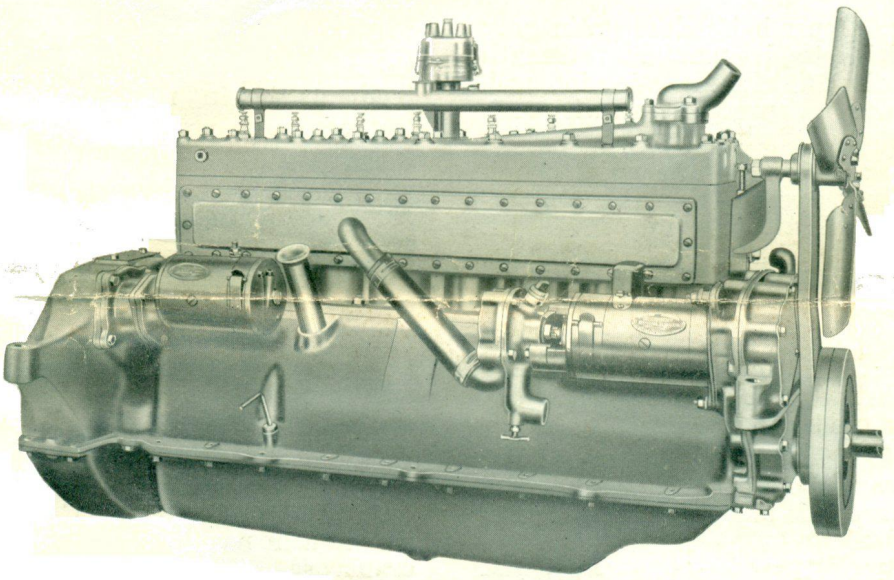
INSTRUCTIONS for the Care and Operation of the

Lycoming Model "HD" "MD" Series 8-in-Line Engine



LYCOMING MANUFACTURING CO.

WILLIAMSPORT, PENNA.

General Description
Lycoming Model "MD" "HD" 8-in-Line

CYLINDERS: Special grade alloyed gray iron cast en bloc; integral water jacket; water circulation around barrels and large water passages around valves. Cylinder block is cast with a large opening on the side of the jacket extending nearly the full length of the block. This design greatly facilitates setting of cores and cleaning, and also insures uniform water passages, and even wall thickness of barrels. All blocks are subjected to a high water pressure to insure against leaks.

CYLINDER HEAD: High turbulence type, permitting the use of high compression without detonation. Close grain gray iron; detachable, permitting easy access to valves and pistons; large water passages around spark plug bosses and over combustion chambers. Attached to cylinder by twenty-seven 7/16" studs.

CRANK CASE: Upper half; close grain gray iron; thoroughly ribbed to give maximum strength and rigidity; upper half flywheel housing integral. Oil reservoir, or lower half, pressed steel with cork gaskets used to insure oil tight union.

PISTONS: Invar-Strut type of special aluminum alloy, permitting closer fitting than is possible with cast iron. Extremely light in weight and hand fitted to each individual barrel. Assembled with two individually cast compression and one double oil regulating ring.

PISTON PINS: Exterior case hardened, drilled hollow to insure maximum toughness, ground and lapped to the highest possible degree of accuracy. Securely clamped in rod by a special locking device.

CONNECTING RODS: Steel—I beam section, drop forged, high carbon double heat treated steel giving maximum strength and toughness together with light weight.

CONNECTING RODS: Aluminum Alloy—Drop forged aluminum alloy, heat treated to give ample strength together with light weight, reducing reciprocating loads to a minimum.

CRANKSHAFT: Drop forged, high carbon double heat treated steel, accurately balanced both statically and dynamically. Bearing surfaces ground and polished. Shaft drilled for oil pressure to connecting rod bearings.

BEARINGS: Connecting rod bearings centrifugally cast into the large end insuring proper refinement of the bearing metal and perfect heat conductivity from the bearing to the rod.

Main bearings are bronze back babbit lined.

All bearings hand fitted to proper clearance.

VALVES: Exhaust valves are of Silcrome, an alloy steel developed especially for exhaust valves. It resists burning and warping, insuring freedom from valve leaks, and rendering frequent regrinding of valves unnecessary.

Intake valves are of special alloy steel particularly adapted for this use. Seats and stems of exhaust and intake valves are given the proper degree of hardness by a special heat treatment to resist wear.

VALVE TAPPETS: Mushroom type; fitted with hardened steel adjusting screws and lock nuts.

CHAIN: Automatic Adjustment—1 1/2 inches wide, silent type driving camshaft, water pump and generator, uniform tension maintained by an eccentric idler which obviates the possibility of chain whip.

CHAIN: Manual Adjustment—1 1/2 inches wide, triangular drive to camshaft and accessory shaft. Adjustment provided for by swinging out the generator. Chain shoe provided in chain case to prevent possibility of a loose chain jumping and throwing the engine out of time.

CAMSHAFT: Drop forged—Carefully inspected for hardness, finish and accuracy in timing.

FLYWHEEL: Semi-steel. Completely machined and perfectly balanced. Provided with teeth for starting motor.

DISTRIBUTOR DRIVE: Driven from camshaft by spiral cut gears. Mounted on top of cylinder head and adapted to any standard make distributor. This mounting is ideal, being best for accessibility and simplicity of wiring.

LUBRICATION: Full pressure system. Self contained in upper half of crankcase permitting removal of oil pan without disturbing any piping. Oil pump submerged at all times preventing any possibility of pump losing prime. Pressure automatically controlled by piston type of oil regulator which is mounted on the left hand side of the crankcase just ahead of the carburetor.

COOLING SYSTEM: Centrifugal water pump mounted in readily accessible position on side of crankcase. The water inlet to the cylinder is taken through a pressed steel plate attached to the side of the cylinder. On the inside of this plate is fastened a water passage so constructed as to evenly distribute the water along the full length of the cylinder. The water is forced between all the cylinder barrels to the valve side insuring uniform cooling of all cylinders and valves. Fan is mounted on an adjustable bracket. Fan drive is by 7/8" "V" Belt.

OIL STRAINER: Vertical cylindrical type. Removable for cleaning through a small cover plate on the bottom of the oil pan.

OIL PUMP: Gear type; mounted on upper half of crankcase extending into oil reservoir. Lower end of pump always immersed in oil and requires no priming. This construction permits oil reservoir to be removed without interfering with any part of lubricating system.

INTAKE MANIFOLD: Designed to give the least possible resistance to gas flow, insuring high volumetric efficiency. Provided with variable heat control reducing the length of warming up period and the prolonged use of the choke, thus removing a principal cause of crankcase dilution.

Instructions for Care and Operation Lycoming Model "MD" "HD" Series 8-in-Line

PISTONS: The pistons are readily removable without removing the cylinder head. Drain off the oil. (It is not necessary to drain the water system unless you intend removing the cylinder head). Remove all cap screws and bolts holding the oil pan on the crankcase. With the hand crank, turn the crankshaft until a connecting rod is pointing straight down. Remove the cotter pins, nuts and take off the cap. With the starting crank, turn the crankshaft until the piston will slide by the crankshaft. Then assemble, at once, the cap and nuts onto the connecting rod.

The fitting of Lycoming gray iron pistons is accomplished with the aid of a hardened steel shim about 10" long, ½" wide and .0025 thick, acting as a go gauge. The shim is placed along side the piston at right angles to the piston pin and the fit should be such as to permit the shim to be pulled freely from its position between the piston and cylinder wall when grasped with the fingers. The fitting should then be checked with another piece of shim stock of the same width but .0035 in thickness which should fit sufficiently tight to prevent pulling out of the shim.

Bohnalite invar strut pistons used in a number of Lycoming eight-cylinder engines are fitted with a shim .0015 in thickness and ¼" wide. The shim is placed directly opposite the strut in the piston skirt and on the same side of the piston as the slot in the skirt and should pull freely when grasped with the fingers. To check the fitting of this type piston a shim of the same width but .0025 in thickness should stick sufficiently when placed in the same position as above, as to prevent pulling out of the shim.

CONNECTING RODS: You must replace the connecting rod cap in exactly the position that it was originally. For example, No. 1 connecting rod and cap have a "1" stamped on the side of the rod and also on the cap. This number must be on the same side.

The large end of the rod is offset 1/16". In replacing rods be careful to see that they are replaced with the offset on the same side as they were originally. The short side of the rod is assembled nearest to the main bearing in every case. Rods 1-3-5-7 have the short side toward the front of the motor and rods 2-4-6-8 have the short side toward the rear of the motor.

The connecting rods are of the shimless type. The babbitt is cast directly into the rod by the centrifugal casting process. The clearance between the bearing and the shaft is set at the factory .0015". This clearance is checked by using a piece of paper .0015" thick and 1-1/8" square. The paper is assembled between the shaft and the bearing and the nuts drawn up tightly. The rod with the paper in place, should support its own weight on the shaft, but it should be possible to move it with very little pressure.

Duralumin connecting rods, used in a number of Lycoming eight-cylinder engines in connection with Bohnalite pistons, are fitted with the same clearances as specified above. However, inasmuch as these rods are considerably lighter and softer than steel, care must be taken by the mechanic not to draw up too tightly on the connecting rod bolt nuts as the large end of the rod will be forced out of round thereby taking up the bearing clearance which will result in the failure of the bearing.

After refitting connecting rods of this type, as a check against any tight fitting bearings, the engine should be turned over freely by hand.

Adjustment should be made when wear of .004 or more has taken place. The work of adjusting the connecting rod bearings should be undertaken only by an expert mechanic in a properly equipped service station. Adjustment can be made by filing off the face of the cap. Care must be taken in filing to see that the surface is kept straight.

A loose connecting rod bearing is usually most noticeable on a hard pull and an experienced mechanic can usually determine which bearing is giving the difficulty by listening closely or by removing the oil pan and noting any looseness in the cap. Pressing against this cap and at the same time rocking the crankshaft will usually enable the mechanic to determine which bearing is in need of adjustment.

CYLINDER BLOCK: The cylinder block is made detachable to promote accessibility and facilitate repair work.

It is very important when replacing the cylinder block to see that the cylinder base stud nuts are drawn up as tightly as possible. A loose cylinder will cause a dull heavy knock or pound very similar to a knock caused by a loose main bearing. When attempting to locate a motor knock, it is well to see that these nuts, especially the ones on the extreme front and back ends of the cylinder, are drawn up tight.

GRINDING THE VALVES: It is necessary that valves be reground into their seat whenever they become pitted or scored sufficient to cause loss of compression. To remove the valves drain the water and remove the cylinder head as described in the paragraph under cylinder head and gaskets.

Remove the valve cover plates from the side of the engine and with a suitable valve lifter raise the

valve springs and take out the horseshoe valve spring supports. Be careful that the horseshoe supports do not drop through the oil holes in the cylinder into the crankcase. Lift out the valves.

When grinding the valves, it is advisable to place under the head a spring of sufficient tension to hold the valve away from its seat when not under pressure from the valve tool.

Valve grinding compound may be purchased at any accessory store and is usually sold in combination tins containing coarse and fine grades. A little of the coarse grade should be placed on the valve and with an oscillating movement of the valve it should be worked into the seat, always bearing lightly on valve and being careful not to make more than 1/8 to 1/2 a revolution of the valve before reversing its direction of motion, or otherwise grooves in the valve face will result. When all pits and black spots have disappeared and the valve presents a dull, silvery appearance, finish the grinding with the fine compound. The valve face should have a uniform surface, free from grooves and pits, but should not necessarily have a polish. The valve acquires a glassy polish while in use. Each valve should be ground and returned to the seat from which it was removed.

An excellent test to determine whether a perfect seat has been ground is as follows: With a soft lead pencil, mark lines across the face of the valve head, spacing them approximately 1/8 inch apart around the entire face of the valve. Then replace the valve and make a quarter rotation backward and forward. All lead pencil lines should be broken. If not, continue grinding until such time as all pencil marks are broken, which indicates that the valve is seating all around. Remember, all of the pencil mark is not to be rubbed out, but the pencil mark should be broken at one point on the seat, wherever the valve comes in contact with the seat in the cylinder block.

After regrinding valves and seats, make certain that every trace of the grinding compound is removed as well as cloth or other material used to prevent the grinding compound from reaching the cylinder bores.

PISTON PIN: After having removed the connecting rod, test the pin for looseness in the piston bosses. On some models the pin was held in the connecting rod by means of a bolt passing through the sawed end and engaging in a notch in the piston pin, clamping the pin tightly and preventing it from turning in the rod.

In other models, however, the pin is held stationary in the piston by a special locking device and takes its bearing in a bronze bushing pressed in the upper end of the connecting rod. A loose pin will cause a sharp metallic knock similar to a valve tappet and should be replaced.

In reaming the bearings in the piston pin bosses, it is very important that the holes are reamed smoothly and in perfect alignment. The pin should be fitted tightly enough so that when assembled and the rod is held by the piston, its free end will, with a slight push, drop of its own weight. The pin should be fitted in the piston, however, so that a light tap will be required to drive it through.

PISTON RING: When the piston rings become worn to any extent, immediate replacement should be made.

In fitting new piston rings to the pistons they should have about .0015 side clearance between the ring and piston groove. The gaps between the ends of the piston rings should be .006 to .012.

MAIN BEARINGS: The main crankshaft bearings are of the bronze back babbitt lined type. No shims are used and adjustment is secured by filing off the faces of the caps the same as described under Connecting Rod Bearings.

The proper clearance between the crankshaft and the main bearings is .0025" to .003". The bearing clearance can readily be checked by inserting a feeler gauge of the proper thickness between the shaft and the bearing and drawing the cap nuts up tight. The bearings should be adjusted after wear of .003" or more has taken place. Never fit them so tight that the shaft cannot be turned by hand with a .002" feeler 1/2 inch wide, assembled between the bearing and shaft. This insures the proper clearance for oil film. The bearings are extra large and well lubricated. Adjustment is required only at comparatively long intervals.

However, overheating or overloading of a new engine, due to operation without sufficient quantity of oil, or with an inferior oil, is sure to cause loosening of the bearings by the melting of a small portion of the facing.

A loose bearing always causes in the engine a knock of a magnitude depending upon the degree of looseness. It is readily discernible by any person in the immediate vicinity, and ignorance of its existence is inexcusable. Proper attention must be given immediately or the wrecking of the entire engine may result. A loose or burned-out bearing will pound the crankshaft out of round, necessitating replacement. Pounding will crystalize the connecting rod and the connecting rod cap bolts, resulting in their failure and generally the smashing of both halves of the crankcase, camshaft, piston and cylinder block. When adjustment of connecting rod or crankshaft bearings is necessary, it is our suggestion that you have the work done in a properly equipped service station. This class of work is for an experienced mechanic only.

We cannot too strongly impress on the inexperienced owner the necessity of having an expert mechanic do all the work on adjustment and replacement of main or crankshaft bearings. In the great majority of cases there is no necessity for having to replace main bearings, as they will last the lifetime of the car if proper attention is given to lubrication and necessary adjustment for looseness.

CAMSHAFT: The camshaft has six large bearings. Under normal conditions they will not have to be replaced during the life of the car. End thrust is taken by the rear face of the sprocket against the front bearing boss in the crankcase. No end play exists due to an automatic spring plunger which bears against a hardened plug in the chain case.

The clearance between the shaft and bearings when fitting new bearings should be from .0025″ to .0035″.

VALVE ADJUSTMENT: It is important that sufficient clearance be had between the end of the valve and the head of the adjusting screw on the valve tappet, to insure the proper fitting of the valve in its seat. The clearance should not be less than .006″ and not more than .008″ when the motor is warm.

The clearance is readily adjusted by removing the valve cover plates and adjusting the screw on the top of the tappet with suitable wrenches.

VALVES AND TIMING: The intake valves are larger than the exhaust to provide a full charge at high speed. The firing order is 1, 6, 2, 5, 8, 3, 7, 4. The valve timing is as follows:

Intake open upper dead center. Intake close 45 degrees past lower dead center. Exhaust open 50 degrees before lower dead center. Exhaust close 10 degrees after upper dead center.

When checking the valve timing the clearance between the valve stem and the tappet must be exactly .010″. This clearance should then be reset to .006″ to .008″ for quietness. A change in the valve timing is possible only by removing the front end chain.

In resetting the camshaft, the sprockets on the camshaft and on the crankshaft should be lined up so that the prick punch mark on the crankshaft sprocket is between the two prick punch marks on the camshaft sprocket when these marks are nearest together, and lined up between the camshaft and crankshaft centers. With the sprockets in this position the top dead center mark for No. 1 and No. 8 cylinders will be in line with dead center mark on the crankcase.

OIL CIRCULATION: The oil is drawn from the reservoir through the strainer, and is pumped to the main bearings. The main bearings Nos. 1, 2, 4, and 5 are supplied by copper tubing manifolds which are connected to the bottom of the bearing caps. The center bearing is supplied through a drilled passage in the oil pump. Oil is forced to the connecting rod lower bearings through drilled passages leading through the shaft from the main bearings. The front end chain where the automatic adjustment is used is supplied through a special lubricating device built into the automatic chain tightener. Oil is forced to the tightener stud through a drilled passage in the crankcase leading from the front main bearing. Oil holes in the revolving sprocket ring of the automatic tightener register with oil passages in the stud so that at every revolution of the tightener ring several shots of oil are supplied to the chain and sprockets. Where the manual adjustment is used, surplus oil from the regulator is piped to the front end.

The surplus oil from the front end drains back into the oil reservoir. The accessory shaft is supplied by pressure through a copper tube which connects with an oil passage in the crankcase. The cylinder walls, piston pin bearings and valve operating mechanism are oiled by spray thrown from the connecting rod bearings. The valve stems are lubricated by oil spray through cored holes in the cylinder base.

OIL SUPPLY: Oil is poured through the filler tube on the side of the crankcase. Keep filled between the two marks on the bayonet type gauge located near the filler. About two gallons are required to fill to the high level. Do not carry oil above the high mark. The oil should be drained from the reservoir and replaced with a fresh supply every 500 miles unless a test shows the oil has lost its viscosity before this time, in which case it should be drained more frequently. The oil is drained by removing a plug in the bottom of the reservoir.

OIL PUMP: The gear type pump is bolted to the center bearing cap. It is located in the oil reservoir about even in height with the normal oil level. The pump is operated by a shaft driven by a spiral gear on the camshaft. It may be removed for cleaning or inspection by taking off the lower half of the crankcase and disconnecting the oil manifolds.

OIL PRESSURE REGULATOR: The oil pressure is controlled by a regulator located on the valve side of the engine near the front end. The pressure is controlled by a spring with tension on a steel plunger. Any excess pressure causes the plunger to rise. The excess oil goes through the regulator body into the crankcase and is returned to the oil reservoir. The pressure of the spring on the plunger which regulates the oil pressure is controlled by the number of washers placed beneath the spring in the oil relief.

Adjustment is secured in the following manner: Disconnect the oil line which leads from the regulator to the pressure gauge on the dash. Remove cylindrical shaped air chamber which is screwed into the top of the oil regulator body. Withdraw steel plunger, noting that the head end points toward the top. Remove spring by the means of a hooked wire and then insert or remove the small washers from the bottom of the pressure regulator. The addition of washers will increase the pressure and the removal of one or more washers will reduce the pressure. Do not add or remove more than one washer at a time as the pressure is affected considerably.

OIL PRESSURE: The oil pressure with hot engine and hot oil should be 15 pound at idling speeds. At 30 M. P. H. the pressure should read not less than 30 pounds and at speeds of 50 M. P. H. or over the pressure should show a minimum

of 40 pounds. During extremely cold weather the oil may show excessive pressure due to its congealing in the lines. Running the engine slowly for a few minutes will give the oil a chance to warm up and become thinner.

Failure of the gauge to show pressure is an indication that something is wrong, lack of oil or a clogged strainer. The motor should be stopped immediately and the cause determined.

MANIFOLD HEAT CONTROL: This is so arranged that under ordinary operating conditions the intake riser is heated by the exhaust from the two middle cylinders. In order to reduce the warming up period provision is made to increase the heat on the riser by closing a damper valve in the exhaust outlet causing all the exhaust gases to be forced around the riser and thence through the by-pass tube to the muffler pipe. This damper valve is controlled from the dash.

It is advisable to close this valve whenever starting with a cold engine. It is imperative that the valve be opened as soon as the motor has reached a proper operating temperature inasmuch as there is considerable loss of power due to exhaust back pressure when the valve is closed.

Religious use of the heat control when starting will materially reduce the hazard of crankcase dilution and its attendant results.

COMPRESSION: Compression in all cylinders should be equal. Weakness or loss of compression is probably due to imperfectly seated valves, which may be caused by insufficient clearance between the valve stems and tappets or by sticky valve stems or tappets.

The use of a poor or improper grade of lubricating oil, or running with too rich a mixture, may cause carbon deposits to collect on the valve seats preventing valves from seating properly. If the compression varies greatly between the various cylinders, it will result in a loss of power and the cause should be determined and remedied.

AUTOMATIC FRONT END CHAIN: The camshaft and accessory shaft are driven from the crankshaft by a Link-Belt silent chain 1-1/2″ wide with automatic chain tightener which automatically keeps the proper tension and makes adjustment to take up wear on the chain. The tension on the tightener spring is set at the factory and no further adjustment is required. In case it is desired to remove the chain, proceed as follows:

Remove the cotter pin and washer from the front of the tightener stud, pull out the inside member of the tightener which contains the spring, leaving the revolving sprocket ring in contact with the chain. After the inside member is withdrawn, the chain can readily be removed.

TO REPLACE THE CHAIN, PROCEED AS FOLLOWS: First line up the timing marks on the crankshaft and camshaft sprockets, as described under Valves and Timing, and wrap the chain over the sprockets and under the tightener stud. When replacing the tightener, push it around into the chain until the chain is taut, and wind up the spring one and a half turns, using a tool made from 15/16 diameter stock with hack saw slot in the end to engage the spring.

FRONT END CHAIN-MANUAL ADJUSTMENT: Adjustment is secured by swinging the generator on the SAE standard three bolt flange. The generator is pivoted on the lower stud.

To adjust the chain, loosen the three nuts on the generator flange studs and move the top of the generator away from the motor. Adjustment will ordinarily be necessary after about 1,000 miles. After that, adjustment will be required only when the chain becomes noisy. The proper tension can be determined by adjusting until a slight humming noise develops and then slacking up until the noise disappears. After securing the proper adjustment tighten the three nuts. A total deflection of 1/8″ to 1/4″ of the chain will result from this adjustment.

When the manual chain adjustment is used, the generator drive sprocket is mounted directly on the generator armature shaft. A hand hole with a cover plate is provided on the chain case directly in front of the generator sprocket making it possible to remove the generator without removing the front chain case. Be careful that the chain is always held in mesh with the camshaft and crankshaft sprockets so that the timing is not disturbed.

CARBON: If the motor knocks easily under load and does not seem to develop its normal amount of power, it is generally an indication that there is carbon in the cylinders. The carbon can readily be cleaned by removing the cylinder head. Before replacing the cylinder head, be sure that the cylinder and surface of the cylinder head gasket are clean.

CYLINDER HEAD AND GASKET: To remove the cylinder head proceed as follows:

Drain water; disconnect the upper hose; disconnect the spark plug wires; disconnect the cable tube brackets from the cylinder head; loosen the distributor set screw. Lift the distributor together with the cable tube and cable tube brackets off the cylinder head out of the way. Remove the cylinder head and then the gasket, being very careful of the gasket.

The method of replacement of the gasket and head is as important as the method of removing them. Put the gasket in position on the studs and press it down on the cylinder face.

The cylinder nuts should be tightened gradually and in such a manner as to insure their pressure being equally distributed throughout the entire cylinder head. Tighten the nuts in the center of the cylinder head first and work both ways toward the ends. This is important and will insure freedom from strains in the cylinder head casting. The driving tongues and slots for the distributor are offset, so that it can be reassembled without disturbing the timing.

General Specifications

TYPE—Eight cylinders enbloc, four cycle, detachable vertical "L" head.

	Bore	Stroke	Piston Displacement	N. A. C. C. H. P. Rating	H. P. Developed
Model "HD"	3-1/4″	4-1/2″	298.6 Cu. In.	33.8	112 @ 3200
Model "MD"	3-1/4″	4-1/2″	298.6 Cu. In.	33.8	112 @ 3200

FIRING ORDER—1, 6, 2, 5, 8, 3, 7, 4.

BELL HOUSING FLANGE—SAE No. 4.

COOLING—Centrifugal water pump.

IGNITION—Battery—Mounting adapted for any standard make of ignition distributor.

GENERATOR MOUNTING—
HD—SAE standard base type
MD—SAE standard flange type.

STARTING MOTOR MOUNTING—SAE standard No. 1 flange outboard type.

FLYWHEEL—Furnished to suit any standard make of clutch.

INTAKE—Carburetor flange adapted for 1-3/4″ single or 1-1/4″ or 1-1/2″ dual.

SUSPENSION—Four point.

Detail and Dimensional Specifications

CAMSHAFT—Six bearing, .15-.25 carbon steel, cams integral.

CAMSHAFT DIAMETER—1-1/8″.

CAMSHAFT BEARINGS—

	Diameter	Length
Front	2.039″	2-5/8″
1st Inter.	2.007″	1″
2nd Inter.	1.991″	3/4″
3rd Inter.	1.975″	3/4″
4th Inter.	1.959″	1″
Rear	1.944″	1-1/2″

CONNECTING ROD—"I" Beam section, .30-.40 Carbon Steel. Length (center to center) 9″.

DROP FORGED—Heat treated aluminum alloy (optional).

CONNECTING ROD BEARINGS—Diameter and length 2-1/8 x 1-1/2.

CONNECTING ROD BOLTS—Nickel steel 7/16″—two per rod.

CRANKSHAFT—Five bearing type, .40-.50 Carbon Steel.

	Diameter	Length
Front bearing	2-3/8″	2-11/16″
Center bearing	2-3/8″	1-15/16″
1st Inter. bearing	2-3/8″	1-3/4″
2nd Inter. bearing	2-3/8″	1-11/16″
Rear bearing	2-3/8″	2-11/16″

PISTON—Length 3-15/16″.

PISTON RINGS—Three per piston.

PISTON PIN—Diameter 7/8″.

VALVES—Effective working diam. (port diameter) Intake 1-7/16″; Exhaust 1-5/16″.

VALVE LIFT—11/32″.