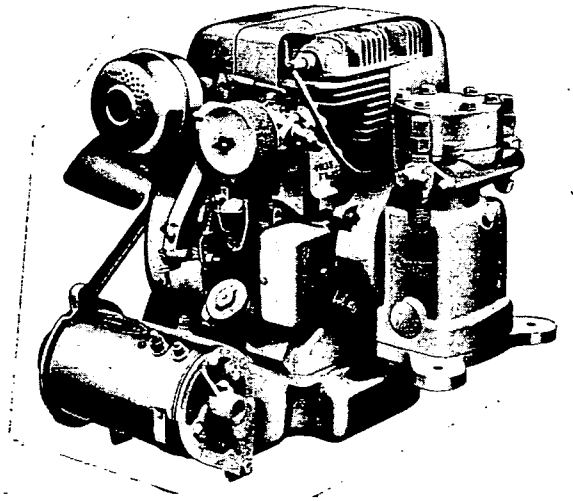
INSTRUCTION MANUAL
and PARTS CATALOG

FOR

ONAN
ENGINE-COMPRESSOR

Series

LK



Onan
DIVISION OF STUDEBAKER-PACKARD CORPORATION
MINNEAPOLIS 14, MINNESOTA

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Price $1.00

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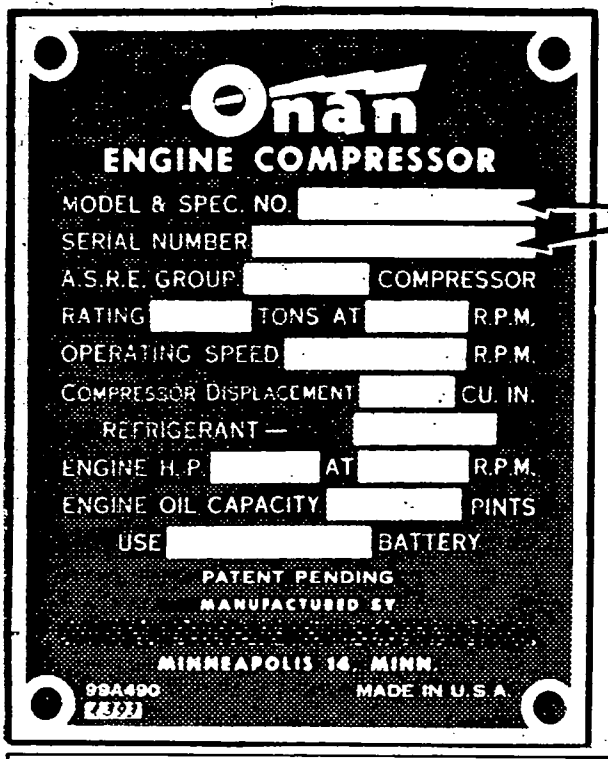
Important !



Always GIVE THESE NUMBERS WHEN ORDERING REPAIR PARTS OR REQUESTING SERVICE INFORMATION FOR YOUR UNIT !

NOTICE !

EXPLANATION OF "R-12" AND "R-22".

THESE ARE IMPARTIAL DESIGNATIONS THAT HAVE BEEN ACCEPTED BY THE REFRIGERATION INDUSTRY. REFER TO THE NAMEPLATE FOR THE REFRIGERANT USED.

R-12

Type	Refrigerant 12
Marketing Designation	R-12
Chemical Name	Dichlorodifluoromethane
Chemical Formula	CCl_2F_2
Various Brand Names are Acceptable.	Freon 12 (F-12), etc.

R-22

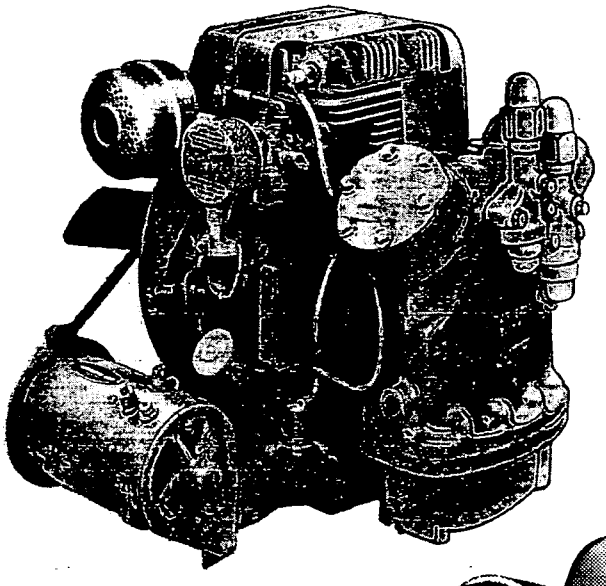
Type	Refrigerant 22
Marketing Designation	R-22
Chemical Name	Monochlorodifluoromethane
Chemical Formula	$CHClF_2$
Various Brand Names are Acceptable.	Freon 22 (F-22), etc.

This instruction manual applies to the LK series Engine-Compressor Unit package manufactured by ONAN Division of Studebaker Packard Corporation, Minneapolis 14, Minnesota

This instruction manual does not cover the particular equipment in which the unit is to be installed. Either the term Engine-Compressor or the term Motor-Compressor may be used when speaking of this unit.

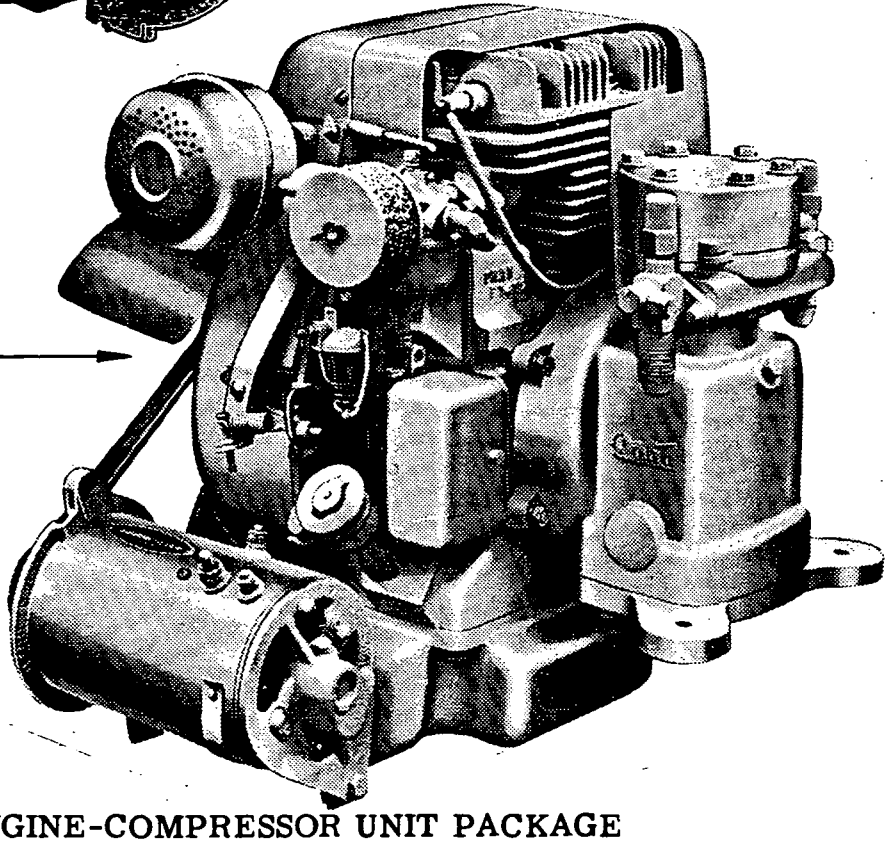
The PACKAGE referred to as the ENGINE-COMPRESSOR UNIT is a machine which consists of only the engine-compressor. It serves to compress the refrigerant gas in the system. It is the power unit for air-conditioning or refrigeration equipment in which it is to be installed.

The installer of this machine must provide connections and the remainder of the refrigerant system.



View Showing Two-Cylinder Compressor.

View Showing One-Cylinder Compressor.



ENGINE-COMPRESSOR UNIT PACKAGE

Most of the instructions in this manual apply to all models (basic and variations of basic) of the machines covered herein. The person using this instruction manual must select the instructions which apply according to the equipment on, and the characteristics of, the particular model in question. Some instructions, especially those pertaining to the refrigerant system beyond the compressor, apply only generally to the engine-compressor unit package and may be superseded by corresponding instructions supplied by the manufacturer or installer of the other components of the complete system.

It may be necessary to modify some of these instructions to suit the particular application.

This machine is designed to compress either Refrigerant 12 (R-12, dichlorodifluoromethane, CCl_2F_2) or Refrigerant 22 (R-22, $CHClF_2$, monochlorodifluoromethane) in a system operating with an evaporating temperature of between $15^{\circ}F$. and $40^{\circ}F$.

The engine-compressor is especially suitable for portable type installations. The compressor is directly connected to the internal combustion engine, making a single compact unit, and permitting operation while in transit as in vehicle air conditioning.

PACKAGE. - The engine-compressor unit package is defined in the foregoing INTRODUCTION section.

DIMENSIONS. - The outline assembly drawings reproduced on the following pages show specifications and dimensions of the basic models covered by this manual and show also several variations of optional equipment.

NAMEPLATE. - The nameplate attached to the engine blower housing identifies the engine-compressor. Always furnish the MODEL and SPEC. NO. and the SERIAL NUMBER with each inquiry.

When the unit Model and Spec (specification) are written together a diagonal (/) is used between them. The Spec Letter indicates a manufacturers production modification, while the Spec Number indicates optional equipment installed or furnished at the time of manufacture.

ENGINE DETAILS. - The ONAN manufactured engine is a 4 stroke cycle; single vertical cylinder; L-head; 3-1/4" bore; 3" stroke; air cooled; splash lubricated; electrically cranked; battery ignition; governor controlled; internal combustion engine.

Refer to the "Identification Chart" herein for orientation on parts and characteristics which may differ between basic and special models.

COMPRESSOR DETAILS. - The ONAN manufactured compressor is direct connected to the engine for permanent alignment. The one-cylinder compressor has a piston displacement within the range of 4.32 cubic inches to 6.28 cubic inches as determined by the length of stroke. The two-cylinder compressor has a piston displacement within the range of 8.64 cubic inches to 12.56 cubic inches as determined by the length of stroke.

The operating range is from 1800 to 2400 rpm. The capacity is proportional to the speed. Rated speed is 2400 rpm.

On the one-cylinder compressor, the suction valve has a 7/8 inch sweat connection and the discharge valve has a 5/8 inch sweat connection.

On the two-cylinder compressor, the suction valve has 1-1/8 inch sweat connection and the discharge valve has a 7/8 inch sweat connection.

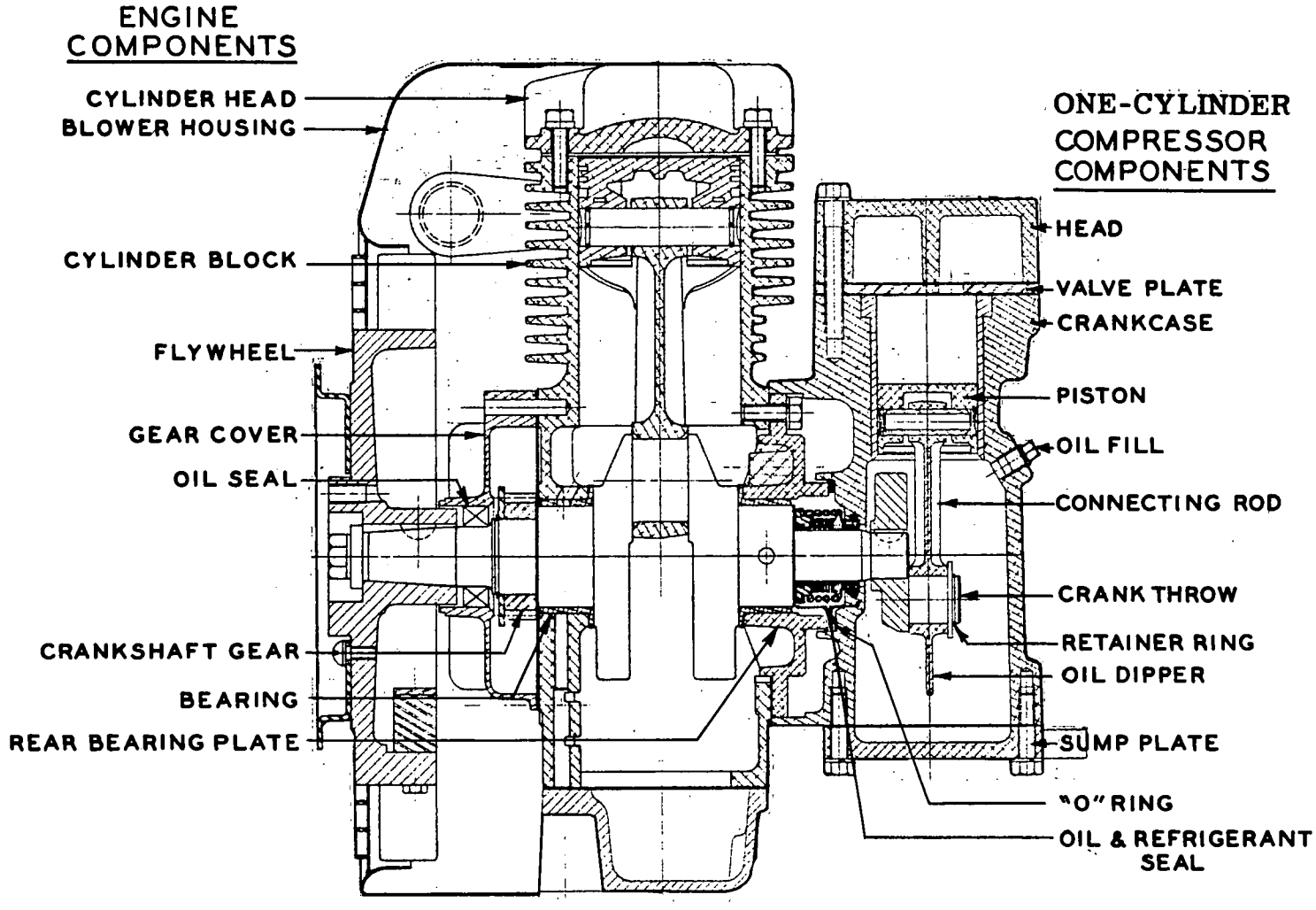


FIG. 1 - FRONT TO REAR CROSS SECTIONAL VIEW OF ENGINE-COMPRESSOR

The following "Identification Chart" qualifies various components and characteristics as being standard or optional and is intended to aid the reader when selecting the instructions which apply according to the characteristics of the particular machine in question.

IDENTIFICATION CHART
(Subject to change.)

Component Item or Characteristic	Contained in Engine-Compressor Unit Package
Oil Base - 9 Pint Capacity, 2 Recessed Mtg. Feet.	Standard (a)
Carburetor - Gasoline, Manual Choke.	Standard (b)
Carburetor - Gasoline, Electric Choke.	Optional (b)
Carburetor - Gas (LPG), with Secondary Regulator.	Optional (b)
Air Cleaner - Dry Type.	Standard
Air Cleaner - Oil Bath Type.	Optional
Fuel Pump - Engine Driven.	Standard
Fuel Pump - Electric (12 Volt, Negative Ground).	Optional
Gravity Feed - Fuel System.	Standard
Fuel Filter - Mounted on Pump.	Standard
Start Solenoid - Mounted.	Optional
Starting Switches.	Note (c)
Starter - 12 Volt.	Standard
Charge Regulator - 12 Volt, Negative Ground.	Optional
Governor - Constant Speed (Adjustable at engine only).	Standard
Muffler - Multiple outlet, to carburetor side.	Standard
Radio Noise Suppression - Electrical System.	Optional
Fan and Hub - Condensing Air.	Optional

Note (a) - Mounting cushions are included.
Note (b) - Gasoline fuel equipment is standard and LPG is optional.
Note (c) - To be obtained by Customer.

MODEL EXPLANATION

Example: LK-5MC / 2 A

- SPEC LETTER - Advances with production modification resulting in parts not interchangeable.
- SPEC NO. - Identifies optional equipment.
- DIAGONAL - Separates basic model from specification.
- Designates Motor(Engine)-Compressor application.
- Designates compressor displacement to nearest cu. in. ★
- Designates ONAN LK Series engine.

★ The one cylinder compressors are basic LK-5MC and LK-6MC, displacement proportional to stroke. The two cylinder compressors are basic LK-9MC and larger, displacement proportional to stroke.

EXHAUST GASES FROM INTERNAL COMBUSTION ENGINES ARE DEADLY POISONOUS. EXCESSIVE INHALATION WILL CAUSE SERIOUS ILLNESS OR DEATH. NEVER OPERATE THE ENGINE INSIDE A BUILDING OR OTHER CONFINED SPACE WITHOUT PIPING ALL EXHAUST GASES OUTSIDE THE ENCLOSURE.

GENERAL. - Proper installation of the engine-compressor in the equipment is important. The life of the machine, its economy of operation, and the less frequent need for repairs and adjustments are a few of the factors that are dependent upon proper installation.

The instructions given must necessarily be of a general nature due to the application differences. Follow generally the instructions given for the installation.

VENTILATION. - An ample volume of fresh cool air must be supplied to the engine at all times for proper cooling. If operated out of doors, ventilation is no problem, but reasonable care should be taken to protect the engine from unnecessary exposure to the elements.

Each enclosed installation requires that somewhat different provisions be made for proper cooling.

EXHAUST. - If operated out of doors, exhaust gases are no problem.

If operated in an enclosure, pipe the exhaust gases to the outside. The exhaust line should be of the same inside diameter as the exhaust outlet of the engine (1 inch) for the first 10 feet. If a longer line is needed, increase the pipe size one size for each additional 10 feet used. The exhaust line should always be shielded where it passes through a wall or partition or near flammable material. A thimble 12 " larger than the exhaust line must be provided, extending 9" beyond wall or ceiling on each side. Install a length of metal flexible exhaust tubing, at least one foot long, between the exhaust outlet of the engine and any rigid exhaust line. Avoid sharp bends if possible by using bent pipe or sweeping elbow where necessary. Do not connect the exhaust line of the engine to an exhaust line used by other equipment. Install the muffler on the pipe outside the enclosure. If the exhaust line must be inclined upward from the engine, construct a condensation trap of pipe fittings and install it at the point where the upward pitch begins. Drain the trap periodically.

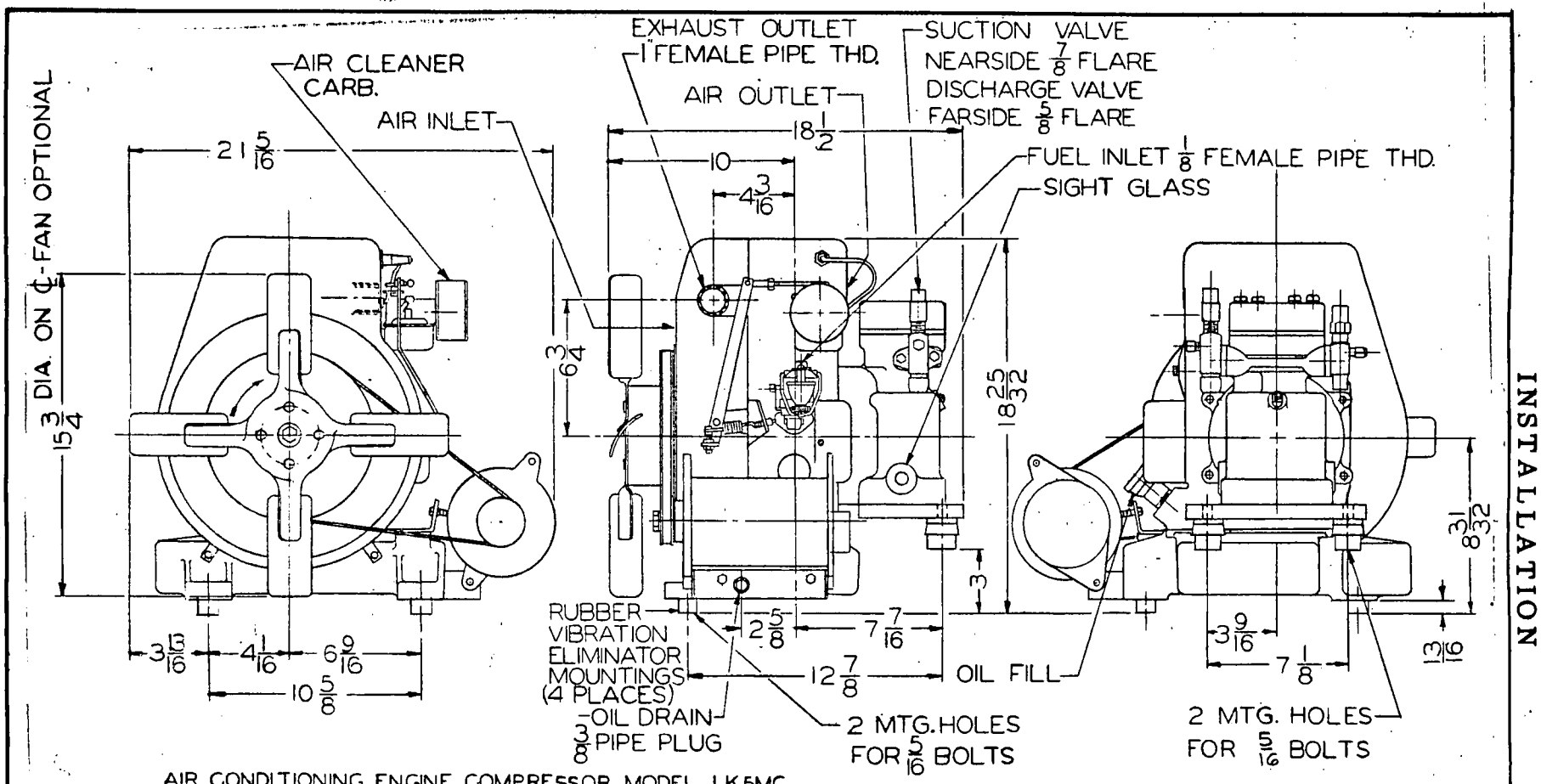


FIG. 2 - DIMENSIONAL OUTLINE (1-CYL. COMP.) (# 500A538)

AIR CONDITIONING ENGINE COMPRESSOR MODEL LK5MC

COMPRESSOR—ONAN
5 1/2 CUBIC INCHES
F-22 REFRIGERANT
28000 BTU CAPACITY
2400 R.P.M.
125° F CONDENSING
40° EVAPORATING

ENGINE—ONAN MODEL LK
25 CUBIC INCHES—6.25 HP AT 2400 R.P.M.
CORRECTED TO SAE STANDARDS
OIL CAPACITY 9 PINTS
BATTERY IGNITION—12 VOLT STARTER GENERATOR
D.C. OUTPUT 14.5 VOLTS 17 AMPERES

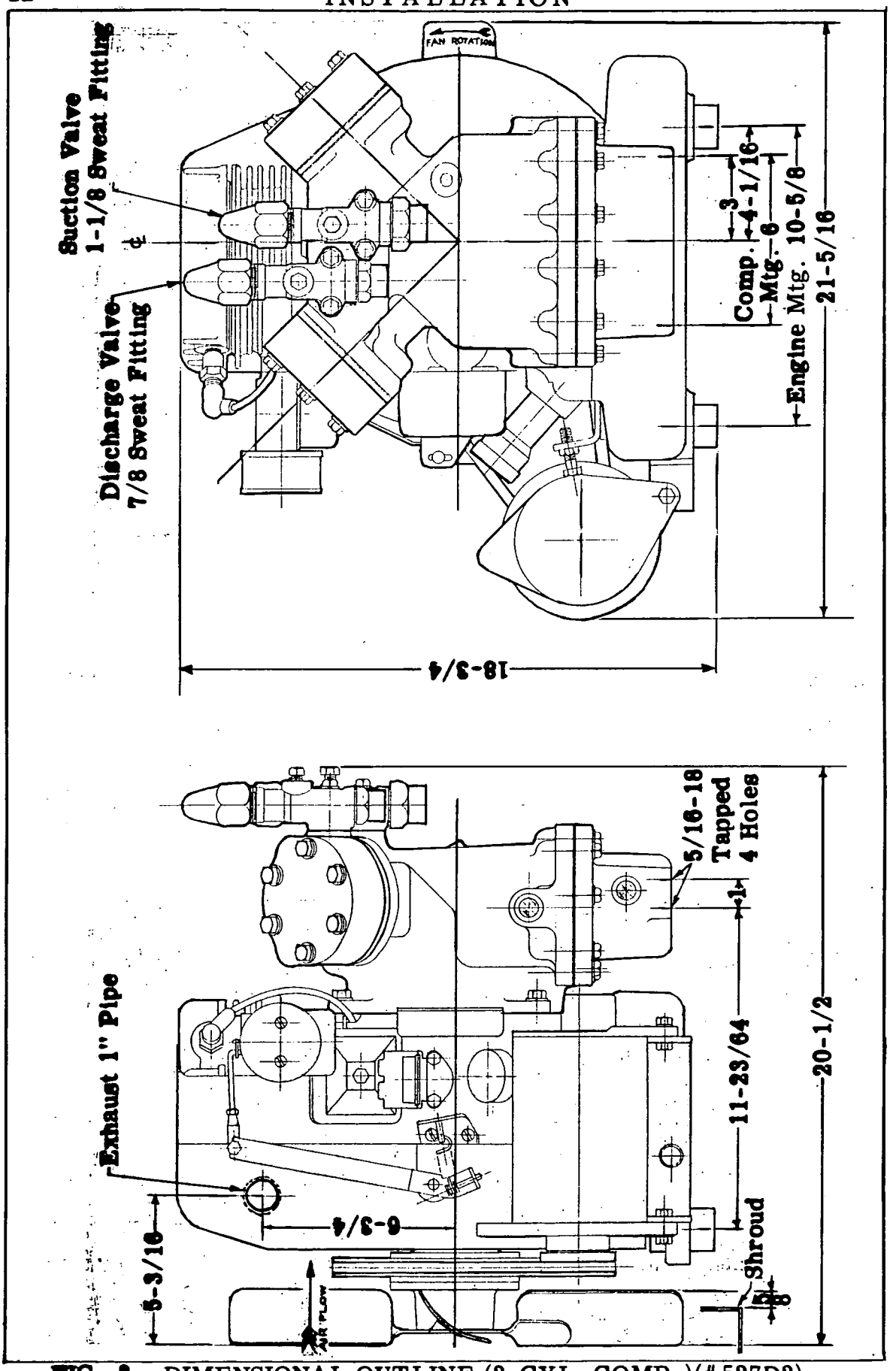


FIG. 3 - DIMENSIONAL OUTLINE (2-CYL. COMP.)(# 527D2)

VIBRATION ISOLATING MOUNTS. - Mounting cushions serve to prevent metal-to-metal contact.

The engine oil base which has two recessed points of mounting provides for using one cylindrical shaped cushion (rubber mount) below and a shorter cushion above each of the two mounting points, as illustrated. Likewise, mount the compressor, except install one aligning cup against the underside of the compressor mounting foot or bridge, whichever applies. Excessive vibration will result if the upper cushion is compressed when the nut is tightened against the steel spacer bushing. If compression occurs, check for improper fit of lower cushion in the base recess. Provide four nuts, lock washers and 5/16" bolts for mounting. The bolt must be long enough to pass through the floor plus 3 inches to pass through the cushion assembly.

Dimensions between mounting hole centers appear on the Dimensional Outline illustrations.

A flexible bond strap or a second wire must be used to complete the electrical circuit to battery ground.

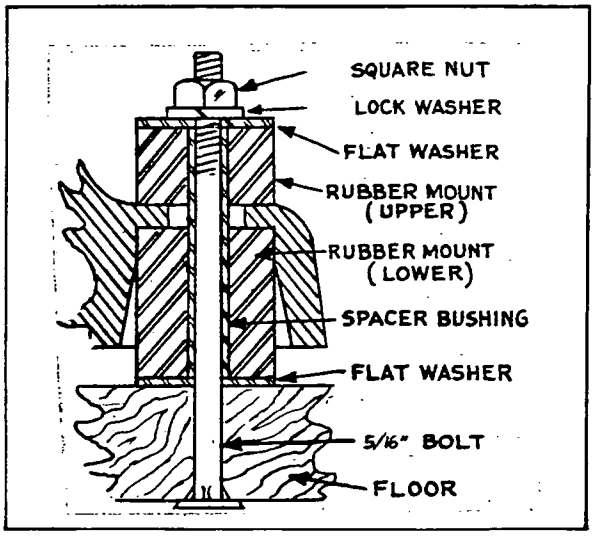


FIG. 4 - MOUNTING CUSHIONS

INITIAL RUN. - This portion of the publication is directed primarily to the fabricator or service man installing the engine-compressor unit into the refrigerant system. Some installations may require special procedures not covered herein.

The engine-compressor is test run before shipment to assure proper performance of the machine. The refrigerant oil and a small charge of refrigerant gas are in the compressor at the time of shipment and the compressor service valves are front seated. This aids in preventing air and moisture from entering.

The engine lubricating oil is drained and preservative oil is sprayed into the combustion chamber before shipment.

Comply with all precautions common to refrigeration servicing.

NOTE:- The following parts are standard equipment:
Ignition Breaker Points;
Ignition Coil;
Starter-Generator;

(WD 625164)

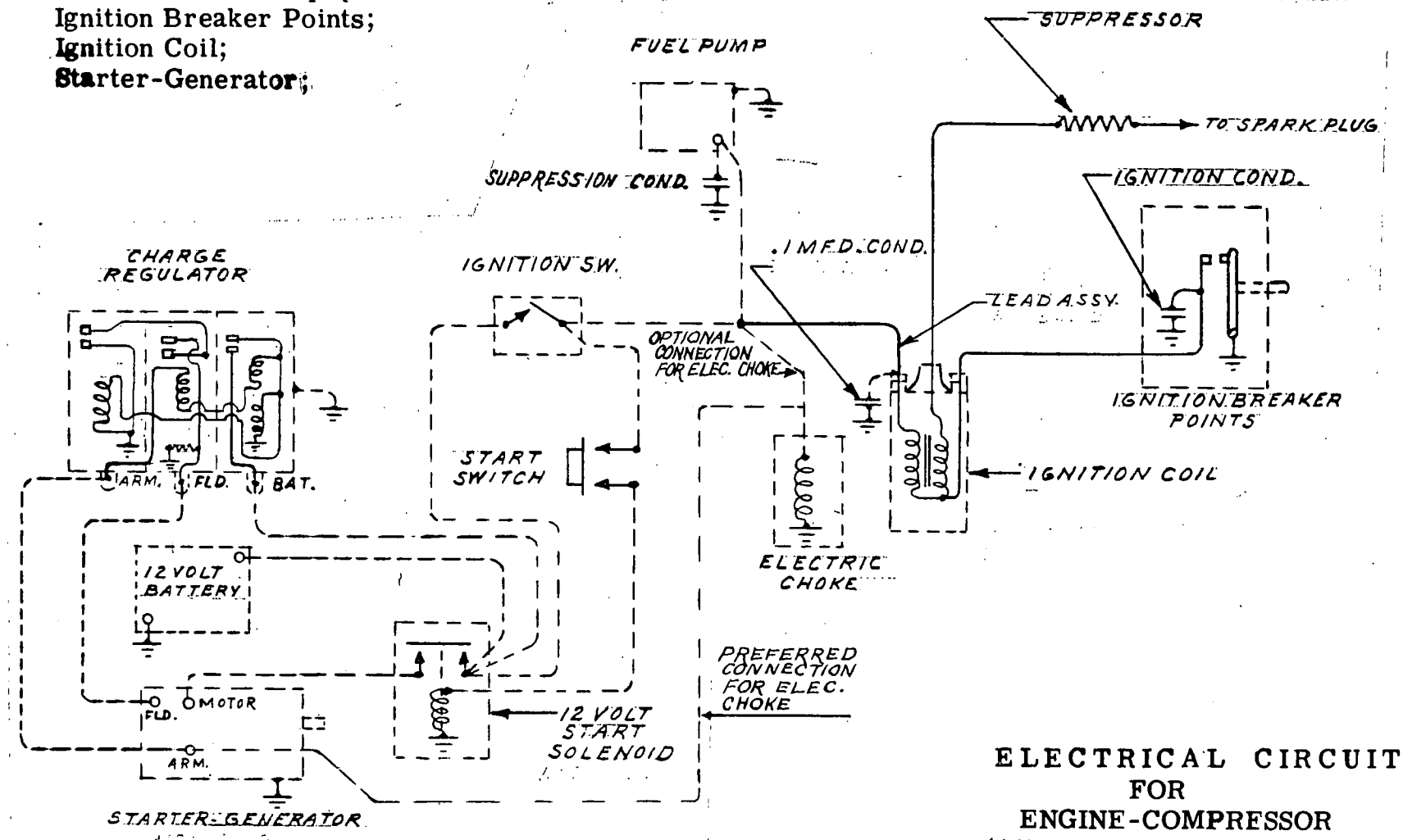


FIG. 5 -

ELECTRICAL CIRCUIT FOR ENGINE-COMPRESSOR
(All parts shown are not necessarily on all models.)

Before operating the engine-compressor it should be properly installed and prepared for service considering the following factors and procedures:

A. Install the engine-compressor.

1. Be sure the condensing unit and evaporating unit are selected to agree with the capacity of the engine-compressor so that maximum efficiency can be attained.

2. Bolt the engine-compressor securely to a sturdy level base located as near as practicable to the refrigerant system. If permissible use vibration isolators under the engine-compressor and use suitable flexible refrigerant lines which will allow for engine-compressor movement. Use self locking nuts or an equal positive arrangement to avoid mounting failure from vibration.

3. Attach the refrigerant suction line to the compressor suction (larger) service valve and attach the refrigerant discharge line to the compressor discharge (smaller) service valve. Use 95-5 solder (or equal). To avoid damage to the valve gasket, remove the service valve from the compressor during soldering.

4. Provide a means of by-passing the discharge pressure to the suction side of the compressor during the cranking period.

5. Connect the fuel supply to the engine. Whenever practicable the fuel filter should be mounted at or near the fuel tank outlet rather than at the pump or carburetor. Locate the filter away from the engine heated air stream to avoid vapor lock at higher ambients.

If the engine is equipped with a diaphragm-type engine-driven fuel pump, install the fuel tank so that the bottom of the tank is not more than 4 feet below the fuel pump.

If the engine is not equipped with a fuel pump, install an electric fuel fuel pump (12-volt, negative ground, static pressure 2-1/2 to 3-1/4 psi) or use gravity feed. With gravity feed, install the bottom of the tank one inch above the carburetor inlet. Too much fuel head may cause a leakage of the carburetor fuel valve especially during transit.

If the engine is equipped to burn liquid petroleum gas (LPG, propane), install the secondary regulator in a vertical position, where the least vibration occurs, near as practicable to the engine for quick starting but not directly on the engine and not so that engine periodic servicing is obstructed, and within reach of the hose from the carburetor. The primary regulator at the LPG tank must feed gas not exceeding the maximum for the gas regulator use.

A. Install the engine-compressor (Cont.)

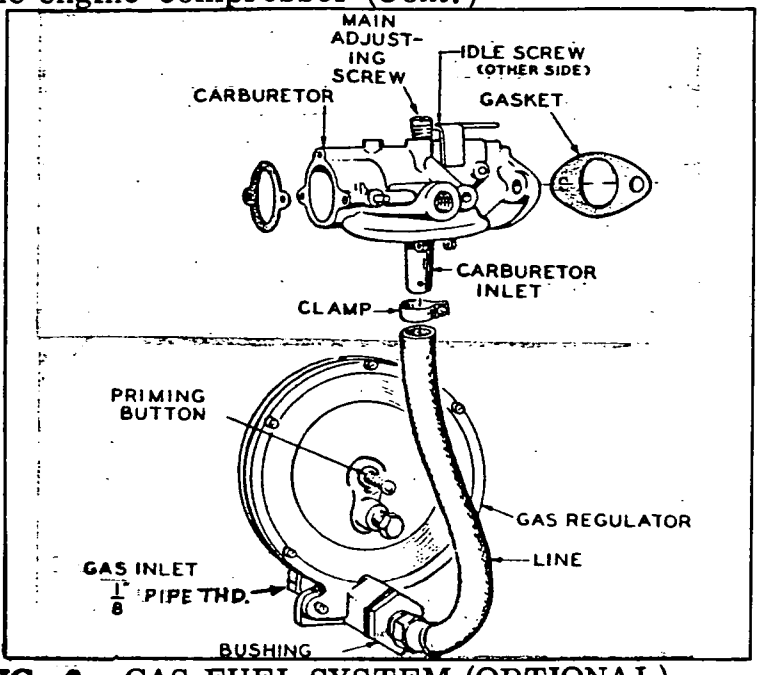


FIG. 6 - GAS FUEL SYSTEM (OPTIONAL)

6. Supply battery current to the engine for cranking and ignition.

Connect a battery cable (#4 or larger size with lug) between the battery positive (+) and the start solenoid on the engine-compressor. If a start solenoid is not used provide a manually-operated start switch and connect the battery cable through the switch to the starting motor. Provide a good electrical ground connection to complete the circuit. Use a flexible bond strap between the engine-compressor and the chassis to which the battery is grounded or use a second cable between the battery negative post and a good ground on the engine-compressor. Also if desired install a charge rate ammeter. (NOTE: To assure satisfactory electric choke operation, install a DPDT switch having a center OFF position and the two other positions as START and RUN. Then connect the choke to the RUN switch terminal so that the choke does not open until the engine starts.)

7. If the engine-compressor has a variable-speed governor, provide a device to serve as an extended variable speed control so that when the control is operated, it will increase governor spring tension and therefore engine speed.

8. Refer to the applicable wiring diagram to make all electrical connections. To serve as an ignition switch, install a single pole single throw switch (10 Amp. dc current) in series with the ignition coil and the start solenoid battery terminal. To serve as a cranking switch, install a momentary contact switch (7 Amp. dc current, maximum) in series with the ignition coil (same terminal as ignition switch) and the start solenoid smaller (coil energizing) terminal.

B. Prepare the engine for service. Details appear under PERIODIC SERVICE.

1. Service the engine air cleaner.

2. Provide a supply of fuel.

3. Fill the engine crankcase with the proper lubricating oil.

4. To remove the preservative oil before the initial start, wash the spark plug in gasoline.

5. Prime the gasoline fuel system. Priming the fuel system is not required where a gravity-feed fuel system is used. If the engine is equipped with a fuel pump, work the pump priming lever to fill the carburetor then return the priming lever to disengaged (inward) position. If an electric fuel pump is used, a few seconds of operation will be required to fill the carburetor.

6. If LPG fuel is used, open the tank valve. If the secondary regulator has a priming button, press it momentarily to purge the air from the line. Check the installation for leaks. If the regulator does not have a priming device, release a spurt of LPG before tightening the supply line to the secondary regulator to purge air from the line.

C. Prepare the refrigerant system for service.

1. Assuming that the system is filled with air, that connections have been made and that the refrigerant oil level appears 3/4 of the way up on the sight glass, use a vacuum pump to evacuate the system. Evacuate through a manifold and test gauge set connected to the service valves, open valves in the system and have the suction service valve cracked off of back seat. Avoid pulling the vacuum too rapidly which would allow loss of refrigerant oil. Pump to 100 microns (or 30" vacuum) for 1 hour.

2. If there is a shortage of refrigerant oil in the compressor, add refrigerant oil. Most systems keep refrigerant oil in circulation equal to approximately 10% of the refrigerant gas capacity by weight. This is in addition to the refrigerant oil required in the compressor for splash type lubrication. DO NOT ALLOW THE REFRIGERANT OIL LEVEL TO DROP BELOW THE SIGHT GLASS DURING THE INITIAL RUN. The refrigerant oil should be added when the system is being charged. This additional oil can be quickly poured into the compressor through the filler plug hole after the refrigerant gas charge is approximately 2 pounds gauge pressure which prevents re-entry of air. (A preferred method of adding oil is through a sealed measuring tube connected to the charging line and

C. Prepare the refrigerant system for service. (Cont.)

added while the compressor is under a vacuum.) It is advisable to pass both refrigerant and oil through a filter-dryer unit when adding to the system.

3. Charge the system with enough refrigerant gas to produce about 15 pounds pressure in the system then check for leaks and repeat the evacuation. This second evacuation adds to the assurance that air and moisture have been removed. If the results are questionable repeat the procedure.

4. Charge the system with a full charge by weight of refrigerant gas. After the tank has fed a partial charge, run the engine-compressor while finishing the charging. Stop the machine and again check for leaks with a leak detector.

5. After operating the engine-compressor for 15 minutes or until the system has stabilized, stop the unit and check the oil level on the compressor sight glass. NOTE: If the refrigerant oil fails repeatedly to return due to too low a gas velocity, or to an unusually long suction line required by a particular installation, it is advisable to pitch the suction line downward and to install one or more goose-neck oil traps in the suction line, near the evaporator outlet but not nearer the suction service valve than 1/2 the distance, to force the mixing of oil with the refrigerant gas.

6. After the system operates satisfactorily, back-seat the service valves, cap the stems, disconnect the manifold and test gauge set and cap the valve ports.

PRELIMINARY. - Before operating the machine be sure the engine has been serviced with oil and fuel. Do not operate the engine within an enclosure unless the exhaust gases are piped outside. Service the air cleaner as instructed under PERIODIC SERVICE. Be sure the compressor service valves and other valves in the refrigerant system are open to back seat.

The procedure for starting, operating and stopping depends on the particular installation, and on the type of equipment (governor, choke, fuel, etc.) furnished. Use these instructions in conjunction with any instructions supplied by the installer of this package and which cover other portions of the entire equipment.

If the engine has run out of fuel, prime the fuel system as instructed under INSTALLATION for the initial run. Be sure all fuel valves are open to back seat position. The air vent on the separate tank (where used) must be partially open.

If a manual choke is used, adjust it as necessary for the temperature conditions. Open it gradually as the engine warms up.

TO START (CONSTANT SPEED GOVERNED). - Set the ignition switch at the "ON" position and press the "START" button until the engine fires and runs. If the engine does not start readily, allow a short time between successive attempts.

TO START (VARIABLE SPEED GOVERNED). - Follow these steps:

A. Set capacity or speed control at the slow speed position.
B. Set ignition switch at the "ON" position.
C. Press "Start" button until engine fires and runs.
D. Readjust the speed control depending on the cooling required. Faster speed gives more cooling.

TO STOP (CONSTANT SPEED GOVERNED). - Return the ignition switch to the "OFF" position.

TO STOP (VARIABLE SPEED GOVERNED). - Return the speed control to the slow speed position, then return the ignition switch to the "OFF" position.

OTHER DUTIES OF OPERATOR. - Perform periodic services and preventive maintenance as recommended for the machine.

If severe or abnormal noises occur, shut it off to avoid damage and have the fault corrected.

FALSE STARTS. - Continued failure of the engine to start readily usually points to trouble in the fuel or ignition system. Check each system thoroughly and make repairs or adjustments as necessary.

During a false start, the reaction of the electric choke (where used) depends on either of two methods of connection.

1. If wired to the ignition switch, the electric choke may have opened the carburetor choke during a delay in starting to crank, or during extended cranking. Cranking should be started as soon as the ignition switch is "ON". If "under choking" has occurred, operate the choke manually, or turn off the switch and allow time for the choke to cool and close again.

2. If wired to the charging generator regulator (armature terminal) the choke will not begin to open until the engine starts and the generator voltage builds up. If "over choking" has resulted, operate the choke manually, or allow time for the flooded condition to disappear.

LPG FUEL OPERATION. - Some engines are equipped to burn liquid petroleum gas (Butane-Propane) fuel. After the initial start, successive starts should normally require simply cranking the engine. Choking is either not required or a weight type choke which opens with the air stream into the carburetor is used. The regulator shuts off the fuel supply when there is no demand, as when the engine is stopped.

Noticeable differences exist in the B. T. U. rating of LPG fuel when purchased in different parts of the country. A difference in the B. T. U. rating of the fuel or a major difference in the altitude will require readjustment of the carburetor to correct the fuel-air mixture. Refer to ADJUSTMENTS for the procedure.

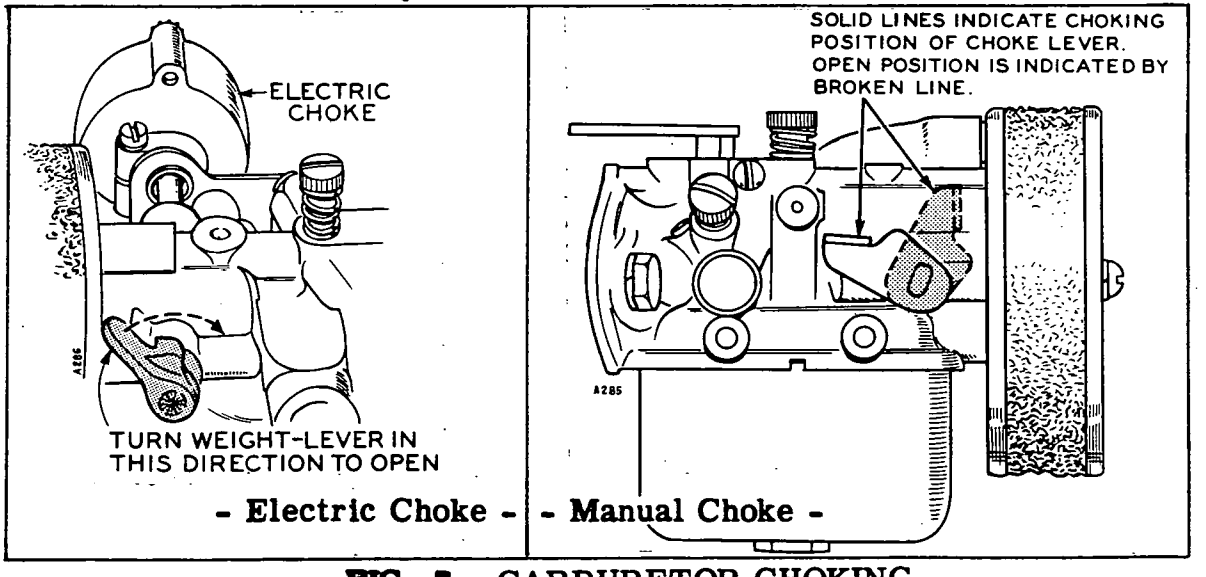


FIG. 7 - CARBURETOR CHOKING

HIGH ALTITUDE OPERATION

If the unit is to be operated at an altitude of 2, 500 feet or more above sea level, the carburetor main jet adjustment should be "leaned" slightly to obtain maximum possible power. The carburetor was factory adjusted for best performance at the factory altitude: approximately 860 feet.

Because the air becomes less dense as the altitude increases, less fuel is required to maintain the proper air-to-fuel ratio. Consequently, any engine will develop less power at higher altitudes. The usual altitude de-rating amount is approximately 4 percent for each 1, 000 feet above sea level.

ONAN GASOLINE ENGINE SERVICE CHART

The following recommended **Servicing Chart** may be used as a guide to estimating servicing requirements of Onan Engine-Compressor units. It is based on the average of records kept by the factory.

The chart is based on the Units operating under favorable conditions, such as: satisfactory installation, use of recommended fuel and oils, etc.

SERVICE & PARTS REQUIRED	HOURS OF OPERATION																
	100	200	300	400	500	600	700	800	900	1000	1500	2000	2500	3000	3500	4000	4500	5000
Oil Change	x	x	x	x	x	x	x	x	x	x								COMPLETE RECONDITIONING
Clean and Adjust Spark Plugs	x	x	x	x	x	x	x	x	x	x								
Service Air Cleaner	x	x	x	x	x	x	x	x	x	x								
Check Ignition Points		x		x		x		x		x								
Clean Carbon					x					x	x	x	x	x	x	x	x	
Clean Carburetor										x		x		x		x		
Check Tappets					x					x	x	x	x	x	x	x	x	
Grind Valves										x		x		x		x		
Remove and Clean Oil Base										x		x		x		x		
Clean Crankcase Breather	x	x	x	x	x	x	x	x	x	x								
Inspect Starter-Gen. Brushes	x	x	x	x	x	x	x	x	x	x								
Check Compressor Oil Level	x	x	x	x	x	x	x	x	x	x								
Starter-Gen. Lubrication		x		x		x		x		x								
Replace Spark Plugs	AS REQUIRED																	
Replace Valves	AS REQUIRED																	
Replace Points	AS REQUIRED																	
Replace Generator Brushes	AS REQUIRED																	
Replace Piston Rings	AS REQUIRED																	

If it is necessary to remove parts for inspection and gaskets are disturbed they should be replaced with new ones. Keep spare cylinder head, cylinder base, oil base and other gaskets on hand.

Periodic Inspection: For Loose or Poor Connections, Fittings, etc.

Recommended Fuel: Use a regular grade of automotive type gasoline. If a high lead content fuel is used, it will be necessary to remove the lead deposits more frequently.

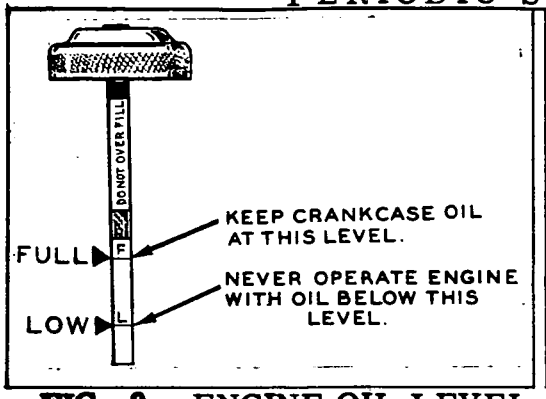


FIG. 8 - ENGINE OIL LEVEL

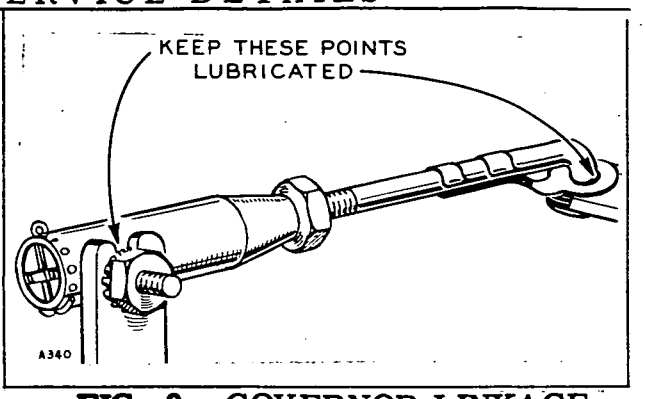
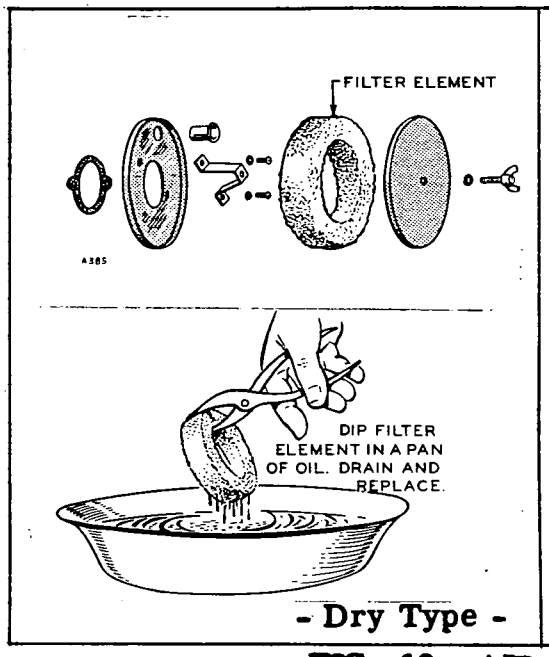
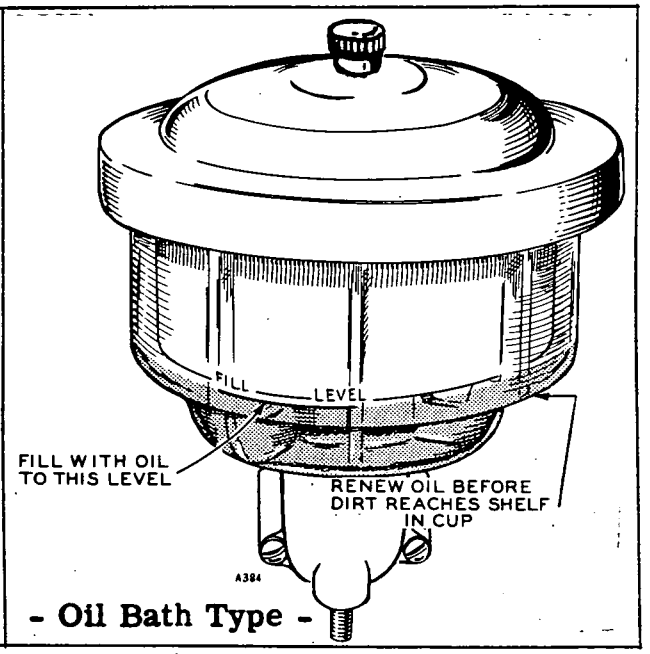


FIG. 9 - GOVERNOR LINKAGE



- Dry Type -



- Oil Bath Type -

FIG. 10 - AIR CLEANER SERVICE

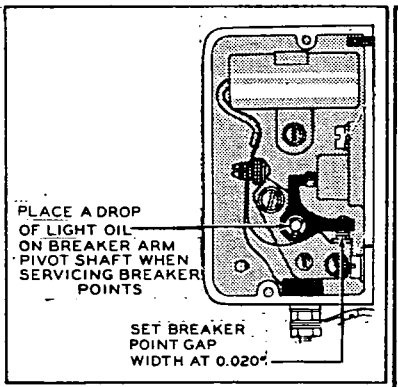


FIG. 11 - BREAKER POINT GAP

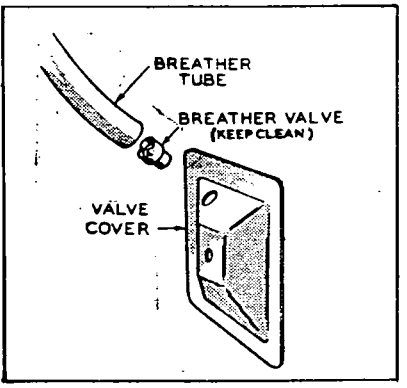


FIG. 12 - BREATHER VALVE

FIG. 13 - COMPRESSOR OIL LEVEL

Intervals for periodic service appear under "ONAN GASOLINE ENGINE SERVICE CHART" and in the "SERVICE LOG".

ENGINE OIL. - Frequently remove the oil fill cap and check the crankcase oil level. Add oil of the same brand as necessary to keep the oil level at the full mark on the gauge. Avoid overfilling which will allow the connecting rod to cause oil foaming and interfere with efficient lubrication.

The oil fill cap gasket must always be in good condition and the cap must always be securely tightened in place. Air leakage into the crankcase at this point will cause oil carryover at the breather, oil leakage around the seals and excessive oil consumption.

Every 100 operating hours (under normal conditions) change the engine lubricating oil. Under abnormal operating conditions as, unusually dusty, severe service or using highly leaded gasoline, change oil every 50 operating hours.

Use detergent oils classified by the American Petroleum Institute (API) as Service "DG" or, as marketed by most manufactureres, "MS/DG". The use of service "DS" is satisfactory, but its higher cost is not justified. Do not use a non-detergent oil unless unavoidable.

Use SAE 30 grade oil for normal air-conditioning-operation temperatures and use SAE 40 grade for extremely hot weather. Below 30°F. use a lighter oil to insure cranking and lubrication. Multiviscosity oils as SAE 10W-30 are not recommended because the oil consumption is more. The engine oil capacity is 9 pints U. S. Measure.

ENGINE FUEL. - Check the fuel supply often enough to avoid running out of fuel. Comply with safety precautions when handling gasoline. Use clean, fresh, regular grade gasoline. Use of a highly leaded premium grade of gasoline is not recommended.

AIR CLEANER, DRY TYPE. - Remove the "crimp" type element from the air cleaner and wash it thoroughly in kerosene or gasoline. Dry it thoroughly and dip it in oil of the same SAE number as used in the engine crankcase. Allow it to drain until dripping stops, then reassemble.

AIR CLEANER, OIL BATH TYPE. - Daily add oil, of the same SAE number as used in the engine crankcase, as necessary to raise the level to the indicated mark just above the shelf in the cup.

Before dirt reaches the shelf in the cup, remove and disassemble the air cleaner. Wash it thoroughly in a solvent, dry thoroughly and moisten the element with oil. Replenish the oil in the cup and reinstall the air cleaner.

SPARK PLUG. - Clean the spark plug and reset the gap at .025" for gasoline operation. For gas (LPG) operation, reset the gap at .018". Test the plug under compression on a plug testing machine, if one is available. If the plug is defective, install a new one.

BREAKER POINT GAP. - Remove the cover and inspect the ignition breaker points. Contact points which are not badly burned or pitted may be dressed smooth, using a fine abrasive stone or hone. If the points are pitted or burned deeply, replace them with a new point set. Excessive burning of the contact points is usually an indication of a defective ignition condenser, which should be replaced with a new one. Adjust the gap between the points as given in the Table of Clearances. If retiming the ignition is needed, refer to MAINTENANCE and REPAIR herein. CLEAN BREAKER POINTS ACCURATELY ADJUSTED AID STARTING. A worn or sticky operating plunger should be replaced with a new one.

GOVERNOR LINKAGE. - Put a drop or two of lubricating oil at the point where the link engages the carburetor throttle arm.

Lubricate the governor arm ball joint with a dry type lubricant as powdered graphite to assure best performance and longest life of the ball joint. If graphite is not available, use a light non-gummy oil.

BATTERY. - Keep the electrolyte at the proper level above the separators in the battery by adding clean distilled water. Do not use water which contains alkali or minerals. Keep the connections tight and clean. Use a hydrometer to check the charge condition before adding water.

STARTER-GENERATOR. - Each 50 operating hours, inspect the starter-generator belt for tension and condition. When pressure is applied between the pulleys the belt should deflect approximately 3/4 of an inch.

Each 100 operating hours, or at intervals to coincide with an engine oil change, put a few drops of oil in the oiler on the starter-generator.

Each 200 operating hours, check the condition of the starter-generator commutator and brushes. Clean the commutator with a dry, lint free cloth. If heavily coated or slightly rough, sand smooth with #00 sandpaper. Do not use emery or carborundum cloth or paper.

BREATHER VALVE. - To check the action of the breather valve while the engine is running, remove the breather hose at the air cleaner and observe a rapid pulsating.

The nylon ball, contained in the breather valve, helps maintain a partial vacuum which is created in the crankcase while running. Remove the hose which carries expelled air from the breather valve at the valve compartment cover, to the air intake. Loosen valve with pliers. Occasionally the valve will lift out and remain inside the hose. Wash the valve assembly in kerosene or some other suitable solvent. Then dry and replace. The valve must work freely and must prevent expelled air from re-entering the crankcase. The hose must not be restricted. Reinstall parts removed.

COMPRESSOR OIL SIGHT GLASS. - The compressor oil sight glass is located on the side of the compressor. While the compressor is not running, the oil level should appear at least half-way up on the sight glass. The addition of oil to the compressor sump should not be required unless the refrigerant system has been opened and the refrigerant is lost. Some of the oil travels with the refrigerant to lubricate working parts in the system.

Comply with the usual procedure (pump down system etc.) if oil must be added. The cleanest and driest oil available should be used in the compressor. Always use type #300 refrigerant oil (various brands suitable) in the compressor. The fill plug is on the rear of the compressor.

GENERAL INSPECTION. - Thoroughly inspect the entire machine for loose connections, loose screws or nuts, oil leaks, symptoms of faulty operation, etc.

CARBON REMOVAL. - Remove carbon deposits from the engine combustion chamber each 200 hours of operation. This service is important to keep engine efficiency high.

GENERAL. - Engine satisfactory performance is dependent upon correct adjustments. Adjustments can not fully compensate for troubles as low engine power due to faulty engine condition.

GOVERNOR. - The governor controls the speed of the engine. The capacity of the compressor is nearly proportional to compressor speed. The normal operating speed range is from 1800 to 2400 rpm. The variable speed governed units should be adjusted to operate over this speed range. For constant speed governed units, refer to the nameplate for the correct operating speed for each particular application. To assure adequate lubrication, do not operate the unit above 2700 rpm. The final adjustment of the governor should be made under average operating conditions of load and temperature.

The governor arm is fastened to a shaft which extends from the gear cover, and is connected by linkage to the carburetor throttle arm. If the carburetor has been removed, or the governor disassembled, it may be necessary to readjust the governor.

A binding in the bearings of the shaft which extends from the gear cover, in the linkage, or in the carburetor throttle assembly will cause slow governor action or poor regulation. Looseness or excessive wear in the governor mechanism will cause erratic governor action or alternate increase and decrease in speed (hunting). A lean carburetor adjustment may also cause hunting. Springs of all kinds have a tendency to lose their calibrated tension through fatigue after long usage. If all governor and carburetor adjustments are properly made, and the governor action is still erratic, replacing the spring with a new one and resetting the adjustments will usually correct the trouble.

When the engine is stopped, tension of the governor spring should hold the carburetor throttle arm at the wide open position, pulled toward the front end of the engine. At wide open position, the lever on the throttle shaft should just touch the carburetor body or clear it by no more than 1/32 inch. This setting can be obtained by increasing or decreasing the length of the connecting linkage as necessary, by turning the ball joint on the threads of the link. Be sure to retighten the ball joint to the governor arm. This operation synchronizes governor action with the carburetor throttle action.

ADJUSTING THE GOVERNOR. - Use a Strobo-tac focused at the condenser fan (where used) or use a tachometer on the engine flywheel (where accessible) to check the speed of the engine.

A. SENSITIVITY. - There is always a load on the engine. The load changes gradually with temperature changes. Therefore the setting of the governor sensitivity screw is not critical. The original factory sensitivity setting should not require readjustment.

The preferred sensitivity setting gives a minimum change in speed between heavy load and light load operation without causing a hunting condition.

B. CONSTANT SPEED GOVERNOR. - Adjust the spring tension by turning the knurled nut to give an engine speed of 2400 rpm (or the rated speed given on the nameplate). Increasing spring tension increases engine speed.

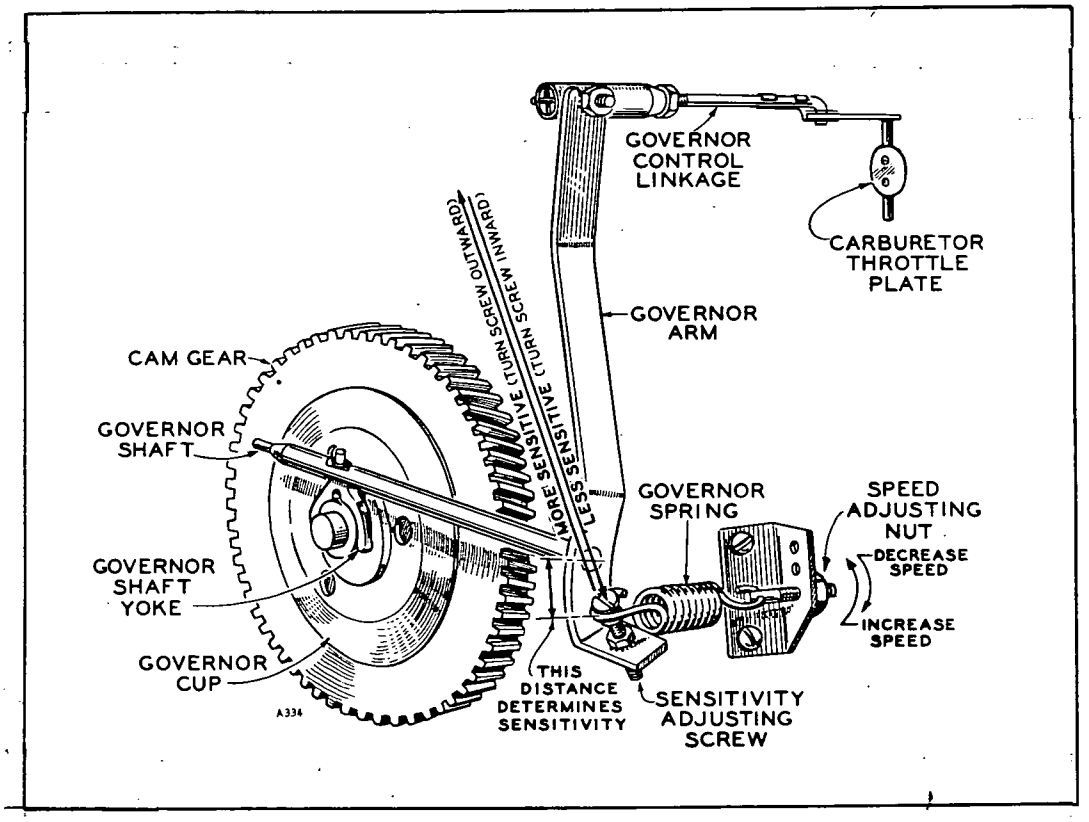


FIG. 14 - CONSTANT SPEED GOVERNOR ADJUSTMENT

A compensating speed adjustment will be required after a major carburetor adjustment or a change in the sensitivity adjustment.

C. VARIABLE SPEED GOVERNOR. - The variable speed governor is suitable for remote manual control of the engine speed and therefore the compressor capacity.

By operating the governor control device, the governor spring tension is changed to give the desired speed. Be sure the control is mounted securely.

First, adjust the spring tension for minimum operating speed (refer to the nameplate), by turning the speed adjusting nut, while the control device is relaxed (not affecting operation). Then, operate the control device to give maximum operating speed and set the stop on the engine so that maximum speed will not be exceeded.

A change in any one of the foregoing adjustments will require a compensating change in one or more of the other adjustments. A major carburetor adjustment requires a readjustment of the governor.

CARBURETOR. - Refer to MAINTENANCE and REPAIR-CARBURETOR if it becomes necessary to remove the carburetor for repairs. A small piece of foreign matter lodging in a jet may cause hard starting and poor operation. Dirty gasoline may cause the jets to wear larger, resulting in excessive gasoline consumption. Before tampering with jet settings, mark the existing adjustment or count the number of turns the needle was backed out from its seat.

The carburetor is a side (horizontal) draft type and has two adjusting needles. The "idle" needle is located nearer the cylinder head. The "main" needle is located nearer the air cleaner. Turning the needle inward gives a leaner fuel mixture for either jet.

The correct setting for the main jet needle gives the best stability at full rated speed and load operation. The correct setting for the idle needle is approximately 1 to 1-1/2 turns open and because operation is always under load condition adjustment is not critical except if it is opened farther it could interfere with the main jet mixture control.

A substantial change in the carburetor setting requires a readjustment of the governor.

To adjust the carburetor, turn the adjusting needles in gently (finger tight) to their seats. Do not force them in, as they may be damaged by seating too tightly. To permit starting, back the main needle out about 2-1/2 full turns. Back the idle needle out about 1 to 1-1/2 full turns. Start the engine and allow it to thoroughly warm up under a full rated speed condition before making final main jet adjustment.

Slowly turn the main adjusting needle inward (clockwise) for leaner mixture, until the engine begins to lose speed. Turn the needle outward (counterclockwise) to the point where the engine will carry the full load. Check the operation at various speeds. If there is a tendency to hunt (alternately increase and decrease speed) at any speed, turn the adjusting needle out for richer fuel mixture, until the hunt is corrected, but do not turn the adjusting needle out more than 1/2 turn beyond the point where maximum speed is obtained.

The throttle idle stop screw should be adjusted to clear the throttle shaft stop by 1/32" when the engine is operating at minimum speed.

See that the float is not damaged. If necessary to reset the float level, use a small screw driver to bend the lip of the float. With the carburetor casting inverted and the float resting lightly against the needle in its seat, there should be 11/64 inch clearance between the outer edge

of the casting and the free end of the float (side opposite needle seat).

CARBURETOR FOR GAS FUEL ONLY. - To adjust the gas fuel carburetor, set the main adjusting screw approximately 1-1/2 turns open, and set the idle adjusting screw approximately 1-1/4 turns open, to permit starting the engine. Further adjust the screws as necessary for best operation while allowing the engine to thoroughly warm up under an average load condition. Make the final adjustment of the main adjusting screw while operating with a full load condition. Turn the screw in until the speed begins to drop, then turn the screw slowly outward until the speed returns to normal, and operation is steady. If it is necessary to turn the screw out more than 1/2 turn after normal speed is attained, in order to prevent surging, it may be necessary to adjust the governor for slightly less sensitivity. Make the final adjustment of the "idle" screw for best operation under light load.

Check the operation of the carburetor choke. The weighted choke should just close, but must be free to open with the air stream which enters the carburetor during operation.

On the initial start, press the priming button (if so equipped) on the gas pressure demand regulator for just a moment to prime the system.

ELECTRIC CHOKE. - Some engines are equipped with a thermal action electric choke. A thermostatic coil (bi-metal) engages the choke shaft and is set at the factory to give the correct choking action for average temperature conditions. Current from the battery (or charging generator, where used) is supplied to a small heating element in the choke cover. This heating element causes the thermal coil to wind tighter and turn the choke shaft, gradually opening the choke as the engine warms up. When the engine is stopped, the thermal coil cools off, causing the choke shaft to return to the correct position for the next start.

At a temperature of 70°F., the choke plate should be approximately 1/8" from the fully **closed** position. The thermal coil (bi-metal) is installed in the choke body in a clockwise direction as viewed starting from the inside turn. The thermal coil tends to coil tighter when heated rather than unwind. Allow the choke to cool before each readjustment.

Extreme temperature may require a slight readjustment of the choke setting. To adjust the choke, loosen the two screws which retain the choke cover to the choke body. For less choking action, turn the cover assembly slightly in a counterclockwise direction, looking at the thermal unit end. For more choking action, turn the cover assembly slightly in a clockwise direction.

If the choke does not operate properly, check to see that the heating element heats properly. There must be no binding of the choke shaft or thermal coil. Be sure to retighten the lock screw after any adjustment.

A manual operating lever and weight, fastened on the opposite end of the choke shaft, may be used to operate the choke in the event the electric element burns out or the choke does not operate for any reason. Turn the lever to horizontal position to open the choke. The choke would remain at closed position if electric choke element failure occurred.

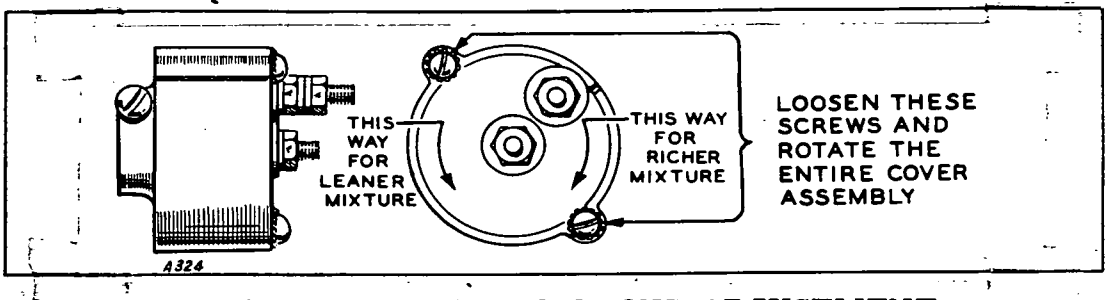


FIG. 15 - ELECTRIC CHOKE ADJUSTMENT

Note that the direction marking "CHOKE ⟶" as appears cast on the body of some carburetors is wrong for electric choked engines due to the choke valve arrangement. Choking position of the weight lever is vertical, on the shaft of electrically choked engines.

When installing the choke cover, be sure the insulated terminal will not touch other equipment. By reinstalling the thermostatic coil on the carburetor choke shaft at 180 degrees from the existing position, the cover terminal will be at the diametrically opposite side.

GENERAL. - Refer to the Service Diagnosis section for assistance in locating and correcting troubles which may occur. If a major repair or overhaul of the engine becomes necessary, the engine should be carefully checked and necessary repairs made by a competent mechanic. Maintain factory limits and clearances as given in the Table of Clearances, replacing worn parts when necessary.

TABLE OF CLEARANCES AND SPECIFICATIONS (ENGINE)

All clearances given at room temperature of 70°F.

	MINIMUM	MAXIMUM
Intake Valve Tappet Clearance at 70°F.	0.015"	0.017"
Exhaust Valve Tappet Clearance at 70°F.	0.015"	0.017"
Intake Valve Stem Clearance in Guide.	0.001"	0.0025"
Exhaust Valve Stem Clearance in Guide.	0.0025"	0.004"
Valve Seat Width.	1/32"	3/64"
Valve FACE Angle.	44°	
Valve SEAT Angle.	45°	
Valve Interference Angle.	1°	
Crankshaft Main Bearing Clearance.	0.002"	0.003"
Crankshaft End Play.	0.006"	0.012"
Camshaft Bearing Clearance.	0.0015"	0.003"
Camshaft End Play.	0.003"	
Connecting Rod Bearing Clearance (Alum. Rod).	0.002"	0.003"
Connecting Rod End Play.	0.013"	0.038"
Timing Gear Backlash.	0.002"	0.003"
Oil Pump Gear Backlash (where used).	0.002"	0.005"
Piston Clearance in Cylinder, slotted Skirt type (at bottom of skirt).		
Interference	0.0005"	
Clearance		0.0015"
Piston Pin Clearance in Piston at 70°F.	Thumb Push Fit	
Piston Pin Clearance in Rod at 70°F.	0.0001"	0.0006"
Piston Ring Gap in Cylinder.	0.010"	0.023"
Breaker Point Gap at Full Separation.	0.020"	
Spark Plug Gap - For Gaseous Fuel.	0.018"	
Spark Plug Gap - For Gasoline Fuel.	0.025"	
Crankshaft Main Bearing Journal-Std. Size.	1.9995"	2.000"
Crankshaft Rod Bearing Journal-Std. Size.	1.6255"	1.6260"
Cylinder Bore - Standard Size.	3.248"	3.249"
Cylinder Head Capscrews.	29 to 31 lb. ft.	
Rear Bearing Plate Nuts.	20 to 25 lb. ft.	
Connecting Rod Bolts.	24 to 26 lb. ft.	
Flywheel Capscrew.	40 to 45 lb. ft.	

TABLE OF CLEARANCES AND SPECIFICATIONS (COMPRESSOR)

	MINIMUM	MAXIMUM
Crankshaft - Throw Rod Bearing Journal - Standard Size - Two Cylinder	1.4995"	1.5000"
Crankshaft - Throw Rod Bearing Journal - Standard Size - One Cylinder	0.9265"	0.9270"
Compressor Rod Bearing Clearance - One Cylinder and Two Cylinder (Prior Spec E)	0.0015"	0.0025"
Compressor Rod Bearing Clearance - Two Cylinder (Begin Spec E)	0.002"	0.003"
Crankshaft Throw Outboard Bearing Journal - Standard Size - Two Cylinder - (Begin Spec E)	1.500"	1.501"
Crankshaft Throw Bearing Clearance - Two Cylinder - (Begin Spec E)	0.0015"	0.003"
Compressor Piston Pin in Rod - One Cylinder and Two Cylinder - (Prior Spec E) - 72°F	0.0000"	0.0005"
Compressor Piston Pin in Rod - Two Cylinder (Begin Spec E) - 72°F	0.0002"	0.0007"
Compressor Piston Pin in Piston	Thumb Push Fit	
Compressor Piston to Cylinder	0.002"	0.004"
Compressor Cylinder Bore - Standard Size	1.9990"	2.0000"
Compressor Discharge Valve Spring Tension	6 to 7 lbs. each	
Compressor Head Screw, Torque (3/8-16)	35 lb. ft.	
Compressor Crank Throw Screw - One Cylinder and Two Cylinder (Prior Spec E) Torque 5/16-18	25 to 30 lb. ft.	
Compressor Crank Throw Screw - Two Cylinder (Begin Spec E) Torque - (Hardened)	40 lb. ft.	
Compressor Sump Plate Screw, Torque - (5/16-18)	25 lb. ft.	
Compressor Connecting Rod Screw, Torque - Two Cylinder (Begin Spec E)	10 to 12 lb. ft.	
1-Cylinder Comp. Service Valve Screw Torque	15 lb. ft.	
2-Cylinder Comp. Service Valve Screw Torque	25 lb. ft.	
Compressor to Engine (HHC Screw - 1 Cylinder) (Stud Nut - 2 Cylinder) Torque	15 lb. ft.	
Operating Pressure - (Varies greatly according to ambient temperature and relative humidity).		
Normal Pressure at Discharge Valve	Consult system mfr.	
Maximum Pressure at Discharge Valve		350 p.s.i.
Normal Pressure at Suction Valve	Consult system mfr.	
Minimum Pressure at Suction Valve	Consult system mfr.	
Type Refrigerant Oil in Compressor Sump	Suniso 4G, Ansul #300 or equal.	
Type Refrigerant Used (R-12 or R-22)	Refer to nameplate.	

TROUBLE SHOOTING. - It is advisable to employ the services of a qualified refrigeration service man for repairs which require entering the closed refrigeration system. A qualified service man can acquire helpful information from operating the machine and performing tests prior to disassembly. Trouble analysis consists primarily of comparing all the observed conditions in a trouble job with conditions normally found or expected. Such an analysis serves to isolate troubles which should be corrected when the closed refrigerant system is entered for other reasons.

SAFETY

SAFETY PRECAUTIONS. - Safety precautions which are common to the refrigeration industry should be observed, to protect the parts involved and the person working on the unit. These precautions include the following even though the gas is considered a safe refrigerant.

Wear safety goggles. The fast freezing action of liquid refrigerant will injure the skin and especially the eyes. If an accident should occur, immediately apply sterile mineral oil to absorb the refrigerant then wash the eyes with weak boric acid solution and seek a doctor's aid.

To avoid a dangerous explosion due to excessive pressure never solder, weld, steam clean, or use any excessive amount of heat on or in the immediate area of, any part of the system or refrigerant supply tank, while they are closed to the atmosphere whether filled with refrigerant or not.

To avoid **suffocation** due to displacement of oxygen, work in a well ventilated area and discharge any gases outside. The refrigerant is heavier than air.

To avoid gas poisoning avoid inhaling the fumes from the leak detector or the engine exhaust fumes.

Always slowly release the pressure in the system before changing parts of the system.

Always have the refrigerant tank in an upright position to feed gas rather than liquid refrigerant.

Do not attempt to operate the compressor with the discharge service valve completely front-seated unless the service port is uncapped.

COMPRESSOR AND REFRIGERANT SYSTEM

SUCTION AND DISCHARGE SERVICE VALVES. - The valves are opened to back seat during normal operation. Opening the valve to back seat connects the compressor to the refrigerant line, the service port is then shut off.

Closing the valve to front seat connects the compressor to the service port, then the refrigerant line is shut off. Use this position and have the service port capped, when dismounting the engine-compressor.

Cracking the valve open off of back seat connects the compressor to the refrigerant line and the service port. Use this position while recharging the system, reading pressures, etc.

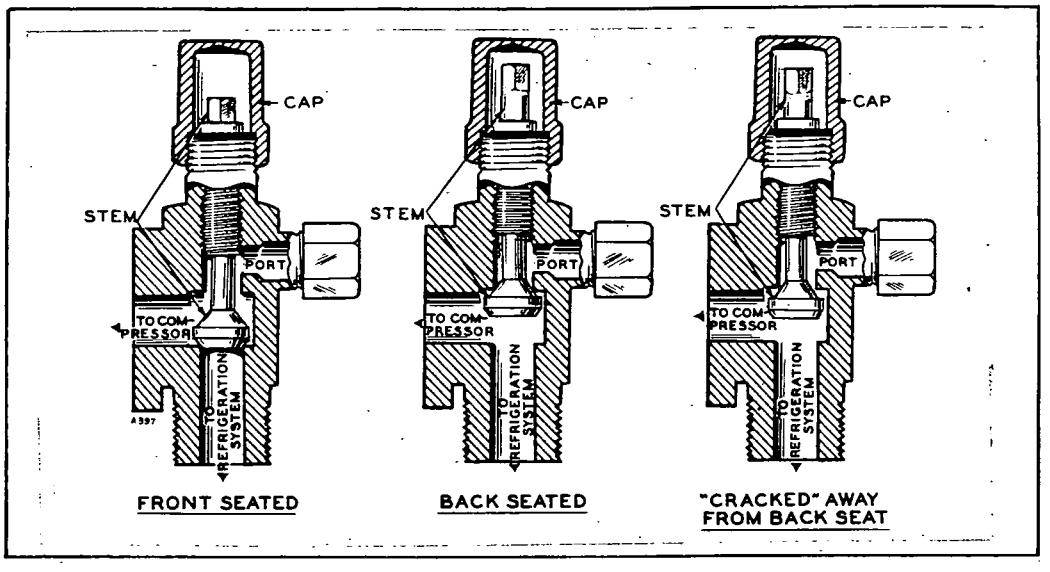


FIG. 16 - THREE POSITIONS OF COMPRESSOR SERVICE VALVES

MANIFOLD AND TEST GAUGE SET. - The refrigeration serviceman should always connect gauges to the system to check suction (low or evaporating) pressure and discharge (high, head or condensing) pressure when charging or otherwise servicing the system. Refer to the illustration, Charging System and Checking Pressures.

Do not connect the test equipment while the unit is operating.

Remove the caps from the service valve stems and make sure that both valves are back-seated (maximum counterclockwise position).

Remove the caps from the service valve ports. Use one flexible hose to connect between the suction service valve port and the port on the compound gauge side of the manifold. Use a second flexible hose to connect between the discharge service valve port and the port on the high pressure gauge side of the manifold.

(Compressor and Refrigerant System, Cont.)

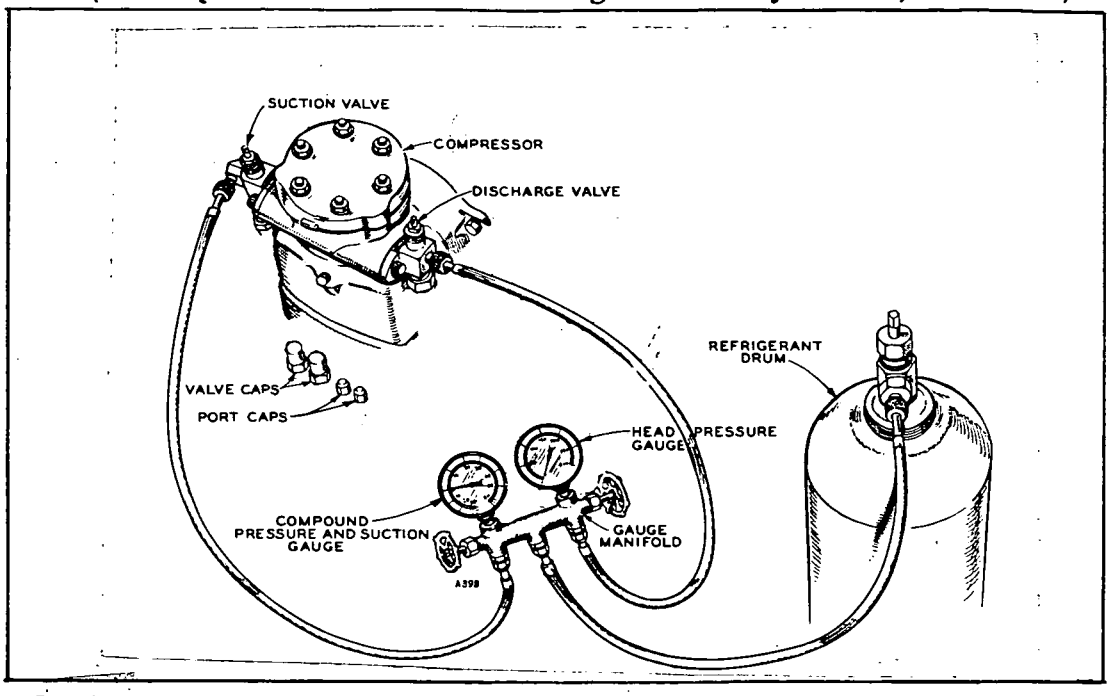


FIG. 17 - CHARGING SYSTEM AND CHECKING PRESSURES

Purge air from the manifold and hoses by cracking open the discharge service valve and allowing a spurt of refrigerant escape at the service hose connection at the suction service valve.

The center manifold connection should be either capped or connected to the vacuum pump or the spare drum of refrigerant depending upon the job being done. Close (front-seat) both manifold valves by turning them to maximum clockwise position. When the manifold valves are closed the center manifold connection (port) is shut-off from the gauges, but the gauges continue to read pressures in their respective hoses.

Crack open (away from back-seat) both service valves on the compressor to get readings on the gauges. Gauge readings may be taken while the unit is stopped or running.

PUMPING DOWN THE REFRIGERANT SYSTEM. - Before entering the closed refrigerant system, as necessary during certain repair procedures, it is economically advisable to save the refrigerant unless air and moisture have entered the system. This procedure applies only to systems equipped (with liquid valve) for pumping down.

In preparation for storing the refrigerant liquid in the receiver, connect a manifold and test gauge set to the system. Operate the unit and read the gauge pressures. Use a leak detector to test for leaks. The foregoing analysis will aid the serviceman to isolate troubles which should be corrected when the closed refrigerant system is entered for other reasons.

(Compressor and Refrigerant System, Cont.)

Front seat the receiver liquid valve. Operate the engine-compressor to pump down the system until the refrigerant liquid is stored in the receiver (tank). Continue operating until the suction pressure drops to 1 or 2 pounds pressure.

Repeat the pumping down process if the gauge pressure rises after stopping the unit. The pumping down process will require several minutes and the time will vary with ambient conditions.

EVACUATING THE REFRIGERANT SYSTEM. - The procedure depends on whether the system is filled with air as after a major repair or whether it is operating with some air in the system as a trouble job may be.

If the refrigerant is to be saved, refer to the instructions, PUMPING DOWN THE SYSTEM. Then evacuate either or both sides as required.

If the refrigerant is not to be saved, attach a manifold and test gauge set to the service valves and a vacuum pump to the manifold port. Set both service valves at cracked off of back-seat position so that gauges read pressures but so that the pump will pull the vacuum slowly and the refrigerant oil will not be lost. Open both manifold valves. Release slowly any pressure in the system. Operate the vacuum pump until the low pressure gauge reads at least 25 inches and as close to 30 inches of vacuum as possible. Continue vacuum pump operation for 20 to 30 minutes to help boil any moisture out of the system. The extended pumping time is important because moisture tends to cling to cool surfaces and the system, which was chilled by refrigerant evaporation, should reach room temperature. Close the manifold valves. The system should hold the low pressure reading if there are no leaks. Stop the pump.

After entering the closed refrigerant system, as during a repair, and if a vacuum pump is not available, attempt to evacuate the system by running the engine compressor. If a partial charge is to be made, stop the engine-compressor and allow gas and air to escape from the discharge service valve port for 15 to 20 seconds to purge the system of air, then recharge the system. If a complete charge is to be made, as after a major repair, the system must be pumped out and recharged 2 or 3 times to satisfactorily purge the system if a vacuum pump is not used.

CHARGING SYSTEM WITH REFRIGERANT. - The procedure for charging depends on whether a partial charge or a complete charge is being made.

(Compressor and Refrigerant System, Cont.)

There is either air or a shortage of refrigerant in the system if, during normal operation, bubbles appear behind the refrigerant sight glass (where used) after the engine-compressor has operated at least 15 minutes. Check the system while under pressure with a leak detector to find a suspected leak and to determine if correction procedures are advisable at this time. If the compressor refrigerant oil level is below the middle of the sight glass when just stopped after running at full speed long enough to stabilize the system, replenish as instructed herein, assuming that some oil has escaped along with lost refrigerant or replaced component parts.

If a leak is discovered, and correcting involves more than tightening a mechanical fitting, pump down the system and stop the engine, or release the pressure and evacuate the system, whichever applies, then repair as necessary. If air and moisture have entered the system it is advisable to release the pressure, install a new filter-dryer unit, evacuate the system, give it a partial charge and again evacuate the system before giving it a complete and final charge.

If no leak can be discovered, continue to put the system back into operation. If the head (discharge) pressure was excessively high, stop the unit, wait 15 minutes for any air to rise, then purge (bleed) it out by allowing gas and air to escape for 5 to 10 seconds at the discharge service valve, then add refrigerant if necessary. If the head pressure was normal, just add refrigerant as necessary.

Measure a complete charge by the difference in tank weight before and after the complete charge. Use a scale under the refrigerant tank.

In preparation to charge the system, have the service valves and liquid valve fully back-seated. Connect a manifold and test gauge set to the compressor service valves. Connect the charging line (flexible hose) from the spare tank (drum) of refrigerant to the service port on the manifold. Open the manifold valves. Before fully tightening each line to the service valve release a spurt of refrigerant gas to purge the line of air. Tighten the lines and leave the refrigerant tank valve partially open.

Close the manifold valve on the high pressure side and have the manifold valve on the low pressure (suction) side open. Turn the discharge service valve 1/4 turn off of back-seat to read the discharge pressure. Turn the suction service valve 1/4 turn off of back-seat, allow a short time for the tank to feed gas, start the engine and continue to charge from the spare refrigerant tank until bubbles disappear from the refrigerant line sight glass (if used). Weigh the tank and charge with the additional amount specified (probably one pound) for the equipment.

(Compressor and Refrigerant System, Cont.)

When the system is fully charged, close the tank valve, close the manifold valves, then read the operating pressures and observe the cooling effect to assure the job is satisfactory. (An overcharge of refrigerant will give a discharge pressure higher than normal). To complete the job back-seat the discharge service valve, back-seat the suction service valve, stop the unit if desired, disconnect the manifold and test gauge set and tightly replace the service valve stem caps and the service valve port caps.

Have the spare tank valve adjusted so that the refrigerant is fed slowly and carefully, to prevent LIQUID from entering the compressor and causing slugging.

Have the tank in upright position to feed gas. Inverting the tank would feed liquid refrigerant. If the tank temperature is very cold or nearly empty, apply warm water or warm wet towels to the tank to speed vaporization and raise the pressure of the refrigerant within the spare tank.

REFRIGERANT LEAK DETECTOR. - Follow the directions furnished with the leak detector equipment. One type of leak detector is a Halide leak detector attachment to a Prestolite solder torch outfit.

Have pressure in the system. Have the room well ventilated. Have the unit stopped. Operate the torch with a low flame. Hold the detector sampling tube for 2 or 3 seconds near each sweat fitting, mechanical coupling, valve, gasket, engine oil fill hole, or wherever refrigerant gas could possibly leak out.

The slightest leak will be indicated by a change in color of the flame.

An evidence of refrigerant oil outside of the system indicates a possible refrigerant leak. A refrigerant seal leak will probably cause strong smelling engine exhaust fumes. Avoid inhaling the fumes.

COMPRESSOR LUBRICATION. - Only dehydrated refrigerant oil may be used in the compressor. Oil that has been exposed to the atmosphere so as to become permeated with moisture is not satisfactory. Refer to the Table of Specifications herein for the recommended viscosity oil.

The oil level should be observed soon after stopping the compressor because the liquid refrigerant is heavier than oil and may raise the level to give a false reading during the off period. This liquid boils off when the compressor runs. Focus a light at the sight glass to facilitate observing the level. The oil level should never be allowed to drop below

(Compressor and Refrigerant System, Cont.)

the sight glass and should preferably be kept at the middle level. Approximately 1-1/2 ounces of refrigerant oil for each pound of refrigerant in the system is normally carried throughout the system and serves to lubricate the valves. Normally, refrigerant oil never has to be added unless refrigerant is lost or component parts are replaced.

Have about 2 pounds gauge pressure in the compressor crankcase preparatory to adding oil so that air will not be taken in. Remove the oil fill plug, add the oil and replace the plug immediately.

If the compressor is disassembled for repair, always use new oil and add additional refrigerant oil above the middle of the sight glass equal to 10% by weight of the refrigerant to be added.

If the refrigerant oil level drops repeatedly, indications are the refrigerant oil is not being returned to the compressor. This condition is not common but could possibly occur during operation at abnormal low ambient or at abnormally low operating speed either of which would not maintain sufficient velocity of gas through the evaporator coil and suction line.

ENGINE-COMPRESSOR DISASSEMBLY AND ASSEMBLY. - This subject is treated under several sub-headings. The serviceman should be familiar with the entire procedure before starting the work.

A. GENERAL DISCUSSION. - Remove the engine-compressor only when necessary. The engine-compressor assembly may remain installed in the equipment while performing various maintenance and repair operations such as carbon removal, valve service and ignition service. Avoid entering the closed refrigerant system unless necessary.

If the engine-compressor must be removed the system should first be pumped down, then the service valves closed to front-seat before entering the closed refrigerant system. Protect all exposed parts of the closed system, as much as possible, from the entrance of air. All air contains moisture. Both air and moisture must be purged from the system during the reinstallation, and for best results requires the use of a vacuum pump, manifold and test gauge set, and recharging the system. (In the absence of such equipment it is possible to evacuate then recharge the system 2 or 3 times to displace the foreign substances by running the compressor.)

Always be extremely clean. Have hands and tools clean. Air causes high head pressure, moisture causes corrosion, and dirt causes faulty valve operation.

(Compressor and Refrigerant System, Cont.)

Reference to the exploded illustrations in the parts list for the unit and to the cut-away view illustration near the front of this book will aid in disassembling and reassembling of the machine components. Most disassembly and reassembly procedures are self evident. Together with the following instructions and design knowledge, refer to the Table of Clearances and to the subject under MAINTENANCE AND REPAIR for the part in question.

It may be necessary to revise the procedure to meet the existing conditions such as: (1) If all of the refrigerant charge has been lost, disregard pumping down; (2) if the engine or compressor fails and can not be run, the system can not be pumped down prior to the repair; (3) if air or moisture has entered the system, the system must be evacuated and it is advisable to install a new filter-dryer unit.

CAUTIONS. - Comply with all precautions common to refrigeration servicing. Precautions include these: Wear googles when handling refrigerant or when entering a closed system; never fill the tank more than 4/5 full; be clean; use refrigerant oil and a clean cloth to clean parts which the refrigerant will contact.

B. TO REMOVE THE ENGINE-COMPRESSOR ASSEMBLY. - After reading the foregoing discussion follow the step by step procedure.

1. Remove the equipment housing as necessary to gain access.

2. If the refrigerant is to be saved, refer to the instructions headed "PUMPING DOWN THE REFRIGERANT SYSTEM", then refer again to these removal instructions.

3. Assuming the machine will not run, front seat the service valves to close the system to the compressor.

4. Disconnect all attached parts, including the fuel line, battery cable and leads.

5. Remove the four nuts as necessary to dismount the engine and compressor.

6. Slowly release any pressure within the compressor by loosening the port cap on both service valves.

7. Remove the service valve mounting screws. Avoid damage to the strainer in the compressor inlet. Tap each valve gently to release it from the compressor.

(Compressor and Refrigerant System, Cont.)

8. Lift the engine and compressor assembly out of the equipment. If further disassembly is required, refer to the instructions "TO REMOVE COMPRESSOR".

C. TO REMOVE THE COMPRESSOR FROM THE ENGINE. - The procedure differs between the earlier compressor without an outboard bearing (Prior to Model Spec E) and the later compressor with an outboard bearing, (2 Cylinder Beginning with Model Spec E).

Have hands and tools clean. Refer to the illustrations, Two Cylinder V Type Compressor and Relative Location of Refrigerant Seal Parts.

1. Compressor with outboard bearing (Begin Spec E). - The refrigerant seal is not volnerable to damage during removing nor installing the compressor crankcase.

   a. Drain the engine crankcase oil.

   b. Remove the compressor oil base to drain the refrigerant oil. Do not reuse this oil.

   c. Remove compressor heads and valve plates.

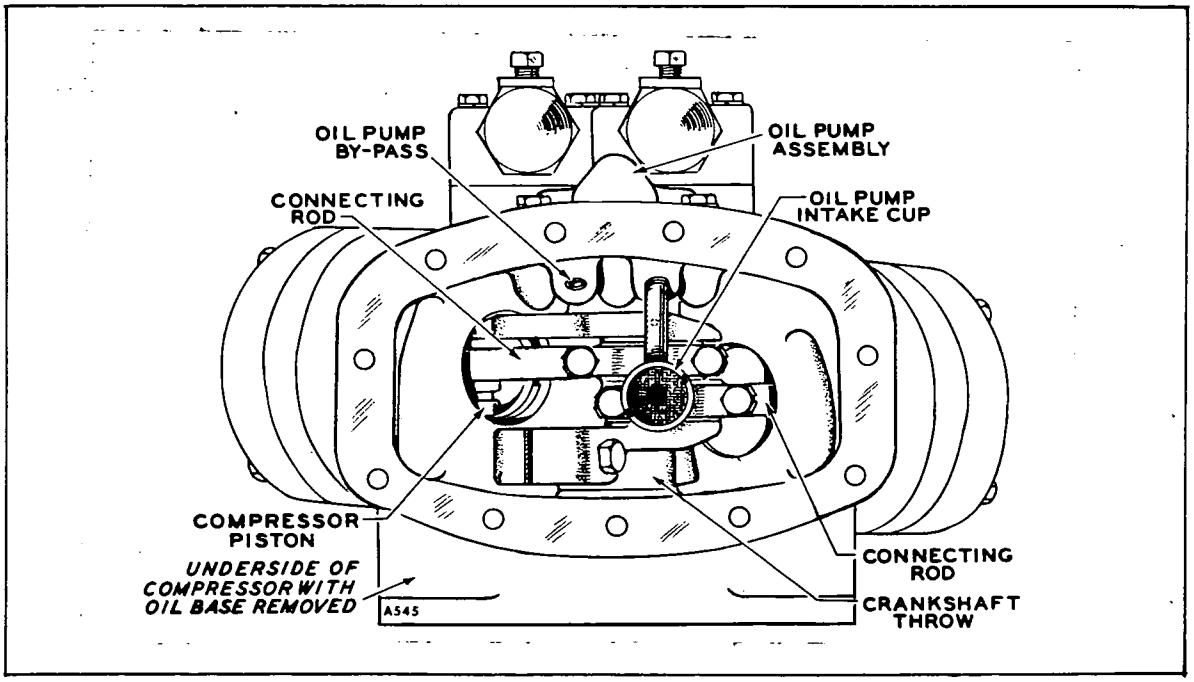


FIG. 18 - TWO-CYLINDER "V" TYPE COMPRESSOR
(Begin with Spec E, with outboard bearing - View from bottom showing internal parts.)

(Compressor and Refrigerant System, Cont.)

1. (Continued).

d. Invert and support the engine-compressor bottom side up or on side for accessibility.

e. To assure reassembly to the same connecting rod, notice rod caps are marked #1 and #2 to agree with mark on rod. Remove connecting rod and piston assemblies from top.

f. Remove the compressor to engine mounting nuts and pull compressor straight away from engine.

g. Loosen the crank throw to crankshaft screw. It may help to spread the slotted crank throw. The crankthrow is keyed to the engine crankshaft and supports the refrigerant seal's pressure spring and washer.

h. In handling the refrigerant seal, do not let the carbon seal (washer) drop or fall and take particular care not to scratch the lapped faces on the carbon seal or metal seat. The neoprene bellows grips the shaft to drive the rotating portion of the refrigerant seal assembly. To remove the rotating portion, remove its pressure spring and washer, then while gripping its circumference, pull and turn at the same time to work it off the shaft. To remove the stationary metal seat, held by its "O" ring seal, first remove the engine rear bearing plate, then press the seat out.

i. Remove the gear type oil pump from the compressor before reinstalling the compressor to the engine. This permits easy assembly and pump engagement.

2. Compressor without outboard bearing (one cylinder and two cylinder prior spec E). - Be extremely careful to avoid damaging the refrigerant seal when removing the compressor from the engine. Procedure follows: (a) Drain the engine crankcase oil. (b) Invert and support the engine-compressor bottom side up for accessibility. (c) Remove the compressor oil base, (Discard oil). It is not necessary to remove the compressor head. (d) Remove the compressor to engine mounting nuts. Models using cap screws, remove two diagonally opposite compressor mounting screws and install a pilot stud (Onan tool 420A226) in each to support the compressor during the job. (e) Crank the engine for best accessibility and loosen the crank throw to crankshaft screw. It may help to spread the slotted throw. The crank throw is keyed to the crankshaft. It is not necessary to remove the compressor connecting rod from the crank throw. (f) Work the compressor

(Compressor and Refrigerant System, Cont.)

loose from the engine and at the same time work the crank throw off the end of the crankshaft. Do not allow one end of the key to raise up because the carbon refrigerant seal must pass over it and not become scratched or otherwise damaged. (g) Further disassembly is mostly self evident.

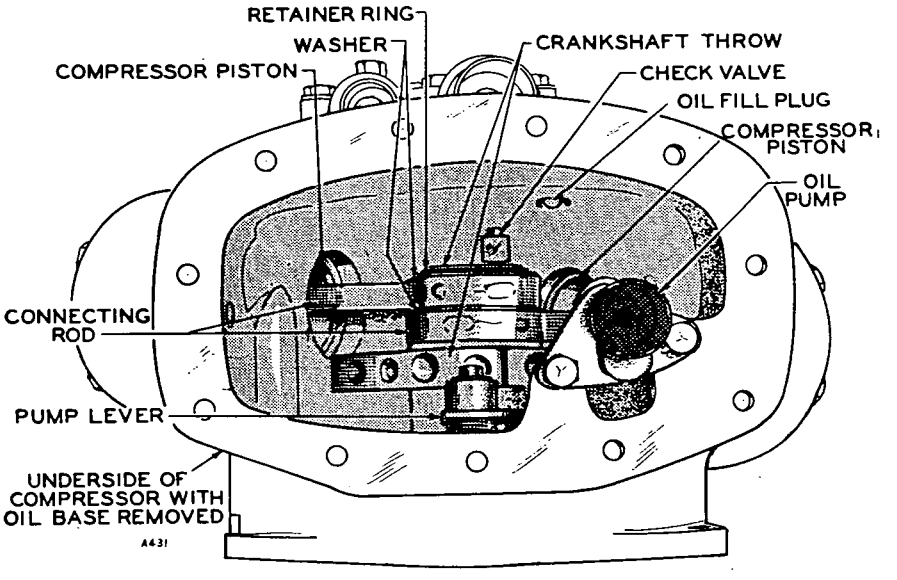


FIG. 18A - TWO-CYLINDER "V" TYPE COMPRESSOR
(Prior to Spec E, without outboard bearing -
View from bottom showing internal parts.)

D. TO INSTALL THE COMPRESSOR ON THE ENGINE. - Refer to the instructions headed "REFRIGERANT SEAL INSTALLATION" because the seal and the compressor installation is one procedure. Select the separate instructions to agree with the type compressor in question.

E. TO REINSTALL THE ENGINE-COMPRESSOR ASSEMBLY. - This procedure is basically the removal procedure in reverse.

1. Place the engine-compressor assembly upon its mounting-cushions and install the mounting hardware. See that the condenser fan (where used) centers properly.

2. Install the fuel line, battery cable, etc.

(Compressor and Refrigerant System, Cont.)

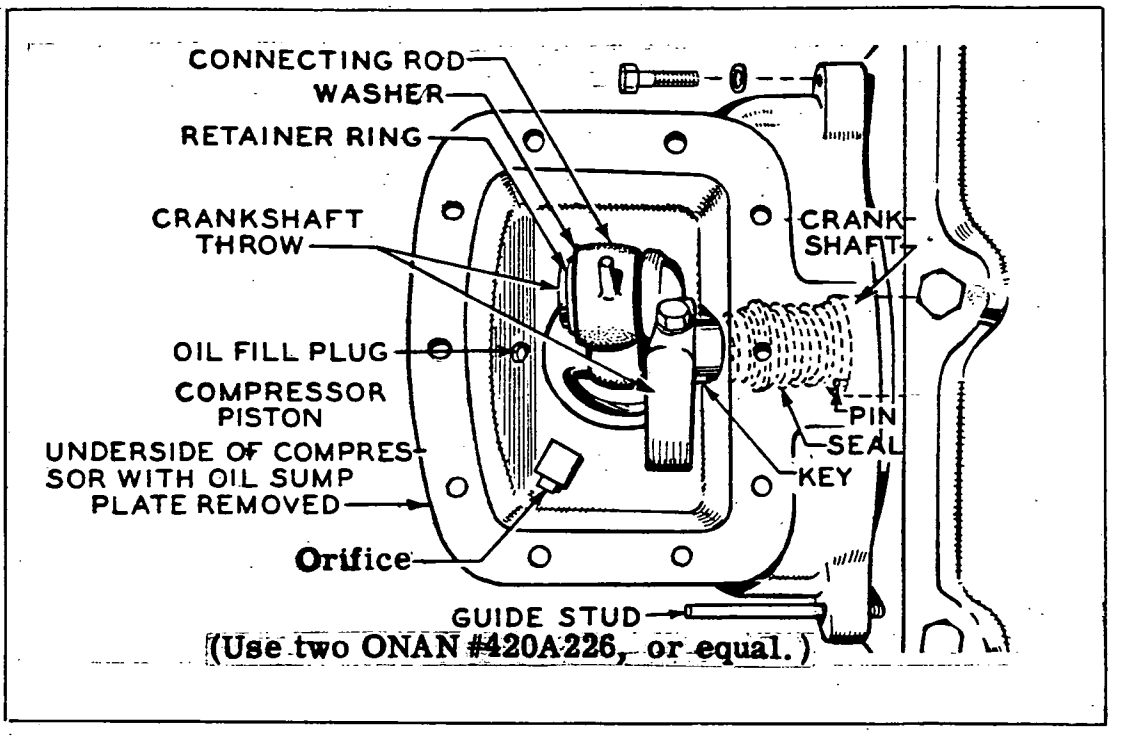


FIG. 18B - **ONE-CYLINDER COMPRESSOR**
(View **from bottom showing internal** parts.)

3. Install a new gasket and the discharge service valve. Install a new strainer gasket, the suction strainer, a new valve mounting gasket, and then the suction valve.

4. Refer to the instructions "TO PREPARE THE ENGINE AND COMPRESSOR ASSEMBLY FOR OPERATION", then complete the installation by reinstalling any equipment parts previously removed.

F. TO PREPARE THE ENGINE-COMPRESSOR ASSEMBLY FOR OPERATION. - The problem here will be to evacuate the compressor so that air and moisture will not enter the refrigerant system. These instructions apply to a pumped down system having a refrigerant charge to which an air filled compressor has been connected but the service valves are still front seated.

1. Connect a manifold and test gauge set and a vacuum pump to the service valves.

(Compressor and Refrigerant System, Cont.)

2. Pull a vacuum slowly in the compressor crankcase to remove the air. Then close the manifold valves.

3. Check the refrigerant oil level. If low or empty feed a small charge of refrigerant into the compressor crankcase to give 1 or 2 pounds gauge pressure, remove the plug, add the recommended oil and reinstall the plug.

4. Continue to charge the compressor crankcase to reach 15 pounds gauge pressure then check for leaks.

5. Repeat the vacuum pump operation to again evacuate the compressor with manifold valves open.

6. Close the manifold valves, set the service valves at "cracked off of back-seat" position, and recheck the refrigerant oil level on the compressor sight glass.

7. Service the engine to prepare it for operation.

8. Operate the unit, check the operation, back-seat the service valves, disconnect the manifold and test gauge set and use a leak detector to check for leaks.

A spare drum of refrigerant is usually required to replace refrigerant lost while evacuating the compressor. Only in the absence of a spare drum of refrigerant, and provided the system contains more than a minimum supply, some of the refrigerant in the system may be used to purge air from the compressor crankcase and service hoses when installing an air filled compressor to a pumped down system. In the absence of a vacuum pump a fairly satisfactory job of evacuating the compressor can be done by cranking with spark plug removed and discharging the air through the discharge valve service port (preferrably through a manifold connected). Two or three partial charges of refrigerant in the compressor should each be pumped out slowly to reduce to a minimum the proportion of foreign substances in the contaminated gas, then check the oil level again and continue to put the system into operation. When allowed to stabilize, air in the compressor will rise because the refrigerant is heavier. Too fast evacuation will chill the compressor and invite moisture to cling.

If the refrigerant system has zero pressure before the installation work is started, refer to the instructions, "CHARGING SYSTEM WITH REFRIGERANT".

REFRIGERANT SEAL INSTALLATION (Begin Spec E, Compressor with outboard bearing). - The complete refrigerant seal consists of a seal assembly (carbon seal, neoprene bellows, housing, pressure spring and washer) which rotates with the engine crankshaft and seats against a metal seat with an "O" ring, held stationary in the engine rear bearing plate.

The seal is installed at the time the compressor is mounted on the engine. The refrigerant seal serves as a dividing point between the refrigerant oil in the compressor and the lubricating oil in the engine. It is more satisfactory to install a new refrigerant seal and a new compressor to engine "O" ring seal, rather than attempt to reuse these parts.

In handling, be extremely careful to avoid damage to the carbon seal. Avoid scratching the seating face of the carbon seal and of the metal seat. They are lapped surfaces for a precision fit. Be sure the shaft is smooth and clean before installing the bellows. Lubricate parts by washing them before installing the bellows. Lubricate parts by washing them in clean refrigerant oil and assemble them wet.

In preparation for the work, have the engine turned and supported on the engine's side or bottom side up. Have the engine rear bearing plate installed. Have studs installed in the engine to mount the compressor. Have the compressor-to-engine new "O" ring seal wetted with refrigerant oil and installed on the engine bearing plate (this is not a component of the refrigerant seal). Do not reuse a questionable "O" ring.

1. Seat (Stationary) - If not already in place, install a new "O" ring seal wetted with refrigerant oil into the confined groove of the metal seat. Then, install the metal seat squarely into the cavity of the engine bearing plate. Be sure its beveled outside diameter is facing in toward the engine. If not possible to insert with the fingers, place cardboard protecting ring (like furnished with seal) over face of seat and press into

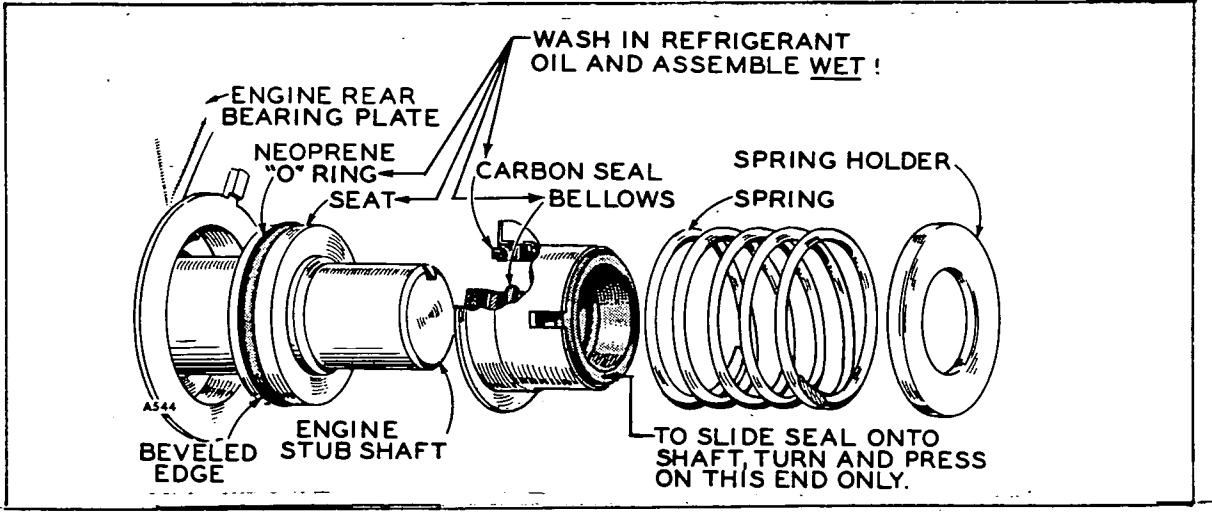


FIG. 19 - **RELATIVE LOCATION** OF REFRIGERANT SEAL **PARTS** - (Begin spec **E**. Compressor with outboard bearing)

bore with piece of tubing having end cut square.

2. Seal and Bellows (Rotating) - Before completing the shaft seal installation, wipe the lapped sealing faces of the metal seat and carbon seal perfectly clean and again apply refrigerant oil. Avoid scratching sealing surfaces! Apply refrigerant oil to the seal and bellows and to the shaft.

Remove spring and its washer temporarily from the seal assembly. Slide seal and bellows assembly onto engine crankshaft until it just touches the seat, being sure to press ONLY on tail section of bellows and driving band. If not possible to slide on with fingers, use a smooth installing tool (Onan #420A247, or equal) just larger than the shaft and with a wall thickness sufficient to butt against the driving band (floating portion). Reinstall the spring and washer.

3. Place the key in the crankshaft and install compressor crank throw all-the-way on and temporarily tighten its clamping screw.

4. Have heads, pistons, rods and oil pump removed from compressor crankcase. Carefully install compressor crankcase to engine. Have engine to compressor new large "O" ring seal installed on engine bearing plate and lubricated with refrigerant oil. See that bearing receives crank throw without damage. Tighten compressor mounting nuts evenly.

5. Loosen crank throw clamp screw, crank engine one revolution to assure alignment, then push crank throw all-the-way toward engine and tighten its screw to 40 lbs. ft. CAUTION: See that an oil cavity exists between the end of the crank throw and the oil pump.

This is an oil passage to the rods and seal.

Refer to torques in Table of Specifications. Install piston and rod assemblies (lock the rod screws), valve plate assemblies, heads, oil pump, oil pick up tube (face cup horizontally) and oil base.

REFRIGERANT SEAL INSTALLATION (Prior to Spec E, Compressor without outboard bearings). The refrigerant seal consists of a bellows and "O" ring seal which rotate with the engine crankshaft and seat against a carbon seat and "O" ring seal held stationary in the compressor crankcase. The seal is installed at the time the compressor is mounted on the engine. The refrigerant seal serves as a dividing point between the refrigerant and refrigerant oil in the compressor and the lubricating oil in the engine.

Be extremely careful to avoid damage to the carbon seat of the refrigerant seal when installing the compressor. The seating radius is a lapped surface for a precision fit.

Use refrigerant oil to lubricate the "O" ring seals and the carbon seat before installation. Be sure to have parts, tools and hands clean.

In preparation for the work, have the engine turned and supported bottom side up. Have the compressor-to-engine "O" ring seal in place (this is not a component of the refrigerant seal). Have studs installed in the engine to mount the compressor. Have the compressor assembled except for the oil base and when the compressor is inverted the piston, rod and throw assembly will be in their top position. Have the key installed in the crankshaft and do not allow one end of the key to raise up because the carbon seat must pass over it and not become scratched or otherwise damaged.

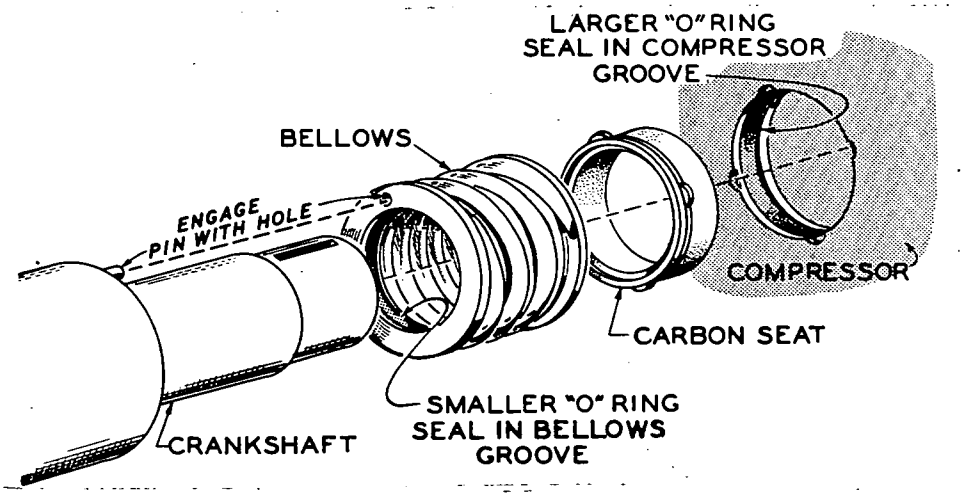


FIG. 20 - RELATIVE LOCATION OF REFRIGERANT SEAL PARTS - (Prior to **spec E, Compressor** without outboard bearing)

1. Place the smaller "O" ring seal into the inside diameter groove of the bellows portion of the seal then slide the bellows over the end of the crankshaft. Fit the hole in the bellows radius over the driving pin in the crankshaft radius.

2. Place the larger "O" ring seal into the inside diameter groove of the compressor then gently press the carbon portion of the seal into place inside the "O" ring, using hand pressure on pilot tool (Onan tool #420A227) or have the seat protected with rubber or cardboard to avoid scratches.

3. Carefully install the compressor to the engine. Do not allow the key to tilt. Grasp the compressor crankcase with one hand and grasp the crankshaft throw, with compressor rod and piston assembled, with the other hand.

Align the throw keyway with the crankshaft key, and shift the parts simultaneously into place. Fasten the compressor to the engine with lock washers and nuts, tightening nuts evenly. Be sure the crank throw is all the way on, then tighten the throw clamping screw. Crank the engine

to check for no binding and proper alignment. Install the compressor sump plate to complete the installation.

STRAINER SCREEN. - A screen in the suction side of the compressor, serves to trap foreign substances which might be present in the system and which could cause valve malfunction. A plugged screen can usually be cleaned in a solvent. To install the compressor suction screen, install the screen, the service valve gasket, then the service valve. Test for leaks under pressure.

A partially plugged screen is one of several troubles which could cause inefficient operation making the cause difficult to isolate.

REFRIGERANT OIL RETURN. - A passage is located between the suction chamber and the oil sump of the compressor crankcase. This passage permits refrigerant oil and suction gas to return to the crankcase. The earlier compressor had a check valve here which should be inspected for free operation if the compressor is disassembled for a major repair.

COMPRESSOR OIL PUMP (Models Begin Spec E). - These compressors have an outboard bearing and use a gear type oil pump. The non-adjustable oil pressure relief valve has a spring loaded ball with a sleeve pressed in to retain the spring. The compressor bearing and connecting rods are pressure lubricated. A small hole at the end of the crank throw oil passage feeds oil to the refrigerant seal. The oil pump engages with the end of the crank throw. Look through sigh glass (above oil level) to see operation of oil pump.

COMPRESSOR OIL PUMP (Where used, Models Prior to Spec E). -This plunger type oil pump has a spring loaded piston and nylon ball type check valves. It delivers a fountain-like stream of refrigerant oil to splash-lubricate the compressor. Before installing the compressor oil base, crank the compressor slowly and see that the pump operating lever has slightly more travel available than the operating cam offers. It is not necessary to prime the pump.

COMPRESSOR PISTON. - Beginning with model "Spec E" the piston does not have a piston compression ring. If the piston does have a groove, DO NOT install a piston ring because it is not required.

ENGINE

CARBURETOR. - Carburetor maintenance should consist of regular cleaning. Some types of gasoline have a tendency toward formation of gum deposits inside the carburetor. This gum formation can usually be removed by soaking in alcohol or acetone. A fine soft wire may be used to clean jets.

See that the float is not damaged. If necessary to reset the float level, use a small screw driver to bend the lip of the float. With the carburetor casting inverted and the float resting lightly against the needle in its seat, there should be 11/64 inch clearance between the outer edge of the casting and the free end of the float (side opposite needle seat).

Carburetor adjustments appear in the ADJUSTMENT section herein. Be sure the throttle assembly works freely. When reinstalling adjusting needles, do not force them into their seats.

IGNITION COIL INSTALLATION. - Refer to the illustration, Coil Installation, for a pictorial view. Refer to the Wiring Diagram (electrical circuit illustration) for a schematic view of connections to the ignition coil for standard and optional equipment. The ignition coil is not grounded and the spark occurs at the collapse of battery current.

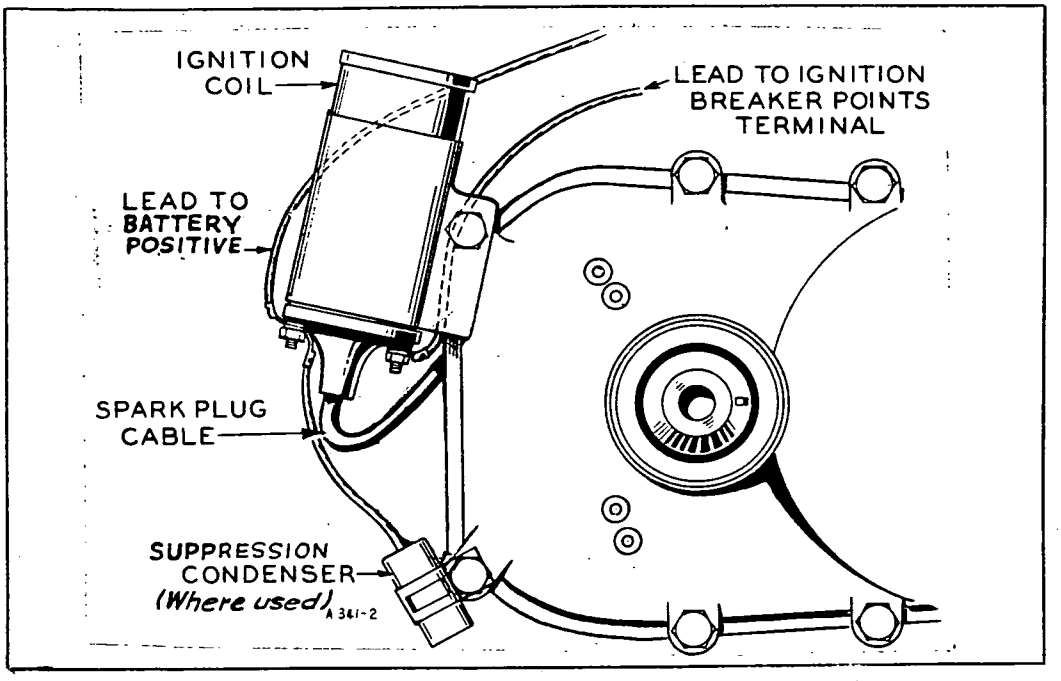


FIG. 21 - COIL INSTALLATION FOR BATTERY IGNITION

TIMING THE IGNITION. - The correct spark advance is 19° before top center. (Disregard the 25° mark on the gear cover.)

Shifting the breaker box to correct the timing should not be attempted until the breaker points have been gapped correctly, as instructed under PERIODIC SERVICE, and the timing checked.

In most installations ignition breaker points can be replaced without disturbing the position of the breaker box.

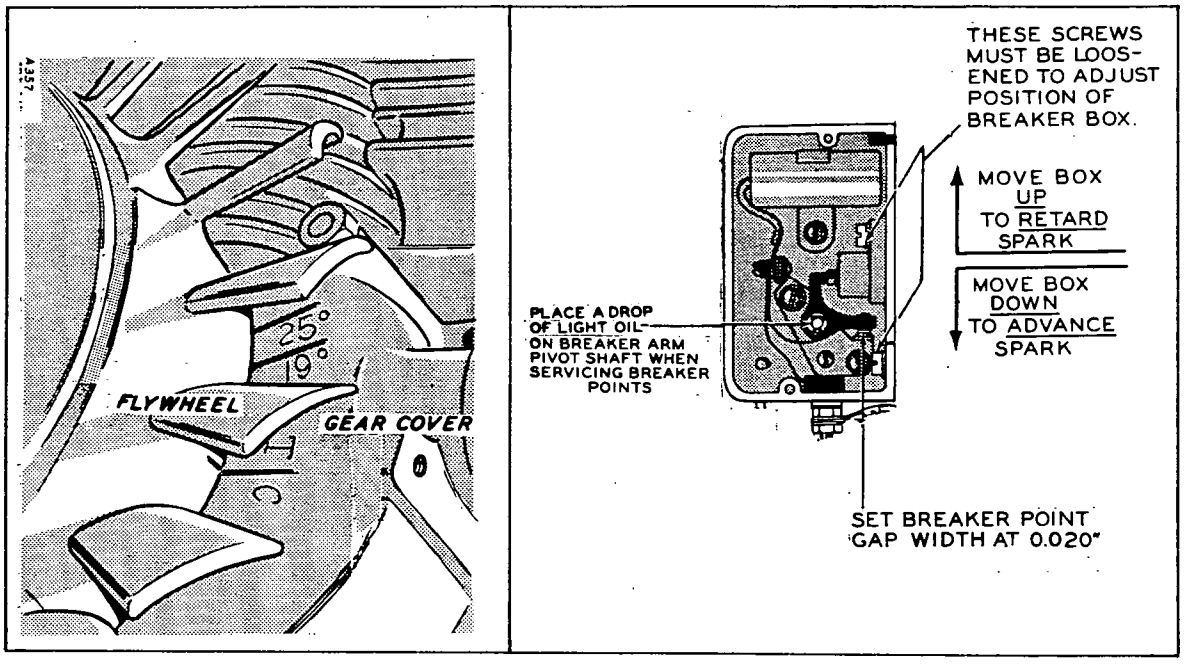


FIG. 22 - IGNITION TIMING

Timing procedure follows:

1. Remove the cover from the breaker box.

2. Crank the engine over slowly by hand in the direction of crankshaft rotation until the witness mark on the flywheel and the "TC" mark on the gear cover are exactly in line ON THE COMPRESSION STROKE. See the illustration Ignition Timing.

3. Adjust the ignition breaker point gap width to .020 inch at full separation.

4. Turn the flywheel to the left, against crankshaft rotation, until the mark is about two inches past the 25^{o} mark on the gear cover.

5. Turn the flywheel slowly to the right and note whether the ignition points just separate when the mark on the flywheel aligns with the 19^{o} mark (for 19 degree spark advance) on the gear cover. The engine must be on the compression stroke. If the marks align as the points break, timing is correct. If they do not, loosen the breaker box mounting screws and shift the whole breaker box assembly slightly upward to retard the timing (points breaking too soon), or shift it slightly down-

ward to advance the timing (points not breaking soon enough). Tighten the breaker box mounting screws securely after making an adjustment.

To accurately check the time at which the spark occurs, an automotive type timing light may be used when the engine is running.

To accurately check the time at which the spark occurs, without running the engine, connect a continuity test lamp set across the ignition breaker points. Touch one test prod to the breaker box terminal (to which the lead to the coil is connected), and touch the other test prod to a good ground on the engine. Turn the crankshaft against rotation (backwards) until the points close. Then slowly turn the crankshaft with rotation. The lamp should go out just as the points break.

6. Reinstall the breaker box cover.

FLYWHEEL. - To remove the flywheel turn the flywheel mounting screw outward about 2 turns. Use a screw driver behind the flywheel to take up the crankshaft end play. Then strike a sharp endwise blow on the head of the capscrew with a heavy soft faced hammer to loosen. A suitable puller can easily be fashioned from a piece of bar steel and the flywheel removed with the aid of the puller if so desired.

Do not drop the flywheel. A broken fin will destroy the balance. Use a steel key for mounting the flywheel.

VALVE SERVICE. - Properly seated valves are essential to good engine performance. The aluminum cylinder head is removable for valve servicing. Do not use a pry to loosen the cylinder head, rap sharply on the edge with a soft faced hammer, taking care not to break any cooling fins. A conventional type valve spring lifter may be used when removing the valve spring locks, which are of the split type. Clean all carbon deposits from the cylinder head, piston top, valves, guides, etc. If a valve face is burned or warped, or the stem worn, install a new valve.

Worn valve stem guides may be replaced from inside the valve chamber. The intake valve guide must have an "O" ring under the shoulder. This "O" ring must contact tightly against the upper valve chamber surface. Valve locks are the split, tapered type, the smaller diameter of which must face toward the valve head. Tappets are also replaceable from the valve chamber, after first removing the valve assemblies.

The valve FACE angle is 44^{o}. The valve SEAT angle is 45^{o}. This 1^{o} interference angle results in a sharp seating surface between the valve and the top of the valve seat. The interference angle method of grinding valves minimizes face deposits and lengthens valve life.

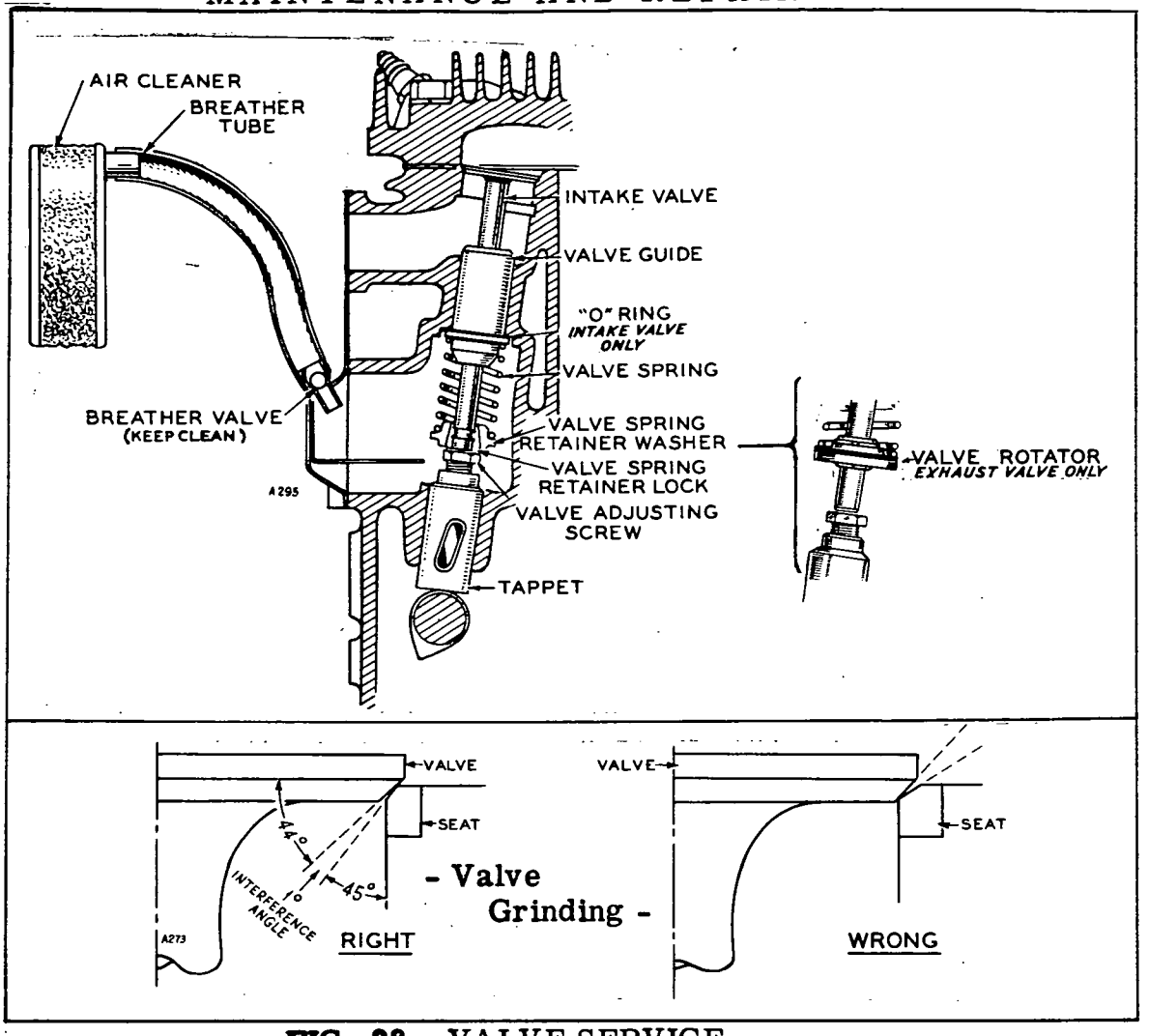


FIG. 23 - VALVE SERVICE

The valves should not be hand lapped, if at all avoidable, since the sharp contact may be destroyed. This is especially important where stellite faced valves and seats are used. Valve faces should be finished in a machine to 44°. Valve seats should be ground with a 45° stone, and the width of the seat band should be 1/32 to 3/64 of an inch wide. Grind only enough to assure proper seating.

Remove all grinding compound from engine parts and place each valve in its proper location. Check each valve for a tight seat, using an air pressure type testing tool. If such a tool is not available, make pencil marks at intervals across the valve face and observe if the marks rub off uniformly when the valve is rotated part of a turn against the seat.

Lightly oil the valve stems and reassemble all parts removed. Adjust the valve clearance.

TAPPET ADJUSTMENT. - The tappet clearance may be easily checked after first removing the valve compartment cover and the blower housing. Crank the engine over by hand until the intake valve (the one nearest the carburetor) opens and closes. Continue turning the flywheel slowly until the mark on the flywheel is in alignment with the TC mark on the gear cover. The correct tappet clearance for both the intake and exhaust valves appear in the Table of Clearance. Tappets are fitted with self locking adjusting screws. Use a 7/16" wrench for the screw, and a 9/16" wrench for the tappet when making any adjustment.

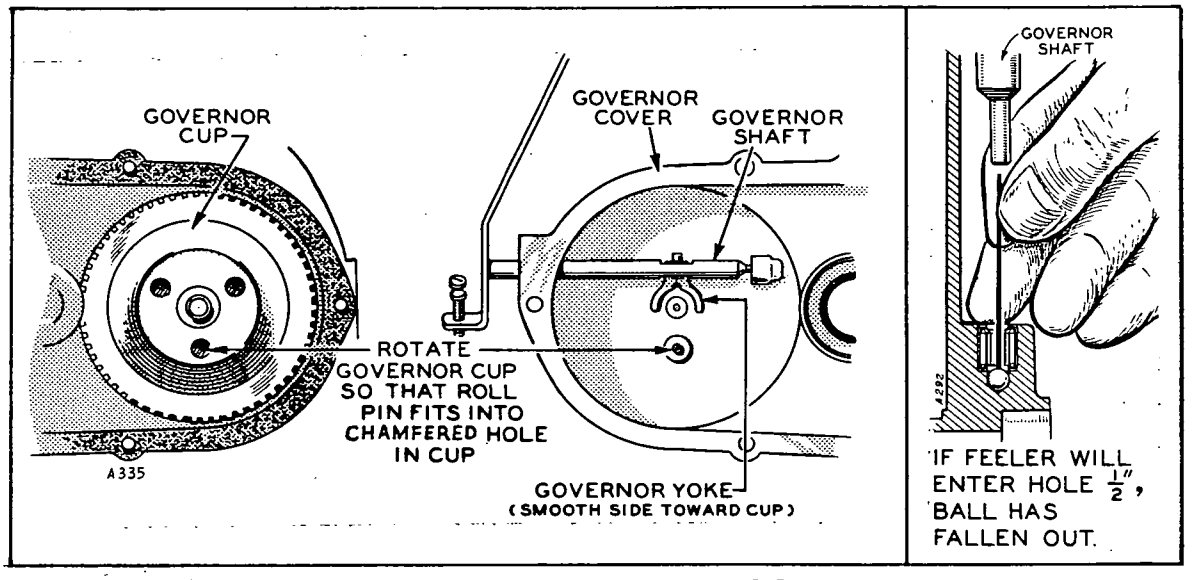


FIG. 24 - INSTALLING THE GEAR COVER

GEAR COVER. - When installing the gear cover, make sure that the pin in the gear cover engages the chamfered (smoothest) hole in the governor cup. Turn the governor cup so that the chamfered hole is in downward position. Turn the governor arm and shaft clockwise as far as possible and hold in this position until the gear cover is installed flush against the crankcase. Be careful not to damage the gear cover oil seal.

GOVERNOR CUP. - The governor cup may be removed from the cam gear and shaft after first removing the small lock ring from the camshaft center pin. Catch the governor flyballs in the hand as the cup assembly is removed.

If a new governor cup is being installed, the distance from the small lock ring on the center pin to the face of the governor cup must be exactly 7/32" when the cup is pressed back against the flyballs as far as possible. If the distance is too small, carefully dress the face of the cup as required, being sure to remove any burr from the inside of the cup bore. If the distance is more than 7/32", carefully press the pin in the required amount. Be very careful not to damage the pin, as it is

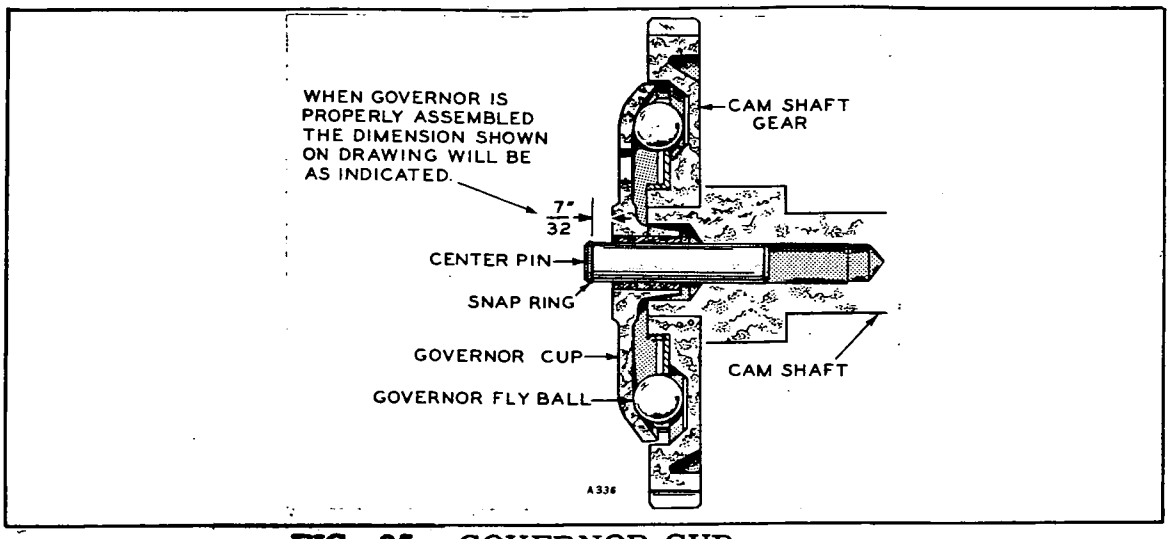


FIG. 25 - GOVERNOR CUP

difficult to replace in the field. Replacement of governor flyballs is easier if the unit is tipped backward with the timing gears upward. Be sure that all flyballs are replaced and evenly spaced.

TIMING GEARS. - If replacement of either the crankshaft gear or the camshaft gear becomes necessary, install both gears new, never one only. To remove the crankshaft gear, insert two long #10-32 steel screws into the tapped gear holes and tighten the screws alternately. As the screws are tightened, the screw ends will seat against the crankshaft shoulder and force the gear off the end of the crankshaft.

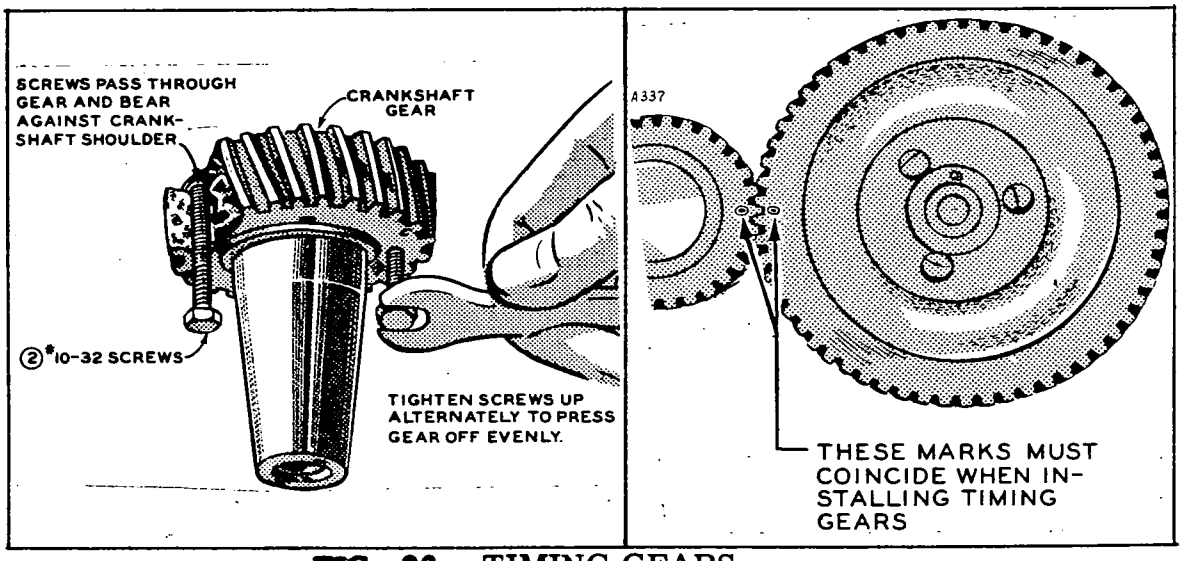


FIG. 26 - TIMING GEARS

The camshaft gear is pressed on and keyed to the camshaft. The camshaft and gear must be removed as an assembly, after first removing the crankshaft gear lock ring and washer. Before removing the camshaft and gear assembly, remove the cylinder head and valve assemblies. Remove the operating plunger for the breaker points. Remove

the fuel pump (where used) and tappets. After removing the governor cup assembly from the gear, the camshaft may be pressed out of the gear by use of a hollow tool or pipe which will fit over the camshaft center pin. Do not press on the center pin or damage it in any way. The governor ball spacer is a press fit to the camshaft gear.

When pressing a camshaft gear onto the camshaft, be sure the gear is started straight and that the key is properly in place. Install the governor cup assembly before installing the camshaft and gear in the engine.

Note that each timing gear is stamped with "O" mark near the edge. The gear teeth must mesh so that these marks exactly coincide when the gears are installed in the engine. Be sure, when installing the camshaft gear and shaft assembly, that the thrust washer is properly in place behind the gear. Replace the retaining washer and lock ring to the crankshaft.

CYLINDER. - The cylinder wears very little in normal service. If, through improper lubrication or accident, the cylinder wall should become scored or worn badly, the cylinder may be rebored and honed to accomodate a new piston and rings of one of the available oversizes. Pistons are obtainable in .010", .020", .030", and .040" oversizes. Piston rings are available in .010", .020", .030" and .040" oversizes. Use standard size rings on a .005" oversize piston. If the cylinder is not being reconditioned, but new piston rings are being installed, remove any ridge which may have become formed at the top of piston ring travel in the cylinder bore. Engines might be fitted at the factory with a .005" oversize piston and are so indicated by a letter "E" following the engine serial number stamped on the side of the crankcase near the oil fill, and on the plant nameplate.

PISTON AND RINGS. - The piston and connecting rod assembly are removed through the top of the cylinder. The piston is fitted with two compression rings and one oil control ring. The piston ring grooves should be cleaned of any carbon deposits, and the oil return holes in the lower groove must be open. Before installing new rings on the piston, check the ring gap by placing each ring squarely in the cylinder at a position corresponding to the bottom of its travel. The gap between the ends of the ring should be as given in the Table of Clearances. Rings which are slightly oversize may be filed as necessary to obtain the correct gap, but do not use rings which require too much filing. Standard size rings may be used on a .005" oversize piston. .010", .020", .030", and .040" oversize rings are to be used on .010", .020", .030", and .040" oversize pistons, respectively. Rings of the tapered type are usually marked "TOP" on one side, or identified in some other manner, and the ring must be installed with this mark toward the closed end of the piston. Space each ring gap one third of the way around the piston from the preceding one, with no gap directly in line with the piston pin. The bottom piston ring groove should be

fitted with an oil control ring and the two upper grooves fitted with compression rings. If a chrome faced ring is used, it will be in the top groove.

The piston is fitted with a full floating type piston pin. The pin is kept in place by two lock rings in the piston, one at each side. Be sure these lock rings are properly in place before installing the piston and connecting rod in the engine. Correct piston to cylinder clearance appears in the Table of Clearance.

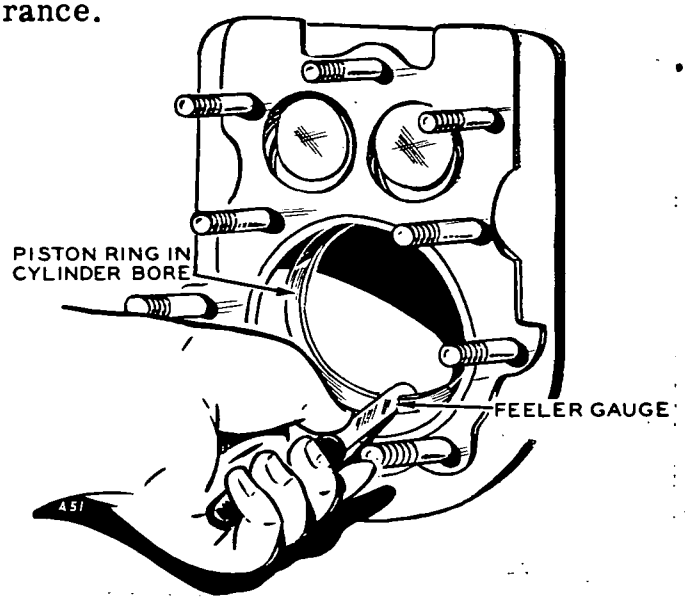


FIG. 27 - FITTING PISTON RINGS TO THE CYLINDER

CONNECTING ROD. - Mark the connecting rod before removing it to assure reassembling with the same side facing the camshaft. Note that the oil dipper splashes oil away from the camshaft. The connecting rod cap is installed on the side away from the camshaft.

The connecting rod bearing clearance to the crankshaft journal may be reduced as necessary by carefully dressing the cap on a sheet of abrasive cloth (#320 grit or finer) placed flat on a surface plate or piece of plate glass.

The connecting rod and piston assembly must be properly aligned before reassembly to the engine. The aligning should be done on an accurate aligning gauge by a competent operator. Misalignment may cause rapid wear of piston, pin, cylinder and connecting rod.

Be sure the connecting rod oil dipper is properly installed, as it is vital to proper lubrication.

BEARINGS. - Removal of the camshaft or crankshaft bearings requires complete disassembly of the engine. Use a press or a suitable drive plug to remove the bearings. Drive or press the crankshaft bearings and the camshaft bearings from the outside toward the

inside of the cylinder block. Avoid damaging the block during bearing removal.

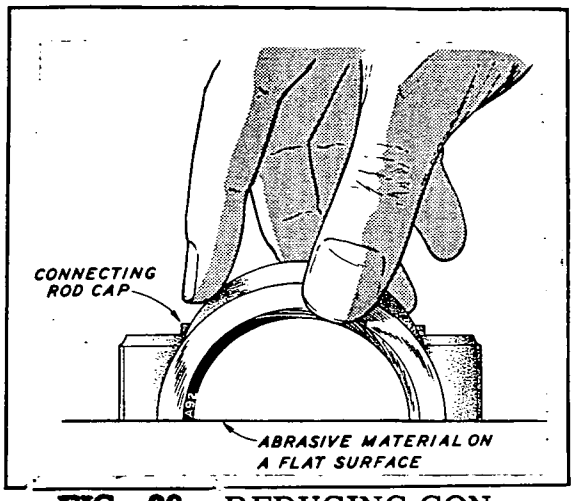


FIG. 28 - REDUCING CONNECTING ROD CLEARANCE

The crankshaft main bearings must be installed from the inside of the cylinder block with the oil hole in each bearing aligned with the oil hole in the bearing boss and the notch in the bearing flange aligned with the stop pin. The oil passage must be at least 1/2 open and near the top on splash lubricated engines. New crankshaft main bearings are precision type which DO NOT require line reaming or line boring after installation. Crankshaft bearings are available in standard size or in 0.002 inch or 0.020 inch undersize. Using a press or drive plug to install the bearing in a cold cylinder block might result in damage to this type of bearing. Warm the bearing plate and cylinder block to expand the bearing bore size. Use hot water, a 200°F. oven, or in an emergency a low flame from a torch. Only a little heat is required. The cold precision bearing should then require only light taps to position it. The flange of the bearing must be against the inner end of the bearing boss. Use oil on the outer surface of the bearing to reduce friction and coat the inner surface before installing the crankshaft.

The oil groove of the front camshaft bearing must be centered at the top. The plunger notch in the rear camshaft bearing must be aligned with the hole in the bearing boss. Install both bearings from the outside. Press or drive the front bearing in flush with the bearing boss and the rear bearing in flush with the bottom of the counterbore which receives the expansion plug. Replace the expansion plug of the rear bearing.

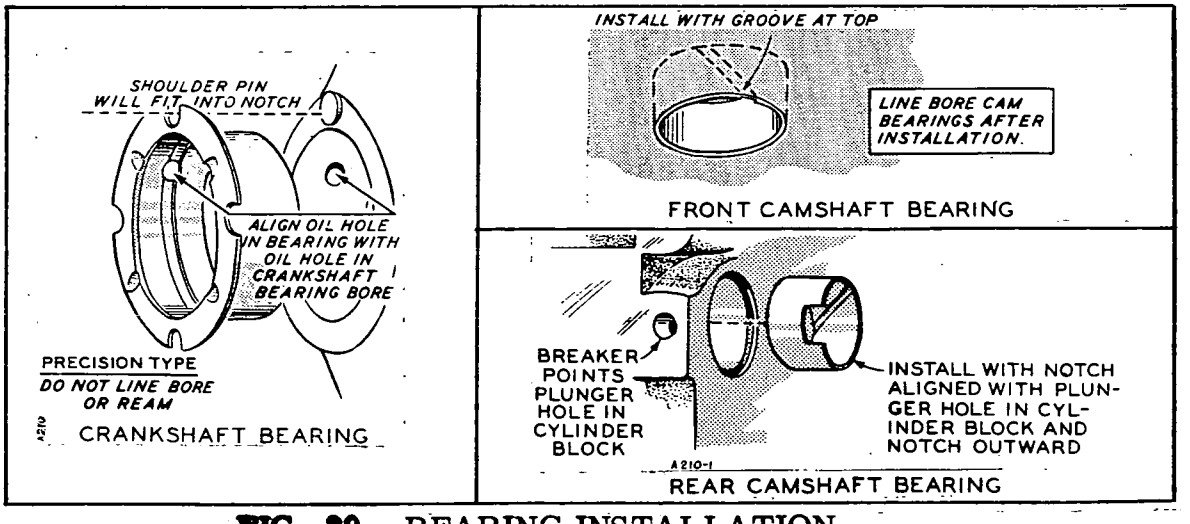


FIG. 29 - BEARING INSTALLATION

The camshaft bearings must be line bored or line reamed after being installed in the cylinder block, to allow a clearance as shown in the Table of Clearances. Any reliable machine shop should be able to perform this service. If equipment for the line boring or reaming is not available locally, see the dealer from whom you purchased the engine or return it to the factory for repairs.

OIL SEALS. - The gear cover must be removed to replace its oil seal. Drive the old seal out from the inside of the gear cover.

When installing the gear cover oil seal, tap the seal inward until it is 31/32 of an inch from the mounting face of the cover.

The refrigerant seal serves the additional function of an engine rear oil seal.

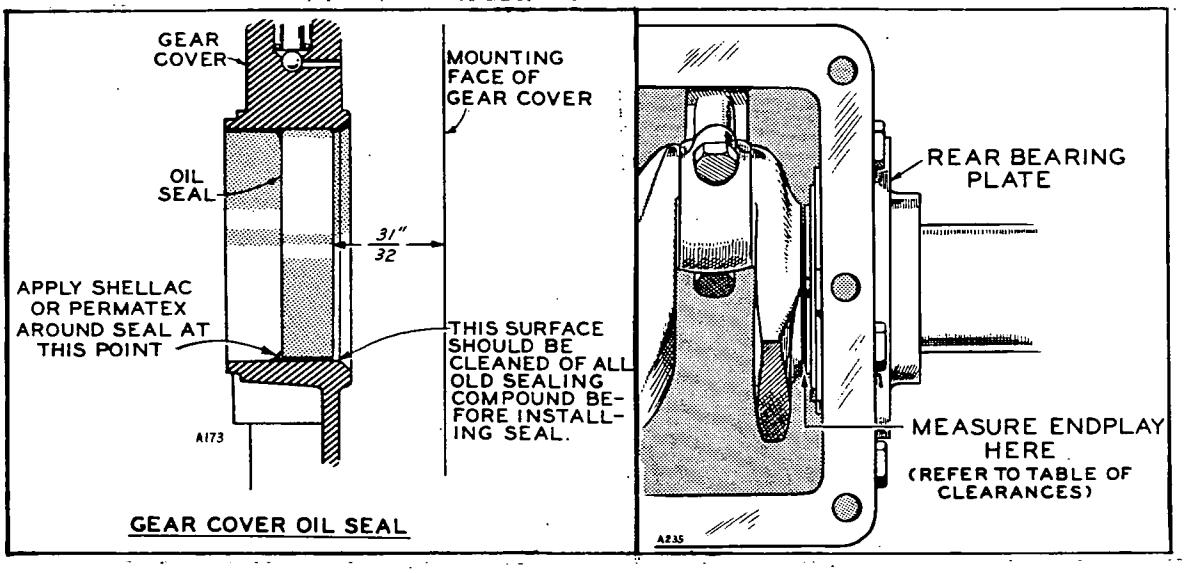


FIG. 30 - OIL SEAL INSTALLATION FIG. 31 - CRANK. END PLAY

CRANKSHAFT. - Inspect the bearing journals. If they are scored and can not be smoothed out by dressing down, the bearing journals should be refinished to use 0.002" or 0.020" undersize bearings or a new crankshaft should be installed.

If a worn main bearing journal can not be fitted with an available precision type undersize bearing, then refinish it to the next undersize. If a worn connecting rod bearing journal can not be fitted by dressing down the rod cap, then refinish it to take the undersize rod available. When installing the crankshaft, use gaskets as needed behind the bearing plate to assure end play as given in the Table of Clearances.

VALVE COMPARTMENT OIL DRAIN. - A drain hole from the valve compartment enters the crankcase. This hole must be unobstructed to provide for proper drainage of oil from the valve compartment.

POSSIBLE CAUSE	REMEDY
ENGINE CRANKS TOO STIFFLY	
Excessive high head pressure in refrigerant system.	Purge air or overcharge of refrigerant. Clean dirty condenser.
Too heavy oil in crankcase.	Drain, refill with lighter oil.
Engine stuck.	Disassemble and repair.
ENGINE WILL NOT START WHEN CRANKED	
Faulty ignition.	Clean, adjust, or replace breaker points, plug, condenser, etc.
Open ignition circuit.	Bond strap must be connected between compressor and frame.
Lack of fuel or faulty carburetion.	Refill the tank. Check the fuel system. Clean, adjust or replace parts necessary. Allow electric choke (where used) to cool (ignition OFF), then attempt to restart, or operate choke manually for initial start.
Clogged fuel screen.	Clean.
Cylinder flooded.	Crank few times with spark plug removed.
Poor fuel.	Drain, refill with good fuel.
Poor compression.	Tighten cylinder head and spark plug. If still not corrected, grind the valves. Replace piston rings if necessary.
Wrong timing.	Reset breaker points. Retime ignition if necessary.
EXCESSIVE OIL CONSUMPTION, LIGHT BLUE SMOKY EXHAUST	
Poor compression, usually due to worn piston, rings or cylinder.	Refinish cylinder. Replace piston and rings.
Oil leaks from oil base or connections. This does not cause smoky exhaust.	Replace gaskets. Tighten screws and connections. Check breather valve.

POSSIBLE CAUSE	REMEDY
EXCESSIVE OIL CONSUMPTION, LIGHT BLUE SMOKY EXHAUST (Cont.)	
Oil too light or diluted.	Drain, refill with correct oil.
Worn engine.	Repair as necessary.
Worn intake valve guide or valve stem.	Replace.
Engine misfiring.	Refer to symptoms of ENGINE MISFIRING.
Faulty ignition.	Clean, adjust, or replace breaker points, plug, condenser, etc.
Too much oil.	Drain excess oil.
BLACK, SMOKY EXHAUST, EXCESSIVE FUEL CONSUMPTION, FOULING OF SPARK PLUG WITH BLACK SOOT, POSSIBLE LACK OF POWER UNDER HEAVY LOAD	
Fuel mixture too rich.	Adjust carburetor or choke. Install needed carburetor parts.
Choke not open.	See that choke opens properly.
Dirty air cleaner.	Clean.
Excessive crankcase pressure, causing excessive fuel pump pressure.	Clean breather valve.
LIGHT POUNDING ENGINE KNOCK	
Loose connecting rod bearing.	Adjust or replace.
Low oil supply.	Add oil.
Oil badly diluted.	Change oil.
ENGINE STOPS UNEXPECTEDLY	
Fuel tank empty.	Refill.
Defective ignition.	Check the ignition system. Repair or replace parts necessary.

POSSIBLE CAUSE	REMEDY
ENGINE STOPS UNEXPECTEDLY (Cont.)	
Excessive high head pressure in refrigerant system.	Purge air or overcharge of refrigerant. Clean dirty condenser. Check for shut off liquid line.
DULL METALLIC THUD. IF NOT BAD, MAY DISAPPEAR AFTER FEW MINUTES OPERATION. IF BAD, INCREASES WITH LOAD	
Loose crankshaft bearing.	Replace unless one of the next two remedies permanently corrects the trouble.
SHARP METALLIC THUD, ESPECIALLY WHEN COLD ENGINE FIRST STARTED	
Low oil supply.	Add oil.
Oil badly diluted.	Change oil.
PINGING SOUND WHEN ENGINE IS SUDDENLY OR HEAVILY LOADED	
Carbon in cylinder.	Remove carbon.
Spark too early.	Adjust breaker points. Retime if necessary.
Wrong spark plug.	Install correct spark plug.
Spark plug burned or carboned.	Install new plug.
Valves hot.	Adjust tappet clearance.
Fuel stale or low octane.	Use good fresh fuel.
Lean fuel mixture.	Clean and adjust carburetor.
Engine hot.	Check air circulation.
TAPPING SOUND	
Tappet clearance too great.	Adjust or replace tappets.
Broken valve spring.	Install new spring.

POSSIBLE CAUSE	REMEDY
HOLLOW CLICKING SOUND WITH COOL ENGINE UNDER LOAD	
Loose piston.	If noise only slight and disappears when engine warms up, no immediate attention needed. Otherwise replace worn parts.
ENGINE BACKFIRES AT CARBURETOR	
Lean fuel mixture.	Clean or adjust carburetor.
Clogged fuel screen.	Clean screen.
Poor fuel.	Refill with good, fresh fuel.
Spark too late.	Adjust breaker points.
Intake valve leaking.	Grind or replace.
SPEED DROPS UNDER HEAVY LOAD	
Engine lacks power.	See remedies for engine misfires under heavy load.
Poor compression.	Tighten cylinder head and spark plug. If still not corrected, grind the valves. Replace piston rings, if necessary.
Faulty carburetion.	Check the fuel system. Clean, adjust or replace parts necessary.
Dirty air cleaner.	Clean.
Choke partially closed.	See that it opens wide.
Carbon in cylinders.	Remove carbon.
Restricted exhaust line.	Clean or increase the size.
ENGINE MISFIRES AT LIGHT LOAD	
Spark plug gap too narrow.	Adjust to correct gap.
Intake air leak.	Tighten or replace gaskets.
Faulty ignition.	Clean, adjust or replace breaker points, plug, condenser, etc. If necessary retime ignition.

POSSIBLE CAUSE	REMEDY
ENGINE MISFIRES AT LIGHT LOAD (Cont.)	
Low compression.	Tighten cylinder head and spark plug. If still not corrected, grind valves. Replace piston rings, if necessary.
ENGINE MISFIRES AT HEAVY LOAD	
Spark plug gap too wide.	Adjust gap.
Faulty ignition.	Clean, adjust or replace breaker points, plug, condenser, etc. If necessary retime ignition.
Clogged carburetor.	Clean jet.
Clogged fuel screen.	Clean.
COOLED SPACE TEMPERATURE TOO HIGH	
Heat loss to compartment too great making refrigeration load too high.	Provide insulation, close openings and air leaks.
Unit not running at maximum rated speed and capacity, refrigerant circulating too slowly.	Increase speed. If necessary repair controls. See engine troubles. Correct system if overloaded.
Capacity of unit reduced by refrigerant not circulating at proper rate (suction pressure high, head pressure low).	Check for blown cylinder head gasket. Check speed. Check shortage of refrigerant. Repair compressor if valves inside compressor are stuck open or leaking badly.
Capacity of unit reduced by high head pressure (suction pressure high).	Clean condenser if air flow is restricted. See that discharge valve is fully open to back seat. Purge system if overcharged with refrigerant or system contains air.
Compressor slugged by refrigerant fed too fast to completely vaporized in evaporator coil (suction line cold, suction pressure high, head pressure normal or high).	Check faulty installation of expansion valve bulb (where used). Install new expansion valve if stuck open.

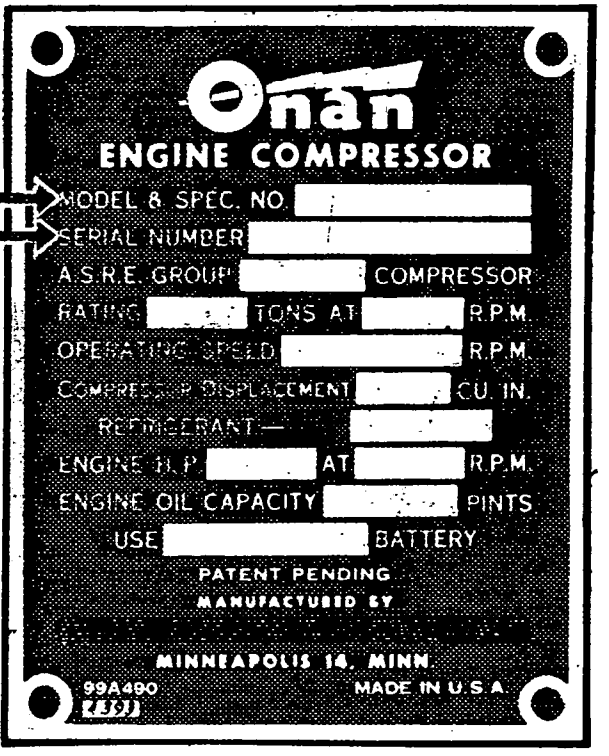
POSSIBLE CAUSE	REMEDY
COOLED SPACE TEMPERATURE TOO HIGH (Cont.)	
Capacity of unit reduced by refrigerant leak from high to low side of compressor cylinder head.	Replace cylinder head gasket.
Capacity of unit reduced by low suction pressure but normal head pressure and normal cooled space temperature.	Check for obstruction to air flow past evaporator coil.
COOLED SPACE TEMPERATURE TOO LOW	
Unit capacity too high.	Decrease speed if equipped with variable speed governor.
Drop in ambient temperature.	Shut off unit, or decrease speed of variable speed governed unit.
NOISY COMPRESSOR	
Moving parts worn, broken or loose.	Repair or replace.
Pumping oil, but pressures normal.	Reduce supply.
Oil not returning to compressor.	Check faulty installation of suction line if unusually long.
Liquid refrigerant entering compressor causing slugging and suction line frosted.	Install new expansion valve if stuck open.
Suction line frosted due to faulty installation of expansion valve bulb (where used).	See that expansion valve bulb is securely clamped to evaporator outlet tube to properly react to temperature of superheated low pressure refrig.
Air in system (head pressure extremely high).	Purge system.
Overcharge of refrigerant (head pressure extremely high).	Purge excess.
Oil slugging due to sudden reduction in suction pressure.	Install new expansion valve if stuck closed. Thaw valve if frozen and install new filter dryer unit (if used).

REPLACEMENT PARTS SECTION

FOR PARTS OR SERVICE, CONTACT THE DEALER FROM WHOM YOU PURCHASED THIS EQUIPMENT OR REFER TO YOUR NEAREST AUTHORIZED SERVICE STATION.

TO AVOID ERRORS OR DELAY IN FILLING YOUR PARTS ORDER, PLEASE FURNISH ALL INFORMATION REQUESTED.

1. Always give the following data from the Engine-Compressor Nameplate;
   MODEL & SPEC. NO._____.
   SERIAL NO._____.



2. State definite shipping instructions.

3. Give the part number, description and quantity needed of each item. Do not order by reference number or group number ! If an old part cannot be identified, return the part prepaid to your dealer or nearest AUTHORIZED SERVICE STATION. Print your name and address plainly on the package. Write a letter to the same address stating the reason for returning the part.

Any claim for loss or damage to your unit in transit should be filed promptly against the transportation company making the delivery. Shipments are complete unless the packing list indicates items are back-ordered.

"Prices are purposely omitted from this Parts Catalog due to the confusion resulting from fluctuating costs, import duties, sales taxes, exchange rates, etc.

For Current parts prices, consult your ONAN Dealer, Distributor or Parts and Service Center."

Parts apply to all models except where otherwise called-out by the part description or by the group heading. Reference to the Identification Chart near the front of this book will aid the user of this parts list to determine which parts may differ between models.

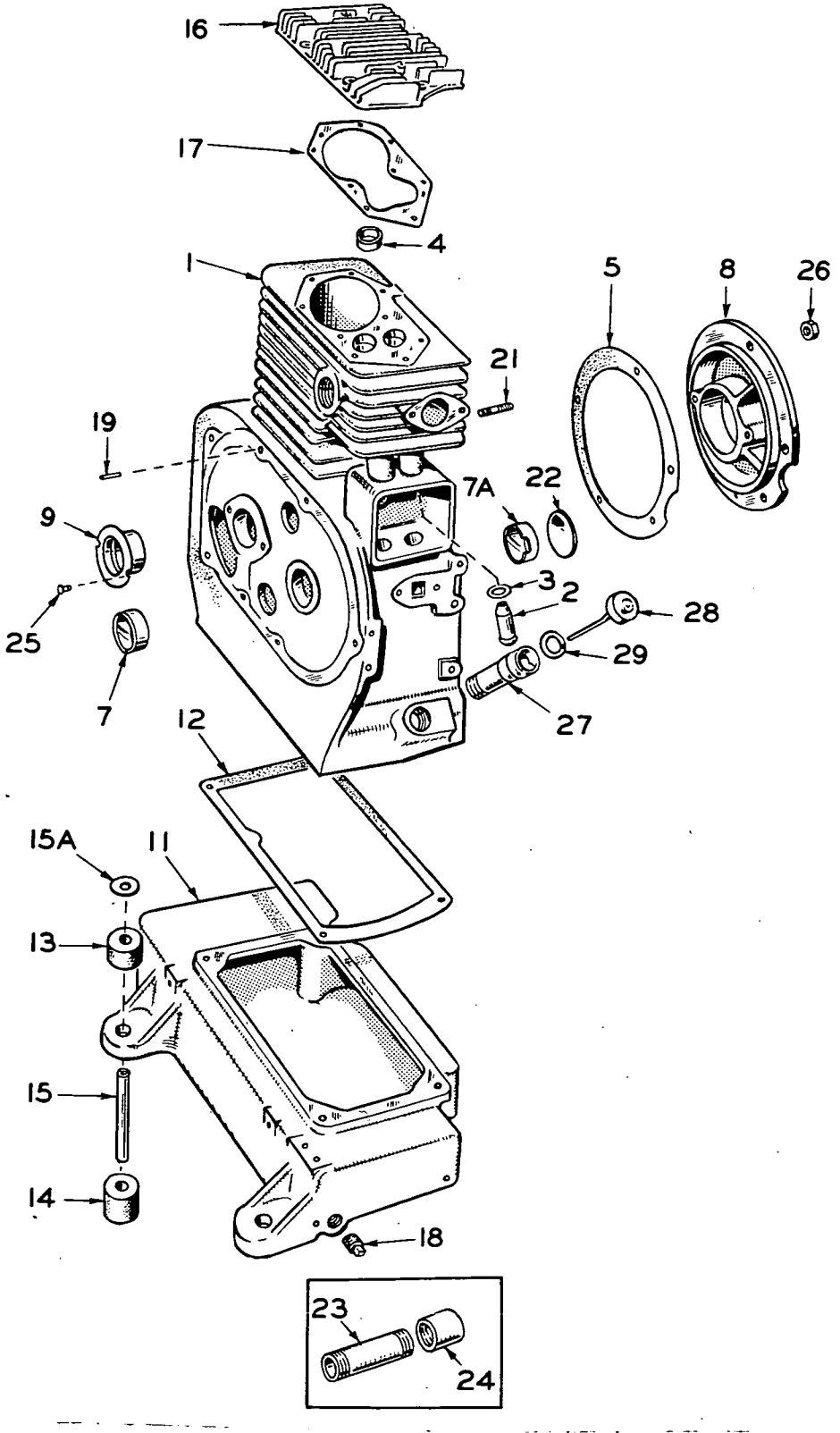


FIG. A - ENGINE CYLINDER BLOCK & OIL BASE GROUP

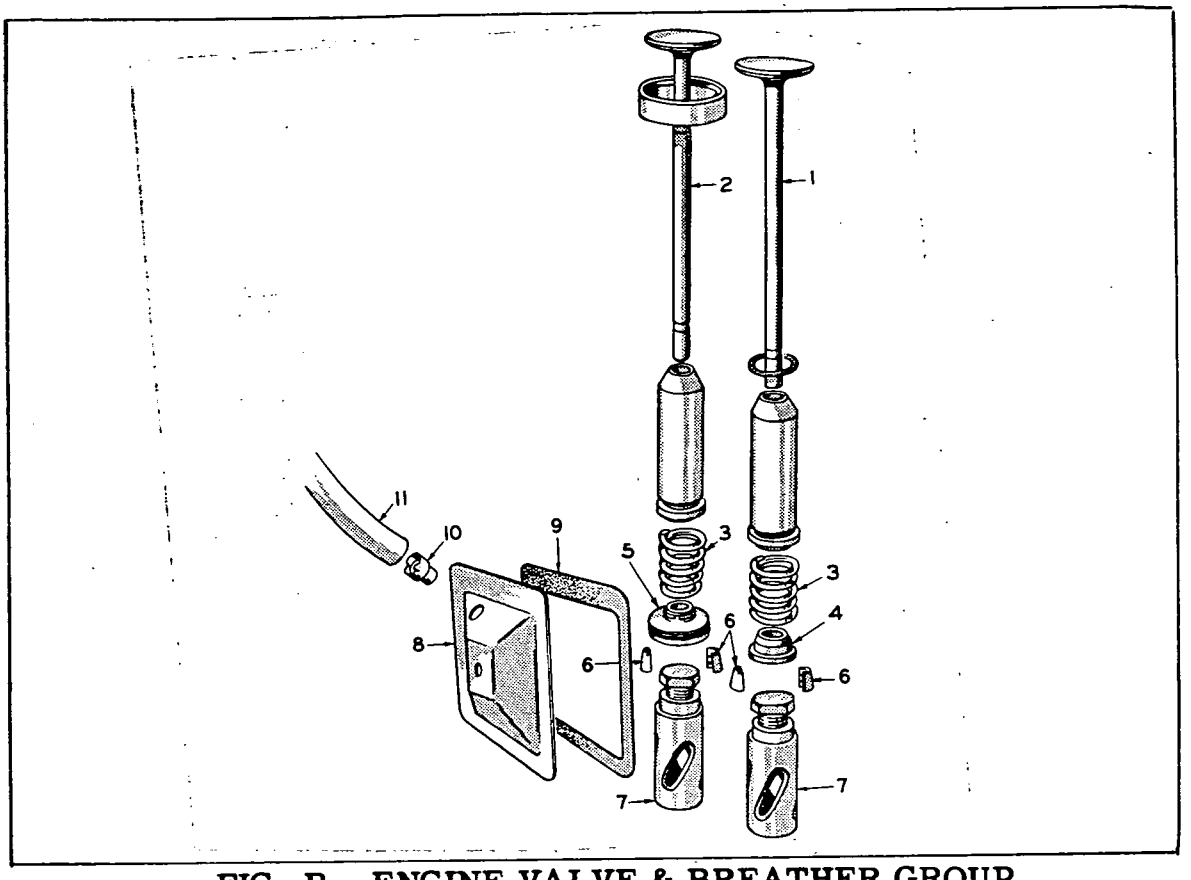


FIG. B - ENGINE VALVE & BREATHER GROUP

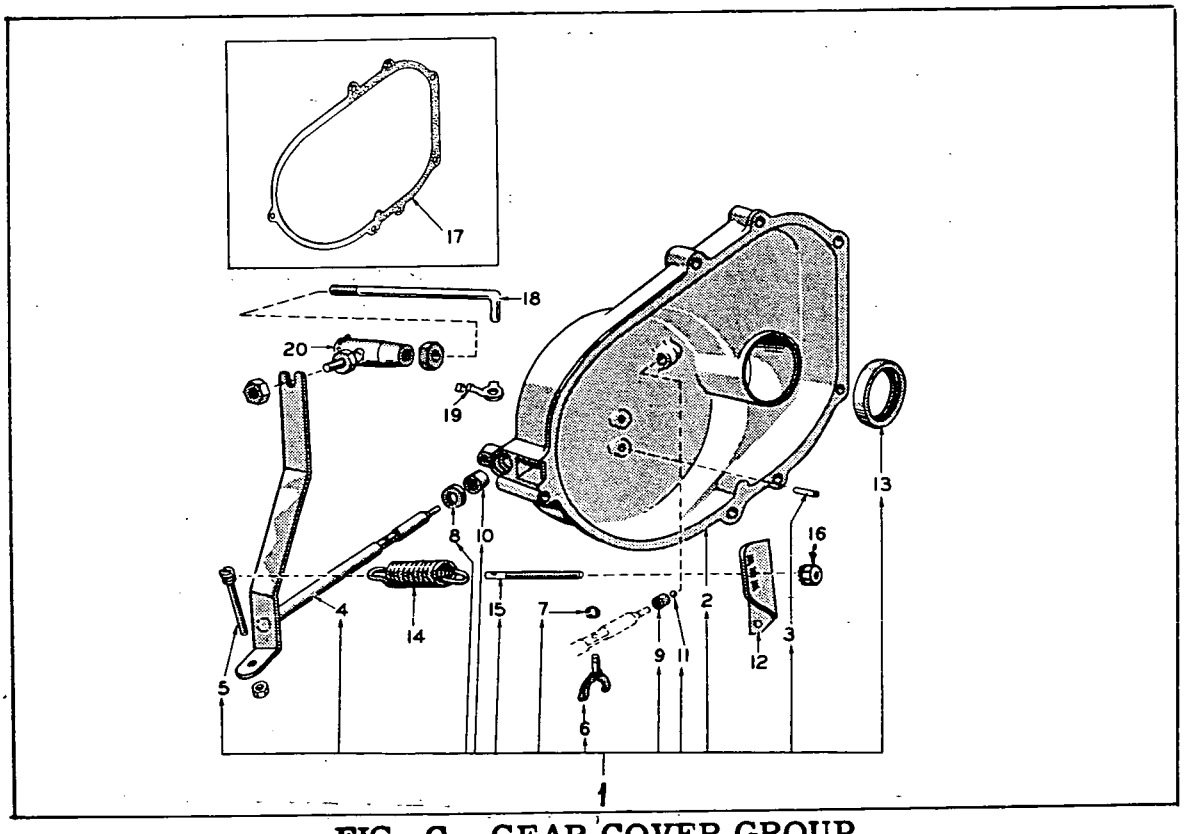


FIG. C - GEAR COVER GROUP

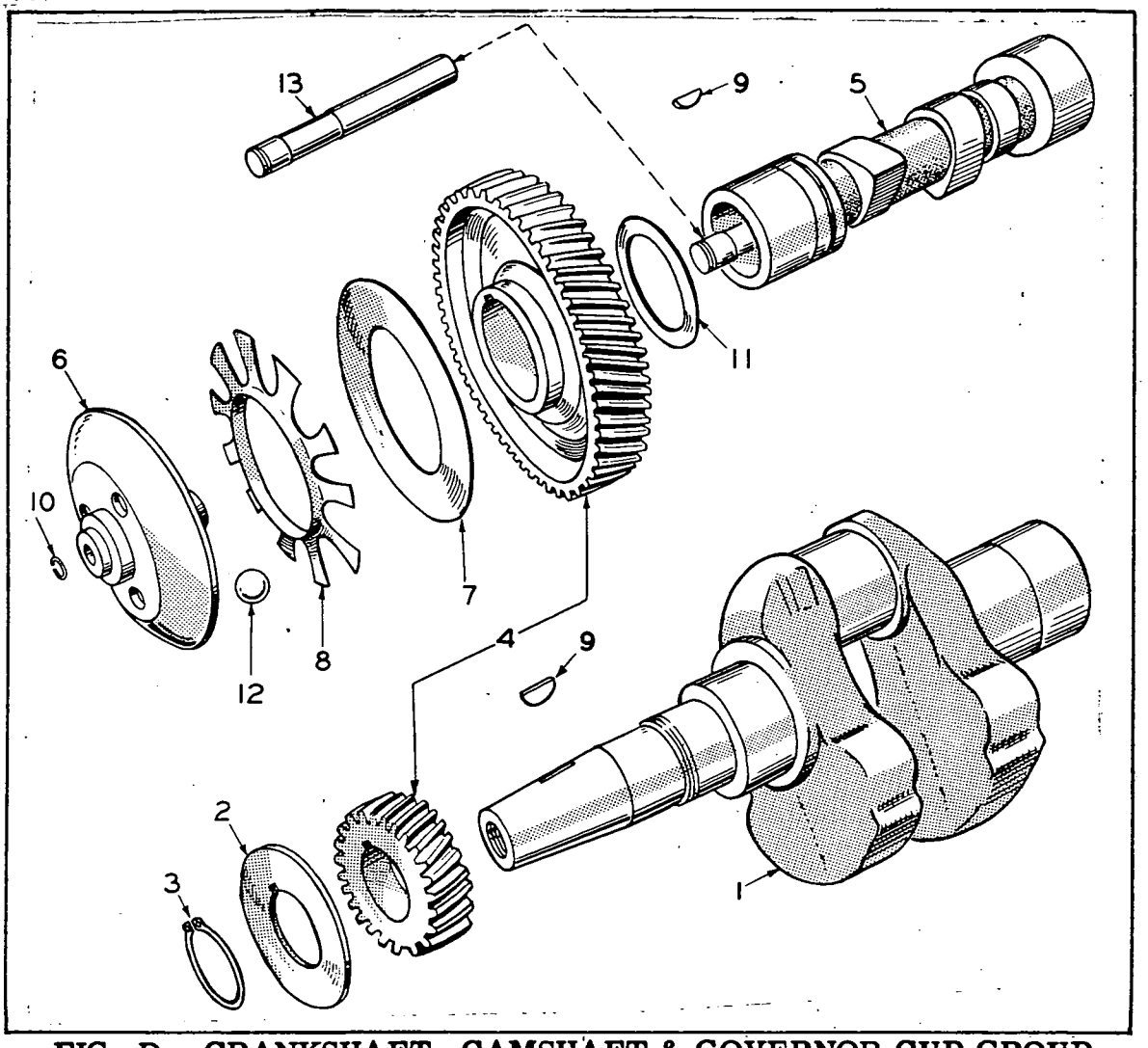


FIG. D - CRANKSHAFT, CAMSHAFT & GOVERNOR CUP GROUP

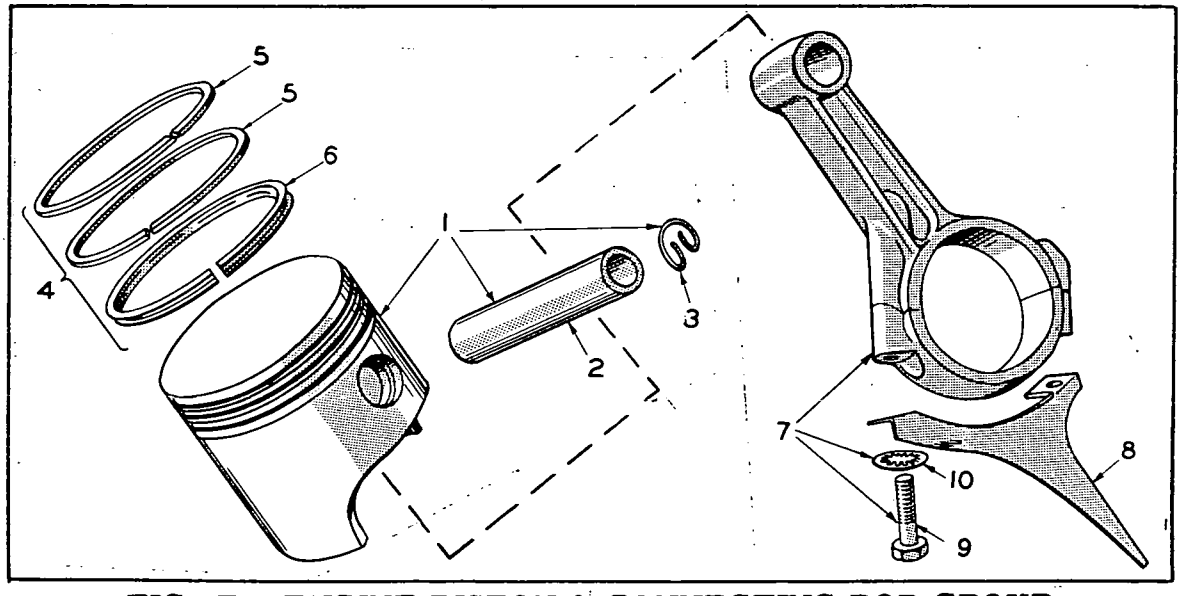


FIG. E - ENGINE PISTON & CONNECTING ROD GROUP

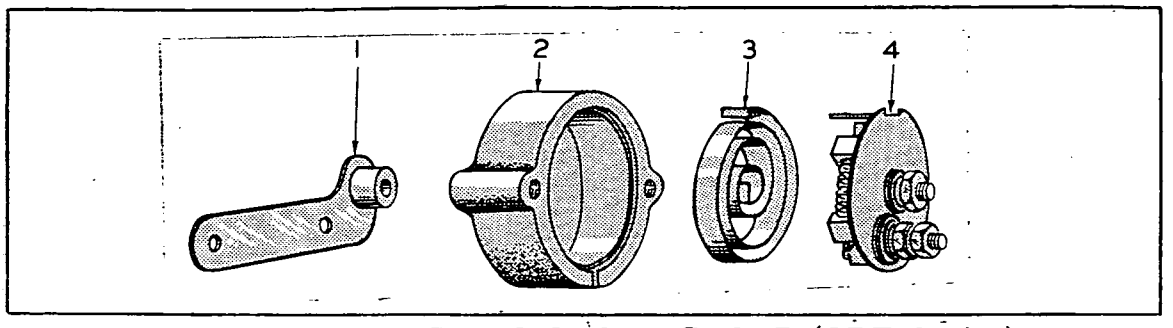


FIG. F - ELECTRIC CHOKE GROUP (OPTIONAL)

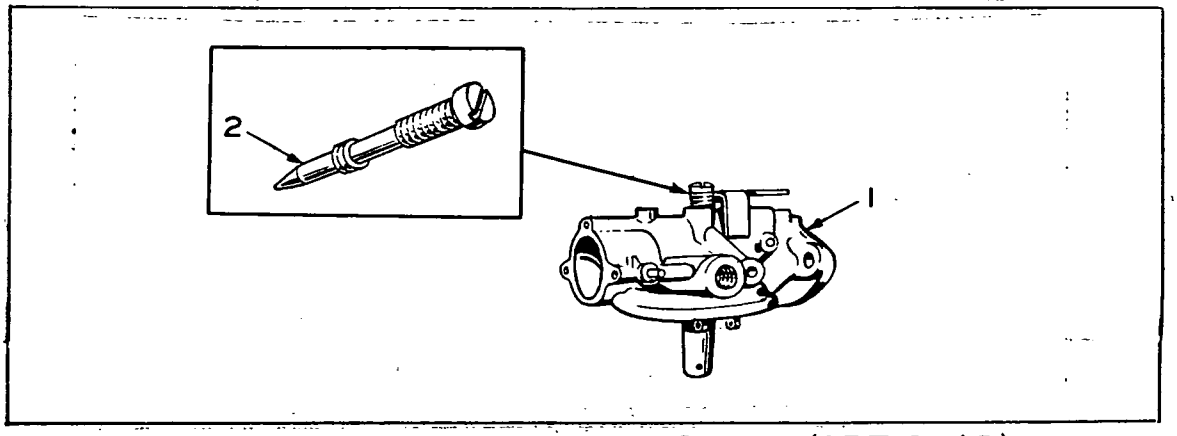


FIG. G - GAS FUEL SYSTEM GROUP (OPTIONAL)

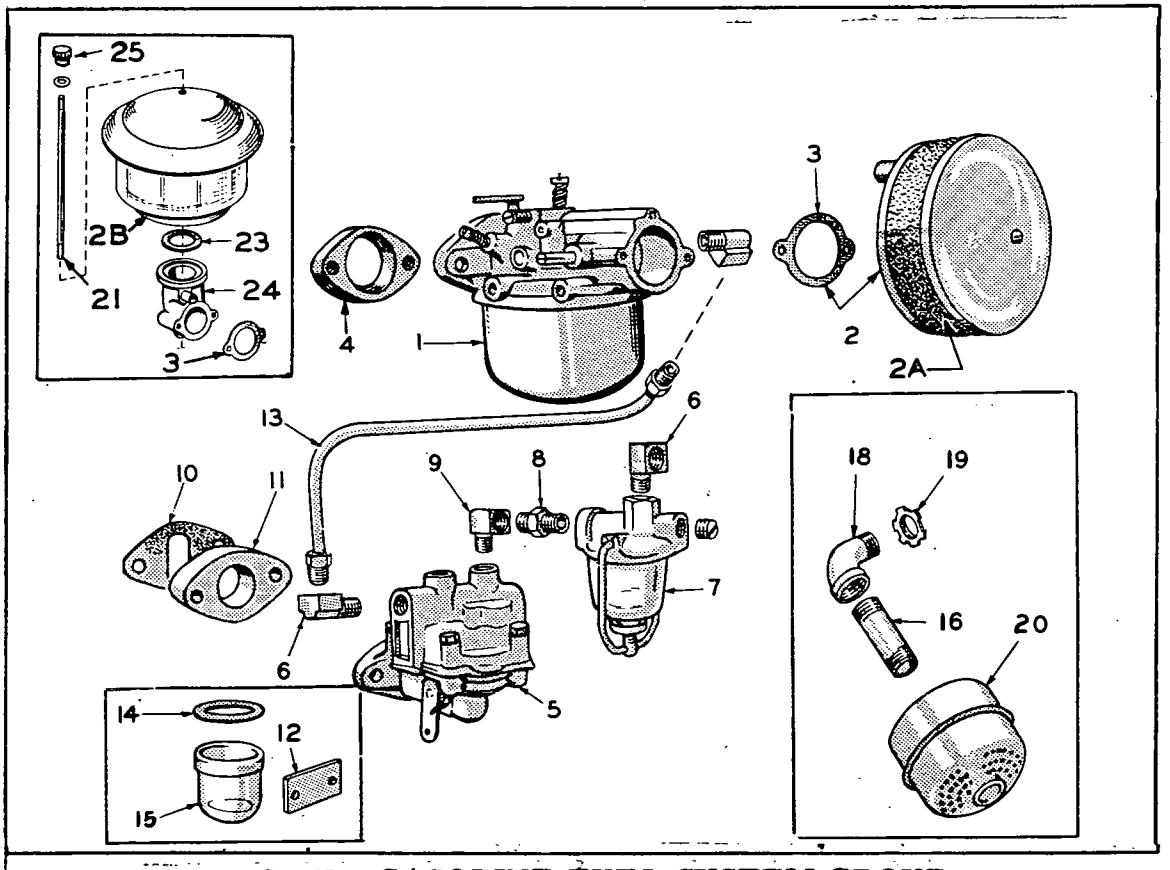


FIG. H - GASOLINE FUEL SYSTEM GROUP

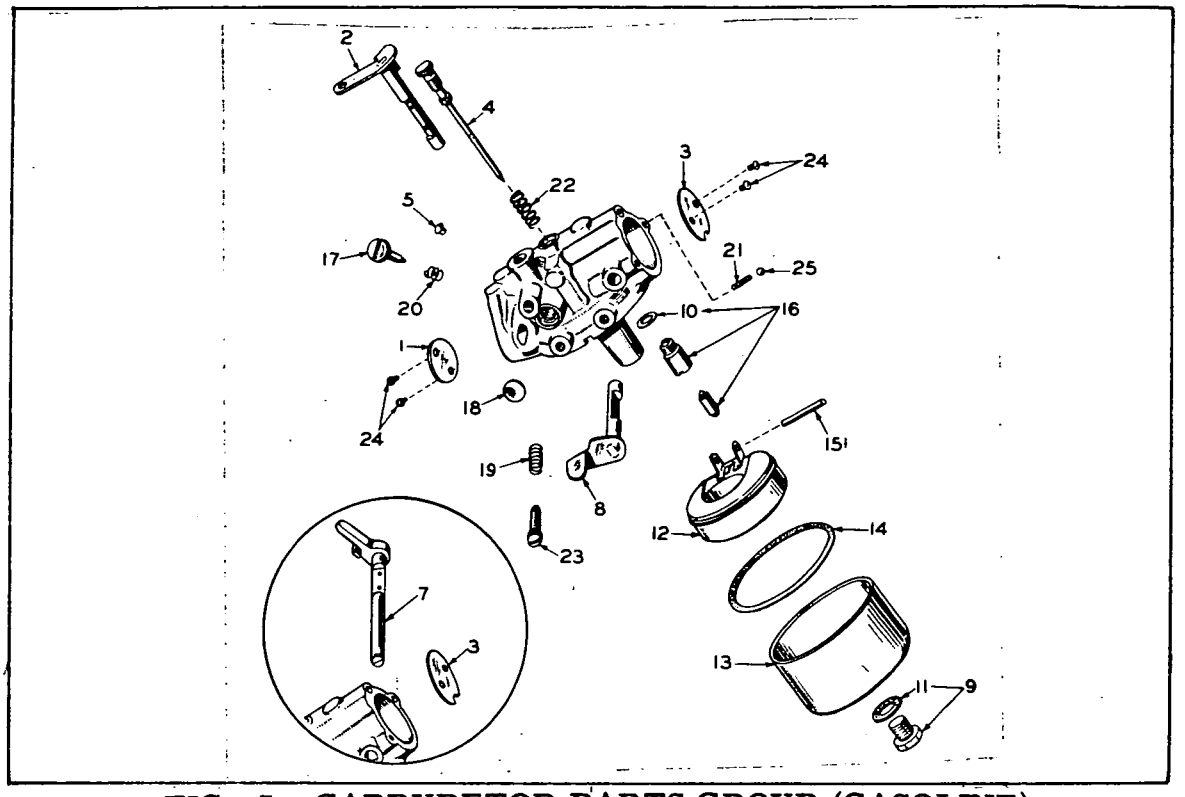


FIG. J - CARBURETOR PARTS GROUP (GASOLINE)

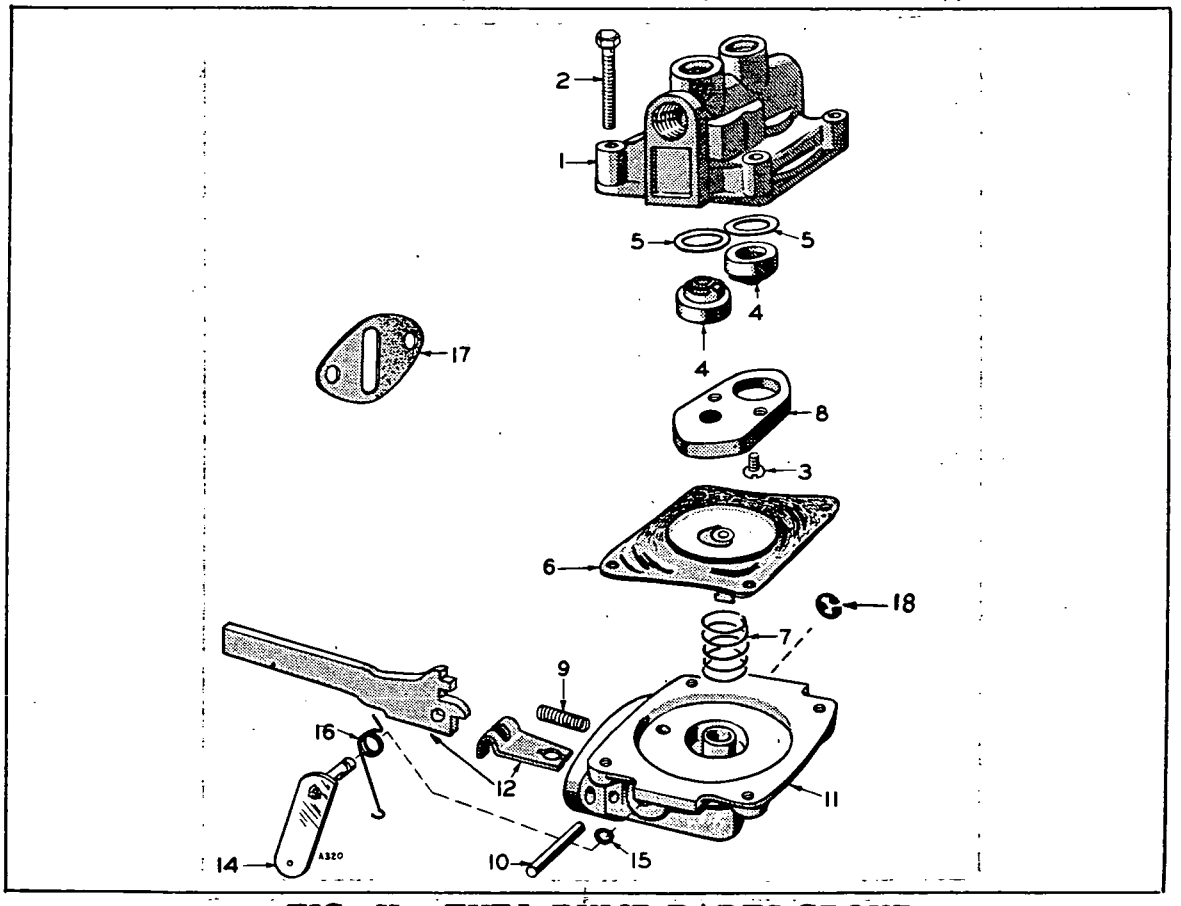
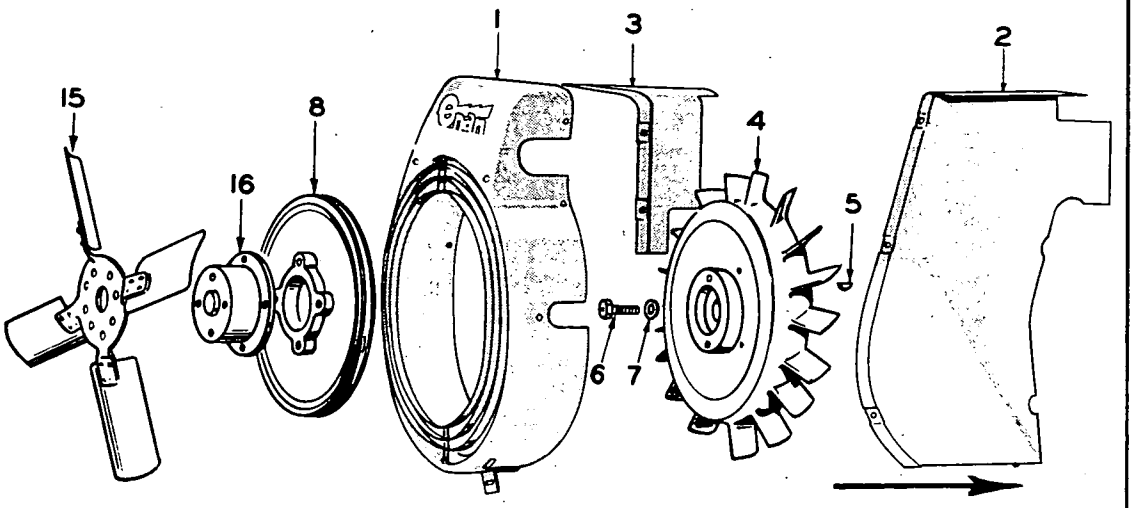
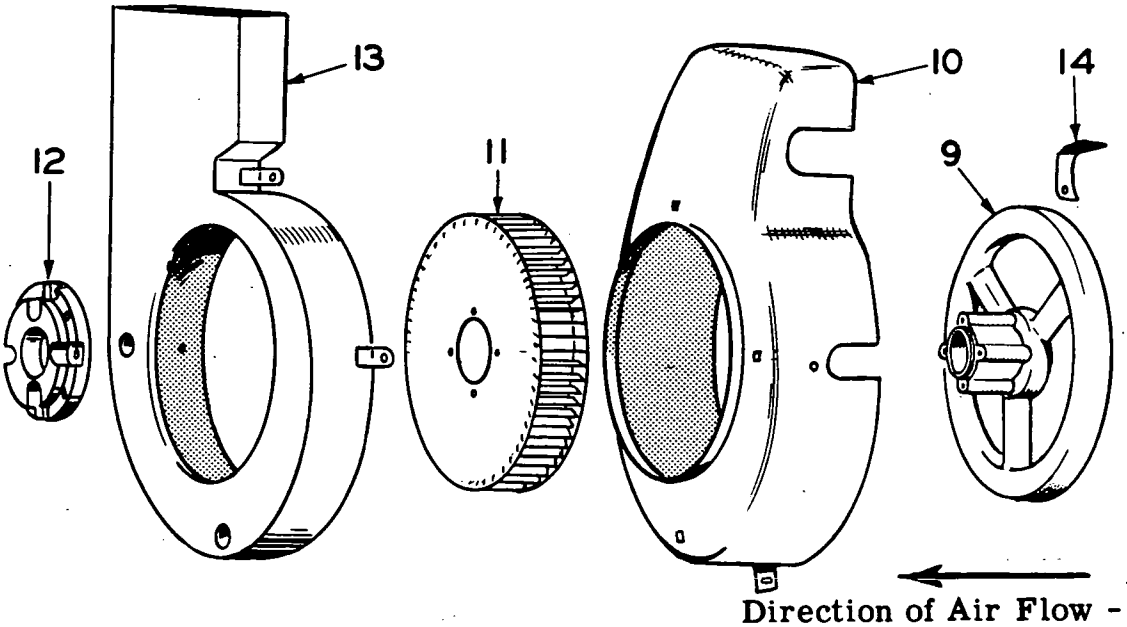


FIG. K - FUEL PUMP PARTS GROUP



Direction of Air Flow - Pressure Type Cooling.



Direction of Air Flow - Vacu-Flo Type Cooling.

FIG. L - FLYWHEEL & HOUSING GROUP

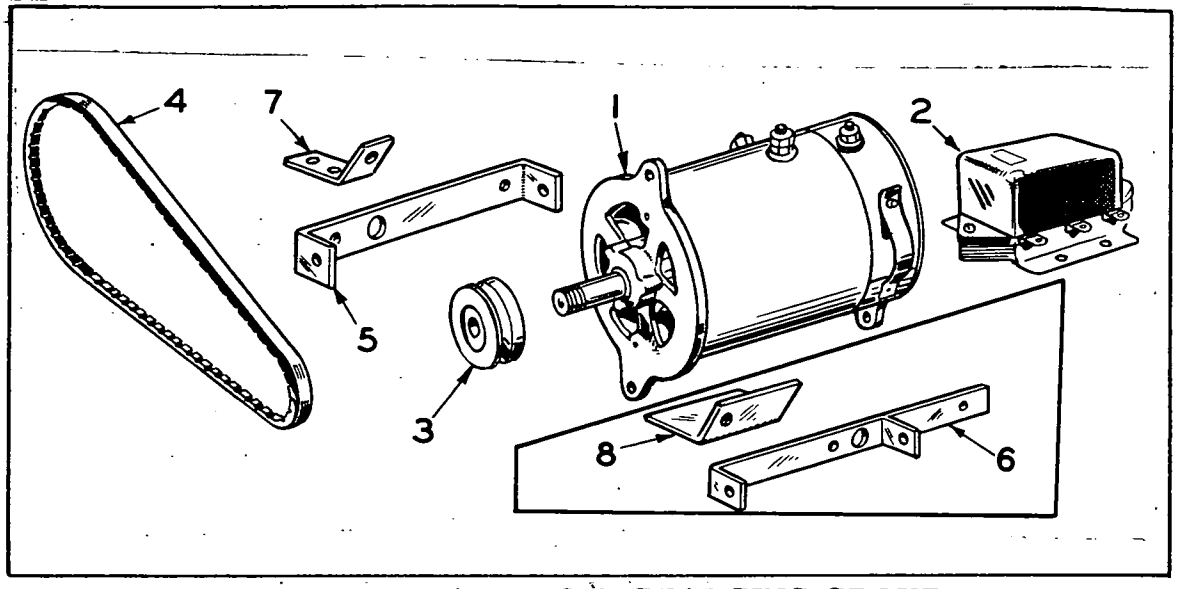


FIG. M - STARTING & CHARGING GROUP

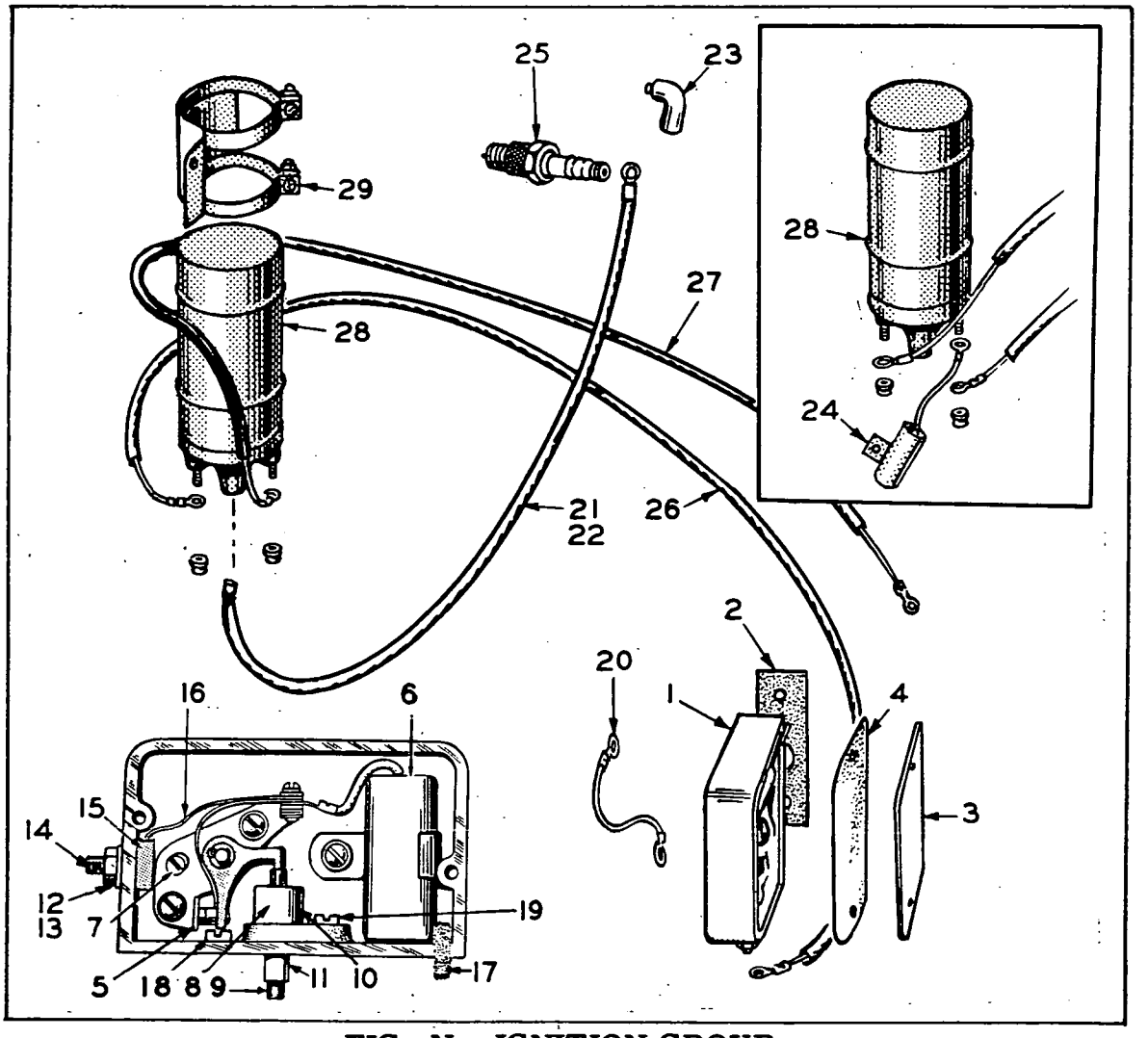


FIG. N - IGNITION GROUP

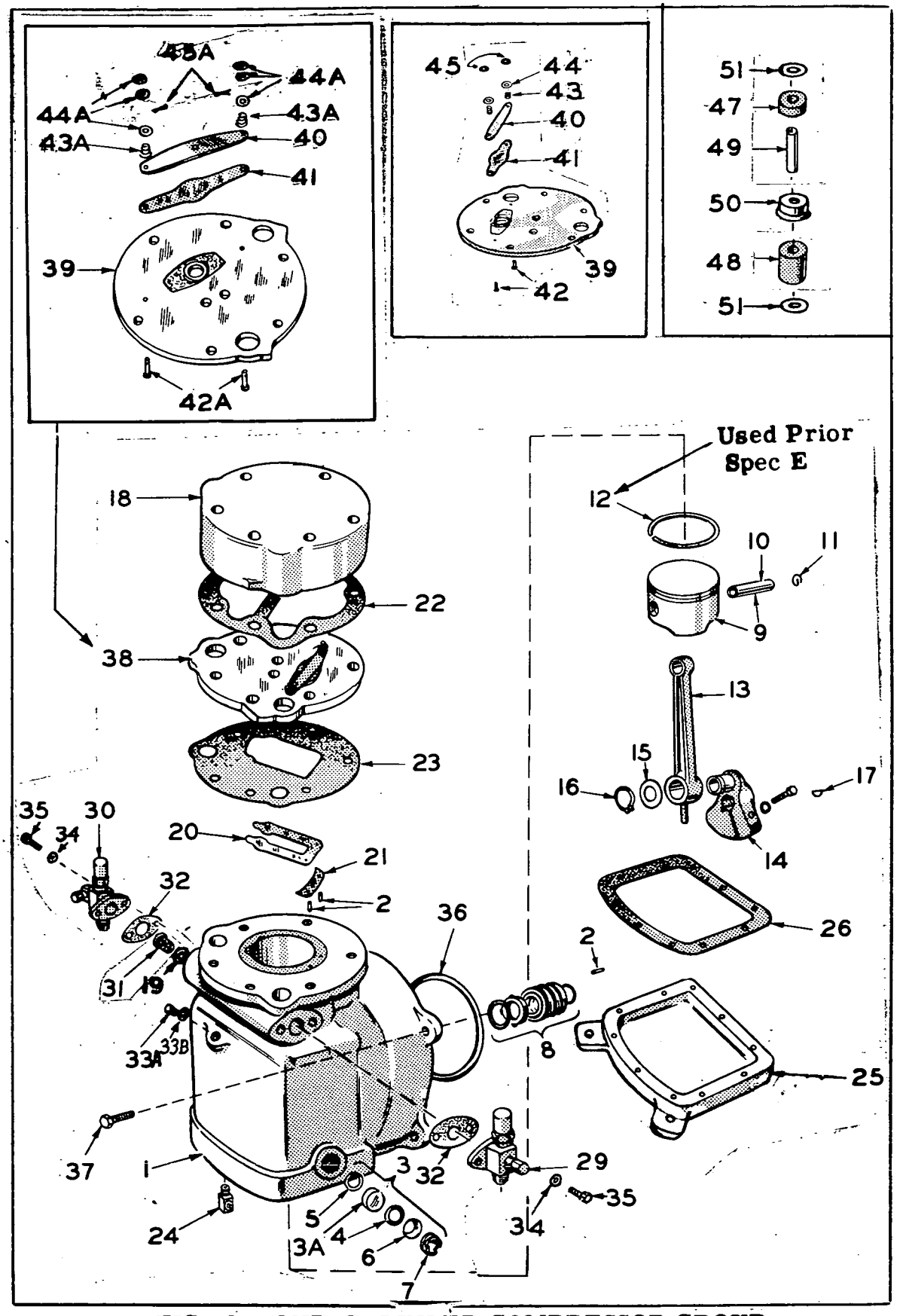


FIG. O - ONE-CYLINDER COMPRESSOR GROUP

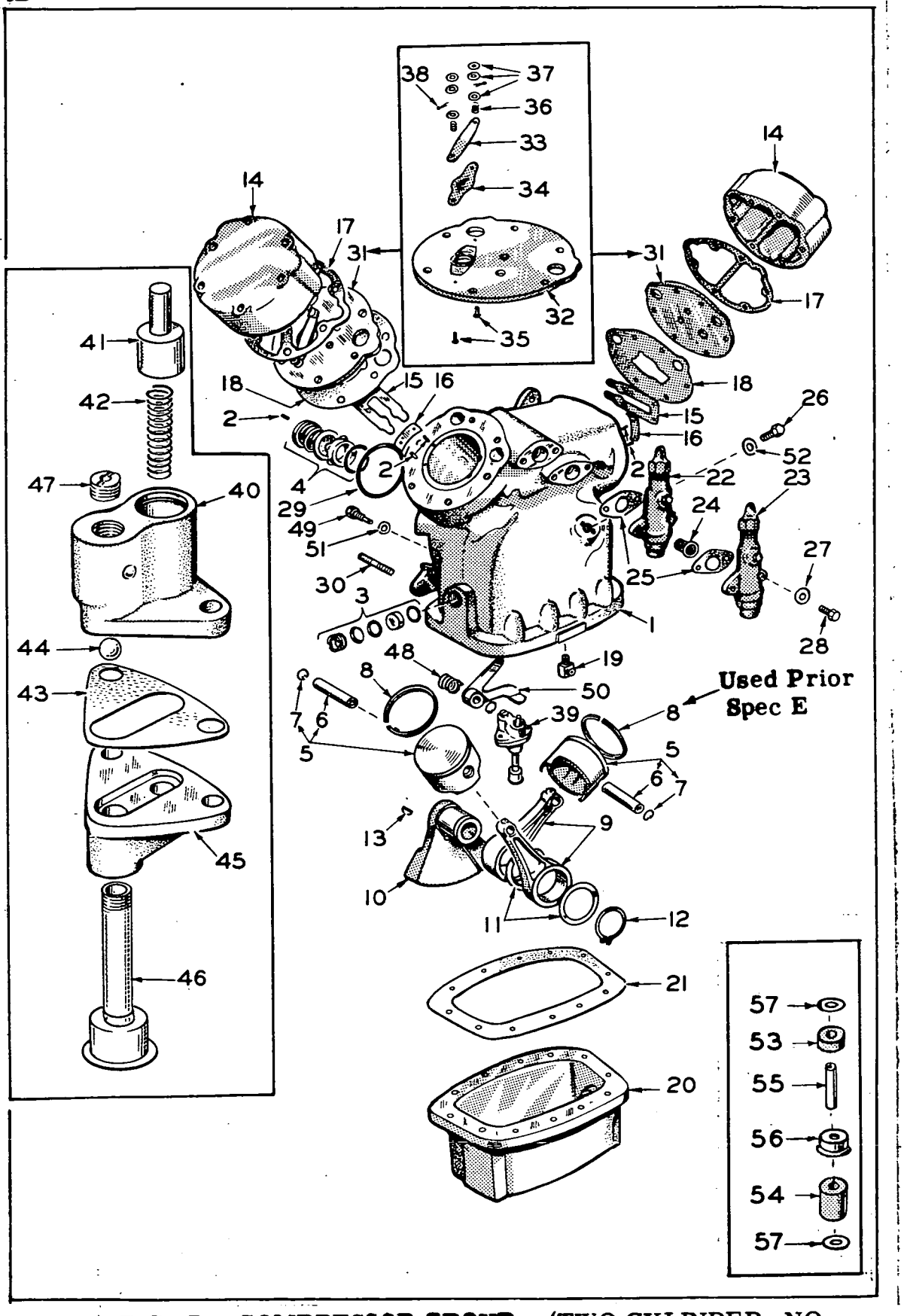


FIG. P - COMPRESSOR GROUP - (TWO CYLINDER, NO OUTBOARD BEARING, FOR UNITS PRIOR TO SPEC "E") LK-9MC

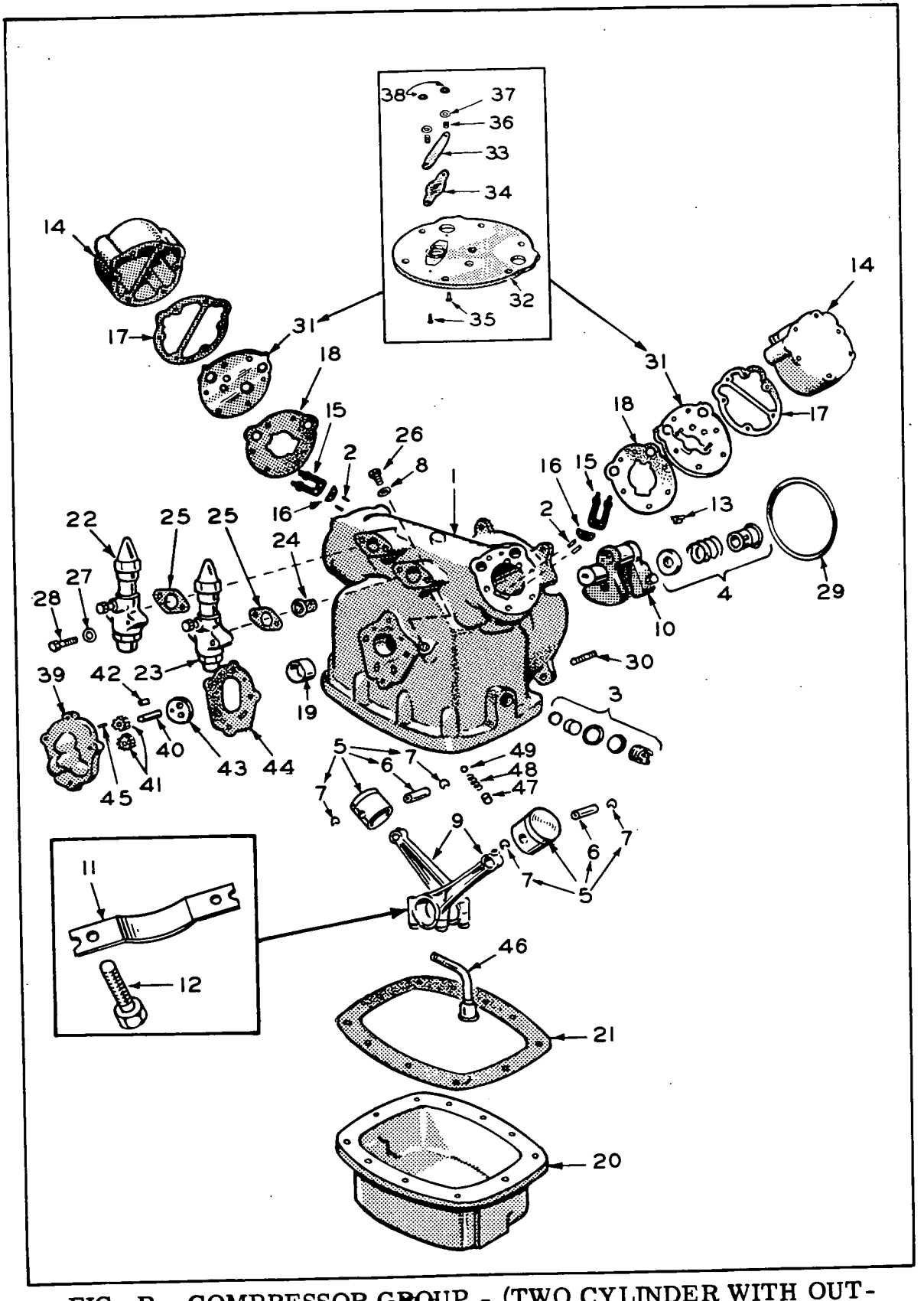


FIG. R - COMPRESSOR GROUP - (TWO CYLINDER WITH OUT-BOARD BEARING, FOR UNITS BEGIN SPEC "E")
LK-9MC

Ref. No.	Part No.	Quan. Used	Description
			FIG. A - ENGINE CYLINDER BLOCK & OIL BASE GROUP
1	110A1108	1	Block Assembly, Cylinder - 3-1/4" Bore, Cast Iron - Machined for splash lubrication - For models with one cylinder compressor - Includes parts below marked (a).
1	110A1109	1	Block Assembly, Cylinder - 3-1/4" Bore, Cast Iron - Machined for splash lubrication - For models with two cylinder "V" compressor - without outboard bearings, prior to spec "E" - Includes parts below marked (a).
1	110A1325	1	Block Assembly, Cylinder - 3-1/4 Bore, Cast Iron - Machined for splash lubrication - For models with two cylinder "V" compressor - with outboard bearings, begin spec "E" - Includes parts below marked (a).
2	110A902	2	a. Guide, Valve.
3	509-30	1	a. "O" Ring, Valve Guide - Intake.
4	110A872	1	a. Insert, Exhaust Valve Seat - Stellite.
5	101K115	1	a. Gasket Kit, Rear Bearing Plate.
7	101A49	1	a. Bearing, Front Camshaft.
7A	101A50	1	a. Bearing, Rear Camshaft.
8	101C289	1	a. Plate, Rear Bearing - Excludes Bearing and Stop Pin - For models with one cylinder compressor.
8	101D293	1	a. Plate, Rear Bearing - Excludes Bearing and Stop Pin - For models with two cylinder compressor - Prior to spec "E".
8	101D317	1	a. Plate Rear Bearing - Excludes Bearing and Stop Pin - For models with two cylinder compressor - Begin Spec E.
9	101K181	2	a. Bearing Kit, Crankshaft - Front or Rear - Precision Type - Specify Standard, or 0.002" or 0.020" Undersize.
11	102E399	1	Base, Oil.
12	102B107	1	Gasket, Oil Base.
13	402A147	2	Cushion, Rubber Mounting - Engine Upper.
14	402A146	2	Cushion, Rubber Mounting - Engine Lower.
15	402A148	2	Bushing, Cushion Spacing - Engine - 2-7/16" Long.
15A	526-76	4	Washer, Flat - Engine Mounting Cushions.
16	110D891	1	Head, Cylinder - Aluminum Alloy - For Gasoline Fuel.
17	110A892	1	Gasket, Cylinder Head - Metal Clad.
18	505-110	1	Plug, Square Head Pipe - 3/8" - Oil Drain.
19	516-64	2	a. Pin, Groove - Gear Cover Alignment.

Ref. No.	Part No.	Quan. Used	Description
			FIG. A - ENGINE CYLINDER BLOCK & OIL BASE GROUP (cont.)
21	520A114	4	a. Stud, Rear Bearing Plate - 5/16" x 1-5/16" - All except top location.
21	520A532	1	a. Stud, Rear Bearing Plate - 5/16" x 1-3/16" - Top Location.
22	517-48	1	a. Plug, Expansion - Camshaft.
23	505-76	1	Nipple, Pipe - 3/8" x 3" - Oil Drain Extension (OPTIONAL).
24	505-28	1	Coupling, Pipe - 3/8" - Oil Drain Extension (OPTIONAL).
25	516A72	2	a. Pin, Crankshaft Bearing Stop - (1) Block, (1) Bearing Plate.
26	110A445	5	a. Nut, Hex - Hardened - 5/16-24" - Mounting Bearing Plate.
27	123A517	1	Tube, Oil Fill - Includes Neck and Adapter.
28	123A559	1	Cap and Indicator, Oil Fill.
29	123A191	1	Gasket, Oil Fill Cap.
	110A879	4	Screw, Hex Head Cap - Hardened - 5/16-18" x 1-1/4" - Cylinder Head.
	114A22	5	Screw, Hex Head Cap - Hardened - 5/16"-18" x 1-3/4" - Cylinder Head.
	800-32	4	Screw, Hex Head Cap - 5/16-18 x 1-3/4" - Gear Cover.
	800-34	1	Screw, Hex Head Cap - 5/16-18 x 2-1/4" - Gear Cover.
	800-56	4	Screw, Hex Head Cap - 3/8-16 x 2-1/2" - Oil Base.
	851-5	5	Washer, Lock - 5/16" Special - Mounting Bearing Plate.
			FIG. B - ENGINE VALVE & BREATHER GROUP
1	110B881	1	Valve, Intake.
2	110B880	1	Valve, Exhaust - Stellite Faced.
3	110A539	2	Spring, Valve.
4	110A893	1	Retainer, Valve Spring - Intake.
5	110A904	1	Rotocap - Exhaust Valve.
6	110A639	4	Lock, Valve Spring Retainer.
7	115A6	2	Tappet, Valve.
8	110A919	1	Cover, Valve Compartment.
9	110A667	1	Gasket, Valve Compartment Cover.
10	123A486	1	Valve, Breather - With 5/16" Ball.
11	503A193	1	Hose, Breather - 5/16"I.D. x 3-3/8" Long.
	800-15	1	Screw, Hex Head Cap - 1/4-20 x 3" - Valve Compartment Cover.
	526-63	1	Washer, Flat - Copper - Valve Compartment Cover Screw.

Ref. No.	Part No.	Quan. Used	Description
			FIG. C - GEAR COVER GROUP
1	103C160	1	Cover Assembly, Gear - Includes parts marked (b).
2		1	b. Cover, Gear - Not Sold Separately.
3	516-117	1	b. Pin, Roll - 3/16" x 13/16" - Governor Cup Stop.
4	150B610	1	b. Arm and Shaft, Governor - Excludes Stud.
5	150A136	1	b. Stud, Governor Sensitivity Adjusting.
6	150A236	1	b. Yoke, Governor Shaft - Includes Retainer Ring #518-129.
7	518-129	1	b. Ring, Retaining - Governor Yoke.
8	509-8	1	b. Seal, Oil - Governor Shaft.
9	510-8	1	b. Bearing, Needle - Governor Shaft - Lower.
10	510-13	1	b. Bearing, Needle - Governor Shaft - Upper.
11	510-14	1	b. Ball, Governor Shaft Thrust.
12	150A611	1	Bracket, Governor Spring.
13	509-11	1	b. Seal, Oil - Crankshaft - Front.
14	150A98	1	Spring, Governor.
15	150A96	1	Stud, Governor Spring Tension Adjusting.
16	870-131	1	Nut, Governor Adjusting - Small - Replaces 150A89.
17	103B11	1	Gasket, Gear Cover.
18	150A578	1	Link, Governor Arm to Carburetor.
19	518-6	1	Clip, Governor Link to Carburetor.
20	150A639	1	Joint, Ball.
			FIG. D - CRANKSHAFT, CAMSHAFT & GOVERNOR CUP GROUP
1			Crankshaft - For Splash Lubrication - Includes Stub Shaft and Pin for Bellows.
	104B334	1	For models with one cylinder compressor.
	104B346	1	For models with two cylinder compressor - prior to spec E.
	104B390	1	For models with two cylinder compressor - Begin Spec E.
2	104A43	1	Washer, Crankshaft Gear.
3	518-14	1	Ring, Lock - Crankshaft Gear.
4	105A72	1	Gear Set, Timing - Crankshaft and Camshaft.
5	105-141	1	Camshaft and Pin Assembly - For Spec "A" models only.
5	**105-183**	1	Camshaft and Pin Assembly - For models beginning with Spec "B".
6	150B612	1	Cup, Governor.
7	150A77	1	Plate, Governor Ball.
8	150B85	1	Spacer, Governor Ball.
9	515-1	2	Key, Gear.

Ref. No.	Part No.	Quan. Used	Description
			FIG. D - CRANKSHAFT, CAMSHAFT & GOVERNOR CUP GROUP (cont.)
10	150A78	1	Ring, Lock - Governor Center Pin.
11	105A4	1	Washer, Camshaft Thrust.
12	510-15	10	Ball, Governor Fly.
13	150A75	1	Pin, Governor Center.
			FIG. E - ENGINE PISTON & CONNECTING ROD GROUP
1	112-71	1	Piston and Pin Assembly - Specify: Standard or, .010", .020", .030" Oversize.
2	112A69	1	Pin, Piston - Specify: Standard or .002" Oversize.
3	112A3	2	Ring, Piston Pin Retaining.
4	113A87	1	Ring Set, Piston - Specify: Standard or .010", .020", .030", .040" Oversize.
5		2	Ring, Piston Compression - Order Ring Set #113A87.
6		1	Ring, Piston Oil Control - Order Ring Set #113A87.
7	114C107	1	Rod, Connecting - Specify: Standard or .020" Undersize.
8	114B108	1	Dipper, Oil - Splash Lubrication.
9	110A284	2	Screw, Hex Head Cap - 5/16-18 x 1-1/2" Replaces 114A10.
10	854-17	2	Washer, I.T. Shakeproof - 5/16".
			FIG. F - ELECTRIC CHOKE GROUP (OPTIONAL)
1	153A196	1	Adapter, Electric Choke.
2	153A58	1	Bracket, Electric Choke.
3	153A17	1	Element, Choke Bimetal.
4	153A113	1	Cover Assembly, Choke - Includes 12 Volt Heating Element.
	815-190	2	Screw, Round Head Self Tapping - #8-32 x 3/8" - Choke Bracket to Carburetor.

Ref. No.	Part No.	Quan. Used	Description

FIG. G - GAS FUEL SYSTEM GROUP (OPTIONAL)

NOTE: For carburetor parts not shown here, refer to the Gasoline Fuel System Group.

1	143A91	1	Carburetor - Gas Fuel.
2	148A268	1	Valve, Needle - Main Adjustment - Included in Carburetor.
	Describe	1	Regulator, Gas Pressure.
	Describe	1	Hose, Gas Fuel.

FIG. H - GASOLINE FUEL SYSTEM GROUP

1	143B73	1	Carburetor - Carter - Manual Choke - #20 Venturi - Gasoline.
1	143B75	1	Carburetor - Carter - With Provision for Electric Choke - #20 Venturi - Gasoline.
2	140A397	1	Cleaner, Air - Dry Type, Complete.
2A	140P408	1	Element only, Air Cleaner - Dry Type.
2B	140B441	1	Cleaner, Air - Oil Bath Type **(OPTIONAL)**.
3	145A111	1	Gasket, Air Cleaner to Carburetor.
4	145A110	1	Gasket, Spacing - Carburetor Flange.
5	149D693	1	Pump, Fuel - Replaces all earlier pumps.
6	502-2	2	Elbow, Inverted Male - (1) Pump outlet, (1) Carburetor Inlet.
7	149B79	1	Filter, Fuel.
8	502-82	1	Nipple, Brass Hex - Filter to Pump Elbow.
9	502-20	2	Elbow, Street - 3400 x 2 - (1) Filter Inlet, (1) Filter Nipple to Pump.
10	149A3	2	Gasket, Fuel Pump Mounting and Pump Spacer.
11	149A45	1	Shim, Spacer - Fuel Pump Mounting.
12	149A136	1	Cover, Fuel Pump Hole - (OPTIONAL).
13	149B614	1	Line, Fuel - Fuel Pump to Carburetor.
14	149A149	1	Gasket, Fuel Filter Bowl.
15	149-150	1	Bowl, Fuel Filter.
16	505-87	1	Nipple, Pipe - 1" x 3" - Muffler to Block.
17	155B127	1	Tube, Flexible Exhaust - Includes Coupling - (OPTIONAL) (Not Illustrated).
18	505-3	1	Elbow, Pipe Street - 1" x 90° - Exhaust Tube.
19	331-53	1	Locknut, Chase - Exhaust Elbow.
20	155B484	1	Muffler, Multiple Outlet - With 1" Female Pipe Thread.

Ref. No.	Part No.	Quant.	Description
			FIG. H - GASOLINE FUEL SYSTEM GROUP (Cont.)
21	520A538	1	Stud, Air Cleaner to Adapter (Oil Bath) **(OPTIONAL)**.
23	140A443	1	Gasket, Air Cleaner (Oil Bath) **(OPTIONAL)**.
24	140B493	1	Adapter, Air Cleaner (Oil Bath) **(OPTIONAL)**.
25	140P587	1	Knob, Plastic - Oil Bath Air Cleaner Mounting - Optional.
	520A363	2	Stud, Carburetor Mounting - 1/4 x 1-9/16.
	815-190	2	Screw, Rd. Hd. Self Tapping - #8-32 x 3/8" - Electric Choke Bracket to Carburetor (OPTIONAL).
			FIG. J - CARBURETOR PARTS GROUP (Gasoline)
	143B73	1	Carburetor - With Manual Choke - #20 Venturi - Gasoline.
	143B75	1	Carburetor - With provision for Electric Choke - #20 Venturi - Gasoline (OPTIONAL).
	143K81	1	Kit, Carburetor Repair Parts - Includes parts below marked (**) and (*).
	143K80	1	**Kit, Carburetor Gasket - Includes parts below marked (*).
	145A111	1	Gasket, Air Cleaner to Carburetor (See Fuel System Group).
	145A110	1	*Gasket, Spacing - Carburetor Flange (Illustrated in Fuel System Group).
1	143-97	1	Valve, Throttle.
2	143-98	1	Shaft and Lever, Throttle.
3	143-99	1	Valve, Choke.
4	143-78	1	**Needle, Idle Jet and High Speed Adjusting.
5	143-30	1	Plug, Idle Passage.
7	143-100	1	Shaft and Weight, Choke - Electrically Choked Carburetor.
8	143-101	1	Shaft and Lever, Choke - Manually Choked Carburetor.
9	143-118	1	Screw and Gasket, Bowl.
10	143A15	1	*Gasket, Fuel Inlet Valve.
11	143-36	1	*Gasket, Bowl Screw.
12	143-105	1	Float and Lever.
13	143-119	1	Bowl.

NOTE: * - Parts contained in Carburetor Gasket Kit.
NOTE: ** - Parts contained in Carburetor Repair Parts Kit.

Ref. No.	Part No.	Quant.	Description
			FIG. J - CARBURETOR PARTS GROUP (Gasoline)(Cont.)
14	143-77	1	*Gasket, Bowl Ring.
15	143-107	1	Pin, Float Lever.
16	143-39	1	**Valve, Fuel Inlet.
17	143-109	1	Screw, Idle Adjustment.
18	143-110	1	Plug, Welch.
19	143-111	1	Spring, Throttle Lever Adjusting Screw.
20	143-112	1	Spring, Idle Adjusting Screw.
21	143-113	1	Spring, Choke Shaft - Manually Choked Carburetor.
22	143-114	1	Spring, High Speed Adjusting Needle.
23	143-115	1	Screw, Throttle Lever Adjusting.
24	812-14	4	**Screw, Round Head Mach. #3-48 x 3/16" - Choke and Throttle Valve Attaching.
25	143-117	1	Ball, Choke Shaft - Manually Choked Carburetor.

NOTE: * - Parts contained in Carburetor Gasket Kit.
NOTE: ** - Parts contained in Carburetor Repair Parts Kit.

			FIG. K - FUEL PUMP PARTS GROUP
	149D693	1	Pump, Fuel - ONAN with Primer Lever - Replaces all earlier pumps.
	149K526	1	Kit, Fuel Pump Repair - Includes Parts marked (***).
1			Body, Upper - Not Sold Separately.
2	815-148	4	Screw, Hex Head Self Tapping - #8-32 x 7/8" - Pump Assembly.
3	815-147	2	Screw, Phillips Flat Head Self Tapping - #6-32 x 5/8" - Valve Retainer.
4	149-96	2	***Valve and Cage.
5	149A95	2	***Gasket, Valve.
6	149A582	1	***Diaphragm Assembly.
7	149A672	1	***Spring, Diaphragm - Replaces 149A93.
8	149A539	1	Retainer, Valve Cage.
9	149A675	1	***Spring, Rocker Arm - Replaces 149A94.
10	516A113	1	Pin, Rocker Arm.
11			Body, Lower - Not Sold Separately.
12	149-710	1	Arm and Link, Rocker - Sold only as a set.

NOTE: *** - Parts contained in Repair Kit.

Ref. No.	Part No.	Quan. Used	Description
	FIG. K - FUEL PUMP PARTS GROUP (Cont.)		
14	149A551	1	Lever, Hand Primer.
15	509-65	2	Seal, "O" Ring.
16	149A404	1	Spring, Fuel Pump Priming Lever.
17	149A3	1	***Gasket, Fuel Pump Mounting.
18	518-129	1	Ring, Retainer - Primer Lever.

NOTE: *** - Parts contained in Repair Kit.

FIG. L - FLYWHEEL & HOUSING GROUP

NOTE: Pressure type cooling is standard. Vacu-Flo type cooling is optional. The part description qualifies the part when a choice must be made.

1	134D821	1	Housing, Blower - For Pressure-cooled models.
2	134D822	1	Housing, Cylinder Air - For Models with one cylinder compressor.
2	134D839	1	Housing, Cylinder Air - For models with two cylinder compressor.
3	134C586	1	Cover, Cylinder Head.
4	134D887	1	Flywheel, Blower - Used with Battery Ignition - For pressure-cooled models - Replaces 134B803.
6	104A170	1	Screw, Hex Head Cap.
7	526A17	1	Washer, Flat - 15/32 x 1-1/4" x 1/4" - Flywheel Mounting.
8	134D886	1	Pulley, Engine - Replaces 104C339.
9	104D266	1	Flywheel - Used with Battery Ignition and Vacu-Flo Cooling.
10	134D830	1	Housing, Flywheel - For Vacu-Flo Cooled models.
11	134B565	1	Wheel, Blower - For Vacu-Flo Cooled models.
12	104B327	1	Adapter, Pulley - For Vacu-Flo Cooled models.
13	134D564	1	Scroll, Air - Blower Wheel - For Vacu-Flo Cooled models.
14	160B500	1	Bracket, Timing - For Vacu-Flo Cooled models.
15	130C390	1	Fan, Refrigerant Condenser - (OPTIONAL) - For Pressure Cooled models only.
16	130B411	1	Hub, Fan - (OPTIONAL) - For Pressure Cooled models only.- Replaces 130B393.

Ref. No.	Part No.	Quan. Used	Description
			FIG. **L** - FLYWHEEL & HOUSING GROUP (cont.)
	870-110	as req.	Nut, Cage - 1/4-20 - Housing.
	870-107	as req.	Nut, Tinnerman Speed - 14A, "J" Type - Housing.
			FIG. **M** - STARTING & CHARGING GROUP (12-Volt)
1	191C194	1	Starter-Generator, Combination - 12 Volt - (Electric Autolite #GJH-6002-A).
2	191P195	1	Regulator, Voltage - 12 Volt - (Electric Autolite #VRS-6101-A) (OPTIONAL).
3	191B215	1	Pulley, Starter-Generator.
4	511P55	1	Belt, Starter-Generator.
5	191B212	1	Bracket, Starter-Generator Mounting - For models having Pressure Cooling.
6	191B221	1	Bracket, Starter-Generator Mounting - For models having Vacu-Flo Cooling.
7	191B213	1	Bracket, Belt Tension Adjusting - For models having Pressure Cooling.
8	191B222	1	Bracket, Belt Tension Adjusting - For models having Vacu-Flo Cooling.
9	**307P367**	1	Start Solenoid **(OPTIONAL)**.
			FIG. **N** - IGNITION GROUP
1	**160A612**	1	Box Assembly, Ignition Breaker - Complete - Includes Cover and Plunger.
2	160A43	1	Gasket, Breaker Box Mounting.
3	160A152	1	Cover, Breaker Box.
4	160A150	1	Gasket, Breaker Box Cover.
5	160A2	1	Point Set, Ignition.
6	312A19	1	Condenser - 0.5 Mfd.
7	160A75	1	Cam, Point Gap Adjusting.
8	160A262	1	Plunger Assembly, Breaker - Ignition - Includes Plunger, Guide and Diaphragm.
9	160A265	1	Plunger only, Breaker.
10	160A263	1	Diaphragm, Breaker Plunger.
11	160A264	1	Guide, Breaker Plunger.
12	508-16	1	Washer, Insulating.
13	508-17	1	Washer, Insulating.
14	332A284	1	Screw, Terminal Block.

Ref. No.	Part No.	Quan. Used	Description
			FIG. N - IGNITION GROUP (cont.)
15	332A319	1	Block, Terminal.
16	160A428	1	Strap, Point Set to Terminal Block.
17	160A261	1	Wick, Oil Drain.
18	815-111	1	Screw, Fillister Head Machine - 1/4-20 x 5/8".
19	815-112	1	Screw, Fillister Head Machine - 1/4-20 x 3/4".
20	336A596	1	Lead, Breaker Box Ground.
21	167A1309	1	Lead, Hi-Tension - Spark Plug - For model not having suppression resistor.
22	167A1319	1	Lead, Hi-Tension - Spark Plug - For special models having suppression resistor - (OPTIONAL).
23	314-32	1	Resistor, Suppression - Spark Plug Lead (OPTIONAL).
24	312A15	1	Condenser - 0.1 Mfd. - Suppression at Ignition Coil (OPTIONAL).
25	167A28	1	Plug, Spark.
26	336A1061	1	Lead, Coil to Breaker Box.
27	336A882	1	Lead, Coil to Switch.
28	166P278	1	Coil, Ignition - 12 Volt - Replaces 166B259.
29	166B260	1	Bracket, Ignition Coil Mounting - Includes Clamps.

FIG. O - COMPRESSOR GROUP - (ONE CYLINDER)
(For Model LK-5MC and LK-6MC)

1	110A1100	1	Crankcase, Compressor - For 1-3/4" stroke compressor, Model LK-5MC.
1	110A1102	1	Crankcase, Compressor - For 2" stroke compressor, Model LK-6MC.
2	127A39	3	Pin - 3/32 x 7/16" - (2) Suction Flapper Valve, (1) Crankshaft Rear Seal Drive.
3	127K65	1	Kit, Sight Glass - Compressor Oil - Includes Reference Nos. 3A thru 7).
3A	127P16	1	Glass, Oil Sight - Compressor.
4	127P17	1	Seal, "O" Ring - Oil Sight Glass.
5	127P18	1	Gasket, Oil Sight Glass.
6	127A23	1	Washer, Oil Sight Glass Thrust.
7	127A20	1	Nut, Oil Sight Glass Retainer.
8	127A35	1	Seal, Refrigerant - Compressor to Crankshaft - Consists of 127-41 Seat "O" Ring; 127-42 Carbon Seat; 127-43 Bellows "O" Ring; 127-44 Bellows.

Ref. No.	Part No.	Quan. Used	Description
			FIG. 0 - COMPRESSOR GROUP - (ONE CYLINDER) cont. (For Model LK-5MC and LK-6MC)
9	112-80	1	Piston, Compressor - Includes Pin.
10	112A29	1	Pin, Piston - Compressor.
11	112A31	2	Ring, Piston Pin Retainer.
12	113A90	1	Ring, Piston - Prior to Spec E - None used beginning Spec E.
13		1	Rod, Connecting
	114A26		For 1-3/4" Stroke (LK-5MC).
	114B131		For 2" Stroke (LK-6MC).
14	104B301	1	Throw, Crankshaft - For Compressor Rod - For 1-3/4" Stroke, Model LK-5MC.
14	104B341	1	Throw, Crankshaft - For Compressor Rod - For 2" Stroke, Model LK-6MC.
15	104A296	1	Washer, Crank Throw.
16	518-132	1	Ring, Retainer - Crank Throw.
17	515-93	1	Key, Woodruff - #505 - Crank Throw to Shaft.
18	110C981	1	Head, Compressor.
19	127P21	1	Gasket, Suction Strainer.
20	127A27	1	Valve, Suction Flapper.
21	127A28	1	Crimp, Suction Flapper Valve - Install with bow upward and concave edge toward piston.
22	110A982	1	Gasket, Compressor Head.
23	110A983	1	Gasket, Valve Plate.
24	127A84	1	Orifice, Oil Return - Replaces 502P204.
25	102C414	1	Plate, Oil Sump - Compressor, with 3/4" hole in ears for centering crip.
26	102B341	1	Gasket, Oil Sump Plate.
29		1	Valve, Discharge Service
	127B48		With 5/8" Sweat Connection - For LK-5MC.
	127B70		With 5/8" Sweat Connection - For LK-6MC.
30	127B30	1	Valve, Suction Service - with 7/8 sweat connection.
31	127A22	1	Strainer, Suction.
32	127A63	2	Gasket, Service Valve.
33A	800-88	1	Screw, Hex Head Cap - 1/2-13 x 3/4" - Oil Fill Hole.
33B	526-153	1	Washer, Flat Copper - Oil Fill Hole Screw.
34	526-65	4	Washer, Flat Copper - Service Valve Mounting.
35	806-35	4	Screw - 12 Point Head, counter bore machine - 5/16-18 x 1" - Service Valve Mounting.
36	509-70	1	Seal, "O" Ring - Compressor to Engine Rear Bearing Plate.
37	110-879	4	Screw, Hex Head Cap - Hardened - 5/16-18 x 1-1/4" - Compressor to Engine.

Ref. No.	Part No.	Quant.	Description
	FIG. O - COMPRESSOR GROUP - (ONE CYLINDER) cont. (For Model LK-5MC and LK-6MC)		
38	127B105	1	Valve and Plate Assembly, Discharge - Consists of Parts Marked (†).
39	127B29	1	†Plate, Compressor Valve.
40	127A24	1	†Stop-Plate, Discharge Valve.
41	127A26	1	†Valve, Discharge Flapper Valve.
42	127A103	2	†Pin, Discharge Flapper Valve - Use with 870-168 Retaining Ring.
42A	127A31	2	Pin, Discharge Flapper Valve - Use with 516-**516-12**6 Cotter Pin
43	127A104	2	†Spring, Stop Plate - Use with 870-168 Retaining Ring.
43A	127A25	1	Spring, Stop Plate - Use with 516-126 Cotter Pin.
44	526-170	2	†Washer, Flat 1/8 x 5/16 x 1/32 - Use with 870-168 Retaining Ring.
44A	526-1	2 to 6	Washer, Flat - Use as required to give 6 to 7 pounds pressure on each spring - **Use with** 126 Cotter Pin.
45	870-168	2	†Ring, Retaining - Use with 127A103 Pin.
45A	516-126	2	Pin, Cotter - Use with 127A31 Pin.
47	402A147	2	Cushion, Rubber Mounting - Compressor Upper.
48	402A146	2	Cushion, Rubber Mounting - Compressor Lower.
49	402A137	2	Bushing, Cushion Spacing - Compressor.
50	402A94	2	Cup, Lower Mounting Cushion Centering.
51	526-76	4	Washer, Flat - Compressor Mounting Cushions.
	800-33	1	Screw, Hex Head Cap - 5/16-18 x 2" - Locking Crank Throw.
	800-57	6	Screw, Hex Head Cap - 3/8-16 x 2-3/4" - Compressor Head.
	526A127	6	Washer, Flat - 13/32 x 25/32 x 1/8" - Compressor Head.
	110-284	10	Screw, Hex Head Cap - 5/16-18 x 1-1/2" - Oil Sump Plate - Hardened.
	850-45	15	Washer, Lock - 5/16" - (4) Compressor to Engine, (4) Service Valve Mounting, (10) Oil Sump Plate, (1) Crank Throw.

Ref. No.	Part No.	Quant.	Description
			FIG. P- COMPRESSOR GROUP - (TWO CYLINDER, NO OUTBOARD BEARING, FOR UNITS PRIOR TO SPEC "E"), LK-9MC
1	110E1090	1	Crankcase, Compressor - Specify Model - For all Strokes Beginning with Spec B Models.
1	110E1091	1	Crankcase, Compressor - Specify Model -For 1-3/8 inch stroke - Spec A Models only.
2	127A39	5	Pin - 3/32 x 7/16" (4) Suction Flapper Valve, (1) Crankshaft Rear Seal Drive.
3	127K65	1	Kit, Sight Glass - Compressor Oil - Consists of:
		1	127P16 Glass.
		1	127P17 "O" Ring Seal.
		1	127P18 Gasket.
		1	127A23 Washer.
		1	127A20 Nut.
	127A82	1	Seal, Refrigerant - Compressor to Crankshaft - Consists of:
		1	127-41 Seat "O" Ring.
		1	127A78 Carbon Seat.
		1	127-43 Bellows "O" Ring.
		1	127-44 Bellows (Order complete seal).
5	112-80	2	Piston, Compressor - Includes Pin.
6	112A29	2	Pin, Piston - Compressor.
7	112A31	4	Ring, Piston Pin Retainer.
8	113A90	2	Ring, Piston - Prior to Spec E - None used beginning with Spec E.
9	114A128	2	Rod, Connecting - Spec A and B Models only.
9	114B137	2	Rod, Connecting - Begin Spec C Models.
10	104C345	1	Throw, Crankshaft - For 1-3/8" Compressor Stroke - Specify Model.
11	526A150	2	Washer, Crank Throw.
12	518-14	1	Ring, Retainer - Crank Throw.
13	515-93	1	Key, Woodruff - #505 - Crank Throw to Shaft.
14	110C981	2	Head, Compressor.
15	127A27	2	Valve, Suction Flapper.
16	127A28	2	Crimp, Suction Flapper Valve - Install with bow upward and concave edge toward piston.
17	110A982	2	Gasket, Compressor Head.
18	110A983	2	Gasket, Valve Plate.
19	502P204	1	Valve, Check.
20	102D413	1	Base, Compressor Oil.
21	102C406	1	Gasket, Compressor Oil Base.
22	127B59	1	Valve, Discharge Service - 7/8" Sweat.
23	127B60	1	Valve, Suction Service - 1-1/8" Sweat.

Ref. No.	Part No.	Quant.	Description
	FIG. P - COMPRESSOR GROUP - (TWO CYLINDER, NO OUTBOARD BEARING, FOR UNITS PRIOR TO SPEC "E") LK-9MC (Cont.)		
24	127A61	1	Strainer, Suction.
25	127A64	2	Gasket, Service Valve.
26	800-88	1	Screw, Hex Head Cap - 1/2-13 x 3/4" - Oil Fill Hole.
27	526-65	4	Washer, Flat Copper - 5/16" - Service Valve Mounting.
28	800-33	4	Screw, Hex Head Cap - 5/16-18 x 2" - Service Valves.
29	509-70	1	Seal, "O" Ring - Compressor to Engine Rear Bearing Plate.
30	520A119	4	Stud, Compressor to Engine.
31	**127B105**	2	Valve and Plate Assembly, Discharge - **Replaces 127B32 - See Fig. R for components.**
32	127B29	2	†Plate, Compressor Valve.
33	127A24	2	†Stop-Plate, Discharge Valve.
34	127A26	2	†Valve, Discharge Flapper.
35	127A31	4	†Pin, Discharge Flapper Valve.
36	127A25	4	†Spring, Stop Plate.
37	526-1	4 to 12	†Washer, Flat - Use as required to give 6 to 7 pounds pressure on each spring.
38	516-126	4	†Pin, Cotter - 3/64 x 1/2" - Valve Assembly.
39	120A471	1	Pump Assembly, Upper - Compressor - Complete.
40	120A463	1	Body Assembly, Upper - Compressor Oil Pump - Includes Retainer Ring, Ball, Rivet and Outlet Restriction.
41	120A450	1	Piston, Oil Pump.
42	120A445	1	Spring, Pump Piston.
43	120A464	1	Gasket, Oil Pump.
44	123P382	1	Ball, Nylon - 1/4" diameter - Suction Valve.
45	120B459	1	Body, Lower - Compressor Oil Pump.
46	120A470	1	Pickup, Oil Pump - Includes Screen.
47	120A490	1	Plug, Orfice - Oil Pump Outlet Restriction.
48	120A449	1	Spring, Oil Pump Lever.
49	120A462	1	Screw, Oil Pump Lever - Pivot.
50	120A466	1	Lever, Oil Pump - Includes Bushing.
51	526-153	1	Washer, Flat Copper - 1/2" - Pump Screw.
51A	518-115	1	Ring, Retainer - Oil Pump Lever.
52	526-153	1	Washer, Flat Copper - 1/2" I.D. - Oil Fill Hole Screw.
53	402A147	2	Cushion, Rubber Mtg. - Compressor Upper.
54	402A146	2	Cushion, Rubber Mtg. - Compressor Lower.

† - Component of original discharge valve and plate assembly 127B32 only.

Ref. No.	Part No.	Quant.	Description
	FIG. P - COMPRESSOR GROUP - (TWO CYLINDER, NO OUTBOARD BEARING, FOR UNITS PRIOR TO SPEC "E") LK-9MC (Cont.)		
55	402A137	2	Bushing, Cushion Spacing - Compressor.
56	402A94	2	Cup, Lower Mounting Cushion Centering.
57	526-76	4	Washer, Flat - Compressor Mounting Cushions.
	526A127	12	Washer, Flat - 13/32 x 25/32 x 1/8" - Compressor Head.
	110A879	11	Screw, Hex Head Cap - 5/16-18 x 1-1/8" - Compressor Oil Base.
	800-56	12	Screw, Hex Head Cap - 3/8-16 x 2-1/2" - Compressor Head.
	800-53	1	Screw, Hex Head Cap - 3/8-16 x 1-3/4" - Locking Crank Throw.
	850-45	15	Washer, Lock - 5/16" - (11) Compressor Oil Base, (4) Compressor to Engine.
	850-50	1	Washer, Lock - 3/8" - Crank Throw.
	800-7	2	Screw, Hex Head Cap - 1/4-20 x 1" - Oil Pump.
	850-40	2	Washer, Lock - 1/4" - Oil Pump.
	FIG. R - COMPRESSOR GROUP - (TWO CYLINDERS WITH OUTBOARD BEARING FOR UNITS BEGIN SPEC "E") LK-9MC		
1			Crankcase, Compressor - Specify Model - Includes sight glass, oil by-pass and machined bearing.
	110C1167	1	With Sight Glass on Left Side.
	110C1170	1	With Sight Glass on Both Sides.
2	127A39	4	Pin - 3/32 x 7/16" (4) Suction Flapper Valve.
3	127K65	1 or 2	Kit, Sight Glass - Compressor Oil - Consists of:
		1	127P16 Glass.
		1	127P17 "O" Ring Seal.
		1	127P18 Gasket.
		1	127A23 Washer.
		1	127A20 Nut.
4	127B102	1	Seal, Refrigerant - Compressor to Crankshaft - Consists of:
		1	Seal "O" Ring (Stationary).
		1	Cast Iron Seat (Stationary).
		1	Seal, Carbon (Rotating).
5	112-80	2	Piston, Compressor - Includes Pin.
6	112A29	2	Pin, Piston - Compressor.
7	112A31	4	Ring, Piston Pin Retainer.
8	526-153	1	Washer, Flat Copper - 1/2" I.D. - Oil Fill Hole Screw.

FIG. R - COMPRESSOR GROUP - (TWO CYLINDER WITH OUTBOARD BEARING, FOR UNITS BEGIN SPEC "E") (Cont.)
LK-9MC

Ref. No.	Part No.	Quant.	Description
9	114C157	2	Rod, Connecting - For 1-3/8" Stroke.
10	104A382	1	Throw, Crankshaft - Includes Plug and Bolt - For 1-3/8" Stroke.
11	114A151	2	Lock, Connecting Rod.
12	114A150	4	Screw, Hex Head Cap - Hardened - 1/4 - 20 x 1-1/2" - Connecting Rod.
13	127A101	1	Key - Crank Throw to Shaft - "T" Shape.
14	110C981	2	Head, Compressor.
15	127A27	2	Valve, Suction Flapper.
16	127A28	2	Crimp, Suction Flapper Valve - Install with bow up and concave edge toward piston.
17	110A982	2	Gasket, Compressor Head.
18	110A983	2	Gasket, Valve Plate.
19	127A100	1	Bearing, Compressor Rear - Not finished.
20	102D413	1	Base, Compressor Oil.
21	102C406	1	Gasket, Compressor Oil Base.
22	127B59	1	Valve, Discharge Service - 7/8" Sweat.
23	127B60	1	Valve, Suction Service 1-1/8" Sweat.
24	127A61	1	Strainer, Suction.
25	127A64	2	Gasket, Service Valve.
26	800-88	1	Screw, HH Cap - 1/2 - 13 x 3/4 - Oil Fill Hole.
27	850-45	4	Washer, Lock - 5/16" - Service Valve.
28	800-33	4	Screw, HH Cap - 5/16 - 18 x 2" - Service Valve.
29	509P81	1	Seal, "O" Ring - Compressor to Engine Bearing Plate.
30	520A119	4	Stud, Compressor to Engine.
31	127B105	2	Valve and Plate Assembly, Discharge - Consists of parts marked (†).
32	127B29	2	† Plate, Compressor Valve.
33	127A24	2	† Stop-Plate, Discharge Valve.
34	127A26	2	† Valve, Discharge Flapper.
35	127A103	4	† Pin, Discharge Flapper Valve.
36	127A104	4	† Spring, Stop Plate.
37	526-170	4	† Washer, Flat.
38	870-168	4	† Ring, Retainer - Valve Assembly.
39	120A525	1	Cover, Compressor Oil Pump - Includes Idler Shaft.
40	120A510	1	Shaft, Oil Pump Drive.
41	120A512	2	Gear, Oil Pump - Compressor.
42	515A151	1	Key, Oil Pump Gear to Shaft.
43	120A513	1	Plate, Compressor Oil Pump.

Ref. No.	Part No.	Quant.	Description
			FIG. R - COMPRESSOR GROUP - (TWO CYLINDERS WITH OUT-BOARD BEARING FOR UNITS BEGIN SPEC "E")(Cont.) LK-9MC
44	120A516	1	Gasket, Oil Pump Cover.
45	516-135	2	Pin, Roll - 1/8 x 3/8" - Oil Pump Cover
46	120A515	1	Intake, Oil Pump - Includes Cup, Screen, and Pipe.
47	127A106	1	Retainer, Oil By-Pass Spring.
48	120A517	1	Spring, Oil Pump By-Pass.
49	510-45	1	Ball, Steel - Oil Pump By-Pass.
	800-29	4	Screw, H H Cap - 5/16 - 18 x 1-1/8" - Oil Pump Cover.
	110A879	11	Screw, HH Cap - 5/16 - 18 x 1-1/4" Compressor Oil Base.
	800-56	12	Screw, HH Cap - 3/8 - 16 x 2-1/2" - Compressor Head.
	805-17	1	Bolt, Place - 3/8 - 16 x 1-3/4" - Locking **Crank Throw**
	850-45	19	Washer, Lock - 5/16" - (11) Compressor Oil Base, (4) Compressor to Engine (4) Oil Pump Cover.
	526A127	12	Washer, Flat - 13/32 x 25/32 x 1/8 - Compressor Head.
			MISCELLANEOUS
	168K70	1	Gasket Kit, Engine Compressor - For Models with one Cylinder Compressor.
	168K71	1	Gasket Kit, Engine Compressor - For Models with two Cylinder Compressor.
			STA-BIL (Gasoline Additive) prevents gum formation.
	524-73	1	4 ounce can.
	524-74	1	16 ounce can.
	524-75	1	32 ounce can.
			Paint, Touch-up (pressurized can) Enamel.
	525P90	1	Mouse Grey - 12 ounce Can.
	525P137	1	Green - 16 ounce can.

Storage procedure during an off period depends on various factors and the owner's choice.

The off season is a good time to perform maintenance and repair on the unit to prepare it for the following season and the operating hours completed will affect the decision.

In an outdoor installation if the machine is to remain installed, as probable during a short off season, a canvas cover should be used to protect it from the elements. It should be cycled occasionally by operating once or twice a month for at least 1/2 hour in ambient conditions above 60°F.

If the machine is to be dismounted, disconnect the battery cable at the current source to prevent shorts. Cap the fuel source to keep it clean. If there is any indication that the machine might require major repair or servicing during the storage period, before dismounting it, employ the services of a qualified refrigeration serviceman to check the operation and perform tests which will help diagnose and isolate troubles or otherwise guide the service procedure. If the refrigerant in the system is to be pumped down be sure the system does not contain an overcharge which would create a hazard if the receiver (where used) were filled more than 85 per cent full of liquid.

Spray preservative oil into the combustion chamber through the spark plug hole.

Do not store the machine next to a heating device which could cause high internal pressures on a system containing refrigerant.

To remount and put the machine back into service, follow the procedure for the initial installation as it applies.

PERFORM ALL THE SERVICES RECOMMENDED ACCORDING TO THE NUMBER OF HOURS OF OPERATION COMPLETED, THEN WRITE THE DATE IN THE SPACE PROVIDED. PERFORM DAILY SERVICES EACH 8 HOURS OF OPERATION BUT OMIT ENTERING THE DATE ON THE SERVICE LOG. REPEAT THE SHORTER INTERVAL SERVICES AT MULTIPLE INTERVALS (50 HR. Services at 100, 150, 200 Hrs. etc.). A WELL KEPT RECORD WILL ASSURE SERVICING AT THE PROPER TIME. SERVICE DETAILS APPEAR IN THE INSTRUCTION MANUAL.

GROUP I, SERVICES: Check engine oil level; Check engine fuel; Check condenser grille for air restrictions; Check oil bath air cleaner oil level.

GROUP II, SERVICES: Service engine air cleaner (dry type); Clean and gap spark plug; Check breaker point gap; Lubricate governor link; Inspect battery & belt.

GROUP III, SERVICES: Change engine oil; Lubricate starter-generator; Service engine breather valve; Check compressor sight glass; Check refrigerant sight glass (where used); General inspection and general cleaning.

GROUP IV, SERVICES: Remove carbon from combustion chamber; Inspect starter-generator brushes.

GROUP V, SERVICES: Set valve tappet clearance.

GROUP VI, SERVICES: Clean carburetor; Grind engine valves.

PERFORM GROUP I SERVICES DAILY (EACH 8 HOURS OF OPERATION).

PERFORM GROUP II SERVICES EACH 50 HOURS OF OPERATION.

PERFORM GROUP III SERVICES EACH 100 HOURS.

PERFORM GROUP IV SERVICES EACH 200 HOURS.

PERFORM GROUP V SERVICES EACH 500 HOURS.

PERFORM GROUP VI SERVICES EACH 1000 HRS.

					1ST 1000 HRS.	2ND. 1000 HRS	3RD. 1000 HRS	4TH 1000 HRS.	5TH 1000 HRS.
50									
	100								
150									
		200							
250									
	300								
350									
		400							
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