

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

---

DS, GS, AND DEPOT MAINTENANCE MANUAL

TRUCK, FIREFIGHTING  
POWERED PUMPER; FOAM AND WATER  
500-GPM; CENTRIFUGAL PUMP  
POWER TAKEOFF DRIVEN;  
400-GAL WATER TANK  
40-GAL WATER TANK  
(WARD LAFRANCE MODEL M44A1WLF)  
FSN 4210-225-9127

---

HEADQUARTERS, DEPARTMENT OF THE ARMY  
24 SEPTEMBER 1964

TAGO 5947-A-October



## **SAFETY PRECAUTIONS**

Keep decks free of oil, grease, ice, and mud to prevent slipping or falling.

When servicing the battery or refueling, do not smoke or allow open flame nearby. Batteries generate hydrogen, a highly explosive gas. If battery electrolyte is spilled on flesh or clothing, wash the effected parts immediately.

Provide sufficient ventilation. Exhaust gases contain carbon monoxide which is a colorless, odorless, and deadly poison.

Do not lubricate or adjust any assembly or part while the firetruck is operating.

Care must be taken not to touch the muffler with bare hands.

Properly support pump assembly and compartment assemblies during removal and installation.

Before doing any work on the electrical system of the fire fighting truck, disconnect the ground lead of the batteries and remove the power cord from the 115-volt ac receptacle on the apron.

When operating the firefighting truck water pump, take care to avoid surging conditions in suction and discharge lines. Increase or decrease pressure slowly to avoid danger to personnel.



Change

No. 1

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D. C., 25 August 1966

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

**TRUCK, FIRE FIGHTING: POWERED PUMPER: FOAM AND WATER, 500-GPM,  
CENTRIFUGAL PUMP, POWER TAKE OFF DRIVEN; 400-GAL WATER TANK,  
40-GAL FOAM CHEMICAL TANK (WARD LAFRANCE MODEL M44A1WLF)  
NON WINTERIZED FSN 4210-225-9127  
(WARD LAFRANCE MODEL M44A2WLF-W)  
WINTERIZED FSN 4210-965-1306.**

TM 5-4210-205-35, 24 September 1964, is changed as follows:

Title is changed as shown above.

Page 1. Add chapter 4 after section VI.

**CHAPTER 4  
WINTERIZATION**

---

**Section I. INTRODUCTION**

**73. General**

This supplement is published to provide repair and overhaul instructions for the winterization kit supplied with the Ward LaFrance Model M44A2WLF Fire Truck.

**74. Change**

Thorough understanding of the description and operating instructions described in this change will enable personnel to more expeditiously analyze, isolate, and repair malfunctions which may occur within the winterization kit systems.



## Section II. TROUBLE SHOOTING

### 75. General

Refer to chart below for probable causes and possible remedies for malfunctions which may occur in the

winterization kit components. Refer to applicable paragraphs for additional tests to further analyze and correct specific component malfunctions.

Trouble	Probable cause	Remedy
Heater falls to ignite	Ignition failure	Replace spark plug and/or adjust contact points
	Preheater failure	Replace preheater.
	Excessive carbon deposits in burner	Clean burner bowl.
	Fuel system failure	Test and repair fuel system.
	Electrical system failure	Test and repair electrical system.
	Preheater relay or power relay failure	Replace relay.
	Flame switch failure	Replace flame switch.
Excessive time required for Ignition	Low Voltage	Test batteries for proper operating voltage.
	Fuel flow rate slow	Test and repair fuel system.
Heater starts but fails to keep burning	Non-fire relay failure(fuel) shuts off shortly after ignition occurs	Replace non-fire relay.
	Combustion chamber overheated (limit switch stops operation)	Correct overheating. (Make sure air blower is distributing combustion air adequately Check for plugged liquid circulating hoses or passages Reset limit switch.
Heater starts but fails to keep burning (Continued)	Burner clogged	Clean burner.
	Vapor lock in fuel line	Prevent excessive heat near fuel line.
	Electrical system failure	Test electrical system.
	Timing or power relay failure	Replace relay
Heater combustion surges	Fuel system not supplying steady or proper flow	Test and repair fuel system.
	Low combustion air blower motor speed	Replace motor.
	Low voltage	Test batteries for proper operating voltage.



Trouble	Probable cause	Remedy
Heater smokes	Fuel system not supplying steady or adequate flow	Test and repair fuel system.
	Low combustion air blower motor speed	Replace motor.
	Low voltage	Test batteries for proper operating voltage.
Heater fails to respond to "ON-HI" and "ON-LO" switch operation	Fuel regulator valve failure	Replace regulator valve.
No warm liquid circulated	Liquid circuiting pump failure.	Replace pump
	Faulty thermoswitch	Replace thermoswitch
No warm air distributed	Circulating air blower failure	Replace blower motor.
	Faulty thermostat	Replace thermostat

## 76. Electrical System Test

- Make certain power supply is adequate for the unit.
- Check all electrical connections for tightness and good condition.
- Check limit switch. If switch is open, correct the reason for overheating of the combustion chamber. Reset limit switch manually.
- Check the circuit breaker reset button position on the control box. The power supply circuit is closed when the button is pushed in. If the button jumps out when the heater is started, test further for the electrical failure.
- Press in "press-to-test" indicator lamp on the control box. If the power supply circuit through the circuit breaker is complete, the lamp will light. If the lamp does not light, make certain the lamp is not burned out. If the lamp is not faulty, check the power supply and the power circuit through the circuit breaker.

*f.* If these steps fail to localize the trouble, check the operation of the preheater, the preheat relay, the power relay, and other electrical components.

## 77. Fuel System Test.

- Make certain the feed line shutoff valve is open.
- Check the fuel supply. Make certain the fuel is the proper type for the heater and that it is not contaminated.
- If the fuel pump is not operating, test as described in paragraph 94.
- If the fuel pump is operating, disconnect the pump outlet connections and check for fuel flow. If flow does not occur, check the fuel lines for obstructions. Make sure the fuel filter is clean.
- If a flow occurs, reconnect the pump outlet and remove the regulator valve and the nozzle assembly. Test the operation of these units as described in paragraph 84d.



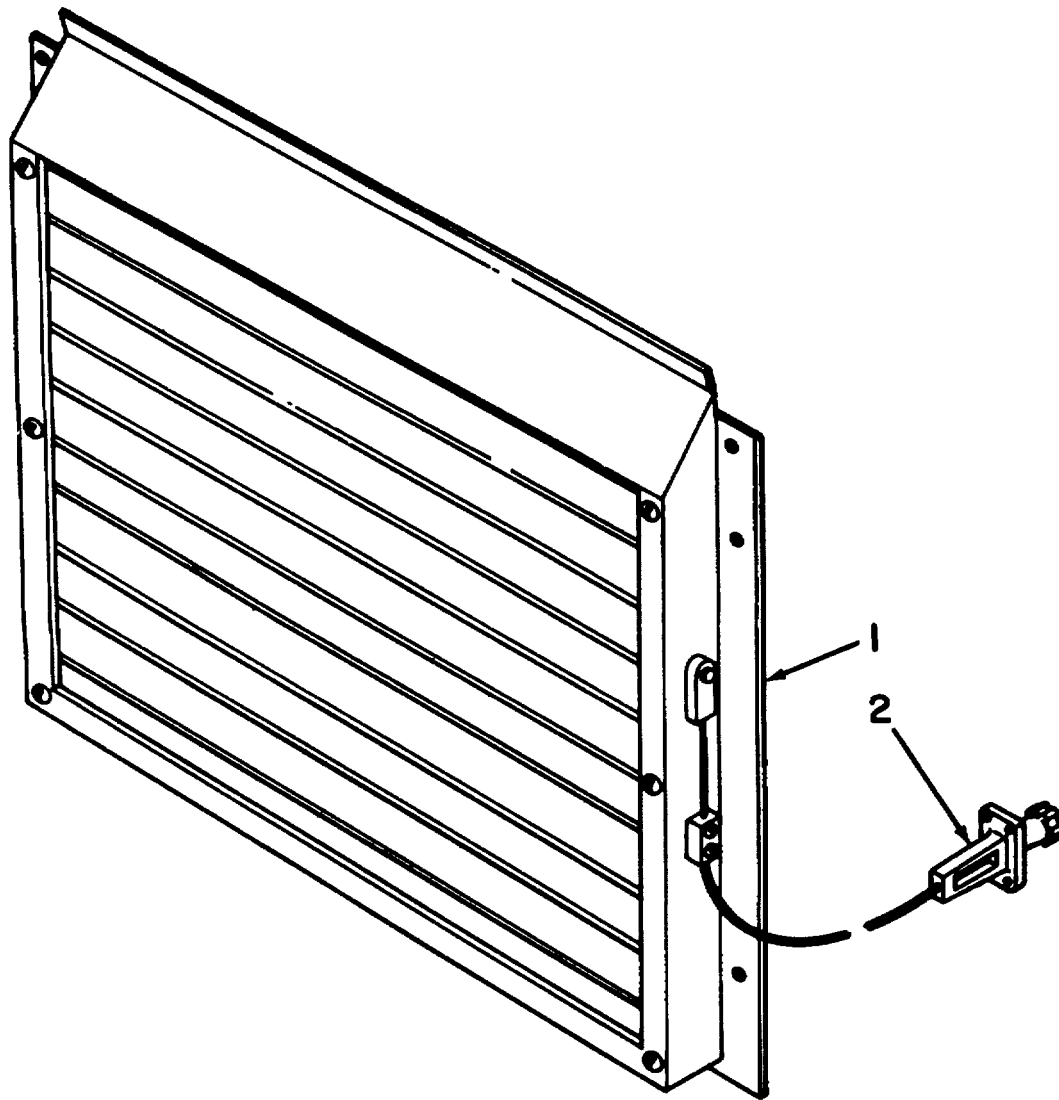
### Section III. REPAIR

#### 78. General

Repair procedures which are standard or obvious may be excluded in this supplement. In instances where specific instructions have been omitted, procedures shall be performed in accordance with good mechanical practices.

#### 79. Engine Radiator Shutter

Repair of the engine radiator shutter is limited to replacement of defective components. Refer to figure 18 for assembly sequence.



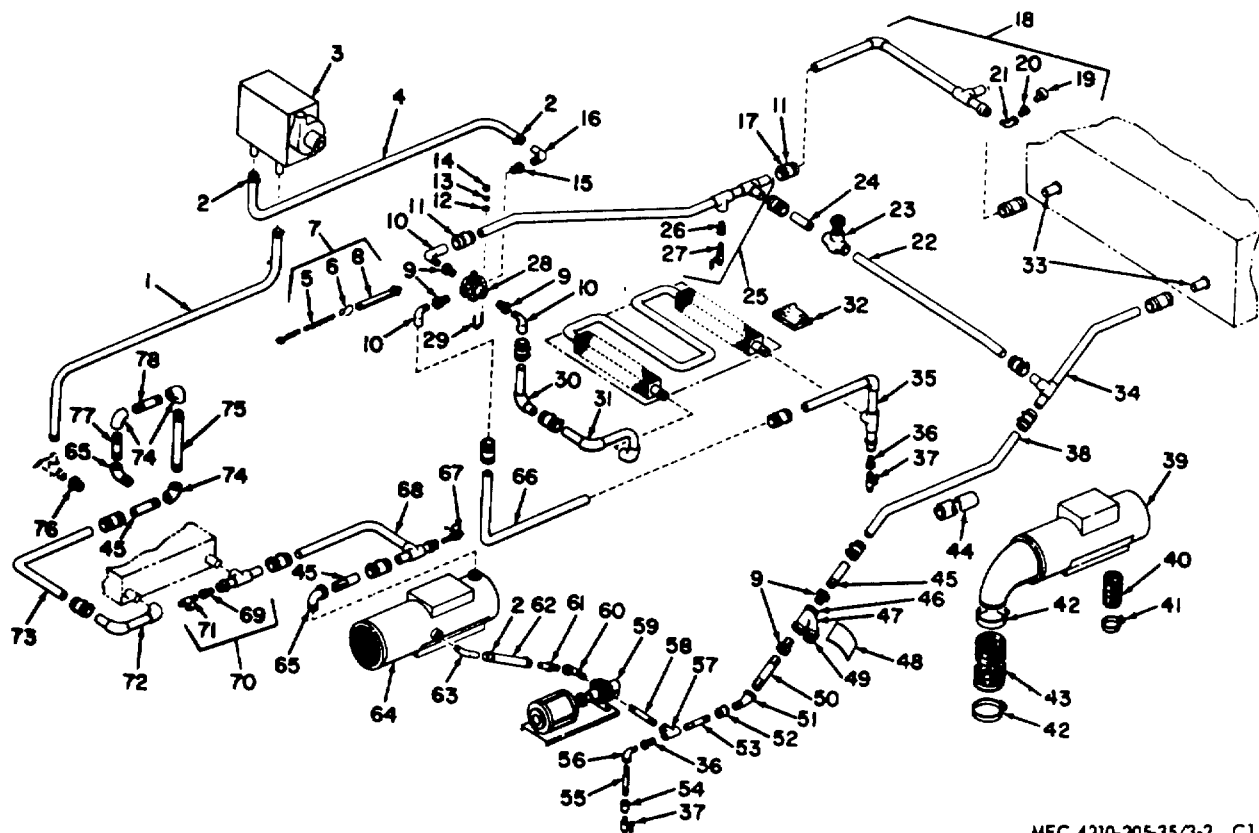
MEC 4210-205-35/3-1 CI

1 Shutter

2 Shutter control

Figure 18. Radiator shutter assembly.





MEC 4210-205-35/3-2 C1

- |                       |                   |                      |                   |
|-----------------------|-------------------|----------------------|-------------------|
| 1 Hose                | 21 Elbow          | 41 Clamp             | 61 Adapter        |
| 2 Clamp               | 22 Tube           | 42 Clamp             | 62 Hose           |
| 3 Heater              | 23 Valve          | 43 Hose              | 63 Elbow          |
| 4 Hose                | 24 Tube           | 44 Insulation        | 64 Coolant heater |
| 5 Chain               | 25 Tube assembly  | 45 Adapter           | 65 Elbow          |
| 6 Hook S              | 26 Bushing        | 46 Strainer          | 66 Tube           |
| 7 Handle installation | 27 Cock           | 47 Element           | 67 Switch         |
| 8 Handle              | 28 Valve          | 48 Insulation        | 68 Tube assembly  |
| 9 Bushing             | 29 Bolt U         | 49 Plug              | 69 Bushing        |
| 10 Elbow              | 30 Elbow assembly | 50 Nipple            | 70 Tee assembly   |
| 11 Clamp              | 31 Tube assembly  | 51 Elbow             | 71 Cock           |
| 12 Washer             | 32 Insulation     | 52 Reducer           | 72 Tube assembly  |
| 13 Washer             | 33 Tube           | 53 Nipple            | 73 Tube           |
| 14 Nut                | 34 Tube assembly  | 54 Coupling          | 74 Elbow          |
| 15 Bushing            | 35 Tube assembly  | 55 Nipple            | 75 Pipe           |
| 16 Elbow              | 36 Bushing        | 56 Elbow             | 76 Bushing        |
| 17 Hose               | 37 Cock           | 57 Tee               | 77 Nipple         |
| 18 Tube assembly      | 38 Tube           | 58 Nipple            | 78 Nipple         |
| 19 Valve              | 39 Space heater   | 59 Pump installation |                   |
| 20 Bushing            | 40 Hose           | 60 Elbow             |                   |

Figure 19. Liquid heating system.

## 80. Liquid Heating System

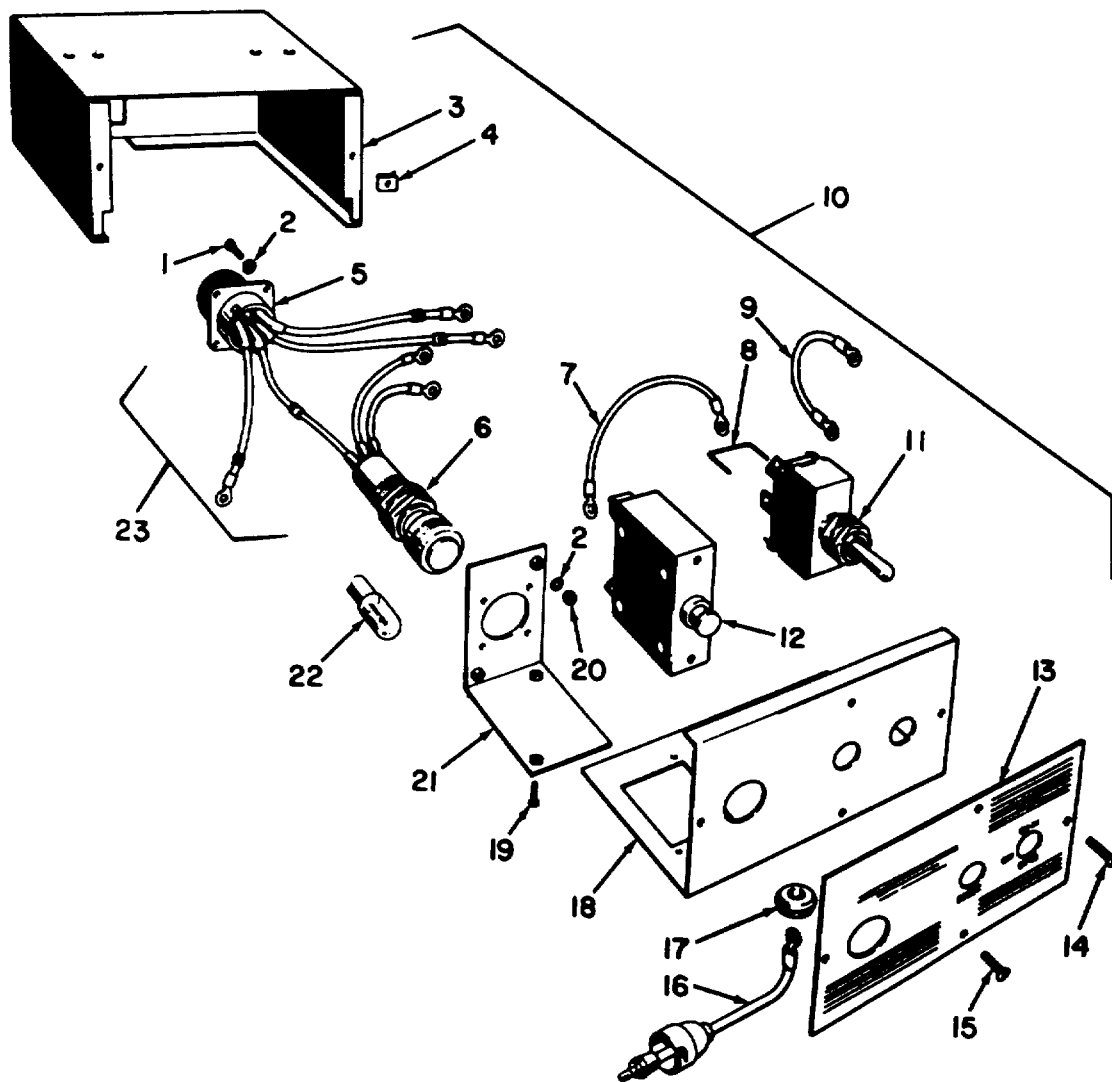
Refer to figure 19 for assembly sequence of the liquid heating system.

## 81. Liquid Heater

## 82. Control Box Repair (fig. 20)

Remove the two screws (14) on each side of the nameplate and separate the box (3) from the panel (18). Inspect the assembly visually for wiring defects and faulty parts. Check the circuits, using the wiring diagram (fig. 21). Replace any units that are obviously faulty. Disassemble and test the control box components as follows:





MEC 4210-205-35/3-3 C1

1 Screw	7 Lead	13 Plate	19 Screw
2 Washer	8 Wire	14 Screw	20 Nut
3 Box	9 Lead	15 Screw	21 Bracket
4 Nut	10 Distribution box	16 Lead	22 Lamp
5 Connector	11 Switch	17 Grommet	23 Connector and light assembly
6 Light	12 Circuit breaker	18 Panel	

Figure 20. Heater control box assembly

a. *Circuit Breaker.*

- (1) To remove the circuit breaker, disconnect the electrical leads from the terminals. Tag leads to facilitate re-assembly. Remove two mounting screws (15, fig. 20) from the panel (18) and remove circuit breaker (12).

- (2) To test, connect the circuit breaker to a test circuit which will supply 40 amperes current. Press in the reset button; the circuit breaker should open within 10 to 125 wands. If it fails to meet this requirement, replace the circuit breaker.
- (3) To install the circuit breaker, position it on the panel and fasten in place with the two mounting screws. Connect the leads according to the wiring diagram (fig. 21).



*b. Control Switch.*

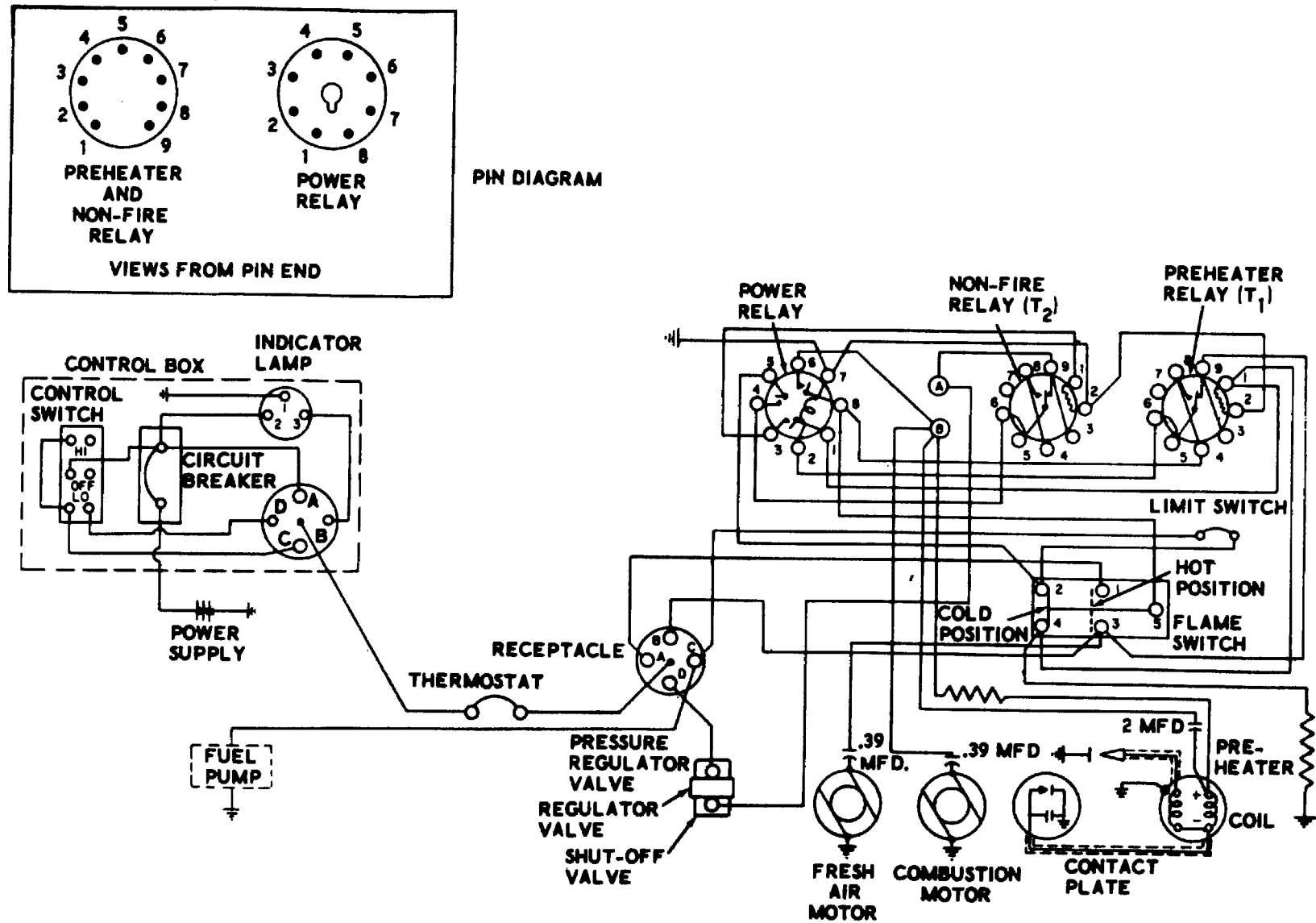
- (1) To replace the control switch, disconnect the electrical leads. Tag leads to facilitate reassembly. Remove the mounting nut from the threaded lever lug. Remove control switch (11, fig. 20) from panel (18).
- (2) Check switch continuity with an ohmmeter in all positions. Make sure the switch operates freely. Replace if faulty.
- (3) To install the control switch, position on the panel and secure with the mounting nut. (Make certain the switch lever correctly indicates "ON-HI, OFF, ON-LO" operation on the plate.) Connect the leads according to the wiring diagram (fig. 21)

*c. Indicator Lamp.*

- (1) To replace the indicator lamp (22, fig. 20), remove the lamp button from the light socket (6); then remove lamp (22).

- (2) To replace the connector and light assembly (23), remove both as an assembly. Disconnect the wires leading to the control switch, circuit breaker, and ground. To remove the connector (5), remove the screws (1), washers (2), and nuts (20) fastening the receptacle to the angle bracket (21). Remove the light socket (6) by removing the lamp button and external mounting nut. Inspect the indicator light socket and receptacle for broken leads, damaged terminals, and worn or damaged threads. If any parts are faulty, replace the entire assembly.
- (3) To install the connector and light assembly, insert the light socket through the hole in the panel (18) and plate (13). Fasten in place with the external mounting nut and install the button.
- (4) Fasten the connector to the angle Bracket (21) with the mounting screws, washers, and nuts. Connect the wires according to the wiring diagram (fig. 21.) The ground wire from the lamp connects to a receptacle mounting nut.





MEC 4210-205-35/3-14 C1

Figure 21. Fluid system heater electrical diagram.



### 83. Heater Disassembly (fig. 22)

#### a. Control Head Assembly Removal.

- (1) Remove two screws (12) from the control head cover (13) and lift cover.
- (2) Disconnect ignition coil high-tension wire from the spark plug assembly (25). Disconnect both primary wires leading to the ignition coil.
- (3) Loosen the fuel tube nuts (16) and remove the fuel tube (15) and sleeves (17).
- (4) Disconnect at their terminal points the three wires extending through the grommet (48) in the heater casing. Unscrew the flame switch mounting nut.
- (5) Remove the two wires from the limit switch (2) and disconnect the wire which extends to the liquid circulating pump through the grommet (24, fig. 23) in the control head base.
- (6) Remove the screw (9, fig. 22) and the nut (20), and lift the control head assembly (21) and the flame switch assembly (11) from the casing and combustion chamber. When necessary to further disassemble the control head, see control head repair instructions in paragraph 84.

*b. Limit Switch Removal.* Disconnect the wires at the two limit switch terminals. Remove the two screws (4) fastening the limit switch (2) to the combustion chamber. Remove the switch retainer (3) and the switch.

#### c. Casing Disassembly.

- (1) Remove the spark plug assembly (25), washer (6), and seal (7) from the burner.
- (2) Remove the two screws (76) attaching the heater mounting base assembly (75) to

the c-sing and the combustion chamber. Remove the heater mounting base assembly and remove seal (62).

- (3) Remove the three screws (49) and the intake cover (52) from the casing.
- (4) Remove the four screws (50) attaching the casing (53) to the combustion chamber (1).
- (5) Remove four screws (49) joining the casing at the seam. Spread the casing and lift from the blower assembly (63), burner (28), and combustion chamber, withdrawing wire through the rubber grommet (48) in the casing.

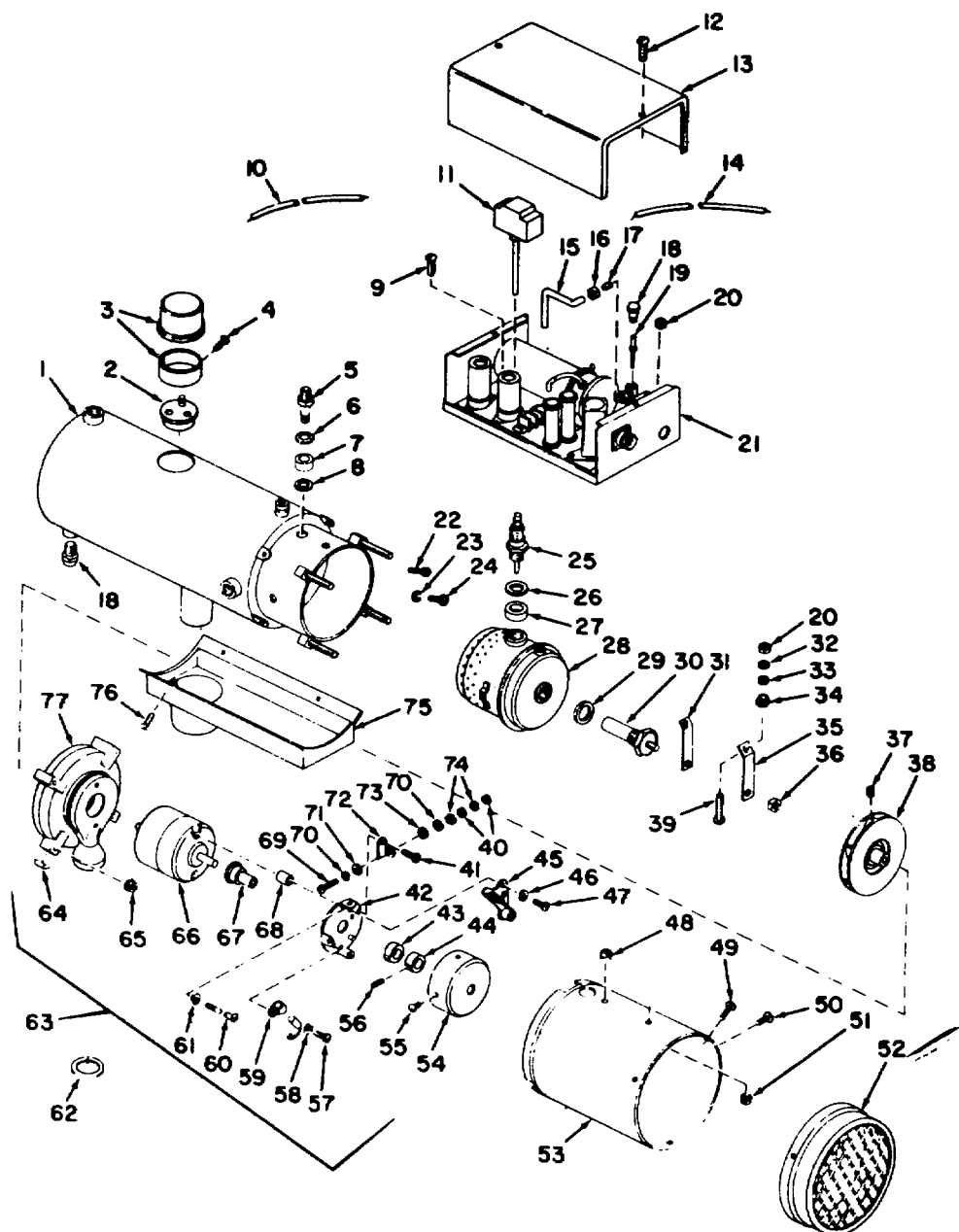
### 84. Control Head Repair (fig. 23)

Most of the parts of the control head assembly can be replaced by merely removing the cover and disconnecting the part. Refer to paragraph 83a if complete removal is required.

#### a. Power Relay.

- (1) The power relay controls the circuits to the fuel regulator valve, combustion blower motor, ignition system, and the non-fire relay. A defective power relay would affect operation of the heater beyond the preheating cycle.
- (2) Remove the power relay (9, fig. 83) by pulling it from the socket (11).
- (3) To test, apply nominal voltage to terminals 2 and 7 (check fig. 21 for method of determining terminal numbers); the contacts should close immediately. Use an ohmmeter to check continuity between contacts 1 and 3, 4 and 5, and 6 and 8, when the relay is energized. Replace a faulty relay; do not attempt to adjust or repair it.



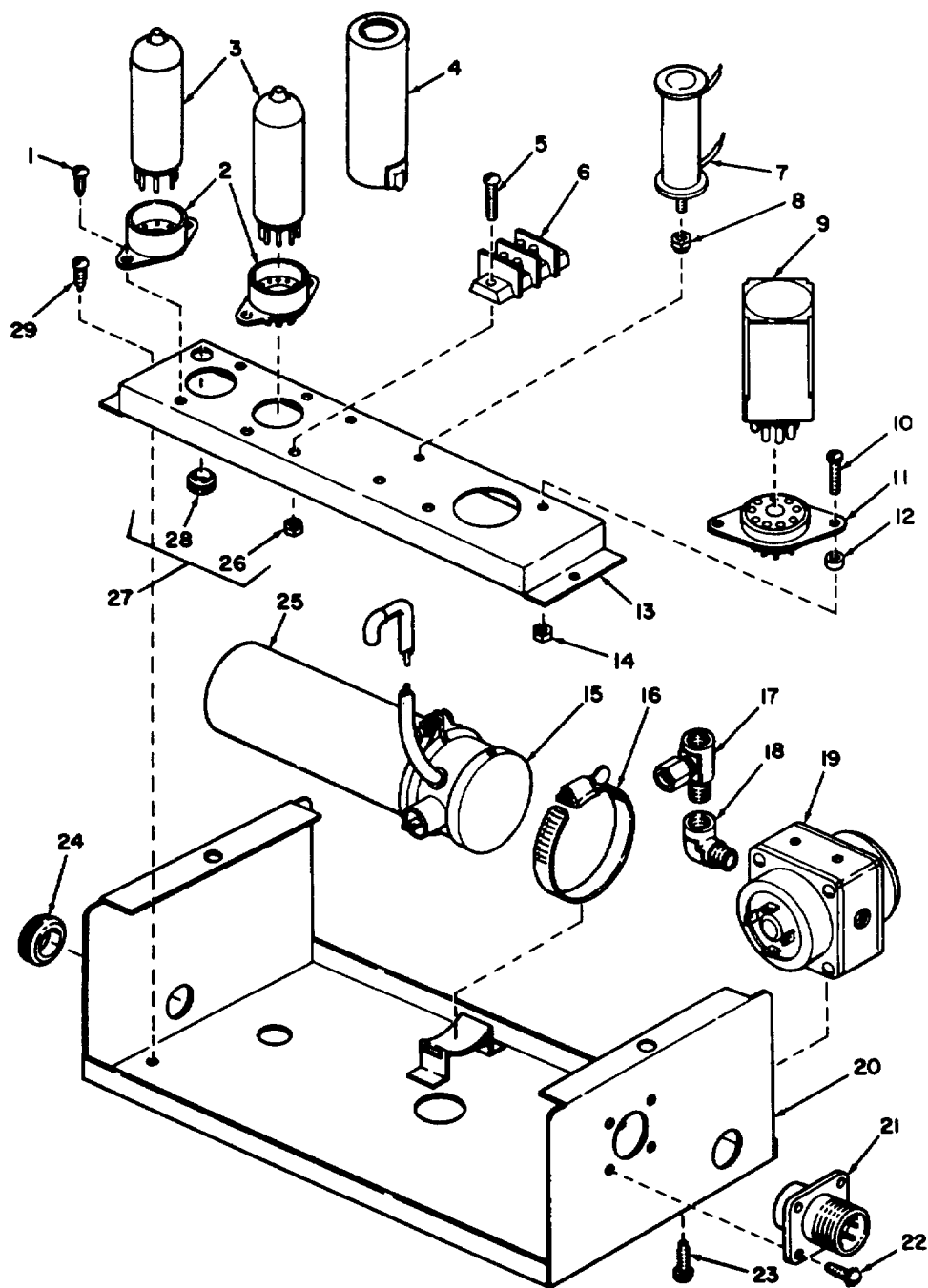


MEC 4210-205-35/3-5 CI

1 Chamber	17 Sleeve	33 Insulator	49 Screw	64 Bumper
2 Switch	18 Plug	34 Insulator	50 Screw	65 Nut
3 Retainer	19 Nozzle	35 Band	51 Nut	66 Motor
4 Screw	20 Nut	36 Nut	52 Cover	67 Cam
5 Union	21 Head assembly	37 Setscrew	53 Casing	68 Spacer
6 Washer	22 Screw	38 Fan	54 Cap	69 Screw
7 Seal	23 Washer	39 Screw	55 Screw	70 Washer
8 Gasket	24 Screw	40 Nut	56 Setscrew	71 Insulator
9 Screw	25 Spark plug	41 Screw	57 Screw	72 Bracket
10 Lead	26 Washer	42 Plate	58 Washer	73 Insulator
11 Switch	27 Seal	43 Collar	59 Bracket	74 Washer
12 Screw	28 Burner	44 Bushing	60 Screw	75 Base
13 Cover	29 Gasket	45 Contact set	61 Washer	76 Screw
14 Lead	30 Preheater	46 Washer	62 Seal	77 Shell
15 Tube	31 Insulator	47 Screw	63 Blower assembly	
16 Nut	32 Washer	48 Grommet		

Figure 22. Liquid heater assembly.





MEC 4210-205-35/3-6 C1

1 Screw	7 Resistor	13 Base	19 Valve	25 Coll
2 Socket	8 Nut	14 Nut	20 Base	26 Nut
3 Relay	9 Relay	15 Shield	21 Connector	27 Base assembly
4 Shield	10 Screw	16 Clamp	22 Screw	28 Grommet
5 Screw	11 Socket	17 Tee	23 Screw	29 Screw
6 Terminal block	12 Spacer	18 Elbow	24 Grommet	

Figure 23. Control head assembly.



b. *Preheat and Non-Fire Relays* (fig. 23). preheat relay and the non-fire relay (3) are identical timing relays effective during different cycles of heater operation. Remove and test the relays as follows:

- (1) Remove the control head cover. Depress and turn the shield (4), then lift off. Pull relay from the shield-type socket (2).
- (2) To test the timing relay, apply proper voltage across terminals 1 and 2 and check continuity across terminals 6 and 9 (check fig. 21 for method of determining terminal numbers). Within 30 to 60 seconds, the circuit through terminals 6 and 9 should open. Continuity should now be between terminals 4 and 6.  
Replace a faulty relay; do not attempt to adjust or repair it.
- (3) Either relay can operate in either socket. If the operation of the preheat relay is suspected, interchange it with the non-fire relay and operate the heater. If ignition takes place, the relay originally in the preheat circuit is defective. If ignition does not take place, continue testing the relays and the other circuits.

c. *Ignition Coil Assembly* (fig. 23.)

- (1) If ignition troubles occur, inspect the ignition coil assembly (25) for a corroded high-tension terminal socket or a crazed high-tension cable. Test the coil with standard coil testing equipment, using voltage stamped in the coil case. If it is defective, replace the coil. Do not attempt to repair a faulty coil.
- (2) To replace the ignition coil assembly, loosen the clamp that secures the shield (15) to the ignition coil, remove the shield, and disconnect the wires. Loosen the screw on the coil mounting clamp (16); remove the coil assembly. When installing the coil assembly, connect the wires as indicated in figure 21.

d. *Fuel Regulator Valve and Nozzle Assembly*. If faulty fuel regulator operation is suspected, remove the regulator valve and nozzle assembly and test for correct fuel flow.

- (1) Regulator valve and nozzle assembly removal.

- (a) Remove the control head assembly (para 23a).
- (b) Remove the adapter tee (17, fig. 23) and the elbow (18) from the fuel regulator valve. Remove the pipe plug (18, fig. 22) from the adapter tee and unscrew the nozzle assembly (19) from the tee.
- (c) Disconnect the wires at the terminals of the regulator valve. Remove the two screws (23, fig. 23) fastening regulator valve (19) to the control head base (20).

- (2) Test regulator valve and nozzle assembly.

- (a) Install a tee with pressure gage in the regulator valve outlet port. To this tee, install the adapter tee with the nozzle assembly. Connect a fuel supply capable of supplying a steady flow of fuel under constant pressure of 3 to 5 psig to the regulator valve inlet port. Connect the fuel tube (15, fig. 22) to the adapter tee, and make provisions to catch the fuel flow in a measuring graduate (approximately 50-100 ml).
- (b) Connect a power supply of proper voltage to both sides of regulator valve and make provision to energize one or both sides of the valve.
- (c) Operate the test setup to energize the shut-off valve (nameplate end) of the regulator valve and to supply fuel to the system. The fuel flow should be between 40 and 48 cc/min at a pressure of, 2 + 0.2 psi. Break the circuit and the fuel flow should stop immediately.
- (d) Connect both sides of the regulator valve to the power supply and 12



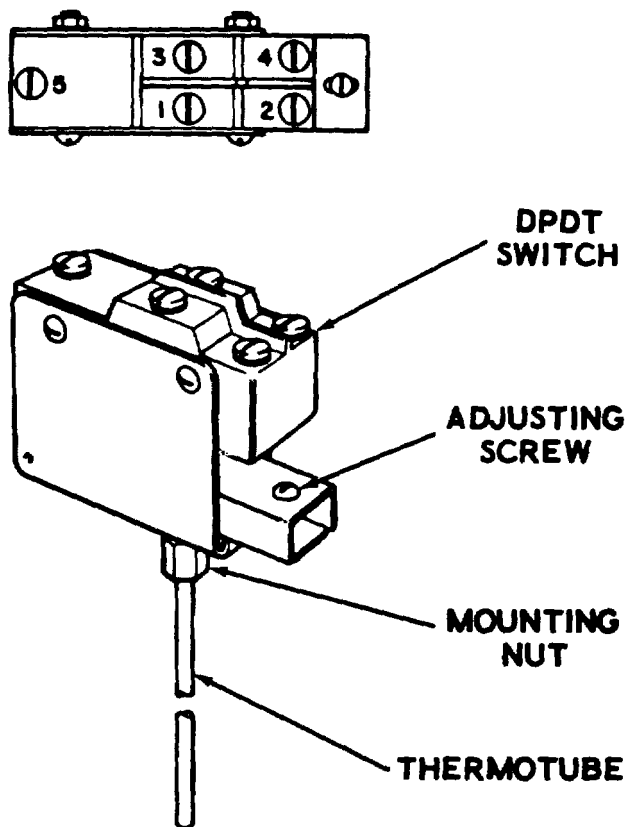
- note the fuel flow and pressure. The fuel flow should be between 27 and 33 cc/min at a pressure of 140.15 psi. Break the circuit and the fuel flow should stop immediately.
- (e) If outlet pressures do not conform to specification, or fuel flow does not stop when the circuit is broken, the fuel regulator valve is faulty and should be replaced.
  - (f) If outlet pressures do conform, but the fuel flow is lower than specified during tests, the nozzle assembly is clogged. Clean the passages of the nozzle assembly with compressed air only. Do not attempt to clean the fuel regulator with any type of instrument.
  - (g) If outlet pressures do conform, but fuel flow is higher than specified during tests, replace a faulty assembly.
- (3) Install fuel regulator valve and nozzle assembly.

- (a) Position the fuel regulator valve (19, fig. 23) on the control head base (20) and fasten with two screws (23). Connect wires as shown in wiring diagram (fig.2)
- (b) Place the nozzle assembly (19, fig. 22) in the adapter tee (17, fig. 23) and insert pipe plug (18, fig. 22).
- (c) Install the elbow (18, fig. 23) and the adapter tee on the outlet port of the fuel regulator valve.
- (d) Attach the nut (16, fig. 22), sleeve (17), and fuel tube (15) to the adapter tee. Install the control head assembly (para 93).

## 85. Flame Switch

*a. Removal.* Disconnect the wires from the terminals of the flame switch (11, fig. 22). Unscrew the flame switch mounting nut and remove the flame switch.





MEC 4210-205-35/3-7 C1

Figure 24. Flame switch adjustment.

*b. Flame Switch Adjustment (fig. 24.)*

- (1) The adjusting screw is a spring-loaded screw at the open end of the switch frame. It adjusts the travel of the actuating pin of the switch.
- (2) With the flame switch at room temperature, loosen the adjusting screw until a distinct click is heard. Then tighten the screw until a second click occurs. At this point continue to tighten for three-eighths of a turn to correctly position the adjusting screw.

*c. Flame Switch Test.*

- (1) At room temperature, check for continuity across terminals 2 and 4 and terminals 2 and 5 (fig. 24) with an ohmmeter. If continuity exists, continue the test.
- (2) Apply heat to the flame switch tube. The switch should change to hot position at 400° to 500°F. Continuity should now be across terminals 1 and 2 and terminals 1 and 5. Allow the tube to cool. The switch should return to cold position at 200° 300°F.
- (3) If a correctly adjusted switch does not meet these requirements, replace the flame switch.

*d. Flame Switch Installation.* To install the flame switch (11, fig. 22), position the switch in the control head; secure with the mounting nut. Connect the wiring as indicated in figure 81.



## 86. Contact Plate

a. *Inspect Contact Set.* Disassemble the heater to provide access to the contact plate. Clean the contacts with fine sandpaper. If the contacts are burned or deeply pitted and are difficult to clean, replace both the contact set and the capacitor, since the capacitor probably caused the faulty contact condition. Adjust contact as described in paragraph c below.

b. *Replace Contact Set and Capacitor.*

- (1) Loosen the terminal nuts (40, fig. 22) and disengage the capacitor lead wire from the terminal. Remove the capacitor mounting screw (57) and remove the capacitor bracket (59) and capacitor.
- (2) Disengage the contact spring from the terminal screw (69), and lift the movable (top) contact from the pivot pin. Remove the screw (47) and washer (46), and then

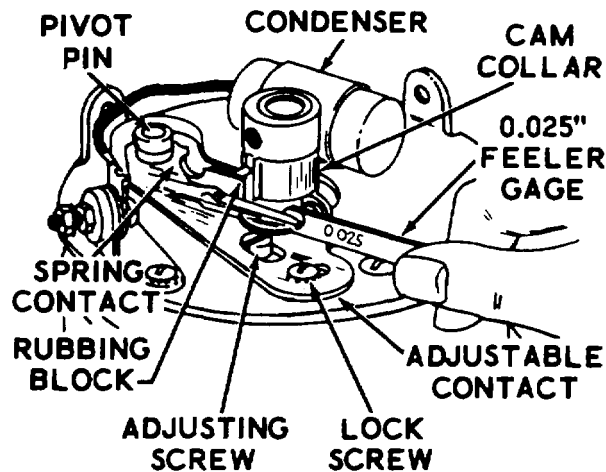
remove the adjustable (bottom) contact from the pivot pin.

- (3) To install the contact set (45), put the adjustable contact on the pivot pin and fasten to the contact plate (42) with screw (47) and washer (46). Place the movable contact on the pivot pin and press down, inserting the spring on the terminal screw (69) between the flat brass washer (70) and the head of the terminal screw (69).

**Note.**

**Be sure to place the rubbing block of the movable contact between the two teeth on the brass cam collar.**

- (4) Secure the capacitor to the contact plate with the capacitor bracket (59), screw and washer (57 and 58). Engage the capacitor lead wire with the terminal between the contact spring and brass washer. Tighten the terminals nuts (40).



MEC 4210-205-35/3-8 C1

Figure 25. Contact plate gap adjustment.

c. *Contact Gap Adjustment (fig. 25).*

- (1) With the cam and contact plate assembled to the motor, rotate the motor shaft until the movable contact is at the high point of the cam. Make sure the

rubbing block of the movable contact is between the teeth of the cam collar. At this position, an 0.025-inch feeler gage should just pass between the contacts.

- (2) If the gap needs adjusting, loosen the adjustable contact mounting screw



and position the stationary contact to correct the contact gap. Tighten the mounting screw.

d. Contact Plate Reassembly. Install contact plate on the blower motor as instructed in paragraph 90.

#### **87. Blower, Burner, and Combustion Chamber Disassembly**

To disassemble the combustion air blower, burner, and combustion chamber, remove the assembled parts as described in paragraph 83. Disassemble as follows:

a. Remove four nuts (65, fig. 22) fastening the combustion blower assembly (63) to the combustion chamber; remove the blower assembly.

b. Insert a screwdriver through the shell intake opening; loosen the special screw (37) and remove the fan (38).

c. Disconnect the lead wire at the contact plate terminal. Remove the three screws (55) and the contact plate cap (54). Remove the screws and lock washers joining the contact plate assembly, motor, and shell. Remove the contact plate assembly and the two spacers (68); on the opposite end of the motor, remove the combustion air intake shell (77).

d. Remove setscrew (56), and remove the bushing (44), cam collar (43), and contact cam (67) from the motor shaft.

e. To remove the burner assembly from the combustion chamber, remove the union (5), union seal washer (6), union seal (7), and gasket (8), extending from the burner fuel connector. Remove the nut (20), lead wire, washer (32), insulator washer (33), post insulator (34), connector band (35), and screw (39) from the combustion chamber.

f. Remove the screw (24) and washer (23) from each side of the combustion chamber; then remove the burner (28).

g. The preheater (30) is threaded to the burner; unscrew to remove the preheater and gasket (29). Remove the preheater nut (36) to remove the connector band (35) from the preheater.

#### **88. Cleaning and Inspection of Burner Parts.**

a. Use a cloth dampened with solvent, and dry, compressed air to clean accumulated dirt from all heater parts. Scrape carbon deposits and other foreign materials caused by combustion, being careful to avoid damaging the ceramic wick. Clean air ports thoroughly to remove all accumulations of carbon, or restrictions.

b. Inspect burner and blower parts, combustion chamber, and casing for cracked, burned, dented or otherwise damaged condition. Replace faulty parts

#### **89. Blower Motor Test**

Reassemble the blower assembly to test the motors. Connect a power supply of proper voltage to the assembly and operate the motor. Check motor speed with a stroboscope. The motor speed should be a minimum of 6,500 rpm. Replace this motor if it does not meet this requirement.

#### **90. Blower, Burner, and Combustion Chamber Reassembly**

a. To assemble the blower, burner, and the combustion chamber, position the gasket (29, fig. 22) on the preheater (30), and screw the heater onto the burner assembly (28).

b. Insert the post insulator (34) into the opening on the combustion chamber. Attach the connector band (35) to the post insulator with a brass screw (39) Inserted from inside the combustion chamber. Position the insulator washer (33), flat washer (32), and control head lead on the screw; secure with a nut (20).

c. Insert the burner assembly into the combustion chamber (1). Align the burner brackets with the screw holes in the combustion chamber sides, and fasten with two screws (24) and washers (23), holding the burner in place against the throat of the combustion chamber. Secure the connector band (35) to the terminal of the preheater (30) with the preheater nut (36).

d. Install the gasket (8), union seal (7), union seal washer (6), and union (5) on burner fuel feed connector.



e. Apply several drops of light oil on the cam collar (43). Position the cam collar and the cam bushing (44) on the contact can (67). Align the holes of the contact cam and the cam bushing, and install the setscrew (56) just far enough to hold the parts together. Position the cam assembly on the motor shaft so that the setscrew is aligned with the flat on the motor shaft, and tighten the setscrew. Make sure that some clearance exists between the motor and the cam assembly.

f. Insert the screws and lockwashers through the contact plate (42), and place the spacers (68) on threaded end of the screws.

Insert the screws straight through motor (66). Make sure the teeth of the cam collar (44) engage the rubbing block of the movable contact. Position the shell assembly (77) on the opposite end of motor, and attach with the two screws inserted through the motor into the tapped holes of the shell.

g. Install the contact plate cap (54) over the cam assembly and the contact plate assembly, and fasten with three screws (55). Connect the lead wire from the ignition coil to the contact plate terminal.

h. Place the fan (38) on the motor shaft and adjust the mounting position to allow approximately 1/16-inch clearance between shell and fan. Tighten setscrew (37) with a screwdriver inserted through the shell intake opening to secure fan to motor shaft. Make sure the setscrew is aligned with the flat on the motor shaft.

i. Position the combustion air blower assembly (63) on four combustion chamber studs. Apply a coat of "Permatex Form-A-Gasket, Aviation Grade No. 3" or equivalent for se-ling. Fasten with the four nuts (65). Rotate motor shaft slowly to make certain the fan does not hit any stationary parts.

## 91. Casing Reassembly

a. Place the casing (53, fig. 22) over the assembled blower, burner, and combustion chamber, passing the three lead wires through the grommet (48). Fasten together the edges of the casing with screws provided.

b. Fasten the casing to the combustion chamber with four screws (50). Install the combustion air seal (62) on the intake port of the blower shell.

c. Install intake cover (52) and fasten with three screws (49).

d. Position the heater mounting base assembly (75) on the casing and the combustion chamber, and fasten to the casing with two screws (76).

e. Install the seal (27), washer (26), and spark plug (25) on the burner.

## 92. Limit Switch Installation

Position the limit switch (2, fig. 22) on the combustion chamber. Place the switch retainer (3) on the switch and fasten to the weld nuts on the combustion chamber with two screws (4). Connect the lead wires to the switch.

## 93. Control Head Installation

a. Position the control head assembly (21, fig. 22) on the heater, and fasten to the casing with the screw (9) and to the combustion chamber stud with the nut (20).

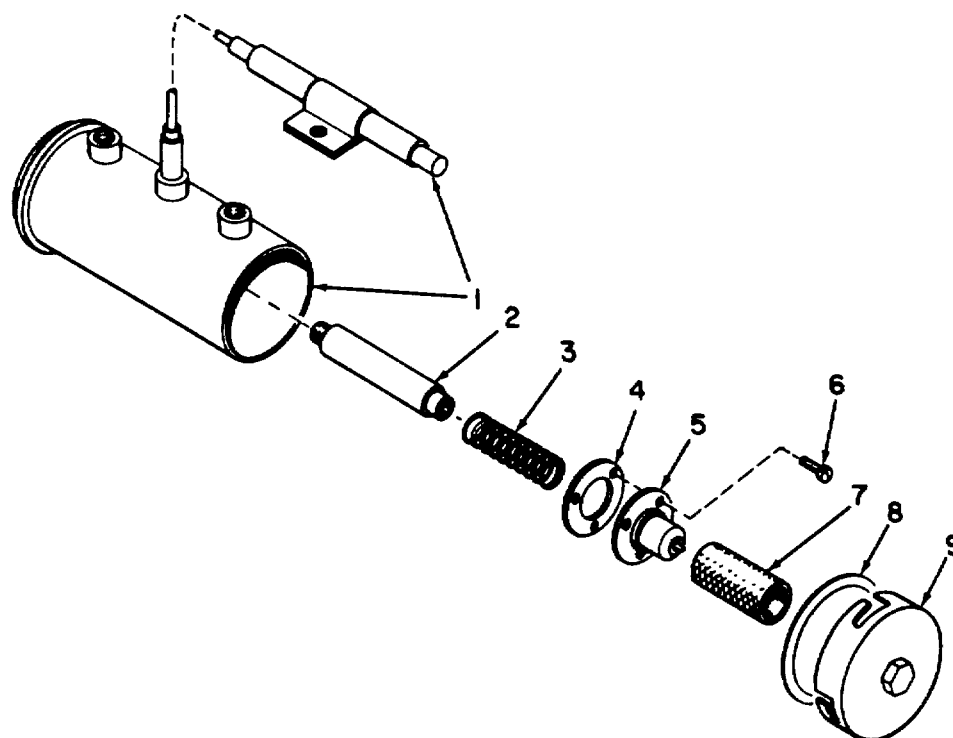
b. Insert the tube of the flame switch (11) into the flame switch support tube of the combustion chamber and tighten the mounting nut. Connect the wires as indicated in the wiring diagram (fig. 21).

c. Connect the fuel tube (15, fig. 22) to the metering tee and union with sleeves (17) and nuts (16).

d. Connect the primary lead wires of the coil shield and connect the high-tension wire to the spark plug, as indicated in the wiring diagram (fig. 21).

e. Install the cover (13, fig. 22) and fasten with the two screws (12).





MEC 4210-205-35/3-9 C1

1 Pump assembly  
2 Plunger  
3 Spring

4 Gasket  
5 Cup  
6 Screw

7 Screen  
8 Gasket  
9 Cover assembly

**Figure 26. Fuel pump assembly.**

## 94. Fuel Pump

operate satisfactorily, replace the pump assembly.

### a. Fuel Pump Test.

- (1) With the fuel pump assembled, connect a power supply of proper voltage to the fuel pump, making sure to check for proper polarity. Connect a fuel supply to the fuel pump. Connect a liquid pressure gage to the output port and operate the pump. Observe the fuel discharge pressure. The pump should discharge at 3 to 5 psig.
- (2) If the pump does not operate satisfactorily, disassemble, and inspect the screen (7, fig. 26) for clogging. If the screen is clean and the pump does not

### b. Fuel Pump Disassembly.

- (1) Give the cover (9) one-quarter turn counterclockwise, using a wrench on the cover nut to remove it from the bottom of the pump. Carefully remove the screen (7).
- (2) If further pump disassembly is required, remove screws; lift out the cup (5), gasket (4), spring (3), and the plunger assembly (2). Do not disassemble the plunger assembly or the pump assembly.



*c. Cleaning and Inspection.*

- (1) Immerse the screen (7) and the cover (9) in cleaning solvent; flush carefully.
- (2) Clean dirt and dust particles from other pump parts, using dry, compressed air, carefully applied.
- (3) Check the screen (7) for distortion and damage.
- (4) Check all the parts for cracks, distortion, signs of overheating, and damaged threads.

*d. Fuel Pump Reassembly.*

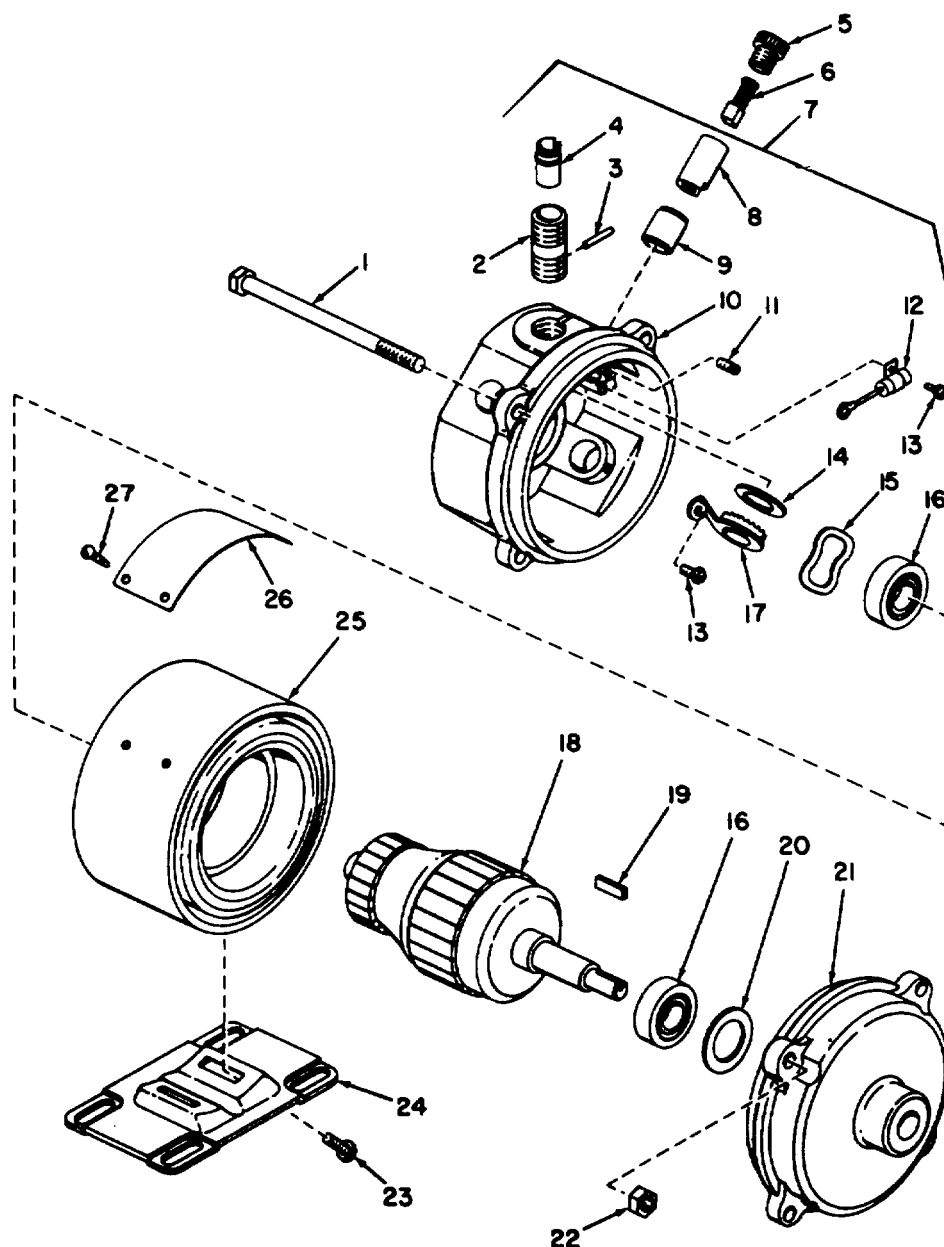
- (1) Insert the plunger assembly (2) in the pump assembly (1). Check the fit of the plunger by slowly raising and lowering the

plunger in the pump cylinder. The plunger assembly should move freely without binding or sticking. A click will be heard each time the plunger approaches the top of the cylinder.

This indicates that the pump interrupter system is operating properly.

- (2) Insert the spring (3), gasket (4), and cup (5) into the housing; secure with the screws.
- (3) Place the gasket (8) on the cover (9) and seat the screen (7) in the cover. Assemble these parts to the pump, being careful to guide the screen around the cup. Use a wrench on the cover nut and turn the cover one-quarter turn clockwise to secure it to the housing.





MEC 4210-205-35/3-10 C1

1 Screw	6 Brush	11 Setscrew	16 Bearing	20 Washer	24 Base
2 Nipple	7 End bell assembly	12 Capacitor	17 Arm	21 End bell	25 Stator
3 Pin	8 Holder	13 Screw	18 Armature	22 Nut	26 Plate
4 Insulator	9 Insulator	14 Washer	19 Key	23 Screw	27 Screw
5 Cap	10 End bell	15 Washer			

Figure 27. Liquid pump drive motor.



## 95. Liquid Pump Drive Motor

Disassemble as shown in figure (27). Replace all defective parts.

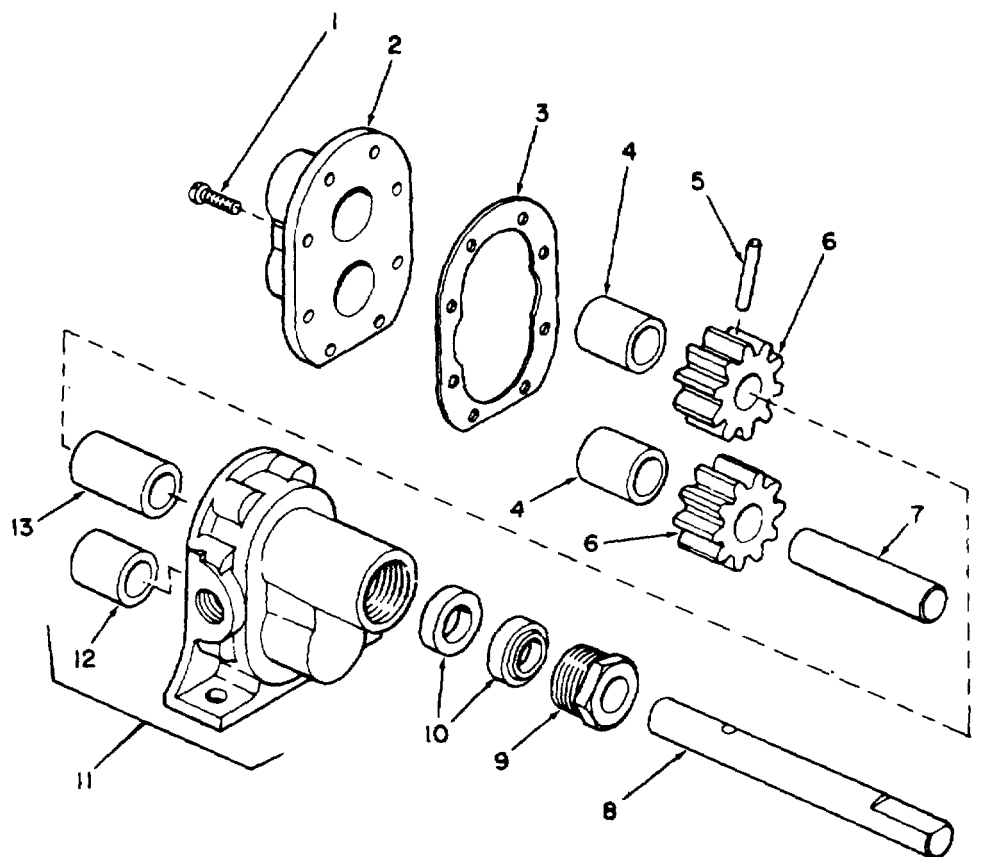
## 96. Liquid Circulating Pump

(fig. 28)

Repair of the pump is limited to replacement of the shaft packing.

## 97. Personnel Heater

- a. Disconnect inlet hose (4, fig. 19) at valve (28).
- b. Disconnect outlet hose (1) at the engine.
- c. Allow the fluid to drain from the heater.
- d. Disassemble the heater as shown in figure 29.



MEC 4210-205-35/3-11 CI

1 Screw  
2 Cover  
3 Gasket

4 Bushing  
5 Pin  
6 Gear

7 Shaft  
8 Shaft  
9 Nut

10 Packing  
11 Body assembly

12 Bushing  
13 Bushing

Figure 28. Liquid circulating pump.



## **98. Space Heating System**

### **99. Space Heater**

Repair procedures for the space heater are similar to the procedures described in paragraph 81 with the following exceptions. Refer to figure 31 for electrical schematic.

#### **100. Circulating Air Blower Removal and Disassembly**

a. Remove the three screws (50, fig. 30) and the intake cover (48) from the casing. After removing the three screws (50), remove the circulating air blower assembly (48) from the casing. Withdraw the wire through the rubber grommet (23) in the casing during removal. If the control head has not been removed, disconnect the wire at its terminal in the control head.

b. Loosen the setscrew (45) and remove the fan (52) from the motor shaft. Insert a screwdriver through the motor clamp assembly to loosen clamp screw (46). Remove the motor (47) from the motor clamp (51).

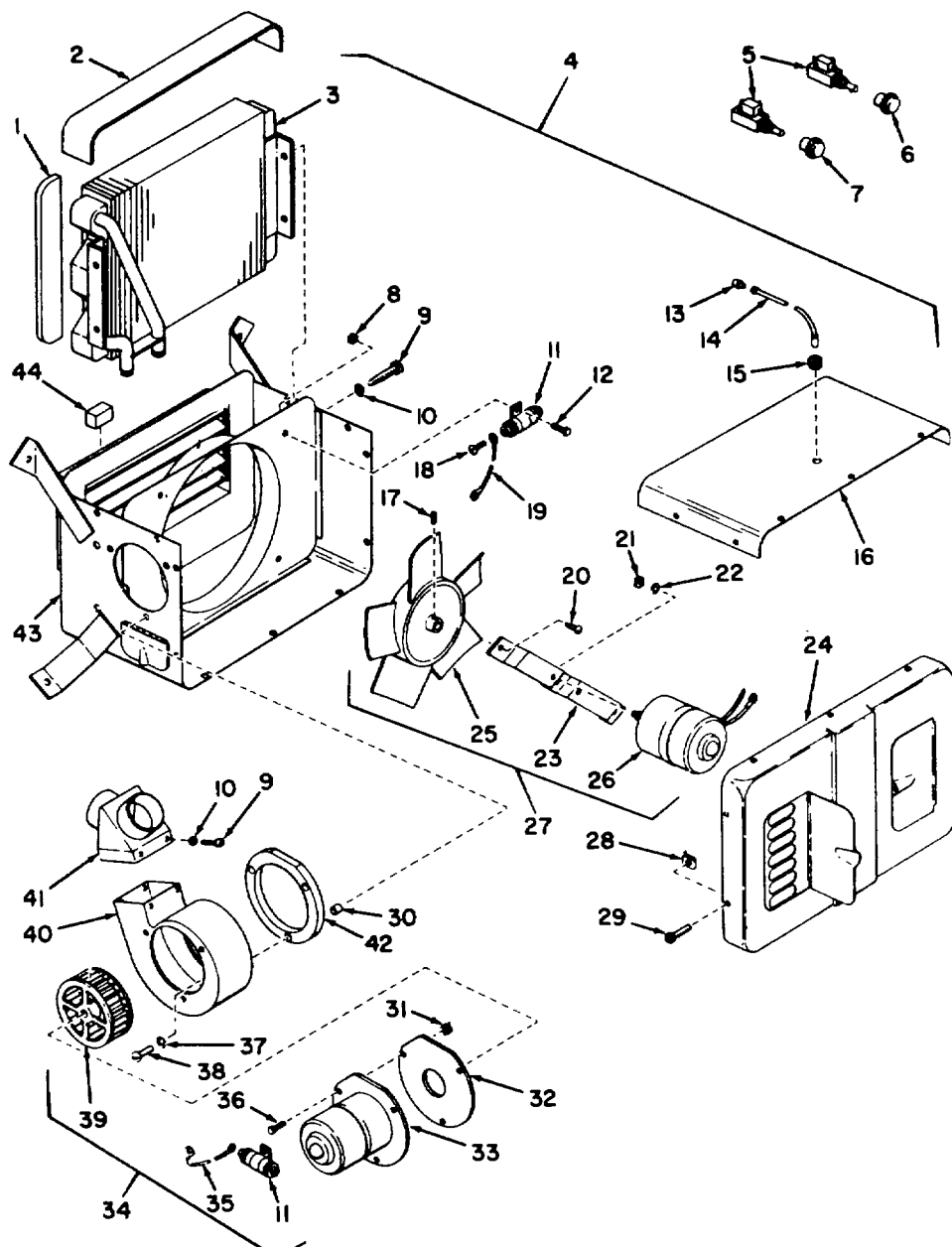
#### **101. Casing Disassembly**

a. Remove the spark plug assembly (6), spark plug seal washer (7), and spark plug seal (8) from the burner.

b. Remove the four screws (79) attaching the heater mounting base assembly (80) to the casing; remove the base assembly.

c. Remove the seals (81) from the combustion air ports, and the five screws (24) fastening the casing assembly (1). Spread the casing apart at the Joint and remove the combustion air blower assembly (63), burner (40), and combustion chamber (26) as an assembly. Withdraw the wires through the grommets (9) and (23) in the casing during the removal.



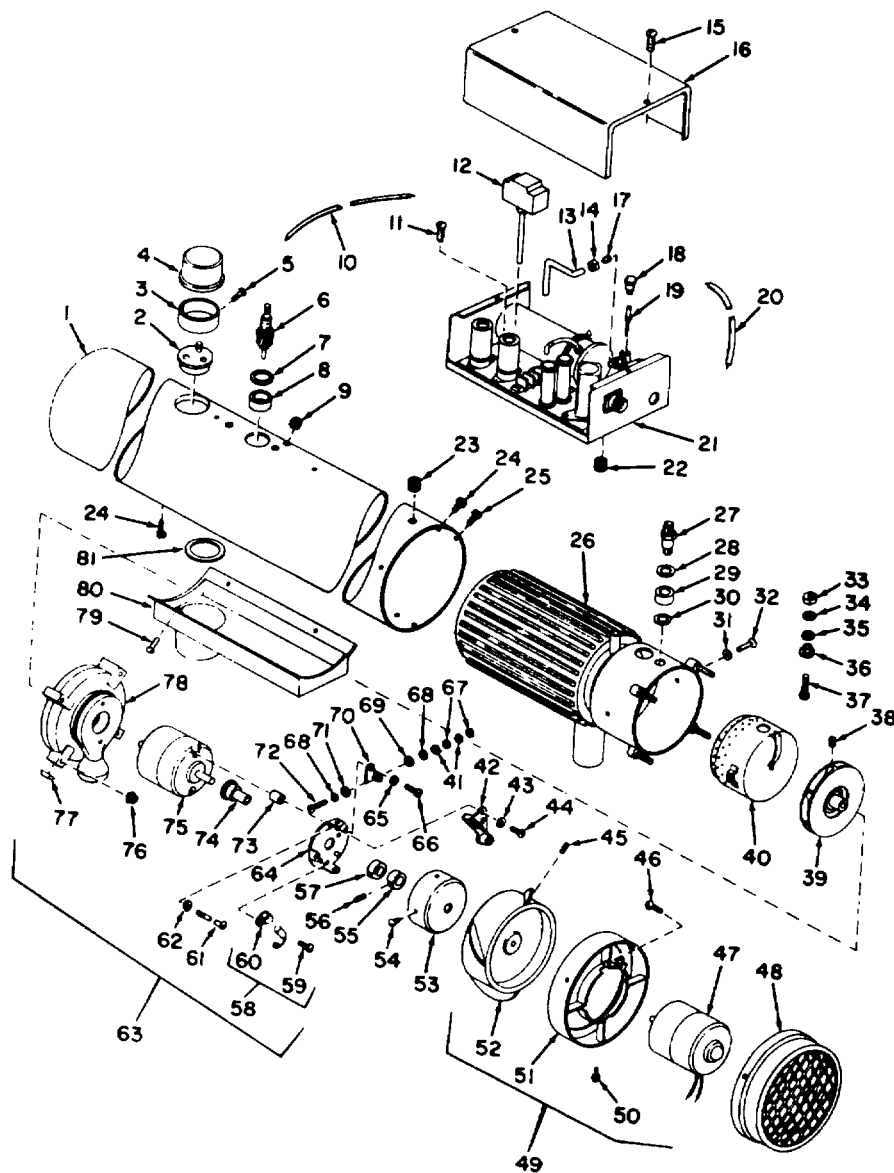


MEC 4210-205-35/3-12 C1

- |          |               |                  |                    |                |
|----------|---------------|------------------|--------------------|----------------|
| 1 Spacer | 10 Washer     | 19 Lead          | 28 Nut             | 37 Washer      |
| 2 Spacer | 11 Suppressor | 20 Screw         | 29 Screw           | 38 Screw       |
| 3 Core   | 12 Screw      | 21 Nut           | 30 Spacer          | 39 Wheel       |
| 4 Heater | 13 Connector  | 22 Washer        | 31 Nut             | 40 Housing     |
| 5 Switch | 14 Lead       | 23 Bracket       | 32 Gasket          | 41 Defroster Y |
| 6 Knob   | 15 Grommet    | 24 Cover         | 33 Motor           | 42 Gasket      |
| 7 Knob   | 16 Panel      | 25 Fan           | 34 Motor and wheel | 43 Housing     |
| 8 Nut    | 17 Setscrew   | 26 Motor         | 35 Lead            | 44 Block       |
| 9 Screw  | 18 Screw      | 27 Motor and fan | 36 Screw           |                |

Figure 29. Personnel heater.





MEC 4210-205-35/3-13 C1

1 Casing	18 Plug	34 Washer	50 Screw	86 Screw
2 Switch	19 Nozzle	35 Insulator	51 Clamp assembly	87 Nut
3 Retainer	20 Lead	36 Insulator	52 Fan	88 Washer
4 Cap	21 Head assembly	37 Screw	53 Cap	89 Insulator
5 Screw	22 Grommet	38 Screw	54 Screw	90 Bracket
6 Spark plug	23 Grommet	39 Fan	55 Bushing	91 Insulator
7 Washer	24 Screw	40 Burner	56 Setscrew	92 Screw
8 Seal	25 Screw	41 Washer	57 Collar	93 Spacer
9 Grommet	26 Chamber	42 Contact set	58 Capacitor and bracket	94 Cam
10 Lead	27 Union	43 Washer	59 Screw	95 Motor
11 Screw	28 Washer	44 Screw	60 Bracket	96 Nut
12 Switch	29 Seal	45 Setscrew	61 Screw	97 Bumper
13 Tube	30 Gasket	46 Screw	62 Washer	98 Shell
14 Nut	31 Washer	47 Motor	63 Blower assembly	99 Screw
15 Screw	32 Screw	48 Cover	64 Plate	100 Base
16 Cover	33 Nut	49 Blower assembly	65 Washer	101 Seal

Figure 30. Space heater assembly.



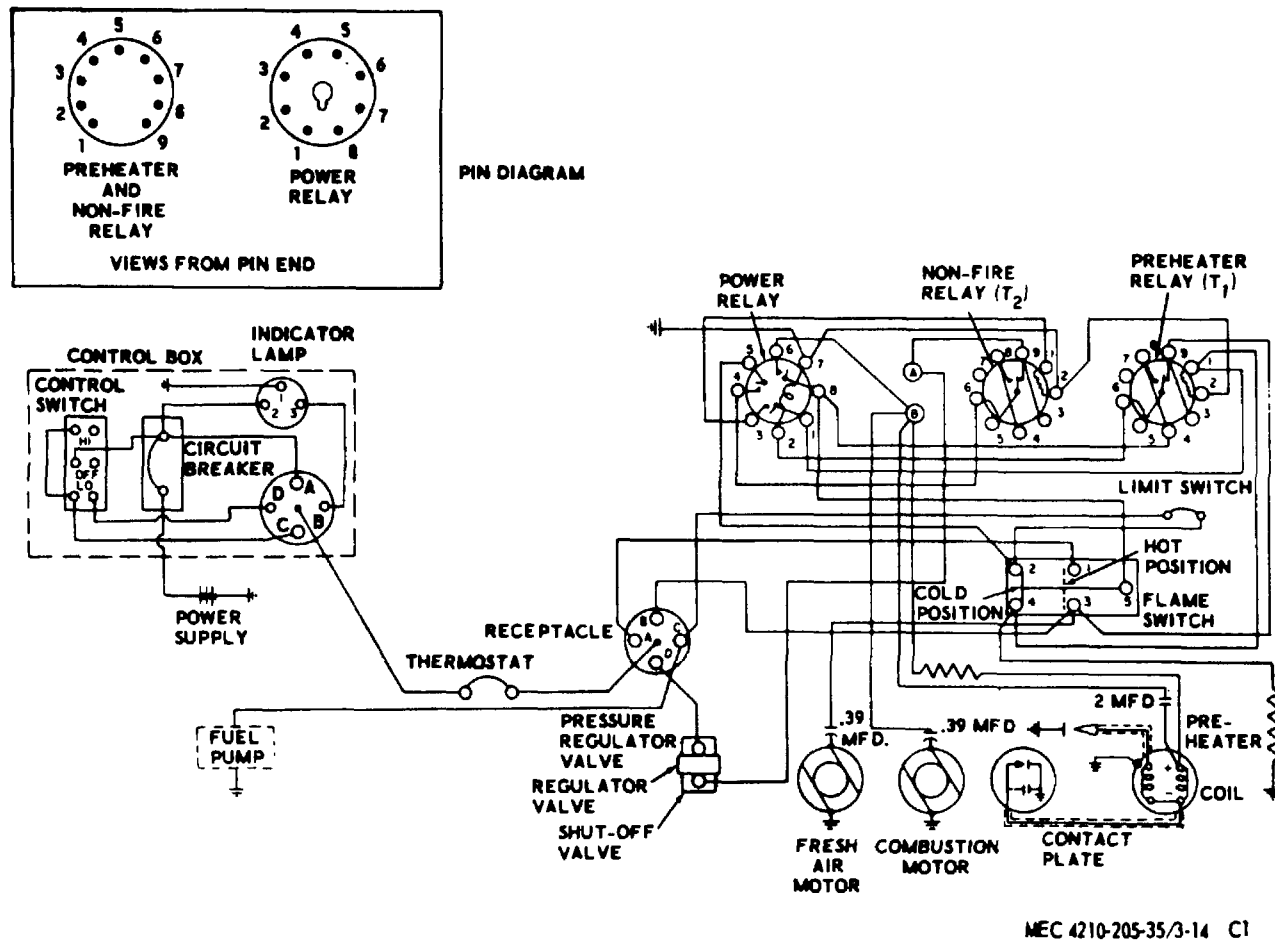


Figure 31. Space heater wiring diagram.



## 102. Test Regulator Valve and Nozzle Assembly

a. Install a tee with the pressure gage in the regulator valve outlet port. To this tee, install the adapter tee with nozzle assembly. Connect a fuel supply capable of supplying a steady flow of fuel under constant pressure of 3 to 5 psig to the regulator valve inlet port. Connect the fuel tube (13, fig. 30) to the tee and allow the fuel to flow into a measuring graduate (approx. 50-100 ml).

b. Connect the nominal voltage power supply to both sides of the regulator valve and make provision to energize one or both sides of the valve.

c. Operate the test setup to energize the shut-off valve (nameplate end) of the regulator valve and to supply fuel to the system. The fuel flow should be within the limits shown in the fuel regulator valve test chart below for the model heater tested. Break the circuit, and the fuel flow should stop immediately.

	Fuel Flow	Pressure	Fuel Flow	Pressure
	(cc/min)	(psig)	(cc/min)	(psig)
Minimum	22	$2 \pm 0.2$	14.5	$1 \pm 0.15$
Maximum	28		19.5	

**Figure 32. Fuel regulator valve test limits.**

d. Connect both sides of the regulator valve to the power supply and note the fuel flow and pressure. The fuel flow and pressure should be within the limits shown in figure 32. Break the circuit, and the fuel flow should stop immediately.

e. If outlet pressures do not conform to specification or fuel flow does not stop during test, the fuel regulator valve is faulty and should be replaced.

f. If outlet pressures do conform but the fuel flow is lower than specified during tests, the nozzle assembly is clogged. Clean the passages of the nozzle assembly with air. Do not attempt to clean the regulator with any type of instrument.

g. If outlet pressures do conform, but fuel flow is higher than specified during tests, replace a faulty nozzle assembly.

## 103. Install Fuel Regulator Valve and Nozzle Assembly

a. Position the fuel regulator valve (19, fig. 23) on the control head base (20) and fasten with two screws (23). Connect wires as shown in the wiring diagram. (fig. 31.)

b. Install the nozzle assembly (19, fig. 30) in the adapter tee (17, fig. 23) and insert the pipe plug (18, fig. 30).

c. Install the elbow (18, fig. 23) and the tee on the outlet port of the fuel regulator valve.

d. Attach nut (14, fig. 30), sleeve (17) and fuel tube (13) to the adapter tee. Install the control head assembly.

## 104. Flame Switch

Refer to paragraph 85.

## 105. Contact Plate

Refer to paragraph 86.

## 106. Blower Motor Test

Reassemble the blower assembly to test the motors. Connect a 24 vdc power supply to the assembly and operate the motor. Check the motor speed with a stroboscope. Minimum s allowed is: 5,000 rpm circulating motor; 6,500 rpm, combustion motor.

## 107. Blower, Burner and Combustion Chamber Reassembly

a. To assemble the blower, burner, and combustion chamber, insert the burner assembly (40, fig. 30) into the combustion chamber. Align the burner brackets with the screw holes in the combustion chamber sides and fasten in place with two washers (31) and screws (32), being careful to hold the burner in place against the throat of the combustion chamber.

b. Attach the preheater lead of burner to the post insulator (36) with the brass screw 26



(37) inserted from in Ride the combustion chamber assembly (26). Attach the insulator washer (35), flat washer (34), and nut (33) to the screw and tighten.

c. Install the gasket (30), union seal (29), union seal washer (28), and union (27) on the burner fuel feed connector.

d. Apply several drops of light oil on the cam collar (57). Position the cam collar and the cam bushing (55) on the contact cam (74). Align the holes of the contact cam and the cam bushing and install the setscrew (56) just far enough to hold the parts together. Position the cam assembly on the motor shaft so that the setscrew is aligned with the flat on the motor shaft. Tighten the setscrew. Make sure that some clearance exists between the motor and the cam.

e. Insert the screws (61) and lockwashers (62) through the contact plate (64) and place the spacers (73) on the threaded end of the screws. Insert the screws straight through the motor (75). Make sure that the teeth of the cam collar (57) engage the rubbing block of the movable contact. Position the combustion air shell assembly (78) on the opposite end of the motor and attach by turning the two screws inserted through the motor into the tapped holes of the shell.

f. Install the contact plate cap (53) over the contact plate assembly and fasten with three screws (54).

g. Place the fan Assembly (39) on the motor shaft and adjust the mounting position to allow approximately 1/16-inch clearance between the shell and the fan. Tighten the special screw (38) with a screwdriver inserted through the shell intake opening to secure the fan to the motor shaft. Make sure the special screw is aligned with the flat on the motor shaft.

h. Position the combustion air blower assembly (63) on the four combustion chamber studs. Apply a coat of "Permatex Form-A-Gasket, Aviation Grade No. 3," or equivalent for sealing; fasten with nuts (76). Rotate motor shaft slowly to check for free rotation.

## **108. Casing Reassembly**

a. Spread the casing (1, fig. 30); install the assembled combustion blower, burner, and combustion chamber into the casing, passing the lead wires from the preheater, ignition coil, and the combustion blower

motor through the grommet. Connect the lead from the ignition coil to the terminal on the contact plate (64).

b. Install the exhaust tube seals (81) around the combustion air ports and fasten together the edges of the casing with screws (24). Install the spark plug seal (8), spark plug seal washer (7), and the spark plug assembly (6) into the burner.

c. Position the heater mounting base assembly (80) at the bottom of the casing and fasten with four screws (79).

## **109. Circulating Air Blower Reassembly**

a. Place the motor (47, fig. 30) within the motor clamp assembly (51), allowing the front of the motor to extend approximately 1/16-inch beyond the clamp assembly. Insert a screwdriver through the clamp shell to tighten the screw (46).

b. Place the fan (52) on the motor shaft and adjust the mounting position to allow approximately 1/16-inch clearance between the fan and motor hub. Tighten the setscrew (45) to secure the fan to shaft.

c. Rotate the motor shaft to check for free rotation.

d. Insert the circulating air blower assembly (49) through air intake, first passing the lead wire through the grommet (23). Fasten the assembly to the casing with three screws (50).

## **110. Fuel Pump**

Refer to paragraph 94.

## **111. Motor-Generator Set**

See figure 33 for disassembly sequence. An electrical schematic is supplied in figure 34 for electrical connections.

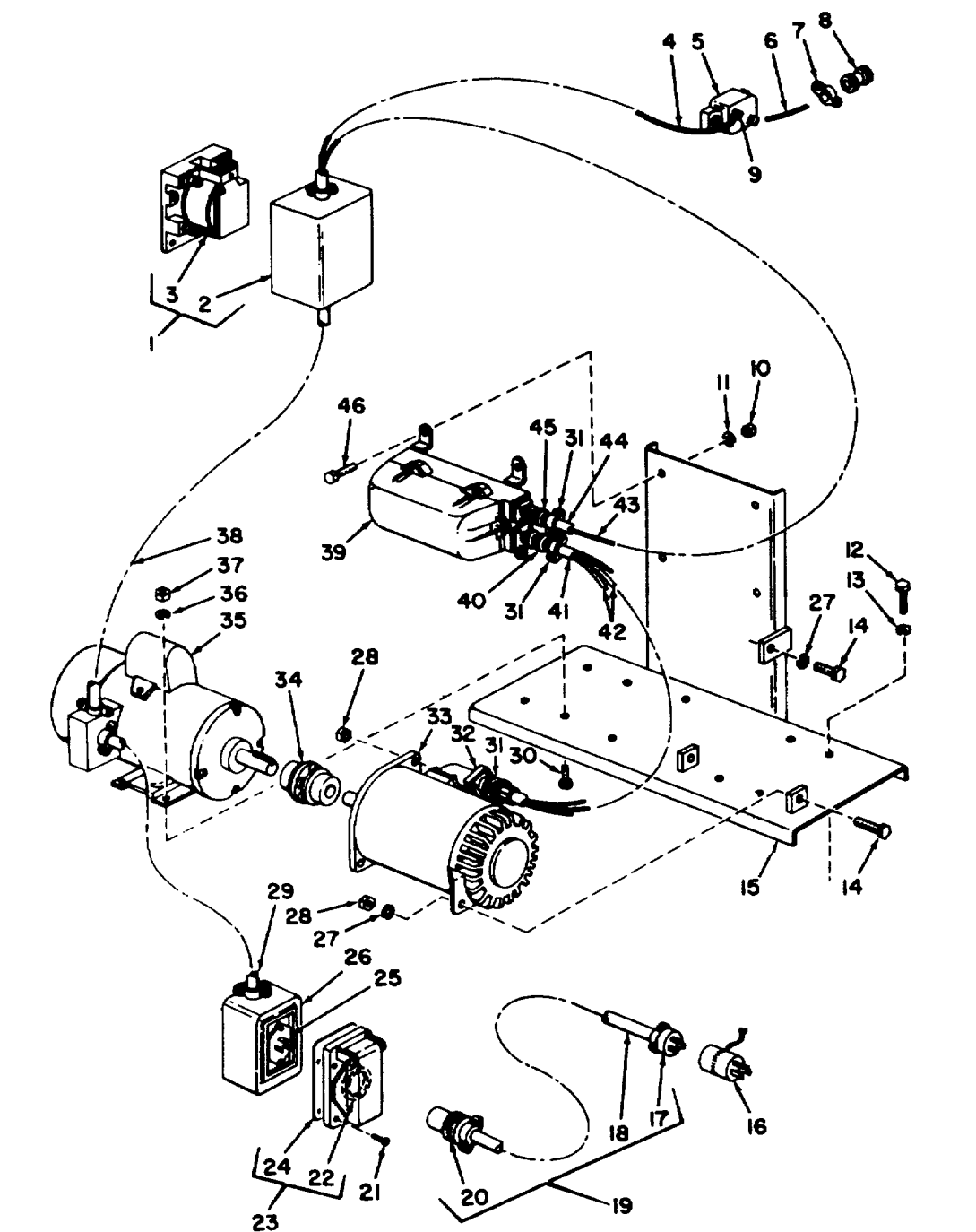
## **112. Generator**

Refer to TM 9-2920-209-35 for maintenance instructions.

## **113. Generator Drive Motor**

Disassemble the motor as shown in figure 35. Replace all defective parts.



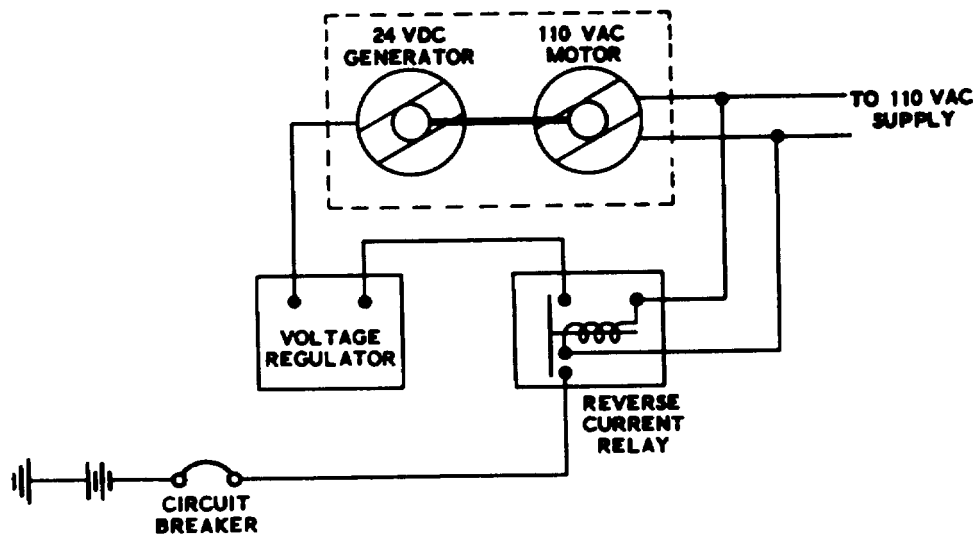


MEC 4210-205-35/3-16 C1

- |                   |                   |                 |              |              |
|-------------------|-------------------|-----------------|--------------|--------------|
| 1 Relay assembly  | 11 Washer         | 20 Connector    | 29 Cable     | 38 Cable     |
| 2 Inclosure       | 12 Screw          | 21 Screw        | 30 Screw     | 39 Regulator |
| 3 Relay           | 13 Washer         | 22 Gasket       | 31 Clamp     | 40 Connector |
| 4 Lead            | 14 Screw          | 23 Cover        | 32 Connector | 41 Loom      |
| 5 Circuit breaker | 15 Base           | 24 Gasket       | 33 Generator | 42 Lead      |
| 6 Lead            | 16 Adapter        | 25 Connector    | 34 Coupling  | 43 Lead      |
| 7 Clamp           | 17 Connector      | 26 Junction box | 35 Motor     | 44 Loom      |
| 8 Connector       | 18 Cable          | 27 Washer       | 36 Washer    | 45 Connector |
| 9 Terminal        | 19 Cable assembly | 28 Nut          | 37 Nut       | 46 Screw     |
| 10 Nut            |                   |                 |              |              |

Figure 33. Motor-generator set.

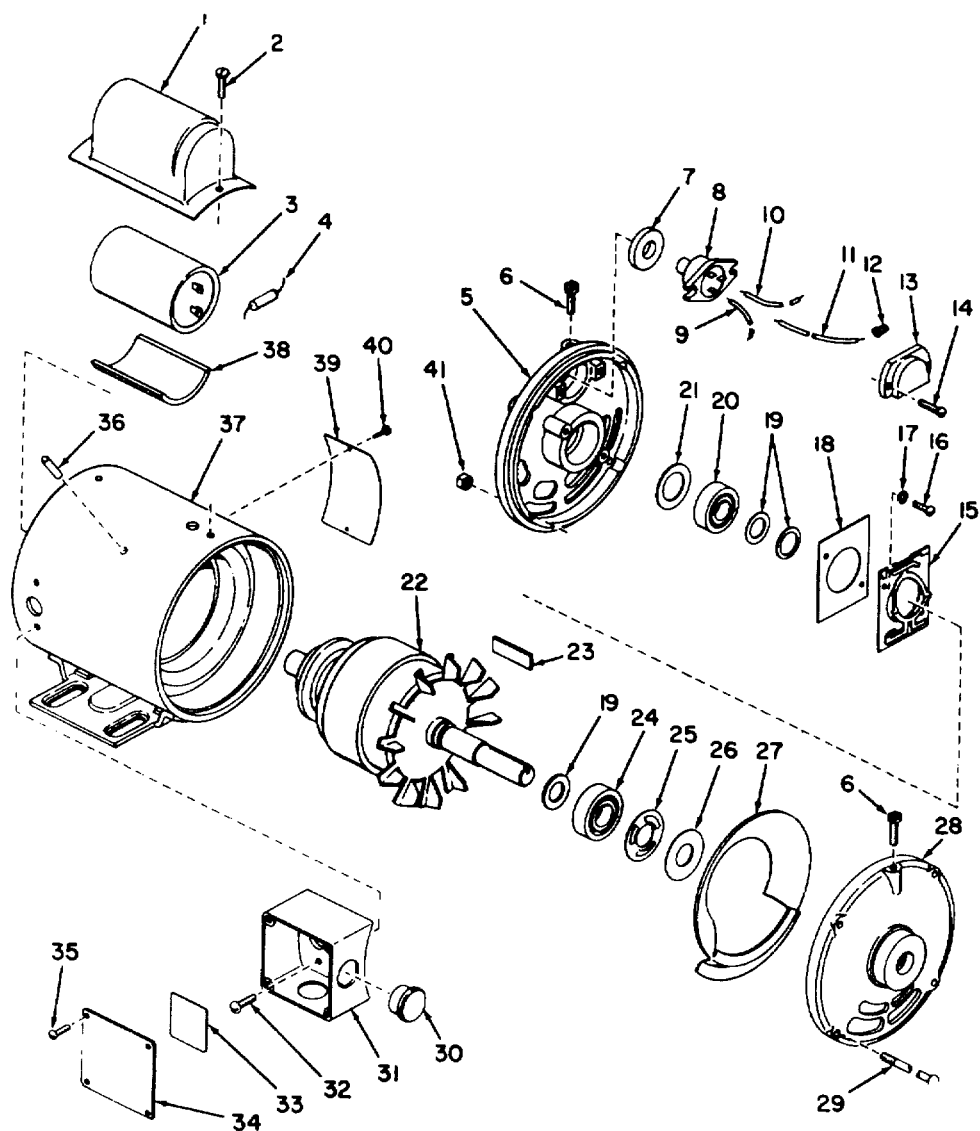




MEC 4210-205-35/3-17 C1

Figure 34. Motor-generator set wiring diagram.





MEC 4210-205-35/3-18 C1

- |             |              |               |                 |           |
|-------------|--------------|---------------|-----------------|-----------|
| 1 Cover     | 10 Lead      | 18 Insulation | 26 Deflector    | 34 Cover  |
| 2 Screw     | 11 Lead      | 19 Washer     | 27 Baffle       | 35 Screw  |
| 3 Capacitor | 12 Connector | 20 Bearing    | 28 End bell     | 36 Pin    |
| 4 Resistor  | 13 Shield    | 21 Deflector  | 29 Screw        | 37 Stator |
| 5 End bell  | 14 Screw     | 22 Rotor      | 30 Cover        | 38 Pad    |
| 6 Screw     | 15 Switch    | 23 Key        | 31 Junction box | 39 Plate  |
| 7 Gasket    | 16 Washer    | 24 Bearing    | 32 Screw        | 40 Screw  |
| 8 Relay     |              | 25 Washer     | 33 Label        | 41 Nut    |
| 9 Lead      |              |               |                 |           |

Figure 35. Generator drive motor.



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:*

USS1 (1)  
DCSLOG (1)  
CNGB (1)  
TBG (1)  
CofEngrs (3)  
CC-E (1)  
Dir of Trans (1)  
CofSptS (1)  
USAMB (1)  
USAARTYBD (2)  
USAARMBD (2)  
USAIB (2)  
USAADB (2)  
USAAESWBD (2)  
U8AAVNBD (2)  
USCONARC (3)  
OS Maj Comd (5) except  
    USASETAF (2)  
    USARJ (1)  
USAMOCOM (2)  
MDW (1)  
Armies (2)  
Corps (2)  
Div (2)  
Engr Bde (1)  
Svc Colleges (2)  
Br Svc Sch (2)  
USACDCEC (10)

GENDEP (10)  
Engr Dep (10)  
A Dep (2) except  
    TOAD (3)  
USA Tm1 Comd (2)  
Army Tm1 (1)  
Div Engr (2)  
Dist Engr (2)  
USAERDL (3)  
USAMEC (46)  
Engr Cen (5)  
USAREUR Engr Proc Cen (2)  
USAREUR Engr Sup Con Agcy (10)  
Engr FLDMS (2)  
Ft Knox FLDMS (10)  
Fld Comd, DABA (8)  
AMS (3)  
USAREURCOMZ (2)  
USAC (1)  
MAAG (1)  
JBUSMC (1)  
Units ors under fol TOE:  
    5-48 (2)  
    5-237 (5)  
    5-262 (5)  
    5-267 (2)  
    5-278 (5)  
    5-279 (2)

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

☆U.S. GOVERNMENT PRINTING OFFICE: 1996 - 406-421/52044



TECHNICAL MANUAL

No. 5-4210-205-35

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D.C., 24 September 1964

**DS, GS, AND DEPOT MAINTENANCE MANUAL  
TRUCK, FIREFIGHTING: POWERED PUMPER; FOAM AND WATER, 500-GPM CAP;  
CENTRIFUGAL PUMP, POWER TAKEOFF DRIVEN; 400-GAL WATER TANK,  
40-GAL FOAM CHEMICAL TANK (WARD LAFRANCE MODEL M44A1WLF)  
FSN 4210-225-9127**

---

	Paragraph	Page
CHAPTER 1. INTRODUCTION		
Section I. General .....	1, 2	2
II. Description and data .....	3, 4	2
CHAPTER 2. GENERAL MAINTENANCE INSTRUCTIONS		
Section I. Special tools and equipment .....	5, 6	4
II. Troubleshooting .....	7-13	4
III. Removal and installation of major components or auxiliaries	14, 15	5
CHAPTER 3. REPAIR INSTRUCTIONS		
Section I. Control valves, lines, and fittings .....	16-40	9-12
II. Primer pump assemblies .....	41-47	18-20
III. Water pump assembly .....	48-57	22-24
IV. Hose reel assembly .....	58-61	28
V. Water tank .....	62-65	30-32
VI. Special purpose body, wiring and data plates .....	66-72	32
APPENDIX. REFERENCES .....	----	34
INDEX .....	----	35



# CHAPTER 1 INTRODUCTION

## Section I. GENERAL

### 1. Scope

a. These instructions are published for the use of direct support, general support, and depot maintenance personnel maintaining the Model NM44A1WLF Ward Lafrance Firefighting Truck. They provide information on the maintenance of the equipment which is beyond the scope of the tools, equipment, personnel, or supplies normally available to using organizations.

b. Appendix contains a list of publications applicable to this manual. The maintenance allocation chart is located in the operators and organizational maintenance manual (TM 5-4210-205-12).

c. Numbers in parentheses on illustrations indicate quantity. Numbers preceding nomenclature callouts on illustrations indicate the preferred maintenance sequence.

d. 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 the Commanding Officer, U.S. Army Mobility Equipment Center, ATTN: SMiOME-NMMI, P.O. 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.).

e. Report all equipment improvement recommendations as prescribed by TM 38-750.

### 2. Record and Report Forms

For other record and report forms applicable to direct support, general support, and depot 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 description of the Ward Lafrance Model M44A1WLF Fire-Truck, the location, and the description of the identification and instruction plates, and detailed description of the components is contained in TM 5-4210-205-12. The repair and maintenance instructions are described in appropriate sections of this manual. For truck engine and chassis maintenance instructions, refer to TM 9-2320-235-35.

### 4. Tabulated Data

#### a. Primer Pump.

Suction side pipe ..... ¾ in. (inch) (es)  
Discharge pipe..... 1 5/16 in. diameter

#### b. Water Pump.

Relief valve regulator limit.....	250 psi (pounds per square inch)
Rated capacity maximum.....	500 gpm (gallons per minute)
Type .....	Centrifugal
Pump ratio .....	1 to 2:28
Shaft diameter .....	12 in.
Taper per foot .....	1 in.

c. *Time Standards.* Table 1 lists the number of man-hours required under normal conditions to perform the indicated maintenance and repair for the firetruck. Components are listed under the appropriate functional index. The times listed are not intended to be rigid standards. Under adverse conditions, the operations will take longer; but under ideal conditions with highly skilled mechanics, most of the operations can be accomplished in considerably less time.



Table 1. Time Standards

	Removal and replacement	Man-hours
03	FUEL SYSTEM	
	0312 THROTTLE CONTROL	
	Controls, throttle .....	0.7
06	ELECTRICAL SYSTEM	
	0607 INSTRUMENT OR ENGINE CONTROL	
	PANEL	
	Switches .....	0.5
	Gages .....	0.5
	Hourmeter .....	0.5
	Box, instrument .....	1.2
	Tachometer .....	0.5
	Lampholder .....	0.4
	Panel	
	(includes removal and installation of gages, levers, linkage, couplings, switches.) .....	3.5
	Cable assembly wiring (includes removal and installation of panel.) .....	5.0
	0608 MISCELLANEOUS ITEMS	
	Receptacle, slave .....	0.4
	Switch, turn signal .....	0.5
	0609 LIGHTS	
	Lights .....	0.6
	Lens; door; gasket .....	0.4
	Light, rotating .....	1.8
	0611 SIREN	
	Siren .....	2.6
	Switch .....	0.5
	0612 BATTERIES	
	Box, battery	
	(includes removal and installation of batteries; cables.) .....	1.3
	0613 CHASSIS WIRING HARNESS	
	Harness, wiring .....	4.5
	0615 RADIO INTERFERENCE SUPPRESSION	
	Components	
	(includes removal and installation of siren or light, rotating.) .....	0.8
12	BRAKES	
	1208 AIR BRAKE SYSTEM	
	Fittings; tubing .....	0.5 ea
18	BODY	
	1808 HOSE REELS	
	Reels, hose .....	4.5
	1812 SPECIAL PURPOSE BODIES	
	Body	
	(includes removal and installation of accessory items; lights; wiring.) .....	7.5
	Doors .....	0.4
	Apron	
	(includes removal and installation of lights, fire extinguisher bracket, receptacle, plug.) .....	1.8
	Tank, water .....	2.0
	Bracket .....	0.3
	Grating .....	0.2
	Holder, nozzle .....	0.3

	Removal and replacement	Man-hours
40	ELECTRIC MOTORS	
	4000 MOTORS, ELECTRIC	
	Major assemblage	
	(includes removal and installation of wiring; strap.) .....	0.8
	4006 STARTING AND PROTECTIVE DEVICES	
	Switches .....	0.5
	Solenoid .....	0.4
47	GAGES	
	4702 GAGES, MOUNTING, LINES AND FITTINGS	
	Gages .....	0.5
55	PUMPS	
	5500 PUMP ASSEMBLY	
	Pump, primer .....	3.5
	Pump, fire	
	(includes removal and installation of instrument panel, pump housing, lines, fittings, universal.) .....	11.5
	5501 IMPELLERS, ROTORS	
	Rotor, primer	
	(pump removed from unit.) .....	1.0
	Impeller, fire pump	
	(pump out of unit.) .....	1.5
	5505 SUCTION AND/OR DISCHARGE SYSTEMS	
	Manifolds	
	(pump removed from unit.)	
	(removal and installation of headers, linkage, valves.) .....	11.0
	Valves	
	(includes removal and installation of control panel.) .....	3.5
	Head, suction	
	(includes removal and installation of control panels.) .....	3.0
	Solenoid .....	0.5
	Tubing .....	0.5
	5507 PUMP DRIVES	
	Gears; shafts; seals; bearings	
	(includes removal and installation of universal joint.) .....	2.1
	Universal joint .....	1.0
	Controls, clutch	
	(includes removal and installation of tool box.) - .....	1.5
	5513 FLUID LINES	
	Fittings; lines .....	0.8
	Valves; controls .....	0.5
76	FIREFIGHTING EQUIPMENT COMPONENTS	
	7601 FOAM MAKING UNITS	
	Tank, storage	
	(includes removal and installation of pipes and fittings, hose.) .....	1.3
	Valve	
	(includes removal and installation of control panel, linkage.) .....	4.5
	Rod, valve operating	
	(includes removal and installation of control panel.) .....	4.0
	Pipes; fittings; baffles	
	(includes removal and installation of control panel.) .....	4.5



## CHAPTER 2 GENERAL MAINTENANCE INSTRUCTIONS

---

### Section I. SPECIAL TOOLS AND EQUIPMENT

#### 5. Special Tools and Equipment

No special tools or equipment are required by direct support, general support, and depot maintenance personnel for maintenance of the firetruck.

#### 6. Specially Designed Tools

No specially designed tools are required by direct support, general support, and depot maintenance personnel for maintenance of the firetruck.

### Section II. TROUBLESHOOTING

#### 7. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the pumping unit or any of its components. Each trouble symptom stated is followed by a list of probable causes of the trouble. The possible remedy recommended is described opposite the probable cause.

#### 8. Water Pump Will Not Operate

Probable cause	Possible remedy
Pump impeller shaft damaged	Repair or replace impeller shaft (paras. 55-57).
Pump gearbox damaged .....	Replace or repair gearbox (paras. 49-51).
Key sheared in pump drive	Replace or repair key (paras. 49-51).

#### 9. Water Pump Fails To Prime or Loses Prime

Probable cause	Possible remedy
Primer pump defective .....	Replace or repair primer pump (paras. 42-44).
Primer valve defective .....	Replace or repair primer valve (paras. 45-47).
Microswitch defective .....	Replace microswitch (TM 5-4210-205-12).
Air leaks	Repair or replace leaking pipes or fittings (paras. 17-19).

#### 10. Water Pump Fails To Deliver Rated Flow or Develop Desired Pressure

Probable cause	Possible remedy
Relief valve defective .....	Replace or repair defective relief valve (paras. 52-54).
Water pump impeller defective	Replace impeller (paras. 55-57).

Water pump impeller vanes ..	Clean blades (para. 56). fouled with foreign matter.
Relief valve control defective.	Replace or repair defective relief valve (paras. 32-34).

#### 11. Pumping Unit Will Not Produce Foam

Probable cause	Possible remedy
Metering valve defective .....	Replace or repair foam metering valve (paras. 38-40).
Defective foam valve .....	Replace or repair foam valve (paras. 35-37).
Foam lines damaged or broken	Replace defective foam lines (paras. 17-19).

#### 12. Hose Reel Inoperative

Probable cause	Possible remedy
Drum will not turn .....	Replace or repair shaft bearings or defective drum (paras. 59-61).
Sprocket teeth broken .....	Replace or repair defective sprocket (paras. 59-61).
Drive motor or chain defective	Replace motor or chain (TM 5-4210-205-12).

#### 13. Water Tank Leaks or Fails To Drain Properly.

Probable cause	Possible remedy
Defective drain valve .....	Repair drain valve (paras. 26-28).
Drain filled with foreign matter	Remove cover and clean draining system (paras. 63-65).
Discharge line damaged .....	Remove cover and replace discharge line (paras. 63-65).



### Section III. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS OR AUXILIARIES

#### 14. General

This section provides the information necessary to direct support, general support, and depot maintenance personnel for removal of the water pump from the firetruck.

#### 15. Water Pump

##### *a. Removal.*

- (1) Remove the pump gage panel (TM 54210-205-12).
- (2) Disconnect hose reel piping and wiring (TM 5-4210-205-12).
- (3) Remove the drain line valve and lines (TM 5-4210-205-12).
- (4) Remove the pump suction heads (TM 54210-205-12).
- (5) Remove the pump drive universal joint (TM 5-4210-205-12).
- (6) Remove the primer pump and primer pump motor (TM 5-4210-205-12).

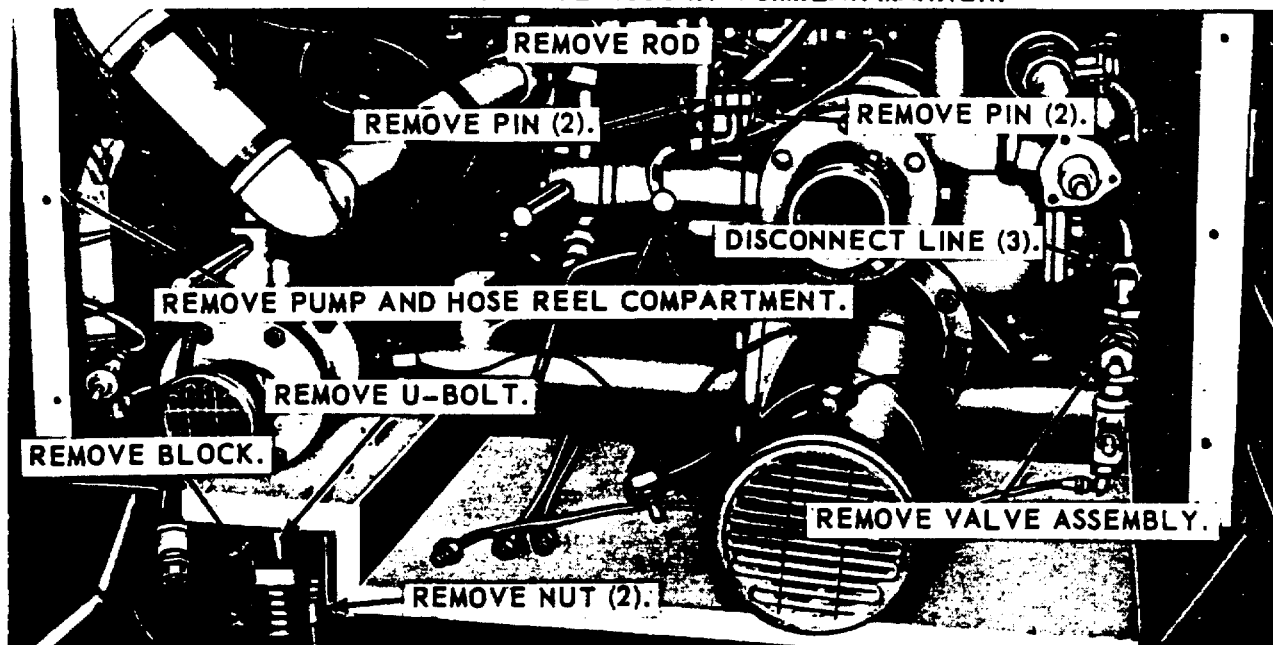
- (7) Remove the foam tank and disconnect the tank fill and tank suction lines (TM 5-4210-205-12).
- (8) Refer to figure 1 and remove the water pump from the firetruck.

##### *b. Installation.*

- (1) Refer to figure 1 and install the water pump on the firetruck.
- (2) Install the foam tank and connect the tank fill and tank suction lines (TMI 5-4210205-12).
- (3) Install the primer pump and primer pump motor (TM 5-4210-205-12).
- (4) Install the pump drive universal joint (TM 5-4210-205-12).
- (5) Install the pump suction heads (T,4210-205-12).
- (6) Install the drain line valve and lines (TA\par5-4210-205-12).
- (7) Connect hose reel piping and wiring (T.[ 5-4210-205-12).
- (8) Install the pump gage panel (T[ 5;-4210205-12).



NOTE: REMOVE REMAINING CONTROL RODS IN A SIMILAR MANNER.



REMOVE SPRING (2).

NOTE: REMOVE REMAINING U-BOLTS IN A SIMILAR MANNER.

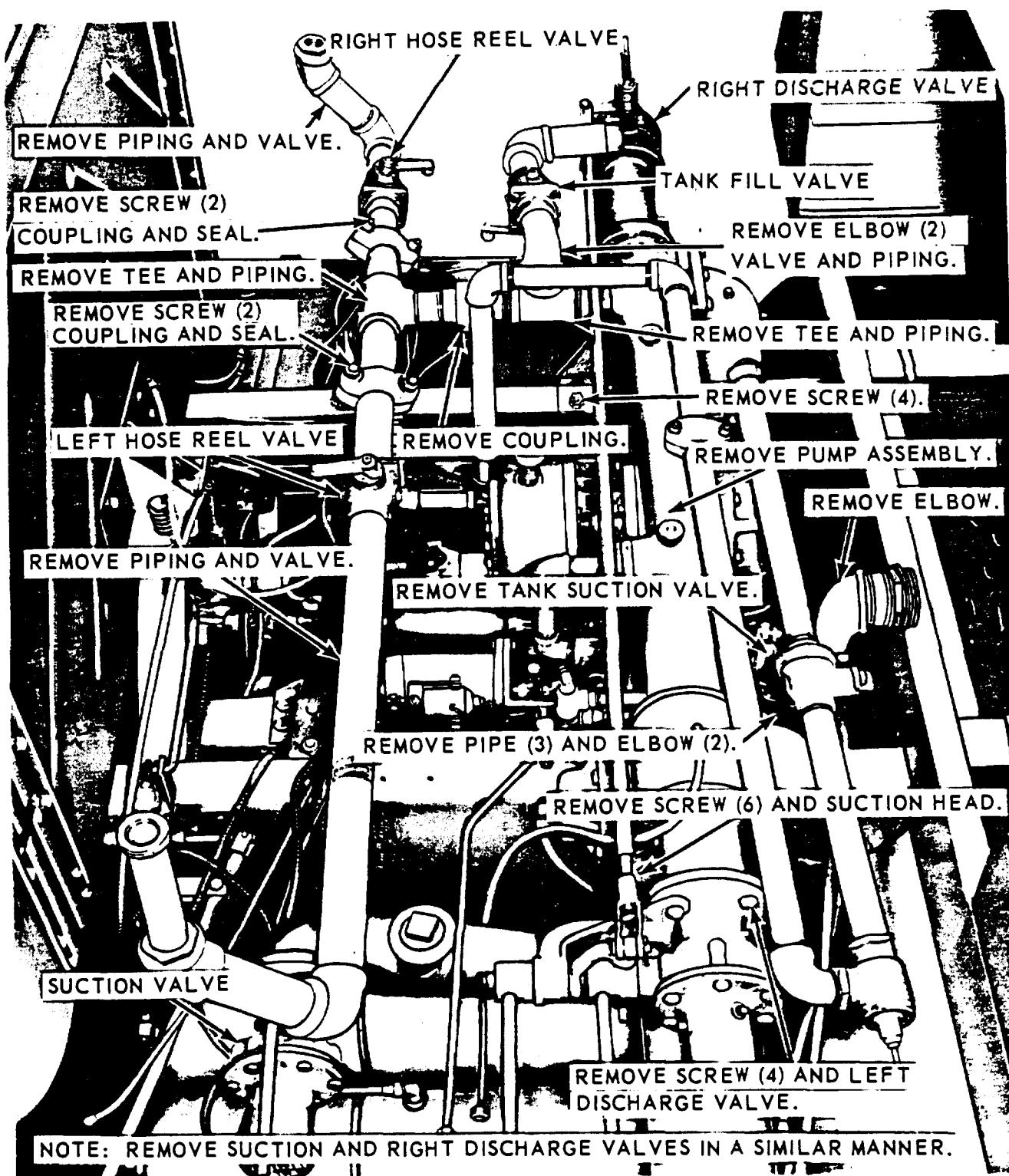
**A**

MSC 4210-205-35/1 ①

A-Pump compartment, cooling valve, sad control rods

Figure, 1. Water pump, removal and installation.





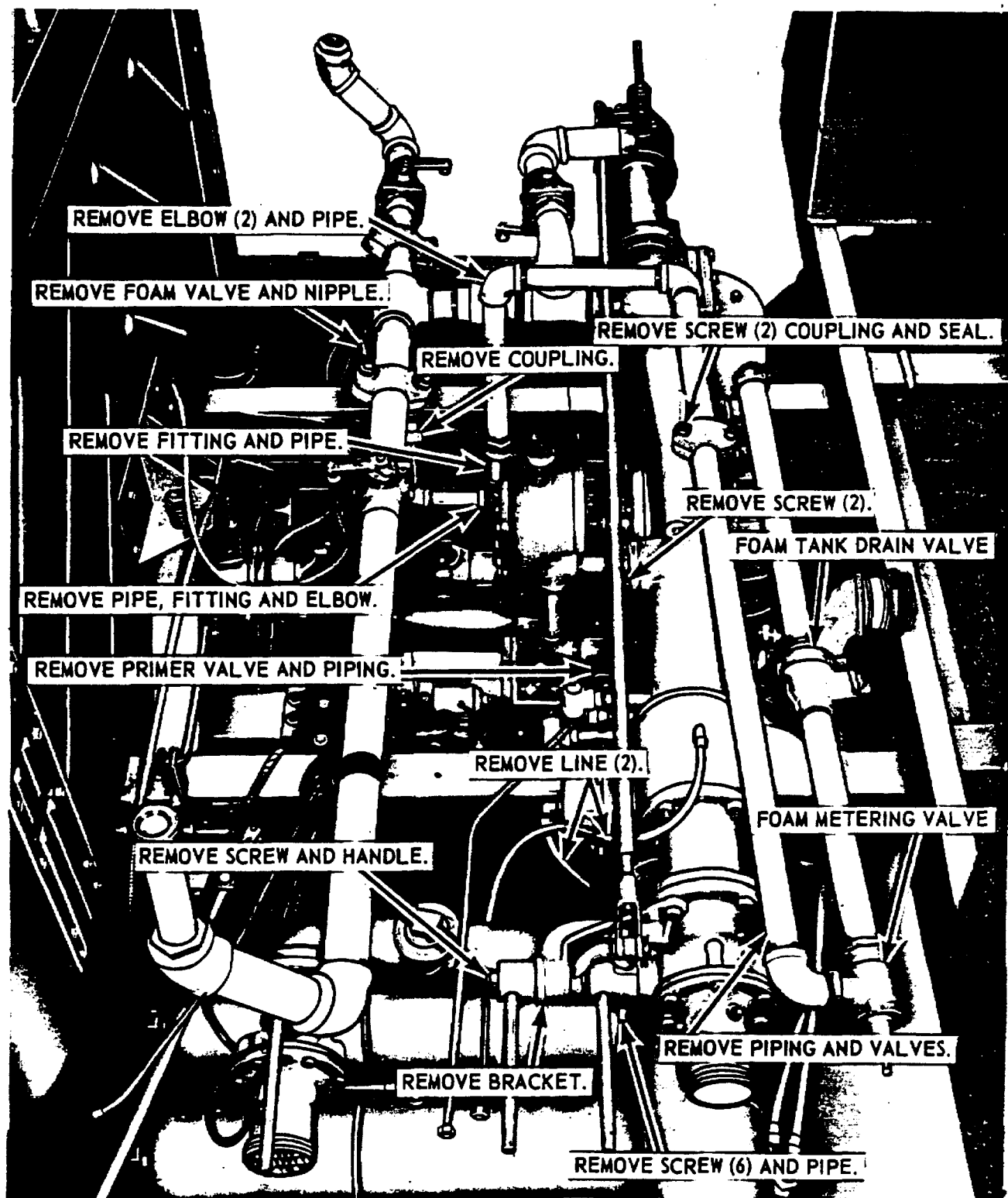
C

MSC 4210-205-35/1 ③

B--Foam piping, discharge handle priming valve, and relief valve lines

Figure 1. Continued.





**B**

MSC 4210-205-35/1 (2)

C-Pump piping, hose reel. suction, discharge, fill valves, and pump assembly  
Figure 1. Continued.



## CHAPTER 3 REPAIR INSTRUCTIONS

---

### Section I. CONTROL VALVES, LINES, AND FITTINGS

#### 16. General

A series of valves, and piping, mounted to the fire pump perform such functions as filling the water tank, discharging either water or a water and foam combination, through the reel hose, or draining the water pump. All operating valves, except the foam proportioning valve, and tank drain valve are of the one-quarter quick opening ball type.

#### 17. Water and Foam Pipes and Fittings, Removal

a. Refer to figure 1 and remove the water and foam piping, from the pump assembly.

b. Separate the pipes, valves, and fittings.

#### 18. Water and Foam Pipes and Fittings, Cleaning, Inspection, and Repair

a. *Cleaning.* Clean all parts with an approved cleaning solvent and dry thoroughly.

b. *Inspection.* Inspect all parts for wear, damage, or defects.

c. *Repair.* Replace or repair worn, damaged, or defective parts as necessary.

#### 19. Water and Foam Pipes and Fittings, Installation

a. Connect the pipes, valves, and fittings.

b. Refer to figure 1 and install the piping assembly on the pump assembly.

#### 20. Suction and Discharge Valves, Removal and Disassembly

a. *Removal.* Refer to figure 1 and remove the suction and discharge valves from the suction and discharge heads.

b. *Disassembly.* Refer to figure 2 and disassemble the suction and discharge valves.

#### 21. Suction and Discharge Valves, Cleaning, Inspection, and Repair

a. *Cleaning.* Clean all parts in an approved cleaning solvent and dry thoroughly.

b. *Inspection.* Inspect all parts for wear, defects, and damage.

c. *Repair.* Replace or repair worn, defective, or damaged parts as necessary.

#### 22. Suction and Discharge Valves, Reassembly and Installation

a. *Reassembly.* Refer to figure 2 and reassemble the suction and discharge valves in the reverse order.

b. *Installation.* Refer to figure 1 and install the suction and discharge valves on the suction and discharge head.

#### 23. Hose Reel Valves, Tank Fill Valve, and Tank Suction Valve, Removal and Disassembly

a. *Removal.* Refer to figure 1 and remove the hose reel valves.

b. *Disassembly.* Refer to figure 3 and disassemble the hose reel valve, tank fill valve, and tank suction valves.

#### 24. Hose Reel Valves, Tank Fill Valve, Tank Suction Valve, Cleaning, Inspection, and Repair

a. *Cleaning.* Clean all parts in an approved cleaning solvent and dry thoroughly.

b. *Inspection.* Inspect all parts for wear, defects, and damage.

c. *Repair.* Replace or repair worn, defective, or damaged parts as necessary.



**25. Hose Reel Valves, Tank Fill Valve, and Tank Suction Valve, Reassembly and Installation**

- a. *Reassembly.* Refer to figure 3 and reassemble the hose reel valves, tank fill valve, and tank suction valve in the reverse order.
- b. *Installation.* Refer to figure 1 and install the hose reel valves, tank fill valve, and tank suction valve on the pump assembly.

**26. Water Tank Drain Valve, Removal and Disassembly**

- a. *Removal.* Remove the water tank drain valve (TI 5-4210-205-12).
- b. *Disassembly.* Refer to figure 4 and disassemble the water tank drain valve.

**27. Water Tank Drain Valve, Cleaning, Inspection, and Repair**

- a. *Cleaning.* Clean all parts in an approved cleaning solvent and dry thoroughly.
- b. *Inspection.* Inspect all parts for wear, defects, and damage.
- c. *Repair.* Replace or repair worn, defective, or damaged parts as necessary.

**28. Water Tank Drain Valve, Reassembly and Installation**

- a. *Reassembly.* Refer to figure 4 and reassemble water tank drain valve in the reverse order.
- b. *Installation.* Install the water tank drain valve (TM 5-4210-205-12).

**29. Drain Line Valve, Removal and Disassembly**

- a. *Removal.* Remove the drain line valve (TM 5421205-12).
- b. *Disassembly.* Refer to figure 5 and disassemble the drain valve.

**30. Drain Line Valve, Cleaning, Inspection, and Repair**

- a. *Cleaning.* Clean all parts in an approved cleaning solvent and dry thoroughly.

- b. *Inspection.* Inspect all parts for wear, defects, and damage.
- c. *Repair.* Replace or repair worn, defective, or damaged parts as necessary.

**31. Drain Line Valve, Reassembly and Installation**

- a. *Reassembly.* Refer to figure 5 and reassemble the drain line valve in the reverse order.
- b. *Installation.* Install the drain line valve (TM[ 5-4210-205-12).

**32. Relief Valve Control, Removal and Disassembly**

- a. *Removal.* Remove the relief valve control (T.I 5-4210-205-12).
- b. *Disassembly.* Refer to figure 6 and disassemble the relief valve control.

**33. Relief Valve Control, Cleaning, Inspection, and Repair**

- a. *Cleaning.* Clean all parts in an approved cleaning solvent and dry thoroughly.

**Caution:** Do not use abrasives.

- b. *Inspection.*
  - (1) Inspect piston before placing in body.
  - (2) Inspect all parts for wear, defects, and damage.
- c. *Repair.* Replace or repair worn, defective, or damaged parts as necessary.

**34. Relief Valve Control, Reassembly and Installation**

- a. *Reassembly.* Refer to figure 6 and reassemble the relief valve control in the reverse order.
- b. *Installation.* Install the relief control valve (TM 54210-205-12).

INDEX TO FIGURE 2		
1 Pipe plug	8 Nut, 3/8-24	15 Packing
2 Pipe plug	9 Setscrew, 5/16-24 x 3/8 in.	16 Nut, 7/8-20
3 Packing	10 Handle	17 Ball
4 Screw, cap, 3/8-24 x 1 in. (6 rqr)	11 Stop	18 Pivot
5 Cover	12 Pin	19 Spring
6 Gasket (3 rqr)	13 Retainer (2 rqr)	20 Body
7 Packing	14 Collar	



NOTE: DISASSEMBLE AND ADJUST DISCHARGE VALVES IN A SIMILAR MANNER.



- MSC 4210-205-35/2

**TAGO 5947-A**



### **35. Foam Tank Drain Valve and Foam Valve, Removal and Disassembly**

*a. Removal.* Refer to figure 1 and remove the foam tank drain valve and foam valve from the pump assembly.

*b. Disassembly.* Refer to figure 7 and disassemble the foam tank drain valve and foam valve.

### **36. Foam Tank Drain Valve and Foam Valve, Cleaning, Inspection, and Repair**

*a. Cleaning.* Clean all parts in an approved cleaning solvent and dry thoroughly.

*b. Inspection.* Inspect all parts for wear, defects, and damage.

*c. Repair.* Replace or repair worn, defective, or damaged parts as necessary.

### **37. Foam Tank Drain Valve and Foam Valve, Reassembly and Installation**

*a. Reassembly.* Refer to figure 7 and reassemble the foam tank drain valve and foam valve in the reverse order.

*b. Installation.* Refer to figure 1 and install the foam tank drain valve and foam valve on the pump assembly.

### **38. Foam Metering Valve, Removal and Disassembly**

*a. Removal.* Refer to figure 7 and remove the foam metering valve from the pump assembly.

*b. Disassembly.* Refer to figure 8 and disassemble the foam metering valve.

### **39. Foam Metering Valve, Cleaning, Inspection, and Repair**

*a. Cleaning.* Clean all parts in an approved cleaning solvent and dry thoroughly.

*b. Inspection.* Inspect all parts for wear, defects, and damage.

*c. Repair.* Replace or repair worn, defective, or damaged parts as necessary.

### **40. Foam Metering Valve, Reassembly, and Installation**

*a. Reassembly.* Refer to figure 8 and reassemble the foam metering valve in the reverse order.

*b. Installation.* Refer to figure 1 and install the foam metering valve on the pump assembly.

---

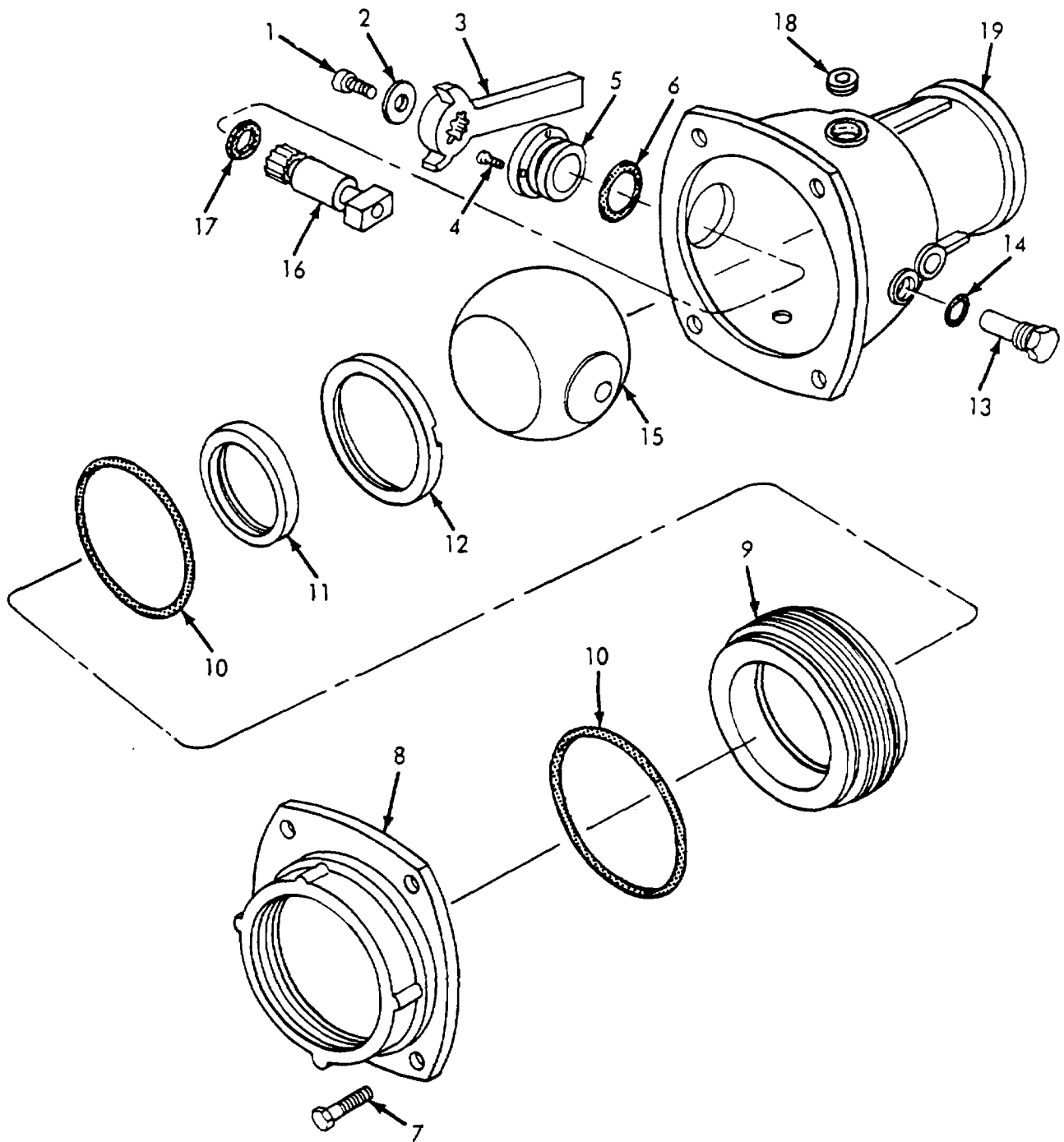
#### **INDEX TO FIGURE 3**

1 Screw, cap, 46-18 x s in.  
2 Washer, 56 in.  
3 Handle  
4 Screw, machine, 3/16-24 x 5/8 in.  
(5 rqr)  
5 Stop  
6 Packing

7 Screw, cap, 3/8-16 x 1 in. (4 rqr)  
8 Adjuster  
9 Packing  
10 Packing  
11 Seal  
12 Retainer  
13 Special screw

14 Packing  
15 Ball  
16 Pivot  
17 Packing  
18 Pipe plug  
19 Body



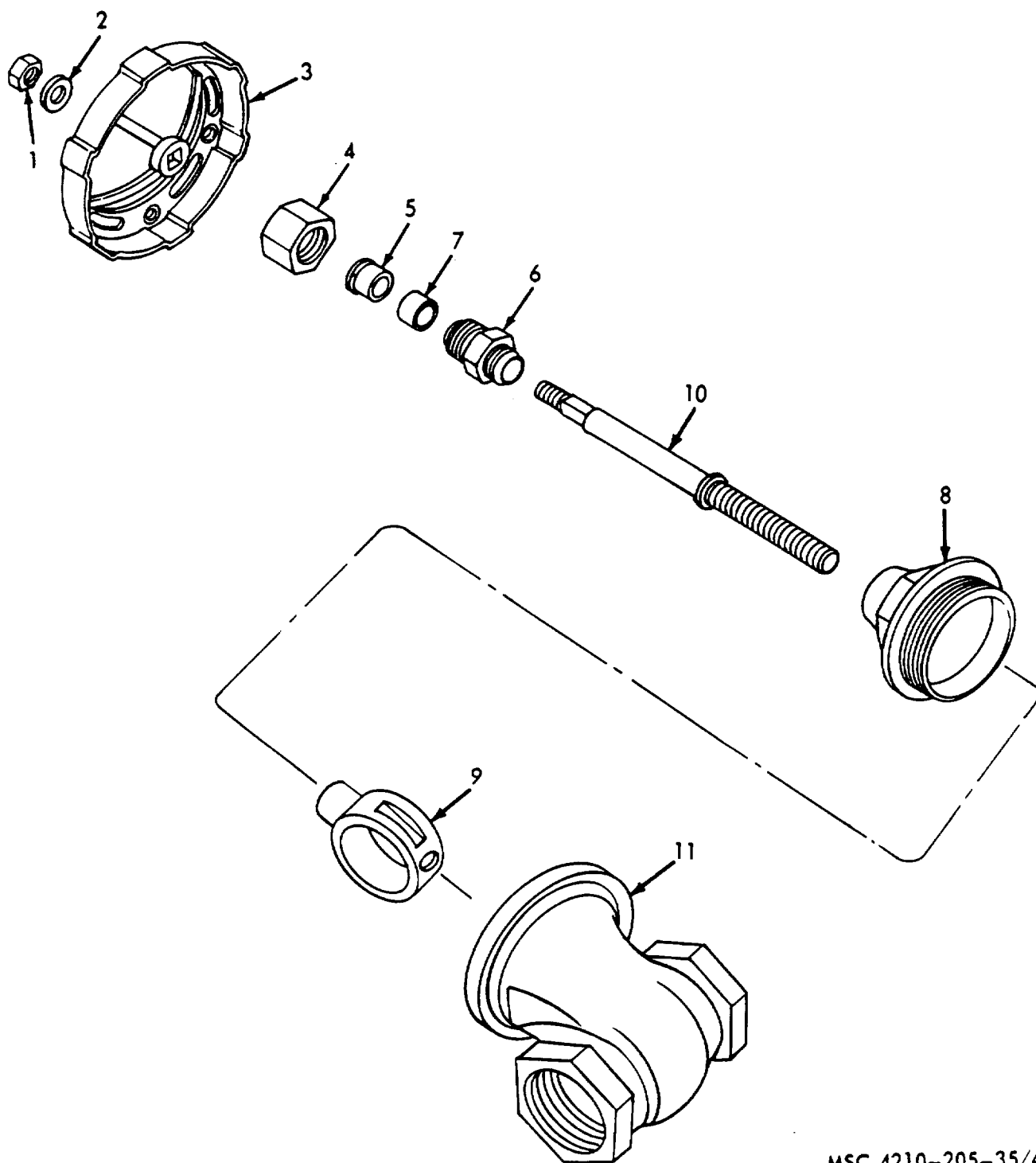


NOTE: DISASSEMBLE TANK SUCTION, TANK FILL AND REMAINING HOSE REEL VALVE IN A SIMILAR MANNER.

MSC 4210-205-35.3

Figure 3. Hose reel valves, tank fill valve, and tank suction valve, exploded view.





MSC 4210-205-35/4

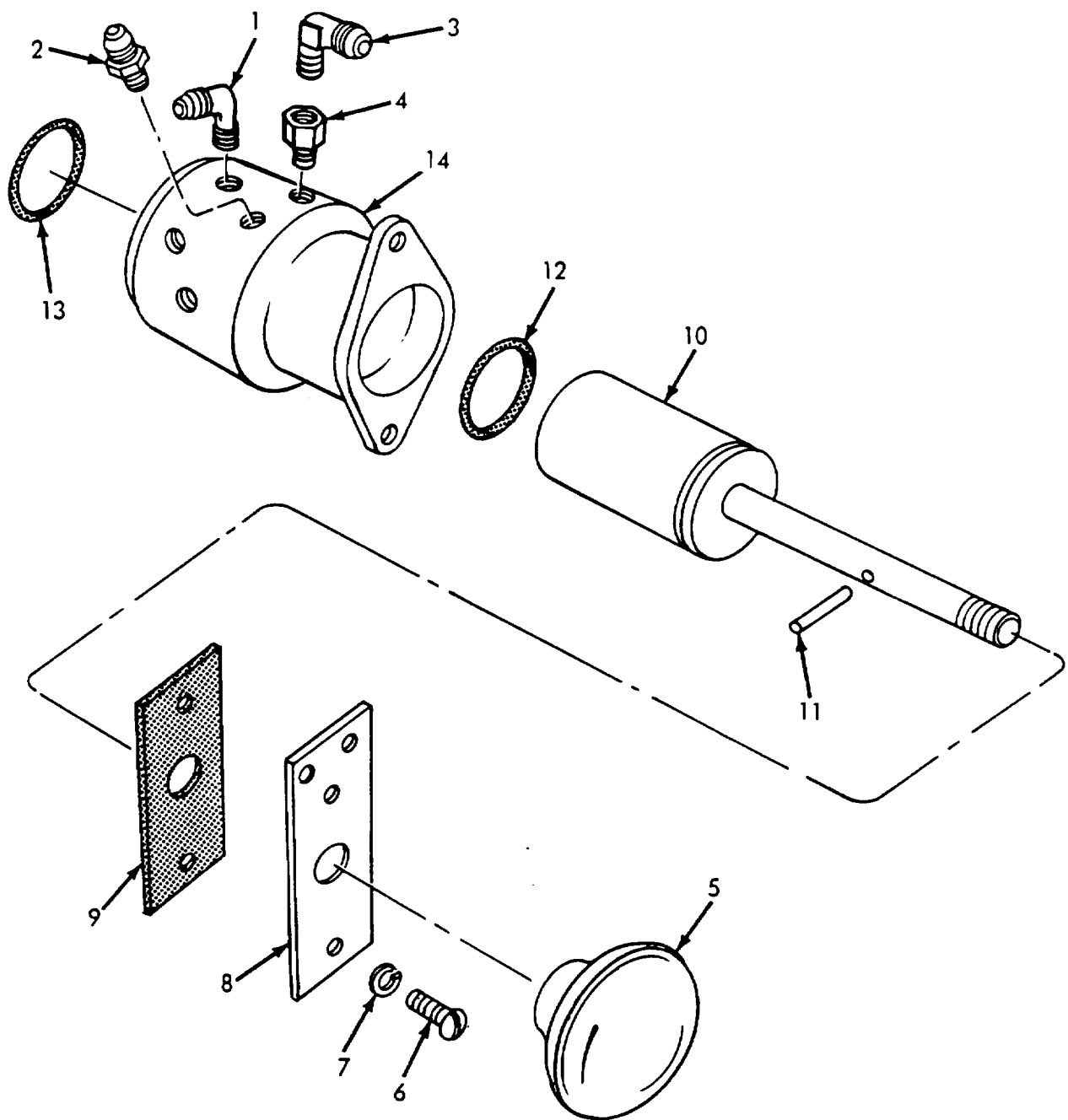
1 Nut,  $\frac{5}{16}$ -18  
2 Special washer  
3 Handle  
4 Nut

5 Bushing  
6 Fitting  
7 Packing  
8 Bonnet

9 Ball  
10 Stem  
11 Body

Figure 4. Water tank drain valve, exploded view.





MSC 4210-205-35/5

1 Elbow  
2 Fitting  
3 Elbow  
4 Adapter  
5 Knob

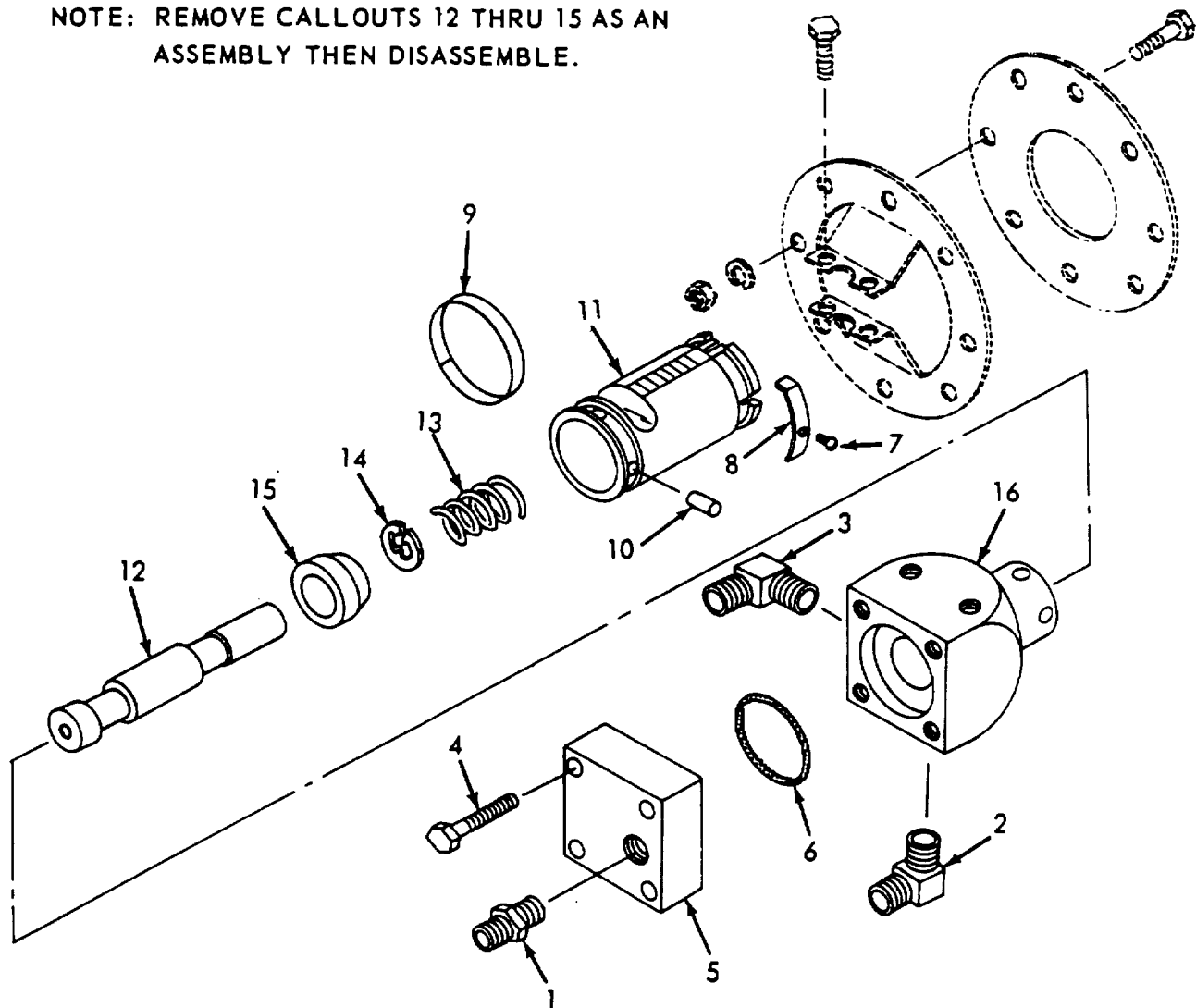
6 Screw,  $\frac{1}{4}$ -20 x  $\frac{5}{8}$  in. (2 rqr)  
7 Washer, lock,  $\frac{1}{4}$  in. (2 rqr)  
8 Panel  
9 Stop plate  
10 Piston

11 Pin  
12 Packing  
13 Packing  
14 Body

Figure 5. Drain line valve, exploded view.



NOTE: REMOVE CALLOUTS 12 THRU 15 AS AN ASSEMBLY THEN DISASSEMBLE.



NOTE: OIL CLOSE FIT IN BODY (16) AND PISTON (12).

MSC 4210-205-35/6

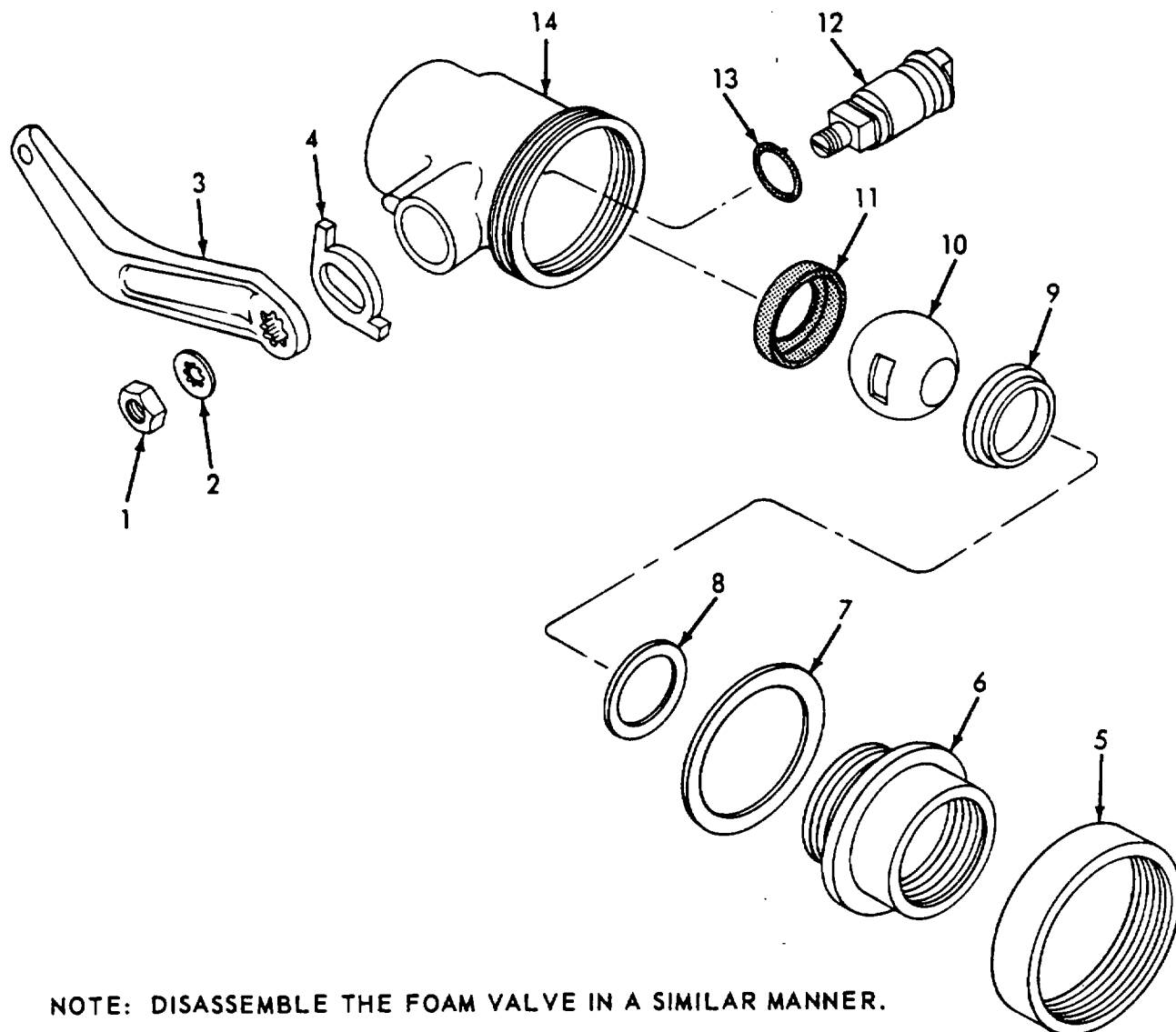
- 1 Fitting
- 2 Elbow
- 3 Elbow
- 4 Screw, cap,  $\frac{3}{16}$ -24 x  $1\frac{1}{4}$  in. (4 rqr)
- 5 Bonnet
- 6 Packing

- 7 Special screw
- 8 Stop
- 9 Clip
- 10 Pin (4 rqr)
- 11 Cover

- 12 Piston
- 13 Spring
- 14 Ring
- 15 Retainer
- 16 Body

Figure 6. Relief valve control, exploded view.





NOTE: DISASSEMBLE THE FOAM VALVE IN A SIMILAR MANNER.

MSC 4210-205-35/7

- 1 Nut,  $\frac{1}{8}$ -20
- 2 Washer,  $\frac{1}{8}$  in.
- 3 Handle
- 4 Stop
- 5 Special nut

- 6 Adapter
- 7 Gasket
- 8 Gasket
- 9 Retainer
- 10 Ball

- 11 Seal
- 12 Pivot
- 13 Packing
- 14 Body

Figure 7. Foam tank drain valve and foam valve, exploded view.



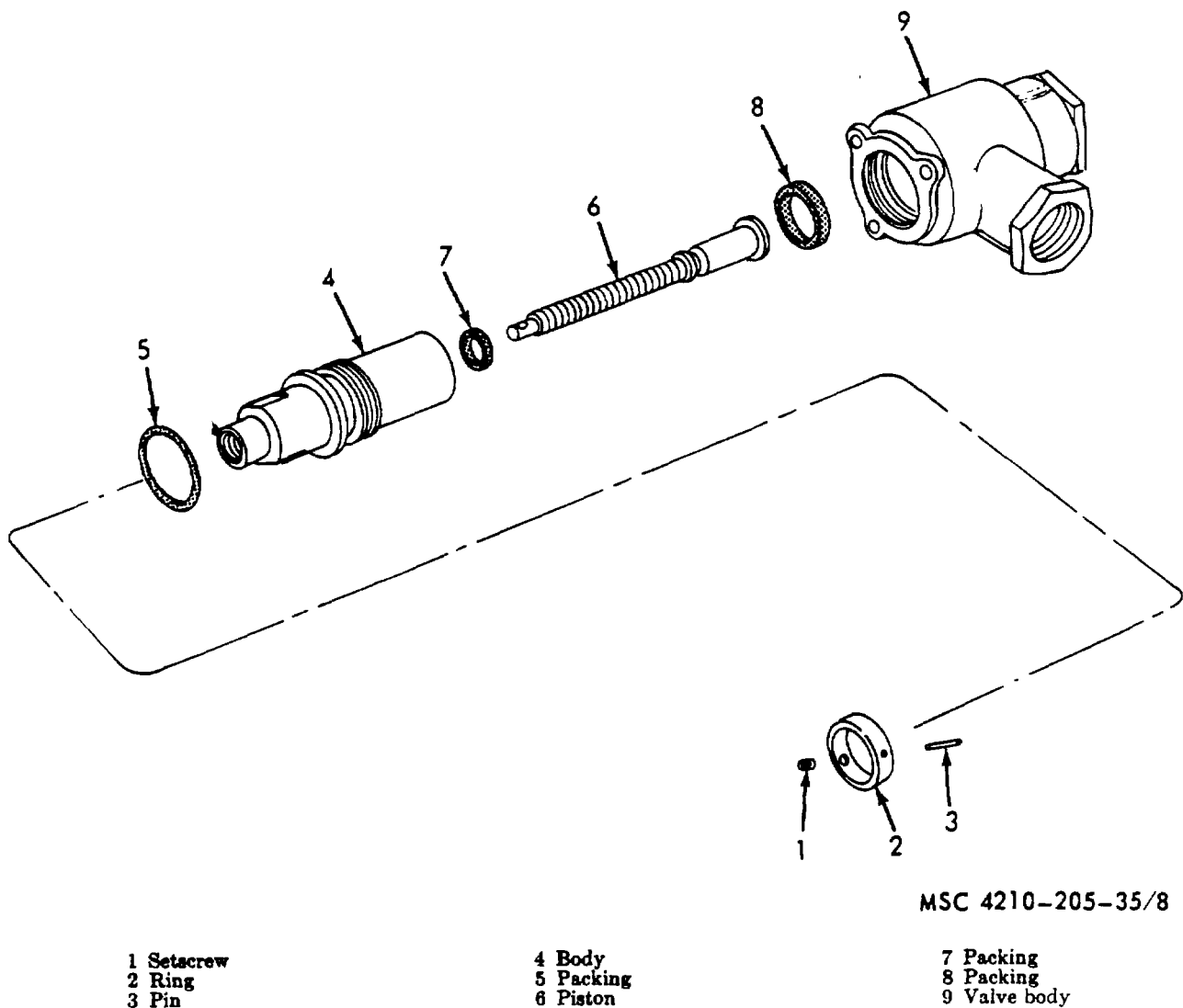


Figure 8. Foam metering valve, exploded view.

## Section II. PRIMER PUMP ASSEMBLY

### 41. General

The priming system consists of a rotary vacuum pump operated by a 24-volt electric motor controlled through a priming pump valve mounted in the pump compartment, and a microswitch mounted on the priming pump valve. As the priming pump valve is actuated the microswitch starts the priming pump motor. The priming pump motor drives the primer pump which sucks water into the centrifugal type fire pump suction line, priming the pump. After both the suction and discharge casings have been completely filled, water is then discharged through the bottom of the primer pump, and the primer pump must be manually shut off.

### 42. Primer Pump Assembly, Removal and Disassembly

a. *Removal.* Remove the primer pump assembly (TM 5-4210-205-12).

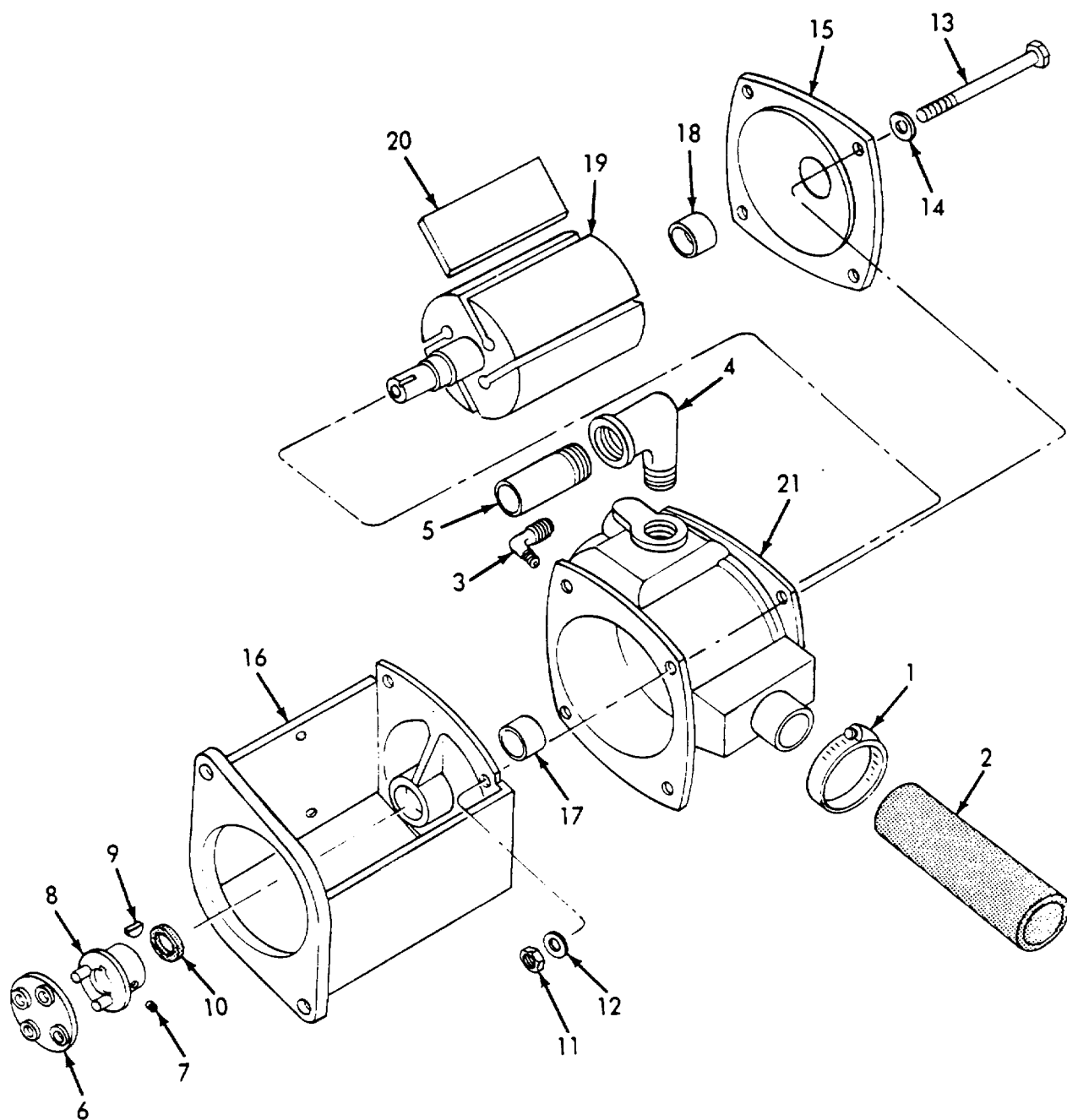
b. *Disassembly.* Refer to figure 9 and disassemble the primer pump assembly.

### 43. Primer Pump Assembly, Cleaning, Inspection, and Repair

a. *Cleaning.* Clean all parts in an approved cleaning solvent and dry thoroughly.

b. *Inspection.* Inspect all parts for wear, defects, and damage.





MSC 4210-205-35/9

- 1 Clamp
- 2 Hose
- 3 Elbow
- 4 Street ell
- 5 Nipple
- 6 Coupling
- 7 Setscrew

- 8 Drive coupling
- 9 Key
- 10 Seal
- 11 Nut,  $\frac{5}{16}$ -18 (4 rqr)
- 12 Washer, flat,  $\frac{5}{16}$  in. (4 rqr)
- 13 Screw, cap,  $\frac{5}{16}$ -18 x  $4\frac{1}{2}$  in. (4 rqr)
- 14 Washer, flat,  $\frac{5}{16}$  in. (4 rqr)

- 15 Head
- 16 Mounting head
- 17 Bushing
- 18 Bushing
- 19 Rotor
- 20 Vane
- 21 Body

Figure 9. Primer pump assembly, exploded view.



c. *Repair.* Replace or repair worn, defective, or damaged parts as necessary.

**44. Primer Pump Assembly, Reassembly and Installation**

a. *Reassembly.* Refer to figure 9 and reassemble the primer pump assembly in the reverse order.

b. *Installation.* Install the primer pump assembly (TM 5-210-205-12).

**45. Primer Valve, Removal and Disassembly**

a. *Removal.* Refer to figure 1 and remove the primer valve from the pump assembly.

b. *Disassembly.* Refer to figure 10 and disassemble the primer valve.

**46. Primer Valve, Cleaning, Inspection, and Repair**

a. *Cleaning.* Clean all parts in an approved cleaning solvent and dry thoroughly.

b. *Inspection.* Inspect all parts for wear, defects, and damage.

c. *Repair.* Replace or repair worn, defective, or damaged parts as necessary.

**47. Primer Valve, Reassembly and Installation**

a. *Reassembly.* Refer to figure 10 and reassemble the primer valve in the reverse order.

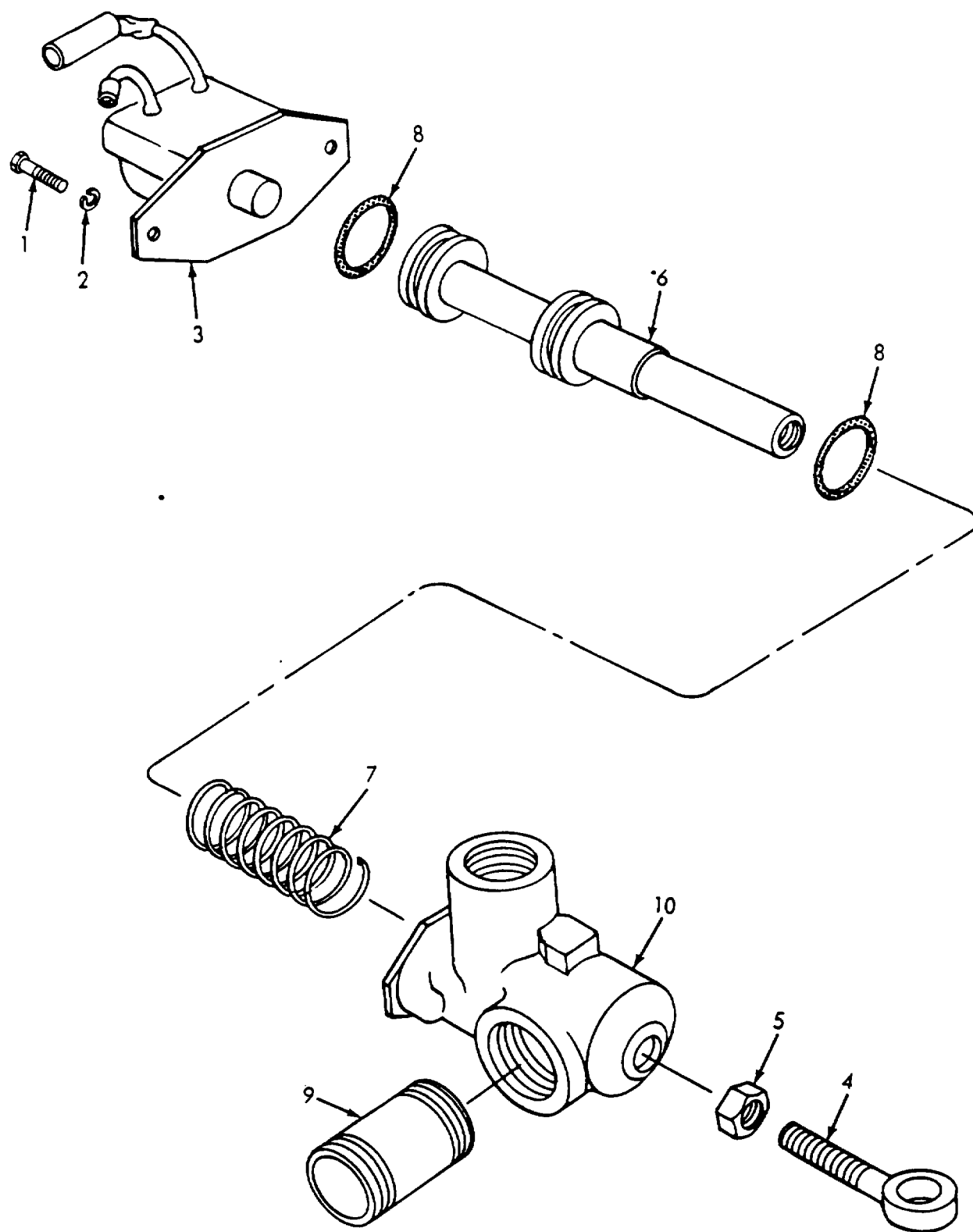
b. *Installation.* Refer to figure 1 and install the primer valve on the pump assembly.

---

INDEX TO FIGURE 10

1 Screw, machine, 10-32 x 3/8 in. (2 rqr)	4 Rod end	8 Packing (2 rqr)
2 Washer, lock, No. 10 (2 rqr)	5 Nut, 3/8-16	9 Nipple
3 Switch	6 Piston	10 Body
	7 Spring	





MSC 4210-205-35/10

Figure 10. Primer valve, exploded view.



### Section III. WATER PUMP ASSEMBLY

#### 48. General

The water pump assembly consists of a main pump, drive unit and relief valve. The main pump includes the impeller, main shaft, main bearings and head, suction and discharge pipes, and the volute case. The drive unit contains driving gears and bearings for the main pump, which is driven by the power takeoff unit on the truck transmission. Series of vanes on the rapidly rotating impeller produce centrifugal force which forces the water through the inside of the impeller, this increases the pressure of the water and creates a vacuum which draws more water into the impeller. The relief valve bypasses water within the pump to prevent pressure rise when the hose lines are shut off.

#### 49. Pump Gearbox, Removal and Disassembly

*a. Removal.* Refer to figure 11 and remove the pump gearbox from the pump assembly.

*b. Disassembly.* Refer to figure 12 and disassemble the pump gearbox.

#### 50. Pump Gearbox, Cleaning, Inspection, and Repair

*a. Cleaning.* Clean all parts in an approved cleaning solvent and dry thoroughly.

*b. Inspection.* Inspect all parts for wear, defects, and damage.

*c. Repair.* Replace or repair worn, defective, or damaged parts as necessary.

#### 51. Pump Gearbox, Reassembly and Installation

*a. Reassembly.* Refer to figure 12 and reassemble the pump gearbox in the reverse order.

*b. Installation.* Refer to figure 11 and install the pump gearbox on the pump assembly.

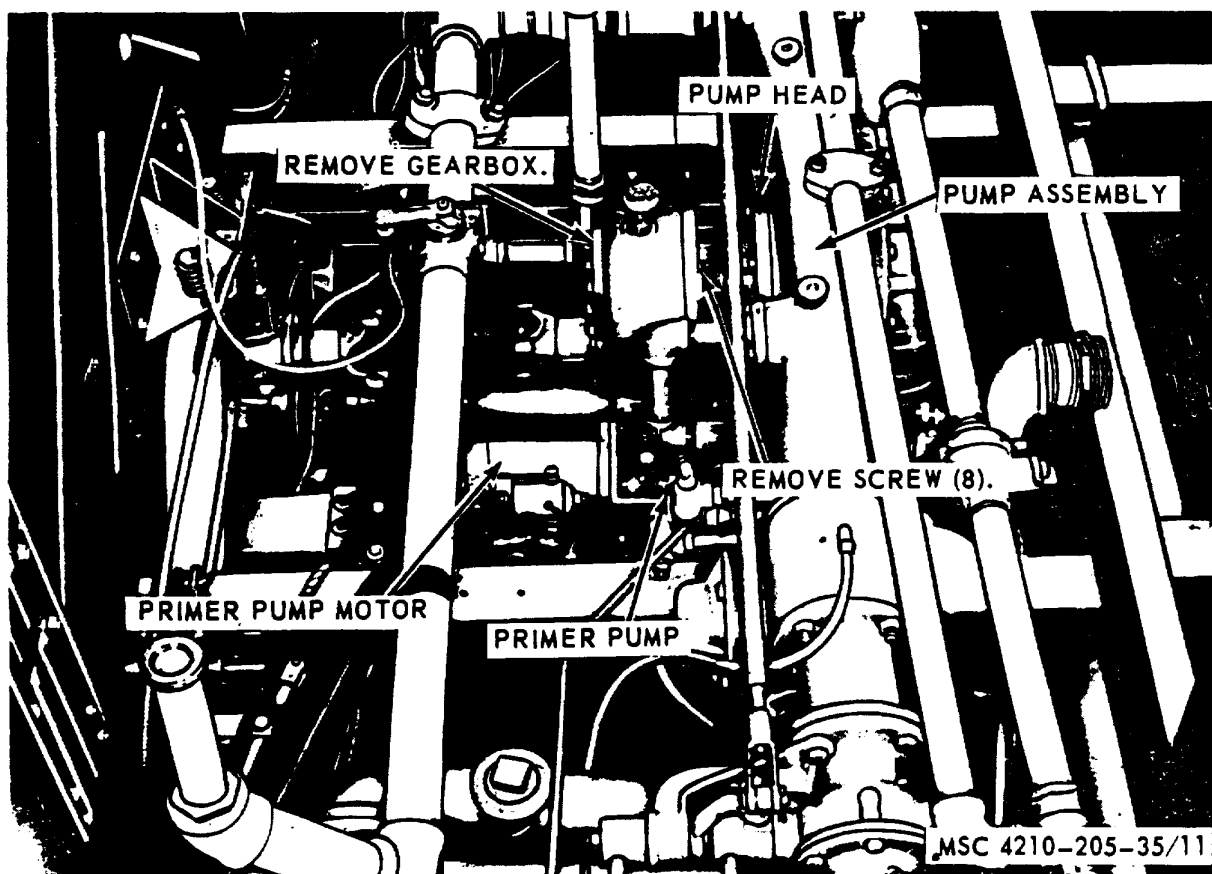
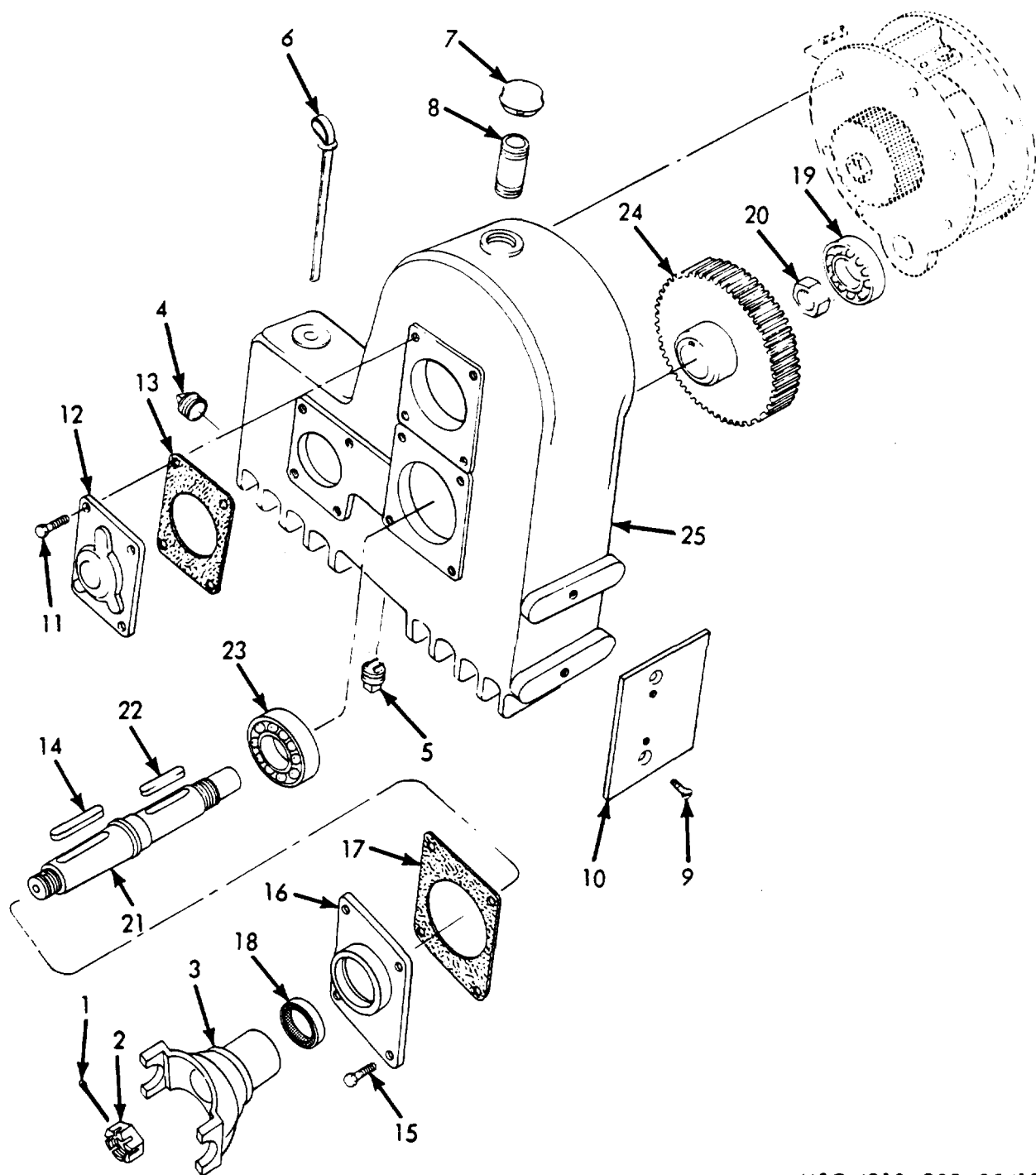


Figure 11. Pump gearbox, removal and installation.





MSC 4210-205-35, 12

- 1 Cotter pin
- 2 Nut, special
- 3 Yoke
- 4 Pipe plug
- 5 Pipe plug
- 6 Bayonet gage
- 7 Air vent
- 8 Nipple
- 9 Screw,  $\frac{1}{16}$ -20 x 1 in. (2 rqr)

- 10 Plate
- 11 Screw, cap,  $\frac{1}{16}$ -20 x  $1\frac{1}{4}$  in. (4 rqr)
- 12 Plate
- 13 Gasket
- 14 Key
- 15 Screw, cap,  $\frac{1}{16}$ -20 x  $1\frac{1}{4}$  in. (4 rqr)
- 16 Cap
- 17 Gasket

- 18 Seal
- 19 Bearing
- 20 Nut, special
- 21 Shaft
- 22 Key
- 23 Bearing
- 24 Gear
- 25 Housing

Figure 12. Pump gearbox, exploded view.



## **52. Relief Valve and Adapters, Removal and Disassembly**

- a. Remove the pump assembly (para. 15).
- b. Refer to figure 13 and remove and disassemble the relief valve and adapters.

## **53. Relief Valve and Adapters, Cleaning, Inspection, and Repair**

- a. Cleaning. Clean all parts in an approved cleaning solvent and dry thoroughly.
- b. Inspection. Inspect all parts for wear, defects, and damage.
- c. Repair. Replace or repair worn, defective, or damaged parts as necessary.

## **54. Relief Valve and Adapters, Reassembly and Installation**

- a. Refer to figure 13 and reassemble and install the relief valve and adapter in the reverse order.
- b. Test valve for movement as follows:
  - (1) Remove bonnet (13) and move valve (17) in and out.
  - (2) If packing (16) sticks in cylinder, remove cover (11) and lightly grease the cylinder wall in path of packing.
  - (3) Install bonnet (13) and cover (11).
- c. Install the pump assembly (para. 15).

## **55. Pump Head and Body, Removal and Disassembly**

- a. Remove the pump assembly (para. 15).
- b. Remove the pump gearbox (para. 49).
- c. Remove the relief valve and adapters (para. 52).
- d. Refer to figure 14 and removal and disassemble the pump head and body.

## **56. Pump Head and Body, Cleaning, Inspection, and Repair**

- a. Cleaning. Clean all parts in an approved cleaning solvent and dry thoroughly.
- b. Inspection. Inspect all parts for wear, defects, and damage.
- c. Repair. Replace or repair worn, defective, or damaged parts as necessary.

## **57. Pump Head and Body, Reassembly and Installation**

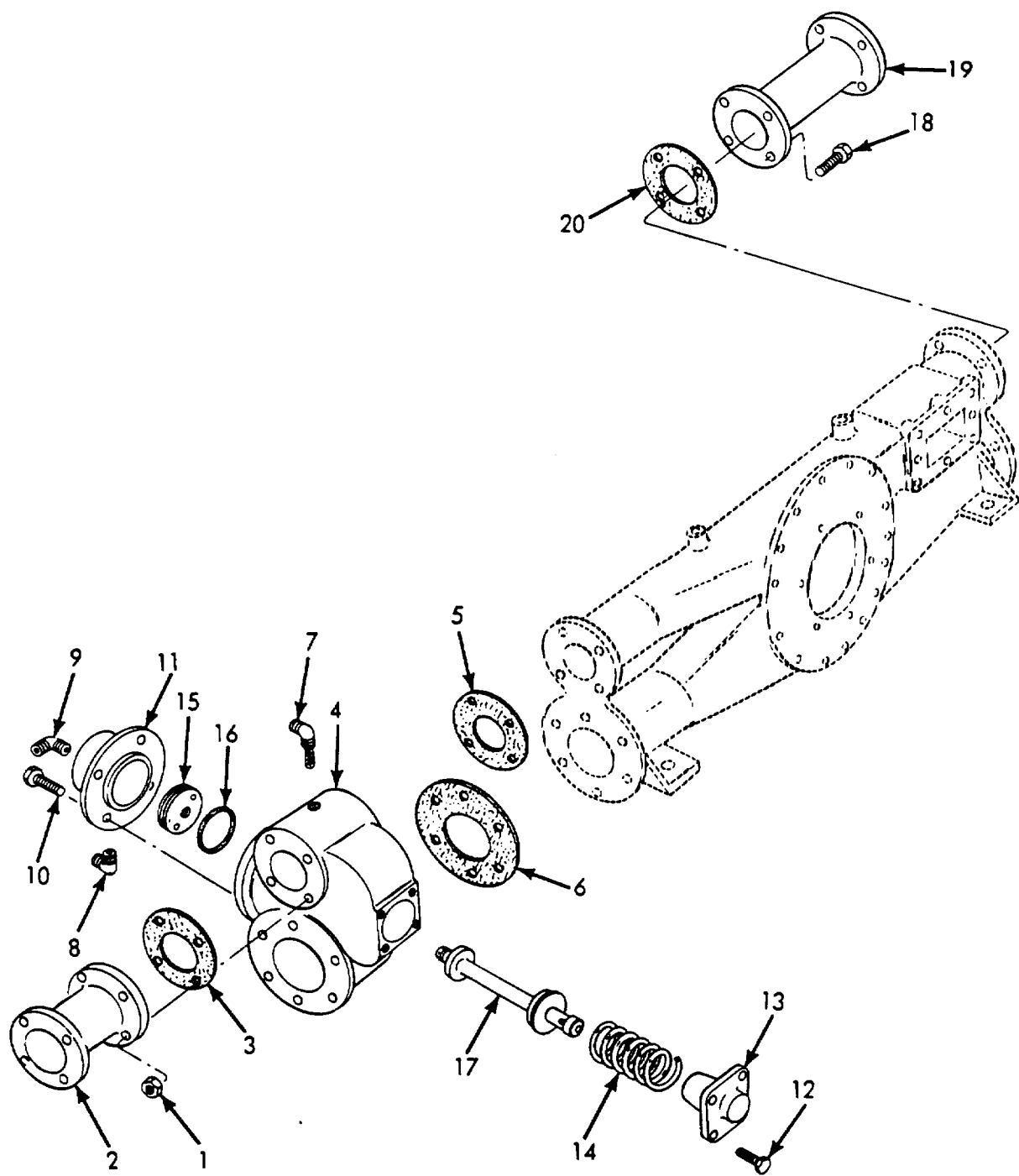
- a. Refer to figure 14 and reassembly and install the pump head and body in the reverse order.
- b. Install the relief valve and adapters (para. 54).
- c. Install the pump gearbox (para. 51).
- d. Install the pump assembly (para. 15).

---

### **INDEX TO FIGURE 13**

1 Nut, 7/16-20 (4 rqr)	8 Elbow	15 Piston
2 Discharge adapter	9 Elbow	16 Packing
3 Gasket	10 Screw, cap, 7/16-20 x 1 2/4 in. (4 rqr)	17 Valve
4 Body	11 Cover	18 Screw, cap, 7/16-20 x 14 in. (4 rqr)
5 Gasket	12 Screw, cap, 7/16X-20 x 1 in. (4 rqr)	19 Discharge adapter
6 Gasket	13 Bonnet	20 Gasket
7 Screen and elbow	14 Spring	

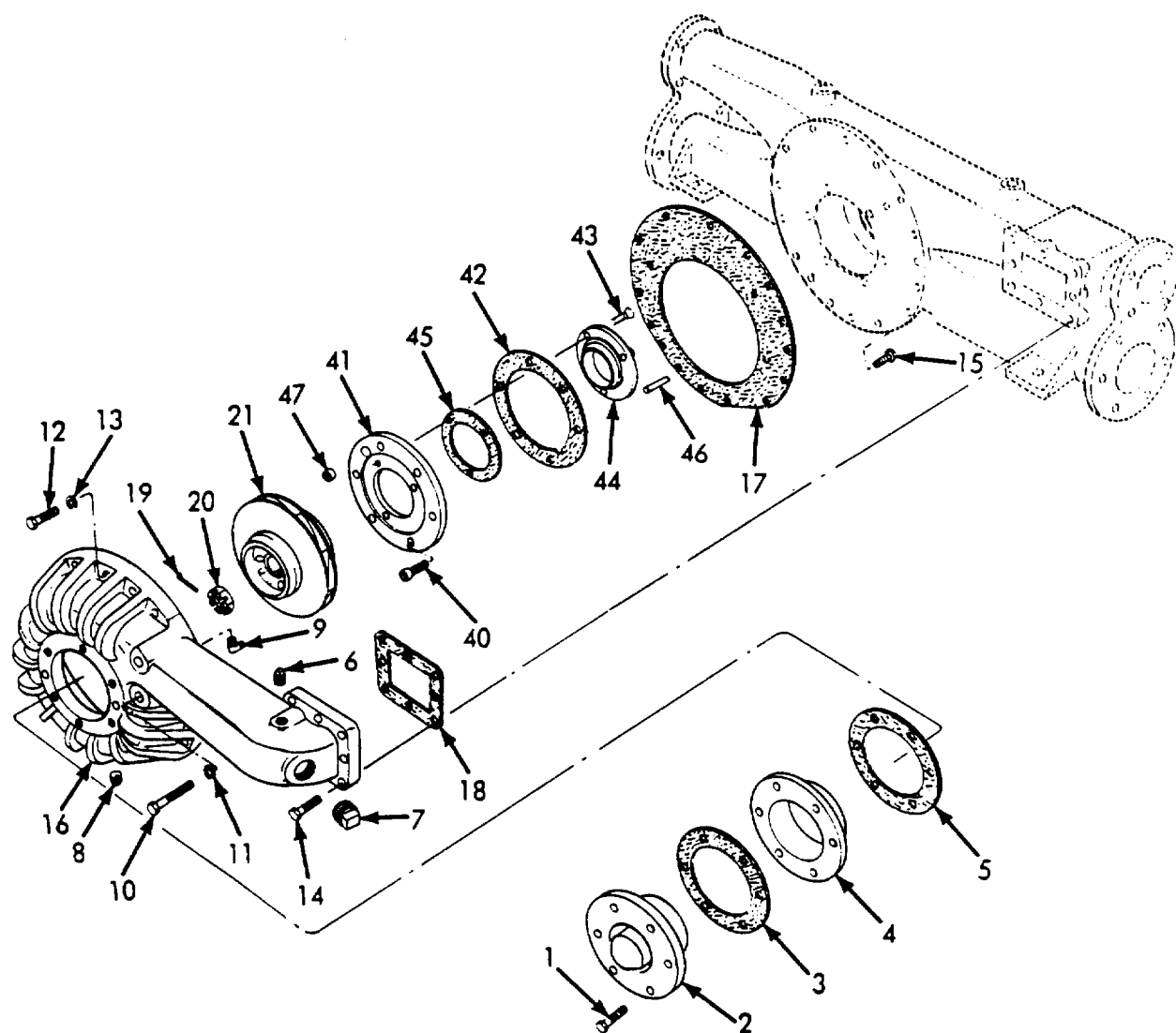




MSC 4210-205-35/13

Figure 13. Relief valve and adapter, exploded view.





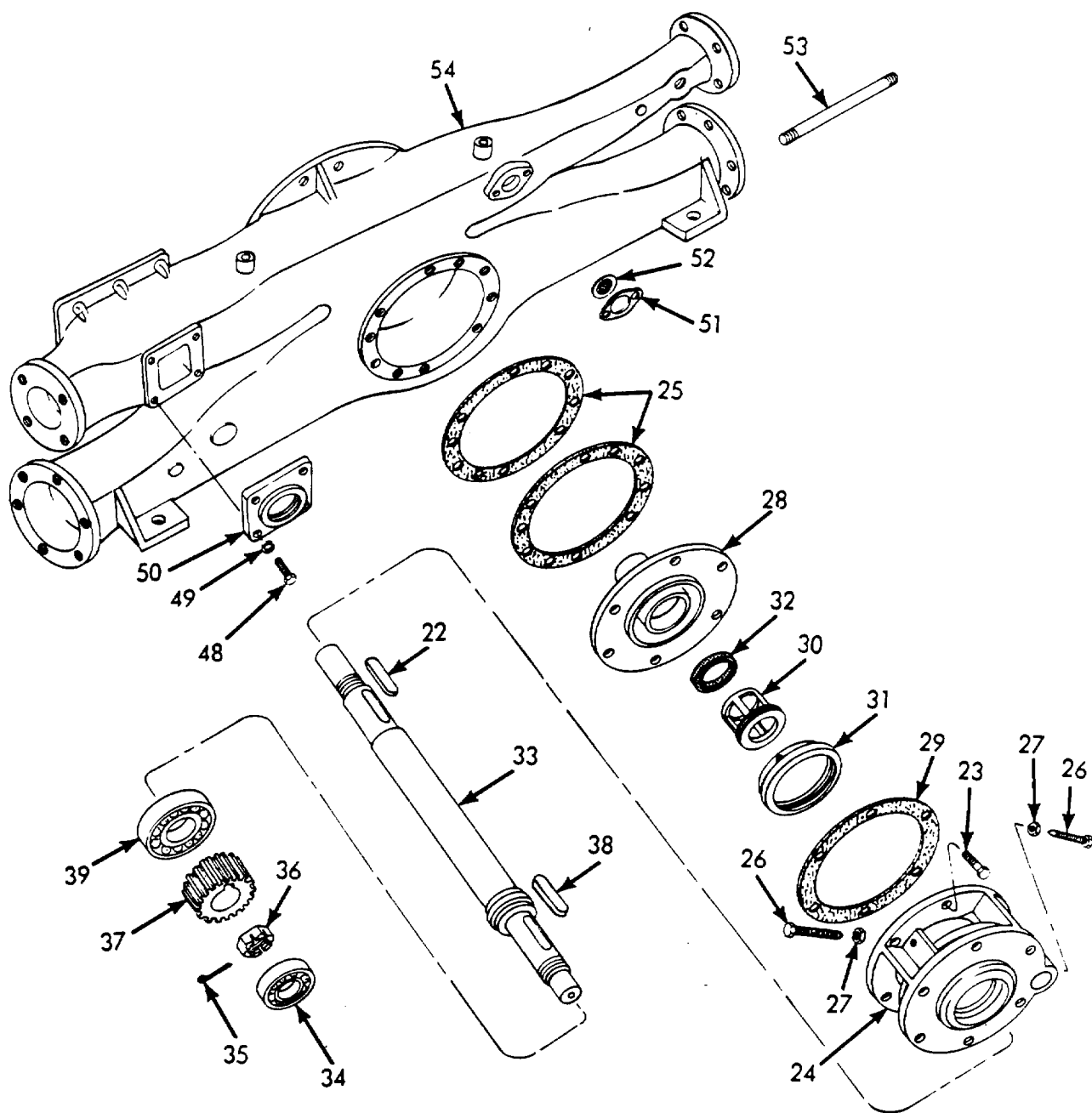
MSC 4210-205-35/14 ①

- |  |  |  |
|--|--|--|
| 1 Screw, cap, $\frac{1}{8}$ -20 x $1\frac{1}{2}$ in. (6 rqr) | 12 Screw, cap, $\frac{1}{8}$ -20 x $1\frac{1}{2}$ in. (11 rqr) | 40 Screw, socket head, $\frac{3}{8}$ -16 x $\frac{3}{4}$ in. (6 rqr) |
| 2 Housing  | 13 Washer, flat, $\frac{1}{8}$ in. (11 rqr)                    | 41 Housing   |
| 3 Gasket   | 14 Screw, cap, $\frac{1}{8}$ -20 x $1\frac{1}{2}$ in. (7 rqr)  | 42 Gasket  |
| 4 Ring   | 15 Screw, cap, $\frac{1}{8}$ -20 x $1\frac{1}{2}$ in. (4 rqr)  | 43 Screw, flat head, $\frac{3}{8}$ -16 x $1\frac{3}{4}$ in. (3 rqr)  |
| 5 Gasket   | 16 Volute body   | 44 Ring  |
| 6 Pipe plug (3 rqr)  | 17 Gasket  | 45 Gasket  |
| 7 Pipe plug  | 18 Gasket  | 46 Tube  |
| 8 Pipe plug  | 19 Cotter pin  | 47 Check valve   |
| 9 Elbow  | 20 Nut, special  |  |
| 10 Screw, cap, $\frac{1}{8}$ -20 x 4 in. (2 rqr)             | 21 Impeller  |  |
| 11 Washer, flat (2 rqr)                                      |  |  |

Callouts 1-21 and 40-47

Figure 14. Pump head and body, exploded view.





NOTE: REMOVE PARTS 24 THRU 39 ASSEMBLED, THEN DISASSEMBLE.

CAUTION: SHAFT (33) MUST BE REMOVED FROM FRONT SIDE OF HEAD (24) AS SHOWN.  
 MSC 4210-205-35/14 (2)

Figure 14. Continued.

INDEX ON NEXT PAGE



## INDEX TO FIGURE 14-Continued

22 Key	31 Sleeve	39 Bearing
23 Screw, cap, 7/16-20 x 2 in. (6 rqr)	32 Packing (as rqr)	48 Screw, cap, 7/16-20 x 1 1/4 (4 rqr)
24 Pump head	33 Shaft	49 Washer, flat, 7/16 in. (4 rqr)
25 Gasket	34 Bearing	50, Plate
26 Screw, special (2 rqr)	35 Cotter pin	51 Gasket
27 Nut, 5/16--18 (2 rqr)	36 Nut, special	52 Strainer
28 Housing	37 Gear	53 Stud, 7/16-20 x 6 1/2 in. (9 rqr)
29 Gasket	38 Key	54 Body
30 Gland		

Callouts 22-39 and 48-54

## Section IV. HOSE REEL ASSEMBLY

### 58. General

Two electric motor driven fire hose reels are mounted in the reel compartments behind the cab. One is located above the left side instrument panel, and the other above the right side instrument panel. An electric rewind button is installed on each control panel to permit automatic rewind of fire hose on each reel. A reel handcrank provides a means of rewinding fire hose, in the event of failure in the electric system. Each reel is chain driven by a ¼ horsepower electric motor, or handcranked by a pinion gear working on the reel ring gear.

### 59. Hose Reel Assembly, Removal and Disassembly

*a. Removal.* Remove the hose reel assembly (TMI 4210-205-12).

*b. Disassembly.* Refer to figure 15 and disassemble the hose reel assembly.

### 60. Hose Reel Assembly, Cleaning, Inspection, and Repair

*a. Cleaning.* Clean all parts in an approved cleaning solvent and dry thoroughly.

*b. Inspection.* Inspect all parts for wear, defects, and damage.

*c. Repair.* Replace or repair worn, defective, or damaged parts as necessary.

### 61. Hose Reel Assembly, Reassembly and Installation

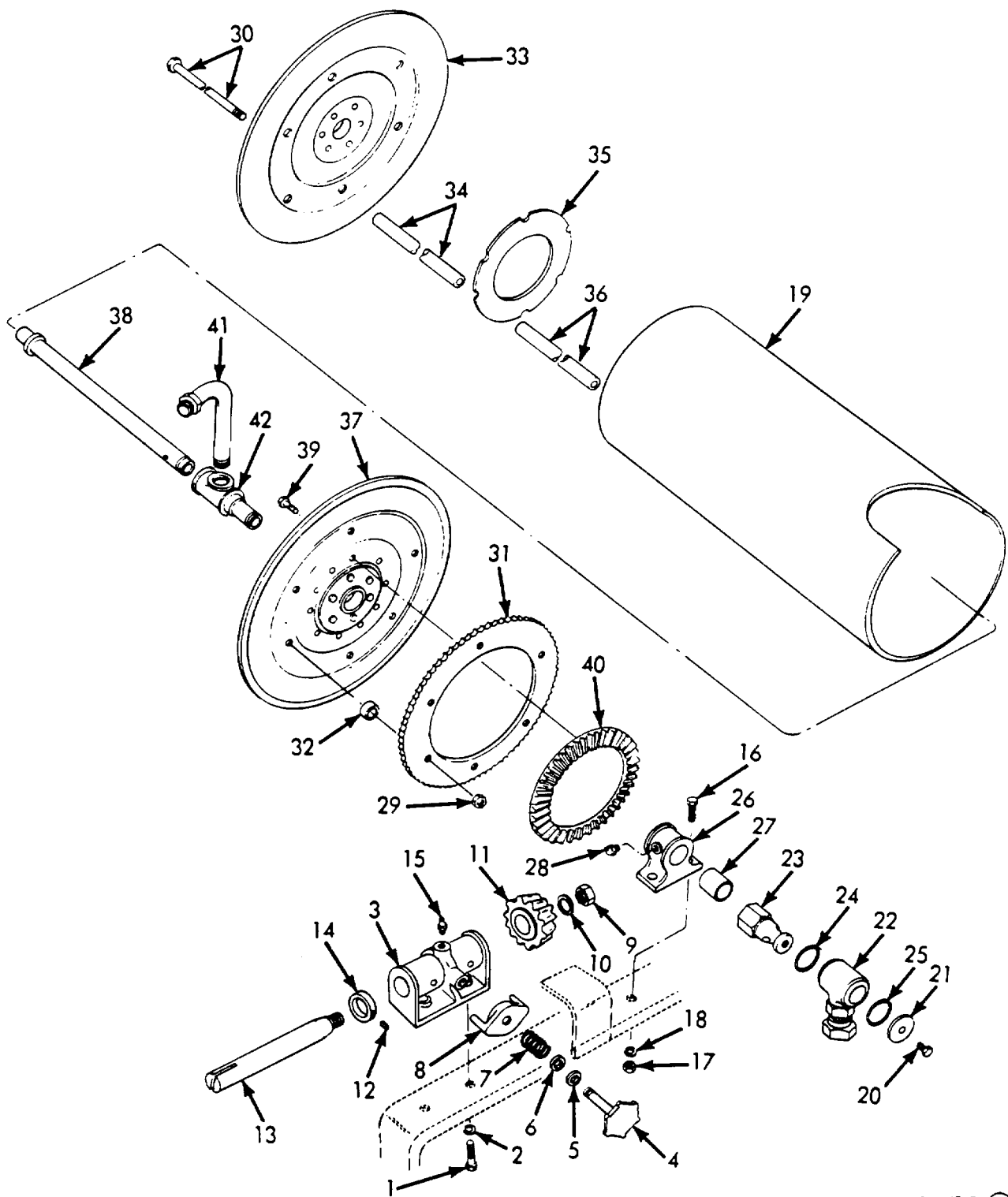
*a. Reassembly.* Refer to figure 15 and reassemble the hose reel assembly in the reverse order.

*b. Installation.* Install the hose reel assembly (TM 5-4210-205-12).

## INDEX TO FIGURE 15

1 Screw, cap, 1/20 x 1 in. (2 rqr)	15 Lubrication fitting	29 Nut, .7/16-18 (6 rqr)
2 Washer, lock, ½ in. (2 rqr)	16 Screw, 3/8-16 x 1 ¼ in. (4 rqr)	30 Screw, special (6 rqr)
3 Bearing unit	17 Nut, 3/8-16 (4 rqr)	31 Sprocket
4 Wheel	18 Washer, lock, 3/8 in. (4 rqr)	32 Spacer (6 rqr)
5 Spacer	19 Drum	33 Back disk
6 Spacer	20 Screw, special	34 Spacer (6 rqr)
7 Spring	21 Cover	35 Separator
8 Pad	22 Body	36 Spacer (6 rqr)
9 Nut	23 Stem	37 Front disk
10 Washer	24 Packing	38 Shaft
11 Gear	25 Packing	39 Screw, special (10 rqr)
12 Setscrew	26 Bearing (2 rqr)	40 Gear
13 Shaft	27 Bushing (2 rqr)	41 Elbow
14 Collar	28 Lubrication fitting (2 rqr)	42 Fitting

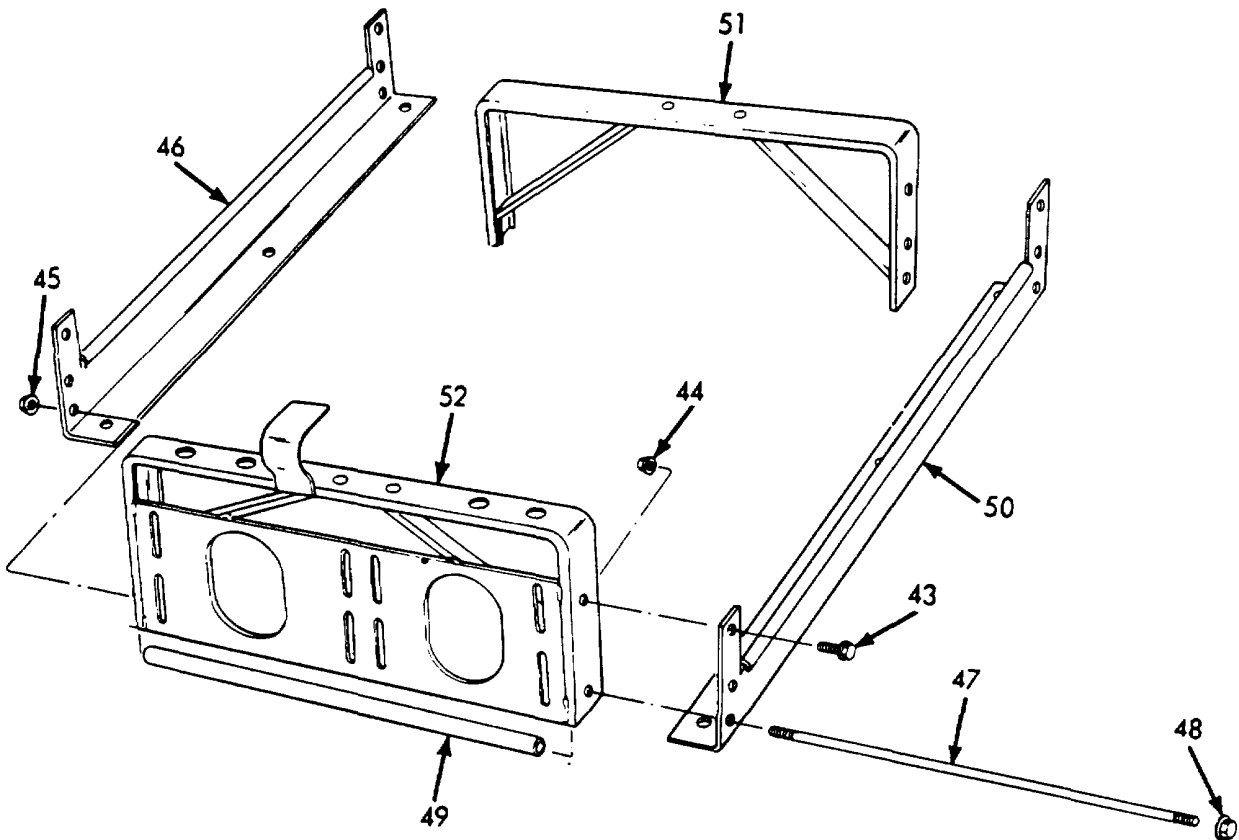




MSC 4210-205-35/15 ①

Figure 15. Hose reel assembly, exploded view.





MSC 4210-205-35/15 (2)

43 Screw, special (4 rqr)  
44 Nut, special (4 rqr)  
45 Nut, special (2 rqr)  
46 Foot

47 Stud (4 rqr)  
48 Nut, special (2 rqr)  
49 Spacer

50 Foot  
51 Frame  
52 Frame

Figure 15. Continued.

## Section V. WATER TANK

### 62. General

The water tank is made from fabricated welded stainless steel panels, and has a capacity of 400 gallons. The tank is fully insulated and equipped with four lifting eyes for removal. An overflow pipe is mounted on the left front side of the tank. The tank is mounted directly to the carrier chassis.

### 63. Water Tank, Removal and Disassembly

a. *Removal.* Remove the water tank (TMI 54210-205-12).

b. *Disassembly.* Refer to figure 16 and disassemble the water tank.

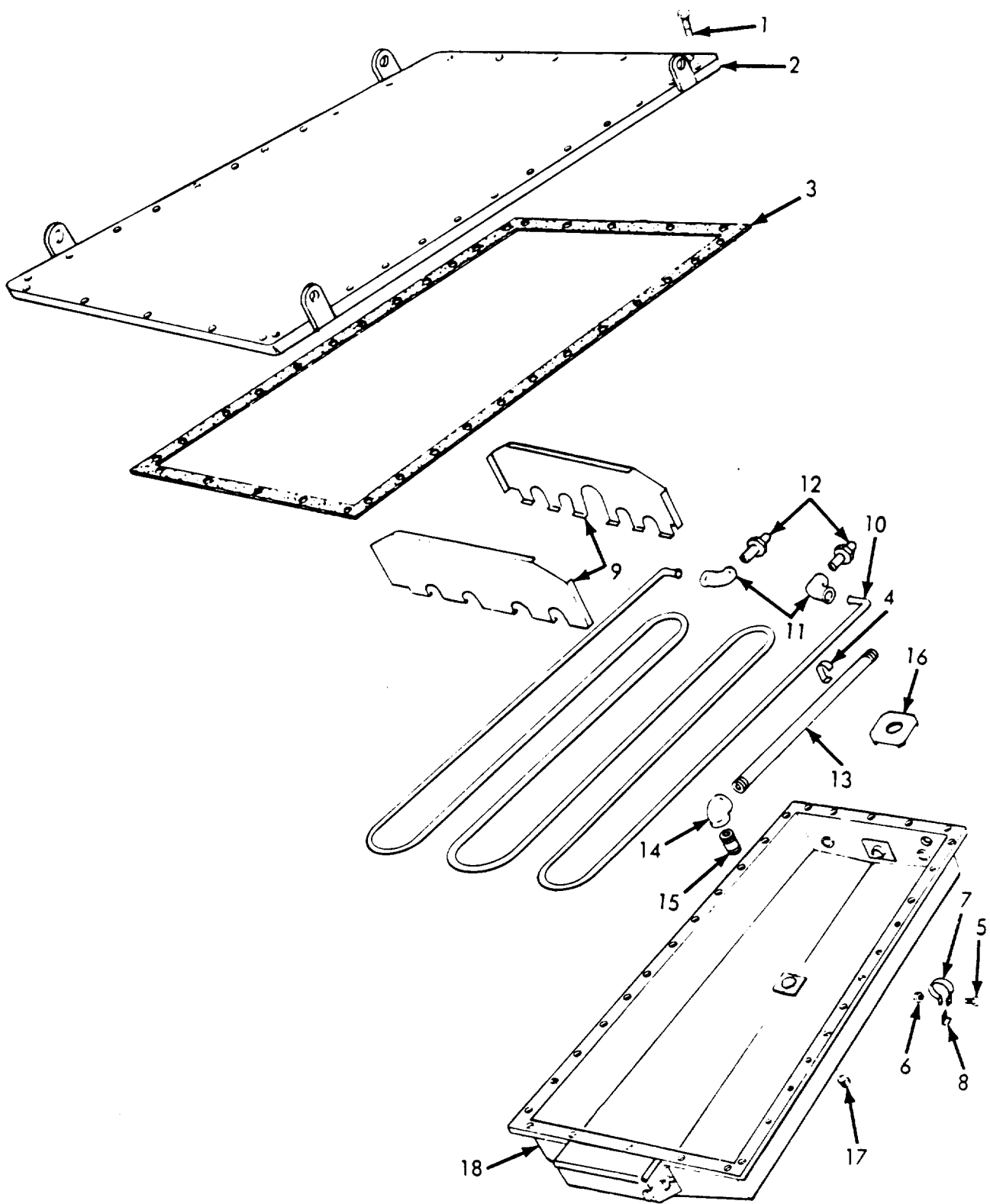
#### INDEX TO FIGURE 16

1 Screw, cap, 3/8-16 x 1 in. (42 rqr)  
2 Cover  
3 Gasket  
4 Clip (12 rqr)  
5 Screw, cap, 3/8-16 x 1/2 in. (2 rqr)  
6 Nut, 3/8 in. (2 rqr)

7 Ring (2 rqr)  
8 Retainer (2 rqr)  
9 Baffle plate (2 rqr)  
10 Tube  
11 Elbow (2 rqr)  
12 Fitting (2 rqr)

13 Pipe  
14 Elbow  
15 Nipple  
16 Plate  
17 Nipple  
18 Tank





MSC 4210-205-35 16

Figure 16. Water tank, exploded view.



#### **64. Water Tank, Cleaning, Inspection, and Repair**

*a. Cleaning.* Clean all parts in an approved cleaning solvent and dry thoroughly.

*b. Inspection.* Inspect all parts for wear, defects, and( damage).

*c. Repair.* Replace or repair worn, defective, or damaged parts as necessary.

### **Section VI. SPECIAL PURPOSE BODY, WIRING AND DATA PLATES**

#### **66. General**

The special purpose body includes the right, left, and pump compartments. The special purpose compartment\* are bolted to the chassis frame by a series of U-bolts. The right and left compartments rest on wooden stringers attached to the chassis frame. The pump data plates are mounted on the special purpose body. The wiring will include all wiring covered by the firetruck. The chassis wiring harness will include the basic truck, plus items that have been added to the firetruck.

#### **67. Special Purpose Body Compartment, Removal**

*a.* Remove the water tank and apron (TM 5-4210-205-12).

*b.* Refer to paragraph 15 and remove the pump compartment from the chassis.

*c.* Refer to figure 17 and remove the left and right compartments from the chassis.

#### **68. Special Purpose Body Compartments, Cleaning, Inspection, and Repair**

*a. Cleaning.* Clean all parts in an approved cleaning solvent and dry thoroughly.

*b. Inspection.* Inspect all Farts for wear, defects, and damage.

*c. Repair.* Replace or repair worn, defective, or damaged parts as necessary.

#### **69. Special Purpose Body Compartments, Installation**

#### **65. Water Tank, Reassembly and Installation**

*a. Reassembly.* Refer to figure 16 and reassemble the water tank in the reverse order.

*b. Installation.* Install the water tank (T.I 54210-205-12).

*a.* Refer to figure 17 and install the left- and righthand compartments on the chassis.

*b.* Refer to paragraph 15 and install the pump compartment on the chassis.

*c.* Install the water tank and apron (TM 5-4210-205-12).

#### **70. Control Panel Testing and Wiring, Replacement**

*a. Testing.* Refer to wiring diagram (TM 5-4210-205-12) and test a wire for continuity by disconnecting each end from the component or components to which it is connected. With a multimeter set on the ohms scale touch the test probes to each end of the wire. If continuity is not indicated, the wire is defective and must be repaired or replaced.

*b. Replacement.* Replace a wire by disconnecting it from the component or components and remove the wire. Install a new wire and connect it. If a broken wire is part of a wiring harness, disconnect the wire and tape the ends. Install a new wire and attach it to the outside of the wiring harness.

#### **71. Chassis Wiring Harness, Replacement**

Refer to the chassis wiring diagram (T-1 9-2320235) and fire-truck wiring diagram (T.I 5-4210205-12), remove the necessary hardware and disconnect necessary leads and remove the %wiring harness from the chassis and firetruck.

#### **72. Data Plates, Replacement**

Remove necessary screws and rivets and remove data plates from firetruck.



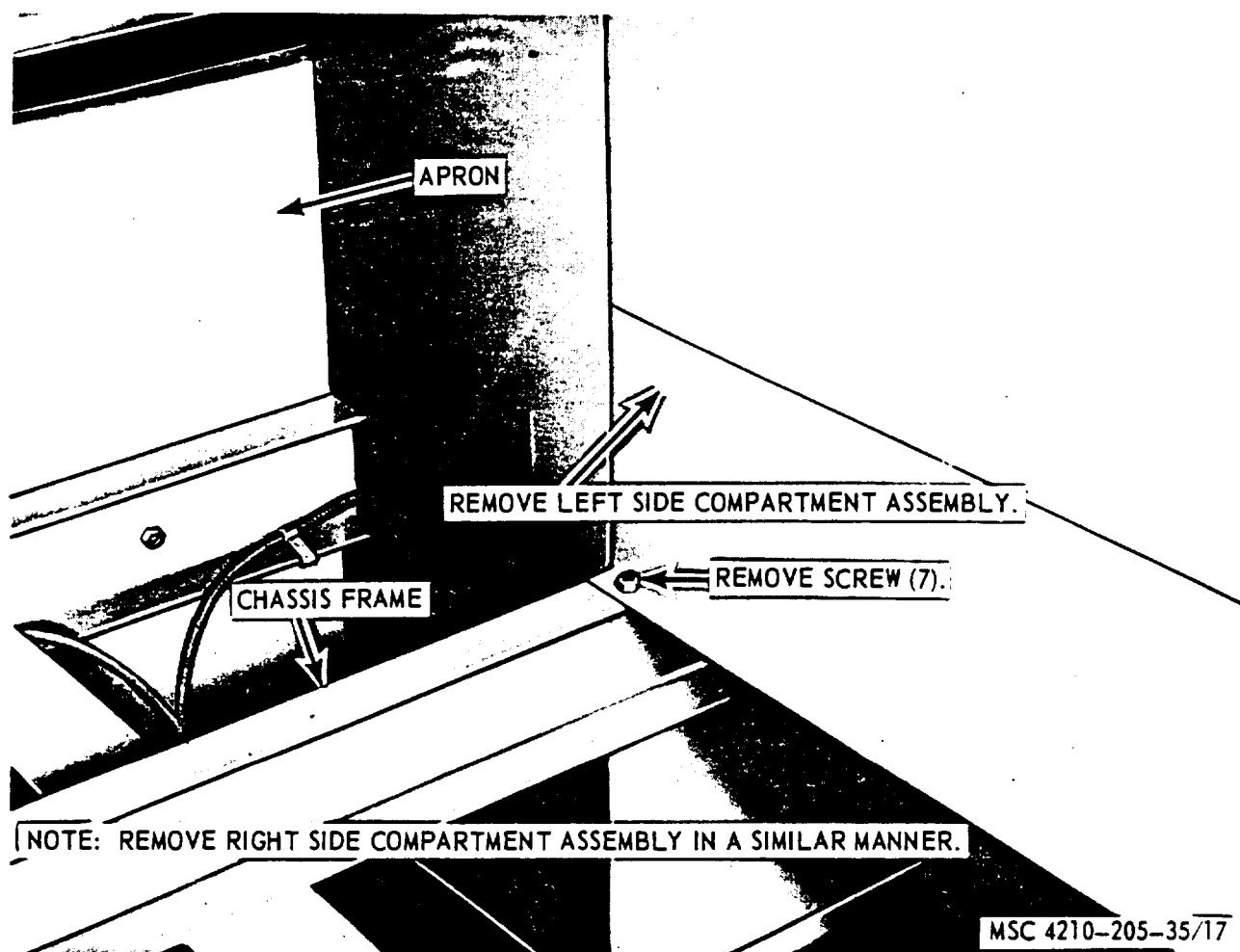


Figure 17. Special purpose body compartments, removal and installation.



## APPENDIX REFERENCES

---

### 1. Dictionaries of Terms and Abbreviations

AR 320-5	Dictionary of United States Army Terms.
AR 320-50	Authorized Abbreviations and Brevity Codes.

### 2. Fire Protection

TM 5-687	Repairs and Utilities: Fire Protection Equipment and Appliances; Inspections, Operations, and Preventive Maintenance.
TM 9-1799	Ordnance Maintenance: Fire Extinguishers.

### 3. Lubrication

LO 5-4210-205-20	Lubrication Order. (To be published)
LO 9-2320-235-12	Lubrication Order Truck, Cargo 2 ½--Ton, 6 x 6.

### 4. Operator's and Organizational Maintenance

TM 5-4210-205-12	Operator's and Organizational Maintenance Manual.
------------------	---

### 5. Painting

TM 9-213	Painting Instructions for Field Use.
----------	--------------------------------------

### 6. Preventive Maintenance

TM 38-750	Army Equipment Record Procedures.
-----------	-----------------------------------

### 7. 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.

### 8. Training Aids

FM 5-25	Explosives and Demolitions.
FM 21-5	Military Training.
FM 21-6	Techniques of Military Instruction.
FM 21-30	Military Symbols.



## INDEX

	Paragraph	Page
Control valves, lines, and fittings:		
Drain line valve cleaning, inspection, and repair .....	30	10
Drain line valve reassembly and installation .....	31	10
Drain line valve removal and disassembly .....	29	10
Foam metering valve cleaning, inspection, and repair .....	39	12
Foam metering valve reassembly and installation.....	40	12
Foam metering valve removal and disassembly .....	38	12
Foam tank drain valve and foam valve cleaning, inspection, and repair.....	36	12
Foam tank drain valve and foam valve reassembly and installation.....	37	12
Foam tank drain valve and foam valve removal and disassembly .....	35	12
General .....	16	9
Hose reel valves, tank fill valves, and tank suction valve (cleaning, inspection, and repair ..	24	9
Hose reel valves, tank fill valves, and tank suction valve reassembly -and installation .....	25	10
Hose reel valves, tank fill valves, and tank suction valve removal and disassembly .....	23	9
Relief valve control cleaning, inspection, and repair. ....	33	10
Relief valve control reassembly and installation.....	34	10
Relief valve control assembly removal and disassembly.....	32	10
Suction and discharge valves cleaning, inspection and repair .....	21	9
Suction and discharge valves reassembly and installation .....	22	9
Suction and discharge valves removal and disassembly .....	20	9
Water and foam pipes and fittings cleaning, inspection, and repair .....	18	9
Water and foam pipes and fittings installation .....	19	9
Water and foam pipes and fittings removal .....	17	9
Water tank drain valve cleaning, inspection, and repair .....	27	10
Water tank drain valve reassembly and installation .....	28	10
Water tank drain valve removal and disassembly .....	26	10
Description .....	3	2
Hose reel assembly:		
General .....	58	28
Cleaning, inspection, and repair.....	60	28
Reassembly and installation .....	61	28
Removal and disassembly .....	50	28
Troubleshooting.....	12	4
Primer pump assembly:		
General .....	41	18
Primer pump assembly cleaning, inspection, and repair.....	43	18
Primer pump assembly reassembly and installation .....	44	20
Primer pump assembly removal and disassembly .....	42	18
Primer valve cleaning, inspection, and repair .....	46	20
Primer valve reassembly and installation .....	47	20
Primer valve removal and disassembly .....	42	20
Troubleshooting.....	9	4
Record and report forms .....	2	2
Removal and installation of major components or auxiliaries:		
General .....	14	5
Water pump.....	15	5
Scope .....	1	2



	Paragraph	Page
Special purpose body wiring and data plates:		
Chassis wiring harness replacement .....	71	32
Control panel testing and wiring replacement .....	70	32
Data plates replacement .....	72	32
General .....	66	32
Special purpose body compartment cleaning, inspection, and repair .....	68	32
Special purpose body compartment installation .....	60	32
Special purpose body compartment removal .....	67	32
Troubleshooting .....	11	4
Special tools and equipment:		
Special tools and equipment .....	5	4
Specially designed tools .....	6	4
Tabulated data .....	4	2
Troubleshooting:		
Control valves, lines and fittings .....	11	4
General .....	7	4
Hose reel assembly .....	12	4
Primer pump assembly .....	9	4
Water pump assembly .....	8,10	4
Water tank .....	13	4
Water pump:		
Installation .....	15b	5
Removal .....	15a	5
Water pump assembly:		
General .....	48	22
Pump gearbox cleaning, inspection, and repair .....	50	22
Pump gearbox reassembly and installation .....	51	22
Pump gearbox removal and disassembly .....	49	22
Pump head and body cleaning, inspection, and repair .....	56	24
Pump head and body reassembly and installation .....	57	24
Pump head and body removal and disassembly .....	55	24
Relief valve and adapters cleaning, inspection, and repair .....	53	24
Relief valve and adapters reassembly and installation .....	54	24
Relief valve and adapters removal and disassembly .....	52	24
Troubleshooting .....	8,10	4
Water tank:		
General .....	62	30
Cleaning, inspection, and repair .....	64	32
Reassembly and installation .....	65	32
Removal and disassembly .....	63	30
Troubleshooting .....	13	4



By Order of the Secretary of the Army:

Official:

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

HAROLD K. JOHNSON,  
General, United States Army,  
Chief of Staff.

Distribution:

*Active Army:*

USASA (2)  
ACSI (1)  
DCSLOG (1)  
CNGB (1)  
TSG (1)  
CofEngrs (1)  
C/COMMEL (1)  
CofT (1)  
CofSptS (1)  
USA Maint Bd (1)  
USAARTYBD (2)  
USAARNIBD (2)  
USAIB (2)  
USAADBD (2)  
USAAESWBD (2)  
USAAVNBD (2)  
USCONARC (3)  
OS Maj Comd (5) except  
    USASETAF (2)  
    USARJ (10)

USAMOCOM (2)  
USASMCOM (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)  
Army Dep (2)  
USA Trans Tml Comd (2)  
USA Tml (1)  
USAOSA (2)  
Div Engr (2)  
Engr Dist (2)  
USAERDL (3)

USA Mbl Equip Cen (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 (S)  
AMIS (3)  
USAREURCONIZ (2)  
USA Corps (1)  
MAAG (1)  
JBUSMC (1)  
Units org under fol TOE's (2 ea  
    UNOINDC):  
5-48  
.5-237 (5)  
5-262 (5)  
5-267 (1)  
5-278 (5)  
5-279

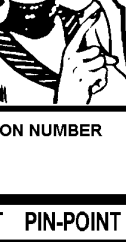
NG: State AG (3).

USAR: Same as active Army except allowance is one copy to each unit.

For explanation of abbreviations used, see AR 320-5-0.

☆U.S. GOVERNMENT PRINTING OFFICE: 1979-299-926/597  
U. S. ARMY ADJUTANT GENERAL PUBLICATIONSCENTER, ST. LOUIS, MO 1965



<h2>SOMETHING WRONG WITH PUBLICATION</h2>				
 <p><i>THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL.</i></p>		FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)		
		DATE SENT		
PUBLICATION NUMBER		PUBLICATION DATE		PUBLICATION TITLE
<b>BE EXACT PIN-POINT WHERE IT IS</b>		IN THIS SPACE, TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT.		
PAGE NO.	PARA-GRAPH			
PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER		SIGN HERE		



## THE METRIC SYSTEM AND EQUIVALENTS

### LENGTH MEASURE

1 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

### WEIGHTS

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

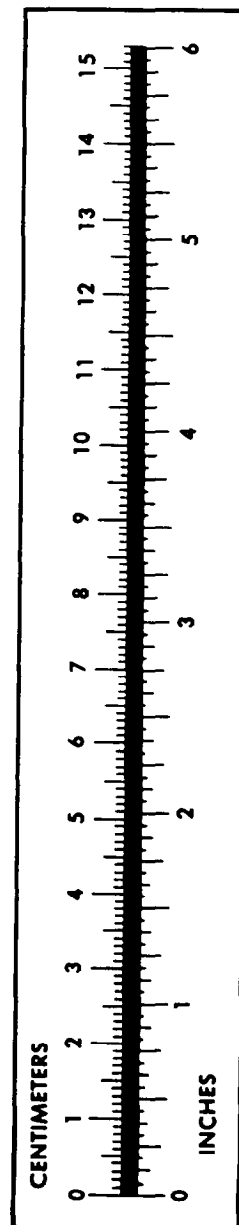
### TEMPERATURE

$5/9(^{\circ}\text{F} - 32) = ^{\circ}\text{C}$   
 212° Fahrenheit is equivalent to 100° Celsius  
 90° Fahrenheit is equivalent to 32.2° Celsius  
 32° Fahrenheit is equivalent to 0° Celsius  
 $9/5^{\circ}\text{C} + 32 = ^{\circ}\text{F}$

### 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
Quarts	Liters	0.473
Gallons	Liters	0.946
Ounces	Liters	3.785
Pounds	Grams	28.349
Short Tons	Kilograms	0.454
Pound-Feet	Metric Tons	0.907
Pounds per Square Inch	Newton-Meters	1.356
Miles per Gallon	Kilopascals	6.895
Miles per Hour	Kilometers per Liter	0.425
	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
Liters	Gallons	0.264
Grams	Ounces	0.035
Grams	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621





**PIN: 005826-001**



This fine document...

Was brought to you by me:



### [Liberated Manuals -- free army and government manuals](#)

Why do I do it? I am tired of sleazy CD-ROM sellers, who take publicly available information, slap “watermarks” and other junk on it, and sell it. Those masters of search engine manipulation make sure that their sites that sell free information, come up first in search engines. They did not create it... They did not even scan it... Why should they get your money? Why are not letting you give those free manuals to your friends?

I am setting this document FREE. This document was made by the US Government and is NOT protected by Copyright. Feel free to share, republish, sell and so on.

I am not asking you for donations, fees or handouts. If you can, please provide a link to [liberatedmanuals.com](http://liberatedmanuals.com), so that free manuals come up first in search engines:

<A HREF=<http://www.liberatedmanuals.com/>>Free Military and Government Manuals</A>

- Sincerely  
Igor Chudov  
<http://igor.chudov.com/>
- [Chicago Machinery Movers](#)