DEPARTMENT OF THE ARMY TECHNICAL MANUAL

ORGANIZATIONAL, DS, GS, AND DEPOT MAINTENANCE MANUAL

DISTRIBUTOR, WATER TANK TYPE GASOLINE DRIVEN, TRUCK MOUNUTED (MACLEOD MODEL W15A) FSN 3825-954-9033

This copy is a reprint which includes current pages from Changes 1, 4, 5, 6 and 7.

HEADQUARTERS, DEPARTMENT OF THE ARMY

16 DECEMBER 1964

SAFETY PRECAUTIONS

When the engine is operated in a closed area, pipe the exhaust gases outside. The exhaust gases contain carbon monoxide which is colorless, odorless, and deadly poison.

Do not smoke or permit an open flame within 50 feet of the equipment when handling or storing fuel.

Stop the engine when performing any work around the flywheel or drive shaft.

Do not touch the exhaust manifold, muffler, or exhaust line during operation of the engine or before they have cooled. A severe burn could result.

Do not operate the engine while filling the fuel tank.

Provide a metallic contact between the filling device and the fuel tank, to prevent a static spark which would ignite the fuel vapors.

Depress emergency magneto ground button before working on engine.

Keep the operator's platform free of obstructions.

When welding a fuel tank make sure that the tank has been properly steam cleaned or is filled with water.

Changes In force: C1, C4, C5, C6, and C7

TM 5-3825-221-15
C7

Change No. 7

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D. C., *6 May 1992*

Operators, Organizational, Direct Support, General Support, and Depot Maintenance Manual
DISTRIBUTOR, WATER, TANK TYPE, TRUCK MOUNTED: GASOLINE DRIVEN (MACLEOD W15A NONWINTERIZED) NSN 3825-00-954-9033; MULTIFUEL DRIVEN (MACLEOD MODEL W15A WINTERIZED) NSN 3825-00-774-9090; MULTIFUEL DRIVEN (MACLEOD MODEL W15A 4112) NSN 3825*4*0-077-0550; DIESEL DRIVEN (MACLEOD MODEL W15E9019) NSN 3825-00-474-3742

TM 5-3825-221-15, 16 December 1964, is changed as follows:

1. Remove old pages and insert new pages as indicated below.

2. New or changed material is indicated by a vertical bar in the margin of the page.

3. Add the following WARNING to the inside front cover of the manual:

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.

Remove Pages	*Insert Pages*
5 thru 8	5 thru 8
11 and 12	11 and 12
19 and 20	19 and 20
25 and 26	25 and 26
29 and 30	29 and 30
37 thru 44	37 thru 44
103 and 104	103 and 104

4. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

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

Official:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
01259

Distribution:
To be distributed in accordance with DA Form 1225-E (Block 0673) Operator, Unit, Direct Support and General Support maintenance requirements for TM5-3825-221-15.

Changes in force: C1, C4, C5, and C6

TM 5-3825-221-15
C6

Change No. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C. *25 July 1984*

NSN 3825-00-954-9033; MULTIFUEL DRIVEN (MACLEOD MODEL W15A WINTERIZED) NSN 3825-00-774-9090 MULTIFUEL DRIVEN (MACLEOD MODEL W15A4112) NSN 3825-00-077-0550; DIESEL DRIVEN (MACLEOD MODEL W15E9019) NSN 3825-00-474-3742)

TM 5-3825-221-15, 16 December 1964 is changed **as** follows:

Title: The Federal stock numbers have been changed to National stock numbers as shown above.

Maintenance Allocation Chart

Page 103. Functional group column. Change 0194 to 0104.
Page 104. Functional group column. Change 0108 to 0106, 0110 to 0108 and 0114 to 0107.
Page 105. Functional group column. Change 0310 to 0311 and 0604 to 0605.
Page 106. Add the functional group 0610 before 0612 as follows:

Maintenance Allocation Chart

Functional group	Components and related operation	Levels of maintenance					Remarks
		1	2	3	4	5	
0610	SENDING UNITS AND WARNING SWITCHES						
	Switch; Safety, High Temperature						
	Replace		X				
	Switch; Pressure, Low Oil						
	Replace		X				
0612	BATTERIES, STORAGE, WET OR DRY						Use truck batteries
	Cable						
	Replace		X				
	Repair		X				

Functional group column. Add 1501 below 15 and adjacent to "Frame", change 17 to 18, and 1700 to 1801, delete 170S, change 1708 to 1808 and 1711 to 1811.

Components and related operation column. Change TANK BOXES to read TANK BODIES.

Page 107. Paragraphs 26, 2602, 2603 and 2605 are rescinded in all columns.

Functional group column. Change 5504 to 5510, 5512 to 5510 and 5515 to 5513.

Page 108. Paragraphs 76 and 7603 are rescinded in all columns.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-25B, (qty rqr block No. 378) Organizational Maintenance Requirements for Distributors, Water.

Changes In force: C 1, C 4, and C 5

***TM 5-3825-221-15**
C5

Change No. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C., 31 *August 1973*

Operator's, Organizational, Direct Support, General Support, and Depot Maintenance Manual
DISTRIBUTOR, WATER, TANK TYPE, TRUCK MOUNTED: GASOLINE DRIVEN (MACLEOD W15A NONWINTERIZED) FSN 3825-954-9033; MULTIFUEL DRIVEN (MACLEOD MODEL W15A WINTERIZED) FSN 3825-774-9090; MULTIFUEL DRIVEN (MACLEOD MODEL W15A4112) FSN 3825-077-0550; DIESEL DRIVEN (MACLEOD MODEL W15E9019) FSN 3825-474-3742

TM 5-3825-221-15, 16 December 1964, is changed as follows:

Page 1. Appendix III title is changed to read as follows: BASIC ISSUE ITEMS LIST AND ITEMS TROOP INSTALLED OR AUTHORIZED LIST.
Page 2 and 3. Section I, GENERAL, is superseded as follows:

Section I. GENERAL

1. Scope
These instructions are published for the use of the personnel to whom the Macleod Company Models W15A and W15A4112, Water Distributor are issued. The following pages contain information on operator's organizational. direct support, general support, and depot maintenance. Also included are descriptions of the main units and their functions in relationship to other components.

2. Forms and Records
DA Forms and Records used for equipment maintenance are prescribed in TM 38-750.

3. Reporting of Equipment Publication Improvements
The reporting 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 Commander, US Army Troop Support Command, ATTN: AMSTS-MPP, 4300 Goodfellow Boulevard, St. Louis, MO 63120.
Page 8. Paragraph 5q is superseded as follows:
g. Application Chart. Table I provides water application information in gallons per square yard in relation to operating pressure in PSI

***This changes supersedes C 3, 5 January 1973.**

(pounds per square inch) and speed of the truck in feet per minute.

Page 9. Table 1 is superseded as follows:

Table 1. Application Chart

Application rate gal / sq. yd	40 PSI	30 PSI	10 PSI
	Truck speed in feet per minute*		
0. 1	1780	1440	864
0. 2	890	720	431
0. 3	595	480	288
0. 4	445	360	216
0. 5	356	288	173
0. 6	297	240	144
0. 7	255	206	123
0. 8	223	180	108
0. 9	198	160	96
1. 0	178	144	86
1. 1	162	131	78
1. 2	148	120	72
1. 3	137	111	66
1. 4	127	103	62
1. 5	119	96	62
1. 6	111	90	
1. 7	105	85	
1. 8	99	80	
1. 9	94	76	
2. 0	89	72	

*Speeds are to be used for all spraybar lengths between 4 feet and 16i feet inclusive.

Page 12. Subparagraph 9c is added as follows:

c. For maintenance and operating supplies see table 1.1.

Table 1.1. MAINTENANCE AND OPERATING SUPPLIES

(1) Component applicable	(2) Federal stock number	(3) Description	(4) Quantity required f / initial operation	(5) Quantity required f / 8 hrs operation	(6) Notes
0101 CRANKCASE (1)	9150-265-9435(2) 9150-265-9428(2) 9150-242-7603(2)	OIL LUBRICATING 5-gal pails as follows: OE-30 OE-10 OES	 5 qt 5 qt 5 qt	 (3) (3) (3)	(1) Includes quantity of oil to fill engine oil system as follows: 4 qt-Crankcase 1 qt-Oil filter
0304 AIR CLEANER(4)		OIL LUBRICATING(4)	½ qt	(3)	(2)See FSC C9100-IL for additional data and requisitioning procedure.
0306 FUEL TANK	 9130-160-1818 9130-160-1830	FUEL GASOLINE: Bulk as follows: Automotive Combat 91A Automotive Combat 91C	 50 gal 50 gal		(3)See current LO for grade application and replenishment intervals. (4)Use oil as prescribed in item 1.

P*age 109.* APPENDIX III is superseded as follows:

APPENDIX III
BASIC ISSUE ITEM LIST AND ITEMS
TROOP INSTALLED OR AUTHORIZED

1. Scope

This appendix lists basic issue items and items troop installed or authorized which accompany the water distributor and are required by the crew/operator for installation or operator's maintenance.

2. General

This basic issue items and 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.

3. Explanation of Columns

The following provides an explanation of the columns in the tabular list of items troop installed or authorized, section Ill.

a. Source, Maintenance, and Recoverability Code(s) (SMR): Not applicable.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item which 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 2-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 Authorized. This column indicates the quantity of the item authorized to be used with the equipment.

Section III. ITEMS TROOP INSTALLED OR AUTHORIZED LIST

(1) SMR code	(2) Federal stock No.	(3) Description	(4) Unit of mass	(5) Qty auth
	4210-889-2221 7520-559-9618	EXTINGUISHER. FIRE CASE, PUBLICATIONS	ea ea	1 1

By Order of the Secretary of the Army:

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

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

Distribution:
To be distributed in accordance with DA Form 12-25B. (qtv rqr block No. 378) Organizational Maintenance Requirements for Distributors. Water.

Changes in Force: C 1, C 3 and C 4

TM 5-3825-221-15
C4

Change No. 4

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C. 5 *April 1973*

Operator's Organizational, DS, GS,
and Depot Maintenance Manual

DISTRIBUTOR, WATER, TANK-TYPE:
TRUCK MOUNTED: GASOLINE DRIVEN
(MACLEOD MODEL W15A, NON-WINTERIZED) FSN 3825-954-9033; MULTI
FUEL DRIVEN (MACLEOD MODEL W15A, WINTERIZED) FSN 3825-774-9090;
MULTI-FUEL DRIVEN (MACLEOD MODEL W15A4112) FSN 3825-077-0550;
DIESEL DRIVEN (MACLEOD MODEL W15B9019) FSN 3825-474-3742.

TM 5-3825-221-15, 16 December 1964, is changed as follows:

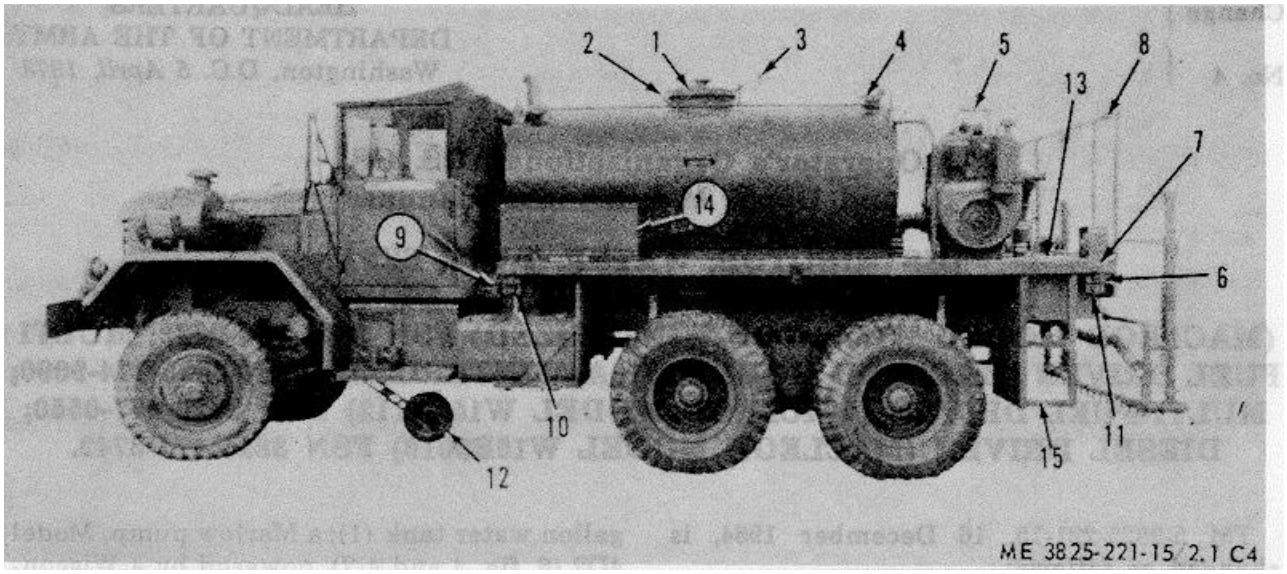
Cover page and table of contents. The title is changed as shown above:

Page 2. Paragraph la (page 1, C3). The first sentence is changed to read:
These instructions are published for the use of personnel to whom the Macleod Company Models W15A, W15A4112 and W15B9019 water distributors are issued.

Page 3. In paragraph 3a the first four sentences are superseded as follows:

a. General The water distributors (fig. 1) are truck mounted units consisting of 1, 000 gallon water tank (1); a Marlow pump, Model 4D2 (6, fig.4 and 4-2), powered by a Wisconsin gasoline engine, Model MVF4D (2, fig.1);and the necessary piping, controls, and instruments to permit complete and proper operation. The distributor normally is operated by a crew of two men, a driver in the truck cab and an operator on the operator's platform. For information relating to the truck, using and maintenance personnel should refer to TM 9-2320-211-10 and TM 9-2320-211-20. Some of the uses and functions of the water distribution are as follows:

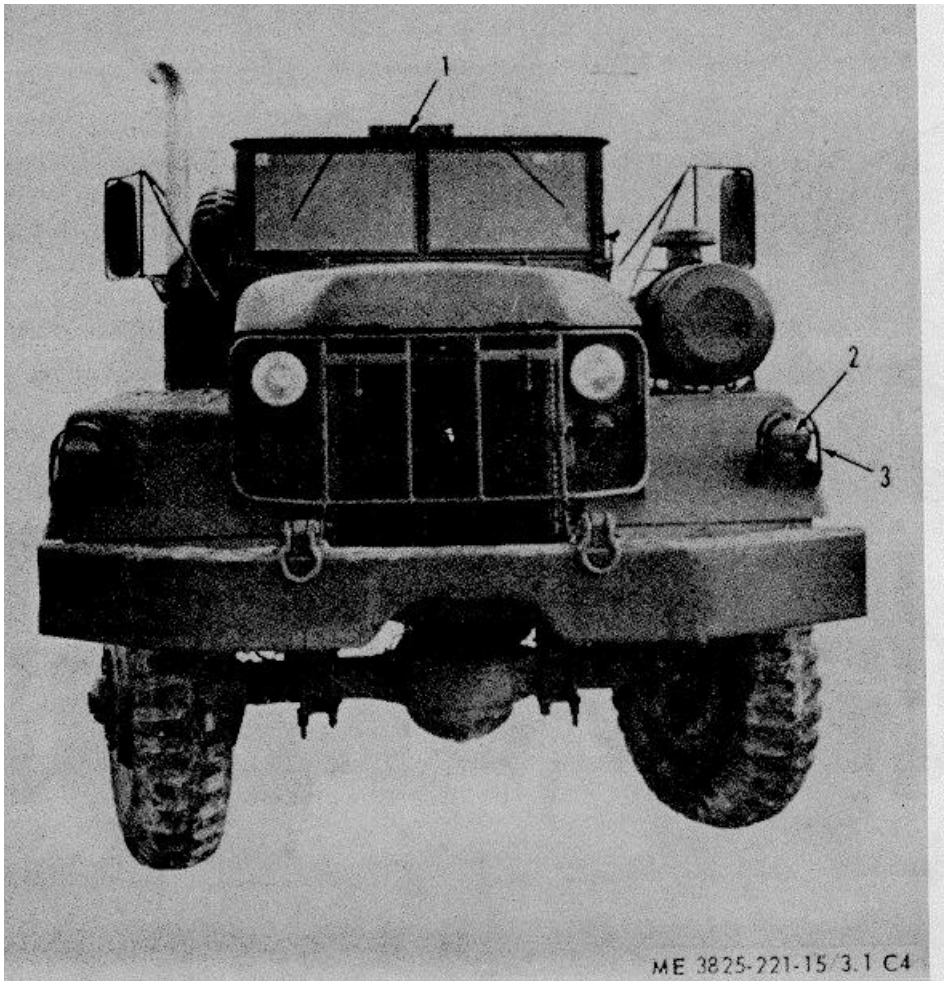
Page 3. Add Figure 2-1.



1	Manhole cover assembly	6	Marker light	11	Light bracket, rear
2	Hinge bolt	7	Reflector	12	Bitumeter wheel
3	Keeper crank	8	Guard rail	13	Operator's platform
4	Signal gong	9	Marker light	14	Tool box
5	Muffler shield	10	Light bracket, front	15	Step stringer

Figure 2-1. Water distributor, left side (Model WI5B9019)
(ME 3825-221-15/2.1, C4)

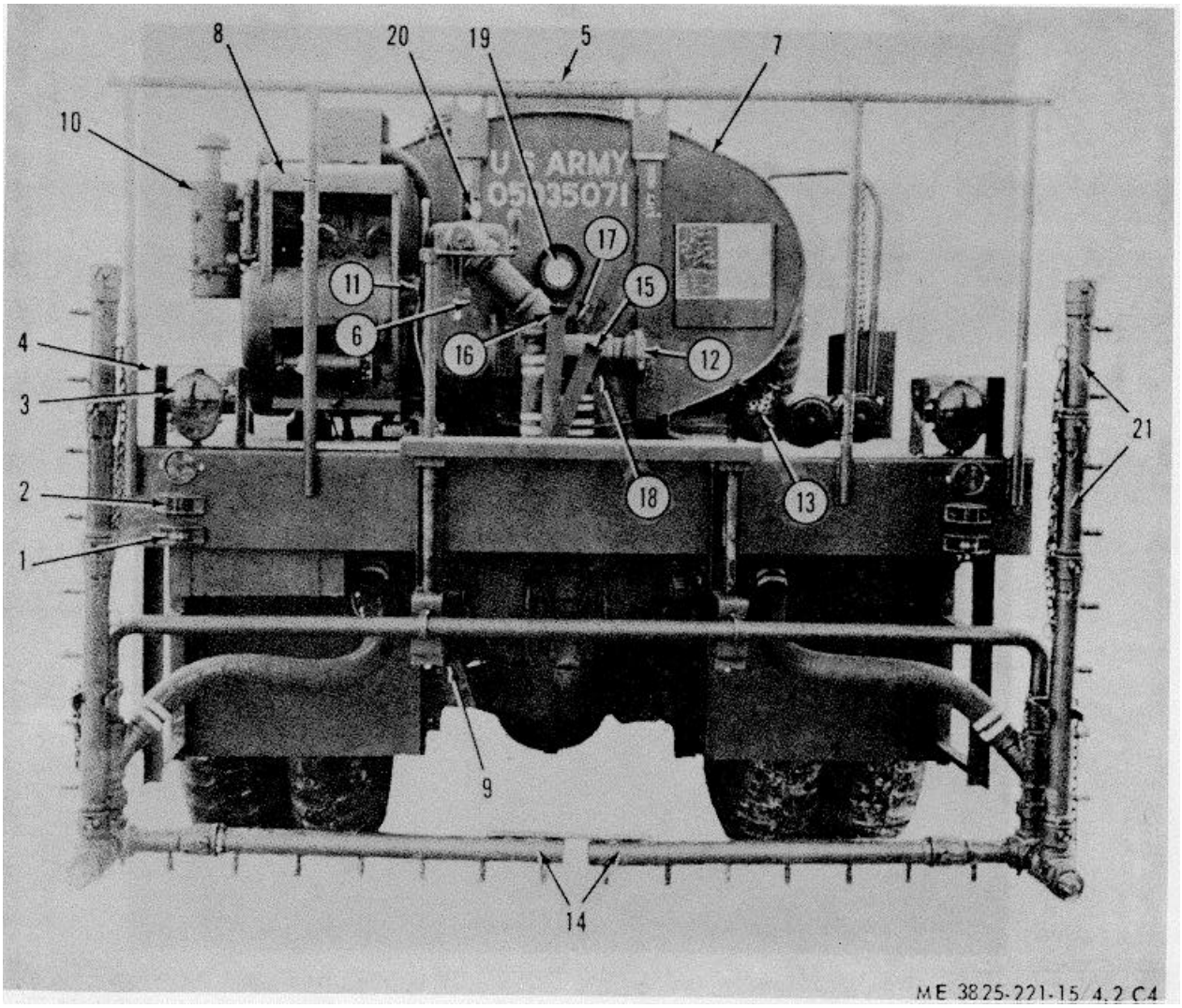
Page 4. At the end of paragraph 3b after "water level gage (14), add "(19, fig. 4.2)". At the end of paragraph 3c change reference "(6, fig. 4)" to read "(6, fig. 4 and fig. 4.2)". *Add figure 3.1.*



1 Clearance light 2 Turn signal light 3 Turn signal guard

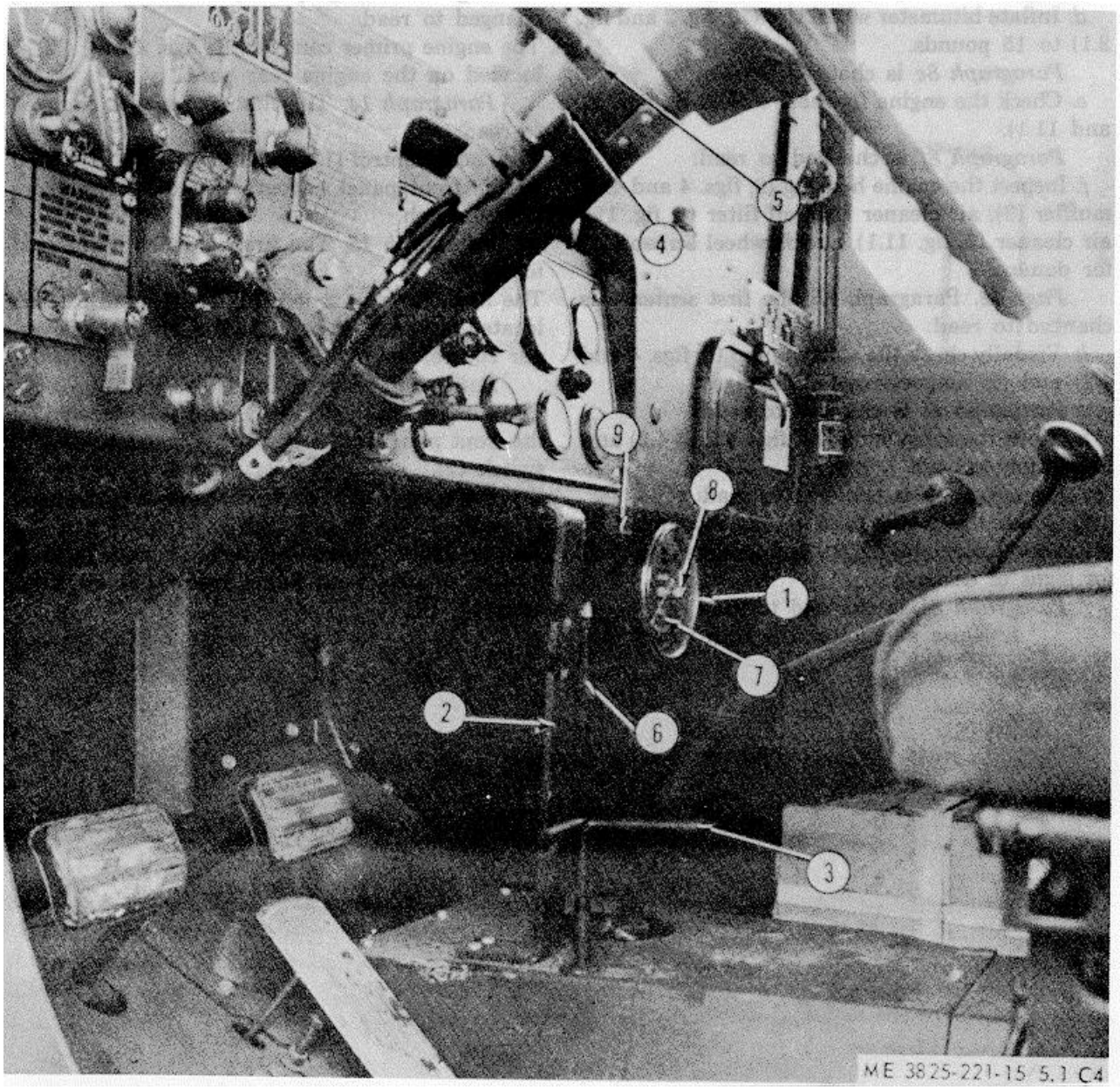
Figure 3.1. Water distributor, front view (Model W15B9019).
ME 3825-221-15/3.1, C4)

Page 5. Add Figure 4.2.



1	Blackout clearance light	8	Engine	15	Spray bar valve lever, left
2	Clearance light	9	Muffler	16	Spray bar valve lever, right
3	Turn signal-stop light	10	Air cleaner	17	Suction valve lever
4	Guard	11	Prime control	18	Suction tee
5	Clearance light	12	Suction cup	19	Tank gage
6	Water pump	13	Foot valve and strainer	20	Discharge pressure gage
7	Water tank	14	Spray bar assembly	21	Spray bar extensions

Figure 4.2. Water distributor, rear view (Model W15B-9019).
(ME 3825-221-15/4.2, C4)



1	Tachometer head	4	Turn signal switch	7	Static needle
2	Fifth wheel lift bracket	5	Emergency flasher switch	8	Knob
3	Fifth wheel lift rod	6	Tachometer cable	9	Bracket

Figure 5.1. Inside carrier cab (Model W15B-9019).
(ME 3825-221-15/5.1, C4)

Page 8. Paragraph 5f is changed to read:

f. Dimensions and Weights, Including Carrier.

Overall length----------319 inches
Overall width----------96 inches
Overall height----------112 inches

Overall weight:
Model W15A ----------20,050 pounds
Model W15B-9019 ----------23,000 pounds

Page 11. Paragraph 8*d* is changed to read:

d Inflate bitumeter wheel tire (12, fig. 2 and fig. 2..1) to 15 pounds.

Paragraph 8e is changed to read:

e. Check the engine flywheel shroud (9, figs. 11and 11.1).

Paragraph 8f is changed to read:

f. Inspect the engine housing (8, figs. 4 and 4.2), muffler (9), air cleaner (10), oil filter (6, fig. 11), air cleaner (7, fig. 11.1), and flywheel screen (12) for damage.

Page 12. Paragraph *8h,* the first sentence is changed to read:

h. Visually check the water pump (6, figs. 4 and 4.2) and its connections for damage.

Paragraph 8i is changed to read:

i. Check the spray bars (14, figs. 4 and 4.2) and nozzle for damage.

Paragraph 8j is changed to read:

j. Check the water tank (7, figs. 4 and 4.2), water level gage (14, fig. 2), and fenders (8, fig. 8) for signs of damage.

Paragraph 8l is changed to read:

1. Raise and lower the fifth wheel (12, fig. 2) to see if the lift rod (3, fig. 5 and fig. 5.1) is working properly. Spin the wheel to see if the bitumeter drive cable (6) and tachometer head (1) are working properly.

Paragraph 8m is changed to read:

m. Check the turn signal (2, figs. 3 and 3.1) and marker lamps (9, figs. 2 and 2..1) for proper operation.

Page 13. Paragraph 13, the first sentence is changed to read:

The engine primer control (11, figs. 4 and 4.2) is located on the engine rear panel.

Paragraph 14. The first sentence is changed to read:

The choke control (13, figs. 11 and 11.1) is located on the front panel beneath the low oil pressure safety switch.

Paragraph 15. The first sentence is changed to read:

The magneto stop switch (2, figs. 11 and 11.1) is located on the front panel to the left of the governor control knob (3).

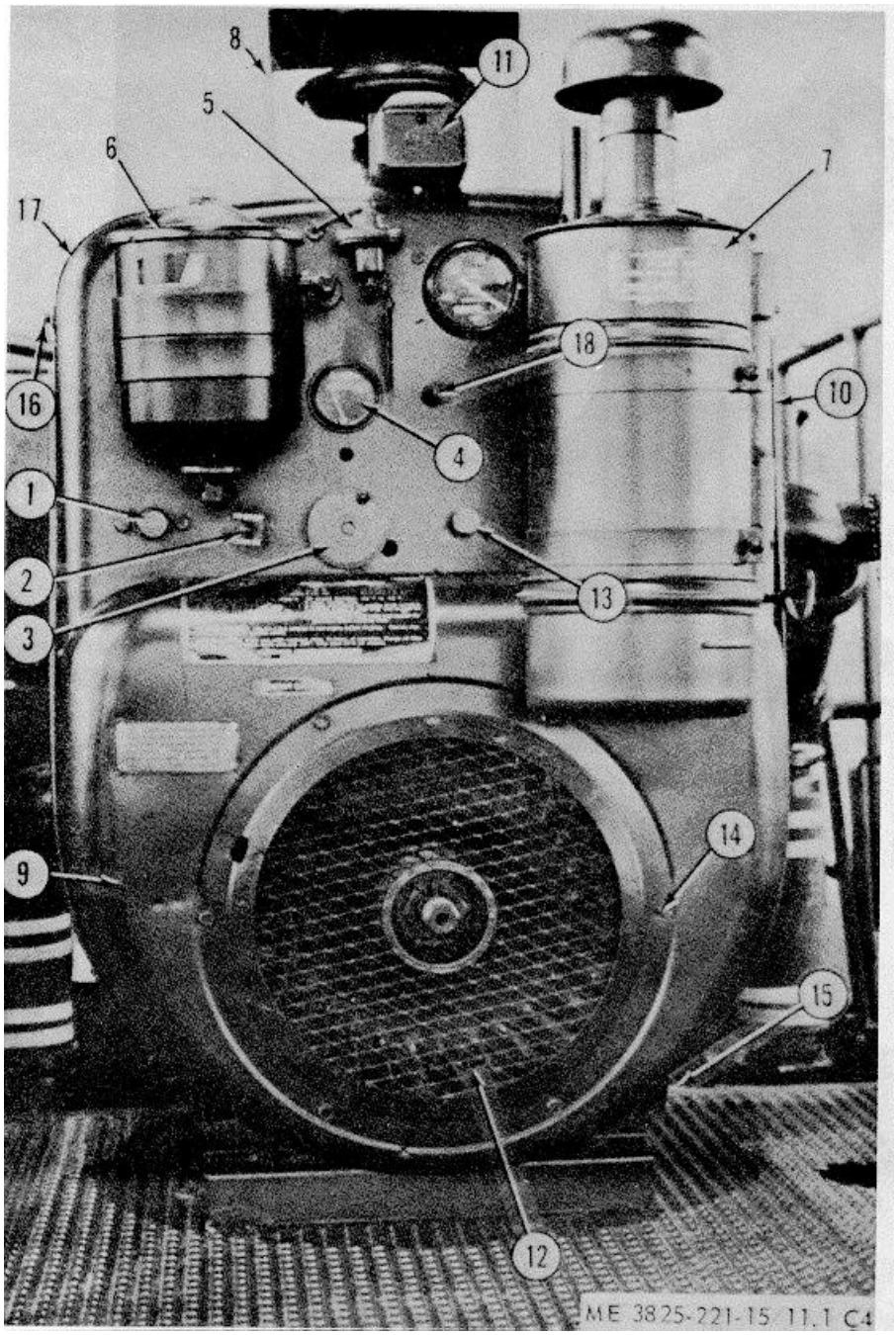
Paragraph 17 is changed to read:

The starter button (1, figs. 11 and 11.1) located on the front panel to the left of the magneto ground switch (2).

Paragraph 19. The first sentence is changed to read:

The governor control (3, figs. 11 and 11.1) is located on the front panel below the oil filter assembly (6).

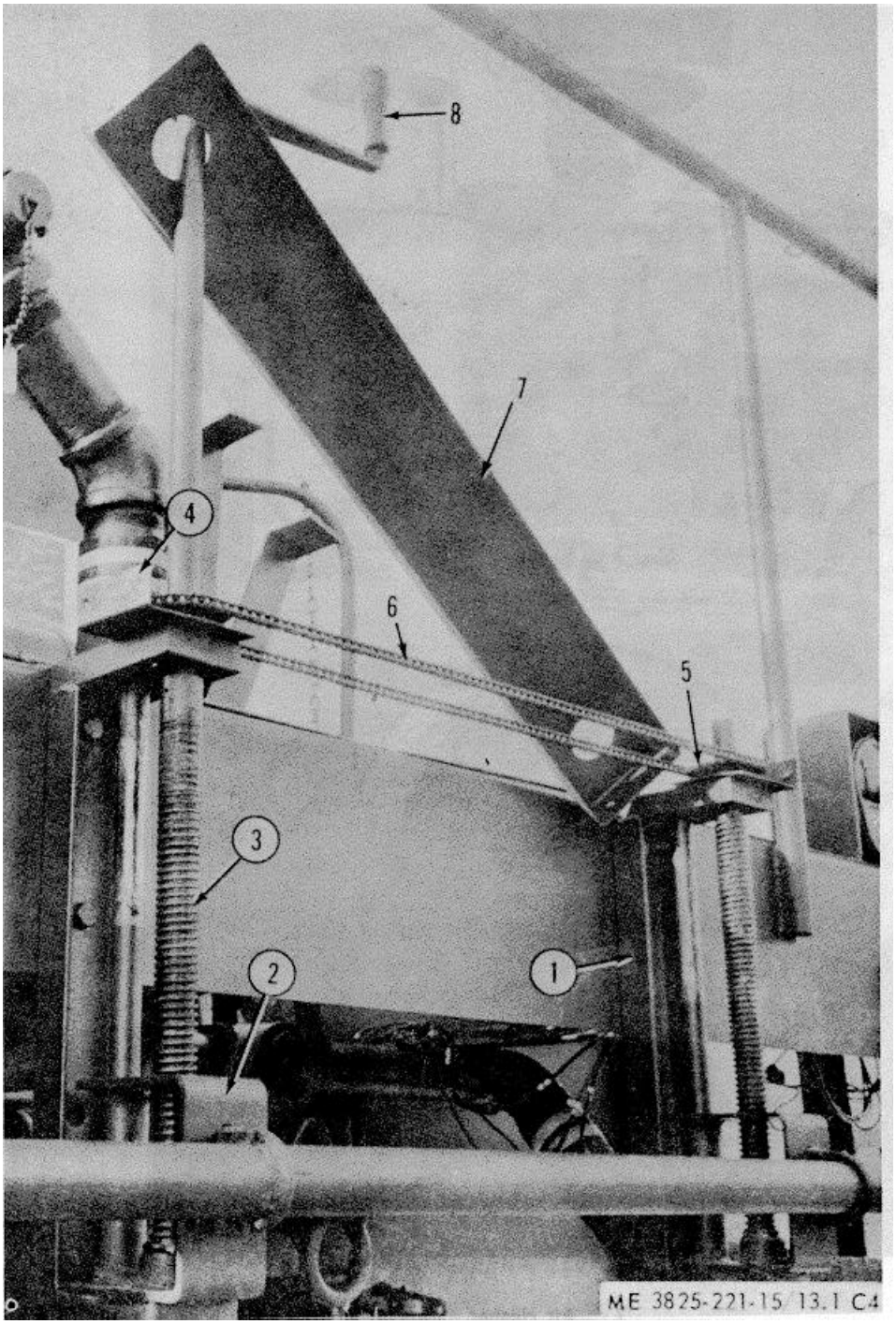
Page 14. Add figure 11.1.



1	Starter switch	7	Air cleaner	13	Choke control
2	Ignition switch	8	Muffler shield	14	Capscrew
3	Governor control	9	Flywheel shroud	15	Dv charge valve lever
4	Oil pressure gage	10	Engine house door	16	Capscrew
5	Low oil pressure safety switch	11	Light	17	Canopy
6	Oil filter	12	Flywheel screen	18	Switch

Figure 11.1. Pump engine panel (Model W15B;9019).
(ME 3825-221-15/11.1, C4)

Page 16. Add figure 13.1.



1	Takeup bracket	5	Sprocket
2	Bracket	6	Chain
3	Jackscrew	7	Guard
4	Retainer	8	Vertical adjustment crank

Figure 13.1. Spray bar takeup assembly (Model W15B-9019).
(*ME 3825-221-15/113.1, C4)*

Page 16. Paragraph 27. The first sentence is changed to read:
The distributor is provided with a valve of each side of the spraybar (15 and 16, figs. 4 and 4.2).

Paragraph 28. The first sentence is changed to read:
The discharge valve (15, figs.11 and 11.1) is located beneath the operator's platform and is operated from the operator's platform.

Paragraph 29. The first sentence is changed to read:
The suction valve (17, figs. 4 and 4.2) is located adjacent to the pump inlet tee.

Paragraph 30. The first sentence is changed to read:
The discharge pressure gage (20, figs. 4 and 4.2) is located in the discharge line.

Paragraph 31. The first sentence is changed to read:
A signal gong is provided at each end of the water tank (4, figs. 2 and 2.1).

Paragraph 32. The first sentence is changed to read:
The bitumeter assembly consists of a tachometer (1, figs. 5 and 5.1) attached to the instrument panel inside the cab of the carrier and a drive cable (6) running from the tachometer (1) through the floorboard of the carrier cab to the frame (9, fig. 29) of the fifth wheel, where the bitumeter drive (5) is located.

Page 17. Paragraph *34a* is changed to read:

a. Turn the suction valve control lever (17, figs. 4 and 4.2) and the discharge valve control lever (15, fig.11) to OFF.

Paragraph 34b is changed to read:

b. Turn the spray bar valve levers (15 and 16, figs. 4 and 4.2) to OFF and perform the daily preventive maintenance services (para. 49).

Paragraph 34j, the second sentence is changed to read:
Adjust governor control (3, figs. 11 and 11.1) for proper operating speed.

Paragraph 35a (1) is changed to read:

(1) Unlock the governor control (3, figs. 11 and 11.1) by turning it counterclockwise and push in to allow the engine speed to decrease to an idling speed.

Paragraph 36a (2) is changed to read:

(2) Turn the suction valve control lever (17, figs.4 and 4.2) to OFF.

Paragraph 36a (3) is changed to read:

(3) Turn the discharge valve control lever (15, figs.11 and 11.10 to OFF.

Page 18. Paragraph 36b (3) is changed to read:

(3) Remove the suction cap (12, figs 4 and 42.) from the suction tee and attach the necessary length of 4-inch hose to the suction line and tighten.

Paragraph 36b (6) is changed to read:

(6) Turn the suction valve (17, figs. 4 and 4.2) and the two spray bar control levers to OFF. Turn the discharge valve control lever to ON.

Paragraph 36b (7). The first sentence is changed to read:

(7) Open the water tank manhole cover (1, figs. 2 and 2.1).

Paragraph 36b (10) is changed to read:

(10) Remove the *suction* hose (5, *fig.* 9) and install the cap (12, figs. 4 and 4.2) on the suction line tee (18) and tighten securely.

Paragraph 36c (1)(a). The first sentence is changed to read:

(a) Pressure-spray. The water pump (6, figs. 4 and 4.2) pumps the water from the water tank (7) through the spray bars (14).

Paragraph 36c (2)(a). The first sentence is changed to read:

(a) The engine governor control (3, figs.11 and 11.1) sets the engine speed, which controls pump pressure.

Page 19. Paragraph (*36c(5)(c)* is changed to read:

(c) Ring the signal gong (4, figs.2 and 2.1) to signal the vehicle driver to lower the bitumeter wheel assembly (12, figs.2 and 2.1).

Paragraph 36c (5)(d) is changed to read:

*(*d) The truck operator will increase the speed of the carrier until the fpm (ft. per min.) indicating pointer coincides with the needle (7, figs.5 and 5.1).

Paragraph 36c (5)(h) is changed to read:

*(*h) Raise bitumeter wheel assembly with the lift rod (3, figs.5 and 5.1).

Paragraph 36c (7)(a)1 is changed to read:

1. Remove the suction cap (12, figs.4 and 4.2) from the suction tee (18).

Paragraph 36c (7)(a)2 is changed to read:

2. Remove the strainer (8, figs.33 and 33.1) from the tee (7).

Paragraph 36c (7)(a)5 is changed to read:

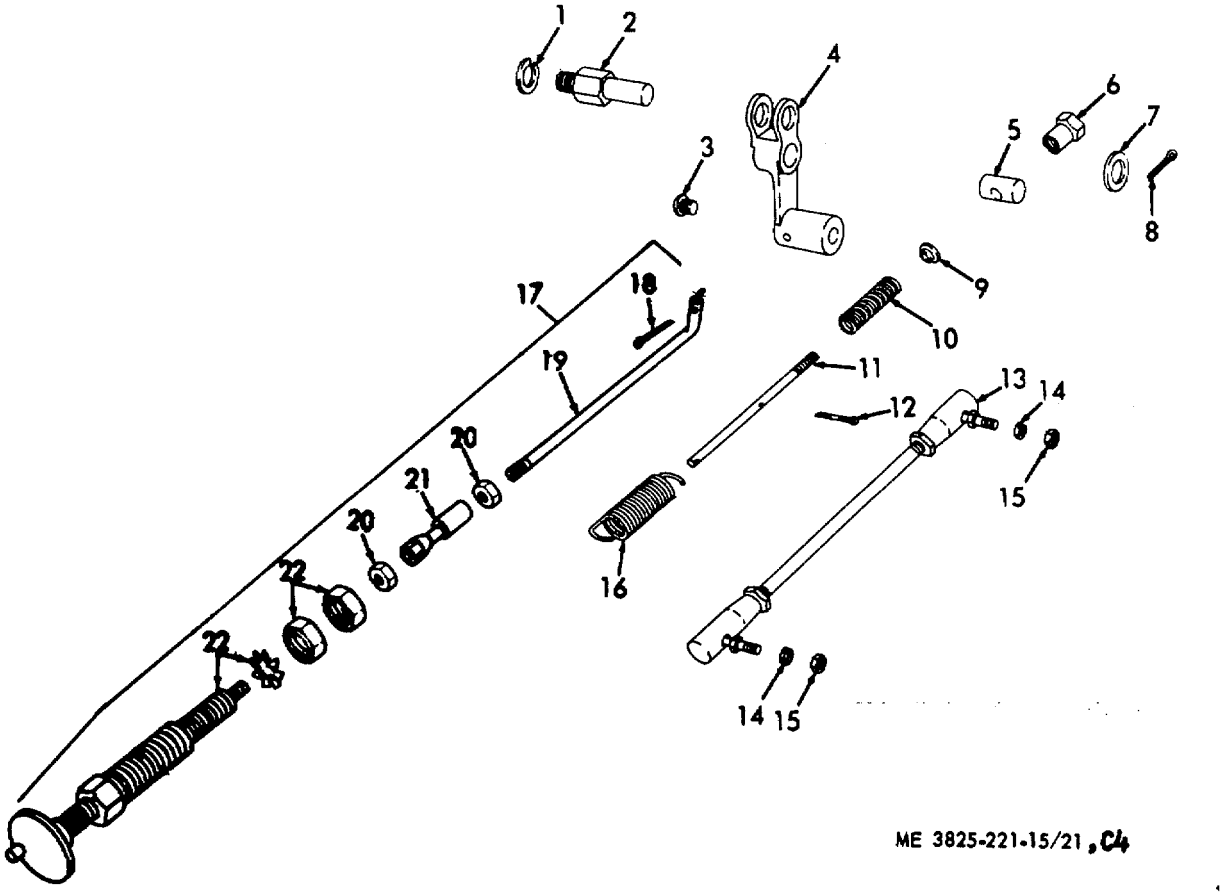
5. Position cap (12, figs.4 and 4.2) on the

suction line tee (18).

Paragraph 36c (7)(b)l is changed to read:

Page 37. Figure 21 is superseded.

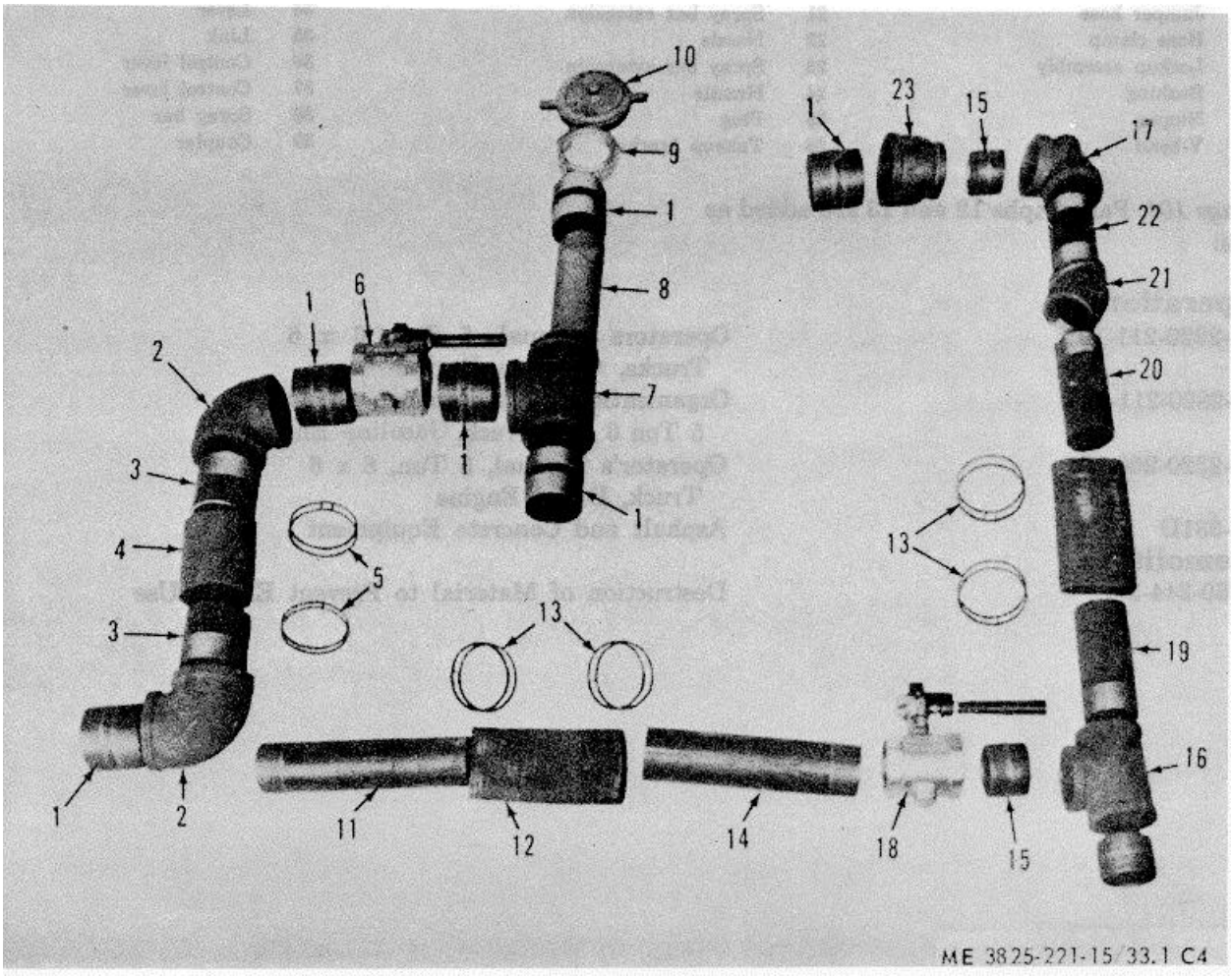
1. Turn the spray bar valve levers (15 and 15, figs.4 and 4.2) to ON.



1	Lockwasher	9	Retainer	17	Governor control assembly
2	Pin	10	Spring	18	Cotter pin
3	Screw	11	Adjusting screw	19	Rod
4	Variable speed lever	12	Cotter pin	20	Nut
5	Pin	13	Rod assembly	21	Swivel
6	Locknut	14	Lockwasher	22	Control shaft
7	Plain washer	15	Nut		assembly
8	Cotter pin	16	Spring		

Figure 21. Governor controls.
(ME 3825-221-15/21, C4)

Page 62. Add figure 33. 1.



Legend for Figure 34. 2.

1	Nipple	13	Hose clamp
2	Elbow	14	Pipe
3	Nipple	15	Nipple
4	Connector hose	16	Tee
5	Hose clamp	17	Reducing tee
6	Butterfly valve	18	Butterfly valve
7	Tee	19	Pipe
8	Strainer	20	Pipe
9	Faucet end	21	45° ell
10	Dust cap	22	Nipple
11	Pipe	23	Reducing coupling
12	Connector hose		

Figure 33.1. Suction and discharge piping (Model W15B9019)
(ME 3825-221-15/33.1, C4)

1	Support bar	14	Nipple	27	Elbow
2	Reducing tee	15	Slip joint	28	Coupler
3	Bracket	16	Seal	29	Adapter
4	Nipple	17	Extension elbow	30	Sprocket
5	Valve	18	Extension arm pivot spool	31	Chain
6	Pipe	19	Extension pivot	32	Guard
7	Pipe	20	Locknut	33	Shear pin
8	Jumper hose	21	Spray bar extension	34	Lever
9	Hose clamp	22	Nozzle	35	Link
10	Lockup assembly	23	Spray bar extension	36	Control lever
11	Bushing	24	Handle	37	Control lever
12	Nipple	25	Plug	38	Spray bar
13	Y-bend	26	Takeup bracket	39	Coupler

Page 101. Paragraphs 12 and 13 are added as follows:

12 Operation

TM 9-2320-211-10	Operators Manual, 5 Ton, 6 x 6 Trucks, Gasoline Engine
TM 9-2320-211-20	Organizational Maintenance Manual 5 Ton 6 x 6 Truck, Gasoline Engine
TM 9-2320-260-10	Operator's Manual, 5 Ton, 6 x 6 Truck, Diesel Engine
TM 5-331D	Asphalt and Concrete Equipment

13 Demolition

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

Page 63. Add figure 34.2.

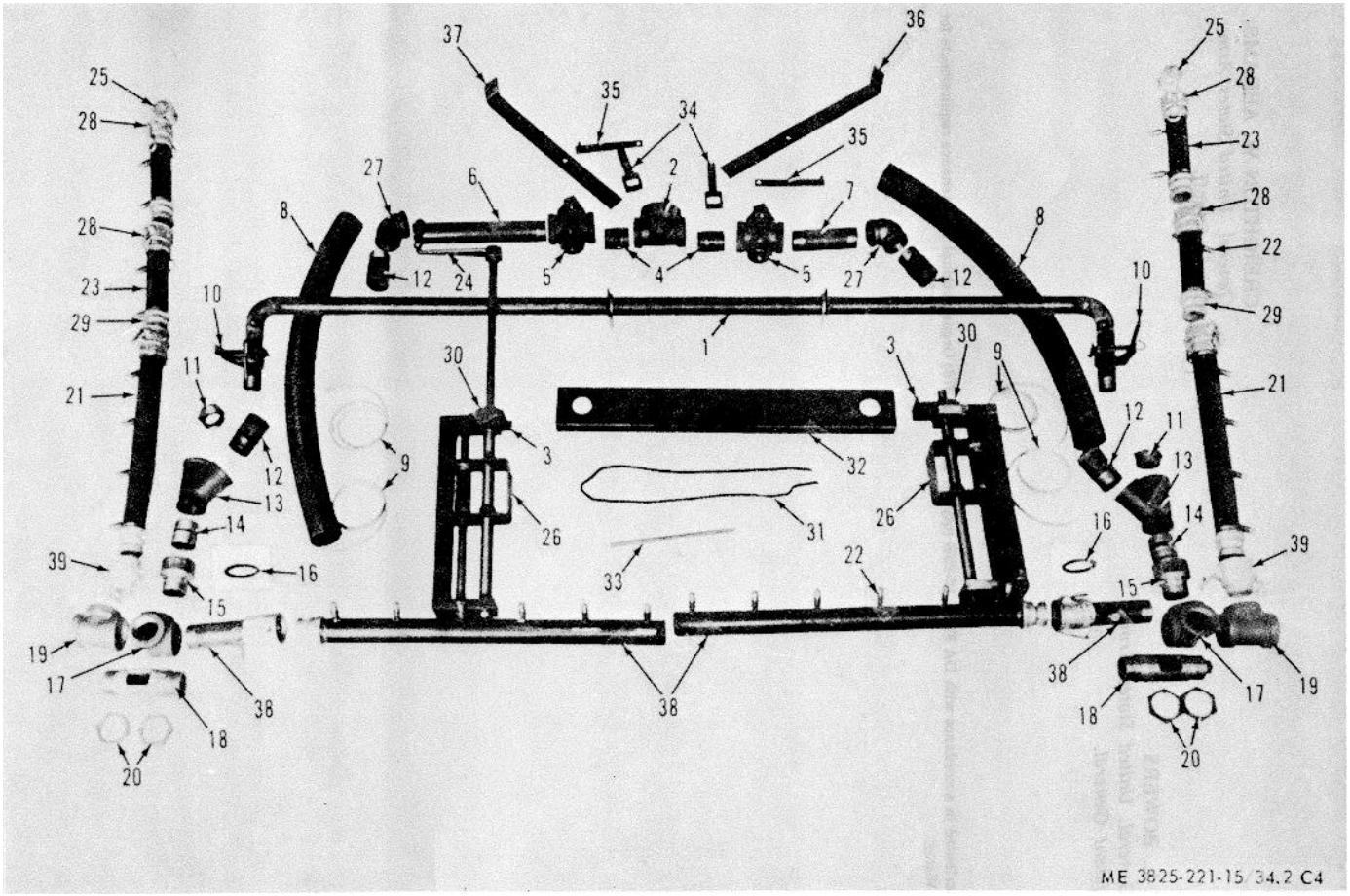


Figure 34.2. Spray bar assembly.
(ME 3825-221-15/34.2, C4)

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 12-25B (qty rqr block No. 378) Organizational Maintenance requirements for Distributors, Water.

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C. , *19 September 1968*

**Operator, Organizational, DS, GS, and
Depot Maintenance Manual**

**DISTRIBUTOR, WATER, TANK TYPE, TRUCK MTD;
GASOLINE DRIVEN (MACLEOD MODEL W1 SA)
FSN 3825-954-9033
MULTI-FUEL DRIVEN (MACLEOD MODEL W15A)
FSN 3825-774-9090
MULTI-FUEL DRIVEN (MACLEOD MODEL W15A4112)
FSN 3825-077-0550**

TM 5-3825-221-15, 16 December 1964, is changed as follows:

Cover page and contents page are changed as shown above.

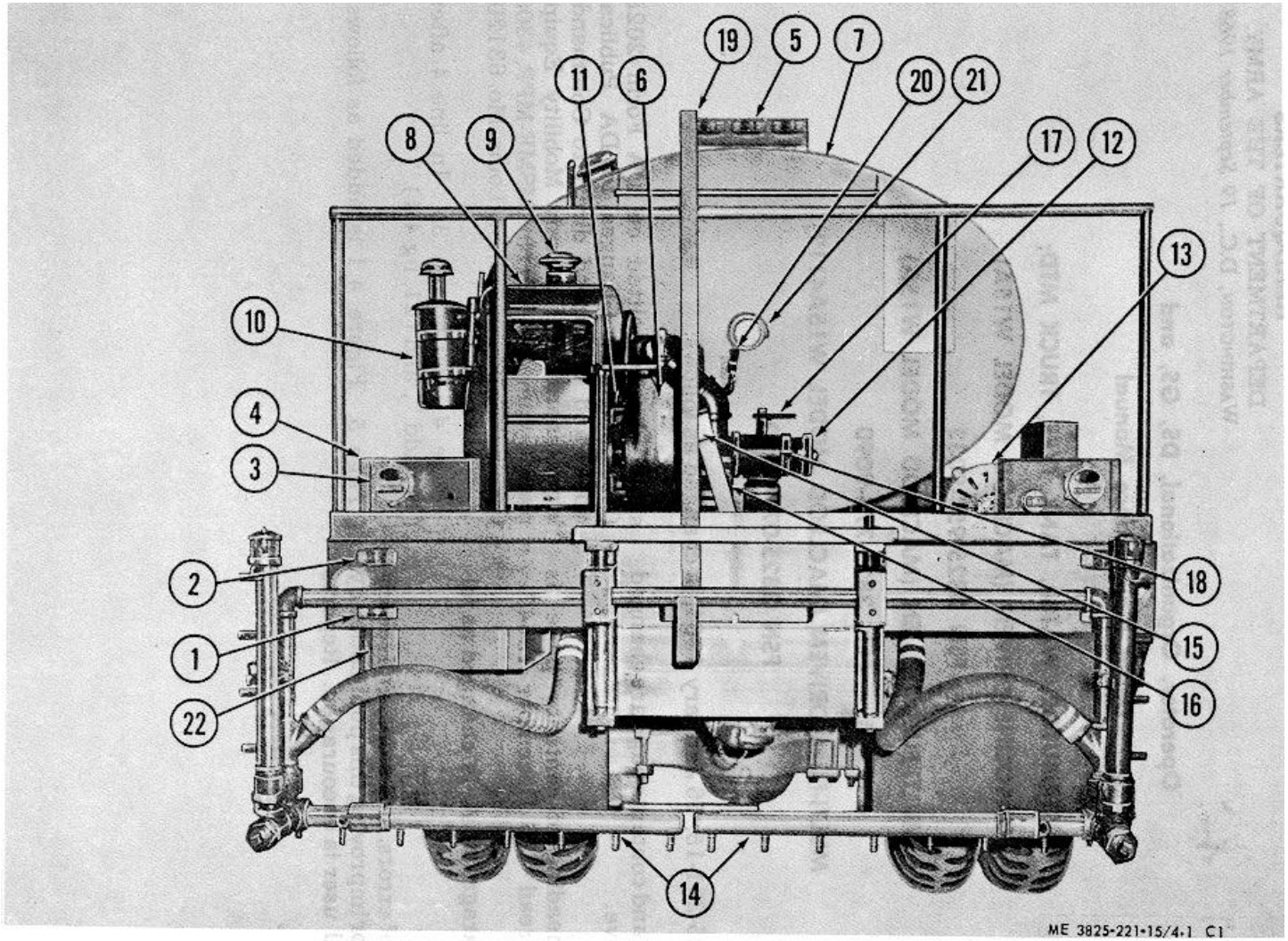
Date on heading of contents page is changed to read "16 December 1964".

Page 2. Paragraph *1c* is changed as follows:

c. 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 DA Publications) and forwarded direct to Commanding General, U. S. Army Mobility Equipment Command, ATTN: AMSME-MPP, 4300 Goodfellow Boulevard, St. Louis, Mo. 63120.

Page 4. Paragraph 3b. In line 4 after (14) add ", and (21, fig 4.1). "

Page 5. Figure 4. 1 is added as follows:



1	Blackout clearance light	7	Water tank	12	Suction cap	17	Suction valve lever
2	Clearance light	8	Engine	13	Foot valve and strainer	18	Suction Tee
3	Turn signal-Stop light	9	Engine	14	Spraybar assembly	19	Lateral adjustment lever
4	Guard	10	Air cleaner	15	Spraybar valve lever, left	20	Discharge pressure gage
5	Clearance light	11	Primer control	16	Spraybar valve lever, right	21	Water level gage
6	Water tank					22	Engine fuel tank

Figure 4. 1. Water distributor, rear (Model W15A4112).

Page 4. Paragraph *3e.* 1 is added after paragraph 3e.

e 1. Spraybar Assembly (Model W15A-4112). The spraybar assembly (14, fig. 4. 1) is composed of a framework of discharge lines and a number of spraybar sections which are attached to the vertical lift frame assembly at the rear of the carrier chassis (fig. 4-1). Water is discharged from the spraybars through a series of nozzles located along the outer surface of the spraybars. Auxiliary extensions of the spraybars are in the toolbox mounted on the left side of the distributor. The spray bar extensions are fitted with quick disconnect couplings, permitting rapid assembly of various spraybar configurations to cover any desired width from 8 feet to 24 feet in increments of one and two feet.

Page 8. Paragraph 5d is superseded as follows:

d. Performance.

Pumping pressure..... 10 to 50 pounds maximum

Spray range:

Model..... 4 to 16 feet
Model W15A4112 ..... 8 to 4 feet

Page 13. Paragraph 12 is superseded as follows:

12. Engine Fuel Shutoff Valve

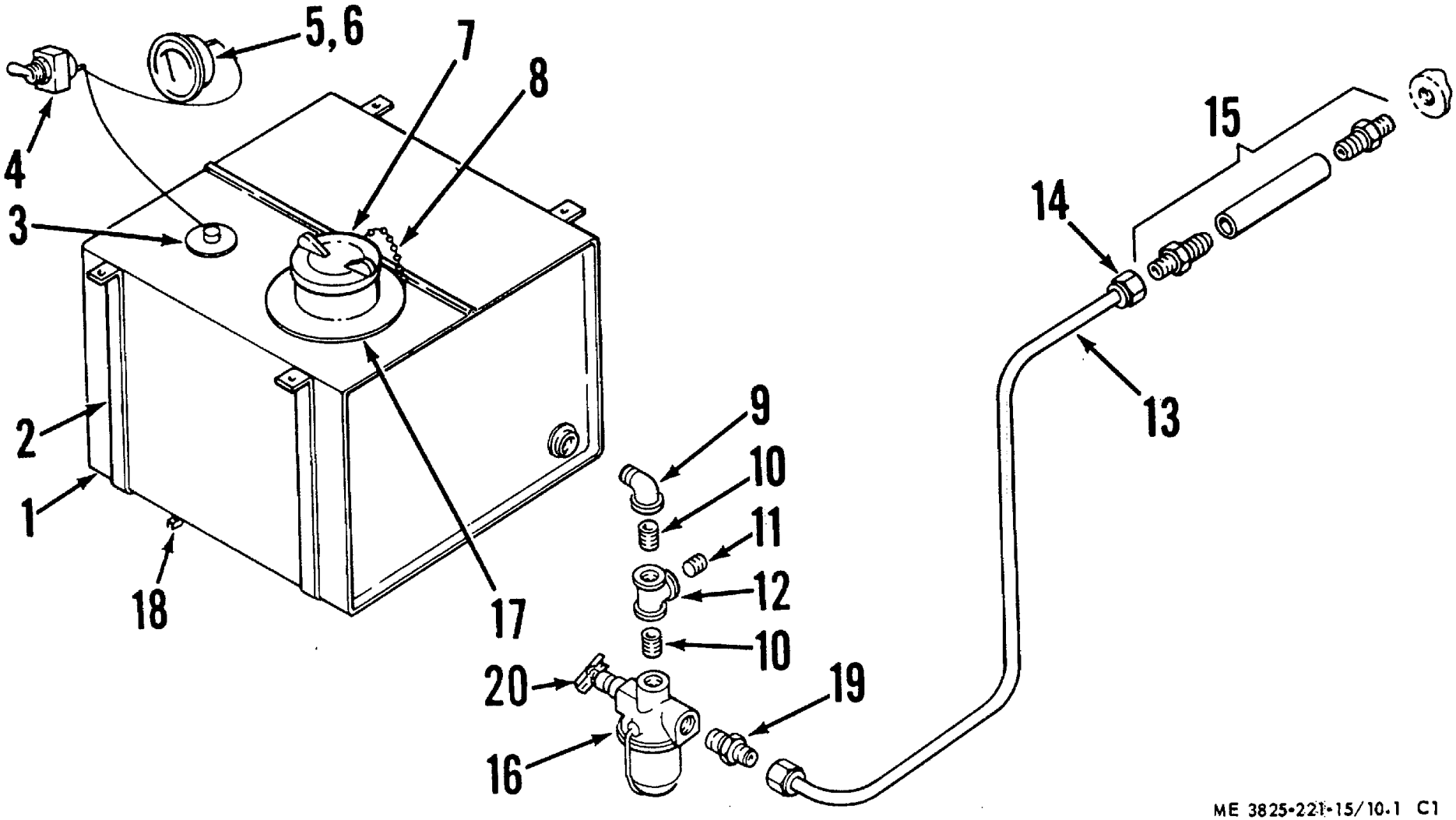
a. The Model W 15A water distributor engine fuel shutoff valve (3, fig. 10) is located on the carrier fuel strainer and is used to stop the flow of fuel from the truck fuel tank to the distributor engine fuel pump (6, fig. 27). The Model W15A4112 engine fuel shutoff valve is located at the fuel tank outlet (20, fig. 10. 1) and is used to stop the fuel flow to the distributor engine.

b. Close spray bar valves (15 and 16, fig. 4), and discharge valve (15, fig. 11). Open suction valve (17, fig. 4).

c. Attach fire hose to fire hose outlet (6, fig. 9).

d. Start engine and pump (para. 34).

Page 13. Figure 10. 1 is added as follows:



1 Tank
2 Mounting strap
3 Sending unit
4 Switch
5 Gage
6 Resistor
7 Cap
8 Chain
9 Elbow
10 Nipple
11 Plug
12 Tee
13 Tube
14 Nut
15 Hose assembly
16 Strainer
17 Strainer
18 Draindock
19 Adapter
10 Fuel shutoff valve

Figure 10.1. Fuel tank and lines.

Page. 15. Paragraph 20. 1 is added after paragraph 20.

20.1. Engine Fuel Level Gage (Model W15A4112)

The engine fuel level gage is mounted on the engine control panel to the right of the oil pressure gage. The gage indicates the amount of fuel remaining in the tank. A switch is provided in the gage circuit to turn the gage off and on (4, fig. 10.1).

Paragraph 25.1 is added after paragraph 25.

25.1. Water Tank Level Gage (Model W15A4112)

The water tank level gage (21, fig. 4. 1) is located at the rear of the tank, in the approximate center. The gage indicates in 25 gallon increments, the quantity of water remaining in the tank.

Page 18. Paragraph 36c(3). 1 is added after Paragraph 36c(3).

(3). *1. Attaching Spraybar Extensions.* The spraybar extensions (24 and 25, fig. 34.1) are used to increase the spray pattern width from 8 feet up to 24 feet, in increments of one or two feet. The extensions are fitted with quick disconnect couplings, and are stored in the tool box. Extension sections should be positioned for proper alignment of the nozzles before the couplings are locked.

Page 41. Paragraph 71. 1 is added after paragraph 71.

71.1. Description (Model W15A4112) Fuel is drawn from the engine fuel tank (1, fig. 10.1) through a fuel strainer (16, fig. 10.1) which incorporates a fuel shutoff valve.

Page 42. Paragraph *73a* (1). 1 is added after paragraph *73a* (1).

(1). 1 On model W15A4112, remove the fuel strainer (16, fig. 10. 1) from the engine fuel tank outlet line.

Paragraph 73c(2). 1 is added after paragraph 73c(2).

(2). On model W15A4112, thread the copper fuel line along the carrier frame to the fuel strainer at the fuel tank outlet, and attach the copper fuel line to the strainer with the connector (19, fig. 10.1).

Page 57. Paragraph 101. 1 is added after paragraph 101.

101. 1. Water Tank Level Gage (Model W15A4112)

a. General. The water tank level gage is mounted on the rear of the water tank near the operator's position and indicates water level.

b. Removal and Disassembly.

(1) Drain the water tank.

(2) Remove the two screws (6, fig. 30.1) securing the dial bezel. Remove the bezel and dial.

(3) Remove the four screws (3) that secure the gage assembly to the tank. Carefully draw out the gage assembly and gasket.

c. Cleaning, Inspection and Repair.

(1) Clean all metal parts with an approved cleaning solvent and dry thoroughly.

(2) Inspect the collar welded to the water tank for cracks or broken welds. Repair a broken weld.

(3) Inspect the gage for damage. Replace a damaged or defective gage.

(4) Inspect the dial assembly for damage. Replace a damaged dial.

(5) Discard gasket and replace with a new one when reinstalling the gage assembly

d. Reassembly and Installation.

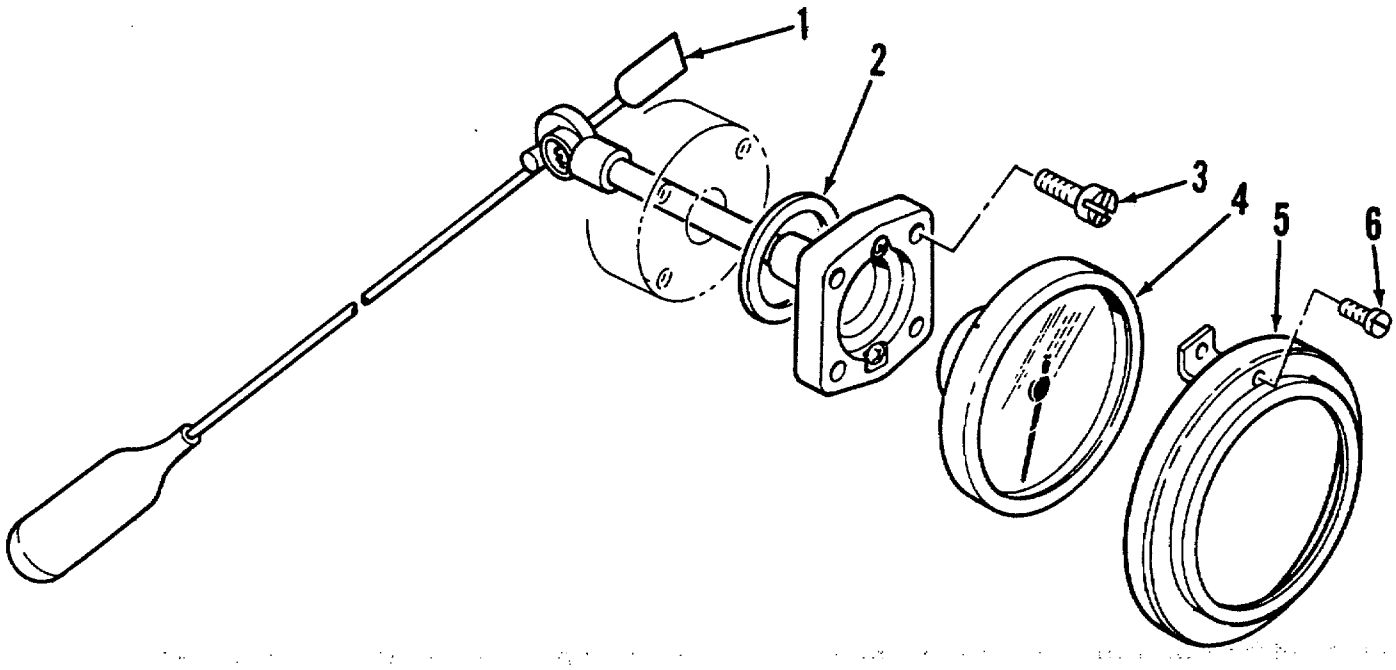
(1) Place gasket over shoulder at rear of gage mounting plate.

(2) Carefully insert gage assembly through hole in the collar welded to the water tank.

(3) Install four screws to retain mount-

ing plate.
(4) Place dial assembly in position and secure with bezel and two screws.
(5) Fill the water tank and observe gage operation.

Page 56. Figure 30.1 is added as follows:



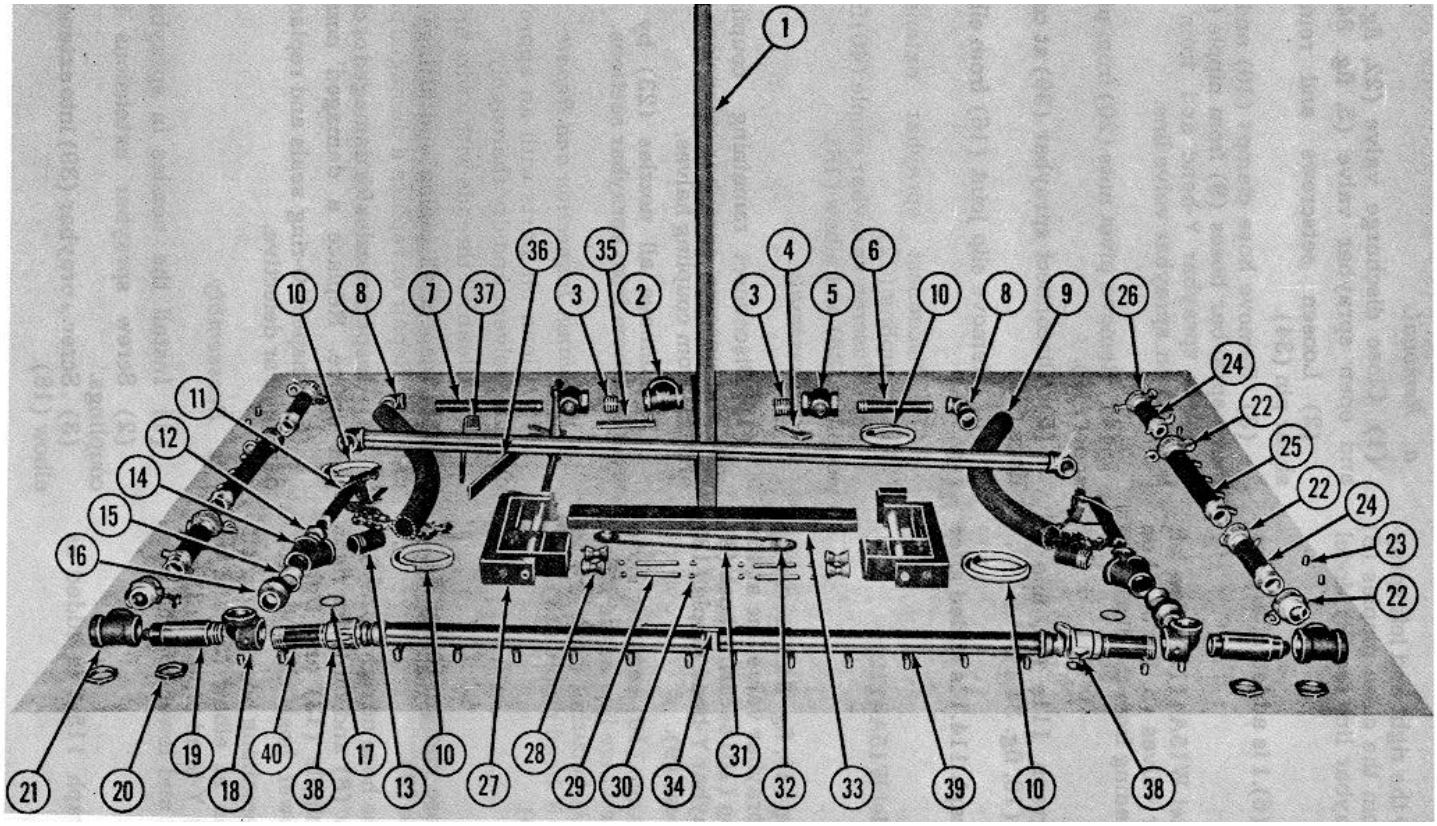
ME 3825-221-15/30.1 C1

1	Gage Assembly	4	Dial Assembly
2	Gasket	5	Bezel
3	Screw	6	Screw

Figure 30.1. Water level gage (Model W15A4112.).

Page 64. Paragraph- 111*a(3).* In line 1 after (9, fig. 34), add "and (10, fig. 34.1). "

Page 63. Figure 34.1 is added as follows:



1 Horizontal shifter assembly
2 Reducing tee
3 Nipple
4 Lever 14
5 Valve 15
6 Pipe 16
7 Pipe 17
8 Elbow
9 Jumper hose
10 Hose clamp
11 Lockup assembly
12 Stopped bushing
13 Nipple
Y-bend
Nipple
Slip joint
Seal
18 Extension elbow
19 Extension arm pivot spool
20 Locknut
21 Extension pivot
22 Coupling
23 Nozzles
24 Spraybar extension
25 Spraybar extension
26 Ca p
27 Take-up bracket
28 Rollers
29 Pin
30 Retainer
31 Chain
32 Sprocket
33 Guard
34 Shear pin
35 Link
36 Control lever
37 Control lever
38 Coupling
39 Spraybar

Figure 34.1. Spraybar assembly.

Paragraph 111*b*(2). 1 is added after paragraph 111*b* (2).

(2).1 Unscrew the right and left spraybar valves (5) from the close nipples (3) leading to the spraybar line tee (2) Model W15A4112).

Paragraph 111*d* (6).1 is added after paragraph 111d (6).

(6).1. On model W15A4112, screw left and right spraybar valves (5, fig. 34.1) on close nipples (3) leading from the discharge line tee (2).

Page 65. Paragraph 11lle (6), line 3, after (9) add "and (10, fig. 34.1)."

Page 66. Paragraph 114.1 is added after paragraph 114.

114.1 Hoses (Model W15A4112)

a. Removal.

(1) Loosen clamp (10, fig. 34.1)securing hose (9) to right spraybar valve line at the elbow (8) and clamp (10) securing hose (9) to lower right spraybar Y-bend nipple (13) and remove right hose (9).
(2) Loosen clamp (10) securing hose (9) to left spraybar valve line at the elbow (8) and clamp (10) securing hose (9) to lower left spraybar Y -bend nipple (13) and remove left hose (9).

b. Installation.

(1) Position hose clamp (10, fig. 34.1) on both ends of hose (9).
(2) Position one hose on right spraybar valve line at elbow (8) and on lower right spraybar Y-bend nipple (13) and tighten both upper and lower hose clamps (10).
(3) Position remaining hose (9) on left spraybar valve line at elbow (8) and on lower left spraybar Y-bend nipple (13) and tighten both upper and lower hose clamps (10).

Page 67. Paragraph 115.1 is added as follows:

115.1. Spraybar and Extensions (Model W15A4112)

a. Removal.

(1) Close discharge valve (22, fig.33) and open spraybar valve (5, fig. 341).
(2) Loosen setscrews and remove shear pin (34).
(3) Remove hose clamps (10) and remove spraybar hoses (9) from nipple (13) on lower spraybar Y-bend and from elbow (8) on spraybar valve line.
(4) Remove pivot nuts (20) from pivot spool (19).
(5) Disconnect spraybar (39) at couplings (38)
(6) Remove slip joint (16) from elbow (18).
(7) Disconnect spraybar extension (24) at coupling (22).
(8) Unscrew spraybar nipple (40)from coupling (38) and elbow (18).

b. Disassembly.

(1) Disconnect remaining couplings (22) and unscrew spraybar extensions (24 and 25) from coupling halves.
(2) Remove all nozzles (23) by unscrewing them from spraybar sections.

c. Cleaning, Inspection and Repair.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.
(2) Clean all threads with a wire brush.
(3) Inspect all piping and fittings for damage. Repair or replace a damaged part.
(4) Inspect nozzles for damaged or clogged orifice. Replace a damaged nozzle.
(5) Inspect O-ring seals and replace if damaged or defective.

d. Reassembly.

(1) Install the nozzles in spraybars.
(2) Screw spraybar extensions into couplings.
(3) Screw spraybar (39) into extension elbow (18).

(4) Screw spraybar nipple (40) into elbow (18) and coupling half (38).
(5) Connect spraybar (3) at coupling (38).
(6) Screw spraybar extensions (24 and 25) into coupling halves (22) and connect couplings.

e. Installation.
(1) Replace extension pivot (21) on pivot spool (19) and secure with locknuts (20).
(2) Connect spraybar extension (24) to coupling (22) at extension pivot (21).
(3) Replace nipple (13) in spraybar Y -bend (14).
(4) Replace hoses (9) on nipple (13) and elbow (8) and secure with clamps (10).

Page 109. Appendix III is superseded as follows:

APPENDIX III
BASIC ISSUE ITEMS LIST

Section 1. INTRODUCTION

1. Scope
This appendix lists items which accompany the water distributor or are required for installation, operation, or operator's maintenance.

2. General
This Basic Issue Items List is divided into the following sections:
a. Basic Issue Items - Section II. A list of items which accompany the water distributor or are required for the installation, operation, or operator's maintenance.
b. Maintenance and Operating Supplies - Section III. A listing of maintenance and operating supplies required for initial operation.

3. Explanation of Columns
The following provides an explanation of columns in the tabular list of Basic Issue Items, Section II.
a. Source, Maintenance, and Recoverability Codes (SMR), Column (1).

***Note:* Common hardware items known to be readily available in Army supply will be assigned Maintenance Codes only. Source Codes, Recoverability Codes, and Quantity Authorized i1 will not be assigned to this category of item.**

(1) Source Code, indicates the selection status and source for the listed item. Source codes are:

Code	*Explanation*
P'	Applied to repair parts which are stocked in or supplied from GSA/DSA or Army supply system, and authorized for use at indicated maintenance categories.

(2) Maintenance Code, indicates the lowest category of maintenance authorized to install the listed item. The Maintenance level code is:

Code	*Explanation*
C	Operator/crew

b. Federal Stock Number, Column (2). This column indicates the Federal stock number for the item.
c. Description, Column (3). This column indicates the Federal item name and any additional description of the item required. A part number or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parentheses. Repair parts quantities included in kits, sets, and assemblies are shown in front of the repair part name.
d. Unit of Issue, Column(4). This column indicates the unit used as a basis for issue, e.g., ea., pr, ft, yd, etc.

e. Quantity Incorporated in Unit pack. Column(5). This column indicates the actual quantity contained in the unit pack.

f.) Quantity Incorporated in Unit, Column (6). This column indicates the quantity of the item used in the functional group.

g. Quantity Furnished With Equipment, Column(7). This column indicates the quantity of an item furnished with the equipment.

h. Quantity Authorized, Column(8). This column indicates the quantity of an item authorized the operator/crew to have on hand or to obtain as required. As required items are indicated with an asterisk.

i. Illustration, Column(9) This column is divided as follows:

(1) Figure number, column(9a). Indicates the figure number of the illustration in which the item is shown.

(*2) Item number, column(9b).* Indicates the callout number used to reference the item in the illustration.

4. Explanation of Columns in the Tabular List of Maintenance and Operating Supplies -Section III

a. Component Application, Column(I). This column identifies the component application of each maintenance or operating supply item.

b. Federal Stock Number, Column(2). This column indicates the Federal stock number for the item and will be used for requisitioning purposes...

c. Description, Column(3) This column indicates the item and brief description.

d. Quantity Required for Initial Operation, Column (4). This column indicates the quantity of each maintenance or operating supply item required for initial operation of the equipment.

e. Quantity Required for 8 Hours Operation, Column (5). This column indicates the estimated quantities required for an average eight hours of operation.

f Notes, Column(6). This column indicates informative notes keyed to data appearing in a preceding column.

5. Abbreviations

ea.	each
lb	pound
gal	gallon
qt	quart

6. Federal Supply Code for Manufacturer

Code	*Manufacturer*
66289..	Wisconsin Motor Corp.
37562..	Macleod Co.

Section II. BASIC ISSUE ITEMS

(1) SMR Code	(2) Federal Stock No.	(3) DESCRIPTION	(4) Unit of Issue	(5) Qty Inc. In Unit Pack	(6) Qty Inc. In Unit	(7) Qty furn with Equip	(8) Qty Auth	(9) Illustration (a) Fig No.	(9) Illustration (b) Item No
		GROUP 31-BASIC ISSUE ITEMS MANUFACTURER INSTALLED 3100-BASIC ISSUE ITEMS MANUFACTURER OR DEPOT INSTALLED							
PC		DA Technical Manual TM 5-3825-221-15	ea.		1	1	1		
PC	4210-889-2221	Fire Extinguisher 2 ½ lb hand type Dry Chemical	ea.		1	1	1		
PC	7520-559-9618	Case: Operation and Maintenance Publications, cotton duck, water repellent, mildew resistant, MIL-B-11743B	ea.		1	1	1		
PC	7510-889-3494	Binder: Loose leaf U.S. Army Equipment Log Book	ea.		1	1	1		

Section III. MAINTENANCE AND OPERATING SUPPLIES

(1)	(2)	(3)	(4)	(5)	(6)
Component Application	Federal Stock Number	D E S C R I P T I O N	Quantity Required F/Initial Operation	Quantity Required F/8 Hrs Operation	N O T E S
ITEM 1. 0101 CRANK CASE (1)		OIL LUBRICATING: 5 gal pails as follows			(1) Includes quantity of oil to fill engine oil systems as follows:
	9150-265-9435 (2)	OE-30	5 qt	(3)	4 qt-CRANKCASE
	9150-265-9428 (2)	OE-10	5 qt	(3)	1 qt-OIL FILTER
	9150-242-7603-(2)	OES	5 qt	(3)	
ITEM 2. 0304 AIR CLEANER		OIL, LUBRICATING (4)	½ QT	(3)	(2) See FSC C9100-IL for additional data and requisitioning procedure.
ITEM 3. 0306 FUEL TANK					(3) See current LO for grade application and replenishment intervals.
	9130-160-1818	Automotive, Combat 91A	50 gal		(4) Use oil as purchased in item 1.
	9130-160-1830	Automotive, Combat 91C	50 gal		

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:
KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:
To be distributed in accordance with DA Form 12-25, (qty rqr block No. 378) Section II, Organizational Maintenance requirements for Distributors, Water.

TECHNICAL MANUAL
No. 5-3825-221-15

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. *16 December 1964*

ORGANIZATIONAL, DS, GS, AND DEPOT MAINTENANCE MANUAL

DISTRIBUTOR, WATER, TANK TYPE: GASOLINE DRIVEN; TRUCK MOUNTED (MACLEOD MODEL W 5SA) FSN 3825-95.9033

AGO 6817A

CHAPTER 1
INTRODUCTION

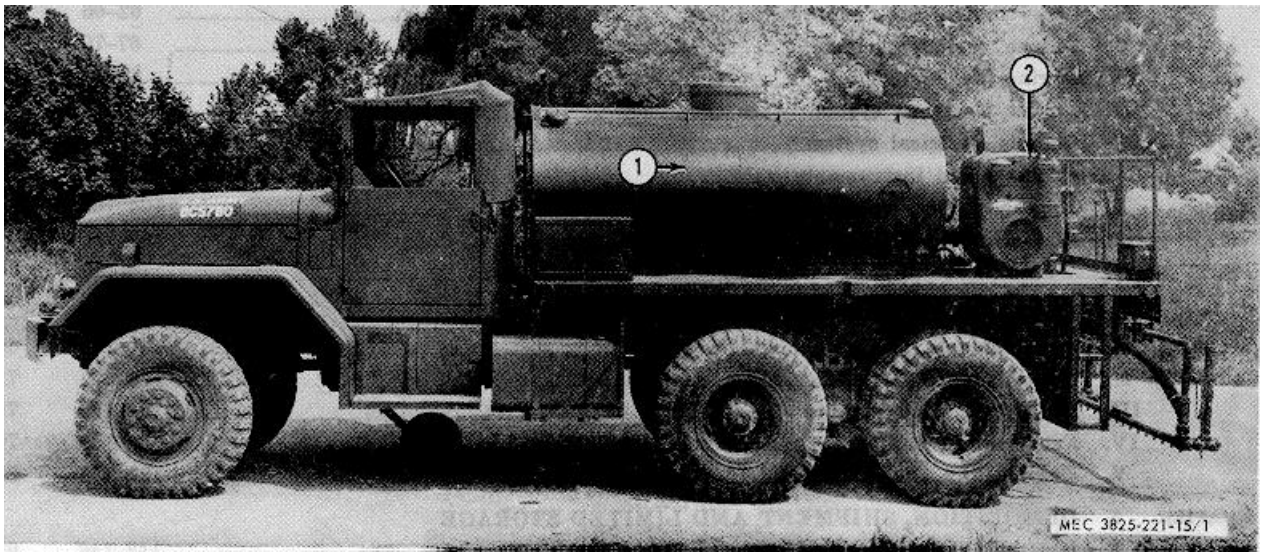
Section I. GENERAL

1. Scope

a. These instructions are published for the use of the personnel to whom the Macleod Company Model W15A Water Distributor is issued. Chapters 1 through 5 provide information on the operation, preventive maintenance services, and organizational maintenance of the equipment, accessories, components, and attachments. Chapter 4 provides information for direct and general support and depot maintenance. Also included are descriptions of main units and their functions in relationship to other components.

b. Appendix I contains a list of publications applicable to this manual. Appendix II contains the maintenance allocation chart. Appendix III contains the list of basic issue items authorized the operator of this equipment and the list of maintenance and operating supplies required for initial operation.

c. The direct reporting by the individual user, of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended Changes to DA Publications) will be used for reporting these improvements. This form will be completed in triplicate using pencil, pen, or typewriter. The original and one copy will be forwarded direct to Commanding General, U. S. Army Mobility Equipment Center, ATTN: SMOME-MMP, Post Office Drawer 58, St. Louis, MO 63166. One information copy will be provided to the individual's immediate supervisor (e.g., officer, noncommissioned officer, supervisor, etc.).



1 Water tank 2 Wisconsin engine

Figure 1. Water Distributor.

d. Report all equipment improvement recommendations as prescribed by TM 38-750.
e. "Left" and "Right" as used herein, in regard to Macleod Water Distributor will be used in the same sense as when referring to the carrier on which is mounted, when operational. "Left" therefore, will mean the driver's side. "Operator" as used herein, will refer to the Macleod Water Distributor operator. "Driver" will refer to the operator of the carrier on which the distributor is mounted. "Carrier" as used herein, will refer to the unit on which the distributor is mounted.

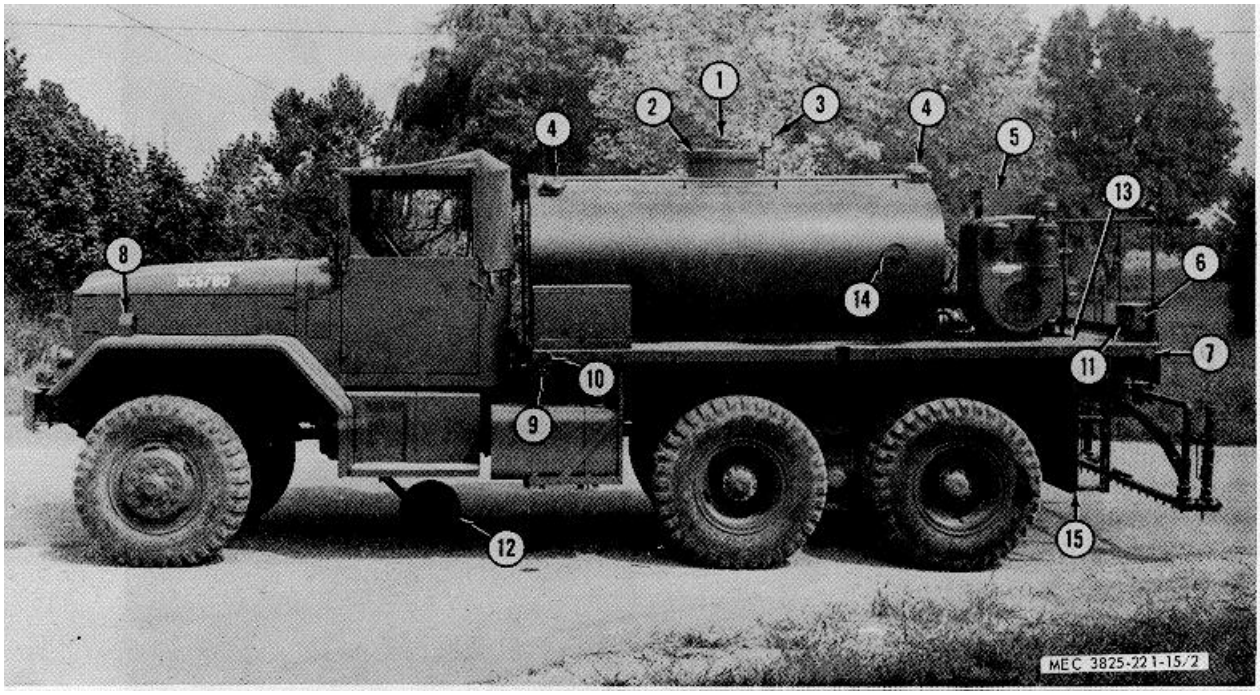
2. Record and Report Forms

a. 'DA Form 2258 (Depreservation Guide of Engineer Equipment).
b. For other record and report forms applicable to operation, crew and organizational maintenance, refer to TM 38-750.
Note. Applicable forms, excluding Standard Form 46 which is carried by the operator, will be kept in a canvas bag mounted on the equipment.

Section II. DESCRIPTION AND DATA

3. Description

a. General. The water distributor (fig. 1) Macleod Company Model W15A, is a truck mounted unit consisting of a 1,000-gallon water tank (1), a Marlow pump Model 4D2 (6, fig. 4) powered by a Wisconsin gasoline engine Model MVF4D (2, fig. 1), and the necessary piping, controls, and instruments to" permit complete and proper operation with a truck carrier. For information relating to the truck, using and maintenance personnel should refer to TM 9-2320-211-10 and TM 9-2320-211-20. The distributor normally is operated by a crew of two men, a driver in the truck cab and an operator on the operator's platform. (13, fig. 2). Some of the uses and functions of the Macleod Model W15A Water Distributor are as follows:



1	Manhole cover assembly	6	Marker light	11	Light bracket, rear
2	Hinge bolt	7	Reflector	12	Bitumeter wheel
3	Keeper crank	8	Turn signal guard	13	Operator's platform
4	Signal gong	9	Marker light	14	Water gage
5	Muffler shield	10	Light bracket, front	15	Step stringer

Figure 2. Water distributor, left side.

Spraying----------To uniformly apply a quantity of water measured in gallons per square yard over surface.

Transfer----------To transfer water from one outside source to another without water entering the tank.

Auxiliary fire--------To extinguish or control fires with one or more discharge hoses.
fighting

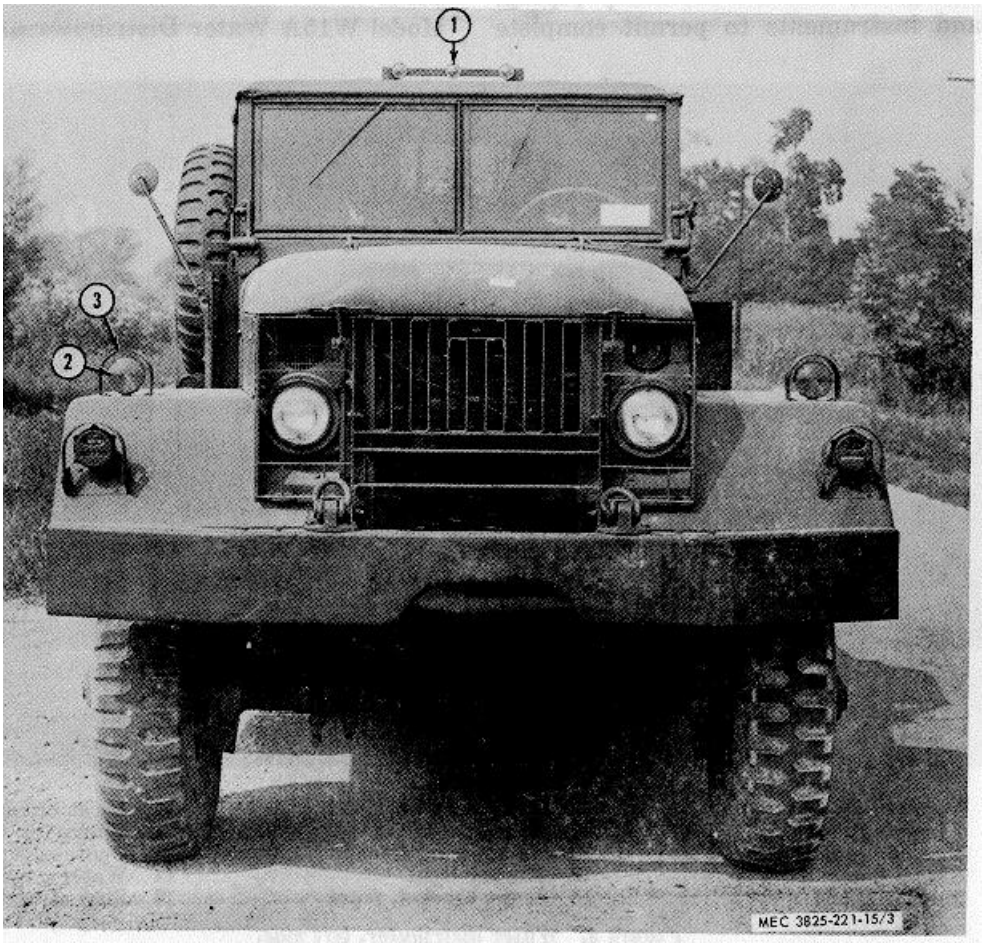
Pumping service--Used for draining surface water ditches, barges, boats or for any other pumping or washing service where a large volume of water is to be handled quickly.

b. Water Tank. The water tank (1, fig. 1) is a 1,000-gallon welded steel unit, oval in cross section, and equipped with a manhole and cover (1, fig. 2) and a water level gage (14).

c. Engine. The gasoline engine (2, fig. 1) is a Wisconsin Model MVF4D four-cylinder, four-cycle air cooled unit. It is mounted on the operator's platform of the distributor and coupled to the pump (6, fig. 4).

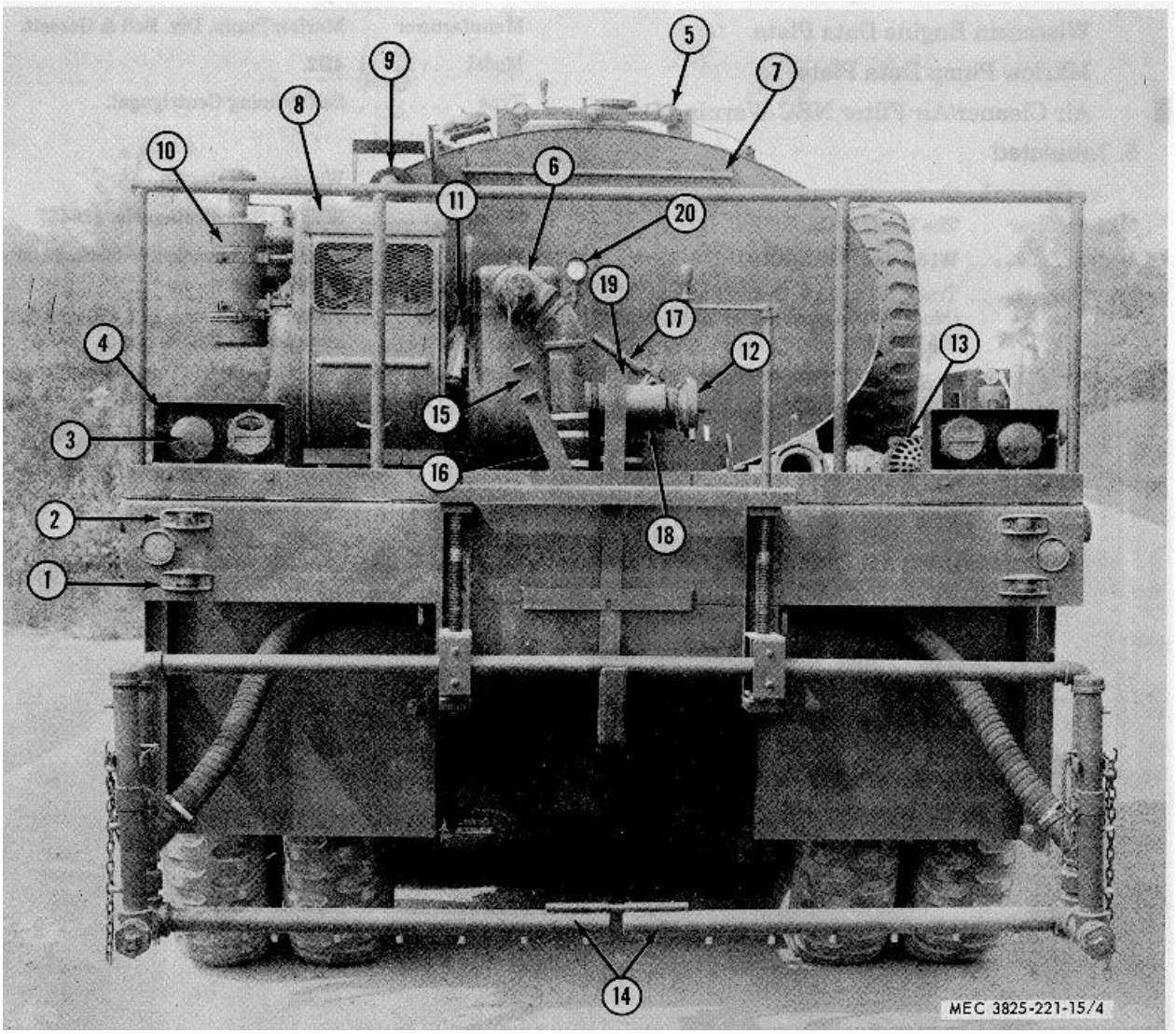
d. Water Pump. The water pump assembly (6) is a Marlow Model 4D2 centrifugal pump coupled directly to the engine crankshaft. The pump and engine are mounted at the center of the operator's platform. This pump normally operates within the pressure range of 10 to 30 pounds per square inch during the spraying operation.

e. Spraybar Assembly. The spraybar assembly (14) is made up of a framework of discharge lines and a number of spraybar sections which are attached to the vertical lift frame assembly at the rear of the carrier frame (fig. 4). Auxiliary extensions of spraybar are stowed in the tool box (fig. 12) on the distributor. In the bottom of the spraybars are nozzles where the water is discharged. These spraybars may be used in various combinations which will cover any desired width from 4 feet to 16 feet in increments of 1 or 2 feet.



1 Clearance **light** **2 Tu**rn **signal** light **3 Turn signal guard**

Figure 3. Water distributor, front.



1	Blackout clearance light	8	Engine	15	Spraybar valve lever, left
2	Clearance light	9	Muffler	16	Spraybar valve lever, right
3	Turn signal-stop light	10	Air cleaner	17	Suction valve lever
4	Guard	11	Primer control	18	Suction tee
5	Clearance light	12	Suction cap	19	Lateral adjustment lever
6	Water pump	13	,Foot valve and strainer	20	Discharge pressure gauge
7	Water tank	14	Spraybar assembly		

Figure 4. Water distributor, back.

f. Bitumeter Assembly. The bitumeter assembly consists of a frame (9, fig. 29) wheel assembly (18), lifting rod (3, f ig. 5), and a tachometer head (1) which is located on the instrument panel of the carrier. The bitumeter drive is mounted on a frame (9, fig. 29), and attached to the tachometer by the tachometer cable (6, fig. 5) coming through the floor board of the truck.

4. Identification

Identification of the various components of the water distributor, and detailed specifications regarding these components are provided by various identification and data plates consisting of the following:

Corps of Engineers Identification Plate.
Shipping Dimensions.
Lifting Attachment Diagram.

Water Distributor Operation Data Plate.
Wisconsin Engine Data Plate.
Marlow Pump Data Plate.
Air Cleaner/Air Filter NBC Warning Decal

5. Tabulated

a. General.

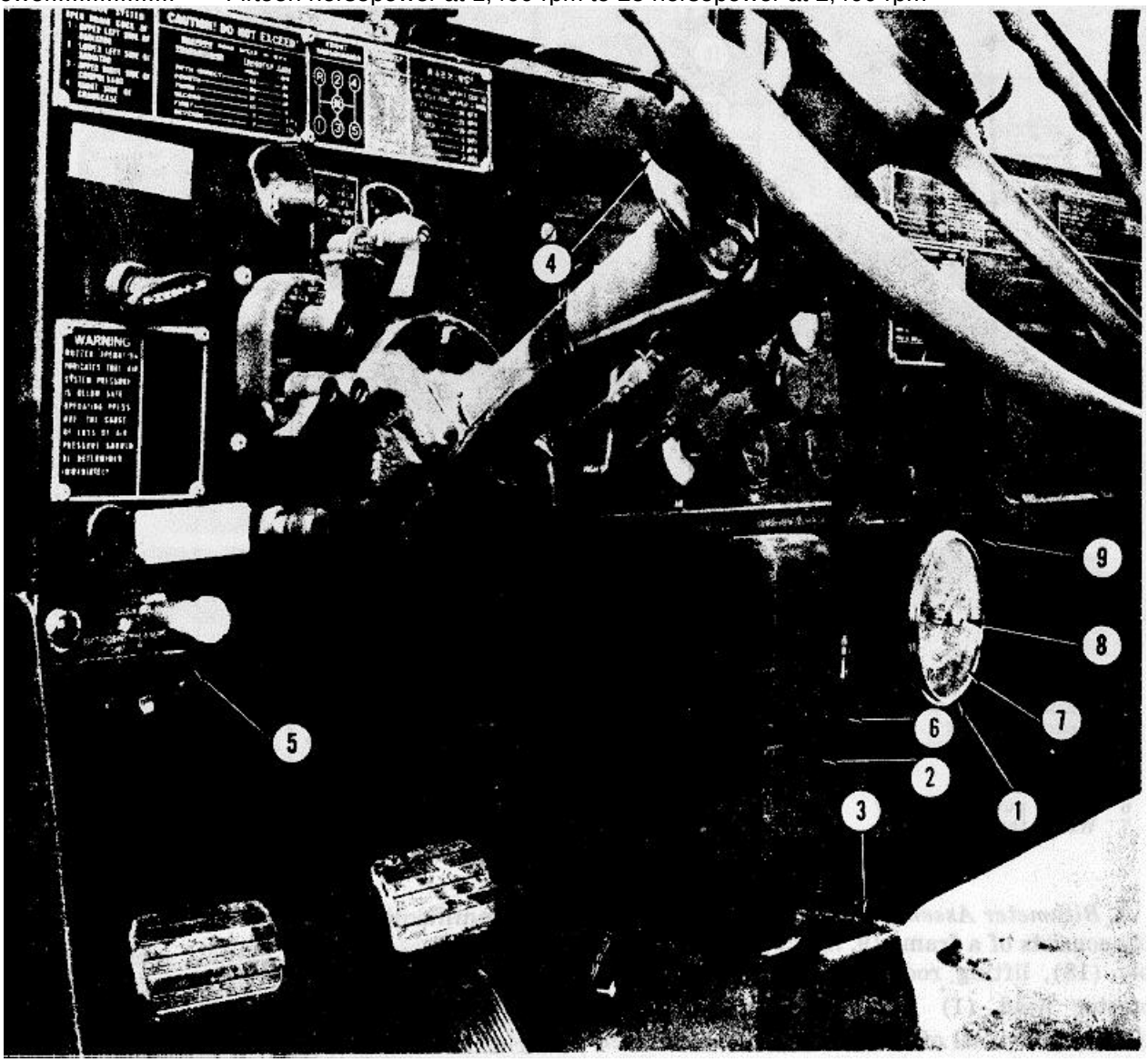
Manufacturer The Macleod Co.
Models..... W15A and W15B-9019.
Mounting..... Truck, 5 Ton 6 x 6, Ordnance model M-61 (Model W15A) and Model M810 (Model W15B-1909

b. Water Pump.

Manufacturer..... Marlow Pump, Div. Bell & Gossett.
Model..... 4D2.
Type..... Self Priming Centrigugal.

c. Engine.

Manufacturer..... Wisconsin Motor Co.
Model..... MVF4D Specification No. 223457
Type..... Four-cycle, aircooled, V-block, gasoline driven
Horsepower..... Fifteen horsepower at 1,400 rpm to 25 horsepower at 2,400 rpm



1	Tachometer head	4	Turn signal switch	7	Static needle
2	Fifth wheel lift bracket	5	Emergency flasher switch	8	Knob
3	Fifth wheel lift rod	6	Tachometer cable	9	Bracket

Figure 5. Inside of carrier cab.

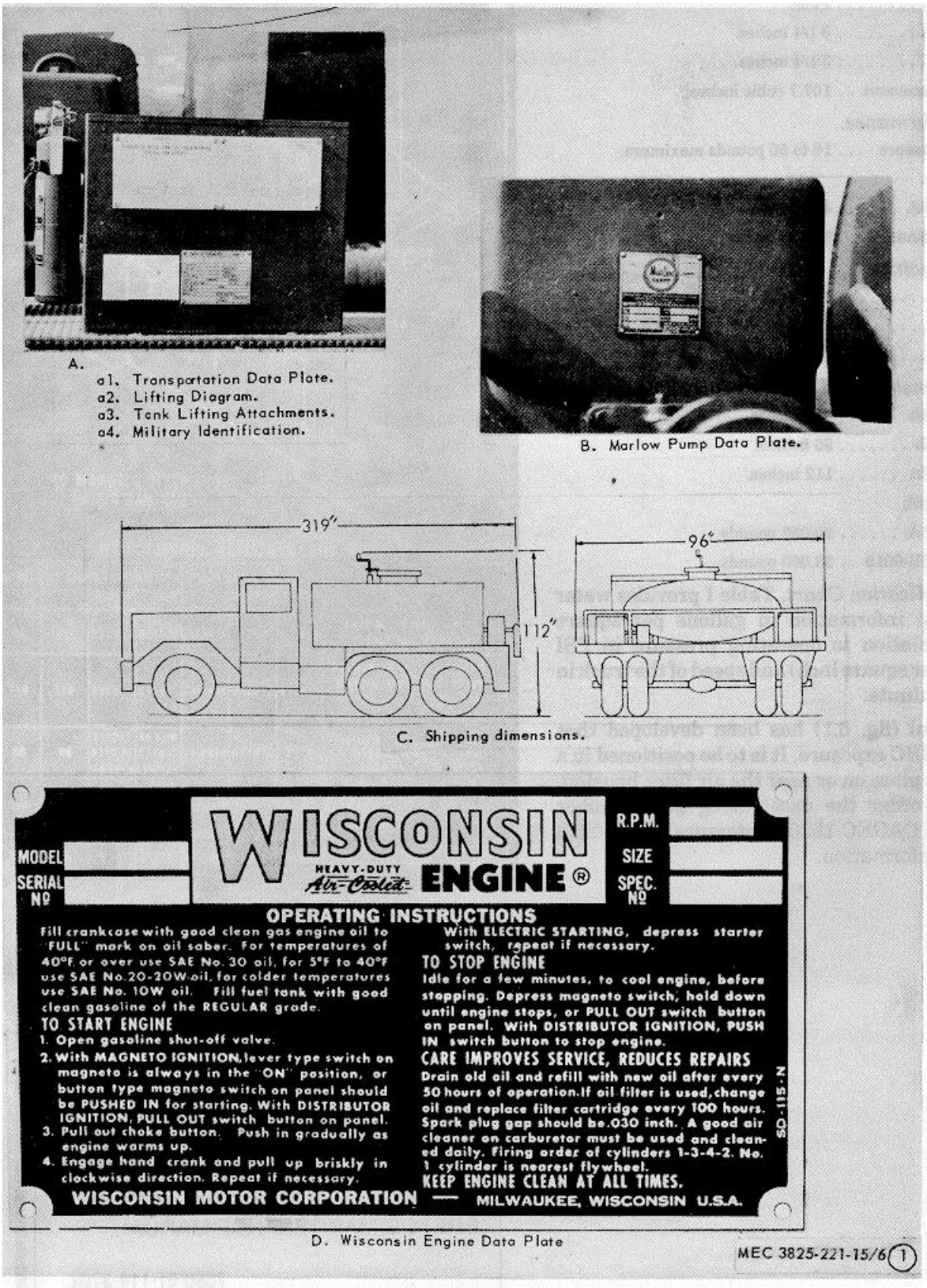


Figure 6. Data plates.

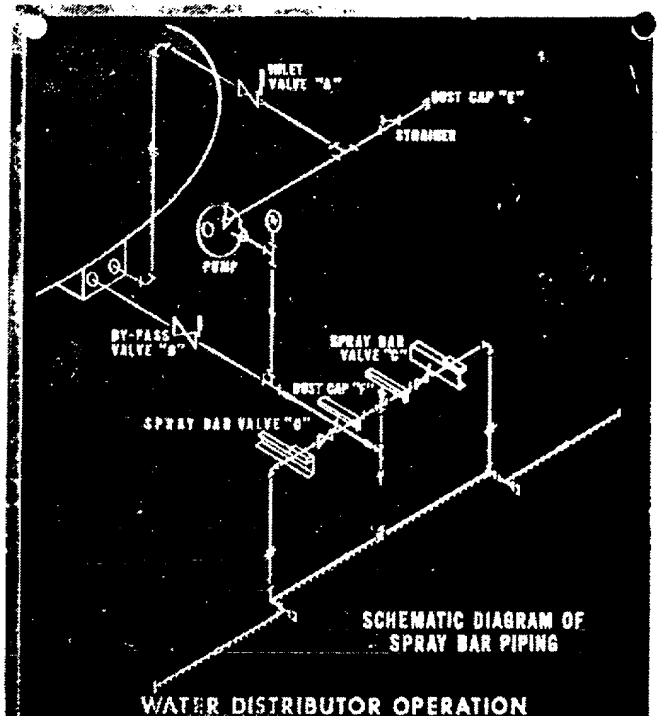
Cylinders..... Four.
Bore..... 3 1/4 inches.
Stroke..... 3 1/4 inches.
Piston displacement..... 107.7 cubic inches.

d. Performance.
Pumping pressure..... 10 to 50 pounds maximum.
Spray range:
Model W15A..... 4 to 16 feet.
Model W15A4112..... 8 to 24 feet.

e. Capacities.
Crankcase..... 5 quarts.
Air cleaner..... 1 pint.
Water tank..... 1,000 gallons.

f Dimensions and Weights, Including Carrier.
Overall length ..... 319 inches.
Overall width..... 96 inches.
Overall height ..... 112 inches.
Overall weight:
Model W15A..... 20,050 pounds.
Model W15B-9019..... 23,000 pounds.

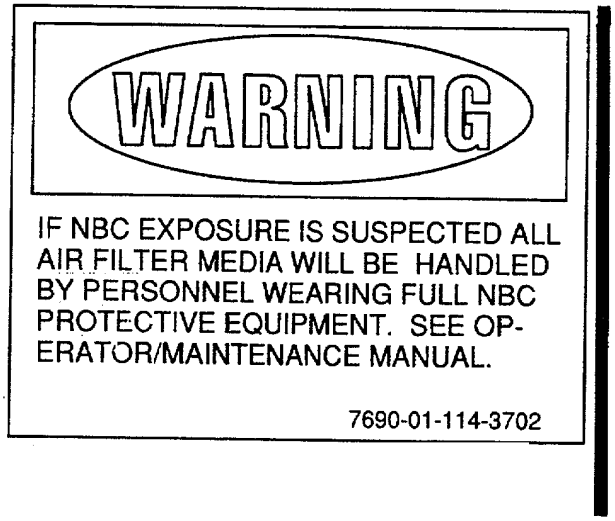
g. Application Chart. Table 1 provides water application information in gallons per square yard in relation to operating pressure in PSI (pounds per square inch) and speed of the truck in feet per minute. A decal (fig. 6.1) has been developed that warns of NBC exposure. It is to be positioned in a noticeable place on or near the air filter housing. You may order the decal using part number 12296626, CAGEC 19207; reference TB 43-0219 for more information.



SCHEMATIC DIAGRAM OF SPRAY BAR PIPING

WATER DISTRIBUTOR OPERATION

CONDITION	INLET VALVE "A"	BY-PASS VALVE "B"	PUMP	SPRAY BAR VALVE "C"	SPRAY BAR VALVE "D"	DUST CAP "E"	DUST CAP "F"
a) FILLING DISTRIBUTOR TANK FROM SOURCE OF SUPPLY	CLOSED	OPEN	RUNNING	CLOSED	CLOSED	OFF	ON
b) PUMPING MATERIAL FROM ONE POINT TO ANOTHER WITHOUT MATERIAL ENTERING THE DISTRIBUTOR TANK	CLOSED	CLOSED	RUNNING	CLOSED	CLOSED	OFF	OFF
c) PUMPING FROM DISTRIBUTOR TANK TO EITHER OR BOTH HALVES OF SPRAY BAR	OPEN	CLOSED	RUNNING	OPEN OR CLOSED (AS REQUIRED)	CLOSED OR OPEN (AS REQUIRED)	ON	ON
d) PUMPING FROM DISTRIBUTOR TANK TO 1 ½" DIA. CONNECTION FOR HOSE ATTACHMENT	OPEN	CLOSED	RUNNING	CLOSED	CLOSED	ON	OFF
e) EMPTYING DISTRIBUTOR TANK BY GRAVITY THROUGH SPRAY BAR	CLOSED	OPEN	STOPPED	OPEN	OPEN	ON	ON



F. Air Cleaner/Air Filter NBC Warning Decal
Figure 6.1

Table 1. Application Chart--0SO Pounds Pressure Truck Speed in Feet Per Minute

Gallons Square Yard	Length of spraybar in feet									
	4	8	9	10	11	12	13	14	15	16
*0.1	1,495	1,450	1,430	1,409	1,399	1,390	1,376	1,345	1,325	1,301
**0.2	1,470	1,500	1,390	1,290	1,250	1,220	1,193	1,187	1,180	1,175
0.3	1,190	1,000	928	868	835	808	801	794	787	783
0.4	894	750	696	650	625	605	600	595	590	588
0.5	715	600	556	520	500	485	480	476	472	470
0.6	595	500	464	434	417	404	400	397	394	392
0.7	510	428	398	372	358	346	343	340	337	336
0.8	446	375	348	325	312	302	301	300	299	298
0.9	397	334	310	288	278	268	267	265	263	262
1.0	357	300	278	260	250	242	240	238	236	235
1.1	324	271	251	236	227	220	217	215	213	212
1.2	298	250	231	217	208	202	200	199	197	196
1.3	275	230	212	200	192	186	184	183	182	181
1.4	255	212	198	185	178	173	171	170	169	168
1.5	238	200	185	173	166	162	160	158	157	156
1.6	223	187	174	162	156	151	150	149	148	147
1.7	210	176	163	153	147	142	141	140	139	138
1.8	198	167	155	144	139	134	133	132	131	130
1.9	188	158	146	137	131	127	126	125	124	123
2.0	179	150	139	130	125	121	120	119	118	117

* To obtain coverage of 0.1 gallon per square yard-operate at 10 pounds pressure.
** To obtain coverage of 0.2 gallon per square yard-operate at 20 pounds pressure.

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

6. Unloading of Equipment

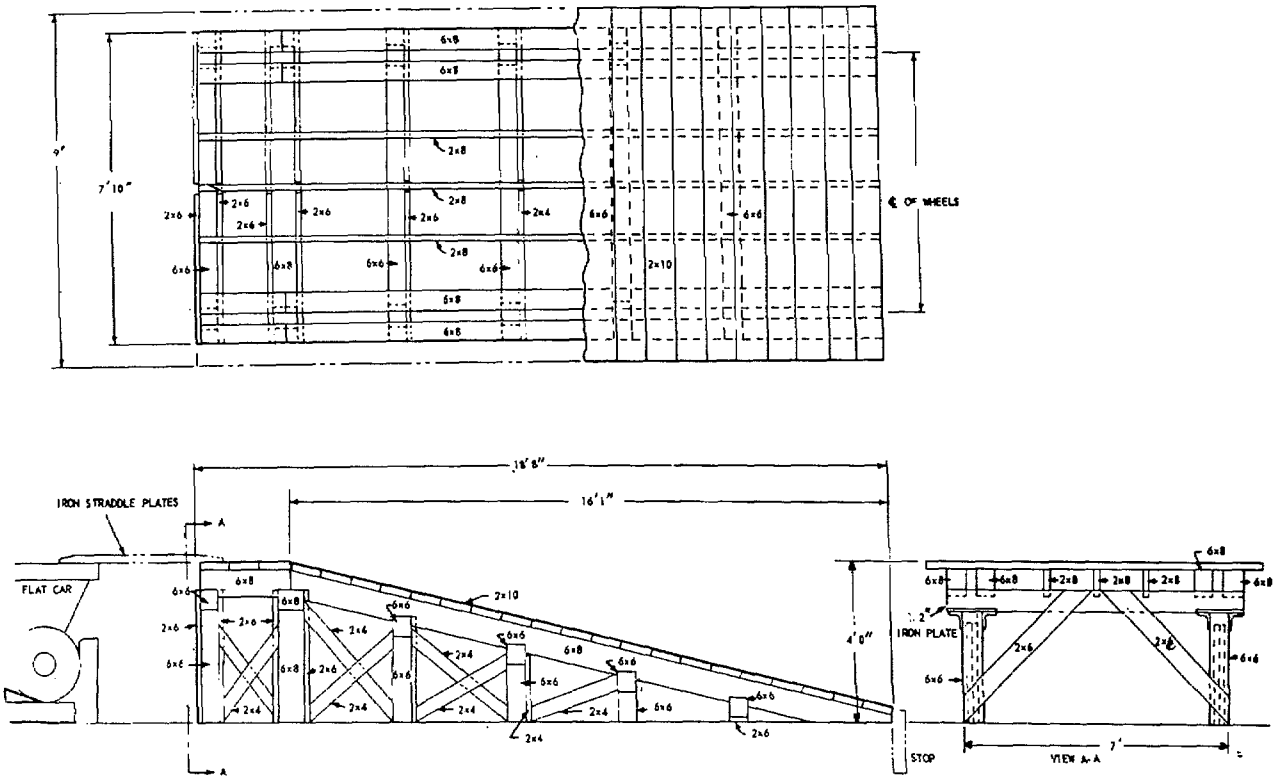
a. General. The water distributor, for long distance movement normally will be transported by flatcar. For railroad shipment the water distributor will be secured to the flatcar by means of tiedown cables and the wheels blocked with blocks and planks.

b. Blocking and Tiedown Removal.

(1) Remove the cable clamps and cables from the distributor and the ftatcar.

(2) Remove the stakes and planks, blocking the front wheels and rear wheels.

c. Driving the Water Distributor from the Flatcar. Construct an unloading ramp as follows:



MEC 3825-221-15/7

Figure 7. Typical unloading ramp.

(1) Use 6- by 6-inch timbers for the construction of the ramp runners and vertical supports.
(2) Secure the ramp runners and vertical supports with 2- by 4inch cross supports.
(3) After the ramp construction is completed, block the flatcar wheels with the 6- by 6-inch wheel blocks.
(4) After all tiedown cables and blockings have been removed and the ramp has been positioned, drive the water distributor off the flatcar taking extreme care descending the ramp.

d. Lifting the Water Distributor from the Flatcar. Using a suitable sling and spreaders, position the lifting hooks in the lifting lugs and lift the distributor from the flatcar. Refer to (fig. 6).

7. Unpacking Equipment

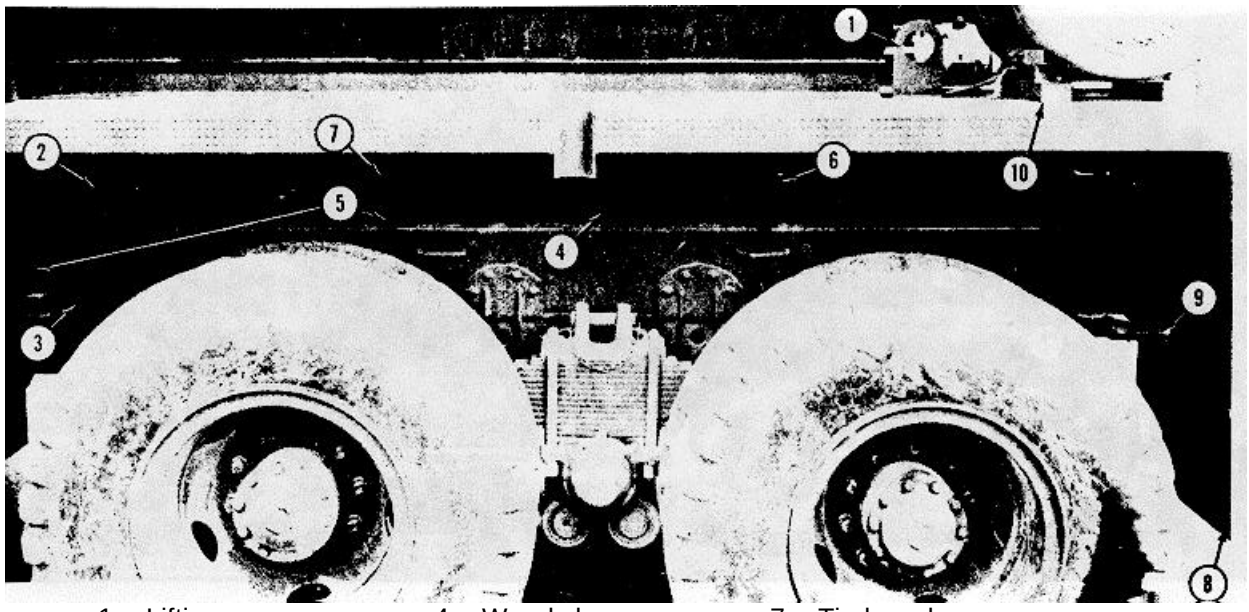
Remove the spraybar extensions, tools and other accessories from the toolbox. Clean them and replace them in the toolbox. Cut the metal bands securing the suction hoses. Remove the tiedown straps from the spraybar. Remove the tape covering the gages and reflectors. Remove the tape and waterproof paper from the fire hose and stow the hose in the rack provided.

8. Inspection of Equipment

a. Perform the preventive maintenance services (paras. 49 and 50).
b. Make a complete visual inspection to see that the repair tools, repair parts, publications, accessories, and attachments are with the distributor.
c. Visually inspect the entire distributor for loss of parts or damage.
d. Inflate bitumeter wheel tire (12, fig. 2 and fig. 2.1) to 15 pounds.
e. Check the engine flywheel shroud (9, figs. 11 and 11.1).

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.**

f. Inspect the engine housing (8, figs. 4 and 4.2), muffler (9), air cleaner (10), oil filter (6, fig. 11), air cleaner (7, fig. 11.1), and flywheel screen (12) fordamage.
g. Remove the engine side doors and check the spark plug cables (29, fig. 20) for firm connection. Check the magneto (fig. 18) and starters (fig. 19) for loose connections and secure mounting.



1	Lifting eye	4	Wood sleeper	7	Tiedown bar
2	Distributor frame	5	Tie rod	8	Rear fender
3	Carrier frame	6	Nut	9	Service air extension
				10	Engine sleeper

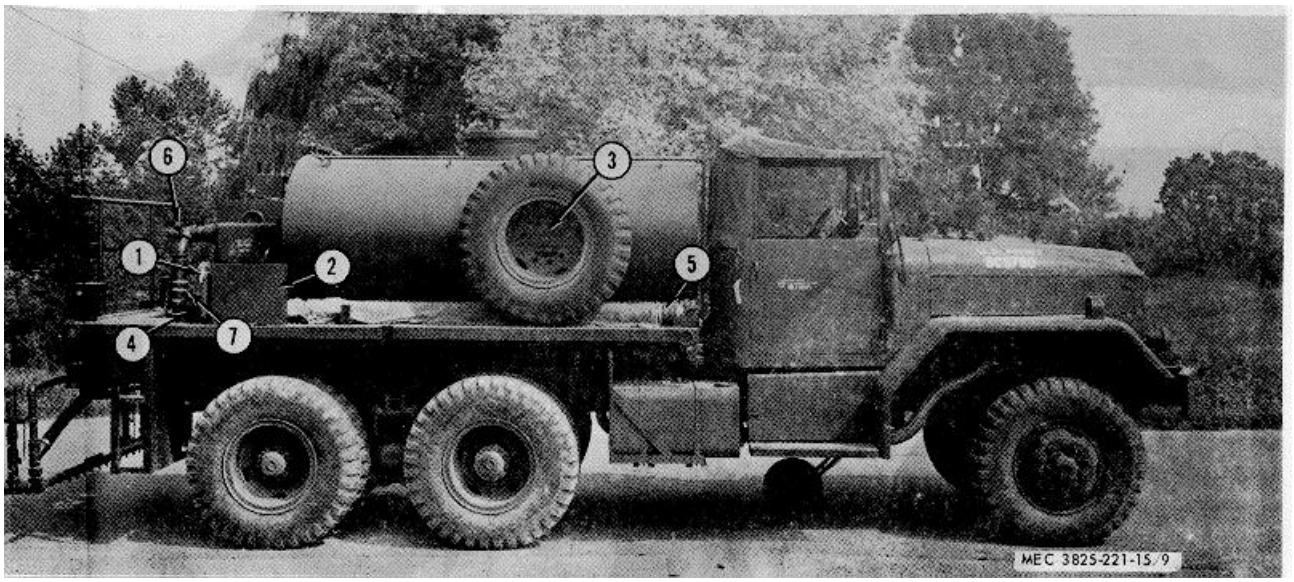
Figure 8. Attachment of distributor fragie to carrier frame.

h. Visually check the water pump (6, fig. 4) and its connections for damage. Check all piping, lines, hose, and extensions for damage, loose connections, or missing parts. Make sure all drain plugs are securely tightened.
i. Check the spray bars (14, fig. 4) and nozzles for damage.
j. Check the water tank (7, fig. 4) water level gage (14, fig. 2) and fenders (8, fig. 8) for signs of damage.
k. Be sure the operator's platform (13, fig. 2) is mounted securely and is not damaged. Test the signal gongs (4) for proper operations.
l. Raise and lower the fifth wheel (12, fig. 2) to see if the lift rod (3, fig. 5) is working properly. Spin the wheel to see if the bitumeter drive cable (6) and tachometer head (1) are working properly.
m. Check the turn signal (2, fig. 3) and marker lamps (9, fig. 2) for proper operation.
n. Report all damaged and missing parts to organizational maintenance.

9. Servicing Equipment
a. Lubricate the water distributor in accordance with L05-3825-221-15.
b. Perform the preventive maintenance services (paras. 49 and 50).

10. Equipment Conversion
a. Transfer Pumping.
(1) Turn all spray control valves to OFF position.
(2) Attach suction hose (5, fig. 9) to suction tee (18, fig. 4) and submerge suction hose in water source.
(3) Start engine and water pump (para. 34).
b. Firefighting.
(1) Using outside water source.
(a) Turn all control valves to OFF position.
(b) Attach suction hose (5, fig. 9) to suction tee (18, fig. 4) and submerge suction hose in water source.
(c) Attach fire hose to fire hose outlet (6, fig. 9).
(d) Start engine and pump (para. 34).

(2) Using water tank source.



1 Fire extinguisher
2 Discharge hose rack
3 Spare tire bracket
4 Foot valve and strainer
5 Suction hose
6 Discharge hose outlet
7 Discharge valve lever

Figure 9. Water distributor, right side.

Section II. CONTROLS AND INSTRUMENTS

11. General

This section describes, locates, illustrates, and furnishes the operator sufficient information pertaining to the various controls and instruments provided-for he proper operation of- the Macleod Water Distributor.

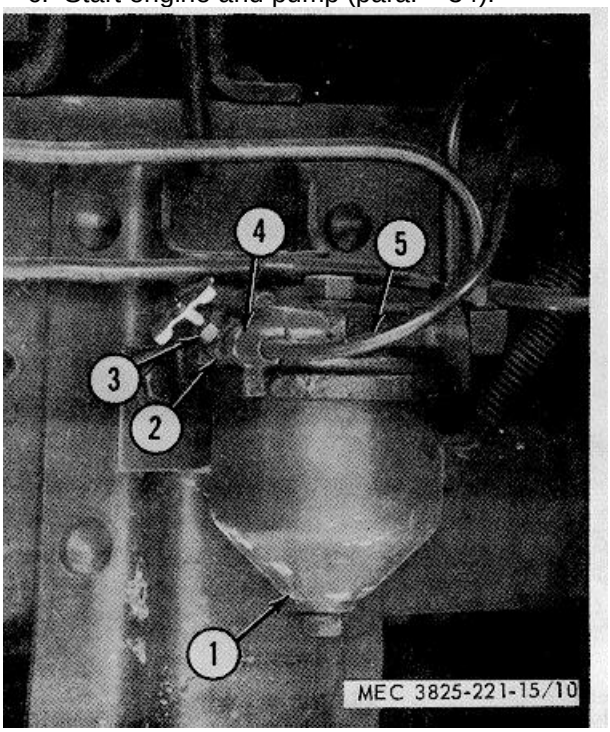
12. Engine Fuel Shutoff Valve

The engine fuel shutoff valve (3, fig. 10) is located on the carrier fuel strainer and is used to stop the flow of fuel from the truck gas tank to the fuel pump (6, fig. 27).

a. Close spray bar valves (15 and 16, fig. 4) and discharge valves (15, fig. 1). Open suction valve (17, fig. 4).

b. Attach fire hose to fire hose outlet (6, fig. 9).

c. Start engine and pump (para. 34).



1	Fuel filter	4	Nut
2	Street ell	5	Fuel line
3	Valve		

Figure 10. Carrier fuel filter

13. Engine Primer Control

The engine primer control (11, fig. 4) is located on the engine rear panel. It allows the operator to prime the carburetor manually.

14. Engine Choke Control

The choke control (13, fig. 11) is located on the front panel beneath the low oil pressure cutoff switch (5). It is a wire type manual control that closes the butterfly valve in the carburetor to enrich the fuel mixture when starting a cold engine.

15. Engine Magneto Stop Switch

The magneto stop switch (2, fig. 11) is located on the front panel to the left of the governor control knob (3). It is a push-pull switch and stops the engine by grounding the magneto. The ON position is with the switch pulled OUT. The OFF position is with the switch pushed IN.

16. Emergency Ground Button

The emergency ground button (22, fig. 18) is located on the bottom of the magneto. Pushing the button IN stops the engine in an emergency.

17. Engine Starter Button

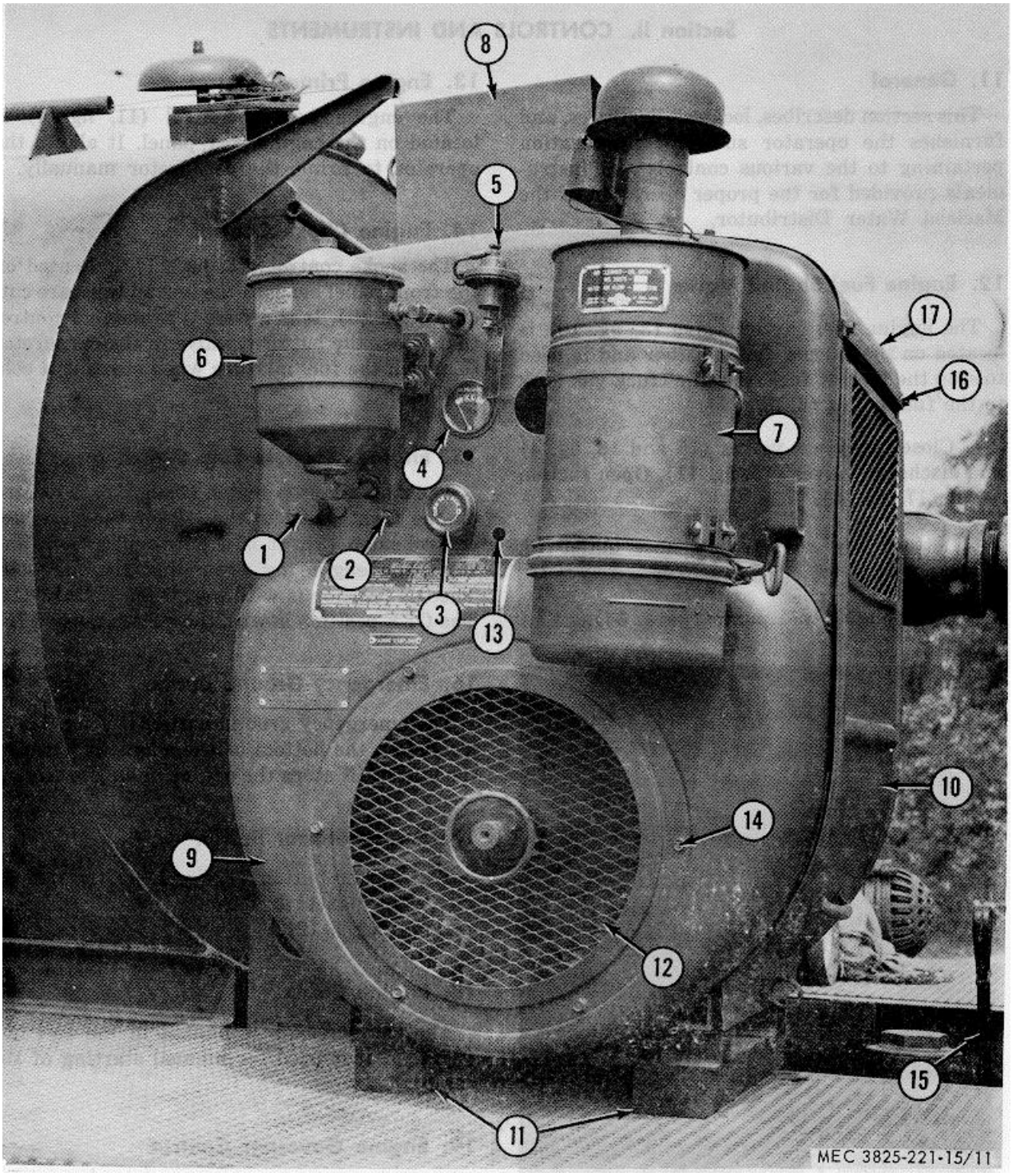
The starter button (1, fig. 11) is located on the front panel to the left of the magneto ground switch (2).

18. Engine Crank

The engine crank is located in the tool box (fig. 12). It is used for manual starting of the engine.

19. Engine Governor Control

The governor control (3, fig. 11) is located on the front panel below the oil filter assembly (6). It is a pushpull handle and rod control. It controls the speed of the engine. Pulling out the control increases engine speed. It may be locked in any position by turning the knob in a clockwise direction.



1	Starter switch	7	Air cleaner	13	Choke control
2	Ignition switch	8	Muffler shield	14	Capscrew
3	Governor control	9	Flywheel shroud	15	Discharge valve lever
4	Oil pressure gage	10	Engine house door	16	Capscrew
5	Low oil pressure safety switch	11	Engine sleeper	17	Canopy
6	Oil filter	12	Flywheel screen		

Figure 11. Pump engine panel.

20. Engine Oil Pressure Gage

The oil pressure gage (4) is located on the control panel below the low oil pressure shutoff switch (5). It shows engine oil pressure when the engine is running. The oil pressure is normal if the needle points to X on the oil pressure gage dial.

21. Engine Low Oil Pressure Shutoff Switch

The low oil pressure shutoff switch (5) is located on the upper center of the front panel. It shuts the engine off automatically when the oil pressure is dangerously low.

22. Engine Oil Level Gage

A saber type oil level gage is provided on each side of the engine crankcase. One is to the rear of the starter (short), and one is below the oil filler tube (long).

23. Engine High Temperature Safety Switch

The high temperature safety switch is located on the engine cylinder head opposite the No. 4 spark plug. The switch automatically shuts off when the engine temperature becomes too high.

24. Spraybar Lateral Adjustment Lever

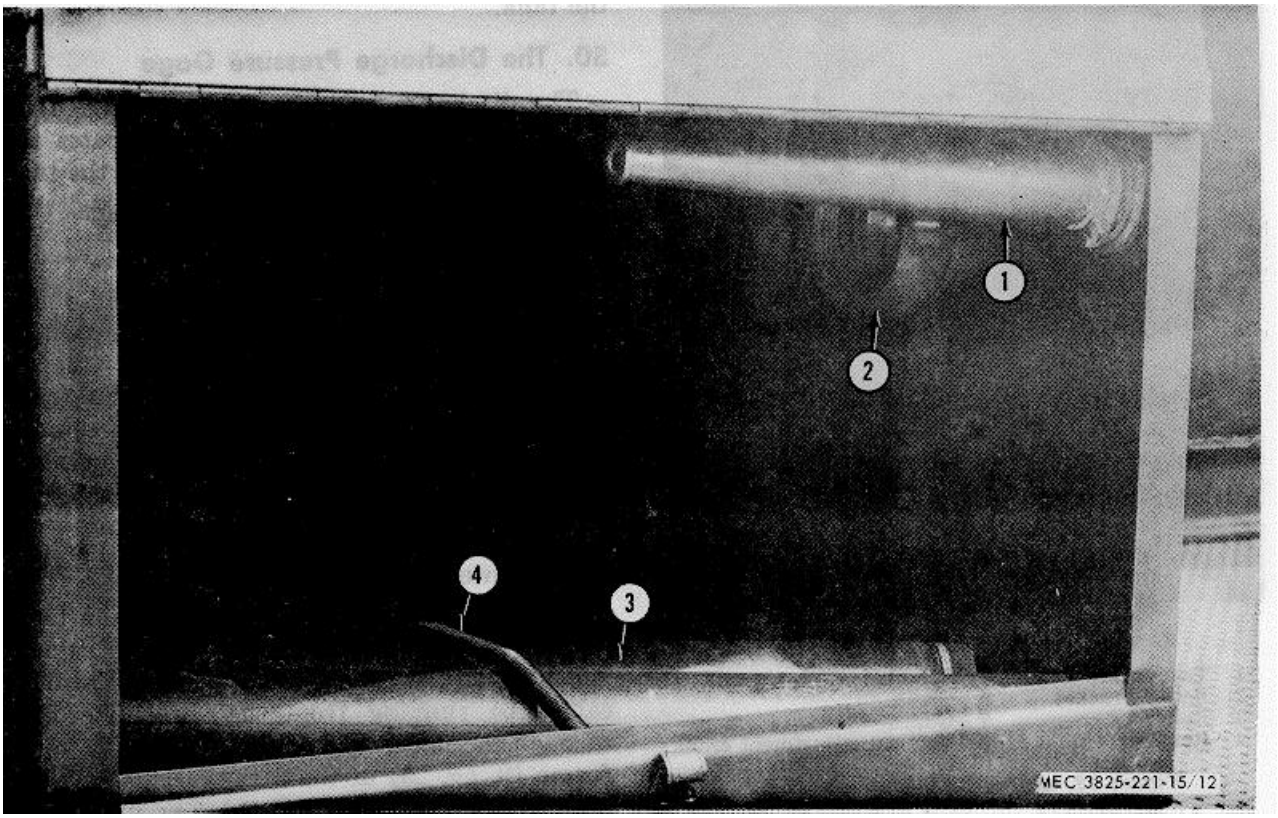
The spraybar lateral adjustment lever (19, fig. 4) is used to adjust the spray pattern laterally in relation to the track of the truck. There is 7 inches of adjustment available to the right or left.

25. Distributor Water Tank Level Gage

The water tank level gage (14, fig. 2) is located on the left side of the water tank. It shows the amount of water in the tank.

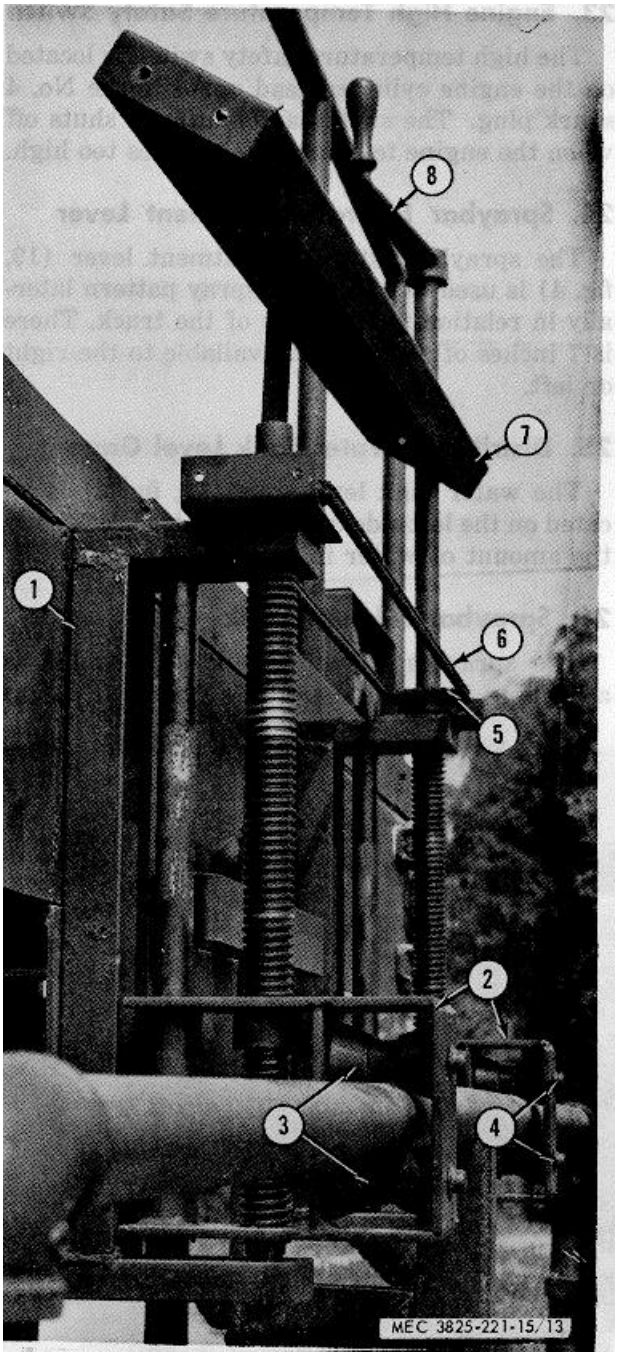
26. Spraybar Takeup Crank

The spraybar takeup crank (8, fig. 13) is accessible from the operator's platform and is



1 Fire hose nozzle
2 Fire hose adapter
3 Spray bar extension
4 Holddown spring

Figure 12. Inside of toolbox.



1 Takeup bracket
2 Roller bracket
3 Roller
4 Retainer
6 Sprocket
6 Chain
7 Guard
8 Vertical adjustment crank

Figure 13. Spraybar takeup assembly.

used for vertical adjustment of the spray bar position. An adjustment of 10 inches is made possible by the use of jack screws.

27. Spraybar Valves Control Levers
The distributor is provided with a valve for each side of the spraybar (15 and 16, fig. 4). These valves may be controlled independently or together. Moving the levers to the extreme left position opens the valves to maximum discharge.

28. Discharge Valve Control Lever
The discharge valve (15, fig. 11) is located beneath the operator's platform and is operated from the operator's platform. Moving the lever to the right opens the valve, permitting gravity flow from the tank to the spraybars. When pumping water through the spraybars this valve should be closed.

29. Suction Valve
The suction valve (17, fig. 4) is located adjacent to the pump inlet tee. The operating lever is mounted on the valve. This valve should be closed when pumping from supply other than the tank.

30. The Discharge Pressure Gage
The discharge pressure gage (20, fig. 4) is located in the discharge line. It indicates the water pressure being discharged from the tank to the spraybars or the fire hose.

31. Signal Gongs
A signal gong is provided at each end of the water tank (4, fig. 2). These are to be used by the driver and operator to signal each other in order to coordinate the operation of the truck and water distributor. A pull cord is accessible to the driver that rings the gong at the rear of the tank and the forward gong is operated by a pull cord accessible from the platform.

32. Bitumeter Assembly
The bitumeter assembly consists of a tachometer (1, fig. 5) attached to the instrument panel inside the cab of the carrier and a drive cable (6) running from the tachometer (1) through the floorboard of the carrier cab to the frame (9, fig. 29) of the fifth wheel, where the bitumeter drive (5) is located. The fifth wheel is located on the underside of the carrier, and the lift rod (3, fig. 5) used for lowering or raising the fifth wheel is located inside the cab of the carrier.

Section III. OPERATION UNDER USUAL CONDITIONS

33. General

a. The instructions in this section are published for the information and guidance of the personnel responsible for the operation of the water distributor.

b. It is essential that the operator know how to perform every operation of which the water distributor is capable. This section gives instructions on starting and stopping the water distributor, the basic motions of the machine, and how to coordinate the basic motions to perform the specific tasks for which the water distributor is designed. Because nearly every job presents a different problem, the operator may have to vary the given procedure to fit the individual job.

34. Starting the Engine and Water Pump

a. Turn the suction valve control lever (17, fig. 4) and the discharge valve control lever (15, fig. 11) to OFF.

b. Turn the spraybar valve levers (15 and 16, fig. 4) to OFF and perform the daily preventive maintenance services (para. 49).

Caution: **Do not start the engine unless the pump housing is full of water or serious damage will result.**

c. Remove the primer cap (11, fig. 42), fill the pump housing if necessary, and replace the cap.

d. Open the fuel shutoff valve (3, fig. 10).

e. Pump the fuel pump priming lever (11, fig. 4) 20 or 30 times to inject gasoline into the carburetor for easier starting.

f. Pull out the choke control (13, fig. 11) when starting a cold engine.

g. Set low oil pressure shutoff switch to start position.

h. Pull out the magneto stop switch (2).

i. Press the starter button (1) to actuate the electric starting motor. Release the button as soon as the engine starts.

Warning: **When using the handcrank to start the engine, do not attempt to spin the engine. If the engine does not start on the first pull, re-engage the crank and pull up again. Be sure the crank does not bind on the crankshaft.**

j. After the engine starts, adjust the choke control for best idle until the engine is warm then push the choke all the way in. Adjust governor control (3, fig. 11) for proper operating speed.

35. Stopping the Engine and Water Pump

a. Normal Stopping.

(1) Unlock the governor control (3, fig. 11) by turning it counterclockwise and push in to allow the engine speed to decrease to an idling speed.

Caution: **Run the engine at idling speed for at least 3 minutes to assure even cooling.**

(2) Push in the magneto stop switch (2).

(3) Close the fuel shutoff valve (3, fig. 10).

(4) Perform the daily preventive maintenance services (para. 49).

(5) Drain the water tank, pump and lines if freezing weather is expected.

b. Emergency Stopping. In an emergency, such as failure of the magneto stop switch, stop the engine by depressing the emergency ground button (22, fig. 18) on the bottom of the magneto.

36. Operating Details

To operate the water distributor, the operator must become familiar with the position of the valves and the direction of the water flow for each operation. The following paragraphs provide step-by-step instructions for the operations for which the distributor is designed. (See Operating Instructions Plate.)

a. Filling the Tank front an Overhead or Other Pressure Source.

(1) Move the water distributor within easy reach of the water source.

(2) Turn the suction valve control lever (17, fig. 4) to OFF.

(3) Turn the discharge valve control lever (15, fig. 11) to OFF.

(4) Open the manhole cover (1, fig. 2), to insert a hose from the water source, open the valve at the water source, and fill the tank.

(5) When the tank is full, close the valve in the water source line, remove the filling hose, and close the water tank manhole cover.

b. Filling the Tank With the Pumping Unit.

(1) Move the water distributor within easy reach of the water supply.
Note. Place the water distributor so that the suction lift is not more than 25 feet. The water pump will deliver a greater volume of water at a lower suction lift.
(2) Remove the suction hose from the storage racks on the distributor frame.
(3) Remove the suction cap (12, fig. 4) from the suction tee and attach the necessary length of 4-inch hose to the suction line and tighten.
(4) Install the suction strainer and foot valve (13, fig. 4) on the end of the suction hose to keep debris from entering the suction hose.
(5) Submerge the end of the suction hose (5, fig. 9) in the water source.
(6) Turn the suction valve (17, fig. 4) and the two spraybar control levers to OFF. Turn the discharge valve control lever to ON.
(7) Open the water tank manhole cover (1, fig. 2). Start the engine and water pump (para. 34) and fill the water tank.
(8) When the tank is full, stop the engine and water pump (para. 35) and close the water tank manhole cover.
(9) Turn the discharge valve control lever to OFF.
(10) Remove the suction hose (5, fig. 9) and install the cap (12, fig. 4) on the suction line tee (18) tighten securely.
(11) Clean the suction strainer.
(12) Stow the suction hose and strainer in position on the water tank.

c. Operating as a Sprayer.

(*1) General.* Water spraying is the primary function of the water distributor. There are two methods of spraying:
(a) Pressure-spray. The water pump (6, fig. 4) pumps the water from the water tank (7) through the spray-bars (14). The pump pressure forces the water through any desired length of spraybar. The pressure can be varied by regulating the engine speed with the governor control.
(b) Gravity-spray. Spraying can be accomplished through the spraybar with the flow of water from the tank by gravity. This method does not permit the operator as much control over the amount of water sprayed, since the water pressure cannot be varied.
(*2) Regulating water pressure.*
(a) The engine governor control (3, fig. 11) sets the engine speed, which controls pump pressure. For fire fighting, adjust the engine speed to the maximum governed speed for greatest pump pressure.
(b) In gravity spraying, the discharge control valve lever (15, fig. 11) controls water pressure. Opening the valve increases the pressure and closing the valve decreases the pressure.
(*3) Attaching spraybar extensions.* The spraybar extensions, which will increase the total spray pattern width from 8 to 16 feet, in one foot increments, (3, fig. 12). Couplings to connect the spraybar sections are also stored in the tool box. The spraybar sections should be screwed into the couplings until they are snug and alignment of the nozzles is obtained.
(*4) Use of water application chart.* The controlled amount of water sprayed over a given area depends on three major factors: water pressure, truck speed, and spraybar length. These factors are listed and cross-referenced in the application chart, table I.
(a) Determine the working width of the spraybar to be used.
(*b*) Use pressure and travel speed recommended in table I for desired application. Use the 10 psi chart for all light applications, and the 30 psi chart for all heavy applications, to permit a more satisfactory speed of truck travel.

(*c*) Consult the proper application chart to determine the pump pressure and truck speed for the correct gallons per square yard desired.

(d) Set the static needle (7, fig. 5) of the tachometer with the knurled knob (8) to the desired feet per minute of travel.

(5) Distributing water.

(a) Start the engine and water pump (para. 34).

(b) Regulate the pump pressure to the required pressure according to the application chart.

(*c*) Ring the signal gong (4, figs. 2 and 2.1) to signal the vehicle driver to lower the bitumeter wheel assembly (12, figs. 2 and 2.1).

(d) The truck operator will increase the speed of the carrier until the fpm (ft. Per min.) indicating pointer coincides with the needle (7, figs. 5 and 5.1).

(e) Turn the spraybar control levers (15 and 16, fig. 4) to ON for full width spray. Use left or right spraybar valve if only one segment is desired.

Caution: **Do not speed, make sharp turns, or attempt to back up the carrier when the bitumeter wheel is down.**

(f) Move the spraybar to the right or left with the spraybar lateral control level (19, fig. 4) to avoid obstructions and to maintain as straight a line as possible.

(g) When the spraying operation is completed, turn the spraybar control levers to OFF.

*(*h) Raise bitumeter wheel assembly with the lift rod (3, figs. 5 and 5.1).

(i) Stop the engine and pump (para. 35).

(*6) Firefighting.* The water distributor can be used to fight fires and for other spraying operations. For instructions on firefighting, refer to (para. 10).

(*7) Shutdown precautions.* Do not drain the water tank, pump and lines unless freezing weather is expected.

*(*a) Clean the suction strainer as follows:

1. Remove the suction cap (12, figs. 4 and 4.2) from the suction tee (18).
2. Remove the strainer (8, figs. 33 and 33.1) from the tee (7).
3. Clean lint, sand, and twigs from the strainer and wash the strainer in an approved cleaner and dry thoroughly.
4. Reinstall the strainer (8).
5. Position cap (12, figs. 4 and 4.2) on the suction line tee (18).

*(*b) Drain and clean the water pump as follows:

1. Turn the spray bar valve lever (15 and 15, figs. 4 and 4.2) to ON.
2. Remove primer cap (11, fig. 42) from the top of the water pump drain plug (13) from bottom of pump, and flush pump with clean water. Always perform this operation after pumping salt water or other corrosive liquids.
3. Install primer plug (11) at the top of the pump and the drain plug (13) at the pump base.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

37. Extreme Heat

a. General. Care must be taken to prevent the engine from overheating. Allow the engine to idle for at least three minutes, with the distributor not in operation, before shutting it off.

b. Lubrication. Select the proper lubricants in accordance with the temperature. See L05-3825-221-15. Lubricate more frequently than specified when operating in exteme heat.

c. Cooling System. Be sure all shrouding is installed and in good condition. Keep the cylinder heads and cylinder fines free from any oil and dirt. If dirt accumulates, remove the shrouding, clean the fins and vanes, and reinstall the shrouding.

d. Fuel System. Fill the truck fuel tank at the end of each day's operation to prevent vapor lock.

38. Operation Under Sandy or Dusty Conditions

a. General. Because dust and sand are highly abrasive, careful maintenance is required. Use

a compressed air jet to clean hard-to-reach places.

***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.**

b. Lubrication. Keep all external parts clean and lubricated. Be sure to clean all fittings before applying lubricant. Lubricate sparingly and more frequently. Clean any oily or greasy parts, as they catch dust and sand. Service the air cleaner, breather, and oil filter more frequently. Refer to LO-3825-221-15.

c. Fuel and Oil Storage Protection. Keep the reserve supply of fuel and oil tightly closed to protect them from dust, sand, and other contamination.

d. Fuel System. Remove and clean the fuel filter frequently. Clean around the fuel truck tank filler cap, and use every precaution to prevent dust or sand from entering the tank when filling. Keep all vent holes open.

e. Electrical System. Keep the insulators on the spark plug and all electrical connections on the starter clean to prevent short circuits.

39. Operation in High Humidity and Salt Water Areas

a. General. When operating in salt water areas, precautions must be taken to prevent corrosion and rust. Any exposed metal parts should be coated with a standard rustproofing material.

b. Painting. Keep the entire unit well painted to prevent rust and corrosion.

c. Fuel System. Keep the fuel tanks and containers as full as possible to reduce the possibility of condensation.

d. Cleaning Water System. If salt water was used in the operation, flush and drain the entire water system with clean fresh water after each operating period.

e. Cleaning Distributor. Wash distributor in clean, salt-free water, under pressure, following operation in salt water areas.

40. Operation in High Altitudes

Air Cleaner. Clean and service the air cleaner more often for maximum air intake for engine operation.

41. Operation with Dirty or Sludge-Laden Water

a. Inspect, remove, and clean the suction hose strainer and foot valve and suction line strainer frequently.

b. Flush the water tank by draining, filling with clean water, and draining again.

Section V. OPERATION OF AUXILIARY EQUIPMENT USED IN CONJUNCTION WITH THE DISTIBUTOR

42. Carrier

Operation procedures of the carrier necessary for the operation of this water distributor, and maintenance instructions for the carrier, are available in TM-9-8028.

43. Fire Hose and Nozzle

a. Description. The fire hose is a 25-foot length of 1 1/2-inch canvas fire hose. The nozzle is a non-adjustable solid-stream type.

b. Location. The fire hose is stowed in a rack on the right side of the operator's platform. The nozzle is stored inside the tool box (fig. 12).

c. Fire Hose and Nozzle Operation. Remove the fire hose from the storage rack (2, fig. 9)and attach it to the fire hose outlet (6). Install the nozzle (1, fig. 12) on the fire hose, close all valves and attach the suction hose. Start the engine and pump and direct the stream of water at the base of the fire.

44. Fire Extinguisher (Dry Chemical Type)

a. Description. The dry chemical type fire extinguisher is suitable for use on all types of fire and is effective in areas where ambient temperature is -25° F. and above. If winterized (pressurized with nitrogen), the fire extinguisher may be used in temperatures below -25° F. The fire extinguisher is a 2 1/2 pound, stored pressure, level-operated extinguisher.

b. Operation. Remove the fire extinguisher from its location, lift the handle, press lever, and direct the powder at the base of the flame using a side-to-side sweeping motion.

c. Maintenance. Weigh the fire extinguisher every 6 months and replace the extinguisher if weight is less than 4 1/2 pounds, or if pressure is below 125 pounds. Refer to SB5-111.The dry chemical fire extinguishers will be serviced at installation level through Repair and Utilities facilities, with the filling agent supplied by local procurement through Troop Supply channels.

Section I. SPECIAL TOOLS AND LUBRICANTS

45. Tools and Equipment

There are no special tools and equipment required to perform the repair, maintenance, or overhaul operations of the Macleod Water Distributor.

46. General Lubrication Information

a. This section contains a reproduction for the lubrication order (LO) and lubrication instructions which are supplemental to but are not specifically covered in the lubrication order.

b. The lubrication order shown in (fig. 14) is an exact reproduction of the approved lubrication order for the water distributor. For current lubrication order, always refer to L05-3825-221-15.

47. Detailed Lubrication Information

a. Care of Lubricants. Keep all lubricants, such as grease and oil, in closed containers and store in a clean, dry place away from heat. Allow no dirt, water, or foreign matter to mix with the lubricant at any time. Keep all lubrication equipment clean and ready for use at all times.

b. Oil Level Gages. Remove the oil level gages (E, 2, fig. 15) from the engine crankcase. Inspect them for unreadable marks or damage. Replace a faulty gage.

c. Points of Application. Follow the instructions given beneath each lubrication point illustration indicating procedures to be followed at each point. Apply the lubricant indicated on the lubrication order.

d. Cleaning. Keep all external parts not requiring lubrication clean from lubricants. After every lubrication operation remove any excess lubricant from the point of application and wipe up any spilled lubricant. Old or hardened lubricants may be easily removed by using a cleaning solvent.

LUBRICATION ORDER

LO 5-3825-221-15

28 JUNE 1963

DISTRIBUTOR, WATER, TANK TYPE: GASOLINE DRIVEN; TRUCK MOUNTED; 1000 GAL; (MACLEOD MODEL W15A) W/ENGINE WISCONSIN MODEL MVF4D

Reference: C9100-SL

Intervals are based on normal hours of operations. Reduce to compensate for abnormal operations and severe conditions. During inactive periods sufficient lubrication must be performed for adequate preservation.

Clean fittings before lubricating.

Relubricate after washing or fording.

Clean parts with SOLVENT, dry-cleaning, or with OIL, fuel, Diesel. Dry before lubricating.

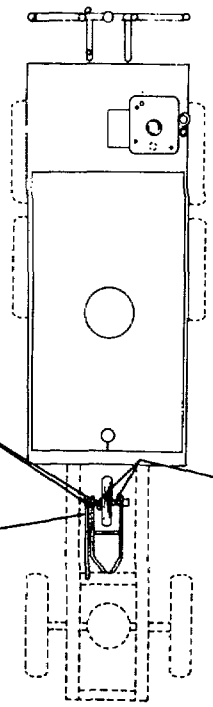
A dotted circle indicates a drain below.

Drain crankcase when hot. Fill and check level.

FOLD FOLD

LUBRICANT • INTERVAL

INTERVAL • LUBRICANT



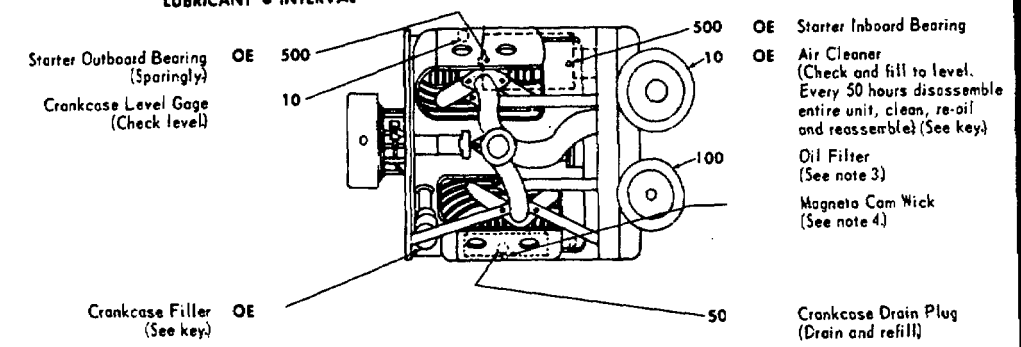
Tachometer Adapter Plugs (Remove plugs, insert fittings, lubricate, remove fittings and install plugs) GAA 1000

Tachometer Drive Cable GAA 1000

50 OE Tachometer Wheel Bushing

MEC 3825-221-15/14 (1)

Figure 14. Lubrication order.



-KEY-

LUBRICANTS	CAPACITY	EXPECTED TEMPERATURE			INTERVALS
		Above +32°F	+40°F to -10°F	0°F to -65°F	
OE-OIL, Engine, Heavy Duty					
Air Cleaner	½ qt	OE 30 or 9250	OE 10 or 9110	OES	Intervals given are in hours of normal operation.
Crankcase	5 qt				
Oil Can Points					
OES-OIL, Engine, Sub-zero					
GAA-GREASE, Automotive and Artillery		All Temperatures			

FOLD FOLD

NOTES:

1. FOR OPERATION OF EQUIPMENT IN PROTRACTED COLD TEMPERATURES BELOW -10°F. Remove lubricants prescribed in the key for temperatures above -10°F. Clean parts with SOLVENT, dry-cleaning. Relubricate with lubricants specified in the key for temperatures below -10°F.

2. OIL CAN POINTS. Every 50 hours lubricate all control connections, pins and latches with OE.

3. OIL FILTERS. Every 100 hours remove filter element, clean housing, install new element, fill crankcase, operate engine for 5 minutes, check for leaks, check crankcase oil level, and bring to full mark.

4. MAGNETO CAMWICK. To be serviced by (Third Echelon) at time of disassembly.

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained herein are mandatory.

BY ORDER OF THE SECRETARY OF THE ARMY:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

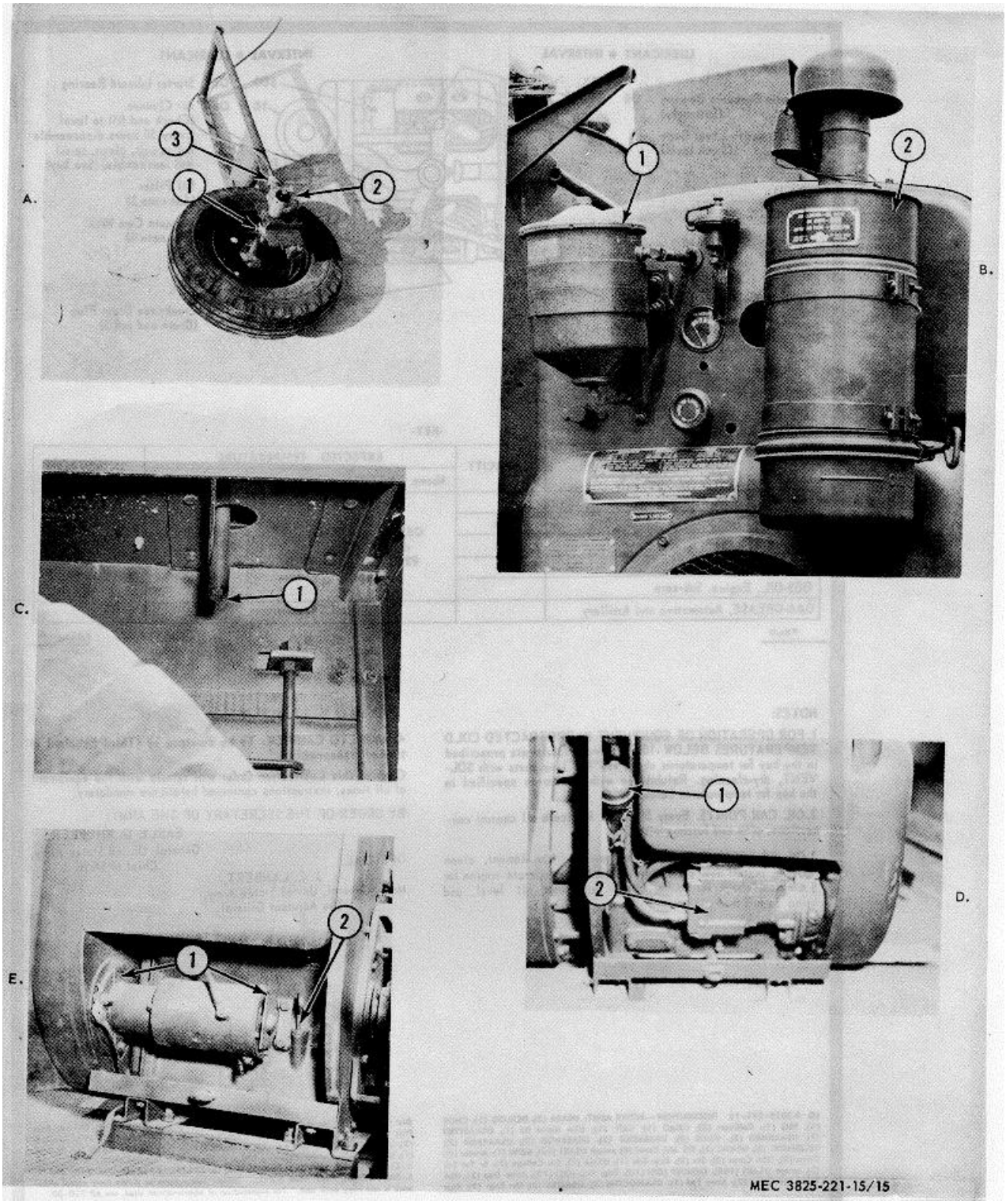
OFFICIAL:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

LO 5-3825-221-15 DISTRIBUTION—ACTIVE ARMY: USASA (2); DCSLOG (1); CNGB (1); TSG (1); CofEngrs (3); CSigO (1); CofT (1); USA Maint Bd (1); USAARTYBD (2); USAARMBD (2); USAIB (2); USARADBD (3); USAESWBD (2); USAAVNBD (2); USCONARC (3); USAMC (5); OS Maj Comd (5) except USARJ (10); MDW (1); Armies (2); Corps (2); USA Corps (2); Div (2); Engr Bde (1); USMA (2); Svc College (2); Br Svc Sch (2) except USAES (100); GENDEP (OS) (10); Engr Dep (OE) (10); Army Dep (2); USA Trans Tml Comd (2); Army Tml (1); USAMOCOM (2); USAOSA (2); Div Engr (2); Engr Dist (2); Engr Fld Maint Shop (2); USAERDL (3); Engr Con (5); AMS (3); Chicago Engr Proc Ofc (10); USA Mob Spt Con (36); ESCO (10); Fld Comd, DASA (8); USACOMZEUR (2); USAREUR Engr Sup Con Agcy (10); USAREUR Engr Proc Con (2); MAAG (1); JBUSMC (1); Units organized under following TOE's: (2 copies each unit UNORMDC): 5-48, 5-54, 5-114, 5-115, 5-117, 5-118, 5-237 (5), 5-262 (5), 5-267 (1), 5-278 (5), 5-279, 5-500 (HF, HG). NG: State AG (3). USAR: Units—Same as Active Army except allowance is one copy each unit. For explanation of abbreviations used, see AR 320-50.

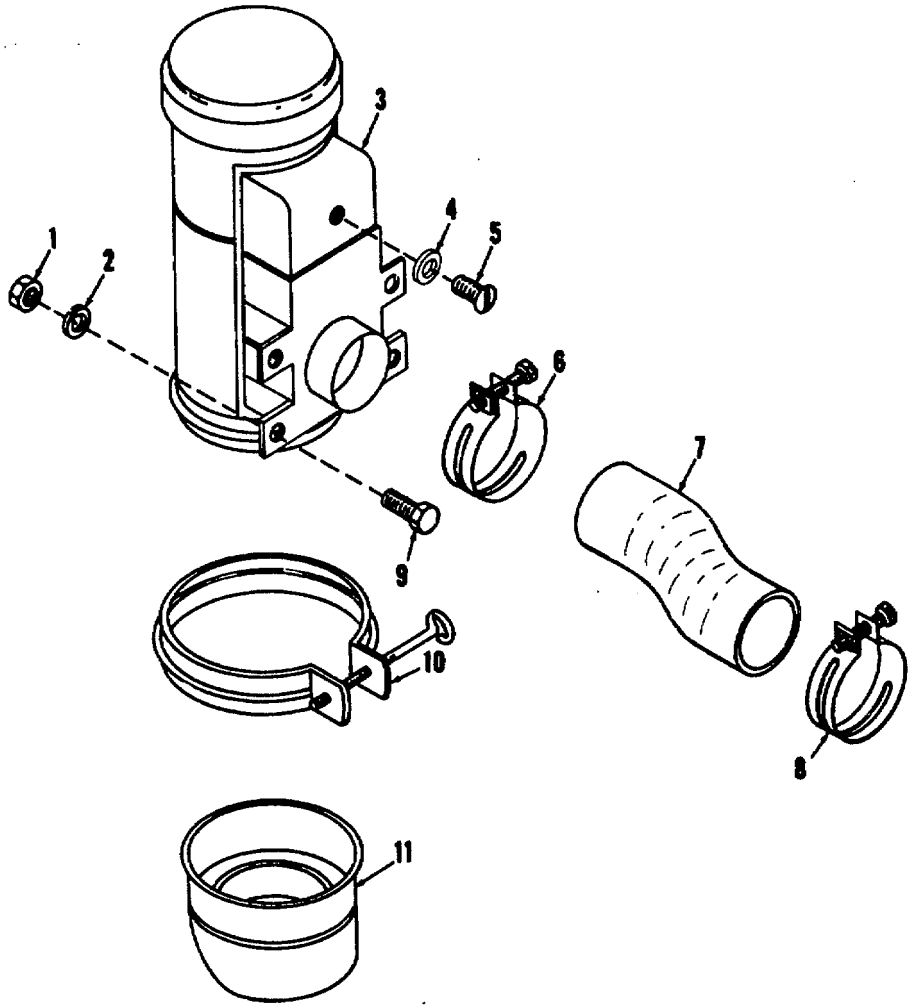
MEC 3825-221-15/14 (2)

Figure 14-Continued.



A-1	Oil cup	B-1	Oil Filter	D-1	Oil Filler
2	Tach. drive plug	2	Air cleaner	2	Magneto oil wick
3	Tach. Cable	C-1	Drain plug	E-1	Starter bearings
				2	Oil gage

Figure 15. Lubrication reference points.



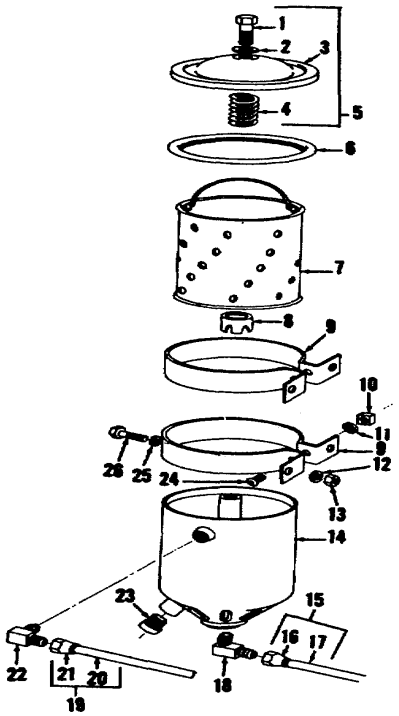
1	Nut	4	Washer	7	Hose	10	Clamp
2	Lockwasher	5	Machine screw	8	Hose clamp	11	Cup
3	Body	6	Hose clamp	9	Capscrew		

Figure 16. Air cleaner.

e. Operation Immediately After Lubrication. Operate the engine immediately after lubrication. Check the oil filter assembly, and lubrication lines and connections for leaks.

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.**

f. Air Cleaner. Service intervals and the correct grade of lubricant to service the air cleaner are prescribed in the current lubrication order. To service the air cleaner, proceed as follows:



1	Shoulder bolt	14	Filter body
2	Washer	15	Tube assembly
3	Cover	16	Nut
4	Spring	17	Tube
5	Cover assembly	18	Elbow
6	Gasket	19	Tube assembly
7	Element	20	Tube
8	Spacer	21	Nut
9	Clamp	22	Elbow
10	Nut	23	Plug
11	Lockwasher	24	Screw
12	Lockwasher	25	Lockwasher
13	Nut	26	Capscrew

Figure 17. Oil Filter.

(1) Loosen the clamp (10, fig. 16) securing the oil cup (11) to the air cleaner (3).
(2) Dispose of the oil in the oil cup.
(3) Clean the oil cup with a cloth dampened with an approved cleaning solvent and dry thoroughly.
(4) Fill the oil cup to the oil level mark.
(5) Position the oil cup (11) on the air cleaner (3) and secure the clamp (10).

g. Oil Filter. Service intervals and the correct grades of lubricant to service the oil filter are prescribed in the current lubrication order to service the oil filter proceed as follows:
(1) Remove the shoulder bolt (1, fig. 17), washer (2) cover (3), gasket (6), and spring (4) from the oil filter (14).
(2) Remove the connecting nut (16) securing the outlet oil line (17) to the oil filter (14).
(3) Drain the oil from the filter housing into a suitable container.
(4) Remove the filter element (7).
(5) Wash the oil filter with an approved cleaning solvent and dry thoroughly with a clean, dry cloth.
(6) Install a new filter element (7) being careful to face the correct end toward the top.
(7) Install a new gasket (6) in the cover (3).
(8) Position the spring (4), gasket (6), and cover (3) on the filter (14) and install the washer (2) and shoulder bolt (1).
(9) Install the connecting nut (16) securing the outlet oil line (17) to the elbow fitting (18) in the filter (14).
(10) Start the engine and pump (para. 34) and inspect for leaks.
(11) Stop engine and pump (para. 35) and repair any leaks noticed.

Section II. OPERATOR AND CREW PREVENTIVE MAINTENANCE

48. General

To insure that the equipment is ready for operation at all times, it must be inspected systematically before operation, during operation, at halt, and after operation, so that defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance services will be performed before operation. Defects discovered during operation of the unit will be noted for further correction, to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. After-operation services will be performed by the operator after every operating period. After-operation services will be performed at intervals based on the normal operations of the equipment. Reduce intervals to compensate for abnormal conditions. Defects or unsatisfactory operating characteristics beyond the scope of the operator to correct must be reported at the earliest opportunity to organizational maintenance. The responsibility for performance of preventive maintenance services rests not only with the operator, but with the entire chain of command from section chief to commanding officer. (AR750-5).

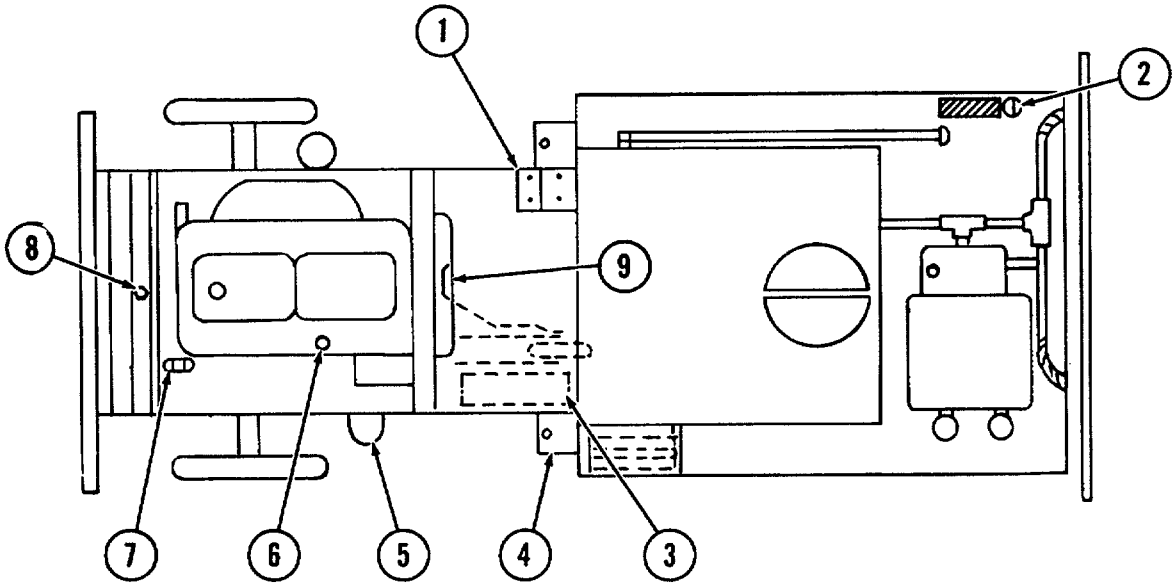
49. Daily Preventive Maintenance Services

50. Quarterly Preventive Maintenance Services

PREVENTIVE MAINTENANCE SERVICES

DAILY

TM5-3825-221-15 MACLEOD MODEL W15A DISTRIBUTOR, WATER, TANK TYPE



LUBRICATE IN ACCORDANCE WITH CURRENT LUBRICATION ORDER

ITEM		PAR. REF.
1	BATTERIES. Check electrolyte level. Fill to within 1/4 inch of filler holes. (Weekly).	
2	FIRE EXTINGUISHER. Inspect for broken seal.	
3	AIR RECEIVER. Drain condensate.	
4	FUEL TANK. Add fuel. Clean strainer.	
5	FUEL FILTERS. Drain and clean. (Weekly)	
6	OIL LEVEL DIPSTICK. Check oil level. Change or add oil to level mark.	
7	GENERATOR AND FAN BELT. Check adjustment. Correct deflection is 1/8 to 1/4 inch midway between pulleys. (Weekly)	
8	RADIATOR. Check coolant level. Fill to within 2 inches of filler neck.	

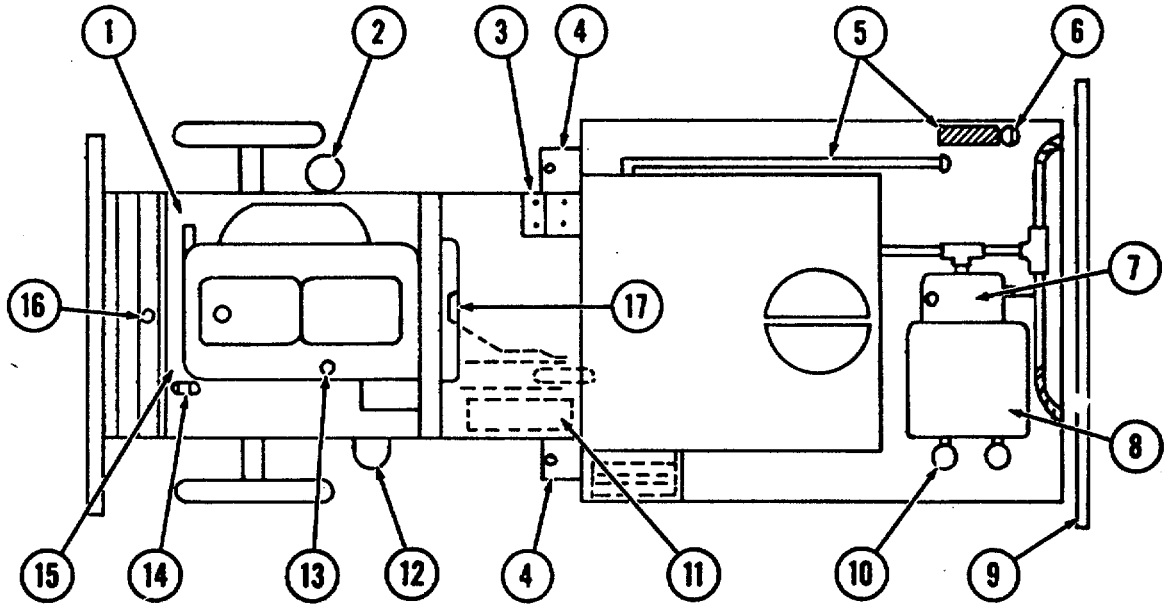
Chart 1. Daily Preventive Maintenance Services

ITEM		PAR. REF.
9	CONTROLS AND INSTRUMENTS. Check gages for normal readings. Normal readings are:	
	Carrier Engine Oil Pressure - 15 psi at idle speed. Temperature - 160° - 180° F. Ammeter - In charge area. Air Pressure - 110 to 115 psi. Water Pump Engine Oil Pressure - In "X" area.	

Chart 1. Daily Preventive Maintenance Services - Continued.

PREVENTIVE MAINTENANCE SERVICES QUARTERLY

TM5-3825-221-15 MACLEOD MODEL W15A DISTRIBUTOR, WATER, TANK TYPE



LUBRICATE IN ACCORDANCE WITH CURRENT LUBRICATION ORDER

ITEM		PAR. REF.

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.**

1	AIR COMPRESSOR, AIR CLEANER. Clean, inspect for secure mounting.	
2	AIR CLEANER. Inspect for secure mounting. Check oil level; add oil to level mark.	
3	BATTERIES. Inspect for secure mounting. Check electrolyte level. Fill to within 1/4 inch of filler holes.	
4	FUEL TANK. Inspect for leaks. Add fuel. Inspect and service fuel strainer.	
5	FIRE AND SUCTION HOSES. Inspect for cracks, deterioration and damage.	
6	FIRE EXTINGUISHER. Inspect for broken seal. Check weight. If weight has decreased more than 4-1/2 pounds or if pressure is below 125 pounds, replace extinguisher.	
7	WATER PUMP. Inspect for leaks.	

ITEM		PAR. REF.
8	DISTRIBUTOR ENGINE, CRANKCASE BREATHER. Clean.	
9	SPRAYBAR. Inspect for secure mounting and damage.	
10	DISTRIBUTOR ENGINE, AIR CLEANER. Inspect for secure mounting. Add oil to level mark.	
11	OIL LEVEL DIPSTICK. Check oil level. Change or add oil to level mark.	
12	FUEL FILTERS. Drain and clean. (Weekly)	
13	AIR RECEIVER. Drain condensate. Inspect for leaks.	
14	GENERATOR. Inspect for secure mounting.	
15	GENERATOR AND FAN BELT. Check adjustment. Correct deflection is 1/8 to 1/4 inch midway between pulleys. Inspect for wear and damage.	
16	RADIATOR. Check coolant level. Fill to within 2 inches of the filler neck.	
17	CONTROLS AND INSTRUMENTS. Inspect for broken, damaged, or defective gages. Check gages for normal readings. Normal readings are:	
	Carrier Engine Oil Pressure - 15 psi at idle speed. Temperature - 160° - 180° F. Ammeter - In charge area. Air Pressure - 110 to 115 psi. Water Pump Engine Oil Pressure - In "X" area.	

Chart 2. Quarterly Preventive Maintenance Services---Continued.

Section III. TROUBLESHOOTING

51. General

This section provides information useful in detecting, diagnosing, and correcting malfunctions in the water distributor and its components. Opposite each statement of a typical troubleshooting problem is the statement of possible recommended remedies for solution of the problem. Any operational trouble beyond the scope of the operator or crew should be reported to organizational maintenance.

52. Engine Fails or Hard To Start

Probable cause	*Possible remedy*
Lack of fuel	Fill fuel tank.
Fuel shutoff valve closed.	Open the shutoff valve
Engine flooded by too much fuel.	Crank engine with throttle wide open, or let the engine sit for a few minutes and repeat the starting operation.

53. Engine Misses or Runs Erratically

Probable cause	*Possible remedy*
Empty fuel tank	Fill fuel tank.
Water in fuel	Drain fuel system and fill with fuel.
Excess of foreign matter in fuel strainer	Remove sediment bowl, empty it and replace it.

54. Engine Knocks or Develops Excessive Noise

Probable cause	*Possible remedy*
Improper grade of fuel	Drain and fill the fuel tank with the proper grade of fuel. (para. 50).
Governor not set properly for existing load.	Adjust governor setting.
Engine operating under heavy load.	Turn engine with hand crank, with ignition off, to determine excessive load due to unusual cause.
Defective oil pump.	Report to organizational maintenance.
Ignition timing advanced too far.	Report to organizational maintenance.
Loose connecting rod.	Report to organizational maintenance.

55. Engine Stops

Probable cause	*Possible remedy*
Faulty ignition	Check magneto (para. 87).
Erratic fuel flow.	Check feed to carburetor.

56. Engine Oil Pressure Low

Probable cause	*Possible remedy*
Defective oil pump	Report to organizational maintenance.
Restricted oil lines	Report to organizational maintenance.
Oil too light	Check for diluted oil and replace with proper grade.
Oil level low	Fill crankcase to specified level with proper grade of oil (L05-3825-221-15).

57. Engine Overheats

Probable cause	*Possible remedy*
Oil level low	Replenish the oil supply (L05-3825-221-15).
Air shrouding removed or obstructed.	Replace air shrouding and remove obstruction (para. 68).
Engine idles too slowly	Adjust the idle speed (para. 77).
Magneto spark improperly timed.	Adjust magneto timing (para. 87).

58. Engine Exhaust Smoke Excessive

Probable cause	*Possible remedy*
Oil or carbon piston ring	Report to organizational maintenance.

59. Pump Fails to Prime or Deliver Rated Capacity

Probable cause	*Possible remedy*
Suction valve set incorrectly.	Move the suction line lever to open.
Suction strainer clogged	Remove and clean strainer.
Loose suction line connections.	Check and tighten all connections.
Suction check valve defective.	Report to organizational maintenance.
Defective pump	Report to organizational maintenance.
Damaged or impaired impeller.	Report to organizational maintenance.
Air leak at pump shaft seal.	Report to organizational maintenance.

60. Little or No Water From Spraybar

Probable cause	*Possible remedy*
Spraybar valves not set properly.	Set spraybar valves correctly.
Defective water pump	Report to organizational maintenance.
Defective valves	Report to organizational maintenance.

61. Bitumeter Does Not Register or Operates Erratically

Probable cause	*Possible remedy*
Fifth wheel does not fully lower.	Inspect to determine if lift rod is bound.
Broken drive cable	Report to organizational maintenance.
Drive cable improperly lubricated	Lubricate the cable (para. 46)
Defective fifth wheel assembly.	Report to organizational maintenance.

Section IV. RADIO INTERFERENCE SUPPRESSION

62. Definition

a. Interference. The term (interference) as used here, applies to electrical disturbances in the radio frequency range which are generated by the water distributor and which may interfere with the proper operation on radio receivers or other electronic equipment.

b. Interference Suppression. The term (interference suppression), as used here, applies to the methods used to eliminate or effectively reduce radio interference generated by the water distributor.

63. Purpose of Interference Suppression

The technical importance of effective interference suppression cannot be stressed too greatly. Since the electrical disturbances generated by the water distributor are composed partly by electrical waves in the radio frequency range, they must be suppressed for two important reasons: First, they will interfere with the proper operation of both civilian and military radio sets, and second, they will enable an enemy to locate the equipment and associated units.

64. General Sources of Interference

General radio interference is generated anywhere a spark occurs, or where a high frequency current is present. A spark is a small amount of current jumping an air gap to response to the force to the relatively high voltage. The gasoline engine ignition system is a common source. Magneto breaker points, generator commutators, relay contacts, and static charges collecting on the frame are other common sources which in some way must be suppressed.

65. General Methods Used to Obtain Proper Suppression

Essentially, suppression is obtained by providing a low resistance to ground for the stray currents. The methods used to attain suppression includes: shielding the ignition and high frequency wires, grounding the frame with bounding straps, and using capacitors and resistors where necessary.

66. Replacement of Suppression Components

a. General. Replacement of suppression components must be performed with parts identical to the component being removed. All shielding capacitors must be exactly the same size and have the same microfarad and voltage rating as specified in the original components.

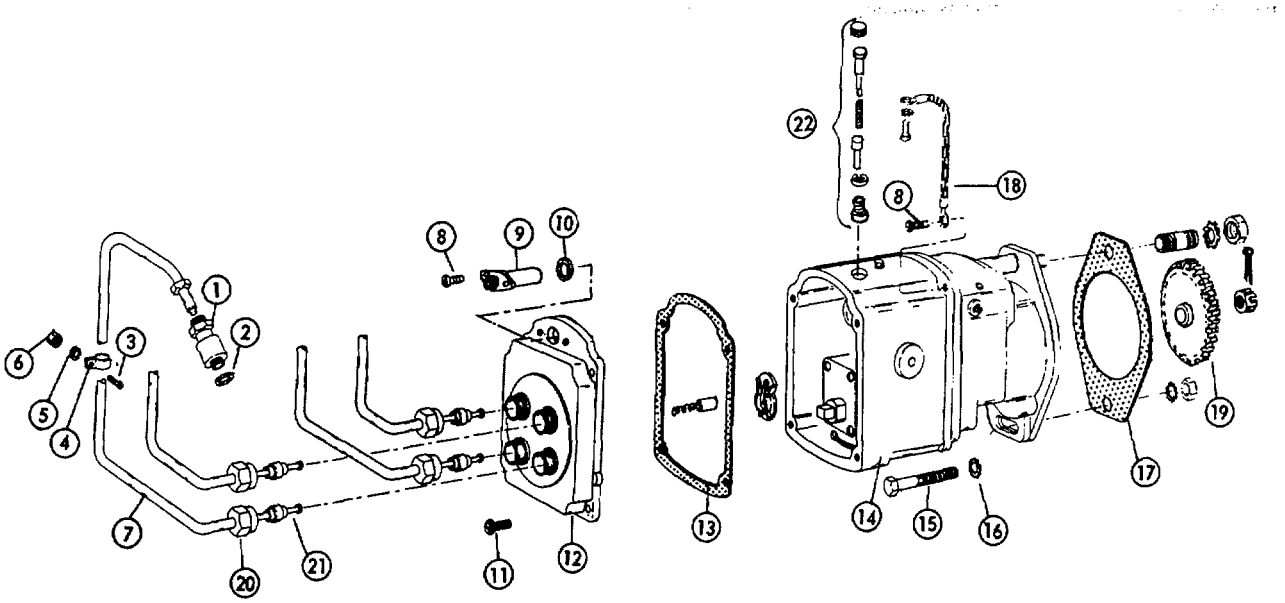
b. Components. The suppression components include the following: magneto, spark plug cables, spark plugs, ground straps, and associated hardware.

c. Replacement of Magneto Capacitor.

(1) Remove screw (8, fig. 18) and disconnect magneto stop switch wire (13) and high temperature safety switch wire.

(2) Remove two screws (8) securing capacitor (9). Remove capacitor and 0-ring (10).

(3) Position new capacitor and O-ring in magneto and secure with two screws (8).

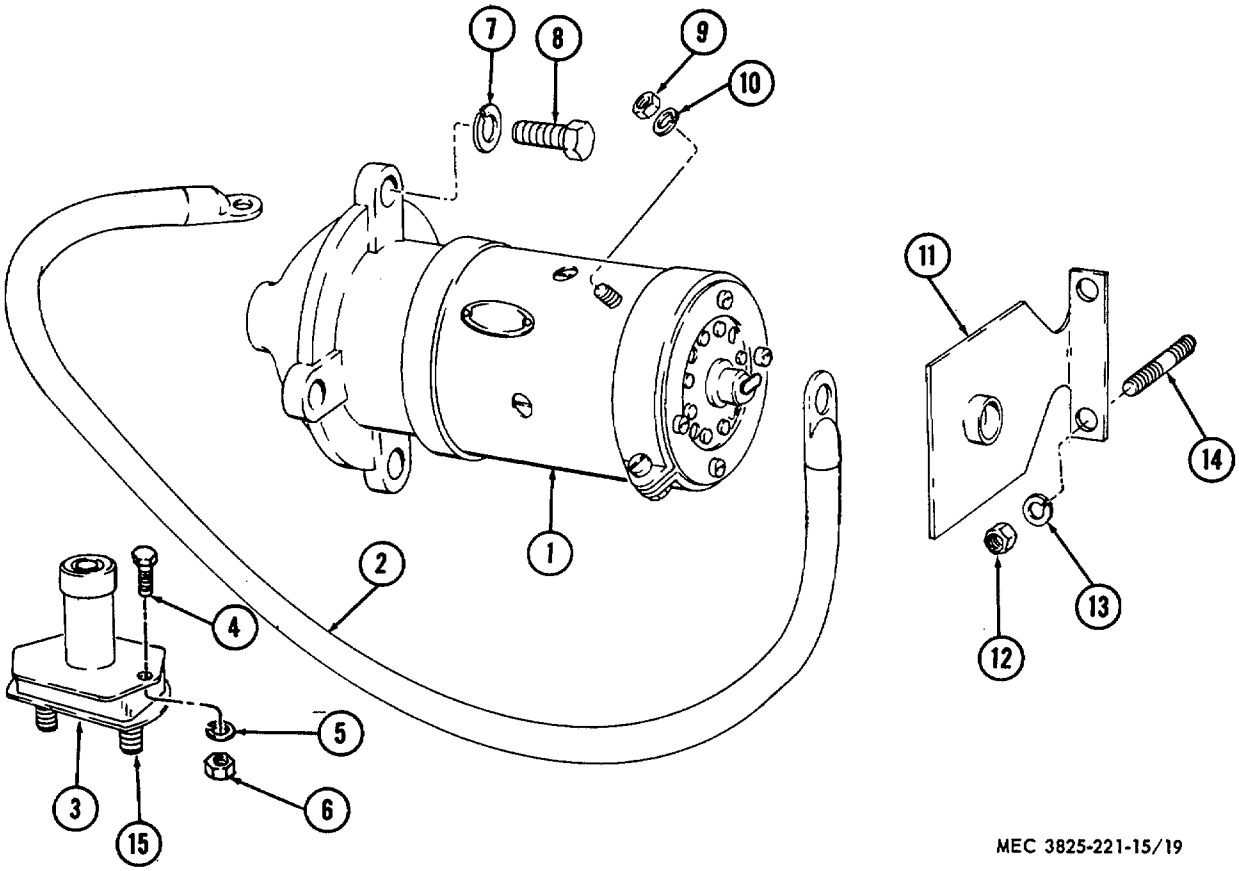


1	Spark plug	7	Spark plug lead	13	Gasket	18	Stop, switch wire
2	Gasket	8	Screw	14	Magneto housing	19	Gear, magneto
3	Machine screw	9	Capacitor	15	Capscrew	20	Connector
4	Clamp	10	Seal	16	Lockwasher	21	Terminal
5	Lockwasher	11	Screw	17	Gasket	22	Ground switch
6	Nut	12	Magneto cover				

Figure 18. Radio interference suppression parts.

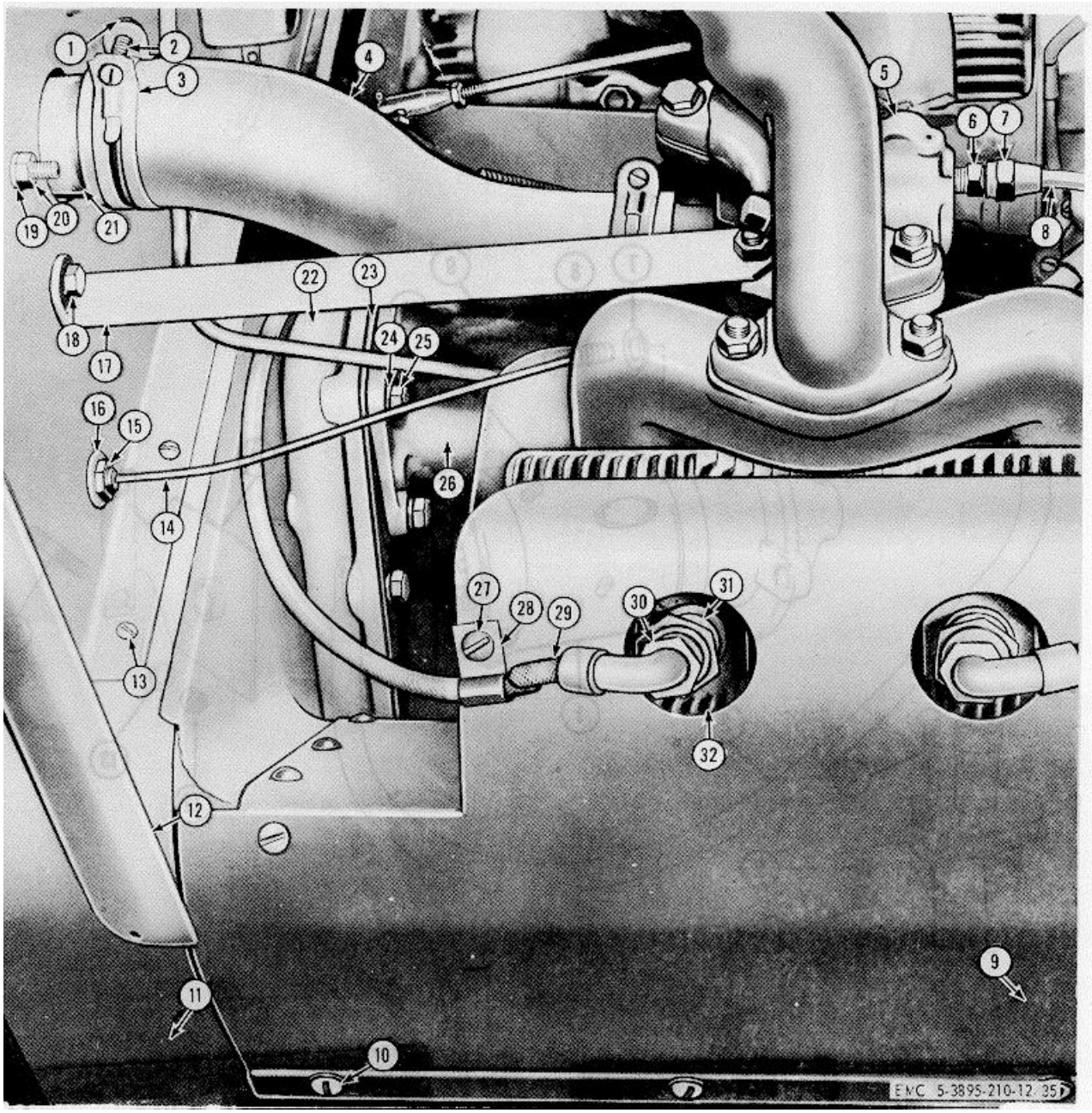
(4) Position magneto stop switch wire and high temperature safety switch on capacitor terminal and secure with screw.

d. Replacement of Spark Plugs and Cables.
Remove the terminal (30, fig. 20) from one spark plug cable. Remove cable from the spark plug (31) and the magneto. Remove the spark plug cable and replace with a new cable, clip and spark plug (31).



1 Starter
2 Starter cable
3 Starter switch
4 Capscrew
5 Lockwasher
6 Nut
7 Lockwasher
8 Capscrew
9 Nut
10 Lockwasher
11 Starter bracket
12 Nut
13 Lockwasher
14 Stud
15 Terminal

Figure 19. Starter and cable.



1	Nut	9	Cylinder head shroud	17	Panel brace	25	Capscrew
2	Screw	10	Screw	18	Capscrew	26	Crank case
3	Hose clamp	11	Flywheel air shroud	19	Washer	27	Screw
4	Hose	12	Panel	20	Nut	28	Clamp
5	Carburetor	13	Screw	21	Air filter	29	Spark plug lead
6	Nipple	14	Choke control	22	Timing gear cover	30	Connector
7	Nut	15	Nut	23	Spacer	31	Spark plug
8	Fuel line	16	Washer	24	Washer	32	Cylinder head

Figure 20. Engine, top view.

Section V. ENGINE COOLING SYSTEM

67. Description

The engine is enclosed in a sheet metal housing composed of a top canopy, a rear housing panel, a flywheel housing, two side doors, and a front panel. The cylinder heads are enclosed by shrouding and heat deflectors.

68. Cowling, Deflectors, Airduct and Shrouding

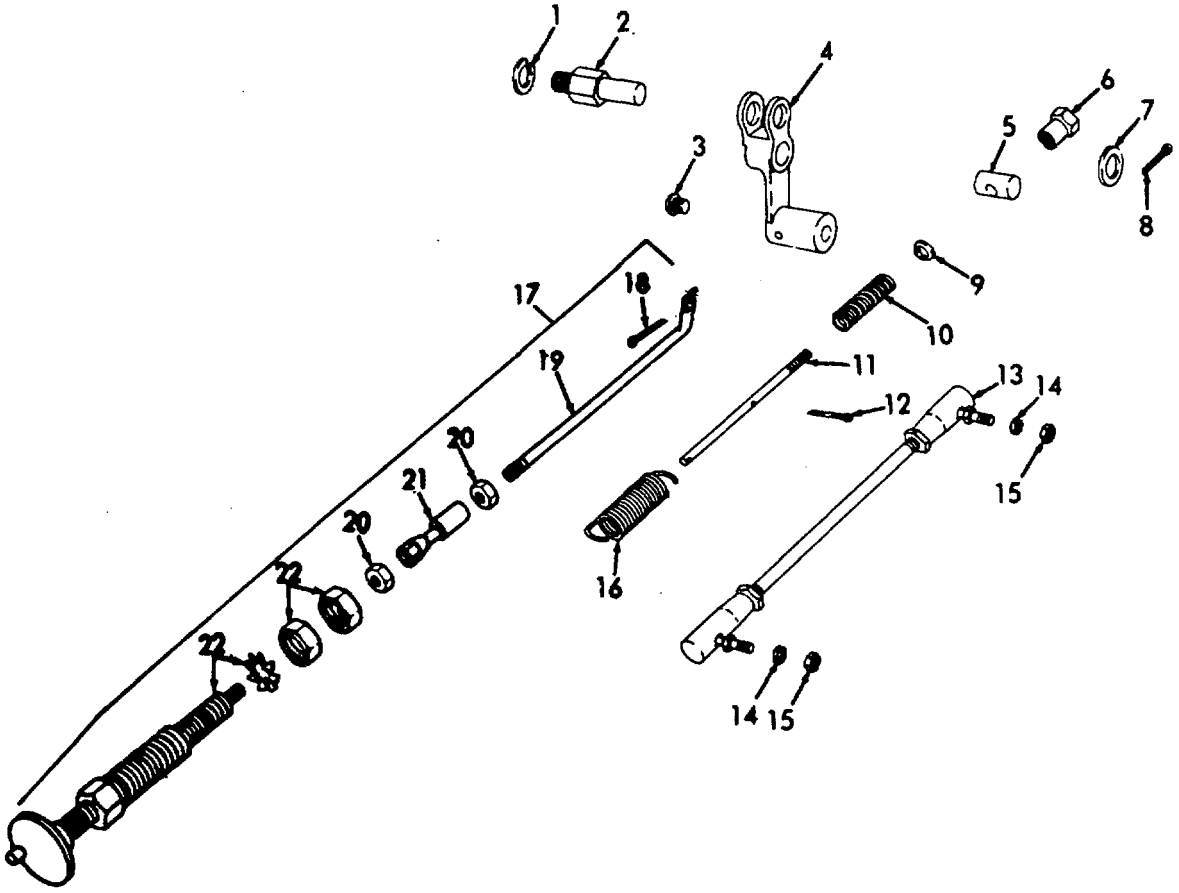
a. Removal.

(1) Remove four screws holding muffler shield (8, fig. 11). Remove shield and unscrew muffler (9, fig. 4).

(2) Remove the eight nuts, lockwashers, and capscrews (16, fig. 11) holding the canopy (17) to the engine housing and lift off the canopy.

(3) Remove the choke wire (14, fig. 20) at the carburetor.

(4) Disconnect the oil pressure gage line at the rear of the oil pressure gage (4, fig. 11) by unscrewing nut.



1	Lockwasher	9	Retainer	17	Governor control assembly
2	Pin	10	Spring	18	Cotter pin
3	Screw	11	Adjusting screw	19	Rod
4	Variable speed lever	12	Cotter pin	20	Nut
5	Pin	13	Rod assembly	21	Swivel
6	Locknut	14	Lockwasher	22	Control shaft assembly
7	Plain washer	15	Nut		
8	Cotter pin	16	Spring		

Figure 21. Governor controls.

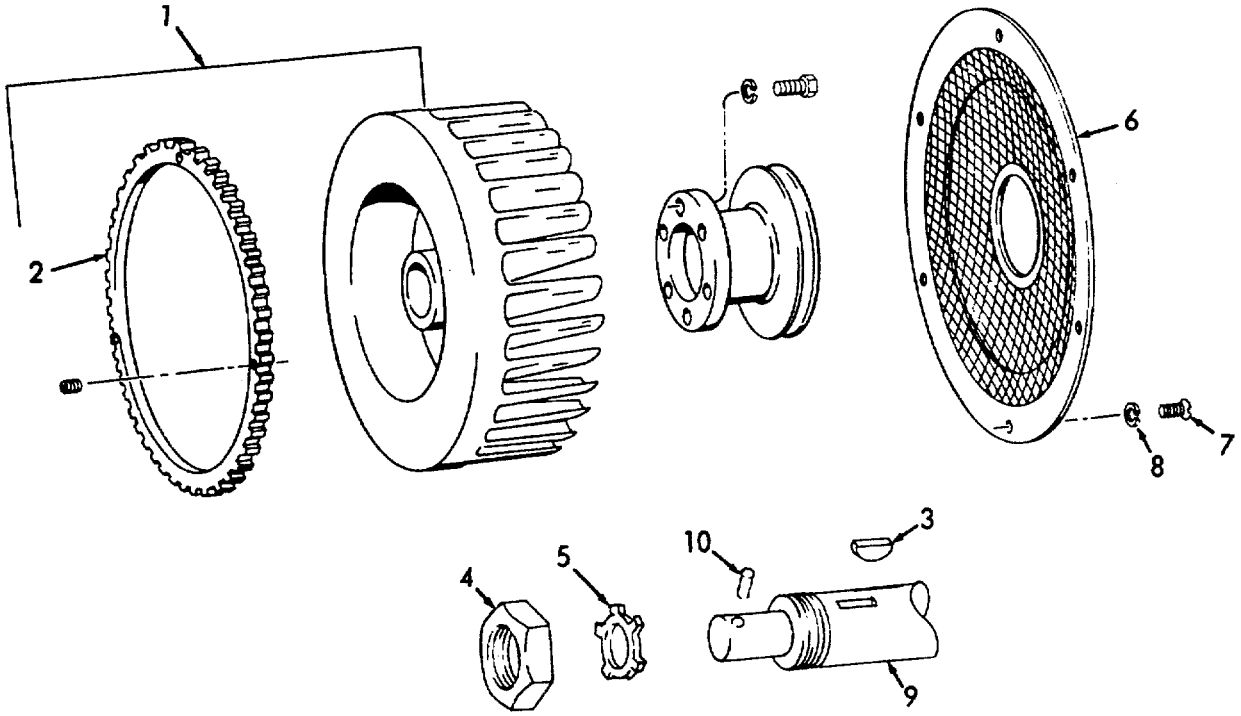
Warning: **If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal instructions.**

(5) Disconnect the air cleaner hose from air cleaner (21, fig. 20).
(6) Remove the magneto stop switch (2, fig. 11) by removing the nut.
(7) Disconnect the governor control rod at the governor by removing the cotter pin (24, fig. 21) securing the governor control chain (23).
(8) Disconnect the oil filter inlet and outlet lines (15 and 19, fig. 17) by unscrewing the nuts at the oil filter.
(9) Remove the six screws (7, fig. 22) and lockwashers (8) holding the flywheel screen (6) to the flywheel shroud.
(10) Drive out the starting crank pin (10) from the crankshaft (9).
(11) Remove the flywheel nut (4) and washer (5).
(12) Take a firm hold on the flywheel fins, pull outward, and at the same time strike the end of the crankshaft with a babbit hammer.

Caution: **Do not strike the end of the crankshaft with a hard hammer, to do so will ruin the crankshaft and bearings.**

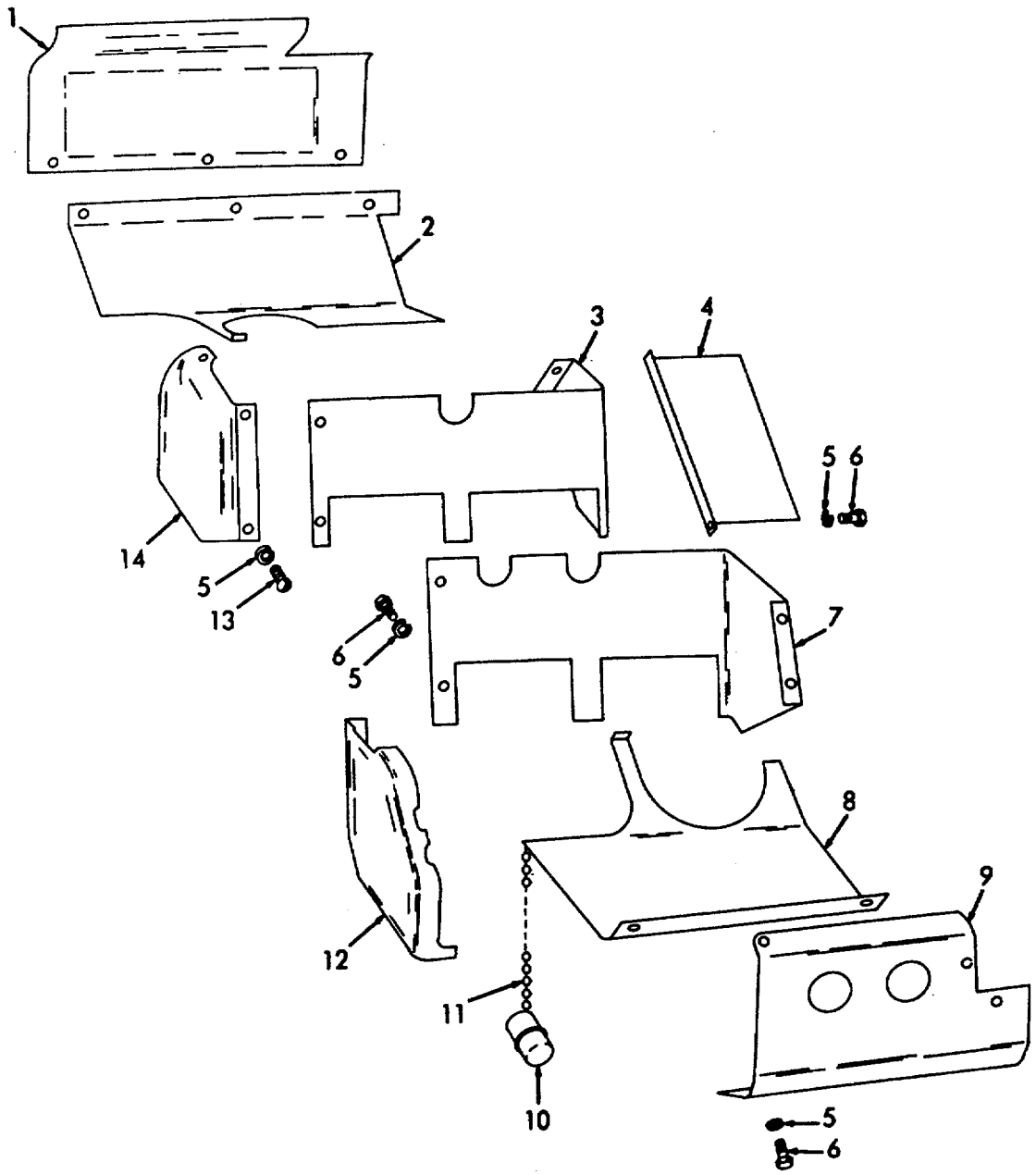
(13) Remove the screws (6, fig. 23) and lockwashers (5) holding the cylinder head covers (9) and remove the cylinder head screws.

screws.



1 Flywheel
2 Ring gear
3 Woodruff key
4 Hex nut
5 Key washer
6 Screen
7 Machine screw
8 Lockwasher
9 Crank shaft
10 Crank pin

Figure 22. Flywheel.



1	Cylinder head shroud right hand	8	Lower cylinder shroud left
2	Lower cylinder shroud right side	9	Cylinder head shroud left
3	Cylinder heat deflector right side	10	Breather cap
4	Side cover	11	Chain
5	Lockwasher	12	Rear shroud cover, left
6	Screw	13	Screw
7	Cylinder heat deflector left	14	Rear shroud cover, right

Figure 23. Air shrouding.

(14) Remove the six screws (6) and lockwashers (5) holding the flywheel shroud to the lower cylinder shrouds (8) and cylinder heat deflectors (3). Then remove the two screws (6) and lockwashers (5) holding the flywheel shroud to the gear cover and remove the flywheel shroud.
(15) Remove the screws (6) and lockwashers (5) securing lower shroud (8) and heat deflector.

b. Cleaning, Inspection, and Repair.
(1) Using a suitable cleaning solution, clean all housing, shrouding, and deflectors.
(2) Inspect all housing, shrouding, and deflectors for damage.
(3) Replace any damaged parts.

c. Reassembly.
(1) Position lower shroud (8) and heat deflector on engine and secure with screws (6) and lockwashers.
(2) Replace the flywheel shroud (9, fig. 11) on the gear cover. Install the two screws (6, fig. 23) and lockwashers (5) holding the flywheel shroud to the gear cover. Install the screws (6) and lockwashers (5) holding the flywheel shroud to the lower cylinder shrouds (8) and cylinder heat deflectors (7).
(3) Replace the cylinder head covers (9) and secure with screws (6) and lockwashers (5).
(4) Replace the flywheel (1, fig. 22) on the crankshaft (9) and secure with nut (4) and washer (5).
(5) Drive the starting crank pin (10) into the hole in the crankshaft. Be sure that the pin is centered in the crankshaft.
(6) Install the flywheel screen (6) on the flywheel shroud and secure with six screws (7) and lockwashers (8).
(7) Connect the oil filter inlet and outlet lines (15 and 19, fig. 17) to the oil filter with the nuts.
(8) Connect the governor control chain (23, fig. 21) to the governor control with cotter pin (24).
(9) Install the magneto stop switch (2, fig. 11) and secure with nut.

***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.**

(10) Connect the air cleaner hose (4, fig. 20) to the carburetor air horn and the air filter (21).
(11) Connect the oil pressure gage line to the oil pressure gage (4, fig. 11) and tighten the nut.
(12) Connect the choke wire (14, fig. 20) to the butterfly valve arm and tighten the setscrew.
(13) Position the canopy on the engine housing (8, fig. 4) and secure with eight capscrews (16, fig. 11) and lockwashers.
(14) Screw muffler pipe into manifold.
(15) Screw muffler onto pipe.
(16) Position muffler shield (8, fig. 11) on canopy (17, fig. 11) and secure with four screws.

69. Flywheel Assembly

a. General. The flywheel assembly contains fins to force air around the cylinder heads to facilitate cooling. A ring gear on the flywheel provides an engagement surface for the starter gear.

b. Removal. Remove the flywheel assembly as described in paragraph *68a.*

c. Cleaning, Inspection, and Repair.
(1) Clean the flywheel assembly with an approved cleaning solvent. Brush all debris from the blower fins, and all dirt from the ring gear teeth.
(2) Inspect the flywheel blower for cracks and other damage. Replace as necessary.
(3) Inspect the blower fins for damage. Replace a flywheel with broken blower fins.
(4) Inspect the ring gear for chipped, cracked, or missing teeth. Replace as necessary.

d. Installation. Install the flywheel assembly as described in paragraph 68c.

70. Engine Doors

a. Cleaning.
(1) Clean the doors with an approved cleaning solvent.
(2) Brush all debris from the door screen.

b. Inspection and Repair.
Inspect the doors for dents, corrosion,

and other damage. Repair or replace as necessary.

(2) Inspect catches for proper orientation. Repair or replace as necessary.

Section VI. ENGINE FUEL SYSTEM

71. Description

The fuel system consists of a shutoff valve, fuel pump, fuel pump adapter and hand primer, carburetor governor, air cleaner and all the necessary fuel lines and connections, and controls. Fuel is drawn from the tank through the carrier fuel strainer (1, fig. 10) which incorporates a shutoff valve. The strainer and sediment bowl removes and collects all foreign matter and solids from the fuel. From this strainer the fuel passes through the fuel pump into the carburetor. The air cleaner removes dust, water, and other foreign matter from the air and passes clean air to the carburetor where it is mixed and sprayed into the cylinders with the fuel for proper combustion. A governor controls the amount of fuel discharged from the carburetor.

71.1 Description (Model W15A4112)

Fuel is drawn from the engine fuel tank (1, fig. 10.1) through a fuel strainer (16, fig. 10.1) which incorporates a fuel shutoff valve.

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.**

72. Air Cleaner

a. Removal

(1) Remove the hose from the air cleaner.

(2) Remove the hex nuts and lockwashers from the four studs securing the air cleaner.

b. Cleaning and Inspection.

(1) Wash the air cleaner in an approved cleaning solvent and dry thoroughly.

(2) Wash the oil cup with an approved cleaning solvent and dry thoroughly.

(3) Inspect the air cleaner body and cup for cracks and breaks. Replace as required if defective.

(4) Wipe the air cleaner hose and inspect the hose for cracks or deterioration. Check all hardware for stripped or damaged threads and replace defective parts as required.

LOAD R.P.M.	NO LOAD R.P.M.	HOLE NO.
1400	1525	4
1500	1650	5
1600	1725	5
1700	1850	6
1800	1950	7
1900	2025	7
2000	2150	8
2100	2225	8
2200	2350	9
2300	2425	9
2400	2550	10

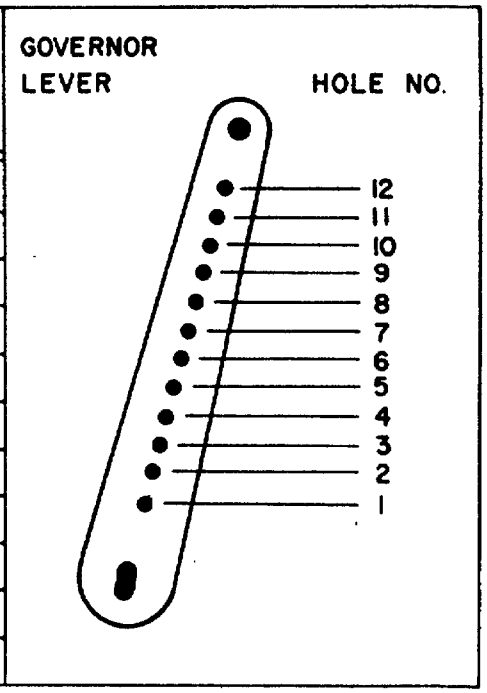


Figure 24. Governor lever chart.

c. Installation

(1) Align the air cleaner (3, fig. 16) with the studs and position on the engine house panel. Secure with lockwashers and nuts.

(2) Connect the hose to the carburetor (5, fig. 20) and the air cleaner (21). Secure the hose by pressing on firmly and installing the clamps.

(3) Fill the oil cup (11, fig. 16) with oil as specified in LO5-3825-221-15. Position this cup on the bottom of the air cleaner (3) and secure with the oil cup clamp (10).

73. Fuel Lines

a. Removal.

(1) Remove the fuel shutoff valve (3, fig. 10) from the carrier fuel strainer (1).

(1).1 On the model W15A4112, remove the fuel strainer (16, fig. 10.1) from the engine fuel tank outlet line.

(2) Remove all holddown clamps securing the fuel line to the carrier frame.

(3) Disconnect the copper fuel line from the rubber fuel line at the connection point.

(4) Remove the copper fuel line. Disconnect the rubber fuel line from the fuel pump, and remove the rubber fuel line.

b. Cleaning, Inspection, and Repair.

(1) Clean the fuel lines with an approved cleaning solvent.

(2) Inspect the copper fuel line for kinks, breaks, or other damage.

(3) Inspect the rubber fuel line for breaks, fraying, or deterioration. Repair or replace as necessary.

(4) Inspect all fuel line nuts for cracks or stripped threads. Repair or replace as necessary.

c. Installation.

(1) Connect the rubber fuel line to the fuel pump.

(2) Thread the copper fuel line along the frame to the carrier fuel strainer, and attach the copper fuel line to the fuel strainer with the shutoff valve (3, fig. 10).

(2).1 On model W15A4112, thread the copper fuel line along the carrier frame to the fuel strainer at the fuel tank outlet, and attach the copper fuel line to the strainer with the connector (19, fig. 10.1).

(3) Connect the copper fuel line to the rubber fuel line at the connection point.

(4) Secure the fuel line to the frame with holddown clamps.

74. Governor Controls, Adjust

a. Refer to (fig. 24) to select proper spring hole to obtain desired engine speed.

b. Disconnect the throttle control rod (13, fig. 21) from the governor lever.

c. Push the throttle control rod toward the carburetor as far as it will go. The throttle should not be wide open.

d. Line up the right angle stud of the control rod (13) with the hole in the governor lever (fig. 24) by screwing the ball joint on the throttle control rod (13, fig. 21) either clockwise or counterclockwise.

75. Governor Controls

a. Removal.

(1) Remove cotter pin (24, fig. 21) securing governor control chain (23) to governor control knob rod (17).

(2) Remove nut (22) securing governor control knob (17) to the front panel, and remove governor control knob.

(3) Remove governor spring (16) connecting governor adjusting screw (11) to governor shaft level (fig. 24).

(4) Remove pin (2, fig. 21) and lockwasher (1) securing governor control assembly to manifold, and remove governor control assembly.

b. Disassembly.

(1) Remove screw (3, fig. 21) securing governor control chain cotter pin (24) to variable speed lever (4), and remove governor control chain.

(2) Remove locknut (6) securing governor adjusting screw (11), and unscrew and remove governor adjusting screw.

(3) Remove governor adjusting screw swivel spring (10), retainer (9), pin (5), and cotter pin (12).

(4) Remove cotter pin (8) and flatwasher (7) securing variable speed lever support pin (2).

c. Cleaning, Inspection, and Repair.
(1) Clean all parts in an approved cleaning solvent.
(2) Inspect all parts for excessive wear or damage. Replace as necessary.

d. Assembly.
(1) Position variable speed lever (4) on variable speed lever support pin (2), and secure with cotter pin (8) and flatwasher (7).
(2) Install cotter pin (12), spring (10), and retainer (9) on governor adjusting screw (11).
(3) Position adjusting screw swivel pin (5) in variable speed lever.
(4) Screw governor adjusting screw (11) into adjusting screw swivel pin and secure with locknut (6).
(5) Position governor control chain cotter pin (24) in variable speed level (4), and secure with screw (3).

e. Installation.
(1) Screw variable speed lever support pin (2) and lockwasher (1) into manifold.
(2) Connect governor spring (16) to adjusting screw (11) and governor shaft lever (19, fig. 25).
(3) Position governor control knob (17, fig. 21) in front panel mounting hole, and secure with nut (22).
(4) Connect governor control knob rod to governor control chain (23) with cotter pin (18).
(5) Adjust governor controls (para. 74).

76. Engine Governor Assembly

a. General. The engine governor automatically controls the constant speed of the engine be centrifugal force acting or a pair of flyweights which overcome the tension of a spring to control the flow of fuel from the carburetor to the engine. The governor is housed in the upper part of the timing gear housing and is driven by the camshaft gear.

b. Removal.

***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.**

(1) Remove canopy (para. 68), and remove air cleaner hose.
(2) Disconnect choke wire at carburetor (para. 68).
(3) Disconnect governor and throttle controls (para. 75).
(4) Loosen nuts, and remove oil lines.
(5) Remove four bolts and lockwashers securing governor (1, fig. 25), and remove governor.

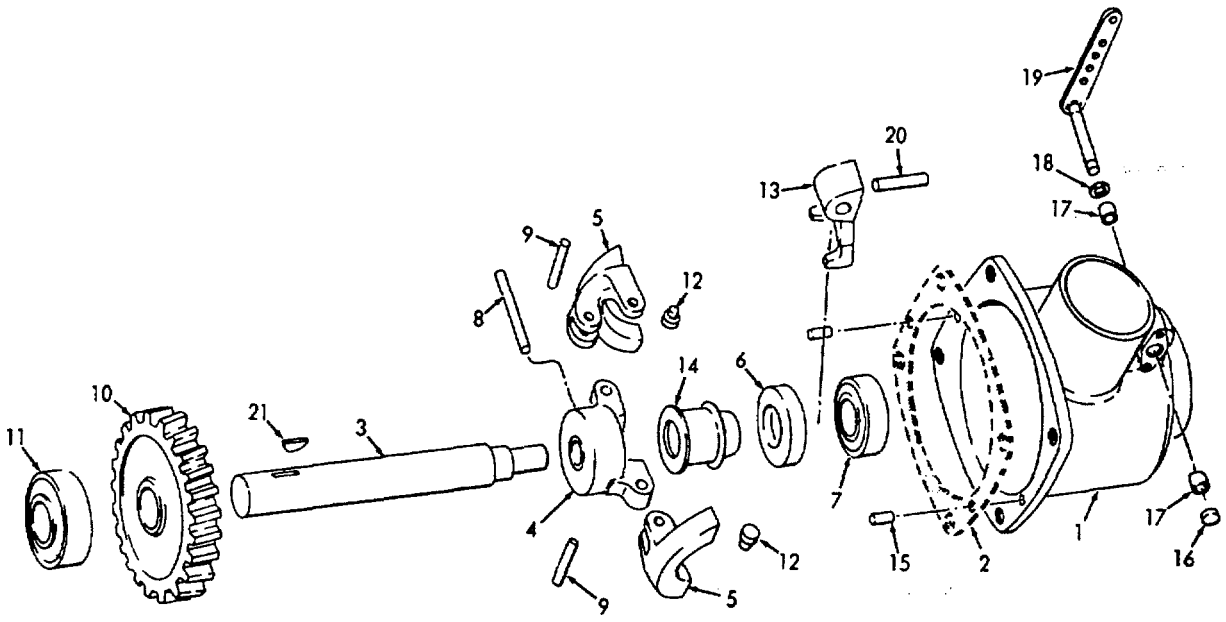
c. Installation.
(1) Position governor (1) on engine, and secure with four bolts and lockwashers.
(2) Position oil lines on governors, and secure with nuts.
(3) Connect governor spring (16, fig. 21). Connect throttle control rod (13) with nut (15).
(4) Connect choke wire to carburetor (para. 68).
(5) Install air cleaner hose and canopy (para. 72).

77. Carburetor

a. General. The carburetor is an updraft single-venturi design. It has a semi-concentric fuel bowl which allows engine to operate without flooding or starving in rough terrain.

b. Adjustment.
(1) Remove nut (15, fig. 21) securing the throttle control rod to the governor cross shaft and lever (19, fig. 25), and pull the control rod loose from the lever.
(2) Start the engine, and let it run until it reaches the normal operating temperature (para. 34). Push the choke all the way in.
(3) Move the governor control lever until the engine runs at idle speed. Turn the idle adjusting screw counterclockwise until the engine falters; slowly turn the screw clockwise until the engine runs smoothly. Stop the engine.
(4) Position the throttle rod (13, fig. 21) in the governor cross shaft and lever (19, fig. 25), and secure spring (16, fig. 21).

c. Removal.
(1) Disconnect the governor control rod (13, fig. 21).
(2) Remove the air cleaner hose (4, fig. 20).



1 Housing assembly	7 Bearing	12 Thrust pin	17 Bearing
2 Gasket	8 Pin, tapered	13 Yoke	18 Packing
3 Shaft, drive	9 Pin, lock	14 Thrust sleeve	19 Shaft and lever
4 Hub	10 Gear	15 Pin, dowel	20 Pin, tapered
5 Fly weight	11 Shaft bearing	16 Expansion plug	21 Key
6 Bearing			

Figure 25. Governor.

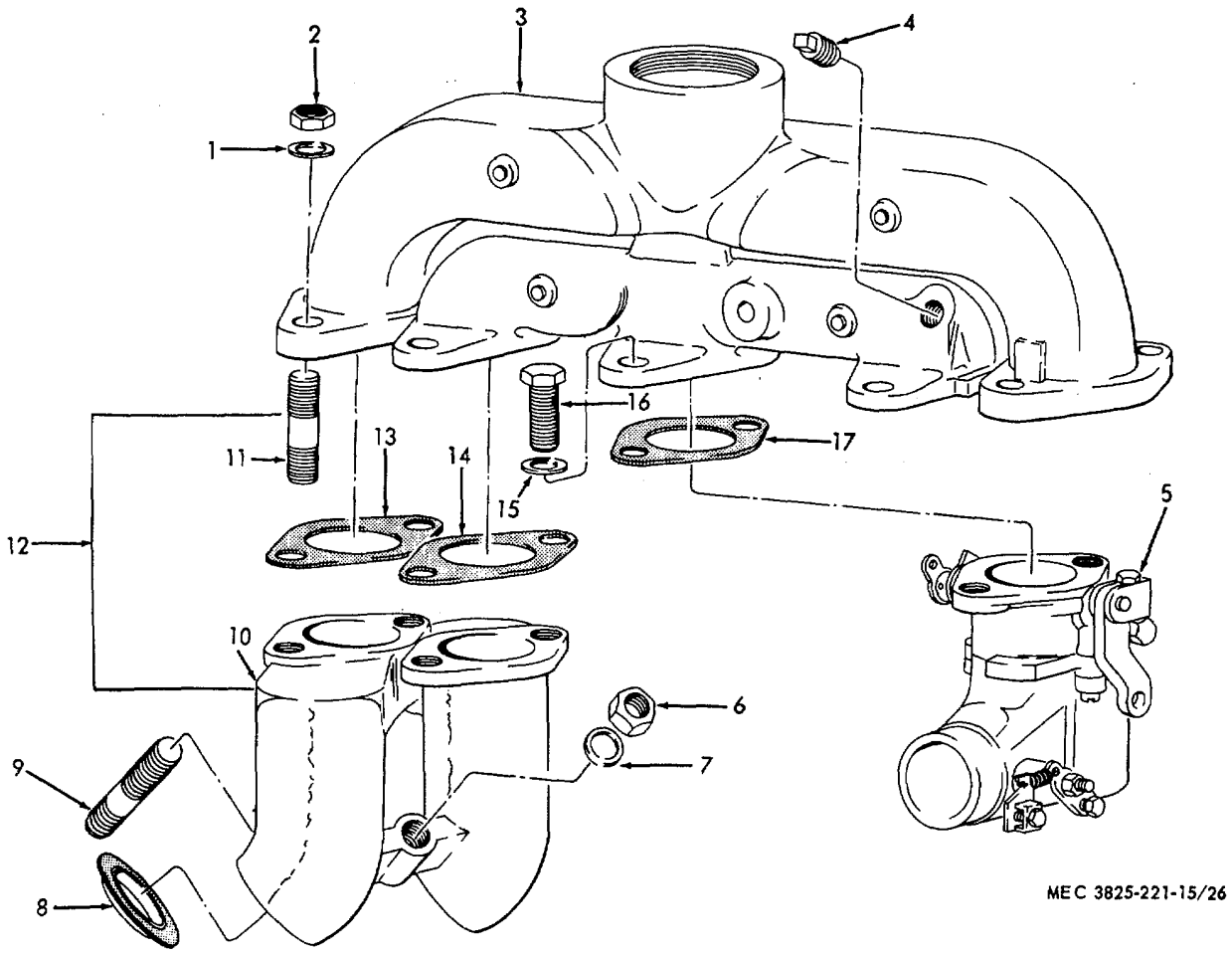
(3) Loosen the fuel line nut (7) securing the fuel line (8) to the carburetor assembly (5), and remove the line from the carburetor.
(4) Remove the two hex screws (16, fig. 26) and lockwashers (15) securing the carburetor assembly to the intake manifold (3), and remove the carburetor and flange gasket (17).

d. Cleaning and Inspection.
(1) Wash the carburetor with an approved cleaning solvent and dry thoroughly.
(2) Check the throttle body and fuel bowl for cracks or burrs on the gasket surfaces, and repair minor damage, such as small burrs, with a fine file. Replace the carburetor if defective.

e. Installation.
(1) Position a new flange gasket (17, fig. 26) on the carburetor flange, and secure the carburetor assembly (5) on the intake manifold (3) with two lockwashers (15) and the hex screws.
(2) Attach the fuel line (8, fig. 20) to the carburetor assembly (5), and secure with nut (7).
(3) Insert the choke wire (14) in the hole in the butterfly valve arm. Position the butterfly valve arm so that the butterfly valve is wide open. Push the choke control knob on the instrument panel all the way in, and tighten butterfly valve arm swivel screw.

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.**

(4) Install the air cleaner hose (4).
(5) Insert the throttle control rod into the variable speed lever (4, fig. 21), and secure nut (15).
(6) Adjust the carburetor. See b above.



1	Lockwasher	7	Lockwasher	13	Gasket
2	Nut	8	Seal	14	Gasket
3	Manifold, upper branch	9	Stud	15	Lockwasher
4	Plug, pipe	10	Manifold, lower branch	16	Capscrew
5	Carburetor	11	Stud	17	Gasket
6	Nut	12	Manifold, lower branch assembly		

Figure 26. Manifolds and carburetor.

78. Choke Control

a. Removal.

(1) Remove setscrew securing choke wire to carburetor.

(2) Remove nut (15, fig. 20) securing choke control knob (13, fig. 11) to front panel and remove choke control.

b. Installation.

(1) Position choke control knob (13, fig. 11) in front panel and secure with nut.

(2) Push choke control all the way in. Thread choke wire through butterfly valve arm mounting hole. Open butterfly valve all the way and secure choke control wire with setscrew.

(3) Pull choke control all the way out and check to make sure that the butterfly valve is completely closed.

79. Throttle Control Rod

a. Removal.

(1) Remove nut (15, fig. 21) and lock-

washer (14) securing throttle control rod (13) to the governor control shaft lever (19, fig. 25).
(2) Remove nut (15, fig. 21) and lockwasher (14) securing throttle control rod to carburetor.

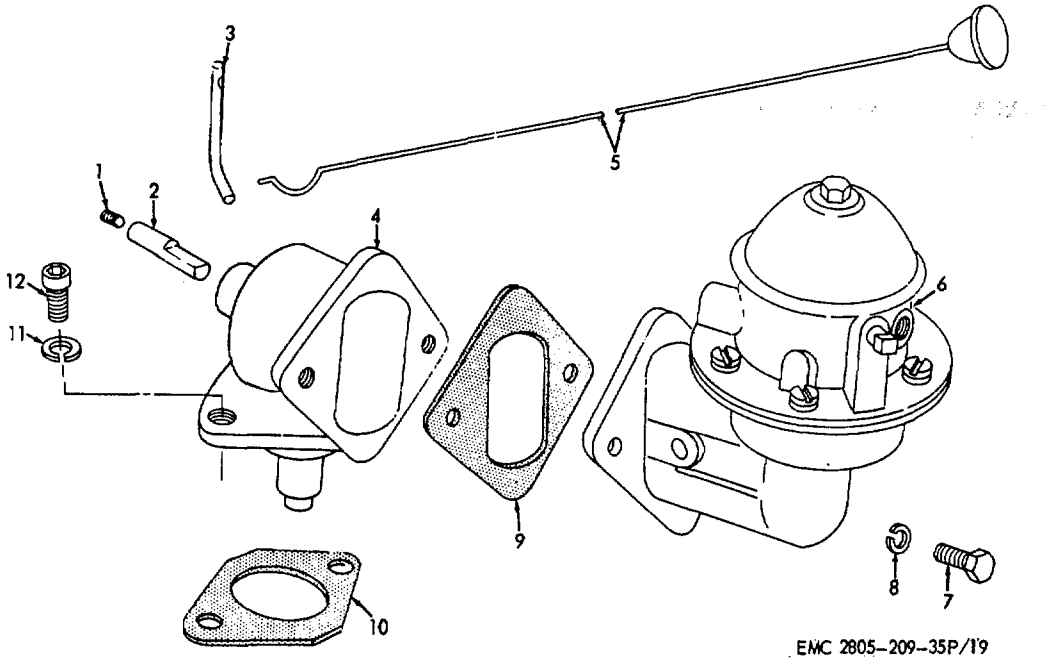
b. Installation.
(1) Position throttle control rod stud in carburetor throttle lever and secure with lockwasher (14, fig. 21) and nut (15).
(2) Position throttle control rod stud in governor control shaft lever (19, fig. 25) and secure with lockwasher (14, fig. 21) and nut (15).
(3) Adjust governor controls (para. 74).

80. Engine Fuel Pump, Adapter and Priming Mechanism

a. General. The engine fuel pump adapter operates the fuel pump by pulling down a flexible diaphragm which pulls fuel from the fuel tank to the carburetor. A plunger housed in the fuel pump adapter actuates a rocker arm and link assembly which actuates the fuel pump diaphragm. The plunger rides on an eccentric of the camshaft. The fuel pump can be operated by a hand priming lever on the fuel pump adapter if the eccentric on the camshaft is in the low position so the plunger can be operated.

b. Removal.
(1) Remove the canopy (para. 68) and fuel lines.
(2) Remove the two capscrews (12, fig. 27) and lockwashers (11) securing the fuel pump and adapter to the crankcase and remove the adapter and gasket.

c. Disassembly.
(1) Remove two bolts (7, fig. 27) and lockwashers (8) securing fuel pump (6) to adapter. Remove pump and gasket (9).
(2) Remove the plunger cap and the plunger from the adapter (4).



1	Setscrew	4	Adapter housing	7	Capscrew	10	Gasket
2	Shaft	5	Primer control	8	Lockwasher	11	Lockwasher
3	Lever	6	Fuel pump	9	Gasket	12	Capscrew

Figure 27. Fuel pump and fuel pump adapter assembly.

(3) Remove the priming lever (3) from the shaft (2).
(4) Remove the spring shaft (2) and washer from the adapter.
(5) Remove the preformed packing from the shaft (2).

d. Cleaning, Inspection, and Repair.
(1) Clean all parts in an approved cleaning solvent and dry thoroughly with compressed air.
(2) Wipe the preformed packing clean with a cloth dampened with an approved cleaning solvent.

e. Inspection and Repair.
(1) Inspect all hardware for breaks or damaged threads and replace as necessary.
(2) Inspect the adapter for cracks, breaks, rust or corrosion. Check the gasket surfaces for nicks or burrs and remove any burrs. Repair or replace as necessary.
(3) Inspect all springs for weakness, pitting, or rust and replace as necessary.
(4) Inspect the plunger and plunger cap for excessive wearing, burrs, or rust. Remove rust and burrs. Replace a worn cap or plunger.
(5) Inspect the priming lever and control lever for cracks or rust. Replace a defective control or priming lever.
(6) Replace the gaskets.

f. Reassembly.
(1) Install the preformed packing on the shaft (2).
(2) Install the washer, shaft (2) and spring on the adapter (4).
(3) Install the priming lever (3) in the shaft (2).

(4) Install the plunger and cap in the adapter (4).
(5) Position the gasket (9) on the adapter (4).

g. Installation.
(1) Position a new gasket (10, fig. 27) on the crankcase. Position the fuel pump adapter (4) on the crankcase and secure with two lockwashers (11) and capscrews (12).
(2) Position a new gasket on the fuel pump adapter (9).
(3) Position the fuel pump (6) on the fuel pump adapter and secure with the two lockwashers (8) and bolts (7).
(4) Position the fuel lines on the fuel pump and secure with the two fuel line nuts (7, fig. 20).
(5) Install the canopy (para. 68).

Section VII. ENGINE ELECTRICAL SYSTEM

81. Description

The electrical system for the Macleod Water Distributor consists of a starter and cable, battery cable, spark plug cables, spark plugs, and a magneto. All of the components are radio suppressed.

82. Starter

a. General. The starter motor supplies the necessary amount of torque for a short period of time to crank the engine. It is a series-wound, 4-pole type, with power transmitted to the flywheel through a Bendix drive. The starter motor consists of five major subassemblies, commutator head, frame and field, armature, drive, and pinion housing.

b. Removal.
(1) Remove the two nuts (12, fig. 19) and lockwashers (13) securing the front mounting bracket (11).
(2) Remove the nut (9) and starwasher (10) securing the starter cable (2) and remove the cable from the terminal.
(3) Remove the three bolts (8) and lockwashers (7) securing the starter (1) to the crankcase and remove the starter from its mounting.

c. Installation.
(1) Position starter motor in its crankcase mounting and secure with three bolts (8), and lockwashers.

(2) Replace starter cable (2) and secure with nut (9) and lockwasher (10).
(3) Position the mounting bracket (11) on the crankcase and secure with two nuts (12) and lockwashers (13).

83. Starter Cable

a. Description. The starter cable conducts electric current from the starter switch to the starter motor.

b. Removal.
(1) Remove the nut (9, fig. 19) and starwashers (10) securing the starter cable to the starter motor (1).
(2) Remove the nut (6) and washer (5) holding the starter cable to the starter switch terminal (3) and remove the starter cable.

c. Cleaning, Inspection, and Repair
(1) Clean the starter cable with an approved cleaning solvent.
(2) Clean the terminals with a stiff wire brush.
(3) Inspect the insulation for fraying, cracking, or checking.
(4) Repair any frays, cracks, or checks in the insulation by wrapping them securely with plastic tape. If the insulation is completely worn away, exposing the wire, replace the starter cable.

d. Installation.
(1) Position one starter cable terminal on the switch terminal and secure with nut (6) and lockwashers.
(2) Position the other starter cable terminal on the starter terminal and secure with nut (9) and lockwashers (10).

84. Battery Cable

a. Removal.
(1) Loosen bolt securing battery cable clamp to carrier battery and remove battery cable from carrier battery.
(2) Remove nut (6, fig. 19) and lockwasher (5) securing battery cable to starter switch (3). Remove all plastic wrapping.
(3) Pull battery cable through frame rails and remove battery cable.

b. Cleaning, Inspection, and Repair.
(1) Clean battery cable with an approved cleaning solvent.
(2) Clean corrosion from battery cable clamp and terminal with a wire brush.
(3) Inspect battery cable sheathing for cracks, breaks, and worn or deteriorated insulation. Repair or replace as necessary.
(4) Inspect battery cable terminal and clamp for erosion from battery acid. Replace a cable with badly eroded terminal or clamp.
(5) Inspect clamp bolt for corrosion damaged threads. Replace as necessary.

c. Installation.
(1) Thread battery cable along water tank frame rail from engine to carrierbattery.
(2) Position cable clamp on carrier starter switch terminal and tighten nut.
(3) Position battery cable terminal on battery terminal and secure with lockwasher and nut.
(4) Secure cable to carrier frame with hold down clamps.

85. Spark Plug Cables

a. Description. There are four shielded spark plug cables, connecting the magneto terminal to the spark plug terminals. The cables are screwed to the magneto terminals and spark plug terminals with threaded connector. The entire spark plug cable assembly is radio suppressed.

b. Testing the Spark Plug Cables for Internal breakage.
(1) Loosen, but do not remove, the four connectors (30, fig. 20) connecting the spark plug cables to the spark plugs (31).
(2) Start the engine.
(3) With the engine running, disconnect one spark plug cable from its socket on the spark plug.

Caution: **Hold the cable by the connector only. Do not touch the terminal or a shock will result. Do not perform this test if gasoline fumes are present.**

(4) Hold the end of the cable about 1/16 of an inch away from the flywheel housing. If the cable is unbroken, a spark will jump from the cable terminal to the flywheel housing. If a spark does not jump, remove and replace the cable (29) and recheck. Should the spark not jump with the new cable in place, the trouble is probably in the magneto. Use the above procedure to check all spark plug cables.

c. Removal.

(1) Tag each cable so that it can be replaced in its proper position. Remove the holddown clamp screws (27, fig. 20).

(2) Unscrew the four spark plug terminal connectors (30) and the four magneto terminal connectors and remove the cables.

(3) Remove the holddown clamps from the cables.

d. Cleaning, Inspection, and Repair.

(1) Clean the cable shielding, connectors, and terminals with an approved cleaning solvent.

(2) Inspect the shielding for fraying or breaks. Replace all broken or frayed cables.

(3) Inspect the terminals and connectors for damage. Replace any damaged cables.

e. Reassembly and Installation.

(1) Replace the holddown clamps (28, fig. 20) on the cables.

(2) Insert the cable terminals (21, fig. 18) into the magneto and spark plug sockets (31, fig. 20) and tighten the connectors (30, fig. 20).

(3) Position the holddown clamps over the screw holes and secure with screws (27) and lockwashers.

86. Spark Plugs

a. Removal.

(1) Unscrew the four connectors (30, fig. 20) holding the spark plug cables (29) to the spark plugs (31) and remove the cables.

(2) Blow out the spark plug wells with compressed air.

(3) Remove the spark plugs with a spark plug wrench and lift out the plug gaskets.

(4) Plug the four spark plug holes with cork or wooden plugs, to prevent dirt from entering the cylinders.

b. Cleaning and Inspection.

(1) Clean the outside of the spark plugs with an approved cleaning solvent.

(2) Inspect the terminal socket for corrosion. Clean with wire brush.

(3) Inspect the insulators for lead, carbon deposits, and cracks, clean all deposits from the insulators, and use a brush to clean the threads. Replace any plugs with cracked insulators.

(4) Examine the spark plug electrodes for pitting. Replace a badly pitted spark plug.

(5) If the center electrodes are not excessively worn, file them level with a spark plug file.

(6) Adjust the spark plug gap to 0.030 ofan inch by bending the ground, or flat, electrode.

Caution: **Do not bend the center electrode. To do so will break the insulation, rendering the spark plug inoperative.**

c. Installation.

(1) Remove the cork or wooden plugs from the spark plug holes in the cylinder head.

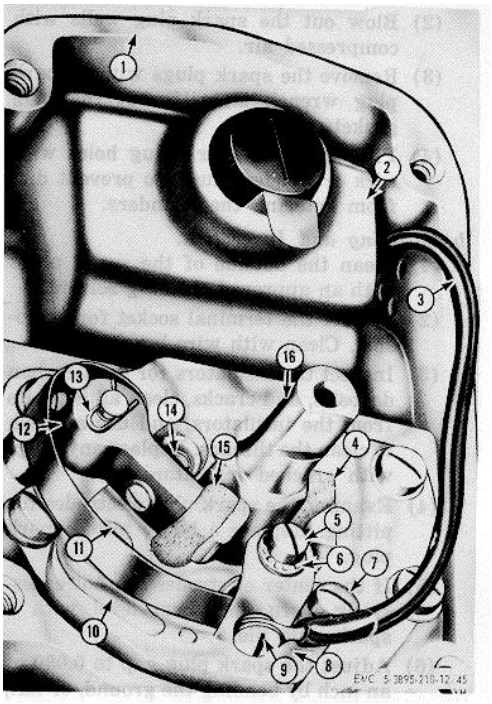
(2) Position the spark plug gasket over each spark plug, and install the plugs in the cylinder head.

(3) Use a spark plug socket and a torque wrench to tighten the spark plugs to a torque of from 25 to 30 foot-pounds.

(4) Insert the spark plug cable terminals (30, fig. 20) into the spark plug sockets (31) and secure the connectors (30).

87. Magneto

a. Description. The engine magneto assembly provides the high voltage electrical current for the engine ignition system. It is radio shielded



1	Housing	5	Screw	9	Screw	13	Pivot snapring
2	Coil	6	Lockwasher	10	Plate	14	Contact
3	Ground Wire	7	Screw	11	Screw	15	Feltwick
4	Camwick	8	Plate	12	Breaker arm	16	Rotor shaft

Figure 28. Magneto adjustment

and is driven off the timing gears at camshaft speed. The magneto is enclosed in a metal frame, cap, and end cover. Threaded cable outlets are provided for connection to the spark plug lead shielding. All the interior metal is interconnected and grounded to provide radio shielding. The magneto armature is a one-piece magneto rotor that rotates between the pole pieces of a laminated iron frame causing an induced current to flow in the primary circuit of the coil, during the time the contact points are closed. When the points open, the primary circuit is broken, instantly collapsing the field and inducing the secondary circuit of the coil to produce the intense ignition spark for startings. An impulse coupling is provided which makes possible the production of a spark at cranking speed equal to that produced when the engine is running. The impulse consists of a hub and shell connected by a torsion type spring. Through this device, the magneto armature is held back while the engine is turned over to just past top dead center, at which instant the pawls of the coupling are released by the pawl stop pin, causing the power coil spring to snap the magneto armature forward at high speed. This produces an intense spark, automatically retarded to prevent kick-backs. When the engine starts, the pawls are disengaged by centrifugal action of the drive gear, causing the coupling to act as a direct drive.

b. Adjustment.

(1) Remove screw (8, fig. 18) and lockwasher securing the magneto stop switch wire.

(2) Remove the four connectors (20) securing the spark plug cables and disconnect the cables, tagging each so they can be replaced in their proper sockets in the magneto.

(3) Remove the four screws (11) and lockwashers securing the end cover (12) and remove the end cover and gasket (13).

(4) Rotate the crankshaft with the starting crank until the breaker arm is riding on the high spot of the camshaft and the breaker points are wide open.

(5) Loosen the locking screws (7, fig. 28) on the contact plate so that the plate is movable.

(6) Insert the end of a small screwdriver into the adjusting slot at the bottom of the contact plate (10) and open or close the breaker points by moving the contact plate until the clearance is .015 checked with a feeler gage.

(7) Tighten the locking screws (7 and 11) and recheck the breaker point gap (14) to make sure it has not changed.

(8) Position gasket (13, fig. 18) and end cover (12) on the magneto and secure with four lockwashers and screws (11).

(9) Insert the spark plug cables into the magneto sockets and secure with four connectors.
(10) Position the magneto stop switch wire terminal (18) on the magneto capacitor terminal and secure with lockwasher and screw.

c. Removal.
(1) Remove the spark plug cables from the magneto (14, fig. 18).
(2) Remove the magneto stop switch wire (18).
(3) Remove the high temperature safety switch by removing the terminal screw (8).
(4) Remove the holddown bolt (15).
(5) Remove the adjusting bolt and remove the magneto from its mounting.

d. Installation.
(1) Position the magneto and gasket (7) in its mounting hole, secure with the holddown bolt (15) and the adjustment bolt.
(2) Attach the magneto stop switch wire with the screw (8).
(3) Attach the high temperature safety switch wire with the screw.

Section VIII. CHASSIS ELECTRICAL SYSTEM

88. Description
The distributor wiring harness consists of five wiring harnesses which conduct current to the marker and identification lamps and turn signals. Connectors at the rear of the carrier chassis connect the distributor wiring to the chassis electrical system.

89. Wiring Harness
a. Removal.
(1) Separate connectors at rear of chassis.
(2) Separate connectors at marker lamps, identification lamps and turn signals.
(3) Release all plastic retainers from harnesses.
(4) Remove harnesses by pulling them through grommets in distributor frame.

b. Cleaning, Inspection, and Repair.
(1) Clean the wiring harnesses with an approved cleaning solvent.
(2) Inspect the insulation for chafing, breakage or deterioration. Replace a wiring harness with badly deteriorated or chafed insulation. Tape any places where minor damage has occurred.
(3) Clean all connectors and remove any corrosion present.

c. Installation.
(1) Thread the harnesses through the grommets in the distributor frame.
(2) Fasten harnesses in plastic retainers.
(3) Make connections to lamps.
(4) Make connections to carrier wiring at rear of chassis.

90. Turn Signal Switch
a. Removal.
(1) Disconnect turn signal switch wires at flasher unit.
(2) Loosen screw securing clamp securing turn signal switch mounting bracket to steering wheel post, and remove turn signal switch and wiring harness.

b. Installation.
(1) Position turn signal switch mounting bracket under holddown clamp on carrier steering wheel post and tighten screw.
(2) Connect turn signal switch wires at flasher unit terminals.

91. Turn Signal Lamps and Brackets
a. Lamp Replacement.
(1) Remove the four screws securing the lens to the lamp body and remove the lens.
(2) Remove the socket-type bulb from the receptacle by pushing in and turning counterclockwise.
(3) Install the bulb by inserting into the receptacle and pressing in while turning clockwise.
(4) Position the lens on the lamp body and secure with four phillips screws.

b. Removal.
(1) Disconnect the socket connectors behind the turn signal lamps tagging the wires to facilitate installation.
(2) Remove the nut securing the turn signal lamp and remove the turn signal lamp.
(3) Remove the two bolts and nuts securing the rear turn signal lamp bracket to the water distributor frame and remove the turn signal bracket. Repeat this procedures to remove the opposite turn signal bracket.
(4) Remove the four nuts, bolts, and lockwashers securing the front turn signal bracket to the carrier fender and remove the front turn signal bracket. Repeat this procedure to remove the opposite turn signal bracket.

c. Disassembly.
(1) Remove the lens, see a above.
(2) Remove the screws securing the blackout lamp in the rear turn signal bracket and remove the blackout lamp.

d. Inspection, Cleaning, and Repair.
(1) Clean all parts in an approved cleaning solvent.
(2) Wash the lens in warm soapy water and rinse. Polish the lens with a soft cloth.
(3) Brush all rust and corrosion from the mounting brackets.
(4) Inspect turn signal lens, lamp body and mounting bracket for damage. Repair or replace as necessary.
(5) Paint a rusted or corroded bracket.

e. Assembly.
(1) Position blackout lamp in rear turn signal bracket and secure with screws.
(2) Position lens on lamp body and secure with four phillips screws.

f. Installation.
(1) Position the rear turn signal bracket on the water distributor frame and secure with bolts and nuts. Repeat procedure to install opposite bracket.
(2) Position the turn signal lamp in the bracket and secure with nut. Repeat this procedure to install each turn signal lamp.
(3) Connect the electrical lead to the turn signal lamp with the socket connector. Repeat for each turn signal lamp.

92. Marker Lamps, Top

a. Lamp Replacement.
(1) Remove the snapring securing the lens to the lamp body.
(2) Remove the socket-type bulb from the receptacle by pushing in and turning counterclockwise.
(3) Install the bulb by inserting into the receptacle and pressing in while turning clockwise.
(4) Position the lens on the lamp body and secure with snapring.

b. Removal.
(1) The top marker lamp assembly is unrepairable and must be replaced as a unit, if defective.
(2) Disconnect and tag the electrical lead from lamp assembly.
(3) Remove the four screws securing the lamp assembly to the water tank, and remove the lamp assembly.

c. Installation.
(1) Position the lamp assembly on the water tank and secure with four screws.
(2) Connect the electrical lead to the lamp assembly.

93. Marker Lamps, Frame

a. Lamp Replacement.
(1) Remove the two screws securing the lamp to the water tank frame. Remove the lamp frame and lens.
(2) Remove the socket-type bulb from the receptacle by pushing in and turning counterclockwise.
(3) Install the bulb by inserting into the receptacle and pressing in while turning clockwise.
(4) Position the lens and frame against the body and secure with the two machine screws.

b. Removal and Disassembly.
(1) Disconnect and tag the electrical lead from the lamp.

(2) Remove the frame, lens, lens clips, lens gasket and the bulb.
(3) Remove the four nuts, lockwashers, and the machine screws securing the back plate to the frame. Remove the back plate assembly and the body pad from the skirting.

c. Cleaning, Inspection, and Repair.
(1) Clean all metal parts with an approved cleaning solvent. Dry thoroughly.
(2) Wash the lens with soap and warm water, and rinse thoroughly. If the lens is not cracked or chipped, polish with a soft, lint-free cloth. Replace a cracked or chipped lens.
(3) Inspect the backplate and the frame for dents, corrosion, or other damage and replace if necessary.
(4) Check the socket for corrosion. Repair or replace as necessary.
(5) Inspect the electrical leads for cracked, frayed or oil-soaked insulation and replace if damaged.
(6) Check all hardware and replace any that is damaged.

d. Reassembly and Installation.
(1) Install the wire assembly in the front of the back plate with the rubber nipple over the wire assembly protruding from the rear of the back plate.
(2) With the body pad properly positioned secure the back plate to the frame with the four machine screws, lockwashers, and nuts.
(3) Install the bulb, lens gasket, the lens and the body. See *a* above.
(4) Connect the electrical leads to the marker lamp and remove the identification tags.

94. Reflectors

a. Removal. Remove the screw securing the reflector (7, fig. 2) to the water distributor.

b. Cleaning and Inspection.
(1) Clean all parts in an approved cleaning solvent.
(2) Inspect for cracks, breaks, worn gasket, or other damage, and replace as necessary.

c. Installation. Position the reflector (7) on the water distributor and secure with screw.

Section IX. CONTROLS AND INSTRUMENTS

95. Description

The engine control and instrument system is comprised of the high temperature safety switch, starter switch, magneto stop switch and wire, low oil pressure shutoff switch. The distributor control and instrument system is comprised of the bitumeter assembly. water tank level gage, water discharge pressure gage, and the signal gongs.

96. Starter Switch

a. Description. The starter switch is a spring loaded, push-type switch. Pushing the button completes an electrical circuit from the battery to the starter. Because the switch is a one-piece unit, it must be replaced if defective.

b. Testing. If the starter motor fails to operate, short the switch by placing a screwdriver across the terminals (15, fig. 19) at the back of the starter switch (3). If the starter motor operates, the switch is defective and must be replaced.

c. Removal.
(1) Remove the battery cable, and the starter cable (2) from the terminals (15) on the back of the starter switch.
(2) Remove the two bolts (4), nuts (6) and lockwashers (5) holding the starter switch to the front panel and remove the switch.

d. Installation. Position the starter switch in the engine front panel mounting hole and secure with two bolts (4), nuts (6) and lockwashers (5).

97. High Temperature Safety Switch

a. Description. The high temperature safety switch is a temperature sensing unit that shuts off an overheating engine automatically. The

sensing unit is fastened to the cylinder head. A wire runs from the switch to the magneto. The switch is not repairable and must be replaced as a unit.

b. Removal.

(1) Disconnect the switch wire by pulling the clip connector from the terminal.

(2) Unscrew the cylinder head capscrew, remove the washer, and lift off the switch.

c. Installation.

(1) Position the switch on the cylinder head and secure with the washer and capscrew.

(2) Connect the switch wire by installing the clip connector on the switch terminal.

98. Magneto Stop Switch and Wire

a. Description. The magneto stop switch is a push-pull switch. It grounds the magneto, thereby, stopping the engine. Because the switch is a one-piece unit it must be replaced if defective. The stop switch wire leads from the rear of the stop switch to the magneto.

b. Removal.

(1) Remove the screw securing stop switch wire to the rear of magneto stop switch and screw (8, fig. 18) securing stop switch wire to magneto (14) and remove wire.

(2) Remove nut securing stop switch (2, fig. 11) to front panel and remove stop switch.

c. Installation.

(1) Position magneto stop switch (2) in front panel and secure with nut.

(2) Secure magneto stop switch wire to rear of stop switch with screw and to magneto with screw (8, fig. 18).

99. Low Oil Pressure Shutoff Switch

a. Removal.

(1) Unscrew knurled nut (5, fig. 11) and remove wire from top of switch.

(2) Remove nut securing oil line to rear of switch and remove switch.

b. Installation.

(1) Position switch on front panel. Secure oil line to rear of switch with nut.

(2) Position wire on switch and secure with knurled nut.

100. Bitumeter Assembly

a. Removal.

(1) Loosen nut and disconnect bitumeter drive cable (6, fig. 5) at tachometer drive head (1). Loosen nut and locknut securing lift rod and remove lift rod (3).

(2) Remove three bolts, nuts, and lockwashers securing bitumeter wheel mounting bracket (3, fig. 29) to carrier frame and remove bitumeter wheel assembly.

(3) Loosen nut securing tachometer drive cable (6, fig. 5) to tachometer head (1) and pull tachometer drive cable through the floor of the carrier.

(4) Remove the two screws and lockwashers securing tachometer head to carrier instrument panel and remove tachometer head.

(5) Pull tachometer drive cable from its conduit.

b. Disassembly.

(1) Remove cotter pins (1, fig. 29) securing pin (2) in mounting bracket (3). Remove pin and remove bitumeter frame (9) and wheel assembly from mounting bracket (3).

(2) Remove setscrew (4) and remove drive unit (5).

(3) Remove pins (16) securing wheel assembly (18).

(4) Remove the four nuts (6), bolts (8) and lockwashers (7) securing the bearing supports (10) to the bitumeter frame shaft (9) and slide the bearing supports and wheel assembly off the bitumeter frame shafts.

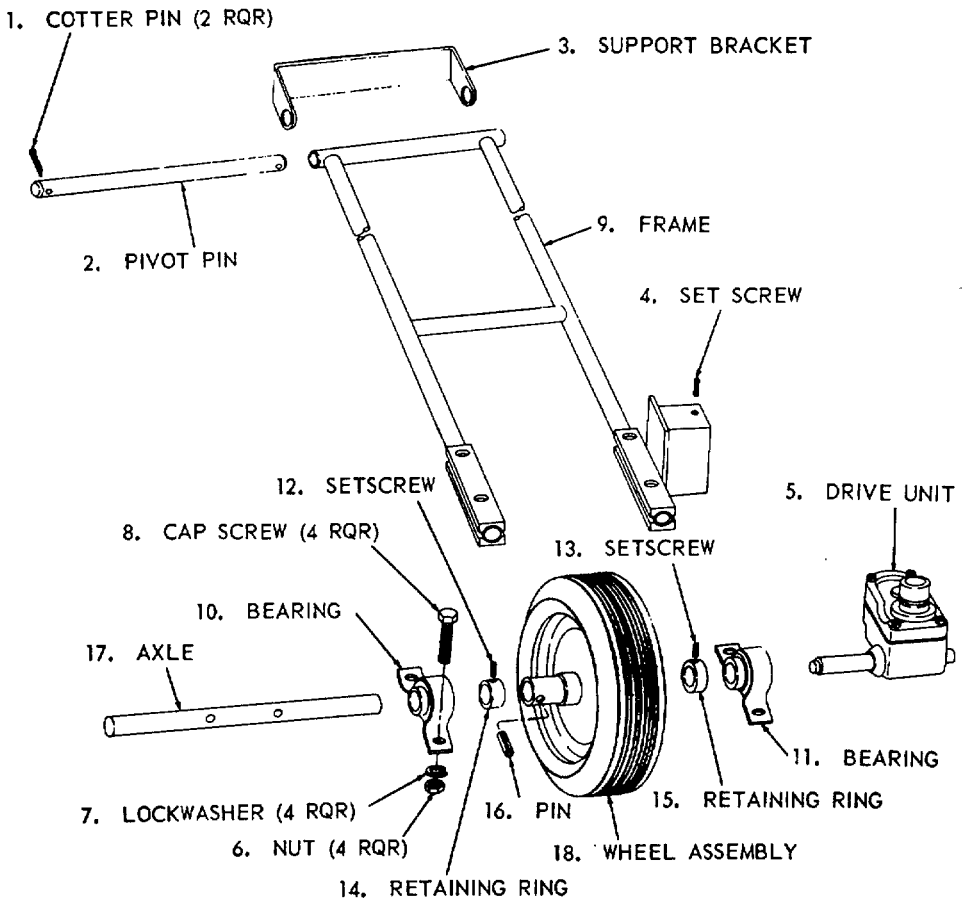
(5) Remove the tire and tube.

(6) Remove three bolts, nuts and lockwashers securing lift rod bracket and remove lift rod bracket (2, fig. 5).

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent.

(2) Inspect frame and mounting brackets for bends, cracks, corrosion, and brok-



1	Cotter pin	7	Lockwasher	13	Setscrew
2	Pivot pin	8	Capscrew	14	Retaining ring
3	Support bracket	9	Frame	15	Retaining ring
4	Setscrew	10	Bearing	16	Pin
5	Drive unit	11	Bearing	17	Axle
6	Nut	12	Setscrew	18	Wheel assembly

Figure 29. Fifth wheel assembly.

en weldments. Repair or replace as necessary.

(3) Inspect bitumeter drive cable drive head, and tachometer head for damage. Repair or replace as necessary.

(4) Inspect the outside of the tire for checking and cracking. Pry apart the bends, and check the inside of the tire for breaks. Replace a tire with broken cords.

(5) Inflate the tube, submerge it in water, and check for leaks. If the tube is badly checked or ripped, replace it.

(6) Check the valve stem for damaged threads. Inflate the tube, replace the valve core and place a drop of water on top of the valve stem to check the valve core for leakage. Replace a defective valve core.

(7) Inspect all hardware and spring for damage. Repair or replace as necessary.

d. Assembly.

(1) Install the tire and tube.

(2) Install the bearing supports (10, fig.29) on both sides of the frame (9).

(3) Insert the axle shaft (17) into the bearing (10) and drive it through the wheel assembly.

(4) Secure the wheel assembly with pins (16).
(5) Position the tachometer drive assembly (5) on bracket and secure with setscrew (4).
(6) Position bitumeter frame (9) in mounting bracket (3), install pin (2) and secure pin with cotter pins (1).

e. Installation.

(1) Install tachometer drive cable in its conduit.
(2) Position tachometer head (1, fig. 5) on instrument panel and secure with two screws and lockwashers.
(3) Thread tachometer drive cable through floorboard of carrier.
(4) Position bitumeter wheel mounting bracket (3, fig. 29) on carrier frame and secure with three bolts, nuts, and lockwashers.
(5) Connect tachometer drive cable (6, fig.5) to tachometer unit with nut and to tachometer drive head (5, fig. 29).
(6) Position bitumeter lift rod (3, fig. 5) and secure with nut and locknut.
(7) Install lift rod bracket (2) with three bolts, nuts, and lockwashers.

101. Water Tank Level Gage

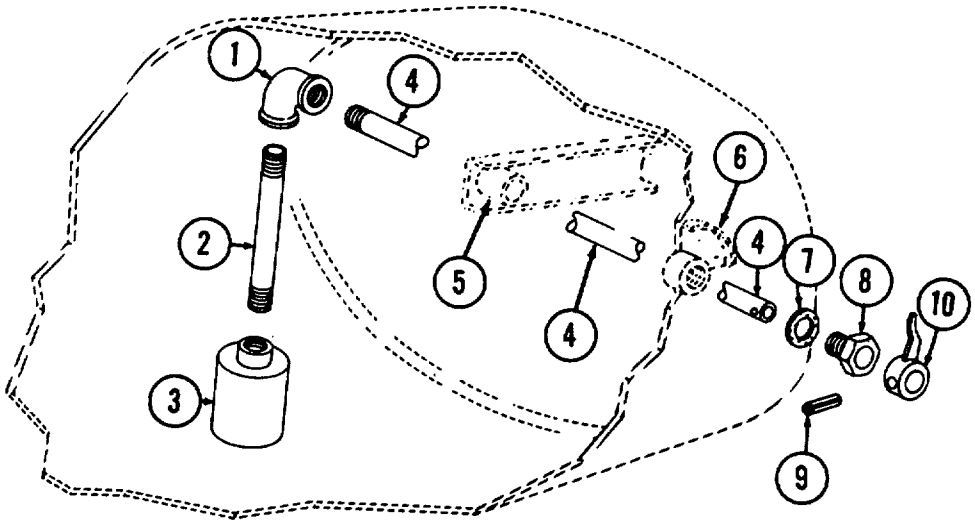
a. Description. The water tank level gage is mounted on the left rear of the water tank near the operator's position. This gage is designed so that the operator may tell at a glance the approximate amount of water in the tank. This gage is of simple construction and needs very little maintenance other than tightening packing nut where the shaft comes through the tank shell.

b. Removal and Disassembly.

(1) Drain the water tank.
(2) Remove the pin (9, fig. 30) securing the pointer (10) on the upper arm (4) and remove the pointer.
(3) Unscrew the lower arm (2) from the elbow (1) inside the water tank. Lift the lower arm with float (3) attached out of the tank.
(4) Unscrew elbow (1) arm (4). Remove the upper arm from the collar (5).

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts with an approved cleaning solvent and dry thoroughly.
(2) Inspect the collar and dial welded to the water tank for cracks, or broken



MEC 3825-221-15/30

1	Elbow	4	Arm, horizontal	7	Packing
2	Arm, vertical	5	Mounting strap	8	Nut, packing
3	Float	6	Dial	9	Pin
				10	Pointer

Figure 30. Water level gage.

welds. Repair broken welds or replace if damaged.
(3) Inspect the float for damage. Replace if necessary.
(4) Inspect the support bracket inside the water tank for secureness of mounting. Reinforce with a tack weld if the bracket is loose.
(5) Inspect the upper and lower arms for straightness or thread damage. Replace if necessary.
(6) Inspect the packing nut, pin, elbow and pointer for damage. Replace if necessary.
(7) Use new packing when reassembling the gage.

d. Reassembly and Installation.
(1) Insert the upper arm (4) in the collar (5) from inside the water tank.
(2) Install the elbow (1) on the threaded end of the upper arm (4).
(3) Screw the float on the lower arm (2) and screw the lower arm with float attached into the elbow (1).
(4) Position new packing (7) on the upper arm and secure with packing nut (8).
(5) Position the pointer (10) on the upper arm (4) so that the pointer is on the empty mark and secure in this position with a pin (9).
(6) Check to see that the float moves without binding. If movement appears to be binding or loose; tighten or loosen the packing nut (8) accordingly.
(7) Fill the water tank.

102. Water Discharge Pressure Gage

a. Removal.
(1) Unscrew water discharge pressure gage (31, fig. 33) from nipple (29) connecting water discharge pressure gage to discharge elbow (25).
(2) Unscrew elbow (28) from discharge elbow (25).

b. Installation.
(1) Using an approved thread sealer, dope all pipe threads. Screw elbow (28) into discharge elbow (25).
(2) Screw water discharge pressure gage onto nipple (28) connecting water discharge pressure gage to discharge line.

103. Signal Gongs

a. Removal.
(1) Disconnect signal gong pull cords from signal gong (4, fig. 2).
(2) Remove four screws and nuts securing signal gongs to bracket and remove signal gongs.

b. Disassembly.
(1) Remove the acorn nut securing bell to the bracket and remove the bell.
(2) Detach the spring from the bracket and the gong arm and remove the spring.
(3) Detach spring from bracket and gong arm and remove the spring.

c. Cleaning, Inspection, and Repair.
(1) Clean all parts with an approved cleaning solvent.
(2) Check the bell for cracks and replace if necessary.
(3) Check the gong arm and lever for freedom of movement of the pivot points and replace the complete assembly if it is defective.
(4) Check the tension of the springs and replace where necessary.
(5) Replace frayed or otherwise defective cables.

d. Reassembly.
(1) Install spring on the bracket and the gong arm.
(2) Install spring on bracket and gong arm.
(3) Position the bell on the bracket and secure with acorn nut.

e. Installation.
(1) Position gongs on brackets and secure with four screws and nuts.
(2) Connect pull cords.

Section X. ENGINE MUFFLER, CYLINDER HEADS, AND VALVES

104. Description

The muffler is a one-piece unit and is screwed to the muffler pipe. Three cast-iron manifolds comprise the intake and exhaust manifold system. A center manifold is bolted to the left and right bank manifolds. Eight mushroom type valves, driven from the camshaft, are located in the cylinder blocks.

105. Muffler

a. Removal. Remove muffler (para. 68).

b. Cleaning, Inspection, and Repair.

(1) Clean all parts in an approved cleaning solvent.
(2) Clean all rust from the piping with a wire brush.
(3) Inspect all parts for damage. Inspect all threads for stripping or other damage. Repair or replace as necessary.
(4) Check muffler for holes or other damage. Repair or replace as necessary.

c. Installation. Install muffler (para. 68).

106. Manifolds

a. Description. There are three units in the manifold assembly; the right cylinder bank manifolding, the left cylinder bank manifolding, and the center manifolding. All three assemblies contain both exhaust and intake manifolding cast as a unit.

b. Removal.

(1) Remove the canopy (para. 68).
(2) Remove the cylinder head housing,shrouding, and heat deflectors (para.68).
(3) Disconnect carburetor fuel line (para.68), governor control rod (para. 68) and choke control (para. 68) from the carburetor.
(4) Remove the two nuts (6, fig. 26) and lockwashers (7) securing the left cylinder bank manifolding (10). Remove the two nuts (6) and lockwashers (7) securing the right cylinder bank manifolding (10) and remove the manifold assembly as a unit. Remove the manifold gaskets (13 and 14) from the cylinder block.

c. Disassembly.

(1) Remove the muffler pipe from the center manifold (3, fig. 26).
(2) Remove the four nuts (2) and lockwashers (1) securing the left cylinder bank manifolding to the center manifold (3) and remove the four nuts (2) and lockwashers (1) securing the right cylinder bank manifolding (10) to the center manifold. Remove the four manifold gaskets (13 and 14) from the left and right cylinder bank manifold studs.
(3) Remove the two bolts (16) and lockwashers (15) securing the carburetor (5) to the center manifold and remove the carburetor. Remove the carburetor gasket (17).

d. Cleaning, Inspection, and Repair.

(1) Clean the outside of the manifolds with an approved cleaning solvent. Blow out the insides of the manifolds with compressed air. Clean the mounting stud threads on the cylinder bank manifolds with a wire brush.
(2) Check the machine gasket surfaces for warpage with a straightedge. Replace any manifolds with warped or deeply pitted gasket surfaces.
(3) Inspect the manifolds and gasket surfaces for cracks or breakage. Replace any cracks or broken manifolds.

e. Reassembly.

(1) Position a new carburetor gasket (17, fig. 26) on the center manifold. Position the carburetor (5) on the center manifold (3) and secure with two lockwashers (15) and bolts (16).
(2) Position new gaskets (13 and 14) on the studs (11) of both the left and the right cylinder bank manifolds (10). Position the cylinder bank manifolds on the center manifold and secure with eight lockwashers (1) and nuts (2).

f. Installation.

(1) Position new gaskets (13 and 14) into both left and right cylinder bank ports.

(2) Position the assembled manifold assembly (3) on the four mounting studs (9) and secure with four lockwashers (7) and nuts (6).

(3) Connect the carburetor fuel line (para. 68) and choke control (para. 68).

(4) Install the cylinder head housing, shrouding and heat deflectors (para.8).

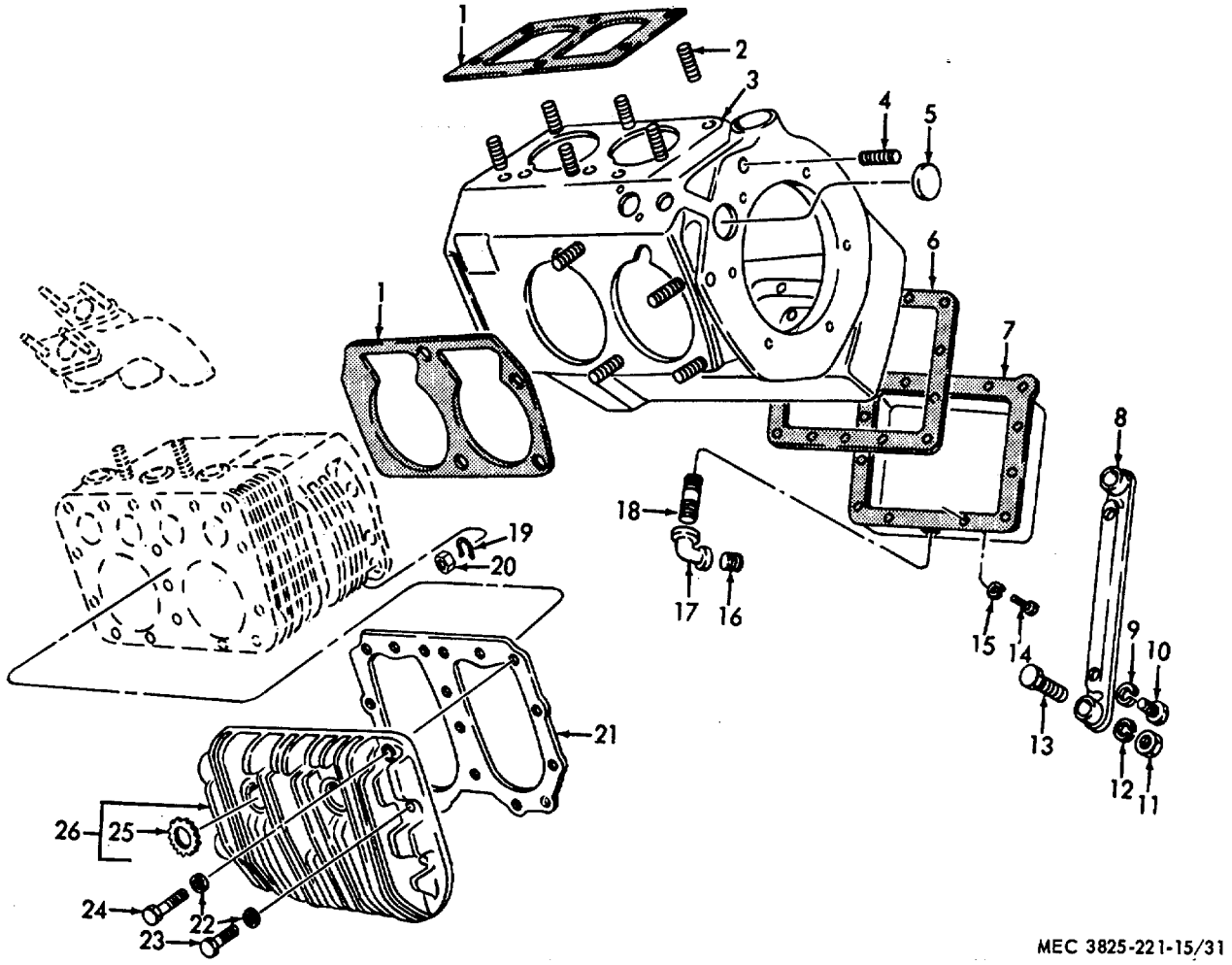
(5) Install the canopy (para. 68).

107. Cylinder Heads

a. Description. Each of the L-type cylinder heads is secured to the cylinder block with seventeen capscrews and plain washers. The cylinder heads must be removed if it is necessary to grind the valves or do work on the pistons and connecting rods.

b. Removal.

(1) Remove the canopy (para. 68), cylin-



1	Gasket, cyl. base	10	Capscrew	19	Lockwasher
2	Stud	11	Nut	20	Nut
3	Crankcase	12	Lockwasher	21	Cylinder head gasket
4	Plug	13	Capscrew	22	Plain washer
5	Plug, expansion	14	Capscrew	23	Capscrew
6	Gasket	15	Lockwasher	24	Capscrew
7	Oil pan	16	Plug	25	Insert, spark plug
8	Engine support	17	Elbow	26	Cylinder head
9	Lockwasher	18	Nipple		

Figure 31. Crank case assembly.

der head, shrouding and heat deflectors (para. 68).
(2) Remove the high temperature safety switch (para. 97b).
(3) Remove the spark plugs (para. 85c).
(4) Remove the seventeen capscrews (23 and 24, fig. 31) and plain washers (22) securing the cylinder head and remove the cylinder head. Remove the cylinder head gasket (21). Repeat the same procedure to remove the left cylinder head.
(5) Stuff rags into the cylinder bores to prevent dirt from entering.

c. Cleaning, Inspection, and Repair.

(1) Brush all debris from the cylinder head cooling fins.
(2) Scrape all carbon and gasket residue from both the cylinder head and cylinder block, combustion chambers and gasket surfaces.
(3) Clean the cylinder head and the cylinder block combustion chamber and

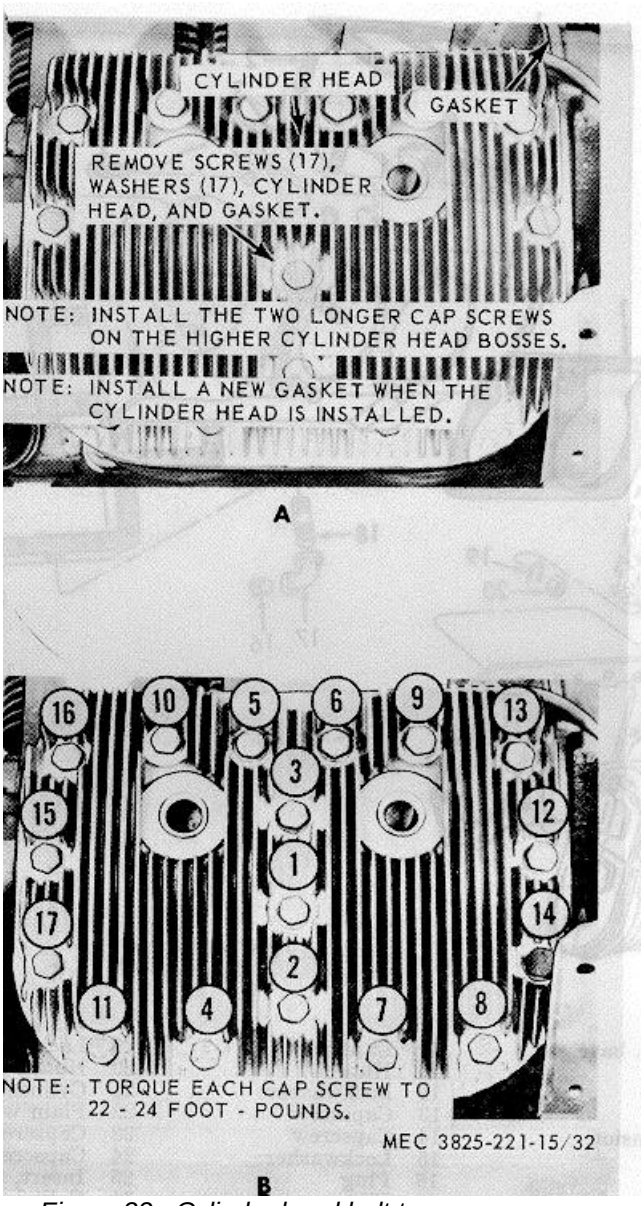


Figure 32. Cylinder head bolt torque sequence.

gasket surfaces with an approved cleaning solvent. Dry thoroughly with compressed air.
(4) Clean the capscrew threads with a wire brush and coat them lightly with OE 20.
(5) Inspect the cylinder heads for warpage with a straightedge.
(6) Inspect the cylinder heads for cracks, broken fins, and damaged gasket surfaces. Replace a damaged cylinder head.

d. Installation.

(1) Remove the rags from the cylinder bores. Wipe the bores with an oiled rag to make sure all dirt has been removed.
(2) Coat a new cylinder head gasket (21, fig. 31) lightly with OE 30 and position it on the cylinder block.
(3) Position the cylinder head (26, fig. 31) on the gasket (21) and secure with seventeen plain washers (22) and capscrews (23 and 24). Torque cylinder head capscrews to 22 to 24 foot pounds in sequence (fig. 32). Use the same procedure to install the opposite cylinder head.
(4) Install the spark plugs (para. 85*e*).
(5) Install the high temperature safety switch (para. 97*c*).
(6) Install the cylinder head heat deflectors and shrouding (para. 68).
(7) Install the canopy (para. 68).

108. Valve Tappet Adjustment

a. Remove the canopy (para. 68).

b. Remove the manifolds (para. 106).

c. Remove the cylinder head shrouding (para.68).

d. Remove the valve covers.

e. With the engine cold, turn the engine over with the crank until the valve is closed; then continue turning one-half turn to be sure that the tappet is not riding on the side of the cam.

Note. The engine must be cold when performing this adjustment or the clearances will not be correct.

f. Using a standard feeler gage and tappet wrenches, set the intake valve clearances to .008 of an inch and exhaust valve clearances to .016 of an inch.

g. Replace the valve covers, cylinder head shrouding (para. 68), manifolds (para. 106) and canopy (para. 68).

Section XI. WATER LINES, VALVES AND FITTINGS

109. General

a. Water Lines. The water lines consist of piping, functioning as an outlet for water in the tank, and also as an inlet for bringing water into the tank.

b. Valves. There are four valves. Each valve controls the flow of water through the piping. The suction line valve and the discharge valve regulate the flow of water into and out of the tank, respectively. The two valves located on the spraybar control the flow of water to either the left or the right end of the spraybar.

c. Fittings. The fittings consist of a suction line cap, spraybar extensions, hoses, a suction strainer and a foot valve.

a. Removal.

(1) Disconnect suction line tee (7, fig. 33) from the water pump (para. 121).

110. Suction Line

(2) Loosen clamp (5) securing rubber connector (4) to suction line and remove suction line tee and piping.
(3) Unscrew pipe (3) from lower elbow. Unscrew lower elbow (2) from close nipple (1). Remove close nipple.

b. Disassembly.

(1) Remove suction line cap (10) and suction strainer (8).
(2) Remove nipple (1) from suction line tee (7).
(3) Remove suction valve and close nipple (1) from upper elbow (2) and remove suction valve.
(4) Unscrew upper elbow (2) from nipple leading to suction line tee.

c. Cleaning, Inspection, and Repair.

(1) Clean all piping in an approved cleaning solvent.
(2) Clean all pipe threads with a wire brush.
(3) Inspect piping, elbows and valves for corrosion, cracks, breaks, or damaged threads. Replace as necessary.
(4) Inspect hose clamps and rubbercontors for damage or deterioration. Replace as necessary.

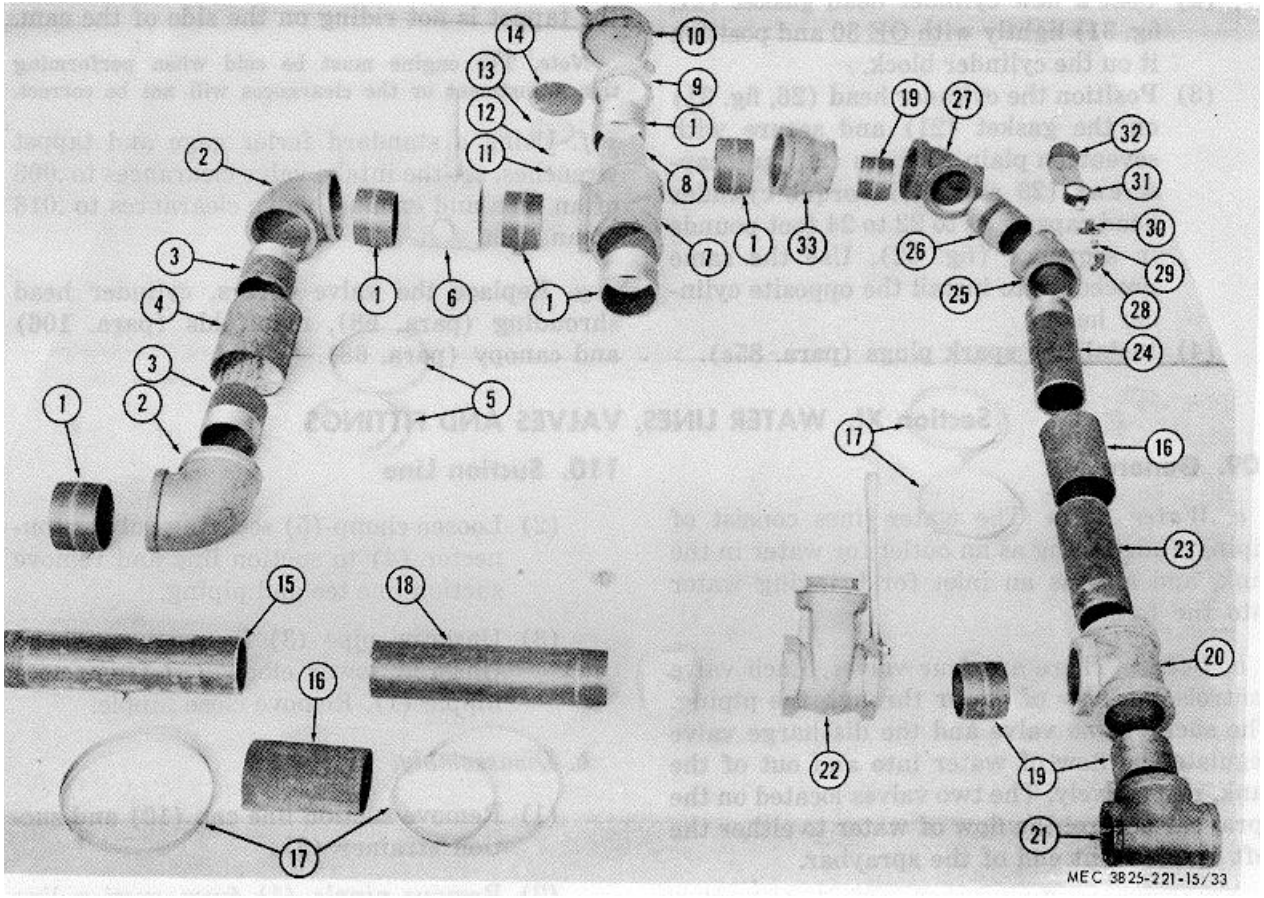
Note. Be sure to coat all pipe threads with sealing compound before installing pipe.

d. Assembly.

(1) Screw nipple (1, fig. 33) into suction line tee (7).
(2) Screw upper elbow (2) onto nipple leading into suction valve (6).
(3) Screw suction valve (6) and close nipple (1) into tee (7).
(4) Install suction line strainer (8) and cap (10).
(5) Tighten all joints securely.

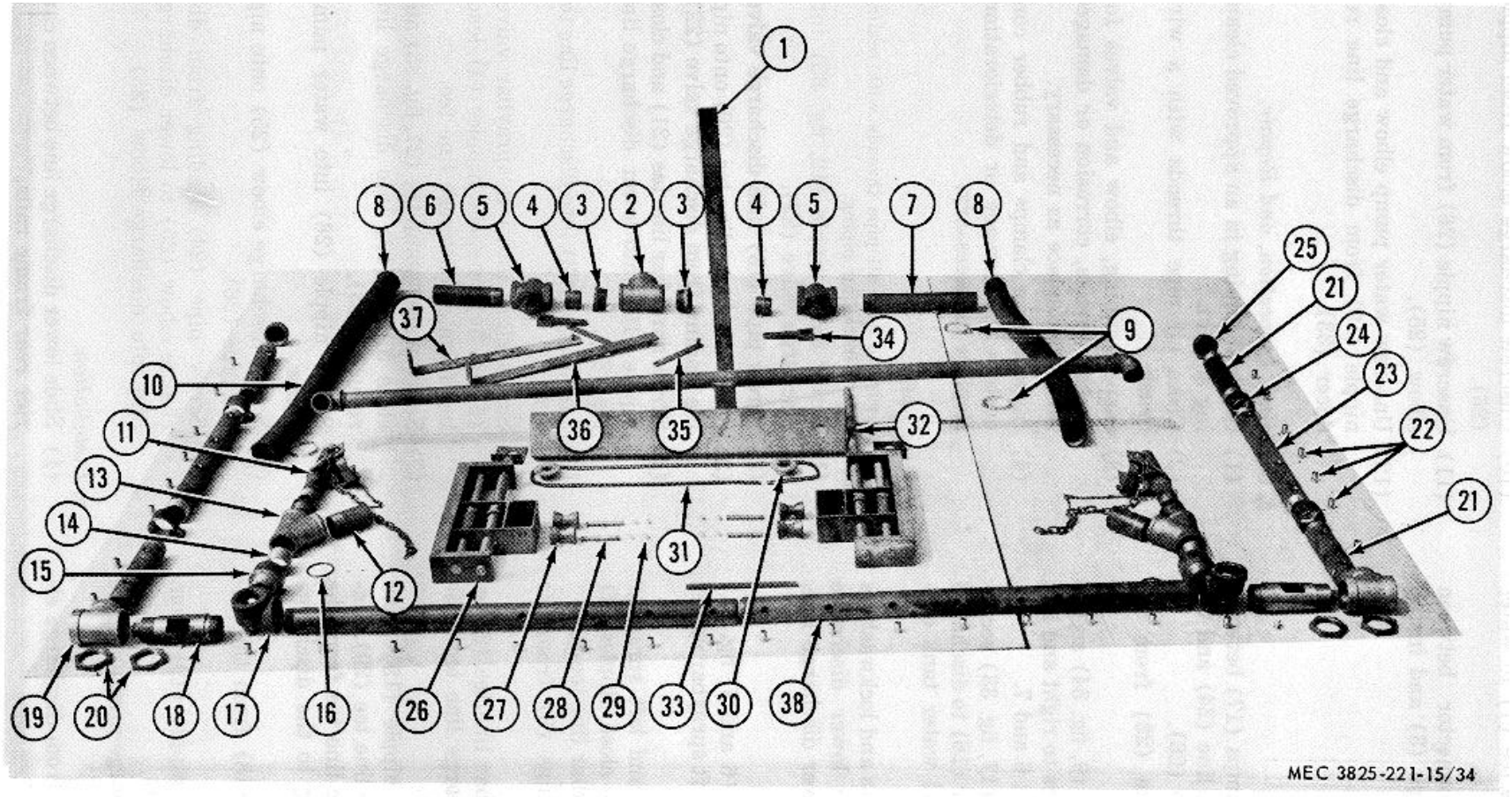
e. Installation.

(1) Screw close nipple (1) into lower elbow (2). Position rubber connector (4) and hose clamps (5) on water tank outlet nipple (3) and install hose clamps (5).
(2) Screw pipe (3) into lower elbow.
(3) Install suction line rubber connector (4) and hose clamps (5) on pipe (3).



1	Nipple	10	Dust cap	18	Pipe	26	Nipple
2	Elbow	11	Screw	19	Nipple	27	Reducing tee
3	Nipple	12	Lockwasher	20	Tee	28	Street ell
4	Connector hose	13	Plate	21	Reducing tee	29	Nipple
5	Hose clamp	14	Gasket	22	Gate valve	30	Bracket
6	Butterfly valve	15	Pipe	23	Pipe	31	Gage
7	Tee	16	Connector hose	24	Pipe	32	Guard
8	Strainer	17	Hose clamp	25	45' ell	33	Reducing coupling
9	Faucet end						

Figure 33. Suction and discharge piping.



1	Horizontal shifter assembly	11	Stopped bushing	21	Spray bar extension	30	Sprocket
2	Reducing tee	12	Nipple	22	Nozzles	31	Chain
3	Bushing	13	Y-Bend	23	Spray bar extension	32	Guard
4	Nipple	14	Nipple	24	Coupling	33	Shear pin
5	Valve	15	Slip joint	25	Cap	34	Lever
6	Pipe	16	Seal	26	Takeup bracket	35	Link
7	Pipe	17	Extension elbow	27	Rollers	36	Control lever
8	Jumper hose	18	Extension arm pivot spool	28	Pin	37	Control lever
9	Hose clamp	19	Extension pivot	29	Retainer	38	Spray bar
10	Lockup assembly	20	Locknut				

Figure 34. Spraybar assembly.

(4) Connect suction line tee (7) to water pump (para. 123).
(5) Position rubber connector between upper and lower pipe (3) and install hose clamps.

111. Discharge Line

a. Removal.

(1) Remove the hose clamps (17) between the upper discharge line (24) and the lower discharge line (28).
(2) Unscrew lower pipe (23) from tee (20).
(3) Loosen hose clamps (9, fig. 34) securing rubber connectors to right and left spraybar valve pipes 6 and 7.
(4) Loosen hose clamp (17, fig. 33) securing rubber connector (16) to discharge valve pipe (18) and water tank outlet (15).
(5) Remove the four nuts and lockwashers securing U-bolts to lower discharge line and remove lower discharge line.

b. Disassembly.

(1) Unscrew the pipes (6 and 7, fig. 34) from the right and left spraybar valves (5).
(2) Unscrew the right and left spraybar valves (5) from the close nipples (4) leading to the spraybar line tee (2).
(3) Unscrew the bushings (3) from the spraybar tee.
(4) Unscrew the spraybar line tee (2, fig.34) from the discharge line tee close nipple (19, fig. 33).
(5) Unscrew the close nipple (19) from the lower discharge line tee (20). Unscrew the discharge line tee from the nipple (19) leading to the discharge valve (22).
(6) Unscrew the pipe (18) from the discharge valve (22).
(7) Unscrew the close nipple (19) from the discharge valve.
(8) Remove water discharge pressure gage (31).
(9) Unscrew pipe (24) from discharge elbow (25).
(10) Unscrew discharge elbow from nipple (26).
(11) Unscrew nipple (26) from water pump elbow (25).
(12) Unscrew water pump elbow and close nipple (19) from discharge line reducer (33).

c. Cleaning, Inspection, and Repair.

(1) Clean all piping in an approved cleaning solvent.
(2) Clean all pipe threads with a wire brush.
(3) Inspect piping, elbow and valves for cracks, breaks, corrosion or damaged threads. Replace as necessary.
(4) Inspect hose clamps and rubber connectors for damage or deterioration. Replace as necessary.

d. Assembly.

Note. Be sure to coat all pipe threads with sealing compound before installing piping.

(1) Screw close nipple (19, fig. 33) into discharge valve (22).
(2) Screw pipe (18) into discharge valve.
(3) Screw discharge line tee (20) onto nipple leading from discharge valve (22).
(4) Screw spraybar line tee (21) and close nipple (19) into lower discharge line tee (20).
(5) Screw pipe (23) into discharge line tee (20).
(6) Screw right and left spraybar valves (5, fig. 34) to space nipples (4) leading from a discharge line tee.
(7) Screw water pump tee (27, fig. 33) and close nipple (19) into discharge line reducer (33).
(8) Screw nipple (26) into water pump elbow.
(9) Screw discharge elbow (25) onto nipple pipe (26).
(10) Screw pipe (24) leading from discharge elbow (25) to lower discharge line into discharge elbow (25).

e. Installation.

(1) Slide lower discharge line between carrier rear frame rails.

(2) Slip rubber connector over pipe (15) leading from water tank, but do not tighten hose clamps.
(3) Insert discharge pipe (18) into rubber connector.
(4) Position U-bolts over spraybar piping (6 and 7, fig. 34) and secure to frame with four nuts and lockwashers.
(5) Tighten hose clamps on rear rubber connector.
(6) Position hose over right and left spraybar valve pipes 6 and 7 and tighten clamps (9).
(7) Screw pipe into tee (20, fig. 33).
(8) Slip upper discharge line hose clamps over connector leading from lower discharge line.
(9) Position upper discharge line in rubber connector and tighten clamps (17, fig.33).

112. Suction Valve

a. Removal. Remove the suction valve (para.110).

b. Disassembly.

(1) Remove pin (16, fig. 44) and remove handle assembly (1-6).
(2) Remove handle (6) and adjusting nut (5) from handle stub (4).
(3) Remove handle stub (4) from handle (1).
(4) Remove nuts (14) and lockwashers (13) from studs (11) on disc (10).
(5) Turn disc 180° and remove from body (12).
(6) Remove disc O-ring (9), shaft (7) and shaft O-rings (8).

c. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent.
(2) Inspect the shaft for scoring or obvious damage.
(3) Remove all corrosion and dirt from inside body.

d. Reassembly.

(1) Roll shaft O-rings (8) onto shaft (7) until they snap into the O-ring grooves (15).
(2) Lay disc (10) flat with small end up. Coat disc O-ring (9) lightly with OE 20.
(3) Compress O-ring into groove at one point on disc. Moving clockwise around disc face at 1-inch intervals compress O-ring into disc until it appears like a gear. Then compress the bulges until the O-ring is completely installed.
(4) Lubricate the shaft (7) and disc (10) with OE 30.
(5) Install the shaft (7) in the body (12). Position the disc (10) on the flat sideside of the shaft (7) and secure with lockwashers (13) and nuts (14).
(6) Install the ball (2), spring (3), handle stub (4), adjusting nut (5) and handle extension (6) in the handle (1).
(7) Position the handle (1) on the shaft (7) and secure with pin (16).

e. Installation. Install the suction valve (para.110).

113. Discharge Valve

a. Removal. Remove the discharge valve (para. 111).

b. Disassembly.

(1) Remove the cap (10, fig. 43).
(2) Remove the locknut (7), handle (6),spring (5), packing nut (4), fulcum lever (3) and stuffing box (2) from the body (1).
(3) Remove the fulcum lever (12) and discs (9 and 11) through the drain hole.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts in an approved cleaning solvent.
(2) Inspect the mating surfaces of the discs for nicks or burrs which would prevent them from seating. Repair or replace as necessary.
(3) Inspect the fulcrum lever and fulcrum for excessive wear. Repair or replace as necessary.
(4) Inspect the body for cracks or breaks. Repair or replace as necessary.

(5) Inspect the cup gasket for tears or deterioration. Replace as necessary.
(6) Replace the packing.

d. Reassembly.

(1) Insert the fulcum lever (12) and discs (9 and 11) through the drain hole into the valve body (1).
(2) Install the fulcrum (3) in the fulcrum lever (12).
(3) Install the stuffing box (2), packing nut (4), spring (5) and handle (6) in the body (1).
(4) Install the gasket (8) and cap (10) on the body (1).

e. Installation. Install the discharge valve (para. 111).

114. Hoses

a. Removal.

(1) Loosen clamp (9, fig. 34) securing hose (8) to right spraybar valve nipple and clamp (9) securing hose (8) to lower right spraybar elbow nipple (12) and remove right hose (8).
(2) Loosen clamp (9) securing the hose (8) to left spraybar valve, nipple (6) and clamp (9) securing hose (8) to lower left spraybar elbow nipple (12) and remove left hose (8).

b. Installation.

(1) Position hose clamps (9, fig. 34) on both ends of hoses (8).
(2) Position right hose on right spraybar valve nipple and lower spraybar elbow nipple (12) and tighten both lower and upper hose clamp (9).
(3) Position left hose on left spraybar valve nipple (6) and left lower spraybar elbow nipple (12) and tighten both lower and upper hose clamp (9).

115. Spraybar and Extensions

a. Removal.

(1) Close discharge valve (22, fig. 33) and open spraybar valves (5, fig. 34).
(2) Loosen setscrews and remove shear pin (33, fig. 34).
(3) Remove hose clamps (9) and remove spraybar hoses (8) from nipple (12) on spraybar Y (13).
(4) Remove pivot nuts (20) from pivot spool (18).
(5) Unscrew spraybar (38) from extension elbow (17).
(6) Remove slip joint (15) from elbow (17).
(7) Unscrew spraybar extension from extension pivot (19).

b. Disassembly.

(1) Unscrew remaining spraybar extensions from couplings (24).
(2) Remove all nozzles (22) by unscrewing them from spraybars.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts in an approved cleaning solvent.
(2) Clean all threads with a wire brush.
(3) Inspect all piping and fittings for damage. Repair or replace damaged parts.
(4) Inspect nozzles for damage or clogged orifice. Repair or replace damaged nozzles.
(5) Inspect O-ring seals and replace if damaged.

d. Reassembly.

(1) Replace nozzles in spraybars.
(2) Screw spraybar extensions into couplings.
(3) Screw spraybar (38) into extension elbow (17).

e. Installation.

(1) Replace extension pivot (19) on pivot spool and secure with hex nuts (20).
(2) Screw spraybar extensions (21) into extension pivot (19).
(3) Replace nipple (12) in spraybar Y (13).
(4) Replace hose (8) on nipple (12) and secure with clamp (9).

Section XII. WATER TANK AND FRAME ASSEMBLY

116. Water Tank and Frame

a. Description. The water tank and frame assembly consist of the water tank, frame, guard rails, and catwalk. These are assembled into one welded unit. The water tank is oval in cross section and is galvanized for corrosion resistance. Wood sleepers are used between the carrier frame and the distributor frame.

b. Removal.

(1) Disconnect wiring harnesses at rear of carrier chassis.
(2) Remove spare tire.
(3) Remove the sixteen tiedown bolts (5,fig. 8) and tiedown bars.
(4) Attach suitable slings to the lift eyes at the front and rear, on left and right sides of the distributor frame.
(5) Using a crane with a minimum of 3 ton-capacity lift the assembly clear of the carrier.
(6) Place the distributor on suitable blocking that is of adequate strength and stable enough to permit work on the assembly without creating a safety hazard.

c. Cleaning, Inspection, and Repair. Refer to paragraph 41.

d. Installation.

(1) Position sleepers on carrier frame rails (fig. 8).
(2) Attach cable slings to four lifting eyes (1). Lift distributor tank and frame assembly using a crane with a 3-ton capacity and position on carrier frame rails.
(3) Install sixteen tiedown bars and bolts.
(4) Connect wiring harness.

117. Manhole Cover

a. Description. The water distributor tank is equipped with a 20-inch diameter manhole cover for filling and inspecting the tank. The tank vent is located on the manhole cover. The manhole cover is hinged at the front and is secured at the rear by a 6-inch crank screwed onto a bolt hinged to the outside of the manhole.

b. Manhole Cover, Removal and Disassembly.

(1) Open manhole cover by unscrewing crank.
(2) Remove hinge bolts at front and rear of manhole.

c. Manhole Cover, Cleaning, and Inspection.

(1) Clean machined parts in an approved solvent.
(2) Inspect threads and replace or repair defective parts.
(3) Inspect manhole cover gasket and replace if defective.

d. Manhole Cover Installation.

(1) Position manhole cover hinge bushing in bracket at front of manhole and install hinge bolt.
(2) Position crank bolt in bracket at rear of manhole and install hinge bolt.

118. Spraybar Takeup Assembly

a. Description. The spraybar takeup assembly provides for the vertical adjustment of the spraybar position by means of two jack screws operated by a crank and connected by a roller chain meshed with a sprocket on each screw. In addition, the spraybar takeup assembly permits lateral adjustment of the spraybar position by providing rollers which support the spraybar assembly.

b. Removal.

(1) Remove spraybar assembly (para.115).
(2) Remove roller chain from sprockets by removing connecting link.
(3) Remove left and right spraybar takeup bracket from distributor by removing two bolts and nuts holding each bracket.

c. Disassembly.

(1) Remove pipe rolls from pipe roll frame by prying retainers off ends of pipe roll shafts.
(2) Do not remove jack screw from assembly because the top bearing in the spraybar takeup bracket is pressed in the bracket.

d. Cleaning, Inspection, and Repair.
(1) Clean all parts in an approved solvent.
(2) Inspect visually and by operating screw for damaged threads or bearings or bent screws.
(3) Repair or replace all damaged parts.

e. Assembly.
(1) Install pipe rolls in pipe roll frame by inserting shafts.
(2) Press retainers on ends of pipe roll shafts.
(3) Install takeup brackets on distributor by inserting two belts in each and secure with lockwashers and nuts.
(4) Adjust both pipe roll frames to same vertical position and install roller chain on sprockets and secure with connecting link.
(5) Install spraybar assembly.

119. Fender and Step Assembly

a. Remove.
(1) Remove two each nut, bolt, and lockwasher securing step stringer (15, fig.2) to distributor frame.
(2) Remove five each nut, bolt, and lockwasher securing fender to (8, fig. 8) catwalk.

b. Cleaning, Inspection, and Repair.
(1) Clean all parts in an approved solvent.
(2) Brush off all rust and corrosion.
(3) Inspect fender for dents, bends or corrosion damage. Repair or replace damaged parts.
(4) Inspect steps and step stringer for breaks or weakened welds. Repair or replace damaged parts.

c. Assembly.
(1) Install fender by inserting five bolts in angle under catwalk. Secure with lockwashers and nuts.
(2) Fasten step stringer to rear of distributor frame and secure with lockwasher and nuts.

Section I. OVERHAUL AND REPLACEMENT STANDARDS

120. General

The following tables provide overhaul and replacement standards far the water distributor engine and pump, defining maximum and minimum installation clearances, tolerances, wear limits, and nut and bolt torque data.

121. Description

The power pumping unit is comprised of a four cylinder air cooled gasoline engine and a self-priming centrifugal pump mounted on the engine crankcase.

Table 2. Engine Repair and Replacement Standards

	Manufacturer's Dimensions and tolerance in inches		Desired Clearance		Maximum Allowable Wear and Clearance
	Minimum	Maximum	Minimum	Maximum	
Camshaft:					
Diameter of Journals:					
No. 1 Journal	1.8725	1.8730			0.0035
No. 2 Journal	1.2475	1.2480			0.0035
Camshaft Bores in Crankcase:					
Nominal dimension of inside diameter:					
No. 1 Journal	1.875	1.876			0.0035
No. 2 Journal	1.250	1.251			0.0035
Clearance between camshaft journal and crankcase bore			0.002	0.0035	
Connecting Rod:					
ID of Crankshaft End	1.9370	1.9375			
ID of Installed Bushing (crankshaft end)	1.8115	1.8125			
Clearance between bushing and crankshaft			0.0019	0.0025	0.003
Side clearance between bushing and crankshaft			0.004	0.011	0.016
Maximum out of round of bushing (crankshaft end)					0.0005
ID of Piston End	0.9125	0.9130			
ID of Installed Bushing (Piston End)	0.8594	0.8597			0.001
Interference OD of bushing to ID of rod			0.0025	0.0055	
Clearance between piston pin and bushing			0.0005	0.001	0.001
Allowable twist of connecting rod measured 3 inches from end		0.002			
Crankshaft:					
Nominal dimension of main bearing:					
Journal diameters	1.8100	1.8105			0.002
End Play of Crankshaft Bearing			0.002	0.004	Adjustable
Cylinders:					
Nominal dimension of bore diameter	3.254	3.255			0.005

Table 2. Engine Repair and Replacement Standards-Continued

	Manufacturer's Dimensions and tolerance in inches		Clearance Desired		Maximum Allowable Wear and Clearance
	Minimum	Maximum	Minimum	Maximum	
Fuel Pump:					
Plunger shaft diameter	0.3715	0.3720			0.002
ID of plunger shaft bore in adapter	0.373	0.374			0.002
Idler Gear:					
Diameter of idler gear shaft	0.7400	0.7495			0.002
Diameter of shaft bore in gear	0.7510	0.7515			0.002
Clearance of gear bore to shaft			0.001	0.0025	
Backlash of idler gear			0.002	0.004	
Oil Pump:					
Drive shaft diameter	0.4995	0.5000			0.002
Diameter of shaft bore in pump body	0.500	0.5015			0.002
Clearance, bore-to-shaft			0.0005	0.003	
Driven gear stud shaft diameter	0.4996	0.5000			0.002
Diameter of bore in driven gear	0.5005	0.5015			0.002
Piston:					
Allowable wear from diameter of skirt					0.005
Clearance, skirt-to-cylinder bore			0.004	0.0045	
Pistons:					
Diameter of piston pin bore	0.8593	0.8596			
Clearance piston pin-to-piston			0.0000	0.0005	0.001
Diameter of piston pin	0.8591	0.8593			
Piston Ring:					
Cap Clearance (fitted in cylinder)			0.015		
Clearance of ring in piston groove:					
Groove No. 1			0.002	0.0035	
Groove No. 2			0.001	0.0025	0.0055
Groove No. 3			0.0025	0.004	
Tappets:					
Diameter of guide holes in block	0.6245	0.6255			0.002
Clearance, tappet-to-hole			0.0005	0.0025	
Diameter to tappet	0.623	0.624			
Valves (Intake and Exhaust):					
Stem diameter	0.3405	0.3415			0.002
Stem-to-guide hole clearance			0.003	0.005	0.007
Nominal dimension of valve guide hole	0.344	0.345			0.002
Valve Seat (Insert):					
Nominal dimensions of seat diameter	1.3765	1.3770			
Interference OD of insert-to-ID bore			0.001	0.003	

Table 3. Torque data

Connecting rod bolts nuts	22-24 ft-lb
Crankshaft main bearings plate capscrews	25-30 ft-lb
Cylinder-block nuts	40-50 ft-lb
Cylinder head capscrews	22-24 ft-lb
Gear cover capscrews	14-18 ft-lb
Manifold nuts	14-18 ft-lb
Oil pan (crankcase bottom plate)	6-9 ft-lb
Spark plugs	25-30 ft-lb

122. Removal of Power Pumping Unit

a. Remove water piping from pump (para.115).

b. Disconnect fuel line at flexible line.

c. Drain oil from engine crankcase. Remove oil drain nipple.

d. Disconnect starter cable, first at carrier battery terminal and then at pump engine starter switch terminal.

e. Remove eight nuts, starwashers and bolts securing power pumping unit to distributor frame.

f. Using a suitable lifting device, lift the engine and pump assembly from the waterdis-

tributor and remove the four capscrews (10,fig. 31) and starwashers securing the engine supports (8) to the engine.

g. Remove the six screws, lockwashers securing the rear panel to the support (8) and remove the supports.

h. Lower the engine and pump assembly to suitable blocking.

123. Installation of the Power Pumping Unit

a. Using a suitable lifting device, lift the power pumping unit from its blocking.

b. Position the two engine supports (8) on the engine and install the four capscrews (10) and lockwashers (9).

c. Position the wood engine sleepers on the distributor frame.

d. Place the power pumping unit on the engine sleepers and install the four capscrews, starwashers, and nuts.

e. Install the oil drain nipple and drain plug and fill engine crankcase with oil per LO 5-3825-221-15.

f. Connect the starter cable at the pump engine starter switch terminal and then at the carrier battery terminal.

g. Connect the fuel line.

h. Install water piping to pump (para. 115).

Section II. WATER PUMP

124. Description

The water pump is self-priming and contains a certifugal impeller keyed to the engine crankshaft and retained by a washer and acorn nut on the end of the crankshaft. The pump will prime and reprime once the pump tank is filled with water. A suction strainer located in the suction line, prevents harmful debris from harming the impeller.

125. Water Pump Removal

a. Remove the power pumping unit (para.122).

b. Remove twelve capscrews (27, fig. 42) securing lantern (24) to tank (12) and remove tank.

c. Remove impeller nut (17) and washer (18) and remove impeller (20) and woodruff key (19) from crankshaft.

d. Remove four each nuts, lockwashers and bolts (29) securing lantern (24) to engine crankcase and remove lantern and seal (22) from crankshaft.

e. Remove diffuser (16) and gasket (15) from pump tank (12).

f. Remove four capscrews (1) securing suction inlet and check valve (7) to pump tank.

g. Remove nut (10) from carriage bolt (4) and disassemble check valve.

126. Water Pump Cleaning, Inspection, and Repair

a. Clean all pump parts and engine crankshaft with an approved cleaning solvent.

b. Inspect crankshaft threads and keyway for damage. Repair any nicks at keyway by dressing with a fine stone.

c. Inspect pump parts for cracks, breaks or other damage. Repair or replace damaged parts.

127. Water Pump Assembly

a. Position lantern (24) against engine crankcase and secure with four capscrews (29).

b. Coat the surfaces of the seal cavity and crankshaft with light cup grease orvaseline and install shaft seal (22).

c. Install impeller key (19) and impeller (20) and secure with impeller nut (17) washer (18).

d. Assemble check valve (7) and secure with carriage bolt (4) and nut (10).

e. Position check valve (7) and suction inlet (2) on tank (12) and secure with four capscrews (1).

f. Position gasket (15) and diffuser (16) in pump tank (12) being sure diffuser is engaged with alignment pin.

g. Place gasket (23) on lantern flange, position pump tank (12) on lantern (24) and secure with twelve capscrews (27).

128. Starter

a. The starter motor supplies the necessary amount of torque for a short period of time to crank the engine. It is a series-wound, four-pole type and transmits power to the flywheel through a Bendix drive. The starter motor consists of five major sub-assemblies; commutator head, frame and field, armature, drive and pinion housing.

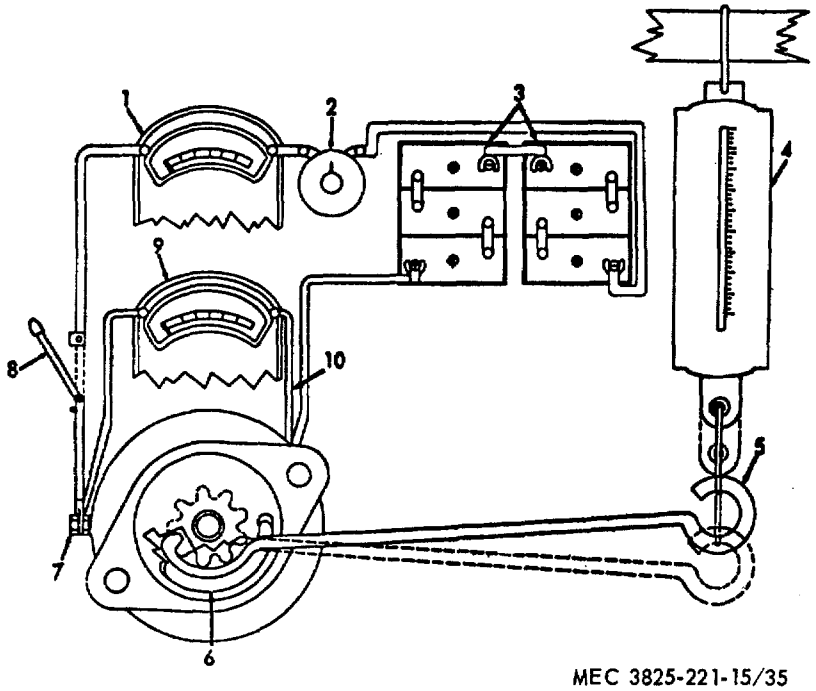
b. Removal. Remove the starter motor as described in (para. 82).

c. Testing Assembled.

(1) *Load test.* Connect a voltmeter (9, fig.35), knife switch (8), ammeter (1).variable resistor (2) and a 24-volt power source to starter motor as illustrated in (fig. 35). Attach a spanner wrench (5) to the drive pinion (6). Hang a scale (4) to a support strong enough to hold 5 pounds. Attach the scale to the spanner wrench at a point 12 inches from the center of the drive pinion (6). Close the knife switch (8). Note the reading on the ammeter (1), voltmeter (9) and the scale (4). The load test readings must be 70 amperes. Maximum 6 volts and 3.3 foot-pounds minimum. Open the knife switch (8). If the starter motor does not test as specified it must be repaired.

Caution: Always connect highest range of ammeter into circuit for initial test because the heavy current encountered when a shorted or grounded field exists, or when a shorted or grounded armature exists.

(2) *No-load tests.* Remove the scale (4, fig. 35) and spanner wrench (5). Close the knife switch (8) and note the readings on the ammeter (1) and voltmeter



1	Ammeter	6	Drive pinion
2	Variable resistors	7	Terminal
3	Batteries	8	Knife switch
4	Scale	9	Voltmeter
5	Spanner wrench	10	Ground terminal

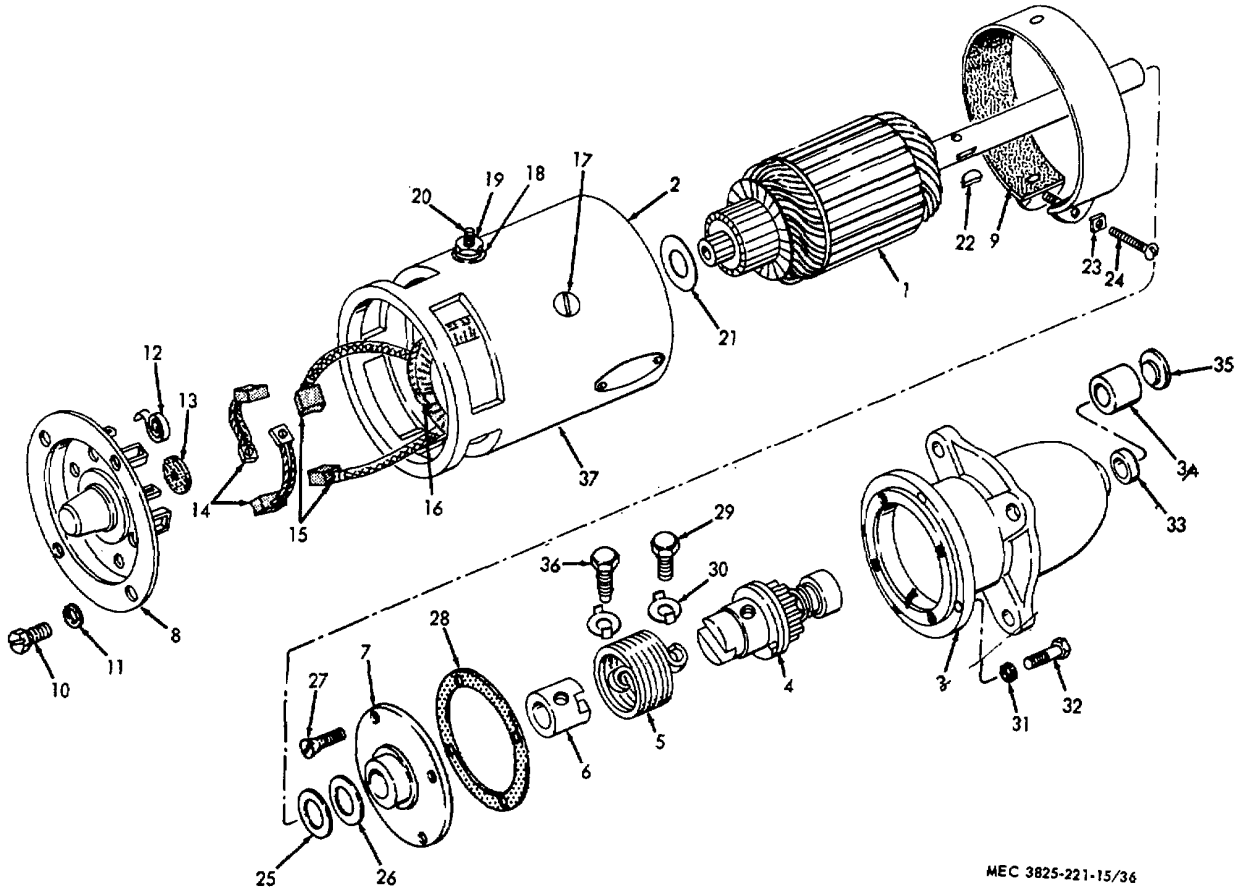
A Test diagram

Figure 35. Starter motor.

(9) The no-load test readings must be 10 volts, and 2,700-rpm minimum armature speed. If the starting motor does not test as specified, it must be repaired.

d. Disassembly

(1) Remove the nut (23, fig.35), screw (24) and cover (9) from the frame and field assembly (37).
(2) Remove the insulation from cover band (9).
(3) Lift the brush springs (12) and remove the two insulated brushes (15) from their holders.
(4) Remove the fillister head screws (10), lockwashers (11) and commutator head assembly (8) from the frame and field assembly (37).



1	Armature	14	Ground brush	27	Screw
2	Starter housing	15	Insulated brush	28	Gasket
3	Pinion housing	16	Field coil assembly	29	Capscrew
4	Drive assembly	17	Screw	30	Lockwasher
5	Drive spring	18	Insulator	31	Lockwasher
6	Drive head	19	Nut	32	Capscrew
7	Intermediate bearing assembly	20	Terminal stud	33	Oil seal
8	Commutator head assembly	21	Thrust washer	34	Bearing
9	Cover band	22	Key	35	Bearing cap
10	Machine screw	23	Nut	36	Screw
11	Lockwasher	24	Screw	37	Frame assembly
12	Spring	25	Thrust washer		
13	Felt	26	Shim		

B Exploded view

Figure 35-Continued.

(5) Remove the two grounded brushes (14) from the brush holders on the commutator head assembly (8).
(6) Remove the two insulated brushes (15) from the frame and field assembly (37).
(7) Remove bearing and felt disk (13) from the commutator head assembly (8).
(8) Remove the four capscrews (32) and lockwashers (31) from the pinion housing (3) and remove the frame and field assembly (37).
(9) Remove the nuts (19), lockwashers (18), flat washer and insulating washer from the terminal stud on the frame and field assembly (37).
(10) Remove the thrust washer (12) from the armature (1).
(11) Remove the four flathead screws (27) from the intermediate bearing assembly (7) and remove the armature (1) from the pinion housing (3).
(12) Bend the lips of the special lockwashers (30) from the special screws (29 and 36) and remove the special screws and lockwashers from the drive spring (5), drive assembly (4), and drive head (6).
(13) Remove the drive assembly (4), drive spring (5) and drive head (6) from the armature shaft (1).
(14) Remove the intermediate bearing assembly (7), gasket (28) and thrust washer (25) from the armature (1).
(15) Remove the bearing from the intermediate bearing assembly (7).
(16) Remove the bearing cap (35), bearing (34) and oil seal (33) from the pinion housing (3).

e. Cleaning.

(1) Clean the field coils and armature with a clean cloth dampened with an approved cleaning solvent. Be careful not to damage the insulation.
(2) Clean remaining parts with an approved cleaning solvent and dry thoroughly with compressed air.

f. Inspection.

(1) Inspect the commutator head for damaged threads, cracks, abrasions, pits, corrosion, distortion, and other damage. Replace if defective.
(2) Inspect cover band for thrown solder. Inspect armature to make sure windings are pressed into core slots and are staked and soldered to commutator risers. If core is scored excessively, replace the armature.
(3) Place the armature in a padded vise and install commutator head on the armature shaft. Do not clamp tightly as this distorts the laminations. Check fit of the armature shaft in the bearing by feel. Excessive side play indicates a worn bearing or a worn armature shaft. Replace as necessary.
(4) Inspect commutator for pits, worn spots and high mica ridges. Remove pits and worn spots with 00 or 000 sand paper. Undercut high mica ridges with an undercutting tool 0.002 inch wider than the mica. Cut, clean and square to remove all mica to a depth of 1/32 of an inch. Deburr copper after rushes are seated. Use 00 sandpaper.
(5) To check for out-of-roundness, place armature on V-blocks and put dial indicator against commutator. Turn armature slowly. Out-of-roundness more than 0.003 of an inch indicates need for turning on a lathe. Turn the commutator down until all worn or bad spots disappear. Remove burrs with 00 or 000 sandpaper. Again check run-out. If necessary repeat turning on lathe. Then again check depth of mica. Repeat undercutting, if necessary.
(6) Inspect the pinion housing for cracks or distortion. Check the fit of the armature shaft in the pinion housing bearing by feel. Excessive side play indicates worn bearing or worn armature shaft. Replace as necessary.

g. Testing, Disassembled.

(1) Test armature for shorts by placing it on a growler and holding a thin steel strip lengthwise along the core 1/2 inch

from the core surface. Turn the armature slowly. The strip will become magnetized and vibrate if the armature is shorted. If a short is present, inspect the commutator risers and bars for solder or copper chips which will short out between the bars. Remove solder or chips. If the short cannot be found, replace the armature.

(2) Test the armature for ground with a probe. Touch one test probe to the armature shaft and one test probe to each commutator segment in turn. A lighted probe lamp indicates a ground. Do not touch probes to bearing or brush areas because an are would burn and damage the smooth surfaces. Replace armature if grounded.

(3) Test the frame and field for grounds using a test probe. Touch one probe to the terminal and touch the other probe to an unpainted spot on the frame. The probe lamp will light if a ground is present. Replace the entire frame assembly, if grounded.

h. Repair.

(1) Solder any armature windings that are loose on the commutator risers. Do not short across the commutator segments.

(2) Replace any defective or damaged parts such as screws, nuts, springs, and washers.

(3) Replace entire drive assembly if pinion is chipped or corners are worn excessively.

i. Reassembly.

(1) Press the bearing (34, fig. 35) and oil seal (33) into the pinion housing (3).

(2) Press the bearing into the intermediate bearing assembly (7).

(3) Install the thrust washer (25), gasket (28) and intermediate bearing assembly (7) onto the armature shaft (1).

(4) Insert the woodruff key (22) into the armature shaft (1).

(5) Install the drive head (6), drive spring (5) and drive assembly (4) on to the armature shaft (1). Position the drive head over the woodruff key. Align the AGO 6571A holes in the drive spring over the holes in the drive head and drive assembly and secure with special screws (36 and 29) and lockwashers (30). Bend the lockwashers against screw heads.

(6) Install the thrust washer (21) on the armature shaft (1). Install combined armature, drive units, and intermediate bearing as an assembly into the pinion housing with screws.

(7) Install the insulating washer, flat washer, lockwashers (18) and nuts (19) on the terminal stud of the frame and field assembly (37).

(8) Position gasket (28) on pinion housing (3). Install frame and field assembly (37) over armature (1) and secure against pinion housing with capscrews (32) and lockwashers (31).

(9) Insert felt disk (13) and press bearing into commutator head assembly (8).

(10) Install the starter motor brushes (14and 15).

(11) Install insulation on inside of the cover band (9). Place the cover band in position on the field and frame assembly (37) and secure with screw (24) and nut (23).

(12) To measure end play, mount a dial gage on the drive end of the armature shaft. Move the shaft to its maximum and minimum position of travel of less than 0.006 of an inch minimum. Remove commutator head assembly (8). Install thrust or spacer washers as needed on commutator end of armature shaft until end play is within specified limits.

(13) To measure pinion drive stop clearance, use a thickness gage and measure the distance between the pinion drive assembly and the inside of the bearing end of the pinion housing. Clearance must be 1/16 of an inch. If pinion clearance is not as specified, repair starter and install spacer washers as needed in the commutator end of the armature shaft until pinion drive clearance meets specifications.

j. Installation. Install the starter as described in paragraph 82.

129. Magneto

a. Description. Refer to paragraph 87*a*.

b. Removal. Remove the magneto as described in paragraph 87*c*.

c. Disassembly.

(1) Remove the screw assembly (4, fig.36) and capacitor (5) from the end cover (2).
(2) Remove the preformed packing (6) from the capacitor (5).
(3) Remove the machine screw assemblies (1), end cover (2) and gasket (3) from the cap (18).
(4) Remove the machine screw assemblies (7) and distributor (9) from the end cover (2).
(5) Remove the radio suppression tube (10) from the distributor (9) and slide the radio suppression element (11) and spring (12) out of the tube (10).
(6) Remove the screw (20), hood vent (21) and wire fabric 23) from the cap (18).
(7) Remove the primary ground nut (24), ground button (25) and primary ground assembly (26 through 29) from the cap (18).
(8) Remove the nut (30), ground wire (35), ground clip (36), fiber plate (37) and machine screw (32) from the cap (18).
(9) Remove the machine screw assembly (17), cap (18) and gasket (19) from the housing (83).
(10) Pull rotor (14) off the rotor shaft (70).
(11) Remove the screw (54) that secures the ground wire on the high tension coil (53) and breaker arm support bracket (50) to the clip (55).
(12) Remove the screw (15), ground clip (40), and ground wire (16) from the point plate (50).
(13) Remove the fulcrum pin and snap ring (42), and lift the breaker arm support bracket (50) from the point plate (71).
(14) Remove the screws (48), oil wick (47) and contact set (44) from the point plate (50), and lift the point plate (50) out of the housing (83).
(15) Remove the machine screw (75), coil cover (76) and vent screen (77) from the housing (83).
(16) Remove the setscrews (52) and slide the coil (53) out of the housing (83).
(17) Remove the special screw (54) and clip (55) from the coil (53).
(18) Remove the cotter pin (56), nut (57),gear (58) and bushing (59) from the rotor shaft (70).
(19) Remove the impulse coupling shell (64), impulse coupling assembly (62) and woodruff key (60) from the rotor shaft (70) and remove the impulse coupling spring (63) from the impulsecoupling shell (64).
(20) Remove the stop pins (79 and 80) by unscrewing them from the housing (83).
(21) Slide the rotor shaft (70) out of the housing (83).
(22) Remove the snapring (81) and press the bearing out of the housing (83).
(23) Remove the snapring (69) from the rotor shaft and remove the outer washer (68), oil seal (67) and inner washer (66) from the housing (83).
(24) Remove the bearing retainer (65) out of the housing (83).
(25) Remove the inner race from the rotor shaft (70).
(26) Remove the bearing grease retainer (73) and bearing (74) from the point plate (71).

d. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent.
(2) Inspect all mounting hardware for damage. Replace damaged parts as necessary.

(3) Inspect the magneto housing, end plate and coverfor cracked, chipped or broken condition. Replace defective parts as necessary.
(4) Inspect the impulse coupling hub, spring and cover for damage. Replace a damaged impulse coupling.
(5) Inspect the gear for chipped, cracked, broken or excessively worn condition. Replace a damaged gear.
(6) Replace all gaskets.

e. Reassembly.

(1) Press the bearing (74) in the point plate and install the bearing grease retainer (73).
(2) Position the inner race (74) on the rotor shaft (70).
(3) Press the bearing retainer (65) in the housing (83) and install the inner washer (65), oil seal (67) and outer washer (68).
(4) Press the bearing (82) in the housing (83) and install the snapring (81).
(5) Slide the rotor shaft (70) into the housing (83) and install the snapring (69).
(6) Install the stop pills (79 and 80) in the housing (83).
(7) Position the impulse coupling assembly (62), woodruff key (60), impulse coupling shell (64), impulse coupling spring (63) on the rotor shaft (70).
(8) Position the bushing (59), gear (58), nut (57) and cotter pin (56) on the rotor shaft (70).
(9) Position the clip (55) on the coil (53) and install the screw (54).
(10) Slide the coil (53) into the housing (83) and install the setscrew (52).
(11) Position the vent screen (77) and coil cover (76) and install the machine screw (75).
(12) Position the point plate (71) in the housing (83) and the contact set (50) and oil wick (47) on the point plate (71); install the screw assembly (51).
(13) Position the breaker arm support bracket (44) on the point plate (71) and install the fulcrum pin and snapring (42).
(14) Position the ground wire (16) and ground clip (40) on the point plate (50) and install the screw (39).
(15) Install the screw (39) that secures the ground wire of the high tension coil and breaker arm support bracket (44) to the clip (40).
(16) Push the rotor (14) on the rotor shaft (70).
(17) Position the gasket (19) and cap (18) on the housing (83) and install the machine screw (17).
(18) Position the primary ground assembly (29), ground button (25), on the cap (18) and install the primary ground nut (24).
(19) Position the wire fabric (22) and hood vent (21) on the cap (18) and install the screw (20).
(20) Slide the suppression element (11) and spring (12) in the radio suppression tube (10) and install the radio suppression tube (10) in the distributor (9).
(21) Position the distributor (9) on the end cover (2) and install the machine screw assemblies (7).
(22) Position the gasket (3) and cover (2) on the cap (18) and install the machine screw assemblies (1).
(23) Position the capacitor (5) in the end cover (2) and install the screw assemblies (4).

f. Installation. Install the magneto as described in paragraph 87*d*.

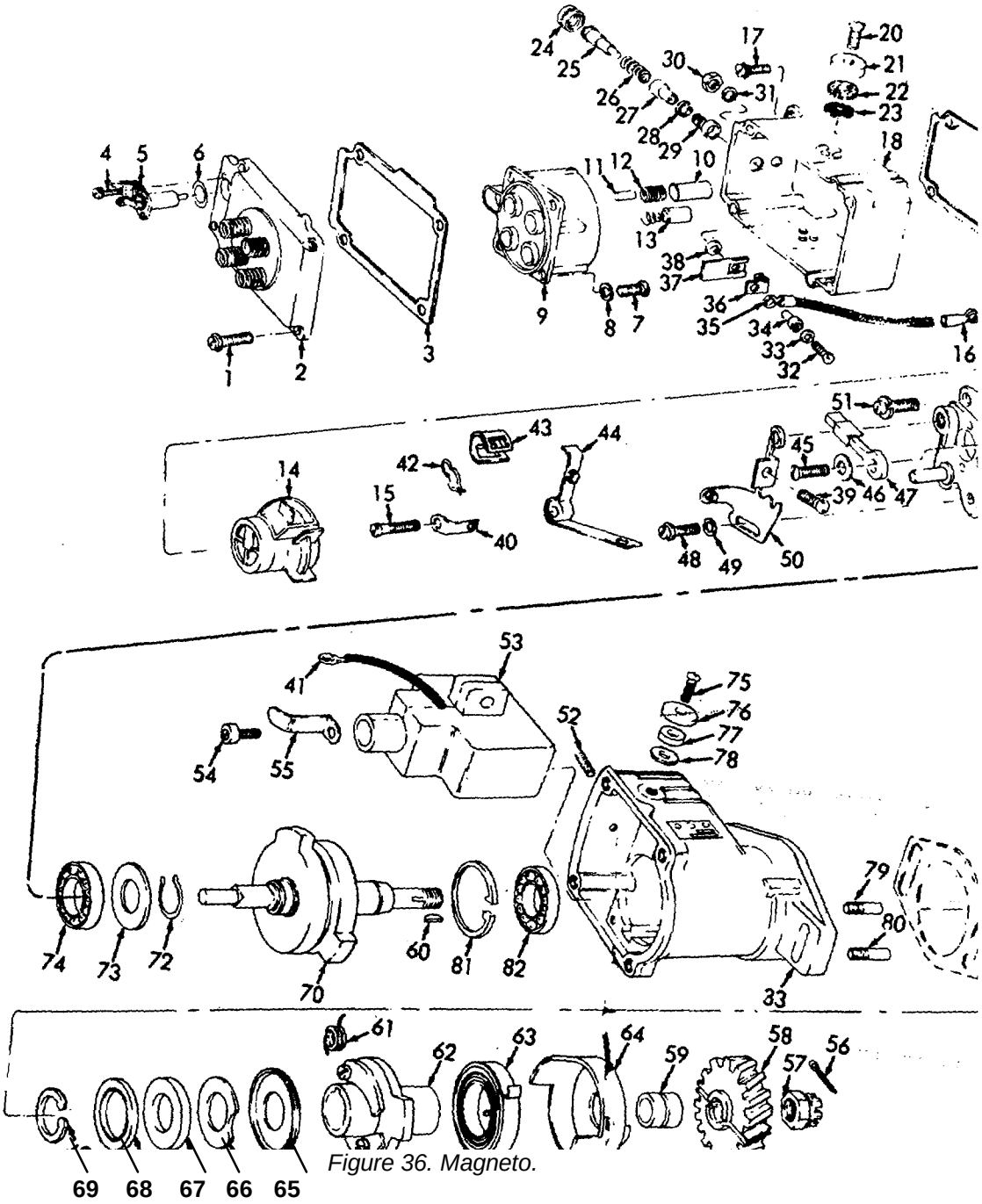


Figure 36. Magneto.

1 Screw, w/washer, 8-32 x 5/8 in.
2 End cap cover
3 End cap cover gasket
4 Screw, w/washer, 6-32 x 3/8 in. (12 rqr)
5 Capacitor
6 Preformed packing
7 Screw, machine, 8--32 x 1/2 in. (4 rqr)
8 Washer, lock, No. 8 (4 rqr)
9 Ignition distributor cap
10 Suppressor, insulating
11 Brush
12 Spring
13 Electrical brush
14 Ignition distributor rotor
15 Screw, w/washer, 6-32 x 3/8 in.
16 Electrical wire lead terminal clip
17 Screw, w/washer, 10-24 x 5/8 in. (4 rqr)
18 End cap
19 End cap gasket
20 Screw, machine 6-32
21 Hood (2 rqr)
22 Wire fabric (2 rqr)
23 Wire fabric (2 rqr)
24 Nut, pushbutton
25 Pushbutton
26 Spring
27 Sleeve bearing
28 Retaining ring
29 Primary ground tube
30 Nut, plain, hex, No. 6-32
31 Screw, lock, No. 6
32 Screw, machine, 6-32 x 1/2 in.
33 Washer, flat No. 6
34 Switch bushing
35 Lead assembly
36 Electrical contact
37 Guide
38 Washer, flat No. 6
39 Screw, machine 6-32 x 3/8 in.
40 Electrical clip
41 Magneto coil
42 Retaining clip
43 Wick
44 Breaker arm
45 Screw, machine 9-32 x 3/8 in.
46 Washer, flat, No. 8
47 Cam wick holder
48 Screw, w/washer, 632 x M in.
49 Washer, flat, No. 6
50 Contact support
51 Screw, w/washer, 8-32 x 3/8 in.
52 Setscrew, ¼--20 x 7/8 in. (2 rqr)
53 Magneto coil assembly
54 Screw, button, special
55 Electrical clip
56 Pin, cotter, 3/32 x 3/4 in.
57 Nut, sleeve, special
58 Gear
59 Sleeve bearing
60 Woodruff Key, No. 3
61 Spring (2 rqr)
62 Hub assembly
63 Spring
64 Shell
65 Baffle disk
66 Washer, flat
67 Seal
68 Washer, flat, special
69 Retaining ring
70 Magneto motor
71 Bearing support
72 Retaining ring
73 Washer, flat, 23/32 in.
74 Bearing
75 Screw, machine 6-32 x 5/16 in. (2 rqr)
76 Magneto coil cover (2 rqr)
77 Wire fabric
78 Wire fabric (2 rqr)
79 Setscrew, impulse coupling pawl stop
80 Setscrew, impulse coupling pawl stop
81 Retaining ring
82 Bearing
83 Housing

Figure 36-Continued.

Section IV. FUEL SYSTEM, ENGINE

130. Governor

a. Description. For a description of the engine governor, refer to paragraph 76.

b. Removal. Remove the governor as described in paragraph 76*b*.

c. Disassembly.

(1) Press the shaft bearing (11, fig. 25) and gear (10) from the drive shaft (3) and remove the woodruff key (21).
(2) Remove the gasket (2) from the housing (1).
(3) Remove the oil line fitting from the housing (1).
(4) Remove the cap and tachometer adapter from the housing (1).
(5) Remove the tapered pin (20) securing the yoke (13) to the shaft and lever (19).
(6) Remove the expansion plug (16) and bearing (17) from the housing (1).
(7) Slide the shaft and lever (19) out of the housing (1) and remove the preformed packing (18) and bearing (17).
(8) Remove the drive shaft (3) and attaching assembly from the housing (1).
(9) Slide the bearing (6), yoke (13) and bearing (7) off the drive shaft (3) exterior surfaces.
(10) Remove the thrust pins (12) and slide the thrust sleeve (14) off the drive shaft (3).
(11) Remove the lockpins (9) securing the flyweights (5) to the flyweight hub(4).

(12) Remove the tapered pin (8) securing the flyweight hub (4) to the drive shaft (3).
(13) Remove the fittings from the housing (1).

d. Cleaning.

(1) Clean all parts wih an approved cleaning solvent and dry thoroughly with compressed air.
(2) Remove all gasket residue from the mounting surfaces.
(3) Remove all corrosion or rust from all exterior surfaces.

e. Inspection and Repair.

(1) Inspect all bearings for smooth operation and signs of cracks, chipped, or worn balls or races. Replace all damaged bearings as necessary.
(2) Inspect the casting for cracks, breaks, nicks, burrs, or corrosions. Smooth all nicks or burrs and rough surfaces. Remove all corrosion. Replace a broken casting.
(3) Inspect the governor drive shaft for scoring or wear and replace a defective drive shaft.
(4) Slide the driver gear bushing on the drive gear and check for loose fit. A sliding fit is a correct installation. Inspect the bushing for wear or any other damage and replace as necessary.
(5) Check the ends of the hardened pins on the flyweights for wear or roughness and replace both flyweights if either is defective.
(6) Inspect the yoke for wear or deterioration and replace as necessary.
(7) Inspect the lever shaft bearing and preformed packing for wear or deterioration and replace as necessary.
(8) Inspect the governor gear for cracked or chipped teeth and replace as necessary.
(9) Inspect the hardware and remaining parts for stripped threads, cracks or any other damage and replace as necessary.

f. Reassembly.

(1) Install the fitting in the housing (1).
(2) Position the flyweight hub (4) on the drive shaft (3) and secure with tapered pin (8).
(3) Position the flyweights (5) on the flyweight hub (4) and install the lock-pins (9).
(4) Slide the thrust sleeve (14) on the drive shaft (3) and install the thrust-pins (12).
(5) Slide the bearing (6), yoke (13) and bearing (7) on the drive shaft (3).
(6) Position the drive shaft (3) and attaching parts in the housing (1).
(7) Position the bearing (17) and preformed packing (18) on the shaft and lever (19).
(8) Slide the shaft and lever (19) through the yoke (13) and install the tapered pin (20).
(9) Install the bearing (17) and expansion plug (16) in the housing (1).
(10) Install the tachometer adapter and cap on the housing (1).
(11) Install the oil line fitting in the housing (1).
(12) Position the gasket (2) on the housing (1).
(13) Place the woodruff key (21) in the drive shaft (3) and slide the gear (10) and shaft bearing (11) into position.

g. Installation. Install the governor as described in paragraph 76c.

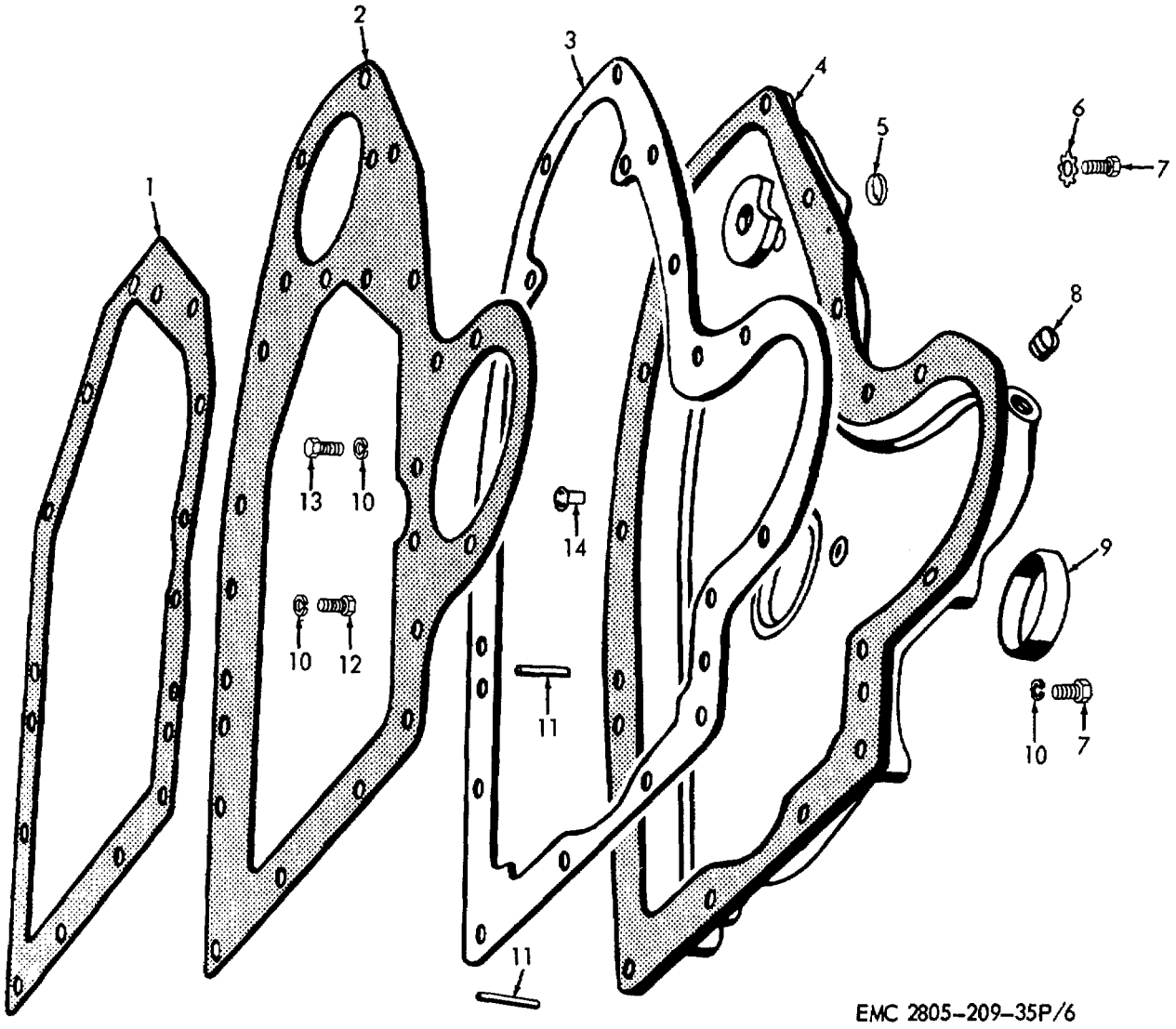
Section V. ENGINE

131. Timing Gear Cover and Accessory Drive Assembly

a. Description. The timing gear cover and accessory drive assembly is located at flywheel end of the engine. The gear train consists of six gears: A crankshaft gear, driving the camshaft gear and governor gear; an idler gear driving the magneto and oil pump gears.

b. Removal.

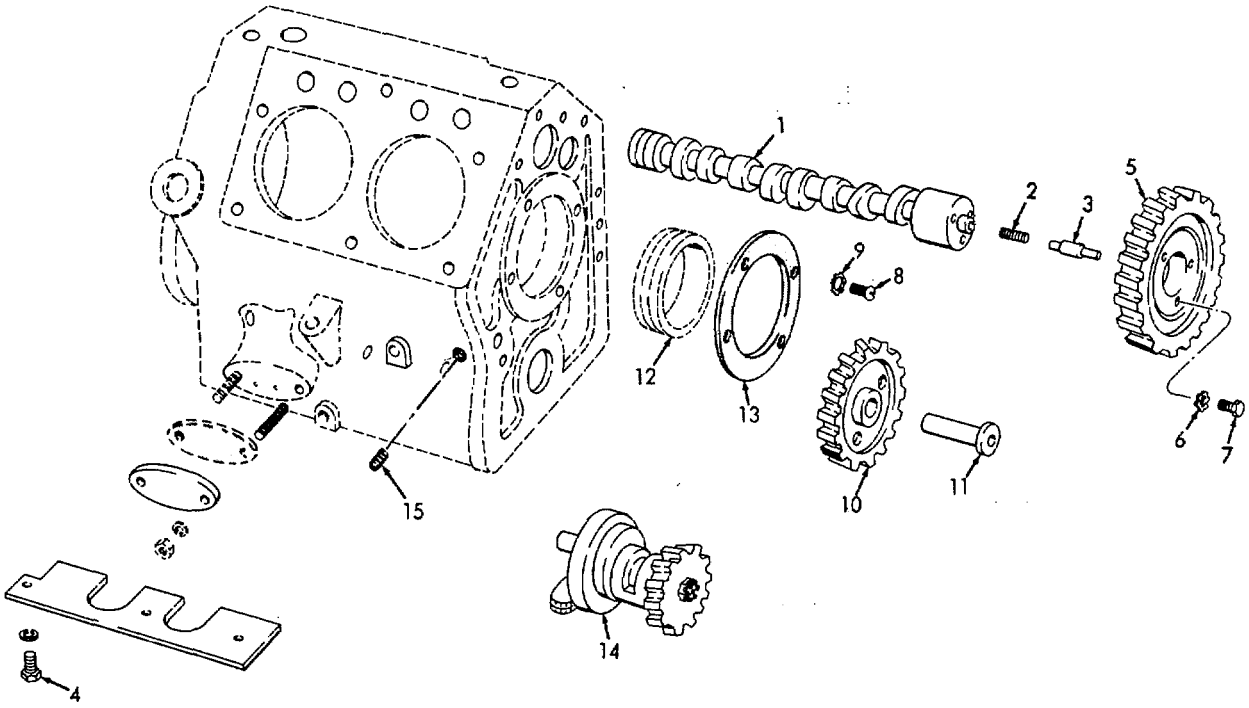
(1) Remove the canopy (para. 68).
(2) Remove the flywheel and flywheel housing (para. 68).
(3) Remove the magneto assembly (para.87c).
(4) Remove the governor (para. 76).



1	Gasket	6	Lockwasher	11	Pin, dowel
2	Spacer	7	Machine screw	12	Machine screw
3	Gasket	8	Pipe plug	13	Machine screw
4	Gear cover assembly	9	Oil seal	14	Button
5	Expansion plug	10	Lockwasher		

Figure 37. Timing gear cover group.

(5) Remove the engine oil drain plug and drain the oil into a suitable container.
(6) Remove the capscrews (7, fig. 37) lockwashers (10) securing the cover (4) and gasket (1) to the crankcase.
(7) Remove the capscrews (13), lockwashers (10), cover (4) and gasket (3) from the spacer (2).
(8) Remove the capscrews (7, fig. 38), lockwashers (6) and camshaft gear (5) from the camshaft (1).
(9) Remove the screw (15) securing the idler gear shaft (11) in the crankcase.
(10) Using a suitable puller, remove the idler gear (10) and shaft (11) from the crankcase and slide the idler gear from the shaft.



1	Camshaft	6	Lockwasher	11	Stud
2	Spring	7	Capscrew	12	Bearing cup
3	Thrust plunger	8	Machine screw	13	Bearing retainer plate
4	Capscrew	9	Lockwasher	14	Oil pump
5	Camshaft gear	10	Idler gear	15	Screw

Figure 38. Cam shaft.

(11) Remove the capscrews (12, fig. 37), lockwashers (10) spacer (2) and gasket (1) from the crankcase.

c. Disassembly.

(1) Press the oil seal (9, fig. 37) out of the cover (4).
(2) Remove the dowel pins (11) from the cover (4).
(3) Remove the pipe plug (8) from the cover (4).
(4) Remove the camshaft thrust plunger button (14) from the cover (4).

d. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent and dry with compressed air.
(2) Clean all gasket residue from the mating surfaces of the cover.
(3) Clean all oil passages and parts in the shafts gears and covers.
(4) Inspect the cover for dents, cracks, breaks, damaged threads, and corrosion. Repair as necessary. Remove any corrosion. Replace or repair a dented, broken or cracked cover as necessary.
(5) Inspect the cover gasket surfaces for nicks, burrs, and shaft bores for wear. Smooth any rough surfaces. Replace covers that have worn shaft bores.
(6) Inspect the gears for worn, pitted, chipped, cracked or damaged teeth or hub. Replace or repair defective gears as necessary.
(7) Inspect shaft and bearing for cracks, pits, galls, corrosion and wear. Replace defective shafts or bearings.
(8) Inspect all hardware for damaged threads cracks, breaks or any other damage. Replace defective hardware.

(9) Inspect the oil seal for wear or deterioration. Replace a defective oil seal.

e. Reassembly.

(1) Install the camshaft thrust plunger button (14, fig. 37) in the gear cover (4).
(2) Install the pipe plug (8) in the gear cover (4).
(3) Install the dowel pins (11) in the gear cover (4).
(4) Press the oil seal (9) in the gear cover (4).

f. Installation.

(1) Position the gasket (1) and spacer (2) on the crankcase and install the lockwashers (10) and capscrews (12).
(2) Position the idler gear (10, fig. 38) on the idler gear shaft (11) and press the idler gear shaft into the crankcase.
(3) Install the screw (15) in the crankcase.
(4) Position the camshaft gear (5) on the camshaft (1) and install the lockwashers (6) and capscrews (7).
(5) Position the gasket (3, fig. 37) and cover (4) on the spacer (2) and install the lockwasher (10) and capscrews (13).
(6) Install the lockwashers (10) and capscrews (7) securing the gasket (3) and cover (4) to the crankcase.
(7) Install the engine oil drain plug and fill the engine with oil as specified in LO 5-3825-221-15.
(8) Install the governor (para. 76).
(9) Install the magneto assembly (para.87d).
(10) Install the flywheel and flywheel housing (para. 68).
(11) Install the canopy (para. 68).

132. External Oil Lines

a. Removal.

(1) Remove the nut (21, fig. 17) securing the oil filter inlet line and remove the line.
(2) Remove the nut (16) securing the oil filter outlet line (17) and remove the line.
(3) Remove the nuts securing the crankcase pressure line and remove the line.

b. Cleaning, Inspection, and Repair.

(1) Clean the outside of the lines with an approved cleaning solvent.
(2) Blow out the inside of the lines with compressed air.
(3) Inspect the lines for kinks, cracks, or breaks. Replace a damaged line.
(4) Inspect the nuts and flares for cracks. If the line is long enough, cut off the damaged end, replace the damaged nut, and reflare the end of the line. Cut off a damaged flare and reflare.

c. Installation.

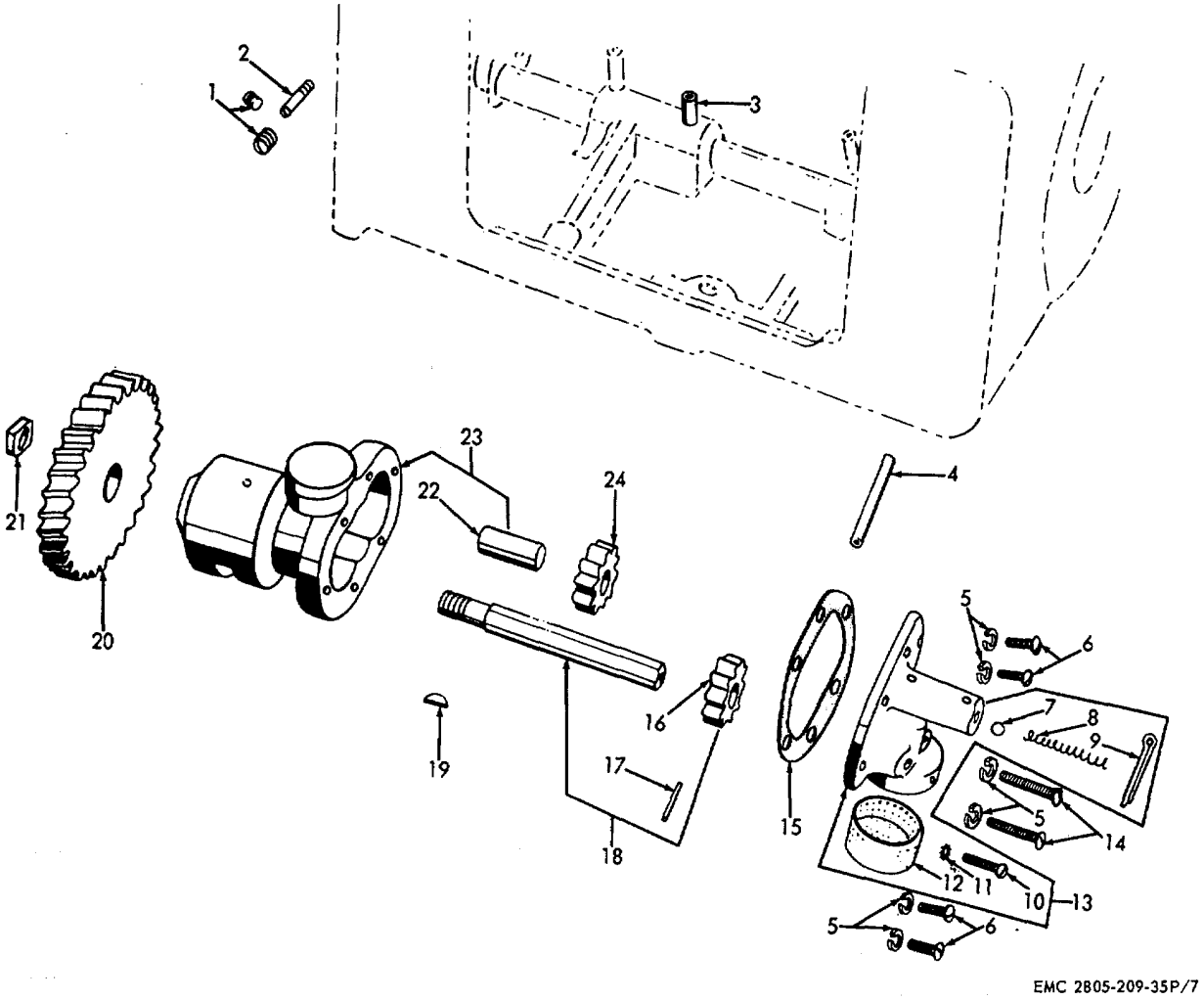
(1) Secure the crankcase pressure line with the two nuts.
(2) Secure the oil filter outlet line with the two nuts (16).
(3) Secure the oil filter inlet line with the two nuts (21).

133. Engine Oil Pan and Pump Assembly

a. Description. The oil pan is of one-piece sheet metal construction. The gear-type oil pump driven from the idler gear in the timing gear train, draws oil from the crankcase oil sump through its filter screen. It delivers the oil under pressure to an oil header which sprays oil against the connecting rod cap fins for rod bearing lubrication, and directs oil through exterior lines to the governor and bypass oil filter. The cylinders are lubricated by the mist resulting from the connecting rod cap lubrication. Splash plates, installed inside the crankcase, prevent excess lubrication of the cylinder walls.

b. Removal.

(1) Remove canopy (para. 68).
(2) Remove the flywheel and flywheel housing (para. 68).
(3) Remove the engine and pump assembly from the water distributor (para.122).
(4) Remove the oil drain plug and drain the oil into a suitable container.
(5) Remove the timing gear cover (para.131*b*).
(6) Remove the fourteen capscrews and lockwashers (15, fig. 31) securing the oil pan and gasket to the engine crankcase.



1	Pipe plug	9	Cotter pin	17	Pin
2	Lock screw	10	Machine screw	18	Drive shaft
3	Oil spray nozzle	11	Lockwasher	19	Key
4	Pipe	12	Screen	20	Oil pump drive gear
5	Lockwashers	13	Cover assembly	21	Nut
6	Machine screws	14	Machine screws	22	Stub shaft
7	Check ball	15	Cover gasket	23	Body
8	Spring	16	Drive gear	24	Driven gear

Figure 39. Oil pump.

(7) Remove the slotted pipe plug (1, fig.39) and allen head setscrew (2) locking the oil pump to the engine crankcase.
(8) Remove the nut (21) securing the gear (20) in the crankcase.
(9) Remove the oil pump from the crankcase.
(10) Remove the woodruff key (19) from the drive shaft.

c. Disassembly.

(1) Remove the cotter pin (9) and remove the spring (8) and check ball (7) from the cover (13).
(2) Remove the machine screw (10), lockwasher (11) and screen (12) from the cover (13).
(3) Remove the machine screws (14), cover (13), and gasket (15) from the oil pump body (23).

(4) Remove the drive gear (16) and drive shaft (18) from the oil pump body(23).
(5) Remove the pin (17) and drive gear(16) from the drive shaft (18).
(6) Lift the idler gear shaft (22) and idler gear (24) from the oil pump body(23).

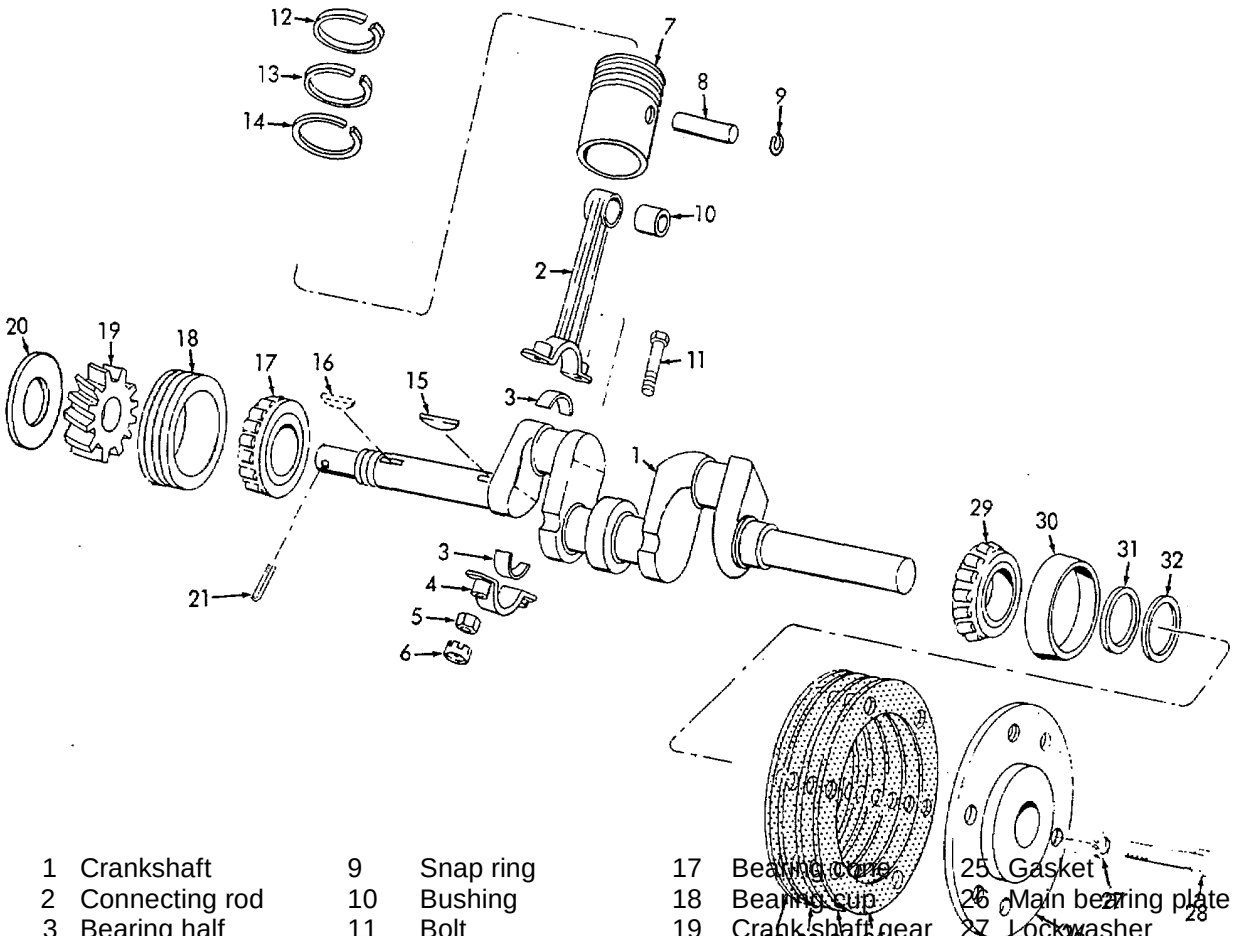
d. Cleaning, Inspection, and Repair.
(1) Clean all parts with an approved cleaning solvent and dry thoroughly with compressed air.
(2) Clean the screen in an approved cleaning solvent and dry thoroughly with compressed air.
(3) Inspect the gears for chipping, cracks, scoring or broken teeth. Replace defective gears.
(4) Inspect the shafts for cracks, chips and scoring. Repair as necessary.
(5) Test the fit of the idler gear on the idler gear shaft. The gear should turn freely, but should have no perceptible wobble. If the gear wobbles, measure the gear bore diameter. If the gear bore diameter exceeds 0.0015 of an inch replace the gear.
(6) Measure the drive shaft diameter and pump body bore. Replace either item if worn beyond 0.020 of an inch.
(7) Check the keyway in the drive shaft and drive gear. Repair any burred keyways, or replace the shaft as necessary.
(8) Inspect the screen for enlarged openings or tears. Replace as necessary.
(9) Inspect the check ball and check ball seat for smoothness and wear. Replace either ball or cover as necessary.
(10) Inspect the valve spring for pitting or weakness and replace as necessary.
(11) Inspect the hardware for cracks, or damaged threads and replace as necessary.
(12) Inspect the cover for cracks, dents, or breaks. Repair or replace as necessary.

e. Reassembly.
(1) Install the idler gear shaft (22, fig. 39)and idler gear (24) in the oil pump body (23).
(2) Position the drive gear (16) on the drive gear shaft and install the pin (17).
(3) Slide the drive shaft (18) into the oil pump body (23).
(4) Install the machine screws (14) securing the gasket (15) and cover (13) to the oil pump body (23).
(5) Position the screen (12) on the cover (13) and install the lockwasher (11) and screw (10).
(6) Position the check ball (7) and spring (8) in the cover (13) and install the cotter pin (9) securing them in the cover (13).

f. Installation.
(1) Position the oil pump in the engine crankcase.
(2) Insert the woodruff key in the drive shaft.
(3) Slide the oil pump gear (20, fig. 39) on the drive shaft and install the nut (21) securing the gear to the shaft.
(4) Install the allen head setscrew (2) and slotted pipe plug (1) in the oil pump into position.
(5) Install the lockwashers (15, fig. 31) and capscrews (14) securing the gasket (6) and oil pan (7) to the engine crankcase.
(6) Install the oil drain plug in the oil pan.
(7) Install the engine and water pump unit in the water distributor (para. 123).
(8) Install the timing gear cover (para. 131).
(9) Fill the engine crankcase (LO 5-3825-221-15).
(10) Install the engine flywheel housing and flywheel (para. 68).
(11) Install the canopy (para. 68).

134. Oil Pump Relief Valve

a. Removal.
(1) Remove the oil pan and remove the oil pump (para. 133).
(2) Remove the machine screw (10, fig. 39), lockwasher (11) and screen (12) from the cover (13).
(3) Remove the machine screws (14), cover (13), and gasket (15) from the oil pump body (23).



1	Crankshaft	9	Snap ring	17	Bearing cone	25	Gasket
2	Connecting rod	10	Bushing	18	Bearing cup	26	Main bearing plate
3	Bearing half	11	Bolt	19	Crankshaft gear	27	Lockwasher
4	Connecting rod cap	12	Compression ring	20	Oil slinger	28	Capscrew
5	Nut	13	Scraper ring	21	Pin	29	Bearing cone
6	Pal nut	14	Oil ring	22	Gasket	30	Bearing cup
7	Piston	15	Key, gear	23	Shim	31	Packing
8	Piston pin	16	Key, flywheel	24	Shim	32	Seal

Figure 40. Crankshaft assembly.

b. Installation.

(1) Position a new gasket (15) on the oil pump. Position the cover (13) and secure with lockwashers (5) and machine screws (14).

(2) Position the screen (12) on the cover and secure with lockwasher (11) and machine screw (10).

(3) Install the oil pump and oil pan (para. 133).

135. Piston, Rings, Pins, Rods and Bearing Assembly

a. Description. The piston assembly consists of a piston that has four rings: two compression rings in the top groove, the scraper ring in the center, and an oil ring on the bottom. The piston is made of cast iron. The connecting rods and caps are drop-forged and have removable, shell-type bearings. The piston pins connect the connecting rods to the pistons, and the bearings

and caps connect the connecting rods to the crankshaft.

b. Removal.

(1) Remove the canopy (para. 68).
(2) Remove the manifolds (para. 106).
(3) Remove the carburetor (para. 106).
(4) Remove the cylinder head shrouding (para. 68).
(5) Remove the cylinder heads (para.107b).
(6) Remove the engine and water pump assembly (para. 121).
(7) Remove the oil pan and oil pump assembly (para. 133).
(8) Remove the locknuts (6, fig. 40), nut (5), connecting rod cap (4), lower bearing half (3), and upper bearing half (3) from the connecting rod (2) and crankshaft (1).

c. Disassembly.

(1) Push the piston (7) and connecting rod (2) out through the top of the cylinder bore.
(2) Lift the connecting rod bolts (11) out of the connecting rod (2).
(3) Remove the compression rings (12),scraper ring (13), and oil ring (14)from the piston (7) with a suitable ring expander.
(4) Remove the retaining rings (9) from the piston (7).
(5) Remove the piston pin (8) and the connecting rod (2) from the piston (7).
(6) Place the connecting rod (2) in a press and press out the bushing (10).

d. Cleaning.

(1) Clean all parts in an approved cleaning solvent and dry thoroughly with compressed air.
(2) Clean the carbon from the piston top and from the ring grooves.

e. Inspection and Repair.

(1) Inspect the piston pin bushing for wear or out-of-round. The proper clearance between the piston and bushing should be from 0.005 to 0.001 of an inch. When replacing a bushing and pin, ream the bushing to a light press fit on the pin. When pressing in new bushings, be careful to align the oil hole in the bushing and oil hole in the connecting rod.
(2) Inspect the connecting rod for breaks. Straighten bent or twisted rods. Make sure the oil holes in the connecting rods are open.
(3) Inspect the bearing halves for wear or scoring. Replace both bearing halves if either one is unserviceable. Measure the bearing-to-crankshaft clearance by installing a piece of 0.001 of an inch shim stock on both bearing halves. Assemble the connecting rod and cap with shimmed bearings to the appropriate crankshaft journal, and tighten the nuts to 14 to 18 foot-pounds torque. A slight drag on the shaft, when turned by hand, indicates proper bearing clearance.
(4) To measure the piston ring gap, place the ring into the cylinder bore in the approximate operating position and measure the gap with a feeler gage. The correct gap is 0.015 of an inch. If the ring gap exceeds 0.030 of an inch replace the ring.
(5) Measure the piston ring side clearance. Replace the piston when clearance exceeds 0.006 of an inch in the top and bottom grooves, or 0.005 of an inch in the intermediate groove. The top ring should be from 0.002 of an inch to 0.0035 of an inch. The scraper ring is from 0.001 to 0.0025 of an inch and the oil ring is from 0.0025 of an inch to 0.005 of an inch.
(6) Measure the piston pin fit in the piston. If new pistons are being used, ream the piston pin bores in the piston to a clearance not exceeding 0.005 of an inch.

f. Reassembly.

(1) Press the bushing (10) into the connecting rod (2).

Note. A number ( ) is stamped on the side of the rod and cap to match each connecting rod with its corresponding cap. The SC numbers must be on the same side of all caps and connecting rods. An arrow located on the top of the piston will be placed facing the direction of the engine rotation. The piston and connecting rod will be installed in the same bore from which it was removed. The number located on the connecting rod will indicate its location in the engine.

(2) Install the piston Din (8) securing the connecting rod (2) to the piston (7).
(3) Install the retaining rings (9).
(4) Position the oil ring (14) scraper ring(13), compression rings (12) on the piston (7).

Note. Make certain that the wiping lip on the oil ring is pointed toward the bottom of the piston and that the gap in the piston rings are staggered.

g. Installation.

(1) Position the connecting rod (2, fig. 40)and piston (7) in the cylinder block bore.
(2) Using a suitable ring compressor, compress the piston rings and tap the piston into the cylinder block.
(3) Position the upper bearing half (3)connecting rod (2), lower bearing half (3) and bearing rod cap (4) on the crankshaft (1) and install the connecting rod bolts (11), nuts (5) and lock-nuts (6).
(4) Install the oil pan and pump assembly (para. 133f).
(5) Install the engine and pump assembly (para. 121).
(6) Install the cylinder heads (para. 107).
(7) Install the cylinder heads shrouding (para. 68).
(8) Install the manifold assembly (para.106).
(9) Install the carburetor (para. 106).
(10) Install the canopy (para. 68).

136. Engine Crankshaft Assembly

a. Description. The forged steel crankshaft is supported at both ends by roller bearings mounted in the crankcase. At the crankcase power end, the main bearing plate supports the bearing race. Shims installed between the bearing plate and crankcase provide the proper crankshaft end play adjustment.

b. Removal.

(1) Remove the canopy (para. 68).
(2) Remove the manifold (para. 106).
(3) Remove the cylinder head shrouding (para. 68).
(4) Remove the flywheel assembly and fly-wheel shrouding (para. 68).
(5) Remove the fuel pump and adapter(para. 80).
(6) Remove the cylinder heads (para.107).
(7) Remove the engine and pump assembly (para. 121).
(8) Remove the water pump and rear panel (para. 125).
(9) Remove the oil pan and oil pump assembly (para. 133).
(10) Remove the connecting rods from the crankshaft (para. 135), but do not remove the pistons from the cylinder blocks unless they are to be worked on.
(11) Remove the screw (15, fig. 38) securing the idler gear shaft (11) to the crankcase.
(12) Using a suitable puller remove the idler gear (10) and idler gear shaft
(11) from the crankcase and slide the gear from shaft.
(13) Remove the capscrew (28, fig. 40) and lockwasher (27) securing the main bearing plate (26), gasket (25), shims (24) and gasket (22) to the engine crankcase.
(14) Remove the screws (8, fig. 38) and ET lockwashers (9) securing the bearing retainer plate (13) to the engine crankcase.
(15) Remove the crankshaft from the engine crankcase.

c. Disassembly.

(1) Remove the oil seal retainer and oil seal (32, fig. 40) from the crankshaft(1).
(2) Remove the crankshaft gear (19) and woodruff key (15) from the crank-shaft.
(3) Press the bearing cups (18 and 30) out of the main bearing plate (26) and bearing retainer plate (13, fig. 38).
(4) Remove the oil slinger (20, fig. 40)from the crankshaft (1).
(5) Using a suitable puller, remove the bearings (17 and 29) from the crank-shaft (1).

d. Cleaning, Inspection, and Repair.

(1) Clean all parts with an approved cleaning solvent and dry thoroughly.
(2) Inspect the crankshaft journals for wear and out-of-roundness. The main bearing journals should be 1.8100 to1.8105 inches.
(3) Inspect the main bearings for wear.
(4) Inspect all hardware for cracks, breaks, or damaged threads. Replace as necessary.
(5) Inspect the crankshaft surfaces for cracks. Inspect carefully at fillets and counter bores, areas where cracks frequently originate. Repair or replace the crankshaft as necessary. Inspect the keyways in the crankshaft and test the key for snug fit. Remove any burrs or nicks in the key or key-way.
(7) Inspect the crankshaft and nut threads. Replace any damaged nuts.
(8) Inspect the crankshaft gear for worn, broken, chipped or damaged teeth. Replace a defective gear.
(9) Inspect the crankshaft oil seal in the gear housing front section. Replace a worn or damaged seal.

e. Reassembly.

(1) Preheat the bearings (17 and 29, fig.40) in oil at 4000 F., and slide into position in the crankshaft (1).
(2) Press the bearing cups (18 and 30) in the main bearing plate (26) and bearing retainer plate (13, fig. 38).
(3) Position the woodruff key (15, fig. 40)in the crankshaft (1).
(4) Position the oil slinger (20) on the crankshaft (1).
(5) Preheat the crankshaft gear (19) in oil at 4000 F., and slide into position on the crankshaft (1).

f. Installation.

(1) Position the crankshaft (1, fig. 40) in he crankcase and align the timing marks with the camshaft gear.
(2) Position the bearing retainer plate(13, fig. 38) on the crankcase and se-cure with the lockwashers (9) and screws (8).
(3) Position the gasket (22, fig. 40), shims,(23 and 24), gasket (25) and main bearing plate (26) on the crankcase and secure with the lockwashers (27)and capscrews (28).
(4) Check the main bearing end clearance. The proper clearance is 0.002 to 0.004of an inch. If the end clearance exceeds0.002 of an inch, add or remove shims until the clearance is correct.
(5) Install the idler gear shaft (11, fig. 38)and idler gear (10) in the crankcase and secure with the setscrew located on the left-hand side of the crankcase.
(6) Install the piston and connecting rod assembly (para. 134f).
(7) Install the oil pan and pump assembly(para. 132f).
(8) Install the water pump and rear panel assembly (para. 125).
(9) Install the engine and pump assembly(para. 121).
(10) Install the cylinder heads (para.107d).
(11) Install the fuel pump and adapter(para. 82g).
(12) Install the flywheel and flywheel housing (para. 68).
(13) Install the cylinder head shrouding(para. 68).
(14) Install the manifolds (para. 106f).
(15) Install the canopy (para. 68).

137. Engine Cylinder Block and Valve Assemblies

a. Description. The cylinder blocks are cast in pairs and are provided with cooling fins. The blocks are mounted on the crankcase and house the valves and pistons. The cylinder block can be removed, but not replaced, without disassembly of piston rods. The adjustable rotary valves are actuated by mushroom tappets located in the crankcase. The camshaft lobes actuate the tappets. The tappets cannot be removed with out the camshaft. The firing order of the cylinders is 1, 3, 4, 2. No. 1 cylinder is the nearest to the flywheel in the left bank of cylinder and No. 3cylinder is behind No. 1. No. 2 is nearest to the flywheel in the right bank and No. 4 is behind it.

b. Removal.

(1) Remove the canopy (para. 68).

(2) Remove the manifolds (para. 106b).
(3) Remove the cylinder head shrouding (para. 68).
(4) Remove the flywheel and flywheel shrouding (para. 68).
(5) Remove the fuel pump and adapter (para. 80b).
(6) Remove the cylinder heads (para*.107b).*
(7) Remove the engine and pump assembly (para. 122).
(8) Remove the water pump and rear panel assembly (para. 125).
(9) Remove the timing gear cover and accessory drive assembly (para. 131b).
(10) Remove the oil pan and oil pump assembly (para*.133b).*
(11) Remove the piston and connecting rod assemblies (para. 134b).
(12) Remove the nuts (20, fig. 31) and lock-washers (19) securing the cylinder block to the crankcase.

c. Disassembly.

(1) Remove the capscrews (8, fig. 41) and copper washers (7) securing the valve cover (6) and gasket (7) to the cylinder block (3) and discard the gaskets.
(2) Remove the valve stem rotor cap (12) and valve seat spring lock (11), valve spring seat (10), valve spring (9), valve (1), guides (4), and valve seat inserts (2) from the cylinder block(3).
(3) Remove the lower manifold gaskets(13 and 14, fig. 26) from the cylinder block (3,*fig.* 41).

d. Cleaning.

(1) Clean parts in an approved cleaning solvent and dry thoroughly with compressed air.
(2) Clean the cylinder block with a clean cloth dampened with an approved cleaning solvent and dry thoroughly with a clean, lint-free cloth.
(3) Clean the cylinder head, cover and valves with an approved cleaning solvent and dry thoroughly with compressed air.

d. Inspection and Repair.

(1) Inspect the valve guides for scoring, pitting, boring, cracks, and other signs of damage or excessive wear. Check the guide inside diameter for wear or out-of-roundness. Replace a defective guide as necessary.
(2) Inspect the valves for cracks, pits and excessively thin heads. Examine the stems for scoring, warpage and excessive wear. Measure the valve stem outside diameter for wear in three places. Use the measurement near the op of the valve stem where the stem does not touch the guide. The proper stem-to-guide clearance is 0.003 to0.005 of an inch. Replace all defective valves with stem-to-guide wear exceeding 0.007 of an inch.
(3) Inspect the valve and seat faces for pits, cracks, warpage, 360° contact, and proper seat angle. Recondition valve or seat faces as necessary. Replace valves if they are badly cracked, warped or deeply pitted.
(4) Inspect the valve springs for wear, cracks, breaks, and proper tension. Replace all springs that are worn, cracked, or broken.(5) Inspect the locks and retainers for cracks, chips, or wear. Replace defective locks or retainers.(6) Inspect the manifold mounting studs, cylinder head mounting bolts, or hard ware. Replace defective hardware or studs.

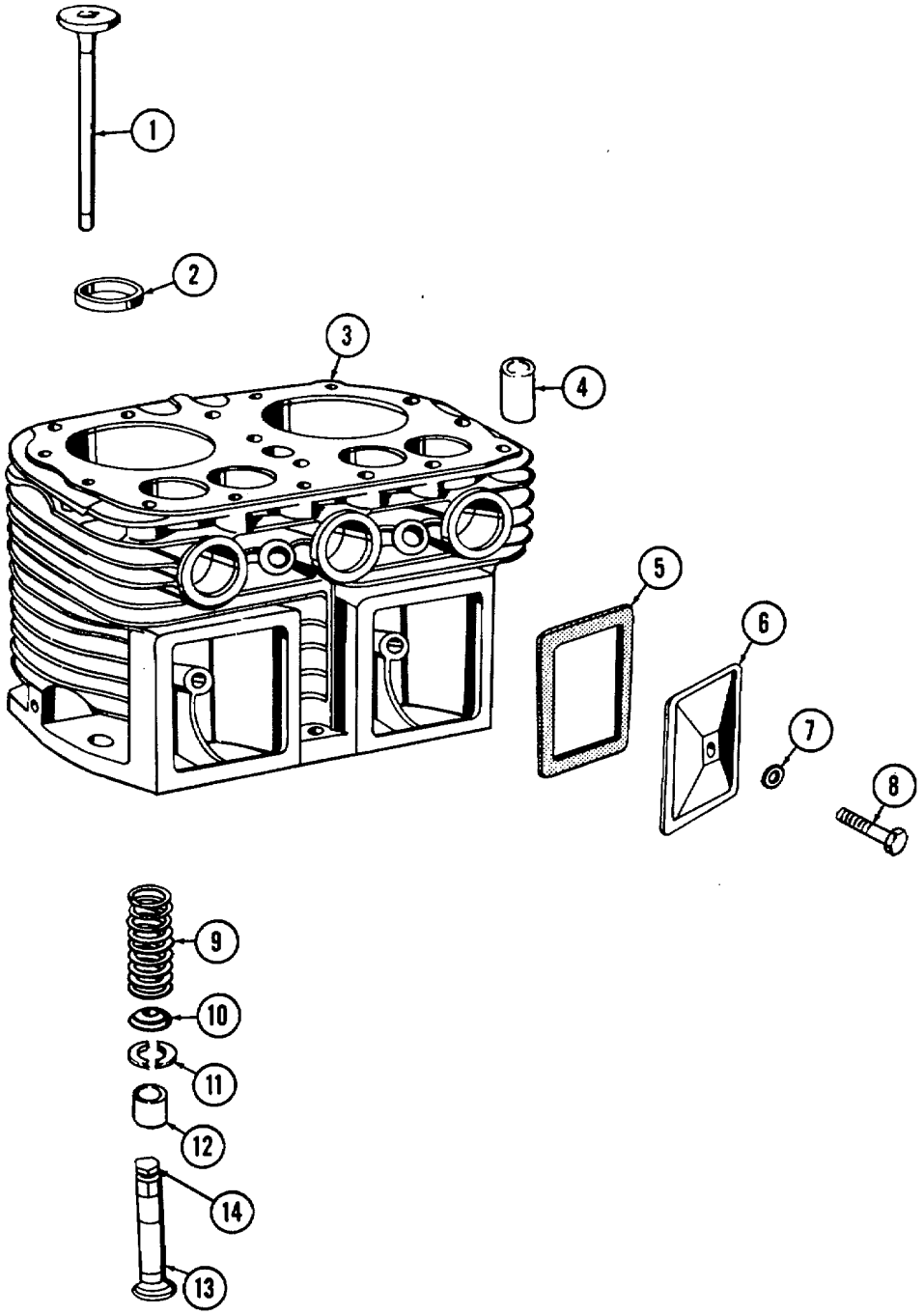
f. Engine Valve and Valve Seat Reconditioning.

(1) Coat the valve face with prussian blue and rotate the valve in the valve face and seat. The entire circumference of the seat should indicate contact with the valve face.
(2) With a suitable grinder and lapping machine, recondition the valve face and seat to correct high spots, eccentricity, or remove minor imperfections. The valve seat angle is 45°.

Caution: **Never turn the valve a complete turn while lapping, as the abrasive in the compound may groove the seat.**

g. Reassembly.

(1) Install the cylinder block manifold gaskets (13 and 14, fig. 26) on the cylinder block (3, fig. 41).



1 Valve
2 Valve seat
3 Cylinder block
4 Valve guide
5 Gasket
6 Cover plate
7 Washer
8 Capscrew
9 Valve spring
10 Seat, valve spring
11 Locks
12 Rotator cap
13 Tappet
14 Tappet screw

Figure 41. Cylinder block assembly.

(2) Position the valve seat inserts (2),valve guides (4) and valve (1) in the cylinder block (3), and install the
valve spring (9), valve spring seat(10), valve seat spring lock (11), and valve stem rotor cap (12) securing the
valve (1) to the cylinder block (3).

h. Installation.

(1) Position the gasket (1, fig. 31) and cylinder block (3, fig. 41) on the engine crankcase and install the lock-
washers (19, fig. 31) and nuts (20)securing the gasket (1) and cylinder block to the crankcase.
(2) Install the piston and connecting rod assembly (para. 13Sf).
(3) Install the oil pan and oil pump assembly (para. 133).
(4) Install the timing gear cover and accessory drive assembly (para. 131).
(5) Install the water pump and rear panel assembly (para. 127).
(6) Install the engine and pump assembly (para. 127).
(7) Install the cylinder heads (para. 107).
(8) Install the fuel pump and adapter(para. 80).
(9) Adjust the valves (para. 108).
(10) Install the flywheel shrouding and fly-wheel (para. 69).
(11) Install the cylinder head shrouding(para. 68).
(12) Install the manifolds (para. 106).
(13) Install the canopy (para. 68).

138. Camshaft Expansion Plug

a. Removal.

(1) Remove the engine and pump assembly from the water distributor (para.125).
(2) Remove the water pump and rear panel from the engine (para. 126).
(3) Remove the six bolts (28, fig. 40) and lockwashers (27) securing the main bearing plate (26) to the crankcase and remove the main bearing plate, gaskets (22 and 25) and shims (23and 24).
(4) Using a punch, punch a hole in the middle of the camshaft expansion plug(5, fig. 31) and pry it out.
(5) Scrape all residue from the expansion plug hole, making sure not to drop any debris inside the crankcase.

b. Installation.

(1)Coat a new expansion plug (5, fig. 31)with gasket sealer, and position it in the camshaft hole (fig. 31).
(2) Using a punch with a flat end, carefully drive the expansion plug (5) into the crankcase. Work the punch around the outside edge of the expansion plug so that the plug goes into the crankcase evenly.
(3) Position the main bearing plate gaskets (22 and 25, fig. 40) shims (23 and24) and main bearing plate (26) on the crankcase and secure with six lock-washers (27) and bolts (28).
(4) Install the rear panel and water pump on the engine (para. 127).
(5) Install the engine and water pump assembly on the water distributor (para.122).

139. Engine Camshaft and Tappet Assembly

a. Description. The camshaft is forged cast with polished lobes and journals and a fuel pump eccentric integral with the shaft. It operates the valve tappets and fuel pump. The two camshaft journals ride in honed bores in the crankcase. The mushroom tappets have self-locking adjusting screws and ride in bores in the crankcase. The crankshaft gear runs the camshaft gear. Both the crankshaft gear and camshaft gear have match marks on the faces to facilitate timing.

b. Removal.

(1) Remove the canopy (para. 68).
(2) Remove the manifolds (para. 106b).
(3) Remove the cylinder shrouding (para. 68).
(4) Remove the flywheel and flywheel shrouding (para. 68).
(5) Remove the cylinder heads, (para.107b).
(6) Remove the fuel pump and adapter(para. 80b).

(7) Remove the engine and pump assembly from the water distributor (para.122).
(8) Remove the timing gear cover (para.131b).
(9) Remove the oil pan and oil pump assembly (para. 133b).
(10) Remove the water pump and rear panel;(para. 125).
(11) Remove the pistons and crankshaft assemblies (para. 134b).
(12) Remove the engine cylinder block and valve assembly (para. 137b).
(13) Lift the tappets toward the top of the engine and slide the camshaft and gear from the crankcase.
(14) Remove the tappets from the inside of the crankcase.

c. Disassembly.

(1) Remove the capscrews (7, fig. 38),lockwashers (6), and camshaft gear(5) from the camshaft (1).
(2) Remove the expansion plug (5, fig. 31)from the engine crankcase.
(3) Remove the camshaft thrust plug (3,fig. 38) and spring (2) from the camshaft.
(4) Remove the tappet screw (14, fig. 41) from the tappet (13).

d. Cleaning, Inspection, and Repair.

(1) Clean all parts in an approved cleaning solvent and dry thoroughly with compressed air.
(2) Inspect the camshaft for alignment, scoring and roughness on the cams and journal. Repair or replace the camshaft as necessary.
(3) Measure the camshaft journals and cambores in the crankcase. If the difference in diameter exceeds 0.0065 of an inch, measure a new camshaft and again note the difference between the new camshaft and journals. If the differences in diameters still exceeds 9.9965 of an inch, replace the crank-case. If the difference in diameter is less than 0.001 of an inch, ream and hone the crankcase bores.
(4) Inspect the tappets. Replace if they show signs of wear. Replace a defective or worn adjusting screw.

e. Reassembly.

(1) Install the tappet screw (14, fig. 41) in the tappet (13).
(2) Install the spring (2, fig. 38) and cam-shaft thrust plug (3) in the camshaft(1).
(3) Position the expansion plug (5, fig. 31)in the engine crankcase.
(4) Position the camshaft gear (5, fig. 38)on the camshaft (1) and secure with the lockwashers (6) and capscrews (7).

f. Installation.

(1) Position the tappets in the engine crankcase.
(2) Position the camshaft assembly in the crankcase and align.
(3) Install the cylinder blocks and valve assembly (para. 137g).
(4) Install the piston and crankshaft assemblies (para. 134f). Align the matching marks on the camshaft gear with the matching marks on the crank-shaft gear.
(5) Install the oil pan and oil pump assembly (para. 133f).
(6) Install the water pump and rear panel(para. 127).
(7) Install the timing gear cover (para.131e).
(8) Install the engine and pump assembly on the water distributor (para. 123).
(9) Install the cylinder heads (para. 107d). Install the fuel pump and adapter (para. 80g).
(10) Install the flywheel and flywheel shrouding (para. 68).
(11) Install the cylinder shrouding (para.68).
(12) Install the manifolds (para. 106f).
(13) Install the canopy (para. 68).

140. Engine Crankshaft Assembly

a. Description. The engine crankcase is a one-piece casting, machined at the top and fitted with studs to mount the cylinder blocks. The camshaft bores are honed and are bearing surfaces for the camshaft.

b. Removal.

(1) Remove the canopy (para. 68).
(2) Remove the governor (para. 76b).

(3) Remove the magneto (para. 87c).
(4) Remove the manifolds (para. 106b).
(5) Remove the cylinder shrouding (para. 68).
(6) Remove the starter motor (para. 82b).
(7) Remove the flywheel and flywheel housing (para. 68).
(8) Remove the fuel pump and fuel pump adapter (para. 80b).
(9) Remove the engine and pump assembly(para. 122).
(10) Remove the timing gear cover (para.131b).
(11) Remove the water pump and rear panel (para. 125).
(12) Remove the oil pan and oil pump assembly (para. 133b).
(13) Remove the pistons, rings, pins and connecting rods (para.*13*5b*).*
(14) Remove the crankshaft (para. 136b).
(15) Remove the camshaft and tappet assembly (para. 139b).
(16) Remove the engine cylinder blocks, valves and cylinder heads assembly(para. 137b).

C. Disassembly.
(1) Remove the studs (2, fig. 31) from the crankcase (3).
(2) Remove the capscrews, lockwashers and baffle plates from the inside of the crankcase.
(3) Remove the pipe plugs (1, fig. 39) and oil spray nozzle (3) from the oil spray bars inside of the crankcase.

d. Cleaning, Inspection, and Repair.
(1) Wash all parts in an approved cleaning solvent and dry thoroughly with compressed air.
(2) Inspect the crankcase and filter cover for cracks, breaks or roughly machined surfaces. Repair or replace as necessary.
(3) Inspect all hardware for damaged threads. Replace all damaged hard-ware.

c. Reassembly.
(1) Position the oil spray nozzles (3, fig. 39) and pipe plug in thespraybar located in the crankcase.
(2) Position the baffle plates in the crank-case and install the lockwashers and capscrews.
(3) Install the studs (2, fig. 31) in the crankcase (3).

f. Installation.
(1) Install the camshaft and tappet assembly (para. 139f).
(2) Install the oil pan and oil pump assembly (para. 133f).
(3) Install the crankshaft (para. 136f).
(4) Install the cylinder block and valves(para. 137h).
(5) Install the pistons, rings, pins and connecting rods (para. 135g).
(6) Install the timing gear cover (para. 131f).
(7) Install the water pump and rear panel(para. 127).
(8) Install the cylinder heads (para.*107d).*
(9) Install the engine and pump assembly on the water distributor (para. 123).
(10) Install the fuel pump and fuel pump adapter (para. 80g).
(11) Install the flywheel and flywheel shroud (para. 68).
(12) Install the cylinder shrouding (para. 68).
(13) Install the manifolds (para. 106f).
(14) Install the magneto (para. 87d).
(15) Install the governor (para. 76).
(16) Install the canopy (para. 8).

141. Water Tank Body

a. The water tank is a welded, elliptically shaped tank with a 1,000-gallon capacity. The water tank is welded to the distributor frame.

b. Test.
(1) Clean the outside of the water tank.
(2) Fill the tank completely with water and inspect for leaks.

c. Cleaning, Inspection, and Repair.
(1) Clean tank with an approved cleaning solvent and brush away all rust and corrosion with a wire brush.
(2) Inspect for leaks, repair by welding or brazing.

(3) Inspect brackets and handrails for weakened welds, bends, rust and other damage. Repair by welding , brazing, straightening and reinforcing as necessary.
(4) Inspect all hardware for damaged threads, straightness and rust
(5) Repaint the water tank if necessary.

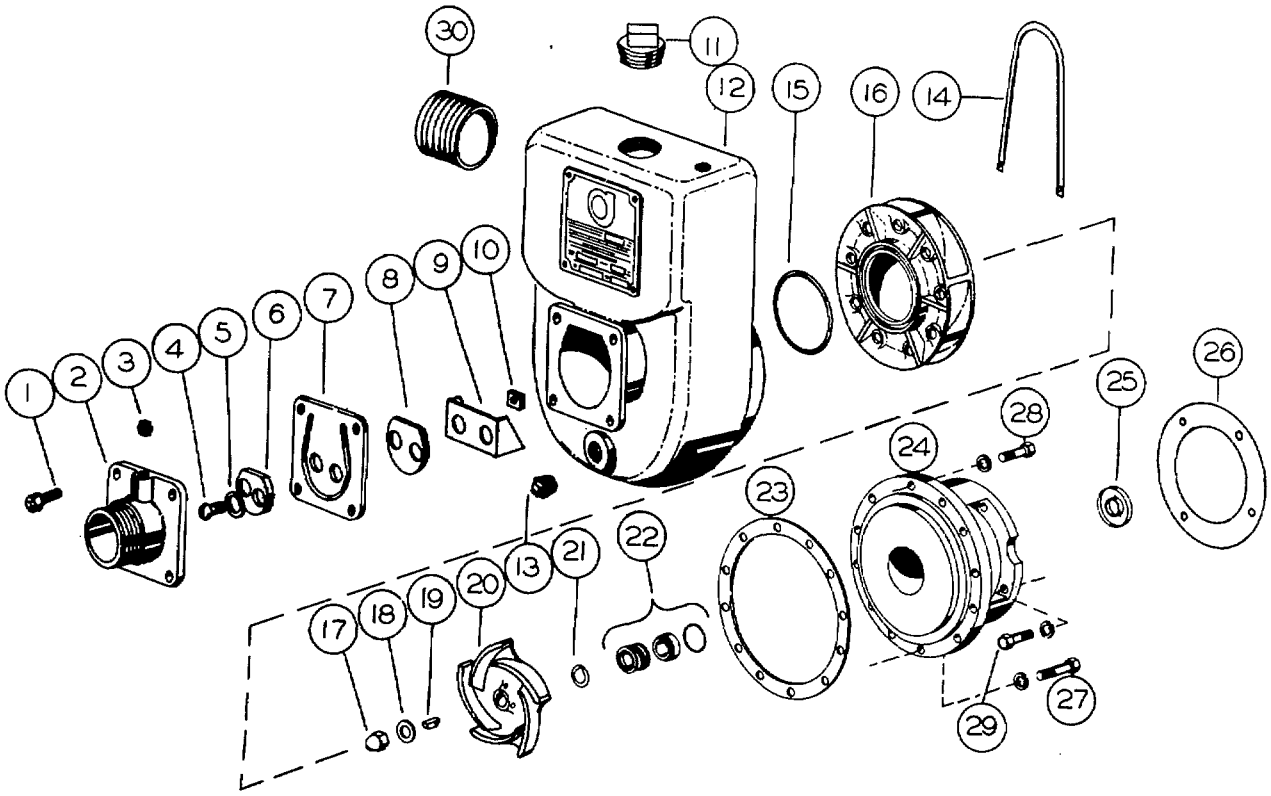
142. Data Plates

a. Description. Identification and data plates are attached to the distributor, hose rack, the engine, and pump by sheet metal screws and drive screws.

b. Removal. Remove the data plates by re-moving the self-tapping screws or by twisting out the drive screws.

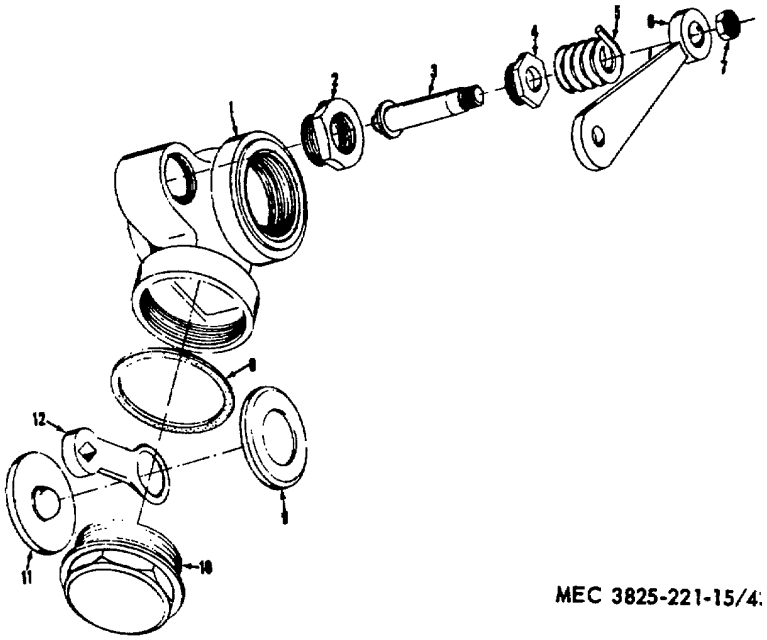
c. Cleaning, Inspections, and Marking.
(1) Clean the data plates in a suitable cleaning solvent.
(2) Inspect the plates for legibility, tears, defacement or corrosion.
(3) Stamp new data plates when necessary.

d. Installation. Position the data plates on the engine, pump housing or distributor skirt and install the self-tapping screws or drive screws.



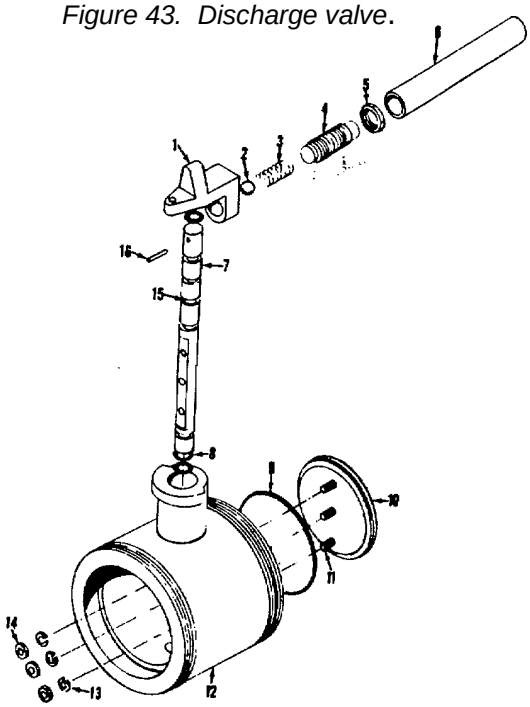
2 Suction inlet	10 Square nut	18 Impeller washer	26 Shim
3 Pipe plug	11 Pipe plug	19 Impeller key	27 Capscrew
4 Carriage bolt	12 Tank	20 Impeller	28 Capscrew, hardened Allen head
5 Gasket	13 Pipe plug	21 Impeller shim	29 Capscrew
6 Lower weight	14 Lifting hook	22 Seal assembly	30 Nipple, XH faced
7 Check valve	15 Gasket	23 Gasket	
8 Upper weight	16 Diffuser	24 Lantern	

Figure 42. Pump model 4D2 Spec Q548-S918.



1 Body	4 Packing nut	7 Locknut	10 Cap
2 Stuffing box	5 Spring	8 Gasket	11 Convex disc
3 Fulcrum	6 Handle	9 Concave disc	12 Fulcrum lever

Figure 43. Discharge valve.



1 Handle	5 Adjusting nut	9 Disc O-ring	13 Lockwasher (3 rqr)
2 Ball	6 Handle extension	10 *Disc*	14 Nut (3 rqr)
3 Spring	7 Shaft	11 Stud	15 O-ring grooves
4 Handle stub	8 O-ring (3 rqr)	12 Body	16 Pin

Figure 44. Suction valve.

CHAPTER 5

DEMOLITION, SHIPMENT AND LIMITED STORAGE

Section I. DEMOLITION OF THE WATER DISTRIBUTOR TO PREVENT ENEMY USE

143. Demolition By Mechanical Means

a. General. When capture or abandonment of the water distributor is imminent, the responsible unit commander must make the decision either to destroy the equipment or to render it inoperative. Based on this decision, orders are issued which cover the desired extent of destruction. Whatever method of demolition is employed, it is essential to destroy the same vital parts of all water distributors and all corresponding repair parts.

b. Misuse.

(1) Drain the oil from the crankcase and the water from the pump housing.
(2) Throw sand or other abrasive material into the engine crankcase.
(3) Start the engine and pump and run at high speed until failure occurs.

c. Mechanical Means. Use sledge hammers, crow bars, picks, axes or any other heavy tools which may be available together with the tools normally included with the distributor to destroy the following:

(1) Distributor water pump.
(2) Engine fuel pump, carburetor, governor, magneto, starter and generator.
(3) Fuel tanks and fuel lines.
(4) Water lines, valves, hoses and water tank.
(5) Engine cylinder head and cylinder block.

144. Demolition By Explosives or Weapons Fire

Demolition by explosives may be accomplished by detonating explosives in the quantities and positions indicated in figure 45.

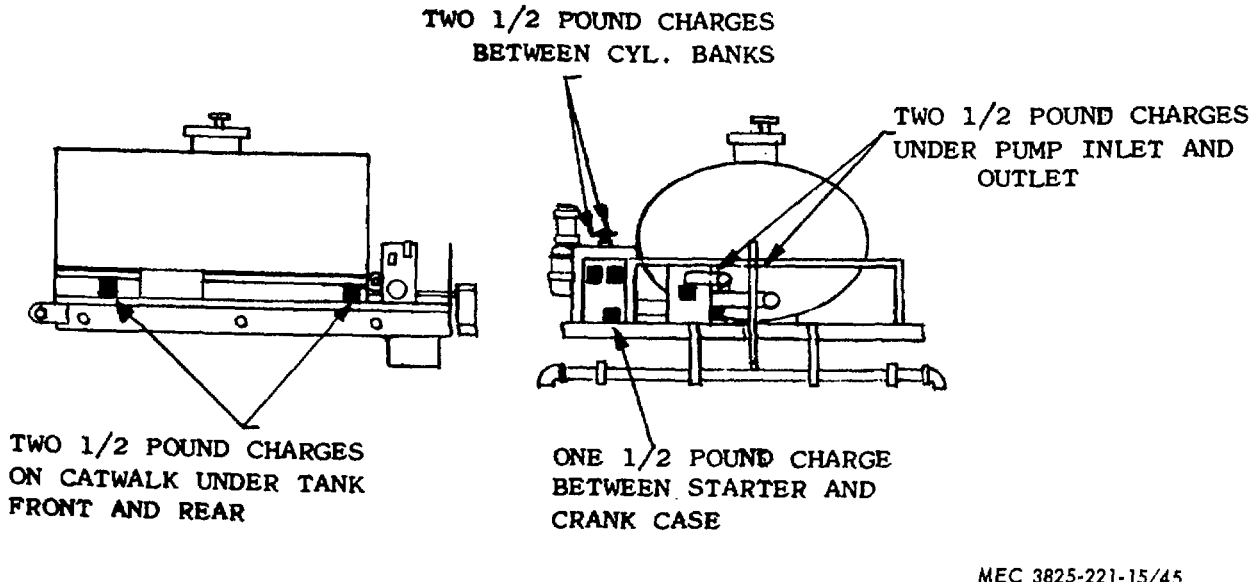


Figure 45. Demolition diagram.

Rifle fire or automatic weapons fire directed in the locations indicated for explosives may be used instead of explosives.

145. Other Demolition Methods

a. Demolition By Scattering and Concealment. Remove all easily accessible parts such as generator, starter, magneto, battery, carburetor, and fuel pump and conceal them by burying, throwing into heavy brush, a deep well, a river, or a lake. Salt water is preferable.

b. Demolition By Burning. Pack any combustible material around the engine, saturate the material with gasoline, oil, or diesel fuel and ignite.

c. Demolition By Submersion. Totally submerge the equipment in a body of water for concealment and water damage. Salt water will do the greatest damage to metal.

146. Training

All operators should receive thorough training in the destruction of the Macleod Water Distributor. Refer to FM 5-25. Simulated destruction, using all methods listed above, should be included in the operator's training program. It must be emphasized in training that demolition operations are usually necessitated by critical situations when the time available for destruction is limited. For this reason, it is necessary that operators are thoroughly familiar with all methods of destruction and are able to carry out demolition instructions without reference to this or any other manual.

Section II. SHIPMENT AND LIMITED STORAGE

147. Preparation of Equipment for Shipment

When preparing the water distributor for shipment, an inspection must be made to see that all equipment is in good repair and can be put into immediate operation upon receipt of the equipment. Remove the suction and discharge hoses and the spraybars and strap them on the distributor skirting on the right catwalk. Place all the on-equipment tools and accessories in the toolbox and secure the toolbox cover. Cover the pump pressure gage, muffler, ends of pipe openings, engine side panels, oil filter, air cleaner, manhole cover, fuel and oil filler caps with preservative tape. Make sure that the water tank and water pump are drained.

148. Loading Equipment for Shipment

Load the water distributor on a flatcar. If hoisting equipment of sufficient of 21,000 pounds or over is available, attach lifting cables to the front hook and the stiff-leg cables on each side of the truck frame. If hoisting equipment is not available, construct a wooden ramp as shown in (fig. 7). Use anchor cables, blocks, planks, and steel straps to secure the distributor to the flatcar bed.

149. Preparation of Equipment for Storage

a. Limited Storage.

(1) Lubricate all points indicated on the lubrication chart, regardless of time interval indicated. No special inhibitors are required for 30 days storage.
(2) Remove the water pump drain plug and drain all water. Replace plug and open the priming chamber cover. Pour in about 2 quarts OE 20 and replace the priming chamber cover.
(3) Check engine oil level and add enough oil to bring the oil level up to FULL on the oil level gage. Remove the spark plugs and pour 4 tablespoons of OE into each cylinder. Turn engine over several times to coat cylinder walls. Replace spark plugs.
(4) Open the discharge valve and allow all the water to drain from the tank.
(5) Drain all water lines.

b. Dead Storage.

(1) Remove the water pump drain plug and drain all water. Replace plug and open the priming chamber cover. Pour in about 1 quart OE 20 and replace the priming chamber cover.
(2) Drain oil from the crankcase and refill with an approved rust inhibitor. Remove spark plugs and fill each cylinder with 4 tablespoons of an approved rust inhibitor. Turn the engine over a few times to coat the cylinder walls. Replace spark plugs.

(3) Open the discharge valve and allow all water to drain from the water tank.
(4) Drain all water lines.
(5) Lubricate all valves as indicated in lubrication chart.
(6) Block up the carrier unit so that it is not resting on its tires.

150. Inspection and Maintenance of Equipment in Storage

The water distributor should be inspected at least every 30 days for low tire pressure, evidence of physical damage such as rusting, accumulation of water, pilferage, leakage of lubrication, fuel or coolant. Inspect the painted surface of the unit and repair any damage noticed. Equipment in limited storage should be operated long enough to bring it up to operating temperature and for complete lubrication of ball bearings, gears, and so on at 30-day intervals.

APPENDIX I

REFERENCES

1. Dictionaries of Terms and Abbreviations

AR 320-50	Authorized Abbreviations and Brevity Codes.
AR 320-5	Dictionary of United States Army Terms.

2. Fire Protection

TM 5-687	Repairs and Utilities: Fire Protection Equipment, and Appliances: Inspection, Operations, and Preventive Maintenance.

3. Lubrication

LO 5-3825-221-15	Lubrication Order.
FSC C9100-IL	FSC Group 91; Fuels, Lubricants, Oils, and Waxes.

4. Painting

TM 9-213	Painting Instructions for Field Use.

5. Preventive Maintenance

AR 750-5	Maintenance Responsibilities and Shop Equipment.
TM 9-207	Operation and Maintenance of Ordnance Material in Extreme Cold Weather (0 to -65 F.).
TM 9-6140-200-15	Storage Batteries, Lead Acid Type.
TM 9-1870-1	Care and Maintenance of Pneumatic Tires.

6. Publication Indexes

DA Pam 108-1	Index of Army Motion Pictures, Film Strips, Slides, and Phono Recordings.
DA Pam 310-1	Index of Administrative Publications.
DA Pam 310-2	Index of Blank Forms.
DA Pam 310-3	Index of Doctrinal Training, and Organizational Publications.
DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 4, 6, 7, 8, and 9), Supply Bulletins, Lubrication Orders, and Modification Work Orders.
DA Pam 310-5	Index of Graphic Training Aids and Devices.
DA Pam 310-25	Index of Supply Manuals-Engineer Type Items.

7. Radio Interference Suppression

TM 11-483	Radio Interference Suppression.

8. Supply Publications

TM 5-3825-221-20P	Organizational Maintenance Repair Parts and Special Tool List.

9. Shipment and Limited Storage

TM 9-200	General Packaging Instructions for Ordnance General Supplies.
AR 743-505	Limited Storage of Engineer Mechanical Equipment.

10. Training Aids

FM 5-25	Explosives and Demolition.
FM 21-5	Military Training.
FM 21-6	Techniques of Military Instruction.
FM 21-30	Military Symbols.

11. Record and Report Forms

TM 38750	Army Equipment Record Procedures.

APPENDIX II

MAINTENANCE ALLOCATION CHART

Section I. EXPLANATION OF MAINTENANCE FUNCTIONS

1. General

This appendix contains a maintenance allocation chart listing all maintenance and repair operations authorized for the various echelons.

2. Maintenance

Maintenance is any action taken to keep material in a serviceable condition or to restore it to serviceability when it is unserviceable. Maintenance of material includes the following:

a. Service. To clean, to preserve, and to replenish fuel and lubricants.

b. Adjust. To regulate periodically to prevent malfunction.

c. Inspect. To verify serviceability and to detect incipient mechanical failure by scrutiny.

d. Test. To verify serviceability and to detect incipient mechanical failure by use of special equipment such as gages, meters and so on.

e. Replace. To substitute serviceable assemblies, subassemblies, and parts for unserviceable components.

f. Repair. To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes but is not limited to, inspection, cleaning, preserving, adjusting, replacing, welding, riveting, and straightening.

g. Overhaul. To restore an item to completely serviceable condition as prescribed by serviceability standards developed and published by heads of technical services. This is accomplished through employment of the technique of "Inspect and Repair Only as Necessary" (IROAN). Maximum utilization of diagnostic and test equipment is combined with minimum disassembly of the item during the overhaul process.

3. Explanation of Columns

a. Functional Group. The functional group is a numerical group set up on a functional basis. The applicable functional grouping indexes are taken from the Corps of Engineers Functional Grouping Indexes, and appear on the maintenance allocation chart in their correct numerical sequence. These indexes normally are set up according to their proximity to each other and their function.

b. Components and Related Operation. This column contains the functional index grouping heading, subgroup headings, and a brief description of the part starting with the name. It also designates the operation to be performed such as service, adjust, inspect, test, replace, repair, and overhaul.

c. Levels of Maintenance.

Column 1, operator. Operator maintenance is that maintenance performed by user or operator of the equipment, such as servicing, cleaning, lubricating, and limited adjustments. It also includes removal and replacement of items to accomplish servicing and lubrication.

Column 2, organizational. Organizational maintenance is that maintenance performed by trained personnel provided for that purpose in the using organization, such as replacement of all items in column 2, limited parts fabrication from bulk material, adjustments, and repair of assemblies, components, and end items that can be accomplished without extensive disassembly.

Column 3, Direct support. Direct support maintenance is that maintenance performed by specially trained units in direct support of the using organization, such as replacement of all

items in columns 2 and 3, repair assemblies, components, and end items, and fabricate parts from bulk material.

Column 4, General support. General support maintenance is that maintenance performed by units organized as semifixed or permanent shops to serve lower level maintenance within a geographical area, such as replacement of items in columns 2, 3 and 4 repair end items, overhaul assemblies, components and fabricate general use common hardware and parts.
Column 5, Depot. Depot maintenance is that maintenance authorized to overhaul assemblies, components, end items, and replacement of all parts in columns 2, 3, 4, and 5.

d. Symbol X. The symbol X placed in the appropriate column indicates the lowest level responsible for performing the particular maintenance operation, but does not necessarily indicate repair parts will be stocked at that level.

e. Remarks. The remarks column is used to explain why maintenance, that would normally be done at a lower level is moved to a higher level because of some peculiarity in the construction of the end item.

Maintenance Allocation Chart

Functional group	Components and related operation	Levels of maintenance					Remarks
		1	2	3	4	5	
	DISTRIBUTOR, WATER, TANK TYPE; GASOLINE DRIVES 1,000-GALLON						
01							
0100	ENGINE						
	ENGINE ASSEMBLY						
	Engine, Gasoline						
	Service ----------	X					
	Inspect ----------	X					
	Test ----------	------	X ---	------	------	------	Compression
	Replace ----------	------	------	X			
	Repair ----------	------	X				
	Overhaul ----------	------	------	------	X		
0101	CRANKCASE, BLOCK CYLINDER HEAD						
	Crankcase: Blocks						
	Replace ----------	------	------	------	X		
	Heads						
	Replace ----------	------	X				
0102	CRANKSHAFT						
	Crankshaft; Bearings; Seals						
	Replace ----------	------	-----	-----	X		
0103	FLYWHEEL ASSEMBLY						
	Flywheel ----------	------	X				
	Replace ----------	------	------	X			
	Ring Gear						
	Replace						
0104	PISTONS, CONNECTING RODS						
	Pistons; Rings; Pins; Retainers						
	Replace ----------	------	------	------	X		
	Rods, Connecting						
	Replace ----------	------	------	------	X		
	Repair ----------	------	------	------	X		
0105	VALVES, CAMSHAFTS AND TIMING SYSTEM						
	Valves; Seats						
	Replace ----------	------	------	X			
	Repair ----------	------	------	X			

Functional Group	Components and related operation	Levels of Maintenance					Remarks
		1	2	3	4	5	
	Guides; Springs; Locks; Plunges Button; Gears; Timing; Cover						
	Replace	-------	-------	X			
	Lifters; Valve						
	Adjust	-------	X------				
	Replace	-------	-------	-------	X------	------	Camshaft removal necessary
	Cover; Valve Lifter				-		
	Replace	-------	X				
	Camshaft; Bearings						
	Replace	-------	-------	-------	X		
0106	ENGINE LUBRICATION SYSTEM						
	Pump; Oil; Pan						
	Replace	-------	-------	X			
	Filter; Oil; Cap Breather						
	Service	X					
	Replace	-------	X				
	Tube; Filler; Fittings						
	Replace						
	Lines	-------	-------	-------	-------	-------	External
	Replace	-------	X				
	Repair	-------	X				
	Dipstick						
	Replace	X					
0108	MANIFOLDS						
	Manifolds						
	Replace	-------	X				
0107	ENGINE STARTING SYSTEM (OTHER THAN ELECTRIC)						
	Crank						
	Replace	X					
03							
0301	FUEL SYSTEM						
	CARBURETOR: FUEL INJECTOR						
	Carburetor						
	Adjust	-------	X				
	Replace	-------	X				
	Gasket; Bowl						
	Replace	-------	X				
0308	FUEL PUMPS						
	Pump; Fuel						
	Replace	-------	X				

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.

0304	AIR CLEANER						
	Cleaner; Air						
	Service						
	Replace	X					
0306	TANKS LINES, FITTINGS	-------	-------	-------	-------	-------	Uses truck tank
	Lines						
	Replace	-------	X				
	Repair	-------	X				
	Fittings; Hose						
	Replace						
0308	ENGINE SPEED GOVERNOR	-------	X				
	Governor						
	Replace	-------	X				
	Repair	-------	X				
	Controls						
	Replace	-------	X				

Functional group	Components and related operation	Levels of maintenance					Remarks
		1	2	3	4	5	
0310	ENGINE STARTING AIDS						
	Primer; Fuel						
	Replace ----------	----------	X				
0312	ACCELERATION, THROTTLE OR CHOKE CONTROLS						
	Control; Choke						
	Replace----------	----------	X				
04	EXHAUST SYSTEM						
0401	MUFFLER AND PIPES						
	Muffler; Pipes; Shield						
	Replace ----------	----------	X				
05	COOLING SYSTEM						
0502	COWLING, DEFLECTORS, AIR DUCT, SHROUD, ETC.						
	Shrouds; Deflectors; Screen						
	Replace ----------	----------	X				
06	ELECTRICAL SYSTEM (ENGINE AND VEHICULAR ETC.)						
0603	STARTER						
	Starter						
	Test----------	----------	X				
	Replace ----------	----------	X				
	Repair ----------	----------	----------	X			
	Brushes						
	Replace ----------	----------	X				
0604	IGNITION COMPONENTS						
	Magneto						
	Service ----------	----------	X				
	Adjust ----------	----------	X				
	Replace ----------	----------	X				
	Repair ----------	----------	----------	X			
	Points; Condenser; Cables						
	Replace ----------	----------	X				
	Spark Plugs						
	Service ----------	----------	X				
	Adjust ----------	----------	X				
	Test ----------	----------	X				
	Replace ----------	----------	X				
0606	ENGINE SAFETY CONTROLS						
	Switch; Safety						
	Replace ----------	----------	X				
0607	INSTRUMENT OR ENGINE CONTROL PANEL						
	Switches						
	Replace ----------	----------	X				
	Wiring						
	Replace ----------	----------	X				
	Repair ----------	----------	X				
0608	MISCELLANEOUS ITEMS						
	Switch; Turn Signal						
	Replace ----------	----------	X				
0609	LIGHTS						
	Lights; Marker and Turn Signals						
	Replace ----------	----------	X				
	Lamps; Lens; Gaskets						
	Repair ----------	----------	X				

Functional group	Components and related operation	Levels of maintenance					Remarks
		1	2	3	4	5	
0612	BATTERIES, STORAGE, WET OR DRY	----------	----------	----------	----------		Use truck batteries
	Cable						
	Replace ----------	----------	X				
	Repair ----------	----------	X				
0613	HULL OR CHASSIS WIRING HARNESS						
	Harness; Wiring						
	Replace ----------	----------	----------	X			
	Repair ----------	----------	X				
0615	RADIO INTERFERENCE SUPPRESSION						
	Components						
	Test ----------	----------	X				
	Replace ----------	----------	X				
13	WHEELS AND TRACKS						
1311	WHEEL ASSEMBLY						
	Wheel; Tachometer Drive						
	Service ----------	X					
	Repair ----------	----------	X				
1313	TIRES, TUBES						
	Tire						
	Service ----------						
	Replace ----------	----------	X				
	Tube						
	Replace ----------	----------	X				
	Repair ----------	----------	X				
15	FRAME						
	Frame						
	Replace ----------	----------	----------	----------	X		
	Platforms; Catwalks; Guides; Lift; Ladders; Handrails						
	Replace ----------	----------	X				
1504	SPARE WHEEL CARRIER AND TIRE LOCK						
	Bar; Mounting						
	Replace ----------	----------	X				
17	BODY; CAB; HOOD; HULL (STATIONARY OR TRANSPORTABLE)						
1700	BODY, CAB, HOOD, HULL ASSEMBLIES						
	Hood; Guards; Shields						
	Replace ----------	----------	X				
1703	DOORS, HATCHES, AND PANELS						
	Panels; Doors						
	Replace ----------	----------	X				
1708	STORAGE RACKS, BOXES, STRAPS, CARRYING CASES, CABLE REELS, HOSE HEELS, ETC.						
	Box, Tool						
	Replace ----------	----------	X				
1711	TANK BOXES (Gasoline, Water, Etc.)						
	Tank, Water						
	Repair ----------	----------	X				
22	MISCELLANEOUS BODY, CHASSIS OR HULL AND ACCESSORY ITEMS						
2202	ACCESSORY ITEMS						
	Accessories, Mounted						
	Replace----------	----------	X				

Functional group	Components and related operation	Levels of maintenance					Remarks
		1	2	3	4	5	
2210	DATA PLATES AND INSTRUCTION HOLDERS						
	Plates; Data						
	Replace	----------	----------	X			
	Plates; Instruction						
	Replace	----------	X				
26	ACCESSORIES, PUBLICATIONS, TEST EQUIPMENT AND TOOLS						
2602	ACCESSORIES						
	Accessories; Unmounted						
	Replace	X					
2603	COMMON TOOLS						
	Tools; Common						
	Replace	X					
2605	PUBLICATIONS						
	Publications						
	Replace	X					
47	GAGES (NONELECTRICAL); WEIGHING AND MEASURING DEVICES						
4701	INSTRUMENTS, SPEED & DISTANCE						
	Tachometer; Tachourmeter						
	Replace	----------	----------	X			
	Drives						
	Service	X					
	Repair	----------	X				
4702	GAGES, MOUNTINGS LINES AND FITTINGS						
	Gages; Pressure						
	Replace	----------	X				
	Indicator; Water Level						
	Repair	----------	X				
55	PUMPS (EXCLUDE ENGINE PUMPS)						
5500	PUMP ASSEMBLY						
	Pump; Centrifugal						
	Service	X					
	Repair	----------	----------	X			
5501	SHAFTS, MOTORS, IMPELLERS						
	Impeller						
	Replace	----------	----------	X			
5504	DISCHARGE SYSTEM						
	Valve; Check						
	Replace	----------	----------	X			
5512	INLET AND OUTLET COMPONENTS						
	Valve; Foot						
	Replace	----------	X				
	Strainers						
	Service	X					
	Replace	----------	X				
5515	FLUID LINES						
	Pipes; Fittings; Hoses; Valves; Controls; Spray-Bars						
	Replace	----------					
	Extensions; Nozzles						
	Replace	X					

Functional group	Components and related operation	Levels of maintenance					Remarks
		1	2	3	4	5	
76 7603	FIRE FIGHTING EQUIPMENT FIRE EXTINGUISHER Extinguisher; Fire Service ---------- Replace ----------	 X X					

APPENDIX III

BASIC ISSUE ITEMS LIST AND MAINTENANCE AND OPERATING SUPPLIES

Section I. INTRODUCTION

1. General

Section II lists the accessories, tools, and publications required for maintenance and operation by the operator, initially issued with, or authorized for the water distributor. Section III lists the maintenance and operating supplies required for initial operation.

2. Explanation of Columns Contained in Section II

a. Source Codes. The information provided in each column is as follows:

(*1) Materiel.* This column lists the basic materiel code number of the supply service assigned responsibility for the part. Blank spaces denote supply responsibility of the preparing agency. General Engineer supply parts are identified by the letters GE in parentheses, following the nomenclature in the description column. Other basic materiel code numbers are--

10-Quartermaster Materiel
12-Adjutant General

(2) *Source.* The selection status and source of supply for each part are indicated by one of the following code symbols:

(a) P-applied to high-mortality repair parts which are stocked in or supplied from the supply service depot system, and authorized for use at indicated maintenance level.

(b) P1-applied to repair parts which are low-mortality parts, stocked in
or supplied from supply service depots, and authorized for installation at indicated maintenance level.

(c) X2-applied to repair parts which are not stocked. The indicated maintenance level requiring such repair parts will attempt to obtain them through cannibalization; if not obtainable through cannibalization, such repair parts will be requisitioned with supporting justification through normal supply channels.

(3) *Maintenance.* The lowest maintenance level authorized to use, stock, install, or manufacture the part is indicated by the following code symbol: O--Organizational Maintenance

(4) *Recoverability.* If no code is shown in the recoverability column the part is considered expendable.

b. Federal Stock Number. The Federal stock number will be shown in this column, and will be used for requisitioning purposes.

c. Description.

(1) The item name and a brief description of the part are shown.

(2) A five-digit Federal supply code for manufacturers and/or other supply services is shown in parentheses followed by the manufacturer's part number. This number will be used for requisitioning purposes when no Federal stock number is indicated in the Federal stock number column. *Example:* (08645) 86543.

(3) The letters GE, shown in parentheses immediately following the description, indicates General Engineer supply responsibility for the part.

d. Unit of Issue. If no abbreviation is shown in this column, the unit of issue is "each".

e. Quantity Authorized. This column lists the quantities of repair parts, accessories, tools, or publications authorized for issue to the equipment operator or crew as required.

f. Quantity Issued with Equipment. This column lists the quantities of repair parts, accessories, tools, or publications that are initially issued with each item of equipment. Those indicated by an asterisk are to be requisitioned through normal supply channels as required.

g. Illustrations. This column is subdivided into two columns which provide the following information:

(1) *Figure number.* Provides the identifying number of the illustration.

(2) *Item number.* Provides the referenced number for the parts shown in the illustration.

3. Federal Supply Code for Manufacturers

66289 ..... Wisconsin Motor Corp.
37562..... The Macleod Co.

4. Explanation of Columns Contained in Section III

a. Item. This column contains numerical sequenced item numbers, assigned to each component application, to facilitate reference.

b. Component Application. This column identifies the component application of each maintenance or operating supply item.

c. Source of Supply. This column lists the basic materiel code number of the supply service assigned responsibility for the item. Blank space denotes supply responsibility of the preparing agency. Other basic materiel code numbers are-

10-Quartermaster Materiel
12-Adjutant General

d. Federal Stock Number. The Federal stock number will be shown in this column and will be used for requisitioning purposes.

e. Description. The item and a brief description are shown.

f. Quantity Required for Initial Operation. This column lists the quantity of each maintenance or operating supply item required for initial operation of the equipment.

g. Quantity Required for 8 Hours Operation. Quantities listed represent the estimated requirements for an average 8 hours of operation.

Section II. BASIC ISSUE ITEMS LIST

Source code				Federal Stock No.	Description	Unit of Issue	Quantity authorized	Quantity issue with Equipment	Illustration	
Materiel	Source	Maintenance	Recoverability						Fig.	Item
					GROUP 31-BASIC ISSUE ITEMS, MANUFACTURER INSTALLED					
					3100-BASIC ISSUE ITEMS MANUFACTURER OR DEPOT INSTALLED					
	X2	0			ADAPTER: fire hydrant one end and fire hose other end (37562) 6511-60.03.		1	1		
10	P1	0		7520-559-9618	CASE: carrying (Repair Parts Manual Group 1708)		1	1		
	P	0		2990-353-5959	CRANK, HAND		1	1		
12					DEPARTMENT OF THE ARMY OPERATOR, ORGANIZATIONAL, FIELD AND DEPOT MAINTENANCE MANUAL TM 5-3895-221-15.		2	2		
12					DEPARTMENT OF THE ARMY ORGANIZATIONAL, FIELD AND DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LISTS TM 5-3895-221-25P.		2	2		

Source code				Federal stock No.	Description	Unit of Issue	Quantity authorized	Quantity issue with Equipment	Illustration	
Materiel	Source	Maintenance	Recoverability						Fig.	Item
					3100-BASIC ISSUE ITEMS, MANUFACTURER OR DEPOT INSTALLED-(Continued)					
12					DEPARTMENT OF THE ARMY LUBRICATION ORDER LO 5-3895-221-15.					
	X2	0			FOOT VALVE AND STRAINER: 4 in. dia. (37562) 6511-6508 (37562) 6511-65.08	 1 1	 1 1			
	X2	O			HOSE: 4 in. dia x 10 ft lg with quick detachable couplings (51805) 4 in. x 10 ft (37562) 6511-65.00.	3	3			
	X2	0			HOSE, FIRE: (37562) 6511-66.00	1	1			
	X2	O			NOZZLE, FIRE: (37562) 6511-60.02	1	1			
	X2	O			SPRAY BAR, EXTENSION: with spray nozzles, 2 ft lg. (37562) 5611-60.81.	3	3			
	X2	O			SPRAY BAR, EXTENSION: w/gaskets and spray nozzles, 1 ft lg. (37562) 5611-60.83.	2	2			
					GROUP 32-BASIC ISSUE ITEMS, TROOP INSTALLED					
					3200-BASIC ISSUE ITEMS, TROOP INSTALLED OR AUTHORIZED					
	P1	0		4210-893-1092	EXTINGUISHER, FIRE, DRY CHEMICAL charged, hand, pressurized w/dry air or nitrogen; w/pressure gage; squeeze grip control; steel cylinder, enameled red; factory mutual or UL approved, class 4-B, C; 21/2 lb; w/Universal bracket.	1	*			
10	P	0		4930-360-2801	GREASE-GUN, HAND: lever operated 16-ounce capacity, extension 7 in. lg and hydraulic coupler.					
10	P	0		5120-242-3917	HAMMER, HAND, machinist's ball peen	1	*			
10	P	O		5120-223-7396	PLIERS, SLIP JOINT: straight nose combination w/cutter 6 in. lg.	1	*			
10	P	0		5120-234-910	SCREWDRIVER, FLAT TIP, flared tip, plastic handle, 6 in. lg.	1	*			
10	P	0		5120-264-3796	WRENCH, OPEN END, ADJUSTABLE: single head type 0 to 1.322 in. opening 12 in. lg.	1	*			
10	P	O		5120-277-1479	WRENCH, PIPE, adjustable jaw style, stillson pat tern 1 to 2 in. pipe size.	1	*			

Section II. MAINTENANCE AND OPERATING SUPPLIES

Item	Component application	Source of Supply	Federal stock No	Description	Quantity required for initial operation	Quantity required for 8 hours operation	Notes
1	0101 CRANKCASE (1)			OIL, LUBRICATING: 5-Gal pails as follows:			(1) Includes quantity of oil to fill engine oil system as follows:
		10	9150-265-9435(2)	OE-30	5 qt	(3)	4 qt-CRANKCASE
		10	9150-265-9428(2)	OE-10	5 qt	(3)	1 qt-OIL FILTER
		10	9150-242-7603(2)	OES	5 qt	(3)	
2	0304 AIR CLEANER			OIL, LUBRICATING (4)	1/2 qt	(3)	(2) See FSC C9100-IL for additional data and requisitioning procedure
3	0306 FUEL TANK			FUEL, GASOLINE:			(3) See current LO for grade application and re-plenishment intervals.
		10	9130-160-1818	Bulk as follows: Automotive, Combat 91A	50 gal		
		10	9130-160-1830	Automotive, Combat 91C			(4) Use oil as prescribed in item 1.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:
Active Army:

USASA (2)
ACSI (1)
DCSLOG (1)
CNGB (1)
CofEngrs (3)
TSG (1)
CC-E (1)
CofT (1)
CofSptS (1)
USAMB (1)
USAARTYBD (2)
USAARMBD (2)
USAIB (2)
USAADBD (2)
USAAESWBD (2)
USAAVNBD (2)
USCONARC (3)
OS Maj Comd (5) except
USASETAF (2)
USARJ (10)
USAMOCOM (2)
USASMC (1)
MDW (1)
Armies (2)
Corps (2)
Div (2)
Engr Bde (1)
Svc Colleges (2)
Br Svc Sch (2) except
USAES (100)
USMA (2)
GENDEP (OS) (10)
Engr Dep (OS) (10)
A DEP (2)
USA Tml Comd (2)
Army Tml (1)
Div Engr (2)
Dist Engr (2)
USAMEC (46)
Engr Cen (5)
USAREUR Engr Proc Cen (2)
USAREUR Engr Sup Con Agcy (10)
Chicago Proc Ofc (10)
Engr Fld Maint Shops (2)
Fld Comd, DASA (8)
AMS (3)
USAREURCOMZ (2)
USAC (1)
MAAG (1)
JBUSMC (1)
Units org under fol TOE:
(2 copies each UNOINDC)
5-48
5-54
5-114
5-115
5-117
5-118
5-237 (5)
5-262 (5)
5-267
5-278 (5)
5-279

NG: State AG (3).
USAR: Same as Active Army except allowance is one copy to each unit.
For explanation of abbreviations used, see AR 320-50.

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL.

SOMETHING WRONG WITH PUBLICATION

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE

BE EXACT PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT.

PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER	SIGN HERE

DA FORM 1 JUL 79 **2028-2**

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

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

'VEIGHTS

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

LIQUID MEASURE

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

SQUARE MEASURE

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

CUBIC MEASURE

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

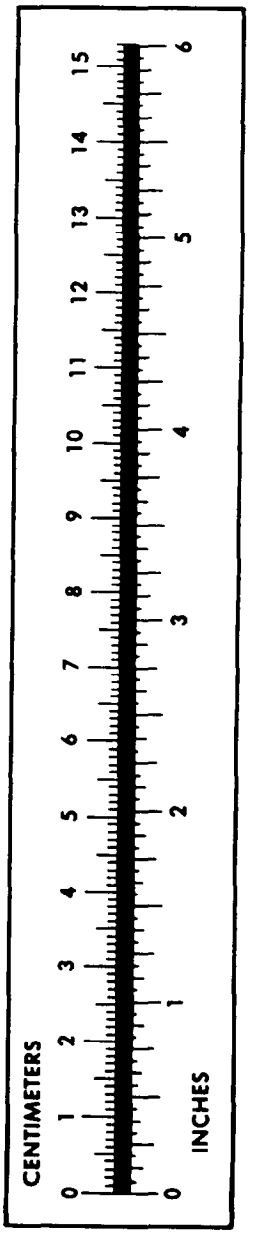
TEMPERATURE

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

APPROXIMATE CONVERSION FACTORS

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

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



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