Instruction and Parts Book
of
The RED SEAL
CONTINENTAL ENGINES
and POWER UNITS

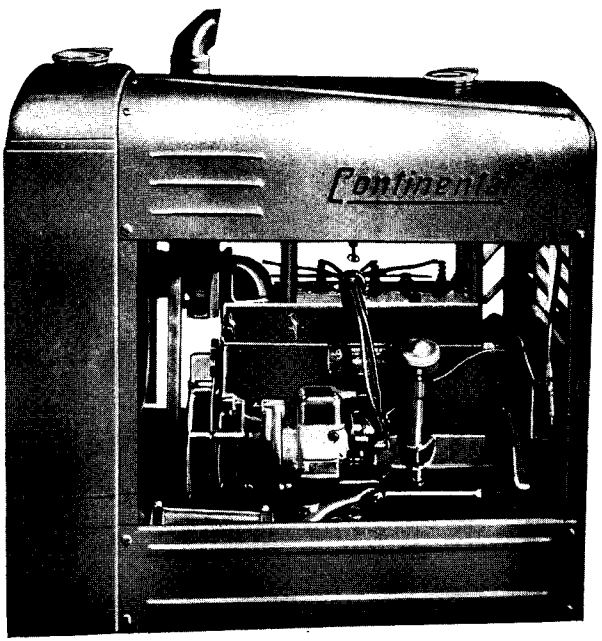
MODELS

Y69 Industrial	Y4069 Automotive	PY69 Power Unit
	Bore 2-1/2″	
	Stroke 3-1/2″	
	Displacement 68.72 cu. in.	
	S.A.E. Rating 10 H.P.	
Y91 Industrial	Y4091 Automotive	PY91 Power Unit
	Bore 2-7/8″	
	Stroke 3-1/2″	
	Displacement 90.89 cu. in.	
	S.A.E. Rating 13.22 H.P.	

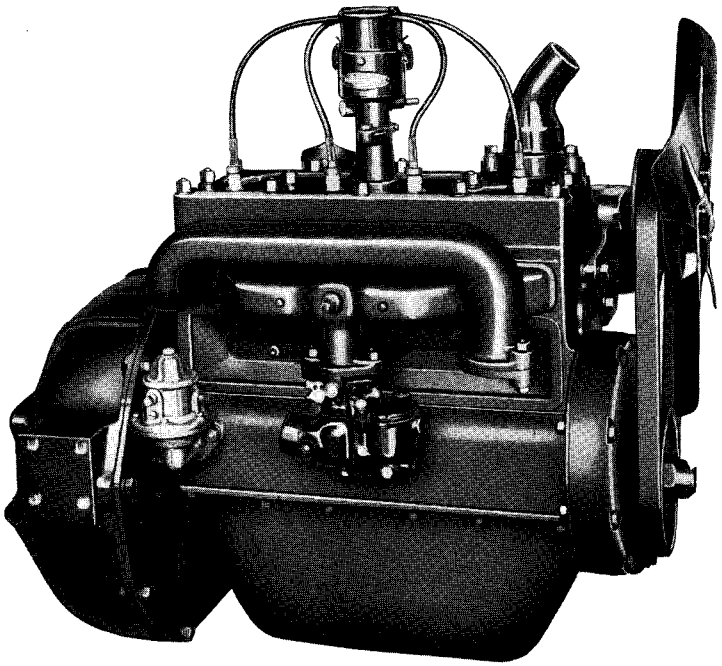
Effective June 1, 1939

CONTINENTAL MOTORS CORPORATION
Offices and Factories: Detroit and Muskegon
Largest Exclusive Motor Manufacturers in the World

GENERAL INDEX



Left Hand View Industrial Engines Y69, Y91
Power Units PY69, PY91



Right Hand View Automotive Engines
Y4069, Y4091

FOREWORD

The CONTINENTAL Engine (now in your care) is provided by the oldest and largest manufacturer of internal combustion engines in the world. All Engines are thoroughly tested before leaving the Continental factory. Notwithstanding this, it requires some attention on your part. To simply fill the gasoline and water tanks and replenish the oil supply is not enough, if you are to obtain the fullest measure of satisfaction from its performance. The amount of attention required is small, but IMPORTANT.

When through wear or accident new parts are required, make certain that only those of GENUINE CONTINENTAL manufacture are used. Unauthorized dealers in spare parts now exist in large numbers but their product in no way measures up to the standard in material and workmanship established by Continental.

This manual is divided into sections which cover the operation and maintenance of any internal combustion engine.

In these you are given all information required to operate your engine successfully. Extensive repairs or rebuilding should be undertaken only by a mechanic fully capable of doing such work.

INSTRUCTIONS

Operating Details

Certain distinct steps must be taken to prepare a Continental Engine for service. By following these closely the operator will obtain best results.

1. Check equipment to see that you have received:
   (Note: Following applies to industrial engines and power units only.)
   1 Radiator Filler Cap ..... (in place)
   1 Gasoline Filler Cap ..... (in place)
   4 Spark Plugs ..... (in place)
   2 Long-handled Tappet Wrenches ..... (in box)
   1 Instruction Book for Carburetor ..... (in box)
   1 Instruction Tag for Governor ..... (in box)
   1 Instruction Book for Magneto ..... (in box)
   1 Service Manual and Parts Book ..... (in box)
   1 Grease Gun (if required) ..... (in box)
2. Inspect bolts holding down the Engine to ascertain that they are firmly set.
3. Open Carburetor Feed Valve by turning handle from right to left (counterclockwise) as far as it will go.
4. Close Water Drain Cock in lower Radiator Connection also on L.H. side of block.
5. Examine Oil Drain to make sure that it is tightly closed.
6. Fill Oil Reservoir through Filler located on left side of Crankcase to "full" level as marked on Bayonet Gauge located on filler side, in center of Block. 3½ quarts will be required. Be sure that the container used for filling is absolutely clean and free from grit.
7. Uncover Gasoline and Radiator Filler Caps.
8. Fill Radiator with clean water. Replace Cap Securely.
9. Fill Gasoline Tank. Be sure that the container used for filling the Tank is absolutely clean and free from dirt. Replace Cap securely. Capacity of Tank is 5¼ gallons.
10. Pull out Throttle Control located on Front Panel under Radiator until Carburetor Throttle is approximately 2/3 closed.
11. Turn Ignition Switch to "on" position.

12. Pull out Choker Button which is located at front of Radiator.
13. Push Starting Crank into engagement and turn the Engine over two or three times. Where Clutch is used same must be disengaged to relieve the operator of unnecessary effort and permit the engine to get up speed before applying load. The engine is provided with a Mechanical Governor set to maintain load and speed specified when engine was ordered. It may be necessary to reset Governor to meet requirements of the individual installations. The details of the Governor and its resetting when necessary are outlined under "Governor Adjustment."

    It will be found that in service the Engine will, or will not require throttling, depending upon whether the speed desired comes below or equals that for which the Governor has been set. Where extended periods occur between the applications of load it is recommended that engine be throttled down to minimum idling speed or, if the intervals are unusually long, that it be shut down entirely.
14. Immediately after starting engine, push Choker Button against Radiator. Should the engine stop after pushing back the choker button it indicates that the engine is not warm enough to operate on normal adjustment. After starting engine as before push choker button part way in. The manipulation of the choker is dependent entirely upon the temperature of the engine. The colder the engine the more choking will be necessary. A warm engine requires little or no choking. NEVER RUN AFTER WARMING PERIOD WITH CHOKER BUTTON PULLED OUT. When starting engine permit it to warm up before applying load. This especially is true during cold weather and where the engine is operating in the open. Another precaution during extremely cold weather is to partially cover the radiator.

Lubricating Oil Recommendations

Engine design, the service it performs and the prevailing atmospheric temperatures in which it operates, are factors which determine the body and character of the lubricating oil required to assure maximum performance with minimum costs for supplies, adjustments, repairs and replacements.

Engines of this series are particularly adapted to, and used in motor vehicles and for industrial purposes. Encompassing as they do, a wide field of operating conditions, the lubricating oil recommendations are established to meet the requirements of the several classifications of service.

Heavy Duty Service

SUMMER

In summer, when atmospheric temperature above freezing (32°F) prevail, and in such installations where the engine is called upon to produce averagely more than half its rated power, it is interpreted as heavy duty operation. For this service use a high quality oil of S.A.E. body Number 30 such as Mobiloil "A."

Normal Duty Service

For summer atmospheric temperatures and where the operation demands on an average less than half the rated power of the engine, it shall be regarded as normal duty service. Where these conditions prevail use a high quality oil of S.A.E. body Number 20 or 30 such as Mobiloil "A."

SPRING AND FALL

The atmospheric temperatures of these seasons are moderate. Where good grade, high viscosity index oils are employed, one grade lighter than those specified may be used, if desired by the operator.

WINTER

Protected Operation

Where the vehicle or unit is housed in a warm building when not in operation, the Spring and Fall recommendations are to apply.

Unprotected Operation

For atmospheric temperatures from 32°F to Zero ° F., and where the vehicle or unit is exposed to a thorough chilling when not in operation, then a high grade, good viscosity index oil of S.A.E. number 20 or 20 W oil such as Mobiloil Arctic should be used. Similarly for temperatures consistently below zero ° F. use a high grade S.A.E. number 10 or 10 W oil such as Mobiloil Arctic Special.

NEW ENGINES

The crankshaft clearances and those between the pistons, piston rings and cylinders are very small in new engines before they have been thoroughly run-in. To assure adequate distribution of oil to these closely fit surfaces during the first week or 50 hours of operation, a lighter bodied oil should be used. For this run-in period we recommend the use of high grade oil of S.A.E. Number 20 W such as Mobiloil Arctic.

RECONDITIONED ENGINES

The expression of Reconditioned Engines is to be interpreted as those engines which have been renewed in the sense of remachining the cylinder bores, installation of new pistons and piston rings, also new crankshaft bearings. As such reconditioning re-establishes the small mechanical clearances similar to that of new engines, therefore, a high grade oil of S.A.E. Number 20 W such as Mobiloil Arctic should be used for the first 50 hours of operation.

Oil Pressure

Normal oil pressures will be between 30 and 40 pounds on oil Gauge. If due to extreme cold operating temperatures the oil pressure tends to go above 50 pounds, oil should be changed to one having lighter body. Also if due to extreme hot operating temperatures the oil pressure tends to drop below 10 pounds, oil should be changed to one having heavier body.

CAUTION: Do not overfill the Crankcase. An excess amount of oil does not improve lubrication. It causes high oil consumption, smoking and carbon deposit. Fill to the proper level, never letting it come below the low mark on Bayonet Gauge.

Draining the Crankcase Oil

A very important factor in reducing wear and maintaining engine efficiency is the frequent and regular draining of the Crankcase oil. Drain the used oil after the first twenty hours of operation, if used for industrial service, and after two hundred miles if used in automotive service. Thereafter drain oil each fifty hours for industrial engines and each five hundred miles for automotive service.

Do Not Wash Out With Kerosene

The reason for this is that some of the kerosene will be trapped and will remain to thin out the new oil, reducing its lubricating properties. The best method is to drain the oil when the engine is thoroughly heated. This will carry off most of the sediment. If, then, a pint of flushing or light oil is poured in through the Filler Pipe, it will flush out the remainder.

Water Pump and Fan Bearing

On some engines of this Series the Water Pump and Fan Bearing is equipped with a Zerk fitting and a Grease Gun supplied with those engines. Lubricate this bearing at the end of each 50-hour operating period.

Water pumps which do not have Zerk fitting are packed with grease at factory and require repacking only when pump is disassembled for repairs. Use high quality sodium soap base grease, such as Mobiloil Number 5.

Governor

Mechanical Type. Automatically lubricated from Engine Reservoir. Requires no attention other than to keep Control Rod clean, applying a few drops of oil to joint daily.

Distributor

Fill oiler or grease cup on the side of Distributor when necessary. With Industrial engines and Power Units using this type of ignition a grease gun is furnished to fill the Zerk Fitting on the side of drive. Lubricates at the end of each 50 hour operating period.

Throttle Shaft

Occasionally lubricate Throttle Shaft on Panel and Throttle Control Rod joints.

Carburetion

NOTE: Carburetor adjustment is predetermined and made at factory. No readjustment is necessary except for extreme deviations from normal operating conditions.

Cooling

If the water is permitted to drain or evaporate down to an insufficient amount, serious over-heating will take place. Moderately soft water is most desirable; if not obtainable we recommend that the system be drained every two weeks and flushed with clear running water. Under extreme conditions it is well to add a pound of soda ash, the addition of this tending to soften the water and delay, if not prevent entirely, the formation of lime and other coatings on the inside of the Water Jacket and Radiator Core.

Never use kerosene for cooling purposes in place of water, as its vapor is highly inflammable, increasing the fire risk to a prohibitive extent.

In cold weather Radiator should be kept partially covered and the following amount of alcohol used at the corresponding temperatures:

Freezing Temperature	Denatured Alcohol Percentage by Volume	Water Percentage by Volume
30° above zero	5%	95%
20° above zero	15%	85%
10° above zero	25%	75%
Zero	30%	70%
10° below zero	35%	65%
20° below zero	40%	60%
35° below zero	50%	50%

Magneto

See separate instruction booklet on Magneto.

Power Take-Off
Industrial Engines and Power Units Only

When Power Take-Off is used it should be lubricated through the Zerk Fitting provided for that purpose following the instructions on the plate attached to the unit.

Where clutch is used follow the direction on manufacturer's plate attached to unit. Where, in isolated cases, this plate is omitted, the following should be observed:

IMPORTANT: If clutch does not pull, heats, or operating lever jumps out, the clutch must be adjusted.

ADJUSTMENT: Remove hand hole plate, turn clutch until adjusting lock pin can be reached. Pull adjusting pin out and turn adjusting yoke to right or clockwise, until operating lever requires a distinct pressure to engage. A new clutch requires several adjustments until friction discs are worn in.

LUBRICATION: Lubricate clutch throw-out collar and ball bearings once a day before starting.

GOVERNOR ADJUSTMENT

INSTRUCTIONS FOR ADJUSTMENT PIERCE GOVERNOR ON CONTINENTAL MOTORS

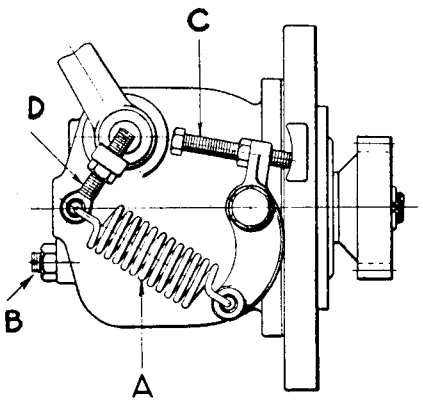
1—With spring tension on Main Governor Spring "A" adjust Rod length so Carburetor Lever clears Wide Open Stop Pin by at least 1/64 inch.

2—Screw Bumper Screw "B" out far enough that it does not function. Adjust Governor for desired speed by turning Adjusting Screw "C."

3—Should Governor surge under load or part load conditions, screw Auxiliary Adjusting Screw "D" out a few turns at a time until surging stops. For close regulation, keep Auxiliary Adjusting Screw in as close as possible, without making Governor surge.

4—Should Governor surge at no load speed, screw Bumper Screw "B" in until surge is eliminated, then set lock nut. Don't run Screw "B" in far enough to increase engine speed.

PIERCE
Industrial Type
GOVERNOR



Diagnosis of Engine Troubles

Continental Engines are exceptionally free from trouble and will continue so if given ordinary care and attention.

Should difficulties be experienced, however, they may be remedied by going over the engine in accordance with the following outline:

Engine Fails to Start

1. No Gasoline in Tank.
2. Carburetor Feed Valve below Tank is closed.
3. Ignition Switch is off.
4. If engine is cold, continued cranking with full use of Choker may flood the Cylinders, preventing a ready start.
5. Water in gasoline freezes up the Line in cold weather.
   (a) Wrap line with cloth or waste soaked in hot water.
   NOTE: DO NOT use an open flame for thawing out this Line.
6. Air leak in Intake Manifold.
   (a) Test for leak with oil or by wrapping a cloth soaked in fuel around the joints. Repair leaks and renew gaskets.

7. Spark Plug Gap improperly adjusted.
   (a) Adjust using Magneto Breaker Gauge or to a space of about .025 inches: approximately the thickness of a worn dime.
8. Poor contact in Magneto Breaker.
   See Magneto Instruction Book.
9. Magneto demagnetized.
   (a) Remove and recharge.
10. Magneto out of time.
    Turn engine in running direction until dead center mark on outside circumference of Flywheel is in line with Pointer. Turn SLOWLY in same direction until a clicking sound from the Magneto is heard. This sound, the tripping of the Impulse Coupling, should occur between ¼" and ¾" late or past the dead center mark on Flywheel.
11. Sediment clogs the Spray Nozzle in Carburetor.
    (a) Remove Carburetor and Clean thoroughly.
    See Carburetor instruction book.

Engine Stops Without Warning

1. Gasoline supply exhausted.
2. Disconnected or broken Ignition Cable.
3. Gasoline Line Clogged. This will be found if engine responds briefly to "priming" tests.
4. Choker is partially closed, causing too rich a mixture.

Engine Misses Fire

1. Improper adjustment of Carburetor.
2. Defective Spark Plugs—a cracked porcelain, too wide a gap between points, or sooted points and porcelains. Replace or clean Plug as required.
3. A broken or disconnected Ignition Cable.
4. Dirt in Carburetor. Remove Carburetor and clean thoroughly.
5. Loss of compression. This is due to worn Piston Rings, Cylinders, or improperly seated Valves.
6. Water in gasoline. This is detected when Engine stops and starts intermittently. Strain gasoline through chamois to remove water.

Precautions

1. Watch oil supply and shut down when pressure drops below 10 pounds at normal operating speed.
2. Keep Engine clean.
3. Do not overload the Engine.
4. Do not tamper with Governor.
5. Do not be continually re-adjusting the Carburetor. (Only necessitated by changes of fuel or seasonal changes in temperature.)
6. Be sure that Air Cleaner is firmly attached to Carburetor.
7. Watch for trouble signs and shut down immediately should they appear.
8. When parts are needed see The Distributor or Authorized Parts Station or order direct from the factory at Muskegon, giving engine model and serial number. Both will be found on the name plate fastened to the crankcase immediately below carburetor.

GENERAL DESCRIPTION AND REPAIR INSTRUCTIONS

The engine is of modern conventional design and does not present any difficulties in servicing. The construction of the engine is of the main frame (cylinder and crankcase cast integral) unit power plant type. This engine incorporates the Continental fuel induction system (individual porting) which represents an outstanding development in design and gives this engine superior smoothness of performance and economy of operation which makes it outstanding from the usual run of engines in this power range. Large full length water jackets surround the cylinders and valves in strict accordance with today's design practice. As proper and uniform cooling is an essential part of efficient engine performance, much care has been exercised in developing the cooling system of this engine.

1. CYLINDER HEAD

The cylinder head is of the conventional cast iron type. When removing the cylinder head a sharp chisel or screw driver should never be used to pry it loose from the cylinder block. The better way is to use an eyebolt in the second or third spark plug hole. Lift up on the eyebolt while tapping lightly around the edges of the head with a lead or rawhide hammer or mallet. Be sure all cylinder head stud nuts have been removed before starting to remove the head. By following the above instructions breakage will be eliminated and the cylinder head gasket will not be ruined. In replacing the head the stud nut at the center of the head should be tightened first and then from this work towards the ends and sides. Spark plug size 18 mm.

2. VALVE TAPPETS

The tappets are of the barrel type and will require little or no servicing. They are designed with a self-locking adjusting screw which feature requires only two wrenches when adjusting for clearance, instead of the usual three necessary when a lock-nut is used. If a tappet face scores from too close adjustment, or if breakage results, servicing consists of replacing such a defective tappet with a new one. The adjusting screw clearance for both intake and exhaust valves on this engine is .014 with the engine cold; the tappet screws should not be set closer than indicated above because should this be done when the engine has become heated and normal expansion takes place the valves will hold open with the result that tappet faces and cam faces become badly scored or cut; the head of the valve becomes warped and in instances actually badly burned. If the tappet face becomes scored there is nothing to do but replace it. If not too badly damaged, marks on the cams of the camshaft can often be smoothed out by honing them with an oil stone.

3. VALVES

Both intake and exhaust valves used in this engine are one-piece forgings. Intakes are chrome nickel steel and exhausts are of XCR steel. Both metals are well known for their qualities of endurance in this kind of service. The angle of the intake valve seat is 30° and that of the exhaust valve is 45°. Servicing of valves will consist, except in those cases where actual replacement is necessary, of grinding them in. The necessity for valve grinding is usually quickly detected by loss of power due to loss of compression when the valve seats and sometimes stems become warped. With this condition the valve does not form a perfect seal entirely all the way around its seat when in its closed position and consequently leakage of compression and loss of power follows.

The regrinding of valves is not a difficult job but each operation must be given careful thought and attention. After the head is removed all of the valve spring retainers should be disassembled from the lower ends of the valve stems. The valve springs need not necessarily be removed but should be lowered to the

top of the tappet screw. All of the valves should be removed and their heads and stems as well as block parts thoroughly cleaned of all carbon, and the holes in the guides cleaned out and oiled after which grinding is to be done. On final assembly it is important that each valve be put back in the same position from which it was taken. In grinding, a small tapered coil spring should be placed over the end of the stem of the valve to be ground, after applying grinding compound sparingly to the valve seat and the valve thus assembled in the guide. The spring should just raise the valve from its closed position. A rubber suction driver or hand grinder may be used in the absence of an electric grinder to oscillate the valve on the block seat. After a reasonable period of grinding, the valve should be removed and both valve and block seats thoroughly cleaned of compound with gasoline. Blueing should then be applied to either valve or block seat and the parts blued in to determine what degree of perfect seating has been attained by disclosing any low spots. These operations are to be repeated until there are no more spots. Caution is suggested against removing more metal than is necessary to provide a good seat. Pencil marks may be used on valve face in absence of blueing.

4. VALVE TIMING

Proper setting of the valves with relation to the crankshaft (valve timing) is one of the most important phases of successful motor operation. In this, as in any other engine the recommended timing of valves is the result of exhaustive tests. For this reason the mechanic should never attempt to alter the original factory setting. The practical method of setting the camshaft is by flywheel markings and tappet clearances. On the rim of the flywheel there are certain stamped markings which can be seen through the flywheel housing inspection hole as the wheel is rotated. These markings are "Ex.C." indicating exhaust closing and "IGN" indicating ignition and "D.C." indicating top dead center of No. 1 or No. 4 pistons. The mark D.C. when under the inspection hole pointer indicates that No. 1 or No. 4 piston is at top dead center and is about to descend on the intake stroke. When the markings Ex. C are just beneath the flywheel pointer the exhaust valve should just have closed. This should be the case when the tappet adjusting screw is adjusted to .014. Because of manufacturing tolerances "building up" in one direction in the case of gear driven front ends it may be that the cam and idler gears will not mesh together exactly when the Ex. C. mark on the flywheel is under the pointer and the camshaft is actually in the exhaust closing position. In other words, a tooth on the gear will not be exactly opposite a space in the other. The mechanic should always bear in mind that the cam gear will turn slightly to the right or to the left as the case may require, due to angular pitch of the teeth in the case of helical gears. This turning may be just enough so that when fully in mesh the camshaft will be exactly in the correct position for proper timing. In case this spiral wind does not compensate for manufacturing tolerances advance the cam gear the fractional tooth width necessary for correct meshing. Under no circumstances should the camshaft be retarded in order to effect proper meshing. The timing of the top center events of the camshaft used in this engine is: exhaust closing on dead center and inlet opening on dead center.

5. CONNECTING ROD BEARINGS—Their Adjustment and Replacement

The lower end connecting rod bearings are thin shell, steel backed, cadmium nickel lined. They are securely locked in place and are readily interchangeable. Phosphor bronze bushings are employed in the upper end of the connecting rod for the piston pin. The connecting rod bearing diameter at crank end is 1½". The piston pin bearing diameter is 45/64". The length of the rod from center to center of bearings is 5¾". The connecting rod is a drop forging.

Servicing of the rod will consist of bushing replacements. The piston pin bushing is diamond bored in our production. It is not recommended that replacement of this bushing be done in the field. If this bushing needs replacing the

entire rod assembly should be replaced. Incidentally, when rod and piston assemblies are removed from or assembled to this engine they must be taken out or replaced through the top of the block as they will not pass the crankshaft.

The lower end of the connecting rod is fitted with thin shell steel backed cadmium nickel lined bearing shells. Notches machined in blade and cap of the rod act as retainers for matching ears which are stamped into the steel back of the shells. This arrangement locks the shells and prevents their rotating in the rod. The design is such that when assembled to the crankshaft the rod bearing has a clearance of .0015 to .002. When a shell becomes defective for any reason it should be serviced by discarding the old one at once and replacing it with a new one. Under no condition should fitting ever be attempted by scraping or filing of the cap or blade. This would permanently ruin the rod. Since the shells are interchangeable, simple replacement results in a proper fit. Care should be taken not to get foreign matter behind the shells when assembling.

6. MAIN BEARINGS—Their Adjustment and Replacement

The crankshaft bearings are also thin shell, steel back cadmium nickel lined. Notches machined in block and caps act as retainers for matching ears stamped into the steel back of the shells. This arrangement locks the shells and prevents their rotating in the crankcase. The design is such that when the crankshaft is assembled to the case the main bearings have a clearance of .0015 to .002. Servicing of main bearing shells will consist of replacing them. If a shell becomes defective for any reason it should be discarded and replaced with a new one. Under no condition should fitting ever be attempted by scraping or filing of the bearing caps. Such practice would permanently ruin the case. In replacing these bearing shells it is important to make sure that there is no foreign matter between the shell and case boss or bearing cap. Since the shells are interchangeable simple replacement results in proper fit.

7. CRANKSHAFT

The crankshaft in this engine is forged of high carbon steel and is carried on three large main bearings of 1¾" diameter. The front bearing is 1⅜" long; center bearing 1-23/32" long, and the rear bearing 1-25/32" long. It is precisely balanced which contributes materially to the smooth flexible performance of this model. It is well proportioned in relation to engine size which insures rigidity and long dependable service. The crankshaft should seldom, if ever, cause trouble due to its large diameter, special heat treatment and accurate balancing. Unless cut by dirty oil, badly burned bearings or sprung by accident, the shaft will last the lifetime of the engine with but scant attention. End play should be adjusted immediately when it becomes noticeably excessive, not because of damage to the shaft, but because of damage to the front main bearing, the rear face of which is the thrust face on this model. The end thrust of the crankshaft is regulated by a removable thrust collar just to the rear of the crank gear, together with a shim pack to the rear of this collar.

The recommended crankshaft end play for this engine is .003 to .005. When servicing a crankshaft or any parts in connection with the shaft, especially rod and main bearing shells, always make sure that all oil holes in the shaft are open and clean.

8. PISTON RINGS—Their Replacement

The pistons in this engine each carry three rings all above the piston pin. The top ring is a plain compression ring 3/32" thick. The second is a grooved compression ring 3/32" thick. The lower ring is an oil control ring 5/32" thick. A properly fitted piston ring, while not a large part, is probably one of the most important parts in an engine.

Servicing of piston rings will consist obviously of replacing old rings with new ones. Care must be taken to place the correct type of ring in the proper groove. New rings should be fitted to each individual bore, same being carefully filed at the joint so that a gap of .008 to .013 of an inch exists, this gap to be determined by actually applying a feeler to the gap while the ring is in the bore to which it is being fitted. All rings should be true as regards thickness and should be just thick enough to have .0015 to .002 clearance in its groove. This clearance should be established by actually applying a feeler. Should the ring be too thick (which is seldom the case) it can be reduced to fit its groove by lapping on a sheet of (000) emery cloth, this emery cloth having been placed on a surface plate or other perfectly flat surface. While lapping the pressure on the ring should be the same at all points. Whatever method of assembling the rings is used care must be taken to see that the rings are not sprung out of their natural shape and permanently distorted.

9. PISTON PINS

The piston pins in this engine are locked in place by retaining snap rings in the piston bosses at either end of the pin. The pins are case hardened. The standard finished size of the pin is .7084 to .7086 and are available for service in several oversizes. Pins are selected in production to obtain fits as follows: .0003 loose in piston pin bushing and .0003 tight in piston boss. The pins are manufactured with an out of round and taper allowance of only .0002. It is important that when assembling the piston pin that both lock rings are in place in each piston before the rod and piston assembly is put back into the engine.

10. PISTONS

The pistons in this engine are made of fine gray iron and are of the cylindrical rib type. Like all mechanical units being subject to wear, pistons will eventually require replacement. In addition to the standard size they are available in a number of standard oversizes. To properly fit a piston to a bore the use of a set of feeler strips and a clamp type fish scale is recommended. The feelers are strips of steel about ½" wide and 10" long. The thickness will depend on the clearance to which the pistons are to be fitted. In this engine they should be on a .002 feeler ½" wide to a scale pull of 10 - 15 lbs. The application of this test is the insertion of the feeler attached to the scale the full length from the bottom preferably, then insert the piston to a position about half way down the bore. With the piston in this position pull the feeler out slowly and if the fit is correct the scale should register the weight mentioned above. The bore should be tested for roundness by inserting a feeler in several positions around the cylinder walls. Any variation in roundness will be noted by an increased or decreased weight on the scale as the feeler is pulled out. In making this test it is presumed that the piston has been previously miked to learn that it is round. Any pistons not true as to diameter can be corrected by lightly tapping with a rawhide mallet. Extreme care is required for this operation and a very careful examination made afterwards to determine that no cracks have resulted.

The bore should also be checked for taper. Any ridge at top of bore should be removed.

Any bores in unsatisfactory condition should be rehoned before any attempt is made to fit pistons. Even if a bore is in acceptable condition, it is good practice to run a hone up and down its length once or twice to roughen up the walls which will produce a wall condition permitting of more rapid seating of the new rings on a newly installed piston.

11. FRONT END DRIVE

Front end drive is accomplished by means of gears. Gears are of the helical type and have ¾" wide faces. The gear train is all metallic, no composition gears being used. The gears should be fitted metal to metal when replacement is necessary after many seasons of service; generally in an all metallic

train all of the gears in the train must be replaced at one time. Where both gears are to be replaced, new gears of exactly the same size as the replaced parts should be used unless at some previous time changes such as replacement of bushings have been made which would affect gear centers. In the case where a single gear is replaced the new one should be slightly larger to compensate for the slight wear on the teeth of the other gears. Various over and undersize gears will be available in service.

12. CAMSHAFT AND BUSHINGS

The camshaft in this engine is an alloy steel forging. The camshaft is seldom of itself the cause of any trouble. All of the bearings and cam faces are almost glass hard and ground to a mirror-like surface. Such conditions resist natural wear to an unbelievable degree. Bearings of the shaft will outlive other parts of the engine, while the cams, unless cut by too close tappet adjustment, will last equally long. Unless sprung while out of the engine assembly the shaft as a whole will always remain in perfect alignment. All of these statements are based on the qualification that ample lubrication be provided at all times. Should cams become cut or scored provided they are not too badly damaged they can, as mentioned before, be reconditioned by honing. Care must be taken to hold the hone squarely on the cam face and the movement should be in the direction of rotation. If too badly cut on the cams or at the bearings as the result of scratches from dirt in the oil, the camshaft should be serviced by replacement with a new one.

The shaft operates in solid bronze bushings which are assembled to the crankcase. A clearance of .0015 to .002 is provided at assembly. It is not recommended that replacement of any camshaft bushing be attempted in the field because this is an operation requiring align reaming equipment which cannot be carried in a service man's kit. These bearings usually do not require attention except at normal complete engine servicing periods and sometimes not even then, except in cases of accident or complete absence of lubrication.

13. FLYWHEEL

The semi-steel flywheel is attached to the crankshaft flange with six bolts. One of these is offset $\frac{1}{16}$". This is so arranged that with a correspondingly located hole in the shaft flange the flywheel can be assembled in but one position with regard to number 1 and 4 crank pins. Seldom will the flywheel require replacing. About the only precaution to be exercised when replacing an old wheel or installing a new one is to make certain that it is true and securely bolted to the crankshaft flange. When finally secured to the shaft, the flange or rim of the wheel should run within .004" of being true. This condition can best be noted by clamping a dial indicator to the flywheel housing. If not within limits specified the wheel must be removed and any chips or foreign matter on the flange face or recess of the wheel removed. Hand scraping of the recess contact face in the wheel is permissible in cases of uneven or rough machining. The flywheel bolts are provided with lockwashers and the nuts should be set up very tightly against these at final assembly.

14. LUBRICATION

The lubrication system is one of the most important features of the present day engine. Upon its proper functioning depends the successful operation of the engine which means continued operation of the equipment. The oiling system of this engine is full pressure from a helical gear pump driven through spiral gears from the camshaft. Pressure is supplied directly through drilled oil ducts to the main, lower connecting rod and camshaft bearings and to the timing gears. The piston pin is lubricated by oil vapor. A bayonet type oil level indicator is employed on the side of the crankcase and oil pressure relief adjustment is also

provided. With the oil hot the oil pressure of this engine should be 5-10 lbs. at idle and 20-40 lbs. at governed speed. Very little wear takes place in the oil pump during normal engine life and failures are rare. If a pump should require service it is recommended that the entire oil pump assembly be replaced.

15. GASKETS

In replacing gaskets a good general rule to follow is to coat them with graphite grease such as Gredag.

16. CONNECTING RODS

The sides of the crank end of the connecting rods are not protected by babbitt in this engine. These faces are steel and are exposed to the steel crankshaft. In fitting rods it is of vital importance that a side play clearance of .008 to .012 be provided to prevent scoring of the rod side faces. In replacing complete piston and rod assemblies it is important to align them on an aligning fixture available in most any garage.

17. WATER PUMP—Front End Type

This water pump is a front mounted centrifugal ball-bearing, self-sealing type. It incorporates the Schwitzer-Cummins type carbon seal against a stainless steel thrust and should ordinarily give little trouble. The impeller is pressed on the Nitralloy shaft and locked in place with a dog-tooth bronze screw obviating any chance of a loose impeller. The bearings are of the sealed type packed at the factory. The fan hub is locked to the bearing assembly by a nut on the front end of the shaft.

In case one desires to dismantle the pump the following procedure should be followed:

1. Remove the nut holding the fan pulley and pull or press the pulley off. Do not pound on the pulley flange with a hammer as breakage will result.
2. Remove rear cover.
3. To remove impeller, remove ⅛" pipe plug which will be noted in the left top side (viewed from the front) of the pump body, then using the slot in the pump shaft as a guide line up the retaining set screw with this hole and loosen set screw with a long screw driver. Be sure that screw is out enough to be free from the hole in the shaft. The impeller may then be pulled off.
4. If desirous of removing the ball bearings, remove the lock screw noted on the under side of the pump body and press the entire assembly out through the front.
5. The seal will be found assembled in the impeller hub. (Care must be taken in removing this assembly as the carbon seal is fragile and easily broken.) The holes in the brass cup holding the seal in place should be lined up with the slots in the impeller hub. These are provided to prevent dirt from forming behind the seal ears and preventing efficient sealing.
   To reassemble merely reverse the procedure. One point to note on reassembly is to have the dog-tooth screw project far enough to line up the impeller on the shaft. Press impeller flush with end of shaft.
   When reassembling pump pack space between bearings with a good grade of sodium soap type grease such as Mobilgrease No. 5.

STANDARD WARRANTIES, FIELD SERVICE, RETURNS AND EXPENSES ISSUED BY THE INTERNAL COMBUSTION ENGINE INSTITUTE, OCTOBER 20, 1933

CONTINENTAL MOTORS CORPORATION is a MEMBER of THE INTERNAL COMBUSTION ENGINE INSTITUTE and all engines, power units, parts and accessories are sold by us subject to the terms of the "STANDARD WARRANTIES, FIELD SERVICE, RETURNS AND EXPENSES" of said Institute adopted and issued October 20, 1933 and all amendments thereof which may be in effect from time to time hereafter. The following is a copy of the terms of the "Standard Warranties, Field Service, Returns and Expenses" issued October 20, 1933, but it is subject, however, to future amendment without notice. Notwithstanding any different terms or conditions which may be contained in any customer's purchase order received by us, we will be governed by and conform to the terms and provisions of the "Standard Warranties, Field Service, Returns and Expenses" of The Internal Combustion Engine Institute.

1. **Standard Service Warranties**

The term "member of this industry" as used herein means a member of the Internal Combustion Engine Institute.

The term "Buyer," as used herein, means a customer of a member of this Institute.

a) The members of this industry shall guarantee their engines and parts thereof against defective material or workmanship as prescribed in paragraph 1-(b).

b)

Type of Application	Warranty Period
Bus and Truck Equipment	Six months from date of shipment but not to exceed ninety days or 15,000 miles of service.
Rail Cars and Locomotives	Six months from date of shipment but not to exceed ninety days or 15,000 miles of service.
Agricultural Equipment	Six months from date of shipment but not to exceed ninety days of service.
Industrial and Oil Field Equipment	Six months from date of shipment but not to exceed ninety days of service.
Marine Equipment	One year from date of shipment.
Fire Equipment	One year from date of shipment.

c) Parts returned to any member of this industry, transportation charges prepaid, which are found by the member to be defective in material or workmanship, shall at the member's option be repaired, replaced or credited. No claims will be allowed which, in the opinion of the member, result from engines or parts having been subjected to abuse or neglect or where failure has been caused by accident.

d) Warranty on accessories furnished by each member shall be limited to the warranty of the accessory manufacturer.

e) Any warranty is void unless the Buyer or his agents provide proper care and storage of engines and parts from date of shipment to date placed in service.

f) Each member reserves the right to improve his product through changes in design or materials without being obligated to incorporate such changes in engines of prior manufacture.

g) No responsibility for contingent liability through the failure of any engine or engine part will be assumed by a member of this industry.

2. **Field Service**

a) The responsibility of maintaining or arranging for adequate and proper field service facilities shall be with the Buyer, and he shall not request the assistance of any member of this industry except in cases of a complex character.

b) All requests for service in the field shall emanate from the Buyer of the engines. Requests received from a Buyer's dealer or the ultimate user shall, under normal conditions, be referred to the Buyer.

c) If a member renders field service at the request of the Buyer and the fault is found not to be with the engine, the Buyer shall pay the time and expense of the member's field representative.

d) No member shall accept bills for service, labor or other expense that he has not previously approved and authorized.

e) Before consideration can be given to requests for adjustments covering field service and alleged defective material, the Buyer shall furnish the member with the following data:
Owner's name and address.
Engine model.
Serial number.
Information as to the nature of the trouble.
Date actually placed in service.
Accumulated days or miles of service.

3. **The Return of New Material**

a) Any member of this industry may at his option accept the return of any part or parts provided such return has been authorized, and at prices agreed upon, transportation charges prepaid. Such authorized returns shall be subject to the member's inspection and to a handling charge of ten per cent (10%) of the cost of the part or parts returned.

4. **Labor and Other Expenses**

a) No member of this industry shall assume any expense except direct labor in replacing parts or servicing engines within the warranty period, and in no case shall such expense be assumed unless authorized by the member.

The obligation hereinabove provided to repair, replace or credit at the option of CONTINENTAL MOTORS CORPORATION any engines, power units or parts that are found by it to be defective in material or workmanship is in lieu of any and all other warranties expressed or implied by law and all other obligations or liabilities on the part of CONTINENTAL MOTORS CORPORATION to the Buyer or to any other party.

CONTINENTAL MOTORS CORPORATION

Factories: Detroit and Muskegon -:- Offices: Muskegon, Michigan

CALIFORNIA	Charles W. Carter Company Los Angeles, 770 E. Ninth Street
	Charles W. Carter Company San Francisco, 525 — 4th Street
	Charles W. Carter Company Sacramento, 714 — 12th Street
	Charles W. Carter Company Oakland, 1800 E. 12th Street
	Charles W. Carter Company Fresno, 1325 "L" Street
COLORADO	The Bruhn Company Denver, 1023 Broadway
CONNECTICUT	Universal Parts Company Bridgeport, 386 Fairfield Avenue
DISTRICT OF COLUMBIA	Quaker City Motor Parts Company Washington, 2206 14th Street, N. W.
FLORIDA	United Auto Supply Company Pensacola, 215 North Palafox Street
GEORGIA	Genuine Parts Company Atlanta, 289 Ivy Street
ILLINOIS	Warshawsky and Co., Inc. Chicago, 1916 So. State Street
INDIANA	Motor Parts Depot Evansville, 1046 Main Street
	Motor Service & Parts Incorporated South Bend, 317 So. Lafayette Blvd.
IOWA	Standard Motor Parts Company Des Moines, 12th and Mulberry Streets
	Iowa Portable Milling Co. Oelwein, Iowa
KENTUCKY	Wombwell Automotive Parts Company Lexington, 151 E. Short Street (Ten Branches covering Central and Eastern Kentucky)

MAINE	Farrar Brown Company Portland, 494 Forrest Avenue
	Farrar Brown Company Waterville, 18 Silver Street
MARYLAND	Quaker City Motor Parts Company Baltimore, 1213 Maryland Avenue
MASSACHUSETTS	Campbell Motor Parts Company Boston, 1040 Commonwealth Avenue
	City Auto Parts Incorporated Worcester, 11 Church Street
MICHIGAN	Hill Piston Service Company Battle Creek, 83 West Jackson Street
	Continental-DeVaux Parts & Service Detroit, 477 Selden Avenue
	Kennedy Motors Parts Company Flint, 1223 No. Saginaw Street
	I. H. Gingrich & Sons Grand Rapids, Grandville and Cherry Streets
	Hill Piston Service Company Jackson, 622 E. Michigan Avenue
	Friend Motor Company St. Clair Shores, 23141 Dorian Avenue
MINNESOTA	Auto Gear Company Minneapolis, 1505 Hennepin Avenue
MISSOURI	H and H Mach. & Motor Parts Company St. Louis, 4216 W. Easton Avenue
MONTANA	Motor Supply Company Missoula, 121 East Broadway
NEBRASKA	Motor Parts Corporation Omaha, 2574 Harney Street
NEW YORK	Rose Unit Parts Corporation Binghamton, 69 Water Street
	Haulmor Mfg. Company Brooklyn, 479 Baltic Street
	Unit Parts Corporation Buffalo, 1339 Main Street

NEW YORK (Continued)	Selden Parts Company Long Island City, L. I.
	Serval Motor Corporation New York City, 311 West 66th Street
	Unit Parts Rochester Corporation Rochester, 1185 Main Street
	Unit Parts Syracuse Corporation Syracuse, 500 East Water Street
NORTH DAKOTA	The Hedahl Motor Company Bismarck
OHIO	Patterson Parts Company Cincinnati, 118 E. 8th Street
	G. W. Holmes Company Columbus, 198 East Gay Street
	Dayton Auto Parts Company Dayton, 235 South Jefferson Street
	Courtney Machine Company Lima, 111 Elm Street, West
	Motor Rebuilders & Parts Incorporated Toledo, 1008 Jefferson Avenue
OREGON	Moty and VanDyke Klamath Falls
	Roberts Motor Company Portland, 123 N. E. Pacific Street
	W. E. Burns Salem, Ferry and High Streets
PENNSYLVANIA	Bee Incorporated Allentown, 618 Linden Street
	Automotive Supply Company Altoona, 1500 — 12th Street
	Quaker City Motor Parts Company Harrisburg, 4 So. 11th Street
	Automotive Supply Company Johnstown, 111 Adams Avenue
	Continental Motor Service Philadelphia, 1417 Melon Street
	Superior Motors Parts Company Pittsburgh, 5614 Penn Avenue

TENNESSEE	Harts Automotive Parts Company Chattanooga
	Automotive Equipment & Supply Company Knoxville, 810 Tyson Street
TEXAS	Western Battery & Magneto Company El Paso
	Oriental Transmission and Packing Co. Dallas, 2615 Commerce Street
VIRGINIA	Standard Parts Corporation Norfolk, 763 Granby Street
	Standard Parts Corporation Richmond, 1806 W. Broad Street
WASHINGTON	Automotive Parts Service Incorporated Bellingham, 1322 State Street
	A. H. Cox & Co. Seattle, 1757 First Street
	Motor Supply Company Spokane, 1202 West 1st Avenue
WEST VIRGINIA	Genuine Parts Company Wheeling, 907 Market Street
CANADA	United Auto Parts Limited Quebec, 3461 Park Avenue Montreal
	Durant Frontenac Motors, Ltd. Toronto, Ontario, 91-97 Jarvis Street
	National Automotive Parts Company Toronto, Ontario, 865 Bay Street
	Mumford Medland, Ltd. Winnipeg, Manitoba, Wall Street and Portage Avenue

LIST OF ACCESSORY MANUFACTURERS

Carburetors

Zenith Carburetor Co., Detroit, Michigan
Ensign Carburetor Co., Chicago, Illinois.

Clutches

Twin Disc Clutch Co., Racine, Wisconsin

Electric Equipment (including ignition, coil, generators, distributors, starting motors, starting switch, etc.).

Electric Auto Lite Co., Toledo, Ohio
Delco-Remy Corp., Anderson, Indiana

Governors

Pierce Governor Co., Anderson, Indiana

Magnetos

American Bosch Magneto Co., Springfield, Mass.
Wico Electric Co., Springfield, Mass.

WHEN ORDERING PARTS

Each parts order should give the MODEL AND SERIAL NUMBER shown on the Continental Name Plate attached to the Crankcase.

Continental Engines are built in many sizes and styles and it sometimes happens that two models having an equal number of cylinders of the same size are entirely different in construction. For this reason your co-operation in giving us the above data will be of material assistance in filling your orders promptly and correctly.

WHERE TO ORDER PARTS

Genuine Continental Repair Parts will be supplied by the Dealer through whom you purchased the equipment or the Manufacturer thereof.

However, if they cannot be obtained from these sources, they may be ordered direct from the

CONTINENTAL MOTORS CORPORATION
MUSKEGON, MICHIGAN

Parts orders must show model and number of Engine. Also name of the equipment in which it is installed.

Order repair parts for accessories from the manufacturer of the accessory or from his authorized representative.

PLATE NO.	DRAWING NO.	PART NAME	INDUSTRIAL
	Y91M-303	Accessory Drive Shaft	1
2	Y400G-204	Accessory Drive Shaft Bushing	2
	7RK-118	Accessory Drive Shaft Bushing Pin	2
	Y91L-202	Accessory Drive Shaft Oil Seal	1
	D600M-212	Accessory Drive Shaft Shim .002 thick	UAR
	D600M-213	Accessory Drive Shaft Shim .008 thick	UAR
5	Y400I-403	Camshaft	1
	X-2236	Camshaft Bearing Hubbard Plug (Rear)	1
6	F600G-207	Camshaft Bushing (Front)	1
8	D600G-217	Camshaft Bushing (Center)	1
9	F600G-208	Camshaft Bushing (Rear)	1
	7RG-119	Camshaft Bushing Pin	3
10	Y400H-301	Camshaft Gear	1
	X-506	Camshaft Gear Key	1
	PYC-202	Camshaft Nut Lock	1
	X-18156	Camshaft Sprocket Nut	1
	Y400I-203	Camshaft Thrust Plate	1
	X-3182	Camshaft Thrust Plate Screw—$\frac{5}{16}$-18 x $\frac{3}{4}$	2
	X-202	Camshaft Thrust Plate Screw Lockwasher—$\frac{5}{16}$	2
12	Y400D-4001	Conn. Rod Assembly No. 1-3 Includes conn. rod and cap, bearings, pin bushing, bolt and nuts	2
12	Y400D-3001	Conn. Rod Assembly No. 2-4 Includes conn. rod and cap, bearings, pin bushing, bolt and nuts	2
13	Y400G-304	Conn. Rod Bearing No. 1-3	4
13	Y400G-303	Conn. Rod Bearing No. 2-4	4
	Y400D-200	Conn. Rod Bolt	8
	X-18210	Conn. Rod Bolt Nut	8
	X-608	Conn. Rod Bolt Nut Cotter Pin	8
	Y400B-418	Crankcase End Plate (Front)	1
15	Y400B-319	Crankcase End Plate Gasket	1
	Y400B-219	Crankcase End Plate Ring Dowel	1
	6FK-132	Crankcase End Plate Screw—$\frac{5}{16}$-18 x $\frac{7}{8}$	2
	6TB-102	Crankcase End Plate Screw—$\frac{5}{16}$-18 x 1$\frac{1}{8}$	1
	X-3270	Crankcase End Plate Screw—$\frac{3}{8}$-16 x 1	1
	X-202	Crankcase End Plate Screw Lockwasher—$\frac{5}{16}$	3
	X-1375	Crankcase End Plate Screw Plain Washer	1
	X-100	Crankcase Oil Filter Return Hole Pipe-plug—$\frac{1}{8}$	1
	X-101	Crankcase Oil Gauge Hole Pipe-plug—$\frac{1}{8}$	1
	X-116	Crankcase Oil Header Pipe-plug—$\frac{1}{4}$	2
16	Y400C-506	Crankshaft	1
17	Y400G-2121	Crankshaft Bearing (Front Up & Lo)	1
18	Y400G-2151	Crankshaft Bearing (Center Up & Lo)	1
19	Y400G-2161	Crankshaft Bearing (Rear Upper)	1
20	Y400B-318	Crankshaft Bearing Cap (Front)	1
21	Y400B-316	Crankshaft Bearing Cap (Center)	1
23	Y400B-317	Crankshaft Bearing Cap (Rear)	1
	X-3544A	Crankshaft Bearing Cap Screw (Center)—$\frac{1}{2}$-13 x 2	1
	X-3544	Crankshaft Bearing Cap Screw—$\frac{1}{2}$-13 x 2$\frac{3}{8}$	5
	3X-6AB-112	Crankshaft Bearing Cap Screw Washer	6
25	D600B-323	Crankshaft Bearing Filler Block (Front)	1
30	D600B-406	Crankshaft Bearing Filler Block (Rear)	1

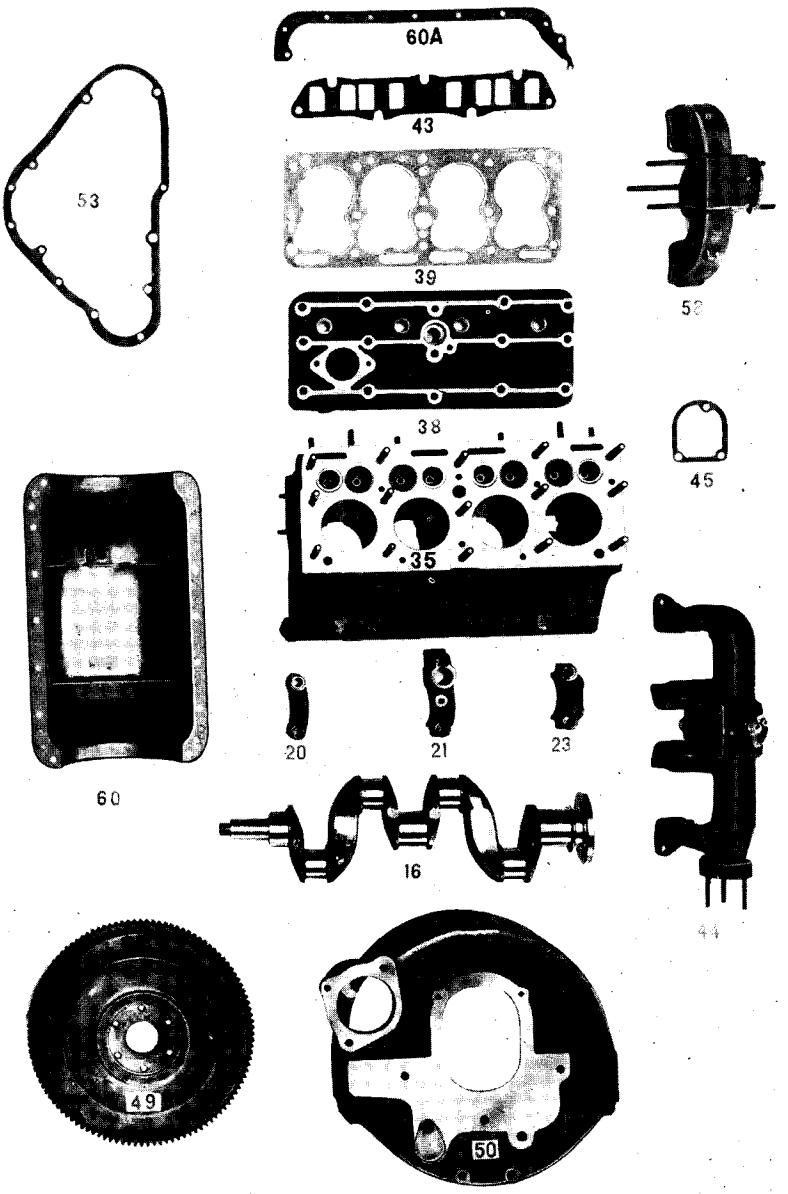

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PLATE NO.	DRAWING NO.	PART NAME	INDUSTRIAL
31	D600B-217	Crankshaft Bearing Filler Block Cork (Rear)	2
24	D600B-214	Crankshaft Bearing Filler Block Gasket	2
	X-3164	Crankshaft Bearing Filler Block Screw (Front)—$\frac{5}{16}$-18 x $\frac{7}{8}$	2
	6RB-105	Crankshaft Bearing Filler Block Screw (Rear)—$\frac{5}{16}$-18 x 2$\frac{5}{8}$	2
	X-202	Crankshaft Bearing Filler Block Screw Lockwasher—$\frac{5}{16}$ (Rear)	2
	X-202	Crankshaft Bearing Filler Block Screw Lockwasher (Front)—$\frac{5}{16}$	2
	D600B-305	Crankshaft Bearing Oil Guard (Rear)	1
26	Y400H-205	Crankshaft Gear	1
	X-511	Crankshaft Gear Key	1
	21RM-201	Crankshaft Oil Seal	1
28	Y400C-212	Crankshaft Oil Thrower	1
33	10EO-201	Crankshaft Starting Jaw	1
	X-1377A	Crankshaft Starting Jaw Washer	1
	C400C-213	Crankshaft Thrust Plate	1
	9LC-208	Crankshaft Thrust Shim .002 thick	4
	9LC-218	Crankshaft Thrust Shim .008 thick	3
35	Y69A-4001A	Cylinder & Crankcase Assembly (Y69)	1
35	Y400A-6111A	Cylinder & Crankcase Assembly (Y91) "A" Includes cylinder, valve stem guide, bushings, bearings, brg. caps, oil guard, idler gear studs, screws, studs and nuts	1
35	Y69A-4001C	Cylinder & Crankcase Assembly (Y69)	1
35	Y400A-6111C	Cylinder & Crankcase Assembly (Y91) "C" Includes all of the "A" Assembly parts above plus complete piston and piston rings	1
35	Y69A-4001-I	Cylinder & Crankcase Assembly (Y69)	1
35	Y400A-6111-I	Cylinder & Crankcase Assembly (Y91) "I" Includes all of the "C" Assembly parts above plus complete valve mechanism	1
	X-2207	Cylinder Core Hole Plug	3
	Y69A-2001	Cylinder Head Assembly (Y69)	1
	Y400A-5031	Cylinder Head Assembly (Y91) Includes cylinder head, studs and pipe-plug	1
38	Y69A-200	Cylinder Head (Y69)	1
38	Y400A-503	Cylinder Head (Y91)	1
39	Y400A-412	Cylinder Head Gasket	1
	X-101B	Cylinder Head Pipe-plug—$\frac{1}{2}$	1
	X-19046	Cylinder Head Stud—$\frac{3}{8}$-24 x 3$\frac{1}{2}$	15
	3XX-18231	Cylinder Head Stud Nut—$\frac{3}{8}$-24	15
	UB-110	Cylinder Head Stud Nut Washer	15
40	Y91K-306	Cylinder Water Inlet Elbow	1
	X-1005	Cylinder Water Inlet Elbow Drain Cock	1
	Y400K-212	Cylinder Water Inlet Elbow Gasket	1
	X-4266	Cylinder Water Inlet Elbow Stud—$\frac{3}{8}$-16 x 2$\frac{1}{8}$	1
	X-19019	Cylinder Water Inlet Elbow Stud—$\frac{3}{8}$-16 x 3$\frac{15}{16}$	1
	X-1802G	Cylinder Water Inlet Elbow Stud Nut—$\frac{3}{8}$-16	2
	X-203	Cylinder Water Inlet Elbow Stud Nut Lockwasher—$\frac{3}{8}$	2
	F600K-335	Cylinder Water Outlet Elbow	1
	C400K-215	Cylinder Water Outlet Elbow Gasket	1
	X-1955	Cylinder Water Outlet Elbow Stud—$\frac{5}{16}$-18 x 1$\frac{5}{8}$	2
	X-1801E	Cylinder Water Outlet Elbow Stud Nut—$\frac{5}{16}$-18	2

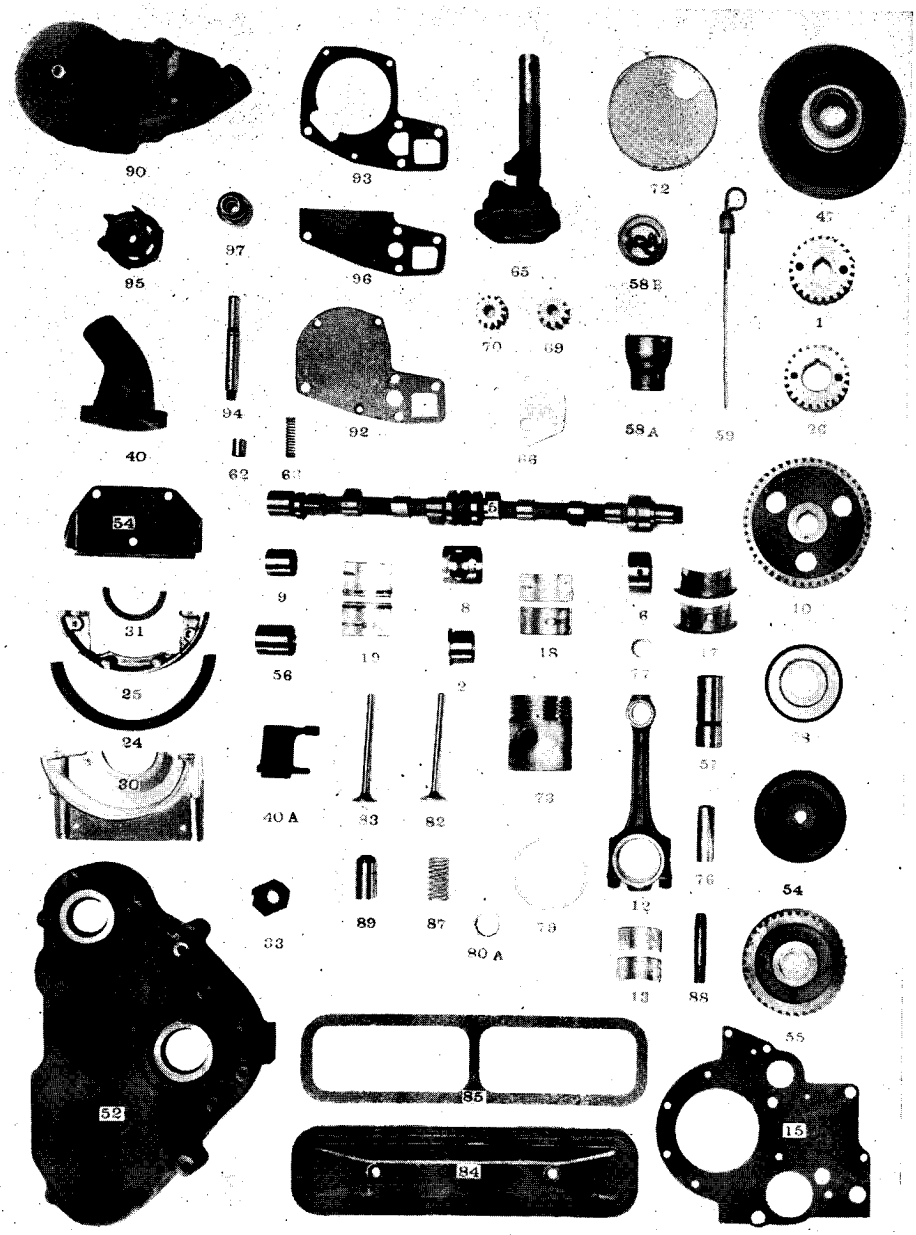
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PLATE NO.	DRAWING NO.	PART NAME	INDUSTRIAL
	X-202	Cylinder Water Outlet Elbow Stud Nut Lockwasher—$\frac{5}{16}$	2
40A	C400M-230	Distributor Adapter	1
	6AB-107	Distributor Adapter Plugging Screw—$\frac{3}{8}$-16 x $\frac{5}{8}$	1
	X-211A	Distributor Adapter Plugging Screw Gasket	1
	C143M-202	Distributor Drive Hole	1
44	Y400E-5044	Exhaust & Intake Manifold Assembly (Y69)	1
44	Y400E-5041	Exhaust & Intake Manifold Assembly (Y91) Includes exhaust, intake, studs and pipe-plugs	1
44	Y400E-504	Exhaust Manifold	1
43	Y400E-302	Exhaust Manifold Gasket	1
	C143E-300	Exhaust Manifold Outlet Elbow	1
	C43E-201	Exhaust Manifold Outlet Elbow Gasket	1
	X-1960	Exhaust Manifold Outlet Elbow Stud—$\frac{5}{16}$-18 x 2½	3
	X-18051B	Exhaust Manifold Outlet Elbow Stud Nut—$\frac{5}{16}$-18	3
	B2K-134	Exhaust Manifold Outlet Elbow Stud Nut Washer	3
	X-100	Exhaust Manifold Pipe-plug—⅛	1
	X-4200	Exhaust Manifold Stud—$\frac{3}{8}$-16 x $1\frac{11}{16}$	4
	X-4279	Exhaust Manifold Stud—$\frac{3}{8}$-16 x $2\frac{5}{16}$	3
	6EE-100	Exhaust Manifold Stud Nut—$\frac{3}{8}$-16	7
	UB-110	Exhaust Manifold Stud Nut Washer	7
45	Y400E-203	Exhaust Manifold to Intake Gasket	1
47	Y400K-314	Fan Drive Pulley	1
	Y400K-219	Fan Drive Pulley Dust Seal	1
	C400K-218	Fan Drive Pulley Key	1
	C400K-217	Fan Drive Pulley Keyway Plug	1
	C400C-206	Flywheel Bolt	6
	X-3292	Flywheel Bolt Nut	6
	X-226	Flywheel Bolt Nut Lockwasher	6
50	Y400B-6001	Flywheel Housing Assembly Includes housing, starter hole cover, timing hole cover, flywheel pointer, screws and nuts	1
50	Y400B-600	Flywheel Housing	1
	C400B-226	Flywheel Housing Dowel Screw	2
	X-3362	Flywheel Housing Screw—$\frac{7}{16}$-14 x 1¼	3
	X-204	Flywheel Housing Screw Lockwasher—$\frac{7}{16}$	3
	Y400B-314	Flywheel Housing Starter Hole Cover	1
	6AB-107	Flywheel Housing Starter Hole Cover Screw—$\frac{3}{8}$-16 x $\frac{5}{8}$	3
	X-203	Flywheel Housing Starter Hole Cover Screw Lockwasher	3
	UB-110	Flywheel Housing Starter Hole Cover Screw Plain Washer	3
	8FC-205	Flywheel Housing Timing Hole Cover	1
	6AB-107	Flywheel Housing Timing Hole Cover Screw—$\frac{3}{8}$-16 x $\frac{5}{8}$	1
	X-203	Flywheel Housing Timing Hole Cover Screw Lockwasher—$\frac{3}{8}$	1
	15SC-309	Flywheel Ring Gear	1
	Y400B-220	Fuel Pump Hole Cover	1
	Y400V-200	Fuel Pump Hole Cover Gasket	1

PLATE NO.	DRAWING NO.	PART NAME	INDUSTRIAL
	X-1952	Fuel Pump Hole Cover Stud—$\frac{5}{16}$-18 x 1¼	2
	X-1801E	Fuel Pump Stud Nut—$\frac{5}{16}$-18	2
	X-202	Fuel Pump Stud Nut Lockwasher—$\frac{5}{16}$	2
	7TC-215	Gear Case Ring Dowel	1
	X-3283	Gear Case Screw—⅜-16 x 3⅝	3
	X-1802G	Gear Case Screw Nut—⅜-16	3
	X-203	Gear Case Screw Nut Lockwasher—⅜	3
52	Y400B-5011	Gear Case Cover Assembly Includes cover and oil seal	1
52	Y400B-501	Gear Case Cover	1
	X-3170	Gear Case Cover Screw—$\frac{5}{16}$-18 x 2⅛	4
	X-202	Gear Case Cover Screw Lockwasher	4
53	Y400B-215	Gear Case Gasket	1
	X-3181	Gear Case Screw—$\frac{5}{16}$-18 x 2	1
	X-335	Gear Case Screw Washer	1
	Y91M-203	Generator (Y69, 1-105) (Y91, 1-128)	1
	Y91M-210	Generator (Y69, 105 upward) (Y91, 128 upward)	1
54B	Y91H-300	Generator Bracket	1
	X-3334	Generator Bracket Plugging Screw—⅜-16 x ½	2
	X-203	Generator Bracket Plugging Screw Lockwasher—⅜	2
54	C143M-302	Generator Driven Pulley (Y69, 1-105) (Y91, 1-128)	1
54	D600M-313	Generator Driven Pulley (Y69, 105 upward) (Y91, 128 upward)	1
55	Y400H-3021	Idler Gear Assembly	1
56	Y400G-203	Idler Gear Bushing	1
	E600H-244	Idler Gear Retaining Screw	1
	21RL-200	Idler Gear Shim	2
57	Y400H-207	Idler Gear Stud	1
	X-18001	Idler Gear Stud Nut	1
	Y400H-210	Idler Gear Stud Set Screw	1
	D600H-202	Idler Gear Thrust Washer	1
	21RM-216	Ignition Cable Grommet	1
	Y91M-200	Ignition Cable Grommet Support	1
58	Y400F-314	Intake Manifold (Y69)	1
58	Y400F-500	Intake Manifold (Y91)	1
1	Y400H-206	Magneto Drive Gear	1
	X-599A	Magneto Drive Gear Key	1
	X-18230	Magneto Drive Gear Shaft Nut	1
	Y91M-302	Magneto Drive Support	1
	Y400M-250	Magneto Drive Support Gasket	1
	D600M-208	Magneto Drive Support Gasket	1
	X-3258	Magneto Drive Support Screw—⅜-16 x 1½	1
	X-19006	Magneto Drive Support Stud—⅜-16 x 1¾	1
	X-1802G	Magneto Drive Support Stud Nut—⅜-16	2
	X-203	Magneto Drive Support Stud Nut Lockwasher—⅜	2
	UB-110	Magneto Drive Support Stud Nut Plain Washer	2

PLATE NO.	DRAWING NO.	PART NAME	INDUSTRIAL
58A	20CL-2010	Oil Filler Body Assembly	1
	Y91L-304	Oil Filler Body	1
58B	20CL-2020	Oil Filler Cap Assembly	1
59	Y400L-2490	Oil Gauge Assembly	1
		Includes oil gauge rod, cover and felt	
	10EL-227	Oil Gauge Support	1
60	Y400B-4200	Oil Pan	1
	W4B-109	Oil Pan Drain Plug	1
	W4B-108	Oil Pan Drain Plug Gasket	1
60A	Y400B-320	Oil Pan Gasket	2
	6FK-132	Oil Pan Screw—$\frac{5}{16}$-18 x $\frac{7}{8}$	12
	X-202	Oil Pan Screw Lockwasher—$\frac{5}{16}$	12
	P640-222	Oil Pressure Gauge	1
	Y91L-305	Oil Pressure Gauge Tube	1
	X-12232	Oil Pressure Gauge Tube Compression Nut	2
	X-12233	Oil Pressure Gauge Tube Elbow	1
	15SL-211	Oil Pressure Relief Valve	1
62	41AL-200	Oil Pressure Relief Valve Plug	1
	X-365	Oil Pressure Relief Valve Plug Gasket	1
63	10EL-230	Oil Pressure Relief Valve Spring	1
	W5L-213	Oil Pressure Relief Washer	UAR
	Y400L-4032	Oil Pump Assembly	1
		Includes oil pump body, gears, strainer frame, screen, cover, shaft, idler stud, suction tube, screws and nuts	
65	Y400L-403	Oil Pump Body	1
	C400L-231	Oil Pump Body Gasket	1
	X-19003	Oil Pump Body Stud—$\frac{3}{8}$-16 x 1$\frac{3}{8}$	1
	X-1802G	Oil Pump Body Stud Nut—$\frac{3}{8}$-16	1
	X-203	Oil Pump Body Stud Nut Lockwasher—$\frac{3}{8}$	1
66	17EL-2001	Oil Pump Cover	1
		Includes cover and suction tube	
	17EL-204	Oil Pump Cover Gasket	1
	X-3056	Oil Pump Cover Screw—$\frac{1}{4}$-20 x $\frac{5}{8}$	2
	X-201	Oil Pump Cover Screw Lockwasher—$\frac{1}{4}$	2
69	F600H-205	Oil Pump Drive Gear (Driven)	1
	S4L-105	Oil Pump Drive Gear Pin (Driven)	1
	Y400L-245	Oil Pump Drive Shaft	1
	Y400G-208	Oil Pump Drive Shaft Bushing	1
	D600L-204	Oil Pump Drive Shaft Snap Ring	1
70	C400H-213	Oil Pump Gear (Driven)	1
	Y400H-209	Oil Pump Gear (Driver)	1
	X-584	Oil Pump Gear Key (Driver)	1
	21UL-210	Oil Pump Idler Gear Stud	1
	17EL-300	Oil Pump Strainer Frame	1
	X-3056	Oil Pump Strainer Frame Screw—$\frac{1}{4}$-20 x $\frac{5}{8}$	4
72	7GL-3040	Oil Pump Strainer Screen Assembly	1
		Includes screen and wire	
	C400L-228	Oil Pump Strainer Spacer	1
	10EL-204	Oil Pump Suction Tube	1
73	Y69A-401	Piston (Y69)	4
73	Y400A-401	Piston (Y91)	4
73	Y69A-401SF	Piston (Semi-fin.) (Y69)	4
73	Y400A-401SF	Piston (Semi-fin.) (Y91)	4

PLATE NO.	DRAWING NO.	PART NAME	INDUSTRIAL
	Y69A-4011A	Piston Assembly (Y69)	4
	Y400A-4011A	Piston Assembly (Y91)	4
		Includes piston, pin, retaining ring and complete piston rings	
	Y69A-4011E	Piston Assembly (Y69)	4
	Y400A-4011E	Piston Assembly (Y91)	4
		Includes piston, pin and ret. ring	
	Y69A-4011ESF	Piston Assembly (Semi-fin.) (Y69)	4
	Y400A-4011ESF	Piston Assembly (Semi-fin.) (Y91)	4
		Includes piston (semi-fin.) pin and ret. ring	
76	Y69A-201	Piston Pin (Y69)	4
	Y400A-207	Piston Pin (Y91)	4
77	PYG-203	Piston Pin Bushing	4
	PYA-202	Piston Pin Retaining Ring	8
79	Y69A-300	Piston Ring—Top Groove (Y69)	4
79	Y400A-310	Piston Ring—Top Groove (Y91)	4
79	Y69A-301	Piston Ring—Middle Groove (Y69)	4
79	Y400A-311	Piston Ring—Middle Groove (Y91)	4
79	Y69A-302	Piston Ring—Bottom Groove (Y69)	4
79	Y400A-309	Piston Ring—Bottom Groove (Y91)	4
83	Y400I-210	Valve (Exhaust)	4
82	Y400I-301	Valve (Intake)	4
84	Y400A-3120	Valve Chamber Cover Assembly	1
85	PYA-305	Valve Chamber Cover Gasket	1
	X-4008	Valve Chamber Cover Stud—¼-20 x 2⅛	2
	X-1800C	Valve Chamber Cover Stud Nut—¼-20	2
	X-366	Valve Chamber Cover Stud Nut Washer	2
88	Y400I-209	Valve Stem Guide	8
	Y400I-205	Valve Stem Key	8
87	Y400I-206	Valve Spring	8
	Y400I-204	Valve Spring Seat	8
89	F600I-237	Valve Tappet	8
	T2	Valve Tappet Wrench—$\frac{3}{4}$	1
	T7	Valve Tappet Wrench	
90	Y400K-4051	Water Pump Assembly	1
		Includes body, support, shaft, bushing, impeller, seal, fan hub, screws, studs and nuts	
	X-13073	Water Pump Ball Bearing	2
	F600K-272	Water Pump Ball Bearing Retaining Snap Ring	1
	Y400K-235	Water Pump Ball Bearing Ret. Screw	1
	Y400K-233	Water Pump Ball Bearing Spacer	1
	Y400K-405	Water Pump Body	1
96	Y400K-232	Water Pump Body Gasket	1
	X-940	Water Pump Body Grease Fitting	1
	X-100	Water Pump Body Pipe-plug—⅛	2
	D600G-283	Water Pump Bushing	1
94	Y400K-231	Water Pump Drive Shaft	1
95	Y400K-332	Water Pump Drive Shaft Impeller	1
	X-3054B	Water Pump Drive Shaft Impeller Screw	1
	X-504	Water Pump Drive Shaft Key	1
	X-18053B	Water Pump Drive Shaft Nut—$\frac{7}{16}$-20	1
	X-270	Water Pump Drive Shaft Nut Lockwasher—$\frac{7}{16}$	1
	Y400K-230	Water Pump Fan Hub	1
	Y400K-320	Water Pump Fan Hub Adj. Flange	1
	8UK-205	Water Pump Fan Hub Adj. Flange Nut Lock	1

PLATE NO.	DRAWING NO.	PART NAME	INDUSTRIAL
	JS-108	Water Pump Fan Hub Adj. Flange Screw—¼-20 x ½	2
	X-201	Water Pump Fan Hub Adj. Flange Screw Lockwasher—¼	2
97	Y400K-3330	Water Pump Seal Assembly	1
	F600K-273	Water Pump Snap Ring Retainer	1
	X-4131	Water Pump Stud—$\frac{5}{16}$-18 x 1⅜	1
	Y400K-406	Water Pump Support	1
93	Y400K-222	Water Pump Support Gasket	1
	X-4141	Water Pump Support Stud—$\frac{5}{16}$-18 x 1½	4
	X-19047	Water Pump Support Stud—⅜-24 x 5½	2
	X-1801E	Water Pump Support Stud Nut—$\frac{5}{16}$-18	5
	X-202	Water Pump Support Stud Nut Lockwasher—$\frac{5}{16}$	5

POWER UNIT PARTS

DRAWING NO.	PART NAME	NO. REQUIRED
H9V-213	Air Cleaner	1
Y91A-200	Air Cleaner Breather Tube	1
C143F-201	Air Cleaner Breather Tube Hose	2
H9K-213	Air Cleaner Breather Tube Hose Clamp	4
C143F-220	Air Cleaner Breather Tube Nipple	1
Y91F-305	Air Cleaner Elbow	1
X-2378	Air Cleaner Elbow Hose Clamp	1
X-3123	Air Cleaner Elbow Screw—¼-20 x 5	1
X-12247	Air Cleaner Elbow Street Ell	1
X-1409	Air Cleaner Elbow Wing Nut	1
X-201	Air Cleaner Elbow Wing Nut Lockwasher	1
X-1373	Air Cleaner Elbow Wing Nut Plain Washer	1
Y69F-208	Carburetor (Y69)	1
Y91F-302	Carburetor (Y91)	1
H7K-218	Carburetor Gasket	1
X-12015	Carburetor Gasoline Inlet Elbow	1
F218F-212	Carburetor Idling Control Lever	1
26HS-209	Carburetor Idling Control Lever Rod End Pin	1
Y91F-201	Carburetor Idling Control Lever Swivel	1
X-3033B	Carburetor Idling Control Lever Swivel Screw	1
X-14166	Carburetor Idling Control Lever Swivel Washer	1
W5L-213	Carburetor Idling Control Lever Washer	1
Y91F-303	Carburetor Idling Control Support	1
F218F-213	Carburetor Idling Lever	1
X-3047	Carburetor Idling Lever Clamp Screw—10-32 x ½	1
6FK-132	Carburetor Screw—$\frac{5}{16}$-18 x ⅞	1
X-1801E	Carburetor Screw Nut—$\frac{5}{16}$-18	1
X-202	Carburetor Screw Nut Lockwasher—$\frac{5}{16}$	1
Y91F-200	Carburetor Stud	1
X-1801E	Carburetor Stud Nut—$\frac{5}{16}$-18	1
X-202	Carburetor Stud Nut Lockwasher—$\frac{5}{16}$	1
X-3105	Carburetor Throttle Control Tube Screw—¼-20 x $1\frac{1}{8}$	1
X-201	Carburetor Throttle Control Tube Screw Lockwasher—¼	1
X-1373	Carburetor Throttle Control Tube Screw Plain Washer	1
C143F-309	Choke Control	1
X-18180	Choke Control Nut	1
X-203	Choke Control Nut Lockwasher	1
Y91K-302	Fan	1
Y91K-300	Fan Bracket	1
X-19003	Fan Bracket Stud—⅜-16 x 1⅜	3
X-1802G	Fan Bracket Stud Nut—⅜-16	3
X-203	Fan Bracket Stud Nut Lockwasher—⅜	3
Y91C-3000	Flywheel Assembly Includes flywheel and ring gear	1
PY91-401	Gasoline Tank	1
P423-303	Gasoline Tank Filler Cap	1
P39A-211	Gasoline Tank Liner	2
X-12183	Gasoline Tank Outlet Reducing Bushing	1
W9V-201	Gasoline Tank Shut-off Cock	1
PY91-302	Gasoline Tank Support	2
6FK-132	Gasoline Tank Support Screw—$\frac{5}{16}$-18 x ⅞	4
X-202	Gasoline Tank Support Screw Lockwasher—$\frac{5}{16}$	4

DRAWING NO.	PART NAME	NO. REQUIRED
B2K-134	Gasoline Tank Support Screw Washer	4
PY91-201	Gasoline Tank Support Spacer Nut	4
PY91-3030	Gasoline Tank Tube	1
Y2L-249	Gasoline Tank Tube Clip	1
Y91S-300	Governor	1
Y91S-200	Governor Control Rod	1
X-18137	Governor Control Rod Nut	1
W5L-213	Governor Control Rod Washer	UAR
26HS-211	Governor Control Rod Yoke End	1
26HS-209	Governor Control Rod Yoke End Pin	1
26AB-202	Governor Gasket	1
Y400H-211	Governor Gear	1
W4M-109	Governor Screw—⅜-16 x 2½	2
X-1802G	Governor Screw Nut—⅜-16	2
X-203	Governor Screw Nut Lockwasher—⅜	2
PY91-6001	Hood Top	1
PY91-6002	Hood Top Dash	1
B2B-111	Hood Top Dash Screw—⅜-16 x 1	4
X-1802G	Hood Top Dash Screw Nut—⅜-16	4
X-203	Hood Top Dash Screw Nut Lockwasher—⅜	4
PF218-208	Hood Top Ledge Strip	1
PY91-6004	Hood Top Panel (Front)	1
PY91-6005	Hood Top Panel (Left Side)	1
PY91-6006	Hood Top Panel (Right Side)	1
P423-204	Hood Top Panel Screw—¼-20 x ½	18
PY91-6003	Hood Top Panel Support	2
Y400M-240	Ignition Wire Insulator	1
HW-200-16	Ignition Wire Magneto to Cyl. No. 1—16"	1
HW-200-13	Ignition Wire Magneto to Cyl. No. 2—13"	1
HW-200-14	Ignition Wire Magneto to Cyl. No. 3—14"	1
HW-200-17	Ignition Wire Magneto to Cyl. No. 4—17"	1
LW-202-21	Ignition Wire Magneto to Switch—21"	1
PY91-313	Instrument Panel	1
B2B-111	Instrument Panel Screw—⅜-16 x 1	2
X-1802G	Instrument Panel Screw Nut—⅜-16	2
X-203	Instrument Panel Screw Nut Lockwasher—⅜	2
Y69M-202	Magneto (Y69)	1
Y91M-400	Magneto (Y91)	1
P20-275	Magneto Switch	1
CB-157	Magneto Switch Screw—10-32 x ½	2
X-1896	Magneto Switch Screw Nut	2
X-200	Magneto Switch Screw Nut Lockwasher	2
S4L-272	Magneto Switch Wire Clip	1
B2B-111	Magneto Switch Wire Clip Screw—⅜-16 x 1	1
X-1802G	Magneto Switch Wire Clip Screw Nut—⅜-16	1
X-203	Magneto Switch Wire Clip Screw Nut Lockwasher—⅜	1
PY91-300	Muffler	1
PY91-304	Muffler Brace	1
P423-204	Muffler Brace Screw—¼-20 x ½	2
PY91-219	Muffler Clamp	1
6TB-102	Muffler Clamp Screw—⅝-18 x 1⅛	1
PY91-218	Muffler Insulation	1

DRAWING NO.	PART NAME	NO. REQUIRED
P423-205	Muffler Insulation Strap	2
PC143-313	Muffler Outlet Elbow	1
C143E-203	Muffler Outlet Elbow Lock Screw	1
PY69-4000	Radiator (Y69)	1
PY91-4000	Radiator (Y91)	1
PY91-317	Radiator Brace	2
X-1801E	Radiator Brace Nut—5/16-18	2
X-202	Radiator Brace Nut Lockwasher—5/16	2
P423-303	Radiator Cap	1
P57A-204	Radiator Inlet Hose	1
X-2354	Radiator Inlet Hose Clamp	2
W9K-306	Radiator Liner	2
P57A-204	Radiator Outlet Hose	1
X-2354	Radiator Outlet Hose Clamp	2
W9K-305	Radiator Support Plage	1
X-3458	Radiator Support Screw—1/2-13 x 2 3/8	2
P423-401	Radiator & Starting Crank Support	1
X-3611	Radiator & Starting Crank Support Screw—5/8-11 x 1 7/8	1
X-3368	Radiator & Starting Crank Support Screw—7/16-14 x 1 1/2	2
X-273	Radiator & Starting Crank Support Screw Lockwasher—5/8	1
X-204	Radiator & Starting Crank Support Screw Lockwasher—7/16	2
6FK-128	Radiator & Starting Crank Support Screw Plain Washer—7/16	2
PY91-307	Radiator & Starting Engine Support (Front)	1
X-3468	Radiator & Starting Engine Support Screw—1/2-13 x 1 1/2	2
X-296	Radiator & Starting Engine Support Screw Lockwasher—1/2	2
PY91-308	Starting Crank	1
C143F-310	Throttle Control	1
X-18180	Throttle Control Nut	1
X-203	Throttle Control Nut Lockwasher	1