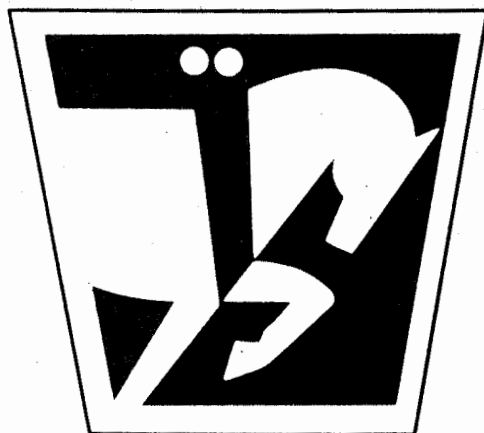




WISCONSIN ENGINES

INSTRUCTION BOOK AND PARTS LIST

Model VH4D

BASIC ISSUE MM-274

IMPORTANT

READ THESE INSTRUCTIONS CAREFULLY

All points of operation and maintenance have been covered as carefully as possible but if further information is required, inquiries sent to the factory will receive prompt attention.

When writing the factory ALWAYS GIVE THE MODEL, SPECIFICATION AND SERIAL NUMBER of engine referred to.

STARTING AND OPERATING OF NEW ENGINES

Careful breaking in of a new engine will greatly increase its life and result in trouble-free operation. A factory test is not sufficient to establish the polished bearing surfaces, which are so necessary to the proper performance and long life of an engine. Neither is there a quick way to force the establishment of good bearing surfaces. These can only be obtained by running a new engine carefully and under reduced speeds and loads for a short time, as follows:

First, be sure the engine is filled to the proper level with a good quality of engine oil, see "Grade of Oil" chart.

Before a new engine is put to its regular work, the engine should be operated at low idle speed (1000 to 1200 R.P.M.) for one half hour, without load. The R.P.M. should then be increased to engine operating speed, still without load, for an additional two hours.

If at all possible, operate the engine at light loads, for a period totaling about eight hours, before maximum load is applied. This will greatly increase engine life.

The various bearing surfaces in a new engine have not been glazed, as they will be with continued operation, and it is in this period of "running in," that special care must be exercised, otherwise the highly desired glaze will never be obtained. A new bearing surface that has once been damaged by carelessness will be ruined forever.

Our engine warranty is printed on the inside back cover of this manual. Read it carefully.

For Your Own Record

THIS MANUAL IS FOR MY WISCONSIN MODEL ENGINE

SPEC. No. SERIAL No.

THE ABOVE INFORMATION, WHICH WILL BE FOUND ON THE INSTRUCTION PLATE ATTACHED TO THE AIR SHROUD OF THE ENGINE, SHOULD BE FILLED IN. YOUR PROMPT ATTENTION TO THIS MATTER WILL MAKE IT CONVENIENT FOR YOU IN THE FUTURE, AS THIS INFORMATION MUST BE GIVEN WHEN ORDERING ENGINE REPAIR PARTS.

BOOK OF INSTRUCTIONS

WISCONSIN *Air-Cooled*

Four Cylinder Engine



READ THE *STARTING AND OPERATING INSTRUCTIONS* THOROUGHLY BEFORE STARTING A NEW ENGINE. BECOME ACQUAINTED WITH THE ENGINE COMPONENTS; THEIR LOCATION, MAINTENANCE AND ADJUSTMENT REQUIREMENTS.

LOCATED IN REAR SECTION OF MANUAL

3RD BEARING ENGINE ILLUSTRATION and PARTS LIST, Form MP-1497

FLYWHEEL ALTERNATOR, INSTRUCTIONS and PARTS LIST, Form MY-110-2

CARBURETOR, FUEL PUMP and MAGNETO INSTRUCTIONS and PARTS LIST

Models VH4 • VH4D

3-1/4" Bore – 3-1/4" Stroke
107.7 cu. in. Displacement

ISSUE MM-274-E

NOTE: The VH4 engine with STELLITE exhaust valves and seat inserts has the letter

~~U~~ *substituted to the model designation and is referred to as the Model VH4D.*

INTRODUCTION

This manual has been compiled to suit the service requirements of the basic engine and accessories most commonly supplied with the engine.

Teledyne Wisconsin adapts its engines to suit individual customer requirements whenever practical. However, it would become too involved to include all variations in one manual; therefore, should any problems arise concerning engine servicing, we advise that a Teledyne Wisconsin Distributor or authorized Service Center be contacted, as they are capable of identifying all parts by the specification number stamped on the name plate of engine.

A listing of approved Service Centers appears in the rear section of this manual.

WISCONSIN heavy duty air cooled engines are of the most advanced design and are built in a modern factory, equipped with the latest machinery available.

Only the best materials, most suitable for the particular part, are used. During production, every part is subjected to the most rigid inspection, as are also the completely assembled engines. After assembly, every engine is operated on its own power and all adjustments are carefully made so that each engine will be in perfect operating condition when it leaves the factory.

Teledyne Wisconsin Motor is backed by over sixty years of engineering experience in the design of internal-combustion engines for every conceivable type of service. The performance of these engines is proof of the long satisfactory service you too can expect from your engine.

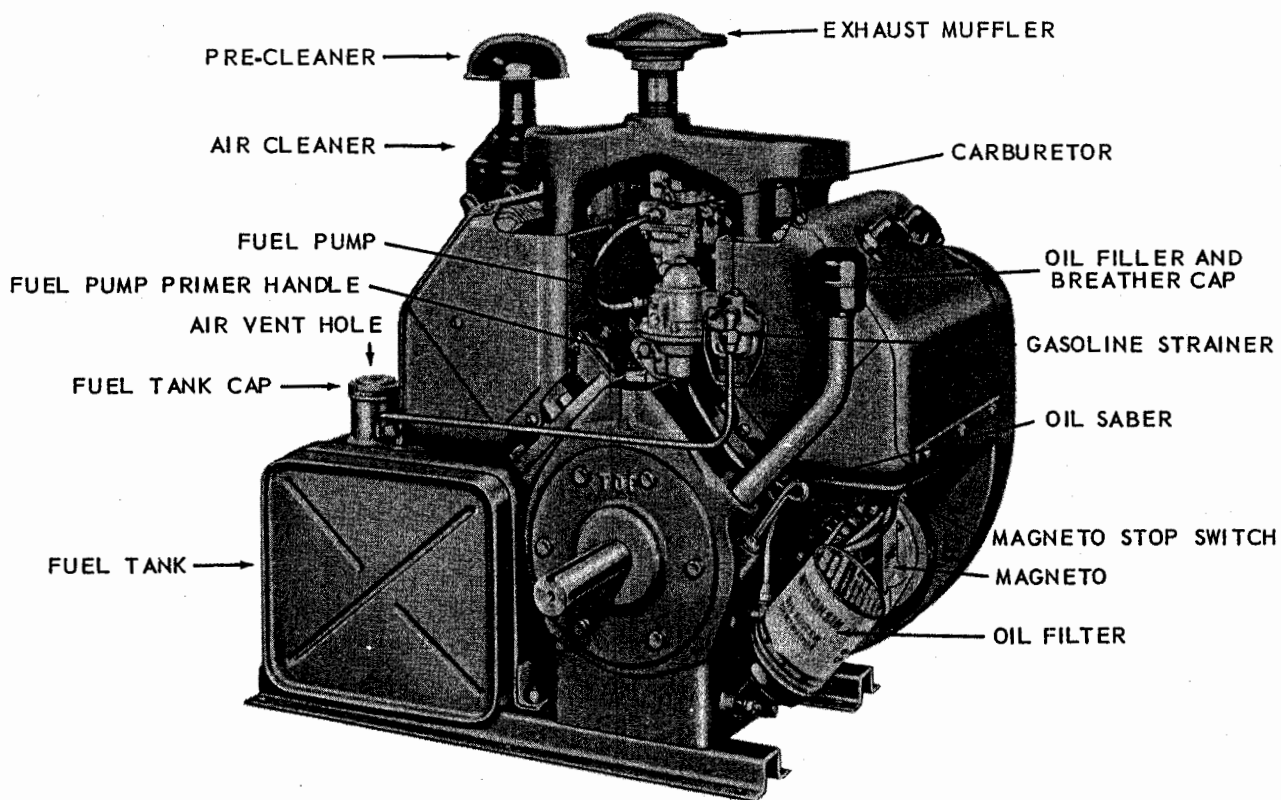
Like all fine machinery, the engine must be given regular care and be operated in accordance with the instructions.

SAFETY PRECAUTIONS

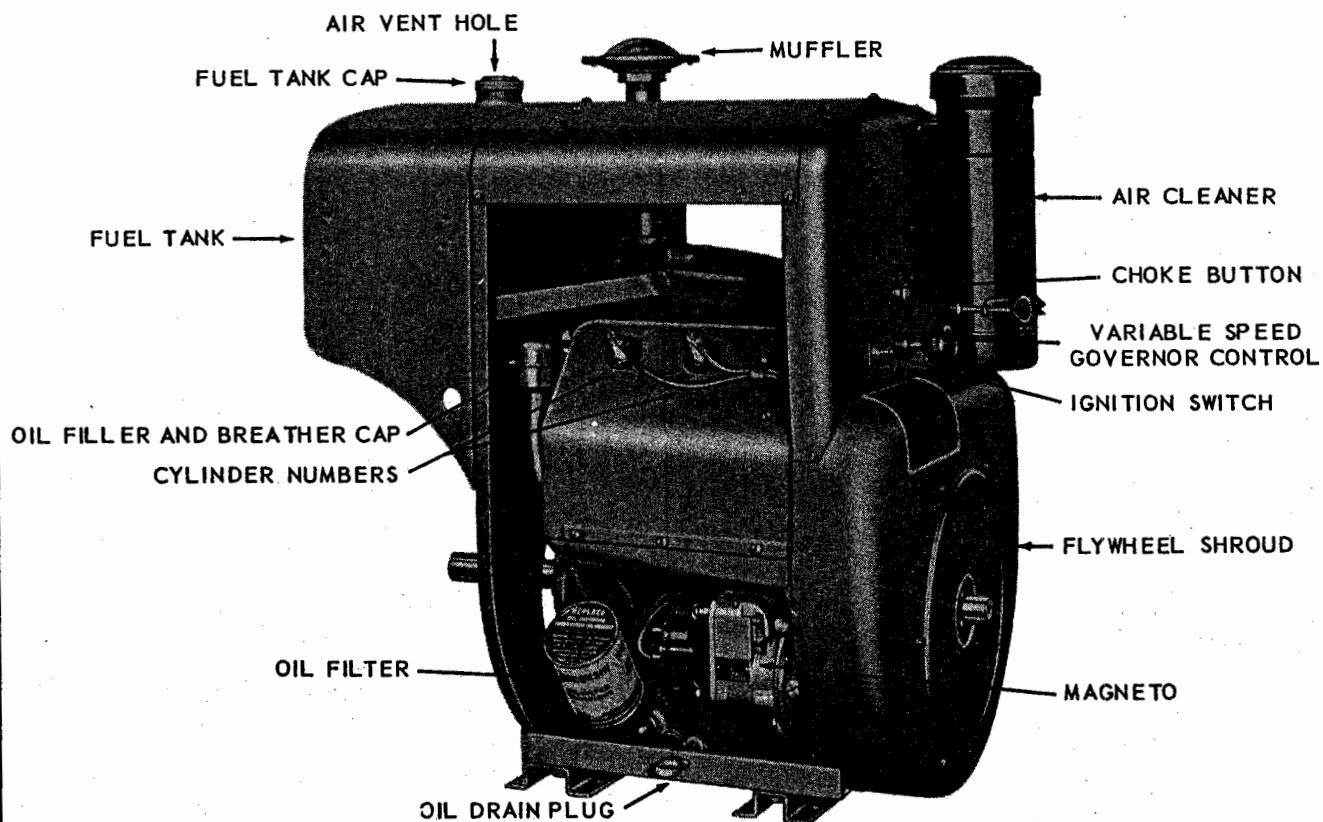
- Never fill fuel tank while engine is running or hot; avoid the possibility of spilled fuel causing a fire.
- Always refuel slowly to avoid spillage.
- When starting engine, maintain a safe distance from moving parts of equipment.
- Do not start engine with clutch engaged.
- Do not spin hand crank when starting. Keep cranking components clean and free from conditions which might cause the crank jaw to bind and not release properly. Oil periodically to prevent rust.
- Never run engine with governor disconnected, or operate at speeds in excess of 2800 R.P.M. load.
- Do not operate engine in a closed building unless the exhaust is piped outside. This exhaust contains carbon monoxide, a poisonous, odorless and invisible gas, which if breathed causes serious illness and possible death.
- Never make adjustments on machinery while it is connected to the engine, without first removing the ignition cable from the spark plug. Turning the machinery over by hand during adjusting or cleaning might start the engine and machinery with it, causing serious injury to the operator.
- Precaution is the best insurance against accidents.

Keep this book handy at all times, familiarize yourself with the operating instructions.

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TAKE-OFF (Side Mount Tank) VIEW OF ENGINE



POWER UNIT FAN END VIEW OF ENGINE

Fig. 1
MODEL VH4 OPEN ENGINE AND POWER UNIT

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218642C-1

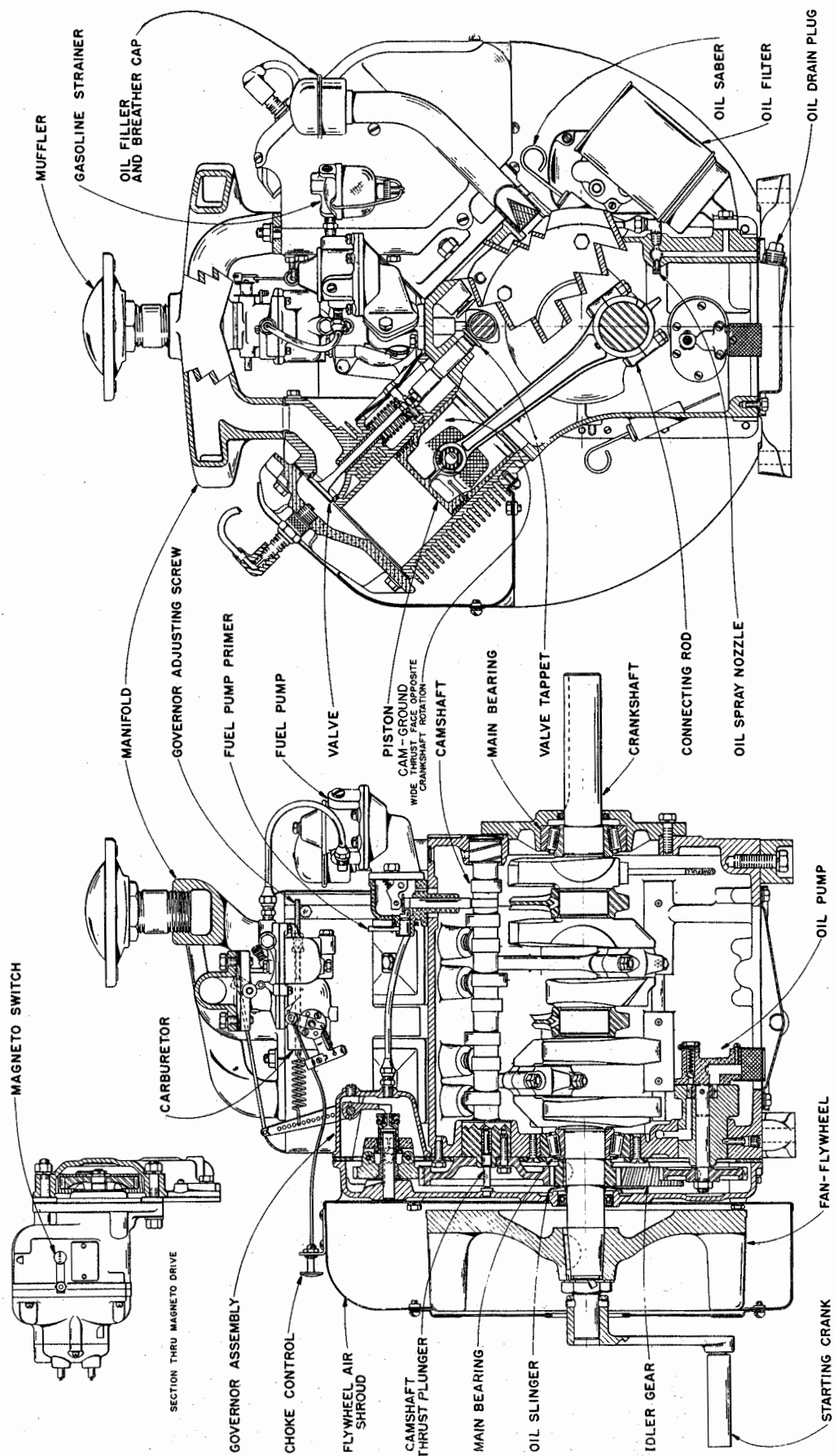


Fig. 2
CROSS SECTION OF ENGINE MODEL VH4

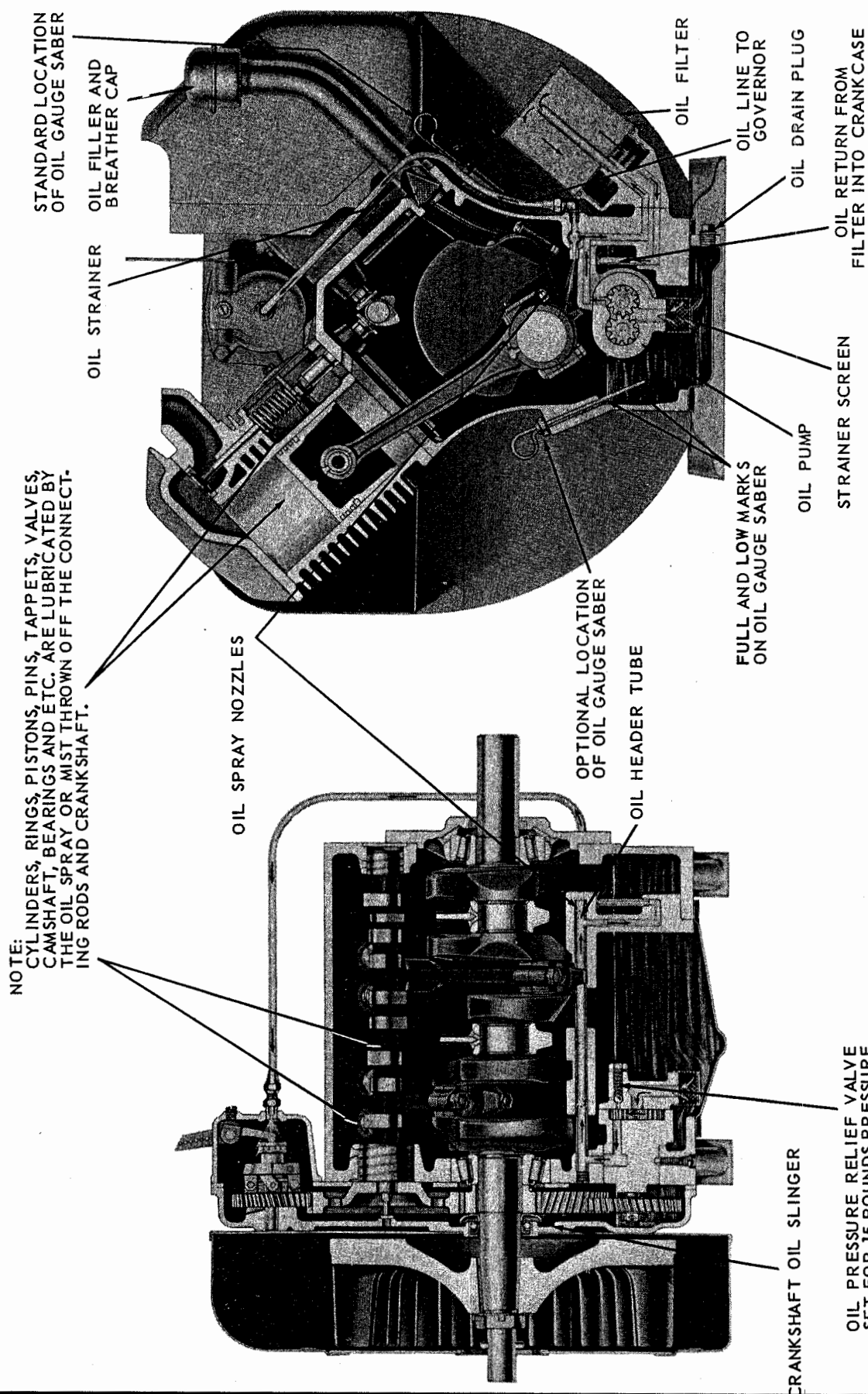


Fig. 3
LUBRICATION SYSTEM

WITH ENGINE AT OPERATING TEMPERATURE, OIL PRESSURE IN HEADER WILL BE APPROXIMATELY 5 POUNDS. AN OIL PRESSURE GAUGE IS NOT REQUIRED.

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GENERAL INFORMATION and DESIGN

Wisconsin engines are of the *four cycle* type, in which each of the four operations of *suction, compression, expansion* and *exhaust* requires a complete stroke. This gives one power stroke per cylinder for each two revolutions of the crankshaft.

COOLING

Cooling is accomplished by a flow of air, circulated over the cylinders and heads of the engine, by a combination fan-flywheel encased in a sheet metal shroud. The air is divided and directed by ducts and baffle plates to insure uniform cooling of all parts.

Never operate an engine with any part of the shrouding removed – this will retard air cooling.

Keep the cylinder and head fins free from dirt and chaff. Improper circulation of cooling air will cause engine to overheat.

CARBURETOR

The proper combustible mixture of gasoline and air is furnished by a balanced carburetor, giving correct fuel to air ratios for all speeds and loads.

IGNITION SYSTEM

The spark for ignition of the fuel mixture is furnished by a high tension magneto driven off the timing gears at crankshaft speed. The magneto distributor rotor turns at half-engine speed. The magneto is fitted with an impulse coupling, which makes possible a powerful spark for easy starting. Also, the impulse coupling automatically retards the spark for starting, thus eliminating possible kick back from engine while cranking.

Battery ignition (12 volt); distributor is furnished in place of magneto on engines equipped with flywheel alternator or belt driven generator. See Page 12.

LUBRICATION SYSTEM (Fig. 3)

A gear type pump supplies oil to four nozzles which direct oil streams against fins on the connecting rod caps. Part of the oil enters the rod bearing through holes in the rods, and the balance of the oil forms a spray or mist which lubricates the cylinder walls and other internal parts of the engine. An external oil line from the oil header tube in the crankcase lubricates the governor and gear train.

GOVERNOR

A governor of the centrifugal flyweight type maintains the engine speed by varying the throttle opening to suit the load imposed upon the engine. These engines are equipped with either a *fixed speed* governor, a *variable speed control* to regulate the governed speed of the engine, or an *idle control*.

ROTATION

The rotation of the crankshaft is clockwise when viewing the flywheel or cranking end of the engine. This gives *counter-clockwise rotation* when viewing

R.P.M.	HORSEPOWER
1400	17.2
1600	20.0
1800	22.5
2000	24.7
2200	26.5
2400	28.0
2600	29.2
2800	30.0

the power take-off end of the crankshaft. The flywheel end of the engine is designated the *front end*, and the power take-off end, the *rear end* of the engine.

HORSEPOWER

Horsepower specified in the accompanying chart is for an atmospheric temperature of 60° Fahrenheit at sea level and at a Barometric pressure of 29.92 inches of mercury.

For each inch lower the Barometric pressure drops, there will be a loss in horsepower of 3½%.

For each 10° temperature rise there will be a reduction in horsepower of 1%.

For each 1000 ft. altitude above sea level there will be a reduction in horsepower of 3½%.

The friction in new engines cannot be reduced to the ultimate minimum during the regular block test, but engines are guaranteed to develop at least 85 per cent of maximum power when shipped from the factory. The power will increase as friction is reduced during the first few days of operation. The engine will develop at least 95% of maximum horsepower when friction is reduced to a minimum.

For continuous operation, allow 20% of horsepower shown as a safety factor.

STARTING and OPERATING INSTRUCTIONS

Engines that are enclosed in a sheet metal house, as shown in bottom view of *Fig. 1*, are called *power units*. Others are furnished without a house, as shown in top view of *Fig. 1*, and are called *open engines*.

On engines with a house, the side doors must always be removed when operating.

This is necessary for circulating sufficient air for cooling the engine.

LUBRICATION

Before starting a new engine, fill the oil base with good "gasoline engine" oil, as specified in the "Grade of Oil" chart. Fill through the breather tube shown in *Fig. 3*, with 4 quarts of oil.

For *run-in of new engines*, use same oil as recommended in *Grade of Oil Chart*.

After the engine has been run for a short time, the oil lines and oil filter will have been filled with oil. Shut

GRADE OF OIL

SEASON OR TEMPERATURE		GRADE OF OIL
Spring, Summer or Fall + 120°F to + 40°F		SAE 30
Winter + 40°F to + 15°F + 15°F to 0°F Below Zero		SAE 20-20W SAE 10W SAE 5W-20
Use oils classified as Service MS, SD or SE		
Crankcase Capacity	New engine	4 Qts.
	Oil and filter change	4 Qts.
	Less — filter or filter change	3½ Qts.

off the engine and check the oil level by means of *dip stick* (oil gauge saber). If necessary, add enough oil to bring level up to the *full mark*. The standard dip stick location is below the oil filler-breather tube, but can be located on starting motor side upon request.

Use only high-grade highly refined oils, corresponding in body to the S. A. E. (Society of Automotive Engineers) Viscosity Numbers listed in *Grade of Oil Chart*.

SERVICE CLASSIFICATION OF OIL

In addition to the S.A.E. Viscosity grades, oils are also classified according to severity of engine service. Use oils classified by the American Petroleum Institute as *Service MS, SD or SE*. These types of oil are for engines performing under unfavorable or severe operating conditions such as: high speeds, constant starting and stopping, operating in extreme high or low temperatures and excessive idling.

Follow summer recommendations in winter if engine is housed in warm building.

Check oil level every 8 hours of operation.

The old oil should be drained and fresh oil added after every 50 hours of operation.

To drain oil, remove drain plug illustrated in *Fig. 3*. Oil should be drained while engine is hot, as it will then flow more freely.

OIL PRESSURE

At engine operating temperature, the oil pressure will be about 4 to 5 pounds per square inch, and due to this low pressure system, an oil pressure gauge is not required. When the engine is cold the pressure will be higher, and a relief valve is fitted to the oil pump so that under these conditions the maximum pressure will be limited to 15 pounds.

FUEL

These engines can be furnished with either a gravity feed tank mounted above the carburetor fuel level, a side mount tank, or tank mounted below the engine. In the latter two cases, a fuel pump is furnished.

The fuel tank should be filled with a *good quality* gasoline free from dirt and water. The capacity of the

tank is approximately 6 gallons. Some of the poorer grades of gasoline contain gum which will deposit on valve stems, piston rings, and in the various small passages in the carburetor, causing serious trouble in operating and in fact might prevent the engine from operating at all.

Use only reputable, well known brands of REGULAR GRADE gasoline.

The gasoline should have an octane rating of at least 90. Low octane gasoline will cause the engine to detonate, or *knock*, and if operation is continued under this condition, cylinders will score, valves will burn, pistons and bearings will be damaged, etc.

Be sure that air vent in tank cap is not plugged with dirt, as this would prevent fuel from flowing to the carburetor.

FUEL PUMP and PRIMING (Fig. 4)

The diaphragm type fuel pump, furnished on engines with side mount or underslung fuel tanks, is actuated by an eccentric on the camshaft, as illustrated in cross section of engine, *Fig. 2*.

Hand Primer for *hand crank engine* is an accessory furnished only upon request, and is a necessary function when starting a new engine for the first time, or when engine has been out of operation for a period of time. Gravity feed and electric start engines do not require hand priming.

When priming, a distinct resistance of the fuel pump diaphragm should be felt when moving the hand lever up and down. If this does not occur, the engine should be turned over one revolution so that the fuel pump drive cam will be rotated from its upper position which prevents movement of the pump rocker arm.

Assuming the gasoline strainer is empty, approximately 25 strokes of the primer lever are required to fill the bowl. *See Fig. 4*. After strainer bowl is full, an additional 5 to 10 strokes are required to fill the carburetor bowl. When carburetor is full the hand primer lever will move more easily.

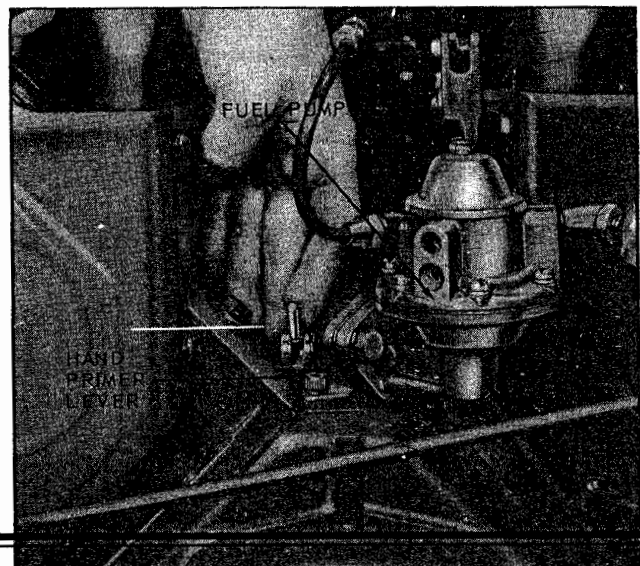


Fig. 4

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IGNITION SWITCH

Magneto ignition is standard on these engines, with a lever type switch on the side of the magneto, which is always in the **on** or running position, except when depressed for stopping the engine. See *top view of Fig. 1*.

On power unit engines, a push button ignition switch is mounted on the outside of the house panel at the flywheel end. See *bottom view of Fig. 1*. When starting engine, the ignition switch button is **pulled out**. To stop, **push in**. This will apply to both *magneto* and *battery ignition* systems.

STARTING

STARTING PROCEDURE

1. Check crankcase oil level and gasoline supply. Open shut-off valve in fuel strainer.
2. Disengage clutch, if furnished.
3. New engines may require priming; refer to "Fuel Pump" paragraph for instructions.
4. Set throttle about 1/2 open if a variable speed control is furnished; with a two-speed control, start in full load position — idle after engine starts.
5. Pull out ignition switch button, if applicable (switch tag reads "To Stop Push In"). Refer to *Ignition Switch* paragraph.
6. Close carburetor choke by pulling choke button to extreme out position.
7. Turn engine over slowly one or two revolutions. *Caution:* Be sure that crank does not bind. Push choke button in about half-way and then pull up briskly on the starting crank. **Do not** attempt to *spin* the engine with the starting crank. If the engine does not start on the first pull up of crank, re-engage the crank and repeat the operation. *With electric starting motor;* depress starter button in place of hand cranking.
8. After engine starts, push choke button in gradually as required for smooth running. Choke must be completely open (button in) when engine is warmed up.

If flooding should occur, open choke fully by pushing choke button in and continue cranking. Less choking is necessary in warm weather or when engine is warm, than when cold.

If all conditions are right, engine will start promptly after one or two attempts. Allow engine to warm up a few minutes before applying load, as prescribed in "Warm-Up Period" paragraphs.

New engines should be "run-in" gradually to insure trouble-free service. Refer to "Starting and Operation of New Engine", on the inside front cover of this manual, for correct "running-in" procedure.

WARM-UP PERIOD

The engine should be allowed to warm up to operating temperature before load is applied. This requires only

a few minutes of running at moderate speed. *Racing an engine or gunning it*, to hurry the warm-up period, is **very destructive** to the polished wearing surfaces on pistons, rings, cylinders, bearings, etc., as the proper oil film on these various surfaces cannot be established until the oil has warmed up and become sufficiently fluid. This is especially important on new engines and in cool weather.

Racing an engine by disconnecting the governor, or by doing anything to interfere with the governor controlled engine speed, is **extremely dangerous**. The governor is provided as a means for controlling the engine speed to suit the load applied, and also as a safety measure to guard against excessive speeds, which not only overstrain all working parts, but which might cause wrecking of the engine and possible injury to bystanders.

All parts of the engine are designed to safely withstand any speeds which might normally be required, but it must be remembered that the stresses set up in rotating parts, increase with the square of the speed. That means that if the speed is doubled the stresses will be quadrupled; and if the speeds are trebled, the stresses will be nine times as great.

Strict adherence to the above instructions cannot be too strongly urged, and greatly increased engine life will result as a reward for these easily applied recommendations.

STOPPING ENGINE

Magneto ignition engines, less house, have a lever type stop switch on the side of the magneto. On these, **to stop engine**, depress lever and **hold down until engine stops**.

Power units and battery ignition engines, are furnished with an ignition switch, "To Stop Push In".

If the engine has been running hard and is hot, do not stop it abruptly from full load, but remove the load and allow engine to run idle at 1000 to 1200 R.P.M. for three to five minutes. This will reduce the internal temperature of the engine much faster, minimize valve warping, and of course the external temperature, including the manifold and carburetor will also reduce faster, due to air circulation from the flywheel.

Two main troubles resulting from abruptly shutting off a hot engine are **vapor lock** and **dieseling**. Vapor lock will prevent the flow of fuel in the fuel lines and carburetor passages, which will result in hard starting. This can be overcome by choking the engine when cranking or waiting until the engine has cooled off sufficiently to overcome the vapor lock.

Dieseling, is caused by the carbon and lead deposits in the cylinder head being heated up to such an extent that they continue to fire the engine and keep it running after the ignition has been shut off. By idling the engine, as previously mentioned, the carbon and lead deposits cool off, break up and will blow out thru the exhaust. If engine has a tendency to diesel, by ~~suddenly setting the throttle wide open and at the same time shutting off the ignition~~, the engine will stop.

MAINTENANCE

OIL FILTER

A *by-pass* type oil filter is furnished on these engines, as shown in *Fig. 3*, except in a few cases where the use of other accessories prevents the mounting of an oil filter. The oil *filtering cartridge* should be replaced after every other oil change. If operating conditions are *extremely dusty*, replace cartridge after every oil change.

AIR CLEANERS

The air cleaner is an essential accessory, filtering the air entering the carburetor and preventing abrasive dirt from entering the engine and wearing out valves and piston rings in a very short time.

The air cleaner must be serviced frequently, depending on the dust conditions where engine is operated. Check hose connections for leaks or breaks; replace all broken or damaged hose clamps.

Excessive smoke or loss of power are good indications the air cleaner requires attention.

The *oil bath* type air cleaner, illustrated in *Fig. 5* is standard equipment on power units. On open engines, the oil bath air filter furnished is illustrated in *Fig. 6*. A *dry element* air cleaner is optionally available for both power unit and open engine.

OIL BATH AIR CLEANER (Fig. 5)

Service daily or twice a day; if engine is operating in very dusty conditions. *Once each week*; in comparatively clean conditions.

Remove oil cup from bottom of air cleaner and clean thoroughly. Add fresh oil to the *level line* indicated on cup, using the same grade oil as used in engine crankcase.

Operating the engine under dusty conditions without oil in the air cleaner or with dirty oil, may wear out cylinders, pistons, rings and bearings in a few days time, and result in costly repairs.

Once a year; or oftener in very dusty conditions, the air cleaner should be removed from the engine and the element, which is not removable, should be washed in a solvent to clean out accumulated dust and dirt.

DRY ELEMENT AIR CLEANER

Service daily; squeeze rubber dust unloader once or twice a day to check for possible obstruction. If engine is operating in very dusty conditions, remove cartridge and shake out accumulated dirt.

Once each week; the filtering cartridge should be taken out and either dry-cleaned with compressed air or washed by repeated dipping for several minutes in a solution of lukewarm water and a mild *non-sudsing* detergent. Rinse in cold water from the inside out and allow to dry overnight before installing.

Do not use gasoline, kerosene or solvent for cleaning. - Do not oil element.

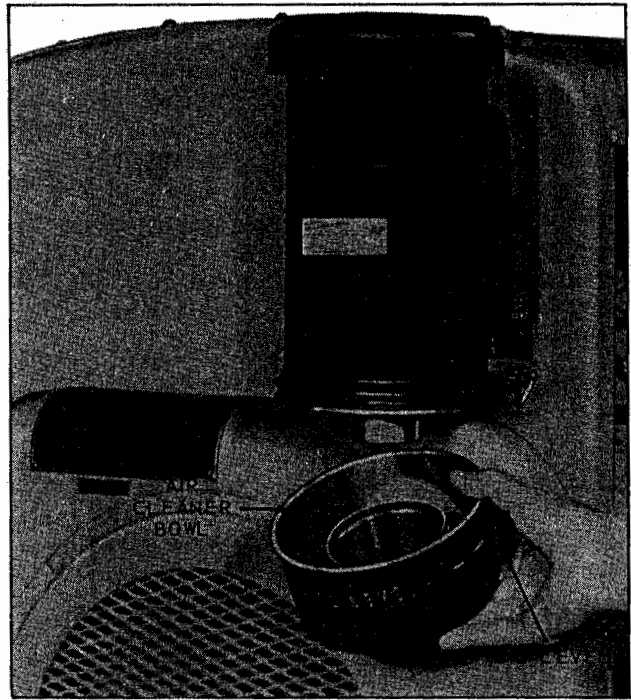


Fig. 5

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After ten washings or one year of service, whichever comes first, replace cartridge.

PRE-CLEANER (Fig. 6)

The collector type pre-cleaner, mounted to the top of the air cleaner, removes the larger dirt and dust particles before the air reaches the main air cleaner.

Daily; clean bowl of accumulated dust and dirt. *Do not use oil or water in pre-cleaner. This must be kept dry.*

FUEL STRAINER (Fig. 7)

A fuel strainer is very necessary to prevent sediment, dirt and water from entering the carburetor and causing trouble or even complete stoppage of the engine. The strainer has a glass bowl and should be inspected frequently and cleaned if dirt or water are present. To remove bowl, first shut off fuel valve, then loosen the knurled nut below bowl and swing the wire bail to one side. After cleaning bowl and screen, reassemble the parts, being sure the gasket

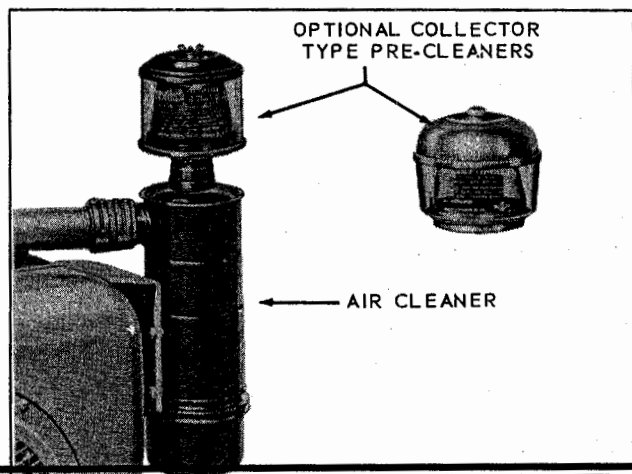


Fig. 6

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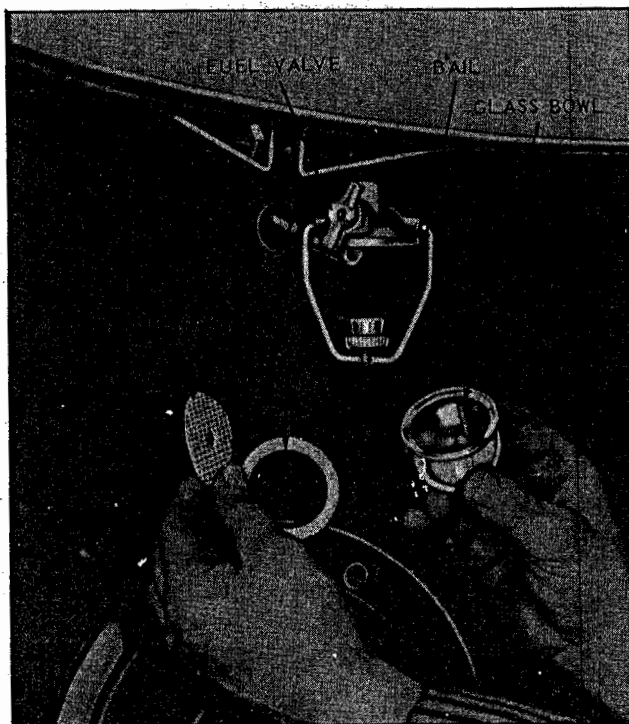


Fig. 7

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is in good condition; otherwise use a new gasket. See Fig. 7, which shows the strainer mounted to the fuel tank of a power unit. On open engines, the strainer is mounted to the inlet of the fuel pump.

CARBURETOR ADJUSTMENT

The main metering jet in the carburetor is of the fixed type, that is, it requires no adjustment. The idle needle should be adjusted for best low speed operation, while carburetor throttle is closed by hand. For illustrations and more information, see Carburetor Manufacturer's Instruction Bulletin in the back of this manual.

MAGNETO BREAKER POINT ADJUSTMENT

Magnetos are properly adjusted before leaving factory. The *breaker points* on the Fairbanks-Morse magneto and on the Wico magneto should be **.015"** at full separation. If the spark becomes weak after continued operation, it may be necessary to readjust these points. To do this first remove the end cover on the magneto. The crankshaft should then be rotated with the starting crank, (this also rotates the magneto), until the breaker points are wide open. The opening or gap should then be measured with a feeler gauge as shown in Fig. 8 and if necessary reset. To readjust points, first loosen the *locking screws* on the *contact plate* enough so that the plate can be moved. Insert the end of a small screw driver into the *adjusting slot* at the bottom of the *contact plate* and open or close the contacts by moving the plate until the proper opening is obtained. See Fig. 9. After tightening the locking screws, recheck breaker point gap to make sure it has not changed. If it is found that the breaker points have become rough, they should be smoothed with a breaker point file before the preceding adjustments are made. Replace magneto end cover carefully

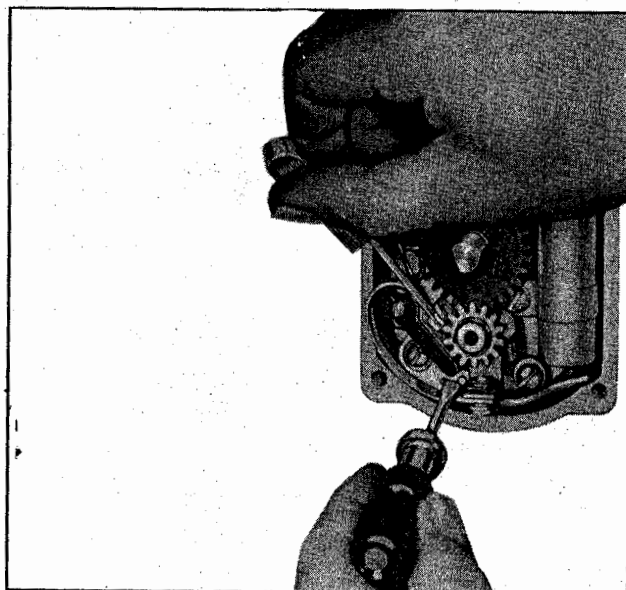
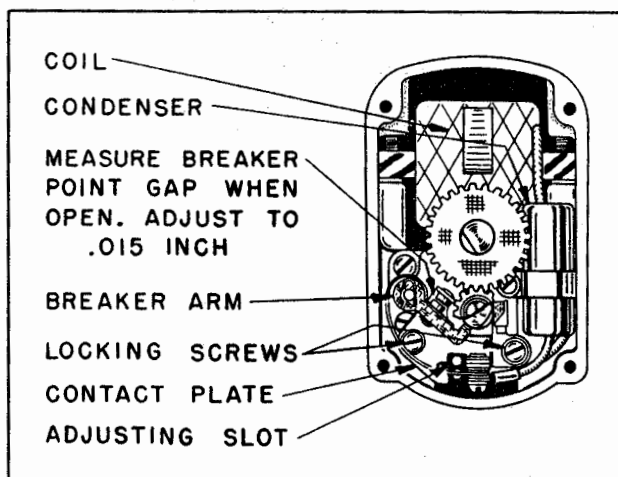


Fig. 8

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OPEN END VIEW OF FAIRBANKS-MORSE MAGNETO

Fig. 9

so that it will seal properly. Do not force cover screws too tightly otherwise cover may crack. For further information, see Fairbanks-Morse or Wico Magneto Maintenance Manual in the back of this manual.

MAGNETO IGNITION SPARK

If difficulty is experienced in starting the engine or if engine misses firing, the strength of the ignition spark may be tested by disconnecting the No. 1 ignition cable from the spark plug and holding the terminal about 1/8 inch away from the air shroud or any other conveniently located metal part of the engine. If the ignition cables have a molded rubber insulated spark plug terminal at the end, as illustrated in Fig. 10, wedge a piece of bare wire up into the terminal and let one end of the wire extend out. Turn the engine over slowly by the starting crank two complete revolutions and watch for a strong spark discharge, which should occur during the cycle at the instant the impulse coupling on the magneto snaps. Repeat this check with each of the other ignition cables. If there is a weak spark or none at all, check breaker point opening as mentioned in preceding paragraph under

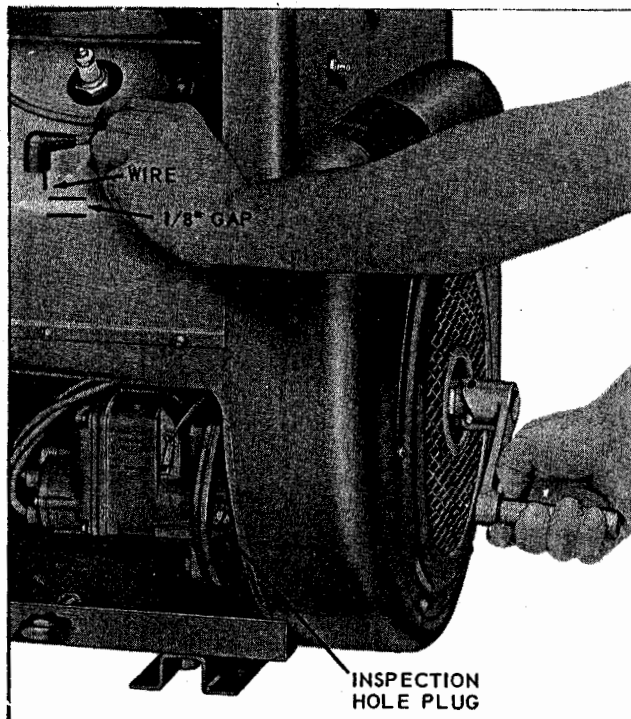


Fig. 10

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"Magneto Breaker Point Adjustment". If this does not remedy the trouble, it may be necessary to install a new condenser. See Magneto Manufacturer's Maintenance Instructions in back of this manual.

FIRING ORDER

The *firing order* of the cylinders is 1-3-4-2, and the magneto and battery type distributor rotate at one-half engine speed, as is the case with conventional "in line" engines. The intervals between the firing of the cylinders is 180°. No. 1 cylinder is the one nearest to the flywheel in the left bank of cylinders, when viewed from the flywheel end of the engine. No. 3 cylinder is the other cylinder in this bank. No. 2 cylinder is the one nearest to the flywheel in the right bank of cylinders and No. 4 is the other cylinder in this bank. The cylinders are numbered from 1 to 4 on the air shroud near the spark plugs. The flywheel end of the engine is designated the *front* and the power take-off end, the *rear* of the engine.

MAGNETO TIMING

The proper spark advance is 23°. To check timing with a *neon light*, the running spark advance is indicated by a 3/8 inch slotted hole in the rim of the air intake screen, 68° left of the flywheel shroud vertical centerline, *marked VH*, or if screen is removed, time to the *lower half* of the 1/4 inch elongated hole on the face of flywheel shroud 23° below the centerline of No. 1 and No. 3 cylinders as illustrated in Fig. 11. The end of the 'X' marked vane should be whitened with chalk or paint for this operation.

To Time Magneto to Engine: Remove air intake screen to expose *timing marks* on both flywheel and shroud. See *Magneto Timing Diagram*, Fig. 11.

Next, remove the spark plug from No. 1 cylinder and slowly turn the flywheel clockwise, at the same time holding a finger over the spark plug hole, so that the compression stroke can be determined from the air blowing out of the hole.

The flywheel is marked with the letters 'DC' near one of the air circulating vanes. This vane is further identified by an 'X' mark cast on the end. See Fig. 11. When the air blows out of the No. 1 spark plug hole, continue turning the crank until the edge of the *marked vane* on flywheel is on line with the *mark* on the *vertical centerline* of the *shroud* as shown on Fig. 11. Leave flywheel in this position. At this point the *keyway* for mounting the flywheel is also on top. Reassemble spark plug.

Next, remove the inspection hole plug from the magneto timing opening, located in the gear cover as shown in Fig. 10.

Assuming that the magneto has been removed from the engine, the following procedure should be followed before remounting.

The Number 1 cylinder firing position of the magneto must be determined. Insert the ignition cable into the No. 1 tower terminal of the magneto end cap and hold the spark plug terminal at the other end, about 1/8" away from the magneto body. Turn the magneto gear in a clockwise rotation, tripping the impulse coupling, until the No. 1 terminal sparks, then hold the gear in this position. Mount the magneto to the engine, meshing the gears so that when the magneto is in place, the gear tooth marked with an 'X' will be visible through the *lower half* of the *inspection hole* in the gear cover, as shown in *Timing Diagram*, Fig. 11. Tighten the nut and capscrew for mounting the magneto to the gear cover, making sure the magneto flange gasket is in place.

The **No. 1** terminal is identified on the magneto cap. The terminals follow the proper firing order of 1-3-4-2 in a clockwise direction viewing the cap end. The leads from the magneto should be connected to spark plugs of corresponding numbers.

No. 1 cylinder is the cylinder nearest the fan-flywheel of the engine in the left bank and No. 3 cylinder is the other cylinder in that bank. No. 2 cylinder is across the engine from No. 1 and No. 4 is across from No. 3.

When the magneto is properly timed the impulse coupling will snap when the 'DC' and 'X' marked vane of the flywheel, line up with the *mark* on the flywheel shroud which indicate the *centerline* of the No. 1 and 3 cylinders. This can be checked by turning crankshaft over slowly by means of a hand crank. The impulse will also snap every 180° of flywheel rotation thereafter.

DISTRIBUTOR - BATTERY IGNITION

On engines equipped with Flywheel Alternator or direct mounted Generator, battery ignition is used in place of magneto ignition. The distributor is of the automatic advance type, and rotor turns at *one-half engine speed* in a counter-clockwise direction. As

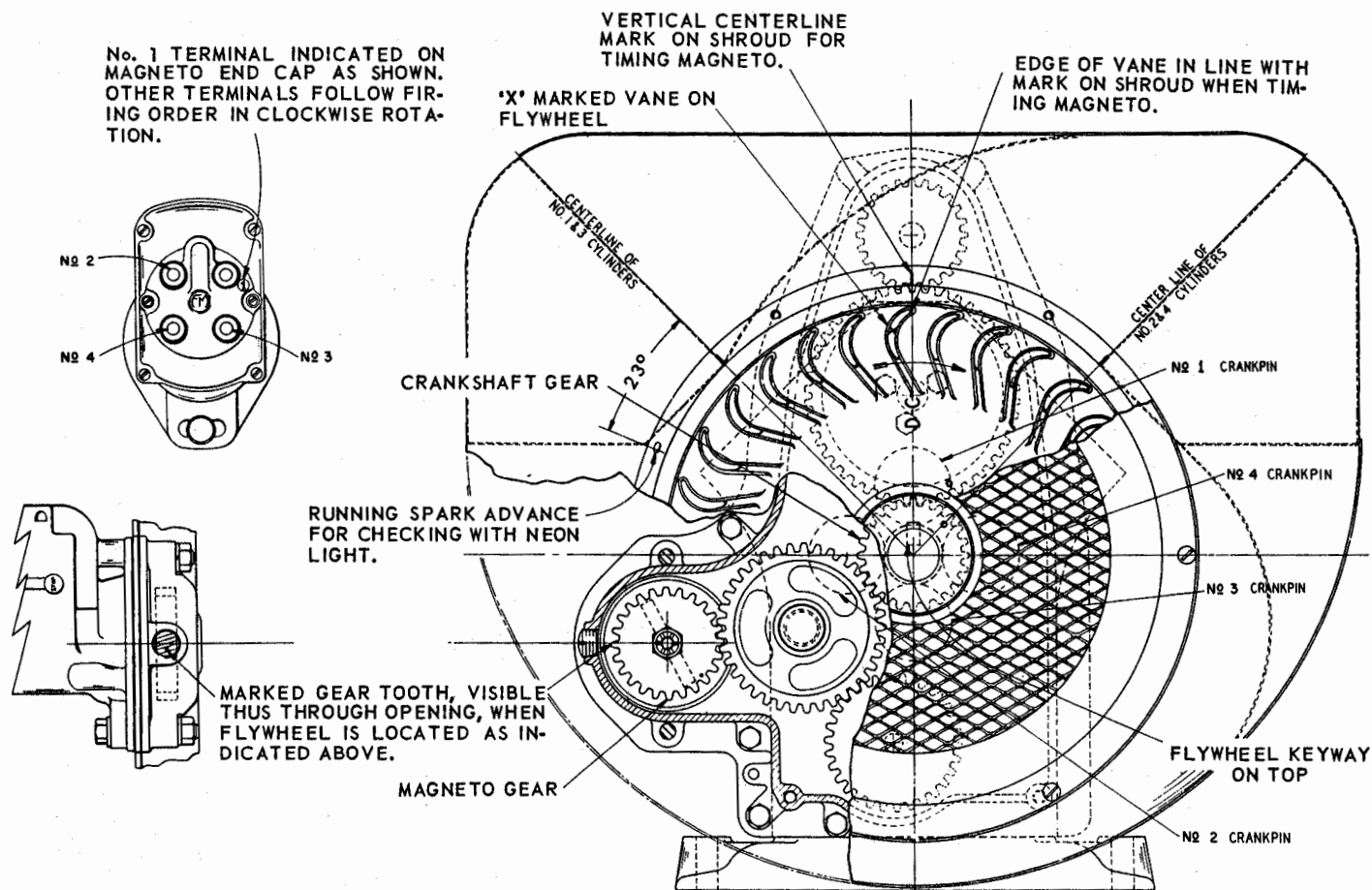


Fig. 11, MAGNETO TIMING DIAGRAM

illustrated in Fig. 15, the distributor is mounted to the end of the generator — with Flywheel Alternator it is mounted to an adapter attached to the gear cover, or Top Mounted — attached to the governor housing.

The *spark advance* for normal speeds is 23°, the same as for magneto ignition. *Engine must be running at 2000 R.P.M. or over when adjusting spark advance.*

ELECTRICAL WIRING CIRCUITS

NOTE: Beginning with engine serial No. 3987113, the standard wiring circuits for all 12 volt electrical equipment is *negative ground polarity*, in place of the previously furnished positive ground. All 6 volt systems remain positive ground.

The Flywheel Alternator circuit illustrated in Fig. 12 always was and is a negative ground system. It replaces the previously furnished gear driven generator which was available both negative and positive ground.

Wiring diagram and service parts information for *obsolete* gear driven type generator can be obtained by writing to Teledyne Wisconsin Motor, Product Support Center, Milwaukee, Wisconsin 53219.

removing screen. To make a *stationary check* of the timing—remove the screen over the flywheel air intake opening by taking out the screws holding the screen in

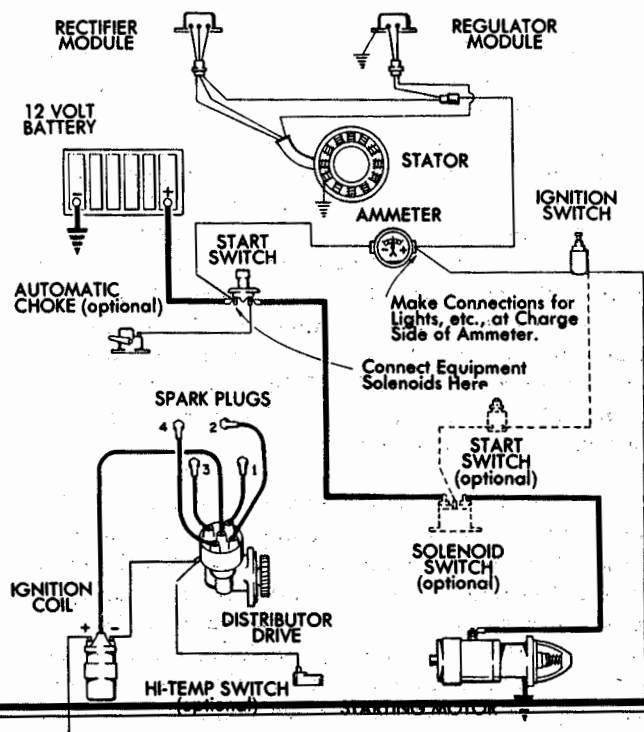


Fig. 12, WIRING DIAGRAM, Flywheel Alternator and Battery Ignition

A slotted opening has been added to the rim of the flywheel screen to check *running spark advance* without

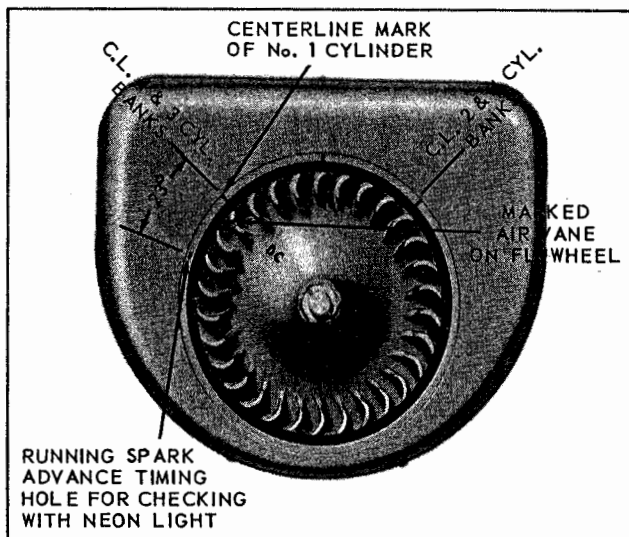


Fig. 13

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place. This will expose the timing marks on the flywheel shroud, also the *vane* on flywheel, marked by an 'X' and the letters 'DC'. See Fig. 13. Next, remove the spark plug from No. 1 cylinder and turn the engine over slowly by the starting crank, at the same time holding a finger over the spark plug hole, so that the compression stroke can be determined from the air blowing out of the hole.

Upon reaching the compression stroke, continue turning the starting crank until the leading edge of the *marked vane* on the flywheel is in line with the *centerline mark* on the flywheel shroud of the *No. 1* cylinder. The No. 1 piston is on top dead center in the position shown in Fig. 13. Reassemble spark plug.

Remove the upper half of the distributor body by disengaging snap springs. The *centerline* of the *distributor rotor* should be in line with the *center* of the *notch* in the distributor housing. No. 1 cylinder is ready to fire in the retarded timing position, when the distributor rotor is in this position, as shown in Figs. 14 and 15. If the distributor rotor is not in the above mentioned position, withdraw the entire distributor from the generator. Remove the distributor rotor in order to take off the dust cover from the distributor body, which will expose the breaker points. Mount rotor back on distributor shaft. Assemble distributor

with the *distributor rotor* in line with the *notch* in the distributor housing as shown in Fig. 14, and the *primary terminal* pointing toward the generator circuit breaker. See Fig. 15. Be sure that the *advance arm lock screw*, Fig. 14, which is mounted to the *distributor clamp* is tight, as a manual spark advance is not used with these engines.

With the *advance arm clamp screw* loose, turn the distributor body slightly in a counter-clockwise rotation so that the breaker points are firmly closed. Then turn the distributor body in a *clockwise* rotation until the *breaker points* are just *beginning to open*, see Fig. 14. At this point, a slight resistance can be felt as the breaker point cam strikes the breaker point arm. Tighten *advance arm clamp screw*. The No. 1 cylinder is now ready to fire in the retarded position,

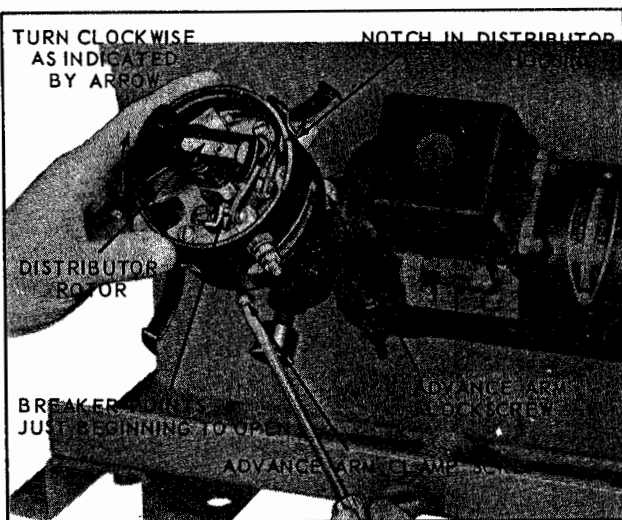


Fig. 14

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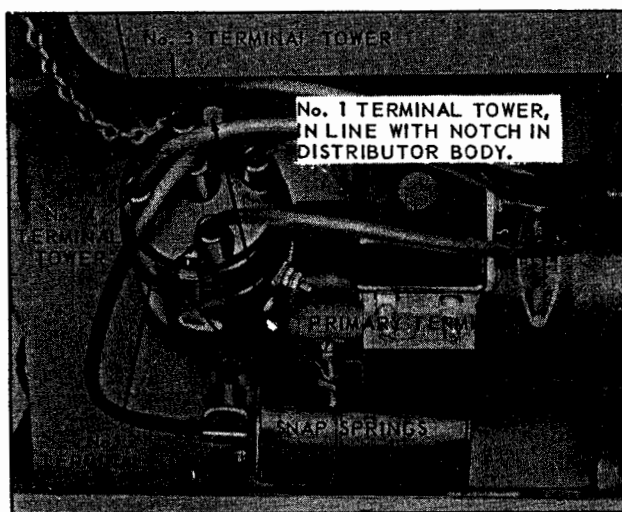


Fig. 15

180187C

with the *centerline* of the *distributor rotor* in line with the *center* of the *notch* in the distributor body as shown in Fig. 14.

The breaker point gap should be .018 to .022 inches. This opening should be checked before the distributor body is set, otherwise any adjustment made to the breaker point opening will change the ignition advance. Replace distributor dust cover. If care is exercised in the above operations, the spark timing should be accurate enough for satisfactory starting, however, *checking spark advance with a neon lamp*, as described in 'Neon Lamp Timing', is necessary.

The four ignition cables from the distributor should be connected to the proper spark plugs. The cylinder shroud covers are marked for identification. The No. 1 terminal tower on the distributor is in line with the notch in the distributor body. The terminal sequence is 1-3-4-2 in a counter-clockwise rotation. See Fig. 15.

NEON LAMP TIMING

The engine should be timed to the 23° advanced position at not less than 2000 R.P.M.

The timing should be checked with a neon lamp connected in series with No. 1 spark plug. Chalk or paint

the end of the 'X' marked vane on the flywheel, white. Then with the engine operating at **2000 R.P.M.** or over, allow the flash from the neon lamp to illuminate the whitened vane. At the time of the flash, the leading edge of the vane should line up with the lower half of the *running spark advance timing hole* on the flywheel shroud, *see Fig. 13*. If it does not, the *advance arm clamp screw* should be loosened as shown in *Fig. 14*, and the distributor body turned slightly clockwise or counter-clockwise, as required, until the *white flywheel vane* matches up with the lower half of the *advance timing hole*. Be sure *advance arm clamp screw* is then carefully tightened. If the engine is running below **2000 R.P.M.** when timing, the automatic advance in the distributor will not be fully advanced and the inaccurate timing may cause serious damage to the engine when operating at high speeds. Mount flywheel screen if removed — use *slotted opening* without removing screen for running spark advance check only.

DISTRIBUTOR AND GENERATOR MAINTENANCE

The distributor breaker point gap should be .018 to .022 inches. To readjust breaker point gap, turn engine over by means of the starting crank until the distributor breaker arm *rubbing block* is on a high point of the cam. Loosen the *stationary contact lock-nut* and screw *fixed contact*, in or out, until correct gap is obtained. Tighten locknut and recheck gap.

The generator and distributor should be periodically lubricated and inspected for external conditions which would affect their operation.

It is recommended that the generator oiler, located below the primary terminal of the distributor, be given 3 to 5 drops of medium engine oil every 50 hours.

Every 50 hours of operation, the oiler on the side of the distributor base should have 3 to 5 drops of medium engine oil added, and the grease cup given one complete turn. Use a high melting point grease. Every 100 hours, apply 3 to 5 drops of medium engine oil to the felt in the top of the cam sleeve. **Do not over-lubricate.**

FLYWHEEL ALTERNATOR

12 volt — 10 or 25 amp flywheel alternator furnished in place of gear driven generator. Instructions and parts bulletin is located in the rear of this manual.

RESTORING COMPRESSION

In a new engine or one which has been out of operation for some time, oil may have drained off the cylinders so that compression will be weak, causing difficulty in starting. To remedy this condition, remove the spark plugs and pour about a fluid ounce of crankcase oil through the spark plug hole into each cylinder. Turn engine over several times with the hand crank to distribute oil over the cylinder walls. Assemble spark plugs and compression should be satisfactory.

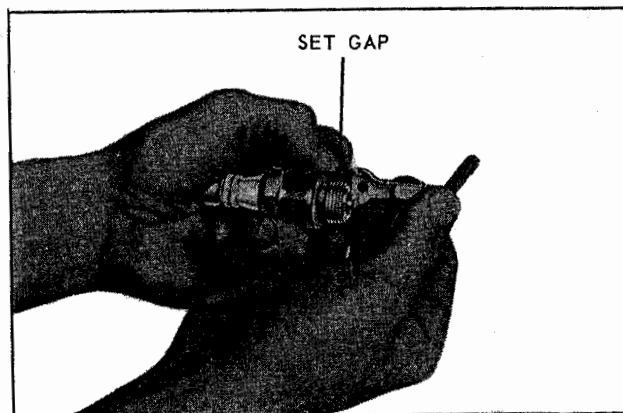


Fig. 16

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SPARK PLUGS, Fig. 16

Incorrect gap, fouled or worn spark plug electrodes, will have an adverse affect on engine operation. Remove spark plugs periodically, clean, regap or replace if necessary. Thread size is 18 mm.

Spark plug gap — 0.030 of an inch.

Replacement plugs must be of the correct heat range, like Champion No. D-16J, AC No. C86 commercial. Tighten spark plugs, 25 to 30 foot pounds torque.

HIGH TEMPERATURE SAFETY SWITCH

As a safety precaution against overheating, engines can be equipped with a high temperature switch mounted to the cylinder head at the **No. 4** spark plug.

When cylinder head temperature becomes critically high, the safety switch will automatically stop the engine by shorting out the ignition system. A waiting period of about **10 minutes** will be required before the switch has cooled off sufficiently to re-start the engine. An overheated engine will score the cylinder walls, burn out connecting rod and crankshaft bearings, also warp pistons and valves. The cause of the overheating condition will have to be remedied before the engine is re-started. *See Engine Overheats paragraph in Troubles, Causes and Remedies section.* *Service Kit* is available — see parts list section.

KEEP ENGINE CLEAN - PREVENT OVERHEATING (Agricultural and Industrial Engines)

This engine is cooled by blasts of air which must be allowed to circulate all around the cylinders and cylinder heads to properly cool the engine and thereby keep it in good running condition. If *dust, dirt or chaff is allowed to collect in the cylinder shrouding or in the V between the cylinders*, it will retard the flow of air and cause the engine to overheat. Keep *flywheel screen* and *rotating screen* clean, so as not to restrict the intake of cooling air.

With reference to *Fig. 17*; follow the cleaning and maintenance instructions pointed out, to obtain trouble free and satisfactory engine performance.

1. Remove these covers frequently and clean out all dust, dirt and chaff. Be sure to replace covers.

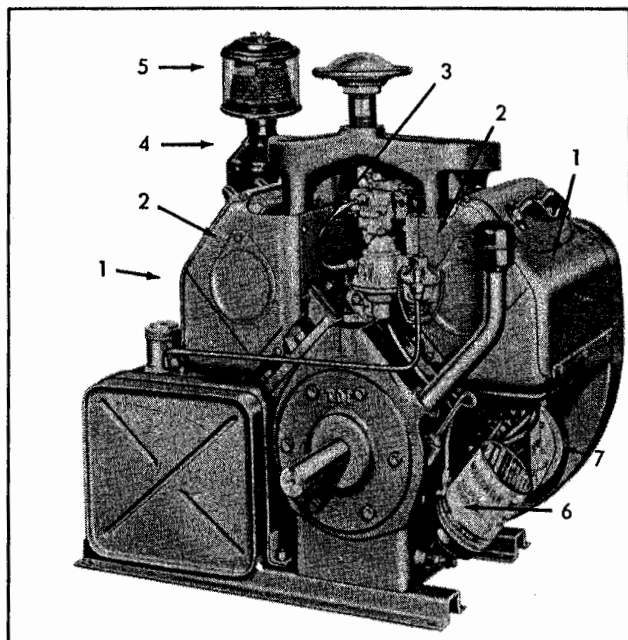


Fig. 17

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2. Open these covers frequently and clean out all dust and chaff. Be sure to close covers.
3. Keep this space between cylinders free of dust and chaff.
4. Read instructions on this air cleaner regarding its care. This is important. The entire air cleaner should be removed from the engine at least once a year, and washed in a cleaning fluid to clean out dirt gathered in the back fire trap in the top part of the air cleaner.
5. Empty pre-cleaner of accumulated dust and dirt frequently. Do not use oil or water in pre-cleaner, this must be kept dry.
6. Replace this oil filter cartridge every other oil change. If operating conditions are extremely dusty replace cartridge every oil change. Be sure that your replacement is a Wisconsin Micro-Fine filter.
7. Do not allow shrouding to become damaged or badly dented as this will retard air flow.

Never operate engine with air shrouding removed. This will retard air cooling.

Always keep all parts of the engine clean. This will prolong engine life, and give more satisfactory operation.

Every 4 to 8 hours, depending on dust conditions, check air cleaner and change oil. See Page 10.

Every 8 hours check crankcase oil level. Keep filled to full mark on oil gauge, but no more. See Fig. 3.

Every 50 hours drain crankcase and refill with fresh oil. See Lubrication, Pages 6 and 7.

TROUBLES CAUSES AND REMEDIES

Three prime requisites are essential to starting and

maintaining satisfactory operation of gasoline engines. They are:

1. **A proper fuel mixture** in the cylinder.
2. **Good compression** in the cylinder.
3. **Good spark, properly timed**, to ignite the mixture.

If all three of these conditions do not exist, the engine cannot be started. There are other factors which will contribute to hard starting; such as, too heavy a load for the engine to turn over at a low starting speed, a long exhaust pipe with high back pressure, etc. These conditions may affect the starting, but do not necessarily mean that the engine is improperly adjusted.

As a guide to locating any difficulties which might arise, the following causes are listed under the three headings: **Fuel Mixture, Compression, and Ignition.**

In each case, the causes of trouble are given in the order in which they are most apt to occur. In many cases the remedy is apparent, and in such cases no further remedies are suggested.

STARTING DIFFICULTIES

FUEL MIXTURE

No fuel in tank or fuel shut-off valve closed.

Fuel pump diaphragm worn out, so pump does not supply carburetor with fuel.

Carburetor not choked sufficiently, especially if engine is cold. See 'Choke', Page 9.

Water, dirt, or gum in gasoline interfering with free flow of fuel to carburetor.

Poor grade or stale gasoline that will not vaporize sufficiently to form the proper fuel mixture.

Carburetor flooded, caused by too much choking especially if engine is hot. See 'Choke', Page 9.

Dirt or gum holding float needle valve in carburetor open. This condition would be indicated if fuel continues to drip from carburetor with engine standing idle. Often tapping the float chamber of the carburetor very lightly with the handle of a screw driver or similar tool will remedy this trouble. Do not strike carburetor with any metal tools, it may cause serious damage. Also if the mixture in the cylinder, due to flooding, is too rich, starting may be accomplished by continued cranking, with the carburetor choke open.

If, due to flooding, too much fuel should have entered the cylinder in attempting to start the engine, the mixture will most likely be too rich to burn. In that case, the spark plugs should be removed from the cylinders and the engine then turned over several times with the starting crank, so the rich mixture will be blown out through the spark-plug holes. The choke on the carburetor should of course be left open during this procedure. The plugs should then be replaced and starting tried again.

To test for clogged fuel line, loosen fuel line nut at carburetor slightly. If line is open, fuel should drip out at loosened nut.

COMPRESSION

If the engine has proper compression, considerable resistance will be encountered in the pull on the starting crank. If this resistance is not encountered, compression is faulty. Following are some reasons for poor compression:

Cylinder dry due to engine having been out of use for some time. *See 'Restoring Compression', Page 15.*

Loose spark plugs or broken spark plug. In this case a hissing noise will be heard when cranking engine, due to escaping gas mixture on compression stroke.

Damaged cylinder head gasket or loose cylinder head. This will likewise cause hissing noise on compression stroke.

Valve stuck open due to carbon or gum on valve stem. To clean valve stems, *see 'Valves', Page 22.*

Valve tappets adjusted with insufficient clearance under valve stems. *See 'Valve Tappets', Page 23.*

Piston rings stuck in piston due to carbon accumulation. If rings are stuck very tight, this will necessitate removing piston and connecting rod assembly and cleaning parts. *See 'Piston and Connecting Rod' Page 21.*

Scored cylinders. This will require reboring of the cylinders and fitting with new pistons and rings. If scored too severely, an entirely new cylinder block may be necessary.

IGNITION

See 'Magneto Ignition Spark', Page 11 or 'Distributor-Battery Ignition', Page 12: No spark may also be attributed to the following:

Ignition cable disconnected from magneto or spark plugs.

Broken ignition cables, causing short circuits.

Ignition cables wet or soaked.

Spark plug insulators broken.

Spark plugs wet or dirty.

Spark plug point gap wrong. *See Page 15.*

Condensation on spark plug electrodes.

Magneto or distributor breaker points pitted or fused.

Magneto or distributor breaker arm sticking.

Magneto or distributor condenser leaking or grounded.

Spark timing wrong. *See 'Magneto Timing', Page 12, or 'Distributor-Battery Ignition', Page 12.*

ENGINE MISSES

Spark plug gap incorrect. *See Page 15.*

Worn and leaking ignition cables.

Weak spark. *See 'Magneto Ignition Spark', Page 11, or 'Distributor-Battery Ignition', Page 12.*

Loose connections at ignition cable.

Magneto or distributor breaker points pitted or worn.

Water in gasoline.

Poor compression. *See 'Compression', Page 17.*

ENGINE SURGES OR GALLOPS

Carburetor flooding.

Governor spring hooked into wrong hole in lever. *See 'Governor Adjustment', Page 24.* Governor rod incorrectly adjusted. *See 'Governor Adjustment', Page 24.*

ENGINE STOPS

Fuel tank empty.

Water, dirt or gum in gasoline.

Gasoline vaporized in fuel lines due to excessive heat around engine (Vapor Lock). *See 'Stopping Engine', Page 9.*

Vapor lock in fuel lines or carburetor due to using winter gas (too volatile) in hot weather.

Air vent hole in fuel tank cap plugged. Engine scored or stuck due to lack of oil.

Ignition troubles. *See 'Ignition', Page 17.*

ENGINE OVERHEATS

Crankcase oil supply low. Replenish immediately.

Ignition spark timed wrong. *See 'Magneto Timing', Page 12, or 'Distributor-Battery Ignition', Page 12.*

Low grade of gasoline.

Engine overloaded.

Restricted cooling air circulation.

Part of air shroud removed from engine.

Dirt between cooling fins on cylinder or head.

Engine operated in confined space where cooling air is continually recirculated, consequently becoming too hot.

Carbon in engine.

Dirty or incorrect grade of crankcase oil.

Restricted exhaust.

Engine operated while detonating due to low octane gasoline or heavy load at low speed.

ENGINE KNOCKS

Poor grade of gasoline or of low octane rating. *See 'Fuel', Page 8.*

Engine operating under heavy load at low speed.

Carbon or lead deposits in cylinder head.

Spark advanced too far. *See 'Magneto Timing', Page 12, or 'Distributor-Battery Ignition', Page 12.*

Loose or burnt out connecting rod bearing.

Engine overheated due to causes under previous heading.

Worn or loose piston pin.

ENGINE BACKFIRES THROUGH CARBURETOR

Water or dirt in gasoline.

Engine cold.

Poor grade of gasoline.

Sticky inlet valves. See 'Valves', Page 22.

Overheated valves.

Spark plugs too hot. See 'Spark Plug', Page 15.

Hot carbon particles in engine.

DISASSEMBLY AND REASSEMBLY OF VH4 ENGINE

Engine repairs should be made only by a mechanic who has had experience in such work. When disassembling the engine, it is advisable to have several boxes available so that parts belonging to certain groups can be kept together, such as, for instance, the cylinder head screws, etc. Capscrews of various lengths are used in the engine, therefore great care must be exercised in reassembly so the right screw will be used in the various places, otherwise damage may result.

Tighten the capscrews and nuts of the manifolds, cylinder heads, gear cover, oil pan, connecting rods, cylinder blocks, main bearing plate and the spark plugs to the specified torque readings indicated in the following paragraphs of reassembly.

While the engine is partly or fully dismantled, all of the parts should be thoroughly cleaned. Remove all accumulated dirt between the fins.

If it is desired to disassemble the engine, the following order should be substantially adhered to. As disassembly progresses, the order may be altered somewhat if desired, as will be self-evident to the mechanic. Reassembly of the engine should be made in the reverse order.

TESTING REBUILT ENGINE

An engine that has been completely overhauled, such as having the cylinders rebored and fitted with new pistons, rings and valves, should go through a thorough "run-in" period, before any amount of load is applied to the engine.

The engine should be started and allowed to run for about one-half hour, at about 1200 to 1400 R.P.M. without load. The R.P.M. should then be increased to engine operating speed, still without load, for an additional three and one-half to four hours.

The proper "running-in" of the engine will help to establish polished bearing surfaces and proper clear-

ances between the various operating parts and thus add years of trouble free service to the life of your engine.

ACCESSORIES

The air cleaner, oil filter, magneto, and if an electric starter and generator are used, these should be removed first.

Remove clutch or clutch reduction unit if engine is equipped with either of these accessories.

SHEET METAL HOUSE

On power units, remove the muffler and canopy first. Disconnect air cleaner, choke, governor control and instrument wires at the front house panel. The front panel can be removed as part of the flywheel shroud, as explained in the following paragraphs of disassembly.

FLYWHEEL

After the flywheel screen has been removed, drive out the starting crank pin in the crankshaft and remove the flywheel nut and washer.

The flywheel is mounted to a taper on the crankshaft. Take a firm hold on the flywheel fins, pull outward and at the same time strike the end of the crankshaft with a babbitt hammer, see Fig. 18. The flywheel will slide off the taper of the crankshaft. Do not use a hard hammer as it may ruin the crankshaft and bearings. When reassembling the flywheel, be sure the Woodruff key is in position on the shaft and that the keyway in the flywheel is lined up accurately with the key.

AIR SHROUDING

To disassemble air shrouding, refer to Fig. 19. First remove cylinder head covers and the screws mount-

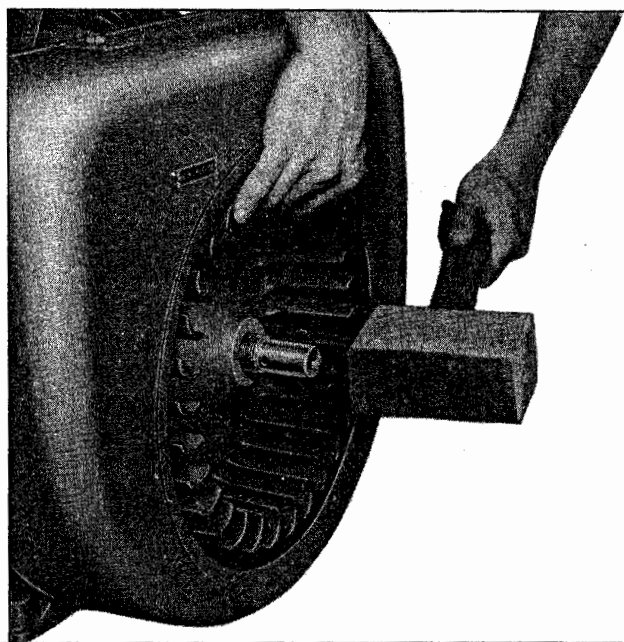


Fig. 18

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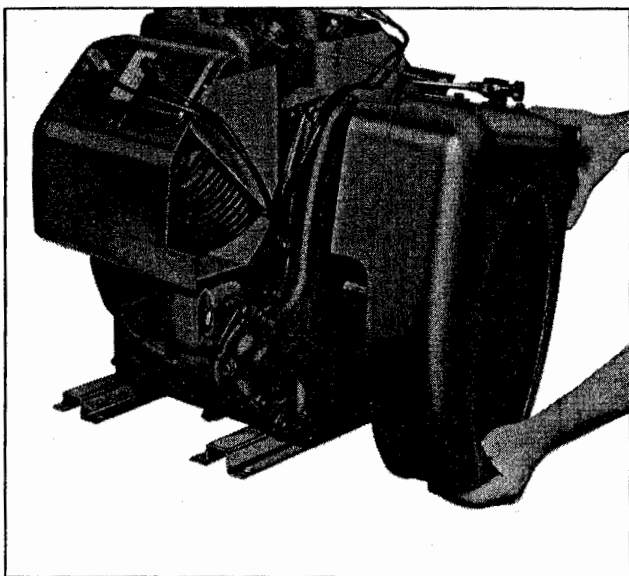


Fig. 19

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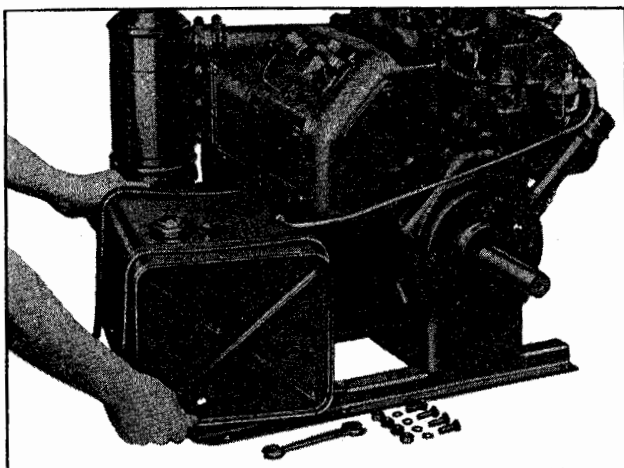


Fig. 20

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ing the flywheel shroud to the lower cylinder shrouds and cylinder heat deflectors, then remove the screws holding the flywheel shroud to gear cover.

On power units, remove the front end panel together with flywheel shroud. Remove the rear end panel complete with fuel tank. Balance of shrouding can now be readily removed.

In Reassembly; use the *thin head* capscrews, for mounting the flywheel shroud, in the two holes close to the horizontal centerline. This is for *stator* clearance on engines with flywheel alternator.

FUEL TANK

If a side mount fuel tank is used, disconnect fuel line and remove tank assembly as illustrated in Fig. 20.

CARBURETOR AND MANIFOLD

The carburetor and manifold can be removed as a complete unit. **In reassembly;** tighten the manifold nuts to **18 ft. lbs. torque**. Tightening beyond specifications may cause the flanges to break.

CYLINDER HEAD

The cylinder head must be removed if it is necessary to regrind valves, or to work on the piston, rings or connecting rods. All of the cylinder head screws are plainly in view and can be easily removed. Screws of different lengths are used but these can be properly reassembled according to the various lengths of cylinder head bosses.

In reassembly; remove all carbon and lead deposits from combustion chamber. It is recommended that new cylinder head gaskets be used as the old gaskets will be compressed and hard and may not seal properly. Use a mixture of graphite and oil on the cylinder head screws to prevent them from rusting tight against the cylinder block. Tighten cylinder head screws to **24 ft. lbs. torque** in the sequence shown in Fig. 21. After complete assembly and engine is run in, re-torque head screws.

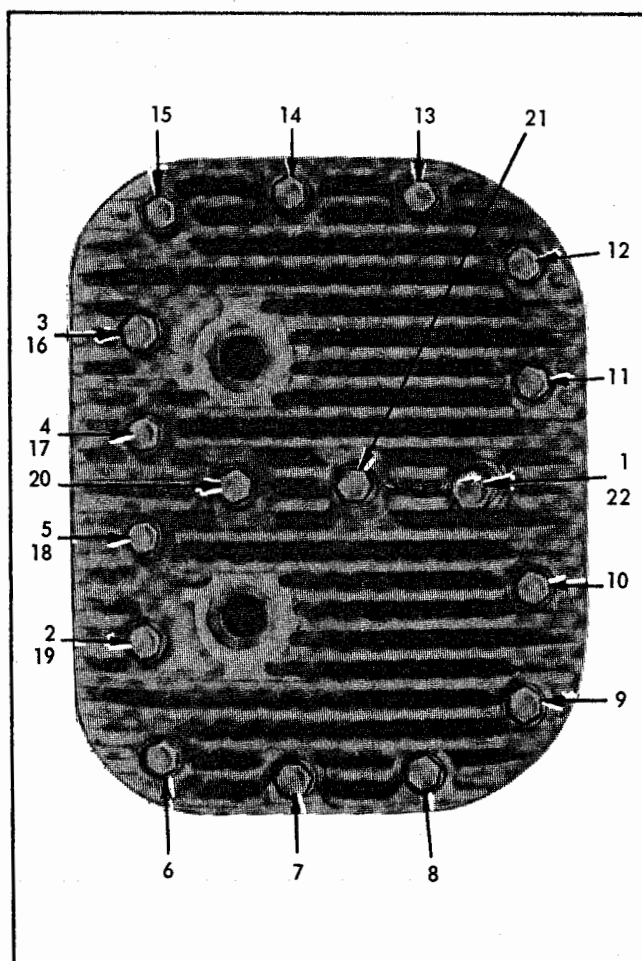


Fig. 21

GEAR COVER

Disconnect the governor linkage and remove governor housing and gear-flyweight assembly from shaft in gear cover. Take out the ten gear cover capscrews and drive out the two dowel pins as shown in Fig. 23. The cover can then be taken off – exposing the gear train as illustrated in Fig. 24.

In reassembly; inspect crankshaft oil seal and replace if necessary. Be sure that oil sling is in place on crankshaft, then mount gear cover using a new flange gasket. Tap the two dowel pins in place and mount capscrews. Tighten screws 14 to 18 ft. lbs. torque.

CAMSHAFT GEAR

If it is necessary that the camshaft gear be removed, first pry oil sling off crankshaft, and remove thrust plunger and spring from end of camshaft. Take out the three capscrews and lockwashers, and remove gear from camshaft using a screw driver or similar wedge tool.

The *camshaft gear* has offset mounting holes to provide accurate assembly for valve timing. The gear can only be put on the correct way for matching up the timing mark with that of the crankshaft gear. See Fig. 24.

IDLER GEAR AND SHAFT

A tapped hole in the side of the crankcase contains a setscrew for locking idler shaft in place. See Fig. 25. Remove screw with a 5/32" Allen wrench. Disassemble shaft and gear from case by means of the 3/8"-16 tapped puller hole in end of idler shaft.

In reassembly; be sure oil groove in shaft is facing up. Drive shaft into crankcase with soft metal hammer and maintain a .003 to .004 inch clearance between idler gear and shoulder of shaft. Lock shaft in place with the Allen set screw.

OIL PAN

The engine can now be inverted so that the supports and oil pan can be removed, see Fig. 26.

In reassembly; tighten oil pan mounting screws, 6 to 9 foot pounds torque.

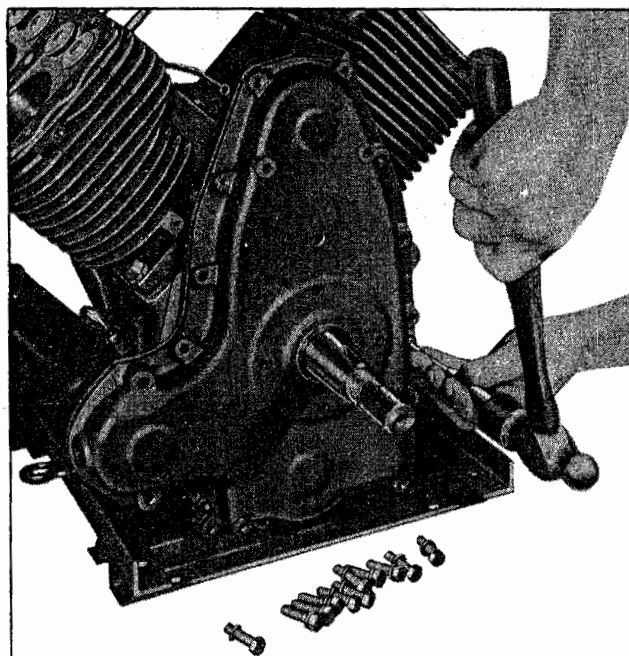


Fig. 23

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OIL PUMP (Fig. 27)

Remove locknut and driver gear from shaft. If gear is too tight to remove by hand, use a puller, *hammering* on end of shaft to loosen gear will *damage pump*.

Take out slotted pipe plug from bottom of crankcase. By means of a 5/32 inch Allen wrench, remove lock-screw from pipe plug hole. Withdraw oil pump from inside crankcase. If pump fits too tight to remove by hand, tap front of pump housing (not shaft), with hammer and brass rod.

PISTONS and CONNECTING RODS (Figs. 28, 29, 32)

By means of a 1/2" socket wrench, loosen and remove the hex locknuts from connecting rod bolts. Then, by tapping the ends of the bolts lightly, the connecting rod cap will break free from the bolts.

Scrape off all carbon deposits that might interfere with removal of pistons from upper end of cylinder. Turn

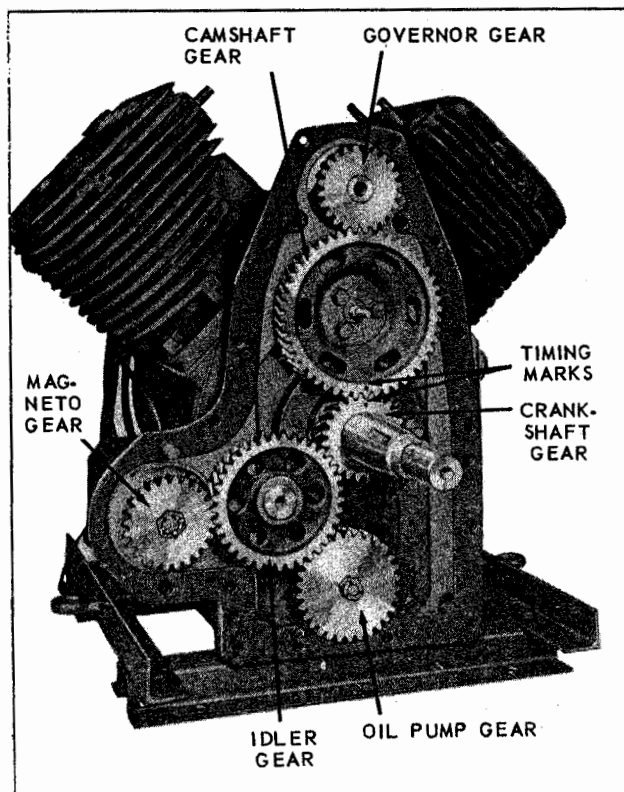


Fig. 24

104716C-1

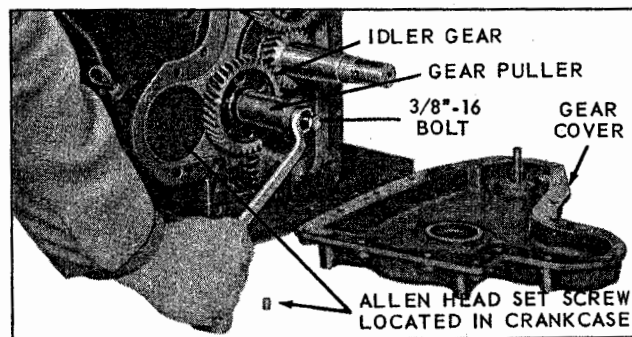


Fig. 25

71066C

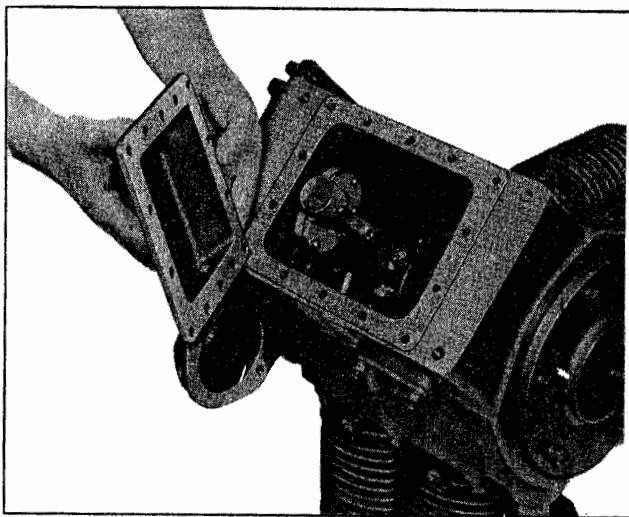


Fig. 26

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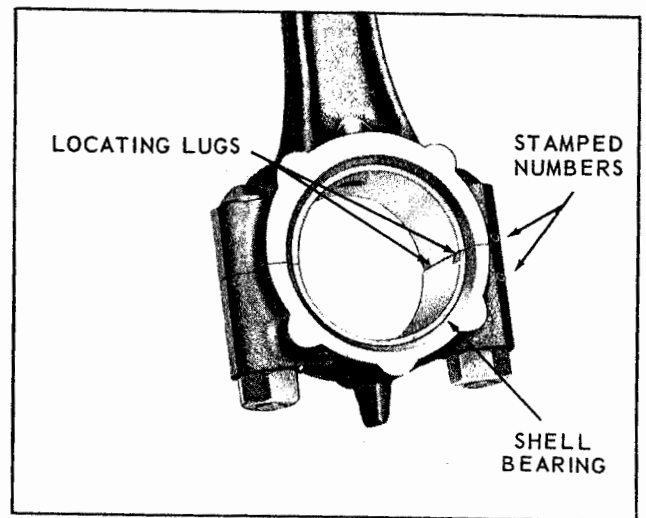


Fig. 28

316307C



Fig. 27

180178C

crankshaft until piston is at top, then push connecting rod and piston assembly upward and out thru top of cylinder. Be careful not to mar the crank pin by allowing the rod bolts to strike or scrape across it. Place caps on rods immediately so that they will not be mismatched in reassembly. Be sure that shims (used in babbitt bearing rods), are in place before cap is put on.

NOTE: These models of engines were originally furnished with *babbitt cast* connecting rod bearings. *Shell bearing* rods are now being used for current production engines, and are interchangeable with babbitt bearing rods for service replacement. Care should be taken *in reassembly* to mount bearings properly. The cap should be assembled to the rod so that the *locating lug* of both bearing halves are on the same side as illustrated in *Fig. 28*. Refer to chart, *Fig. 32*, for clearance between bearing and crank pin.

The piston skirt is *cam-ground* to an elliptical contour. Clearance between the piston and cylinder must be measured at the center of the thrust face at the bottom of the piston skirt. Refer to Chart, *Fig. 32*, for proper clearance. The thrust faces on the piston skirt

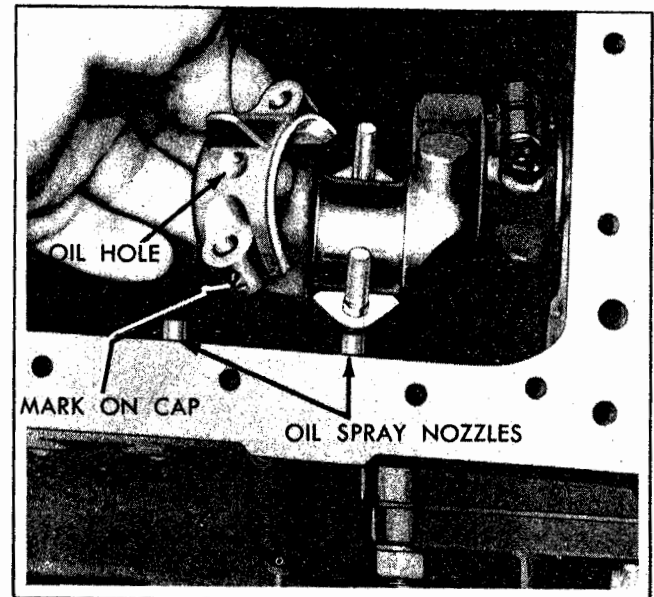


Fig. 29

104819C

are 90° from the axis of the piston pin hole, with the wide section of the piston skirt toward the maximum thrust side, or opposite the crankshaft rotation. See *Engine Sectional*, *Fig. 2*.

In reassembly; be sure piston and connecting rod assemblies are put back into the same bore from which they were removed. Use a suitable ring compressor and stagger the piston ring gaps 90° apart around the piston. Oil the pistons, rings, wrist pins, rod bearings and cylinder walls before assembly.

CAUTION: Identical numbers are stamped on the side of the rod with its corresponding cap. These numbers must be on the same side of the connecting rod when mounted in engine. Be sure that *oil hole* in connecting rod cap is facing toward the oil spray nozzle, as illustrated in *Fig. 29*. **Install new nuts** on connecting rod bolts and **torque 22 to 28 foot pounds**.

PISTON RINGS (Fig's. 30, 31, 32)

If a ring expander tool is not available, install rings by placing the open end of ring on piston first, as shown in *Fig. 30*. Spread ring only far enough to slip



Fig. 30

71152C

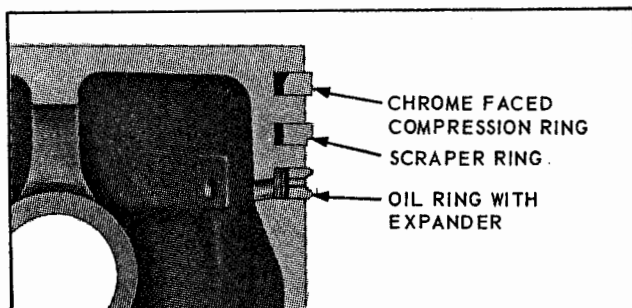


Fig. 31

285335C

over piston and into correct groove, being careful not to distort ring. Install bottom ring first and work toward the head of the piston, installing top ring last. The word '**TOP**' on compression and scraper rings indicates direction of ring placement on piston.

Beginning with serial #5538322, *three ring* pistons (chrome faced compression ring, scraper ring, oil ring and expander), with improved oil control characteristics, replaces four ring pistons furnished with two compression rings.

CAUTION: When replacing four ring pistons with three ring pistons, a complete set of *four pistons* must be used. **Do not** mix three and four ring pistons in the same engine.

The outer diameter of the compression ring is *chrome plated*. Mount scraper ring with scraper edge down, otherwise oil pumping and excessive oil consumption will result. Refer to Fig. 31 for the correct placement of piston rings.

CYLINDER BLOCKS

Clean all dirt and foreign deposits from between the cylinder fins and manifold ports.

The cylinder blocks do not have to be removed unless the cylinder bore is scored, out-of-round, or worn over-size more than 0.005 inch. In this event, the block will have to be removed, rebored and fitted with over-size pistons and rings. This work should be done by an authorized Wisconsin Service Center.

In Reassembly; tighten the cylinder block mounting nuts, 40 to 50 foot pounds torque.

PISTON TO CYLINDER AT PISTON SKIRT THRUST FACE		.003 to .004"
PISTON RING GAP		.010 to .020"
PISTON RING SIDE CLEARANCE IN GROOVES	TOP RING	.002 to .004"
	SCRAPER RING	.002 to .004"
	OIL RING	.001 to .003"
PISTON PIN TO CONNECTING ROD BUSHING		.0004 to .0012"
PISTON PIN TO PISTON		.0000 to .0008" tight
CONNECTING ROD TO CRANK PIN - SIDE CLEARANCE		.009 to .016"
CONNECTING ROD SHELL BEARING TO CRANK PIN DIA. (VERTICAL)		.0012 to .0033"
CONNECTING ROD BABBITT BEARING TO CRANK PIN		.0007 to .0020"

Fig. 32, PISTON, RING AND ROD CLEARANCES CHART

VALVES and SEAT INSERTS (Fig. 33)

Remove valve tappet inspection plate and compress valve springs with a standard automotive type valve lifter as illustrated. Insert a rag in the opening at the bottom of valve chamber so the retaining locks do not fall into engine crankcase. Remove retaining locks, seats, springs, valves and clean these, as well as the ports and guides, of all carbon and gum deposits. Tag each valve so that in reassembly they will be mounted in the same guide they were removed from. Replace valves that are burned or pitted.

The inlet and exhaust valve *seat inserts* can be removed, when replacement becomes necessary, by means of Wisconsin Motor *DF-66-A* insert puller.

Before grinding valves, inspect valve guides for possible replacement. Refer to *Valve Guide* paragraph. The valve face is ground at 45° to the vertical center line of the valve stem and the valve seat insert should also be ground at a 45° angle. **After grinding,** lap valves in place until a uniform ring will show entirely around the face of the valve. Clean valves and wash block thoroughly with a hot solution of soap and water. Wipe cylinder walls with clean lint free rags and light engine oil, especially if cylinders were rebored and honed.

Valve guides in the cylinder block are easily replaceable by use of Wisconsin *DF-72* driver tool.

In Reassembly; mount guides with inside chamfer down. The valve stem has a clearance of .003 to .005" in the guide. When the clearance becomes

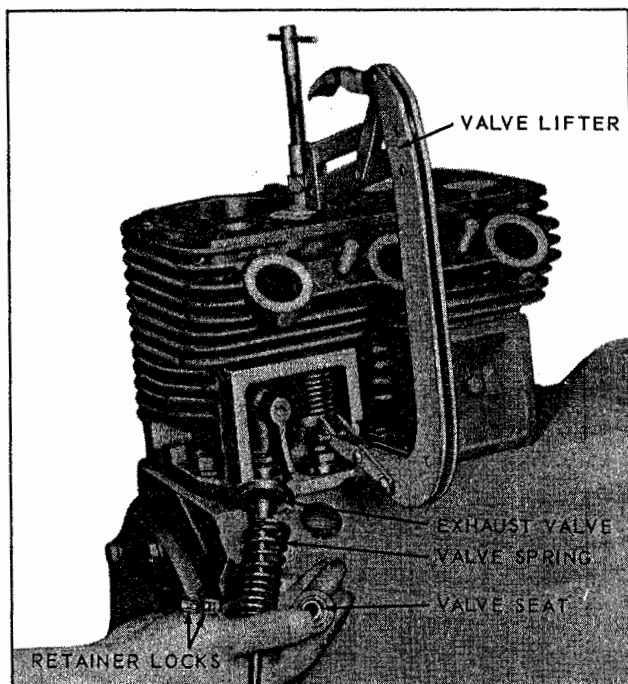


Fig. 33

180188C

.007", the guides should be driven out and replaced with new guides.

These engines that have *Stellite* exhaust valves and inserts are designated as Model **VH4D** and are equipped with *positive* type *exhaust valve rotators*. The action of the rotocap, which rotates the valve slightly each time the valve opens, helps prevent sticky valve and will impart a wiping action between the valve face and valve seat, thereby preventing the build-up of foreign deposits. Valve rotation will also avoid prolonged exposure of any one sector of the valve face to a local hot spot on the seat which will result in lower and more uniform valve face-seat temperatures.

CRANKSHAFT

To remove the crankshaft, first remove the six cap-screws in the main bearing plate at the take-off end of the engine. This plate can then be pried off, and crankshaft removed from that end of crankcase. See Fig. 34. Be sure to keep shims and gaskets in place as these are necessary to give the proper end play to

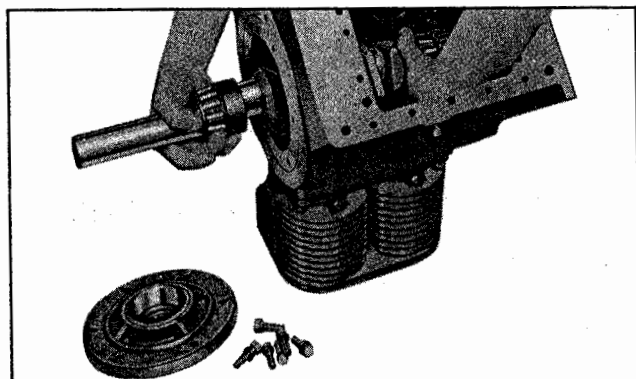


Fig. 34

71075C

the tapered roller main bearings on the crankshaft. This *end play* should be .002 to .004 inch when engine is cold. There is practically no wear in these bearings so that no readjustment is necessary after proper assembly.

When reassembling crankshaft, the timing marks on the crankshaft gear and the camshaft gear must be matched as shown in Fig. 24, otherwise engine will not operate properly, or if timing is off considerably, engine will not run at all.

The mounting holes for the main bearing plate are off-set in such a manner that it can only be mounted in the correct position. Tighten main bearing plate capscrews, 25 to 30 foot pounds torque.

CAMSHAFT

The camshaft must be withdrawn from the flywheel end of the engine as shown in Fig. 35. When reassembling, be sure the spring and plunger are in place in the end of the camshaft, as they hold the camshaft in position endwise. These parts are shown in the sectional view of the engine, Fig. 2.

VALVE TAPPETS

The valve tappets are taken out after the camshaft is removed. In reassembly, the tappets must of course be inserted in proper position in crankcase, before the camshaft is assembled.

After the cylinder blocks have been assembled to the crankcase, adjust the valve tappets as shown in Fig. 36. With the tappets in their lowest positions, engine cold, the clearance should be .008 inch for the *inlet* and .016 inch for the *exhaust*, with or without *Stellite* valves.

GOVERNOR - OPERATION

The centrifugal flyball governor rotates on a stationary pin driven into the upper part of the timing gear

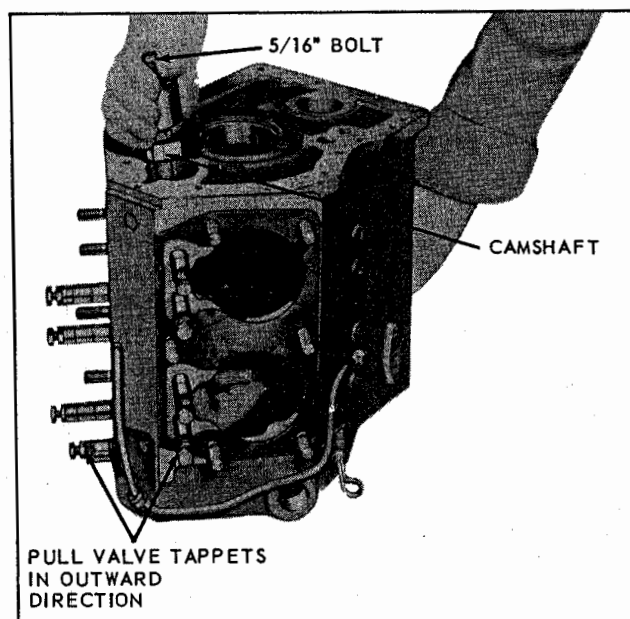


Fig. 35

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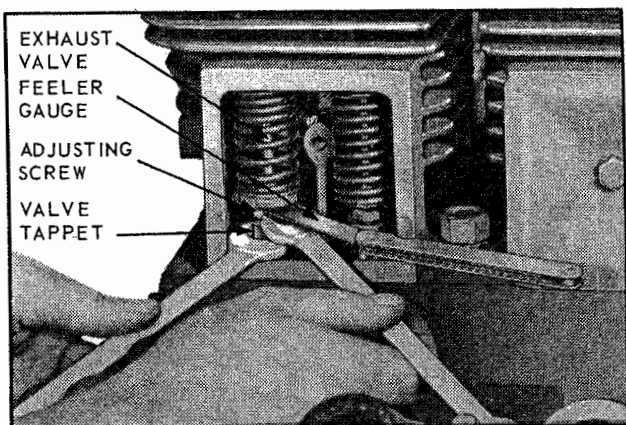


Fig. 36

180186C

cover, and the governor is driven off the camshaft gear at crankshaft speed.

Flyweights are hinged to lugs on the drive gear. Hardened pins on the flyweights bear against the flanged sliding sleeve, moving it back and forth as the flyweights move in or out. The motion of the sleeve is transmitted through a ball thrust bearing to the governor lever, which in turn is connected to the carburetor throttle lever. A spring connected to the governor lever tends to hold the governor flyweights to their *inner* position, also to hold the carburetor throttle open. As the engine speed increases, the centrifugal force in the flyweights acts against the spring and closes the throttle to a point where the engine speed will be maintained practically constant under varying load conditions. This speed can be varied to suit conditions by adjusting the governor spring tension to suit.

GOVERNOR ADJUSTMENT

The governor rod connection to the carburetor must be very carefully adjusted for length, otherwise the governor will not function properly and cause the engine to surge badly. With the engine at rest, the governor spring will keep the flyweights *in*, and the control rod must be of such length as to hold the carburetor throttle wide open at that point. The accuracy of this adjustment can be tested by disconnecting the control rod from the governor lever, and then pushing the rod toward the carburetor as far as it will go. This will open the throttle wide. The governor lever should then be moved as far as possible in the same direction, all of this being done with the rod disconnected from the lever. Holding both parts in the above position, the rod should be screwed into the swivel block on the carburetor, until the bent end of the rod will register with the hole in the lever, then, screw the rod in two more turns. Insert the rod into the hole in the governor lever and assemble cotter pin. With the governor lever pushed toward the carburetor as far as it will go, there should be about a 1/16 inch clearance between the throttle lever and the stop pin on the carburetor. The clearance will cause the lever to bounce back from the stop pin, rather than jam against the pin, when a load is suddenly applied to an idling engine. This will eliminate excessive wear on the threads in the carburetor throttle swivel block.

LOAD R.P.M.	STANDARD Vertical Mounted Carburetor		SPECIAL Horizontal Mtd. Carburetor - Top Mtd. Distributor		GOVERNOR LEVER
	NO LOAD R.P.M.	HOLE NO.	NO LOAD R.P.M.	HOLE NO.	
1400	1525	4	1600	4	
1500	1650	5	1735	5	
1600	1725	5	1775	5	
1700	1850	6	1905	6	
1800	1950	7	2050	7	
1900	2025	7	2115	7	
2000	2150	8	2230	8	
2100	2225	8	2300	8	
2200	2350	9	2430	9	
2300	2425	9	2480	9	
2400	2550	10	2625	10	
2500	2625	10	2685	10	
2600	2750	11	2795	11	
2700	2850	12	2930	12	
2800	2925	12	3005	12	

Fig. 37

The governor lever is furnished with 12 holes, as shown in *Fig. 37*, for attaching the governor spring. It is very important that the spring is hooked into the proper hole to suit the speed at which the engine is to be operated. The Governor Lever Chart, *Fig. 37*, shows the *full load* and *no load* speeds of the engine and the hole corresponding thereto. Note that the *full load* speed is less than the *no load* speed and this must be taken into consideration when readjusting the governor. As an example; if the engine is to be operated at 2000 revolutions per minute under load, the spring should be hooked into the *8th* hole in the governor lever, and the spring tension adjusted by means of the adjusting screw, to run 2150 R.P.M. at no load. When load is applied, the engine will run at approximately 2000 R.P.M.

A tachometer or revolution counter should be used against the crankshaft to check speed while adjusting the governor spring tension. Tightening the adjusting screw locknut will give higher speeds, while loosening the locknut will lower the spring tension and reduce the R.P.M.

NOTE: The settings, in the column of *Fig. 37* marked *special*, are for engines that have an Ignition Distributor attached to and driven off the governor. These engines have a horizontal mounted carburetor, resulting in governor settings different than standard.

CLUTCH AND REDUCTION GEARS

CLUTCH

The clutch furnished with this model of engine is of the disc type running in oil. Use the same grade of oil in the clutch as is used in the engine crankcase. The oil should be filled through the inspection plate opening, to the height of the oil level plug. Approximately a pint of oil is required. See *Fig. 38*.

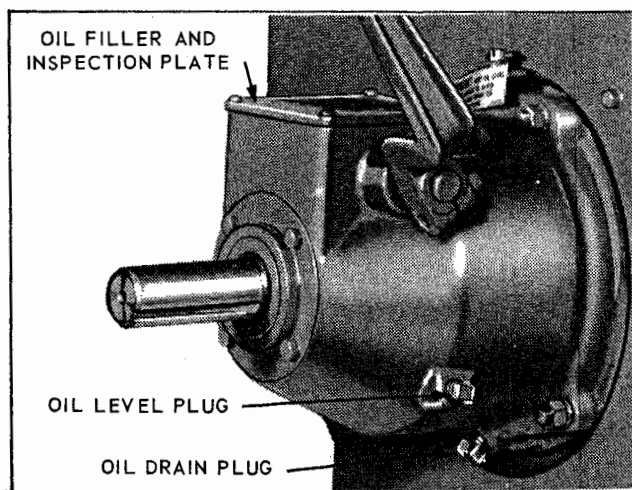


Fig. 38

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CLUTCH ADJUSTMENT

If the clutch begins to slip, it should be readjusted, otherwise it will become overheated and damaged. First remove the inspection plate which will expose the notched *adjusting ring*. Release the *clutch*, by pushing the *engaging lever* forward. Turn engine over until the clutch *adjustment lock* is visible thru the inspection opening. Loosen *adjustment lock screw*, one full turn. Keep the engine crankshaft from turning, then, by means of a screw driver as shown in Fig. 39, turn the *adjusting ring*, one notch at a time in a clockwise direction, until a very firm pressure is required to engage the clutch with the lever. Be sure that the clutch cams snap over-center on final adjustment. Securely tighten adjustment lock screw. Assemble inspection plate, being sure that the gasket fits properly and is not broken.

CLUTCH REDUCTION UNIT

ADJUSTMENT

The clutch in the clutch reduction unit is the same as used in the clutch take-off assembly. The clutch adjustment is made thru two pipe tap openings; one for the *adjustment lock screw* and the other for turning the *adjusting ring*, as illustrated in Fig. 40. There are four ½ inch square head pipe plugs in the housing, to provide a means of adjusting the clutch regardless of what position the unit is mounted in.

Remove the two pipe plugs on the side of the housing (if not accessible, use the two optional taps). Disengage the clutch and turn engine over slowly with a hand crank until the *adjustment lock screw* is visible thru the pipe plug opening nearest to the engine. Loosen *lock screw* one full turn, or enough to relieve the tension of the lock against the notches on the *adjusting ring*. Then, turn engine over slightly to expose the *notches on adjusting ring*. Keep engine crankshaft from turning, while thru the adjacent pipe plug opening, turn the *adjusting ring* with a screw driver, one notch at a time in a clockwise direction (viewing from take-off end), until a very firm pressure is required to engage the clutch with the lever. Tighten adjustment lock screw and mount pipe plugs, when adjustment is completed.

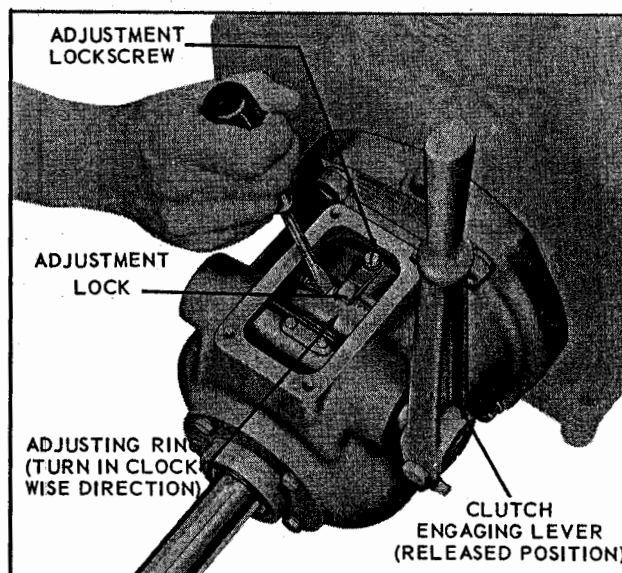


Fig. 39

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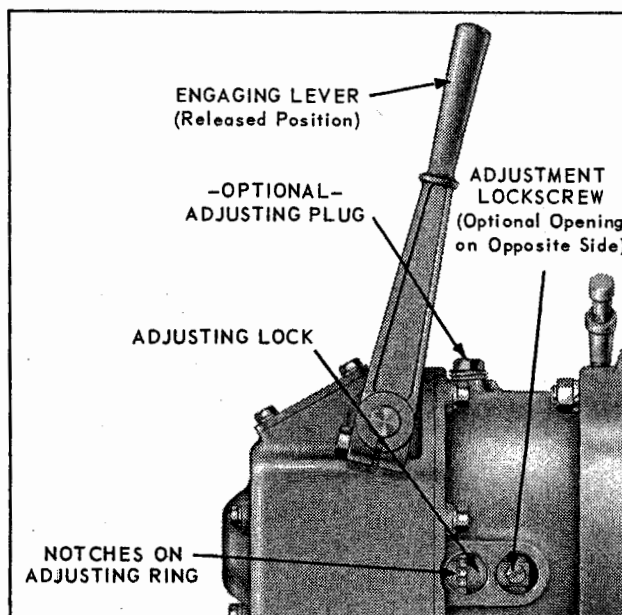


Fig. 40

275568C

REDUCTION GEARS

Reduction gears are furnished with several different ratios, some with spur gears, others with chains. All are of the same general design, except that some are furnished with clutches, others without, and for various installations can be mounted with the take-off shaft in either a 3, 6, 9 or 12 o'clock position. Use the same grade of oil in the reduction unit as is used in the engine crankcase.

Several plugs are furnished so that lubrication may be properly taken care of regardless of the position of the installation. There will always be one plug on top to be used for filling oil, a plug below for draining oil, and there will be one plug on the side slightly above the bottom, to be used as an oil level plug. See Fig. 41.

The oil should always be filled when the engine is at rest. When the oil becomes dirty, it should be drained, while the engine is hot, and fresh oil added. The fre-

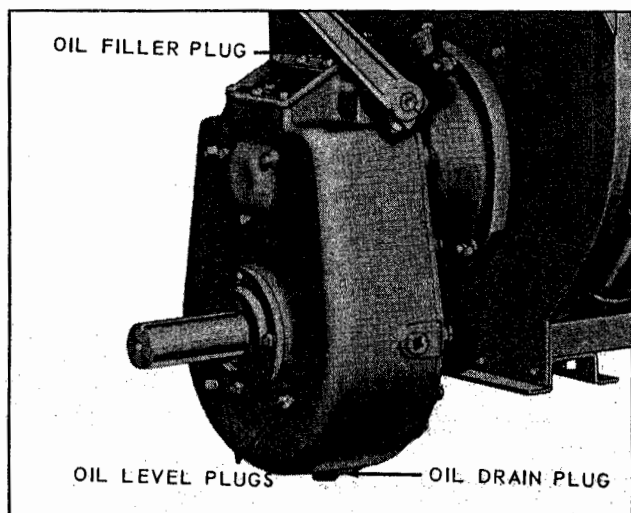


Fig. 41

76090C

quency at which these oil changes should be made depends entirely on the kind of service in which these gears are used, but even with light service the change should be made at least once every five hundred hours of operation, adding sufficient oil between changes to keep the oil up to the oil level plug.

STORAGE OF ENGINE FOR WINTER

When the season's work is completed, the following instructions should be carried out very carefully to protect the engine over winter.

The outside of the engine, including the cooling fins on the cylinders and heads, should be thoroughly cleaned of all dirt and other deposits.

The air cleaner, at the carburetor intake, should be thoroughly cleaned of all oil and accumulated dust, and the sediment removed from the oil cup at the bottom of the cleaner.

To protect the cylinders, pistons, rings and valves and keep them from rusting and sticking, a half and half mixture of kerosene and good "gasoline engine" oil (the same kind of oil as used in the crankcase of the engine), should be injected into the *pipe tap* opening on the *intake manifold* while the engine is warm and running at moderate speed. About a quarter of a pint is necessary, or enough so that a heavy bluish smoke will appear at the exhaust. The ignition switch should then be shut off and the engine stopped. This fogging operation will leave a coating of oil on the above mentioned parts, protecting them from the atmosphere.

On engines where the pipe tap opening on the intake manifold is inaccessible, the rust preventative may be injected into the air intake on the carburetor while the engine is running, so the mixture will be drawn into the engine. The air cleaner connection will of course have to be disconnected from the carburetor to do this.

All the oil should be drained from the crankcase while the engine is warm, as the oil will then flow more freely than when cold.

Drain fuel system, including gasoline lines, carburetor, fuel pump and tank of all gasoline, to prevent lead and gum sediment interfering with future operation.

The air cleaner or carburetor intake, as well as the exhaust manifold and breather openings, should be taped or otherwise sealed off, for the duration of the storage period.

All exposed unpainted metal parts should be coated with grease or heavy oil.

Before starting the engine again the next season, the crankcase drain plug should again be removed, so that any condensation, which may have collected during the winter, may be drained before new crankcase oil is added.

A good plan, and one that is recommended, is to remove the crankcase oil base in the spring before starting the engine for the new season, and scrubbing off all sediment which may have collected there.

When replacing the engine base, a new gasket should be used.

Be sure to fill the crankcase with a good quality of crankcase oil to the high level point, before starting the engine. Do not use any oil heavier than SAE No. 30. Also be sure to put oil to the proper level in the air cleaner.

It is also recommended to use new spark plugs at the beginning of the next season, especially if the engine has given considerable service.

Refuel engine and follow the starting instructions as shown on preceding pages of this manual.

It is highly recommended that machines be stored inside a building through the winter. If this is not possible, the engine should be protected from snow and ice by a proper covering.

REPAIR PARTS LIST

READ THESE INSTRUCTIONS BEFORE ORDERING PARTS

The **MODEL, SPECIFICATION and SERIAL NUMBERS** of your engine, shown on the name plate prominently located on the engine, **MUST BE GIVEN WHEN ORDERING PARTS.**

COPY THE ABOVE SPECIFIED INFORMATION INTO THE SPACES PROVIDED BELOW
SO THAT IT WILL BE AVAILABLE TO YOU WHEN ORDERING PARTS.

MODEL		SERIAL	
		NO.	
SIZE		R.P.M.	
		SPEC.	
		NO.	



**TO INSURE PROMPT AND ACCURATE SERVICE, THE FOLLOWING
INFORMATION MUST ALSO BE GIVEN.**

1. State exactly, quantity of each part and part number.
2. State definitely, whether parts are to be shipped by express, freight or parcel post.
3. State exact mailing address.

SERVICE FACILITIES

Wisconsin Engine Distributors and Service Centers, located throughout the U.S. and foreign countries, have been carefully selected in order to assure complete and efficient repair and inspection service to owners of Wisconsin Engines. These service centers, equipped and staffed for complete engine repair, also stock parts to facilitate immediate delivery for all Wisconsin Air Cooled Engine Models.

Order parts from the Wisconsin Distributor or Service Center in your locality – Refer to the Yellow Pages of the Telephone Directory under **ENGINES – GASOLINE, Wisconsin Engines.**

Do not order parts from TELEDYNE WISCONSIN MOTOR.

A **DIRECTORY** of Distributors and Service Centers is available by mailing cut-out card on back cover of this manual to Teledyne Wisconsin Motor, Product Support Center.

PARTS FOR MODEL VH4D ENGINE

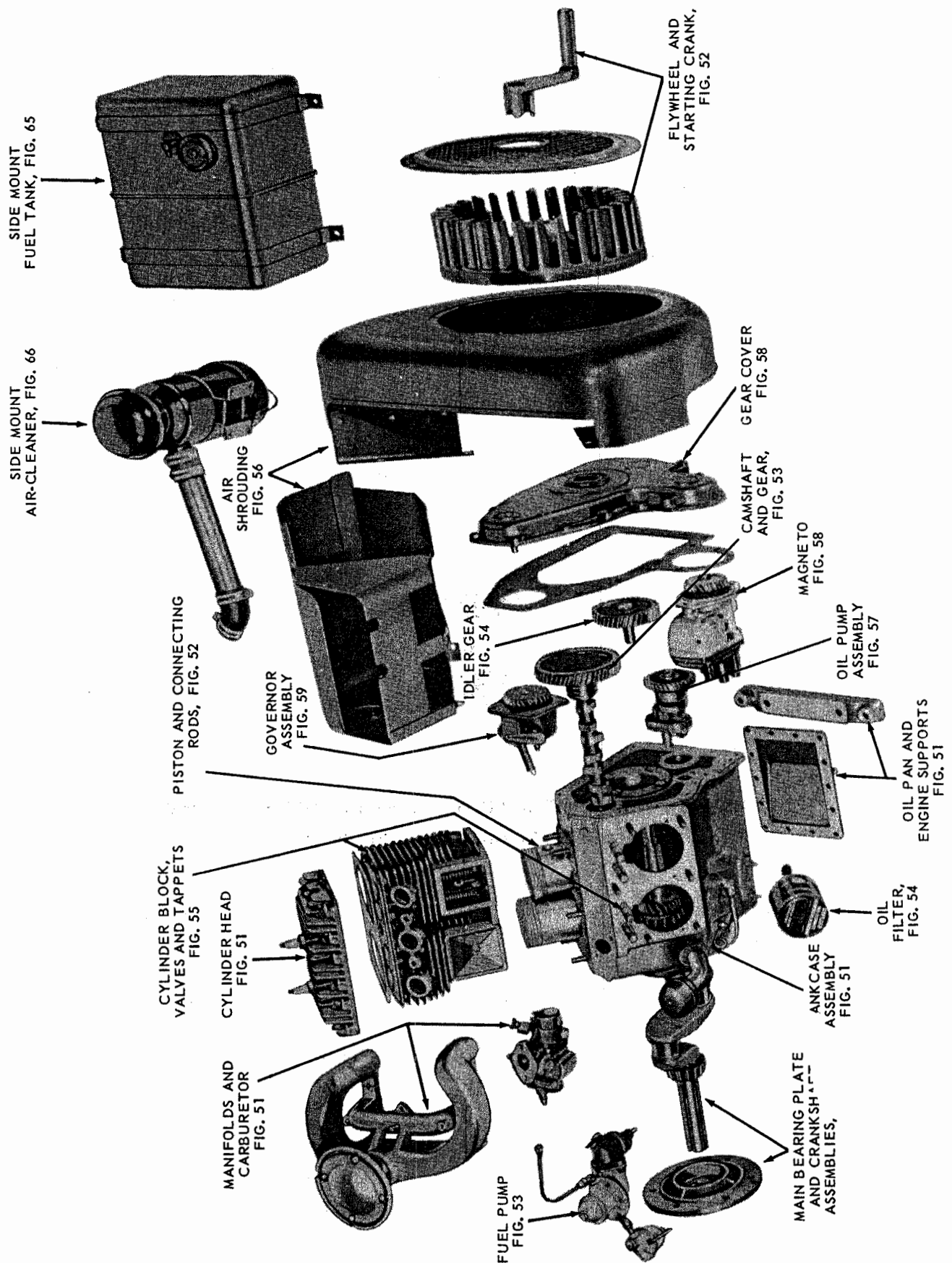


Fig. 50, EXPLODED VIEW OF ENGINE

Refer to figure numbers for break down of parts.

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PARTS FOR MODEL VH4D ENGINE

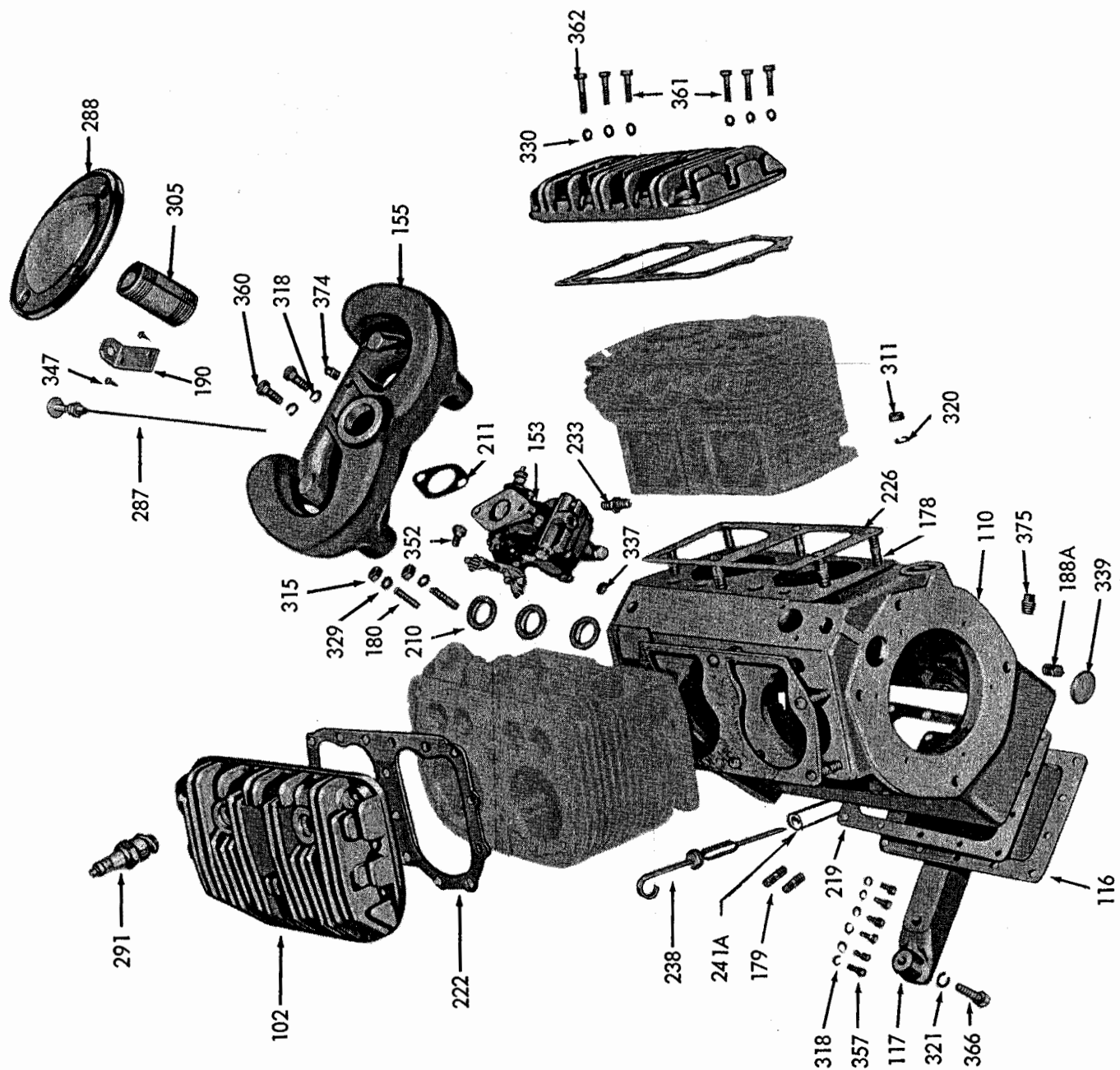


Fig. 51, MANIFOLD AND CRANKCASE GROUP

Parts are identified by reference number. See parts list for correct part number.

PARTS FOR MODEL VH4D ENGINE

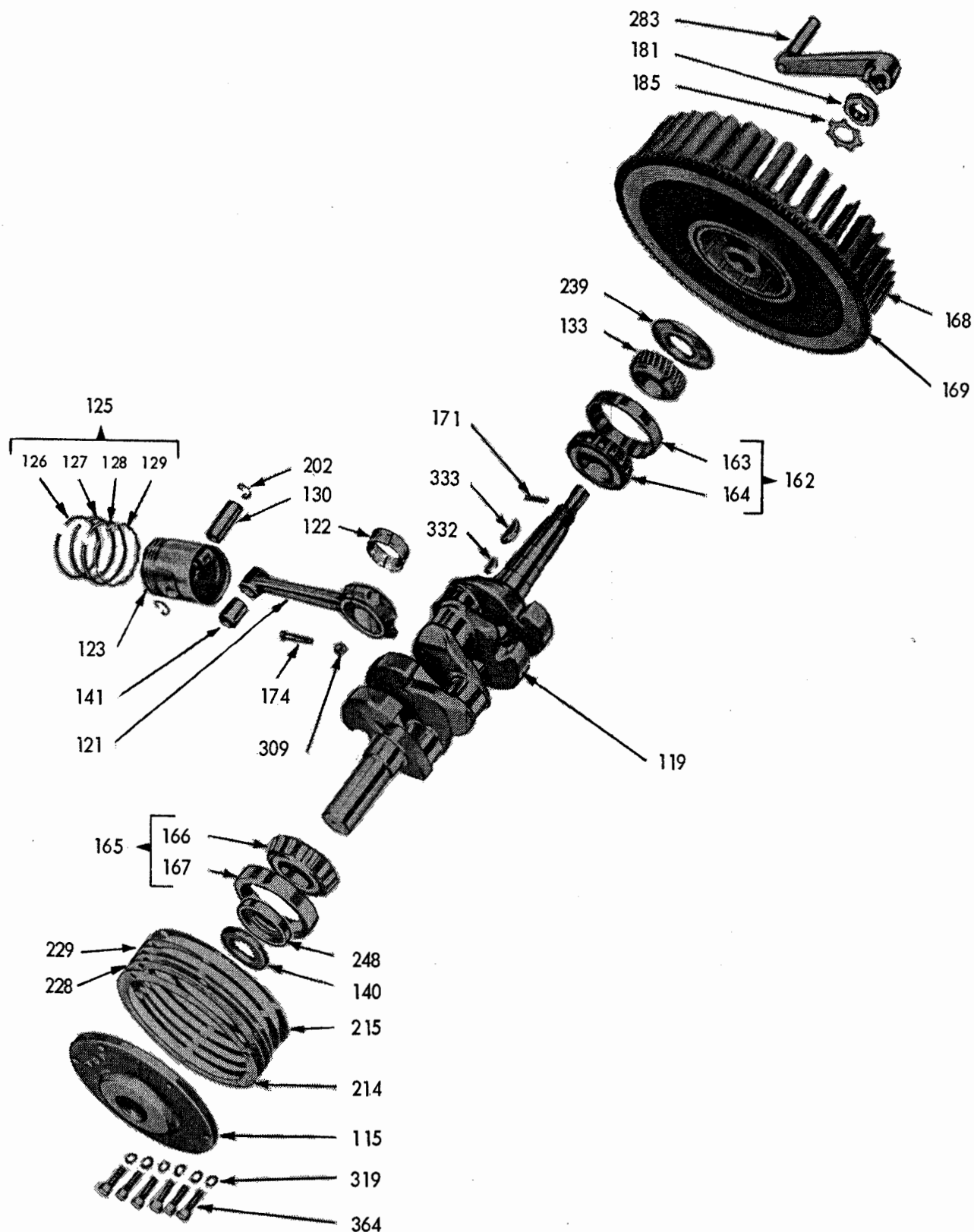


Fig. 52, CRANKSHAFT, PISTON AND CONNECTING ROD GROUP
 Parts are identified by reference number. See parts list for correct part number.

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PARTS FOR MODEL VH4D ENGINE

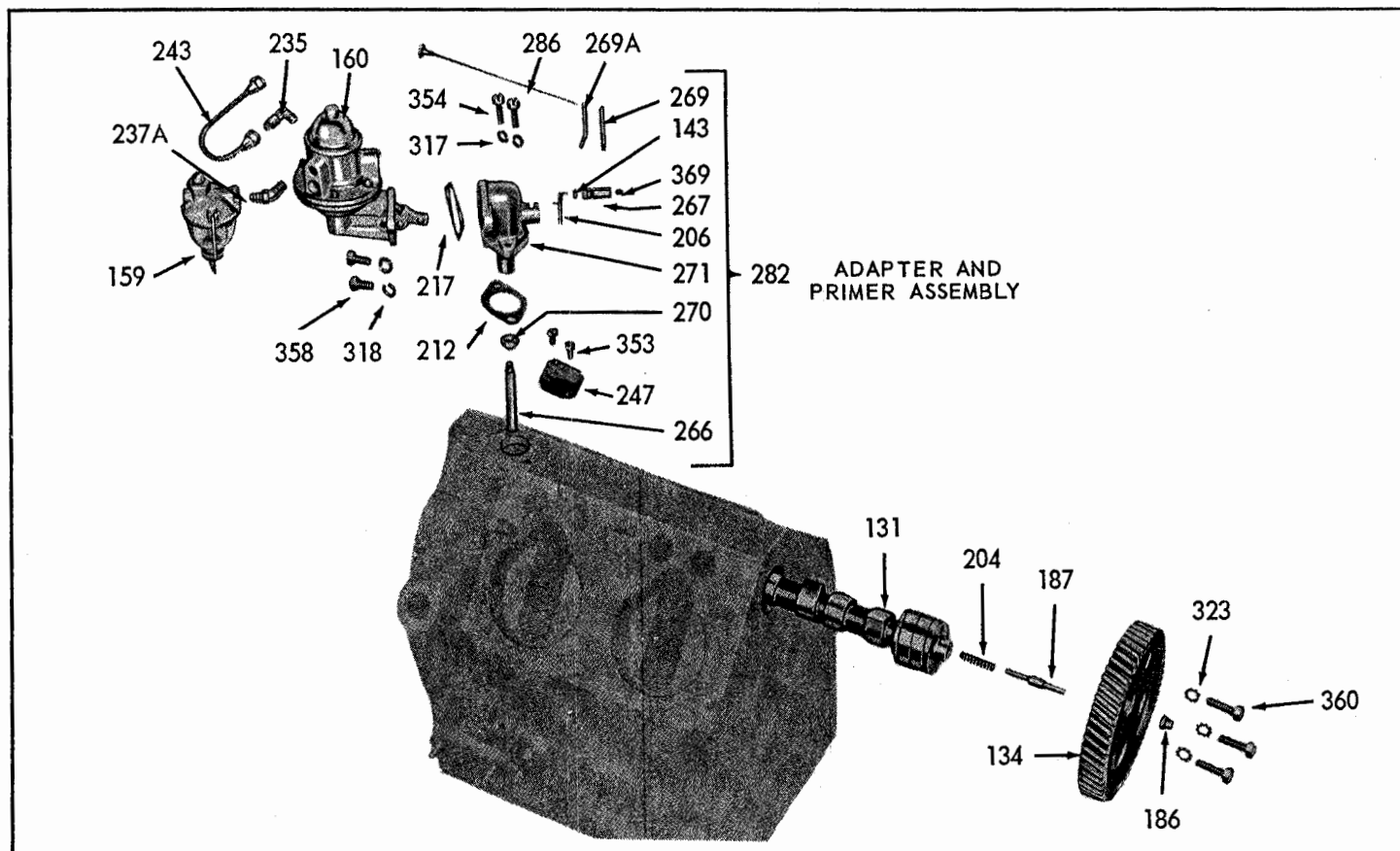


Fig. 53, CAMSHAFT AND FUEL PUMP MOUNTING GROUP

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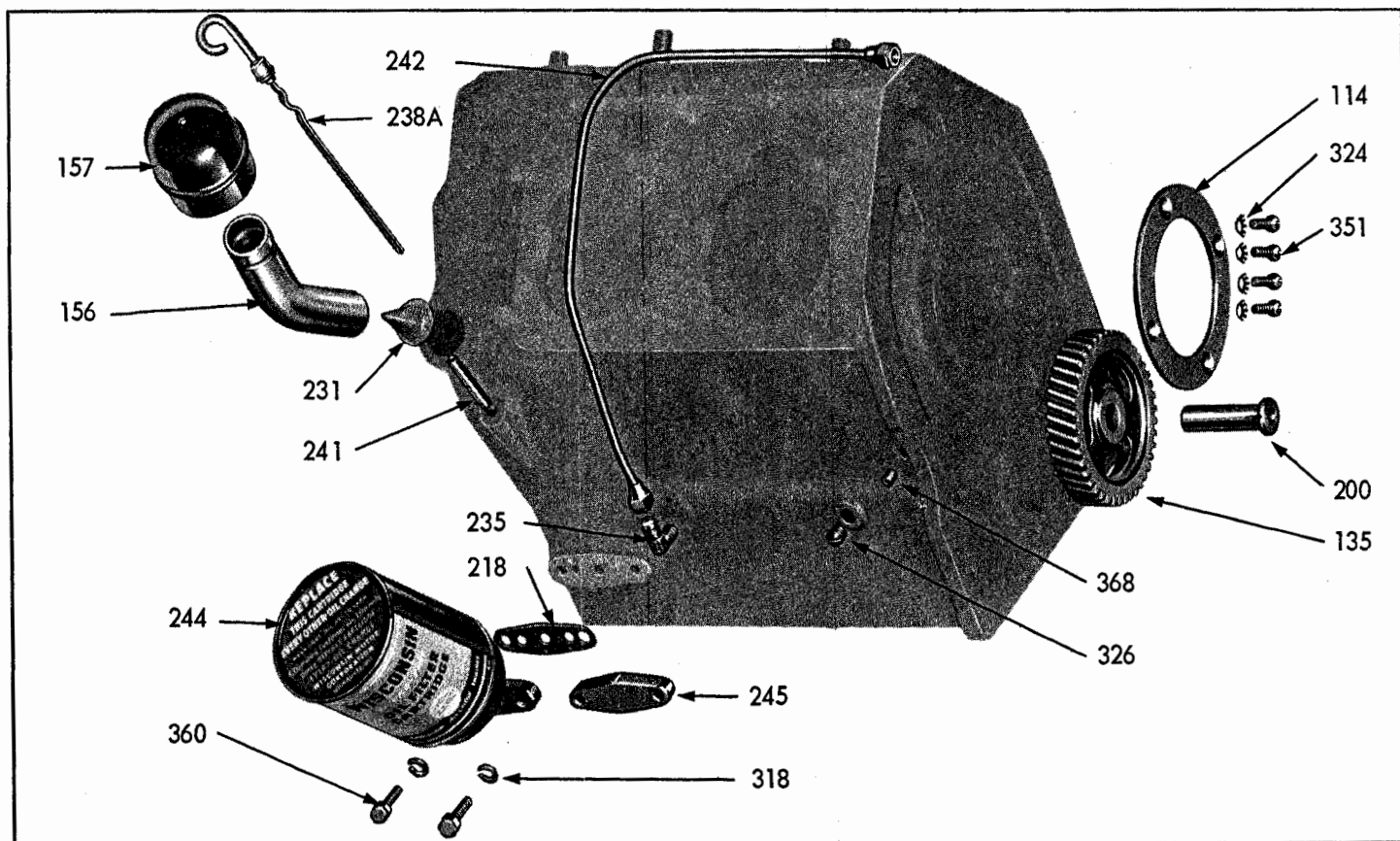


Fig. 54, OIL FILTER AND OIL FILLER MOUNTING GROUP

Parts are identified by reference number. See parts list for correct part number.

PARTS FOR MODEL VH4D ENGINE

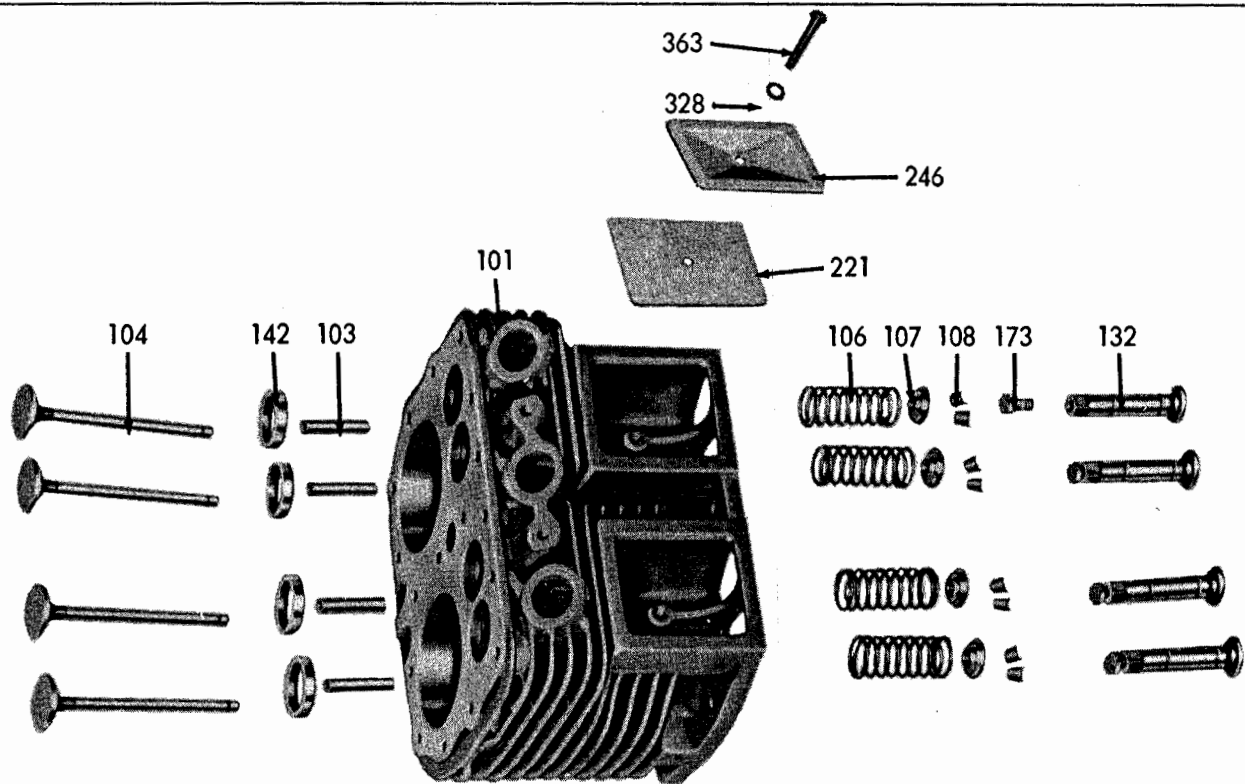


Fig. 55, CYLINDER BLOCK ASSEMBLY

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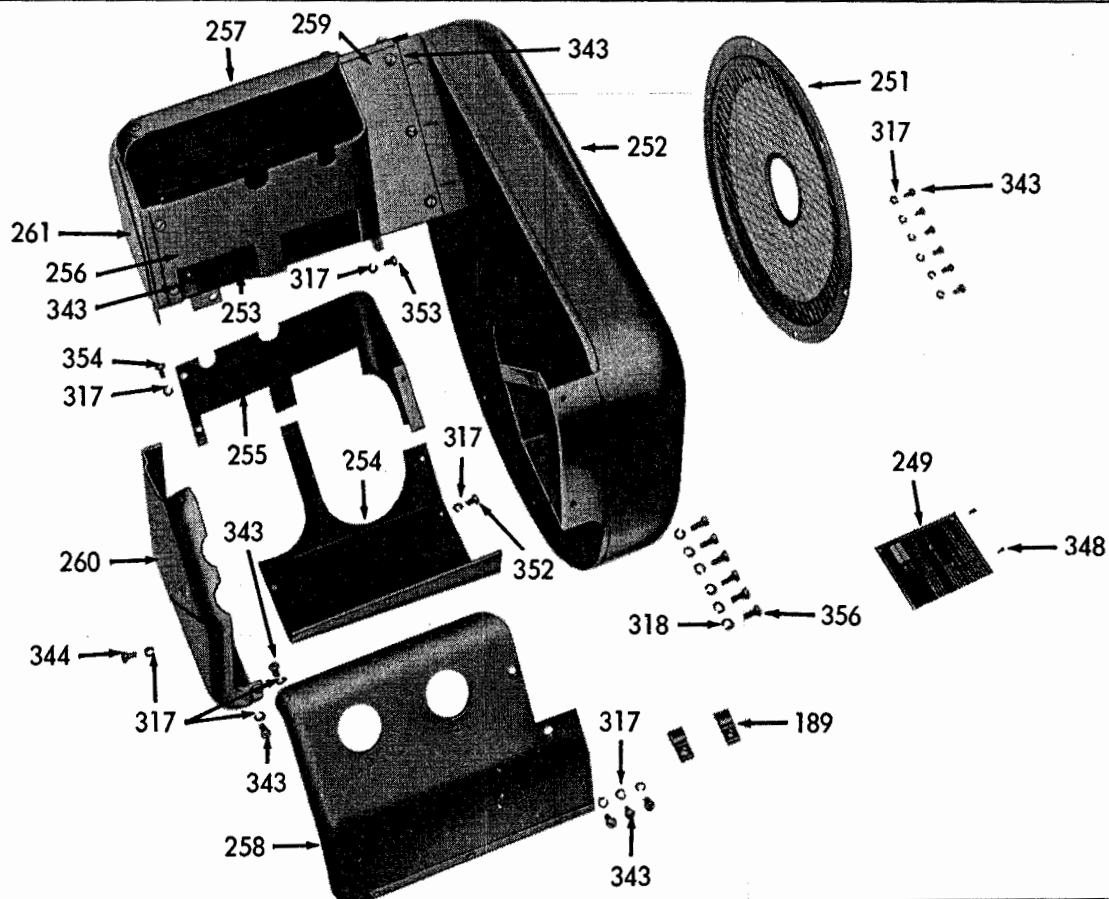


Fig. 56, AIR SHROUDING

Parts are identified by reference number. See parts list for correct part number.

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PARTS FOR MODEL VH4D ENGINE

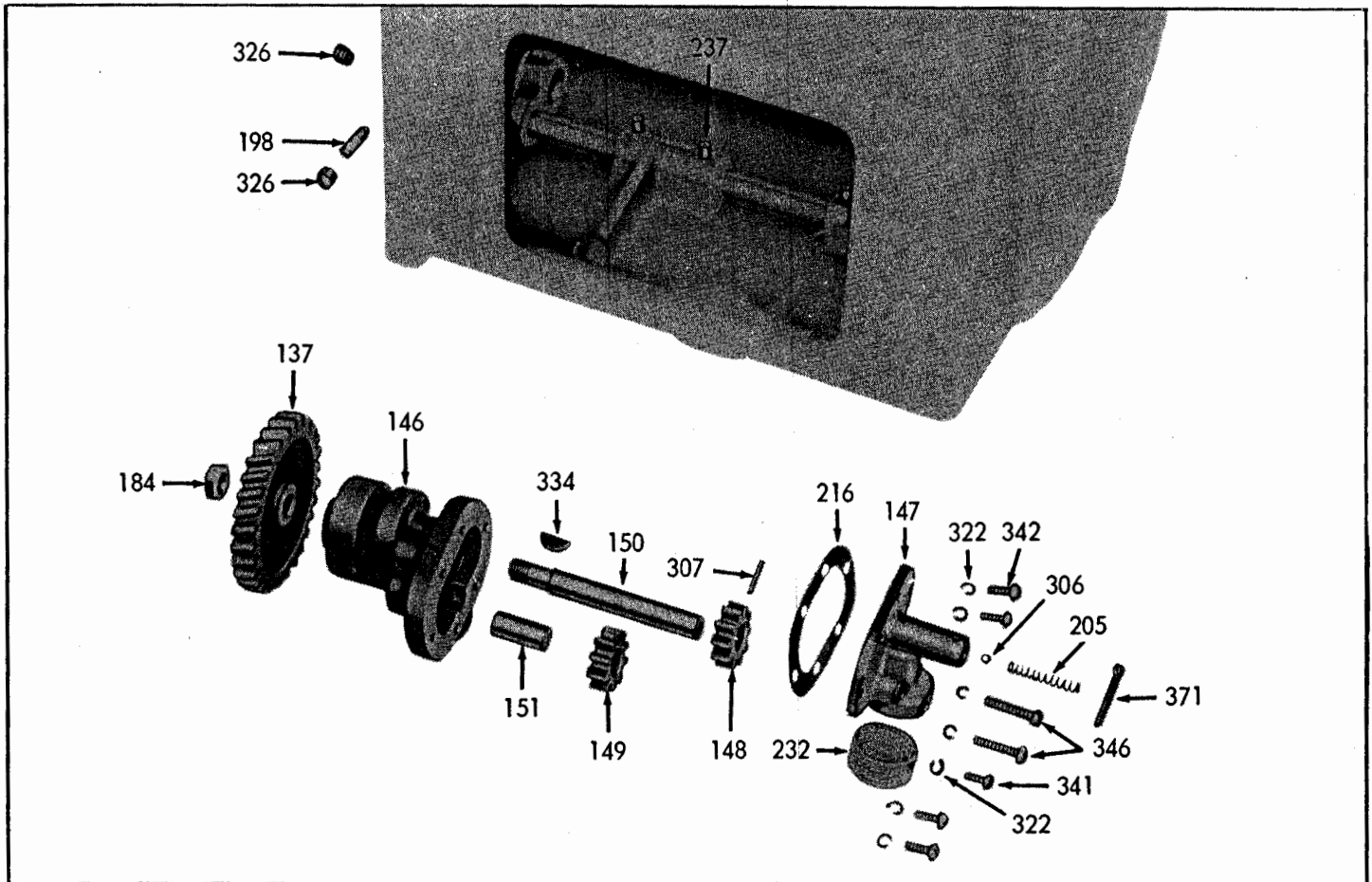


Fig. 57, Ref. No. 144, OIL PUMP ASSEMBLY

129786C-2

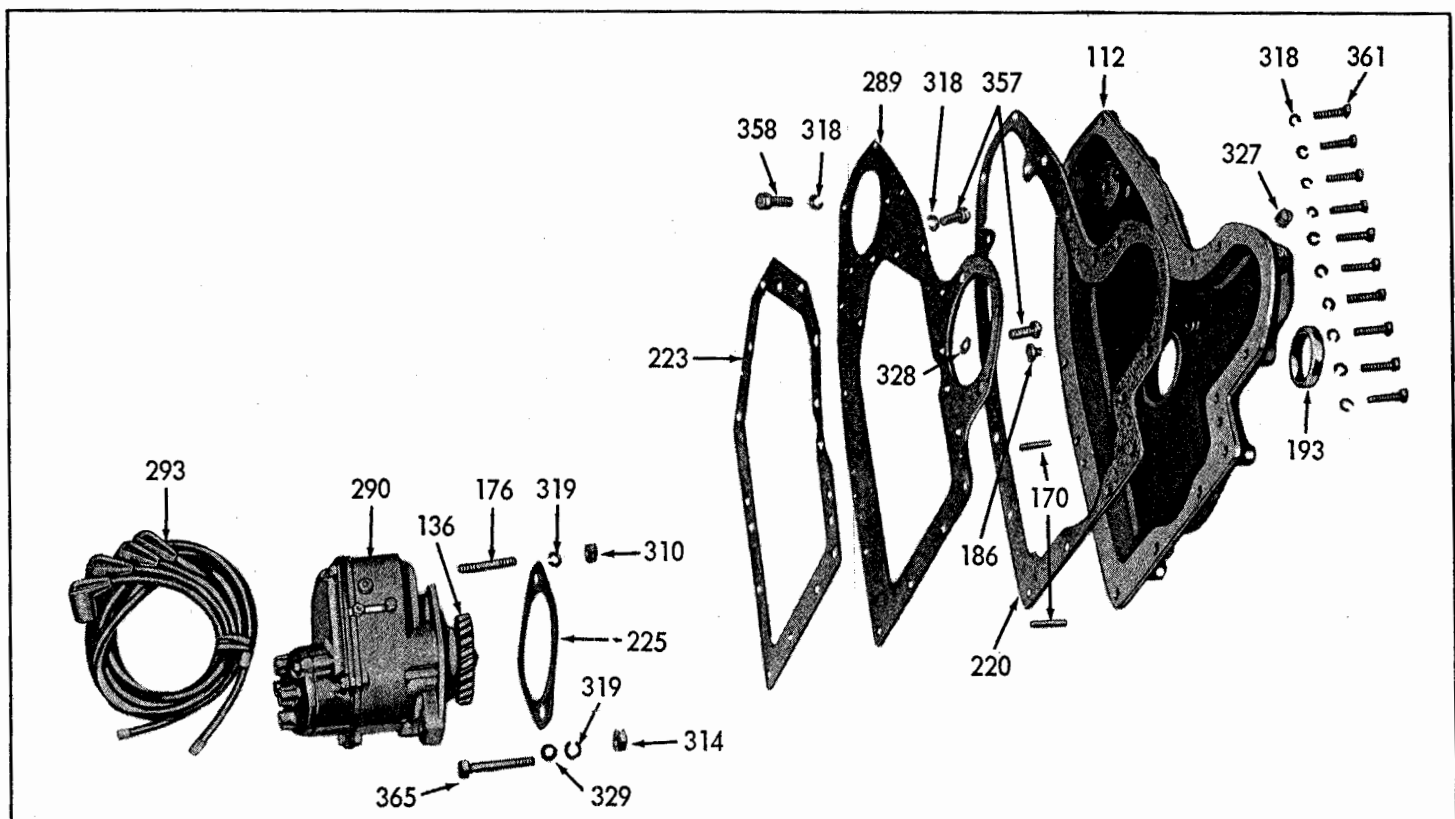


Fig. 58, MAGNETO AND GEAR COVER GROUP

Parts are identified by reference number. See parts list for correct part number.

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PARTS FOR MODEL VH4D ENGINE

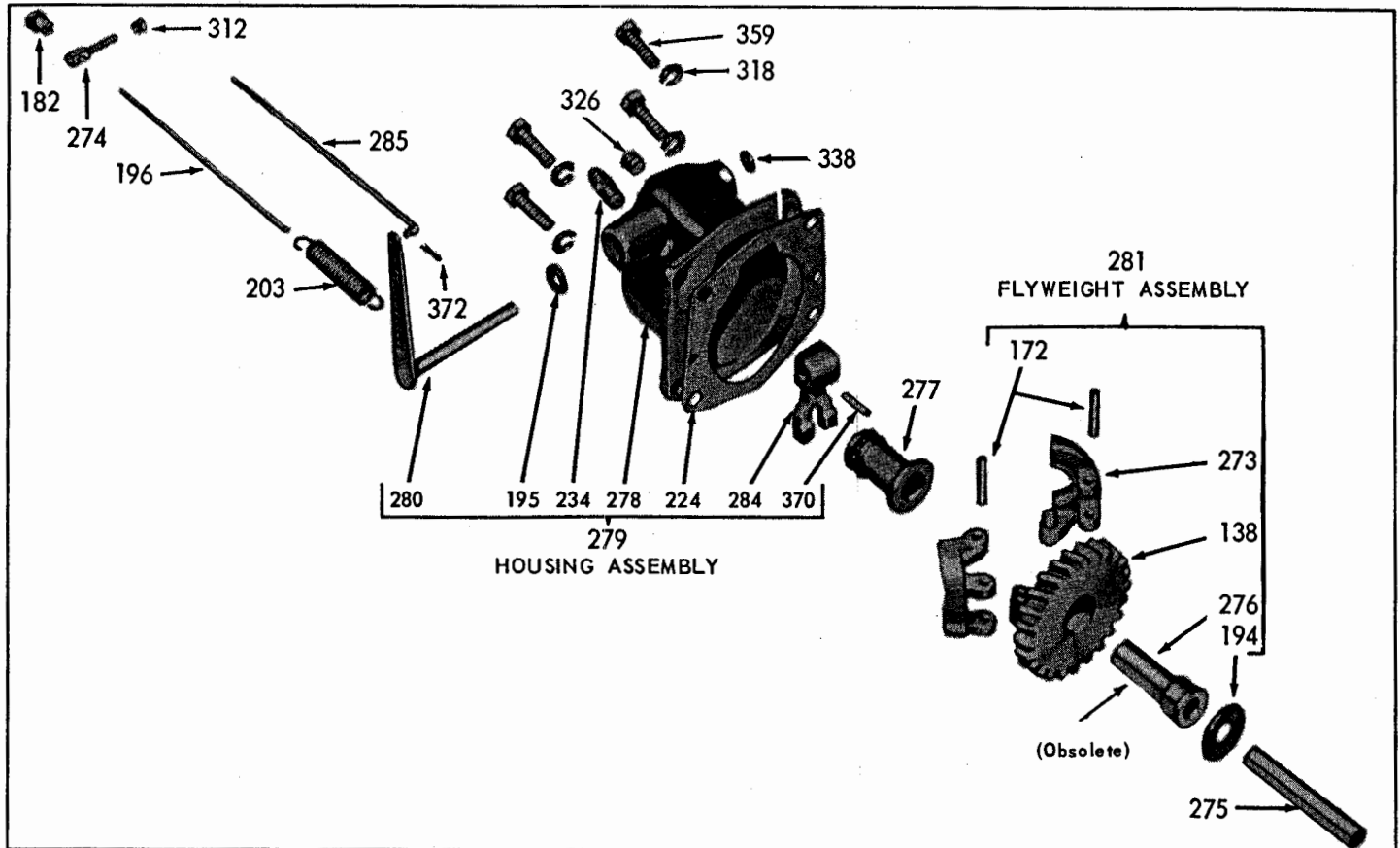


Fig. 59, Ref. No. 265, GOVERNOR ASSEMBLY

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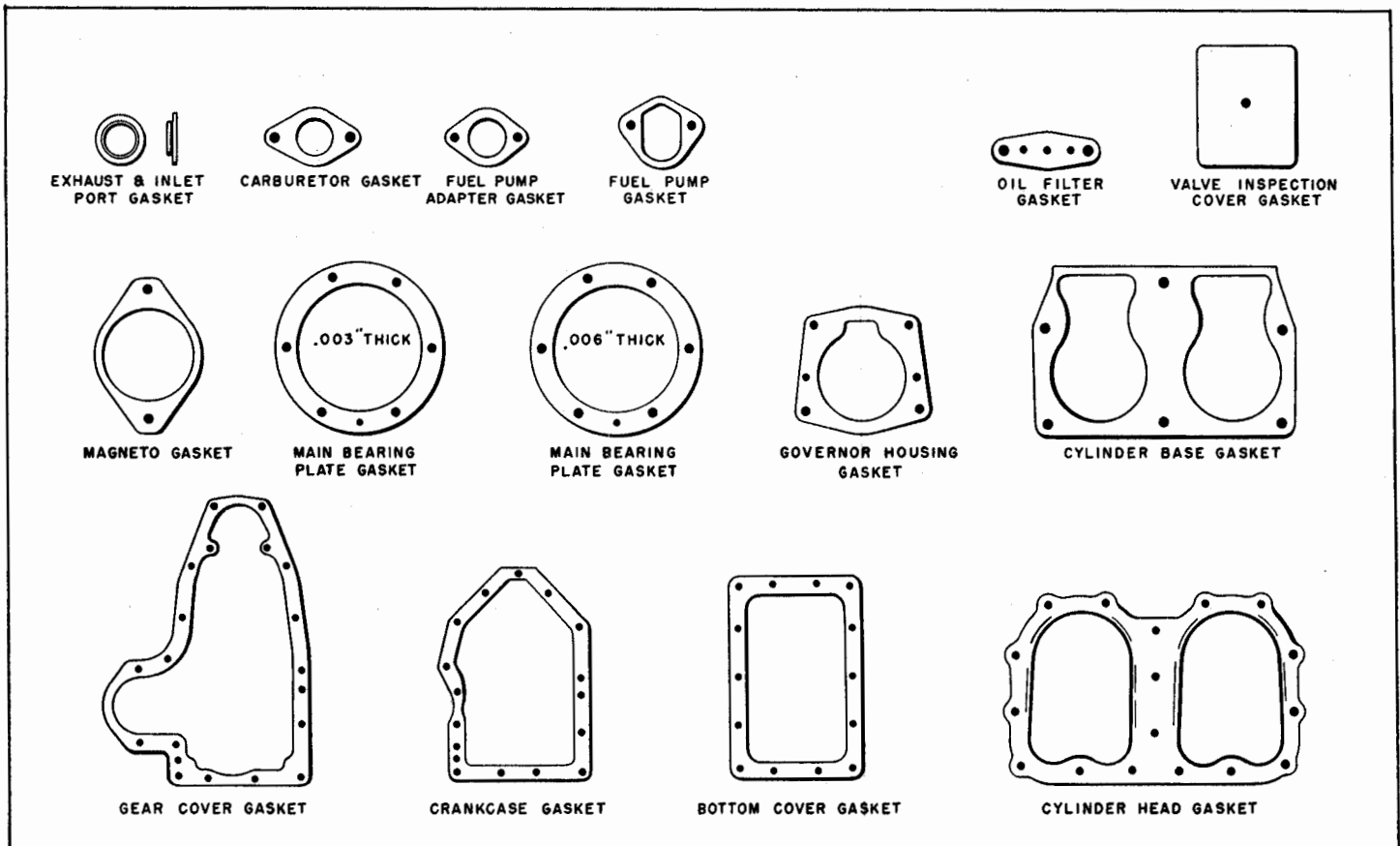


Fig. 60, Ref. No. 208, GASKET SET

Parts are identified by reference number. See parts list for correct part number.

PARTS LIST

Model **VH4D** 4 Cylinder Standard Engine

Engines without Stellite Exhaust Valves, Seats and Positive Exhaust Rotators were designated as Model VH4.
Refer to page 41 for Power Unit house parts and Accessories commonly supplied on this model engine.

Ref. No.	Part Number	Description	No. Req.	Net Wt. Lb.	Oz.
101	AA 98 57	CYLINDER BLOCK ASSEMBLY Complete — Consisting of: 1 AA 98 Block 8 AH 9 Locks 4 AD 41 Guides 2 HG 201 Seats 2 AE 75B Valves 2 HG 201D Seats 2 AE 75D Valves 2 PC 406 Studs 2 AF 49A Springs 2 PH 14 Washers 2 AF 54 Springs 2 QD 612A Gaskets 2 AG 26 Seats 2 SA 68 Covers 2 AG 31 Rotator 2 XD 21 Screws	2	33	8
102	AB 100	CYLINDER HEAD	2	3	14
103	AD 41 E	VALVE STEM GUIDE for service AD 41 used in production engines.	8	2	
104	AE 75 B	VALVE , inlet	4	2	
		(For inlet and exhaust in model VH4)			
	AE 75 D	VALVE , exhaust, stellite faced	4	4	
106	AF 49 A	VALVE SPRING , inlet	4	1	
		2-5/16" free length. Rated at 49 pounds when compressed to 1-3/8" height. (For inlet and exhaust in model VH4)			
	AF 54	VALVE SPRING , exhaust, for stellite valves and valve rotators	4	2	
		1-13/16" frelength, rated at 85 pounds, when compressed to approx. 1-1/8".			
	AF 51	VALVE SPRING , exhaust, for stellite valves, less valve rotators	2		
		1-31/32" frelength, rated at 85 pounds, when compressed to approx. 1-9/32".			
107	AG 26	SEAT for valve springs, inlet	4	1	
		(For inlet and exhaust in model VH4)			
	AG 31	VALVE ROTATOR and spring SEAT (exhaust) used with stellite valves	4	1	
108	AH 9	LOCK for valve spring seat	16	1	
110	See Fig. A	CRANKCASE ASSEMBLY — Includes: .. 1 LJ 300P Tube 4 RF 1143 Nozzles 12 PC 615 Studs 1 RF Tube 2 PC 396 Studs 1 RJ Dip stick 7 PF 18 Plugs 2 SA 26 Plugs 4 PF 144 Plugs 1 SA 58 Plug 1 RC 91 Screen 2 XD 17 Screws	1	58	

NOTE: The basic standard crankcase part number is **BA 48 C**. Any special machining is indicated by a number stamped in the location shown in **FIG. A**. Add this number to **BA 48 C**. Order by complete number and by giving the Model, Spec and Serial Number of the engine.

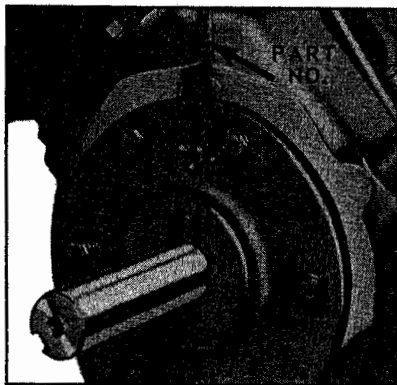


Fig. A

Ref. No.	Part Number	Description	No. Req.	Net Wt. Lb.	Oz.
112	BD 100K-51	GEAR COVER ASSEMBLY beginning with engine serial No. 4238373 (has rough flange for flywheel alternator). Includes: 1 PF 52 Button 1 TC 388-1 Shaft 1 PH 299 Seal 1 XK 3 Plug BD 100C 2-51 for engines to and including serial No. 4238372	1	12	8
	BD 100K 4-51	For engine with flywheel alternator	1	12	
114	BG 209	PLATE , bearing retainer — flywheel end	1	10	
115	BG 210C-52	MAIN BEARING PLATE ASSEMBLY , std Includes: HF 261 Cork seal ME 114-2 Brg. cup SD 43 Retainer	1	6	
116	BH 141 A	BOTTOM COVER for CRANKCASE	1	1	8
117	BK 65	ENGINE SUPPORT (cast iron)	2	1	13
119	See Fig. B	CRANKSHAFT ASSEMBLY , includes .. 1 GA Gear 1 ME 114 Bearing 1 ME 71 Bearing 1 PL 53 Key	1	38	

NOTE: Engines equipped with a clutch, reduction or clutch reduction unit, require a special main bearing plate as specified in the rear section of this manual where these accessories are located.

NOTE: The basic crankshaft part number is **CA 71 A**. Dash numbers are added to the basic part number to identify special machining at the take-off end. The dash (-) number will be found stamped on the cheek facing the take-off end of the shaft, as illustrated in **Fig. B**. Order by **complete part number**, (dash No. added to basic No.) and by giving the **model, spec and serial numbers** of engine.

Caution: Engines equipped with hydraulic pump drive require a **hardened** crankshaft gear. **GA 36 B**, identified by a 1/16" wide groove around gear hub. When ordering crankshaft with hardened gear, add an **S4** behind crankshaft part number.

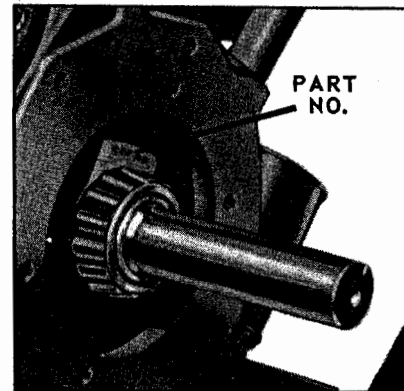


Fig. B

121	DA 68A-51	CONNECTING ROD — shell bearing type Assembly includes: HG 157A Bushing 2 PB 148 Bolts 2 PD 246 Locknuts	4	1	6
		NOTE: The connecting rod is furnished LESS shell bearings. Refer to following HA 134 part number for standard and undersize bearings.			
		DA 68-51 Babbitt Lined connecting rod, repl'd by DA 68A-51 and shell bearings.			
122	HA 134-5	SHELL BEARING (2 halves) std. size..	4	2	
		NOTE: The following undersize shell bearings available.			
		HA 134-51 (.001") HA 134-510 (.010")			
		HA 134-52 (.002") HA 134-520 (.020")			

Order parts from nearest **WISCONSIN DISTRIBUTOR** or **SERVICE CENTER**.

IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

Model VH4D Parts List

Ref. No.	Part Number	Description	No. Req.	Net Wt. Lb.	Oz.	Ref. No.	Part Number	Description	No. Req.	Net Wt. Lb.	Oz.
123	DB 210-4	PISTON, standard size (3 Ring Piston) NOTE: Beginning with serial #5538322 DB190A 1 (4 ring piston) is replaced by DB 210-4. For service replacement, DB 190A 1 (4 ring piston) is available. When replacing with 3 ring piston, all four pistons must be changed. Use appropriate Ring Set.	4		10	148	KC 56 A Driver Gear	1		1	
125	DR 64	RING SET, Std. size (3 Ring Piston) .. Beginning with serial #5538322. Consisting of:	1		4	149	KC 56 A Driven Gear .499—.498 I.D. beginning with Serial No. 3810396	1		1	
126	DC 363	COMPRESSION RING, top groove	4				KC 56-2 (K 95D pump) .5015—.5005 I.D. previous to Serial No. 3810396. For replacement use KC 56A 1.				
127	DC 364	SCRAPER RING, 2nd groove	4			150	KD 121-S1 Drive Shaft with KC 56 A gear	1		4	
128	DC 211	OIL RING, 3rd groove	4			151	KD 122 A Stub Shaft, for engines beginning with Serial No. 3810396	1		2	
129	DC 365	EXPANDER for oil ring	4				KD 122 (K 95 D pump) previous to engine No. 3810396.				
		DR 31 C Ring Set (4 Ring Piston)			6		ME 60 Check Ball, 1/4" dia. steel	1		1	
		Used previous to serial #5538322.					PA 64 Pin, 1/8" dia. x 3/4" long steel straight, for driver gear	1		1	
		NOTE: Pistons and Ring Sets are also furnished .010", .020", .030" oversize.					PD 195 Jam Lock-Nut, 7/16"-20 thread For gear mounting.	1		1	
130	DE 65	PISTON PIN, standard size	4		3		PE 14 Lockwasher, No. 10 Positive 6-for cover 1-for screen	7		1	
		Piston pins are also furnished .005" and .010" oversize.					PL 137 Key, No. 1 Woodruff	1		1	
131	EA 113	CAMSHAFT	1	3	8		For drive gear.				
132	F 61	VALVE TAPPET with adjusting screw	8		4		PM 111 Spring for relief valve	1		1	
133	GA 36 A	CRANKSHAFT GEAR, standard	1		14		QD 535 A Cover gasket (see Ref. No. 216	1		1	
		GA 36 B hardened gear.					RD 112 Screen	1		1	
134	GB 45 A	CAMSHAFT GEAR	1	2	2		XA 7 Screw for screen, No. 10-32 thread x 3/8" long steel round head	1		1	
135	GC 27 B 1	IDLER GEAR	1	1	6		XA 8 Screw for cover, No. 10-32 thread x 1/2" long steel round head	4		1	
136	GD 93 C 4	MAGNETO GEAR	1		9		XA 56 Screw for cover, No. 10-32 thread x 1-1/4" long steel round head	2		1	
		GD 93 C, GD 93 C 2, repl'd by GD 93 C 4.					XI 16 Cotter Pin for valve, 1/8" x 1"	1		1	
137	GD 94 C	OIL PUMP GEAR	1		11	153	L 63-S1	CARBURETOR, Zenith No. 12098	1	1	12
138	Not serviced separately	GOVERNOR GEAR Use governor fly-weight assembly, Ref. 281.						LQ 39 Carburetor Repair Kit			8
140	HF 261	OIL SEAL, cork	1		1			NOTE: The above is a standard carburetor. Special carburetors are identified by Part Number stamped on carburetor name plate. Refer to this number for service replacement carburetor or parts. See carburetor bulletin in back of manual for service replacement parts list.			
		For main bearing, take-off end.				155	LD 253	INLET and EXHAUST MANIFOLD	1		15
		PH 364 Oil seal for engines with clutch, reduction or clutch reduction unit.					LD 253-1	For open engines.			15
141	HG 157 A	PISTON PIN BUSHING	4		1			MANIFOLD, for power units			
142	HG 201	VALVE SEAT INSERT, inlet	4		1			Has two 1/4"-20 taps for support straps.			
	HG 201 D	VALVE SEAT INSERT, stellite exhaust	4		1	156	LJ 300 P	OIL FILLER TUBE	1		6
143	JK 50	PACKING RING	1		1	157	LO 60	OIL FILLER and BREATHER CAP	1		6
		For fuel pump primer shaft.				159	LP 43	FUEL STRAINER (small) with shut-off Mounted to fuel pump inlet.	1		3
144	K 95 L	OIL PUMP ASSEMBLY, Fig. 57	1	3	13			LQ 31 Repair Kit (bowl, gasket, screen)			
		K 95 D, replaced by K 95 L.					LP 19 B (Optional)	FUEL STRAINER (large) less shut-off LQ 32 Repair Kit (bowl, gasket, screen)			9
		NOTE: Beginning with Serial No. 3810396 the K 95 L oil pump replaces K 95 D and utilizes the same internal gears for both the drive and driven gears. Therefore, driven gear and stub shaft for old pumps are not interchangeable since gear bore diameters are not the same.				160	LP 38 E-S1	FUEL PUMP, for open engine (low dome)	1	1	8
		Pump assembly consists of:					LP 38 H-S1	LQ 46 Repair Kit, for LP 38 E-S1	1		2
146		GD 94 C Oil Pump Drive Gear (external)	1		11			FUEL PUMP, for power units (with rotating dome and fuel inlet connection) ..	1	1	12
		KA 61 D-S1 Body - Includes:						LQ 47 Repair Kit, for LP 38 H-S1	1		2
		KC 56 A Gear KD 122 S Shaft						LP 38-S1 (high dome style pump), replaced by LP 38 E-S1, but for service replacement, LP 38 H-S1 can be used for both LP 38-S1 and LP 38 E-S1.			
		KA 61 A 1-S1, KA 61 C-S1, replaced by KA 61 D-S1.						LQ 30 Repair Kit, for obsolete LP 38-S1	1		2
147		KB 42-52 Cover Assembly, includes relief valve and screen	1		11			NOTE: Refer to ML-34 for fuel pump repair instructions, in rear section of manual.			

Order parts from nearest **WISCONSIN DISTRIBUTOR** or **SERVICE CENTER**.

IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

Model VH4D Parts List

Ref. No.	Part Number	Description	No. Req	Net Wt.		Ref. No.	Part Number	Description	No. Req	Net Wt.	
				Lb	Oz					Lb	Oz
162	ME 71	MAIN BEARING ASSEMBLY, flywheel .. end. Consisting of:	1	1	14	204	PM 108	SPRING for camshaft thrust plunger	1		1
163		1 ME 69-1 Bearing cup *			12	205	PM 111	SPRING for oil pump relief valve	1		1
164		1 ME 71-1 Bearing cone *	1		2	206	PM 145	SPRING for fuel pump primer handle	1		1
		* Not sold separately.				208	Q 12 J	GASKET SET (Fig. 60) Consisting of:	1		8
165	ME 114	MAIN BEARING ASSEMBLY, take-off end Consisting of:	1	3				6 QB 75 1 QD 538 A 2 QD 613 C			
166		1 ME 114-1 Bearing cone *		2	4			3 QC 71 A 1 QD 595 A 1 QD 614			
167		1 ME 114-2 Bearing cup *			12			1 QD 67 1 QD 610 A 1 QD 615 A			
		* Not sold separately.						3 QD 527 C 1 QD 611 1 QD 616			
168	NC 140 G N 101 A	FLYWHEEL, standard (No Ring Gear) ..	1	34				3 QD 527 D 4 QD 612 A 2 QD 617			
		FLYWHEEL for engines with electric starting motor only. Includes:	1	35				NOTE: QB 78, QB 79, QD 527 A and QD 527 B Gaskets, also included in this kit, are for engine models VE4D, VF4D and can be discarded.			
169		GH 44 Ring gear	1		13		Q 28	VALVE GRINDING GASKET SET	1		2
		NC 140 G1-S1, replaced by N 101 A.						Consisting of:			
		FLYWHEELS, for flywheel alternator,						6 QB 75 4 QD 612 A 2 QD 613 C			
NOTE: Give Model, Specification and Serial numbers of engine when ordering flywheels for mounting stub shafts, rotating screens, alternators, etc.											
170	PA 291	DOWEL PIN for gear cover	2		1	210	QB 75	GASKET for manifold to cylinder block	6		1
171	PA 333	PIN for hand crank starting	1		1	211	QC 71 A	GASKET for carburetor flange	3		1
172	PA 340	ROLL PIN for governor flyweight	2		1			QC 58 A, replaced by QC 71 A.			
173	PB 169 A	TAPPET ADJUSTING SCREW	8		1	212	QD 67	GASKET for fuel pump adapter	1		1
174	PB 148-S1	CONNECTING ROD BOLT ASSEMBLY Includes PD 246 Locknut.	8		1	214	QD 527 C	GASKET for bearing plate, .006" thick	3		1
176	PC 110	STUD for magneto mounting	1		1	215	QD 527 D	GASKET for bearing plate, .003" thick	3		1
178	PC 615	STUD for cylinder block to crankcase ..	12		2	216	QD 535 A	GASKET for oil pump cover (not included in gasket set) — .003" thick, for engines beginning with Serial No. 3810396	1		1
179	PC 396	STUD for starter bracket	2		1			QD 535 (.012" thick) for obsolete K 95 D pump. Not interchangeable with QD 535 A.	1		1
180	PC 406	STUD for manifold to cylinder block	4		1	217	QD 538 A	GASKET for fuel pump mounting	1		1
181	PD 123	NUT for flywheel mounting	1		3	218	QD 595 A	GASKET for oil filter mounting	1		1
182	PD 173 A	NUT for governor adjusting screw	1		1	219	QD 610 A	GASKET for crankcase bottom cover	1		1
184	PD 195	NUT for mounting oil pump gear	1		1	220	QD 611	GASKET for gear cover	1		1
185	PE 66	LOCKWASHER for flywheel nut	1		1	221	QD 612 A	GASKET for valve inspection cover plate	4		1
186	PF 52 A	BUTTON (11/16" long), camshaft thrust Has extension for alignment of flywheel shroud for starting motor mounting.	1		1	222	QD 613 C	GASKET for cylinder head	2		4
		PF 52 (3/8" long) for engines without alignment hole in shroud.	1		1	223	QD 614	GASKET for gear cover spacer to case	1		1
187	PF 101	THRUST PLUNGER for camshaft	1		1	224	QD 615 A	GASKET for governor housing	1		1
188 A	PF 144	PLUG for 7/16"-14 taps in face of case	4		1	225	QD 616	GASKET for magneto flange	1		1
189	PG 314	CLIP for spark plug ignition cables	2		1	226	QD 617	GASKET for cylinder base	2		1
190	PG 475	BRACKET for choke control	1		2	228	QF 33 B	SHIM for main bearing plate, .006" thick * Obsolete — 2 were used — replaced by 1 each QD 527 C and QD 527 D.	*		1
193	PH 299	OIL SEAL for crankshaft, flywheel end	1		2	229	QF 33 C	SHIM for main bearing plate, .013" thick NOTE: Use same quantity of shims and gaskets as were removed — to give .002 to .005" end play.	1		1
194	PH 313 A	WASHER for governor gear bushing	1		1	231	RC 91	SCREEN for oil filler	1		1
195	PH 571	OIL SEAL for governor cross shaft	1		1	232	RD 112	OIL PUMP SCREEN	1		1
		(Neoprene) mount with lips in.				233	RF 269	STRAIGHT FITTING in carburetor	1		2
196	PI 115 F	ADJUSTING SCREW for governor	1		2	234	RF 269-2	FITTING in governor housing for oil line	1		2
198	PI 143 B	OIL PUMP LOCKSCREW	1		1	235	RF 1225	ELBOW for fuel line	2		2
200	PJ 105	STUD for idler gear	1		5			1-for fuel pump outlet.			
202	PK 52	RETAINING RING for piston pin	8		1			1-for oil line to governor, in crankcase.			
203	PM 76	GOVERNOR SPRING	1		1	237	RF 1143	OIL SPRAY NOZZLE	4		1

Order parts from nearest **WISCONSIN DISTRIBUTOR** or **SERVICE CENTER**.

IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

Model VH4D Parts List

Ref. No.	Part Number	Description	No. Req.	Net Wt.	
				Lb	Oz
237	RF 1397	ELBOW, 45° male, for fuel strainer mt'g.	1	1	
NOTE: Oil dip stick, used in conjunction with an adaptor tube, replaces dip stick mounted directly into crankcase, but is not interchangeable. Order by part number indicated on blade of dip stick.					
238	RJ 173 A (Optional)	DIP STICK, (6-1/4" long) starter side ..	1	3	
		RJ 159 (obsolete) 3-5/8" long blade		2	
238	RJ 173 (Std.)	DIP STICK, (10" long) below oil filler ..	1	5	
		RJ 159 C (obsolete) 7-1/8" long, blade ..		3	
239	RK 170	OIL SLING on crankshaft	1	2	
241	RF 1495 (Std.)	ADAPTER TUBE for dip stick below oil filler tube — mount with 'Loctite'	1	2	
241	RF 1495 F	ADAPTER TUBE (curved) dip stick on starter side — mount with 'Loctite'	1	2	
242	RM 675	OIL LINE, crankcase to governor	1	3	
243	RM 1122 C	FUEL LINE, pump to carburetor	1	2	
244	-----	OIL FILTER, consisting of: RV 40-54 CARTRIDGES (4 pack) with QD685 gaskets	1	3	4
		RV 40A 1 BASE ASSEMBLY	1	1	
NOTE: Beginning with engine Serial No. 3408750, the RV 29 A oil filter is replaced by a BASE ASSEMBLY and CARTRIDGE listed above. Replacement cartridges are not interchangeable, therefore RV 29-54 cartridges must be used for obsolete RV 29 A oil filter. Part number is located on top of cartridge for identification.					
245	SA 65 C	PAD COVER, for engine less oil filter	1	4	
246	SA 68	COVER PLATE for valve inspection	4	9	
247	SA 69	COVER for fuel pump pad	1	2	
		For engines without fuel pump.			
248	SD 43	RETAINER, oil seal cork, take-off end	1	1	
249	SD 312 A	ENGINE NAME PLATE	1	1	
		When ordering name plate, give Model, Specification Number and Serial Number for correct stamping.			
251	SE 20 B 3	SCREEN for flywheel shroud	1	1	2
NOTE: Beginning with engine Serial No. 4238373 the SE 74 Y series of flywheel shrouds replaces the SE 74 V series because of a gear cover alteration for mounting flywheel alternator. The new shrouds are interchangeable if gear cover is replaced, or by omitting use of the two center screws for attaching flywheel shroud to gear cover.					
252	SE 74 Y	FLYWHEEL SHROUD, for std. engine and power unit (no pad for air cleaner) ..	1	11	
		SE 74, SE 74 V replaced by SE 74 Y.			
		SE 74 YA, with pad for mounting starter SE 74 A, SE 74 VA, repl'd by SE 74 YA.		11	8
		SE 74 YC, with pads for air cleaner and starter mounting		12	
		SE 74 G, SE 74 VG, repl'd by SE 74 YC.			
253	SE 75 B	LOWER CYLINDER SHROUD, R.H. side	1	14	
254	SE 76 B	LOWER CYLINDER SHROUD, L.H. side	1	12	
255	SE 77 C	HEAT DEFLECTOR, L.H. side	1	11	
256	SE 77 D	HEAT DEFLECTOR, R.H. side	1	14	
257	SE 78 C	CYLINDER HEAD SHROUD, R.H. side	1	14	
258	SE 79 C	CYLINDER HEAD SHROUD, L.H. side	1	1	
259	SE 80	SIDE COVER for flywheel shroud	1	4	
260	SE 82 C	REAR SHROUD COVER, L.H. side	1	15	

Ref. No.	Part Number	Description	No. Req.	Net Wt.	
				Lb	Oz
261	SE 83 C	REAR SHROUD COVER, R.H. side	1	15	
265	T 89K-S1	GOVERNOR ASSEMBLY (Fig. 59)	1	3	3
		Consisting of: 1 TC 391 D Thrust sleeve and bearing 1 TC 395-S1 Housing assembly 1 TC 405 J Flyweight assembly			
		T 89 2-S1 Governor replaced by T 89K-S1 (gear bushing deleted) as of Serial No. 5388502.			
266	TA 111 B	PLUNGER for fuel pump with primer (TA 116 must also be ordered.)	1	1	
	TA 111 B 1	PLUNGER for fuel pump less primer	1	1	
267	TA 114-S1	PRIMER SHAFT, with JK 50 ring	1	1	
		For engine with fuel pump.			
	TA 114 C-S1	PRIMER SHAFT, with JK 50 ring	1	1	
		For power unit with fuel pump.			
269	TA 115	PRIMER HANDLE (straight)	1	1	
		For engine with fuel pump.			
269A	TA 115-4	PRIMER HANDLE (bent)	1	1	
		For power unit with fuel pump.			
270	TA 116	PLUNGER CAP for fuel pump	1	1	
271	TB 105 B	FUEL PUMP ADAPTER, not serviced separately, order complete adapter and primary assembly, Ref. 282. TF 96-10 (for open engine) TF 96-12 (for power units)	1		
	or TF 96-18 (Std.)	ADAPTER ASSEMBLY (less primer) Includes: PK 176 Retainer clip TA 111 B 1 Plunger	1	3	
273	TC 322 D-S1	GOVERNOR FLYWEIGHT ASSEMBLY Includes TC 328 D Thrust pin.	2	3	
274	TC 367	ADJUSTING SCREW PIN for governor ..	1	1	
275	TC 388-1	GOVERNOR SHAFT	1	3	
276	TC 389A 1 (Obsolete)	GOVERNOR GEAR BUSHING for engines previous to Serial No. 5388502. For Service Replacement — order TC 405 J Flyweight assembly and TC 391 D Thrust sleeve and Brg.	1	2	
277	TC 391 D	THRUST SLEEVE and BEARING, gov. Beginning with Serial No. 5388502. TC 391 B previous to Serial No. 5388502 (obsolete T 89-2 gov.). When no longer available, use TC 391 D along with TC 405 J.	1	2	
278	TC 395	GOVERNOR HOUSING, not serviced separately, order TC 395-S1 Housing assembly. (Ref. 279)			
279	TC 395-S1	GOVERNOR HOUSING ASSEMBLY	1	2	
		Consisting of: 1 PF 18 Plug 1 TC 395 Housing 1 PH 571 Seal 1 TC 398 Shaft & lever 1 QD 615 A Gasket 1 RF 269-2 Fitting 1 VB 151 Yoke 1 SA 52 Plug 1 PA 367 Pin			
280	TC 398	CROSS SHAFT and LEVER, for gov.	1	2	

Order parts from nearest **WISCONSIN DISTRIBUTOR** or **SERVICE CENTER**.

IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

Model VH4D Parts List

Ref. No.	Part Number	Description	No.			Ref. No.	Part Number	Description	No.		
			Req	Lb	Oz				Req	Lb	Oz
281	TC 405 J	GOVERNOR FLYWEIGHT ASSEMBLY Beginning with Serial No. 5388502, assembly consists of: 1 GD 100A 3 Gear 2 TC 322 D Weights 2 PA 340 Pins 2 TC 328 D Pins 1 PH 313 A Washer TC 405 previous to Serial No. 5388502 (includes GD 100A gear, TC 389A 1 bushing). For replacement use TC 405 J along with TC 391 D thrust sleeve.	1	1				MISCELLANEOUS STANDARD HARDWARE			
282	TF 96-10 (Optional)	FUEL PUMP ADAPTER and PRIMER .. ASSEMBLY (with straight handle, for open engines). Consisting of: 1 JK 50 Packing 1 TA 114 Shaft 1 PM 145 Spring 1 TA 115 Handle 1 TA 111 B Plunger 1 TA 116 Cap 1 TB 105 B Adapter	1			305	LJ 184	NIPPLE , 1 1/4" x 2 1/2" long, W.I. pipe For muffler mounting.	1		5
	TF 96-12 (Optional)	ADAPTER and PRIMER ASSEMBLY (with bent handle for power units with fuel pump). Consisting of: 1 JK 50 Packing 1 TA 115-4 Handle 1 PM 145 Spring 1 TA 116 Cap 1 TA 111 B Plunger 1 TB 105 B Adapter 1 TA 114 C Shaft 1 XE 65 Screw	1			306	ME 60	STEEL BALL , 1/4" dia. For oil pump relief valve.	1		1
283	U 212	STARTING CRANK	1	1	8	307	PA 64	PIN , 1/8" dia. x 3/4" long, straight For oil pump gear.	1		1
284	VB 151	GOVERNOR YOKE	1		3	309	PD 246	LOCKNUT , 5/16"-24 thread (special) .. For connecting rod bolts.	8		1
285	VE 464	CONTROL ROD to carburetor	1		1	310	PD 11	NUT , 3/8"-24 thread, hexagon steel For magneto stud.	1		1
286	VE 471-4	PRIMER CONTROL	1		1	311	PD 12	NUT , 7/16"-20 thread, hexagon steel .. For mounting cylinder block.	12		1
287	VE 693	CHOKE CONTROL	1		4	312	PD 77	NUT , 1/4"-20 thread, hexagon steel For governor adjusting screw pin.	1		1
288	WD 98-55	MUFFLER , standard, for 1 1/4" pipe tap ..	1	2		314	PD 79	NUT , 3/8"-16 thread, hexagon steel For magneto mounting screw.	1		1
289	WE 182 A	SPACER for gear cover	1	2		315	PD 206	NUT , 3/8"-24 thread (Seez-proof), hexagon steel For manifold to cylinder block studs.	4		1
290	Y 97-52	MAGNETO , 'Fairbanks-Morse', No. FMX-4B7A, with gear and gasket	1	6		317	PE 3	LOCKWASHER , 1/4" spring lock 2-for mounting fuel pump adapter. 6-for flywheel screen. 33-for air shrouding.	41		1
	Optional Y 95-52	YQ 8 Points and Condenser Kit. YQ 9 Overhaul Kit. MAGNETO , 'Wico', No. XHG-4, with gear and gasket		5		318	PE 4	LOCKWASHER , 5/16" spring lock 14-for crankcase bottom cover plate. 6-for flywheel shroud to gear cover. 15-for gear cover and spacer. 4-for governor housing. 2-for fuel pump. 2-for carburetor. 2-for oil filter.	45		1
		YQ 5 Points and Condenser Kit. YQ 2 Overhaul Kit.				319	PE 5	LOCKWASHER , 3/8" spring lock 6-for main bearing plate—take-off end. 2-for magneto.	8		1
NOTE: See magneto sheets in back of manual for service replacement parts and instructions.						320	PE 63	LOCKWASHER , 7/16" external tooth For cylinder block to crankcase. PE 6 (spring lock) repl'd by PE 63.	12		1
291	YD 6-51 (Optional)	SPARK PLUG , Champion No. D-16-J	4		2	321	PE 7	LOCKWASHER , 1/2" spring lock For engine supports to crankcase.	4		1
	YD 6-52	SPARK PLUG , AC No. C86 Commercial				322	PE 14	LOCKWASHER , No. 10 spring lock For oil pump cover and screen.	7		1
	YD 20	RUBBER NIPPLE for magneto towers .. (Not illustrated)	4		1	323	PE 46	LOCKWASHER , 5/16" external tooth For mounting camshaft gear.	3		1
293	YL 100 A	IGNITION CABLE SET for magneto	1	12		324	PE 49	LOCKWASHER , 5/16" countersunk, for bearing retainer plate—flywheel end	4		1
		YL 339-26 Cable for No. 1 cylinder	1	3		326	PF 18	PIPE PLUG , 1/8" slotted 1-for oil hole to pump. 4-for oil spray nozzle. 1-for oil pump lockscrew hole. 1-for oil header. 1-for governor housing.	8		1
		YL 339-34 Cable for No. 2 cylinder	1	3		327	XK 3	PIPE PLUG , 3/8" square head For timing hole in gear cover. PF 25, slotted, replaced by XK 3.	1		2
		YL 339-32 Cable for No. 3 cylinder	1	3		328	PH 14	PLAIN WASHER , 5/16" copper 4-for valve inspection cover plate. 2-for spacer plate to crankcase (at idler gear)	6		1
		YL 339-38 Cable for No. 4 cylinder	1	3							

Order parts from nearest **WISCONSIN DISTRIBUTOR** or **SERVICE CENTER**.

IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

Model VH4D Parts List

Ref. No.	Part Number	Description	No. Req.	Net Wt.		Ref. No.	Part Number	Description	No. Req.	Net Wt.	
				Lb	Oz					Lb	Oz
329	PH 22 A	PLAIN WASHER, 3/8" steel 1-for magneto mounting screw. 4-for manifold to cylinder blocks.	5		1	356	XD 172	SCREW, 5/16"-18 x 1/2" long, 1/8" thick hexagon head For flywheel shroud (two center holes).	2		1
330	PH 77 A	PLAIN WASHER, 5/16" steel For mounting cylinder heads.	34		1	357	XD 14	SCREW, 5/16"-18 x 5/8" long, hex. hd. 14-for crankcase bottom cover plate. 5-for mounting spacer to crankcase.	19		1
332	PL 53	KEY, No. 8 Woodruff For crankshaft gear.	1		1	358	XD 15	SCREW, 5/16"-18 x 3/4" long, hex. hd. 2-for mounting spacer to crank cover. 2-for mounting fuel pump.	4		1
333	PL 83	KEY, No. 23 Woodruff For mounting flywheel.	1		2	359	XD 16	SCREW, 5/16"-18 x 7/8" long, hex. hd. For mounting governor housing.	4		1
334	PL 137	KEY, No. 1 Woodruff For oil pump gear.	1		1	360	XD 17	SCREW, 5/16"-18 x 1" long, hex. head .. 3-for mounting camshaft gear. 2-for mounting carburetor. 2-for oil filter mounting. PC 112 Studs for oil filter, replaced by XD 17.	7		2
337	SA 26	PLUG, 5/8" expansion For camshaft bearing oil hole.	2		1	361	XD 19	SCREW, 5/16"-18 thread x 1-1/4" long, hexagon head (special hardness) 10-for mounting gear cover. 30-for mounting cylinder heads.	40		2
338	SA 52	PLUG, 1/2" expansion For governor housing.	1		1	362	XD 20	SCREW, 5/16"-18 thread x 1-3/8" long, hexagon head (special hardness) For mounting cylinder heads. XD 21 (1 1/2" long), replaced by XD 20.	4		2
339	SA 58	PLUG, 1-3/8" expansion For camshaft end hole.	1		1	363	XD 21	SCREW, 5/16"-18 x 1 1/2" long, hex. head For valve inspection cover plates.	4		2
341	XA 7	SCREW, No. 10-32 x 3/8" long, rd. hd. .. For mounting oil pump screen.	1		1	364	XD 29	SCREW, 3/8"-16 x 1 1/4" long, hex. head For main bearing plate—take-off end.	6		2
342	XA 8	SCREW, No. 10-32 x 1/2" long, rd. hd. .. For mounting oil pump cover.	4		1	365	XD 33	SCREW, 3/8"-16 x 2-1/4" long, hex. hd. For mounting magneto (Lower hole).	1		2
343	XA 33	SCREW, 1/4"-20 x 3/8" long, ind. hex. hd. 6-for flywheel screen. 4-for lower cylinder shroud, R & L sides. 2-for cylinder head deflector, R.H. side. 12-for cylinder head shrouds. 3-for air shroud side cover. 2-for rear shroud cover, lower holes.	29		1	366	XD 43	SCREW, 1/2"-13 x 1 1/2" long, hex. head For mounting engine supports.	4		2
344	XA 36	SCREW, 1/4"-20 x 3/4" long, ind. hex. hd. For rear shroud cover, top holes.	2		1	368	XE 55	SCREW, 5/16"-18 x 3/8" long, Allen head set For idler stud.	1		1
346	XA 56	SCREW, No. 10-32 x 1 1/4" long, ind. hex. hd. For oil pump cover.	2		1	369	XE 65	SCREW, No. 10-32 x 1/4" long, Allen head set For fuel pump primer shaft.	1		1
347	XA 65	SCREW, No. 8 x 1/2" long, self-tapping, sheet metal For mounting choke bracket.	2		1	370	PA 367	ROLL PIN, 1/8" x 3/4" long For governor yoke mounting. XH 1 Taper Pin, #0 x 3/4" long, replaced by PA 367 if new yoke, cross shaft and lever are used.	1		1
348	XA 67	SCREW, No. 4 x 1/4" long, self-tapping, sheet metal For mounting name plate.	4		1	371	XI 16	COTTER PIN, 1/8" x 1" long For oil pump relief valve spring.	1		1
	Optional XJ 52	RIVET, 9/64" dia. x 1/4" long, tubular steel For mounting name plate to cylinder head cover.	4		1	372	XI 32	COTTER PIN, 3/64" x 3/8" long For governor control rod.	1		1
351	XC 68	SCREW, 5/16"-18 x 3/4" flat socket head For bearing retainer plate—flywheel end. XC 17 flat slot head, repl'd. by XC 68.	4		1	374	XK 1	PLUG, 1/8" pipe, square head For inlet manifold.	1		1
352	XA 33	SCREW, 1/4"-20 x 1/2" long, ind. hex. hd. 4-for lower cylinder shrouds. 1-for exhaust manifold tap, R.H. side.	5		1	375	XK 3	PLUG, 3/8" pipe, square head For oil drain.	1		1
353	XA 34	SCREW, 1/4"-20 x 1/2" long, hex. hd. 2-for fuel pump pad cover. 4-for cylinder head deflector.	6		1						
354	XD 6	SCREW, 1/4"-20 x 3/4" long, hex. hd. For fuel pump adapter. XB 75 (Allen cap screw), repl'd by XD 6.	2		1						
354	XA 36	SCREW, 1/4"-20 x 3/4" long, ind. hex. hd. For cylinder head deflector, L.H. side.	2		1						
356	XD 13	SCREW, 5/16"-18 x 1/2" long, hex. hd. For flywheel shroud mounting.	4		1						

Order parts from nearest **WISCONSIN DISTRIBUTOR** or **SERVICE CENTER**.
IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

REPAIR PARTS LIST

FOR

ACCESSORIES COMMONLY SUPPLIED

ON THIS MODEL ENGINE



IMPORTANT

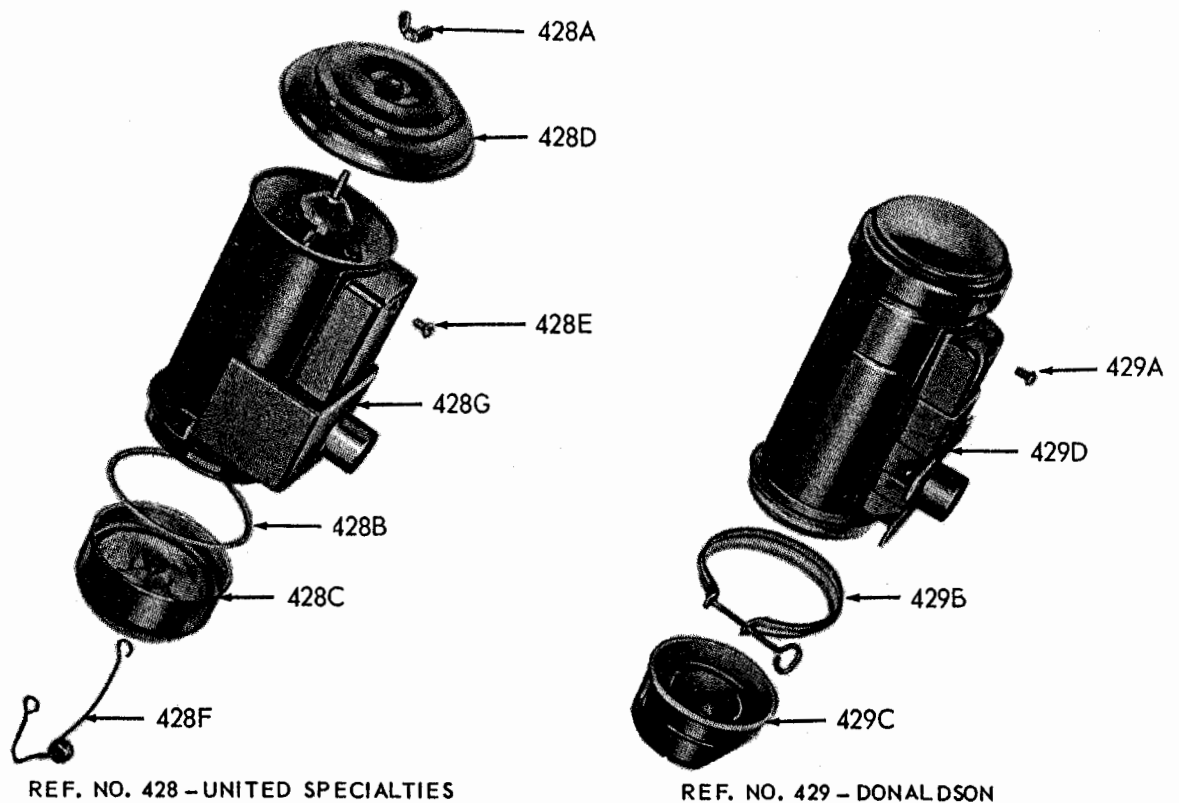
The following section is intended to be an aid in selecting service parts only if they had originally been supplied with the engine.

Should it be desired to convert an engine to use any accessories, contact Teledyne Wisconsin Motor or an authorized Dealer or Distributor before ordering parts. In most cases, a conversion can only be made if major engine parts are also changed.

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Parts are identified by reference number. See parts list for correct part number.

VH4 ENGINE HOUSE WITH FUEL TANK AT TAKE-OFF END



OPTIONAL AIR CLEANERS

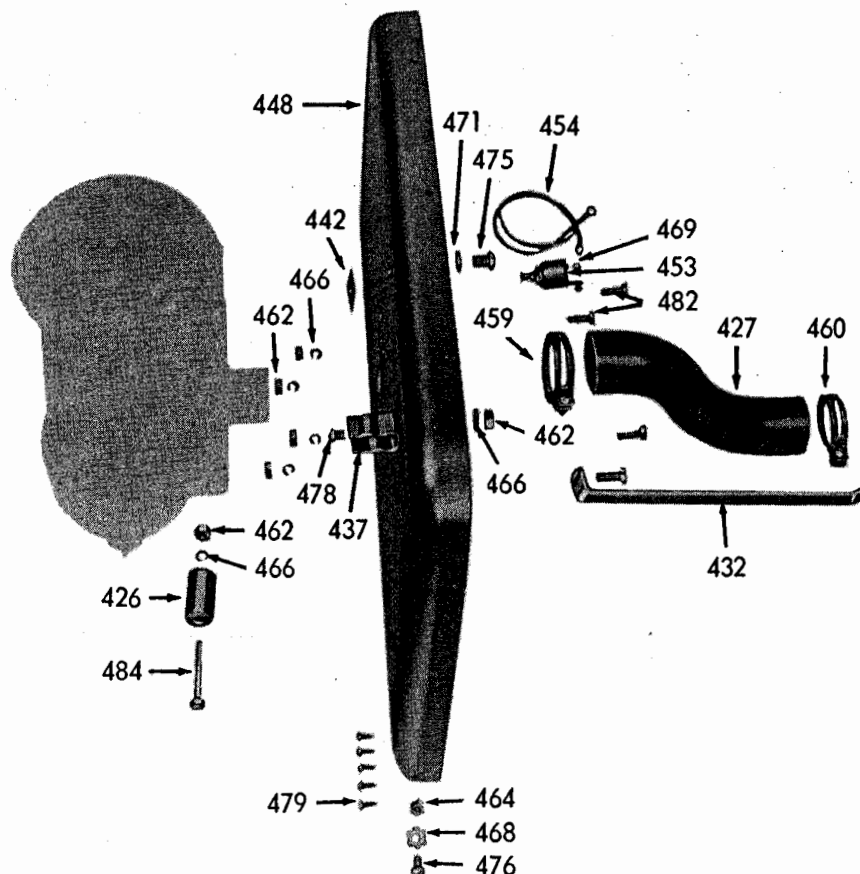


Fig. 62, END PANEL AND AIR CLEANER FOR ENGINE HOUSE WITH FUEL TANK AT TAKE-OFF END

Parts are identified by reference number. See parts list for correct part number.

VH4D ENGINE HOUSE WITH FUEL TANK AT TAKE-OFF END

Ref. No.	Part Number	Description	No. Req	Net Wt.		Ref. No.	Part Number	Description	No. Req	Net Wt.	
				Lb	Oz					Lb	Oz
425	HF-380	SPACER for rear panel to cylinder block	1		1	443	WE-192	FUEL TANK ASSEMBLY Consisting of:	1	17	2
426	HF-387	SPACER for crank mounting (Used only with LO-123 air cleaner).	1		3			WE-192-9 Support and straps	1	10	
427	LL-64	RUBBER ELBOW for air cleaner to carburetor	1		8			RC-77 Cap, Easy-on	1		2
428	LO-123-S1 (Obsolete)	AIR CLEANER, United Specialties No. 47D1 For complete replacement use LO-158-S2. Service parts:	1		6	444	WE-193-A	ENGINE SUPPORT, take-off end	1	3	1
428A		81-A1317 Wing nut	1		1	445	WE-194-A	ENGINE SUPPORT, flywheel end	1	2	9
428B		81-A9986 Gasket	1		1	446	WE-195	SIDE RAILS	2	1	8
428C		81-335B1 Oil cup and baffle assembly	1		8	447	WE-196	HOUSE DOORS (Standard)	2	4	8
428D		81-A10713 Top cap assembly	1		6			WE-196-F (Bumped out to clear distributor)	1	4	8
428E		81-A10962 Screw, 5/16"-18 x 1/2" long	1		1			For units with generator and distributor on left hand side of engine.			
428F		81-B9982 Roller and ball assembly	1		3	448	WE-197	FRONT PANEL (Standard)	1	4	4
428G		Body assembly	1					WE-197-2 (With additional holes for switch and ammeter)	1	4	4
429	LO-158-S2	AIR CLEANER (4-3/8" dia.) Donaldson No. FGA04-2512. Service parts:			4			For units with electric starting.			
429A		5/16-18 x 1/2" round head support screw	1		1	450	WE-199-A	REAR PANEL	1	7	9
429B		22-P9595 Clamp assembly	1		3	451	WE-345	PARTITION PLATE for canopy	1	1	14
429C		22-P15463 Inner oil cup (not illustrated)	1		4	452	WE-346	CANOPY	1	4	5
429D		22-P14889 Outer oil cup	1		6	453	YC-9-F-S1	IGNITION SWITCH ASSEMBLY	1		2
		BODY ASSEMBLY - not serviced, order complete air filter. LO-120-S1, Donaldson No. A-4578, replaced by LO-158-S2 (Interchangeable) 22-P10498 Oil cup assem. must be used on LO-120-S1. Replaces P16457 cup	1		6	454	YL-352-21	IGNITION WIRE, switch to magneto	1		1
430	LP-43	FUEL STRAINER (small)	1		3			STANDARD HARDWARE			
		LQ-31 Repair Kit.				458	LJ-175	NIPPLE, 1 1/4" x 8" long, W.I. pipe	1	1	
	LP-19 (Optional)	FUEL STRAINER (large)			12			For muffler mounting.			
		LQ-32 Repair Kit.				459	LK-8	HOSE CLAMP, 2-1/8" I.D.	1		1
431	PG-323A-S1	DOOR CLIP ASSEMBLY (wire type) Consisting of: PG-323A Clip PM-137-1 Spring PH-196 Washer XI-16 Cotter pin PG-323 Clip (cast iron), with PH-2 washer and XI-23 cotter pin - replaced by PG-323A-S1 assembly.	2		4	460	LK-10	HOSE CLAMP, 2" I.D.	1		1
432	PG-799	HOUSE BRACE, flywheel end	1		8	462	PD-77	NUT, 1/4"-20 thread, hexagon steel 5-for tank support to rear panel. 4-for air cleaner mounting. 4-for partition plate. 1-for crank spacer. (Used with LO-123). 1-for crank spring clip. 1-for house brace, L.H. (T.O. end).	16		1
433	PG-801	HOUSE BRACE, take-off end, R.H. side	1		4	463	PD-79	NUT, 3/8"-16 thread, hexagon steel For side rails to engine supports.	4		1
434	PG-816	HOUSE BRACE, take-off end, L.H. side .. PG-800, replaced by PG-816.	1		6	464	PD-115	NUT, No. 10-32 thread, hexagon steel .. For front panel to side of shroud.	2		1
436	PH-198	GROMMET for fuel line	1		1	466	PE-3	LOCKWASHER, 1/4" spring lock	34		1
437	PK-87	SPRING CLIP for crank mounting	1		1			10-for canopy. 5-for rear panel to engine support. 6-for fuel tank support. 4-for air cleaner mounting. 4-for partition plate. 1-for crank spacer. (Used with LO-123). 1-for crank spring cup. 1-for house brace, L.H. (T.O. end). 2-for house braces to manifold.			
440	RF-1225	ELBOW for fuel strainer outlet	1		1						
		RF-270, replaced by RF-1225.									
441	RM-1049-A	FUEL LINE, tank to carburetor	1		2						
442	SD-109	TAG for ign. switch. "To Stop Push In"	1		1						

VH4D ENGINE HOUSE WITH FUEL TANK AT TAKE-OFF END

Ref. No.	Part Number	Description	No. Req	Net Wt.	
				Lb	Oz
467	PE-5	LOCKWASHER, 3/8" spring lock For side rails to engine support.	4		1
468	PE-45	LOCKWASHER, No. 10 External 'Ever- lock' for front panel to side of shroud	2	1	
469	PE-72	LOCKWASHER, ignition switch terminal	1	1	
471	PH-77-A	PLAIN WASHER, 5/16" I.D. x 1/16" thick steel For air cleaner support screw.	1	1	
472	PH-196	PLAIN WASHER, 1/4" I.D. x 1/16" thick steel For rear panel to cylinder block mount- ing.	3	1	
474	RF-794	NIPPLE, 1/8" x 3/4" long, close pipe For fuel strainer mounting.	1	1	
475		SCREW, 5/16"-18 thread x 1/2" long, round head Furnished with air cleaner.	1	1	
476	XA-8	SCREW, No. 10-32 thread x 1/2" long, round head For front panel to side of shroud.	2	1	
477	XA-33	SCREW, 1/4"-20 thread x 3/8" long, round or indented hexagon head 7-for canopy mounting. 5-for rear panel to engine support. 4-for partition plate.	16	1	
478	XA-34	SCREW, 1/4"-20 thread x 1/2" long, round or indented hexagon head 6-for fuel tank support. 3-for canopy and tank support. 1-for crank spring clip. 1-for house brace, L.H. (T.O. end).	11	1	
479	XA-65	SCREW, No. 8 x 1/2" long, self-tapping, sheet metal For front panel to shroud.	5	1	
481	XD-4	SCREW, 1/4"-20 thread x 1/2" long, hex- agon head For house braces to manifold.	2	1	
482	XD-6	SCREW, 1/4"-20 thread x 3/4" long, hex- agon head For mounting air cleaner.	4	1	
483	XD-7	SCREW, 1/4"-20 thread x 1" long, hex- agon head For rear panel to cylinder block, R.H. side.	1	1	
484	XD-11	SCREW, 1/4"-20 thread x 2" long, hex- agon head For mounting crank spacer to L.O-123 air cleaner.	1	1	
486	XD-25	SCREW, 3/8"-16 thread x 3/4" long, hex- agon head For side rails to engine supports.	4	1	

Ref. No.	Part Number	Description	No. Req	Net Wt.	
				Lb	Oz
487	XD-41	SCREW, 1/4"-13 thread x 1" long, hex- agon head For engine supports to crank case.	4		2
488	XD-120	SCREW, 1/4"-20 thread x 3/4" long, hex- agon head For rear panel to cylinder block, L.H. side.	1		2

VH4 ENGINE HOUSE WITH UNDERSLUNG FUEL TANK

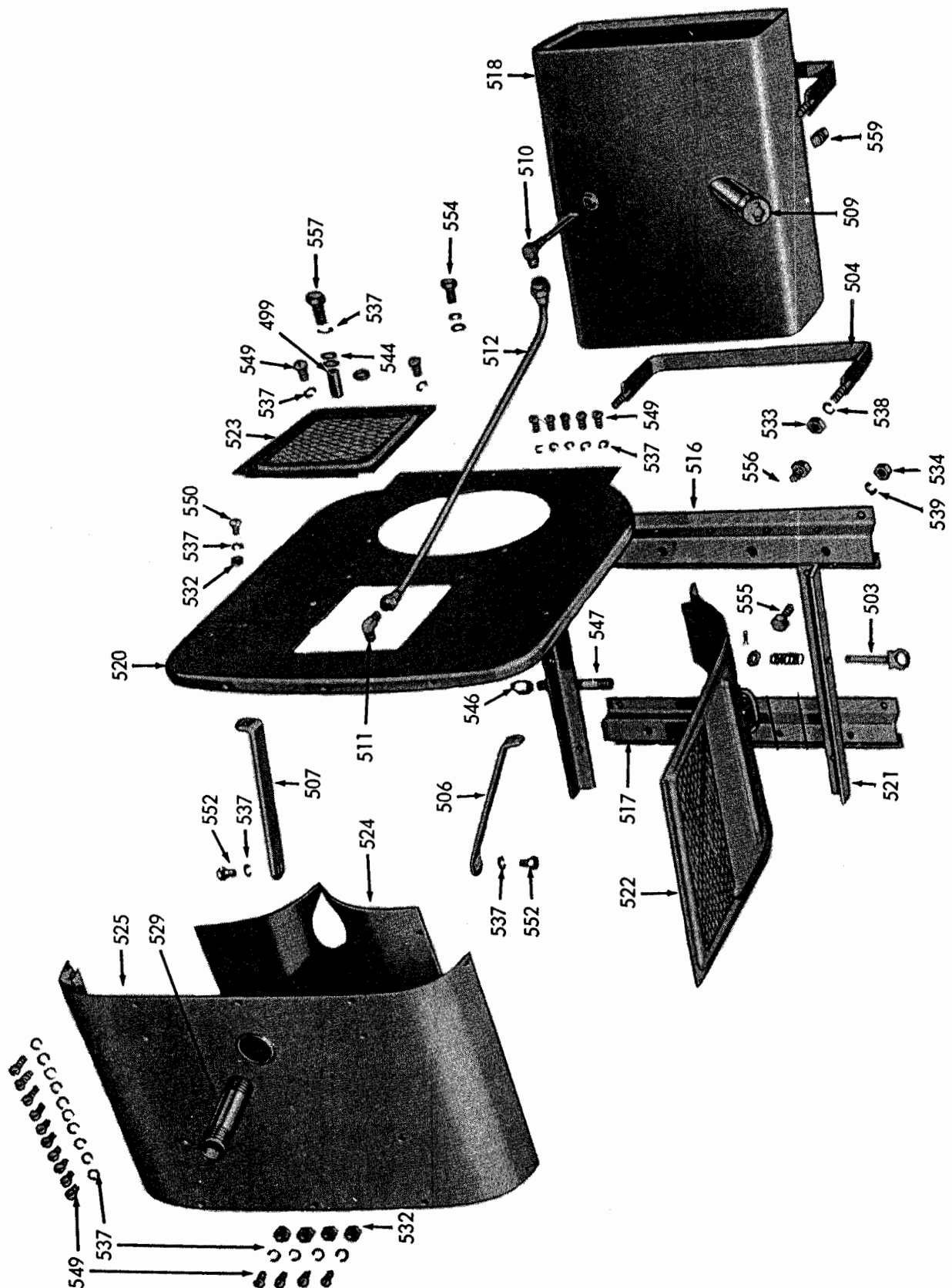
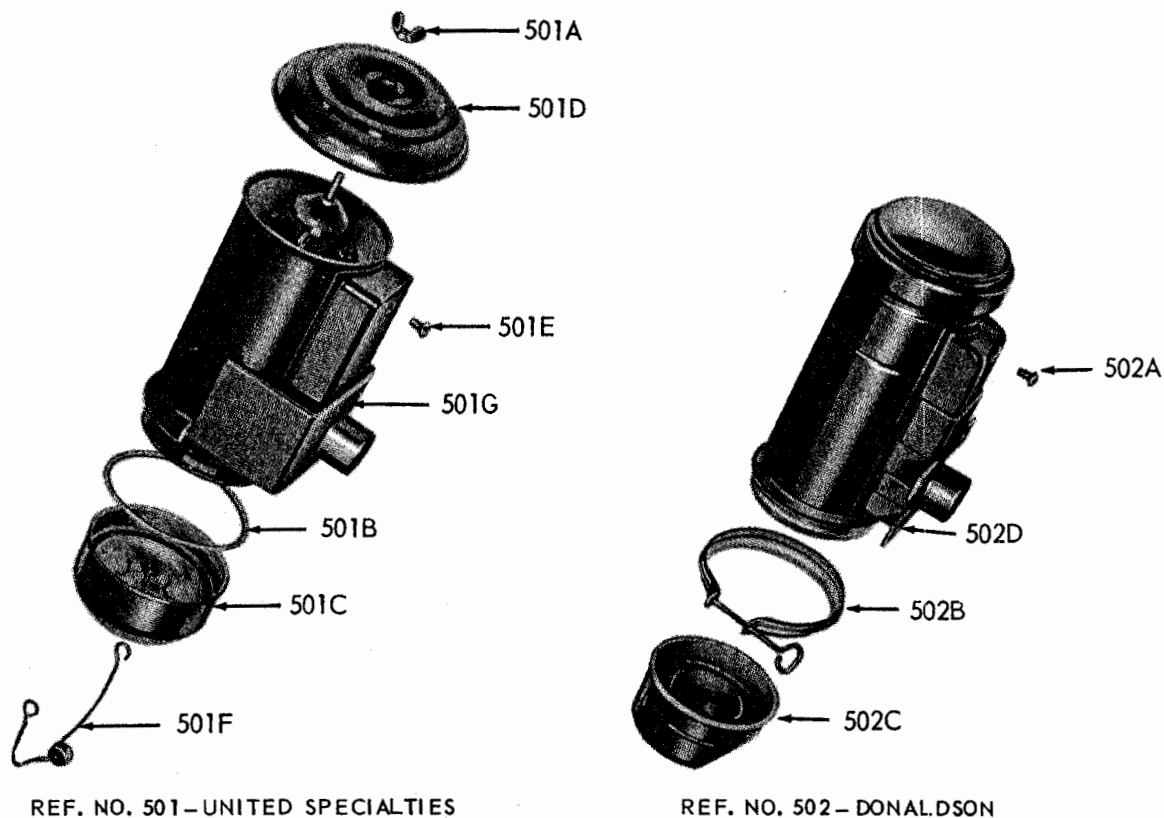


Fig. 63, ENGINE HOUSE WITH UNDERSLUNG FUEL TANK

Parts are identified by reference number. See parts list for correct part number.

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VH4 ENGINE HOUSE WITH UNDERSLUNG FUEL TANK



OPTIONAL AIR CLEANERS

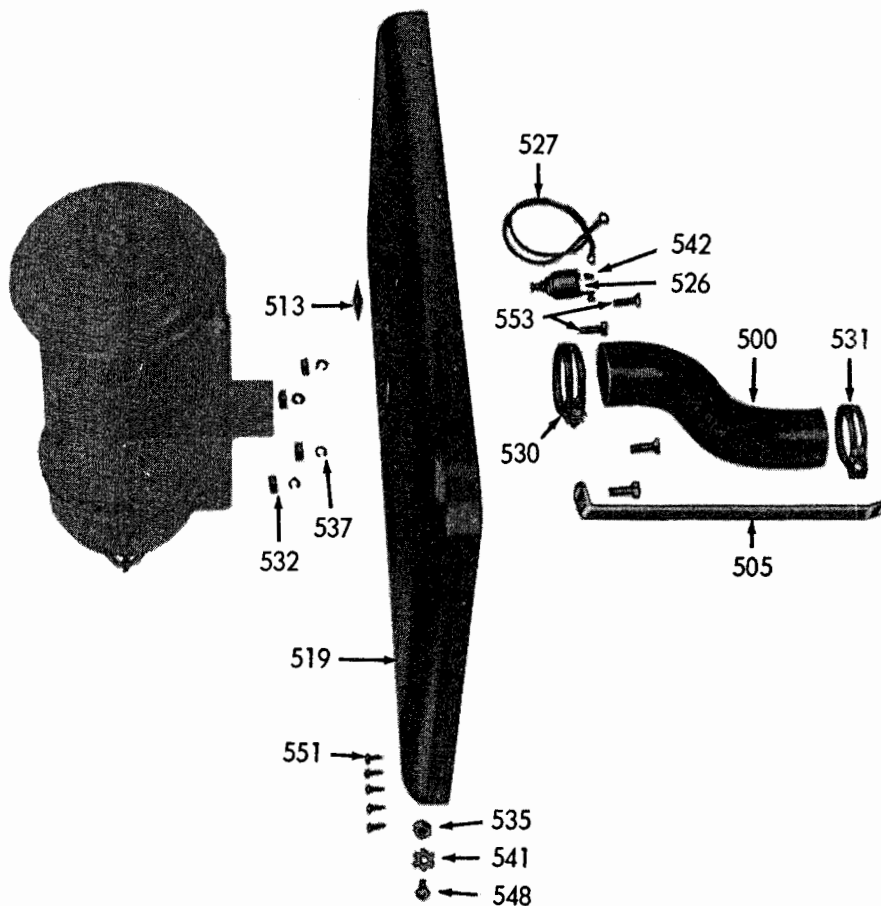


Fig. 64, END PANEL AND AIR CLEANER FOR ENGINE HOUSE WITH UNDERSLUNG FUEL TANK

Parts are identified by reference number. See parts list for correct part number.

VH4D ENGINE HOUSE WITH UNDERSLUNG FUEL TANK

Ref. No.	Part Number	Description	No. Req	Net Wt.	
				Lb	Oz
499	HF-380	SPACER for rear panel to cylinder block	1		1
500	LL-64	RUBBER ELBOW for air cleaner to carburetor	1		8
501	LO-123-S1 (Obsolete)	AIR CLEANER, United Specialties No. 47D1 For complete replacement use LO-158-S2. Service parts:	1	6	
501A		81-A1317 Wing nut	1		1
501B		81-A9986 Gasket	1		1
501C		81-335B1 Oil cup and baffle assembly	1		8
501D		81-A10713 Top cap assembly	1		6
501E		81-A10962 Screw, 5/16"-18 x 1/2" long	1		1
501F		81-B9982 Roller and bail assembly	1		3
501G		Body assembly	1		
502	LO-158-S2	AIR CLEANER (4-3/8" dia.) Donaldson No. FGA04-2512 Service parts:		4	
502A		5/16-18 x 1/2" round head support screw	1		1
502B		22-P9595 Clamp assembly	1		3
		22-P15463 Inner oil cup (Not illustrated)	1		4
502C		22-P14889 Outer oil cup	1		6
502D		BODY ASSEMBLY—not serviced, order complete air filter. LO-120-S1, Donaldson No. A-4578, replaced by LO-158-S2 (Interchangeable) 22-P10498 Oil cup assm. must be used on LO-120-S1. Replaces P16457 cup	1		6
503	PG-323A-S1	DOOR CLIP ASSEMBLY (wire type) ... Consisting of: PG-323A Clip PM-137-1 Spring PH-196 Washer XI-16 Cotter pin PG-323 Clip (cast iron), with PH-2 washer and XI-23 cotter pin—replaced by PG-323A-S1 assembly.	2		4
504	PG-329-B	STRAP for fuel tank with 2" corner radius PG-329-A for tank with 1-1/8" corner radius.	2	1	3
505	PG-799	HOUSE BRACE, flywheel end	1		8
506	PG-801	HOUSE BRACE, take-off end, R.H. side	1		4
507	PG-816	HOUSE BRACE, take-off end, L.H. side PG-800, replaced by PG-816.	1		6
509	RC-87	CAP for fuel tank	1		2
510	RM-1206-C	SUCTION TUBE ASSEMBLY in fuel tank	1		3
511	RF-1225	ELBOW for fuel pump inlet	1		2
512	RM-900	FUEL LINE, tank to pump	1		6
513	SD-109	TAG for ign. switch. "To Stop Push In"	1		1
516	WE-202-A	ENGINE SUPPORT, take-off end	1	4	10
517	WE-203	ENGINE SUPPORT, flywheel end	1	3	9
518	WE-204-S1	FUEL TANK with RC-87 cap and RM-1206C suction tube WE-204A-S1 (Filler neck relocated) for units with electric starter and generator	1	9	
519	WE-206	FRONT PANEL (Standard) WE-206-6 (With additional holes for switch and ammeter) For units with electric starting.	1	3	10
520	WE-207-A	REAR PANEL	1	5	10
521	WE-208	SIDE RAIL	2	1	8
522	WE-209	HOUSE DOOR WE-209-E (Bumped out to clear distributor) For units with generator and distributor on left hand side of engine.	2	3	11
523	WE-211	COVER for rear panel	1		12
524	WE-345	PARTITION PLATE for canopy	1	1	14
525	WE-346	CANOPY	1	4	5
526	YC-9-F-S1	IGNITION SWITCH ASSEMBLY Includes: SD-109 Tag and PE-72 L.W.	1		2
527	YL-352-21	IGNITION WIRE, switch to magneto	1		1
		STANDARD HARDWARE			
529	LJ-279	PIPE NIPPLE, 1 1/4" x 3 1/2" W.I. For muffler mounting.	1		8
530	LK-8	HOSE CLAMP, 2-1/8" I.D. For air cleaner connection, cleaner end.	1		1
531	LK-10	HOSE CLAMP, 2" I.D. For air cleaner connection, carburetor end.	1		1
532	PD-77	NUT, 1/4"-20 thread, hexagon steel 4-for air cleaner mounting. 4-for partition plate. 2-for house braces to panel, take-off end.	10		1
533	PD-78	NUT, 5/16"-18 thread, hexagon steel For tank straps to engine supports.	4		1
534	PD-79	NUT, 3/8"-16 thread, hexagon steel For side rails to engine supports.	4		1
535	PD-115	NUT, No. 10-32 thread, hexagon steel For front panel to side of shroud.	2		1
537	PE-3	LOCKWASHER, 1/4" spring lock 10-for canopy. 4-for partition plate. 5-for rear panel to engine support. 2-for cover to rear panel. 4-for air cleaner mounting. 2-for house braces to panel, take-off end. 2-for house braces to manifold.	29		1
538	PE-4	LOCKWASHER, 5/16" spring lock For tank straps to engine supports.	4		1

VH4D ENGINE HOUSE WITH UNDERSLUNG FUEL TANK

Ref. No.	Part Number	Description	No. Req.	Net Wt.	
				Lb	Oz
539	PE-5	LOCKWASHER, 3/8" spring lock For side rails to engine supports.	4		1
541	PE-45	LOCKWASHER, No. 10 External 'Ever-lock', for front panel to side of shroud	2		1
542	PE-72	LOCKWASHER, ignition switch terminal	1		1
544	PH-196	PLAIN WASHER, 1/4" I.D. x 1/16" thick steel For rear panel to cylinder block mtg.	3		1
546	RF-937	COUPLING, 3/8" W.I. pipe For oil drain pipe.	1		2
547	RF-1086-A	NIPPLE, W.I. pipe for oil drain	1		4
548	XA-8	SCREW, No. 10-32 thread x 1/2" long, round head For front panel to side of shroud.	2		1
549	XA-33	SCREW, 1/4"-20 thread x 3/8" long, round or indented hexagon head 10-for canopy. 4-for partition plate. 5-for rear panel to engine support. 2-for cover to rear panel.	21		1
550	XA-34	SCREW, 1/4"-20 thread x 1/2" long, round or indented hexagon head For housebraces to panel, take-off end.	2		1
551	XA-65	SCREW, No. 8 x 1/2" long, self-tapping, sheet metal, for front panel to shroud ..	5		1
552	XD-4	SCREW, 1/4"-20 thread x 1/2" long, hexagon head For house braces to manifold.	2		1
553	XD-6	SCREW, 1/4"-20 thread x 3/4" long, hexagon head For air cleaner mounting.	4		1
554	XD-7	SCREW, 1/4"-20 thread x 1" long, hexagon head For rear panel to cylinder block, R.H. side.	1		1
555	XD-25	SCREW, 3/8"-16 thread x 3/4" long, hexagon head For side rails to engine supports.	4		1
556	XD-41	SCREW, 1/2"-13 thread x 1" long, hexagon head For engine supports to crankcase.	4		2
557	XD-120	SCREW, 1/4"-20 thread x 3/4" long, hexagon head For rear panel to cylinder block, L.H. side.	1		2
559	XK-1	PLUG, 1/8" square head pipe For fuel tank drain.	1		1

Order parts from nearest **SERVICE CENTER** shown in directory following parts list.
IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

SIDE MOUNT FUEL TANK

For Model VH4D

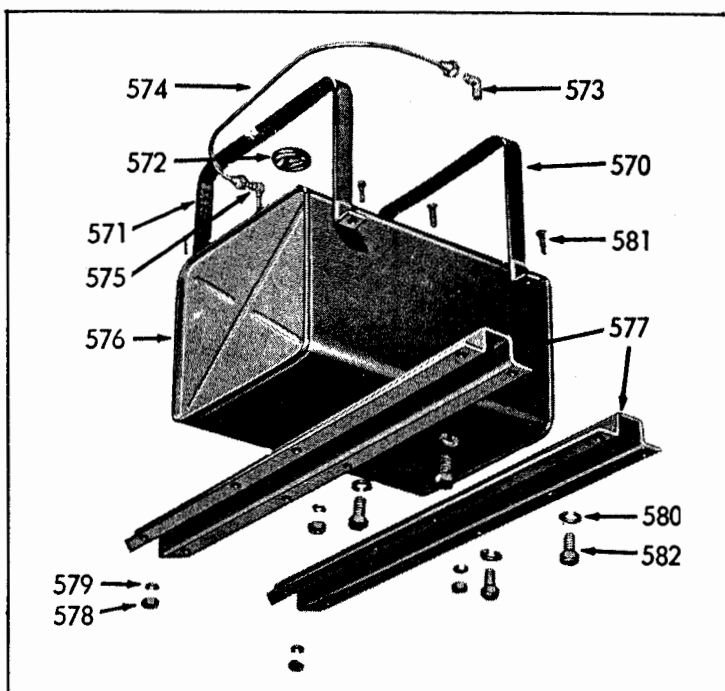
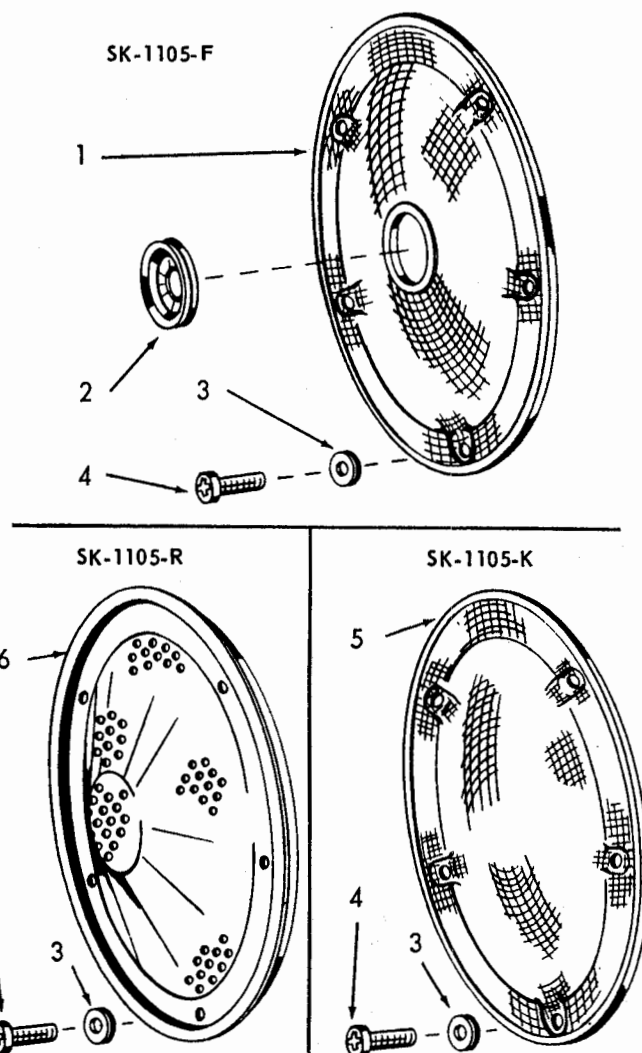


Fig. 65

104724C

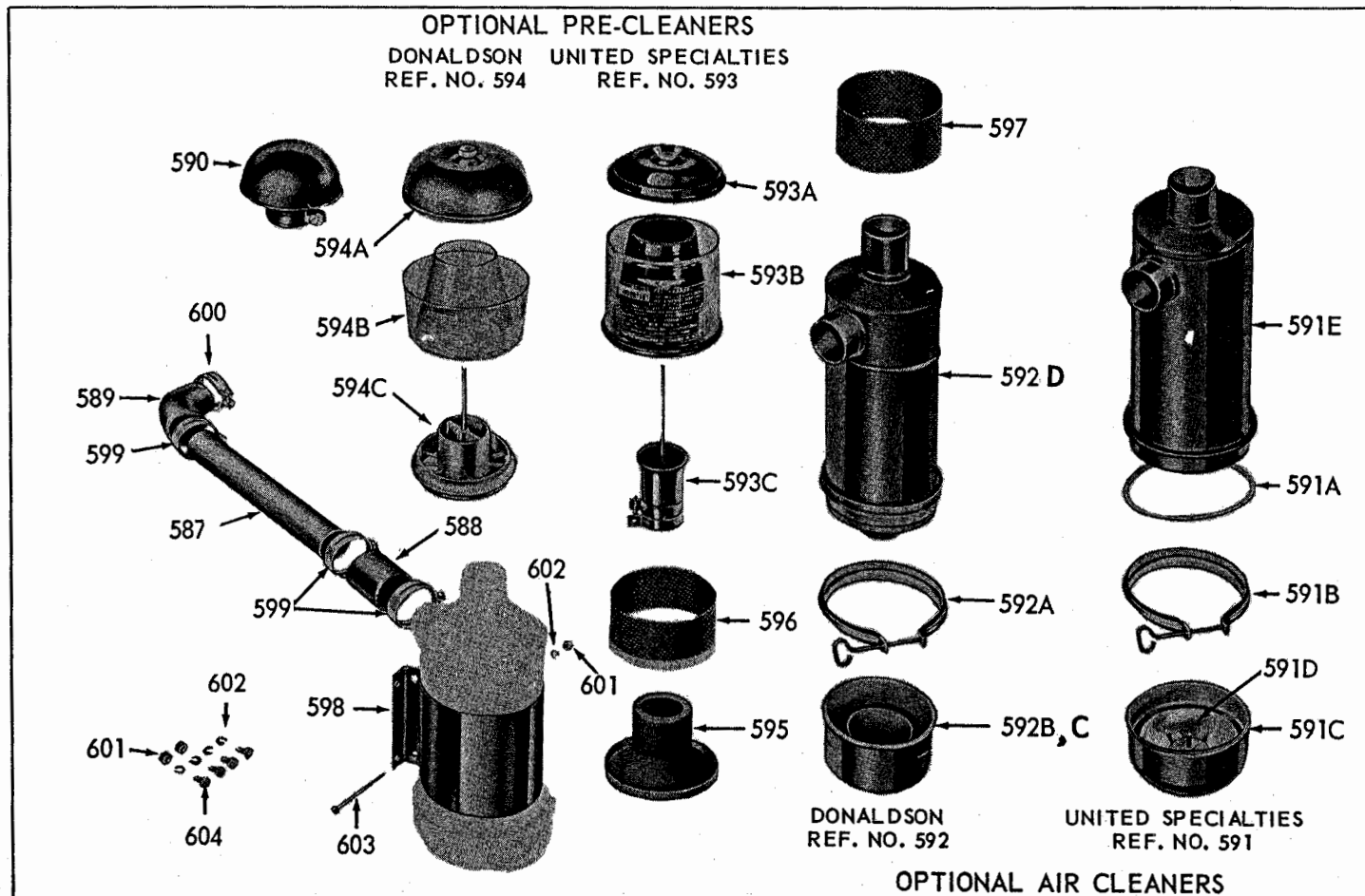
Ref. No.	Part Number	Description	No. Req	Net Wt.	
				Lb	Oz
570	PG-321	STRAP for fuel tank	2	1	
571	PH-244-A	FELT for fuel tank strap	2		2
572	RC-77	CAP for fuel tank	1		3
573	RF-1225	ELBOW for fuel line, in fuel strainer ..	1		1
574	RM-1161	FUEL LINE from tank to fuel strainer (22½" long)	1		4
		RM-822 for engines with electric starter (26½" long)	1		5
575	RM-1206-B	SUCTION TUBE ASSEMBLY for fuel tank ..	1		3
576	WE-187-S1 WE-187E-S1 (Optional)	FUEL TANK, 6 gal. capacity	1	7	
		With RC-77 cap, and RM-1206-B suction tube.			
577	WE-188	ENGINE SUPPORT	2	4	11
		WE-188D for engines with electric starter	5	4	
STANDARD HARDWARE					
578	PD-79	NUT, 3/8"-16 thread, hexagon steel For fuel tank straps to supports.	4		1
579	PE-5	LOCKWASHER, 3/8" spring lock	4		1
580	PE-7	LOCKWASHER, 1/2" spring lock	4		1
581	XD-27	SCREW, 3/8"-16 thread x 1" long, hexagon head	4		1
582	XD-41	SCREW, 1/2"-13 thread x 1" long, hexagon head	4		2
		For engine supports to crankcase.			

ROTATING SCREENS



Ref. No.	Part Number	Description	No. Req	Net Wt.	
				Lb	Oz
	THE FOLLOWING REPLACE STANDARD PARTS				
	N-101A-2	FLYWHEEL—Includes GH-43 Ring Gear and tappedholes for mt'g rotating screen	1	35	
	N-101-7	FLYWHEEL — for 10 amp alternator, ring gear and rotating screen	1		
	N-101-11	FLYWHEEL — for 25 amp alternator, ring gear and rotating screen	1		
	U-212-A	HAND CRANK	1	2	
		PER SK-1105-F			
1	SE-204C-S1	ROTATING SCREEN ASSEMBLY Consisting of:	1	2	
2	PH-426	Grommet	1		1
3	PH-442	Washers	5		1
—	SE-204-C	Screen	1	1	8
4	XA-104	Lok-Thread screws	5		1
		PER SK-1105-K			
5	SE-204-D	ROTATING SCREEN	1	1	
		PER SK-1105-R			
6	SE-321	ROTATING SCREEN	1	2	8

LAA-102, LAA-103 Side Mount Air Cleaner Assemblies for Model VH4D



LAA-102 includes LO-86, LAA-103 includes LO-114, all other parts are the same.

Fig. 66

222996C-1

Ref. No.	Part Number	Description	No. Req.	Net Wt. Lb	Oz	Ref. No.	Part Number	Description	No. Req.	Net Wt. Lb	Oz
587	LJ-120	TUBE for air cleaner to carburetor elbow	1	1	1	594	LO-114	PRE-CLEANER, collector type.....	1	1	8
588	LL-27	RUBBER HOSE for air cleaner tube	1		2			Service parts:			
589	LL-67	RUBBER ELBOW for air cleaner tube ..	1		4	594A	22-P20116	Cover assembly	1		4
590	LO-96	STACK CAP for United Spec. air cleaner	1		12	594B	22-P20115	Body	1		4
	LO-86	STACK CAP for Donaldson air cleaner			10	594C	22-P20120	Sleeve assembly	1	1	
591	LO-121-S1 (Obsolete)	AIR CLEANER, United Spec. No. 45D4 For replacement order LO-157-1-S1.	1	3	12	595	LO-133	BASE for United Spec. pre-screener	1		4
		Service parts:				596	LO-134	PRE-SCREENER for LO-109 pre-cleaner	1		2
591A	81-615A6	Gasket	1		1	597	LO-147-A	PRE-SCREENER for LO-114 pre-cleaner	1		4
591B	81-214B1K011	Clamp assembly	1		2	598	PG-291	STRAP for mounting air cleaner	1	1	
591C	81-496B1K111	Oil cup (order baffle sep.)	1		6			STANDARD HARDWARE			
591D	81-415B1K11	Baffle	1		3	599	LK-8	HOSE CLAMP, 2-1/8" I.D.	3		2
591E		Body assembly	1					For air cleaner connections.			
592	LO-157-1-S1 (2 1/2" stack)	AIR CLEANER	1	3	12	600	LK-10	HOSE CLAMP, 2" I.D.	1		2
		Service parts:						For air cleaner elbow, carburetor end.			
592A	22-P2846	Clamp assembly	1		3	601	PD-77	NUT, 1/4"-20 thread, hexagon steel	4		1
592B	22-P15463	Inner oil cup	1		4			For air cleaner strap mounting.			
592C	22-P14889	Outer oil cup	1		6	602	PE-3	LOCKWASHER, 1/4" spring lock	6		1
592D		BODY (Order complete air cleaner.)						For air cleaner strap mounting.			
		LO-119-A-S1, replaced by LO-157-1-S1.				603	XA-74	SCREW, 1/4"-20 thread x 2 1/4" long, round head, for air cleaner strap clamping	2		1
		22-P14818 Oil cup assembly must be used for service on LO-119-A-S1.				604	XD-4	SCREW, 1/4"-20 thread x 1/2" long, hexagon head, for strap to shroud	4		1
593	LO-109	PRE-CLEANER, collector type	1	1	12						
		Service parts:									
593A	81-A16380	Cap assembly	1		4						
593B	81-B16382	Body assembly	1	1							
593C	81-A16370	Sleeve assembly	1		8						

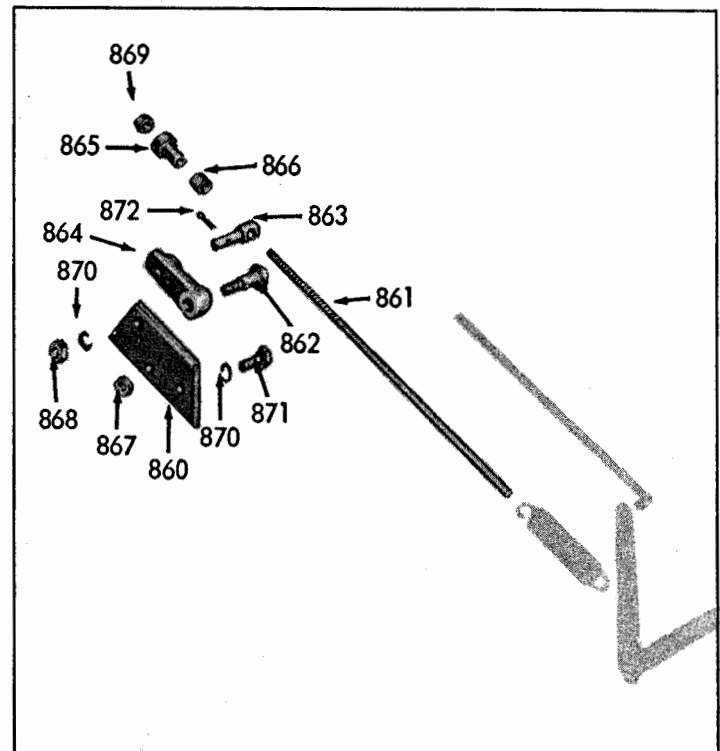
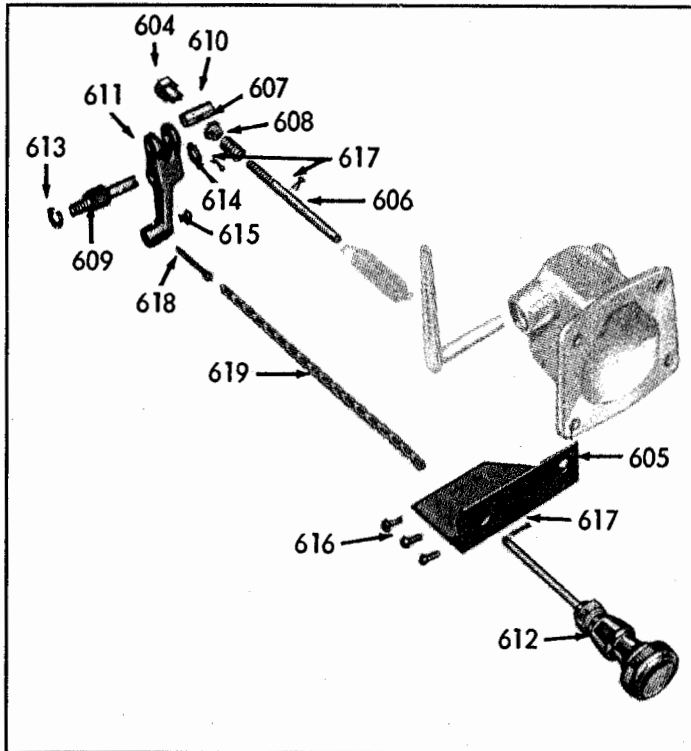
Order parts from nearest **SERVICE CENTER** shown in directory following parts list.

IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

TT-45-L AND TT-45L-1
GOVERNOR CONTROL ASSEMBLIES

TT-45-D-1
IDLE CONTROL ASSEMBLY

FOR VH4 ENGINE



104568C-1

Fig. 68

223371C

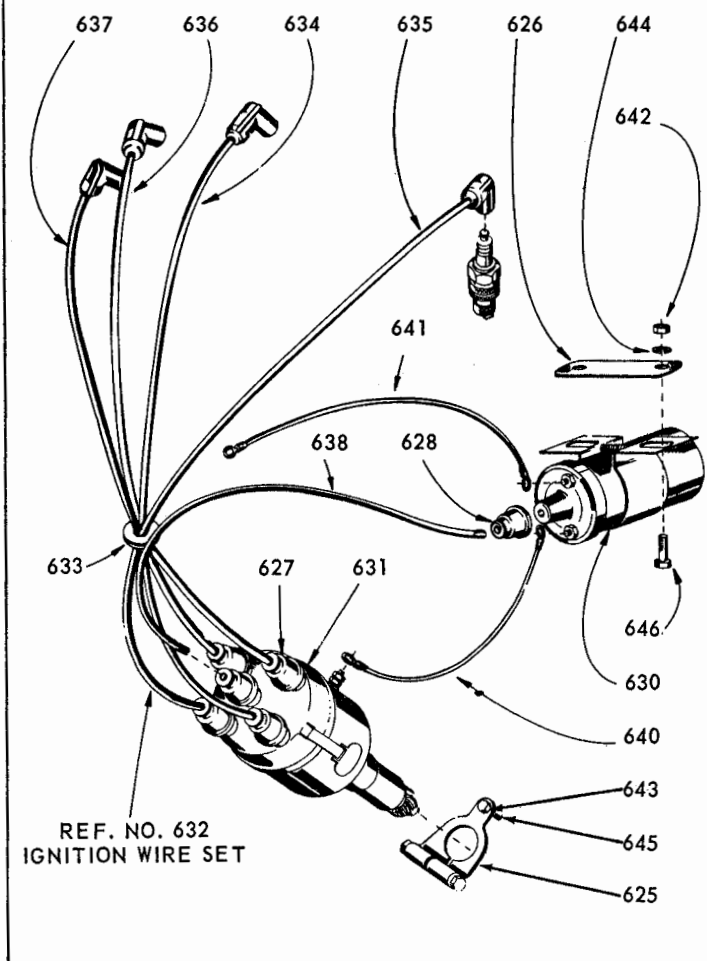
Ref. No.	Part Number	Description	No. Req	Net Wt. Lb Oz
	TT-45-L	GOVERNOR CONTROL ASSEMBLY - for open engine	1	1
	TT-45-L-1	GOVERNOR CONTROL ASSEMBLY - for power unit	1	1
		NOTE: The following parts are identical on both the above assemblies, except PG-342 bracket is not furnished on TT-45L-1 assembly.		
604	PD-173-A	LOCKNUT for adjusting screw	1	1
605	PG-342	BRACKET for governor and choke control	1	4
606	PI-115-E	ADJUSTING SCREW	1	2
607	PK-121	RETAINER for adjusting screw spring ..	1	1
608	PM-111-1	SPRING for adjusting screw	1	1
609	TC-365	PIN for variable speed lever support	1	1
610	TC-368-A	PIN for adjusting screw swivel	1	1
611	VB-134-A	VARIABLE SPEED LEVER	1	4
612	VE-527-W	CONTROL	1	8
		STANDARD HARDWARE		
613	PE-3	LOCKWASHER, 1/4" Positive	1	1
		For support pin.		
614	PH-77	PLAIN WASHER, 5/16" I.D. x 5/8" O.D. x 1/16" thick steel	1	1
		For variable speed lever.		
615	XA-62	SCREW, 8-32 thread x 1/2" long, round head	1	1
		For cotter pin in lever.		
616	XA-65	SCREW, 8 x 1/2" long, self-tapping, sheet metal. For control bracket	3	1
617	XI-1	COTTER PIN, 1/16" x 1/2" long	3	1
		1-for variable speed lever pin.		
		1-for adjusting screw spring.		
		1-for chain at control.		
618	XI-11	COTTER PIN, 3/32" x 1 1/4" long	1	1
		For chain at lever.		
619		No. 1/0 GALVANIZED SAFETY CHAIN	1 pc	1
		8 1/2" long. For control to lever.		

Ref. No.	Part Number	Description	No. Req	Net Wt. Lb Oz
860	PG-348-A	BRACKET for control lever	1	2
861	PI-145-B	ADJUSTING SCREW	1	2
862	TC-380	FULCRUM PIN for control lever	1	1
863	TC-381	PIN for adjusting screw	1	1
864	VB-142-5	IDLE CONTROL LEVER	1	4
865	VE-452-A	CONTROL ROD HEAD	1	2
866	VE-657	CONTROL ROD NUT	1	1
		STANDARD HARDWARE		
867	HF-390	WASHER, 9/32" I.D. x 5/8" O.D. x 1/8" thick steel	1	1
		For mounting bracket.		
868	PD-77	NUT, 1/4"-20 thread, hexagon steel	1	1
		For fulcrum pin.		
869	PD-115	NUT, No. 10-32 thread, hexagon steel	1	1
		For control rod head.		
870	PE-3	LOCKWASHER, 1/4" Positive	2	1
		1-for fulcrum pin.		
		1-for bracket mounting.		
871	XD-4	SCREW, 1/4"-20 thread x 1/2" long, hexagon head	1	1
		For bracket mounting.		
872	XI-1	COTTER PIN, 1/16" x 1/2" long	1	1
		For adjusting screw pin.		

ELECTRICAL EQUIPMENT FOR MODEL VH4D ENGINE

IGNITION COIL and DISTRIBUTOR

APPLICABLE TO ACCESSORY DRIVE OR
GEAR GENERATOR DRIVE MOUNTING



Ref. No.	Part Number	Description	No. Req.	Net Wt.	
				Lb	Oz
631	YF-10C-S1	DISTRIBUTOR , Prestolite No. IAD-6004-2N YF-10A-S1 (IAD-6004-2F), replaced by YF-10C-S1. NOTE: For distributor service parts, refer to illustration, Page 61.	1	3	3
632	YL-285-F	DISTRIBUTOR IGNITION CABLE SET Consisting of:	1		12
633		PH-198 GROMMET	1		1
634		YL-339-28 CABLE ASSEMBLY Distributor to No. 1 spark plug.	1		2
635		YL-339-36 CABLE ASSEMBLY Distributor to No. 2 spark plug.	1		3
636		YL-339-32 CABLE ASSEMBLY Distributor to No. 3 spark plug.	1		3
637		YL-339-42 CABLE ASSEMBLY Distributor to No. 4 spark plug.	1		4
638		YL-358-8 CABLE ASSEMBLY Distributor to coil.	1		1
640	YL-352-8	IGNITION WIRE ASSEMBLY , 8" long, coil to distributor	1		1
641	YL-352-30	IGNITION WIRE ASSEMBLY , 30" long, coil to ignition switch For open engines. YL-352-23 WIRE ASSEMBLY , 23" long For power unit engines.	1		1
STANDARD HARDWARE					
642	PD-78	NUT , 5/16"-18 thread, hexagon steel .. For ignition coil mounting.	2		1
643	PE-3	LOCKWASHER , 1/4" spring lock For advance arm lock.	1		1
644	PE-4	LOCKWASHER , 5/16" spring lock For ignition coil mounting.	2		1
645	XD-4	SCREW , 1/4"-20 thread x 1/2" long, hexagon head..... For advance arm lock.	1		1
646	XD-15	SCREW , 5/16"-18 thread x 3/4" long, hexagon head..... For ignition coil mounting.	2		1

Ref. No.	Part Number	Description	No. Req.	Net Wt.	
				Lb	Oz
625	PG-543A-1	ADVANCE ARM ASSEMBLY	1		3
626	PG-791	SUPPORT PLATE for ignition coil mtg.	1		1
627	YD-20	TERMINAL PROTECTOR for distributor ignition cables	5		1
628	YD-20-A	TERMINAL PROTECTOR for ignition coil cable.....	1		1
630	YF-5-A (12 Volt)	IGNITION COIL with strap	1	1	14
	YF-4-A (6 Volt)	IGNITION COIL with strap		1	14

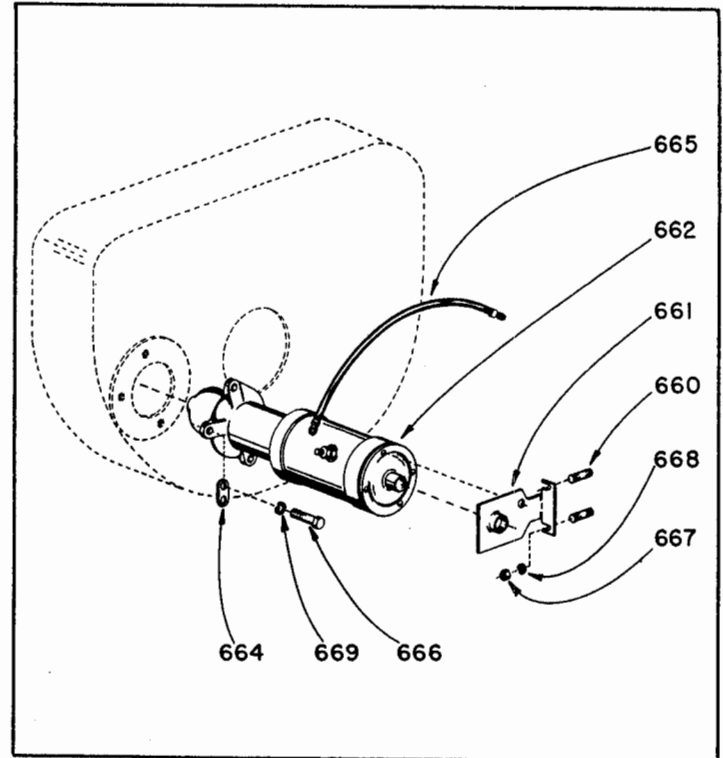
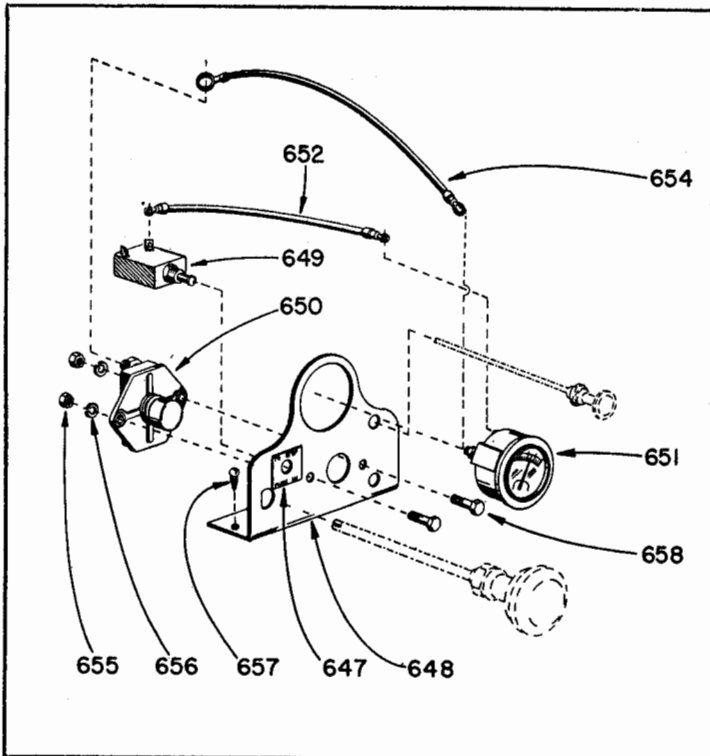
Order parts from nearest **SERVICE CENTER** shown in directory following parts list.

IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

ELECTRICAL EQUIPMENT FOR MODEL VH4D ENGINE

CONTROL PANEL GROUP

EEA-101 STARTING MOTOR ASSEMBLY (12 Volt) (Obsolete 6 Volt Starting Motor)

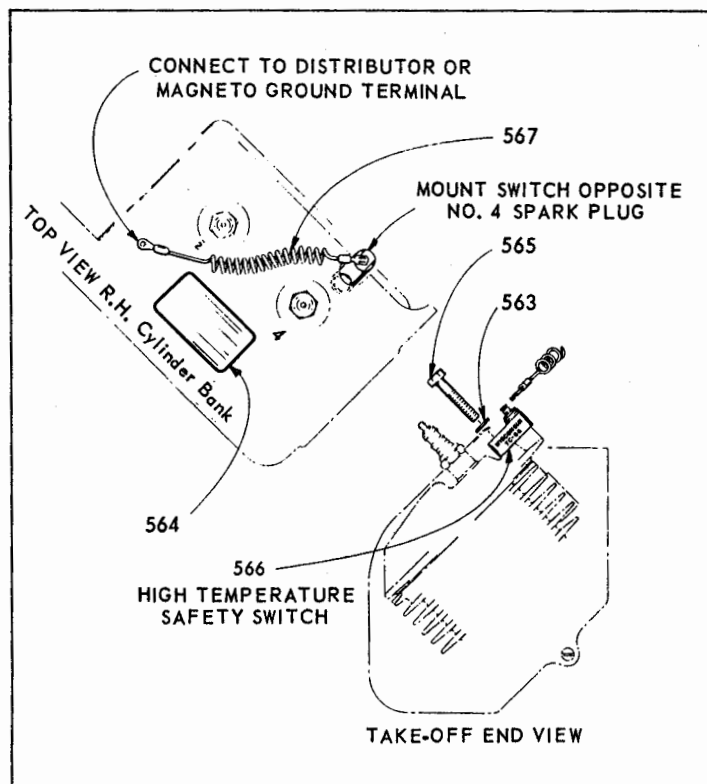


Ref. No.	Part Number	Description	No. Req	Net Wt. Lb Oz
647	SD-109	TAG, for ignition switch..... "To Stop Push In"	1	1
648	VE-439-D	CONTROL PANEL VE-439, replaced by VE-439-D.	1	8
649	YC-9-B-S1	IGNITION SWITCH ASSEMBLY	1	2
650	YC-10-C	STARTING SWITCH	1	4
651	YE-2	AMMETER (0—30 amps)	1	6
652	YL-352-4	IGNITION WIRE ASSEMBLY	1	1
		4" long, ammeter to ignition switch. For open engines.		
		YL-352-8 WIRE ASSEMBLY, 8" long ...	1	1
		For power unit engines.		
654	YL-353-6	IGNITION WIRE ASSEMBLY	1	1
		6" long, starter switch to ammeter.		
STANDARD HARDWARE				
655	PD-77	NUT, 1/4"-20 thread, hexagon steel	2	1
		For starter switch mounting.		
656	PE-3	LOCKWASHER, 1/4" spring lock	2	1
		For starter switch mounting.		
657	XA-65	SCREW, No. 8 x 1/2" long, self-tapping, sheet metal	4	1
		For mounting control panel.		
658	XD-6	SCREW, 1/4"-20 thread x 3/4" long, hex- agon head	2	1
		For starter switch mounting.		

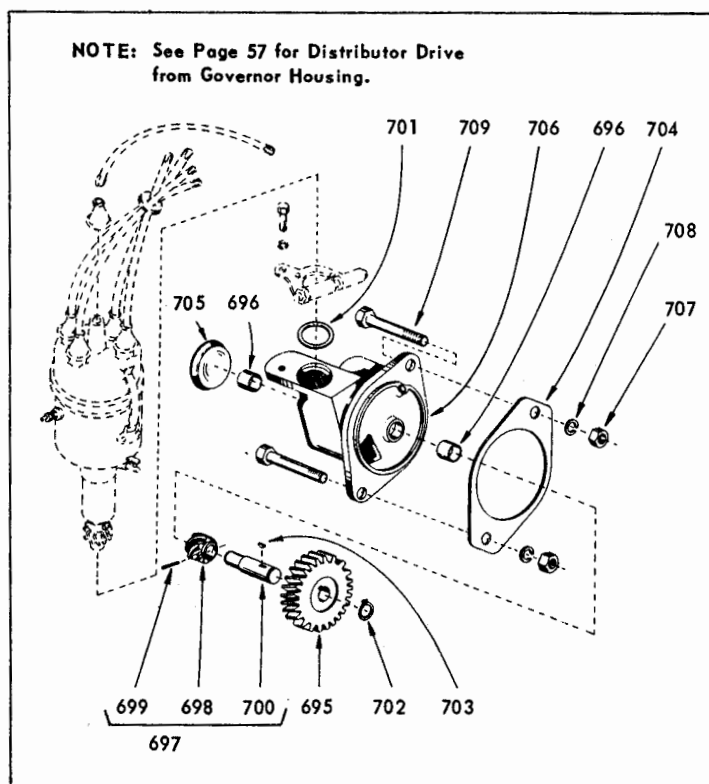
Ref. No.	Part Number	Description	No. Req	Net Wt. Lb Oz
660	PC-396	STUD, for starter bracket	2	1
661	PG-514-A-1	BRACKET, for starter support	1	6
662	YA-54-A (12 Volt)	STARTING MOTOR Prestolite MBG-4141 YA-18-3 (MBG-4109) was MBG-4024, replaced by YA-54-A.	1	17 8
	YA-55-A (6 Volt)	STARTING MOTOR Prestolite MZ-4212 YA-19-3 (MZ-4192 and MZ-4184), re- placed by YA-55-A.	1	17 8
		NOTE: For starting motor service parts, refer to illustration following electrical accessories.		
664	YD-296	TERMINAL CONNECTOR for ground....	1	1
665	YL-356-20	STARTER CABLE ASSEMBLY	1	4
		20" long, for open engines.		
		YL-356-26 CABLE ASSEMBLY, 26" long For power unit engines.	1	6
STANDARD HARDWARE				
666	PB-187	SCREW, 3/8"-24 thread x 1" long, hex- agon head.....	3	2
		For mounting electric starter. PB-24, replaced by PB-187.		
667	PD-10	NUT, 5/16"-24 thread, hexagon steel ..	2	1
		For mounting starter bracket.		
668	PE-4	LOCKWASHER, 5/16" spring lock	2	1
		For mounting starter bracket.		
669	PE-5	LOCKWASHER, 3/8" spring lock	3	1
		For mounting electric starter.		

ELECTRICAL EQUIPMENT FOR MODEL VH4D ENGINE

YC-66D-S1 HIGH TEMP. SAFETY SWITCH KIT



TF-129 DISTRIBUTOR DRIVE ASSEMBLY



Ref. No.	Part Number	Description	No. Req	Net Wt. Lb Oz
	YC-66-D-S1	HIGH TEMPERATURE SAFETY SWITCH KIT — Complete Consisting of:		8
563	PH-77	WASHER, 5/16" I.D., plain steel For switch to cylinder head mounting.	1	1
564	SD-233	INSTRUCTION DECAL	1	1
565	XD-22	CAPSCREW, 5/16"-18 thread x 1 1/4" long, hexagon head (special hardness) For switch to cylinder head mounting.	1	1
566	YC-66-D	HIGH TEMPERATURE SAFETY SWITCH For replacement, order YC-66-D-S1 Kit.	1	3
567	YL-357-42	WIRE ASSEMBLY, 42" long, with terminals. (Wire coiled to suit all models.)	1	1

Ref. No.	Part Number	Description	No. Req	Net Wt. Lb Oz
	NOTE: The TF-129 Distributor Drive Assembly includes the YF-10C-S1 distributor and ignition cable set illustrated on Page 53.			
695	GD-140	DRIVE GEAR	1	8
696	HG-182	BUSHING, for drive shaft	2	2
697	JJ-324	DRIVE SHAFT and GEAR ASSEMBLY Consisting of:	1	
698	GF-88	gear for distributor	1	2
699	PA-367	pin for distributor gear, 1/8" x 3/4" long	1	1
700	TA-132	drive shaft	1	2
701	JK-59	PACKING RING, for distributor mt'g. ..	1	1
702	PK-109	LOCK RING for drive gear	1	1
703	PL-161	KEY, No. 213 Woodruff, for drive gear ..	1	1
704	QD-616	GASKET for housing (std. engine part)	1	1
705	SA-143	CUP PLUG for housing	1	2
706	TB-146-S1	HOUSING ASSEMBLY includes: bushings and cup plug	1	12
	STANDARD HARDWARE			
707	PD-79	NUT, 3/8"-16 thread, hexagon steel For mounting housing.	2	1
708	PE-5	LOCKWASHER, 3/8" spring lock	2	1
709	XD-32	SCREW, 3/8"-16 thread x 2" long, hexagon head	2	1
		For mounting accessory drive housing.		

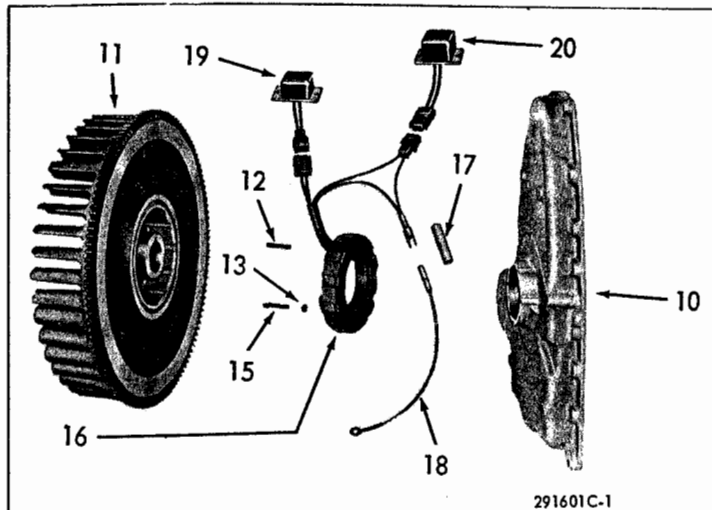
Order parts from nearest **SERVICE CENTER** shown in directory following parts list.

IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

Obsolete FLYWHEEL ALTERNATORS for Model VH4D

Used on engines previous to serial No. 5188288

NOTE: Refer to form MY-110 in rear section of manual for current Flywheel Alternator.

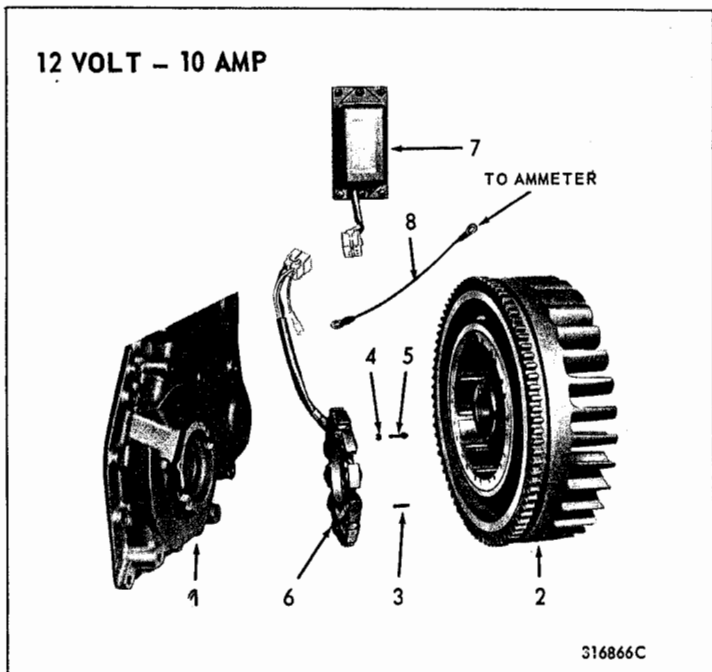


291601C-1

Ref. No.	Description	Part Number	No. Req.
10	GEAR COVER ASSEMBLY — replaces std.	BD-100K-4-S1	1
11	FLYWHEEL with rotor and ring gear—repl. std. For 10 amp alternator	N-101-6	1
	For 30 amp alternator	N-101-10	1

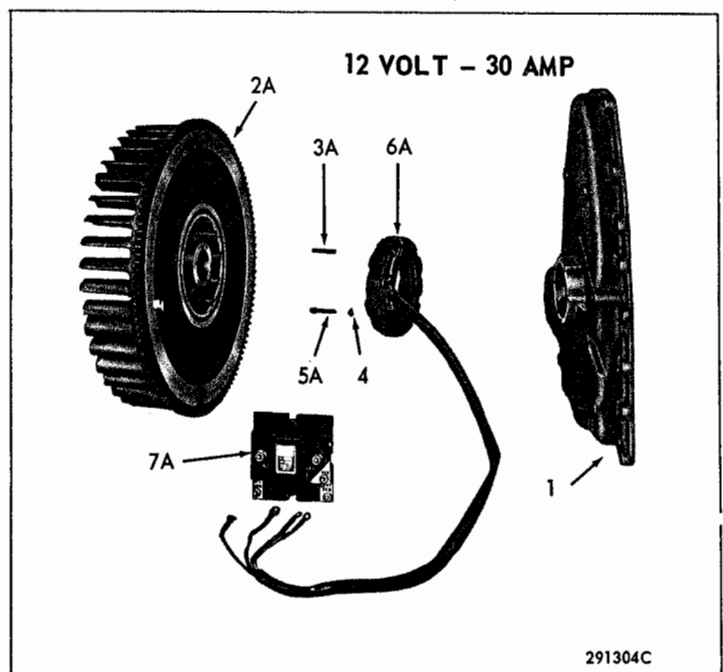
Ref. No.	Description	Part Number	No. Req.
12	ROLL PIN — For 10 amp stator For 30 amp stator	PA-368 PA-340	2 2
13	LOCKWASHER, No. 10, for stator mounting	PE-14	4
15	SCREW — For 10 amp stator mounting For 30 amp stator mounting	XB-113 XB-106	4 4
16	STATOR ASSEMBLY — For 10 amp circuit For 30 amp circuit	YB-75 YB-76	1 1
17	INSULATOR — ammeter wire connector	YD-350	1
18	WIRE ASSEMBLY — stator plug to ammeter For 10 amp stator For 30 amp stator	YL-381-14 YL-380-14	1 1
19	RECTIFIER MODULE — 10 and 30 amp	YJ-58	1
20	REGULATOR MODULE — For 10 amp circuit For 30 amp circuit	YJ-59 use YJ-60) YJ-60	
Not illust.	NUT, #10-32, for mounting modules	PD-115	4
	LOCKWASHER, #10 I.E.T., for modules	PE-78-A	4
	SCREW, #10-32, for mounting modules	XA-8	4

(obsolete) FLYWHEEL ALTERNATORS



316866C

Ref. No.	Description	Part Number	No. Req.
1	GEAR COVER ASSEMBLY	BD-100K-4-S1	1
2	FLYWHEEL with rotor and ring gear For 10 amp alternator circuit	N-101-6	1
2A	For 30 amp alternator circuit	N-101	1
3	ROLL PIN for 10 amp stator mounting	PA-368	2
3A	ROLL PIN for 30 amp stator mounting	PA-340	2
4	LOCKWASHER, No. 10, for stator	PE-14	4

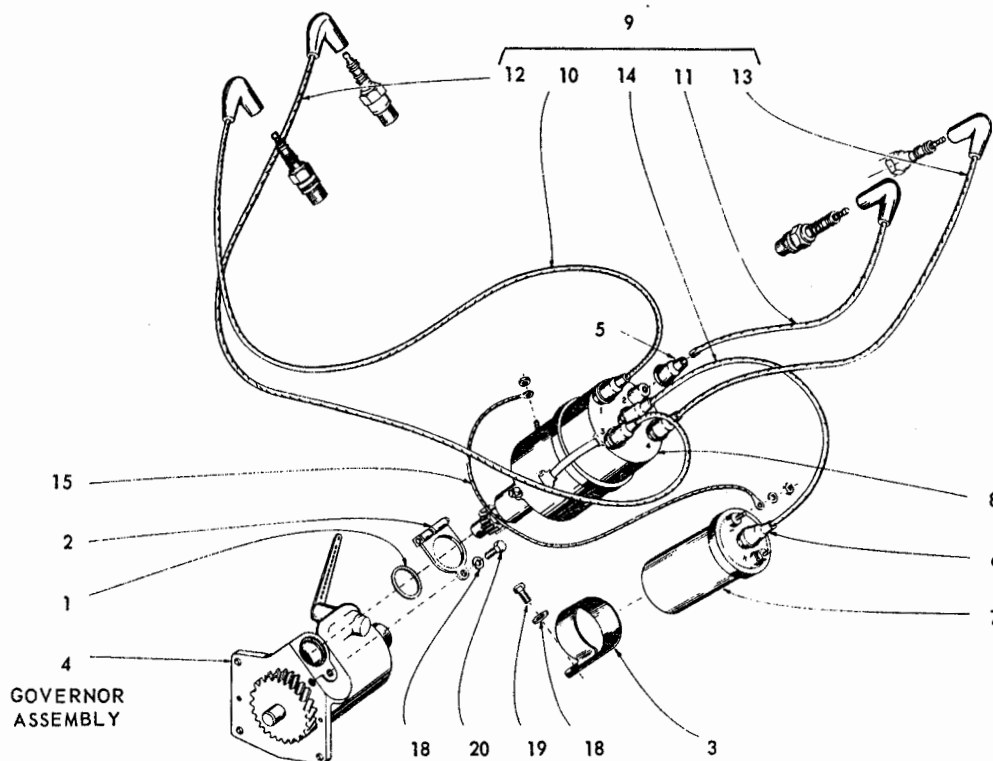


291304C

5	SCREW, for 10 amp stator mounting	XB-113	4
5A	SCREW, for 30 amp stator mounting	XB-106	4
6	STATOR ASSEMBLY, for 10 amp circuit	YB-72	1
6A	STATOR ASSEMBLY, for 30 amp circuit	YB-67	1
7	RECTIFIER-REGULATOR MODULE For 10 amp alternator circuit	YJ-56	1
7A	For 30 amp alternator circuit	YJ-49-S1	1
8	WIRE ASSEMBLY for 10 amp circuit Stator receptacle to ammeter	YL-379-14	1

* NOTE: Because of the variations in Flywheels, for mtg. rotating screen, stub shaft, etc. — give Model, Spec. and Serial Numbers when ordering.

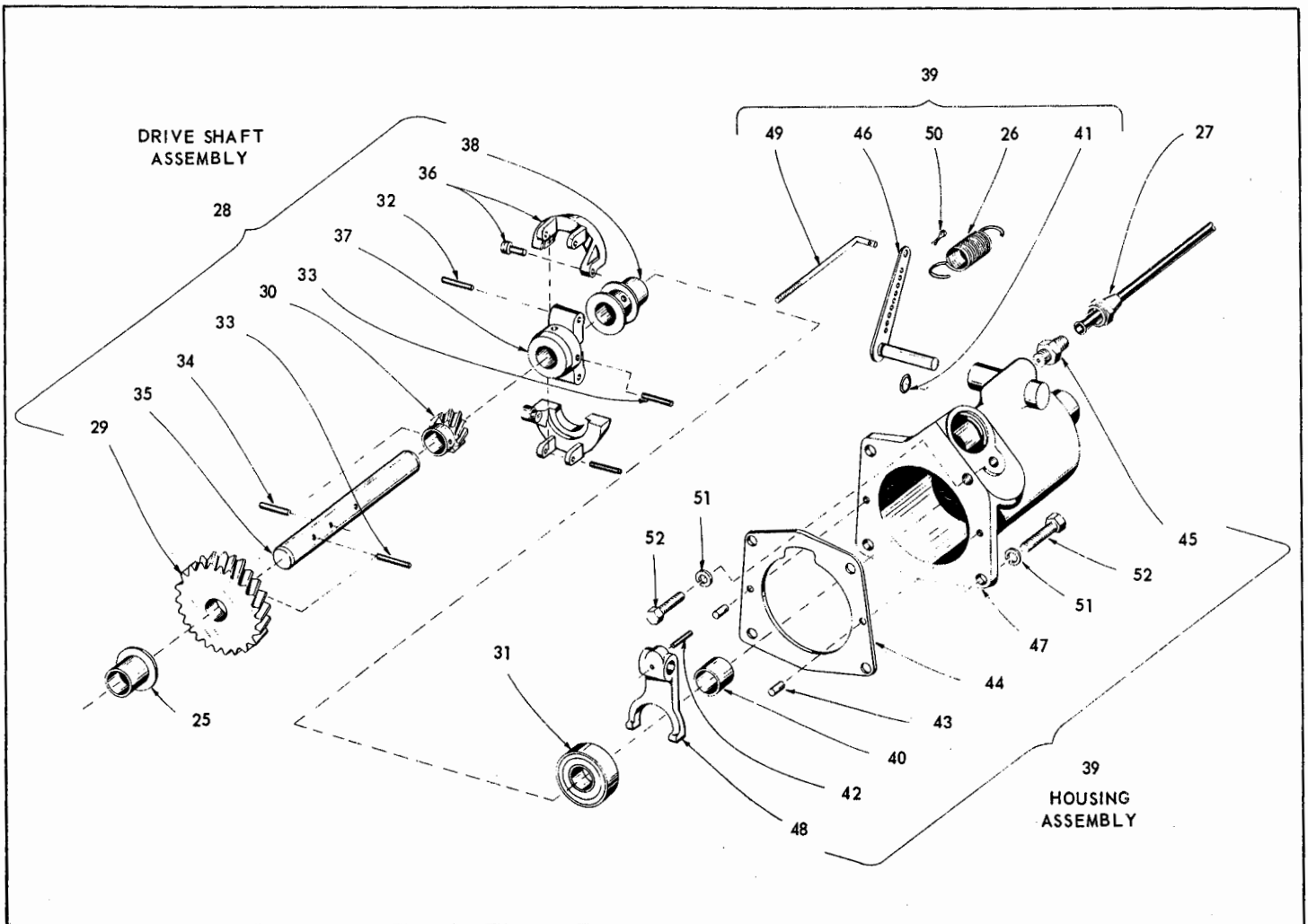
TF-132-A TOP MOUNTED Distributor Drive Assembly
For Model VH4D Engine



* NOTE: Ignition coil and mounting parts are not included in TF-132-A assembly.

Ref. No.	Part Number	Description	No. Req.	Net Wt. Lb Oz.	Ref. No.	Part Number	Description	No. Req.	Net Wt. Lb Oz.
1	JK-59	"O" RING, distributor to housing	1	1	15	YL-352-11	IGNITION WIRE ASSEMBLY	1	1
2	PG-543A-1	CLAMP ASSEMBLY for distributor	1	3			Coil to distributor.		
3	PG-1257	STRAP for YF-38-A ignition coil	1	4			STANDARD HARDWARE		
4	T-113	GOVERNOR ASSEMBLY	1	6	18	PE-3	LOCKWASHER, 1/4" spring lock	2	1
		See page 58 for Service Parts.					1-for advance arm lock		
5	YD-20	TERMINAL CAP	5	1			1-for ignition coil mounting		
		For distributor ignition cables.			19	XB-75	SCREW, 1/4"-20 x 3/4" long, socket hd.	1	1
6	YD-20-A	TERMINAL CAP for ignition coil	1	1			For ignition coil mounting.		
7	YF-38-A (Optional)	* IGNITION COIL (12 volt) Prestolite ..	1	2	20	XD-5	SCREW, 1/4"-20 x 5/8" long, hex. head	1	1
	YF-41A-S1	IGNITION COIL ASSEMBLY					For advance arm lock.		
		Includes: PG-556B strap.							
8	YF-10D-S1	DISTRIBUTOR with clamp assembly ..	1	3 8					
		Prestolite No. IAD-6004-2P.							
9	YL-385	IGNITION CABLE SET	1	1					
		Consisting of:							
10		YL-339-28 Cable for #1 cylinder	1						
11		YL-339-14 Cable for #2 cylinder	1						
12		YL-339-32 Cable for #3 cylinder	1						
13		YL-339-14 Cable for #4 cylinder	1						
14		YL-358-12 Coil cable	1						
		YD-20 Terminal cap	5						
		YD-20A Terminal cap	1						

T-113 GOVERNOR ASSEMBLY For Distributor Drive For Model VH4D Engine



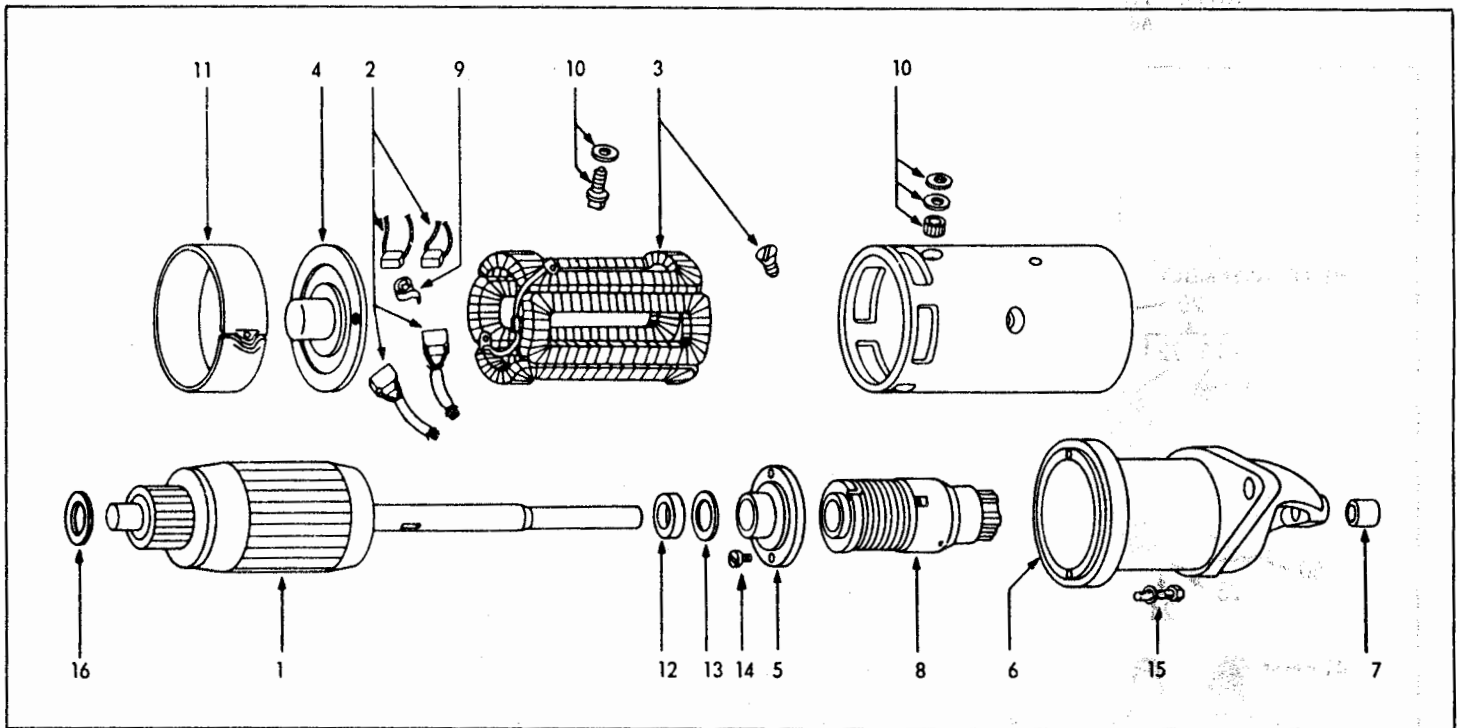
Ref. No.	Part Number	Description	No. Req	Net Wt. Lb Oz
25	HG-271	BUSHING, drive shaft (in gear cover)	1	1
26	PM-76	GOVERNOR SPRING	1	1
27	RM-476	OIL LINE, governor to crankcase	1	3
28	TA-133	DRIVE SHAFT ASSEMBLY	1	2
		Consisting of:		
29	GD-143	DRIVE GEAR	1	8
30	GF-90	DISTRIBUTOR GEAR	1	1
31	(Ref. 38)	THRUST BEARING		
32	PA-340	ROLL PIN for flyweights	2	1
33	PA-359	ROLL PIN for gear and hub	2	1
34	PA-367	ROLL PIN for distr. gear	1	1
35	TA-134	DRIVE SHAFT	1	8
36	TC-322D-S1	FLYWEIGHT w/thrust pin	2	3
37	TC-346B-1	HUB	1	4
38	TC-348D-S1	THRUST SLEEVE and ME-100A bearing assembly	1	4

Ref. No.	Part Number	Description	No. Req	Net Wt. Lb Oz
39	TC-507-S1	GOVERNOR HOUSING ASSEMBLY	1	3 8
		Consisting of:		
40	HG-268	BUSHING, shaft	1	1
41	JK-52	"O" RING for cross shaft	1	1
42	PA-367	ROLL PIN for yoke	1	1
43	PA-467	DOWEL PIN for housing	2	1
44	QD-615A	HOUSING GASKET	2	1
45	RF-269-2	FITTING, oil line restriction	1	1
46	TC-506	CROSS SHAFT and LEVER	1	2
47	TC-507	HOUSING (Order TC-507-S1)		
48	VB-98A-6	YOKE	1	2
49	VE-440-B	CONTROL ROD	1	1
50	XI-32	COTTER PIN, 3/64 x 3/8" ..	1	1
		STANDARD HARDWARE		
51	PE-4	LOCKWASHER, 5/16" spring lock	4	1
		For governor housing mounting.		
52	XD-17	SCREW, 5/16"-18 x 1" long, hex. head	4	1
		For governor housing mounting.		

STARTING MOTOR ASSEMBLY

With FOLO-THRU BENDIX

YA-54-A (12 Volt) – Prestolite No. MBG-4141
YA-55-A (6 Volt) – Prestolite No. MZ-4212



Ref No	Part Number		Description	No Req	Ref No	Part Number		Description	No Req
	YA-54A (12 Volt)	YA-55A (6 Volt)				YA-54A (12 Volt)	YA-55A (6 Volt)		
1	28-MBG-2411	28-MZ-2411	ARMATURE	1	11	28-MZ-1024U	28-MZ-1024U	COVER BAND	1
2	28-MBG-2012S	28-MZ-2012AS	BRUSH SET *	1	12	28-XA-832	28-XA-832	OIL SEAL	1
3	28-MBG-3005AS	28-MZ-3005ES	FIELD COIL PACKAGE	1	13	28-MZ-359	28-MZ-359	GASKET, for intem. bearing ..	1
			Includes: MZ-38C SCREW, for pole shoe		14	28-P90-822	28-P90-822	MOUNTING SCREW PACKAGE ..	1
4	28-MZ-2002Q	28-MZ-2002F	COMMUTATOR END HEAD	1				Includes: 8X-3649 SCREW, intem. bearing, Flat Head #8-32 x 3/8 ..	4
		*	Includes: ASSEMBLY MBG-1021S BRUSH, grounded MAD-110 FELT	2	15	28-MZ-52	28-MZ-52	SCREW, pinion housing, hex head #10-32 x 31/32	4
			MZ-19S BRUSH SPRING SET	1				Includes: TAJUZMI ** 102M	
5	28-MZ-1360	28-MZ-1360	BEARING PLATE ASSEM.	1	16	28-P90-448	28-P90-448	THRUST WASHER PACKAGE ..	1
6	28-PS-2330BS	28-PS-2330BS	PINION HOUSING ASSEMBLY	1					
			Includes: MZ-364 BRONZE BEARING MZ-358 BEARING CAP	1					
			XA-832 OIL SEAL	1					
			28-PS1330B, replaced by 28-PS2330BS.	1					
7	28-MZ-364	28-MZ-364	BRONZE BEARING	1					
8	28-EBB-137A	28-EBB-137A	BENDIX DRIVE	1					
			(Eclipse #480187)						
9	28-MZ-19S	28-MZ-19S	BRUSH SPRING SET	1					
10	28-P90-743	28-P90-716	TERMINAL STUD PACKAGE	1					
			Includes: TERMINAL	1					
			INSULATING BUSHING, stud ..	1					
			TERMINAL STUD	1					
			INS. WASHER, term. stud, in.	1					
			INS. WASHER, term. stud, out.	1					
			PLAIN WASHER, term. stud ..	1					

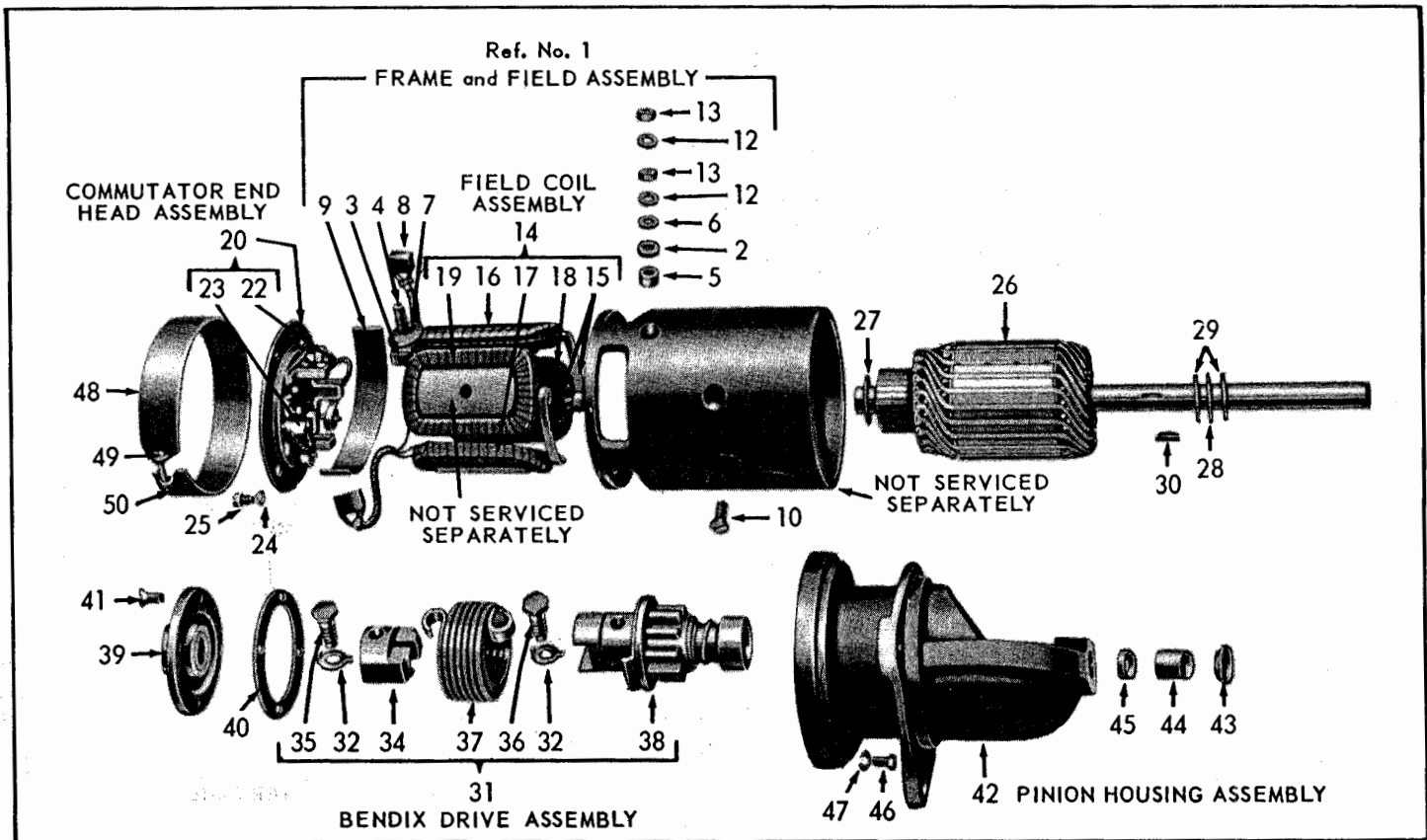
* Brush Set for Service (Ref. 2)

** Contains additional parts to service other applications.

Note: BOLD TYPE ITEMS indicate recommended Prestolite service parts.

YA-19-3-S1 (6 Volt) STARTING MOTOR – PRESTOLITE No. MZ-4192
YA-18-3-S1 (12 Volt) STARTING MOTOR – PRESTOLITE No. MBG-4109

NOTE: YA-19-3 (MZ-4192) was Prestolite No. MZ-4184. YA-18-3 (MBG-4109) was Prestolite No. MBG-4024.
 Addition of clean-out hole in pinion housing by vender necessitated their Part No. change.



NOTE: All parts are interchangeable for both starting motors, except where noted.

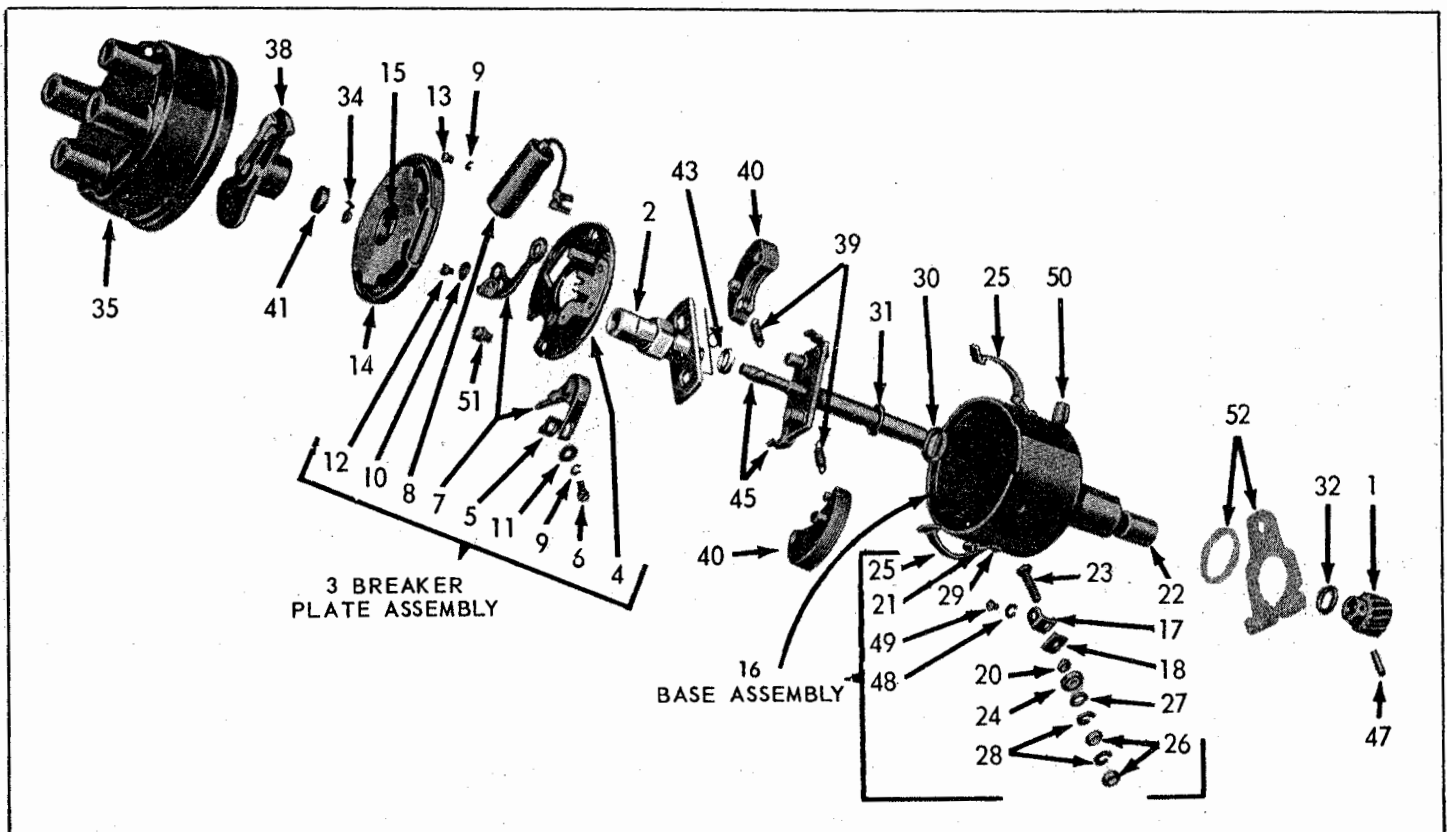
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Ref No	Prestolite Part Number	Description	No Req	Ref No	Prestolite Part Number	Description	No Req
1		FRAME and FIELD ASSEMBLY	1	26	MZ-2366 MBG-2366	ARMATURE ASSEMBLY for YA-19-3-S1	1
2	**	Consisting of:		27	***	ARMATURE ASSEMBLY for YA-18-3-S1	1
3	**	INSULATING WASHER, terminal stud	1	28	***	THRUST WASHER for Armature, C.E.	2
4	**	TERMINAL	1	29	***	SPRING WASHER for Armature	1
5	**	TERMINAL STUD	1	30	***	THRUST WASHER for Armature, Int.	2
6	**	INSULATING BUSHING for terminal stud	1	31	EBB-44B	KEY for mounting Bendix, No. 6 Woodruff	1
7	**	PLAIN WASHER, 5/16" for terminal stud	1			BENDIX DRIVE ASSEMBLY	
8	**	INSULATING WASHER, terminal stud	1			Eclipse No. 480029.	
9	*	INSULATING BRUSH	2	39	MZ-1360	BEARING PLATE ASSEMBLY, intermediate ..	1
10		INSULATION, field connection	1	40	MZ-359	GASKET for bearing plate	1
11		SCREW for pole shoe	4	41		SCREW for mounting bearing plate	4
12		LOCKWASHER, 5/16", for terminal stud	2			No. 8-32 thread x 3/8" long, flat head.	
13		NUT, for terminal stud, 5/16"-24 thread, hex	2	42	PS-1330B	PINION HOUSING ASSEMBLY	1
14	MZ-3005S MBG-3005S	FIELD COIL ASSEMBLY for YA-19-3-S1	1			Includes:	
15		FIELD COIL ASSEMBLY for YA-18-3-S1	1	43		BEARING CAP	1
16		Consisting of:		44	MZ-364	BRONZE BEARING	1
17		CONNECTOR for field coil	2	45	XA-832	OIL SEAL	1
18		FIELD COIL, U.L.	1	46		SCREW for pinion housing mounting	4
19		FIELD COIL, L.R.	1			No. 10-32 thread x 31-32" long, hexagon head.	
20	MZ-2002F MZ-2002Q	FIELD COIL, L.L.	1	47		LOCKWASHER for housing screw, No. 10	4
21		FIELD COIL, U.R.	1	48	MZ-1024U	COVER BAND	1
22		COMMUTATOR END HEAD ASSEMBLY for		49		SCREW for cover band	1
23		YA-19-3-S1	1	50		No. 10-32 thread x 1-1/2" long, round head.	
		COMMUTATOR END HEAD ASSEMBLY for				NUT for cover band	1
		YA-18-3-S1	1			No. 10-32 thread, square.	
		Includes:					
24		FELT (not illustrated)	1				
25	MZ-19S	BRI' H SPRING SET	1				
26	*	GROUND BRUSH	2		*	MZ-2012AS BRUSH SET for YA-19-3-S1.	
27		LOCKWASHER for head screw, No. 10	4		**	MBG-2012S BRUSH SET for YA-18-3-S1.	
28		SCREW for head mounting	4		***	P90-368 Terminal Stud Pkg. for YA-19-3-S1.	
29		No. 10-32 thread x 3/8" long, fillister head.				P90-333 Terminal Stud Pkg. for YA-18-3-S1.	
30						P90-448 Armature Thrust Washer Package.	

IGNITION DISTRIBUTOR (Prestolite)

YF-10C-S1 (IAD-6004-2N) for VH4D, VG4D, V465D
YF-10B-S1 (IAD-6004-26) Less Condenser

YF-10D-S1 (IAD-6004-2P) VH4D, top mt'd.
YF-10E-S1 (IAD-6004-2R) VG4D, top mt'd.



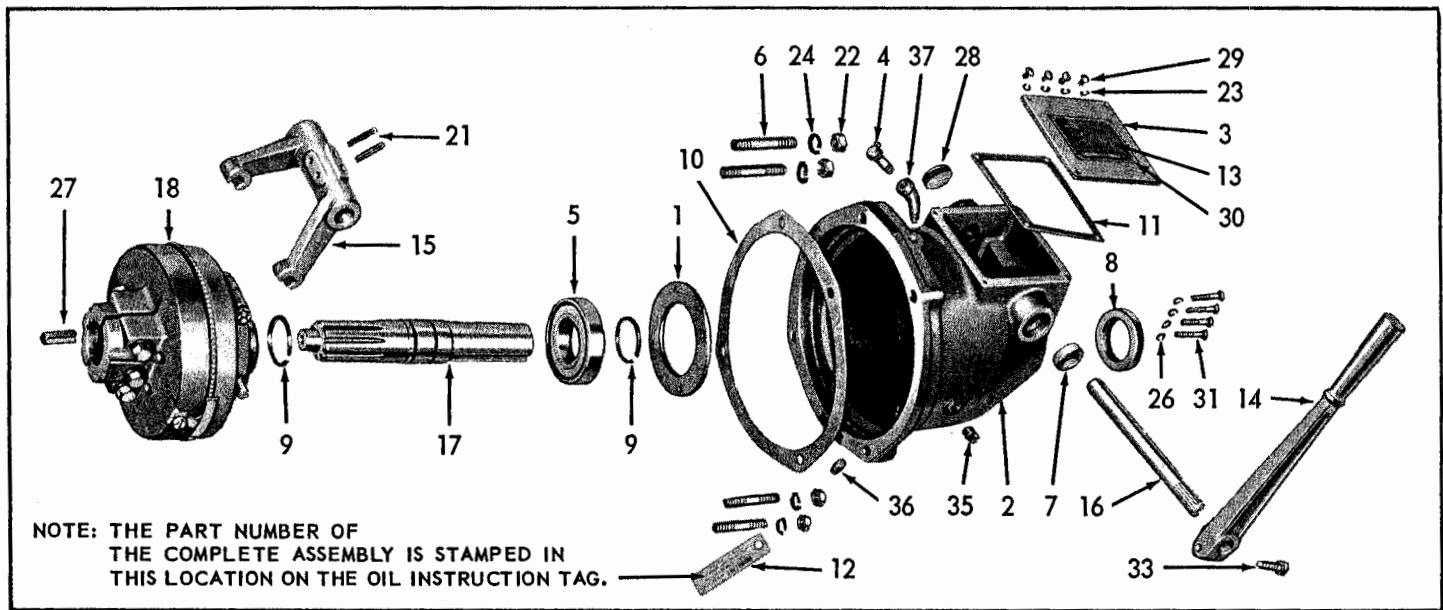
NOTE: Parts are interchangeable except where noted by distributor part number.

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Ref. No.	Part Number	Description	No. Req.	Ref. No.	Part Number	Description	No. Req.
1	****	FOLLOWER GEAR.....	1	31	*	THRUST WASHER (outer) for drive shaft	1
2	28-IAD-1100LE1	CAM and STOP PLATE (YF-10C-S1)	1	32	* ****	THRUST WASHER for drive shaft (lower) ..	1
3	28-IAD-2004	BREAKER PLATE ASSEMBLY, includes:..	1	34		SNAP RING for cam	1
4		BREAKER PLATE	1	35	28-IG-1324D	DISTRIBUTOR CAP ASSEMBLY includes: PLUNGER CONTACT and SPRING	1
5		SPRING CLIP for contact arm	1				
6		SCREW, spring clip, #6-32 x 5/16", hex. hd.	1	38	28-IG-1657R	ROTOR	1
7	28-IGS-2224LB	BREAKER CONTACT SET	1	39	28-IGC-203S	SPRING SET, governor weights (YF-10C-S1) ..	1
8	28-IBB-2042SS1	CONDENSER Pkg. (YF-10C-S1, YF-10D-S1) ..	1	40	28-IGC-2168LS	GOVERNOR WEIGHT SET (YF-10C-S1)	2
9	28-IAT-3076DS	CONDENSER Pkg. (YF-10E-S1)	1	41	*****	FELT WICK for cam sleeve	1
		LOCKWASHER, No. 6	3	42	28-IGS-32S	CAP PLUG PKG. for vent hole (not illust.) ..	1
10		2-for condenser mtg. 1-for spring clip.		43	*	CAM SPACER	1
11		PLAIN WASHER for contact lock screw, #8	1	44	*****	FELT WICK (not illustrated)	1
12		PLAIN WASHER for spring clip screw, #6	1	45	28-IGS-1180L	DRIVE SHAFT (YF-10C-S1)	1
13		LOCKSCREW for breaker contact	1		28-IAD-3180LR-1	SHAFT, gov. and cam assy. (YF-10D-S1, ES1) ..	1
		#8-32 thread x 3/16" long fillister head.		47	* ****	PIN for gear	1
		SCREW for condenser mounting	1	48		LOCKWASHER for connector screw, #6	1
		#6-32 thread x 5/32" long, fillister head.		49		SCREW for connector	1
14	28-IAD-2015	DUST COVER ASSEMBLY, includes:	1			#6-32 thread x 3/16" long, round head.	
15		FELT WASHER	1	50	28-8X-1590	OILER (replaces 28-X-1590)	1
16		BASE ASSEMBLY, includes:	1	51		SCREW for breaker plate mounting	2
17	**	CONNECTOR for terminal stud	1			#10-32 thread x 5/16" long, fillister head.	
18	**	INSULATOR for terminal stud	1	52	PG-543-A	ADVANCE ARM ASSEMBLY	1
19	***	BRACKET for breaker plate (Not illust.) ..	2		*	28-P90-390 Bearing & Thrust Washer Pkg.	
20	**	INSULATING BUSHING for terminal stud ..	1		**	28-P90-337 Terminal Stud & Parts Pkg.	
21	***	BRACKET for cap spring	2		***	28-P90-2157 Cap Clamp Spring Pkg.	
22	*	Bronze BEARING	2		****	28-P90-427 Follower Gear Pkg. (YF-10C-S1) ..	
23	**	TERMINAL STUD, #10-32 thd. x 15/16" lg.	1			28-P90-2107 Follower Gear Pkg. (YF-10D-S1) ..	
24	**	INSULATING WASHER for terminal stud ..	1			28-P90-728 Wick and Washer Pkg.	
25	***	CLAMP SPRING for cap	2				
26		NUT for terminal stud, #10-32 thread	2				
27		PLAIN WASHER for terminal stud, #10	1				
28		LOCKWASHER for terminal stud, #10	2				
29	***	RIVET for clamp spring	4				
30	*	THRUST WASHER (inner) for drive shaft	1				

NOTE: Parts less part number are not serviced separately.

WW-61-E CLUTCH TAKE-OFF ASSEMBLY FOR V4H ENGINE



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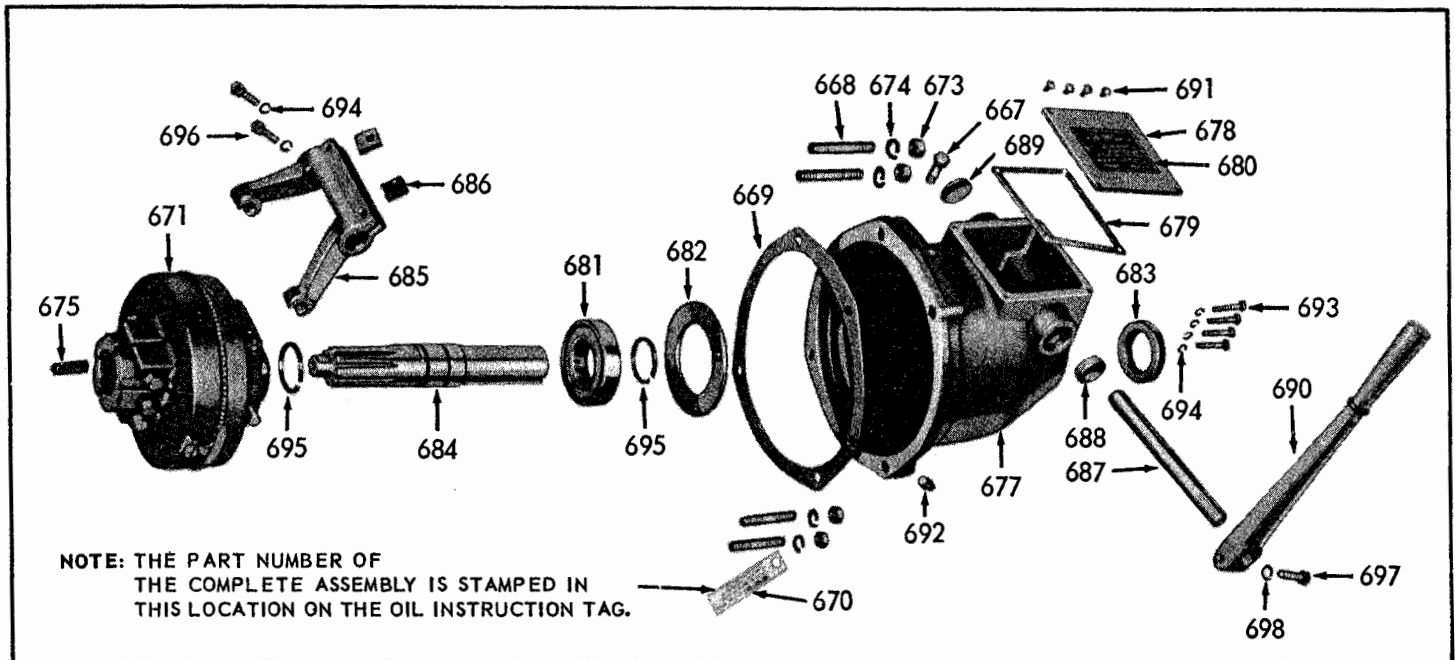
NOTE: Engines equipped with a clutch take-off assembly require a special main bearing plate assembly, crankshaft and crankcase as follows:

- BG-210-C-1-S2 MAIN BEARING PLATE ASSEMBLY** (Not illustrated) consisting of:
 1 BG-210-C-1 Plate 1 PH-364 Oil Seal 1 ME-114-2 Bearing Cup
- CRANKCASE ASSEMBLY** (Not illustrated) Order by giving the **MODEL, SPECIFICATION and SERIAL NUMBERS** of the engine.
- CA-71-A-23-S1 CRANKSHAFT ASSEMBLY** (Not illustrated) consisting of:
 1 CA-71-A-23 Crankshaft 1 ME-71 Bearing 1 PL-53 Key
 1 GA-36-A Gear 1 ME-114 Bearing

Ref. No.	Part Number	Description	No. Req.	Net Wt. Lb Oz
	WW-61-E	CLUTCH TAKE-OFF ASSEMBLY -		
		Complete	1	40
1	BG-225-A	BEARING RETAINER PLATE.....	1	8
2	BG-234	HOUSING	1	15
3	BH-158	COVER for housing	1	10
4	LO-44	BREATHER.....	1	1
5	ME-36-A	BEARING, N.D.No. 7208, at T.O.end....	1	1
		ME-36 (7508), replaced by ME-36-A.		
6	PC-392	STUDS for mounting hous'g to crankcase	4	2
7	PH-234-A	OIL SEAL, Trosel No. BR-124484	1	1
		For yoke shaft.		
8	PH-344-A	OIL SEAL, Victor No. 60534.....	1	3
		For T.O. shaft.		
9	PK-148	SNAP RING, bearing retainer, take-off shaft. Beginning with engine Serial No. 3205301.	2	1
		PK-136 Snap Ring for engines to and including Serial No. 3205300.		
10	QD-618	GASKET for housing to crankcase.....	1	1
11	QD-652	GASKET for cover	1	1
12	SD-79	OIL INSTRUCTION TAG.....	1	1
13	SD-132	INSTRUCTION PLATE	1	2
14	VB-55-1	SHIFTING LEVER	1	2
15	VB-64-A	CLUTCH YOKE	1	3
16	WA-61	YOKE SHAFT, order 2 PK-148 Snap rings	1	14
17	WA-96-B	CLUTCH T.O. SHAFT	1	3
18	WC-288-A	CLUTCH ASSEMBLY	1	12
		Rockford Drilling Model 5 1/2 L.O.C. No. CLA-1467-AF.		
		See Rockford illustration and parts list of clutch.		
		STANDARD HARDWARE		
21	PA-341	ROLL PIN, 1/4" x 1-1/8" long	2	1
		For clutch yoke.		
22	PD-12	NUT, 7/16"-20 thread, hexagon steel...	4	1
		For mounting clutch housing.		
23	PE-3	LOCKWASHER, 1/4" Positive, cover to housing	4	1
24	PE-6	LOCKWASHER, 7/16" Positive.....	4	1
		For mounting clutch housing.		
26	PH-30-A	WASHER, 1/4" plain	4	1
		For bearing retainer plate to housing.		
27	PL-140	KEY, 5/16" square x 1-1/8" long, steel	1	1
		For mounting clutch to crankshaft.		
28	SA-58	WELCH PLUG, 1-3/8"	1	1
29	XA-34	ROUND HEAD SCREW, 1/4"-20 x 1/2"....	4	1
		Cover to housing.		
30	XA-106-B	DRIVE SCREW for instruction plate	2	1
		XA-64 Self-tapping screw, replaced by XA-106-B.		
31	XD-8	HEXAGON HEAD SCREW, 1/4"-20 x 1 1/4"	4	1
		Bearing retainer plate to housing.		
33	XD-30	HEX. HEAD SCREW, 3/8"-16 x 1 1/2"	1	1
		For shifter lever clamp.		
35	XK-1	PIPE PLUG, 1/8" square head	2	1
		For oil level hole.		
36	XK-2	PIPE PLUG, 1/4" square head	1	1
		For oil drain hole.		
37	XK-77-A	ST. ELL, 1/8" - 45° brass, for breather	1	1
		XK-77 (Cast iron) replaced by XK-77-A		

WW-58-A CLUTCH TAKE-OFF ASSEMBLY

NOTE: This unit is obsolete and was used on VH4 engines to and including Serial No. 3012339. Replaced by WW-61-E thereafter, and interchangeable as a complete unit, but individual parts are not interchangeable.



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NOTE: Engines equipped with a clutch take-off assembly require a special main bearing plate assembly, crankshaft and crankcase as follows:

BG-210-C-1-S2 MAIN BEARING PLATE ASSEMBLY (Not illustrated) consisting of:
 1 BG-210-C-1 Plate 1 PH-364 Oil Seal 1 ME-114-2 Bearing Cup

CRANKCASE ASSEMBLY (Not illustrated) Order by giving the **MODEL, SPECIFICATION and SERIAL NUMBERS** of the engine.

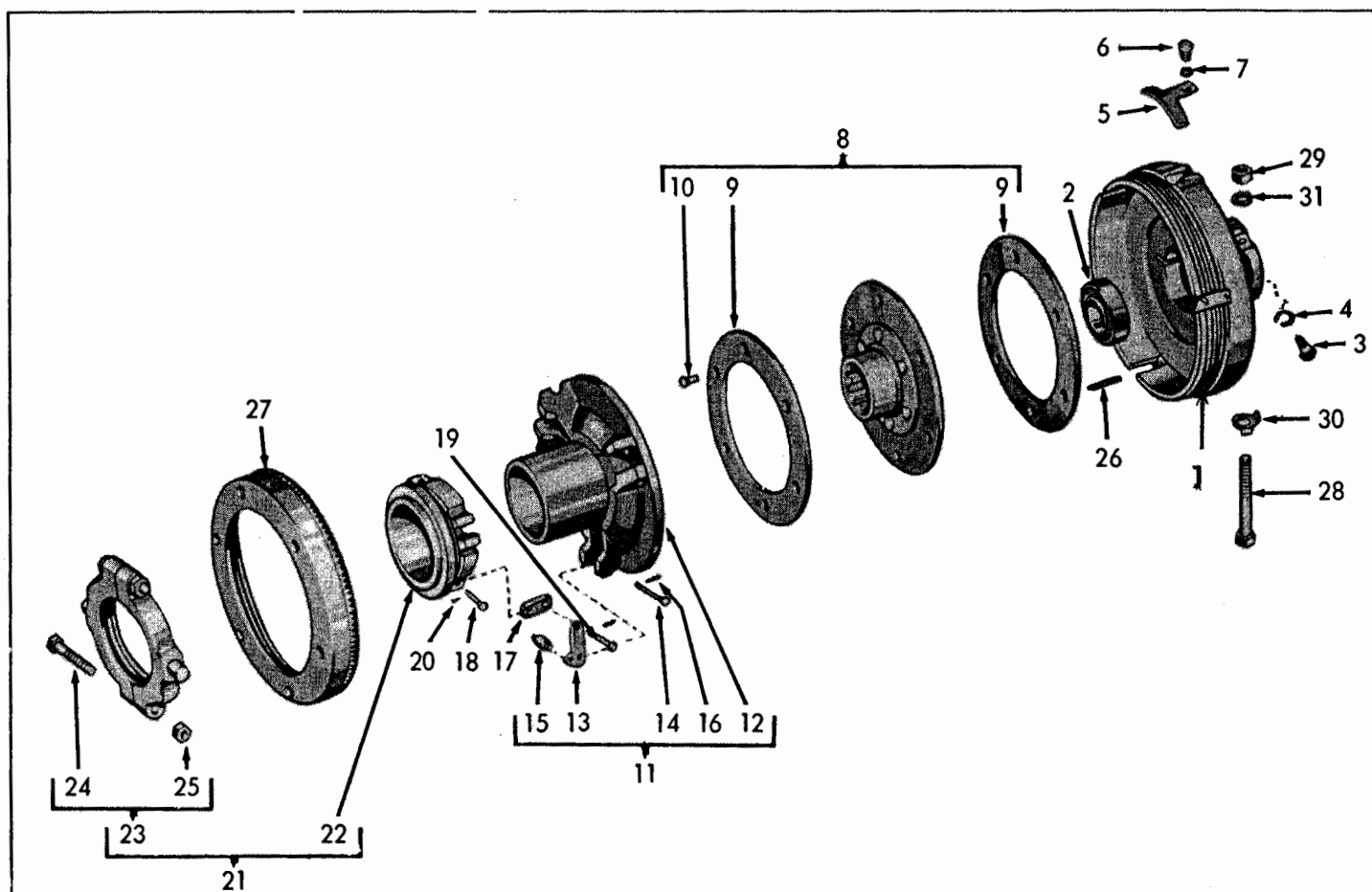
CA-71-A-23-S1 CRANKSHAFT ASSEMBLY (Not illustrated) consisting of:
 1 CA-71-A-23 Crankshaft 1 ME-71 Bearing 1 PL-53 Key
 1 GA-36-A Gear 1 ME-114 Bearing

*** NOTE:** Items marked with an (*) are Wisconsin Motor part numbers, all other items are Rockford Drilling part numbers.

Ref. No.	Part Number	Description	No. Req.	Net Wt. Lb Oz
	*WW-58-A	CLUTCH TAKE-OFF ASSEMBLY - Complete Rockford Drilling No. PTA-S5½15.	1	40
667	*LO-44	BREATHER	1	1
668	*PC-419	STUDS for mounting housg to crankcase PC-242, replaced by PC-419.	4	2
669	*QD-618	GASKET for housing to crankcase.....	1	1
670	*SD-79	OIL INSTRUCTION TAG	1	1
671	*WC-288-A	CLUTCH ASSEMBLY Rockford Drilling Model 5½ L.O.C. No. CLA-1467-AF. See Rockford illustration and parts list of clutch.	1	12
STANDARD HARDWARE				
673	*PD-12	NUT , 7/16"-20 thread, hexagon steel For mounting clutch housing.	4	1
674	*PE-6	LOCKWASHER , 7/16" Positive	4	1
675	*PL-140	KEY , 5/16" square x 1-1/8" long, steel For mounting clutch to crankshaft.	1	1
677	PT-539	HOUSING	1	15
678	PT-557	COVER for housing	1	10
679	PT-673	GASKET for cover	1	1
680	PT-1800	INSTRUCTION PLATE PT-669, replaced by PT-1800.	1	2
681	*ME-191	BEARING , N.D. No. 7208	1	1
682	PT-536	BEARING RETAINER PLATE	1	8
683	PT-581	OIL SEAL , National No. 50064 For T.O. shaft.	1	3
684	PT-623	CLUTCH T.O. SHAFT	1	3 12
685	PT-1704	CLUTCH YOKE	1	1 3
		PT-531, replaced by PT-1704, but order 2 PT-1707 Roll pins.		
686	PT-533	KEY for obsolete PT-531 Yoke	2	1
	PT-1707	ROLL PIN for PT-1704 Yoke.....	2	1
687	PT-1705	SHAFT for PT-1704 Yoke.....	1	14
	PT-534	SHAFT for obsolete PT-531 Yoke.....		
688	PT-583	OIL SEAL for yoke shaft	1	1
689	PT-584	WELSH PLUG	1	1
690	PT-532	SHIFTING LEVER - straight	1	2
		PT-564 Off-set Lever, repl'd by PT-532.		
STANDARD HARDWARE				
691	PT-1832	BUTTON HEAD SCREW , cover to hous'g. PT-576, replaced by PT-1832.	4	1
692	PT-577	PIPE PLUG	2	1
		1-for oil level hole. 1-for oil drain hole.		
693	PT-579	HEXAGON HEAD SCREW Bearing retainer plate to housing.	4	1
694	CL-4701	LOCKWASHER (replaces PT-580)..... 4-for bearing retainer plate to housing. 2-for obsolete PT-531 yoke clamp.	6	1
695	PT-535	SNAP RING , bearing location on take-off shaft.....	2	1
696	PT-582	HEX. HEAD SCREW , for obsolete PT-531 yoke	2	1
697	PT-352	HEX. HEAD SCREW , shifter lever clamp	1	1
698	PT-353	LOCKWASHER , shifter lever clamp	1	1

WC-288-A CLUTCH ASSEMBLY

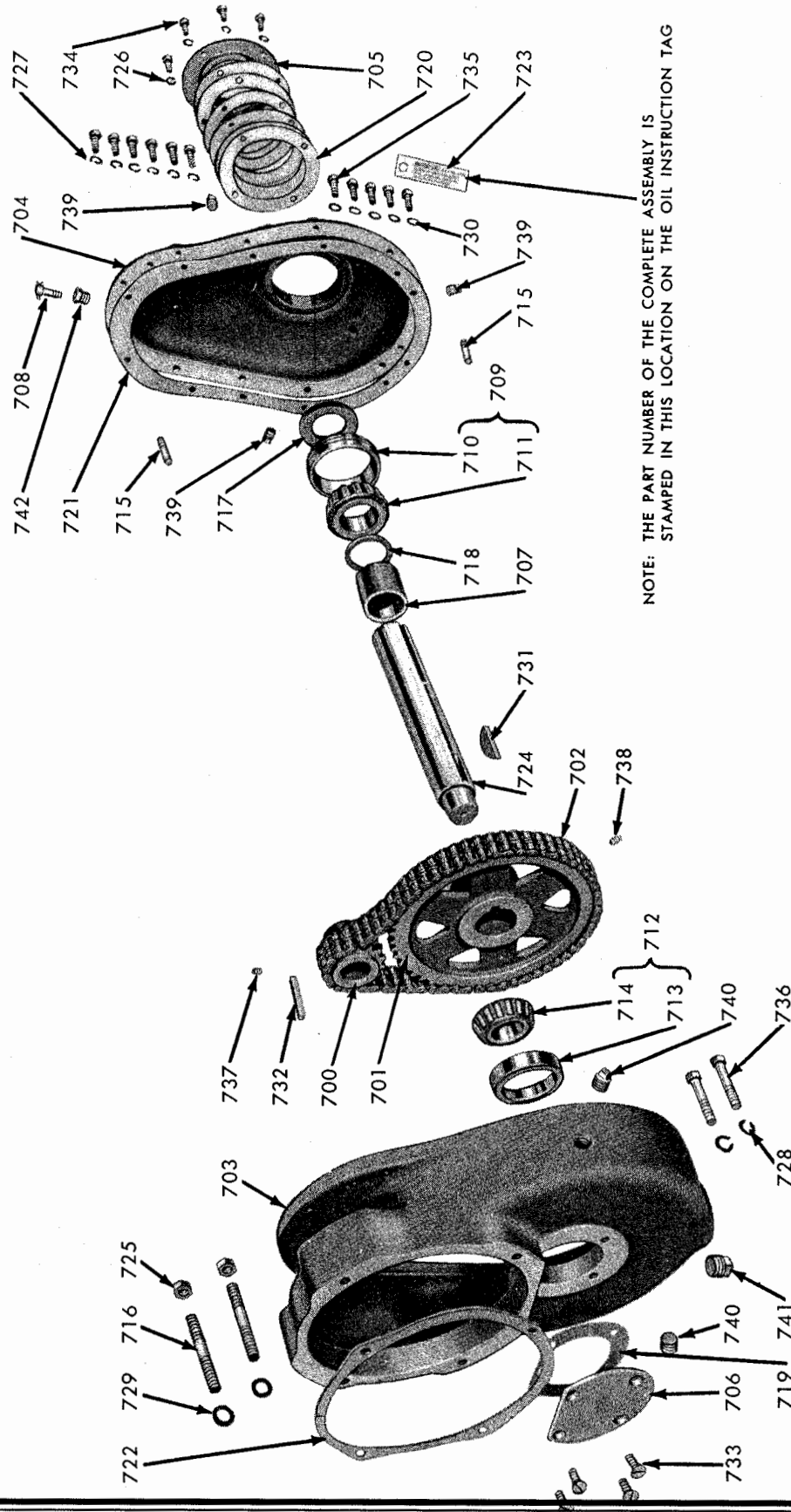
Rockford No. CLA-1467-AF



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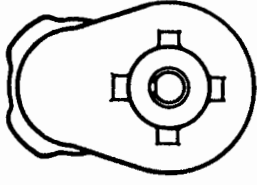
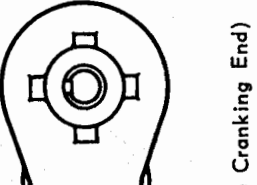
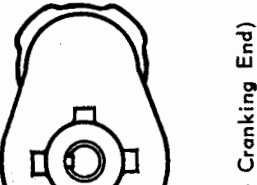
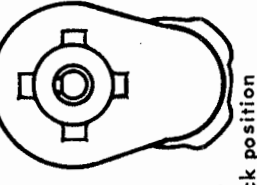
Ref. No.	Part Number	Description	No. Req.	Ref. No.	Part Number	Description	No. Req.
1	63-CL-5210-1	CLUTCH HOUSING	1	17	63-CL-4776	CONNECTING LINK	6
2	ME-189	PILOT BEARING	1	18	63-CL-5153	LINK PIN, long	3
		CL-5970, use ME-189.		19	63-CL-5152	LINK PIN, short	3
3	XD-14-2	SCREW, 5/16"-18 x 5/8" Dog point hex. hd.	1	20	63-CL-5092	COTTER PIN, 1/16" x 3/8"	6
4	PE-46	LOCKWASHER, 5/16" external tooth	1	21	63-UCL-4-5145	RELEASE SLEEVE ASSEMBLY	1
5	63-CL-4973	ADJUSTING LOCK	1			Consisting of:	
6	63-CL-8807-1	SCREW, 1/4"-20 x 3/8" slotted hex. head	1	22		63-CL-5145 Release sleeve	1
		63-CL-3917-1 (Fillister head), replaced		23		63-UCL-6-5144 Release bearing assem. ..	1
		by 63-CL-8807-1.				Consisting of:	
7	63-CL-3468	LOCKWASHER, 1/4" Shakerproof	1	24		Release bearing	
8	63-UCL-1-1244-10	DRIVEN MEMBER ASSEMBLY	1			63-CL-3335-1 Screw, 5/16"-24 x 1-3/4"	2
		Consisting of:		25		hexagon head	2
9	*	Splined center and plate assembly		26	63-CL-5087	RETURN SPRING	3
10		63-CL-5321-40 Facing (Thermoid DK)	2	27	63-CL-5147	ADJUSTING RING	1
		63-CL-1011 Tubular rivets (brass)	6	28	63-CL-5318	SCREW, 3/8"-24 x 2-1/2" hexagon head ..	2
11	63-UCL-5146-1A	PRESSURE PLATE and LEVER ASSEM.	1	29	63-CL-5319	NUT, 3/8"-24 hexagon	2
		Consisting of:		30	63-CL-5211	SCREW LOCK	1
12		63-UCL-5146-1 Pressure plate assembly ..	1	31	63-PT-353	LOCKWASHER, 3/8" Positive	1
13		63-CL-5544 Lever	6			(*) Not serviced separately from sub-	
14		63-CL-5156 Lever pin	3			assembly, it is included in	
15		63-LM-408 Roller	3				
16		63-CL-5092 Cotter pin, 1/16" x 3/8"	2				

WW-27-J ETC. REDUCTION GEAR ASSEMBLIES FOR VH4 ENGINE



WW-27-J ETC. REDUCTION GEAR ASSEMBLIES

For Model VH4D Engine

Determine position of take-off shaft when viewing from cranking end of engine. (Views showing take-off end and are shown)	Assembly Number	Reduction Ratio	Rotation of Take-off Shaft	Ref. No. 700 Driver Gear Part No.	Ref. No. 701 Driven Gear Part No.	Ref. No. 702 Chain Part No.	Ref. No. 703 Housing Part No.	Ref. No. 704 Housing Cover Part No.
 TAKE-OFF SHAFT BELOW - 6 o'clock position	WW-27-J	2.07 to 1	Counter Engine-Wise	GG-66-3	GG-67-1	.....	BG-149-G-4	BH-119-C
	WW-27-J-1	3.00 to 1	Counter Engine-Wise	GG-79-1	GG-77-1	.....	BG-149-G-4	BH-119-C
	WW-27-J-2	3.84 to 1	Counter Engine-Wise	GG-80-1	GG-69-1	.....	BG-149-G-4	BH-119-C
	WW-27-J-3	2.00 to 1	Engine-Wise	GG-81	GG-71	GJ-8	BG-149-G-4	BH-119-C
	WW-27-J-4	2.67 to 1	Engine-Wise	GG-82	GG-71	GJ-9	BG-149-G-4	BH-119-C
	WW-27-J-5	3.79 to 1	Engine-Wise	GG-83	GG-73	GJ-10	BG-149-G-4 replaces BG-149B-6	BH-119-C replaces BH-119
 TAKE-OFF SHAFT ON LEFT SIDE as Viewed from the Cranking End)	WW-27-J-6	2.07 to 1	Counter Engine-Wise	GG-66-3	GG-67-1	.....	BG-149-G-5	BH-119-C-1
	WW-27-J-7	3.00 to 1	Counter Engine-Wise	GG-79-1	GG-77-1	.....	BG-149-G-5	BH-119-C-1
	WW-27-J-8	3.84 to 1	Counter Engine-Wise	GG-80-1	GG-69-1	.....	BG-149-G-5	BH-119-C-1
	WW-27-J-9	2.00 to 1	Engine-Wise	GG-81	GG-71	GJ-8	BG-149-G-5	BH-119-C-1
	WW-27-J-10	2.67 to 1	Engine-Wise	GG-82	GG-71	GJ-9	BG-149-G-5	BH-119-C-1
	WW-27-J-11	3.79 to 1	Engine-Wise	GG-83	GG-73	GJ-10	BG-149-G-5 replaces BG-149B-7	BH-119-C-1 replaces BH-119-1
 TAKE-OFF SHAFT ON RIGHT SIDE as Viewed from the Cranking End)	WW-27-J-12	2.07 to 1	Counter Engine-Wise	GG-66-3	GG-67-1	.....	BG-149-G-6	BH-119-C-2
	WW-27-J-13	3.00 to 1	Counter Engine-Wise	GG-79-1	GG-77-1	.....	BG-149-G-6	BH-119-C-2
	WW-27-J-14	3.84 to 1	Counter Engine-Wise	GG-80-1	GG-69-1	.....	BG-149-G-6	BH-119-C-2
	WW-27-J-15	2.00 to 1	Engine-Wise	GG-81	GG-71	GJ-8	BG-149-G-6	BH-119-C-2
	WW-27-J-16	2.67 to 1	Engine-Wise	GG-82	GG-71	GJ-9	BG-149-G-6	BH-119-C-2
	WW-27-J-17	3.79 to 1	Engine-Wise	GG-83	GG-73	GJ-10	BG-149-G-6 replaces BG-149B-8	BH-119-C-2 replaces BH-119-2
 TAKE-OFF SHAFT ON TOP - 12 o'clock position	WW-27-J-18	2.07 to 1	Counter Engine-Wise	GG-66-3	GG-67-1	.....	BG-149-G-7	BH-119-C-5
	WW-27-J-19	3.00 to 1	Counter Engine-Wise	GG-79-1	GG-77-1	.....	BG-149-G-7	BH-119-C-5
	WW-27-J-20	3.84 to 1	Counter Engine-Wise	GG-80-1	GG-69-1	.....	BG-149-G-7	BH-119-C-5
	WW-27-J-21	2.00 to 1	Engine-Wise	GG-81	GG-71	GJ-8	BG-149-G-7	BH-119-C-5
	WW-27-J-22	2.67 to 1	Engine-Wise	GG-82	GG-71	GJ-9	BG-149-G-7	BH-119-C-5
	WW-27-J-23	3.79 to 1	Engine-Wise	GG-83	GG-73	GJ-10	BG-149-G-7 replaces BG-149B-9	BH-119-C-5 replaces BH-119-6

NOTE: Beginning with engine serial No. 5310000 the BG-149-G-etc. Housing replaces BG-149-B-etc., and BH-119-C-etc. Cover replaces BH-119-etc. (The cover to housing mounting hole centers are changed.) Consequently, new individual housing and cover are not interchangeable with the old unless all three parts; the cover, gaskets and housing are replaced at the same time. Parts are identified by cast on part numbers.

See following page for weights and description.

WEIGHTS OF PARTS SHOWN ON PRECEDING PAGE

Part Number	Net Wt.		Part Number	Net Wt.		Part Number	Net Wt.	
	Lb	Oz		Lb	Oz		Lb	Oz
BG-149-G-4.....	22		GG-81 (20 teeth)	2		WW-27-J-9	62	
BG-149-G-5.....	22		GG-82 (15 teeth)	1	1	WW-27-J-10	61	
BG-149-G-6.....	22		GG-83 (14 teeth)		15	WW-27-J-11	63	
BG-149-G-7.....	22		GJ-8 (27" long)	1	13	WW-27-J-12	66	
BH-119-C.....	14		GJ-9 (26" long)	1	12	WW-27-J-13	68	
BH-119-C-1.....	14		GJ-10 (30" long)	2		WW-27-J-14	67	
BH-119-C-2.....	14		WW-27-J.....	66		WW-27-J-15	62	
BH-119-C-5.....	14		WW-27-J-1.....	68		WW-27-J-16	61	
GG-66-3 (30 teeth)	2	12	WW-27-J-2.....	67		WW-27-J-17	63	
GG-67-1 (62 teeth)	8	11	WW-27-J-3.....	62		WW-27-J-18	66	
GG-69-1 (73 teeth)	10	15	WW-27-J-4.....	61		WW-27-J-19	68	
GG-71 (40 teeth)	5	4	WW-27-J-5.....	63		WW-27-J-20	67	
GG-73 (53 teeth)	7	10	WW-27-J-6.....	66		WW-27-J-21	62	
GG-77-1 (69 teeth)	10	4	WW-27-J-7.....	68		WW-27-J-22	61	
GG-79-1 (23 teeth)	2		WW-27-J-8.....	67		WW-27-J-23	63	
GG-80-1 (19 teeth)	1	4						

INTERCHANGEABLE PARTS for WW-27-J etc. REDUCTION GEAR ASSEMBLIES

For Model VH4D Engine

NOTE: Engines equipped with a Reduction Gear Assembly require a special Main Bearing Plate Assembly and Crankshaft as follows:

BG-210C-1-S2 MAIN BEARING PLATE ASSEMBLY (Not illustrated) consisting of:
1 BG-210C-1 Plate 1 PH-364 Oil Seal 1 ME-114-2 Bearing Cup

CA-71A-11-S1 CRANKSHAFT ASSEMBLY (Not illustrated) consisting of:
1 CA-71A-11 Crankshaft 1 ME-71 Bearing 1 PL-53 Key
1 GA-36-A Gear 1 ME-114 Bearing

Ref. No.	Part Number	Description	No. Req	Net Wt.		Ref. No.	Part Number	Description	No. Req	Net Wt.	
				Lb	Oz					Lb	Oz
705	BG-150	PLATE for retaining bearing (outer)	1	1		720	QD-544	GASKET for bearing retainer plate-outer * 6 to 12 gaskets required for .001 to .003" end play.	*		1
706	BG-151	PLATE for retaining bearing (inner)	1		6	721	QD-857	GASKET for cover to housing	1		1
707	HF-265	SPACER for take-off shaft	1		3			For BH-119-C cover. QD-545 for obsolete BH-119 cover. See note on Page 66.			
708	LO-44	BREATHER	1		1	722	QD-618	GASKET for housing to crankcase	1		1
709	ME-76	BEARING ASSEMBLY (outer)	1	1	11	723	SD-79	OIL INSTRUCTION TAG	1		1
710		Consisting of:				724	WA-55	TAKE-OFF SHAFT	1	6	14
711		1 ME-76-1 Cup *									
		1 ME-76-2 Cone *									
		* Not sold separately.									
712	ME-77	BEARING ASSEMBLY (inner)	1		15						
713		Consisting of:									
714		1 ME-77-1 Cup *				725	PD-12	NUT, 7/16"-20 thread, hexagon steel ... For housing to crankcase mounting with obsolete PC-425 stud.	2		1
		1 ME-77-2 Cone *									
		* Not sold separately.				726	PE-4	LOCKWASHER, 5/16" spring lock	4		1
715	PA-279	DOWEL PIN for cover to housing	2		1			For outer bearing retainer plate.			
716	XD-37	SCREW, 7/16"-14 x 1-3/4" lg. hex. hd. For housing to crankcase (outer holes) PC-425 studs, replaced by XD-37.	2		2	727	PE-5	LOCKWASHER, 3/8" spring lock	6		1
717	PH-202	OIL SEAL for take-off shaft	1		4			For cover to housing mounting, above oil level.			
718	PH-206	COLLAR for take-off shaft spacer	1		2	728	PE-6	LOCKWASHER, 7/16" spring lock	2		1
719	QD-543-A	GASKET for bearing retainer plate-inner	1		1			For housing to crankcase mounting, inner holes.			

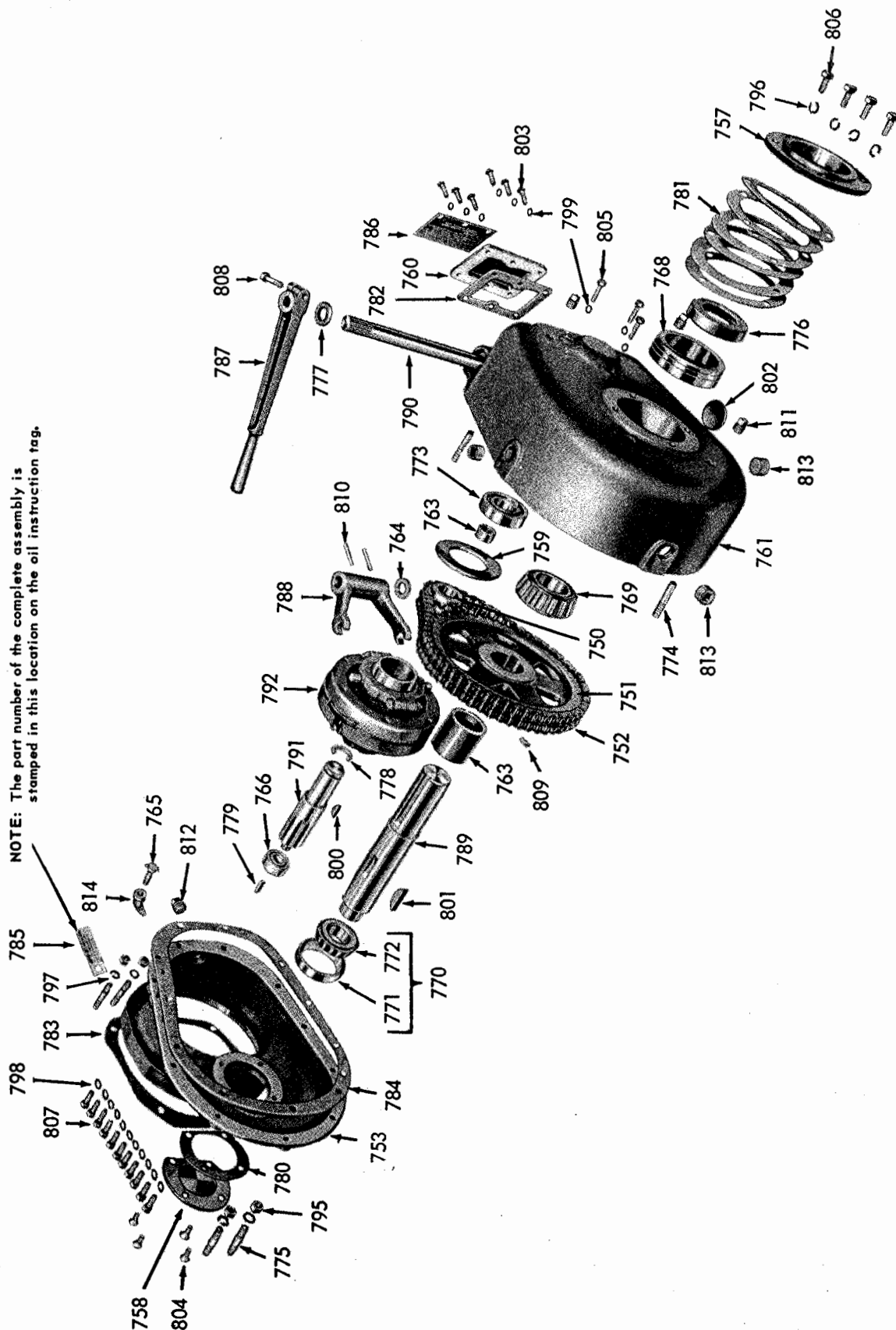
**INTERCHANGEABLE PARTS FOR WW-27-J ETC. REDUCTION GEAR ASSEMBLIES
FOR VH4D ENGINE**

Ref. No.	Part Number	Description	No. Req	Net Wt.	
				Lb	Oz
729	PH-2	PLAIN WASHER, 7/16" I.D. x 1/16" thick steel For housing to crankcase mounting, outerholes.	2		1
730	PH-22	PLAIN WASHER, 3/8" I.D. x 1/16" thick steel For cover to housing mounting, below oil level.	5		1
731	PL-24	KEY, No. 29 Woodruff For driven gear mounting.	1		1
732	PL-88	KEY, 1/4" square x 2" long For driver gear mounting.	1		1
733	XC-17	SCREW, 5/16"-18 thread x 3/4" long, flat head For inner bearing retainer plate.	4		1
734	XD-15	SCREW, 5/16"-18 thread x 3/4" long, hexagon head For outer bearing retainer plate.	4		1
735	XD-27	SCREW, 3/8"-16 thread x 1" long, hexagon head For cover to housing mounting.	11		1
736	XD-130	SCREW, 7/16"-14 thread x 2 1/4" long, hexagon head For housing to crankcase, inner holes.	2		2
737	XE-17	SCREW, 1/4"-20 thread x 3/8" long, headless set For driver gear mounting.	1		1
738	XE-44	SCREW, 5/16"-18 thread x 5/8" long, headless set For driven gear mounting.	1		1
739	XK-2	PLUG, 1/4" pipe, square head For oil level.	3		1
740	XK-3	PLUG, 3/8" pipe, square head For oil level—when take-off shaft is in horizontal position.	2		2
741	XK-4	PLUG, 1/2" pipe, square head For oil drain.	1		2
742	XK-88	REDUCER BUSHING, 3/8" to 1/8" pipe For mounting breather.	1		1

Order parts from nearest **SERVICE CENTER** shown in directory following parts list.
IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

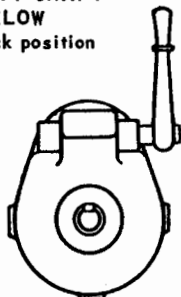
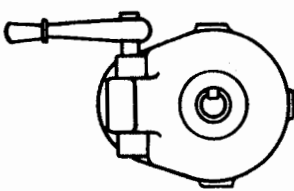
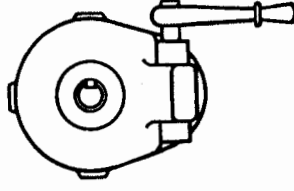
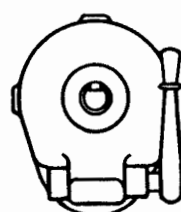
WW-62-A ETC. CLUTCH REDUCTION GEAR ASSEMBLIES FOR VH4 ENGINE

NOTE: The part number of the complete assembly is stamped in this location on the oil instruction tag.



WW-62-A ETC. CLUTCH REDUCTION GEAR ASSEMBLIES

For Model VH4D Engine

Determine position of take-off shaft when viewing from cranking end of engine. (View facing take-off end are shown.)	Assembly Number	Reduction Ratio	Rotation of Take-off Shaft	Ref. No. 750	Ref. No. 751	Ref. No. 752	Ref. No. 753
				Driver Gear Part No.	Driven Gear Part No.	Chain Part No.	Housing Part No.
TAKE-OFF SHAFT BELOW 6 o'clock position 	WW-62-A	2.07 to 1	Ctr. Engine-Wise	GG-116	GG-67-1	.....	See Note Below BG-215-B
	WW-62A-1	3.00 to 1	Ctr. Engine-Wise	GG-117	GG-77-1	.....	BG-215-B
	WW-62A-2	3.84 to 1	Ctr. Engine-Wise	GG-118	GG-69-1	.....	BG-215-B
	WW-62A-3	2.00 to 1	Engine-Wise	GG-113	GG-71	GJ-8	BG-215-B
	WW-62A-4	2.67 to 1	Engine-Wise	GG-114	GG-71	GJ-9	BG-215-B
	WW-62A-5	3.79 to 1	Engine-Wise	GG-115	GG-73	GJ-10	BG-215-B replaces BG-215
TAKE-OFF SHAFT ON LEFT SIDE as viewed from the cranking end 	WW-62A-6	2.07 to 1	Ctr. Engine-Wise	GG-116	GG-67-1	.....	BG-215B-1
	WW-62A-7	3.00 to 1	Ctr. Engine-Wise	GG-117	GG-77-1	.....	BG-215B-1
	WW-62A-8	3.84 to 1	Ctr. Engine-Wise	GG-118	GG-69-1	.....	BG-215B-1
	WW-62A-9	2.00 to 1	Engine-Wise	GG-113	GG-71	GJ-8	BG-215B-1
	WW-62A-10	2.67 to 1	Engine-Wise	GG-114	GG-71	GJ-9	BG-215B-1
	WW-62A-11	3.79 to 1	Engine-Wise	GG-115	GG-73	GJ-10	BG-215B-1 replaces BG-215-1
TAKE-OFF SHAFT ON RIGHT SIDE as viewed from the cranking end 	WW-62A-12	2.07 to 1	Ctr. Engine-Wise	GG-116	GG-67-1	.....	BG-215B-2
	WW-62A-13	3.00 to 1	Ctr. Engine-Wise	GG-117	GG-77-1	.....	BG-215B-2
	WW-62A-14	3.84 to 1	Ctr. Engine-Wise	GG-118	GG-69-1	.....	BG-215B-2
	WW-62A-15	2.00 to 1	Engine-Wise	GG-113	GG-71	GJ-8	BG-215B-2
	WW-62A-16	2.67 to 1	Engine-Wise	GG-114	GG-71	GJ-9	BG-215B-2
	WW-62A-17	3.79 to 1	Engine-Wise	GG-115	GG-73	GJ-10	BG-215B-2 replaces BG-215-2
TAKE-OFF SHAFT ON TOP 12 o'clock position 	WW-62A-18	2.07 to 1	Ctr. Engine-Wise	GG-116	GG-67-1	.....	BG-215B-3
	WW-62A-19	3.00 to 1	Ctr. Engine-Wise	GG-117	GG-77-1	.....	BG-215B-3
	WW-62A-20	3.84 to 1	Ctr. Engine-Wise	GG-118	GG-69-1	.....	BG-215B-3
	WW-62A-21	2.00 to 1	Engine-Wise	GG-113	GG-71	GJ-8	BG-215B-3
	WW-62A-22	2.67 to 1	Engine-Wise	GG-114	GG-71	GJ-9	BG-215B-3
	WW-62A-23	3.79 to 1	Engine-Wise	GG-115	GG-73	GJ-10	BG-215B-3 replaces BG-215-3

NOTE: Beginning with engine serial No. 5347000 the BG-215-B-etc. Housing replaces BG-215-etc., and BH-143-B Cover (ref. 761) replaces BH-143. (The cover to housing mounting hole centers are changed.) Consequently, new individual housing and cover are not interchangeable with the old unless all three parts; the cover, gasket and housing are replaced at the same time. Parts are identified by cast on part numbers.

WEIGHTS of PARTS LISTED ABOVE

WW-62-A-etc. complete units weigh approximately 90 lbs.

Part Number	Net Wt.		Part Number	Net Wt.		Part Number	Net Wt.		Part Number	Net Wt.	
	lb	oz		lb	oz		lb	oz		lb	oz
BG-215-B	20		GG-69-1 (73 teeth)	10	15	GG-113 (20 teeth)	1	14	GG-188 (19 teeth)	1	12
BG-215-B-1	20		GG-71 (40 teeth)	5	4	GG-114 (15 teeth)		14	GJ-8 (54 links)	1	12
BG-215-B-2	20		GG-73 (53 teeth)	7	10	GG-115 (14 teeth)	1	11	GJ-9 (52 links)	1	12
BG-215-B-3	20		GG-77-1 (69 teeth)	10	4	GG-116 (30 teeth)	2	10	GJ-10 (60 links)	2	
GG-67-1 (62 teeth)	8	11				GG-117 (23 teeth)	2	1			

INTERCHANGEABLE PARTS for WW-62-A etc. CLUTCH REDUCTION GEAR ASSEMBLIES

For Model VH4D Engine

NOTE: Engines equipped with a Clutch Reduction Gear Assembly require a special Main Bearing Plate Assembly and Crankshaft as follows:

BG-210-C-1-S2 MAIN BEARING PLATE ASSEMBLY (Not illustrated) consisting of:
 1 BG-210-C-1 Plate 1 PH-364 Oil Seal 1 ME-114-2 Bearing Cup

CA-71-A-23-S1 CRANKSHAFT ASSEMBLY (Not illustrated) consisting of:
 1 CA-71-A-23 Crankshaft 1 ME-71 Bearing 1 PL-53 Key
 1 GA-36-A Gear 1 ME-114 Bearing

Ref. No.	Part Number	Description	No.			Ref. No.	Part Number	Description	No.		
			Reg	Lb	Oz				Reg	Lb	Oz
757	BG-150	PLATE for retaining bearing (outer)	1	1							
758	BG-151	PLATE for retaining bearing (inner)	1		6						
759	BG-216	PLATE for clutch bearing	1		8	795	PD-12	NUT, 7/16"-20 thread, hexagon steel For housing to crankcase studs.	4		1
760	BH-127-B	COVER for inspection opening	1		8	796	PE-4	LOCKWASHER, 5/16" spring lock	4		1
761	BH-143-B	COVER for reduction gear housing	1	20		797	PE-6	LOCKWASHER, 7/16" spring lock	4		1
		Beginning with serial No. 5347000				798	PE-5	LOCKWASHER, 3/8" spring lock	11		1
		BH-143 previous to serial No. 5347000						For housing to crankcase mounting.			
		See Note on Page 70.				799	PH-30	PLAIN WASHER, 1/4" I.D. x 1/16" thick copper	9		1
762	HF-265-A	SPACER for take-off shaft	1		6			6-for inspection hole cover.			
763	HF-372	SPACER for ball bearing	1		3			3-for bearing retainer plate.			
764	HF-392-A	SPACER for shifter yoke, 3/16" thick .. (Used only when take-off shaft is on the right or left hand side).	1		2	800	PL-17	KEY, No. 13 Woodruff, for drive gear ...	1		1
765	LO-44	BREATHER	1		1	801	PL-24	KEY, No. 29 Woodruff, for driven gear ..	1		1
766	ME-189	PILOT BEARING (Furnished as part of WC-288-A Clutch Assembly)	1		8	802	SA-58	PLUG, 1-3/8" expansion	1		1
767	ME-76	BEARING ASSEMBLY (outer)	1	1	11			For shifter shaft hole.			
		Consisting of:				803	XA-34	SCREW, 1/4"-20 thread x 1/2" long, round or indented hexagon head	6		1
768		ME-76-1 Cup *						For inspection hole cover.			
769		ME-76-2 Cone *				804	XC-17	SCREW, 5/16"-18 thread x 3/4" long, flat head	4		1
		* Not sold separately.						For inner bearing retainer plate.			
770	ME-77	BEARING ASSEMBLY (inner)	1		15	805	XD-7	SCREW, 1/4"-20 thread x 1" long, hexagon head	3		1
		Consisting of:						For clutch bearing retainer plate.			
771		ME-77-1 Cup *				806	XD-15	SCREW, 5/16"-18 thread x 3/4" long, hexagon head	4		1
772		ME-77-2 Cone *						For outer bearing retainer plate.			
		* Not sold separately.				807	XD-27	SCREW, 3/8"-16 thread x 1" long, hexagon head	11		1
773	ME-119	BALL BEARING for clutch shaft	1		6			For cover to housing mounting.			
774	PA-279	DOWEL PIN for cover to housing	2		1	808	XD-30	SCREW, 3/8"-16 thread x 1 1/2" long, hexagon head, for shifter lever clamp	1		2
775	PC-419	STUD for housing to crankcase	4		2	809	XE-44	SCREW, 5/16"-18 thread x 5/8" long, headless set, for driven gear	1		1
776	PH-202	OIL SEAL for take-off shaft	1		4						
777	PH-234-A	OIL SEAL for shifter lever shaft	1		3	810	PA-341	ROLL PIN, 1/4" dia. x 1-1/8" long	2		1
778	PK-82	RETAINING RING	1		1			For shifter yoke to shaft.			
		For clutch shaft bearing.						XH-26, No. 4 x 1-3/8" long, taper pin, replaced by PA-341.			
779	PL-140	SQUARE KEY, 5/16" x 1-1/8" long	1		1	811	XK-2	PLUG, 1/4" pipe, square head	2		1
		For clutch drive hub.						For oil level.			
780	QD-543-A	GASKET for bearing retainer plate (inner)	1		1	812	XK-4	PLUG, 1/2" pipe, square head	5		2
781	QD-544	GASKET for bearing retainer plate (outer) *	*		1			For oil filler and adjustment holes.			
		* 8 to 12 gaskets required to maintain .004 inch end play.				813	XK-6	PLUG, 1/2" pipe, countersunk head	1		2
782	QD-592	GASKET for inspection hole cover	1		1			For oil drain.			
783	QD-618	GASKET for housing to crankcase	1		1	814	XK-77-A	STREET ELL, 1/8" pipe x 45°, brass ..	1		1
784	QD-856	GASKET for cover to housing	1		1			For breather mounting.			
		For BH-143-B cover.									
		QD-619 for obsolete BH-143 cover. See note on Page 70.									
785	SD-79	OIL INSTRUCTION TAG	1		1						
786	SD-125-A	INSTRUCTION PLATE, for clutch adj.	1		1						
787	VB-55-1	SHIFTER LEVER	1	2							
788	VB-64-A	SHIFTER YOKE	1	1	8						
789	WA-55-H	TAKE-OFF SHAFT	1	6	10						
790	WA-61-D	SHIFTER SHAFT	1	1	12						
791	WA-87-A	DRIVE SHAFT	1	2	8						
792	WC-288-A	CLUTCH ASSEMBLY	1	12							
		NOTE: See illustration and parts list of clutch on Page 64.									

FUEL PUMP REPAIR INSTRUCTIONS

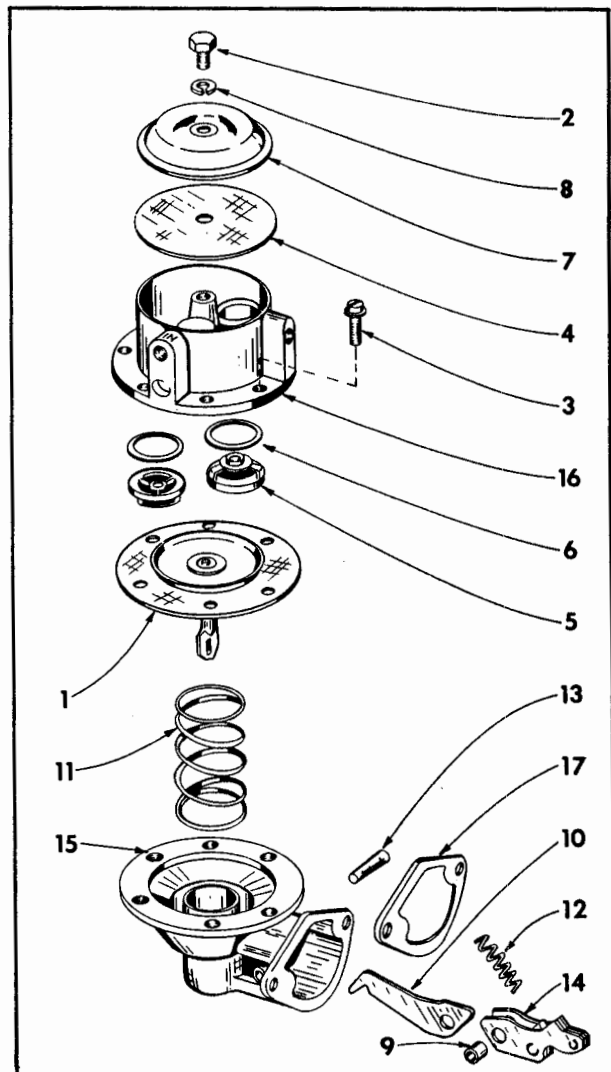
WISCONSIN FUEL PUMPS, No. LP-38E, LP-38H and LP-38F (Cold Weather: -65°F)

For all 4 cylinder engine models

The fuel pump, like all other parts of the engine, is subject to wear and you will find that any time after 500 hours of use, its efficiency will gradually decrease. This is indicated by the engines faltering at high speeds or when heavy loads are suddenly applied. The pump can easily be restored to its normal efficiency by the installation of a repair kit. Wisconsin LQ-46 (for LP-38E), LQ-47 (for LP-38H) or LQ-46A (LP-38F, cold weather, - 65°).

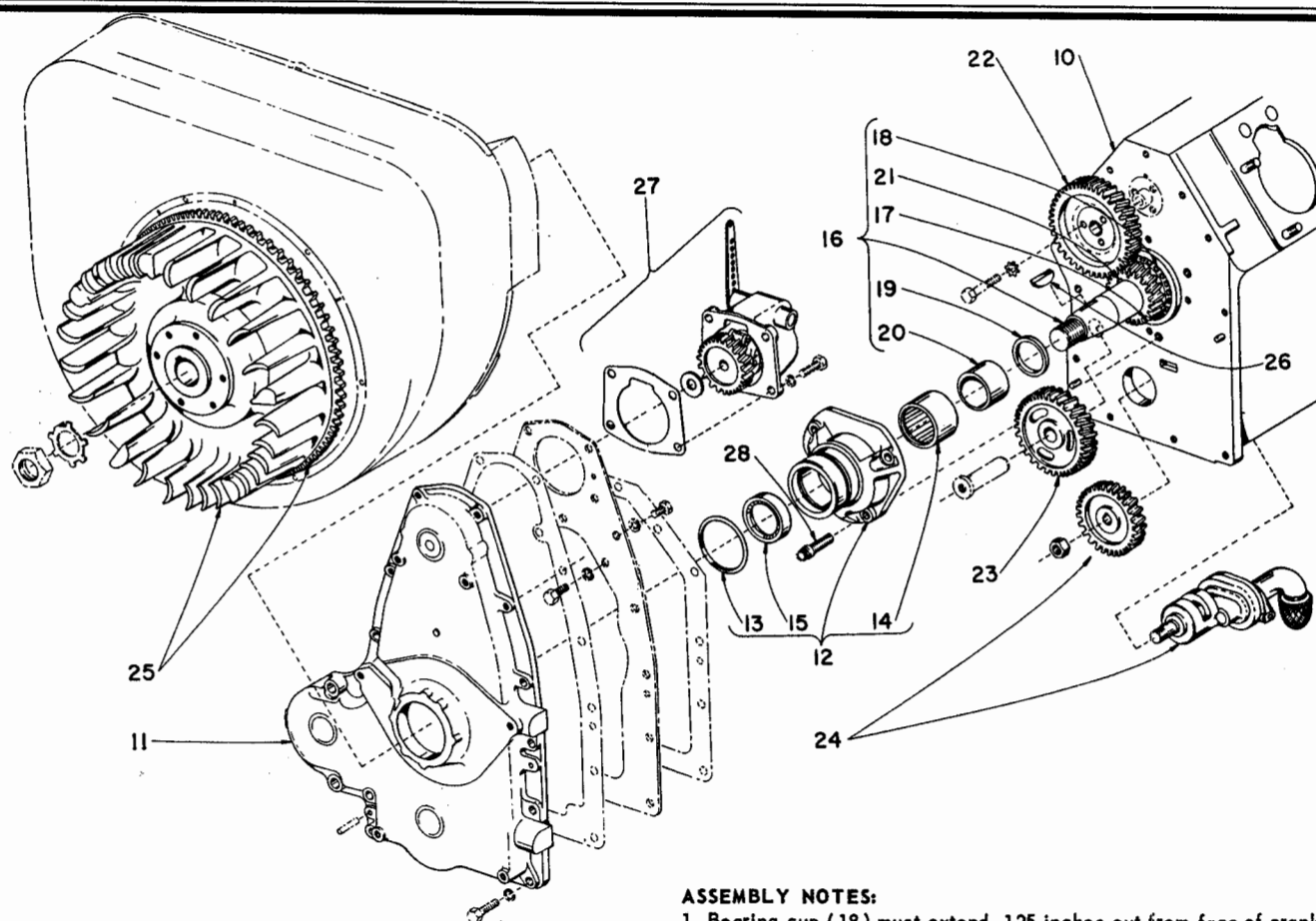
1. Disconnect fuellines from pump and remove fuelstrainer if mounted to pump. Remove fuel pump from adapter housing by taking out the two mounting screws.
2. File a groove across a point at the union of castings (15 and 16). This is a positive location of the fuel INLET and OUTLET positions when reassembling. Remove six head to flange screws (3) and remove fuel head. Take off screw (2), remove cover (7) and discard cover gasket (4).
3. Turn fuel head (16) over and remove both valve assemblies (5), and gaskets (6). Note position of valves.
4. Clean head thoroughly with kerosene or diesel fuel and a fine brush.
5. Place fuel head (16) with diaphragm surface up. Assemble new valve gaskets (6) and mount valve assemblies (5) in positions shown on illustration. Press valves in evenly without distortion, and stake in place.
6. Mount new cover gasket (4), cover (7) and washer (8). Securely tighten in place with cover screw (2).
7. Set fuel head assembly aside and proceed to rebuild lower diaphragm section.
8. Insert the end of a small screw driver into the coils of rocker arm spring (12) and remove.
9. Hold mounting bracket (15) in the left hand, with the rocker arm toward your body and the thumb nail on the end of link (10). With the heel of right hand on diaphragm (1), compress the diaphragm spring (11), and at the same time pull toward your body. Unhook link (10) from end of diaphragm and remove.
10. Remove rocker arm pin (13). Note that pin is larger on one end. Drive pin out by means of a punch from small end.
11. Clean mounting bracket (15) with kerosene or diesel fuel.
12. Assemble new link (10), bushing (9) and pin (13) to bracket (15) along with rocker arm (14). Stake rocker arm pin (10) in bracket to keep it in place.
13. Place new diaphragm spring (11) into bracket (15). Repeat in reverse order paragraph 9, using a new diaphragm (1). Assemble new rocker arm spring (12).
14. Mount this assembly to adapter on engine using new flange gasket (17).
15. Crank the engine over to a position where the diaphragm (1) is laying flat on the mounting bracket (15). Place the fuel head assembly back in position so the locating grooves of Step 2 are in line, and start the six head screws approximately three turns. Again crank the engine over to where the diaphragm (1) is pulled down into mounting bracket (15) to its lowest position. Securely tighten the six head screws (3).
16. Mount fuel strainer to fuel inlet and connect fuel lines.

NOTE: The LQ-46, LQ-47 or LQ-46-A Repair Kit and the parts included there-in, which are identified by an asterisk (*), are the only parts of the fuel pump available for service.



Ref. No.	Description	No. Req.
* 1	DIAPHRAGM	1
2	COVER SCREW	1
3	SCREW, head to bracket mounting	6
* 4	GASKET, cover (pulsator in LQ-47)	1
* 5	VALVE ASSEMBLY	2
* 6	GASKET for valve	2
7	COVER	1
8	WASHER for cover screw	1
* 9	BUSHING for rocker arm pin	1
* 10	LINK for rocker arm	1
* 11	SPRING for diaphragm	1
* 12	SPRING for rocker arm	1
* 13	PIN for rocker arm	1
14	ROCKER ARM	1
15	MOUNTING BRACKET	1
16	FUEL HEAD	1
* 17	GASKET for mounting flange	1

Per Wisconsin Spec No. 390568 as furnished to MELROE DIVISION of Clark Equipment Company

**ASSEMBLY NOTES:**

1. Bearing cup (18) must extend .125 inches out from face of crankcase.
2. When mounting Bearing Race (20), apply 1/8 inch wide bead of Loctite 601 to I. D. at center, and to crankshaft.
3. Torque housing screws (28), 40 to 45 foot pounds.

SERVICE PARTS LIST:

The following are in addition to, or replace similar parts found in the standard VH4D Instruction Book and Parts Manual.

Ref. No.	Part Number	Description	No. Req	Ref. No.	Part Number	Description	No. Req
10	BA 48C 105S1	CRANKCASE ASSEMBLY	1	25	N 101B 15	FLYWHEEL ASSEMBLY	1
11	BD 100MS1	GEAR COVER ASSEMBLY Includes: 1 PF 52 Button 1 TC388-1 Shaft 1 XK3 Plug	1	26	PL 165	KEY, Woodruff 'B' For flywheel mounting	1
12	BG 358A S1	BEARING and HOUSING ASSEMBLY Includes: JK 72 'O' Ring Seal ME 224 Needle Bearing PH 299 Oil Seal	1	27	T 89R 151	GOVERNOR ASSEMBLY Note: All parts same as standard T 89KS1 Governor except: TC 405P Flyweight assembly including GD 100A 6 Gear-In place of TC 405 J and GD 100A 3 Gear. Also TC 395-4 Housing in place of TC 395	1
13			1	28	XB 88	CAP SCREW, (special) 3/8-16x1" long For 3rd bearing housing mounting	3
14			1			OMIT FROM STANDARD ENGINE PARTS:	
15			1	BG 209	PLATE, bearing retainer-flywheel end	1	
16	CA 71G S1	CRANKSHAFT ASSEMBLY Includes: GA 36C Gear ME 223 *Roller Bearing (flywheel end) HF 643 Bearing Spacer ME 225 Needle Bearing (inner race) (mount to crankshaft with No 601 Loctite) PL 21 Key, No 3 Woodruff ME 114 * Rolle Bearing, Std. (T.O. end) * Includes Cup and Cone	1	PE 49	LOCKWASHER, bearing retainer plate mtg.	4	
17			1	RK 170	OIL SLING	1	
18			1	XC 68	SCREW, bearing retainer plate mounting	4	
19			1				
20			1				
21			1				
-	(Not illust.)		1				
22	GB 45D	CAMSHAFT GEAR	1				
23	GC 27D	IDLER GEAR	1				
24	K 95R	OIL PUMP ASSEMBLY Note: All parts same as standard K 95L Oil Pump except: KB 46-152 Cover assembly rep'l. KB 42 S2 KD 121B S1 Drive shaft replaces KD 121 S1	1				

WICO MODEL XHG-4 MAGNETO

FOR WISCONSIN MODELS VG4D AND VH4 ENGINES

INSTRUCTIONS

TIMING

The magneto is properly timed to the engine at the factory. If it becomes necessary to retune the magneto to the engine, refer to the diagram and instructions in the engine instruction book.

LUBRICATION

The only lubricating point in the magneto is the cam wiper felt (*Ref. No. 19*). This felt, which lubricates the breaker arm at point of contact with the cam, should be replaced whenever it is necessary to replace the breaker contacts.

IMPORTANT

Incorrectly adjusted spark plug gaps cause magneto failure more frequently than any other condition.

Sparkplugs should be inspected at frequent intervals, the size of the gap should be carefully checked and adjusted and the plugs thoroughly cleaned.

All oil, grease, and dirt should frequently be wiped off the magneto, lead wires, and spark plug insulators. Keeping these parts clean and the spark plugs properly adjusted will improve the engine performance and at the same time will prolong the life of the magneto.

DISTRIBUTOR CAP AND ARM

The distributor cap (*Ref. No. 43*) may be removed by loosening the 4 screws, 5622, which hold it in place.

After the cap has been removed the distributor arm, (*Ref. No. 57*), may be pulled off the bridge. When replacing the arm make sure the timing marks on the distributor arm and the pinion gear are in line.

BREAKER CONTACTS - REPLACEMENT AND ADJUSTMENT

The breaker contacts should be adjusted to .015" when fully opened. To adjust the contacts, loosen the two clamp screws (*Ref. No. 44*) enough so that the contact plate can be moved.

Insert the end of a small screwdriver in the adjusting slot and open or close the contacts by moving the plate until the opening is .015", measuring with a feeler gauge of that thickness, tighten the two clamp screws.

To replace the contacts remove the breaker spring clamp screw (*Ref. No. 48*), the breaker arm lock and washer, (*Ref. No. 14*) and (*Ref. No. 18*), then lift the breaker arm from its pivot. Remove the spacing washer, 5717, and the two breaker plate clamp screws (*Ref. No. 44*). The breaker plate can then be removed.

If the contacts need replacing it is recommended that both the fixed contact and the breaker arm be replaced at the same time, using replacement breaker set X5996 (*Ref. No. 46*).

After assembly, the contacts should be adjusted as described in *Breaker Contacts* paragraph. The contacts should be kept clean at all times. Lacquer thinner is an ideal cleaner for this purpose. Use WICO tool S-5449, to adjust the alignment of the contacts so that both surfaces meet squarely.

CONDENSER

To remove the condenser (*Ref. No. 35*), first disconnect the condenser lead by removing the breaker arm spring screw (*Ref. No. 48*), then remove the two condenser clamp screws (*Ref. No. 22*), and the condenser clamp (*Ref. No. 30*). When replacing the condenser make sure it is properly placed between the two locating bosses and that the clamp screws are securely tightened.

COIL AND COIL CORE

The coil and coil core must be removed from the magneto housing as a unit. After the distributor cap, and distributor arm, have been removed and the primary wire disconnected from the breaker arm spring terminal by removing screw (*Ref. No. 48*), take out the two coil core clamp screws (*Ref. No. 21*), and remove the clamps (*Fig. No. 38*). The coil and core can then be pulled from the housing. When replacing this group make sure that the bare primary wire is connected under the core clamp screw and that the insulated wire is connected to the breaker arm spring terminal.

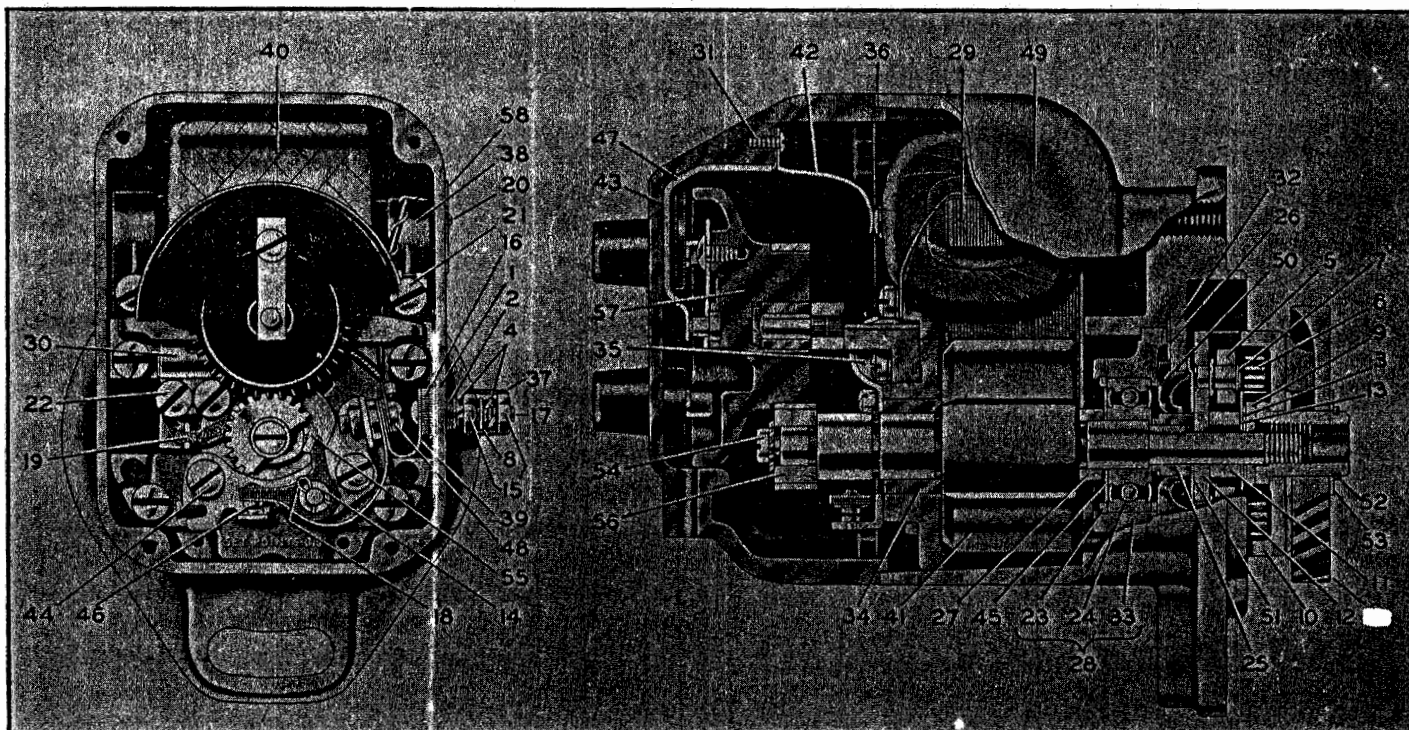
REMOVAL OF COIL FROM CORE

The coil (*Ref. No. 40*) is held tight on the core (*Ref. No. 29*) by a spring wedge. It will be necessary to press against the coil core with considerable force to remove it from the coil. The coil should be supported in such a way that there is no danger of the primary of the coil being pushed out of the secondary.

MAGNETO PARTS LIST

Model XHG-4, No. XH-2207
WISCONSIN Y-95 Series

Y-95-S1 For engine model VG4D with GD-103-1 drive gear
Y-95-1-S1 For engine model VH4D with GD-93C-4 drive gear



Ref. No.	Part Number	Description	No. Req.	Ref. No.	Part Number	Description	No. Req.
1	90-M-34X	SPACING WASHER for ground stud (insul.)	2	37	90-X5632	STOP BUTTON GROUP	1
2	90-M-35X	WASHER for ground stud (insulating)	1	38	90-5633	COIL CORE CLAMP	2
3	90-M-42XA	SPACING WASHER for driven flange	1	39	90-5635	GROUND CONNECTOR	1
4	90-M-55XA	GROUND STUD L.W.	2	*	90-X5654	GROUND CONNECTION UNIT	1
5	90-A-179X	TRIP ARM	2			(Ref. Nos. 1, 2, 4, 8, 15, 16, 17, & 39)	
6	90-15-186	DRIVE SPRING	1	40	90-X5700C	COIL GROUP	1
7	90-A-243X	SNAP RING	2	41	90-Y5710	ROTOR	1
8	90-IXA-256	WASHER for ground stud (steel)	1	*	90-5717	ALIGNING WASHER for breaker point	1
9	90-IVA-583	SPACING WASHER for drive cup	1	*	90-5719	GASKET for distributor cap window	1
10	90-9352	DRIVE CUP	1	*	90-5753	WINDOW for distributor cap	1
11	90-2122	DRIVEN FLANGE SPACER	1	42	90-5773	COIL CONTACT SPRING	1
12	90-X2286	DRIVEN FLANGE GROUP	1	43	90-X5777	DISTRIBUTOR CAP UNIT	1
13	90-2288	RETAINER for drive spring	1	*	90-5895	CLAMP PLATE for distributor window	1
14	90-3219	PIVOT WASHER for breaker arm	1	44	90-5900	CLAMP SCREW for fixed contact	2
15	90-3230	NUT for ground stud	2	45	90-5926	BALL BEARING SHIELD	1
16	90-3539	INSULATING LOCK for ground stud	2	46	90-X5996	BREAKER CONTACT SET	1
17	90-3945	GROUND STUD	1	47	90-X6001	SECONDARY INTERLEAD GROUP	1
18	90-4210	BREAKER ARM LOCK	1	48	90-5431	CLAMP SCREW for breaker spring	1
19	90-5077	CAM WIPER FELT	1	49	90-X6195	MAIN HOUSING ASSEMBLY	1
20	90-5250	NAME PLATE SCREW	2	50	90-6199	OIL SEAL	1
21	90-5411	CLAMP SCREW for coil core	2	51	90-6204	OIL SLINGER	1
22	90-5411	CLAMP SCREW for condenser	2	52	90-6424	IMPULSE LOCK RING	1
23	90-5516	RETAINING RING for rotor bearing	1	53	90-6425	THRUST WASHER	1
24	90-5517	ROTOR BEARING	1	*	90-K6445	IMPULSE LOCK NUT KIT	1
25	90-5518	IMPULSE SPACER	1			(Includes Ref. Nos. 52, 53, and nut)	
26	90-5519	IMPULSE STOP GASKET	1	*	90-6465	CLAMP SCREW for impulse stop	4
27	90-5520	SPACER for bearing cage group	1	54	90-6466	DISTRIBUTOR GEAR SCREW	1
28	90-X5521	BEARING CAGE GROUP	1	55	90-6468	BREAKER ARM FELT	1
29	90-X5524	COIL CORE GROUP	1	*	90-X9366	IMPULSE COUPLING UNIT (Includes Ref. Nos. 3, 5, 6, 7, 9, 10, 11, 12, 13, 52, and 53)	1
30	90-5532	CONDENSER CLAMP	1	56	90-6865	DISTRIBUTOR GEAR	1
31	90-5536	COIL CONTACT SCREW	1	57	90-X9564	DISTRIBUTOR ARM GROUP	1
*	90-5536	SCREW for distr. window clamp plate	2	58	90-8792	NAME PLATE	1
32	90-X5549	IMPULSE STOP GROUP	1	*	90-10407	ALIGNING WASHER (if nec.) thin, brk'r point ..	1
33	90-5567	BEARING CAGE	1				
34	90-5610	BREAKER PLATE BUSHING	1				
35	90-X5614	CONDENSER ASSEMBLY	1	YQ-5		KIT, points and condenser	
36	90-5618	GASKET for distributor cap	1	YQ-2		KIT, overhaul	
*	90-5622	SCREW for distributor cap	4			* Not illustrated.	

NOTE: Code number 90, prefixed to the part number, is a vendor identification. When ordering, please use part number with code number as shown.

MAGNETO SERVICE INSTRUCTIONS

Y-97 Series

FAIRBANKS-MORSE TYPE FM-X4B7A

Wisconsin No. Y-97-S1 (With GD-103-1 DRIVE GEAR) FOR MODEL VG4D
Wisconsin No. Y-97-S2 (With GD-93C-4 DRIVE GEAR) FOR MODEL VH4D

GENERAL DESCRIPTION

Fairbanks-Morse Type FM-X4B7A Magneto is designed and engineered to provide quick easy starting and maximum dependability of operation with minimum service. The compact alnico magnetic rotor assures an intensely hot spark under most operating conditions.

SERVICE PROCEDURE

The first step in magneto field servicing is to examine the magneto for corroded high tension towers, broken wires, or high tension wires not pushed far enough into the magneto tower to make good contact.

Then test the ignition spark while engine is being cranked. If a strong spark is observed, the magneto is not the cause of engine malfunction. If no spark is seen, proceed with servicing magneto.

SERVICING BREAKER POINTS, FIG. 1

Remove the end cap cover, distributor rotor and the end cap. Then inspect the breaker points for pitting, oxidation and shorting. If points are worn or shorted, they should be replaced.

To remove the point set, take out the breaker arm terminal screw releasing the breaker arm spring, coil lead and condenser lead. Remove the fulcrum pin snap ring and slide the breaker arm off the fulcrum pin. Remove the contact support locking screws and lift off the contact support.

The installation of new points is the reverse of the removal. After the points have been installed, they should be adjusted to the correct clearance of 0.015 inch at high point of cam. Be sure the points are clean and bright before adjusting them. Insert a screwdriver in the slot of the support bracket and pivot it between the two small bosses on the bearing support until the desired clearance is obtained. Then clean the points again before sealing the magneto.

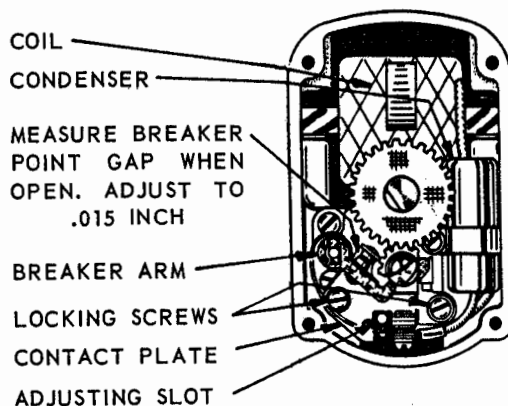


Fig. 1, BREAKER POINT ADJUSTMENT

FIELD SERVICE NOT RECOMMENDED

The cam wick, if dry or hard, should be replaced with a new factory impregnated wick. Other than this the magneto does not require field lubrication. No attempt should be made to oil or grease the magneto bearings. The magneto lubricant should be replaced only during the overhaul of the magneto by a Fairbanks-Morse authorized service station using recommended lubricant and factory engineered parts.

Coil and condenser replacement while simple are not recommended unless adequate test equipment is available. No attempt should be made to remove magnetic rotor from housing unless specific instructions for releasing the shaft are available.

INTERNAL TIMING, FIG. 2

If, for any reason, the magneto has been dismantled to the extent that the distributor gear has been removed the teeth must be properly meshed with those of the magnetic rotor gear upon reassembly. The gear teeth are marked to facilitate internal timing. The single marked tooth of the rotor gear must mesh between the two teeth of the distributor gear designated by the letter C.

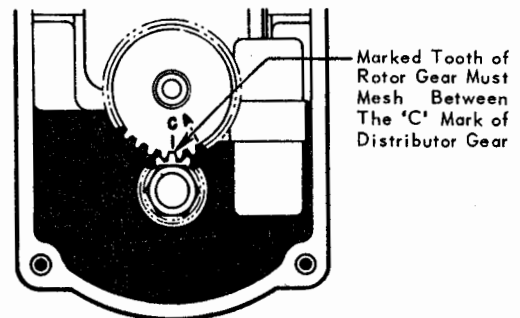


Fig. 2, INTERNAL TIMING GEARS

TIMING THE MAGNETO TO THE ENGINE

If the magneto has been removed from the engine for servicing, the operator must follow the engine manufacturer's instructions for timing the magneto to the engine. Refer to 'Magneto Timing' in engine instruction manual. When installing the magneto on the engine, be sure the magneto is properly attached and that the housing to engine gasket is in good condition.

SPECIAL DRIVE GEAR, FIG. 3

The magneto is equipped with a special drive gear mounted directly on the impulse coupling. If it is necessary to replace the drive gear, special care must be exercised in reassembly. It is possible to be off 180° in timing if gear is improperly mounted.

Assemble gear as follows: Remove magneto end cap cover and turn distributor rotor until it is in firing position for No. 1 cylinder. Retain rotor in this position and fit the drive gear to the impulse coupling lugs so that the prick punch mark on front of gear is located as shown.

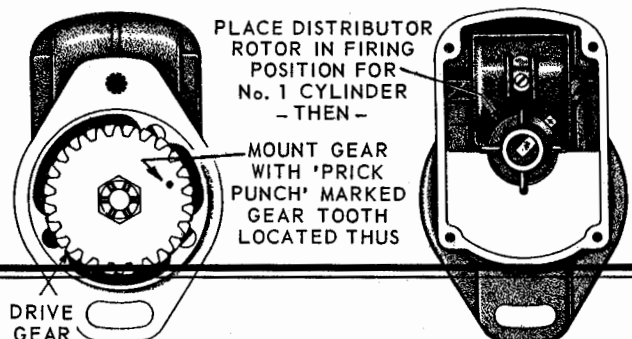
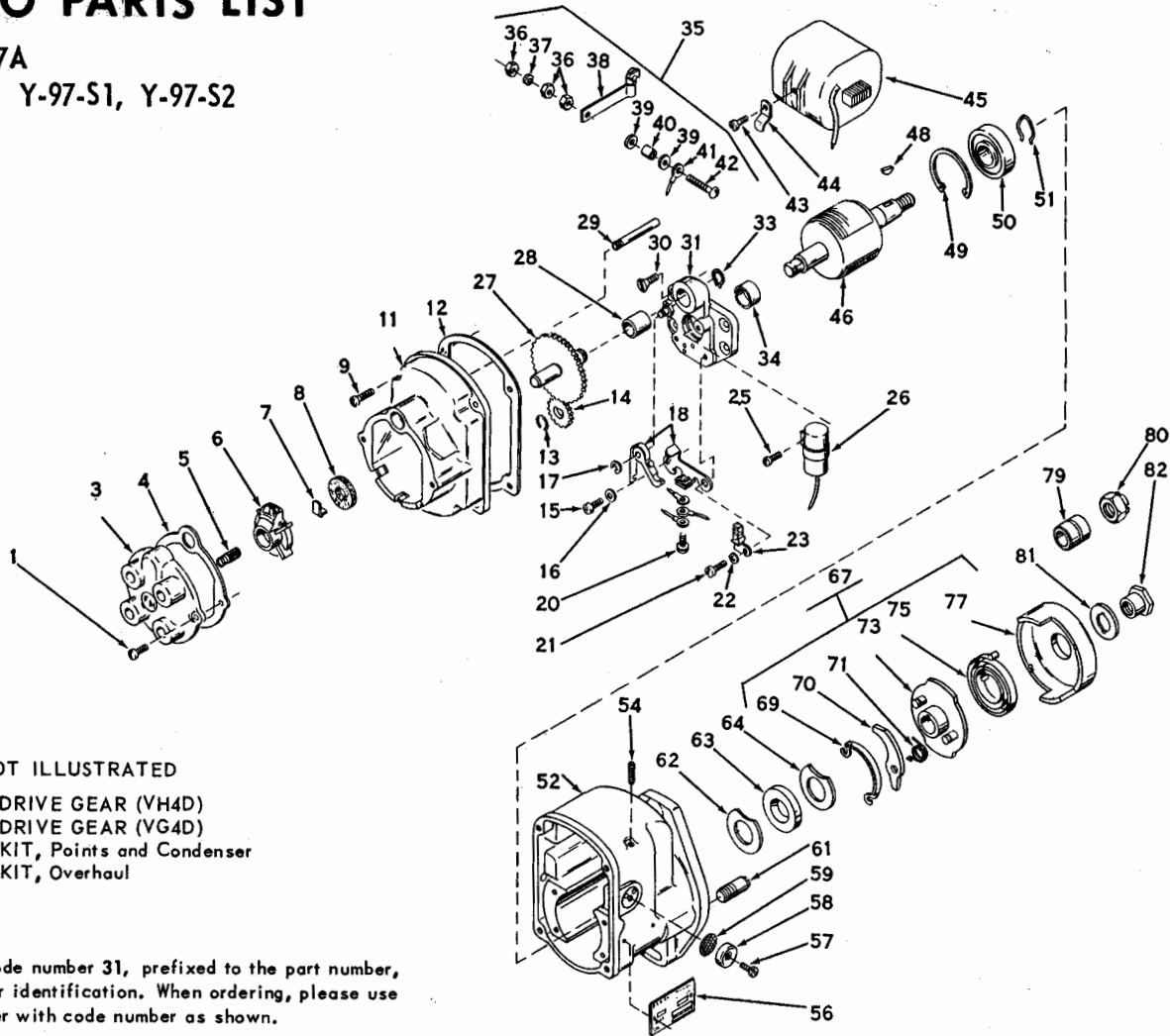


Fig. 3, DRIVE GEAR MARKING AND ASSEMBLY

MAGNETO PARTS LIST

TYPE FM-X4B7A

WISCONSIN No. Y-97-S1, Y-97-S2



NOT ILLUSTRATED

GD-93C-4 DRIVE GEAR (VH4D)
GD-103-1 DRIVE GEAR (VG4D)
YQ-8 KIT, Points and Condenser
YQ-9 KIT, Overhaul

NOTE: Code number 31, prefixed to the part number, is a vendor identification. When ordering, please use part number with code number as shown.

Ref. No.	Part Number	Description	No. Req.
1	31-859D	SCREW, cover, 8-32 x 9/16	2
3	31-W800	COVER, end cap	1
4	31-B682	GASKET, end cap cover	1
5	31-E2460B	BRUSH and SPRING	1
6	31-M2765	DISTRIBUTOR ROTOR	1
7	31-A2766	SPRING CLIP, rotor	1
8	31-G2501	SEAL, distributor shaft	1
9	31-10S14D	SCREW, end cap, 10-24 x 7/8	4
11	31-AZ2430	END CAP	1
12	31-H2498	GASKET, end cap	1
13	31-D1498	SNAP RING, rotor gear	1
14	31-Q5952	ROTOR GEAR	1
15	31-6S6U	SUPPORT SCREW, 6-32 x 3/8	1
16	31-D2458	WASHER, support screw, #6	1
17	31-C1498G	SNAP RING, fulcrum pin	1
18	31-A2437A	POINT SET - clockwise	1
20	31-6S6Z	TERMINAL SCREW, 6-32 x 3/8	1
21	31-856U	SUPPORT SCREW, 8-32 x 3/8	1
22	31-B5969	WASHER, support screw, #8	1
23	31-G2788	CAM WICK - clockwise	1
25	31-8S5NA	SCREW, condenser, 8-32 x 5/16	1
26	31-AXMR2433	CONDENSER	1
27	31-Y5939	SHAFT and GEAR, distributor	1
28	31-D5950C	BEARING, distributor	1
29	31-J983A	LEAD ROD	1
30	31-8S6G	SUPPORT SCREW, 8-32 x 3/8	4
31	31-X4631	SUPPORT, bearing	1
33	31-G1498	SNAP RING, distributor shaft	1
34	31-A5958A	BEARING, cam end	1
35	31-L2514C	SWITCH, assembly	1
36	31-8N1	NUT, switch screw	3
37	31-8LW5	LOCKWASHER, switch screw	1

Ref. No.	Part Number	Description	No. Req.
38	31-M2514	INSULATED LEVER	1
39	31-C6018	INSULATING WASHER	2
40	31-K2457A	INSULATING BUSHING	1
41	31-J2499A	WIRE, assembly	1
42	31-8S14N	SCREW, switch, 8-32 x 7/8	1
43	31-6S4U	SCREW, clip, 6-32 x 1/4	1
44	31-D6120	COIL CLIP	1
45	31-R2477C	COIL	1
46	31-HW2480	MAGNETIC ROTOR	1
48	31-3K1	KEY	1
49	31-B1498B	SNAP RING, bearing	1
50	31-C5949	BEARING, drive end	1
51	31-B1498D	SNAP RING, shaft	1
52	31-TZ2425	HOUSING	1
54	31-31S514A	SETSCREW, coil - 5/16-24 x 7/8	2
56	31-N195	NAME PLATE	1
57	31-6S4U	SCREW, cover, 6-32 x 1/4	2
58	31-B6030A	VENT COVER	2
59	31-C6032B	VENT SCREEN	2
61	31-S2568	STOP PIN, pawl	1
62	31-A2492C	WASHER, seal (inner)	1
63	31-G3861	SHAFT SEAL	1
64	31-A2492A	WASHER, seal (outer)	1
67	31-BW2563C-27	COUPLING, complete (27° lag angle)	1
69	31-A1498J	LOCK SPRING, pawl	1
70	31-Q2566	COUPLING PAWL	2
71	31-S5963	PAWL SPRING	2
72	31-C6568-27	COUPLING, complete (27° lag angle)	1
75	31-E2565	COUPLING SPRING	1
77	31-Y5957	COUPLING SHELL	1
79	31-F2572	GEAR BUSHING	1
80	31-M2570	COUPLING NUT	1

CARBURETOR

ZENITH MODEL 68-7

WISCONSIN L-63 SERIES

The Zenith 68-7 Series carburetor is of an up-draft single venturi design with a 1" S.A.E. barrel size and a 7/8" S.A.E. flange. The carburetors are made with selective fuel inlet, and with or without a main jet adjustment. These carburetors are "balanced" and "sealed", and the semi-concentric fuel bowl allows operation to quite extreme angles without flooding or starving.

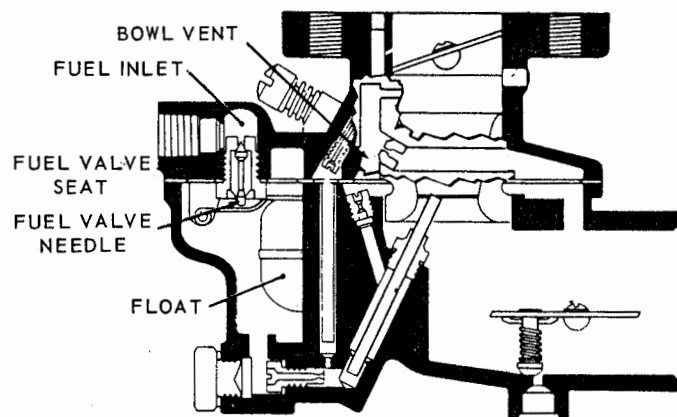


Fig. 1

Fuel supply system, Fig. 1, is made up of a threaded fuel inlet, fuel valve seat, fuel valve needle, float and fuel bowl. Fuel travels through the fuel valve seat and passes around the fuel valve and into the fuel bowl. The level of the fuel in the fuel chamber is regulated by the float through its control of the fuel valve. The fuel valve does not open and close alternately but assumes an opening, regulated by the float, sufficient to maintain a proper level in the fuel chamber equal to the demand of the engine according to its speed and load.

The inside bowl vent as illustrated by the passage originating in the air intake and continuing through to the fuel bowl, is a method of venting the fuel bowl to maintain proper air fuel mixtures even though the air cleaner may become restricted. This balancing is frequently referred to as an "inside bowl vent".

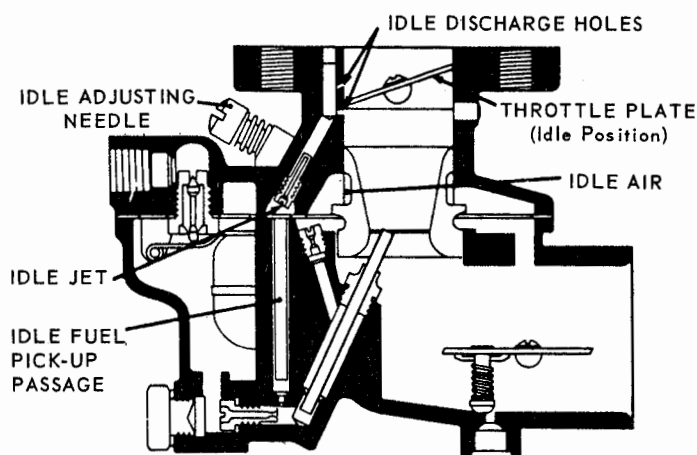


Fig. 2

Idle system, Fig. 2, consists of two idle discharge holes, idle air passage, idle adjusting needle, idle jet, and fuel pick-up passage. The fuel for idle is supplied through the main jet to a well directly below the main discharge jet. The pick-up passage is connected to this well by a restricted drilling at the bottom of this passage. The fuel travels through this channel to the idle jet calibration. The air for the idle mixture originates back of (or from behind) the main venturi. The position of the idle adjusting

needle in this passage controls the suction on the idle jet and thereby the idle mixture. Turning the needle in closer to its seat results in a greater suction with a smaller amount of air and therefore a richer mixture. Turning the needle out away from its seat increases the amount of air and reduces the suction, and a leaner mixture is delivered. The fuel is atomized and mixed with the air in the passage leading to the discharge holes and enters the air stream at this point.

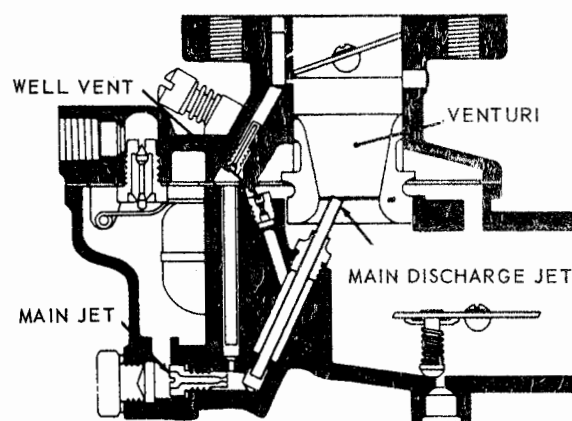


Fig. 3

High speed system, Fig. 3, controls the fuel mixture at part throttle speeds and at wide open throttle. This system consists of a venturi, controlling the maximum volume of air admitted into the engine; the main jet, which regulates the flow of fuel from the float chamber to the main discharge jet; the well vent, which maintains uniform mixture ratio under changing suction and engine speeds; and a main discharge jet, which delivers the fuel into the air stream.

The main jet controls the fuel delivery during part throttle range from about one-quarter to full throttle opening. To maintain a proper mixture, a small amount of air is admitted through the well vent into the discharge jet through air bleed holes in the discharge jet at a point below the level of fuel in the metering well.

The passage of fuel through the high speed system is not a complicated process. The fuel flows from the fuel chamber through the main jet and into the main discharge jet where it is mixed with air admitted by the well vent, and the air-fuel mixture is then discharged into the air stream of the carburetor.

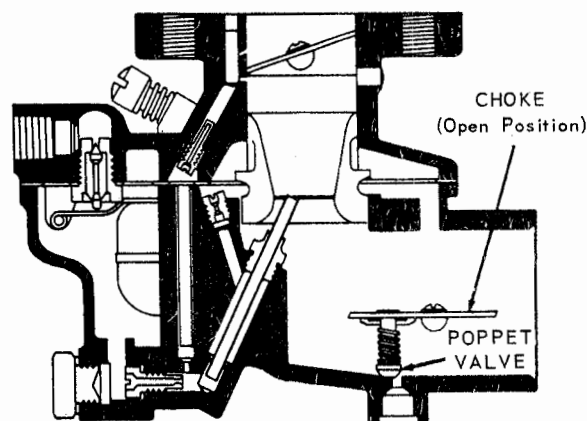


Fig. 4

Choke system, Fig. 4, consists of a valve mounted on a shaft located in the air entrance and operated externally by a lever mounted on the shaft. The choke valve is used to restrict the air entering the carburetor. This increases the suction on the jets

when starting the engine. The choke valve is of a "semi-automatic" type, having a poppet valve incorporated in its design, which is controlled by a spring. The poppet valve opens automatically when the engine starts and admits air to avoid over-choking or flooding of the engine. The mixture required for starting is considerably richer than that needed to develop power at normal temperatures. As the engine fires and speed and suction are increased, the mixture ratio must be rapidly reduced. This change is accomplished through adjustment of the choke valve and the automatic opening of the poppet valve to admit more air when the engine fires.

FLOAT SETTING, Fig. 5

If float position is not to the dimension shown, use a long nose pliers and bend lever close to float body, to obtain correct float setting.

FUEL LEVEL

The liquid level in float chamber is $17/32$ to $19/32$ inch below top of float bowl. This level was established with a #35 fuel valve seat at $1\frac{1}{2}$ p.s.i. and a sight tube approximately $1/4$ to $9/32$ inch i.d.

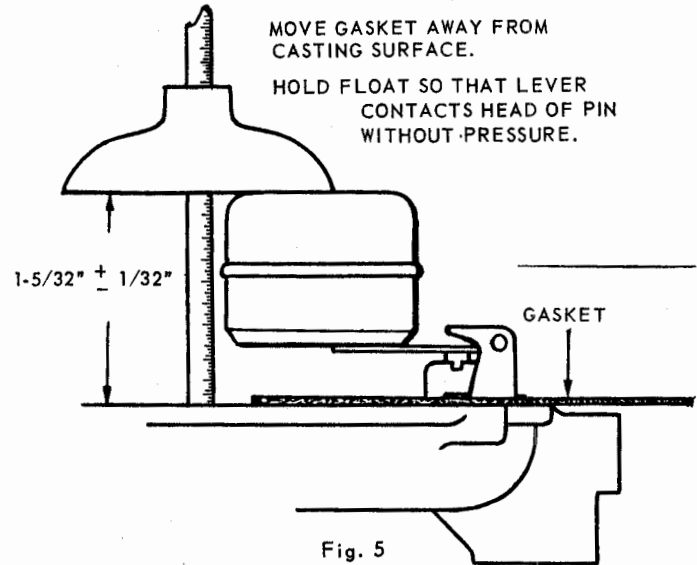
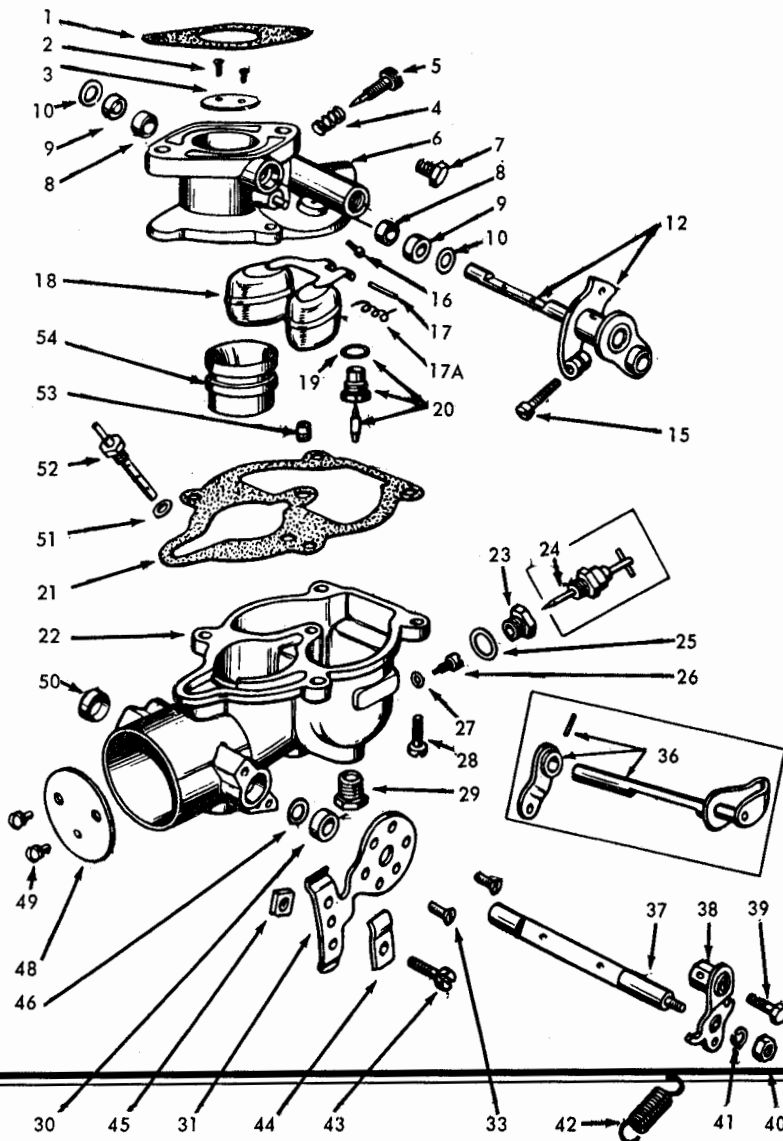


Fig. 5

SERVICE PARTS LIST

Parts are identified by reference number. See parts list for correct part number.



CARB. REF.	ZENITH NO.	WISCONSIN NO.
1	12098A ●	L-63
2	12188G ●	L-63-A
3	12158D ●	L-63-C
4	12325	L-63-D
5	12199E ●	L-63-E
6	12205A ●	L-63-F
7	12235E ●	L-63-G
8	12236	L-63-H
9	12239C ●	L-63-J
10	12234F ●	L-63-K
11	12288C ●	L-63-L
12	12300	L-63-M
13	12599D ●	L-63-N
14	12375D ●	L-63-R
15	12448D ●	L-63-U
16	12449D ●	L-63-V
17	12545C ●	L-63-W
18	12543C ●	L-63-Y
19	12546	L-63-Z
20	12647	L-63-AA
21	12253A ●	LZ-63-2
22	12229D ●	LZ-63-C
23	12238D ●	LZ-63C-2
24	12744B ●	L-63-AF
25	12982B ●	L-63-AN
26	13201A ●	L-63-AP
27	13238A ●	L-63-AQ
28	13405A ●	L-63-AV
29	13420A ●	L-63-BC
30	13449A ●	L-63-BD
31	13694	L-63-BL

NOTE: Beginning with this letter designation ●, bushings (Ref. 8) were discontinued.

CARBURETOR PARTS LIST

ZENITH MODEL 68-7

WISCONSIN L-63 Series

Item No.	Part Number	Description	No. Req.	Item No.	Part Number	Description	No. Req.
1	QC-71-A *	GASKET - flange, (Zenith No. C141-4-5)	1		93-C81-50-35 *	VALVE & SEAT, fuel (spring type) for 2, 3, 7, 9, 11, 12, 14, 15, 22, 23, 24, 26	1
2	93-T315S5-4	SCREW & WASHER - throttle plate	2		93-C81-50-25 *	For 17 and 19	1
	93-T315B5-4	SCREW & WASHER - throttle plate, for 30	2				
3	93-C21-176	PLATE - throttle, for all except 5, 7, 8, 10, 12, 14, 18	1	21	93-C142-74 † *	GASKET - BOWL TO BODY	1
	93-C21-205	PLATE - throttle, for 5, 7, 8, 10, 12, 14, 18	1	22	93-B3-121B-1	BOWL - FUEL, for 1, 6, 20, 21	1
4	93-C111-17	SPRING - idle needle	1		93-B3-121A-3	BOWL - FUEL, for 2, 5, 10, 12, 18	1
5	93-C46-6 *	NEEDLE - idle adjusting	1		93-B3-121A-1	BOWL - FUEL, for 3, 7, 8, 9, 11, 14, 17, 19, 22, 24, 29, 31	1
6		BODY - throttle, (Not available for service)			93-B3-121B-2	BOWL - FUEL, for 4	1
7	93-T91-3	1/8" PLUG - fuel inlet R.H.	1		93-B3-121E-1	BOWL - FUEL, for 13	1
8	93-C9-75	BUSHING - throttle shaft (See Note)	2		93-B3-121F-1	BOWL - FUEL, for 15, 23, 30	1
9	93-T48-9 *	SEAL - throttle shaft	2		93-B3-121D-6	BOWL - FUEL, for 16	1
10	93-T52-57 *	RETAINER - shaft seal (1 used for 28)	2		93-B3-121A-7	BOWL - FUEL, for 25	1
	93-C131-38	CUP PLUG, for 28	1		93-B3-121A-8	BOWL - FUEL, for 26	1
12	93-C29-491	SHAFT & STOP LEVER - throttle, for 1, 3, 6, 9, 11, 17, 19, 20, 21, 22, 23, 29, 31	1	23	93-C138-24	PLUG - MAIN JET PASSAGE, for 1, 3, 4, 8, 10, 15, 16, 19, 20, 21, 22, 23, 24, 26, 28, 29, 30, 31	1
	93-C29-1301	SHAFT & STOP LEVER - throttle, for 4	1	24	93-C71-21	ADJUSTMENT - MAIN JET, for 2, 5, 6, 7, 9, 11, 12, 13, 14, 17, 18, 25, 27	1
	93-C29-926	SHAFT & STOP LEVER - throttle, for 5, 7, 8, 10, 14, 18	1	25	93-T56-23 † *	WASHER (fiber) - PLUG & ADJUSTMENT ..	1
	93-C29-1418	SHAFT & STOP LEVER - throttle, for 25, 27	1	26	93-C52-7-22	JET - MAIN, for 1, 4, 16, 20, 21, 28, 29, 30	1
	93-C29-1476	SHAFT & STOP LEVER - throttle, for 15, 16, 30	1		93-C52-7-33	JET - MAIN, for 2, 13, 25, 27	1
	93-C29-858	SHAFT & STOP LEVER - throttle, for 2, 13, 24	1		93-C52-7-26	JET - MAIN, for 5, 7, 11, 12, 14, 17, 18	1
	93-C29-1475	SHAFT & STOP LEVER - throttle, for 12	1		93-C52-7-25	JET - MAIN, for 6	1
	93-C29-1584	SHAFT & STOP LEVER - throttle, for 26	1		93-C52-7-19	JET - MAIN, for 8	1
	93-C29-1607	SHAFT & STOP LEVER - throttle, for 28	1		93-C52-7-30	JET - MAIN, for 9	1
15	93-T858-12-NP	SCREW - THROTTLE STOP, for all except 25, 27, 30	1		93-C52-7-21	JET - MAIN, for 10	1
	93-T858-10-NP	SCREW - THROTTLE STOP, for 25, 27, 30	1		93-C52-7-23	JET - MAIN, for 3, 15, 19, 22, 23, 24, 26	1
16	93-C55-6-12	JET - IDLE, for all except 25, 27, 29, 30	1		93-C52-7-24	JET - MAIN, for 31	1
	93-C55-6-10	JET - IDLE, for 29, 30	1	27	93-T56-24 † *	WASHER (fiber) - MAIN JET	1
	93-C55-22-11	JET - IDLE, for 25, 27	1	28	93-T301S10-10	SCREWS - BOWL TO BODY ASSEMBLY	4
17	93-C120-4 *	AXLE - FLOAT	1	29	93-T91-3	PLUG - BOWL DRAIN	1
17A	93-C117-79	SPRING - FLOAT, for all except 1, 6, 16, 21, 28	1	30	93-C131-4X2 *	RETAINER - CHOKE SHAFT SEAL, for 1 thru 25, 27, 29, 30, 31	1
18	93-C85-103	FLOAT and HINGE ASSEMBLY	1		93-T52-53 *	RETAINER - CHOKE SHAFT SEAL, for 26, 28	1
19	93-T56-20 † *	WASHER (.040" thick fiber) for 93-C81-17	1	31	93-C109-60C	BRACKET - CHOKE, for 1, 3, 6, 7, 8, 9, 11, 14, 15, 16, 17, 19, 20, 21, 23, 24, 26, 29, 30, 31	1
	93-T56-70 † *	WASHER (.020" thick fiber) for 93-C81-50	1		93-C109-60C-2	BRACKET - CHOKE, for 4, 13, 27	1
		Spring type fuel valve and seat.			93-C109-60C-1	BRACKET - CHOKE, for 22	1
20	93-C81-17-35 *	VALVE & SEAT, fuel (solid type) for 1, 4, 5, 6, 8, 10, 13, 16, 21, 25, 27, 28, 29, 30, 31 ...	1		93-C109-60E-1	BRACKET - CHOKE, for 28	1
	93-C81-17-25 *	For 18 and 20	1	33	93-C140-58	SCREWS - CHOKE BRACKET ASSEMBLY ..	2
						For all except 2, 5, 10, 12, 18, 25.	
				36	93-C108-280	SHAFT & FRICTION LEVER - CHOKE, for 2	1
					93-C108-279	SHAFT & FRICTION LEVER - CHOKE, for 5, 10, 12, 18	1
					93-C108-277	SHAFT & FRICTION LEVER - CHOKE, for 25	1
				37	93-C105-286	SHAFT - CHOKE, for all except 2, 5, 10, 12, 18, 25	1
				38	93-C106-2	LEVER - CHOKE, for all except 2, 5, 10, 12, 18, 25	1
				39	93-T858-7	SCREW - CHOKE LEVER SWIVEL, for all except 2, 5, 10, 12, 18, 25	1
				40	93-T22S8	NUT - CHOKE SHAFT, for all except 2, 5, 10, 12, 18, 25	1

(Continued)

Order parts from nearest **SERVICE CENTER** shown in directory

IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

CARBURETOR PARTS LIST

ZENITH MODEL 68-7

WISCONSIN L-63 Series

Item No.	Part Number	Description	No. Req.
41	93-T41-10	LOCKWASHER - CHOKE SHAFT NUT, for all except 2, 5, 10, 12, 18, 25	1
42	93-C112-6	SPRING - CHOKE LEVER RETURN, for all except 2, 5, 10, 12, 18, 25	1
43	93-T858-8	SCREW - BRACKET CLIP, for all except 2, 5, 10, 12, 18, 25	1
44	93-C110-7	CLIP - BRACKET TUBE, for all except 2, 5, 10, 12, 18, 25	1
45	93-T2158	NUT - CLAMP SCREW, for all except 2, 5, 10, 12, 18, 25	1
46	93-T57-4	* SEAL - CHOKE SHAFT, for all except 26, 28	1
	93-T48-9	* SEAL - CHOKE SHAFT, for 26, 28	1
48	93-C101-80	PLATE - CHOKE, for all except 2, 13, 25, 27	1
	93-C101-85	PLATE - CHOKE, for 2, 13, 25, 27	1
49	93-T31555-4	SCREW & WASHER CHOKE PLATE, for all except 30	2
	93-T315B5-4	SCREW & WASHER CHOKE PLATE, for 30 ..	2
50	93-CR37-1X1 *	PLUG - CHOKE SHAFT HOLE, for all except 2, 5, 10, 12, 18	1
51	93-T56-48 †	WASHER (fiber) - DISCHARGE JET	1
52	93-C66-114-60	JET - DISCHARGE, for 1, 4, 6, 16, 20, 21, 28	1
	93-C66-114-45	JET - DISCHARGE, for 2, 13, 25, 27	1
	93-C66-114-50	JET - DISCHARGE, for 3, 9, 11, 15, 17, 19, 22, 23, 24, 26, 29, 30, 31	1
	93-C66-114-40	JET - DISCHARGE, for 5, 7, 8, 10, 12, 14, 18	1
53	93-C77-18-12	JET - WELL VENT, for 1, 4, 6, 16, 20, 21, 28	1
	93-C77-18-13	JET - WELL VENT, for 2, 13, 25, 27	1
	93-C77-18-22	JET - WELL VENT, for 3, 9, 11, 15, 17, 19, 22, 23, 24, 26, 29, 30, 31	1
	93-C77-18-17	JET - WELL VENT, for 5, 7, 8, 10, 12, 14, 18	1
54	93-B38-74-18	VENTURI, for 1, 3, 4, 6, 9, 11, 15, 16, 17, 19, 20, 21, 22, 23, 24, 26, 28	1
	93-B38-74-19	VENTURI, for 2, 13, 25, 27, 29, 30, 31	1
	93-B38-74-17	VENTURI, for 5, 7, 8, 10, 12, 14, 18	1
Not Illust.	93-C2454AD1X2	LEVER - THROTTLE CLAMP, for 15, 16, 30	1
	93-T8B10-9	SCREW - LEVER CLAMP, for 15, 16, 30	1
	93-T8B8-10	SCREW - LEVER SWIVEL, for 15, 16, 30	1
	93-C181-329	GASKET KIT	1
	LQ-33	REPAIR PARTS KIT (with spring type fuel valve and seat) for 2, 3, 7, 9, 11, 12, 14, 15, 22, 23, 24, 26	1
	LQ-39	REPAIR PARTS KIT (with solid type fuel valve and seat) for 1, 4, 5, 6, 8, 10, 13, 16, 21, 25, 27, 28, 29, 30, 31	1
	93-K-2130	REPAIR PARTS KIT, for 17, 19	1
	93/K-**	REPAIR PARTS KIT, for 18, 20	1
		* Parts in Repair Kit	
		† Parts in Gasket Set	
		** Specify Zenith Carburetor Number	

Order parts from nearest **SERVICE CENTER** shown in directory

IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

WALBRO CARBURETOR Model LUB

For WISCONSIN Engine Models VH4D and TJD

OPERATION, Fig. 1

Fuel is gravity fed or pumped through the gas line from the tank to Inlet fitting (1), through inlet needle Valve seat (2) and into the fuel bowl. As the level in fuel bowl increases, the Float (3) rises, shutting off the fuel supply by forcing needle valve into Valve seat (2). As fuel is being consumed, the float drops and allows additional fuel to enter the bowl through the valve seat. Internal Air vent (7) provides clean air to balance atmospheric pressure in fuel bowl.

WHEN STARTING; the Choke valve (5) is closed and the Throttle valve (10) is wide open causing an abnormally high suction. This high vacuum demand draws fuel and air from both idle and main systems for ease in cold starts.

Fuel from the bowl enters the Main metering jet (4), then up through Main nozzle (9) where it combines with air from Nozzle well air-vent (6). This mixture passes thru Venturi (8) and blends with fuel/air mixture from Air vent (15) and Idle holes (11) and (12) to provide a highly volatile rich mixture for starting.

AT IDLE SPEEDS; the Throttle valve (10) remains closed, exposing only the Idle hole (11) from which a fuel/air mixture is drawn. Air volume is closed off up to the idle hole by the throttle valve as the Choke valve (5) is now open. The Idle adjusting needle (14) regulates the amount of fuel/air mixture to the Idle hole (11), from Idle air vent (15) and Idle fuel channel (16), to meet various engine operating conditions.

AT HIGH SPEED, or full throttle operation; gradual acceleration is obtained when the Throttle valve (10) is partially opened allowing additional fuel/air mixture from the Idle hole (11) and Part throttle hole (12) to enter the engine combustion chamber, causing the engine to run faster. As the throttle valve opening is increased and the engine demands a greater fuel/air volume, the Nozzle (9) begins to satisfy this requirement beyond the idle hole and part throttle hole capacities.

After the acceleration assist from the idle system; at full throttle the complete idle circuit is reversed, as air only, in place of the fuel/air mixture, is drawn through the Idle holes (11), (12), and Channel (16), to Nozzle (9), where it is blended with fuel drawn from float chamber thru Jet (4).

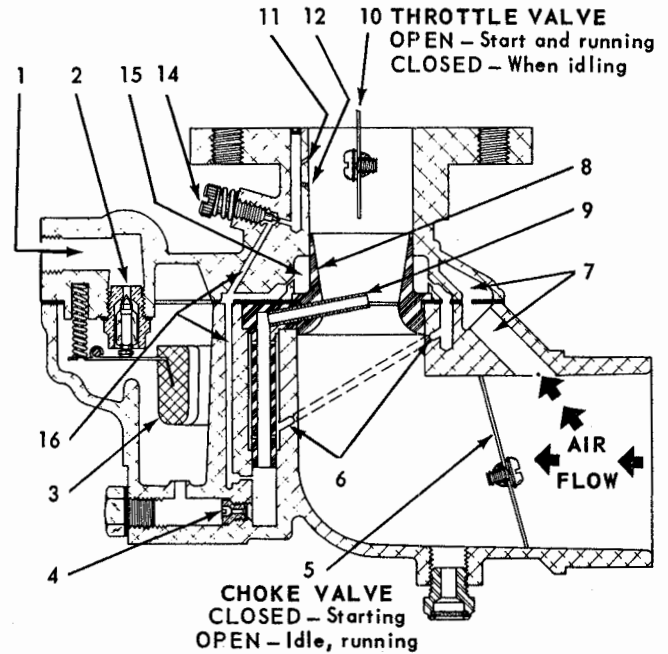


Fig. 1

CARBURETOR TROUBLES CAUSES AND REMEDIES

Dirt is the major cause of field service carburetor problems. An adequate Fuel Filter must be used between the tank and carburetor, and should be serviced frequently. Service Air Filter daily - Keep carburetor and linkage free of dirt.

FUEL LEAKS FROM CARBURETOR

Float level set too high: Remove bowl, invert carburetor and set float. See Fig. 2 and Float Setting Instructions, page 2.

Dirt under inlet needle valve: Remove inlet valve, clean seat by rinsing in mild solvent or clean fuel, and blow off with compressed air.

Bowl vent plugged: Remove bowl and blow clean with compressed air.

Collapsed float, caused by blowing assembled carburetor with compressed air. Replace float.

Carburetor gummed from storage - float stuck: Remove fuel bowl and clean.

ENGINE SMOKES AND RUNS RICH

Dirty air filter: Clean per instructions.

Improper adjustment: Set Idle Needle $1 \pm 1/8$ turns open from seat. Refer to Adjustment Instruction, page 2.

Bowl to body gasket leaks: Tighten securely, or replace.

Air vent in carburetor plugged: Remove fuel bowl and idle needle. Clean air and idle channels thoroughly with compressed air.

ENGINE RUNS LEAN

Improper adjustment: Set Idle Needle $1 \pm 1/8$ turns open from seat. Refer to Adjustment Instructions, page 2.

Idle holes plugged. Dirt in fuel delivery channels: Remove fuel bowl and idle needle. Clean thoroughly with compressed air.

Low fuel level: See Fig. 2 and Float Setting Instructions, page 2.

Fuel filter plugged: Remove and clean.

ENGINE STARTS HARD

Improper adjustment: Set Idle Needle $1 \pm 1/8$ turns open from seat. Refer to Adjustment Instructions, page 2.

No fuel in carburetor: Check carburetor drain plug. Clean tank, filter and carburetor. Check fuel lines for obstructions, and test fuel pump.

Choke valve not closing: Check linkage for proper travel.

GOVERNOR SURGE

Governor sticking: Check linkage for binding.

Throttle shaft and valve binding: Remove and replace shaft if worn. Clean carburetor body and reassemble throttle shaft.

DISASSEMBLY

Before disassembling: Clean outside of carburetor from all foreign material.

IMPORTANT: When cleaning a completely assembled carburetor do not blow with compressed air, you may collapse the float.

For a complete disassembly, follow the sequence of part reference numbers in the carburetor exploded view, Fig. 3. Nozzle Ref. 9, Fig. 1 is not removable.

IMPORTANT: Before removing Throttle and Choke levers, note their position and location. Optional mounting is available and may differ from exploded view illustration.

CLEANING

Wash all parts in a mild solvent or fuel. Blow air through orifices (holes) and channels in throttle body and fuel bowl. Do not probe with any sharp tools which might damage small metering holes.

REASSEMBLY

Replace all worn or damaged parts — use all new gaskets. **Note;** Body Gasket (18) is put on before float is assembled, and round opening in gasket fits into groove of Venturi (11).

Be sure that Notch in Venturi is facing toward float needle valve — this is clearance for Main nozzle in throttle body.

Assemble Throttle Valve (8) and Choke Valve (25) with part numbers facing to the outside, when valves are in the closed position.

IMPORTANT: Be careful in tightening brass screws and fittings, so as not to strip threads and screw driver slots.

Tighten firmly but not excessively.

Valve Seat (16) — 40 to 50 inch pounds torque

Main Jet (22) — 50 to 60 inch pounds torque

FLOAT SETTING, Fig. 2

With fuel bowl removed and float assembly in place, turn throttle body upside down so that float assembly is on top. Check float height with a depth gauge. Setting should be 1.010 inch $\pm$.020 above bowl gasket. If necessary, bend float arm (at float), to obtain correct height.

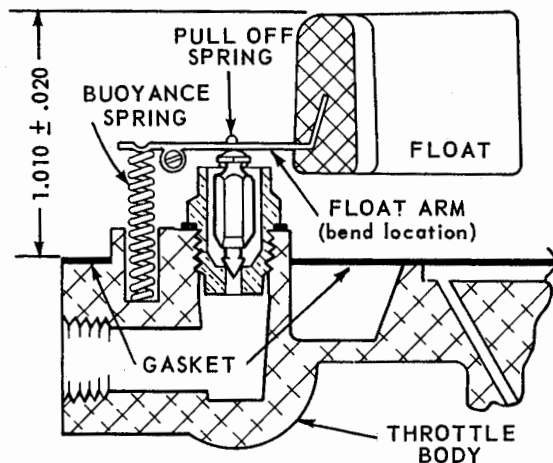


Fig. 2 FLOAT SETTING

ADJUSTMENTS, Fig. 1

Turn Idle speed screw (5), Fig. 3, in until throttle valve is slightly open. With engine warmed up and running, turn adjusting screw in or out as required to obtain desired low idle speed (1000 to 1200 r.p.m.).

The Idle adjusting needle (14) should be seated lightly (clockwise), then backed out $1 \pm 1/8$ turns as a preliminary setting. With engine warmed up and running at about 1200 R.P.M., fine tune idle mixture for smooth steady running.

The Main Metering Jet (4), for high speed operation is fixed (not adjustable), as standard equipment, and used in the majority of engine applications. However, an Adjustable Jet carburetor is available, and the High Speed Adjustment is made by means of the Needle Assembly, Item 22A of Fig. 3, in the following manner:

1. As a preliminary setting, turn needle out from its seat about 1 to $1/4$ turns open.
2. With engine warmed up and running at idle speed, crack throttle open suddenly.
3. If engine hesitates before speeding up, open Main Jet Needle $1/8$ to $1/4$ turn. Repeat until engine goes from idle to high speed without hesitation.

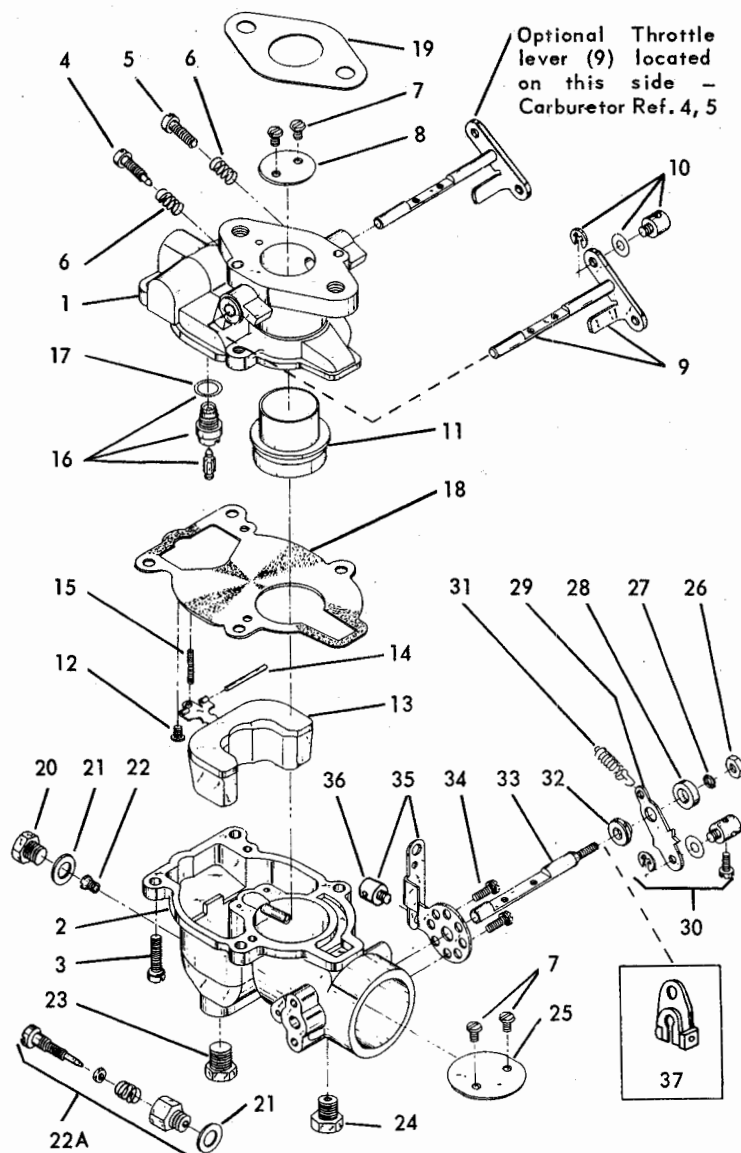


Fig. 3 EXPLODED VIEW
Instructions and Service Parts Illustration

SERVICE PARTS LIST

WALBRO Series LUB Carburetors

Wisconsin
L 108, L 111
Series

CARB. REF. NO.	For Engine Model VH4D WALBRO ASSEMBLY NO.	WISCONSIN PART NO.
1	LUB-1	L 108
2	LUB-7	L 108-1
3	LUB-8	L 108-2, L 108-3
4	LUB-9	L 108 A
5	LUB-10	L 108 B

CARB. REF. NO.	For Engine Model TJD WALBRO ASSEMBLY NO.	WISCONSIN PART NO.
15	LUB-11	L 111
16	LUB-15	L 111-1
17	LUB-16	L 111-2
18	LUB-17	L 111-3, L 111-4

NOTE: Parts are identical for all carburetors, except those identified by carburetor Ref. No.

Item No.	Part Number	Description	No. Req.	Item No.	Part Number	Description	No. Req.
1		THROTTLE BODY - Not serviced separately		22	83-114-0520	MAIN JET (.052), for 15, 16, 17, 18	1
2	83-20-566	FUEL BOWL assembly, for 1, 2, 3, 4, 5	1		83-114-0560	MAIN JET (.056), for 1, 2, 3, 4, 5	1
	83-20-573	FUEL BOWL assembly, for 15, 16, 17, 18	1	22A		NEEDLE assembly, main jet adjustment	
3	83-96-570	SCREW-WASHER, fuel bowl #10-32 x 3/4" Philips head with L.W.	4	23	83-88-109	PLUG, bowl drain, 1/8-27 pipe	1
4	†	NEEDLE, idle adjusting	1	24	83-125-515	DRIP PLUG assembly, for all except 17	1
5	83-96-262	SCREW, idle speed adjustment #10-32 x 3/4" Fillister head.	1	25	83-62-73	VALVE, choke	1
6	83-98-14	SPRING, idle and throttle stop	2	26	83-134-51	NUT, choke shaft, #6-32 Hex. For all except 3, 18.	1
7	83-96-185	SCREW-WASHER, choke and throttle valves, #6-40 x 1/4" Pan Head.	4	27	83-136-162	LOCKWASHER, shaft nut, #6 For all except 3, 18.	1
8	83-34-113	VALVE, throttle	1	28	83-108-89	RETAINER, choke lever For all except 3, 18.	1
9	83-30-827	THROTTLE SHAFT assembly for all except 4, 5.	1	29	83-42-520	CHOKE LEVER assembly For all except 3, 4, 18.	1
	83-30-839	THROTTLE SHAFT assembly, for 4, 5	1		83-42-522	CHOKE LEVER assembly, for 4	1
10	83-52-515	SWIVEL assembly, throttle lever	1	30	83-52-501	SWIVEL assembly, choke lever For all except 3, 18.	1
11	83-46-28	VENTURI (50), for 1, 2, 3, 4, 5	1	31	83-98-349	SPRING, choke return For all except 3, 18.	1
	83-46-29	VENTURI (52), for 15, 16, 17, 18	1	32	83-148-68	BUSHING, choke lever retainer For all except 3, 18.	1
12	†	SCREW, float lever pin #6-32 x 3/16" Pan Head.	1	33	83-44-235	CHOKE SHAFT, for all except 3, 18	1
					83-44-246	CHOKE SHAFT, for 3, 18	1
13	83-75-545	FLOAT ASSEMBLY	1	34	83-96-551	SCREW-WASHER, choke bracket #8-32 x 7/16" Pan Hd., for all except 3, 18.	2
14	†	PIN, float assembly	1	35	83-167-518	BRACKET assembly, choke For all except 3, 4, 18.	1
15	†	SPRING, float buoyancy	1		83-167-515	BRACKET assembly, for 4	1
16	†	FUEL VALVE and SEAT ASSEMBLY	1	36	83-52-521	SWIVEL assembly, choke cable support For all except 3, 18.	1
17	*	GASKET, valve seat	1	37	VB-243	LEVER assembly, choke, for 3, 18	
18	*	GASKET, bowl to body	1				
19	*	GASKET, mounting flange	1				
20	83-96-155	SCREW, main jet plug 5/16-24 x 1/2" Hex Head.	1		LQ 55	REPAIR KIT † Parts included in LQ 55 Repair Kit	
21	*	GASKET, main jet plug screw	1			GASKET SET (also included in Repair Kit) * Parts included in Q 47 Gasket Set	

FLYWHEEL ALTERNATOR



with solid state regulation

12 Volt – 10 amp and 25 amp Systems For
WISCONSIN Single, Two and Four Cylinder Engine Models

DESCRIPTION of Change

Beginning with engine serial No. 5188288, a new **two module** flywheel alternator system replaces the previously furnished three module system, that included an isolation diode module, and the two unit system without the isolation diode.

The **isolation diode** module was incorporated into the old system to eliminate battery discharge problems during shut down, cranking and idling.

INTERCHANGEABILITY

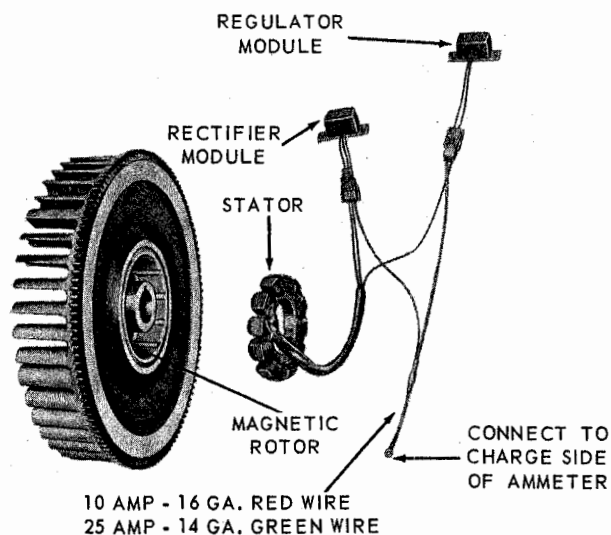
The **Regulator module** was not changed and is completely interchangeable between the new and old systems. The **Rectifier module** and **Stator assembly** have been modified to incorporate the advantages of an isolation diode without adding a third module. These new parts are **not** interchangeable with the old unless both rectifier and stator are replaced simultaneously. The new system has a **three prong** plug connector between the rectifier and stator – the old system has a two prong connector.

DESCRIPTION and OPERATION

This flywheel alternator is of the permanent magnet type and has **no brushes, commutator, belts or adjustments**. A series of coils (stator) is mounted to the engine gear cover, and the magnetic flux is provided by a permanent magnet in the flywheel which rotates around these stationary coils. Only four components make up this light weight space saving system; a **flywheel** with magnetic rotor, **stator**, **rectifier** module and **regulator** module.

The **center-tap** rectifier arrangement prevents damage to the alternator system when arc welding, because the winding acts as a choke and its inductance prevents the transient voltage from damaging the diodes.

Since the physical appearance of both 10 amp and 25 amp alternator systems are very similar, the **25 amp**



319423C-1

unit can be distinguished from the **10 amp unit** by the ammeter calibrations, and by a **14 gage green wire** in place of a **16 gage red wire**, from the ammeter to the stator-regulator connector.

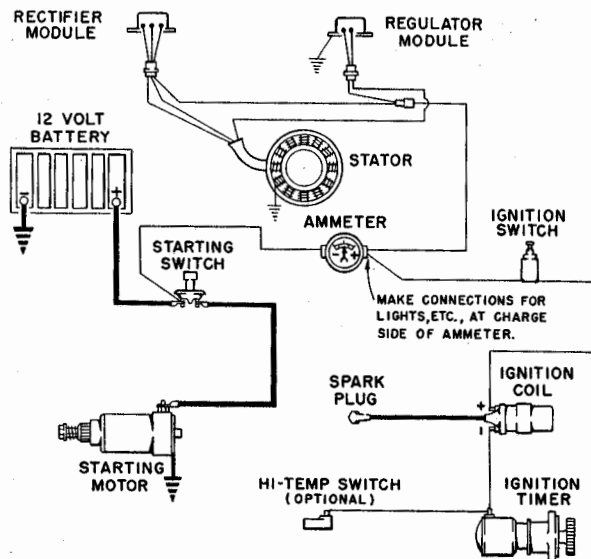
PRECAUTIONS to be exercised in the use of this flywheel alternator:

1. **Do Not** reverse battery connections. This is for a **negative ground** system only.
2. Connect booster batteries properly – positive to positive and negative to negative.
3. **Do Not** polarize the alternator.
4. **Do Not** ground any wires from stator or modules which terminate at connectors.
5. **Do Not** operate engine with battery disconnected from system.
6. Disconnect at least one battery lead if a battery charger is used.

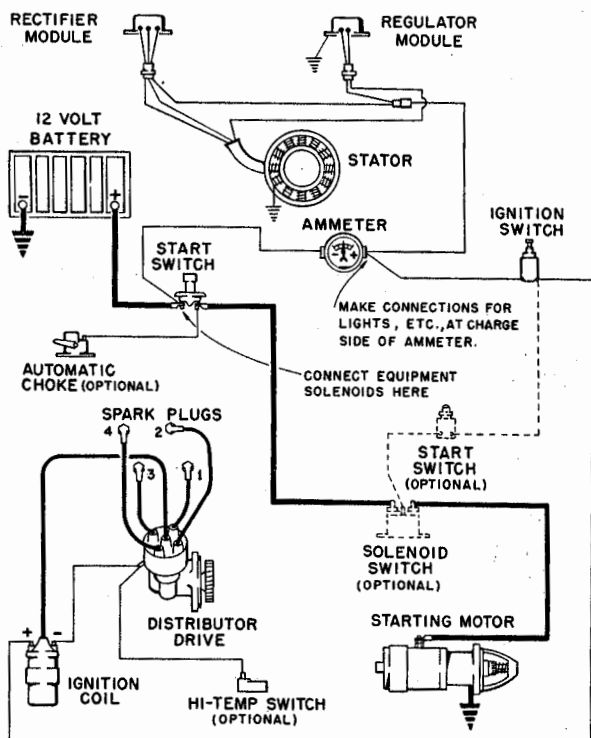
WIRING CIRCUIT

The *fool-proof* type connectors used prevent incorrect wiring from the stator to the rectifier and regulator modules. To disconnect plugs, squeeze outer ends of receptical and pull apart.

The rectifier is insulated from ground, but the stator and regulator module are grounded to the engine thru their mounting surface. The regulator module therefore should not be removed and mounted at some remote location. This is a **negative ground circuit**. Connect ground strap from negative post of battery to starting motor flange, or good clean grounding surface on engine.



WIRING DIAGRAM
For Single Cylinder Models



WIRING DIAGRAM
For Two and Four Cylinder Models

SERVICE PROCEDURE:

Prior to electrical testing, a thorough visual inspection should be made to eliminate conditions that may be interpreted as a defected alternator. Examine leads for broken or loose connections, and make sure modules are securely mounted. The **regulator module** must be mounted to a metal surface for grounding purposes, while the **rectifier module**, although insulated from ground, should be securely mounted for heat dissipation. The mounting surfaces must be clean and free of contaminants, oil, grease, etc. When assured that the problem is with the alternator, follow the tests outlined in 'Trouble Shooting'.

TROUBLE SHOOTING

10 and 25 amp Flywheel Alternator

Problem: Battery Overcharge	Possible Cause & Remedy
Test 1.0 With engine running at full RPM, check battery voltage w/ DC Voltmeter.	
1.1 If voltage is over 15.0	1.1 Regulator not functioning properly. Replace module.
1.2 If voltage is under 15	1.2 Alternator functioning properly. Check battery condition.

Problem: Low/No Charge	Possible Cause & Remedy
Test 1.0 With engine running at full RPM, check battery voltage w/ DC meter. If voltage is greater than 14 volts, place * load on battery to reduce voltage below 14 volts.	
1.1 If the charge rate increases -	1.1 Alternator functioning properly. Battery was fully charged.
1.2 If the charge rate does not increase -	1.2 Proceed with Test 2.0.

* Place as many 12 volt light bulbs across battery as required to reduce voltage below 14 volts.

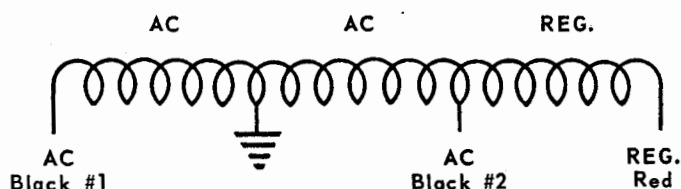
A carbon pile resistor may be used in place of bulbs.

Problem: Low/No Charge	Possible Cause & Remedy
Test 2.0 Conditions and procedure the same as Test 1.0 except the regulator module is disconnected. 2.1 If the charge rate increases — 2.2 If the charge rate does not increase— Test 3.0 Test conditions and procedure the same as 1.0 except with new rectifier module plugged in. 3.1 If the charge rate increases — 3.2 If the charge rate does not increase— Test 4.0 With engine stopped, unplug all connectors between modules and stator. Start engine and run at 2400 RPM. With AC voltmeter check voltage between each of the black stator leads and ground. 4.1 If one of the two voltages is zero or they are over 10% apart —	2.1 Regulator was at fault. Replace regulator module. 2.2 Regulator is not at fault. Continue with Test 3.0. 3.1 Rectifier module at fault. Permanently install new rectifier module. 3.2 Continue with Test 4.0. 4.1 The stator is faulty and should be replaced.

Further testing can be done on the component level with the engine stopped, and the stator and module connections including output lead uncoupled.

TO CHECK STATOR

Use an ohmmeter and check continuity as follows:



NOTE: Wire numbers indicated for probe connections are for convenience only and are not indicated on the connectors.

For 10 amp unit STATOR

METER PROBE CONNECTIONS	METER VALUE	REPLACE STATOR
+	-	
Black #1 to Black #2	APPROX. 2.0 ohms	0 Indicates Short Circuit. ∞ Indicates Open Circuit.
Black #1 to Eng. Gnd.	1.0 ohm	
Black #2 to Eng. Gnd.	1.0 ohm	
Black #1 to Red	3.0 ohms	
Black #2 to Red	1.0 ohm	

For 25 amp unit STATOR

METER PROBE CONNECTIONS	METER VALUE	REPLACE STATOR
+	-	
Black #1 to Black #2	APPROX. 0.40 ohm	∞ Indicates Open Circuit.
Black #1 to Eng. Gnd.	0.20 ohm	
Black #2 to Eng. Gnd.	0.20 ohm	
Black #1 to Red	3.20 ohms	
Black #2 to Red	2.80 ohms	

STATOR IDENTIFICATION:

10 amp — 3/8" wide flange 25 amp — 5/8" wide flange

TO CHECK RECTIFIER MODULE, Part No. YJ-68

The same module is used for both the 10 amp and 25 amp systems. It can be distinguished from the regulator by the three lead wires instead of two and the identification decal. Use an ohmmeter and static check continuity as follows:

METER PROBE CONNECTIONS	METER INDICATION
+	-
White lead to Black #1	No Continuity
Black #1 to White lead	Continuity
White lead to Black #2	No Continuity
Black #2 to White lead	Continuity

Note: Continuity shall be in one direction only. If readings are not as indicated, replace module.

TO CHECK REGULATOR MODULE, Part No. YJ-60

The same Regulator module is used for both the 10 amp and 25 amp systems. Use an Ohmmeter and static check as follows:

METER PROBE CONNECTIONS	METER INDICATION	REPLACE MODULE
+	-	
Red to Eng. Gnd.	No Continuity	Continuity
Eng. Gnd. to Red	↓ Continuity	↓ No Continuity
Red to Black		
Black to Red		
Black to Eng. Gnd.		
Eng. Gnd. to Black		

AMP OUTPUT regulated by engine speed

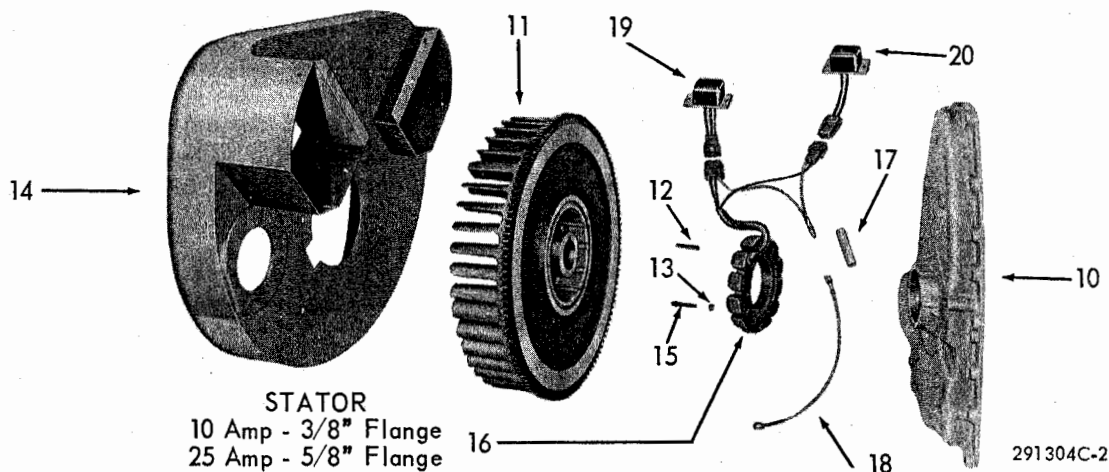
MODEL	MAXIMUM ENGINE SPEED	10 AMP SYSTEM	25 AMP SYSTEM
S-12D, S-14D	3600 RPM	10 amps	25 amps
AENL, TJD	3200 RPM	10 amps	23 amps
AGND	3200 RPM	10 amps	23 amps
VH4D	2400 RPM	8 amps	17 amps
VG4D	2400 RPM	8 amps	17 amps

FLYWHEEL ALTERNATOR

12 VOLT - 10 AMP and 25 AMP Systems

For Engines beginning with Serial Number 5188288

SERVICE PARTS LIST: The following items are in addition to, or replace similar parts found in the parts manual of each specific engine model. The parts illustration is for the VG4D engine, but can be applied to all models.



REF. NO.	DESCRIPTION	NO. REQ.	PART NUMBER PER ENGINE MODEL					
			AENL	AGND	S-10D, S-12D, S-14D	THD, TJD	VF4D, VH4D	VG4D
10	GEAR COVER ASSEMBLY BEARING RETAINER PLATE - flywheel end	1				BD-103J-S1	BD-100K-4-S1	BD-101B-S1
* 11	FLYWHEEL with rotor and ring gear For 10 amp alternator circuit For 25 amp, alternator circuit	1	N-104-5	N-103-5	N-105-2	N-102-5	N-101-6	N-100-5
		1	N-104-9	N-103-9	N-105A-3	N-102-9	N-101-10	N-100-9
12	ROLL PIN - For 10 amp stator For 25 amp stator	2	PA-336	PA-340		PA-368	PA-368	PA-368
		2	PA-362	PA-340		PA-340	PA-340	PA-340
13	LOCKWASHER, No. 10, for stator mt'g.	4	PE-14	PE-14	PE-14	PE-14	PE-14	PE-14
* 14	FLYWHEEL SHROUD	1	SE-154-A	SE-217-H	SE-289-A w/ SE-301B-1 Pl.	SE-135-AT	SE-74-YA	SE-124-AM
15	SCREW - For 10 amp stator mt'g. For 25 amp stator mt'g.	4	XB-114	XB-113	XB-113	XB-113	XB-113	XB-113
		4	XB-110	XB-106	XB-106	XB-106	XB-106	XB-106
16	STATOR ASSEMBLY - For 10 amp circuit For 25 amp circuit	1	YB-81	YB-81	YB-81	YB-81	YB-81	YB-81
		1	YB-82	YB-82	YB-82	YB-82	YB-82	YB-82
17	INSULATOR - ammeter wire connector	1	YD-350	YD-350	YD-350	YD-350	YD-350	YD-350
18	WIRE ASSEMBLY - stator plug to ammeter For 10 amp stator For 25 amp stator	1	YL-381-6	YL-381-6	YL-381-18	YL-381-14	YL-381-18	YL-381-22
		1	YL-380-6	YL-380-6	YL-380-18	YL-380-14	YL-380-18	YL-380-22
19	RECTIFIER MODULE - For 10 and 25 amp	1	YJ-68	YJ-68	YJ-68	YJ-68	YJ-68	YJ-68
20	REGULATOR MODULE - For 10 amp and 25 amp circuit	1	YJ-60	YJ-60	YJ-60	YJ-60	YJ-60	YJ-60

PARTS REQUIRED - NOT ILLUSTRATED

* CRANKCASE	1	AA-91B-10	BA-54-20				
	1	BB-128A-5					
	1	PG-630-1	PG-430				
	1			PH-198B-1			
CASKE I for bearing retainer plate							
NUT, #10-32, for mounting modules	4	PD-115	PD-115	PD-115	PD-115	PD-115	PD-115
LOCKWASHER, #10 I.E.T., for mounting modules	4	PE-78-A	PE-78-A	PE-78-A	PE-78-A	PE-78-A	PE-78-A
SCREW, #10-32, for mounting modules	4	XA-7	XA-7	XA-7	XA-8	XA-8	XA-8

* NOTE: Because of the available variations in Flywheels, Flywheel Shrouds and Crankcases - give Engine Model, Specification and Serial Numbers when ordering.

OPERATION and SERVICE

DESCRIPTION

The Zenith 87-Series is a horizontal carburetor with a concentric fuel bowl. It is a "balanced" carburetor, because all air for fuel chamber and metering well ventilation and idling must come through the air cleaner. Air cleaner restrictions have a minimum influence on the fuel-air ratio when a carburetor is thus "balanced".

The main jet and discharge jet are centrally located. The metering well which completely surrounds the discharge jet is in the center of the fuel bowl assembly. This construction permits extremely high angle operation in any direction.

The venturi, which is part of the throttle body casting, measures the volume of air that passes through the carburetor. In selecting the venturi size, the smallest size that will permit full power development should be used.

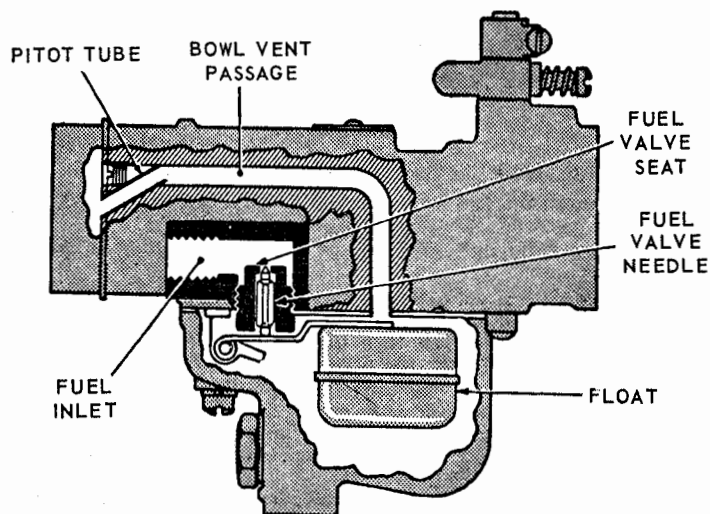


Fig. 1 FUEL SUPPLY SYSTEM

OPERATION**FUEL SUPPLY SYSTEM (Fig. 1)**

Fuel under normal pressure entering the float chamber through the fuel valve seat is controlled by the twin float which, moving on its axle, closes the needle valve when the fuel reaches the proper level in the bowl.

IDLE SYSTEM (Fig. 2)

At idling speeds the throttle plate is almost closed, thus a very high suction exists at the edge of the throttle plate where the idle discharge holes are located. All fuel for idling and part throttle operation is supplied through the

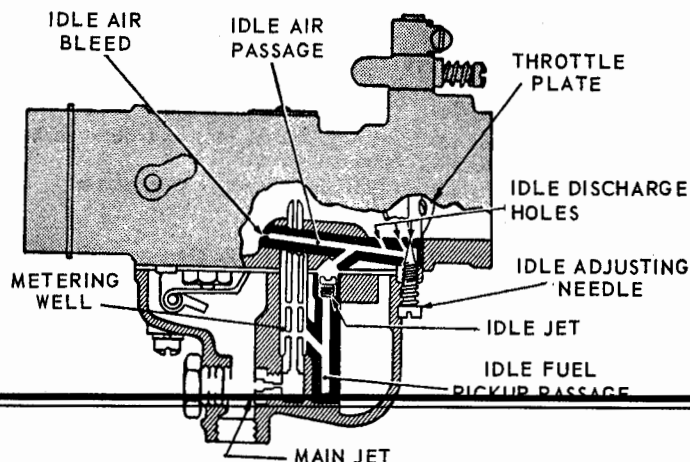


Fig. 2 IDLE SYSTEM

main jet. Fuel from the float chamber flows through the main jet into the metering well. Fuel for idling is drawn from this well through the calibration, or metering orifice, in the center of the idling jet. As the fuel reaches the idling channel it is mixed with air which is admitted through a calibrated orifice in the channel from the inside of the air intake to form an emulsion. This emulsion is discharged into the air stream, to form the idling mixture, through two holes one of which is controlled by the idle adjusting needle. Turning the adjusting needle counter-clockwise (out) permits more of the emulsion to reach the air stream and make the idling mixture richer while turning the needle in (clockwise) cuts off the amount of the emulsion reaching the air stream and makes the mixture leaner.

HIGH SPEED SYSTEM (Fig. 3)

As the throttle is opened, the suction on the idling system diminishes, but the increased volume of air entering the engine through the venturi creates sufficient vacuum (suction) on the discharge jet to draw an emulsion of fuel and air from the metering well which receives its fuel from the main jet and its air from the well vent. The flow characteristics of the discharge jet are influenced by the size, location, and number of holes in the sides of that part of the jet which is in the metering well, as well as by

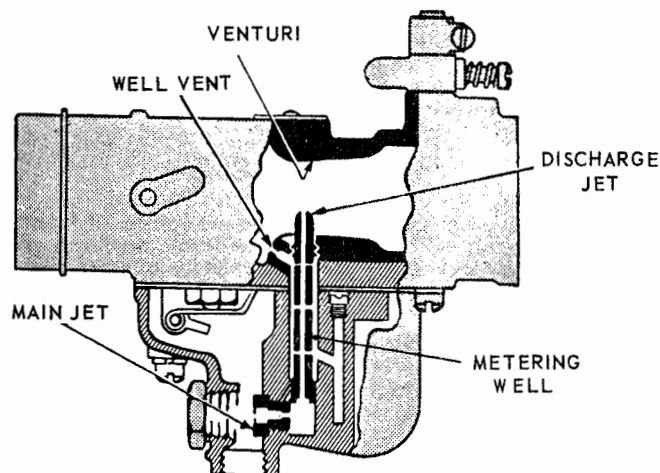


Fig. 3 HIGH SPEED SYSTEM

the sizes of the discharge jet orifice, the size of the main jet, and the size of the well vent. The well vent is located in the air intake and permits air to enter the top of the metering well around the outside of the discharge jet. The flow of fuel through the main jet is controlled by the size of main jet opening.

CHOKE SYSTEM (Fig. 4)

Starting a cold engine requires a much richer mixture of fuel and air. Moving the choke lever to close the choke plate restricts the air entering the carburetor (except at the pitot tube, Fig. 1, to the bowl vent) and increases the suction on the idling system which makes the mixture richer.

STARTING THE ENGINE

Before cranking the engine, the carburetor throttle should be opened a little to expose both idle discharge holes to suction. The choke should be fully closed until the engine starts, then opened a little to prevent stalling from being over-choked, then when the engine is fully warmed up the choke can be returned to wide open position and the throttle closed to the idling position.

ADJUSTMENTS

Adjust the throttle stop screw to obtain the desired idling speed by turning screw in (clockwise) to increase speed and out (counter-clockwise) to decrease engine speed.

Adjust the idle adjusting needle to obtain smooth idling of the engine at idling speed. Turn the needle out (counter-clockwise) to make the mixture richer, and in (clockwise) to make it leaner.

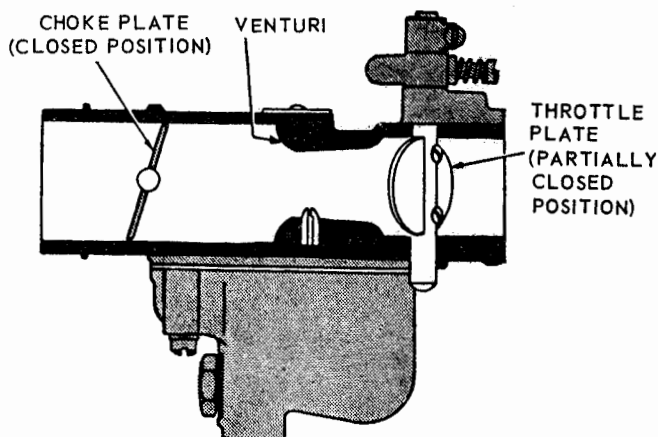


Fig. 4 CHOKE SYSTEM

SERVICE AND REPAIR PROCEDURE

IDENTIFY CARBURETOR

Check the numbers on the metal identification disc pinned to the top of the throttle body or indented in it. The plain number is the Zenith assembly number, the number with the letter "L" pre-fixed to it is Teledyne Wisconsin Motor's part number for the complete assembly.

EXPLODED VIEW (Page 3)

The exploded view identifies the serviceable component parts of the carburetor and shows their relationship to the complete assembly. Use the key numbers on the exploded view to identify and locate parts when performing both the disassembly and assembly operations.

DISASSEMBLY

SEPARATE CARBURETOR BODIES

Remove the three bowl assembly screws (45, 46) and separate fuel bowl (39) from throttle body (26).

DISASSEMBLE FUEL BOWL

1. Remove the main jet plug (43) and fibre washer (42), using a 9/16" open end wrench.
2. Remove the main jet (41) and fibre washer (40), using Zenith Tool No. C161-83 main jet wrench.
3. Remove the Idle Jet (38), using a small screwdriver.
4. Remove the bowl drain plug (44).

DISASSEMBLE THROTTLE BODY

1. Remove the float axle (35) by pressing against the end with the blade of a screwdriver.
2. Remove the float (36).
3. Remove the fuel valve needle (31), using the fingers.
4. Remove the fuel bowl to throttle body gasket (37).
5. Remove the main discharge jet (32), using a small screwdriver.
6. Remove the fuel valve seat (31) and fibre washer (30), using Zenith Tool No. C161-85.
7. Remove the idle adjusting needle (17) and spring (18).

CLEANING

Thoroughly clean all metal parts in Bendix Metalclene or Speedclene and rinse in cleaning solvent. Blow out all passages in throttle body and fuel bowl with reduced air pressure. Be sure all carbon deposits have been removed from throttle bore and idle discharge holes. Reverse the flow of compressed air through all passages to insure the removal of all dirt. NEVER USE A DRILL OR AIR TO CLEAN OUT JETS OR IDLE HOLES.

INSPECTION OF PARTS

1. Float Assembly — Replace if loaded with gasoline, damaged or if float axle bearing is worn excessively. Inspect float lever for wear at point of contact with fuel valve needle. Replace if wear is excessive.
2. Float Axle — Replace if any wear has occurred on the bearing surface.
3. Fuel Valve (Needle & Seat) Assembly — Replace as a complete unit. Wear of any of these parts can seriously affect the operation of the float.
4. Idle Adjusting Needle — Inspect tapered end of the needle to make sure it is smooth and free of grooves. Replace if pitted or grooved.
5. Gaskets, Seal and Retainer — Replace all gaskets, throttle shaft seal and retainer each time the carburetor is overhauled.
6. Check Specifications. Verify the correctness of the following parts. Numbers will be found on the parts. Main Jet, Idling Jet and Fuel Valve.

REASSEMBLY

ASSEMBLY OF THROTTLE BODY

1. Install the fuel valve seat (31) and fibre washer (30), using Zenith Tool No. C161-85.
2. Install the main discharge jet (32), using a small screwdriver.
3. Install fuel valve needle in seat (31), followed by float (36) and float axle (35). NOTE: Insert tapered end of float axle (35) into float bracket on side opposite slot and push through the other side. Press float axle (35) into slotted side until the axle is centered in bracket.

4. FLOAT SETTING

- a. Fuel Level. Check position of float assembly (36), for correct measurement to obtain proper fuel level by using a depth gage. NOTE: Do not bend, twist, or apply pressure on the float body.
 - b. With bowl cover assembly (26) in an inverted position, viewed from free end of float (36), the float body must be centered and at right angles to the machined surface. The float setting is measured from the machined surface (no gasket) of float bowl cover to top side of float body at highest point. This measurement should be 31/32", plus or minus 1/32".
 - c. Bending Float Lever. To increase or decrease distance between float body (36) and machined surface (26) use long nosed pliers and bend lever close to float body. NOTE: Replace with new float if position is off more than 1/16".
5. Install throttle body to fuel bowl assembly gasket (37) on machined surface of throttle body (26).
 6. Install idle adjusting needle (17) and spring (18). Screw needle IN (clockwise) until it seats lightly against the idle discharge hole, then back it out 1 1/2 turns as a preliminary idle adjustment.

REASSEMBLE FUEL BOWL

1. Install the main jet (41) and fibre washer (40), using Zenith Tool No. C161-83 main jet wrench.
2. Install the main jet hex plug (43) and fibre washer (42), using a 9/16" open end wrench.
3. Install the idle jet (38), using a small screwdriver.
4. Install the bowl drain plug (44).

REASSEMBLE CARBURETOR BODIES

Install the three bowl assembly screws (45, 46) through the fuel bowl and into the throttle body and draw down firmly and evenly.

SPECIAL TOOLS

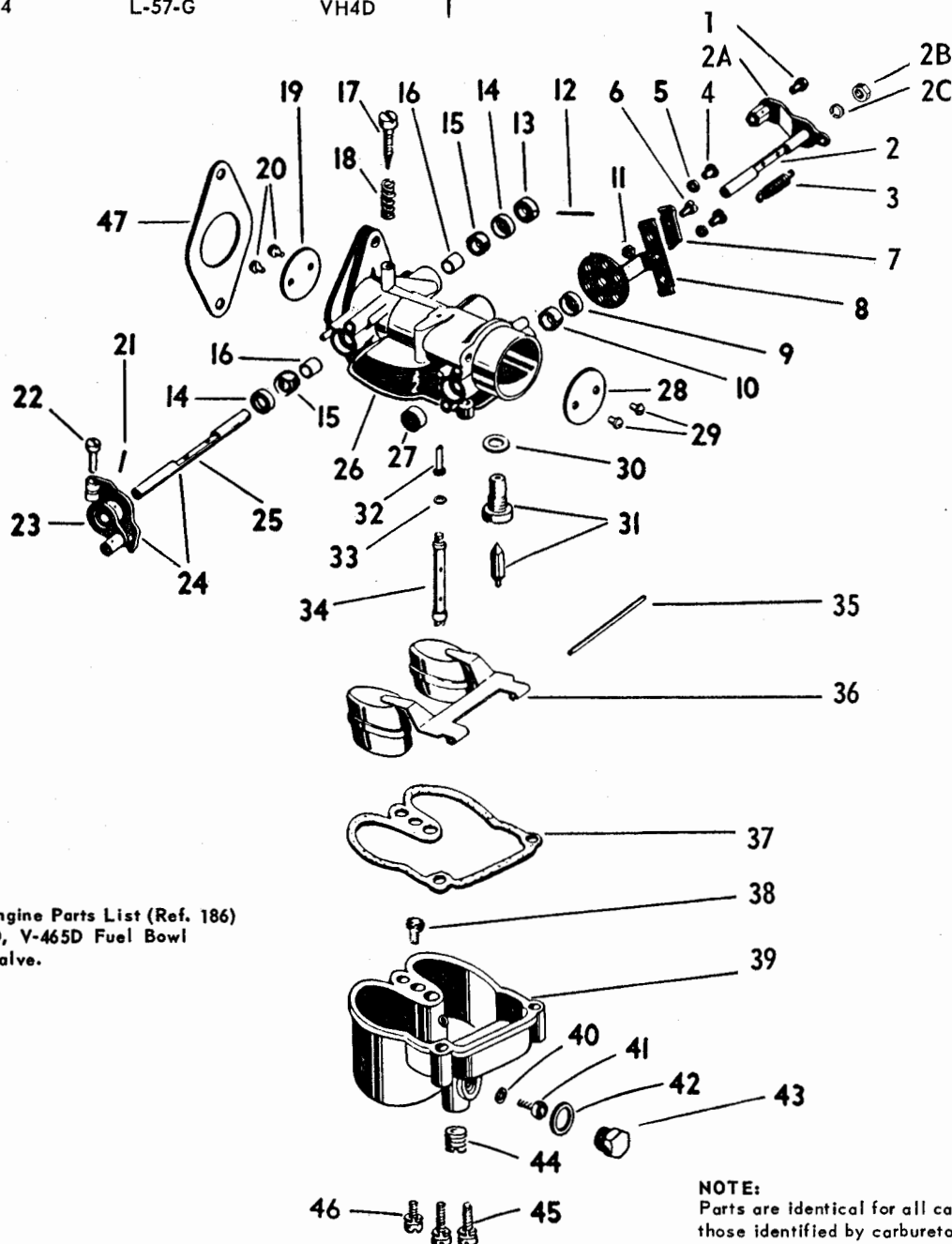
The special tools recommended are:

1. C161-83 Main Jet Wrench.
2. C161-85 Fuel Valve Seat Wrench.

CARBURETOR PARTS LIST

L-57, L-77
Series

CARB. REF. NO.	ZENITH ASSEM. NO.	WISCONSIN PART NO.	WIS. ENGINE MODEL	CARB. REF. NO.	ZENITH ASSEM. NO.	WISCONSIN PART NO.	WIS. ENGINE MODEL
1	11288	L-57	VP4D	14	12708	LZ-77-S1	V-460D
2	11532	L-57-1	VG4D	15	12825	LZ-77B-S1	V-461D, V-465D
3	12347	L-57-B	VG4D			LZ-77C-S1	V-465D
4	13401	L-57-E	VG4D			(w/Auto-Choke)	V-461D
5	13714	L-57-G	VH4D				



Refer to Engine Parts List (Ref. 186)
for V-461D, V-465D Fuel Bowl
Solenoid Valve.

NOTE:
Parts are identical for all carburetors, except
those identified by carburetor Ref. No.

Item No.	Part Number	Description	No. Req.	Item No.	Part Number	Description	No. Req.
1	93-T858-7	SCREW, Lever Swivel for 1, 2, 3, 4, 5, 14	1	4	93-C140-58	SCREW, Bracket for 1, 2, 3, 4, 5, 14	2
2	93-C105-3	SHAFT - CHOKE for 1, 2, 3, 4, 5, 14	1	5	93-T41-8	LOCKWASHER, Bracket for 1, 2, 3, 4, 5, 14	2
	93-C105-302	SHAFT - CHOKE for 15	1	6	93-T858-8	SCREW - TUBE CLAMP for 1, 2, 3, 4, 5, 14	1
2A	93-C106-2	LEVER - CHOKE for 1, 2, 3, 4, 5, 14	1	7	93-C110-7	CLAMP - BRACKET for 1, 2, 3, 4, 5, 14 ..	1
	93-C106-13AE	LEVER ASSY. - CHOKE CLAMP for 15	1	8	93-C109-60	BRACKET - CHOKE for 1, 2, 3, 4, 5, 14 ..	1
2B	93-T2258	NUT, CHOKE LEVER for 1, 2, 3, 4, 5, 14	1	9	93-C131-4x2	RETAINER - CHOKE SHAFT PACKING .. For 1, 2, 3, 14, 15.	1
2C	93-T-41-10	LOCKWASHER, Choke Lever Nut	1	10	93-T57-4	WASHER - CHOKE SHAFT PACKING	1
3	93-C112-12	SPRING - CHOKE LEVER for 1, 2, 3, 4, 14.	1			For 1, 2, 3, 14, 15.	
	93-C112-21	SPRING - CHOKE LEVER for 5	1				

PARTS LIST
L-57, L-77 Series

Model 87A8 ZENITH CARBURETOR

Item No.	Part Number	Description	No. Req.
11	93-T21S8	NUT, Clamp Screw for 1, 2, 3, 4, 5, 14	1
12	93-T63-9	PIN, Washer Retaining for 1, 2, 3, 14, 15 ..	1
13	93-C130-4	WASHER, Shaft Thrust for 1, 2, 3, 14, 15....	1
14	93-T52-57 †	RETAINER, Throttle Shaft Packing	2
		(One required for 4, 5)	
15	93-T48-9 †	SEAL, Throttle Shaft	2
		(One additional for 4, 5)	1
16	93-C9-75	BUSHING, Throttle Shaft	2
17	93-C46-49 †	NEEDLE, Idle Adjusting	1
18	93-C111-155	SPRING, Adjusting Needle	1
19	93-C21-42	PLATE, Throttle	1
20	93-T315S5-4 †	SCREW, Throttle Plate	2
21	N. S. S.	ROLL PIN, Throttle Lever	1
22	93-T8S8-10	SCREW, Lever Stop	1
23	93-CR27-241	LEVER and STOP, Throttle for 1, 2, 4	1
	93-CR27-241-1	LEVER and STOP, Throttle for 14, 15	1
	93-CR27-307	LEVER and STOP, Throttle for 3	1
	93-CR27-451	LEVER and STOP, Throttle for 5	1
24	93-C29-1037 **	SHAFT and LEVER, Throttle for 1, 2	1
	93-C29-1429 **	SHAFT and LEVER, Throttle for 3	1
	93-C29-1386 **	SHAFT and LEVER, Throttle for 14, 15	1
	93-C29-1688 **	SHAFT and LEVER, Throttle for 4	1
	93-C29-1886 **	SHAFT and LEVER, Throttle for 5	1
25	N. S. S.	SHAFT, Throttle	1
Not III.	93-T52-24	WASHER - THROTTLE LEVER SPACER For 14, 15	1
26	N. S. S.	BODY, Throttle	1
27	93-CR37-1x1 †	PLUG, Choke Shaft Hole for 1, 2, 3, 4, 5, 14 (One additional in Throttle Shaft Hole for 4, 5)	1
28	93-C102-113	PLATE, Choke for 1, 2, 3, 4, 5	1
	93-C102-123	PLATE, Choke for 14	1
	93-C102-129	PLATE, Choke for 15	1
29	93-T315S5-4 †	SCREW, Choke Plate	2
30	93-T56-20 † *	FIBER WASHER, Fuel Valve Seat	1
31	93-C81-17-35 †	VALVE and SEAT, Fuel for 1, 2, 3, 14, 15	1
	93-C81-66-35 †	VALVE and SEAT, Fuel for 4, 5	1
32	93-C66-96-40	JET, Discharge for 1	1
	93-C66-104-42	JET, Discharge for 2, 3, 4	1
	93-C66-104-45	JET, Discharge for 14, 15	1
	93-C66-124-40	JET, Discharge for 5	1
33	93-T56-73 † *	FIBER WASHER, Well	1
34	93-C76-50-1	WELL, Metering for 1, 2, 3, 4, 5	1
	93-C76-55	WELL, Metering for 14, 15	1
35	93-C120-18 †	AXLE, Float for 1, 2, 3, 14, 15	1
	93-C120-81 †	AXLE, Float for 4, 5	1
36	93-C85-97	FLOAT ASSEMBLY	1
37	93-C142-55 † *	GASKET, Bowl to Body	1
38	93-C52-2-12	JET, Idle	1

Item No.	Part Number	Description	No. Req.
39	93-B3-129A	BOWL, Fuel	1
		93-B3-98A replaced by 93-B3-129A.	
40	93-T56-24 † *	FIBER WASHER, Main Jet	1
41	93-C52-7-29	JET, Main for 5	1
	93-C52-7-34	JET, Main for 1	1
	93-C52-7-38	JET, Main for 2, 3, 4	1
	93-C52-7-42	JET, Main for 14, 15	1
42	93-T56-23 † *	FIBER WASHER, Passage Plug	1
43	93-C138-24	PLUG, Main Passage	1
44	93-T91-3	PLUG, 1/8" Pipe (Bowl Drain)	1
45	93-T301S8-14	SCREW, Bowl to Body (Long)	2
46	93-T301S8-9	SCREW, Bowl to Body (Short)	1
47	QC-12-A †	GASKET, Flange (Zenith C141-4-6)	3
(Not Illust.)	93-C162-71	AUTO. CHOKE ASSEMBLY for 15	1
	93-B190-30A	AUTO. CHOKE ADAPTER ASSEM. for 15 ..	1
	93-C146-25	AUTO. CHOKE ADAPTER GASKET for 15 ..	1
	93-C181-296	GASKET SET	1
	LQ-37	REPAIR KIT for 1, 2, 3, 14, 15	1
	93-K2212	REPAIR KIT for 4, 5	1
† Parts Included in Repair Kit			
* Gasket Set			
** Shaft and Lever assemblies Item 24, Includes Items 12, 13, 21, 22, 23.			
N. S. S. Not Sold Separately			
NOTE: The Idle Air Bleed Bushing and Well Vent Bushing are calibrated parts of the Throttle Body (Item 26) and are not readily removable.			

Order parts from nearest Wisconsin Distributor or Service Center.

IMPORTANT: Always give Model, Specification and Serial Numbers as shown on name plate.

Limited Engine Warranty

TELEDYNE WISCONSIN MOTOR, hereinafter referred to as "Manufacturer," warrants each new Wisconsin engine sold by the Manufacturer to be free from defects in material and workmanship, under normal use and service, for a period of one (1) year (except in the case of an engine used on any recreational type vehicle the period shall be ninety (90) days) after the date of delivery to the original retail purchaser, and Manufacturer will, at its option, replace or repair, at one of the Manufacturer's factories, or at a point designated by the Manufacturer, any part or parts which shall appear to the satisfaction of the Manufacturer upon inspection at such point, to have been defective in material or workmanship. This Warranty does not obligate the Manufacturer to bear any transportation charges in connection with the replacement or repair of defective parts.

This Warranty shall not apply to any engine which shall have been installed or operated in a manner not recommended by the Manufacturer; nor to any engine which shall have been repaired, altered, used in any type of competition, neglected or used in any way which, in the Manufacturer's opinion, adversely affects its performance; nor to any engine in which parts not manufactured or approved by the Manufacturer have been used; nor to any accessories installed on the engine where the accessory manufacturer has its own warranty; nor to normal maintenance services or replacement of normal service items.

Manufacturer reserves the right to modify, alter, and improve any engine or parts without incurring any obligation to replace any engine or parts previously sold with such modified, altered, or improved engine or part.

THIS WARRANTY, AND THE MANUFACTURER'S OBLIGATION HEREUNDER, IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, and all other obligations or liabilities, including special or consequential damages or contingent liabilities arising out of the failure of any engine or part to operate properly. No person is authorized to give any other warranty or to assume any additional obligation on the Manufacturer's behalf unless made in writing and signed by an officer of the Manufacturer.

 TELEDYNE WISCONSIN MOTOR

Dear Customer:

If you would like to receive a free copy of a list of Authorized Teledyne Wisconsin Motor DISTRIBUTORS and SERVICE CENTERS in your area please complete the following;

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