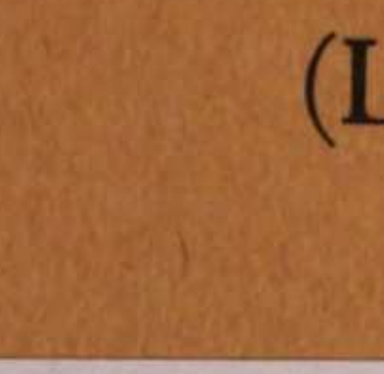
DEPARTMENT OF THE ARMY
TECHNICAL MANUAL

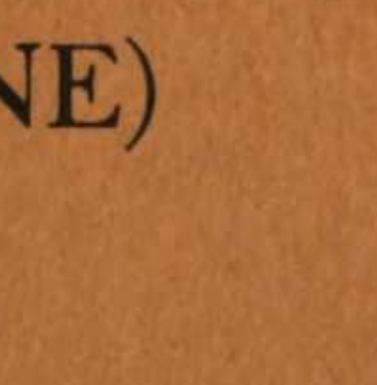
DEPARTMENT OF THE AIR
FORCE TECHNICAL ORDER

TM 5-9095
TO 40R6-5-21

ICE PLANT

1-TON
EQUIPMENT ONLY
GASOLINE-DRIVEN
RECO MODEL G2000-S50D
(LESS ENGINE)





DEPARTMENTS OF THE ARMY AND THE AIR FORCE

NOVEMBER 1955

SAFETY PRECAUTIONS

Never fill the fuel tank near an open flame or when the engine is running. When pouring in fuel, keep the metal of the funnel in contact with the metal of the fuel tank to avoid the possibility of an electric spark igniting the gasoline. Do not use an open flame and do not smoke near gasoline, as the air within a radius of several feet is permeated with highly explosive vapor.

Never attempt to operate the ice plant in an unventilated room without proper provision for piping the exhaust gases outside. Carbon monoxide gas, produced by all gasoline engines, is an invisible, deadly poison.

When hand cranking the engine, keep the thumb on the same side of the crank as the fingers to avoid a broken wrist should the crankshaft reverse direction.

Never run the engine at full load when cold.

Never lubricate the ice plant while it is in operation.

Never operate the compressor with the discharge service valve closed.

Never open the compressor to add or remove oil without first pumping down the system. Low pressure gage must register neither above nor below zero.

Never operate the ice plant unless brine level is above brine agitator propeller (at least 10 ice cans in place) or brine agitator is disconnected from gear box.

Never allow the refrigeration system to contain more than 13 lbs of Freon–12 by actual weight (not pressure), for there is danger of explosion if it is exposed to heat.

TECHNICAL MANUAL
No. 5–9095
TECHNICAL ORDER
No. 40R6–5–21

DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., *17 November 1955*

ICE PLANT, 1 TON, EQUIPMENT ONLY, GASOLINE DRIVEN, RECO MODEL G2000–S50D (LESS ENGINE)

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. These instructions are published for the use of the personnel to whom this ice plant is issued. They contain information on the operation, organizational maintenance, and field and depot maintenance of the ice plant as well as a description of the major units and their functions in relation to other components of the materiel. They apply only to the Refrigeration Engineering Corp. Model G2000–S50D.

b. Other publications applicable to the equipment covered by this manual are listed in appendix I. Appendix II tabulates the replaceable parts available for the equipment. Appendix III lists the supplies, equipment and tools required by the operator for maintenance and operation of the unit.

Note. **Request any errors or suggestions for improvement of this manual be brought to the attention of The Commandant, The Engineer School, Fort Belvoir, Va., ATTN: TECES–TP. Direct communication is authorized.**

2. Record and Report Forms

The maintenance record forms listed in *a* through *r* below will be used in the maintenance of this equipment.

a. DA Form 5–13, Spot Check Inspection Report of Organizational Maintenance of Engineer Equipment.

b. DA Form 5–14, Annual Technical Inspection Report of Engineer Equipment.

c. DA Form 9–71, Locator and Inventory Control Card.

d. DA Form 9–77, Job Order Register.

e. DA Form 9–79, Parts Requisition.

f. DA Form 9–81, Exchange Part of Unit Identification Tag.

g. DA Form 285, Accident.

h. DA Form 446, Issue Slip.

i. DA Form 447, Turn-in-Slip.

j. DA Form 460, Work Sheet for Preventive Maintenance Roster.

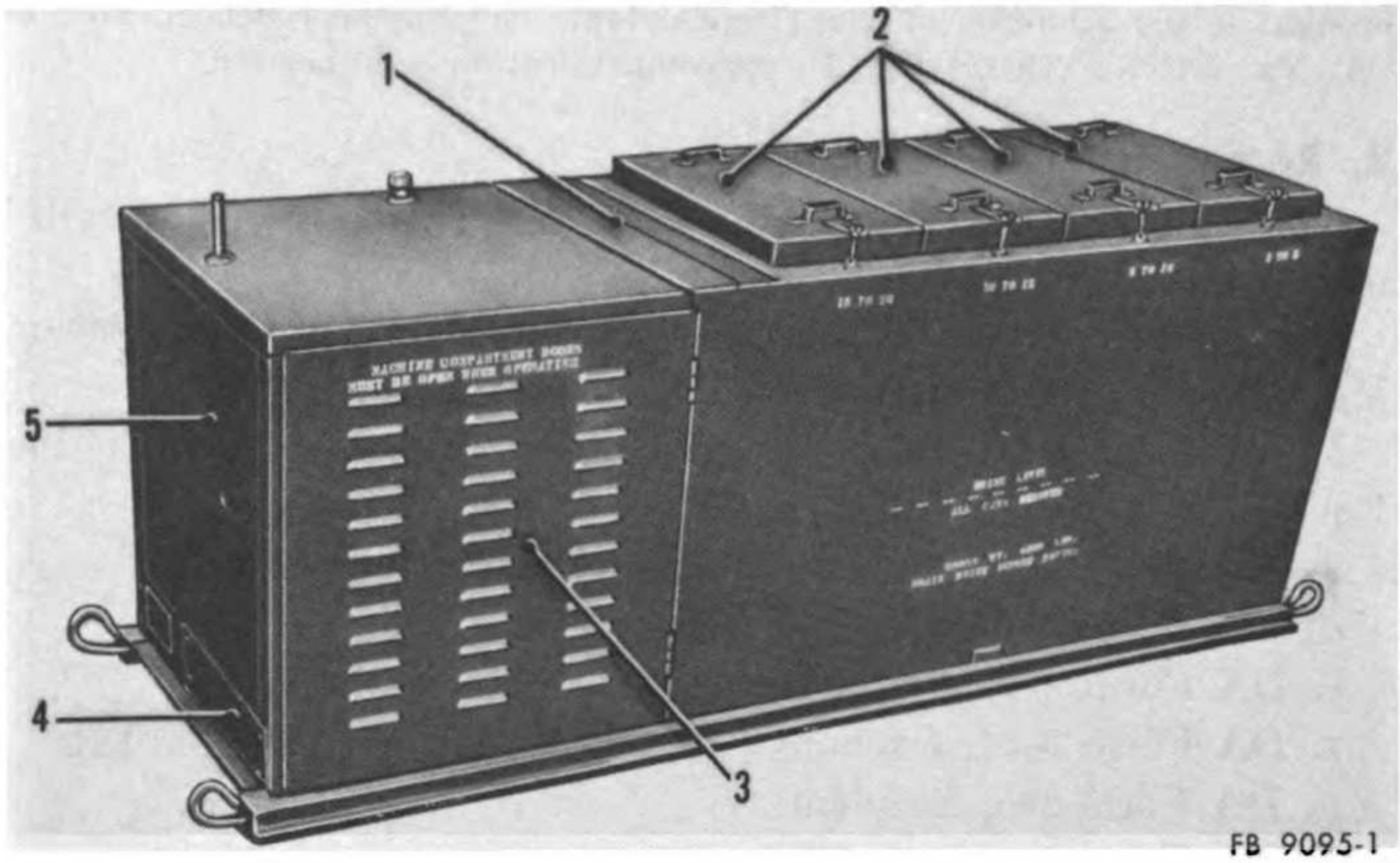
k. DA Form 468, Unsatisfactory Equipment Report.

l. DA Form 478, Organizational Equipment File.
m. DD Form 518, Accident-Identification Card.
n. DA Form 811, Work Request and Job Order.
o. DA Form 867, Status of Modification Work Order.
p. DD Form 6, Report of Damaged or Improper Shipment.
q. DD Form 110, Vehicle and Equipment Operational Record.
r. DA Form 5–43, Work Sheet for Warehouse Cold Storage Plant (no Attendants) Inspection and Preventive Maintenance Services.

Section II. DESCRIPTION AND DATA

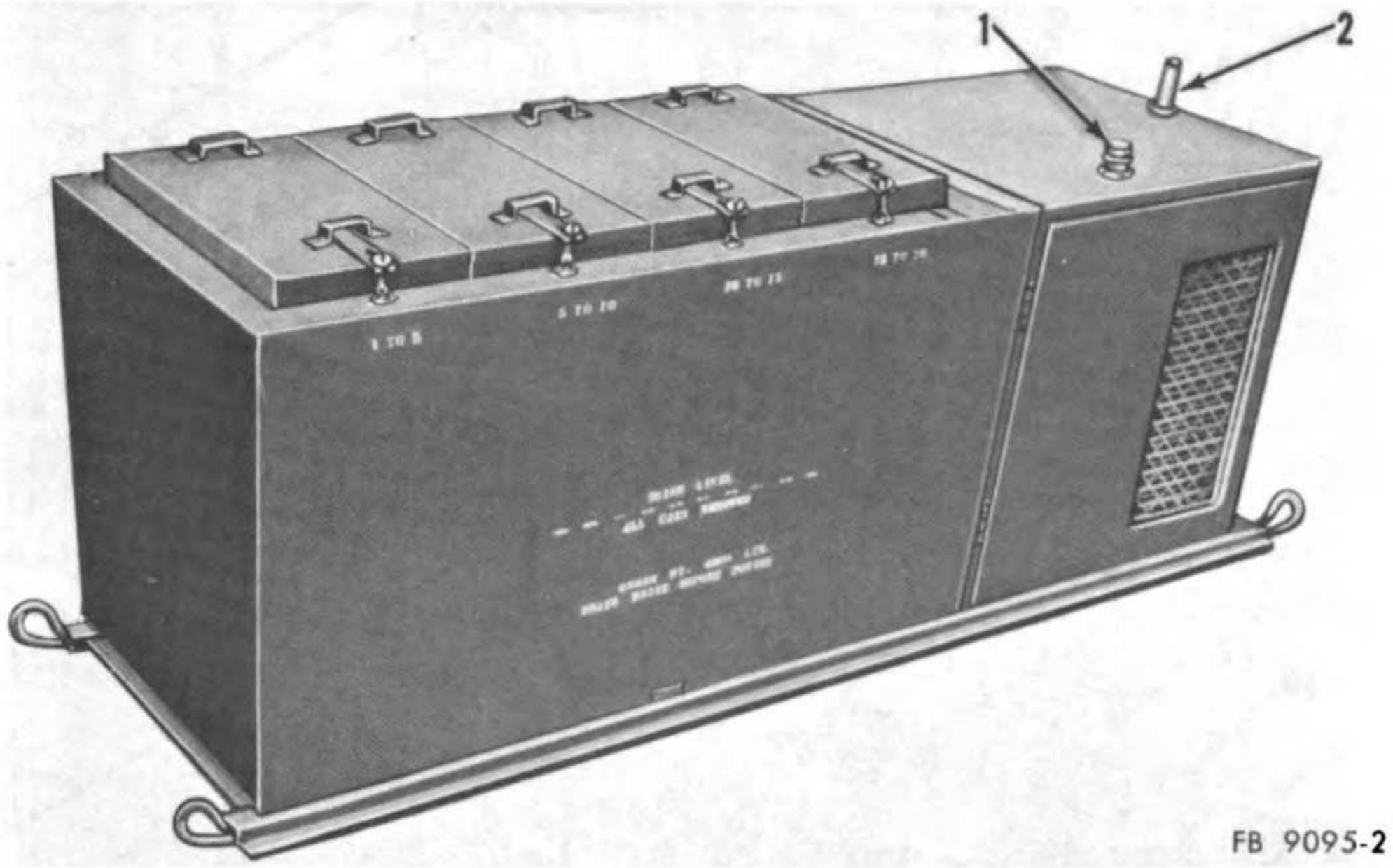
3. Description

a. General Information. The Refrigeration Engineering Corp. Model G2000–S50D, ice plant (figs. 1 and 2), serial numbers 1001 to 1240, inclusive, is a self-contained, skid-mounted unit for the manufacture of opaque ice. The plant includes a gasoline-engine-driven compressor, an air-cooled condenser, a receiver, a brine tank with removable covers, ice cans, controls, gages, and refrigeration piping and dehydrator. It produces not less than 1,900 pounds of ice in 24 hours when the ambient temperature is 125° F., and when the water supplied to the ice cans is at a temperature of not more than 90° F. Calcium chloride is furnished in sufficient quantity to prepare an initial brine for the operation of the plant. See (fig. 3) for layout of refrigeration system components.



1 Brine agitator cover
2 Ice can covers
3 Front machine compartment door
4 Bell and battery cover
5 End machine compartment door

Figure 1. Ice plant, left front, three-quarter view.



1 Fuel tank fillercap **2 Exhaust pipe**

Figure 2. Ice plant, right rear three-quarter view.

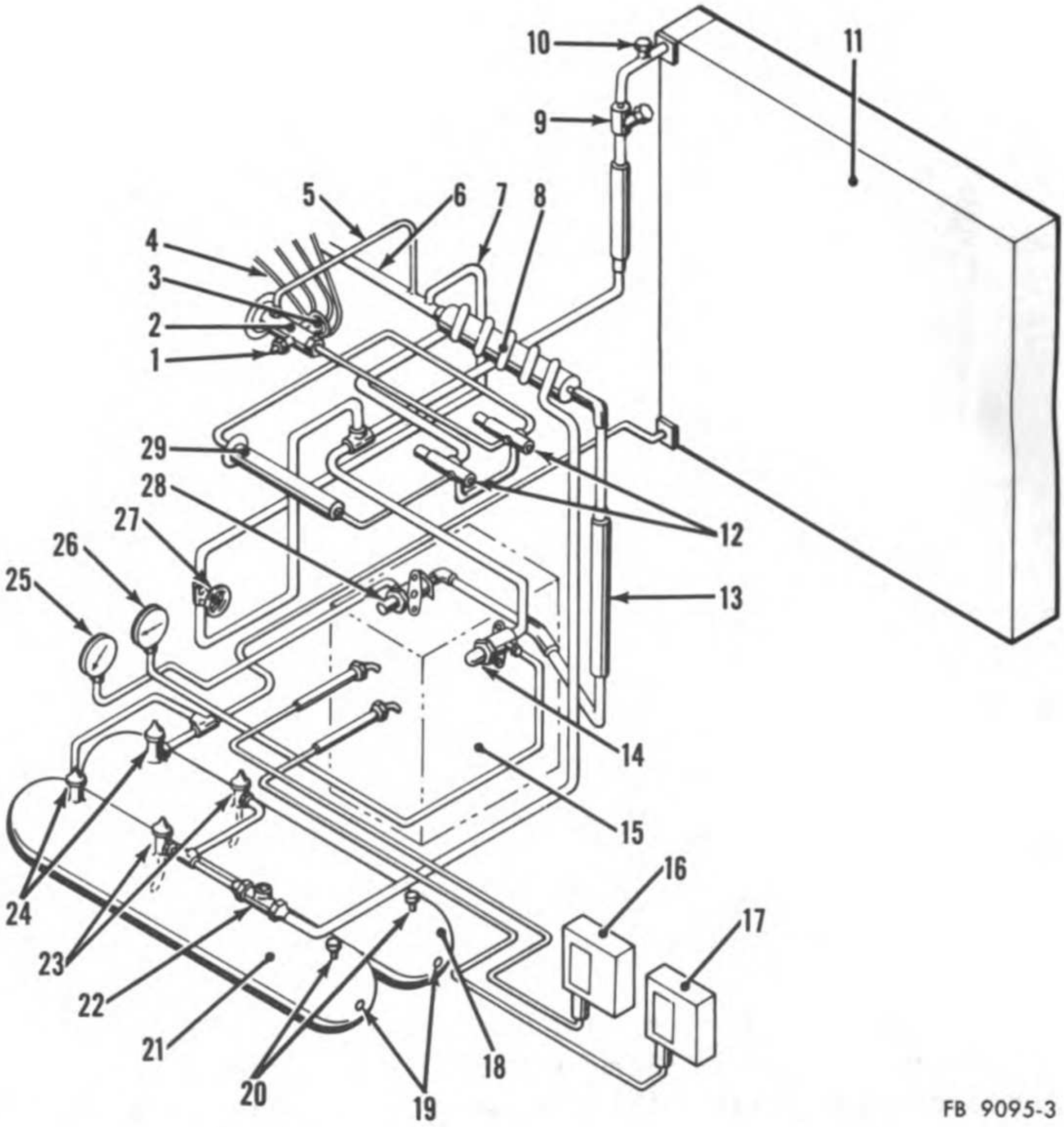
b. Engine. The compressor is driven by an International Harvester, Model U–1 engine (fig. 4). It is a four-cylinder four-stroke cycle, L-head, water-cooled, gasoline engine. Its speed is regulated by a centrifugal, variable-speed type governor which is set for 2,250 rpm (revolutions per minute).

c. Compressor. The ice plant has a two-cylinder, 3¼-inch bore, 3-inch stroke, Copeland Refrigeration Corp. compressor (5) (fig. 5) for operation with Freon-12 refrigerant. It is driven by dual V-belts attached to the engine, operates at 680 rpm, and is equipped with a suction shutoff valve and discharge shutoff valve.

4. Identification

(fig. 6)

The ice plant carries three identification plates. The Corps of Engineers identification plate (A), located in the machine compartment on the wall between the machine compartment and the brine tank, above the suction and discharge gages, specifies the official nomenclature, model and serial numbers, type, operating charge, compressor and engine rpm, and operating weight. The engine identification plate (B), located on the side of the engine control panel, between the control panel and the refrigerant condenser, specifies the manufacturer, model, serial number, payload and maximum idling speed of the engine. The transportation data plate (C), located on the right side panel of the ice plant, specifies the location and lifting capacities of the towing eyes.



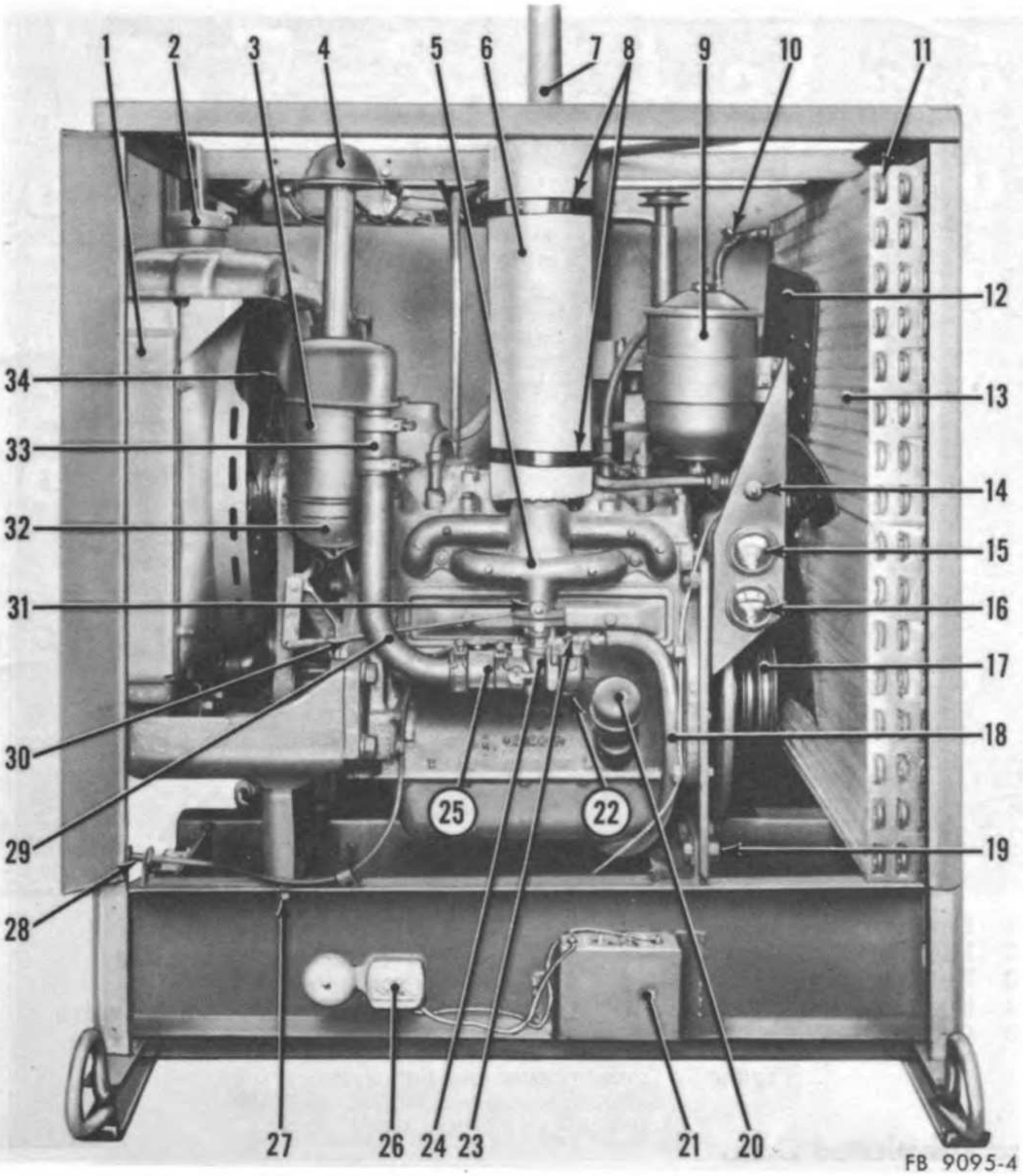
FB 9095-3

1 Superheat adjustment
2 Thermostatic expansion valve
3 4-pass distributor
4 External equalizer line
5 Line to evaporator coils
6 Suction line from evaporator coils
7 Bypass line
8 Heat exchanger
9 Check valve
10 Purge port
11 Condenser
12 Dehydrator bypass valves
13 Vibration eliminators
14 Discharge service valve
15 Compressor
16 High pressure cutout
17 Low pressure cutout
18 Spare receiver
19 Receiver fusible plugs
20 Receiver purge ports
21 Active receiver
22 Sight glass
23 Receiver outlet valves
24 Receiver inlet valves
25 Low pressure gage
26 High pressure gage
27 Refrigeration bypass valve
28 Suction service valve
29 Dehydrator

Figure 3. Ice plant refrigeration system, schematic view.

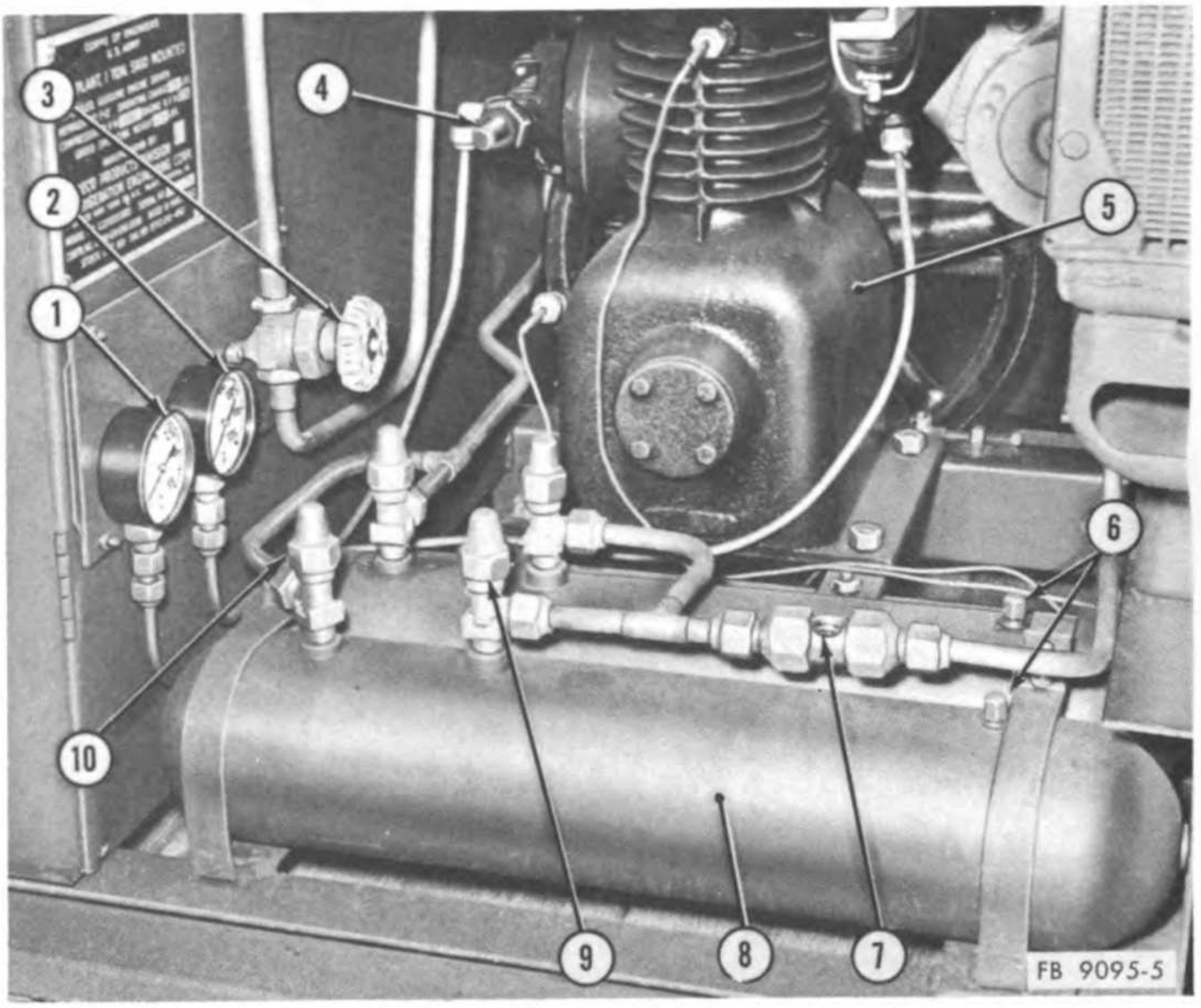
5. Differences in Models

This manual applies only to the Refrigeration Engineering, Model G2000–S50D ice plant, serial numbers 1001 to 1240. inclusive, all of which are identical.



1	Engine radiator	18	Fuel line
2	Radiator fillercap	19	Bolt, hex, ½–13 x 1¼ (2 rqr)
3	Air cleaner	20	Oil fillercap
4	Air cleaner intake cap	21	Battery box
5	Engine manifold	22	Carburetor drain plug
6	Exhaust pipe covering	23	Idle adjustment screw
7	Exhaust pipe	24	Carburetor
8	Metal fastening band (2 rqr)	25	Carburetor air intake coupling
9	Oil filter	26	Alarm bell
10	Condenser purge port	27	Bolt, hex ½–13 x 1 (2 rqr)
11	Condenser upper return bend	28	Choke control button
12	Condenser fan	29	Air intake pipe
13	Condenser	30	Governor control rod
14	Ignition switch	31	Exhaust manifold drain plug
15	Engine oil pressure gage	32	Air cleaner oil cup
16	Engine water temperature gage	33	Air cleaner outlet coupling
17	Engine drive pulley	34	Engine fan

Figure 4. Machine compartment, end view.



1 Low pressure gage
2 High pressure gage
3 Refrigeration bypass valve
4 Suction service valve
5 Compressor
6 Receiver purge ports
7 Refrigerant sight glass
8 Active receiver
9 Active receiver outlet valve
10 Active receiver inlet valve

Figure 5. Compressor and gages, rear view.

6. Tabulated Data

a. Ice Plant.

Manufacturer	Refrigeration Engineering Corp.
Model	G2000–S50D, serial numbers 1001 to 1240, inclusive.
Type	1-ton, cake type, gasoline-engine driven, skid mounted.
Receiver	Refrigeration Engineering Corp.
Type	Two tanks, 5 x 23 inches, drawn steel, each with two ½-inch shutoff valves, 212° F. fusible pressure-relief plug and vent.
Heat exchanger	Heat X–Changer Company.
Type	200 XS.
Thermostatic expansion valve	Detroit Controls Corporation.
Type	777EF.
Unit weight:	
Gross	4,300 lbs.
Net	2,158 lbs.
Length, overall	127 in.

A

B

C

FB 9095-6

Figure 6. Identification plates.

Width, overall	37¼ in.
Height, overall	44¼ in.

b. Engine.

Manufacturer	International Harvester Company.
Model	U–1.
Type	4-stroke cycle, gasoline, L-head.
Number cylinders	4.
Bore	2.625 in.
Stroke	2.750 in.
Piston displacement	59.5 cu in.
Lubrication	Pressure type.
Cooling	Liquid.
Governed speed	2,250 rpm.
Horsepower	16.3 @ 2,500 rpm.
Maximum torque (pounds-feet)	39.5 @ 1,400 rpm (minus fan).
Compression ratio	6.5 to 1.
Starting method	Hand crank.
Ignition	High tension magneto.
Spark plug gap	0.023 in. to 0.027 in.
Firing order	1–3–4–2.
Intake air filter	United Specialties Company.
Type	Oil bath.
Oil filter	Fram.
Type	F21–P2, bypass.
Magneto	Fairbanks-Morse.
Type	FMXE4B11G.
Carburetor	International.
Type	Updraft.
Water pump	International.
Type	7077–13–1.
Governor	International.
Type	B3010.
Fuel filter	Imperial Brass.
Type	42935–1.
Length, overall	26 13/32 in.
Width, overall	16 11/32 in.
Height, overall	25 in.
Weight	279 lbs.

c. Compressor.

Manufacturer	Copeland Refrigeration Corporation.
Model	83.
Type	Freon–12.
Number cylinders	2.
Bore	3.25 in.
Stroke	3.0 in.
Piston displacement	49.77 cu. in.
Operating speed	680 rpm.
High pressure cutout switch	Penn Controls, Incorporated.
Type	270BP10.
Low pressure cutout switch	Penn Controls, Incorporated.
Type	270BP20.
Alarm bell	Edwards and Company.
Type	Nubel No. 740.

d. Capacities.

Brine tank	100 gal.
Ice can	50 lbs ice, 6 gal water.
Engine coolant	10 qts.
Engine crankcase	3 qts.
Air cleaner oil cup	⅜ pt.
Gasoline tank	30 gal.
Compressor oil charge	6½ pts.
Brine agitator gear box	2 pts.

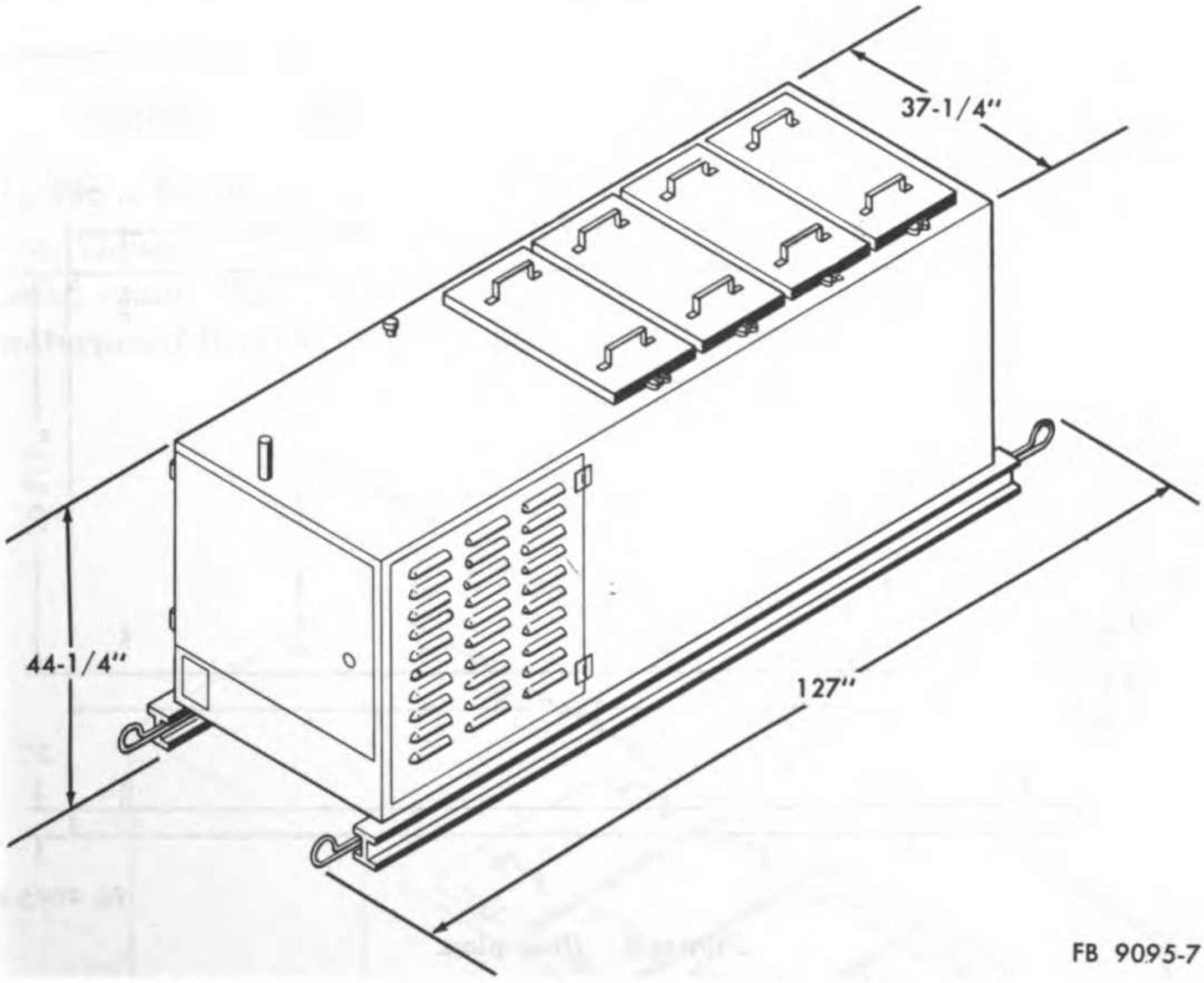


Figure 7. Dimensions of ice plant ready for shipment.

e. Base Plan (fig. 8). A substantial permanent foundation for the ice plant may be made of poured concrete to the dimensions given in figure 8. Since no holes are provided in the skid of the ice plant for permanent mounting, it may be permanently affixed to the platform by the use of U-shaped clamps over the towing eyes. Prior to pouring the concrete, eight 5 x ½-inch bolts with large plain washers at the head ends should be set in the positions shown in figure 8. After the concrete has hardened these bolts will act as studs and the ice plant should be positioned so that each towing eye is between two of them. Place a U-shaped clamp on each pair of studs over each towing eye and fasten with plain washers and ½-inch hex nuts.

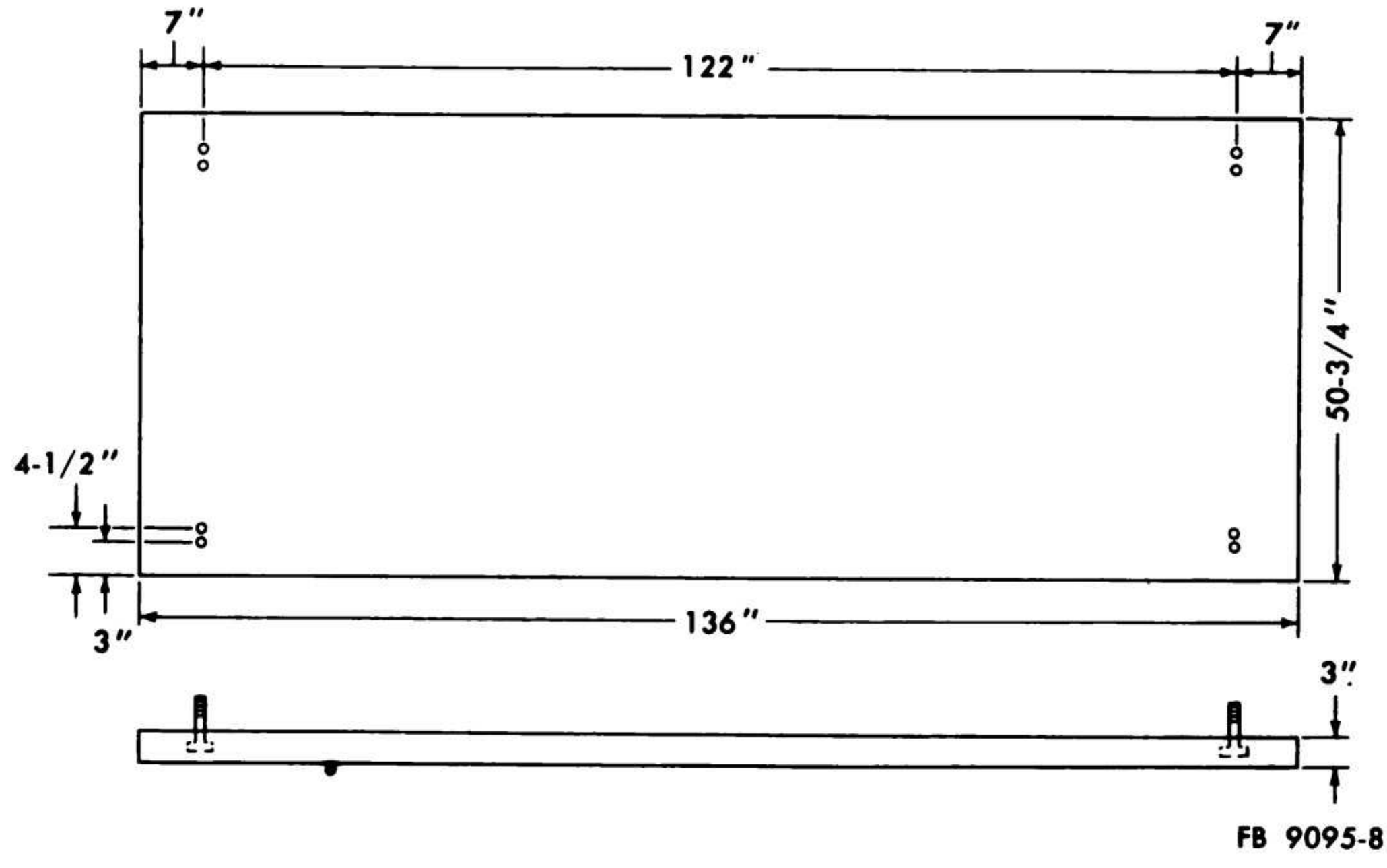


Figure 8. Base plan.

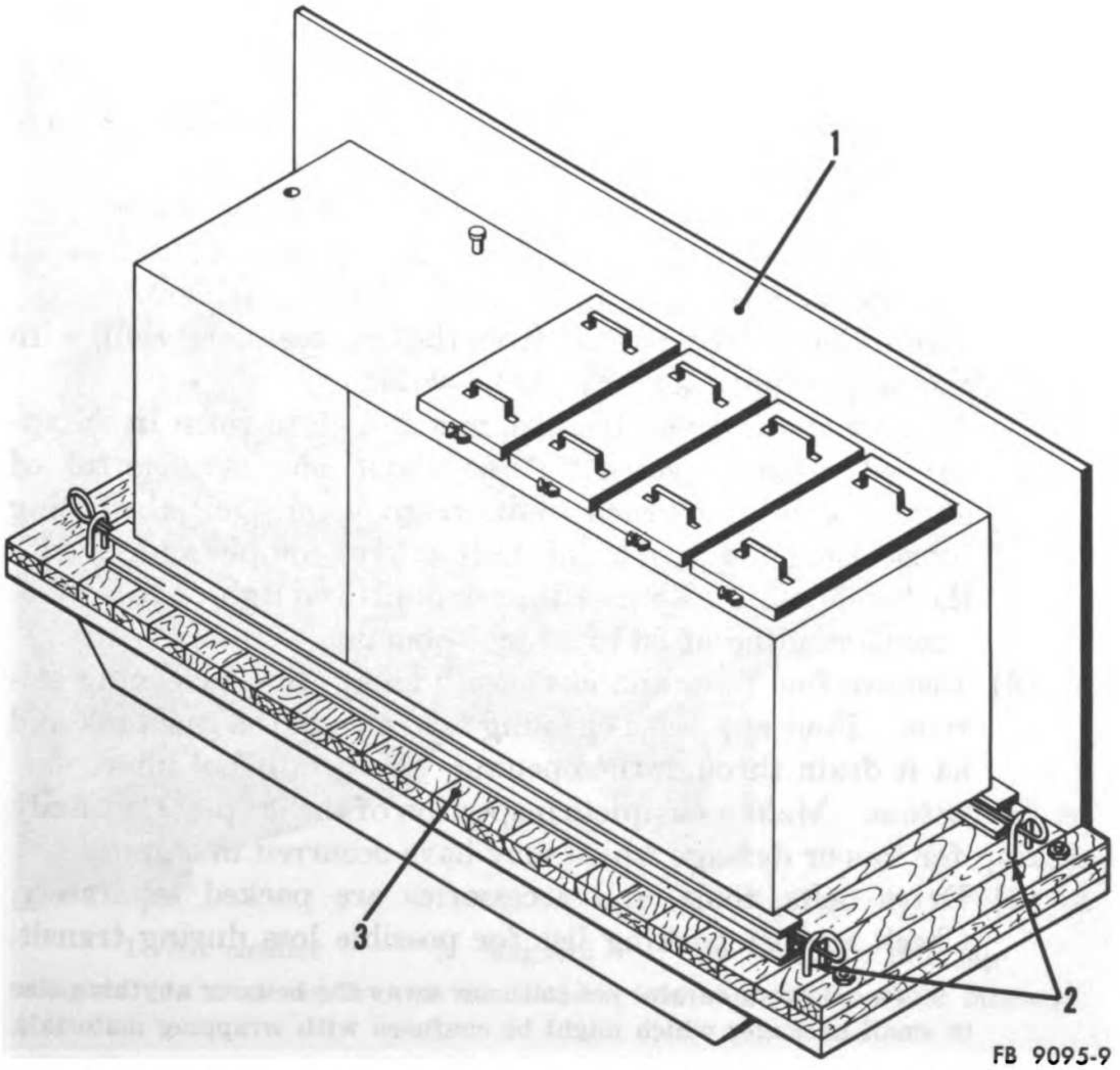
CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

7. New Equipment

a. General. For domestic shipment, the ice plant is packed in a wood crate. For overseas shipment, it is packed in greaseproof and waterproof barrier-material and packing cases.



1 Side of packing case **2 Mounting bolts** **3 Packing platform**

Figure 9. Packing case.

b. Unloading.

(1) The packing case is unloaded by means of a forklift truck.

Caution: Be sure the fork of the truck extends under the full width of the base of the crate before raising the crated unit.

(2) If a forklift truck is not available, the equipment can be unloaded by a crane. A sling is secured around the ends of the packing case and the unit is hoisted by the crane.

c. Uncrating.

(1) Unpack the crate as close to the point of use as possible.

(2) Remove angle irons from corners of crate, and remove screws or nails holding top and sides.

Caution: Do not drive a crowbar into the crate as it may damage the equipment.

(3) Remove the U-shaped mounting bolts holding towing eyes to base of packing crate.

(4) Lift the ice plant clear of the crate and place it in a position which is solid and level, and is away from walls or any obstructions which would interfere with free operation of doors and covers of the equipment.

d. Removal of Preservative Compounds, Lubricants and Devices.

(1) Remove seals over vents, openings in carburetor and air cleaner, radiator, and magneto.

(2) Remove wrappings from the two dry-cell batteries.

(3) Remove protective paper from door panels and clean all exterior surfaces with an approved cleaning solvent.

(4) Drain the preservative oil from the crankcase and refill with the proper lubricant. See LO 5–9095.

(5) Remove spark plugs from engine and clean them in an approved cleaning solvent. Put about one teaspoonful of crankcase oil into each cylinder to assure initial-starting lubrication, and turn crankshaft several complete turns with the hand crank. Reinstall spark plugs and tighten to torque-wrench reading of 26 to 28 foot-pounds.

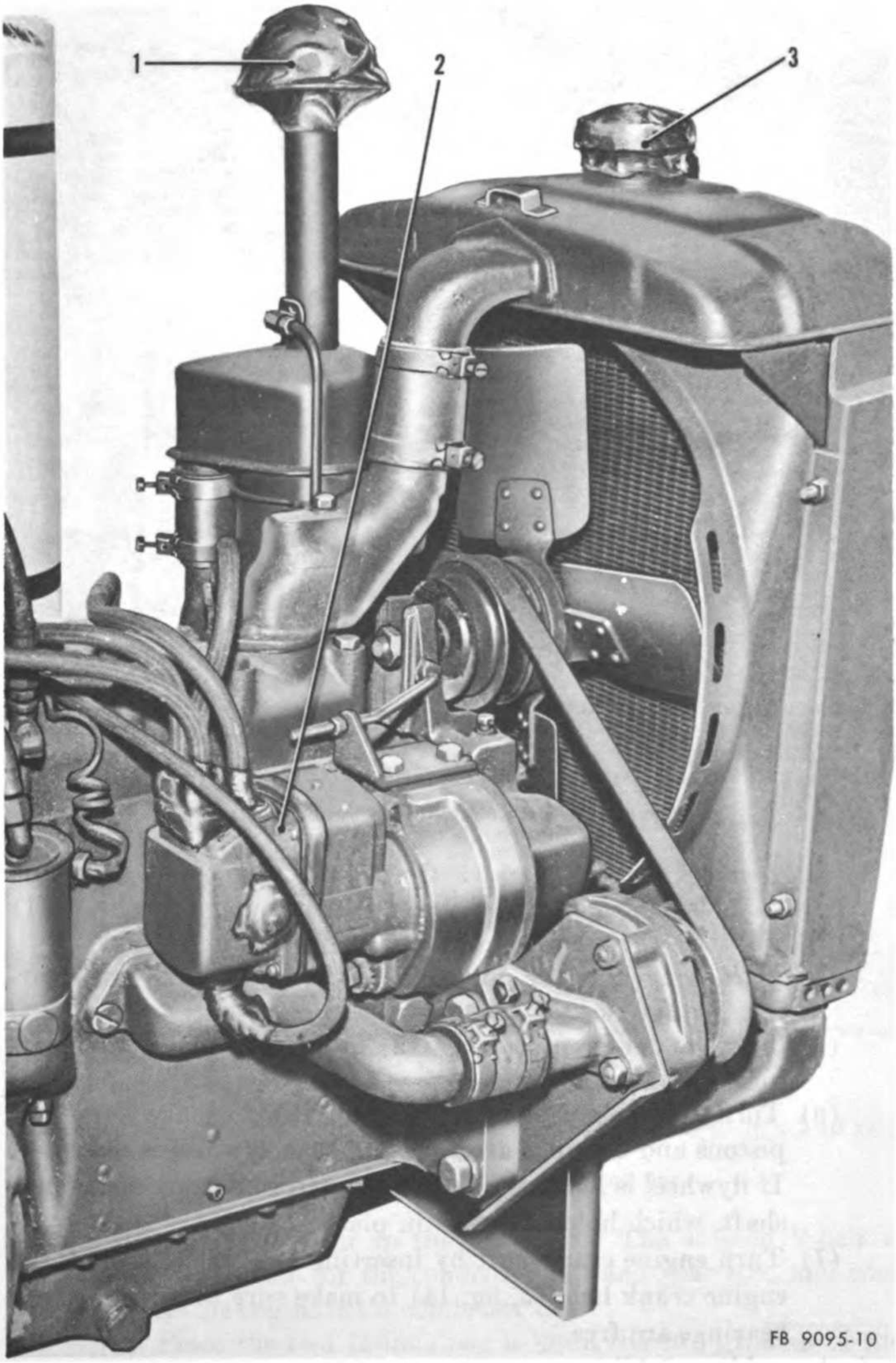
(6) Remove fuel filter and clean with an approved cleaning solvent. Pour approved cleaning solvent into the fuel tank and let it drain through the opening. Reinstall fuel filter.

e. Inspection. Make a complete inspection of the ice plant, visually checking for loss or damage which may have occurred in shipment.

(1) Drive belts, tools, and accessories are packed separately. Check against packing list for possible loss during transit.

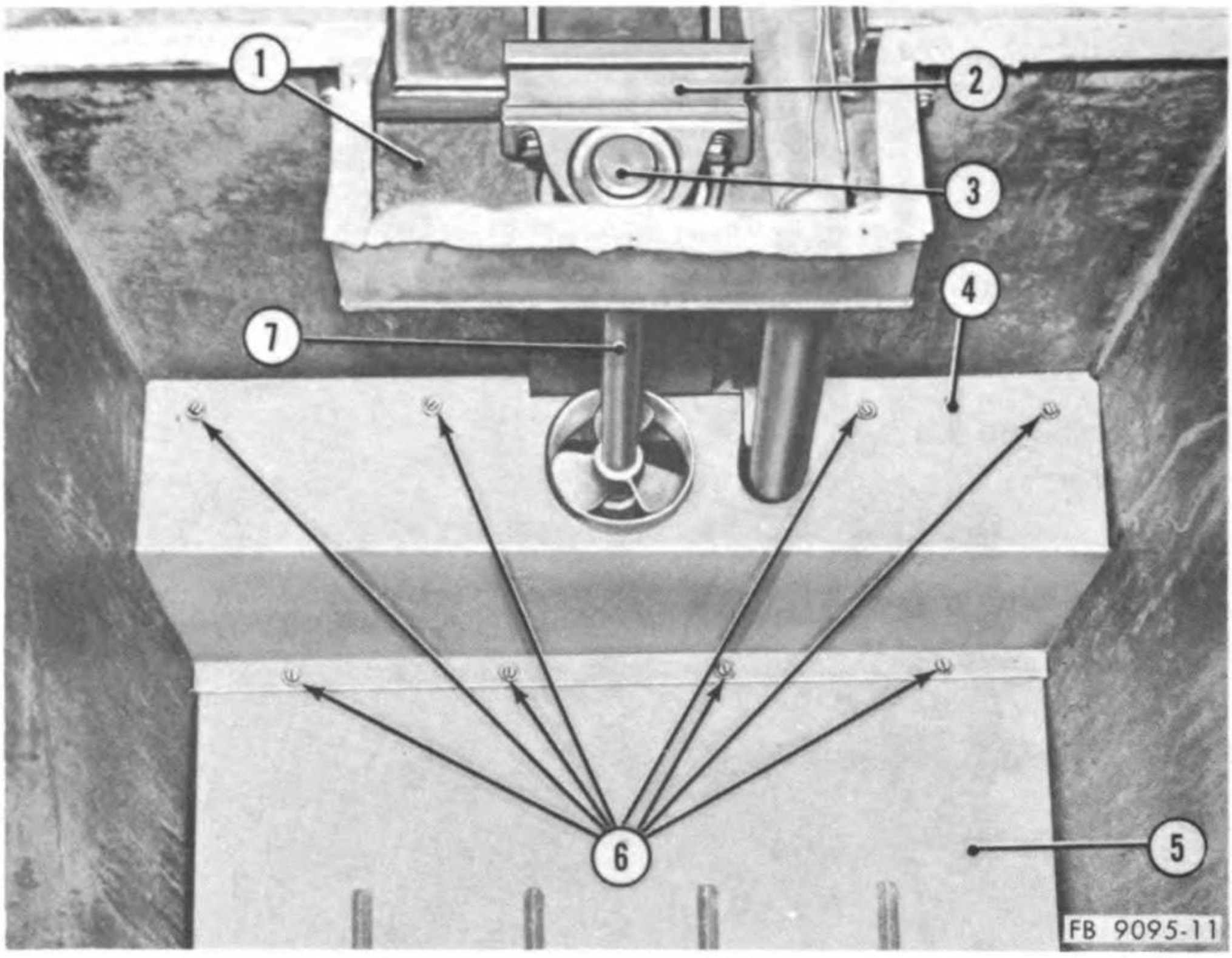
Note. **Be very careful not to throw away the belts or anything else in small packages which might be confused with wrapping materials.**

(2) Check pressure gages, cutout switches, and engine instrument gages to make sure that glasses have not been cracked or broken.



1 Air cleaner **2 Magneto** **3 Radiator fillercap**

Figure 10. Preservatives on air cleaner, radiator fillercap and magneto.



1 Brine agitator pulley splash cover
2 Spacer bar
3 Brine agitator pulley
4 Brine raceway inlet cover
5 Baffle
6 Screw, sheet mtl, Type A, No. 10 x ½
7 Brine agitator shaft

Figure 11. Brine agitator, cover removed.

(3) Remove ice can covers (2, fig. 1) and look inside brine tank to make sure nothing obstructs the brine agitator (fig. 11) and that no loose paper or other material is in the tank.

(4) Turn brine agitator pulley (3) by hand to make sure bearings are free.

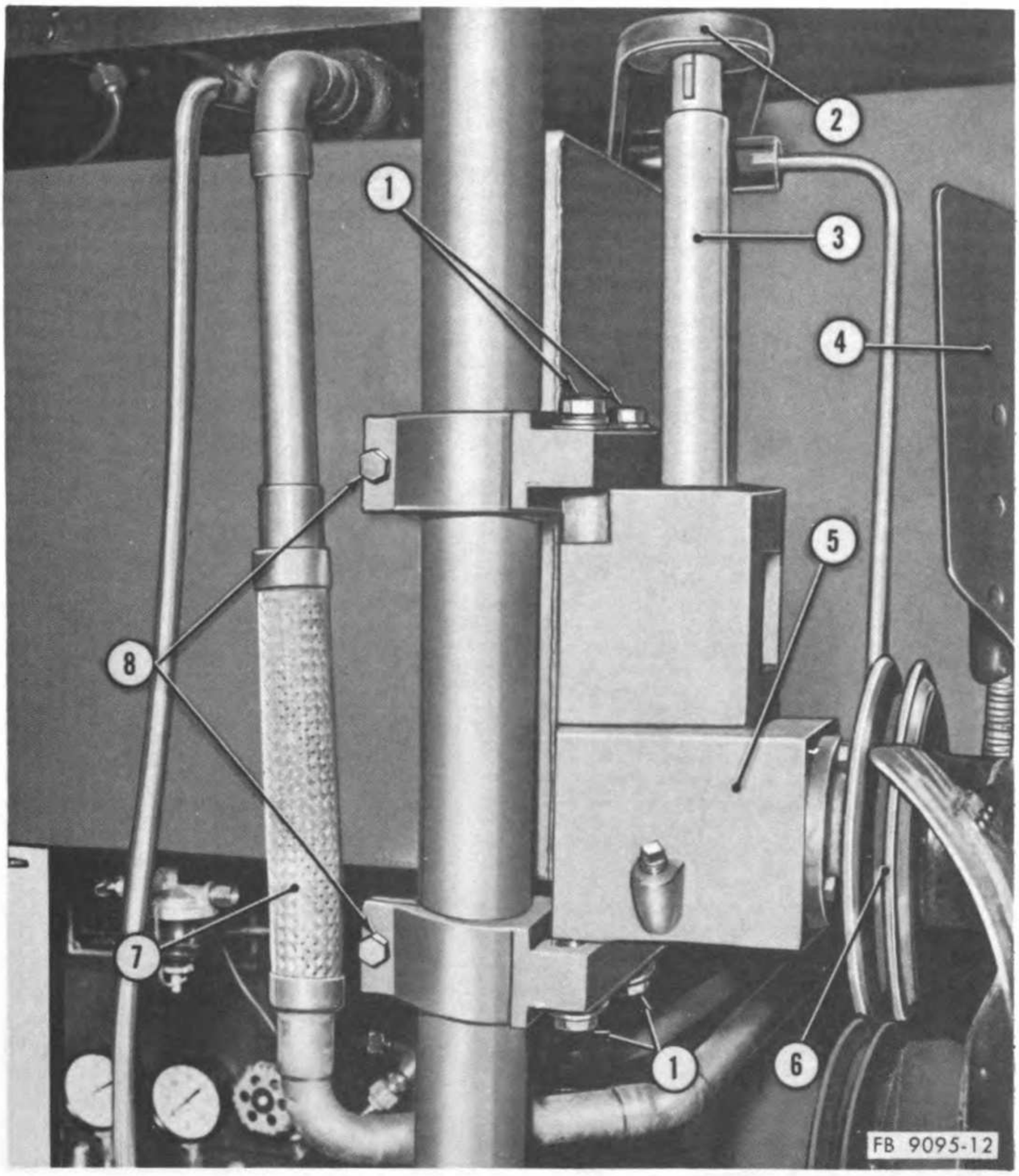
(5) Turn condenser fan (4, fig. 12) by hand to make sure bearings and gears are free.

(6) Turn compressor flywheel (2, fig. 13) to make sure that pistons and bearings are free, and that flywheel is not loose. If flywheel is loose, tighten nut on end of compressor crankshaft, which holds flywheel in place.

(7) Turn engine crankshaft by inserting the crank through the engine crank hole (5, fig. 14) to make sure that pistons and bearings are free.

f. Assembly and Alinement.

(1) *Belts.* There are four belts supplied with the ice plant. The two 71-inch cog belts are the drive belts for the compressor and connect the engine to the compressor. The 64-inch V-belt is the drive belt for the brine agitator and connects



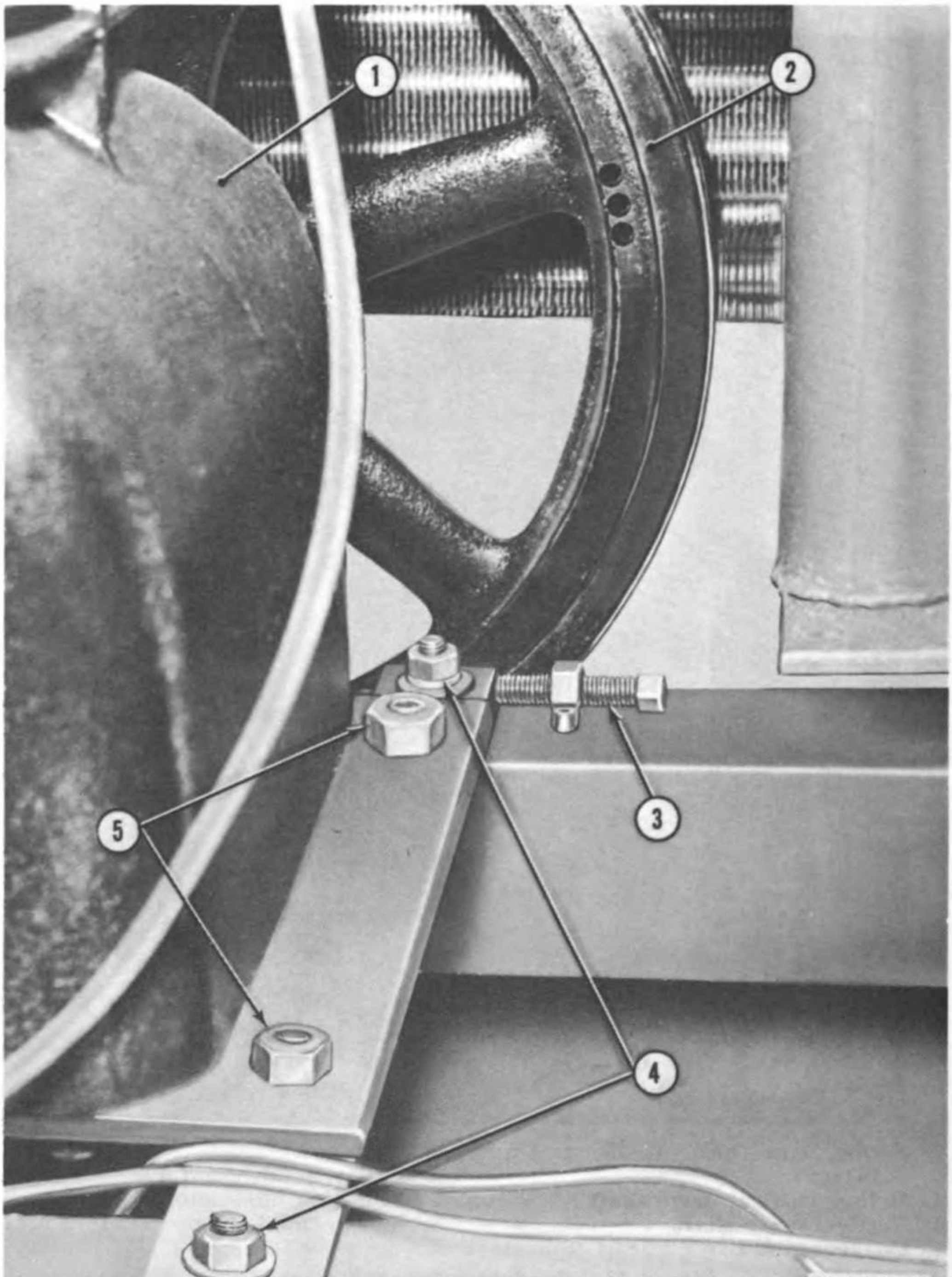
1 Screw, cap, hex, ½–13 x 1¾ (4 rqr)
2 Pulley, vertical drive shaft
3 Vertical drive shaft
4 Condenser fan
5 Gear box
6 Pulley, condenser fan
7 Vibration eliminator
8 Screw, cap, hex, ⅜–16 x 1 (2 rqr)

Figure 12. Condenser fan and gear box.

the brine agitator to the gear box. The 45-inch V-belt is the drive belt for the condenser fan and gear box, and connects the engine to the condenser fan.

(*a*) Place the two 71-inch cog belts in the two grooves of the engine pulley nearest the engine and in the two grooves in the compressor flywheel (2, fig. 13).

(*b*) Check pulley alinement by placing one end of a straightedge across the face of the compressor flywheel and resting the other end on the engine drive pulley. One end of the

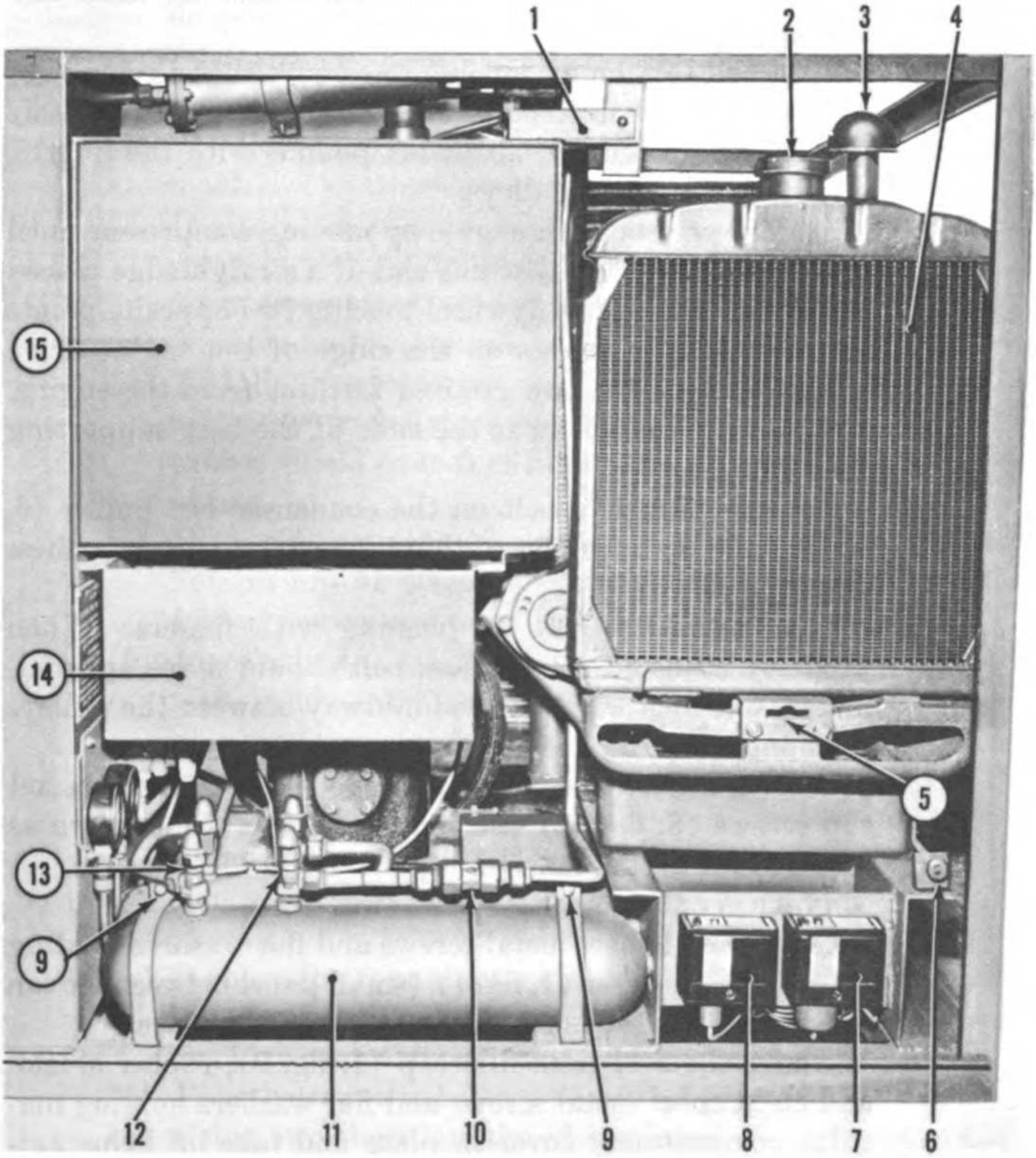


1 Compressor
2 Compressor flywheel
3 Setscrew, sq hd, ⅜–16 x 2
4 Nut, hex, ⅜–16 (4 rqr)
5 Nut, hex, ½–13 (4 rqr)

Figure 13. Compressor mountings and drive belt adjustment.

straightedge should touch two opposite points on the face of the compressor flywheel and the other should rest on the ridge between the two grooves farthest from the engine.

(*c*) Check belt tension by pushing the belts with the fingers. When a force of approximately ten pounds is applied mid-



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1 Fuel tank mounting bracket
2 Radiator fillercap
3 Air intake cap
4 Engine radiator
5 Engine crank hole
6 Choke button
7 Low pressure cutout switch
8 High pressure cutout switch
9 Bolt, hex, 5/16–18 x 1¾ (2 rqr)
10 Refrigerant sight glass
11 Active receiver
12 Receiver outlet valve
13 Receiver inlet valve
14 Tool box
15 Fuel tank

Figure 14. Machine compartment, rear view, door removed.

way between the pulleys, the belts should be depressed approximately ¾ inch.

(*d*) If adjustment is necessary either to aline the compressor flywheel with the engine drive pulley or to adjust the belt tension, loosen the bolts (4) at the ends of the bars supporting the compressor, and the setscrew (3) at the base

of the compressor between the compressor flywheel and the engine.

(*e*) Adjust belt tension by turning setscrew either clockwise or counterclockwise until belts can be depressed approximately ¾ inch by pressure of about ten pounds with the fingers, midway between the pulleys.

(*f*) Aline compressor with engine by moving compressor until it is in such position that one end of a straightedge placed across the face of the flywheel touches two opposite points and the other end rests on the ridge of the engine drive pulley between the two grooves farthest from the engine.

(*g*) Tighten the four bolts at the ends of the bars supporting the compressor.

(*h*) Place the 45-inch V-belt on the condenser fan pulley (6, fig. 12) and in the groove of the engine drive pulley farthest from the engine.

(*i*) Check tension on belt by pushing with fingers. When properly adjusted for tension, belt should move approximately one inch when pressed midway between the pulleys with fingers.

(*j*) If tension adjustment is necessary loosen gear box bracket cap screws (8, fig. 12) and move gear box up or down as required for proper tension.

(*k*) Tighten gear box bracket cap screws.

(*l*) Remove the 11 sheet metal screws and flat washers holding brine agitator cover (1, fig. 1) (small panel between ice can covers and machine compartment cover) in place.

(*m*) Remove the fuel tank fillercap (1, fig. 2), rubber shield, and eight sheet metal screws and flat washers holding machine compartment cover in place and take off brine agitator and machine compartment covers.

(*n*) Place the 64-inch V-belt on the brine agitator pulley and feed the free end of the belt through the opening to the machine compartment.

(*o*) Run the belt under the bypass refrigerant line, leading from the refrigeration bypass valve to the heat exchanger, and place the free end on the pulley (2, fig. 12) of the vertical drive shaft (3) leading from the gear box (5).

(*p*) Check tension on belt by pushing with fingers. When properly adjusted for tension, belt should move approximately 1 inch when pressed midway between the two pulleys with fingers.

(*q*) If tension adjustment is necessary loosen the four gear box cap screws (1) and slide gear box toward or away from engine as required to obtain proper tension.

(*r*) Tighten gear box cap screws.

Note. **Compressor fan belt tension may need readjustment at this point. See paragraph 7*f*(1) (*i*) through (*k*).**

(*s*) Check brine agitator pulleys for alinement. With belt installed, pulleys are in proper alinement when belt is parallel to horizontal frame members of machine compartment.

(*t*) If alinement adjustment is required, loosen Allen head setscrew in vertical drive shaft pulley and move pulley up or down as required. Setscrew is located in groove of pulley.

(*u*) Tighten pulley setscrew.

(*v*) Install brine agitator and machine compartment covers and secure with flat washers and sheet metal screws. Place rubber shield over fuel filler pipe and screw cap in place.

(2) *Exhaust.*

(*a*) Place exhaust pipe (7, fig. 4) threaded end down, through hole in top of machine compartment into exhaust manifold of engine and screw it in place.

(*b*) Place asbestos exhaust pipe covering (6) around exhaust pipe inside machine compartment and paste flap down. Secure with metal fastening bands (8) placed three inches from the top and three inches from the bottom of the covering.

(*c*) Slide muffler down on top of exhaust pipe and tighten clamp.

(3) *Batteries.*

(*a*) Remove the four sheet metal screws and flat washers holding the small panel (4, fig. 1) in place below the end machine compartment door, and remove panel.

(*b*) Place batteries in battery box (21, fig. 4).

(*c*) Using two short lengths of insulated wire with bare ends, connect the positive terminals of the batteries together and also connect the negative terminals together.

(*d*) Connect the wire from the cutout switches to the positive terminal of either battery.

(*e*) Connect the wire leading to the bell (26) to the negative terminal of either battery.

(*f*) Replace the panel and secure with the four sheet metal screws and flat washers.

g. Ice Plant Installation Recommendations.

(1) *Location.* Make sure that the ice plant is located far enough away from all walls and other obstructions which might prevent any of the doors, covers, or ice cans from being opened or removed.

(2) *Leveling.* Select a level, solid area which is free from irregularities and humps. After the ice plant is in position,

check it with a carpenter's level to make sure that one end or one side is not higher than another. Small blocks may be needed for placement under the skid to make the machine perfectly level.

(3) *Indoor installation.* If the ice plant is to be installed indoors or in a shed, make sure that it is not placed against a wall, and that adequate ventilation is supplied. Provisions must also be made to pipe the exhaust outside the building.

h. Service.

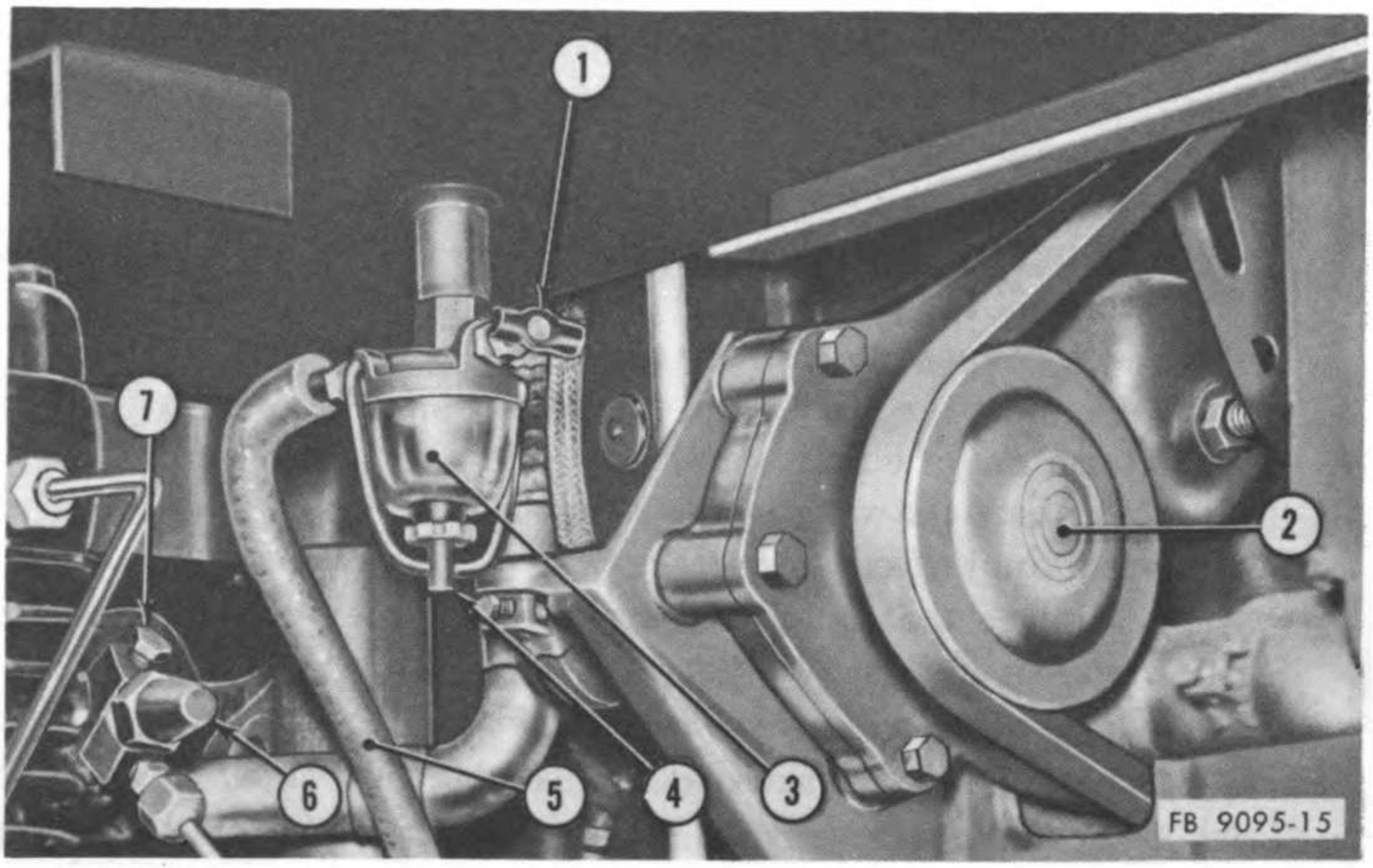
(1) *Leak testing.* The ice plant is shipped with all valves closed and with all Freon-12 refrigerant pumped down into the receiver. However, there is always danger of leaks developing in the refrigeration system during shipment, and it is mandatory to check over the entire system before putting it into operation, to prevent loss of the refrigerant. The following steps must be taken before the refrigeration system is put into operation:

(*a*) Remove caps from suction service valve (4, fig. 5) and from discharge service valve (6, fig. 15) on compressor.

(*b*) Remove caps from dehydrator bypass valves (6, fig. 16)

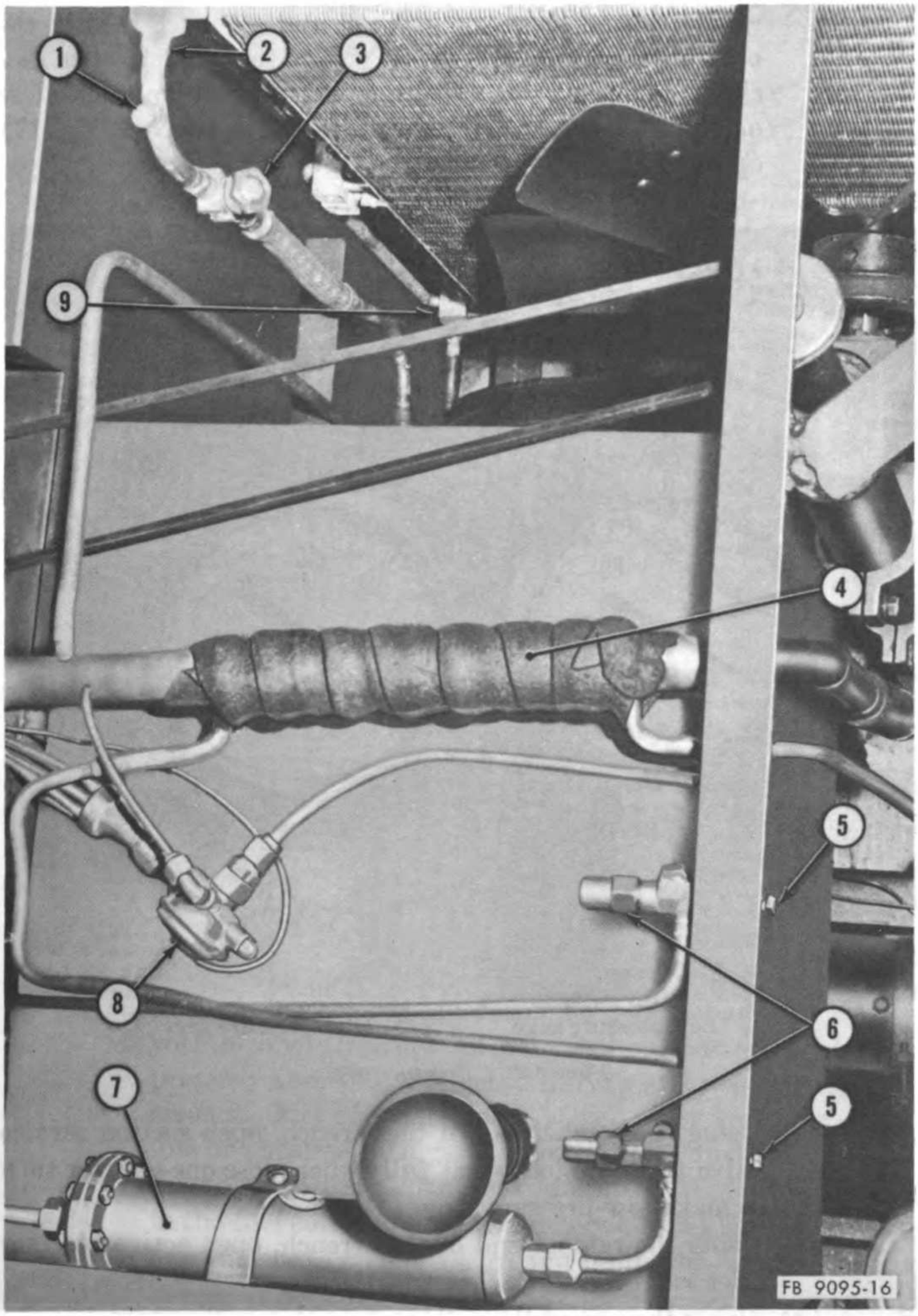
(*c*) Remove caps from inlet valve (10, fig. 5) and outlet valve (9) of active receiver (8).

Note. Be careful not to lose copper gasket rings contained in valve caps.



1 Fuel shutoff valve
2 Water pump
3 Fuel filter sediment bowl
4 Fuel filter clamp
5 Fuel line
6 Discharge service valve
7 Discharge service valve port

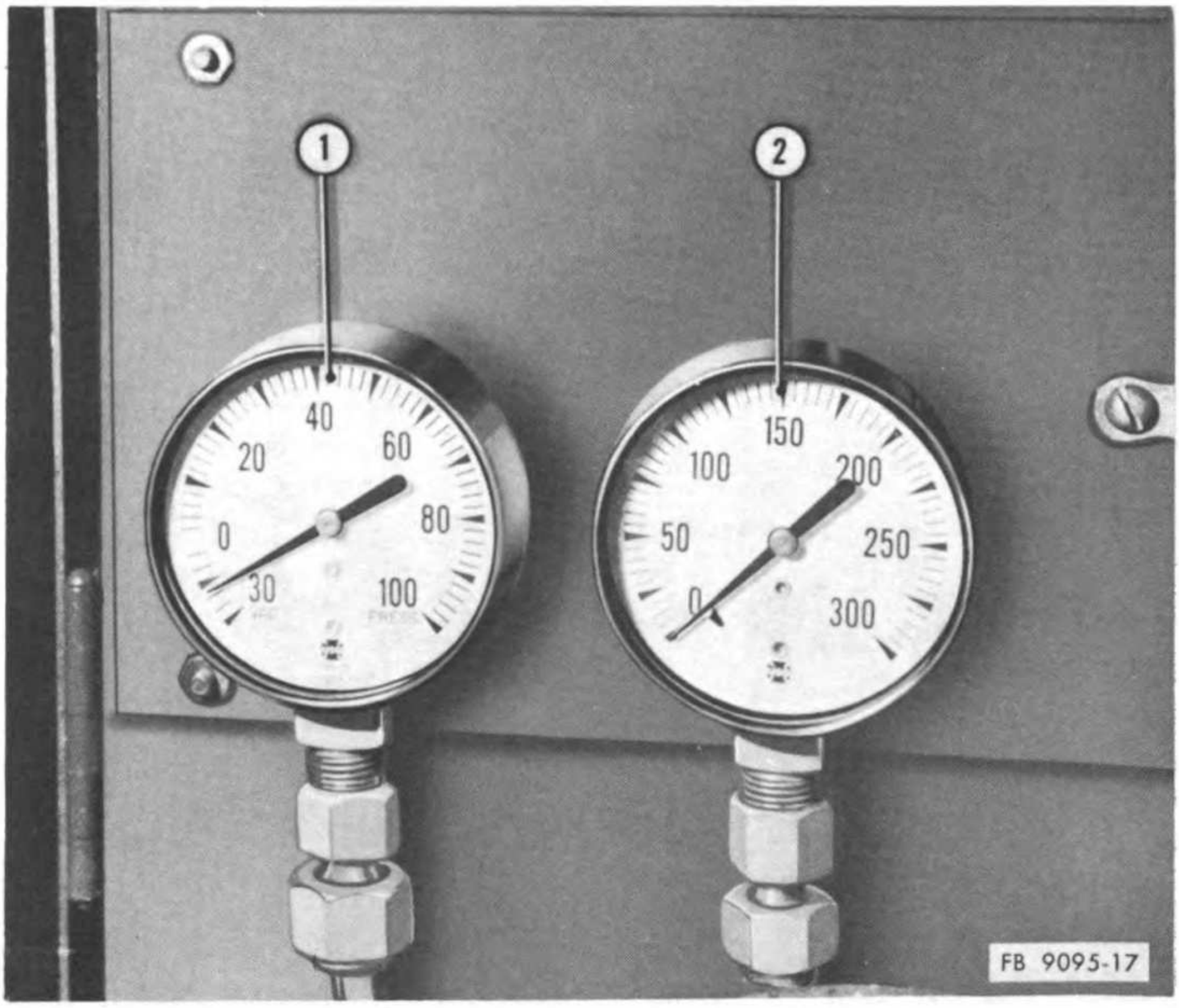
Figure 15. Fuel filter and shutoff valve.



1 Condenser purge port
2 Condenser inlet
3 Check valve
4 Heat exchanger
5 Bolt, hex, 5/16–24 x 5/8 (2 rqr)
6 Dehydrator bypass valve
7 Dehydrator
8 Thermostatic expansion valve
9 Condenser outlet

Figure 16. Machine compartment with cover removed, top view.

(*d*) The tool set includes a refrigerator repair wrench with a ratchet-action socket at one end and a square hole at the other end. Using the ratchet end of the wrench, open discharge service valve (counterclockwise) fully, then close one-quarter turn to make high pressure gage (2, fig. 17) operate.



1 Low pressure gage 2 High pressure gage

Figure 17. Pressure gages.

(*e*) Using the ratchet end of the wrench, open suction service valve (counterclockwise) fully, then close one-quarter turn to make low pressure gage (1) operate.

(*f*) Using the ratchet end of the wrench, open active receiver inlet valve (counterclockwise) fully.

(*g*) Using the end of the ratchet wrench handle which has the square hole (no ratchet action) (fig. 18), open the active receiver outlet valve (counterclockwise) until the low pressure gage (1, fig. 17) reads about 15 pounds, and then close it. Pressure builds up very rapidly (within about two seconds) so be prepared to close the valve almost immediately after opening.

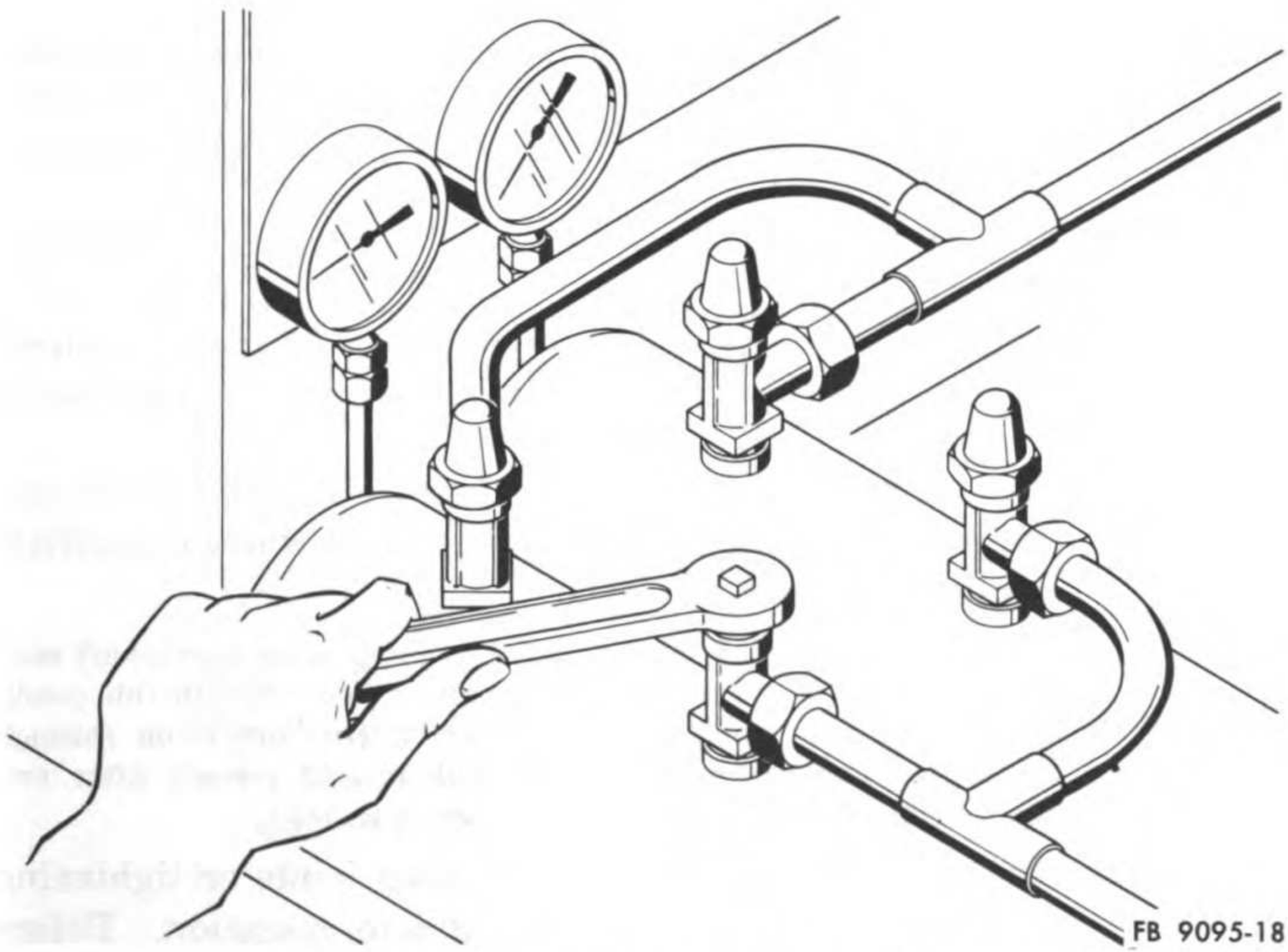


Figure 18. Adjusting receiver outlet valve.

(*h*) Using the ratchet end of the wrench, open both dehydrator bypass valve (counterclockwise) fully. Equipment is now ready to be tested for leaks.

(*i*) A leak usually produces an oily spot where the gas escapes. If such spots are noticed, immediately check the area in which the spot occurs with a Halide leak detector. A Halide leak detector is essentially an alcohol torch with a sampling tube through which air is fed to the flame. Remove the bottom cap from the detector and fill slowly with alcohol to avoid spilling, and so that the wick will properly absorb it. Reinstall the cap and wipe any spilled alcohol. Make sure the torch is well away from any gasoline or gasoline fittings, and half-fill the fuel cup beneath the burner with alcohol and ignite it. When the alcohol in the fuel cup is almost completely burned, open the valve one-quarter to one-half turn and ignite the burner. If the burner is difficult to light, partially close off the sampling tube so that the air supply is cut down. When the burner is ignited, adjust the flame by turning the valve so that it is approximately ¼- to ½-inch high. Flame should be kept fairly small, as it is most sensitive to Freon-12 gas when small. Under no circumstances should the flame extend above the chimney. When the flame is properly adjusted it

should be almost colorless. Hold the end of the sampling tube near a refrigerant fitting and pass it slowly over and around the fitting. If Freon-12 gas is drawn into the tube, the flame will change color to green if it is a small amount, and to bright blue if it is a large amount.

(*j*) If a Halide leak detector is not available, an alternate method of testing for leaks is to brush soap lather on the suspected area and watch for bubbles. If there is a leak, bubbles will form continually at the point where gas is escaping.

(*k*) Test all fittings and joints for leaks. Be sure to test compressor crankshaft seal, which is located where crankshaft enters compressor.

Note. A slight leak may be noted at compressor crankshaft seal. It is permissible to run the unit for about two hours in this condition, for it will usually correct itself during operation through lubrication and self-reseating. If leak is still present after two hours of operation, seal must be replaced (par. 149).

(*l*) Leaks must be repaired by rebrazing joints or tightening fittings before system can be put into operation. Before repairing leaks, system must be pumped down (par. 15*b*(1)).

(*m*) After leaks have been repaired, retest system thoroughly.

(*n*) Reinstall brine agitator and machine compartment covers and secure with sheet metal screws and flat washers.

(2) *Preparing brine.* The ice plant is designed to operate with approximately 100 gallons of solution in the brine tank. When all ice cans are in place they will raise this amount of solution above the level of the water in the ice cans, assuring even freezing of the water. Brine level mark on outside of tank indicates brine level with no ice cans in place. Brine level is measured with a stick, or other suitable object, from the top of the tank and then checked against the mark on the outside of the tank.

(*a*) Brine consists of calcium chloride salt dissolved in water, 350 pounds of calcium chloride salt being required to make 100 gallons of brine.

(*b*) Brine should be prepared in a separate container, if possible, and allowed to cool before placing in brine tank in order not to place a great load on the refrigeration system when it is started.

(*c*) Place approximately 95 gallons of clean, fresh water in a large, clean container. This will make 100 gallons of solution after the calcium chloride salt has been added.

(*d*) Add the calcium chloride salt gradually to the water with constant stirring, until it is completely dissolved. Solution will become warmer as it is made stronger.

(*e*) Remove scum or dirt accumulation from top of solution. Allow solution to cool as much as possible before placing in brine tank.

(*f*) Place solution in brine tank and check level.

(*g*) If separate container is not available, mix solution in brine tank, but leave ice can covers off until ready to start equipment as brine tank is insulated and this will permit solution to cool.

(*h*) Immediately before starting equipment, place 10 empty ice cans in the second and fourth openings of the tank to bring brine level above the agitator propeller, and hold them in place with ice can covers. Do not fill the ice cans with water at this point.

Caution: Do not operate the ice plant when brine level is below agitator propeller without first disconnecting brine agitator belt.

(3) Lubricate as required by LO 5–9095.

(4) Perform preventive maintenance services described in paragraph 33.

(5) Fill the engine radiator with fresh, clean water. If antifreeze solution is to be added, mix solution thoroughly before filling radiator.

(6) Fill the fuel tank with clean gasoline.

Note. During the first 100 hours of operation of a new or rebuilt engine, add one pint of engine oil to each 5 gallons of gasoline.

8. Used Equipment

Procedures for servicing used equipment are the same as those for new equipment. Follow procedures in paragraph 7. In addition, check for frayed drive belts, and bent or inoperative controls. Make sure no valve caps are missing. Check tool set to make sure none are damaged or missing. Check ice cans for holes and dents, and make sure that all covers and doors may be easily removed and reinstalled, and that they fit tightly.

Section II. CONTROLS AND INSTRUMENTS

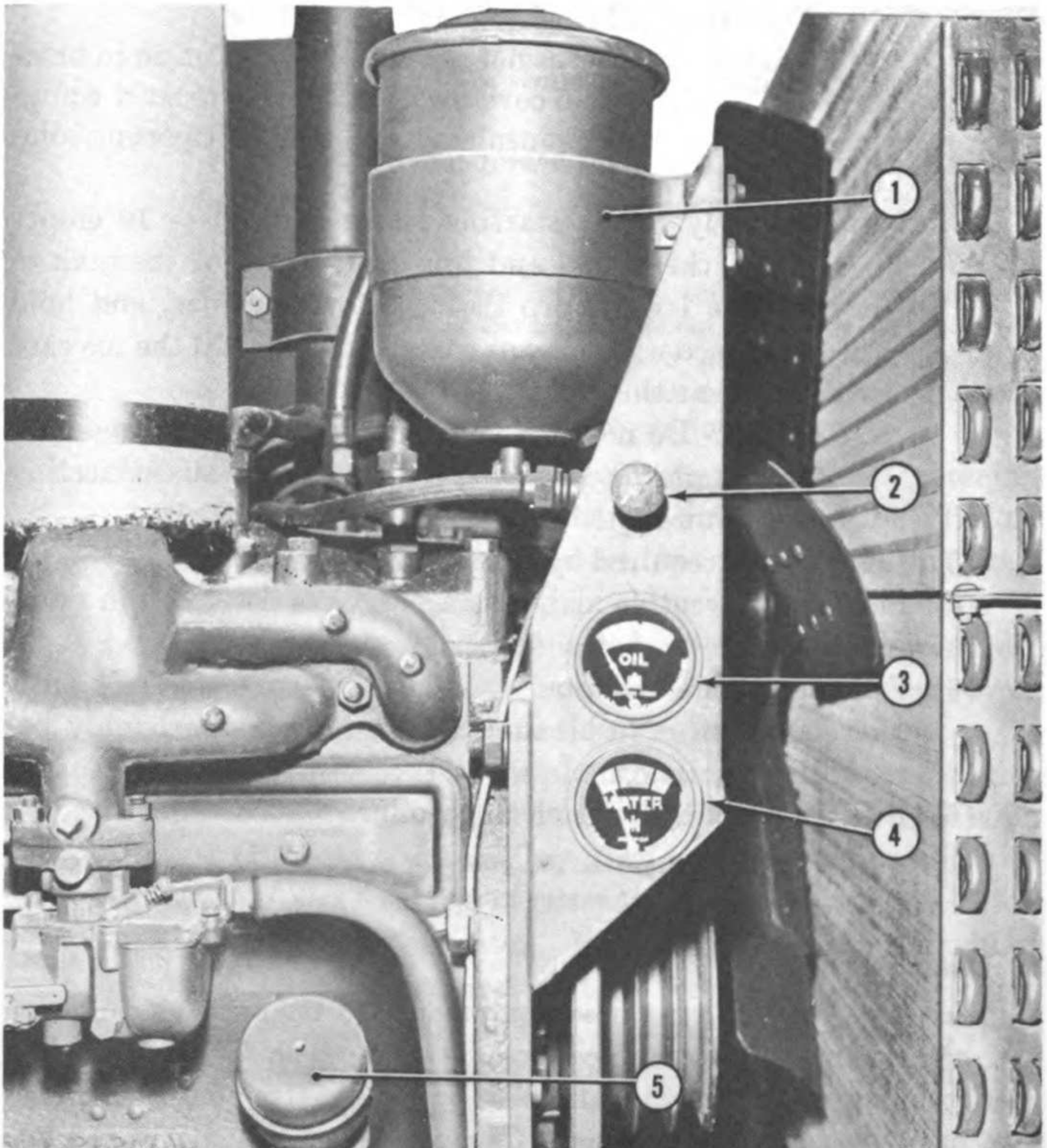
9. General

This section describes, locates, illustrates, and furnishes the operator sufficient information about the various controls and instruments for the proper operation of the materiel.

10. Engine Controls and Instruments

a. Ignition Switch (fig. 19).

(1) *Location.* The ignition switch (2) is located near the top of the control panel on the left side of the engine.



1 Oil filter
2 Ignition switch
3 Oil pressure gage
4 Water temperature gage
5 Oil fillercap

Figure 19. Engine control panel.

(2) *Purpose.* The ignition switch is used to remove the ground from the magneto to the spark plugs (when pulled out) to run the engine, and to ground out the magneto (when pushed in) to stop the engine.

b. Oil Pressure Gage (fig. 19).

(1) *Location.* The oil pressure gage (3) is located just below the ignition switch (2) on the control panel on the left side of the engine.

(2) *Purpose.* It indicates the pressure of the engine lubricating oil. When the engine is running the indicator needle should be in the white area. If it falls below the white area, there is not enough oil pressure to lubricate the engine properly and the engine should be stopped immediately to determine the cause.

c. Water Temperature Gage (fig. 19).

(1) *Location.* The water temperature gage (4) is located below the oil pressure gage (3) on the control panel on the left side of the engine.

(2) *Purpose.* It indicates the temperature of the engine coolant in the cylinder head of the engine. When the engine is running the indicator needle should be near the low side of the RUN area. If the needle goes to the high side of the RUN area or to the HOT area, it indicates lack of coolant, blockage in the cooling system, or improper operation of the water pump. Stop engine immediately and investigate the cause.

d. Fuel Shutoff Valve (fig. 15).

(1) *Location.* The fuel shutoff valve (1) is located below the fuel tank at the top of the fuel filter (3). Tool box (14, fig. 14) must be removed to gain access to fuel shutoff valve.

(2) *Purpose.* The engine used in the ice plant utilizes a gravity-feed fuel system (no fuel pump) and the fuel shutoff valve is used to shut off the fuel supply (when turned fully clockwise) when the engine is not running. To open fuel shutoff valve, turn fully counterclockwise.

e. Choke Control Button (fig. 20).

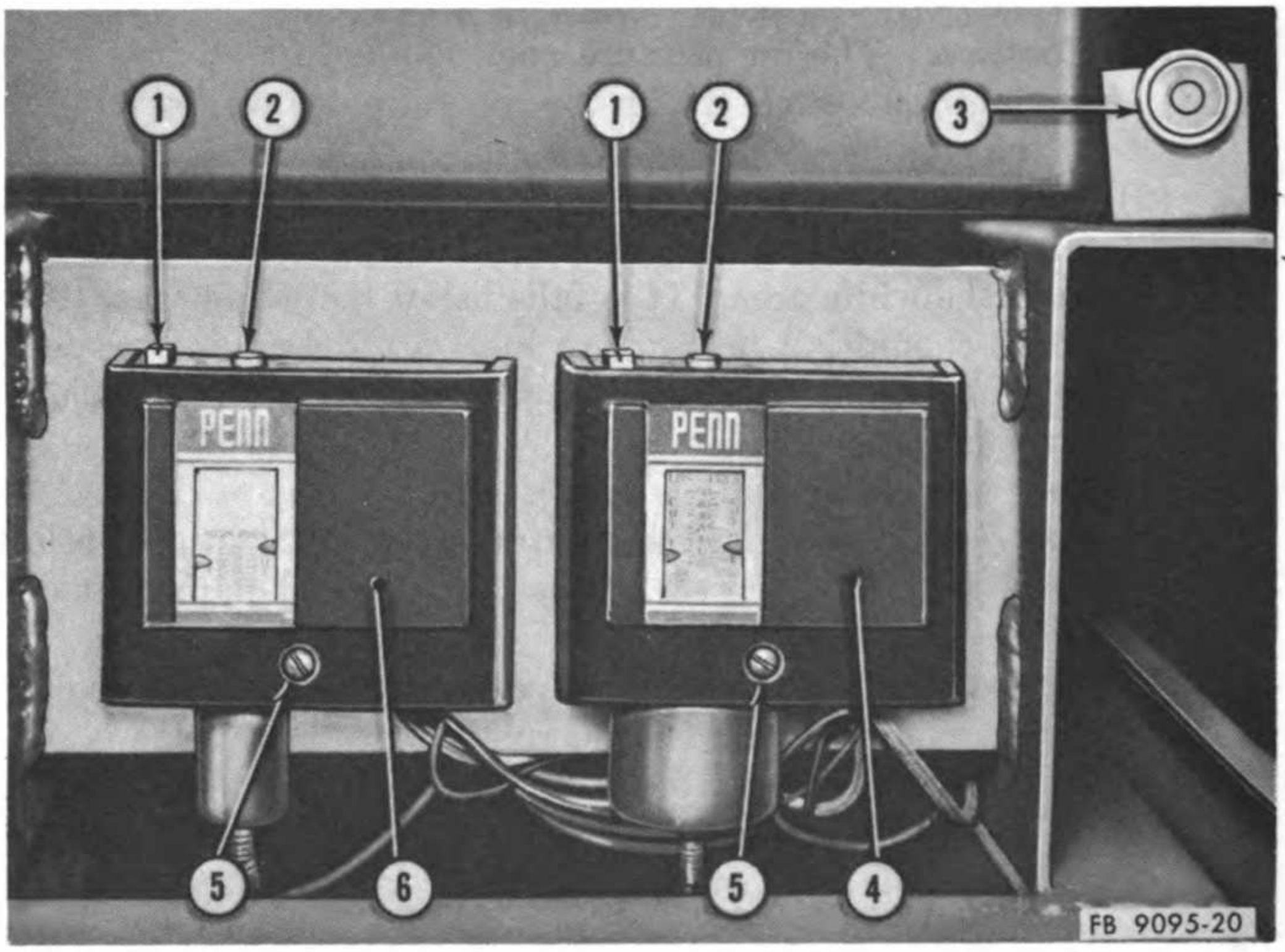
(1) *Location.* The choke control button (3) is located behind the rear machine compartment door below the engine radiator.

(2) *Purpose.* It operates the choke control of the carburetor, which controls the amount of air entering the carburetor. It is used to cut down the air supply (when pulled out) when starting a cold engine to supply a richer fuel mixture than is normally used.

11. Refrigeration System Controls and Instruments

a. Discharge Service Valve (fig. 15).

(1) *Location.* The discharge service valve (6) is located on the right side of the compressor as seen from the rear of the machine compartment.



1 Differential adjusting screw
2 Range adjusting screw
3 Choke control button
4 Low pressure cutout switch
5 Screw, cover mounting
6 High pressure cutout switch.

Figure 20. Choke control button and cutout switches.

(2) *Purpose.* It is used to close off the compressor from the high pressure side of the refrigeration system to prevent air from entering the compressor when the high pressure line is disconnected from the compressor.

b. Suction Service Valve (fig. 5).

(1) *Location.* The suction service valve (4) is located on the left side of the compressor as seen from the rear of the machine compartment.

(2) *Purpose.* It is used to close off the compressor from the low pressure side of the refrigeration system to prevent air from entering the compressor when the low pressure line is disconnected from the compressor.

c. Refrigeration Bypass Valve (fig. 5).

(1) *Location.* The refrigeration bypass valve (3) is located in the rear of the machine compartment next to the pressure gages (1 and 2), on the wall between the machine compartment and the brine tank.

(2) *Purpose.* It is used to relieve the pressure in the refrigeration system (when turned counterclockwise) during engine-starting operation. It is opened before cranking the engine and gradually closed when the system is in operation (par. 13).

d. Refrigerant Sight Glass (fig. 5).

(1) *Location.* The refrigerant sight glass (7) is located above the active receiver (8) near the receiver outlet valve (9) on the low pressure line of the refrigeration system.

(2) *Purpose.* It is used to determine whether the refrigerant passing through the low pressure line from the receiver is foamy or solid liquid thereby indicating whether or not sufficient refrigerant is in the system for efficient operation.

e. High Pressure Cutout Switch (fig. 20).

(1) *Location.* The high pressure cutout switch (6) is located in the rear of the machine compartment below the engine radiator and to the left of the low pressure cutout switch (4).

(2) *Purpose.* It is an automatic control, set to stop the engine by grounding out the magneto if the pressure in the high pressure side of the refrigeration system reaches 240 pounds per square inch.

f. Low Pressure Cutout Switch (fig. 20).

(1) *Location.* The low pressure cutout switch (4) is located in the rear of the machine compartment below the engine radiator and to the right of the high pressure cutout switch (6).

(2) *Purpose.* It is an automatic control, set to stop the engine by grounding out the magneto if the pressure in the low pressure side of the refrigeration system drops to 2 inches of vacuum.

g. Thermostatic Expansion Valve (fig. 16).

(1) *Location.* The thermostatic expansion valve (8) is located at the top of the machine compartment over the fuel tank.

(2) *Purpose.* It controls the amount of refrigerant entering the cooling coils.

h. Dehydrator Bypass Valves (fig. 16).

(1) *Location.* The dehydrator bypass valves (6) are located at the top of the machine compartment over the fuel tanks.

(2) *Purpose.* They are used to cut the dehydrator out of the refrigeration circuit (when fully closed) for the purpose of changing the dehydrator cartridge or to protect the system against moisture released by the dehydrator in hot weather.

i. Check Valve (fig. 16).

(1) *Location.* The check valve (3) is located on the high pressure line between the vibration eliminator and the condenser purge port, near the point where the line enters the condenser.

(2) *Purpose.* It prevents the flow of refrigerant back toward the compressor when the pressure in the line between the condenser and the compressor drops below the pressure in the condenser.

j. Liquid Level Indicator (fig. 21).

(1) *Location.* The liquid level indicator (2) is located on the left side of the compressor crankcase.

(2) *Purpose.* It shows the proper level for the compressor crankcase oil. Oil level should be at center of BULLSEYE when compressor is not running, but should be checked only after a period of operation.

k. Low Pressure Gage (fig. 17).

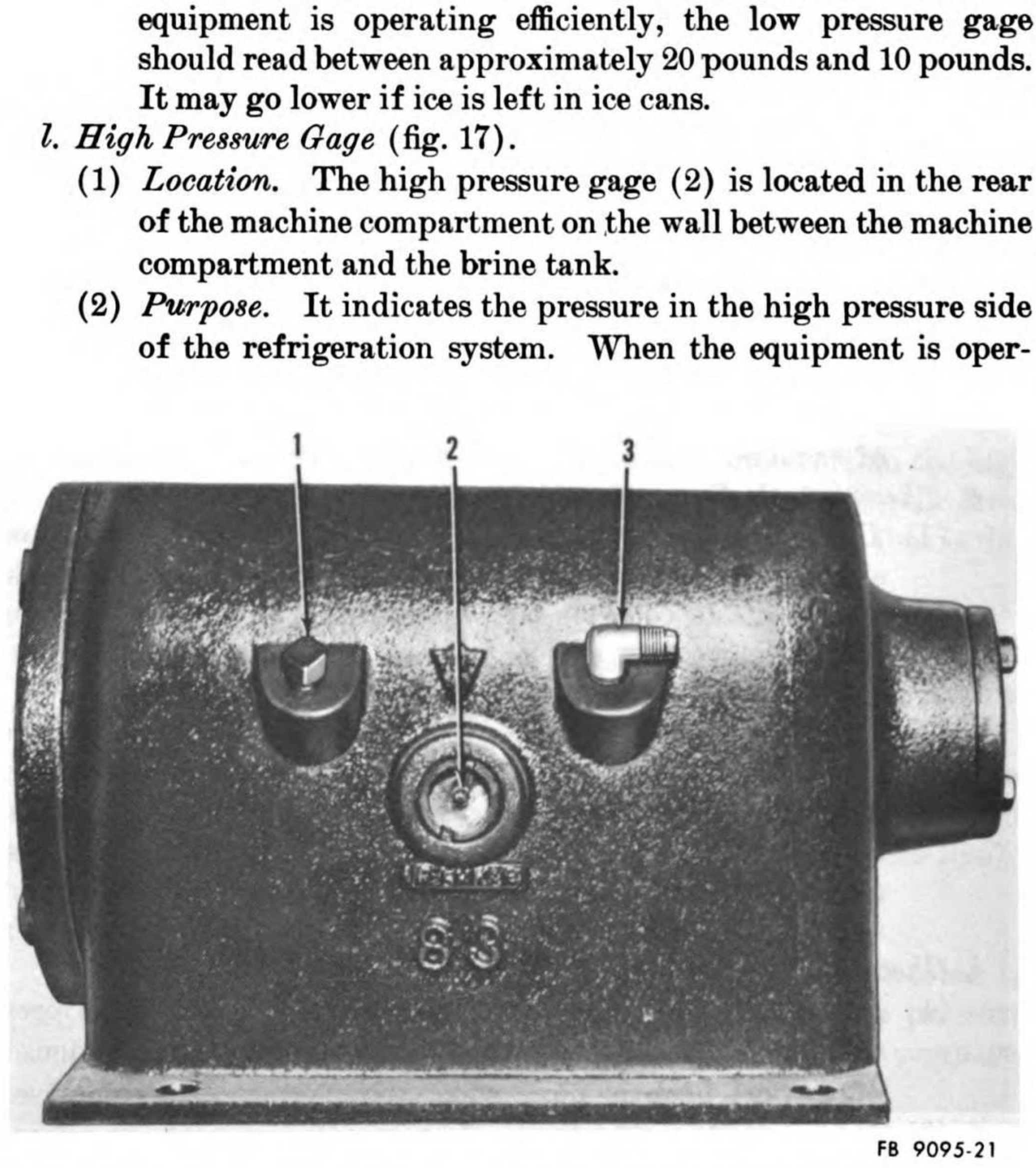
(1) *Location.* The low pressure gage (1) is located in the rear of the machine compartment on the wall between the machine compartment and the brine tank.

(2) *Purpose.* It indicates the pressure or the vacuum in the low, or suction side of the refrigeration system. When the equipment is operating efficiently, the low pressure gage should read between approximately 20 pounds and 10 pounds. It may go lower if ice is left in ice cans.

l. High Pressure Gage (fig. 17).

(1) *Location.* The high pressure gage (2) is located in the rear of the machine compartment on the wall between the machine compartment and the brine tank.

(2) *Purpose.* It indicates the pressure in the high pressure side of the refrigeration system. When the equipment is oper-



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1 Compressor crankcase filler plug
2 Liquid level indicator
3 Low pressure cutout connection

Figure 21. Liquid level indicator.

ating efficiently, the high pressure gage should read approximately 125 pounds when the low pressure gage reads 20 pounds and ambient temperature is approximately 80° F. If ambient temperature is lower, high pressure reading will be lower (low pressure reading will be the same) and if ambient temperature is higher, reading will be correspondingly higher (it can go as high as 210 pounds when outside temperature is 125° F.).

Section III. OPERATION UNDER USUAL CONDITIONS

12. General

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

b. It is essential that the operator know how to perform every operation of which the ice plant is capable. This section gives instructions on starting and stopping the machine, instructions on the basic functions of the machine and instructions on how to coordinate the basic functions to perform the specific tasks for which the ice plant is designed.

13. Starting

a. See paragraph 33*c* for before-operation services to be performed before starting operation of equipment.

Caution: Whenever ice plant is to be operated, at least 10 ice cans must be in brine tanks and all ice can covers (2, fig. 1) must be securely in place.

b. Open and remove front, end, and rear doors of machine compartment. Doors are removed after opening by lifting, which uncouples the hinges.

c. Pull ignition switch (2, fig. 19) out.

d. Tool box (14, fig. 14) must be removed to gain access to fuel shutoff valve (1, fig. 15). Remove tool box and open fuel shutoff valve. Reinstall tool box.

e. Pull choke control button (3, fig. 20) half-way out.

f. Open refrigeration bypass valve (3, fig. 5) fully.

g. Crank engine 2 or 3 up-strokes.

Warning: When cranking the engine, stand slightly to the left of the center of the radiator and in such position that there is no possibility of being struck by the crank if the engine crankshaft reverses direction. Crank the engine with quick-up-strokes, do not spin it.

h. Push choke control button in.

i. Crank with quick up-strokes until engine starts.

j. Open active receiver outlet valve (9, fig. 5) fully.

Note. **When active receiver outlet valve is fully open, do not run engine more than 2 or 3 minutes without starting to close the refrigeration bypass valve.**

k. Alternately close refrigeration bypass valve about one-eighth turn at a time, and check for temperature rise in condenser upper return bend (11, fig. 4) by placing hand on return bend.

l. Continue closing refrigeration bypass valve about one-eighth turn at a time and checking condenser until temperature is felt to rise in the return bend.

m. When temperature rises, stop closing refrigeration bypass valve and keep hand on return bend of condenser to make sure temperature either remains constant or continues to rise.

n. If temperature drops, begin closing refrigeration bypass valve very gradually until temperature rises again.

o. When temperature remains constant or continues to rise, stop closing bypass valve and run ice plant for 10 minutes.

p. After ice plant has run for 10 minutes with bypass valve stationary, close bypass valve gradually by turning it no faster than approximately ½ inch at the circumference of the hand wheel every 30 seconds until completely closed.

q. Replace copper gasket rings and caps on suction service valve (4, fig. 5), discharge service valve (6, fig. 15), dehydrator bypass valves (6, fig. 16), and active receiver inlet valve (10, fig. 5) and outlet valve (9).

14. Stopping

a. Equipment To Be Started Again Within 12 Hours.

(1) Stop engine by pushing ignition switch (2, fig. 19) in.

(2) Remove tool box and close fuel shutoff valve. Reinstall tool box.

b. Equipment Not To Be Started Again Within 12 Hours.

(1) If the equipment is to be shut down for more than 12 hours, or for repairs to the refrigeration system, it must be pumped down (par 15*b*(1)) before stopping the engine.

(2) Stop engine by pushing ignition switch in.

(3) Remove tool box and close fuel shutoff valve. Reinstall tool box.

(4) Reinstall and close front, end, and rear doors, if no work is required on the equipment.

15. Operating Details

a. General. The ice-making operation utilizes an indirect freezing system. The refrigeration equipment cools the brine, which has a much lower freezing point than water, and which is circulated around the ice cans and cools them to make ice. This type of system allows simple mechanical construction and even cooling.

b. Operating Procedures.

(1) *Pumping down the system.* Before the refrigeration system can be opened for any reason except changing the dehydrator cartridges or purging, or if the ice plant is to be shut down for more than 12 hours, the refrigerant must be pumped down into the receiver.

(*a*) Disconnect the magneto wire from the low pressure cutout switch (4, fig. 20). Remove screw (5) at front bottom center and take off cover. Inside are four wires connected to screw terminals. Remove upper left screw and take off wire.

(*b*) If ice plant is running, make sure it has been running for at least 20 minutes before starting to pump down the system.

(*c*) If ice plant is not running, start the equipment (par. 13) and let it run for at least 20 minutes before starting to pump down the system.

(*d*) Remove caps from active receiver outlet valve (9, fig. 5), suction service valve (4), and discharge service valve (6, fig. 15).

(*e*) Close receiver outlet valve and watch low pressure gage (1, fig. 17), which will begin to go down.

(*f*) When low pressure gage registers 10 inches of vacuum, stop the engine. Low pressure gage will now begin to rise slowly.

(*g*) When low pressure gage registers zero pounds (no pressure) close discharge service valve and suction service valve.

(*h*) If low pressure gage rises above zero pounds (no pressure) before compressor valves are closed, start the ice plant and run it until vacuum is obtained then stop the engine and close valves when zero pounds (no pressure) is registered on low pressure gage.

Warning: Never close discharge service valve while ice plant is running, as pressure will build up inside compressor creating danger of explosion.

(*i*) If low pressure gage does not rise to zero pounds (no pressure) after vacuum is obtained, barely open the receiver outlet valve to let a small amount of refrigerant back into the system to bring the pressure up to zero pounds, then close the receiver outlet valve immediately.

Caution: Never open the system if the low pressure gage registers below zero pounds pressure, as air and moisture will be drawn into the system causing corrosion of internal compressor parts.

(*j*) Connect magneto wire to low pressure cutout switch and attach cover.

Note. If ice plant is not to be operated again within 12 hours, close active receiver inlet valve (10, fig. 5).

(*k*) Replace caps on all valves. Refrigeration system may now be opened.

(2) *Charging the system with Freon-12 refrigerant.* If the refrigeration system has lost part of the refrigerant, the refrigerant sight glass (7, fig. 5) will show foam, rather than solid liquid, passing through. Before charging the system with refrigerant, test thoroughly for leaks (par. 7*h*(1)). Leaks must be repaired before charging the system with refrigerant.

(*a*) *Using spare receiver to charge system.* If small amounts of refrigerant have been lost from the system due to leaks or opening of the system for repairs, the system may be recharged by transferring refrigerant from the spare receiver to the active receiver. Refrigerant is transferred while the ice plant is running.

1. If ice plant is not running, start the equipment (par. 13*a*–*p*).
2. Remove caps and gaskets from active and spare receiver outlet valves.
3. Close active receiver outlet valve.
4. Open spare receiver outlet valve.
5. After 1 minute, close spare receiver outlet valve and open active receiver outlet valve.
6. Run ice plant for 10 minutes.
7. Remove refrigerant sight glass cover and check refrigerant passing through system.
8. If refrigerant is still foamy, repeat steps *3* through *6* above. When sight glass shows solid liquid passing through system, enough refrigerant has been transferred to operate system efficiently.
9. Replace valve caps, sight glass cover, and gaskets.
10. If all, or nearly all, refrigerant has been lost from the system, it is simpler to change operation from the active to the spare receiver, if the spare receiver has not previously been used to charge the system. Remove caps from outlet and inlet valves of both receivers, and open inlet valve of spare receiver.
11. Close both valves fully on active receiver, and open spare receiver outlet valve fully.
12. Run ice plant for 10 minutes.

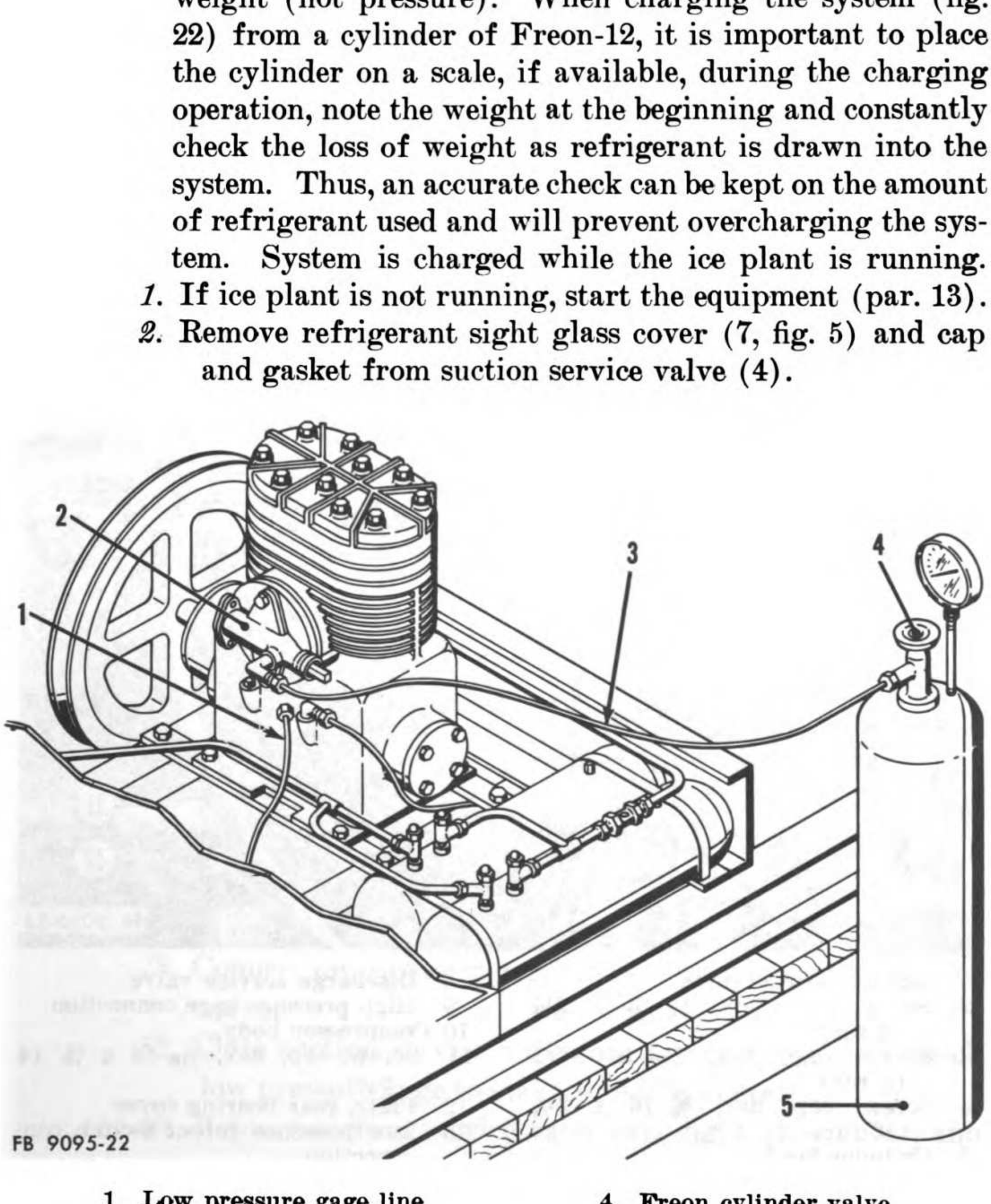
13. Remove refrigerant sight glass cover and check refrigerant passing through system. Sight glass should show solid liquid. If refrigerant is still foamy, spare receiver does not contain enough refrigerant to operate system efficiently, and system must be recharged from a drum or cylinder of refrigerant.

14. Replace valve caps, sight glass cover, and gaskets.

(*b*) *Using cylinder of refrigerant to charge system.* The full charge of refrigerant required to operate the refrigeration system efficiently is 13 pounds of Freon-12 by actual weight (not pressure). When charging the system (fig. 22) from a cylinder of Freon-12, it is important to place the cylinder on a scale, if available, during the charging operation, note the weight at the beginning and constantly check the loss of weight as refrigerant is drawn into the system. Thus, an accurate check can be kept on the amount of refrigerant used and will prevent overcharging the system. System is charged while the ice plant is running.

1. If ice plant is not running, start the equipment (par. 13).

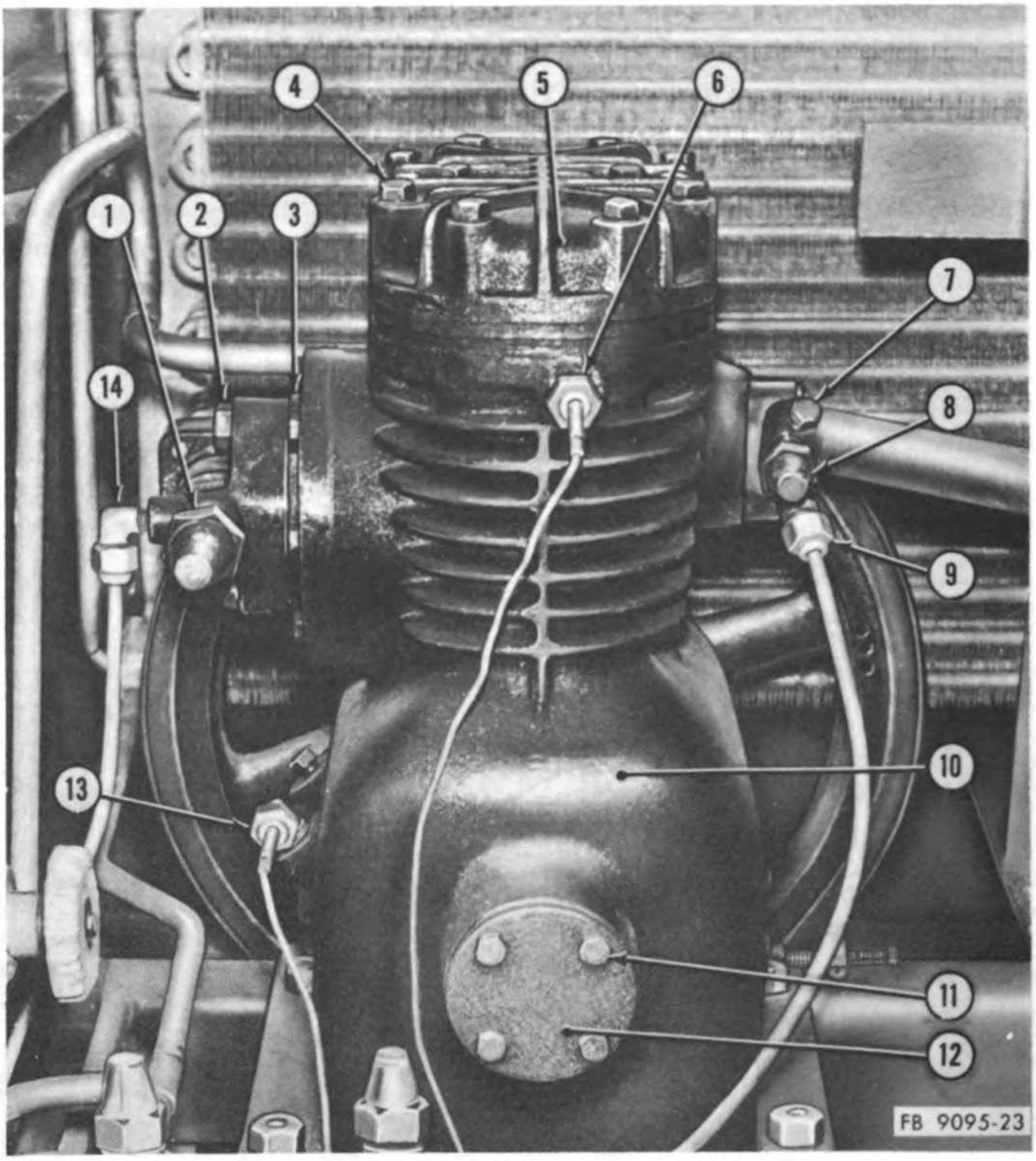
2. Remove refrigerant sight glass cover (7, fig. 5) and cap and gasket from suction service valve (4).



1 Low pressure gage line
2 Suction service valve
3 Charging line
4 Freon cylinder valve
5 Freon cylinder

Figure 22. Charging refrigeration system with cylinder of Freon-12.

3. Make sure suction service valve is fully open (turned counterclockwise as far as possible).
4. Disconnect low pressure gage line (14, fig. 23) from suction service valve.
5. Securely connect charging line (3, fig. 22) to Freon cylinder (5). Place cylinder on a scale, if available.



1 Suction service valve
2 Screw, cap, hex, ½–13 x 2¼ (2 rqr)
3 Screw, cap, hex, 5/16–18 x 1 (8 rqr)
4 Screw, cap, hex, ⅜–16 x 2½ (10 rqr)
5 Cylinder head
6 High pressure cutout switch connection
7 Discharge service valve purge port
8 Discharge service valve
9 High pressure gage connection
10 Compressor body
11 Screw, cap, hex, 5/16–18 x ⅞ (4 rqr)
12 Plate, rear bearing cover
13 Low pressure cutout switch connection
14 Low pressure gage connection

Figure 23. Compressor connections.

Warning: When charging, be sure cylinder is upright. Do not apply heat and do not leave cylinder in direct sun.

6. Connect charging line to suction service valve (2) but do not tighten completely.

7. Barely open valve (4) on Freon cylinder so that gas comes out very slowly.

8. Allow gas to escape at loose connection to suction service valve for a few seconds to purge the line of air.

9. Tighten connection to suction service valve securely.

10. Fully open valve on Freon cylinder. Make sure that fittings at both ends of charging line are tight enough to prevent leaks.

11. Fully close (clockwise) suction service valve. Refrigerant will now be drawn into the system from the Freon cylinder.

12. If cylinder is on a scale, allow 2 or 3 pounds of refrigerant to be drawn into the system and then open suction service valve fully.

13. If cylinder is not on a scale, leave suction service valve closed for 1 minute, then open it fully.

14. Check sight glass. If refrigerant is still foamy, repeat steps *11* through *13* above, until sight glass shows solid liquid. When sight glass shows solid liquid, system is fully charged.

Warning: When charging system with cylinder on a scale, do not put more than 13 pounds of refrigerant into the system, and use this amount only when system is completely empty. If no scale is available, do not charge system for more than 3 minutes total time with valve on cylinder fully open and suction service valve fully closed.

15. Make sure suction service valve is fully open.

16. Close valve on cylinder.

17. Remove charging line from suction service valve.

18. Connect low pressure gage line securely to suction service valve.

19. Close suction service valve one-quarter turn and check low pressure gage to make sure it is operating.

20. Replace suction service valve cap, sight glass cover, and gaskets.

21. If ice plant is operating on active receiver and it is desired to charge the spare receiver, remove valve caps from inlet and outlet valves of both receivers.

22. Make sure spare receiver inlet and outlet valves are fully closed.

23. If the spare receiver is empty, or nearly empty, it should be "blown off," or pressure should be relieved, before charging. Remove cap from spare receiver purge port (6, fig. 5) and allow all gas to escape. This will remove air which may have become trapped in the receiver, as well as relieve the pressure from the small amount of refrigerant left.

24. Replace purge port cap immediately after pressure is relieved.

25. Open spare receiver outlet and inlet valves.

26. Close active receiver outlet and inlet valves.

27. Perform steps *1* through *20* above.

28. Close spare receiver outlet valve and open active receiver outlet valve.

29. Open active receiver inlet valve.

30. Close spare receiver inlet valve.

31. Replace valve caps and gaskets.

(3) *Removing refrigerant from the system.*

(*a*) Refrigerant is removed from the system while the ice plant is running. If ice plant is not running, start the equipment.

(*b*) Remove cap from discharge service valve (6, fig. 5) and make sure valve is fully open (turned counterclockwise as far as possible).

(*c*) Connect charging line (3, fig. 22) securely to Freon cylinder (5).

(*d*) Place Freon cylinder upright on a scale during charging.

(*e*) Remove plug from discharge service valve port (7, fig. 15).

(*f*) Connect charging line to discharge service valve port but do not tighten it securely.

(*g*) Barely open valve on Freon cylinder so that gas comes out very slowly.

(*h*) Allow gas to escape at loose connection to discharge service valve for a few seconds to purge the line of air.

(*i*) Tighten connection to discharge service valve securely.

(*j*) Fully open valve on cylinder. Make sure that fittings at both ends of charging line are tight enough to prevent leaks.

(*k*) Close discharge service valve two turns only. Compressor will now pump gas into the cylinder instead of the condenser.

(*l*) Cool the cylinder with water, if possible, to aid in condensing the gas in the cylinder.

Warning: Capacity of cylinder is stamped on outside. Do not charge beyond this capacity. If an overcharged cylinder is exposed to heat or direct sun there is extreme danger of explosion.

(*m*) When the capacity of cylinder has been reached, or when desired amount of refrigerant has been removed from system, open discharge service valve fully.

(*n*) Close valve on cylinder.

(*o*) Disconnect charging line from discharge service valve and replace plug in port.

(*p*) Replace cap and gasket on discharge service valve.

(4) *Purging the system.* If air has entered the system, it will usually collect in the condenser and be indicated by a higher than normal reading on the high pressure gage when the system is not running and is not pumped down. This air must be bled off.

(*a*) If ice plant is running, stop the equipment (par. 14*a*) without pumping down the system.

(*b*) Let the ice plant stand idle for several hours to allow the condenser and receiver to reach the same temperature as the surrounding atmosphere. This will allow the air in the condenser to separate from the Freon gas and come to the top of the condenser.

(*c*) Determine temperature of atmosphere and check reading of high pressure gage.

(*d*) Check high pressure gage reading against table of temperatures and corresponding pressures (table I). This table shows the correct readings for the high pressure gage at given temperatures.

Note. The above pressures for given temperatures apply only when ice plant is not running and has not been running for several hours. Pressures are higher for given temperatures when ice plant is running.

Table I. Table of Temperatures

Temperature °F.	High pressure gage reading	Temperature °F.	High pressure gage reading
20	21. 0	84	90. 1
28	26. 9	92	103. 0
36	33. 4	100	116. 9
44	40. 7	108	132. 1
52	48. 8	116	148. 4
60	57. 7	124	166. 1
68	67. 5	132	185. 1
76	78. 3	140	205. 5

(*e*) Loosen condenser purge port (10, fig. 4) so that gas escapes, but not enough so that cap will come off.

(*f*) Allow pressure to drop until high pressure gage reading corresponds to given reading indicated in table I. For temperatures between the readings in table I, estimate the pressures.

(*g*) When proper pressure is reached for atmospheric temperature, tighten purge port cap securely.

(5) *Adding or removing compressor crankcase oil.* The lubricating oil for the compressor is a specially refined dehydrated oil (see LO 5–9095). Correct oil level in the compressor crankcase is at the approximate center of the liquid level indicator (2, fig. 21). Oil level must be checked when the ice plant is not operating, but only after a period of operation. The oil will absorb refrigerant during a shutdown and will show an inaccurately high level. Before adding or removing oil, system must be pumped down.

(*a*) Pump down the system (par. 15*b*(1)). If ice plant has not been running, let it run for not less than 30 minutes before starting to pump down.

(*b*) Allow compressor crankcase oil to settle so that foam disappears, then check oil level.

(*c*) Remove the oil filler plug (1, fig. 21) slowly as there will still be slight pressure in the crankcase. Allow pressure (indicated by hissing sound) to subside completely before removing plug entirely.

Caution: Never remove compressor oil filler plug while low pressure gage registers above zero pounds pressure.

(*d*) If oil level is low, add enough oil to bring level to approximate center of liquid level indicator.

(*e*) If oil level is too high, it will be necessary to remove some.

1. Remove excess oil with suction pump, if available.

2. If suction pump is not available, pressure from the system may be used to force oil out of the crankcase.

3. Place a bent glass or copper tube through a cork or other suitable stopper which will fit snugly into the oil filler hole in compressor crankcase, and insert it in the hole so that the tube is well below the oil level.

4. Have suitable container ready to receive oil. Remove suction service valve cap.

5. Carefully open suction service valve very slightly to obtain slight pressure in crankcase. Oil will be forced out through tube.

Caution: Be very careful not to apply too much pressure to compressor crankcase as it may force stopper and tube from oil filler hole.

(*f*) When oil is at proper level, close suction service valve and remove stopper and tube. Replace oil filler plug and tighten securely.

(*g*) Remove caps from suction service and discharge service valves and open valves fully. Replace caps.

(*h*) Purge the system (par. 15*b*(4)) before starting ice plant.

(6) *Checking and correcting brine.* For the ice plant to operate efficiently, the brine must be maintained at the proper level and density. If water is accidentally spilled or added to the brine after mixing, it will lower its density, increasing the possibility of ice forming on the cooling coils. This would seriously interfere with the proper cooling and circulation of the brine. Brine density, or specific gravity, is checked with the salometer supplied with the ice plant. Check brine weekly.

(*a*) Fill the graduate almost to the top with brine from the brine tank and warm or cool it to 60° F.

(*b*) Insert salometer, weighted end down, into the graduate, making sure there is enough solution so that it does not touch the bottom.

(*c*) Read the numbers on the stem of the salometer at the surface of the brine. This is the specific gravity of the brine.

(*d*) Compare specific gravity of the brine with table II. Find the specific gravity, shown by the salometer, in the first column. When brine is at proper strength, specific gravity should be 1.240 (underlined figure in table II).

(*e*) Find number in second column on same line as specific gravity number as shown by salometer. This is the number of pounds of flake calcium chloride required to be added to the brine in order to correct the specific gravity to 1.240.

(*f*) The third column of table II shows the number of pounds of calcium chloride required for each gallon of water to make brine of given specific gravity.

(*g*) The fourth column shows the temperature at which brine of given specific gravity will freeze.

(*h*) Weigh out the amount of calcium chloride indicated by the second column and add gradually to the brine with constant stirring, making sure it dissolves completely. If reading is between two given figures, estimate amount to be used.

Table II. Specific Gravity of Brine Solution

Specific gravity as shown by salometer	Calcium chloride (lbs) to be added to correct to 1.240 sp. gr.	Weight (lbs) of calcium chloride per gallon of water	Freezing temperature of brine in degrees F.
1. 100	211	1. 42	20. 3
1. 120	181	1. 72	16. 5
1. 140	151	2. 02	12. 2
1. 160	121	2. 32	7. 0
1. 180	92	2. 61	1. 2
1. 200	60	2. 93	−5. 8
1. 220	31	3. 22	−13. 2
1. 240	0	3. 53	−21. 5
1. 260	---	3. 86	−31. 2
1. 280	---	4. 18	−44. 3

Note. If solid, instead of flake, calcium chloride is used, multiply the figure in the second column by 1.06 to find the weight of calcium chloride to be used.

Caution: Do not allow specific gravity of brine to go above 1.240. Higher specific gravity makes the brine a poorer heat carrier and requires that it be circulated longer to do the same amount of cooling.

(*i*) If specific gravity of brine is too high, remove some of the brine from the tank and add water until correct specific gravity is obtained.

(*j*) Check brine level when specific gravity has been corrected. If level is too high, remove enough brine from the tank to bring level to proper height.

(7) *Filling ice cans.* When the ice plant is started initially or after a prolonged shutdown, it will take about 12 hours of continuous operation to bring the temperature of the brine down to freezing (32° F.). More or less time may be required, depending on the surrounding temperature. During this period 10 empty ice cans are placed in the brine tank with covers in place.

(*a*) When brine is at freezing temperature (indicated by low pressure gage reading of 20 pounds or less) fill the 10 ice cans which are not in the brine tank with fresh, clean water to 7 inches from the top and place them in the first and third openings in the brine tank and secure the covers in place. Do not fill the remaining 10 cans.

Caution: Do not fill ice cans higher than 7 inches from the top. This allows for expansion as the water freezes, and also keeps the water below the brine level.

(*b*) After 6 hours of operation with 10 full ice cans, remove and fill the remaining ice cans with fresh, clean water to 7 inches from the top and place them in the brine tank.

(8) *Harvesting ice.* When brine is at freezing temperature it will take approximately 12 hours to freeze 10 cans of ice. Ice is made in 10-can lots to prevent overloading the refrigeration system and to have a fresh supply of ice every 6 hours.

(*a*) Remove ice can covers from first and third openings 12 hours after placing full ice cans in these openings.

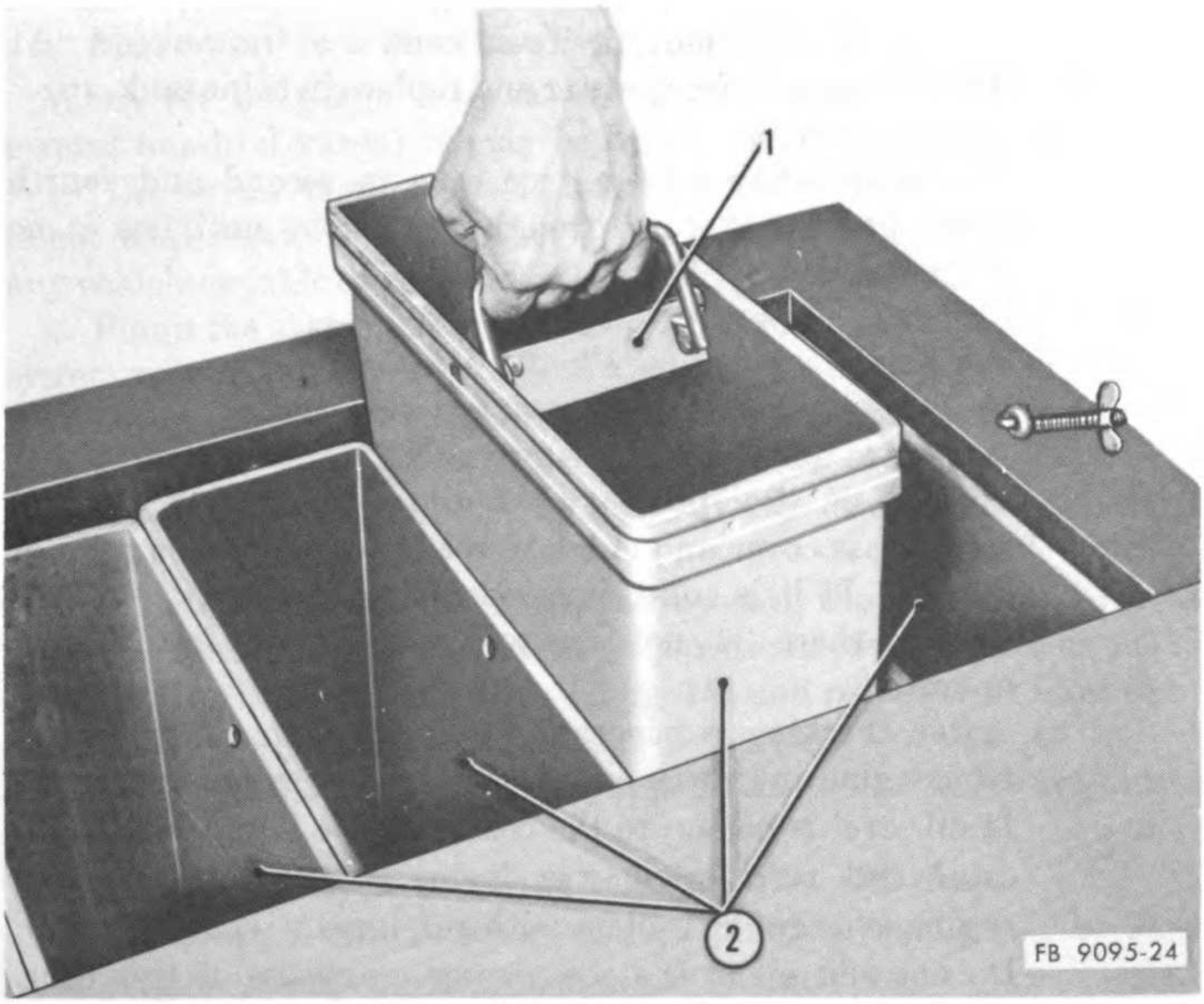
(*b*) Turn only one movable lug on ice can lifting handle so that it does not project beyond side of handle.

(*c*) Place handle horizontally at top of ice can so that projecting lug fits into one hole at top of can.

(*d*) Turn other lug so that it projects into other hole at top of ice can.

(*e*) Grasp handle and lift straight up (fig. 24).

(*f*) Rest bottom edge of ice can on supporting tail at top of brine tank and allow all the brine to drain from the outside of the can.



1 Ice can lifter 2. Ice cans

Figure 24. Removing ice cans.

Caution: When draining ice cans of brine, be very careful not to allow brine to run into cans of ice not yet removed.

(*g*) Remove can from ice plant and place upright in a tank of water, if available, so that water level on outside of ice can comes above ice level but not above top of can. Leave can in water for 2 minutes to loosen ice from can.

(*h*) If a tank of water is not available, wash the outer surface of the can with a hose, being careful not to get water into the can.

(*i*) If neither a tank nor a hose is available, allow the ice can to stand in warm air or sunshine for about 10 minutes.

(*j*) Lay ice can on side and lift from bottom. Ice will slide out of can.

(*k*) Remove all ice cans from first and third openings in brine tank and remove ice from cans.

(*l*) Refill cans with fresh water and replace in brine tank.

(*m*) Replace covers.

(*n*) After 6 hours of operation after refilling ice cans in first and third openings, remove covers from second and fourth openings.

(*o*) Remove all ice cans from second and fourth openings in brine tank and remove ice from cans.

(*p*) Refill cans with fresh water and replace in brine tank.

(*q*) Replace covers.

(*r*) Six hours after refilling ice cans in second and fourth openings, repeat (*a*) through (*q*) above until ice is no longer needed.

(*s*) Stop the equipment (par. 14).

c. Notes and Suggestions on Ice Plant Operation.

(1) *Refrigerant and compressor crankcase oil level.*

(*a*) After ice plant has been operating for one hour either initially or after prolonged shutdown, remove refrigerant sight glass cover and check to see if refrigerant is solid or foamy. If it is solid, it is operating efficiently. If it is foamy, there is not enough refrigerant for efficient operation.

(*b*) After checking refrigerant after one hour of operation, stop engine and check oil level in the compressor crankcase. If oil level is not up to the center of the liquid level indicator and refrigerant was foamy just before stopping engine, charge the system with refrigerant (par. 15*b*(2)). Do not add oil to the compressor crankcase at this time. When there is a shortage of refrigerant, compressor oil level will tend to go down.

(*c*) Operate ice plant for one more hour with full charge of refrigerant in system, then stop engine and check compressor crankcase oil level. If oil level of compressor is low and refrigerant was solid liquid just before stopping engine, add oil (par. 15*b*(5)).

(2) *Handling of ice cans.*

(*a*) Ice cans must be kept clean at all times. They should be lifted or lowered in the brine tank straight up or down to avoid spilling and excessive wear on the cans, can-rails, and can-guides.

(*b*) Handle cans carefully to avoid spilling water into the brine, or letting brine dip into cans containing ice or water.

(*c*) When ice cans are not being removed or replaced in brine tank, covers must be in place at all times and fastened securely at both ends, to allow ice plant to operate most efficiently.

(*d*) When removed from brine tank, outside of ice cans must be rinsed with fresh water to prevent brine from drying on cans.

(*e*) When not in use, ice cans must be thoroughly cleaned with an approved cleaning solvent and dried before storing.

16. Movement to a New Location

When the ice plant is to be moved to a nearby location (within several hundred yards) it may be towed slowly on its skid base provided the terrain is smooth. If the terrain is rough or if the location is not within skidding distance, the ice plant may be transported by any vehicle capable of carrying it.

a. Pump the system down (par. 15*b*(1)) and close all refrigeration system valves.

b. Drain brine from tank into suitable container, for re-use. Brine tank drain is located at lower left rear corner of the ice plant.

c. Place all ice cans in brine tank and attach ice can covers securely.

d. Close all doors.

e. If the ice plant is to be shipped by rail, the fuel tank must be drained in addition to the other preparations covered in this paragraph. Close fuel shutoff valve (1, fig. 15) and remove fuel filter sediment bowl (3) by loosening fuel filter clamp (4).

f. Have suitable container ready, open fuel shutoff valve and drain fuel tank.

g. Close fuel shutoff valve and reinstall filter and clamp.

h. If terrain is rough, secure the ice plant to the carrier by steel strapping or U-shaped bolts through the towing eyes.

i. Follow procedures in paragraph 7 for reinstallation, paying special attention to leak testing.

Section IV. OPERATION OF MATERIEL USED IN CONJUNCTION WITH THE ICE PLANT

17. Description of Fire Extinguisher

A hand operated, 1 quart, carbon tetrachloride fire extinguisher is provided with the ice plant. It is located in the tool box.

18. Operation of Fire Extinguisher

To operate the fire extinguisher, turn the handle one turn counter-clockwise to unlock, and pump stream at base of flame.

19. Refilling of Fire Extinguisher

See TM 5–687 and TM 9–1799.

Section V. OPERATION UNDER UNUSUAL CONDITIONS

20. Operation in Extreme Cold (Below 0° F.)

The ice plant will not be operated in continued extreme cold since it is more practical to fill the ice cans and expose them to the cold weather to make ice. However, if the weather is changeable, the ice plant may be operated occasionally.

a. Engine. Use an approved antifreeze solution in the amount specified by table III for the lowest expected ambient temperature.

Table III. Freezing Points, Composition and Specific Gravities of Military Antifreeze Materials

Lowest expected ambient temp ° F.	Pints of inhibited glycol per gal of coolant [1]	Compound antifreeze, Arctic [2]	Ethylene glycol coolant solution specific gravity at 68° F.[3]
+20	1½	Issued full-strength and ready mixed for 0° to −65° F. temperatures for both initial installation and replenishment of losses. DO NOT DILUTE WITH WATER OR ANY OTHER SUBSTANCE.	1. 022
+10	2		1. 036
0	2¾		1. 047
−10	3¼		1. 055
−20	3½		1. 062
−30	4		1. 067
−40	4¼		1. 073
−50	(4)		
−60	(4)		
−75	(4)		

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

[2] Military Specification MIL–C–11755 Arctic type, nonvolatile antifreeze compound is intended for use in the cooling system of liquid-cooled internal combustion engines for protection against freezing primarily in Arctic regions where the ambient temperature remains for extended periods of time close to −40° F. or drops below, to as low as −90° F.

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

[4] Arctic antifreeze preferred.

Note. Fasten a tag near the radiator fillercap indicating the type of antifreeze.

If no antifreeze solution is available, cover the radiator completely, start the engine (par. 13*a–i*), then fill the radiator immediately with water. This will prevent the radiator from freezing during the warmup period. Drain the cooling system completely immediately after operation.

Caution: Never run the engine without water or approved antifreeze solution.

Caution: Never substitute oil, kerosene, salt, or any other substance for approved antifreeze solution.

b. Refrigeration System. Follow procedure in paragraph 14*b* when equipment is not in use.

c. Lubrication. Lubricate according to LO 5–9095.

21. Operation in Extreme Heat

a. Engine. Check coolant level frequently and keep radiator filled. Be sure that radiator fillercap is on tightly at all times. Check engine fan belt between operating periods and adjust if necessary. Check engine operating temperature (par. 10*c*) frequently. Clean and flush cooling system between operating periods.

b. Special Lubrication. Lubricate according to paragraph 30.

c. Refrigeration System. The dehydrator must be cut out of the refrigeration circuit by the dehydrator bypass valves (6, fig. 16) because, during excessive heat it has a tendency to release moisture collected from the system.

(1) Remove machine compartment cover (par. 7*f*(1)(*l*) and (*m*)) and caps and gaskets from dehydrator bypass valves.
(2) Close the dehydrator bypass valve nearest dehydrator fully.
(3) Close the other dehydrator bypass valve fully, then open very slightly.
(4) Reinstall valve caps and gaskets, and machine compartment cover (par. 7*f*(1)(*v*)).

d. Fuel Tank. Keep fuel tank full to prevent condensation of moisture inside the tank.

22. Operation Under Dusty or Sandy Conditions

a. Engine. Be sure that radiator fillercap is on tightly at all times. Flush and clean cooling system between operating periods.

b. Special Lubrication. Care must be taken in dusty or sandy areas to keep lubricants free of dust and sand. Clean lubrication fittings, prior to lubricating, with an oil-dampened cloth. Lubricate as prescribed in LO 5–9095 but reduce specified intervals. Air cleaner and oil filter must be checked and cleaned at more frequent intervals.

c. Cleaning Recommendations. Using an approved cleaning solvent as often as necessary, keep the ice plant free of dust and grime. Be careful to remove all excessive grease, since it tends to collect dust.

d. Fuel Protection. Keep fuel containers and fuel tank tightly closed. Clean fuel filter between operating periods.

e. Protect Screens. Since air is drawn into the machine compartment by both the condenser fan and the engine radiator fan, screens should be set up to prevent any direct wind from reaching the ice plant. Care should be taken to assure free circulation of air through the machine compartment when screens are set up.

Note. **Do not close any of the machine compartment doors to prevent dust from entering.**

f. Tools and Accessories. Tools and accessories must be kept dry and clean and stored in tool box when not in use.

g. Ice Cans. Ice cans must be kept clean and dry when not in use. Outside of cans must be rinsed off and dried before replacing in brine tank.

Note. **Do not leave ice can covers off brine tank any longer than necessary to remove or to replace ice cans.**

23. Operation in Salt Water Areas

a. Engine. Be sure radiator fillercap is on tightly at all times. Do not use salt water to fill cooling system.

b. Lubrication. Lubricate according to LO 5–9095 but reduce specified intervals.

c. Cleaning Recommendations. Salt water has a corrosive effect on metals, and care should be taken to keep the equipment as dry as possible. Wipe spray and moisture from the ice plant frequently and check constantly for signs of corrosion. Wipe unpainted metal surfaces only with an oil-dampened cloth.

d. Tools and Accessories. Tools and accessories must be kept clean and stored in tool box when not in use. Coat metal tools and accessories with light film of oil when not in use.

e. Protective Screens. Screens should be set up to prevent salt water spray from reaching the ice plant. Care must be taken to assure free circulation of air through the machine compartment.

24. Operation in High Humidity

a. Lubrication. Lubricate according to LO 5–9095 but reduce specified intervals.

b. Cleaning Recommendations. Equipment must be kept as dry as possible. Wipe frequently with clean, dry cloths. Wipe unpainted metal surfaces only with an oil-dampened cloth.

c. Tools and Accessories. Tools and accessories must be kept clean and stored in tool box when not in use. Coat metal tools and accessories with light film of oil when not in use.

d. Fuel Tank. Keep fuel tank full to prevent moisture from condensing inside tank.

25. Operation in High Altitude

a. Engine. Engine is designed to operate at altitudes up to 3,000 feet above sea level with no loss of power. Engine will lose approximately 3 percent of its power for each 1,000-foot rise above 3,000 feet above sea level. To adjust the carburetor for high altitudes, start the engine (par. 13*a–i*) and let it warm up, then turn the idle adjustment screw (23, fig. 4) slowly clockwise to provide a leaner mixture, until the engine operates most smoothly. Adjustment will vary according to the altitude.

b. Lubrication. Lubricate according to LO 5–9095.

c. Refrigeration System. The refrigeration system is a closed system and will not be affected by operation at a high altitude. Check the system frequently for leaks, paying special attention to the high pressure side.

d. Brine. It is very important that the brine be kept at the proper specific gravity in high altitudes. Check brine (par. 15*b*(6)) frequently to make sure that it does not go below the specified density.

e. Ice Making. Water will freeze more quickly at a high altitude because it freezes at a higher temperature since atmospheric pressure is lower. Ice making time will be cut down, so ice cans must be checked more frequently to determine the proper intervals at which to harvest ice. Intervals will vary according to the altitude.

CHAPTER 3
ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

26. General

The tools and equipment required to perform organizational maintenance on the ice plant are standard mechanics' hand tools.

27. Tool and Publications Set

The tools required for the use of the operator are listed in appendix III.

28. Special Organizational Maintenance Tools and Equipment

No special tools or equipment are required for organizational maintenance other than the tools and equipment listed in appendix III.

Section II. LUBRICATION AND PAINTING

29. General Lubrication Information

a. Lubrication Order 5–9095 prescribes first and second echelon lubrication maintenance for the ice plant.

b. A lubrication order is published for each item of equipment. The lubrication order shown in figure 25 is an approved lubrication order for this ice plant. For the current LO 5–9095, refer to DA Pam 310–4.

c. Lubrication orders prescribe approved first and second echelon lubrication procedures. The instructions contained therein are mandatory.

30. Detailed Lubrication Information

a. Care of Lubricant. Keep the lubrication equipment where it will be safe from damage and free from dust and dirt. Clean the equipment both before and after use.

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

c. Cleaning. Wipe lubrication fittings and openings clean before lubricating.

d. Operation Immediately After Lubrication. Operate the ice plant immediately after lubrication so that the lubricants will circulate to all moving parts of the equipment.

e. Engine Crankcase Oil. It is not necessary to change engine crankcase oil during operation when atmospheric temperature rises or falls within the temperature range specified for a different grade of oil.

f. Oil Filter (fig. 26).

(1) *Removal.*

(*a*) Have suitable container ready. Remove drain plug (17) and drain the filter.

(*b*) Disconnect oil lines from oil filter, at elbows (8).

(*c*) Remove bolts (11), lockwashers (14), and nuts (15) holding bracket (10) to frame, and remove filter assembly and bracket.

(*d*) Remove stove bolt (16), nut (12), and lockwasher (13), spread bracket apart and remove bracket from filter assembly.

(*e*) Unscrew cover screw (1), remove cover (3), and discard the gasket (5) and filter element (6).

(*f*) Remove and discard the cover screw gasket (2). Remove spring (4) from cover.

(*g*) Remove spacer (7) from filter body (9).

(*h*) Remove inlet and outlet elbows (8).

(2) *Cleaning.*

(*a*) Using an approved cleaning solvent, clean body, cover, and bracket thoroughly.

(*b*) Soak fittings in an approved cleaning solvent, dry, and blow through with clean compressed air.

(*c*) Replace filter element.

(3) *Installation.*

(*a*) Screw inlet and outlet elbows (8), and drain plug (17) into filter body (9).

(*b*) Place spacer (7) and new filter element (6) in body.

(*c*) Place cover screw (1), new cover screw gasket (2), and spring (4) in cover (3), and attach cover to filter body, using a new cover gasket (5).

(*d*) Slide bracket (10) on filter body and secure with stove bolt (16), lockwasher (13), and nut (12).

(*e*) Attach bracket to frame using bolts (11), lockwashers (14), and nuts (15).

(*f*) Connect oil lines to oil filter.

LUBRICATION ORDER

LO 5-9095

10 March 1954

ICE PLANT, 1 TON, EQUIPMENT ONLY, GASOLINE DRIVEN, RECO MODEL G 2000-S50D

References: TM 5-9095, TB 5-9095-1, TM 5-5189, TB 5-5189-1

Intervals given are maximums for normal 8-hour day operation. For abnormal conditions or activities, intervals should be shortened to compensate.

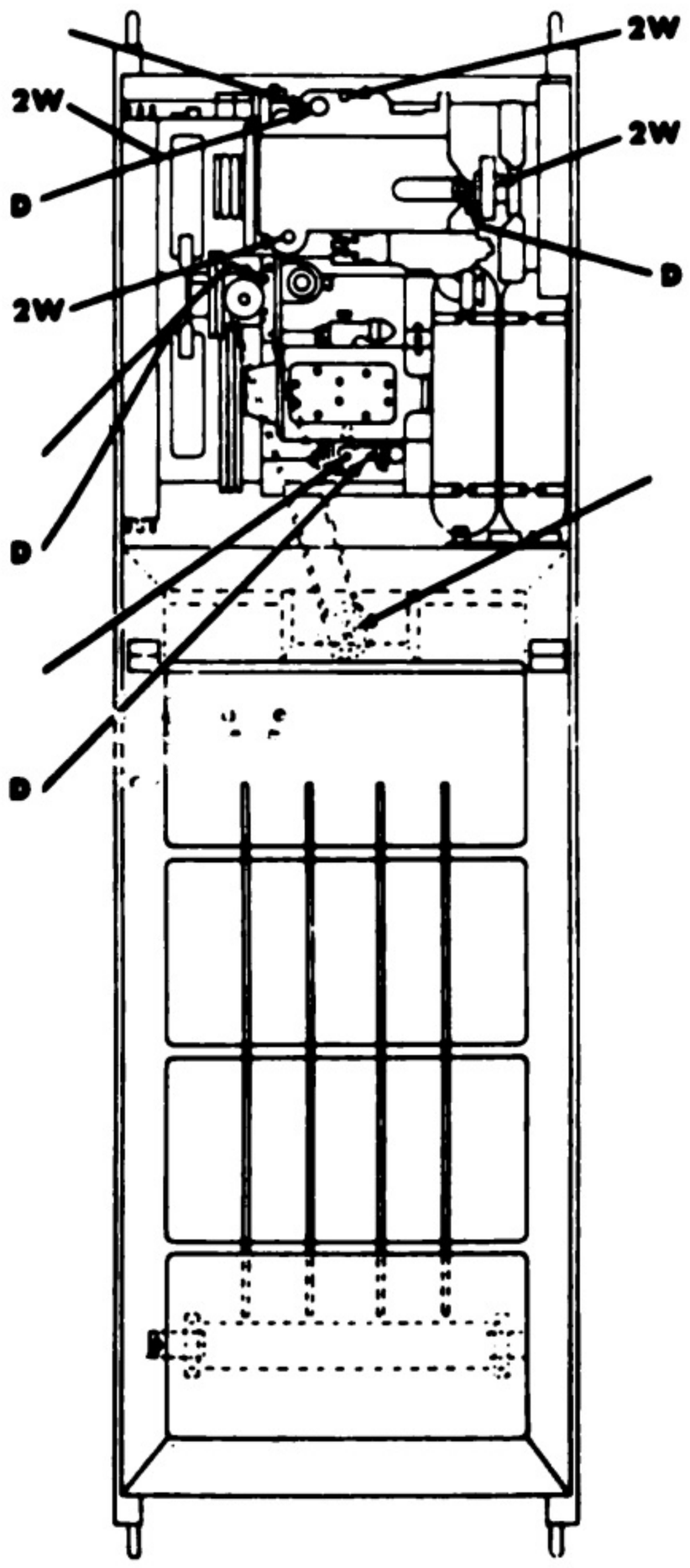
Relubricate after washing or fording.

Clean parts with SOLVENT, Dry Cleaning, or with OIL, fuel, Diesel. Dry before lubricating.

Drain crank and gearcases only when hot after operation; replenish and check level when cool.

LUBRICANT • INTERVAL

1. Crankcase Fill OE (See Key)
   Crankcase Breather Cap (Clean and Oil)
   Crankcase Level Gage (Check level)
2. Oil Filter OE (Remove, clean housing, renew element and replace)
3. Bevel Gearbox GO Fill (See Key)
   Bevel Gearbox Level (Check level at filler opening)
4. Compressor Crankcase Fill OR (See Key)
   Compressor Level Gage (Check level)



INTERVAL • LUBRICANT

5. Crankcase Drain Plug (Drain and refill)
6. OE Fan Hub (Remove retaining screw, add oil and replace screw.)
   OE Air Cleaner (Clean and refill oil cup. Every week, disassemble and wash)
   Fan and Brine Agitator Bearings (Life Seal Bearings; no lubrication required. CAUTION: Do not use solvents in cleaning. Wipe with Oil Dampened Cloth Only.)

CONTINUED ON FOLLOWING PAGE

FB 9095-25/1

Figure 25. Lubrication order.

CONTINUED FROM
PRECEDING PAGE

—KEY—

LUBRICANT	CAPACITY	EXPECTED TEMPERATURE		INTERVALS
		Above +32 F	+32 F to —10 F	
OE—Oil, Engine, Heavy Duty		OE 30 or 9250	OE 10 or 9110	D—Daily 2W—Two Weeks
Engine Crankcase	3 qts.			
Air Cleaner				
Other Points				
GO—LUBRICANT, Gear, Universal		GO 90	GO 75	
Bevel Gearbox	1 qt.			
OR—Oil, Lubricating Refrigerant Compressors		OR-1	OR-1	
Compressor Crankcase	3 ½ qts.			

NOTES:

1. COMPRESSOR CRANKCASE—Check level of Oil, Lubricating, Refrigerant Compressors frequently during the start-up period. It may be necessary to add a nominal amount of Oil. After the ice plant has been in operation a short while, and if the Oil is at proper level, additional amounts are not usually required. The refrigeration system is completely closed and it is undesirable to open it to add oil unless made necessary because of a shortage. Opening the system too often introduces moisture into it.

2. OIL CAN POINTS—Weekly coat and clean carburetor and governor control linkages, all yokes, pins, clevises, springs and exposed threaded surfaces with OE.

3. DO NOT LUBRICATE—Governor, magneto.

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained herein are mandatory and supersede all conflicting lubrication instructions dated prior to the date of this Lubrication Order.

BY ORDER OF THE SECRETARY OF THE ARMY:

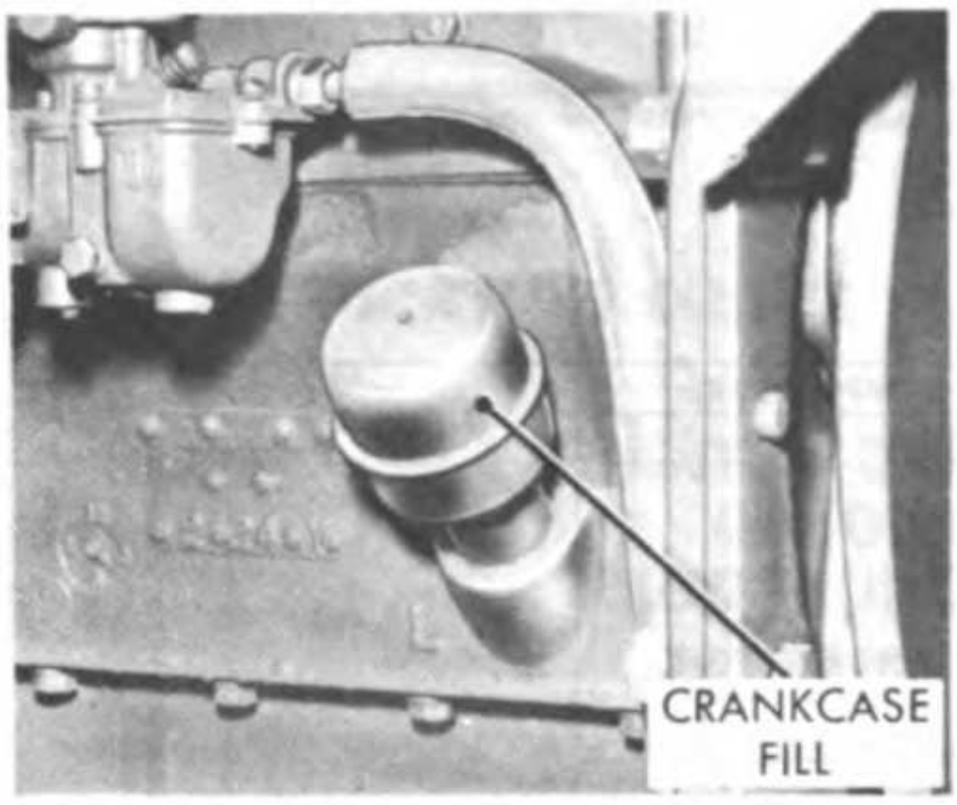
M. B. RIDGWAY
Chief of Staff
United States Army

OFFICIAL:

WM. E. BERGIN
Major General, USA
The Adjutant General

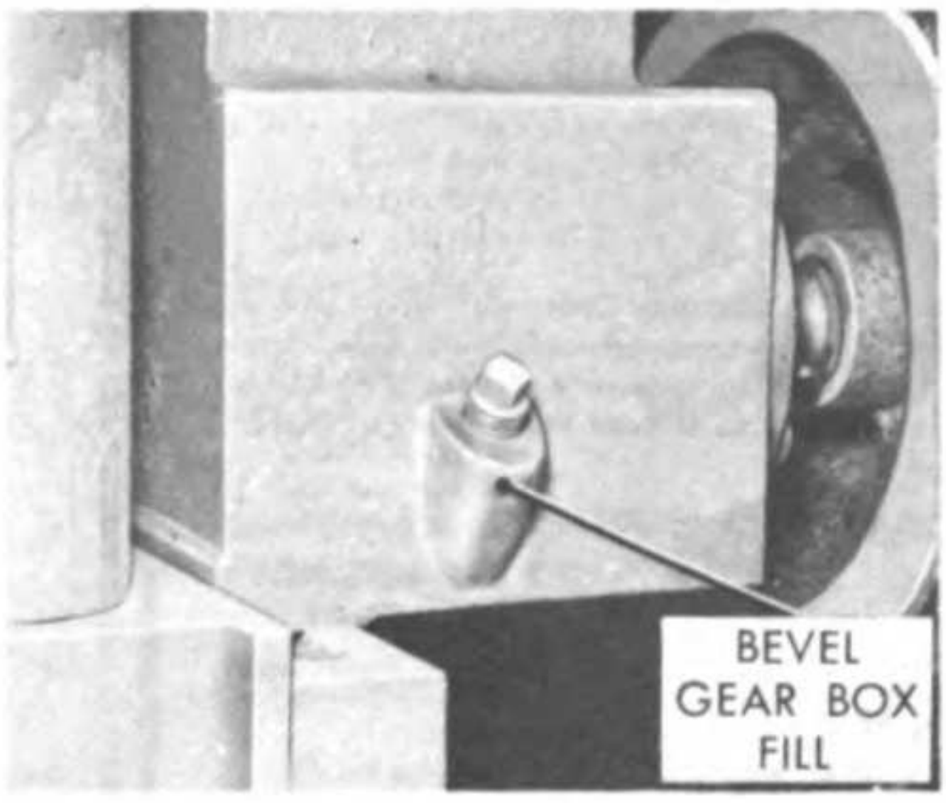
FB 9095-25/2

Figure 25—Continued.

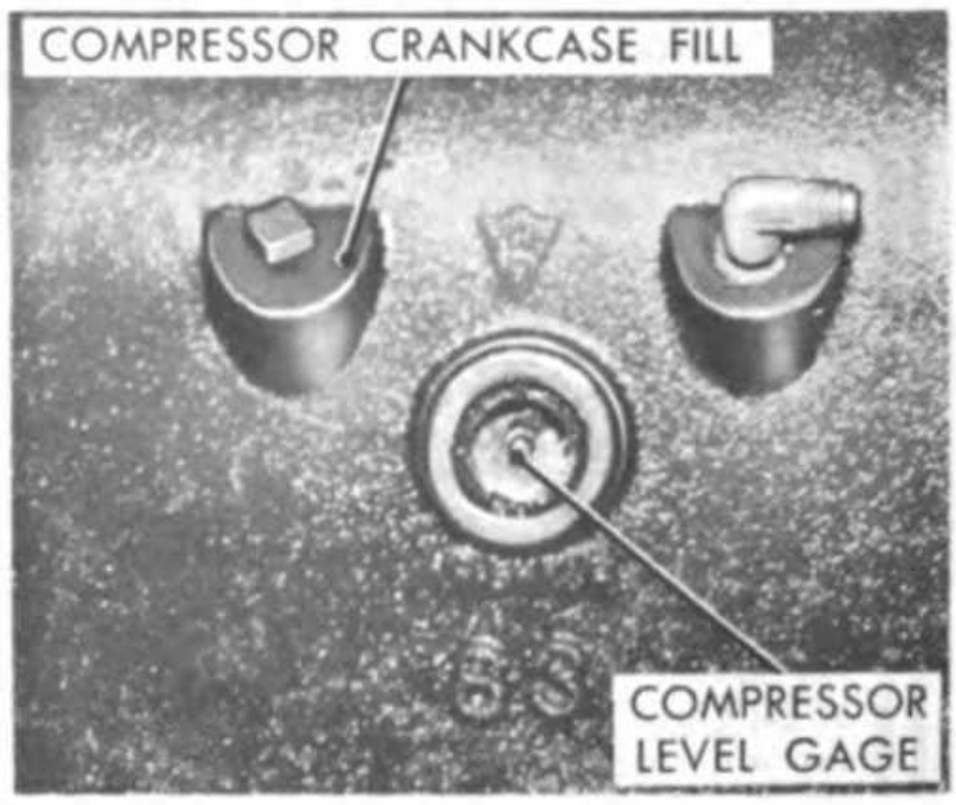


REFERENCE 1: Check level, fill to level mark.

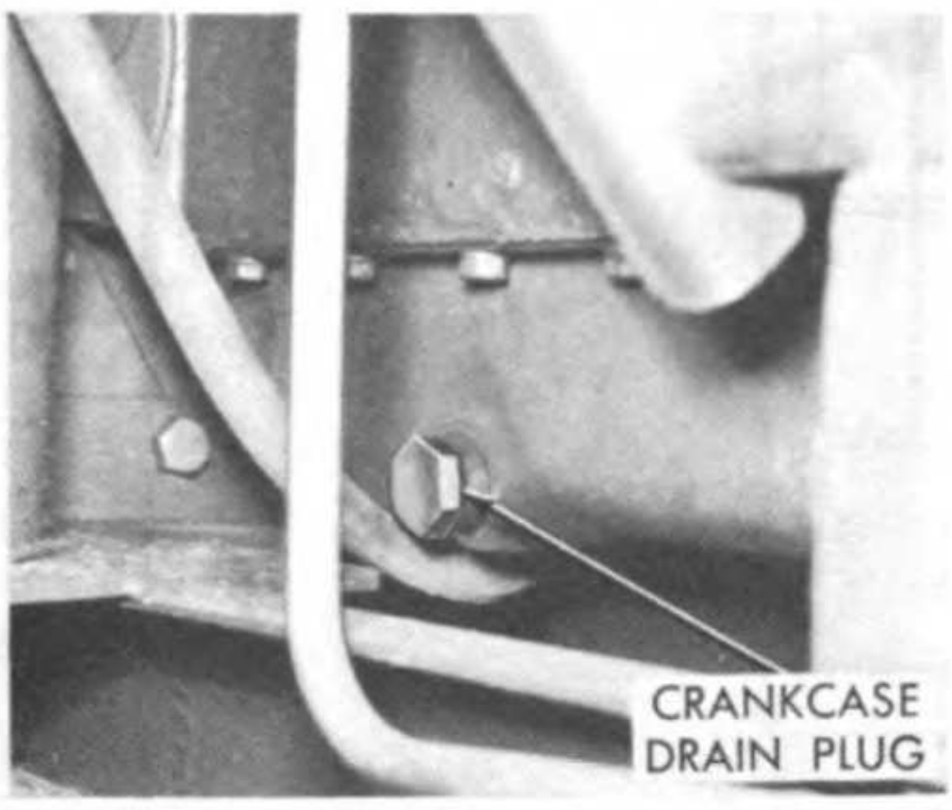
REFERENCE 2: Remove, clean housing, renew element, replace.



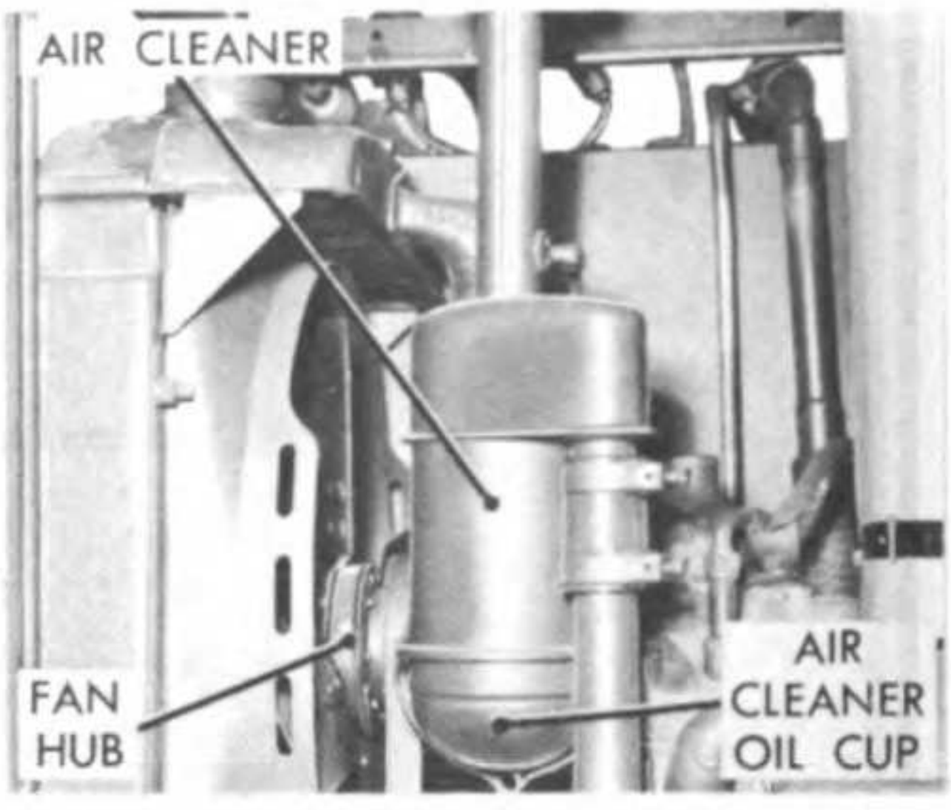
REFERENCE 3: Check level, fill.



REFERENCE 4: Check level, fill.



REFERENCE 5: Drain.



REFERENCE 6: Remove fan oil retaining screw, add oil, drain excess, replace screw. Remove air cleaner oil cup, clean, add oil, replace.

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***Figure 25*—Continued.**

g. Air Cleaner.

(1) *Removal.*

(*a*) Loosen upper hose clamp of air cleaner outlet coupling (33, fig. 4).

(*b*) Disconnect crankcase breather pipe (6, fig. 27) from breather pipe elbow (4).

(*c*) Remove cap screws (11) and lockwashers (12) holding air cleaner bracket (7) to frame.

(*d*) Carefully disengage air outlet pipe (5) from outlet coupling and remove air cleaner.

(*e*) Remove oil cup bail (9) by pushing spring loop at bottom.

(*f*) Remove and empty oil cup (10).

(*g*) Remove air intake cap (1).

(*h*) Remove breather pipe elbow (4) from air intake pipe (2).

(*i*) Disconnect breather pipe from breather pipe elbow (8) and remove elbow from engine block.

(2) *Cleaning.*

(*a*) Thoroughly clean oil cup and bail with an approved cleaning solvent.

(*b*) Soak air cleaner body (13), air intake cap (1), breather pipe (6), and elbows (4 and 8) in an approved cleaning solvent. Dip the air cleaner body in the solvent repeatedly to remove dust and fine dirt lodged inside.

(*c*) Dry all parts thoroughly and blow through breather pipe and elbows with clean compressed air.

(3) *Installation.*

(*a*) Screw breather pipe elbow (8) into engine block.

(*b*) Connect breather pipe (6) to breather pipe elbow (8).

(*c*) Engage air outlet pipe (5) in outlet coupling and attach air cleaner to frame with cap screws (11) and lockwashers (12) through bracket (7).

(*d*) Screw breather pipe elbow (4) into air intake pipe (2).

(*e*) Connect breather pipe (6) to breather pipe elbow (4).

(*f*) Install air intake cap (1).

(*g*) Fill oil cup (10) to oil level mark (indentation near top), and place cup on bottom of air cleaner.

(*h*) Hook ends of oil cup bail (9) into sides of air cleaner body and slide spring loop under oil cup to hold it in place.

(*i*) Tighten upper hose clamp of air cleaner outlet coupling (33, fig. 4).

h. Engine Fan Hub (fig. 28).

(1) To add oil to the engine fan, turn fan so that oil retaining screw (3) is horizontal when seen from left side of engine (end door of machine compartment).

(2) Remove oil retaining screw (3) and gasket (2).

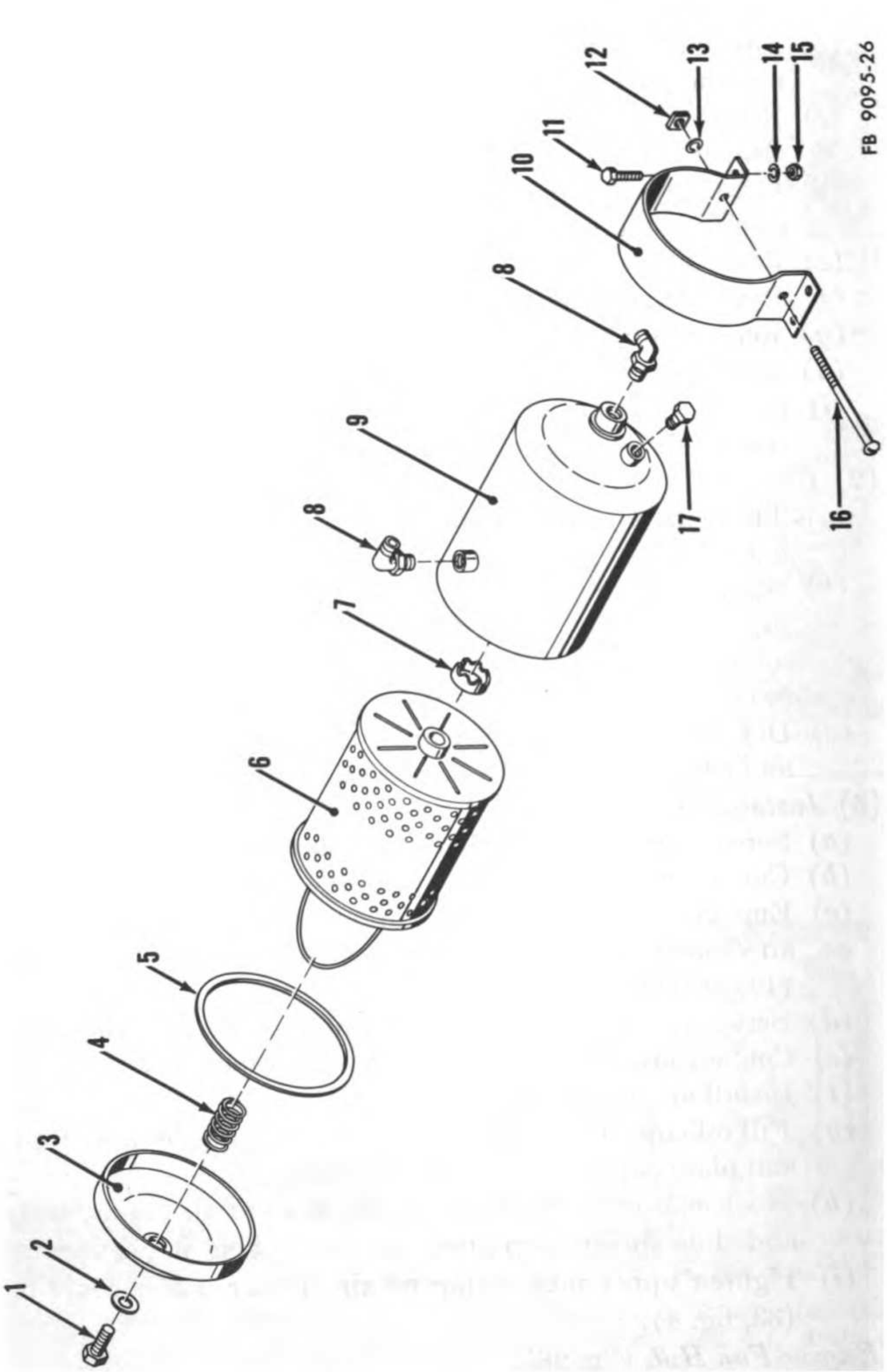

Figure 26. Oil filter, exploded view.

1	Cover screw	7	Spacer	13	Lockwasher, ¼
2	Cover screw gasket	8	Elbow (2 rqr)	14	Lockwasher, 5/16 (4 rqr)
3	Cover	9	Body	15	Nut, hex, 5/16–18 (4 rqr)
4	Cover spring	10	Bracket	16	Bolt, stove, ¼–20 x 2¼
5	Cover gasket	11	Bolt, hex, 5/16–18 x ¾ (4 rqr)	17	Drain plug
6	Filter element	12	Nut, sq, ¼–20		

Figure 26—Continued.

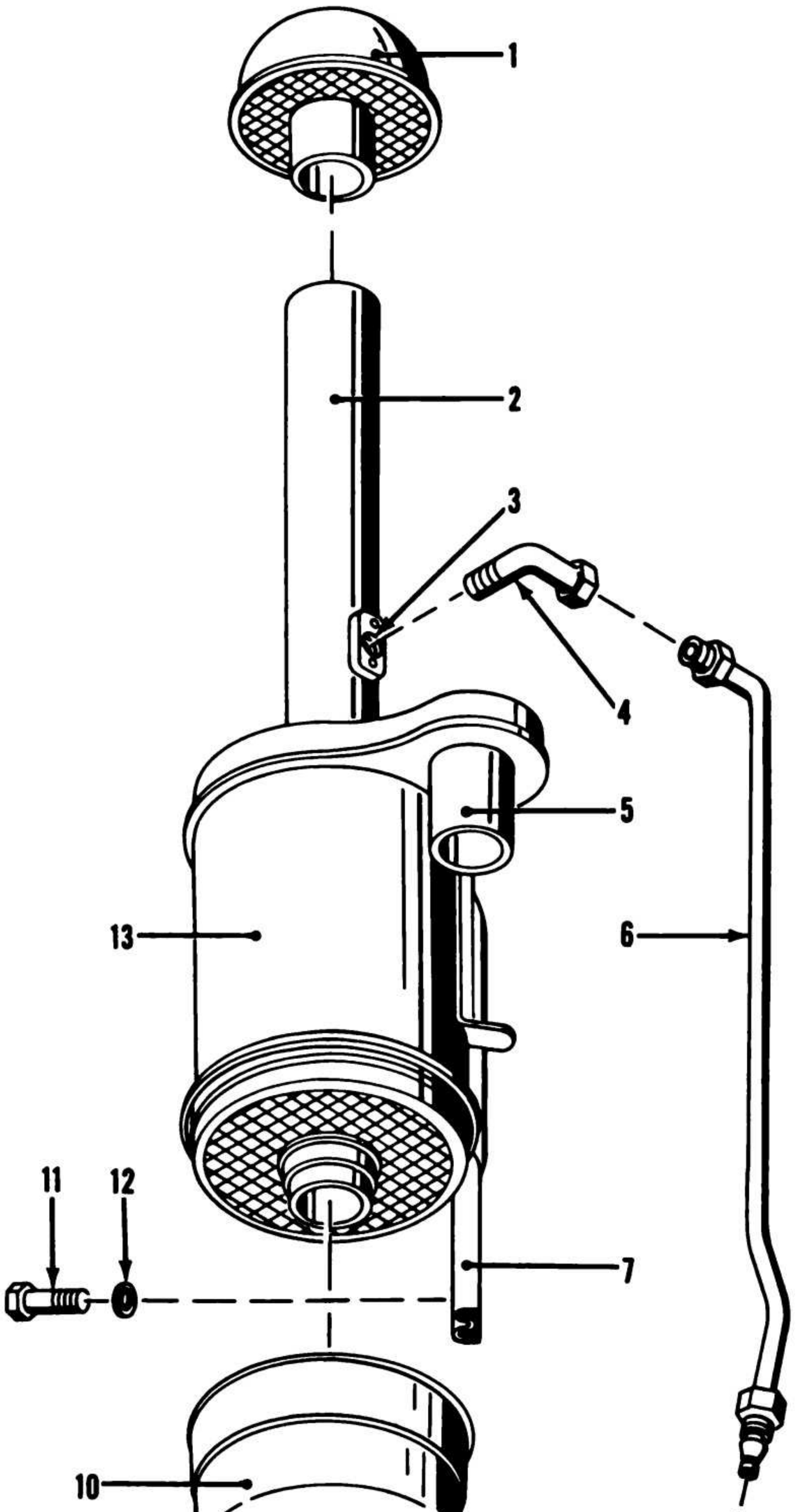

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Figure 27. Air cleaner, exploded view.

1	Air intake cap	8	Breather pipe elbow
2	Air intake pipe	9	Oil cup bail
3	Breather opening	10	Oil cup
4	Breather pipe elbow	11	Screw, cap, hex, 5/16–18 x ½ (2 rqr)
5	Air outlet pipe		
6	Breather pipe	12	Lockwasher, 5/16 (2 rqr)
7	Air cleaner bracket	13	Air cleaner body

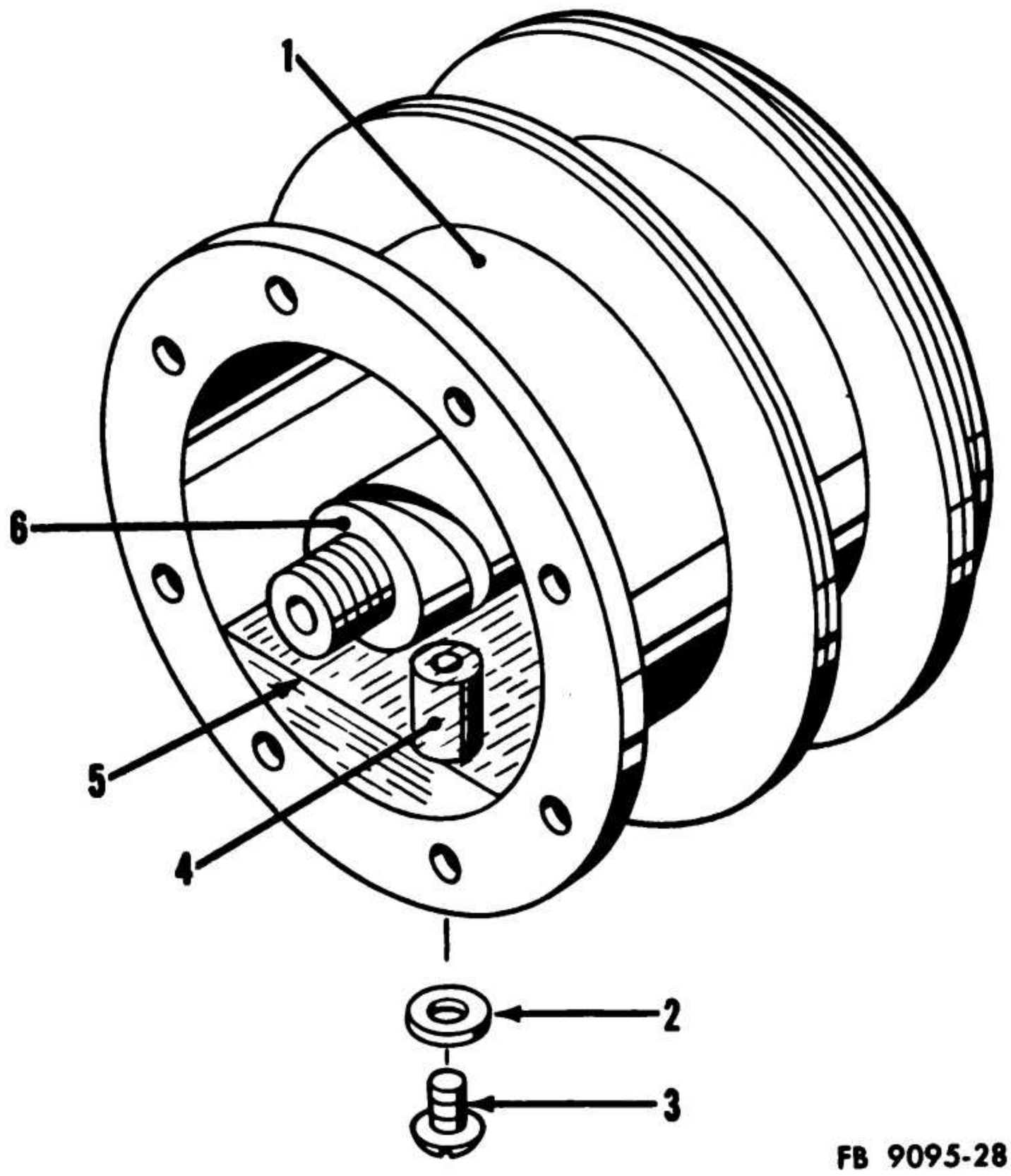
Figure 27—Continued.

(3) Add oil to the level of the opening.
(4) Have suitable container under fan hub, and turn fan so that opening points downward. Oil will drain to top of standpipe (4).
(5) Reinstall oil retaining screw and gasket.

31. Painting

a. Surfaces, such as skid, housing, doors, panels, and covers, on which paint is defective or damaged must be thoroughly cleaned and painted.

b. Mask all surfaces which should not be painted or which would be damaged by paint. Machined surfaces, lubrication fittings, wires, and electrical parts, takeup adjustment threads, vents, refrigeration



1	Fan hub	3	Oil retaining screw	5	Oil level
2	Oil retaining gasket	4	Stand pipe	6	Spindle

Figure 28. Fan hub.

lines, identification plates, gages, hoses, belts, and valves must be masked before painting.

c. Refer to TM 9–2851 for additional information on painting.

Section III. PREVENTIVE MAINTENANCE SERVICES

32. General

The operator of the ice plant and the organizational maintenance personnel must perform their preventive maintenance services regularly, to make sure the ice plant operates well and to lessen the chances of mechanical failure.

33. Operator Maintenance

a. Inspection. Inspections must be made before operation, during operation, at halt, and after operation, as described in this section. All inspections of assemblies, subassemblies, or parts must include any supporting members or connections and must determine whether the unit is in good condition, correctly assembled, secure, or excessively worn. Any mechanical condition which may result in further damage to the unit must be corrected before the equipment is operated.

(1) The inspection for "good condition" is usually an external visual inspection to determine whether the unit is damaged beyond safe or serviceable limits, or to determine if it is in such a condition that damage will result from the operation. The term "good condition" is further defined as: not bent or twisted; not chafed or burned; not broken or cracked; not bare or frayed; not dented or collapsed; not torn or cut; adequately lubricated.

(2) Inspection of a unit to see that it is "correctly assembled" is usually an external visual inspection to determine whether it is in its normal assembled position in the equipment.

(3) Check of a unit to determine if it is "secure" is usually an external inspection, a hand-feel, or a pry-bar or wrench check for looseness in the unit. Such an inspection should include brackets, lockwashers, locknuts, locking wires, or cotter pins used in the assembly.

(4) "Excessively worn" means worn close to or beyond serviceable limits, a condition likely to result in a failure if replacement of the affected parts is not made before the next scheduled inspection.

b. Reporting Deficiencies. The operator will report all deficiencies on DD Form 110.

c. Before-Operation Services. The following services will be performed to determine if the condition of the equipment has changed since it was last operated, and to make sure the equipment is ready

for operation. Any deficiencies must be corrected or reported to the proper authority before the unit is put into operation.

(1) *Brine.* Check density by taking sample of brine in graduate, cooling or heating it to 60° F., and inserting salometer into graduate, weighted end down, making sure there is enough solution so that it does not touch bottom. Read density of brine at liquid level on salometer. Correct density, if necessary, by adding calcium chloride or water as indicated to bring density to 1.240. Check brine level in tank. A mark is provided on outside of cabinet showing proper brine level before ice cans are placed inside. Use ruler or stick to check level by measuring from top of tank.

(2) *Ice cans.* Check cans, can rails, and can guides for damage. See that all ice cans are clean. When brine level in tank is correct, place at least ten cans in tank. Be sure to cover cans to hold them in place. Brine level should rise above agitator propeller. Do not fill any of the ice cans with water for the present.

(3) *Fuel.* Check fuel supply. See that tank is full. Check reserve supply of fuel and replenish if necessary.

(4) *Engine oil.* Check oil level in engine and add oil if necessary.

(5) *Water.* Check coolant level in radiator. Add coolant if necessary. When filling cold radiator containing antifreeze, allow room for coolant expansion.

(6) *Instruments.* Check all gage readings. At normal operating speed and temperature, engine oil pressure reading should be in white range, coolant temperature reading should be near low side of RUN area. Coolant temperature should increase gradually, after starting, until it reaches normal. High pressure gage rises or falls in accordance with ambient temperature; it will register 125 pounds at 20 pounds suction pressure, when operating in 80° F. air, and can go as high as 210 pounds at 20 pounds suction pressure, when operating in 125° F. air. Low pressure gage falls slowly as brine cools and will register 20 pounds when brine reaches freezing temperature (32° F.) and will register as low as 10 pounds if ice is left in cans.

(7) *Leaks, general.* Check for leaks in fuel, oil, and coolant lines and connections. Carefully check for Freon-12 leaks (par. 7*h*(1)). Test all fittings and joints with a Halide torch. When flexible suction, or exploring, tube of the torch is passed over a fitting, leaking Freon-12 is pulled into the burner, resulting in a green or purple flame. A leak usually leaves an oily spot. If a Halide torch is not available, soap lather may be applied to fittings and joints. Formation of

soap bubbles indicates a leak. If any are noted, repair immediately by tightening connections or soldering joints.

Caution: Before opening compressor for examination or repairs, the system must be pumped down to prevent refrigerant loss.

(8) *Starting precautions.* To place system in operation, remove front, end, and rear doors, remove valve caps from compressor suction and discharge service valves, dehydrator bypass valves, and active receiver outlet and inlet valves. Open fully, compressor discharge service valve, dehydrator bypass valves, and active receiver inlet valve. Open compressor suction service valve fully, then close one-quarter turn. Watch low pressure gage and open active receiver outlet valve until gage reads 15 pounds (about two seconds), then close valve. Test for leaks. Start refrigeration system as follows: Open refrigeration bypass valve fully. Start engine (par. 13). Open receiver outlet valve fully. Place hand on top return bends of condenser and close refrigeration bypass valve about one-eighth turn at a time until temperature rise is felt in return bend. Do not let engine run more than two or three minutes with receiver outlet valve open before starting to close refrigeration bypass valve. If increased temperature is felt, stop closing bypass valve. Check to see that increased temperature is maintained. If cooling occurs, resume closing bypass valve very gradually until temperature rises again, then stop closing valve. Run ice plant with bypass valve stationary for ten minutes after temperature in the return bends is maintained. Then close bypass valve about one-half inch at the rim of the handwheel every one-half minute, no faster, until valve is closed. Replace all valve caps. Remove refrigerant sight glass cover and check refrigerant passing through the system.

Caution: When the ice plant is started after a shutdown with, or without pumping down, follow the above procedure. This will prevent slugging of liquid refrigerant into the compressor and causing serious damage.

(9) *Visual inspection.* Make a general check of the entire unit for cracked or broken parts and loose or missing bolts. Check operation of all valves.

d. During-Operation Services. The operator is responsible for correcting or reporting unusual sounds and odors, deficiencies in performance, or other signs of abnormal operation.

(1) *Instruments.* Check all gage readings frequently. Check high and low pressure gages for proper operation of the refrigeration system (par. 11*k* and *l*). If oil pressure indi-

cator shows an unusual drop, or no pressure, or if coolant temperature gage shows engine overheating (coolant temperature should be in the RUN area), stop operation immediately and report the irregularity to the proper authority. Do not operate until cause of failure is corrected.

(2) *Brine.* Check density of brine solution. Use graduate and salometer furnished with equipment. Specific gravity at 60° F. should be 1.240. Check level of brine in tank. Brine should be about one inch above water level in ice cans when all ice cans are in place.

(3) *Ice cans.* When harvesting ice, do not remove more than one-fourth the total number of ice cans from the tank at any one time. Harvest the ice in two steps, taking five cans at a time.

(4) *Compressor oil.* After one hour of operation, check refrigerant, then stop the engine and check compressor oil level. If refrigerant is foamy and oil level is low, charge the system with refrigerant (par. 15*b*(2)), run ice plant for one hour, stop engine again and check compressor oil level. If oil level is still low, add compressor oil. If refrigerant is not foamy after first hour of operation and compressor oil level is low, add compressor oil (par. 15*b*(5)).

(5) *Unusual operation.* Check for unusual operation such as excessive vibration, engine lacking power, overheating, smoking. Report any irregularity immediately to the proper authority.

(6) *Unusual noises.* Check for abnormal noises. If any are noticed, stop operation and report to the proper authority.

e. After-Operation Services. To make sure that the equipment is ready to operate at any time, the following services must be performed by the operator or crew immediately after any operating periods. All deficiencies must be corrected or reported to the proper authority.

(1) *Shutdown precautions.* If the ice plant is to be shut down for more than 12 hours, or for repairs, the system must be pumped down (par. 15*b*(1)). The unit must run for at least 20 minutes before starting to pump down. If the ice plant is not running, start the equipment and run it for at least 20 minutes before starting to pump down. Disconnect the wire from the low pressure cutout switch (par. 15*b*(1)(*a*)). Remove caps from compressor suction and discharge valves and receiver outlet valve and close receiver outlet valve. Watch low pressure gage and stop engine when gage registers 10 inches of vacuum. Pressure will begin to rise slowly. When it reaches zero pounds, close compressor discharge and suction valves. If pressure rises above zero pounds before

valves are closed, start the equipment and run it to obtain vacuum, then stop engine and close compressor valves when zero pounds is obtained. If pressure does not rise to zero pounds, barely open receiver outlet valve and watch low pressure gage until it registers zero pounds, then close receiver outlet valve, compressor suction valve, and compressor discharge valve, and connect wire to low pressure cutout switch.

Warning: Never open the system if low pressure gage registers below zero pounds.

After compressor valves have been closed, system may be opened. If ice plant is not to be used for more than 12 hours, or is to be moved, close receiver inlet valve.

(2) *Fuel, oil, and water.* Check and refill all tanks. Change contaminated coolant. Check coolant freezing point if antifreeze is used. If antifreeze is added, mix solution thoroughly by running the engine to normal temperature.

(3) *Clean equipment.* Remove all dirt and excess grease from exterior of engine and refrigeration condenser. Remove, empty and clean the ice cans.

(4) *Tools and equipment.* See that all tools and equipment assigned to the ice plant are serviceable, clean and properly stowed.

(5) *Lubrication.* Lubricate as specified in the current lubrication order.

(6) *Fuel filter.* Inspect the sediment bowl for water and sediment. Clean if necessary. To remove, close the shutoff valve and take the strainer apart by loosening the clamp and removing the glass bowl. Clean the screen and glass bowl. Reassemble and reinstall.

(7) *Fire extinguisher.* Check condition of fire extinguisher and inspect for full charge and proper working order. The amount of charge can be determined by shaking the extinguisher and judging by sound and weight whether it is full.

(8) *Visual inspection.* Check for fuel, oil, coolant and refrigerant leaks; for loose or missing bolts, nuts, and pins; for excessively worn, cracked and broken parts. Check condition and tension of fan belts.

(9) *Protection.* Close all cabinet doors.

34. Maintenance and Safety Precautions

a. Always correct or report any mechanical deficiencies that may result in damage to the ice plant if operation is continued.

b. Always stop engine before attempting adjustments, repairs or lubrication.

c. Never pour cold coolant into radiator while engine is hot, as there is danger of cracking the cylinder head.

d. Always provide a metallic contact between container and tank when filling fuel tanks.

e. Never fill the fuel tank near an open flame or while engine is running.

35. Organizational Maintenance

a. Organizational preventive maintenance is performed by organizational maintenance personnel, with the aid of the operator, at weekly and monthly intervals. The weekly interval will be equivalent to 60 hours of use. The monthly interval will be equivalent to 4 weeks, or 240 hours, of use, whichever occurs first.

b. The column headed "Technical Inspection" is provided for the information and guidance of personnel performing technical inspection, and constitutes the minimum inspection requirements for the equipment.

c. The preventive maintenance services to be performed at these regular intervals are listed and described below. The numbers 1 to 29 appearing in the columns opposite each service refer to a corresponding number appearing on DA Form 5–43, and indicate that a report of the service should be made at that particular number on DA Form 5–43. These numbers appear in either monthly, weekly or both columns, as an indication of the interval at which the service is to be performed. The services listed opposite the numbers 44 to 73 inclusive are not shown on DA Form 5–43. The services listed in connection with these numbers should be performed and the report of the services should be made on the back of the DA Form 5–43 in numerical order.

d. Services indicated by " * " in the "Weekly" column will be performed with the regular weekly inspection only if the ice plant is not operating properly.

Technical inspection	Monthly	Weekly	
1	1	------	*Doors.* Check the removable end and side panels for proper closing. Check door catches for tight closing. Lubricate hinges. Check for deterioration or damage to top and side panels.
9	9	9	*Normal operation.* Observe all units of refrigerating equipment for normal operation. Investigate unusual noises or vibrations during operation.
11	11	(*)	*Fan assembly.* Check shaft bearing. Lubricate only when necessary (par. 30*h*). Observe operation and check for bent blades and excessive vibration.
12	12	(*)	*Fan drive.* Check fan drive for pulley alinement, belt tension, and condition of belts (par. 72*b*). Wipe off dirt and oil or grease from pulleys and belts.

Technical inspection	Monthly	Weekly	
15	15	(*)	*Evaporator coils.* Clean cooling coils. Check for excessive coil corrosion. Check cooling-coil support, hangers, baffles and bunkers for dirt and rust; paint when necessary to prevent deterioration. Clean drain screen and connection.
16	16	(*)	*Expansion valve.* Check operation of the expansion valve. Adjust only when necessary (par. 119). Replace cartridges in the dehydrator when moisture in the system is suspected (par. 102).
23	23	(*)	*Condenser.* Clean condenser coil, fins and condenser-fan blades.
25	25	(*)	*Compressor drive.* Check compressor drive for pulley alinement, belt tension, and condition of belts (par. 7*f*(1)). Wipe dirt and oil or grease from pulleys, flywheel, and belts.
26	26	(*)	*Compressor body.* Check compressor and shaft seals for signs of gasket or seal failures (par. 7*h*(1)). Check level of oil in compressor crankcase and observe condition of oil. Fill to proper level when necessary (par. 15*b*(5)).
28	28	(*)	*Refrigerant piping accessories.* Clean or renew filters, strainers and dryers (pars. 102 and 120). Check cut-in and cut-out pressures of low and high controls. Check efficiency of compressor valves (par. 88) and record maximum vacuum obtainable. Record pressures on DA Form 5–43 before and after adjustments.
29	29	(*)	*Refrigerant leaks.* Test all refrigerant lines, accessories, connections, and refrigerant containing equipment for leaks (par. 7*h*(1)). Halide torches are the only flame devices authorized for detecting refrigerant leaks. Halide torches will not be used in hazardous locations.
44	44	44	*Cabinet* (*brine tank, ice cans, brine agitator, cooling coils.*) When full, brine level should be 1 inch above the water level in the ice cans. Check brine for specific gravity using the salometer. Correct specific gravity is 1.240. Make sure ice cans are clean. Check ice cans, can rails and can-guides for wear and stress. Inspect for proper operation of brine agitator. Clean brine tank and ice cans if necessary. Fill brine tank to proper level. Correct brine by adding proper amount of calcium chloride as shown in the following table.

Specific gravity of brine	*Calcium chloride to be added (pounds)*
1. 100	211
1. 120	181
1. 140	151
1. 160	121
1. 180	92
1. 200	60
1. 220	31

Technical inspection	Monthly	Weekly	
			Report any wear or stress of ice cans, can rails and can-guides, and improper functioning of brine agitator and cooling coils to the proper authority.
45	45	45	*Receivers.* Check for a spare charge of refrigerant in the nonactive receiver. Provide receiver with spare charge of refrigerant if necessary (par. 15*b*(2)).
46	46	46	*Agitator gear box and drive belt.* Check gear box for loose, missing, or broken parts. Check belt tension and condition and alinement of pulleys (par. 7*f*(1)). Replace or tighten any loose, missing, or broken parts in the gear box. To adjust tension of belt, loosen the cap screws at the top and bottom of the gear box brackets. The gear box may then be slid in two directions and tension on the belt properly adjusted. To aline pulleys, loosen the setscrew at the hub of the pulley on the end of the vertical shaft which extends upward from the gear box. The pulley may be raised or lowered on the shaft until the belt is parallel to the horizontal angle iron framing members at the top of the machine compartment. Lubricate gears as specified in the current lubrication order.
47	47	47	*Valves* (*suction and discharge*). Check valves for leaks and faulty valve seats (par. 88). Make sure compressor is warm when testing. Close the suction valve and operate the compressor until the greatest vacuum is obtained. At this point the low pressure gage will remain stationary. Stop the engine and close discharge valve. Efficient suction valves will hold an 18-inch vacuum against 125 pounds head pressure. Observe for at least 10 minutes and then open compressor discharge valve about two turns and note pressure rise in crankcase for a few minutes. When the vacuum will hold with a closed discharge valve and then rise after discharge valve is opened, this indicates leakback through the discharge valves and the valve plate should be replaced. Replace valve plate if valve seats are worn, cut or pitted (pars. 89–91). Replace valve plate if there is a leakback through the discharge valves.
48	48	48	*Valves* (*bypass, check*). Stop unit with refrigeration bypass valve closed. Open refrigeration bypass valve. Head pressure should descend to approximately suction pressure. If hissing noise persists, it is likely that check valve is leaking. However, it is seldom that a check valve is faulty and a slight leak should not affect operation adversely. Report leaky check valve to the proper authority. A leak in the refrigeration bypass valve will be noted when system is checked for leaks with a Halide torch. If refrigeration bypass valve leaks, pump down system and replace valve.

Technical inspection	Monthly	Weekly	
			CONTROL SYSTEM
49	49	49	*Gages.* Inspect temperature and oil pressure gages and refrigerant sight glass for cracked or broken glass, insecure mounting and defective operation. Check that the protective cover of the sight glass is not missing. Check high and low pressure gage for proper operation of refrigeration system (par. 11*k*(2) and 11*l*(2)). See that gages are securely mounted. Replace damaged or defective gages. Replace protective cover of refrigerant sight glass if necessary.
50	50	50	*Switches, wiring, connections.* Inspect wiring for cracked or frayed insulations, broken wires and loose or corroded connections. Check for defective switches. Replace (pars. 122 and 123) or report defective switches and wires. See that connections are clean and tight. See that all switches and wiring conduits are securely mounted.
51	51	51	*Alarm bell.* Check for loose or missing mounting screws. Inspect ball assembly for broken or corroded wires, springs, and contacts. Replace any missing or broken parts and secure mountings. Clean and tighten dirty or loose electrical connections.
52	52	52	*Batteries.* Check condition of batteries paying particular attention for signs of corrosion and swelling. Check for loose, broken or dirty connections. Clean all dirt and corrosion from batteries and connections. Tighten or repair all loose or broken connections. Replace weak, dead, or otherwise defective batteries.
53	53	53	*Before-Operation services.* Check and perform services listed in daily Before-operation services (par. 33*c*).
54	54	54	*Lubrication.* Inspect the entire machine for missing or damaged lubrication fittings, lines and grease cups and for insufficient lubrication. Lubricate if necessary. Refer to the current lubrication order. Replace missing or damaged fittings and grease cups.
55	55	55	*Tools and equipment.* Inspect condition of all tools and equipment assigned to the ice plant. Check condition and mounting of tool box. See that all tools and equipment assigned to the ice plant are clean, serviceable and properly stowed. See that tool box is in good condition and that it closes properly.
56	56	56	*Fire extinguisher.* Check condition of fire extinguisher and inspect for full charge, proper working order. The amount of charge can be determined by shaking the extinguisher and judging by sound and weight whether it is full. See that any deficiencies noticed are corrected or reported to the proper authority.
57	57	57	*Publications.* See that this technical manual, TB 5–9095–1, LO 5–9095 and Standard Form 91 are on the machine and in serviceable condition.

Technical inspection	Monthly	Weekly	
58	58	58	*Appearance.* Inspect the general appearance of the ice plant, paying particular attention to cleanliness, legibility of identification markings and condition of paint. See that deficiencies noticed are corrected or reported to the proper authority.
59	59	59	*Modifications.* See if all available modification work orders applying to this machine have been completed and recorded on DA Form 478.
60	60	60	*Crankcase, breathers.* Inspect the crankcase for leaks. Check the condition of crankcase breather and caps. Correct or report any oil leaks noticed. Change the oil and clean the breather if necessary. Refer to the current lubrication order.
61	61	61	*Oil filters.* Inspect the oil filter assembly and connections for leaks while the engine is running. Service the oil filter as specified in the current lubrication order. After servicing, check carefully for leaks while the engine is running.
62	62	62	*Radiator.* Inspect the radiator for leaks, obstructions in core air passages, and loose mounting bolts. Check all cooling-system hoses for leaks, excessive deterioration, and loose connections. Check operating temperature and condition of coolant. If coolant temperature remains below or rises above RUN area during operation, thermostat may be defective. If antifreeze is used, check the freezing point of the coolant (par. 20*a*). Drain, flush, and refill the cooling system if coolant is contaminated with rust or dirt. See that core air passages are clean. Renew any damaged or defective cooling system hose, lines and gaskets. See that all mounting bolts and connections are tight. Protect the coolant from freezing, and record its freezing point on DA Form 464.
63	63	63	*Water pump, fan and shroud.* Inspect the water pump for leaks and for loose mounting and assembly bolt. Check the condition and mounting of fan blades and shroud. Tighten or replace loose or missing bolts and screws. If the pump leaks, tighten the packing gland only enough to stop the leak; replace if necessary.
64	64	64	*Belts and pulleys.* Inspect for worn, cracked or frayed belts. Check belt tension and condition and alinement of pulleys (par. 7*f*(1)). Belts are properly adjusted when they can be deflected ¾ inch from normal position at a point midway between the pulleys by applying a force of 10 pounds with the fingers. Adjust the tension of the belts if necessary. Replace belts if frayed or badly worn.

Technical inspection	Monthly	Weekly	
65	65	65	*Governor and linkage.* Check the governor adjustment. If the engine surges when running at top speed without load, the governor is out of adjustment. Adjust governor (par. 143). Report deficiencies to the proper authority.
66	66	66	*Fuel filter.* Inspect fuel filter for leaks. Check for loose mounting and assembly screws. Check sediment bowl for water and dirt. Tighten any loose screws and connections. Clean sediment bowl if it contains water or dirt. See that screen is clean. Use new gasket before reinstalling bowl.
67	67	67	*Carburetor and linkage.* See if all carburetor mounting and assembly bolts and screws are in place and secure. Check flexibility and operation of linkage. Tighten any loose mounting and assembly bolts and screws. Replace worn or damaged linkage connections.
68	68	68	*Filters.* Check filters for dirt and sludge. Check for leaks and loose connections. Clean oil filter screen. Replace oil filter element if necessary (par. 30*f*).
69	69	69	*Air cleaner.* Inspect air cleaner for loose connections. Check condition and level of oil in bowl. Service air cleaner as specified in the current lubrication order (par. 30*g*). Make sure there are no air leaks between air cleaner and carburetor.
70	70	70	*Fuel tank, cap and gasket.* Inspect frame and mounting of fuel tank. Check tank, gasket and connections for leaks. See that tank is securely mounted, air vent open and filter cap clean and tight fitting. Repair or replace leaky or damaged gaskets and connections.
71	71	71	*Fuel lines.* Check the fuel lines for leaks, loose connections and damage. Repair or replace damaged or collapsed fuel lines. Tighten loose connections. Report all uncorrected deficiencies to the proper authority.
			ELECTRIC SYSTEM
72	72	72	*Spark plugs.* Inspect spark plugs for dirty or cracked insulators. Clean dirt and oil from spark plug insulators. Replace defective plugs. Remove and clean spark plugs and adjust point gap. Proper gap is 0.023 inch. See that plugs and gaskets are in good condition before they are reinstalled.
73	73	73	*Magneto.* Inspect distributor cap and rotor for cracks, burned contacts, and corroded terminals. Correct point gap is 0.013 inch. Clean or replace distributor cap and rotor, and adjust breaker points if necessary (par. 67*b*(5)). Replace if they are badly burned or pitted.

Section IV. TROUBLESHOOTING

36. Use of Troubleshooting Section

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the ice plant 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.

Note. All references in this section to paragraphs 127 through 161 pertain to operations that are the responsibility of the field and depot maintenance personnel. Organizational maintenance personnel should not proceed without proper authority.

37. Engine Will Not Start

Probable cause	*Possible remedy*
No gasoline in tank	Fill tank.
Fuel shutoff valve closed	Open fuel shutoff valve (par. 10*d*(2)).
Fuel filter screen clogged	Clean fuel filter (par. 62).
Water in gasoline	Drain gasoline tank, fuel filter, and carburetor. Refill with clean gasoline.
Moisture on spark plugs	Remove spark plugs, wipe off moisture, and dry plugs. Check gap, which must be 0.023 to 0.027 inch.
Magneto ignition switch inoperative	Disconnect ignition switch cable from magneto. Attempt to start engine. If engine starts, switch is inoperative or cable is defective and should be repaired or replaced.
No spark from magneto	Remove end cap from magneto and crank engine to see if distributor rotor turns. If rotor turns but engine does not start, reinstall end cap and remove cable from any spark plug and hold cable terminal ¼ inch from cylinder head and crank engine. If spark appears, plugs may be fouled or need replacement. If no spark appears, check breaker points in magneto. If rotor does not turn, remove, inspect, and replace magneto (par. 67).
Magneto grounded by high pressure or low pressure cutout switch.	Check refrigeration pressure gages. If high pressure gage shows higher than normal pressure (par. 11*l*(2)), or if low pressure gage shows lower than normal pressure (par. 11*k*(2)), determine and remedy cause (pars. 45 and 48).
Carburetor choked too much	Push the choke control button in and crank engine several turns with ignition switch in OFF position. Pull ignition switch out again and crank engine.

38. Engine Misses and Backfires

Probable cause	*Possible remedy*
Water in gasoline	Drain gasoline tank, fuel filter, and carburetor. Refill with clean gasoline.
Air leaks around intake manifold	Tighten manifold stud nuts.
Improper firing order	Check spark plug cables at spark plugs and at magneto for correct installation.
Magneto not correctly timed to engine	Check and adjust timing (par. 67c).
Spark plug fouled, or cracked	Remove plugs, wipe clean and dry, check gap (0.023 to 0.027 inch) and adjust if necessary. Replace cracked plugs.
Engine not warmed up	Allow engine to warm up properly.
Excessive carbon deposits in cylinders	Remove carbon (see TM 5–5189).

39. Loss of Oil Pressure

Probable cause	*Possible remedy*
Low oil level	Add oil to specified mark on dipstick.
Oil diluted or not specified grade	Change oil regularly (see LO 5–9095).
Oil pressure gage or line defective	Check line for leaks, repair if defective. If oil pressure line not faulty, replace gage.
Dirt in regulating valve, or regulating valve spring broken.	Clean valve, replace spring if necessary (see TM 5–5189).
Oil pump worn	Remove pump, repair or replace (see TM 5–5189).
Camshaft bearings worn	Install new bearings (see TM 5–5189).
Main bearings or connecting rod bearings worn.	Install new bearings (see TM 5–5189).

40. Smoky Exhaust

Probable cause	*Possible remedy*
Worn pistons or piston rings	Replace pistons and/or rings (see TM 5–5189).
Carburetor float sticking or leaking	Clean carburetor, repair or replace float (pars. 132–134). See Note in paragraph 36.
Carburetor needle valve open too far	Clean and adjust carburetor (pars. 132–134). See Note in paragraph 36.

41. Engine Does Not Operate Smoothly or Does Not Develop Full Power

Probable cause	*Possible remedy*
Insufficient air to engine	Service air cleaner (par. 30g).
Choke partly closed	Open choke fully (push choke control button all the way in).
Muffler or exhaust pipe clogged	Remove muffler, check muffler and exhaust pipe.
Magneto not correctly timed to engine	Check and adjust timing (par. 67c).
Governor incorrectly adjusted	Adjust governor (par. 143). See Note in paragraph 36.

42. Engine Overheats

Probable cause	*Possible remedy*
Insufficient coolant	Check coolant level in radiator, add water if necessary.
Fan belt broken or slipping	Replace fan belt or adjust tension (par. 72*c*).
Magneto not correctly timed to engine	Check and adjust timing (par. 67*c*).
Water pump faulty	Replace water pump (see TM 5–5189).
Cooling system clogged	Flush out radiator and engine.
Dirt or trash on outside of radiator core.	Clean all trash from between radiator tube fins with compressed air.
Lubricating oil low	Check level, add oil if necessary.
Carburetor mixture too lean	Adjust carburetor (par. 65*c*).

43. Excessive Lubricating Oil Consumption

Probable cause	*Possible remedy*
Oil leaks	Check all gaskets, oil lines, and oil seals, replace faulty parts (see TM 5–5189).
Improper lubricant	Change oil, using specified grade (see LO 5–9095).
Overheated engine	Correct cause of overheating (par. 42).

44. Excessive Fuel Consumption

Probable cause	*Possible remedy*
Choke partly closed	Open choke fully (push choke control button all the way in).
Magneto not correctly timed to engine	Check and adjust timing (par. 67*c*).
Carburetor mixture too rich	Adjust carburetor (par. 65*c*).
Insufficient air to engine	Service air cleaner (par. 30*g*).

45. High Compressor Head Pressure

Probable cause	*Possible remedy*
Air in system	Purge the system (par. 15*b*(4)).
Dirt or trash on outside of condenser	Clean all trash from between condenser fins with compressed air.
High pressure side of system restricted	Check discharge service valve and receiver inlet valve to make sure both are fully open. If head pressure is high with both valves open, pump down the system (par. 15*b*(1)) and check high pressure lines for clogging.
Overcharge of refrigerant	Purge the system (par. 15*b*(4)), or remove excess refrigerant (par. 15*b*(3)).

46. Low Compressor Head Pressure

Probable cause	*Possible remedy*
Shortage of refrigerant	Charge the system (par. 15*b*(2)).
Compressor belts loose	Adjust belt tension (par. 7*f*(1) (*c*), (*d*), and (*e*)).
Expansion valve open too far	Adjust expansion valve (par. 119).
Compressor valves stuck open or leaking.	Clean or replace compressor valve plate (pars. 89, 90, and 91).

Probable cause	*Possible remedy*
Leak from high to low side of cylinder head.	Replace cylinder head gasket (pars. 89 and 91).
Low compressor speed	Check and adjust engine governor (par. 143). See Note in paragraph 36.

47. High Compressor Suction Pressure

Probable cause	*Possible remedy*
Overcharge of refrigerant	Purge the system (par. 15*b*(4)), or remove excess refrigerant (par 15*b* (3)).
Compressor belts loose	Adjust belt tension (par. 7*f*(1) (*c*), (*d*), and (*e*)).
Compressor valves stuck open or leaking.	Clean or replace valve plates (pars. 89, 90, and 91).
Leak from high to low side of cylinder head.	Replace cylinder head gasket (pars. 89 and 91).
Low compressor speed	Check and adjust engine governor (par. 143). See Note in paragraph 36.
Expansion valve stuck open	Replace expansion valve (pars. 116 and 118).
Expansion valve superheat adjustment too low.	Adjust expansion valve (par. 119).
Air in system	Purge the system (par. 15*b*(4)).
High pressure side of system restricted	Check discharge service valve and receiver inlet valve to make sure both are fully open. If suction pressure is high with both valves open, pump down the system (par. 15*b*(1)) and check high pressure lines for clogging.

48. Low Compressor Suction Pressure

Probable cause	*Possible remedy*
Shortage of refrigerant	Charge the system (par. 15*b*(2)).
Ice on cooling coils	Drain brine tank, defrost coils. Refill brine tank, check brine density and correct if necessary (par. 15*b*(6)).
Obstruction in brine raceway	Drain brine tank (par. 16*b*), remove obstruction, refill brine tank (par. 7*h*(2)).
Dirt clogging expansion valve, or valve out of adjustment.	Remove expansion valve strainer (par. 120), clean, and reinstall, or adjust valve (par. 119).
Expansion valve frozen	Thaw valve, clean strainer (par. 120), replace dehydrator cartridges (par. 102).
Liquid line restricted	Make sure receiver outlet valve and dehydrator bypass valves are fully open (par. 7*h*(1)). If values are fully open, pump down system (par. 15*b* (1)) and check refrigerant lines for obstruction.
Expansion valve feeler bulb has lost charge.	Replace expansion valve and feeler bulb (pars. 116 and 118).

49. Unit Short Cycles

Probable cause	*Possible remedy*
High compressor head pressure_____	Check for air in system, dirt on outside of condenser, restriction in high pressure side, or overcharge of refrigerant, and remedy cause of high pressure (par. 45).
High pressure cutout switch set too low.	Adjust switch (par. 124).
High pressure cutout switch defective_	Replace switch (pars. 122*d* and 123*a*).
Low compressor suction pressure_____	Check for shortage of refrigerant, obstruction in brine raceway, clogged, frozen, or improperly adjusted expansion valve, restricted liquid line, or feeler bulb not functioning, and remedy the cause of low pressure (par. 48).
Low pressure cutout switch set too high.	Adjust switch (par. 124).
Low pressure cutout switch defective__	Replace switch (pars. 122 and 123).

50. Compressor Noisy

Probable cause	*Possible remedy*
Compressor flywheel loose_____	Tighten flywheel nut (par. 7*e*(6)).
Compressor pumping oil_____	Remove excess compressor oil (par. 15*b*(5)(*e*)).
Liquid refrigerant entering compressor (slugging).	Adjust expansion valve superheat (par. 119).
Sudden suction pressure drop due to expansion valve freezing or sticking.	Thaw expansion valve and replace dehydrator cartridges (par. 102), or replace expansion valve (pars. 116 and 118).
Compressor valves noisy_____	Replace compressor valve plate (pars. 89 and 91).
Compressor bearings or pistons worn__	Repair compressor (pars. 145, 146, and 147). See Note in paragraph 36.
High head pressure, high pressure cutout switch not functioning.	Remedy cause of high pressure (par. 45), replace high pressure cutout switch (pars. 122 and 123).

51. Faulty Temperature of Compressor

Probable cause	*Possible remedy*
Compressor crankcase or suction chamber cold.	Adjust expansion valve (par. 119).
Compressor crankcase hot_____	Check compressor oil level (par. 15*b*(5)), if satisfactory, remove drive belts and turn flywheel by hand to check for internal tightness, or seizure.

Probable cause	*Possible remedy*
Compressor head cool	Check for shortage of refrigerant, sticking or leaking compressor valves, low compressor speed, ice on cooling coils, clogged, frozen, or improperly adjusted expansion valve, restricted liquid line, or feeler bulb not functioning, and remedy the cause (pars. 46 and 48).

52. Faulty Temperature of Liquid Side

Probable cause	*Possible remedy*
Line hotter than normal, indicating shortage of refrigerant.	Charge the system (par. 15*b*(2)).
Line cold at one point, indicating restriction in line.	Pump down the system (par. 15*b*(1)), disconnect line and remove restriction.

53. Faulty Temperature of Suction Side

Probable cause	*Possible remedy*
Line excessively cold, or backfrosting	Adjust expansion valve for higher superheat (par. 119).
Line excessively warm	Adjust expansion valve for lower superheat (par. 119).

54. Unit Runs But Fails To Make Ice

Probable cause	*Possible remedy*
Ice can covers not in place or not tightly closed.	Make sure all ice can covers are tight.
Refrigerant feeding too fast to completely vaporize in cooling coil.	Adjust expansion valve for higher superheat (par. 119) or replace valve, if faulty (pars. 116 and 118).
Refrigerant not circulating fast enough.	Check for leaky compressor valves (par. 88) and replace valve plate if necessary (pars. 89, 90, and 91). Check for leaky compressor head gasket (par. 88) and replace if necessary. Check engine governor and adjust if necessary (par. 143). Check compressor drive belts for slippage, adjust tension, if necessary (par. 7*f*(1)(*d*) and (*e*)). See Note in paragraph 36.
Expansion valve frozen or clogged	Thaw valve, clean strainer, replace dehydrator cartridges (par. 102).
Shortage of refrigerant	Charge the system (par. 15*b*(2)).
Cooling capacity reduced by high head pressure.	Check for air in system, dirt on outside of condenser, restriction in high pressure side, or overcharge of refrigerant and remedy cause (par. 45).
Insufficient brine in tank	Check brine level, add brine (par. 7*h*(2)).
Brine density too high	Check brine density (par. 15*b*(6)), correct, by lowering specific gravity.

Probable cause	*Possible remedy*
Ice on cooling coils	Drain brine tank, defrost coils.
	Refill brine tank, check brine density and correct if necessary (par. 15*b*(6)).

Section V. RADIO SUPPRESSION

55. Definition of Suppression

Radio noise suppression is the elimination or minimizing of engine electrical disturbances within the equipment which interfere with radio reception and disclose the location of the ice plant and its associated equipment to sensitive electrical detectors.

56. Source of Interference

Spark plugs, high-tension wires from the magneto to the spark plugs, magneto breaker points, and poor electrical joints are sources of electrical interference.

57. Methods Used To Suppress Interference

a. Shielding. The leads from the ignition switch to the magneto and from the magneto to the spark plugs are shielded for radio suppression.

b. Grounding. Internal-external toothed washers are used to ground the magneto to the engine block and the engine to the frame.

c. Spark Plugs. The four spark plugs are of the radio shielded type.

58. Effects of Suppression

There is no interference from equipment satisfactorily suppressed for radiated and conducted interference over the frequency range of 0.55 through 156.0 megacycles at a distance of 25 feet from the unit.

59. Suppression System Testing

a. Install a battery-powered radio receiver in good operating condition not more than 10 feet from the ice plant. A wide band receiver covering the frequency range of 0.55 to 156.0 megacycles is preferred.

b. Start equipment and tune receiver. Turn receiver volume control to maximum, and select three widely separated frequencies for listening. Use frequencies that are free from signals with strong carriers so that the receiver will be in its most sensitive operating condition.

c. Operate engine and listen to receiver speaker or headset. A regular clicking sound, which varies with engine speed and ceases the instant the ignition is shut off, is caused by the ignition circuit.

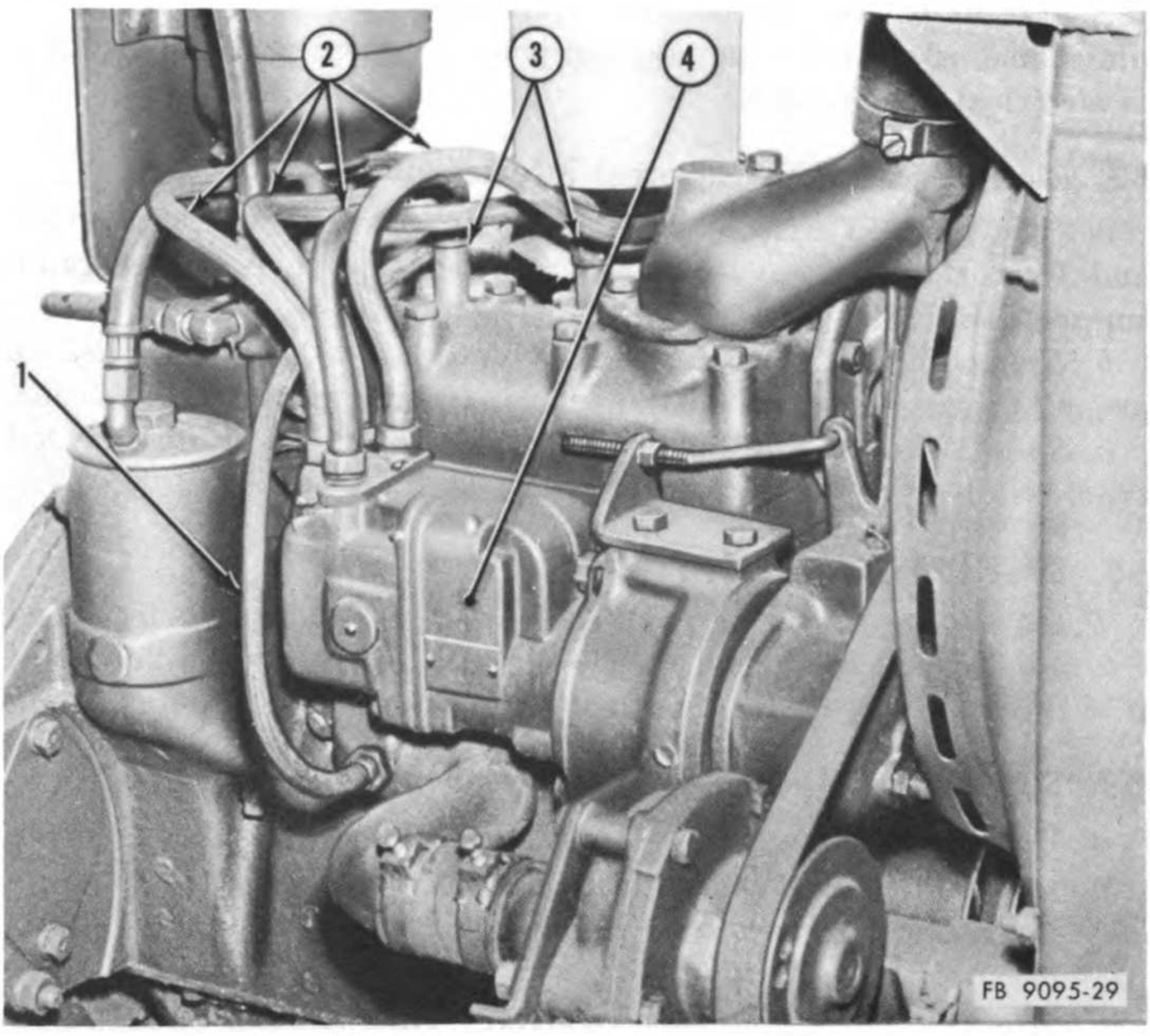
d. Systematically replace suppression components in the circuit, testing after the replacement of each component to see if the trouble has been eliminated.

60. Suppression Component Replacement

a. General. Replace suppression equipment with the exact equipment specified herein.

b. Ignition System Components (fig. 29).

(1) *Magneto.* The magneto (4) has shielded leads (1 and 2) to the spark plugs (3) and to the ignition switch, and is grounded to the engine block by two internal-external toothed washers. Refer to paragraph 67 for magneto removal and reinstallation.



1 Ignition switch lead
2 Spark plug lead (4 rqr)
3 Spark plug (4 rqr)
4 Magneto

Figure 29. Ignition system components.

(2) *Spark Plugs.* The engine is equipped with four Champion XE–15J radio shielded spark plugs (3).

Section VI. FUEL SYSTEM

61. Description

The fuel system consists of a 30-gallon fuel tank, a combined fuel shutoff valve and fuel filter, a covered fuel line from the filter to an updraft carburetor, and an air cleaner to protect the intake from dirt and grit.

62. Fuel Shutoff Valve and Filter

The combined fuel shutoff valve and fuel filter consists of a small stem-seating valve to control the flow of the fuel, and a strainer screen and sediment bowl directly beneath the valve to trap and retain dirt and water from the fuel.

a. Removal.

(1) Slide tool box (14, fig. 14) out and remove.
(2) Close fuel shutoff valve (1, fig. 15).
(3) Loosen fuel filter clamp (4) and remove clamp, sediment bowl (3), screen, and gasket, and discard the gasket.
(4) Have suitable container ready, open fuel shutoff valve and drain fuel tank.
(5) Disconnect fuel line (5) from fuel shutoff valve.
(6) Unscrew and remove fuel shutoff valve.

b. Cleaning.

(1) Empty sediment bowl and remove all dirt from bowl and screen.
(2) Open fuel shutoff valve fully and blow air through all openings to make sure there are no obstructions.

c. Inspection.

(1) Inspect screen for breaks and tears. If screen is torn, replace it.
(2) Inspect sediment bowl for cracks or breaks. If it is cracked or broken, replace it.
(3) Inspect fuel shutoff valve for proper seating. Close it fully and test by blowing through inlet opening to make sure it does not leak when closed. If it leaks when fully closed, replace it.

d. Installation.

(1) Screw fuel shutoff valve (1, fig. 15) into bottom of fuel tank (15, fig. 14).
(2) Place screen and new gasket at top of sediment bowl (3, fig. 15) and attach to fuel shutoff valve with fuel filter clamp (4).
(3) Connect fuel line (5) to fuel shutoff valve.
(4) Install tool box (14, fig. 14).

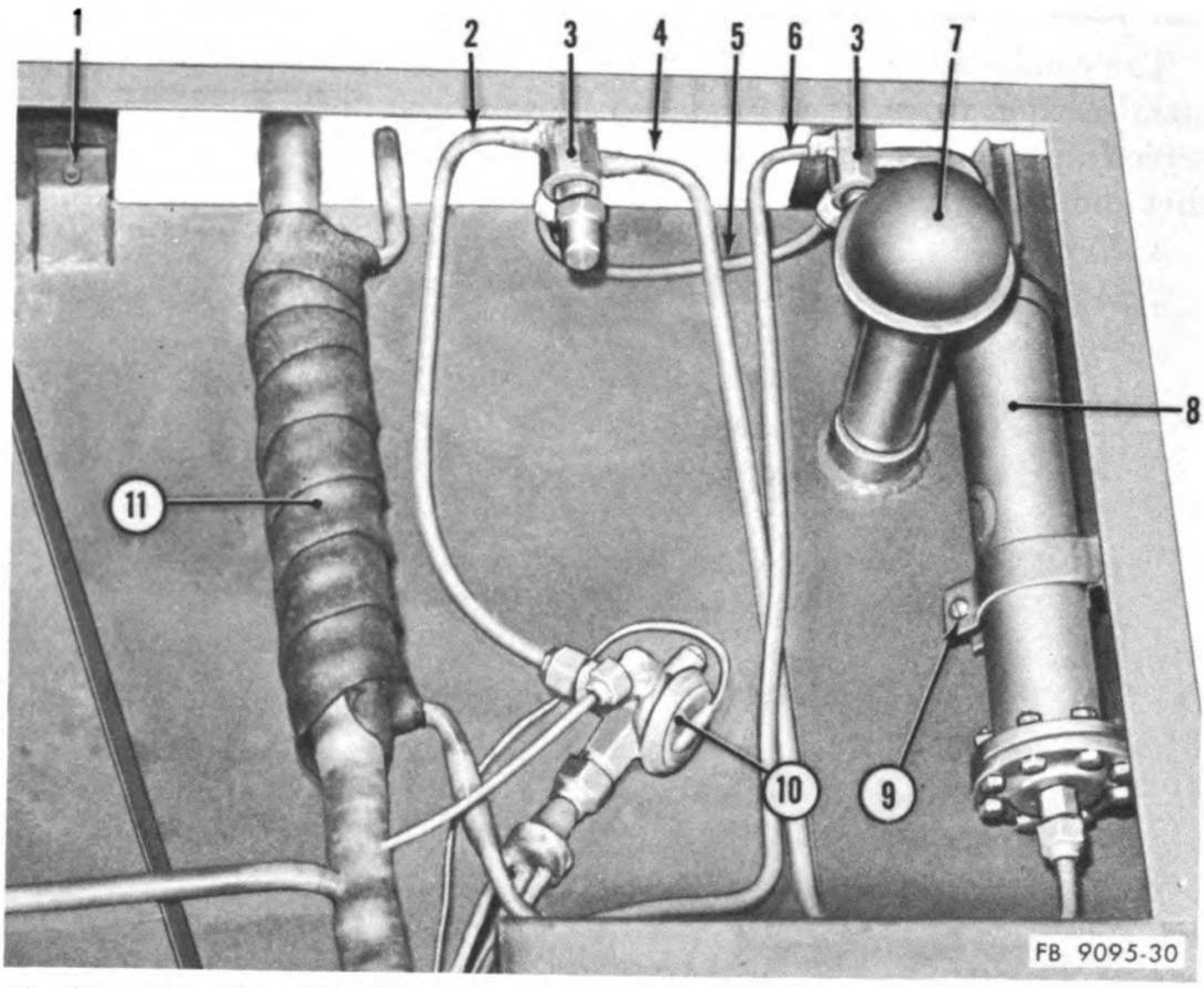
63. Fuel Tank

a. Removal.

(1) Remove fuel shutoff valve and filter (par. 62*a*).

(2) Remove fuel tank fillercap (1, fig. 2) and unscrew and remove filler pipe and rubber shield.

(3) Remove cap screw (1, fig. 30) and lockwasher holding inner fuel tank bracket to round frame member.



1 Screw, cap, hex, 5/16–18 x 3/4
2 Thermostatic expansion valve line
3 Dehydrator bypass valve
4 Dehydrator line
5 Dehydrator bypass line
6 Heat exchanger line
7 Fuel tank fillercap
8 Dehydrator
9 Bolt, rd hd, No. 10–24 x 1
10 Thermostatic expansion valve
11 Heat exchanger

Figure 30. Machine compartment, top view with cover removed.

(4) Remove nut, lockwasher, and machine screw holding outer fuel tank bracket (1, fig. 14) to frame.

(5) Lift fuel tank slightly and slide it out.

b. Cleaning.

(1) Flush out fuel tank with an approved cleaning solvent to remove sediment and water.

(2) Using suitable pointed tool, remove dirt from vent hole in side of fillercap and blow through hole to make sure it is not obstructed.

c. Installation.

(1) Slide fuel tank (15, fig. 14) into place with brackets on top and toward engine.

(2) Attach inner bracket to round frame member with cap screw and lockwasher.

(3) Attach outer bracket (1) to frame with machine screw, lockwasher and nut.

(4) Attach fuel shutoff valve and filter (par. 62*d*).

(5) Place filler pipe through hole in machine compartment cover and screw it into fuel tank.

(6) Place rubber shield on filler pipe so that it covers hole in machine compartment cover, and screw fillercap on filler pipe.

64. Fuel Line

a. Removal.

(1) Remove tool box (14, fig. 14).

(2) Close fuel shutoff valve (1, fig. 15).

(3) Disconnect fuel line (5) from fuel shutoff valve.

(4) Disconnect fuel line (18, fig. 4) from carburetor (24), and remove.

b. Cleaning and Inspection.

(1) Blow clean compressed air through fuel line to remove any obstructions.

(2) Run an approved cleaning solvent through the line to remove sediment.

(3) Inspect fuel line covering for tears and worn spots and replace fuel line if covering is worn or torn in any spot which will allow fuel line to touch engine or frame.

c. Installation.

(1) Carefully place fuel line under engine so that one end is near fuel filter and other end is near carburetor.

Caution: Be very careful not to bend fuel line any more than is absolutely necessary. Do not make sharp bends.

(2) Connect fuel line (5, fig. 15) to fuel shutoff valve (1).

(3) Connect fuel line (18, fig. 4) to carburetor (24).

(4) Install tool box (14, fig. 14).

65. Carburetor

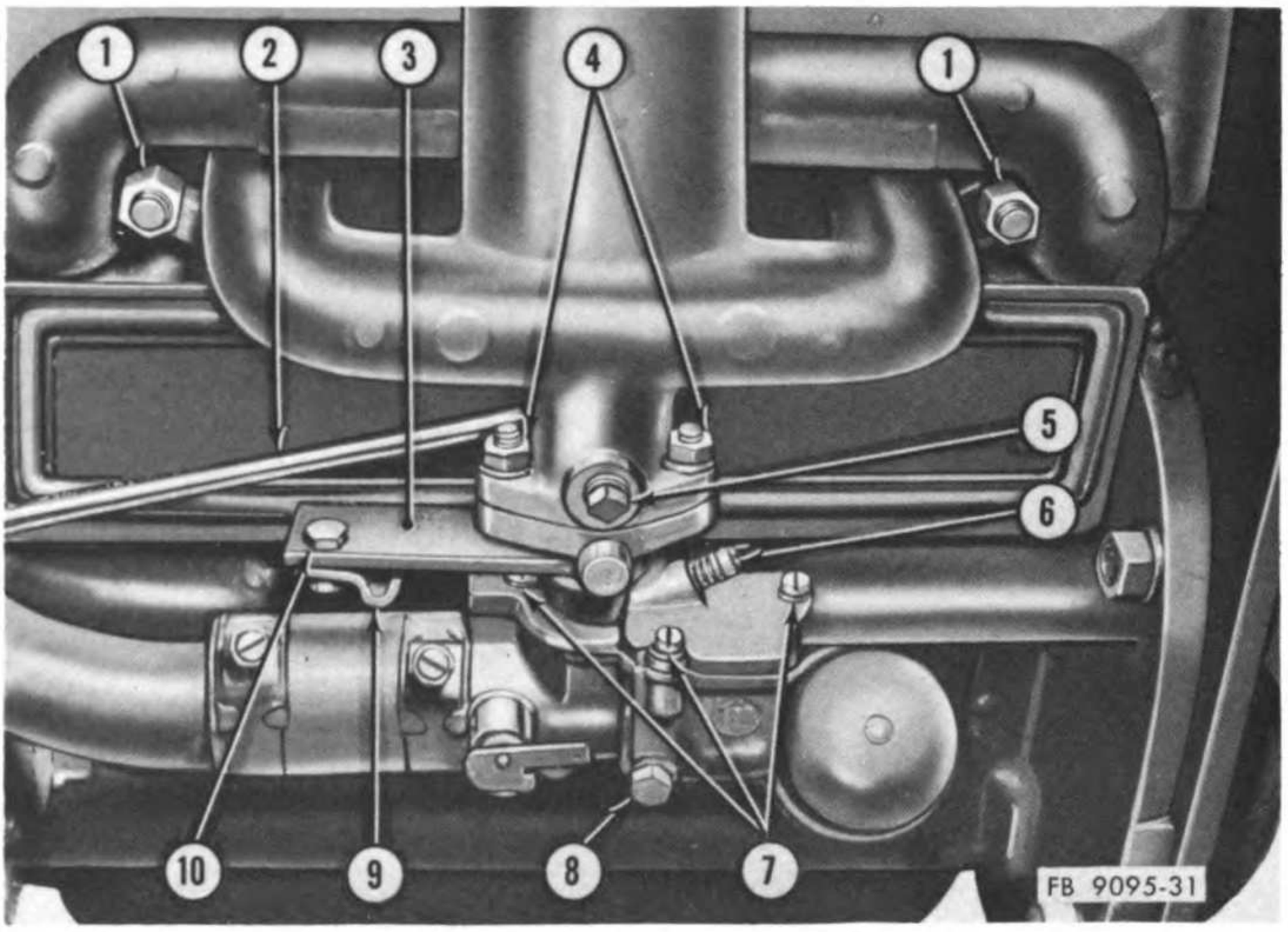
The carburetor is a ¾-inch, side updraft type, with choke and throttle levers and an idle mixture adjusting screw.

a. Removal.

(1) Remove tool box (14, fig. 14) and close fuel shutoff valve (1, fig. 15). Reinstall tool box.

(2) Disconnect fuel line (18, fig. 4) from carburetor (24).

(3) Have suitable container ready, remove drain plug from the bottom of the fuel bowl and drain carburetor.
(4) Loosen hose clamp nearest carburetor on air intake coupling (25, fig. 4) and ease coupling from carburetor.
(5) Remove choke control wire retaining screw from choke lever between carburetor and engine block.
(6) Remove bolt (10, fig. 31), nut, and lockwasher which hold choke control wire clip (9) to bracket (3) and remove choke cable and wire clip.



1 Manifold stud nut, hex, 5/16–18 (4 rqr)
2 Governor control rod
3 Choke control bracket
4 Carburetor stud nut, hex, 1/4–20 (2 rqr)
5 Exhaust manifold drain plug
6 Idle adjusting screw
7 Screw, cap, slotted, #10–24 x 9/16 (4 rqr)
8 Jet, main metering
9 Choke control wire clip
10 Bolt, hex, 3/8–16 x 3/4

Figure 31. Carburetor, fuel line removed.

(7) Remove nuts (4) and lockwashers from carburetor studs and remove carburetor and manifold gasket from manifold flange. Ease governor control rod (2) from carburetor throttle lever. Discard manifold gasket.

b. Installation.

(1) Place governor control rod (2, fig. 31) into carburetor throttle lever.
(2) Using a new manifold gasket, attach carburetor to manifold with lockwashers and nuts (4).

(3) Turn choke lever (8) to full open position (clockwise) and make sure choke control button (3, fig. 20) is all the way in.
(4) Place choke control wire into choke control lever between carburetor and engine block and lock in place with retaining screw.
(5) Make sure that choke stays in full open position, attach choke control cable to bracket (3, fig. 31) with wire clip (9) and nut, lockwasher, and bolt (10) so that there is no slack between wire clip and choke control lever.
(6) Pull choke control button all the way out and check to see that choke control lever moves fully closed without hindrance. Choke control wire should move freely inside cable, and end of cable should be far enough away from choke control lever so that it is not struck by lever when choke control button is pulled all the way out.
(7) Ease air intake coupling (25, fig. 4) on carburetor and tighten hose clamp.
(8) Connect fuel line (18) to carburetor.
(9) Install drain plug in the bottom of the fuel bowl.

c. Adjustment (fig. 31).

(1) Screw idle adjusting screw (6) all the way in, then unscrew it one full turn.
(2) Start engine (par. 13*a–i*) and run it until warm.
(3) Disconnect governor control rod (2) from throttle lever.
(4) Slow engine by moving throttle lever slowly counterclockwise (towards air cleaner).
(5) If engine misses or operates unevenly, turn idle adjusting screw slowly in or out until engine operates smoothly.
(6) Open throttle (away from air cleaner) and connect governor control rod.
(7) If ice plant is to be operated, continue starting procedure (par. 13*j–q*). If ice plant is not to be operated, stop engine (par. 14).

Section VII. IGNITION SYSTEM

66. Description

The ignition system consists of a high tension, radio suppressed, fungus proofed magneto, a shielded cable leading to an ignition switch which grounds the magneto when in the OFF position, and four shielded spark plugs.

67. Magneto

The magneto is a high tension spark generator and distributor, driven by the camshaft gear of the engine. The magneto has a mounting clip and elongated hole which permits timing adjustments.

a. Removal.

(1) Remove tool box (14, fig. 14) and disconnect ignition switch lead (1, fig. 29) from magneto (4).

(2) Disconnect spark plug leads (2) from magneto.

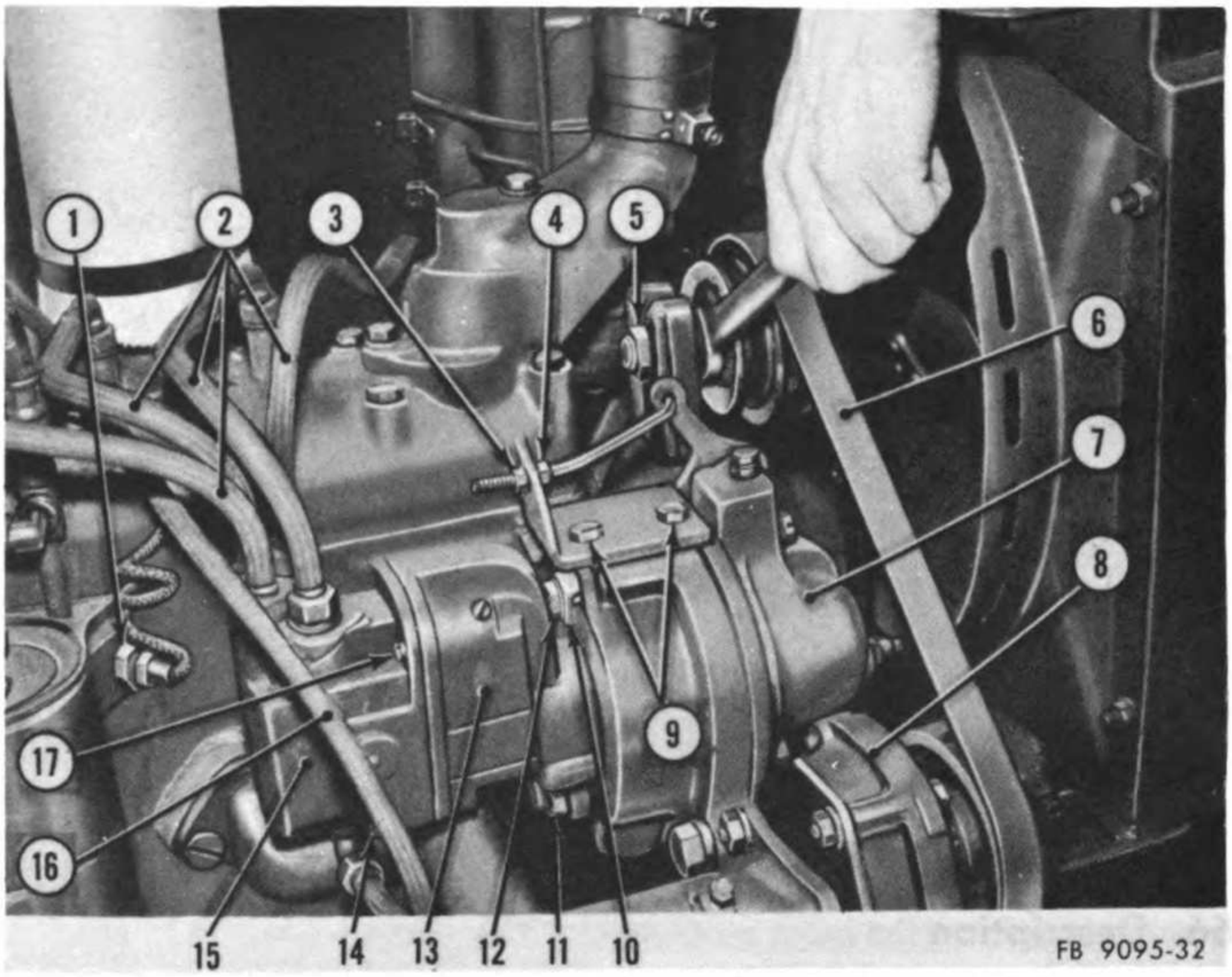
(3) Remove upper nut (12, fig. 32) and magneto mounting clip (10) from magneto.

(4) Remove lower cap screw (11), lockwasher, and two internal-external washers and remove magneto and discard the gasket.

(5) Remove screws (14 and 17) holding magneto together and separate end cap (15) from frame (13). Discard the gasket.

b. Inspection, Cleaning, and Repair (fig. 33).

(1) Inspect carbon brush (1). It should move freely in holder and should be under light spring pressure. Replace if worn or damaged.



1 Water temperature bulb
2 Spark plug lead
3 Governor adjusting nut
4 Locknut
5 Fan retaining nut
6 Fan belt
7 Governor
8 Water pump
9 Screw, cap, hex, 3/8–16 x 1¼ (2 rqr)
10 Magneto mounting clip
11 Screw, cap, hex, 3/8–16 x 1⅜
12 Nut, 3/8–16
13 Magneto frame
14 Screw, mach, #10–24 x 1⅛ (2 rqr)
15 Magneto end cap
16 Ignition switch lead
17 Screw, mach, #10–24 x ⅝ (2 rqr)

Figure 32. Magneto, removal points.

(2) Inspect felt wick (7). If dirty or saturated with grease, replace with clean, dry wick.
(3) Remove rotor (14) and inspect for cracks or breaks. Replace if damaged.
(4) Clean the inside of both sections thoroughly with a dry, clean, lint-free rag. Make sure air vents are clean and free of dirt or other foreign matter.
(5) Inspect breaker points (12) for pitting or pyramiding. A small tungsten file or fine stone may be used to resurface the points. If the points cannot be trued up by resurfacing, they should be replaced. Remove lockpin (13), locking screws (9), and breaker arm terminal screw (10). Remove breaker point assembly and replace with new assembly. After points have been resurfaced, or new assembly has been installed, loosen locking screws. With breaker points at full separation, place screwdriver in slot (11) and pivot until gap of 0.013 inches is obtained. Tighten locking screws and recheck gap.
(6) Clean distributor block electrodes (2) by carefully scraping with a small tungsten file or fine stone.

c. Installation and Timing.

(1) Using new gasket, attach end cap (3, fig. 33) to frame (4).
(2) Remove spark plug from No. 1 cylinder (nearest engine radiator) and place thumb over spark plug hole.
(3) Crank engine until outward pressure is felt, then crank very slowly until timing notch in engine fan drive pulley (15, fig. 34) is lined up with timing pointer (14) on front of engine crankcase (below air cleaner and governor control rod). Reinstall spark plug.
(4) Place a short, insulated wire in the No. 1 terminal (marked A) of the magneto and bend the end to within ⅛ inch of the frame. Turn the rotor (14, fig. 33) clockwise (when viewed from the drive end) until a spark is observed between the wire and the frame. Hold rotor in this position.
(5) Without disturbing either the engine or the magneto, place new gasket on end of magneto frame (4), carefully engage the drive lugs of the impulse coupling in the drive slots of the governor shaft, and attach but do not tighten magneto with lower cap screw (11, fig. 32), lockwasher, and two internal-external washers.
(6) Install, but do not tighten, magneto mounting clip (10) and upper nut (12).
(7) Pivot magneto top as close to engine as possible. Crank engine one complete turn so that the timing notch on engine fan drive pulley is lined up with timing pointer on the en-

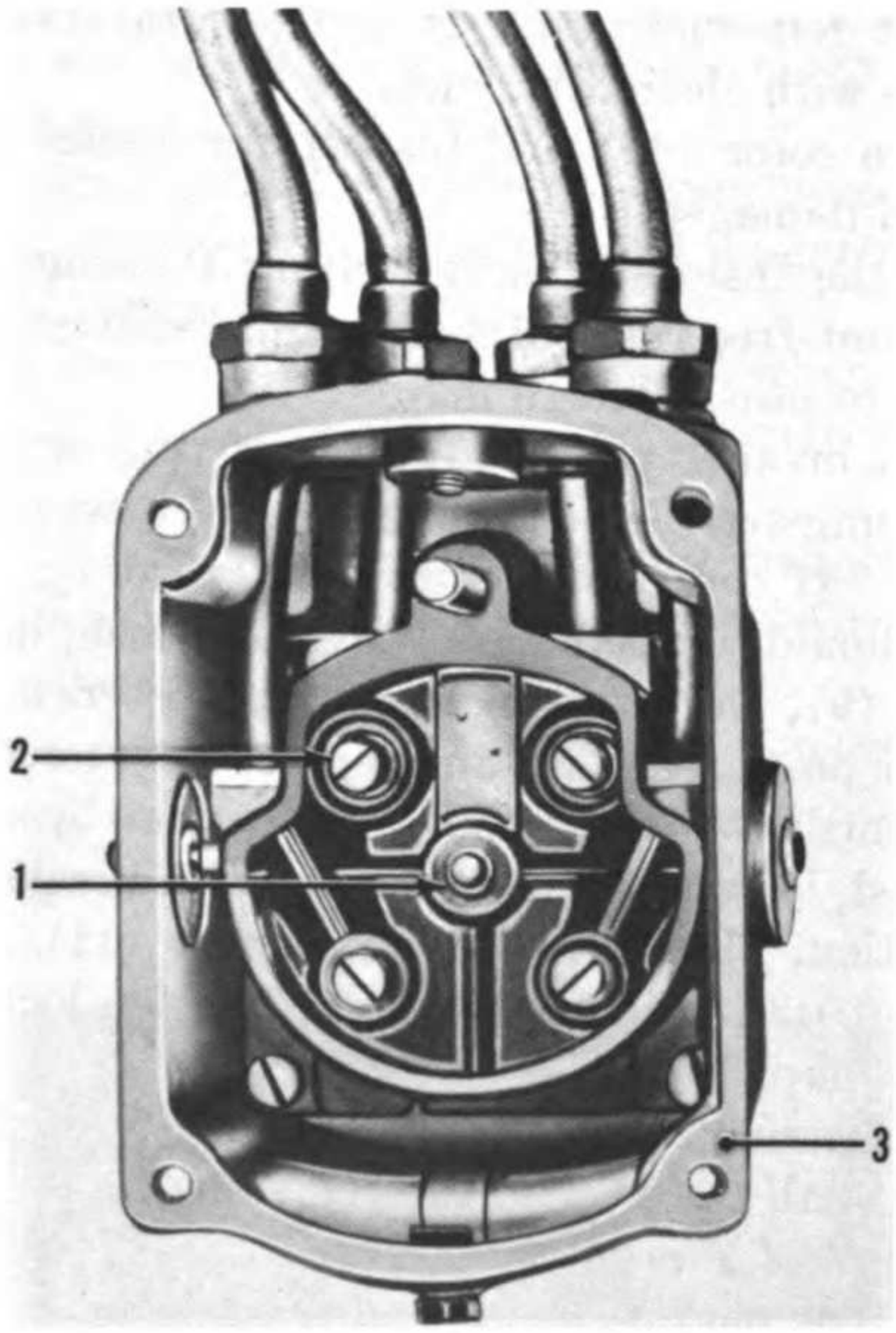


Figure 33. Magneto frame and end cap, separated.

1 Carbon brush
2 Distributor block electrode
3 End cap
4 Frame
5 Coil
6 Capacitor
7 Felt wick
8 Magnetic rotor gear
9 Locking screws
10 Breaker arm terminal screw
11 Slot
12 Breaker points
13 Lockpin
14 Rotor
15 Distributor gear

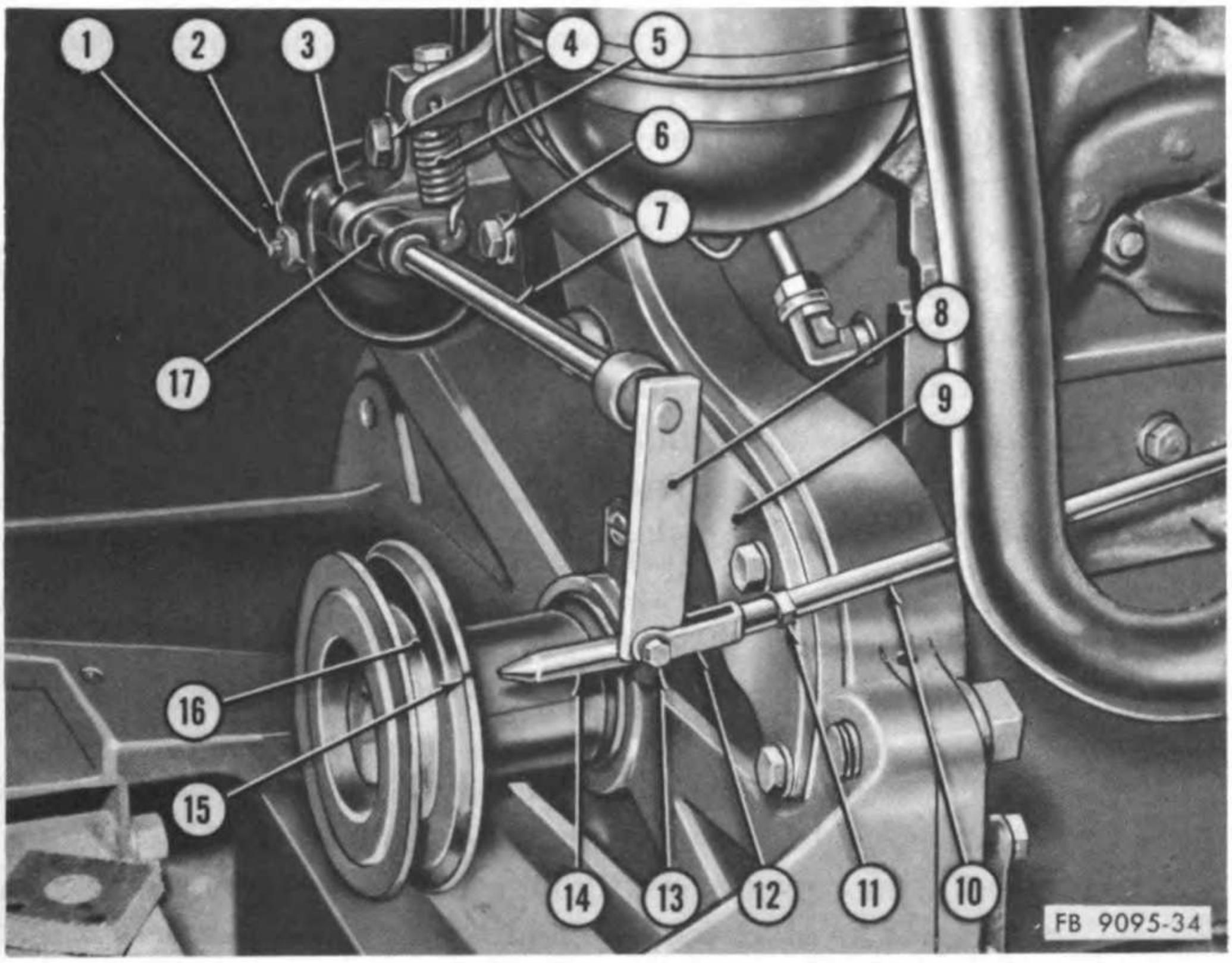
Figure 33—Continued.

gine crankcase behind the pulley. Pointer is almost directly beneath the air cleaner and governor control rod.

(8) Slowly pivot magneto top away from engine until impulse coupling trips.

(9) Tighten upper nut (12) and lower cap screw (11).

(10) Connect spark plug and ignition switch leads (1 and 2, fig. 29) to magneto, and install tool box.



1 Governor bumper spring body
2 Nut, hex, 7/16–20
3 Governor
4 Screw, cap, hex, 1/4–20 x 1 1/4
5 Governor spring
6 Screw, cap, hex, 3/8–16 x 2 3/4
7 Rockshaft extension
8 Governor control rod lever
9 Rockshaft extension bracket
10 Governor control rod
11 Nut, hex, No. 10–32
12 Governor control rod yoke
13 Governor control rod yoke pin
14 Timing pointer
15 Timing notch
16 Engine fan drive pulley
17 Governor spring lever

Figure 34. Engine, three-quarter front view with fan belt removed.

d. Testing Ignition Spark.

(1) Remove cable from any spark plug.

(2) Hold terminal of cable 1/8 inch from cylinder head of engine.

(3) Slowly crank engine. Magneto impulse coupling will snap with each complete revolution of engine, and on one of the first four revolutions a spark should appear between the terminal of the cable and the engine.

68. Spark Plugs

The ice plant engine uses four Champion XE–15J radio shielded spark plugs.

a. Removal.

(1) Disconnect leads (2, fig. 29) from spark plugs (3).

(2) Unscrew and remove spark plugs and gaskets from engine cylinder head.

b. Inspection, Cleaning, and Adjusting.

(1) Inspect porcelain for cracks. If cracked, replace spark plugs.

(2) Clean the spark plugs in an approved spark plug cleaner. If an approved spark plug cleaner is not available, carefully scrape as much of the carbon deposits as possible from the electrodes and insulator, taking care not to damage them.

(3) Check spark gap with feeler gage. Gap should be between 0.023 inch and 0.027 inch. Gap may be anywhere within this range, but gap for all plugs must be the same. If electrodes are not badly burned, set gap by bending outer electrode, since bending inner electrode may damage insulator. If electrodes are badly burned, replace spark plug.

(4) Check gaskets for breaks and replace if broken.

c. Installation.

(1) Place gasket over threaded part of spark plug.

(2) Screw plug into well in engine cylinder head and tighten by hand.

(3) When using old gaskets, tighten spark plug to torque-wrench reading of 26 to 28 foot-pounds.

(4) When using new gaskets, tighten spark plug to torque-wrench reading of 30 to 32 foot-pounds.

69. Cables

a. Removal.

(1) Remove tool box (14, fig. 14) and unscrew shielding from spark plugs (3, fig. 29) and from magneto (4).

(2) Remove cables from spark plugs and magneto, and pull shielding from cables.

(3) Unscrew ignition switch cable shielding (1) from ignition switch and from magneto and remove cable. Pull shielding from cable.

b. Inspection and Repair.

(1) Inspect shielding for worn spots and breaks. Replace worn or broken cables. If connector has come loose, it must be resoldered.

(2) Inspect cables for cracked, worn, or broken insulation. Replace cable, if necessary.

c. Installation.

(1) Thread cables through shielding.

(2) Attach ignition switch lead to magneto and to ignition switch and screw shielding connectors in place.

(3) Attach cables to spark plugs and screw connectors in place.

(4) Push the cable from the No. 1 spark plug (nearest radiator) into the No. 1 socket of the magneto. Working in a clockwise direction, push the cable from the No. 3 spark plug into the next socket and the cables from the Nos. 4 and 2 spark plugs, in that order, into the next two sockets.

(5) Screw the connectors in place, and install tool box.

Section VIII. COOLING SYSTEM

70. Description

The engine cooling system consists essentially of a radiator for storing and cooling the engine coolant, a water pump for circulating the coolant, a thermostat to control its flow, and a fan to cool the radiator.

71. Radiator

The radiator consists of a water storage tank with a water inlet pipe, a core made up of small outlet tubes and cooling fins, and a lower collecting channel and water outlet pipe.

a. Removal.

(1) Drain radiator (par. 16*f*).

(2) Remove tool box (14, fig. 14) and loosen both upper engine water outlet hose clamp (6, fig. 35) and radiator outlet hose clamp nearest radiator (10), which connect radiator outlet to water pump (11).

(3) Remove nuts, lockwashers, and bolts (3) and take fan shroud (8) off radiator.

(4) Remove nuts (18, fig. 36) and lockwashers (17) underneath radiator holding radiator to front support and remove radiator, easing couplings from radiator inlet and outlet pipes. Take off fan shroud, revolving fan blades, as necessary, for it to clear fan.

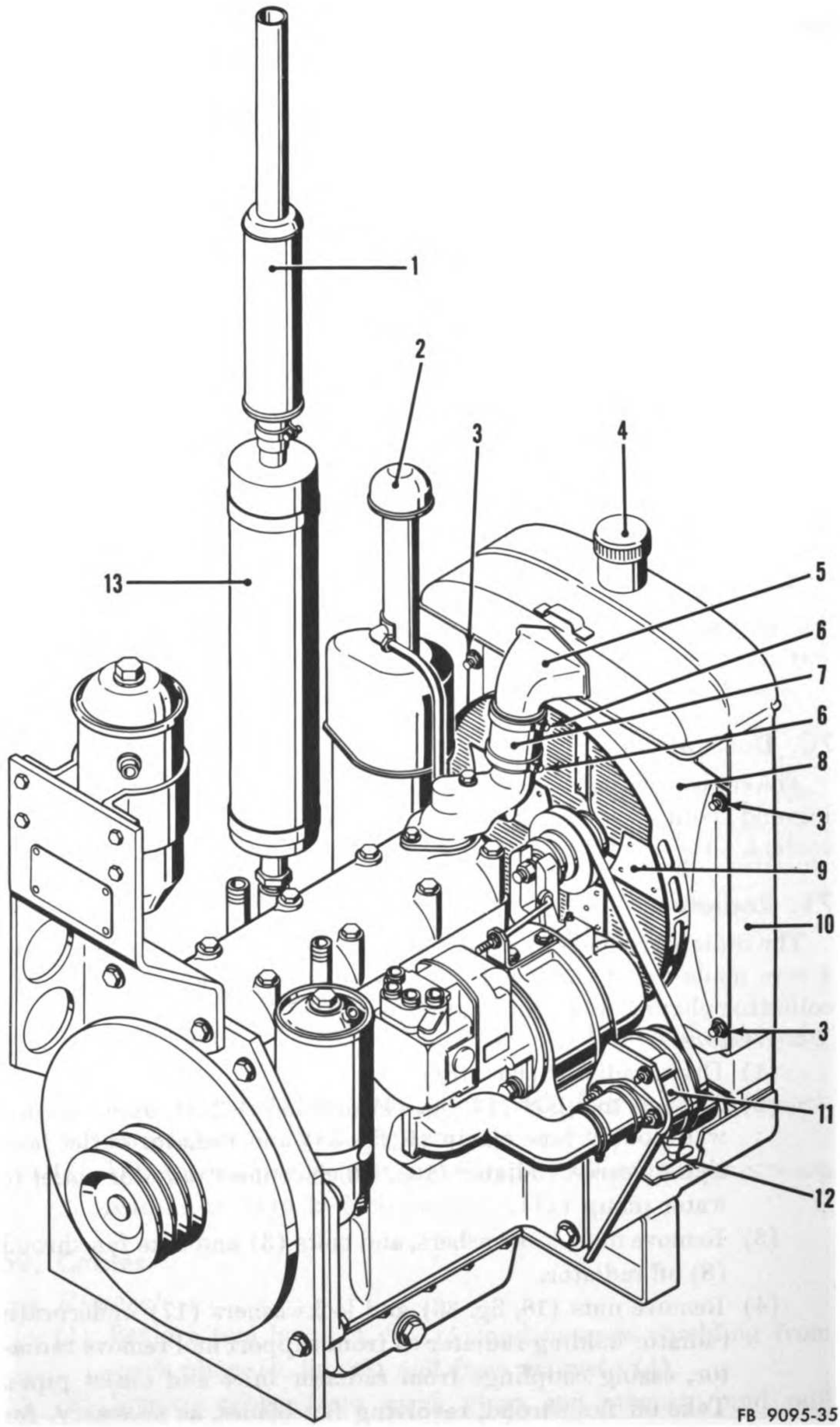


Figure 35. Engine, three-quarter top rear view.

b. Inspection, Cleaning, and Repair.

(1) Inspect fan shroud, radiator core and radiator for dents, torn metal, corroded parts, and bent or clogged radiator fins.

(2) Smooth out dents, repair or straighten torn metal, and clean corroded parts. Clean clogged radiator with air or water pressure and straighten bent fins.

(3) Inspect radiator hoses for cracks or breaks. Replace defective hose.

(4) Make sure radiator overflow pipe (27, fig. 36) is not obstructed.

(5) Check drain valve for ease of operation.

(6) Repaint chipped or damaged surfaces (par. 31).

c. Installation.

(1) Place fan shroud (1, fig. 36) behind fan, revolving fan blades as necessary for fan to clear shroud.

(2) Carefully place radiator (13) on front support and ease couplings (8 and 20) on radiator inlet (9) and outlet (19) pipes.

(3) Attach radiator to front support with lockwashers (17) and nuts (18). Move hose clamps (7) near ends of couplings and tighten.

(4) Attach fan shroud to radiator with bolts (26), lockwashers (15), and nuts (14). Install tool box.

72. Engine Fan and Fan Belt

The engine fan draws air through the radiator to cool the water, and is driven by a belt from the engine drive pulley.

a. Removal and Disassembly.

(1) Loosen fan spindle by turning hex portion with wrench (fig. 32).

(2) Lower fan assembly to bottom of slot, take fan belt (6) from water pump and engine drive pulleys, and remove it by working it out over the fan blades.

(3) Lift fan assembly out of slot, making sure it clears the shroud, and remove.

(4) Remove oil retaining screw (7, fig. 37) and oil retaining screw gasket (6), turn fan so hole is on bottom and empty oil into suitable container. Some oil will remain in fan.

---

1 Muffler
2 Air cleaner cap
3 Bolt, hex, 5/16–24 x 3½ (4 rqr)
4 Radiator fillercap
5 Radiator inlet pipe
6 Hose clamp
7 Hose coupling
8 Fan shroud
9 Fan
10 Radiator
11 Water pump
12 Radiator drain

Figure 35—Continued.

(5) Remove bolts (16), lockwashers (15), and double nuts (17) and take off fan (14), blade spacer (13), and gasket (12), being careful to empty remaining oil into suitable container. Discard the gasket (12).

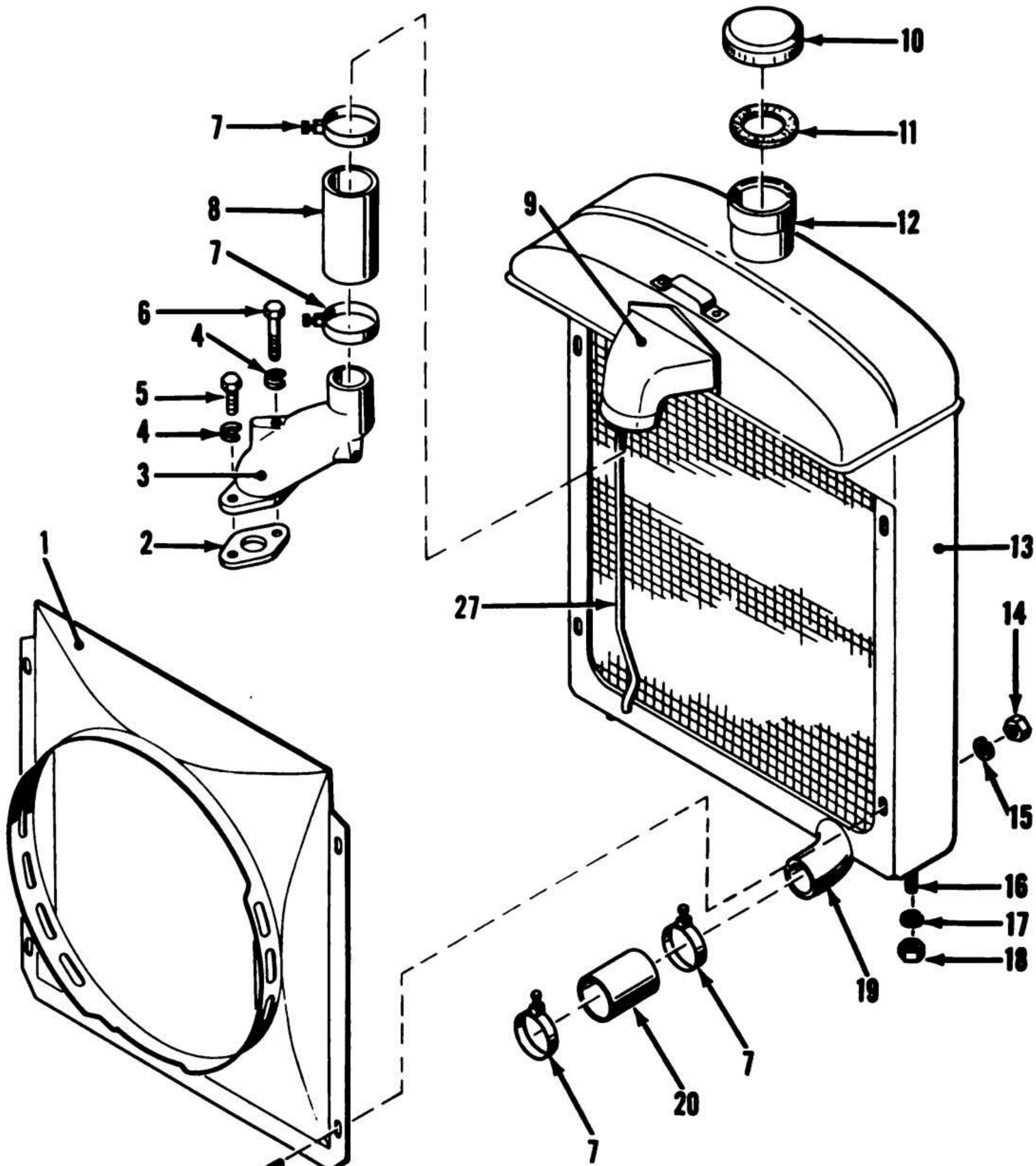


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Figure 36. Radiator, hoses, and connections, exploded view.

(6) Remove locknut (11) and take oil impeller (10), fan bearing (9), and front fan hub O-ring (8) from fan hub (5). Discard O-ring.

(7) Take spindle (3), and rear fan hub O-ring (4) from fan hub, and remove fan retaining nut (1) and fan spindle washer (2) from spindle. Discard O-ring.

b. Cleaning, Inspection, and Repair.

(1) Soak all metal parts of fan assembly in approved cleaning solvent and wipe dry.

(2) Inspect fan belt for fraying. If frayed or soaked with grease, replace.

(3) Inspect fan for bent blades and cracks. Straighten bent blades carefully. If cracks are found, replace fan.

(4) Inspect all parts for corrosion and replace corroded parts.

(5) Inspect bolts, screws, nuts, and spindle for worn or stripped threads and replace defective parts.

c. Assembly, Installation, and Adjustment.

(1) Place new rear fan hub O-ring (4, fig. 37) on spindle (3) and insert spindle into fan hub (5).

(2) Place new front fan hub O-ring (8) and fan bearing (9) in fan hub and attach oil impeller (10) to spindle with locknut (11).

(3) Place new fan bearing gasket (12), blade spacer (13), and fan (14) on fan hub and attach with bolts (16), lockwashers (15), and double nuts (17).

(4) Place fan spindle washer (2) and fan retaining nut (1) no more than two turns on spindle.

(5) Move fan spindle washer next to hex portion of spindle and slide fan assembly into slot of fan bracket on engine so that nut fits inside slot and does not turn.

1	Fan shroud	15	Lockwasher, 5/16 (4 rqr)
2	Engine water outlet gasket	16	Radiator stud
3	Engine water outlet elbow	17	Lockwasher, 7/16 (2 rqr)
4	Lockwasher, 3/8 (2 rqr)	18	Nut, hex, 7/16–20 (2 rqr)
5	Screw, cap, hex, 3/8–16 x 7/8	19	Radiator outlet pipe
6	Screw, cap, hex, 3/8–16 x 3¾	20	Radiator outlet coupling
7	Hose clamp water outlet (4 rqr)	21	Water pump
8	Engine water outlet coupling	22	Hose clamp, water pump outlet (2 rqr)
9	Radiator inlet pipe		
10	Radiator fillercap	23	Water pump outlet coupling
11	Fillercap gasket	24	Engine water inlet elbow
12	Radiator filler pipe	25	Engine water inlet gasket
13	Radiator	26	Bolt, hex, 5/16–24 x 3½ (4 rqr)
14	Nut, hex, 5/16–24 (4 rqr)	27	Overflow pipe

Figure 36—Continued.

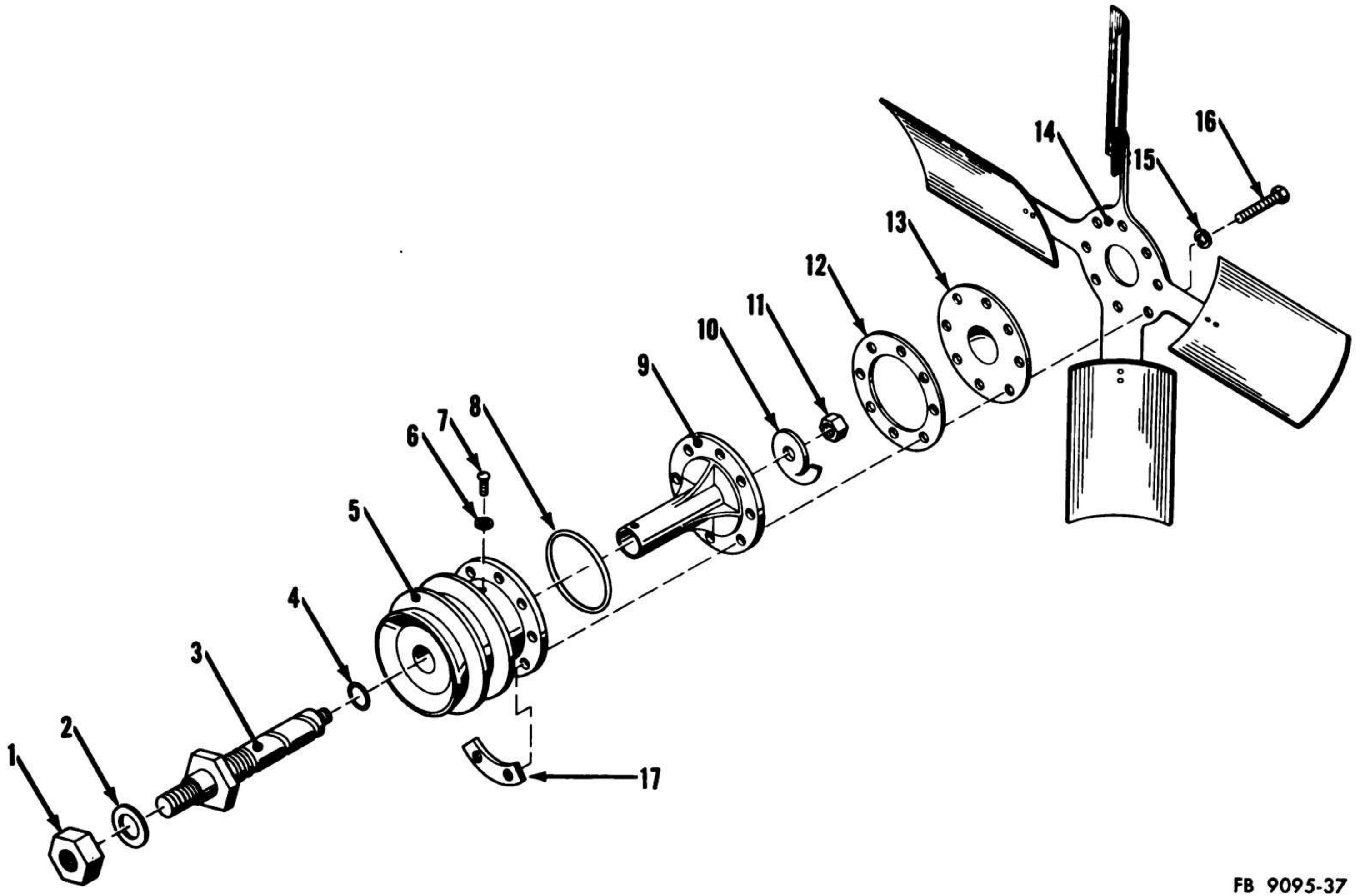

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Figure 37. Engine fan, exploded view.

1 Nut, fan retaining, hex, 5/8
2 Washer, fan spindle, 5/8
3 Spindle
4 O-ring, fan hub, rear
5 Fan hub
6 Gasket, oil retaining screw
7 Screw, oil retaining
8 O-ring, fan hub, front
9 Fan bearing
10 Oil impeller
11 Locknut, 3/16
12 Gasket, fan bearing
13 Blade spacer
14 Fan
15 Lockwasher, 3/16 (8 rqr)
16 Bolt, hex, 3/16–24 x 2¼ (8 rqr)
17 Nut, double (4 rqr)

Figure 37—Continued.

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(6) Work fan belt over fan blades and place it around fan, water pump, and engine drive pulleys.
(7) Slide fan assembly as high as it will go and tighten hex portion of spindle.
(8) Push fan belt with fingers midway between fan and engine drive pulleys. Belt should depress about ¾ inch. Raise or lower fan to obtain proper belt tension.
(9) Lubricate fan (par. 30*h*).

Section IX. GOVERNOR

73. Description

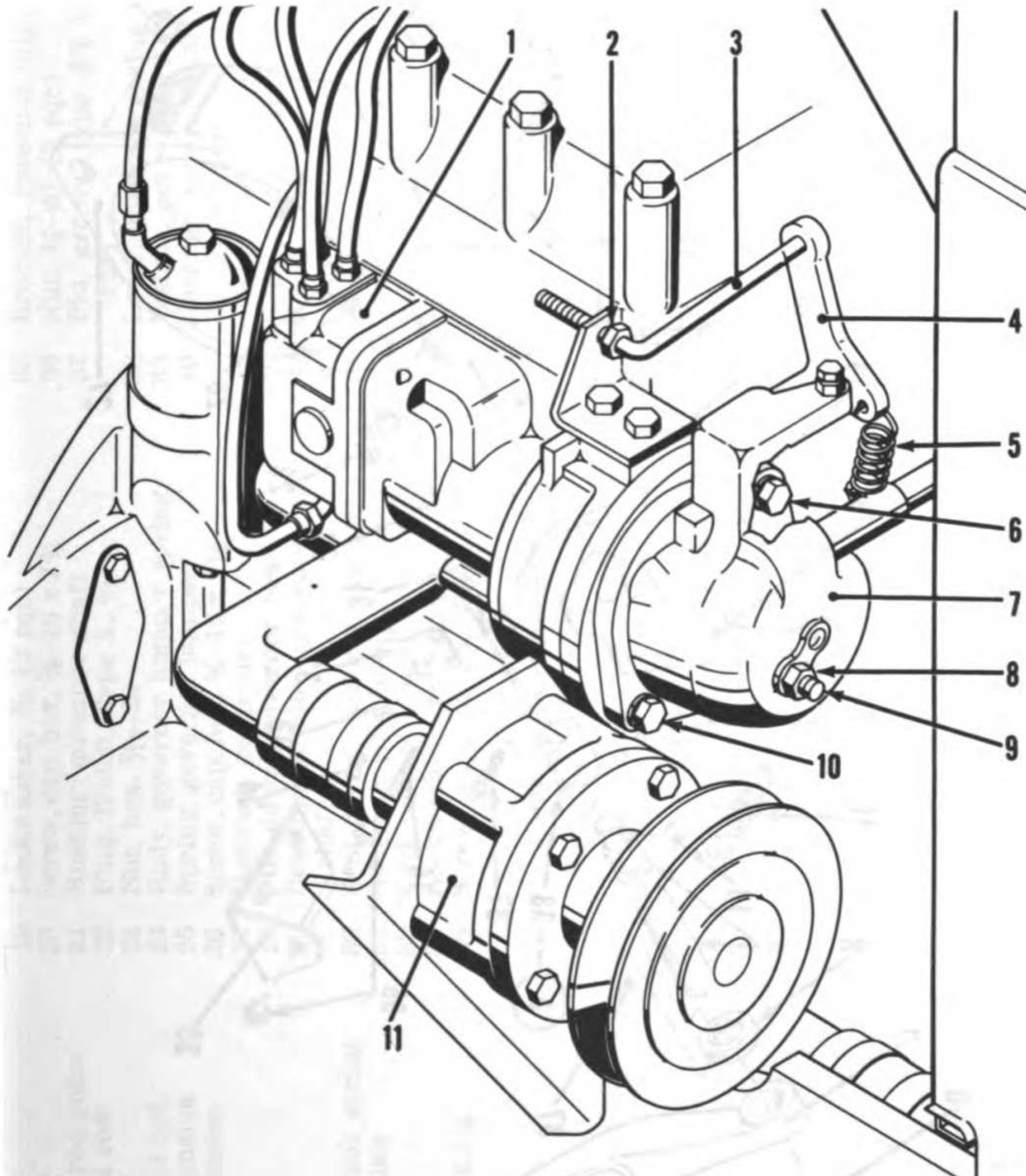
The governor is the fly-ball type, preventing overspeed of the engine by controlling the throttle of the carburetor. It utilizes two weights which react to centrifugal force and maintain engine speed at 2,250 rpm.

74. Governor Removal

a. Remove radiator (par. 71*a*).
b. Disconnect governor control rod (10, fig. 34) from carburetor.
c. Take off governor rockshaft extension bracket (9) (on which governor control rod is mounted) by removing cap screws and lockwashers.
d. Remove cap screws (9, fig. 32) and washers.
e. Remove cap screws (6 and 10, fig. 38) and lockwashers holding governor body (7) to frame, carefully disengage gear teeth and remove governor, gasket, and brackets. Discard the gasket.

75. Governor Installation

a. Turn engine crankshaft slowly and observe camshaft gear (which drives governor) through opening in which governor is to be mounted. There is a punch mark between two of the camshaft gear teeth, marked "Magneto set." The mating governor shaft gear tooth will either be marked with a punch mark or will have the sharp edge ground off to identify it. Using new gasket, carefully engage gear of governor shaft (50, fig. 39) so that marked tooth is in marked groove of camshaft gear. Fit governor base dowel pin (28) into locating hole and attach governor to frame with capscrews (20 and 26) and lockwashers (19).
b. Attach bracket to frame with washers and cap screws (9, fig. 32).
c. Attach rockshaft extension bracket (7, fig. 39) to engine with lockwashers and cap screws.
d. Connect governor control rod (1) to carburetor.
e. Install radiator (par. 71*c*).



1 Magneto
2 Locknut
3 Governor adusting arm
4 Governor spring throttle lever
5 Governor spring
6 Screw, cap, hex, 3/8–16 x 2¾
7 Governor
8 Governor bumper spring body locknut
9 Governor bumper spring body
10 Screw, cap, hex, 3/8–16 x 1¼
11 Water pump

Figure 38. Governor, water pump, and magneto.

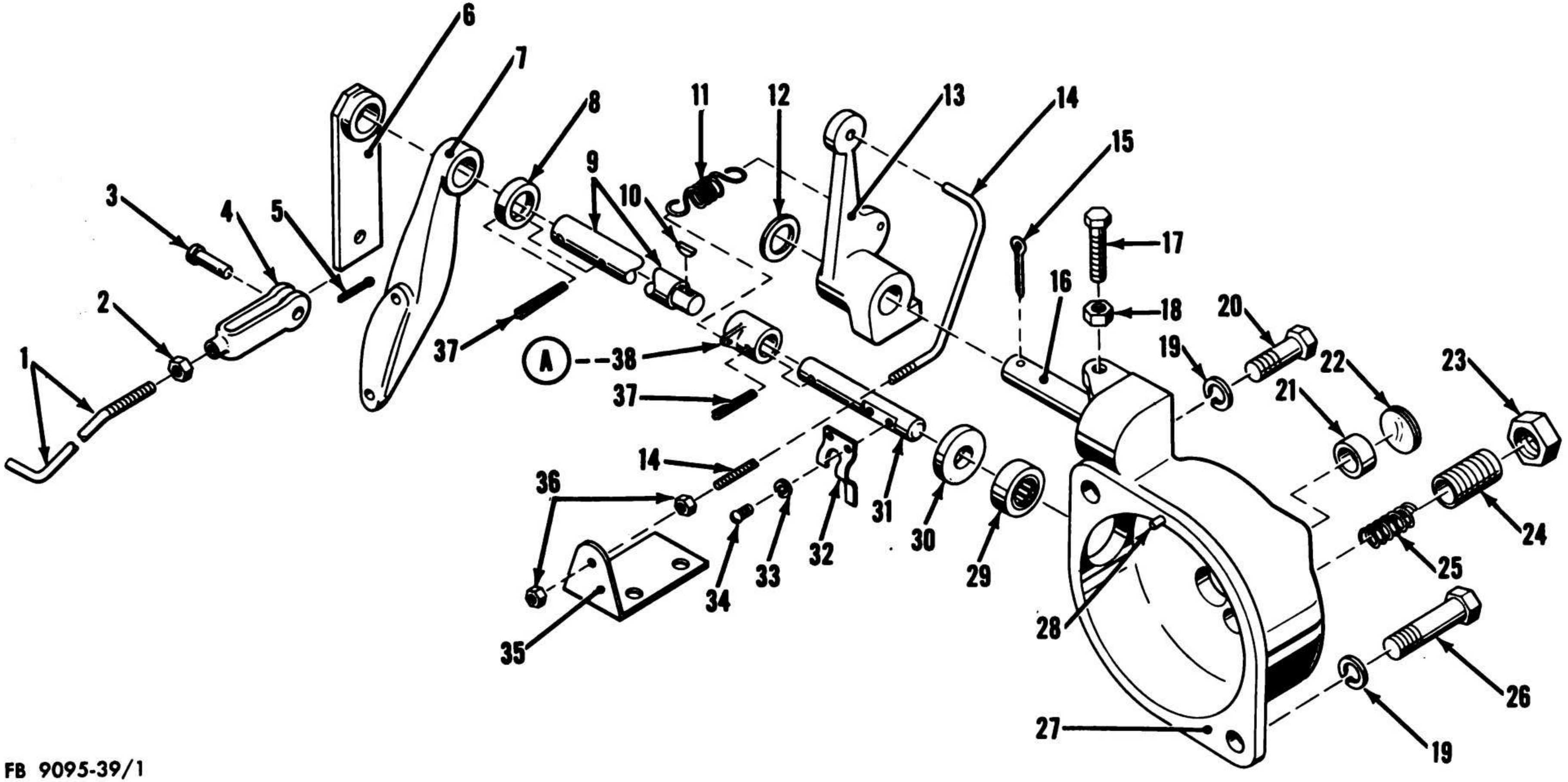


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Figure 39. Governor, exploded view.

1 Governor control rod
2 Nut, hex, #10-32
3 Pin, governor control rod yoke
4 Yoke, governor control rod
5 Pin, cotter, 1/16 x 1/2
6 Lever, governor control rod
7 Bracket, rockshaft extension
8 Collar, rockshaft extension
9 Rockshaft extension
10 Key, woodruff #2
11 Spring, governor
12 Washer, plain, 13/32 ID
13 Lever, throttle, governor spring
14 Arm, governor adjusting
15 Pin, cotter 3/32 x 5/8
16 Throttle lever shaft
17 Screw, cap, hex, 1/4-20 x 1 1/4
18 Nut, hex, 1/4-20
19 Lockwasher, 5/8 (2 rqr)
20 Screw, cap, hex, 5/8-16 x 2 3/4
21 Bushing, governor shaft
22 Plug, Welch, Type A, 5/8
23 Nut, hex, 7/16-20
24 Body, governor bumper spring
25 Spring, governor bumper
26 Screw, cap, hex, 5/8-16 x 1 1/2
27 Housing, governor
28 Pin, dowel, governor base
29 Bearing, needle, governor rockshaft
30 Seal, oil, governor rockshaft
31 Governor rockshaft
32 Fork, governor tension
33 Lockwasher, #8 (2 rqr)
34 Screw, cap, rd hd, #8-32 x 3/8 (2 rqr)
35 Bracket, governor adjusting arm
36 Nut, 1/4-20 (2 rqr)
37 Pin, groove, type #1 1/8 x 5/8 (3 rqr)
38 Lever, governor spring
39 Weight, governor (2 rqr)
40 Bushing, governor shaft
41 Base, governor
42 Sleeve, thrust
43 Race, bearing, thrust
44 Bearing, thrust
45 Race, bearing, thrust
46 Ring, retaining, thrust sleeve
47 Gasket, governor base
48 Pin, cotter, 3/32 x 2 (4 rqr)
49 Pin, governor weight (2 rqr)
50 Shaft, governor

Figure 39—Continued.

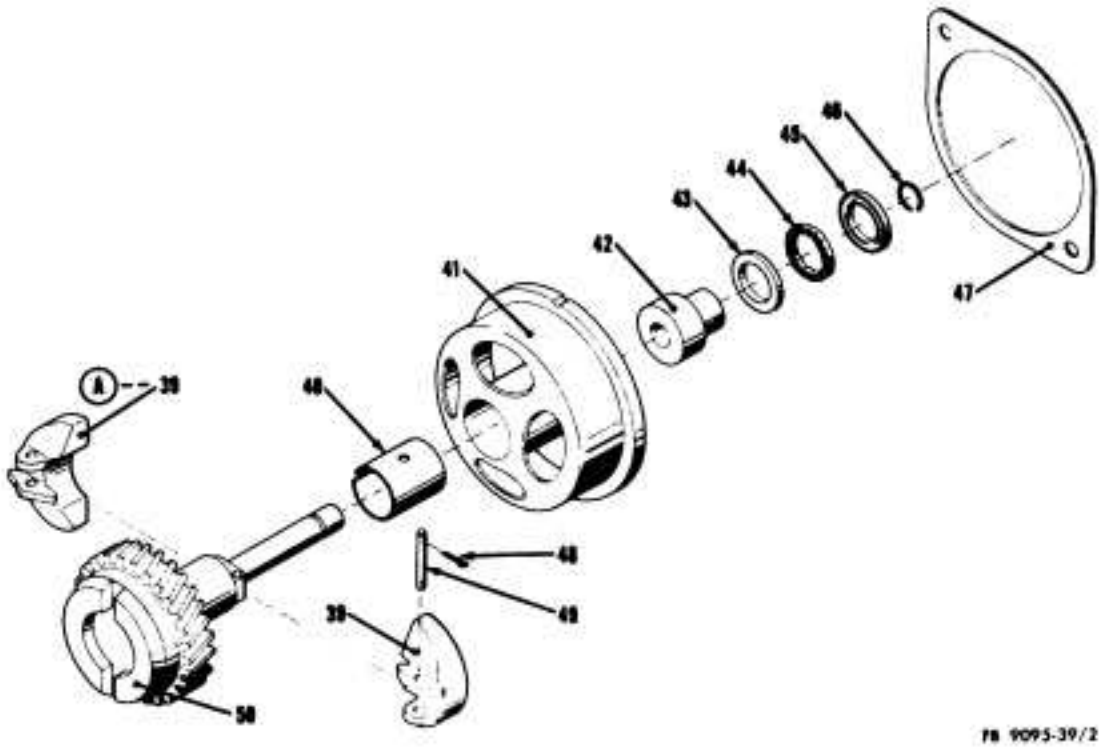


Figure 39—Continued.

Section X. CONTROL PANEL

76. Control Panel Removal and Disassembly

The control panel is attached to the side of the engine and contains the ignition switch, the engine water temperature and oil pressure gages, and the engine identification plate.

a. Remove oil filter (par. 30*f*(1)(*a*)–(*c*)).

b. Disconnect ignition cable, and high and low pressure cutout switch terminals from ignition switch (6, fig. 40).

c. Disconnect oil line from oil pressure gage (1).

d. Unscrew and remove water temperature bulb (1, fig. 32) from well in engine cylinder head (next to magneto).

e. Remove nuts (16, fig. 40), lockwashers (11), bolts (13), and cap screw (12) and take off control panel (5).

f. Unscrew and remove ignition switch knob (2), ignition switch mounting nut (3), and ignition switch spacer (4), and take ignition switch out from rear of panel.

g. Remove nuts (7) and washers (8) from gage studs, take off clamps (9) and remove gages through front of panel.

77. Control Panel Reassembly and Installation

a. Place water temperature bulb (14, fig. 40) and gage (15) through front of lower gage opening in control panel (5).

b. Place gage clamp (9) over studs on back of gage and attach gage to panel with washers (8) and nuts (7).

c. Place oil pressure gage (1) through front of upper gage opening in control panel and attach with clamp, washers, and nuts.

d. Place ignition switch (6) through rear of upper opening in control panel and attach with ignition switch spacer (4) and ignition switch mounting nut (3). Screw on ignition switch knob (2).

e. Attach control panel to engine with bolts (13), lockwashers (11), nuts (16), and cap screw (12).

f. Attach oil line to oil pressure gage.

g. Screw water temperature bulb (1, fig. 32) into well in engine cylinder head (next to magneto).

h. Connect ignition switch cable, and high and low pressure cutout switch terminals to ignition switch.

i. Install oil filter (par. 30*f* (3) (*e*) and (*f*)).

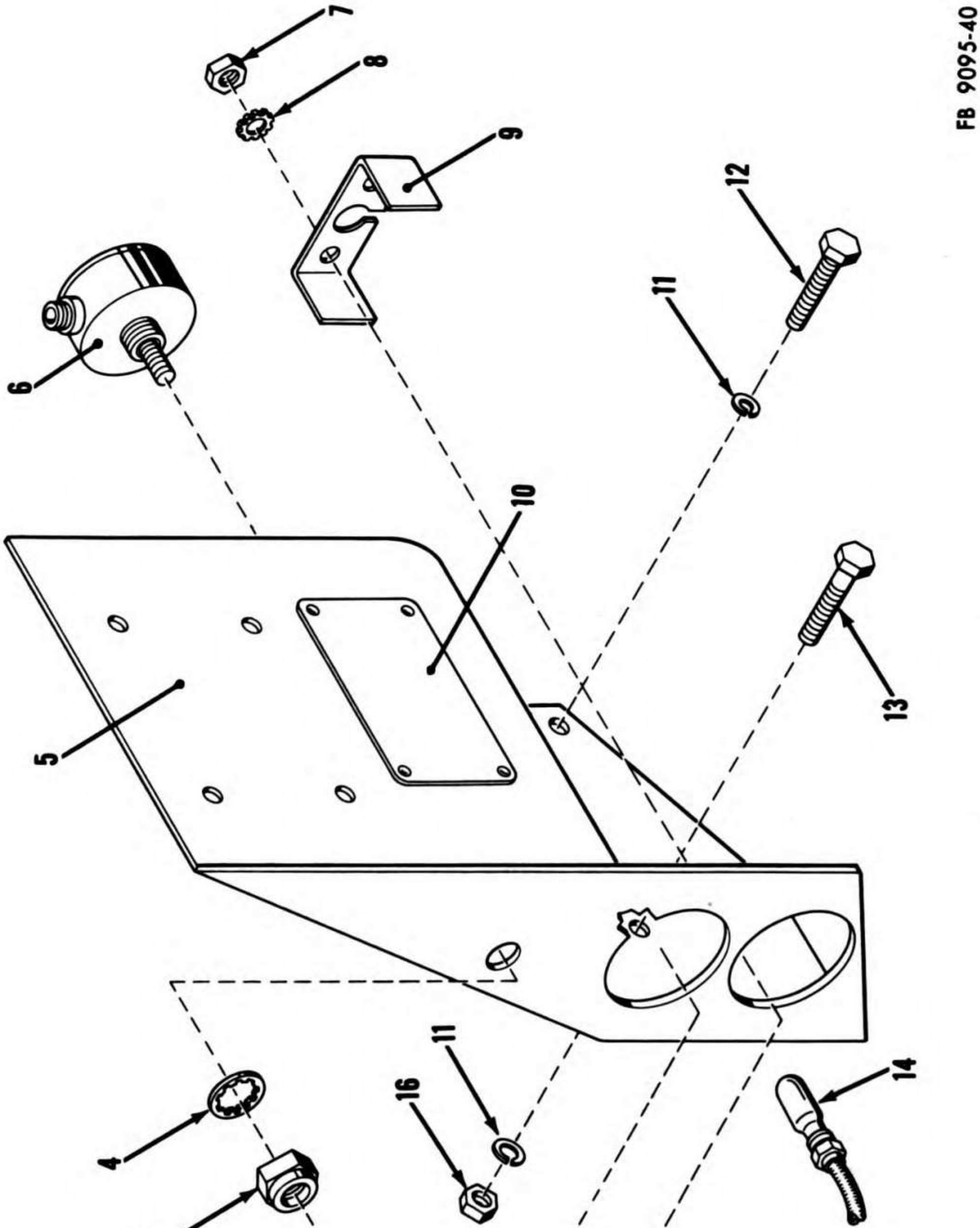


Figure 40. Control panel, exploded view.

1 Gage, oil pressure
2 Knob, ignition switch
3 Mounting nut, ignition switch
4 Spacer, ignition switch
5 Control panel
6 Switch, ignition
7 Nut, hex, ¼–20 (4 rqr)
8 Washer, external-internal (4 rqr)
9 Clamp, gage (2 rqr)
10 Plate, engine identification
11 Lockwasher, 7/16 (3 rqr)
12 Screw, cap, hex, 7/16–14 x 1⅛
13 Bolt, hex, 7/16–14 x 1⅜ (2 rqr)
14 Water temperature bulb
15 Gage, water temperature
16 Nut, hex, 7/16–14 (2 rqr)

Figure 40—Continued.

Section XI. HOUSING

78. Description

The housing consists of a brine tank outer shell, four ice can covers, a machine compartment cover, a brine agitator cover, and three removable doors.

79. Housing Removal

a. Remove front (3, fig. 1), end (5), and rear machine compartment doors by opening and lifting to uncouple hinges.

b. Remove ice can covers (2, fig. 1).

c. Remove brine agitator and machine compartment covers (par. 7*f*(1) (*l*) and (*m*)).

80. Housing Cleaning, Inspection, and Repair

a. Clean panels, doors, and covers with an approved cleaning solvent and wipe dry.

b. Inspect panels, doors, and covers for dents, chipped paint, and corrosion.

c. Inspect ice can covers for holes or punctures. If punctured badly, replace cover since this would destroy insulating properties.

d. Inspect ice can covers for snug fit. If covers are bent or warped, straighten them if possible. If covers cannot be straightened, replace them.

e. Inspect cover fasteners for worn or stripped threads. If fasteners do not tighten securely, replace them.

f. Tap out dents in panels and doors.

g. Remove any rust or corrosion, and repaint where necessary (par. 31).

81. Housing Installation

a. Install machine compartment and brine agitator covers (par. 7*f*(1) (*v*)).

b. Install ice can covers.

c. Install front (3, fig. 1), end (5), and rear machine compartment doors by placing upper sections of hinges into lower sections and lowering to couple hinges, then close doors.

Section XII. ENGINE

82. Description

The ice plant is equipped with an International Model U–1, four-cylinder, liquid cooled, four-stroke cycle, L-head, gasoline engine with radio suppressed and fungus proofed magneto ignition, which operates at a governed speed of 2,250 rpm.

83. Engine Removal

a. Loosen clamp base of muffler (1, fig. 35) and slide muffler off exhaust pipe.

b. Remove metal fastening bands (8, fig. 4) and carefully take exhaust pipe covering (6) from exhaust pipe.

c. Unscrew exhaust pipe from engine manifold (5) and remove.

d. Remove radiator (par. 71*a*).

e. Remove engine fan and fan belt (par. 72*a*(1) through (3)).

f. Remove governor (par. 74).

g. Remove magneto (par. 67*a*).

h. Remove fuel line (par. 64*a*).

i. Remove carburetor (par. 65*a*).

j. Remove oil filter (par. 30*f*(1)(*a*) through (*c*)).

k. Remove air cleaner (par. 30*g*(1)).

l. Disconnect high and low pressure cutout switch wires from ignition switch.

m. Loosen gear box cap screws (8, fig. 12) and move condenser fan pulley (6) down far enough to disengage drive belt from engine drive pulley (17, fig. 4). Tighten cap screws.

n. Loosen the four bolts (4, fig. 13) at the ends of the bars supporting the compressor, and the setscrew (3) at the base of the compressor. Move compressor enough to disengage drive belts from engine drive belts from engine drive pulley.

o. Place sling around engine so that it runs under front support and under crankcase immediately in front of rear mounting plate (fig. 41). Engine is removed through end of machine compartment (not through top) and sling must be connected to lifting device around outside of top end horizontal frame member.

Note. **Engine may be removed without first removing accessories. Sling placement (fig. 41) is the same whether or not accessories are removed before removing engine.**

p. Remove nuts, lockwashers, and bolts (19 and 27, fig. 4).

q. Carefully hoist engine and ease it sideways out of end of machine compartment, making sure that engine water inlet elbow clears refrigerant line which runs betwen fuel tank and engine. Be careful not to allow engine to hit condenser (13) during removal.

84. Engine Installation

a. Place sling around engine so that it runs under front support and under crankcase immediately in front of rear mounting plate (fig. 41).

b. Hoist engine and ease it sideways into end of machine compartment, being careful not to allow engine to hit condenser (13, fig. 4) during installation. Make sure that engine water inlet elbow clears refrigerant line running between fuel tank and engine.

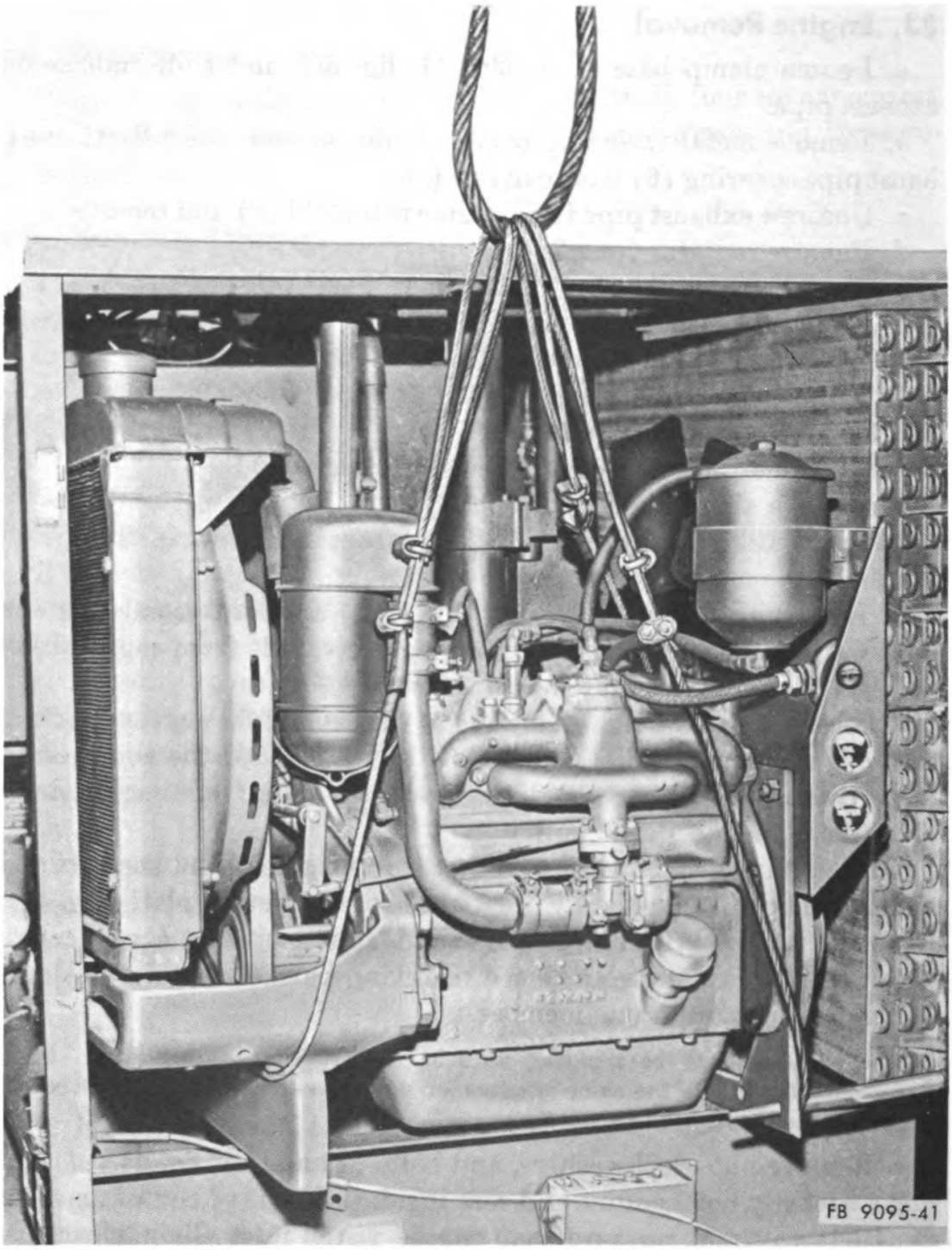


Figure 41. Sling placement for hoisting engine.

c. Attach engine to ice plant with bolts, lockwashers, and nuts (19 and 27). Remove sling.

d. Attach drive belts (par. 7*f*(1)(*a*)–(*k*)).

e. Connect high and low pressure cutout switch wires to ignition switch.

f. Install air cleaner (par. 30*g*(3)).

g. Install oil filter (par. 30*f*(3)(*e*) and (*f*)).

h. Install carburetor (par. 65*b*).

i. Install fuel line (par. 64*c*).

j. Install magneto (par. 67*c*).
k. Install governor (par. 75).
l. Install engine fan (par. 72*c*(5)–(8)).
m. Install radiator (par. 71*c*).
n. Install exhaust pipe, covering, and muffler (par. 7*f*(2)).

Section XIII. COMPRESSOR

85. Description

The ice plant is equipped with a Copeland Model 83, two cylinder, Freon-12 compressor, which operates at 680 rpm.

86. Compressor Removal

a. Pump out the compressor as follows:
(1) If the ice plant is running, make sure it has been running for at least one hour before starting to pump out the compressor.
(2) If the ice plant is not running, start the equipment and let it run for at least one hour before starting to pump out the compressor. This will leave the least amount of refrigerant mixed with the compressor oil.
(3) Remove caps from suction service valve (4, fig. 5) and discharge service valve (6, fig. 15).
(4) Close suction service valve fully, and close discharge service valve two turns only.
(5) Watch low pressure gage (1, fig. 17), and when zero pounds is reached, shut off engine and completely close discharge service valve.
(6) If pressure rises rapidly to 15 pounds or more pressure, it indicates there is considerable refrigerant mixed with the compressor oil and (1) through (5) above must be repeated. Pressure will rise slowly even when there is the least amount of refrigerant mixed with the compressor oil, for some of the gas will be continually released.
(7) When the pressure rises slowly to 2 or 3 pounds pressure, the compressor may be opened.

Caution: Do not open the compressor if the low pressure gage registers below zero pounds pressure.

b. Remove brine agitator and machine compartment covers (par. 7*f*(1)(*l*) and (*m*)).

c. Remove fuel tank (par. 63*a*).

d. Disconnect low pressure cutoff switch connection (13, fig. 23) from compressor.

e. Disconnect high pressure cutout switch connection from compressor.

f. Remove cap screws (2) and lockwashers holding suction service valve (1) to compressor and take off valve and discard gasket.

g. Remove cap screws and lockwashers holding discharge service valve (8) to compressor and take off valve and discard gasket.

h. Loosen cap screws (1, fig. 12) and slide gear box enough to remove brine agitator belt from drive pulley.

i. Remove the four nuts (5, fig. 13), lockwashers, and bolts which hold the compressor base to the supporting bars, and move compressor enough to remove drive belts.

j. Place sling carefully under front and rear crankshaft supports (fig. 42) of compressor crankcase and hoist compressor out of machine compartment, being careful not to allow it to hit condenser (13, fig. 4).

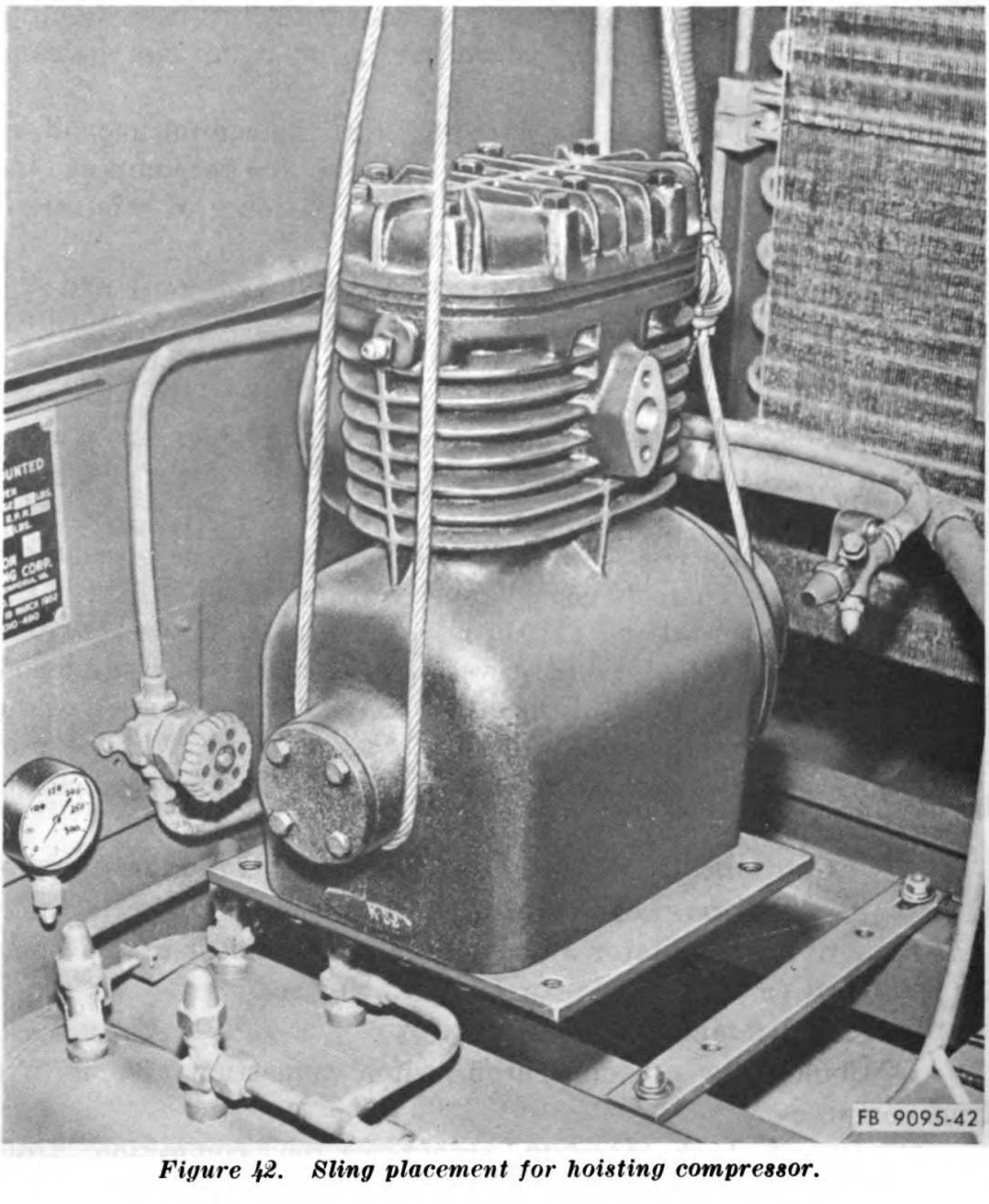


Figure 42. Sling placement for hoisting compressor.

87. Compressor Installation

a. Place sling carefully under front and rear crankshaft supports (fig. 42) and lower compressor into machine compartment, being careful not to allow it to hit condenser (13, fig. 4).

b. Attach compressor base to support bars with bolts, lockwashers, and nuts (5, fig. 13).

c. Attach drive belts to compressor and adjust tension and alinement (par. 7*f*(1) (*a*)–(*g*)).

d. Attach brine agitator belt and adjust tension and alinement (par. 7*f*(1) (*n*)–(*u*)).

e. Using new gasket, attach discharge service valve (8, fig. 23) to compressor with cap screws and lockwashers.

f. Using new gasket, attach suction service valve (1) to compressor with cap screws (2) and lockwashers.

g. Connect high pressure cutout switch connection (13) to compressor.

h. Connect low pressure cutout switch connection (6) to compressor.

i. Install fuel tank (par. 63*c*).

j. Install machine compartment and brine agitator covers (par. 7*f*(1) (*v*)).

k. Check compressor oil level and add oil if necessary (par. 15*b*(5)).

l. Purge the compressor as follows:

(1) Make sure receiver outlet and compressor discharge service valves are fully closed. Open compressor suction service valve.

(2) Remove plug from discharge service valve purge port (7, fig. 23).

(3) Partially open receiver outlet valve (9, fig. 5). Allow gas to escape through purge port for 5 or 6 seconds to remove air in the low side of the system, then close receiver outlet valve and install purge port plug.

m. Open discharge service valve (8, fig. 23) and test for leaks (par. 7*h*(1)).

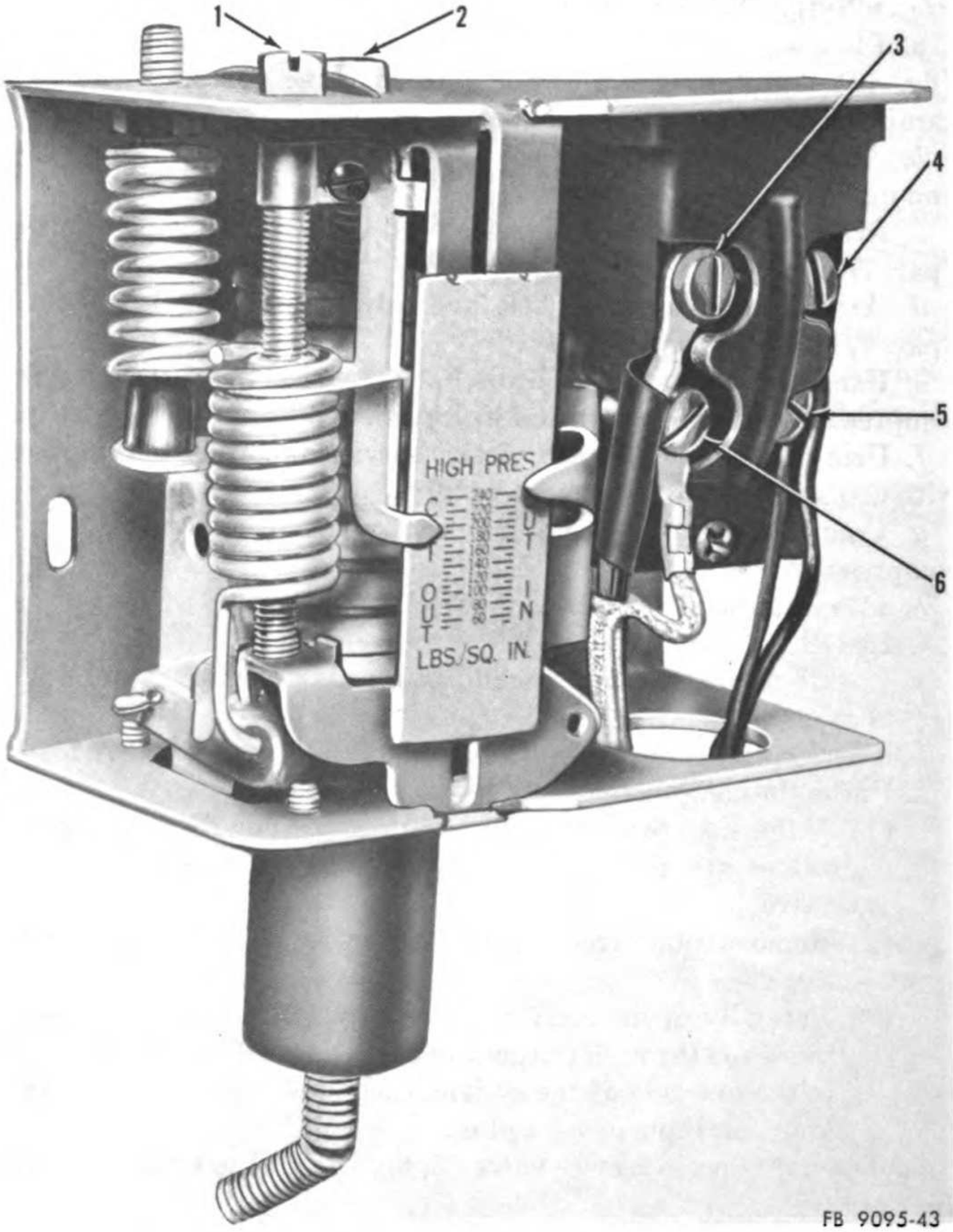
n. Install machine compartment and brine agitator covers (par. 7*f*(1) (*v*)).

88. Compressor Efficiency Test

If the suction or discharge valves in the compressor leak, the compressor will not operate efficiently. Compressor efficiency may be tested before removing the compressor from the ice plant. Compressor must be warm before testing.

a. Start and operate the ice plant (par. 13) for at least one hour.

b. Electrical connections for both high and low pressure cutout switches are identical (fig. 43). Take out screw (5, fig. 20), remove cover from low pressure cutout switch (4) and disconnect magneto wire (3, fig. 43).



1 Differential adjusting screw
2 Range adjusting screw
3 Magneto wire terminal
4 Battery terminal
5 Bell terminal
6 Ground terminal

Figure 43. High pressure cutout switch, cover removed.

c. Remove cap from suction service valve (1, fig. 23) and close valve. Operate compressor until highest vacuum is obtained (low pressure gage will remain stationary).

d. Remove cap from discharge service valve (8).

e. Stop engine (par. 14) and immediately close discharge service valve.

f. Observe pressure gages. Efficient suction valves will hold an 18-inch vacuum against 125 pounds head pressure. Low pressure gage will now begin to rise very slowly, due to gas being released from compressor oil. If low pressure gage rises fairly rapidly, leaky cylinder head gasket or leaky suction and discharge valves are indicated.

g. Open discharge service valve about two turns. Low pressure gage should not change noticeably. If low pressure gage begins to rise rapidly after discharge service valve is opened, leaky discharge valves are indicated.

h. Open suction service and discharge service valves fully and install caps.

i. Connect magneto wire to low pressure cutout switch and install cover.

j. If leaky suction or discharge valves are indicated by compressor efficiency test, replace valve plate assembly (pars. 89*a–e* and 91*f–m*).

89. Compressor Cylinder Head and Valve Plate Removal and Disassembly

a. Pump out the compressor (par. 86*a*).

b. Remove brine agitator and machine compartment covers (par. 7*f* (1) (*l*) and (*m*)).

c. Remove fuel tank (par. 63*a*).

d. Disconnect high pressure cutout switch connection (6, fig. 23) from compressor.

e. Remove cap screws (4), discard copper gaskets, and take off cylinder head (5), valve plate assembly, and the two gaskets. Discard the gaskets (13 and 17, fig. 44).

Caution: Do not pry cylinder head or valve plate loose from compressor body. If they do not come off readily, place a block of wood against side of head or valve plate and tap with hammer to loosen.

f. Remove cap screws (1) and lockwashers (2) and carefully take off discharge valve retainers (3), discharge valve springs (5), spacers (6), dowels (4), and discharge valve reeds (7).

Note. **Tag all valve parts so that if they must be used again they will be installed in original positions.**

g. Remove cap screws (12) and take off suction valve retainers (11), spacers (10), and suction valve reeds (9).

h. Coat exposed inner parts of compressor body (18) heavily with compressor oil and cover with paper.

90. Compressor Cylinder Head and Valve Plate Cleaning and Inspection

a. Soak all metal parts in an approved cleaning solvent and wipe dry.

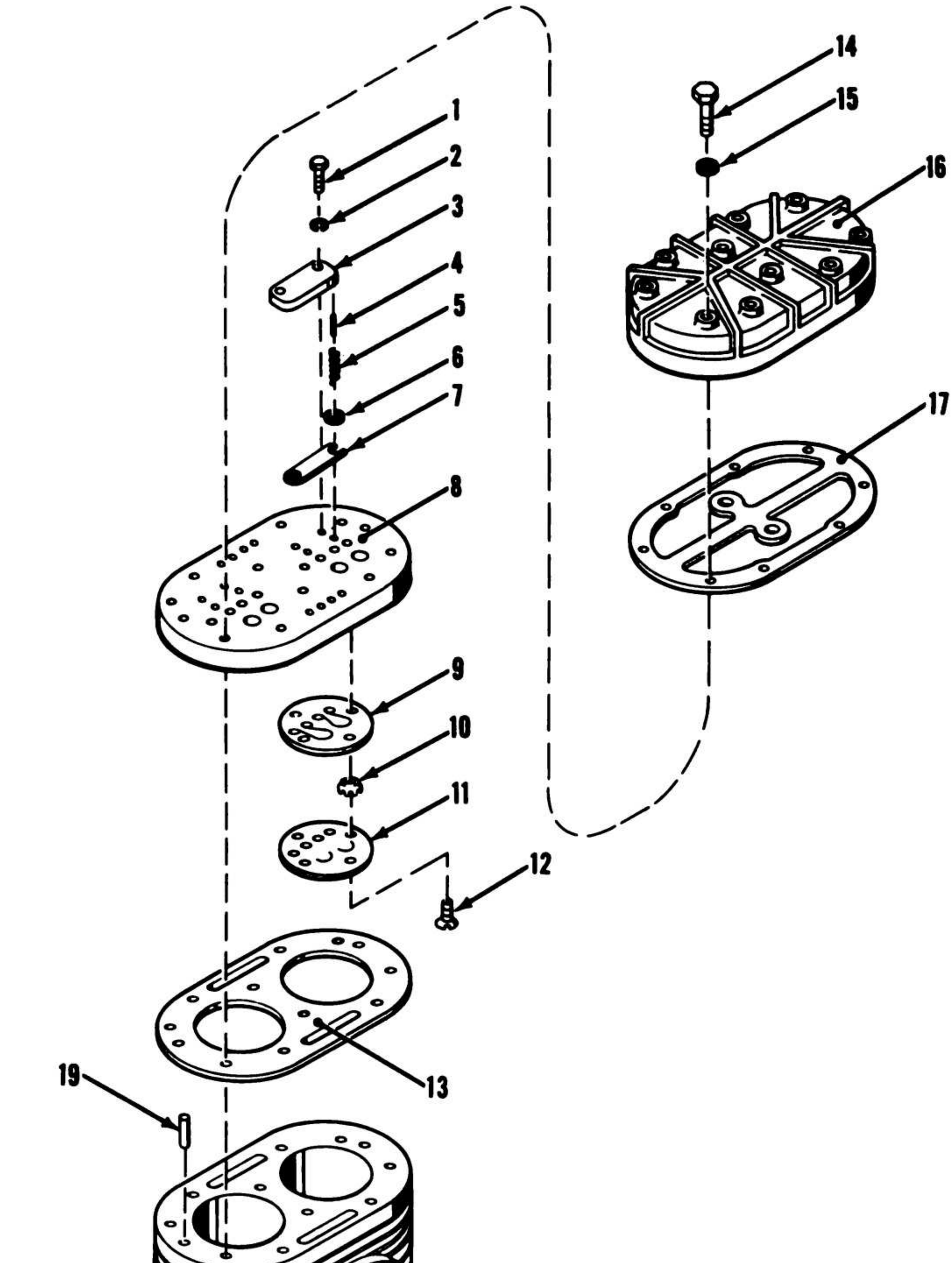


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Figure 44. Compressor cylinder head and valve plate assembly, exploded view.

b. Inspect cylinder head, valve plate, compressor body for rust or corrosion. Carefully remove gasket material and rust or corrosion by scraping.

c. Inspect valve plate with magnifying glass for nicks or dents around valve seats. If nicks or dents are found around valve seats, replace entire valve plate assembly.

d. Inspect valve reeds for warping or improper seating. If any reeds are warped or do not seat properly, replace all reeds, springs and dowels.

e. Inspect springs, and if they tend to stay compressed, replace all springs and dowels.

91. Compressor Cylinder Head and Valve Plate Reassembly and Installation

a. Attach suction valve reeds (9, fig. 44) to valve plate (8) with spacers (10), suction valve retainers (11), and screws (12).

Note. If new valve parts are not used, make sure that all valve parts are installed in positions from which they were removed.

b. Place dowel pins (4) in dowel pin holes and position discharge valve reeds (7) on them.

c. Place one spacer (6) on each dowel pin so that one rests on each end of each reed.

d. Place one spring (5) on each spacer, and another spacer on each spring.

e. Place another spring on each spacer and hold down springs and spacers so that tops of dowel pins are exposed.

f. Place discharge valve retainer (3) on dowel pins and attach to valve plate with lockwashers (2) and cap screws (1).

1 Screw, cap, hex, ¼–20 x 1 (4 rqr)
2 Lockwasher, ¼ (4 rqr)
3 Retainer, discharge valve (2 rqr)
4 Pin, dowel, discharge valve (4 rqr)
5 Spring, discharge valve (8 rqr)
6 Spacer, discharge valve (8 rqr)
7 Reed, discharge valve (2 rqr)
8 Plate, valve
9 Reed, suction valve (2 rqr)
10 Spacer, suction valve (4 rqr)
11 Retainer, suction valve (2 rqr)
12 Screw, cap, rd hd, ¼–20 x 7/16 (4 rqr)
13 Gasket, valve plate
14 Screw, cap, hex, ⅜–16 x 2½ (10 rqr)
15 Gasket, copper, ⅜ (10 rqr)
16 Cylinder head
17 Gasket, cylinder head
18 Compressor body assembly
19 Pin, dowel, cylinder head (2 rqr)

***Figure 44*—Continued.**

g. Place a new gasket (13), lightly coated with compressor oil, on cylinder head dowel pins (19) and carefully place valve plate assembly, with discharge valves on top, on dowel pins and gasket.

h. Place a new gasket (17), lightly coated with compressor oil, and cylinder head (16) on valve plate assembly and attach with new copper gaskets (15) and cap screws (14), tightening the cap screws to hand-tightness only.

i. Using a torque wrench, first tighten the two center cap screws, then the four side cap screws, and finally the four end cap screws, to a reading on the torque wrench of 40–50 foot-pounds.

j. Connect high pressure cutout switch connection (6, fig. 23) to compressor.

k. Purge the compressor (par. 87*l*).

l. Test compressor for leaks (par. 7*h*(1)).

m. Install fuel tank (par. 63*c*).

n. Install machine compartment and brine agitator covers (par. 7*f*(1)(*v*)).

Section XIV. RECEIVER TANKS

92. Description

The receiver consists of two 23½-inch steel tanks, 5 inches in diameter. Under normal conditions, both tanks contain a full charge of refrigerant, and either tank may be used to operate the system. The tank not being used to operate the system contains a spare charge of refrigerant, and they are interconnected so that refrigerant may be transferred from one tank to the other, and so that system operation may be easily changed from one tank to the other. Each tank is equipped with inlet and outlet valves, 212° F. fusible plugs to relieve pressure due to excess heat, and capped pin-hole vents for purging air from the tank.

93. Receiver Tank Removal

a. Remove all refrigerant from the system (par. 15*b*(3)), and close all valves.

b. Disconnect refrigerant lines from receiver inlet (13, fig. 14) and outlet (12) valves of both tanks.

c. Remove nuts, lockwashers, and bolts (9) which connect the straps holding the receiver tanks to frame.

d. Remove one or both receiver tanks.

94. Receiver Tank Inspection

a. Inspect tanks for chipped or damaged paint and repaint, if necessary (par. 31).

b. Inspect valve couplings for stripped or worn threads and replace valves, if defective.

c. Check fusible plugs and make sure they are in good condition and do not leak. If plug is in poor condition or leaks, replace tank.

95. Receiver Tank Installation

a. Place receiver tanks in straps in machine compartment and secure straps with bolts (9, fig. 14), lockwashers, and nuts.

b. Connect condenser outlet line to receiver inlet valves (13), of both tanks and connect liquid refrigerant line (containing refrigerant sight glass) to receiver outlet valves (12) of both tanks.

c. Charge each tank with refrigerant (par. 15*b*(2)(*b*)).

d. Replace dehydrator cartridges (par. 102*a*(1)–(10)).

e. Test for leaks (par. 7*h*(1)).

f. Purge the system (par. 15*b*(4)).

Section XV. DEHYDRATOR BY-PASS VALVES

96. Description

The refrigeration system is equipped with two steel 3-way valves, one before and one after the dehydrator, which are used to control the direction of flow of the liquid refrigerant, allowing it to flow either directly to the thermostatic expansion valve or through the dehydrator to the thermostatic expansion valve.

97. Dehydrator Bypass Valve Removal

a. Pump down the system (par. 15*b*(1)), and close all valves.

b. Remove machine compartment cover (par. 7*f*(1)(*l*).

c. Remove fuel tank (par. 63*a*).

d. Remove bolts (5, fig. 16), nuts and lockwashers, holding valves (6) to frame.

e. Remove bypass line (5, fig. 30) from both valves.

f. Using a blowtorch, heat each refrigerant line connection at each valve evenly until joint separates, then remove valve.

Warning: **Make sure to move fuel tank and other gasoline fittings well away from area in which blowtorch is used.**

98. Dehydrator Bypass Valve Installation

a. Considering valve cap to be the front of the valve (2, fig. 45), and with flare connector on bottom, braze the refrigerant line (6) from the heat exchanger (10) to the rear joint of one valve.

b. Braze line (3) leading to the dehydrator body (4) to front joint of same valve.

c. Braze line (5) from dehydrator cap to front joint of other valve.

d. Braze line (1) leading to the thermostatic expansion valve (9) to rear joint of same valve.

e. Mount valves on frame member above fuel tank using bolts (5, fig. 16), lockwashers, and nuts.

f. Connect the two valves to each other with the short bypass line (11, fig. 45).

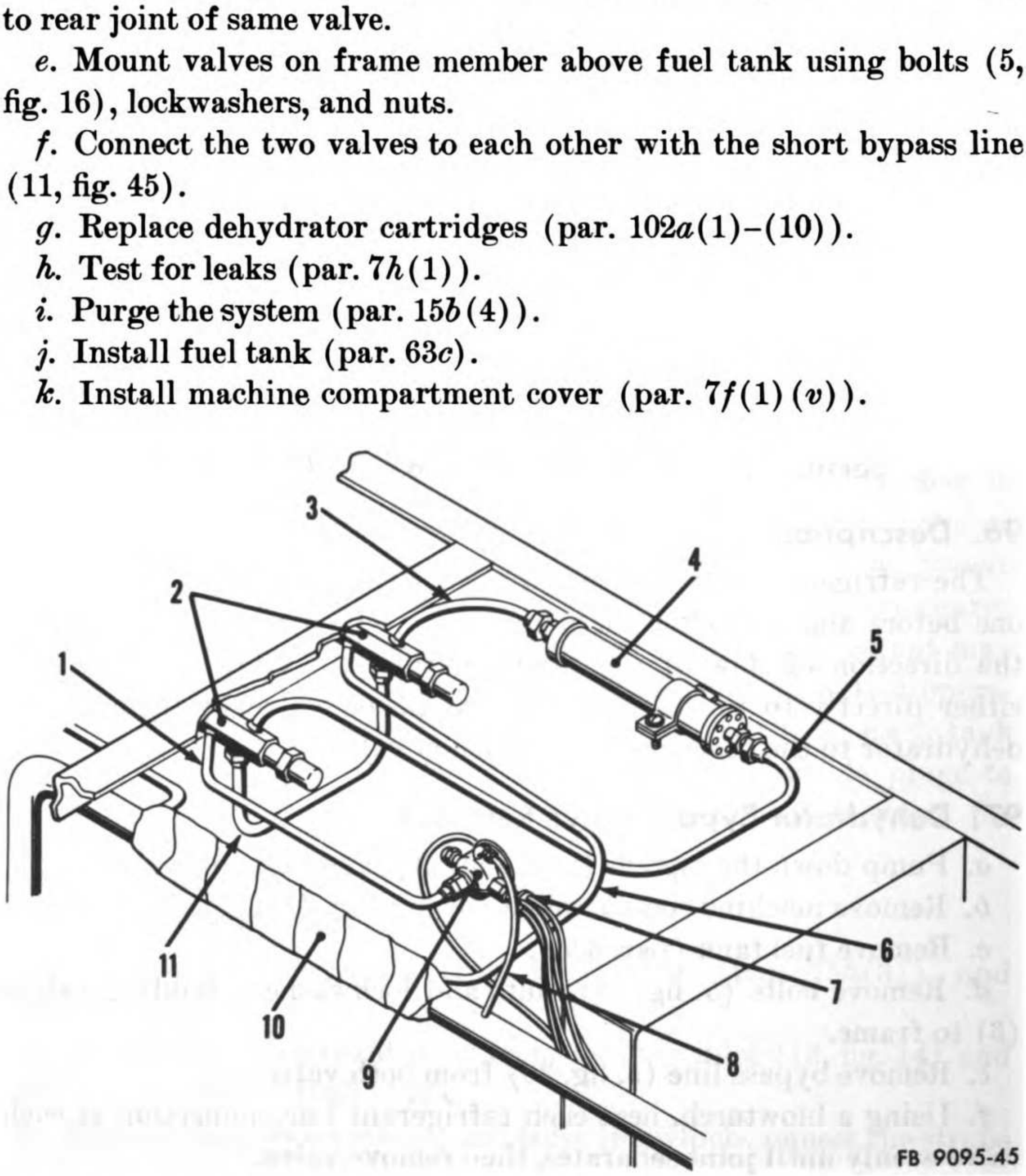
g. Replace dehydrator cartridges (par. 102*a*(1)–(10)).

h. Test for leaks (par. 7*h*(1)).

i. Purge the system (par. 15*b*(4)).

j. Install fuel tank (par. 63*c*).

k. Install machine compartment cover (par. 7*f*(1)(*v*)).



1 Thermostatic expansion valve line
2 Dehydrator bypass valve
3 Dehydrator line
4 Dehydrator
5 Dehydrator line
6 Heat exchanger line
7 Refrigerant distributor
8 Equalizer line
9 Thermostatic expansion valve
10 Heat exchanger
11 Bypass line

Figure 45. Refrigerant components and lines above fuel tank.

Section XVI. DEHYDRATOR

99. Description

The liquid, or low pressure, side of the refrigeration system contains a dehydrator to remove moisture from the system. It consists of a container and two removable silica gel cartridges, through which all the liquid refrigerant must pass when the dehydrator bypass valves are open.

100. Dehydrator Removal and Disassembly

a. Pump down the system (par. 15*b*(1)) and close all valves.

b. Remove machine compartment cover (par. 7*f*(1)(*l*)).

c. Disconnect refrigerant lines (3 and 5, fig. 45) from dehydrator (4), remove bolt (9, fig. 30) and nut from strap holding dehydrator, and take dehydrator out.

d. Remove nuts and bolts holding cap in place, take off cap and remove spring.

e. Take out the two silica gel cartridges and sealing washers.

f. Unscrew couplings from dehydrator cap and body.

101. Dehydrator Reassembly and Installation

a. Screw flare couplings (1, fig. 46) into dehydrator body (2) and cap (6).

b. Place dehydrator body in strap with open end pointing away from engine, and secure with bolt (9, fig. 30) and nut.

c. Connect refrigerant line (3, fig. 45) to dehydrator body.

d. Remove new silica gel cartridges (4, fig. 46) from sealed package and place sealing washer (3), cartridge, remaining sealing washer, and remaining cartridge into dehydrator body (2).

Note. **Do not break cartridge package sealing or expose cartridges to air until ready to install in dehydrator.**

e. Install spring (5) and dehydrator cap (6) and secure with nuts (8) and bolts (7).

f. Open dehydrator bypass valves (2, fig. 45).

g. Open receiver outlet valve (12, fig. 14) slightly and allow refrigerant to escape through end of dehydrator for 3 or 4 seconds to purge air from dehydrator, then close valve.

h. Connect refrigerant line (5, fig. 45) to dehydrator cap.

i. Purge the system (par. 15*b*(4)).

j. Test for leaks (par. 7*h*(1)).

k. Install machine compartment cover (par. 7*f*(1)(*v*)).

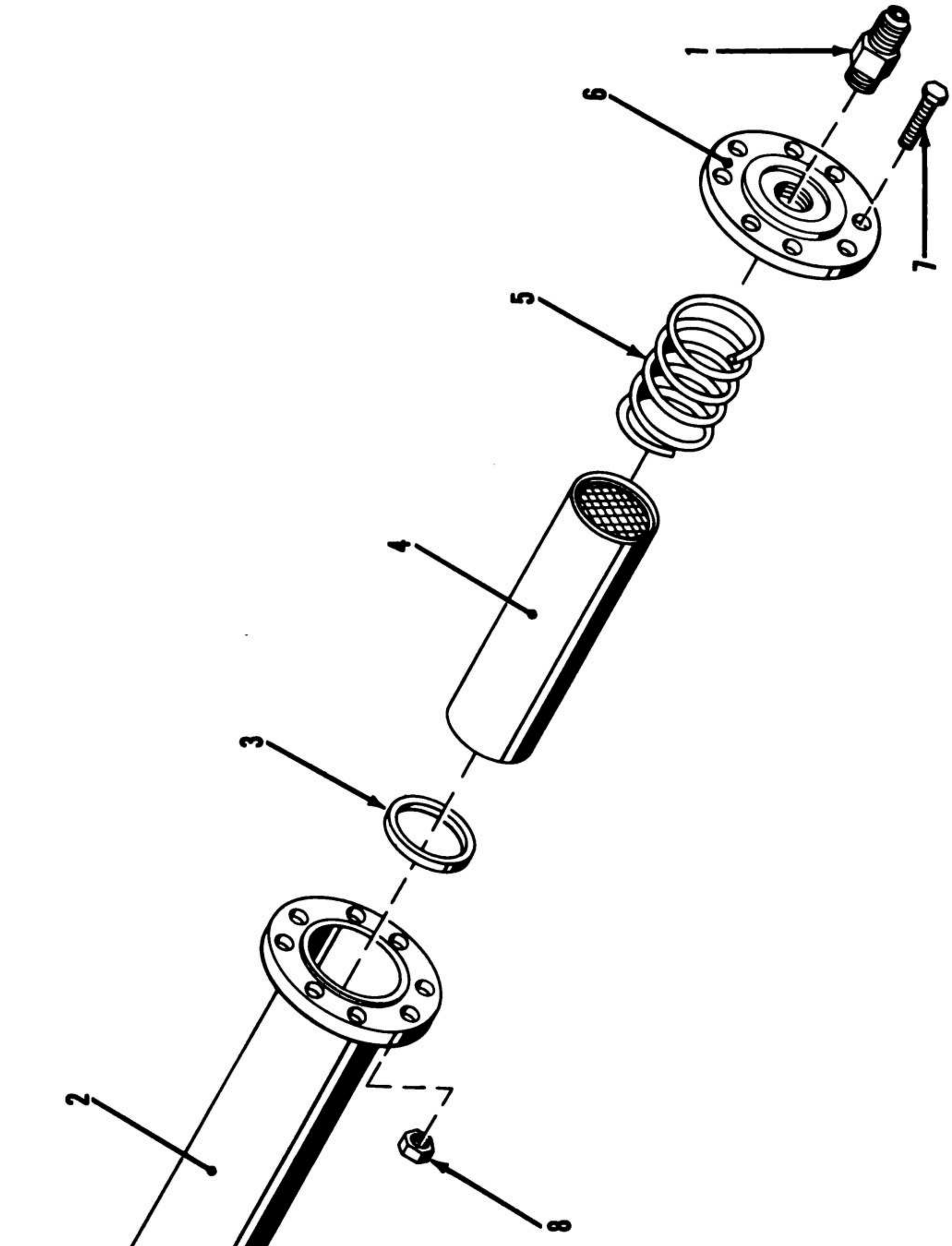


Figure 46. Dehydrator, exploded view.

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1 Flare coupling, ⅜ (2 rqr)
2 Dehydrator body
3 Sealing washer (2 rqr)
4 Silica gel cartridge (2 rqr)
5 Spring
6 Dehydrator cap
7 Bolt, hex, ¼–20 x 1 (8 rqr)
8 Nut, hex, ¼–20 (8 rqr)

Figure 46—Continued.

102. Changing Dehydrator Cartridges Without Removing Dehydrator

a. Preferred Method of Cartridge Replacement.

(1) Pump down the system (par. 15*b*(1)).
(2) Remove machine compartment cover (par. 7*f*(1)(*l*)).
(3) Disconnect refrigerant line (5, fig. 45) from dehydrator cap.
(4) Remove nuts and bolts, take off dehydrator cap and remove spring.
(5) Remove cartridges and sealing washers.
(6) Perform steps *d* through *k*, paragraph 101.

b. Emergency Cartridge Replacement. Should cartridges need changing while ice is badly needed, they may be replaced while system is in operation. This is not recommended as a general practice because air is taken into the system.

(1) Remove machine compartment cover (par. 7*f*(1)(*l*)).
(2) Close dehydrator bypass valves (2, fig. 45).
(3) Follow steps in paragraph 102*a*(3) through (5) and paragraph 101*d* and *e*.
(4) Open dehydrator bypass valve nearest dehydrator (4) very slightly and allow slight amount of refrigerant to escape to purge air from dehydrator, then close valve.
(5) Connect refrigerant line (5) to dehydrator cap and open both dehydrator bypass valves.
(6) Test dehydrator for leaks (par. 7*h*(1)).
(7) Install machine compartment cover (par. 7*f*(1)(*v*)).
(8) As soon as possible, purge the system (par. 15*b*(4)).

Section XVII. CHECK VALVE

103. Description

The refrigeration system is equipped with a brass, one-way, spring loaded check valve in the high pressure line between the compressor and the condenser to prevent gas from flowing back toward the compressor when compressor pressure is lower than condenser pressure.

104. Check Valve Removal

a. Pump down the system (par. 15*b*(1)), and close all valves.
b. Remove machine compartment cover (par. 7*f*(1)(*l*).
c. Remove fuel tank (par. 63*a*).
d. Remove condenser purge port cap (1, fig. 16).
e. Using a blowtorch, heat each refrigerant line connection to check valve (3) evenly until joint separates, then remove valve.

Warning: **Make sure to move fuel tank and other gasoline fittings well away from area in which blowtorch is used.**

105. Check Valve Installation

a. Braze to refrigerant lines near condenser purge port (1, fig. 16) to check valve (3) so that removable retaining cap angles upward.

Caution: **It is important that check valve be placed in proper position before brazing. If valve is reversed, it will shut off flow from compressor to condenser and considerable damage may result. Test valve by blowing through openings. Opening which, when blown through, allows air to pass through valve must be connected to line from compressor. Opening which, when blown through, does not allow air to pass through must be connected to condenser.**

b. Install condenser purge port cap.

c. Replace dehydrator cartridges (par. 102*a*(1)–(10)).

d. Test for leaks (par. 7*h*(1)).

e. Purge the system (par. 15*b*(4)).

f. Install fuel tank (par. 63*c*).

g. Install machine compartment cover (par. 7*f*(1)(*v*)).

Section XVIII. VIBRATION ELIMINATORS

106. Description

The refrigeration system contains two pliable, reinforced hose sections (7, fig. 12), one on each side of the compressor, which are brazed to the refrigerant lines and are used as flexible couplings to prevent vibrations from the compressor from reaching the rest of the refrigeration system.

107. Vibration Eliminator Removal

a. Pump down the system (par. 15*b*(1)), and close all valves.

b. Remove machine compartment cover (par. 7*h*(1)(*l*)).

c. Remove fuel tank (par. 63*a*).

d. Remove condenser purge port cap (10, fig. 4) and open refrigeration bypass valve (3, fig. 5).

e. Using a blowtorch, heat each refrigerant line connection to vibration eliminator (7, fig. 12) evenly until joint separates, then remove vibration eliminator.

Warning: **Make sure to move fuel tank and other gasoline fittings well away from area in which blowtorch is used.**

Caution: **Be very careful to apply blowtorch only to metal connections at ends of vibration eliminator.**

108. Vibration Eliminator Installation

a. Braze the vibration eliminator (7, fig. 12) to the refrigerant lines, being very careful to apply heat to the metal ends only.

b. Install condenser purge port cap (10, fig. 4).

c. Replace dehydrator cartridges (par. 102*a*(1)–(10)).

d. Test for leaks (par. 7*h*(1)).

e. Purge the system (par. 15*b*(4)).

f. Install fuel tank (par. 63*c*).

g. Install machine compartment cover (par. 7*f*(1)(*v*)).

Section XIX. HEAT EXCHANGER

109. Description

The heat exchanger consists of a ½-inch liquid refrigerant line coiled around a 1⅛-inch gas line, the whole unit being covered with sponge rubber for insulation. The liquid lines from the receiver and to the dehydrator bypass valve are brazed to the liquid line of the heat exchanger, and the gas lines from the cooling coils and to the compressor are brazed to the gas line of the heat exchanger. When the system is in operation, heat passes from the liquid to the gas, aiding the efficiency of the refrigeration cycle.

110. Heat Exchanger Removal

a. Pump down the system (par. 15*b*(1)), and close all valves.

b. Remove machine compartment cover (par. 7*f*(1)(*l*)).

c. Remove fuel tank (par. 63*a*).

d. Remove condenser purge port cap (10, fig. 4) and open refrigeration bypass valve (3, fig. 5).

e. Using a blowtorch, heat each refrigerant line connection to heat exchanger (4, fig. 16) evenly until joint separates, then remove heat exchanger.

Warning: Make sure to move fuel tank and other gasoline fittings well away from area in which blowtorch is used.

Caution: Be very careful to apply blowtorch only to metal connections of heat exchanger.

111. Heat Exchanger Installation

a. Carefully place heat exchanger (4, fig. 16) so that gas refrigerant lines aline and liquid refrigerant lines aline.

b. Braze the heat exchanger to the refrigerant lines, being careful to apply heat to the metal connections only in order not to damage sponge rubber insulation.

c. Install condenser purge port cap (10, fig. 4).
d. Replace dehydrator cartridges (par. 102*a*(1)–(10)).
e. Test for leaks (par. 7*h*(1)).
f. Purge the system (par. 15*b*(4)).
g. Install fuel tank (par. 63*c*).
h. Install machine compartment cover (par, 7*f*(1)(*v*)).

Section XX. CONDENSER

112. Description

The refrigeration system contains a condenser, or cooling radiator, in the circuit between the compressor and the receiver. It consists of three ½-inch refrigerant lines mounted in cooling fins and running back and forth across the width of the unit. The condenser fan draws air through the condenser into the machine compartment to cool and condense the gas inside the refrigerant lines.

113. Condenser Removal

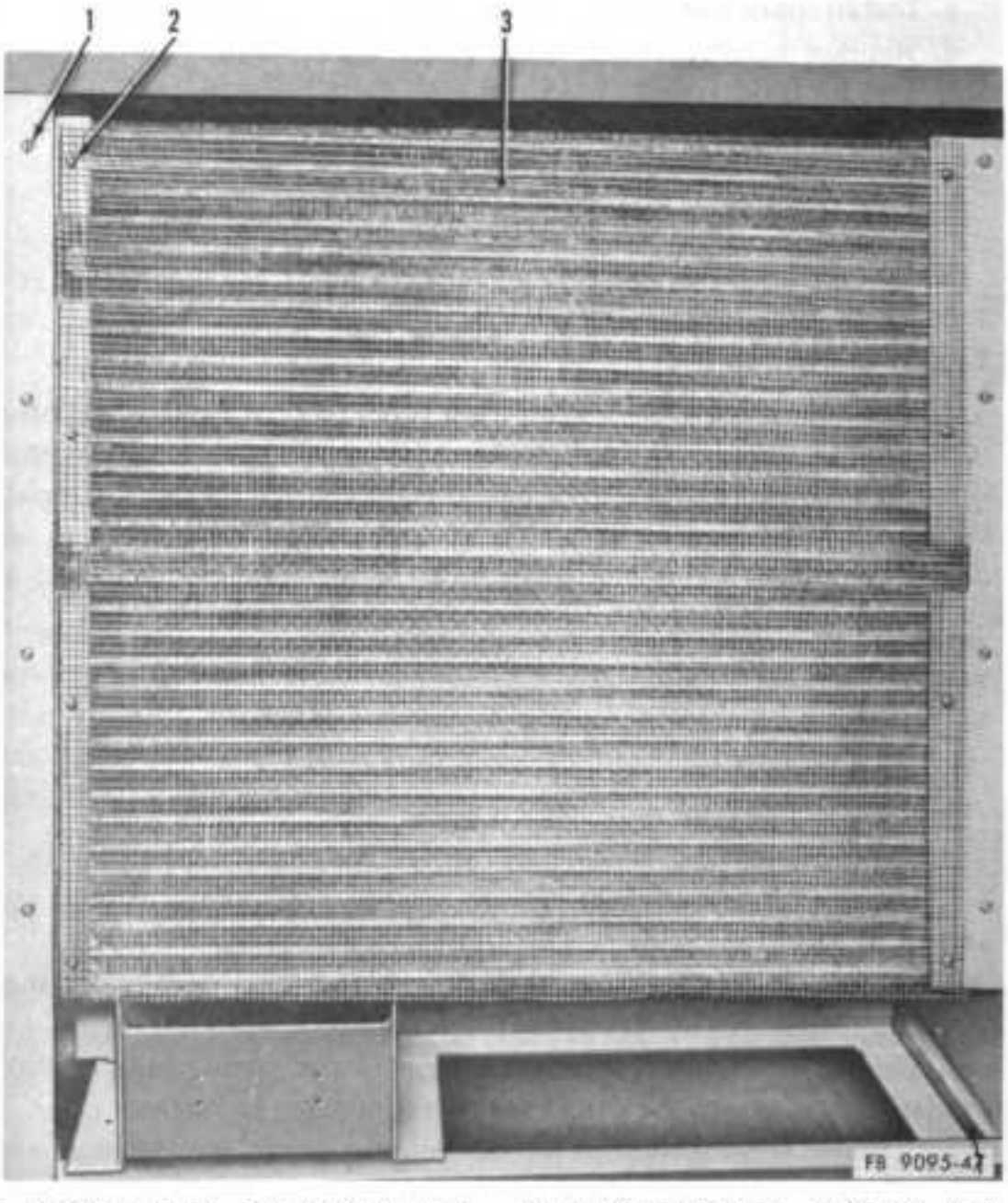
a. Pump down the system (par. 15*b*(1)).
b. Remove machine compartment cover (par. 7*f*(1)(*l*)).
c. Remove fuel tank (par. 63*a*).
d. Remove condenser purge port cap (1, fig. 16).
e. Using a blowtorch, heat refrigerant line connections at inlet (2) and outlet (9) of condenser evenly until joints separate.

Warning: Make sure to move fuel tank and other gasoline fittings well away from area in which blowtorch is used.

f. Remove sheet metal screws (1, fig. 47) and spring nuts holding condenser brackets to frame and take out condenser and screen.
g. Remove sheet metal screws (2) holding screen to condenser and take off screen.

114. Condenser Installation

a. Attach screen to condenser using binder head sheet metal screws (2, fig. 47).
b. Using sheet metal screws (1) and spring nuts, attach condenser brackets to frame, making sure that inlet (2, fig. 16) and outlet (9) connections are nearest wall between machine compartment and brine tank.
c. Silver-solder refrigerant line from compressor to inlet (2) (top) connection of condenser.



1 Screw, hex hd, sheet mtl, type Z #10 x 58 (8 rqr)
2 Screw, binder hd, sheet mtl, type A #10 x ½ (8 rqr)
3 Condenser screen

Figure 47. Condenser and screen, front view.

d. Silver-solder refrigerant line to receiver to outlet (9) (bottom) connection of condenser.

e. Install condenser purge port cap (1).

f. Replace dehydrator cartridges (par. 102*a*(1)–(10)).

g. Test for leaks (par. 7*h*(1)).

h. Purge the system (par. 15*b*(4)).

i. Install fuel tank (par. 63*c*).

j. Install machine compartment cover (par. 7*f*(1)(*v*)).

Section XXI. THERMOSTATIC EXPANSION VALVE

115. Description

The refrigeration system contains a thermostatic expansion valve which automatically regulates the amount of liquid refrigerant fed to the cooling coils, so that they are not too full, and so that the gas leaving them is a few degrees warmer than the liquid.

116. Thermostatic Expansion Valve Removal

a. Pump down the system (par. 15*b*(1)) and close all valves.

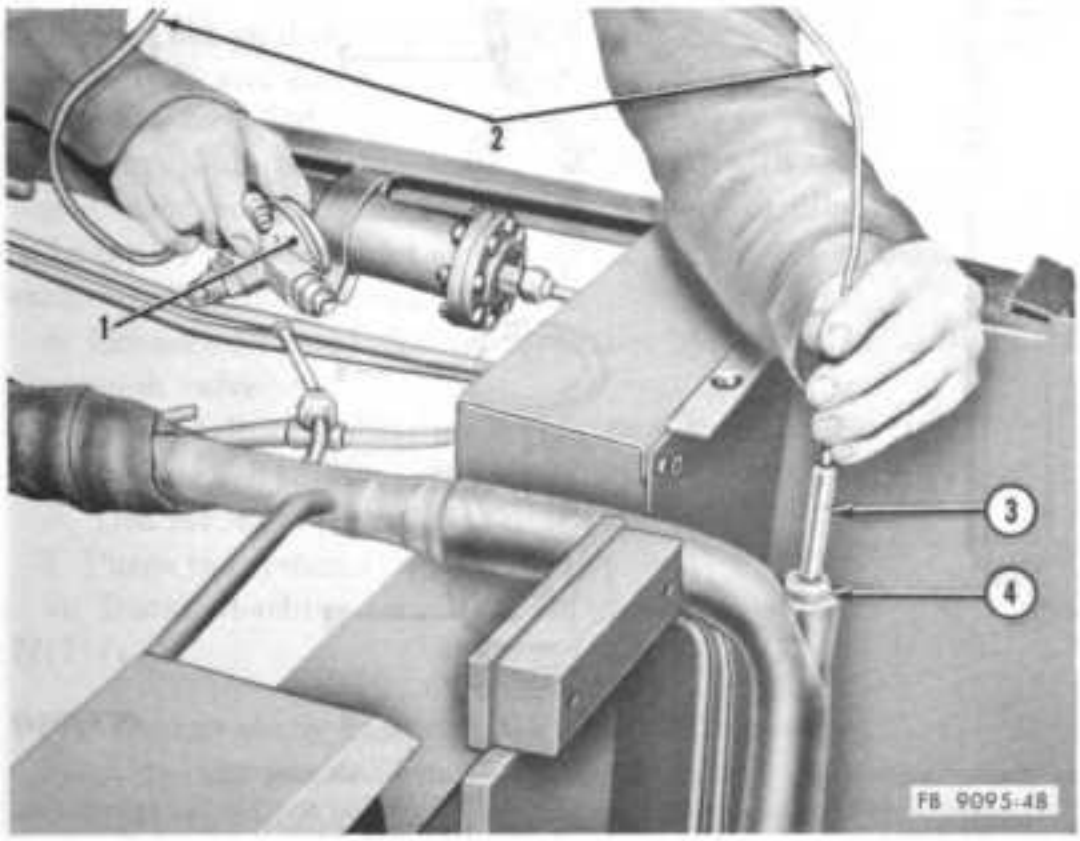
b. Remove machine compartment and brine agitator covers (par. 7*f*(1)(*l*) and (*m*)).

c. Disconnect refrigerant lines (1, 7 and 8, fig. 45) from thermostatic expansion valve (9).

Note. The very small diameter line (2, fig. 48) attached to the round, flat portion of the valve is not a refrigerant line. This is the feeler bulb capillary tube. Do not attempt to remove it from the valve.

d. Carefully remove sealing compound from feeler bulb capillary tube where it enters feeler bulb well (4).

e. Mark the tube where it enters the well.



1 Thermostatic expansion valve
2 Capillary tube
3 Feeler bulb
4 Feeler bulb well

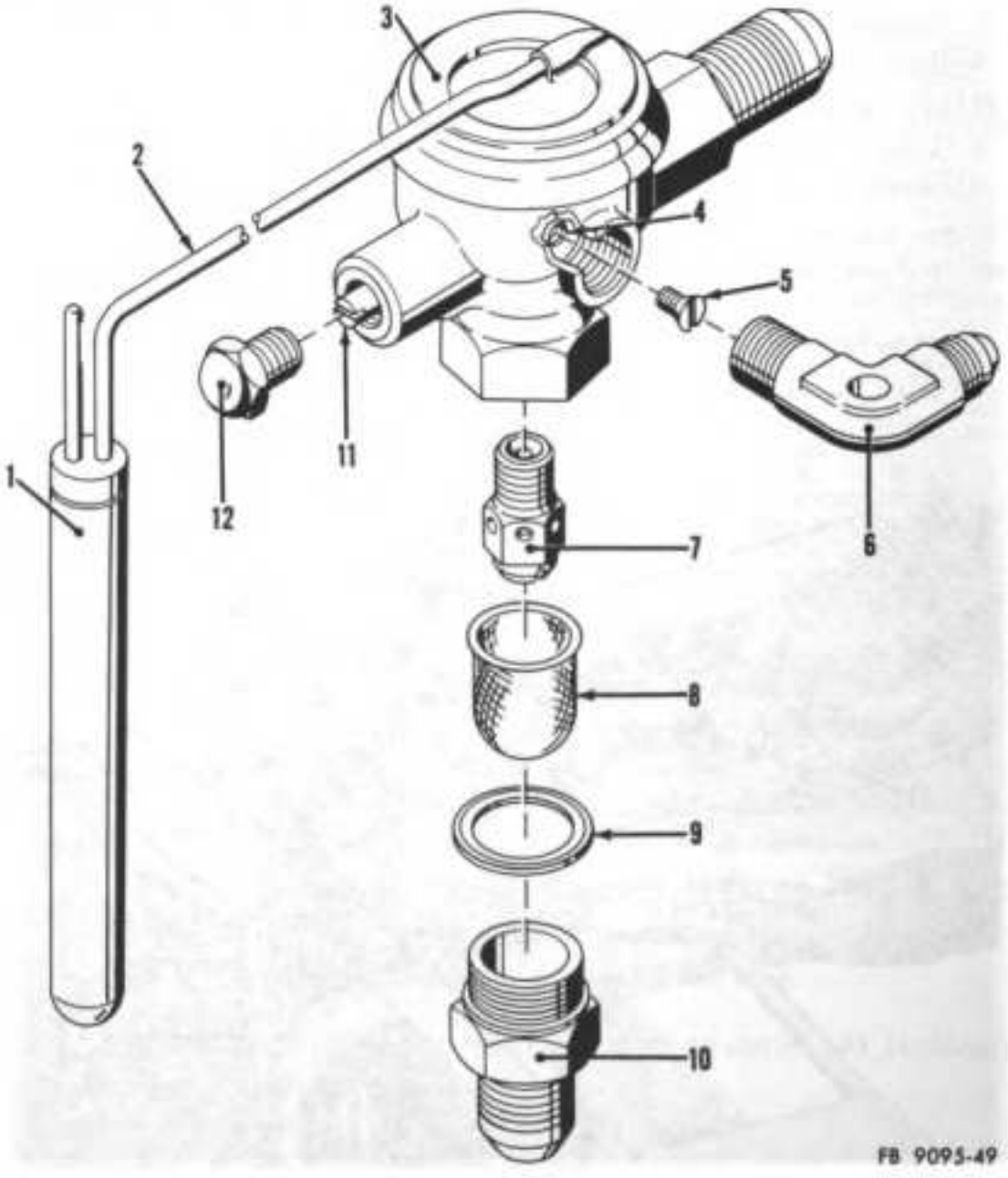
Figure 48. Removing thermostatic expansion valve and feeler bulb.

f. Well is 27½ inches deep and feeler bulb will be at bottom. Carefully pull feeler bulb (3) from the well (4) and remove thermostatic expansion valve (1) and feeler bulb.

117. Thermostatic Expansion Valve Disassembly and Cleaning

a. Remove male connector (10, fig. 49) from bottom of valve body (3) and take out gasket (9) and strainer (8). Discard gasket.

b. Using a socket wrench, carefully remove valve seat assembly (7), making sure that pushrod and gasket remain in valve.



1 Feeler bulb
2 Capillary tube
3 Valve body
4 Internal equalizer opening
5 Equalizer opening screw
6 Male elbow
7 Valve seat assembly
8 Strainer
9 Strainer gasket
10 Male connector
11 Superheat adjustment screw
12 Superheat adjustment screw cap

Figure 49. Thermostatic expansion valve, partially exploded view.

Note. Bottom of valve seat assembly is slotted for disassembly purposes only. Do not use a screwdriver to remove valve seat assembly from valve.

c. Remove male elbow (6) from valve.

d. Soak all removed parts except valve (3) and feeler bulb (1) in an approved cleaning solvent and let dry.

Note. Do not use compressed air to dry valve parts.

e. Look through all openings in valve and make sure there are no obstructions.

118. Thermostatic Expansion Valve Reassembly and Installation

a. Make certain that screw (5, fig. 49) is firmly seated in opening (4).

b. Screw elbow (6) into opening at side of valve (over screw (5)) so that flared end is approximately parallel to horizontal axis of valve.

c. Carefully place valve seat assembly (7) in body of valve so that pushrod fits inside it and tighten in place with socket wrench.

d. Place strainer (8), new gasket (9), and connector (10) over valve seat assembly and tighten connector in place.

e. Place feeler bulb (3, fig. 48) in well (4) and ease it down to bottom, making sure that mark on capillary tube is at top of well. If bulb does not go down far enough so that mark comes to top of well, remove bulb and check for obstruction. Bulb must be at bottom of well when installed.

f. When bulb is in place, seal top of well with sealing compound.

g. Considering round, flat portion (where capillary tube enters) to be top of valve, connect equalizer line (8, fig. 45) (running to heat exchanger) to elbow at side of valve.

h. Connect line (1) from dehydrator bypass valve to bottom of expansion valve.

i. Connect line to distributor (7) to rear of valve.

j. Replace dehydrator cartridges (par. 102*a*(1) through (10)).

k. Test for leaks (par. 7*h*(1)).

l. Purge the system (par. 15*b*(4)).

m. Install machine compartment and brine agitator covers (par. 7*f*(1)(*v*)).

119. Thermostatic Expansion Valve Adjustment

Note. The thermostatic expansion valve is carefully set at the factory and adjustment should not be undertaken unless it is absolutely certain that valve is out of adjustment. Adjustment of this valve to correct any specific faulty operation should be the last corrective measure taken. Only when all other corrective measures have failed should this valve be adjusted, for if it is not the cause of the trouble and is incorrectly adjusted, it will be very difficult to readjust properly.

a. Conditions Requiring Superheat Adjustment (Not Remedied by Any Other Adjustment or Repair).

(1) Excessively low suction pressure (below 10 pounds pressure) indicated by low pressure gage. To remedy, lower superheat.

(2) Suction line warm. To remedy, lower superheat.

(3) Excessively high suction pressure (above 20 pounds pressure, except during the first 12 hours of operation after a shutdown) indicated by low pressure gage. To remedy, raise superheat.

(4) Compressor suction chamber or crankcase cold. To remedy, raise superheat.

(5) Suction line frosted. To remedy, raise superheat.

(6) Excessively low compressor head pressure (below 125 pounds pressure) indicated by higher pressure gage. To remedy, raise superheat.

(7) Liquid refrigerant entering compressor (scrubbing, or pumping noise made by compressor). To remedy, raise superheat.

b. Superheat Adjustment Procedure (fig. 49).

(1) Remove machine compartment cover (par. 7*f*(1)(*l*)).

(2) Remove superheat adjustment screw cap (12) from thermostatic expansion valve (3). Slotted setscrew (11) is the superheat adjustment screw. Superheat is raised by turning screw clockwise. Superheat is lowered by turning screw counterclockwise.

(3) To correct conditions listed in paragraph 119*a*, except (7), raise or lower superheat by turning superheat adjustment screw one-eighth turn in required direction.

(4) Operate ice plant for one hour.

(5) Repeat (3) and (4) above until condition is corrected.

(6) If liquid refrigerant is entering compressor (par. 119*a*(7)), stop engine (par. 14*a*) immediately. Turn superheat adustment screw one-quarter turn clockwise, and start equipment (par. 13). If liquid refrigerant is still entering compressor after 3 or 4 minutes of operation, stop engine, turn superheat adjustment screw one-quarter turn clockwise, and start equipment. Repeat until condition is corrected.

Note. When making superheat adjustments, do not turn superheat adjustment screw more than one complete turn in either direction, since the capacity of the refrigeration system is then changed too much for proper operation. If a complete turn of the superheat adjustment screw does not correct the condition, recheck other probable causes. If there are no other probable causes, replace thermostatic expansion valve (pars. 116 and 118).

(7) Install superheat adjustment screw cap on thermostatic expansion valve.

(8) Install machine compartment cover (par. 7*f*(1)(*v*)).

120. Thermostatic Expansion Valve Cleaning Without Removal

a. Pump down the system (par. 15*b*(1)).

b. Remove machine compartment cover (par. 7*f*(1)(*l*)).

c. Disconnect refrigerant line from male connector (10, fig. 49).

d. Remove male connector and take out gasket (9) and strainer (8).

e. Using socket wrench, carefully remove valve seat assembly (7), making sure that pushrod and gasket remain in valve.

Note. **Bottom of valve seat assembly is slotted for disassembly purposes only. Do not use a screwdriver to remove valve seat assembly from valve.**

f. Repeatedly dip strainer and valve seat assembly in an approved cleaning solvent to remove all dirt, and let dry.

Note. **Do not use compressed air to dry valve parts.**

g. Carefully place valve seat assembly in body of valve so that pushrod fits inside and tighten in place with socket wrench.

h. Place strainer, gasket, and connector over valve seat assembly and tighten connector in place.

i. Connect refrigerant line to connector.

j. Test for leaks (par. 7*h*(1)).

k. Install machine compartment cover (par. 7*f*(1)(*v*)).

Section XXII. PRESSURE CUTOUT SWITCHES

121. Description

The refrigeration system contains two adjustable, automatic, pressure-operated electric switches to ground the engine and magneto and operate an alarm bell in case of excessively high or low pressure. The pressure lines are connected to the high and low pressure sides of the compressor and the switches are set to stop the engine if the high pressure reaches 240 pounds per square inch or the low pressure drops to 2 inches of vacuum.

122. High or Low Pressure Cutout Switch Removal

a. Pump down the system (par. 15*b*(1)).

b. Remove the four sheet metal screws and flat washers holding the small panel (4, fig. 1) in place below the end machine compartment door, and remove panel.

c. Remove the battery wire (which leads from the positive terminal of the batteries to the cutout switch) from the battery.

d. High Pressure Cutout Switch Removal.

(1) Disconnect high pressure cutout switch connection (6, fig. 23) from compressor.

(2) Remove screws (5, fig. 20) at front bottom center of cutout switch (6) and take off cover.

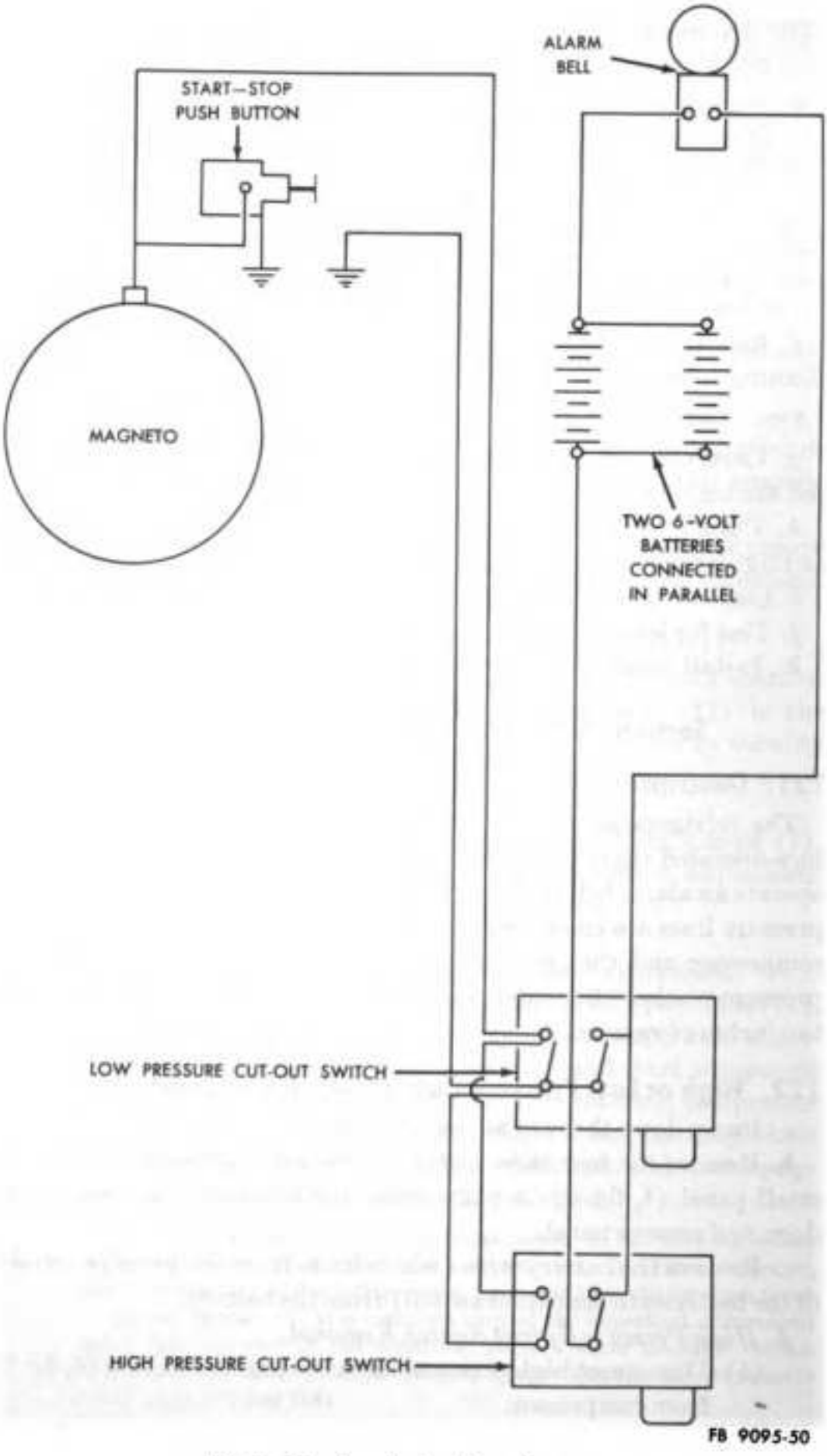
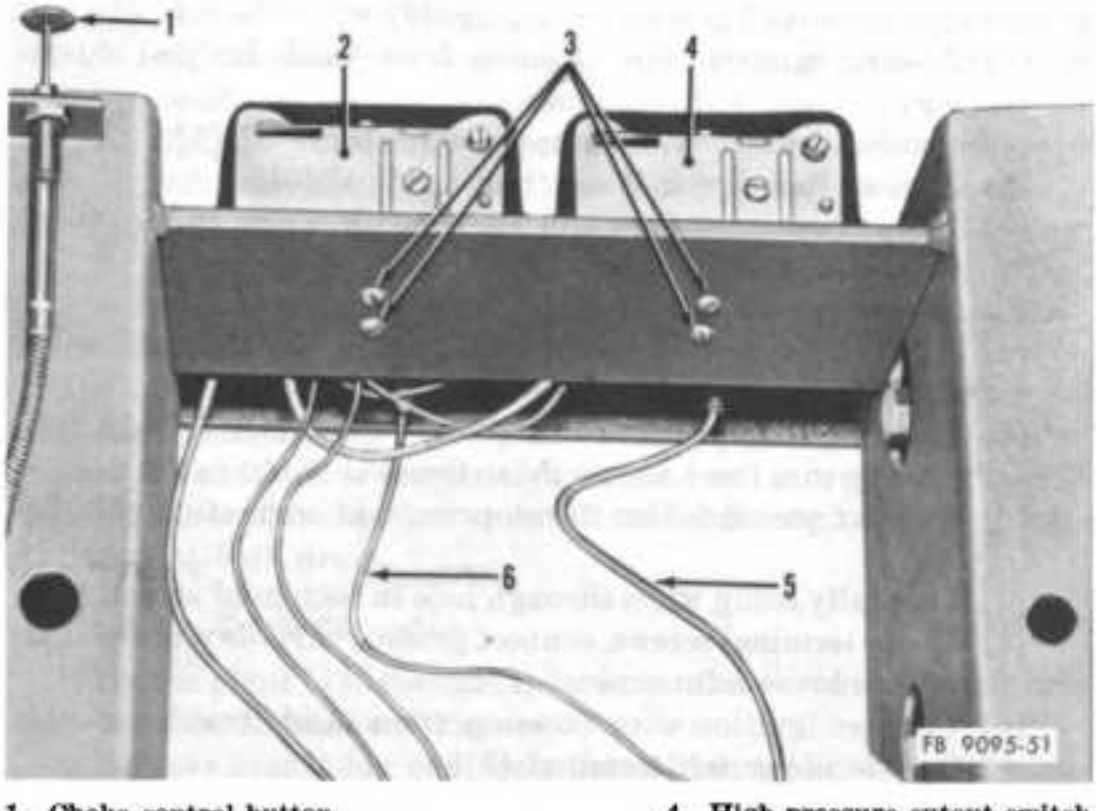


Figure 50. Practical wiring diagram.

(3) Electrical connections for both high and low pressure cutout switches are identical (fig. 43). Remove screws (3, 4, 5, and 6) and carefully take wires from switch through bottom.

(4) Remove the two screws (3, fig. 51) and lockwashers holding switch (4) to frame from rear, and take off switch, being careful not to bend or kink pressure line (5) which was disconnected from compressor.



1 Choke control button
2 Low pressure cutout switch
3 Screw, cap, rd hd, #6-32 x ½ (4 rqr)
4 High pressure cutout switch
5 High pressure line
6 Low pressure line

Figure 51. Cutout switches, rear view.

e. Low Pressure Cutout Switch Removal.

(1) Disconnect low pressure cutout switch connection (13, fig. 23) from compressor.

(2) Remove screw (5, fig. 20) at front bottom center of cutout switch and take off cover.

(3) Electrical connections for both high and low pressure cutout switches are identical (fig. 43). Remove screws (3, 4, 5, and 6) and carefully take wires from switch through bottom.

(4) Remove the two screws (3, fig. 51) and lockwashers holding switch (2) to frame from rear, and take off switch, being careful not to bend or kink pressure line (6) which was disconnected from compressor.

123. High or Low Pressure Cutout Switch Installation

a. High Pressure Cutout Switch Installation.

(1) Attach high pressure cutout switch (4, fig. 51) to frame using screws (3) and lockwashers through rear of frame.
(2) Carefully run pressure line (5) to compressor (10, fig. 23), making sure there are no sharp bends or kinks in the line.
(3) Connect pressure line to compressor at connection.
(4) Carefully bring wires through hole in bottom of switch.
(5) Using terminal screws, connect ground wire (braided shielding) to lower left terminal (6, fig. 43).
(6) Connect ignition wire (coming from inside braided shielding) to upper left terminal (3).
(7) Connect battery wire to upper right terminal (4).
(8) Connect bell wire to lower right terminal (5).
(9) Place cover on switch and attach with screw (5, fig. 20) at front bottom center.

b. Low Pressure Cutout Switch Installation.

(1) Attach low pressure cutout switch (2, fig. 51) to frame using screws (3) and lockwashers through rear of frame.
(2) Carefully run pressure line (6) to compressor (10, fig. 23), making sure there are no sharp bends or kinks in the line.
(3) Connect pressure line to compressor at connection (13, fig. 23).
(4) Carefully bring wires through hole in bottom of switch.
(5) Using terminal screws, connect ground wire (braided shielding) to lower left terminal (6, fig. 43).
(6) Connect ignition wire (coming from inside braided shielding) to upper left terminal (3).
(7) Connect battery wire to upper right terminal (4).
(8) Connect bell wire to lower right terminal (5).
(9) Place cover on switch and attach with screw (5, fig. 20) at front bottom center.

c. Connect the battery wire (which leads to the cutout switches from the positive terminal of the batteries) to the battery.

d. Reinstall the panel (4, fig. 1) and secure with the four sheet metal screws and flat washers.

e. Test for leaks (par. 7*h*(1)).

124. High or Low Pressure Cutout Switch Adjustment

There are two adjusting screws on top of each cutout switch. Differential adjusting screw controls the point at which the contacts close and stop the engine. This adjusts the pressure difference between the closing (stopping) and opening (operating) points of the contacts. Range adjusting screw controls the operating range by adjusting the point at which the contacts open, and correspondingly

adjusting the point at which the contacts close, maintaining the pressure differences set by the differential adjusting screw in the opening and closing points of the contacts.

a. Low Pressure Cutout Switch Adjustment.

(1) Adjust range adjusting screw (2, fig. 20) so that pointer on right side of dial (cut-out) of low pressure cutout switch (4) reads 5 pounds pressure.

(2) Adjust differential adjusting screw (1) so that pointer on left side of dial (cut-in) reads 2 inches vacuum.

b. High Pressure Cutout Switch Adjustment.

(1) Adjust range adjusting screw (2, fig. 20) so that pointer on right side of dial (cut-in) of high pressure cutout switch (6) reads 240 pounds pressure.

(2) Adjust differential adjusting screw (1) so that pointer on left side of dial (cut-out) reads 200 pounds pressure.

Section XXIII. BRINE TANK

125. Description

The brine tank is a steel tank 20 inches wide, 68 13/64 inches long, and 35⅞ inches deep, designed to hold twenty 50-pound ice cans and 100 gallons of brine. It is completely insulated and is covered by an outer vapor-tight steel casing and an insulated lid for each row of ice cans. It has a 1¼-inch drain.

126. Brine Tank Cleaning

If the ice plant is to be stored, ice cans must be removed and brine tank must be drained and cleaned.

a. Remove drain plug and drain brine from tank into suitable container. Drain is located at lower left rear corner of the ice plant.

b. Remove ice can covers and take out ice cans.

c. Using a long-handled mop or soft-bristled brush, clean all inner surfaces of brine tank with an approved cleaning solvent and let dry.

d. Install drain plug.

CHAPTER 4

FIELD AND DEPOT MAINTENANCE

Section I. INTRODUCTION

127. General

Instructions in this chapter are published for the use of maintenance personnel responsible for third and higher echelons of maintenance of the ice plant. It contains information on maintenance which is beyond the scope of the tools, equipment, or supplies normally available to using organizations.

128. Procedure

Paragraphs 129 through 161 describe the complete disassembly, repair, and reassembly of each major unit or system comprising the ice plant. Before proceeding with overhaul, check to see that replacement parts are available.

Section II. TOOLS AND EQUIPMENT

129. General

The tools and equipment as listed in this section are those that are required to perform field and depot maintenance on the ice plant. Common mechanic's hand tools have not been enumerated in this section. No specially designed tools or equipment are required for field and depot maintenance on the ice plant.

130. Field and Depot Maintenance Tools and Equipment

The tools and equipment in table IV bearing identification numbers are listed in Department of the Army Supply Manuals ENG 5 41. The tabulation contains only the tools and equipment necessary to perform the operations illustrated or described in this chapter. This table is included for information only and is not to be used for requisitioning tools or equipment.

Section III. CARBURETOR

131. Description

The engine of the ice plant is equipped with an up-draft, pumpless, single float carburetor, with idle mixture adjusting screw.

Table IV. Field and depot maintenance tools and equipment

Item	Stock No.	References		Use
		Fig.	Par.	
Puller	41–6272.349.060	Not illustrated.	145	Remove compressor flywheel and gear box drive shaft bearings.
Test unit	17–9048.500.500	Not illustrated.	137	Test magneto.

132. Carburetor Disassembly

a. Remove carburetor from engine (par. 65*a*).

b. Remove screws (7, fig. 31) and lockwashers holding fuel bowl to throttle body and take off fuel bowl and discard gaskets.

c. Remove idle adjusting screw (6) and spring.

d. Remove throttle stop screw (18, fig. 52) and spring (17).

e. Remove screws (3) and lockwashers (4) and take out throttle plate (2).

f. Pull throttle lever shaft (1) from throttle body (12) and take out throttle shaft dust seal retainer (16) and discard dust seal (15).

g. Remove strainer screen (9) from fuel inlet.

h. Unscrew idle tube (44) from throttle body.

i. Press screwdriver against headless end of float lever pivot (45) and push pivot sideways so that it may be grasped with the fingers and removed.

j. Take out float (23) and needle valve (22).

k. Unscrew and remove needle valve seat (21) and take out and discard gasket (20).

l. Unscrew discharge nozzle (43) and remove nozzle and gasket (42) from fuel bowl (24). Discard gasket (42).

m. Unscrew and remove main metering jet (26) and discard gasket (25).

n. Remove drain plug (31).

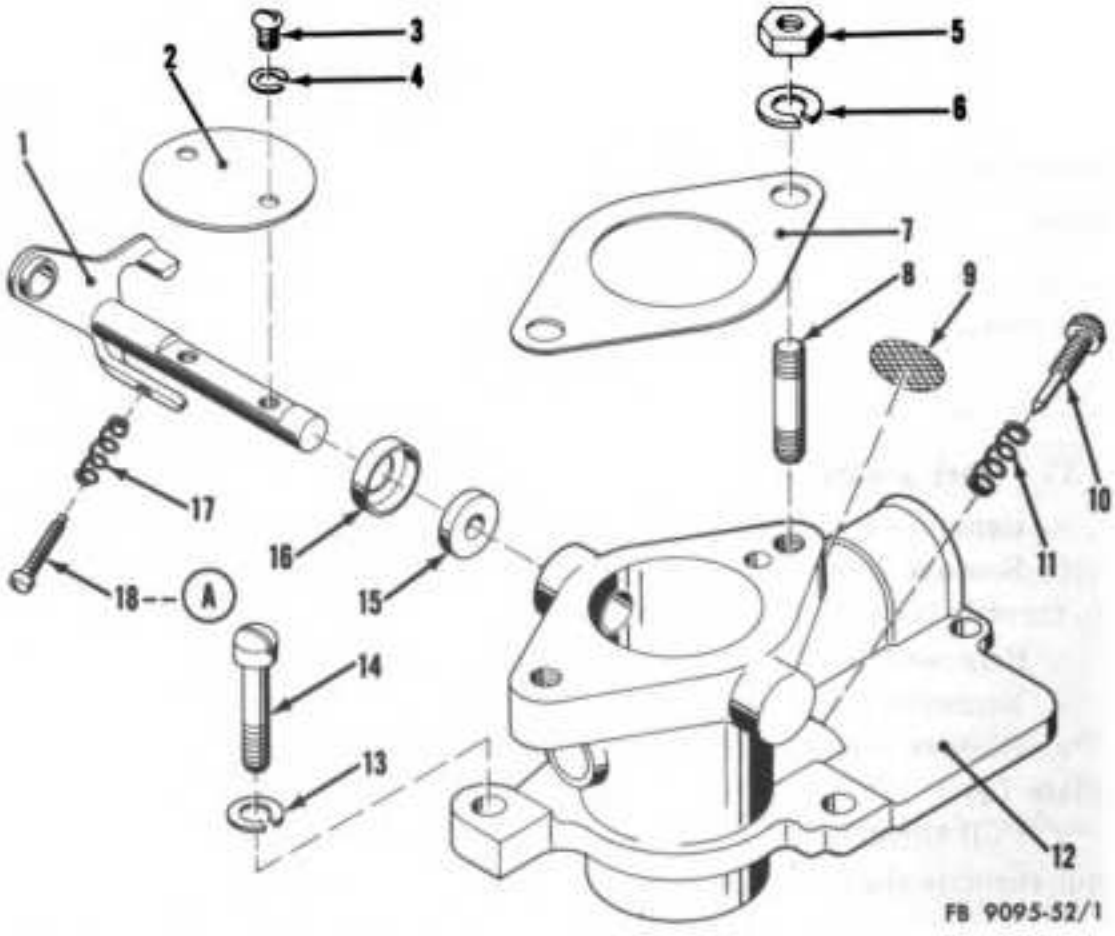
o. Remove and discard drip hole plug retainer (34) and take out and discard drip hole plug (35).

p. Remove screws (27) and lockwashers (28) and take out choke plate (29).

q. Remove screw (40) and lockwasher (41) and take off choke control lever (38) and plain washer (37).

r. Pull choke (30) from fuel bowl and remove friction spring (34).

s. Remove choke shaft dust seal retainers (32), remove and discard dust seals (33).



1 Throttle lever and shaft
2 Throttle plate
3 Screw, cap, rd hd, #5–40 x ¼ (2 rqr)
4 Lockwasher, #5 (2 rqr)
5 Nut, hex, ¼–20 (2 rqr)
6 Lockwasher, ¼ (2 rqr)
7 Gasket, manifold
8 Stud, ¼ x ¾ (2 rqr)
9 Screen, strainer
10 Screw, idle adjusting
11 Spring, idle adjusting screw
12 Throttle body
13 Lockwasher, #10 (4 rqr)
14 Screw, cap, fil hd, #10–24 x 9/16 (4 rqr)
15 Seal, dust, throttle shaft
16 Retainer, dust seal, throttle shaft
17 Spring, throttle stop screw
18 Screw, throttle stop
19 Gasket, fuel bowl
20 Gasket, needle valve seat
21 Needle valve seat
22 Needle valve
23 Float
24 Fuel bowl
25 Gasket, main metering jet
26 Jet, main metering
27 Screw, cap, rd hd, #4–40 x 3/16 (2 rqr)
28 Lockwasher, #4 (2 rqr)
29 Choke plate
30 Choke shaft and lever
31 Plug, pipe, sq hd, ⅛
32 Retainer, dust seal, choke shaft (2 rqr)
33 Seal, dust, choke shaft (2 rqr)
34 Retainer, drip hole plug
35 Plug, drip hole
36 Friction spring
37 Washer, plain, 7/32
38 Choke control lever
39 Screw, mach, fil hd, #8–32 x 5/16 (1 rqr)
40 Screw, mach, fil hd, #8–32 x ½ (1 rqr)
41 Lockwasher, #8 (1 rqr)
42 Gasket, discharge nozzle
43 Discharge nozzle
44 Idle tube
45 Pivot, float lever

Figure 52. Carburetor, exploded view.

133. Carburetor Cleaning and Inspection

a. Soak all metal parts in an approved cleaning solvent and dry.

b. Inspect float for leaks, and if leaky, replace.

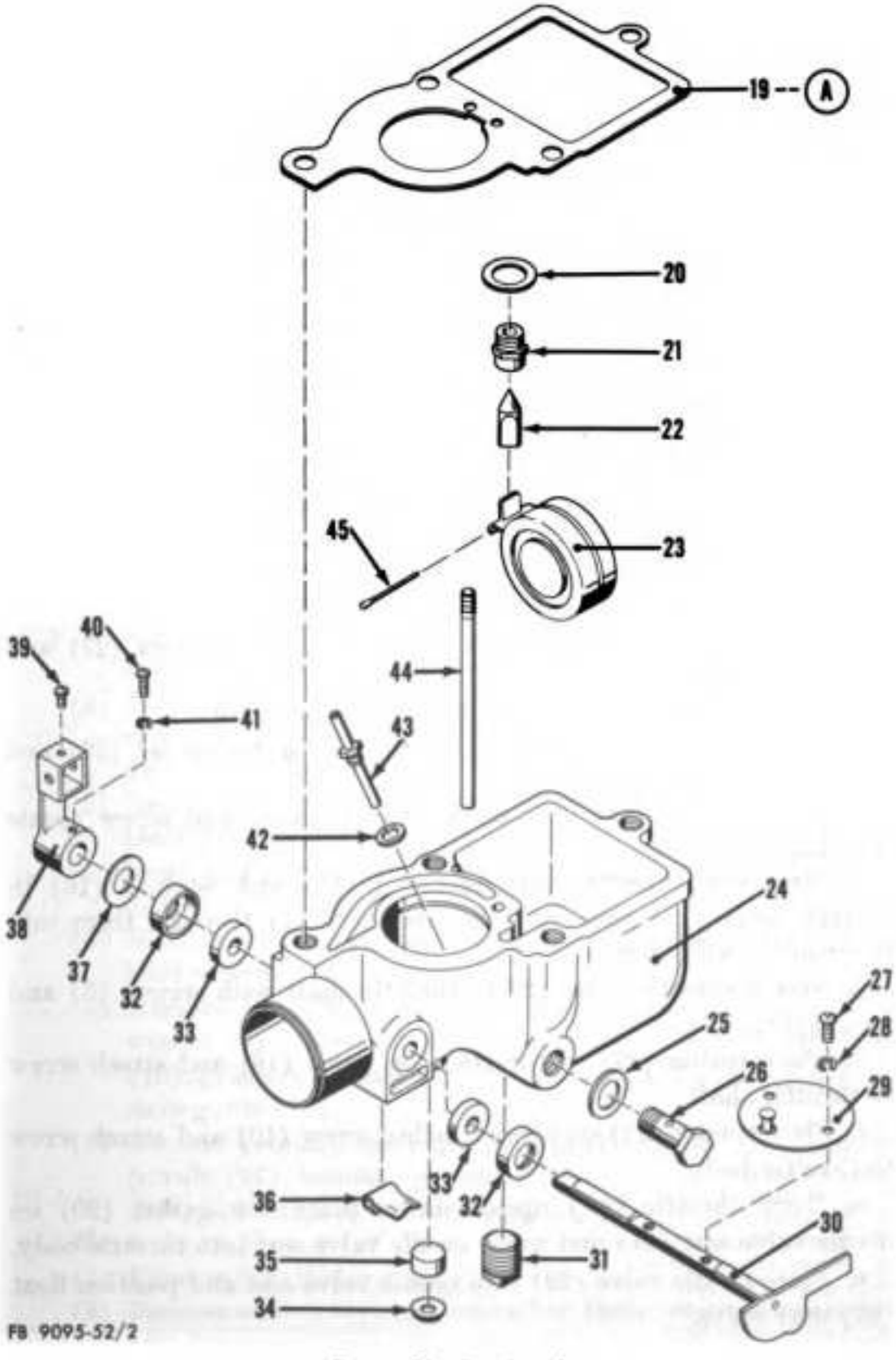


Figure 52—Continued.

c. Inspect needle valve and needle valve seat for wear. If needle valve is grooved or needle valve seat is worn out-of-round, replace both parts.

d. Inspect strainer screen for holes or tears and replace if defective.

e. Inspect all screws for worn or stripped threads and replace if defective.

f. Blow compressed air through idle tube, discharge nozzle, and needle valve seat to clear obstructions.

Note. Do not use wire or similar material to clear obstructions in discharge nozzle, idle tube, or needle valve seat.

g. If idle tube or discharge nozzle is bent, replace it.

134. Carburetor Reassembly

a. Place new choke shaft dust seals (33, fig. 52) and dust seal retainers (32) in fuel bowl (24).

b. Slide friction spring (36) in slot and push choke shaft and lever (30) through dust seal retainer, under friction spring, and out opposite side of fuel bowl, through dust seal retainer.

c. Place plain washer (37) and choke control lever (38) on choke shaft and lock in place with screw (40) and lockwasher (41).

d. Place new drip hole plug (35) in drip hole and secure by tapping new drip hole plug retainer (34) in place.

e. Attach choke plate (29) to choke shaft with screws (27) and lockwashers (28).

f. Screw drain plug (31) into bottom of fuel bowl.

g. Place new metering jet gasket (25) on metering jet (26) and screw jet into fuel bowl.

h. Place new gasket (42) on discharge nozzle and screw nozzle into fuel bowl.

i. Place new throttle shaft dust seal (15) and retainer (16) in throttle body (12) and push throttle shaft (1) through them into place in throttle body.

j. Attach throttle plate (2) to throttle shaft with screws (3) and lockwashers (4).

k. Place spring (17) on throttle stop screw (18) and attach screw to throttle shaft.

l. Place spring (11) on idle adjusting screw (10) and attach screw to throttle body.

m. Turn throttle body upside down, place new gasket (20) on needle valve seat (21) and screw needle valve seat into throttle body.

n. Place needle valve (22) into needle valve seat and position float (23) over valve.

o. Secure float by pushing float lever pivot (44) into place with the fingers as far as it will go. Use flat end of screwdriver to press pivot all the way in. Make sure that float moves freely.

p. Screw idle tube (44) into throttle body.

q. Using new gasket (19) attach throttle body (12) to fuel bowl (24) with screws (14) and lockwashers (13).

r. Carefully place strainer screen (9) into fuel inlet opening and using new manifold gasket (7), install carburetor on engine (par. 65*b*).

s. Adjust carburetor (par. 65*c*).

Section IV. MAGNETO

135. Description

The magneto is a Fairbanks-Morse type XE4. It is equipped with an impulse coupling which holds back the rotor while the engine continues to turn. At the correct instant the pawls of the coupling release, and the rotor is snapped forward at high speed, producing an intense spark, automatically retarded to prevent backfiring.

136. Magneto Disassembly

a. Remove the magneto from the engine (par. 67*a*).

b. End Cap.

(1) Separate end cap (6) from frame assembly (46) by removing screws (28) and (30) and shakeproof washers (29). Remove and discard gasket (13).

(2) Remove screws (2) and shakeproof washers (3). Remove end cap cover (1) and discard gasket (4). Remove upper distributor block (5).

(3) Remove screws (2) and lockwashers (18) holding distributor block (14) to end cap. Remove distributor block. Remove brush and spring (17) and high tension lead rod (15) from distributor block.

(4) Remove screws (19) and take off vent hoods (20) and vent hood screens (21).

(5) Remove nut (22) and remove lockwasher (18) and plain washer (9). Remove screw (8), plain washer (9), bushing (10), primary ground strips (7 and 11), and primary ground strip guide (12).

(6) Remove primary cable ground outlet nut (23) and remove ferrule (24), insulating washer (25), ground cable terminal (26), and terminal insulator (27).

c. Frame.

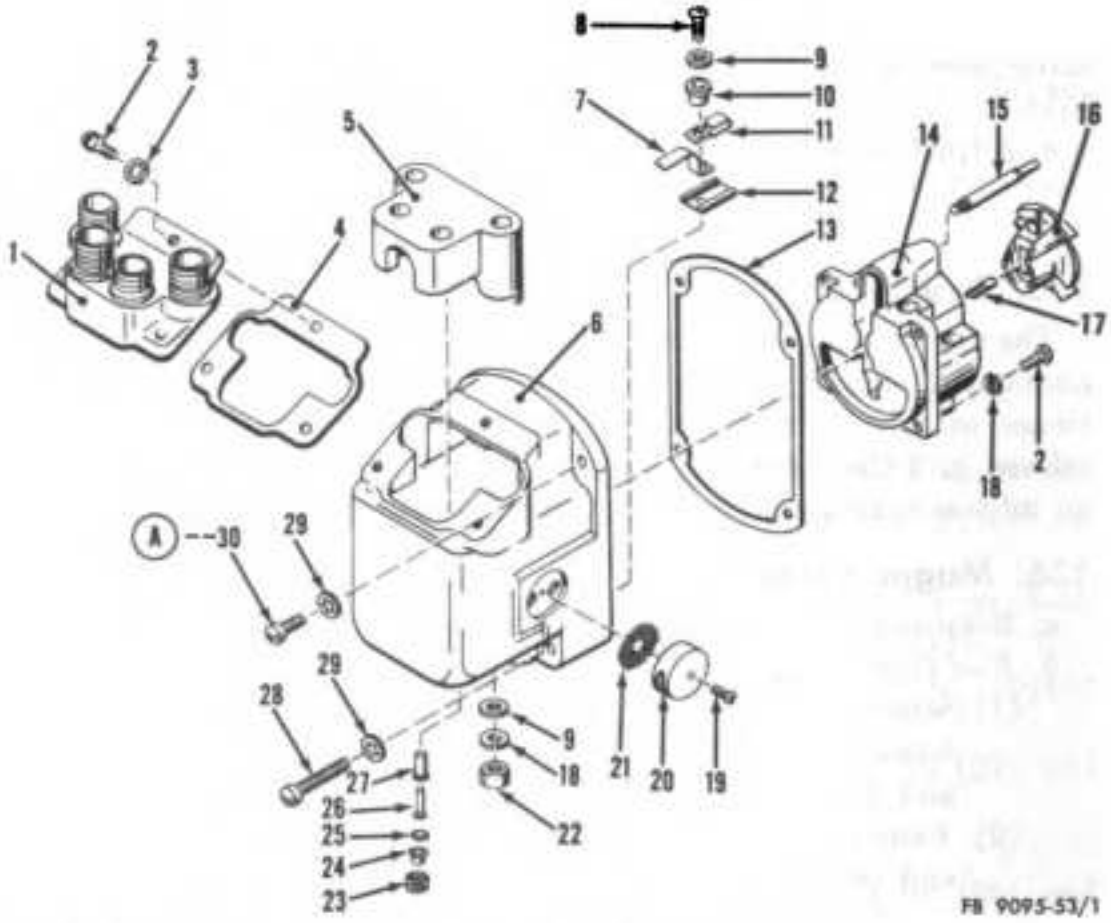
(1) Remove distributor rotor (16).

(2) Remove screw (53) and lockwasher (52). Remove capacitor (40) by removing screw (39) and lockwasher (18).

(3) Remove lockpin (43) and remove breaker arm assembly (37).

(4) Remove screws (19 and 33), lockwashers (35 and 18), and plain washers (36). Remove cam wick and holder assembly (34) and contact support bracket assembly (38).

(5) Remove snap ring (31) and remove magnetic rotor gear (32).



1 End cap cover
2 Screw, mach, #8–32 x ½ (7 rqr)
3 Washer, shakeproof, #8 (3 rqr)
4 End cap cover gasket
5 Upper distributor block
6 End cap
7 Primary ground strip
8 Screw, mach, #8–32 x 5/16
9 Washer, plain, #8
10 Bushing
11 Primary ground strip
12 Primary ground strip guide
13 Gasket, end cap to frame
14 Distributor block
15 High tension lead rod
16 Distributor rotor
17 Brush and spring assembly
18 Lockwasher, #8 (5 rqr)
19 Screw, mach, #6–32 x ⅜ (3 rqr)
20 Vent hood
21 Vent hood screen
22 Nut, hex, #8
23 Primary cable ground outlet nut
24 Ground cable ferrule
25 Insulating washer
26 Ground cable terminal
27 Terminal insulator
28 Screw, mach, #10–24 x 1⅛ (2 rqr)
29 Washer, shakeproof, #10 (4 rqr)
30 Screw, mach, #10–24 x ⅝ (2 rqr)
31 Snap ring
32 Magnetic rotor gear
33 Screw, mach, #8–32 x ⅝
34 Cam wick and holder assembly
35 Lockwasher, #8
36 Washer, plain, #8
37 Breaker arm assembly
38 Contact support bracket assembly
39 Screw, mach, #8–32 x ¼
40 Capacitor
41 Distributor shaft and gear
42 Thrust washer
43 Lockpin
44 Bearing support assembly
45 Coil
46 Frame
47 Setscrew, ¼–20 x ¾ (2 rqr)
48 Impulse coupling stop pin
49 Snap ring
50 Drive end bearing
51 Bearing snap ring
52 Lockwasher, #10
53 Screw, mach, #10–24 x 5/16
54 Woodruff key
55 Screw, mach, flat head, #8–32 x ⅜ (4 rqr)
56 Magnetic rotor assembly
57 Bushing
58 Impulse coupling hub
59 Impulse coupling spring
60 Impulse coupling shell
61 Washer, plain, ⅝
62 Impulse coupling nut
63 Pin, cotter, 1/16 x ¾

Figure 53. Magneto, exploded view.

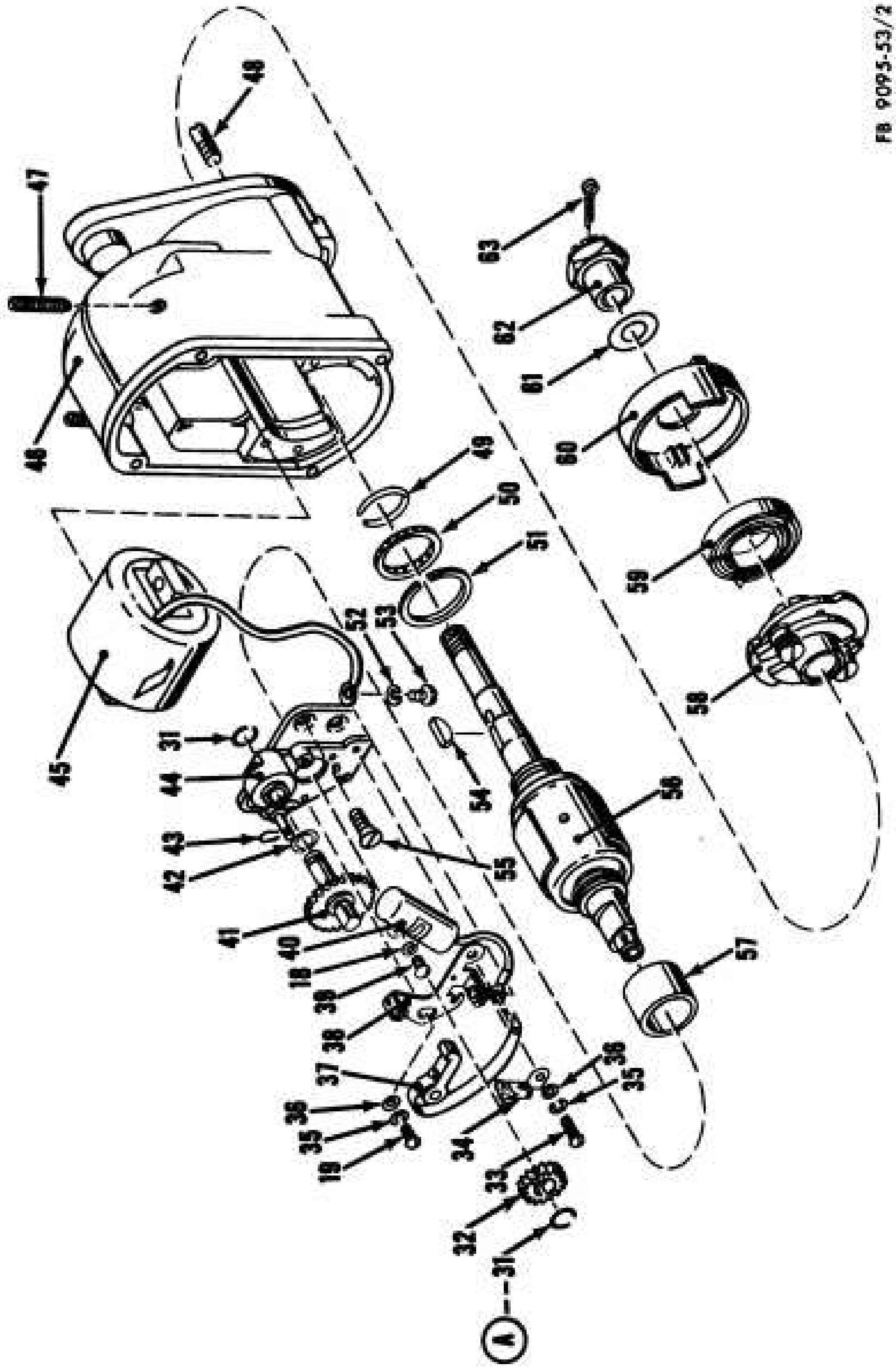


Figure 53—Continued.

(6) Remove screws (55) and remove bearing support assembly (44). Remove snap ring (31), remove distributor shaft and gear (41) and thrust washer (42). Press bushing (57) out of support assembly.
(7) Remove cotter pin (63). Unscrew impulse coupling nut (62). Remove washer (61).
(8) Remove magnetic rotor assembly (56) from frame. Lightly tap off impulse coupling assembly. Remove woodruff key (54).
(9) Disassemble the impulse coupling by holding the lugs on the shell (60) with a pair of pliers and pulling and turning the shell until it comes off. Remove the impulse coupling spring (59) from hub (58).
(10) Remove snap rings (49 and 51) and drive end bearing (50).
(11) Remove setscrews (47). Remove coil (45).
(12) Remove impulse coupling stop pin (48).

137. Magneto Inspection and Repair

a. Inspect coil for loose core, and intact soldered connections. Solder loose connections using resin core solder.

b. Perform inspection procedures outlined in paragraph 67*b*.

c. Inspect gears for chipped or broken teeth and replace if necessary.

d. Inspect distributor blocks for breaks or cracks and replace if damaged.

e. Make sure the contact points on the rotor and coil are clean. If dirty, they may be cleaned by rubbing gently with fine sandpaper until all corrosion is removed. Never use emery. Clean the primary ground strip, if necessary, in the same manner.

f. The impulse coupling may be cleaned in an approved cleaning solvent, dried, and lightly oiled.

g. Using an ohmmeter, test the coil for opens in the circuit by contacting one test probe to the lead and the other to the ground connection of the coil and testing as for resistance. Full scale deflection of the needle indicates no opens in the circuit. If needle does not deflect, or deflects only a short distance, replace the coil.

h. Using an ohmmeter set for full scale deflection (highest resistance), test the capacitor for shorts by contacting one test probe to each capacitor lead and testing as for resistance. No deflection of the needle indicates no shorts in the capacitor. If the needle deflects any distance, a short is indicated and capacitor must be replaced.

138. Magneto Reassembly

a. End Cap.

(1) Place vent screens (21, fig. 53) and vent hoods (20) on end cap (6) and secure with screws (19).

(2) Fit terminal insulator (27), ground cable terminal (26), insulating washer (25), and ferrule (24) into end cap. Screw on primary ground outlet nut (23).
(3) Attach primary ground strips (7 and 11), bushing (10), and guide (12) to end cap with screw (8), plain washers (9), lockwasher (18), and nut (22).
(4) Place distributor block (14) into end cap and secure with lockwashers (18) and screws (2).
(5) Place upper distributor block (5) into end cap. Place new gasket (4) on end cap. Secure end cap cover (1) to end cap with screws (2) and shakeproof washers (3).
(6) Screw high tension lead rod (15) into distributor block. Place brush and spring (17) into distributor block.

b. Frame.

(1) Screw impulse coupling stop pin (48) into frame (46).
(2) Secure coil (45) to frame with setscrews (47).
(3) Place snap ring (51) and drive end bearing (50) on magnetic rotor assembly (56). Fit on snap ring (49). Fit magnetic rotor assembly into frame and place woodruff key (54) in slot.
(4) Place impulse coupling spring (59) on hub (58). Attach shell (60). Place impulse coupling on magnetic rotor assembly so that slotted portion of hub fits over woodruff key (54).
(5) Place plain washer (61) on magnetic rotor shaft and screw on impulse coupling nut (62). Secure nut to shaft with cotter pin (63).
(6) Press bushing (57) into bearing support assembly (44).
(7) Place thrust washer (42) on distributor gear and shaft (41). Fit distributor gear and shaft in bearing support assembly and secure with snap ring (31).
(8) Attach bearing support assembly to frame with screws (55).
(9) Attach magnetic rotor gear (32) to magnetic rotor assembly with snap ring (31). Make sure red tooth of magnetic rotor gear meshes between the two teeth of distributor gear marked C.
(10) Attach capacitor (40) to bearing support assembly with screw (39) and lockwasher (18).
(11) Attach contact support bracket assembly (38) and cam wick and holder (34) to bearing support assembly with screws (19 and 33), lockwashers (35), and plain washers (36).
(12) Lightly coat arm of bearing support assembly with clean grease and fit breaker arm assembly (37) on arm and secure it with lockpin (43).

Caution: Make sure points are alined so they meet squarely and without overlapping. If points do not meet squarely, bend one or both contact leaves with long nose pliers so that

the surfaces match. If points overlap, adjust contact support bracket assembly (38).

(13) Secure leads from coil and capacitor and breaker arm to contact support bracket assembly with screw (53) and lockwasher (52). Place distributor rotor (16) on distributor shaft.

(14) Adjust breaker point gap (par. 69*b*(5)).

(15) Place new gasket (13) between end cap assembly and frame assembly. Secure end cap to frame with screws (28 and 30) and shakeproof washers (29).

(16) Install and time magneto (par. 67*c*).

Sector V. GOVERNOR

139. Description

The governor is the flyball type which controls the throttle position of the carburetor, thus controlling the speed of the engine. It is geared to and driven by the camshaft, and utilizes two weights which react to centrifugal force. As the engine speeds up or slows down, the weights correspondingly move out or in, controlling the throttle of the carburetor through a system of levers.

140. Governor Disassembly

a. Remove the governor from the engine (par. 74).

b. Loosen locknut (11, fig. 34) and unscrew governor control rod (10).

c. Remove cotter pin, take out yoke pin (13) and remove yoke (12).

d. Tap out groove pins and remove control rod lever (8), rockshaft extension bracket (9), and collar from governor rockshaft extension (7).

e. Pull rockshaft extension from spring lever (17) and take out woodruff key.

f. Remove spring (5) from spring lever and from governor spring throttle lever.

g. Ease governor assembly from housing (3), and discard gasket.

h. Remove screws (34, fig. 39) and lockwashers (33) and take out governor tension fork (32). Slide rockshaft (31) from housing.

i. Drive out groove pin (37) and remove spring lever (38) from rockshaft (31).

j. Remove cotter pin (15) and take off flat washer (12) and throttle lever (13).

k. Remove throttle lever from governor adjusting arm (14). Remove nuts (36) and take arm from bracket (35).

l. Loosen nut (18) and remove governor speed change lever stop screw (17).

m. Loosen nut (23), remove governor bumper spring body (24) and take out bumper spring (25).

n. Using a small rod, carefully tap out expansion plug (22) to avoid damaging bushing (21). Discard expansion plug (22).

o. Drive out bushing (21), being careful to hit edge only.

p. Press oil seal (30) and bearing (29) from housing.

q. Slide races (43 and 45) and bearing (44) from thrust sleeve (42).

r. Remove sleeve retaining ring (46) and take off thrust sleeve.

s. Remove cotter pins (48) from weight pins (49), take out pins and remove weights (39).

t. Remove shaft (50) from base (41).

u. Remove bushing (40) from base.

141. Governor Cleaning, Inspection, and Repair

a. Soak all metal parts in an approved cleaning solvent and dry thoroughly with compressed air.

b. Inspect drive gear teeth. Replace gear and shaft if teeth are cracked or chipped.

c. Inspect bushings, shafts, and base for scoring and replace scored parts.

d. Inspect bearings for free action. If bearings are hard to turn or stick in places, replace defective parts.

e. Inspect weights and weight pins for free action. If weights do not move freely on weight pins, replace pins.

f. Inspect rockshaft for scoring and for free action inside housing and bearing. Replace if defective.

g. Inspect rockshaft extension and bracket for freedom of action. Replace parts which do not move freely.

142. Governor Reassembly

a. Place bushing (40, fig. 39) in base (41) and slide shaft into base.

b. Attach weights (39) to shaft with pins (49) and secure with cotter pins (48).

c. Place thrust sleeve (42) on shaft with small end pointing away from base.

d. Place sleeve retaining ring (46) in groove of shaft, to secure thrust sleeve.

e. Place race (43), bearing (44), and race (45) on thrust sleeve.

f. Carefully drive bushing (21) in place and tap new expansion plug (22) in place.

g. Place spring lever (38) on rockshaft (31) so that hole for spring is on same side as flat portion of shaft and drive groove pin (37) in place to secure it.

h. Carefully press bearing (29) into place in housing from inside and place oil seal (30) into housing from outside.

i. Insert rockshaft through oil seal and bearing into housing as far as it will go. Attach governor tension fork (32) with screws (34) and lockwashers (33).

j. Using new gasket (47), carefully insert governor assembly through governor tension fork into bushing so that notched portion of base fits into pin (28) on housing. Check action of governor shaft and rockshaft to make sure both move freely. Rockshaft should turn freely in a limited arc controlled by thrust sleeve and bearing. Governor shaft should spin freely.

k. Slide governor throttle lever (13) on shaft (16), place flat washer (12) on shaft and secure with cotter pin (15).

l. Place locknut (18) on governor speed change lever stop screw (17) and screw governor speed change lever stop screw into housing. Do not tighten locknut.

m. Place collar (8) on rockshaft extension (9) and drive groove pin (37) through holes to secure it.

n. Place rockshaft extension through bracket (7) and attach control rod lever (6) using groove pin.

o. Screw locknut (2) on governor control rod (1), then screw yoke (4) on control rod.

p. Attach yoke to control rod lever with yoke pin (3) and secure with cotter pin (5).

q. Place woodruff key (10) in rockshaft extension and push end of shaft into spring lever as far as it will go.

r. Turn rockshaft so that tension fork pushes bearing, thrust sleeve, and weights toward base as far as they will go. Place bumper spring (25) in bumper spring body (24) and screw bumper spring body into housing until spring lightly touches tension fork (rockshaft should now have no play). Lock bumper spring body in place with nut (23).

s. Attach spring (11) to throttle lever and to spring lever.

t. Attach governor adjusting arm (14) to bracket (35) with nuts (36) and place arm in throttle lever.

u. Install governor on engine (par. 75).

v. Move carburetor throttle to full closed position (toward air cleaner). Tighten locknut (2) against control rod yoke. Screw governor speed change lever stop screw (17) down so that it touches throttle lever, lock in place with nut (18).

w. Adjust governor (par. 143).

143. Governor Adjustment

The governor is set at the factory for the proper speed and should not be adjusted unless absolutely necessary. If the engine is not running at the proper speed, governor may be adjusted.

a. Check engine speed with a tachometer. Proper speed is 2,250 rpm.

b. Loosen locknut (4, fig. 32).

c. If engine is running faster than 2,250 rpm, tighten adjusting nut (3) until tachometer indicates that engine is running at 2,250 rpm, then lock in place by tightening locknut (4). This adds tension to the governor spring. If full adjustment does not correct overspeed of engine, check to see that the governor is properly installed on the engine (par. 75).

d. If engine is running slower than 2,250 rpm, loosen adjusting nut (3) until tachometer indicates that engine is running at 2,250 rpm, then lock in place by tightening locknut (4). This decreases tension on the governor spring. If full adjustment does not correct underspeed of engine, check to see that the governor is properly installed on the engine (par. 75).

e. If governor is properly installed on engine, yet will not correct improper running speed, remove and disassemble (par. 140), inspect and repair (par. 141), and reassemble and reinstall (par. 142) governor.

f. Adjust governor (steps *a*, *b*, and either *c* or *d* above).

g. If governor will not properly control the engine speed after disassembly, inspection and repair, and reassembly, replace governor (pars. 74 and 75).

Section VI. COMPRESSOR

144. Description

The ice plant is equipped with a Copeland Model #83, 3¼-inch bore, 3-inch stroke, two cylinder, Freon-12 compressor. It is driven by two V-belts and operates at 680 rpm.

145. Compressor Disassembly

a. Remove compressor (par. 86).

b. Remove cylinder head and valve plate assembly (par. 89).

c. Secure flywheel and remove flywheel nut (2, fig. 54).

d. Using a gear puller, remove flywheel and take out woodruff key (8).

e. Remove oil plug (58) and drain compressor oil. If pump is not available, turn compressor on side and drain into suitable container.

f. Remove cap screws (1) and carefully slide seal assembly (3) and gasket (4) from crankshaft (9). Discard gasket (4).

Note. Do not pry seal assembly loose from housing cover assembly (6). If it does not come off readily, tap lightly around edges to loosen gasket, then ease seal assembly from shaft.

g. Remove cap screws (56) and take off bottom plate (55) and discard gasket (54).

h. Remove cotter pins (18), take off nuts (17) and bolts (15) and remove connecting rod bearing caps (16). Push connecting rods (10) and pistons (14) up so that they are completely clear of crankshaft.

Note. Mark connecting rod caps and connecting rods so that caps may be reassembled with corresponding rods and in original positions.

i. Remove cap screws (42) and take off rear bearing cover plate (43), gasket (44), and thrust ball (45). Discard gasket (44).

j. Remove cap screws (5) and carefully take off housing cover assembly (6) and discard gasket (7).

Note. Do not pry housing cover assembly loose from compressor body (53). If it does not come off readily, tap lightly around edges to loosen gasket, then ease assembly from crankshaft.

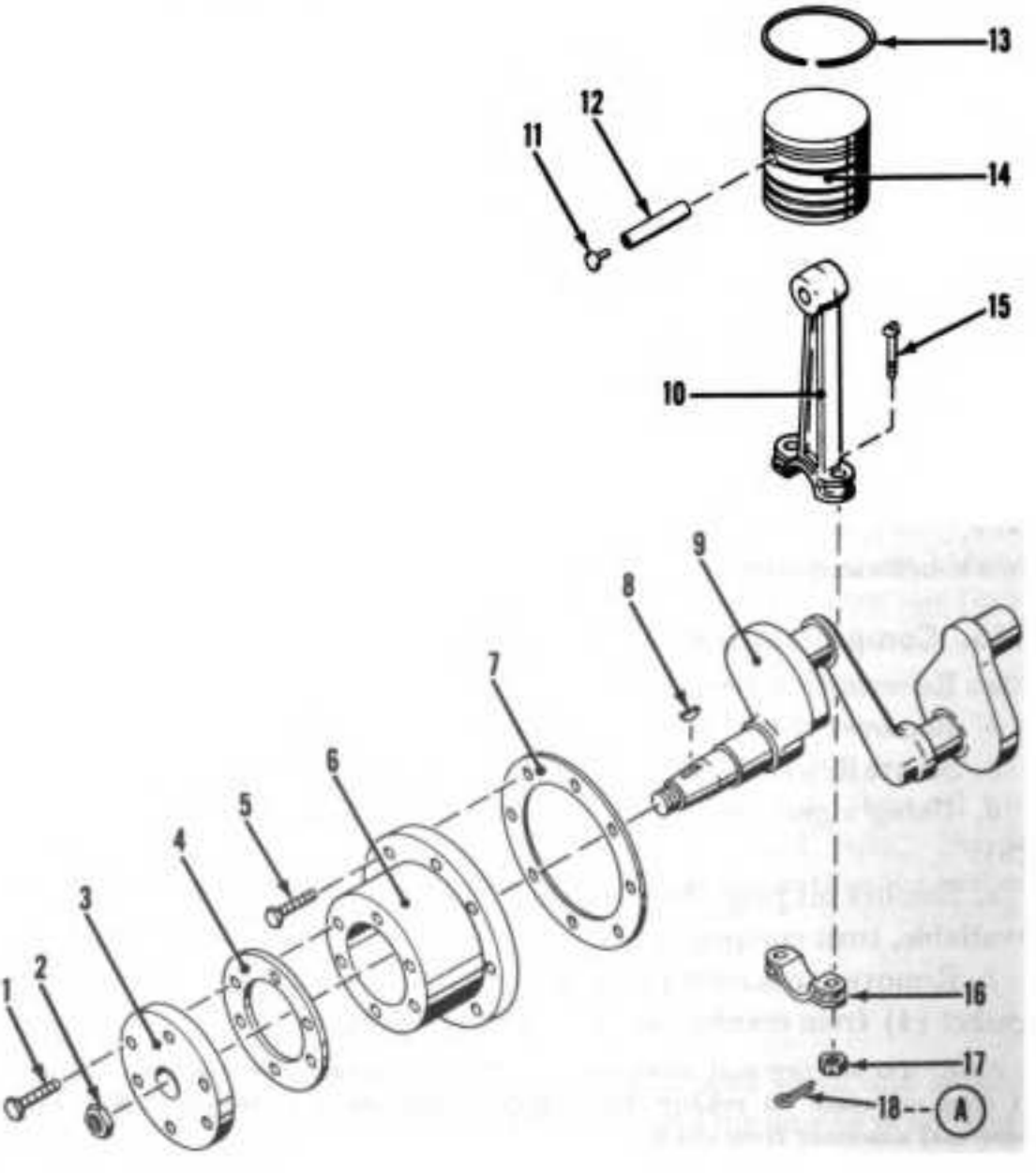


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Figure 54. Compressor, exploded view.

k. Carefully ease crankshaft out of compressor body through front (large opening).

Caution: All internal compressor parts must be wrapped in paper immediately after being removed to prevent corrosion.

l. Push pistons down and remove pistons and connecting rods through bottom of compressor crankcase. Mark pistons and rods with respect to bores so they may be installed in original positions. Unless the piston rings (13) are to be replaced, do not remove them from the pistons.

m. If piston rings are to be replaced, remove them from pistons by inserting tip of knife blade between ring and piston and moving around piston so that ring comes off.

n. Carefully drive wrist pin (12) from piston and remove buttons (11).

o. Remove cap screws (52) and take off suction chamber mounting flange (47) and gasket (46).

p. Take out strainer (48).

q. Remove oil return check valve (57).

---

1 Screw, cap, hex, 5/16–18 x 7/8 (6 rqr)
2 Nut, hex, 3/4–16
3 Seal assembly
4 Seal assembly gasket
5 Screw, cap, hex, 5/8–16 x 1 (8 rqr)
6 Housing cover assembly
7 Housing cover assembly gasket
8 Key, Woodruff #9
9 Crankshaft
10 Connecting rod (2 rqr)
11 Button, piston pin (4 rqr)
12 Pin, piston 3/4 x 2 15/16, 3/8 bore (2 rqr)
13 Ring, piston (6 rqr)
14 Piston, (2 rqr)
15 Bolt, connecting rod, 3/8–24 x 2 11/16 (4 rqr)
16 Cap, connecting rod (2 rqr)
17 Nut, castle, 3/8–24 (4 rqr)
18 Pin, cotter, 3/32 x 1 (4 rqr)
19 Discharge service valve
20 Screw, cap, hex, 5/16–18 x 1 1/4 (2 rqr)
21 Plug, discharge service valve port
22 Gasket, discharge flange
23 Pin, dowel (2 rqr)
24 Gasket, valve plate
25 Retainer, suction valve (2 rqr)
26 Reed, suction valve (2 rqr)
27 Plate, valve
28 Reed, discharge valve (2 rqr)
29 Spacer, discharge valve (8 rqr)
30 Spring, discharge valve (8 rqr)
31 Pin, dowel, discharge reed (4 rqr)
32 Retainer, discharge valve (2 rqr)
33 Lockwasher, 1/4 (4 rqr)
34 Screw, cap, hex, 1/4–20 x 1 (4 rqr)
35 Screw, cap, hex 3/8–16 x 2 1/2 (10 rqr)
36 Gasket, copper, (10 rqr)
37 Cylinder head
38 Gasket, cylinder head
39 Spacer, suction valve (4 rqr)
40 Screw, cap, rd hd, 1/4–20 x 7/16 (4 rqr)
41 Elbow, 1/8
42 Screw, cap, hex, 5/16–18 x 7/8 (4 rqr)
43 Plate, rear bearing cover
44 Gasket, rear bearing cover plate
45 Ball, thrust
46 Gasket, suction chamber mounting flange
47 Flange, suction chamber mounting
48 Strainer
49 Gasket, suction service valve
50 Suction service valve
51 Screw, cap, hex, 1/2–13 x 2 1/4 (2 rqr)
52 Screw, cap, hex, 5/16–18 x 1 (8 rqr)
53 Compressor body
54 Gasket, bottom plate
55 Bottom plate
56 Screw, cap, hex 5/8–16 x 1 (18 rqr)
57 Oil return check valve
58 Plug, oil filler, 1/8

Figure 54—Continued.

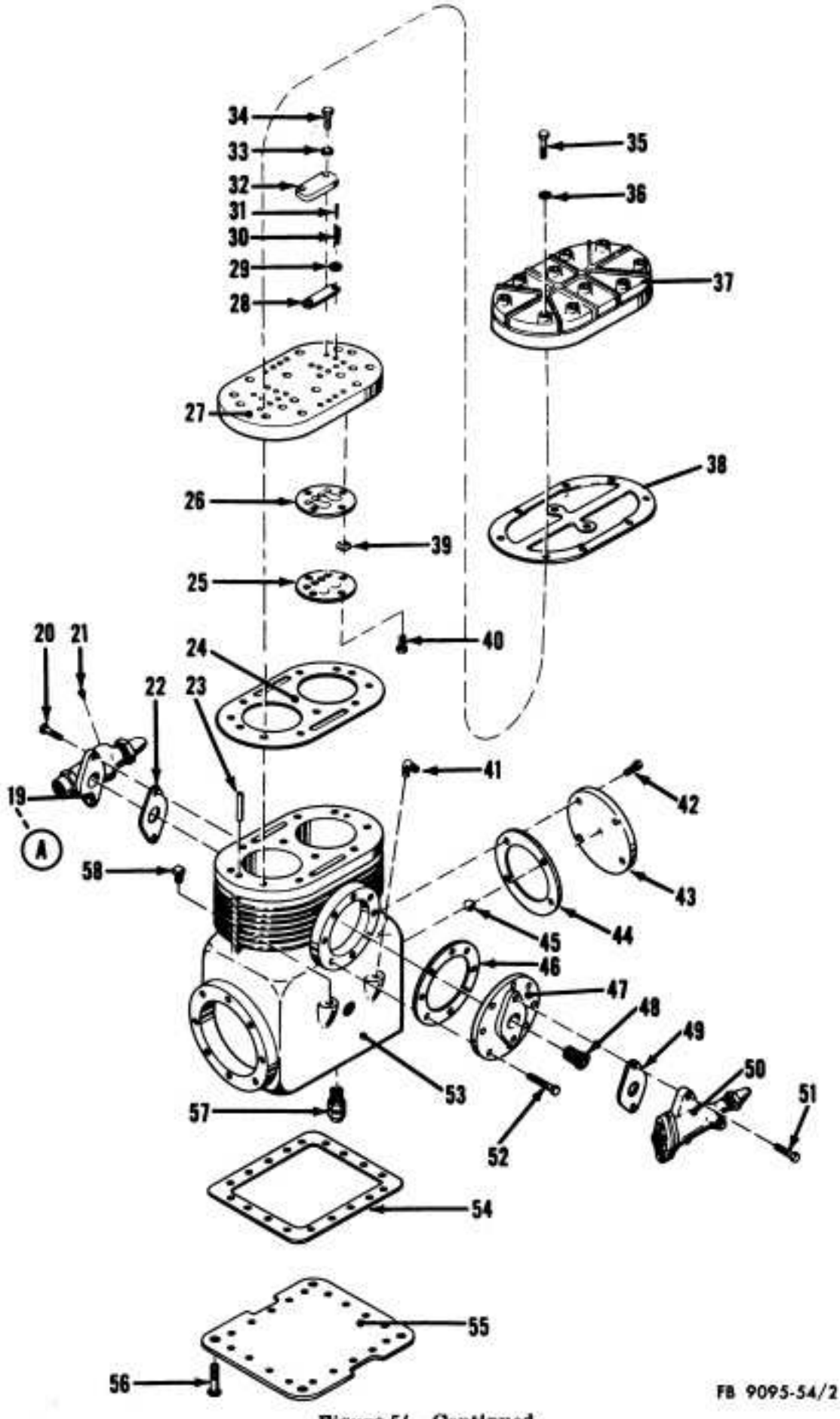

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Figure 54—Continued.

146. Compressor Cleaning, Inspection, and Repair

a. Soak all metal parts in an approved cleaning solvent and dry thoroughly. Use a stiff nonmetallic brush, such as a toothbrush, to clean grooves, holes, etc.

b. Carefully scrape gasket material from all facings to which gaskets are fitted.

c. Inspect cylinder head and valve plate assembly (par. 90).

d. Check cylinder bores of compressor body for scoring and wear. If bores show deep scratches or have worn out-of-round, replace compressor body.

e. Check rear main bearing bushing for scoring and wear. If scored, or worn out-of-round, drive old bushing out and carefully press new one into place, making sure that oil holes are alined. Insert bushing from inside and press flush with inside boss. Run a drill through the oil holes of the casting and bushing to assure alinement.

f. Check connecting rod bushings for scoring and wear. If scored, or worn out-of-round, drive out bushing and carefully press new one in place.

g. Check connecting rod bearings and caps for scoring and wear. If babbit bearing material is cracked, chipped, or scored, replace rod and cap.

h. Check wrist pins for scoring and wear. If pin is scored, or worn out-of-round, replace it.

i. Check pistons for scoring and wear. If either piston is scored, replace both pistons.

j. Check piston wrist pin bores for scoring and wear. If scored, or worn out-of-round, replace piston.

k. Check housing cover assembly for scratches or wear at the seal bearing surface. If surface is scratched, or if wear is evident (a slight groove worn by the seal), replace assembly and seal.

l. Check housing cover assembly main bearing bushing for scoring and wear. If bushing is scored, or worn out-of-round, drive out bushing and carefully press new one into place, making sure oil holes in casting and bushing are alined. Run a drill through the oil holes to assure alinement.

m. Check seal for scratches, and replace seal assembly and housing cover assembly if seal is scratched or damaged.

n. Check seal surface on crankshaft (surface between woodruff key and front bearing surface) for scratches or scoring. If fine scratches or rust are evident, polish carefully with steel wool. If scoring is evident, replace crankshaft.

o. Check front and rear main bearing surfaces and connecting rod

journals of crankshaft for scoring and wear. If scoring is evident on either bearing or connecting rod journal surfaces, replace crankshaft.

p. Carefully check crankshaft for cracks, and replace it if any are found.

q. Check thrust ball for flat spots, chips, or cracks and replace if defective.

r. Check strainer for tears and replace if defective.

s. Check all screws, bolts, and nuts for worn or stripped threads and replace defective parts.

t. Inspect oil return check valve for clogged openings and clean with suitable pointed tool. Make sure check ball moves freely. If ball does not move freely, replace oil return check valve.

147. Compressor Reassembly and Installation

a. Screw oil return check valve (57) into place inside compressor body (53).

b. Place connecting rod (10, fig. 54) in piston (14) from which it was removed (unless new connecting rod or piston is used) and carefully tap wrist pin (12) into place, making sure ends of pin are not burred.

c. Place new buttons (11) in each end of each wrist pin.

d. Carefully place pistons through bottom of compressor body into bores. If old rings have not been removed compress each ring to allow it to enter the bore, and push so that connecting rods will completely clear crankshaft.

Note. If original connecting rods or pistons are used, make sure they are installed in same cylinder from which they were removed, and are facing in same direction in which they were originally installed.

e. Ease crankshaft (9) into place through front of compressor body into rear main bearing bushing.

f. Using new gasket (7) carefully place housing cover assembly (6) over crankshaft so that crankshaft fits into front main bearing bushing, and attach with cap screws (5).

Note. Coat all compressor gaskets lightly with clean compressor oil before installing.

g. If new piston rings (13) are to be installed, push pistons up so they extend above compressor body, place rings in piston grooves, compress rings and push pistons down into bores.

h. Attach connecting rods (10) to crankshaft by placing bearing caps (16) around crankshaft connecting rod journals, and placing connecting rod bolts (15), with flat side of head against connecting rod through both parts of connecting rod bearing. Secure with castle nuts (17). Lock nuts in place with new cotter pins (18).

Note. If original connecting rods and bearing caps are used, make sure bearing caps are installed on corresponding connecting rods and in same positions from which they were removed.

i. Place thrust ball (45) in rear end of crankshaft, hold in place with new gasket (44) and rear bearing cover plate (43), and secure with cap screws (42).

j. Using new gasket (54), attach bottom plate (55) with cap screws (56).

k. Using new gasket (4), install new seal assembly (3). Lightly coat seal with clean compressor oil and push straight on shaft, making sure neoprene binder fits snugly.

Note. Do not exert force on seal nose. Apply pressure evenly to seal face plate and flange only.

l. Secure seal assembly with cap screws (1).

m. Using new gasket (46), attach suction chamber mounting flange (47) to compressor body with cap screws (52) and install strainer (48).

n. Install cylinder head and valve plate assembly (par. 91*a* through *j*).

o. Place woodruff key (8) in slot in crankshaft and slide flywheel on crankshaft. Secure with flywheel nut (2).

p. Turn flywheel to make sure pistons and bearings are free.

q. Fill compressor crankcase with 3½ quarts of clean compressor oil, and install plug (58).

r. Install compressor in ice plant (par. 87).

s. Run compressor at least 8 hours, checking oil frequently, then drain oil completely (par. 15*b*(5)(*e*)) and add 3½ quarts of fresh compressor oil.

148. Compressor Piston Ring Replacement

a. Remove compressor (par. 86).

b. Remove cylinder head and valve plate assembly (par. 89*a–e*).

c. Drain oil from compressor (par. 15*b*(5)(*e*)).

d. Remove cap screws (56, fig. 54) and take off bottom plate (55) and discard gasket (54). Scrape gasket material from all surfaces.

Caution: During entire procedure, make sure all internal parts are well coated with oil to prevent corrosion.

e. Remove cotter pins (18), take off nuts (17) and bolts (15), and remove connecting rod bearing caps (16).

Note. Mark connecting rod caps and connecting rods so that caps may be reassembled with corresponding rods and in original positions.

f. Push connecting rods and pistons (14) up so that pistons extend above compressor body.

g. Remove piston rings (13) by inserting tip of knife blade between ring and piston and moving around piston so that ring comes off.

h. Push pistons down into bores.

i. Place new ring inside bore and check end clearance with feeler gage. Correct clearance is 0.005 inch to 0.010 inch. If clearance is less than 0.005 inch, remove ring and carefully file ends to obtain proper clearance, making sure no burrs or filings are left on the ring. If clearance is more than 0.010 inch, replace ring.

j. Push pistons up above compressor body and install rings in grooves. Compress rings and push pistons down into bores.

k. Attach connecting rods (10) to crankshaft by placing bearing caps (16) around crankshaft connecting rod journals and securing with bolts (15) and castle nuts (17). Lock nuts in place with new cotter pins (18).

Note. Make sure bearing caps are installed on corresponding connecting rods and in same positions from which they were removed.

l. Using new gasket (54), attach bottom plate (55) with cap screws (56).

m. Install cylinder head and valve plate assembly (par. 91*g*, *h*, and *i*).

n. Turn flywheel to make sure pistons are free.

o. Install compressor in ice plant (par. 87).

p. Run compressor at least 8 hours, checking oil frequently, then drain oil completely (par. 15*b*(5)(e)) and add 3½ quarts of fresh compressor oil.

149. Compressor Shaft Seal Replacement

a. Remove compressor (par. 86).

b. Secure flywheel and remove flywheel nut (2, fig. 54).

c. Using a gear puller, remove flywheel and take out woodruff key (8).

d. Remove cap screws (1) and carefully slide seal assembly (3) and gasket (4) from crankshaft (9). Discard gasket (4).

e. Remove all gasket material from housing by scraping.

f. Check crankshaft for rust or corrosion and carefully polish with steel wool, if necessary, and clean with an approved cleaning solvent and dry.

g. Using new gasket (4), install new seal assembly (3). Lightly coat seal with clean compressor oil and push straight on shaft, making sure neoprene binder fits snugly.

Note. Do not exert force on seal nose. Apply pressure evenly to seal face plate and flange only.

h. Secure seal assembly with cap screws (1).

i. Place woodruff key (8) in slot in crankshaft and slide flywheel on crankshaft. Secure with flywheel nut (2).

j. Install compressor in ice plant (par. 87).

Section VII. CONDENSER FAN AND GEAR BOX

150. Description

The condenser fan draws air through the condenser into the machine compartment, and is driven by a belt connected to the engine. The fan shaft extends into a gear box, and through a set of miter gears drives the brine agitator belt.

151. Condenser Fan and Gear Box Removal and Disassembly

a. Remove brine agitator drive belt from pulley (2, fig. 12) of vertical drive shaft (3).

b. Remove condenser fan drive belt from condenser fan pulley (6).

c. Remove cap screws (1) and lockwashers and slide gear box and condenser fan from bracket.

d. Remove filler plug from gear box and drain lubricant from gear box.

e. Remove cap screws (21, fig. 55) and lockwashers (20) and take off fan (19).

f. Remove setscrew (2) and take fan hub and pulley (18) from horizontal driveshaft (13). Remove fan hub key (14) from horizontal drive shaft.

g. Remove cap screws (17) and take off gear box cover (16), carefully easing bearing (15) from gear box cover.

h. Pull out horizontal drive shaft assembly, carefully easing inner bearing from gear box.

i. Using a bearing puller, remove inner (11) and outer (15) bearings from horizontal drive shaft (13).

j. Drive out pin (7) and slide miter gear (12) from horizontal drive shaft.

k. Remove setscrew (2) and take pulley (1) and key (5) from vertical drive shaft (6).

l. Remove snap ring (3) from gear box and pull vertical drive shaft assembly from gear box, carefully easing upper (4) and lower (8) bearings from gear box.

m. Drive out pin (7) and slide miter gear (9) from vertical drive shaft.

n. Using a bearing puller, remove bearings (8 and 4) from vertical drive shaft.

152. Condenser Fan and Gear Box Cleaning, Inspection, and Repair

a. Soak all parts in an approved cleaning solvent and use a small nonmetallic brush to remove stubborn grease. Repeatedly dip bearings in solvent, turning the races between dippings. Dry all parts thoroughly.

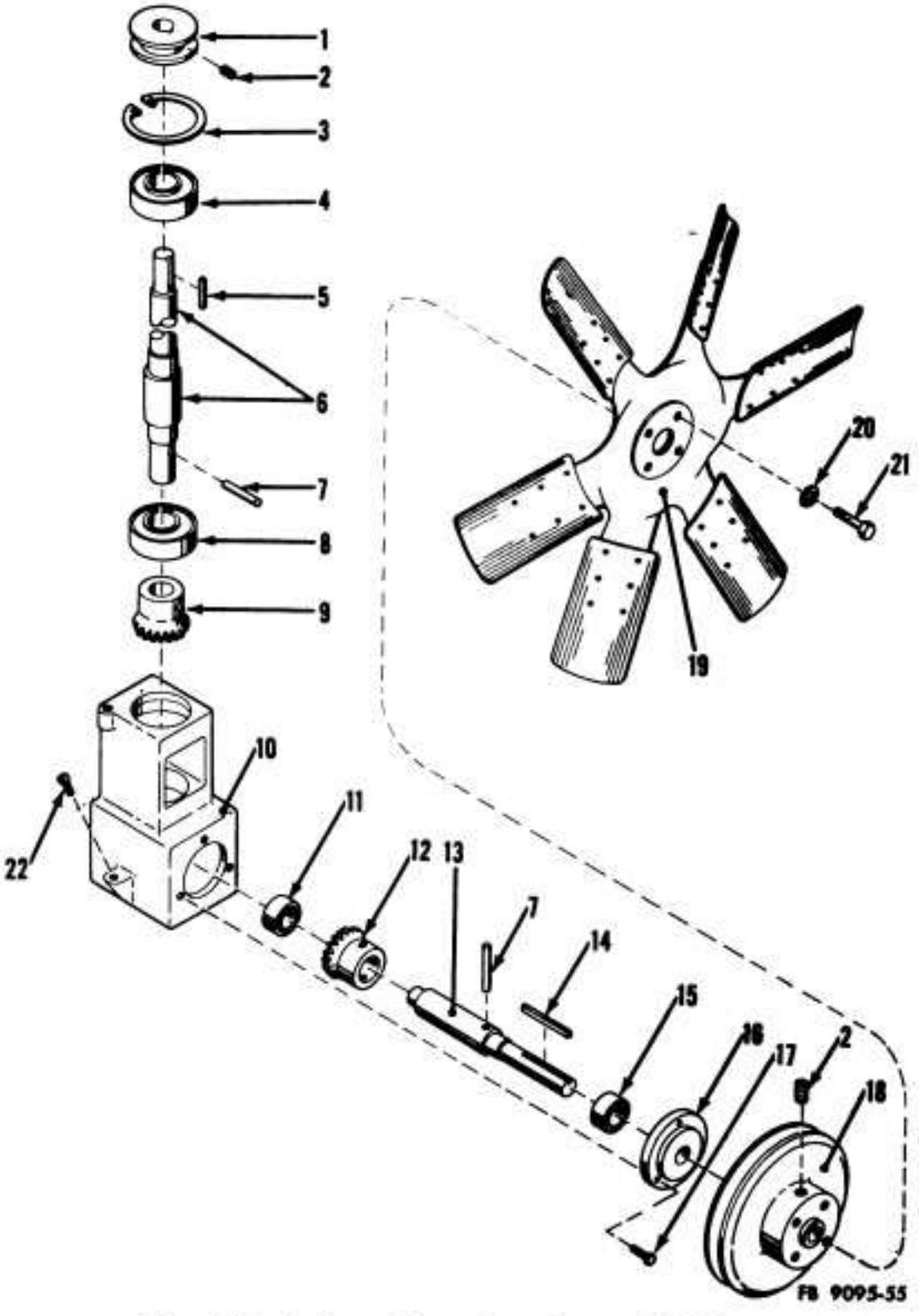

Figure 55. Condenser fan and gear box, exploded view.

b. Check fan for dents and cracks. Hammer out and straighten dents. If cracks are found, replace fan.

c. Inspect bearing balls for chips, cracks, and flat spots. Hold inner race and spin outer race. If bearing balls are defective, or if bearing does not spin freely, replace bearing. Wear of bearings should be negligible, and should not be a factor for consideration for replacement of bearings.

d. Inspect miter gears for chipped or broken teeth and replace if defective. Wear of gears should be negligible, due to design of gear box, and should not be a factor for consideration for replacement of gears.

e. Inspect all screws for worn or stripped threads and replace if defective.

153. Condenser Fan and Gear Box Reassembly and Installation

a. Slide miter gear (12, fig. 55) on horizontal drive shaft (13) and aline holes in miter gear with hole in horizontal drive shaft. Drive pin (7) through holes to secure miter gear.

b. Carefully press bearing (11) on end of horizontal drive shaft next to miter gear.

c. Carefully press bearing (15) on other end of horiztontal drive shaft so that sealed end of bearing is facing away from miter gear (toward keyway).

d. Place horizontal drive shaft assembly in gear box (10) and ease bearing (11) into position inside gear box.

e. Ease gear box cover (16) over bearing (15) and attach to gear box with cap screws (17).

f. Carefully press bearing (8) into place over lower end of veritcal drive shaft (6).

g. Place miter gear (9) on lower end of vertical drive shaft so that holes in miter gear aline with hole in vertical drive shaft. Drive pin (7) through holes to secure miter gear.

h. Carefully press bearing (4) into place over upper end of vertical drive shaft.

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1 Pulley, vertical drive shaft
2 Setscrew, Allen hd, 3/8–16 x 1/2 (2 rqr)
3 Ring, snap, bearing, retaining
4 Bearing, ball, double seal
5 Key, drive shaft, vertical 1/4 x 1/4 x 1 1/4
6 Shaft, drive, vertical
7 Pin, taper, #4 x 2 (2 rqr)
8 Bearing, ball, single seal
9 Gear, miter, 1 1/8 inch bore
10 Gear box
11 Bearing, ball
12 Gear, miter, 1 inch bore
13 Shaft, drive, horizontal
14 Key, drive shaft, horizontal, 1/4 x 1/4 x 3
15 Bearing, ball, single seal
16 Cover, gear box
17 Screw, cap, hex, 5/16–18 x 3/4 (3 rqr)
18 Fan hub and pulley
19 Fan
20 Lockwasher, 5/16 (4 rqr)
21 Screw, cap, hex, 5/16–18 x 3/4 (4 rqr)
22 Plug, filler, gear box

Figure 55—Continued.

i. Ease vertical drive shaft assembly into gear box so that teeth of gears mesh and lower bearing (8) fits into hole inside gear box.

j. Install snap ring (3) in gear box to secure upper bearing (4).

k. Place key (5) in keyway in vertical drive shaft, slide pulley (1) over upper end of vertical drive shaft and secure with setscrew (2).

l. Place key (14) in keyway in horizontal drive shaft, slide fan hub and pulley (18) over end of horizontal drive shaft and secure with setscrew (2).

m. Attach fan (19) to fan hub with cap screws (21) and lockwashers (20).

n. Turn fan by hand to make sure gears and bearings do not bind.

o. Slide gear box and condenser fan into bracket and secure with cap screws and lockwashers.

p. Install drive belts and adjust belt tension and alinement (par. 7*f*(1)).

q. Fill gear box with 2 pints of fresh oil (LO 5–9095) and install filler plug (22).

Section VIII. BRINE AGITATOR

154. Description

The brine tank contains a brine agitator which circulates the brine over the cooling coils, then out around the ice cans. The brine agitator consists of a propeller on a shaft, which is driven by a belt connected to the vertical drive shaft of the gear box in the machine compartment. The upper end of the shaft runs in a ball bearing and the lower end is supported by, and runs in, a lignum vitae underwater bearing.

155. Brine Agitator Removal and Disassembly

a. Drain brine tank (par. 126*a*). Reinstall drain plug.

b. Remove brine agitator cover (par. 7*f*(1)(*l*)), and take off brine agitator drive belt.

c. Remove the four cap screws holding brine agitator pulley splash cover (1, fig. 11) and take off cover.

d. Remove sheet metal screws (6) and plain washers holding brine raceway inlet cover (4) in place.

e. Slide brine raceway inlet cover up and remove lower brine agitator bearing cap screws and lockwashers and carefully slide lower brine agitator bearing from brine agitator shaft (7).

f. Remove cap screws (14, fig. 56) and lockwashers (2) from bearing pillow block (15) and take out brine agitator assembly. Remove brine raceway inlet cover (4, fig. 11) from brine tank.

g. Remove propeller retaining nut (4, fig. 56) and lockwasher (5), slide propeller (6) from brine agitator shaft (7), and remove key (17).

h. Remove setscrews (11) from upper bearing (10) and slide upper bearing assembly from brine agitator shaft. Remove setscrew (12) and plug (13) from bearing pillow block and take bearing from pillow block.

i. Remove setscrew (11) from pulley (9) and slide pulley from brine agitator shaft.

j. Remove setscrew (11) from splash plate (8), take off splash plate, and remove key (16).

156. Brine Agitator Cleaning, Inspection, and Repair

a. Soak all parts, except lower brine agitator bearing, in an approved cleaning solvent and dry thoroughly. Clean lower brine agitator bearing, which is lined with lignum vitae, by very carefully scraping to remove brine salts.

b. Inspect upper bearing by holding inner race and spinning outer race. If bearing does not spin freely, replace it.

c. Inspect lower end of brine agitator shaft and lignum vitae lining of lower bearing for scoring. If shaft or bearing is scored, replace affected part.

d. Place lower bearing over lower end of brine agitator shaft and check sideplay. If sideplay is more than $\frac{1}{32}$-inch, replace bearing.

157. Brine Agitator Reassembly and Installation

a. Place splash plate (8, fig. 56), flanged side up, temporarily on brine agitator shaft (7) a few inches below upper keyway and secure with setscrew (11).

b. Place key (16) in upper keyway and slide pulley (9), flanged side up, on brine agitator shaft and center over key. Secure with setscrew (11).

c. Place upper bearing (10) in bearing pillow block (15) so that identation in outer race of bearing is directly beneath setscrew hole of bearing collar. Place plug (13) in setscrew hole and insert setscrew (12) into setscrew hole so that plug holds bearing in plate.

d. Slide upper bearing assembly, flanged side up, temporarily on brine agitator shaft above pulley, and secure with setscrews (11).

e. Place key (17) in lower keyway of brine agitator shaft and slide propeller (6) on lower end of brine agitator shaft over key. Hold in place with lockwasher (5) and propeller retaining nut (4).

f. Carefully slide lower brine agitator bearing (3) on lower end of brine agitator shaft.

g. Hold entire brine agitator assembly against brine agitator mounting plate in brine tank so that mounting holes in lower brine agitator bearing are alined with corresponding holes in brine agitator mounting plate. If necessary, loosen setscrews (11) in upper bearing and raise or lower bearing assembly so that mounting holes in bearing collar are

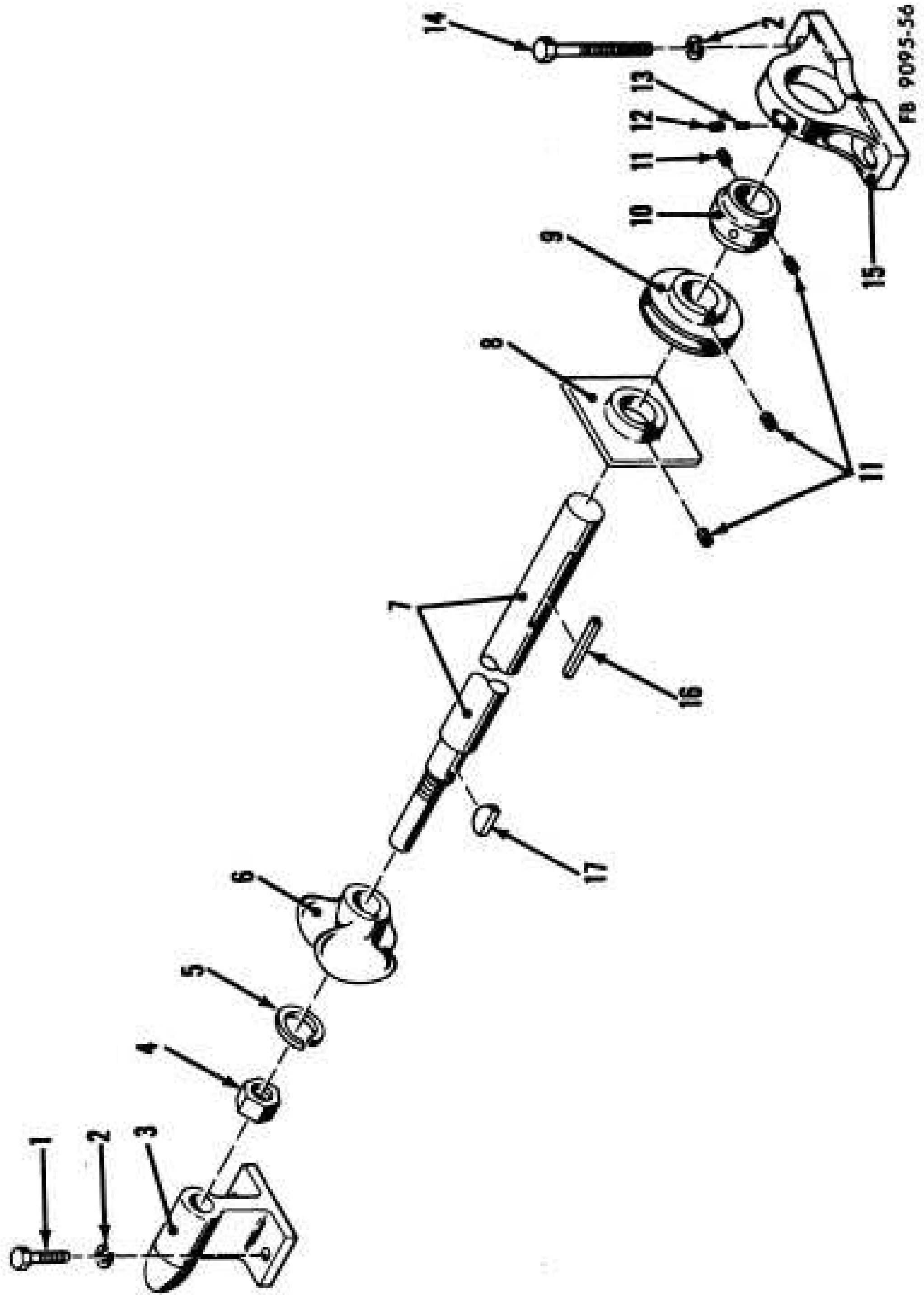


Figure 56. Brine agitator, exploded view.

1 Screw, cap, hex, $\frac{3}{8}$-16 x $\frac{3}{4}$ (2 rqr)
2 Lockwasher, $\frac{3}{8}$ (4 rqr)
3 Bearing, underwater, lignum vitae
4 Nut, hex, bronze, $\frac{7}{8}$-14
5 Lockwasher, bronze, $\frac{7}{8}$
6 Propeller, bronze
7 Shaft, brine agitator
8 Plate, splash
9 Pulley, brine agitator shaft
10 Bearing, ball, sealed
11 Setscrew, Allen hd, #12-24 x $\frac{1}{4}$ (4 rqr)
12 Setscrew, Allen hd, #10-24 x $\frac{1}{4}$
13 Plug, $\frac{3}{16}$ x $\frac{3}{16}$ x $\frac{1}{4}$
14 Screw, cap, hex, $\frac{3}{8}$-16 x $1\frac{3}{4}$ (2 rqr)
15 Block, pillow, ball bearing
16 Key, brine agitator shaft, $\frac{1}{4}$ x $\frac{1}{4}$ x $1\frac{1}{4}$
17 Key, woodruff #9

Figure 56—Continued.

alined with corresponding holes in spacer bar (2, fig. 11). Tighten setscrews and remove brine agitator assembly.

h. Place brine raceway inlet cover (4) in brine tank.

i. Carefully lower propeller through hole in brine raceway inlet cover and attach bearing pillow block (15, fig. 56) to spacer bar with cap screws (14) and lockwashers (2).

j. Slide brine raceway inlet cover up and carefully slide lower brine agitator bearing (3) over end of brine agitator shaft and attach to brine agitator mounting plate with cap screws (1) and lockwashers (2).

k. Slide brine raceway inlet cover into place and secure with sheet metal screws (6, fig. 11) and plain washers.

l. Hold brine agitator pulley splash cover (1) temporarily in place in brine tank and loosen setscrew (11, fig. 56) in splash plate (8). Move splash plate up so that it almost meets brine agitator pulley splash cover and tighten setscrew.

m. Attach brine agitator pulley splash cover to brine tank with cap screws and lockwashers.

n. Turn brine agitator by hand to make sure bearings are free and no parts bind.

o. Attach and aline brine agitator belt and adjust tension (par. 7*f*(1)).

p. Install brine agitator cover (par. 7*f*(1)(*v*)).

Section IX. HOUSING

158. Description

The housing consists of an insulated, vapor-tight, steel casing covering the brine tank; insulated covers for the ice can compartments; removable covers for the brine agitator and machine compartment; and three machine compartment doors mounted with slip-pin hinges for easy removal.

159. Housing Removal

a. Remove housing doors and covers (par. 79).

b. Pump down the system (par. 15*b*(1)), and close all valves.

c. Remove ice can covers and ice cans. Drain brine tank (par. 16*b*).

d. Remove brine agitator (par. 155*a–f*).

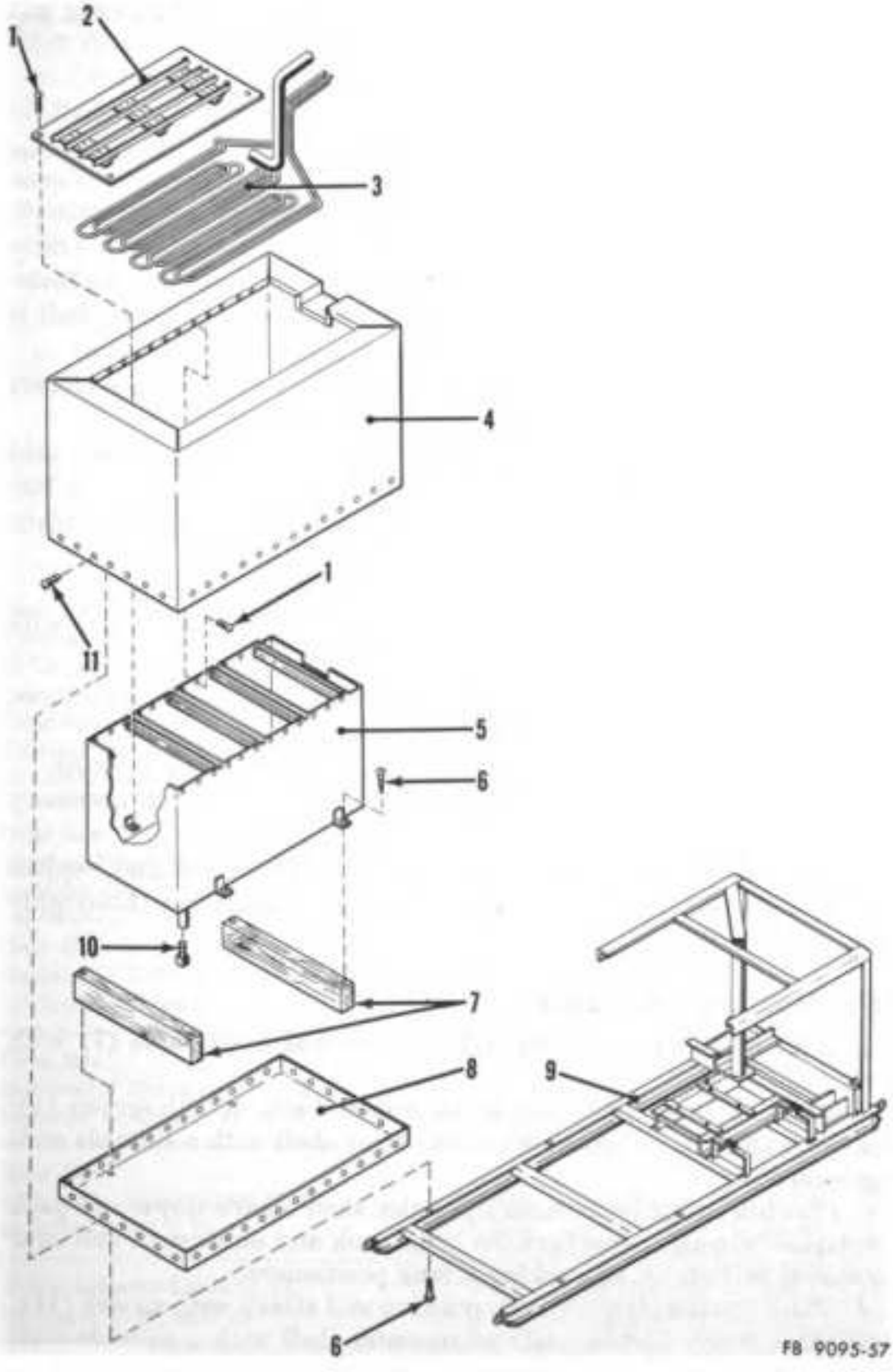
e. Remove sheet metal screws (6, fig. 11) from baffle (5) and take baffle out of brine tank.

f. Remove cap from discharge service valve port (7, fig. 15).

g. Disconnect distributor (7, fig. 45) from thermostatic expansion valve (9).

h. Remove thermostatic feeler bulb (par. 116*d*, *e*, and *f*).

i. Using a blowtorch, carefully heat joint at top of coil suction line where it is joined to heat exchanger. When joint separates remove coils (3, fig. 57) from brine tank.



1 Screw, sheet mtl, type A #10 x ½ (44 rqr)
2 Baffle
3 Coils
4 Outer shell
5 Brine tank
6 Screw, rd hd, #12 x 1½ (8 rqr)
7 Brine tank positioner (2 rqr)
8 Bottom plate
9 Skid
10 Plug, pipe, 1¼
11 Screw, sheet mtl, #10 x 1 (40 rqr)

Figure 57. Ice plant housing, exploded view.

Warning: Be careful to keep blowtorch away from fuel tank and other gasoline fittings.

j. Remove screws (1) holding brine tank to outer shell (4).

k. Remove screws (11) holding bottom plate (8) to outer shell.

Note. Outer shell is sealed at all edges joined by screws, to prevent moisture from entering. Sealing compound should be loosened with a knife or other suitable pointed tool before removing shell from brine tank and bottom plate.

l. Break the welds where upper frame joins outer shell and carefully lift outer shell from brine tank and skid (9). Insulating material is packed between outer shell and brine tank. As outer shell is removed, carefully remove the insulating material for reuse.

m. Remove screws (6) holding brine tank to brine tank positioners (7), and lift off brine tank.

n. Remove insulating material from bottom plate, and turn skid on side. Remove screws (6) holding brine tank positioners and bottom plate to skid, and remove brine tank positioners and bottom plate.

160. Housing Cleaning, Inspection, and Repair

a. Clean brine tank, coils, baffle, outer shell, and bottom plate with an approved cleaning solvent.

b. Inspect brine tank, outer shell, and bottom plate for punctures, dents, chipped paint, and corrosion.

c. Seal punctures with solder and file smooth. Tap out dents.

d. Remove any rust or corrosion, and repaint where necessary (par. 31).

e. Inspect insulation for moisture and rot. If rot is found, replace rotted insulation. If moisture is found, dry insulation thoroughly before reinstalling.

161. Housing Installation

a. Attach brine tank (5, fig. 57) to brine tank positioners (7) with screws (6).

b. Place outer shell (4) over brine tank and attach with screws (1). Seal all edges where brine tank meets outer shell with a suitable sealing compound.

c. Carefully turn brine tank and outer shell upside down and pack insulation into all spaces between brine tank and outer shell and over bottom of brine tank, around brine tank positioners.

d. Place bottom plate (8) into position and attach with screws (11). Seal edges where bottom plate meets outer shell with a suitable sealing compound.

e. Carefully turn entire unit over and attach to skid with screws (6). Weld upper frame members to outer shell where they meet at corners of outer shell.

f. Carefully place coils (3) in brine tank and braze upper end to heat exchanger suction line.

Warning: Be careful to keep blowtorch away from fuel tank and other gasoline fittings.

g. Connect distributor (7, fig. 45) to thermostatic expansion valve (9).

h. Install thermostatic feeler bulb (par. 118*e* and *f*).

i. Attach baffle (2, fig. 57) with screws (1).

j. Install brine agitator (par. 157*f–o*).

k. Replace dehydrator cartridges (par. 102*a*(1)–(10)).

l. Test for leaks (par. 7*h*(1)).

m. Purge the system (par. 15*b*(4)).

n. Install remainder of housing (par. 81), and brine tank drain (10, fig. 57).

Table V. Tolerances and Clearances (Refrigeration Components)

	M'fd diameter	M'fd tolerance	Minimum clearance	Maximum allowable wear
Gear Box Vertical Drive Shaft O. D. to Upper Bearing I. D.	1. 3784 1. 3779		0	0
Gear Box Vertical Drive Shaft O. D. to Lower Bearing I. D.	1. 3784 1. 3779		0	0
Gear Box Vertical Drive Shaft O. D. to Miter Gear I. D.	1. 000 1. 000	−0. 0005 −0. 0010	0	0
Gear Box Horizontal Drive Shaft O. D. to Outer Bearing I. D.	0. 9846 0. 9842		0	0
Gear Box Horizontal Drive Shaft O. D. to Inner Bearing I. D.	0. 7877 0. 7873		0	0
Gear Box Horizontal Drive Shaft O. D. to Miter Gear I. D.	1. 000 1. 000	−0. 0005 −0. 0010	0	0
Brine Agitator Shaft O. D. to Upper Bearing I. D.	1. 000 1. 000	−0. 0005 −0. 0010	0	0
Brine Agitator Shaft O. D.	0. 740	+0. 000 −0. 007		0. 003
to Lower (Lignum Vitae) Bearing I. D.	0. 740	+0. 003 −0. 000	0. 010	0. 010

Miter Gears—Minimum Allowable Backlash 0.000.
Maximum Allowable Backlash 0.010.

CHAPTER 5

SHIPMENT, LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

162. Limited Storage

a. Inspection and Maintenance Before Placing in Storage.

(1) *Inspection.* Make a complete inspection of the ice plant as outlined in paragraph 35. Correct any deficiencies.

(2) *Cleaning.*

(*a*) Remove ice can covers, take out ice cans and drain brine tank.

(*b*) Clean all surfaces both outside of unit and inside of brine tank that can be reached without disassembly. Remove all rust or other forms of corrosion from metal surfaces and wash the surfaces with cleaning solvent and dry thoroughly.

(*c*) Any surfaces where the paint film has been damaged should be repainted. Mask all finished or threaded surfaces prior to painting.

(*d*) Pump down the system (close valve in outlet line from compressor and pump gas into compressor; then close inlet valve) and remove drive V-belts from the engine to the compressor.

(*e*) Remove any defective lines or fittings from the condenser and brine tank piping system and install new parts.

(3) *Lubrication.* Lubricate the unit as directed in LO 5-9095.

(4) *Protection.*

(*a*) *Location.* Block the unit so it does not rest on the ground.

(*b*) *Cooling system.* Protect the cooling system of the engine by the addition of rust inhibitor to the coolant or the addition of antifreeze compound if freezing temperatures are anticipated.

(*c*) *Battery.* The storage battery must be fully charged and filled with sufficient electrolyte. In extremely cold climate, remove the battery and place it in a dry heated room.

(*d*) *Breathers.* Cover the breathers with waterproof tape, or other suitable material, to prevent the entrance of foreign material into the engine.

(*e*) *Covers.* See that all hoods or covers are closed and securely latched or cover the entire unit with a tarpaulin and lash the tarpaulin in place.

b. Inspection and Maintenance in Storage.

(1) *Inspection.* Every ten days, while the ice plant is in storage, check for evidence of physical damage such as rusting, accumulation of water and pilferage of parts. Check also for leaks of lubricants, fuel, or coolant and that the battery is fully charged and is properly filled with electrolyte.

(2) *Maintenance.* Service the unit as necessary for operation of the engine and perform any reasonable or necessary maintenance.

(3) *Operation.* Start the engine and run it long enough to allow it to come up to operating temperature and to lubricate all working surfaces.

c. Technical Inspection. Perform a technical inspection of the entire unit every 30 days.

163. Domestic Shipment

a. General. Refer to paragraph 162 for method of preparing ice plant for shipment.

b. Hoisting and Handling.

(1) Uncrated unit may be lifted with two slings by placing slings through the front and rear towing eyes and lifting both slings simultaneously with one hook above the center of the unit (fig. 58). Unit may be slowly towed by either front or rear towing eyes.

(2) Crated unit may be lifted by means of a sling and crane or by a forklift truck.

Caution: Make sure slings are securely fastened to unit before lifting. Never lift unit higher than necessary to clear obstacles.

c. Packaging and Blocking.

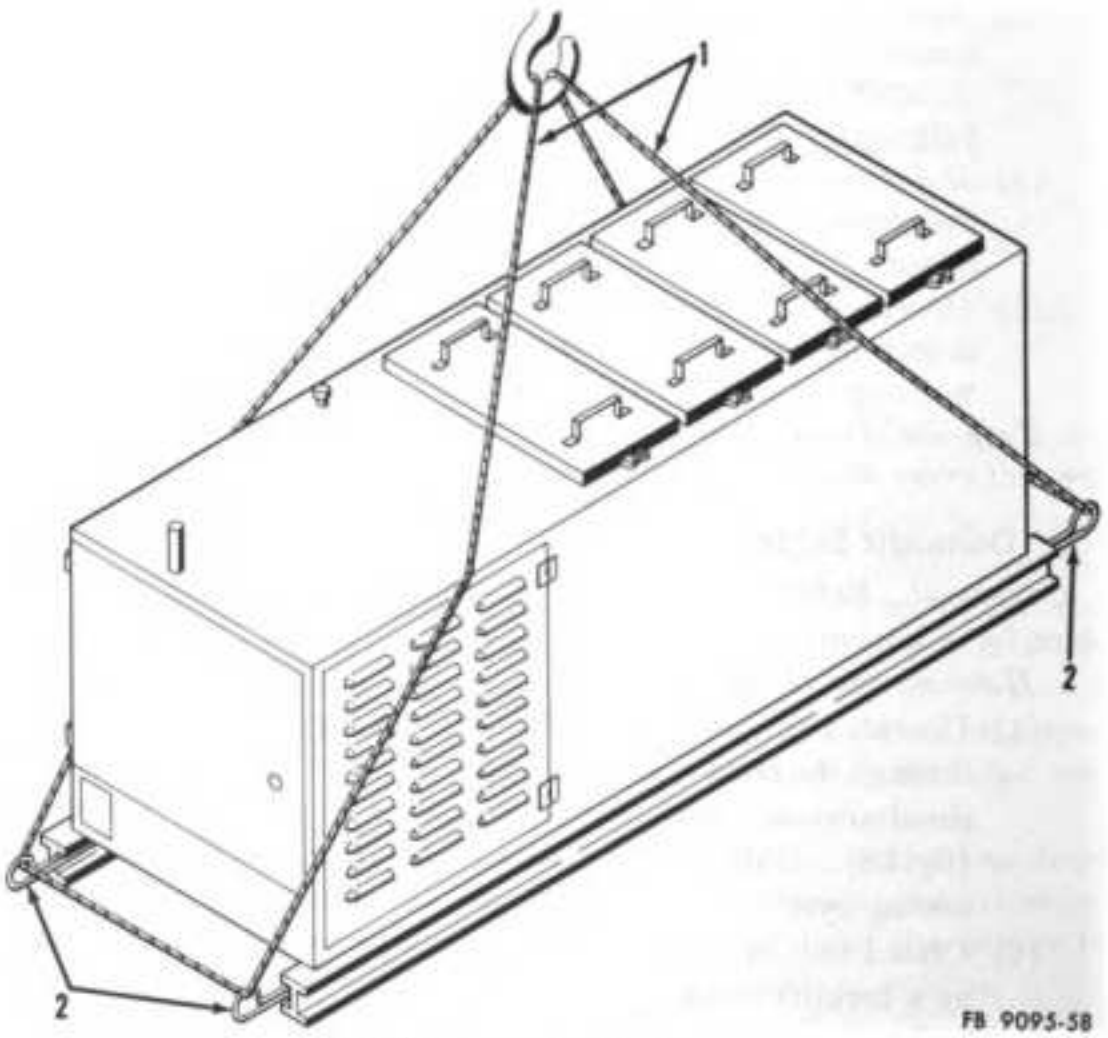
(1) Place sealing tape over glass dials of all gages.

(2) Build a strong wood platform (3, fig. 9) slightly longer and wider than the longest and widest dimensions of the ice plant.

(3) Secure the ice plant to the platform with U-shaped mounting bolts (2) over the towing eyes.

(4) Build a strong wood crate totally enclosing the unit.

(5) Block crated unit with wood wedges placed around the crate and nailed to the base of the carrier (fig. 59).



1 Slings 2 Towing eyes

Figure 58. Ice plant, slings in place.

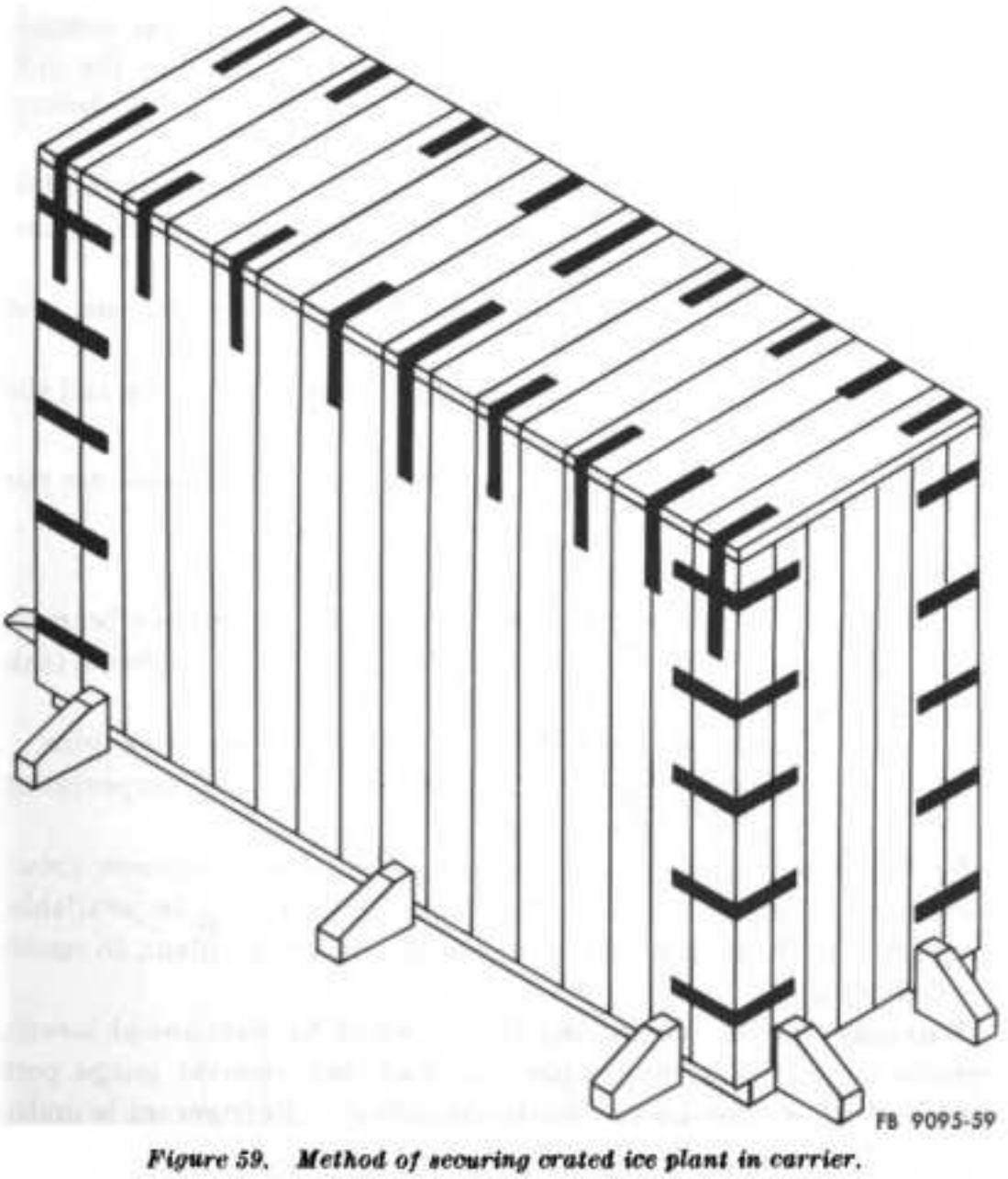


Figure 59. Method of securing crated ice plant in carrier.

Section II. DEMOLITION OF ICE PLANT TO PREVENT ENEMY USE

164. General

When capture or the abandonment of the ice plant to an enemy is imminent, the responsible unit commander makes the decision either to destroy the unit or to render it inoperative. Based on this decision, orders are issued which cover the desired extent of destruction. Whatever method of demolition is employed, it is essential to destroy the same vital parts of all ice plants and all corresponding repair parts.

165. Preferred Demolition Methods

Explosives and mechanical means, either alone or in combination, are the most effective methods to employ. Listed below are the vital

parts in order of priority of demolition for each preferred method. In each case, completion of the first two steps will render the unit inoperative. Completion of the additional steps will further destroy the unit.

a. Demolition by Explosives (fig. 60). Place as many of the following charges as the situation permits and detonate them simultaneously with detonating cord and a suitable detonator:

(1) A ½-pound charge between the governor, the magneto, and the engine.

(2) A ½-pound charge between the suction service valve and the compressor.

Note. The above charges are the minimum requirement for this equipment.

(3) A ½-pound charge in the brine tank drain.

(4) A ½-pound charge under the upper brine agitator bearing, between the brine agitator propeller shaft and the brine tank wall.

(5) A ½-pound charge between the carburetor and the engine.

(6) A ½-pound charge underneath the machine compartment cover on top of the fuel tank.

b. Demolition by Mechanical Means. Use sledge hammers, crowbars, picks, axes, or any other heavy tools which may be available, together with the tools normally included with the ice plant, to smash the following:

Warning: Before destroying the ice plant by mechanical means, remove the condenser purge port cap and both receiver purge port caps, and allow pressure to subside completely. Refrigerant is under pressure inside the system and destruction by mechanical means may cause an explosion if pressure is not relieved before damaging the equipment.

(1) The engine carburetor, magneto, and governor, and the engine block.

(2) The compressor suction service valve, discharge service valve, liquid level indicator, flywheel, and the compressor head.

Note. The above steps are the minimum requirement for this method.

(3) The brine tank and ice cans.

(4) The engine radiator and condenser cores.

(5) The receiver tanks and refrigerant lines.

(6) The brine agitator.

(7) The refrigeration system pressure gages and the engine gages.

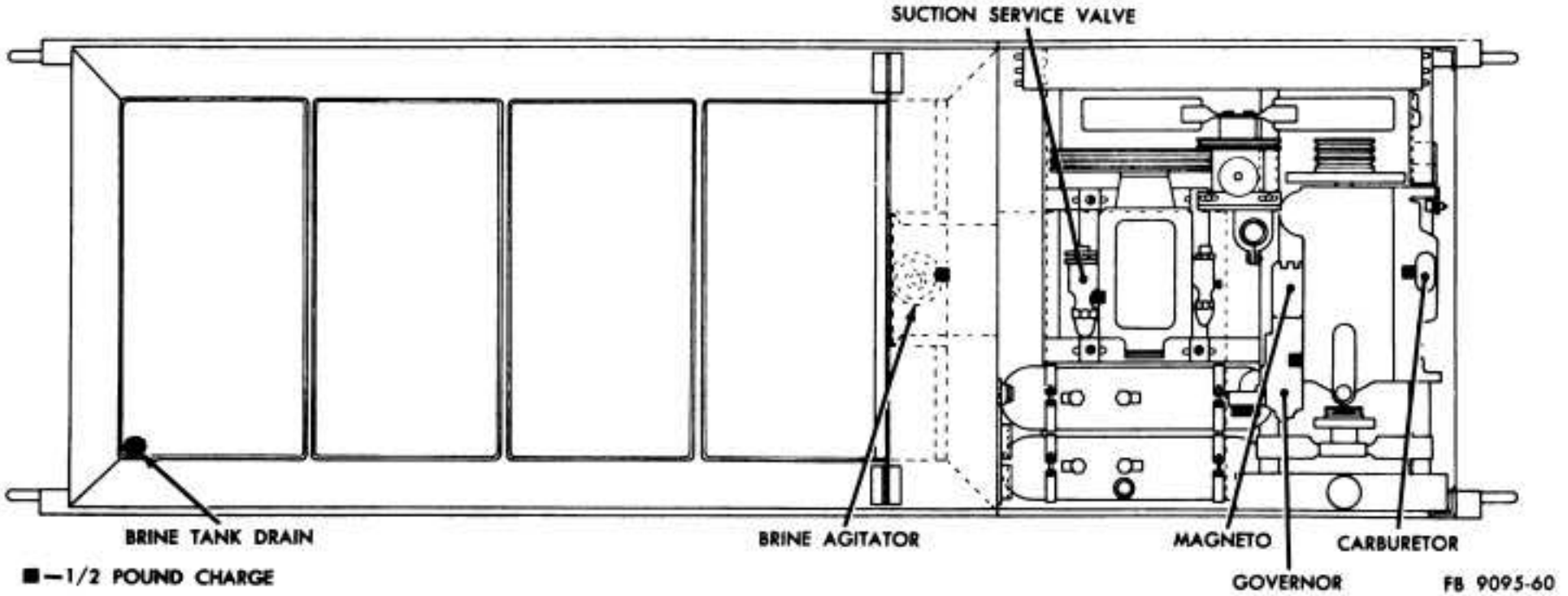


Figure 60. Placement of charges.

166. Other Demolition Methods

If the situation prohibits employing either of the preferred methods, use the following, either singly or in combination.

a. Demolition by Weapons Fire. Fire on the ice plant with the heaviest weapons available. Direct fire at both the machine compartment and the brine tank.

b. Demolition by Scattering and Concealment.

Warning: Before removing refrigeration components for scattering or concealment, remove the condenser purge port cap and both receiver tank purge port caps. Refrigerant is under pressure inside the system and removal of refrigeration components without first relieving pressure is dangerous to personnel.

Remove all easily accessible parts, such as spark plugs, magneto, carburetor, suction service valve, discharge service valve, thermostatic expansion valve, dehydrator, dehydrator bypass valves, and receiver tanks, breaking refrigerant lines where necessary for removal of refrigeration components, and scatter them through dense foliage, bury them in dirt or sand, or throw them in a lake, stream, well, or other body of water.

c. Demolition by Burning. Pack rags, clothing, or canvas under and around the unit. Saturate this packing with gasoline, oil, or diesel fuel, and ignite.

d. Demolition by Submersion. Totally submerge the unit in a body of water to provide some water damage and concealment. Salt water will do the greatest damage to metal parts. Remove condenser purge port cap and both receiver tank purge port caps to relieve refrigerant pressure and allow water to enter the refrigeration system.

e. Demolition by Misuse. Perform the steps listed below to make the unit inoperative:

(1) Disconnect governor control rod from carburetor.
(2) Remove a spark plug and throw sand into the cylinder. Reinstall the spark plug. Drain engine radiator and crankcase.
(3) Disconnect high pressure cutout switch and close discharge service valve.
(4) Start the engine.
(5) Open the throttle fully so that the engine operates at full speed until failure occurs.

167. Training

All operators should receive thorough training in the destruction of the ice plant. Simulated destruction, using all the methods listed above, should be included in the operator training program. It must be emphasized in training that demolition operations are usually

necessitated by critical situation, when the time available for destruction is limited. For this reason, it is necessary that operators be thoroughly familiar with all methods of destruction and be able to carry out demolition instructions without reference to this or any other manual.

APPENDIX I

REFERENCES

1. Accessory Equipment

TM 5–5189 International Harvester Engine U–1.
TM 5–687 Inspection and Preventive Maintenance Services for Fire Protection Equipment and Appliances.
TM 9–1799 Ordnance Maintenance: Fire Extinguishers.

2. Dictionaries of Terms and Abbreviations

SR 320–5–1 Dictionary of United States Army Terms.
SR 320–50–1 Authorized Abbreviations.

3. Lubrication and Painting

LO 5–5189 Engine, Gasoline, International Harvester Model U–1.
LO 5–9095 Ice Plant, 1-ton, Equipment Only, Gasoline Driven, Reco Model.

4. Preparation for Export Shipment

TB 5–9711–1 Preparation of Corps of Engineers Equipment for Overseas Shipment.
TB 5–9713–1 Preparation for Export, Spare Parts for Corps of Engineer Equipment.

5. Preventive Maintenance

TB 5–5189–1 Preventive Maintenance Services: Engine, Gasoline International Harvester Model U–1.
TB 5–9095–1 Preventive Maintenance Services, Ice Plant, 1-ton, Equipment Only, Gasoline Driven, Reco Model G 2000–S50D (Less engine).
TM 5–505 Maintenance of Engineer Equipment.

6. Publication Indexes

DA Pam 108–1 Index of Army Motion Pictures, Television Recordings and Filmstrips.
DA Pam 310–1 Index of Administration Publications.

DA Pam 310–2	Index of Blank Forms.
DA Pam 310–3	Index of Training Publications.
DA Pam 310–4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders and Modification Work Orders.
DA Pam 310–25	Index of Supply Manuals—Corps of Engineers.

7. Supply Manuals

ENG 1	Introduction.
ENG 3 41	List of Current Issue Items, Federal Class 41, Hand Tools.
ENG 5 51	List of All Items, Stock List, Federal Class, Acids and Chemicals.
ENG 7, 8, & 9 9095	Organizational Allowances, Field and Depot Maintenance Initial Stock Guide, Depot Stock Guide for Repair Parts and List of all Services Parts.

8. Training Aids

FM 21–8 Military Training Aids.

APPENDIX II

IDENTIFICATION OF REPLACEABLE PARTS

This appendix contains a list of replaceable parts for information only, and is not to be used as a basis for requisition of parts.

1. Standard Hardware

Fig. No.	Index No.	Federal supply and class item identification No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code	Part No.	Code	Part No.		
							BOLT, hex hd, 5/16-13 x 2¼	8
							BOLT, hex hd, 5/16-18 x ¾	6
							BOLT, hex hd, 5/16-18 x 1¾	2
							BOLT, hex hd, 5/16-24 x ⅝	2
							BOLT, hex hd, 5/16-24 x 3½	4
							BOLT, hex hd, ⅜-16 x ¼	2
							BOLT, hex hd, ⅜-16 x ⅝	2
							BOLT, hex hd, ⅜-16 x 1¼	4
							BOLT, hex hd, ⅜-16 x 1¾	2
							BOLT, hex hd, ¼-16 x 1	8
							BOLT, hex hd, ½-13 x 1	2
							BOLT, hex hd, ½-13 x 1¼	2
							BOLT, hex hd, ½-13 x 1½	4
							BOLT, sheet mtl, hex hd, Type Z, #10 x ⅜	10
							BOLT, stove, sq hd, ¼ x 2¼	1
							CAP, pipe, 1¼	1
							CLAMP, hose, size B	10
							KEY, 3/32 x 1	1

KEY, ¼ x ⅜	1
KEY, plain, ¼ x 1¼	3
KEY, plain, ¼ x 3	1
KEY, woodruff, #6	1
KEY, woodruff, #9	2
LOCKNUT, 5/16	1
LOCKWASHER, #4	2
LOCKWASHER, #5	2
LOCKWASHER, #6	1
LOCKWASHER, #8	7
LOCKWASHER, #10	9
LOCKWASHER, 3/16	20
LOCKWASHER, ¼	5
LOCKWASHER, 5/16	24
LOCKWASHER, ⅜	17
LOCKWASHER, 7/16	4
LOCKWASHER, ½	8
NUT, castle, ⅜–24	4
NUT, flare, ¼	7
NUT, flare, 5/16	1
NUT, flare, ⅜	3
NUT, flare, ½	6
NUT, hex, #8	1
NUT, hex, #10	10
NUT, hex, ¼	13
NUT, hex, 5/16	22
NUT, flare, ⅝	11
NUT, hex, 7/16	3
NUT, hex, ½	8
NUT, hex, ⅝	1
NUT, hex, ¾	1

1. Standard Hardware—Continued

Fig. No.	Index No.	Federal supply and class item identification No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code	Part No.	Code	Part No.		
							NUT, spring, #10	12
							NUT, sq, ¼	1
							NUT, wing, 5/16	8
							NIPPLE, pipe, 1¼ x 5½	1
							PIN, cotter, 1/16 x ½	2
							PIN, cotter, 1/16 x ¾	1
							PIN, cotter, 3/32 x ⅝	1
							PIN, cotter, 3/32 x 1	4
							PIN, cotter, 3/32 x 2	2
							PIN, taper, #4 x 2	2
							PLUG, pipe, ⅛	3
							PLUG, pipe, ¼	1
							PLUG, pipe, 1¼	1
							RING, O, ¾	1
							SCREW, cap, fillister hd, #6–32 x ½	1
							SCREW, cap, fillister hd, #10–24 x 5/16	4
							SCREW, cap, hex hd, ¼–20 x 1	4
							SCREW, cap, hex, ⅜–16 x 2½	10
							SCREW, cap, hex hd, ½–13 x 2¼	2
							SCREW, cap, hex hd, 5/16–18 x ¾	10
							SCREW, cap, hex hd, 5/16–18 x ⅞	10
							SCREW, cap, hex hd, 5/16–18 x 1	8
							SCREW, cap, hex hd, 5/16–18 x 1¼	4
							SCREW, cap, hex hd, 5/16–20 x ½	2
							SCREW, cap, hex hd, ⅜–14 x 1½	1

SCREW, cap, hex hd, 3/8–16 x 7/8	1
SCREW, cap, hex hd, 3/8–16 x 1	28
SCREW, cap, hex hd, 3/8–16 x 1 1/4	1
SCREW, cap, hex hd, 3/8–16 x 2 3/4	1
SCREW, cap, hex hd, 3/8–16 x 3 3/4	1
SCREW, cap, hex hd, 1/2–13 x 1 3/4	4
SCREW, cap, rd hd, #4–40 x 5/16	2
SCREW, cap, rd hd, #5–40 x 1/4	4
SCREW, cap, rd hd, #8–32 x 3/8	2
SCREW, mach, flat hd, #8–32 x 3/8	4
SCREW, cap, rd hd, 1/4–20 x 7/16	8
SCREW, mach, fillister hd, #10–24 x 5/8	2
SCREW, mach, fillister hd, #10–24 x 1 1/8	2
SCREW, mach, rd hd, #6–32 x 3/8	3
SCREW, mach, rd hd, #6–32 x 1/2	4
SCREW, mach, rd hd, #8–32 x 3/8	1
SCREW, mach, rd hd, #8–32 x 1/4	1
SCREW, mach, rd hd, #8–32 x 7/16	1
SCREW, mach, rd hd, #8–32 x 1/2	7
SCREW, mach, rd hd. #10–24 x 5/16	1
SCREW, mach, rd hd, #10–24 x 1/2	2
SCREW, mach, rd hd, #10–32 x 1/2	4
SCREW, sheet mtl, binder hd, type A, #10 x 1/2	65
SCREW, sheet mtl, binder hd, type A, #10 x 1	40
SCREW, sheet mtl, hex, type Z, #10 x 1/2	16
SCREW, wood, rd hd, #10 x 1/2	2
SCREW, wood, rd hd, #12 x 1 1/2	8
SETSCREW, Allen hd, 3/8–16 x 1/2	2
SETSCRLW, slotted hd, 1/4–20 x 3/4	2
SETSCREW, sq hd, 3/8–16 x 2	1
WASHER, plain, 5/16	28

1. Standard Hardware—Continued

Fig. No.	Index No.	Federal supply and class item identification No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code	Part No.	Code	Part No.		
							WASHER, plain, 3/8	4
							WASHER, plain, 1/2	4
							WASHER, plain, 5/8	1
							WASHER, plain, #6	1
							WASHER, plain, #8	1
							WASHER, shakeproof, #8	3
							WASHER, shakeproof, #10	4

2. Parts List

Fig. No.	Index No.	Federal supply and class item identification No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code	Part No.	Code	Part No.		
26			975	262398R91	975	262 398 R91	FILTER, oil	1
26	2				975	11581	GASKET, cover screw	1
26	3				975	11559	COVER	1
26	4				975	11583	SPRING, cover	1
26	5		975	68805R1	975	11582	GASKET, cover	1
26	6		975	262861R91	975	26 2861 R91	ELEMENT, filter	1
26	7				975	11562	SPACER	1
26	8				975	17 216 D	ELBOW	2
26	9				975	5310	BODY	1

26	10				975	262 859 R91	BRACKET	1
26	17				975	68 810 R1	PLUG, drain	1
27			975	353461R91	975	35 3461 R91	CLEANER, air	1
27	1		975	350750R91	975	350 750 R91	CAP, air intake	1
27	4				975	257 460 R1	ELBOW, breather pipe	1
27	6				975	353 402 R11	PIPE, breather	1
27	8				975	60 046 D	ELBOW, breather pipe	1
27	9				975	352 163 R2	BAIL, oil cup	1
27	10				975	352 162 R91	CUP, oil	1
27	13				975	353 750 R91	BODY, air cleaner	1
36	1		975	353403R1	975	353 403 R1	SHROUD, fan	1
36	2				975	4 665 D	GASKET, engine water outlet	1
36	3				975	7077–13–33	ELBOW, engine water outlet	1
36	8				975	351 964 R2	COUPLING, engine water outlet	1
36	10		975	43983D	975	43 983 D	CAP, radiator	1
36	11		975	43984D	975	43 984 D	GASKET, radiator cap	1
36	13		975	257957R91	975	257 957 R91	RADIATOR	1
36	20		975	257958R1	975	257 958 R1	COUPLING, radiator outlet	1
36	21		975	7077–13–1	975	7077–13–1	PUMP, water	1
36	23				975	27 648 D	COUPLING, water pump outlet	1
36	24				975	7077–13–28	ELBOW, engine water inlet	1
36	25				975	251 431 R1	GASKET, engine water inlet	1
37			975	263883R91	975	263 883 R91	FAN, engine cooling	1
37	3				975	262 687 R91	SPINDLE	1
37	5				975	262 685 R91	HUB, fan	1
37	6				975	70 208 D	GASKET, oil retaining screw	1
37	7				975	251 014 R1	SCREW, oil retaining	1
37	9		975	262687R91	975	262 687 R91	BEARING, fan	1
37	10				975	262 687 R91	IMPELLER, oil	1
37	12		975	70200D	975	70 200 D	GASKET, fan bearing	1
37	13				975	70 204 D	SPACER, blade	1

2. Parts List—Continued

Fig. No.	Index No.	Federal supply and class item identification No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code	Part No.	Code	Part No.		
37	14				975	262 686 R91	FAN	1
37	17				975	70 203 D	NUT, double	4
39	1		975	251470R1	975	251 470 R1	ROD, governor control	1
39	3				975	103 493	PIN, governor control rod yoke	1
39	4				975	117 824	YOKE, governor control rod	1
39	6				975	251 472 R91	LEVER, governor control rod	1
39	7				975	251 469 R1	BRACKET, rockshaft extension	1
39	8				975		COLLAR, rockshaft extension	1
39	9		975	251472R91	975	251 472 R91	EXTENSION, rockshaft	1
39	11		975	251464R1	975	251 464 R1	SPRING, governor	1
39	13		975	251465R11	975	251 465 R11	LEVER, throttle, governor spring	1
39	14		975	49-01-04	975	49-01-4	ARM, governor adjusting	1
39	16				975	251 450 R1	SHAFT, throttle lever	1
39	21		975	36152DA	975	36 152 DA	BUSHING, governor shaft	1
39	22				975	103 891	PLUG, Welch, type A	1
39	24		975	251473R1	975	251 473 R1	BODY, governor bumper spring	1
39	25		975	28078D	975	28 078 D	SPRING, governor bumper	1
39	27		975	251446R11	975	251 446 R11	HOUSING, governor	1
39	28				975	251 448 R1	PIN, dowel, governor base	1
39	29	3110-198-1775	381	BH68-OH	975	45 753 D	BEARING, needle, governor rockshaft	1
39	30		226	08412	975	251 449 R91	SEAL, oil, governor rockshaft	1
39	31		975	251461R11	975	251 461 R11	ROCKSHAFT, governor	1
39	32		975	251462R1	975	251 462 R1	FORK, governor tension	1
39	35		975	49-01-1	975	49-01-1	BRACKET, governor adjusting arm	1
39	37				975	142 485	PIN, groove, type #1	3

39	38				975	251 461 R11	LEVER, governor spring	1
39	39		975	351891R1	975	351 891 R1	WEIGHT, governor	2
39	40		975	354760R1	975	354 760 R1	BUSHING, governor shaft	1
39	41				975	355 304 R91	BASE, governor	1
39	42		975	251459R1	975	251 459 R1	SLEEVE, thrust	1
39	43		975	43481D	975	43 481 D	RACE, bearing	1
39	44		975	43481D	975	43 481 D	BEARING, thrust	1
39	45		975	43481D	975	43 481 D	RACE, bearing, thrust	1
39	46		975	251460R1	975	251 460 R1	RING, retaining, thrust sleeve	1
39	47				975	251 458 R1	GASKET, governor base	1
39	48		975	251457R1	975	251 457 R1	PIN, governor weight	2
39	50		975	355303R91	975	355 303 R91	SHAFT, governor	1
40	1		975	353407R91	975	353 407 R91	GAGE, oil pressure	1
40	2				975	8 732 D	KNOB, ignition switch	1
40	3				975	56 717 D	NUT, ignition switch mounting	1
40	5				975	47-01-06	PANEL, control	1
40	6		975	355302R91	975	355 302 R91	SWITCH, ignition	1
40	9				975	60 805 D	CLAMP, gage	2
40	15				975	60 278 DA	GAGE AND BULB, water temperature	1
46	1				758	470573	COUPLING, flare, ⅜	2
46	2				758	470573	BODY, dehydrator	1
46	3				758	470573	WASHER, sealing	2
46	4		758	470574	758	470574	CARTRIDGE, silica gel	2
46	5				758	470573	SPRING	1
46	6		758	470573	758	470573	CAP, dehydrator	1
49	3		073	777EFZ	758	470585	VALVE, thermostatic expansion, feeler bulb and capillary tube:	1
49	5				758	470585	SCREW, equalizer opening	1
49	6				758	470585	ELBOW, male	1
49	7				758	470585	ASSEMBLY, valve seat	1
49	8				758	470585	STRAINER	1

2. Parts List—Continued

Fig. No.	Index No.	Federal supply and class item identification No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code	Part No.	Code	Part No.		
49	9				758	470585	GASKET, strainer	1
49	10				758	470585	CONNECTOR, male	1
49	12				758	470585	CAP, superheat adjustment	1
52			975	355692R1	975	355 692 R1	CARBURETOR, float	1
52	1				975	351 845 R11	LEVER, throttle, and shaft	1
52	2				975	251 290 R1	BUTTERFLY, throttle	1
52	7				975	251 235 R1	GASKET, manifold	1
52	8				975	251 236 R1	STUD	2
52	9				975	251 294 R1	STRAINER, screen	1
52	10				975	351 958 R1	SCREW, idle adjusting	1
52	11				975	351 959 R1	SPRING, idle adjusting screw	1
52	12				975	355 713 R91	BODY, throttle	1
52	15				975	45 149 DA	SEAL, dust, throttle shaft	1
52	16				975	45 148 D	RETAINER, dust seal, throttle shaft	1
52	17				975	251 289 R1	SPRING, throttle stop screw	1
52	18				975	131 899	SCREW, throttle stop	1
52	19				975	251 337 R2	GASKET, fuel bowl	1
52	20		975	25948D	975	25 948 D	GASKET, needle valve seat	1
52	21				975	251 300 R21	SEAT, needle valve	1
52	22				975	251 300 R21	VALVE, needle	1
52	23		975	251293R1	975	251 293 R91	FLOAT	1
52	24				975	352 065 R21	BOWL, fuel	1
52	25				975	47 401 D	GASKET, main metering jet	1
52	26		975	355716R91	975	355 716 R91	JET, main metering	1
52	29				975	251 312 R11	SHUTTER, starting	1

52	30				975	351 324 R1	SHAFT, starting shutter and lever	1
52	32				975	45 148 D	RETAINER, dust seal, starting shutter shaft	2
52	33		975	45149DA	975	45 149 DA	SEAL, dust, starting shutter shaft	2
52	34				975	354 263 R91	RETAINER, drip hole plug	1
52	35				975	354 263 R91	PLUG, drip hole	1
52	36				975	251 308 R1	SPRING, friction	1
52	38		975	48-01-3	975	48-01-3	LEVER, choke control	1
52	42				975	47 401 D	GASKET, discharge nozzle	1
52	43		975	355717R11	975	355 717 R11	NOZZLE, discharge	1
52	44				975	251 331 R1	TUBE, idle	1
52	45				975	251 299 R1	PIVOT, float lever	1
53			636	FMXE4B11G	636	45-01-1	MAGNETO, ignition	1
53	1				636	A800	COVER, end cap	1
53	4		636	B682A	636	B682A	GASKET, end cover	1
53	5		636	B2474E	636	B2474E	BLOCK, distributor, upper	1
53	6				636	F2430A	CAP, end	1
53	7		636	H2514	636	H2514	GROUND STRIP, primary	1
53	10		636	G2457A	636	G2457A	BUSHING	1
53	11				636	H2514	GROUND STRIP, primary	1
53	12		636	B1355	636	B1355	GUIDE, primary ground strip	1
53	13		636	K2498	636	K2498	GASKET, end cap to frame	1
53	14				636	B2474E	BLOCK, distributor	1
53	15				636	F983A	ROD, high tension lead	1
53	16		636	M2765	636	M2765	ROTOR, distributor	1
53	17		636	E2460B	636	E2460B	ASSEMBLY, brush and spring	1
53	20		636	B1232	636	B1232	HOOD, vent	2
53	21		636	A6032A	636	A6032A	SCREEN, vent hood	2
53	23				636	A2735A	NUT, primary ground outlet	1
53	24		636	B1077	636	B1077	FERRULE, ground cable	1
53	25		636	A6018	636	A6018	WASHER, insulating	1
53	26		636	A3969	636	A3969	TERMINAL, ground cable	1

2. Parts List—Continued

Fig No.	Index No.	Federal supply and class item identification No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code	Part No.	Code	Part No.		
53	27		636	A1166	636	A1166	INSULATOR, terminal	1
53	31		636	D1498	636	D1498	RING, snap	1
53	32		636	F5952	636	F5952	GEAR, magnetic rotor	1
53	34		636	G2788	636	G2788	ASSEMBLY, cam wick and holder	1
53	37				636	W2437	ASSEMBLY, breaker arm	1
53	38	2920-354-0753	636	J2454	636	J2454	ASSEMBLY, contact support bracket	1
53	40				636	R2433	CAPACITOR	1
53	41		636	Q5939	636	Q5939	SHAFT AND GEAR, distributor	1
53	42		636	C2665	636	C2665	WASHER, thrust	1
53	43	5340-358-7578	636	B1498G	636	B1498G	LOCKPIN	1
53	44	2920-354-0767	636	X4631	636	X4631	ASSEMBLY, bearing support	1
53	45				636	C2477A	COIL	1
53	46				636	LZ2425	FRAME	1
53	48				636	2568	STOP PIN, impulse coupling	1
53	49	5340-358-7579	636	C1498D	636	C1498D	RING, snap	1
53	50				636	B5949A	BEARING, drive end	1
53	51	5340-358-7642	636	B1498B	636	B1498B	RING, snap	1
53	56				636	MW2480	ASSEMBLY, rotor	1
53	57	2920-428-7543	636	A5950A	636	A5950A	BUSHING	1
53	58			Q2563	636	Q2563	HUB, impulse coupling	1
53	59			D2565	636	D2565	SPRING, impulse coupling	1
53	60				636	C5491	SHELL, impulse coupling	1
53	62				636	A5931A	NUT, impulse coupling	1

54	------	----------	802	83000	758	470618	COMPRESSOR, reciprocating, power driven: refrigerant.	1
54	3	----------	802	81027	802	81027	ASSEMBLY, seal	1
54	4	----------	-----	----------	802	81040	GASKET, seal assembly	1
54	6	----------	-----	----------	802	83038	COVER, housing assembly	1
54	7	----------	-----	----------	802	26023	GASKET, housing cover assembly	1
54	9	----------	802	83007	802	83007	CRANKSHAFT	1
54	10	----------	-----	----------	802	26008RF	ROD, connecting	2
54	11	----------	-----	----------	802	25067	BUTTON, piston pin	4
54	12	----------	802	26011	802	26011	PIN, piston	2
54	13	----------	802	22025	802	22025	RING, piston	6
54	14	----------	-----	----------	802	26055	PISTON	2
54	15	----------	802	26069	802	26069	BOLT, connecting rod	4
54	16	----------	-----	----------	802	26008CF	CAP, connecting rod	2
54	19	----------	-----	----------	802	21051	VALVE, discharge service	1
54	21	----------	-----	----------	802	21051	PLUG, discharge service valve port	1
54	22	----------	-----	----------	802	21024	GASKET, discharge flange	1
54	23	----------	802	26026	802	26026	PIN, dowel	2
54	24	----------	-----	----------	802	26021	GASKET, valve plate	1
54	25	----------	-----	----------	802	85018	RETAINER, suction valve	2
54	26	----------	-----	----------	802	85033	REED, suction valve	2
54	27	----------	802	83069	802	83069	PLATE, valve	1
54	28	----------	-----	----------	802	85062	REED, discharge valve	2
54	29	----------	-----	----------	802	26064	SPACER, discharge valve	8
54	30	----------	-----	----------	802	85063	SPRING, discharge valve	8
54	31	----------	-----	----------	802	44054–1	PIN, dowel, discharge reed	4
54	32	----------	-----	----------	802	85061	RETAINER, discharge valve	2
54	35	----------	802	26070	802	26070	SCREW, cap, hex	10
54	36	----------	-----	----------	802	23079	GASKET, copper	10
54	37	----------	802	26002	802	26002	HEAD, cylinder	1
54	38	----------	-----	----------	802	26020	GASKET, cylinder head	1

2. Parts List—Continued

Fig. No.	Index No.	Federal supply and class item identification No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code	Part No.	Code	Part No.		
54	39				802	114616	SPACER, suction valve	4
54	41				802		ELBOW	1
54	43		802	81010	802	81010	PLATE, rear bearing cover	1
54	44		802	22019	802	22019	GASKET, rear bearing cover plate	1
54	45		802	81060	802	81060	BALL, thrust	1
54	46				802	22015	GASKET, suction chamber mounting flange	1
54	47		802	22014	802	22014	FLANGE, suction chamber mounting	1
54	48		802	22013	802	22013	STRAINER	1
54	49				802	22041	GASKET, suction service valve	1
54	50				802	21051	VALVE, suction service	1
54	53				802	26001	BODY, compressor	1
54	54				802	26022	GASKET, bottom plate	1
54	55		802	26006	802	26006	PLATE, bottom	1
54	57				802	81080–1	OIL return check valve	1
54	58				802	1007–1	PLUG, oil filler	1
55			758	470657	758	470657	GEAR ASSEMBLY, speed increaser	1
55	1		758	470659	758	470659	PULLEY, vertical drive shaft	1
55	3		758	470666	758	470666	RING, snap, bearing retainer	1
55	4	3110–156–3576	522	207KLL	758	470662	BEARING, ball, double seal	1
55	6		758	470661	758	470661	SHAFT, drive, vertical	1
55	7		758	470669	758	470669	PIN, taper	2
55	8	3110–156–3575	870	87507	758	470663	BEARING, ball, single seal	1
55	9		758	470668	758	470668	GEAR, miter, 1⅛-inch bore	1
55	10				758	470658	GEAR box	1
55	11		870	3L04	758	470664	BEARING, ball	1

55	12	----------	758	470667	758	470667	GEAR, miter, 1-inch bore	1
55	13	----------	758	470686	758	470686	SHAFT, drive, horizontal	1
55	15	3110-156-3545	870	87505	758	470665	BEARING, ball, single seal	1
55	16	----------	-----	----------	758	470658	COVER, gear box	1
55	18	----------	-----	----------	758	470672	FAN hub and pulley	1
55	19	----------	758	470671	758	470671	FAN	1
55	22	----------	-----	----------	758	470684	PLUG, filler, gear box	1
56	3	----------	758	470709	758	470709	BEARING, underwater, lignum vitae	1
56	4	----------	758	470706	758	470706	NUT, hex, bronze	1
56	5	----------	758	470707	758	470707	LOCKWASHER, bronze	1
56	6	----------	758	470705	758	470705	PROPELLER, bronze	1
56	7	----------	758	470704	758	470704	SHAFT, brine agitator	1
56	8	----------	-----	----------	758	470694	PLATE, splash	1
56	9	----------	758	470691	758	470691	PULLEY, brine agitator shaft	1
56	10	----------	875	NP16	758	470693	BEARING, ball, sealed	1
56	13	----------	-----	----------	758	470693	PLUG	1
56	15	----------	-----	----------	758	470693	BLOCK, pillow, ball bearing	1
57	2	----------	-----	----------	758	----------	BAFFLE	1
57	3	----------	-----	----------	758	470522	COILS	1
57	4	----------	-----	----------	758	----------	SHELL, outer	1
57	5	----------	-----	----------	758	----------	TANK, brine	1
57	7	----------	-----	----------	758	----------	POSITIONER, brine tank	2
57	8	----------	-----	----------	758	----------	PLATE, bottom	1
57	9	----------	758	20CA758	758	----------	SKID	1

APPENDIX III

SUPPLIES, EQUIPMENT AND TOOLS

1. Supplies

The following supplies are required for the continued operation in addition to the initial starting of the unit.

Quantity	Description	Stock number
3	CALCIUM CHLORIDE; hydrated; technical; FS O-C-106; flake; 100 lb bag (CLM111308).	CE 51-3380.500.500
1	GAS; Freon; F-12; 50 lb cylinder	CE 51-5116.500.600

2. Equipment

The following equipment is required for operation and testing.

1	CYLINDER; lucite or glass; graduated in 10 cci divisions; 0 to 100 cci 5 in height; 120 cci cap; TAN-T-473.	CE 57-3112.300.500
1	GRIP, handle; tank	758 470614
1	HYDROMETER, graduated scale	437 FX-1368
1	DETECTOR, leak; refrigerant gases; Halide No. 205A or equal.	CE 41-2611.500.600

3. Tool and Publication Set

The tools listed herein are those required to perform the operator maintenance services of the ice plant. To insure that a surplus of tools is not supplied and that proper accounting is maintained, the tool and publication set will be requisitioned as a separate item as indicated in ENG 7 & 8 9095.

Quantity	Description	Stock number
1	HAMMER, machinists; FS GGG-H-86; ball peen; Class I; type L; handled; 1 lb.	CE 41-4277.200.100
1	MODIFICATION KIT, MWO ENG 1999-1, for lubrication guides, check cards and manuals; MIL-P-11743.	CE 99-1999.000.010
1	OILER; steel; rd; ½ pt cap; sin spout, Eagle Mfg Co No. 145 PS or equal.	CE 13-5496.050.500
1	PLIERS, combination; slip joint; 6 in.; FS GGG-P-471; type F.	CE 41-5976.300.060

Quantity	Description	Stock Number
1	SCREWDRIVER, common; plastic handle; heavy duty; 8 in. blade; 7/16 in. tip; MIL-S-15713; type II, Class 2.	CE 41-7164.080.045
1	WRENCH, adjustable; crescent type; single hd; open end; heavy duty; FS GGG-W-631; type I; 15/16 in. opening x 8 in. long.	CE 41-9587.500.200
1	WRENCH, refrigerator repair; ratchet; Bonney No. RF 22 or equal.	CE 41-9698.500.600
1	WRENCH, spark plug; pressed steel type; w/bar handle; double end; 27/32 x 1 1/32 in. opening.	CE 41-9783.077.102

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[AG 673 (12 Oct 55)]

BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

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General, United States Army,
Chief of Staff.

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Major General, United States Army,
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5-279R, Engr Parts Depot Co (2)

NG: State AG (6); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see SR 320-50-1.

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