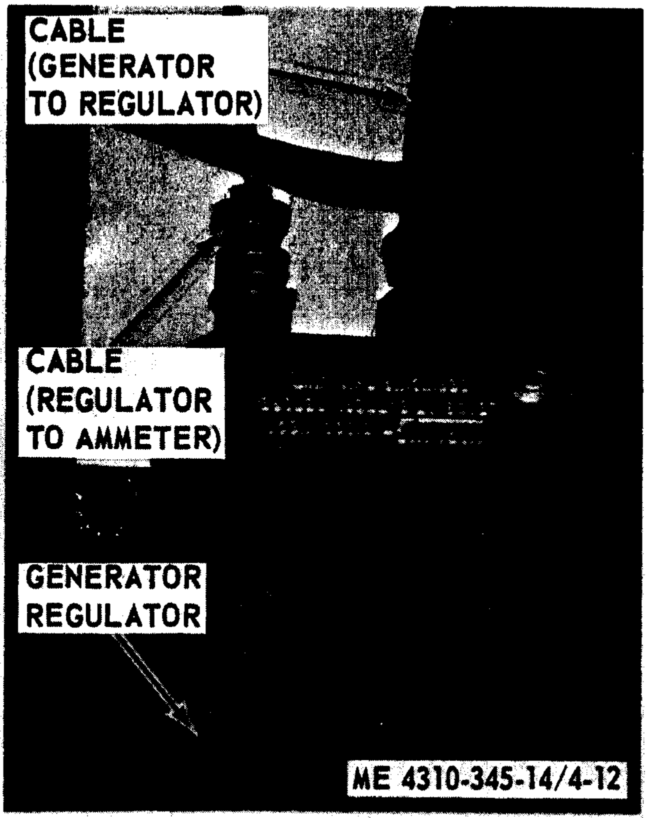
WARNING

DISCONNECT BATTERY TERMINALS BEFORE REMOVING CABLES.

STEP 1. REMOVE SCREWS, WASHERS, AND CLAMPS. UNSCREW AND REMOVE CABLE (GENERATOR TO GENERATOR REGULATOR).

STEP 2. REMOVE SCREW AND CLAMP FROM REGULATOR TO AMMETER CABLE. REMOVE NUT AND WASHERS FROM AMMETER.

STEP 3. UNSCREW CABLE FROM GENERATOR REGULATOR AND REMOVE CABLE (GENERATOR REGULATOR TO AMMETER).



B REGULATOR CABLES

INSTALLATION

STEP 1. INSTALL AND TIGHTEN BOTH CABLES TO GENERATOR REGULATOR. INSTALL AND TIGHTEN CABLE TO GENERATOR.

STEP 2. INSTALL CABLE ON AMMETER AND SECURE WITH FLAT WASHER, LOCKWASHER, AND NUT.

STEP 3. ATTACH CLAMPS ON CABLES AND SECURE WITH WASHERS AND SCREWS.

STEP 4. CONNECT BATTERY TERMINALS.

Figure 4-12. Primary suppression components, removal and installation.

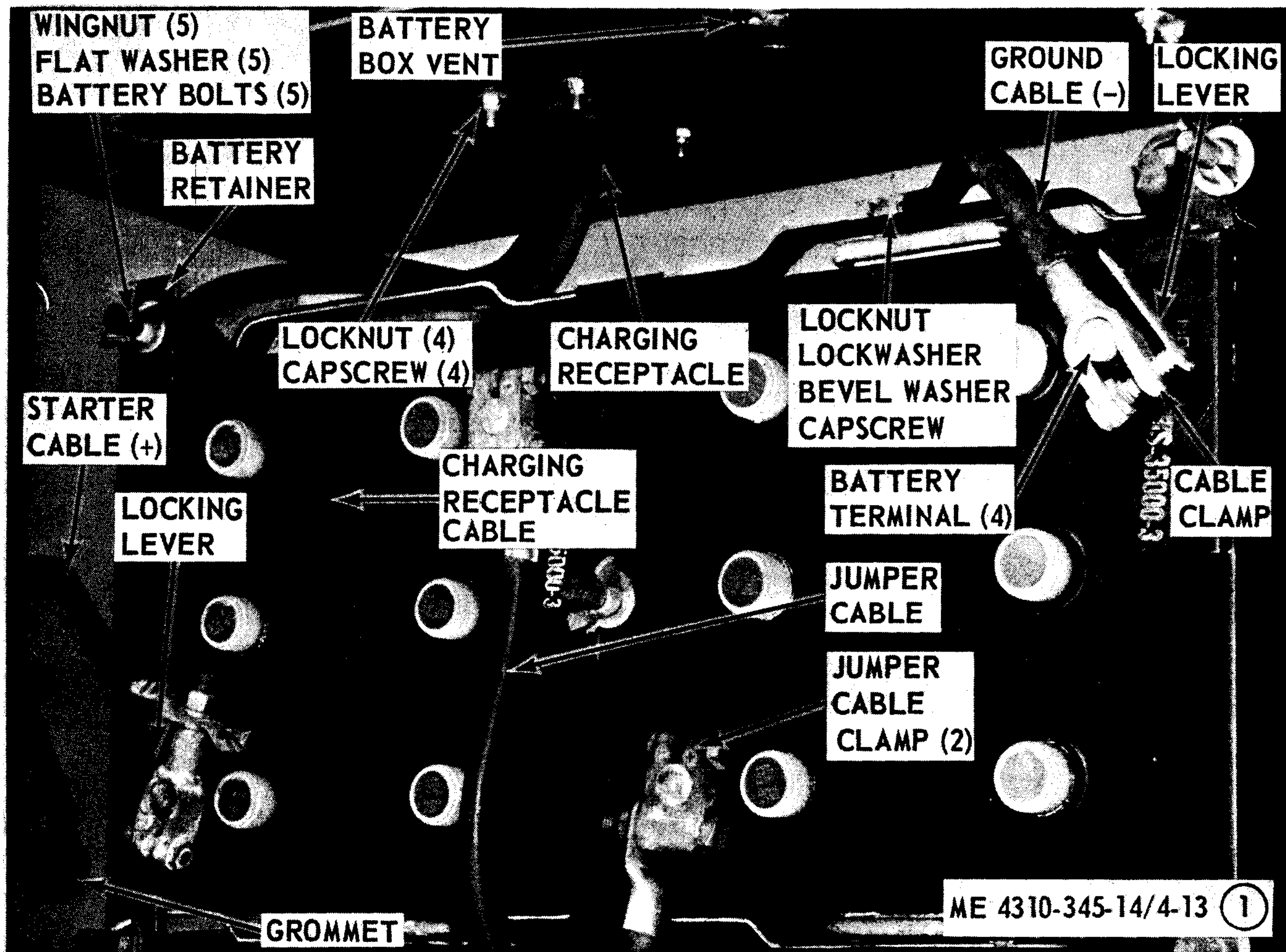
4-27. General

The toolbox group consists of the right side toolbox, left side toolbox and rear toolbox. Each toolbox is of sheet metal construction with compartments and tie-down eyes for various air tools. A tool disposition plate is attached to the underside of each toolbox lid. The right and left side toolbox has three separate hinged lids. All lids are provided with means for locking. Clearance lights, stoplights, reflectors, battery charging receptacle, and battery box vent fasten to the outside of the toolboxes. The front portion of the right side toolbox serves as the battery box.

4-28. Toolbox Group

a. Removal and Disassembly.

(1) Disconnect and remove battery cables, batteries, charging receptacle, and battery box vent as shown in figure 4-13.



A REMOVAL

REMOVAL

STEP 1. RELEASE LOCKING LEVER ON GROUND CABLE (-) CLAMP. REMOVE GROUND CABLE FROM BATTERY TERMINAL. REMOVE LOCKNUT, LOCKWASHERS, BEVEL WASHER, AND CAPSCREW. REMOVE GROUND CABLE.

STEP 2. LOOSEN NUTS ON JUMPER CABLE CLAMPS. REMOVE JUMPER CABLE FROM BATTERY TERMINALS.

STEP 3. RELEASE LOCKING LEVER ON CHARGING RECEPTACLE CABLE AND STARTER CABLE (+) CLAMP. REMOVE CABLE CLAMP FROM BATTERY TERMINAL.

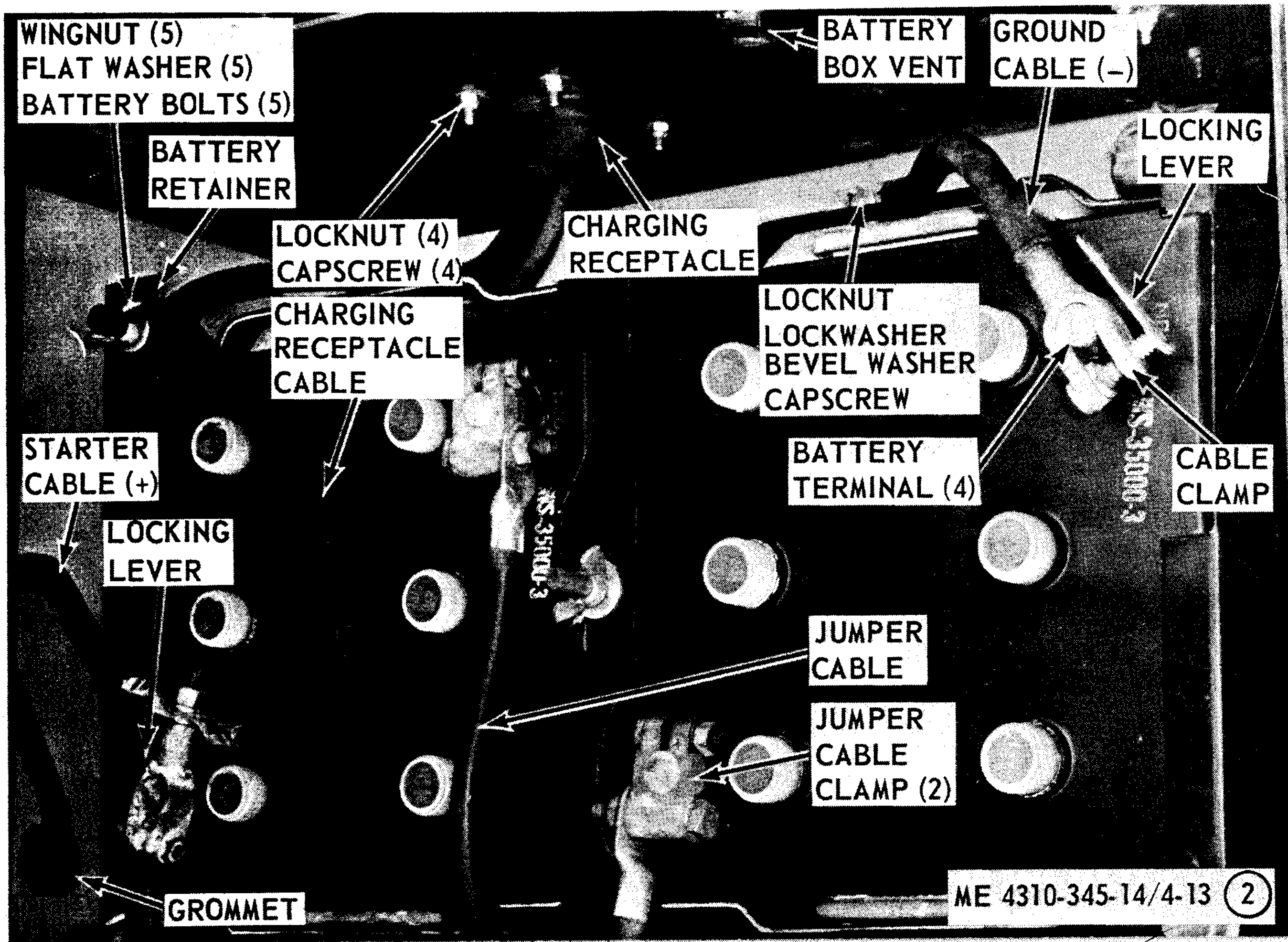
STEP 4. REMOVE WINGNUTS, FLAT WASHERS, BATTERY RETAINER, BATTERY BOLTS, BATTERIES, AND BATTERY PAD.

STEP 5. REMOVE NUT AND FLAT WASHER FROM POSITIVE TERMINAL CLAMP. FROM INSIDE OF FRAME, PULL STARTER CABLE THROUGH GROMMET. REMOVE GROMMET.

STEP 6. REMOVE LOCKNUTS, CAPSCREWS, AND CHARGING RECEPTACLE FROM TOOLBOX.

STEP 7. UNSCREW AND REMOVE BATTERY BOX VENT FROM VENT PIPE.

Figure 4-13. Battery cables, batteries, charging receptacle, and battery box vent, removal and installation (sheet 1 of 2).



B INSTALLATION

INSTALLATION

STEP 1. INSTALL BATTERY BOX VENT ON VENT PIPE.

STEP 2. INSTALL CHARGING RECEPTACLE IN MOUNTING POSITION AND SECURE WITH CAPSCREWS AND LOCKNUTS.

STEP 3. INSTALL GROMMET FOR STARTER CABLE. FROM INSIDE OF FRAME, PUSH STARTER CABLE THROUGH GROMMET. ASSEMBLE STARTER CABLE AND CHARGING RECEPTACLE CABLE (+) ON TERMINAL CLAMP AND SECURE WITH FLAT WASHER AND NUT.

STEP 4. INSTALL BATTERY PAD, BATTERIES, BATTERY BOLTS, BATTERY RETAINER; SECURE WITH FLAT WASHERS AND WINGNUTS.

STEP 5. INSTALL POSITIVE CABLE CLAMP ON POSITIVE TERMINAL OF INBOARD BATTERY. ACTUATE CLAMP LEVER TO CLAMP POSITION.

STEP 6. INSTALL JUMPER CABLE ON NEGATIVE BATTERY TERMINAL OF INBOARD BATTERY TO POSITIVE TERMINAL OF OUTBOARD BATTERY. TIGHTEN CLAMP NUTS.

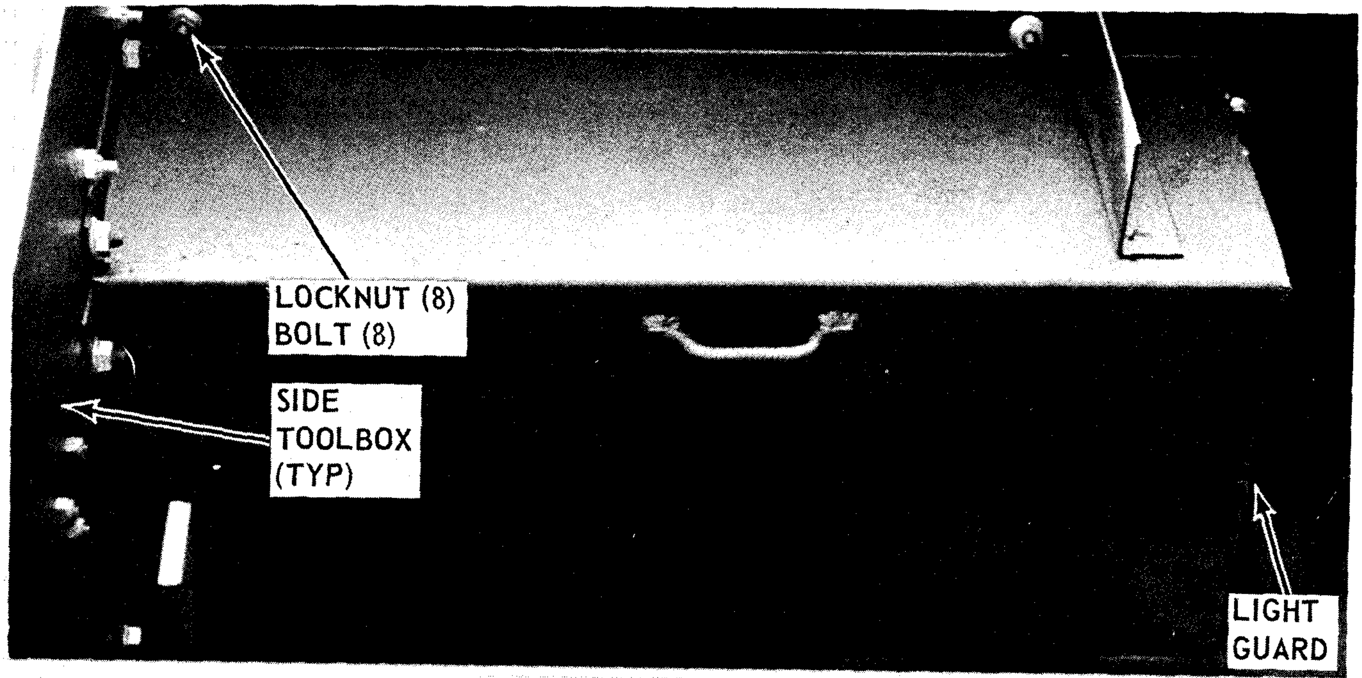
STEP 7. SECURE CHARGING RECEPTACLE NEGATIVE CABLE AND BATTERY GROUND CABLE TO TOOLBOX AND FRAME WITH CAPSCREW, LOCKWASHERS, BEVEL WASHER, AND LOCKNUT.

STEP 8. INSTALL BATTERY GROUND CABLE ON OUTBOARD BATTERY NEGATIVE TERMINAL. ACTUATE CLAMP LEVER TO CLAMP POSITION.

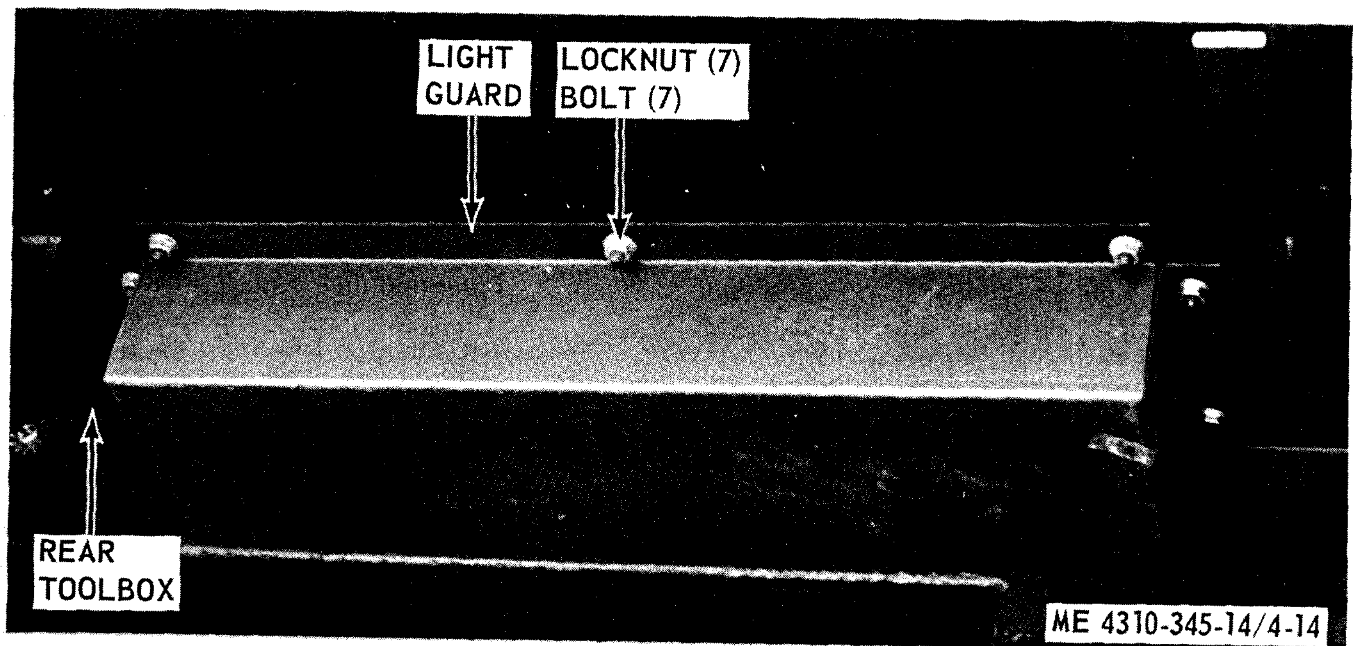
Figure 4-43. Battery cables, batteries, Charging receptacle, and battery box vent, removal and installation (sheet 2 of 2).

(2) Remove all tools that may be stored in toolboxes and all tool straps.

(3) Remove all light guards as shown in figure 4-14.



A CORNER LIGHT GUARDS



B REAR LIGHT GUARD

REMOVAL

STEP 1. REMOVE LOCKNUTS AND BOLTS SECURING LIGHT GUARDS TO TOOLBOXES.

STEP 2. REMOVE LIGHT GUARDS FROM TOOLBOXES.

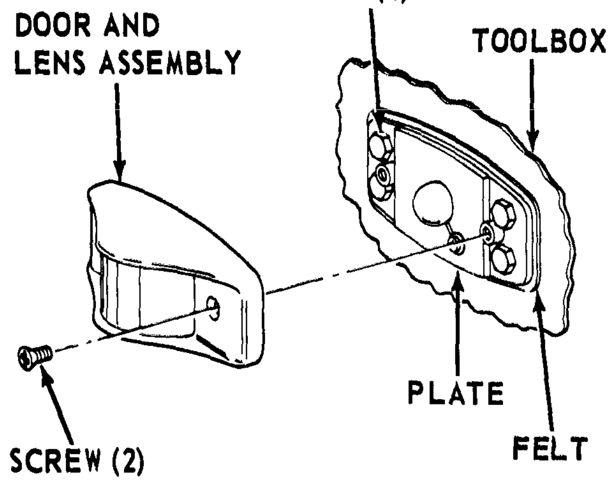
INSTALLATION

STEP 1. INSTALL LIGHT GUARDS IN MOUNTING POSITION IN TOOLBOXES.

STEP 2. SECURE LIGHT GUARDS TO TOOLBOXES WITH BOLTS AND LOCKNUTS.

Figure 4-14. Light guards, remova[and installation.

(4) Remove clearance lights, stoplights, taillights, and reflectors as shown in figure 4-15.



A CLEARANCE LIGHTS

REMOVAL

STEP 1. DISCONNECT ELECTRICAL CONNECTOR FROM WIRING HARNESS.

STEP 2. REMOVE SCREWS FROM DOOR AND LENS ASSEMBLY. REMOVE DOOR AND LENS.

STEP 3. REMOVE LOCKNUTS AND BOLTS FROM PLATE. REMOVE PLATE AND FELT.

INSTALLATION

STEP 1. INSTALL FELT AND PLATE IN MOUNTING POSITION AND SECURE WITH BOLTS AND LOCKNUTS.

STEP 2. INSTALL DOOR AND LENS ASSEMBLY ON PLATE AND SECURE WITH SCREWS.

STEP 3. CONNECT CLEARANCE LIGHT TO WIRING HARNESS ELECTRICAL CONNECTOR.

Figure 4-15. Clearance lights, stoplights, taillights, and reflectors, removal and installation (sheet 1 of 2).

STOPLIGHTS

REMOVAL

STEP 1. DISCONNECT ELECTRICAL CONNECTOR FROM WIRING HARNESS.

STEP 2. REMOVE LOCKNUTS AND SCREWS.

STEP 3. REMOVE STOPLIGHT FROM TOOLBOX.

INSTALLATION

STEP 1. INSTALL STOPLIGHT IN MOUNTING POSITION IN TOOLBOX.

STEP 2. SECURE WITH SCREWS AND LOCKNUTS.

STEP 3. CONNECT STOPLIGHT TO WIRING HARNESS ELECTRICAL CONNECTOR.

TAILLIGHTS

REMOVAL

STEP 1. DISCONNECT ELECTRICAL CONNECTOR FROM WIRING HARNESS.

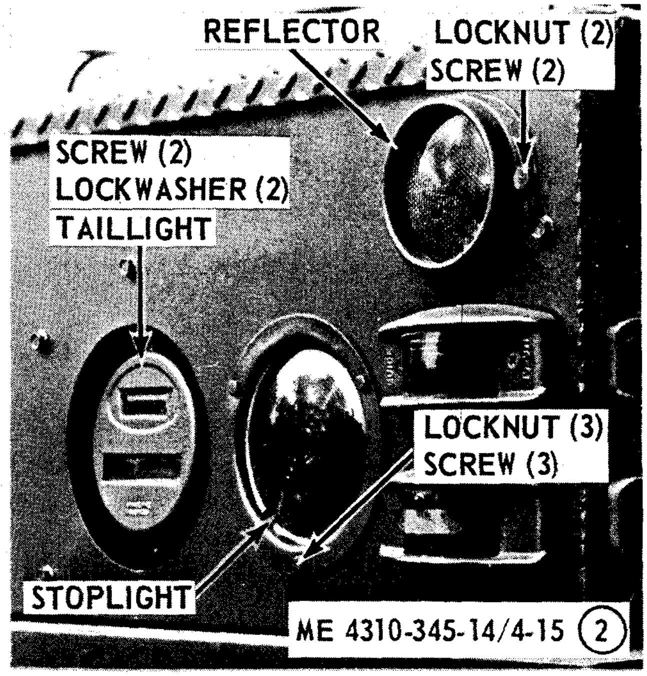
STEP 2. REMOVE SCREWS AND LOCKWASHERS SECURING TAILLIGHT TO BRACKET.

STEP 3. REMOVE TAILLIGHT FROM TOOLBOX.

INSTALLATION

STEP 1. INSTALL TAILLIGHT IN MOUNTING POSITION AND SECURE TO BRACKET WITH LOCKWASHERS AND SCREWS.

STEP 2. CONNECT TAILLIGHT TO WIRING HARNESS ELECTRICAL CONNECTOR.



B STOPLIGHTS, TAILLIGHTS AND REFLECTORS

REFLECTORS

REMOVAL

STEP 1. REMOVE LOCKNUTS AND SCREWS.

STEP 2. REMOVE REFLECTOR FROM TOOLBOX.

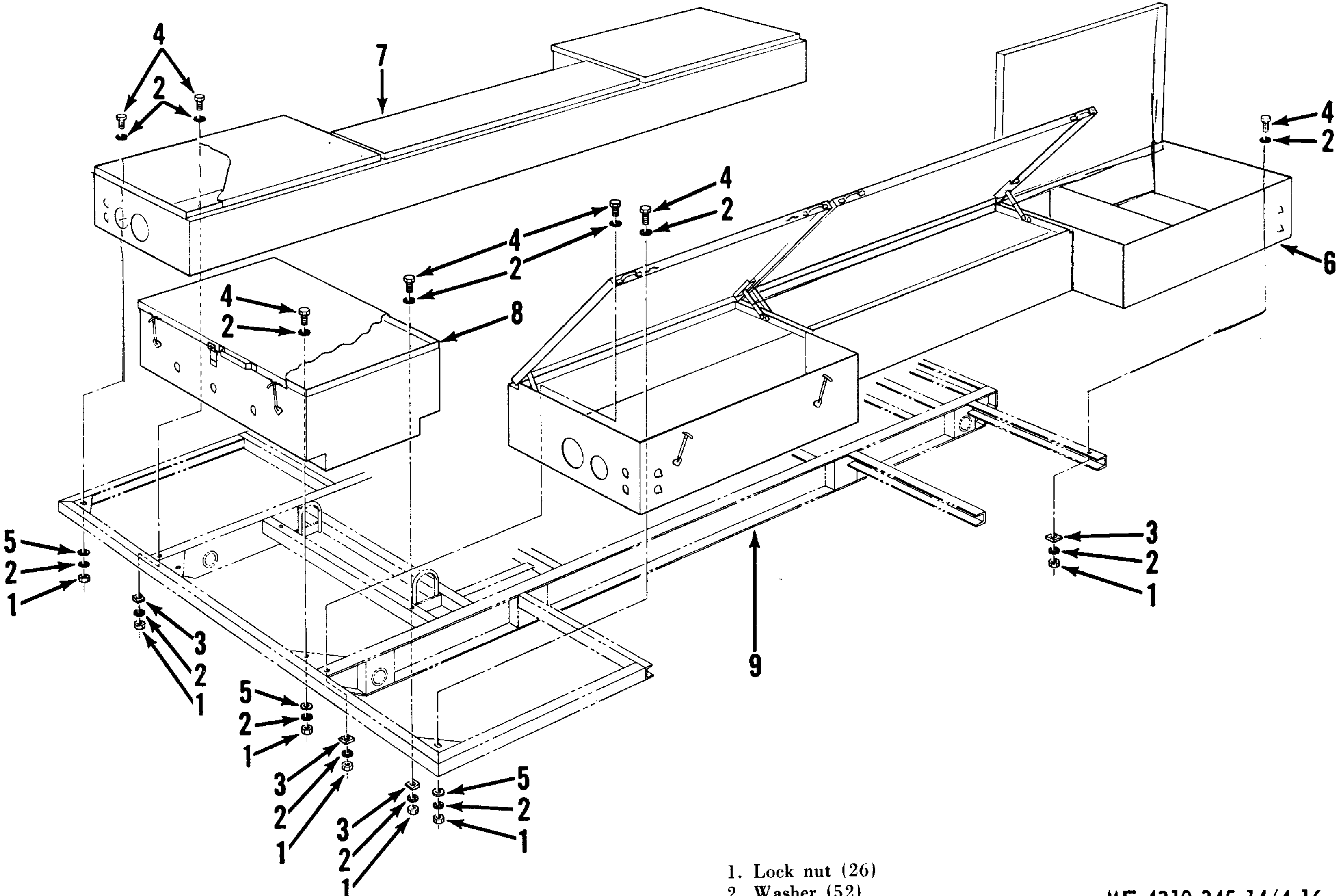
INSTALLATION

STEP 1. INSTALL REFLECTOR IN MOUNTING POSITION ON TOOLBOX.

STEP 2. SECURE WITH SCREWS AND LOCKNUTS.

Figure 4-15. Clearance lights, stoplights, taillights, and reflectors, removal and installation (sheet 2 of 2).

(5) Remove toolboxes as shown in figure 4-16.



1. Lock nut (26)
2. Washer (52)
3. Bevel washer (22)
4. Bolt (26)
5. Flat washer (4)
6. RH Toolbox
7. LH Toolbox
8. Rear toolbox
9. Frame

ME 4310-345-14/4-16

Figure 4-16. Toolboxes, removal and installation.

b. Cleaning, Inspection, and Repair.

(1) Clean the toolboxes with solvent conforming to Federal Specification P-D-680. Dry the toolboxes thoroughly.

(2) Inspect toolboxes for cracks, breaks, distortion, or any other defects.

(3) Inspect all attaching hardware for damaged threads, distortion, cracks, or other defects.

(4) Repair toolboxes by welding, straightening, or replacing, as necessary.

c. Reassembly and Installation.

(1) Install toolboxes as shown in figure 4-16.

(2) Install clearance lights, stoplights, taillights, and reflectors as shown in figure 4-15.

(3) Install light guards as shown in figure 4-14.

(4) Install battery box vent, charging receptacle, batteries, and battery cables as shown in figure 4-13.

Section IX. MAINTENANCE OF UNIT ELECTRICAL GROUP

4-29. General

The unit electrical group consists of the clearance lights, stoplights, taillights, battery charging receptacle, batteries, and wiring harness. Each stoplight assembly serves as a stoplight, taillight, and turn signal, Blackout taillight assemblies are also provided. The clearance lights are either red, amber, or blackout and are mounted at various points on the toolboxes. The clearance lights are used when towing the air compressor unit after dark so that a following vehicle can judge the distance to the unit. The battery charging receptacle, mounted on the front of the right toolbox, provides a connection for charging the batteries from an external power source. All of the external lights are interconnected by a chassis wiring harness and receive power from the towing vehicle via the intervehicular electrical cable. The remaining electrical components are connected by individual wires or small wiring harnesses.

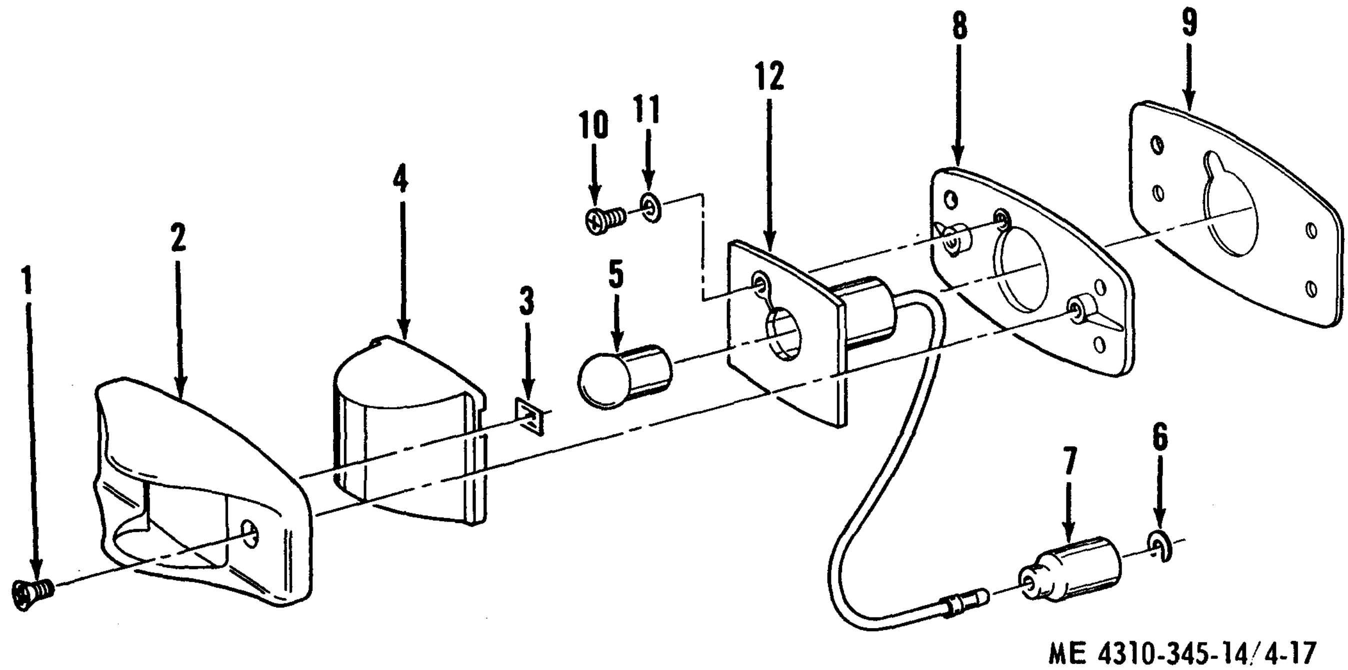
4-30. Clearance Light Assembly

a. Removal. Remove each clearance light assembly as shown in figure 4-15.

b. Disassembly. Disassemble clearance light assembly in numerical sequence shown in figure 4-14.

c. Cleaning, Inspection, and Repair.

(1) Wipe all parts clean with a dry, clean cloth. Clean nonelectrical parts using solvent conforming to Federal Specification P-D-680. Dry parts thoroughly.



1. Screw (2)
2. Door
3. Nut(2)
4. Lens
5. Lamp
6. Washer
7. Shell
8. Plate
9. Gasket
10. Screw
11. Washer
12. Grommet-wire

Figure 4-17. Clearance light assemblies, disassembly and reassembly.

(2) Inspect socket for cracks, breaks, corrosion, or any other defects.

(3) Inspect door and lens for cracks, breaks, distortion, or any other defects.

(4) Inspect lamp for broken filament.

(5) Inspect wire and plug for damaged insulation, cracks, or any other defect.

(6) Inspect all other parts for cracks, breaks, distortion, or any other defect.

(7) Repair is limited to the replacement of any defective part.

d. Reassembly. Reassemble clearance light assembly in reverse numerical sequence shown in figure 4-17.

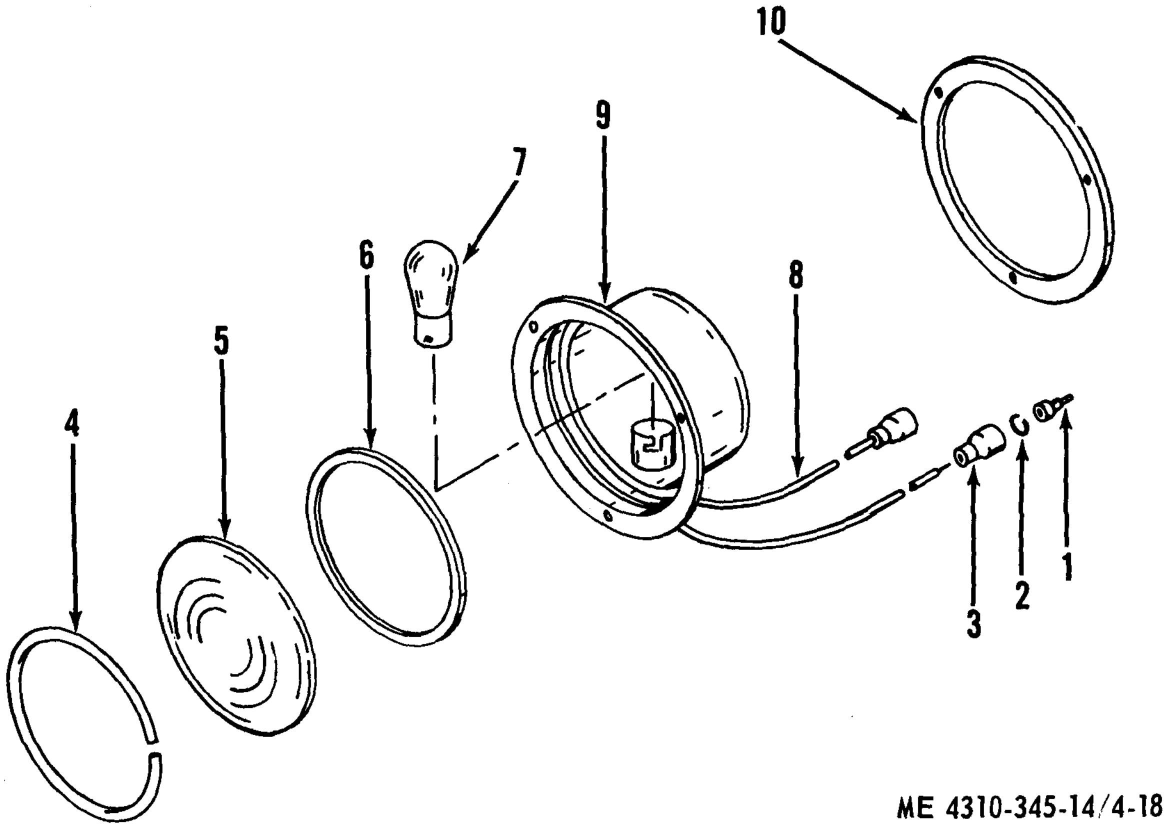
e. Installation. Install each clearance light assembly as shown in figure 4-15.

4-31. Stoplight Assembly

a. Removal and Disassembly.

(1) Remove each stoplight assembly as shown

(2) Disassemble stoplight assembly in numerical sequence shown in figure 4-18.



1. Contact pin (2)
2. Washer (2)
3. Shell (2)
4. Retaining ring
5. Lens
6. Lens gasket
7. Lamp
8. Wire assembly (2)
9. Body assembly
10. Mounting gasket

Figure 4-18. Stoplight assemblies, disassembly and reassembly.

b. Cleaning, Inspection, and Repair.

(1) Clean all metal parts using solvent conforming to Federal Specification P-D-680. Dry parts thoroughly.

(2) Inspect lamp socket for cracks, breaks, distortion, corrosion, or any other defect.

(3) Inspect lamp for broken filament and any other defect.

(4) Inspect lens for cracks and breaks.

(5) Inspect body assembly for cracks, breaks, distortion, damaged insulation, or any other defect.

(6) Inspect gaskets for deterioration, stretching, or any other defect.

(7) Inspect all other parts for cracks, breaks, distortion, or any other defect.

(8) Repair is limited to replacement of defective parts.

c. Reassembly. Reassemble stoplight assembly in reverse numerical sequence shown in figure 4-18.

d. Installation. Install each stoplight assembly as shown in figure 4-15.

4-32. Blackout Taillight Assembly

a. Removal and Disassembly.

(1) Remove each taillight assembly as shown in figure 4-15.

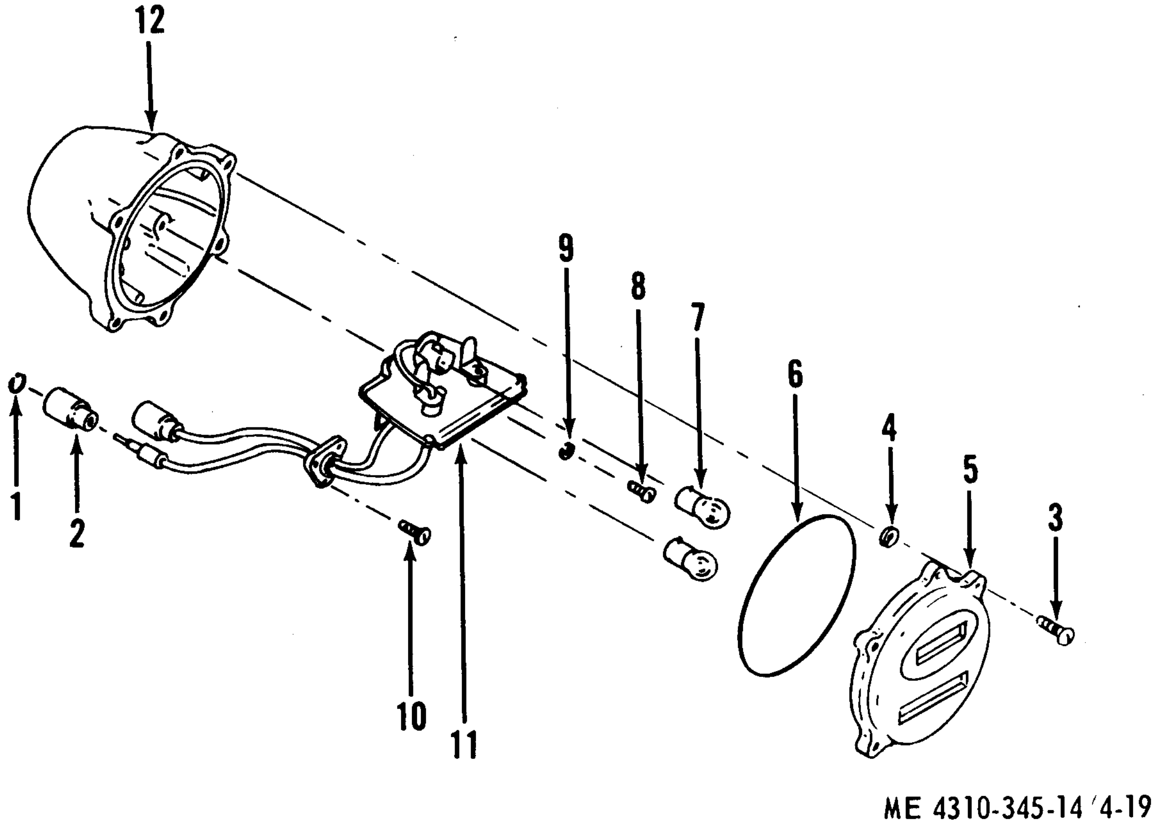
(2) Disassemble each taillight assembly in numerical sequence shown in figure 4-19.

b. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with solvent conforming to Federal Specification P-D-680. Dry parts thoroughly.

(2) Inspect lamp sockets for cracks, breaks, corrosion, or any other defect.

(3) Inspect door and body assembly for cracks, breaks, distortion, or any other defect.



1. Washer (2)
2. Shell (2)
3. Screw (6)
4. Retaining ring (6)
5. Door
6. Gasket
7. Lamp (2)
8. Screw (2)
9. Washer (2)
10. Screw (3)
11. Socket assy
12. Body assy

Figure 4-19. Blackout taillight assemblies, disassembly and reassembly.

(4) Inspect gaskets for distortion, deterioration, or any other defect.

(5) Inspect leads for damaged insulation and sockets for cracks, breaks, or any other defect.

(6) Inspect all other parts for cracks, breaks, distortion, or any other defect.

(7) Repair is limited to replacement of defective parts.

c. Reassembly. Reassemble blackout taillight assembly in reverse numerical sequence shown in figure 4-19.

d. Installation. Install blackout taillight assembly as shown in figure 4-15.

4-33. Battery Charging Receptacle

a. Removal. Remove battery charging receptacle as shown in figure 4-13.

b. Cleaning, Inspection, and Repair.

(1) Clean charging receptacle by wiping with a clean, dry cloth.

(2) Inspect leads for damaged insulation and burned, cracked, or broken terminals.

(3) Inspect contact sockets for corrosion, distortion, or any other defect.

(4) Inspect cover gasket for deterioration and distortion.

(5) Inspect body and cover for damaged threads, cracks, breaks, or any other defect.

(6) Repair of charging receptacle is limited to repair of leads and replacement of defective assembly.

c. *Installation.* Install battery charging receptacle as shown in figure 4-13.

4-34. External Lighting Wiring Harness

a. Removal. Remove external lighting wiring harness as shown in figure 4-20.

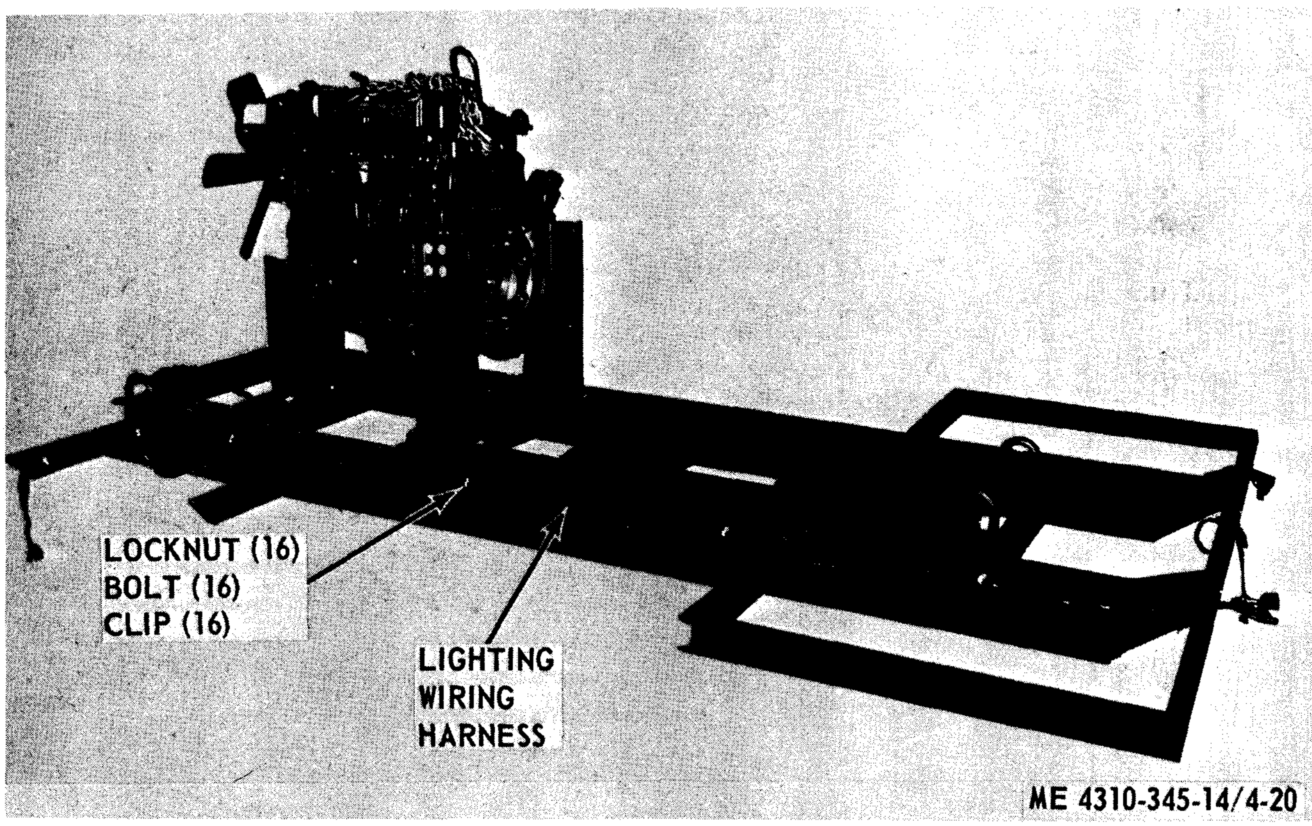
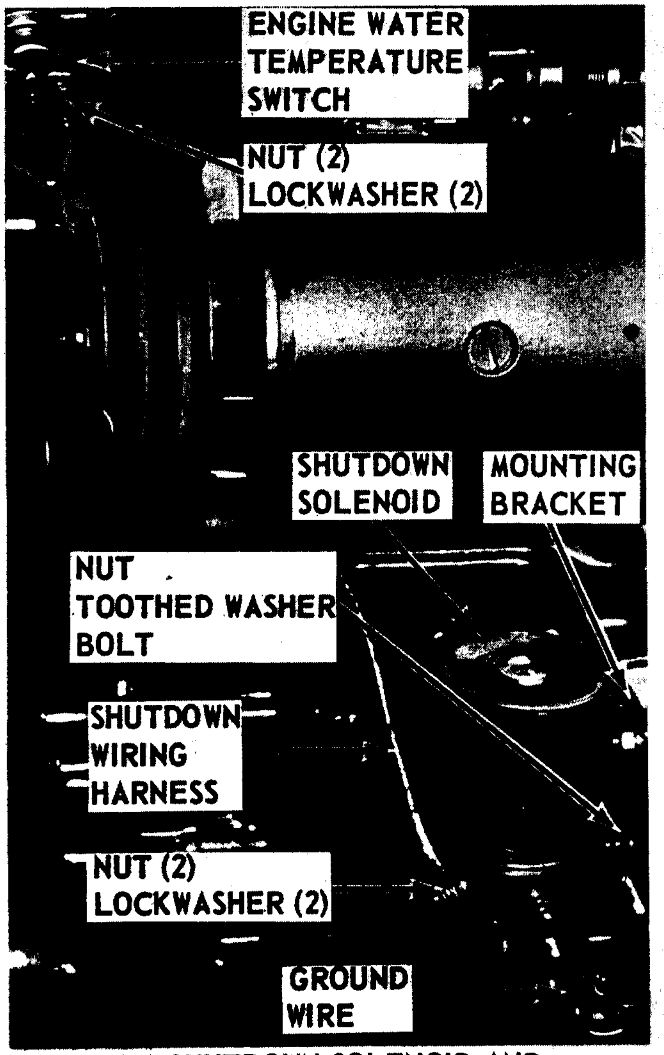


Figure 4-20. External lighting wiring harness, removal and installation.

b. Installation. Install external lighting wiring harness as shown in figure 4-20.

4-35. Shutdown Solenoid Wiring Harness

a. Removal. Remove shutdown solenoid wiring harness as shown in figure 4-21.



A SHUTDOWN SOLENOID AND WATER TEMPERATURE SWITCH

STEP 2. REMOVE NUT AND LOCKWASHER FROM SOLENOID GROUND TERMINAL. REMOVE NUT, TOOTHED WASHER, BOLT, AND GROUND WIRE.

STEP 3. REMOVE TWO NUTS AND LOCKWASHERS FROM ENGINE WATER TEMPERATURE SWITCH. REMOVE HARNESS LEADS FROM SWITCH TERMINALS.

B FUEL PRESSURE SWITCH AND OIL PRESSURE SWITCH

REMOVAL

WARNING

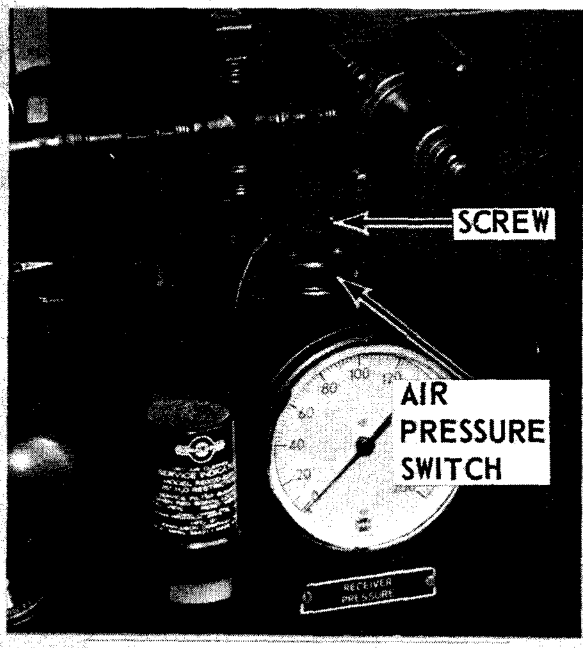
DISCONNECT BATTERY TERMINALS BEFORE REMOVING CABLES AND LEADS.

STEP 1. REMOVE NUT AND LOCKWASHER FROM SHUTDOWN SOLENOID TERMINAL. REMOVE THE TWO HARNESS LEADS.

STEP 4. REMOVE TWO NUTS AND LOCKWASHERS FROM FUEL PRESSURE SWITCH TERMINALS. REMOVE THREE HARNESS LEADS FROM SWITCH TERMINALS.

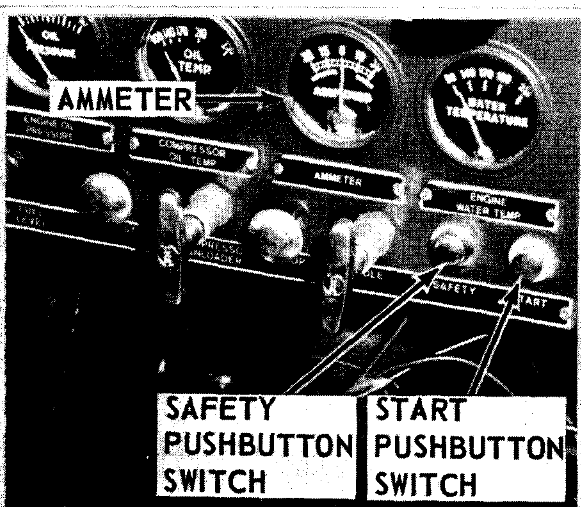
Figure 4-21. Shutdown solenoid wiring harness, removal and installation (sheet 1 of 4).

STEP 5. REMOVE TWO NUTS AND LOCKWASHERS FROM ENGINE OIL PRESSURE SWITCH TERMINALS. REMOVE FOUR HARNESS LEADS FROM SWITCH TERMINALS.

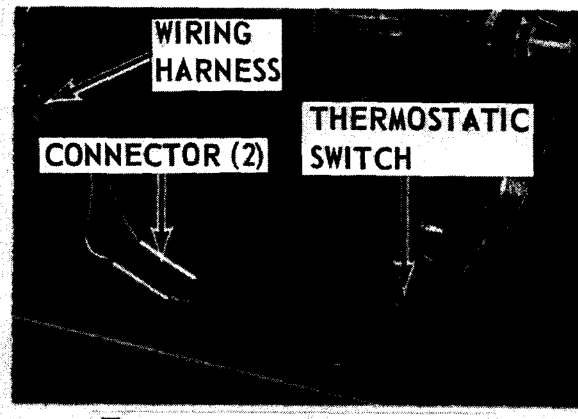


C AIR PRESSURE SWITCHES

STEP 6. REMOVE SCREW AND HARNESS LEAD FROM THE AIR PRESSURE SWITCH. REMOVE SCREW AND HARNESS LEAD FROM START PUSHBUTTON SWITCH. REMOVE SCREW AND HARNESS LEAD FROM SAFETY PUSHBUTTON SWITCH. REMOVE NUT, LOCKWASHER, AND HARNESS LEAD FROM AMMETER.



D START AND SAFETY PUSHBUTTON SWITHCES AND AMMETER

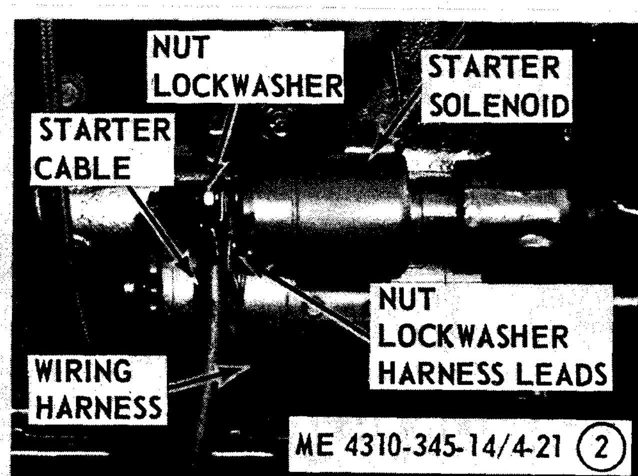


E THERMOSTATIC SWITCH

STEP 7. DISCONNECT TWO CONNECTORS TO THERMOSTATIC SWITCH.

STEP 8. REMOVE NUT, LOCKWASHER, STARTER CABLE, AND TWO HARNESS LEADS FROM STARTER SOLENOID TERMINAL. REMOVE NUT, LOCKWASHER, AND ONE HARNESS LEAD FROM STARTER SOLENOID TERMINAL.

STEP 9. REMOVE BOLT, LOCKWASHER, AND CLIP SECURING SHUTDOWN WIRING HARNESS TO FLYWHEEL ADAPTOR. REMOVE WIRING HARNESS.



F STARTER SOLENOID

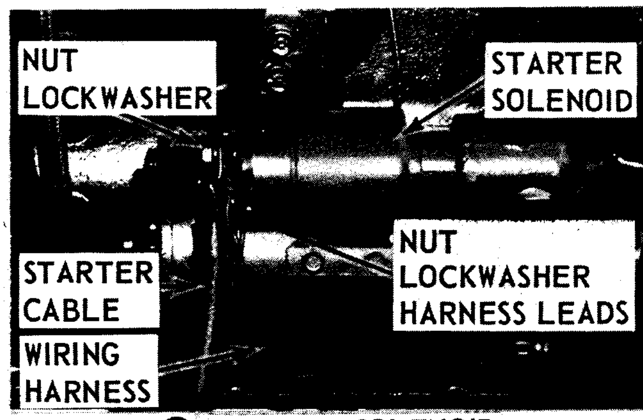
Figure 4-21. Shutdown solenoid wiring harness, removal and installation (sheet 2 of 4).

INSTALLATION

NOTE

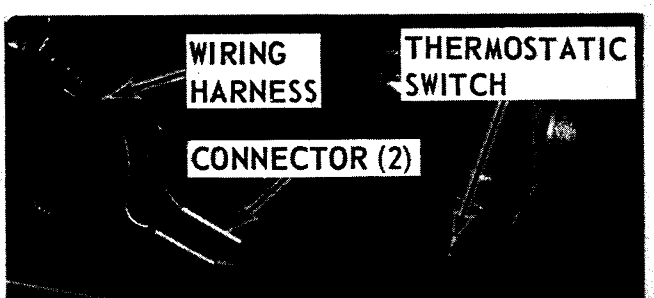
REFER TO FIGURE 1-3 FOR WIRING DIAGRAM.

STEP 1. INSTALL BLACK HARNESS LEAD TO STARTER SOLENOID TERMINAL AND SECURE WITH LOCKWASHER AND NUT. INSTALL WHITE AND RED HARNESS LEADS AND STARTER CABLE ON SOLENOID TERMINAL. SECURE WITH LOCKWASHER AND NUT.



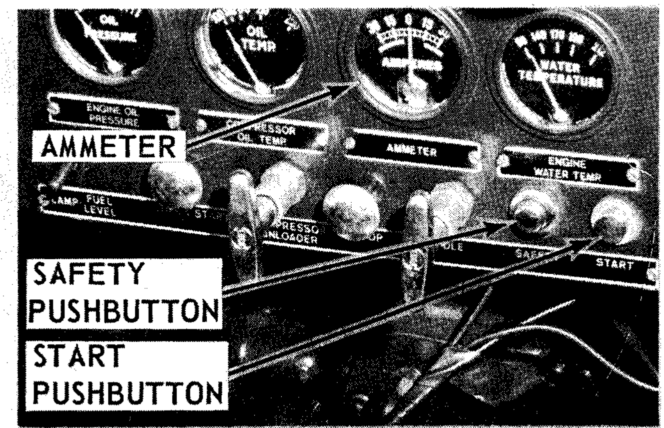
G STARTER SOLENOID

STEP 2. CONNECT THE TWO THERMOSTATIC SWITCH CONNECTORS.



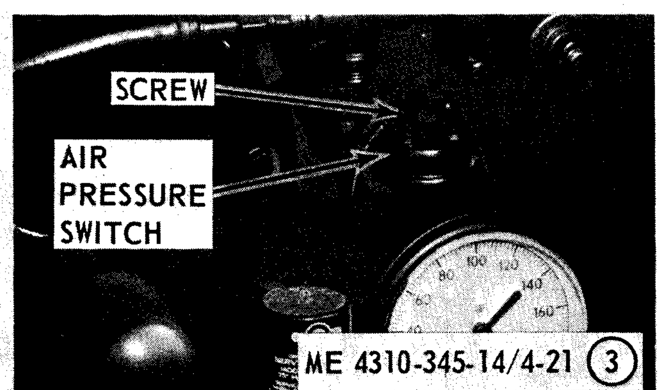
H THERMOSTATIC SWITCH

STEP 3. INSTALL RED HARNESS LEAD ON AMMETER TERMINAL. SECURE



I START AND SAFETY PUSHBUTTON SWITCHES AND AMMETER

WITH NUT AND LOCKWASHER. INSTALL YELLOW HARNESS LEAD ON SAFETY PUSHBUTTON SWITCH AND SECURE WITH SCREW. INSTALL WHITE HARNESS LEAD ON START PUSHBUTTON SWITCH AND SECURE WITH SCREW. INSTALL BLACK HARNESS LEAD ON AIR PRESSURE SWITCH AND SECURE WITH SCREW.



J AIR PRESSURE SWITCHES

Figure 4-21. Shutdown solenoid wiring harness, removal and installation (sheet 3 of 4).

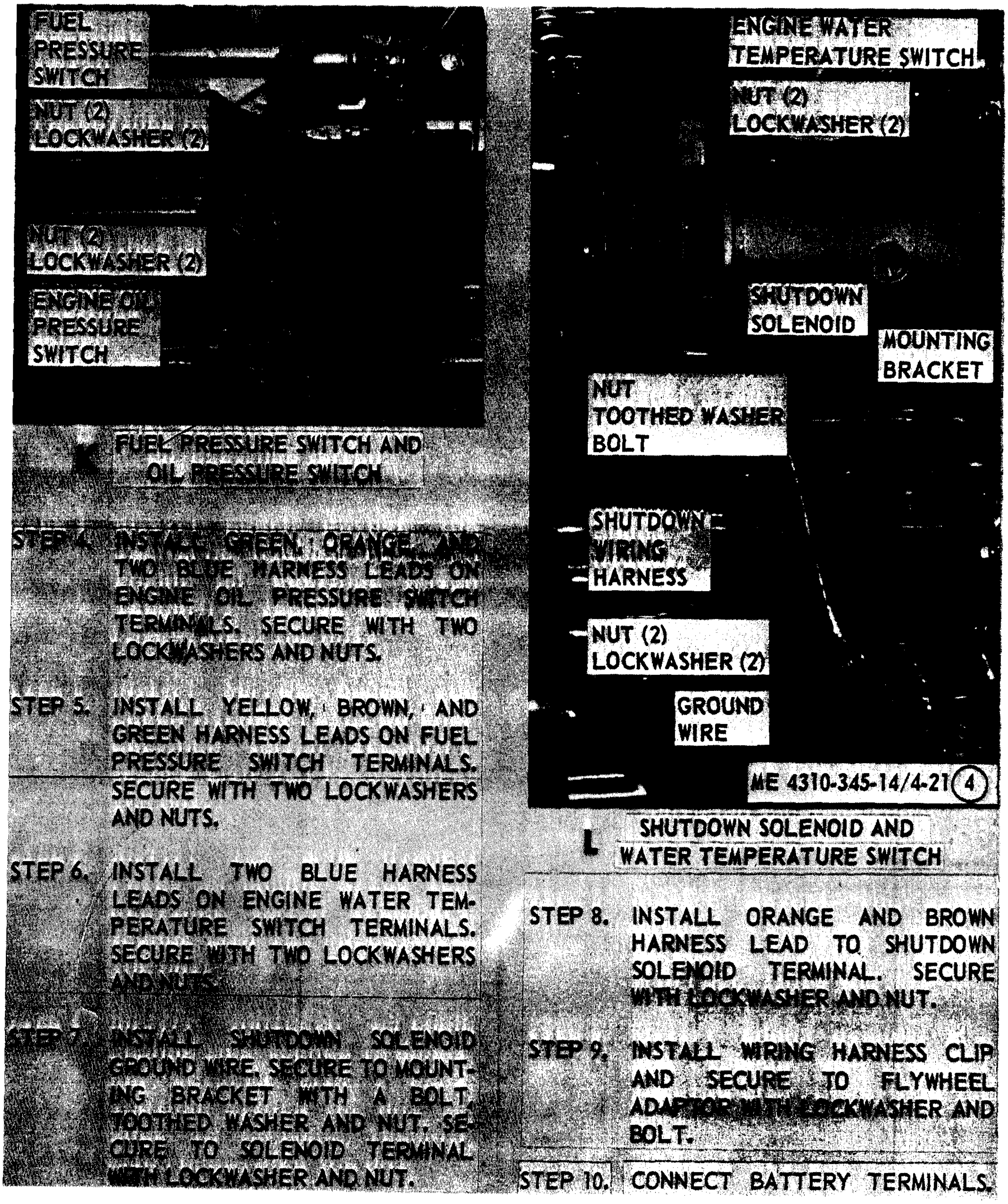
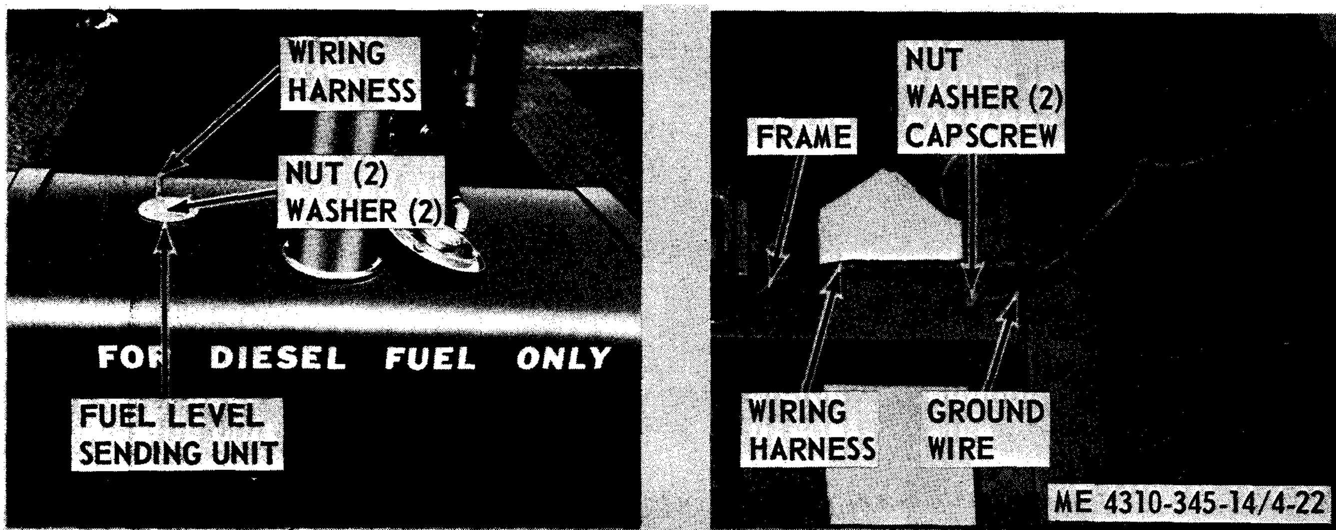


Figure 4-21. Shutdown solenoid wiring harness, removal and installation (sheet 4 of 4).

b. Installation. Install shutdown solenoid wiring harness as shown in figure 4-21.

4-36. Fuel Level Sending Unit Wiring Harness

a. Removal. Remove fuel level sending unit wiring harness as shown in figure 4-22.



A FUEL LEVEL SENDING UNIT

B WIRING HARNESS

REMOVAL

STEP 1. REFER TO FIGURE 4-4 AND REMOVE FUEL TANK GUARD TO GAIN ACCESS TO FUEL LEVEL SENDING UNIT.

STEP 2. REMOVE NUTS, WASHERS, AND WIRING HARNESS FROM SENDING UNIT TERMINALS.

STEP 3. REMOVE NUT, WASHERS, AND CAPSCREW SECURING GROUND WIRE OF HARNESS TO FRAME.

STEP 4. REMOVE NUT, WASHER, AND WIRING HARNESS FROM FUEL LEVEL GAGE ON INSTRUMENT PANEL. REMOVE WIRING HARNESS.

INSTALLATION

STEP 1. CONNECT WIRING HARNESS TO FUEL LEVEL GAGE ON INSTRUMENT PANEL AND SECURE WITH WASHER AND NUT ON TERMINAL.

STEP 2. INSTALL CAPSCREW, WASHERS, AND NUT SECURING GROUND WIRE OF HARNESS TO FRAME.

STEP 3. CONNECT HARNESS TO TERMINALS OF SENDING UNIT AND SECURE WITH WASHERS AND NUTS.

STEP 4. REFER TO FIGURE 4-4 AND INSTALL FUEL TANK GUARD.

Figure 4-22. Fuel level sending unit wiring harness, removal and installation.

b. Installation. Install fuel level sending unit wiring harness as shown in figure 4-22.

Section X. MAINTENANCE OF COLD WEATHER STARTING AID

4-37. General

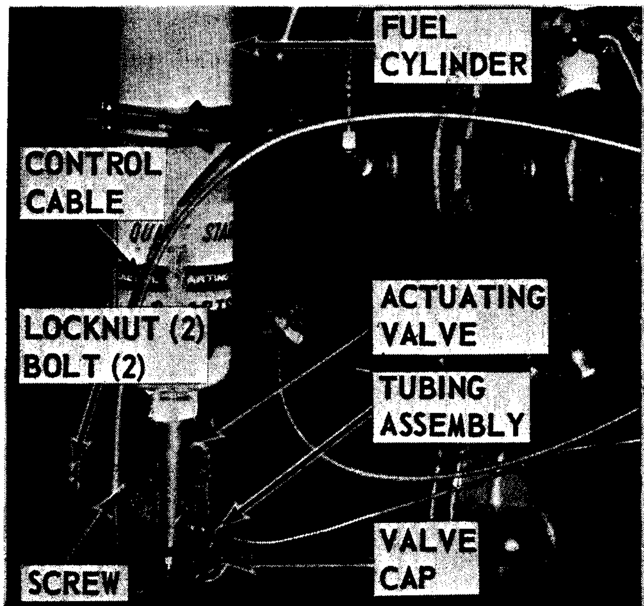
The cold weather starting aid (quick-start) provides a means of injecting a highly combustible fuel mixture into the engine air intake to aid in starting the engine when ambient temperatures are below + 32°F. The fuel, an ether base mixture, is stored in a metal cylinder that has a capacity of 790 cubic centimeters (cc). The cylinder is approximately 95 per cent expendable. The fuel cylinders mounts to a valve assembly which is actuated by a control cable mounted on the instrument panel. Each actuation of the valve lever injects a measured shot of 5 cc of fuel into the engine intake air stream. The fuel travels via copper tubing from the valve to an atomizer on the engine air intake.

4-38. Valve, Atomizer, and Tubing

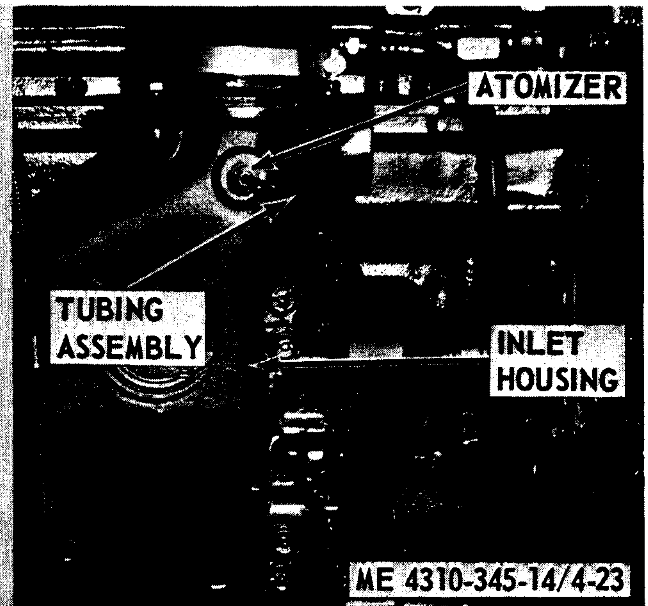
a. Removal.

(1) Remove fuel cylinder (fig. 3-22).

(2) Remove valve, atomizer, and tubing as shown in figure 4-23.



A ACTUATING VALVE AND TUBING



B ATOMIZER AND TUBING

REMOVAL

STEP 1. REFER TO FIGURE 3-22 AND REMOVE THE FUEL CYLINDER. INSTALL VALVE CAP ON TOP OF ACTUATING VALVE.

STEP 2. LOOSEN SCREW SECURING CONTROL CABLE TO VALVE AND DISCONNECT CONTROL CABLE FROM VALVE.

STEP 3. DISCONNECT TUBING ASSEMBLY FROM ACTUATING VALVE.

STEP 4. REMOVE LOCKNUTS AND BOLTS SECURING ACTUATING VALVE TO HOUSING AND REMOVE ACTUATING VALVE.

STEP 5. DISCONNECT TUBING ASSEMBLY FROM ATOMIZER. REMOVE SCREW AND CLIP SECURING TUBING ASSEMBLY AND WIRING HARNESS TO FLYWHEEL ADAPTOR. REMOVE TUBING ASSEMBLY.

STEP 6. REMOVE ATOMIZER FROM ENGINE INLET HOUSING.

INSTALLATION

STEP 1. INSTALL ATOMIZER IN ENGINE INLET HOUSING.

STEP 2. CONNECT TUBING ASSEMBLY TO ATOMIZER. SECURE TUBING ASSEMBLY TO FLYWHEEL ADAPTOR, ALONG WITH WIRING HARNESS, WITH CLIP AND SCREW.

STEP 3. INSTALL ACTUATING VALVE ON HOUSING AND SECURE WITH BOLTS AND NUTS.

STEP 4. CONNECT TUBING ASSEMBLY TO ACTUATING VALVE.

STEP 5. INSTALL CONTROL CABLE ON ACTUATING VALVE AND TIGHTEN SCREW. CONNECT WIRE END OF CONTROL CABLE TO LEVER OF ACTUATING VALVE.

STEP 6. REMOVE VALVE CAP. REFER TO FIGURE 3-22 AND INSTALL FUEL CYLINDER.

Figure 4-23. Value, atomizer, and tubing, removal and installation.

b. Cleaning and Inspection.

(1) Clean all metal parts and tubing with cleaning solvent conforming to Federal Specification P-D-680. Dry parts thoroughly.

(2) Inspect actuating valve for cracks, breaks, distortion, improper operation, or any other defect.

(3) Inspect tubing for cracks, breaks, kinks, or any other defect.

(4) Inspect atomizer for cracks, condition of threads and orifice hole, or any other defect.

(5) Inspect control cable for improper operation, kinks, breaks, or any other defect.

(6) Inspect mounting hardware for cracks, breaks, damaged threads, distortion, or any other defect.

c. Installation.

(1) Install valve, atomizer, and tubing as shown in figure 4-23.

(2) Install fuel cylinder (fig. 3-22).

Section XI. MAINTENANCE OF CONTROLS AND INSTRUMENTS

4-39. General

The controls and instruments are categorized into three basic groups; operation indicating group, control group, and safety group. The operation indicating group consists of gages that show engine fuel pressure, fuel level, receive air pressure, engine oil pressure, compressor oil temperature, battery-generator amperage, engine water temperature, and engine RPM and elapsed running time. Also included in this group are the engine and compressor air cleaner restriction indicators. The control group consists of the compressor unloader control, engine stop control, engine speed control, safety pushbutton switch, start pushbutton switch, cold weather starting aid control, panel fuel level gauge lamp switch, air pressure switches, and fuel pressure switch. The safety group consists of components that monitor unit operation and shut down the engine if an abnormal condition develops. This group includes the water temperature safety switch, engine oil pressure safety switch, compresser thermostatic switch, and engine shutdown solenoid.

4-40. Instrument Panel Assembly

a. Removal.

(1) Disconnect air, fuel, and oil lines from gages as required for removal of instrument panel assembly.

(2) Disconnect negative battery terminal and wiring from switches and gages as required for removal of instrument panel assembly.

(3) Disconnect tachometer cable.

(4) Drain engine coolant and remove engine water temperature sensing bulb from engine thermostat housing.

(5) Remove compressor oil temperature sensing bulb from the compressor thermal bypass valve.

(6) Disconnect control cables as required for removal of instrument panel assembly.

(7) Remove instrument panel assembly as shown in figure 4-24.

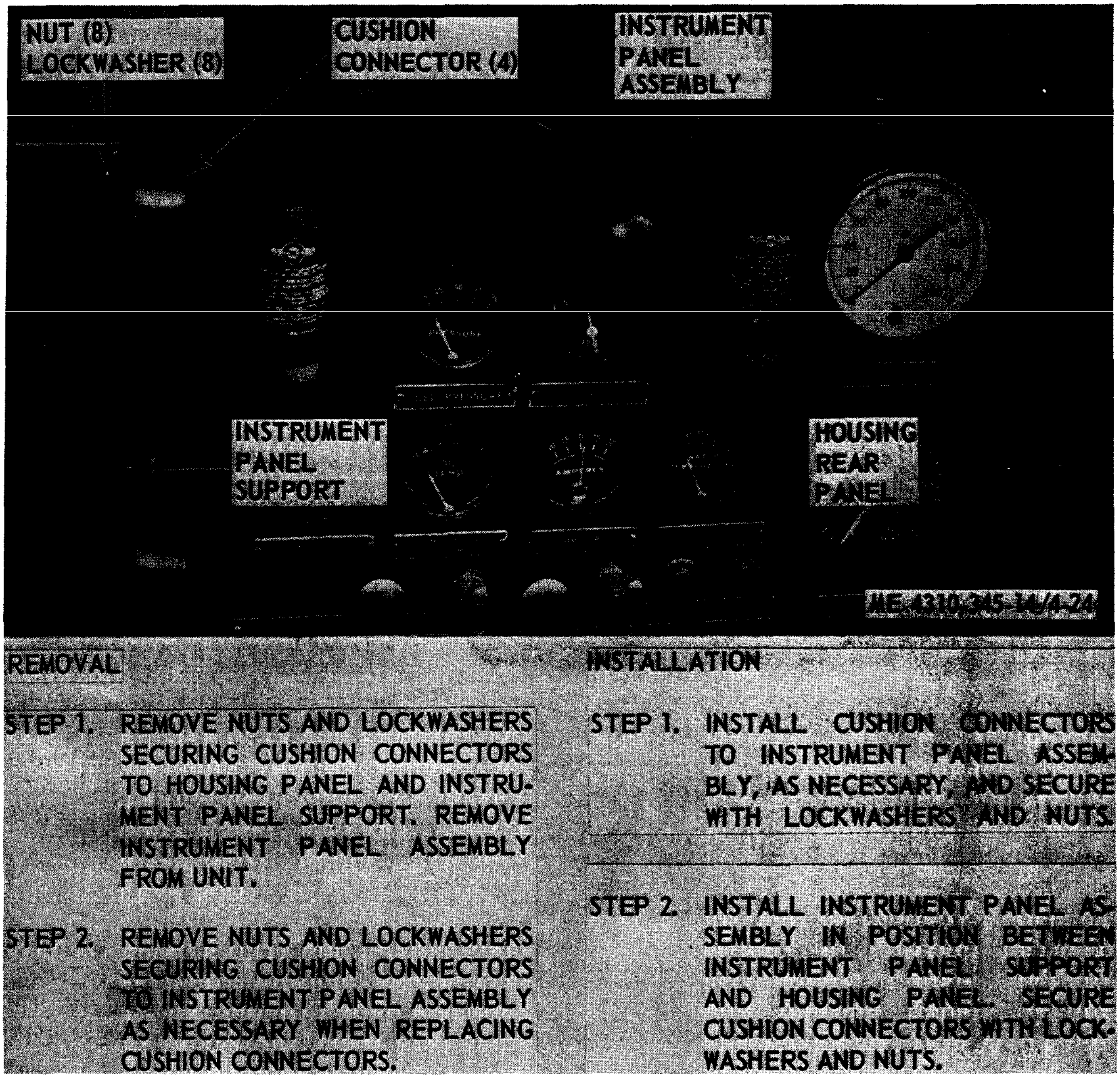


Figure 4-24. Instrument panel assembly, removal and installation.

b. Cleaning and Inspection.

(1) Wipe instrument panel clean using a clean cloth soaked in cleaning solvent conforming to Federal Specification P-D-680. Dry thoroughly.

(2) Inspect all instruments for damage or loose mounting.

(3) Inspect hoses and cables for kinks, cracks, or any other defect.

(4) Inspect all other parts for cracks, breaks, distortion, or any other defect.

c. ***Installation.***

(1) Install instrument panel assembly as shown in figure 4-24.

(2) Connect control cables.

(3) Connect compressor oil temperature sensing bulb in thermal bypass valve (fig. 4-25).

(4) Connect engine water temperature sensing bulb in thermostat housing (fig. 4-25).

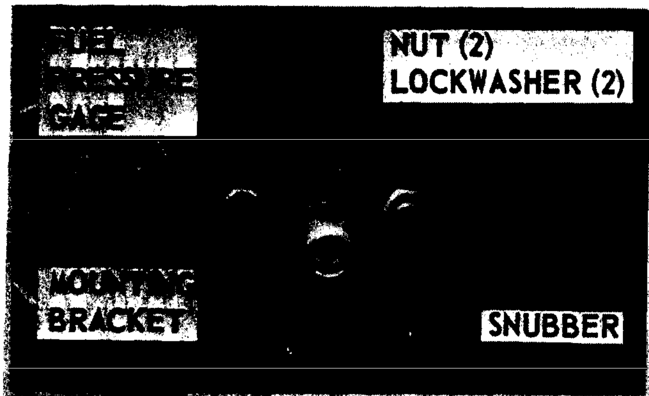
(5) Connect tachometer cable.

(6) Connect wiring to switches and gages (fig. 4-25).

(7) Connect air, fuel, and oil lines to gages (fig. 4-25).

4-41. Fuel Pressure Gage

a. Removal. Remove fuel pressure gage as shown in figure 4-25.



FUEL PRESSURE GAGE, REMOVAL AND INSTALLATION

REMOVAL

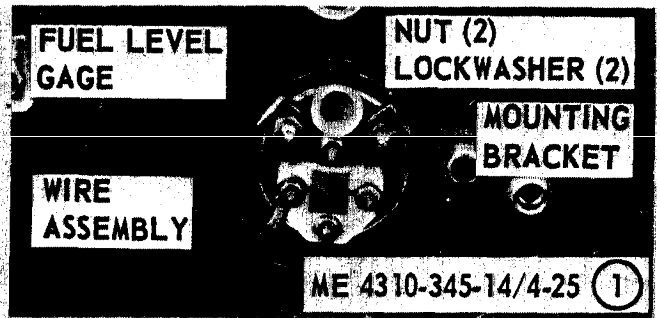
STEP 1. DISCONNECT FUEL PRESSURE HOSE FROM SNUBBER. REMOVE SNUBBER AND TUBING CONNECTOR FROM GAGE.

STEP 2. REMOVE NUTS, LOCKWASHERS, AND MOUNTING BRACKET, REMOVE FUEL PRESSURE GAGE FROM INSTRUMENT PANEL.

INSTALLATION

STEP 1. INSTALL FUEL PRESSURE GAGE IN POSITION ON INSTRUMENT PANEL. SECURE WITH MOUNTING BRACKET, LOCKWASHERS, AND NUTS.

STEP 2. INSTALL TUBING CONNECTOR AND SNUBBER ON GAGE. CONNECT FUEL PRESSURE HOSE TO SNUBBER.



B FUEL LEVEL GAGE, REMOVAL AND INSTALLATION

REMOVAL

STEP 1. REMOVE FUEL TANK SENDING UNIT WIRING HARNESS FROM GAGE TERMINALS. REMOVE WIRE ASSEMBLY FROM GAGE TERMINAL. REINSTALL LOCKWASHERS AND NUTS ON TERMINALS TO PREVENT THEIR LOSS.

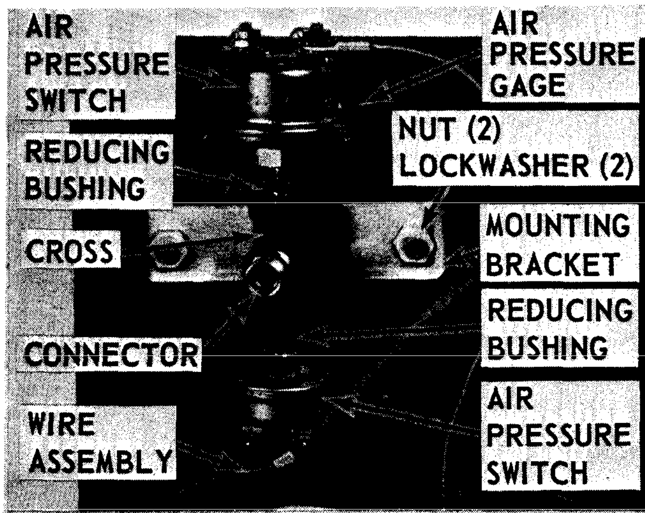
STEP 2. REMOVE NUTS, LOCKWASHERS, AND MOUNTING BRACKET. REMOVE FUEL LEVEL GAGE FROM INSTRUMENT PANEL.

INSTALLATION

STEP 1. INSTALL FUEL LEVEL GAGE IN POSITION ON INSTRUMENT PANEL. SECURE WITH MOUNTING BRACKET, LOCKWASHERS, AND NUTS.

STEP 2. CONNECT WIRE ASSEMBLY FROM LAMP-FUEL LEVEL SWITCH TO GAGE TERMINAL. CONNECT FUEL LEVEL SENDING UNIT WIRING HARNESS TO GAGE TERMINALS. SECURE WIRES WITH LOCKWASHERS AND NUTS. (SEE FIGURE 1-3 FOR WIRING DIAGRAM.)

Figure 4-25. Instrumen-panel control and instruments, removal and installation (sheet 1 of 8).



C AIR PRESSURE GAGE, REMOVAL AND INSTALLATION

REMOVAL

STEP 1. DISCONNECT AIR PRESSURE HOSE FROM CONNECTOR. DISCONNECT SHUTDOWN WIRING HARNESS LEADS FROM PRESSURE SWITCHES. DISCONNECT WIRE ASSEMBLIES FROM PRESSURE SWITCHES. REINSTALL SCREWS IN PRESSURE SWITCH TERMINALS TO PREVENT THEIR LOSS.

STEP 2. REMOVE AIR PRESSURE SWITCHES, REDUCING BUSHINGS, CONNECTOR, AND CROSS.

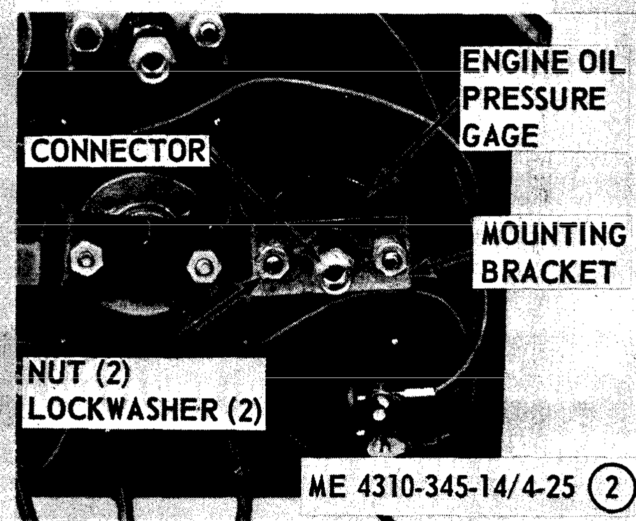
STEP 3. REMOVE NUTS, LOCKWASHERS, AND MOUNTING BRACKET. REMOVE AIR PRESSURE GAGE FROM INSTRUMENT PANEL.

INSTALLATION

STEP 1. INSTALL AIR PRESSURE GAGE IN POSITION ON INSTRUMENT PANEL. SECURE WITH MOUNTING BRACKET, LOCKWASHERS, AND NUTS.

STEP 2. INSTALL CROSS, CONNECTOR, REDUCING BUSHINGS, AND AIR PRESSURE SWITCHES.

STEP 3. CONNECT WIRE ASSEMBLIES TO PRESSURE SWITCHES. CONNECT SHUTDOWN WIRING HARNESS LEADS TO PRESSURE SWITCH TERMINALS. CONNECT AIR PRESSURE HOSE TO GAGE. (SEE FIGURE 1-3 FOR WIRING DIAGRAM.)



D ENGINE OIL PRESSURE GAGE, REMOVAL AND INSTALLATION

REMOVAL

STEP 1. DISCONNECT ENGINE OIL PRESSURE HOSE FROM CONNECTOR. REMOVE CONNECTOR.

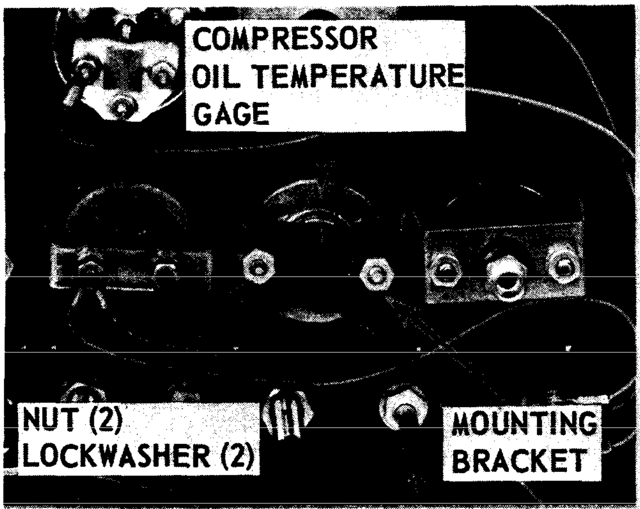
STEP 2. REMOVE NUTS, LOCKWASHER, AND MOUNTING BRACKET. REMOVE ENGINE OIL PRESSURE GAGE FROM INSTRUMENT PANEL.

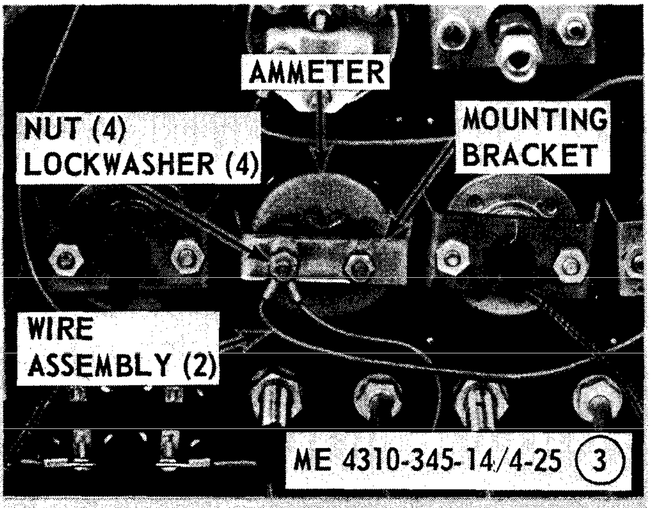
INSTALLATION

STEP 1. INSTALL ENGINE OIL PRESSURE GAGE IN POSITION ON INSTRUMENT PANEL. SECURE WITH MOUNTING BRACKET, LOCKWASHERS, AND NUTS.

STEP 2. INSTALL CONNECTOR ON GAGE AND CONNECT ENGINE OIL PRESSURE HOSE.

Figure 4-25. Instrument panel controls and instruments, removal and installation (sheet 2 of 8).





E COMPRESSOR OIL TEMPERATURE GAGE, REMOVAL AND INSTALLATION

REMOVAL

STEP 1. REMOVE COMPRESSOR OIL TEMPERATURE SENSING BULB FROM THE THERMAL BYPASS VALVE ASSEMBLY. (REFER TO FIGURE 4-52.)

STEP 2. REMOVE NUTS, LOCKWASHERS, AND MOUNTING BRACKET. REMOVE COMPRESSOR OIL TEMPERATURE GAGE FROM INSTRUMENT PANEL.

INSTALLATION

STEP 1. INSTALL COMPRESSOR OIL TEMPERATURE GAGE IN POSITION ON INSTRUMENT PANEL. SECURE WITH MOUNTING BRACKET, LOCKWASHERS, AND NUTS.

STEP 2. INSTALL COMPRESSOR OIL TEMPERATURE SENSING BULB IN THERMAL BYPASS VALVE ASSEMBLY. (REFER TO FIGURE 4-52.)

F AMMETER, REMOVAL AND INSTALLATION

REMOVAL

STEP 1. REMOVE REGULATOR LEAD FROM AMMETER TERMINAL. REMOVE TWO WIRE ASSEMBLIES FROM AMMETER TERMINAL.

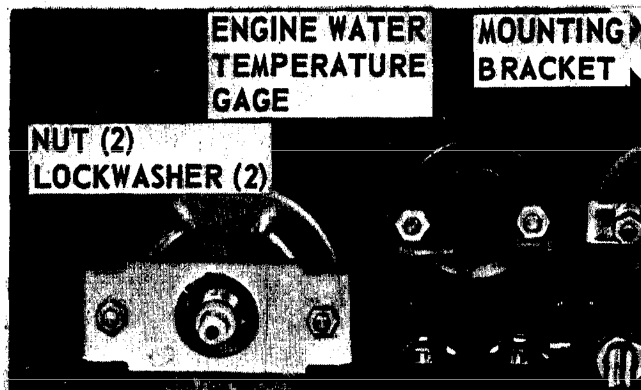
STEP 2. REMOVE NUTS, LOCKWASHERS, AND MOUNTING BRACKET. REMOVE AMMETER FROM INSTRUMENT PANEL. REINSTALL LOCKWASHERS AND NUTS TO AVOID THEIR LOSS.

INSTALLATION

STEP 1. INSTALL AMMETER IN POSITION ON INSTRUMENT PANEL. SECURE WITH MOUNTING BRACKET, LOCKWASHERS, AND NUTS.

STEP 2. INSTALL TWO WIRE ASSEMBLIES, ONE FROM SAFETY PUSHBUTTON SWITCH; ONE FROM LAMP-FUEL LEVEL SWITCH, TO AMMETER TERMINAL. INSTALL REGULATOR LEAD TO AMMETER TERMINAL. SECURE WIRES WITH LOCKWASHERS AND NUTS. (SEE FIGURE 1-3 FOR WIRING DIAGRAM.)

Figure 4-25. Instrument panel controls and instrument, removal and installation (sheet 3 of 8).



G ENGINE WATER TEMPERATURE GAGE, REMOVAL AND INSTALLATION

REMOVAL

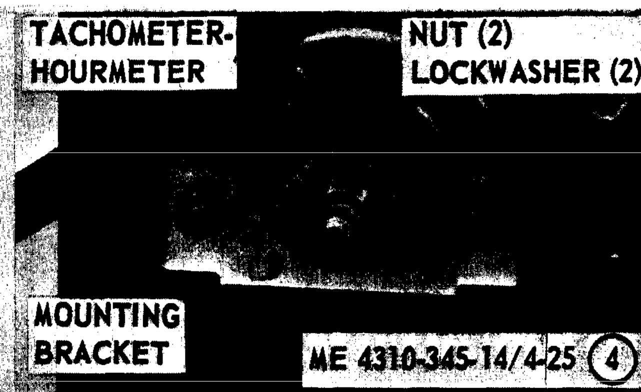
STEP 1. DRAIN ENGINE COOLANT, REMOVE ENGINE WATER TEMPERATURE SENSING BULB FROM THERMOSTAT HOUSING.

STEP 2. REMOVE NUTS, LOCKWASHERS, AND MOUNTING BRACKET. REMOVE ENGINE WATER TEMPERATURE GAGE FROM INSTRUMENT PANEL.

INSTALLATION

STEP 1. INSTALL ENGINE WATER TEMPERATURE GAGE IN POSITION ON INSTRUMENT PANEL. SECURE WITH MOUNTING BRACKET, LOCKWASHERS, AND NUTS.

STEP 2. INSTALL ENGINE WATER TEMPERATURE SENSING BULB IN THERMOSTAT HOUSING. REPLENISH ENGINE COOLANT.



H TACHOMETER-HOURMETER, REMOVAL AND INSTALLATION

REMOVAL

STEP 1. UNSCREW AND DISCONNECT TACHOMETER CABLE FROM TACHOMETER-HOURMETER.

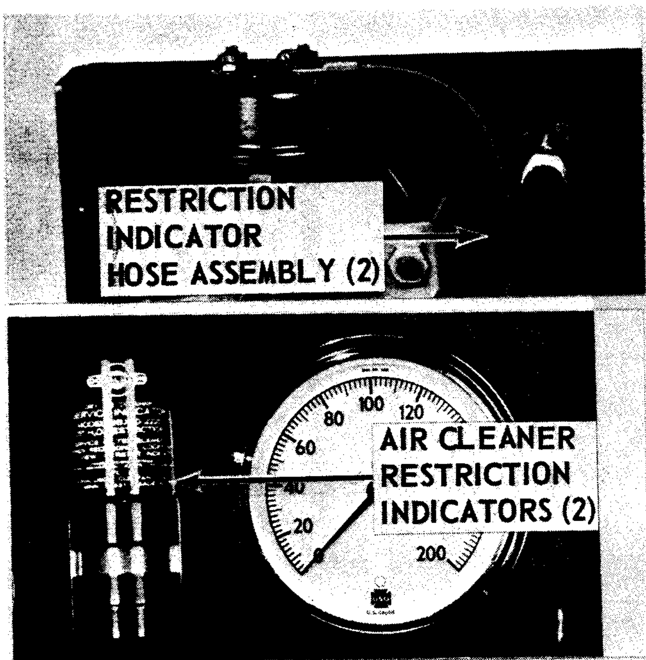
STEP 2. REMOVE NUTS, LOCKWASHERS, AND MOUNTING BRACKET. REMOVE TACHOMETER-HOURMETER FROM INSTRUMENT PANEL.

INSTALLATION

STEP 1. INSTALL THE TACHOMETER-HOURMETER IN POSITION ON INSTRUMENT PANEL. SECURE BRACKET, WITH LOCKWASHERS, AND NUTS.

STEP 2. CONNECT TACHOMETER CABLE TO TACHOMETER-HOURMETER.

Figure 4-25. Instrument panel controls and instruments, removal and installation (sheet 4 of 8).



I AIR CLEANER RESTRICTION INDICATORS, REMOVAL AND INSTALLATION

REMOVAL

STEP 1. REMOVE HOSE ASSEMBLIES FROM RESTRICTION INDICATORS. REMOVE CONNECTORS.

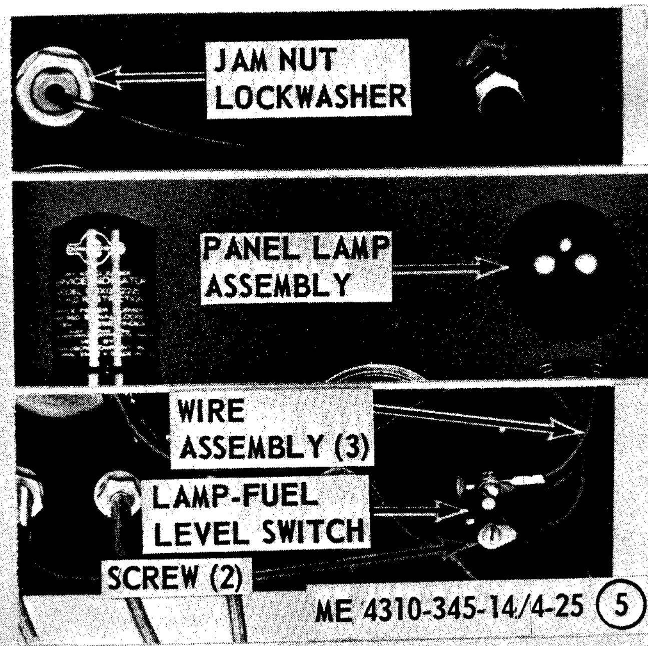
STEP 2. UNSCREW AND REMOVE RESTRICTION INDICATORS FROM INSTRUMENT PANEL.

INSTALLATION

STEP 1. INSTALL RESTRICTION INDICATORS IN VERTICAL POSITION ON INSTRUMENT PANEL.

STEP 2. INSTALL CONNECTORS AND CONNECT HOSE ASSEMBLIES.

STEP 3. DEPRESS RESET BUTTON ON TOP OF INDICATOR.



J PANEL LAMP ASSEMBLY AND SWITCH, REMOVAL AND INSTALLATION

REMOVAL

STEP 1. DISCONNECT WIRE ASSEMBLIES FROM LAMP-FUEL LEVEL SWITCH.

STEP 2. REMOVE JAM NUT AND LOCKWASHER AND REMOVE PANEL LAMP ASSEMBLY FROM INSTRUMENT PANEL.

STEP 3. REMOVE NUT, PLATE, AND LAMP-FUEL LEVEL SWITCH.

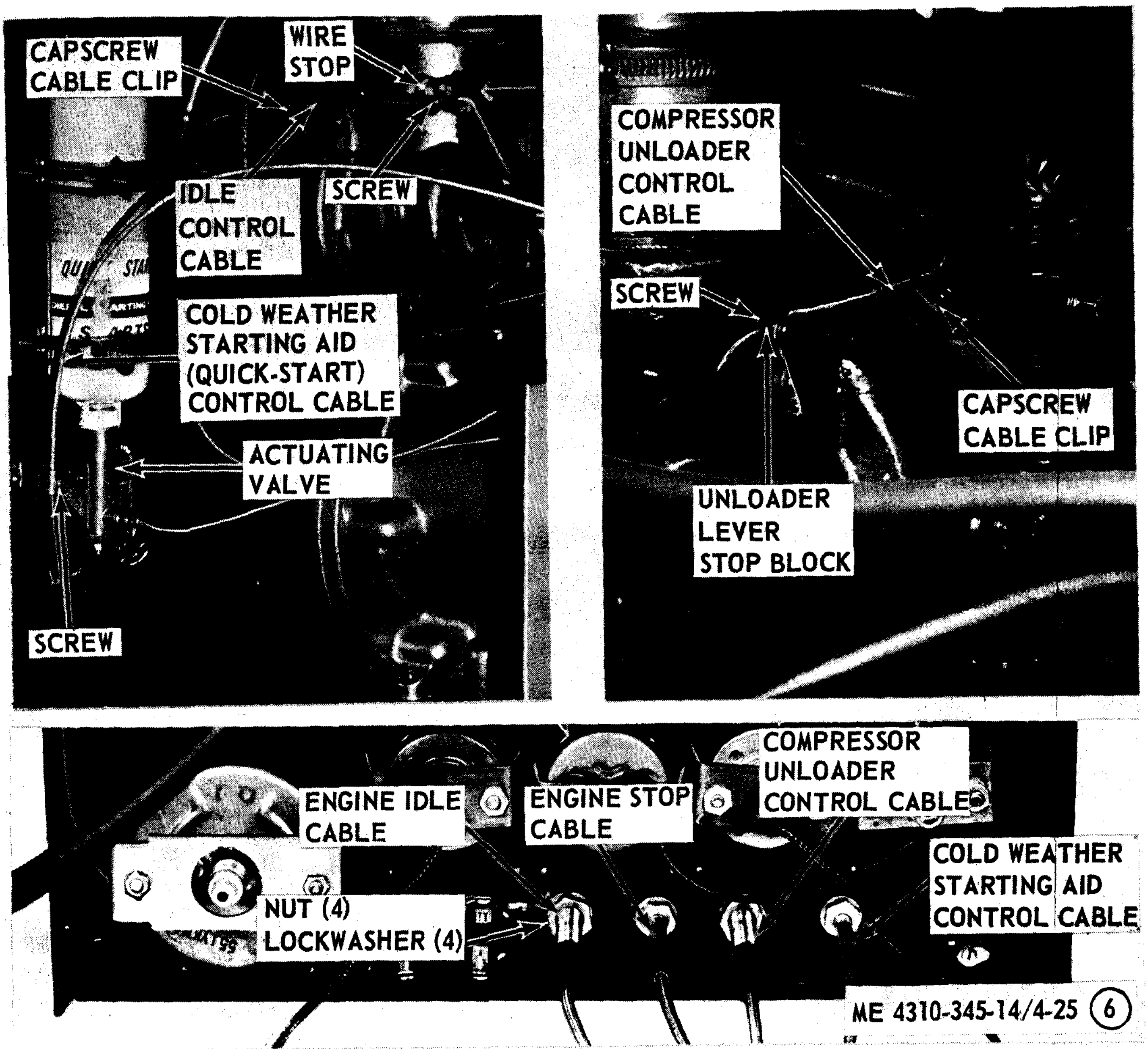
INSTALLATION

STEP 1. INSTALL LAMP-FUEL LEVEL SWITCH AND PLATE IN POSITION ON INSTRUMENT PANEL AND SECURE WITH NUT.

STEP 2. INSTALL PANEL LAMP ASSEMBLY IN POSITION AND SECURE WITH LOCKWASHER AND JAM NUT.

STEP 3. CONNECT WIRE ASSEMBLIES TO SWITCH. (REFER TO FIGURE 1-3 FOR WIRING DIAGRAM.)

Figure 4-25. Instrument panel controls and instruments, removal and installation (sheet 5 of 8).



K CONTROL CABLES, REMOVAL AND INSTALLATION

REMOVAL

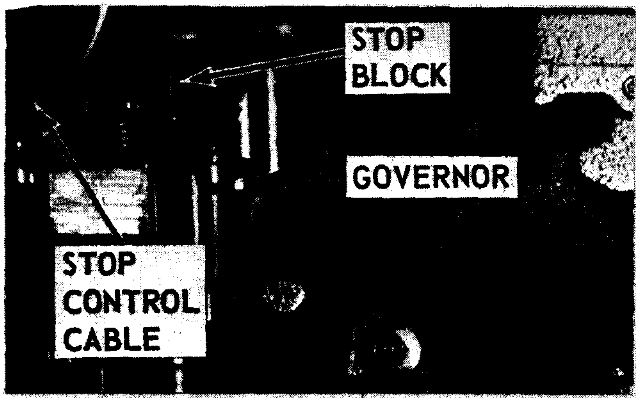
STEP 1. DISCONNECT WIRE END OF COLD WEATHER STARTING AID CONTROL CABLE FROM ACTUATING VALVE. LOOSEN SCREW AND REMOVE CABLE FROM VALVE.

STEP 2. REMOVE NUT, LOCKWASHER, AND COLD WEATHER STARTING AID CONTROL CABLE.

STEP 3. LOOSEN SCREW ON UNLOADER LEVER STOP BLOCK. LOOSEN CAPSCREWS SECURING CABLE CLIPS. SLIDE CONTROL CABLE OUT OF CLIPS.

STEP 4. REMOVE NUT, LOCKWASHER, AND COMPRESSOR UNLOADER CONTROL CABLE.

Figure 4-25. Instrument panel controls and instruments, removal and installation (sheet 6 of 8).



K CONTROL CABLES, REMOVAL AND INSTALLATION (CONTINUED)

STEP 5. LOOSEN SCREW ON GOVERNOR STOP BLOCK. LOOSEN CAPSCREWS SECURING CABLE CLIPS. SLIDE ENGINE STOP CONTROL CABLE OUT OF CLIPS.

STEP 6. REMOVE NUT, LOCKWASHER, AND ENGINE STOP CONTROL CABLE.

STEP 7. REMOVE WIRE STOP FROM WIRE END OF IDLE CONTROL CABLE. LOOSEN CAPSCREWS SECURING CABLE CLIPS. SLIDE IDLE CONTROL CABLE OUT OF CLIPS.

STEP 8. REMOVE NUT, LOCKWASHER, AND IDLE CONTROL CABLE.

INSTALLATION

STEP 1. INSTALL IDLE CONTROL CABLE AND SECURE WITH LOCKWASHER AND NUT.

STEP 2. SLIDE IDLE CONTROL CABLE THROUGH CLIPS AND IDLE CONTROL STOP BLOCK. INSTALL WIRE STOP ON WIRE END OF CONTROL CABLE. TIGHTEN CAPSCREWS SECURING CABLE CLIPS. (REFER TO FIGURE 4-7 FOR ADJUSTMENT.)

STEP 3. INSTALL ENGINE STOP CONTROL CABLE AND SECURE WITH LOCKWASHER AND NUT.

STEP 4. SLIDE CONTROL CABLE THROUGH CLIPS AND SECURE WIRE END OF CABLE TO STOP BLOCK ON GOVERNOR LEVER. TIGHTEN CAPSCREWS SECURING CABLE CLIPS.

STEP 5. INSTALL COMPRESSOR UNLOADER CONTROL CABLE AND SECURE WITH LOCKWASHER AND NUT.

STEP 6. SLIDE CONTROL CABLE THROUGH CABLE CLIPS. SECURE WIRE END OF CONTROL CABLE IN UNLOADER LEVER STOP BLOCK BY TIGHTENING SCREW.

STEP 7. INSTALL COLD WEATHER STARTING AID (QUICK START) CONTROL CABLE AND SECURE WITH LOCKWASHER AND NUT.

STEP 8. SLIDE CONTROL CABLE THROUGH ACTUATING VALVE. CONNECT WIRE END OF CABLE TO VALVE LEVER. TIGHTEN SCREW ON VALVE SECURING CONTROL CABLE.

Figure 4-25. Instrument panel controls and instruments, removal and installation (sheet 7 of 8).

L START AND SAFETY PUSHBUTTON SWITCHES, REMOVAL AND INSTALLATION

REMOVAL

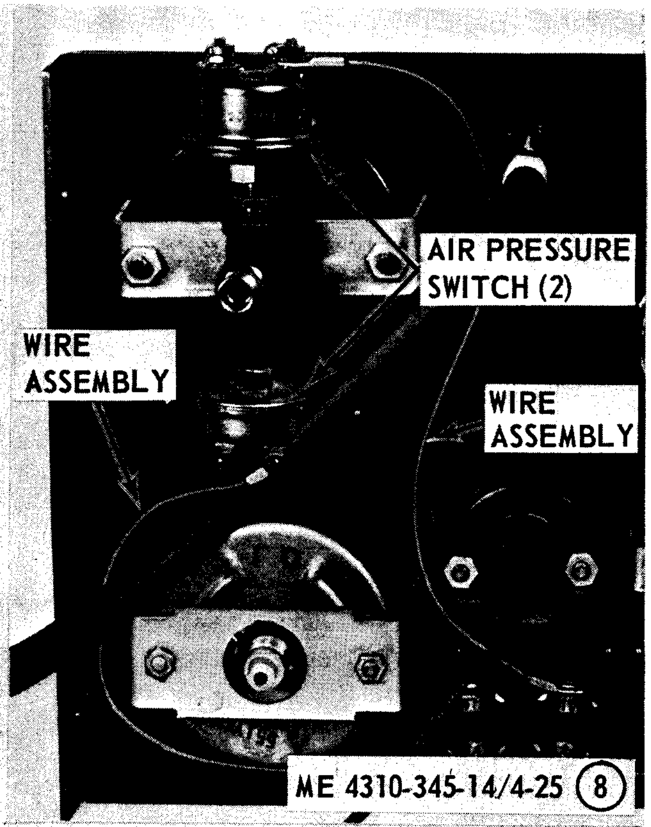
STEP 1. DISCONNECT WIRE ASSEMBLIES.

STEP 2. REMOVE NUT AND SWITCH.

INSTALLATION

STEP 1. INSTALL START PUSHBUTTON AND SAFETY PUSHBUTTON SWITCH. SECURE WITH NUT.

STEP 2. CONNECT WIRE ASSEMBLIES. (REFER TO FIGURE 1-3 FOR WIRING



M AIR PRESSURE SWITCH, REMOVAL AND INSTALLATION

REMOVAL

STEP 1. DISCONNECT WIRE ASSEMBLIES.

STEP 2. UNSCREW AND REMOVE AIR PRESSURE SWITCHES.

INSTALLATION

STEP 1. INSTALL AIR PRESSURE SWITCHES.

STEP 2. CONNECT WIRE ASSEMBLIES. (REFER TO FIGURE 1-3 FOR WIRING

Figure 4-25. Instrument panel controls and instruments, removal and installation (sheet 8 of 8).

b. Cleaning and Inspection.

(1) Clean gage using a clean cloth soaked in a cleaning solvent conforming to Federal Specification P-D-680. Dry thoroughly.

(2) Inspect gage face glass for damage. Inspect case for cracks, distortion, or any other defect.

(3) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. Installation. Install fuel pressure gage as shown in figure 4-25.

4-42. Fuel Level Gage

a. Removal. Disconnect the battery terminals and remove fuel level gage and sending unit as shown in figure 4-25.

b. Cleaning and Inspection.

(1) Clean fuel level gage and sending unit using a clean cloth soaked in a cleaning solvent conforming to Federal Specification P-D-680. Dry thoroughly.

(2) Inspect gage face glass for damage. Inspect case for cracks, distortion, or any other damage.

(3) Inspect sending unit float for freedom of movement. Inspect for cracks, breaks distortion, or any other damage.

(4) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. Installation. Install fuel level gage and sending unit as shown in figure 4-25 and connect battery terminals.

4-43. Air Pressure Gage

a. Removal. Remove receiver air pressure gage as shown in figure 4-25.

b. Cleaning and Inspection.

(1) Clean the air pressure gage using a clean cloth soaked in a cleaning solvent conforming to Federal Specification P-D-680. Dry thoroughly.

(2) Inspect gage face glass for damage. Inspect case for cracks, distortion, or any other defect.

(3) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. Installation. Install receiver air pressure gage as shown in figure 4-25.

4-44. Engine Oil Pressure Gage

a. Removal Remove engine oil pressure gage as shown in figure 4-25.

b. Cleaning and Inspection.

(1) Wipe engine oil pressure gage clean using a clean cloth soaked in a cleaning solvent conforming to Federal Specification P-D-680. Dry thoroughly.

(2) Inspect gage face glass for damage. Inspect case for cracks, distortion, or any other defect.

(3) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. Installation. Install the engine oil pressure gage as shown in figure 4-25.

4-45. Compressor Oil Temperature Gage

a. Removal. Remove compressor oil temperature gage as shown in figure 4-25.

b. Cleaning and Inspection.

(1) Clean gage, line, and sensing bulb using a clean cloth soaked in a cleaning solvent conforming to Federal Specification P-D-680. Dry thoroughly.

(2) Inspect gage face glass for damage. Inspect case for cracks, distortion, or any other defect.

(3) Inspect sensing bulb and line for kinks, breaks, distortion, or any other defect.

(4) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. Installation. Install compressor oil temperature gage as shown in figure 4-25.

4-46. Ammeter

a. Removal. Remove ammeter as shown in figure 4-25.

b. Cleaning and *Inspection.*

(1) Wipe ammeter clean using a clean, dry cloth .

(2) Inspect gage face glass for damage. Inspect case for cracks, distortion, or any other defect.

(3) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. Installation. Install ammeter as shown in figure 4-25.

NOTE

Be certain that ammeter terminals are tightened securely to provide a good charging circuit for the battery. If ammeter reads in reverse, check wiring for proper connections.

4-47. Engine Water Temperature Gage

a. Removal. Remove engine water temperature gage as shown in figure 4.25.

b. Cleaning and Inspection,

(1) Clean gage, line, and sensing bulb using a clean cloth soaked with a cleaning solvent conforming to Federal Specification P-D-680. Dry thoroughly.

(2) Inspect gage face glass for damage. Inspect case for cracks, distortion, or any other defect.

(3) Inspect sensing bulb and line for kinks, breaks, distortion, or any other defect.

(4) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. Installation. Install engine water temperature gage as shown in figure 4-25.

4-48. Tachometer. Hourmeter

a. Removal. Remove tachometer-hourmeter as shown in figure 4-25.

b. Cleaning and Inspection.

(1) Clean tachometer-hourmeter using a clean cloth soaked in a cleaning solvent conforming to Federal Specification P-D-680. Dry thoroughly.

(2) Inspect tachometer-hourmeter face glass for damage. Inspect case for cracks, distortion, or any other defect.

(3) inspect tachometer cable for kinks, breaks, or any other defect.

(4) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. Installation. Install tachometer-hourmeter as shown in figure 4-25.

4-49. Air Cleaner Restriction Indicators

AM Removal. Remove air cleaner restriction indicators as shown in figure 4-25.

b. Cleaning and Inspection.

(1) Wipe restriction indicators clean using a clean, dry cloth.

(2) Inspect for cracks, breaks, and thread damage.

c. Installation. Install air cleaner restriction indicators as shown in figure 4-25.

4-50. Panel Lamp Assembly and Switch

a. Removal. Remove panel lamp assembly and switch as shown in figure 4-25.

b. Cleaning and Inspection.

(1) Wipe panel lamp assembly and switch clean using a clean, dry cloth.

(2) Check switch for proper operation. Inspect terminals for cracks, breaks, or any other defect.

(3) Inspect panel lamp and bulb for breaks, cracks, distortion, or any other defect.

(4) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. Installation. Install panel lamp assembly and switch as shown in figure 4-25.

4-51. Control Cables

a. Removal. Remove engine idle control cable, stop cable, compressor unloader control cable, and cold weather starting aid cable as shown in figure 4-25.

b. Cleaning and Inspection.

(1) Clean control cables using a cleaning solvent conforming to Federal Specification P-D-680.

(2) Inspect control cables for breaks, kinks, or any other defect.

(3) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. Installation. Install engine idle control cable, stop cable, compressor unloader control cable, and cold weather starting aid cable as shown in figure 4-25.

4-52. Start and Safety Pushbutton Switches

a. Removal. Remove the safety pushbutton switch and start pushbutton switch as shown in figure 4-25.

b. Cleaning and Inspection.

(1) Wipe safety switch and start switch clean using a clean, dry cloth.

(2) Check switches for proper operation. Inspect terminals for cracks, breaks, or any other defect.

(3) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. Installation. Install safety pushbutton switch and start pushbutton switch as shown in figure 4-25.

4-53. Air Pressure Switches

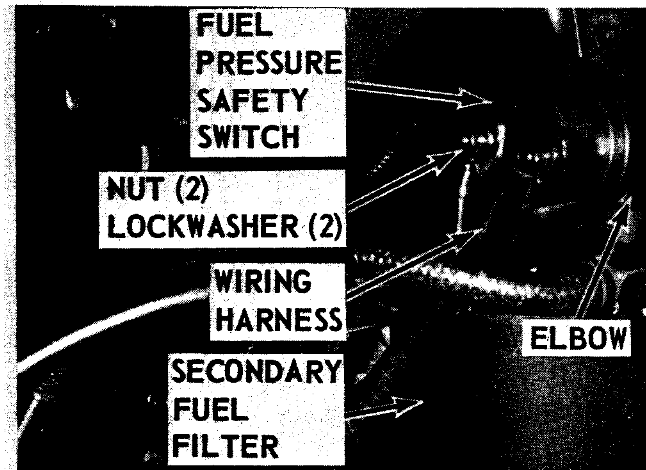
a. Removal. Remove air pressure switches as shown in figure 4-25.

b. Installation. Install air pressure safety switch as shown in figure 4-25.

4-54. Fuel Pressure Safety Switch

a. Removal. Remove fuel pressure safety switch
a. shown in figure 4-26.

b. Installation. Install fuel pressure safety switch as shown in figure 4-26.



A FUEL PRESSURE SAFETY SWITCH, REMOVAL AND INSTALLATION

REMOVAL

STEP 1.	REMOVE NUTS AND LOCKWASHERS. REMOVE WIRING HARNESS FROM TERMINALS.
STEP 2.	UNSCREW AND REMOVE FUEL PRESSURE SAFETY SWITCH FROM SECONDARY FUEL FILTER ELBOW.

INSTALLATION

STEP 1.	INSTALL FUEL PRESSURE SAFETY SWITCH ON ELBOW AT TOP OF SECONDARY FUEL FILTER.
STEP 2.	CONNECT WIRING HARNESS AND SECURE WITH LOCKWASHERS AND NUTS. (REFER TO FIGURE 1-3 FOR WIRING DIAGRAM.)

B OIL PRESSURE SAFETY SWITCH, REMOVAL AND INSTALLATION

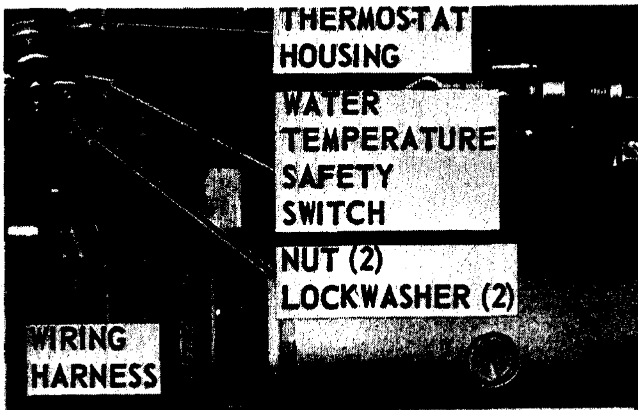
REMOVAL

STEP 1.	REMOVE NUTS AND LOCKWASHERS. REMOVE WIRING HARNESS FROM TERMINALS.
STEP 2.	UNSCREW AND REMOVE ENGINE OIL PRESSURE SAFETY SWITCH.

INSTALLATION

STEP 1.	INSTALL ENGINE OIL PRESSURE SAFETY SWITCH.
STEP 2.	CONNECT WIRING HARNESS AND SECURE WITH LOCKWASHERS AND NUTS. (REFER TO FIGURE 1-3 FOR WIRING DIAGRAM.)

Figure 4-26. Safety switches, removal and installation (sheet 1 of 3).



C WATER TEMPERATURE SAFETY SWITCH, REMOVAL AND INSTALLATION

REMOVAL

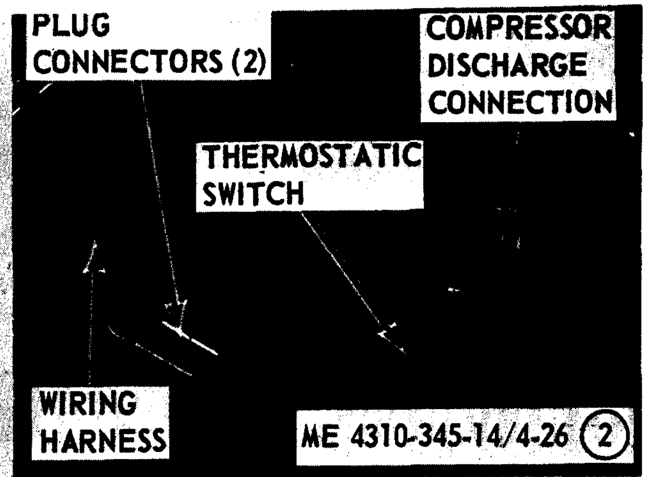
STEP 1. REMOVE NUTS AND LOCKWASHERS. REMOVE WIRING HARNESS FROM TERMINALS.

STEP 2. UNSCREW AND REMOVE WATER TEMPERATURE SAFETY SWITCH FROM THERMOSTAT HOUSING.

INSTALLATION

STEP 1. INSTALL WATER TEMPERATURE SAFETY SWITCH IN THERMOSTAT HOUSING.

STEP 2. CONNECT WIRING HARNESS AND SECURE WITH LOCKWASHERS AND NUTS. (REFER TO FIGURE 1-3 FOR WIRING DIAGRAM.)



D THERMOSTATIC SWITCH, REMOVAL AND INSTALLATION

REMOVAL

STEP 1. DISCONNECT WIRE PLUG CONNECTORS BY PULLING APART.

STEP 2. UNSCREW AND REMOVE THERMOSTATIC SWITCH FROM COMPRESSOR DISCHARGE CONNECTION.

INSTALLATION

STEP 1. INSTALL THERMOSTATIC SWITCH IN COMPRESSOR DISCHARGE CONNECTION.

STEP 2. RECONNECT WIRE PLUG CONNECTORS.

Figure 4-26. Safety switches, removal and installation (sheet 2 of 3).

REMOVAL

STEP 1. REMOVE NUTS AND LOCKWASHERS. REMOVE WIRING HARNESS FROM TERMINALS. REMOVE NUT AND LOCKWASHER; REMOVE GROUND WIRE FROM TERMINAL.

STEP 2. REMOVE NUT FROM SOLENOID ROD.

STEP 3. REMOVE NUTS, LOCKWASHERS, AND BOLTS SECURING SHUTDOWN SOLENOID SWITCH TO MOUNTING BRACKET. LIFT SOLENOID SWITCH UPWARD REMOVING ROD FROM ACTUATING BRACKET.

E SHUTDOWN SOLENOID SWITCH, REMOVAL AND INSTALLATION

INSTALLATION

STEP 1. INSTALL SOLENOID SWITCH WITH ROD EXTENDING THROUGH HOLE IN ACTUATING BRACKET. SECURE ROD WITH NUT; SECURE SOLENOID SWITCH TO MOUNTING BRACKET WITH BOLTS, LOCKWASHERS, AND NUTS.

STEP 2. INSTALL GROUND WIRE. SECURE WITH LOCKWASHER AND NUT ON SOLENOID SWITCH TERMINAL AND TOOTH TYPE LOCKWASHER UNDER LUG AT MOUNTING BRACKET GROUND.

STEP 3. INSTALL WIRING HARNESS ON TERMINAL AND SECURE WITH LOCKWASHER AND NUT. (REFER TO FIGURE 1-3 FOR WIRING DIAGRAM.)

Figure 4-26. Safety switches, removal and installation (sheet 3 of 3).

b. Installation. Install air pressure switches as shown in figure 4-25.

4-55. Oil Pressure Safety Switch

a. Removal. Remove engine oil pressure safety switch as shown in figure 4-26.

b. Installation. Install engine oil pressure safety switch as shown in figure 4-26.

4-56. Water Temperature Safety Switch

a. Removal. Drain engine coolant and remove engine water temperature safety switch as shown in figure 4-26.

b. Installation. Install engine water temperature switch as shown in figure 4-26 and fill radiator with coolant.

4-57. Thermostatic Switch

a. Removal. Remove compressor thermostatic switch as shown in figure 4-26.

b. Installation. Install compressor thermostatic switch as shown in figure 4-26.

4-58. Shutdown Solenoid Switch

a. Removal. Remove engine shutdown solenoid switch as shown in figure 4-26.

b. Installation. Install engine shutdown solenoid switch as shown in figure 4-26.

4-59. Engine Throttle Lever and Rods

a. Removal. Remove engine throttle lever and control rods as shown in figure 4-27.

REMOVAL

STEP 1. REFER TO FIGURE 4-25 AND REMOVE IDLE CONTROL CABLE FROM STOP BLOCK.

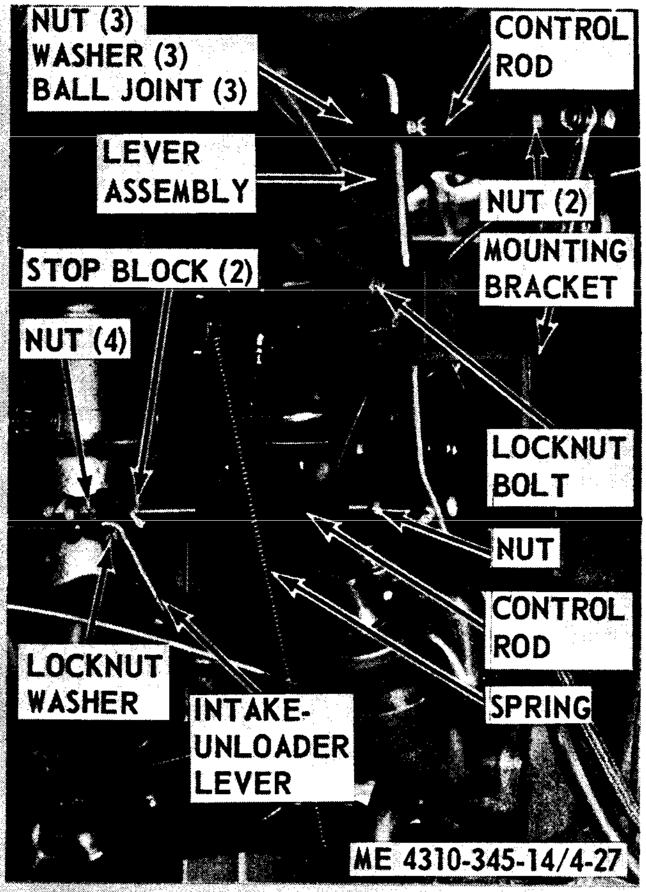
STEP 2. REMOVE SPRING FROM LEVER ASSEMBLY AND BRACKET ON FLYWHEEL ADAPTOR.

STEP 3. REMOVE LOCKNUT AND WASHER SECURING CONTROL ROD STOP BLOCK TO INTAKE-UNLOADER LEVER.

STEP 4. REMOVE THE FOUR NUTS AND TWO STOP BLOCKS FROM CONTROL ROD. LOOSEN NUT AT BALL JOINT AND REMOVE CONTROL ROD.

STEP 5. REMOVE NUTS, LOCKWASHERS, AND BALL JOINTS. LOOSEN NUTS AT BALL JOINTS AND REMOVE CONTROL ROD.

STEP 6. REMOVE LOCKNUT AND BOLT. REMOVE LEVER ASSEMBLY FROM MOUNTING BRACKET.



INSTALLATION

STEP 1. INSTALL LEVER ASSEMBLY ON MOUNTING BRACKET AND SECURE WITH BOLT AND LOCKNUT.

STEP 2. INSTALL BALL JOINT ON EACH END OF SHORT CONTROL ROD AND SECURE IN POSITION WITH NUT. INSTALL CONTROL ROD BETWEEN GOVERNOR LEVER AND LEVER ASSEMBLY. SECURE WITH LOCKWASHERS AND NUTS.

STEP 3. INSTALL BALL JOINT ON CONTROL ROD AND SECURE WITH NUT. INSTALL BALL JOINT ON LEVER ASSEMBLY WITH LOCKWASHER AND NUT. SLIDE INTAKE-UNLOADER LEVER STOP BLOCK ON CONTROL ROD. SECURE STOP BLOCK TO LEVER WITH WASHER AND LOCKNUT.

STEP 4. INSTALL IDLE CONTROL CABLE STOP BLOCK AND NUTS.

STEP 5. INSTALL SPRING BETWEEN LEVER ASSEMBLY AND BRACKET ON FLYWHEEL ADAPTOR.

STEP 6. REFER TO FIGURE 4-25 AND INSTALL IDLE CONTROL CABLE TO STOP BLOCK. REFER TO FIGURE 4-7 FOR CONTROL ADJUSTMENT.

Figure 4-27. Engine throttle lever and rods, removal and installation.

b. Installation. Install throttle lever and rods as shown in figure 4-27.

c. Adjustment. Adjust engine idle speed as shown in figure 4-7.

Section XII. MAINTENANCE OF HOUSING GROUP

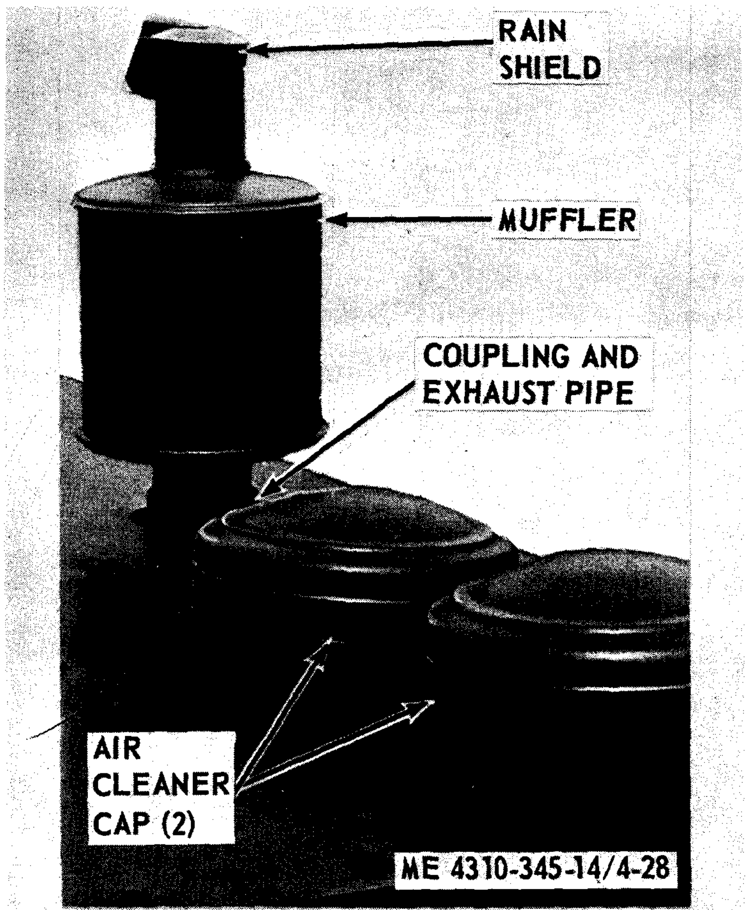
4-60. General

The engine, air compressor, radiator, and compressor oil cooler are enclosed in a sheet metal housing. Doors on both sides of the unit provide access to engine and compressor components. In addition to the doors, the housing group consists of side and end panels, door and roof supports and roof section. The data and instruction plates fasten to the outside of the housing side and door panels.

4-61. Housing Group

a. Removal and Disassembly.

(1) Remove external components on housing group as shown in figure 4-28.



REMOVAL

STEP 1. REMOVE RAIN SHIELD FROM MUFFLER.

STEP 2. REMOVE MUFFLER, COUPLING, AND EXHAUST PIPE.

STEP 3. REMOVE THE TWO AIR CLEANER CAPS.

INSTALLATION

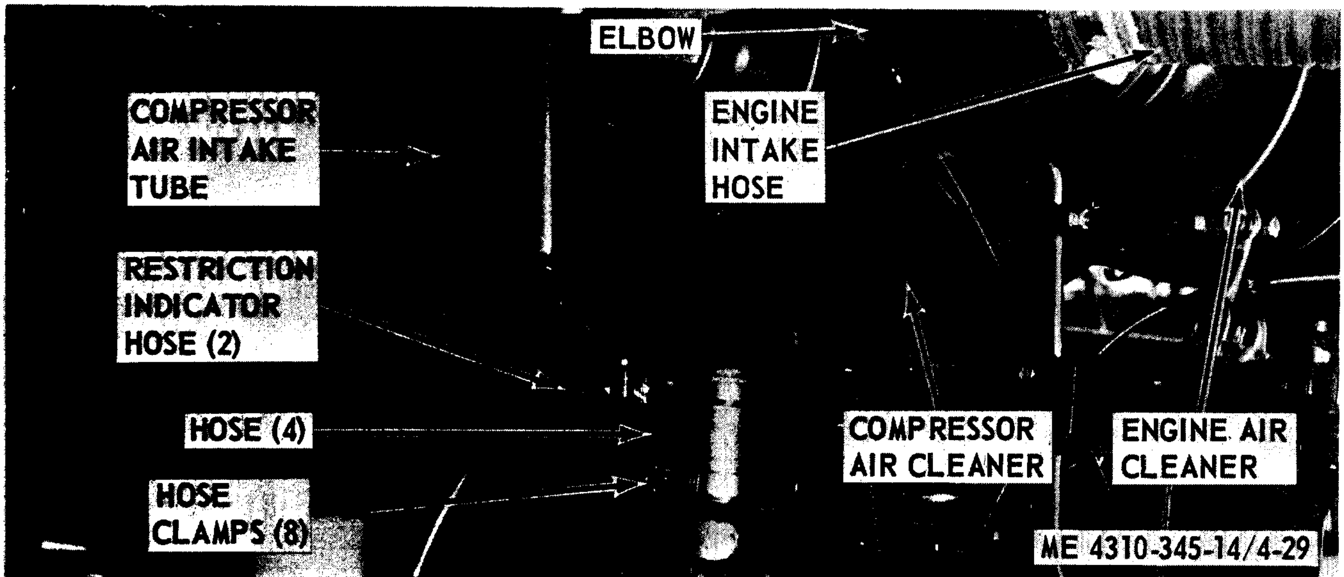
STEP 1. INSTALL THE TWO AIR CLEANER CAPS.

STEP 2. INSTALL EXHAUST PIPE, COUPLING, AND MUFFLER.

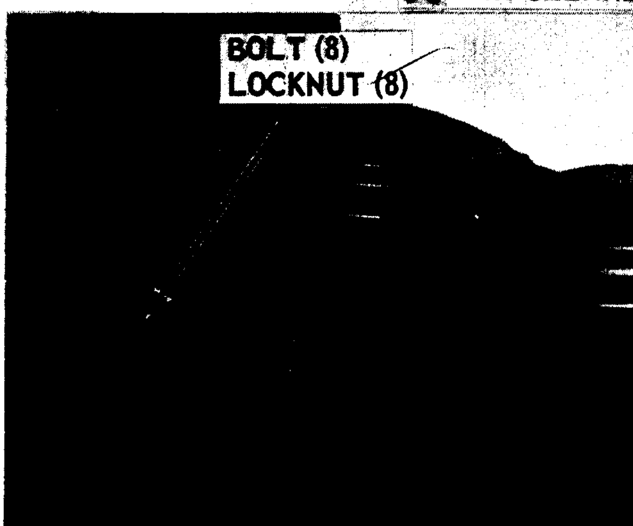
STEP 3. INSTALL RAIN SHIELD ON MUFFLER.

Figure 4-28. External components on housing group, removal and installation.

(2) Remove engine and compressor air cleaner assemblies as shown in figure 4-29.



A AIR CLEANER HOSES AND INTAKE



B AIR CLEANER ATTACHMENT TO ROOF SECTION

REMOVAL

STEP 1. LOOSEN THE EIGHT HOSE CLAMPS. REMOVE ENGINE AIR INTAKE HOSE BETWEEN ELBOW AND INTAKE HOUSING. DISCONNECT THE TWO RESTRICTION INDICATOR HOSES. REMOVE ELBOW AND HOSE FROM ENGINE AIR CLEANER.

STEP 2. REMOVE COMPRESSOR AIR INTAKE TUBE AND HOSES.

STEP 3. REMOVE EIGHT LOCKNUTS AND BOLTS. REMOVE THE TWO AIR CLEANERS.

INSTALLATION

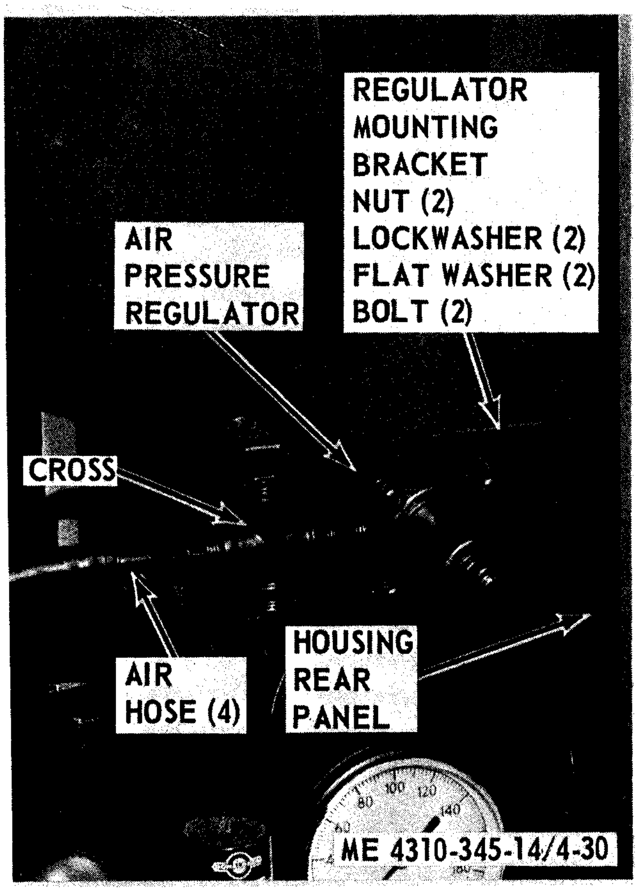
STEP 1. INSTALL THE TWO AIR CLEANERS AND SECURE TO ROOF PANEL WITH EIGHT BOLTS AND LOCK-NUTS.

STEP 2. INSTALL HOSES ON AIR CLEANER AND COMPRESSOR INTAKE. INSTALL COMPRESSOR AIR INTAKE TUBE. SECURE HOSE CONNECTIONS WITH HOSE CLAMPS.

STEP 3. INSTALL HOSES ON AIR CLEANER AND ENGINE INTAKE HOUSING. INSTALL ELBOW; SECURE HOSE CONNECTIONS WITH HOSE CLAMPS. CONNECT THE TWO RESTRICTION INDICATOR HOSES.

Figure 4-29. Engine and compressor air assemblies, removal and installation.

(3) Remove air pressure regulator assembly and bracket as shown in figure 4-30.



REMOVAL

STEP 1. DISCONNECT AIR HOSES FROM REGULATOR AND CROSS.

STEP 2. REMOVE NUTS, LOCKWASHERS, FLAT WASHERS, AND BOLTS SECURING MOUNTING BRACKET TO HOUSING REAR PANEL. REMOVE AIR PRESSURE REGULATOR ASSEMBLY AND BRACKET.

INSTALLATION

STEP 1. INSTALL AIR PRESSURE REGULATOR ASSEMBLY AND BRACKET AND SECURE TO REAR HOUSING PANEL WITH BOLTS, FLAT WASHERS, LOCKWASHERS, AND NUTS.

STEP 2. CONNECT AIR HOSES TO CROSS AND REGULATOR. (REFER TO FIGURE 5-1 FOR AIR LINE DIAGRAM).

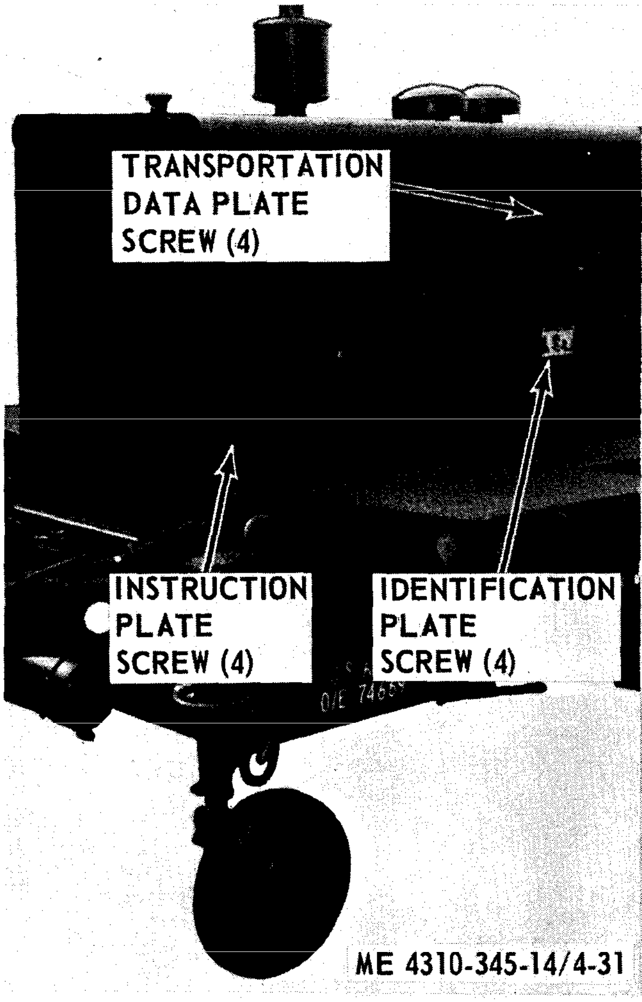
Figure 4-30. Air pressure regulator assembly and bracket, removal and installation.

(4) Remove instrument panel assembly (fig. 4-24).

(5) Remove cold weather starting aid cylinder (fig. 3-22), cylinder brackets and valve (fig. 4-23).

(6) Remove toolboxes (right and left side) (fig. 4-16).

(7) Remove data and instruction plates as shown in figure 4-31.



REMOVAL

STEP 1. REMOVE FOUR SCREWS AND INSTRUCTION PLATE.

STEP 2. REMOVE FOUR SCREWS AND TRANSPORTATION DATA PLATE.

STEP 3. REMOVE FOUR SCREWS AND IDENTIFICATION PLATE.

INSTALLATION

STEP 1. INSTALL IDENTIFICATION PLATE; SECURE WITH FOUR SCREWS.

STEP 2. INSTALL TRANSPORTATION DATA PLATE; SECURE WITH FOUR SCREWS.

STEP 3. INSTALL INSTRUCTION PLATE; SECURE WITH FOUR SCREWS.

Figure 4-31. Data and instruction plates, removal and installation.

(8) Disassemble housing group in numerical sequence shown in figure 4-32.

NOTE

Left and right side panels (61, 69, fig. 4-32) are used as support panels for the radiator and compressor oil cooler. These panels cannot be removed from unit unless the radiator and oil cooler are also removed.

b. Cleaning, Inspection, and Repair.

(1) Clean all metal parts using a cleaning solvent conforming to Federal Specification P-D-680. Dry thoroughly.

(2) Inspect parts for dents, cracks, breaks, or any other damage.

(3) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

(4) Repair is limited to the straightening of dents and replacement of defective parts.

c. Reassembly and Installation.

(1) Reassemble housing group in reverse numerical sequence shown in figure 4-32.

(2) Install data and instruction plates as shown in figure 4-31.

(3) Install toolboxes (right and left side) (fig. 4-16).

(4) Install cold weather starting aid valve and brackets (fig. 4-23) and fuel cylinder (fig. 3-22).

(5) Install instrument panel assembly (fig. 4-24).

(6) Install air pressure regulator assembly and bracket (fig. 4-30).

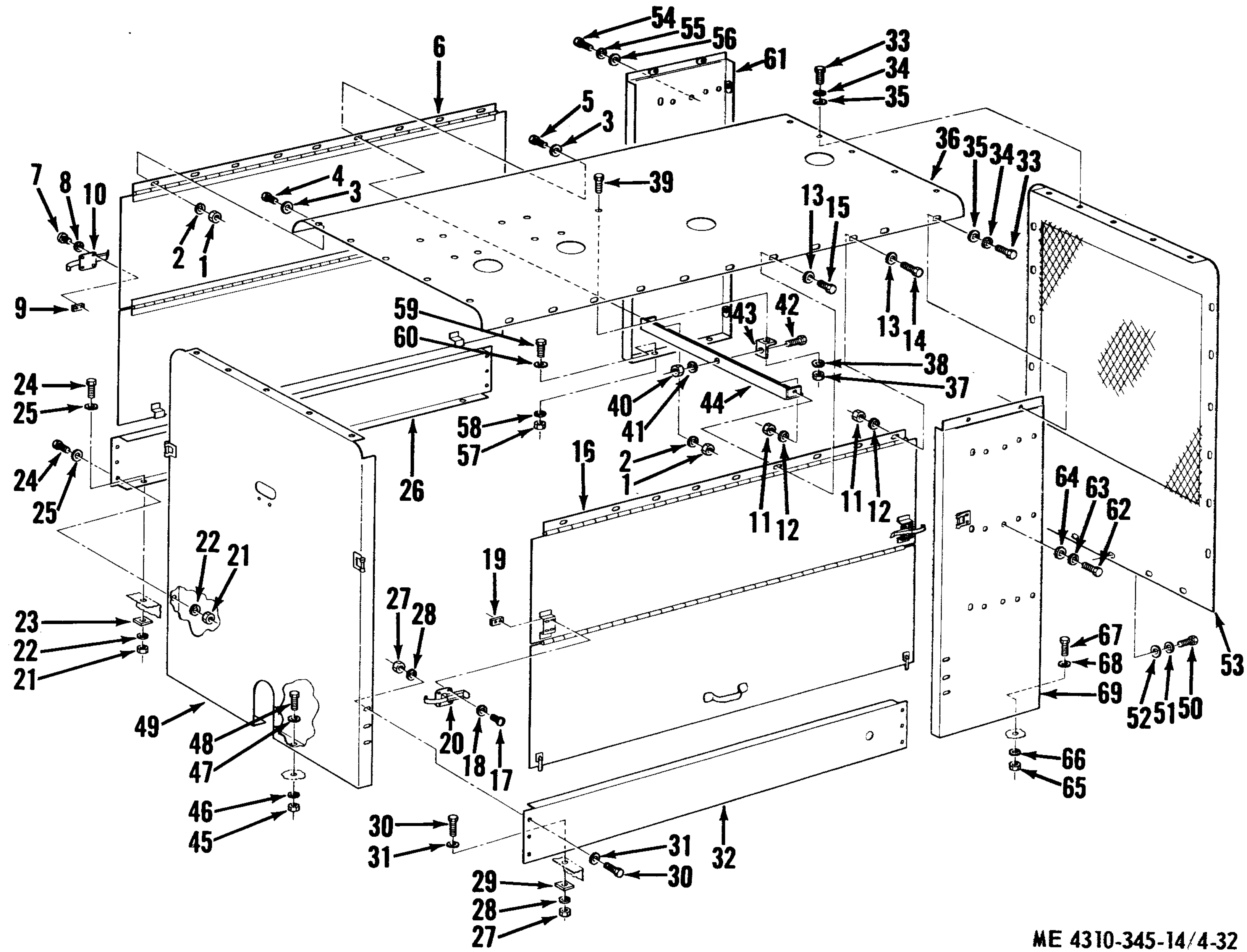


Figure 4-32. Housing group disassembly and reassembly.

Key to figure 4-32.

1. Nut (9)
2. Lockwasher (9)
3. Flat washer (9)
4. Bolt (8)
5. Bolt
6. Door, LH
7. Screw (8)
8. Lockwasher (8)
9. Nut plate (4)
10. Clamp (2)
11. Nut (9)
12. Lockwasher (9)
13. Flat washer (9)
14. Bolt (8)
15. Bolt
16. Door, RH
17. Screw (8)
18. Lockwasher (8)
19. Nut plate (4)
20. Clamp (2)
21. Nut (9)
22. Lockwasher (9)
23. Bevel washer (3)
24. Bolt (9)
25. Flat washer (9)
26. Side panel, LH
27. Nut (9)
28. Lockwasher (9)
29. Bevel washer (3)
30. Bolt (9)
31. Flat washer (9)
32. Side panel, RH
33. Bolt (14)
34. Lockwasher (14)
35. Flat washer (14)
36. Roof
37. Nut
38. Lockwasher
39. Bolt
40. Nut
41. Lockwasher
42. Bolt
43. Support
44. Brace
45. Nut (4)
46. Lockwasher (4)
47. Flat washer (4)
48. Bolt (4)
49. Rear support
50. Bolt (17)
51. Lockwasher (17)
52. Flat washer (17)
53. Front support
54. Bolt (12)
55. Lockwasher (12)
56. Flat washer (12)
57. Nut (2)
58. Lockwasher (2)
59. Bolt (2)
60. Flat washer (2)
61. Front side panel, LH
62. Bolt (12)
63. Lockwasher (12)
64. Flat washer (12)
65. Nut (2)
66. Lockwasher (2)
67. Bolt (2)
68. Flat washer (2)
69. Front side panel, RH

(7) Install engine and compressor air cleaner assemblies (fig. 4-29).

(8) Install external components on housing group as shown in figure 4-28.

Section Xiii. MAINTENANCE OF COOLING SYSTEM

4-62. General

The rotary air compressor unit cooling system consists of the radiator, compressor oil cooler assembly, fan guard, fan assembly and drive group, drive belts, engine coolant thermostat, engine water pump, engine oil cooler, coolant lines, hoses, fittings, and clamps. The engine has a pressure cooling system. An impeller-type pump circulates the coolant through the engine components and the radiator. Coolant temperature is reduced by ambient air which is drawn through the radiator core by the fan assembly. The engine coolant thermostat controls the flow of coolant through the radiator. The ambient air pulled through the radiator also passes through the compressor oil cooler which reduces the temperature of air compressor oil.

4-63. Fan Guard

a. Removal. Remove the fan guard as shown in figure 4-33.

REMOVAL

STEP 1. REMOVE SCREWS AND FLAT WASHERS. REMOVE FAN GUARDS.

NOTE

THE HOUSING ROOF SECTION AND TOP RADIATOR HOSE MUST BE REMOVED TO REMOVE THE FAN SHROUD. REFER TO FIGURE 6-9 FOR SHROUD REMOVAL AND FIGURE 4-32 FOR ROOF REMOVAL.

INSTALLATION

STEP 1. INSTALL FAN GUARDS AND SECURE WITH FLAT WASHERS AND SCREWS. CHECK FAN GUARD AND FAN BLADE CLEARANCE.

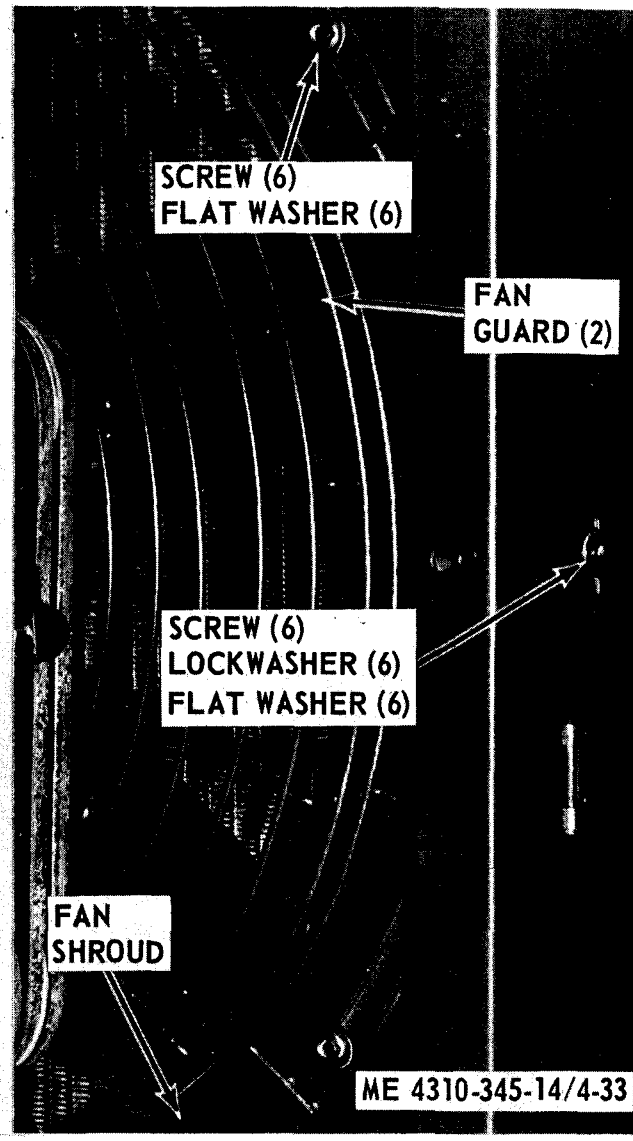


Figure 4-33. Fan guard, removal and installation.

b. Cleaning and Inspection.

(1) Clean the fan guard using a cleaning solvent conforming to Federal Specification P-D-680. Dry thoroughly.

(2) Inspect fan guard for cracks, breaks, distortion, or any other defects.

(3) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. *Installation.* Install fan guard as shown in figure 4-33.

4-64. Coolant Lines, Hoses, Fittings, and Clamps

a. Removal. Remove coolant lines, hoses, fittinge, and clamps as shown in figure 4-34.

REMOVAL

STEP 1. REMOVE HOSE CLAMPS AND UPPER RADIATOR HOSE.

STEP 2. REMOVE HOSE CLAMPS AND LOWER RADIATOR HOSE.

STEP 3. REMOVE HOSE CLAMPS AND OIL COOLER WATER OUTLET HOSE.

STEP 4. REMOVE HOSE CLAMPS, HOSE, BOLTS, LOCKWASHERS, WATER BYPASS TUBE, AND GASKET.

STEP 5. REFER TO FIGURE 3-20 AND REMOVE SECONDARY FUEL FILTER. REMOVE BOLTS, LOCKWASHER, ELBOW, AND GASKET.

INSTALLATION

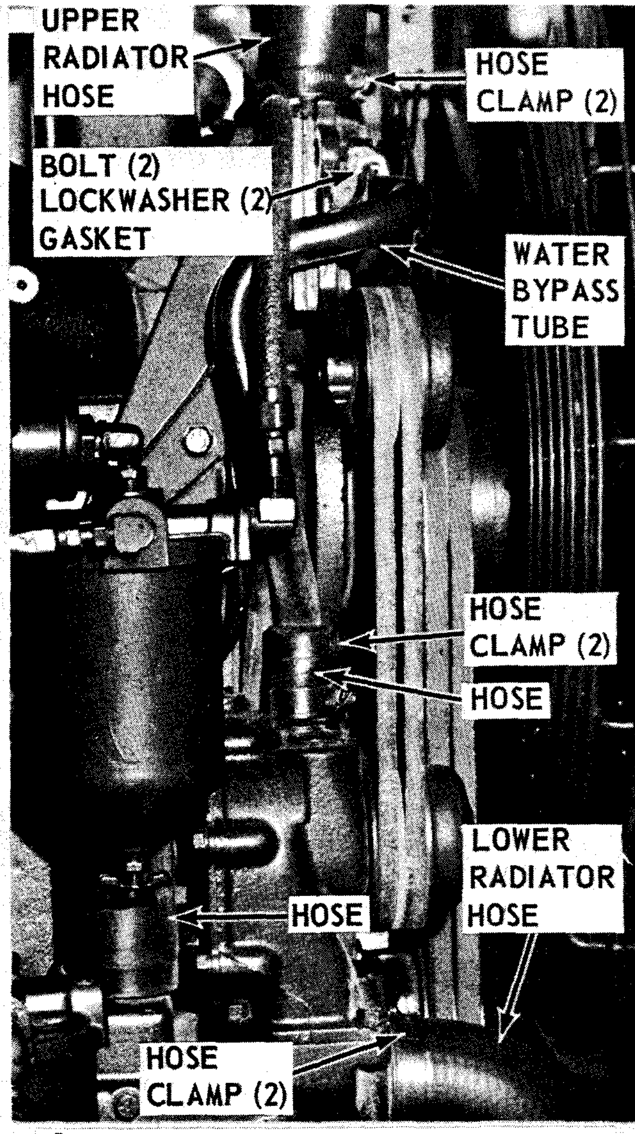
STEP 1. INSTALL GASKET AND ELBOW. SECURE TO ENGINE BLOCK WITH LOCKWASHERS AND BOLTS. REFER TO FIGURE 3-20 AND INSTALL SECONDARY FUEL FILTER ON ELBOW.

STEP 2. INSTALL GASKET AND WATER BYPASS TUBE; SECURE TO THERMOSTAT HOUSING WITH LOCKWASHERS AND BOLTS. INSTALL HOSE AND HOSE CLAMPS BETWEEN BYPASS TUBE AND WATER PUMP.

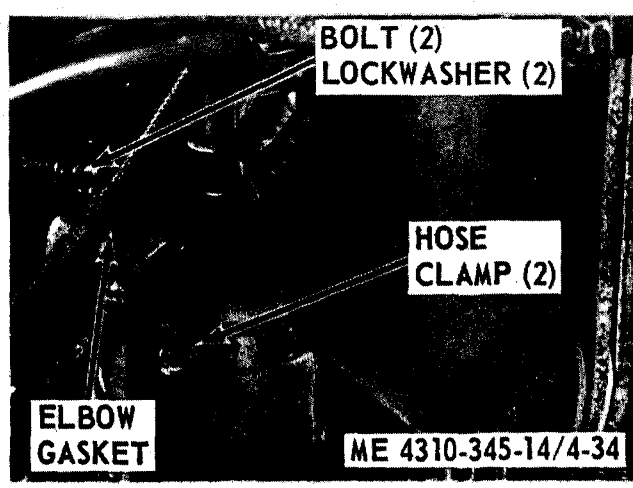
STEP 3. INSTALL OIL COOLER WATER OUTLET HOSE AND HOSE CLAMPS.

STEP 4. INSTALL LOWER RADIATOR HOSE AND HOSE CLAMPS.

STEP 5. INSTALL UPPER RADIATOR HOSE AND HOSE CLAMPS.



A RADIATOR AND WATER PUMP HOSES



B OIL COOLER HOSE AND ELBOW

Figure 4-34. Coolant lines, hoses, fittings, and clamps, removal and installation.

b. Cleaning and Inspection.

(1) Clean all metal parts using a cleaning solvent conforming to Federal Specification P-D-680. Dry parts thoroughly.

(2) Inspect parts for kinks, breaks, cracks, deterioration, or any other defect.

(3) Inspect attaching hardware for cracks, distortion, or any other defect.

c. Installation. Install coolant lines, hoses, fittings, and clamps as shown in figure 4-34.

4-65. Drive Belts

a. Removal.

(1) Remove fan guard (fig. 4-33).

(2) Remove drive belts as shown in figure 4-35.

GENERATOR DRIVE BELTS

REMOVAL

STEP 1. LOOSEN SCREWS SECURING GENERATOR TO PIVOTS.

STEP 2. LOOSEN SCREW SECURING GENERATOR TO ADJUSTING STRAP.

STEP 3. MOVE GENERATOR IN DIRECTION TO LOOSEN BELTS. REMOVE DRIVE BELTS FROM PULLEYS.

INSTALLATION

STEP 1. INSTALL DRIVE BELT SET ON PULLEYS. MOVE GENERATOR IN DIRECTION TO TIGHTEN BELTS. (REFER TO FIGURE 4-6 FOR ADJUSTMENT.)

STEP 2. TIGHTEN SCREW SECURING GENERATOR TO ADJUSTING STRAP.

STEP 3. TIGHTEN SCREWS SECURING GENERATOR TO PIVOTS.

FAN DRIVE BELTS

REMOVAL

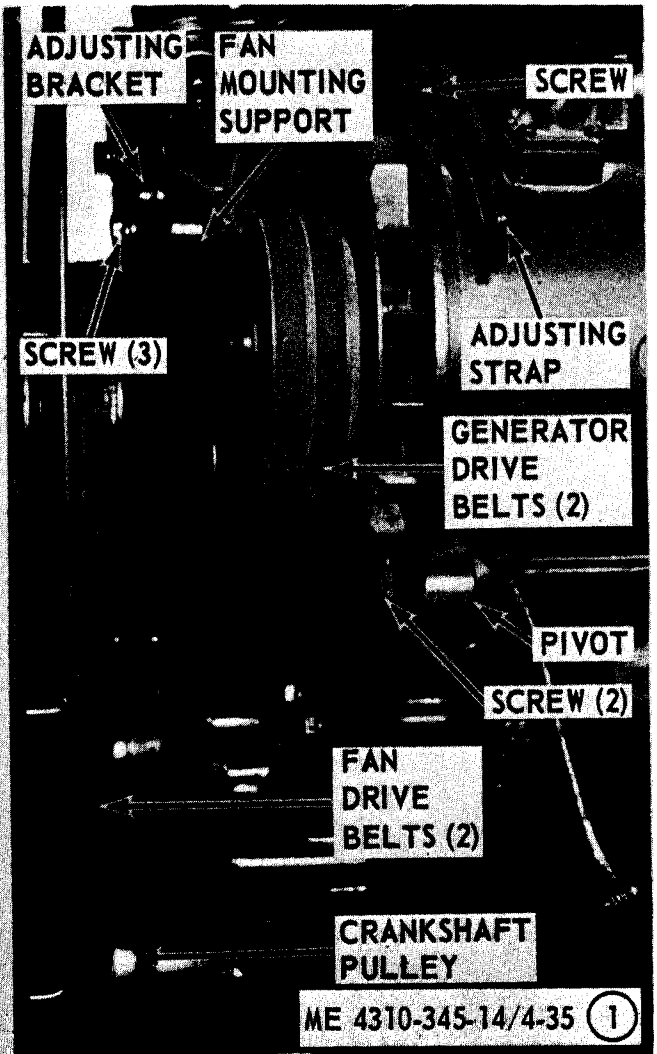
STEP [illegible] SCREWS SECURING ADJUSTING BRACKET TO FAN MOUNTING SUPPORT.

STEP 2. [illegible] DRIVE AND ADJUSTING [illegible] IN DIRECTION TO [illegible] DRIVE BELTS.

STEP [illegible] DRIVE BELTS FROM [illegible] PULLEY; REMOVE [illegible] BY WEAVING OVER FAN [illegible]

INSTALLATION

STEP 1. [illegible] DRIVE BELT SET OVER FAN BLADES. INSTALL BELTS ON FAN PULLEY AND CRANKSHAFT PULLEY.



A GENERATOR AND FAN DRIVE BELTS, REMOVAL AND INSTALLATION

STEP 2. MOVE FAN DRIVE AND ADJUSTING BRACKET IN DIRECTION TO TIGHTEN BELTS. (REFER TO FIGURE 4-6 FOR ADJUSTMENT.)

STEP 3. TIGHTEN SCREWS SECURING ADJUSTING BRACKET TO FAN MOUNTING SUPPORT.

Figure 4-35. Drive belts, removal and installation.

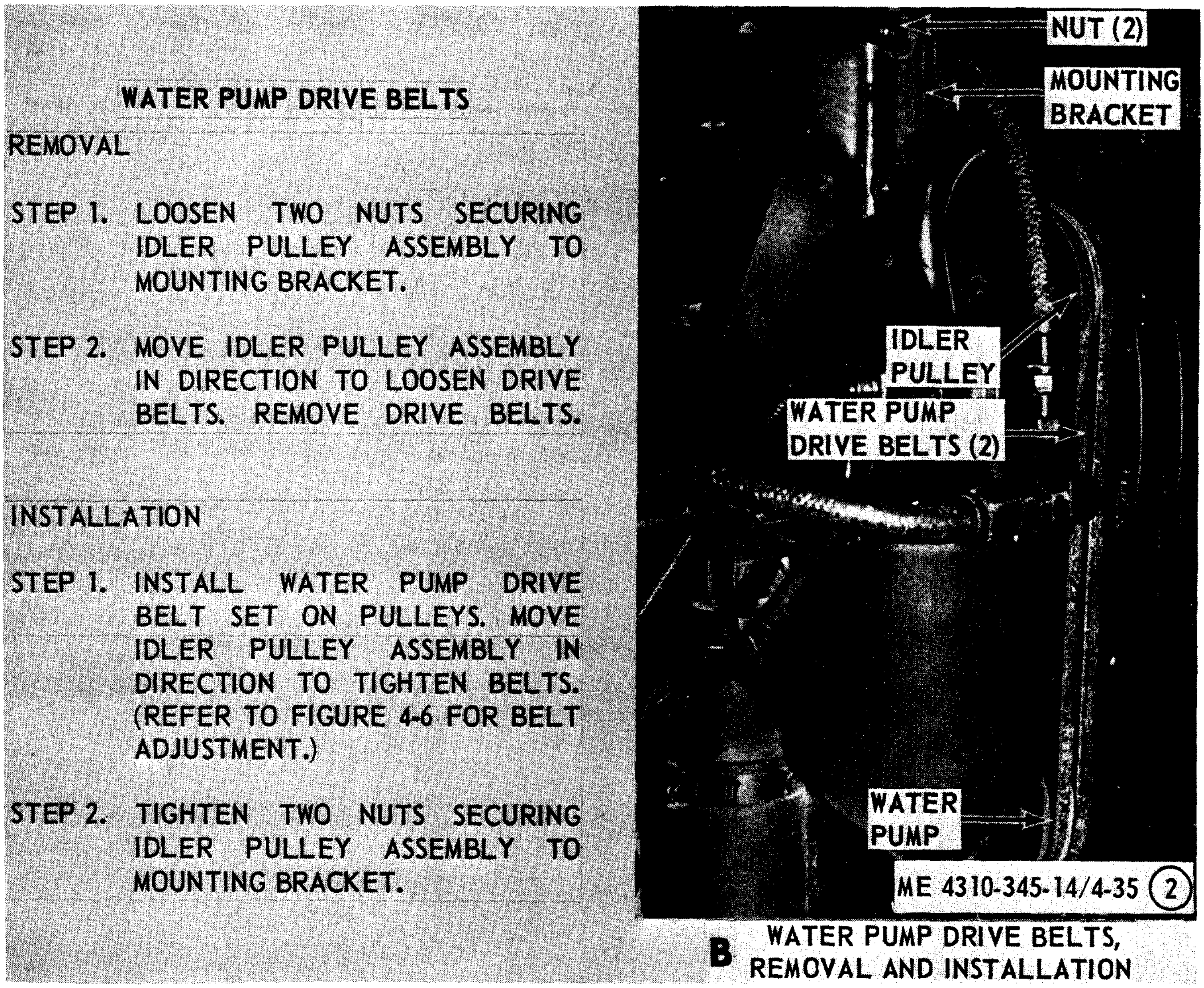


Figure 4-35. Drive belts, removal and installation.

b. Inspection. Inspect drive belts for cracks, breaks, fraying, excessive wear, or any other defect.

NOTE

Always replace drive belts in sets.

c. Installation.

(1) Install drive belts as shown in figure 4-35.

(2) Install fan guard (fig. 4-33).

d. Adjustment. Adjust drive belts as shown in figure 4-6.

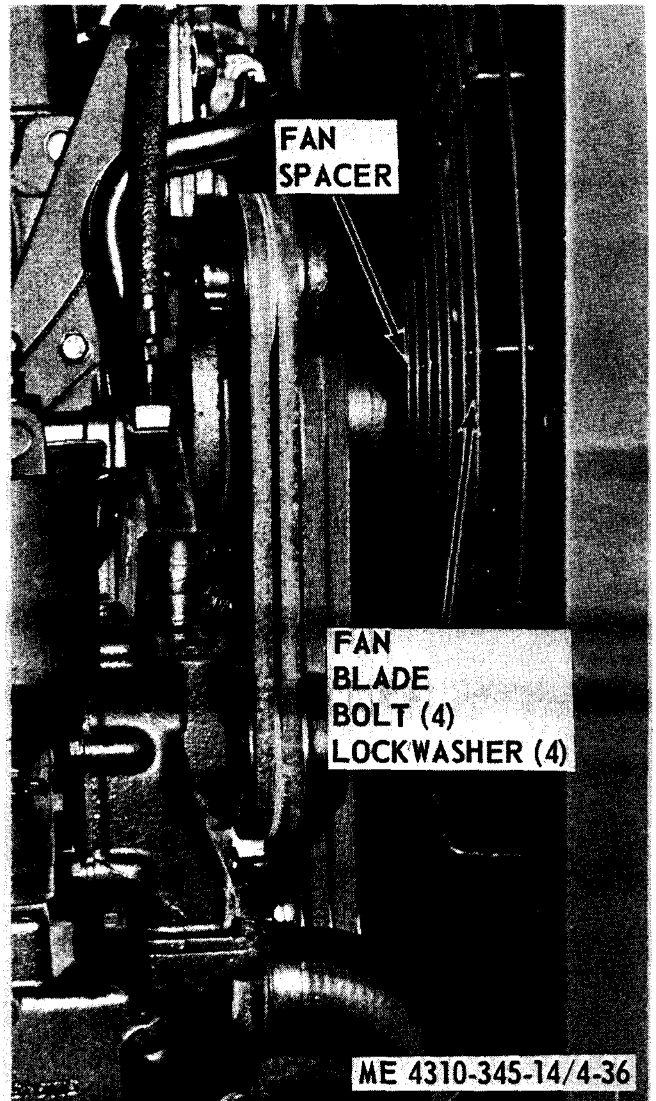
4-66. Fan Assembly

a. Removal.

(1) *Remove* fan guard (fig. 4-33).

(2) Loosen drive belts (fig. 4-35).

(3) Remove fan assembly as shown in figure 4-36.



REMOVAL

STEP 1. REMOVE BOLTS AND LOCKWASHERS. REMOVE FAN BLADE.

STEP 2. REMOVE FAN SPACER.

INSTALLATION

STEP 1. INSTALL FAN SPACER ON FAN PULLEY.

STEP 2. INSTALL FAN BLADE ON FAN SPACER AND SECURE TO FAN PULLEY WITH LOCKWASHERS AND BOLTS.

Figure 4-36. Fan assembly, removal and installation.

b. Cleaning and Inspection.

(1) Clean fan assembly and spacer using a cleaning solvent conforming to Federal Specification P-D-680. Dry parts thoroughly.

(2) Inspect fan assembly for cracks, bent blades, or any other defect.

(3) Inspect spacer for cracks, breaks, or any other defect.

(4) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. In stallation.

(1) Install fan assembly as shown in figure 4-36.

(2) Install drive belts (fig. 4-6).

(3) Adjust drive belts (fig. 4-6).

(4) Install fan guard (fig. 4-33).

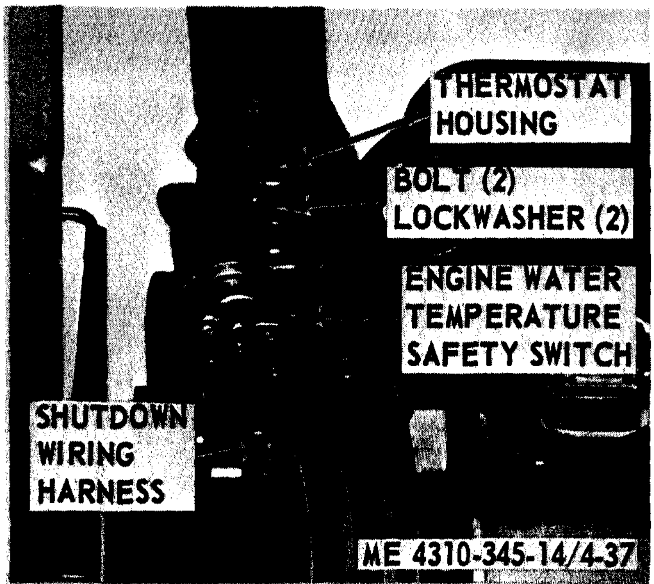
4-67. Engine Coolant Thermostat

a. Removal.

(1) Drain engine cooling system.

(2) Remove clamps and hose from thermostat housing (fig. 4-34).

(3) Remove engine coolant thermostat as shown in figure 4-37. Discard gasket.



REMOVAL

STEP 1. DISCONNECT SHUTDOWN WIRING HARNESS LEADS FROM SAFETY SWITCH (REFER TO FIGURE 4-26.)

STEP 2. REMOVE ENGINE WATER TEMPERATURE SAFETY SWITCH (FIGURE 4-26). REMOVE WATER TEMPERATURE SENSING BULB (FIGURE 4-25).

STEP 3. REMOVE BOLTS AND LOCKWASHERS. REMOVE THERMOSTAT HOUSING FROM ENGINE. DISCARD GASKET.

INSTALLATION

STEP 1. POSITION NEW GASKET AND INSTALL THERMOSTAT HOUSING WITH LOCKWASHERS AND BOLTS.

STEP 2. INSTALL ENGINE WATER TEMPERATURE SENSING BULB IN HOUSING (FIGURE 4-25). INSTALL WATER TEMPERATURE SAFETY SWITCH (FIGURE 4-26).

STEP 3. CONNECT SHUTDOWN WIRING HARNESS LEADS TO SAFETY SWITCH (FIGURE 4-26).

Figure 4-37. Engine coolant thermostat, removal, disassembly, reassembly, and installation.

b. Testing.

(1) Make test set-up as shown in figure 4-38.

Figure 4-38. Engine coolant thermostat test set-up.

(2) Apply heat to pan and stir water to maintain uniform water temperature.

(3) Observe temperature of water when thermostat begins to open. The opening temperature should be 167° to 172° F. The thermostat should be fully open at approximately 190° —192°F.

c. Installation.

(1) Install engine coolant thermostat as shown in figure 4-37. Install a new housing gasket.

NOTE

Clean sealing surfaces before installing new housing gasket and housing.

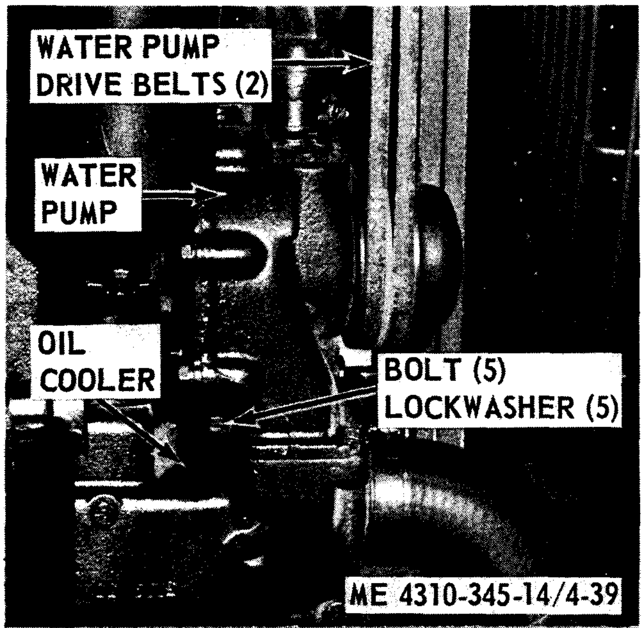
(2) Install hose and clamps on thermostat housing and radiator (fig. 4-34).

(3) Replenish engine coolant.

4-68. Water Pump Assembly

a. Removal.

(1) Drain engine cooling system.
(2) Remove drive belts (fig. 4-35).
(3) Remove engine coolant line, hose, and clamps from thermostat housing and water pump (fig. 4-34).
(4) Remove water pump assembly as shown in figure 4-39.



REMOVAL

STEP 1. REMOVE BOLTS AND LOCKWASHERS. REMOVE WATER PUMP.

STEP 2. DISCARD GASKET. REMOVE ANY GASKET MATERIAL FROM MOUNTING FACES OF WATER PUMP AND OIL COOLER.

INSTALLATION

STEP 1. INSTALL NEW GASKET BETWEEN WATER PUMP AND OIL COOLER.

STEP 2. INSTALL WATER PUMP AND SECURE WITH LOCKWASHERS AND BOLTS.

Figure 4-39. Engine water pump assembly, removal and installation.

b. Installation.

(1) Install engine water pump assembly as shown in figure 4-39.

(2) Install coolant line, hose, and clamps from water pump to thermostat housing (fig. 4-34).

(3) Install and adjust drive belts (fig. 4-35 and 4-6).

(4) Replenish engine coolant.

4-69. Fan Drive Group

a. Removal.

(1) Remove fan guards (fig. 4-33).

(2) Remove drive belts (fig. 4-35).

(3) Remove fan assembly and spacer (fig. 4-36).

(4) Remove fan drive group as shown in figure 4-40.

REMOVAL

STEP 1. REMOVE BOLTS AND LOCKWASHER ATTACHING FAN MOUNTING SUPPORT TO ENGINE.

STEP 2. REMOVE FAN MOUNTING SUPPORT WITH FAN DRIVE AND PULLEY FROM ENGINE. (REFER TO FIGURE 4-41 FOR DISASSEMBLY.)

INSTALLATION

STEP 1. POSITION FAN MOUNTING SUPPORT, WITH FAN DRIVE AND PULLEY ASSEMBLED, ON ENGINE.

STEP 2. SECURE FAN MOUNTING SUPPORT TO ENGINE WITH LOCKWASHERS AND BOLTS.

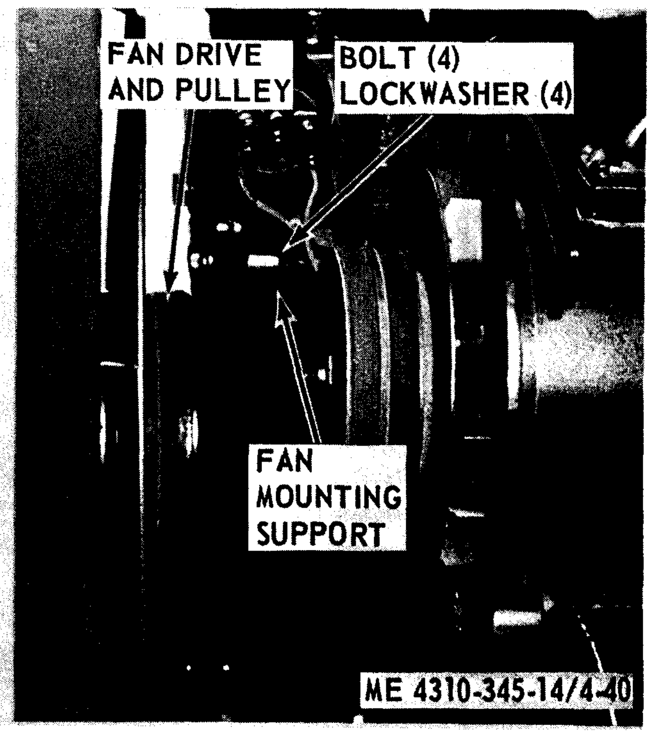
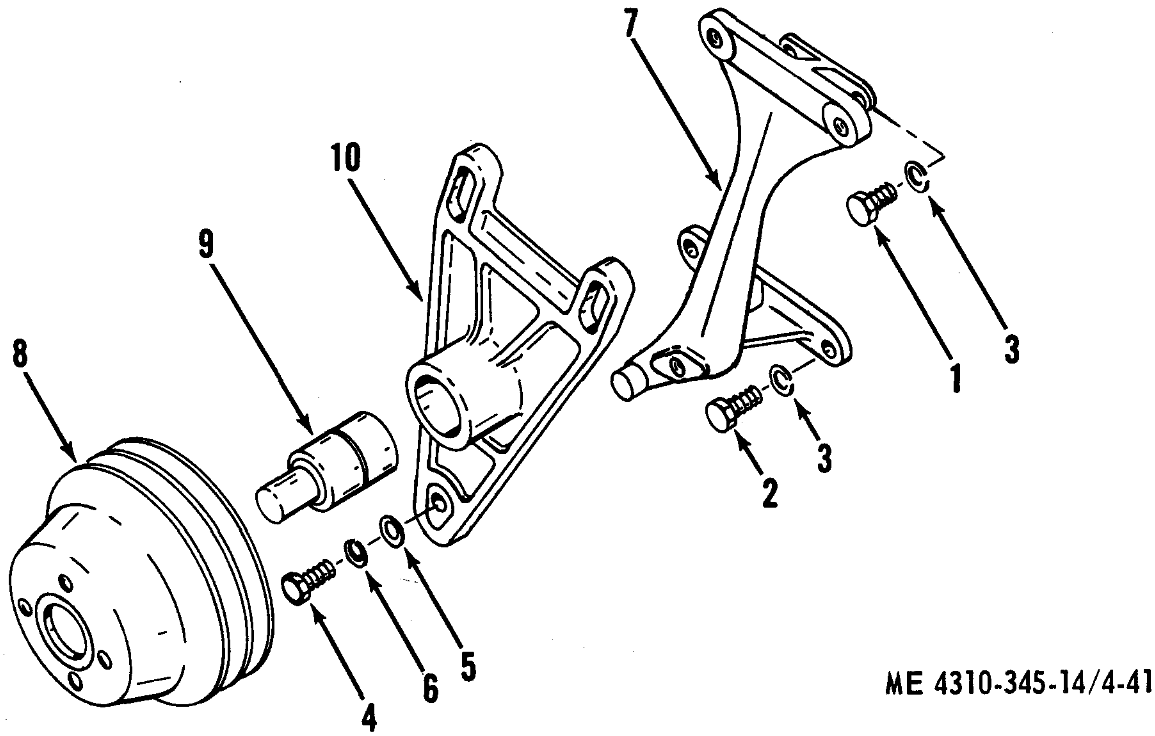


Figure 4-40. Fan drive group, removal and installation.

b. Disassembly. Disassemble fan drive group in numerical sequence shown in figure 4-41.

c. Cleaning and Inspection.

(1) Clean parts using a cleaning solvent conforming to Federal Specification P-D-680. Dry parts thoroughly.



1. Bolt (2)
2. Bolt (2)
3. Lockwasher (4)
4. Bolt (3)
5. Flat washer (3)
6. Lockwasher (3)
7. Support
8. Pulley
9. Shaft
10. Bracket

Figure 4-41. Fan drive group, disassembly and reassembly.

CAUTION

Bearings are pre-lubricated type. Do not wash the bearings. Clean by wiping with a clean lint-free cloth.

(2) Inspect bearings for excessive wear, freedom of movement, or any other defect.

(3) Inspect shaft for cracks, breaks, distortion, or any other defect.

(4) Inspect hub assembly for cracks, breaks, or any other defect.

(5) Inspect all other parts for cracks, breaks, distortion, or any other defect.

d. Reassembly. Reassemble fan drive group in reverse numerical sequence shown in figure 4-41.

e. Installation.

(1) Install fan drive group as shown in figure 4-40.

(2) Install fan and spacer (fig. 4-36).

(3) Install and adjust drive belts (fig. 4-35 and fig. 3-8).

(4) Install fan guard (fig. 4-33).

Section XIV. MAINTENANCE OF AIR COMPRESSOR SYSTEM

4-70. General

The air compressor system consists of the air cleaner, a single-stage air compressor assembly, oil separator assembly, blowdown valve assembly, minimum pressure valve, thermal bypass valve, speed control linkage, air pressure regulator, and oil filter. Free air is drawn through the air cleaner into the compressor intake control. A valve in the intake control opens and closes to allow air into the compressor stator according to the discharge air demand. When the valve is completely closed, the compressor is running unloaded. When the compressor is stopped, this same valve closes to prevent oil and air from the stator from being vented to the atmosphere. The speed control linkage is also connected to the intake control valve and moves the engine throttle to increase or decrease RPM as required to maintain the rated air output. A single-stage rotor-stator assembly develops an air output of 250 CFM at a discharge pressure of 100 PSI. The oil separator assembly contains a labyrinth and filter arrangement which separates the oil from the air before the air passes through the minimum pressure valve.

The minimum pressure valve consists of a valve, spring, and piston arrangement which maintains a minimum air pressure of approximately 55 PSI within the oil separator when the compressor is running. This minimum air pressure is necessary to produce proper oil circulation in the system and efficient air / oil separation. See figure 4-42. The valve is held closed by the piston and spring until air pressure reaches approximately 55 PSI, at which time the force of the air pressure moves the valve open and the piston upward, allowing compressed air to flow to the air discharge valves. When air pressure drops below 55 PSI, the force of the spring overcomes air pressure and moves the piston downward closing the valve. The blowdown valve automatically relieves air pressure from the system immediately after compressor shutdown. The safety valve opens automatically if the air pressure should exceed 125 PSI. The pressure regulator is connected between the oil separator and the intake-control. As the air load demand increases, the regulator controls a flow of air into the intake-control to open the valve. This action increases air input and engine speed. As the air pressure reaches the rated value, the pressure regulator causes the valve to close and the engine to return to the idle speed.

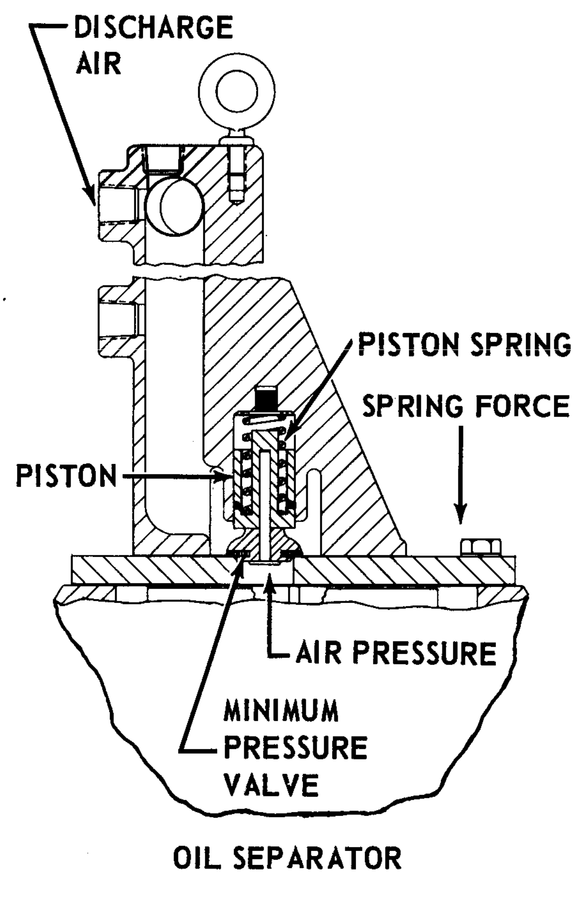


Figure 4-42. Operation of minimum pressure valve.

4-71. Compressor Air Cleaner Assembly

a. Removal. Remove compressor air cleaner assembly as shown in figure 4-29.

b. Disassembly. Disassemble compressor air cleaner assembly in numerical sequence shown in figure 4-43.

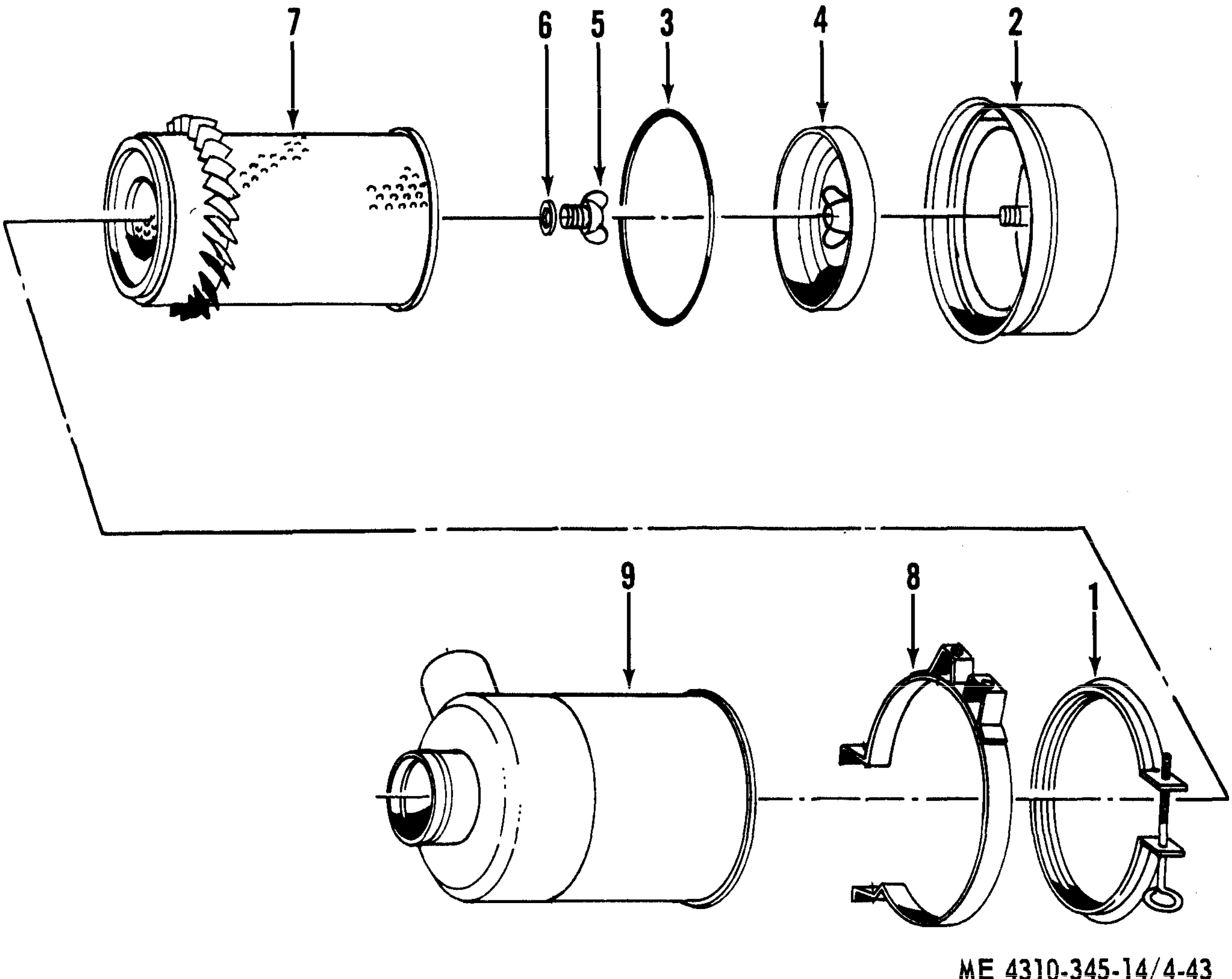
c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts using a cleaning solvent that is in accordance with Federal Specification P-D-680. Dry parts thoroughly.

(2) Clean air cleaner element as follows:

CAUTION

Compressed air used in following step should not exceed 100 PSI.



1. Clamp
2. Cup
3. Gasket
4. Baffle
5. Wing nut
6. Gasket
7. Element
8. Bracket (2)
9. Body assembly

Figure 4-43. Compressor and engine air cleaner assembly, disassembly and reassembly.

(a) Direct dry, clean compressed air to inside of element so that dust is blown outside. Move air stream up and down along pleats while slowly rotating element. Continue until no more dust is being removed. If further cleaning is required, proceed to step *(b)* below; otherwise proceed to step (3).

(b) Mix a good nonsudsing detergent with lukewarm water in a suitable container. Soak element in detergent for at least 15 minutes, then agitate element for two minutes to loosen dirt.

CAUTION

Water pressure used in following step should not exceed 40 PSI.

(c) After cleaning element with detergent, use a fresh water source and flush clean water through element from inside to outside. Continue to rinse element until water coming through to outside is clear and free from any detergent. Repeat step *(a)* above to dry element.

(3) Inspect element for dirt, rupture, pin holes, or any other defect. A good method of inspection is to place a light inside element and look toward light from outside. Any hole in element, even the smallest, will pass dust and cause unnecessary equipment wear.

(4) Inspect cap for cracks, breaks, distortion, or any other damage.

(5) Inspect hoses for cracks, breaks, deterioration, or any other defect.

(6) Inspect gaskets and O-ring for cracks, breaks, deterioration. or any other defect.

(7) Inspect body and cup for cracks, dents, distortion, or any other defect.

(8) Inspect attaching hardware, including clamps, for damaged threads, distortion, cracks, or any other defect.

d. Reassembly. Reassemble compressor air cleaner in reverse numerical sequence shown in figure 4-43.

e. installation. Install compressor air cleaner as shown in figure 4-29.

4-72. Air Discharge Connections, Service Valves, and Piping

a. Removal. Remove air discharge connections, service valves, and piping as shown in figure 4-44.

REMOVAL

STEP 1. UNSCREW AND REMOVE GLOBE VALVE AND NIPPLE.

STEP 2. UNSCREW AND REMOVE NIPPLES AND SERVICE VALVES.

STEP 3. UNSCREW AND REMOVE ELBOW AND NIPPLE FROM MINIMUM PRESSURE VALVE HOUSING.

INSTALLATION

STEP 1. INSTALL 7 INCH LG. NIPPLE AND ELBOW ON MINIMUM PRESSURE VALVE HOUSING.

STEP 2. INSTALL CLOSE NIPPLES, SERVICE VALVES, AND 3 INCH LG. NIPPLES.

STEP 3. INSTALL 4 INCH LG. NIPPLE AND GLOBE VALVE.

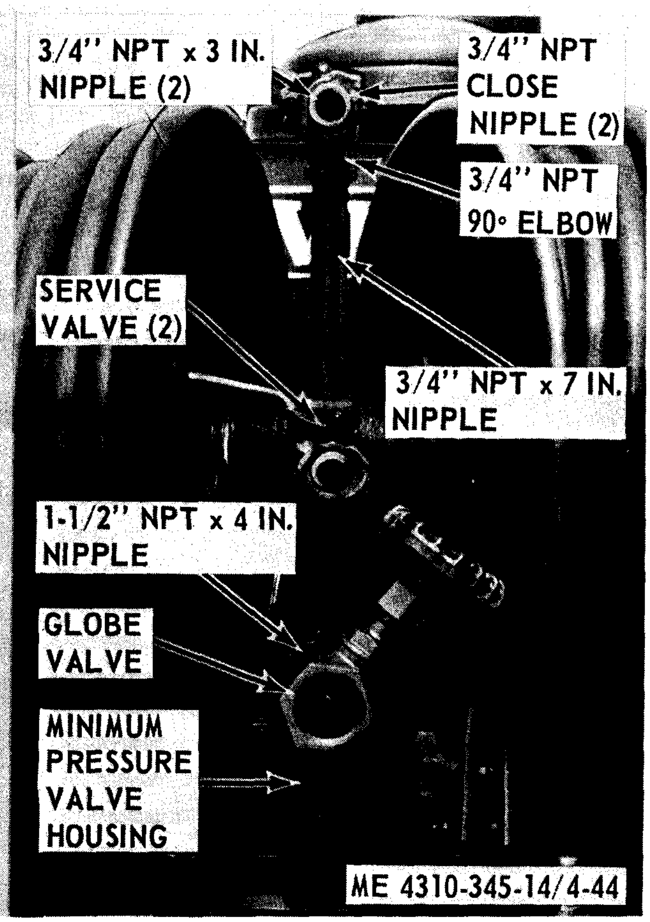


Figure 4-44. Air discharge connections, service valves, and piping, removal and installation.

b. Cleaning and Inspection.

(1) Clean all parts using a cleaning solvent conforming to Federal Specification P-D-680. Dry parts thoroughly.

(2) Check valves for proper operation. Inspect valves for cracks, breaks, or any other defect.

(3) Inspect all threaded areas for cross-threading, nicks, cracks, breaks, distortion, or any other defect.

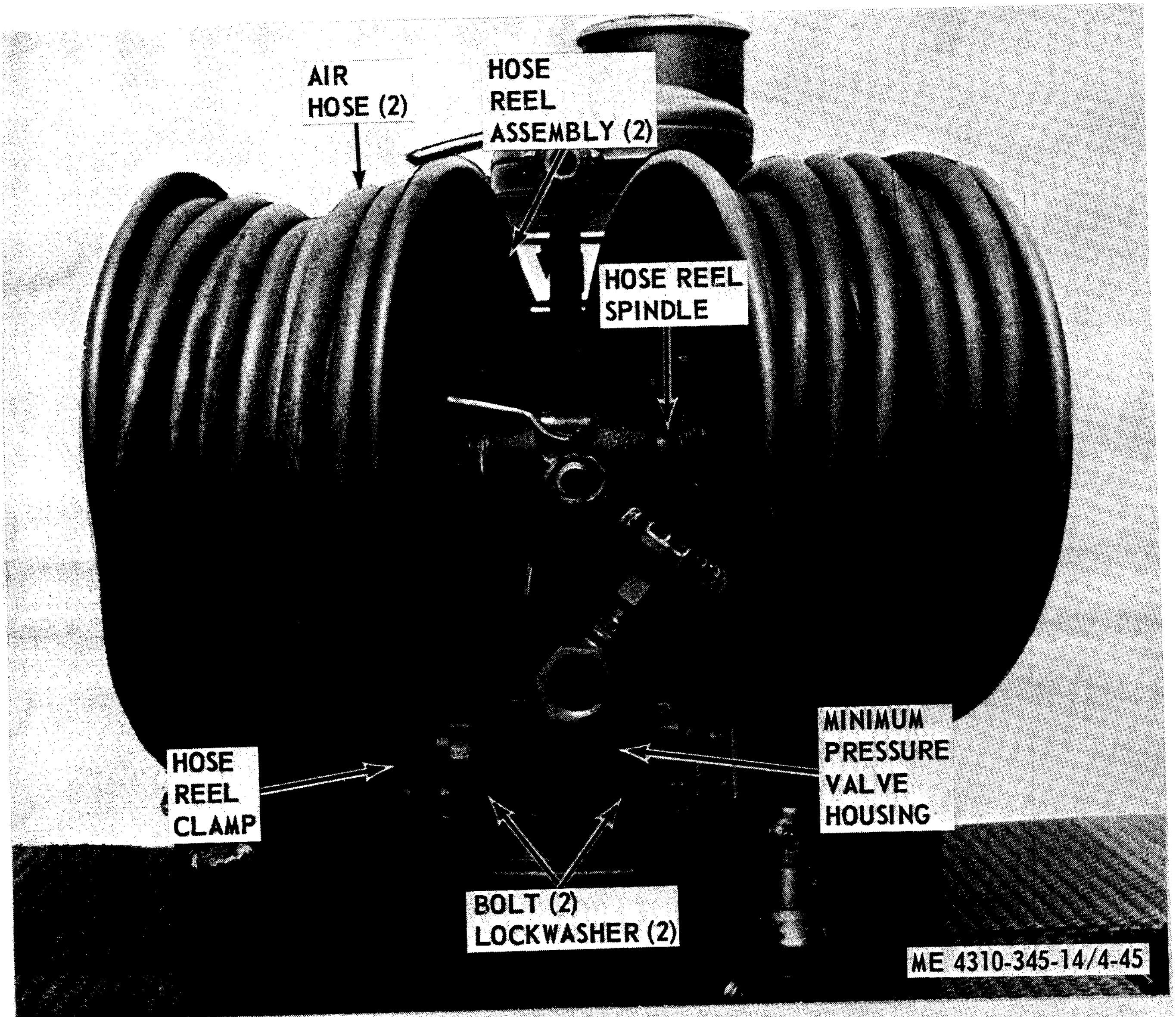
c. Installation. Install air discharge connections, service valves, and piping as shown in figure 4-44.

4-73. Hose Reel Assemblies and Clamps

a. Removal.

(1) Remove air hoses from hose reel assemblies.

(2) Remove hose reel clamps and hose reel assemblies as shown in figure 4-45.



REMOVAL

STEP 1. LOOSEN KNOB ON HOSE REEL CLAMPS FREEING HOSE REELS.

STEP 2. REMOVE BOLTS AND LOCKWASHERS SECURING CLAMPS. REMOVE HOSE REEL CLAMPS.

STEP 3. USING A WRENCH ON HOSE REEL SPINDLE, UNSCREW SPINDLE AND REMOVE HOSE REEL ASSEMBLY FROM MINIMUM PRESSURE VALVE HOUSING.

INSTALLATION

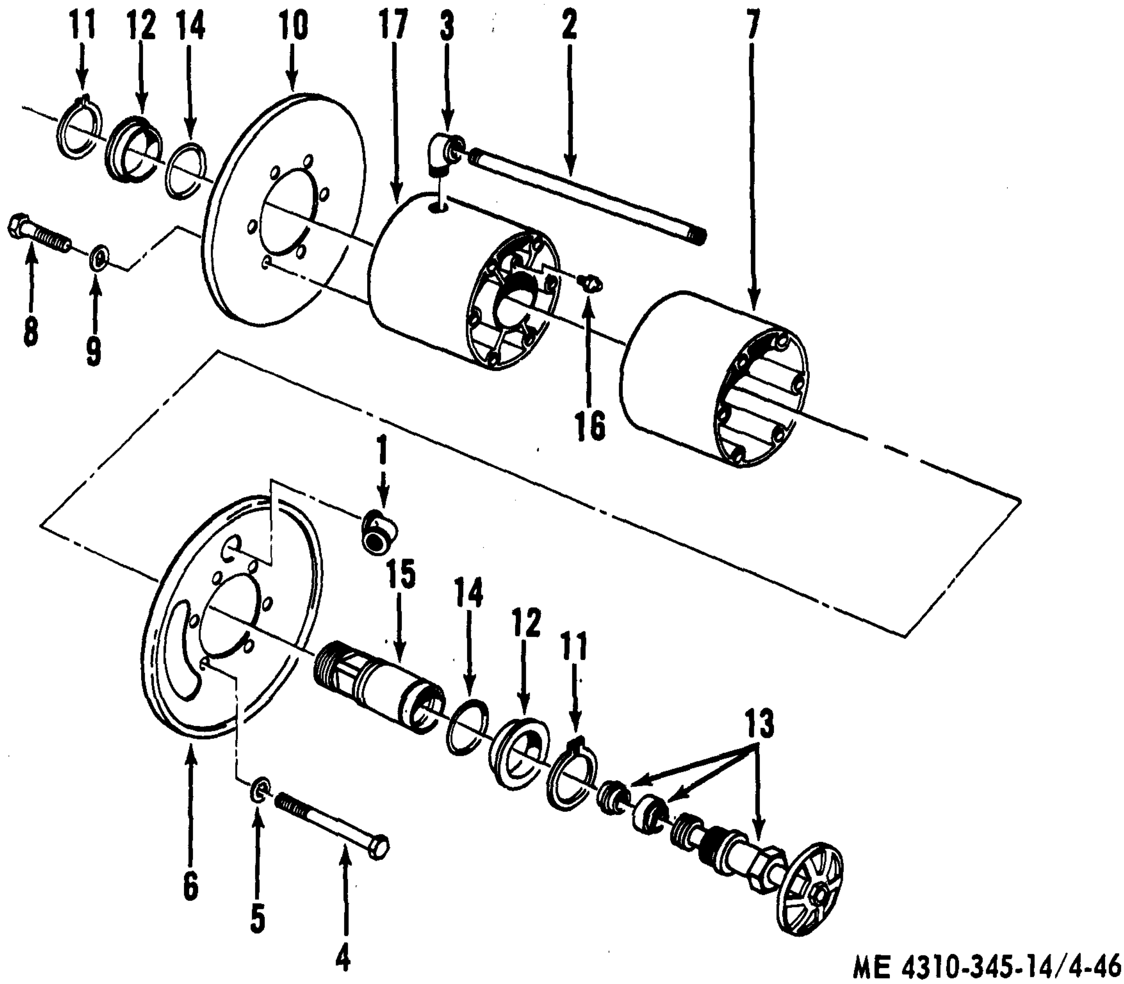
STEP 1. INSTALL HOSE REEL ASSEMBLY ON MINIMUM PRESSURE VALVE HOUSING. USE A WRENCH ON HOSE REEL SPINDLE TO SECURE ASSEMBLY.

STEP 2. INSTALL HOSE REEL CLAMPS. SECURE WITH BOLTS AND LOCKWASHERS.

STEP 3. TIGHTEN KNOB ON HOSE REEL CLAMPS TO SECURE HOSE REELS.

Figure 4-45. Hose reel assemblies and clamps, removal and installation.

b. Disassembly. Disassemble hose reel assemblies in numerical sequence shown in figure 4-46.



1. Pipe elbow
2. Pipe nipple
3. Street elbow
4. Bolt (6)
5. Lockwasher (6)
6. Hose reel end
7. Body extender
8. Bolt (6)
9. Lockwasher (6)
10. Hose reel end
11. Retaining ring (2)
12. Retaining plate (2)
13. Air valve assembly
14. O-Ring (2)
15. Spindle
16. Fitting
17. Body

Figure 4-46. Hose reel assemblies, disassembly and reassembly.

c. Cleaning and Inspection.

(1) Clean all metal parts using a cleaning solvent conforming to Federal Specification P-D-680. Dry parts thoroughly.

(2) Check air valve assembly for proper operation and seating. Inspect valve assembly for cracks, breaks, damaged threads, or any other defect.

(3) Inspect all threaded parts for damaged threads, cracks, breaks, or any other defect.

(4) Inspect O-rings for cuts, breaks, or distortion, or any other defect.

(5) Inspect all parts for dents, cracks, breaks, distortion, or any other defect.

d. Reassembly. Reassemble hose reel assemblies in reverse numerical sequence shown in figure 4-46.

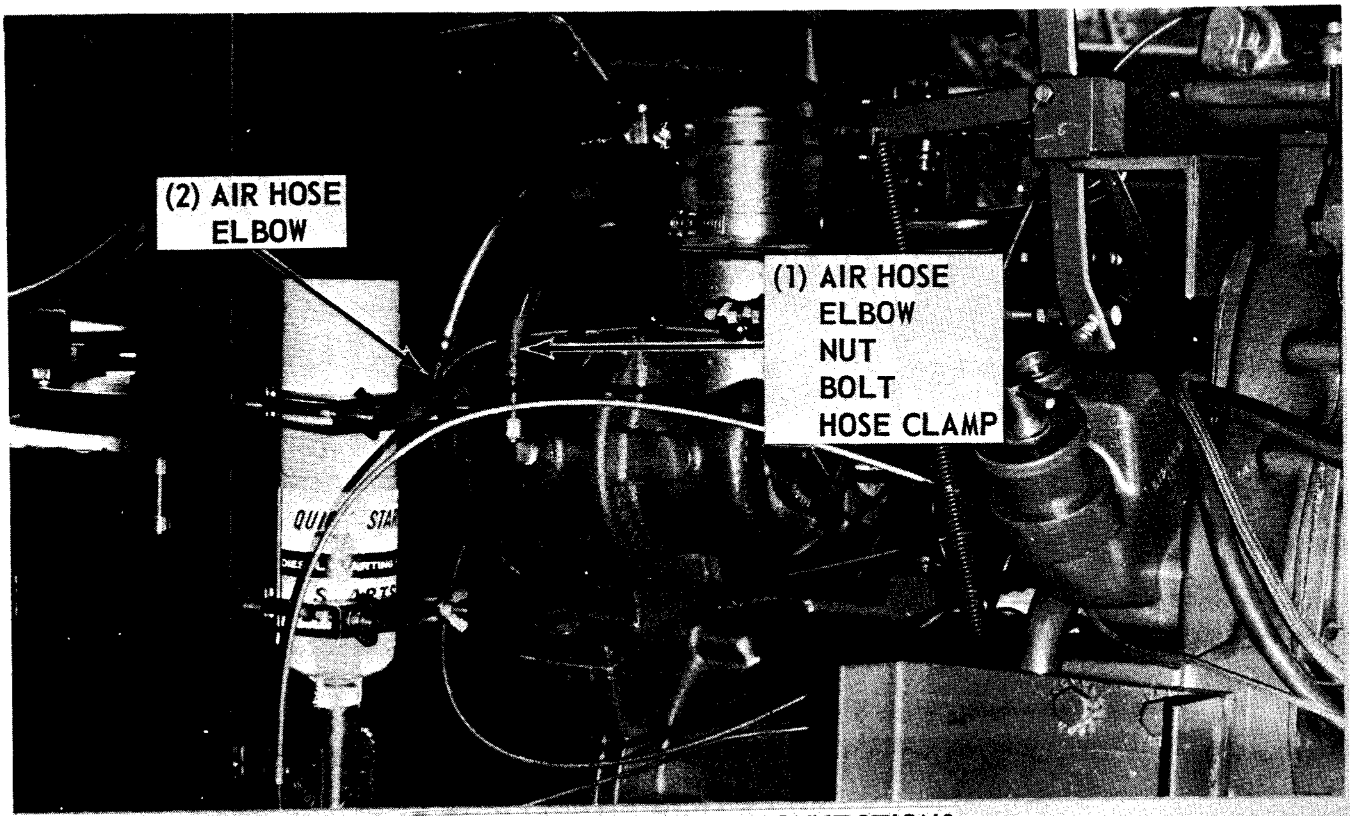
e. Installation.

(1) Install hose reel assemblies and clamps as shown in figure 4-45.

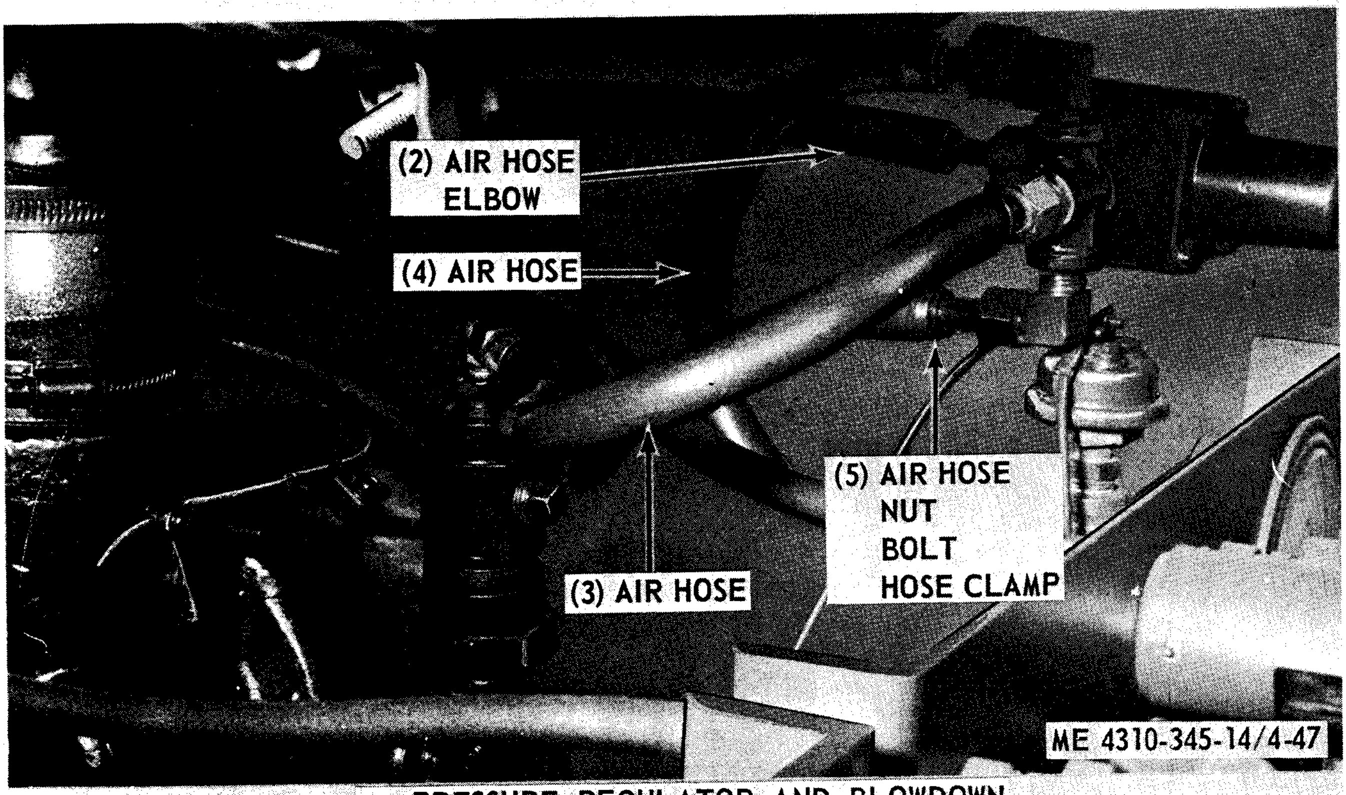
(2) Install air hoses on hose reel assemblies.

4-74. Air Hoses and Fittings

a. Removal. Remove air hoses and fittings by following numerical sequence shown in figure 4-47.



A COMPRESSOR HOSE CONNECTIONS



B PRESSURE REGULATOR AND BLOWDOWN VALVE HOSE CONNECTIONS

Figure 4-47. Air hoses and fittings, removal and installation.

b. Cleaning and Inspection.

(1) Clean all metal parts using a cleaning solvent conforming to Federal Specification P-D-680. Clean hoses using a clean cloth soaked in solvent. Dry parts thoroughly.

(2) Inspect all hoses for cracks, breaks, deterioration, or any other damage.

(3) Inspect all fittings for damaged threads, cracks, distortion, or any other defect.

(4) Inspect attaching hardware for damaged threads, cracks, distortion, or any other defect.

c. Installation. Install air hoses and fittings by following reverse numerical sequence shown in figure 4-47.

4-75. Minimum Pressure Valve Assembly

a. Removal and *Disassembly.*

(1) Remove air hose assemblies from minimum pressure valve assembly (fig. 4-47).

(2) Remove hose reel assemblies (fig. 4-45).

CAUTION

Make certain that all air is discharged from oil separator assembly before attempting to replace minimum pressure valve assembly.

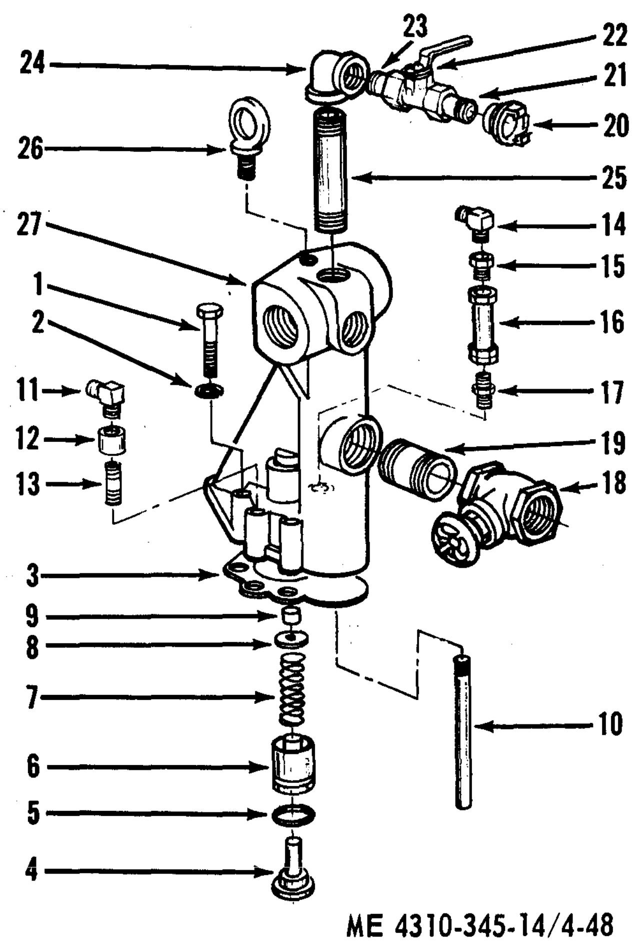
(3) Remove and disassemble minimum pressure valve assembly in numerical sequence shown in figure 4-48.

b. Cleaning, Inspection, and Repair.

(1) Clean all metal parts using a cleaning solvent conforming to Federal Specification P-D-680. Dry parts thoroughly. Discard gasket and O-ring.

(2) Inspect spring for defective coils, cracks, distortion, or any other defect.

(3) Inspect non-return valve for condition of washer facing, cracks, distortion, or any other defect.



1. Bolt (4)	10. Pipe	19. Pipe nipple
2. Lockwasher (4)	11. Elbow	20. Coupling (2)
3. Gasket	12. Coupling	21. Pipe nipple (2)
4. Non-return valve	13. Pipe nipple	22. Service valve (2)
5. O-Ring	14. Elbow	23. Close nipple (2)
6. Piston	15. Orifice	24. Elbow
7. Spring	16. Filter	25. Pipe nipple
8. Washer	17. Nipple	26. Eyebolt
9. Felt	18. Globe valve	27. Housing

Figure 4-48. Minimum pressure valve assembly, disassembly and reassembly.

(4) Inspect attaching hardware and all other parts for cracks, breaks, distortion, damaged threads, or any other defect.

c. Reassembly and Installation.

(1) Reassemble minimum pressure valve in reverse numerical sequence shown in figure 4-48. Install new O-ring and gasket.

(2) Install hose reel assemblies (fig. 4-45).

(3) Install air hose assemblies on minimum pressure valve assembly (fig. 4-47).

4-76. Safety Valve

CAUTION

Make certain that all air pressure is discharged from oil separator before attempting to remove safety valve.

a. Removal. Remove safety valve as shown in figure 4-49.

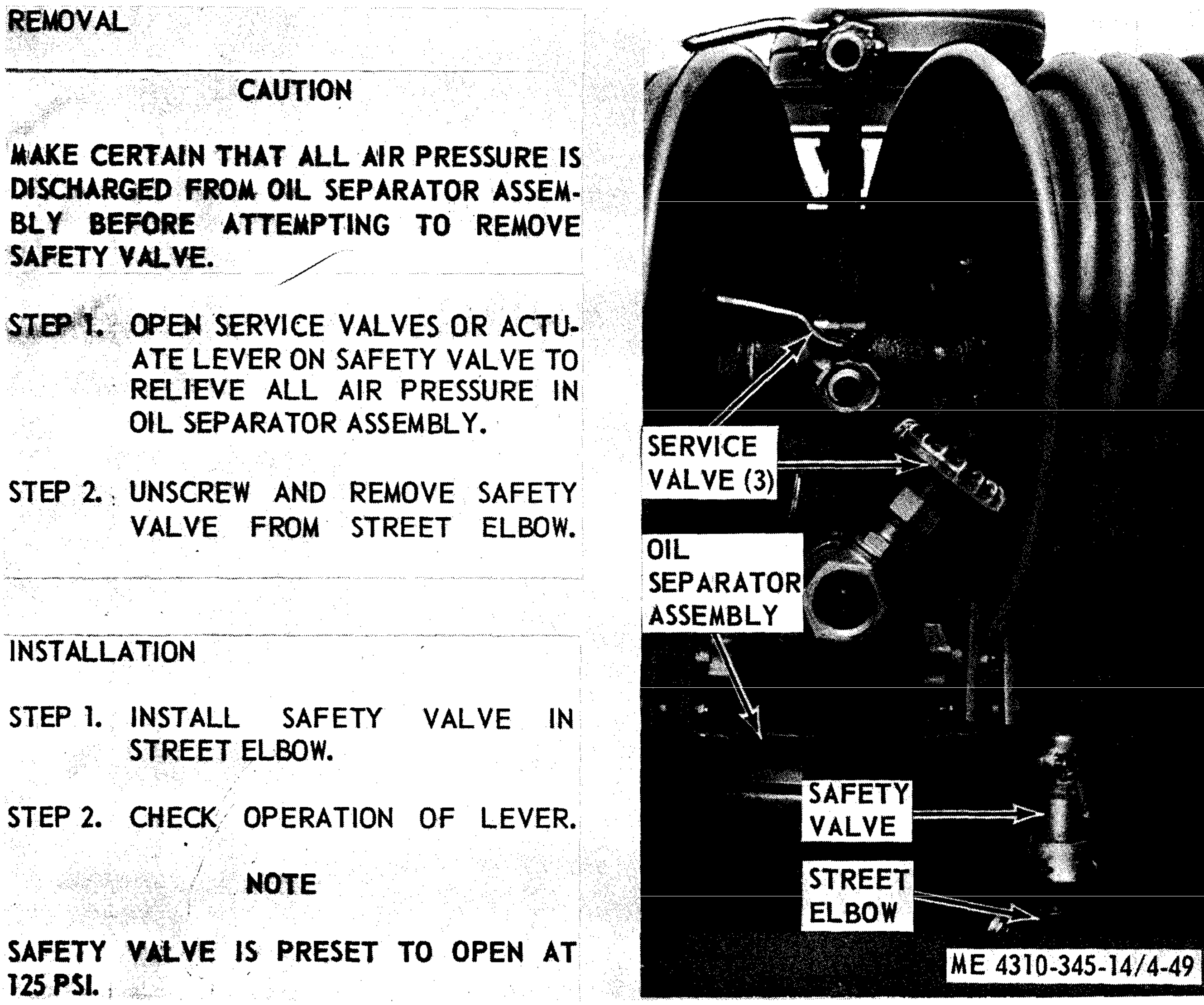


Figure 4-49. Safety valve, removal and installation.

b. Cleaning and Inspection.

(1) Clean safety valve using a cleaning solvent conforming to Federal Specification P-D-680. Dry thoroughly.

(2) Check lever operation. Inspect valve for cracks, breaks, distortion, damaged threads, or any other defect.

c. Installation. Install safety valve as shown in figure 4-49.

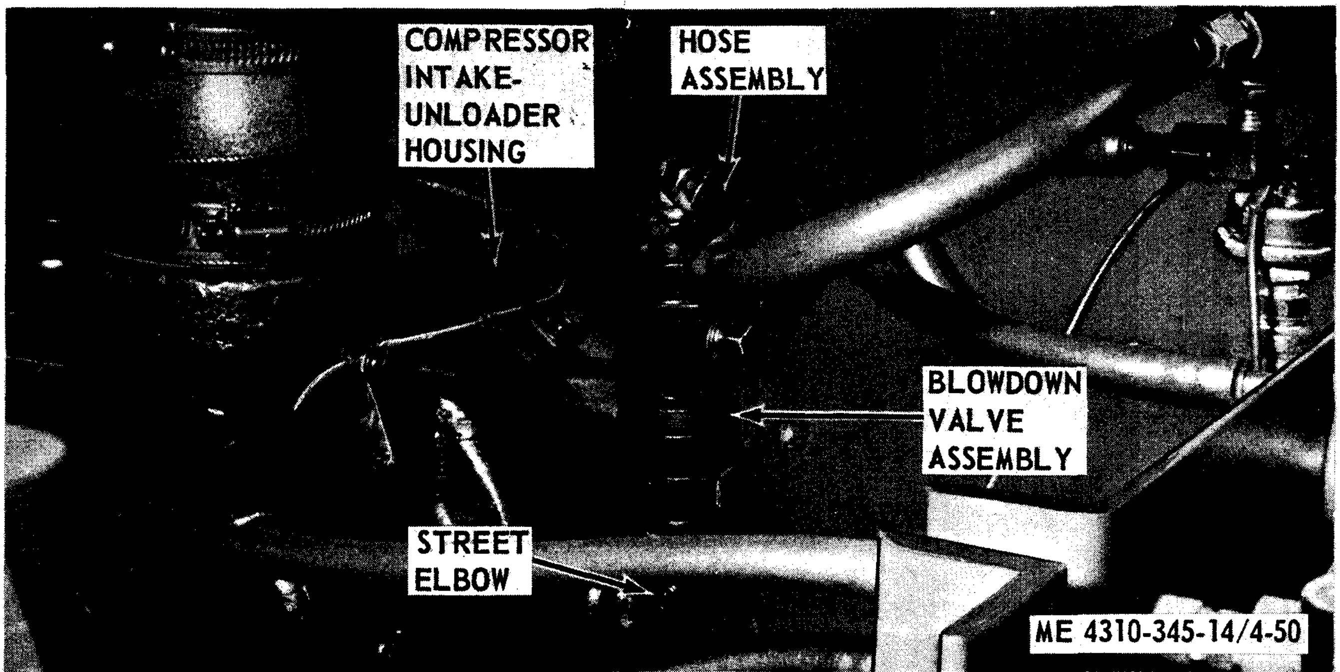
4-77. Blowdown Valve Assembly

CAUTION

Make certain that all air pressure is discharged from oil separator assembly before attempting to remove blowdown **valve** assembly.

a. Removal. Remove blowdown valve assembly as shown in figure 4-50.

b. Disassembly. Disassemble blowdown valve assembly in numerical sequence shown in figure 4-51.



REMOVAL

CAUTION

MAKE CERTAIN THAT ALL AIR PRESSURE IS DISCHARGED FROM OIL SEPARATOR ASSEMBLY BEFORE ATTEMPTING TO REMOVE BLOWDOWN VALVE ASSEMBLY.

STEP 1. OPEN SERVICE VALVES OR ACTUATE LEVER ON SAFETY VALVE TO RELIEVE ALL AIR PRESSURE FROM OIL SEPARATOR ASSEMBLY.

STEP 2. DISCONNECT HOSE ASSEMBLY AT BLOWDOWN VALVE ELBOW.

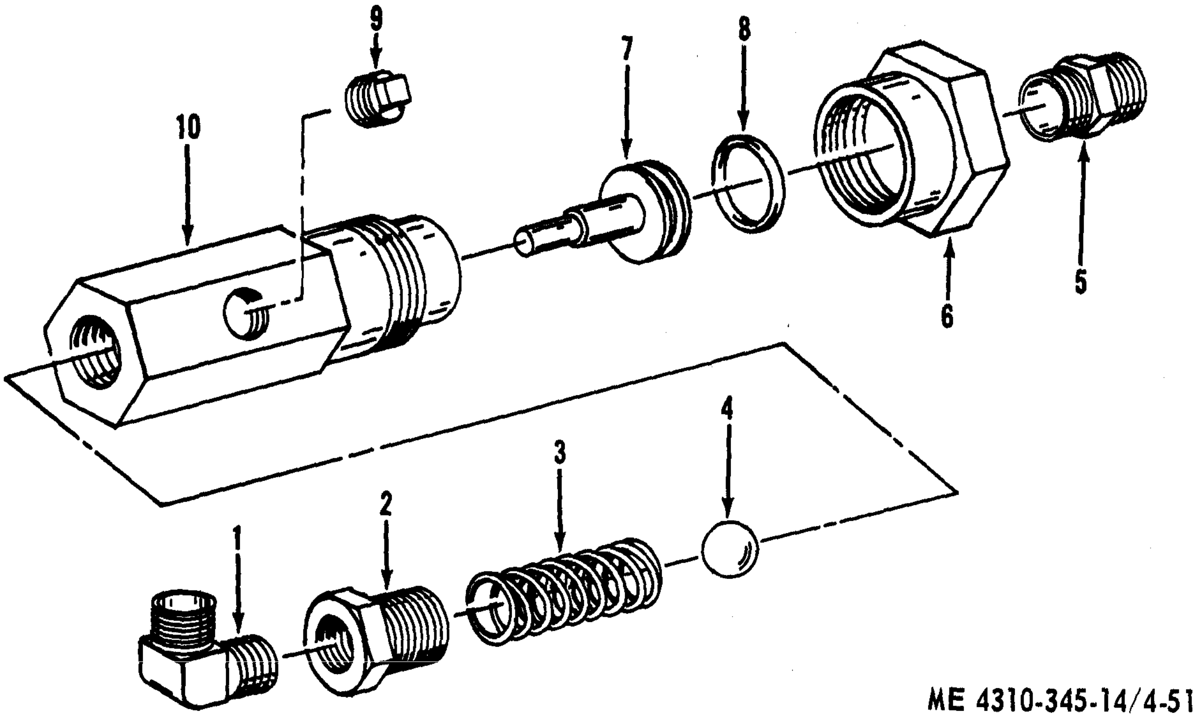
STEP 3. UNSCREW BLOWDOWN VALVE ASSEMBLY, WITH FITTING, FROM STREET ELBOW IN THE SIDE OF COMPRESSOR INTAKE-UNLOADER HOUSING. REMOVE BLOWDOWN VALVE ASSEMBLY AND FITTINGS.

INSTALLATION

STEP 1. INSTALL BLOWDOWN VALVE ASSEMBLY WITH FITTINGS IN STREET ELBOW.

STEP 2. CONNECT HOSE ASSEMBLY AT BLOWDOWN VALVE ELBOW.

Figure 4-50. Blowdown valve assembly, removal and installation.



1. Elbow
2. Bushing
3. Spring
4. Ball
5. Connector
6. Cap
7. Piston
8. O-Ring
9. Plug
10. Body

Figure 4-51. Blowdown valve assembly, disassembly and reassembly.

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts using a cleaning solvent conforming to Federal Specification P-D-680. Dry parts thoroughly. Discard O-ring.

(2) Inspect spring for defective coils, cracks, distortion, or any other defect.

(3) Inspect ball for scoring, roughness, cracks, or any other defect.

(4) Inspect fittings, bushings, and all other parts for cracks, breaks, damaged threads, or any other defect.

d. Reassembly. Reassemble blowdown valve assembly in reverse numerical sequence shown in figure 4-51. Install a new O-ring.

e. Installation. Install blowdown valve assembly as shown in figure 4-50.

4-78. Thermal Bypass Valve Assembly

a. Removal. Remove thermal bypass valve assembly as shown in figure 4-52.

REMOVAL

STEP 1. REMOVE COMPRESSOR OIL TEMPERATURE SENSING BULB.

STEP 2. DISCONNECT OIL LINES.

STEP 3. REMOVE SOCKET HEAD CAPSCREWS AND LOCKWASHERS. REMOVE THERMAL BYPASS VALVE ASSEMBLY. DISCARD GASKET.

INSTALLATION

STEP 1. INSTALL NEW GASKET; POSITION THERMAL BYPASS VALVE ASSEMBLY AND SECURE TO COMPRESSOR WITH LOCKWASHERS AND SOCKET HEAD CAPSCREWS.

STEP 2. CONNECT OIL LINES.

STEP 3. INSTALL COMPRESSOR OIL TEMPERATURE SENSING BULB.

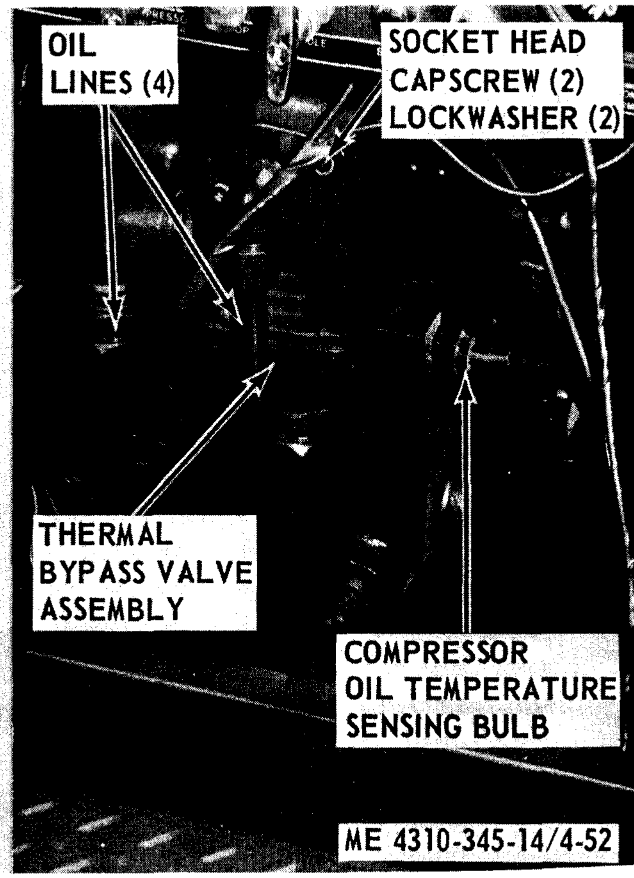
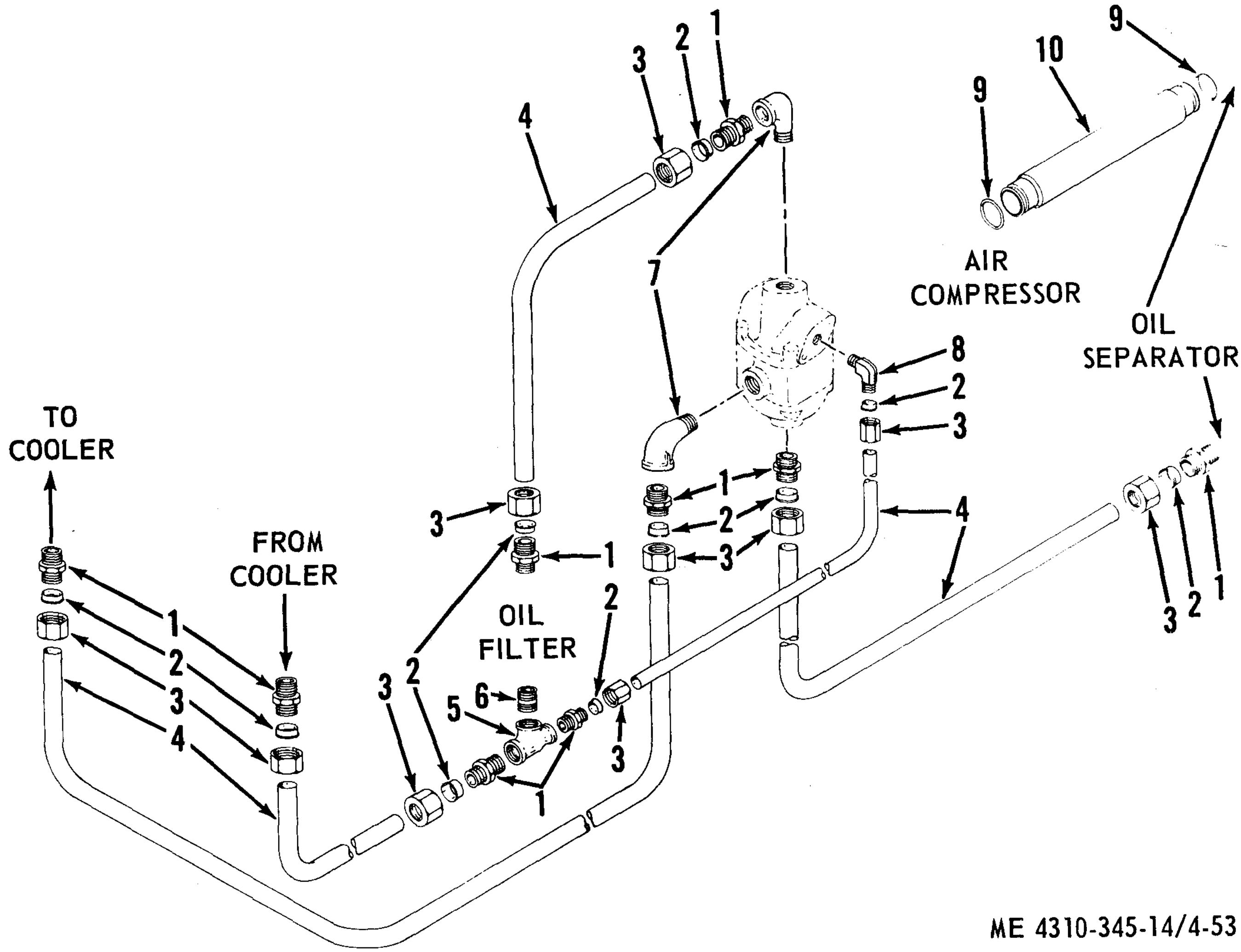


Figure 4-52. Thermal bypass valve assembly, removal and installation.

b. Installation. Install thermal bypass valve assembly as shown in figure 4-52.

4-79. Compressor Oil Lines and Fittings

a. Removal. Remove compressor oil lines and fittings as shown in figure 4-53.



1. Connector (9)
2. Sleeve (10)
3. Nut (10)
4. Tubing (5)
5. Reducing tee
6. Close nipple
7. Street elbow (2)
8. Elbow
9. O-Ring (2)
10. Tube

Figure 4-53. Compressor oil lines and fittings, removal and installation.

b. Cleaning and Inspection.

(1) Clean all parts using a cleaning solvent conforming to Federal Specification P-D-680. Dry parts thoroughly. Discard O-rings.

(2) Inspect oil tubes for cracks, breaks, distortion, or any other defect.

(3) Inspect all fittings for cracks, damaged threads, distortion, or any other defect.

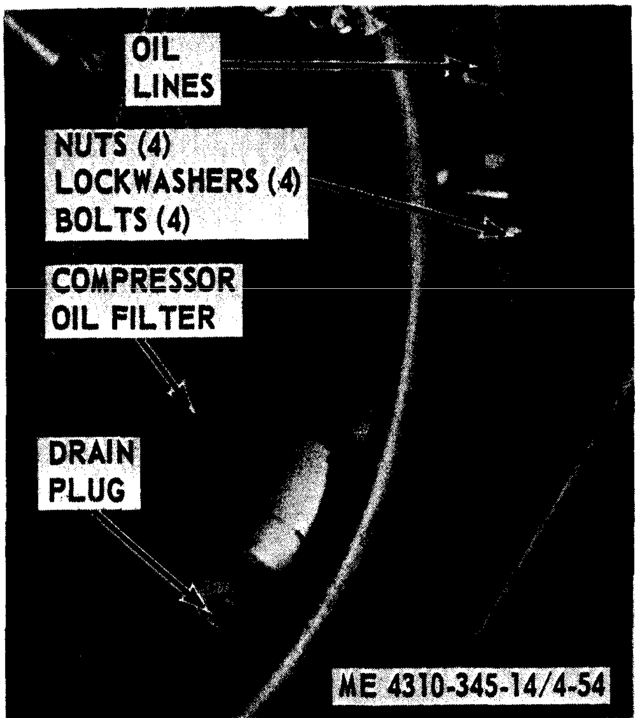
c. Installation. Install compressor oil lines and fittings as shown in figure 4-53. Install new O-rings.

4-80. Compressor Oil Filter

a. Removal.

(1) Place a container of approximately three quart capacity under compressor oil filter and drain all oil from filter.

(2) Remove oil filter assembly as shown in figure 4-54.



REMOVAL

STEP 1. LOOSEN DRAIN PLUG AND DRAIN OIL. REMOVE OIL LINES FROM FILTER ASSEMBLY (REFER TO FIGURE 4-53).

STEP 2. REMOVE NUTS, LOCKWASHERS, AND BOLTS. REMOVE OIL FILTER ASSEMBLY.

INSTALLATION

STEP 1. INSTALL OIL FILTER ASSEMBLY AND SECURE WITH BOLTS, LOCKWASHERS, AND NUTS.

STEP 2. INSTALL OIL LINES TO FILTER. (REFER TO FIGURE 4-53.) TIGHTEN DRAIN PLUG. AFTER UNIT HAS BEEN RUN FOR SHORT WARMUP PERIOD, SHUT DOWN AND CHECK OIL LEVEL IN OIL SEPARATOR. REPLENISH OIL AS NECESSARY. REFER TO LO5-4310-345-12.

Figure 4-54. Compressor oil filter assembly, removal and installation.

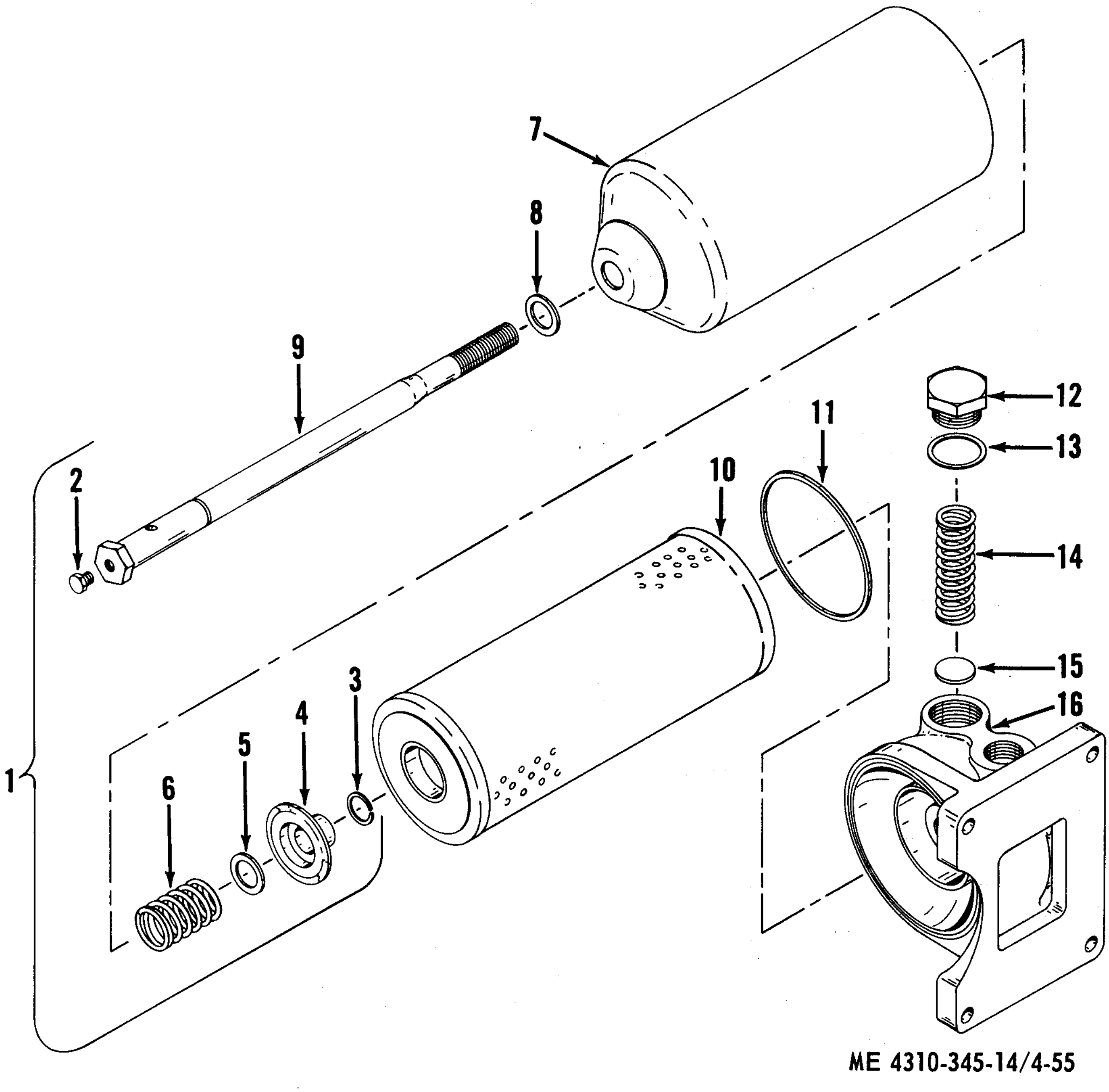
b. Disassembly. Disassemble compressor oil filter assembly in numerical sequence shown in figure 4-55.

c. Cleaning and Inspection.

(4) Clean all metal parts using a cleaning solvent conforming to Federal Specification P-D-680. Dry parts thoroughly. Discard gaskets and element.

(2) Inspect all parts for cracks, breaks, distortion, damaged threads, or any other defect.

(3) Inspect attaching hardware for cracks, breaks, damaged threads, or any other defect.



1. Shell assembly
2. Plug
3. Retaining ring
4. Retainer
5. Gasket
6. Spring
7. Shell
8. Washer
9. Center stud
10. Element
11. Gasket
12. Bypass plug
13. Gasket
14. Spring
15. Valve
16. Base

Figure 4-55. Compressor oil filter assembly, disassembly and reassembly.

d. Reassembly. Reassemble compressor oil filter assembly in reverse numerical sequence shown in figure 4-55. Install new gaskets and element.

e. Installation. Install compressor oil filter assembly as shown in figure 4-54.

4-81. General

The rotary air compressor unit fuel system consists of a fuel tank, suction and return fuel hose assemblies, primary fuel filter with check valve, fuel pump, secondary fuel filter. and fuel injectors. A restricted fitting is located in the cylinder head fuel return manifold outlet to maintain pressure in the fuel system. The check valve installed on the inlet side of the primary fuel filter prevents fuel from draining back to the fuel tank when engine is shut down. The fuel tank is equipped with an electrical fuel level sending unit connected to the fuel level gage on the instrument panel by means of a wiring harness. A fuel pressure safety switch is mounted on the secondary fuel filter. A fuel pressure hose assembly is connected to the secondary fuel filter and fuel pressure gage on the instrument panel.

4-82. Fuel Lines and Fittings

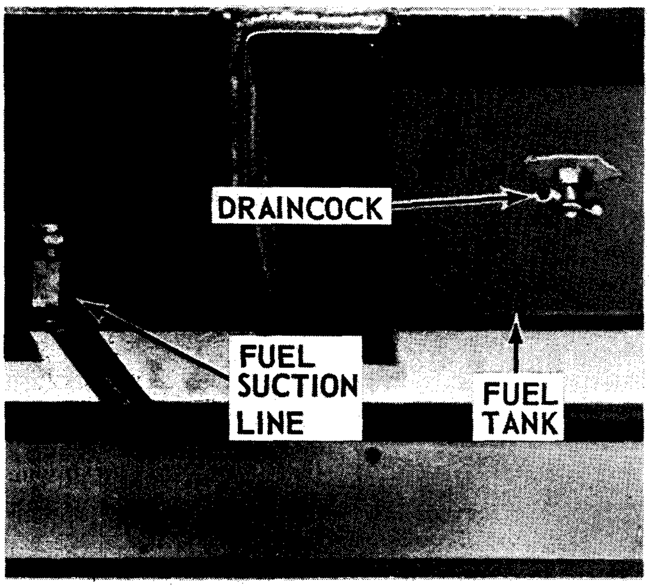
WARNING

Use extreme care when handling fuel. Do not allow an open flame or smoking near fuel.

a. Removal.

(1) Drain fuel from fuel tank.

(2) Remove fuel lines and fittings as shown in figure 4-56.



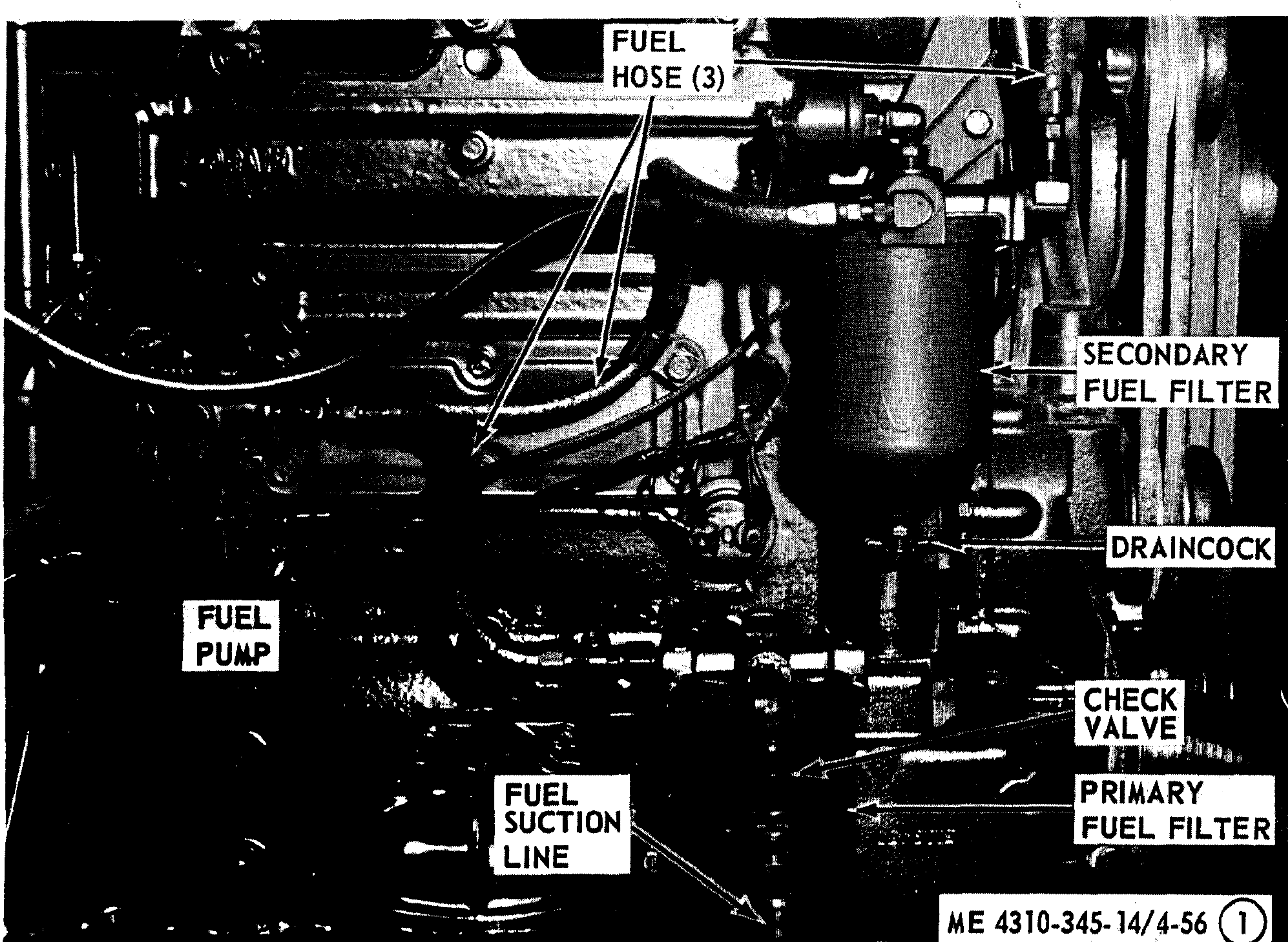
A FUEL TANK DRAIN AND SUCTION LINE

REMOVAL

STEP 1. OPEN DRAINCOCK TO DRAIN FUEL FROM TANK.

STEP 2. DISCONNECT FUEL SUCTION LINE FROM BOTTOM OF FUEL TANK AND PRIMARY FUEL FILTER CHECK VALVE. REMOVE HOSE CLIPS AS NECESSARY; REMOVE FUEL SUCTION HOSE.

STEP 3. DISCONNECT FUEL HOSES BETWEEN THE TWO FUEL FILTERS AND FUEL PUMP. DISCONNECT FUEL HOSE BETWEEN SECONDARY FUEL FILTER AND CYLINDER HEAD. REMOVE HOSE CLIPS AS NECESSARY AND THE FUEL HOSES.



B FUEL FILTERS, PUMP, AND HOSES

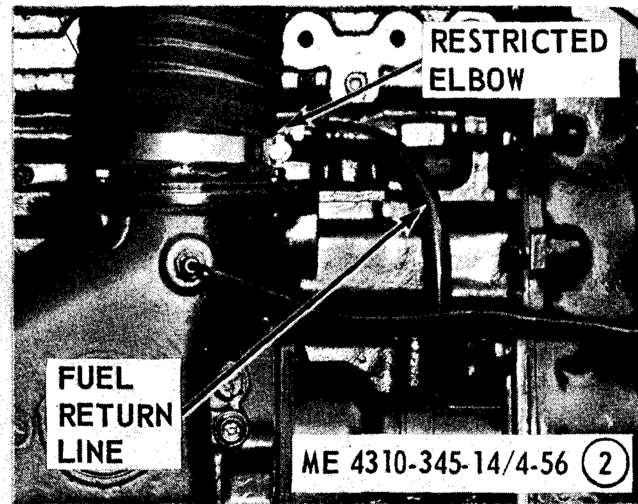
Figure 4-56. Fuel lines and fittings, removal and installation (sheet 1 of 2).

STEP 4. DISCONNECT FUEL RETURN LINE FROM RESTRICTED ELBOW AND TOP OF FUEL TANK. REMOVE HOSE CLIPS AS NECESSARY AND THE RESTRICTED ELBOW.

INSTALLATION

STEP 1. INSTALL RESTRICTED ELBOW IN FUEL RETURN GALLERY OF CYLINDER HEAD. CONNECT FUEL RETURN LINE BETWEEN RESTRICTED ELBOW AND TOP OF FUEL TANK. INSTALL HOSE CLIPS AS NECESSARY.

STEP 2. INSTALL FUEL HOSE BETWEEN SECONDARY FUEL FILTER AND FUEL GALLERY IN CYLINDER HEAD. INSTALL FUEL HOSES BETWEEN THE TWO FUEL FILTERS AND THE FUEL PUMP. INSTALL HOSE CLIPS AS NECESSARY.



C FUEL RETURN HOSE

STEP 3. INSTALL FUEL SUCTION HOSE BETWEEN PRIMARY FUEL FILTER CHECK VALVE AND BOTTOM OF FUEL TANK. INSTALL HOSE CLIPS AS NECESSARY.

STEP 4. CLOSE FUEL TANK DRAINCOCK AND REPLENISH FUEL SUPPLY.

Figure 4-56. Fuel lines and fittings, removal and installation (sheet 2 of 2).

b. Cleaning and Inspection.

(1) Clean all metal parts and fitting using a cleaning solvent conforming to Federal Specification P-D-680. Wipe fuel hoses clean using a clean cloth soaked with solvent. Dry all parts thoroughly.

(2) Inspect fittings for cracks, breaks, damaged threads, or any other defect. Inspect fuel hoses for cracks, deterioration, kinks, or any other defect.

(3) Inspect attaching hardware for cracks, breaks, distortion, damaged threads, or any defect.

c. Installation.

(1) Install fuel lines and fittings as shown in figure 4-56.

(2) Replenish fuel supply in fuel tank and check lines for leaks.

4-83. Primary Fuel Filter Assembly

a. Removal.

(1) Open draincock and drain fuel from primary fuel filter assembly.

(2) Remove fuel lines from primary filter inlet and outlet ports (para 4-82).

(3) Remove primary fuel filter assembly as shown in figure 4-57.

NOTE

When removing fuel hose assembly from engine, elevate disconnected end to prevent fuel draining from tank.

REMOVAL

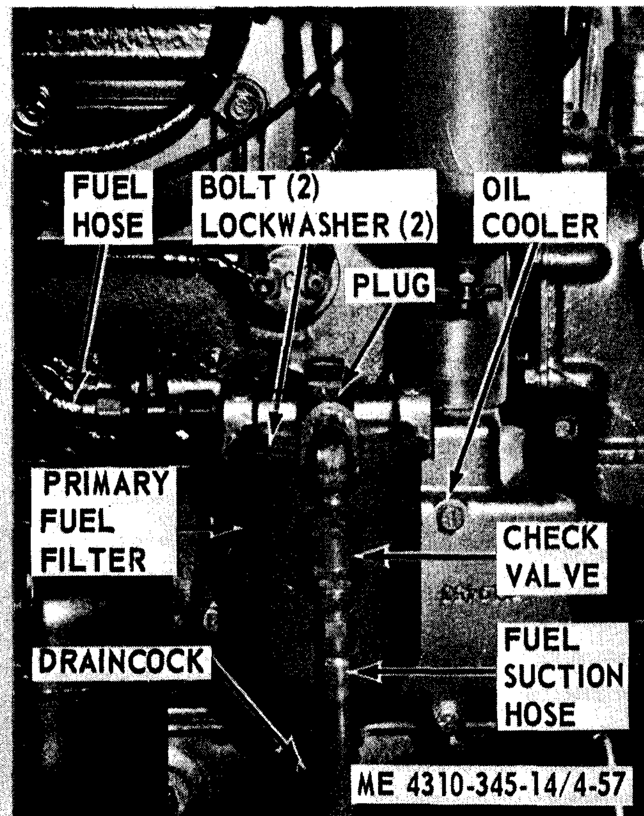
STEP 1. OPEN DRAINCOCK AND DRAIN FUEL FROM PRIMARY FUEL FILTER.

STEP 2. DISCONNECT FUEL SUCTION HOSE, REMOVE CHECK VALVE, AND DISCONNECT FUEL HOSE.

STEP 3. REMOVE BOLTS AND LOCKWASHERS SECURING FILTER ASSEMBLY TO OIL COOLER. REMOVE PRIMARY FUEL FILTER.

INSTALLATION

STEP 1. INSTALL FILTER ASSEMBLY IN POSITION ON OIL COOLER AND SECURE WITH LOCKWASHERS AND BOLTS.



STEP 2. CONNECT FUEL HOSE TO FILTER, INSTALL CHECK VALVE TO FILTER INLET, AND CONNECT FUEL SUCTION HOSE.

STEP 3. CLOSE DRAINCOCK. REMOVE PLUG FROM TOP OF FILTER AND FILL THE FILTER ASSEMBLY WITH CLEAN FUEL. INSTALL PLUG.

Figure 4-57. Primary fuel filter assembly, removal and installation.

b. Disassembly. Disassemble the primary fuel filter assembly in numerical sequence shown in figure 4-58. Discard gaskets and element.

c. cleaning, Inspection, and Repair.

(1) Clean all metal parts using a cleaning solvent conforming to Federal Specification P-D-680. Dry parts thoroughly.

(2) Inspect all parts for cracks, breaks, distortion, damaged threads, or any other defect.

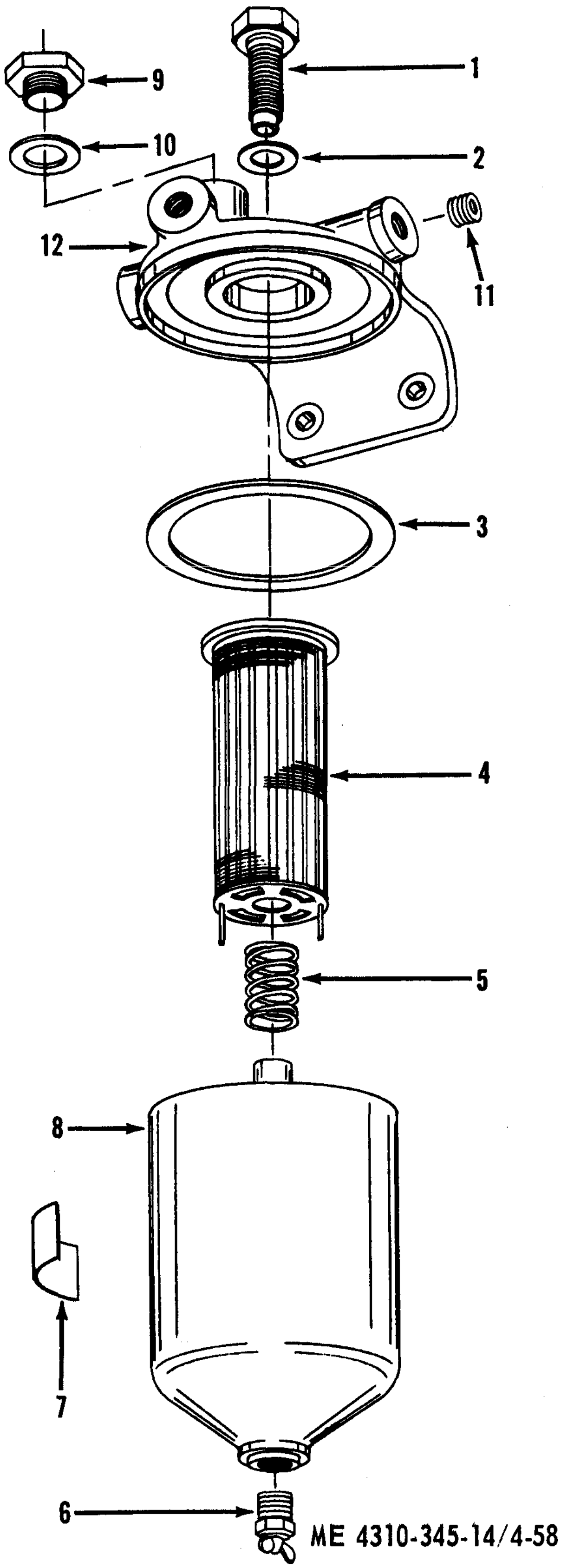


Figure 4-58. Primary fuel filter assembly, disassembly and reassembly.

KEY to figure 4-58:
1. Cover bolt
2. Gasket
3. Gasket
4. Element
5. Spring
6. Draincock
7. Decal
8. Shell assembly
9. Plug
10. Gasket
11. Plug
12. Cover

(3) Inspect attaching hardware for cracks, breaks, damaged threads, or any other defect.

d. Reassembly. Reassemble primary fuel filter assembly in reverse numerical sequence shown in figure 4-58. Replace element and gaskets.

e. Installation.

(1) Install primary fuel filter assembly as shown in figure 4-57.

(2) Install fuel lines to primary fuel filter assembly inlet and outlet ports (para 4-82).

(3) Remove pipe plug from top cover and fill the filter assembly with clean fuel. Install the pipe plug.

(4) Check connections for leaks after engine is started.

4-84. Secondary Fuel Filter Assembly

a. Removal.

(1) Open draincock and rain fuel from secondary fuel filter assembly.

(2) Remove fuel lines from secondary fuel filter inlet and outlet ports (para 4-82).

(3) Remove fuel pressure safety switch from top of filter assembly.

(4) Remove secondary fuel filter assembly as shown in figure 4-59.

REMOVAL

STEP 1. OPEN DRAINCOCK AND DRAIN FUEL FROM FILTER ASSEMBLY.

STEP 2. DISCONNECT FUEL INLET AND OUTLET HOSES. REMOVE FITTINGS. DISCONNECT WIRING HARNESS LEADS, REMOVE FUEL PRESSURE SWITCH AND FITTINGS. REMOVE FUEL PRESSURE HOSE.

STEP 3. REMOVE NUTS, LOCKWASHERS, AND BOLTS SECURING SECONDARY FUEL FILTER ASSEMBLY TO BRACKET. REMOVE FILTER ASSEMBLY.

INSTALLATION

STEP 1. INSTALL SECONDARY FUEL FILTER ASSEMBLY IN POSITION ON BRACKET AND SECURE WITH BOLTS, LOCKWASHERS, AND NUTS.

STEP 2. CLOSE DRAINCOCK AND FILL FILTER ASSEMBLY WITH CLEAN FUEL. INSTALL FITTINGS AND FUEL PRESSURE SWITCH. CONNECT WIRING HARNESS LEADS (REFER TO FIGURE 1-3 FOR WIRING DIAGRAM). INSTALL FITTINGS AND CONNECT HOSES TO INLET AND OUTLET. INSTALL FUEL PRESSURE HOSE.

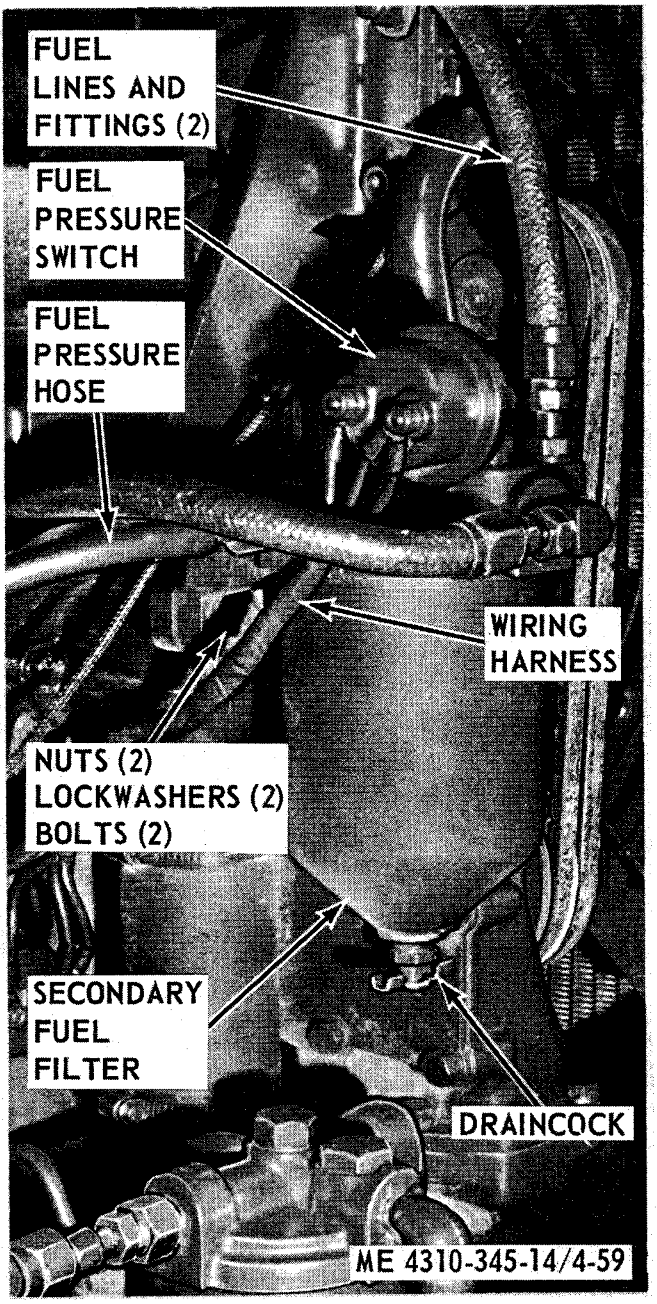


Figure 4-59. Secondary fuel filter assembly, removal and installation.

b. Disassembly. Disassemble the secondarv fuel filter assembly in the numerical sequence shown in figure 4-60. Discard gaskets and element.

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts using a cleaning solvent conforming to Federal Specification P-D-680. Dry parts thoroughly.

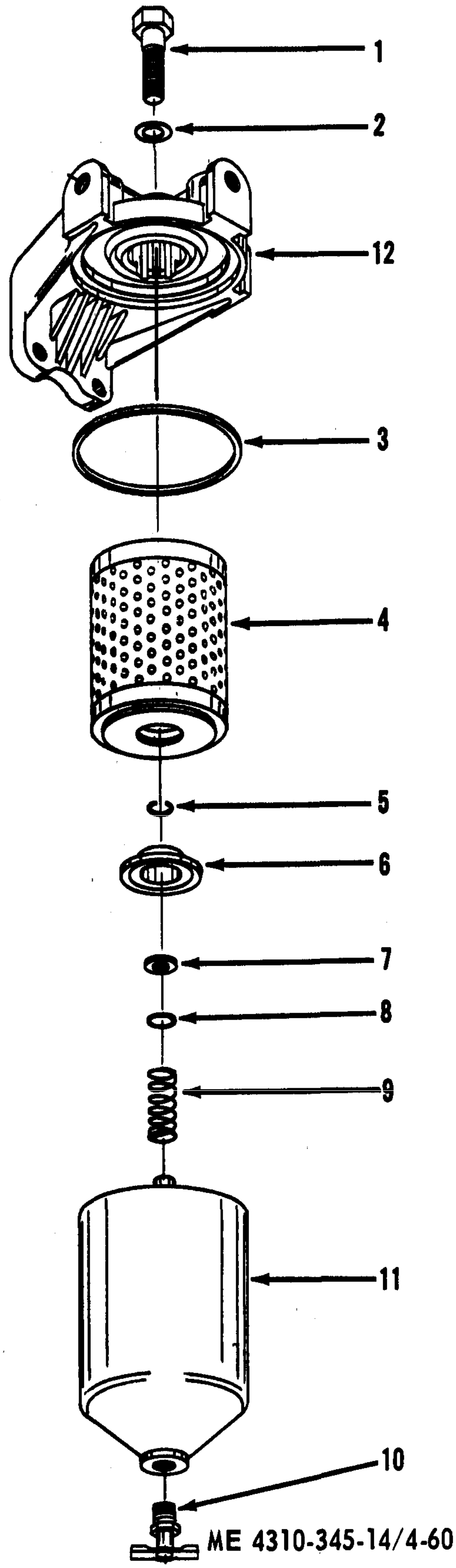


Figure 4-60. Secondary fuel filter assembly, disassembly and reassembly.

KEY to figure 4-60:

1. Cover bolt
2. Gasket
3. Gasket
4. Element
5. Retaining ring
6. Seat
7. Seal
8. Washer
9. Spring
10. Draincock
11. Shell assembly
12. Cover

(2) Inspect all parts for cracks, breaks, distortion, damaged threads, or any other defect.

(3) Inspect attaching hardware for cracks, breaks, damaged threads, or any other defect.

d. Reassembly. Reassemble secondary fuel filter assembly in reverse numerical sequence shown in figure 4-60. Replace element and gaskets.

e. Installation.

(1) Install secondary fuel filter assembly as shown in figure 4-59.

(2) Install fuel pressure safety switch to top of filter assembly.

(3) Install fuel lines to filter assembly inlet and outlet ports (para 4-82).

(4) Remove pipe plug from top cover and fill the filter assembly with clean fuel. Install pipe plug.

(5) Check connections for leaks after engine is started.

4-85. Fuel Pump Assembly

a. Removal.

(1) Remove fuel lines from fuel pump assembly inlet and outlet ports (para 4-82).

(2) Remove fuel pump assembly as shown in figure 4-61. Discard gasket.

REMOVAL

STEP 1. DISCONNECT FUEL HOSES FROM INLET AND OUTLET PORTS.

STEP 2. REMOVE BOLTS AND LOCKWASHERS. REMOVE FUEL PUMP ASSEMBLY AND DRIVE. DISCARD GASKET.

INSTALLATION

STEP 1. INSTALL NEW GASKET. POSITION FUEL PUMP ASSEMBLY AND DRIVE. SECURE WITH LOCKWASHERS AND BOLTS.

STEP 2. CONNECT FUEL HOSES TO INLET AND OUTLET PORTS.

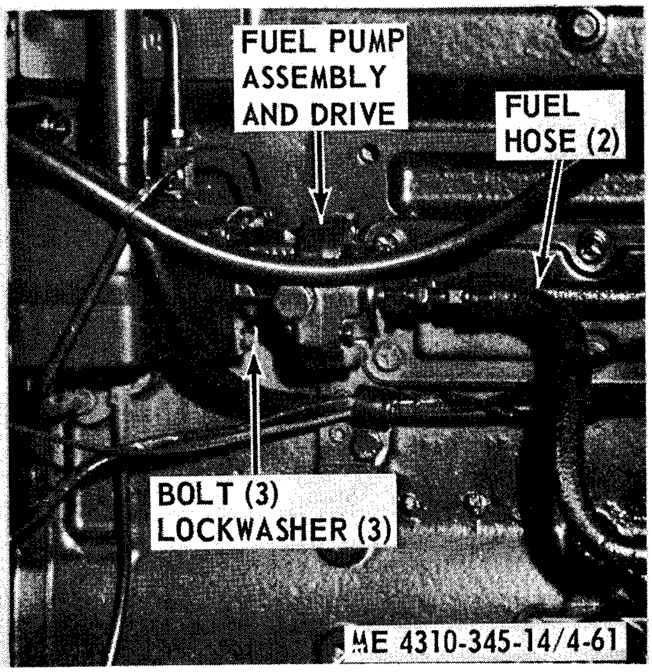


Figure 4-61. Fuel pump assembly, removal and installation.

b. Installation.

(1) Install fuel pump assembly as shown in figure 4-61. Install new gasket.

(2) Install fuel lines to fuel pump assembly inlet and outlet ports (para 4-82).

4-86. Fuel Injectors

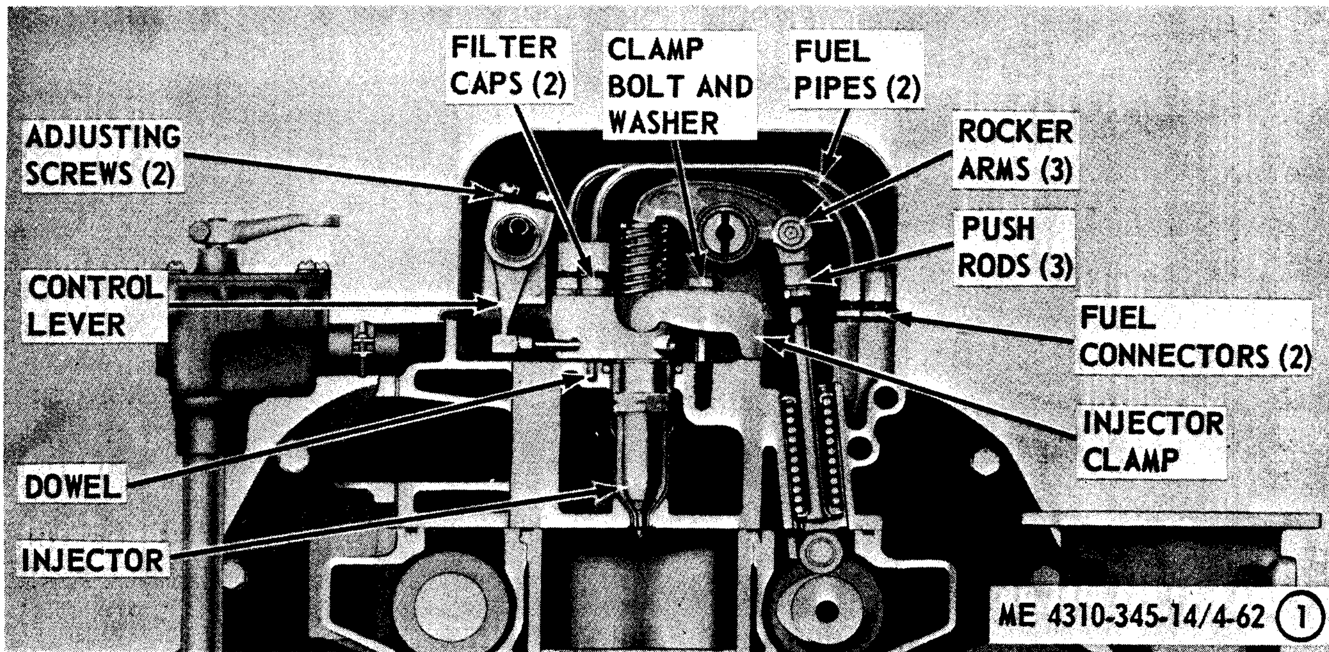
a. Removal.

(1) Remove valve rocker cover from engine cylinder head.

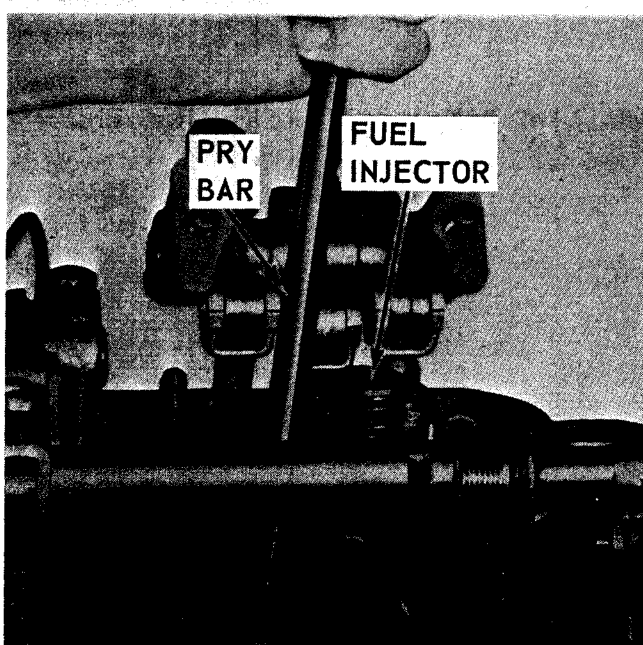
(2) Remove fuel injector pipes and fuel injectors as shown in figure 4-62.

NOTE

Immediately after removal of the fuel pipes from an injector, cover the injector filter caps to prevent dirt from entering the injector. Also, protect the fuel pipes and fuel connectors from entry of dirt or foreign material.



A FUEL INJECTOR REMOVAL AND INSTALLATION



B REMOVING FUEL INJECTOR

REMOVAL

STEP 1. CRANK THE ENGINE TO BRING THE OUTER ENDS OF THE PUSH RODS OF THE INJECTOR AND VALVE ROCKER ARMS IN LINE HORIZONTALLY.

STEP 2. REMOVE THE TWO ROCKER SHAFT BRACKET BOLTS AND SWING THE ROCKER ARMS AWAY FROM THE INJECTOR AND VALVES.

STEP 3. REMOVE THE INJECTOR CLAMP BOLT, SPECIAL WASHER, AND CLAMP.

STEP 4. LOOSEN THE INNER AND OUTER ADJUSTING SCREWS ON INJECTOR RACK CONTROL LEVER AND SLIDE THE LEVER AWAY FROM THE INJECTOR.

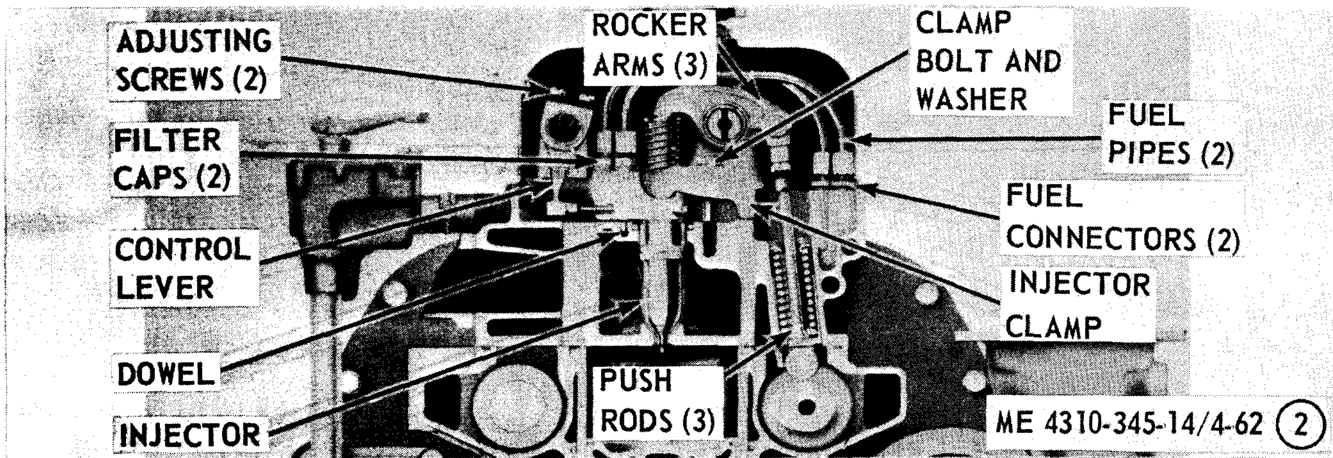
STEP 5. LIFT THE INJECTOR FROM ITS SEAT IN THE CYLINDER HEAD.

STEP 6. COVER THE INJECTOR HOLE IN THE CYLINDER HEAD TO PREVENT ENTRY OF FOREIGN MATERIAL.

INSTALLATION

STEP 1. FILL THE INJECTOR WITH CLEAN FUEL BY ADDING FUEL AT INLET FILTER CAP UNTIL IT RUNS OUT OF THE OUTLET FILTER CAP.

Figure 4-62. Fuel injectors, removal and installation (sheet 1 of 2).



C FUEL INJECTOR REMOVAL AND INSTALLATION

STEP 2. INSERT INJECTOR INTO THE INJECTOR TUBE WITH THE DOWEL REGISTERING IN CYLINDER HEAD LOCATING HOLE.

STEP 3. SLIDE THE RACK CONTROL LEVER OVER SO THAT IT REGISTERS WITH THE INJECTOR RACK.

STEP 4. INSTALL INJECTOR CLAMP, SPECIAL WASHER, AND BOLT. TIGHTEN BOLT TO 20-25 LB-FT TORQUE.

NOTE

CHECK INJECTOR CONTROL RACK FOR FREE MOVEMENT. EXCESSIVE TORQUE WILL CAUSE CONTROL RACK TO STICK OR BIND.

STEP 5. MOVE ROCKER ARM ASSEMBLY INTO POSITION AND SECURE ROCKER ARM BRACKETS TO CYLINDER HEAD WITH BOLTS. TIGHTEN BOLTS TO 50-55 LB-FT TORQUE.

STEP 6. INSTALL FUEL PIPES ON INJECTOR AND FUEL CONNECTORS. TIGHTEN CONNECTIONS TO 12-15 LB-FT TORQUE.

CAUTION

DO NOT BEND FUEL PIPES OR EXCEED SPECIFIED TORQUE. EXCESSIVE TORQUE WILL TWIST OR FRACTURE FLARED END OF TUBE AND RESULT IN LEAKS.

STEP 7. ADJUST VALVE CLEARANCE (REFER TO FIGURE 4-75); TIME THE INJECTOR (REFER TO FIGURE 4-76); POSITION INJECTOR CONTROL LEVER (REFER TO FIGURE 7-32).

NOTE

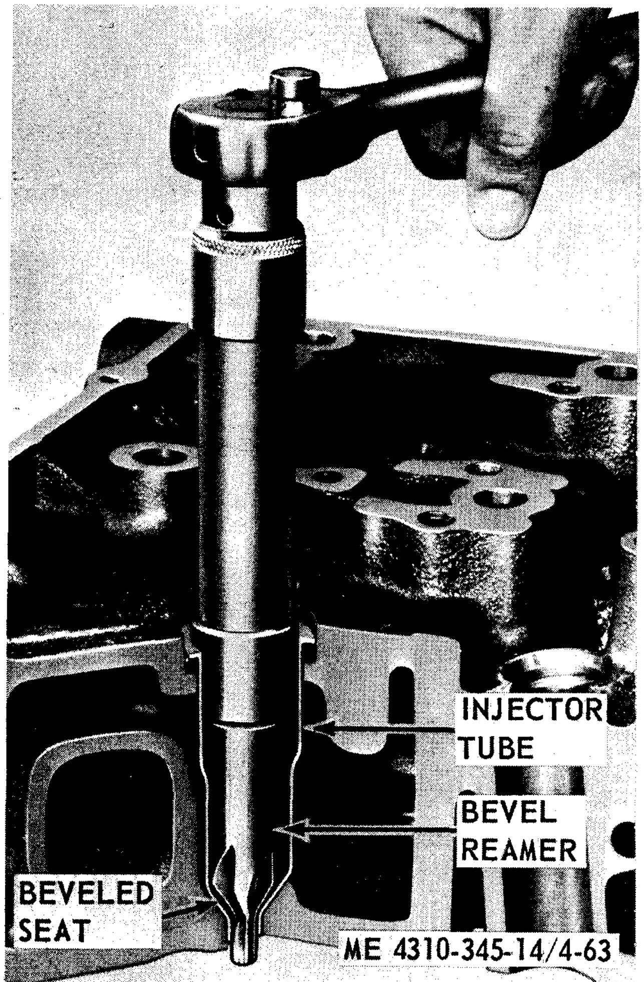
IF MORE THAN ONE INJECTOR HAS BEEN INSTALLED AND GOVERNOR ADJUSTMENT HAS BEEN DISTURBED, IT WILL BE NECESSARY TO PERFORM A COMPLETE ENGINE TUNE-UP. (REFER TO DIRECT AND GENERAL SUPPORT.)

Figure 4-62. Fuel injectors, removal and installation (sheet 2 of 2).

b. Cleaning and Inspection.

(1) Clean injector pipes using a cleaning solvent conforming to Federal Specification P-D-680, or use clean diesel fuel. Dry thoroughly.

(2) Clean carbon deposits from injector tube in cylinder head as shown in figure 4-63.



CLEANING

STEP 1. PACK FLUTES OR REAMER WITH GREASE TO RETAIN CARBON REMOVED FROM INJECTOR TUBE.

STEP 2. CLEAN CARBON FROM INJECTOR TUBE. EXERCISE CARE TO REMOVE ONLY THE CARBON SO THAT PROPER CLEARANCE BETWEEN INJECTOR BODY AND CYLINDER HEAD IS MAINTAINED.

Figure 4-63. Injector tube cleaning.

(3) Inspect injector pipes for cracks, breaks, kinks, damaged threads, or any other defect.

(4) Inspect fuel pipe connectors for damaged threads.

c. Installation.

(1) Install injectors and fuel pipes as shown in figure 4-62.

(2) Install valve rocker cover on engine cylinder head.

4-87. Fuel Tank

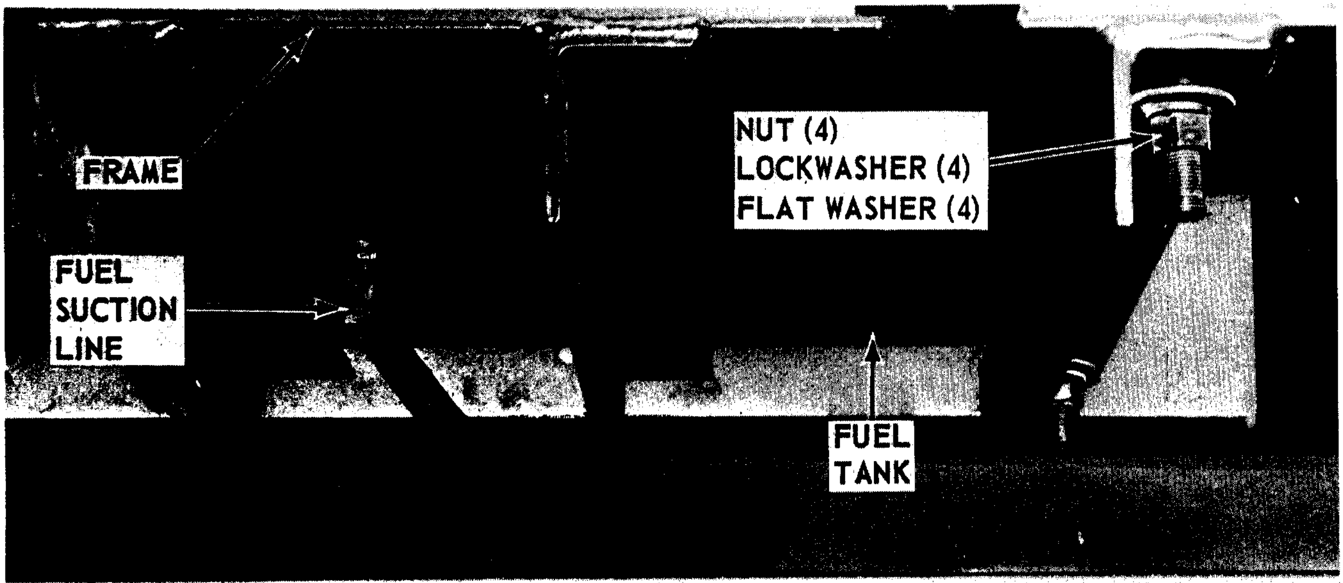
a. Removal.

(1) Drain all fuel from the fuel tank.

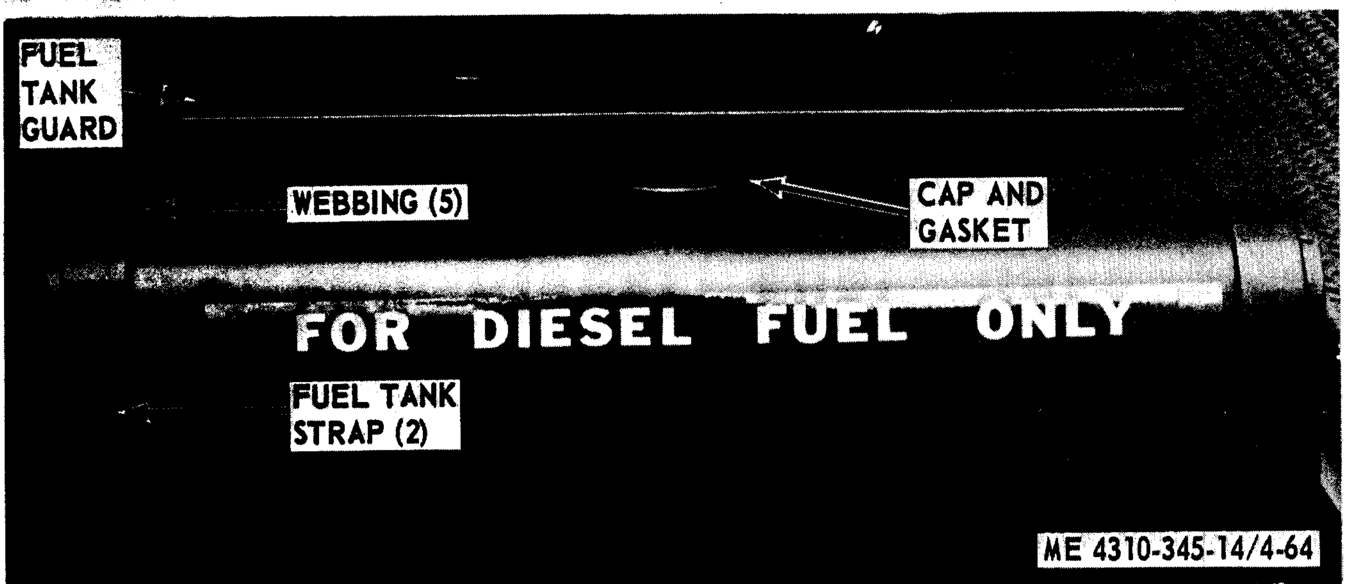
(2) Remove fuel supply and return hoses from fuel tank (para 4-82). Observe fuel tank guard removal procedure.

(3) Remove fuel level sending unit guard and fuel level sending unit (para 4-42).

(4) Remove fuel tank as shown in figure 4-64.



A FUEL TANK BOTTOM VIEW



B FUEL TANK TOP VIEW

REMOVAL

STEP 1. REMOVE NUTS, LOCKWASHERS, AND FLAT WASHERS FROM TANK STRAP ENDS. REMOVE TANK STRAPS.

STEP 2. REMOVE FUEL TANK. REMOVE WEBBING AS NECESSARY.

INSTALLATION

STEP 1. INSTALL WEBBING ON FRAME AS NECESSARY. INSTALL FUEL TANK IN POSITION ON FRAME.

STEP 2. INSTALL TANK STRAPS, AND WEBBING AS NECESSARY. SECURE STRAPS WITH FLAT WASHERS, LOCKWASHERS, AND NUTS.

Figure 4-64. Fuel tank, removal and installation.

b. Cleaning and Inspection.

(1) Clean the fuel tank using a cleaning solvent conforming to Federal Specification P-D-680. Dry thoroughly.

(2) Inspect fuel tank for cracks, holes, corrosion, or any other defect.

(3) Inspect cap for proper sealing and condition of gasket.

(4) Inspect filler tube screen for breaks.

(5) Inspect conditions of threads in flange connections of tank.

(6) Inspect attaching hardware for cracks. breaks, distortion, damaged threads, or any other defect.

c. *Installation.*

(1) Install fuel tank as shown in figure 4-64 and leave fuel tank hold down strap loose.

(2) Install fuel level sending unit and guard (para 4-42).

(3) Connect fuel supply and return hoses (para 4-82). Install fuel tank guard and tighten fuel tank straps.

(4) Replenish fuel supply in tank.

Section XVI. MAINTENANCE OF ENGINE LUBRICATING OIL SYSTEM

4-88. General

The engine lubricating oil system includes an oil filler tube assembly, oil intake screen and tube assembly, oil pump, oil pressure regulator, full-flow oil filter with bypass valve, oil cooler, and oil cooler bypass valve. The rotor type oil pump is driven directly by the crankshaft. Clean engine oil is assured at all times by the use of the replaceable element type full-flow filter. Should the filter become plugged, the oil will flow through a bypass valve directly to the oil cooler. If the oil cooler becomes plugged, the oil flow will be to a bypass valve and then to the cylinder block oil galleries. Stabilized oil pressure is maintained at all speeds, regardless of oil temperature, by means of a regulator valve. The regulator valve, when open, returns excess oil directly to the crankcase. Engine coolant passing through the oil cooler cools the lubricating oil. The crankcase oil level is checked by use of the dipstick type oil level gage.

4-89. Engine Oil Filter Assembly

a. Removal.

(1) Remove drain plug from shell assembly and drain oil from oil filter assembly.

(2) Remove engine oil filter assembly as shown in figure 4-65.

REMOVAL

STEP 1. REMOVE BOLTS, LOCKWASHERS, AND FLAT WASHERS.

STEP 2. REMOVE ENGINE OIL FILTER ASSEMBLY. DISCARD GASKET.

INSTALLATION

STEP 1. INSTALL NEW GASKET. EXERCISE CARE WHEN INSTALLING GASKET SO THAT OIL PASSAGES ARE NOT BLOCKED.

STEP 2. POSITION OIL FILTER ASSEMBLY AND INSTALL FLAT WASHERS, LOCKWASHERS AND BOLTS.

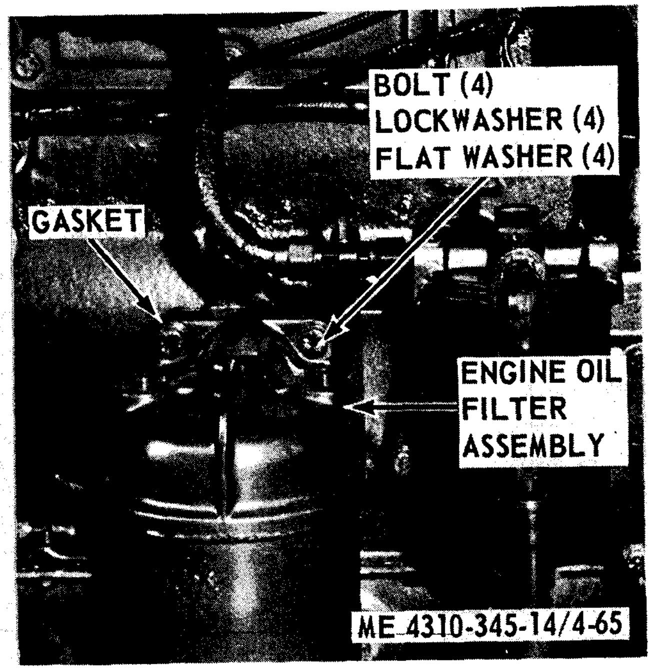


Figure 4-65. Engine oil filter assembly, removal and installation.

b. Disassembly. Disassemble engine oil filter assembly in numerical sequence shown in figure 4-66. Discard gaskets and element.

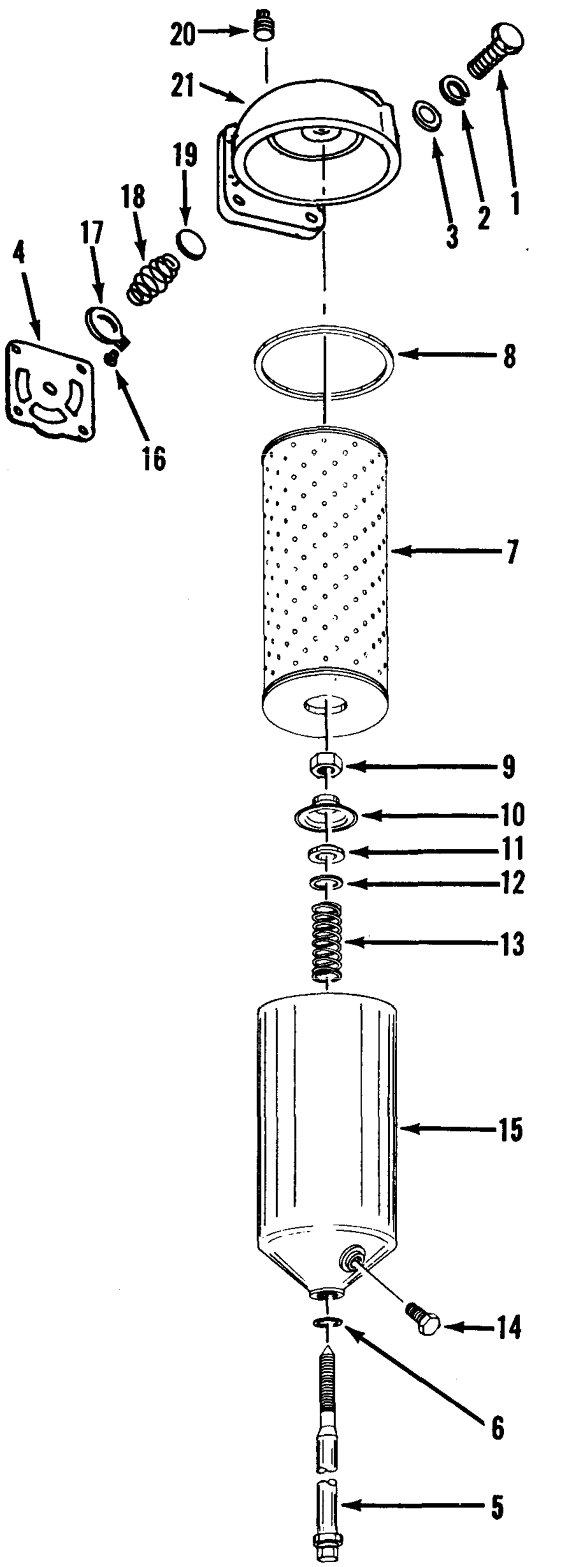


Figure 4-66. Engine oil filter assembly, disassembly and reassembly.

KEY to figure 4-66:
1. Bolt
2. Lockwasher
3. Flat washer
4. Gasket
5. Stud
6. Gasket
7. Element
8. Gasket
9. Nut
10. Retainer
11. Seal
12. Washer
13. Spring
14. Drain plug
15. Shell
16. Screw
17. Retainer
18. Spring
19. Valve
20. Pipe plug
21. Base

c. Cleaning and Inspection.

(1) Clean all metal parts using a cleaning solvent conforming to Federal Specification P-D-680. Dry thoroughly.

(2) Inspect springs for cracks, breaks, distortion, or any other defect.

(3) Inspect all other parts for cracks, breaks, damaged threads, or any other defect.

(4) Inspect attaching hardware for cracks, breaks, distortion, damaged threads, or any other defect.

d. Reassembly. Reassemble engine oil filter assembly in reverse numerical sequence shown in figure 4-66. Replace gaskets and element.

CAUTION

The small protrusion on the oil filter base gasket must mate with the boss on the filter base. If gasket is not positioned correctly, the flow of oil may be obstructed.

e. Installation.

(1) Install the engine oil filter as shown in figure 4-65.

(2) Start the engine and check for oil leaks. Stop engine and check oil level. Replenish crankcase oil as necessary.

4-90. Engine Oil Cooler

a. Removal.

(1) Drain the cooling system by opening draincock at bottom of oil cooler housing and at bottom of radiator.

(2) Remove hose and hose clamps from lower radiator connection and oil cooler inlet (fig. 4-34).

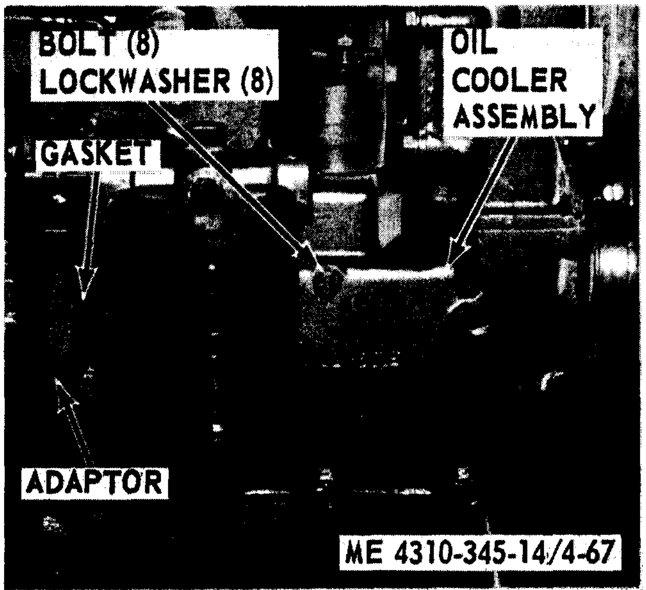
(3) Remove hose and hose clamps from oil cooler outlet (fig. 4-34).

(4) Remove hose and hose clamps from thermostat bypass line connection to water pump (fig. 4-34).

(5) I Remove primary fuel filter assembly (para 4-83).

(6) Remove water pump assembly (para 4-68).

(7) Remove engine oil cooler assembly as shown in figure 4-67.



REMOVAL

STEP 1. REMOVE BOLTS AND LOCKWASHERS.

STEP 2. REMOVE OIL COOLER ASSEMBLY FROM ADAPTOR. DISCARD GASKET.

INSTALLATION

STEP 1. INSTALL NEW GASKET. INSTALL OIL COOLER ASSEMBLY ON ADAPTOR.

STEP 2. SECURE OIL COOLER WITH LOCKWASHERS AND BOLTS.

Figure 4-67. Engine oil cooler assembly, removal and installation.

b. Installation.

(1) Install engine oil cooler assembly as shown in figure 4-67.

(2) Install water pump assembly (para 4-68).

(3) Install primary fuel filter assembly (para 4-83).

(4) Install hose and hose clamps on thermostat bypass line connection water pump (fig. 4-34).

(5) Install hose and hose clamps on oil cooler outlet (fig. 4-34).

(6) Install hose and hose clamps on lower radiator connection and oil cooler inlet (fig. 4-34).

(7) Fill the radiator with coolant,

4-91. Oil Filler and Crankcase Breather Assembly

a. Removal. Remove oil filler and crankcase breather assembly as shown in figure 4-68.

REMOVAL

STEP 1. REMOVE BOLTS AND LOCKWASHERS.

STEP 2. REMOVE OIL FILLER AND CRANKCASE BREATHER ASSEMBLY. DISCARD GASKET.

INSTALLATION

STEP 1. INSTALL NEW GASKET. POSITION OIL FILLER AND CRANKCASE BREATHER ASSEMBLY ON FLYWHEEL HOUSING.

STEP 2. SECURE ASSEMBLY WITH LOCKWASHERS AND BOLTS.

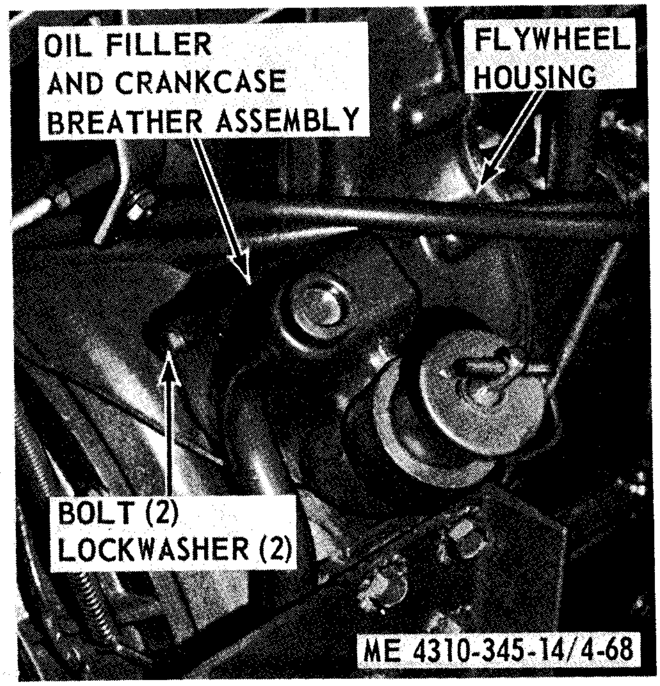


Figure 4-68. Oil filler and crankcase breather assembly, removal and installation.

b. Disassembly. Disassemble oil filler and crankcase breather assembly in numerical sequence shown in figure 4-69.

c. Cleaning and Inspection.

(1) Clean all metal parts using a cleaning solvent conforming to Federal Specification P-D-680. Dry parts thoroughly.

(2) Clean breather element in clean diesel fuel and dry thoroughly.

(3) Inspect all parts for cracks, breaks, distortion, damaged threads, or any other defect.

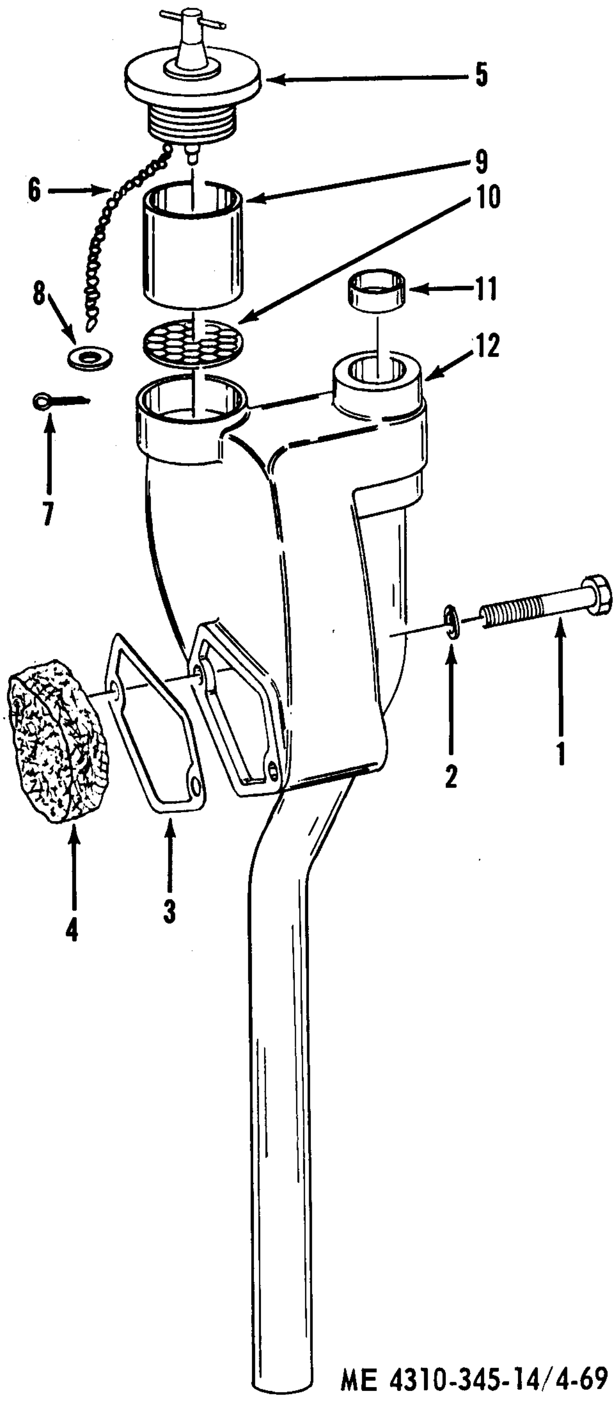


Figure 4-69. Oil filler and crankcase breather assembly, disassembly and reassembly.

KEY to figure 4-69:
1. Bolt (2)
2. Lockwasher (2)
3. Gasket
4. Filter
5. Cap
6. Chain
7. Cotter pin
8. Flat washer
9. Filler tube
10. Strainer
11. Plug
12. Breather assembly

d. Reassembly. Reassemble oil filler and crankcase breather assembly in reverse numerical sequence shown in figure 4-69.

e. Installation. Install oil filler and crankcase breather assembly as shown in figure 4-68.

4-92. General

The engine 24-volt electrical system consists of a battery-charging generator, battery-charging generator regulator, starting motor, two 12 volt batteries, and necessary cables and wiring. The battery-charging generator restores electrical energy to the batteries and supplies electrical power to meet the load demands of the engine and accessories when the air compressor unit is operating. The battery-charging generator regulator opens and closes the charging circuit, prevents overcharging of the batteries and damaging high voltage in the system, and maintains the battery-charging generator output within its rated limits. The starting motor engages the ring gear on the flywheel and turns the engine over for starting. The batteries supply power to the starting motor and to electrical accessories when the unit is not operating. The unit is also equipped with a battery charging receptacle which permits charging of the batteries from an outside power source.

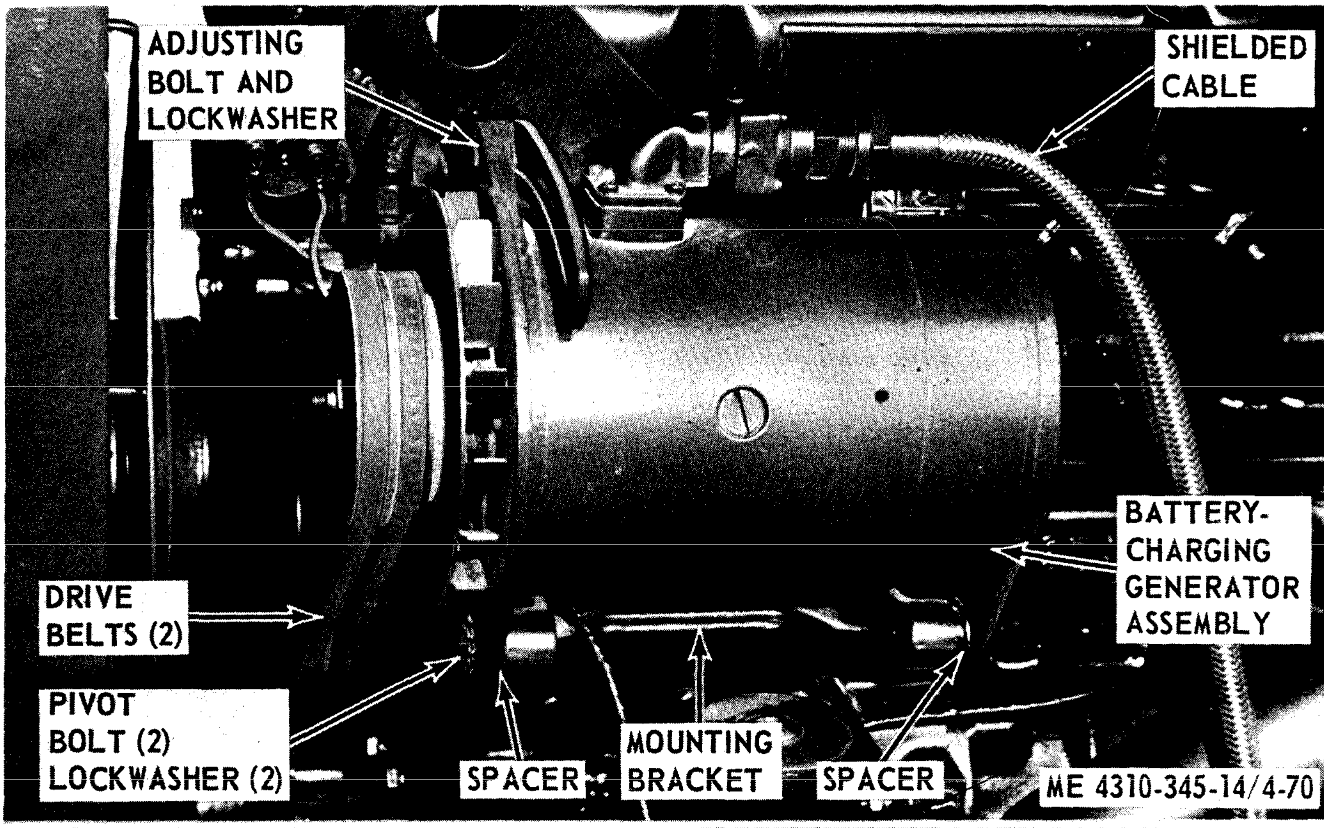
4-93. Battery-Charging Generator Assembly

a. Removal.

(1) Disconnect battery cables.

(2) Remove shielded cable from battery-charging generator assembly.

(3) Remove battery-charging generator assembly as shown in figure 4-70.



REMOVAL		INSTALLATION	
STEP 1.	DISCONNECT SHIELDED CABLE. REMOVE DRIVE BELTS (FIGURE 4-35).	STEP 1.	INSTALL GENERATOR ASSEMBLY ON MOUNTING BRACKET. INSTALL SPACERS AND SECURE GENERATOR IN POSITION WITH PIVOT LOCKWASHERS AND BOLTS.
STEP 2.	REMOVE ADJUSTING BOLT AND LOCKWASHER. REMOVE PIVOT BOLTS, LOCKWASHERS, AND SPACERS.	STEP 2.	INSTALL ADJUSTING LOCKWASHER AND BOLT.
STEP 3.	REMOVE GENERATOR ASSEMBLY FROM MOUNTING BRACKET.	STEP 3.	INSTALL AND ADJUST DRIVE BELTS (FIGURE 4-35). CONNECT SHIELDED CABLE.

Figure 4-70. Battery-charging generator assembly, removal and installation.

b. Cleaning and Inspection.

(1) Clean exterior surfaces of the battery-charging generator assembly with a clean cloth soaked with a solvent conforming to Federal Specification P-D-680. Dry thoroughly. Blow dust and dirt out of inside of the assembly using dry compressed air.

(2) Inspect brushes for excessive wear, cracks, or any other defect. Replace brushes as a set.

(3) Inspect drive belts and pulley for wear, cracks, or any other defect.

(4) Inspect attaching hardware for cracks, distortion, damaged threads, or any other defect.

c. Installation.

(1) Install battery-charging generator assembly as shown in figure 4-70.

(2) Adjust drive belt tension (fig. 4-6).

(3) Connect battery cables.

CAUTION

Failure to polarize battery-charging generator assembly may result in damage to the battery-charging generator regulator since reversed polarity causes arcing and burning of cutout relay contact points and subsequent generator motoring.

(4) Polarize battery-charging generator assembly before starting engine. To achieve polarization, momentarily connect a jumper wire between the "BAT" and "GEN" terminals of the battery-charging regulator assembly.

(5) Connect shielded cable to battery-charging generator assembly.

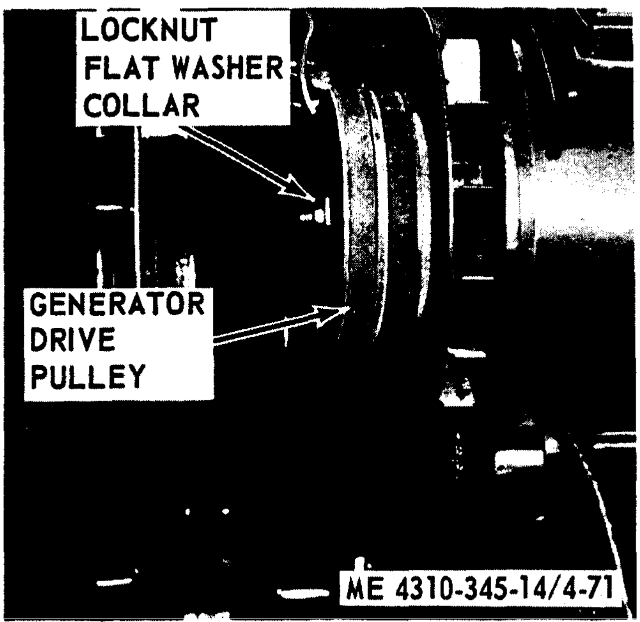
4-94. Battery-Charging Generator Pulley

a. Removal.

(1) Loosen adjusting strap screw and pivot screws. Move battery-charging generator to loosen drive belts.

(2) Remove drive belts from pulley.

(3) Remove pulley as shown in figure 4-71.



REMOVAL

STEP 1. REMOVE LOCKNUT, FLAT WASHER, AND COLLAR.

STEP 2. PRY GENERATOR DRIVE PULLEY OFF SHAFT EXTENSION.

INSTALLATION

STEP 1. INSTALL GENERATOR DRIVE PULLEY ON SHAFT EXTENSION. MAKE CERTAIN KEYWAY OF PULLEY ALIGNS WITH SHAFT KEY.

STEP 2. INSTALL COLLAR, FLAT WASHER, AND LOCKNUT.

Figure 4-71. Battery-charging generator pulley, removal and installation.

b. Installation.

(1) Install pulley as shown in figure 4-71.

(2) Install drive belts on pulley.

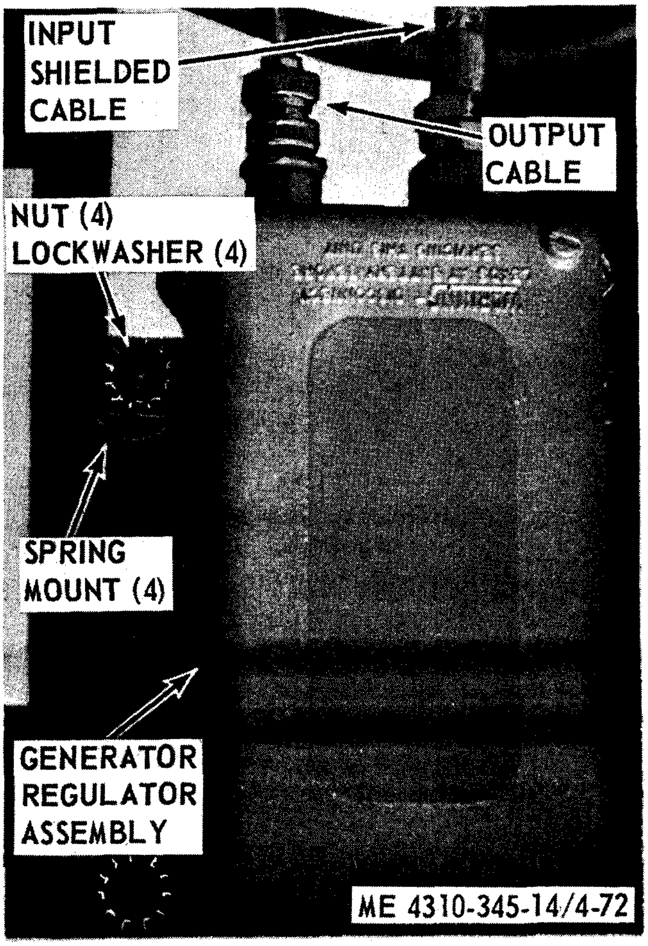
(3) Adjust drive belts (fig. 4-61).

4-95. Battery-Charging Generator Regulator Assembly

WARNING

Disconnect battery terminals before removing cable.

a. Removal. Remove battery-charging generator regulator assembly as shown in figure 4-72.



REMOVAL

STEP 1. DISCONNECT INPUT SHIELDED CABLE. DISCONNECT OUTPUT CABLE.

STEP 2. REMOVE NUTS AND LOCKWASHERS. REMOVE GENERATOR REGULATOR ASSEMBLY FROM SPRING MOUNTS.

INSTALLATION

STEP 1. INSTALL GENERATOR REGULATOR ASSEMBLY IN POSITION ON SPRING MOUNTS. SECURE WITH LOCKWASHERS AND NUTS.

STEP 2. CONNECT OUTPUT CABLE. CONNECT INPUT SHIELDED CABLE.

Figure 4-72. Battery-charging generator regulator assembly, removal and installation.

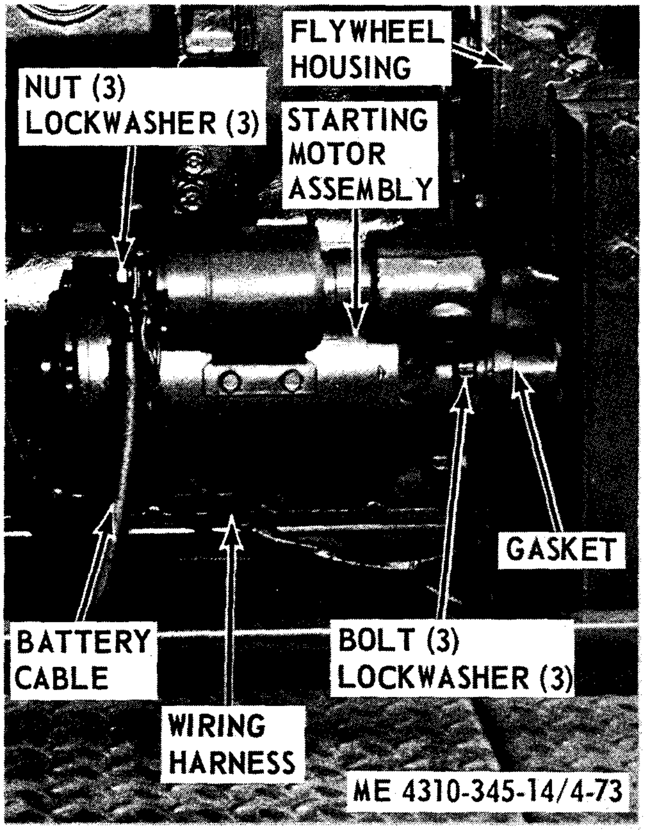
b. Installation. Install battery-charging generator regulator as shown in figure 4-72.

4-96. Starting Motor Assembly

WARNING

Disconnect battery terminals before removing cable.

a. Removal. Remove starting motor assembly as shown in figure 4-73. Discard mounting gasket.



REMOVAL

STEP 1. REMOVE SOLENOID TERMINAL NUTS AND LOCKWASHERS. REMOVE BATTERY CABLE AND WIRING HARNESS LEADS.

STEP 2. REMOVE BOLTS AND LOCKWASHERS. REMOVE STARTING MOTOR ASSEMBLY. DISCARD GASKET.

INSTALLATION

STEP 1. INSTALL NEW GASKET. POSITION STARTING MOTOR ASSEMBLY ON FLYWHEEL HOUSING AND SECURE WITH LOCKWASHERS AND BOLTS.

STEP 2. INSTALL WIRING HARNESS AND BATTERY CABLE ON TERMINALS. SECURE WITH LOCKWASHERS AND NUTS. REFER TO FIGURE 1-3 FOR WIRING DIAGRAM.

Figure 4-73. Starting motor assembly. removal and installation.

b. Cleaning and Inspection.

(1) Clean exterior surfaces of starting motor assembly using a clean cloth soaked with a solvent conforming to Federal Specification P-D-680. Dry thoroughly. Blow dust and dirt out of inside of assembly using dry compressed air.

(2) Inspect clutch for chipped or cracked teeth, or any other defect.

(3) Inspect brushes and springs for excessive wear, cracks, distortion, or any other defect.

(4) Inspect attaching hardware for cracks, breaks, distortion, damaged threads, or any other defect.

c. Installation. Install starting motor assembly as shown in figure 4-73.

CAUTION

Check for sufficient clearance between battery cable connections and solenoid connections on the starter.

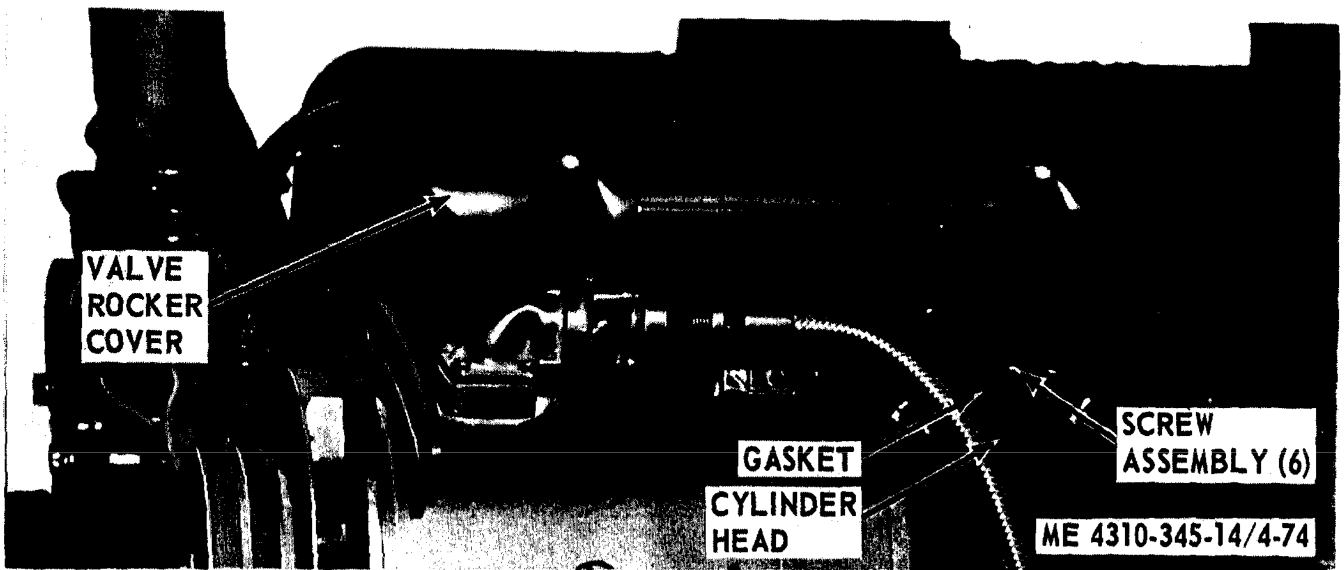
Section XVIII. MAINTENANCE OF ENGINE EXHAUST VALVES, FUEL INJECTORS, AND EXHAUST MANIFOLD GROUP

4-97. General

This section contains instructions for adjustment of exhaust valves, timing of fuel injectors and removal of engine valve rocker cover. All of the exhaust valves may be adjusted and all fuel injectors timed, in firing order sequence, during one full revolution of the crankshaft. Insufficient valve clearance can result in loss of compression, misfiring cylinders, and eventually burned valve seats and valve seat inserts. Excessive valve clearance will result in noisy operation, especially in lower speed range.

4-98. Valve Rocker Cover

a. Removal. Remove valve rocker cover as shown in figure 4-74. Discard gasket.



REMOVAL

STEP 1. REMOVE SCREW ASSEMBLIES.

STEP 2. REMOVE VALVE ROCKER COVER. DISCARD GASKET.

INSTALLATION

STEP 1. INSTALL NEW GASKET. INSTALL VALVE ROCKER COVER.

STEP 2. SECURE VALVE ROCKER COVER TO CYLINDER HEAD WITH SCREW ASSEMBLIES.

Figure 4-74. Valve rocker cover, removal and installation.

b. Cleaning and Inspection.

(1) Clean valve rocker cover using a cleaning solvent conforming to Federal Specification P-D-680. Dry cover thoroughly.

(2) Inspect valve rocker cover for dents, cracks, or any other defect.

(3) Inspect attaching hardware for cracks, distortion, or any other defect.

c. Installation. Install valves rocker cover as shown in figure 4-74. Use a new gasket.

4-99. Exhaust Valve Adjustment

a. Valve Adjustment (cold engine).

(1) Clean loose dirt from exterior of engine and remove valve rocker cover (para 4-98).

(2) Place governor speed control lever in idle speed position. Secure stop lever in the no-fuel position.

CAUTION

If wrench is used on the crankshaft bolt to manually rotate the crankshaft, do not turn in a left-hand direction of rotation or the bolt will be loosened.

(3) Rotate the crankshaft, manually or with the starting motor, until the injector follower is fully depressed on the cylinder to be adjusted.

(4) Loosen the push rod lock nut as shown in figure 4-75.

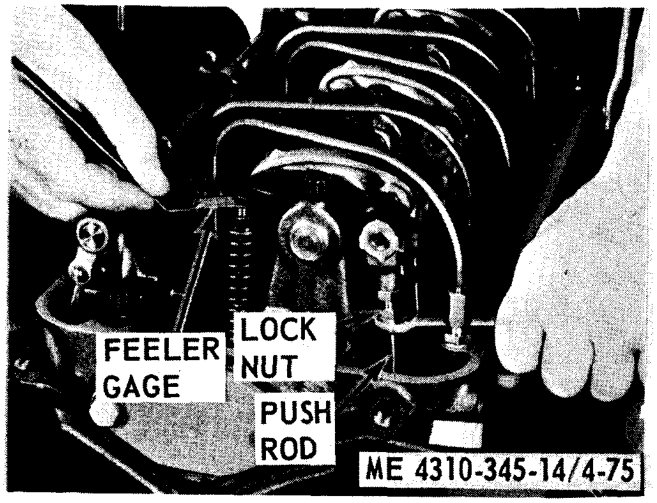


Figure 4-75. Exhaust valve adjustment.

(5) Place a 0.012 inch feeler gage between the valve stem and the rocker arm. Adjust the push rod to obtain a smooth pull on the feeler gage.

(6) Remove the feeler gage. Hold the push rod with a 5/16 inch wrench and tighten the lock nut with a 1/2 inch wrench.

(7) Recheck the clearance. At this time, if the adjustment is correct, a 0.010 inch feeler gage will pass freely between the end of the valve stem and the rocker arm and a 0.012 inch feeler gage will not pass through.

(8) Check and adjust the remaining valves in the same manner as outlined above.

(9) Install the valve rocker cover (para 4-98) and release the stop lever that was secured in no-fuel position.

b. Value Adjustment (Hot Engine).

(1) With engine at normal operating temperature of 160° — 185° F, check exhaust valve clearance. (Reference paragraph *4-99a* steps (1) through (3)). If valve clearance is correct, a 0.008 inch feeler gage will pass freely between the end of the valve stem and the rocker arm and a 0.010 inch feeler gage will not pass through.

(2) If clearance is not correct, adjust valves as outlined in paragraph 4-99 *a,* except use 0.010 inch feeler gage to adjust clearance and a 0.008 inch feeler gage to check adjustment after locking push rod.

4-100. Fuel Injector Timing

a. Timing.

(1) Clean loose dirt from exterior of engine and remove valve rocker cover (para 4-98).

(2) Place governor speed control lever in idle speed position. Secure stop lever in no-fuel position.

CAUTION

If a wrench is used on the crankshaft bolt to manually rotate the crankshaft, do not turn in a left-hand direction of rotation or the bolt will be loosened.

(3) Rotate the engine crankshaft, manually or with the starting motor, until the exhaust valves are fully depressed on the particular cylinder to be timed.

(4) Place the small end of injector timing gage in the hole provided in the top of the injector body, with the flat of the gage toward the injector follower as shown in figure 4-76.

(5) Loosen the push rod nut.

(6) Turn the push rod and adjust injector rocker arm until the extended part of the timing gage will just pass over the top of the injector follower.

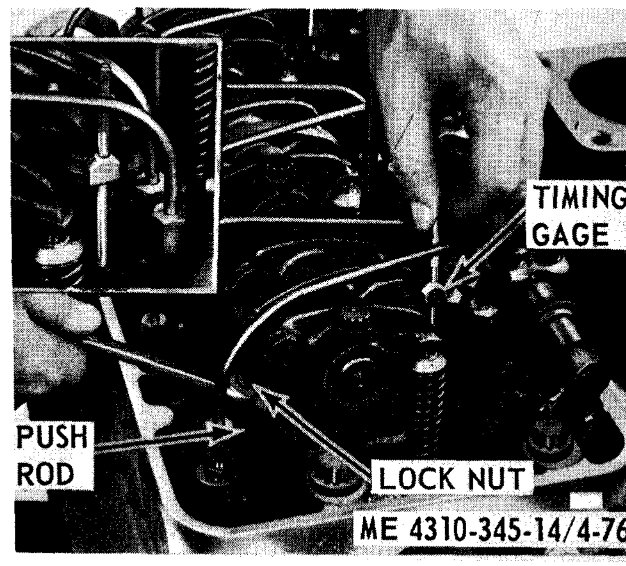


Figure 4-76. Fuel injector timing.

(7) Hold the push rod and tighten the lock nut. Check the adjustment and readjust, if necessary.

(8) Time the remaining injectors in the same manner as described above.

(9) Install valve rocker cover (para 4-98) and release stop lever that was secured in no-fuel position.

4-101. Exhaust Manifold

a. Removal.

(1) Remove exhaust muffler and exhaust pipe.

(2) Remove exhaust manifold in numerical sequence shown in figure 4-77. Discard gasket.

KEY to figure 4-77:
1. Pipe coupling
2. Exhaust pipe
3. Nut (4)
4. Lockwasher (4)
5. Exhaust flange
6. Flange gasket
7. Nut (5)
8. Washer (5)
9. Manifold
10. Gasket
11. Pipe plug
12. Stud (4)

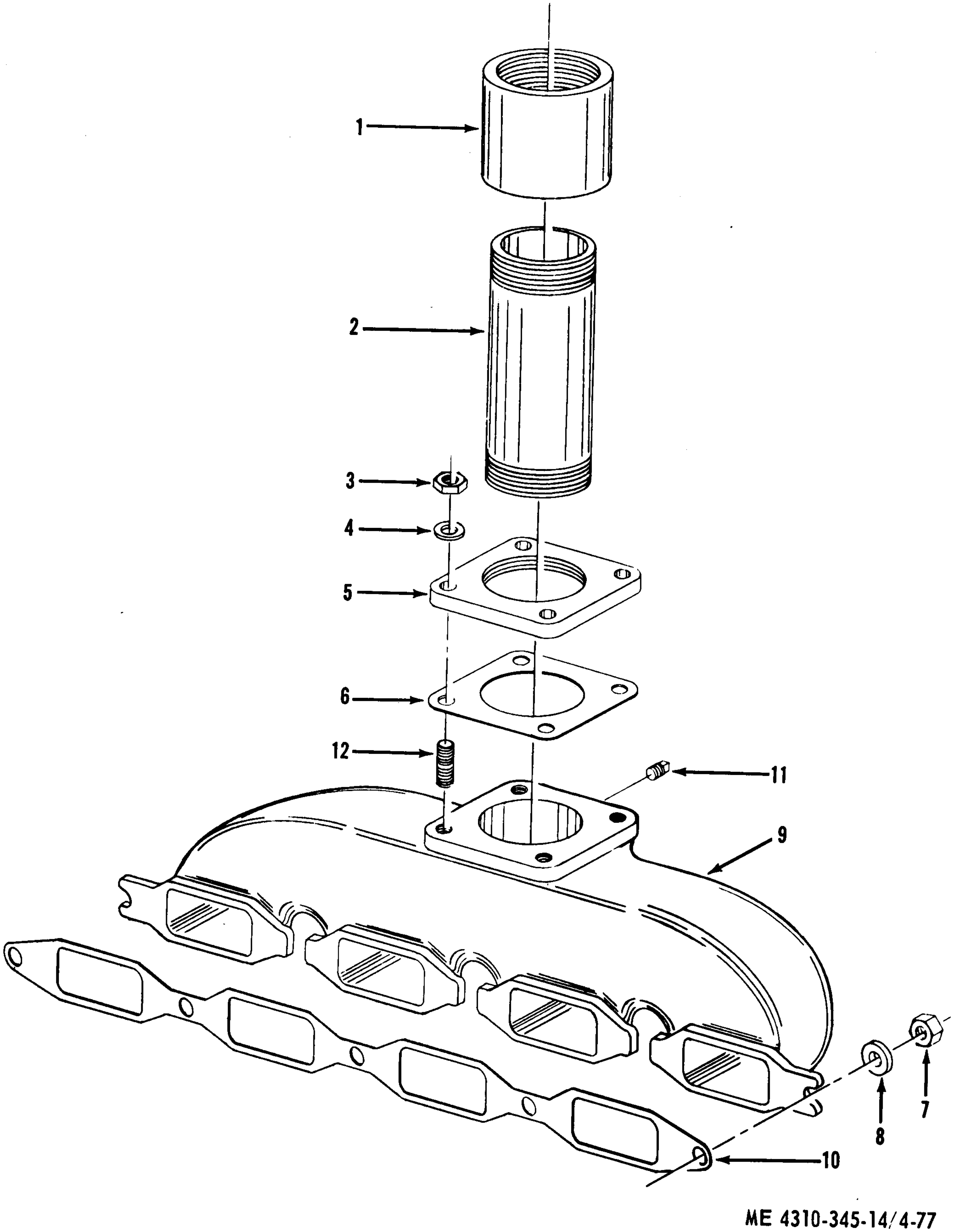


Figure 4-77. Exhaust manifold, removal and installation.

b. Cleaning and Inspection.

(1) Clean parts using a wire brush and scrape to remove all scale deposits and carbon. After brushing and scraping, clean parts using a cleaning solvent conforming to Federal Specification P-D-680.

(2) Inspect parts for cracks, breaks, or any other defect.

(3) Inspect attaching hardware for cracks, damaged threads, or any other defect.

c. Installation.

(1) Install exhaust manifold in reverse numerical sequence shown in figure 4-77. Install new gasket.

(2) Install exhaust pipe and muffler.

CHAPTER 5

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

5-1. Tools and Equipment

Items issued with or authorized for the rotary air compressor unit are listed in the basic issue items list, appendix C.

5-2. Special Tools and Equipment

There are no special tools or equipment required for direct support and general support maintenance of the rotary air compressor unit.

5-3. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in TM 5-4310-345-24P for the compressor and TM 9-2330-247-14 for the trailer.

Section II. TROUBLESHOOTING

5-4. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the Model 14M250RPV Rotary Air Compressor unit that is beyond the scope of organizational maintenance. Malfunctions which may occur are listed in table 5-1. Each malfunction stated is followed by a list of probable causes of the trouble. The corrective action recommended is described opposite the probable cause. References to applicable procedural paragraphs or illustrations are also included in the corrective action column.

Table 5-1. Troubleshooting

Trouble	Probable Cause	Corrective Action
1. Engine will not turn over.	*a.* Engine internal seizure.	*a.* Overhaul engine to replace defective parts.
	b. Compressor internal seizure.	*b.* Overhaul compressor to replace defective parts,
	c. Starting motor or solenoid defective.	*c.* Replace or repair starting motor (para 7-6).
2. Engine turns over but will not start or is hard to start.	*a.* Defective fuel pump.	*a.* Replace or repair fuel pump (para 7-10).
	b. Exhaust valves sticking or burned.	*b.* Replace or recondition valves and seats (para 7-25).
	c. Cylinder liner worn or cracked.	*c.* Replace cylinder liner (para 7-43).
	d. Piston or connecting rod defective.	*d.* Replace defective piston or connetting rod (para 7-42).
	e. Piston rings worn or broken.	*e.* Replace piston rings (para 7-42).
	f. Engine timing incorrect.	*f.* Time the engine (para 7-36).
3. Engine misses or runs erratically.	*a.* Fuel pump defective.	*a.* Replace or repair fuel pump (para 7-10).
	b. Valve clearance incorrect.	*b.* Adjust valves (para 4-99).
	c. Defective fuel injectors.	*c.* Run engine at speed where defect is most noticeable. Remove valve rocker cover. Hold an injector follower clown with a screw driver, thus preventing operation of the injector.

Table 5-1. *Troubleshooting—Continued*

Trouble	Probable Cause	Corrective Action
3. Engine misses or runs erratically —continued	*c.* Defective fuel injectors-continued	*c.* If cylinder is misfiring. there will be no noticeable difference in the sound and operation of the engine. If the cylinder has been firing properly, there will be a noticeable difference in the sound and operation when the injector follower is held down. This is similar to shortcircuiting a spark plug in a gasoline engine. Repeat above procedure on each cylinder until defective injector is found. Replace or repair injector (para 7-14).
	d. Fuel rack setting incorrect.	*d.* Adjust fuel rack setting (para 7-26).
	e. Push rods bent or broken.	*e.* Replace defective push rods (para 7-25).
	f. Exhaust valves sticking or burned.	*f.* Replace or recondition valves (para 7-25).
	g. Cylinder liner worn or cracked.	*g.* Replace cylinder liner (para 7-43).
	h. Piston rings, piston, or connecting rod defective.	*h.* Replace piston rings, piston, or connecting rod (para 7-42).
	i. Governor defective.	*i.* Repair or replace governor (para 7-12).
4. Engine lacks power.	*a.* Exhaust valve clearance incorrect.	*a.* Adjust valve clearance (para 4-99).
	b. Defective fuel pump.	*b.* Replace or repair fuel pump (para 7-10).
	c. Fuel rack setting incorrect.	*c.* Adjust fuel rack (para 7-26).
	d. Defective fuel injector.	*d.* See corrective action c under trouble 3.
	e. Cylinder liner worn or cracked.	*e.* Replace cylinder liner (para 7-43).
	f. Piston rings, piston, or connecting rod defective.	*f.* Replace piston rings, piston, or connecting rod (para 7-42).
	g. Exhaust valves sticking or burned.	*g.* Replace or recondition valves and seats (para 7-25).
	h. Governor assembly defective.	*h.* Repair or replace governor (para 7-12).
5. Engine knocks, develops excessive noise or vibration.	*a.* Crankshaft pulley or vibration damper defective.	*a.* Replace crankshaft pulley or vibration damper (para 7-38 and 7-40).
	b. Push rods bent or broken.	*b.* Replace defective push rod (para 7-25).
	c. Valve clearances incorrect.	*c.* Adjust valve clearances (para 4-99).
	d. Piston pin loose.	*d.* Locate loose piston pin by deactivating injectors, one at a time, until noise stops. Replace defective piston pin (para 7-42).
	e. Cylinder liner worn or cracked.	*e.* Replace defective cylinder liner (para 7-43).
	f. Piston or connecting rod defective.	*f.* Replace defective piston or connecting rod (para 7-42).
	g. Connecting rod bearings worn or loose.	*g.* Replace defective connecting rod bearings (para 7-40d(10)).
	h. Main bearings worn.	*h.* Replace worn main bearings (para 7-40d(10)).
	i. Crankshaft worn or out-of-round.	*i.* Replace crankshaft (para 7-40).
	j. Excessive crankshaft end clearance.	*j.* Replace crankshaft thrust washers (para 7-40d(10)).
	k. Flywheel loose.	*k.* Tighten flywheel attaching capscrews.
	l. Balance weights loose or defective.	*l.* Tighten or replace balance weights (para 7-34).
6. Engine stops suddenly.	*a.* Engine seizure.	*a.* Overhaul engine and replace defective parts.

Table 5-1. Troubleshooting—continued

Trouble	Probable Cause	Corrective Action
6. Engine stops suddenly-continued	*b.* Compressor seizure.	*b.* Overhaul compressor and replace defective parts.
7. Engine has low or no oil pressure.	*a.* Connecting rod bearings worn.	*a.* Replace connecting rod bearings (para 7-40d(10)).
	b. Oil pump defective.	*b.* Replace oil pump (para 7-29).
	c. Crankshaft worn excessively.	*c.* Replace crankshaft (para 7-40).
	d. Main bearings worn excessively.	*d.* Replace main bearings (para 7-40d(10)).
	e. Oil pump bypass valve sticking.	*c.* Clean or replace bypass valve (para 7-29).
	f. Camshaft bearings worn excessively.	*f.* Replace camshaft bearings (para 7-38).
	g. Valve rocker arm bore or rocker arm shaft worn excessively.	*g.* Replace defective rocker arm shaft and related parts (para 7-25).
	b. Timing gear bearing clearances excessive.	*h.* Inspect bearings and replace components as necessary (para 7-40d(10)).
	i. Engine oil cooler defective.	*i.* Clean, repair, or replace oil cooler (para 7-16).
	j. Engine oil filter defective.	*j.* Repair or replace engine oil filter (para 4-89).
8. Engine overheats.	*a.* Clogged coolant passages in cylinder block.	*a.* Clean cylinder block (para 7-45).
	b. Water pump defective.	*b.* Repair or replace water pump (para 7-18).
	c. Cylinder block cracked.	*c.* Replace cylinder block (para 7-45).
9. Engine fails to stop.	*a.* Governor defective.	*a.* Repair or replace governor (para 7-12).
	b. Fuel injector broken or jammed.	*b.* Repair or replace fuel injector rack (para 7-14).
10. Excessive engine oil consumption.	*a.* Piston rings cracked or worn excessively.	*a.* Replace piston rings (para 7-42).
	b. Cylinder liner worn excessively.	*b.* Replace cylinder lines (para 7-43).
	c. High crankcase pressure.	*c.* Check the compression pressure and make necessary repairs.
	d. Oil cooler clogged or bypass valve defective.	*d.* Clean oil cooler: repair or replace defective parts (para 7-16).
	e. Blower oil seal leaking.	*e.* Repair the blower (para 7-22).
	f. Piston and connecting rod alignment incorrect.	*f.* Replace piston and connecting rod (para 7-42).
	g. Piston pin retainer loose.	*g.* Replace piston pin retainer and defective parts (para 7-42).
11. Engine exhaust excessively white or blue.	*a.* Piston rings cracked or worn excessively.	*a.* Replace piston rings (para 7-42).
	b. Defective fuel injectors.	*b.* Replace or repair fuel injectors (para 7-14).
	c. Cylinder liners worn excessively.	*c.* Replace cylinder liners (para 7-43).
	d. High crankcase pressure.	*d.* Check compression pressure and make necessary repairs.
	e. Coolant in combustion chamber.	*e.* Overhaul engine.
12. Engine exhaust excessively black or gray.	*a.* High exhaust back pressure or restricted air inlet causing incomplete burning of fuel.	*a.* Inspect exhaust pipe and muffler for obstructions. Correct as necessary. Inspect and clean blower inlet screen (para 7-22). Clean cylinder liner parts.
	b. Defective fuel injectors or improperly positioned fuel injector rack.	*b.* Replace defective fuel injectors (para 7-14). Adjust fuel injector control rack (pack 7-26).
13. Coolant in engine lubricating oil.	a. Cylinder head gasket failure.	*a.* Replace cylinder head gasket (para 7-25).
	b. Cylinder head cracked or defective.	*b.* Replace cylinder head (para 7-25).
	c. Cylinder block cracked or defective.	*c.* Replace cylinder block (para 7-45).

Table 5.1. Troubleshooting-Contioued

Trouble	Probable Cause	Corrective Action
14. Engine stalls at low speed.	*a.* Defective fuel pump.	*a.* Repair or replace fuel pump (para 7-10).
	b. Fuel injector rack out of adjustment.	*b.* Adjust fuel injector rack (para 7-26).
15. Valve train noise.	*a.* Insufficient lubrication due to defective oil pump.	*a.* Replace oil pump (para 7-29).
	b. Valve out of adjustment.	*b.* Adjust valve clearances (para 4-99).
	c. Push rods bent or broken.	*c.* Replace defective push rods (para 7-25).
16. Premature engine wear.	Lubricating oil being diluted fuel oil (probably accompanied by high fuel consumption and low engine oil pressure).	Check engine thoroughly and replace leaking and defective components.
17. Little rocker arm movement and excessive valve clearances.	*a.* Camshaft excessively worn.	*a.* Replace camshaft (para 7-38).
	b. Push rods worn or broken.	*b.* Replace defective push rode (para 7-25).
	c. Valve stem excessively worn.	*c.* Replace valves and recondition valve seats (para 7-25).
18. Mechanical knock.	*a.* Connecting rod bearings defective.	*a.* Replace connecting rod bearings (para 7-40d(10)). Inspect and replace connecting rode and crankshaft as necessary.
	b. Timing gear train defective.	*b.* Repair timing gear train (para 7-35).
	c. Crankshaft defective.	Replace crankshaft (para 7-40).
	d. Main bearing defective.	*c.* Replace main bearinge (para 7-40d(10)). Inspect and replace crankshaft if necessary.
19. Compressor overheats.	*a.* Oil separator element clogged.	*a.* Replace element (para 6-3).
	b. Oxidized oil (varnished).	*b.* Disassemble and clean compressor (para 6-9) and oil separator (para 6-2). Replace separator element (para 6-3).
20. Noisy compressor operation.	*a.* Rotor bearings defective.	*a.* Replace rotor bearings (para 6-9).
	b. Broken rotor blades.	*b.* Replace rotor blades (para 6-10).
21. Compressor not operating to full capacity or pressure.	*a.* Intake control defective.	*a.* Repair or replace intake control (para 6-9).
	b. Engine governor defective or set incorrectly.	*b.* Adjust governor setting (para 7-26b) or repair or replace governor (para 7-12).
	c. Blades sticking in rotor.	*c.* Disassemble and clean compressor (para 6-9).
22. Compressor fails to load or unload.	*a.* Intake control defective.	*a.* Repair or replace intake control (para 6-9).
	b. Air pressure regulator defective.	*b.* Repair or replace air pressure regulator (para 6-7).
23. Compressor vibrates and metallic noise in compressor.	*a.* Rotor blades stuck or broken.	*a.* Clean or replace rotor blades as necessary. Clean stator (para 6-10).
	b. Defective rotor bearings.	*b.* Replace rotor bearinge (para 6-9).
	c. Damaged rotor or stator.	*c.* Replace a damaged rotor or stator (para 6-91).
24. Excessive compressor oil consumpt ion.	Damaged or defective oil separator element.	Replace oil separator element (para 6-31).

5-5. General

This section contains those repair instructions and references which are the responsibility of direct support and general support maintenance as authorized by the maintenance allocation chart (app. B) and are general in nature. These data are listed or referenced below.

a. Air Compressor Unit Torque Table. Table 1-1 lists sizes and torque valves recommended by the manufacturer for the compressor unit.

b. Engine Assembly Torque Table. Table 1-2 lists sizes, torque valves, exceptions to standard torque, and applications of the non-standards as recommended by the manufacturer of the engine.

c. Wiring Diagram. Refer to figure 1-3, sheet 1 of 2, for schematic wiring diagram of the model 14M250RPV Rotary Air Compressor.

d. Air Line Diagram. Refer to figure 5-1 for air line diagram of the model 14M250RPV Rotary Air Compressor.

e. Compressor Oil Cycle Diagram. Figure 5-2 depicts the path of oil flow throughout the air compressor system.

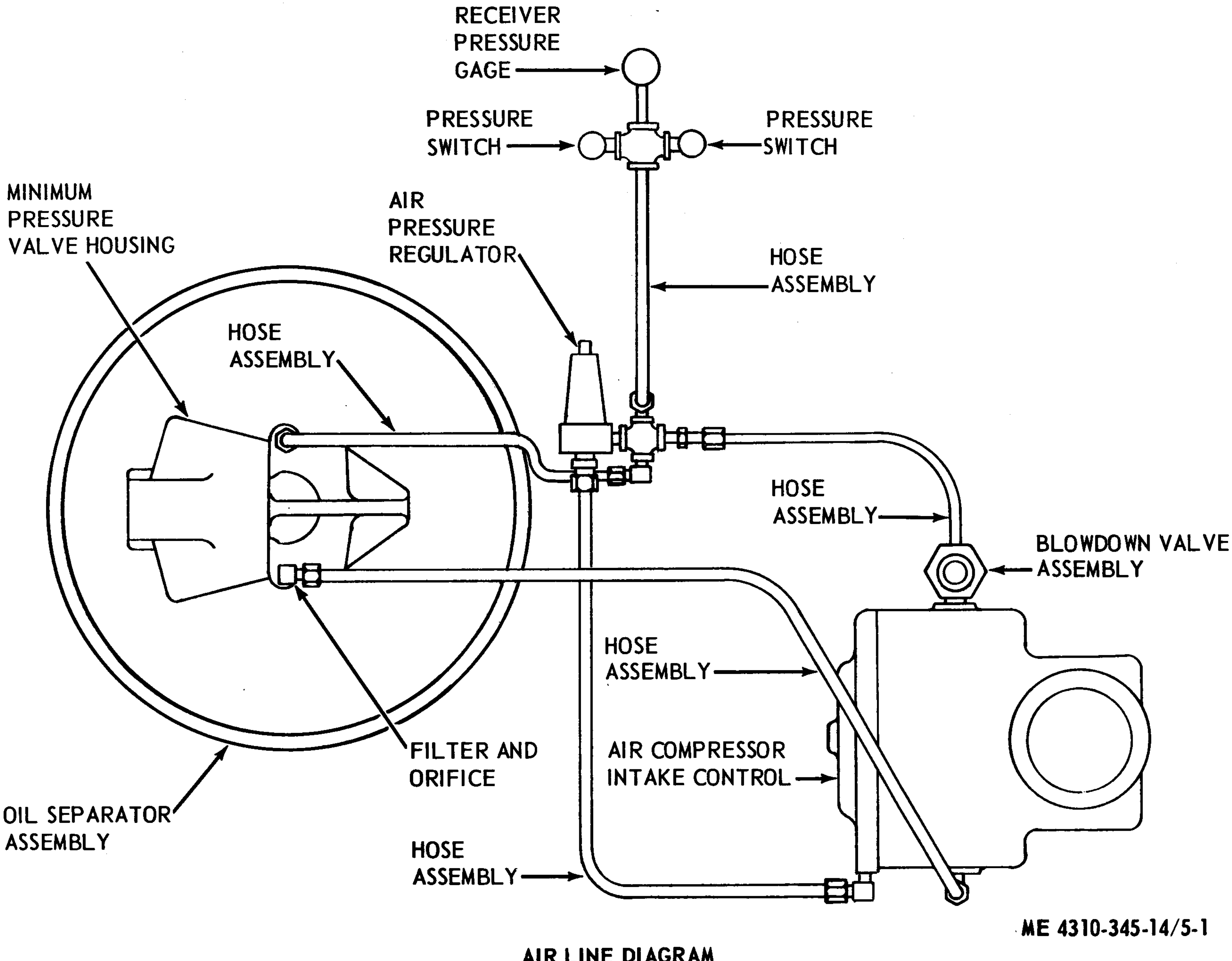


Figure 5-1. Air line diagram.

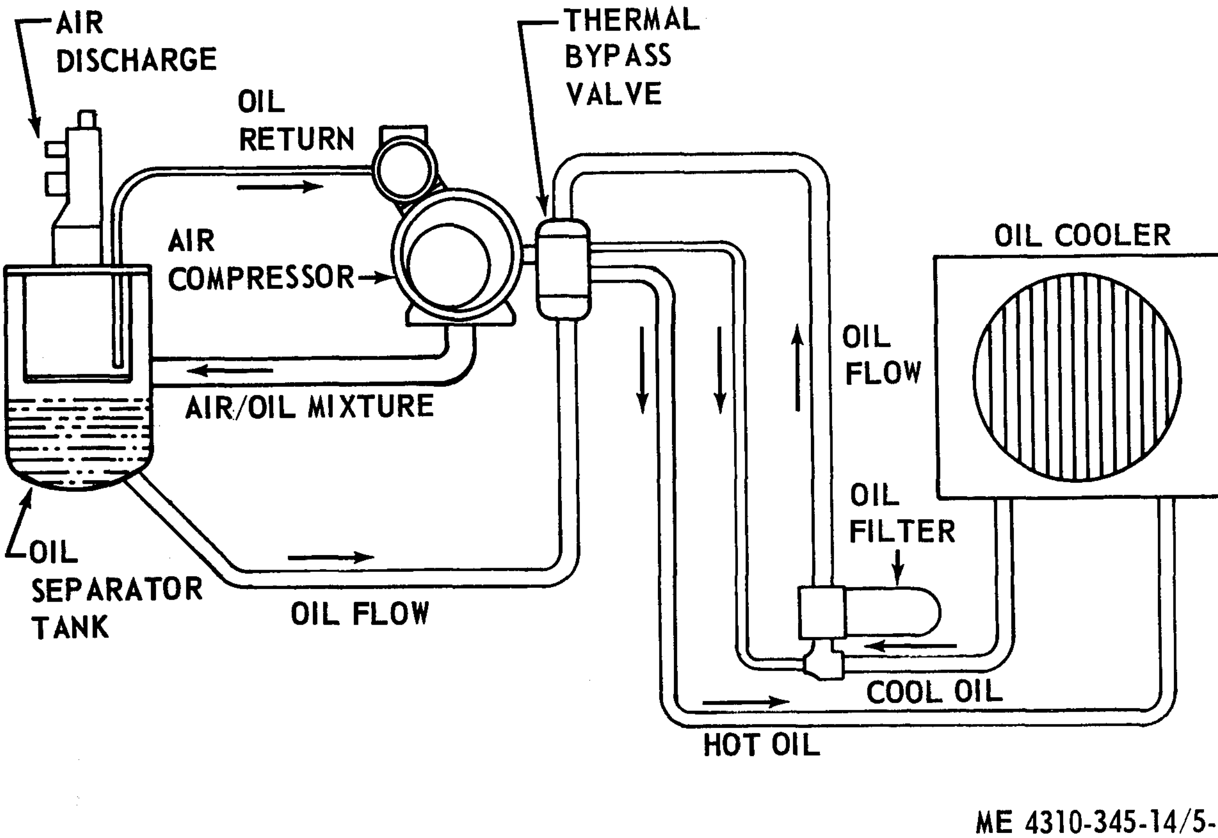


Figure 5-2. Compressor oil cycle diagram.

f. General Cleaning of Parts. In general, clean all metallic parts using a cleaning solvent conforming to Federal Specification P-D-680. Clean non-metallic parts using a clean cloth soaked with the solvent. Dry all parts thoroughly. Any cleaning which differs from this standard will be found in instructions for that specific item.

g. Repair and Replacement Standards. Refer to table 5-2 for repair and replacement standards for the Model 14M250RPV Rotary Air Compressor.

Table 5-2. Repair and Replacement Standards

Component	New Parts Minimum	New Parts Maximum	Wear limits
ENGINE			
Cylinder Block:			
Block Bores			
Diameter (Top)	4.5195"	4.5215"	4.5235"
Diameter (Center)	4.4865"	4.4880"	4.4900"
Diameter (Bottom)	4.3565"	4.3575"	4.3595"
Out-of-Round		0.0015"	
Taper		0.0015"	
Top Surface			
Flatness—Transverse			0.0030"
Flatness—Longitudinal			0.0070"
Depth of Counterbores (Top Surface)			
Cylinder Head Seal Strip Groove	0.0970"	0.1070"	
Oil Holes	0.0920"	0.0980"	
Water Holes	0.1090"	0.1150"	
Main Bearing Bore			
Inside Diameter (Vertical Axis)	3.2510"	3.2520"	

Components	New Parts Minimum	New Parts Maximum	Wear Limits
Cylinder Liner Counterbore			
Diameter	4.8200"	4.8350"	
Depth	0.3000"	0.3020"	
Cylinder Liners:			
Outside Diameter (Upper Seal Ring Surfaces)	4.4850"	4.4860"	
Outside Diameter (Lower Seal Ring Surface)	4.3550"	4.3560"	
Inside Diameter	3.8752"	3.8767"	
Out-of-Round		0.0020"	0.003"
Taper-Liner		0.0010"	0.002"
Depth of Liner Flange Below Block	0.0465"	0.0500"	0.050"
Piston:			
Diameter (At Skirt)	3.8693"	3.8715"	
Cleanance-Piston-to-Liner	0.0037"	0.0074"	0.010"
Out-of-Round		0.0005"	
Taper		0.0005"	
Piston Pin Bushing-Inside Diameter	1.3775"	1.3780"	
Piston Pins:			
Diameter	1.3746"	1.3750"	
Clearance-Pin-to-Piston Bushing	0.0025"	0.0034"	0.010"
Clearance-Pin-to-Rod Bushing	0.0010"	0.0019"	0.010"
Piston Rings:			
Compression Rings			
Gap (Cast iron ring)	0.0200"	0.0360"	0.060"
Clearance-Ring-to-Groove Top (No. 1)	0.0030"	0.0060"	0.012"
No. 2	0.0070"	0.0100"	0.014"
No. 3 and 4	0.0050"	0.0080"	0.013"
Oil Rings			
Gap	0.0100"	0.0250"	0.044"
Clearance-Ring-to-Groove	0.0015"	0.0055"	0.008"
Connecting Rods:			
Length—Center-to-Center	8.7990"	8.8010"	
Lower Bore—Diameter	2.7515"	2.7525"	
Upper Bore—Diameter	1.6000"	1.6010"	
Bushing Inside Diameter	1.3760"	1.3765"	
Normal Rod Side Clearance	0.0060"	0.0120"	
Crankshaft:			
Journal Diameter—Main Bearing	2.9990"	3.0000"	
Journal Diameter—Connecting Rod	2.4990"	2.5000"	
Journal Out-of-Round		0.00025"	
Journal Taper		0.0005"	0.0030"
Thrust Washer Thickness	0.1205"	0.1220"	
End Thrust Clearance	0.0040"	0.0110"	0.0180"
Main Bearings:			
Bearing Inside Diameter (Vertical Axis)	3.0020"	3.0030"	
Bearing Thickness—90° from Parting Line	0.1245"	0.1250"	0.1230"
Clearance—Bearing-to-Journal	0.0010"	0.0040"	0.0060"
Connecting Rod Bearings:			
Bearing Inside Diameter (Vertical Axis)	2.5015"	2.5035"	
Bearing Thickness—90° from Parting Line	0.1245"	0.1250"	0.1230"
Clearance—Bearing-to-Crankshaft Journal	0.0015"	0.0045"	0.0060"
Cylinder Head:			
Cam Follower Bore	1.0626"	1.0636"	See Cam Follower Clearance
Exhaust Valve Seat Insert Counterbore Diameter	1.4390"	1.4400"	
Valve Seat Inserts:			
Outside Diameter	1.4405"	1.4415"	
Seat Width	3/64"	5/64"	5/64"
Valve Seat Runout		0.0020"	0.0020"
Exhaust Valves:			
Stem Diameter	0.3100"	0.3105"	See Guide Clearance
Valve Head Relation to Cylinder Head	.002" Max. above	.032" Max. below	.037" Max below

Table 5-2. Repair and Replacement Standards—Continued

Components	New Parts		Wear Limits
	Minimum	Maximum	
Valve Guides:			
Distance Below Top of Head	0.0100"	0.0400"	
Diameter—Inside	0.03125"	0.3135"	
Clearance—Stem-to-Guide	0.0020"	0.0040"	0.0060"
Rocker Arms and Shafts:			
Rocker Arm Shaft Diameter	0.8735"	0.8740"	
Injector Rocker Arm Bushing Inside Diameter	0.8750"	0.8760"	
Diameter of Bore in Exhaust Valve Rocker Arm for Rocker Arm Shaft	0.8753"	0.8763"	
Clearance—Shaft-to-Injector Rocker Arm Bushing	0.0010"	0.0025"	0.0040"
Clearance-Shaft-to-Exhaust Valve Rocker Arm Bore	0.0013"	0.0028"	0.0040"
Cam Followers:			
Diameter	1.0600"	1.0610"	
Clearance—Follower-to-Head	0.0016"	0.0036"	0.0060"
Width of Roller Slot	0.5635"	0.5685"	
Roller Pin Hole Diameter	0.4362"	0.4370"	
Cam Follower Rollers and Pins:			
Roller Outside Diameter	0.9020"	0.9070"	
Roller Bushing Inside Diameter	0.4390"	0.4395"	
Roller Pin Outside Diameter	0.4374"	0.4377"	
Clearance—Pin-to-Bushing	0.0013"	0.0021"	0.010" Horiz.
Side Clearance—Roller-in-Follower	0,0150"	0.0230"	0.0230"
Camshaft:			
Shaft Diameter at Bearings	2.1820"	2.1825"	
Runout at Center Bearing (When mounted on End Bearings)		0.002"	
Thrust Washer Thickness	0.208"	0.210"	
End Thrust	0.008"	0.015"	0.019"
Balance Shaft:			
Shaft Diameter at Bearings	2.1820"	2.1825"	
Thrust Washer Thickness	0.208"	0.210"	
End Thrust	0.008"	0.015"	0.019"
Camshaft and Balance Shaft Bearings:			
Bearing Inside Diameter	2.187"	2.188"	
Clearance—Bearings-to-Shaft	0.0045"	0.006"	0.008"
Camshaft and Balance Shaft Gears:			
Backlash	0.003"	0.005"	0.007"
Idler Gear:			
Backlash	0.003"	0.005"	0.007"
Idler Gear Bearing Inside Diameter	3.186"	2.187"	
Idler Gear Hub Outside Diameter	2.1825"	2.1835"	
Clearance—Bearing-to-Hub	0.0025"	0.0045"	0.007"
Thrust Washer Thickness	0.118"	0.120"	
End Play	0.006"	0.013"	0.017"
Crankshaft Timing Gear:			
Backlash	0.003"	0.005"	0.007"
Blower Drive Gear:			
Backlash	0.003"	0.005"	0.007"
Blower Drive Gear Shaft End Play	0.004"	0.006"	
Thrust Washer Thickness	0.093"	0.0103"	
Governor Drive Gear:			
Backlash	0.003"	0.005"	0.007"
COMPRESSOR			
Drive End Cover:			
Bearing Bore Diameter	3.9370"	3.9384"	
Bearing Bore Depth	2.495"	2.500"	
Stator Register Diameter	11.3755"	11.3775"	
Concentricity-Bearing Bore to Stator Register (Total indicator reading)	0.000"	0.001"	

Components	New Parts Minimum	New Parts Maximum	Wear Limits
Non-Drive End Cover:			
Bearing Bore Diameter	3.9370"	3.9384"	
Bearing Bore Depth	2.495"	2.500"	
Stator Register Diameter	11.3755"	11.3775"	
Concentricity-Bearing Bore to Stator Register (Total indicator reading)	0.000"	0.001"	
Bearing Retaining Cover:			
Register Outside Diameter	3.925"	3.930"	
Flange to Face	0.930"	0.935"	
Oil Seal Cover:			
Register Outside Diameter	3.925"	3.930"	
Flange to Face	0.950"	0.955"	
Seal Bore Diameter	2.498"	2.502"	
Face to Seal Bore Depth	1.745"	1.750"	
Stator:			
Length	10.506"	10.508"	
Inside Diameter (through bore)	7.994"	8.003"	
End Cover Mounting Diameters (each end)	11.3735"	11.3755"	
Rotor:			
Length	10.498"	10.500"	
Outside Diameter	6.873"	6.875"	
Bore	2.230"	2.231"	
Blade Slot Width	0.250"	0.253"	
Rotor to End Cover Clearance	0.006"	0.010"	0.015"
Shaft:			
Bearing Journals	1.7719"	1.7723"	
Rotor Journal	2.228"	2.229"	
Seal Journal	.749"	1.750"	0.002"
Coupling Journal	1.623"	1.625"	
Concentricity of Journals (Total indicator reading)	0.000"	0.001"	
Blades:			
Length	10.485"	10.487"	
Height	1810"	1.812"	1.790"
Thickness	0.244"	0.246"	
Clearance in Rotor Slot	0.004"	0.009"	

Section iV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS AND AUXILIARIES

5-6. General

The major components covered in this section are the engine assembly, air compressor assembly, and compressor oil separator assembly.

5-7. Compressor Oil Separator Assembly

a. Removal.

(1) Drain all oil from oil separator assembly (fig. 3-4).

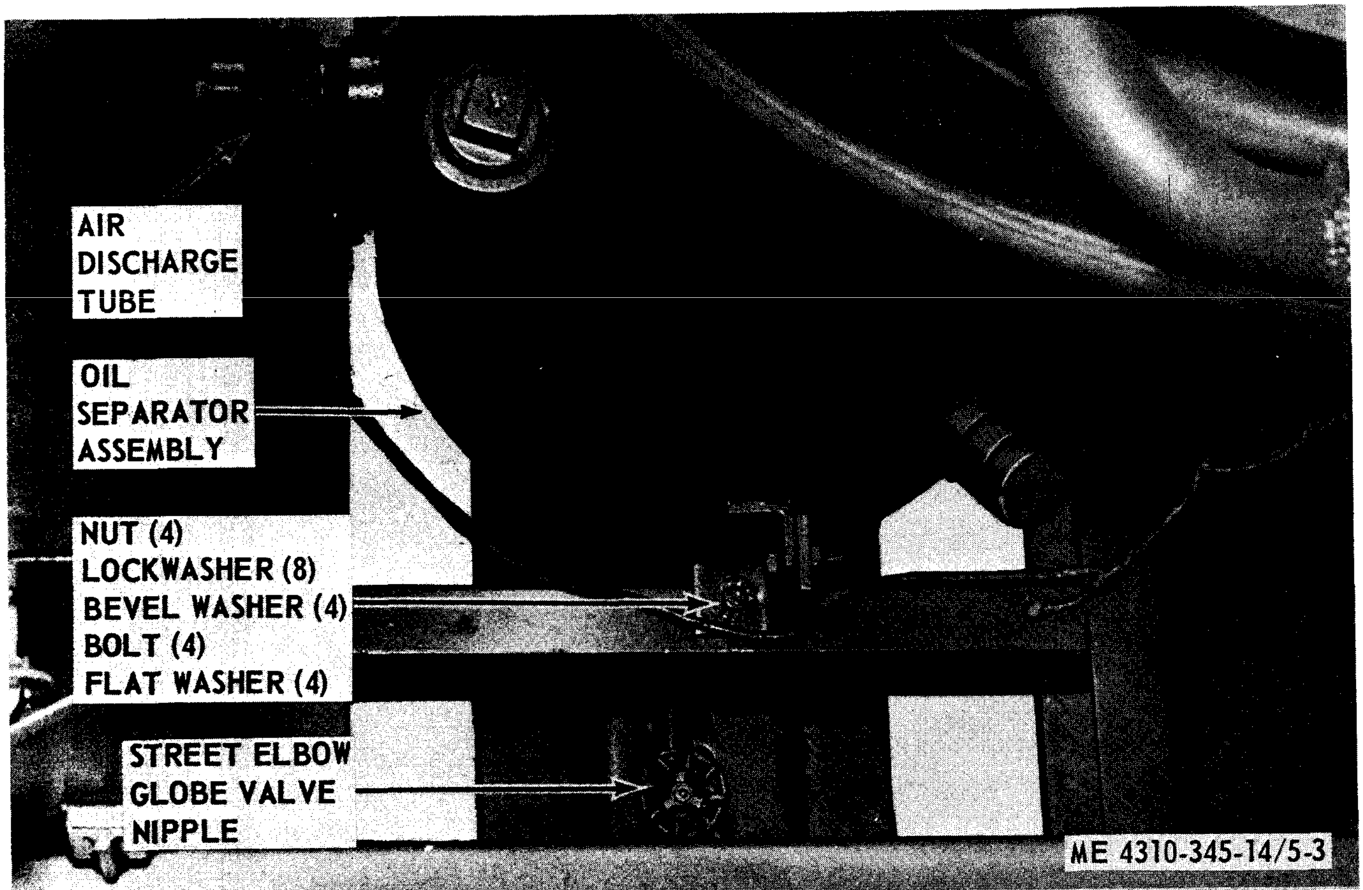
(2) Remove discharge connections, service valves, and piping (fig. 4-44).

(3) Remove hose reel assemblies and clamps (fig. 4-45).

(4) Remove air hoses and fittings as necessary from oil separator assembly (fig. 4-47).

(5) Remove safety valve (fig. 4-49).

(6) Attach lifting device to lifting eye on minimum pressure valve assembly and remove oil separator assembly as shown in figure 5-3.



REMOVAL

STEP 1. REMOVE STREET ELBOW, GLOBE VALVE, AND NIPPLE.

STEP 2. REMOVE NUTS, LOCKWASHERS, BEVEL WASHERS, BOLTS, AND FLAT WASHERS.

STEP 3. DISCONNECT COMPRESSOR AIR DISCHARGE TUBE.

STEP 4. REMOVE OIL SEPARATOR ASSEMBLY.

INSTALLATION

STEP 1. INSTALL OIL SEPARATOR ASSEMBLY IN POSITION ON FRAME.

STEP 2. SECURE WITH FLAT WASHERS, LOCKWASHERS, BOLTS, BEVEL WASHERS, AND NUTS.

STEP 3. INSTALL NIPPLE, GLOBE VALVE, AND STREET ELBOW.

STEP 4. CONNECT COMPRESSOR AIR DISCHARGE TUBE.

Figure 5-3. Oil separator assembly, removal and installation.

b. Installation.

(1) Install oil separator assembly as shown in figure 5-3.

(2) Install safety valve (fig. 4-49).

(3) Install air hoses and fittings to oil separator assembly (fig. 4-47).

(4) Install hose reel assemblies and clamps (fig. 4-45).

(5) Install discharge connections, service valves and piping (fig. 4-44).

(6) Replenish oil in accordance with LO 5-4310-345-12. Fill to full mark on dipstick.

5-8. .Air Compressor Assembly

a. Removal.

(1) Drain all oil from oil separator (fig. 3-4).

(2) Remove air hoses as necessary (fig. 4-47). and discharge connection from bottom of air compressor assembly.

(3) Remove cold weather starting aid (para 4-38).

(4) Remove air pressure regulator assembly and bracket (fig. 4-30).

(5) Remove external components on housing group (fig. 4-28).

(6) Remove engine and compressor air cleaner assemblies (fig. 4-29).

(7) Remove housing components as necessary for removal of air compressor assembly (fig. 4-32).

(8) Remove engine throttle lever and rods as necessary for removal of air compressor assembly (fig. 4-27).

(9) Disconnect control cables as necessary (fig. 4-25

(10) Remove blowdown valve assembly (fig. 4-50).

(11) Remove thermal bypass valve assembly (fig. 4-52).

(12) Remove oil lines and fittings as necessary (fig. 4-53).

(13) Remove thermostatic switch (fig. 4-26).

(14) Remove air compressor assembly as shown in figure 5-4.

REMOVAL

STEP 1. DISCONNECT DISCHARGE TUBE FROM OIL SEPARATOR TANK. REMOVE TUBE AND "O" RINGS.

STEP 2. REMOVE BOLTS, LOCKWASHERS, DISCHARGE CONNECTION, AND "O" RING.

STEP 3. REMOVE TWO BOLTS AND LOCKWASHERS SECURING COMPRESSOR MOUNTING FEET.

STEP 4. REMOVE TWELVE BOLTS AND LOCKWASHERS SECURING ENGINE FLYWHEEL ADAPTOR TO FLYWHEEL HOUSING.

STEP 5. PULL COMPRESSOR ASSEMBLY TO THE REAR TO DISENGAGE COUPLING. REMOVE COMPRESSOR ASSEMBLY.

INSTALLATION

STEP 1. INSTALL COMPRESSOR ASSEMBLY ON FLYWHEEL HOUSING. MAKE CERTAIN COUPLING IS ENGAGED PROPERLY.

STEP 2. INSTALL TWELVE LOCKWASHERS AND BOLTS SECURING FLYWHEEL ADAPTOR TO FLYWHEEL HOUSING.

STEP 3. INSTALL TWO LOCKWASHERS AND BOLTS SECURING COMPRESSOR MOUNTING FEET.

STEP 4. INSTALL "O" RING AND DISCHARGE CONNECTION. SECURE WITH LOCKWASHERS AND BOLTS.

STEP 5. INSTALL "O" RINGS AND DISCHARGE TUBE. CONNECT TUBE TO OIL SEPARATOR TANK.

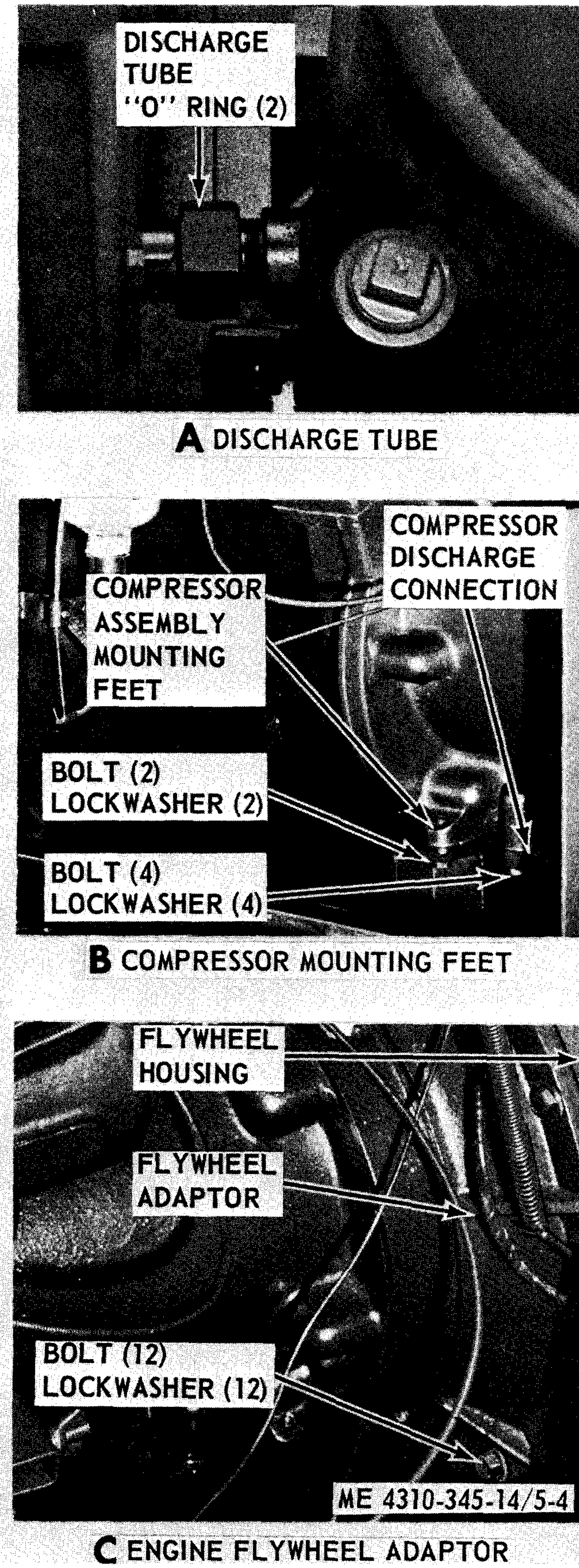


Figure 5-4. Air compressor assembly, removal and installation.

b. Installation.

(1) Install air compressor assembly as shown in figure 5-4.

(2) Install thermostatic switch. (fig. 4-26).

(3) Install oil lines and fittings as necessary (fig. 4-53).

(4) Install thermal bypass valve assembly (fig. 4-52).

(5) Install blowdown valve assembly (fig. 4-50).

(6) Connect control cables as necessary (fig. 4-25).

(7) Install engine throttle lever and rods as necessary (fig. 4-27).

(8) Install housing components (fig. 4-32).

(9) Install engine and compressor air cleaner assemblies (fig. 4-29).

(10) Install external components on housing group (fig. 4-28).

(11) Install air pressure regulator assembly and bracket (fig. 4-30).

(12) Install cold weather starting aid (para 4-38).

(13) Install air hoses (fig. 4-47) and discharge connection on bottom of compressor.

(14) Replenish oil in oil separator assembly in accordance with LO 5-4310-345-12. Fill to full mark in dipstick.

5-9. Engine Assembly

a. Removal.

(1) Remove external components on housing group (fig. 4-28).

(2) Remove fuel pressure hose to fuel gage from secondary filter (fig. 4-56).

(3) Remove housing components as necessary for removal of engine assembly (fig. 4-32).

(4) Remove fan guard and shroud (fig. 4-33).

(5) Drain engine coolant from radiator and remove coolant lines and hoses as necessary (fig. 4-34).

(6) Remove engine throttle lever and rods as necessary (fig. 4-27).

(7) Remove fuel lines from primary fuel filter and fuel return. Remove fuel pressure hose from secondary fuel filter (fig. 4-56).

(8) Remove cold weather starting atomizer and line from engine air intake (fig. 4-23).

(9) Remove shielded cable from battery-charging generator (fig. 4-70).

(10) Disconnect battery cables from starting motor (fig. 4-13).

(11) Remove shutdown solenoid wiring harness (fig. 4-21).

(12) Remove tachometer-hourmeter cable from engine adaptor (fig. 4-25).

(13) Remove bolts attaching compressor adaptor to engine flywheel housing (fig. 5-4).

(14) Attach lifting device to engine and remove engine assembly as shown in figure 5-5.

REMOVAL

STEP 1. REMOVE THE SIX BOLTS AND LOCKWASHERS SECURING ENGINE ASSEMBLY TO FRONT ENGINE SUPPORTS.

STEP 2. REMOVE THE EIGHT BOLTS AND LOCKWASHERS (4 EACH SIDE) SECURING ENGINE ASSEMBLY TO REAR ENGINE SUPPORTS.

STEP 3. USING CHAIN HOIST OR OTHER SUITABLE LIFTING DEVICE, REMOVE ENGINE ASSEMBLY.

CAUTION

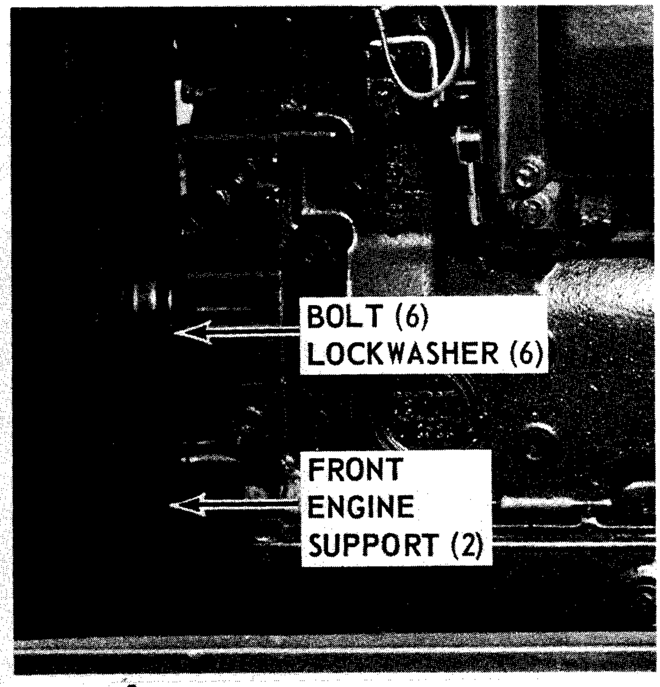
ENGINE MUST BE MOVED FORWARD TO DISENGAGE PIN TYPE COUPLING TO COMPRESSOR ASSEMBLY.

INSTALLATION

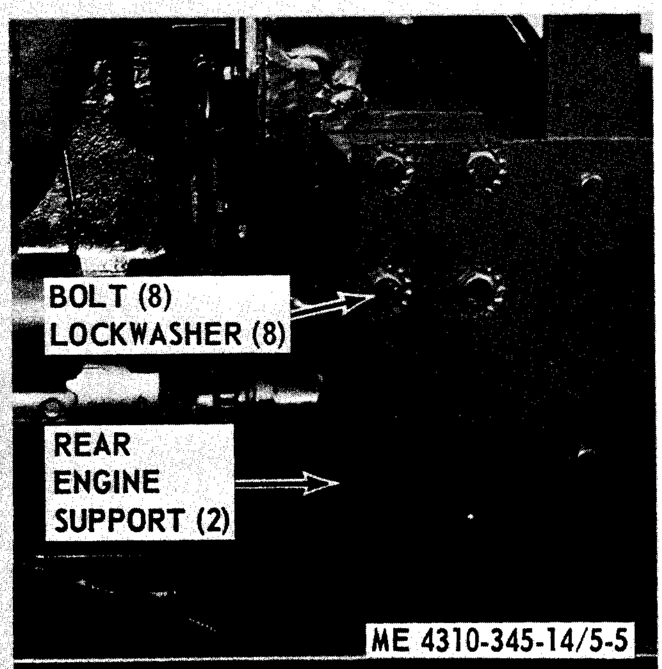
STEP 1. POSITION ENGINE ASSEMBLY CAREFULLY AND MOVE IN DIRECTION OF COMPRESSOR ASSEMBLY. MAKE CERTAIN COUPLING IS ENGAGED BETWEEN ENGINE AND COMPRESSOR.

STEP 2. INSTALL LOCKWASHERS AND BOLTS SECURING ENGINE ASSEMBLY TO REAR ENGINE SUPPORTS.

STEP 3. INSTALL LOCKWASHERS AND BOLTS SECURING ENGINE ASSEMBLY TO FRONT ENGINE SUPPORTS.



A FRONT ENGINE MOUNTING



B REAR ENGINE MOUNTING

Figure 5-5. Engine assembly, removal and installation.

b. Installation.

(1) Install engine assembly as shown in figure 5-5.

(2) Install bolts to attach compressor adaptor to engine flywheel housing (fig. 5-4).

(3) Install tachometer-hourmeter cable to engine adaptor (fig. 4-25).

(4) Install shutdown solenoid wiring harness (fig. 4-21).

(5) Connect battery cables to starting motor (fig. 4-13).

(6) Connect shielded cable to battery-charging generator (fig. 4-70).

(7) Install cold weather starting aid atomizer and line (fig. 4-23).

(8) Install fuel lines on primary fuel filter and fuel return. Install fuel pressure hose to secondary fuel filter (fig. 4-56).

(9) Install engine throttle lever and rods (fig. 4-27).

(10) Install coolant lines and hoses (fig. 4-34). Replenish engine coolant (para 3-5).

(11) Install fan guard and shroud (fig. 4-33).

(12) Install housing components (fig. 4-32).

(13) Install fuel pressure hose to fuel gage from secondary filter (fig. 4-56).

(14) Install external components on housing group (fig. 4-28).

(15) Start engine and check for leaks.

CHAPTER 6

REPAIR OF AIR COMPRESSOR

Section I. OIL SEPARATOR ASSEMBLY

6-1. General

The oil separator assembly consists of a labyrinth type tank, minimum pressure valve, service valves, safety valve, dipstick type oil level gage, and filter element. A compressed air-oil mixture flows from the air compressor into the oil separator. The air-oil mixture swirls through the labyrinth where most of the oil separates from the air and returns to the bottom of the tank. The air passes through the filter element, which removes the remainder of the oil, then through the minimum pressure valve and on to the air service valves. The minimum pressure valve maintains a pressure within the tank to effect air-oil separation and to circulate the oil throughout the air compressor system. The safety valve protects the system from abnormally high air pressure. The valve opens and vents the air to atmosphere if air pressure in the tank exceeds 125 PSI.

6-2. Oil Separator Assembly

a. Removal. Remove oil separator assembly (para 5-7).

b. Disassembly. Disassemble oil separator assembly in numerical sequence shown in figure 6-1.

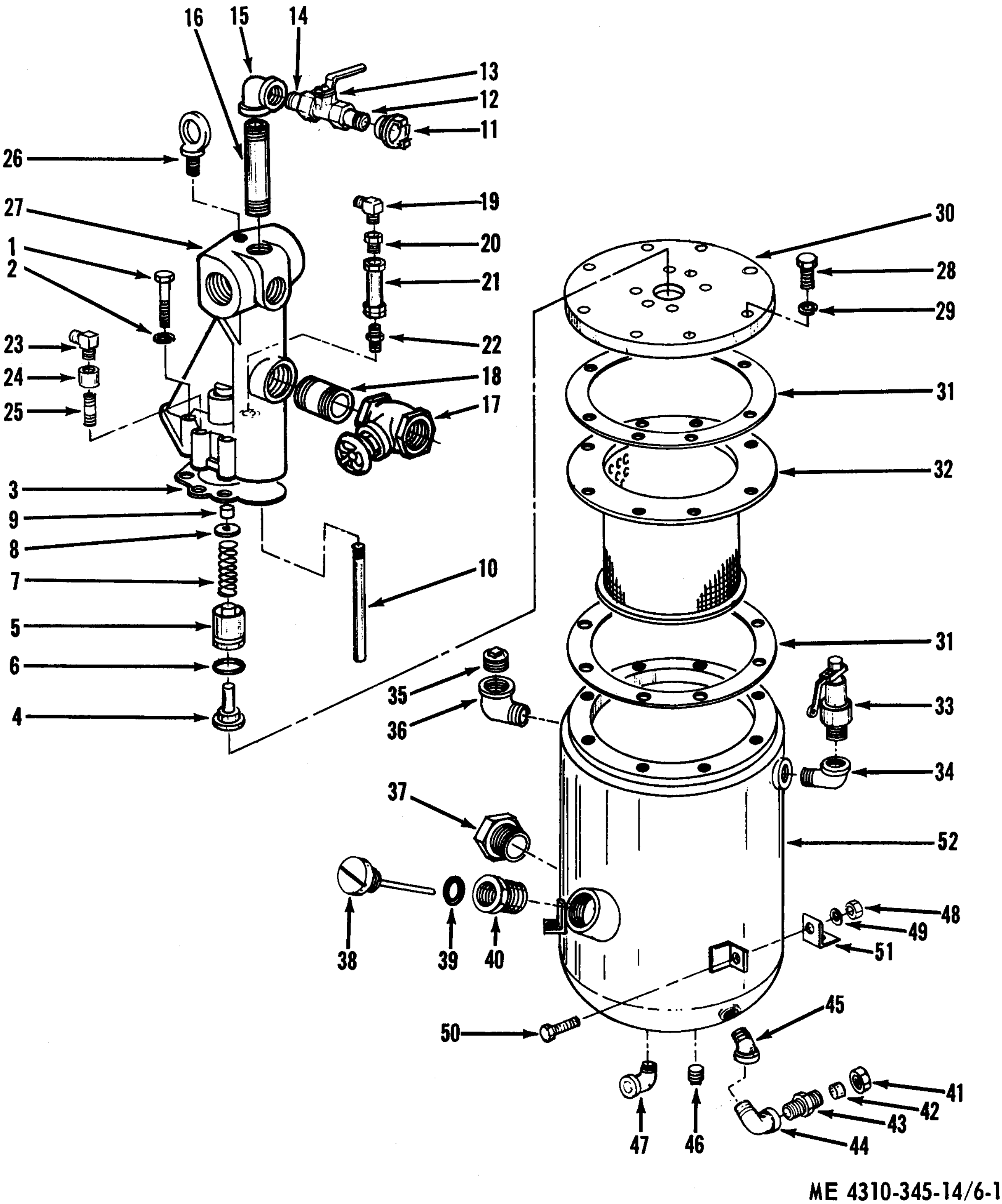


Figure 6-1. Oil separator assembly, disassembly and reassembly.

KEY to figure 6-1:
1. Bolt (4)
2. Lockwasher (4)
3. Gasket
4. Valve assembly
5. Piston
6. O-Ring
7. Spring
8. Washer
9. Felt
10. Pipe
11. Hose coupling
12. Nipple
13. Service valve
14. Close nipple
15. Elbow
16. Nipple
17. Valve
18. Nipple
19. Elbow
20. Orifice
21. Filter
22. Connector
23. Elbow
24. Coupling
25. Nipple
26. Eyebolt
27. Housing
28. Bolt (8)
29. Lockwasher (8)
30. Cover
31. Gasket (2)
32. Element
33. Safety valve
34. Elbow
35. Plug
36. Elbow
37. Adaptor
38. Dipstick
39. O-Ring
40. Adaptor
41. Nut
42. Sleeve
43. Connector
44. Elbow
45. Elbow
46. Plug
47. Elbow
48. Lock nut
49. Washer
50. Bolt
51. Bracket
52. Tank

c. Cleaning, Inspection, and Repair.

(1) Clean parts, except element, in accordance with paragraph 5-5*f*. Discard all gaskets and O-rings.

(2) Inspect element for holes, varnish, or any other defect.

(3) Inspect spring for defective coils, distortion, or any other defect.

(4) Inspect all minimum pressure valve parts for cracks, breaks, distortion, deterioration, or any other defect.

(5) Inspect all other parts for cracks, breaks, distortion, or any other defect.

d. Reassembly. Reassemble oil separator assembly in reverse numerical sequence shown in figure 6-1.

e. Installation. Install oil separator assembly (para 5-7).

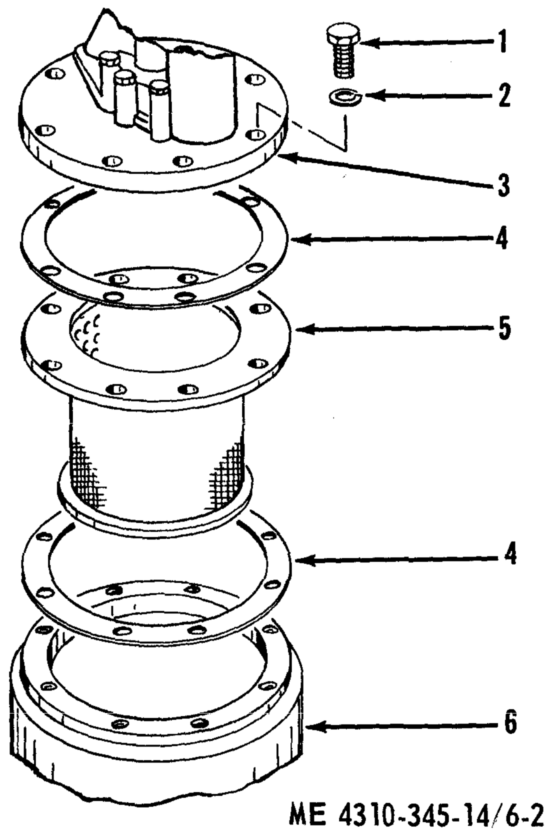
6-3. Oil Separator Element

a. Removal.

(1) Disconnect air lines necessary for removal of oil separator cover (fig. 4-47).

(2) Remove hose reel assemblies and clamps (fig. 4-45).

(3) Remove minimum pressure valve assembly, oil separator cover, gaskets, and element in numerical sequence shown in figure 6-2. Discard gaskets.



1. Bolt (8)
2. Lockwasher (8)
3. Cover
4. Gasket (2)
5. Element
6. Tank

Figure 6-2. Oil separator element, removal and installation.

b. Inspection. Inspect element for holes, varnishing, distortion, or any other defect.

c. Installation.

(1) Install element, new gaskets, oil separator cover, and minimum pressure valve assembly in reverse numerical sequence shown in figure 6-2.

(2) Install hose reel assemblies and clamps (fig. 4-45).

(3) Connect air lines to oil separator cover (fig. 4-47).

Section II. THERMAL BYPASS VALVE ASSEMBLY

6-4. General

The thermal bypass valve assembly provides rapid warming of the compressor at initial start by channeling the oil from the oil separator, through the oil filter, into the compressor (fig. 5-2). When the oil temperature reaches approximately 150° F, the bypass valve channels part of the oil through the oil cooler before it goes to the filter and compressor. At approximately 180° F all oil flow is directed through the oil cooler. Between these two temperatures, the therm al bypass valve mixes hot oil from the oil separator with cool oil from the oil cooler to maintain a relatively constant minimum operating temperature.

6-5. Thermal Bypass Valve Assembly

a. Removal. Remove thermal bypass assembly (fig. 4-52).

b. Disassembly. Disassemble thermal bypass assembly in numerical sequence shown in figure 6-3.

c. Cleaning, Inspection, and Repair.

(1) Clean parts in accordance with paragraph 5-5 *d.* Discard O-rings.

(2) Inspect covers and body for cracks, breaks, damaged threads, or any other defect.

(3) Inspect springs for cracks, breaks, distortion, or any other defect.

(4) Inspect power element for distortion, jamming, or any other defect.

KEY to figure 6-3:
1. Bolt (4)
2. Lockwasher (4)
3. Cover
4. O-Ring
5. Bypass connection
6. O-Ring
7. Spring
8. Bolt
9. Guide
10. Plunger
11. Spring
12. O-Ring
13. Shuttle
14. Nut
15. Lockwasher
16. Power element
17. O-Ring
18. Retaining ring
19. Washer
20. Spring
21. Ball
22. Body

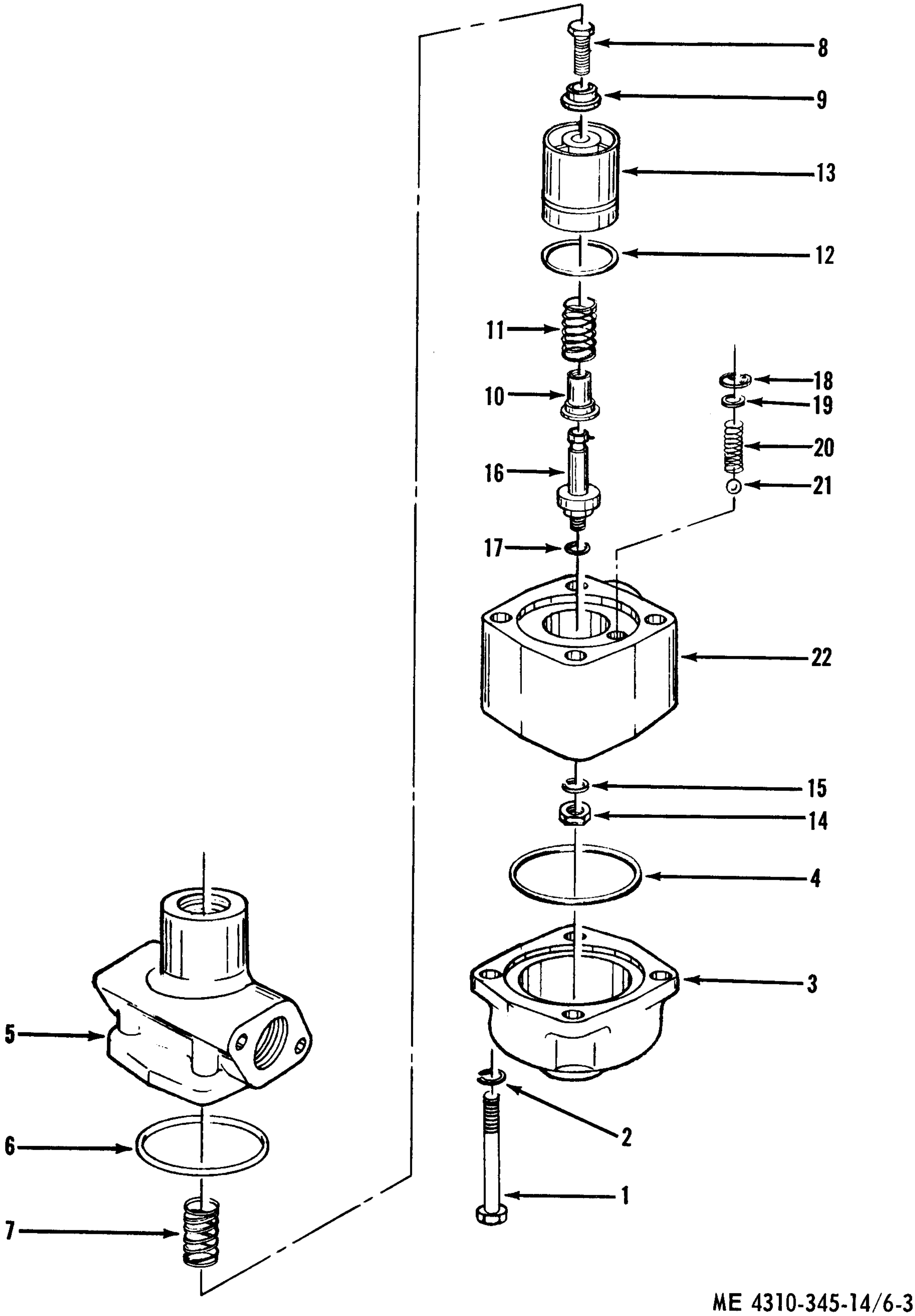


Figure 6-3. Thermal bypass assembly. disassembly and reassembly.

(5) Inspect all attaching hardware for cracks, damaged threads, or any other defect.

CAUTION

During reassembly, do not overtighten power element retaining nut. Overtightening can cause distortion, resulting in a malfunction.

d. Reassembly. Reassemble thermal bypass valve assembly in reverse numerical sequence shown in figure 6-3. Install new O-rings.

e. Installation. Install thermal bypass assembly (fig. 4-52).

Section iii. AIR PRESSURE REGULATOR ASSEMBLY

6-6. General

The air pressure regulator assembly controls the intake control valve opening and engine RPM to meet any air output demand within the capabilities of the Model 14M250RPV Rotary Air Compressor. When the Compressor. When the compressor is running loaded, the air pressure regulator also bleeds air into the stator to prevent a vacuum buildup and consequential blade chattering. Discharge air acting on a valve and spring in the regulator causes the valve to open as air pressure reaches 100 PSI. As the valve opens, it allows air to enter the intake-control between the cover and diaphragm and forces the intake valve closed. As the intake valve closes, engine RPM decreases. As long as air pressure is held at 100 PSI, the intake valve remains closed and the engine RPM remains at idle. When air is demanded again, the valve in the air pressure regulator closes, which allows the intake control valve to open and engine RPM to increase.

6-7. Air Pressure Regulator Assembly

a. Removal. Remove air pressure regulator assembly (fig. 4-30).

b. Disassembly. Disassemble air pressure regulator assembly in numerical sequence shown in figure 6-4.

c. Cleaning, Inspection, and Repair.

(1) Clean parts in accordance with paragraph 5-5 *f.* Remove all sealant that was used during assembly. Discard O-ring and diaphragm.

(2) Inspect springs for defective coils, cracks, distortion, or any other defect.

KEY to figure 6-4:
1. Bolt (2)
2. Lockwasher (2)
3. Bracket
4. Connector (2)
5. Elbow (2)
6. Cross
7. Nipple
8. Screw (4)
9. Washer (4)
10. Base
11. Seat
12. Screw
13. Diaphram
14. Plate
15. O-Ring
16. Stem
17. Spring
18. Nut
19. Spring
20. Seat
21. Nut
22. Screw
23. Housing

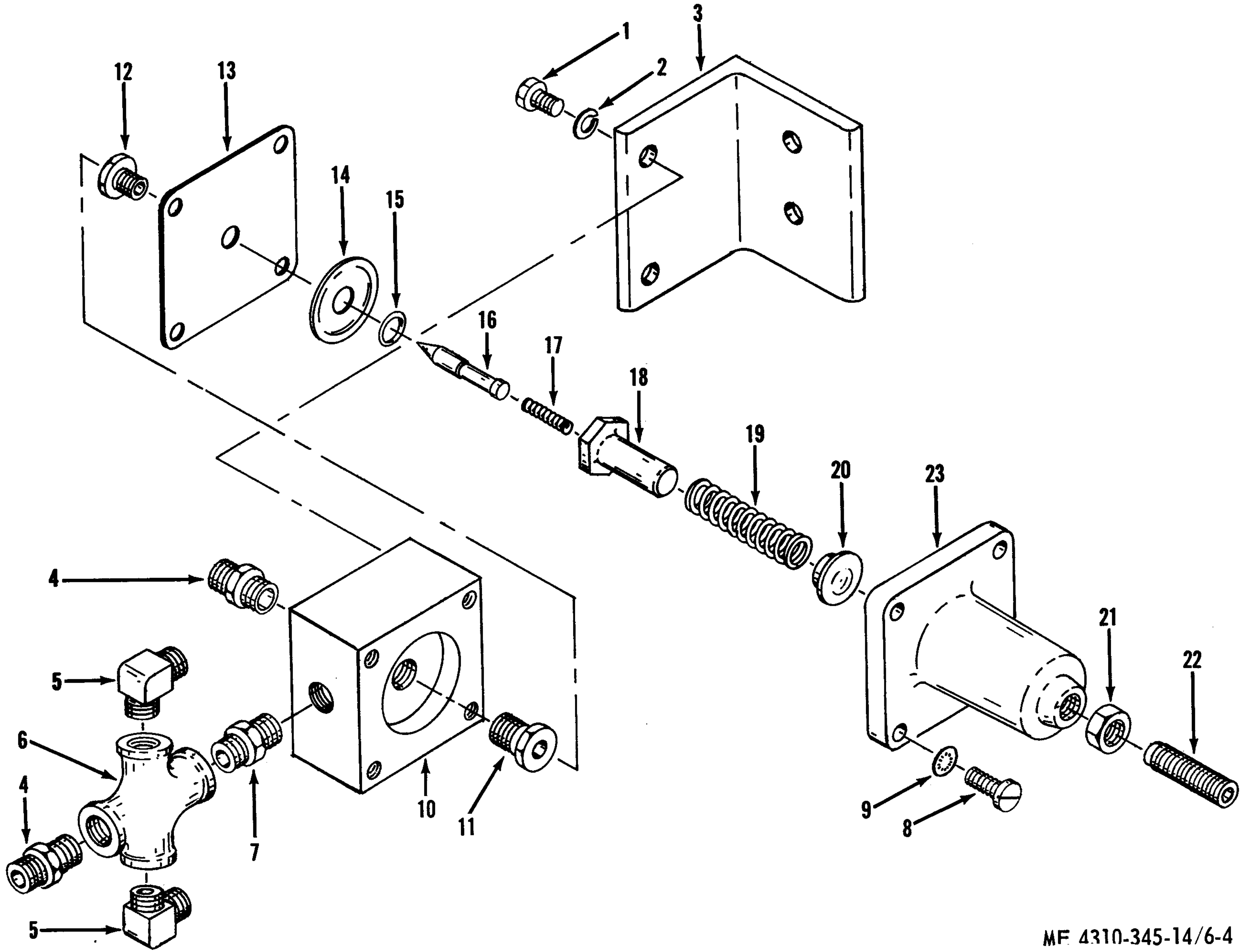


Figure 6-4. Air pressure regulator assembly, disassembly and reassembly.

(3) Inspect valve and seat for excessive wear, distortion, cracks, or any other defect.

(4) Inspect all other parts for distortion, cracks, breaks, excessive wear, or any other defect.

(5) Inspect attaching hardware for damaged threads, distortion, cracks, or any other defect.

d. Reassembly. Reassemble air pressure regulator assembly in reverse numerical sequence. shown in figure 6-4. Install a new O-ring and diaphragm. Use sealant when installing valve seat; also use sealant when assembling diaphragm and washer with screw and nut.

e. Installation. Install air pressure regulator assembly (fig. 4-30).

f. Adjustment. Adjust air pressure regulator assembly (fig. 4-30).

Section IV. AIR COMPRESSOR ASSEMBLY

6-8. General

Basically, the air compressor assembly consists of the intake control, a cast single stage stator, rotor, rotor blades, end covers, flywheel housing adaptor, and coupling. A valve in the intake control unit controls the amount of air that is taken into the compressor and shuts off the air input when a pressure of approximately 115 PSI is reached in the oil separator assembly. When the valve is closed, the compresser is running unloaded. The valve also closes when the compresser shuts down, thereby preventing any oil and air mixture from the rotor-stator from being vented to the atmosphere. When the compresser is running unloaded, a vacuum can develop within the stator and cause internal damage. To prevent this, the air pressure regulator valve causes the intake control valve to open slightly, which allows just enough air input to prevent a vacuum buildup. The compressor also incorporates spring loaded drain valves which prevent hydraulic locks within the stator. The rotor is mounted in the stator housing on a shaft which protrudes through the end covers and rotates on two roller bearings. Air and oil is drawn into the stator and compressed by the action of the rotor and blades. The compressed air-oil mixture is discharged into the oil separator where a labyrinth chamber and filter separate the oil from the air. The air is then passed on to the service valves and the oil is recirculated into the compressor. The air compressor develops an air flow of 250 CFM at a discharge pressure of 100 PSI.

6-9. Air Compressor Assembly

a. Removal. Remove air compressor assembly (para 5-8).

b. Disassembly. Disassemble air compressor assembly in numerical sequence shown in figure (6-5.

NOTE

Do not disassemble drive end cover-rotor combination except to replace defective parts. If an inspection reveals that any of these parts are defective and need to be replaced, refer to paragraph *c*, below.

c. Drive End Cover-Rotor Disassembly.

NOTE

It is recommended that the drive end cover-rotor combination not be disassembled unless an inspection reveals defective parts that need replacing.

(1) Disassemble in numerical sequence is shown in figure 6-6.

CAUTION

Since excessive heat causes softening of the metal, any inner race heated in the following manner must be discarded and the entire bearing replaced. Never heat inner race unless it is intended to replace entire bearing.

KEY to figure 6-5:
1. Bolt (6)
2. Lockwasher (6)
3. Bracket (2)
4. Cover
5. Diaphragm
6. Nut
7. Piston
8. Spring
9. Stem
10. Cylinder
11. Gasket
12. Spring
13. Valve
14. Bolt (3)
15. Lockwasher (3)
16. Gasket
17. Guide
18. Lever
19. Lock nut
20. Bolt
21. Clamp
22. Bolt (2)
23. Lockwasher (2)
24. Guide
25. Gasket
26. Bushing
27. O-Ring
28. Pushrod
29. Screw
30. Lever arm
31. Stop pin
32. Screw
33. Washer
34. Valve plate
35. Shaft
36. Housing
37. Bolt (6)
38. Lockwasher (6)
39. Cover
40. Gasket
41. Bolt (6)
42. Seal washer (6)
43. End cover
44. O-Ring
45. Bearing outer race
46. Bolt
47. Lockwasher
48. Retainer
49. Coupling
50. Gripspring (2)
51. Key
52. Bolt (6)
53. Seal washer (6)
54. Adaptor
55. Gasket
56. Bolt (6)
57. Lockwasher (6)
58. Cover
59. Gasket
60. Oil seal
61. Cover
62. O-Ring
63. Drive screw
64. Plate
65. Ball
66. Blade (8)
67. Rotor
68. Key
69. Bearing inner race
70. Bearing
71. Shaft
72. Plug (2)
73. O-Ring (2)
74. Spring (2)
75. Valve (2)
76. Eyevolt
77. Stator

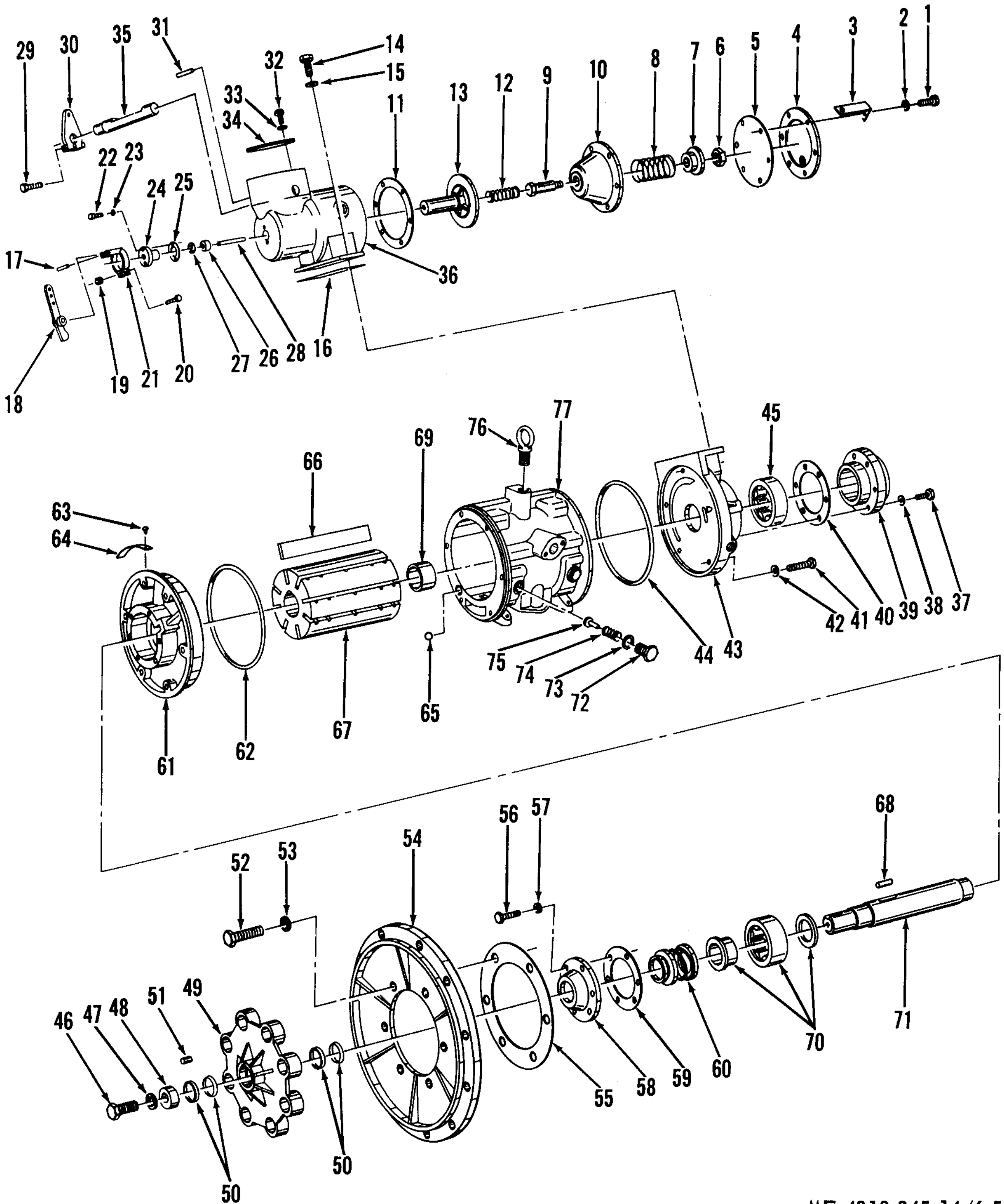
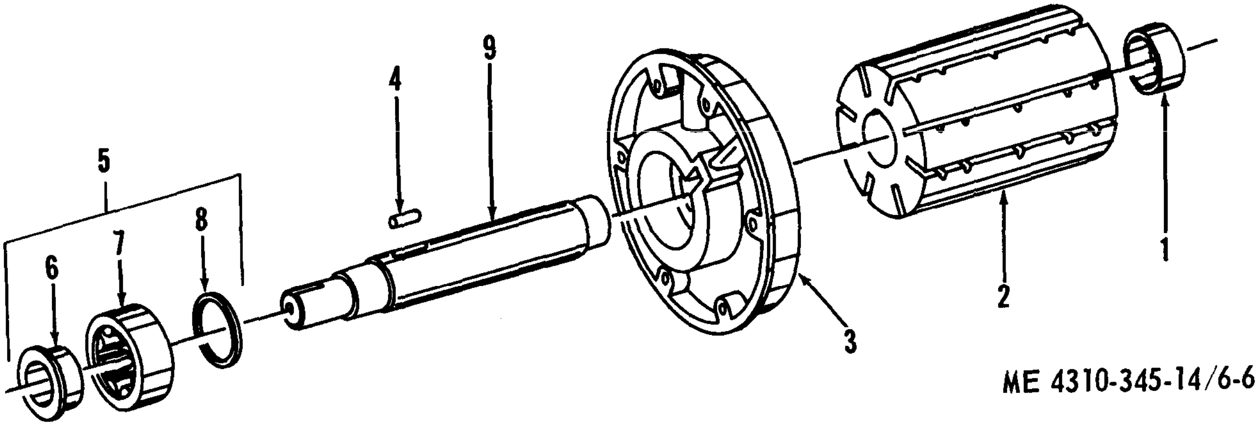


Figure 6-5. Air compressor assembly, disassembly and reassembly.



1. Bearing inner race
2. Rotor
3. Drive end cover
4. Key
5. Bearing assembly
6. Inner race
7. Outer race
8. Inner ring
9. Shaft

Figure 6-6. Drive end cover-rotor, disassembly and reassembly.

(2) Remove bearing inner races using a gear puller or the equivalent. If either inner race will not move, use a torch and heat race evenly. With heat applied, remove inner race as quickly as possible.

d. Cleaning, Inspection, and Repair.

(1) Clean all parts in accordance with paragraph 5-5 *f.* Discard all gaskets and O-rings.

(2) Inspect all springs for defective coils, cracks, distortion, or any other defect.

(3) Inspect intake control diaphragm for rupture, deterioration, or any other defect.

(4) Inspect intake control valve for cracks, distortions, condition of seat, excessive wear, or any other defect.

(5) Inspect rotor blades for cracks, breaks, chipping, excessive wear, or any other defect. If blades are worn on one side only, they can be turned over and reused. Refer to figure 6-8.

(6) Inspect rotor and stator for cracks, gouges, excessive wear, raised metal, or any other defect.

(7) Inspect bearings for freedom of rotation, excessive wear, cracks, breaks, or any other defect.

(8) Inspect all other parts for cracks, breaks, distortion, or any other defect.

(9) Inspect attaching hardware for damaged threads, distortion, cracks, or any other defect.

c. Reassembly. Reassemble air compressor assembly in reverse numerical sequence shown in figure 6-5, except rotor blades are installed after drive end cover-rotor assembly is installed. Install new gaskets and O-rings.

NOTE

If drive end cover-rotor assembly is disassembled, refer to Paragraph *f*, below, for reassembly instruction.

f. Drive End Cover-Rotor Reassembly. Reassemble drive end cover-rotor assembly in reverse numerical sequence shown in figure 6-6.

CAUTION

Do not use a torch or any similar heating method on bearing inner races. Excessive or uneven heat will cause softening of the metal. To prevent galling the shaft, do not allow an inner race to cool before it is installed.

(1) When installing bearing inner races, submerge them in hot cooking oil and heat to 350° F. maximum.

(2) Install rotor with oil drain holes in blade slots positioned at leading edge of slots in accordance with rotor rotation.

g. Installation. Install air compressor assembly (para 5-8).

6-10. Air Compressor Rotor Blade Inspection and Replacement

a. Disassembly.

(1) Remove locknut and disconnect stop block from speed control arm.

(2) Disconnect control cables from speed control; compressor unloader; and cold weather starting aid.

(3). Disconnect cold weather starting aid tubing at control valve.

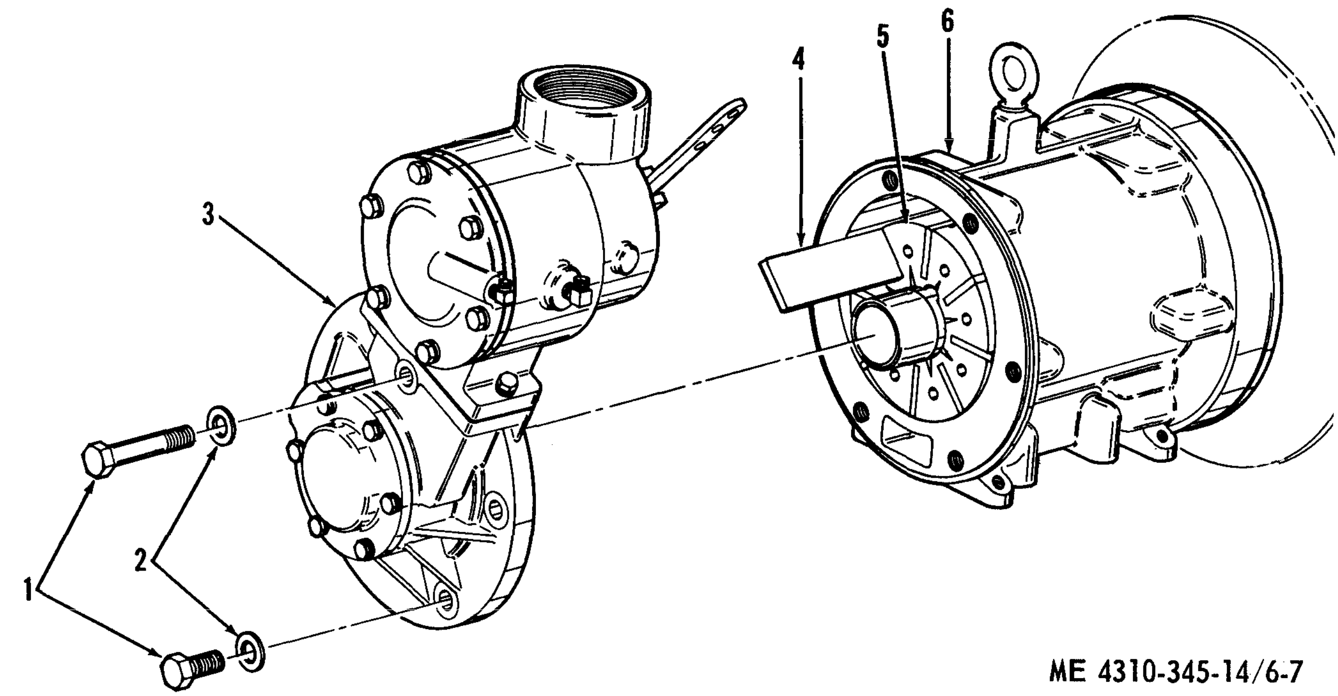
(4) Disconnect air hoses from oil separator, intake unloader, and blowdown valve.

(5) Remove nuts and lockwashers attaching instrument panel assembly to rear housing panel.

(6) Remove hose clamps and hose from intake unloader and compressor air cleaner assembly.

(7) Block up housing roof section and remove rear housing panel.

(8) Disassemble compressor non-drive end in numerical sequence shown in figure 6-7. Use a wire bent into a hook on one end to extract rotor blades from slots at top of rotor. To bring blades into position at top of rotor, rotate engine by repeatedly pressing start button.



1. Bolt (6)
2. Lockwasher (6)
3. Intake housing and end cover assembly
4. Blade (8)
5. Rotor
6. Stator

Figure 6-7. Compressor non-drive end, disassembly, blade inspection, and reassembly.

b. Inspection. Inspect blades for evidence of excessive wear. See figure 6-8. Blades are excessively worn when 25 per cent of covering per side has been removed, and shiny metal exposed. Blades worn on one side only can be turned around and reused. Replace blades which have suffered a loss of 1 / 16 -inch in height due to wear. See figure 6-8. Replace blades worn on both sides. Replace blades damaged by scores or chips.

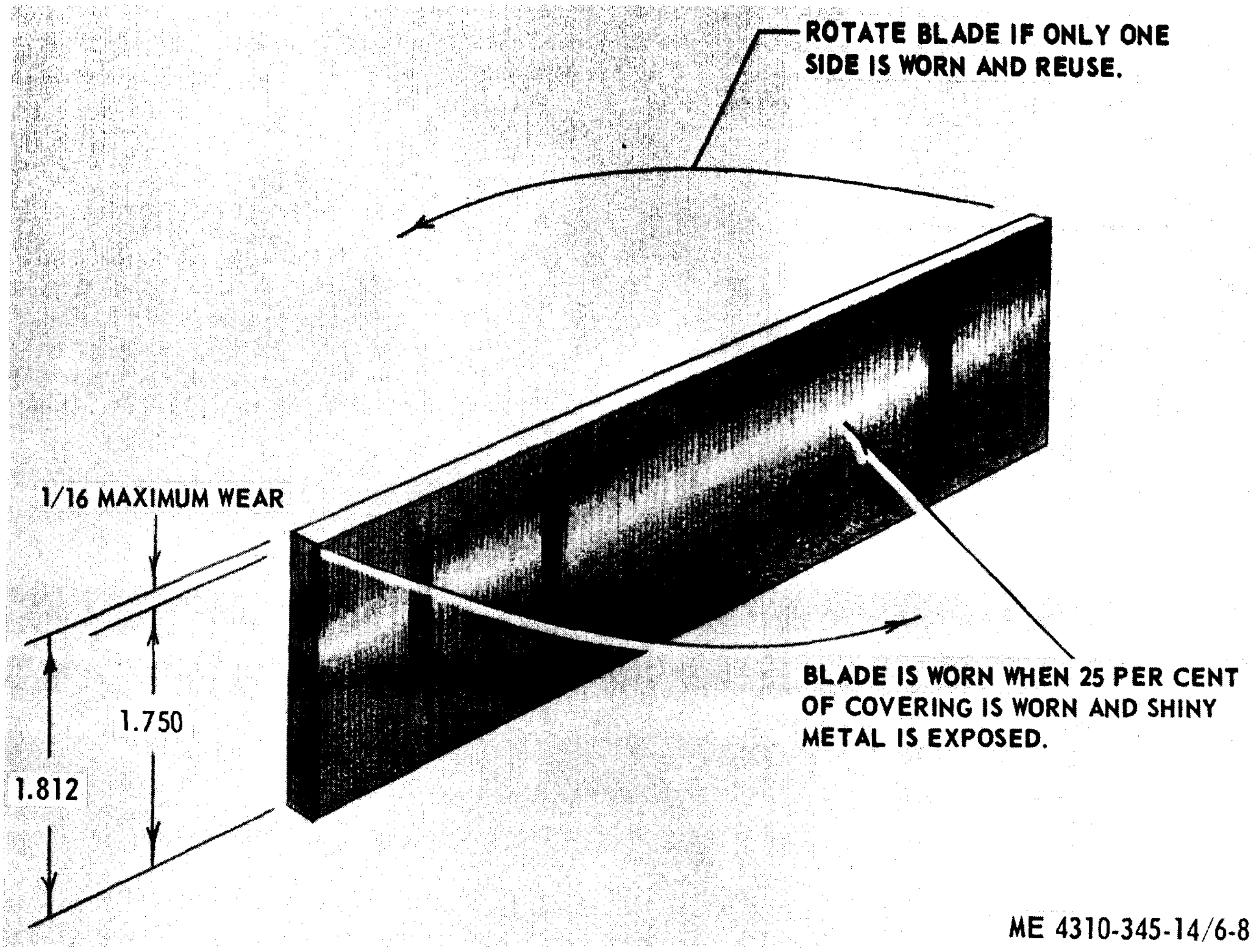


Figure 6-8. Rotor blade inspection.

c. Reassembly.

(1) Dip new O-ring and new blades in clean compressor oil before installing.

(2) Reassemble compressor non-drive end in reverse numerical sequence shown in figure 6-7.

(3) Install rear housing panel.

(4) Install hose and hose clamps on intake unloader and compressor air cleaner assembly.

(5) Attach instrument panel assembly to rear housing panel using lockwashers and nuts.

(6) Connect air hoses to blowdown valve, intake unloader, and oil separator assembly.

(7) Connect tubing to cold weather starting aid valve.

(8) Connect control cables to cold weather starting aid, compressor unloader, and speed control.

(9) Connect stop block to speed control arm and secure with locknut.

(10) Start unit (fig. 2-10) and check compressor and air lines for leaks or other malfunctions. Correct any malfunction by referring to tables 3-2, 4-2, and 5-1.

Section V. OIL COOLER ASSEMBLY

6-11. General

The compressor oil cooler assembly consists of a two-section lower tank connected to an upper tank by a series of open end vertical tubes. Radiator style fins are connected to the tubes. Hot oil is directed to the oil cooler from the oil separator by the thermal bypass valve assembly. The oil enters one section of the lower tank and flows upward through one-half of the vertical tubes to the upper tank. The oil then flows downward through the other half of the tubes into the second section of the lower tank. From this section, the oil flows to and through the compressor oil filter and then to the compressor. The fins on the oil cooler tubes act as a heat sink, cooling the oil as air is drawn through the cooler by the engine driven fan.

6-12. Oil Cooler Assembly

a. Removal.

(1) Disconnect oil lines at bottom of oil cooler (fig. 4-53).

(2) Remove housing components necessary for removal of oil cooler assembly (fig. 4-32).

b. Disassembly. Disassemble radiator and oil cooler assembly as shown in figure 6-9.

c. Cleaning, Inspection, and Repair.

(1) Clean oil cooler assembly in accordance with paragraph 5-5 *f.* Flush interior of cooler using the same solvent.

(2) Inspect oil cooler for cracks, breaks, distortion, or any other defect.

(3) Plug outlet connection and fill oil cooler with clean compressor oil (LO 5-4310-345-12). Apply air pressure of from 4 to 10 PSI to inlet connection and check for leaks. Mark each leak detected.

(4) Remove air pressure and drain oil from cooler. Solder or braze all leaks detected and recheck by repeating step (3) above.

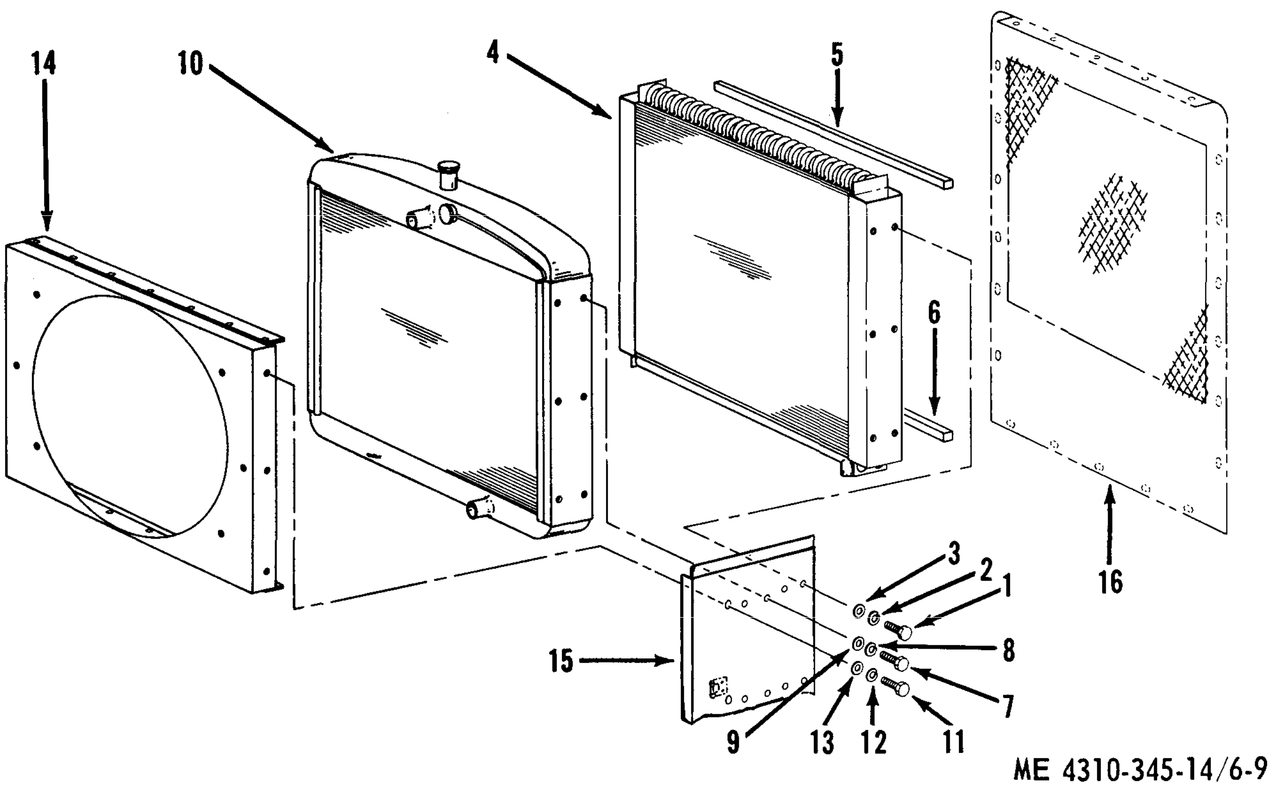
(5) Inspect attaching hardware for cracks, damaged threads, or any other defect.

d. Reassembly. Reassemble radiator and oil cooler assembly in reverse numerical sequence shown in figure 6-9.

e. Installation.

(1) Install housing components that were removed for the removal of the oil cooler assembly (fig. 4-32).

(2) Connect oil lines to bottom of oil cooler (fig. 4-53).



1. Bolt (12)
2. Lockwasher (12)
3. Flat washer (12)
4. Oil cooler
5. Sponge strip
6. Sponge strip
7. Bolt (12)
8. Lockwasher (12)
9. Flat washer (12)
10. Radiator
11. Bolt (12)
12. Lockwasher (12)
13. Flat washer (12)
14. Fan shroud
15. Housing side panel (2)
16. Housing front panel

Figure 6-9. Radiator and oil cooler assembly, disassembly and reassembly.

CHAPTER 7

REPAIR OF ENGINE ASSEMBLY

Section I. BATTERY-CHARGING GENERATOR ASSEMBLY

7-1. General

The engine battery-charging generator assembly is a 24-volt, two-pole, shunt type with sealed bearings at both ends. The generator is driven by two V-belts off the engine camshaft. The generator supplies electrical energy to recharge the batteries and to fulfill the load requirements of the air compressor unit when the engine is running. The generated current is controlled and distributed by the battery-charging generator regulator. The generator assembly is cooled by a fan mounted on the drive end of the generator.

7-2. Battery-Charging Generator Assembly

a. Removal. Remove the battery-charging generator assembly (fig. 4-70).

b. Disassembly. Disassemble battery-charging generator assembly in numerical sequence shown in figure 7-1.

c. Cleaning, Inspection, and Repair.

NOTE

Refer to TM 5-764 for general repair instructions.

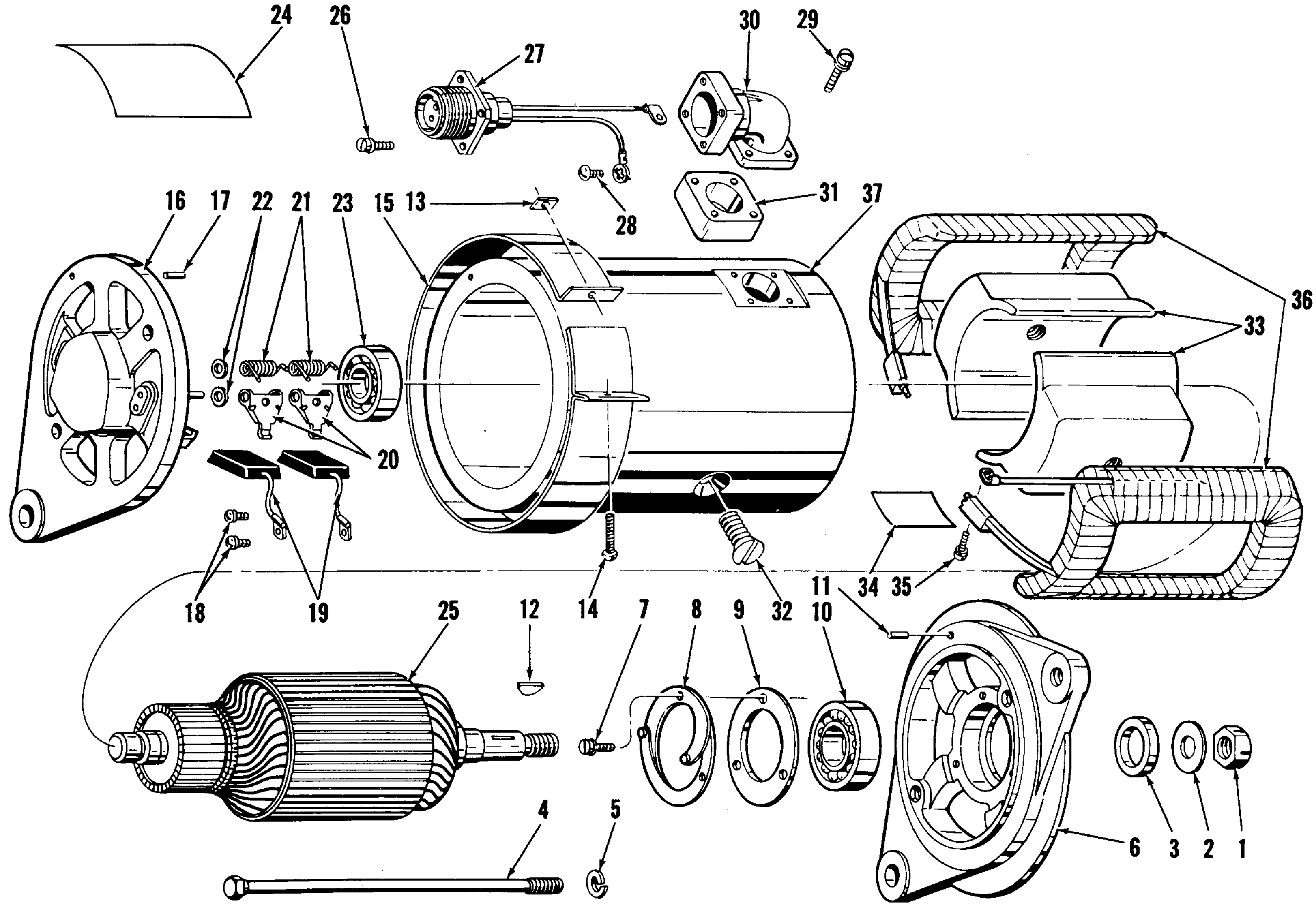


Figure 7-1. Battery-charging generator assembly, disassembly and reassembly.

KEY to figure 7-1:
1. Nut
2. Plain washer
3. Collar
4. Bolt (2)
4. Lockwasher (2)
6. Frame
7. Screw (3)
8. Collector
9. Plate
10. Bearing
11. Pin
12. Key
13. Nut
14. Screw
15. Band
16. Frame
17. Pin
18. Screw (2)
19. Brush (2)
20. Brush arm (2)
21. Brush spring (2)
22. Washer (2)
23. Bearing
24. Insulation
25. Armature
26. Screw (4)
27. Receptacle assembly
28. Screw
29. Screw (4)
30. Elbow
31. Spacer
32. Screw (2)
33. Pole shoe (2)
34. Insulation
35. Screw
36. Field coil assembly (2)
37. Housing

CAUTION

Do not soak or clean, with solvent, any sulation or electrical component such as brushes and field coils.

(1) Clean housing and end covers in accordance with paragraph 5-5 *f*.

(2) Clean internal parts with clean, dry compressed air.

(3) Inspect brushes for cracks, chips, or excessive wear.

(4) Inspect brush springs and arms for cracks, breaks, distortion, wear, or any other defect,

(5) Inspect frame and frame assembly for cracks, breaks, or warpage. If any of these defects are detected, replace entire battery-charging generator assembly.

(6) Inspect bearings for wear, scoring, or pitting. Check for freedom of rotation.

(7) Inspect armature windings to make certain that they are properly pressed in core slots and tightly soldered to commutator risers.

(8) Inspect commutator for rough spots, discoloration, pitting, scoring, and high mica. If commutator is rough pitted, or worn, turn commutator using a lathe. Take cuts until all pits are removed. Remove all burrs by holding No. 00 sandpaper lightly against commutator while armature is turning in lathe. Undercut mica after turning commutator. The mica must be undercut to a depth of 1 / 32 inch to 3/ 64 inch.

(9) Inspect commutator for out-of-round using a dial indicator. Out-of-round shall not exceed 0.001 inch total indicator reading.

(10) Inspect bearing journals on both ends of armature shaft for wear, scoring, or pitting. If armature is defective, replace entire battery-charging generator assembly.

(11) Inspect all other parts for excessive wear, cracks, breaks, or any other defect.

(12) Inspect attaching hardware for cracks, damaged threads, or any other defect.

d. Reassembly. Reassembly battery-charging generator in reverse numerical sequence shown in figure 7-1.

e. Installation. Install battery-charging generator assembly (fig. 4-70).

Section ii. BATTERY-CHARGING GENERATOR REGULATOR ASSEMBLY

7-3. General

Basically, the battery-charging generator regulator assembly consists of relays, capacitors, resistors, a diode, and the associated wiring. This circuitry is divided into three independent sections, each of which has a specific function in the charging circuit. The three sections and their functions are described below.

a. Cutout Relay. The function of the cutout relay in the charging circuit is to automatically open and close the circuit between the generator and battery.

b. Voltage Regulator. The function of the voltage regulator is to limit the generator voltage to a safe valve. This prevents overcharging of the battery and high system voltage which could damage electrical components.

c. Current Regulator. The function of the current regulator is to limit the output of the generator to its maximum safe valve. This prevents generator overheating when the battery is **low** and will accept more than rated generator output, or when a high accessory load is imposed on the electrical system. This section operates independent of the voltage regulator unit.

7-4. Battery-Charging Generator Regulator Assembly

a. Removal. Remove battery-charging generator regulator assembly (fig. 4-72).

b. Disassembly. Disassembly battery-charging generator regulator in numerical sequence shown in figure 7-2. Disassemble only to extent shown.

c. Cleaning, Inspection, and Repair.

CAUTION

Do not soak or clean the overrunning clutch with solvent or any insulating or electrical components such as capacitors, resistors, and coils.

(1) Clean cover and base in accordance with paragraph 5-5 *f.*

KEY to figure 7-2:

1. Screw (4)
2. Seal (4)
3. Lockwasher (4)
4. Cover
5. Gasket
6. Screw (4)
7. Lockwasher (4)
8. Plain washer (4)
9. Panel assembly
10. Screw (3)
11. Lockwasher (3)
12. Screw
13. Lockwasher
14. Plain washer
15. Nut
16. Lockwasher
17. Plain washer
18. Cutout relay assembly
19. Cutout relay spring
20. Nut
21. Lockwasher
22. Current regulator assembly
23. Current regulator spring
24. Nut
25. Lockwasher
26. Voltage regulator assembly
27. Voltage regulator spring
28. Resistor package
29. Connector
30. Panel
31. Screw (4)
32. Lockwasher (4)
33. Input receptacle
34. Gasket
35. Ground spring
36. Screw (4)
37. Lockwasher (4)
38. Output receptacle
39. Grommet
40. Gasket
41. Ground spring
42. Output condenser
43. Screw (4)
44. Lockwasher (4)
45. Bracket (2)
46. Base

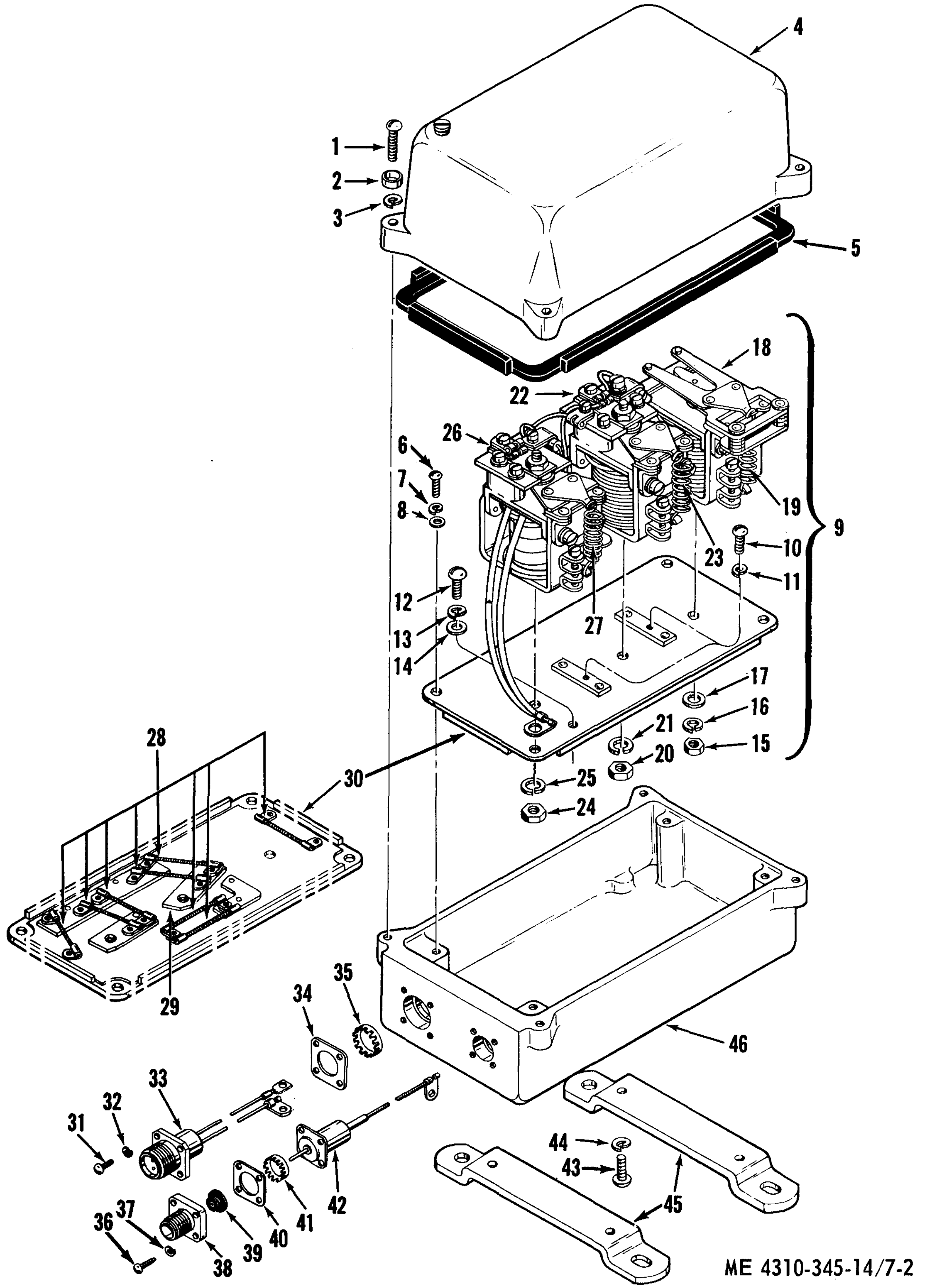


Figure 7-2. Battery-charging generator regulator assembly, disassembly and reassembly.

(2) Clean relay contact points using a strip of ordinary blank bond paper. Hold paper between fingers and slide paper back and forth between contact points.

(3) Inspect relay contact points for burning, pitting, or excessive wear.

(4) Inspect all soldered connections.

(5) Inspect all other parts for any noticeable defects.

(6) Inspect attaching hardware for damaged threads, cracks, or any other defect.

d. Reassembly, Reassemble the battery-charging generator regulator assembly in reverse numerical sequence shown in figure 7-2.

e. Installation. Install battery-charging generator regulator assembly (fig. 4-72).

Section III. STARTING MOTOR ASSEMBLY

7-5. General

The starting motor assembly converts electrical energy from the batteries into mechanical energy to turn the engine flywheel for starting. The starting motor is a heavy-duty type that is completely sealed with gaskets, O-rings, and an oil seal. The solenoid is mounted on the outside of the frame with the solenoid plunger and pinion shaft mechanism totally enclosed. The drive assembly is an over-running clutch type which assures complete drive pinion engagement before the motor begins to rotate. When the engine starts, the clutch releases and allows the pinion to turn faster than the armature shaft until the start switch is released and the return spring action retracts the pinion from the flywheel ring gear.

7-6. Starting Motor Assembly

a. Removal. Remove starting motor assembly (fig. 4-73).

b. Disassembly. Disassemble starting motor in numerical sequence shown in figure 7-3.

c. Cleaning, Inspection, and Repair.

CAUTION

Do not soak or clean, with solvent, any insulating or electrical components such as brushes and coils.

KEY to figure 7-3:
1. Nut
2. Lockwasher (2)
3. Connector
4. Screw (4)
5. Solenoid switch
6. Bolt (2)
7. Lockwasher (2)
8. End frame
9. Washer
10. Nut (2)
11. Screw (2)
12. Lockwasher (2)
13. Lead
14. Pin
15. Bracket
16. Screw (4)
17. Brush (4)
18. Brush holder (2)
19. Brush holder (2)
20. Brush spring (2)
21. Bolt (4)
22. Lockwasher (4)
23. Drive housing
24. Retaining ring
25. Collar
26. Motor drive
27. Gasket
28. Washer
29. Armature
30. Washer
31. Plug (2)
32. Wick (2)
33. Snap ring
34. Pin
35. Snap ring
36. Retainer
37. Spring
38. Boot
39. Washer
40. Retainer
41. Plunger
42. Shaft
43. Lever
44. Lever housing
45. Nut
46. Washer
47. Washer
48. Bushing
49. Stud
50. Screw (4)
51. Pole shoe
52. Field coil
53. Frame

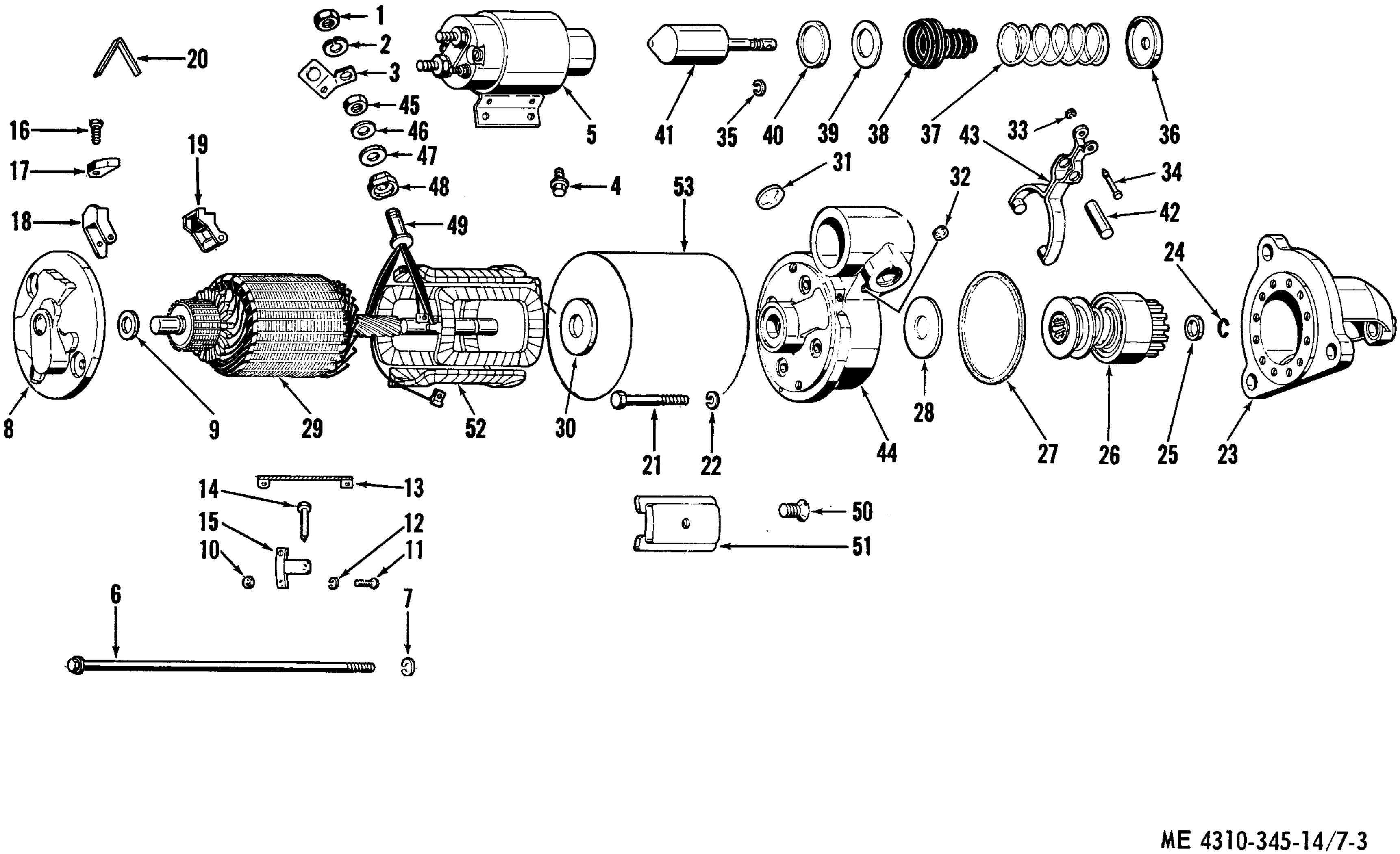


Figure 7-3. Starting motor assembly, disassembly and reassembly.

NOTE

Refer to TM 5-764 for general repair instructions.

(1) Clean housings and end covers in accordance with paragraph 5-5 *f*.

(2) Clean internal parts using clean, dry compressed air.

(3) Inspect brushes for cracks, chips, excessive wear, or any other defect.

(4) Inspect bearings for wear, scoring, pitting, or any other defect.

(5) Inspect brush springs and arms for cracks, breaks, distortion, or any other defect.

(6) Inspect commutator for rough spots, discoloration, pitting, scoring, and high mica. If commutator is rough, pitted, or worn, turn commutator using a lathe. Take light cuts until all pits are removed. Remove all burrs by holding No. 00 sandpaper lightly against commutator while armature is turning in lathe. Undercut mica after turning commutator. The mica must be undercut to a depth of 1 / 32 inch.

(7) Inspect commutator for out-of-round using a dial indicator. Out-of-round shall not exceed 0.001 inch total indicator reading.

(8) Inspect armature shaft for pitting, scoring, or excessive wear. Inspect drive assembly for broken teeth on pinion. Check to make certain that clutch assembly moves on shaft properly and that spring compresses. Slide drive assembly on armature shaft to make certain that splines fit properly.

(9) Inspect solenoid parts. Check condition of moving core and sealing boot. Replace boot if cracked or brittle. Check contact assembly and terminal studs for evidence of burning, corrosion, or excessive pitting.

(10) Inspect all other parts for cracks, breaks, excessive wear, damaged insulation, or any other defect.

(11) Inspect all attaching hardware for damaged threads, cracks, or any other defect.

d. Testing. Refer to TM 5-764 and test armature and field coils for shorts, open circuits, and grounds.

e. Reassembly. Reassemble starting motor in reverse numerical sequence shown in figure 7-3. Install new gaskets and O-rings.

(1) When installing new bearings, always use proper bearing arbor to obtain a correct fit. Remove wick from pinion housing reservoir before installing a new bearing. After new bearing is installed, saturate wick with oil (LO 5-4310-345-12), install wick in reservoir and fill reservoir with oil.

(2) Lubricate all O-rings with a film of light grease to prevent damage during reassembly.

(3) Lubricate armature bearing journals on shaft with SAE 10 oil. Lubricate shaft and splines under drive assembly with grease conforming to Military Specification MIL-G-23827A.

f. Installation. Install the starting motor assembly (fig. 4-73).

Section IV. ENGINE RADIATOR ASSEMBLY

7-7. General

The engine radiator assembly is a standard core, tank, and fin arrangement. The hot engine coolant flows into the upper tank of the radiator, drains down through the core to the lower tank, and back into the engine. The fins on the core act as a heat sink cooling the coolant as air is drawn through the radiator by the engine driven fan.

7-8. Engine Radiator Assembly

a. Removal.

(1) Remove engine radiator cap. Open draincock on bottom tank of radiator assembly and drain coolant.

(2)I Remove coolant hoses and clamps from radiator (fig. 4-34).

(3) Remove fan guard (fig. 4-33).

(4) Remove compressor oil cooler assembly (para. 6-12).

(5) Remove capscrews, lockwashers, and flat washers from housing front side panels and remove radiator assembly.

b. Disassembly. Disassemble radiator and oil cooler assembly in numerical sequence shown in figure 6-9.

c. Cleaning, Inspection, and Repair.

(1) Clean dirt and foreign matter from radiator core using compressed air directed through core. Clean outside of radiator assembly in accordance with paragraph 5-5 *f*.

(2) Flush fresh water through radiator to remove loose scale and rust.

(3) Plug all openings except overflow tube. Connect a 3 to 5 PSI air source to the filler opening and submerge radiator in water.

(4) Apply low pressure air. Check radiator for leaks as indicated by air bubbling up through water. Mark each leak detected.

(5) Solder or braze all leaks detected and recheck by repeating steps (3) and (4) above.

(6) lnspect attaching hardware for cracks. damage threads, or any other defect.

d. Reassembly. Reassemble radiator and oil cooler assembly in reverse numerical sequence Shown in figure 6-9.

e. Installation.

(1) Install radiator in mounting position between housing front side panels and secure with capscrew, lockwashers, and flat washers.

(2) Install compressor oil cooler assembly (para 6-12).

(3) Install fan guard (fig. 4-33).

(4) Install coolant hoses and clamps on radiator connections (fig. 4-34).

(5) Replenish coolant in radiator and install radiator cap.

Section V. FUEL PUMP ASSEMBLY AND DRIVE

7-9. General

The engine fuel pump is a positive displacement gear type which transfers the fuel from the fuel tank through the primary and secondary fuel filters to the fuel injectors. The pump circulates an excess supply of fuel through the injectors which purges air from the system and cools the injectors. Unused fuel returns to the fuel tank by means of a fuel return manifold, integral with the cylinder head, and fuel return hose. The fuel pump is mounted on the governor weight housing and is driven through a drive coupling by the governor weight shaft. The pump is provided with an integral pressure relief valve which opens when fuel pressure reaches approximately 65 PSI on the outlet side. When the pressure relief valve is open, fuel is then recirculated back to the inlet side of the pump. The fuel system is equipped with a normally open pressure switch which closes at 20 PSI. Fuel pressure, at cranking speed, must reach this pressure or engine will not start.

7-10. Fuel Pump Assembly and Drive

a. Removal. Remove fuel pump assembly (fig. 4-61).

b. Disassembly. Disassemble fuel pump in numerical sequence shown in figure 7-4. Refer to figure 7-5 for removal of oil seals from pump body. Discard removed oil seals and gasket.

CAUTION

Use care when disassembling pump cover from body so that damage of finished faces of each part does not occur.

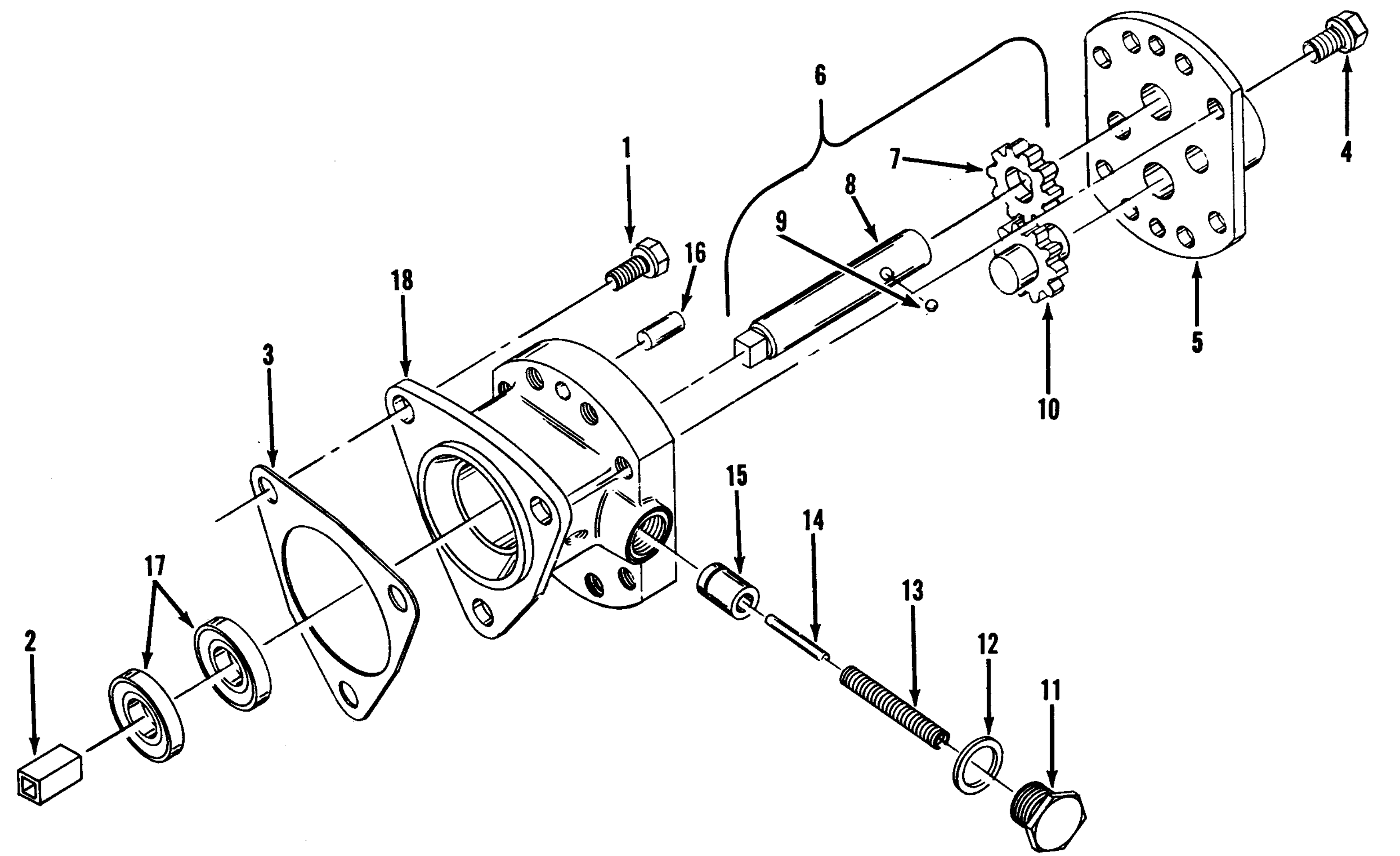


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Figure 7-4. Fuel pump assembly, disassembly and reassembly.

KEY to figure 7-4:

1. Bolt (3)
2. Drive coupling
3. Gasket
4. Bolt (8)
5. Cover
6. Shaft assembly
7. Drive gear
8. Drive shaft
9. Retaining ball
10. Driven gear
11. Plug
12. Gasket
13. Spring
14. Pin
15. Valve
16. Dowel (2)
17. Oil seal (2)
18. Body

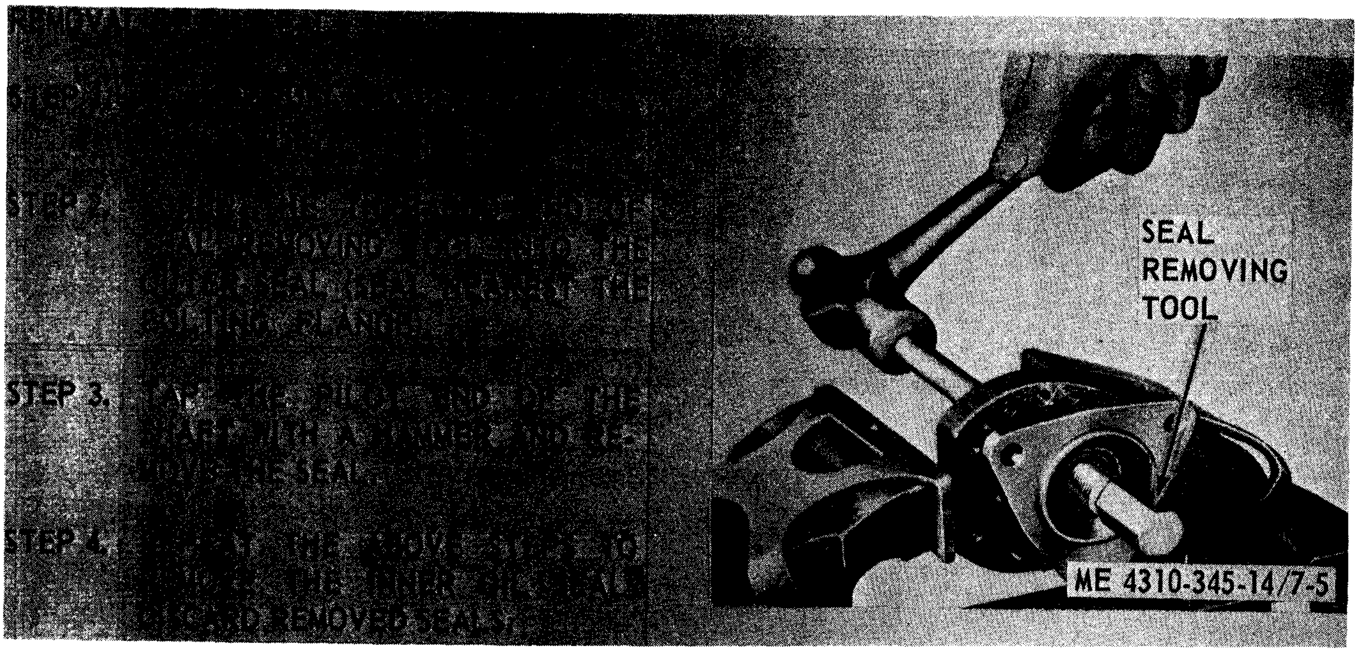


Figure 7-5. Fuel pump oil seal removal.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts using clean fuel oil and dry thoroughly with Compressed air.

(2) Inspect gear teeth for chipping, cracks, breaks, or wear. Check the ball slot in drive gear for wear.

(3) Inspect drive and driven gear shafts for scoring and wear. The driven shaft and gear is serviced as an assembly.

(4) Inspect mating faces of pump body and cover for scratches. These surfaces must be free of any defect or leakage will occur.

(5) Inspect relief valve for nicks, cracks, or any other defect.

(6) Inspect all other parts for cracks, breaks, distortion, or any other defect.

d. Reassemby.

(1) Lubricate the lips of the oil seals, then install oil seals in pump body as shown in figure 7-6.

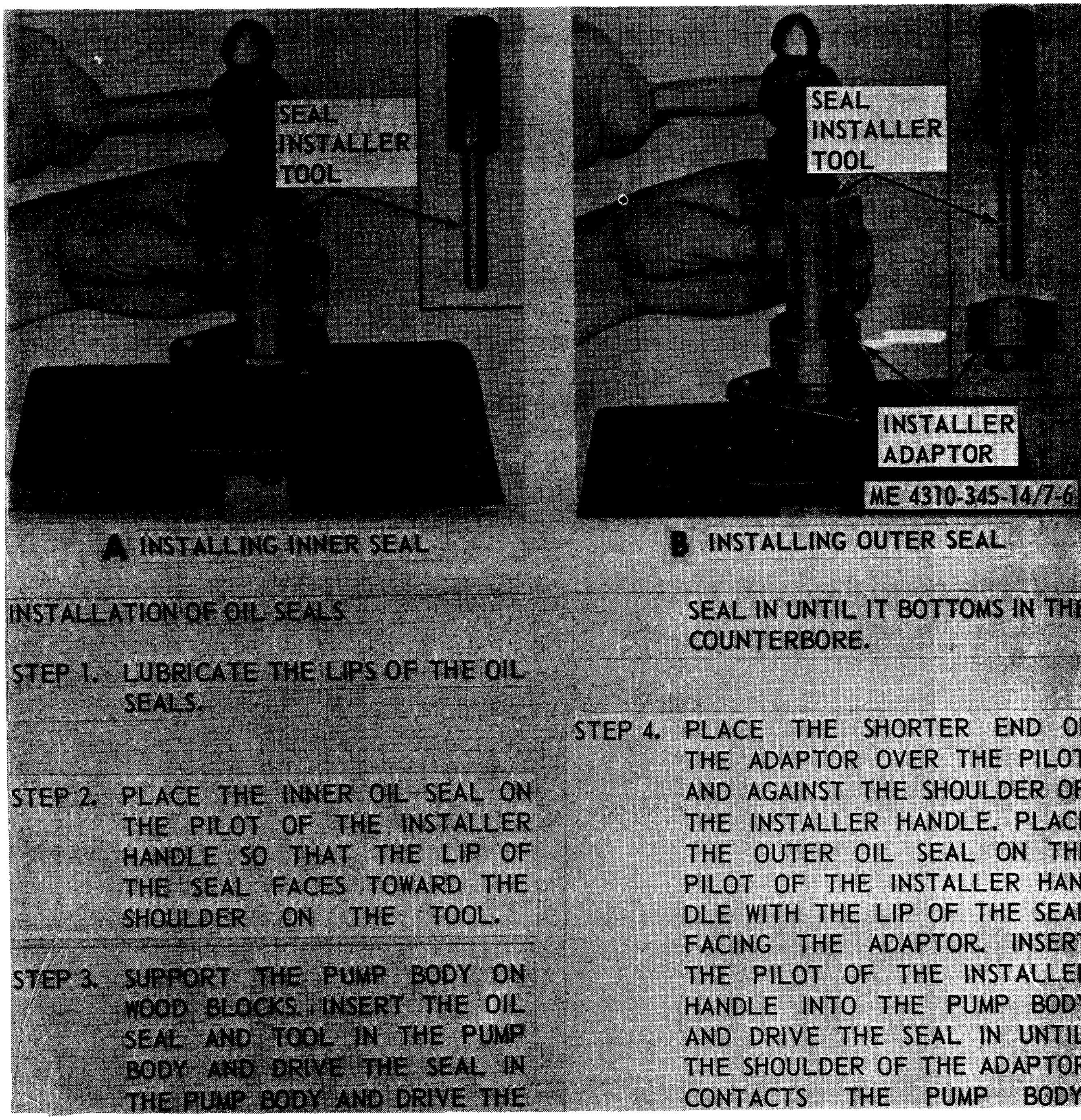


Figure 7-6. *Fuel pump oil seal installation.*

CAUTION

The driven gear must be centered on the shaft to give proper end clearance. Also, the chamfered end of the gear teeth of the production gear must face the pump body. If a service replacement gear with a slot is used, the slot must face toward the pump cover.

(2) Lubricate the gears and shafts with clean engine oil.

(3) Apply a thin coating of quality sealant on the face of the pump cover outside of the gear pocket area. Then, place the cover against the pump body. The cover can be installed in only one position over the two shafts, as governed by the dowel pins.

CAUTION

The coating of sealant must be very thin since pump clearances have been set on basis of metal-to-metal contact. Use care that sealant is not squeezed into gear

compartment, otherwise damage gears and shafts may result.

(4) Reassemble fuel pump in reverse to numerical sequence shown in figure 7-4. Use a new gasket.

e. Installation. Install fuel pump (fig. 4-61).

Section Vi. GOVERNOR ASSEMBLY

7-11. General

Horsepower requirements on the engine vary due to fluctuating loads. The governor assembly is used to control the amount of fuel required to maintain a reasonable constant speed during these load fluctuations. The governor accomplishes this control through linkage between the throttle control and the fuel injectors. The governor is a variable speed mechanical type and performs the following functions: controls engine idle speed; limits maximum no-load speed; holds the engine at constant speed between idle and maximum, as desired by the operator. The governor is mounted on the rear end plate of the engine and is driven by a gear that extends through the end plate and meshes with the balance shaft gear. The governor is equipped with two control levers, speed control lever and engine stop lever. In normal position, the stop lever holds the fuel and engine stop lever. In normal position, the stop lever holds the fuel injector rack near the full-fuel position. When engine is started, the governor moves the injector racks toward the idle speed position. Engine speed is then controlled by moving the speed control lever. This lever is connected to the compressor intake unloader by control lever while unit is operating. The governor stop lever is connected to the instrument panel by a control cable. Normal run position is with instrument panel stop control in the full "in" position. Pulling this control "out"' manually moves the governor stop lever to the no-fuel position, thereby stopping the engine.

7-12. Governor Assembly

a. Removal.

(1) Disconnect speed control rod from governor speed control lever and control cable from governor stop lever (fig. 4-27 and 4-25).

(2) Remove valve rocker cover (fig. 4-74).

(3) Disconnect torsion spring from stop lever (8, fig. 7-8, sheet 1).

(4) Remove cotter pin and straight pin attaching link rod to control tube lever (1, 2, 3, fig. 7-24).

(5) Remove lubrication lines from control housing to weight housing and from weight housing to cylinder block (fig. 7-7).

(6) Remove fuel pump and drive (fig. 4-61).

(7) Loosen and move hose clamp (63, fig. 7-8, sheet 3) on hose connection between governor and cylinder head enough to permit removal of governor.

(8) Remove governor assembly as shown in figure 7-7. Discard gaskets.

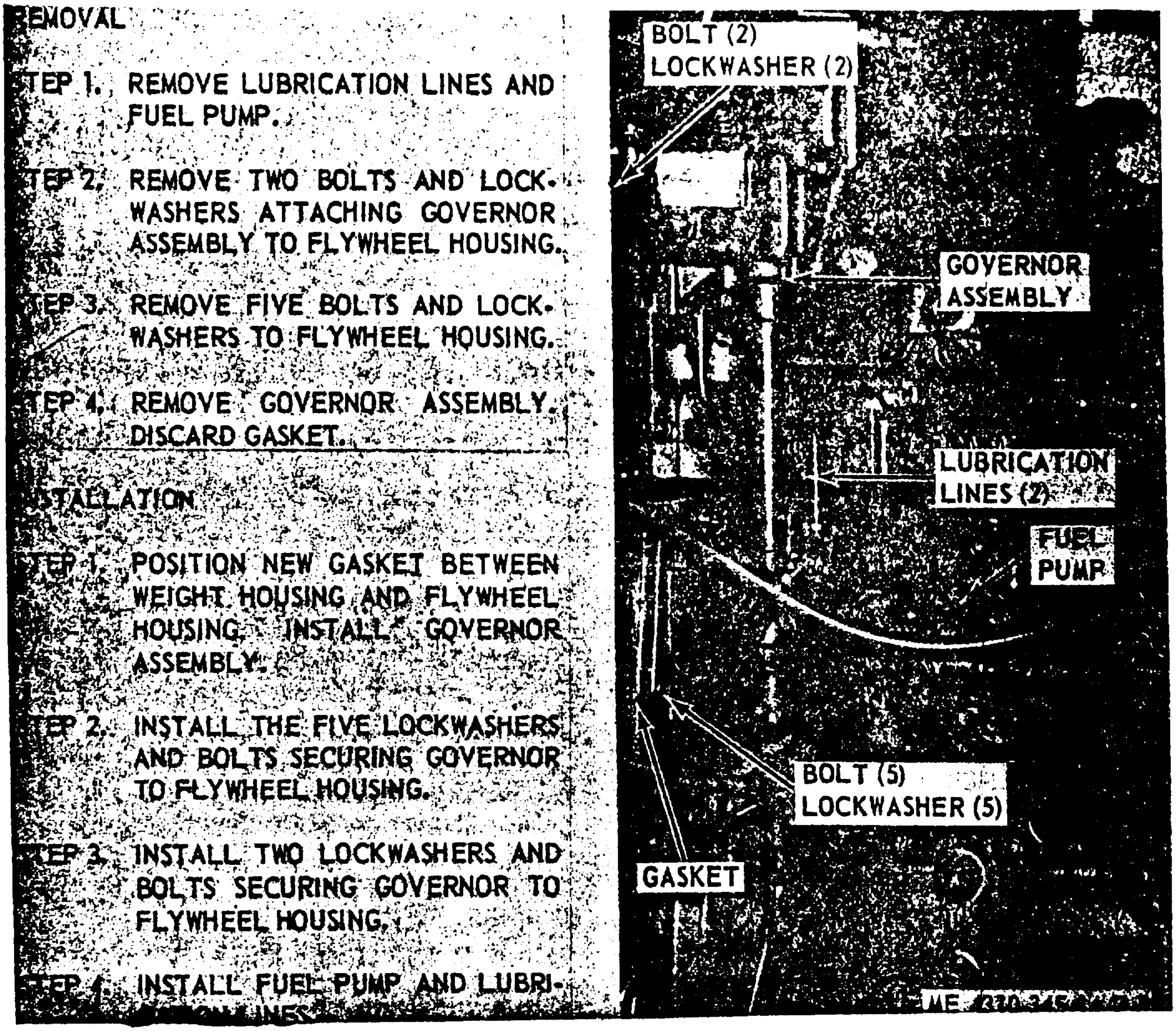


Figure 7-7. Governor assembly, removal and Installation.

b. Disassembly. Disassemble governor assembly in numerical sequence shown in figure 7-8.

c. Cleaning. Inspection. and Repair.

(1) Clean parts in accordance with paragraph 5-5 f. Discard gaskets and O-rings.

(2) Inspect housings and covers for cracks, breaks. distortion, or any other defect.

(3) Inspect all springs for damaged or distorted coils.

(4) Inspect weights and riser for sticking, cracks. or any other defect.

(5) Inspect all shafts for score marks. out-of-round. distortion. or any other defect.

(6) Inspect bearings for freedom of rotation and for any defect.

(7) Inspect drive gear teeth for chipping. cracks breaks, or any other defect.

(8) Inspect lubrication lines for kinks distortion, damaged fittings, or any other defect.

(9) Inspect all other parts for cracks, breaks, distortion, or any other defect.

(10) Inspect attaching hardware for cracks breaks damaged threads, or any other defect

d. Reassembly. Reassemble governor assembly in reverse numerical sequence shown in figure 7-8 Install new gasket and O-rings.

(11) Assemble bearings in governor spring housing as shown in figure 7-9.

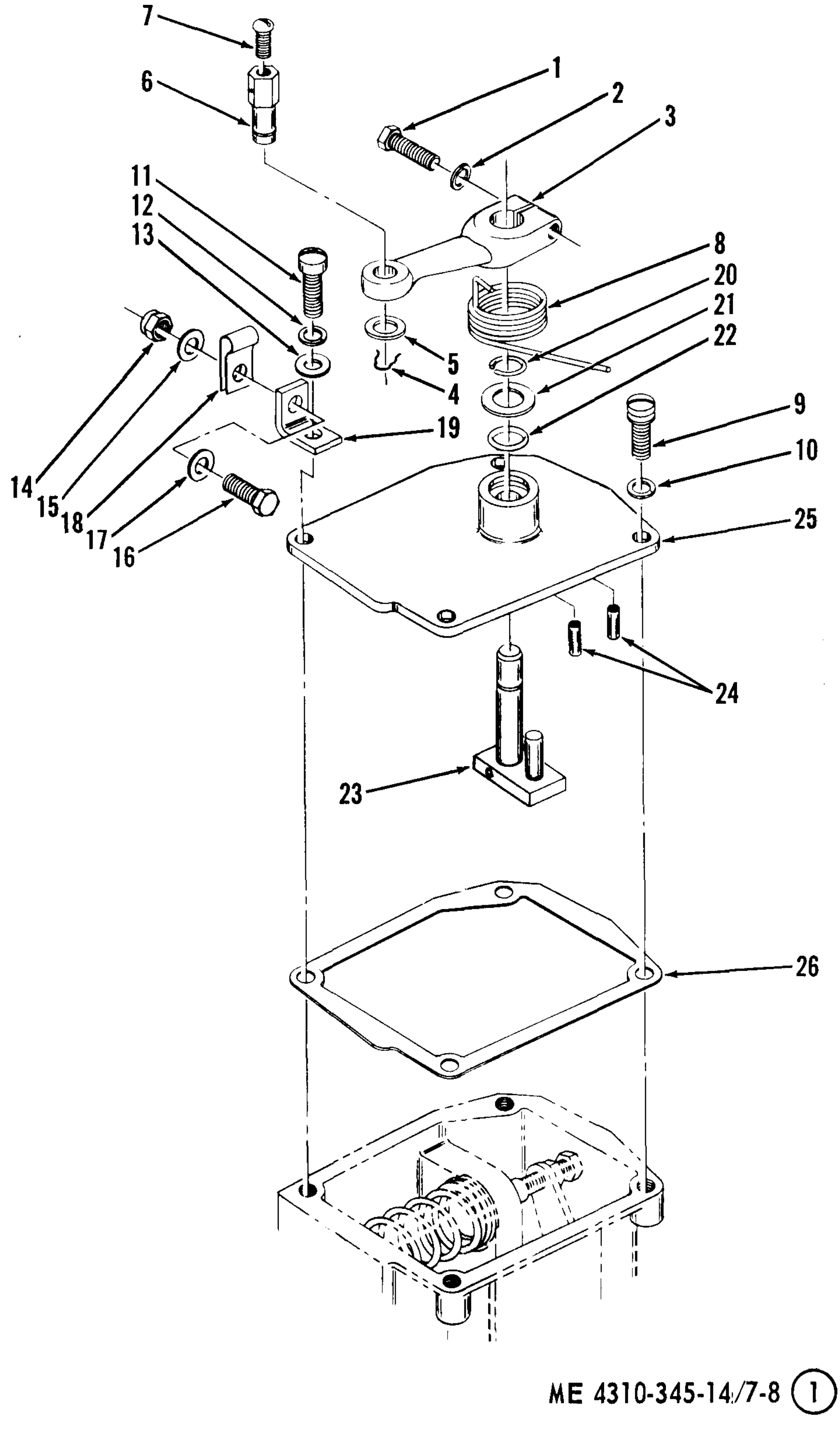
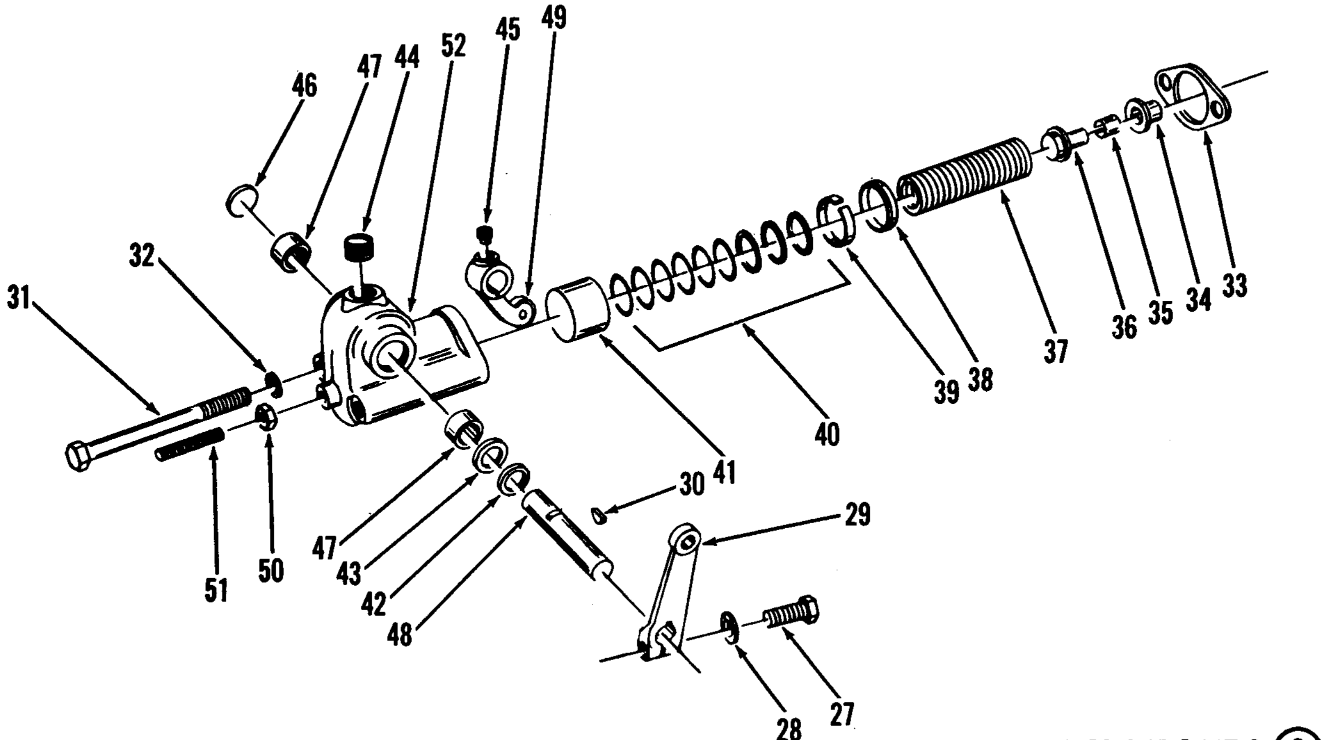


Figure 7-8. Governor assembly, disassembly and reassembly (sheet 1 of 3).

KEY to figure 7-8 (1):
1. Bolt
2. Lockwasher
3. Lever
4. Retainer
5. Washer
6. Pin
7. Screw
8. Spring
9. Special screw
10. Lockwasher
11. Screw (3)
12. Lockwasher (3)
13. Flat washer
14. Lock nut
15. Flat washer
16. Bolt
17. Flat washer
18. Clip
19. Bracket
20. Retainer
21. Washer
22. Seal
23. Shaft
24. Pin (2)
25. Cover
26. Gasket



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27. Bolt
28. Lockwasher
29. Lever
30. Key
31. Bolt (2)
32. Lockwasher (2)
33. Gasket
34. Guide
35. Bushing
36. Plunger
37. Spring
38. Solid stop
39. Split stop
40. Shims (9)
41. Retainer
42. Washer
43. Seal
44. Plug
45. Setscrew
46. Plug
47. Bearing
48. Shaft
49. Lever
50. Lock nut
51. Idle screw
52. Housing

Figure 7-8. Governor assembly, disassembly and reassembly (sheet 2 of 3).

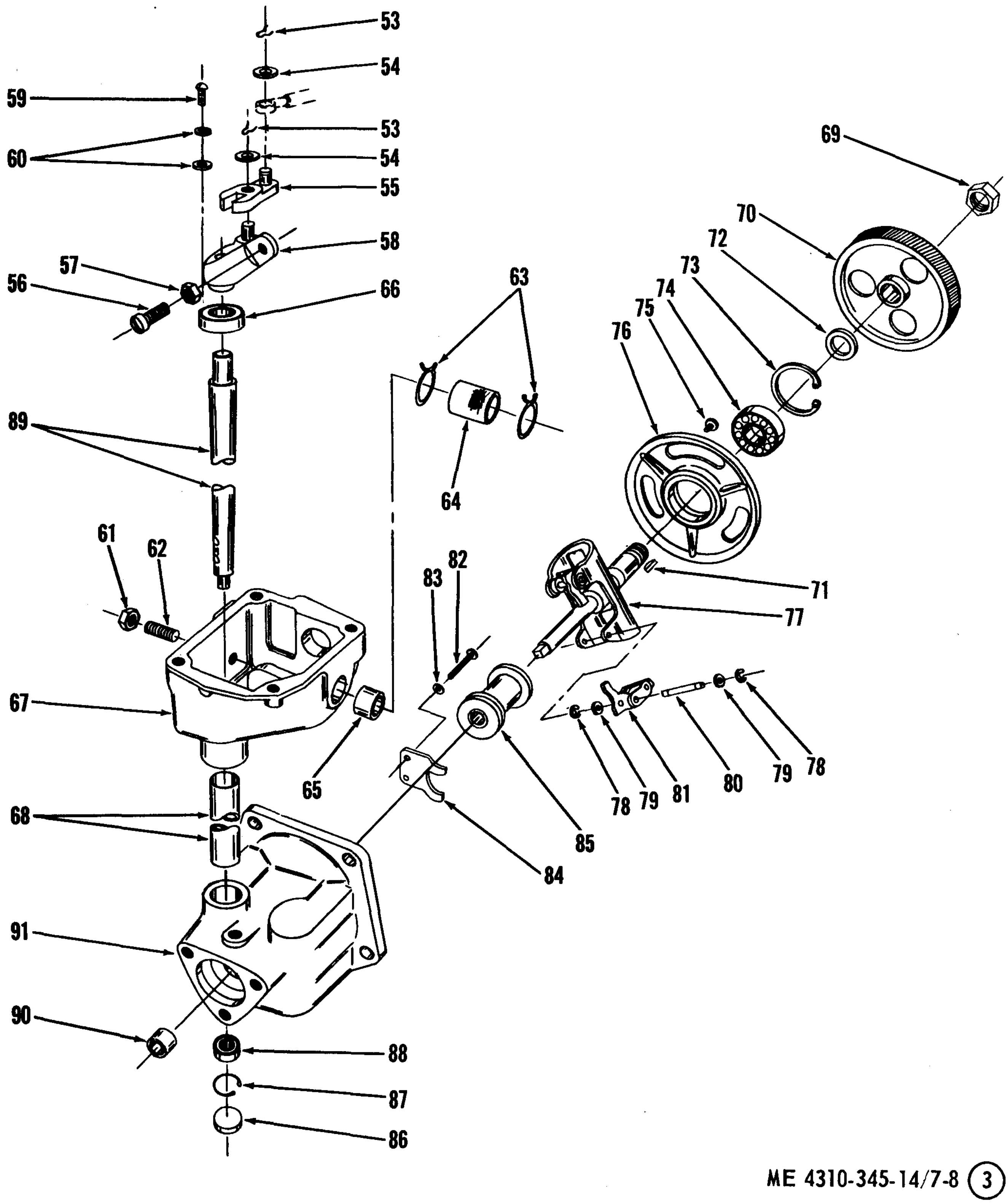

Figure 7-8. Governor assembly, disassembly and reassembly (sheet 3 of 3).

KEY to figure 7-8 3
53. Retainer (2)
54. Washer (2)
55. Lever
56. Screw
57. Nut
58. Lever
59. Screw
60. Washer
61. Nut
62. Screw
63. Clamp
64. Hose
65, Adaptor
66. Bearing
67. Housing
68. Tube
69. Nut
70. Gear
71. Key
72. Spacer
73. Retainer
74. Bearing
75. Screw
76. Support
77. Carrier
78. Retainer (4)
79. Spacer (4)
80. Pin (2)
81. Weight (2)
82. Screw (2)
83. Lockwasher (2)
84. Fork
85. Riser
86. Plug
87. Retainer
88. Bearing
89. Shaft
90. Bushing
91. Housing

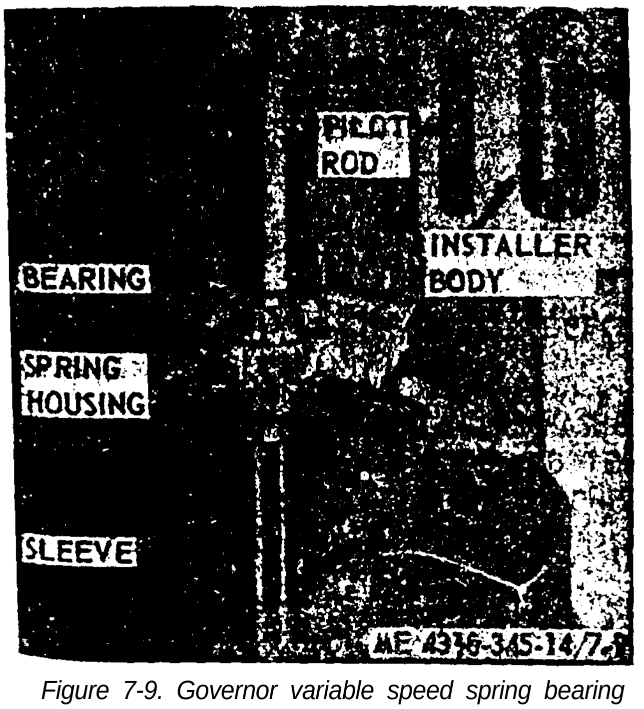

Figure 7-9. Governor variable speed spring bearing installation

(2) Assemble bearings in governor spring housing, control housing, and weight housing with numbered side facing outward. Lubricate bearings with numbered side facing outward. Lubricate bearing with clean engine oil.

(3) Press weight carrier on carrier shaft so as to allow a clearance of from 0.001 to 0.006 inch between the shaft shoulder and rear face of weight carrier

(4) Apply a good quality sealant around edge of the plugs in variable speed spring housing and weight housing before tapping into place.

(5) When installing bearings, press on outer race when bearing is being installed in a housing and on the inner race when bearing is installed on a shaft.

e. Installation.

(1) Install governor assembly, on engine as shown in figure 7-7. Use new gaskets.

(2) Install hose clamp on hose connection between governor assembly and cylinder head.

(3) Install fuel pump and drive (fig. 4-61).

(4) install lubrication lines between weight housing, cylinder block and control housing.

(5) Install straight pin and cotter pin to attach link rod in control tube lever.

(6) Install torsion spring on stop lever and governor cover special screw.

(7) Install valve rocker cover (fig. 1-74).

(8) Install control cable on stop lever and speed control rod to governor speed control lever (fig. 4-27 and 4-25).

(9) Refer to paragraph 7-26 for injector control rack and governor setting.

Section VII. FUEL INJECTORS

7-13. General

The unit fuel injector used in the engine is a lightweight compact unit which enables quick, easy starting directly on diesel fuel. The fuel injector preforms four injections

a. Creates the high fuel pressure required for efficient injections

b. Meters and injects the exact amount of fuel required to handle the load.

c. Atomizes the fuel for mixing with the air in the combustion chamber.

d. Permits continuous flow.

Combustion required for satisfactory engine operation is obtained by injecting under pressure a small quantity of accurately metered and finely atomized fuel oil into the cylinder. Metering of the fuel is accomplished by an upper and lower helix machined in the lower end of the injector plunger. Continuous fuel flow through the injector serves. in addition to preventing air pockets in the fuel system. as a coolant for those injector parts subjected to high combustion temperatures. Each injector control rack is actuated by a lever on the injector control tube which, in turn, is connected to the governor by means of a fuel rod. These levers can be adjusted independently on the control tube. thus permitting a uniform setting of all of the injector racks.

7-14. Fuel Injectors

a. Removal. Remove fuel injector (fig. 4-62).

b. Cleaning and Inspection.

(1) Clean the exterior of the injector with clean fuel oil and dry with compressed air.

(2) Inspect for evidence of any external clam age.

(3) Tag to identify and record the pressure drop and fuel output as indicated by the following tests.

c. Testing.

(1) Injector control rack and plunger test.

(a) Place injector in an injector fixture and rack freeness tester. Refer to figure 7-10 and place the handle on top of the injector follower.

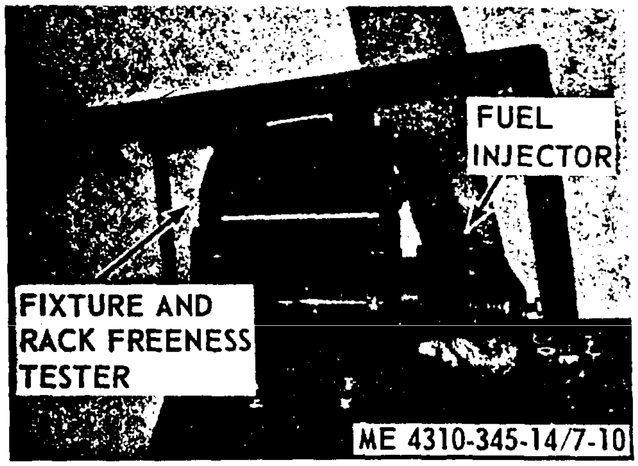

Figure 7-10. Fuel injector rack and plunge free movement check

(b) If necessary adjust contact screw in the handle to ensure the contact screw at the center of the follower when the spring is compressed. pressure

(c) With injector control rank held in no-fuel position. push handle down and depress follower to the bottom of its stroke. Then very slowly release the pressure on the handle while moving control rack up and down as shown in figure 7-10 until the follower reaches the top of its travel. If the rank does not fall freely loosen the injector nut turn the tip, then retighten the nut Loosen and retighten the nut several times if neccessary. General this will free the rack. Then if the rack is not free. change the injector nut. In some cases it may be neccessary to disassemble the injector to eliminate the cause of the misaligned parts.

(2) Injector valve opening pressure test.

(a) Place injector in tester as shown in figure 7-11 with the, dowel on underside of the injector located in the proper slot of the adaptor plant. Position injector handle support to the proper height.

NOTE

When testing an injector, the flow of fuel through the injector on the tester should be the same as in the engine. Connections on the test head of the tester may be changed to obtain the correct direction of flow.

WARNING

Always place injector in the proper position in relation to the spray deflector before it is tested to prevent the fuel spray from penetrating the skin. Fuel oil which enters the blood stream can cause a serious infection.

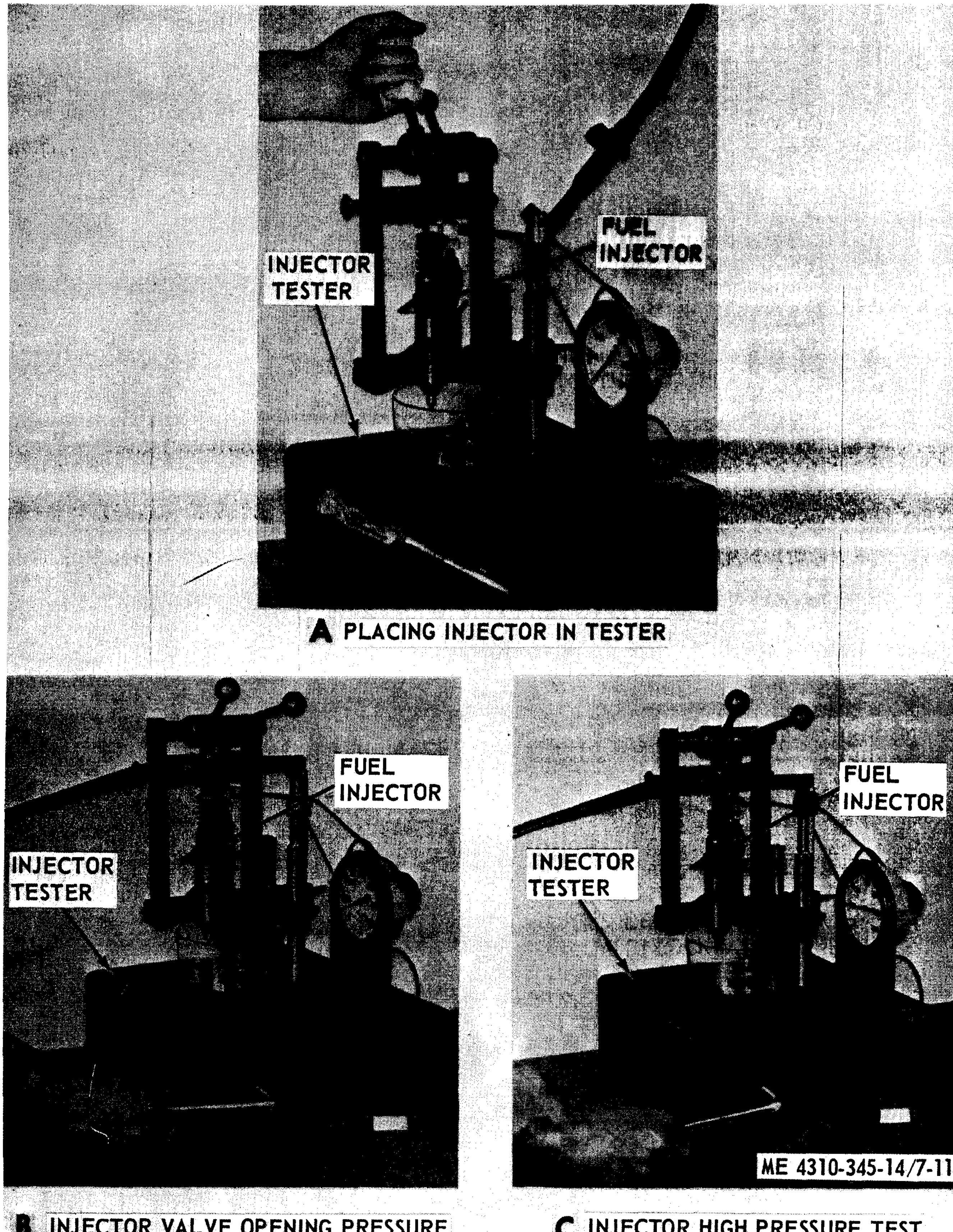

Figure 7-11. Injector valve opening, holding, and high pressure test.

(b) Close inlet clamp of tester. Operate the pump until all air is purged from tester and injector. Then, close outlet clamp of tester.

(c) Place rejector rack m full-fuel position, pump the handle of tester with smooth, even strokes (fig. 7-11) and record injector valve opening pressure, indicated when the injector sprays fuel. Specified valve opening pressure is 450 to 850 PSI. If pressure is not within this range, repair injector.

(3) *Injector valve holding pressure test.*

(a) Operate the pump handle to bring the pressure up to a point just below the injector valve opening pressure previously recorded.

(b) Close the fuel shutoff valve and note the pressure drop. The time for a pressure drop from 450 PSI to 250 PSI should not be less than 40 seconds. If the pressure drop is less than 40 seconds, check injector as follows:

1. Thoroughly dry injector with compressed air.

2. Open tester fuel valve and operate the fuel pump handle to maintain the test pressure.

3. A leak around the spray tip or seal ring usually is caused by a loose injector nut, a damaged seal ring, or a brinelled surface on the injector nut or spray tip.

4. A leak at the filter cap indicates a loose filter cap or damaged filter cap gasket.

5. A "dribble" at the spray tip orifices indicates a leaking valve assembly due to a dam aged surface or dirt. Leakage at the tip will cause preignition in the engine.

NOTE

A drop or two of fuel at the spray tip is only an indication of the fuel trapped in the spray tip at the beginning of the test and is not detrimental as long as the pressure drop specified is not less than 40 seconds.

(4) *Injector high pressure test.*

(a) The high pressure test will indicate any fuel leaks at filter cap gaskets, body plugs, and nut seal ring which did not appear during valve holding pressure test and also if plunger and bushing clearance is satisfactory. Conduct this test as follows :

1. Thoroughly dry the injector with compressed air.

2. Check the fuel connections for leaks. If leaks have occurred, tighten the connections, dry the injector and recheck.

3. Place injector rack in full-fuel position and tester handle locked in position by means of the handle lock (fig. 7-11) operate the pump handle to build up and maintain the pressure.

(b) Use the adjusting screw in the injector tester handle to depress the injector plunger just far enough to close both ports in the injector bushing. The point at which both ports are closed is ascertained by the fact that the injector spray will decrease appreciably and a rise in pressure will occur.

(c) If there is excessive clearance between the plunger and bushing, pressure beyond the normal valve opening pressure cannot be obtained. Replacement of plunger and bushing assembly is then required.

(d) Pump up the injector tester and maintain a pressure of from 1600 to 2000 PSI by actuating the pump handle. Then, inspect for leaks at injector filter cap gaskets, body plugs, and injector nut seal ring.

NOTE

It is normal for fuel to seep out around the rack due to high pressure fuel being applied to a normally low pressure area in the injector assembly. However, fuel droplets at the rack indicate excessive wear.

CAUTION

Do not permit the pressure in the injector tester to equal or exceed the capacity of the pressure gage.

(5) *Spray pattern test.*

(a) After completing injector holding pressure test, open the fuel shutoff valve, place injector rack in full-fuel position and operate the injector several times in succession by operating the tester handle at approximately 40 strokes per minute, refer to figure 7-11. Observe the spray pattern to see that all spray orifices are open and injecting evenly. The beginning and ending of injection should be sharp and the fuel injected should be finely atomized.

(b) If all spray tip orifices are not open and injecting evenly, clean orifices during injector overhaul.

CAUTION

Do not exceed 250 PSI during this test to prevent damage to the pressure gage.

(6) *Visual inspection of plunger.*

(a) Visually check plunger under a magnifying glass for excessive wear or chipping of bottom helix. There is a small area on the bottom helix and lower portion of upper helix, if chipped, that will not be indicated in any of the above described tests.

(b) Remove plunger from injector as follows :

1. Support injector, right side up, in holding fixtures.

2. Compress the follower spring. Raise the spring above the stop pin with a screwdriver and withdraw the pin, refer to figure 7-12. Allow spring to rise gradually.

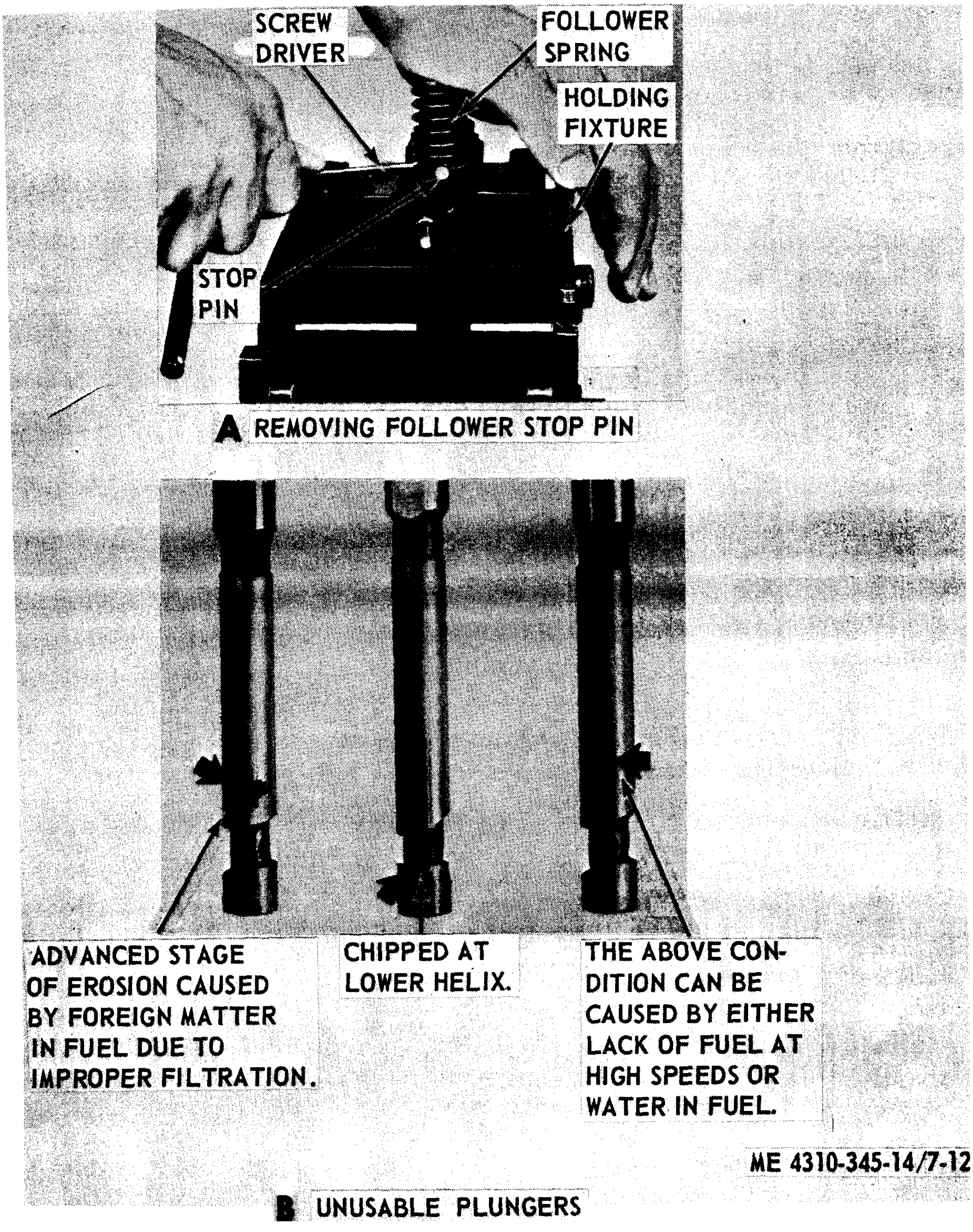

Figure 7-12. Injector plunger visual inspection.

3. Remove injector from holding fixture. Turn injector upside down, to prevent the entry of dirt, and catch the spring and plunger as they drop out.

4. Inspect the plunger. If plunger is chipped (fig. 7-12), replace plunger and bushing assembly.

5. Reinstall the plunger, follower, and spring in the reverse of removal.

(7) *Fuel output test.*

(a) Perform injector fuel output test on either a comparator or a calibrator.

CAUTION

When injectors are removed from the engine for fuel output test and, if satisfactory, reinstalled without disassembly, extreme care shall be taken to avoid reversing the fuel flow. When fuel flow is reversed, dirt trapped by the filter is back-flushed into the injector components.

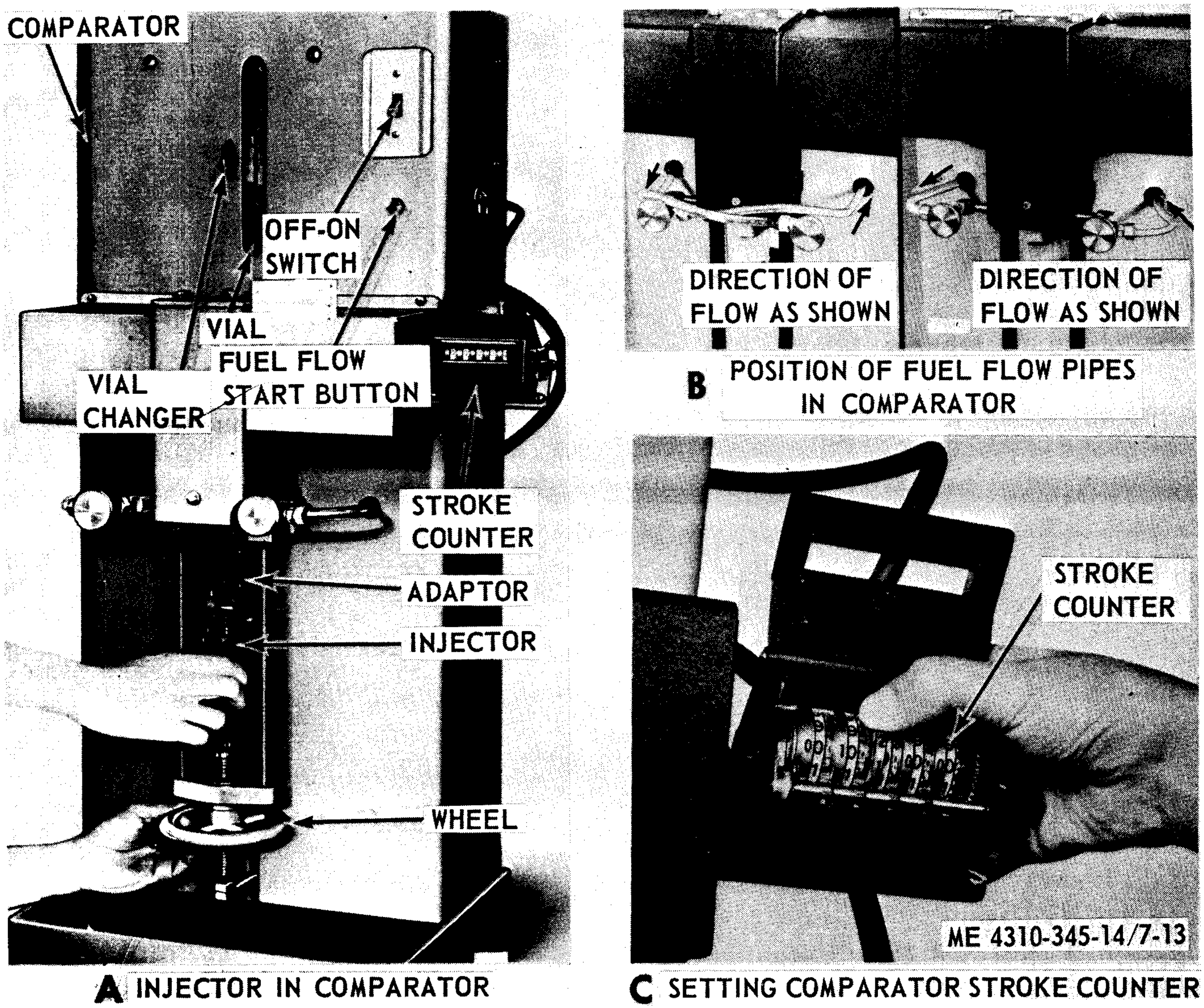

Figure 7-13. Injector fuel output test using comparator.

(b) Before removing an injector from the engine, note the direction of the fuel flow. To avoid reversing the fuel flow when checking injector fuel output, use the appropriate adaptor. The position of the fuel flow pipes on the comparator (fig. 7-13) depends on the adaptor being used and the direction of fuel flow through the injector. The position of the braided fuel inlet tube and the plastic fuel outlet tube on the calibrator (fig. 7-13) depends on the adaptor being used and the direction of fuel flow through the injector.

NOTE

The fuel passages in adaptors are drilled straight through the adaptors. The fuel passages in one adaptor are cross drilled.

(c) Comparator. To check the fuel output, operate the injector in the comparator (fig. 7-13) as follows:

1. Place the injector in the comparator and tighten the hand wheel to clamp the injector and adaptor in position.

NOTE

Make sure the counter on the comparator is preset to 1000 strokes. If, for any reason, this setting has been altered, raise the cover and reset the counter to 1000 strokes by pulling the selector wheel to be changed to the right and rotating it to its proper setting (fig. 7-1 3). Then, release the wheel and close the cover. Refer to the comparator instruction booklet for further information.

2. Pull the injector rack out to the no-fuel position.

3. Start the comparator by turning on the switch.

4. After the comparator has started, push the injector rack in the full-fuel position.

5. Let the injector run for approximately 30 seconds to purge the air that may be in the system.

6. After 30 seconds, press the fuel flow start button. This will start the flow of fuel into the vial. The comparator will automatically stop the flow of fuel after 1000 strokes.

7. After the fuel stops flowing into the vial, pull the injector rack out to the no-fuel position.

8. Turn the comparator off and reset the counter.

9. Observe the reading on the vial. If the quantity of fuel in the vial does not fall within 6 to 12, overhaul injector.

d. Calibrator. To check the fuel output, operate the injector in the calibrator (fig. 7-14) as follows:

NOTE

Place the cam shift index wheel and fuel flow lever in their respective positions. Turn on the test fuel oil heater switch and preheat the test oil to 95° to 105°F.

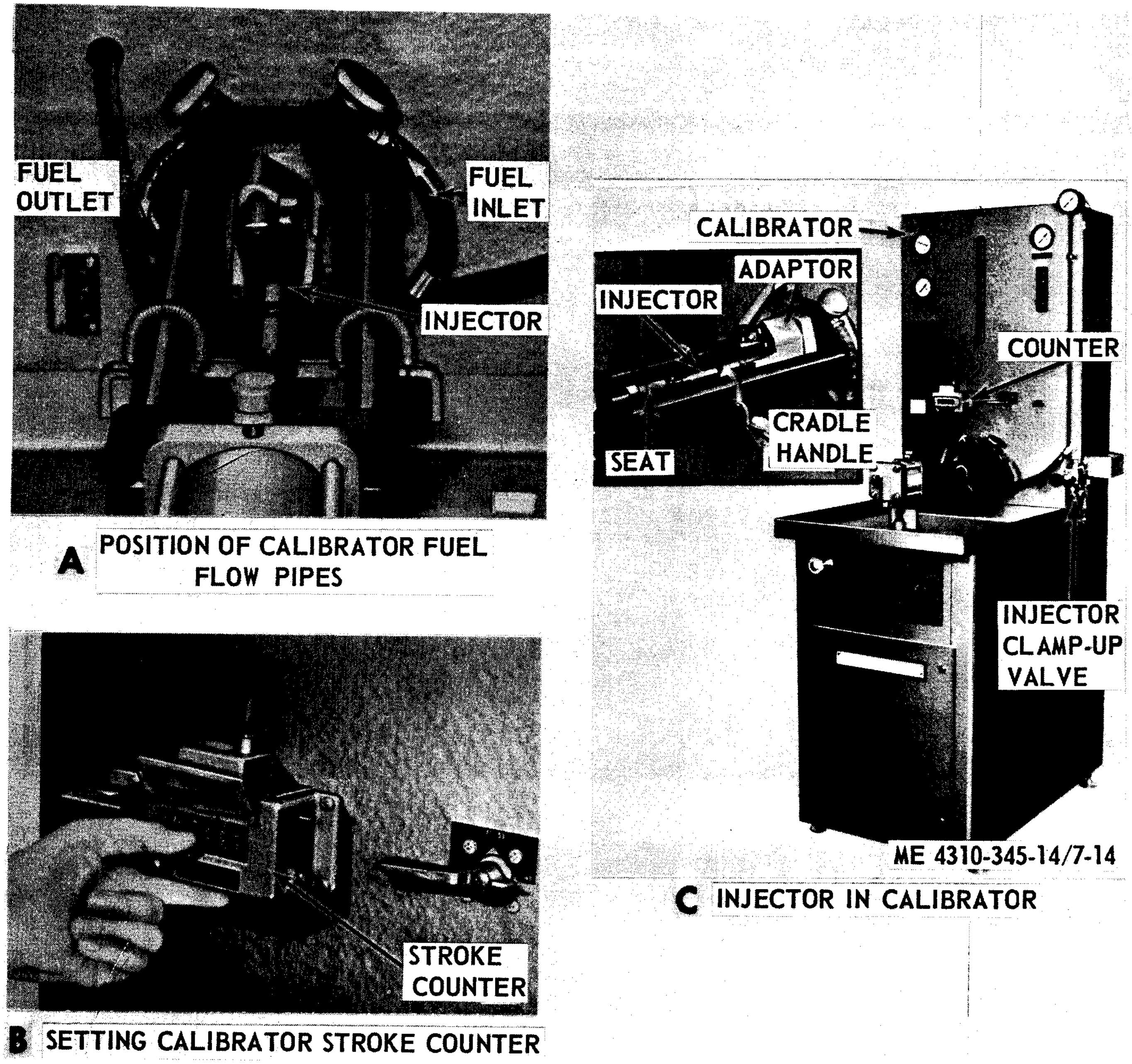

Figure 7-14. Injector fuel output test using calibrator.

1. Place the proper injector adaptor between the tie rods and engage it with the fuel block locating pin. Then, slide the adaptor forward and up against the fuel block face.

2. Place the injector seat into the permanent seat (cradle handle in vertical position). Clamp the injector into position by operating, the air valve.

Fuel Output Check Chart

Injector	Calibrator		Comparator	
	Minimum	Maximum	Minimum	Maximum
S45	48	52	6	12

NOTE

Make sure the counter (fig. 7-1 4) on the calibrator in preset at 1000 strokes. If for any reason thin setting has been altered, reset the counter to 1000 strokes by twisting the cover release button to the left and hold the reset lever in the full up position while setting the numbered wheels. Close the cover. Refer to the calibrator instruction booklet for further information.

3. Pull the injector rack out to the no-fuel position.

4. Turn on the main power control circuit switch. Then, start the calibrator by turning on the motor starter switch.

NOTE

The low oil pressure warning buzzer will sound briefly until the lubricating oil reaches the proper pressure.

5. After the calibrator has started, set the injector rack into the full-fuel position. Allow the injector to operate for approximately 30 seconds to purge the air that may be in the system.

6. After the air is purged, press the fuel flow start button (red). This will start the flow of fuel into the vial. The fuel flow to the vial will automatically stop after 1000 strokes.

7. Shut the calibrator off (the calibrator will stop in lees time at full fuel).

8. Observe the vial reading. If the quantity of fuel in the vial does not fall within 48 to 52, overhaul injector.

(e) The comparator or the calibrator may be used to check and select a set of injectors which will inject the same amount of fuel in each cylinder at a given throttle setting, thus resulting in a smooth running, well balanced engine.

(f) An injector which passes all of the above tests may be put back into service. However, an injector which fails to pass one or more of the tests must be rebuilt and checked on the comparator or the calibrator.

(g) Any injector which is disassembled and rebuilt must be tested again before being placed in service.

d. Disassembly.

(1) Support the injector upright in injector holding fixture (fig. 7-15) and remove the filter caps, filters and gaskets.

NOTE

Whenever a fuel injector is disassembled, discard the filters and gaskets and replace with new filters and gaskets.

(2) Compress the follower spring as shown in figure 7-12. Then, raise the spring above the stop pin with a screwdriver and withdraw the pin. Allow the spring to rice gradually.

(3) Refer to figure 7-15 and remove the plunger follower, plunger and spring as an assembly.

(4) Invert the fixture and, using socket, loosen the nut on the injector body (fig. 7-15).

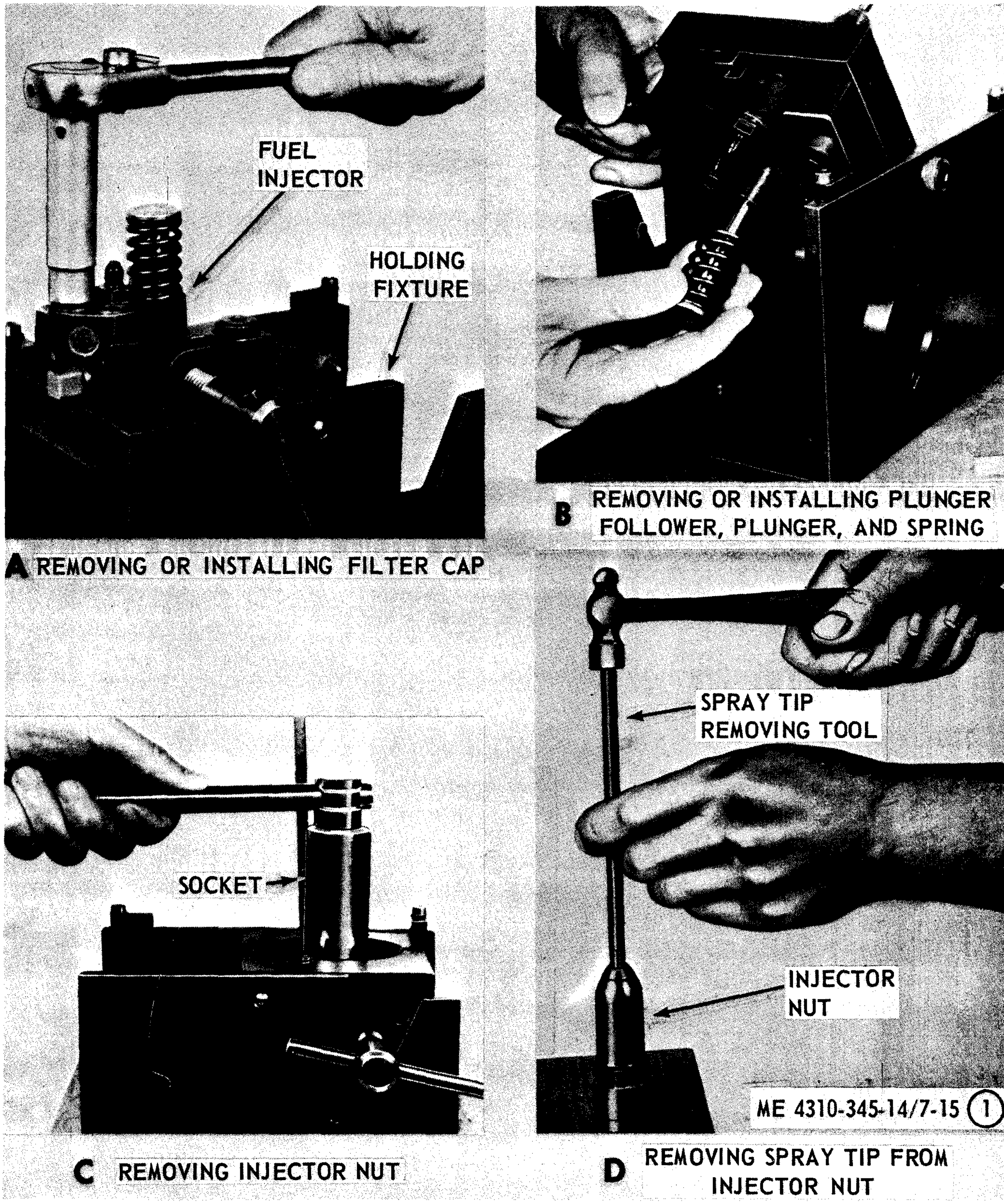

Figure 7-15. Fuel injector, disassembly and cleaning (sheet 1 of 2).

Figure 7-15. Fuel injector, disassembly and cleaning (sheet 2 of 2).

(5) Lift the injector nut straight up, being careful not to dislodge the spray tip and valve parts. Remove the spray tip and valve parts from the bushing and place them in a clean receptacle until ready for assembly.

NOTE

When an injector has been in use for some time, the spray tip, even though clean on the outside, may not be pushed readily from the nut with the fingers. In this event, support the nut on a wood block and drive the tip down through the nut, using tool as shown in figure 7-15.

(6) Remove the spill deflector-and the seal ring from the injector nut.

(7) Remove the plunger bushing, gear retainer and gear from the injector body.

(8) Withdraw the injector control rack from the injector body.

e. Cleaning.

(1) Since most injector difficulties are the result of dirt particles, it is essential that a clean area be provided on which to place injector parts after cleaning and inspection.

(2) Wash all of the parts with clean fuel oil or a suitable cleaning solvent and dry them with clean, filtered compressed air. Do not use waste or rags for cleaning purposes. Clean out all of the passages, drilled holes and slots in all of the injector parts.

(3) Carbon on the inside of the spray tip may be loosened for easy removal by soaking for approximately 15 minutes in a suitable solution prior to the external cleaning and buffing operation. Metyl Ethyl Ketone solution is recommended for this purpose.

(4) Clean the spray tip with tool (fig. 7-15). Turn the reamer in a clockwise direction to remove the carbon deposits. Wash the spray tip and dry it with compressed air. Clean the spray tip orifices with pin vise, using the proper size spray tip cleaning wire (fig. 7-15). Use wire to clean 0.0055 inch diameter holes.

(5) Before using the wire, hone the end until it is smooth and free of burrs and taper the end a distance of 1 / 16 inch with stone. Allow the wire to extend 1 / 8 inch from tool.

(6) The exterior surface of an injector spray tip may be cleaned by using a brass wire buffing wheel. To obtain a good polishing effect and longer brush life, the buffing wheel should be installed on a motor that turns the wheel at approximately 3000 rpm. A convenient method of holding the spray tip while cleaning and polishing is to place the tip over the drill end of spray tip cleaner tool and hold the body of the tip against the buffing wheel. In this way, the spray tip is rotated while being buffed.

(7) When the body of the spray tip is clean, lightly buff the tip end in the same manner. This cleans the spray tip orifice area and will not plug the orifices.

(8) Wash the spray tip in clean fuel oil and dry it with compressed air after cleaning the orifices.

(9) Clean and brush all of the passages in the injector body, using fuel hole cleaning brush and rack hole cleaning brush. Blow out the passages and dry them with compressed air.

(10) Carefully insert reamer in the injector nut as shown in figure 7-15. Turn the reamer in a clockwise direction to remove the carbon deposits. Use care in reaming to prevent the removal of metal or setting up burrs on the spray tip seat. The purpose of the tool is to remove carbon build-up only, and is NOT meant to refinish the end area of the nut by removing metal, Wash the injector nut in clean fuel oil and dry it with compressed air. Carbon deposits on the spray tip seating surface of the injector nut will result in poor sealing and consequent fuel leakage around the spray tip.

(11) Carefully insert reamer in the injector body (fig. 7-15). Turn it in a clockwise direction a few turns, then remove the reamer and check the face of the ring for reamer contact over the entire face of the ring. If necessary, repeat the reaming procedure until the reamer does make contact with the entire face of the ring. Clean up the opposite side of the ring in the same manner.

(12) Carefully insert a 0.375 inch diameter straight fluted reamer inside the ring bore in the injector body. Turn the reamer in a clockwise direction and remove any burrs inside the ring bore. Then, wash the injector body in clean fuel oil and dry it with compressed air.

(13) When handling the injector plunger, do not touch the finished plunger surfaces with your fingers. Wash the plunger and bushing with clean fuel oil and dry them with compressed air. Be sure the high pressure bleed hole in the side of the bushing is not plugged. If this hole is plugged, fuel leakage will occur at the upper end of the bushing where it will drain out of the injector body vent and rack holes, during engine operation, causing a serious oil dilution problem. Keep the plunger and bushing together as they are mated parts.

(14) After washing, submerge the parts in a clean receptacle containing clean fuel oil. Keep the parts of each injector assembly together.

f. Inspection.

(1) Inspect the teeth on the control rack and the control rack gear for excessive wear or damage. Also, check for excessive wear in the bore of the gear and inspect the gear retainer. Replace damaged or worn parts.

(2) Inspect the injector follower and pin for wear.

(3) Inspect both ends of the spill deflector for sharp edges or burrs which could create burrs on the injector body or injector nut and cause particles of metal to be introduced into the spray tip and valve parts. Remove burrs with a 500 grit stone.

(4) Inspect the follower spring for visual defects. Then, check the spring with a tester and an accurate torque wrench.

(5) The injector follower spring (0.142 inch diameter wire) has a free length of approximately 1.504 inches and should be replaced when a load of less than 70 lbs. will compress it to 1.028 inches.

(6) Check the seal ring area on the injector body for burrs or scratches. Also, check the surface which contacts the injector bushing for scratches scuff marks, or other damage. If necessary, lap this surface. A faulty sealing surface at this point will result in high fuel consumption and contamination of the lubricating oil. Replace any loose injector body plugs or a loose dowel pin. Install the proper number tag on a service replacement injector body.

(7) Inspect the injector plunger and bushing for scoring, erosion, chipping or wear. Check for sharp edges on that portion of the plunger which rides in the gear. Remove any sharp edges with a 500 grit stone. Wash the plunger after stoning it. Injector Bushing Inspectalite can be used to check the port holes in the inner diameter of the bushing or cracks or chipping. Slip the plunger into the bushing and check for free movement. Replace plungers and bushings as an assembly if any of the above damage is noted, since they are mated parts. Use new mated factory parts to assure the best performance from the injector.

(8) Injector plungers cannot be reworked to change the output. Grinding will destroy the hardened case at the helix and result in chipping and seizure or scoring of the plunger.

(9) Examine the spray tip seating surface of the injector nut for nicks, burrs or brinelling. Reseat the surface or replace the nut if it is severely damaged.

(10) The injector valve spring plays an important part in establishing the valve opening pressure of the injector assembly. Replace a worn or broken spring.

(11) Inspect the sealing surfaces of the spray tip and valve parts indicated in figure 7-16. Exam the the sealing surfaces with a magnifying glass as shown in figure 7-16, for even the slightest imperfections will prevent the injector from operating properly. Check for burrs, nicks, erosion, cracks, chipping and excessive wear. Also, check for enlarged orifices in the spray tip. Replace damaged or excessively worn parts. Check the minimum thickness of the lapped parts as noted in table 7-1.

(12) Before reinstalling used valve parts in an injector, lap all of the sealing surfaces indicated in figure 7-16, except the injector valve (crown valve). It is also good practice to lightly lap new valve parts, except the injector valve (crown valve) which may become burred or nicked during handling.

Table 7-1. Injector Sealing Surfaces, Minimum Thickness

Part name	Minimum thickness
Tip, Spray (Shoulder)	0.121
Valve, Injector	0.073
Cage, Valve	0.490
Seat, Valve	0.124
Valve, Check	0.027

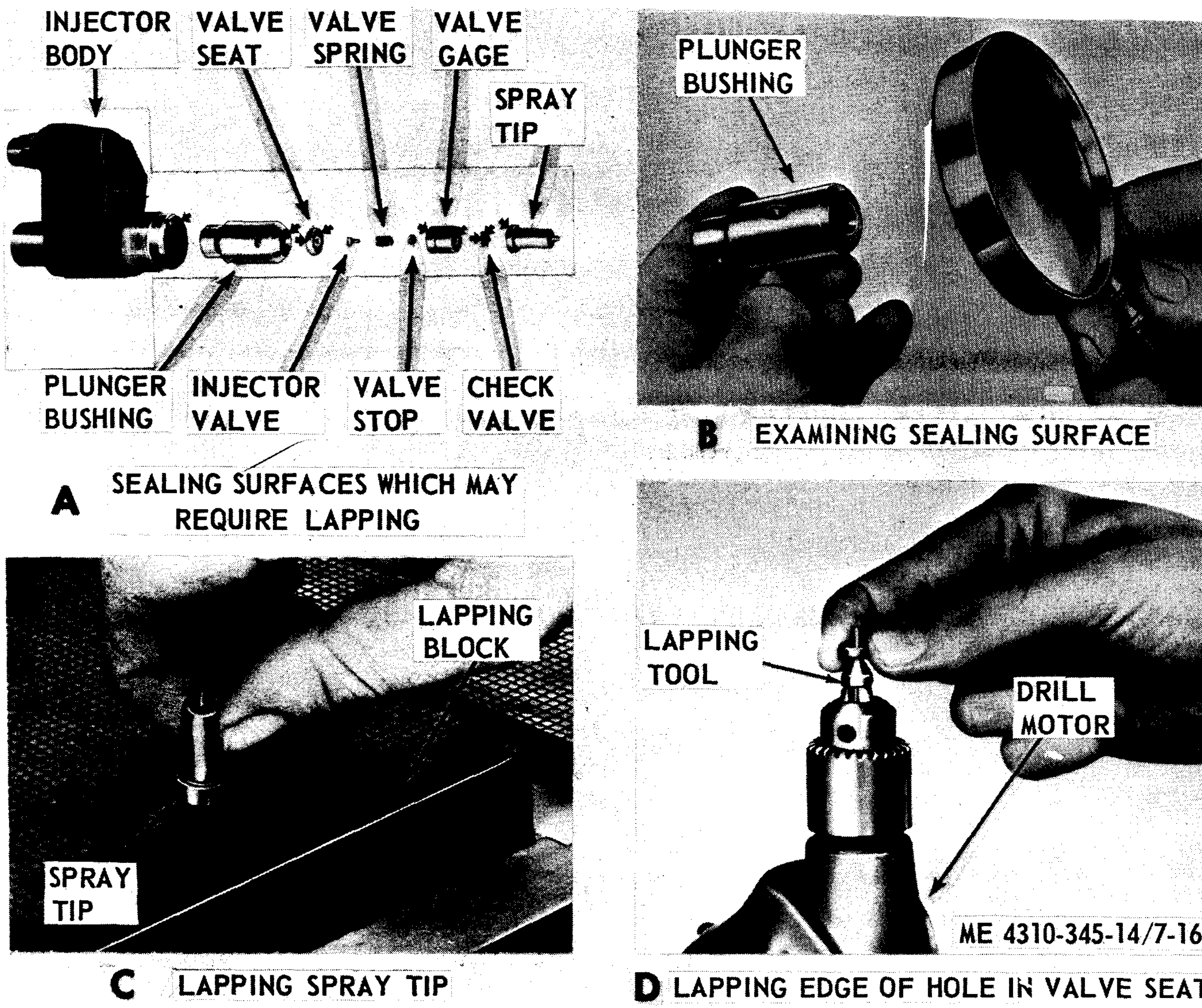

Figure 7-16. Fuel injector, inspection and repair.

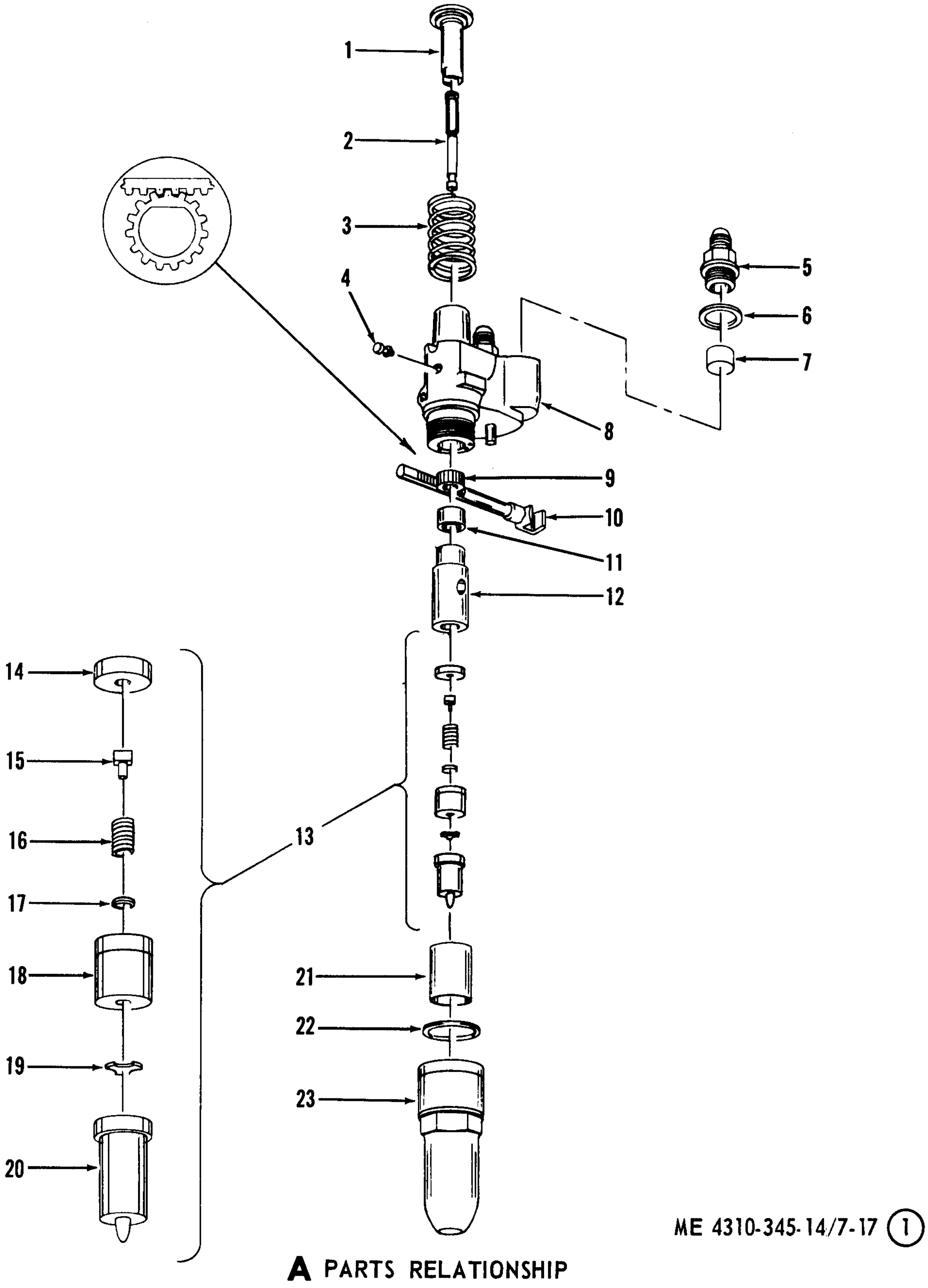

Figure 7-17. Fuel injector, reassembly (sheet 1 of 2).

KEY to figure 7-17 (sheet 1 of 2):

1. Follower
2. Plunger
3. Follower spring
4. Stop pin
5. Filter cap
6. Gasket
7. Filter
8. Body
9. Gear
10. Control rack
11. Gear retainer
12. Bushing
13. Tip assembly
14. Valve seat
15. Valve
16. Spring
17. Stop
18. Cage
19. Check valve
20. Spray tip
21. Spill deflector
22. Seal ring
23. Nut

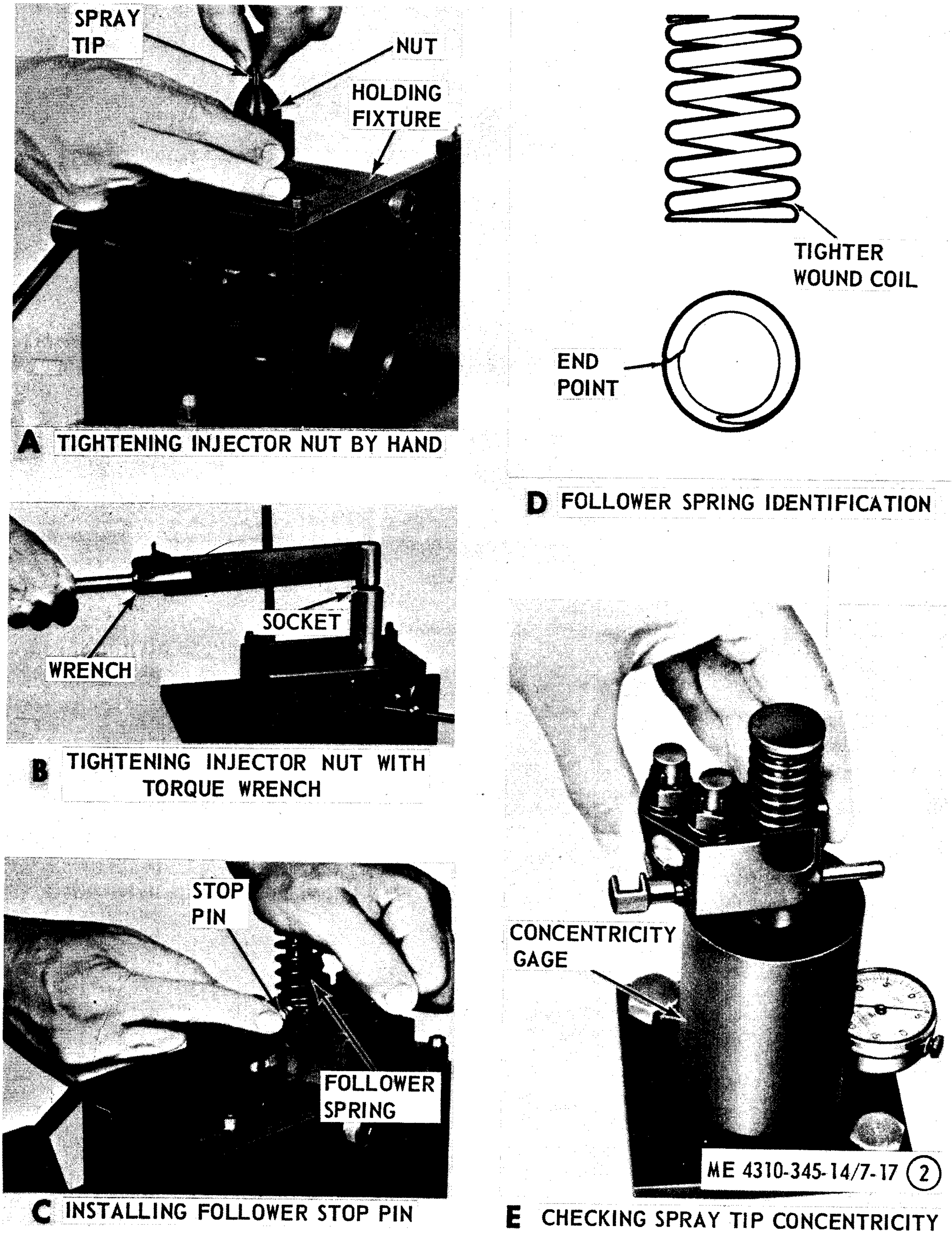

Figure 7-17. Fuel injector, reassembly (sheet 2 of 2).

g. Lapping Sealing Surfaces. Lap the sealing surfaces indicated in figure 7-16 and table 7-1 as follows;

(1) Clean the lapping blocks with compressed air. Do not use a cloth or any other material for this purpose.

(2) Spread a good quality 600 grit dry lapping powder on one of the lapping blocks.

(3) Place the part to be lapped flat on the block as shown in figure 7-16 and, using a figure eight motion, move it back and forth across the block. Do not press on the part, but use just enough pressure to keep the part flat on the block. It is important that the part be kept flat on the block at all times.

(4) After each four or five passes, clean the lapping powder from the part by drawing it across a clean piece of tissue placed on a flat surface and inspect the part. Do not lap excessively (table 7-1).

(5) When the part is flat, wash it in cleaning solvent and dry it with compressed air.

(6) Place the dry part on the second block. After applying lapping powder, move the part lightly across the block in a figure eight motion several times to give it a smooth finish. Do not lap excessively. Again wash the part in cleaning solvent and dry it with compressed air.

(7) Place the dry part on the third block. Do not use lapping powder on this block. Keep the part flat and move it across the block several times, using the figure eight motion. Lapping the dry part in this manner gives it the "mirror" finish required for perfect sealing.

(8) Examine the edge of the hole in the crown valve seat under a magnifying glass. If the edge of the hole shows small irregularities, lap the hole. Since only the edge of this hole contacts the valve, it must be a true circle and present an unbroken surface. Mount tool in a drill motor (fig. 7-16) and place a small amount of lapping powder and oil mixture on the tool. Place the valve seat over the pilot of the tool and start the drill motor. Touch the valve seat lightly against the rotating lapping tool to produce a uniform seat at the hole. After lapping the edge of the hole in this manner, flat lap the face of the seat lightly. Then clean and examine the width of the chamfer produced at the edge of the hole. The specified width is 0.002 to 0.005 inch. A width in excess of these limits, due to excessive lapping, will lower the valve opening pressure of the injector.

(9) Wash all of the lapped parts in clean fuel oil and dry them with compressed air.

h. Reassembly. Use an extremely clean bench to work on and to place the parts when assembling an injector. Also be sure all of the injector parts, both new and used, are clean. Refer to figure 7-17 for the proper relative position of the injector parts, then proceed as follows:

(1) *Assemble injector filters.*

(a) While holding the injector body right side up, place a new filter, slot in the filter up or toward the filter cap, in each of the fuel cavities in the top of the injector body.

(b) Place a new gasket on each filter cap. Lubricate the threads and install the filter caps. Use a 9 / 16 inch deep socket wrench as shown in figure 7-15 to tighten the filter caps to 65-75 lb-ft torque.

(c) Purge the filters after installation by directing compressed air or fuel through the filter caps.

(d) Install clean shipping caps on the filter caps to prevent dirt from entering the injector.

(2) *Assemble rack and gear. Refer to* figure 7-17 and note the drill spot marks on the control rack and gear. Then, proceed as follows:

(a) Hold the injector body, bottom end up, and slide the rack through the hole in the body. Look into the bore for the rack teeth; then, move the rack until you can see the drill marks. Hold the rack in this position.

(b) Place the gear in the injector body so that the marked tooth is engaged between the two marked teeth on the rack.

(c) Place the gear retainer on top of the gear. Next, align the locating pin in the bushing with the slot in the injector body; then, slide the end of the bushing into place.

(3) *Assemble injector valve and related parts.* After having lapped and cleaned the injector valve and its related parts, refer to figure 7-17 and assemble them as follows:

(a) Support the injector body, bottom end up, in the injector holding fixture.

(b) Place a new seal ring on the shoulder of the body. Then, slide the spill deflector over the barrel of the bushing.

(c) Place the valve seat on the end of the bushing. Then insert the stem of the valve in one end of the valve spring and the valve stop in the other end. Lower the valve cage over this assembly so that the valve stop seats in the cage. Place the valve case assembly on the valve seat.

(d) Locate the check valve centrally on the cage and place the spray tip over the check valve and against the valve cage.

(e) Lubricate the threads in the injector nut and carefully thread the nut on the injector body by hand. Rotate the spray tip between your thumb and first finger while threading the nut on the injector body (fig. 7-17). Tighten the nut as tight as possible by hand. At this point there should be sufficient force on the spray tip to make it impossible to turn with your fingers.

(f) Use socket wrench and a torque wrench to tighten the injector nut to 55-65 lob-ft torque (fig. 7-17).

NOTE

Do not exceed the specified torque. Otherwise, the nut may be stretched and result in improper sealing of the lapped surfaces in a subsequent injector overhaul.

(4) *Assemble plunger and follower.*

(a) Refer to figures 7-15 and 7-17 and slide the head of the plunger into the follower.

(b) Invert the injector in the assembly fixture (filter cap end up) and push the rack all the way in. Then place the follower spring on the injector body.

(c) Refer to figure 7-17 and place the stop pin on the injector body so that the tighter wound end of the follower spring rests on the narrow flange of the stop pin. This end of the follower spring has been cut so that the end point is to the outside. Then, align the slot in the follower with the stop pin hole in the injector body. Next align the flat side of the plunger with the slot in the follower. Then insert the free end of the plunger in the injector body. Press down on the follower and at the same time press the stop pin into position. When in place, the spring will hold the stop pin in position.

(5) Spray tip concentricity. To assure alignment, check the concentricity of the spray tip as follows:

(a) Place the injector in the concentricity gage as shown in figure 7-17 and adjust the dial indicator to zero.

(b) Rotate the injector 360° and note the total run-out as indicated on the dial.

(c) If the total run-out exceeds 0.008 inch, remove the injector from the gage. Then, loosen the injector nut, center the spray tip, and tighten the nut to 55—65 lb-ft torque. Recheck the spray tip concentricity. If, after several attempts, the spray tip cannot be positioned satisfactorily, replace the injector nut.

(6) *Test reconditioned injector.* Before placing a reconditioned injector in service, perform all of the tests (except the visual inspection of the plunger) previously outlined in paragraph 7-14 c. The injector is satisfactory if it passes these tests. Failure to pass any one of the tests indicates that defective or dirty parts have been assembled. In this case, disassemble, clean, inspect, assemble and test the injector again.

i. Installation. Before installing an injector in an engine, remove the carbon deposits from the beveled seat of the injector tube in the cylinder head. This will assure correct alignment of the injector and prevent any undue stresses from being exerted against the spray tip. Use injector tube bevel reamer to clean the carbon from the injector tube. Exercise care to remove ONLY the carbon so that the proper clearance between the injector body and the cylinder head is maintained. Pack the flutes of the reamer with grease to retain the carbon removed from the tube. Be sure the fuel injector is filled with fuel oil. If necessary, add clean fuel oil at the inlet filter cap until it runs out of the outlet filter cap. Install the injector in the engine as follows:

(1) Refer to paragraph 4-86 and insert the injector into the injector tube with the dowel in the injector body registering with the locating hole in the cylinder head.

(2) Slide the rack control lever over so that it registers with the injector rack.

(3) Install the injector clamp, special washer and bolt. Tighten the bolt to 20—25 lb-ft torque. Make sure that the clamp does not interfere with the injector follower spring or the exhaust valve spring.

NOTE

Check the injector control rack for free movement. Excess torque can cause the control rack to stick or bind.

(4) Move the rocker arm assembly into position and secure the rocker arm brackets to the cylinder head by tightening the bolts to 50 to 55 foot-pounds torque.

(5) Remove the shipping caps. Then, install the fuel pipes and connect them to the injector and the fuel connectors. Use socket to tighten the connections to 12—15 lb-ft torque.

CAUTION

Do not bend the fuel pipes and do not exceed the specified torque. Excessive tightening will twist or fracture the flared end of the fuel line and result in leaks. Lubricating oil diluted by fuel oil can cause serious damage to the engine bearings.

(6) Refer to paragraphs 4-99, 4-100, 7-26a, and 7-26 *b* to perform a complete engine tune-up. However, if only one injector has been-removed and replaced and the other injectors and the governor adjustment have not been disturbed, it will only be necessary to adjust the valve clearance and time the injector for the one cylinder, and to position the injector rack control levers.

Section VIII. ENGINE OIL COOLER

7-15. General

The engine oil cooler is mounted to an adaptor on the lower right front corner of the engine. The adaptor is in turn mounted to the side of the cylinder block. A full-flow oil filter is also mounted on this adaptor. Engine oil flow is from the oil pump through a passage in the oil cooler adaptor to the full-flow oil filter, through the oil cooler core, and then through the cylinder block oil galleries. To assure engine lubrication should the oil cooler become clogged, a bypass valve located near the top of the lower engine cover bypasses oil from the oil pump discharge port directly to the cylinder block oil galleries. This bypass valve opens at approximately 52 PSI. Cooling water circulated through the oil cooler completely surrounds the oil cooler core, thereby cooling the engine oil as it passes through the core.

7-16. Engine Oil Cooler

a. Removal. Remove the engine oil cooler (para 4-90).

b. Disassembly. Disassemble the engine oil cooler in numerical sequence shown in figure 7-18. Discard gaskets.

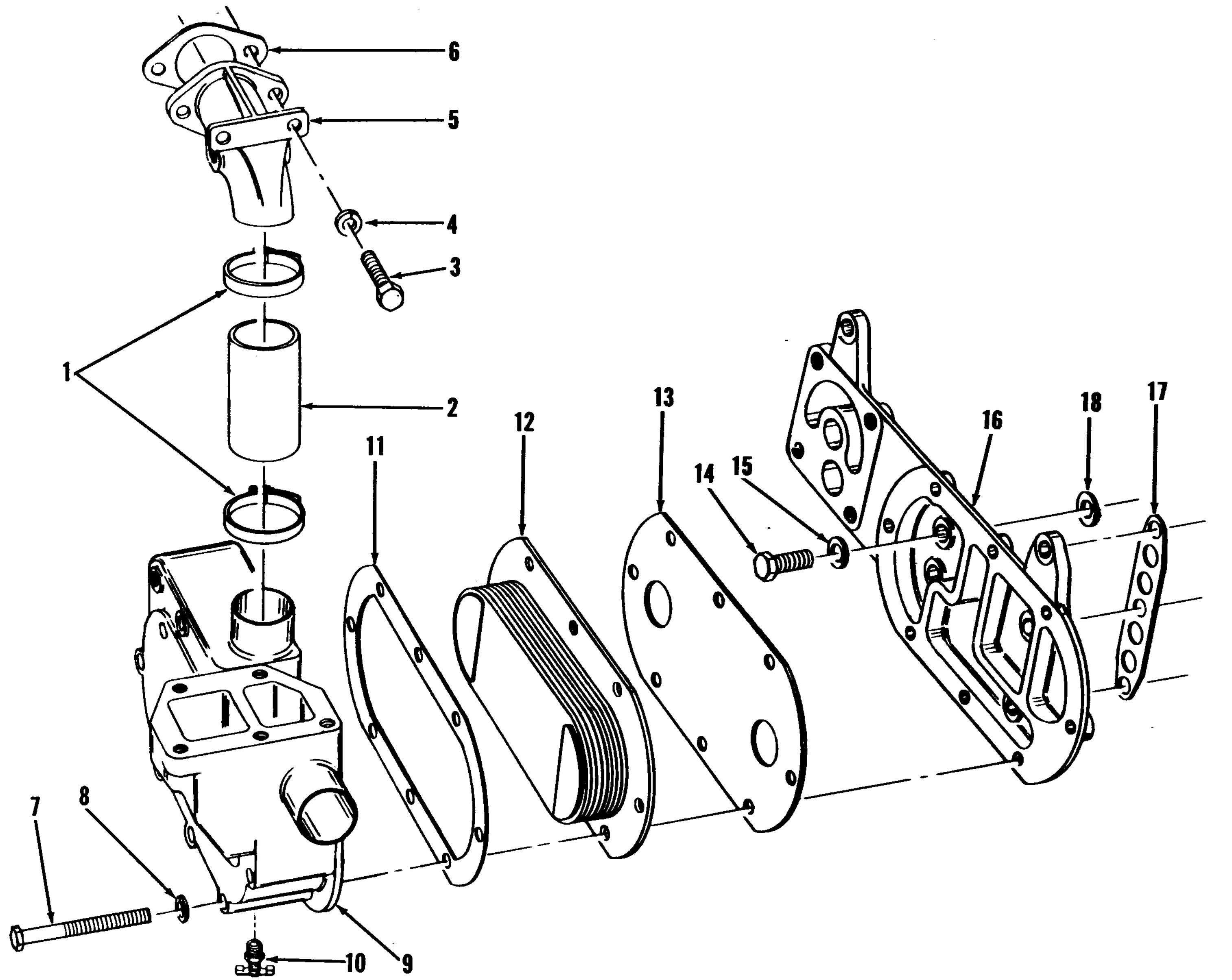

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Figure 7-18. Engine oil cooler, disassembly and reassembly.

KEY to figure 7-18:
1. Hose clamp (2)
2. Hose
3. Bolt (2)
4. Lockwasher (2)
5. Elbow
6. Gasket
7. Bolt (8)
8. Lockwasher (8)
9. Housing
10. Draincock
11. Gasket
12. Core
13. Gasket
14. Bolt (6)
15. Lockwasher (6)
16. Adaptor
17. Gasket
18. Gasket (3)

c. Cleaning, Inspection, and Repair.

(1) Clean all parts except core in accordance with paragraph 5-5 *f.*

(2) Clean oil side of the core. Circulate a solution of trichloroethylene through the core passages with a force pump to remove the carbon and sludge.

CAUTION

Perform this cleaning operation in the open or a well ventilated room when trichloroethylene or other toxic chemicals are used for cleaning.

Clean the core before the sludge hardens. If oil passages are badly clogged, circulate an Oakite or alkaline solution through the core and flush thoroughly with clean, hot water.

(3) Clean water side of the core. After cleaning the oil side of the core, immerse it in the following solution: Add one-half pound of oxalic acid to each two and one-half gallons of a solution composed of one-third muriatic acid and two-thirds water. Cleaning action is evidenced by bubbling and foaming. The cleaning process must be watched carefully and, when bubbling stops (usually in from 30 to 60 seconds), the core shall be removed from the cleaning solution and thoroughly flushed with clean, hot water. After cleaning, dip the core in light oil.

CAUTION

Do not attempt to clean an oil cooler core when an engine failure occurs in which metal particles from worn or broken parts are released into the lubricating oil. Replace the oil cooler core.

(4) Inspect all parts for cracks, breaks, distortion, or any other defect.

(5) Inspect attaching hardware for cracks, dam aged threads, or any other defect.

d. Reassembly. Reassemble the engine oil cooler in reverse numerical sequence shown in figure 7-18. Install new gaskets.

e. Installation. Install engine oil cooler (para 4-90).

Section IX. FRESH WATER PUMP AND IDLER PULLEY ASSEMBLIES

7-17. General

The fresh water pump assembly is a centrifugal type mounted on top of the engine oil cooler. The pump is belt driven by the balance shaft and circulates the engine coolant through the oil cooler, cylinder block, cylinder head, and radiator. The pump driven pulley is pressed onto the pump shaft on the end opposite the impeller. The pump shaft is supported on a sealed double-row combination radial and thrust ball bearing. Coolant is prevented from traveling along the shaft toward the bearing by a seal. The water pump idler pulley assembly is used as a m cans of adjusting drive belt tension.

7-18. Fresh Water Pump Assembly

a. Removal. Remove the water pump assembly (para 4-68).

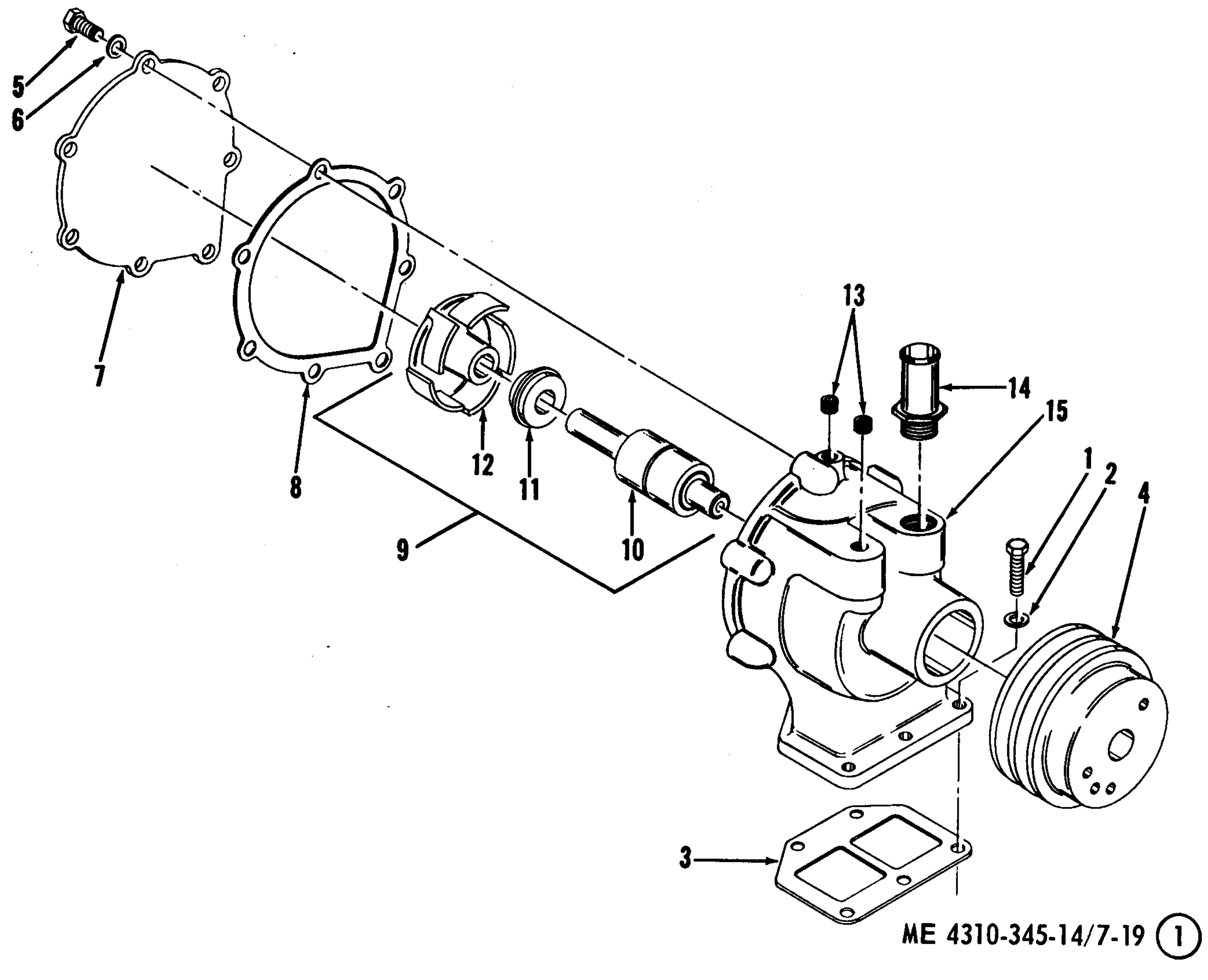
b. Disassembly. Disassemble the fresh water pump in numerical sequence shown in figure 7-19. Discard gaskets and seal.

NOTE

Mark position of pulley on the shaft so that the pulley can be installed in the same position when pump is reassembled.

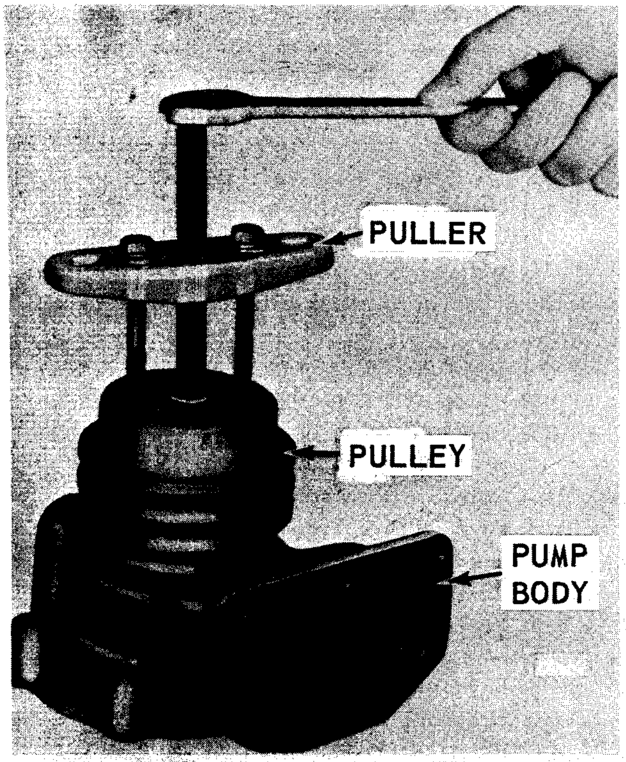
CAUTION

When removing the impeller, protect ceramic insert from damage at all times. Always lay impeller on the bench with ceramic insert up to prevent damage.

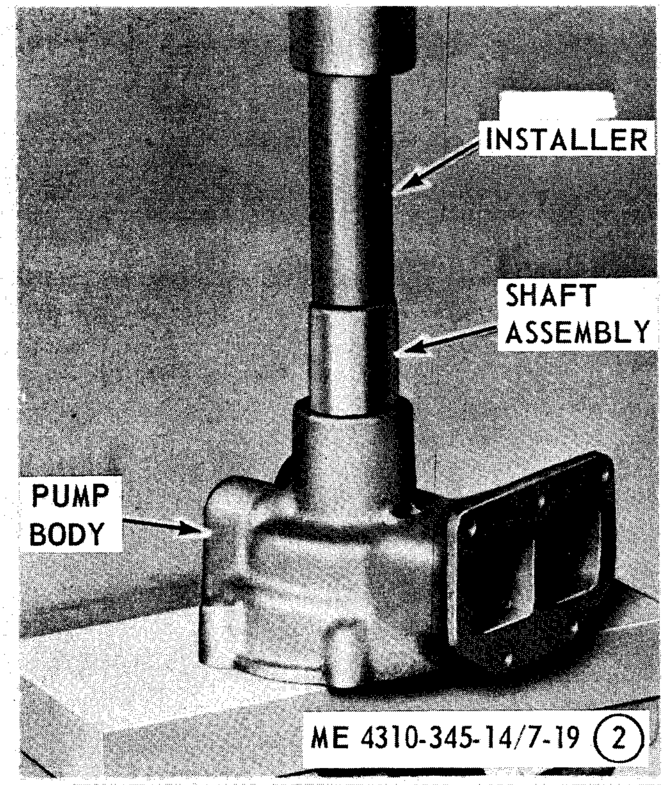


1. Bolt (5)
2. Lockwasher (5)
3. Gasket
4. Pulley
5. Bolt (7)
6. Lockwasher (7)
7. Cover
8. Gasket
9. Shaft assembly
10. Shaft and bearing
11. Seal
12. Impeller
13. Plug
14. Connector
15. Body

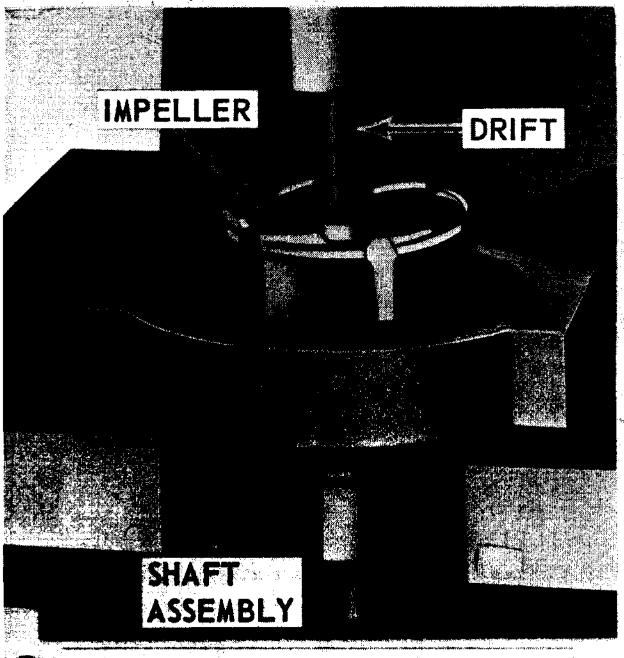
Figure 7-19. *Fresh water pump, disassembly and reassembly (sheet 1 of 2).*



A REMOVING PULLEY



C PRESSING SHAFT ASSEMBLY INTO BODY



B REMOVING SHAFT FROM IMPELLER

Figure 7-19. Fresh water pump, disassembly and reassembly (sheet 2 of 2).

c. Cleaning, Inspection, and Repair.

(1) Clean all parts except shaft and bearing assembly in accordance with paragraph 5-5 *f.* Wipe shaft and bearing assembly clean with a clean, lint-free cloth.

(2) Inspect impeller for cracks, breaks, excessive wear, scratches, and bond of ceramic insert.

(3) Inspect shaft and bearing assembly for cracks, scratches, freedom of rotation, or any other defect.

(4) Inspect pulley for cracked or chipped grooves, breaks, or any other defect.

(5) Inspect all other parts for cracks, breaks, distortion, or any other defect.

d. Reassembly. Reassembly fresh water pump in reverse numerical sequence shown in figure 7-19. Install new seal and gaskets. Assemble pulley on shaft in same position as noted in disassembly.

e. Installation. Install fresh water pump (para 4-68).

7-19. Idler Pulley Assembly

a. Removal.

(1) Remove the two nuts, washers, and bolts attaching the idler pulley assembly to the bracket on upper engine front cover.

(2) Lift the pulley assembly away from bracket and drive belts.

b. Disassembly.

(1) Support the pulley and press the shaft and bearing assembly and bracket from the pulley. Apply pressure to outer race of the bearing.

(2) Support the bracket and press the shaft and bearing assembly from the bracket. Apply pressure on shaft only.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts except shaft and bearing assembly in accordance with paragraph 5-5 *f.* Wipe shaft and bearing assembly with a clean, lint-free cloth .

(2) Inspect shaft and bearing assembly for freedom of rotation, cracks, breaks, distortion, or any other defect.

(3) Inspect all other parts for cracks, breaks, distortion, damaged threads, or any other defect.

d. Reassembly.

(1) Press the shaft and bearing assembly into the pulley until outer race of bearing is flush with the inside surface of the pulley. Press on outer race of bearing only.

(2) Using a short rod, apply pressure on shaft only and press shaft and beating with pulley installed into idler pulley bracket. Distance between face of pulley and the bracket shall be 0.160 inch.

e. Installation.

(1) Install the idler pulley assembly on the bracket provided on the upper engine front cover. Attach with two bolts, washers, and nuts.

(2) Install drive belts on balance shaft pulley, idler pulley assembly, and fresh water pump drive pulley.

(3) Adjust idler pulley assembly to obtain proper belt tension (fig. 4-6).

Section X. AIR SHUTDOWN HOUSING, BLOWER, AND BLOWER DRIVE SUPPORT

7-20. General

The blower supplies the fresh air required for combustion and scavenging. Its operation is similar to that of gear-type oil pump. Two hollow double-lobe rotors revolve in a housing bolted to the side of the engine block. The revolving motion of the rotors provides a continuous and uniform displacement of air. The blower rotors are pinned to the rotor shafts. The shafts are steel and the blower end plates are aluminum, providing for a compatible bearing arrangement. Gears located on the splined end of the rotor shafts space the rotor lobes with a close tolerance. The lobes of the rotors do not touch at any time; therefore, no lubrication is required. Oil seals are used in both front and rear end plates. The seals prevent air leakage past the blower rotor shaft bearing surfaces and also keep timing gear lubrication oil from entering the rotor compartment. The blower drive gear is driven by the camshaft gear. The gear is keyed and pressed onto a shaft which is supported in the blower drive support. This support is attached to the rear end plate on the blower side of the engine. The air shutdown housing is mounted on the side of the blower. This housing contains an air shutoff valve that shuts off the air supply and stops the engine whenever abnormal operating conditions require an emergency shutdown. This valve also closes when the engine is shut down and must be opened manually by setting the shutdown latch to the open position prior to engine starting.

7-21. Air Shutdown Housing

a. Removal.

(1) Loosen hose clamp and remove engine air intake hose from intake adaptor (fig. 4-29).

(2) Remove cold weather starting aid atomizer from intake housing (para 4-38) and generator cable clamp.

(3) Remove the shutdown solenoid switch (fig. 4-26).

(4) Remove the air intake housing in numerical sequence shown m figure 7-20.

b. Cleaning, Inspection, and Repair.

(1) Clean parts in accordance with paragraph *5-5 f.*

(2) Inspect gasket and screen for damaged screening, tears, or any other defect.

(3) Inspect springs for cracks, breaks, distortion, or any other defect.

(4) Inspect all parts for cracks, breaks, damaged threads, or any other defect.

c. Installation.

(1) Install the air intake housing in reverse numerical sequence shown in figure 7-20 and in accordance with the following when a new shaft or air shutoff valve is to be installed.

(2) Refer to figures 7-21 and 7-20 and install new shaft or shutoff valve as follows. Use a 1/8 inch diameter drill. The valve must be in the same plane within 0.03 inch when in the stop position (flush with the housing face).

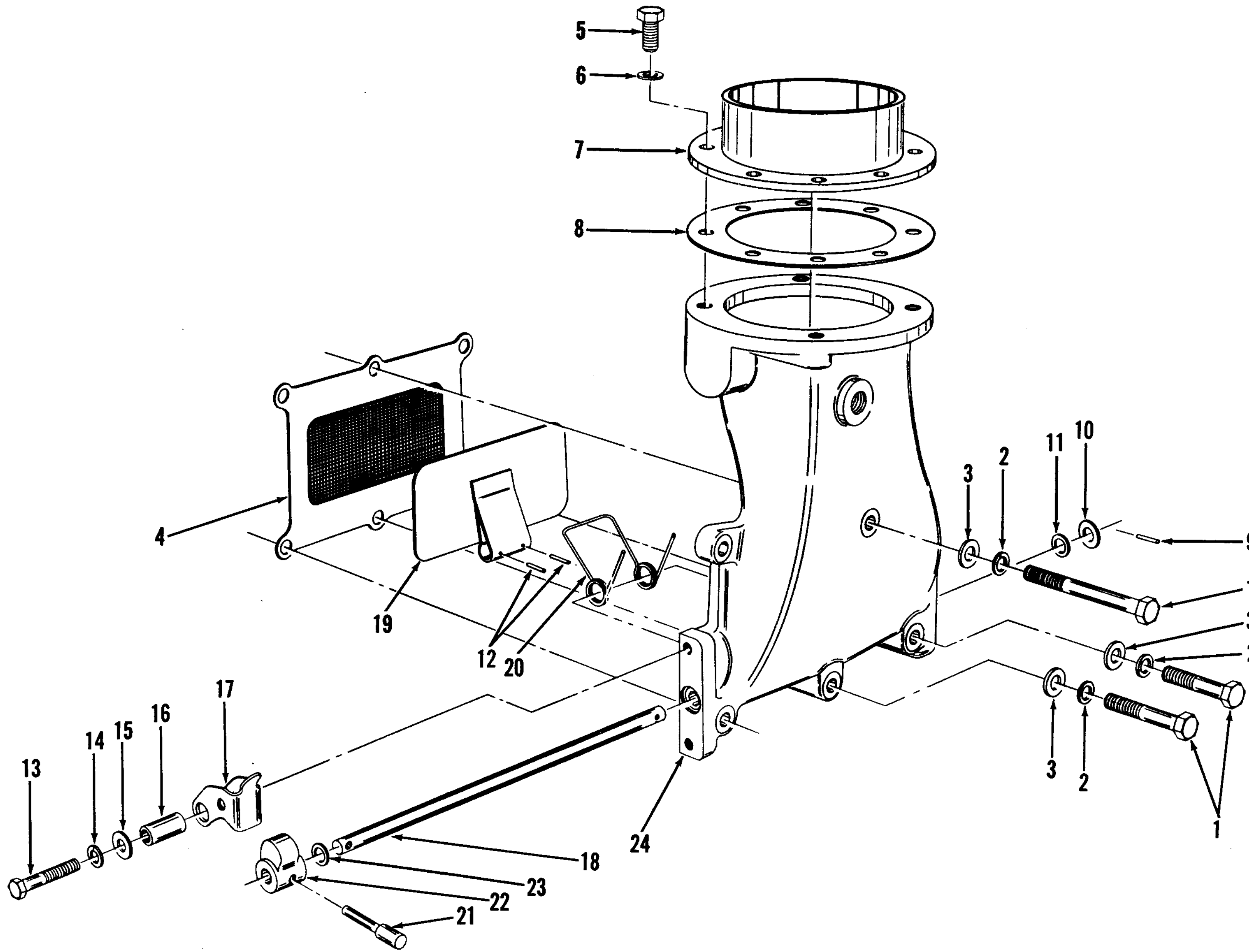


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Figure 7-20. Air shutdown housing, removal and installation.

KEY to figure 7-20:
1. Bolts (6)
2. Lockwashers (6)
3. Flat washers (6)
4. Gasket
5. Bolts (4)
6. Lockwashers (4)
7. Adaptor
8. Gasket
9. Pin
10. Washer
11. Seal ring
12. Pin (2)
13. Bolt
14. Lockwasher
15. Washer
16. Spacer
17. Latch
18. Shaft
19. Valve
20. Spring
21. Handle
22. Cam
23. Seal ring
24. Housing

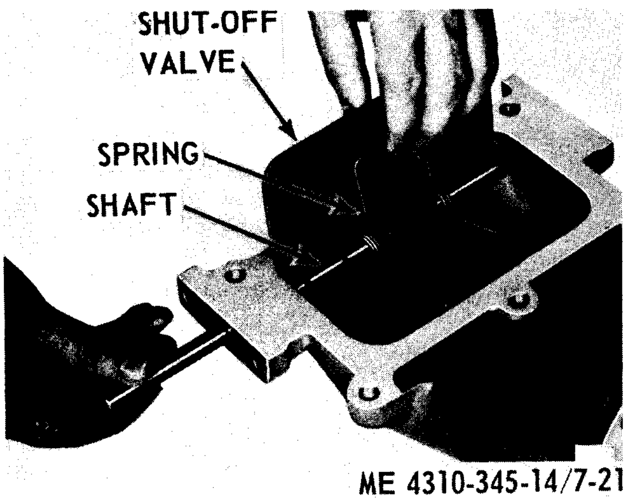


Figure 7-21. Air shutoff valve, spring, and shaft, installation.

(a) Position the valve and spring in the housing as shown in figure 7-21 and slide shaft in place. The shaft must extend 0.70 inch from the side of the housing where shutdown latch is assembled.

(b) Install a new seal ring at each end of the shaft. Make certain that the seals are seated in the counterbores of the housing.

(c) Install the cam and cam pin handle on the shaft.

(d) Install a washer and retaining pin at the other end of the shaft.

(e) Assemble the spacer (bushing), spring, and latch to the shutdown housing with the bolt, lockwasher, and plain washer.

(f) Align the notch on the bushing with the notch on the latch and lock the bushing in this position.

(g) Install the pins in the valve to retain it to the shaft with the cam release latch set and the valve in the run position.

(h) Level the valve in the shutdown position.

(i) Adjust the bushing so the valve contacts the housing when the cam release latch is set.

(3) In-stall the intake housing attaching bolts finger tight; then, tighten the two center bolts to 16-20 lb-ft torque first. Tighten the remaining corner bolts to the same torque.

CAUTION

Do not use a power wrench to tighten these bolts.

(4) Install the shutdown solenoid switch (fig. 4-26).

(5) Install the generator cable clamp and the cold weather starting aid atomizer (para 4-38).

(6) Install the engine air intake hose on the intake adaptor and tighten the hose clamp (fig. 4-29).

7-22. Blower

a. Removal.

(1) Remove the air shutdown housing (para 7-21).

(2) Loosen the clamp retaining the cover-to-suppor

(3) Remove the blower-to-block bolts and special washers and lift the blower away from the engine, being careful not to damage the serrations on the blower drive shaft.

b. Disassembly.

(1) Disassemble the blower assembly in the numerical sequence shown in figure 7-22, sheet 1. Discard oil seals and gaskets.

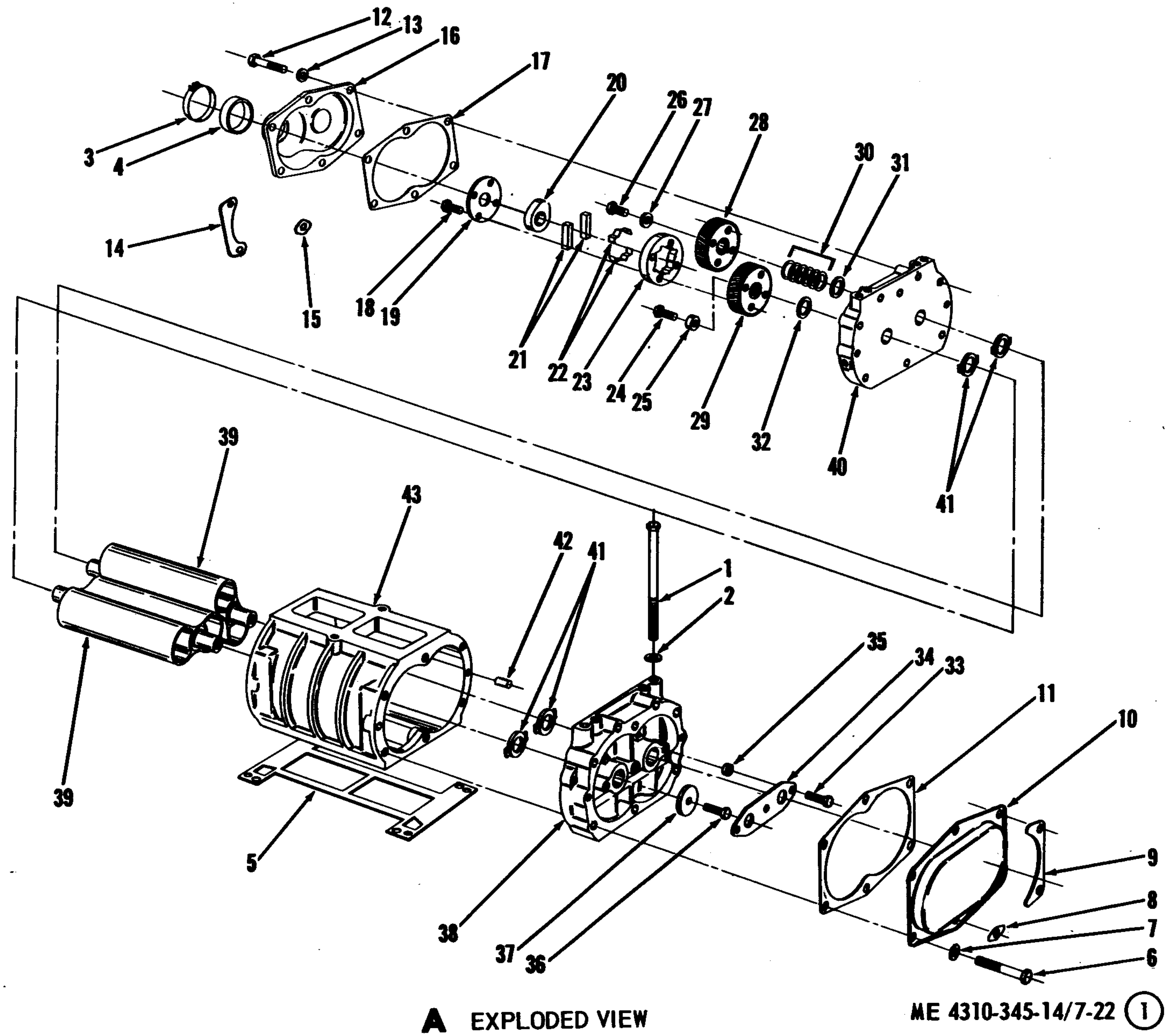


Figure 7-22. Blower assembly, disassembly and reassembly (sheet 1 of 4).

KEY to figure 7-22 (sheet 1):
1. Bolt (4)
2. Lockwasher (4)
3. Clamp
4. Seal
5. Gasket
6. Bolt (6)
7. Lockwasher (6)
8. Special washer (2)
9. Plate (2)
10. Cover
11. Gasket
12. Bolt (6)
13. Lockwasher (6)
14. Plate (2)
15. Special washer (2)
16. Cover
17. Gasket
18. Bolt (4)
19. Retainer
20. Cam
21. Spring
22. Seat
23. Support
24. Bolt
25. Pilot
26. Bolt
27. Washer
28. Gear
29. Gear
30. Shims (as req'd)
31. Spacer
32. Spacer
33. Bolt (3)
34. Thrust plate
35. Spacer (3)
36. Bolt (2)
37. Thrust washer (2)
38. End plate
39. Rotor set
40. End plate
41. Seal (4)
42. Dowel (4)
43. Housing

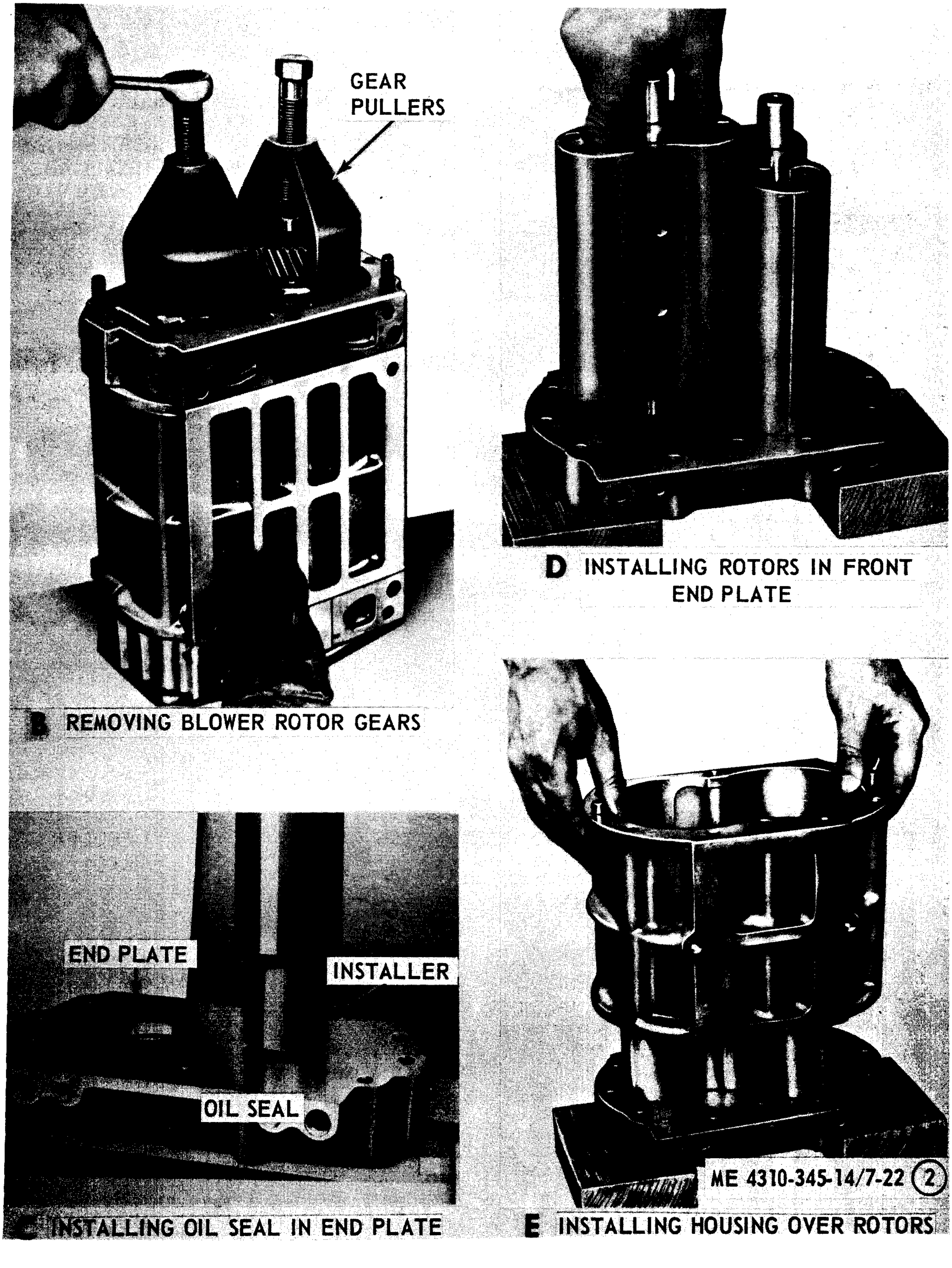
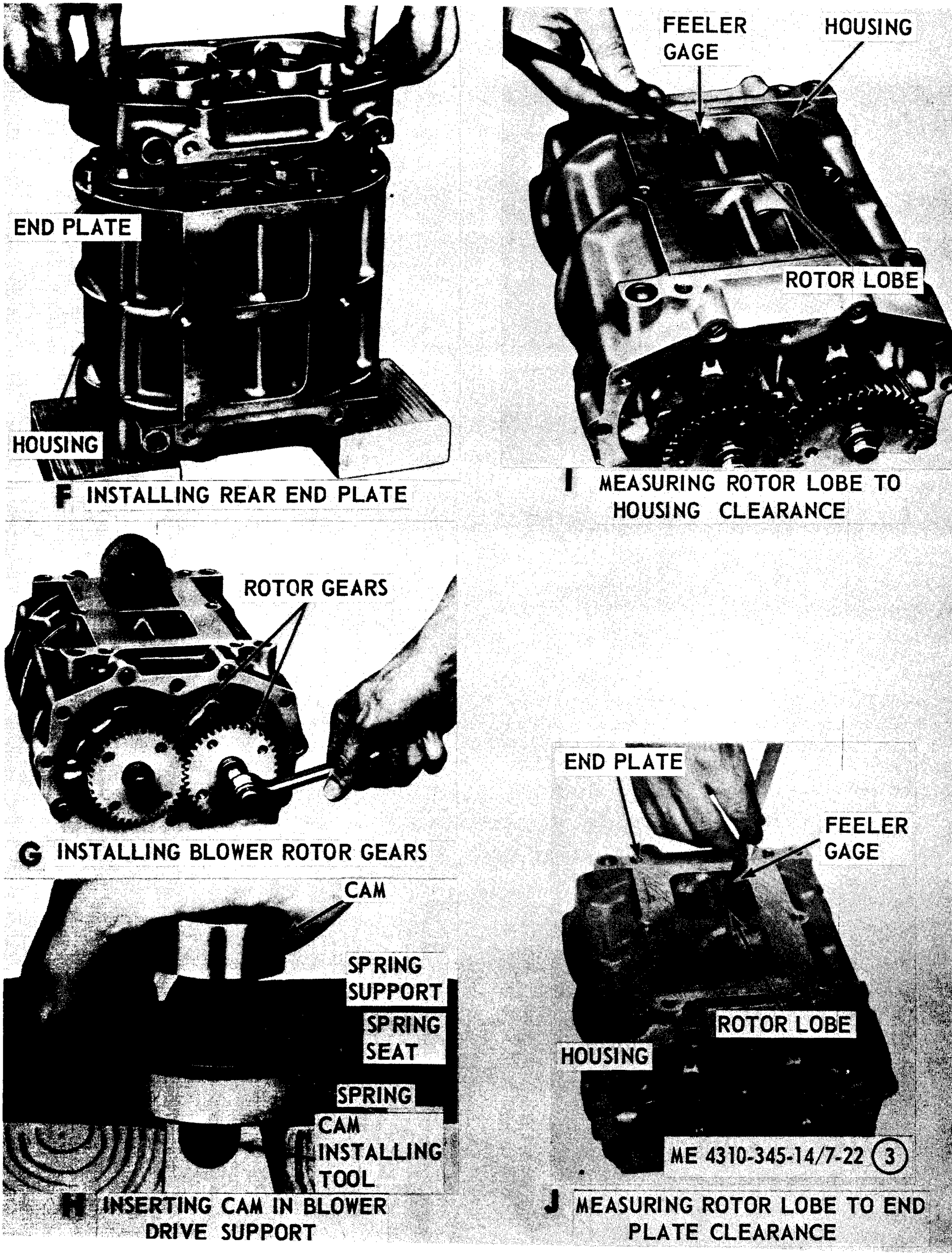


Figure 7-22. Blower assembly, disassembly and reassembly (sheet 2 of 4).



F INSTALLING REAR END PLATE

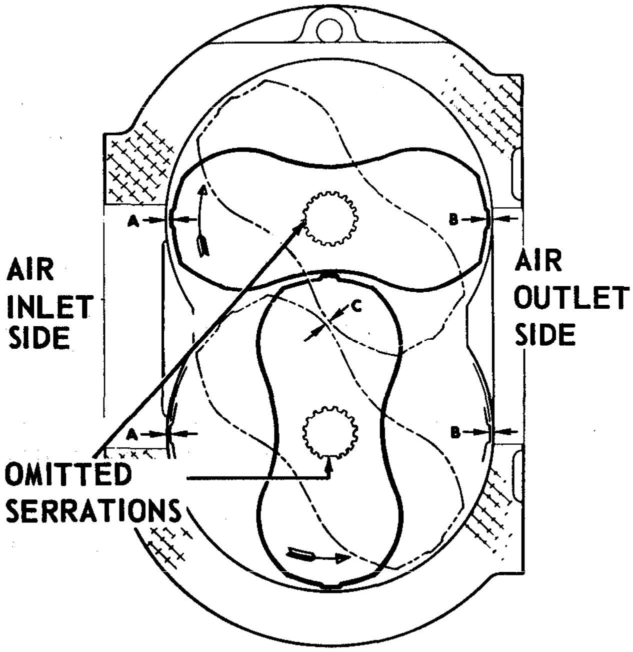
I MEASURING ROTOR LOBE TO HOUSING CLEARANCE

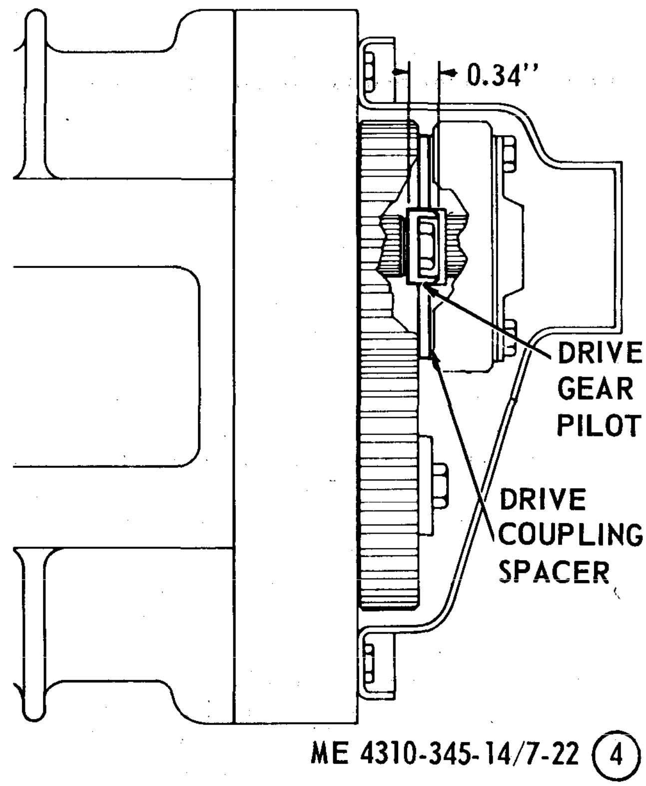
G INSTALLING BLOWER ROTOR GEARS

H INSERTING CAM IN BLOWER DRIVE SUPPORT

J MEASURING ROTOR LOBE TO END PLATE CLEARANCE

Figure 7-22. Blower assembly, disassembly and reassembly (sheet 3 of 4).





K MINIMUM BLOWER ROTOR CLEARANCE

L PILOT AND SPACER

Figure 7-22. Blower assembly, disassembly and reassembly (sheet 4 of 4).

(2) For identification, mark the upper gear on the blower. Use two pullers and remove the blower drive gears simultaneously. Place the rotor shims and gear spacers with their respective gears to ensure correct reassembly. (fig. 7-22, sheet 2 of 4).

c. ***Cleaning, Inspection, and Repair.***

(1) Clean all parts in accordance with paragraph 5-5 *f*.

(2) Inspect the finished inside face of each end plate for nicks, burrs, and scoring. Slight scoring may be cleaned up with a fine grit emery cloth. Inspect end plates for cracks, breaks, or any other defect.

(3) Inspect the drive shaft for burred or worn serrations. Inspect for cracks, breaks, distortion, or any other defect.

(4) Inspect gears fornicked, cracked, or broken teeth, excessive wear or any other defect.

(5) Inspect surfaces or rotors and housing for burrs, scratches, cracks, breaks, or any other defect. Remove burrs and scratches with an oil stone.

d. Reassembly.

(1) Reassemble blower assembly in the reverse numerical sequence shown in figure 7-22, sheet 1, and the following detailed procedures.

(2) Place the end plate on the bed of an arbor press. Lubricate the outer diameter of new oil seals and, using installer, press the seals (lip facing down) into the end plate until the shoulder on the installer contacts the end plate. (fig. 7-22, sheet 2 of 4).

NOTE

A step on the seal installed positions the oil seal below the finished face of the end plate within the 0.002 to 0.008 inch specified.

(3) Place the front end plate on two wood blocks. Install the rotors, gear end up, on the end plate (fig. 7-22, sheet 2 of 4).

(4) Install blower housing over the rotors (fig. 7-22, sheet 2 of 4).

(5) Place rear end plate over the rotor shafts (fig. 7-22, sheet 3 of 4) and secure each end plate with bolts and plain washers.

(6) Attach the two thrust washers to the front of the blower with the washer retaining bolts. Tighten the bolts to 54-59 lb-ft torque.

(7) Attach the three spacers and the thrust plate to the front end of the blower. Tighten the three bolts to 7-9 lb-ft torque. Check the clearance between the thrust plate and the thrust washers. Specified clearance is 0.001 to 0.003 inch.

(8) Position the rotors so that the missing serrations on the gear end of the rotor shafts are 90° apart. Accomplish this by placing the rotors in a "T" shape, with the missing serration in the upper

rotor facing to the left and the missing serration in the lower rotor facing toward the bottom (fig. 7-22, sheet 3 of 4). Install shims and spacers in the counterbore in the rear face of the rotor gears. Place the gears on the ends of the shafts with missing serrations of gears and shafts aligned.

(9) Tap the gears lightly with a soft hammer to seat them on the shafts. Rotate the gears until the punch marks on the face of the gears match. If marks do not match, reposition the gears.

(10) Wedge a clean cloth between the blower rotors. Use the gear retaining bolts and plain washers to press the gears on the shafts (fig. 7-22, sheet 3 of 4). Turn the bolts uniformly until the gears are tight against the shoulders on the shafts.

(11) Remove the gear retaining bolts and washers. Place the blower drive cam pilot in the counterbore of the upper gear and start the gear retaining bolt in the rotor shaft. Place the gear washer on the face of the lower gear and start the gear retaining bolt in the rotor shaft. Tighten the bolts to 25-30 lb-ft torque (fig. 7-22, sheet 4 of 4).

(12) Check the backlash between the blower gears, using a suitable dial indicator. Specified backlash is 0.0005 to 0.0025 inch with new gears or maximum of 0.0035 inch with used gears.

(13) Timing blower rotors. After rotors and gears have been installed, the rotors must be timed. Clearance between the rotors is established by moving one of the helical gears out or in on the shaft relative to the other gear by adding or removing shims between the gear hub and the rotor spacers. Check blower rotor clearances as follows:

(a) Measure clearance between rotor lobes and the housing (fig. 7-22, sheet 3 of 4). Take measurements across the entire length of each rotor lobe to be certain that a minimum clearance of 0.004 inch exists at the *air outlet side* and a, minimum clearance of 0.0075 inch exists at the *air inlet side.*

(b) Measure clearance between the rotor lobes, across the length of the lobes, in a similar manner. By rotating the gears, position the lobes so that they are at their closest relative position (fig. 7-22, sheet 3 of 4). Clearance shall be 0.010 inch. minimum.

(c) Measure clearance between the end of the rotor and the end plate (fig. 7-22, sheet 4 of 4). Front end plate clearance shall be 0.006 inch minimum; rear end plate clearance shall be 0.009 inch minimum; rear end plate clearance shall be 0.009 inch minimum.

NOTE

Push and hold the rotor toward the end plate at which the clearance is being measured.

(14) After timing the rotors, continue reassembly. Remove the bolts and washers used to temporarily secure the front end plate to the housing. Install the front end plate to the blower with six bolts and special washers and two reinforcement plates and tighten the bolts to 20-25 lb-ft torque.

(15) Assemble the blower drive spring support as follows:

(a) Place the drive spring support on two blocks of wood (fig. 7-22, sheet 4 of 4).

(b) Position drive spring seats in the support.

(c) Apply grease to the springs to hold the leaves together. Slide the two spring packs (15 leaves per pack) in place.

(d) Place blower drive cam over the end of a tool and insert the tool between the spring packs and press the cam in place.

(16) Assemble the drive spring support coupling on the rotor gear at the rear end of the blower.

(17) Secure the cam retainer to the coupling with four bolts and tighten them to 3-10 lb-ft torque.

(18) Remove the bolts and washers used to temporarily secure the rear end plate. Assemble the rear end plate cover and gasket and secure with six bolts and special washers and two reinforcement plates. Tighten the bolts to 20-25 lb-ft torque.

e. Installation.

(1) Install a new blower-to-block gasket on the side of the cylinder block. Use Scotch Grip Rubber Adhesive No. 4300, or equivalent, only on the block side of the gasket.

(2) Install the seal and clamp on the blower rear end plate cover.

(3) Slide one end of the blower drive shaft into the drive cam.

(4) Install the blower on the side of the cylinder block. Use care so that the blower gasket is not damaged or dislocated.

(5) Install the blower-to-block bolts and washers. Tighten bolts to 55-60 lb-ft. torque.

(6) Slide the seal and clamp back against the drive gear support and tighten the clamp.

(7) Check backlash between blower drive gear and camshaft gear. Backlash shall be 0.003 to 0.007 inch.

(8) Install the air shutdown housing (para 7-21).

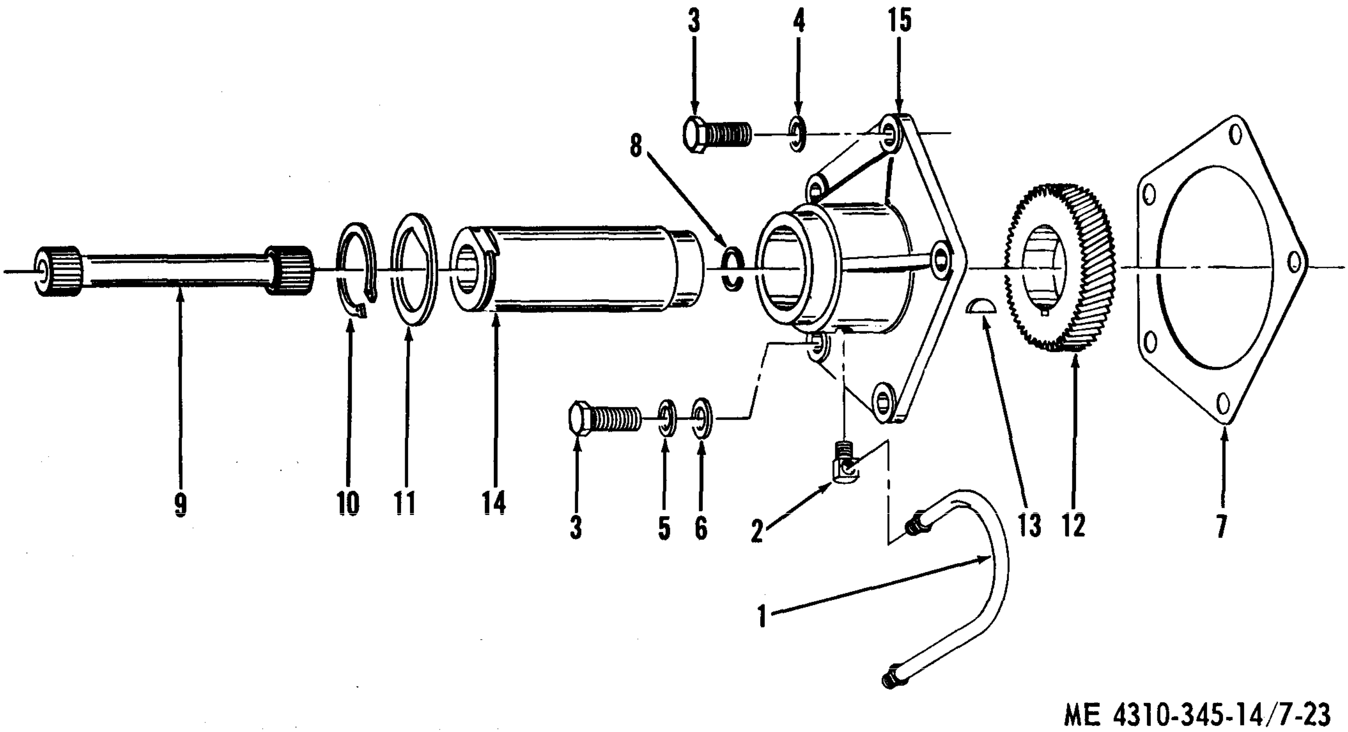
7-23. Blower Drive Support

a. Removal.

(1) Remove the blower (para 7-22).

(2) Disconnect the lubricating oil tube from the blower drive support.

(3) Remove the blower drive support in numerical sequence shown in figure 7-23. Discard gasket.



1. Tube
2. Elbow
3. Bolt (5)
4. Copper washer (3)
5. Lockwasher (2)
6. Flat washer (2)
7. Gasket
8. Retaining ring
9. Drive shaft
10. Retaining ring
11. Washer
12. Gear
13. Key
14. Hub
15. Support

Figure 7-23. Blower drive support assembly, disassembly and reassembly.

(4) To remove the blower drive gear, when necessary, disassemble the gear from the shaft as follows:

(a) Support the blower drive gear in an arbor press.

(b) Place a short 1 1/8 inch diameter brass rod on the end of the shaft and press the shaft out of the gear.

b. Cleaning, Inspection, and Repair.

(1) Clean all parts in accordance with paragraph 5-5 *f*.

(2) Inspect gear teeth for nicks, chipping, breaks, excessive wear, or any other defect.

(3) Inspect serrations in blower drive gear shaft for damage of excessive wear. Inspect the outside diameter-to-support clearance. Clearance shall be 0.0035 to 0.007 inch. Inspect gear shaft for cracks, breaks, or any other defect.

(4) Inspect blower drive support inside diameter and thrust surfaces for scoring and wear. Inspect support for cracks, breaks, or any other defect.

(5) Inspect thrust washer for scoring and wear, . cracks, breaks, distortion, or any other defect. Thickness of thrust washer is 0.093 to 0.103 inch.

(6) Inspect all parts for cracks, breaks, dam aged threads, or any other defect.

c. Installa tion.

(1) Lubricate the blower drive gear shaft with clean engine oil. Insert the shaft into the blower support.

(2) Install the thrust washer and snap ring.

(3) If gear was removed from the shaft, install the gear as follows:

(a) Install key in shaft keyway.

(*b*) Place the shaft and support in an arbor press.

(*c*) Position the gear on the shaft so the keyway is aligned with shaft key. Place a sleeve on the gear and press the gear on the shaft until the clearance between the gear and support is 0.004 to 0.006 inch.

(4) Install new gasket and install blower drive support on the cylinder block rear end plate with bolts and washers (fig. 7-23).

(5) Connect the lubricating oil tube to the blower drive support.

(6) Install the blower (para 7-22).

Section XI. CYLINDER HEAD AND VALVE OPERATING MECHANISM GROUP

7-24. General

The cylinder head proper is a one piece casting that can be removed from the engine as an assembly containing the valve operating mechanism. This cylinder head assembly contains the cam followers, cam follower guides, rocker arms, exhaust valves, and injectors. The cylinder head is securely held to the top of the cylinder block with ten bolts. For each cylinder, there is located in the cylinder head two exhaust valves, a fuel injector and three rocker arms. One rocker arm operates the fuel injector plunger; the other two operate the exhaust valves. The rocker arms are operated by a camshaft, located in the cylinder block, through cam followers and push rods. Exhaust valve inserts (valve seats) are pressed into the underside of the cylinder head. The inserts are ground to very close limits and their freedom from warpage, under ordinary conditions, reduces exhaust valve reconditioning to a minimum. To ensure efficient cooling, each injector is inserted into a thin-walled tube which passes through the water space in the cylinder head. The lower end of the injector tube is pressed into the cylinder head and flared over; the upper end is flanged and sealed with a neoprene seal. The flared lower end and sealed upper end prevent water leaks around the tube. The exhaust passages, from the exhaust valves of each cylinder, lead through a single port to the exhaust manifold. The exhaust passages, exhaust valve inserts, and injector tubes are completely surrounded by the engine coolant.

7-25. Cylinder Head

a. Removal.

(1) Remove housing doors and roof (fig. 4-32).

(2) Remove exhaust manifold (para 4-101).

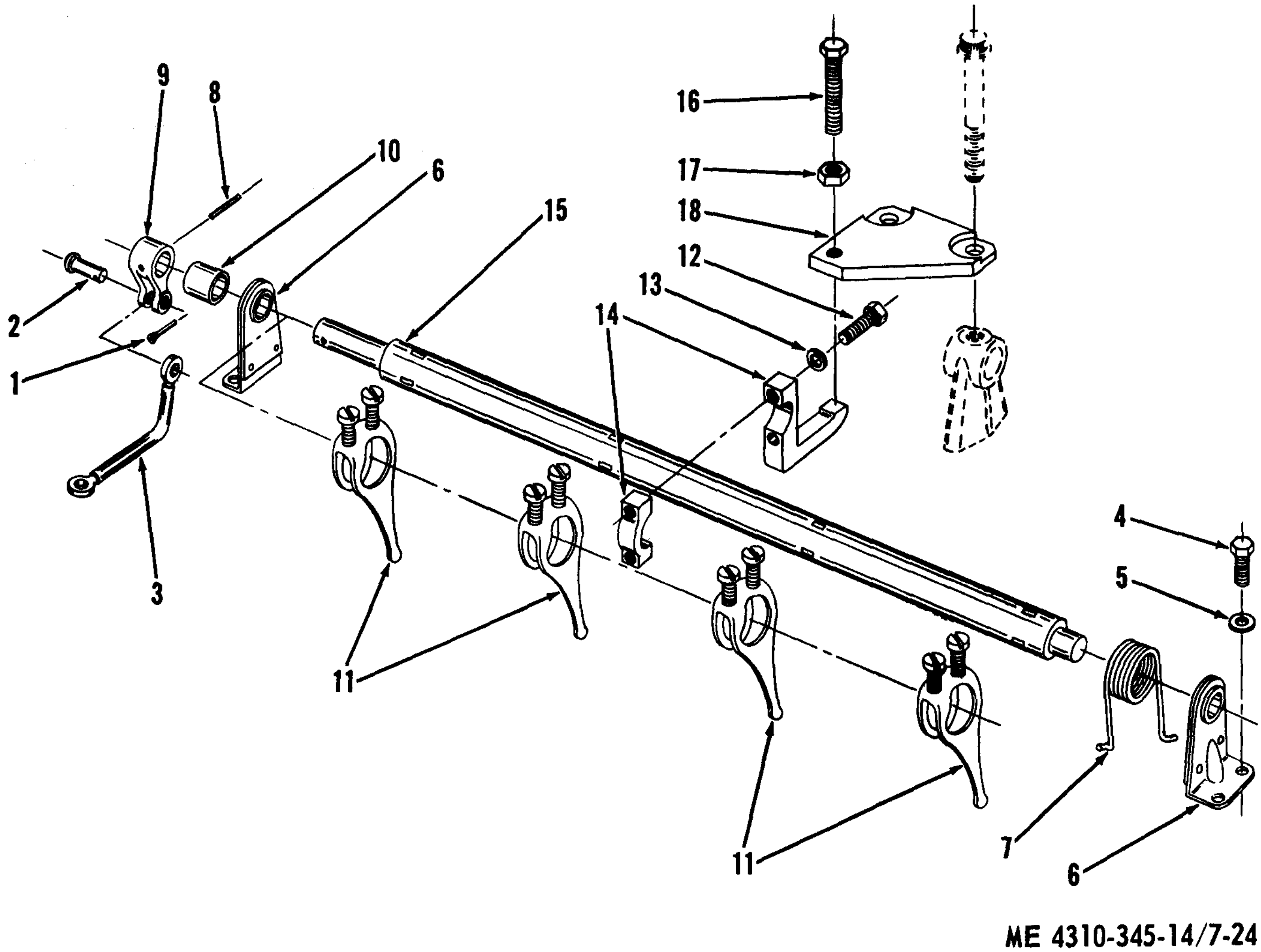
(3) Remove thermostat housing (para 4-67).

(4) Disconnect fuel return line from restricted fitting in fuel return manifold and remove fitting (fig. 4-56).

(5) Loosen and move hose clamp connecting hose from governor to cylinder head. Remove valve rocker cover (para 4-98) and disconnect link rod from governor to injector control tube lever (para 7-12).

(6) Remove injector control tube and brackets as an assembly as shown in figure 7-24.

(7) Remove fuel pipes and injectors (para 4-86).



1. Cotter pin
2. Pin
3. Rod
4. Bolt (4)
5. Lockwasher (4)
6. Bracket (2)
7. Spring
8. Pin
9. Lever
10. Spacer
11. Lever (4)
12. Bolt (2)
13. Lockwasher (2)
14. Arm
15. Tube
16. Bolt
17. Locknut
18. Plate

Figure 7-24. Injector control tube and brackets, removal and installation.

(8) Remove cylinder head bolts. Lift cylinder head off cylinder block using a lifter tool.

CAUTION

When resting cylinder head assembly on a bench, protect the cam follower rollers, and inject spray tips if injectors are not removed, by resting the valve side of the head on 2 inch thick wood blocks.

(9) Remove cylinder head compression gaskets, oil seals, and water seals.

b. Disassembly.

(1) Disassemble injector control tube and

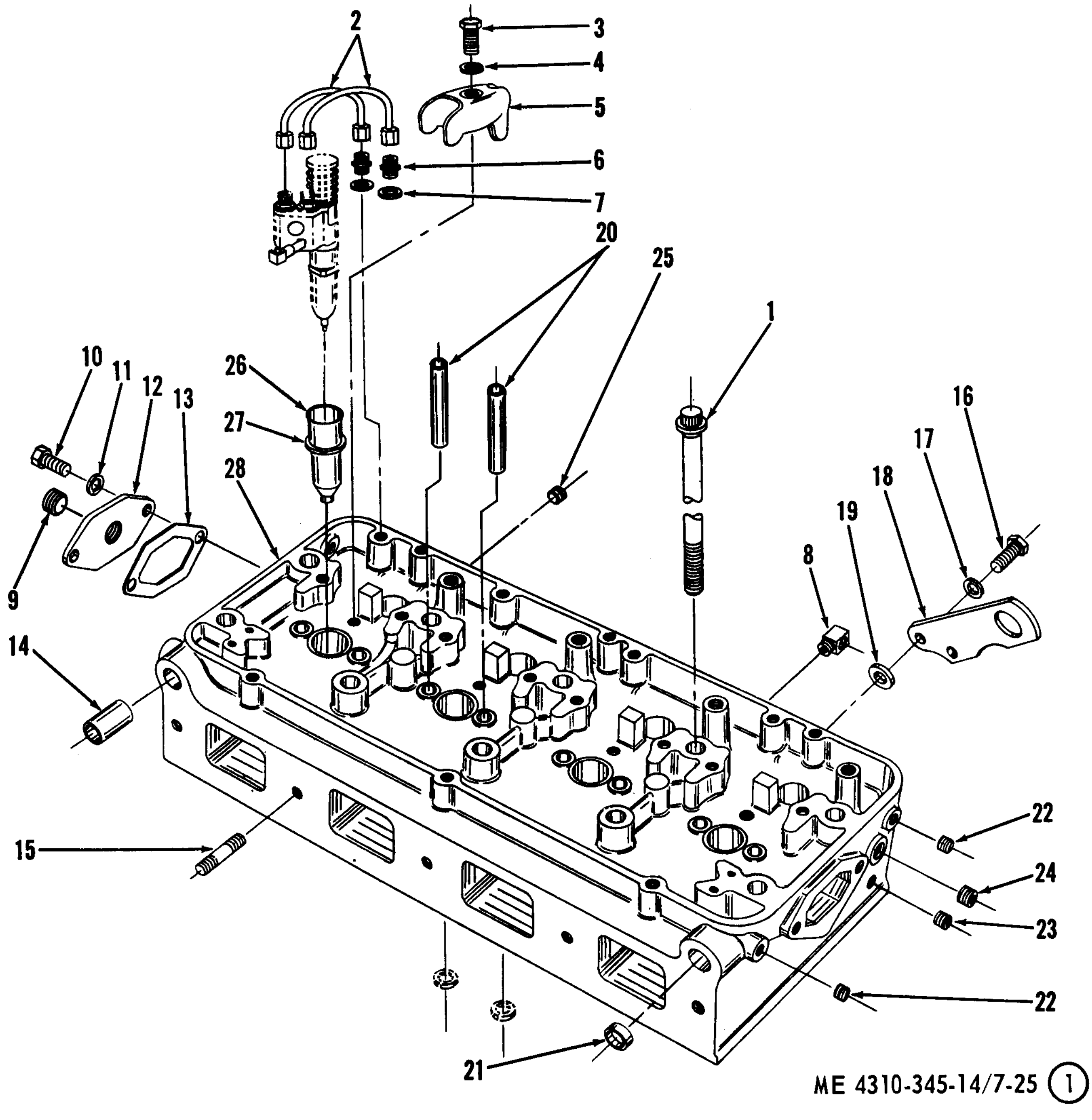
bracket assembly in numerical sequence shown in figure 7-24.

(2) Disassemble cylinder head assembly in numerical sequence shown in figure 7-25.

c. Cleaning, Inspection, and Repair.

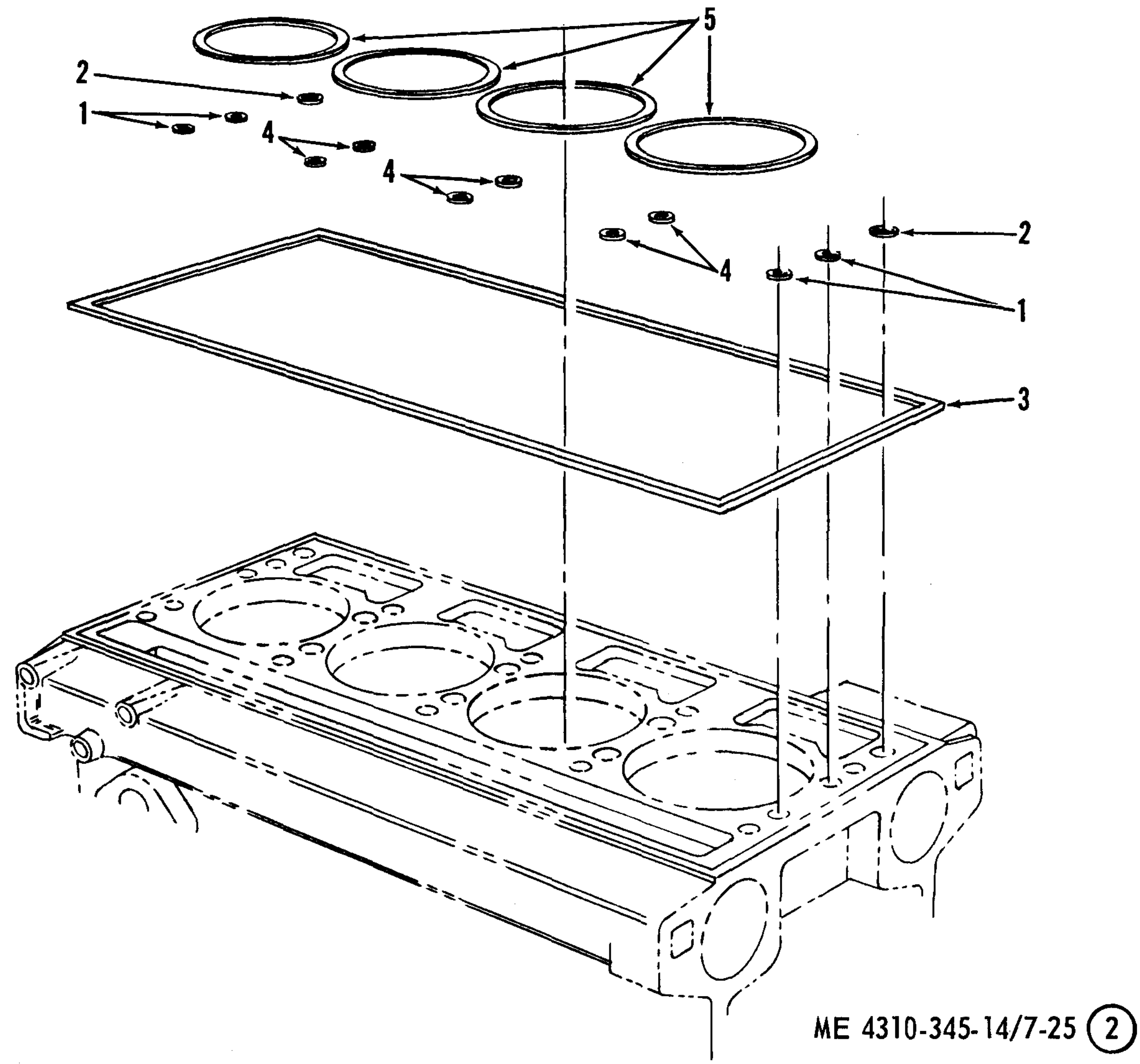
(1) After cylinder head has been stripped of all component parts and all plugs have been removed, steam clean head thoroughly.

(2) Thoroughly clean a new service head to remove rust preventive compound, particularly from the integral fuel manifolds, before installing plugs. Immerse head in solvent, oleum, or fuel oil; then, clean the head and go through all of the openings with a soft bristle brush. A suitable brush for cleaning the fuel manifolds can be made by attaching a 1/8 inch diameter brass rod to a brush. After cleaning, dry head thoroughly with compressed air.



1. Bolt (10)
2. Fuel pipe (8)
3. Bolt (4)
4. Lockwasher (4)
5. Clamp (4)
6. Connector (8)
7. Washer (8)
8. Elbow
9. Plug
10. Bolt (2)
11. Lockwasher (2)
12. Cover
13. Gasket
14. Adaptor
15. Stud (5)
16. Bolt (2)
17. Lockwasher (2)
18. Bracket
19. Spacer (2)
20. Valve guide (8)
21. Cup plug (3)
22. Plug (2)
23. Plug (6)
24. Plug (3)
25. Plug
26. Tube
27. Seal ring
28. Cylinder head

Figure 7-25. Cylinder head assembly, disassembly and reassembly (sheet 1 of 3).



1. End water seal ring (4)
2. Oil seal ring (2)
3. Seal ring
4. Center water seal ring (6)
5. Compression gasket (4)

Figure 7-25. Cylinder head assembly, disassembly and reassembly (sheet 2 of 3).

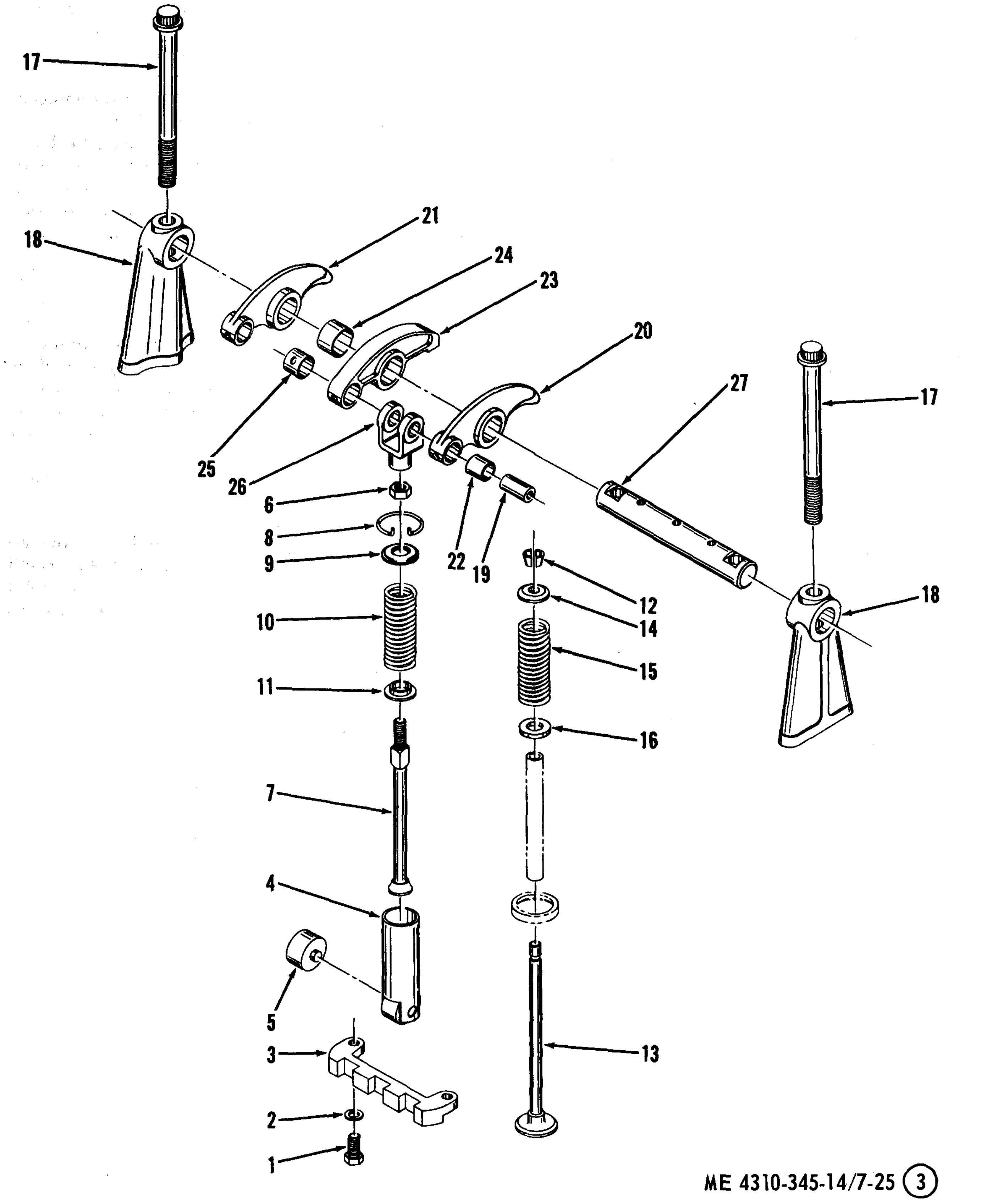


Figure 7-25. Cylinder head assembly, disassembly and reassembly (sheet 3 of 3).

KEY to figure 7-25: (Sheet 3 of 3)

1. **Bolt (8)**
2. **Lockwasher (8)**
3. **Guide (4)**
4. **Follower (12)**
5. **Roller (12)**
6. **Nut (12)**
7. **Push rod (12)**
8. **Retainer (12)**
9. **Seat (12)**
10. **Spring (12)**
11. **Seat (12)**
12. **Lock (16)**
13. **Valve (8)**
14. **Cap (8)**
15. **Spring (8)**
16. **Seat (8)**
17. **Bolt (8)**
18. **Bracket (8)**
19. **Pin (12)**
20. **Rocker arm (4)**
21. **Rocker arm (4)**
22. **Bushing (8)**
23. **Rocker arm (4)**
24. **Bushing (4)**
25. **Bushing (4)**
26. **Clevis (12)**
27. **Shaft (4)**

(3) Clean all other parts in accordance with paragraph 5-5 *f.* Discard gaskets, seals, and O-rings.

CAUTION

Do not use a wire brush or wheel when cleaning any part.

NOTE

If valves are to be removed, number each valve to facilitate reinstallation in the same position.

(4) Place valves, valve springs, retainers, and locks-in solvent and soak for at least one hour. Use a stiff brush and remove all carbon, lacquer, or residue from parts.

(5) Inspect cylinder head for cracks, damaged threads, distortion, or any other defect.

(6) Inspect cylinder head for leaks. Seal off water holes in the head with steel plates and suitable rubber gaskets held in place by capscrews. Install dummy or scrap injectors to ensure seating of injector tubes. Dummy injectors may be made from old injector nuts and bodies. Spray tips are not necessary. Tighten injector clamp bolts to 20-25 lb-ft torque. Drill and tap into one of the water hole cover plates for an air hose connection. Apply 80-100 PSI air pressure to the water jacket. Immerse the head in a tank of water, previously heated to 180°—200° F, for twenty minutes to thoroughly heat the cylinder head. Observe water in tank for bubbles indicating cracks or leaks. Remove head from tank and dry thoroughly with compressed air.

(7) Remove and replace any leaking injector tubes as follows:

(a) Use injector tube service tool set.

(b) Place injector tube installer in the injector tube. Insert the pilot through the small opening of the injector tube and thread the pilot into the tapped hole in the end of the installer. Refer to figure 7-26, sheet 1 of 2.

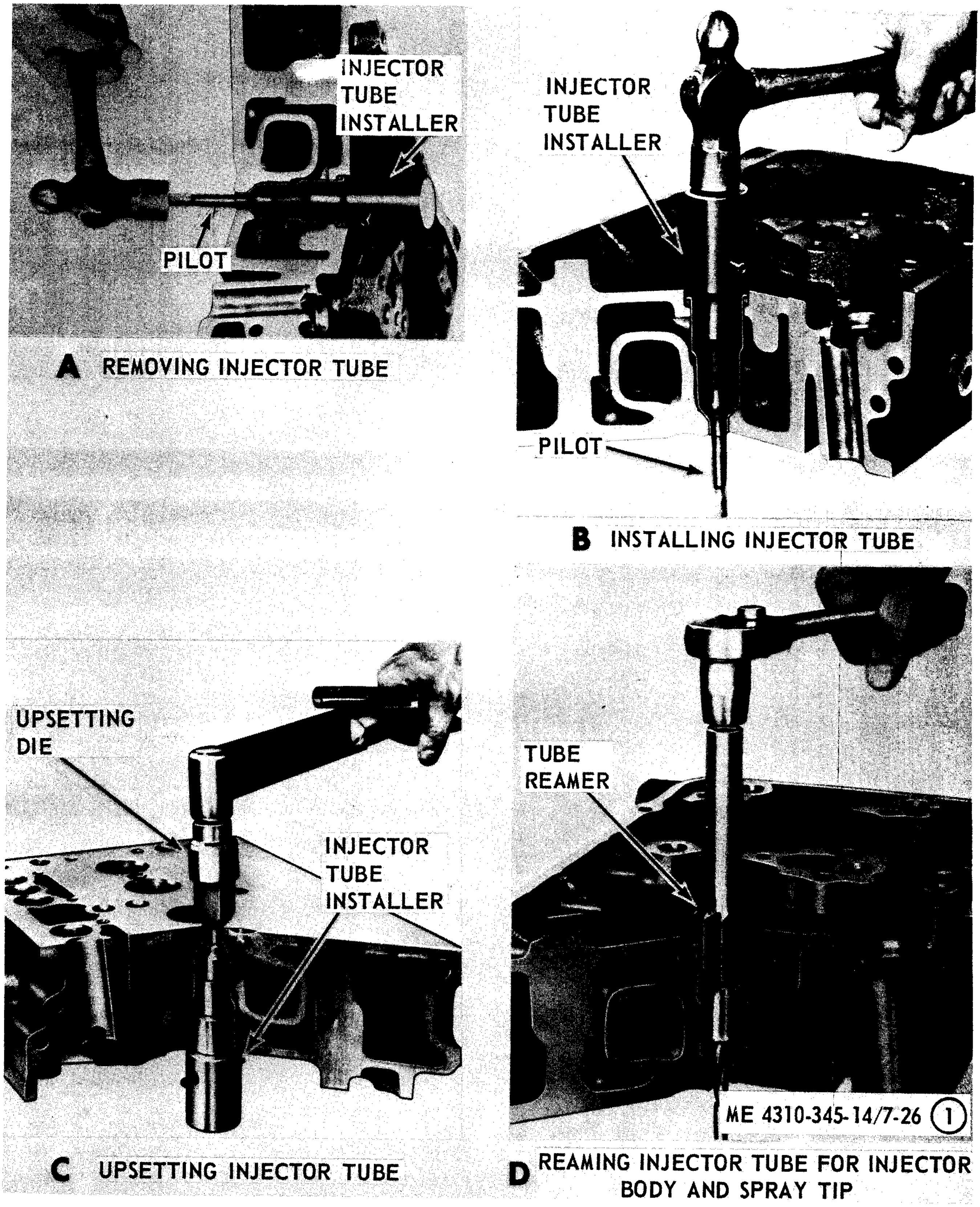


Figure 7-26. Injector tube, removal and installation (sheet I of 2).

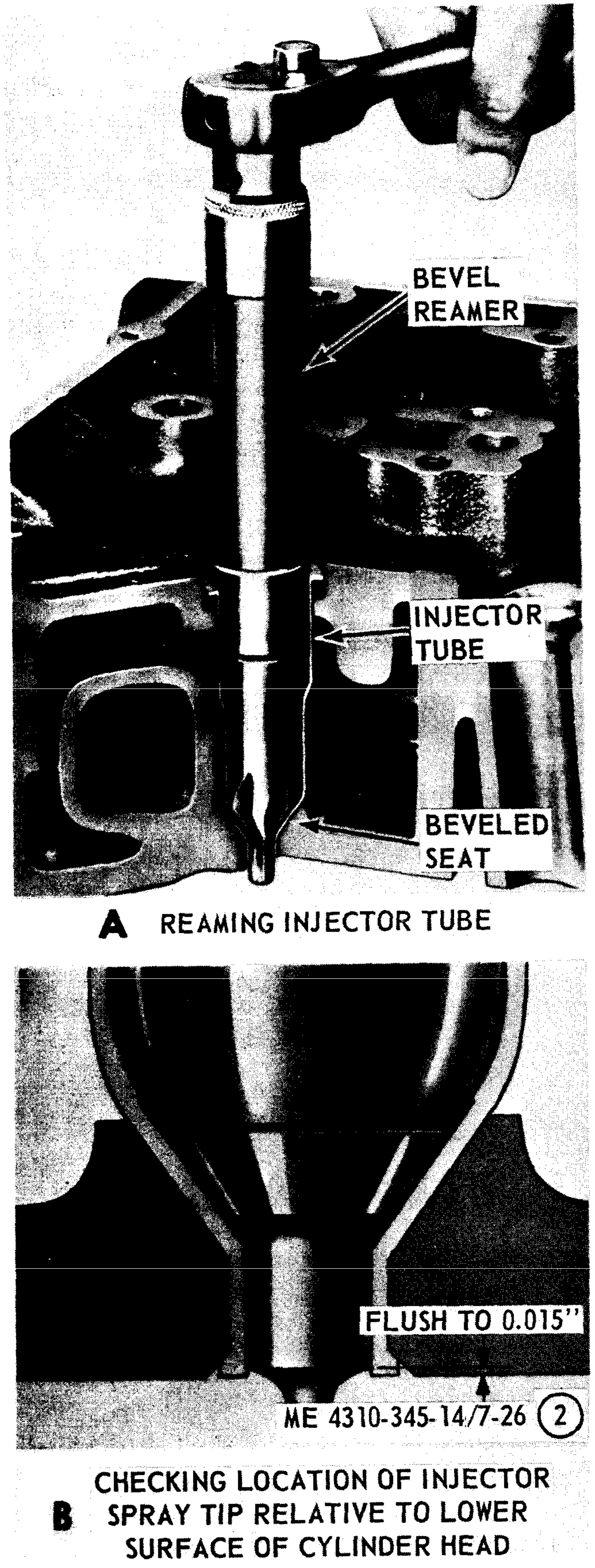


Figure 7-26. Injector tube, removal and installation (sheet 2 of 2).

(c) Tap on the end of the pilot to loosen the injector tube. Lift the injector tube, installer, and pilot from the head.

(d) Thoroughly clean injector tube hole to remove all dirt, burrs, or foreign material that may prevent tube from seating at the lower end or sealing at the upper end.

(e) Place new injector tube seal ring in the counterbore in the cylinder head.

(f) Place installer in the injector tube. Insert pilot through the small opening of the injector tube and thread it into the tapped end of the installer. Refer to figure 7-26, sheet 1 of 2.

(g) Slip injector tube into the injector bore and drive in place as shown in figure 7-26, sheet 1 of 2. Sealing is accomplished between the head counterbore (inside diameter) and outside diameter of the injector tube. The tube flange is merely used to retain the seal ring.

(h) Turn cylinder head bottom side up, remove pilot and thread the upsetting die into the tapped end of installer. Refer to figure 7-26, sheet 1 of 2.

(i) Using a socket and torque wrench, apply approximately 30 lb-ft torque on the upsetting die.

(j) Remove installing tools and ream injector tube in the following manner.

CAUTION

Turn reamer in clockwise direction only when inserting and withdrawing the reamer. Turning in opposite direction will dull cutting edges of flutes.

1. Turn cylinder head right side up. Make certain tube is free from dirt. Place a few drops of light cutting oil on the reamer flutes. Carefully position reamer in injector tube. Refer to figure 7-26, sheet 1 of 2.

2. Turn reamer in clockwise direction (withdraw reamer frequently to remove chips) until lower shoulder of reamer contacts injector tube. Clean out all chips.

3. Turn cylinder head bottom side up. Insert pilot of cutting tool into small hole of injector tube.

4. Place a few drops of cutting oil on the tool. Use a socket and a speed handle to remove excess stock so that lower end of injector tube is from flush to 0.005 inch below the finished surface of the cylinder head.

5. To determine amount of stock to be removed bevel seat of the tube, install an injector assembly in the tube and check relationship between the numbered face of the spray tip to the fire deck of the cylinder head. (fig. 7-26, sheet 2 of 2). Remove injector assembly.

6. Wash interior of injector tube with trichloroethylene or clean fuel oil and dry with compressed air.

7. Place a few drops of cutting oil on the bevel seat of the tube. Carefully lower reamer into injector tube until it contacts bevel seat.

8. Make a trial cut by turning reamer steadily without applying any downward force on the reamer. Remove reamer, blow out chips, and look at the bevel seat to see what portion has been cut.

9. Proceed carefully with reaming operation, withdrawing reamer occasionally to observe reaming progress.

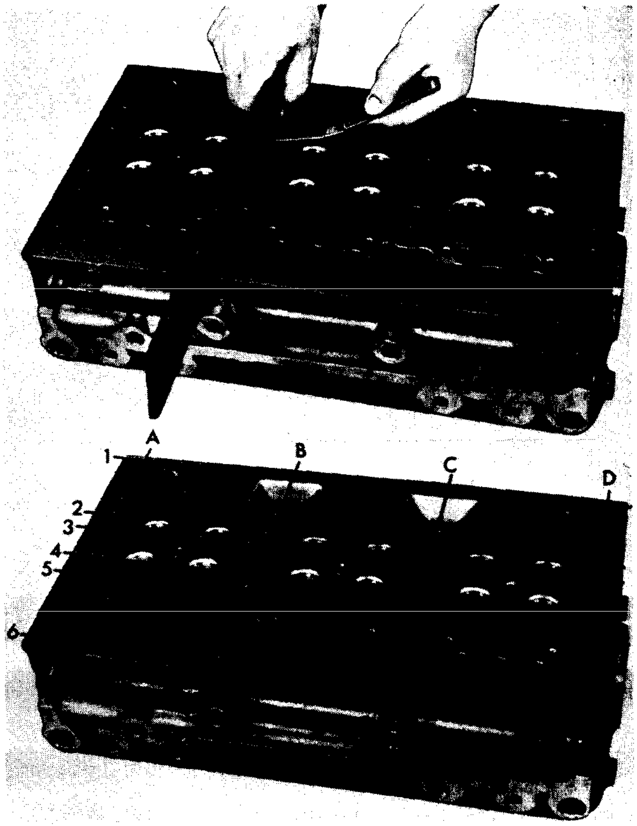
10. Remove chips from injector tube and, using an injector as a gage, continue reaming until shoulder of spray tip is from flush to 0.015 inch recessed in cylinder head as shown in figure 7-26, sheet 2 of 2. Then, wash interior of injector tube with trichloroethylene or clean fuel oil and dry thoroughly with compressed air.

(8) Inspect the bottom (fire deck) of cylinder head for flatness as follows:

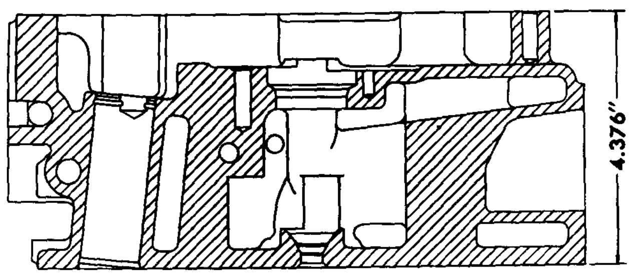
(a) Use an accurate straightedge and a feeler gage to check for transverse warpage at each end and between all cylinders. Check for longitudinal warpage in six places as shown in figure 7-27. Maximum allowable warpage is: Longitudinal 0.006 inch; Transvere 0.004 inch.

(b) If maximum allowable warpage is exceeded, the cylinder head shall be refinished and / or replaced.

(c) Remove injector tubes prior to refinishing cylinder head. Do not machine more than 0.020 inch of metal from fire deck. The distance from top of the cylinder head to fire deck shall not be less than 4.376 inches as shown in figure 7-27. Stamp the amount of stock removed on the face of the fire deck near the outer edge of the head in an area not used as a sealing surface.



A CHECKING BOTTOM FACE OF CYLINDER HEAD FOR WARPAGE



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B MINIMUM DISTANCE BETWEEN TOP AND BOTTOM FACES OF CYLINDER HEAD

Figure 7-27. Checking cylinder head.

(d) After refacing cylinder head, install new injector tubes as described above and pressure check cylinder head for leaks as outlined in step c above.

(9) Inspect cam follower bores in head for scoring or wear. Light score marks may be removed with crocus cloth wet with fuel oil. If bores are excessively scored or worn so that cam follower-to-head clearance exceeds 0.006 inch, replace cylinder head.

(10) Inspect valve seats for cracks or burning. Check valve guides for scoring. Check valve stems for wear.

(11) Remove and install cylinder head valve guides as follows:

(a) Support cylinder head, bottom side up, on 3 inch thick wood blocks.

(b) Drive the valve guides out of cylinder head with valve guide remover as shown in figure 7-28.

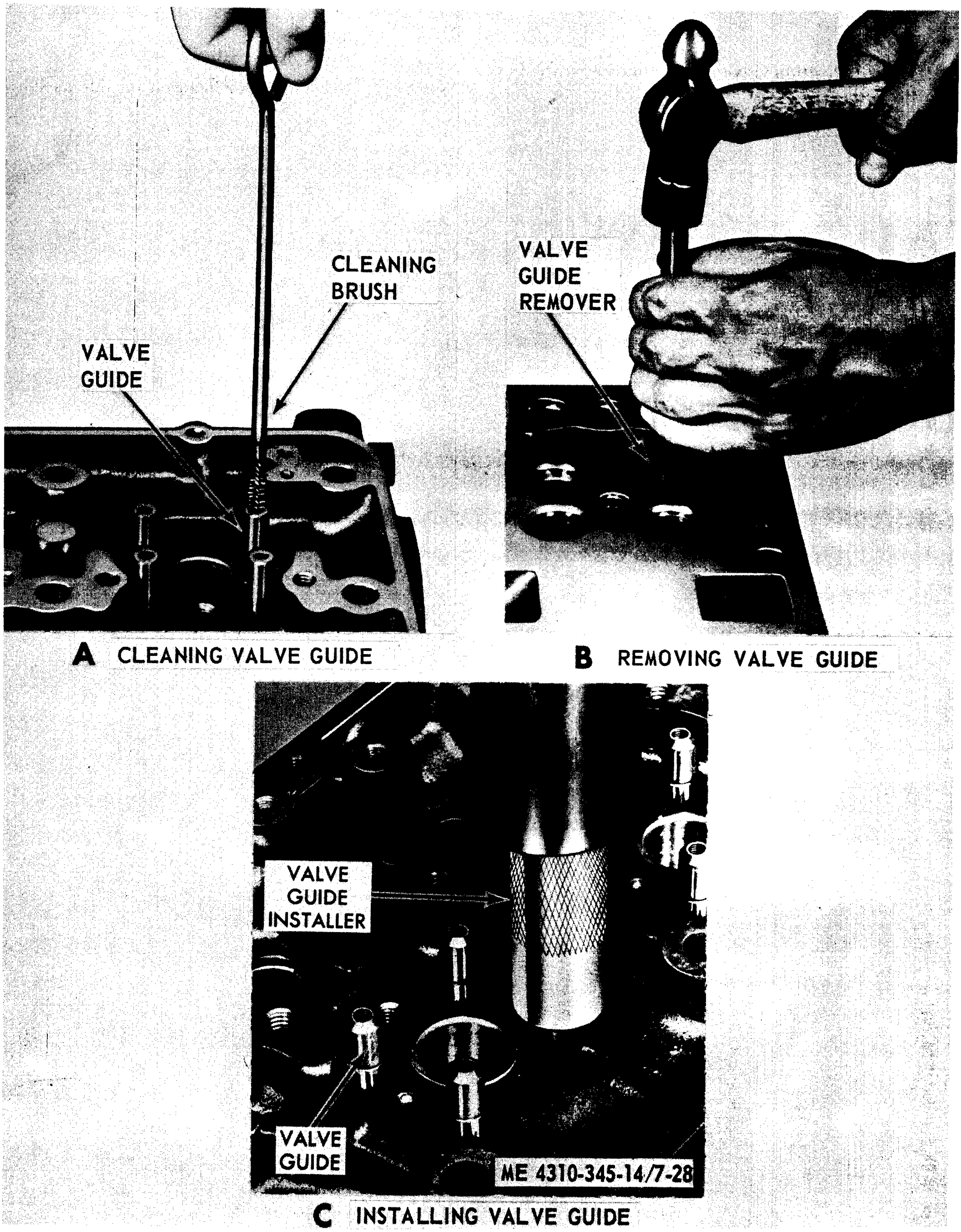


Figure 7-28, Valve guides, removal and installation.

(c) Turn cylinder head right side up and insert internally threaded end of valve guide in the installing tool (fig. 7-28).

(d) Position valve guide squarely in the bore in the cylinder head and press installing tool gently to start the guide in place. Then, press the guide in until tool contacts cylinder head.

(12) Remove and install exhaust valve seat inserts as follows:

(a) Place cylinder head on its side as shown in figure 7-29.

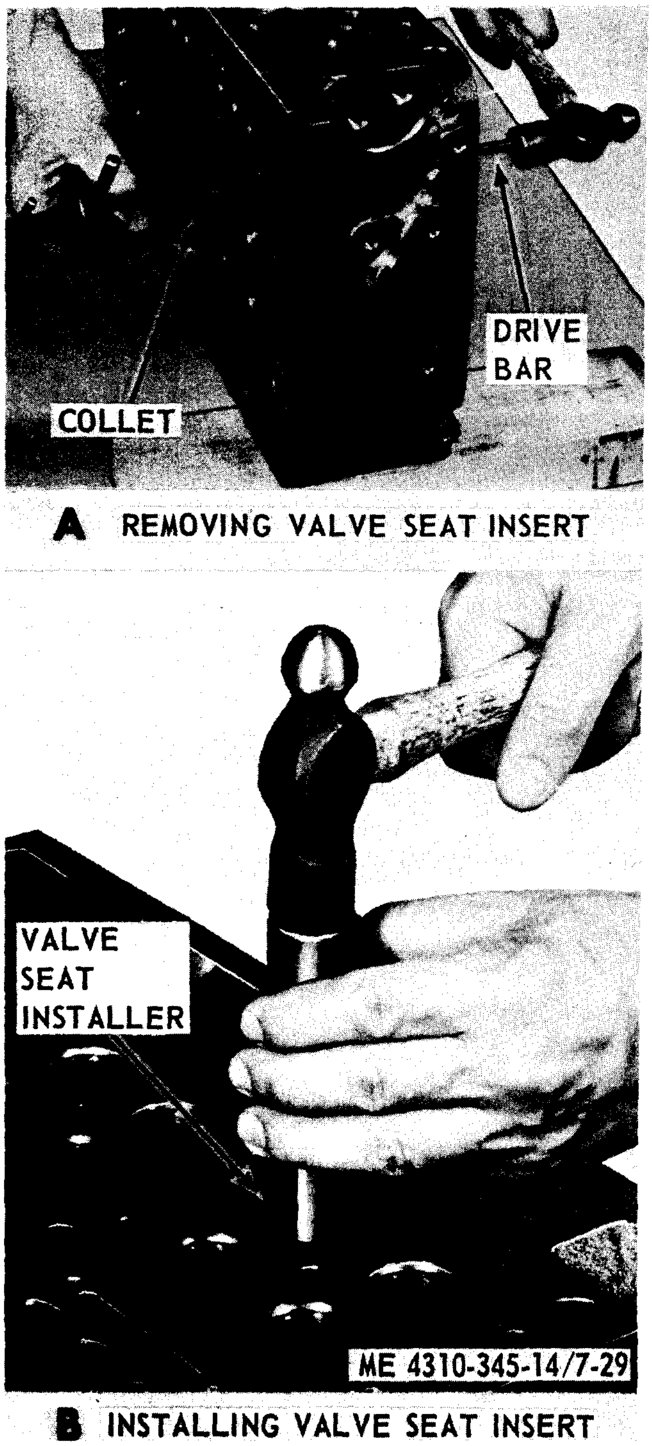


Figure 7-29. Exhaust valve seat inserts, removal and installation.

(b) Place the collet of removing tool inside the valve insert so that the bottom of the collet is flush with the bottom of the insert.

(c) Hold collet handle and turn the T handle to expand the collet cone until the insert is held securely by the tool.

(d) Insert drive bar of the tool through the valve guide.

(e) Tap the drive bar once or twice to move the insert about 1 / 16 inch away from its seat in the cylinder head.

(f) Turn the T handle to loosen the collet cone and move the tool into the insert slightly so the narrow flange at the bottom of the collet is below the valve seat insert.

(g) Tighten the collet cone and continue to drive the insert out of the cylinder head.

(h) Clean valve seat counterbores in the head and new valve seat inserts with solvent. Dry with compressed air.

(i) Inspect counterbores for concentricity, flatness, and for cracks. Counterbore diameter in head shall be 1.430 inches to 1.439 inches and a depth of 0.294 inch to 0.306 inch.

NOTE

Valve seat inserts 0.010 inch oversize on the outside diameter are available.

(j) Immerse cylinder head in water heated to 180° to 200° F. for at least 30 minutes.

(k) Rest cylinder head, bottom side up, on a bench and place insert in the counterbore, valve seat side up. This must be done quickly while cylinder head is still hot and the insert is cold (room termperature).

(l) Drive insert in place with installer tool as shown in figure 7-29 until it seats solidly in the cylinder head.

(m) Grind valve seat insert and check concentricity as outlined below.

(13) Recondition exhaust valves and valve seat inserts as follows:

(a) An exhaust valve which is to be reused

may be replaced, if necessary (fig. 7-30). To provide sufficient valve strength and spring tension, the edge of the valve at the valve head shall not be less than 1 / 32 inch in thickness and shall still be within specifications shown in figure 7-30 after refacing.

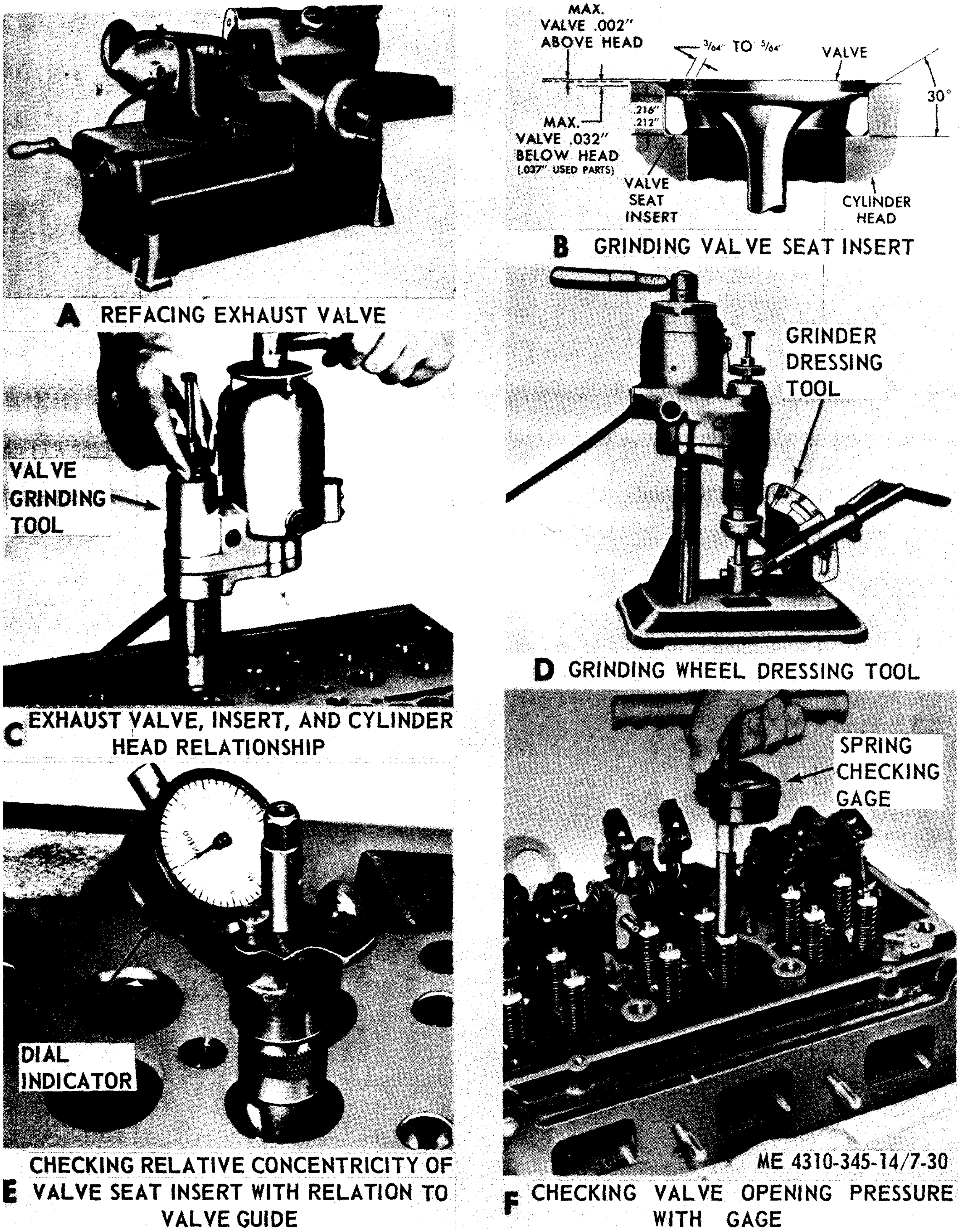


Figure 7-30. Reconditioning exhaust valves and valve seat inserts.

(b) Before either a new or used valve is installed, examine valve seat in cylinder head for proper valve seating. The angle of the seat insert must be exactly the same as the angle of the valve face to provide proper seating of the valve The proper angle is 30 degrees.

(c) Refacing of new or old inserts shall be done with a grinding wheel as shown in figure 7-30.

(d) The eccentric grinding method is recommended. This method produces a finer, more accurate finish since only one point of the grinding wheel is in contact with the valve seat at any time. A micrometer feed permits feeding the grinding wheel into the seat 0.001 inch at a time.

(e) Grind valve seat inserts as follows:

1. First apply a 30° grinding wheel on the valve seat insert.

2. Use a 60° grinding wheel to open the throat of the insert.

3. Grind the top surface with a 15° wheel to narrow the width of the seat from 3 / 64 inch to 5 / 64 inch (fig. 7-30). The 30° face of the insert may be adjusted relative to the center of the valve face with the 15° and 60° grinding wheels.

CAUTION

Do not permit the grinding wheel to contact the cylinder head when grinding valve seat insert.

The maximum amount that the exhaust valve should protrude beyond the cylinder head (when valve is in closed position), and still maintain proper piston-to-valve clearance is shown in figure 7-30. When valve recedes beyond specified limits, replace valve seat insert. After grinding is complete, clean valve seat insert thoroughly with fuel oil and dry with compressed air. Set the dial indicator in position as shown in figure 7-30 and rotate the indicator to determine concentricity of each valve seat relative to the valve guide. If runout exceeds 0.002 inch, check for a bent valve guide before regrinding the insert.

4. Apply a light coating of Prussian Blue or similar paste to the valve seat insert.

5. Lower the stem of the valve in the valve guide and “bounce” the valve on the seat.

NOTE

Do not rotate the valve.

This procedure will show the area of contact on the valve face. Desirable area of contact is at the center of the valve face.

6. Thoroughly clean cylinder head before installing valves.

d. Reassembly.

(1) Reassemble cylinder head assembly in reverse numerical sequence shown in figure 7-25, sheets, 1, 2, and 3.

CAUTION

Make certain that each push rod is threaded into rocker arm clevis until end of push rod projects through the clevis. This is necessary to prevent engine damage when crankshaft is rotated during tune-up.

NOTE

Always use new cylinder head compression gaskets and seals.

CAUTION

Cylinder head bolts are expecially designed for this purpose and shall not be replaced by ordinary capscrews.

NOTE

If reconditioned valves are used, install them in the same relative location from which they were removed.

(2) Reassemble injector control tube and bracket assembly in reverse numerical sequence shown in figure 7-24.

e. Installation.

(1) Install cylinder head on cylinder block. Use guide stud set to aid in preventing gaskets and seals from being disturbed. Install the guide studs in the end cylinder bolt holes.

(2) Lubricate threads and underside of each cylinder head bolt with a small quantity of International Compound No. 2, or equivalent.

(3) Tighten cylinder head bolts gradually and uniformly against gaskets and seals to ensure a good seal between cylinder head and block. Begin tightening on the camshaft side of the head to take up tension in the cam follower springs by tightening the bolts lightly. Finally tighten bolts to 170-180 lb-ft torque with a torque wrench, about one-half turn at a time. Refer to figure 7-31 for sequence of tightening.

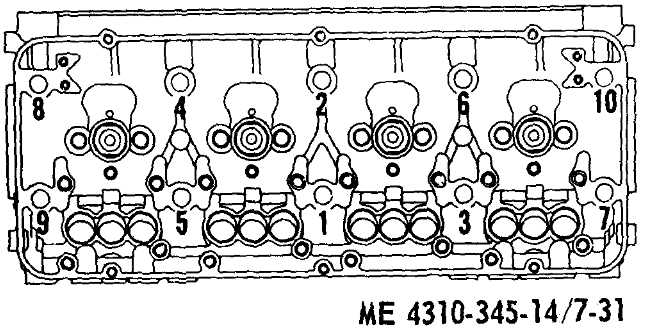


Figure 7-31. Sequence for tightening cylinder head bolts.

(4) Install injectors and fuel pipes (para 4-86). Tighten connections to 12-15 lb-ft torque.

(5) Install injector control tube and bracket assembly as shown in figure 7-24. Tighten bracket bolts to 10-15 Ib-ft torque.

(6) Tighten rocker arm bracket bolts to 50-55 lb-ft torque.

(7) Connect link rod from governor to injector control tube. Connect hose from governor to cylinder head and install hose clamps.

(8) Install fuel return manifold restricted fitting and connect fuel return hose (fig. 4-56).

(9) Install thermostat housing (para 4-67).

(10) Install exhaust manifold (para 4-101).

(11) Refer to paragraph 4-99 and adjust exhaust valves; paragraph 4-100 and time injectors; paragraph 7-26 *a* and adjust fuel control rack; paragraph 7-26 *b* and adjust the governor.

(12) Install valve rocker cover (para 4-98).

(13) Install housing roof and doors (fig. 4-32).

7-26. Injector Control Rack Adjustment

a. Injector Control Rack Levers. The position of the injector control racks must be correctly set in relation to the governor. Their position determines amount of fuel injected and ensures equal distribution of load. Adjust the rear injector rack control lever first to establish a guide for adjusting the remaining levers.

(1) Loosen locknut and back buffer screw on governor out approximately 5/8 inch as shown in figure 7-32.

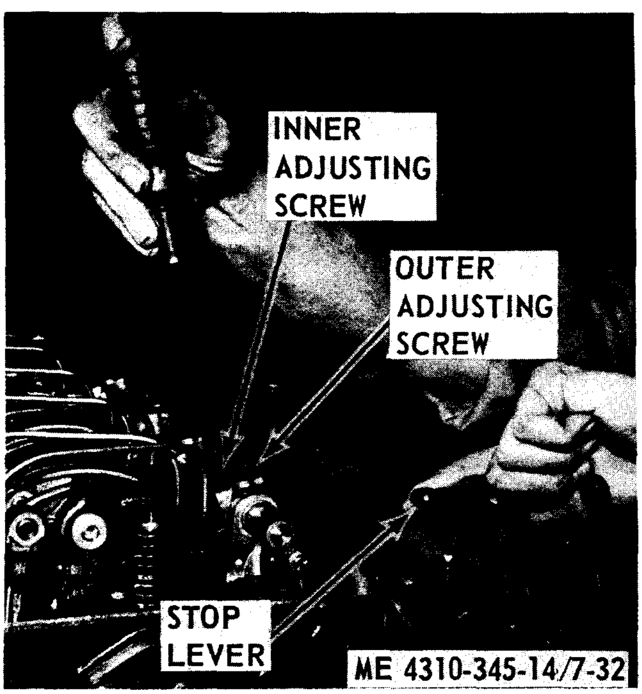


Figure 7-32. Injector control rack adjustment.

(2) If valve rocker cover is not off, remove valve rocker cover (para 4-98).

(3) Loosen all of the inner and outer injector rack control lever adjusting screws (fig. 7-32). Make certain that all of the levers are free on the injector control tube.

(4) Move the governor speed control lever to the maximum speed position.

(5) Move the governor stop lever to the run position and hold in that position with light finger pressure. Turn the inner adjusting screw of the rear injector rack control lever down until a slight movement of the control tube is observed or a step-up in effort to turn the screwdriver is noted. This will place the rear injector rack in the full-fuel position. Turn the outer adjusting screw down until it bottoms lightly on the injector control tube. Then, alternately tighten both the inner and outer adjusting screws. This should result in placing the governor linkage and control tube in the respective positions that they will attain while the engine is running at full load.

(6) To be sure the control lever is properly adjusted, hold the stop lever in the run position and press down on the injector rack with a screwdriver or finger tip, causing the rack to rotate. The setting is sufficiently tight if the rack returns to its original position when the pressure is released. If the rack does not return to its original position, it is too loose. To correct this condition, back off the outer adjusting screw slightly and tighten the inner adjusting screw. The setting is too tight if, when moving the governor stop lever from the *stop* to the *run* position, the injector rack becomes tight before the stop lever reaches the end of its travel. This will result in a step-up in effort required to move the governor stop lever to the *run* position and a deflection in the fuel rod link (fuel rod deflection can be seen at the bend). If rack is found to be too tight, back off the inner adjusting screw slightly and tighten the outer adjusting screw.

(7) Manually, hold the rear injector rack in the full-fuel position with the lever on the injector control tube and turn the inner adjusting screw of the adjacent injector control lever down until the rack of the adjacent injector moves to the full-fuel position. Turn the outer adjusting screw down until it bottoms lightly on the injector control tube. Then, alternately tighten both the inner and outer adjusting screws.

(8) Recheck the rear injector rack to make certain that it has remained snug on the ball end of the rack control lever while adjusting the adjacent injector rack. If the rack of the rear injector has become loose, back off the inner adjusting screw slightly on the adjacent injector rack control lever and tighten the outer adjusting screw. When the settings are correct the racks of both injectors must be snug on the ball end of their respective control levers.

(9) Position the remaining injector rack control levers, one at a time, as outlined in steps 6, 7. and 8 above.

b. Governor Adjustment. After adjusting exhaust valves (para 4-99), timing the injectors (para 4-100), and positioning injector rack control levers (para 7-26 *a*). adjust governor as described below.

NOTE

Loosen the load limit lever for the load limiting device before proceeding with the governor adjustment.

(1) *Adjust governor gap.* With engine stopped and at operating temperature, adjust governor gap as follows:

(a) Disconnect linkage attached to governor levers (para 4-59).

(b) Remove governor cover (para 7-12).

(c) Place the governor speed control lever in the maximum speed position.

(d) Insert a 0.006 inch feeler gage between the spring plunger and the plunger guide as shown in figure 7-33. If required, loosen locknut and turn the gap adjusting screw in or out until a slight drag is noted on the feeler gage.

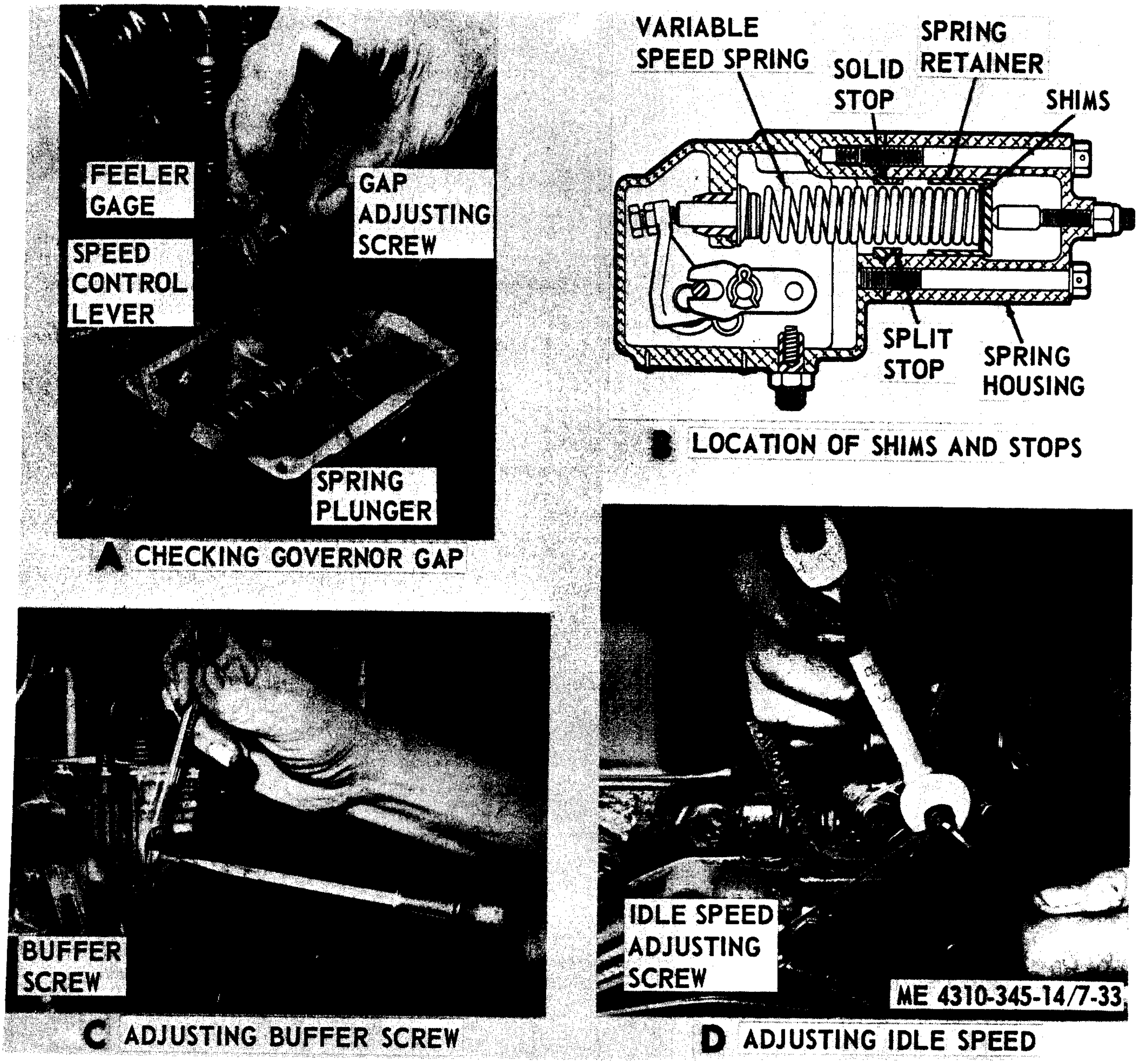


Figure 7-33. Governor adjustment.

(e) Hold adjusting screw and tighten locknut. Check gap and readjust if necessary.

(f) Install the governor cover (para 7-12).

(2) *Adjust maximum no-load speed.* The maximum no-load speed of the engine equals the full-load speed plus a "droop" speed of 185 RPM.

Therefore, maximum no-load speed should be 1985 RPM. Use an accurate tachometer to determine maximum no-load speed of the engine; then, make the following adjustments, if required.

(a) Disconnect the governor stop lever retracting spring (fig. 7-8, sheet 1 of 3).

(b) Remove the two attaching bolts and withdraw the variable speed spring housing and variable speed spring retainer located inside of the housing (fig. 7-8, sheet 2 of 3).

(c) Stops or shims required for full-load speed of 1800 RPM are one solid ring, one split ring, and shims as required. Do not use more than four thick and one thin shim.

(d) Install the variable speed spring housing (fig. 7-8, sheet 2 of 3).

(e) Connect the stop lever retracting spring and recheck the maximum no-load speed (fig. 7-8, sheet 1 of 3).

(f) If required, add shims to obtain the operating speed (1985 RPM). For each 0.001 inch in shims added, the speed will increase approximately 2 RPM.

NOTE

If the maximum no-load speed is raised or lowered more than 50 RPM by the installation or removal of shims, recheck the governor gap. If readjustment of the governor gap is required, the position of the injector racks must be rechecked. The governor stops are used to limit the compression of the governor spring, which determines the maximum speed of the engine.

(3) *Adjust idle speed.* After maximum no-load speed has been set, adjust idle speed as follows:

(a) Place governor stop lever in the *run* position and the speed control lever in the *idle* position.

(b) With engine operating, loosen locknut and turn the idle speed adjusting screw in or out until the engine idles at the speed of 1000 RPM.

(c) Hold the idle speed adjusting screw and tighten the locknut.

(4) *Adjust buffer screw.* With engine idle speed properly set, adjust the buffer screw as follows:

(a) With engine running at 1000 RPM, loosen locknut and turn buffer screw in so that it contacts the differential lever as lightly as possible and still eliminates engine roll.

NOTE

Do not increase the engine idle speed more than 15 RPM with the buffer screw.

(b) Hold buffer screw and tighten locknut.

(5) *Load limit device.* After engine tune-up is complete and it is determined that load limiting device is properly installed, adjust the device as follows:

(a) Loosen load limit screw locknut. Refer to figure 7-34.

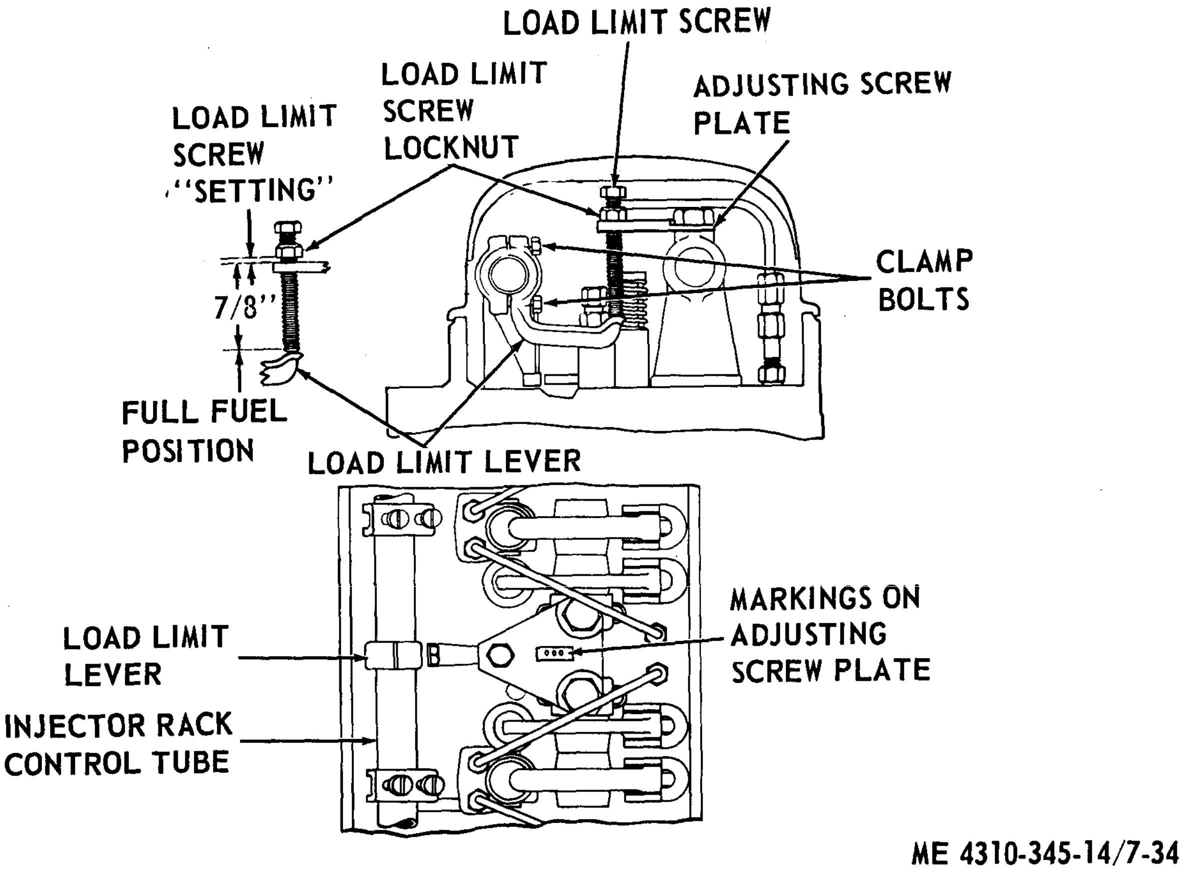


Figure 7-34. Load limiting device adjustment.

(b) Back the load limit screw out of the adjusting screw plate until approximately 1 inch of the screw is below the plate.

(c) Adjust the load limit screw locknut so the bottom of the lock nut is 7 / 8 inch from the bottom of the load limit screw.

(d) Loosen the load limit lever clamp bolts so the lever is free to turn on the injector control tube.

(e) Thread the load limit screw into the adjusting screw plate until the locknut *bottoms* against the top of the plate.

(f) Hold the injector rack control tube in the full-fuel position and place the load limit lever against the bottom of the load limit screw. Tighten load limit lever clamp bolts.

(g) Check to ensure that the injector racks will just go into the full-fuel pisition. Readjust the load limit lever, if necessary.

(h) Hold the load limit screw to keep it from turning, then *set* the locknut until the distance between the bottom of the locknut and the top of the adjusting screw plate corresponds to the markings on the adjusting screw plate.

(i) Thread the load limit screw into the plate until the locknut *bottoms* against the top of the plate.

(j) Hold the load limit screw to keep it from turning and tighten the locknut to secure the setting.

Section XII. OIL PAN AND OIL PUMP ASSEMBLY

7-27. General

The oil pan is a stamped steel, shallow type used with a one-piece gasket. The oil pan is attached to the bottom of the cylinder block and is the reservoir for the engine lubricating oil. The oil pump, assembled to the inside of the lower engine front cover, is the rotor type in which the inner rotor is driven by a gear pressed on the front and of the crankshaft. The outer rotor is driven by the inner rotor. The bore in the pump body, in which the outer rotor revolves, is eccentric to the crankshaft and inner rotor. The outer rotor has nine cavities and the inner rotor has eight lobes; therefore, the outer rotor revolves at eight-ninths crankshaft speed. Only one lobe of the inner rotor is in full engagement with the cavity of the outer rotor at any given time, so the former can revolve inside the latter without interference. As the rotors revolve, a vacuum is formed on the inlet side of the pump and oil is drawn from the oil pan through the oil pump inlet pipe and a passage in the front cover to the pump. The oil flows then from the pump under pressure through a passage which leads to the oil filter and cooler and is then distributed throughout the engine.

7-28. Oil Pan

a. *Removal.*

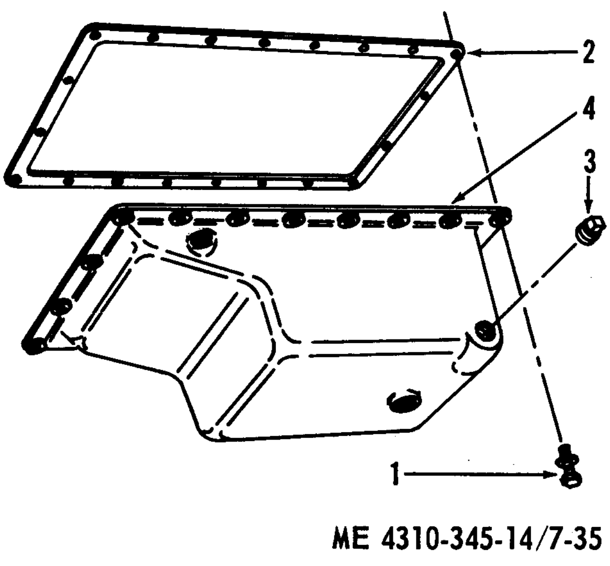
(1) Remove oil level gage (fig. 3-3).

(2) Drain oil from oil pan (fig. 3-3).

(3) Remove oil pan from cylinder block in numerical sequence shown in figure 7-35. Discard gasket.

CAUTION

Remove oil pan with care to avoid any damage to oil pump inlet pipe and screen.



1. Bolt (24)
2. Gasket
3. Plug (4)
4. Pan

Figure 7-35. Oil pan, removal and installation.

b. *Cleaning, Inspection, and Repair.*

(1) Clean oil pan in accordance with paragraph 5-5 *f.*

(2) Inspect oil pan for large dents, cracks, breaks, or any other defect.

(3) Inspect attaching hardware and drain plug for damaged threads, cracks, or any other defect.

c. *Installation.*

(1) Install oil pan in reverse numerical sequence shown in figure 7-35.

(2) Replenish engine oil supply. Refer to LO 5-4310-345-12.

(3) Install oil level gage (fig. 3-3).

7-29. Oil Pump Assembly

a. *Removal.*

(1) Remove the engine assembly (para 5-9

(2) Remove the oil pan (para 7-28).

(3) Remove the crankshaft pulley (para 7-40), fan pulley, and support bracket (para 4-66).

(4) Remove the four bolts which attach the oil pump inlet pipe and screen assembly to the main bearing cap and engine front cover. Slide the flange and seal ring on the inlet pipe and remove the pipe and screen as an assembly.

(5) Remove the lower engine front cover in numerical sequence shown in figure 7-36.

b. *Disassembly.* Disassemble oil pump, and engine front cover components, in numerical sequence shown in figure 7-36. Discard gaskets.

c. *Cleaning, Inspection, and Repair.*

(1) Clean all parts in accordance with paragraph 5-5 *f.*

(2) Inspect the lobes and faces of the pump rotors for scratches or burrs, and the surfaces of the pump body and cover plate for scoring. Remove scratches or score marks with an emery stone.

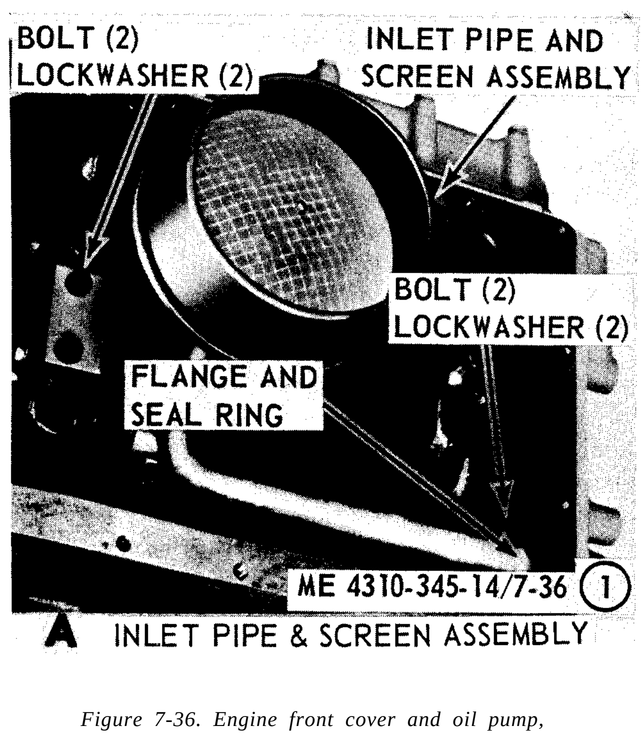
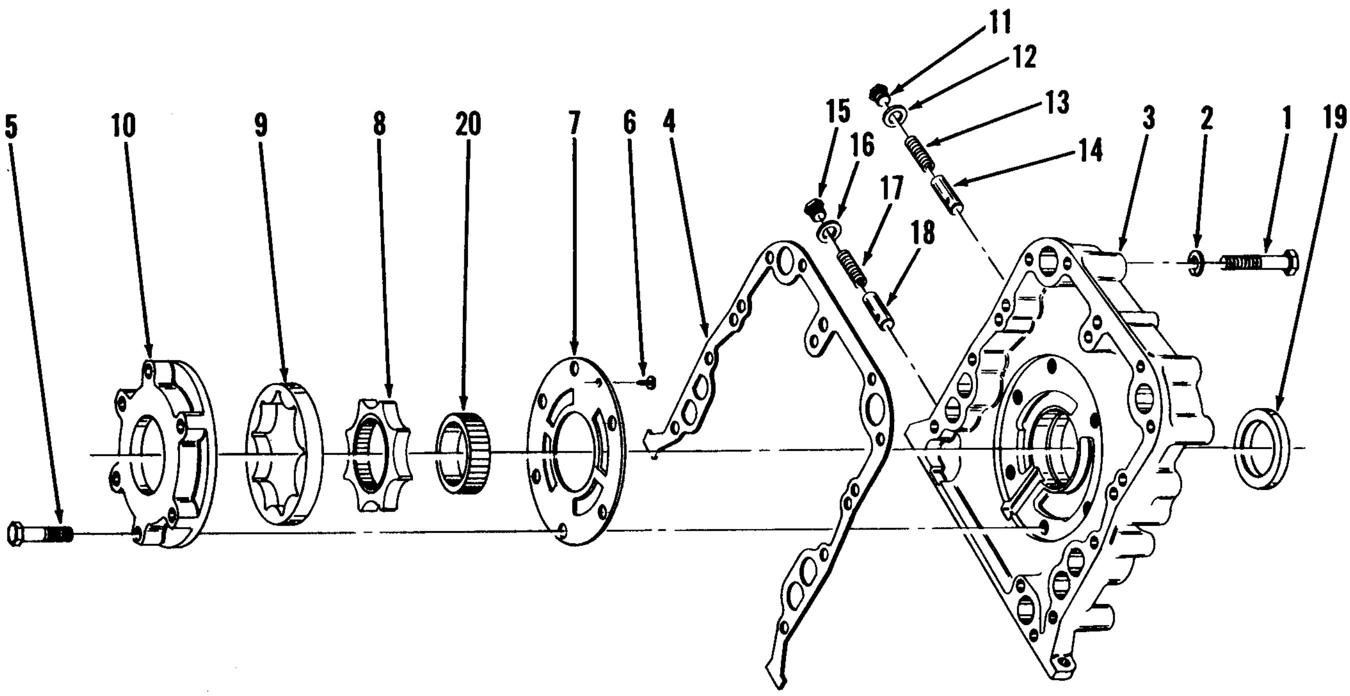


Figure 7-36. Engine front cover and oil pump, disassembly and reassembly (sheet 1 of 2).



B LOWER ENGINE FRONT COVER

ME 4310-345-14/7-36 (2)

1. Bolt (11)
2. Lockwasher (11)
3. Cover
4. Gasket
5. Bolt (6)
6. Screw (2)
7. Cover
8. Inner rotor
9. Outer rotor
10. Body
11. Plug
12. Gasket
13. Spring
14. Bypass valve
15. Plug
16. Gasket
17. Spring
18. Regulator valve
19. Oil seal
20. Drive gear

Figure 7-36. Engine front cover and oil pump, disassembly and reassembly (sheet 2 of 2).

(3) **Measure the clearance between the inner** and outer rotors at each lobe, as shown in figure 7-37. The clearance should not be less than 0.004 inch or more than 0.011 inch. With a micrometer **depth gage, measure clearance from the face of the** pump body to the side of the inner and outer rotor. The clearance should not be less than 0.001 inch or more than 0.0035 inch. Refer to figure 7-37.

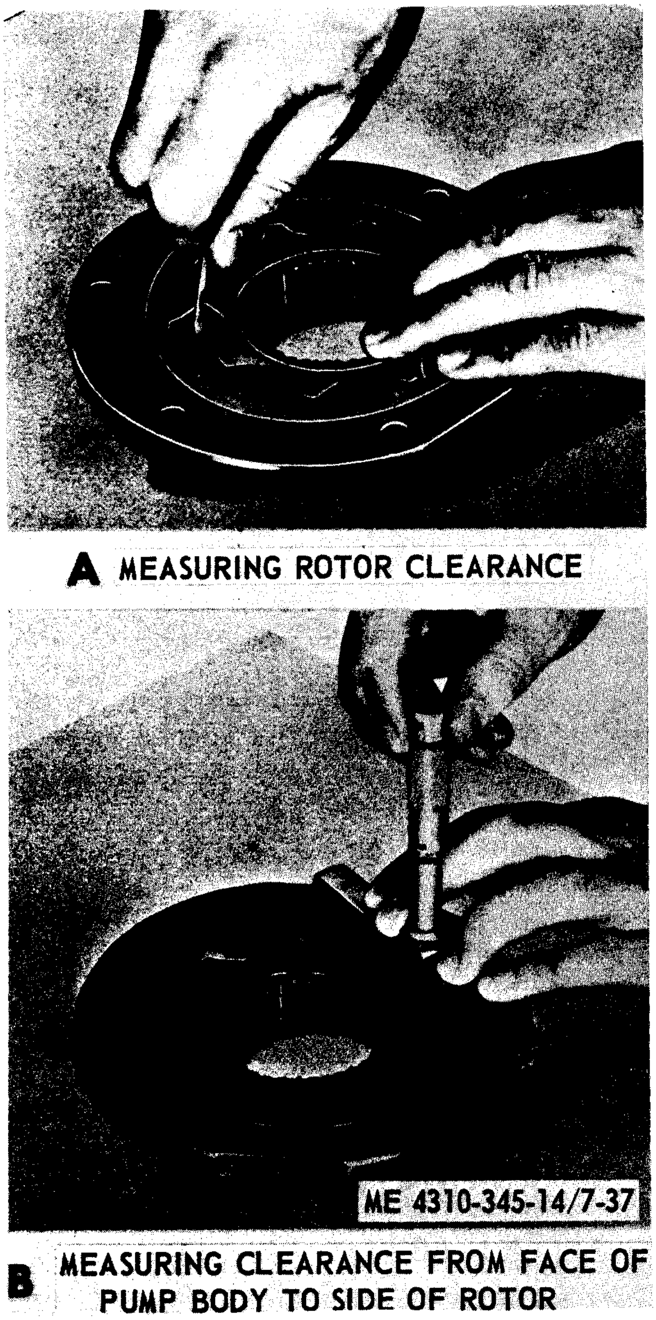


Figure 7-37. Oil pump inspection.

(4) Inspect the splines of the inner rotor, and oil pump drive gear. If splines are worn excessively, replace the parts. The rotors are serviced as matched sets; therefore, if one rotor needs replacing, both rotors must be replaced.

(5) Remove the inlet screen from the oil inlet pipe and clean the screen and pipe with clean fuel oil and blow dry with compressed air. Replace inlet pipe flange seal ring if necessary.

d. Reassembly. Lubricate the inner rotor and outer rotor with clean engine oil and reassemble in reverse numerical sequence shown in figure 7-36, sheet 2 of 2.

e. Installation.

(1) Install the lower engine front cover in reverse numerical sequence shown in figure 7-36, sheet 2 of 2.

(2) Install the oil pump inlet pipe and screen assembly to the front cover and main bearing cap with bolts previously removed. Use a new seal ring if necessary. (fig. 7-36, sheet 1 of 2).

(3) Install fan support bracket and fan pulley (para 4-66) and crankshaft pulley (para 7-40).

(4) Install oil pan (para 7-28).

(5) Install the engine assembly (para 5-9).

7-30. General

The flywheel is attached securely to the rear end of the crankshaft with six self-locking bolts and a scuff plate between the bolt heads and the flywheel. A ring gear is mounted on the flywheel by shrink fit. The ring gear provide for starting motor engagement when cranking the engine. The flywheel housing is mounted against the rear end of the cylinder block. The flywheel housing provides a cover for the gear train and flywheel and also serves as a support for the starting motor and rear engine support. The crankshaft rear oil seal is pressed into the housing and can be removed or installed without removing the flywheel housing.

7-31. Flywheel

a. Removal.

(1) Remove engine assembly (para 5-9).

CAUTION

When removing or installing the flywheel attaching bolts, hold the flywheel firmly against the crankshaft by hand to prevent it from slipping off the end of the crankshaft. The flywheel is NOT doweled to the crankshaft.

(2) Remove flywheel attaching bolts and the scuff plate while holding the flywheel in position by hand; then, reinstall one bolt. (fig. 7-38, sheet 1 of 2).

(3) Attach a lifting tool to the flywheel with two two -16NC bolts of suitable length as shown in figure 7-38, sheet 2 of 2).

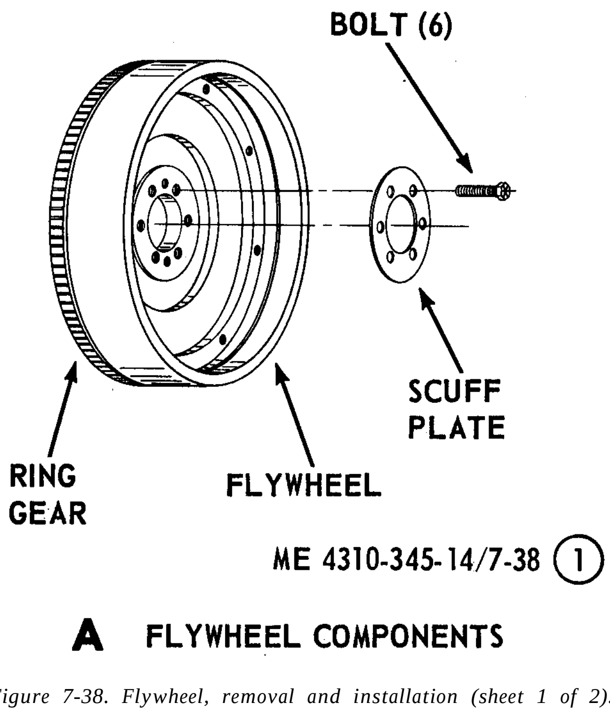


Figure 7-38. Flywheel, removal and installation (sheet 1 of 2).

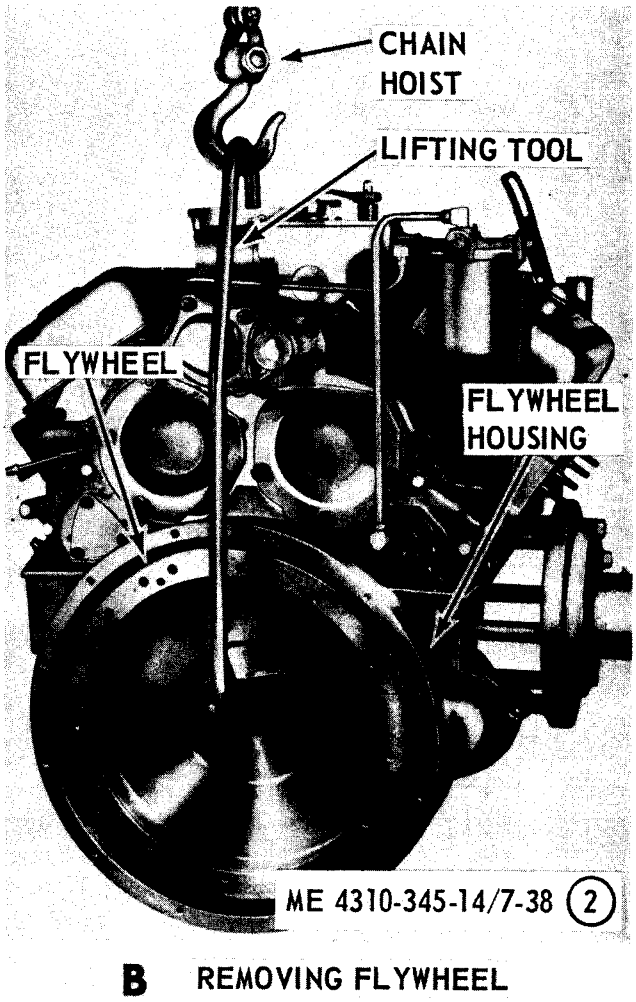


Figure 7-38. Flywheel, removal and installation (sheet 2 of 2).

(4) Attach a chain hoist to the lifting tool and remove the remaining flywheel attaching bolt.

(5) Move the upper end of the lifting tool back and forth to loosen the flywheel; then, withdraw the flywheel.

b. Cleaning, Inspection, and Repair.

(1) Clean flywheel in accordance with paragraph 5-5 *f*.

(2) Inspect flywheel for cracks, breaks, or any other defect.

(3) Inspect ring gear teeth for cracks, broken teeth, excessive wear, or any other defect. If any defect in ring gear is detected it may be replaced as follows:

(a) Support the flywheel, crankshaft side down, on a flat surface or a hardwood block which is slightly smaller than the inside diameter of the ring gear. Before removing the gear, note the chamfer, if any, on the gear teeth so that the new gear may be installed in the same manner.

(b) Drive the ring gear off of the flywheel with a suitable drift and hammer. Work around the circumference of the ring gear to avoid binding the gear on the flywheel.

(c) Turn the flywheel over and support ring gear side on a solid flat surface.

(d) Rest new ring gear on a flat *metal* surface and heat the gear uniformly with an acetylene torch, keeping the torch moving around the gear to avoid hot spots.

CAUTION

Do not, under any circumstances, heat the gear over 400° F. Excessive heating may destroy the original heat treatment.

(e) Use a pair of tongs to place the heated gear on the flywheel with the chamfer, if any, facing the same direction as on the gear just removed.

(f) Tap the gear in place against the shoulder on the flywheel. If gear cannot be tapped into place readily, remove it and apply additional heat, heeding the caution about overheating.

(4) Inspect scuff plate and attaching hardware for cracks, damaged threads, breaks, or any other defect.

c. Installation.

(1) Install the flywheel, using lifting tool and a chain hoist, in position against the rear end of the crankshaft. (fig. 7-38, sheet 2 of 2).

(2) Apply a small quantity of International Compound No. 2, or equivalent, to the bolt threads and bolt head contact areas of the flywheel attaching bolts.

(3) Hold the flywheel in place by hand. Remove lifting tool and install scuff plate and attaching bolts. Tighten the bolts to 110-120 lb-ft torque. (fig. 7-38, sheet 1 of 2).

(4) Mount a dial indicator on the flywheel housing and check the runout of the flywheel at the compressor drive coupling mounting radius. Maximum runout is 0.001 inch total indicator reading per inch of radius.

(5) Install engine assembly (para 5-9).

7-32. Flywheel Housing

a. Removal.

(1) Remove engine assembly (para 5-9).

(2) Remove the starter assembly (para 7-6).

(3) Remove the flywheel (para 7-31).

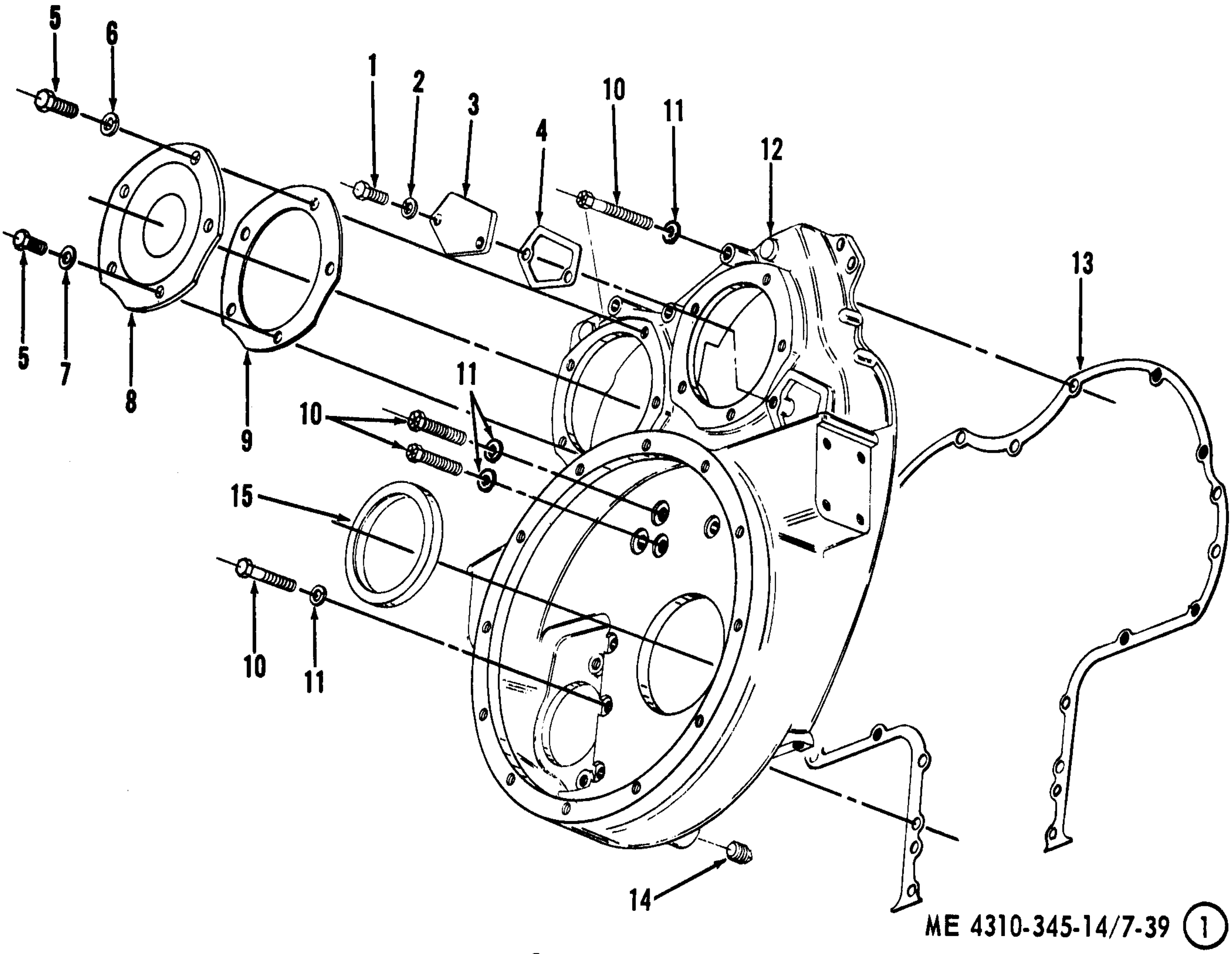
(4) Remove the oil pan (para 7-28).

(5) Remove the governor control housing and governor weight housing (para 7-12).

(6) Remove the blower drive support (para 7-23).

(7) Remove the oil filler and crankcase breather assembly (para 4-91).

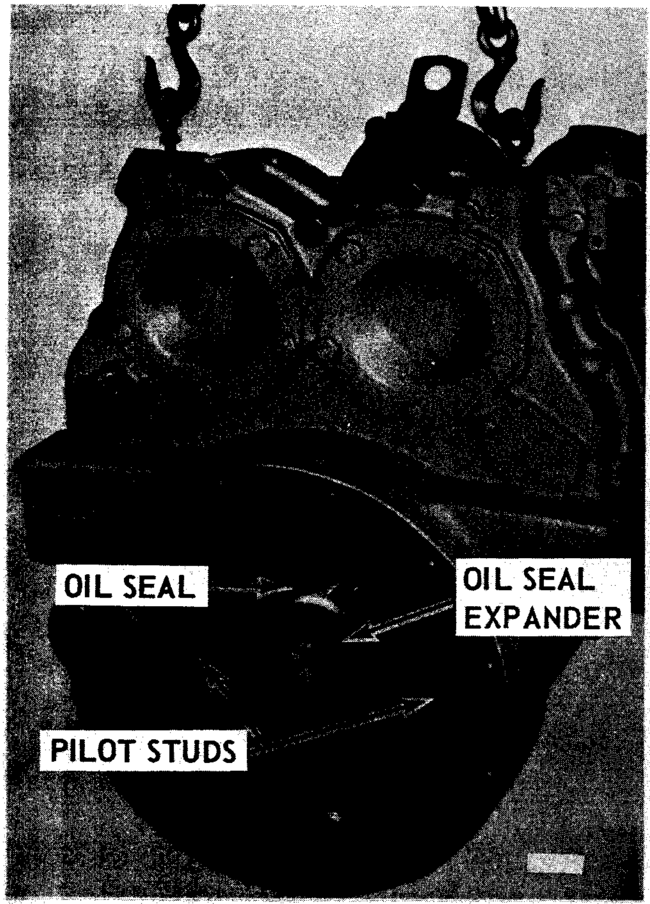
(8) Remove flywheel housing covers, refer to figure 7-39, sheet 1 of 3.



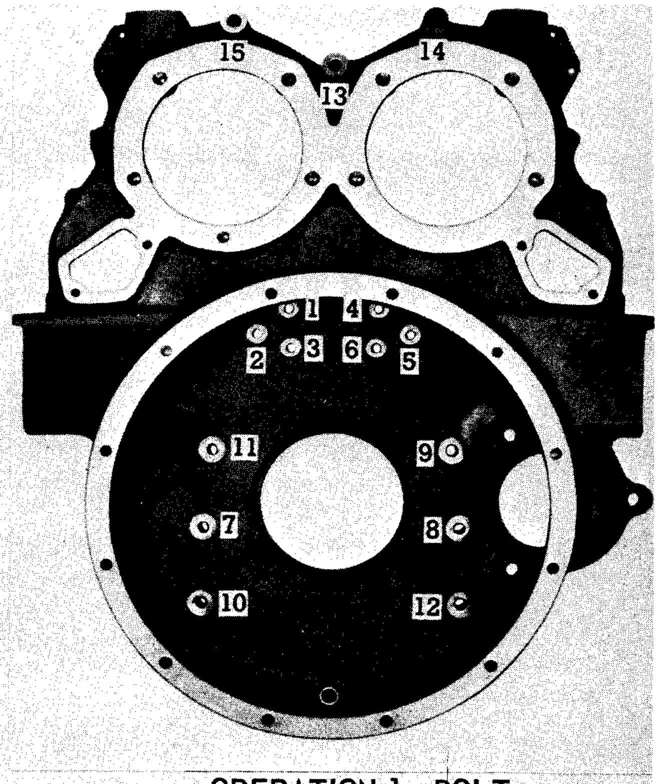
A EXPLODED VIEW

1. Bolt (2)
2. Lockwasher (2)
3. Cover (1)
4. Gasket (1)
5. Bolt (10)
6. Lockwasher (8)
7. Lockwasher (2)
8. Cover (2)
9. Gasket (2)
10. Bolt (8)
11. Lockwasher (8)
12. Housing (1)
13. Gasket (1)
14. Plug (1)
15. Seal (1)

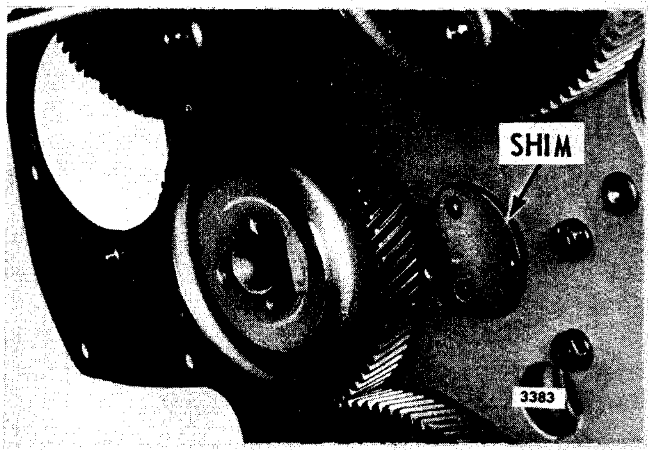
Figure 7-39. Flywheel housing, removal and installation (sheet 1 of 3).



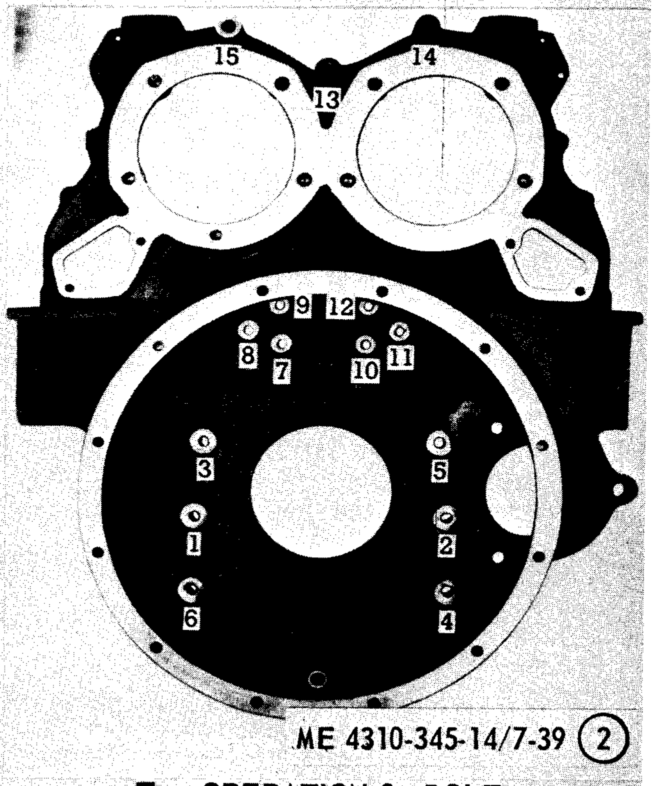
B INSTALLING FLYWHEEL HOUSING



C OPERATION 1 - BOLT TIGHTENING SEQUENCE



D LOCATION OF SHIM



E OPERATION 2 - BOLT TIGHTENING SEQUENCE

Figure 7-39. Flywheel housing, removal and installation (sheet 2 of 3).

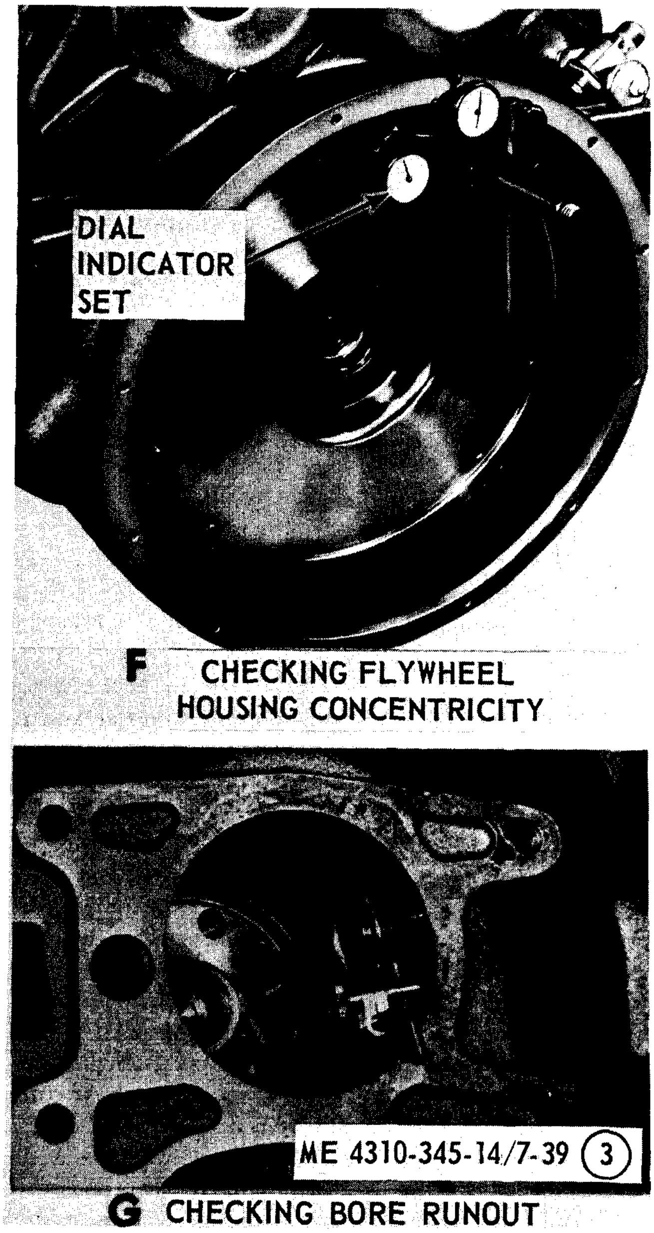


Figure 7-39. Flywheel housing, removal and installation (sheet 3 of 3).

(9) Remove all of the bolts from the flywheel housing.

NOTE

Note the location of the various size bolts, lockwashers, flat washers, and copper washers so that they may be reinstalled in their proper location.

(10) Thread two pilot studs into the cylinder block, refer to figure 7-39, sheet 2 of 3, to guide the flywheel housing until oil seal clears the end of the crankshaft.

(11) Thread eyebolts into the tapped holes in the pads on the top of the flywheel housing. Attach a chain hoist with suitable sling to the eyebolts. Strike the front face of the housing alternately on each side of the engine with a soft hammer to loosen and work the housing off of the dowel pins.

(12) Remove all traces of old gaskets from cylinder block rear end plate and flywheel housing.

b. Cleaning, Inspection, and Repair.

(1) Clean parts in accordance with paragraph 5-5 *f.*

(2) Inspect flywheel housing for cracks, dam aged threads, or any other defect.

(3) Inspect covers and attaching hardware for cracks, breaks, damaged threads, or any other defect.

(4) Inspect oil seal for wear, excessive hardness of rubber seal area, nicks or any other defect.

c. Installation.

(1) Lubricate the gear train teeth with clean engine oil.

(2) Install a new flywheel housing gasket to the rear face of the cylinder block end plate.

(3) Install flywheel housing-to-end plate shim (0.01 5 inch). Use grease to affix the shim to the cylinder block rear end plate. (fig. 7-39, sheet 2 of 3).

(4) Coat the lip of the crankshaft oil seal lightly with grease. Do not scratch or nick the sealing edge of the oil seal.

(5) Use two pilot studs threaded into cylinder block to guide housing in place. Use oil seal expander to pilot oil seal on crankshaft. (fig. 7-39, sheet 2 of 3).

(6) Position housing over the crankshaft and up against the cylinder block rear end plate and gasket.

(7) Install all of the flywheel housing bolts, lockwashers, flat washers, and copper washers in their proper location, finger tight only.

(8) Refer to figure 7-39, sheet 2 of 3, and start at No. 1 (operation 1) and draw the bolts up snug in the sequence shown.

(9) Refer to figure 7-39, sheet 2 of 3, operation 2, for final bolt tightening sequence. Start at No. 1 and tighten the bolts to the following specified torque.

5/16”-18NC bolts (No. 11 and 12)	19-23 lb-ft
3/8”-16NC bolts (No. 7 through 10)	40-45 lb-ft
3/8”-16NC bolts (remaining)	25-30 lb-ft
3/8”-24NF bolts (remaining)	25-30 lb-ft

(10) Check flywheel housing concentricity and bolting flange with tool as follows:

(a) Thread base post tightly into one of the tapped holes in the flywheel. Assemble dial indicators on base post with attaching parts provided. Refer to figure 7-39, sheet 3 of 3.

(b) Position the dial indicators straight and square with the flywheel housing and make certain that each indicator has adequate travel in each direction.

(c) Tap the front end of the crankshaft with

a soft hammer or pry it with a pry bar to ensure end play is in one direction only.

(d) Adjust each dial indicator to read zero at the twelve o'clock position. Rotate the crankshaft one full revolution, taking readings at 45° intervals (8 readings each on flywheel housing bore and bolting flange face). Stop rotation and remove wrench or cranking bar before recording each reading to ensure accuracy. The maximum total indicator reading must not exceed 0.013 inch for either the bore or the face.

(e) If runout exceeds maximum limits, remove the flywheel housing and check for dirt or foreign material (such as old gasket material) between the flywheel housing and the end plate and between the end plate and cylinder block.

(f) Reinstall flywheel housing and tighten attaching bolts in their proper sequence and to specified torque. Recheck the runout. Replace flywheel housing if necessary.

(11) Install flywheel housing covers (fig. 7-39, sheet 1 of 3).

(12) Install the oil filler and crankcase breather assembly (para 4-91).

(13) Install the blower drive support (para 7-23).

(14) Install governor control housing and governor weight housing (para 7-12).

(15) Install the oil pan (para 7-28).

(16) Install the flywheel (para 7-31).

(17) Install the starter assembly (para 7-6).

(18) Install the engine assembly (para 5-9).

Section XIV. BALANCE WEIGHTS, GEAR TRAIN, AND ENGINE TIMING

7-33. General

The balance weights, mounted at the outer ends of the camshaft and balance shaft, in conjunction with the intregral crankshaft balance component, are used to act against the unbalance disturbances within the engine due to reciprocating action of the piston masses. The use of proper balancing by these means provides smooth operation of the engine throughout the entire speed range. A train of helical gears, completely enclosed between the engine end plate and the flywheel housing, is located at the rear of the engine. This gear train consists of the crankshaft gear, an idler gear, camshaft gear, and balance shaft gear. The governor drive gear is driven by the balance shaft gear and the blower drive gear is driven by the camshaft gear. The crankshaft gear is pressed on and keyed to the rear end of the crankshaft. The idler gear rotates on a stationary hub. The camshaft and balance shaft gears are pressed on and keyed to their respective shafts and each gear is secured by a retaining nut and lock plate. The camshaft and balance shaft gears have additional weights attached to the rear face of each gear. The camshaft gear and balance shaft gear mesh with each other and run at the same speed as the crankshaft gear. Since the gears must be in time with each other, and the camshaft and balance shaft gears as a unit in time with the crankshaft gear, timing marks have been stamped on the face of the gears to facilitate correct gear train timing.

7-34. Balance Weights

a. Removal.

(1) Remove the flywheel and flywheel housing (para 7-31 and 7-32).

(Remove drive belts (para 4-65).

(3) Remove fan assembly (para 4-66).

(4) Remove fan drive group (para 4-69).

(5) Remove thermostat housing (para 4-67).

(6) Remove nut attaching front pulley-type balance weights to the camshaft and balance shaft.

(7) Use two screwdrivers or pry bars between the balance weights and upper front cover to force balance weights off the end of each shaft.

b. Cleaning, Inspection, and Repair.

(1) Clean balance weights in accordance with paragraph 5-5 *f.*

(2) Inspect drive belt grooves for cracks, chipping, or any other defect.

(3) Inspect nut and shaft threads for damage.

(4) Inspect key and keyway for excessive wear.

c. Installation.

(1) Install keys in keyways of camshaft and balance shaft.

(2) Align keyway in the balance weights with the key in the shafts; slide the weights on the shafts. If the weight does not slide easily onto the shaft, loosen the thrust washer retaining bolts at the rear end of the shaft; then, to prevent possible damage to the thrust washer, support the rear end of the shaft while tapping the weight into place with a hammer and a sleeve. Retighten the thrust washer retaining bolts to 30-35 lb-ft torque. Both weights are installed in the same manner.

(3) Wedge a clean rag between the camshaft gear and the balance shaft gear. Install and tighten the balance weight retaining nuts to 300-325 lb-ft torque. Remove the rag from the gears.

7-35. Gear Train

a. The symbol system of marking the gears for gear train timing is used. When assembling the engine it is important to remember the engine rotation. This rotation is counterclockwise facing the crankshaft gear. Working from the crankshaft gear to the idler gear and to the camshaft gear in that order, line up the appropriate circle symbols on the gears or the appropriate triangles as each gear assembly is installed. Refer to figure 7-40 for typical gear train timing arrangement.

NOTE

It is advisable to make a sketch indicating the position of the timing marks before removing or replacing any of the gears in the gear train.

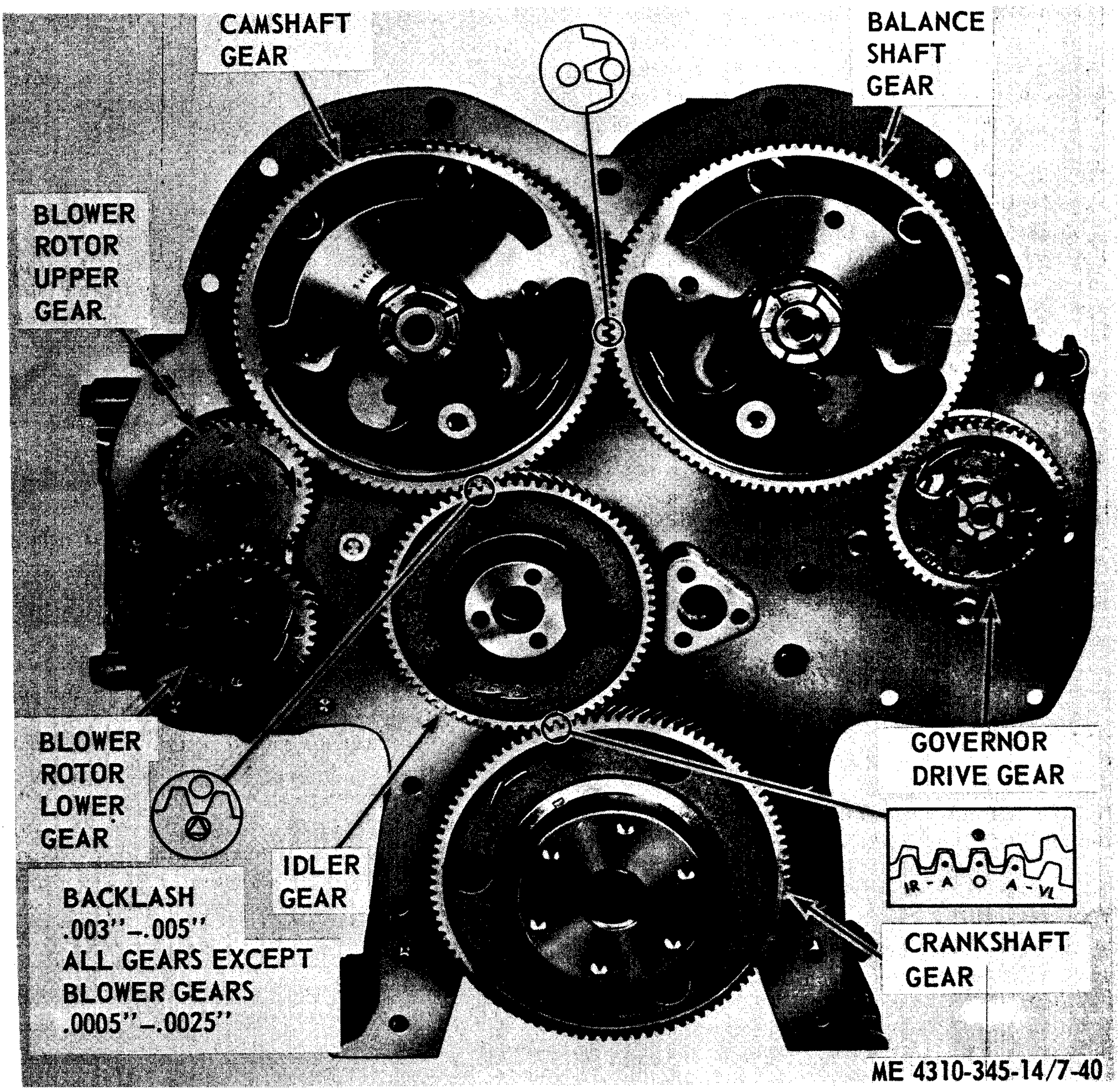


Figure 7-40. Typical gear train timing.

b. The circle and the triangle are the basic timing symbols stamped on the gears. The letters stamped on the crankshaft gear identify the proper timing marks for the particular engine: "I" represents "In-Line" engine, "R" represents right-hand rotation, "A" represents advance timing.

c. The camshaft and balance shaft gears are positioned so that the circle timing marks are adjacent to each other. One circle-triangle timing mark on the idler gear is aligned with the second "circle" on the mating camshaft gear. The other timing mark on the idler gear is aligned with the proper timing mark on the crankshaft gear.

d. The crankshaft gear is stamped "IR-A" and "A-VL" on the left and right side of the circle timing mark for a right hand rotation engine. For standard timing, the circle on the crankshaft gear is aligned with the circle-triangle on the idler gear.

e. There are no timing marks on the governor drive gear or blower drive gears. Therefore, it is not necessary to align these gears in any particular position when meshing the various gears with the camshaft or balance shaft gears.

f. Gear train noise is usually an indication of excessive gear lash, chipped, pitted or burred gear teeth, or excessive bearing wear; therefore, when noise develops in the gear train, inspect the gear train and its bearings. A rattling noise usually indicates excessive gear lash whereas a whining noise indicates too little gear lash.

g. Backlash between the various mating gears in the gear train shall be 0.003 to 0.005 inch, except the blower rotor gears which shall be 0.0005 to 0.0025 inch. Maximum permissible backlash between worn blower gears is 0.0035 inch, and shall not exceed 0.007 inch clearance between all other gears in the gear train.

7-36. Engine Timing

Access to the crankshaft pulley, to mark top dead center position of the selected piston, and to the front end of the crankshaft or the flywheel for turning the crankshaft is necessary when performing timing check, Proceed as follow:

a. With valve rocker cover removed, select any cylinder for timing check.

b. Remove injector (para 4-86).

c. Carefully slide a rod, approximately 12 inches long, through the injector tube until the end of the rod rests on top of piston. Place the throttle in the no-fuel pisition. Turn the crankshaft slowly in the direction of engine rotation. Stop when the rod reaches the end of its upward travel. Remove the rod and turn the crankshaft, opposite the direction of rotation, between 1 / 16 and 1/8 of a turn.

d. Use a dial indicator with 0.001 inch graduations and a spindle movement of at least 1 inch. Use an extension on the indicator spindle. The extension must be long enough to contact the piston just before it reaches the end of its upward stroke. Also, use suitable mounting attachments for the indicator so it can be mounted over the injector tube in the cylinder head.

e. Mount the indicator over the injector tube. Check to be certain that the indicator spindle extension is free in the injector tube and is free to travel at least one inch.

f. Attach a suitable pointer to the engine lower front cover. The outer end of the pointer should extend out over the top of the crankshaft pulley.

g. Turn the crankshaft slowly, in direction of engine rotation, until the indicator hand just stops moving.

h. Continue to turn the crankshaft, in direction of rotation, until the indicator starts to move again. Now set the indicator on zero and continue to turn the crankshaft until the indicator reading is 0.010 inch.

i. Scribe a line on the crankshaft pulley in line with the end of the pointer.

j Slowly turn crankshaft, opposite direction of rotation, until the indicator hand stops moving.

k. Continue to turn crankshaft, opposite direction of rotation, until the indicator starts to move again. Set the indicator on zero and continue to turn crankshaft until indicator reading is 0.010 inch.

l. Scribe the second line on the crankshaft pulley in line with the pointer.

m. Scribe a third line on the pulley half way between the first two lines. This is top dead center.

NOTE

If crankshaft pulley retaining bolt loosens, tighten to 200.220 lb-ft torque.

n. Remove the dial indicator and extension from the engine.

o. Install the injector (para 4-86). Adjust exhaust valve clearance (para 4-99) and time the injector (para 4-100).

p. Turn crankshaft, in direction of rotation, until exhaust valve in the cylinder selected are completely open. Reinstall dial indicator so the indicator spindle rests on the top of the injector follower. Set the indicator on zero. Turn the crankshaft slowly, in direction of rotation until the top dead center mark on the pulley is in line with the pointer.

q. Check the front end of the camshaft for an identification mark. A letter “V” is stamped on each end of the camshaft. Note the indicator reading. Reading shall be 0.206 inch, plus or minus 0.005 inch.

r. Remove dial indicator and pointer attached to front of the engine. Install valve rocker cover.

s. Refer to appropriate group breakdown for replacement of timing gears.

Section XV. CAMSHAFT, BALANCE SHAFT, AND BEARINGS

7-37. General

The camshaft and balance shaft are located just below the top of the cylinder block. The shafts are supported by bushing-type bearings that are pressed into bores in the cylinder block. The balance shaft is supported by front and rear bearings only, whereas the camshaft is supported by end, intermediate, and center bearings. Letters signifying engine models in which a shaft may be used are stamped on the ends of the shaft. Letters on the timing gear end of the camshaft must correspond with the engine model. For additional identification, an engine with low velocity camshaft has a "V7 or V" stamped on both ends of the cam shaft.

7-38. Camshaft or Balance Shaft

a. Removal.

(1) Remove the engine (para 5-9).

(2) Remove the drive belts (para 4-65), fan assembly (para 4-66), thermostat housing (para 4-67), and fan drive group (para 4-69).

(3) Remove the cylinder head (para 7-25).

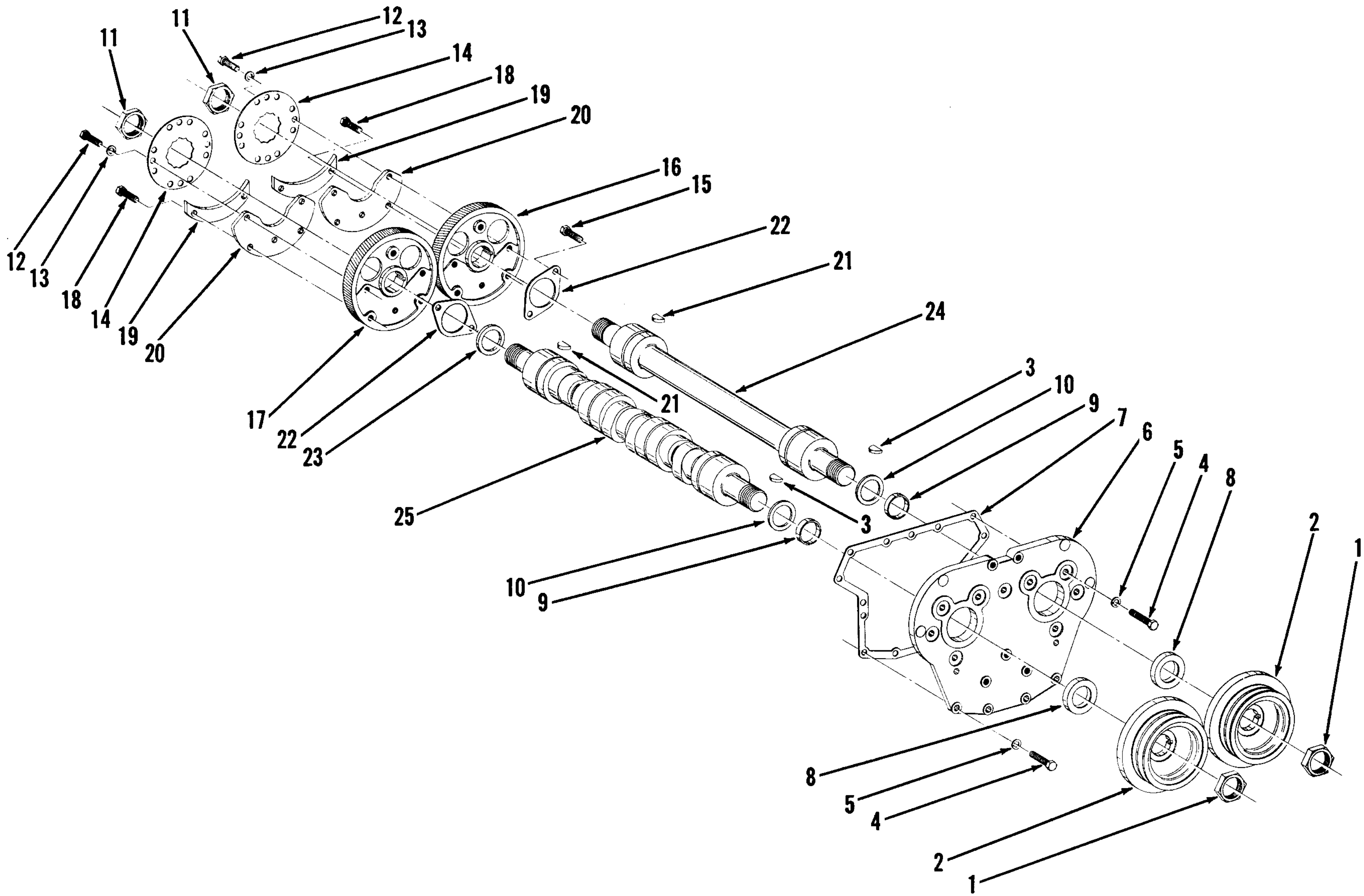
(4) Remove the flywheel and flywheel housing (para 7-31 and 7-32).

(5) Remove balance weights (para 7-34).

(6) Remove camshaft and balance shaft in numerical sequence shown in figure 7-41. Discard gaskets.

KEY to figure 7-41: (Sheet 1 of 2)

1. Nut (2)
2. Pulley (2)
3. Key (2)
4. Bolt (13)
5. Lockwasher (13)
6. Cover
7. Gasket
8. Oil seal (2)
9. Spacer (2)
10. Slinger (2)
11. Nut (2)
12. Bolt (8)
13. Lockwasher (8)
14. Retainer (2)
15. Bolt (4)
16. Balance shaft gear
17. Camshaft gear
18. Bolt (4)
19. Weight (2)
20. Weight (2)
21. Key (2)
22. Thrust washer (2)
23. Spacer
24. Balance shaft
25. Camshaft



A EXPLODED VIEW

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Figure 7-41. Camshaft and balance shaft, removal, disassembly, reassembly, and installation (sheet 1 of 2).

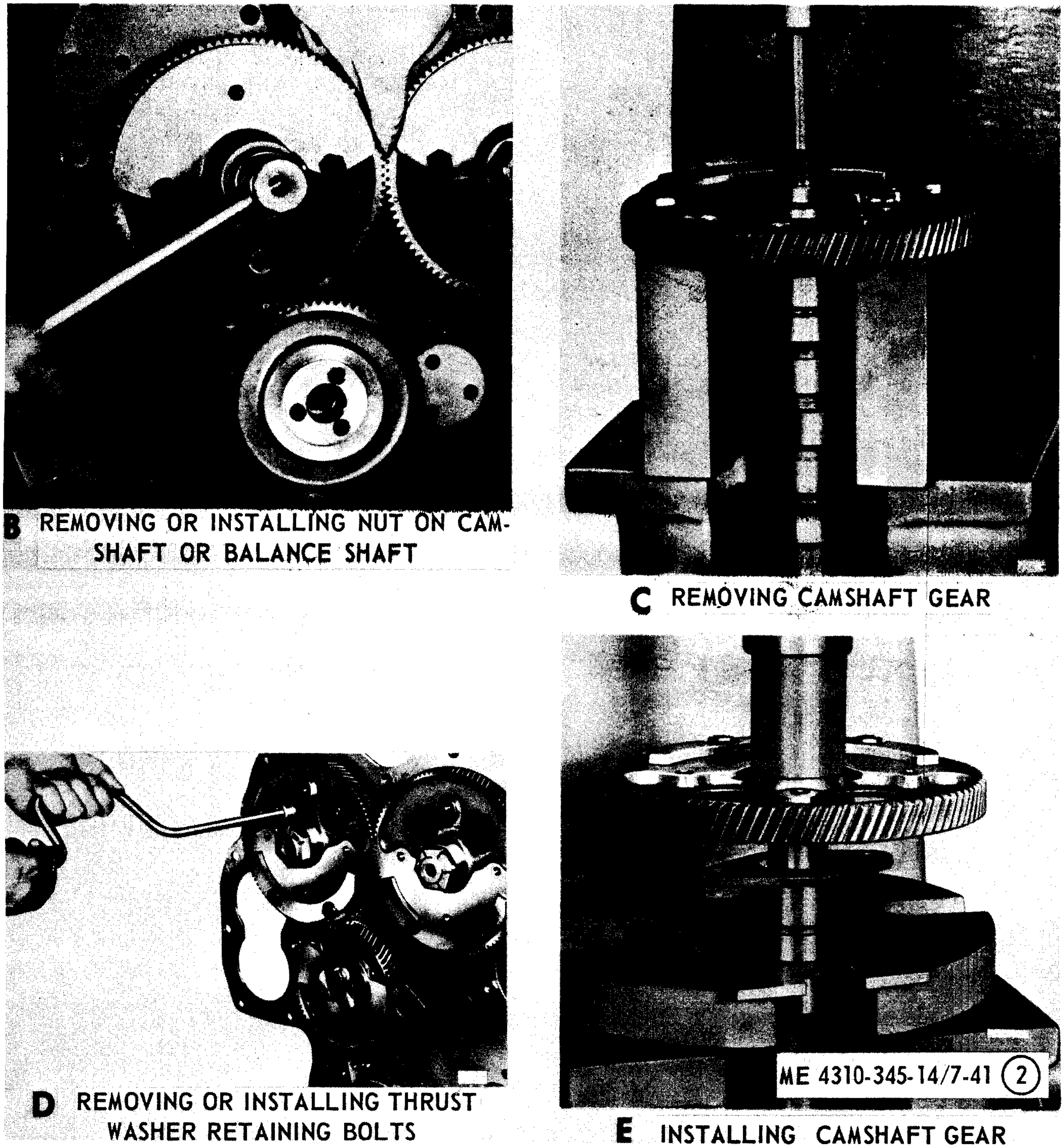


Figure 7-41. Camshaft and balance shaft, removal, disassembly, reassembly, and installation (sheet 2 of 2).

b. Disassembly. Disassemble camshaft and balance shaft in numerical sequence shown in figure 7-41, sheet 1 of 2.

c. Cleaning, Inspection, and Repair.

(1) Clean parts in accordance with paragraph 5-5 *f*.

(2) Inspect cams and journals for wear or scoring.

(3) Check runout of center bearing with camshaft mounted on the end bearing surfaces. Runout shall not exceed 0.002 inch.

(4) Inspect both faces of thrust washers. If either face is scored or if thrust washers are worn excessively, replace the washers. New thrust washers are 0.208 to 0.210 inch thick.

(5) Inspect clearance between shafts and

bearings. Maximum clearance with worn parts is 0.008 inch. Bearings are available in 0.010 inch and 0.020 inch undersize for use with worn or reground shafts.

(6) Inspect all parts for cracks, breaks, distortion, or any other defect.

d. Bearings. Remove and replace camshaft and balance shaft bearings in the following sequence:

NOTE

The end bearing must be removed prior to removing the intermediate bearings.

CAUTION

Note the position of the bearings in the bore with respect to the notch in the bearings. Replacement bearings must be installed in the same position.

(1) Insert small diameter end of the pilot into the end bearing as shown in figure 7-42, sheet 1 of 2.

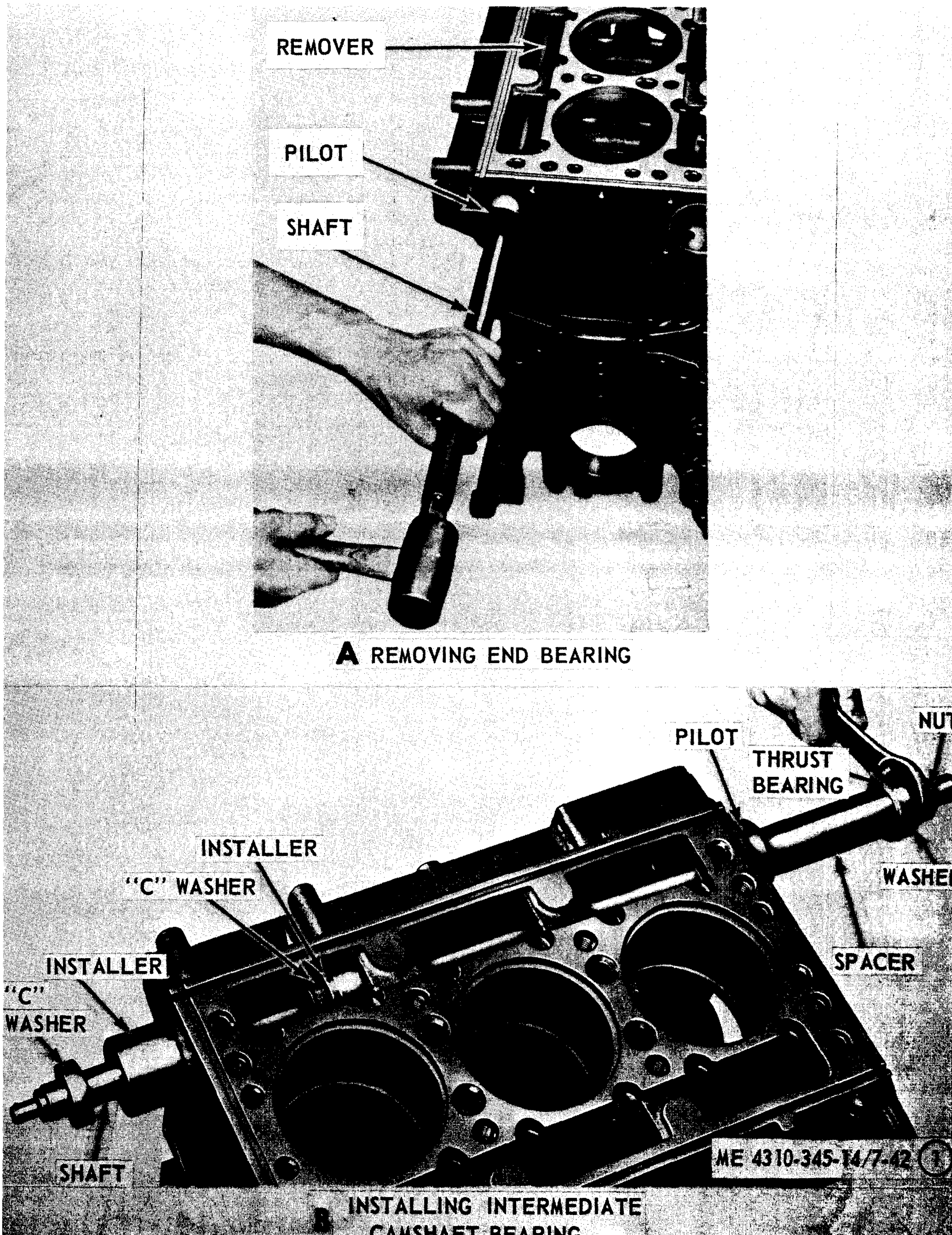


Figure 7-42. Camshaft and balance shaft bearings, removal and installation (sheet 1 of 2).

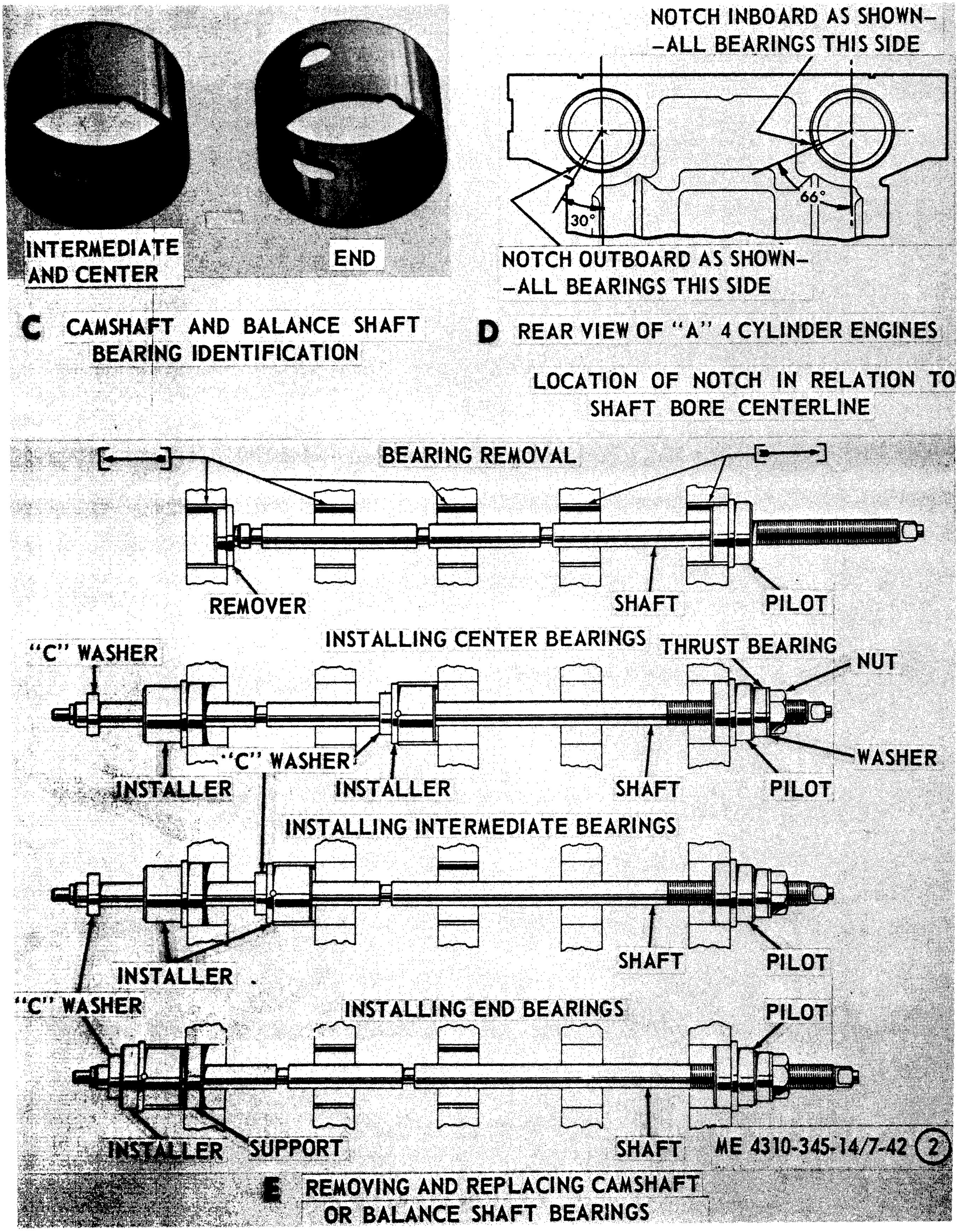


Figure 7-42. Camshaft and balance shaft bearings, removal and installation (sheet 2 of 2).

(2) With unthreaded end of the shaft started through the pilot, push the shaft through the block bore until the end of the shaft snaps into remover.

(3) Drive the end bearing out of the cylinder block. The nearest intermediate and center bearings can be removed now in the same manner. The larger diameter end of pilot will fit into the cam shaft bore and is used when removing the other end bearing and any remaining bearings.

(4) Install camshaft center and intermediate bearings prior to installing end bearings. The center, rear intermediate, and rear bearings are installed in that order by pressing the bearings from the rear to the front of the block. The front intermediate and front bearings are installed by pressing the bearings from the front to the rear of the block.

(5) To properly install the camshaft and balance shaft bearings, refer to figure 7-42, sheet 2 of 2, for location of notch in the bearings in relation to the camshaft or balance shaft bore centerline in the cylinder block. Camshaft and balance shaft bearings are color coded on the side or end as follows:

(a) End bearing—brown
(b) Intermediate bearing—orange
(c) Center bearing—white

(6) Insert pilot in the bore of the block as shown in figure 7-42. Use the small end of the pilot if an end bearing has been installed.

(7) Insert intermediate or center bearing into the cam shaft bore and position correctly. Install center bearing first.

(8) With unthreaded end of shaft started through the pilot, push shaft through the entire length of the block bore.

(9) Slide installer on the shaft until locating pin registers with notch in the bearing. Slide installer on the shaft with large diameter inserted into the end of the block bore.

(10) Place spacer, thrust washer, plain washer, and hex nut over threaded end of puller.

(11) Align shaft in such a way that a "C" washer can be inserted in a groove in the shaft adjacent to installer.

(12) Place a "C" washer in the groove near the end of the shaft and, using a suitable wrench on the hex nut, draw the bearing into place until the "C" washer butts up against installer and prevents shaft from further movement.

(13) Insert pilot in bore of block as shown in figure 7-42 and install end bearings. Use small diameter of the pilot if a bearing has been installed.

(14) Insert support in the bore in the opposite end of the block. With unthreaded end of shaft started through pilot, push the shaft through the block and support.

(15) Place end bearing on installer and align the notch in the bearings with pin on the installer. Slide the installer and bearing on the shaft. Position bearing correctly with the groove in the camshaft bore.

(16) Place "C" washer in the end notch in the shaft; pull shaft back until washer butts against the installer.

(17) Place spacer, thrust washer, plain washer, and hex nut over the threaded end of the shaft. Using suitable wrench on the hex nut, draw the bearing into place until shoulder on installer prevents shaft from further movement.

(18) Install remaining end bearings in the same manner.

e. Reassembly. Reassemble camshaft and balance shaft in reverse numerical sequence shown in figure 7-41, sheet 1 of 2.

f. Installation.

(1) Install camshaft and balance shaft in reverse numerical sequence shown in figure 7-41. Use new gaskets. Refer to paragraph 7-31 for gear train timing.

(2) Install balance weights (para 7-34).

(3) Install flywheel housing and flywheel (para 7-32 and 7-31).

(4) Install the cylinder head (para 7-25).

(5) Install fan drive group (para 4-69), thermostat housing (para 4-67), fan assembly (para 4-66), and drive belts (para 4-65).

(6) Install the engine (para 5-9).

Section XVI. CRANKSHAFT, MAIN BEARINGS, PULLEY, AND TIMING GEAR

7-39. General

The crankshaft is a one-piece steel forging incorporating all main and connecting rod bearing journals. Complete static and dynamic balance of the crankshaft has been achieved by counterweights also incorporated into the shaft. End thrust is controlled by thrust washers located at the rear main bearing cap. Full pressure lubrication to all connecting rod and main bearings is provided by drilled passages within the crankshaft and cylinder block. Tapped holes are provided in the rear end of the crankshaft for attaching the crankshaft to prevent lubricating oil from escaping from the crankcase. The seals also provide protection against the entrance of dirt, dust, mud, or oil from the external portion of the engine. The front oil seal is pressed into the lower front cover. The rear oil seal is pressed into the flywheel housing. The main bearing shells are precision made and are replaceable without machining. They consist of an upper shell seated in each cylinder block main bearing support and a lower shell seated in each main bearing cap. The bearing shells are prevented from endwise or radial movement by a tang at the parting line at one end of each shell. The bearing caps are numbered indicating their respective positions and must always be reinstalled in their original position. An oil hole in the groove of each upper shell registers with an oil passage in the cylinder block. Lubricating oil passes, under pressure from the cylinder block by way of the bearing shells to drilled passages in the crankshaft, then to the connecting rods. The lower main bearing shells have no oil grooves; therefore, the upper and lower shells are not interchangeable. The crankshaft thrust washers absorb the crankshaft thrust. The lower halves of the two-piece washers are doweled to the bearing cap, the upper half is not doweled. The crankshaft pulley is secured to the front end of the crankshaft by a special washer and bolt. The crankshaft gear is keyed and pressed onto the rear end of the crankshaft and drives the camshaft gear through the idler gear.

7-40. Crankshaft, Main Bearings, Pulley, and Timing Gear

a. Removal.

(1) Remove the engine (para 5-9).

(2) Remove the oil pan and oil pump assembly (para 7-28 and 7-29).

(3) Remove the flywheel and flywheel housing (para 7-31 and 7-32).

(4) Remove the cylinder head (para 7-25).

(5) Remove connecting rod bearing caps (para 7-42).

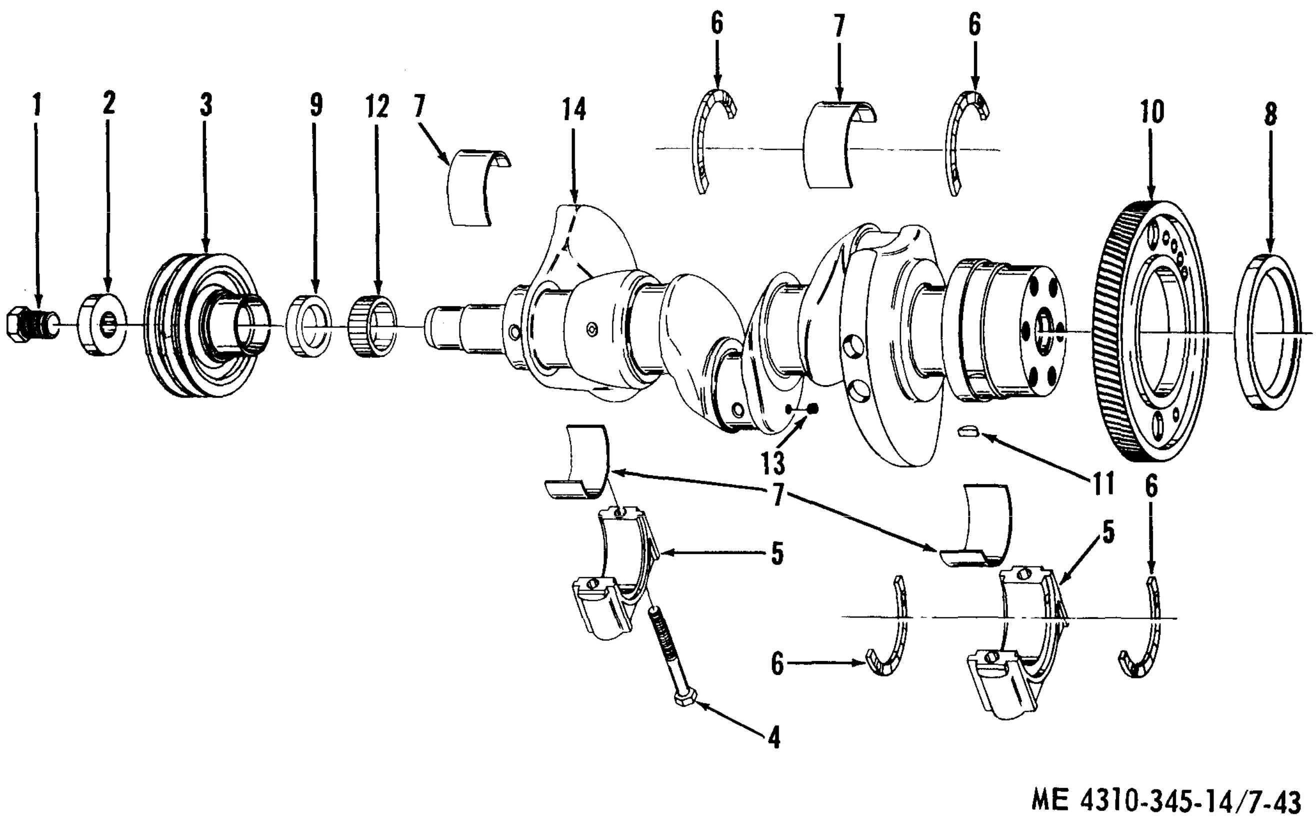
(6) Remove the main bearing caps (para 7-45).

(7) Remove the pistons and connecting rods (para 7-42).

(8) Remove the crankshaft, including the timing gear.

b. Disassembly.

(1) Disassemble crankshaft, main bearing, pulley, and timing gear in numerical sequence shown in figure 7-43.



1. Bolt
2. Retainer
3. Pulley
4. Bolt (10)
5. Bearing cap (5)
6. Thrust washer (4)
7. Shell set (5)
8. Rear seal
9. Front seal
10. Timing gear
11. Key
12. Oil pump gear
13. Plug
14. Crankshaft

Figure 7-43. Crankshaft, main bearings, pulley, and timing gear, disassembly and reassembly.

(2) Attach bar type puller to crankshaft gear as shown in figure 7-44. Turn the center screw of the puller to remove timing gear from crankshaft.

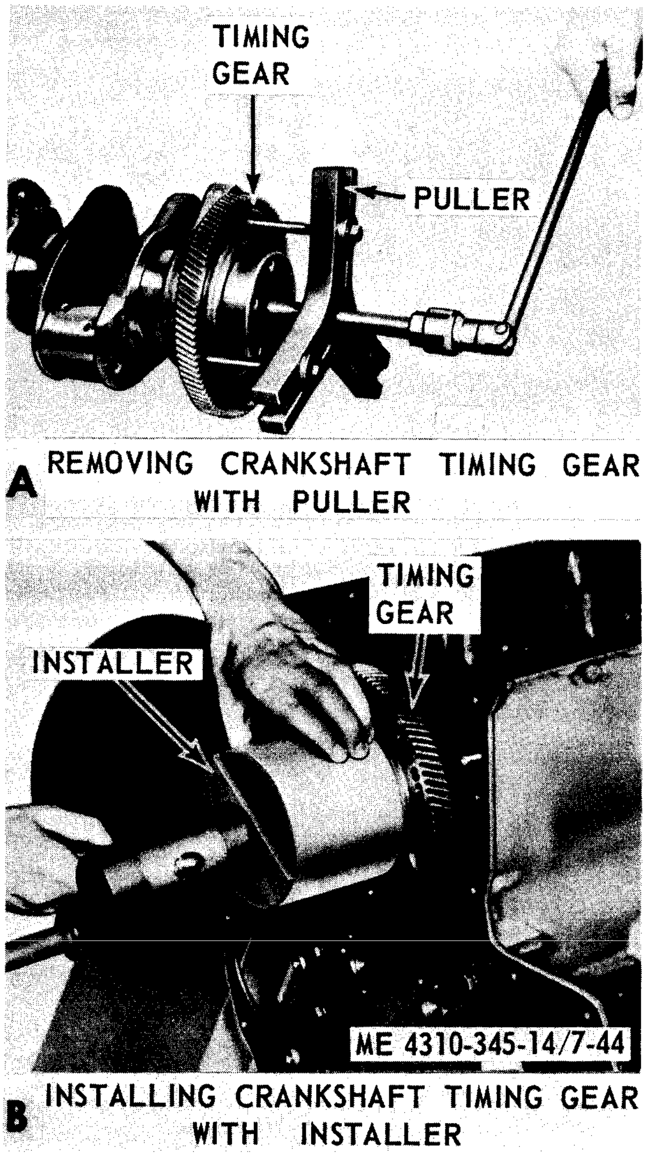


Figure 7-44. Crankshaft timing gear, removal and installation.

(3) Thread the crankshaft pulley retainer bolt in the end of the crankshaft. Attach the jaws of a suitable gear puller behind the oil pump drive gear. Locate the end of the puller screw in the center of the pulley retainer bolt. Turn the puller screw and remove the oil pump drive gear as shown in figure 7-45.

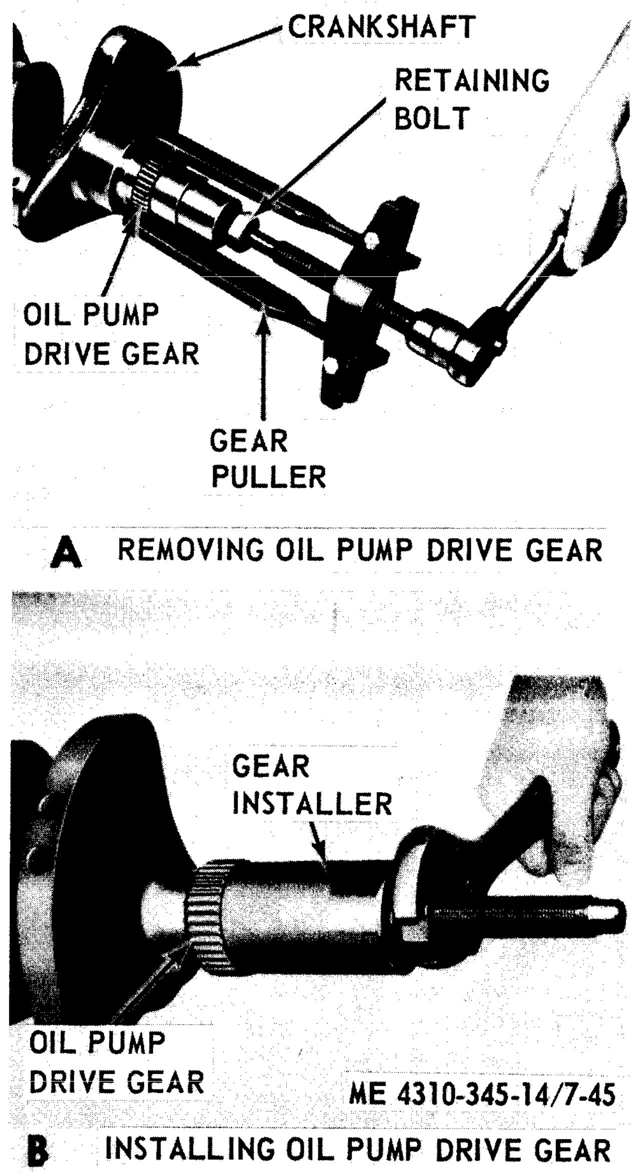


Figure 7-45. Oil pump drive gear, removal and installation,

(4) To remove oil seal from engine front cover, support the forward face of the front cover on two wood blocks next to the oil seal bore. Press or drive the oil seal out of the cover and discard the oil seal.

(5) To remove oil seal from flywheel housing, support the forward face of the flywheel housing on two wood blocks next to the oil seal bore. Press or drive the oil seal out of the flywheel housing and discard the oil seal.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts in accordance with paragraph 5-5 *f*.

(2) Clean out the oil passages thoroughly with a stiff wire brush.

(3) Inspect keyways for evidence of cracks or wear.

(4) If crankshaft shows evidence of excessive overheating, replace the crankshaft.

(5) Inspect main bearing journals for ridging. Remove ridges exceeding 0.0002 inch by working crocus cloth, wet with fuel oil, around the journal. If ridges are greater than 0.0005 inch, first use 120 grit emery cloth; then, 240 grit emery cloth to finish, and wet crocus cloth to polish. If ridges are greater than 0.001 inch, refinish crankshaft in accordance with paragraph *d* below.

(6) Inspect oil seal journals for ridges, rough, or grooved condition. Remove slight ridges with emery cloth or crocus cloth in the same manner as detailed above for main bearing journals. If ridging is excessive, refer to paragraph d below and install an oil seal sleeve on the crankshaft.

(7) Inspect crankshaft thrust surfaces for excessive wear or grooving. If only slightly worn, dress the surfaces with a dressing stone. Otherwise, refinish crankshaft in accordance with paragraph d below.

(8) Inspect oil pump drive gear and crankshaft timing gear for worn or chipped teeth, cracks, or any other defect.

(9) Support crankshaft on the front and rear journals placed on V-blocks or in a lathe and check alignment of adjacent intermediate main journals with a dial indicator. Maximum runout must not exceed 0.002 inch total indicator reading.

(10) Measure main and connecting rod bearing journals. Measure journals at several places so that taper, out-of-round, and bearing clearances can be determined. Maximum connecting rod journal-to-bearing shell clearance is 0.0045 inch. Maximum main bearing journal-to-bearing shell clearance is 0.0040 inch. Taper or out-of-round shall not exceed 0.003 inch. If these clearances are exceeded, refinish crankshaft in accordance with paragraph d below.

(11) Inspect oil seals for nicks, cuts, distortion, or any other defect.

(12) Inspect main bearing shells for scoring, pitting, etching, and dirt grooving. If any of these defects are detected, replace bearing shells.

(13) Measure thickness of main bearing shells at a point 90° from the parting line. Minimum thickness is 0.123 inch. If thickness is thinner, replace bearing shells.

(14) Inspect pulley for cracks, breaks, chips, or any other defect.

d. Refinishing Crankshaft. In addition to the standard size main and connecting rod bearings, 0.002, 0.010, 0.020, and 0.030 inch undersize bearings are available for use after the crankshaft is reground. Regrind crankshaft as follows:

NOTE

The 0.002 inch undersize bearings are used only to compensate for slight wear on crankshafts on which regrinding is unnecessary.

(1) Compare the crankshaft journal measurements taken during inspection with the dimensions in table 7-2 and figure 7-46 and determine the size to which the journals are to be reground. Measurement of the crankshaft journals, and comparison of these measurements to the diameters required for various undersize bearings shown in figure 7-46 and table 7-2, will determine the size to which the crankshaft journals shall be reground.

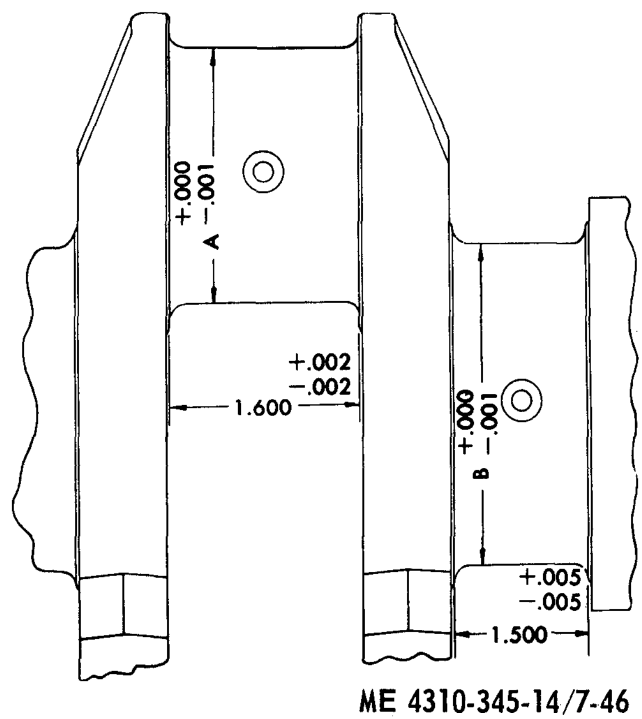


Figure 7-46. Crankshaft journal dimensions.

Table 7-2. Crankshaft Bearing Selection

Bearing size	Connecting rod journal diameter	Main bearing journal diameter
Standard	2.500 inches	3.000 inches
0.002 inch undersize	2.500 inches	3.000 inches
0.010 inch undersize	2.490 inches	2.990 inches
0.020 inch undersize	2.480 inches	2.980 inches
0.030 inch undersize	2.470 inches	2.970 inches

(2) If one or more main or connecting rod journals require grinding, then grind all of the main journals or all of the connecting rod journals to the same required size.

(3) All journal fillets on the crankshaft must have a 0.130 to 0.160 inch radius between the

crank cheek and the journal, and must not have any sharp grind marks (fig. 7-47). The fillet shall blend smoothly into the journal and the crank cheek, and shall be free of scratches. The radius may be checked with a fillet gage.

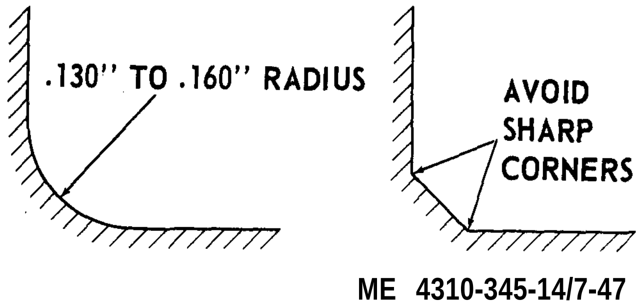


Figure 7-47. Crankshaft journal fillets.

(4) Care shall be taken to avoid localized heating which often produces grinding cracks. Cool the crankshaft while grinding, using coolant generously. Do not crowd the grinding wheel into the work.

(5) Polish the ground surfaces to an 8-12 R.M.S. finish. The reground journals will be subject to excessive wear unless polished smooth.

(6) If the thrust surfaces of the crankshaft are worn or grooved excessively, they must be reground and polished. Care shall be taken to leave a 0.130 to 0.160 inch radius between each thrust face and journal (fig, 7-47).

(7) Using crocus cloth smooth the edge of all oil holes in the journal surfaces smooth to provide a radius of approximately 3 / 32 inch.

(8) After grinding, inspect the crankshaft by the magnetic particle method, Military Specifiaction MIL-I-6868, or equivalent, to determine whether cracks have originated due to the grinding operation. Demagnetize the crankshaft.

(9) Remove the plugs and clean the crankshaft and the oil passages thoroughly with fuel oil. Dry with compressed air and reinstall the plugs.

(10) When a reground, or a new, crankshaft is installed, *allnew* main and connecting rod bearing shells and new thrust washers must be installed. Select thrust washer from table 7-3, main bearings from table 7-4, and connecting rod bearings from table 7-5.

Table 7.3. Thrust Washer Selection

Normal size	Thrust washer thickness	
	Minimum	Maximum
Standard	0.1190 inch	0.1220 inch
0.005 inch oversize	0.1255 inch	0.1270 inch
0.010 inch oversize	0.1300 inch	0.1320 inch

Table 7-4. Main Bearing Selection

Normal size of bearing	Minimum new bearing shell thickness	Crankshaft main bearing journal diameter
Standard	0.1245 inch	2.999—3.000 inches
0.002 inch undersize	0.1255 inch	2.997—2.998 inches
0.010 inch undersize	0.1295 inch	2.989—2.990 inches
0.020 inch undersize	0.1345 inch	2.979—2.980 inches
0.030 inch undersize	0.1395 inch	2.969—2.970 inches

Table 7-5. Connecting Rod Bearing Selection

Nominal size of bearing	Minimum new bearing shell thickness	Crankshaft connecting rod journal diameter
Standard	0.1245 inch	2.499—2.500 inches
0.002 inch undersize	0.1255 inch	2.497—2.498 inches
0.010 inch undersize	0.1295 inch	2.489—2.490 inches
0.020 inch undersize	0.1345 inch	2.479—2.280 inches
0.030 inch undersiz	0.1395 inch	2.469—2.470 inches

(11) *Oil seal sleeves.* If excessive wear or grooving is present on the oil seal journals, install an oil seal sleeve to provide a replaceable wear surface for the seals. An oversize oil seal will then be required for use with the sleeve. Install oil seal sleeves as follows:

(a) Using crocus cloth, remove high spots from the rear oil seal contact surface of the crankshaft.

(b) Coat the area of the shaft where the sleeve will be positioned with shellac or an equivalent sealant.

(c) Drive the sleeve squarely on the shaft with crankshaft rear oil seal sleeve installer. (fig. 7-48.)

(d) Wipe off any excess sealant.

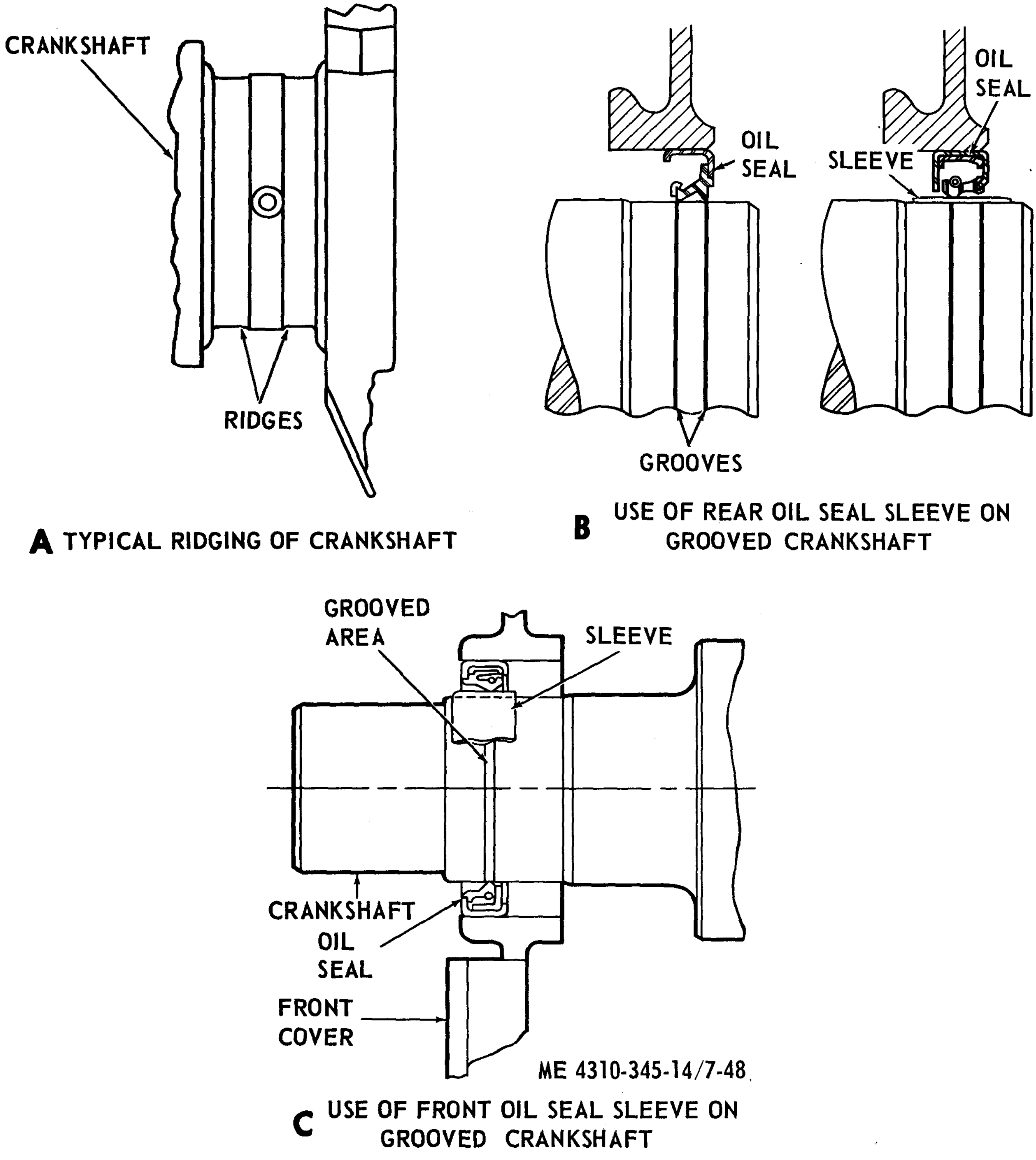


Figure 7-48. Oil seal sleeves, installation.

(e) Using crocus cloth, remove high spots from the front oil seal contact surface of the crankshaft.

(f) Coat the area of the shaft where the sleeve will be positioned with shellac or an equivalent sealant.

(g) Position the sleeve on the crankshaft with the radius on the sleeve facing away from the engine.

(h) Press the sleeve squarely on the crankshaft with front oil seal sleeve installer and the crankshaft pulley retaining bolt. (fig. 7-48)

(i) Wipe off any excess sealant.

(j) To remove a worn sleeve, peen the sleeve

until it stretches sufficiently so that it can be slipped off of the shaft.

e. Reassembly.

(1) Reassemble oil seal in flywheel housing using installer as follows:

(a) Support the inner face of the flywheel housing in an arbor press.

(b) Coat the outside diameter of the oil seal with a non-hardening sealant.

CAUTION

Keep the lip of the oil seal clean and free of scratches.

(c) Apply grease to the lip of the oil seal. Position the seal in the flywheel housing bore with the lip of the seal pointing toward the inner face of the housing.

(d) Press the oil seal into the flywheel housing until the seal is flush with the outside face of the housing.

(e) Remove all excess sealant from the housing and the seal.

(2) Reassemble oil seal in engine front cover using installer as follows:

(a) Coat the cover bore or outside diameter of the seal with a non-hardening sealant.

(b) Apply grease to the lip of the oil seal. Position the seal in the cover with the lip of the seal pointing toward the inner face of the cover.

(c) Place the cover in an arbor press with inner face down. Press the oil seal into the cover until the seal is flush with the outside face of the cover.

(3) Reassemble the oil pump drive gear on the crankshaft as follows:

(a) Lubricate the inside diameter of the oil pump drive gear with engine oil. Start the new gear straight on the crankshaft. Reassembly of used gear is not recommended.

(b) Position drive gear installer over the end of the crankshaft and against the drive gear and force the gear in place as shown in figure 7-44. When the end of the bore in the tool contacts the end of the crankshaft, the drive gear is correctly positioned.

(c) Check the press fit (slip torque) with a tool. The drive gear shall not skip on the crankshaft at 100 lb-ft torque.

CAUTION

Do not exceed this torque. If the gear slips on the shaft, install another oil pump drive gear.

(4) Reassemble crankshaft timing gear on rear end of crankshaft as follows:

(a) Install key in crankshaft keyway.

(b) Start the timing gear over the end of the crankshaft with the timing marks on the outer rim of the gear facing out and keyway of gear aligned with key in crankshaft. Place installer against the rear face of the timing gear and drive the gear up against the shoulder on the crankshaft as shown in figure 7-44.

(5) Reassemble crankshaft, main bearings, and pulley in reverse numerical sequence shown in figure 7-43.

f. Installation.

(1) Install upper grooved bearing shells in the block. If old bearing shells are to be used again, install them in the same location from which they were removed.

(2) Apply clean engine oil to all crankshaft journals and install the crankshaft in place so that the timing marks on the crankshaft timing gear and idler gear match correctly (para 7-35).

(3) Install upper half of crankshaft thrust washers on each side of the rear main bearing support and the doweled lower halves on each side of the rear main bearing cap. The grooved side of the thrust washers must face toward the crankshaft thrust surfaces.

(4) Install lower bearing shells in bearing caps. If old bearing shells are to be used again, install each in the same bearing cap from which they were removed. Lubricate the cap bolt threads and bold head contact surface with a small quantity of International Compound No. 2, or equivalent. Install bearing caps and draw the bolts up snug. Rap the caps sharply with a soft hammer to seat them properly.

(5) Tighten the bearing cap bolts uniformly starting with the center cap and working alternately toward both ends of the block. Tighten to 120-130 lb-ft torque. Rotate crankshaft to make certain that it rotates freely.

(6) Check crankshaft end play by moving the crankshaft toward a dial indicator setup as shown in figure 7-49 with a screwdriver of pry bar. Keep a constant pressure on the pry bar and set the dial indicator at zero. Remove the pry bar from this position and insert the pry bar on the other side of the bearing cap. Force the crankshaft in the opposite direction and note the amount of end play on the dial. Endplay shall be 0.004 to 0.011 inch with new parts or maximum of 0.018 inch with used parts.

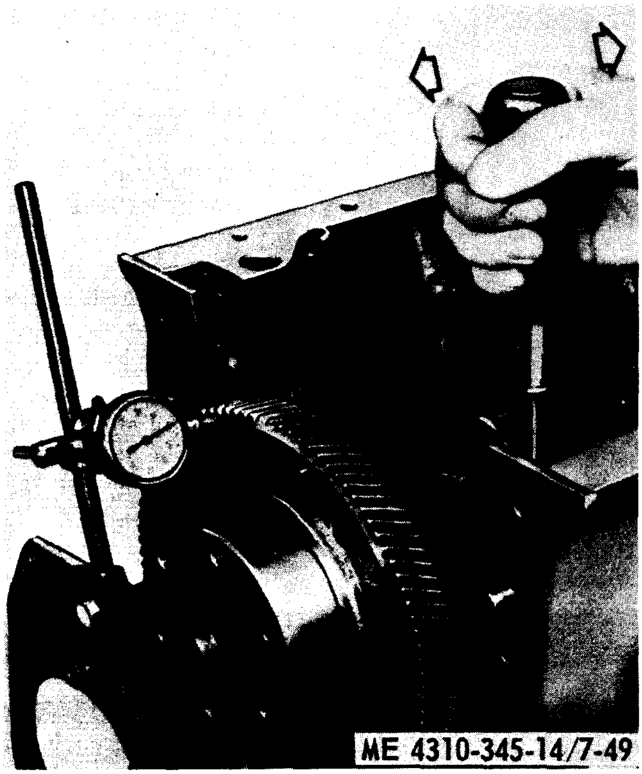


Figure 7-49. Checking crankshaft end play.

(7) Install pistons and connecting rods (para 7-42).

(8) Install connecting rod bearing caps (para 7-42).

(9) Install cylinder head (para 7-25).

(10) Install flywheel housing and flywheel (para 7-32 and 7-31).

(11) Install the oil pump assembly and oil pan (para 7-29 and 7-28).

(12) Install the engine (para 5-9).

section XVII. CONNECTING RODS, PISTONS, PISTON RINGS, AND CYLINDER LINERS

7-41. General.

The connecting rods are forged steel, "I" section type, with a closed hub at the upper end and a cap at the lower end. The rod is drilled to provide lubrication passage to the piston pin at the upper end and is equipped with an oil spray nozzle for cooling the underside of the piston head. A bushing is pressed into each side of the rod at the upper end. A cavity between the inner ends of these bushings forms a duct around the piston pin. A portion of the oil from this duct lubricates the piston pin and bushings; the remainder of the oil is forced out of the spray nozzle. The piston pin floats in both the piston and connecting rodbushings. The pistons are trunk type, malleable iron, plated with a protective coating of tin. The top of the piston forms the combustion chamber bowl and is so designed to compress the air in close proximity to the fuel spray. In addition to cooling by oil spray on underside of head, the pistons are cooled by fresh air from the blower to the top of the piston and indirectly by the water jacket around the cylinder. Two bushings are pressed into the piston to provide a bearing for the floating piston pin. The piston pin is retained in the piston, and the hole in each side of the piston sealed, by a steel retainer on each side of the piston. Each piston is fitted with six piston rings. Four compression rings are placed above the piston pin and two oil control rings placed below the pin to scrape off excess lubricating oil from the cylinder liner walls. The cylinder liners are the replaceable wet type and are a slip fit in the cylinder block. The liners are inserted in the cylinder bores from the top of the cylinder block. The flange of each liner rests on a counterbore in the top of the block. A synthetic rubber seal ring, recessed in the cylinder block bore, is used between the liner and the block to prevent water leakage into the air box. The upper portion of the liner is directly cooled by water surrounding the liner. The center portion of the liner is air cooled by the scavenging air which enters the cylinder through eighteen equally spaced ports. The angle of the ports in the cylinder liner creates a uniform swirling motion to the intake air as it enters the cylinder. This motion persists throughout the compression stroke and facilitates scavenging and combustion.

7-42. Connecting Rods, Pistons, and, Piston Rings

a. Removal.

(1) Remove the engine (para 5-9).

(2) Remove the cylinder head (para 7-25).

(3) Remove the oil pan (para 7-28).

(4) Remove the carbon from the upper inner surface of the cylinder liner.

(5) If there is a ridge in the cylinder liner at the top of the piston ring travel, remove the ridge with a ridge cutter.

NOTE

Move the piston to the bottom of its travel and place a cloth on top of the piston to collect the cuttings.

(6) After ridge is removed, turn the crankshaft until the piston is at the top of its stroke and carefully remove the cloth and the cuttings.

(7) Remove the connecting rod bearing cap and lower bearing shell. Push the piston and rod assembly out through the top of the cylinder block.

(8) Reassemble bearing cap and bearing shell to the connecting rod until ready for disassembly.

b. Disassembly.

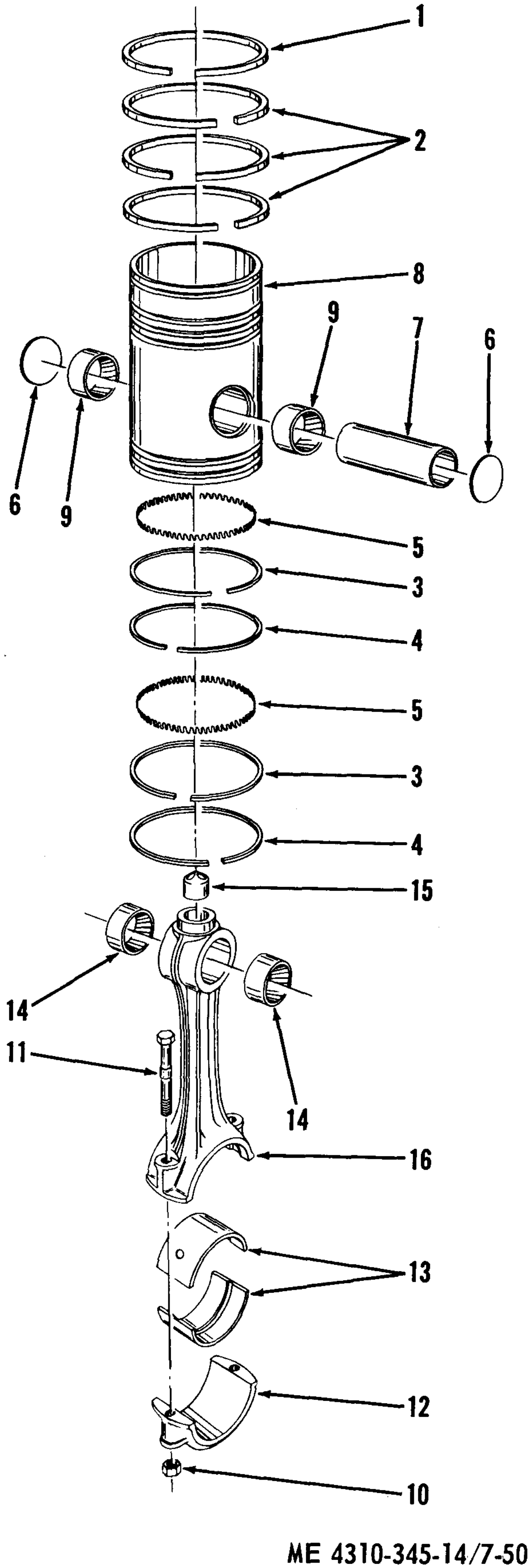
(1) Secure connecting rod in a vise equipped with soft jaws and remove the piston rings with ring removing tool.

(2) Punch a hole through the center of one of the piston ring retainers with a narrow chisel or punch and pry the retainer from the piston. Take care not to damage piston or bushings.

(3) Disassemble connecting rod, piston, and piston rings in numerical sequence shown in figure 7-50.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts in accordance with paragraph *5-5 f.*



1. Fire ring
2. Chrome ring (3)
3. Oil ring half (2)
4. Oil ring half (2)
5. Expander (2)
6. Retainer (2)
7. Pin
8. Piston
9. Bushing (2)
10. Nut (2)
11. Bolt (2)
12. Cap
14. Shell set
14. Bushing (2)
15. Nozzle
16. Rod

Figure 7-50. Connecting rod, piston, and piston rings. disassembly and reassembly.

(2) Wire brush the top of the piston and ring grooves, with care, to remove hard carbon deposits. Clean ring grooves with a suitable tool or piece of an old ring ground to a bevel edge. Clean oil return holes in the piston skirt with care to avoid enlarging holes.

(3) Inspect piston for scoring, evidence of overheating, cracks, damage to ring grooves, or any other defect.

(4) Inspect all piston rings for cracks, breaks, or any other defect.

(5) Inspect and measure piston pin and piston pin bushings. The piston pin-to-bushing clearance shall not exceed 0.010 inch.

(6) Repair piston pin bushings in the following manner:

(a) Place piston in a holding fixture so that bushing bores are aligned with the hole in the fixture base.

(b) Drive each bushing from the piston with bushing remover and handle as shown in figure 7-51.

Figure 7-51. Piston pin bushings, removal and installation.

(c) Place the spacer in the counterbore in fixture, small end up.

(d) Place the piston on the fixture so that the spacer protrudes into the bushing bore.

(e) Insert installer in a bushing; position bushing and installer over the lower bushing bore.

NOTE

Locate the bushing joint toward the bottom of the piston.

(f) Insert handle in bushing installer and drive the bushing in until it bottoms on the spacer.

(g) Install the second bushing in the same manner.

(h) Clamp reaming fixture in a vise. Insert guide bushing in the fixture and secure it with the setscrew.

(i) Place piston in the fixture and insert the pilot end of the reamer through the clamping bar, bushings, and into the guide bushing.

(j) Tighten wing nuts securely, with piston fixture and reamer aligned.

(k) Ream the bushings by turning the reamer in a clockwise direction only, when reaming or withdrawing the reamer. Use only moderate pressure.

(l) Withdraw reamer and remove the piston from the fixture. Blow out the chips and check the inside diameter of the bushings. The inside diameter shall be 1.3775 to 1.3780 inches.

(7) Repair connecting rod bushing and spray nozzle in the following manner:

(a) Clamp the upper end of the connecting rod in holder so that the bore in the bushing is aligned with the hole in the base. Refer to figure 7-52.

(b) Set bushing remover in the connecting rod bushing, insert handle in the remover and drive the bushings from the rod.

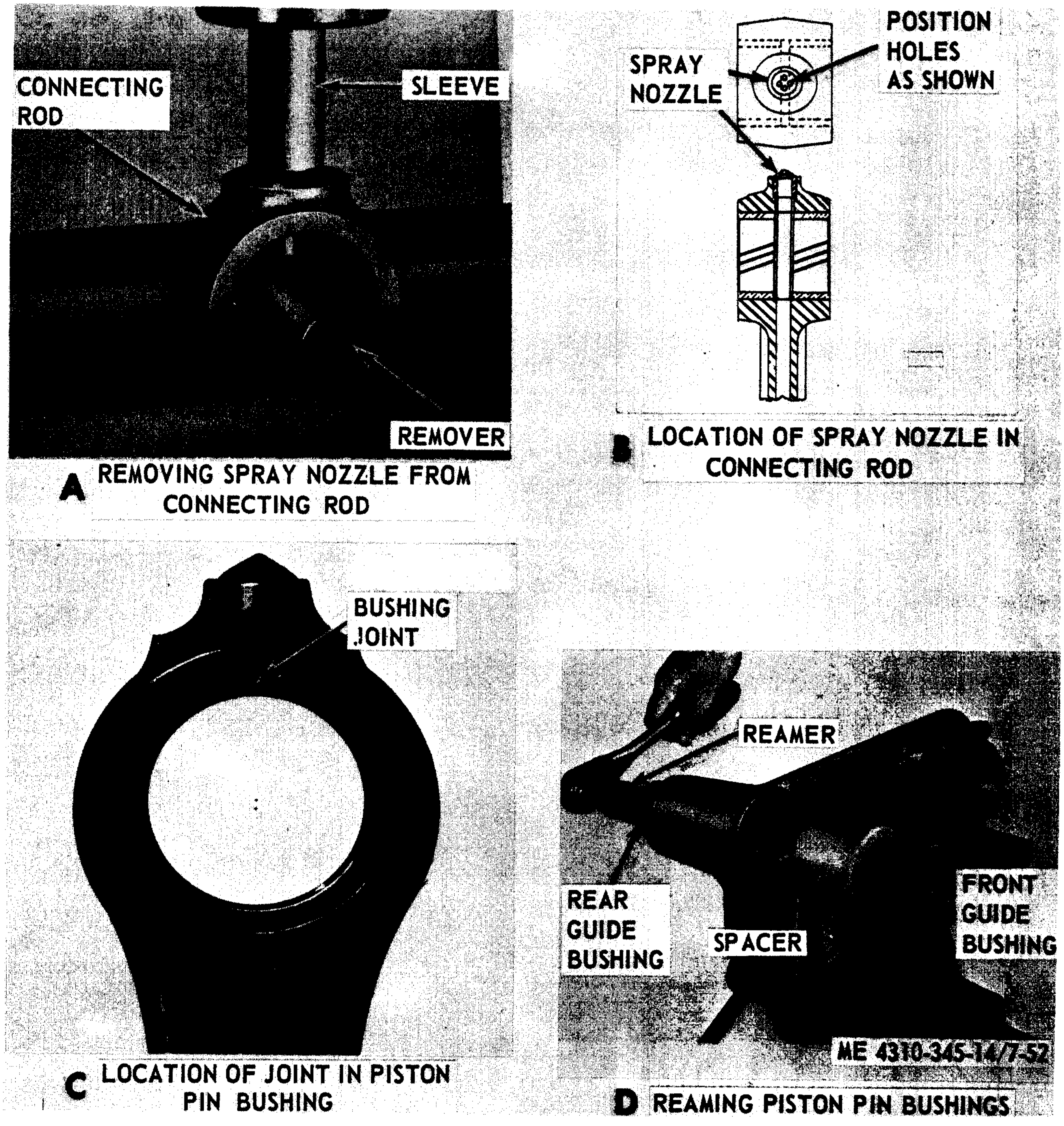


Figure 7-52. Connecting rod bushings and spray nozzle, removal and installation.

(c) If necessary to replace spray nozzle, replacement is accomplished with bushings removed as described above; then, place the connecting rod, nozzle remover, and a short sleeve in an arbor press as shown in figure 7-52.

NOTE

The orifice in the lower end of the drilled passage in the rod is not serviced separately, and it is not necessary to remove it when replacing the spray nozzle.

(d) Press the spray nozzle out of the connetting rod.

(e) Start the new spray nozzle, with holes positioned as shown in figure 7-52, straight into the counterbore in the top of the rod.

(f) Support the rod in an arbor press. Place a short, 3/8 inch inside diameter sleeve on top of the spray nozzle and under the ram of the press.

(g) Press the spray nozzle into the rod until it bottoms in the counterbore.

(h) To install connecting rod bushings, clamp upper end of the rod in holder so that the bore for the bushings align with the hole in the base of the holder.

(i) Start a new bushing straight into the bore of the rod.

NOTE

When installing a bushing in the rod, locate the bushing joint at the top of the rod, refer to figure 7-52.

(j) Insert installer in the bushing. Insert handle in the installer and drive the bushing into the rod until the flange of the installer bottoms on the rod.

(k) Turn the connecting rod over in the holder and install the second bushing in the same manner.

(1) Clamp reaming fixture in a vise. Place the crankshaft end of the rod on the arbor of the fixture. Tighten the nuts on the cap bolts to 40-45 lb-ft torque.

(m) Install the front guide bushing in the fixture (pin end out). Install spacer in the fixture.

(n) Align upper end of the rod with the hole in the reaming fixture.

(o) Install the rear guide bushing on the reamer. Slide the reamer and bushing into the fixture.

(p) Turn the reamer in a clockwise direction only, when reaming or withdrawing the reamer.

(q) Remove the reamer and the connecting rod from the fixture, blow out the chips and measure the inside diameter of the bushings. The diameter shall be 1.3760 to 1.3765 inches.

(8) *Fitting piston*. Piston and cylinder liner measurements should be taken at room temperature (70° F) as follows:

(a) Measure piston skirt diameter. The diameter of a new piston from a point 1.750 inches from the top to the bottom of the piston is 3.8693 to 3.8715 inches, except near the piston pin bore. The inside diameter of a new cylinder liner is 3.8752 to 3.8767 inches. Therefore, with new parts, piston-to-liner clearance is 0.0037 to 0.0074 inch and shall not exceed 0.010 inch with used parts.

(b) Check piston-to-liner clearance in four places, 90° apart, while holding the piston upside down in the cylinder liner as shown in figure 7-53.

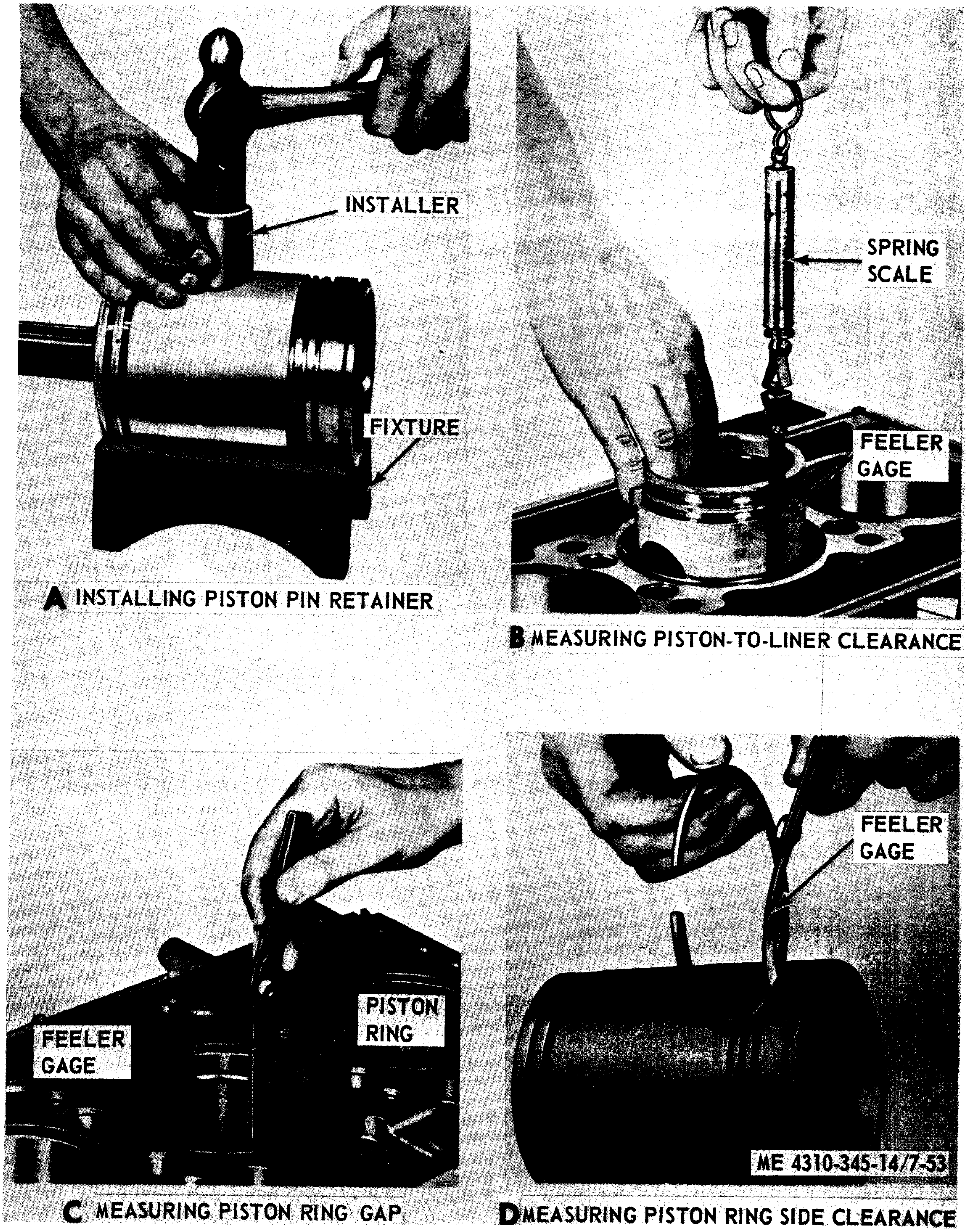


Figure 7-53. Pistons and piston rings, fitting to cylinder liner.

(c) Use a feeler gage to check clearance. Use a spring scale attached to feeler gage to measure force in pounds required to withdraw feeler gage.

(d) The clearance will be 0.001 inch greater than the thickness of feeler gage used, i.e., a 0.004 inch gage will indicate 0.005 inch clearance when it withdraws at a pull of six pounds. The gage must be perfectly flat and free of nicks and bends.

(e) Remove any burrs causing binding with a fine hone (flat hone preferred).

(9) *Fitting piston rings.* Use new piston rings whenever a piston is removed for inspection or replacement. Check piston ring gap and side clearance as follows:

(a) Insert one ring at a time into the cylinder liner to a depth within the normal area of ring travel. Use a piston to push the ring down to be sure it is parallel with the top of the liner. Measure the ring gap with a feeler gage as shown in figure 7-53. Ring gap specifications are:

Compression rings	0.0200 to 0.0360 inch
Wear limit	0.060 inch
Oil rings	0.0100 to 0.250 inch
Wear limit	0.044 inch

(b) If ring gap is below limits, the gap may be increased by filing or stoning the ring in a direction from the outside surface of the ring toward the inside surface. This will prevent chipping or peeling of the plating. The ends of the ring shall remain square and the chamfer shall be approximately 0.015 inch on the outer edge.

(c) Check the ring clearances in the piston grooves as shown in figure 7-53. Ring clearances shall be as follows:

Top compression (fire) ring	0.003-0.006 inch
Wear limit	0.012 inch
Second compression ring	0.007-0.010 inch
Wear limit	0.014inch
Third and Fourth compression ring	0.005-0.008 inch
Wear limit	0.013 inch
Upper and lower oil control ring	0.0015-0.0055 inch
Wear limit	0.008 inch

d. Reassembly.

(1) Reassemble connecting rods, pistons, and piston rings in reverse numerical sequence shown in figure 7-50 and the following specific procedures.

(2) Apply clean engine oil to the piston pin and bushings. Rest the piston in holding fixture with piston pin hole perpendicular to the fixture.

(3) Place a new piston pin retainer in the piston. Place the crowned end of installer on the retainer and strike the tool with a hammer just hard enough to deflect the retainer and seat it evenly.

CAUTION

Do not drive too hard on the retainer or the bushing may be moved inward and result in reduced piston pin end clearance.

(4) Reassemble piston pin into the piston and upper end of the connecting rod. Install the second retainer as outlined above.

(5) Check piston pin end clearance by cocking the connecting rod on the pin and shifting the pin in its bushing.

(6) To check the retainers for proper sealing, place the piston and connecting rod assembly upside down on a bench. Pour clean fuel oil in the piston to a level above the piston pin bosses.

(7) Dry the external surfaces of the piston in the area around the retainers and allow the fuel oil to set for approximately fifteen minutes.

(8) Check for seepage of fuel oil around the retainers. If leakage occurs, install new retainers.

(9) Empty fuel oil from the piston, dry the parts with compressed air and lubricate the piston pin with clean engine oil.

(10) Lubricate the piston rings and piston with clean engine oil. Assemble the compression rings on the piston with ring tool. Stagger the ring gaps around the piston.

(11) Install the oil control rings by hand, with the scraping edge of each ring down, as follows:

(a) Install an expander in the upper oil ring groove, being careful not to overlap the ends.

CAUTION

The expander must be completely seated in the oil ring groove. The ends of the expander can very easily be overlapped. If this occurs, the oil control rings will protrude slightly and be broken when the ring compressor is installed over the piston, or when the piston and rod assembly is installed in the cylinder liner.

(b) Install the top oil ring with the gap 180° from the ends of the expander. Recheck the ends of the expander to make certain that they are not overlapped.

(c) Install the bottom oil ring with the gap 45° from the gap of the top oil ring. Recheck the ends of the expander for overlapping.

NOTE

Do not, at any time, cut off or grind the ends of the oil ring expander to prevent the ends from overlapping. Cutting *or* grinding the ends will decrease the tension on the oil control rings.

(d) Install the second set of oil control rings and expander in the same manner as described above.

e. Installation.

(1) Remove connecting rod bearing cap and lower bearing shell.

(2) Install connecting rod and piston assembly into the proper cylinder as indicated by the marking on bearing cap.

(3) Rotate the crankshaft until the connecting rod journal for the particular cylinder is at the bottom of its travel. Wipe the journal clean and lubricate with clean engine oil.

(4) Lubricate the connecting rod bearing shells with clean engine oil and push or pull the piston and connecting rod assembly down until upper bearing shell seats firmly on the crankshaft journal.

NOTE

Make certain that the identification number on the connecting rod is facing the serial number side of the engine block.

(5) Assemble the lower bearing shell and rod bearing cap on the connecting rod with the number on the cap and the rod adjacent to each other. Tighten the nuts on the connecting rod bolts to 40-45 lb-ft torque.

(6) Check the connecting rod side clearance. The clearance between the side of the rod and the crankshaft shall be 0.006 to 0.012 inch.

(7) Install the oil pan (para 7-28).

(8) Install the cylinder head (para 7-25).

(9) Install the engine (para 5-9).

7-43. Cylinder Liners

a. Removal.

(1) Remove connecting rods, pistons, and piston rings (para 7-42).

(2) Remove the cylinder liners from the block as shown in figure 7-54 and the following steps:

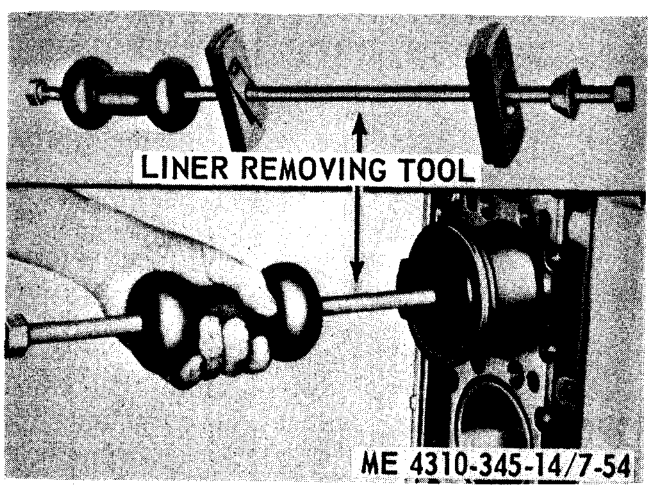


Figure 7-54. Removing cylinder liner.

(a) Using liner removing tool, slide the lower puller clamp up the puller rod and off its tapered seat. Cock the clamp so it will slide down through the liner. The clamp will drop back onto its seat in a horizontal position after it clears the bottom of the liner.

(b) Slide the upper puller clamp down against the top edge of the liner.

(c) With the tool in place, strike the upset head on the upper end of the puller rod a sharp blow with the puller weight, thus releasing the liner. Remove the liner.

(d) Remove the cylinder liner seal ring from the groove in the cylinder block bore.

b. Cleaning, Inspection, and Repair.

(1) Clean cylinder liner in accordance with paragraph 5-5 *f*.

(2) Inspect cylinder liner for cracks, excessive scoring, chipping or nicks on sealing flange.

(3) Install the liner in the cylinder block and measure inside diameter of liner at the various points shown in figure 7-55. If taper exceeds 0.002 inch or the out-of-round exceeds 0.0.03 inch, replace the liner. Use dial bore gage which has a dial indicator calibrated in 0.0001 inch increments. Set the gage on zero with a master ring.

NOTE

A dial bore gage master setting fixture may be used in place of a master ring.

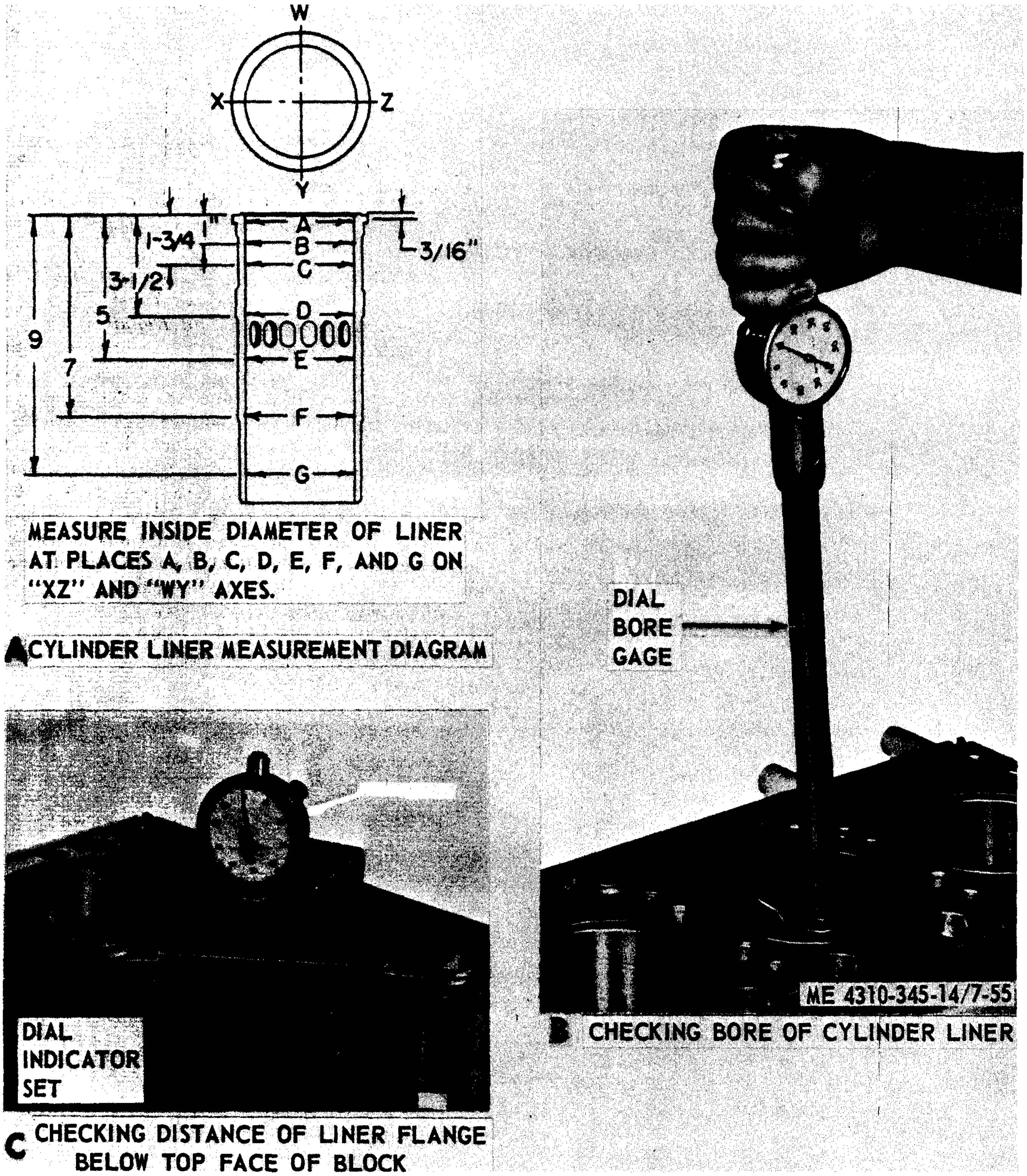


Figure 7-55. Cylinder liner inspection.

(4) *Honing used cylinder liner.* If the taper or out-of-round do not exceed the limits, hone the liner to remove any step or ridge at the top of the ring travel and to remove the glaze caused by rubbing action of the piston rings in the following manner.

(a) Place the liner in appropriate fixture (a scrap cylinder block makes an excellent honing fixture).

(b) Work the hone, equipped with 120 grit stones, up and down the full length of the liner a

few times so a “criss-cross” pattern with the hone marks on a 45° axis will result.

(c) After honing, remove liner from fixture and clean thoroughly. Dry with compressed air and check entire surface for burrs. The liner must conform to the same limits on taper and out-of-round as a new liner. Piston-to-liner clearance shall be within the specified limits (table 5-2).

(5) *Inspecting new cylinder liner.* Install new cylinder liner and measure as described in step 3 above. Dimensions for a new liner are:

Inside diameter . . . . 3.8752 to 3.8767 inch
Straight from top to
bottom within . . . . 0.001 inch total indicator reading
Round within . . . . 0.002 inch total indicator reading
Piston-to-liner clearance 0.0037 to 0.0074 inch

NOTE

Do not modify the surface finish in a new liner. The liner is properly finished at the factory and any change will adversely affect the seating of the piston rings.

(6) *Fitting cylinder liner in cylinder block bore.* Check the fit of each cylinder liner with respect to flange seat as follows:

(a) Clean the inside and outside of the liner, and the cylinder block bore and counterbore thoroughly. Slide the liner into the block until the liner flange rests on the bottom of the counterbore in the block.

CAUTION

Do not drop or slam the liner flange against the bottom of the counterbore in the block.

(b) Tap the liner lightly with a soft hammer to make certain the liner flange seats on the bottom of the counterbore.

(c) Clamp the liner in place with holddown clamp and measure the distance from the top of the liner flange to the top of the block with dial indicator set. Refer to figure 7-55. The top of the liner flange shall be 0.0465 to 0.050 inch below the top of the block, and there shall not be more than 0.0015 inch difference between any two adjacent liners when measured along the cylinder longitudinal center line. If the above limits are not met, install the liner in another bore and recheck, or use another liner.

(d) Matchmark the liner and the block with chalk or paint, so the liner may be reinstalled in the same position in the same bore. Place the matchmark on the engine serial number side of the block. Remove the holddown clamp and the liner.

c. Installation.

(1) Assemble connecting rod, piston, and piston rings (para 7-42 *d).* Apply clean engine oil to the piston, rings, and the inside of the piston ring compressor.

NOTE

Inspect the ring compressor for nicks or burrs, especially at the non-tapered inside diameter end. Nicks or burrs on the inside diameter of the compressor will result in damage to the piston rings.

(2) Place the piston ring compressor on a wood block (tapered end up).

(3) Position (stagger) the piston ring gap properly on the piston. Make certain that the oil ring expanders are not overlapped.

(4) Start the top of the piston straight into the ring compressor; push the piston down until it contacts the wood block. Refer to Operation 1, figure 7-56.

Figure 7-56. Connecting rod, piston, and cylinder liner installation.

(5) Note the position of the matchmark on the liner and place the liner on the wood block.

(6) Place the ring compressor and piston and rod assembly on the liner, so the numbers on the rod and cap align with the matchmark on the liner, refer to Operation 2, figure 7-56.

NOTE

The numbers on the side of the rod and cap identify the rod with the cap and indicate the particular cylinder in which they were used. If new service connecting rod is to be used, the same identification numbers shall be stamped or etched in the same location as on the connecting rod that was replaced.

(7) Push the piston and rod assembly down into the liner until the piston is out of the ring compressor.

CAUTION

Do not force the piston into the liner. The peripheral abutment type expanders apply considerably more force on the oil ring than the standard expander. Therefore, extra care during loading operation shall be taken to prevent ring breakage.

(8) Remove the connecting rod cap and the ring compressor.

(9) Push the piston down into the liner until the compression rings pass the liner ports.

(10) Make certain that the seal ring grooves in the cylinder block are clean. Install the seal rings.

(11) Apply hydrogenated vegetable type shortening or permanent type antifreeze solution to the inner surface of the seal ring.

(12) If any of the pistons and liners are already in the engine, use holddown clamps (fig. 7-55) to retain the liners in place when the crankshaft is rotated.

(13) Rotate the crankshaft until the connetting rod journal of the particular cylinder being worked on is at the bottom of its travel. Wipe the journal clean, and lubricate it with clean engine oil.

(14) Install the upper bearing shell in the connecting rod. Lubricate the shell with clean engine oil.

(15) Hold the piston, rod, and liner in line with the cylinder block bore (fig. 7-56) so the identification number on the rod is facing the serial number side and align the matchmarks on the liner and block. Slide the entire assembly into the block bore and seal rings, being careful not to damage the seal rings.

(16) Pull or push the piston and connecting rod shown until the upper bearing shell seats firmly on the crankshaft journal. Use care so the bearing shell is not dislodged from the rod.

(17) Install lower connecting rod bearing shell in rod cap and install the bearing caps as described in paragraph 7-42 *e*.

(18) Remove the liner holddown clamps.

(19) Install the cylinder head (para. 7-25).

(20) Install the engine (para. 5-9).

Section XVIII. CYLINDER BLOCK, AIR BOX DRAIN, AND END PLATE

7-44. General

The cylinder block is a one-piece casting which forms the main structural part of the engine. Transverse webs provide rigidity and strength and ensure alignment of the block bores and bearings under load. The block is bored to receive replaceable wet-type cylinder liners. A water jacket surrounds the upper half of each cylinder liner. The water jacket and air box are sealed off by a seal ring compressed between the liner and a groove in the block. The camshaft and balance shaft bores are located near the top of the block on opposite sides. The upper halves of the main bearing supports are cast integeral with the block. The main bearing bores are line-bored with the bearing caps in place to ensure longitudinal alignment. Drilled passages in the block carry the lubricating oil to all moving parts of the engine, eliminating external piping, An opening in the side of the block opposite the blower permits access to the air box and inspection of the pistons and rings through the air inlet ports. An air box drain is provided to drain off collected condensate from the air box. This condensate is removed by the air box pressure through the drain tube. The top surface of the block is grooved to accommodate a block-to-head seal ring. Each water or oil hole is counterbored to provide for individual seal rings. Each cylinder liner is retained in the block by a flange at its upper end, which seats in the counterbore in the block bore. An individual compression gasket is used at each cylinder. When the cylinder head is installed, the individual gaskets and seal rings compress sufficiently to form a tight seal between the head and the block. A flat steel plate is bolted to the rear end of the cylinder block to provide a means of attaching the flywheel housing.

7-45. Cylinder Block, Air Box Drain, and End Plate

a. Removal and Disassembly.

(1) Remove the engine (para. 5-9).

(2) Remove the generator (para. 7-2).

(3) Remove the starting motor (para. 7-6).

(4) Remove the fuel pump and drive (para. 7-10).

(5) Remove the governor assembly (para. 7-12).

(6) Remove the engine oil cooler (para. 7-16).

(7) Remove the fresh water pump and idler pulley assemblies (para. 7-18 and 7-19).

(8) Remove the fan drive group (para. 4-69).

(9) Remove the primary fuel filter assembly (para. 4-83).

(10) Remove the secondary fuel filter assembly (para. 4-84).

(11) Remove the engine oil filter assembly (para. 4-89).

(12) Remove the exhaust manifold **(para. 4-**101).

(13) Remove the blower and blower drive support (para. 7-22 and 7-23).

(14) Remove the cylinder head (para 7-25).

(15) Remove the oil pan and oil pump assembly (para. 7-28 and 7-29).

(16) Remove the flywheel and flywheel housing (para 7-31 and 7-32).

(17) Remove the balance weights (para 7-34).

(16) Remove the camshaft and balance shaft (para 7-38).

(19) Remove the crankshaft, main bearings, pulley, and timing gear (para 7-40).

(20) Remove connecting rods, pistons, and cylinder liners (para 7-42 and 7-43).

(21) Remove the air box drain, end plate, inspection covers, and other cylinder block component parts in the numerical sequence shown in figure 7-57.

b. Cleaning, Inspection, and Repair.

(1) Make certain that all plugs, except cup plugs, have been removed, Scrape all old gasket material from the block.

(2) Clean the, block with live steam. Make certain that the oil galleries, air box floor, and air box drain openings are thoroughly cleaned. Dry the block with compressed air.

KEY to figure 7-57:

1. Thrust washer
2. Idler gear
3. Bearing
4. Bolt
5. Hub
6. Thrust washer
7. Bolt (13)
8. Lockwasher (13)
9. End plate
10. Gasket
11. Nut
12. Drain
13. Elbow
14. Bolt (6)
15. Lockwasher (6)
16. Cover
17. Gasket
18. Bolt (2)
19. Lockwasher (2)
20. Cover
21. Gasket
22. Draincock
23. Dowel (4)
24. Plug, 1/8" (6)
25. Plug, 1/4"
26. Plug, 5/8" (2)
27. Cylinder block

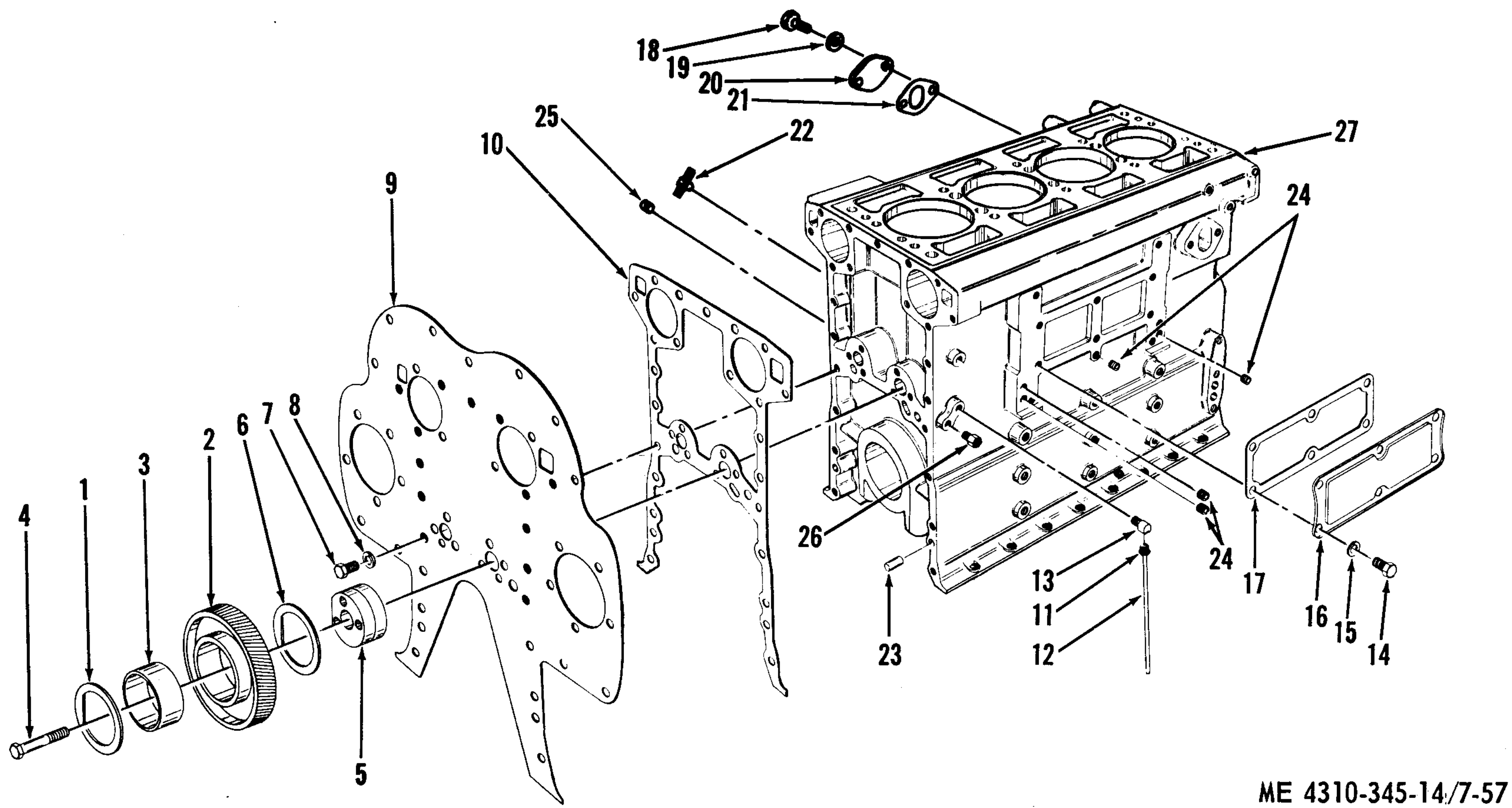


Figure 7-57. Cylinder block, air box drain, and end plate, disassembly and reassembly.

(3) Inspect the block for cracks or leaks by pressure testing in accordance with one of the following two methods. Make a cover for the top of the block from 1 / 2 inch steel plate to cover all of the cylinder bores. Use the cover with the cylinder liner compression gaskets and water hole seal gaskets. Use water hole cover plates and gaskets to seal water inlet openings in the side of the block. Drill and tap one of the cover plates to provide for an air line so the water jacket can be pressurized. Refer to figure 7-58.

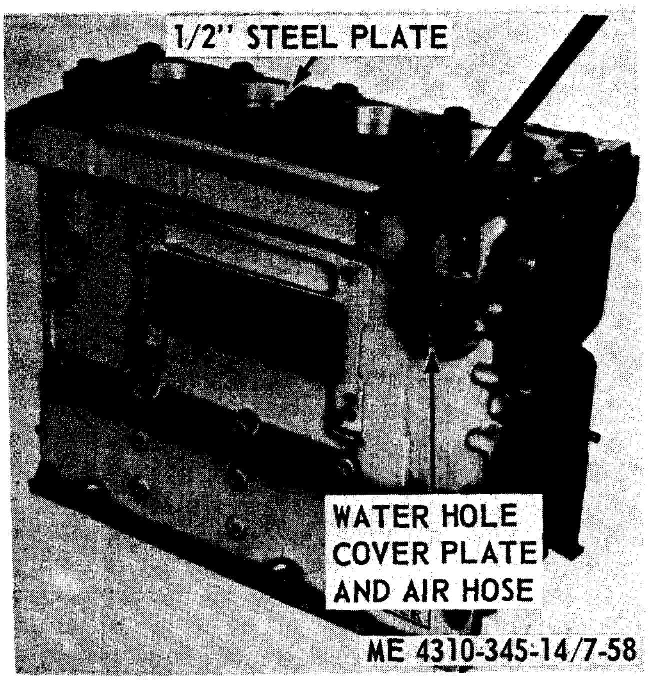


Figure 7-58. Cylinder block pressure test setup.

(a) Method A. Use this method when a water tank large enough to accommodate the cylinder block is available. Install new cylinder liner seal rings in the liner seal ring grooves.

1. Apply a light coating of permanent type antifreeze solution to the seal rings.

2. Slide cylinder liners into the block, being careful not to roll or damage the seal rings. Install new compression gaskets and water hole seal rings in the counterbores in the top surface of the block.

3. Secure the sealing plate on the top of the block with 5 / 8"-11 bolts and flat washer.

4. Install the water hole cover plates and gaskets on the sides of the block.

5. Immerse the cylinder block in a tank of water heated to 180°—200° F., for a period of twenty minutes.

6. Attach an air line to the water hole plate and apply 80— 100 PSI air pressure to the water jackets and observe the water in the tank for bubbles which will indicate cracks or leaks.

7. Remove the block from the water tank. Relieve the air pressure, remove the plates, seals, gaskets, and liners. Blow out all passages in the block with compressed air.

8. Dry cylinder liners with compressed air and coat them with clean engine oil to prevent rust.

(j) Method B. Use this method when large water tank is not available. Prepare the block for testing as described for Method A. Before installing the sealing plate on top of the block, fill the water jacket with a mixture of water and one gallon of permanent type anti-freeze. The antifreeze will penetrate small cracks and its color will aid in detecting their presence.

1. Install the top plate and water hole covers as outlined in Method A.

2. Apply 80—100 PSI air presssure to the water jacket and maintain this pressure for at least two hours.

3. At the end of this test period, examine the cylinder bores, air box, oil passages, crankcase, and exterior of the block for water and antifreeze mixture, which will indicate the presence of cracks.

4. Relieve the air pressure, remove the plates and drain the water jacket. Remove the liners and seal rings and blow out all of the passages in the block with compressed air.

5. Dry the liners with compressed air and coat with clean engine oil to prevent rust.

(4) Inspect the top of the block for flatness with an accurate straight edge and a feeler gage. The surface shall not vary more than 0.003 inch transversely and not more than 0.007 inch longitudinally.

(5) Inspect the cylinder block bores as follows:

(a) Inspect liner seal ring grooves and lands for evidence of pitting and erosion. Two grooves are provided; however, a liner seal ring is required in the upper groove only. The lower groove is provided for the seal ring if inspection reveals defects in the upper groove. If both grooves are defective, the block shall be replaced.

(b) Measure the entire bore of each cylinder with a bore gage which has a dial indicator calibrated in 0.0001 inch increments. Refer to figure 7-59. Use a dial bore gage setting tool to preset the bore gage to zero. Measure each bore at the positions indicated in figure 7-59 on axis 90° apart. If the diameter at position "A" does not exceed 4.5235; at position "B", 4.4900 (and a sealing problem has not occured); at postions "C" and "D", 4.3595, the block may be reused. Also, the taper and out-of-round shall not exceed 0.0015 inch.

(6) Inspect the main bearing bores as follows:

(a) Lubricate the threads and the underside of each bolt head with a small amount of International Compound No. 2, or equivalent. Install the bearing caps and tighten the bolts to t specified torque of 120-130 lb-ft.

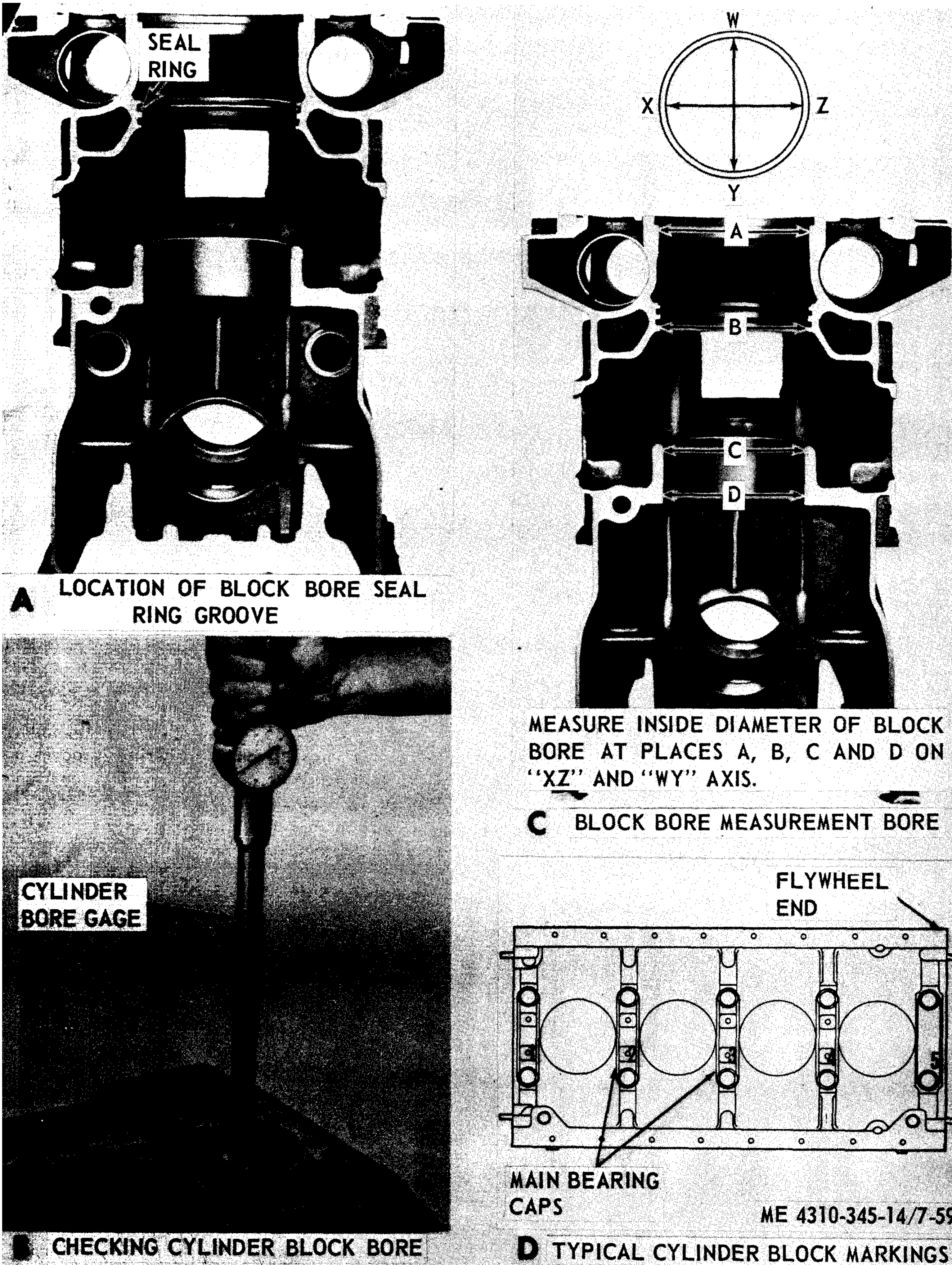


Figure 7-59. Cylinder block inspection.

CAUTION

It is imperative that the main bearing caps are installed in their original positions to maintain the main bearing bore alignment. The bearing caps are numbered to correspond with their respective positions in the block. The number of the front bearing cap is also stamped on the face of the oil pan mounting flange of the block, adjacent to its permanent location in the engine as established at the time of manufacture. The No. 1 cylinder and main bearing cap is always located at the end opposite the flywheel end of the block.

NOTE

Main bearing cap bolts are especially designed for this purpose and shall not be replaced by ordinary bolts.

(b) Measure the bearing bores. The bore diameter shall be 3.251 to 3.252 inches. If bores do not fall within these limits, discard the block.

(c) Check the main bearing bores for alignment. The bearing bores may be considered properly aligned with one another if the crankshaft can be rotated freely by hand, after new bearing shells have been installed and bearing caps properly torqued.

(d) If a new bearing is required, it may be necessary to try several replacement caps before one is found to provide the correct bore alignment. When a new bearing cap is installed, stamp the correct bearing number on the cap.

NOTE

Replacement main bearing caps can be used at the front, intermediate or rear bearing positions.

(7) Make certain that the cylinder liner counterbores in the block are clean and free of dirt. Check the depth. The depth shall be from 0.300 to 0.302 inch and must not vary more than 0.0015 inch throughout the entire circumference. The counterbored surfaces must be smooth and square with the cylinder bore within 0.001 inch total indicator reading. There must not be over 0.001 inch difference between any two adjacent cylinder counterbores, when measured along the cylinder longitudinal centerline of the block.

(8) Inspect all machined surfaces and threaded holes in the block. Remove nicks and burrs from machined surfaces with a file. Clean-up damaged threads with a tap or install helical thread inserts.

(9) Replace loose or damaged dowel pins.

(10) Inspect all parts for cracks, breaks, distortion, or any other defect.

c. Reassembly and Installation.

(1) Reassemble the cylinder block, end plate, air box drain, covers, and all other cylinder block components in the reverse numerical sequent shown in figure 7-57.

(2) If replacement cylinder block is used, stamp the engine serial number and model number on the upper rear corner of the block.

(3) Affix a new gasket to the flywheel end of the block, using a non-hardening gasket cement; also, apply an even coating of the cement to the outer surface of the gasket.

(4) Assemble the end plate to the clock aligning dowel pins with dowel pin holes in end plate.

NOTE

The heads of the end plate plug nuts at the top of the end plate shall always face the forward end of the block.

(5) Install the end plate bolts and lock washers. Tighten bolts to 30-35 lb-ft torque. Refer to figure 7-60.

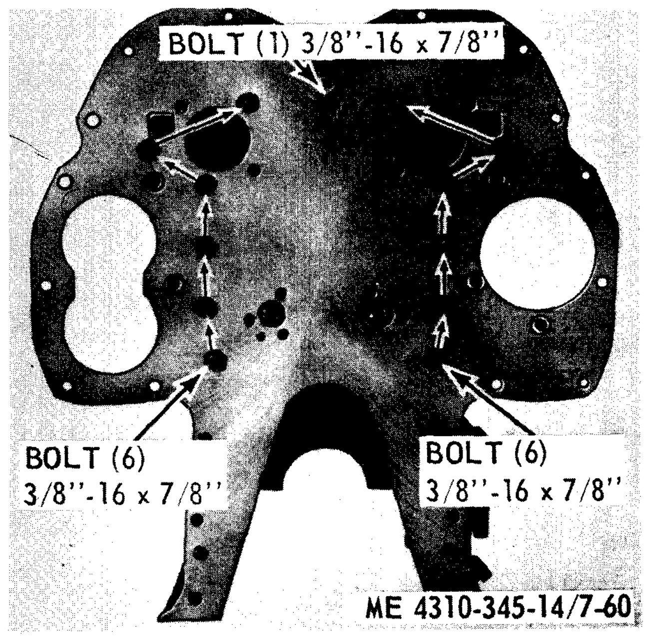


Figure 7-60. End plate mounting.

(6) Install connecting rods, pistons, and cylinder liners (para 7-42 and 7-43).

(7) Install the crankshaft, main bearings, pulley, and timing gear (para 7-40).

(8) Install the camshaft and balance shaft (para 7-38).

(9) Install the balance weights (para 7-34).

(10) Install the flywheel housing and flywheel (para 7-32 and 7-31).

(11) Install the oil pump assembly and oil pan (para 7-29 and 7-28).

(12) Install the cylinder head (para 7-25).

(13) Install the blower drive support and blower (para 7-23 and 7-22).

(14) Install the exhaust manifold (para 4-101).

(15) Install the engine oil filter assembly (para 4-89).

(16) Install the secondary fuel filter assembly (para 4-84).

(17) Install the primary fuel filter assembly (para 4-83).

(18) Install the fan drive group (para 4-69).

(19) Install the fresh water pump and idler pulley assemblies (para 7-18 and 7-19).

(20) Install the engine oil cooler (para 7-16).

(21) Install the governor assembly (para 7-12).

(22) Install the fuel pump and drive (para 7-10).

(23) Install the starting motor (para 7-6).

(24) Install the generator (para 7-2).

(25) Install the engine (para 5-9).

APPENDIX A

REFERENCES

A-1. Fire Protection

TB 5-4200-200-10	Hand Portable Fire Extinguishers Approved For Army Users

A-2. Lubrication

C9100-IL	Identification List for Fuels, Lubricants, Oils and Waxes
LO 5-430-345-12	Lubrication Order

A-3. Radio Suppression

TM 11-483	Radio Interference Suppression

A-4. Maintenance

TM 5-764	Electric Motor and Generator Repair
TM 9-1870-1	Care and Maintenance of Pneumatic Tires
TB 750-651	Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems
TM 38-750	The Army Maintenance Management Systems
TM 9-2330-247-14	Operator, Organizational, DS and GS Maintenance Manual (including repair parts and special tools list) for Chassis: Trailer: general 3 1 / 2 Ton, 2-Wheel, M353
TM 9-6140-200-15	Operation and Organizational, Field and Depot Maintenance: Storage Batteries, Lead Acid Type
TM 5-4310-345-24P	Operator, Organizational, DS, GS and Depot Maintenance Repair Parts and Special Tools List

A-5. Shipment and Storage

TB 740-97-2	Preservation of USAMEC Mechanical Equipment for Shipment and Storage
TM 740-90-1	Administrative Storage of Equipment

A-6. Destruction To Prevent Enemy Use

TM 750-244-3	Procedures for Destruction of Equipment

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. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from section II. (not applicable)

d. Section IV contains supplemental instructions explanatory notes and / or illustrations required for a particular maintenance function.

B-2. Explanation of Columns in Section II.

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

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

c. Maintenance Functions, Column (3). This column lists the various maintenance functions (A through K) and indicates the lowest maintenance category authorized to perform these functions. The symbol designations for the various maintenance categories are 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.

B—TEST: To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

C---SERVICE: To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents, and air. If it is desired that elements, such as painting and lubricating, be defined separately, they may be so listed.

D—ADJUST: To rectify to the extent necessary to bring into proper operating range.

E—ALIGN: To adjust specified variable elements of an item to bring to optimum performance.

F----CALIBRATE: To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison 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 with the certified standard.

G—INSTALL: To set up for use in an operational environment such as an emplacement, site, or vehicle.

H—REPLACE : To replace unserviceable items with serviceable like items.

I—REPAIR: Those maintenance operations necessary to restore an item to serviceable condition through correction of material damage or a specific failure. Repair may be accomplished at each category of maintenance.

J---OVERHAUL: Normally, the highest degree of maintenance performed by the Army in order to minimize time work in process is consistent with quality and economy of operation. It consists of that maintenance necessary to restore an item to completely serviceable condition as prescribed by maintenance standards in technical publications for each item of equipment. Overhaul normally does not return an item to like new, zero mileage, or zero hour condition.

K—REBUILD: The highest degree of materiel maintenance. It consists of restoring equipment as nearly as possible to new condition in accordance with original manufacturing standards. Rebuild is performed only when required by operational considerations or other paramount factors and then only at the depot maintenance category. Rebuild reduces to zero the hours or miles the equipment, or component thereof, has been in use.

d. Tools and Equipment, Column (4). 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. Remarks, Column (5). This column is provided for referencing by code the remarks (sec. IV) pertinent to the maintenance functions.

B-3. Explanation of Columns in Section III (not Applicable)

a. Reference Code. This column consists of a number and a letter separated by a dash. The number references the T&TE requirements column on the MAC. The letter represents the specific maintenance function the item is to be used with. The letter is representative of columns A through K on the MAC.

b. Maintenance Category. This column shows the lowest level of Maintenance authorized to use the special tool or test equipment.

c. Nomenclature. This column lists the name or identification of the tool or test equipment.

d. Tool Number. This column lists the manufacturer's code and part number, or Federal Stock Number of tools and test equipment.

B-4. Explanation of Columns in Section IV

a. Reference Code. This column consists of two separated by a dash, both of which are references to section II. The first letter references column (5) and the second letter references a maintenance function, column (3), A through K.

b. Remarks. This column lists information pertinent to the maintenance function being performed, as indicated on the MAC, section II.

Section II. MAINTENANCE ALLOCATION CHART

(2) Functional group	(3) Maintenance functions											(4) Tools and equipment	(5) Remarks
	A	B	C	D	E	F	G	H	I	J	K		
	Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
ENGINE													
Engine Assembly:													
Engine, diesel	C	F	C	..	..	..	..	F	F	H	D	....	A
Crankcase, Block, Cylinder Head:													
Block, engine	H	..	..	..	..	..	..	H	..	H			
Head, cylinder	F	..	..	..	..	..	..	F	H				
Sleeve assembly cylinder	H	..	..	..	..	..	..	H					
Crankshaft:													
Bearings, sleeve	H	..	..	..	..	..	..	H					
Crankshaft	H	..	..	..	..	..	..	H	D	..	..	....	B
Damper, vibration	O	..	..	..	..	..	..	F					
Pulley, crankshaft	O	..	..	..	..	..	..	F					
Seals	H	..	..	..	..	..	..	H					
Flywheel Assembly:													
Flywheel assembly	F	..	..	..	..	..	..	F	H	..	..	....	C
Housing	F	..	..	..	..	..	..	H					
Pistons, Connecting Rods:													
Bearings, sleeve	H	..	..	..	..	..	..	H					
Pistons, rings, pins and retainers	H	..	..	..	..	..	..	H					
Rods, connecting	H	..	..	..	..	..	..	H					
Valves, Camshafts, and Timing System:													
Bearings, camshaft	H	..	..	..	..	..	..	H					
Cover and gaskets, valve	C	..	O	..	..	..	..	O					
Cover, timing gear	O	..	..	..	..	..	..	H					
Gears, timing	H	..	..	..	..	..	..	H					
Guides, spring and locks	F	..	..	..	..	..	..	F	F				
Rocker arm assembly	..	..	..	O	..	..	..	F	F				
Seat, valve	F	..	..	..	..	..	..	H	H				
Valves	..	..	..	..	..	..	..	F	F	..	..	....	D
Engine Lubrication System:													
Breather, valve cover	C	..	..	..	..	..	..	O					
Cooler assembly, oil	O	..	..	..	..	..	..	O	F				
Element, oil filter	..	..	C	..	..	..	..	O					
Filter assembly, oil	C	..	..	..	..	..	..	O					
Lines, oil	O	..	..	..	..	..	..	O	O				
Pan, oil	H	..	..	..	..	..	..	H	H				
Pump assembly, oil	H	..	..	..	..	..	..	H	H	H			
Regulator, oil pressure	H	..	..	..	..	..	..	H	H				
Manifolds:													
Manifold, intake and exhaust	O	..	..	..	..	..	..	O					
FUEL SYSTEM													
Fuel Injector:													
Injectors, fuel	..	H	..	..	..	..	..	O	F	H			
Fuel Pumps:													
Pump, fuel	..	H	..	..	..	H	..	O	F	H			
Air Cleaner:													
Cleaner, air	..	..	C	..	..	..	..	..	O	O			
Tanks, Lines, Fittings:													
Cap, fuel tank	C	..	..	..	..	..	..	..	C				
Lines and fittings	C	..	O	..	..	..	..	..	O				
Tank, fuel	C	..	..	..	..	..	..	..	F	F			
Tube, injector	C	..	..	..	..	..	..	..	O				
Fuel Filters:													
Element, filter	..	..	C	..	..	..	..	..	O				
Filter, fuel	..	..	O	..	..	..	..	..	O				
Engine Starting Aids:													
Control, starting aid	O	..	..	..	..	..	..	O					
Primer, hand	C	..	..	..	..	..	..	O	O				

(1) Group No.	(2) Functional group	(3) Maintenance functions A Inspect					Cal		H Replace	I Repair	J Overhaul	Rebuild	(4) Tools and equipment	(5) Remarks
0312	Throttle Control:													
	Control, push-pull	C							O	O				
04	XHAUST SYSTEM													
0401	Muffler and Pipes:	C							O	O				
	Cap, rain	C							O	O				
	Clamps	C							O	O				
	Muffler and pipes	C							O	O				
05	OOLING SYSTEM													
0501	Radiator:													
	Cap, radiator								C					
	Grill, radiator								O	O				
	Radiator	..							F	H				
0502	Cowling, Deflectors, Air Ducts, Shrouds:													
	Guards and shrouds	..							O	O				
0503	Water Manifolds, Thermostat and Housing:													
	Gasket	O							O					
	Hose and clamps	O							O	O				
	Lines and fittings	O							O	O				
	Thermostats	O							O					
0504	Water Pump:													
	Pump assembly, water	..							O	F	F			
0505	Fan Assembly:													
	Belt, Drive	..							O					
	Fan assembly								O	O				
06	LECTRICAL SYSTEM													
0601	Generator:													
	Belts, drive	.							C					
	Generator								C	F	F			
0602	Generator Regulator:													
	Regulator, generator	..							C					
0603	Starting Motor:													
	Starter Assembly								C	F	F			
0606	Engine safety Controls:													
	Switches	O							C					
0607	Instrument or Engine Control Panel:													
	Panel assembly	O							C					
	Gages	..							C					
	Wiring	O							C	C				
0608	Miscellaneous Items:													
	Switches	O							C					
0609	Lights:													
	Light assembly								C					
0610	Sending Units and Warning Switches:													
	Sending unit, fuel	O							C					
0612	Batteries Storage (Wet or Dry):													
	Battery storage	C							C					
	Box and clamps	C							C	C				
	Clamps	C							C	C				
0613	Hull or Chassis Wiring Harness:													
	Wiring harness	C							F	C				
0615	Radio Interference Suppression:													
	Capacitor and lead								C	C				

(1) Group No.	(2) Functional group	(3) Maintenance functions A Inspect		C Service	D Adjust	E Align	F Calibrate	G Install	H Replace	I Repair	J Overhaul	K Rebuild	(4) Tools and equipment	(5) Remarks
15	**FRAME TOWING ATTACHMENTS, AND DRAWBARS**													
1501	Frame Assembly:													
	Frame assembly	F		..		..	..	.	H	F				
18	**BODY, CAB, HOOD AND HULL**													
1801	Body Cab, Hood, Hull Assemblies:													
	Cowl, front and rear	C		..		..	..	.	O					
	Doors and panels	C		..			..		O					
	Hood, engine and compressor	C			..			..	O					
1808	Stowage Racks, Boxes, Straps, Carrying Cases, Cable Reels, Hose Reels, Etc.													
	Hose reel assembly	C		..	..	..	..	..	O	O				
	Boxes tool	C		..	..	..	..	..	O	O				
22	**BODY CHASSIS OR HULL, AND ACCESSORY ITEMS**													
2202	Accessory Items:	C							O					
	Reflectors	C						..	O					
2210	Data Plates and Instruction Holders:													
	Plates, identification	C				..	..		F					
	Plates, instruction	C			..	..		..	O					
47	**GAGES (NONELECTRICAL), WEIGHING & MEASURING DEVICES**													
4702	Gages, Mountings, Lines and Fittings:													
	Gages, pressure, temp	C				..	..	..	O					
4703	Hourmeter													
	Adapter tachourmeter	C					.		O					
	Cable drive tachourmeter	O		..	..		..	..	O					
	Tachourmeter	C					..	..	O					
50	**PNEUMATIC EQUIPMENT**													
5000	Air Compressor Assembly:													
	Compressor assembly	C		C		..		..	F	F	H	D		
5001	Crankcase, Block Cylinder Head:													
	Stator, (housing) rotor	F					..	..	H					
	Gaskets	F		..		..		..	H					
5004	Pistons, Connecting Rods and Rotors:													
	Bearings	H					..		H					
	Rotor	H				..		..	H					
	Seals	H		..				..	H					
	Vanes, rotor	H				..	.	..	H					
5006	Lubrication System													
	Cooler, oil				C	..	..	..	F	H				
	Filter, oil			..	O			..	O					
	Separator, oil and air	..			O	..	..	.	F	H				
	Lines and fittings	O		..		..	..	..	O	O				
5007	Compressor Drive:													
	Adapter, housing assy.	H			..	..	..	..	H					
	Coupling, spline	H				.	..	..	H					
5008	Air Intakes:													
	Cleaner, air	C		C	.	..	..	..	O					
	Hoses, clamps	C					..	..	O	O				
5009	Unloader System Components:													
	Regulator, pilot	..			O	..	..	..	O	F				
	Unloader assembly	C		..	O	..	..	..	F	F				

(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
5012	**Throttling Devices:**													
	Engine control	C	..	C	O	..			O	F				
5014	**Air Receiver:**													
	Receiver, air	..	..	C	..	..	.	..	O					
	Safety relief	C	C	..	..	.	..	..	O	F				
5015	**Air Discharge System:**													
	Hose and fittings	C	..	..		..			O					
	Manifold	C	..	..	..		..	..	O					
	Valve assembly	O	..		..	..	..	..	O					
76	**FIRE FIGHTING EQUIPMENT CONPONENTS:**													
7603	**Fire Extinguishers:**													
	Extinguisher, fire	C	..	C	.	..	..	..	O	F				

Section III. SPECIAL TOOL AND SPECIAL TEST EQUIPMENT REQUIREMENTS

Reference code	Maintenance Category	Nomenclature	Tool number
There are no special tools or equipment required for the compressor.			

Section IV. REMARKS

Reference Code	Remarks
A-F	Text includes Engine Operation and Compression
B-D	Metalize, Aline and Grind
C-H	Replace Ring Gear
D-F	Repair of Valves included Refacing

APPENDIX C

BASIC ISSUE ITEM LIST AND ITEMS

TROOP INSTALLED OR AUTHORIZED

EFFECTIVE 1 JULY 1972

Section I. INTRODUCTION

C-1. Scope

This appendix lists basic issue items, items troop installed or authorized which accompany the compressor, and required by the crew / operator for operation, installation, or operator's maintenance.

C-2. General

This basic issue items, items troop installed or authorized list is divided into the following sections:

a. Basic Issue Items List—Section II. Not applicable.

b. Items Troop Installed or Authorized List—Section III. A list, in alphabetical sequence of items which at the discretion of the unit Commander may accompany the end item, but are NOT subject to be turned in with the end item.

C-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items List, section II, and Items Troop Installed or Authorized, section III.

a. Source, Maintenance, and Recoverability Code (s) (SMR):

(1) Source code, indicates the source for the listed item. Source codes are:

Code	*Explanation*
P	Repair parts, special tools and test equipment supplied from GSA / DSA or Army supply system and authorized for use at indicated maintenance levels.
P2	Repair parts, special tools and test equipment which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.

(2) Maintenance code, indicates the lowest level of maintenance authorized to install the listed item. The maintenance level code is:

Code	*Explanation*
C	Crew / Operator

(3) Recoverability code, indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are non-recoverable. Recoverability codes are:

Code	*Explanation*
R	Applied to repair parts (assemblies and components), special tools and test equipment which are considered economically reparable at direct and general support maintenance levels.
s	Repair parts, special tools, test equipment and assemblies which are economically reparable at DSU and GSU activities and which normally are furnished by supply on an exchange basis.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required.

d. Unit of Measure (U/M). A two-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Furnished With Equipment (BIIL only). This column indicates the quantity of an item furnished with the equipment.

f. Quantity Authorized (Items Troop Installed or Authorized Only). This column indicates the quantity of the item authorized to be used with the equipment.

Section III. ITEMS TROOP INSTALLED OR AUTHORIZED LIST

SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION REF NO. & MFG CODE USABLE ON CODE	(4) UNIT OF MEAS.	(5) QTY AUTH
PO	7520-559-9618	CASE, Cotton Duck: (MIL-B-11743)	ea	1
PO	4210-555-8837	EXTINGUISHER, Fire, Monobromotrifluoromethane charged, hand type w / bracket, 2¾ lb, MIL-E-52031	ea	1

INDEX

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:

VERNE L. BOWERS,
Major General, United States Army,
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