HOOD ASSEMBLY

1939 MODELS

HOOD SIDE PANEL BUMPERS: Eight bumpers, Part No. 500222, installed on front and lower edge of side panels to prevent rattles beginning with following Serial Nos.: P6EB35374, P6EA37719, P8EA23622.These bumpers can be installed on earlier cars as follows: Drill four ¼" holes in each panel at following positions, #1 on lower edge 4⅛" forward from rear edge, #2 11¾" ahead of #1, #3 on lower edge 3 5/16" to rear of front edge, #4 on front edge 3¼" up from lower front corner. Press rubber bumper in each of these holes.

1940 MODELS

HOOD LOCK ADJUSTMENT: Should be made whenever considerable force necessary to lock or unlock hood. Check hood and align so that lock hook is centered on lock bar. Remove hand hole cover and adjust lock stud height so that front of ornament is approximately 1⅝" from hood with hood closed and ornament in released position. Lock studs should incline toward rear of car approximately 7° (lock will not operate properly if angle greater or less than 7°). Stud heights must be equal so that lock bar horizontal and stud nuts must be kept tight (install lockwashers under lower nuts if studs loosen in service). Only light hand pressure should be required to snap lock ornament in place to lock hood. If excessive pressure required after adjustment, check lock ornament for binding and oil pivot pin.

1941-48 MODELS

HOOD LOCK ADJUSTMENT: If lock control button requires considerable effort to release catch, or if hood must be slammed to engage lock, lubricate all parts of lock mechanism. If this does not correct trouble, adjust lock pilot stud by loosening locknut on upper end of stud and turning stud in or out (lower end of stud slotted for screwdriver). Check operation and make certain that stud locknut tightened securely. With correct adjustment, hood should close and lock from a position 12" above the hood catch plate with moderate one-hand motion.

1941 MODELS

HOOD REMOVAL & INSTALLATION: Before removing hood, mark location of hinge on cowl (scribe around hinge with pointed tool) so that hinge can be re-installed in exact same position. Use pry bar to remove hood hinge springs, remove two bolts from hood hinge assembly at right and left side of cowl, remove hood. Hood panels can be dismantled by removing center silver streak and then taking out 14 sheet metal screws holding panels together. Re-install hood in same manner.

Hood Fitting—If hood does not fit tightly at cowl, loosen hood hinge to cowl bolts slightly and drive hinge down, tighten hinge bolts. When installing new hinges, install hinge on cowl, note alignment and whether hinge binds with mounting bolts tight. Shim with washers installed between bracket and cowl, if necessary, so that hinge operates freely, then bolt hinge to hood.

1942-51 MODELS

HOOD SERVICING: Replacing Hood Hinges. Lubricate all rivet joints in hinges with engine oil, install hinge in hood, tightening four outer bolts on each end of hinge reinforcement first and four center bolts last (to avoid straining back of hood and hinge). Place hood and hinge assembly on cowl, start outside bolts on each side and tighten only finger-tight. Lower hood and lock in position, align hood with cowl, doors, and fenders. If nose of hood does not line up with radiator center grille and fender, loosen radiator support bolt nuts and shift entire front end assembly by prying on radiator support (to maintain alignment between back of hood and cowl). Without disturbing position of hood, install and tighten both inside bolts on each side (use punch in one bolt hole to line up holes and start the other bolt). Raise hood and tighten outside bolts on each side. Install hood springs.

Hood Adjustment—Disconnect hood hinge springs, loosen outside bolts on both sides (leave nuts finger tight). Lower hood and lock in place. Loosen inside bolts on both sides. Space hood properly at cowl, rear of front fenders, front radiator grille, and fender assembly. Tighten inside bolts on both sides, then raise hood and tighten outside bolts at both sides. Install hinge springs.

Hinge Spring Removal & Installation—Will be facilitated by using special removing tool (pry bar & link) No. J-3075. Place spring bar in position with hollow end of hooked link engaged on hook at bottom end of spring, and lower end of hooked rod engaged in notch of pry bar. Use foot to apply pressure on pry bar.

Right Hand Spring Note—It may be necessary to remove two bolts attaching right front fender baffle to fender skirt and one bolt attaching baffle to fender flange and then pull baffle forward to allow clearance for alignment of lower spring hook with pry bar when removing this right hand hood spring.

FRONT END SHEET METAL

1938 MODELS

FRONT FENDER & RADIATOR REMOVAL: Work on front of engine can be facilitated by removing radiator and front fenders as an assembly. Removal as follows:—Remove hood, side panels, front bumper, drain cooling system and free radiator tie rods at dash. Disconnect headlamp wires at lamps and withdraw from radiator shell. Free fenders from running boards and body, disconnect radiator and front fender support from frame cross member by removing two nuts under center of cross member. Lift off radiator and fenders as an assembly.

1939 MODELS

FRONT FENDER & RADIATOR REMOVAL: To facilitate work on front of engine remove front end assembly as follows: Remove hood side panels, front bumper assembly, fender-to-body and fender-to-frame brace hex head bolts, drain cooling system. Remove 6 stove bolts at top of fender side apron releasing headlamp wiring clips. Disconnect lamp wires at body side of terminal on apron, free wires from apron. Free radiator support by removing nuts on 2 support bolts under center of radiator. Lift off front end assembly as a unit.

1940-41 MODELS

FRONT FENDER & RADIATOR ASSEMBLY REMOVAL:—To facilitate work on front of engine, remove fenders and radiator as an assembly as follows: Drain radiator, disconnect hoses, remove separate hood side panels on 1940 car models only, front bumper assembly, hex head fender-to-body bolts, Fender-to-frame brace bolts, headlamp wires from top side of fender apron and headlamp terminal at body side of terminal, right headlamp wires from back of terminal on right fender side apron, wire harness from radiator, and 2 nuts from beneath radiator support. Lift front end assembly off

1942-48 MODELS

FRONT END SHEET METAL ASSEMBLY UNIT REMOVAL: Front sheet metal, fenders, & radiator core can be removed as a unit as follows: Disconnect wiring assembly and remove fender moulding. Remove fender bolts as follows: 4 (5 on Torpedo) at rear, 3 at rear to rocker panel extension, and 2 fender baffle-to-frame bolts and nuts. Disconnect radiator hoses and hood lock cable. Remove 2 nuts at bottom of radiator support and take off Front End Assembly.

Front End Assembly Alignment—Entire front end assembly should be aligned by inspecting and correcting alignment at each of the following points:

1. Front Door Alignment at Cowl—Each front door must be properly aligned in door opening with 3/16" clearance (¼" max.) at point where door, hood, and cowl meet. Move door forward or backward, as necessary, for correct clearance.

2. Front Fender Alignment at Door—Rear edge of each front fender should be parallel with front edge of door and have uniform clearance of 3/16". To adjust, remove cowl kick pad, loosen four fender mounting bolts, shift fender forward or backward, raising or lowering front end of fender as required for uniform clearance. NOTE—Fender Cap must be aligned to provide clearance for opening of door. See Fender Cap Alignment following.

3. Hood Fit at Cowl—Rear end of hood should have uniform clearance of 3/16" on cowl (at top) and at each front door. Before adjusting, mark original location of hood hinges on cowl, loosen hinge retaining bolts ½-1 turn, shift hood by tapping on hinges. CAUTION—Make certain that lower edges of hinge flange section are parallel on both hinges and that neither tilts down at front. Unequal action of hinges will cause hood to bind and may buckle hinge straps.

4. Hood Fit at Fenders—If nose of hood does not line up with center grille and clearance between hood and fenders is unequal, entire front end sheet metal assembly should be shifted by loosening radiator support bolt nuts and prying against radiator support (CAUTION—make certain that hood guide pin and safety catch are properly lined up). If fender clearance insufficient and fender interferes with hood closing, loosen two bolts at fender and radiator support and shift fender away from hood. If fenders are low (excessive clearance at hood edge), pry up on fender and drive up on radiator support (use wood block).

1949-51 MODELS

FRONT END SHEET METAL ASSEMBLY UNIT REMOVAL & INSTALLATION: Front fenders, radiator grille, and radiator may be removed as a unit for work on engine as follows:

Removal: Remove battery brace screws from fender skirt, disconnect wires from junction block on each front fender, remove Underhood Light switch from left fender, disconnect antenna lead-in, remove defroster air valve control rod trunnion from defroster lever. Disconnect hood lock cable from lock and radiator upper baffle, release lock cable from clips on fender. Disconnect radiator hoses and remove underseat heater return line from radiator lower tank. Remove two nuts on radiator support bolts at frame. Remove rubber sleeves from air ducts to cowl

CONTINUED ON NEXT PAGE

vacuum line at manifold or combination pump.
(2) Remove air cleaner, disconnect throttle linkage remove fuel pump-to-carburetor line, remove crankcase breather outlet pipe, disconnect exhaust pipe at manifold, free exhaust pipe bracket at flywheel housing.
(3) Disconnect following wires: Temperature gauge engine unit, coil primary lead, generator-to-regulator wires at generator (free wires from clips on side of engine), headlamp wire loom at junction block on right fender skirt (free loom from clips on fan shroud), all wires on starter solenoid.
(4) Disconnect control cable at hood latch. Remove radiator upper baffle assembly. Take out screws mounting fan shroud and radiator on radiator support, remove radiator, then remove shroud.
(5) Remove hood catch plate-to-radiator support brace. NOTE—Radiator support cross brace may be removed for extra clearance if desired (requires removal of four rivets—bolts can be used when brace replaced).
(6) Disconnect and remove gearshift linkage at transmission, disconnect clutch throw-out linkage at clutch fork, remove clutch control bracket from flywheel housing. Disconnect and remove propeller shaft.
(7) Attach hoist to engine (see Caution below), take out bolts attaching engine front insulator to frame. Lift weight of engine off rear insulators, remove bolts holding rear insulators to frame. Carefully hoist engine and transmission out of car, maintaining clearance at all points to prevent damaging parts.

►*CAUTION*—If type of hoist used interferes with any engine accessories, remove following to prevent damage: Generator, Starter, Distributor, Carburetor, Fuel Pump.

►**HYDRA-MATIC DRIVE NOTE**—On cars with Hydra-Matic Drive, remove frame cross-member on which engine rear insulators mounted and **use extreme care to prevent transmission swinging down when rear mountings disconnected (special precautions required due to extra weight of Hydra-Matic Drive).**

ENGINE MOUNTINGS

1940-48 MODELS

FRONT ENGINE INSULATOR REMOVAL: Remove splash shields in back of radiator, disconnect exhaust pipe, remove two bolts from front engine to mounting support, jack engine up enough at front end for access to insulator. Clean dirt off mounting from below, remove two screws holding mounting on frame, remove mounting. Re-install in same manner and tighten all mounting bolts securely. **1942-47 Models.** Front insulator redesigned to provide clearance for new rebound clamp which is assembled over top of insulator. Movement of engine does not effect parts since insulator clears clamp. Insulator and clamp can be disassembled by clamping exposed ends of insulator with 'C' clamp. This new clamp should not be used on earlier models.

1949-51 MODELS

ENGINE FRONT INSULATOR: Front mounting consists of a single assembly on cross-member bracket directly under front end of engine. Insulator has special rebound clamp assembled over top of insulator.

Removal & Disassembly: Drain cooling system, disconnect hoses at water pump and cylinder head. Remove front cross member-to-radiator cross member apron. Remove self-locking nuts from two front insulator-to-engine support bolts. Place jack under oil pan (use wood block to prevent damage to pan), raise engine sufficiently to remove weight from insulator, take out two insulator-to-frame bolts, remove insulator and rebound clamp as an assembly. Remove rebound clamp by using two clamps to compress exposed ends of insulator so that clamp can be slipped off.

Installation: Force new insulator into position in rebound clamp. Install assembly on engine support with open side of rebound clamp forward, tighten self-locking nuts to 60 ft. lbs. Lower engine but do not install two insulator-to-frame bolts until after rear insulators have been installed and tightened (see below).
NOTE—Front insulator should not touch rebound clamp with engine weight on insulator (will be tight in clamp when off engine).

ENGINE REAR INSULATORS: Consist of separate rear mounting on each side of engine. These mountings locate engine (see Adjustment below).

Removal: Support engine at rear to remove engine weight from insulators. Take out two bolts attaching insulators to frame cross-member, then take out two bolts holding insulator on flywheel housing.

Installation & Adjustment: With rear of engine securely supported and **with front insulator-to-frame bolts removed,** install rear insulator to frame cross-member and to flywheel housing bolts. Then raise front of engine slightly so that all weight removed from front insulator (to permit engine to shift into correct alignment as determined by rear insulators), then install and tighten front insulator-to-frame bolts.

1940 MODELS

REAR ENGINE SUPPORT INSULATOR RE-INFORCEMENT PLATE: On some cars rear support insulators loosen from frame (insulator-to-frame bolt self-locking nuts gouge into washers). New hardened reinforcement plate #504992 (replacing washers) and longer bolts #120758 used in production starting with following serial numbers:
Special Six—P6HA-5026, L6HA-1976, C6HA-1467.
Deluxe Six—P6HB-17109, L6HB-4067, C6HB-3165.
Deluxe 8—P8HA-8047, L8HA-2425, C8HA-1863.
Torpedo 8—P8HB-5440, L8HB-1969, C8HB-1541.
NOTE—This plate can be installed on early cars.

ENGINE EXCHANGE

1946 MODELS

NUMBERING OF CYLINDER BLOCK & PISTON ASSEMBLIES: All partial engine assemblies and cylinder blocks fitted with pistons will be numbered in production after Sept. 17, 1946. Numbers are stamped in pad on left side of cylinder block at rear (Serial No. pad on left side at front end is left blank). First Nos. are as follows:

Six Cylinder Engines—S-6-5001
Eight Cylinder Engines—S-8-5001.

NOTE—Nos. 1001 to 5000 will be used to designate partial engine assemblies and cylinder blocks prior to beginning date (when required).

CYLINDER HEAD

ALL MODELS

CYLINDER HEAD INSTALLATION: Use Torque Indicating Wrench to tighten cylinder head capscrews, tighten in correct sequence as shown in the diagram. Cast Iron heads should be tightened cold and rechecked after engine has been run sufficiently to bring all parts to normal operating temperature.
Tightening Torque—See Tightening (Torque Wrench) Specifications below.

PONTIAC 6

PONTIAC 8

TIGHTENING SPECIFICATIONS

ALL MODELS

	Ft. Lbs.	In. Lbs.
Cylinder Head Capscrews	60	720
Main Bearing Capscrews①	95	1140
" (6 Cyl. Rear only)	120	1440
Connecting Rod Cap Nuts	45	540
Flywheel-to-Crankshaft②	105	1260
Piston Pin Lock Bolt	10-12	120-144
Frt. Eng. Mount-to-Support	60	720
Rear Eng. Mount-to-frame (SM)	35	420
Rear Eng. Mount-to-frame (HD)	60	720
Harmonic Balancer Bolt	95	1140
Spark Plugs	25-30	300-360

①—Except All 6 Cyl. & 1950 8 Cyl. Rear Main Bearing.
②—With self-locking bolts (no lockwashers), torque should be 100 ft. lbs. or 1200 in. lbs.
SM—Synchro-mesh Trans. cars.
HD—Hydra-Matic Drive Trans. cars.

ORIGINAL BORE & PISTONS

1938-51 MODELS

ORIGINAL BORE & PISTON SIZES: Original bore sizes and size of pistons installed in each cylinder bore, may be determined by letter stamped on piston head and on top face of cylinder block. Piston sizes graduated in .0005" steps as follows:

Six Cylinder

Piston & Engine Mark	Piston Sizes 1939-40	1941-51
A	3.4355"	3.5605"
B	3.436"	3.561"
C	3.4365"	3.5615"
D	3.437"	3.562"
E	3.4375"	3.5625"

Eight Cylinder

Piston & Engine Mark	Piston Sizes 1939-49	1950-51
A	3.247"	3.372"
B	3.2475"	3.3725"
C	3.248"	3.373"
D	3.2485"	3.3735"
E	3.249"	3.374"

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end of seal which was at locking recess in cap during forming operation, will meet locking recess in cap when cap is installed). Install bearing inserts and cap on main bearing forward of the rear main and torque to 95 ft. lbs. to properly seat crankshaft against new oil seal. (NOTE—Make sure that upper half of seal in rear main is flush with edge of block). *(CAUTION*—If inspection shows seal to be an improper length, remove and discard it, and form a new seal as follows: Install a new seal in bearing cap using tool J-1045 and trim one end flush; carefully remove seal from cap and reinstall in cap, rotating it so that trimmed end is below or above edge of cap the proper distance to correct for the improper length of the first seal. Reseat the seal with tool J-1045 and trim the uncut end flush with edge of cap. Reinstall in block groove). Install new seal in rear main bearing cap using tool J-1045 and pack end of seal into locking recess. Trim the other end flush and replace inserts. Install cap and torque to 120 ft. lbs. Remove rear main bearing cap again and inspect break line between cap and block to be certain that none of the seal material has been compressed between the two. Scrape surfaces to insure seating of cap. Re-install and torque to 120 ft. lbs.

Bearing Cap Seal: After rear bearing cap installed, drive wooden wedge seal into groove on each side of bearing cap next to block. ***CAUTION—Use care not to split these wooden wedges.***
NOTE—Late 1950 & 51 bearing cap seals differ from earlier type and are not interchangeable.

VIBRATION DAMPENER

1938-51 MODELS

HARMONIC BALANCER SERVICING: No service operations required. Do not attempt to disassemble balancer (serviced by replacement).
Removal & Installation—Drain cooling system and disconnect radiator hoses. Remove radiator (see Radiator Removal), loosen and remove fan belt. Remove harmonic balancer retaining bolt, lockwasher, and balancer washer. Use J-496 or similar puller to remove balancer from crankshaft. When installing balancer, see that key in place in shaft keyway and balancer washer installed under retaining bolt lockwasher. Tighten bolt to 95 ft. lbs.

CAMSHAFT & BEARINGS

1938-51 MODELS

CAMSHAFT: Removal. Remove Front Fender and Radiator Assembly (see above), remove fan belt, fan, and harmonic balancer (use Puller J-496). Support front end of engine with jack and remove front engine support, timing chain cover, chain, and sprockets. Remove cylinder head and valve covers, take out valves and lifters (lifters are barrel type and can be removed from above with valves out). Remove oil pump, fuel pump, and distributor. Take out screws and remove camshaft thrust plate, withdraw camshaft at front of engine. Re-install camshaft in same manner making certain that timing chain cover is properly centered (see Timing Chain Cover and Oil Seal data below). After camshaft installed, check Valve Timing, Ignition Timing, and Tappet Clearance.

CAMSHAFT BEARINGS: Use tool No. J-550 to remove and install camshaft bearings (rear bearing on Eight must be pulled out toward front as expansion plug at rear prevents driving on bearing from rear). Use driver to install all bearings making certain that oil hole in bearings is lined up with hole in block (holes are at bottom of bearings). Then line ream all bearings to finished sizes as follows:

Bearing Finished Size:	Six	Eight
#1 (Front)	1.9950-1.9955"	1.9950-1.9955"
#2	1.9637-1.9642"	1.9637-1.9642"
#3	1.9325-1.9330"	1.9325-1.9330"
#4	1.9012-1.9017"	1.9012-1.9017"
#5		1.8700-1.8705"

1938-39 MODELS

CAMSHAFT SPROCKET REPLACEMENT: On all 8 cylinder engines for 1938-39 before number 8-188892; a camshaft sprocket with a short hub and a spacer washer was used. New type camshaft sprocket No. 503454 is furnished for service, and when this new sprocket installed on above cars, **spacer washer should be discarded.**

TIMING CHAIN

ALL MODELS

TIMING CHAIN REPLACEMENT: Timing chain must be installed "endless" with both sprockets off the engine as directed below. CAUTION—Any attempt to install the chain by removing only one sprocket will result in breaking of the chain.
Timing Chain Removal—Remove Front End Sheet Metal Assembly as a unit, remove fan belt and fan, remove Harmonic Balancer (see Vibration Dampener). Support front end of engine with support jack, remove front engine support (see Front Engine Insulator Removal), remove timing chain cover, timing chain and sprockets.
Timing Chain Installation—Mesh sprockets in chain with timing marks on both sprockets lined up for correct valve timing (see Camshaft Setting on car model pages), install both sprockets together being careful not to place any side strain on chain. Re-install timing cover (see Timing Chain Cover Oil Seal data below), front engine support, harmonic balancer, fan and fan belt, and front end sheet metal assembly. NOTE—See Front End Sheet Metal Assembly data for alignment directions.

TIMING CHAIN COVER & OIL SEAL: Consists of cork seal and spring assembled on the crankshaft in front of the chain sprocket so that the cork bears against the inner face of the timing chain cover.
Installing New Cork Seal—Coat seal with graphite lubricant, rubbing lubricant well into the face of the cork, before installing seal in engine. This lubrication necessary to prevent noise at this point.
Installing Timing Chain Cover—Use J-546 tool to center timing chain cover before screws tightened.
NOTE: A timing chain bumper has been incorporated in the timing chain cover on the six cylinder engine. This bumper dampens timing chain vibration. The bumper consists of a synthetic rubber pad which is vulcanized to a steel bracket welded on the left edge of the timing chain cover on the driving side of the chain. The new cover is servicable as an assembly on past 6 cylinder engines.

1939 MODELS

TIMING CHAIN COVER OIL SEAL: Squeak Correction. If seal becomes dry forming glazed surface, squeal may develop due to seal rubbing on chain cover. This may be corrected by squirting oil and graphite fluid on seal. If seal must be replaced, rub graphite into seal thoroughly. Also, seal may be drilled with four or five ⅛" holes 3/16" deep. These holes should then be packed with graphite.

1940 MODELS

TIMING COVER NOISE: Crankshaft balaneer hub diameter reduced .006-.007" during production to elliminate noise between hub and timing cover oil seal due to insufficient clearance. Hubs on early cars can be turned down to diameter of 1.866-1.868".

OIL PUMP

1938-51 MODELS

OIL PUMP SERVICING: Pump is gear type mounted externally on right side of engine.

Removal: Turn crankshaft so that #1 piston on top dead center of compression stroke with distributor rotor at #1 firing position. Remove steering idler arm and right hand engine side pan. Take out pump mounting bolts and remove pump.

Overhaul: Remove cover assembly, lift out oil pump driven gear. Take out wire retainer and remove three distributor drive springs. Support pump on bottom surface, press pump shaft out of distributor gear (use drift of slightly smaller diameter than shaft inserted in end of drive gear to press on end of shaft). Take out relief valve plug, remove relief valve parts. Clean all parts thoroughly, replace worn or damaged parts. When re-installing parts, note specifications listed below. NOTE—Oil pump drive gear and shaft furnished as an assembly; distributor drive gear, pump driven gear, and driven gear shaft furnished as individual parts.
Pump Specifications—Driveshaft clearance in body .0025-.0005". Driven gear clearance on shaft .0020-.0005". Shaft fit in body .0025-.001" tight (press fit). Pump gear backlash .004-.006". Gear end clearance in body—Flush to .004" protrusion beyond cover surface of body (with gasket removed). Pump shaft end clearance .002-.006" (press distributor gear on shaft until clearance between gear and end of body is .002-.006".
Relief Valve (1941 Cars)—Assembly consists of spring loaded disc valve located in the pump body beneath the idler gear. When pressure exceeds 40 lbs., disc is forced off its seat and oil is by-passed back to inlet side. Valve is not adjustable.
Relief Valve (Exc. 1941 Cars)—Consists of a spring-loaded ball located under plug on pump cover. Not adjustable. Clean valve thoroughly and replace spring if free length less than 2 5/16".
Distributor Drive Spring Installation—Install bank of three springs (with maximum thickness of .045" in end of distributor drive gear, install retainer ring with curved end hooked in hole in gear and ring seated in notches in both ends of springs. Check to see that drive springs slip readily in slot in distributor shaft when shaft entered in hole in distributor drive gear.

Installation: With crankshaft turned to #1 firing position, turn pump shaft so that drive springs in drive gear are parallel with center-line of crankshaft and punchmark on end of gear points downward (pump body positioned so that relief valve housing on pump cover toward rear of engine). Install pump in this position using new gasket on engine block.

CONTINUED ON NEXT PAGE

of clutch housing (with transmission off car) and a paper gasket is used between the support flange and the face of the housing. An oil slinger is provided on the main drive shaft ahead of the bearing in the transmission and a felt oil seal is installed against shoulder ahead of oil slinger retaining ring (in 1946 seal originally installed in groove on shaft).

Release Bearing Support Removal—When removing support, **do not pry on flange in clutch housing,** tap support out of housing from inside (do not strike tubular portion of support, tap bell end of support at rear lightly with soft hammer).

Bearing Servicing—Do not wash bearing in solvent or attempt to remove grease (bearing is factory-lubricated and sealed). Check fit of bearing on tubular support. Bearing should not bind or have excessive clearance (see Release Bearing Noise Correction Note below).

1946 MODELS

CLUTCH RELEASE BEARING NOISE CORRECTION: May be caused by excessive clearance of release bearing on support tube allowing bearing to move on tube, or by excessive run-out of clutch release fingers. Correct these conditions as follows:

Clutch Release Bearing Support—On cars with first type Release Bearing Support, Part No. 1308585 with tubular section diameter of 1.355-1.357", replace this bearing support with new type, Part No. 509158 with tubular section diameter of 1.366-1.371". Increased diameter of later type support will reduce excessive clearance of bearing on support and prevent bearing moving on tube.

Clutch Release Finger Runout—Maximum permissible runout of fingers is .030" on a 1 15/16" diameter circle (check with a dial indicator). NOTE—Release fingers are integral part of the diaphragm

1938-46 MODELS

CLUTCH & BRAKE PEDAL MOUNTING CHANGE: To Correct Pedal Movement caused by Shaft Rotation. On cars on which clutch and brake pedal shaft is retained by a straight grooved pin driven through the shaft into the bracket, this pin can be replaced by new type bolt and nut which will retain shaft more securely and prevent any movement of one pedal when the other pedal is depressed. Parts required for this installation are as follows:

¼"-28 x 1¾" Hex. Head Bolt	123762
Bolt Nut	120367
Flat Washer	120392
Lock Washer	105109

Install head of bolt at bracket, place plain washer. lockwasher, and nut on bolt at shaft.

NOTE—This type shaft mounting used on 1946 models (after first cars).

1939 MODELS

CLUTCH CHATTER CORRECTION: Clutch chatter may develop due to release bearing being off-center with release bearing plate in clutch assembly. This condition caused by too much clearance between clutch fork guide plate flanges and opening in clutch housing. To correct proceed as follows: With transmission off car, release bearing off-center condition can be checked by viewing through rear opening in housing. Remove clutch fork guide plate, center release bearing with bearing plate in clutch cover to align clutch fork, check fork clearance at guide plate, weld bar shims on outside of guide plate flanges until clutch fork alignment maintained. NOTE—On cars not equipped with flanged guide plate (Part No. 501871), replace part and make sure it does not move in housing.

1939 EIGHT CYL. MODELS

CLUTCH HOUSING REMOVAL & REPLACEMENT: To remove clutch housing, the housing must be turned slightly and worked around until one end slides over frame cross member and clears toeboard.

ELECTRICAL SYSTEM NOTES

1942-46 MODELS

FAULTY HORN OPERATION: Cars with Deluxe Steering Wheel. Failure of horn to blow, or slight shock noticed when pressing horn ring, may be caused by fact that horn circuit not completed to ground through horn contacts in steering wheel hub (pilot hole in hub out of alignment with metal cup insert so that coil type ground spring does not contact cup). Correct by installing two special ground plates, No. 509553, under sponge rubber ring. NOTE—These ground plates installed on late 1946

Horn Ring Rattles (Cars with Deluxe Steering Wheel)—Caused by Sponge Rubber Separator, Part No. 507722, acquiring permanent set with 1/16-1/8" reduction in height. Correct by replacing separator.

IGNITION NOTES

1949-51 MODELS

1949 & 1950-51 IGNITION DISTRIBUTOR CAP & HIGH TENSION CABLE CAUTIONS—These parts are different and not interchangeable because of different type radio interference suppression resistors used as follows:

1949 Distributor Cap & Cables—Distributor cap is special "High Tower" type with suppression resistance built-in the high tension cable terminal housing. Cap can be identified by the high towers and by word "Radio" embossed on lower flange. Cables used with this cap are conventional metallic-conductor type.

►***CAUTION—Use only original type secondary cables with this "High Tower" distributor cap (1950 type cables MUST NOT BE USED).***

1950-51 Distributor Cap & Cables—Distributor cap is conventional "Low Tower" type without built-in suppression resistance. Ignition cables used with this cap are new "NON-METALLIC CONDUCTOR" type (conductors of graphite impregnated linen or rayon) with built-in suppression resistance. This 1950 cable can be identified by marking "RADIO-4000-GM" and individual cable resistances listed below.

►***CAUTION—This "RADIO-4000-GM" 1950 cable must not be used on 1949 cars with "High Tower" distributor cap (combination will have excessive resistance).***

1950-51 Secondary Cable Resistance
►Marked "Radio-4000-GM"

Cable	6 Cyl. (Ohms)	8 Cyl. (Ohms)
Ign. Coil Lead	2000-4400	2000-4400
#1	5200-12200	5200-12200
#2	4400-10300	5000-11500
#3	3600-8500	4200-10000
#4	4400-10300	4200-10000
#5	4400-10300	5500-13000
#6	5200-12200	6000-14000
#7		6300-14500
#8		7500-17500

►***CABLE INSTALLATION CAUTION—Special procedure as given below necessary to secure good contact between cable conductors and terminals.***

Terminal Installation on 1950 Secondary Cables—Before installing terminals, insert piece of metal wire to depth of 7/8"" in end of cable to provide large area of contact with non-metallic conductor, bend end of wire across end of cable to provide good contact with metal of terminal, install conventional terminal on cable.

►**Loose Spark Plug Cable Terminal Correction on early 1950 Cars (where cable terminal pops off spark plug and cylinder cuts out)**—On early cars with first type cable terminal (with single detent dimple on end), detent may not lock securely on later type spark plug nut (with single groove) allowing cable to pop off in service. If terminal bottoms on spark plug nut before detent snaps tightly in spark plug nut groove, **grind approximately 1/16" off end of cable terminal.**

NOTE—This trouble should not be experienced with "double detent" type cable terminals which have detent on each side.

NOTE—The two straight lines of the ignition mark '/IGN.ONE/' indicates allowable timing range of 4° on flywheel. Use first or 6° line in setting ignition. Car manufacturer recommends use of Timing Light (Tool HM-494) or Synchroscope (HMO-161).

To Set Timing (using Timing Light)—Connect timing light between distributor terminal and ground, turn on ignition. With #1 piston on compression, turn engine over until piston is 6° or .0138" before top dead center, stop when first line of ignition mark '/IGN.ONE/' lines up with pointer in inspection hole in left front face of flywheel housing. Loosen Gaselector screw, center pointer on scale, tighten screw, loosen advance arm clamp bolt, rotate distributor until timing lamp lights (contacts opening), tighten clamp bolt.

To Set Timing (using Synchroscope)—Clip one synchroscope lead to #1 spark plug cable, insert other lead in distributor cap terminal from which #1 spark plug wire removed. Fill in first line of flywheel mark '/IGN.ONE/' with white chalk or paint. Direct synchroscope on flywheel through inspection hole in left front face of flywheel housing. Idle engine at 370 R.P.M. or 7 M.P.H., adjust distributor (as directed for Timing Light above) until white line coincides with pointer on housing.

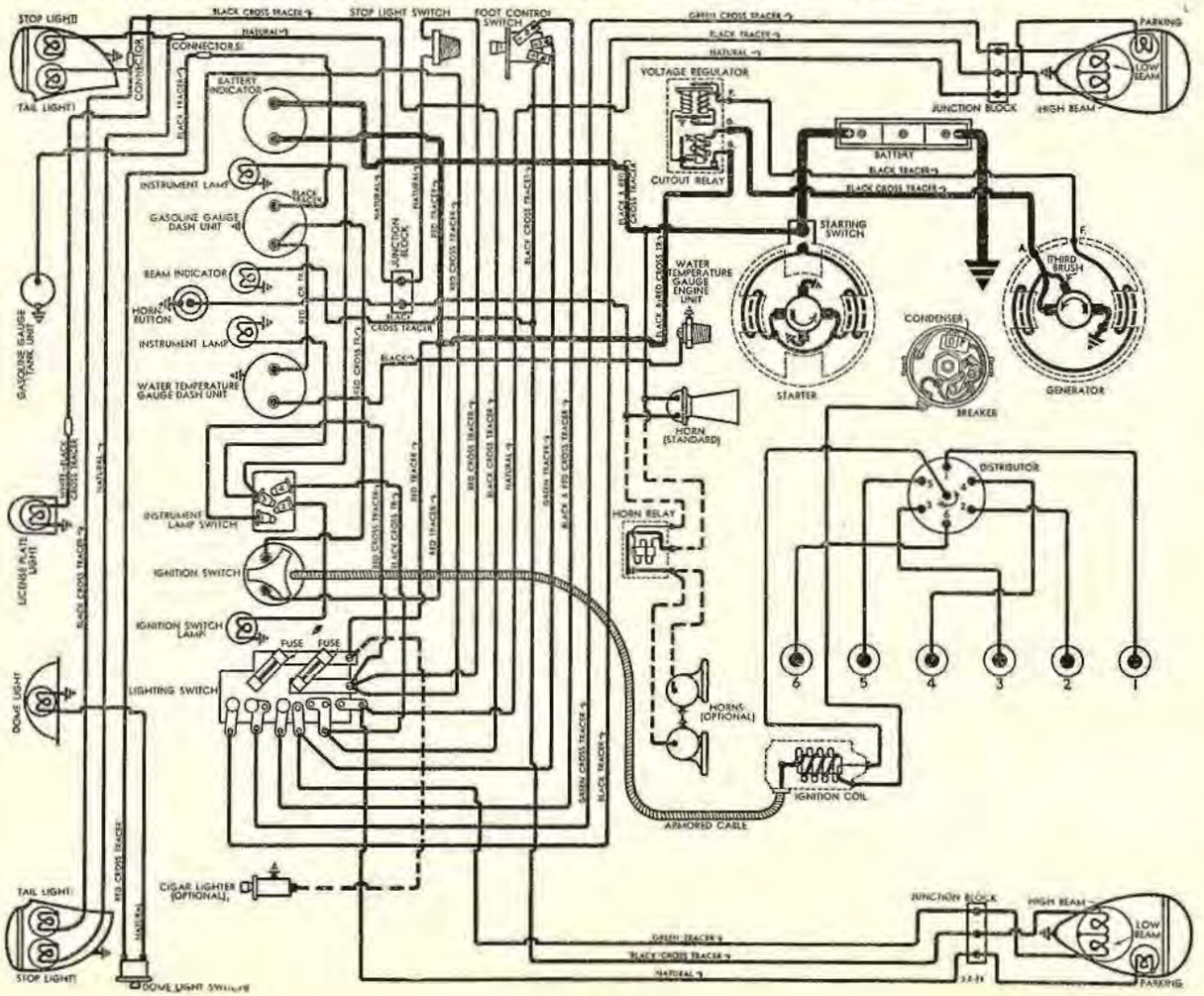
Gaselector Setting—Should be set to provide best performance without spark knock or ping for particular operating conditions and octane rating of fuel used. To adjust, loosen screw, move pointer clockwise to advance or counter-clockwise to retard

CARBURETOR

1938—Carter Type W1 Vacumeter, Model 401-S. 1¼" single barrel downdraft type with Carter Climatic Control. Casting No. 344 on flange.

1939—Carter Type WA-1, Model 433-S. 1¼" single barrel downdraft type with Carter Climatic Control. Casting No. 154 on flange.

For complete data, refer to Carburetor Index.



1939 MODELS

Idle Adjustment—Engine must be warm with automatic choke and fast idle inoperative. Car manufacturer recommends use of vacuum gauge. Set throttle stopscrew to idle engine at 7 M.P.H., adjust idle adjusting screw to give steady gauge reading of 18-20". To adjust without gauge, set throttle stopscrew as above, turn idle adjusting screw in until engine begins to miss, then turn screw out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Final setting should be ¾-1¼ turns open (401-S), ½-1½ turns open (433-S) of screw from inner seated position. Reset idle speed.

Accelerating Pump Setting—Pump lever under dust cover has 3 holes (401S), 2 (433S), for pump link:
Lower Hole (med. stroke)—Normal setting.
Inner Hole (min. stroke)—Extremely hot temperatures, high altitudes or hi-test fuels.
Upper Hole (max. stroke)—Extremely cold temp.

Fast Idle:—Integral type, built-in carburetor.
For complete data, refer to Carburetion Equip. Index.
Setting—With throttle lever stopscrew seated against (not on) first step of fast idle cam clearance between lower edge of choke valve and air horn should be 5/32" (gauge T108-85).

Accelerator Linkage Adjustment:—Must be maintained to provide correct 'Throttle cracking' action for starting. To adjust, after setting carburetor idle speed at 6-7 M.P.H., loosen hand throttle lockwire screw, pull button ⅛" out from instrument panel, position hand throttle lever so that no clearance exists between lever and throttle cross shaft, tighten lockscrew. Turn throttle stopscrew in 2 turns (with throttle stopscrew on high point of cam or 'cold' position), disconnect battery cable at starting motor, to prevent cranking, fully depress starter pedal, adjust throttle cracking pin so that all clearance between cross shaft lever and accelerator pedal lever is taken up. Connect starting motor cable and reset engine idle speed.

Automatic Choke:—Carter Climatic Control.
For complete data, refer to Carburetion Equip. Index.
Setting—Coil housing 1 Point Rich (All 1938, Late 1939), 2 Points Rich (Early 1939).

CARB. EQUIPMENT

Air Cleaner: AC oil-wetted type 1528150 (or 1528128) with crankcase inlet ventilator 498991 ('38), 502783 ('39). Oil bath optl. type 1528304 ('38), 1528944 ('39), with crankcase inlet ventilator 499327.

Fuel Pump: AC type AH standard #1523109 ('38), #1523844 ('39). Optl. comb. fuel-and-vacuum pump type AJ, #1523110 ('38), #1523825 ('39).
For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge: AC Electric type.
Dash Unit: #1515343 ('38), #1515362 ('39).
Tank Unit: #1515470 ('38), #1515481 ('39).
For complete data, refer to Carburetion Equip. Index.

BATTERY

Delco Type 15E-1. 6 volt, 15 plate, 100 Amp. hour.
Starting Capacity—115 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.3 minutes. Five second voltage—4.25 volts.
Grounded Terminal—Negative (—) to engine.
Dimensions—Length 19 5/16". Width 4". Height 9".
Location—Under engine hood on left side.

Police Battery:—**Delco Type 19E-1.** 6 volt, 19 plate, 125 A.H. capacity (20 hr. rate). End-to-end type.
Starting Capacity—150 amperes for 20 minutes.
Grounded Ter. & Location—Same as 15E-1 above.

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ENGINE

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CRANKSHAFT:—4 bearing type with integral counterweights. Balancer mounted on forward end.
See Pontiac Shop Notes for Balancer Removal and Rear Main Bearing Oil Seal Renewal.
Journal Diameters (1938)—#1, 2.3732-2.3743"; #2, 2.4044-2.4054"; #3, 2.4669-2.4679"; #4, 2.4982-2.4992".
Journal Diameters (1939)—#1, 2.4982-2.4992"; #2, 2.5294-2.5304"; #3, 2.5919-2.5929"; #4, 2.6232-2.6242".
Bearing Type—Interchangeable steel-backed, babbit-lined type. Furnished Std. & .001" undersize.
Clearance—.001-.003".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Pontiac Shop Notes.*
End Thrust: At #3 bearing. **Endplay**—.003-.008".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
See Pontiac Shop Notes for Camshaft Removal and Camshaft Bearing Finished Sizes.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32".
Bearing Type—Removable steel-backed, babbitt-lined type. **Clearance**—.0015-.0025".

End Thrust:—Taken by steel thrust plate assembled behind camshaft sprocket. **Endplay**—.002-.005".

Timing Chain:—Morse. Width 1" (¾" nominal). Pitch ⅜". Length 56 links or 21". *See Pontiac Shop Notes for Timing Chain Cover Oil Seal squeak correction.*

Camshaft Setting:—Sprockets are marked. Mesh chain with '0' marks on sprockets adjacent and in line with straightedge across shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 19/32"	.310-.311"	5.718"
Exhaust	1 15/32"	.310-.311"	5.718"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"
Exhaust	45°	19/64"	Free fit to .0006"

Valve Guides:—Removable, tapered guides (.001" taper to the inch, with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through guide of own weight when started in guide. NOTE—Guides should be cleaned with wire brush or taper reamer Tool P.R.131 (also used for reaming replacement guides).

Valve Springs:—Intake and exhaust springs identical. Install with two closed coils at top and dampener on top of each spring. New dampeners should be used whenever removed. **Spring Free Length**—2 9/16".

	Spring Pressure	Spring Length
Valve Closed	54½ lbs.	1 29/32"
Valve Open	96 lbs.	1 19/32"

Valve Lifters:—Single piece, cast-iron, cylindrical type. Furnished .005" oversize. Use pilot reamer J-706-P when installing oversize lifter.
Clearance—Free fit. Lifter should just be free enough to move freely with finger touch.

VALVE TIMING

Tappet Clearance:—.011-.013" all valves (hot and running). Use .011" and .013" feelers as 'go' and 'no go' gauges. NOTE—Car manufacturer recommends .013" exhaust clearance for high speed driving.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #6 intake valve at .0125". This valve should open with piston 5° or .0096" before top dead center with first straight line of flywheel mark '/IGN.ONE/' slightly past indicator in left front face of flywheel housing

LUBRICATION

LUBRICATION:—Gear type pump (right of engine).
See Pontiac Shop Notes for Oil Pump data and installation of 1941 type Pontiac (built-in) Oil Cleaner.
Normal Oil Pressure:—35-45 lbs. with warm oil.
Oil Pressure Regulator—In pump. Non-adjustable.
Crankcase Capacity:—6 quarts (refill).

COOLING

COOLING SYSTEM: Capacity 16 qts. ('38), 17 qts. ('39).
See Pontiac Shop Notes for Radiator Core Removal.
Water Pump:—Packless, sealed ball-bearing shaft.
See Water Pump Section for complete data.
Removal—Remove fan belt, pump mounting bolts and lower hose. Lift off pump and fan assembly.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Closed 140° F. Start 145°. Fully open 172°.
Temperature Gauge ('39): AC Electric type. Part No. 1510771 (Dash Unit), 1510772 (Engine Unit).
See Miscellaneous Section for complete data.

CLUTCH

1938—Own Make. Long 10CF-CS driven member. Single plate, dry disc type.
See Clutch Section for complete data.
Facings—Woven Joined type, 2 required, I.D. 6", O.D. 10", thickness ⅛".
1939—Inland. 'Diaphragm' type. Long 9CF-CS driven member. Single plate, dry disc type.
See Clutch Section for complete data.
Facings—Moulded type, 2 required. Inside Diam. 5¾". Outside Diam. 9". Thickness .125".
NOTE—Install plain facing toward flywheel, facing with cushioned segments on pressure plate side.
Pedal Adjustment: Clearance between underside of felt retainer and pedal ½" ('38), 1" ('39). Adjust by loosening lockscrew and turning adjusting screw. Free movement of pedal 1"±¼" ('38), 1"±⅛" ('39). Adjustment on clutch fork connecting rod.
Removal:—Remove transmission (see below), take off bottom housing cover, unlock pedal pull-back spring, remove fork ball support, fork and throwout bearing. Remove cover screws (turn screws out a few turns at a time until tension relieved). Move clutch away from flywheel at bottom and remove.

TRANSMISSION

TRANSMISSION:—Own. All helical gears, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift control.
See Transmission Section for complete data.
Transmission Control:—Pontiac 'Safety Shift' type. Optl. on 1938. *See Transmission Section for data.*
Removal ('38): Remove floor center panel, front seat assembly, and speedometer cable. (On cars with Safety Shift Gear Control disconnect control cable from selector plate hook and transmission case, withdraw cable and disconnect outer lever from cover shift shaft). Disconnect rear U-joint, remove shaft housing to transmission capscrews, rear engine support bolts, jack up rear of engine to have drain plug clear crossmember, remove fastening bolts. Pull unit straight back (use support at rear to keep in alignment) freeing clutch shaft, then up and forward at front, removing transmission with coupling from propellor shaft. Lift assembly out
Removal ('39): Remove mat, floor center panel and front seat assembly. Disconnect speedometer cable and selector control cable at transmission. Remove selector shaft outer lever (on left side). Remove propeller shaft by disconnecting rear U-joint and pulling to rear to disengage U-joint front yoke from transmission main shaft. Support transmission at rear and remove transmission mounting capscrews. Pull unit straight back freeing main drive gear, up and forward at front, and lift out.

UNIVERSALS

UNIVERSAL JOINTS:—Mechanics—Model 2C. Roller bearing. 2 used. *See Universals Section for data.*

REAR AXLE

REAR AXLE:—Own. Semi-floating, hypoid gear type with Hotchkiss drive. *See Rear Axle Section for data.*

Ratios—	Std.	Mountain	Plains
1938	4.375-1	4.625-1	4.125-1
39-25	4.1-1	4.3-1	3.9-1
39-26	4.3-1	4.55-1	4.1-1

Backlash—Not less than .003". Limits .003-.012".

Removal:—Disconnect rear universal and wire trunnions (do not disengage spline joint at front end of shaft), remove axle shafts (below), remove carrier flange capscrews, pull carrier assembly out.

Axle Shaft Removal: — Hoist rear of car, remove wheel, brake drum, 4 backing plate mounting bolt nuts and loosen bearing retainer (do not allow backing plate to shift to damage brake line). Pull shaft (Puller J-942) taking care not to drag shaft on oil seal. **Wheel Bearing Adjustment**—None.

SHOCK ABSORBERS

SHOCK ABSORBERS: Delco Hydraulic types as follows:

	1938	1939	'39 Exp.
Front	1947-A,B	1947-C,D	1947-C,D
Rear	P-1173-U	1116-V	1754-A,B

Double acting Front (and Rear on Export), Direct acting Rear. NOTE—3 different valve calibrations (front and rear) used during 1939 production.

FRONT SUSPENSION

Front Suspension:—Independent, linked parallelogram type with coil springs.
See Front Suspension Section for complete data.
Kingpin Inclination—4½-5°.
Caster Neg ¾° to Neg. 1¼° ('38). 0° to Neg ¾° ('39).
Camber—Neg. ½° to pos. 1°. ½ turn max. adj'mt.
Toe In—0-1/16". Adjust tie rod for each wheel.
Steering Geometry—Inner wh'122½-23½°. Outer 20°.

STEERING GEAR

Steering Gear: Saginaw Worm-and-Roller with center steering ('38), idler on right frame rail ('39).
See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service—Bendix hydraulic, duo-servo, single anchor. Hand lever applies rear wheel brakes. IMPORTANT—Eccentric adjustment on 1938 only.
See Brake Section for complete data.
Drum—12" ('38), 11" ('39). Chrome nickel iron.
Wheel Cylinder Bore—Front wheel 1". Rear 15/16".
Lining—D-R Multibestos (primary), L-8 Multibestos (secondary). Width 1¾". Thickness 3/16". Length per wheel 23 1/16" ('38), 21 5/16" ('39).
Clearance (1938) .010" at heel and toe of each shoe. **(1939)** .015" at both ends of secondary shoe.
Hand Brake:—See Service Brakes above.

facturer recommends use of Timing Light (HM-494) or Synchroscope (HMO-161).

To Set Timing (using Timing Light)—Connect timing light between distributor terminal and ground, turn on ignition. With #1 piston on compression, turn engine over until piston is 6° or .0128" before top dead center, stop when first line of ignition mark '/IGN.ONE/' lines up with pointer in inspection hole in left front face of flywheel housing. Loosen Gaselector screw, center scale on crankcase mark, tighten screw, loosen distributor clamp bolt, rotate distributor until timing lamp lights (contacts opening), tighten clamp bolt. See Gaselector Setting

To Set Timing (using Synchroscope)—Connect synchroscope in #1 spark plug lead. Fill in first line of flywheel mark '/IGN.ONE/' with white chalk or paint. Direct light on flywheel through inspection hole in left front face of flywheel housing. Idle engine at 376 R.P.M. or 7 M.P.H., adjust distributor (as directed for Timing Light above) until white line coincides with pointer on housing.

Gaselector Setting—Should be set to provide best performance without spark knock or ping for particular operating conditions and octane rating of fuel used. To adjust, loosen screw, move pointer clockwise to advance or counter-clockwise to retard spark

CARBURETOR

1938—Carter Type W1 Vacumeter, Model 400-S. 1¼" single barrel downdraft type with Carter Climatic Control. Casting No. 343 on flange.
For complete data, refer to Carburetor Index.

1939—Carter Type WA-1, Model 432-S. 1¼" single barrel downdraft type with Carter Climatic Control. Casting No. 245 on flange.
For complete data, refer to Carburetor Index.

Idle Adjustment—Engine must be warm with automatic choke and fast idle inoperative. Car manufacturer recommends use of Vacuum Gauge. Set throttle stopscrew to idle engine at 7 M.P.H., adjust idle adjusting screw to give steady gauge reading of 18-20". To adjust without gauge, set throttle stopscrew as above, turn idle adjusting screw in until engine begins to miss, then turn screw out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Final setting ½-1 turn open (400-S), ½-1½ turns open (432-S) of screw from inner seated position. Reset idle speed.

Accelerating Pump Setting—Pump lever under dust cover at top of carburetor has three holes for pump link engagement. Change for seasonal requirements
Lower Hole (medium stroke)—Normal setting.
Inner Hole (minimum stroke)—Extremely hot temperatures, high altitudes or hi-test fuels.
Upper Hole (max. stroke)—Extremely cold temperatures.

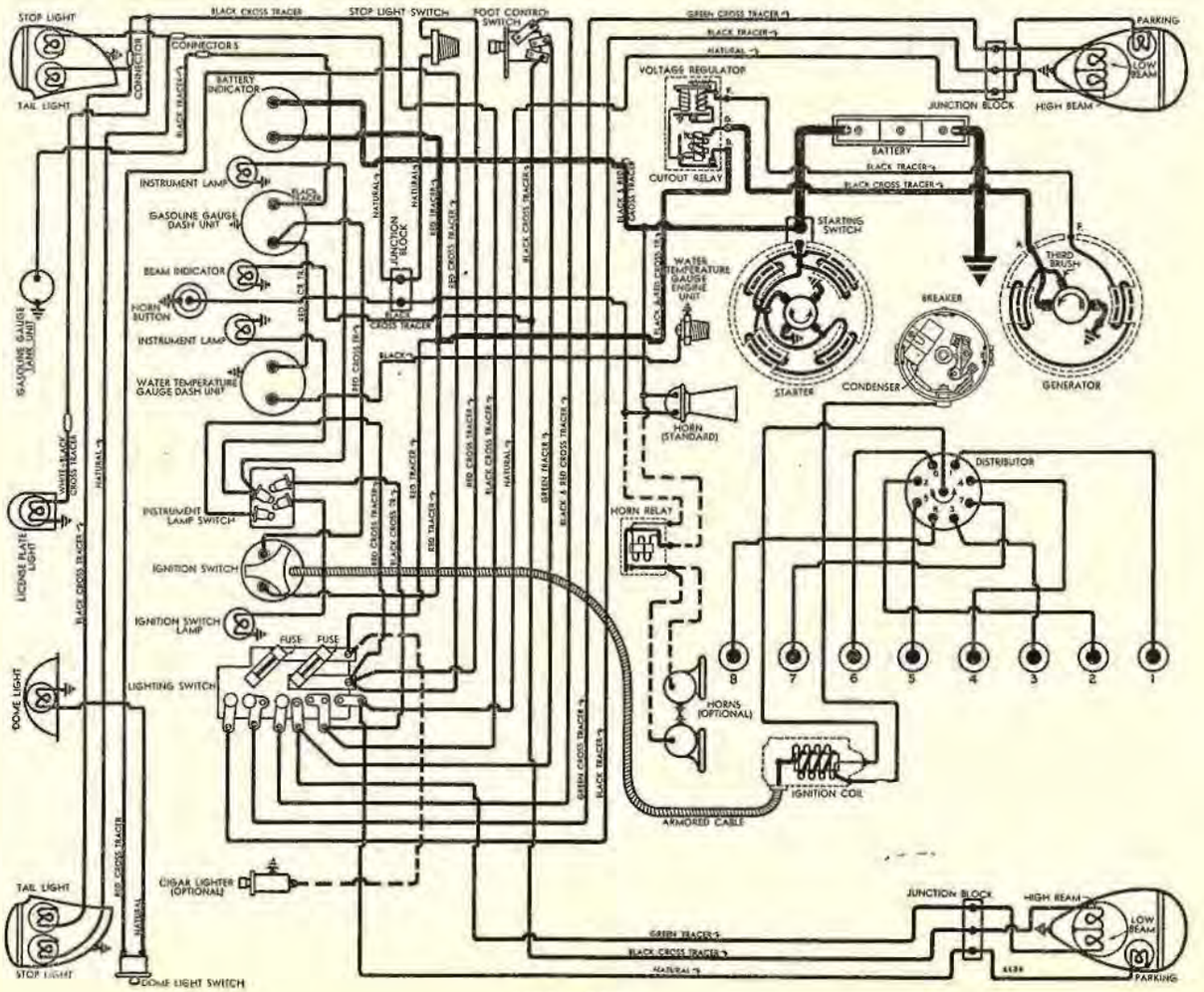
Fast Idle (1938): Fast idle cam linked to the choke mechanism which acts as throttle lever stop. Should not require adjustment. See Carter Cam Type Fast Idle in Carburetion Equipment Section.
For complete data, refer to Carburetion Equip. Index.

Fast Idle (1939): Integral type, built-in carburetor.
For complete data, refer to Carburetion Equip. Index.
Setting—With throttle lever stopscrew seated against (not on) first step of fast idle cam clearance between lower edge of choke valve and air horn should be ⅝" (gauge T108-85).

Accelerator Linkage Setting ('38): Adjust rod connecting bell cranks on side of manifold so that accelerator pedal just touches floor board with carburetor throttle valve wide open. Release accelerator pedal and with throttle valve in closed position (fast idle inoperative), set adjusting screw in lever at forward end of this connecting rod so that clearance between this lever and lever which operates carburetor throttle valve rod is 5/32-3/16", secure locknut. Disconect vacuum switch operating rod at switch lever, turn switch lever so that pointer lines up with line on switch body, adjust length of rod by turning trunnion on rod until rod can be connected to switch lever without disturbing position of lever. See that hand throttle is fully closed, loosen set screw in throttle cable trunnion (at lower end of cable), adjust cable length so that clearance between lever at forward end of hand throttle operating rod and carburetor throttle valve rod lever is 1/16" minimum. Check setting.

Accelerator Linkage Setting ('39): Must be maintained to provide correct 'Throttle cracking' action for starting. To adjust, set carburetor idle speed at 6-7 M.P.H., loosen hand throttle lockwire screw, pull button ⅛" out from instrument panel, position hand throttle lever so that no clearance exists between lever and throttle cross shaft, tighten lockscrew. Turn throttle stopscrew in 2 turns (with throttle stopscrew on high point of cam or 'cold' position), disconnect battery cable at starting motor to prevent cranking, fully depress starting pedal, adjust throttle cracking pin so that all clearance between cross shaft lever and accelerator pedal lever is taken up. Connect starting motor cable and reset engine idle speed.

Automatic Choke:—Carter Climatic Control.
For complete data, refer to Carburetion Equip. Index.
Setting—Coil housing 1 Point Rich (All 1938, Late 1939), 2 Points Rich (Early 1939).



1939 MODELS

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ENGINE

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1938 Piston Rings

Ring	Width	End Gap	Side Clearance
Compression	.1235-.1240"	.007-.017"	.0015-.003"
Oil Control	.1860-.1865"	.007-.017"	.001-.0025"

1939 Piston Rings

Compression	.0930-.0935"	.009-.014"	.0015-.003"
Oil Control	.1860-.1865"	.007-.017"	.001-.0025"

Replacement Rings:—.005", .010", .020", .030" oversize.

PISTON PIN:—**Diameter**—15/16". **Length**—2⅞". Pin locked in one boss. Free end slotted.
Pin Fit in Piston—*See Pontiac Shop Notes.*
Pin Fit in Rod Bushing—.0003-.0005".
Replacement Pins:—.001" (red & brown), .003" (red), .005" (blue) oversize. Painted on ends.
Fitting Pins:—*See Pontiac Shop Notes.*

CONNECTING ROD:—**Length** 7 9/16". **Weight** 29⅞ ozs.
Piston Pin Bushing (Upper Bearing)—Split bushed type. *See Pontiac Shop Notes for complete data.*
Crankpin Journal Diameter—1.9987-1.9997".
Lower Bearing—Removable steel-backed, babbitt-lined type. Furnished std. & .001" undersize.
Clearance—.0005-.0015". **Sideplay**—.005-.010".
Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*

CRANKSHAFT:—5 bearing with integral count'weights. *See Pontiac Shop Notes for Balancer Removal.*
Journal Diameters—#1, 2.3732-2.3742"; #2, 2.4044-2.4054"; #3, 2.4357-2.4367"; #4, 2.4669-2.4679"; #5, 2.4982-2.4992".
Bearing Type—Interchangeable steel-backed, babbit-lined type. Furnished Std. & .001" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. *See Pontiac Shop Notes.*
End Thrust:—Rear center (#4) bearing.
Endplay—.003-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive. *See Pontiac Shop Notes for Camshaft Removal, Bearing finished sizes and Replacement Camshaft Sprocket data.*
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32"; #5, 1⅞".
Bearing Type—Removable steel-backed, babbitt-lined type. **Clearance**—.0015-.0025".
End Thrust:—Thrust plate behind camshaft sprocket.
Endplay—.002-.005".
Timing Chain:—Morse. Width 1" (¾" nominal). Pitch ⅜". Length 56 links or 21".
See Pontiac Shop Notes for Timing Chain Cover Oil Seal squeak correction data.
Camshaft Setting:—Sprockets are marked. Mesh chain with '0' marks on sprockets adjacent and in line with a straightedge across shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.310-.311"	5.53"
Exhaust	1 11/32"	.310-.311"	5.53"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"
Exhaust	45°	19/64"	Free fit to .0006"

Valve Guides:—Removable, tapered guides (.001" taper to the inch, with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through guide of own weight when started in guide. NOTE—Guides should be cleaned with wire brush or taper reamer Tool P.R. 131. Replacement guides straight cut, ream to fit valve after installing with reamer P.R. 131.
Valve Springs:—Intake and exhaust springs identical. Install with two closed coils at top and dampener on top of each spring. New dampeners should be used whenever removed **Spring Free Length**—2 9/16".

	Spring Pressure	Spring Length
Valve Closed	54½ lbs.	1 29/32"
Valve Open	96 lbs.	1 19/32"

Valve Lifters:—Cast-iron, barrel type. Furnished .005" oversize. Use pilot reamer J-551 when installing oversize lifter to insure alignment of lifter hole and valve stem.
Clearance—Free fit. Lifter should move freely with finger touch.

VALVE TIMING

Tappet Clearance:—.011-.013" all valves (hot and running). Use .011" and .013" feelers as 'go' and 'no go' gauges. NOTE—Car manufacturer recommends .013" exhaust clearance for high speed driving.
Valve Timing:—See Camshaft Setting.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #8 intake valve at .0125". This valve should open with piston 5° or .0089" before top dead center with first straight line of flywheel mark '/IGN.ONE/' slightly past pointer in left front face of flywheel housing.

LUBRICATION

LUBRICATION:—Pressure type (pump on right side of engine). *See Pontiac Shop Notes for Oil Pump data.*
Normal Oil Pressure:—35-45 lbs. with warm oil.
Oil Pressure Regulator—On pump. Not adjustable.
Crankcase Capacity:—7 quarts (refill).

COOLING

COOLING SYSTEM:—Capacity—19 quarts. *See Pontiac Shop Notes for Radiator Core Removal.*
Water Pump:—Packless, sealed ball-bearing shaft.
Removal—Remove fan belt, lower hose and pump mounting bolts. Lift off pump and fan assembly.
Thermostat:—Harrison. In cylinder head outlet.
Setting—Closed 140° F. Start 145°. Fully open 172°.
Temperature Gauge ('39): AC Electric type. Part No. 1510771 (Dash Unit), 1510772 (Engine Unit).
See Miscellaneous Section for complete data.

CLUTCH

1938—Own Make. Long 10CF-CS driven member. Single plate, dry disc type.
See Clutch Section for complete data.
Facings—Woven Joined type, 2 required, I.D. 6", O.D. 10", thickness ⅛".
1939—Inland. 'Diaphragm' type. Long 9¼CF-CS driven member. Single plate, dry disc type.
See Clutch Section for complete data.
Facings—Moulded type, 2 required. Inside Diam. 5¾". Outside Diam. 9¼". Thickness .125".
NOTE—Install plain facing toward flywheel, facing with cushioned segments on pressure plate side.
Pedal Adjustment: Clearance between underside of felt retainer and pedal ½" ('38), 1" ('39). Adjust by loosening lockscrew and turning adjusting screw. Free movement of pedal 1"±¼" ('38), 1"±⅛" ('39). Adjustment on clutch fork connecting rod.
Removal:—Remove transmission (see Transmission Removal below), take off bottom housing cover, unlock pedal pull-back spring, remove fork ball support, fork and throwout bearing. Loosen cover screws a little at a time to relieve tension, then take screws out. Move clutch assembly away from flywheel at bottom and lower assembly out.

TRANSMISSION

TRANSMISSION:—Own. All helical gears, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift control.
See Transmission Section for complete data.
Transmission Control:—Pontiac 'Safety Shift' type. Optl. on 1938. *See Transmission Section for data.*
Removal: *All data same as for the 1938-39 Pontiac Six (preceding car article).*

UNIVERSALS

UNIVERSAL JOINTS:—**Mechanics**—Model 2C. Roller bearing. 2 used. *See Universals Section for data.*

REAR AXLE

REAR AXLE:—Own. Semi-floating, hypoid gear type with Hotchkiss drive.
See Rear Axle Section for complete data.

Ratios—	Std.	Mountain	Plains
1938	4.375-1	4.625-1	4.125-1
1939	4.1-1	4.3-1	3.9-1

Backlash—Not less than .003". Limits .003-.012".
Removal:—Disconnect rear universal and wire trunnions (do not disengage spline joint at front end of shaft), remove axle shafts (below), remove carrier flange capscrews, pull carrier assembly out.
Axle Shaft Removal: — Hoist rear of car, remove wheel, brake drum, 4 backing plate mounting bolt nuts and loosen bearing retainer (do not allow backing plate to shift to damage brake line). Pull shaft (Puller J-942) taking care not to drag shaft on oil seal. **Wheel Bearing Adjustment**—None.

SHOCK ABSORBERS

SHOCK ABSORBERS: Delco Hydraulic types as follows:

Front	1947-A,B	1947-C,D	1947-C,D
Rear	P-1173-U	1116-V	1754-A,B

Double acting Front (and Rear on Export), Direct acting Rear. NOTE—3 different valve calibrations (front and rear) used during 1939 production.

FRONT SUSPENSION

Front Suspension:—Independent, linked parallelogram type with coil springs.
See Front Suspension Section for complete data.
Kingpin Inclination—4½-5°.
Caster Neg ¾° to Neg. 1¼° ('38). 0° to Neg ¾° ('39).
Camber—Neg. ½° to pos. 1°. ½ turn max. adj'mt.
Toe In—0-1/16". Adjust tie rod for each wheel.
Steering Geometry—Inner wh'122½-23½°. Outer 20°.

STEERING GEAR

Steering Gear: Saginaw Worm-and-Roller with center steering ('38), idler on right frame rail ('39).
See Steering Gear Section for complete data.

BRAKES

BRAKES:—**Service**—Bendix hydraulic, duo-servo, single anchor. Hand lever applies rear wheel brakes. IMPORTANT—Eccentric adjustment on 1938 only.
See Brake Section for complete data.
Drum—12" ('38), 11" ('39). Chrome nickel iron.
Wheel Cylinder Bore—Front wheel 1". Rear 15/16".
Lining—D-R Multibestos (primary), L-8 Multibestos (secondary). Width 1¾". Thickness 3/16". **Length per wheel 23** 1/16" ('38), 21 5/16" ('39).
Clearance (1938) .010" at heel and toe of each shoe. **(1939)** .015" at both ends of secondary shoe.
Hand Brake:—See Service Brakes above.

NOTE—The two straight lines of the ignition mark '/IGN.ONE/' indicates allowable timing range of 4° on flywheel. Use first or 6° line in setting ignition. Car manufacturer recommends use of Timing Light (Tool HM-494) or Synchroscope (HMO-161).

To Set Timing (using Timing Light)—Connect timing light between distributor terminal and ground, turn on ignition. With #1 piston on compression, turn engine over until piston is 6° or .0138" before top dead center, stop when first line of ignition mark '/IGN.ONE/' lines up with pointer in inspection hole in left front face of flywheel housing. Loosen Gaselector screw, center pointer on scale, tighten screw, loosen advance arm clamp bolt, rotate distributor until timing lamp lights (contacts opening), tighten clamp bolt.

To Set Timing (using Synchroscope)—Clip one synchroscope lead to #1 spark plug cable, insert other lead in distributor cap terminal from which #1 spark plug wire removed. Fill in first line of flywheel mark '/IGN.ONE/' with white chalk or paint. Direct synchroscope on flywheel through inspection hole in left front face of flywheel housing. Idle engine at 376 R.P.M. or 7 M.P.H., adjust distributor (as directed for Timing Light above) until white line coincides with pointer on housing.

Gaselector Setting—Should be set to provide best performance without spark knock or ping for particular operating conditions and octane rating of fuel used. To adjust, loosen screw, move pointer clockwise to advance or counter-clockwise to retard

CARBURETOR

CARBURETION:—Carburetor—Carter Type WA-1, Model 463-S (first), 463-SP (later). 1¼" downdraft type with Carter Climatic Control.
For complete data, refer to Carburetor Index.

Production Change—To correct engine hesitating when starting in second gear, a new pump plunger 64-70S used on 463-SP. On 463-S, change pump link to lower hole in arm and plunger shaft.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (¾-1½ turns open—turn screw in for leaner mixture). Readjust idle speed.

Accelerator Pump Setting—Pump arm and plunger under dust cover at top of carburetor have two holes for connector link engagement. Recommended settings as follows:

Short Stroke—Normal Setting (Inner Hole in Pump Arm, Upper Hole in Pump Plunger).

Long Stroke—Maximum Setting (Outer Hole in Pump Arm, Lower Hole in Pump Plunger).

NOTE—To correct hesitating when starting in second gear on 463-S (Early '40) carburetor, set Accelerating Pump for Long Stroke.

Float Level—7/16" from projection on cover to top of soldered seam at front end of float with needle valve seated (invert to check).

Fast Idle:—Integral type, built-in carburetor.
For complete data, refer to Carburetion Equip. Index.

Fast Idle Setting—Adjust by bending connecting link offset for ⅝" choke valve opening with stopscrew against (not on) first step of fast idle cam.

Accelerator Linkage Adjustment:—Must be maintained to provide correct 'Throttle cracking' action for starting. To adjust, after setting carburetor idle speed at 6-7 MPH, loosen hand throttle wire lock screw, pull button ⅛" out from instrument panel, position hand throttle lever so that no clearance exists between lever and throttle cross shaft, tighten lock screw. Turn throttle stopscrew in 2 turns (with throttle stopscrew on high point of cam or 'cold' position), disconnect battery cable at starting motor to prevent cranking, fully depress starter pedal, adjust throttle cracker lever to take up all clearance on pin. Connect starting motor and reset idle speed.

Automatic Choke:—Carter Climatic Control.
For complete data, refer to Carburetion Equip. Index.
Choke Setting—Set coil housing 1 notch Rich.

CARB. EQUIPMENT

Air Cleaner:—AC #1523985 oil-wetted type Std., #1528944 oil-bath type Optl. with Crankcase Vent Cleaner #502783 Std., #1529288 Optl.

Fuel Pump:—AC Type AH #1523985 standard. Type AJ #1523986 fuel-and-vacuum pump optional.
For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge:—AC Electric. #1515371 (dash unit), #1515481 (tank unit).
For complete data, refer to Carburetion Equip. Index.

BATTERY

BATTERY:—Delco Type 15E-1, 2. 6 volt, 15 plate, 100 ampere hour capacity (20 hour rate).
Starting Capacity—120 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.5 minutes. Five second voltage—4.25 volts.
Grounded Terminal—Negative (—) grounded to lower left side of block. No separate engine ground.
Dimensions—Length 19 5/16". Width 4". Height 9".
Location—Under engine hood on left side.

Police Battery:—Delco Type 19E-1. 6 volt, 19 plate, 130 A. H. capacity (20 hr. rate). End-to-end type.
All other date same as for 15E-1 above.

STARTER

STARTER:—Delco-Remy 1107022, 727-S (RHD).
Armature No.—810601 (1107022), 823881 (727-S).
Drive—Overrunning clutch (manual shift on 1107022, solenoid pinion shift on 727-S).
Cranking Engine—200 amperes at 5 volts.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ounces each.

Performance Data—1107022

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5000	5.0	65
12 ft. lbs.	Lock	3.37	525

Performance Data—727-S

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5500	5.0	65
15 " "	Lock	3.0	600

Removal:—Mounted on left front face of flywheel housing. To remove take out mounting screws.
Starting Switch (1107022):—Delco-Remy Part #820052. Mounted on starter. Operated by starting pedal.
For complete data, refer to Electrical Equipment Index.
Starting Switch (727-S): Delco-Remy Solenoid 1546 operated by pushbutton switch 1996007.
For complete data, refer to Electrical Equipment Index.

GENERATOR

GENERATOR:—Delco-Remy 1102665, Armature 1879002 (Std.), 1106403 (City Police), 1105851 or 1105856 (State Police). Two brush (shunt) types with voltage and current regulation. Ventilated.
Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
Maximum Charging Rate—Standard: 32 amperes min. (hot), 8.0 volts, 2450 RPM, 25 MPH; Police: 34 amperes Min. (hot), 8.0 volts, 1040 RPM., 19.0 MPH. with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data Cold

	*Amperes	Volts	R.P.M.
1102665	30	8.0	1750
1106403	35	8.0	1040
1105851, 6	40	8.0	1850

*—Not maximum output—See Current Regulator.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—25 ounces each.
Field Current—1.75-1.9 amperes (1102665), 1.77-2.0 amperes (1106403), 1.62-1.82 amperes (1105851, 6) at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out clamp and pivot bolts.
Belt Adjustment:—Loosen pivot and clamp bolts, move generator out or away from engine to take up stretch or slack in belt. Belt play should be 1" between pulleys when belt grasped with fingers.

REGULATOR

REGULATOR:—Delco-Remy Model 1118201 (1102665 Gen.), 1118229 (1106403 Gen.), 1118237 (1105851 & 1105856 Gens.). Single Core Type. Vibrating type voltage and current regulators in a single case.
For complete data, refer to Electrical Equipment Index.

CAUTION—Check generator for grounded fields before changing regulator settings. If field coils defective, new field coil parts 1877893 and 1878427 should be installed. Also check regulator terminals for clearance at dash.

Cutout Relay
Cuts In—6.2-6.7 volts (hot).
Cuts Out—0-4.0 amperes discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with points just closed).

Voltage Regulator
Setting—7.2-7.4 volts hot (1118201), 7.0-7.2 volts hot (1118229 & 1118237) at operating temperature.

CONTINUED ON NEXT PAGE

before top dead center with first straight line of flywheel mark '/IGN.ONE/' slightly past indicator in left front face of flywheel housing.

LUBRICATION

LUBRICATION:—Pressure type (gear type pump on right side. *See Pontiac Shop Notes for Oil Pump data, recommended Crankcase Ventilator Outlet Pipe Cleaner removal (to improve crankcase ventilation) and installation of 1941 type Pontiac (built-in) Oil Cleaner.*

Normal Oil Pressure:—35-40 lbs. above 40 MPH.

Oil Pressure Regulator:—On pump. Opens at 40 lbs. Non-adjustable type. **Crankcase Capacity:**—6 qts.

COOLING

COOLING SYSTEM:—Capacity—17 quarts.
See Pontiac Shop Notes for Radiator Core Removal.

Water Pump:—Packless, sealed ball-bearing shaft.
See Water Pump Section for complete data.

Removal—Remove fan belt, pump mounting bolts and lower hose. Lift off pump and fan assembly.

Thermostat:—Harrison. In cylinder head outlet.
Setting—Closed 140°F. Starts 145°. Fully open 172°.

Temperature Gauge:—AC #1510916 (dash), #1510772 (engine unit). Electric type.
See Miscellaneous Section for complete data.

CLUTCH

CLUTCH:—Inland. 'Diaphragm' type, single plate, dry disc type with Long 9CF-CS, 10CF-CS (Taxi) driven member.
See Clutch Section for complete data.

Facings—Moulded (Ammco), 2 used. Inside Diam. 5¾", 6" (Taxi). O.D. 9", 10" (Taxi). Thickness .125".

►**Clutch Pedal Rattle Correction**—Caused by endplay in countershaft lever as pedal depressed resulting from shrinkage of felt at each end of shaft. Correct by installing extra felt No. 502229 on frame end of shaft (CAUTION—leave original felts in place), and soak all felts in engine oil.

IMPORTANT—Oil felts regularly with engine oil.
Replacement Clutch Pilot Bushing Installation—
See Clutch Notes in Pontiac Special Data.

Pedal Adjustment:—Free travel ⅞-1⅛" (adjusting nut on link at clutch fork). Pedal height above toe board (engaged) 5⅛" (Special), 4¾" (Deluxe), stop screw at lower end of pedal arm.

Removal:—Remove transmission (see below), take off bottom housing cover, unlock pedal pull-back spring, remove fork ball support, fork and throwout bearing. Remove cover screws evenly until tension relieved. Move clutch away from flywheel at bottom to remove disc, then lower cover assembly out.

TRANSMISSION

TRANSMISSION:—Own. All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote steering col. shift.
See Transmission Section for complete data.

Transmission Control:—Pontiac 'Safety-Shift' type.
See Transmission Section for complete data.

Removal:—Remove floor mat and center panel. Disconnect speedometer cable, gearshift selector and control rods at transmission. Disconnect rear universal (wire trunnions) and pull propeller shaft to rear to disengage U-joint front yoke from transmission main shaft at slip joint. Remove upper transmission mounting screws, install guide pins (J-851), remove lower screws, pull unit to rear to free main drive gear, then up and forward at front.

UNIVERSALS

UNIVERSAL JOINTS:—Mechanics 2C. Roller bearing.
See Universals Section for complete data.
NOTE—1 piece driveshaft used. Slip joint formed at rear of transmission mainshaft ahead of front universal (front yoke of universal splined directly to mainshaft—no front companion flange used).

REAR AXLE

REAR AXLE:—Own Make. Semi-floating, hypoid gear type with Hotchkiss drive.
See Rear Axle Section for complete data.
Ratio—4.3-1 Std. (white), 4.55-1 Mount. (yellow), 4.1-1 Plains (green), 3.9-1 Economy (red). NOTE—Color marked on end of right or left axle shaft.
Backlash—.003-.012" (new).

Removal:—Disconnect rear universal and wire trunnions (do not disengage spline joint at front end of shaft), remove axle shafts (below), remove carrier flange capscrews, pull carrier assembly out.

Axle Shaft Removal:—Hoist rear of car, remove wheel, brake drum, 4 backing plate mounting bolt nuts and loosen bearing retainer (do not allow backing plate to shift to damage brake line). Pull shaft (Puller J-942) taking care not to drag shaft on oil seal. **Wheel Bearing Adjustment**—None.

SHOCK ABSORBERS

SHOCK ABSORBERS:—Delco. Front—1947-C,D. **Rear**—1000-V (Domestic), 1754-E,F (Export 25), 1754-A,B (Export 26). Double acting, hydraulic (1000-V direct acting—Rear Shocks Domestic cars).

FRONT SUSPENSION

Front Suspension:—Independent, linked parallelogram type with coil springs.
See Front Suspension Section for complete data.
Kingpin Inclination—4⅝° to 5¼°.
Caster—Negative ¾°. Limits Neg. ½° to Neg. 1°.
Camber—Positive ⅜°. Limits 0° to ⅝° positive.
Toe In—0-1/16". Adjust tie rod tubes equally.
Steering Geometry—Inner wh'l 23° ± ½°. Outer 20°.

STEERING GEAR

Steering Gear: Saginaw Worm-and-Roller type with steering idler arm on right frame rail.
See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service. Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear service brakes.
See Brake Section for complete data.

Drums—Chrome nickel iron. Diameter—11".
Wheel Cylinder Bore—Front wheel 1". Rear 15/16".
Lining—Moulded. Width 1¾". Thickness 3/16". Length 9 11/32" (Primary—D-R Multibestos), 11 31/32" (Secondary—L-8 Multibestos).
Clearance—.015" at both ends of secondary shoe (with primary shoe forced out against drum).
Braking Power—53% front wheels, 47% rear.

Hand Brake:—See Service Brakes above.

MISC. MECHANICAL

Power Operated Convertible Top: Vacuum Power type.
See Miscellaneous Section for complete data.

Gaselector—Manual adjustment at distributor providing 10° advance or retard from center '0' position. See Gaselector Setting following.

Distributor Removal:—Mounted on left side of engine. To remove, disconnect vacuum line, take out hold-down screw in Gaselector and lift out.

IGNITION TIMING

IGNITION TIMING:—Standard setting given below (regular fuel Std. hd., Ethyl fuel HC hd.). See Gaselector following for final setting.

	Flywheel Degrees	Piston Position
All engines	6° BTDC	.0128" BTDC.

NOTE—The two straight lines of the ignition mark '/IGN.ONE/' indicates allowable timing range of 4° on flywheel. Use first or 6° line in setting ignition. Car manufacturer recommends use of Timing Light (Tool HM-494) or Synchroscope (HMO-161).

To Set Timing (using Timing Light)—Connect timing light between distributor terminal and ground, turn on ignition. With #1 piston on compression, turn engine over until piston is 6° or .0128" before top dead center, stop when first line of ignition mark '/IGN.ONE/' lines up with pointer in inspection hole in left front face of flywheel housing. Loosen Gaselector screw, center pointer on scale, tighten screw, loosen advance arm clamp bolt, rotate distributor until timing lamp lights (contacts opening), tighten clamp bolt.

To Set Timing (using Synchroscope)—Clip one synchroscope lead to #1 spark plug cable, insert other lead in distributor cap terminal from which #1 spark plug wire removed. Fill in first line of flywheel mark '/IGN.ONE/' with white chalk or paint. Direct synchroscope on flywheel through inspection hole in left front face of flywheel housing. Idle engine at 376 R.P.M. or 7 M.P.H., adjust distributor (as directed for Timing Light above) until white line coincides with pointer on housing.

Gaselector Setting—Should be set to provide best performance without spark knock or ping for particular operating conditions and octane rating of fuel used. To adjust, loosen screw, move pointer clockwise to advance or counter-clockwise to retard spark.

CARBURETOR

DELUXE 8 MODEL 40-28

CARBURETION (DELUXE):—Caburetor—Carter Type WA-1, Model 462-S (first), 462-SP (later). 1¼" downdraft type with Carter Climatic Control.

Production Change—To correct engine hesitating when starting in second gear, a new pump plunger 64-70S used on 462-SP. On 462-S, change pump link to lower hole in arm and plunger shaft to correct this condition.

For complete data, refer to Carburetor Index.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (¾-1½ turns open—turn screw in for leaner mixture). Readjust idle speed.

Accelerator Pump Setting—Pump arm and plunger under dust cover at top of carburetor have two holes for connector link engagement. Recommended settings as follows:

Short Stroke—Normal Setting (Inner Hole in Pump Arm, Upper Hole in Pump Plunger).

Long Stroke—Maximum Setting (Outer Hole in Pump Arm, Lower Hole in Pump Plunger).

NOTE—To correct hesitating when starting in second gear on 462-S (Early '40) carburetors, set Accelerating Pump for Long Stroke.

Float Level—7/16" from machined projection on cover to top of soldered seam on float (Invert to check).

Fast Idle:—Integral type, built-in carburetor.

For complete data, refer to Carburetion Equip. Index.

Fast Idle Setting—Adjust by bending connecting link offset for ⅜" choke valve opening with stopscrew against (not on) first step of fast idle cam.

Accelerator Linkage Adjustment:—Must be maintained to provide correct 'Throttle cracking' action for starting. To adjust, set carburetor idle speed at 6-7 MPH, loosen hand throttle wire lock screw, pull button ⅛" out from instrument panel, position hand throttle lever so that no clearance exists between lever and throttle cross shaft, tighten lockscrew. Turn throttle stopscrew in 2 turns (with throttle stopscrew on high point of cam or 'cold' position), disconnect battery cable at starting motor, to prevent cranking, fully depress starting pedal, adjust throttle cracking pin so that all clearance between pin and cross shaft lever is taken up. Connect starting motor cable and reset idle speed.

Automatic Choke:—Carter Climatic Control.

For complete data, refer to Carburetion Equip. Index.

Setting—Set coil housing one notch rich.

CARBURETOR

TORPEDO 8 MODEL 40-29

CARBURETION (TORPEDO): — Carburetor — Carter Type WDO, Model 469-S (first), 469-SM (later). 1 5/16" dual downdraft type with Carter Climatic Control. ***For data, refer to Carburetor Index.***

Production Change—New metering rods used on 469-SM. ***For data, refer to Carburetor Index.***

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 7 MPH idle speed. Adjust idle adjusting screw for each barrel (in succession) until engine fires smoothly (setting ¼-1¼ turns open—turn screw in for leaner mixture). Readjust idle speed. Car manufacturer recommends use of vacuum gauge for this adjustment.

Accelerator Pump Setting—Not adjustable.

Float Level—5/16" from top of float to gasket seat on cover with needle valve seated (invert to check).

Fast Idle:—Integral type, built-in carburetor.

For complete data, refer to Carburetion Equip. Index.

Fast Idle Setting—Adjust fast idle screw for .010" throttle opening with choke valve fully closed.

Accelerator Linkage Adjustment:—Same as for Deluxe Eight. See instructions listed above.

Automatic Choke:—Carter Climatic Control.

For complete data, refer to Carburetion Equip. Index.

Choke Setting—1½ Notches Rich (may be set 4 notches rich to correct poor starting or leanness after starting) for first type thermostat marked '170-G-16S' on choke housing. Later type thermostat marked '170-F-16S' is set 2 Notches Rich.

CARB. EQUIPMENT

DELUXE 8 MODEL 40-28

Air Cleaner:—AC #1528128 oil wetted type with crankcase ventilator #502783 standard. #1529478 oil bath type with #499327 ventilator cleaner optl.

Fuel Pump:—AC Type AH #1523985 standard. Type AJ #1523986 fuel-and-vacuum pump optional.

For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge:—AC Electric, #1515371 (dash unit), #1515481 (tank unit).

For complete data, refer to Carburetion Equip. Index.

CARB. EQUIPMENT

TORPEDO 8 MODEL 40-29

Air Cleaner:—AC #1529478 heavy duty oil bath type standard.

Fuel Pump:—AC Type AJ #1537087 diaphragm type combination fuel-and-vacuum pump standard.

For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge:—AC Electric. #1515371 (dash unit), #1515481 (tank unit).

For complete data, refer to Carburetion Equip. Index.

BATTERY

BATTERY:—Delco Type 15E-1, 2. 6 volt, 15 plate, 100 ampere hour capacity (20 hour rate).

Starting Capacity—120 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.5 minutes. Five second voltage—4.25 volts.

Grounded Terminal—Negative (—) grounded to lower left side of block. No separate engine ground.

Dimensions—Length 19 5/16". Width 4". Height 9".

Location—Under engine hood on left side.

Police Battery:—Delco Type 19E-1. 6 volt, 19 plate, 130 A. H. capacity (20 hr. rate). End-to-end type.

Starting Capacity—150 amperes for 20 minutes.

Zero Capacity—300 amperes for 5.3 minutes. Five second voltage—4.55 volts.

All other data same as for 15E-1 above.

STARTER

STARTER:—Delco-Remy 1107914. Armature 1867897.

Drive—Overrunning clutch (manual pinion shift).

Rotation—Counter-clockwise at commutator end.

Cranking Engine—220-225 amperes at 5 volts.

Brush Spring Tension—24-28 ounces.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	6000	5.0	60
15 " "	Lock	3.0	600

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out capscrews.

Starting Switch:—Delco-Remy Part #820052. Mounted on starter. Operated by starting pedal.

For complete data, refer to Electrical Equipment Index.

CONTINUED ON NEXT PAGE

ENGINE

CONTINUED FROM PRECEDING PAGE

Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32"; #5, 1⅞".
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0015-.0025".

End Thrust:—Steel thrust plate behind camshaft sprocket. Replace if worn. **Endplay**—.002-.005".

Timing Chain:—Morse No. 2660, Type 766-T. Width ⅞". Pitch ⅜". Length 21" or 56 links.

Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.310-.311"	5.53"
Exhaust	1 11/32"	.310-.311"	5.53"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"
Exhaust	45°	19/64"	Free fit to .0006"

Valve Guides:—Removable, tapered guides (.001" taper to the inch with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through guide of own weight when started in guide. NOTE—Guides should be cleaned with wire brush or taper reamer Tool P.R. 131. Replacement guides straight cut, ream to fit valve stem after installing with reamer P.R. 131.

Valve Springs:—Intake and exhaust springs identical. Install with two closed coils at top and dampener on top of each spring. Use new dampeners whenever removed from spring. **Free Length** 2 9/16".

	Spring Pressure	Spring Length
Valve Closed	56-63 lbs.	1 29/32"
Valve Open	97-105 lbs.	1 19/32"

Valve Lifters:—Barrel type, cast-iron. Guides holes reamed in block. Lifters furnished .005" oversize (use special pilot reamer J-706-P when installing to obtain proper alignment). **Clearance**—Free fit. Lifter should just move freely with finger touch.

VALVE TIMING

Tappet Clearance:—.011-.013" all valves (engine warm). Use .011" feeler as 'go' gauge, .013" as 'no go'. NOTE—Car manufacturer recommends .013" exhaust clearance for sustained high speed driving.

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 5° BTDC. Close 39° ALDC.

Exhaust Valves—Open 45° BLDC. Close 5° ATDC.

Valve Timing Check—With .015" tappet clearance #8 intake valve should open with piston 5° or .0089" before top dead center with first straight line of flywheel mark '/IGN.ONE/' slightly past indicator in left front face of flywheel housing.

LUBRICATION

LUBRICATION:—Pressure type (gear type pump on right side. ***See Pontiac Shop Notes for Oil Pump data, recommended Crankcase Ventilator Outlet Pipe Cleaner removal (to improve crankcase ventilation) and installation of 1941 type Pontiac (built-in) Oil Cleaner.***
Normal Oil Pressure:—35-40 lbs. above 40 MPH.
Oil Pressure Regulator:—On pump. Opens at 40 lbs. Non-adjustable type. **Crankcase Capacity**—6 qts.

COOLING

COOLING SYSTEM:—**Capacity**—19 quarts.
See Pontiac Shop Notes for Radiator Core Removal.

Water Pump:—Packless, sealed ball-bearing shaft.
See Water Pump Section for complete data.

Removal—Remove fan belt, pump mounting bolts and lower hose. Lift off pump and fan assembly.

Thermostat:—Harrison. In cylinder head outlet. **Setting**—Closed 140°F. Starts 145°. Fully open 172°.

Temperature Gauge:—AC #1510916 (dash), #1510772 (engine unit). Electric type.
See Miscellaneous Section for complete data.

CLUTCH

CLUTCH:—**Inland.** 'Diaphragm' type, single plate, dry disc type with Long 9¼CF-CS driven member.
See Clutch Section for complete data.

Facings—Moulded (Ammco), 2 used. Inside Diam. 5¾". Outside Diam. 9¼". Thickness .125".

►**Clutch Slipping Correction**—Starting with engine number 8-217982 clutch cover spring tension has been increased from 1200 to 1400 lbs. to overcome clutch slippage and consequent damage to facings due to regularly starting car in second gear with excessive throttle opening. Car manufacturer recommends that new style clutch cover and pressure plate (Part No. 753615) be installed whenever clutch damage found due to this condition.

►**Clutch Pedal Rattle Correction**—Caused by endplay in countershaft lever as pedal depressed resulting from shrinkage of felt at each end of shaft. Correct by installing extra felt No. 502229 on frame end of shaft (CAUTION—leave original felts in place), and soak all felts in engine oil.
IMPORTANT—Oil felts regularly with engine oil.

Replacement Clutch Pilot Bushing Installation—***See Clutch Notes in Pontiac Special Data.***

Pedal Adjustment:—Pedal free travel ⅞-1⅛" (adjusting nut and locknut on link at clutch fork). Pedal height above toeboard (engaged) 4¾" (Deluxe), 5" (Torpedo). Adjusting screw on pedal.

Removal:—Remove transmission (see below), take off bottom housing cover, unlock pedal pull-back spring, remove fork ball support, fork and throwout bearing. Remove cover screws evenly until tension relieved. Move clutch away from flywheel at bottom to remove disc, then lower cover assembly out.

TRANSMISSION

TRANSMISSION:—**Own.** All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote steering col. shift.
See Transmission Section for complete data.

Transmission Control:—Pontiac 'Safety-Shift' type.
See Transmission Section for complete data.

Removal:—Remove floor mat and center panel. Disconnect speedometer cable, gearshift selector and control rods at transmission. Disconnect rear universal (wire trunnions) and pull propeller shaft to rear to disengage U-joint front yoke from transmission main shaft at slip joint. Remove upper transmission mounting screws, install guide pins (J-851), remove lower screws, pull unit to rear to free main drive gear, then up and forward at front.

UNIVERSALS

UNIVERSAL JOINTS:—**Mechanics 2C.** Roller bearing.
See Universals Section for complete data.
NOTE—1 piece driveshaft used. Slip joint formed at rear of transmission ahead of front universal.

REAR AXLE

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive.
See Rear Axle Section for complete data.
Ratio—4.3-1 Std. (white), 4.55-1 Mount. (yellow), 4.1-1 Plains (green), 3.9-1 Economy (red). NOTE—Color marks on end of right or left axle shaft (Torpedo carries additional blue mark on end of shaft). **Backlash**—.003-.012" (new).

Removal:—Disconnect rear universal and wire trunnions (do not disengage spline joint at front end of shaft), remove axle shafts (below), remove carrier flange capscrews, pull carrier assembly out.

Axle Shaft Removal:—Hoist rear of car, remove wheel, brake drum, 4 backing plate mounting bolt nuts and loosen bearing retainer (do not allow backing plate to shift to damage brake line). Pull shaft (Puller J-942) taking care not to drag shaft on oil seal. **Wheel Bearing Adjustment**—None.

SHOCK ABSORBERS

SHOCK ABSORBERS:—**Delco. Front**—1947-C, **D. Rear**—1000-V (Domestic), 1754-A, B (Deluxe Export), 1754-G, H (Torpedo Export). Double acting, hydraulic (Model 1000-V is direct acting type).

FRONT SUSPENSION

Front Suspension:—Independent, linked parallelogram type with coil springs.
See Front Suspension Section for complete data.
Kingpin Inclination—4⅝° to 5¼°.
Caster—Negative ¾°. Limits Neg. ½° to Neg. 1°.
Camber—Positive ⅜°. Limits 0° to ⅝° positive.
Toe In—0-1/16". Adjust tie rod tubes equally.
Steering Geometry—Inner wh'l 23° ± ½°. Outer 20°.

STEERING GEAR

Steering Gear: Saginaw Worm-and-Roller type with steering idler arm on right frame rail.
See Steering Gear Section for complete data.

BRAKES

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type without eccentric adjustment. Hand lever applies rear service brakes.
See Brake Section for complete data.
Drums—Chrome nickel iron. Diameter—11".
Wheel Cylinder Bore—Front wheel 1". Rear 15/16".
Lining—Moulded. Width 1¾". Thickness 3/16". Length 9 11/32" (Primary—D-R Multibestos 40-28 all wheels, 40-29 front wheels, 1236A Multibestos 40-29 rear wheels). 11 31/32" (Secondary—L-8 Multibestos 40-28, 2320K Hycoe 40-29).
Clearance—.015" at both ends of secondary shoe (with primary shoe forced out against drum).
Hand Brake:—See Service Brakes above.

MISC. MECHANICAL

Power Operated Convertible Top: Vacuum Power type.
See Miscellaneous Section for complete data.

mark '/IGN.ONE/' indicate allowable timing range of 4° on flywheel. Use first (6°) line for setting ignition (second line is 2° before top dead center mark). NOTE—Manufacturer recommends use of HM-494 Timing Light or J-578 Synchroscope for Timing.

To Set Timing (With Timing Light)—Connect timing light between distributor terminal and ground, turn on ignition. With #1 piston on compression, turn engine over until piston is 6° or .0138" before top dead center with first line of ignition mark '/IGN.ONE/' lined up with pointer in inspection hole in left front face of flywheel housing above starter. Loosen Gaselector screw, center pointer scale ('0' mark at reference line), tighten screw. Loosen advance arm clamp bolt, rotate distributor until timing lamp lights (contacts just opening), tighten clamp bolt. Check Gaselector setting.

To Set Timing (With Synchroscope)—Connect synchroscope in series with #1 spark plug, fill in first line of ignition mark '/IGN.ONE/' with chalk or white paint, direct synchroscope light on flywheel (inspection hole on left side), idle engine at 6 MPH., adjust distributor as directed above.

Gaselector Setting—Set for barely audible ping at 20-30 MPH. on level road with wide open throttle to obtain best performance for particular operating conditions and octane rating of fuel used. To adjust, loosen Gaselector arm screw, move arm clockwise (toward 'ADV' end of scale) to advance spark, counter-clockwise (to 'RET' end) to retard spark.

CARBURETOR

All 1941, Early 1942 (U.S.)

Carter Type WA-1, Model 494-S. 1¼" single barrel downdraft type with Carter Climatic Control. Casting Number #348 on flange.

For complete data, refer to Carburetor Index.

Late 1942 (U.S.), All 1942 Canadian

Carter Type W-1 (Cast-iron), Model 545-S (U. S.), 521-S (Canada). 1¼" single barrel downdraft type with Carter Climatic Control. Casting Number #476 (545-S), #461 (521-S) on flange.

For complete data, refer to Carburetor Index.

'42 Note—Accelerator cross shaft spacing washer (Part No. 502306) should be installed on left end of shaft on early cars (if washer missing) to avoid any binding in accelerator linkage assembly.

Idle Setting—Set throttle stopscrew for 7-8 MPH or 450-475 RPM (engine) hot or slow idle speed. Set idle adjusting screw for smooth idle with screw ¾-1¾ (494-S), ½-1½ turns open (Others). Turn screw in for leaner mixture. Recheck idle speed. NOTE—Vacuum gauge method recommended (see reading above).

Accelerator Pump Setting (494-S)—2 holes in Pump Arm and Pump Plunger. Set as follows:

Short Stroke—Normal Setting (Inner Hole in Pump Arm, Upper Hole in Pump Plunger).

Long Stroke—Maximum Setting (Outer Hole in Pump Arm, Lower Hole in Pump Plunger).

Accelerator Pump Setting (545-S, 521-S)—3 holes in pump arm. Set as follows:

Lower Hole—Medium Stroke, Normal Setting.
Inner Hole—Minimum Stroke, Summer Setting.
Upper Hole—Maximum Stroke, Winter Setting.

Float Level (521-S,545-S)—11/16" from top of float at free end to lower face of bowl cover. **(494-S)**—½" from top of projection on underside of bowl cover to top of seam on free end of float (invert to check).

Metering Rods & Jets—*Refer to Carburetor Index for Carter Downdraft Carburetor Jet Specification Table.*

Accelerator Linkage Adjustment:—Must be set to provide correct 'throttle cracking' action for starting. To adjust, after carburetor set for correct 7-8 MPH. hot or slow idle speed, disconnect battery cable at starting motor (to prevent starter cranking engine), fully depress starting pedal, adjust adjusting screw on accelerator cross-shaft lug at idler lever so that clearance between throttle stopscrew and stop is .138" (use 9/64" drill rod as gauge) with carburetor fast idle cam in slow idle position. NOTE—For 1941 cars, this adjustment made by means of eccentric throttle cracker pin on starter motor lever.

Fast Idle:—Integral type (built-in carburetor).

For complete data, refer to Carburetion Equip. Index.

Setting (521-S, 545-S)—Hold choke valve wide open allow fast idle cam to drop free. Back off throttle stopscrew until throttle valve closed and screw just clears low step of fast idle cam. Hold throttle valve closed, release choke valve. Choke will move fast idle cam until stopscrew rests against second position of cam. Bend offset portion of fast idle link (do not disturb cam) so choke valve opening is 5/8". **(494-S)**—With fast idle cam in hot or slow idle position, close choke valve until throttle stopscrew is against (not on) first step of fast idle cam, adjust by bending connector rod offset so that choke valve opening is 5/8" (check opening with gauge T109-85).

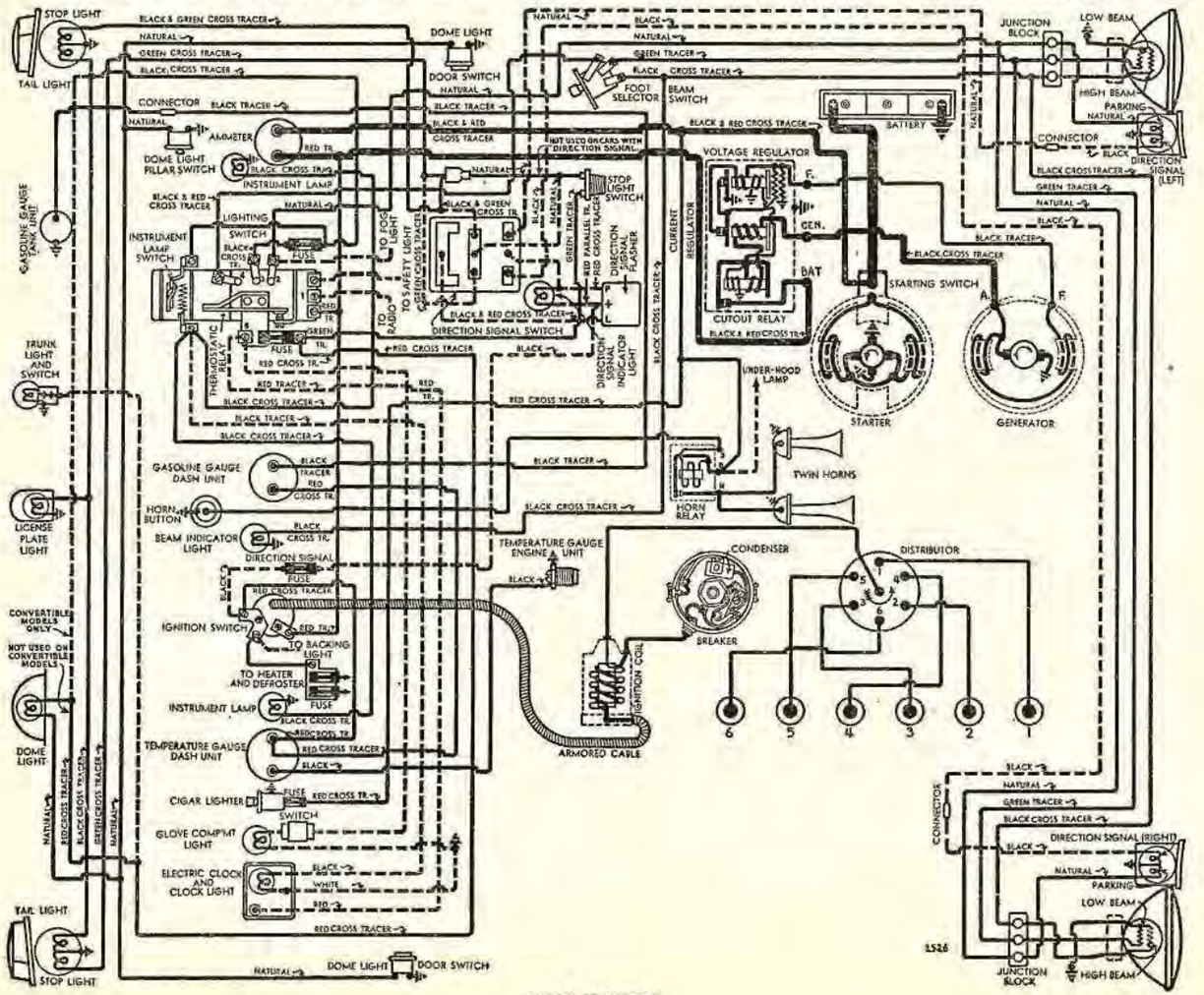
Automatic Choke:—Carter Climatic Control.

For complete data, refer to Carburetion Equip. Index.

Setting—Set coil housing 3 Notches Rich (all).

CARB. EQUIPMENT

Air Cleaner:—AC No. 1529871 oil-wetted type Std. #1542322 heavy duty oil-bath type optl. Use Replacement Filter Element Assembly: Type #1 (for #1529871), #1542245 (for 1542322). Copper gauze type cleaner installed on oil filler and crankcase ventilator cap (also on ventilator outlet pipe on cars with heavy-duty oil-bath air cleaner).



1942 MODELS

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ENGINE

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and .001" undersize. Rod bolt nuts self-locking.
Clearance—.0005-.0015" (new). **Endplay**—.005-.010".
Bearing Adjustment:—None (no shims). *Refer to Pontiac Shop Notes for Connecting Rod Lower Bearing.*
Installing Rods: No offset (can be installed either way).

CRANKSHAFT:—4 bearing, integral counterweights. *Refer to Pontiac Shop Notes for Harmonic Balancer Removal and Rear Main Bearing Oil Seal Renewal.*
Journal Diameters—#1, 2.4982-2.4992"; #2, 2.5294-2.5304"; #3, 2.5919-2.5929"; #4, 2.6232-2.6242".
Bearings—Thin type, steel-backed, white bearing metal alloy. Upper and lower halves alike. Furnished Std. and .001" undersize. **Clearance** .001-.003".
Bearing Adjustment:—None (no shims). *Refer to Pontiac Shop Notes for Bearing Removal & Fitting.*
End Thrust:—At #3 bearing. **Endplay**—.003-.008".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. *Refer to Pontiac Shop Notes for Camshaft Removal, Bearing Servicing and Timing Cover Oil Seal data.*
Bearing Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32".
Bearings—Steel-backed, babbitt-lined bushings.
Clearance—.0015-.0025" (new).
End Thrust:—Steel thrust plate behind camshaft sprocket. Replace if worn. **Endplay**—.002-.005".
Timing Chain: Morse Type C-1882-K (for 1941), Type C-1897-K (for 1942). Morse No. 1532 (all). Width 1". Pitch ⅜". Length 21" or 56 links.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 19/32"	.310-.311"	5.718"
Exhaust	1 15/32"	.310-.311"	5.718"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"①
Exhaust	45°	19/64"	Free fit to .0006"①

①Guides tapered (.0006" max. clearance at bottom).
Valve Guides:—Removable, tapered guides (.001" taper to the inch with greatest clearance at top). IMPORTANT—Measure clearance at bottom end. Valve should just fall through guide of own weight when started in guide. NOTE—Guides should be cleaned with Tool KMO-122 valve guide cleaner (blade type). Service guides not tapered (install and ream to fit valve stems with Reamer P.R.131).
Valve Springs:—Intake and exhaust springs identical. Install with two closed coils at top and dampener on top of each spring. Use new dampeners whenever removed from spring. **Free Length**—2 9/16".

	Spring Pressure	Spring Length
Valve Closed	56-63 lbs.	1 29/32"
Valve Open	97-105 lbs.	1 19/32"

Valve Lifters:—Barrel type, cast-iron. Guide holes reamed in block. Lifters furnished .005" oversize (use pilot reamer J-706-P when reaming holes to maintain alignment). **Clearance**—Free fit. Lifter should just move freely with finger touch.

VALVE TIMING

Tappet Clearance:—.011-.013" all valves (engine warm). Use .011" feeler as 'go' gauge, .013" as 'no go'. NOTE—Car manufacturer recommends .013" exhaust clearance for sustained high speed driving.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
Valve Timing Check—With .015" tappet clearance #1 intake valve should open with #1 piston 5° or .0096" before top dead center with first straight line of flywheel mark '/IGN.ONE/' slightly past indicator in left front face of flywheel housing. Reset tappet clearance .011-.013" (warm).

LUBRICATION

LUBRICATION:—Pressure (pump on right of engine). *Refer to Pontiac Shop Notes for Oil Pump Servicing and Crankcase Oil Cleaner Servicing data.*
Normal Oil Pressure:—35-45 lbs. with warm oil.
Oil Pressure Regulator: New spring-loaded disc type in pump. Not adjustable. Opens at 40 lbs.
Crankcase Capacity:—5 qts. (refill), 6 qts. (dry).

COOLING

COOLING SYSTEM:—**Capacity**—18 quarts. *See Pontiac Shop Notes for Radiator Core Removal.*
Pressure Valve—In filler cap. Opens at 3¾ lbs.
Water Pump:—Packless, sealed ball-bearing type. *See Water Pump Section for complete data.*
Thermostat:—Harrison. In cylinder head outlet. **Setting**—Starts to open 151° F. Fully open 173° F.
Temperature Gauge: AC Electric. Nos. Dash Unit: 1511053 ('41), 1511190 ('42). Engine Unit: 1510772. *See Miscellaneous Section for complete data.*

CLUTCH

CLUTCH:—**Inland.** 'Diaphragm' type, single plate, dry disc type. Driven Member Long 9CF-CS (10CF-CS Taxi). *See Clutch Section for complete data.*
Facings—Moulded, two used. Inside Diam. 6" (all), Outside Diam. 9⅛", 10" (Taxi). Thickness .125".
Pedal Adjustment:—Free travel ⅞-1⅛" (adjusting nut on link at clutch fork). Pedal height to lower face of pedal should be 4¾" (on 25), 5 3/16" (others). Adjust stopscrew at lower end of pedal arm.
Removal:—Remove transmission (see below), take off housing bottom cover and control shaft inner bracket. Disconnect pedal pull-back spring. Remove fork ball support, fork, and throwout bearing. Paint mark cover and flywheel (align marks when reassembling to maintain balance). Remove cover bolts (loosen bolts evenly until tension relieved). Move clutch to rear, take out clutch plate, remove cluteh.

TRANSMISSION

TRANSMISSION:—**Own Make.** All helical gear type, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote type shift. *See Transmission Section for complete data.*
Transmission Control:—Pontiac 'Safety-Shift' type.
►NOTE—Single shifter rod (replacing 2 rods and idler) used on late 41-24, 41-26 and for replacement. *See Transmission Section for complete data.*
Removal:—Disconnect speedometer cable, gearshift selector and control rods from transmission. Disconnect rear universal (wire trunnion) and pull out propeller shaft. Remove upper transmission mounting screws, install guide pins (J-851), remove lower screws, pull transmission to rear and lower out of car.

UNIVERSALS

UNIVERSAL JOINTS:—**Mechanics 2C or 2CR.** Roller bearing. Two used. NOTE—1 piece driveshaft used. *See Universals Section for complete data.*

REAR AXLE

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear with Hotchkiss drive. *See Rear Axle Section for data.*
Ratio—Standard: Model 25, 4.1-1; Others, 4.3-1. Optional: Economy 3.9-1, Heavy Duty 4.55-1. Color marked on end of right axle shaft as follows: 3.9 Red, 4.1 Green, 4.3 White, 4.55 Yellow.
Backlash—.003-.012" (new), slightly over .012" (worn).
Removal:—Disconnect rear universal (wire trunnions, do not disengage spline joint at transmission), remove axle shafts, carrier screws and carrier.
Axle Shaft Removal:—Remove wheel, brake drum, 4 backing plate bolt nuts, static collector, and loosen bearing retainer (do not move backing plate or brake line may be damaged). Pull shaft with puller J-942 (do not drag axle shaft on oil seal).
Wheel Bearing Adjustment—None.

SHOCK ABSORBERS

SHOCK ABSORBERS:—**Delco.** FRONT—Model 1947-C (right), 1947-D (left). REAR—1024-V. Double acting type Front, Direct acting Rear.

FRONT SUSPENSION

Front Suspension:—Independent, linked parallelogram type with coil springs and center steering. *See Front Suspension Section for complete data.*
Kingpin Inclination—5½-6°.
Caster—Negative ¾°. Limits Neg. ½° to Neg. 1°.
Camber—0° preferred. Limits Neg. ¼° to Pos. ¼°.
Toe In—0-1/16". Adjust tie rod tubes equally.
Steering Geometry—Inner wheel 23° ± ½°. Outer 20°.

STEERING GEAR

Steering Gear: Saginaw Worm-and-Roller type with steering idler arm on right frame rail. *See Steering Gear Section for complete data.*

BRAKES

1941 MODELS

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type **without eccentric adjustment.** Hand lever applies rear wheel service brakes. *See Brake Section for complete data.*
Wheel Cylinder Bore—Front wheel 1". Rear 15/16".
Drums—Steel (nickel alloy iron liner). Diameter 11".
Lining—Moulded. Width 1¾". Thickness 3/16". Length 9 11/32" (Primary shoe—D-R Multibestos), 11 31/32" (Secondary shoe—L-8 Multibestos).
Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.
Braking Power—53% front wheels, 47% rear.
Hand Brake:—See Service Brakes above.

BRAKES

1942 MODELS

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type **with eccentric adjustment** (not used in '41). Hand lever applies rear wheel service brakes. NOTE—Braking power increased 3% on front wheels by use of wider lining and larger wheel cylinder. *See Brake Section for complete data.*
Wheel Cylinder Bore—Front 1 1/16". Rear 15/16".
Drums—Pressed steel (alloy iron liner). Diam. 11".
Lining—Moulded. Width 2" (front), 1¾" (rear). Thickness 3/16". Length 9 11/32" (primary), 11 31/32" (secondary).
Clearance—.010" at heel and toe of each shoe.
Braking Power—56% front wheels, 44% rear.
Hand Brake:—See Service Brakes above.

MISC. MECHANICAL

Power Operated Conv. Top: (1941) Vacuum Power. (1942)—Electric type. *See Miscellaneous Section for complete data.*

turn engine over until piston is 6° or .0128" before top dead center with first line of ignition mark '/IGN.ONE/' lined up with pointer in inspection hole in left front face of flywheel housing above starter. Loosen Gaselector screw, center pointer scale ('0' mark at reference line), tighten screw. Loosen advance arm clamp bolt, rotate distributor until timing lamp lights (contacts just opening), tighten clamp bolt. Check Gaselector setting.

To Set Timing (With Synchroscope)—Connect synchroscope in series with #1 spark plug, fill in first line of ignition mark '/IGN.ONE/' with chalk or white paint, direct synchoscope light on flywheel (inspection hole on left side), idle engine at 6 MPH., adjust distributor as directed above.

Gaselector Setting—Set for barely audible ping at 20-30 MPH. on level road with wide open throttle to obtain best performance for particular operating conditions and octane rating of fuel used. To adjust, loosen Gaselector arm screw, move arm clockwise (toward 'ADV' end of scale) to advance spark, counter-clockwise (toward 'RET' end of scale) to retard spark, tighten locking screw.

CARBURETOR

1941 Models

Carter Type WDO, Model 469-SM. 1¼" dual, downdraft type with Carter Climatic Control. Casting No. 306 on flange.

For complete data and recommended corrections for: (1) Hesitation & Stumbling on Acceleration, (2) Throttle Sticking Correction, refer to Carburetor Index for Carter WDO article.

1942 Models

Carter Type WDO, Models 540-S (Early), 548-S (Later). 1¼" dual, downdraft type with Carter Climatic Control. Casting No. 306 on flange.

For complete data, refer to Carburetor Index.

'42 Note—Accelerator cross shaft spacing washer (Part No. 502306) should be installed on left end of shaft on early cars (if washer missing) to avoid any binding in accelerator assembly.

Idle Adjustment—With engine warm so that choke valve wide open and fast idle inoperative, set throttle stopscrew for idle speed of 7-8 MPH (450-475 RPM). Adjust idle adjusting screw so that engine fires smoothly (one screw for each barrel, adjust both screws alike). Final setting for each screw should be ¼-1¼ turns open from inner seated position (turn screws in for leaner mixture). Recheck idle speed. NOTE—Vacuum gauge recommended for this adjustment (see Vacuum Reading above).

Accelerating Pump Setting—Pump arm under dust cover (integral with air horn) has two holes for pump link engagement. Set as follows:
Lower Hole (min. stroke)—Normal all-year setting.
Upper Hole (max.)—If greater charge required.
NOTE—'41 469-SM carburetors not originally equipped with adjustable pump stroke. Replacement Pump Arm and Collar with adjustment provision available. ***See Recommended Correction for Hesitation and Stumbling on Acceleration in Carter WDO Carburetor article in the Carburetor Section.***

Float Level—5/16" from top of float to machined surface of cover (remove gasket, invert to check).

Metering Rods & Jets—***Refer to Carburetor Index for Carter Downdraft Carburetor Jet Specification Table.***

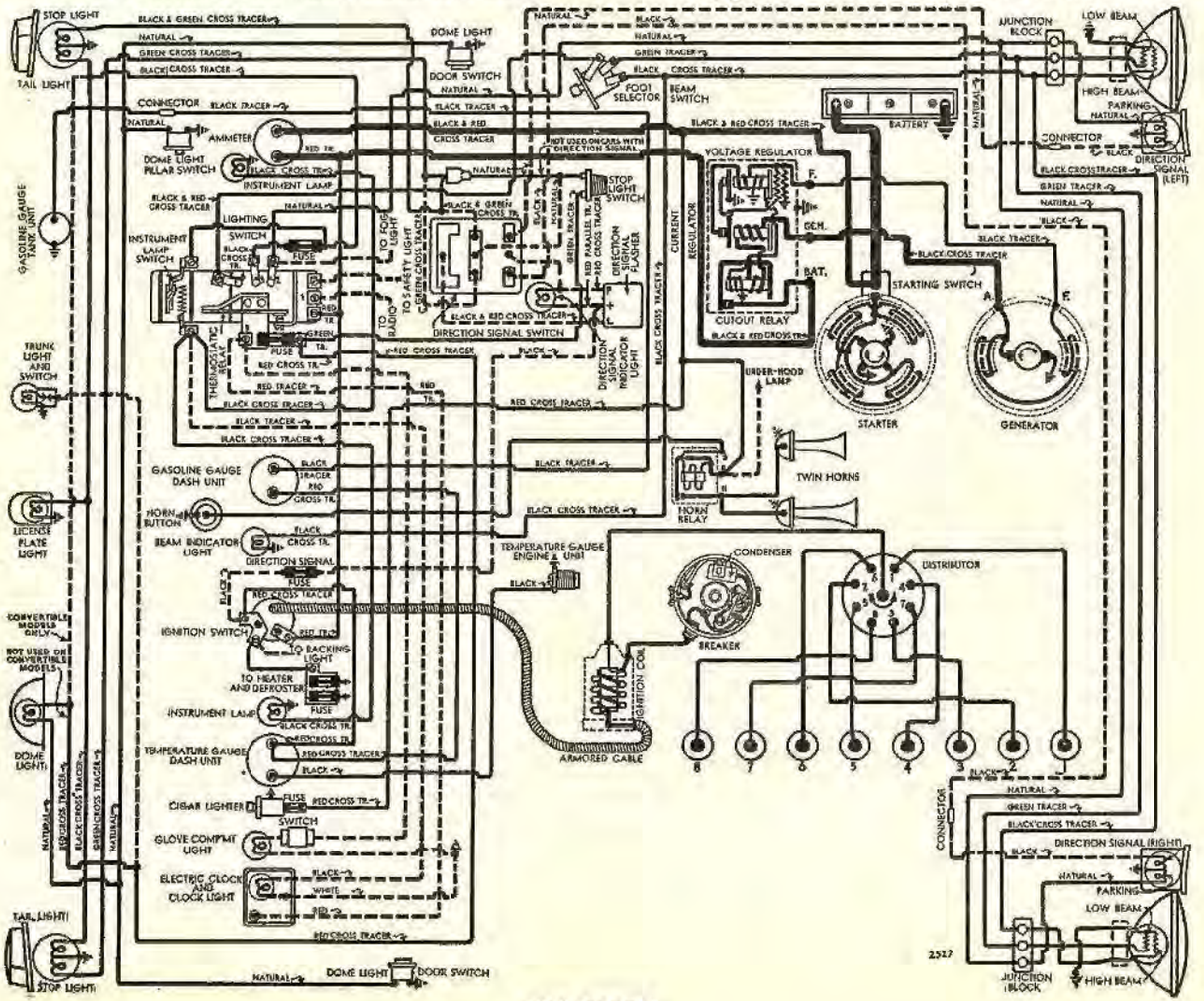
Accelerator Linkage Adjustment:—Must be set to provide correct 'throttle cracking' action for starting. To adjust, after carburetor set for correct 7-8 MPH hot or slow idle speed, disconnect battery cable at starting motor (to prevent starter cranking engine), fully depress starting pedal, adjust adjusting screw on accelerator cross-shaft lug at idler lever so that clearance between throttle stopscrew and stop is .115" (use flat steel stock .115" as gauge) with fast idle cam in hot or slow idle position.
NOTE—For 1941 cars, this adjustment made by means of eccentric throttle cracker pin on starter motor lever.

Fast Idle:—Integral type (built-in carburetor).
For complete data, refer to Carburetion Equip. Index.
Setting—With throttle stopscrew set for correct 7-8 MPH hot or slow idle speed, hold choke valve tightly closed, turn fast idle adjusting screw in until clearance between throttle lever stopscrew and stop on carburetor casting is .032" (1941), .073" (1942).
NOTE—This adjustment can also be made by holding choke valve tightly closed and adjusting fast idle screw for .010" ('41), .026" ('42) throttle opening.

Automatic Choke:—Carter Climatic Control.
For complete data, refer to Carburetion Equip. Index.
Setting (469-SM)—1½ Notches Rich (may be set 4 Notches Rich to correct poor starting or leanness after starting) for first type thermostat marked '170-G-16S' on choke housing. Later type thermostat marked '170-F-16S' is set 2 Notches Rich.
Setting (540-S, 548-S)—2 Notches Rich.

CARB. EQUIPMENT

Air Cleaner:—AC No. 1529473 oil-wetted type Std. #1529474 heavy duty oil-bath type Optl. Use Replacement Filter Element Assembly: Type #3 (for #1529473), #1528691 (for 1529474). Copper gauze type cleaner installed in oil filler and crankcase ventilator cap (also on ventilator outlet pipe on cars with heavy duty oil-bath air cleaner).
CAUTION—Filler cap must be installed with air opening in cap toward front of car and seam in line with groove in tube (may cause excessive oil consumption if installed backwards).



1942 MODELS

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ENGINE

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Pin Fit in Rod Bushing—.0004-.0006" clearance.
Replacement Pins:—.001" (red & brown), .003" (red), .005" (blue) oversize. Paint marked on end of pin.

CONNECTING ROD:—Weight 1.98 lbs. **Length** 7 9/16".
Piston Pin Bushing (Upper Bearing)—Split aluminum bronze bushings. *See Pontiac Shop Notes for data.*
Crankpin Journal Diameter—1.9987-1.9997".
Lower Bearing—New thin type, interchangeable, steel-backed, white bearing metal alloy. Furnished standard size and .001" undersize.
Clearance—.0005-.0015" (new). **Endplay**—.005-.010".
Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*
Installing Rods:—Not offset (install either way).
NOTE—Self-locking rod bolt nuts used.

CRANKSHAFT:—5 bearing, integral counterweights. *See Pontiac Shop Notes for Harmonic Balancer Removal.*
Journal Diameters—#1, 2.3732-2.3742"; #2, 2.4044-2.4054"; #3, 2.4357-2.4367"; #4, 2.4669-2.4679"; #5, 2.4982-2.4992".
Bearings—New thin type, steel-backed, white bearing metal alloy. Upper & lower halves alike. Furnished Std. & .001" undersize. **Clearance** .001-.003".
Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Removal and Fitting of Bearings.*
End Thrust:—At #4 bearing. **Endplay**—.003-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive. *See Pontiac Shop Notes for Camshaft Removal, Bearing Finished Sizes and Timing Cover Oil Seal data.*
Bearing Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32"; #5, 1⅞".
Bearings—Steel-backed, babbitt-lined bushings.
Clearance—.0015-.0025" (new).
End Thrust:—Steel thrust plate behind camshaft sprocket. Replace if worn. **Endplay**—.002-.005".
Timing Chain:—Morse Type 766-T (No. 2660). Width ¾". Pitch ⅜". Length 21" or 56 links.
Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	.310-.311"	5.53"
Exhaust	1 11/32"	.310-.311"	5.53"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"①
Exhaust	45°	19/64"	Free fit to .0006"①

① Guides tapered (.0006" max. clearance at bottom).

Valve Guides:—Removable, tapered guides (.001" taper to the inch with greatest clearance at top).
IMPORTANT—Measure clearance at bottom end. Valve should just fall through guide of own weight when started in guide. NOTE—Guides should be cleaned with Tool KMO-122 valve guide cleaner (blade type). Service guides straight cut, install guides (ream to fit valve stems with reamer P.R. 131).

Valve Springs:—Intake and exhaust springs identical. Install with two closed coils at top and dampener on top of each spring. Use new dampeners whenever removed from spring. **Free Length**—2 9/16".

	Spring Pressure	Spring Length
Valve Closed	56-63 lbs.	1 29/32"
Valve Open	97-105 lbs.	1 19/32"

Valve Lifters:—Barrel type, cast-iron. Guide holes reamed in block. Lifters furnished .005" oversize (use pilot reamer J-706-P when reaming holes to maintain alignment). **Clearance**—Free fit. Lifter should just move freely with finger touch.

VALVE TIMING

Tappet Clearance:—.011-.013" all valves (engine warm). Use .011" feeler as 'go' gauge, .013" as 'no go'. NOTE—Car manufacturer recommends .013" exhaust clearance for sustained high speed driving.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
Valve Timing Check—With .015" tappet clearance #8 intake valve should open with #8 piston 5° or .0089" before top dead center with first straight line of flywheel mark '/IGN.ONE/' slightly past indicator in left front face of flywheel housing. Reset tappet clearance .011-.013" (warm).

LUBRICATION

LUBRICATION:—Pressure (pump on right of engine). *Refer to Pontiac Shop Notes for Oil Pump Servicing and Crankcase Oil Cleaner Servicing data.*
Normal Oil Pressure: 35-45 lbs. with warm oil.
Oil Pressure Regulator: New spring-loaded disc type in pump. Not adjustable. Opens at 40 lbs.
Crankcase Capacity: 5 qts. (refill), 6 qts. (dry).

COOLING

COOLING SYSTEM:—Capacity 19½ qts. *See Pontiac Shop Notes Radiator Core Removal & Water Distr. Tube data.*
Pressure Valve—In filler cap. Opens at 3¾ lbs.
Water Pump:—Packless, sealed ball-bearing type. *See Water Pump Section for complete data.*
Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open 151° F. Fully open 173° F.
Temperature Gauge: AC Electric. Nos. Dash Unit: 1511053 ('41), 1511190 ('42). Engine Unit: 1510772. *See Miscellaneous Section for complete data.*

CLUTCH

CLUTCH:—Inland. 'Diaphragm' type, single plate, dry member. *See Clutch Section for complete data.*
Facings Moulded, 2 used. Inside Diameter 6". Outside Diameter 9½". Thickness .125" (⅛").
Pedal Adjustment:—Free travel ⅞-1⅛" (adjusting nut on link at clutch fork). Pedal height to lower face of pedal should be 4¾" (on 27), 5 3/16" (others). Adjust stopscrew at lower end of pedal arm.
Removal:—Remove transmission (see below), take off bottom housing cover and control shaft inner bracket. Disconnect pedal pull-back spring. Remove fork ball support, fork, and throwout bearing. Paint mark cover and flywheel (locating pin in flywheel discontinued) and reassemble to these marks to maintain balance. Remove cover bolts evenly until tension relieved. Move clutch away from flywheel at bottom to remove disc, lower assembly out of car.

TRANSMISSION

TRANSMISSION:—Own Make. All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with remote shift. *See Transmission Section for complete data.*
Transmission Control:—Pontiac 'Safety-Shift' type.
►NOTE—Single shifter rod (replacing 2 rods and idler) used on late 41-28, 41-29 and for replacement. *See Transmission Section for complete data.*
Removal:—Disconnect speedometer cable, gearshift selector and control rods from transmission. Disconneet rear universal (wire trunnions) and pull out propeller shaft. Remove upper transmission mounting screws, install guide pins (J-851), remove lower screws, pull transmission to rear and lower out of car.

UNIVERSALS

Mechanics 2C or 2CR. Roller bearing type. One piece drive shaft used (slip joint ahead of front U-joint). *See Universals Section for complete data.*

REAR AXLE

REAR AXLE:—**Own Make.** Semi-floating, Hypoid gear with Hotchkiss drive. *See Rear Axle Section for data.*
Ratio—Standard: Model 27, 4.1-1; Others 4.3-1. Optional: Economy 3.9-1, Heavy Duty 4.55-1. Color marked on end of right axle shaft as follows: 3.9 Red, 4.1 Green, 4.3 White, 4.55 Yellow.
Backlash—.003-.012" (new), slightly over .012" (worn).
Removal:—Disconnect rear universal and wire trunnions (do not disengage spline joint at transmission), remove axle shafts (see below), remove carrier flange capscrews, pull carrier assembly out.
Axle Shaft Removal:—Remove wheel, brake drum, 4 backing plate bolt nuts, static collector, and loosen bearing retainer (do not move backing plate or brake line may be damaged). Pull shaft with puller J-942 (do not drag axle shaft on oil seal).
Wheel Bearing Adjustment—None.

SHOCK ABSORBERS

SHOCK ABSORBERS:—Delco. FRONT—Model 1947-C (right), D (left). REAR—1024-V (Domestic). Double acting, hydraulic (1024-V direct acting).

FRONT SUSPENSION

Front Suspension:—Independent, linked parallelogram type with coil springs. *See Front Suspension Section for complete data.*
Kingpin Inclination—5½-6°.
Caster—Negative ¾°. Limits Neg. ½° to Neg. 1°.
Camber—0° preferred. Limits Neg. ¼° to Pos. ¼°.
Toe In—0-1/16". Adjust tie rod tubes equally.
Steering Geometry—Inner wheel 23° ± ½°. Outer 20°.

STEERING GEAR

Saginaw Worm-and-Roller, idler arm on right side. *See Steering Gear Section for complete data.*

BRAKES

1941 MODELS

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type **without eccentric adjustment.** Hand lever applies rear wheel service brakes. *See Brake Section for complete data.*
Wheel Cylinder Bore—Front wheel 1". Rear 15/16".
Drums—Steel (nickel alloy iron liner). Diameter 11".
Lining—Moulded. Width 1¾". Thickness 3/16". Length 9 11/32" (Primary shoe—D-R Multibestos), 11 31/32" (Secondary shoe—L-8 Multibestos).
Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.
Braking Power—53% front wheels, 47% rear.
Hand Brake:—See Service Brakes above.

BRAKES

1942 MODELS

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type **with eccentric adjustment** (not used in '41). Hand lever applies rear wheel service brakes. *See Brake Section for complete data.*
Wheel Cylinder Bore—Front 1 1/16". Rear 15/16".
Drums—Pressed steel (alloy iron liner). Diam. 11".
Lining—Moulded. Width 2" (front), 1¾" (rear). Thickness 3/16". Length 9 11/32" (primary), 11 31/32" (secondary).
Clearance—.010" at heel and toe of each shoe.
Braking Power—56% front wheels, 44% rear.
Hand Brake:—See Service Brakes above.

MISC. MECHANICAL

Power Operated Conv. Top: (1941) Vacuum Power. (1942)—Electric type. *See Miscellaneous Section for complete data.*

Breaker Gap—.020". Limits .018-.024".
Cam Angle or Dwell—35° closed, 25° open.
Breaker Arm Spring Tension—17-21 ozs.
Rotation—Counter-clockwise viewed from above.

Automatic Advance

Distributor Degrees	R.P.M	Engine Degrees	R.P.M.
Start	400	4	800
8	1050	16	2100
8.5	1450	17	2900
14.25	2000	28.5	4000

Gaselector—Manual adjustment providing 10° advance or retard from center '0' position. See Ignition Timing for Gaselector Adjustment.

Vacuum Spark Control: Delco-Remy Mod. No. 681-M (integral type linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit. **Plunger Travel**—9/64" total.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	7-9"
7½	15°	13-16"①
7½-8½	15-17°	16-18"

①—At .125" plunger travel.

Removal:—Distributor mounted on left side of engine. To remove, disconnect vacuum line, take out screw in Gaselector arm, lift distributor out.

IGNITION TIMING

Std. Setting—As given below for Regular Fuel (Std. 6.5-1 Head), Ethyl Fuel (Optl. 7.5-1 Head). See Gaselector Setting (following) for correction for operating conditions and fuel regularly used.

	Flywheel Degrees	Piston Position
All Engines	6°BTDC	.0138"BTDC

Timing Mark Note—Two straight lines of ignition mark '/IGN.ONE/' indicate allowable timing range of 4° on flywheel. Use first (6°) line for setting ignition (second line is 2° before top dead center mark). NOTE—Manufacturer recommends use of HM-494 Timing Light or J-578 Synchroscope for Timing.

To Set Timing (With Timing Light)—Connect timing light between distributor terminal and ground, turn on ignition. With #1 piston on compression, turn engine over until piston is 6° or .0138" before top dead center with first line of ignition mark '/IGN.ONE/' lined up with pointer in inspection hole in left front face of flywheel housing above starter. Loosen Gaselector screw, center pointer scale ('0' mark at reference line), tighten screw. Loosen advance arm clamp bolt, rotate distributor until timing lamp lights (contacts just opening), tighten clamp bolt. Check Gaselector setting.

To Set Timing (With Synchroscope)—Connect synchroscope in series with #1 spark plug, fill in first line of ignition mark '/IGN.ONE/' with chalk or white paint, direct synchroscope light on flywheel (inspection hole on left side), idle engine at 6 MPH., adjust distributor as directed above.

Gaselector Setting—Should be set to provide best performance without spark knock or ping for particular operating conditions and octane rating of fuel used. To adjust, loosen Gaselector arm screw, move arm clockwise (toward 'ADV' end of scale) to advance spark, counter-clockwise (toward 'RET' end of scale) to retard spark, tighten locking screw.

CARBURETOR

Synchro-Mesh Trans......**Carter WA-1, No. 537S**
Hydra-Matic Drive.....**Carter WA-1, No. 652S**
1¼" single barrel downdraft types with Carter Climatic Control.
Casting No. on Flange—388 (537S), 592 (652S).
See Carburetor Section for complete data.

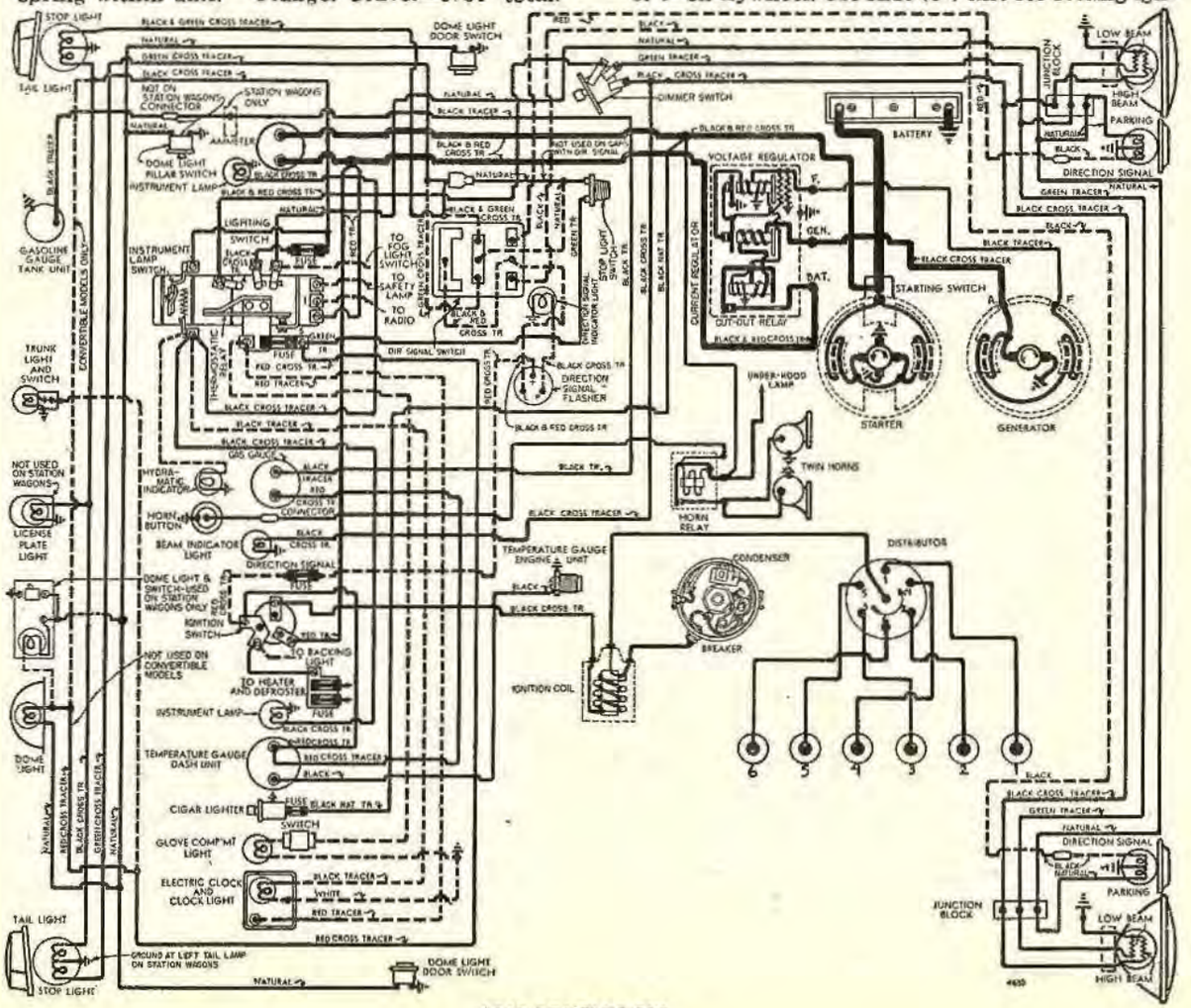
Settings (Idle Setting, Float Level, and Accelerating Pump): ***See Tune-Up data.***

Metering Rod & Jet—***See Carter Jet Table in Carburetor Section for complete data.***

►**Accelerator Pedal Service Note:** On new cars shipped from the factory, accelerator pedal hinge lockscrew is tightened only finger-tight (pedal must be removed for floor mat installation). **This screw must be securely tightened** (place screwdriver alongside locknut while turning screw in to lock hinge pin).

Accelerator Linkage Adjustment:—Must be set to provide correct 'throttle cracking' action for starting. To adjust, set carburetor idle speed at 450-475 RPM. (365-385 Hydra-Matic), disconnect battery cable at starting motor (to prevent starter cranking engine), insert 9/64" drill rod (or .138" diameter round steel rod) between throttle lever stopscrew and stop, fully depress starting pedal, adjust the adjusting screw on accelerator cross-shaft lug at idler lever (on Hydra-Matic, adjust throttle cracker lever mounted on throttle control lever—pin on starter lever must not strike throttle control lever) until gauge between the throttle stopscrew and stop just falls out with fast idle cam in slow idle position. NOTE—Before making this adjustment, check for full throttle opening with accelerator pedal fully depressed (adjust accelerator rod if required).

Hydra-Matic Throttle Adjustment: ***See Hydra-Matic Drive article in Transmission Section.***



1948 PONTIAC SIX

CONTINUED ON NEXT PAGE

position and cutting cigar lighter lead. Correct ineffective stops by drilling a #10 (.193") hole through the handle at the original stop point and installing fillister head machine screw (No. 100659), lockwasher (No. 138481), and nut (No. 120614) in hole.

►**Cigar Lighter Binding Correction (All Streamliner Models)**—This may be caused by misalignment of hole in instrument panel and hole in mounting bracket behind panel causing cigar lighter to stick in engaged position. Correct by installing special spacer, Part No. 509286, on mounting screw between instrument panel and bottom of bracket.

1948 LIGHTING SYSTEM SERVICE NOTES

►**Inoperative Stop Light (with Direction Signal):** On some early 1948 cars, 1 stop lamp (usually left) would not operate with brakes on and Direction Signal Switch in neutral due to misalignment at Direction Signal Switch. Correct by replacing direction signal base and wire assembly, part #5937832.

►**Underhood Light not turning off:** On some early 1948 cars, Underhood Light Switch improperly mounted resulting in light remaining on when hood closed. To correct, install lock washer between mounting nut and radiator baffle (was incorrectly assembled between switch and underside of radiator baffle which resulted in switch being set too low).

Headlamps: Guide "Sealed Beam" type. Upper and lower beams controlled by Beam Selector Switch on toeboard.
See Electrical Equipment Section for complete data.
Adjustment—Aim upper beams straight ahead (hot spot center 3" below lamp center height at 25 ft.).
Beam Indicator—Pontiac emblem on face of speedometer dial. Lighted when upper beams in use.

Direction Signal: *See Electrical Equipment Section.*
Direction Signal Indicator—Pilot bulb in Direction Signal Switch. Lighted whenever Right or Left Direction Signal operating.

Switches

Lighting—D-R Nos. ('46-47) 1995024, ('48) 1995035.
Instrument—Part of Lighting Switch. Rheostat operated by turning lighting switch knob.
Beam Selector—Delco-Remy No. 1997008.
Stop Light—Delco-Remy No. 1997725.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Park & Frt. Direc. Signal	21-3	1154
Park (Without Signal)	3	63
Instrument, Ign. Lock	1½	55
Beam & Direc. Signal Ind.	1	51
Stop & Tail	21-3	1154
Rear License Plate	3	63
Dome	15	88
Dome (Convertible)	1½	55

MISC. ELECTRICAL

THERMOSTATIC RELAY: Lighting. On switch. Contacts remain closed with 30 amperes, open in 3 minutes with current of 42 amperes at 70°F. Not adj.
Convertible Top—On rear of dash on right side. 30 ampere maximum capacity.

FUSES: Tail & Instrument Light. (1946-47) 9 ampere, (1948) SFE 14 ampere. In holder clipped to panel above lighting switch.
Stop & Dome Light—('46-47) 9 amp., ('48) SFE 14 ampere. On lighting switch.
Heater & Defroster—SFE 9 amp. each. In clip on instrument panel brace at steering column.
Direction Signal—SFE 9 amp. In connector in feed wire from ignition switch at panel brace.

HORNS: Delco-Remy No. 1999519 (Low Note), 1999520 (High Note). Vibrator type, blended tone, twin horns operated by relay.

Type	Current (at 6 volts)	Air Gap
1999519 (Low Note)	....19-21 amperes	.044-.049"
1999520 (High Note)	..18-20 amperes	.034-.039"

►**'46 Horn Ring Rattle & Failure of Horn to Blow (Deluxe Models) Correction**—*See Pontiac Shop Notes.*

►**'46 Horn Lead Wear Correction**—Blowing of horns when turning corners or when car is jarred may be caused by steering column shaft wearing through insulation of horn button lead at point where it enters steering column jacket. To correct this trouble (on first cars with rubber grommet in horn lead hole), remove and discard rubber grommet, install new horn button lead, No. 266918, which has 4-inch piece of protecting loom at point where wire enters jacket.

Horn Relay:—Delco-Remy No. 1116775.
Contact Gap—.025". **Air Gap**—.015" (closed).
Contacts Close—2.75-4.0 volts.

ENGINE

ENGINE SPECIFICATIONS: Own. Six Cylinder, "L" Head type.
Bore—3 9/16". **Stroke**—4".
Displacement—239.2 cu. ins. **Rated HP**—30.4.
Developed Horsepower—93½ at 3400 RPM.
Compression Ratio—6.5-1 Std., 7.5-1 Optl. iron hds.
Compression & Vacuum Reading—*See Tune-up data.*

ORIGINAL BORE & PISTONS: *See Pontiac Shop Notes.*

POWER PLANT ASSEMBLY REMOVAL & FRONT INSULATOR REMOVAL: *See Pontiac Shop Notes.*

TIGHTENING TORQUES: *See Pontiac Shop Notes.*

CYLINDER HEAD: Tightening Torque & Cylinder Head Diagram—*See Pontiac Shop Notes.*

PISTONS: Chrome nickel alloy, electro-plated type. Pistons have 20 oil drain holes in oil ring groove (same as 1942 type). NOTE—Pistons are plated with lead-tin alloy or pure tin (lead-tin alloy darker color) and cannot be ground. Use finished replacement pistons.
Length 3 19/32". **Weight**—27.1 ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—Top Land .0175-.0295". Skirt .002".

Fitting New Pistons:—Insert .0015" x ½" feeler between piston and cylinder wall. Pull to withdraw feeler must be 10-20 lbs. Taper and out-of-round limits—Piston .0005", Cylinder .0005" max. new.

Replacement Pistons: *See Pontiac Shop Notes.*

PISTON RINGS: Two tapered-face compression rings above pin, one slotted oil control ring below pin. Oil ring groove has 20 oil drain holes.
NOTE—Rings are cadmium-plated or tin-plated.

Ring	Width	End Gap	Side Clearance
Compr. (#1,2)	3/32"	.006-.013"	.0015-.003"
Oil (#3)	3/16"	.007-.017"	.001-.0025"

Installing Rings—Install compression rings with mark "TOP" upward.

Replacement Rings: Furnished in Oversizes of .005", .010", .020", .030".

PISTON PIN: Diameter 15/16". **Length** 3 1/16". Pin is shot-peened type (shot-peened before final grinding and lapping). Pin is locked in one piston boss by self-locking lockscrew and opposite boss is slotted to permit pin movement.
Pin Fit in Piston—*See Pontiac Shop Notes for data.*
Pin Fit in Rod Bushing—.0004-.0006" clearance.

Pin Removal & Installation: *See Pontiac Shop Notes.*

Replacement Pins:—.001" (red & brown), .003" (red), .005" (blue) oversize. Paint marked on end of pin.

CONNECTING ROD: Weight 37 ozs. **Length** 7 9/16".
Piston Pin Bushing (Upper Bearing)—Split aluminum bronze bushings. *See Pontiac Shop Notes for data.*
Crankpin Journal Diameter—2.1237-2.1247".
Lower Bearing—New thin type, interchangeable, steel-backed, babbitt-lined type.
Clearance—.0001-.0021". **Sideplay** .007-.030".

Bearing Adjustment: None (no shims). *See Pontiac Shop Notes for Fitting and Installing Bearings.*

Replacement Bearings: Standard size & .001" Undersize. NOTE—Bearings have small tongue which must engage groove in rod and cap.

Installing Rods: Not offset (install either way).
NOTE—Rods and bearing caps marked to insure correct reassembly (marks must be together). These marks do not indicate cylinder in which rod used.
CAUTION—Keep each connecting rod and its bearing cap together.

CRANKSHAFT: Four bearing type with integral counterweights and vibration dampener on forward end.

►**Flywheel to Crankshaft Bolts (on Synchro-Mesh Transmission)**—¾" hex head bolts (No. 508463) or 1" hex head bolts (No. 510832) are used. Either type can be used for replacement but **head sizes must be alike on all bolts or engine balance will be destroyed.**

►**Vibration Dampener (Harmonic Balancer) Removal**—*See Pontiac Shop Notes.*
Journal Diameters—#1, 2.4982-2.4992"; #2, 2.5294-2.5304"; #3, 2.5919-2.5929"; #4, 2.6232-2.6242".
Bearings—Thin type, removable, steel-backed, babbitt-lined. Upper and lower bearing halves alike.
Clearance—.0003-.0023".

Bearing Adjustment:—None (no shims). *See Pontiac Shop Notes for Removal and Fitting of Bearings.*

►**Rear Main Bearing Oil Seal Renewal**—*See Pontiac Shop Notes.*

Replacement Bearings: Standard size & .001" Undersize.

End Thrust: Taken by #3 (rear intermediate) bearing. **Endplay**—.003-.007".

CAMSHAFT: Four bearing type with non-adjustable (two sprocket) chain drive.
Camshaft Removal & Timing Cover Oil Seal Servicing—*See Pontiac Shop Notes.*
Bearing Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 29/32".
Bearings—Steel-backed, babbitt-lined bushings. *See Pontiac Shop Notes for bearing finished sizes.*
Clearance—.0015-.0025" (new).

End Thrust:—Steel thrust plate behind camshaft sprocket. Replace if worn. **Endplay**—.002-.005".

Timing Chain: Morse. Width 1". Pitch ⅜". Length 21" or 56 links.
Timing Chain Installation—*See Pontiac Shop Notes.*

Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

CONTINUED ON NEXT PAGE

Transmission Control: Pontiac "Safety-shift" remote control type with gearshift lever on steering column. *See Transmission Section for complete data.*

Removal:—Disconnect speedometer cable, gearshift selector and control rods from transmission. Disconnect rear universal (wire trunnions) and pull out propeller shaft. Remove upper transmission mounting screws, install guide pins (J-851), remove lower screws, pull transmission to rear and lower out of car.

Installation Note—Use guide pins installed in two upper transmission mounting holes to assist in sliding transmission straight forward into place (to avoid damage to clutch release bearing tubular support).

NOTE—These guide pins may be made from ½-13 American National Thread bolts by cutting heads off and reducing over-all length to 4¼".

HYDRA-MATIC DRIVE

OPTIONAL EQUIPMENT

Own Make. Consists of fluid coupling and 4 speed automatic transmission.
See Transmission Section for complete data including Testing & Trouble Shooting.

Lubrication—Check fluid level in transmission every 2000 miles (lubrication period). Drain and refill every 25,000 miles. Use only GM Hydra-Matic Drive Fluid.

Capacity—11 qts. (drain oil pan and torus cover and refill). **12 qts.** (drain, disassemble, assemble transmission and refill).

Checking Fluid Level—Roll back floor mat, remove cover on floor board, set hand brake and start engine, set control lever in "DR" position, allow to run about 2 minutes. Remove indicator, wipe dry, then return and check level of fluid with indicator. Add fluid until level is at "FULL" mark.

►*CAUTION—Always check oil level when oil is hot, engine idling, hand brake tightly set and control lever in "DR" position.*

►**Oil Level Indicator Change**—A new indicator, Part No. 8605800 (stamped on blade—earlier type not marked) reduces capacity approx. 1 pint providing slightly lower fluid operating level to reduce fluid foaming when oil is hot.

Hydra-Matic Linkage Adjustment—*See Hydra-Matic Drive article in Transmission Section.*

Removal: *See Hydra-Matic Drive article in Transmission Section.*

UNIVERSALS

Mechanics Model 2CR. Roller bearing type, 2 used. *See Universal Section for complete data.*

►**1947-48 CAUTION**—Rear universal nut controls rear axle pinion bearing "pre-load" (must be adjusted whenever nut is loosened). *See Pontiac Rear Axle article in Rear Axle Section for complete data.*
NOTE—Driveshaft is one-piece type (slip joint on transmission mainshaft, ahead of front universal).

REAR AXLE

1946 Type—Same as 1942. Hypoid gear, semi-floating type. This type axle has three setscrews equally spaced around pinion housing.
See Rear Axle Section for complete data.

1947-48—New hypoid gear, semi-floating type. Design similar to 1946 type except that pinion is mounted on two taper roller bearings and companion flange nut controls pinion bearing "pre-load." No setscrews are used.

►CAUTION—Rear universal companion nut controls pinion bearing "pre-load".
See Rear Axle Section for complete data.

Ratios—As shown. Axles may be identified by paint mark on end of right hand axle shaft.

Model	Ratio	Ident. Paint Mark
Torpedo Std.	4.1-1	Green
Streamliner Std.	4.3-1	White
Hydra-Matic (All)	3.63-1	Violet
All (Econ.)	3.9-1	Red
All (Heavy Duty)	4.55-1	Yellow

Backlash—.003-.012" (new), slightly over .012" (worn).

Removal:—Disconnect rear universal and wire trunnions (do not disengage spline joint at transmission), remove axle shafts and carrier flange capscrews. Withdraw carrier assembly from housing.

►**1947-48 CAUTION**—Rear U-joint companion flange nut controls pinion bearing "pre-load" (must be adjusted whenever nut is loosened).

Axle Shaft Removal:—Remove wheel, brake drum, 4 backing plate bolt nuts, static collector, and loosen bearing retainer (do not move backing plate or brake line may be damaged). Pull shaft with puller J-942 (do not drag axle shaft on oil seal).

Wheel Bearing Adjustment—None.

SHOCK ABSORBERS

Delco Model 1947-C,D (front), Model 1044-V (rear). Hydraulic, double acting (front), direct (rear).

Adjustment: None (except by changing valve calibration).

Refilling: Requires dismantling of unit. See Shock Absorber article in Shock Absorber Section for directions.

FRONT SUSPENSION

Front Suspension: Independent, linked parallelogram type with coil springs.
See Front Suspension Section for complete data.

Kingpin Inclination—5½-6° crosswise.

Caster—Negative ¾°. Limits Neg. ½° to Neg. 1°.

Camber—0° preferred. Limits Neg. ¼° to Pos. ¼°.

Toe In—0-1/16". Adjust tie rod tubes equally.

Steering Geometry—Inner wheel 23° ± ½°. Outer 20°.

STEERING GEAR

Saginaw. Worm-and-Roller type.
See Steering Gear Section for complete data.

BRAKES

Service: Bendix Hydraulic, Duo-Servo, Single Anchor type with eccentric adjustment. Hand lever applies rear service brakes.
See Brake Section for complete data.

►IMPORTANT SERVICE NOTE—**Brake Drums**—Two different makes are used: 1) Kelsey-Hayes type can be identified by one-piece stamping and flange having a sharp edge; 2) Motor Wheel type consisting of two-stampings and rolled flange. **Each pair of drums (on opposite sides of car) front or rear must be the same type.**

	Brake Drum Part Numbers		
	Front Wheel		Rear
	Left	Right	Wheel
Kelsey-Hayes	507371	507370	505300
Motor Wheel	509221	509220	409176

Drums—Pressed steel with alloy iron liner. Diameter 11".

Clearance—.010" at heel and toe of each shoe.

Lining—Moulded. Width per wheel: 2" (front), 1¾" (rear). Thickness 3/16". Length per shoe: 9 11/32" (primary), 11 31/32" (secondary).

Braking Power—56% Front, 44% Rear.

Master Cylinder Filling Note—New cars shipped from the factory have master cylinder filled to level ⅞" below top of filler neck and this level is satisfactory for service (cylinders were filled to ½" below top).

Hand Brake: See Service Brakes above.
NoRol: Optional. *See Brake Section for complete data.*

MISC. MECHANICAL

Convertible Top Control: Hydro-lectric type (hydraulic actuation with motor-driven pump supplying oil under pressure for power cylinders).
See Miscellaneous Section for complete data.

DISTRIBUTOR: Delco-Remy 1110804. Single breaker, 8 lobe cam, full automatic advance type with auxiliary vacuum control and Gaselector adjustment.

►**Late 1948 Distributor Cap**—Has built-in radio suppression. Can be identified by high wire towers and marks "Radio" on lower edge of cap on each side.

Breaker Gap—.015". Limits .0125-.0175".

Cam Angle or Dwell—31° closed, 14° open.

Breaker Arm Spring Tension—19-23 ozs.

Rotation—Counter-clockwise viewed from above.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	2	600
7	1100	14	2200
8½	1500	17	3000
13½	2100	27	4200

Gaselector—Manual adjustment providing 10° advance or retard from center '0' position. See Ignition Timing for Gaselector adjustment.

Vacuum Spark Control. Delco-Remy Model No. 1116-021. (integral type linked directly to breaker plate). Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit. **Plunger Travel**—7/32".

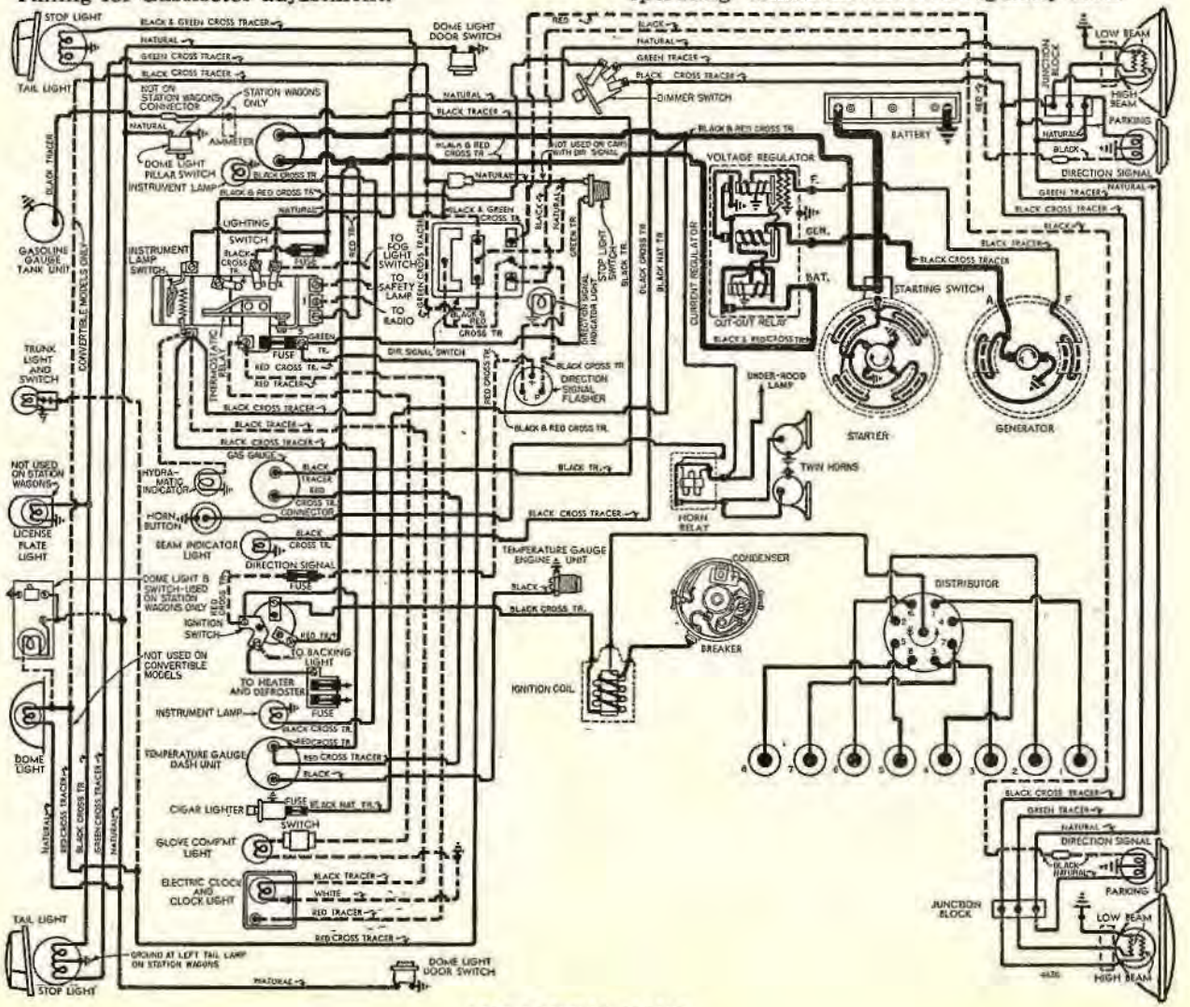
Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	7-9"
7½°	15°	13-16"
9-10°	18-20°	16-21"

Removal:—Distributor mounted on left side of engine. To remove, disconnect vacuum line, take out hold-down screw in Gaselector arm, lift distributor out.

IGNITION TIMING

Std. Setting—As given below for Regular Fuel (Std. 6.5-1 Head), Ethyl Fuel (Optl. 7.5-1 Head). See Gaselector Setting (following) for correction for operating conditions and fuel regularly used.



1948 PONTIAC EIGHT

Flywheel Degrees Piston Position

All Engines ..... 6° BTDC ..... .0128" BTDC.

Timing Mark Note—Two straight lines of ignition mark '/IGN.ONE/' indicate allowable timing range of 4° on flywheel. Use first (6°) line for setting ignition (second line is 2° before top dead center mark).

To Set Timing (With Timing Light)—Connect timing light between distributor terminal and ground, turn on ignition. With #1 piston on compression, turn engine over until piston is 6° or .0128" before top dead center with first line of ignition mark '/IGN.ONE/' lined up with pointer in inspection hole in left front face of flywheel housing above starter. Loosen Gaselector screw, center pointer scale ('0' mark at reference line), tighten screw. Loosen advance arm clamp bolt, rotate distributor until timing lamp lights (contacts just opening), tighten clamp bolt. Check Gaselector setting.

To Set Timing (With Synchroscope)—Connect synchroscope in series with #1 spark plug, fill in first line of ignition mark '/IGN.ONE/' with chalk or white paint, direct synchroscope light on flywheel (inspection hole on left side), idle engine at 6 MPH., adjust distributor as directed above.

Gaselector Setting—Should be set to provide best performance without spark knock or ping for particular operating conditions and octane rating of fuel used. To adjust, loosen Gaselector arm screw, move arm clockwise (toward 'ADV' end of scale) to advance spark, counter-clockwise (toward 'RET' end of scale) to retard spark, tighten locking screw.

CARBURETOR

1946 TYPE "WDO"

Carter Type WDO, Model 548S. 1¼" Dual (double barrel), Downdraft type with Carter Climatic Control.

Casting No. on Flange—306.

See Carburetor Section for complete data.

Settings (Idle Setting, Float Level, and Accelerating Pump): ***See Tune-Up.***

Metering Rods Jets—***See Carter Jet Table in Carburetor Section for complete data.***

Accelerator Linkage Adjustment: See 1947-48 information listed below.

Fast Idle: Carter Dual (WDO) Carburetor type.

See Carburetion Equipment Section for complete data.

Setting—With the carburetor set for correct 7-8 MPH hot or slow idle speed, hold choke valve tightly closed, turn fast idle adjusting screw in until clearance between throttle lever stopscrew and stop on carburetor casting is .073". NOTE—This adjustment can also be made by backing off throttle stopscrew so that throttle valves tightly closed, then hold choke valve closed, turn fast idle screw in until it contacts high point of fast idle cam, then turn screw in until throttle opening is exactly .026".

Automatic Choke: Carter Climatic Control (dual carburetor type).

See Carburetion Equipment Section for complete data.

Setting—Coil housing 2 Notches Rich.

CARBURETOR

1947-48 TYPE "WCD"

Carter WCD, No. 630S, SA, or SB (Standard).
Carter WCD, No. 653S (Hydra-Matic Drive Cars).
1¼" dual barrel downdraft types with Carter Climatic Control.

CONTINUED ON NEXT PAGE

LIGHTING

1946-47 LIGHTING SYSTEM SERVICE NOTES

►**Wiring Harness Wire Colors (1946)**—Some harnesses were used in which wires were incorrectly color-coded (tracers not as shown in wiring diagram). All such wires were marked by typed identification on paper sleeve attached to the wire. CAUTION—If these identification are removed from wires, it will be necessary to trace circuits for continuity.

►**Chafing of Wiring Harness (causing a short in hot lead from starter terminal)**—Clearance between harness containing this lead and moving parts (Starter pedal lever, Accelerator pedal lever, Accelerator cross-shaft) must be ⅜-½". Make certain that harness is correctly installed (should pass down between starter and engine and then under starter), and that lower clamp-on clip on starter pedal bracket is closed tight so that harness cannot bend forward and rub on accelerator cross-shaft.

►**Back-up Light Faulty Operation and Blown Fuses**—Faulty operation caused by bending of switch support by over-travel of gearshift lever on first cars with No. 5933752 switch support. Correct by installing new type flexible Switch Support, Part No. 509257, and Switch Actuating Stop, Part No. 509258. NOTE—New type Back-up Light Switch, Part No. 5936850 (with longer plunger) replaces No. 5933751.

Short-circuits causing Blown Fuses—May be caused by plastic tip of switch plunger cracking off on first type switches allowing plunger insert to short on switch stop. Install new switch No. 5936850.

►**Cigar Lighter Faulty Operation and Short-circuits** Caused by Cowl Ventilator handle cutting into cigar lighter feed wire. Check open position of cowl ventilator, make certain that stop on handle is sufficiently high to prevent handle moving beyond open position and cutting cigar lighter lead. Correct ineffective stops by drilling a #10 (.193") hole through the handle at the original stop point and installing fillister head machine screw (No. 100659), lockwasher (No. 138481), and nut (No. 120614) in hole.

Cigar Lighter Binding Correction (Streamliner Models)—This may be caused by misalignment of hole in instrument panel and hole in mounting bracket behind panel causing cigar lighter to stick in engaged position. Correct by installing special spacer, Part No. 509286, on mounting screw between instrument panel and bottom of bracket.

1948 LIGHTING SYSTEM SERVICE NOTES

►**Inoperative Stop Light (with Direction Signal):** On some early 1948 cars, 1 stop lamp (usually left) would not operate with brakes on and Direction Signal Switch in neutral due to misalignment at Direction Signal Switch. Correct by replacing direction signal base and wire assembly, part #5937832.

►**Underhood Light not turning off:** On some early 1948 cars, Underhood Light Switch improperly mounted resulting in light remaining on when hood closed. To correct, install lock washer between mounting nut and radiator baffle (was incorrectly assembled between switch and underside of radiator baffle which resulted in switch being set too low).

Headlamps: Guide "Sealed Beam" type. Upper and lower beams controlled by Beam Selector Switch on toeboard.
See Electrical Equipment Section for complete data.
Adjustment—Aim upper beams straight ahead (hot spot center 3" below lamp center height at 25 ft.).

Beam Indicator—Pontiac emblem on face of speedometer dial. Lighted when upper beams in use.

Direction Signal: *See Electrical Equipment Section.*
Direction Signal Indicator—Pilot bulb in Direction Signal Switch. Lighted whenever Right or Left Direction Signal operating.

Switches

Lighting—D-R Nos. ('46-47) 1995024, ('48) 1995035.
Instrument—Part of Lighting Switch. Rheostat operated by turning lighting switch knob.
Beam Selector—Delco-Remy No. 1997008.
Stop Light—Delco-Remy No. 1997725.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Park & Frt. Direc. Signal	21-3	1154
Park (Without Signal)	3	63
Instrument, Ign. Lock	1½	55
Beam & Direc. Signal Ind.	1	51
Stop & Tail	21-3	1154
Rear License Plate	3	63
Dome	15	88
Dome (Convertible)	1½	55

MISC. ELECTRICAL

THERMOSTATIC RELAY: Lighting. On switch. Contacts remain closed with 30 amperes, open in 3 minutes with current of 42 amperes at 70°F. Not adj.
Convertible Top—On rear of dash on right side. 30 ampere maximum capacity.

FUSES: Tail & Instrument Light. (1946-47) 9 ampere, (1948) SFE 14 ampere. In holder clipped to panel above lighting switch.
Stop & Dome Light—('46-47) 9 amp., ('48) SFE 14 ampere. On lighting switch.
Heater & Defroster—SFE 9 amp. each. In clip on instrument panel brace at steering column.
Direction Signal—SFE 9 amp. In connector in feed wire from ignition switch at panel brace.

HORNS: Delco-Remy No. 1999519 (Low Note), 1999520 (High Note). Vibrator type, blended tone, twin horns operated by relay.

Type	Current (at 6 volts)	Air Gap
1999519 (Low Note)	19-21 amperes	.044-.049"
1999520 (High Note)	18-20 amperes	.034-.039"

►**'46 Horn Ring Rattle & Failure of Horn to Blow (Deluxe Models) Correction**—*See Pontiac Shop Notes.*

►**'46 Horn Lead Wear Correction**—Blowing of horns when turning corners or when car is jarred may be caused by steering column shaft wearing through insulation of horn button lead at point where it enters steering column jacket. To correct this trouble (on first cars with rubber grommet in horn lead hole), remove and discard rubber grommet, install new horn button lead, No. 266918, which has 4-inch piece of protecting loom at point where wire enters jacket.

Horn Relay: Delco-Remy No. 1116775.
Contact Gap—.025". **Air Gap**—.015" (closed).

ENGINE

ENGINE SPECIFICATIONS: Own. Eight Cylinder, "L" Head type.
Bore—3¼". **Stroke**—3¾".
Displacement—248.9 cubic ins. **Rated HP**—33.8.
Developed Horsepower—107½ at 3700 RPM.
Compression Ratio—6.5-1 Std. 7.5-1 Optl.
Compression & Vacuum Reading—*See Tune-up data.*

ORIGINAL BORE & PISTONS: *See Pontiac Shop Notes.*

POWER PLANT ASSEMBLY REMOVAL & FRONT INSULATOR REMOVAL: *See Pontiac Shop Notes.*

TIGHTENING TORQUES: *See Pontiac Shop Notes.*

CYLINDER HEAD: Tightening Torque & Cylinder Head Diagram—*See Pontiac Shop Notes.*

PISTONS: Chrome nickel alloy, electro-plated type. Pistons have 20 oil drain holes in oil ring groove (same as 1942 type). NOTE—Pistons are plated with lead-tin alloy or pure tin (lead-tin alloy darker color) and cannot be ground. Use finished replacement pistons.
Length—3 19/32". **Weight**—24.7 ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—Top Land .0165-.0285". Skirt .002"

Fitting New Pistons:—Use .0015" x ½" feeler between piston and cylinder wall. Pull to withdraw feeler 10-20 lbs. Taper & out-of-round limits .0005" max.

Replacement Pistons: *See Pontiac Shop Notes.*

PISTON RINGS: Two tapered-face compression rings above pin, one slotted oil control ring below pin. Oil ring groove has 20 oil drain holes.
NOTE—Rings are cadmium-plated or tin-plated.

Ring	Width	End Gap	Side Clearance
Compr. (#1, 2)	3/32"	.008-.015"	.0015-.003"
Oil (#3)	3/16"	.006-.013"	.001-.0025"

Installing Rings—Install compression rings with mark "TOP" upward.

Replacement Rings: Furnished in Oversizes of .005", .010", .020", .030".

PISTON PIN: Diameter 15/16". Length 2⅞".
Pin is shot-peened type (shot-peened before final grinding and lapping). Pin is locked in one piston boss by self-locking lockscrew and opposite boss is slotted to permit pin movement.
Pin Fit in Piston—*See Pontiac Shop Notes for data.*
Pin Fit in Rod Bushing—.0004-.0006" clearance.

Pin Removal & Installation: *See Pontiac Shop Notes.*

Replacement Pins:—.001" (red & brown), .003" (red), .005" (blue) oversize. Paint marked on end of pin.

CONNECTING ROD: Weight 31.7 ozs. Length 7 9/16".
Piston Pin Bushing (Upper Bearing)—Split aluminum bronze bushings. *See Pontiac Shop Notes for data.*
Crankpin Journal Diameter—1.9987-1.9997".
Lower Bearing—Thin type, interchangeable steel-backed, babbitt-lined type.
Clearance—.0001-.0021". **Sideplay**—.007-.012".

Bearing Adjustment:—None (no shims). *Refer to Pontiac Shop Notes for Connecting Rod Lower Bearing.*

Installing Rods: No offset (can be installed either way).
NOTE—Rods and bearing caps marked to insure correct reassembly (marks must be together). These marks do not indicate cylinder in which rod used.
CAUTION—Keep each connecting rod and its bearing cap together.

CONTINUED ON NEXT PAGE

►**Removal of Excess Release Bearing Lubricant to correct clutch sticking**—If recess in bore on release bearing over-lubricated when clutch assembly installed, excess lubricant may be found causing clutch sticking. Clean our excess lubricant found at the following points: transmission drive gear, driven plate hub, clutch facings, pressure plate and and cover assembly, release bearing support tube, fulcrum points of release fork, and recess in bore on release bearing (do not wash bearing, bearing is "sealed" type). Lubricate clutch parts exactly as described under Installation Note following to avoid above condition.

Clutch Installation Note—Install new felt oil seal against shoulder ahead of oil slinger retaining ring on Transmission Main Drive Gear (will bear against flared end of release bearing support when installed). This supersedes original position (on 1946 cars) where seal fitted in recess on Drive Gear. Lubricate seal with engine oil before transmission installed. Coat entire length of outer diameter of release bearing support tube with grease. Lubricate release fork fulcrum points with a very light coat of grease. Apply light coat of Lubriplate on main driving gear splines. Use new paper gasket between support flange and clutch housing, make certain that flange is not bent or distorted (will cause misalignment of transmission).

CAUTION—Make certain that correct type Driven Member is used (see Note above).

Clutch Release Bearing & Support: ***See Pontiac Shop Notes for description.***

►**1946 Release Bearing Noise Correction**—***See Pontiac Shop Notes for new type Support Tube to correct noise due to movement of bearing on early 1946 support tube.***

TRANSMISSION

Own Make. All helical gear. Constant-mesh synchro-mesh (Second & High), sliding gear (Low & Reverse). ***See Transmission Section for complete data.***

Transmission Control: Pontiac "Safety-shift" remote control type with gearshift lever on steering column. ***See Transmission Section for complete data.***

Removal:—Disconnect speedometer cable, gearshift selector and control rods from transmission. Disconnect rear universal (wire trunnion) and pull out propeller shaft. Remove upper transmission mounting screws, install guide pins (J-851), remove lower screws, pull transmission to rear and lower out of car.

Installation Note—Use guide pins installed in two upper transmission mounting holes to assist in sliding transmission straight forward into place (to avoid damage to clutch release bearing support). NOTE—These guide pins may be made from ½-13 American National Thread bolts by cutting heads off and reducing over-all length to 4¼".

HYDRA-MATIC DRIVE

OPTIONAL EQUIPMENT

Own Make. Consists of fluid coupling and 4 speed automatic transmission.
See Transmission Section for complete data including Testing & Trouble Shooting.

Lubrication—Check fluid level in transmission every 2000 miles (lubrication period). Drain and refill every 25,000 miles. Use only GM Hydra-Matic Drive Fluid.

Capacity—**11 qts.** (drain oil pan and torus cover and refill). **12 qts.** (drain, disassemble, assemble transmission and refill).

Checking Fluid Level—Roll back floor mat, remove cover on floor board, set hand brake and start engine, set control lever in "DR" position, allow to run about 2 minutes. Remove indicator, wipe dry, then return and check level of fluid with indicator. Add fluid until level is at "FULL" mark.

►***CAUTION—Always check oil level when oil is hot, engine idling, hand brake tightly set and control lever in "DR" position.***

►**Oil Level Indicator Change**—A new indicator, Part No. 8605800 (stamped on blade—earlier type not marked) reduces capacity approx. 1 pint providing slightly lower fluid operating level to reduce fluid foaming when oil is hot.

Hydra-Matic Linkage Adjustment—***See Hydra-Matic Drive article in Transmission Section.***

Removal: ***See Hydra-Matic Drive article in Transmission Section.***

UNIVERSALS

Mechanics Model 2CR. Roller bearing type, 2 used. ***See Universal Section for complete data.***

►**1947-48 CAUTION**—Rear universal nut controls rear axle pinion bearing "pre-load" (must be adjusted whenever nut is loosened). ***See Pontiac Rear Axle article in Rear Axle Section for complete data.***

NOTE—Driveshaft is one-piece type (slip joint on transmission mainshaft, ahead of front universal).

REAR AXLE

1946 Type—Same as 1942. Hypoid gear, semi-floating type. This type axle has three setscrews equally spaced around pinion housing.
See Rear Axle Section for complete data.

1947-48—New hypoid gear, semi-floating type. Design similar to 1946 type except that pinion is mounted on two taper roller bearings and companion flange nut controls pinion bearing "pre-load." No setscrews are used.

►CAUTION—Rear universal companion nut controls pinion bearing "pre-load".
See Rear Axle Section for complete data.

Ratios—As shown. Axles may be identified by paint mark on end of right hand axle shaft.

Model	Ratio	Ident. Paint Mark
Torpedo Std.	4.1-1	Green
Streamliner Std.	4.3-1	White
Hydra-Matic (All)	3.63-1	Violet
All (Econ.)	3.9-1	Red
All (Heavy Duty)	4.55-1	Yellow

Backlash—.003-.012" (new), slightly over .012" (worn).

Removal:—Disconnect rear universal (wire trunnions, do not disengage spline joint at transmission), remove axle shafts, carrier flange mounting screws and carrier.

►**1947-48 CAUTION**—Rear U-joint companion flange nut controls pinion bearing "pre-load" (must be adjusted whenever nut is loosened).

Axle Shaft Removal:—Remove wheel, brake drum, 4 backing plate bolt nuts, static collector, and loosen bearing retainer (do not move backing plate or brake line may be damaged). Pull shaft with puller J-942 (do not drag axle shaft on oil seal).

Wheel Bearing Adjustment—None.

SHOCK ABSORBERS

Delco Model 1947-C,D (front), Model 1044-V (rear). Hydraulic, double acting (front), direct (rear).

FRONT SUSPENSION

Front Suspension: Independent, linked parallelogram type with coil springs.
See Front Suspension Section for complete data.

Kingpin Inclination—5½-6° crosswise.

Caster—Negative ¾°. Limits Neg. ½° to Neg. 1°.

Camber—0° preferred. Limits Neg. ¼° to Pos. ¼°.

Toe In—0-1/16". Adjust tie rod tubes equally.

Steering Geometry—Inner wheel 23° ± ½°. Outer 20°.

STEERING GEAR

Saginaw. Worm-and-Roller type.
See Steering Gear Section for complete data.

BRAKES

Service: Bendix Hydraulic, Duo-Servo, Single Anchor type with eccentric adjustment. Hand lever applies rear service brakes.
See Brake Section for complete data.

►IMPORTANT SERVICE NOTE—**Brake Drums**—Two different makes are used: 1) Kelsey-Hayes type can be identified by one-piece stamping and flange having a sharp edge; 2) Motor Wheel type consisting of two stampings and rolled flange. **Each pair of drums (on opposite sides of car) front or rear must be of the same type.**

Brake Drum Part Numbers	Front Wheel Left	Front Wheel Right	Rear Wheel
Kelsey-Hayes	507371	507370	505300
Motor Wheel	509221	509220	409176

Drums—Pressed steel with alloy iron liner. Diameter 11".

Clearance—.010" at heel and toe of each shoe.

Lining—Moulded. Width per wheel 2" (front), 1¾" (rear). Thickness 3/16". Length per shoe 9 11/32" (primary), 11 31/32" (secondary).

Braking Power—56% Front, 44% Rear.

Master Cylinder Filling Note—New cars shipped from the factory have master cylinder filled to level ⅞" below top of filler neck and this level is satisfactory for service (cylinders were filled to ½" below top).

Hand Brake: See Service Brakes above.

NoRol: Optional. ***See Brake Section for complete data.***

MISC. MECHANICAL

Convertible Top Control: Hydro-lectric type (hydraulic actuation with motor-driven pump supplying oil under pressure for power cylinders).
See Miscellaneous Section for complete data.

DISTRIBUTOR: Delco-Remy No. (1949) 1110219, (1950-51) 1110222. Automatic and vacuum advance type with "Center-Bearing" breaker plate.

►*CAUTION*—"High Tower" Distributor caps with built-in resistor used on 1949 distributor. "Low Tower" caps without resistor used on 1950-51 distributor. **Never use a "High Tower" cap with 1950-51 "High Resistance" secondary cables.**

►**Breaker Plate Bearing Assembly**—Plate rotates on 3 bakelite buttons on support plate with spring tension adjustment (shim washers) on underside of support plate. Pull required to move plate should be 8 oz. min., 16 oz. max. with breaker plate assembly out of housing.

See "Delco-Remy Center-Bearing Breaker Plate Distributor" in Electrical Equipment Section.

Breaker Gap—.022" (new points), .020" (used pts.).

►*CAUTION*—Dial indicator for setting point gap recommended by car manufacturer. ***Do not use feeler gauge for setting used points.***

Cam Angle—35°. Test limits with .022" gap 31-37°. *See "Delco-Remy Cam Angle" in Electrical Equipment Section.*

Breaker Arm Spring Tension—17-21 ounces.

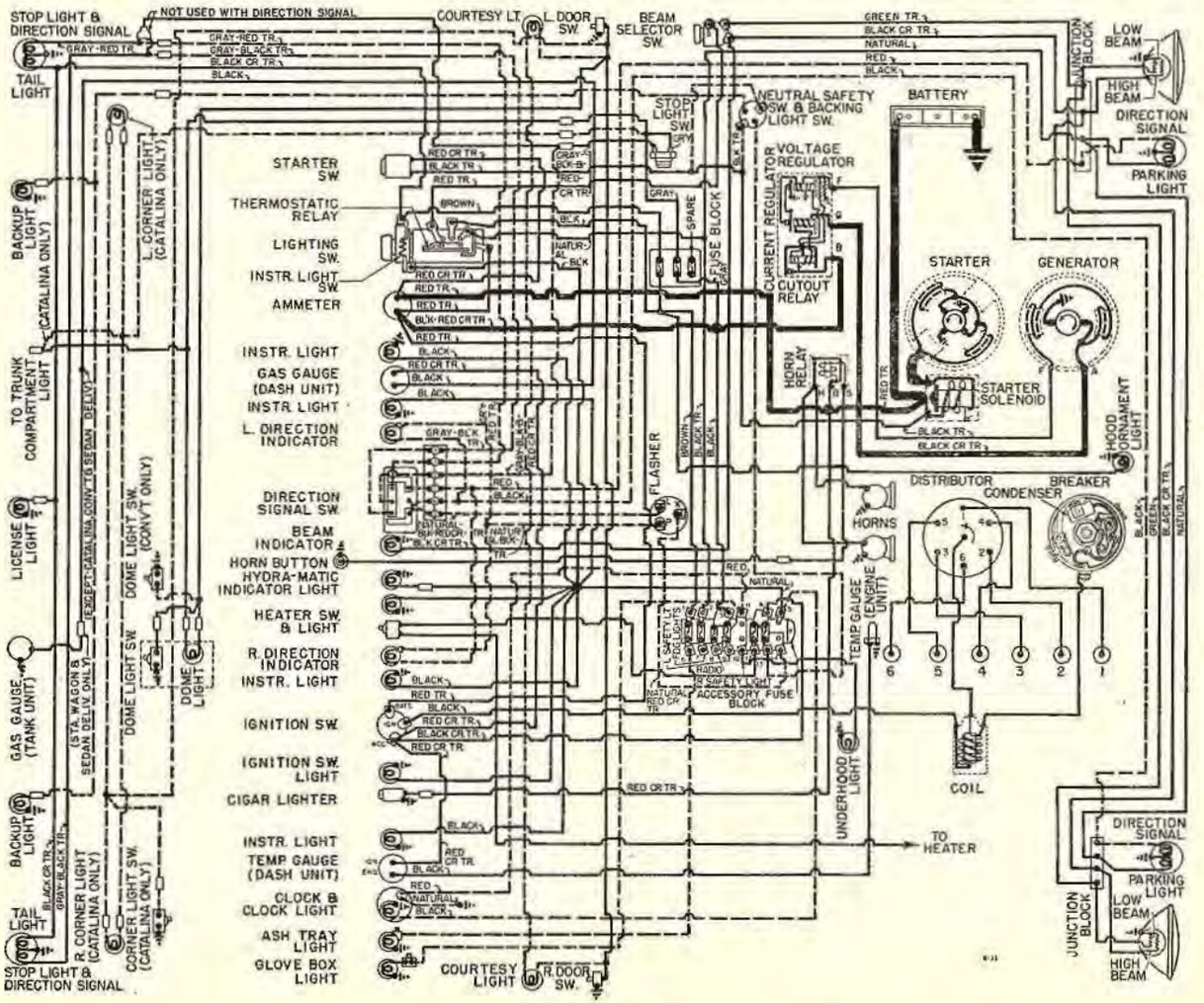
Rotation—Counter-clockwise viewed from above.

Automatic Advance

Degrees Distr.	R.P.M.	Degrees Eng.	R.P.M.
Start	300	2	600
8.25	1100	16.5	2200
8.5	1400	17	2300
14	2050	28	4100

Gaselector—Manual adjustment at distributor. 10° advance or retard. See Ignition Timing.

Vacuum Spark Control: Delco-Remy (part of distr.).



1951 MODELS

Vacuum Advance—1110219

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	7-9"
6.5	13½°	13-16"

Vacuum Advance—1110222

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	7-9"
7½°	15°	14.5-16.5"

IGNITION TIMING

Std. Setting	Flywheel Degrees	Piston Pos.
All Engines①	6° BTDC	.0133" BTDC.

①—Regular Fuel—Std. Hd. Ethyl Fuel—7.5-1 Hd. High Comp. Head Engines set 3° BTDC at factory.

Timing Mark—Three lines on vibration dampener. First (6°) line on vibration dampener aligned with pointer on chain case cover (2nd line 2° or 3° BTDC, 3rd line TDC).

Timing (with Timing Light)—Loosen gaselector indicator arm-to-block clamp bolt, set arm at 0, tighten bolt. Connect Timing Light (KMO318) to No. 1 spark plug, idle engine. Loosen advance arm clamp bolt, rotate distributor until timing light shows pointer at timing mark on vibration dampener which indicates 6° BTDC (1st line). Tighten clamp serew. Check Gaselector Setting (see below).

Gaselector Setting—Set to give best performance without spark knock or ping for fuel used. Marked "ADV" and "RET", adjust according to these marks.

CARBURETOR

1949-50 CARTER

Carter WA-1, No. 717S.....**Synchro-Mesh Trans.**
Carter WA-1, No. 718S.....**Hydra-Matic Drive**
1¼" single barrel downdraft types with Carter Climatic Control.

Casting No. on Flange—(717S) 388, (718S) 592.

See Carburetor Section for complete data.

Settings (Idle Setting, Float Level, and Accelerating Pump): *See Tune-Up.*

Metering Rod & Jet—*See Carter Jet Table in Carburetor Section.*

NOTE—No "throttle cracker" used.

Hydra-Matic Throttle Linkage Adjustment: *See Pontiac Hydra-Matic Drive in Transmission Section.*

Fast Idle: Carter Single Barrel Carburetor type.

Setting—⅝" clearance between choke valve and air horn (Gauge T109-85) with throttle valve closed and stopscrew against (not on) first step of fast idle cam. Adjust by bending connector link at lower offset (use Tool T109-41).

See Carburetion Equipment Section for complete data.

Automatic Choke: Carter Climatic Control (single barrel carburetors).

Setting—3 Points Rich.

See Carburetion Equipment Section for complete data.

1951 ROCHESTER

Rochester Model BC, No. 7002870. Synchro-mesh and Hydra-Matic Drive cars.
1¼" single barrel downdraft with automatic choke.

See Carburetor Section for complete data.

Settings—(Idle Setting, Float Level, and Accelerating Pump): *See Tune-Up.*

Hydra-Matic Throttle Linkage Adjustment: *See Pontiac Hydra-Matic Drive in Transmission Section.*

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ENGINE

CONTINUED FROM PRECEDING PAGE

must be (1950) 10-20 lbs., (1951) 20-35 lbs. Taper and out-of-round limits—Piston .0005", Cylinder .0005" max. new.

Replacement Pistons: *See Pontiac Special Data.*

PISTON RINGS: Two tapered-face compression rings above pin, one slotted oil control ring below pin. *NOTE*—Rings are cadmium-plated or tin-plated.

Ring	Width	End Gap	Side Clearance
Compr. (#1, 2)	3/32"	.007-.012"	.0015-.003"
Oil (#3)	3/16"	.007-.012"	.001-.0025"

Installing Compression Rings—Mark "TOP" up.

Replacement Rings: .005", .010", .020", .030" Oversize.

PISTON PIN: Diameter—.9369-.9375". **Lgth**—3 1/16". Pin is shot-peened type (shot-peened before final grinding and lapping). Pin is locked in one piston boss by self-locking lockscrew and opposite boss is slotted to permit pin movement.
Pin Fit in Rod Bushing—.0004-.0006" clearance.

Replacement Pins:—.001" (red & brown), .003" (red), .005" (blue) oversize. Paint marked on end of pin.

CONNECTING ROD: Weight 37 ozs. **Length** 7 9/16".
Crankpin Journal Diameter—2.1237-2.1247".
Lower Bearing—Thin type, interchangeable, steel-backed, babbitt-lined type.
Clearance—.0001-.0021". **Sideplay**—.007-.012".

Bearing Adjustment:—None (no shims).

Replacement Bearings: Standard size & .001" Undersize. *NOTE*—Bearings have small tongue which must engage groove in rod and cap.

Installing Rods: Not offset (install either way). *NOTE*—Rods and bearing caps marked to insure correct reassembly (marks must be together). These marks do not indicate cylinder in which rod used. *CAUTION*—Keep each connecting rod and its bearing cap together.

CRANKSHAFT: Four bearing type with integral counterweights and vibration dampener on forward end.

►**Flywheel to Crankshaft Bolts (Synchro-Mesh Transmission)**—¾" hex head bolts (No. 508463) or 1" hex head bolts (No. 510832) are used. Either type can be used for replacement but **head sizes must be alike on all bolts or engine balance will be destroyed.**
Journal Diameters—#1, 2.4982-2.4992"; #2, 2.5294-2.5304"; #3, 2.5919-2.5929"; #4, 2.6232-2.6242".
Bearings—Thin type, removable, steel-backed, babbitt-lined. Upper and lower bearing halves alike.
Clearance—.0003-.0023".
Rear Main Bearing Oil Seal Renewal—*See Pontiac Special Data.*

Replacement Bearings: Standard & .001" Undersize.

End Thrust: At #3 (rear intermediate) bearing.
Endplay—.003-.008".

CAMSHAFT: Four bearing, non-adjustable chain.
Clearance—.0015-.0025" (new).

End Thrust:—Steel thrust plate behind camshaft sprocket. Replace if worn. **Endplay**—.003-.007".

Timing Chain: Morse. Width 1". Pitch ⅜". Length 21" or 56 links. *NOTE:* 1951 cars equipped with a timing chain bumper to eliminate vibration.
See "Timing Chain" in Pontiac Special Data Section.

Camshaft Setting:—Sprockets marked. Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across shaft centers.

VALVES:	Head Diam.	Stem Diam.	Length
Intake	1 19/32"	.310-.311"	5.718"
Exhaust	1 15/32"	.310-.311"	5.718"

	Seat Angle	Lift	Stem Clearance
Intake	30°	19/64"	Free fit to .0006"①
Exhaust	45°	19/64"	Free fit to .0006"①

①——Tapered (max. clearance at bottom .0006").

Valve Guides: Guides have tapered hole (.001" taper to inch—greatest clearance at top). Exhaust guides counterbored at top to depth of ¾".
Checking Valve Clearance in Guide—Clean guide with tool KMO122, clean counterbore in exhaust guide with Counterbore Cleaner J-2122. Valve should just fall through guide of own weight.
Installing Guides—Use Valve Guide Remover J-2542 to remove and install guides. Drive new guide down in block (counterbored end up on exhaust guides) until upper end 29/32" below top edge of valve seat. Ream guide with PR-131 tapered reamer and finish counterbore with Counterbore Cleaner J-2122 for correct clearance (see above).
►*CAUTION*—Guides furnished with straight hole which must be taper reamed.
NOTE—Eight cylinder intake valve guide may be used on six cylinder cars.

Valve Springs:—Intake and exhaust springs identical. Install with two closed coils at top and dampener on top of each spring. Use new dampeners whenever removed from spring. **Free Length**—2 9/16".

	Spring Pressure	Length
Valve Closed	56-63 lbs	1 29/32"
Valve Open	97-105 lbs	1 19/32"

Valve Lifters:—Barrel type, cast-iron. Guide holes reamed in block. Lifters furnished .005" oversize (use pilot reamer J-706-P when reaming holes to maintain alignment—valve guides must be removed, use Valve Guide Removing Tool J-2542).
Clearance—Free fit. Lifter should just move freely with finger touch.

VALVE TIMING

Tappet Clearance: .011" to .013", All Valves, Hot. .011" "Go" gauge, .013" "No Go" gauge.
High Speed Setting—.013" EXH. Hot.
Cold Setting with Engine Stopped—.012" to .014" Cold (room temperature). *CAUTION*—Check setting after engine warmed-up for limits of .011" to .013".
►**NOTE**—A removable plate is installed in front fender skirt so tappets are accessible for adjustment.

Valve Timing:—*See Camshaft Setting above.*
Intake Valves—Open 5° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
Valve Timing Check—With .015" tappet clearance #6 intake valve should open with #6 piston 5° or .0096" before top dead center with first straight line of dampener mark '/IGN.ONE/' slightly past pointer on left front face of chain cover. Reset tappet clearance .011-.013" (warm).

LUBRICATION

Engine Oiling System: Pressure to main bearings connecting rod lower bearings and piston pins (rifle-drilled rods), camshaft bearings, and chain.
Crankcase Capacity—5 qts. (refill), 6 qts. (dry).
Normal Oil Pressure—35-45 lbs. at 40 MPH. with warm oil (10-30 lbs. idling).
Oil Pressure Regulator—On oil pump. Opens at 40 lbs. Replace spring if free length less than 2 5/16".

Oil Pump: Gear type. On right side of crankcase.

Oil Cleaner: Precipitation type (in crankcase).

Oil Pressure Gauge: AC No. 1507535. Not electric.

Crankcase Ventilation: Filter element in oil filler cap (inlet). Outlet pipe at valve compt. cover on right rear side of engine (cars with oil bath air cleaner use 3-piece outlet pipe containing filter element). Wash filter element and re-oil by dipping in engine oil when servicing air cleaner.
CAUTION—Filler cap must be installed with air opening in cap toward front of car and seam in line with groove in tube (may cause excessive oil consumption if installed backward).
Crankcase Ventilator Outlet Pipe—On cars with Oil-bath type Air Cleaner, special 3-piece ventilator outlet pipe used with copper gauze air cleaner.

COOLING

Cooling System: Pressure type with pressure valve and vacuum valve (relief valve) in filler cap.
►*1951 WATER PUMP PRODUCTION CHANGE—Water pump changed to include lubrication hole. Earlier type pumps can be changed to lubricated type. See "Pontiac Water Pumps" in Water Pump Section.*
Capacity—18½ qts.
Pressure Valve—AC No. 850549 Filler Cap. Opens at 7 lbs. (6¼-7½ lbs.).

Water Pump: Packless, sealed ball-bearing shaft.
See Water Pump Section for complete data.
Removal—Drain cooling system, remove hose connection at pump, remove belt, take out water pump mounting bolts and lift pump out.
Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open 148-156°F. Fully open 176°F.

Temperature Gauge: AC Electric type.
Dash Unit—AC No. (1949) 1512126, (1950-51) 1512287.
Engine Unit—AC No. 1512015.
See Miscellaneous Section for complete data.

CLUTCH

Inland. Single Plate, "Diaphragm", dry disc type with Long Driven Member Model 9½CF-TS (except Taxicab), Model 10CF-CS (Taxicab).
See Clutch Section for complete data.
►**Heavy Duty Clutch Note**—No separate 1950 Heavy Duty Clutch used. Std. 8 Cyl. clutch cover assembly used with special 6 Cyl. 10" driven member.
See Clutch Section for complete data.
Facings—Woven type, 2 required. I.D. 6" (All O.D. 9½" (exc. Taxi), 10" (Taxi), Thickness ⅛".
Pedal Adjustment:—Free travel ⅞-1⅛" (adjusting nut on link at clutch fork).
Removal: Remove Transmission (see Transmission Removal below), remove clutch bearing support spring washer (in rear face of clutch housing), remove clutch housing bottom cover and control shaft inner bracket. Remove release bearing support and release bearing (see Clutch Release Bearing & Support data), tapping the support from inside the clutch housing to aid in removing (*CAUTION*—avoid striking tubular portion of support). Mark flywheel and clutch cover (to insure reinstallation in same position to maintain balance), remove clutch cover mounting bolts evenly, move clutch assembly away from flywheel at bottom and withdraw driven member, lower cover assy. out.

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MODEL IDENTIFICATION

SERIAL NUMBER: On left front door hinge post.

1949 Numbers—P8TS-1001 Up .....Synchro-mesh Tr.
P8TH-1001 Up.....with Hydra-Matic Drive

1950 Numbers—P8TS-1001 Up.....Synchro-Mesh Tr.
P8TH-1001 Up.....with Hydra-Matic Drive

1951 Numbers—P8RS-1001 Up.....Synchro-mesh Tr.
P8UH-1001 Up.....With Hydra-Matic Drive
Prefix letter indicates Assembly Plant (below).

►**Assembly Plant Prefix Letter. P**—Pontiac, Mich., **C**—South Gate, **L**—Linden, **W**—Wilmington, **K**—Kansas City, **A**—Atlanta, **F**—Framingham.

ENGINE NUMBER: Same as Serial Number. Stamped on boss on left upper front corner of engine block.

TUNE-UP

COMPRESSION PRESSURE: (Std. 6.5-1 Head) 118-135 lbs. at 200 RPM. (Optl. 7.5-1 Head) 135-153 lbs. at 200 RPM.

VACUUM READING: 18-20" steady idling at 7-8 MPH. or 365-385 RPM. on Hydra-Matic cars.

FIRING ORDER: 1-8-2-5-8-3-7-4. See diagram.

SPARK PLUG GAPS: .025". Limits .023-.028".
Plugs—AC No. 45. 14 mm. Metric.

DISTRIBUTOR: Breaker Gap—.016" (new points), .015" (used points).

►*CAUTION*—Dial indicator for setting point gap recommended by car manufacturer. ***Do not use feeler gauge for setting used points.***

Cam Angle—26°. Test limits with .016" gap 21-30°. ***See "Delco-Remy Cam Angle" in Electrical Equipment Section.***

NOTE—If dial indicator not available when setting Breaker Gap on Used Points, car manufacturer recommends gap be set by cam angle at 28° closed.

Breaker Arm Spring Tension—19-23 ounces.

Automatic & Vacuum Advance—***See Ignition.***

Condenser Capacity—.18-.23 microfarad.

IGNITION TIMING: 6° BTDC (initial setting—See Gaselector Setting).

Timing Procedure—***See Ignition Timing.***

Timing Mark—First (6°) line on vibration dampener aligned with pointer on chain case cover (2nd line 2° or 3° BTDC, 3rd line TDC).

Gaselector Setting—Set for barely audible ping when accelerating at 20-30 MPH., full throttle.

CARBURETION:

Idle Setting—¾-1¼ turns open. Two screws—turning screws out gives richer mixture.

Idle Speed (standard)—450-475 RPM. or 7-8 MPH.

Idle Speed (Hydra-Matic)—365-385 RPM.

Float Level—3/16" from top of floats to gasket seat on bowl cover (Gauge T109-162). Sides of floats should barely touch vertical uprights on gauge (to avoid floats binding on sides of bowl).

Accelerating Pump—Lower Hole (minimum) Normal. Upper Hole (max.)—if more charge required.

Choke Setting: Centered at Index.

Fuel Pump Pressure: 4-4¾ lbs.

MANIFOLD HEAT CONTROL: Thermostatic coil type, non-adjustable (fixed anchor pin). Counterweight should be securely clamped to shaft in vertical position with valve closed (cold position).
NOTE—Valve shaft bushings are Stainless Steel.

VALVE TAPPET CLEARANCE: .011" to .013", Hot. .011" "Go" gauge, .013" "No Go" gauge.

High Speed Setting—.013" EXH. Hot.

►**Cold Setting with Engine Stopped**—.012" to .014" Cold (room temperature). *CAUTION*—Check setting after engine warmed-up for limits of .011" to .013".

►*NOTE*—A removable plate is installed in front fender skirt so tappets are accessible for adjustment.

Valve Timing Check—***See Valve Timing.***

STARTING: ***See Batery, Starter, Generator, Regulator.***

IGNITION

►*IGNITION HIGH TENSION CABLE CAUTION*—Special non-metallic conductor cables (with built-in suppression resistance). Marked "RADIO-4000-GM."
See "Ignition Notes" in Pontiac Special Data for cable installation data.

►*CAUTION*—This high-resistance cable must not be used on 1949 cars with "High Tower" resistor type distributor caps.

IGNITION SWITCH: Delco-Remy No. (1949) 1116461, (1950-51) 1116464.

Ignition Lock—Briggs & Stratton Delco-Remy.

COIL: Delco-Remy No. 1115380. Mounted on engine.

Ignition Current—2.5 amperes idling, 4.5 stopped.

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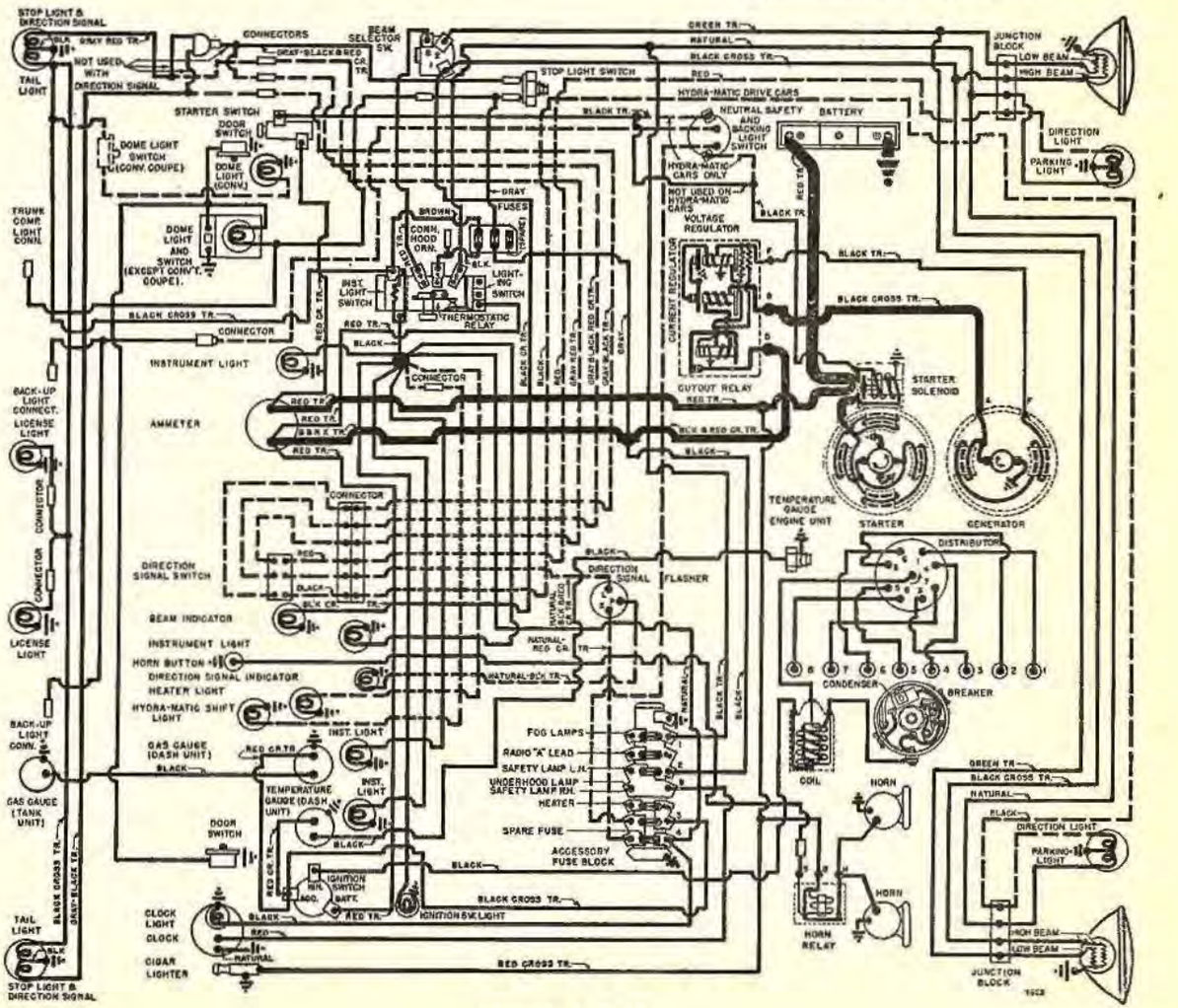

1949-50 MODELS

Fuel Pump (Fuel-&-Vacuum): AC Type AJ, 1537317.

Replacement Pump—AC No. 539.

Pressure—4-4¾ lbs.

See Carburetion Equipment Section for complete data.

Gasoline Gauge: AC Electric type.

Dash Unit—(1949-50) AC No. 1517117. (1951) AC No. 1517378.

Tank Unit—(1949) AC No. 1517083. (1950) AC No. 1517249, Sta. Wgn. AC No. 1517122. (1951) AC No. 1517411. Sta. Wgn. 1517410.

See Carburetion Equipment Section for complete data.

BATTERY

Delco Type (1949-50) 15E4. (1951) 15E6. 6 volt, 15 plate, 100 Ampere Hour Capacity.

Grounded Terminal—Negative (—) to engine.

Location—On left side of engine compartment.

Police Battery Delco Type (1949-50) 19E4. (1951) 19E6. 6 volt, 19 plate, 130 Ampere Hour Capacity.

NOTE—The "E6" battery used on the 1951 cars is the new "Low Gravity Type." Specific gravity range of electrolyte at full charge is 1.260-1.280 ("E4" models 1.275-1.290).

Grounded Ter. & Location—Same as 15E-4 above.

STARTER

LHD .....**Delco-Remy 1107957. Arm. No. 1867897.**

RHD .....**Delco-Remy 1107934. Arm. No. 1867897.**

►***CAUTION—LHD starter operates whenever pushbutton depressed (and shift lever in neutral on Hydra-Matic)***

Drive—Overrunning clutch (solenoid pinion shift).

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—24-28 ozs. each.

Performance Data—1107934 & 957

Torque		R.P.M.	Volts	Amperes
0	ft. lbs.	5500	5.7	80①
14	"	Lock	3.0	600

①—Includes current draw of starter switch.

Removal: Flange mounted at left front of flywheel housing. To remove, take out mounting screws.

Starting Switch (1107957 Starter): (1950-51) Delco-Remy Solenoid 1118140 (no relay used) mounted on starter and controlled by Pushbutton Switch (1950) No. 1996037. (1951) No. 1996045, and Neutral Switch No. 1997846 (1950-51) Hydra-Matic cars.

CAUTION—Overrunning clutch pinion clearance must be adjusted if solenoid removed from starter.

See Electrical Equipment Section for complete data.

(1107934)—Delco-Remy Solenoid 1118102 on starter and controlled by Relay No. 269-G and Pushbutton Switch No. 1996039 (and Neutral Safety Switch 1997846 on Hydra-Matic Drive cars).

See Electrical Equipment Section for complete data.

Neutral Safety Switch Adjustment—***See Pontiac Hydra-Matic Drive in Transmission Section.***

GENERATOR

Year	Generator Delco-Remy No.	Armature Delco-Remy No.
1949-50	1102711	1879002
1951 (Early)	1102750	1911962
1951 (Late)	1102775	
Police	1106403	1880252

Two brush types with voltage and current regulation.

Maximum Charging Rate—No. 1102711, 36 amperes cold, at 2040 Gen. RPM. **No. 1102750,** 40 amperes cold at 1950 Gen. RPM. Actual charging rate set by regulator (dependent on battery condition).

Performance Data (Cold)

	Amperes	Volts	R.P.M.
1102711	30①	8.0	1750
1102750	40	8.0	1950
1106403	35	8.0	1040

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—28 ozs.

Field Current—(1102711) 1.75-1.9 amperes at 6.0 volts. (1102750) 1.90-2.05 amperes at 6.0 volts. (1106403) 1.77-2.0 amperes at 6 volts. (1102775) 1.90-2.05 amperes at 6 volts.

Removal: Generator pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment: Belt deflection or sideplay midway between generator & pump pulley should be 1½".

REGULATOR

Year	Regulator No.	For Generator No.
1949-50 (Std.)	1118301	1102711
1951 (Early)	1118300	1102750
1951 (Late)	1118725	1102775
Police	1118352	1106403

►***NEW "1118300 SERIES"*** regulators have screw adjustment for settings and single regulator springs.

See Electrical Equipment Section for complete data.

CAUTION—Check generator for grounded field coils and leads before changing regulator settings to correct High Charging Rate of High Voltage.

Cutout Relay

Cuts In—5.9-6.8 volts hot (set to 6.4 volts hot).

Contact Gap—.020" (same for both contacts).

Air Gap—.020" (with contacts just closed).

Voltage Regulator

Setting—7.0-7.7 volts hot (set to 7.4 volts hot). Regulator is over-compensated for temperature. Should be checked with cover in place and hot.

Air Gap—.075" with armature pressed down to point where contacts are just touching.

Checking & Adjustment—***See Elec. Equip. Section.***

Current Regulator

Setting (1118301).....32-40 amps. hot (set at 36 hot)

Setting (1118300).....40-46 amps. hot (set at 42 hot)

Setting (1118352).....33-37 amps. hot (set at 35 hot)

Setting (1118725).....45-51 amps. hot (set at 47 hot)

Air Gap—.075" with armature pressed down to point where contacts are just touching.

Checking & Adjustment—***See Elec. Equip. Section.***

LIGHTING

Headlamps: Guide "Sealed Beam" type.

See Electrical Equipment Section for complete data.

Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height at 25 ft.).

Beam Indicator—At speedometer. Lighted when upper beams in use.

Directional Signal: ***See Electrical Equipment Section.***

Direction Signal Indicator—Red pilot light on speedometer dial. Flashes when signal in use.

Switches

Lighting—Delco-Remy No. 1995032.

Instrument—Part of Lighting Switch. Rheostat operated by turning Light Switch Knob.

Beam Selector—Delco-Remy No. 1997008.

MISC. ELECTRICAL

THERMOSTATIC CIRCUIT BREAKER: Delco-Remy. On back of light switch (part of switch assy.). Contacts remain closed with 30 amperes but open in 3 minutes with 42 amperes at 70°F. Not adjustable.

MAIN FUSE BLOCK: On left hand engine side of dash. Two fuses (plus 1 spare) as follows:

Tail Lamp—SFE 14 ampere. In gold colored fuse holder. Protects rear license, instrument, ignition key, and elock lamps (dome on convertible).

Stop Lamp—SFE 14 ampere. In gray colored fuse holder. Protects trunk light and dome light.

ACCESSORY FUSE BLOCK: Six fuses mounted on fuse block on dash behind instrument panel. All fuses are 20 ampere except Radio fuse which is 14 ampere. (Spare Radio fuse on main fuse block on engine side of dash). Fuse identification printed inside fuse block cover.

HORNS: Delco-Remy No. 1999645 (Low Note). No. 1999646 (High Note). Vibrator types operated by relay.

Type	Current (at 6 volts)	Air Gap
Low Note	19-21 amperes	.047-.052"
High Note	18-20 amperes	.039-.044"

Horn Relay: Delco-Remy No. 1116775.

Contact Gap—.027". **Air Gap**—.014" (closed).

Contacts Close—2.75-4.0 volts (set to 3.5 volts).

Contact Gap—.027". **Air Gap**—.014" (closed).

Contacts Close—2.75-4.0 volts (set to 3.5 volts).

ENGINE

ENGINE SPECIFICATIONS: 8 cylinder, "L" head type.

	1949	1950-51
Bore	3¼"	3⅜"
Stroke	3¾"	3¾"
Displacement	248.9 cu. in.	268.2 cu. in.
Rated Horsepower	33.8	36.4
Developed HP	104 at 3800	108 at 3600

Compression Ratio—Std. 6.5-1. Optl. 7.5-1, iron hds.

Compression & Vacuum Reading—***See Tune-Up.***

TIGHTENING TORQUES: ***See Pontiac Special Data.***

CYLINDER HEAD: Tightening Torque & Cylinder Head Diagram—***See Pontiac Special Data.***

►*CAUTION*—New cylinder heads and thinner gasket used on 1950 engine. Interchange of heads on 1949-50 engines will change compression ratio. **Do not use thinner 1950 gasket on 1949 engines.**

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Crankcase Ventilator Outlet Pipe—On cars with Oil-bath type Air Cleaner, special 3-piece ventilator outlet pipe used which has copper gauze type air cleaner in container section. Wash and re-oil filter element when servicing air cleaner.

COOLING

Cooling System: Pressure type with pressure valve and vacuum valve (relief valve) in filler cap.

Capacity—19½ qts.

Capacity—18½ qts.

Pressure Valve—AC No. 850549 Filler Cap. Opens at 7 lbs. (6¼-7½ lbs.).

Water Pump: Packless, sealed ball-bearing shaft.

►*1951 WATER PUMP PRODUCTION CHANGE—Water pump changed to include lubrication hole. Earlier type pumps can be changed to lubricated type. See "Pontiac Water Pumps" in Water Pump Section.*

NOTE—Fan flange reversed over previous models. *See Water Pump Section for complete data.*

Removal—Drain cooling system, remove hose connection at pump, remove belt, take out water pump mounting bolts and lift pump out.

Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open 151°F. Fully open 173°F.

Temperature Gauge: AC Electric type.

Dash Unit—AC No. (1949) 1512126, (1950-51) 1512287.

Engine Unit—AC No. 1512015.

See Miscellaneous Section for complete data.

CLUTCH

Inland. Single Plate, "Diaphragm," dry disc type with Long Driven Member Model 10CF-CS.
See Clutch Section for complete data.

Pedal Adjustment:—Free travel ⅞-1⅛" (adjusting nut on link at clutch fork).

Removal: Remove transmission (see Transmission Removal below), remove clutch bearing support spring washer (in rear face of clutch housing), remove clutch housing bottom cover and control shaft inner bracket. Remove release bearing support and release bearing (see Clutch Release Bearing & Support data), tapping the support from inside the clutch housing to aid in removing. (*CAUTION*—avoid striking tubular portion of support). Mark flywheel and clutch cover (to insure re-installation in same position to maintain balance), remove clutch cover mounting bolts evenly, move clutch assembly away from flywheel at bottom and withdraw driven member, lower cover assembly out.

►**Clutch Sticking Correction (Removal of Excess Release Bearing Lubricant):** If Recess in bore on bearing over-lubricated when clutch assembly installed, excess lubricant may be found causing clutch sticking. Clean out excess lubricant found at the following points: transmission drive gear, driven plate hub, clutch facings, pressure plate and cover assembly, release bearing support tube, fulcrum points of release fork, and recess in bore on release bearing (do not wash bearing, bearing is "sealed" type). Lubricate clutch parts exactly as described under Installation Note following:

Clutch Installation Note—Install new felt oil seal against shoulder ahead of oil slinger retaining ring on Transmission Main Drive Gear (will bear against flared end of release bearing support when installed). Lubricate seal with engine oil before transmission installed. Coat entire length of outer diameter of release bearing support tube with grease. Lubricate release fork fulcrum points with a very light coat of grease. Apply light coat of Lubriplate on main driving gear splines. Use new paper gasket between support flange and clutch housing, make certain that flange is not bent or distorted (will cause misalignment of transmission).

Clutch Release Bearing & Support: *See Pontiac Special Data for description.*

TRANSMISSION

Own Make. All helical gear. Constant-mesh synchro-mesh (Second & High), sliding gear (Low & Reverse). *See Transmission Section for data.*

Transmission Control: Pontiac "Safety-shift" remote control type with gearshift lever on steering column. *See Transmission Section for complete data.*

Removal:—Disconnect speedometer cable, gearshift selector and control rods from transmission. Disconnect rear universal (wire trunnions) and pull out propeller shaft. Remove upper transmission mounting screws, install guide pins (J-851), remove lower screws, pull transmission to rear, down and out.

Installation Note—Use guide pins installed in two upper transmission mounting holes to assist in sliding transmission straight forward into place (to avoid damage to clutch release bearing tubular support). *NOTE*—These guide pins may be made from ½-13 American National Thread bolts by cutting heads off and reducing over-all length to 4¼".

►**New Transmission Main Drive Gear Oil Seal**—*See Transmission Section for complete data.*

HYDRA-MATIC DRIVE

OPTIONAL EQUIPMENT

Own Make. Consists of Fluid Coupling and automatic self-shifting 4-speed planetary transmission. *See Transmission Section for complete data including Testing & Trouble Shooting.*

►**NOTE:** *Different Hydra-Matic Transmission used as follows:*

	Hydra-Matic Model No.
1949 & First 10,000 cars 1950	185-49-P①
1950 (After 10,000 Cars)	185-50-P②
1950 (Late Production)	210-50-D③
1950 (Last 1000 cars)	210-51-D④
1951	210-51-D④

①—P9 preceding Serial No. on black background.
②—P50 preceding Serial No. on black background.
③—D50 preceding Serial No. on green background.
④—D51 preceding Serial No. on green background.

►*D-50 (Late 1950) HYDRAMATIC NOTE—Has Modulated Throttle Pressure.*

►*D-51 (1951) HYDRAMATIC NOTE—Has Modulated Throttle Pressure and "Cone Type Clutch" Reverse mechanism.*

►*HYDRA-MATIC "BUZZING" CORRECTION*—Beginning with Hydra-Matic Serial No. D51-161050, a new front servo exhaust valve entered production to eliminate a buzzing sound encountered when shifting into reverse. This new assembly is interchangeable with previous part No. 8613116.

Lubrication—Check fluid level in transmission every 2000 miles (at lubrication period). Drain and refill every 25,000 miles. Use only GM Hydramatic Fluid or "Automatic Transmission Fluid Type A."

Draining & Refilling—*See "Hydra-Matic Drive" in Transmission Section.*

Checking Fluid Level—Roll back right side of front floor mat. Clean all sand, lint, and dirt away from sheet metal cover in floor, remove cover, clean any dirt away from dipstick cover on transmission. **Set Hand Brake.** Run engine for approx. 1½ minutes at speed equivalent to 20 MPH. with selector lever in "Neutral." Reduce engine speed to slow idle and move selector lever to "Drive" position, measure level with dipstick, add fluid until level is at "FULL" mark with engine idling.

►*CAUTION—Engine must be idling slow and selector lever in "Drive" position when checking fluid level.*

Linkage Adjustment—*See "Hydra-Matic Drive" in Transmission Section.*

Removal: *See "Hydra-Matic Drive" in Transmission Section.*

UNIVERSALS

Mechanics Model 2CR lock ring retainer type or **Saginaw** clamp plate retainer type.
See Universals Section for complete data.

►*CAUTION*—Rear universal companion nut controls rear axle pinion bearing "pre-load" (must be adjusted whenever nut is loosened). *See Pontiac Rear Axle in Rear Axle Section.*

REAR AXLE

Own Make. Hypoid gear, semi-floating type with pinion mounted on two taper roller bearings.

►*CAUTION*—Rear Universal companion nut controls pinion bearing "pre-load" and must be adjusted each time nut is loosened.
See Rear Axle Section for complete data.

►**Filler Plug Production Change**—Moved from axle cover at rear to front face of carrier on right side on late cars.

Model	Ratio	Paint Mark①
Hydra-Matic (All)	3.63-1	Violet or Blue
Synchro-Mesh	4.1-1	Green
Synchro-Mesh	3.9-1	Red
Synchro-Mesh	4.3-1	White
Synchro-Mesh	4.55-1	Yellow
Synchro-Mesh	3.63-1	Violet or Blue

①—On outer end of axle shafts

Backlash—.003-.012" (new), slightly over .012" (worn).

Removal:—Disconnect rear universal and wire trunnions (do not disengage spline joint at transmission), remove axle shafts and carrier flange cap-screws. Withdraw carrier assembly from housing.

►CAUTION—Rear universal joint companion flange nut controls pinion bearing "pre-load" (must be adjusted whenever nut is loosened).

Axle Shaft Removal:—Remove wheel, brake drum, 4 backing plate bolt nuts, static collector, and loosen bearing retainer (do not move backing plate or brake line may be damaged). Pull shaft with puller J-942 —(do not drag axle shaft on oil seal).

Wheel Bearing Adjustment—None.

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HOOD ASSEMBLY

1940-49 MODELS

HOOD LOCK: Alligator type hood with lock handle ('40), release button ('41-49) on instrument panel To release hood, push down on lock handle and press back safety catch on 1940, or pull out on release knob and pull forward on safety catch on 1941-49 cars.

Lock Adjustment (1941-49)—Lock stud should be positioned so that hood locks securely with firm pressure on top of hood (if stud adjusted too high, hood will not lock securely; if stud adjusted too low, hood will rattle). To adjust lock, loosen locknut on upper end of stud, turn stud counter-clockwise to lower stud, clockwise to raise stud, tighten locknut after completing adjustment. Lubricate latch on underside of grille top baffle and control wire in conduit.

1947-49 MODELS

HOOD ALIGNMENT: Raise hood, unhook hinge spring on each side of cowl, loosen three hinge plate to cowl bolts slightly at each plate, loosen four hood latch plate capscrews at front. Close hood, then position hood until aligned properly. Raise hood without disturbing hinge plates on cowl and tighten plate bolts. Hook hinge springs in place, lower hood to permit lock stud to center hood latch plate, raise hood, tighten plate capscrews. If further adjustment required, fenders and grille assembly can be shifted.

1939-42 MODELS

HOOD SIDE PANEL REMOVAL: Separate removable hood side panels used. To remove, take out attaching bolts and screws on upper and lower edges.

ENGINE REMOVAL

CHAMPION (1947-49)

ENGINE REMOVAL: For Oil Pan Removal & Engine Servicing. Drain cooling system, position car under chain hoist, disconnect and remove parts as follows:

1. Remove hood (disconnect at hinge arms).
2. Remove center cylinder head capscrew and install lifting eyebolt (cylinder head must be in place on block). Attach chain hoist to eyebolt and take up slack in hoist chain.
3. Remove two clutch housing to engine rear plate dowel bolts and nuts, and 4 housing to engine plate bolts and nuts on lower edge. Remove 3 capscrews at top of housing by working through opening in front floor (housing will be secured by one bolt and nut at oil pressure pipe).
4. Disconnect battery ground at battery.
5. Remove 3 radiator core-to-core support screws on left side and free headlamp wiring harness from clips on radiator and fender.
6. Remove 2 water outlet-to-cylinder head capscrews.
7. Disconnect wires at generator and primary lead at ignition coil.
8. Disconnect accelerator cross shaft from push rod and heat indicator from cylinder head.
9. Take off starter (not necessary to disconnect wires) and place to left of hand brake cable.
10. Remove water pump inlet hose and 3 radiator core-to-core support screws on right side.
11. Take out radiator core, rotate fan and move headlamp wiring harness to clear radiator inlet and outlet.
12. Remove 4 fan capscrews, remove fan and pulley. Lay headlamp harness on top of core support.
13. Disconnect flexible fuel pump connection from front gasoline line, and exhaust pipe from manifold, lower pipe off manifold studs.
14. Loosen engine breather pipe capscrew. Disconnect windshield wiper hose at manifold and flexible line from upper oil pressure gauge pipe.
15. Remove one bolt and nut on clutch housing at oil pressure pipe.
16. Remove front engine support from front frame cross-member and front engine insulator.
17. Push car to rear to free engine from clutch housing, slowly raise engine while moving forward, tilting engine until clutch clears transmission main drive gear shaft, and engine rear plate clears center tie rod, then push engine to rear, turning engine 45° to right, finally hoist engine slowly from chassis.

NOTE—Engine should be placed on an engine stand for ease in performing service work.

Engine Installation Note: When installing engine, align clutch driven plate with pilot bearing and lubricate bearing with wheel bearing grease. Place car in high gear so that transmission main drive gear can be rotated by moving car for engaging clutch driven member. Use two ¼" x 8" tapered drifts to align clutch housing and engine rear plate, coat two clutch housing dowel bolts with white lead, install these bolts and tighten in place with nuts. *CAUTION—Do not drive these dowel bolts into place.*

Engine Rear Mounting Note—See same note for Commander model (below) for rear engine mounting installation directions.

COMMANDER (1947-49)

ENGINE REMOVAL: For Oil Pan Removal & Engine Servicing. Drain cooling system, position car under chain hoist, disconnect and remove parts as follows:

1. Remove hood (disconnect at hinge arms).
2. Disconnect battery ground from cylinder head.
3. Remove exhaust pipe hanger ahead of muffler and bracket and clamp from pipe at clutch housing. Disconnect exhaust pipe at manifold.
4. Remove transmission (see Transmission Removal on car model page).
5. Disconnect clutch operating shaft from throwout shaft by taking out cotter pin and inner clevis pin from sleeve next to clutch housing and pulling shaft and sleeve toward frame.
6. Take out mounting bolts and remove rear engine mounting lower cushions and spacers and front engine mounting insulator-to-support bolts.
7. Remove center cylinder head capscrew and install lifting eyebolt (cylinder head must be in place on block). Attach chain hoist to eyebolt and take up weight of engine.
8. Remove right horn from cowl (not necessary to disconnect horn wires) and place on wiper motor.
9. Remove engine breather pipe. Disconnect windshield wiper hose at manifold and flexible line from upper oil pressure gauge pipe. Disconnect flexible fuel line coupling at fuel pump.
10. Disconnect radiator inlet and outlet hoses. Remove 6 radiator core-to-core support screws and free headlamp wiring harness from clips on radiator and fender.
11. Take out radiator core, rotate fan to clear radiator inlet and outlet. Remove fan and pulley.
12. Disconnect wires at generator and primary lead at ignition coil. Remove magnetic switch from starter without disconnecting wires and place switch to left of hand brake cable.
13. Disconnect accelerator cross shaft at push rod and heat indicator from cylinder head.
14. Push car to rear slowly, raise front of engine and maneuver front end into core support opening, then push engine to rear (swing rear end to right), finally hoist engine slowly from chassis.

NOTE—Engine should be placed on an engine stand for ease in performing service work.

Engine Installation Note: When installing engine, align clutch driven plate with pilot bearing and lubricate pilot bearing with wheel bearing grease.

Engine Rear Mounting Note—When installing rear mountings, make certain that spacer tube in place in biscuit type rubber mountings and tighten these mounting bolts with torque of 25-30 ft. lbs.

CAUTION—Spacer tube regulates compression of the rubber biscuits and must not be shortened or omitted. Excessive tightening of the bolts will damage spacer tubes.

1950-51 CHAMPION
1950 COMMANDER

ENGINE REMOVAL: Drain cooling system and disconnect water outlet from cylinder head. Remove hood and disconnect battery ground strap. Proceed as follows:

1. Disconnect inlet hose from water pump.
2. On Commander, remove radiator brace.
3. Remove fan blades and pulley.
4. Remove radiator and shroud assembly.
5. Remove center cylinder head capscrew and replace with an engine lifting eyebolt. Attach hoist and take up slack in chain.
6. On the Commander, remove stabilizer shaft assembly with frame brackets attached and turn steering wheel all the way to the right.
7. On the Champion, remove both clutch housing-to-engine rear plate dowel bolts and on the Commander, drive or pull out the dowel rings. Then remove bolts holding clutch housing to rear engine plate.
8. Remove clutch housing cover plate from floor pan and remove clutch housing-to-block capscrews.
9. Disconnect exhaust pipe front support clamp and then remove exhaust pipe flange-to-manifold nuts and lower pipe off manifold studs.
10. Disconnect windshield wiper hose and disconnect upper pressure pipe from flexible coupling.
11. Remove distributor assembly and on the Champion, also remove oil level gauge adapter.
12. Remove starter (without disconnecting wires) and tie to left hood hinge.
13. Disconnect accelerator cross shaft from crank rod, and disconnect all other wiring from engine.
14. Disconnect fuel pump flex lines.
15. Remove front engine support insulator-to-crossmember (crossmember bracket on Champion) and also disconnect engine ground strap.
16. Roll car rearward and separate engine rear plate from clutch housing. Slowly pull engine up and forward, keeping engine tilted until clutch pressure plate clears transmission pinion. Move engine toward rear and turn engine to the right, then slowly lift engine out of chassis.

Engine Installation Note: Lubricate pilot bearing and make sure clutch driven plate is aligned with it. Locate chain hoist so lift chain will exert a rearward force on engine as it is lowered into position. On the Commander, place a hydraulic jack under rear of transmission and raise it so pinion is near its normal operating position. Slowly lower engine into chassis, tilting rear of engine downward, en-

CONTINUED ON NEXT PAGE

Original Pistons—Stamped with size of cylinder bore in which pistons are installed.
Replacement Pistons—Stamped figure on top indicates actual size of piston. Pistons furnished std. & .002", .004", .010", .015", .020", .030" oversize.

PISTONS

1942 MODELS

REPLACEMENT PISTONS: Finished ferric-alloy pistons furnished for replacement on 1942 models as follows:

Champion 4G

Size	Limits	Part No.
Standard①	3.000-3.003"	515746
.002" Oversize①	3.0035-3.0055"	515747
.004" Oversize	3.0065-3.0085"	515748
.010" "	3.0125-3.0145"	515749
.015" "	3.0165-3.0185"	515750
.020" "	3.0215-3.0235"	515751
.030" "	3.0315-3.0335"	515752

Commander 12A

Standard①	3.312-3.315"	515759
.002" Oversize①	3.3155-3.3175"	515760
.004" Oversize	3.3185-3.3205"	515761
.010" "	3.3245-3.3265"	515762
.015" "	3.3285-3.3305"	515763
.020" "	3.3335-3.3355"	515764
.030" "	3.3435-3.3455"	515765

President 8C

Size	Limits	Part No.
Standard①	3.060-3.063"	515772
.002" Oversize①	3.0635-3.0655"	515773
.004" Oversize	3.0665-3.0685"	515774
.010" "	3.0715-3.0735"	515775
.015" "	3.0765-3.0785"	515776
.020" "	3.0815-3.0835"	515777
.030" "	3.0915-3.0935"	515778

①—Pistons in these 2 sizes furnished in .0005" steps. All other oversizes are within limits shown above.

1946-51 MODELS

REPLACEMENT PISTONS: Finished aluminum alloy pistons (with fitted piston pins) are furnished for replacement in the sizes listed below.
NOTE—Standard and .002" Oversize Pistons furnished in .0005" gradations. All pistons are within limits shown.

Champion 5G, 6G, 7G
(Before Engine No. 354, 186)

Size	Limits	Part No.
Standard	3.0000-3.0030"	512409
.002" Oversize	3.0035-3.0055"	512410
.004" Oversize	3.0065-3.0085"	512411
.010" Oversize	3.0125-3.0145"	512412
.015" Oversize	3.0165-3.0185"	512413
.020" Oversize	3.0215-3.0235"	512414
.030" Oversize	3.0315-3.0335"	512415
.040" Oversize	3.0415-3.0435"	522112

Champion 7G, 8G, 9G
(After Engine No. 354, 186)

Size	Limits	Part No.
Standard	3.0000-3.0030"	524316
.010" Oversize	3.0125-3.0145"	524294
.020" Oversize	3.0215-3.0235"	524296
.030" Oversize	3.0315-3.0335"	524297
.040" Oversize	3.0415-3.0435"	522112

Commander 14A, 15A
(Before Engine No. H-252, 223)

Size	Limits	Part No.
Standard	3.3120-3.3150"	521109
.002" Oversize	3.3155-3.3175"	521683
.004" Oversize	3.3185-3.3205"	521684
.020" Oversize	3.3335-3.3355"	521687
.030" Oversize	3.3435-3.3455"	521688
.040" Oversize	3.3535-3.3555"	522119

Commander 15A, 16A, 17A
(After Engine No. H-252,223)
(Except V8 Engines)

Standard	3.3120-3.3130"	524315
.010" Oversize		524309
.020" Oversize	3.3335-3.3355"	524311
.030" Oversize	3.3435-3.3455"	524312
.040" Oversize	3.3535-3.3555"	522119

NOTE—Commander engine pistons are provided with a groove in the second land to reduce blow-by. Groove must be cleaned when pistons removed.

PISTON PINS

1939-51 CHAMPION

1947-51 COMMANDER

PISTON PIN REMOVAL & INSTALLATION: Use fixture J-1293 (1939-49), J-1293-A (1950):

Removal—Place rod and piston assembly on assembling fixture. Remove lock nut and star washer from clamp screw, and by tightening lock nut on other end of clamp screw, remove clamp screw, remove the screw from connecting rod. Then slide piston and connecting rod off piston pin.

Installation—Place piston pin on assembling fixture, slide piston and connecting rod into position. (Oil squirt hole and number on connecting rod should be on the solid slide of the piston). Insert piston pin clamp screw in connecting rod, install star washer and lock nut, and tighten nut securely. On connecting rod Nos. 1, 3 & 5, the clamp screw nut is installed on the T-slot side of the piston. On Nos. 2, 4 & 6, the nut is installed on the solid side of the piston. When installing the screw regardless of the number of the rod, if the rod is held with the offset of the rod to the left and the screw is inserted from the front, the nut will be located on the correct side in relation to the piston. Be sure to align the flat surface on the piston pin with the flat surface on the clamp screw.

CRANKSHAFT & MAIN BEARINGS

1950-51 MODELS

Installation: "Brummer type" Oil Seal. Loosen the bearing capscrews of the three intermediate bearings two turns until the "Brummer" seal has been installed. If these screws are loosened too much while the front bearing screws are tight, the front bearing will be damaged. Place the neoprene seal in the cross grooves of the main bearing cap so that the inner end of each seal is flush with or inset not more than 1/16" from the inner end of the grooves. Thoroughly clean the channel just forward of the rear flange using a swab saturated with alcohol and pulling it through the channel several times. Dry the channel thoroughly. Dip the ends of the seal in liquid soap and spread the liquid soap throughout the inside of the center groove. Carefully insert the end of one half of the seal between the crankshaft and the cylinder block at the crankshaft rear flange. Work the seal around the crankshaft until the end emerges on the opposite side. Place the ends of the other half of the seal against the ends of the half that is in the engine. Then work both halves of the seal around the crankshaft until the exposed joint is approximately 45° from the lower surface of the block. During the installation procedure, great care must be taken to avoid scuffing the soft center sealing cushion at the bottom of the groove of the seal. Apply oil between the compression flange of the seal and the crankshaft journal. Install the bearing cap and the two neoprene seals. Be sure that the exposed part of the "Brummer" oil seal smoothly straddles the rear flange of the bearing cap. Install the bearing capscrews and tighten all capscrews to the specified torque of 88-93 ft. lbs. Lockwire all screw heads. Trim the end of the neoprene seal that protrudes past the cap flush with the side of the cap. Install new cork seals being sure seals are not damaged during the installation. Run the engine for 45 minutes then check for oil leaks.

VIBRATION DAMPENER

PRESIDENT (1938-42)

VIBRATION DAMPENER: President. Consists of a spring-loaded flywheel mounted on four tapered rubber cushions between a friction facing on the fan pulley and a damper plate on the front end of the crankshaft. The flywheel oscillation is controlled by the friction of the friction facing and the compression of the rubber cushions. Flywheel radial movement is controlled by a fibre ring on the fan pulley hub. Spring tension is adjusted by shims under spring in flywheel, compression of rubber cushions adjusted by shims on bolt sleeve between cushion and damper plate.

Removal & Installation:—Dampener can be removed as an assembly (without disturbing adjustment) by removing two of the four retaining screws in the damper plate (do not disturb other two screws). Use Puller HM-925 to remove dampener assembly by installing two puller screws in holes from which dampener retaining screws removed.

NOTE—When installing crankshaft nut, make certain that copper-asbestos gasket in place under nut (necessary to prevent oil leaks at this point).

Servicing:—If dampener disassembled for replacement of rubber cones or springs, these parts must be adjusted when re-installed as follows:

Rubber Cones—Assemble friction facing, damper flywheel, bolt sleeves, and rubber cones on top of fan pulley. Install one heavy washer on top of each cone. Press cones and spacer sleeves firmly down in position, measure amount spacer projects above face of heavy washer on cone by using feeler gauge (build up feeler gauge thickness until top surface of feeler even with top edge of spacer sleeve). Measure total thickness of feeler gauge and heavy washer with micrometer, select two heavy washers and

CONTINUED ON NEXT PAGE

seal. Place the keepers in position and slowly release the spring.

►*CAUTION*—Always install new rubber seals whenever valve springs have been removed.

1938-48 CHAMPION
ALL 1949-51 MODELS

SELF-LOCKING TAPPETS: Tappet screws slotted on lower end and require no locknuts. When tappet screws replaced, car manufacturer recommends that screws must check as follows: Pull required to move tappet screw must be 25 in. lbs. minimum (4 lbs. pull on 6" wrench).

ALL 1949-51 MODELS

VALVE CHAMBER BAFFLES: Oil baffle plates are provided to prevent excessive oil splash in valve spring chamber. One baffle is used in each half of the chamber. Baffles straddle lifters. Champion baffles are same for both halves of the chamber and are interchangeable. Commander baffles are marked front and rear (install as marked).

Installation—Insert baffle so curved portion is upward, with notch aligned with cover plate screw hole. Install cover plate, making sure notches straddle cover plate screws. With cover installed, baffle is held tightly in place against cover and cover plate screws.

V8 ENGINE

ROCKER ARM ASSEMBLY: Two identical hollow steel shafts (ends plugged) are used. Four removable supports doweled to each shaft with cylinder head capscrews. Three springs used to position rocker arms against supports. Lubrication is supplied by oil from the main oil galleys to a passage in the cylinder head which leads the oil up around the relieved capscrew shank in the rocker arm front support on the left bank and the rocker arm rear support on the right bank. The bracket is drilled to connect the capscrew hole with the rocker arm shaft hole. The oil flows under pressure to the rocker arms and through holes drilled in the rocker arms to the adjusting screws and through the center of the adjusting screws to the push rods.

►*DISASSEMBLY CAUTION:* Mark rocker arms, brackets, and the rocker arm shaft so that they can be reassembled in their original position.

Reassembly—Make certain the oil holes and grooves in the rocker arm shaft and the oil holes in the brackets, rocker arms and adjusting screws are clean. Check rocker arms and shaft clearance which should be .0005" to .0025". Test springs. It should require 9½ to 10½ lbs. to compress springs to 2 1/32". If not within these limits, replace spring. Place a spring washer between two flat washers and install on one end of the rocker arm shaft and install a new cotter pin in the shaft. Place a rocker arm on the shaft next to the inner flat washer. *(CAUTION*—The oil groove side of the shaft must be at the bottom of the rocker arm and the adjusting screw end of the rocker arm be on the same side of the shaft as the cylinder head capscrew groove in the shaft). Place a shaft bracket on the shaft so that the bottom of the bracket is on the oil groove side of the shaft and align the cylinder head capscrew hole in the bracket with the capscrew groove in the shaft. Insert a capscrew through the bracket. Clamp the bracket in a vice and install the second rocker arm on the shaft, positioning it in the same way as the first rocker arm. Slide a spacer spring on the shaft and, holding the spring compressed, slide the third rocker arm and the second bracket on the shaft and position it in the same way as the first bracket. Align the screw hole in the bracket with the groove in the shaft, insert a capscrew and release the spring. Install the rest of the rocker arms, springs and brackets in the same manner. Slip the two flat washers with the spring washer between them, on the end of the shaft and install a new cotter pin in the shaft. If correctly assembled, when installed on the engine, the flat side on the end of the rocker arm shaft will be at the rear on the right bank and at the front on the left bank.

See "Tightening (Torque Wrench) Specifications".

V8 ENGINE

VALVE GUIDE REMOVAL AND INSTALLATION: Valve guide tool J-4673 is used to remove and install the valve guides. Drive guide out of cylinder head from the combustion chamber side.

Installation—Coat valve guide lightly with white lead and start chamfered end into cylinder head from the combustion chamber side. Place the installing plate on the face of the head so that the long side of the plate is parallel to the end of the head and the bore of the plate centered over the guide bore. The plate is marked "Intake" on one side and "Exhaust" on the other side. Be sure that the exposed mark of the plate corresponds to the valve guide being installed so that the depth of the counterbore of the plate will control the depth to which the guide is driven into the head. Insert the driver through the plate and into the guide. Drive the guide into the head until the shoulder of the driver contacts the bottom of the counterbore in the plate.

OIL PUMP

1939-51 CHAMPION

OIL PUMP REMOVAL: Oil pump must be disassembled as follows for removal from engine: Remove 4 cover screws and washers, take off cover, gasket, idler gear, and drive gear. Remove woodruff key and "C" washer from driveshaft which allows pump body to be taken off engine (driveshaft stays in engine). Oil pan must be removed in order to take out oil pump driveshaft.

Oil Pump Re-Assembly and Installation: Turn engine over until #1 piston at TDC entering power stroke, and "UDC.1-6" mark aligned with pointer. Engage pump shaft with key-way in end of shaft pointing down (key way will rotate to rear when gears meshed). Install new body gasket and pump body over shaft, insert "C" washer and woodruff key on shaft, install pump drive gear and idler gear. Install cover using a new cover gasket and tighten screws securely. Prime pump with engine oil by disconnecting oil pressure gauge line fitting at pump.

COMMANDER (1947-48)

OIL PUMP REMOVAL: Car manufacturer recommends following procedure for oil pump removal (and vacuum booster pump on 1947 models) with engine in chassis:

1. Drain radiator. Remove hood (disconnect at hinge arms). Position car under chain hoist with hook slightly to left of engine and turn front wheels to extreme right. Disconnect front engine insulator from engine support (take out bolts and nuts).
2. Remove center cylinder head capscrew and install lifting eyebolt. Attach chain hoist hook to eyebolt. IMPORTANT—Upper end of chain hoist should be approx. 15° to left of engine.
3. Take off starter (not necessary to disconnect wires) and place to left of hand brake cable.
4. Disconnect clutch operating shaft from throwout shaft by taking out cotter pin and inner clevis pin from sleeve next to clutch housing and pulling shaft and sleeve toward frame.
5. Take out mounting bolts and remove rear engine mounting lower cushions and spacers.
6. Remove radiator inlet and outlet hoses.
7. Disconnect oil gauge pipe at pump. Loosen opposite end at flexible coupling and move pipe for clearance (do not bend pipe). On 1947 models with booster pump, remove pipe between vacuum booster (on outer end of oil pump) and manifold tee.
8. Hoist engine until bottom of right side of front engine support insulator is 1⅝" above support. With engine in this position, right front corner of cylinder head should be 17¼" from closest point on right fender skirt (if necessary engine can be levered and blocked into position for this clearance).
9. **On 1947 models,** remove booster body, gasket, and vane, by taking out 8 mounting screws (use 5/32" Allen wrench). Pull rotor off shaft using 3/16" drift punch inserted in hole on side of rotor. Take off booster base plate and gasket. Remove 4 screws in booster adapter plate (use 7/32" Allen wrench), take off plate, gasket and idler gear. **On 1948 models,** remove 4 oil pump cover plate screws, take off plate, gasket, and idler gear.
10. Pull pump out of engine with twisting action, keeping pump toward front of engine as far as possible (outer end of shaft will pass between ends of steering knuckle upper control arm-to-frame rear bracket bolts).
11. Remove pin from driveshaft gear, press shaft out of gear and pump body. Pump gear can then be removed from shaft by pressing on outer end of shaft.

Disassembly of Pump: With pump cover off, remove cover gasket, lift out idler gear, drive out pin in pump driveshaft gear, press shaft and gear out of driving gear in an arbor press. Then press pump gear off shaft, remove thrust "C" washer and woodruff key from shaft.

Reassembly of Pump: Install thrust "C" washer on shaft and woodruff key in slot adjacent to "C" washer groove, press oil pump drive gear on shaft. Install shaft with gear in pump body. Press driveshaft gear on opposite end of shaft with pin hole in shaft and gear in alignment. Use new 3/16" pin to lock gear to shaft (peen pin securely). If new driveshaft and driveshaft gear installed, proper endplay secured by pressing shaft on gear with .003" feeler inserted between gear and upper end of pump body, drill hole in shaft using hole in gear as a guide, ream hole to 3/16", use new 3/16" pin to lock gear (peen pin securely). Use new gaskets throughout. Install pump on engine, prime pump with engine oil by disconnecting oil gauge line at elbow on pump.

Installation: Use new pump body gasket. Turn pump shaft so that pump drive gear keyway faces toward rear of car, make certain that crankshaft turned to #1 piston firing position with mark "UDC.1-6" at timing pointer, engage pump drive shaft gear with camshaft gear. With pump in position against engine block, keyway should point almost straight downward. Use new cover gasket when installing cover, reassemble all parts disconnected when removing pump.

CONTINUED ON NEXT PAGE

end of clutch release cross-shaft and shaft, install felt on end of shaft, place cover over felt with attaching bolt holes along line of frame, mark bolt holes for drilling, remove cover and felt, drill holes for attaching bolts with 7/32" drill. Saturate felt (Part No. 199621) with #30 engine oil and install felt on end of shaft, install felt retainer washer, retainer spring (Part No. 631893), and cover (Part No. 199619) in order and tighten cover bolts securely. Cover should be removed and felt lubricated with SAE #30 engine oil every 5000 mlles.

1941-47 MODELS

CLUTCH RELEASE SHAFT LUBRICATION: On all Studebaker models the clutch release cross-shaft bushing at each end of clutch release cross-shaft should be oiled with lubricating oil at regular chassis lubricating periods. CAUTION—If bushings not oiled, clutch may stick or slip due to seizing of shaft.
Clutch Release Shaft—Lubricate shaft at each side of clutch housing with SAE #30 engine oil every 1000 miles.
1941-46 Cross Shaft—Remove cover on outside of frame siderail at left end of clutch cross-shaft and lubricate shaft at this point with SAE #30 engine oil every 5000 miles. CAUTION—When installing cover, make certain that felt, felt retainer, and spring are correctly installed within cover.

1950 CHAMPION

CLUTCH CHATTER (Champion Early 1950)—When clutch chatter in the 1950 Champion (prior to Serial No. G-573846) is the result of engine movement when car is being accelerated from low speed, newly designed clutch linkage should be installed. Remove old Clutch Operating Shaft and Lever assembly, Support Bracket and Clutch Pedal Shaft-to-Operating Shaft Rod. Mount new Support Bracket, Part No. 537911, on new Operating Shaft, Part No. 527893, using a new Bearing and Retainer Kit, Part No. 527424. Insert end of operating shaft in shaft sleeve and secure support bracket on frame cross-member with the upper bolts. Align hole in operating shaft with hole in sleeve and install retaining pin. Position Brake Cable Bracket, Part No. 527909, (with cable loop upward) on the forward side of frame cross-member, securing it with support bracket side mounting bolt. Attach front end of pedal shaft-to-clutch operating shaft rod, and then bend back half of rod to align it with clutch pedal lever. Adjust pedal free travel.

CLUTCH OPERATING SHAFT RATTLE CORRECTION (Commander & Champion Early 1950)—Remove clutch operating shaft bracket and bearing and install neoprene washer Part No. 527281 between bushing and felt washer on each side of bushing. Thoroughly lubricate with SAE 30 motor oil and reassemble bracket and shaft.

TRANSMISSION NOTES

COMMANDER (1937-40) PRESIDENT (1937-42)

OVERDRIVE TRANSMISSION REAR SUPPORT INSTALLATION: On cars with Overdrive, rear support (must be removed to remove transmission) should be installed with original shims in same location in order to maintain alignment. These shims located between support and frame at each end. If shims lost or readjustment necessary, install support as follows: Hold support in place under transmission case, install sufficient shims at each end to take up all except 1/16" clearance between support and frame, install frame bolts, tighten bolts securely with shims in place. This clearance will provide correct compression of the support rubber cushions.

PROPELLER SHAFT

1947-51 MODELS

PROPELLER SHAFT & SUPPORT BEARING ASSEMBLY: New type two-unit propeller shaft (separate Front and Rear Propeller Shafts) with intermediate Universal Joint in Support Bearing Assembly on cross-member.
Front Propeller Shaft—One piece type (no slip joint) with intermediate universal joint yoke splined on rear end and retained by capscrew in end of shaft. See Support Bearing Assembly.
Rear Propeller Shaft—Conventional type with slip joint at forward end.
Universal Joints—Spicer needle bearing type. Bearing cups are retained on yokes by "U" bolts and universals are dismantled by removing nuts from these bolts. *See Universals Section for complete Universal Joint data.*
Propeller Shaft & Support Bearing Removal: Disconnect rear propeller shaft by taking out "U" bolts mounting intermediate universal joint on rear flange of front shaft (behind support bearing assembly) and sliding universal joint and stub shaft back on slip-joint. Remove capscrew and washers retaining universal joint flange on rear of front shaft, punchmark flange and shaft to insure correct re-installation, remove flange using Puller J-2046. Remove nuts and washers on forward end of studs mounting support assembly on frame cross-member, pull assembly off splines of front propeller shaft. To dismantle support cushions, remove nuts and washers on rear end of frame mounting studs. Studs have shoulder at each end to position rubber cushion and prevent excessive compression of the cushion when stud nuts are tightened.
Installation—Re-install support bearing assembly and propeller shafts by reversing removal instruction.
Support Bearing Servicing: Bearing is sealed type (pre-packed with lubricant) and **must never be washed in gasoline or other solvents.**
CAUTION—Do not re-install support bearing which has been washed in gasoline or other liquids which will remove lubricant.
Bearing Removal & Installation—To remove bearing from support bracket, press bearing out using a piece of tubing of sufficient size to engage outer bearing race. Install new bearing in same manner and press bearing in until outer bearing race is just **flush with front edge of support bracket.** With front propeller shaft in place in car, install spacer (some Commander cars—see Note below) and dust shield on shaft, then install support bearing assembly, secure support to cross-member with lockwashers and nuts on forward ends of studs, make certain that plain washer and lockwasher installed on rear end of studs. Tighten nuts securely.

FRONT SUSPENSION NOTES

LATE 1947 COMMANDER

CASTER CHANGE (Late 1947 Commander Model): Caster change (0° to +½° changed to —2° to —3°) went into effect beginning with the following serial numbers (see additional car numbers following):

Caster Change

Serial Number	South Bend	Los Angeles
Comm. 14A	4,276,243	4,819,208
Comm. 14A Convertible	4,276,102	
Land Cruiser 14AY	4,276,053	4,819,188

Serial Nos. (Other Cars)—Following cars also have this changed Caster specification: 4819196, 4819200, 4819201, 4819177, 4819180, 4819185.

Suspension Parts Change: Following parts were changed with change in Caster specification as listed above (these parts not interchangeable with similar parts used previously): Steering Knuckle (Right & Left), Steering Knuckle Shims, Steering Knuckle Arm (Right & Left), Steering Knuckle Upper Bushing (first) and Bearing Rollers (Later), Steering Knuckle Upper Control Arm Support (Right & Left), King Pin (Right & Left), and King Pin Thrust Bearing.
See Front Suspension Section for complete data.

1950 CHAMPION

CHAMPION FRONT END TROUBLE CORRECTION (1950 Cars): To correct conditions such as Excessive Right Front Tire Wear, Front End Vibration or Shimmy, Unstable Steering etc., check and correct following points:

1) Auxiliary Arm Bracket Distortion—Install special brace which will prevent bending or distortion of the bracket: No. 530284 Auxiliary Arm Bracket Brace, 520259 Spacer, 2-0734 Bolt, 2-0626 Bolt, and 361-07 Plain Washer. To install brace, remove right rear outer lower control arm innershaft mounting bolt and both auxiliary steering arm-to-bracket mounting bolts. Install the brace with the single hole to lower control arm and place spacer between the brace and frame cross-member flange. Install the 2-0734 bolt, flat washer, lockwasher and nut. Tighten nut loosely. Install both auxiliary steering arm-to-bracket bolts (use 2-0626 bolt in lower hole with bracket on outside of auxiliary steering arm), tighten bolts securely, then tighten control arm mounting bolt securely. Check front end alignment.
2) Worn or Loose Parts—Check and adjust or replace (end fittings, bushings, insulators, etc.).
3) Steering Gear Adjustment—Adjust if necessary.
4) Caster, Camber, Toe-In & Auxiliary Tie Rod Alignment—*See Front Suspension data.*

BRAKE NOTES

ALL MODELS

HILL-HOLDER ADJUSTMENT: On cars with Hill-Holder (optional equipment), check action whenever clutch adjusted to make certain that brakes release just before clutch engages.
Adjustment—Loosen locknut on end of Hill-holder control rod, shorten rod for earlier brake release, lengthen rod for later release, tighten locknut.

COMMANDER & PRESIDENT (1941)

PARKING BRAKE CABLE (1941 Comm. & Pres.): To correct hand brake cable and conduit assembly being twisted or looped out of line when hand brake applied with hard pull, clip conduit to left front fender apron as follows: Use sheet metal screw Part No. 618x10, clip Part No. 172654, and washer Part No. 41x509. Punch hole in fender apron (opposite rear upper control arm frame bracket) approx. ⅛" diameter, install clip and screw.

until contacts begin to open, insert .016" feeler between advance arm and hold-down plate(to insure clearance for free advance arm movement), tighten clamp bolt, remove feeler gauge.

Octane Selector Setting—With engine at normal operating temperature, adjust Octane Selector so that slight ping evident when accelerating with wide open throttle (rotate distributor clockwise if no ping, counter-clockwise if ping too severe).

CARBURETOR

CARBURETION:—Carburetor—Stromberg Model BXO-26, 1¼" single, downdraft type.

For complete data, refer to Carburetor Index.

NOTE—Metering jets need not be changed when heavy duty oil-bath type air cleaner installed. First size smaller main metering jet can be installed to secure greater fuel economy with slight loss of performance. ***See Jet Specification table in Carburetion Section for complete jet data.***

Settings (Idle Setting, Float Level, and Accelerating Pump): *See Tune-Up data.*

Fast Idle:—Integral (Built-in carburetor).

For complete data, refer to Carburetion Equip. Index.

Setting—No adjustment required (if stopscrew set for correct hot or slow idle speed above). See that stopscrew rests on highest step of fast idle cam with choke valve fully closed.

Automatic Choke:—Integral (built-in carburetor).

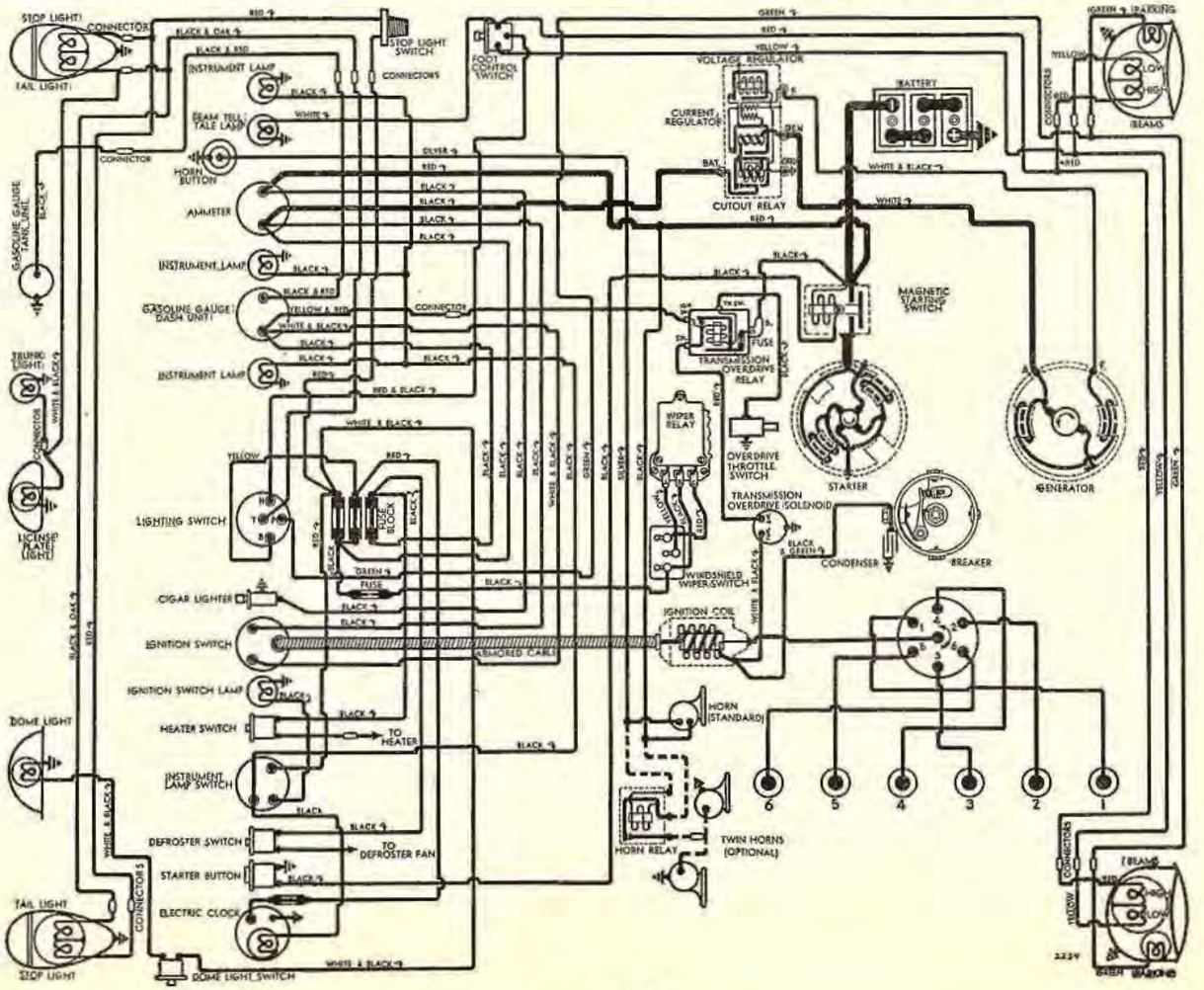
For complete data, refer to Carburetion Equip. Index.

Setting—Mark 'R' on thermostatic spring case should line up with projection on housing (ordinary fuel). If this setting too rich (engine loads up), rotate case to 'M' mark (leaner setting). Use 'H' position only for very volatile fuels.

CARB. EQUIPMENT

Air Cleaner:—AC #1528630 oil-wetted type Std., #1528632 oil-bath type Optl. (Std. in severe-dust states).

NOTE—AC #1528665 oil-vent air cleaner Std., #1528629 type used with oil-bath air cleaners.



1939 MODELS

Fuel Pump:—AC Type W #1522227. Diaphragm type.

For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge: (1938)—Auto-Lite (Motometer) Electric No. NG-8711D (dash unit). (1939)—Stewart (Stewart-Warner) Electric No. G-99370.

For complete data, refer to Carburetion Equip. Index.

BATTERY

1938 MODELS

BATTERY:—Willard, Type WHT-2-105. 6 volt, 15 plate, 105 ampere hour capacity (20 hour rate).

Starting Capacity—133 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.9 minutes. Five second voltage—4.27 volts.

Grounded Terminal—Positive (+) terminal.

Battery grounded to frame. Engine grounded by separate ground strap at front engine mounting.

Dimensions—Width 7 1/6".Length 10 5/16".Height 8 13/16".

Location—On left hand side under front seat.

BATTERY

1939 MODELS

Willard Type SW-1-95. 6 volt, 15 plate, 95 ampere hour capacity (20 hour rate).

Starting Capacity—117 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.1 minutes. Five second voltage 4.2 volts.

Grounded Terminal—Positive (+) grounded to frame.

Engine Ground—Separate ground strap.

Dimensions—Length 9". Width 7". Height 8 13/16".

Location—In engine compartment on left side.

STARTER

Auto-Lite Model MAW-4015. Armature MAW-2091.

Drive—Outboard Barrel Type Bendix No. A-1719.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—43-52 ozs. (new brushes).

Cranking Engine—130 RPM., approximately 175 amperes at 5.0-5.5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4900	5.5	65
.6 "	3300	5.5	100
2.75 "	1480	5.0	200
5.45 "	820	4.5	300
8.5 "	400	4.0	400
11.5 "	Lock	3.0	505
18.0 "	Lock	4.0	670

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out two flange mounting screws, remove starter and switch as assembly.

Starting Switch:—R.B.M. Model 2214. Magnetic type. Mounted on starter and controlled by Douglas #5701 pushbutton switch on instrument panel.

GENERATOR

1938 MODELS

Auto-Lite Model GCJ-4808-A. Armature GCJ-2006B. Fixed third brush type used with Auto-Lite Voltage Regulator Model VRD-4006-A.

MODEL 7A—SERIAL No. 5,591,818 & UP

MODEL 8A—SERIAL No. 4,104,800 & UP

Auto-Lite Model GDF-4804-B. Armature GDF-2006. Fixed third brush type used with Auto-Lite Voltage Regulator Model VRD-4006-B.

NOTE—Third brush is fixed non-adjustable type. Any attempt to adjust third brush position will damage brush holder.

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ENGINE

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Installing Pistons:—T-slot away from camshaft.

PISTON RINGS: Before Engine No. H-81539. 2 (P-C#70) compression, 1 (#85) oil ring, all above pin. Narrow heat-dam groove (no ring fitted) above top ring. Oil ring groove has ten 5/32" oil drain holes.

Engine No. H-81539 & Up. New sealed power type, 2 compression (with upper inner edge beveled), 1 oil control ring (no inner ring used). Narrow heat-dam groove above top ring. Oil drain holes in oil ring groove.

Ring	Width	End Gap	Side Clearance
①Compression	1/8"	.013-.018"	.0015-.002"
②Compression	3/32"	.013-.018"	.0015-.002"
Oil Control	3/16"	.013-.018"	.0015-.002"

①—Before Eng. No. H-81539.
②—Engine No. H-81539 & Up.

Replacement Rings:—Std. & .010", .020", .030" oversize.

PISTON PIN:—Diameter—.8741-.8745". **Length**—2⅞". Pin locked in connecting rod by lock screw.

Pin Fit in Piston—.0001-.0003" clearance or light finger-push fit at room temperature (70°).

Replacement Pins: Std. & .0025", .005" Oversize.

NOTE—Replacement pistons fitted with pins.

CONNECTING ROD:—Length—8⅛". **Weight**—33.2 ozs. **Crankpin Journal Diameter**—2.18675-2.18775".

Lower Bearing—Spun babbitt (cap bearings chamfered on upper edge). New rods furnished on exchange basis standard and .010", .020" undersize. **Clearance**—.0005-.002". **Sideplay**—.005-.009".

NOTE—Use reamer HM-591-D to secure correct bearing clearance. Crankpin out-of-round, tapered or scored .0015" max. (use Tool No. 1C for reconditioning crankpins).

Bearing Adjustment:—None. Replace rods.

Installing Rods:—Narrow portion of bearing to front (#1, 3, 5), to rear (#2, 4, 6). Numbers on rods and caps must be together and installed in same numbered cylinder with numbers and oil hole in lower end of rod toward camshaft side of engine.

CRANKSHAFT:—4 bearing, 5 integral counterweights. Vibration damper mounted on forward end of shaft. *See Studebaker Shop Notes for Vibration Damper data.* **Journal Diameter**—2.4995-2.5000".

Bearings—Removable steel-backed, babbitt-lined. **Clearance**—.0005-.0025".

Adjustment:—None (no shims). Replace bearings (std. size, .010", .020", .030" undersize).

End Thrust:—Thrust plate assembled between front bearing and crankshaft gear. Controlled by shims (furnished .003", .005", .007" thick) between plate and journal face. **Endplay**—.003-.006".

NOTE—Install new seals (specially treated wood) whenever rear main bearing cap replaced

CAMSHAFT:—Four bearing with helical gear drive. *See Studebaker Shop Notes for Camshaft Removal.* **Journal Diameters**—#1, 1.9975-1.998"; #2, 1.96625-1.967"; #3, 1.93575-1.9365"; #4, 1.12325-1.124".

Bearings—Split steel-backed, babbitted bushings.

NOTE—Align bushing with oil hole in block. **Clearance**—.00075-.00225" (#1), .002-.00375" others.

End Thrust:—Taken by thrust plate assembled on front face of engine behind camshaft gear. Spacer assembled back of gear hub. **Endplay**—.004-.008"

Timing Gears:—Crankshaft (cast-iron), Camshaft (Celeron with steel hub). **Backlash** .001-.003". *See Studebaker Shop Notes for Gear Removal and Replacement Gear size selection.*

Camshaft Setting:—Mesh marked camshaft gear tooth between two marked teeth on crankshaft gear.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.0015-.0035"

Valve Guides:—Pressed in block from above (1 5/32" below upper edge of valve seat) with stepped end down. Ream to inside diameter of .3425-.3445".

Valve Springs:—Install with closed-coil up and dampener on top of spring. Replace springs if 10% weak (test with Tool U-15). **Free Length**—2½". *See Studebaker Shop Notes for Valve Spring installation.*

	Spring Pressure	Spring Length
Valve Closed	54-60 lbs.	2 3/32"
Valve Open	125-135 lbs.	1¾"

Valve Lifters:—Barrel type (remove from above with valve, valve spring and adjusting screw removed). Furnished std. size and .0005", .001" oversize. **Diameter** .9985-.999". **Clearance** .0005-.00175".

VALVE TIMING

Tappet Clearance:—.016" (cold) all valves. Remove hood side panel for access to valves.

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 15° BTDC. Close 49° ALDC.

Exhaust Valves—Open 54° BLDC. Close 10° ATDC.

Valve Timing Check—With .020" tappet clearance #1 intake valve should open with #1 piston 15° or .0942" BTDC with vibration damper mark 'IN.OP1-6/' aligned with pointer on timing gear cover. Reset tappet clearance .016" (cold).

LUBRICATION

LUBRICATION:—Pressure (pump on right of engine). *See Studebaker Shop Notes for Oil Pump installation.*

Oil Pan Note—Place #2 piston at approx. top dead center to facilitate Oil Pan Removal & Installation.

Normal Oil Pressure: 40 lbs. (min.) at 40 MPH. (1938), 40 lbs. at 25-30 MPH. (1939).

Oil Pressure Relief Valve:—On lower right front corner of engine. Opens at 30-40 lbs. Not adjustable.

Crankcase Capacity: 5½ qts. (1938), 6 qts. (1939).

COOLING

COOLING SYSTEM: Capacity—14½ quarts.

Water Pump:—Centrifugal with adjustable packing, lubricant fitting and grease cup for bushings. *See Water Pump Section for complete data.*

Thermostat:—Bishop & Babcock or Fulton.. In cylinder head outlet. Install with bellows down.

CLUTCH

CLUTCH: Borg & Beck Model 9A6. Number 869 stamped on cover. Single plate, dry disc type. *See Clutch Section for complete data.*

Facings—Moulded (flywheel), Woven (pressure plate), Inside Diam. 5⅝". O. Diam. 9¼". Thickness .133".

Adjustment:—Free travel 1" (min.). Turn adjusting sleeve on pedal connector link.

Hill-Holder (NoRol) Note—Check whenever clutch pedal adjusted. Set so that Hill-Holder releases just as clutch engages (change rod length).

Removal: Remove transmission (see Transmission Removal following, disconnect clutch pedal linkage, support engine at rear, remove rear engine mountings, remove clutch housing. Take out mounting screws and remove clutch.

For Clutch Cross-shaft Oiler installation data, see Studebaker Shop Notes.

TRANSMISSION

1938 MODELS

TRANSMISSION: Warner 'Horizontal' Types. Model Nos. AS2-T88 (floor shift), AS4-T88 (Evans vacuum shift). All helical gear type with synchro-mesh (2nd & high). *See Transmission Section for complete data.*

Transmission Control: Evans-Studebaker vacuum type optional equipment. Lever mounted on instrument panel. *See Transmission Section for complete data.*

Removal: Disconnect front and rear universal joints. On cars with vacuum shift, disconnect vacuum power cylinder rod. Remove transmission mounting capscrews at clutch housing, pull transmission back and lift out.

TRANSMISSION

1939 MODELS

TRANSMISSION: Warner 'Horizontal' Type. All helical gear type with synchro-mesh on second and high. *See Transmission Section for complete data.*

Transmission Control: Steering Col. Shift Optional. *See Transmission Section for complete data.*

Removal: Remove shift lever (floor shift), or disconnect control rods at transmission (steering col. shift). Remove driveshaft, take out transmission mounting screws, pull transmission back and lift out.

OVERDRIVE

1938 MODELS

OVERDRIVE: Warner Type R6 (Horizontal Transmission). Complete assembly model number (Horizontal transmission with R6 Overdrive) Warner No. AS1-T88 (floor shift), AS3-T88 (vacuum shift). *See Transmission Section for complete data.*

Removal: Same as for regular transmission after removing Overdrive Support. *See Overdrive Transmission Rear Support Installation in Studebaker Shop Notes*

OVERDRIVE

1939 MODELS

OVERDRIVE: Warner R6 (Kick-down) Electric. This Overdrive used with 'Horizontal' T-88 transmission. *See Transmission Section for complete data.*

Overdrive Solenoid—Delco-Remy Model 1569.

Throttle Switch—Hersee #1687S. Adjust so that shoe on idler lever just contacts switch plunger with throttle valve wide open (lever against stop).

Control Relay—Auto-Lite Model HR-4201S. NOTE—Use only 14 ampere fuse on relay.

Removal: Same as for regular transmission after removing Overdrive Support. *See Overdrive Transmission Rear Support Installation in Studebaker Shop Notes*

UNIVERSALS

UNIVERSAL JOINTS: (1938)—Thompson Products. Rubber bushed type. Two used. (1939)—Spicer Model 1271-OIX (front), 1278-OIX (rear). Needle bearing types. *See Universals Section for complete data.*

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MODEL IDENTIFICATION

SERIAL NUMBER: Stamped on plate on left frame member under left front fender. First numbers as follows:

	South Bend	Los Angeles
4C (1938)	7120101	7801801
5C (1939)	7125501	7802501

ENGINE NUMBER: Stamped on boss on left center of cylinder block. First number (1938) B-24601, (1939) B-30201.

TUNE-UP

COMPRESSION:—Ratio—6.0-1 Std. cast-iron head. Pressure—105 lbs. at 150 R.P.M.

VACUUM READING:—Steady 18" at 450 RPM., 8 MPH.

FIRING ORDER: 1-6-2-5-8-3-7-4. See diagram.

SPARK PLUGS: Champion Type 8. 18 mm. Metric. **Gaps—Set at .025".**
NOTE—Champion No. 6 Com-62 recommended by car manufacturer for replacement use.

IGNITION: See Coil, Condenser, and Distributor. Breaker Gap—.020". Cam Angle—33° Closed. Synchronization—Set movable contacts to open 45° after stationary set. Automatic Advance—14½° max. at 1800 RPM (distr.). Vacuum Advance—6° distr. with 11-14" vacuum.

IGNITION TIMING: See Ignition Timing. Std. Setting—TDC. Vibration dampener mark 'UDC.1-8' aligned with pointer at front of engine for stationary contacts. Mark 'UDC.3-6' for movable contacts (¼ revolution from 'UDC.1-8' mark).

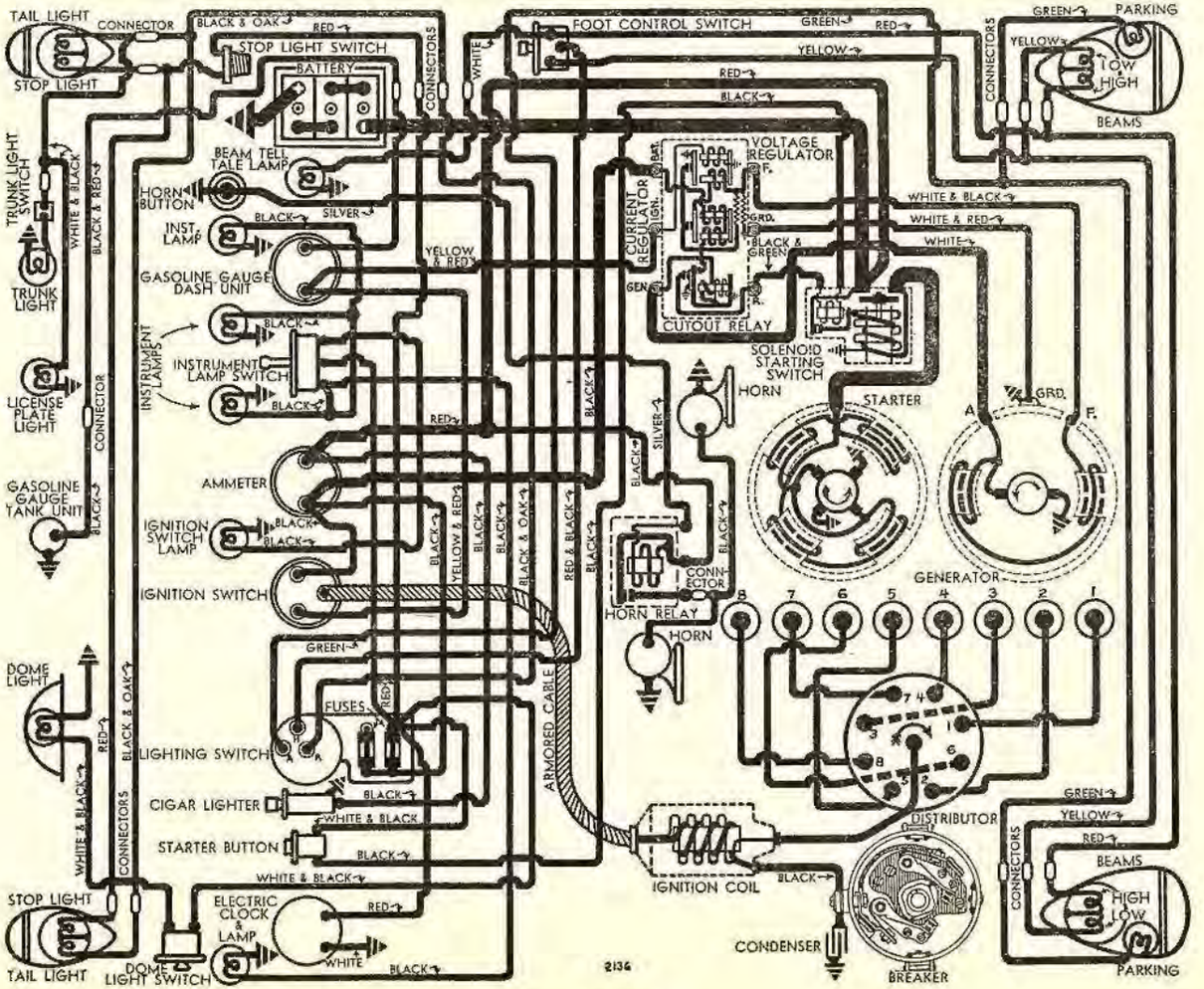
CARBURETION: See Carburetor & Carb. Equipment. Idle Setting—Set idle adjusting screws midway between 'miss' and 'roll' points. Idle speed 450 RPM or 8 MPH. Float Level—Fuel level 5/8" below top edge of bowl. Accelerator Pump—Inner Hole (short stroke) for minimum charge, Outer hole (long stroke) maximum charge.

Fuel Pump Pressure: 3½ lbs. maximum.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. To check valve, unlatch thermostatic coil (free outer end from bracket on manifold), operate valve by hand and see that shaft is free (shaft can be cleaned with emery if necessary). Make certain that thermostatic coil is properly latched to bracket and that tension spring (from shaft to clip on flange) is in place.

VALVES: See Valve Timing. Tappet Clearance—.016" for all valves, Cold.

STARTING: See Battery, Starter, Generator, Regulator.



1938 MODELS

IGNITION

Ignition Switch: Mitchellock Model 24-R, Delco-Remy Model No. 1116257 (1938), No. 1116268 ('39) (switch & cable).
Ignition Lock—Yale & Towne. Mitchell No. 6770 (1938), #8078 ('39).

COIL: Delco-Remy Model 1115021. Mounted on dash.
Ignition Current—½-1½ amps. idling, 4-5 stopped.

CONDENSER: Delco-Remy—Part No. 1838163. Capacity—.18-.25 microfarad.

DISTRIBUTOR: Delco-Remy Model 662-M. Double breaker, 4 lobe cam, full automatic advance type with auxiliary vacuum spark control. NOTE—Movable contacts must be synchronized. Open 45° after stationary set.
Firing Interval—Movable contacts open 45° (distr.) after fixed set.
Breaker Gap—Set at .020". Limits .018-.024".
Cam Angle or Dwell—33° (closed), 12° (open). Both sets operating together and synchronized.
Breaker Arm Spring Tension—22 ounces.
Rotation—Clockwise viewed from top.

Automatic Advance

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	300	2.5	600
14.5	1800	29	3600

Vacuum Spark Control D-R No. 681-S. Mounted under distributor and linked to advance arm.

Vacuum Advance

Dist. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0	5-7"
6°	12°	11-14"

Removal:—Mounted on right hand side of cylinder head. To remove, loosen advance arm clamp bolt (not necessary to disturb vacuum unit or vacuum connections).

IGNITION TIMING

IGNITION TIMING:—Standard setting as follows (see Octane Selector Setting following for correction dependent on fuel regularly used):

Flywheel Degrees	Piston Position
0° (At TDC.)	.0000" TDC.

To Set Timing (Stationary Contacts)—Crank engine by engaging gears and rolling car on floor. With #1 piston on compression, turn engine over until piston reaches top dead center, stop when dead center mark 'U.D.C.1-8' on vibration dampener at front of engine lines up with pointer on timing gear cover. Loosen advance arm clamp bolt, rotate distributor until stationary breaker contacts (mounted directly on breaker plate) begin to open, tighten clamp bolt, then synchronize movable contacts.

Synchronization (On Engine)—Turn engine over 90° to #6 firing position with vibration dampener

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Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output controlled by Current Regulator. See Control Unit section below.

Maximum Charging Rate—26 amperes (cold) with discharged battery as indicated on test ammeter connected in charging line at regulator 'BAT' terminal. Decreases as battery comes up on charge. Generator output constant at all speeds above 1750 R.P.M. or 21.1 M.P.H.

Performance Data—Generator Cold

Amperes	Volts	R.P.M.
25	8.0	1650

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—22-26 ounces each.

Field Current—2.0-2.2 amperes at 6.0 volts.

Removal:—Generator now pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, pull generator out or away from engine until fan can just be turned with belt held stationary.

GENERATOR

1939 MODELS

Delco-Remy Model No. 1102656. Armature Number 1873866. Two brush, shunt type with external vibrating Voltage and Current regulation. Ventilated by fan on drive pulley.

Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. See Regulator data below.

Maximum Charging Rate—30 amperes (cold), 8.0 volts, 1700 R.P.M., 20 M.P.H. and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30	8.0	1700

Rotation—Counter-clockwise at comutator end.

Brush Spring Tension—25 ounces each.

Field Current—2.0-2.2 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Swing generator out until fan can just be turned with belt held stationary.

REGULATOR

1938 MODELS

Delco-Remy Model 5818. Double Core Type Voltage & Current Regulator (With 'IGN' Terminal). Cut-out Relay and vibrating type Voltage & Current Regulators in case on dash. Cutout Relay has special 'ground' contacts for starter solenoid control.

For complete data, refer to Electrical Equipment Index.

NOTE—Cover is sealed and units serviced on exchange basis if seals not broken. Unit can be checked without breaking seal but cover must be removed to make adjustments.

Cutout Relay

Cuts In—6.7-7.6 volts, 800-850 R.P.M., 9.7 M.P.H.

Cuts Out—0-3.0 amperes discharge current.

Contact Gap—.020". **Air Gap**—.020" (closed).

Voltage Regulator

Setting—7.5-7.95 volts (70°F.), 7.4-7.6 volts (150°F). Regulator over-compensated for temperature and must be checked at these points.

To Check (without breaking seal)—Disconnect lead at 'IGN' terminal on regulator, connect jumper between 'IGN' and 'BAT' terminals, connect ammeter in charging line at 'BAT' terminal, connect voltmeter between 'IGN' terminal and ground. Operate generator at 2800-3400 R.P.M., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). Voltmeter reading should check with setting given above.

To Adjust (with cover removed)—Change armature spring tension by bending spring hanger at lower end of spring slightly. Check performance as directed above.

NOTE—Voltmeter regulator readings must be taken with cover in place and setting should be checked by decreasing speed until Cutout Relay contacts open, and then increasing speed to original point.

Contact Gap—.020". **Contact Spring Tension**—3.5 oz.

Air Gap—.063" between armature and core with armature down so that fibre bumper just touches stop. .010" between fibre bumper and stop with armature up.

Current Regulator

Setting—26 amperes.

To Check (without breaking seal)—Disconnect lead on 'IGN' terminal of regulator, connect ammeter in charging line at 'BAT' terminal, operate generator and check output.

NOTE—Generator voltage must not be allowed to exceed 8.5 volts with Voltage Regulator disconnected.

To Adjust (with cover removed)—Change armature spring tension by bending spring hanger at lower end of spring slightly. Check performance as directed above.

Contact Gap—.020". **Contact Spring Tension**—3.5 oz.

Air Gap—.075" between armature and core with armature down so that fibre bumper just touches stop. .010" between fibre bumper and stop with armature up.

REGULATOR

1939 MODELS

Delco-Remy Model 5861. Double Core Type Voltage & Current Regulator (With 'IGN' Terminal). Cutout Relay and vibrating type Voltage & Current Regulators in case on dash. Cutout Relay has special 'ground' contacts for starter solenoid control.

For complete data, refer to Electrical Equipment Index.

NOTE—Regulator cover sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.9-7.6 volts, 800-850 RPM., 9.7 MPH.

Cuts Out—0-4.0 ampere discharge current.

Contact Gap—.020". **Air Gap**—.020" (closed).

Voltage Regulator

Setting—7.5-7.9 volts at 70°F. 7.4-7.6 volts at 150°F. Regulator over-compensated for temperature and must be checked at these points.

To Check (without breaking seals)—Disconnect charging lead at regulator 'BAT' terminal, connect ¾ ohm fixed resistance (Nicrome wire capable of carrying 10 amperes) between this terminal and ground, disconnect lead on 'IGN' terminal, connect jumper between this terminal and 'BAT' terminal. Connect voltmeter between 'IGN' and 'GRD' terminals. Operate generator and increase speed to 2800-3000 R.P.M., note voltmeter reading (see setting above). NOTE—This test method recommended by manufacturer, does not require adjusting charging rate as with other methods (see Electrical Equipment Section for alternative checking directions).

To adjust (with cover removed)—Change armature spring tension by bending spring hanger at lower end of spring slightly. Recheck performance.

NOTE—Cover must be in place when regulator tests made. Check setting by decreasing speed until Cut-out contacts open and then increasing speed to original point.

Contact Gap—.020". **Contact Spring Tension**—3.5 ozs.

Air Gap—.063" between armature and core (armature down so that fibre bumper just touches stop) .010" between fibre bumper and stop (armature up).

Current Regulator

Setting—28-30 amperes.

To Check (without breaking seals)—Connect ammeter in charging line at regulator 'BAT' terminal, disconnect lead at 'IGN' terminal (to eliminate regulator action), turn on car lights. Operate generator and increase speed until Current Regulator limits output, note ammeter reading.

NOTE—Generator must not be operated on open-circuit and voltage must not be allowed to exceed 8.5 volts with Voltage Regulator disconnected.

To adjust (with cover removed)—Same as for Voltage Regulator (see directions above).

Specifications—Contact Gap, Contact Spring Tension, Fibre bumper clearance same as for Voltage Regulator (above). Armature Air Gap should be .075".

LIGHTING

LIGHTING:—Headlamps—Corcoran-Brown pre-focused type. Upper and lower beams controlled by beam selector switch on toeboard (lower beam deflected slightly to right).

Headlamp Adjustment—With car unloaded, 25' from screen, and with upper beams lighted, aim each headlamp so that top of beam is on horizontal line at lamp center height, and beam is centered on vertical lamp center-line. Adjusting screws located behind lamp rim at top (vertical movement), one side (horizontal movement).

Beam Indicator—Dot on face of speedometer. Illuminated when upper beams in use.

Switches

Lighting—Douglas #5740.

Beam Selector—R.B.M. # 1081.

Instrument—Douglas #5697.

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CLUTCH

1939 MODELS

CLUTCH:—Inland. 'Diaphragm' type, single plate, dry disc type with Long 9½CF-CS driven member.
See Clutch Section for complete data.

Facings—Spirally grooved. Moulded (flywheel side). Woven—Man. Hycoe (pressure plate side). Inside Diam. 6". Outside Diam. 9½". Thickness .125".

Replacement Clutch Note—Remove spacers (one at each driving lug) after clutch installed on car.

Pedal Adjustment:—Free travel 1" min. Turn adjusting sleeve on pedal connector link. On cars with Hill-Holder (NoRol), check when pedal adjusted and see that brakes release just as clutch engages.

Removal: Remove transmission (see Transmission Removal following, disconnect clutch pedal linkage, support engine at rear, remove rear engine mountings, remove clutch housing. Take out mounting screws and remove clutch.

For Clutch Cross-shaft Oiler installation data, see Studebaker Shop Notes.

TRANSMISSION

1938 MODELS

TRANSMISSION: Warner 'Horizontal' Types. Model Nos. AS2-T88 (floor shift), AS4-T88 (Evans vacuum shift). All helical gear type with synchro-mesh (2nd & high).
See Transmission Section for complete data.

Transmission Control: Evans-Studebaker vacuum type optional equipment. Lever mounted on instrument panel.
See Transmission Section for complete data.

Removal: Disconnect front and rear universal joints. On cars with vacuum shift, disconnect vacuum power cylinder rod. Remove transmission mounting capscrews at clutch housing, pull transmission back and lift out.

TRANSMISSION

1939 MODELS

TRANSMISSION: Warner 'Horizontal' Type. All helical gear type with synchro-mesh on second and high
See Transmission Section for complete data.

Transmission Control: Steering Col. Shift Optional.
See Transmission Section for complete data.

Removal: Remove shift lever (floor shift), or disconnect control rods at transmission (steering col. shift). Remove driveshaft, take out transmission mounting screws, pull transmission back and lift out.

OVERDRIVE

1938 MODELS

OVERDRIVE: Warner Type R6 (Horizontal Transmission). Complete assembly model number (Horizontal transmission with R6 Overdrive) Warner No. AS1-T88 (floor shift), AS3-T88 (vacuum shift).
See Transmission Section for complete data.

Removal: Same as for regular transmission after removing Overdrive Support. *See Overdrive Transmission Rear Support Installation in Studebaker Shop Notes*

OVERDRIVE

1939 MODELS

OVERDRIVE: Warner R6 (Kick-down) Electric. This Overdrive used with 'Horizontal' T-88 transmission.
See Transmission Section for complete data.

Overdrive Solenoid—Delco-Remy No. 1569, 1573 (12 volt Exp.).

Throttle Switch—Hersee #1687S. Adjust so that end of throttle rod just contacts switch plunger with throttle valve wide open (lever against stop).

Control Relay—Auto-Lite Model HR-4201. NOTE—Use only 14 ampere fuse on relay.

Removal: Same as for regular transmission after removing Overdrive Support. *See Overdrive Transmission Rear Support Installation in Studebaker Shop Notes*

UNIVERSALS

UNIVERSAL JOINTS: Spicer. Model 1271-OIX (front), 1278-OIX (rear). Needle bearing types.
See Universals Section for complete data.

REAR AXLE

REAR AXLE:—Spicer Model 41-2. Semi-floating, Hypoid gear type with Hotchkiss drive.
See Rear Axle Section for complete data.

Ratio—4.55-1 Std., 4.82-1 Optl. (Std. on Overdrive).

Backlash—.005-.007". Shim adjustment.

Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, hydraulic brake lines, brake cables, and shock absorbers. Remove spring U-bolts, disconnect rear spring shackles and withdraw axle.
NOTE—Use Puller HM-931 to remove axle shaft.

Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed (use Hub Puller ST-500) check endplay with dial indicator. To adjust, remove backing plate, add or remove shims (.003", .005", .010", .030" thick).
Endplay—.001-.005".

SHOCK ABSORBERS

SHOCK ABSORBERS: Houdaille Double acting, adjustable, hydraulic types. Rear shocks have thermostat control.

	Front	Rear
1938	BEDVS	ASC
1939	BBFS	ACHS

FRONT SUSPENSION

Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car weight on wheels but without load.
See Front Suspension Section for complete data.

Kingpin Inclination—5½°.

Caster—Negative ¼° to Positive ¾°.

Camber—¼° to ¾°. Shim adjustment.

Toe In—1/16-⅛". Adjust right reach rod only for toe-in. Left rod should be adjusted first for left wheel straight-ahead position (steering wheel centered).
NOTE—If car equipped with non-adjustable reach rods (to wheels), adjustment is made on center rod.

Steering Geometry (toe-out on turns)—Inner wheel turned 22-22½°. Outer wheel 20°.

STEERING GEAR

Steering Gear: Ross Model T-14. Cam & Twin Lever.
See Steering Gear Section for complete data.

BRAKES

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies rear service brakes.
See Brake Section for complete data.

Wheel Cylinders—Stepped or two-stage bore type.
Front Wheels.....Front Shoe cylinder 1⅜". Rear 1".
Rear Wheels.....Front shoe cylinder 1¼". Rear 1".
NOTE—Wheel cylinder bore size marked on casting.

Drum—Budd composite. Diameter—11".

Lining—Front Shoe: woven. Rear: moulded. Width 2¼". Thickness 3/16". Length per wheel 19 11/16".

Clearance—.010" toe, .005" heel, for each shoe.

Hand Brake: See Service Brakes above.

Hill-Holder: Optional equipment on all models.
See Brake Section for complete data.

MISC. MECHANICAL

1939 MODEL

WINDSHIELD WIPER:—**Auto-Lite Model EW-5003** (first cars), **EW-5103** (later cars). Electric type.
See Miscellaneous Section for complete data.
NOTE—Use only 20 ampere fuse in wiper switch lead.

pression, turn engine over until 'IGN' mark (approx. 13/64" ahead of U.D.C.1-6 mark) on flywheel is in line with pointer on engine rear plate on left side of car. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, insert .016" feeler between advance arm and hold-down plate (to insure clearance for free advance arm movement), tighten clamp bolt, remove feeler gauge.

NOTE—Car manufacturer recommends use of Neon timing light.

Octane Selector Setting—After setting ignition timing, loosen selector (hold-down plate) screw and advance (move selector so that pointer toward 'A' end of scale) until motor 'pings' when hot and pulling hard. Then retard (move selector with pointer toward 'R' end of scale) until 'ping' just disappears.

CARBURETOR

CARBURETION:—**Carburetor**—Carter Model WO Type 444-S (Early—may de identified by #229 cast on flange), Type 453-S (Later cars). New type, single barrel, 1¼" downdraft type. IMPORTANT PRODUCTION CHANGE NOTE—See Carburetor article for part changes for Type 444-S to change over to latest type 453-S. *See article in Carburetor Section.*

For complete data, refer to Carburetor Index.

Idle Adjustment—With engine warm and choke valve wide open (fast idle inoperative), adjust throttle stopscrew so that engine idles at 600 RPM. or 8 MPH. Turn idle adjusting screw in until engine begins to miss or lag, then turn screw out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Final setting should be ¾-1¼ turns of screw open from inner or closed position. Readjust throttle stopscrew for correct idle speed.

Accelerating Pump—Non-adjustable type.

Fast Idle Setting—Choke connector link opens throttle 3/32" with choke valve closed. Adjust by bending offset on connector link.

CARB. EQUIPMENT

Air Cleaner:—AC #1529210 oil-wetted type. #1529211 heavy duty oil bath type optional.

Fuel Pump:—AC Type W #1523957 diaphragm type.

For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge:—Auto-Lite electric. No. NG-9211D (dash unit), No. NG-9197T (tank unit).

For complete data, refer to Carburetion Equip. Index.

BATTERY

Willard, Type SW-1-90. 6 volt, 13 plate, 90 ampere hour capacity (20 hour rate).
Starting Capacity—114 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.0 minutes. Five second voltage—4.1 volts.
Grounded Terminal—Positive (+) grounded to dash.
Engine Ground—Strap connector at right front mounting bolt.
Dimensions—Length & Height 9". Width 7".
Location—On left side of dash under hood.

STARTER

EARLY: Auto-Lite MZ-4066. Armature MZ-2120.
LATER: Auto-Lite MZ-4074. Armature MZ-2130.
Drive—Barrel type Bendix No. A-2033 (similar in design to Ford '60' type A-1806).

IMPORTANT—A-2033 drive marked 'D' on pinion barrel. Must not be interchanged with Ford type due to difference in structure of pinion teeth.

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—160 amperes, 5.2 volts, 130 RPM.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 " "	2500	5.5	100
2.55 " "	1325	5.0	200
4.95 " "	750	4.5	300
7.65 " "	220	4.0	400
7.8 " "	Lock	3.0	420
11.8 " "	Lock	4.0	560

Removal:—Starter flange mounted on right rear engine plate. To remove, take out mounting bolts.

Starting Switch:—A-L Model SW-4011. Mounted on left side of car below clutch pedal. Operated by depressing clutch pedal fully.

GENERATOR

STANDARD

Auto-Lite Model GDF-4812-A. Aramature GDF-2006. Third brush control type used with Voltage Regulator.

Maximum Charging Rate—30 amperes (cold), 28 amperes (hot), at 8.0 volts, 3000 R.P.M. (generator), 32.5 M.P.H. Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Charging Rate Adjustment—Maximum output controlled by third brush. Do not adjust third brush for output greater than shown in table below (with field terminal grounded to render regulator inoperative). See Regulator Section (following).

NOTE—Third brush setting 2 bars 1 mica strip to 2 bars 2 mica strips from insulated main brush.

Cold Performance Data			Hot Performance Data		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
Start	6.4	920	0	6.4	1000
4	6.6	1030	4	6.6	1140
8	6.8	1140	8	6.85	1280
12	7.0	1300	12	7.1	1440
16	7.25	1460	16	7.3	1640
20	7.45	1650	20	7.55	1840
24	7.65	1880	24	7.75	2220
28	7.9	2220	28.3	8.0	3200
32	8.0	3100			

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.90-2.10 amperes at 6.0 volts.
Motoring Current—5.3-5.9 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, move generator out away from engine until fan can just be rotated with belt held stationary.

GENERATOR

SPECIAL EQUIPMENT

Auto-Lite GCE-4824-A. Armature No. GBX-2006AF. Two brush type used with Current-Voltage Regulator.

Wiring Note—*Internal wiring for GCE Generator & VRP regulator same as shown on 1940 Studebaker Champion Model 2G car model page wiring diagram.*

Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.

Maximum Charging Rate—As given in table below.

Cold Performance Data			Hot Performance Data		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	740	0	6.4	785
4	6.6	830	4	6.6	880
8	6.8	920	8	6.8	975
12	7.05	1015	12	7.05	1070
16	7.25	1100	16	7.25	1165
20	7.5	1190	20	7.5	1275
24	7.7	1280	24	7.7	1385
*30	8.0	1400	30	8.0	1580

*—Current Regulator setting. See Regulator data.

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—64-68 ozs. (new brushes).
Field Current—1.66-1.84 amperes at 6.0 volts.
Motoring Current—5.03-5.57 amperes at 6.0 volts.

Removal & Belt Adjustment:—As given above.

REGULATOR

STANDARD

Auto-Lite Voltage Regulator Models VRD-4006-B or VRR-4002-B (for GDF generator). In case on dash.
For complete data, refer to Electrical Equipment Index.
NOTE—Regulator cover sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-7.0 volts Cold (VRD), 6.4-6.6 volts Cold (VRR), 900 RPM, 9.1 MPH.

Cuts Out— .5-3.0 amperes discharge current (VRD), 4.2-4.8 volts with approx. 4-6 amps. disch. (VRR).

Contact Gap—.015" minimum.

Air Gap—.034-.038". Contacts open—measure at hinge end of core.

Voltage Regulator

Setting—7.3-7.6 volts at 70° F.

To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' and 'GD' terminals. Operate generator at speed equivalent to 30 MPH., charging battery, until voltage is steady. Voltage reading should agree with setting given above.

To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger. See Electrical Equipment Section for data.

Contact Gap—.010-.020" (VRD), .012" min. (VRR) with armature against stop pin.

Air Gap—.0595-.0625" (VRD), .048-.052" (VRR) with contacts just opening.

REGULATOR

SPECIAL EQUIPMENT

Auto-Lite Current-Voltage Regulator Model VRP-4004B (for GCE generator). In case on dash.
For complete data, refer to Electrical Equipment Index.

Cutout Relay

Air Gap—.031-.034". Contacts open (measure at hinge end of core).

All other data same as for VRR (see preceding data).

CONTINUED ON NEXT PAGE

Thermostat:—Bishop & Babcock. In cyl. head outlet. **Setting**—Starts to open 156° F. to 160° F.

Temperature Gauge:—Auto-Lite (Motometer) Vapor tension type. Part No. H-9210.

See Miscellaneous Section for complete data.

CLUTCH

CLUTCH:—Borg & Beck Model 8A7. Single plate, dry disc type. Identified by #925 stamped on cover.

See Clutch Section for complete data.

Facings—Molded (flywheel side), woven (pressure plate side), Inside Diam. 5⅛". Outside Diam. 7⅞". Thickness .125". NOTE—Grooved facing used on pressure plate side (After '39 Engine No. 17804).

Adjustment—Free travel 1" (min.). Turn clutch adjusting sleeve on connector link. Check Hill-holder.

See Studebaker Shop Notes for Release Shaft Lubrication and new type shaft bushings to correct sticking.

Removal:—Remove transmission (see below), take off clutch housing, take out mounting screws in clutch cover flange, remove clutch cover assembly.

TRANSMISSION

TRANSMISSION: Warner. Model Number AS1-T84F. Helical gear type with synchro-mesh (second & high), sliding spur gear (low & reverse).

See Transmission Section for complete data.

IMPORTANT—Correction for Shifting into Two Gears at Once (installation of Special Interlock), see Special Service Note in Transmission article in Transmission Section.

Transmission Control:—Remote steering col. shift Std.

See Transmission Section for complete data.

Removal (Std.):—Disconnect shift rods and speedometer cable, remove propeller shaft. Place jack under engine rear plate, free rear engine mountings. Take out transmission mounting bolts, pull transmission out.

OVERDRIVE

Overdrive:—Warner Type R7A, Model AS2-T84F with electrical 'kick-down' control. Optl.

See Transmission Section for complete data.

Overdrive Solenoid—Delco-Remy Model 1569.

Throttle Switch—Hersee #1687S. Adjust so that shoe on idle lever just contacts switch plunger with throttle valve wide open (lever against stop).

Control Relay—Auto-Lite Model HR-4201S. NOTE—Use only 14 ampere fuse on relay.

Removal: Same as regular transmission except that top radiator hose must be disconnected, exhaust pipe loosened at manifold and engine rear plate, clutch throw-out shaft pulled free, overdrive control lever and solenoid leads disconnected, propeller shaft disconnected at front universal, engine rear support cross-member removed, and rear of engine lowered so that transmission clears underside of frame X-member when removed.

UNIVERSALS

UNIVERSAL JOINTS: Spicer. Model 1261-01 (front), 1268-02 (rear). Needle bearing types.

See Universals Section for complete data.

REAR AXLE

REAR AXLE:—Spicer Model 23. Semi-floating, hypoid gear type with Hotchkiss drive.

See Rear Axle Section for complete data.

Ratio—4.56-1 standard. 4.1-1 optional.

Backlash—.003-.005". Shim adjustment.

Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, hydraulic brake lines, brake cables, and shock absorbers. Remove spring U-bolts, disconnect rear spring shackles, and withdraw axle

Wheel Bearing Adjustment—Shims provided between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub and drum assembly (Puller J-446), and backing plate. Remove shims to decrease endplay, add shims to increase.

Endplay—.001-.005". Measure with dial indicator.

SHOCK ABSORBERS

SHOCK ABSORBERS:—Houdaille. Model BBFSS (front), BBDS (rear). Double acting, hydraulic.

FRONT SUSPENSION

Front Suspension:—Planar type independent suspension with transverse spring.

See Front Suspension Section for complete data.

Kingpin Inclination—5½°.

Caster—5½-6½°. Not adjustable.

Camber—¼-¾°. Shim adjustment.

Toe In—1/16-1/8". Adjust center rod (Early Cars), right reach rod (Later Cars).

Steering Geometry (Toe-out on Turns)—Inner wheel turned 22½°, Outer wheel 20°.

STEERING GEAR

Steering Gear: Ross Model T-12. Cam & Twin Lever.

NOTE—Steering linkage changed during production. Tie rod (center rod) is adjustable on Early Cars, Reach rods (to each wheel) adjustable on Later Cars.

See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service. Lockheed hydraulic, single anchor type. Hand lever applies rear service brakes.

See Brake Section for complete data.

Drums—Diameter 9".

Lining—Front shoe (U.S. #714) 10 3/16". Rear shoe (Man. DV2921) 7 13/16". Width 1¾". Thick. 3/16".

Clearance—.010" toe, .006" heel, for each shoe.

Braking Power—43% rear.

Hand Brake Adjustment:—See Service Brakes.

Hill-Holder: Optional on all models.

See Brake Section for complete data.

NOTE—When installing distributor, insert .016" feeler between hold-down plate and advance plate while tightening advance plate clamp bolt to prevent binding and allow free advance plate motion.

IGNITION TIMING

IGNITION TIMING:—Standard setting as follows (see Octane Selector Setting following for correction dependent on fuel regularly used):

Flywheel Degrees	Piston Position
2° BTDC	.0015" BTDC

To Set Timing—Crank engine by engaging gears and rolling car on floor. With #1 piston on compression, turn engine over until 'IGN' mark (approx. 13/64" ahead of U.D.C.1-6 mark) on flywheel is in line with pointer on engine rear plate on left side of car. Loosen hold-down plate screw and center scale on pointer, tighten screw. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, insert .016" feeler between advance arm and hold-down plate (to insure clearance for free advance arm movement), tighten clamp bolt, remove feeler gauge. Check Octane Selector Setting (following).

NOTE—Car manufacturer recommends use of Neon Timing Light for setting ignition timing.

Octane Selector Setting—After setting ignition timing, loosen selector (hold-down plate) screw and advance (move selector so that pointer toward 'A' end of scale) until motor 'pings' when it is hot and pulling hard. Then retard (move selector with pointer toward 'R' end of scale) until 'ping' just disappears.

NOTE—FRONT FENDER BAFFLE INSTALLATION (To correct Ignition missing or cutting out due to water splashing). See Studebaker Special Data.

CARBURETOR

CARBURETION:—**Carburetor**—Carter Type WO Model 468-S (#229 cast on flange). 1¼" single barrel, downdraft type.

For complete data, refer to Carburetor Index.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 8 MPH or 600 RPM idle speed. Adjust idle adjusting screw until engine fires smoothly (¾-1¼ turns open—turn screw in for leaner mixture). Readjust idle speed.

Accelerating Pump—Non-adjustable type.

Float Level—¼" from top of float (free end) to gasket seat on cover. Invert to check with float hanging freely and spring in valve stem not compressed.

Fast Idle Setting—Choke connector link opens throttle .018-.022" with choke valve closed. Adjust by bending offset on connector link.

CARB. EQUIPMENT

Air Cleaner:—AC #1529210 oil-wetted type std. Heavy duty oil-bath type optional. Oil filler cap equipped with copper mesh cleaner.

Fuel Pump:—AC Type W # 1523957 diaphragm type.
For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge:—Auto-Lite electric type. No. NG-9211D (dash unit), No. NG-9197T (tank unit).
For complete data, refer to Carburetion Equip. Index.

BATTERY

Willard, Type SW-1-90. 6 volt, 13 plate, 90 ampere hour capacity (20 hour rate).

Starting Capacity—114 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.0 minutes. Five second voltage—4.1 volts.

Grounded Terminal—Positive (+) grounded to dash.

Engine Ground—Strap connector at right front mounting bolt.

Dimensions—Length & Height 9". Width 7".

Location—In carrier on left front side of dash in engine compartment.

STARTER

Auto-Lite Model MZ-4074. Armature No. MZ-2130.

Drive—Barrel type Bendix No. A-2033 (similar in design to Ford '60' type A-1806).

IMPORTANT—A-2033 drive marked 'D' on pinion barrel. Must not be interchanged with Ford type due to difference in structure of pinion teeth.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—160 amperes, 5.2 volts, 130 RPM.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 " "	2500	5.5	100
2.55 " "	1325	5.0	200
4.95 " "	750	4.5	300
7.65 " "	220	4.0	400
7.8 " "	Lock	3.0	420
11.8 " "	Lock	4.0	560

Removal:—Starter flange mounted on right rear engine plate. To remove take out mounting bolts and lift starter off.

Starting Switch:—A-L Model SW-4011. Mounted on left side of car below clutch pedal. Operated by depressing clutch pedal fully.

GENERATOR

Auto-Lite Model GEA-4804-A (Stand.), GEB-4803-a (Police). Two brush type. Current-voltage control.

Armature—GDZ-2006F (GEA Gen.), GEB-2006F (GEB).

Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.

Maximum Charging Rate—35 amperes (GEA), 32 amperes (GEB), 8.0 volts, 1800 RPM (GEA), 1400 RPM (GEB) or approximately 18.3 MPH and above with load or discharged battery (Current Regulator Setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data—GEA-4804A

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	780	0	6.4	840
4	6.6	870	4	6.6	935
8	6.8	960	8	6.8	1025
12	6.95	1050	12	6.95	1120
16	7.15	1140	16	7.15	1220
20	7.3	1230	20	7.3	1320
24	7.6	1320	24	7.6	1420
28	7.7	1410	28	7.7	1550
32	7.85	1500	32	7.85	1685
35	8.0	1570	35	8.0	1800

Performance Data—GEB-4803A

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	560	0	6.4	600
4	6.6	630	4	6.6	675
8	6.8	700	8	6.8	750
12	7.0	775	12	7.0	840
16	7.2	845	16	7.2	930
20	7.4	920	20	7.4	1030
24	7.6	1000	24	7.6	1140
28	7.8	1075	28	7.8	1260
*32	8.0	1150	32	8.0	1400

*—Current regulator setting.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—53 ozs. Max. (GEA Gen.), 64-68 ozs. (GEB Gen.) with new brushes.

Field Current—1.57-1.75 amperes (GEA Gen.), 1.6-1.78 amperes (GEB Gen.) at 6.0 volts.

Motoring Current—4.45-4.9 amperes (GEA Gen.), 4.0-4.5 amperes (GEB Gen.) at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out clamp and pivot bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, move generator out away from engine until fan can just be rotated with belt held stationary.

REGULATOR

Auto-Lite Model VRP-4004-A (for GEA Gen.), VRP-4004C (GEB Gen.). Current-voltage type. In case on dash.

For complete data, refer to Electrical Equipment Index.

NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-6.6 volts, 850 Gen. RPM., 8.6 MPH.

Cuts Out—4.1-4.8 volts (approx. 4-6 amps. disch.).

Contact Gap—.015" minimum.

Air Gap—.031" min., .034" max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting—7.2-7.5 volts at 70° F.

To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH, charging battery until voltage is steady. Voltage reading should be 7.2-7.5 volts at 70° F. See Electrical Equipment Section for voltages at other temperatures.

To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.

Contact Gap—.012" Min. (armature against stop pin).

Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting (VRP-4004A)—34-36 amperes (marked '35' on cover). **(VRP-4004C)**—31-33 amperes (marked '32' on cover).

To Check (without breaking seals)—Connect test meters as for Voltage Check (above). Operate generator at 30 MPH, charging battery, add load (use bank of headlamp bulbs or turn on car lights and accessories and discharge battery) so that generator charges at peak rate and Current Regulator operates. Charging current should not exceed maximum setting given above. If more than slight excess noted, regulator is defective.

Adjustment & Contact Gap—Same as for Voltage Regulator (above).

CONTINUED ON NEXT PAGE

Facings—Molded-metallic (spiral-grooved), 2 used. Inside Diam. 5⅜". Outside Diam. 8". Thickness ⅛".
Adjustment:—Free travel 1" (min.). Turn adjusting sleeve on pedal connector link.
Hill-Holder (NoRol) Note—Check whenever clutch pedal adjusted. Set so that Hill-Holder releases just as clutch engages (change rod length).
For Release Shaft Lubrication and New Type Shaft Bushings to Correct Sticking, see Studebaker Shop Notes.
Removal:—Remove transmission (see below), take off clutch housing, take out 6 mounting screws in clutch cover flange, lift off cover assembly.

TRANSMISSION

TRANSMISSION: Warner. Model Number AS5-T84F. Helical gear type with synchro-mesh (second & high), sliding spur gear (low & reverse).
See Transmission Section for complete data.
IMPORTANT—Correction for Shifting into Two Gears at Once (installation of Special Interlock), see Special Service Note in Transmission article in Transmission Section.
Transmission Control:—Mechanical steering col. shift.
See Transmission Section for complete data.
Removal:—Disconnect the rear universal and withdraw propeller shaft from transmission. Disconnect shift levers and speedometer cable at transmission. Place jack under engine rear plate and free rear engine support. Remove transmission-to-clutch housing capscrews, pull transmission out.

OVERDRIVE

OVERDRIVE: Warner R7A (Kick-down) Electric type. Complete assembly (with transmission) Warner Model No. AS6-T84F.
See Transmission Section for complete data.
Overdrive Solenoid—Delco-Remy Model 1118001.
Throttle Switch—Cole-Hersee No. 1687-S. Adjust so that shoe on accelerator linkage just contacts switch plunger with carburetor throttle in wide open position.
Control Relay—Auto-Lite HR-4201S. 14 ampere fuse mounted in holder on relay.
Removal: Same as for regular transmission after disconnecting overdrive control cable and solenoid wires except that front universal must also be disconnected for removal of driveshaft.

UNIVERSALS

UNIVERSAL JOINTS: Spicer: Model 1268-102 (both universals, cars with standard transmission, rear joint on cars with Overdrive), 1268-101 (front, cars with Overdrive). NOTE—Cars without Overdrive equipped with one piece propeller shaft with slip joint formed in rear of transmission ahead of front universal joint.
See Universals Section for complete data.

REAR AXLE

REAR AXLE:—Spicer Model 23. Semi-floating, Hypoid gear type with Hotchkiss drive.
See Rear Axle Section for complete data.
Ratio—4.56-1 standard. 4.10-1 optional.
Backlash—.005-.007". Shim adjustment.
Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, hydraulic brake lines, brake cables, and shock absorbers. Remove spring U-bolts, disconnect rear spring shackles and withdraw axle.
NOTE—Use Puller HM-931 to remove axle shaft, Handle J-270-1 and disc J-270-13 to install inner shaft oil seal.
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed (use Hub Puller J-446) check endplay with dial indicator. To adjust, remove backing plate, add or remove shims (.003", .005", .010", .030" thick).
Endplay—.001-.005".

SHOCK ABSORBERS

SHOCK ABSORBERS: Houdaille. Model BBFSS (front), BBDS (rear). Double acting, hydraulic.

FRONT SUSPENSION

Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car weight on wheels but without load.
See Front Suspension Section for complete data.
Kingpin Inclination—5½°.
Caster—1° to 2°.
Camber—¼° to ¾°. Shim adjustment.
Toe In—1/16-⅛". Adjust right reach rod only for toe-in. Left rod should be adjusted first for left wheel straight-ahead position (steering wheel centered).
Steering Geometry (toe-out on turns)—Inner wheel turned 22½-23°. Outer wheel turned 20°.

STEERING GEAR

Steering Gear: Ross T-12 Cam-&-Twin Lever type.
See Steering Gear Section for complete data.

BRAKES

BRAKES:—**Service.** Lockheed hydraulic, single anchor type. Hand lever applies rear service brakes.
See Brake Section for complete data.
Drum—Budd composite. Diameter 9".
Lining—Moulded. Length per shoe 10 3/16". (front), 7 13/16" (rear). Width 1¾". Thickness 3/16".
Clearance—.010" toe (top), .005" heel, for each shoe.
Braking Power—43% rear wheels, 57% front.
Hand Brake:—See Service Brakes (above).
Hill-Holder: Optional on all models.
See Brake Section for complete data.

IGNITION TIMING

IGNITION TIMING:—For all engines as follows (see Octane Selector Setting following for correction dependent on fuel regularly used):

Flywheel Degrees	Piston Position
2° BTDC	.0016" BTDC.

To Set Timing—Crank engine by engaging gears and rolling car on floor. With #1 piston on compression, turn engine over until 'IGN/' mark on vibration dampener at front of engine lines up with pointer on timing gear cover (this mark is 2° or 9/64" before top dead center mark '/UDC.1-6'). Loosen hold-down plate screw and center seale on pointer, tighten screw. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, insert .016" feeler between advance arm and hold-down plate (to insure clearance for free advance arm movement), tighten clamp bolt, remove feeler gauge.

Octane Selector Setting—After setting ignition timing, loosen selector (hold-down plate) screw and advance (move selector so that pointer toward 'A' end of scale) until motor 'pings' when it is hot and pulling hard. Then retard (move selector with pointer toward 'R' end of scale) until 'ping' just disappears.

NOTE—FRONT FENDER BAFFLE INSTALLATION (To correct Ignition missing or cutting out due to water splashing). See Studebaker Special Data.

CARBURETOR

CARBURETION:—Carburetor—Carter Type WA-1 Model 410-S or Stromberg Model BXO-26 (code marked 6-84 on float chamber). 1¼" single barrel, downdraft types. *See separate articles in Carburetor Section for data on each model.*

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 8 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (½-1¼ turns open for Carter—turn screw in for leaner mixture). Readjust idle speed.

Accelerating Pump Setting—3 holes provided in pump arm (Carter), throttle lever (Stromberg) for pump link engagement. Set as follows:

Inner Hole (min. stroke)—Extreme warm weather.

Center Hole (Stromberg) or Lower Hole (Carter)—Normal operating conditions.

Outer Hole (Stromberg) or Upper Hole (Carter)—Extreme cold weather.

Float Level (Carter)—¼" from top of machined projection on float bowl cover to top of soldered seam at free end of float (invert to check).

Float Level (Stromberg)—Fuel level ⅝" below top edge of float bowl.

Fast Idle (Carter):—Integral (built-in carburetor). *For complete data, refer to Carburetion Equip. Index.*

Fast Idle Setting—Part of climatic control. Adjust by bending connector link offset to secure ⅝" choke valve opening with throttle stopscrew against (not on) first step of fast idle cam.

Fast Idle (Stromberg):—Stromberg BXO-26 carburetor type. *See article in Carburetion Equipm't Section.*

Fast Idle Setting—With throttle stopscrew against second step of fast idle cam, choke valve should be 11/32" open. To adjust, bend choke lever.

Automatic Choke (Carter):—Carter Climatic Control. *For complete data, refer to Carburetion Equip. Index.*

Setting—Set thermostatic coil housing 1 Notch Rich.

Automatic Choke (Stromberg):—Stromberg BXO-26 carburetor type. *See article in Carburetion Equip. Sec.*

Setting—Mark 'R' on thermostatic spring case should line up with projection on housing (ordinary fuel). If setting too rich rotate case to 'M' mark (leaner setting). Use 'H' position only for very volatile fuels.

CARB. EQUIPMENT

Air Cleaner:—AC #1528630 oil-wetted type Std. Heavy duty oil-bath type optional. Oil filler cap equipped with copper mesh cleaner.

Fuel Pump:—AC Type W #1522227 diaphragm type. *For complete data, refer to Carburetion Equip. Index.*

Gasoline Gauge:—Stewart (Stewart-Warner) Electric. Stewart-Warner No. G-102158. *For complete data, refer to Carburetion Equip. Index.*

BATTERY

Willard Type SW-1-95. 6 volt, 15 plate, 95 ampere hour capacity (20 hour rate).

Starting Capacity—117 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.1 minutes. Five second voltage 4.2 volts.

Grounded Terminal—Positive (+) grounded to frame. **Engine Ground**—Separate ground strap.

Dimensions—Length 9". Width 7". Height 8 13/16".

Location—In engine compartment on left side.

STARTER

Auto-Lite Model MAW-4015. Armature MAW-2091.

Drive—Outboard Barrel Type Bendix No. A-1729.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—43-52 ozs. (new brushes).

Cranking Engine—130 RPM., approximately 175 amperes at 5.0-5.5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4900	5.5	65
.6 " "	3300	5.5	100
2.75 " "	1480	5.0	200
5.45 " "	820	4.5	300
8.5 " "	400	4.0	400
11.5 " "	Lock	3.0	505
18.0 " "	Lock	4.0	670

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out two flange mounting screws, remove starter and switch as assembly.

Starting Switch:—R.B.M. Model 5607. Magnetic type. Mounted on starter and controlled by Douglas #5701 pushbutton switch on instrument panel.

GENERATOR

Auto-Lite Model GEA-4803-A. Armature No. GDZ-2006F. Two brush type with current-voltage control.

NOTE—If GDA-4804A Generator and VRB-4012A Regulator used, refer to the 1939 Commander 9-A car article (preceding) for complete data.

Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. *See Regulator data following.*

Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1600 gen. RPM or 17 MPH and above with load or discharged battery (Current Regulator Setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	780	0	6.4	840
4	6.6	870	4	6.6	935
8	6.8	960	8	6.8	1025
12	6.95	1050	12	6.95	1120
16	7.15	1140	16	7.15	1220
20	7.3	1230	20	7.3	1320
24	7.6	1320	24	7.6	1420
28	7.7	1410	28	7.7	1550
32	7.85	1500	32	7.85	1685
35	8.0	1570	35	8.0	1800

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—53 ozs. max. (new brushes).

Field Current—1.57-1.75 amperes at 6.0 volts.

Motoring Current—4.45-4.9 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out clamp and pivot bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, move generator out away from engine until fan can just be rotated with belt held stationary.

REGULATOR

Auto-Lite Model No. VRP-4004-A. Current-Voltage type. In a single case mounted on engine dash. *For complete data, refer to Electrical Equipment Index.*

NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken.

Cutout Relay

Cuts In—6.4-6.6 volts, 800 Gen. RPM., 6.1 MPH.

Cuts Out—4.1-4.8 volts (approx. 4-6 amps. disch.).

Contact Gap—.015" minimum.

Air Gap—.031" min., .034" max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting—7.2-7.5 volts at 70° F.

To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH, charging battery until voltage is steady. Voltage reading should be 7.2-7.5 volts at 70° F. See Electrical Equipment Section for voltages at other temperatures.

To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.

Contact Gap—.012" Min. (armature against stop pin).

Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked '35' on cover).

To Check (without breaking seals)—Connect test meters as for Voltage Check (above). Operate generator at 30 MPH, charging battery, add load (use bank of headlamp bulbs or turn on car lights and accessories and discharge battery) so that generator charges at peak rate and Current Regulator

CONTINUED ON NEXT PAGE

Facings—Spiral wound molded woven, 2 used. Inside Diam. 6". Outside Diam. 9¼". Thickness ⅛".

Pedal Adjustment:—Free travel 1". min. (sleeve on pedal connecting rod, turn out for greater travel, in for less). Check Hill-Holder after clutch adjustment.
See Studebaker Shop Notes for Clutch Cross-shaft Oiler installation instructions.

Removal:—Disconnect clutch linkage, remove transmission (see Transmission Removal following), support engine at rear, remove rear engine mountings and clutch housing. Take out mounting screws in clutch cover flange (turn screws out evenly) and remove clutch.

TRANSMISSION

TRANSMISSION: Warner—Model AS1-T86C (standard) All helical gear type (synchro-mesh second & high).
See Transmission Section for complete data.

Transmission Control:—New type remote shift.
See Transmission Section for complete data.

Removal:—Disconnect shift rods from levers and speedometer cable at transmission, take out U-bolts in front universal and lower propeller shaft. Remove transmission mounting screws at clutch housing, pull transmission back and lift out.

OVERDRIVE

OVERDRIVE: Warner R7 (Kick-down) Electric type. Complete assembly (with transmission) Warner Model No. AS2-T86C.

See Transmission Section for complete data.

Overdrive Solenoid—Delco-Remy Model 1118001.

Throttle Switch—Cole-Hersee No. 1687-S. Adjust so that shoe on accelerator linkage just contacts switch plunger with carburetor throttle in wide open position.

Control Relay—Auto-Lite HR-4201S. 14 ampere fuse mounted in holder on relay.

Removal: Same as for regular transmission after disconnecting Overdrive cable and solenoid wires, and removing Overdrive Rear Support. ***See Overdrive Transmission Rear Support Installation data in Studebaker Shop Notes.***

UNIVERSALS

UNIVERSAL JOINTS:—Spicer—1271-101 (front), 1278-101 (rear). Needle bearing type. 2 used.
See Universals Section for complete data.

REAR AXLE

REAR AXLE:—Spicer Model 41-2. Semi-floating, hypoid gear type with Hotchkiss drive.
See Rear Axle Section for complete data.

Ratio—4.55-1 Std., 4.82-1 Optl.

Backlash—.005-.007". Shim adjustment.

Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, brake line, and shock absorbers, remove spring U-bolts, disconnect rear spring shackles, withdraw axle assembly from car.

Wheel Bearing Adjustment—Shims provided between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub, drum, and backing plate (retained by 6 nuts). Remove shims to decrease endplay, add shims to increase. Shim thickness at both wheels must be equal within .005".

Endplay—.001-.005". Measure with dial indicator.

SHOCK ABSORBERS

SHOCK ABSORBERS:—Houdaille, Type BBFS (front), ACHS (rear). Double acting, hydraulic, adjustable type with thermostatic control (rear only).

FRONT SUSPENSION

Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car unloaded on level floor.
See Front Suspension Section for complete data.
Kingpin Inclination—5½°.
Caster—Negative ¼° to Positive ¾°. Not adjustable.
Camber—¼° to ¾°. Adjustable.
Toe In—1/16-⅛". Adjust right reach rod for toe-in.
Steering Geometry (Toe-out on Turns)—Inner wheel turned 22°, Outer wheel 20°.

STEERING GEAR

Steering Gear: Ross T-14 Cam-&-Twin Lever type.
See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service—Lockheed hydraulic, double anchor type. Hand lever applies rear wheel brakes.
See Brake Section for complete data.
CAUTION—*See Front Fender Apron Note in Studebaker Shop Notes to correct apron interference with brake tubes on early cars.*
Wheel Cylinders—Stepped or two-stage bore type: Front Wheels—Front shoe cylinder 1⅜", Rear 1". Rear Wheels—Front shoe cylinder 1¼". Rear 1". NOTE—Wheel cylinder bore size marked on casting.
Drum—Budd composite. Diameter 11".
Lining—Front shoe—woven. Rear—moulded. Width 2". Thickness 3/16". Length per wheel 19 11/16".
Clearance—.010" toe, .005" heel, for each shoe.
Hand Brake Adjustment:—See Service Brakes
Hill-Holder: Optional on all models.
See Brake Section for complete data.

MISC. MECHANICAL

WINDSHIELD WIPER:—Auto-Lite Model EWB-4002. Electric type. NOTE—No separate fuse used.
See Miscellaneous Section for complete data.

breaker contacts (mounted directly on breaker plate) begin to open, tighten clamp bolt, then synchronize movable contacts.

Synchronization (On Engine)—Turn engine over 90° to #6 firing position with vibration dampener mark 'U.D.C.3-6' lined up with pointer on timing gear cover. Loosen lockscrews on movable sub-plate carrying second set of contacts, turn eccentric adjusting screw until contacts begin to open, tighten lockscrews.

Synchronization (Using Tool)—Use Delco-Remy tool #1838182. See Distributor Synchronization in Electrical Equipment Section for complete instructions. Distributor firing intervals regular 45-45-45°.

Octane Selector Setting—After setting ignition timing, loosen selector (hold-down plate) screw and advance (move selector so that pointer toward 'A' end of scale) until motor 'pings' when it is hot and pulling hard. Then retard (move selector with pointer toward 'R' end of scale) until 'ping' just disappears

See the Studebaker Shop Notes (preceding) for Front Fender Apron correction to correct ignition missing or cutting out due to water splashing up from road.

CARBURETOR

CARBURETION:—Carburetor—Carter Type WDO Model 409-S or Stromberg Model AAO-161 (code marked 6-85 on top of float chamber cover). 1¼" (Carter), 1" (Stromberg) dual, downdraft types. ***See separate articles in Carburetor Section for data.***

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 8 MPH idle speed. Adjust idle adjusting screw for each barrel (in succession) until engine fires smoothly (¼-1¼ turns open for each screw on Carter—turn screws in for leaner mixture). Readjust idle speed.

Accelerating Pump Setting—2 holes provided in pump arm (Carter), throttle lever (Stromberg) for pump link engagement. Set as follows:
Inner Hole (min. stroke)—Summer temperatures.
Outer Hole (max. stroke)—Winter temperatures.

Float Level (Carter)—3/16" from top of float to gasket seat on cover with needle valve seated (invert float chamber cover to check).

Float Level (Stromberg)—Fuel level ⅝" below top edge of bowl (level sight plug on engine side of carburetor—check with engine idling).

Fast Idle (Carter):—Integral (built-in carburetor). ***For complete data, refer to Carburetion Equip. Index.***

Fast Idle Setting—Adjust fast idle screw for .018" throttle opening with choke valve fully closed.

Fast Idle (Stromberg):—Stromberg AAO-161 carburetor type. ***See article in Carburetion Equipm't Section.***

Fast Idle Setting—No adjustment provided.

Automatic Choke (Carter):—Carter Climatic Control. ***For complete data, refer to Carburetion Equip. Index.***

Setting—Set coil housing one Notch Rich.

Automatic Choke (Stromberg):—Stromberg AAO-161 carburetor type. ***See Carburetion Equip. Sec. article.***

Setting—Mark 'R' on thermostatic spring case should line up with projection on housing (ordinary fuel). If this setting too rich, rotate case to 'M' mark (leaner setting). Use 'H' setting for high test fuels.

CARB. EQUIPMENT

Air Cleaner:—AC #1529440 oil-wetted type Std. Heavy duty oil-bath type optl. Oil filler cap equipped with copper mesh cleaner.

Fuel Pump:—AC Type E #1523926 diaphragm type. ***For complete data, refer to Carburetion Equip. Index.***

Gasoline Gauge:—Stewart (Stewart-Warner) Electric Stewart-Warner No. G-102158. ***For complete data, refer to Carburetion Equip. Index.***

BATTERY

Willard Type SW-1-95. 6 volt, 15 plate, 95 ampere hour capacity (20 hour rate).
Starting Capacity—117 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.1 minutes. Five second voltage 4.2 volts.

Grounded Terminal—Positive (+) grounded to frame. **Engine Ground**—Separate ground strap.

Dimensions—Length 9". Width 7". Height 8 13/16".

Location—In engine compartment on left side.

STARTER

Delco-Remy Model 1107903. Armature No. 820158.
Drive—Solenoid pinion shift & overrunning clutch.
Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—24-28 ozs. each.

Cranking Engine—110 RPM., 150-200 amperes, 5-5.5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	6000	5.0	60
16 "	Lock	3.0	600

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws (remove starter and solenoid switch as an assembly).

Starting Switch: Delco-Remy Solenoid 1546. Mounted on starter and controlled through relay (in switch case by pushbutton switch Douglas #5700 on instrument panel. ***For complete data, refer to Electrical Equipment Index.***

GENERATOR

Delco-Remy Model 1102671. Armature No. 1879002. Two brush type with Current-Voltage Control.

Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator. ***See Regulator data following.***

Maximum Charging Rate—33-35 amperes (hot or cold), 8.0 volts, 1850 gen. RPM or 22 MPH and above with load or discharged battery (Current Regulator setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

	Amperes	Volts	R.P.M.
Cold	30*	8.0	1750

*—Not maximum output—See Current Regulator.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—25 ounces each.

Field Current—1.75-1.9 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Swing generator out until fan can just be turned with belt held stationary.

REGULATOR

Delco-Remy Model 1118202. 'Single Core' type. Vibrating Voltage & Current regulator on dash.
CAUTION—Check generator for grounded fields before changing regulator settings.
For complete data, refer to Electrical Equipment Index.

Cutout Relay

Cuts In—6.2-6.7 volts (hot), 750 RPM., 8.9 MPH.

Cuts Out—0-4.0 amperes discharge current.

Contact Gap—.020" (same for both sets).

Air Gap—.020" (with points just closed).

Voltage Regulator

Setting—7.3-7.4 volts hot (operating temperature). Regulator over-compensated for temperature.

To Check—Connect ammeter in charging line at 'BAT' regulator terminal, voltmeter between 'BAT' terminal and ground. Operate generator at 2800 RPM, adjust charging rate to 8-10 amperes (use variable rheostat or 'AVR' set). With regulator at hot operating temperature, retard generator speed until cut-out relay points open, then increase generator speed to 2800 RPM and check hot voltage setting (above).

To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **light (left) spring (or one spring if both alike) only.** If further adjustment required see Single Core Regulator article in Electrical Equipment Section for Heavy (or Other) Spring adjustment.

Air Gap—.070" between center of core and armature with contacts just closed.

Current Regulator

Setting—34-36 amperes hot (at operating temp.).

To Check—Remove cover, connect short jumper from voltage regulator frame to upper contact support bracket (shorting out Voltage Regulator). Connect ammeter in charging line at 'BAT' regulator terminal. Turn on lights and accessories, operate generator and increase speed until output remains stationary (run until hot). Check setting with regulator at operating temperature.

To Adjust—Change regulator armature spring tension slightly by bending lower spring hanger for **one spring.** If further adjustment required see Single Core Regulator article in Electrical Equipment Section for adjustment of other spring.

Air Gap—.080" (check same as Voltage Regulator).

LIGHTING

LIGHTING:—**Headlamps**—Own 'Sealed Beam' type. ***For complete data, refer to Electrical Equipment Index.***
Headlamp Adjustment—Aim upper beam for each lamp straight ahead with center of hot spot 3" below lamp center height.
Beam Indicator—Red light on speedometer face. Lighted whenever Country (upper) beam in use.

Switches

Lighting—Douglas Model 5704.
Beam Selector—Delco-Remy 1997002.
Instrument—Douglas Model 7290.

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OVERDRIVE

OVERDRIVE: Warner R7 (Kick-down) Electric type. Complete assembly (with transmission) Warner Model No. AS2-T86C.

See Transmission Section for complete data.

Overdrive Solenoid—Delco-Remy Model 1118001.

Throttle Switch—Cole-Hersee No. 1687S. Adjust so that end of accelerator rod just contacts switch plunger with throttle valve wide open.

Control Relay—Auto-Lite HR-4201S. 14 ampere fuse mounted in holder on relay.

Removal: Same as for regular transmission after disconnecting Overdrive cable and solenoid wires, and removing Overdrive Rear Support. ***See Overdrive Transmission Rear Support Installation data in Studebaker Shop Notes.***

UNIVERSALS

UNIVERSAL JOINTS:—Spicer—1271-101 (front), 1278-101 (rear). Needle bearing type. 2 used.

See Universals Section for complete data.

REAR AXLE

REAR AXLE:—**Spicer Model 41-2.** Semi-floating, hypoid gear type with Hotchkiss drive.

See Rear Axle Section for complete data.

Ratio—4.55-1 Std., 4.82-1 Optl. (Std. with Overdrive).

Backlash—.005-.007". Shim adjustment.

Removal:—Hoist rear of car, disconnect brake line, shock absorbers, drive shaft at rear universal, rear spring U bolts and rear spring shackles, withdraw axle assembly from car. NOTE—Bleed brake lines when axle installed.

Wheel Bearing Adjustment:—Shims located between flanged end of axle housing and brake backing plate. To adjust, remove wheel, hub, brake drum, and backing plate (retained by 6 bolts). Remove shims to decrease endplay, add shims to increase. Shim thickness at both wheels must be equal within .005".

Endplay—.001-.005". Measure with dial indicator.

SHOCK ABSORBERS

SHOCK ABSORBERS:—Houdaille, Type BBFS (front), ACHS (rear). Double acting, hydraulic, adjustable type with thermostatic control (rear only).

FRONT SUSPENSION

Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car weight on wheels but without load.

See Front Suspension Section for complete data.

Kingpin Inclination—5½°.

Caster—Negative ¼° to Pos. ¾°. Not adjustable.

Camber—¼° to ¾°. Adjustable.

Toe In—1/16-⅛". Adjust right reach rod for toe-in.

Steering Geometry (Toe-out on Turns)—Inner wheel turned 22°, Outer wheel 20°.

STEERING GEAR

Steering Gear: Ross T-14 Cam-&-Twin Lever type.

See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service—Lockheed hydraulic, double anchor type. Hand lever applies rear wheel service brakes.

See Brake Section for complete data.

CAUTION—***See Front Fender Apron Note in Studebaker Shop Notes to correct apron interference with brake tubes on early cars.***

Wheel Cylinders—Stepped or two-stage bore type: Front—Front Shoe Cylinder 1⅜". Rear 1".
Rear—Front Shoe Cylinder 1¼". Rear 1".

NOTE—Wheel cylinder bore size marked on casting.

Drum—Budd Composite. Diameter 11".

Lining—Front shoe—woven. Rear—moulded. Width 2¼". Thick. 3/16". Length per wheel 19 11/16".

Clearance—.010" toe, .005" heel, for each shoe.

Braking Power—45% rear, 55% front.

Hand Brake:—See Service Brakes above.

Hill-Holder: Optional on all models.

See Brake Section for complete data.

MISC. MECHANICAL

WINDSHIELD WIPER:—**Auto-Lite Model EWB-4002.** Electric type. NOTE—No separate fuse used.

See Miscellaneous Section for complete data.

hole (distributor out) and see that distributor drive tongue in oil pump drive gear is parallel to and narrow half of offset toward camshaft, turn rotor to #1 segment, install distributor (insert .020" feeler between modifier control arm and clamp arm before tightening the clamp, to prevent binding), check timing.

IGNITION TIMING

IGNITION TIMING:—Initial setting for regular fuel (see Octane Selector Setting following for correction dependent on fuel regularly used).

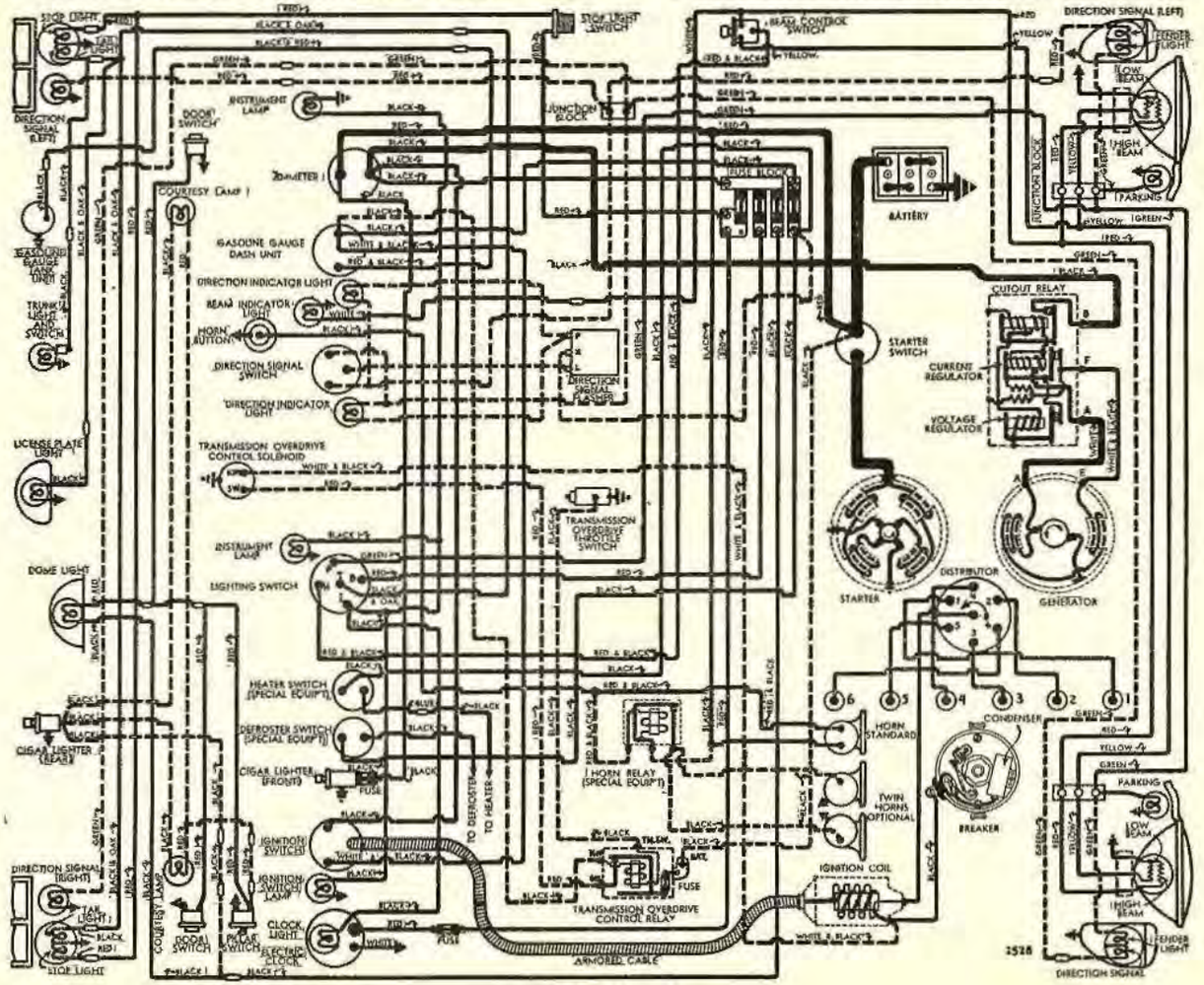
Flywheel Degrees	Piston Position
2° BTDC	.0016" BTDC

1942 Timing Mark Note—Timing marks carried on the flywheel (same as for 1941). Vibration dampener at front of engine is new on 1942 models.

Timing (with Neon Timing Light)—Neon Light No. 890 recommended. Clip Neon light lead in series with #1 spark plug, idle engine and direct Neon light on flywheel inspection hole on left rear motor support. Loosen hold-down plate screw, center scale on pointer, tighten screw. Loosen clamp arm, rotate distributor until 'IGN' mark on flywheel (approx. 13/64" before top dead center mark 'U.D.C.1-6') lines up with pointer on engine rear plate. Insert .020" feeler between modifier control arm and clamp arm before tightening clamp (to insure clearance for modifier control arm). Check Octane Selector Setting (following).

Timing (without Neon Timing Light)—Turn engine over to firing position for #1 piston with 'IGN' mark on flywheel in line with pointer on inspection hole on left rear motor support and distributor rotor at #1 segment in distributor cap. Adjust distributor as directed above.

Octane Selector Setting—After setting ignition timing (above), loosen selector hold-down screw, advance selector (move toward 'A' end of scale) until motor 'pings' when it is hot and pulling hard. Then retard (move selector pointer toward 'R' end of scale) until 'ping' just disappears.



1942 MODELS

CARBURETOR

CARBURETION:—**Carburetor**—Carter Type WA-1 Model 496-S (#356 cast on face of flange). 1¼" single barrel downdraft type with Carter Climatic Control. *For complete data, refer to Carburetor Index.*

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative, set throttle stopscrew for 8 MPH idle speed. Adjust idle adjusting screw until engine fires smoothly (½-1½ turns open—turn screw in for leaner mixture). Readjust idle speed.

Accelerating Pump—Non-adjustable type.

Float Level—5/16" from top of projection on bowl cover to top of soldered seam on float at free end with needle valve seated (invert cover assembly to check level).

Metering Rods & Jets—*See Carter Jet Table in Carburetor Section for complete data.*

Fast Idle:—Integral type (built-in carburetor). *For complete data, refer to Carburetion Equip. Index.*

Setting—Adjust by bending connector rod offset for ⅝" choke valve opening with throttle stopscrew against (not on) first step of fast idle cam.

Automatic Choke:—Carter Climatic Control. *For complete data, refer to Carburetion Equip. Index.*

Setting—1 Notch Lean (supersedes Centered setting originally specified for this model).

CARB. EQUIPMENT

Air Cleaner:—AC #1529210 oil-wetted type standard. #1529211 heavy duty oil-bath type optional. Use Replacement Filter Element Assembly: Type #2 (for 1529210), Type #8 (for 1529211). NOTE—Oil filler cap equipped with filter element which should be serviced at the same intervals as air cleaner.

1941 MODELS

Fuel Pump:—AC Type AE, diaphragm type. Replacement Part No. 527. *For complete data, refer to Carburetion Equip. Index.*

Gasoline Gauge:—Auto-Lite electric type. No. NG-9594D (Dash Unit), No. NG-9659T (Tank Unit). *For complete data, refer to Carburetion Equip. Index.*

1942 MODELS

Fuel Pump:—AC 'W' #1523957—Exch. No. 527. Diaphragm type fuel pump. *For complete data, refer to Carburetion Equip. Index.*

Pressure—3½ lbs. maximum.

Gasoline Gauge:—Stewart-Warner electric type. Studebaker Nos. 515610 (dash unit), 515684 (tank). *For complete data, refer to Carburetion Equip. Index.*

BATTERY

Willard Type WHT-1-13R. 6 volt, 13 plate, 90 ampere hour capacity (20 hour rate).

Starting Capacity—114 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.0 minutes. Five second voltage 4.1 volts.

Grounded Terminal—Positive (+) terminal.

Engine Ground—Strap at right front motor support.

Dimensions—Length 9". Width 7". Height 9⅜".

Location—On left side under engine hood.

STARTER

Auto-Lite Model MZ-4090. Armature No. MZ-2130.

Drive—Barrel type Bendix. Special inboard type A-2033 (marked 'D' on pinion barrel).

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—160 amperes, 5.2 volts, 130 RPM.

CONTINUED ON NEXT PAGE

ENGINE

CONTINUED FROM PRECEDING PAGE

Replacement Pins:—Std. & .0025", .005" oversize. Use Hone No. PH-1 to obtain proper piston fit.
NOTE—Replacement pistons fitted with pins.

CONNECTING ROD:—Length 6⅜". Weight 20.48 ozs. Crankpin Journal Diameter—1.81175-1.81275".
Lower Bearing—Spun babbitt (cap bearings chamfered on upper edge). New rods furnished on exchange basis standard and .010", .020" undersize.
Clearance—.0005-.002". **Sideplay**—.005-.009".
NOTE—Use reamer HM-591-F to secure correct bearing clearance. Crankpin out-of-round, tapered or scored .0015"max.(Crankpin Turning Tool #1-C).

Bearing Adjustment:—None(no shims). Replace rods.

Installing Rods:—Narrow portion of bearing to front (#1, 3, 5), to rear (#2, 4, 6). Numbers on rods and caps must be together and installed in same numbered cylinder with numbers and oil hole in lower end of rod toward camshaft side of engine.

CRANKSHAFT:—4 bearing, 4 integral counterweights. Vibration damper used on 1942 models.
See Studebaker Shop Notes for Vibration Damper data.
Journal Diameter—2.437-2.4375".
Bearings—Removable steel-backed, babbitt-lined.
Clearance—.0005-.0025".

Adjustment:—None (no shims.) Replace bearings (std. size, .010", .020", .030" undersize).
NOTE—Front oil pan seal block may be removed for access to front main bearing cap by removing 4 lower timing gear cover screws (on front face).

End Thrust:—Thrust plate assembled between front bearing and crankshaft gear. Controlled by shims (furnished .003", .005", .007" thick) between plate and journal face. **Endplay**—.003-.006".
NOTE—Install new seals (specially treated wood) whenever rear main bearing cap replaced.

CAMSHAFT:—Four bearing with helical gear drive.
See Studebaker Shop Notes for Camshaft Removal data.
Journal Diameters—#1, 1.7475-1.7480"; #2, 1.71625-1.71700"; #3, 1.68575-1.68650"; #4, 1.62325-1.62400".
Bearings—Split steel-backed, babbitted bushings.
NOTE—Align bushing with oil hole in block.
Clearance—.00075-.00225"(#1),.001-.00275"(others).

End Thrust:—Taken by thrust plate assembled on front face of engine behind camshaft gear. Spacer assembled back of gear hub. **Endplay**—.004-.008".

Timing Gears:—Crankshaft (cast-iron), Camshaft (Celeron with steel hub). **Backlash** .001-:003".
Refer to Studebaker Shop Notes for Timing Gear Removal and Replacement Camshaft Gear size selection.

Camshaft Setting:—Mesh marked camshaft gear tooth between 2 marked teeth on crankshaft gear.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 11/32"	.310-.311"	4 11/32"
Exhaust	1 9/32"	.310-.311"	4 11/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	5/16"	.001-.0035"

Valve Guides:—Pressed in block from above 1 3/16" below top of block. Finish ream to .312-.3135".

Valve Springs:—Install with closed coil up. Replace if springs over 10% weak (test with Tool U-15).

Free length 2 3/32".	Spring Pressure	Length
Valve Closed	52-56 lbs.	1 21/32"
Valve Open	90-94 lbs.	1 11/32"

Valve Lifters:—Mushroom type (remove from below). **Diameter**—.62375-.62425". **Clearance** .0005-.00175". Lifters furnished .0005", .001" oversize. *Refer to Studebaker Shop Notes for Valve Lifter Tension Spring*

VALVE TIMING

Tappet Clearance:—.016" (cold) all valves. Self-locking tappet screw tension should be 25 in. lbs. Remove hood side panel for access to valves.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
Valve Timing Check—With .020" tappet clearance #1 intake valve should open with #1 piston 15° or .0893" BTDC with flywheel mark 'IN.OP.1-6/' aligned with pointer on left rear engine plate. Reset tappet clearance at .016" (cold).

LUBRICATION

LUBRICATION:—Pressure (pump on right of engine).
Refer to Studebaker Shop Notes for Oil Pan and Oil Pump installation instructions.
Normal Oil Pressure:—40 lbs. at 25-30 MPH.
Oil Pressure Relief Valve:—On lower right front corner of engine block. Opens at 30-40 lbs. Not adj.
Crankcase Capacity:—5 quarts.

COOLING

COOLING SYSTEM:—Capacity—10 quarts.
Water Pump:—Packless, sealed ball-bearing type.
See Water Pump Section for complete data.
Thermostat:—Bishop & Babcock. In cyl. head outlet.
Setting—Starts to open 151° F. to 155° F.
Temperature Gauge (1941): Auto-Lite (Motometer vapor tension type. A-L Part No. H-9593.
See Miscellaneous Section for complete data.
Temperature Gauge (1942): Stewart-Warner type. Studebaker Part No. 515609.

CLUTCH

CLUTCH:—Borg&Beck Model 8A7 with 'Borglite' driven member. Clutch assembly No. 925 stamped on cover. Single plate, dry disc type.
See Clutch Section for complete data.
Facings—Molded-metallic (spiral-grooved), 2 used. Inside Diam. 5⅜". Outside Diam. 8". Thickness ⅛".
Adjustment:—Free travel 1" (min.). Turn adjusting sleeve on pedal connector link.
Hill-Holder (NoRol) Note—Check whenever clutch pedal adjusted. Set so that Hill-Holder releases just as clutch engages (change rod length).
Removal:—Remove transmission (see below), take off clutch housing, take out 6 mounting screws in clutch cover flange, lift off cover assembly.
Refer to Studebaker Shop Notes for Clutch Release Shaft Lubrication instructions.

TRANSMISSION

TRANSMISSION:—Warner—Model AS1-T84G (Std.), AS2-T84G, Type R7C (optl. overdrive with electrical 'kick-down' control). All helical gear type, synchromesh (second & high), sliding gear (low & reverse).
See Transmission Section for complete data.
Transmission Control:—Mechanical steering col. shift.
See Transmission Section for complete data.
Removal:—Disconnect the rear universal and withdraw propeller shaft from transmission. Disconnect shift levers and speedometer cable at transmission. Place jack under engine rear plate and free rear engine support. Remove transmission-to-clutch housing capscrews, pull transmission out.

OVERDRIVE

OVERDRIVE: Warner R7C (Kick-down) Electric type. Complete assembly (with transmission) Warner Model No. AS2-T84G.
See Transmission Section for complete data.
►**1941 Production Change:** To correct free-wheel unit slippage when kicking down (also high speed vibration and grease leaks), free wheel unit bearing was changed to needle bearing type. *See Special Service Note in Transmission article in Transmission Section.*
Overdrive Solenoid—Delco-Remy Model 1118013.
Throttle Switch—Cole-Hersee No. 1687-S. Adjust so that shoe on accelerator linkage just contacts switch plunger with throttle valve wide open.
Control Relay—Auto-Lite No. HR-4201S (for 1941), No. HRB-4301 (1942). Fuse mounted in holder on relay. Fuse capacity, 14 ampere ('41), 20 ampere ('42).
Removal: Same as for regular transmission after disconnecting control cable and solenoid wires.

UNIVERSALS

UNIVERSAL JOINTS:—Spicer Model 1268-102. Needle bearing type. Two used.
See Universals Section for complete data.
NOTE—1 piece driveshaft used. Slip joint formed at rear of transmission ahead of front universal.

REAR AXLE

REAR AXLE:—Spicer Model 23. Semi-floating, Hypoid gear type with Hotchkiss drive.
See Rear Axle Section for complete data.
Ratio—4.10-1 Std. 4.56-1 Optl. (Std. on Overdrive).
NOTE—Ratio stamped on each gear and pinion.
Backlash—.005-.007". Shim adjustment.
Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, hydraulic brake lines, brake cables, and shock absorbers. Remove spring U-bolts, disconnect rear spring shackles and withdraw axle.
NOTE—Use Puller HM-931 to remove axle shaft, Handle J-270-1 and disc J-270-13 to install inner shaft oil seal.
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed (use Hub Puller J-446) check endplay with dial indicator. To adjust, remove backing plate, add or remove shims (.003", .005", .010", .030" thick).
Endplay—.001-.005".

SHOCK ABSORBERS

SHOCK ABSORBERS: Houdaille. Dbl. acting, hydraulic

1941	BBFS-2 FRONT	BBDS REAR
1942	BBFS-5 FRONT	BBDS-2 REAR

FRONT SUSPENSION

Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car weight on wheels but without load.
See Front Suspension Section for complete data.
Kingpin Inclination—5½°.
Caster—1° to 2°.
Camber—¼° to ¾°. Shim adjustment.
Toe In—1/16-⅛". Adjust right reach rod only for toe-in.Left rod should be adjusted first for left wheel straight-ahead position (steering wheel centered).
Steering Geometry (toe-out on turns)—Inner wheel turned 22½-23°. Outer wheel turned 20°.

STEERING GEAR

Steering Gear: Ross T-12 Cam-&-Twin Lever type.
See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service. Lockheed hydraulic, single anchor type. Hand lever applies rear service brakes.
See Brake Section for complete data.
Drum—Budd composite. Diameter 9".
Lining—Moulded. Length per shoe 10 3/16" (front), 7 13/16" (rear). Width 1¾". Thickness 3/16".
Clearance—.010" toe (top), .005" heel, for each shoe.
Hand Brake:—See Service Brakes (above).
Hill-Holder: Optional. *See Brake Section for data.*

crank engine to firing position for #1 cylinder ('IGN' on vibration dampener in line with pointer on timing gear cover), sight down distributor shaft hole (distributor out) and see that distributor drive tongue in oil pump drive gear is 30° from the horizontal and offset toward the top, turn rotor to #1 segment, install distributor (insert .020" feeler between modifier control arm and clamp arm before tightening the clamp, to prevent binding), check timing.

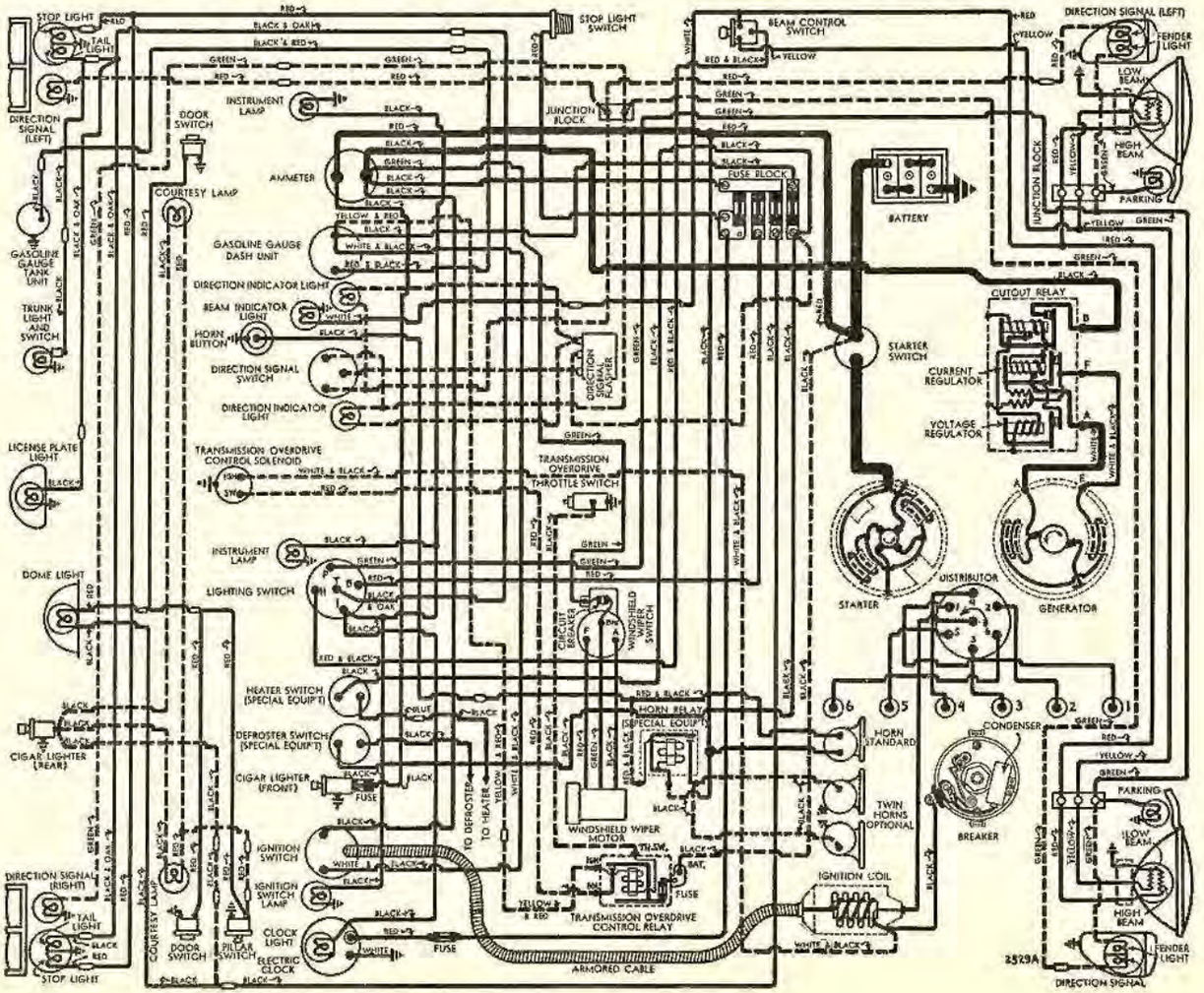
IGNITION TIMING

IGNITION TIMING:—Initial setting for regular fuel (see Octane Selector Setting following for correction dependent on fuel regularly used).

	Flywheel Degrees	Piston Position
All Engines	2° BTDC	.0016" BTDC

Timing (with Neon Timing Light)—Neon Light No. 890 recommended. Clip Neon light lead in series with #1 spark plug, idle engine and direct light on vibration dampener (at pointer on timing gear cover). Loosen hold-down plate screw, center scale on pointer, tighten screw. Loosen clamp arm, rotate distributor until 'IGN' mark on vibration dampener lines up with pointer on timing gear cover. Insert .020" feeler between modifier control arm and clamp arm before tightening clamp (to insure clearance for modifier control arm). Check Octane Selector **Timing (without Neon Timing Light)**—Turn engine over to firing position for #1 piston with 'IGN' mark on vibration dampener in line with pointer on timing gear cover and distributor rotor opposite #1 segment in distributor cap. Adjust distributor as directed above.

Octane Selector Setting—After setting ignition timing (above), loosen selector hold-down screw, advance selector (move toward 'A' end of scale) until motor 'pings' when it is hot and pulling hard. Then retard (move selector with pointer toward 'R' end of scale) until 'ping' just disappears.



1942 MODELS

CARBURETOR

Carter (1941) Type WA-1, Model 410-S. Single barrel, 1¼" downdraft type with Carter Climatic Control. Casting No. 191 on flange.

Stromberg (1941-42) Model BXOV-26. Single barrel, 1¼" downdraft type with Stromberg automatic choke. Float bowl cover carries code No. 6-98 ('41), 6-98A ('42).

For complete data, refer to Carburetor Index.

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 8 MPH idle speed. Adjust idle screw until engine fires smoothly (½-1¼ turns open for Carter—turn screw in for leaner mixture). Readjust idle speed.

Accelerating Pump Setting—3 holes provided in pump arm (Carter), pump lever (Stromberg) for pump rod engagement. Set as follows:
Inner—Min.: Hot weather, hi-test gasoline.
Center—Med.: Std. all-year setting.
Outer—Max.: Cold weather, low-test gasoline.

Float Level (All Carburetors)—As follows:
Carter—¼" from top of projection on bowl cover to top of soldered seam on float at free end with needle valve seated (invert cover assembly to check).
Stromberg—Fuel level ⅝" below top edge of bowl with engine idling (3 lbs. pressure).

Metering Jets & Rods—***See Carter & Stromberg Jet Tables in Carburetor Section for data.***

Fast Idle (All Carburetors):—Integral types.
For complete data, refer to Carburetion Equip. Index.
Setting (Carter)—Adjust by bending connector link offset for ⅝" choke valve opening with throttle stopscrew against (not on) 1st step of fast idle cam.
Setting (Stromberg)—To check, hold throttle stopscrew against lowest step of fast idle cam, close choke valve until lip of next step on cam touches screw, check valve opening with 11/32" drill. Adjust by bending connector link.

Automatic Choke (All Carburetors):—Climatic Control (Carter), BXOV-26 Type (Stromberg). Built-in
For complete data, refer to Carburetion Equip. Index.
Setting (Carter)—Set coil housing 1 Notch Rich.
Setting (Stromberg)—'R' mark on thermostat cover in line with highest projection on housing. Shift to 'M' if engine loads up or overchokes. Use 'H' setting only if highly volatile fuels used.

CARB. EQUIPMENT

Air Cleaner:—AC #1528630 oil-wetted type standard. #1529840 heavy duty oil-bath type optional. Use Replacement Filter Element Assembly: Type #3 (for 1528630), #1542497 (for 1529840). NOTE—Service oil filler cap filter element at regular intervals.

Fuel Pump: AC Type 'AE' ('41), 'W' #1537378 ('42). Exchange #540. Diaphragm type fuel pump.
For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge (1941): Auto-Lite electric. No. NG-9594D (dash unit), No. NG-9659T (tank unit).
For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge (1942): Stewart-Warner elec. type. Studebaker Nos. 515506 (dash unit), 515684 (tank).
For complete data, refer to Carburetion Equip. Index.

BATTERY

Willard Type WHT-1-15R. 6 volt, 15 plate, 95 ampere hour capacity (20 hour rate).
Grounded Terminal—Positive (+) terminal.
Engine Ground—Strap at right front motor support.
Location—In engine compartment on left side.

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ENGINE

CONTINUED FROM PRECEDING PAGE

NOTE—Use reamer HM-591-D to secure correct bearing clearance. Crankpin out-of-round, tapered or scored .0015" max. (Crankpin Turning Tool #1-C).

Bearing Adjustment:—None (no shims). Replace rods.

Installing Rods:—Narrow portion of bearing to front (#1, 3, 5), to rear (#2, 4, 6). Numbers on rods and caps must be together and installed in same numbered cylinder with numbers and oil hole in lower end of rod toward camshaft side of engine.

CRANKSHAFT:—4 bearing, 5 integral counterweights. Vibration damper mounted on forward end of shaft. *See Studebaker Shop Notes for Vibration Damper data.*
Journal Diameter—2.4995-2.5000".
Bearings—Removable steel-backed, babbitt-lined.
Clearance—.0005-.0025".
Adjustment:—None (no shims.) Replace bearings (std. size, .010", .020", .030" undersize).
End Thrust:—Thrust plate assembled between front bearing and crankshaft gear. Controlled by shims (furnished .003", .005", .007" thick) between plate and journal face. **Endplay**—.003-.006".

CAMSHAFT:—Four bearing with helical gear drive. *See Studebaker Shop Notes for Camshaft Removal data.*
Journal Diameters—#1, 1.9975-1.998"; #2, 1.96625-1.967"; #3, 1.93575-1.9365"; #4, 1.12325-1.124".
Bearings—Split steel-backed, babbitted bushings. NOTE—Align bushing with oil hole in block.
Clearance—.00075-.00225" (#1), .001-.00275" (others).
End Thrust:—Taken by thrust plate assembled on front face of engine behind camshaft gear. Spacer assembled back of gear hub. **Endplay**—.004-.008".
Timing Gears:—Crankshaft (cast-iron), Camshaft (Celeron with steel hub). **Backlash** .001-.003". *Refer to Studebaker Shop Notes for Timing Gear Removal and Replacement Camshaft Gear size selection.*
Camshaft Setting:—Mesh marked camshaft gear tooth between 2 marked teeth on crankshaft gear.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.0015-.0035"

Valve Guides:—Pressed in block from above (1 5/32" below upper edge of valve seat) with stepped end down. Ream to inside diameter of .3425-.3445".
Valve Springs:—Install with closed-coil up and dampener on top of spring. Replace springs if 10% weak (test with Tool U-15). **Free Length**—2½".

	Spring Pressure	Spring Length
Valve Closed	54-60 lbs.	2 3/32"
Valve Open	125-135 lbs.	1¾"

Valve Lifters:—Barrel type (remove from above with valve, valve spring and adjusting screw removed). **Diameter** .9985-.999". **Clearance** .0005-.00175". Lifters furnished .0005", .001" oversize. *Refer to Studebaker Shop Notes for Valve Lifter Tension Spring data.*

VALVE TIMING

Tappet Clearance:—.016" (cold) all valves. Remove hood side panel for access to valves.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
Valve Timing Check—With .020" tappet clearance #1 intake valve should open with #1 piston 15° or .0942" BTDC with vibration damper mark 'IN.OP1-6/' aligned with pointer on timing gear cover. Reset tappet clearance .016" (cold).

LUBRICATION

LUBRICATION:—Pressure (pump on right of engine). *See Studebaker Shop Notes for Oil Pump installation.*
Oil Pan Note—Place #2 piston at approx. top dead center to facilitate Oil Pan Removal & Installation.
Normal Oil Pressure:—40 lbs. at 25-30 MPH.
Oil Pressure Relief Valve:—On lower right front corner of engine. Opens at 30-40 lbs. Not adjustable.
Crankcase Capacity:—6 quarts.

COOLING

COOLING SYSTEM:—**Capacity**—13 quarts.
Water Pump:—Centrifugal with adjustable packing, lubricant fitting and grease cup for bushings. *See Water Pump Section for complete data.*
Thermostat:—Bishop & Babcock or Fulton. In cylinder head outlet. Install with bellows down.
Setting—Starts to open 151° F. to 155° F.
Temperature Gauge (1941): Auto-Lite (Motometer) vapor tension type. A-L Part No. H-9593. *See Miscellaneous Section for complete data.*
Temperature Gauge (1942): Stewart-Warner type. Studebaker Part No. 515505.

CLUTCH

CLUTCH:—**Borg & Beck Model 9A7 (all cars).** Clutch assembly No. 943 or 963. Single plate, dry disc type. *See Clutch Section for complete data.*
Facings—Molded-metallic (spiral-grooved), 2 used. Inside Diam. 6". Outside Diam. 9¼". Thickness ⅛".
Pedal Adjustment:—Free travel 1" min. Turn adjusting sleeve on pedal connector link. On cars with Hill-holder (NoRol), check when pedal adjusted and see that brakes release just as clutch engages.
Removal:—Remove transmission (see below), take off clutch housing, take out 6 mounting screws in clutch cover flange, lift clutch off. *Refer to Studebaker Shop Notes for Clutch Release Shaft Lubrication.*

TRANSMISSION

TRANSMISSION:—**Warner**—Model AS1-T86D (Std.), AS2-T86D, Type R7C (optl. overdrive with electrical 'kick-down' control). All helical gear type, synchromesh (second & high), sliding gear (low & reverse). *See Transmission Section for complete data.*
Transmission Control:—Mechanical steering col. shift. *See Transmission Section for complete data.*
Removal:—Disconnect rear universal and withdraw propeller shaft from transmission. Disconnect shift levers and speedometer cable at transmission. Place jack under engine rear plate and free rear engine support. Remove transmission-to-clutch housing capscrews, pull transmission out to rear.

OVERDRIVE

OVERDRIVE: Warner R7C (Kick-down) Electric type. Complete assembly (with transmission) Warner Model No. AS2-T86D. *See Transmission Section for complete data.*
►**1941 Production Change:** To correct free-wheel unit slippage when kicking down (also high speed vibration and grease leaks), free wheel unit bearing was changed to needle bearing type. *See Special Service Note in Transmission article in Transmission Section.*
Overdrive Solenoid—Delco-Remy Model 1118013.
Throttle Switch—Cole-Hersee No. 1687-S. Adjust so that shoe on accelerator linkage just contacts the switch plunger with throttle valve wide open (switch should operate only after accelerator pedal is depressed past the wide open throttle position).
Control Relay—Auto-Lite No. HR-4201S (for 1941), No. HRB-4301 (1942). Fuse mounted in holder on relay. Fuse capacity, 14 ampere ('41), 20 ampere ('42).
Removal: Same as for regular transmission after disconnecting control cable and solenoid wires.

UNIVERSALS

UNIVERSAL JOINTS:—**Spicer 1268-102.** Needle bearing. *See Universals Section for complete data.*
NOTE—1 piece driveshaft used. Slip joint formed at rear of transmission ahead of front universal.

REAR AXLE

REAR AXLE:—**Spicer Model 41-2.** Semi-floating, hypoid gear type with Hotchkiss drive. *See Rear Axle Section for complete data.*
Ratio—4.55-1 (Std. '41, Optl. or with Overdrive '42), 4.09-1 (Std. '42), 4.82-1 (Optl. '41).
NOTE—Ratio stamped on each gear and pinion.
Backlash—.005-.007". Shim adjustment.
Removal:—Hoist rear of car, disconnect propeller shaft at rear universal, hydraulic brake lines, brake cables, and shock absorbers. Remove spring U-bolts, disconnect rear spring shackles and withdraw axle.
NOTE—Use Puller HM-931 to remove axle shaft.
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed (use Hub Puller ST-500) check endplay with dial indicator. To adjust, remove backing plate, add or remove shims (.003", .005", .010", .030" thick).
Endplay—.001-.005".

SHOCK ABSORBERS

SHOCK ABSORBERS: Houdaille. Dbl. acting, hydraulic, adjustable type (thermostatic control on rear).

1941	BBFS-2 FRONT	ACHS-2 REAR
1942	BBFS-4 FRONT	ACHS-3 REAR

FRONT SUSPENSION

Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car weight on wheels but without load. *See Front Suspension Section for complete data.*
Kingpin Inclination—5½°.
Caster—Negative ¼° to Positive ¾°.
Camber—¼° to ¾°. Shim adjustment.
Toe In—1/16-⅛". Adjust right reach rod only for toe-in. Left rod should be adjusted first for left wheel straight-ahead position (steering wheel centered).
Steering Geometry (toe-out on turns)—Inner wheel turned 22-22½°. Outer wheel 20°.

STEERING GEAR

Steering Gear: Ross T-14 Cam-&-Twin Lever type. *See Steering Gear Section for complete data.*

BRAKES

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies rear service brakes. *See Brake Section for complete data.*
Drum—Budd composite. Diameter 11".
Lining—Moulded. Width 2". Thickness 3/16". Length per shoe (each wheel): 11⅛" front, 8 9/16" rear.
Clearance—.010" toe (top), .005" heel, for each shoe.
Hand Brake:—See Service Brakes (above).
Hill-Holder: Standard. *See Brake Section for data.*

MISC. MECHANICAL

WINDSHIELD WIPER: Auto-Lite Electric types. Model EWD-5002 (1941), EWH-5004 (1942). 20 ampere fuse (supersedes 14 ampere on '41 type), Klixon circuit-breaker used on 1942 type. *See Miscellaneous Section for complete data.*

Distributor Removal:—Mounted on right side of cylinder head. To remove, disconnect vacuum line, take out bolt in clamp arm, lift distributor off.

Installation Note—When installing distributor, crank engine to firing position for #1 cylinder ('U.D.C1-8' mark on vibration dampener in line with pointer on timing gear cover), groove in upper end of distributor drive shaft should be at right angles with camshaft and offset to rear, turn rotor to #1 segment, install distributor (insert .020" feeler between modifier control arm and clamp arm to prevent binding), tighten clamp, check timing.

IGNITION TIMING

IGNITION TIMING:—Standard setting as follows (see Octane Selector Setting following for correction dependent on fuel regularly used):

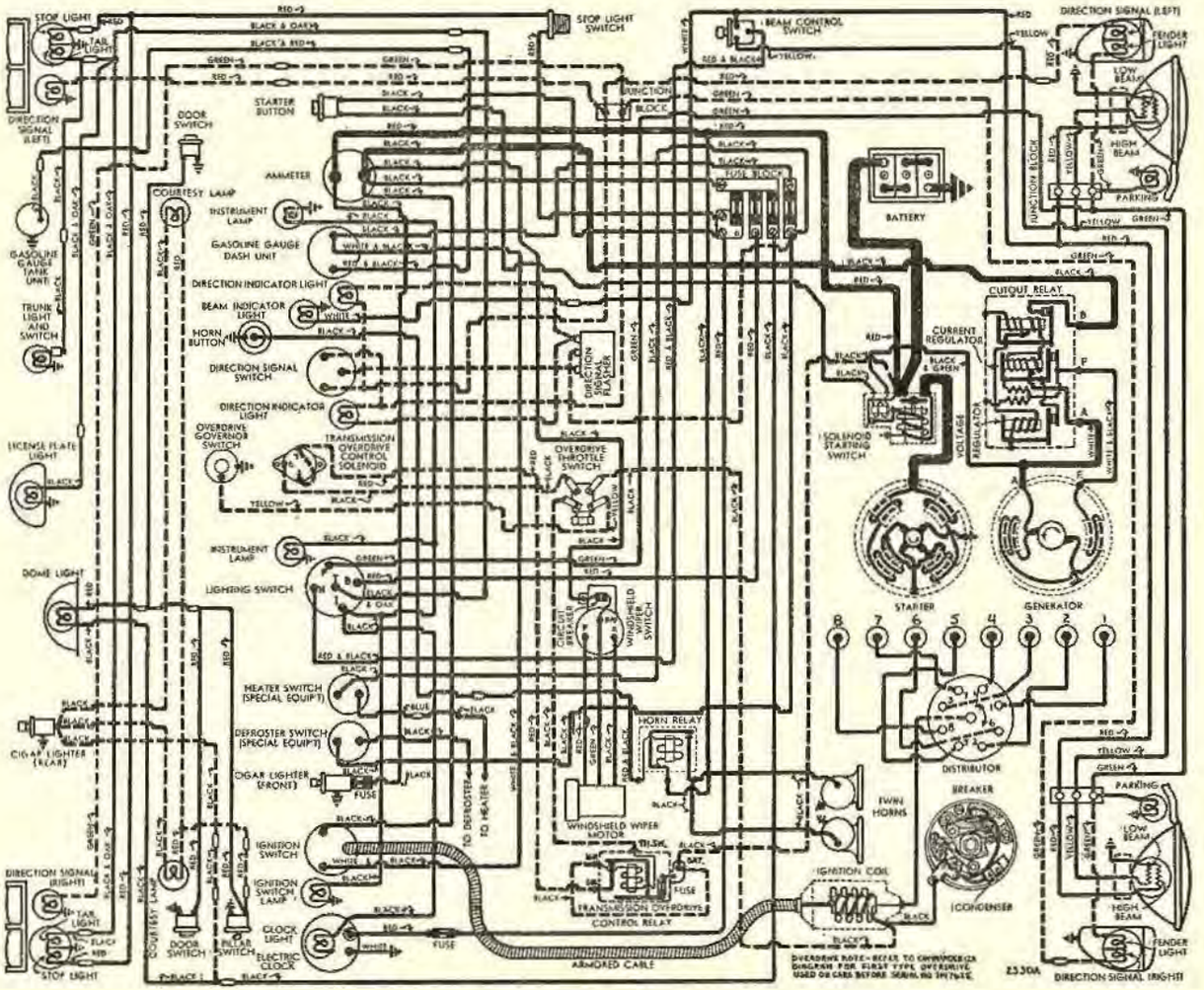
Flywheel Degrees	Piston Position
0° (at TDC)	.0000" TDC

Timing (Stationary Contacts)—With #1 piston on compression, turn engine over until 'U.D.C.1-8' mark on vibration dampener lines up with pointer on timing gear cover. Loosen hold-down plate screw, center pointer on scale, tighten screw. Loosen advance arm clamp bolt, rotate distributor until contacts just open, tighten clamp bolt. Then synchronize movable contacts.

Timing (with Neon Timing Light)—Neon Light No. 890 recommended by car manufacturer. Clip Neon Light lead in series with #1 spark plug. Idle engine and adjust distributor as directed above.

Synchronization (On Engine)—Turn engine over 90° to #6 firing position with vibration dampaner mark 'U.D.C.3-6' lined up with pointer on timing gear cover. Loosen 2 lockscrews on movable subplate carrying second set of contacts, shift subplate by placing screwdriver between knob and plate and turning screwdriver until contacts begin to open, tighten lockscrews.

Octane Selector Setting—After setting ignition timing, loosen selector screw, advance pointer toward 'A' end of scale until motor 'pings' when it is hot & pulling hard, then retard until 'ping' disappears.



1942 MODELS

See 1941 Diagram for R7C Overdrive Circuit. R9 Overdrive Circuit shown above

CARBURETOR

Carter (1941) Type WDO, Model 409-S. Double barrel, 1¼" downdraft with Carter Climatic Control.
For complete data, refer to Carburetor Index.

Stromberg (1941-42) Model AAV-26. Double barrel, 1¼" downdraft type with Stromberg Automatic Choke. Float bowl cover carries Code No. 6-97, 6-97A ('41), 6-97C ('42).
For complete data, refer to Carburetor Index.

►**Stromberg AAV-26 (Code 6-97) change to correct acceleration flat spot**—*See Stromberg AAV-26 carburetor in Carburetor Section.*

Idle Adjustment—With engine warm and running at slow idle speed (choke valve wide open, fast idle inoperative), set throttle stopscrew for 8 MPH idle speed. Adjust idle adjusting screw for each barrel (in succession) until engine fires smoothly (¼-1¼ turns open for each screw on Carter—turn screws in for leaner mixture). Readjust idle speed.

Accelerating Pump Setting—Two holes provided:
Inner Hole (min. stroke)—Normal Setting.
Outer Hole (max.)—If greater charge required.

Float Level (All Carburetors)—As follows:
Carter—3/16" from top of float to machined surface of bowl cover (remove gasket, invert to check).
Stromberg—Fuel level ⅝" below top edge of bowl with engine idling (3 lbs. pressure) or even with bottom of inspection plug hole on side of bowl.

Metering Jets & Rods—*See Carter & Stromberg Jet Tables in Carburetor Section for complete data.*

Fast Idle:—Integral (built-in each carburetor).
For complete data, refer to Carburetion Equip. Index.
Setting (Carter)—Adjust fast idle screw for .018" throttle valve opening with choke valve closed.
Setting (Stromberg)—Hold throttle stopscrew against high lobe of fast idle cam, move choke valve toward closed position as far as possible, check valve opening. Adjust by bending fast idle connector rod for 7/64" choke valve opening.

Automatic Choke:—Climatic Control (Carter), AAV-26 type (Stromberg). Built-in carburetor.
For complete data, refer to Carburetion Equip. Index.
Setting (Carter)—Set coil housing 1 Notch Rich.
Setting (Stromberg)—'R' mark on thermostat cover in line with highest projection on housing. Shift to 'M' if engine loads up or overchokes. Use 'H' setting only if highly volatile fuels used.

CARB. EQUIPMENT

Air Cleaner:—AC #1529907 oil-wetted type standard. #1529745 heavy duty oil-bath type optional. Use Replacement Filter Element Assembly: Type #3 (for 1529907), #1529767 (for 1529745). NOTE—Service oil filler cap filter element at regular intervals.

Fuel Pump: AC Type 'AE' ('41), 'E' #1523926 ('42). Exchange #528. Diaphragm type fuel pump.
For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge (1941): Auto-Lite electric. No. NG-9594D (dash unit), No. NG-9659T (tank unit).
For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge (1942): Stewart-Warner elec. type. Studebaker Nos. 515506 (dash unit), 515684 (tank).
For complete data, refer to Carburetion Equip. Index.

CONTINUED ON NEXT PAGE

ENGINE

CONTINUED FROM PRECEDING PAGE

size. Align oil hole in rod and bearing shell. See that tongues on bearing engage grooves in rod and cap.

Installing Rods:—Rods and caps marked with cylinder number. Numbers must be together and installed in same numbered cylinder with numbers and oil hole in lower end of rod toward camshaft

CRANKSHAFT:—9 bearing, 12 bolted counterweights. Vibration damper mounted on forward end of shaft. *See Studebaker Shop Notes for Vibration Damper data.*
Journal Diameters—2.3435-2.3440".
Bearings—Removable steel-backed, babbitt-lined.
Clearance—.001-.003".
Adjustment:—None (no shims). Replace bearings furnished Std. & .010", .015", .020", .030" undersize.
End Thrust:—Thrust plate assembled between front bearing and crankshaft gear. Controlled by pinned bronze washers (furnished .003", .005", .007" thick) between plate and journal face. **Endplay**—.003-.006". NOTE—Install new seals (specially treated wood) whenever rear main bearing cap replaced.

CAMSHAFT:—Six bearing with helical gear drive. *See Studebaker Shop Notes for Camshaft Removal data.*
Journal Diameters:—#1, 1.935-1.9355"; #2, 1.90275-1.9035"; #3, 1.87225-1.873"; #4, 1.84075-1.8415"; #5, 1.80975-1.8105"; #6, 1.74725-1.748".
Bearings—Split steel-backed, babbitted bushings. NOTE—Align bushing with oil hole in block.
Clearance—.00075-.00225" (#1), .002-.00375" (others).
End Thrust:—Taken by thrust plate assembled on front face of engine behind camshaft gear. Spacer assembled back of gear hub. **Endplay**—.004-.008".
Timing Gears:—Crankshaft (cast-iron), Camshaft (Celeron with steel hub). **Backlash** .001-.003". *Refer to Studebaker Shop Notes for Timing Gear Removal and Replacement Camshaft Gear size selection.*
Camshaft Setting:—Mesh marked camshaft gear tooth between 2 marked teeth on crankshaft gear.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 13/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.001-.003"

Valve Guides:—Pressed in block from above (1 5/16" below upper edge of valve seat) with stepped end down. Ream to inside diameter of .343-.344".
Valve Springs:—Install with closed-coil up and dampener on top of spring. Replace springs if 10% weak (test with Tool U-15). **Free Length**—2½".

	Spring Pressure	Spring Length
Valve Closed	54-60 lbs.	2 3/32"
Valve Open	125-135 lbs.	1¾"

Valve Lifters:—Mushroom type in bolted-on guide brackets (clusters of four). Assemblies may be removed through valve opening on side of engine. *See Studebaker Shop Notes for Lifter Tension Spring.*

VALVE TIMING

Tappet Clearance:—.016" (cold) all valves. Remove hood side panel for access to valves.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
Valve Timing Check—With .020" tappet clearance #1 intake valve should open with #1 piston 15° or .0915"BTDC with vibration damper mark 'IN.OP.1-8/' aligned with pointer on timing gear cover. Reset tappet clearance .018" (cold).

LUBRICATION

LUBRICATION:—Pressure (pump in crankcase). *See Studebaker Shop Notes for Oil Pump installation.*
Normal Oil Pressure:—40 lbs. at 25-30 MPH.
Oil Pressure Relief Valve:—On lower right front corner of engine. Opens at 40 lbs. To adjust, loosen locknut, turn adjusting screw to right to raise pressure, to left to decrease pressure.
Crankcase Capacity:—8 quarts.

COOLING

COOLING SYSTEM:—**Capacity**—15 quarts.
Water Pump:—Packless, sealed ball-bearing type. *See Water Pump Section for complete data.*
Thermostat:—Fulton. In cylinder head outlet.
Setting—Starts to open 151° F. to 155° F.
Temperature Gauge (1941): Auto-Lite (Motometer) vapor tension type. A-L Part No. H-9593. *See Miscellaneous Section for complete data.*
Temperature Gauge (1942): Stewart-Warner type. Studebaker Part No. 515505.

CLUTCH

CLUTCH:—**Inland.** 'Diaphragm' type, single plate, dry disc type with Long 9½CF-CS driven member. *See Clutch Section for complete data.*
Facings—Spirally grooved. Moulded (both sides '42, flywheel side '41). Woven—Man. Hycoe (pressure plate side 1941). Inside Diameter 6". Outside Diameter 9½". Thickness .125".
Replacement Clutch Note—Remove spacers (one at each driving lug) after clutch installed on car.
Pedal Adjustment:—Free travel 1" min. Turn adjusting sleeve on pedal connector link. On cars with Hill-holder (NoRol), check when pedal adjusted and see that brakes release just as clutch engages.
Removal:—Remove transmission (see below), take off clutch housing, take out 6 mounting screws in clutch cover flange, lift clutch off. *Refer to Studebaker Shop Notes for Clutch Release Shaft Lubrication.*

TRANSMISSION

TRANSMISSION:—**Warner**—Model AS1-T86D (Std.). All helical gear type, synchro-mesh (second & high), sliding gear (low & reverse). *See Transmission Section for complete data.*
Transmission Control:—Mechanical steering col. shift. *See Transmission Section for complete data.*
Removal:—Disconnect rear universal and withdraw propeller shaft from transmission. Disconnect shift levers and speedometer cable at transmission. Place jack under engine rear plate and free rear engine support. Remove transmission-to-clutch housing capscrews, pull transmission out to rear.

OVERDRIVE

►**ALL 1941 CARS, EARLY 1942 CARS**

Overdrive (Cars before Serial No. 7147625):—Warner Type R7C electrical 'kick-down' control (with centrifugal pawls). Used with T86D transmission. *See Transmission Section for complete data.*
►**1941 Production Change:** To correct free-wheel unit slippage when kicking down (also high speed vibration and grease leaks), free wheel unit bearing was changed to needle bearing type. *See Special Service Note in Transmission article in Transmission Section.*
Overdrive Solenoid—Delco-Remy Model 1118013.
Throttle Switch—Cole-Hersee No. 1687-S. Adjust so that shoe on accelerator linkage just contacts switch plunger with throttle valve wide open.
Control Relay—Auto-Lite No. HR-4201S (for 1941), No. HRB-4301 (1942). Fuse mounted in holder on relay. Fuse capacity, 14 ampere ('41), 20 ampere ('42).
Removal: Same as for regular transmission after disconnecting Overdrive cable and wiring, and removing Overdrive Rear Support. *See Overdrive Transmission Rear Support Installation in Studebaker Shop Notes*

OVERDRIVE

►**LATE 1942 CARS**

Overdrive (Cars with Serial No. 7147625 & up):—Warner Type R9C Electric type (no centrifugal pawls) with Governor Control and Throttle switch 'kick-down'. Used with T86D transmission. *See Transmission Section for complete data.*
Control Relay—Auto-Lite HRB-4301, 20 amp. fuse.
Removal: Same as for Early '42 type above.

UNIVERSALS

UNIVERSAL JOINTS:—Spicer 1268-102. Needle bearing. *See Universals Section for complete data.*
NOTE—1 piece driveshaft used. Slip joint formed at rear of transmission ahead of front universal.

REAR AXLE

REAR AXLE:—**Spicer Model 41-2.** Semi-floating, hypoid gear type with Hotchkiss drive. *See Rear Axle Section for complete data.*
Ratio—4.55-1 (Std. '41, Optl. or with Overdrive '42), 4.09-1 (Std. '42), 4.82-1 (Optl. '41).
NOTE—Ratio stamped on each gear and pinion.
Backlash—.005-.007". Shim adjustment.
Removal & Wheel Bearing Adjustment: *Same as '41-42 Studebaker Commander (see preceding car article).*

SHOCK ABSORBERS

SHOCK ABSORBERS: Houdaille. Dbl. acting, hydraulic, adjustable type (thermostatic control on rear).

1941	BBFS-2 FRONT	ACHS-2 REAR
1942	BBFS-4 FRONT	ACHS-3 REAR

FRONT SUSPENSION

Front Suspension:—Planar type independent suspension with transverse spring. Specifications below apply with car weight on wheels but without load. *See Front Suspension Section for complete data.*
Kingpin Inclination—5½°.
Caster—Negative ¼° to Positive ¾°.
Camber—¼° to ¾°. Shim adjustment.
Toe In—1/16-⅛". Adjust right reach rod only for toe-in. Left rod should be adjusted first for left wheel straight-ahead position (steering wheel centered).
Steering Geometry (toe-out on turns)—Inner wheel turned 22-22½°. Outer wheel 20°.

STEERING GEAR

Steering Gear: Ross T-14 Cam-&-Twin Lever type. *See Steering Gear Section for complete data.*

BRAKES

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies rear service brakes. *See Brake Section for complete data.*
Drum—Budd composite. Diameter 11".
Lining Moulded. Width 2¼". Thickness 3/16". Length per shoe (each wheel): 11⅛" front, 8 9/16" rear.
Clearance—.010" toe (top), .005" heel, for each shoe.
Hand Brake:—See Service Brakes (above).
Hill-Holder: Standard. *See Brake Section for data.*

MISC. MECHANICAL

WINDSHIELD WIPER: Auto-Lite Electric types.
Model EWD-5002 (1941), EWH-5004 (1942).
20 ampere fuse (supersedes 14 ampere on '41 type), Klixon circuit-breaker used on 1942 type.
See Miscellaneous Section for complete data.

tongue in oil pump drive gear is parallel to and narrow half of offset toward camshaft, turn rotor to #1 segment, install distributor (insert .020" feeler between modifier control arm and clamp arm before tightening the clamp, to prevent binding), check timing.

IGNITION TIMING

Standard Setting—Initial setting for regular fuel (see Octane Selector Setting following for correction depending on fuel regularly used).

Flywheel Degrees	Piston Position
2° BTDC	.0016" BTDC

Timing (with Neon Timing Light)—Neon Light No. 890 recommended. Clip Neon light lead in series with #1 spark plug, idle engine and direct Neon light on flywheel inspection hole on left rear motor support. Loosen hold-down plate screw, center scale on pointer, tighten screw. Loosen clamp arm, rotate distributor until 'IGN' mark on flywheel (approx. 13/64" before top dead center mark 'U.D.C.1-6') lines up with pointer on engine rear plate. Insert .020" feeler between modifier control arm and clamp arm before tightening clamp (to insure clearance for modifier control arm). Check Octane Selector Setting (following).

Timing (without Neon Timing Light)—Turn engine over to firing position for #1 piston with 'IGN' mark on flywheel in line with pointer in inspection hole on left rear motor support and distributor rotor at #1 segment in distributor cap. Adjust distributor as directed above.

Octane Selector Setting—After setting ignition timing (above), loosen selector hold-down screw, advance selector (move toward 'A' end of scale) until motor 'pings' when it is hot and pulling hard. Then retard (move selector pointer toward 'R' end of scale) until 'ping' just disappears.

CARBURETOR

Carter Model WE, Type 532-S. 1¼" Single Barrel, Downdraft type with Fast Idle and Climatic Control
See Carburetor Section for complete data.

Idle Setting—Set throttle stopscrew for 500-525 RPM. or 8 MPH. hot or slow idle speed (fast idle inoperative). Set idle adjusting screw ½-1½ turns open and adjust for smooth idle (turn screw in for leaner mixture), recheck idle speed.

Accelerating Pump—Non-adjustable type.

Float Level—¼" from top of projection on bowl cover to top of seam on free end of float with needle valve seated (invert to check).

Metering Rods & Jets—*Refer to Carburetor Index for Carter Downdraft Carburetor Jet Specification Table.*

Fast Idle:—Integral type (built-in carburetor).
See Carburetion Equipment Section for data.
Setting—.054" throttle valve opening with choke valve closed. To check, open throttle wide to make certain fast idle cam drops into position, then with choke valve closed measure clearance between edge of throttle valve and carburetor wall on side opposite idle port (valve closed to fast idle position). To adjust, loosen locknuts and turn adjusting sleeve on connector link.

Automatic Choke: Carter Climatic Control (mounted on carburetor air horn).
See Carburetion Equipment Section for data.
Setting—Centered (cover reference mark centered on housing scale).

CARB. EQUIPMENT

Air Cleaner: AC. No. 1529210 Oil-wetted type Std., No. 1529211 Heavy Duty Oil-bath type Optl. Replacement Filter Element Assy. No. 2 (1529210), No. 8 (1529211).

Servicing (Oil-wetted type)—Clean and re-oil filter element at 1000 mile intervals or as required by operating conditions.

Servicing (Oil-bath type)—Clean filter element and oil reservoir, fill reservoir to indicated level mark with SAE No. 40 or 50 engine oil at intervals as required by operating conditions.

Fuel Pump: AC Type W (AE). Diaphragm type. Pump Exchange type No. 527. **Pressure**—2½-3½ lbs.
See Carburetion Equipment Section for data.

Gasoline Gauge: Stewart-Warner Electric type.
See Carburetion Equipment Section for data.

BATTERY

Willard Type SW-1-90 (Orig. Equip), SW-1-92 (Replacement). 6 volt, 15 plate, 92 Ampere Hour Capacity (20 hour rate).

Starting Capacity—117 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.1 minutes. Five second voltage 4.2 volts.

Grounded Terminal—Positive (+) to front fender.

Engine Ground—Strap at right front motor support.

Dimensions—Length 9". Width 6 13/16". Height 8⅝".

Location—On left side under engine hood.

STARTER

Auto-Lite Model MZ-4090, Armature No. MZ-2130. Drive—Barrel type Bendix. Special Inboard type A-2033 (marked 'D' on pinion barrel).

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—160 amperes, 5.2 volts, 130 RPM.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
0.65 "	2500	5.5	100
2.55 "	1325	5.0	200
4.95 "	750	4.5	300
7.65 "	220	4.0	400
7.8 "	Lock	3.0	420
11.8 "	Lock	4.0	560

Removal:—Starter flange mounted on right rear engine plate. To remove take out mounting bolts and lift starter off.

Starting Switch:—A-L Model SW-4011. Mounted on left side of car below clutch pedal. Operated by depressing clutch pedal fully.

GENERATOR

Auto-Lite Model GDZ-4804A. Armature No. GDZ-2006F. Two brush type with current-voltage control.

Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.
See Regulator data following.

Maximum Charging Rate—35 amperes, 8.0 volts, 1900 generator RPM. or approx. 18.3 MPH. and above. with load or discharged battery (Current Regulator Setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data

Cold Amperes	Cold Volts	Cold R.P.M.	Hot Amperes	Hot Volts	Hot R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6.75	1140	8	6.75	1235
12	6.95	1250	12	6.95	1350
16	7.15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7.9	1820	32	7.9	2090
35	8.0	1900	35	8.0	2250

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.60-1.78 amperes at 6.0 volts.
Motoring Current—4.16-4.60 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, move generator out until ⅜-½" belt deflection midway between generator and fan pulleys is obtained or until fan can just be turned with belt held stationary.

REGULATOR

Auto-Lite Model VRP-4004F. Voltage & Current Type. Consists of Cutout Relay and vibrating type Voltage and Current Regulators in case on dash.
See Electrical Equipment Section for complete data.

NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay

Cuts In—6.4-7.0 volts (set to 6.4-6.6 volts).
Cuts Out—4.1-4.8 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator

Setting—7.2-7.5 volts at 70°F. See Electrical Equipment Section for settings at other temperatures.

To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage is steady. Voltage reading should agree with setting given above.

To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked '35' on the cover).

To Check (without breaking seals)—Connect test meters as for voltage check (above). Operate generator at speed equivalent to 30 MPH. charging battery, turn on car lights and accessories or connect load (bank of headlamp bulbs, etc.) between ammeter and battery so that generator charges at peak rate and Current Regulator operates. Current reading should agree with setting given above. If more than slight excess noted, regulator is defective.
To Adjust (with cover removed)—Same as for Voltage Regulator (above).
Contact Gap & Air Gap—Same as Voltage Regulator.

CONTINUED ON NEXT PAGE

Oil pump mounted externally on right side of engine.

Crankcase Capacity - 5 qts. ("Add Oil" point on oil level indicator stick is 3 qt. level).

Normal Oil Pressure—40 lbs. at 25-30 MPH.

Oil Pressure Relief Valve—On lower right front corner of engine block. Opens at 40 lbs. Not adjustable.

Oil Pan Removal—*See Studebaker Shop Notes.*

Oil Pump: Helical gear type. Mounted externally on right hand side of crankcase.

Removal—Remove capscrews and lockwashers on pump cover, remove cover, gasket, oil pump gears, and woodruff key. Remove "C" washer (horseshoe washer) from pump shaft within pump body, withdraw pump body. Shaft and driving gear are removed from within crankcase.

Installation—*See Studebaker Shop Notes.*

Oil Filter: Fram (optional equipment).

Oil Pressure Gauge: Stewart-Warner Bourden tube type (not electric).

COOLING

Cooling System: Positive circulation with water pump mounted on front of block with fan.
Capacity—10½ quarts.

Water Pump: Packless, sealed ball bearing type.
See Water Pump Section for complete data.

Removal—Slack off drive belt, take out capscrews in fan pulley hub, remove fan and pulley. Disconnect hose connection, take out mounting screws in pump body flange, withdraw pump from engine block.

Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat: Bishop & Babcock. In water outlet on cylinder head.

Setting—Starts to open at 151-155°F.

Temperature Gauge: Stewart-Warner Bourden tube type (not electric).

CLUTCH

Borg & Beck Model 8A7 with "Borglite" Driven Member. Single plate, dry disc type. NOTE - Clutch Assembly marked by number 959 stamped on cover.
See Clutch Section for complete data.

Facings—Moulded-asbestos, 2 required. Inside Diameter 5 ⅜". Outside Diameter 8". Thickness ⅛".

Adjustment: Pedal free-travel 1" minimum. Loosen locknuts on adjusting sleeve on link connecting pedal and clutch throw-out shaft lever, turn adjusting sleeve. Tighten locknuts after making adjustment.

Hill Holder (NoRol) Note—Check adjustment whenever clutch pedal adjusted. Hill Holder should be set to release just as clutch engages.

Removal: Remove Transmission (see Transmission Removal below), disconnect and remove clutch throw-out shaft, remove clutch housing by taking out mounting bolts in housing flange. Remove six mounting screws in clutch cover flange, lift out clutch assembly and driven member.

For Clutch Release Shaft Lubrication instructions, see Studebaker Shop Notes.

TRANSMISSION

Warner Model T84G Std. All helical gear type, constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse).
See Transmission Section for complete data.

Transmission Control: Remote control type with gearshift lever mounted on steering column.
See Transmission Section for complete data.

Removal: Disconnect propeller shaft at rear universal (remove nuts on "U" bolts), pull propeller shaft out toward rear disengaging front end of shaft from splined shaft in transmission case. Disconnect speedometer cable and shift lever rods at transmission case. Place support jack under engine at rear plate, free rear engine support. Remove transmission to clutch housing capscrews, pull transmission straight back and remove from beneath car.

OVERDRIVE

Warner Type R7C (with special T84G Transmission). Optl. Equipment. Overdrive has electrical "kick-down" control.
See Transmission Section for complete data.

Overdrive Control: Control Solenoid (for "kick-down") mounted on over-drive case and controlled through relay by accelerator pedal operated kick-down switch.
See Transmission Section for complete data.

Overdrive Solenoid—Delco-Remy Model 1118013.

Control Relay—Auto-Lite Model HRB-4301.

Throttle Switch—Adjust so that shoe on accelerator linkage just contacts switch plunger with throttle valve wide open (switch should operate only when accelerator pedal depressed past wide open throttle position).

Overdrive Control Fuse—20 ampere. Mounted on relay.

Removal: Same as for conventional transmission (above) except that overdrive control cable and wires at solenoid terminals must be disconnected first.

UNIVERSALS

Spicer Type 1268-102X. Needle bearing "cross" type, two used. NOTE—Propeller shaft is one piece type with slip joint at transmission main shaft ahead of front universal joint.
See Universals Sections for complete data.

REAR AXLE

Spicer Model 23. Semi-floating, hypoid gear type with Hotchkiss drive.
See Rear Axle Section for complete data.

Ratio—4.10-1 Std., 4.56-1 Optl.

Backlash—.003-.006" Shim adjustment.

Removal: Hoist rear of car, disconnect propeller shaft at rear universal by removing nuts on "U" bolts. Disconnect hydraulic brake lines, brake cables, and shock absorbers. Disconnect spring "U" bolts and rear spring rear shackles, withdraw axle assembly. **Axle Shaft Removal**—Remove wheel hub using Puller J-446, remove nuts on mounting studs and take off brake backing plate and brake assembly (CAUTION—do not lose wheel bearing adjusting shims in back of the backing plate). Use Puller HM-931 to remove axle shaft and bearing assembly.

NOTE—Inner oil seal can be removed by hooking axle shaft puller adapter under oil seal. Use Handle J-270-1 and Disc J-270-13 to install new oil seal.

Wheel Bearing Adjustment: Remove wheel and wheel hub (use Puller J-446). Check shaft endplay with dial indicator. To adjust, take off nuts on backing plate mounting studs, remove backing plate and brake assembly, add or remove shims on housing flange. Shims furnished in thickness of .003", .005", .010", .030".

Endplay—.001-.005".

SHOCK ABSORBERS

Houde (Houdaille) Model BBFS-10 (Front), BBDS-5 (Rear). Double acting, hydraulic type. Adjustable.

Adjustment: Adjusting pointer on end of shaft should be lined up with scribed line on end of shaft. Turn pointer clockwise for firmer action, counter-clockwise for softer action (not more than 1/32-1/16"). Stops provided to limit adjustment in each direction.

Refilling: Check at 5000 mile intervals. Fill to bottom of filler plug hole. CAUTION—use only Houdaille Shock Absorber Fluid No. L-1404 (new type fluid used only on shock absorbers with new circular top plug).

FRONT SUSPENSION

Front Suspension: Planar type independent suspension with transverse spring. Specifications below apply with car weight on wheels but without load.
See Front Suspension Section for complete data.

Kingpin Inclination—5½° crosswise.

Caster—1-2°. No adjustment.

Camber—½° (¼-¾°). Shim adjustment.

Toe In—1/16-1/8". Adjust right hand Reach Rod only for toe in after left hand rod adjusted first to place left wheel straight ahead with steering wheel centered.

Steering Geometry (Toe out on Turns)—Inner wheel turned 22½-23° with outer wheel turned exactly 20°.

STEERING GEAR

Ross Model T-12. Cam-and-Twin Lever type with insulated steering arm and intermediate steering arm (idler) on right hand side of frame.
See Steering Gear Section for complete data.

BRAKES

Service: Lockheed hydraulic, single anchor type. Hand lever applies rear wheel service brakes.
See Brake Section for complete data.

Drum—Budd Composite type. Diameter 9".

Lining—Moulded type. Width 1¾", Thickness 3/16". Length per wheel 18" (10 13/16" front shoe, 7 3/16" rear shoe).

Clearance—.010" toe (top), .005" heel, for each shoe.

Braking Power—43% Rear Wheels, 57% Front.

Hand Brake: See Service Brakes above.

Hill Holder: Optional equipment.
See Brake Section for complete data.

hole (distributor out) and see that distributor drive tongue in oil pump drive gear is parallel to and narrow half of offset toward camshaft, turn rotor to #1 segment, install distributor (insert .020" feeler between modifier control arm and clamp arm before tightening the clamp, to prevent binding).

IGNITION TIMING

Std. Setting	Flywheel Degrees	Piston Pos.
All Engines	2° BTDC	.0016" BTDC

This setting correct for regular fuel (See Octane Selector Setting for service and fuel modification).

Timing (With Neon Timing Light)—Clip timing light lead in series with #1 spark plug, direct light on vibration dampener at front of engine. Loosen hold-down plate screw, center octane selector pointer on scale, tighten hold-down screw. Run engine at idle speed, loosen clamp arm, rotate distributor until "IGN/" mark on dampener appears in line with pointer on left side of timing gear cover, tighten clamp screw. Check Octane Selector setting. CAUTION—Insert .020" feeler between modifier arm and clamp arm when tightening clamp arm

Timing (Without Neon Timing Light)—With #1 piston on compression, turn engine over until "IGN/" mark on vibration dampener lines up with pointer on left side of timing gear case. Adjust distributor as directed above.

Octane Selector Setting—After setting timing (above), loosen selector hold-down screw, advance timing by turning distributor clockwise (move pointer toward "A" end of scale) until engine "pings" when hot and pulling hard, then retard timing by turning distributor counter-clockwise (move pointer toward "R") until ping disappears.

CARBURETOR

1947 Before Eng. #350,841.....**Carter WE-532S**
1947 After Eng. #350,841 & 1948.....**Carter WE-661S**
1949.....**Carter WE-715S**

1¼" single barrel, downdraft, with Carter Climatic Control.

Casting No. on Flange—375 (532S, 661S), 620 (715S). ***See Carburetor Section for complete data.***

Settings (Idle Setting, Float Level, & Accelerating Pump): ***See Tune-Up.***
Metering Rods & Jets—***See Carter Jet Table in Carburetor Section.***

Fast Idle: Carter Single Barrel Carburetor type.
See Carburetion Equipment Section for data.

Setting (532S, 661S)—.054" throttle valve opening with choke valve closed. To check, open throttle wide to make certain fast idle cam drops into position, then with choke valve closed measure clearance between edge of throttle valve and carburetor wall on side opposite idle port (valve closed to fast idle position). To adjust, turn adjusting sleeve on connector link.

Setting (715S)—.046" between throttle valve and bore of carburetor. To check, remove thermostatic coil housing, gasket and baffle plate. Crack throttle valve and hold choke valve closed. Close throttle. Adjust by bending connector rod at lower angle.

Automatic Choke: Carter Climatic Control (Single Carburetor type).
See Carburetion Equipment Section for data.

►*CAUTION—Setting different on each type carburetor.*
Setting (532S)—Centered (cover centered on scale).
Setting (661S)—1 Point Lean.
Setting (715S)—Centered (at index).

CARB. EQUIPMENT

Air Cleaner: AC No. 1543970 Oil-wetted type Std. Filter Element AC #1. Oil-bath Air Cleaner Optl.
Servicing (Oil-wetted type)—Clean and re-oil filter element at 1000 mile intervals.
Servicing (Oil-bath type)—Clean filter element and oil reservoir, fill reservoir to indicated level mark with SAE No. 40 or 50 engine oil at intervals as required by operating conditions.

Fuel Pump (Std.): AC #1539092 or AC #1539416.
Optl. Fuel & Vacuum (1948-49)—AC #1539218 or 1539528.
Exchange Pump—AC No. 576 (Std.), 9218 (Optl.).
Pressure—4-5 lbs. maximum.
See Carburetion Equipment Section for data.

Gasoline Gauge: Stewart-Warner Electric type.
Dash Unit—Studebaker No. 522177.
Tank Unit (1947-48)—Stude. No. 519423, (1949) 525548.
See Carburetion Equipment Section for data.

BATTERY

Willard Type HW-1-100. 6 volt, 15 plate, 100 Ampere Hour Capacity (20 hour rate).
Starting Capacity—120 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.5 minutes. Five Second Voltage 4.3 volts.
Grounded Terminal—Positive (+) to cyl. head.
Location—In engine compartment on left side.

STARTER

1947.....**Auto-Lite MZ-4136. Arm. No. MZ-2211**
1947, 48, 49.....**Auto-Lite MZ-4151. Arm. No. MZ-2211**
Drive—Barrel type Bendix Drive No. A1792.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—150 amperes, 5.2 volts, 150 RPM.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
2.55 "	1325	5.0	200
7.65 "	220	4.0	400
7.8 "	Lock	3.0	420

Starting Switch: Magnetic switch mounted on starter and controlled by Auto-Lite Model SW-4016 manual switch on toeboard operated by clutch pedal.
Removal:—Flange mounted on engine rear plate at left side. To remove, take out flange mounting screws, take off starter and switch assembly.

GENERATOR

Auto-Lite Model GDZ-4804A. Armature No. GDZ-2006F. Two brush type with current-voltage control.
Charging Rate Adjustment—None. See Regulator.
Maximum Charging Rate—35 amperes, 8.0 volts, 2250 Gen. RPM (hot), at car speed of 24 MPH & above with load or discharged battery (regulator setting).

Performance Data

Cold Amperes	Volts	R.P.M.	Hot Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
8	6.75	1140	8	6.75	1235
16	7.15	1370	16	7.15	1460
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
35	8.0	1900	35	8.0	2250

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—35-53 ozs. (new brushes).
Field Current—1.60-1.78 amperes at 6.0 volts.
Motoring Current—4.16-4.60 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, move generator out until ⅜-½" belt deflection midway between generator and fan pulleys is obtained

REGULATOR

Auto-Lite Model VRP-4004F. Voltage & Current Type. Consists of Cutout Relay and vibrating type Voltage & Current Regulators in case on dash.
See Electrical Equipment Section for complete data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay

Cuts In—6.4-7.0 volts (set to 6.4-6.6 volts), 10.4 MPH.
Cuts Out—4.1-4.8 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator

Setting—7.2-7.5 volts at 70°F. See Electrical Equipment Section for settings at other temperatures.
Checking (without breaking seal) & Adjustment—*See Electrical Equipment Section.*
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked '35' on the cover).
Checking (without breaking seal) & Adjustment—*See Electrical Equipment Section.*
Contact Gap & Air Gap—Same as Voltage Regulator.

LIGHTING

Headlamps: Corcoran-Brown "Sealed Beam" type.
See Electrical Equipment Section for complete data.
Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height at 25 ft.).
Beam Indicator—At center of speedometer dial. Lighted whenever Country (upper) beams in use.

Direction Signal: ***See Electrical Equipment Section.***
Direction Signal Indicators—In face of Speedometer dial. Left or right indicator lighted when corresponding direction signal is in operation.

Switches

Lighting—Douglas. Studebaker No. 519798.
Beam Selector—Delco-Remy No. 1997008, Studebaker No. 519246.
Stop Light—Studebaker No. 666858.
Direction Signal—Studebaker No. 520304.

MISC. ELECTRICAL

LIGHTING CIRCUIT BREAKER (On Light Switch): Studebaker No. 522014. 30-ampere thermostatic type. Protects Headlamps, Parking, Tail, & Instrument Lamps by vibrating to limit current.

Auxiliary Circuit Breaker (On Panel): No. 523056. 15-ampere thermostatic type. Protects Body & Stop Lamps by vibrating to limit current.

ACCESSORY CIRCUIT BREAKER: One 15-ampere type used on cars with Climatizer and Defroster.

FUSES: Clock—3 ampere. In clock lead.
Direction Signal—14 ampere. In Flasher lead.
Overdrive—20 ampere. On Overdrive Relay.
Glove Compt. Light—5 ampere. In lamp lead.
Under Hood Light—5 ampere. In lamp lead.
Fog Lights—20 ampere. On Fog Light Switch.

HORNS: Sparton or Delco-Remy No. 1999610 (High Note), 1999611 (Low Note). Twin Airtone type horns operated by relay. **Horn Current**—12-15 ams. (each).

Horn Relay: Delco-Remy No. 1116775.
Contacts Close—2.75-4.0 volts.
Contact Gap—.025". **Air Gap**—.015" (closed).

CONTINUED ON NEXT PAGE

COOLING

Cooling System: Positive circulation with water pump mounted on front of block with fan.
Capacity—11 quarts.

Water Pump: Packless, sealed ball bearing type.
See Water Pump Section for complete data.
Removal—Slack off drive belt, take out capscrews in the fan pulley hub & remove fan blades. Disconnect hose connection, take out mounting screws in pump body flange, withdraw pump from engine
Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat: Bishop & Babcock. In water outlet on cylinder head.
Setting—Starts to open at 151-155°F.

Temperature Gauge: Stewart-Warner Bourden tube type (not electric). Studebaker No. 522180.

CLUTCH

Borg & Beck Model 8A7 with Borglite Driven Member. Single plate, dry disc type. NOTE—Clutch assembly marked by number 980 stamped on cover.
See Clutch Section for complete data.
Facings—Moulded Metallic type, 2 required. I. D. 5⅜". O. D. 8". Thickness ⅛".

►*CAUTION—Special driven member used on cars with Overdrive. Identify each type by hub damper spring color as follows:* Damper Spring Color.
Cars with Conventional Trans.....2 Lavender, 2 Black
Cars with Overdrive Trans. ..... 4 Lavender

Pedal Adjustment: Pedal free travel ½" to 1". To adjust, unhook pull-back spring on outside of frame rail, loosen locknut at adjusting clevis and remove clevis pin at inner end of pedal shaft, turn clevis on rear end of pedal shaft-to-operating shaft rod for correct clearance, reassemble linkage.
Cars before Serial No. G-217064—Pedal free travel must be set to ½" to ¾" on these cars.
Hill-Holder Note—Check setting whenever clutch pedal adjusted and adjust Hill-holder to release just as clutch engages.

Hill-Holder Adjustment: *See Studebaker Shop Notes.*

Removal: Car manufacturer recommends Engine (with clutch attached) be removed. *See "Engine Removal" in Studebaker Shop Notes.* Block release levers. Remove six mounting screws in clutch cover flange, lift off clutch assembly and driven member.

TRANSMISSION

Warner Model AS1-T96 (Std.), AS2-T96 (Optl. 1948-49), AS24-T96 (Optl. Late 1949). Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all helical gear type. *NOTE—Optl. AS2 & AS24 Transmissions have R10 type Overdrive.*
See Transmission Section for complete data.

Transmission Control: Remote control type with gearshift lever mounted on steering column.
See Transmission Section for complete data.

Removal: Drain transmission. Disconnect hand brake cable and move out of way for clearance. Disconnect front universal at transmission (wire caps or use clamp to prevent losing rollers). Take out center support bearing mounting bolts. Push front shaft and support to rear (will slide on splines on rear shaft). Disconnect shift rods from levers on case and speedometer cable (remove speedometer pinion). On Overdrive transmission disconnect all control wires and cable. Take out transmission to clutch housing capscrews, pull transmission straight back and remove from car.

OVERDRIVE

Warner R10 Type (part of AS2-T96 & AS24-T96 Transmission). Optl. Governor controlled type with electrical solenoid operation and throttle operated kick-down switch. *NOTE*—Overdrive in AS24-T96 assembly is new "centered ring gear" type.
See Transmission Section for complete data.
Overdrive Solenoid—Warner Model No. 3AR10B-62, Studebaker No. 521429.
Overdrive Governor—Warner Model No. AR10B-72, Studebaker No. 520454.
Control Relay—Auto-Lite HRT-4001, Studebaker No. 523297.
Throttle Kick-down Switch—Studebaker 515667.
Lock-out Switch—Studebaker No. 521436.
Fuse—20 ampere. On Overdrive Relay.

Removal: See Std. Transmission Removal data

UNIVERSALS

Spicer Model 1268-110X (Front & Rear), 1261-102X intermediate). Needle bearing type. Three used with intermediate universal at propeller shaft support bearing on crossmember (see Propeller Shaft)
See Universals Section for complete data.

Propeller Shaft & Support Bearing: Two shafts used: 1) Front Shaft with intermediate universal yoke bolted on rear end (no slip-joint).
2) Rear Shaft with slip-joint on forward end at intermediate universal.

Propeller Shaft & Support Bearing Removal & Servicing—*See "Propeller Shaft" in Studebaker Shop Notes.*

REAR AXLE

Spicer Salisbury Model 23. Semi-floating, Hypoid Gear type with Hotchkiss Drive.
See Rear Axle Section for complete data.
Ratio—4.1-1 Std. 4.56-1 Optl. (Std. with Overdrive).
NOTE—Rear axle ratio stamped on plate attached to axle by cover capscrew.
Backlash—.003-.006". Shim adjustment.

Removal: Remove hub caps, take out cotter pin from axle nut, loosen rear wheel nuts. Place car on stands on frame just ahead of rear springs. Remove wheels, hubs and drums. Disconnect hand brake cable. Take out backing plate bolts from backing plates, free hydraulic brake line from axle housing clips (do not disconnect brake line). Backing plates and adjusting shims can then be wired to frame (do not disconnect brake line from wheel cylinders). Disconnect rear universal (wire caps or use clamp to prevent losing rollers). Remove rear spring "U" bolts, disconnect lower shock absorber links, remove rear axle assembly from car.
Axle Shaft Removal—Remove wheel, remove wheel hub (use puller J-446-A). Take out backing plate retaining bolts, remove outer oil seal. Pull backing plate out over end of axle shaft and wire plate to frame (CAUTION—do not lose adjusting shims located between backing plate and axle housing flange), pull axle shaft with Puller HM-931.

Wheel Bearing Adjustment: Use dial indicator to check axle shaft endplay. Adjust by removing backing plate (see Axle Shaft Removal above), and adding or removing shims located between backing plate and axle housing flange (shims .003", .005", .010", .030" thick). **Endplay**—.001-.005".

SHOCK ABSORBERS

Houde (Houdaille). Double acting, hydraulic type.
Front—Houde No. A-14269, Studebaker 523646.
Rear—Houde No. A-11478 (Left), A-11477 (Right), Studebaker No. 517696 (Left), 517695 (Right).

Adjustment: Adjusting pointer on end of shaft should be lined up with scribed line on end of shaft. Turn pointer clockwise for firmer action, counter-clockwise for softer action (not more than 1/32-1/16").

Refilling: Check at 5000 mile intervals. Fill to bottom of filler plug hole. CAUTION—Use only Houdaille Shock Absorber Fluid No. L-1404 (new type fluid for shock absorbers with new circular top filler plug

FRONT SUSPENSION

Front Suspension: Planar type independent suspension with transverse spring. NOTE—Suspension system has lower control arms (with leaf spring).
See Front Suspension Section for complete data.
Kingpin Inclination—5½° crosswise.
Caster (1947-48)—0° to Positive 1°. Not adjustable.
Caster (1949)—+½° to +1½°.
Camber (1947-48)—½° ± ½°, (1949) 0° to 1°. Shim adjustment (shims between upper control arm brackets and frame). One thin shim changes setting approx. ¼°. Thick shim equals 4 thin shims.
CAUTION—Add or remove shims equally at front and rear brackets when adjusting Camber.
Toe In—1/16-⅛". Adjust **right hand tie rod only** for toe in after left hand tie rod has been adjusted for wheel straight-ahead position (with steering wheel centered) and center auxiliary tie rod has been adjusted so that steering gear arm and auxiliary steering arm parallel. **RHD Car Note**—Make toe-in adjustments on left hand tie rod.

STEERING GEAR

Ross Model T-12 Cam-and-Twin Lever type.
See Steering Gear Section for complete data.

BRAKES

Service: Lockheed (Wagner Electric) Hydraulic, Self-centering, Self-adjusting type. Brakes are new design with automatic spring-loaded adjusting wedge controlled by contact plug projecting through hole in lining of forward shoe (plug contacts drum when brakes applied). Hand lever applies rear wheel service brakes. NOTE—New type actuating spring used on brake shoe contact plug on 1948-49 cars (replaces hairpin locks and contact plug coil spring).
See Brake Section for complete data.
Drums—Composite type. Diameter 9".
Clearance—Adjustment necessary only when new linings installed. *See Brake article in Brake Section.*
Lining—Moulded type (all shoes). Width 2". Thickness 3/16". Length per wheel 18.5".
Braking Power—57% Front. 43% Rear.

Hand Brake: See Service Brake data (above).

Hill-Holder: Optional Equipment on all models.
See Brake Section for complete data.
Adjustment—*See Studebaker Shop Notes.*

MISC. MECHANICAL

CONVERTIBLE TOP CONTROL: Electric type with motor mounted on left hand lift assembly (right hand lift assembly driven through flexible drive
See Miscellaneous Section for complete data.

Windshield Wiper: Vacuum type—cable operated.
See Miscellaneous Section for complete data.

segment, install distributor (insert .020" feeler between modifier control arm and clamp arm before tightening clamp, to prevent binding), check timing.

IGNITION TIMING

Std. Setting — **Flywheel Degrees**
All Engines ..... 2° BTDC.
This setting correct for regular fuel (see Octane Selector Setting for service and fuel modification)
Timing (with Neon Timing Light)—Neon Light No. 890 recommended. Clip Neon light lead in series with #1 spark plug, idle engine and direct light on vibration dampener (at pointer on timing gear cover). Loosen hold-down plate screw, center scale on pointer, tighten screw. Loosen clamp arm, rotate distributor until 'IGN' mark on vibration dampener lines up with pointer on timing gear cover. Insert .020" feeler between modifier control arm and clamp arm before tightening clamp (to insure clearance for modifier control arm). Check Octane Selector
Timing (without Neon Timing Light)—Turn engine over to firing position for #1 piston with 'IGN' mark on vibration dampener in line with pointer on timing gear cover and distributor rotor opposite #1 segment in distributor cap. Adjust distributor.
Octane Selector Setting—After setting ignition timing (above), loosen selector hold-down screw, advance selector (move toward 'A' end of scale) until motor 'pings' when it is hot and pulling hard. Then retard until ping just disappears.

CARBURETOR

Stromberg Model BXOV-26. 1¼" Single Barrel, Downdraft, with Fast Idle & Automatic Choke.
Code No. (on bowl cover)—6-104.
See Carburetor Section for complete data.

Settings (Idle Setting, Float Level, & Accelerating Pump): ***See Tune-Up data.***
Metering Jet—***Refer to Carburetor Index for Stromberg Downdraft Carburetor Jet Specification Table.***

Fast Idle: Stromberg BXOV-26 carburetor type.
See Carburetion Equipment Section for data.
Fast Idle Setting—To check, hold stopscrew against lowest step of fast idle cam, move choke valve as far as possible toward closed position, check valve opening with 11/32" drill. Adjust by bending connector

Automatic Choke:—Stromberg BXOV-26 type.
See Carburetion Equipment Section for data.
Automatic Choke Setting—'R' mark on thermostat cover in line with highest projection on housing. Shift to 'M' if engine loads up or overchokes. Use 'H' setting only if highly volatile fuels used.

CARB. EQUIPMENT

Air Cleaner: AC No. 1544024 Oil-wetted type Std. Filter Element AC #6. Oil-bath Cleaner Optl.
Servicing (Oil-wetted Type)—Clean and re-oil filter element at 1000 mile intervals or as required.
Servicing (Oil-bath Type)—Clean filter element and oil reservoir, fill reservoir to indicated level mark with SAE No. 40 or 50 engine oil at intervals as required by operating conditions.

Fuel Pump (1947): AC #1537378, 1539415 or 1539067.

Fuel Pump (1948-49): AC #1539217 or 1539502, Combination fuel-and-vacuum pumps.
Pressure—4-5 lbs. maximum.
Exchange Pump (1947): 540, **(1948-49)**—9217.
►***NOTE—Oil pump vacuum booster (for windshield wiper operation) used on 1947 cars only.***
See Carburetion Equipment Section for data.

Gasoline Gauge: Stewart-Warner Electric type.
Dash Unit—Studebaker No. 522177.
Tank Unit—Stude. No. 519423 ('47-48), 525548 ('49).
See Carburetion Equipment Section for data.

BATTERY

Willard Type HW-1-100. 6 volt, 15 Plate, 100 Ampere Hour Capacity (20 hour rate).
Starting Capacity—120 amperes for 20 minutes.
Zero Capacity—300 amperes for 3.5 minutes. Five Second Voltage 4.3 volts.
Grounded Terminal—Positive (+) to cylinder head.
Dimensions—Length 9 3/64". Width 6 13/16". Height 8⅝".
Location—In engine compartment on left side.

STARTER

1947.....Auto-Lite MAW-4020, A. Arm. No. MAW-2091
1947-48-49 Auto-Lite MCH-4001. Arm. No. MCH-2006
Drive—Barrel Type Bendix Drive No. A1729 (MAW Starters), No. A1792 (MCH Starter).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—130 RPM, approx. 175 amperes at 5.0-5.5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4900	5.5	65
2.75 "	1480	5.0	200
5.45 "	820	4.5	300
8.50 "	400	4.0	400
11.55 "	110	3.5	500
18.0 "	Lock	4.0	670

Removal:—Starter flange mounted on engine rear plate, on left side. To remove, take out flange mounting screws, remove starter assembly.

Starting Switch: Magnetic switch mounted on starter and controlled by Auto-Lite Model SW-4016 manual switch. Manual switch is mounted on toeboard and operated by clutch pedal when fully depressed.

GENERATOR

Auto-Lite Model GDZ-4805A. Armature No. GDZ-2006F. Two brush type with current-voltage control.
Charging Rate Adjustment—None. See Regulator.
Maximum Charging Rate—35 amperes, 8.0 volts, 2250 Gen. RPM (hot), at car speed 25.8 MPH and up with load or discharged battery (regulator setting).

Cold Performance Data			Hot Performance Data		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
4	6.6	1035	4	6.6	1120
8	6.75	1140	8	6.75	1235
12	6.95	1250	12	6.95	1350
16	7.15	1370	16	7.15	1460
20	7.3	1480	20	7.3	1590
24	7.5	1590	24	7.5	1730
28	7.7	1710	28	7.7	1900
32	7.9	1820	32	7.9	2090
35	8.0	1900	35	8.0	2250

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—35-53 ozs. (new brushes).
Field Current—1.60-1.78 amperes at 6.0 volts.
Motoring Current—4.16-4.60 amperes at 6.0 volts.

Removal:—Pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, move generator out until ⅜-½" belt deflection midway between generator and fan pulleys is obtained.

REGULATOR

Auto-Lite Model VRP-4004F. Voltage & Current Type. Consists of Cutout Relay and vibrating type Voltage & Current Regulators in case on dash.
See Electrical Equipment Section for complete data.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay
Cuts In—6.4-7.0 volts (set to 6.4-6.6 volts), 10.4 MPH.
Cuts Out—4.1-4.8 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator
Setting—7.2-7.5 volts at 70°F. See Electrical Equipment Section for settings at other temperatures.
Checking (without breaking seal) & Adjustment—***See Electrical Equipment Section.***
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator
Setting—34-36 amperes (marked '35' on the cover).
Checking (without breaking seal) & Adjustment—***See Electrical Equipment Section.***
Contact Gap & Air Gap—Same as Voltage Regulator.

LIGHTING

Headlamps: Corcoran-Brown "Sealed Beam" type.
See Electrical Equipment Section for complete data.
Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height at 25 ft.).
Beam Indicator—At center of speedometer dial. Lighted whenever Country (upper) beams in use.

Direction Signal: ***See Electrical Equipment Section.***
Direction Signal Indicators—In face of Speedometer dial. Left or right indicator lighted when corresponding direction signal is in operation.

Switches
Lighting—Douglas, Studebaker No. 519798.
Beam Selector—Delco-Remy No. 1997008, Studebaker No. 519246.
Stop Light—Studebaker No. 666858.
Direction Signal—Studebaker No. 520304.

MISC. ELECTRICAL

LIGHTING CIRCUIT BREAKER (On Light Switch): Studebaker No. 522014. 30-ampere thermostatic type. Protects Headlamps, Parking, Tail, & Instrument Lamps by vibrating to limit current.

Auxiliary Circuit Breaker (On Panel): No. 523056. 15-ampere type. Protects Body & Stop Lamps.

ACCESSORY CIRCUIT BREAKER: One 15-ampere type used on cars with Climatizer and Defroster.

FUSES: Clock—3 ampere. In clock lead.
Direction Signal—14 ampere. In Fasher lead.
Overdrive—20 ampere. On Overdrive Relay.
Glove Compt. Light—5 ampere. In lamp lead.
Under Hood Light—5 ampere. In lamp lead.
Fog Lights—20 ampere. On Fog Light Switch.

HORNS: Sparton or Delco-Remy No. 1999610 (High Note), 1999611 (Low Note). Twin Airtone type horns operated by relay. **Horn Current**—12-15 amps (ea.).

Horn Relay: Delco-Remy No. 1116775.
Contacts Close—2.75-4.0 volts.
Contact Gap—.025". **Air Gap**—.015" (contacts closed).

CONTINUED ON NEXT PAGE

Thermostat: Fulton or Bishop & Babcock. In water outlet on cylinder head.
Setting—Starts to open at 151-155°F.
Temperature Gauge: Stewart-Warner Bourden Tube type (not electric). Studebaker No. 522180.

CLUTCH

Borg & Beck Model No. 9A7 with Borglite Driven Member. Single plate, dry disc type.
NOTE—Clutch Assembly marked by number 943
See Clutch Section for complete data.

Facings—Moulded-metallic, 2 required. I.D. 6". O.D. 9¼". Thickness ⅛".

Adjustment: Pedal free travel ½ to 1". To adjust, unhook pull-back spring on outside of frame rail, loosen locknut at adjusting clevis and remove clevis pin at inner end of pedal shaft, turn clevis on rear end of pedal shaft-to-operating shaft rod for correct clearance, reassemble linkage.
Hill-Holder Note—Check setting whenever clutch pedal adjusted and adjust Hill-holder to release just as clutch engages. Adjusting nut and locknut at end of Hill-holder operating rod.

Hill-Holder Adjustment: *See Studebaker Shop Notes.*

Removal: Jack up rear end of car and rest on stands under rear axle. Remove transmission (see TRANSMISSION following). Disconnect one battery cable at battery take off starter and hang it clear of clutch housing. Remove clutch housing mounting capscrews and bolts at top, working through opening in front floor. Free speedometer cable from frame cross-member and wire it up out of the way. Support rear end of engine with jack placed under oil pan at rear (CAUTION—Do not damage oil pan). Disconnect rear engine mounting by taking off nuts, bolts with insulators, washers, and spacers. Disconnect parking brake cable at bracket, clutch operating shaft from release shaft, and brake pedal return spring. Loosen exhaust pipe flange nuts at manifold, take off exhaust pipe support bracket at housing, loosen clamp and turn bracket for clearance. Remove rear engine support cross member. Take out clutch housing mounting bolts and remove housing. Block clutch release levers. Remove six mounting screws in clutch cover flange, lift off clutch assembly and driven member.

TRANSMISSION

Warner Model AS1-T86E (Std.), AS2-T86E (Optl. 1948-49), AS32-T86E (Optl. Late 1949). Constant-mesh, synchro-mesh (Second & High), sliding gear (Low and Reverse), all helical gear type. *NOTE—Optl. AS2 & AS32 Transmissions have R10 type Overdrive.*
See Transmission Section for complete data.

Transmission Control: Remote control type with gearshift lever mounted on steering column.
See Transmission Section for complete data.

Removal: Drain transmission. Disconnect hand brake cable and move out of way for clearance. Disconnect front universal at transmission (wire caps or use clamp to prevent losing rollers). Take out center support bearing mounting bolts. Push front shaft and support to rear (will slide on splines on rear shaft). Disconnect shift rods from levers on case and speedometer cable (remove speedometer pinion). On Overdrive transmission disconnect all control wires and cable. Take out transmission to clutch housing capscrews, pull transmission straight back and remove from car.

OVERDRIVE

Warner R10 Type (part of AS2-T86E & AS32-T86E Transmission). Optl. Governor controlled type with electrical solenoid operation and throttle operated kick-down switch. *NOTE*—Overdrive in AS32-T86E assembly is new "centered ring gear" type.
See Transmission Section for complete data.

Overdrive Control Units—*Same as Champion. See Champion (1947-48-49) page for data.*

Removal: See Std. Transmission Removal data

UNIVERSALS

Spicer Model 1268-111X (Front & Rear), 1261-102X intermediate). Needle bearing type. Three used with intermediate universal at propeller shaft support bearing on crossmember (see Propeller Shaft)
See Universals Section for complete data.

Propeller Shaft & Support Bearing: Two shafts used:
1) Front Shaft with intermediate universal yoke
2) Rear Shaft with slip-joint on forward end at intermediate universal.

Propeller Shaft & Support Bearing Removal & Servicing—*See Studebaker Shop Notes.*

REAR AXLE

Spicer Salisbury Model 41-2. Semi-floating, Hypoid Gear type with Hotchkiss Drive.
See Rear Axle Section for complete data.

Ratio—4.09-1 Std., 4.55-1 Optl. (Std. with Overdr.). NOTE—Rear axle ratio stamped on plate attached to axle by cover capscrew.
Backlash—.003-.006". Shim adjustment.

Removal: Remove hub caps, take out cotter pin from axle nut, loosen rear wheel nuts. Place car on stands on frame just ahead of rear springs. Remove wheels, hubs and drums. Disconnect hand brake cable. Take out backing plate bolts from backing plates, free hydraulic brake line from axle housing clips (do not disconnect brake line). Backing plates and adjusting shims can then be wired to frame (do not disconnect brake line from wheel cylinders). Disconnect rear universal (wire caps or use clamp to prevent losing rollers). Remove rear spring "U" bolts, disconnect lower shock absorber links, remove rear axle assembly from car.
Axle Shaft Removal—Remove wheel, remove wheel hub (use puller J-596-A). Take out backing plate retaining bolts, remove outer oil seal. Pull backing plate out over end of axle shaft and wire plate to frame (CAUTION—do not lose adjusting shims located between backing plate and axle housing flange). Pull axle shaft assembly (Puller HM-931).

Wheel Bearing Adjustment: Use dial indicator to check axle shaft endplay. Adjust by removing backing plate (see Axle Shaft Removal above), and adding or removing shims located between backing plate and axle housing flange (shims .003", .005", .010", .030" thick). **Endplay**—.001-.005".

SHOCK ABSORBERS

Houde (Houdaille)—Double acting, hydraulic type. Adjustable type with thermostatic control on rear.
Front (All)—Houde No. A-14269, Studebaker 523646.
Rear (exc. Convt.)—Houde No. A-14174, Studebaker 523497.
Rear (Convertible only)—Studebaker No. 523538 (Right), 523539 (Left).

Adjustment (Front): Pointer on end of shaft should be lined up with scribed line on end of shaft. Turn pointer clockwise for firmer action, counter-clockwise for softer action (not more than 1/32-1/16").
(Rear Shocks)—Remove cap on end of shaft to expose adjusting screw. Slot aligned with scribe mark between "0" and "S" mark is original factory setting. Use special tool No. T-2860 (do not use screwdriver). Turn screw clockwise (toward "S") for firmer action, counter-clockwise (toward "0") for softer action (not more than 1/32" at a time).

Refilling: Check at 5000 mile intervals. Fill to bottom of filler plug hole. CAUTION—Use only Houdaille Shock Absorber Fluid No. L-1404 (new type fluid for shock absorbers with new circular top filler plug

FRONT SUSPENSION

Front Suspension: Planar type independent suspension with transverse spring. NOTE—Suspension system has lower control arms (with leaf spring).
See Front Suspension Section for complete data.
Kingpin Inclination—5½° crosswise.
Caster—(Early 1947) 0° to Pos. ½°. Not adjustable.
(Late '47 & '48-49) Neg. 2° to Neg. 3°. No adjustm't.
▶1947 Serial Numbers when Caster Changed—*See Front Suspension Section for complete data.*
Camber—(1947-48) ½° ± ¼°. (1949) 0° to +1°. Shim adjustment (shims between upper control arm brackets and frame). One thin shim changes setting approx. ¼°. Thick shim equals 4 thin shims.
CAUTION—Add or remove shims equally at front and rear brackets when adjusting Camber.
Toe In—1/16-⅛". Adjust right hand tie rod only for toe in after left hand tie rod has been adjusted for wheel straight-ahead position (with steering wheel centered) and center auxiliary tie rod has been adjusted so that steering gear arm and auxiliary steering arm parallel. **RHD Car Note**—Make toe-in adjustments on left hand tie rod.

STEERING GEAR

Ross Model T-14 Cam-and-Twin Lever type.
See Steering Gear Section for complete data.

BRAKES

Service: Lockheed (Wagner Electric) Hydraulic, Self-centering, Self-adjusting type. Brakes are new design with automatic spring-loaded adjusting wedge controlled by contact plug projecting through hole in lining of forward shoe (plug contacts drum when brakes applied). Hand lever applies rear wheel service brakes. NOTE—New type actuating spring used on brake shoe contact plug on 1948-49 cars (replaces hairpin locks and contact plug coil spring).
See Brake Section for complete data.
Drums—Composite type. Diameter 11".
Clearance—Adjustment necessary only when new linings installed. *See Brake article in Brake Section.*
Lining—Moulded type (all shoes). Width 2". Thickness 3/16". Length per wheel 22¼".
Braking Power—57% Front, 43% Rear.

Hand Brake: See Service Brake data (above).

Hill-Holder: Std. *See Brake Section for complete data.*
Adjustment—*See Studebaker Shop Notes.*

MISC. MECHANICAL

CONVERTIBLE TOP CONTROL: Electric type with motor mounted on left hand lift assembly (right hand lift assembly driven through flexible drive
See Miscellaneous Section for complete data.

Windshield Wiper: Vacuum type—cable operated.
See Miscellaneous Section for complete data.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	4"
1°	2°	4⅞"
4°	8°	7½"
8°	16°	11⅛"
9°	18°	12"

Octane Selector—Provides manual adjustment at distributor (hold-down plate marked with scale) for variation in timing depending on fuel regularly used. See Ignition Timing following for adjustment.

Distributor Removal:—Mounted on left side of engine. To remove, disconnect vacuum line, take out bolt in clamp arm, lift distributor off.

Installation Note—When installing distributor, crank engine to firing position for #1 cylinder (dampener mark 'IGN' in line with pointer on the timing gear cover), sight down distributor shaft hole (distributor out) and see that distributor drive tongue in oil pump drive gear is parallel to and narrow half of offset toward camshaft, turn rotor to #1 segment, install distributor.

►*CAUTION*—On IGC-4805 Distr., insert .020" feeler between modifier arm and clamp arm when tightening clamp arm to prevent binding.

IGNITION TIMING

Std. Setting	Flywheel Degrees	Piston Pos.
All Engines	2° BTDC	.0016" BTDC.

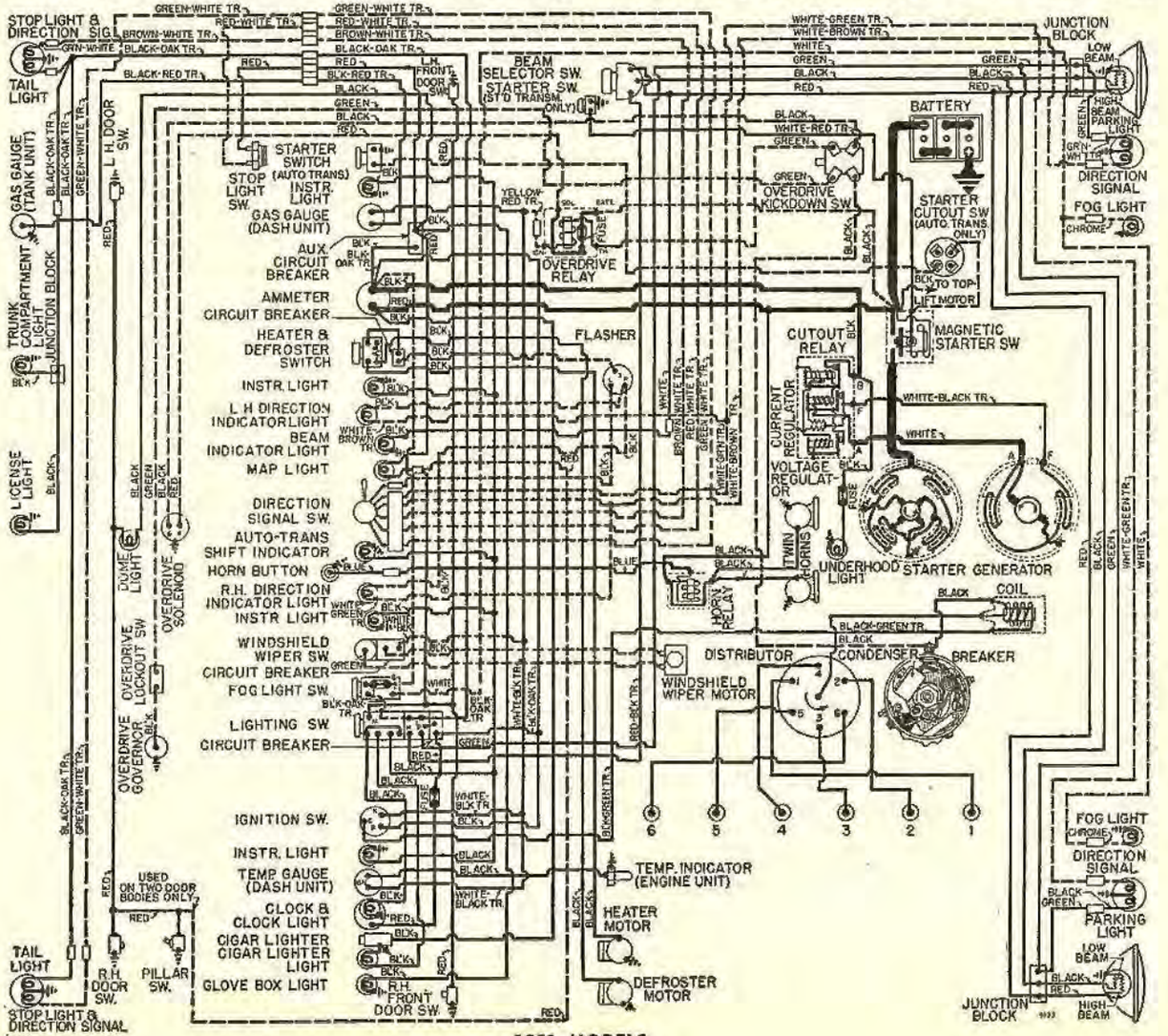
This setting correct for regular fuel (See Octane Selector Setting for service and fuel modification).

Timing (With Neon Timing Light)—Clip timing light lead in series with #1 spark plug, direct light on vibration dampener at front of engine. Loosen hold-down plate screw, center octane selector pointer on scale, tighten hold-down screw. Run engine at idle speed, loosen clamp arm, rotate distributor until "IGN/" mark on dampener appears in line with pointer on left side of timing gear cover, tighten clamp screw. Check Octane Selector setting.

►*CAUTION*—On IGC-4805 Distr., insert .020" feeler between modifier arm and clamp arm when tightening clamp arm.

Timing (Without Neon Timing Light)—With #1 piston on compression, turn engine over until "IGN/" mark on vibration dampener lines up with pointer on left side of timing gear case. Adjust distributor as directed above.

Octane Selector Setting—After setting timing (above), loosen selector hold-down screw, advance timing by turning distributor clockwise (move pointer toward "A" end of scale) until engine "pings" when hot and pulling hard, then retard timing by turning distributor counter-clockwise (move pointer toward "R") until ping disappears.



1951 MODELS

CARBURETOR

Carter WE-715S—1¼" single barrel, downdraft, with Carter Climatic Control.

Casting No. on Flange—620.

See Carburetor Section for complete data.

Settings (Idle Setting, Float Level, & Accelerating Pump): ***See Tune-Up.***

Metering Rods & Jets—***See Carter Jet Table in Carburetor Section.***

Fast Idle: Carter Single Barrel Carburetor type.

Setting—.046" between throttle valve and bore of carburetor. To check, remove thermostatic coil housing, gasket and baffle plate. Crack throttle valve and hold choke valve closed. Close throttle. Adjust by bending connector rod at lower angle.

See Carburetion Equipment Section for data.

Automatic Choke: Carter Climatic Control (Single Carburetor type).

Setting—(Early Production Cover 170P-77S) Centered on index. (Late Production Cover 170U-61S) 1 point lean.

See Carburetion Equipment Section for data.

CARB. EQUIPMENT

Air Cleaner: AC No. 1543970 Oil-wetted type Std. Filter Element AC #1. Oil-bath Air Cleaner Optl.

Servicing (Oil-wetted type)—Clean and re-oil filter element at 1000 mile intervals.

Fuel Pump (Std.): AC #1539416, diaphram type.

Optl. (Fuel & Vacuum): AC #1539218.

Pressure—4-5 lbs. maximum.

See Carburetion Equipment Section for data.

Gasoline Gauge: Stewart-Warner Electric type.

Dash Unit—Studebaker No. 522177.

Tank Unit—Studebaker No. 525548.

See Carburetion Equipment Section for data.

BATTERY

Willard (1950) HW-1-100. (1951) HDW-1-100, 6 volt, 15 plate, 100 ampere hour capacity (20 hour rate).

Starting Capacity—120 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.5 minutes. Five

CONTINUED ON NEXT PAGE

ENGINE

CONTINUED FROM PRECEDING PAGE

rods and bearing caps must be together and installed in same numbered cylinder with number and oil hole in lower end of rod toward camshaft side.

CRANKSHAFT: Four bearing type with integral counterweights. Vibration dampener on front end.
Vibration Dampener—*See Studebaker Shop Notes.*
Journal Diameters—2.4370-2.4375" (All) Std.
►*CAUTION—Journals are .005" Undersize on engines with letter "A" following Engine Number.*
Bearing Type—Removable type, steel-backed, micro-babbitt lined. No shims.
Clearance—.0005-.0025".
Rear Bearing Oil Seals—Consist of rubber ring on crankshaft; two rubber seal strips in grooves on top of bearing cap; and two specially treated wood strips in grooves on sides of bearing cap.
See "Brummer Type Oil Seal" in Studebaker Special Data.
►*CAUTION—Install new wood oil seals (above) each time rear main bearing cap removed and re-installed.*

Bearing Adjustment: None (no shims). Replace bearings. Do not file bearing caps.
NOTE—Front oil pan seal block may be removed for access to front main bearing cap by removing four lower timing gear cover retaining screws. Use only malleable iron type filler block on these cars.
►*CAUTION—Do not securely tighten timing gear cover-to-filler block screws until after oil pan screws tightened uniformly and securely.*

Replacement Bearings: Furnished as sets or single bearings Std. & .001", .005", .010", .020", .030" U. S.

End Thrust: Taken by thrust washer assembled between front main bearing and crankshaft gear. Controlled by shims between thrust washer and main bearing journal. Adjust by changing shims (.003", .005", .007" thick). **Endplay**—.003-.006".

CAMSHAFT: Four bearing type. Helical gear drive.
Journal Diameters—#1, 1.7475-1.7480"; #2, 1-7162-1.7170"; #3, 1.6857-1.6865"; #4, 1.6232-1.6240".
Bearings—Split, steel-backed, babbitted bushings.
Clearance—.0007-.0022" (#1), .0010-.0027" (others).

Bearing Adjustment: None. Replace bushings with camshaft removed. NOTE—Align bushing oil hole with oil hole in block.

Camshaft Removal: *See "Camshaft & Bearings" in Studebaker Shop Notes.*

End Thrust: Taken by thrnst plate assembled on front face of engine block behind camshaft gear (spacer assembled on shaft behind gear hub).
Endplay—.003-.006". Tighten cap screws alternately a few turns at a time to prevent distortion of plate.

Timing Gears: Crankshaft gear Cast Iron, Camshaft gear Celeron with steel hub.
Backlash—.001-.003".
Replacement Gears—Camshaft gear furnished in two sizes; Standard (marked "S"), High Limit (marked "H"), Crankshaft gear furnished Standard size only.
Timing Gear Removal & Installation—*See "Timing Gears" in Studebaker Shop Notes.*

Camshaft Setting: Mesh marked tooth of camshaft gear between two marked teeth of crankshaft gear.

VALVES:	Head Diameter	Stem Diameter	Length
Intake	1 11/32"	5/16"	4 11/32"
Exhaust	1 9/32"	5/16"	4 11/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.0015-.0035"

Valve Guides: Pressed in block from above with top of guide 1 3/16" below top of block. Finish ream guides to inside diameter of .312-.3125" Use Valve Stem Guide Remover and Replacer Tool J-2034. Replace worn guides if clearance greater than .0035".

Valve Springs: Install with closed coil end up. Replace springs if over 10% weaker than pressure listed.

	Spring Pressure	Length
Valve Open	93-103 lbs.	1 5/16"

NOTE—Install valve spring retainer with flange engaging flat surface on lower coil and tongue on inner diameter engaging groove in spring lock.

Valve Lifters: Mushroom type. Remove from below with camshaft out of engine. *For Camshaft Removal directions, refer to Studebaker Shop Notes.*
Clearance—.0005-.00175".
Replacement Lifters—Furnished Std. size and .0005", .001" Oversize.

VALVE TIMING

Tappet Clearance: .016" All Valves, Engine cold.
NOTE—Self-locking tappet adjusting screws used. Tappet screw tension should be 25 in. lbs. minimum.

Valve Timing: See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
Valve Timing Check—Set #1 intake valve to .020". Turning engine with #6 cylinder on compression stroke the intake valve should start to open when the mark "IN-OP 1-6" on front dampener lines up with pointer.

LUBRICATION

Lubrication System: Pressure to crankshaft, connecting rod, and camshaft bearings and to valve lifters. Timing gears lubricated by oil by-passed by pump.
Crankcase Capacity—5 qts. ("Add Oil" point on oil level indicator stick is 3 qt. level).
Normal Oil Pressure—20-40 lbs. at 40 MPH.
Oil Pressure Relief Valve—On lower right front corner of engine. Opens at 40 lbs. Adjustable by inserting shims between outer end of spring and plug.

Oil Pump: Helical gear type. Mounted externally on right hand side of crankcase.
Oil Pump Removal & Installation—*See "Oil Pump" in Studebaker Shop Notes.*

Oil Pressure Gauge: Stewart-Warner Bourden tube (not electric) type.

Crankcase Ventilation: Filter element in oil filler cap (air intake) and in breather pipe on left rear of engine (air outlet).
Servicing—Wash both filter elements in kerosene and re-oil at regular intervals. NOTE—filter in outlet pipe removed by taking out cotter pin.

COOLING

Cooling System: Positive circulation with water pump mounted on front of block with fan.
Capacity—10 quarts.

Water Pump: Packless, sealed ball bearing type.
See Water Pump Section for complete data.
Removal—Slack off drive belt, take out capscrews in the fan pulley hub & remove fan blades. Disconnect hose connection, take out mounting screws in pump body flange, withdraw pump from engine.

Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat: Bishop & Babcock. In water outlet on cylinder head.
Setting—Starts to open at 151-155°F.

Temperature Gauge: Stewart-Warner electric type.
Dash Unit—Studebaker No. 530051.
Engine Unit—Studebaker No. 530127 (without adapter).

CLUTCH

Borg & Beck Model 8A7 with Borglite Driven Member. Single plate, dry disc type. NOTE—Clutch assembly marked by number 980 stamped on cover.
See Clutch Section for complete data.
►*CLUTCH CHATTER & RATTLE CORRECTION—See "Clutch Notes" in Studebaker Special Data.*
Facings—Moulded Metallic type, 2 required. I. D. 5⅜". O. D. 8". Thickness .125".
►*CAUTION—Special driven member used on cars with Overdrive. Identify each type by hub damper spring color as follows:*

	Damper Spring Color.
Cars with Conventional Trans.	2 Lavender, 2 Black
Cars with Overdrive Trans.	4 Lavender

Pedal Adjustment: Pedal free travel ½" to 1". To adjust, unhook pull-back spring on outside of frame rail, loosen locknut at adjusting clevis and remove clevis pin at inner end of pedal shaft, turn clevis on rear end of pedal shaft-to-operating shaft rod for correct clearance, reassemble linkage.
Hill-Holder Note—Check setting whenever clutch pedal adjusted and adjust Hill-holder to release just as clutch engages.

Clutch Housing Removal: Remove distributor and oil level gauge adapter, remove starter and tie up ont of the way (not necessary to disconnect cables), remove front floor plate, take out upper clutch housing cap screws. Remove transmission (SEE TRANSMISSION). Disconnect clutch pedal rod at operating shaft-to-release shaft sleeve, pull operating shaft out and remove sleeve. Remove parking brake cable shield clip, unhook brake pedal pullback spring from cross-member, support engine weight on jack under rear end of oil pan (use block of wood on jack to prevent damage to pan), take out engine rear support bolts, remove lower support insulators. Remove cross-member (with clutch operating shaft support bracket). Loosen exhaust pipe flange nuts at manifold, remove exhaust pipe support bracket-to-clutch housing bolts, loosen clamp and swing bracket out of the way. Take out all clutch housing bolts, remove dowel bolts at right and left center, remove clutch housing.
►**Installation Caution**—Align clutch housing to rear engine plate with two tapered drifts, then install the dowel bolts. Draw the dowel bolts in place by tightening the nuts—**do not drive them in place.**

Clutch Removal: Remove clutch housing (above), remove six screws evenly to relieve spring pressure, lift off clutch assembly and driven member.

TRANSMISSION

Warner Model AS1-T96 (Std.), AS24-T96 with R10 type Overdrive (Optl.). All helical gear type. Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse).
See Transmission Section for complete data.

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MODEL IDENTIFICATION

SERIAL NUMBER: Stamped on plate on left front door lock pillar post.

	South Bend	Los Angeles
1950 Numbers	4398601 Up	4839001 Up

Body Symbol Letter—Used with model designation (and on body number plate) to indicate body type as follows: C, 5-Pass. Coupe; F, 2-Door Sedan; Q, 3-Pass. Coupe; S, Convertible; W, 4-Door Sedan; Y, Land Cruiser.

ENGINE NUMBER: Stamped on pad on upper front left corner of engine block.
1950 Numbers—H-370001 Up.

TUNE-UP

COMPRESSION PRESSURE: 120 lbs. at 150 RPM. cranking speed for Std. 7.0-1 Head.

VACUUM READING: Steady 18-20" idling at 8 MPH.

FIRING ORDER: 1-5-3-6-2-4. See diagram.

SPARK PLUG GAPS: .025" Limits .0225-.0275".
Plug Type—Champion Type J7. 14 mm.

DISTRIBUTOR: Breaker Gap—.022".
Cam Angle—Test limits with .022" gap—31-37°.
See "Delco-Remy Cam Angle" in Electrical Equipment Section.
Breaker Arm Spring Tension—17-21 ozs.
Automatic & Vacuum Advance—*See Ignition.*
Condenser Capacity—.18-.23 microfarad.

IGNITION TIMING: 2° BTDC.
Timing Procedure—*See Ignition Timing.*
Timing Mark—Vibration Dampener mark "IGN/" aligned with pointer on gear case cover.

CARBURETION:
Idle Setting (Stromberg)—Idle screw set for smooth idle. Turn screw out for richer mixture. **(Carter)**—½-1½ turns open. Turn screw out for richer mixture.
Idle Speed (Standard Trans.)—8-10 MPH. at normal operating temperature.
Idle Speed (Auto. Trans.)—500-550 RPM. with selector lever in "N". Adjust by turning idle adjusting screw switch in or out (switch replaces regular stopscrew).
Float Level (Stromberg)—Fuel level ⅝" below top edge of float bowl with engine idling.
(Carter)—7/16" from top of projection on bowl cover to top of soldered seam on free end of float with needle valve seated and cover assembly inverted.
Accelerating Pump (Stromberg)—Center hole (med. stroke) Normal all-season setting. Inner hole (min.) —Summer. Outer hole (max.)—Winter used for temperature extremes.
(Carter)—No seasonal adjustment.

Choke Setting: Centered (at index).

Fuel Pump Pressure: 4-5 lbs. maximum.

MANIFOLD HEAT CONTROL: Automatic thermostatic type operating in stainless steel bushings.
Setting—To test coil tension, free outer end of coil from bracket on manifold. With valve closed, hooked end of coil should be approx. 90° from bracket at 70°F. Replace coil if incorrect.
NOTE—To overcome sticking, lubricate valve shaft with kerosene and soda solution or Bendix Carburetor Cleaner. If necessary, shaft diameter can be reduced for .005" clearance in bushings.

VALVE TAPPET CLEARANCE: .016" All Valves, Cold.
NOTE—Self-locking tappet screws used.
Valve Timing Check—*See Valve Timing.*

STARTING: *See Battery, Starter, Generator, Regulator.*

IGNITION

IGNITION SWITCH: Mitchellock. Studebaker No. 526396.
Ignition Lock—Yale & Towne.

COIL: Delco-Remy #1115380. On engine above distributor (under spark plug cable bracket).

CONDENSER: Delco-Remy Part No. 1869704.
Capacity—.18-.23 microfarad.

DISTRIBUTOR: Delco-Remy #1110220. Automatic and vacuum advance type with new "center-bearing" breaker plate.

►**Breaker Plate Bearing Assembly**—Plate rotates on 3 bakelite buttons on support plate with spring tension adjustment (shim washers) on underside of support plate. Pull required to move plate should be 8 ozs. min., 16 ozs. max. with breaker plate assembly out of housing.

See "Delco-Remy Center-Bearing Breaker Plate Distributor" in Electrical Equipment Section.
Breaker Gap—.022".
Cam Angle—Test limits with .022" gap—31-37°.
See "Delco-Remy Cam Angle" in Electrical Equipment Section.
Breaker Arm Spring Tension—17-21 ozs.
Rotation—Counter-clockwise viewed from above.

Automatic Advance

Degrees	Distr. R.P.M.	Degrees	Eng. R.P.M.
Start	400	2	800
11	1400	22	2800

Vacuum Spark Control: Delco-Remy No. 1116052 linked directly to breaker plate. Provides additional advance at speeds above idling except when engine

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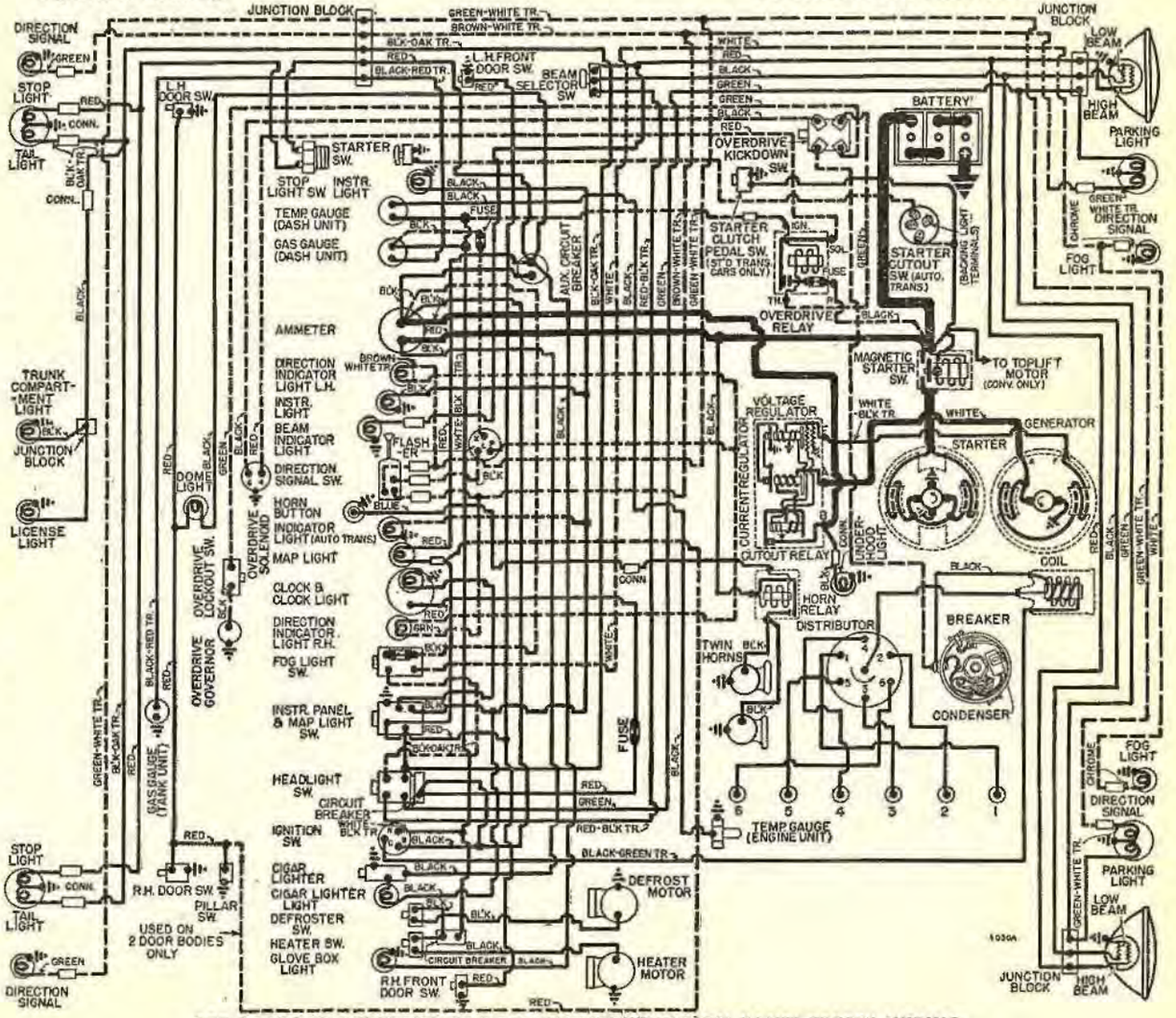

SEE BRAKE SECTION FOR AUTOMATIC TRANSMISSION "ANTI-CREEP" WIRING

Parking, Tail, & Instrument Lamps by vibrating to limit current.
Auxiliary Circuit Breaker (On Instrument Panel): 20-ampere thermostatic type. Protects Body & Stop Lamps by vibrating to limit current.
Convertible Top Circuit Breaker—30 ampere.
ACCESSORY CIRCUIT BREAKER: One 15-ampere type used on cars with Climatizer and Defroster.
FUSES: Clock—3 ampere. In clock lead.
Direction Signal—14 ampere. In Flasher lead.
Overdrive—20 ampere. On Overdrive Relay.
Glove Compt. Light—5 ampere. In lamp lead.
Under Hood Light—5 ampere. In lamp lead.
Fog Lights—20 ampere. On Fog Light Switch.
HORNS: Sparton or Delco-Remy #1999656 (High Note), #1999655 (Low Note). Twin Airtone type horns operated by relay. **Horn Current**—12-15 amps
Horn Relay: Delco-Remy #1116775.
Contacts Close—2.75-4.0 volts.
Contact Gap—.025". **Air Gap** .015" (contacts closed).

ENGINE

OIL PAN REMOVAL: *See Studebaker Special Data.*
►*Not necessary to remove engine for pan removal.*
►**REPLACEMENT ENGINE CAUTION (for Automatic Transmission Cars):** *See Studebaker Automatic Transmission in Transmission Section.*
ENGINE SPECIFICATIONS: Six cylinder, "L" Head.
Bore—3 5/16". **Stroke**—4 3/4".
Displacement—245.6 cu. ins. **Rated H.P.**—26.33.
Developed Horsepower—102 at 3200 RPM.
Compression Ratio—7.0-1 Std.
Compression & Vacuum Reading—*See Tune-Up data.*
CYLINDER HEAD & TIGHTENING TORQUES: *See Studebaker Special Data.*
PISTONS: Lynite aluminum alloy, Cam-ground, T-slot, bearing-metal plated type. **Length** 3¾".
Original Bore & Pistons: *See Studebaker Special Data.*
Weight—14.4 ozs. (stripped).
Clearance—Selective Fit (see Fitting Pistons).
Removal—Pistons and rods removed from above.
NOTE—Car manufacturer recommends that cylinders out-of-round or tapered more than .002" be reconditioned.
Fitting New Pistons: Insert .002" feeler, 1" wide, between piston and cylinder wall on camshaft side (piston pin parallel to camshaft, slot away from camshaft). Pull required to withdraw feeler should be 14-19 lbs.
Replacement Pistons: *See Studebaker Special Data.*
Installing Pistons: T-slot away from camshaft.
PISTON RINGS: Two compression, one oil control ring per piston, all above pin. Oil drain holes provided in oil ring groove.

Ring	Width	End Gap	Side Clearance
Comp. (#1,2)	3/32"	.009-.014"	.0015-.002"
Oil Contr. (#3)	3/16"	.009-.014"	.0015-.002"

Installing Rings: Beveled side of compression rings (Sealed Power) up.
Replacement Rings: Sets furnished Std. size and .020", .030", .040" Oversize. Single rings Std. size and .010", .020", .030", .040" Oversize.
PISTON PIN: Diameter .8741-.8745". **Length** 2⅞". Pin is locked in rod by tapered pin and locknut.
Pin Fit in Piston—.0001-.0003" clearance or light finger push fit at room temperature (70°F.).
Pin Removal & Installation: *See Studebaker Special Data.*
Replacement Pins: Std. & .0025", .005" Oversize. Use Hone PH-1 to obtain proper piston pin fit.
NOTE—Replacement pistons fitted with pins.
CONNECTING ROD: Length 7 15/16". **Weight** 33.3 ozs.
Crankpin Journal Diameter—2.18675-2.18775".
Lower Bearing—Interchangeable steel-backed, micro-babbitt lined type. No shims.
Clearance—.0005-.002". **Sideplay**—.005-.009".
Bearing Adjustment: None (no shims). Replace bearings. Do not file rods or caps.
NOTE—Make certain that small tongue on bearing shells engage grooves. Palnuts used on bolt nuts.
Replacement Bearings: Bearings furnished Std. size and .001", .005", .010", .020" Undersize.
Installing Rods: Lower bearings "offset". Install rods with narrow portion of bearing toward front of engine (#1, 3, 5), toward rear (#2, 4, 6). Numbers on rods and bearing caps must be together and installed in same numbered cylinder with number and oil hole in lower end of rod toward camshaft.
CRANKSHAFT: 4 bearing, 5 integral counterweights. Vibration dampener mounted on forward end.
Vibration Dampener—*See Studebaker Special Data.*
Journal Diameters—2.8745-2.8750".
Bearings—Removable steel backed, babbitt-lined type. No shims.
Clearance—.0006-.0027".
Rear Bearing Oil Seals—Consist of rubber ring, on crankshaft; two rubber seal strips in grooves on top of bearing cap; and two specially treated wood strips in grooves on sides of bearing cap.
►*CAUTION—Install new wood oil seals (above) each time rear main bearing cap removed and re-installed.*
Bearing Adjustment: None (no shims). Replace bearings. Do not file bearing caps.
Replacement Bearings: Furnished as sets or single bearings in Std. Size and .001", .010", .020", .030" U.S.
End Thrust: Taken by thrust plate assembled between front main bearing and crankshaft gear. Controlled by shims between thrust plate and main bearing journal. Adjust by changing shims furnished .003", .005", .007" thick.
Endplay—.003-.006".
CAMSHAFT: Four bearing. Helical gear drive.
Journal Diameters—#1, 1.9975-1.9980"; #2, 1.9662-1.9670"; #3, 1.9357-1.9365"; #4, 1.1232-1.1240".
Bearings—Split steel-backed, babbitted bushings.
NOTE—Oil hole in bushings must be aligned with oil holes in engine block.
Clearance—.0007-.0022" (#1), .0010-.0027" (others).
Camshaft Removal: *See "Camshaft & Bearings" in Studebaker Special Data.*
End Thrust: Taken by thrust plate assembled on front face of engine behind camshaft gear (spacer assembled back of gear hub).
Endplay—.003-.006". Tighten capscrews alternately a few turns at a time to prevent distortion of plate.
Timing Gears: Crankshaft gear Cast Iron. Camshaft gear Celeron with steel hub. **Backlash**—.001-.003".
Replacement Gears—Camshaft gear furnished in two sizes; Standard (marked "S"), High Limit (marked "H"). Crankshaft gear Std. size only.
Timing Gear Removal & Installation—*See "Timing Gears" in Studebaker Special Data.*
Camshaft Setting: Mesh marked tooth of camshaft gear between two marked teeth on crankshaft gear.

VALVES:	Head Diameter	Stem Diameter	Length
Intake	1 15/32"	11/32"	5 7/32"
Exhaust	1 9/32"	11/32"	5 7/32"

	Seat Angle	Lift	Stem Clearance
All Valves	45°	11/32"	.0015-.0035"

Valve Guides: Pressed in block from above with upper end 1 5/32" below upper edge of valve seat and stepped end down. Ream guides to inside diameter of .3425-.3445". Replace worn guides when clearance exceeds .0035".
Valve Springs: Install with closed-coil end up. Replace springs if more than 10% weaker than test pressure listed.

	Spring Pressure	Length
Valve Open	125-145 lbs.	1 3/4"

NOTE—Dampeners used on top of all springs.
Valve Lifters: Mushroom type. Remove from below with camshaft out of engine. *For camshaft removal directions, see Studebaker Special Data.*
Valve Lifter Tension Spring—*See "Valve System" in Studebaker Special Data.*
►**Valve Chamber Baffles**—*See "Valve System" in Studebaker Special Data.*
Diameter—.624". **Clearance**—.0005-.00175".
Replacement Lifters—Std. & .0005", .001" O. S.

VALVE TIMING

Tappet Clearance: .016" All Valves, Engine Cold.
NOTE—Self-locking tappet adjusting screws used. Tappet screw tension should be 25 in. lbs. minimum.
Valve Timing: See Camshaft Setting above.
Intake Valves—Open 15° BTDC. Close 49° ALDC.
Exhaust Valves—Open 54° BLDC. Close 10° ATDC.
Valve Timing Check—Set #1 intake valve to .020". Turning engine with #6 cylinder on compression stroke the intake valve should start to open when the mark "IN-OP 1-6" on front dampener lines up with pointer.

LUBRICATION

Engine Oiling System: Pressure to crankshaft, connecting rod, and camshaft bearings, and to valve lifters. Timing gears lubricated by oil by-passed by pump. Oil pump mounted externally on right side.
Crankcase Capacity—6 quarts.
Normal Oil Pressure—20-40 lbs. at 40 MPH.
Oil Pressure Regulator—On lower right front corner of engine. Opens at 40 lbs. Adjustable by inserting shims between outer end of spring and plug.
Oil Pan Removal: *See Studebaker Special Data.*
Oil Pump: Helical gear type mounted externally on right side of engine.
Oil Pump Removal & Installation—*See "Oil Pump" in Studebaker Special Data.*
Oil Pressure Gauge: Stewart-Warner Bourden Tube (not electric) type.
Crankcase Ventilation: Filter element in oil filler cap (air intake) and in breather pipe on left rear of engine (air outlet).
Servicing—Wash both filter elements in kerosene and re-oil at regular intervals. NOTE—Filter in outlet pipe removed by taking out cotter pin.

COOLING

Cooling System: Positive circulation with water pump mounted on front of block with fan.
Capacity—13.5 qts. (15 qts. with Climatizer).
Water Pump: Packless type. No lubrication required. *See Water Pump Section for complete data.*
Removal—Slack off drive belt, take out capscrews in fan pulley hub and remove blades. Disconnect hose connection, take out mounting screws in pump.
Belt Adjustment—*See Generator Belt Adjustment.*
Thermostat: Fulton or Bishop & Babcock. In water outlet on cylinder head.

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MODEL IDENTIFICATION

SERIAL NUMBER: Stamped on plate on left front door lock pillar post.

	South Bend	Los Angeles
1951 Numbers	8,110,001 Up	8,800,001 Up

Model Symbol & Body Number Plate—Located on engine side of dash. Model designations as follows: (C) 5 Pass. Coupe, (F) Sedan 2-Door, (Q) 3 Pass. Coupe, (S) Conv., (W) Sedan 4-Door, (Y) Land Cruiser.

ENGINE NUMBER: Stamped on boss at the top side, rear end of cylinder block, next to distributor.
1951 Numbers—V101 Up.

TUNE-UP

COMPRESSION PRESSURE: 120 to 140 lbs., at 150 RPM. (normal cranking speed). Not more than 10 lbs. variation between cylinders.

VACUUM READING: Steady 18-20" idling at 8 MPH.

FIRING ORDER: 1-8-4-3-6-5-7-2. See Diagram.

SPARK PLUG GAPS: .0325"-.0375".
Plug Type—Champion Type H-8. 14 mm.

DISTRIBUTOR: Breaker Gap—.013-.018".
Cam Angle—22-29°. Test limits with .016" gap 24-30°. *See "Delco-Remy Cam Angle" in Electrical Equipment Section.*
Breaker Arm Spring Tension—17 to 21 ozs.
Automatic & Vacuum Advance—*See Ignition Timing.*
Condenser Capacity—.18-.23 microfarad.

IGNITION TIMING: 8° BTDC.
Timing Procedure—*See Ignition Timing.*
Timing Marks—Vibration Dampener mark "IGN/" aligned with pointer on gear case cover.

CARBURETION:
Idle Setting—Initial setting 1¾ turns open, final setting midway between missing & rolling points. Adjust both screws alike, turn screws in for leaner mixture.
Idle Speed (Std. Trans.)—550-600 RPM. Equivalent to 8 to 10 MPH.
Idle Speed (Auto. Trans.)—500-550 RPM., with selector lever in "N" position. Adjust by turning idle adjusting screw switch in or out (switch replaces regular stopscrew).
Float Setting—Use KMO No. T-24971, Float Gauge. Hold air horn in inverted position and place float gauge on gasket. Tops of float should be 5/64" ABOVE tops of vertical guides. This will give the approximate fuel level.
Fuel Level—21/32" below top surface of float chamber (without gasket) at 5 lbs. pressure.
Accelerating Pump—Normal setting, inner hole (nearest throttle shaft). For more fuel install rod in outer hole.

Choke Setting (Code 6-107 & 6-111): Centered on index.

Choke Setting (Code 6-107A): 2 points lean.

FUEL PUMP PRESSURE: 4-4¾ lbs.

MANIFOLD HEAT CONTROL: Automatic thermostatic type. Blocker type valve located in right bank exhaust pipe (diverts exhaust gas from right bank through hot spot to left side of engine when closed).
Setting—To test coil spring tension, free outer end of coil spring from bracket on manifold. With valve closed, hooked end of coil should be approx. 90° from bracket at 70°F. Replace coil if incorrect.

►*NOTE*—To overcome sticking, lubricate valve shaft with kerosene and soda solution or Bendix Carburetor Cleaner. If necessary, shaft diameter can be reduced for .005" clearance in bushings.

VALVE TAPPET CLEARANCE: .012-.014" All Valves. (Engine Hot). .014-.016" All Valves (Engine Cold). This setting supersedes previous setting.

►***EXCESSIVE VALVE CLEARANCE CORRECTION***—If difficulty is encountered to maintain a tappet clearance setting, examine tappet screws and replace those having a ¼" bore in upper end. Tappet Screw, Part No. 529400 has been modified to overcome this condition. Two types of Tappet Screws are used. One type has ¼" bore and the other a 3/16" bore. Both are satisfactory for service replacement.

►*NOTE*—Self-locking tappet screws used.

IGNITION

Ignition Switch: Mitchellock. Studebaker No. 524637.
Ignition Lock—Yale & Towne.

COIL: Delco-Remy No. 1115380. Mounted horizontally on fire wall.

CONDENSER: Delco-Remy Part No. 1869704.
Capacity—.18-.23 microfarad.

DISTRIBUTOR: Delco-Remy No. 1110822. Automatic and vacuum advance type with new "center bearing" breaker plate.

►**Breaker Plate Bearing Assembly**—Plate rotates on 3 bakelite buttons on support plate with spring tension adjustment (shim washers) on underside of support plate. Pull required to move plate should be 8 ozs. min., 16 ozs. max., with breaker plate assembly out of housing.

►*NOTE—See "Delco-Remy Center-Bearing Breaker Plate Distributor" in Electrical Equipment Section.*

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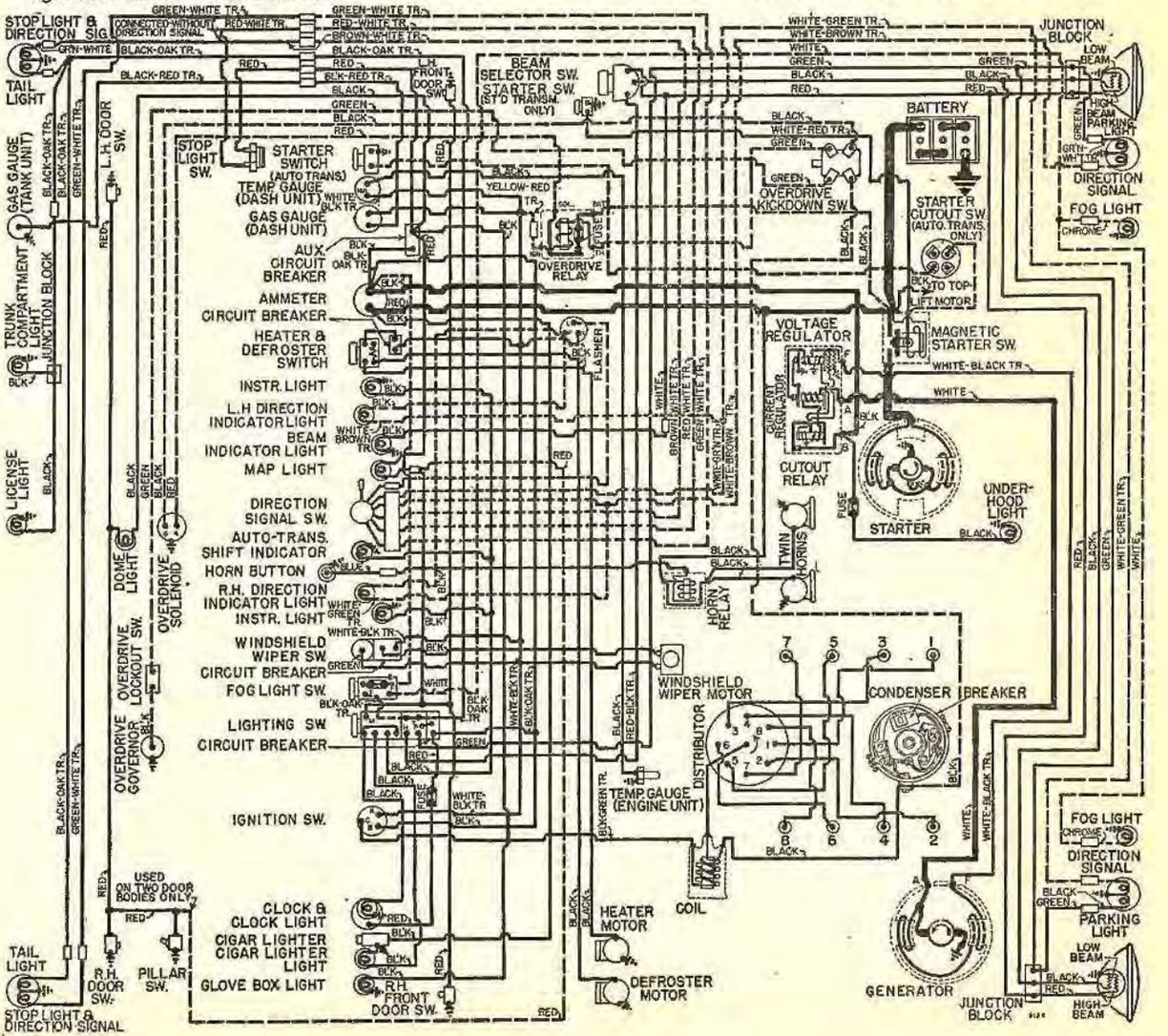

MISC. ELECTRICAL

CIRCUIT BREAKERS: Lighting (On Light Switch). Studebaker No. 522014. 30 ampere thermostatic type. Protects head lamps, parking, tail, and instrument panel lamps by vibrating to limit current.

Auxiliary Circuit Breaker (On Instrument Panel). 20 ampere thermostatic type. Protects body and stop lamps by vibrating to limit current.

Convertible Top Circuit Breaker—30 ampere.

ACCESSORY CIRCUIT BREAKER: One 15 amp. type used on cars with Climatizer and Defroster.

FUSES: Clock—3 ampere. In clock lead.

Directional Signal—14 ampere. In Flasher lead.

Overdrive—20 ampere. On overdrive relay.

Glove Compartment Light—5 ampere. In lamp lead.

Under Hood Light—5 ampere. In lamp lead.

Fog Lights—20 ampere. On fog light switch.

HORNS: Sparton or Delco-Remy No. 1999655 (Low Note), 1999656 (High Note). Airtone twin horns with relay.

Canadian Cars—Auto-Lite HW-4035A (Low Note), HW-4036A (High Note).

Horn Current—12-15 amperes each.

Horn Relay: Delco-Remy No. 1116775.

Contacts Close—2.75-4.0 volts.

Contact Gap—.025". **Air Gap** .015" (contacts closed).

ENGINE

ENGINE SPECIFICATIONS: Own make 8 cylinder "V" type valve-in-head.

Bore—3⅜". **Stroke**—3¼".

Displacement—232.6 cu. in. **Rated HP**—36.4.

Developed Horsepower—120 at 4000 RPM.

Compression Ratio—7.0-1 (Std.). 7.5-1 (Optional).

Compression & Vacuum Reading—*See Tune-Up data.*

OIL PAN REMOVAL: *See "Oil Pan Removal" in Studebaker Special Data.*

►*Not necessary to remove engine for oil pan removal.*

►**REPLACEMENT ENGINE CAUTION (For Automatic Transmission Cars):** *See "Replacement Engine" in Studebaker Special Data.*

ORIGINAL BORE AND PISTONS: *See "Original Bore & Pistons" in Studebaker Special Data.*

TIGHTENING TORQUES: *See Studebaker Special Data.*

CYLINDER HEAD INSTALLATION: *See Studebaker Special Data.*

►**Head Interchangeability**—Same cylinder head and head gasket used for right and left cylinder banks.

PISTONS: Lynite aluminum alloy. Cam ground, tin plated, full skirt "T" slot.

Weight—13.66 ozs.

Clearance—Selective fit (see Fitting Pistons).

Removal—Pistons and rods removed from above.

NOTE—Car manufacturer recommends that cylinders out of round or tapered more than .002" be reconditioned.

Fitting New Pistons: Insert .002" feeler gauge, 1" wide, between piston and cylinder wall on right side (piston T-slot toward left side of engine). Pull required to withdraw feeler should be 11-16 lbs.

Replacement Pistons: *See Studebaker Special Data.*

Installing Pistons: Install piston on rod with slot on same side as nut on piston pin clampscrew (away from oil squirt hole in rod). Install piston in cylinder with slot toward left side of engine (all pistons). See Connecting Rod Installation.

PISTON RINGS: Two compression, one oil control rings per piston, all above pin. Oil drain holes provided in oil ring groove.

Ring	Width	End Gap	Side Clearance
Comp. (#1, 2)	5/64"	.008-.016"	.0015-.002"
Oil Contr. (#3)	3/16"	.008-.016"	.0015-.002"

Installing Rings: Beveled side of compression rings (Sealed Power) up. Expander used with oil ring.

Replacement Rings: Sets furnished; Std., .020", .030", .040", Oversize. Single rings also furnished in same sizes.

PISTON PIN: Diameter .8741-.8745". Pin is locked in rod with tapered pin and lock nut.

Pin Fit in Piston—.0001-.0003" clearance or light finger push fit at room temperature (70°F.).

Pin Removal and Installation: *See Studebaker Special Data.*

Replacement Pins: Std., .0025" & .005" Oversize. Use Hone PH-1 to obtain proper piston pin fit.
NOTE—Replacement pistons fitted with pins.

CONNECTING ROD: Length 6⅝". **Weight**—23.71 ozs.
Crankpin Journal Diameter—1.99925-2.00025".
Lower Bearing—Interchangeable steel-backed, micro-babbitt lined type. No shims.
Clearance—.00005-.00215". **Sideplay**—.007-.012".

Bearing Adjustment: None (no shims). Replace bearings. Do not file rods or caps.

NOTE—Make certain that small tongue on bearing shells engage grooves. Palnut used on bolt nuts.

Replacement Bearings: Bearings furnished; Std., .001", .005", .010", .020" Undersize.

Installing Rods: Number on rod and bearing cap must be on same side and rod installed in same numbered cylinder with nos. down toward oil pan (toward right on right bank rods, toward left on left bank rods) and oil squirt hole on all rods toward right of engine. Rods are offset with widest half of bearing toward rear (right bank), toward front (left bank).

►**New (Unmarked) Rod Note**—Check right and left bank rods by holding rod up (piston pin end up, oil squirt hole toward you). Left bank rod offset (widest half of bearing) will be toward right, right bank rod offset will be toward left. Mark rods by stamping number on rod and cap on oil squirt hole side (right bank rod), opposite side (left bank rod).

CAUTION—Bearing cap must be assembled on rod with groove in cap and rod on same side.

CRANKSHAFT: 4 bearing, 5 integral counterweights. Vibration dampener mounted on forward end.

Vibration Dampener—*See Studebaker Special Data.*

Journal Diameters—2.4995-2.5000".

Bearings—Removable steel backed babbitt lined type. No shims.

Clearance—.0006-.0027".

Rear Bearing Oil Seals—Three seals are used. Cork between the cap and the block, Neoprene between the cap face and the block and the "Brummer" type seal used around the crankshaft journal.
See "Rear Main Bearing Oil Seal" in Studebaker Special Data.

Bearing Adjustment: None (no shims). Replace bearings, do not file caps.

Replacement Bearings: Furnished as sets or single bearings in Std. Size and .001", .010", .020", .030" Undersize.

End Thrust: Taken by thrust plate assembled between front main bearing and crankshaft gear. Controlled by shims between thrust plate and face of main bearing journal.
End Play—.003-.006".

CAMSHAFT: Five bearing. Helical Drive gear.

►*CAMSHAFT REPLACEMENT CAUTION*—Revised type valve lifters must be installed when camshaft is replaced due to cam lobe wear. See Valve Lifters following.

Journal Diameters—#1, 1.86974-1.87075"; #2, 1.85375-1.85475"; #3, 1.83875-1.83975"; #4, 1.82275-1.82375"; #5, 1.24475-1.24575".

Bearings—Split steel-backed, babbitted bushings.

►*NOTE—Oil hole in bushings must be aligned with oil holes in block.*

Clearance—.00075" to .00225" (#1), 0.001" to .00275" (all others).

Cam Shaft Removal: *See "Cam Shaft & Bearings" in Studebaker Special Data.*

End Thrust: Taken by a thrust plate located between the front camshaft bearing and the camshaft gear. **Endplay**—.005" to .007". *See "Camshaft & Bearings" in Studebaker Special Data.*

Timing Gears: Crankshaft gear, cast-iron. Camshaft gear, Celeron with steel hub. **Backlash**—.001-.003". **Replacement Gears**—Camshaft gear furnished in two sizes: Standard (marked "S"), High-Limit (marked "H"). Crankshaft gear Std. size only.
Timing Gear Removal and Installation—*See "Timing Gears" in Studebaker Special Data.*

Camshaft Setting: Mesh marked tooth of camshaft gear between two marked teeth on crankshaft gear. *Note—This is the position for #6 cylinder to fire.*

VALVES:	Head Diam.	Stem Diam.	Length
Intake	1 13/32"	11/32"	
Exhaust	1 9/32"	11/32"	

	Seat Angle	Lift	Stem Clearance
All Valves	45°	23/64"	.0015-.0035"

NOTE—Rubber seal rings installed on all valve stems (seated in groove on valve stem within spring retainer).

Valve Stem Seal Installation—*See valve spring installation data under "Valve System" in Studebaker Special Data.*

Valve Guides: Pressed in head from underside.

Guide Removal & Installation—*See "Valve System" in Studebaker Special Data.*

Valve Springs: Pressure should be 130 lbs. ± 5 lbs. compressed to 1¾" (valve open position).

NOTE—Dampers used on bottom of all springs.

Spring Removal & Installation—*See "Valve System" in Studebaker Special Data.*

Rocker Arms: Arms are pressure-lubricated from

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Linkage Adjustment—*CAUTION*—Two types of Linkage used. Adustments are different. *See "Studebaker Automatic Transmission" in Transmission Section.*

Removal: *See "Studebaker Automatic Transmission" in Transmission Section.*

UNIVERSALS

Spicer Model 1268-111X (Front & Rear), 1261-102X (Intermediate). Needle type bearing. Three used with intermediate universal at propeller shaft support bearing on crossmember (see Propeller Shaft). *See Universals Section for complete data.*

Propeller Shaft and Support Bearing: Two shafts used. Front shaft with intermediate universal yoke. Rear shaft with slip-joint on forward end at intermediate universal.

Propeller Shaft & Support Bearing Removal & Servicing—*See Studebaker Special Data.*

REAR AXLE

Spicer Salsbury Model 41-2. Semi-floating, Hypoid Gear type with Hotchkiss drive.
See Rear Axle Section for complete data.

Ratio—4.09-1 Std., 4.55-1 Optional. (Std. with Overdrive).

Ratio with Automatic Transmission—3.54-1.

NOTE—Rear Axle Ratio stamped on plate attached to axle by cover capscrew and also on gears.

Backlash—.003-.006". Shim adjustment.

Removal: Remove hub caps, take out cotter pin from axle shaft nut, loosen rear wheel nuts. Place car on stands on frame just ahead of rear springs. Remove wheels, hubs and drums. Disconnect hand brake cable. Take out backing plate bolts from backing plate, free hydraulic brake lines from axle housing clips (do not disconnect brake lines). Backing plates and shims can then be wired to frame (do not disconnect brake lines from wheel cylinders). Disconnect rear universal (wire caps or use clamps to prevent losing rollers). Remove rear spring "U" bolts, disconnect lower shock absorber links, remove rear axle assembly from car.

Axle Shaft Removal—Remove wheel, remove wheel hub (use puller J-596-A). Take out backing plate retaining bolts, remove outer oil seal. Pull backing plate out over end of axle shaft and wire plate to frame *(CAUTION—do not lose adjusting shims located between backing plate and axle housing flange).* Pull axle shaft assembly (Puller HM-931).

Wheel Bearing Adjustment: Use dial indicator to check axle shaft end-play. Adjust by removing backing plate (see Axle Shaft Removal above), and adding or removing shims located between backing plate and axle housing flange (shims .003", .005", .010", .030" thick).

Endplay—.001-.005".

SHOCK ABSORBERS

Houde & Monroe—Direct acting, hydraulic type.

Front—Studebaker No. 527924.

Rear—Studebaker No. 530766.

FRONT SUSPENSION

Independent type with coil springs and Direct Acting shock absorbers located within the springs.
See Front Suspension Section for complete data.

Kingpin Inclination—5¼° crosswise.

Caster—Neg. 1° to Neg. 2½°. Not more than ¾° variation between wheels. Eccentric pin adjustment.

Camber—0° to Pos. 1° with ½° more camber favored on driver's side. Eccentric pin adjustment.

Toe-out on Turns—Inner wheel turned 23½°±1°, outer wheel 20°.

Toe-In—1/16" to 1/8". **Adjust right hand tie rod only** for toe-in after left hand tie rod has been adjusted for straight-ahead position (with steering wheel centered) and center auxiliary tie rod has been adjusted so the steering gear arm and auxiliary steering arm parallel. **RHD Car Note**—Make toe-in adjustments on left hand tie rod.

STEERING GEAR

Ross Model T-14 Cam-and-Twin Lever type.
See Steering Gear Section for complete data.

BRAKES

Service: Lockheed (Wagner Electric) Hydraulic, Self-centering, Self-adjusting type.
See Brake Section for complete data.

Drums—Composite type. Diameter 11".

Clearance—If adjustment required, *see "Lockheed (Wagner) Hydraulic Self-Adjusting Brakes" in Brake Section.*

Lining—Molded type (all shoes). Width 2". Thickness 3/16". Length, (Front wheels) 22¼", (Rear wheels) 18½".

Braking Power—57% Front, 43% Rear.

Hand Brake: See Service Brake data above.

Hill-Holder: Std. on Std. Trans. Cars. *See Brake Section for complete data.*

Adjustment—*See Studebaker Special Data.*

Anti-Creep (for Automatic Transmission Cars)—*See Brake Section for complete data.*

MISC. MECHANICAL

CONVERTIBLE TOP CONTROL: Electric type with motor mounted on left hand lift assembly (right hand lift driven through flexible drive).
See Miscellaneous Section for complete data.

Front (Timing Cover) Oil Seal—Braided asbestos type impregnated with graphite and oil. Seal is installed in recess in inner face of timing chain cover and retained by steel retainer. To remove seal, pry out retainer and seal assembly.

CAUTION—Always use new steel retainer when installing new seal.

►**Production Change (Starting CJ-2A Eng. No. 62054, 4-63 Eng. No. 11080, All 2-WD & 4-WD Jeep Trucks)** New timing case cover (double baffle and spring loaded leather seal) and new crankshaft pulley (with polished surface for seal contact) used. This new cover and pulley can be installed as an assembly on earlier engines (either chain or gear drive).

FLYWHEEL

Flywheel—Mounted on crankshaft flange by two special dowel bolts and four special head bolts. Whenever flywheel removed, make certain that arrow on flywheel center lines up with arrow on crankshaft flange when re-installed (to insure correct position of timing marks), tighten bolt nuts with a torque indicating wrench to 36-40 ft.lbs. and check flywheel run-out when installed. Run-out must not exceed .008".

New Flywheel or Crankshaft Installation—Taper dowel bolts should be replaced with new special snug fitting bolts supplied to eliminate necessity of reaming the special tapered holes. Assemble new parts as follows: Install flywheel on crankshaft (lining up arrows on both parts) using the four straight bolts previously used, tighten these bolts securely. Drill out tapered bolt holes with a 35/64" drill, ream these holes with a 9/16" (.5625") straight reamer, install special bolts, Part No. 116295 (with No. 52330 Lockwasher and No. 52804 Nut), in these holes and discard the tapered dowel bolts used previously. Tighten bolts to 36-40 ft.lbs. and check flywheel run-out (.008" max.).

CONNECTING ROD & BEARINGS

PALNUT INSTALLATION: Always use new Palnuts (discard nut after removal). After regular nut correctly tightened, install palnut with flat side down toward nut, tighten finger tight, and **one-half turn additional.**

►*1949 SELF-LOCKING NUT CAUTION*—Special "Huglock" self-locking nut used on some 1949 cars instead of regular nut & Palnut. This nut discontinued on later cars to avoid possibility of stripping bolt threads when nut removed.

CAMSHAFT & BEARINGS

ALL MODELS

CAMSHAFT SERVICING: Removal—Drain radiator and cylinder block, remove radiator and grille, cylinder head, manifold, valves, and valve springs. Remove oil pump, fuel pump, oil pan, crankshaft pulley (use puller), fan and governor drive belts, and fan assembly. Remove nuts on front engine support rubber insulators (Jeep only). Remove timing gear cover, remove camshaft gear and thrust plate, block up all valve lifters (can be tied up with string to manifold studs). On Jeep only, place jack under crankcase (use block of wood on jack to avoid damage to oil pan), raise front end of engine to provide clearance for camshaft. Remove camshaft through front of engine.

Gear Puller Tool—Use Puller Tool No. W-172 to remove gear on engines equipped with timing gears.

Camshaft Front Bearing—Consists of a steel-backed, babbitt-lined bushing which takes thrust. When installing this bushing, make certain oil hole lines up with drilled oil hole in crankcase, stake bearing in place to prevent turning in service.

Camshaft Thrust Plunger (On Engines with Timing Chain)—Plunger and spring should be installed in camshaft hub with round end out. Stationary pin on timing chain cover must be perpendicular so as to bear on spring-loaded plunger.

INSTALLATION CAUTION—Make certain that thrust washer installed in back of camshaft sprocket. Coat end of thrust pin on timing chain cover with cup grease when installing cover.

Camshaft Thrust Plate (On Engines with Timing Gears)—Thrust plate assembled behind gear with a spacer assembled behind plate. If required, a thin shim can be installed behind spacer if too little clearance, or spacer can be dressed to provide greater clearance.

OIL PUMP

1937-42 MODELS
UNIVERSAL JEEP
BEFORE ENG. NO. 44417

PLANETARY GEAR TYPE OIL PUMP SERVICING: Pump mounted externally on left hand side of crankcase.

Pump Removal—Remove nuts and lockwashers on three mounting studs, slide pump off studs. To disassemble pump, remove one screw in pump cover, lift off cover, remove idler gear and rotor disc. To remove rotor shaft assembly, file off end of pin in drive gear hub, drive pin through shaft, using a small drift, remove gear, withdraw rotor shaft assembly from housing.

Pump Servicing & Assembly—Pump shaft clearance in housing is .001-.003" (new), .005" (service Limit). Idler gear clearance on shaft is .002-.004" (new), .006" (service limit). When assembling pump, make certain that gasket installed on shaft within pump housing and that disc in place in shaft assembly. Use new body and cover gaskets. Make certain that driving gear pin is securely installed to prevent loosening in service.

CAUTION—Prime pump by filling with engine oil through plug hole in cover before installing pump on engine.

Pump Installation—Turn flywheel to #1 piston firing position with flywheel mark "IGN" centered in inspection hole in right front face of flywheel housing below starter. Turn distributor shaft to #1 firing position with distributor rotor finger opposite #1 terminal in distributor cap. Hold oil pump in same relative position as when installed on engine, turn pump shaft until tongue offset is upward (widest part of shaft down) and line up gear retaining pin with right hand side of slot in pump body. Slide pump into place on mounting studs, recheck rotor position. NOTE—If distributor rotor not at #1 terminal with pump installed, remove pump, turn shaft as required, and re-install.

1946-50 MODELS
UNIVERSAL JEEP
AFTER ENG. NO. 44417

ROTOR TYPE OIL PUMP SERVICING: Pump mounted externally on left hand side of crankcase.

Pump Removal—Remove mounting screws in pump body flange, slide pump assembly out. To disassemble pump, remove cover screws and lockwashers, lift off cover, remove pump outer rotor. To remove shaft and rotor assembly, file off end of pin in drive gear hub, drive pin through shaft using a small drift, remove gear, withdraw shaft and rotor from housing. To remove oil regulator, remove hexagonal-headed plug on side of housing, withdraw regulator spring and plunger. CAUTION—Do not lose adjusting shims located within plug above spring.

Pump Servicing & Assembly—Replace rotors if clearance between inner and outer rotor excessive, or if rotor clearance in housing excessive. Replace cover if rotor bearing surface is worn or scratched. Use new body and cover gaskets. Make certain that driving gear pin is securely installed.

Pump Installation—See installation directions for previous type planetary gear oil pump (above).

OILING SYSTEM

6 CYLINDER MODELS

EXCESSIVE OIL CONSUMPTION CORRECTION: To correct complaints of excessive oil consumption, when not due to external leakage, excessive bearing clearance, or cracked vacuum pump diaphragm, check and correct following points:

1—On engines before Eng. No. 18121, plug holes in valve compartment floor using special synthetic rubber plugs (furnished in Kit No. 649319) exactly as directed below (CAUTION—all holes must not be plugged). Beginning Eng. No. 18121, number and location of these holes was changed and **plugs should not be installed on these later engines.**

2—If piston clearance not in excess of .005", remove glaze from cylinder walls with a hone and install set of new Service Type piston rings.

3—If piston clearance in excess of .005", install new pistons. Fit pistons to new clearance as specified on car model page.

►*CAUTION*—Coat pistons and rings with engine oil before installation, break engine in at 40 MPH. maximum for 300 miles.

Installation of Valve Compartment Plugs (Engines before No. 18121): Use Kit No. 649319 containing synthetic rubber plugs of correct size and number for installation in holes in floor of valve compartment on left side of engine as follows:

Four No. 649304 Plugs (Small)—Use to plug all four small holes just inside valve cover flange and immediately adjacent to lifter hole for #1, 2, 5, 6 cylinders.

Three No. 649305 Plugs (Medium)—Use to plug all three medium holes of innermost line between pairs of cylinders (1-2, 3-4, 5-6).

Four No. 649306 Plugs (Large)—Use to plug four

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MODEL IDENTIFICATION

SERIAL NUMBER: On frame front cross member at center and on right side of cowl under hood.

1939 Numbers—91,751 Up (see Note below).

NOTE—Cars manufactured after beginning of fiscal year (9/1/38), No. 89,001 up, are 1939 cars.

ENGINE NUMBER: Stamped on right front upper corner of cylinder block.

1939 Numbers—91,751 Up.

TUNE-UP

COMPRESSION:—Ratio—5.7-1. Pressure—87 lbs. at cranking speed of 216 R.P.M.

VACUUM READING:—Steady 18½" idling at 7 M.P.H.

FIRING ORDER: 1-3-4-2. See diagram.

SPARK PLUGS: Champion Type C-7. 18 mm. Metric Gaps—.025".

IGNITION: See Coil, Condenser, and Distributor.

Breaker Gap—.020".

Cam Angle—(IGS) 47°, (IGW) 41° closed.

Automatic & Vacuum Advance—*See Distributor.*

IGNITION TIMING: See Ignition Timing.

Std. Setting—5° ATDC. with flywheel mark "IGN" at indicator in inspection hole in top left face of housing.

CARBURETION: See Carburetor & Carb. Equipment.

Idle Setting—Idle screw approximately 1 turn open (turn screw in from "missing" point until engine runs smoothly). Idle speed 7MPH.

High Speed (Main) Adjustment—Adjusting screw turned in approximately ⅜ turn from point where maximum speed secured with throttle opening of 25 MPH. (screw approx. 2⅜ turns open).

Float Level—Fuel level ¾" below top of bowl.

Fuel Pump Pressure: 3 lbs. maximum.

MANIFOLD HEAT CONTROL:—Manual type with three settings (depressions for valve lever setscrew engagement) as follows: 'Heatoff'—Summer operation (left hand), 'Midway'—Mild Winter operation (middle position), 'Heaton'—Extreme Winter operation (right hand). To adjust, loosen locknut, back off setscrew, move heat valve lever toward right (in direction of arrow) for more heat, opposite direction for less heat, tighten setscrew & locknut.

VALVES: See Valve Timing.

Tappet Clearance—.004" Int., .006" Exh., Hot.

STARTING: See Battery, Starter, Generator, and Regulator (when used).

IGNITION

Ignition Switch:—Douglas. Coil connection is not armored.

COIL: Auto-Lite Model IG-4090, IG-4090A (Truck). Service Coil IG-4070. On right side of engine.

Ignition Current—2.5 amperes idling, 4 stopped.

CONDENSER: Auto-Lite Part No. IG-2671G (IGS-4007 or 7A Distr.), IGB-1035 (IGW-4129A Distr.).

Capacity—.20-.25 microfarad.

DISTRIBUTOR: Auto-Lite Nos. IGS-4007, 7A or IGW-4129A. Single breaker, 4 lobe cam, full automatic advance type with auxiliary vacuum spark control.

NOTE—Vacuum unit integral type (IGS-4007, A), separate VC-4007 or VC-4010 (IGW-4129A).

Breaker Plate Identification (IGS-4007, A)—Maximum vacuum advance limited by slot and marked by number #10 stamped on plate.

Breaker Gap—.020".

Cam Angle (IGS-4007, 7A)—47° closed, 43° open.

Cam Angle (IGW-4129A)—41° closed, 49° open.

Breaker Arm Spring Tension—16-20 ozs.

Rotation—Counter-clockwise viewed from top.

Automatic Advance—IGS-4007, 7A

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	0	600
4.4	420	8.8	840
7	770	14	1540
10	1165	20	2330
14	1700	28	3400

Automatic Advance—IGW-4129A

Start	300	0	600
4	400	8	800
7	790	14	1580
11	1310	22	2620
14	1700	28	3400

Vacuum Spark Control (IGS-4007, A)—Mounted on distributor cup and linked to breaker plate. Provides additional advance at speeds above idling except

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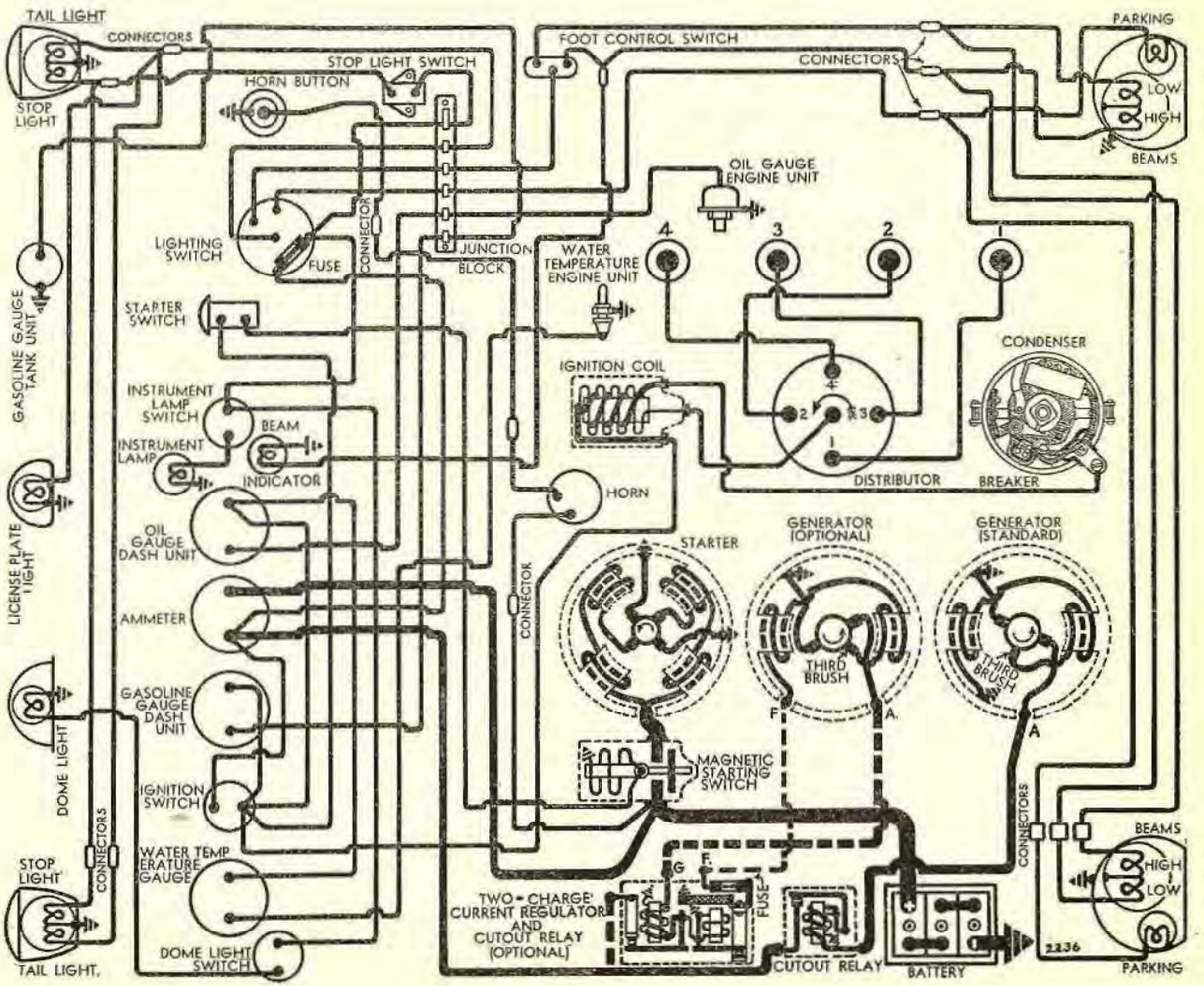

REGULATOR

Auto-Lite Model TC-4317A (GCS-4809A-5 Gen.).

Two-Charge Type. Mounted separately. Consists of Cutout Relay and Two-charge (Current) Regulator *For complete data, refer to Electrical Equipment Index.*

Cutout Relay

Cuts In—6.5-7.25 volts.

Cuts Out—.5-2.5 ampere discharge current.

Contact Gap—.015-.045".

Air Gap—.010-.030" with contacts closed.

Regulator

Contact Opening Voltage—8.25-8.75 volts at 70°F.

Contact Closing Voltage—1.2-1.4 volts below opening voltage at same temperature.

Contact Gap—.005" minimum.

Air Gap—.045" with contacts closed.

LIGHTING

LIGHTING:—**Headlamps**—Corcoran-Brown Stabilite with pre-focused bulbs. Upper and lower beams controlled by Beam Selector Switch on toeboard.

Headlamp Adjustment—Aim upper beam straight ahead (hot spot center at lamp center height at 25').

Beam Indicator—At center of instrument panel. Lighted whenever upper beams in use.

Switches

Lighting—Douglas. **Beam Selector**—Douglas. **Instrument**—Douglas.

MISC. ELECTRICAL

FUSES:—**Lighting**—20 ampere. On Lighting Switch. **Generator Field Fuse (GCS-4809A-5 Generator only)**—5 ampere. In knurled cup on regulator.

HORNS:—**Schwarze.** Vibrator, disc type. One horn Std., Twin horns Optl.
Horn Current—10 amperes (each).

ENGINE

ENGINE SPECIFICATIONS:— 4 cylinder, 'L' head type.

Bore—3⅛". **Stroke**—4⅜".
Displacement—134.2 cubic inches.
Rated Horsepower—15.63 (A. M. A.).
Developed Horsepower—48 HP. at 3200 R.P.M.
Compression Ratio—5.7-1 cast-iron hd.
Compression Pressure—87 lbs. at 217 R.P.M.
Vacuum Reading—Steady 18½" idling at 7 M.P.H.
NOTE—Cylinder bore offset ⅛" from center line of crankshaft toward valve side of engine.

PISTONS:—Full skirt, semi-steel, light weight type. **Weight**—21-23 ozs. (stripped). **Length**—3¾". **Removal**—Pistons and rods removed from above. **Clearance**—Top .016". Skirt .0025-.003".

Replacement Pistons:—Finished pistons furnished Std. and .003", .005", .010", .015", .020", .025", .030" oversize.

Fitting New Pistons:—Use .0025" feeler stock ⅜" wide inserted between piston and cylinder wall to check clearance. Feeler pull must be 4 lbs. ± 2 lbs.

PISTON RINGS:—Three compression, one oil control ring per piston, all above pin. Oil ring groove drilled for oil drainage.

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.008-.013"	.0015"
Oil Control	3/16"	.008-.013"	.0015"

Wall Thickness—.130-.140" (Comp.), .098-.103" (oil).

Replacement Rings:—Furnished Std. and .003", .005", .010", .015", .020", .025", .030", .040" oversize.

PISTON PIN:—**Diameter**—15/16" (.9375"). **Length**—2.682". Pin floats in piston and rod. Retained by locking rings. Furnished .001", .003", .005" oversize.
Pin Fit in Piston—.0002-.0004" clearance or hand push fit with piston dry.
Pin Fit in Rod Bushing—.0004-.0006" clearance or thumb press fit.

CONNECTING ROD:—**Weight** 34 ozs. **Length** 9 3/16". **Crankpin Journal Diameter**—1.9395" (1 15/16").
Lower Bearing—Spun-babbitt-lined type.
Clearance—.001-.0025". **Sideplay**—.005-.009".

Bearing Adjustment:—None (no shims). Replace or rebabbitt rods. Do not file rods or bearing caps. Rods furnished Standard and .010" undersize.

Installing Rods:—Lower bearings offset. Install rods with short side of bearing toward nearest main bearing (toward front of engine for #1 & 3, toward rear for #2 & 4) with oil squirt hole in rod toward right (away from camshaft) on all rods.

CRANKSHAFT:—Three main bearing type.

Journal Diameters—2.334" all bearings.

Bearing Type—Removable slip-in steel-backed, babbitt-lined type. Bearings furnished Standard and .010" undersize. **Clearance**—.001-.0025".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps.

End Thrust:—Taken by #1 front bearing. Adjustable by adding or removing shims between crankshaft thrust washer and shaft. **Endplay**—.004-.006".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. **Bearing Type**—Removable bushing (front), machined in crankcase (all others).
Bearing Clearance—.002-.0035".

End Thrust:—Taken by thrust plate behind camshaft sprocket and spring-loaded plunger in forward end of camshaft bearing against thrust stud on cover.

Timing Chain:—Link-Belt #33403-2. Width 1¼". Pitch ½". Length 23½" or 47 links.

Camshaft Setting:—With #1 piston on top dead center, mesh chain so that timing marks on sprockets are adjacent and in line with a straightedge across the shaft centers.

VALVES:	Head Diam.	Stem. Diam.	Length
Intake	1 17/32"	.372"	5 13/64" (5¾" overall)
Exhaust	1 15/32"	.371"	5 13/64" (5¾" overall)

	Seat Angle	Lift	Stem Clearance
Intake	45°	21/64"	.002-.004"
Exhaust	45°	21/64"	.003-.005"

NOTE—Exhaust valve seat inserts are used.

Valve Guides:—Removable. Installed with taper end up. Remove old guides from above and press in new guides until lower end extends ¾" below valve spring seat recess in block. Exhaust guide longer

Valve Springs:—Free length 2 11/16".

	Spring Pressure	Length
Valve Closed	46½ lbs.	2¼"
Valve Open	85½ lbs.	1 15/16"

Valve Lifters:—Mushroom type. Guide holes reamed directly in block. Serviced by reaming guide hole and installing lifters furnished .005", .010", .020" oversize. **Clearance**—.0007-.001".

VALVE TIMING

Tappet Clearance:—.004" Int., .006" Exh., engine warm. NOTE—Whenever valves ground or new valves installed, car manufacturer recommends .010" setting for all valves for at least the first 100 miles.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open TDC. Close 45° ALDC.
Exhaust Valves—Open 40° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #1 intake valve at .010" (cold). This valve should open with piston on top dead center when flywheel mark 'T.C. I.O.1-4' lines up with pointed end of inspection plate screw in inspection hole on left top face of flywheel housing. Reset tappet clearance at .004" warm.

LUBRICATION

LUBRICATION:—Pressure system. Gear type oil pump mounted on outer left side of crankcase.

►**Oil Pump Installation Note**—Turn engine over until 'IGN' mark on flywheel lines up with indicator (inspection hole in top left surface of flywheel housing) with #1 piston on compression stroke, turn distributor shaft so that rotor is at #1 segment in distributor cap, mesh oil pump gear so that distributor not disturbed when coupling engaged.

Normal Oil Pressure:—30 lbs. at 30 M.P.H.

Oil Pressure Regulator:—Located under plug on oil pump cover. Opens at 30 lbs. Adjustable by adding or removing shims within plug above spring.

Oil Pressure Gauge:—King-Seeley Electric. K-S No. 6275 (dash unit), No. 6425 (engine unit).
See Miscellaneous Section for complete data.

Crankcase Capacity:—4 quarts.

COOLING

COOLING SYSTEM:—**Capacity**—11 quarts.

Water Pump:—Adjustable packing type.
See Water Pump Section for complete data.

Thermostat:—None used. Accessory thermostat (for installation in cylinder head outlet) available.

Temperature Gauge ('39 Pass.): King-Seeley Electric. K-S No. 7205 (Engine Unit). Engine unit controls Signal Light on instrument panel.

Commercial Cars—King-Seeley Electric. K-S No. 6632 (dash unit), No. 5700 (engine unit).
See Miscellaneous Section for complete data.

CLUTCH

CLUTCH:—**Rockford Cover Assembly (with Borg & Beck Driven Plate).** Single plate, dry disc type.
See Clutch Section for complete data.
Facings—Moulded type, 2 required. Inside Diam. 5⅛". Outside Diam. 7⅞". Thickness ⅛".

Adjustment:—Pedal free movement must be ¾-1" (providing 1/16" clearance between release levers and release bearing). To adjust, loosen locknut, turn yoke on rear end of clutch control lever cable.

Removal:—Remove transmission (see Transmission Removal below) and flywheel bell housing, take out mounting screws in clutch cover evenly, lift out.

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MODEL IDENTIFICATION

SERIAL NUMBER:—First number 39-1001. Stamped on plate on right side of cowl under engine hood and on center of front frame cross-member.

ENGINE NUMBER:—First number 39-1001. Stamped on right front corner of engine block.

TUNE-UP

COMPRESSION:—Ratio—6.35-1 (Std.), 6.81-1 (High Alt.) cast-iron heads; 7.0-1 (Optl. HC) aluminum head. **Pressure**—105 lbs. at 185 RPM. (Std. head).

VACUUM READING: Steady 21-23" idling at 7 MPH.

FIRING ORDER: 1-3-4-2. See diagram.

SPARK PLUGS: Champion Type J-8. 14 mm. Metric Gaps—.025".

IGNITION: See Coil, Condenser, and Distributor.
Breaker Gap—.020" **Cam Angle** 47° (IGS-4007B), 41° (IGW-4129) closed.
Automatic Advance—9.5° max. at 1500 RPM (distr.).
Vacuum Advance—7° distr. (IGS-4007B & IGW-4129 with VC4007 Unit), 10° distr. (IGW-4129 with VC-4010 Unit), with 15" vacuum.

IGNITION TIMING: See Ignition Timing.
Std. Setting—At TDC with flywheel mark "TC-IGN" at indicator in inspection hole in top left face of housing.

CARBURETION: See Carburetor & Carb. Equipment.
Idle Setting—Idle screw approximately ¾ turn open (turn in from "missing" point until engine fires smoothly). Idle speed 7 MPH.
Float Level—Fuel level 13/16" below top edge of float bowl.
Fuel Pump Pressure: 3 lbs. maximum.

MANIFOLD HEAT CONTROL:—Automatic thermostatic type. No adjustment required.

VALVES: See Valve Timing.
Tappet Clearance—.014" All Valves, Cold.

STARTING: See Battery, Starter, Generator, and Regulator (when used).

IGNITION

Ignition Switch:—Douglas. Coil connection not armored.

COIL: Auto-Lite Model IG-4090A. Service Coil No. IG-4070. Mounted on right side of engine.
Ignition Current—2.5 amperes idling, 4 stopped.

CONDENSER: Auto-Lite Part No. IG-2671K (IGS-4007B Distr.), IGB-1025 (IGW-4129 Distr.).
Capacity—.20-.25 microfarad.

DISTRIBUTOR: Auto-Lite Model IGS-4007B or IGW-4129. Single breaker, 4 lobe cam, full automatic advance type with auxiliary vacuum spark control. NOTE—Vacuum Unit integral type (IGS-4007B), separate Model VC-4007 or VC-4010 (IGW-4129).
Breaker Plate Identification (IGS-4007B)—Maximum vacuum advance limited by slot and marked by number (#7) stamped on plate.
Breaker Gap—.020".
Cam Angle (IGS-4007B)—47° closed, 43° open.
Cam Angle (IGW-4129)—41° closed, 49° open.
Breaker Arm Spring Tension—16-20 ounces.
Rotation—Counter-clockwise viewed from top.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	0	600
2	550	4	1100
5	930	10	1860
7	1190	14	2380
9.5	1500	19	3000

Vacuum Spark Control (IGS-4007B)—Mounted on distributor cup and linked directly to breaker plate. Provides additional advance at all speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring within unit.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5"
2.5	5	9"
5	10	12.2"
7	14	15"

Vacuum Spark Control (IGW-4129)—Type VC-4007 or VC-4010. On bracket under distributor cup and linked to advance arm. Operates in same manner as IGS-4007B type above.

Vacuum Advance—VC-4007

Start	0°	3⅝"
2°	4°	6⅞"
4°	8°	10⅛"
6°	12°	13¼"
7°	14°	15"

Vacuum Advance—VC-4010

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	3½"
2°	4°	5¾"
5°	10°	9¼"
8°	16°	12¾"
10°	20°	15"

Distributor Removal:—Mounted on right side of engine. To remove, disconnect vacuum line and take out hold-down screw in advance arm. To remove IGW-4129 without disturbing vacuum unit, loosen advance arm clamp bolt.

IGNITION TIMING

IGNITION TIMING:— Flywheel Degrees Pist. Position
All Engines .....0° At TDC.....0000" TDC

Timing—Remove inspection hole cover on top left hand side of flywheel housing. With #1 piston on compression, turn engine over until piston reaches top dead center, stop when flywheel mark "TC-IGN" lines up with pointed end of indicator screw. Loosen

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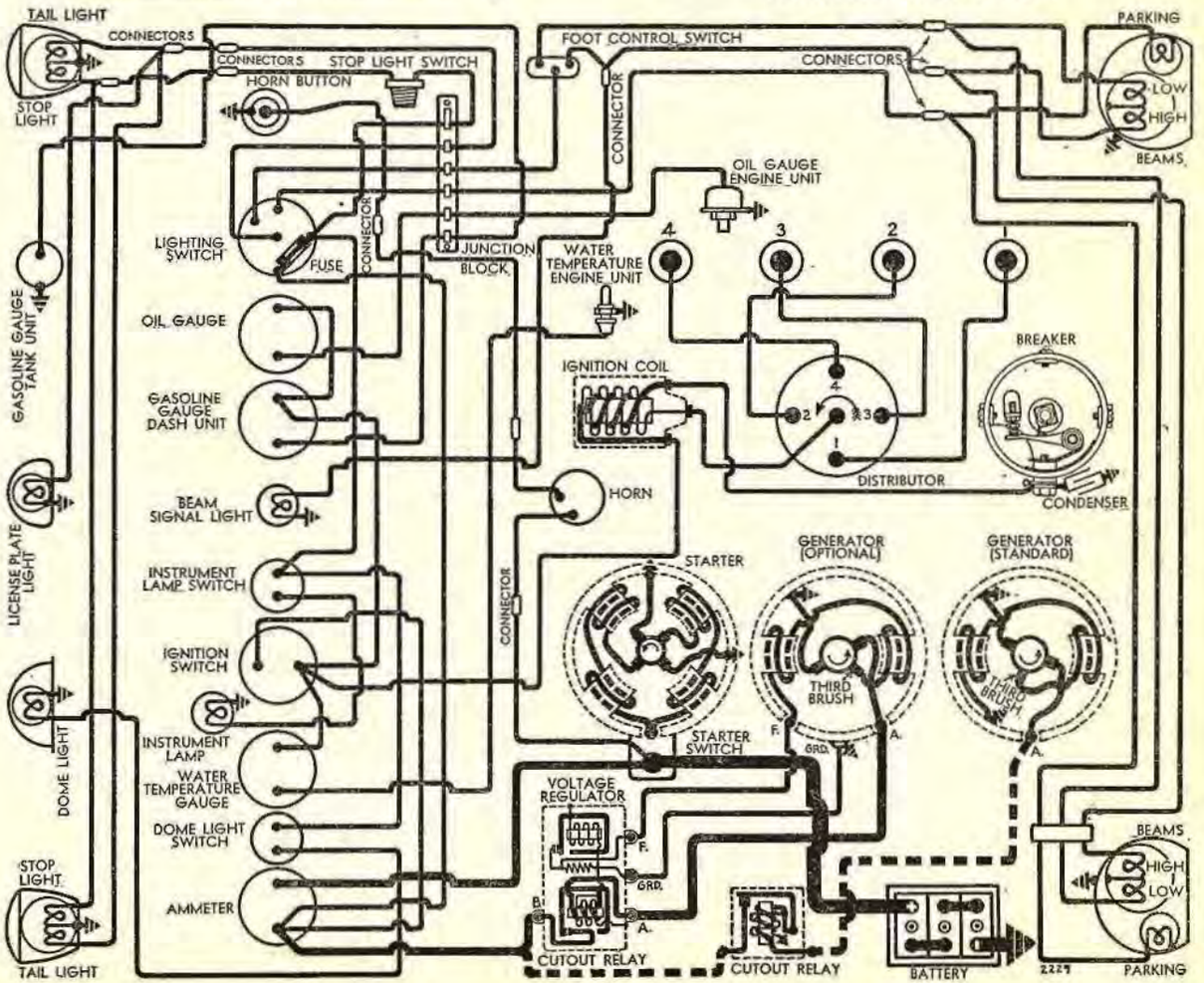

ENGINE

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Weight—12 ozs. (stripped). **Length**—3¾".
Removal—Pistons and rods removed from above.
Clearance—.0025" skirt. See Fitting New Pistons.

Replacement Pistons:—Finished pistons furnished Std. and .002", .005", .010", .020", .030" oversize.

Fitting New Pistons:—Use .0025" feeler stock ¾" wide inserted between piston and cylinder wall on side opposite slot to check clearance. Pull required to withdraw feeler must be within 5 to 10 lbs.

Installing Pistons:—Slot toward left (valve) side.

PISTON RINGS:—Two compression, one oil control ring per piston, all above pin with narrow 'heat-dam' groove (no ring) above top ring. Oil ring groove drilled for oil drainage.

Ring	Width	End Gap	Side Clearance
Compr.	3/32"	.008-.013"	.002"
Oil Contr.	3/16"	.008-.013"	.002"

NOTE—Install taper-face compression ring with mark 'TOP' up.

Replacement Rings:—Furnished Std. and .005", .010", .020", .030" oversize.

PISTON PIN:—**Diameter** .8117-.8121". **Length** 2 25/32". Pin locked in connecting rod by clampscrew.
Pin Fit in Piston—.0001-.0009" clearance or light push fit with piston at 60° F.

Replacement Pins:—Furnished Std. and .005" oversize.

CONNECTING ROD:—**Weight** 34 ozs. **Length** 9 3/16".
Crankpin Journal Diameter—1.9395" (1 15/16").
Lower Bearing—Spun babbitt-lined type.
Clearance—.001-.0025". **Sideplay**—.005-.009".

Bearing Adjustment:—None (no shims). Replace or rebabbitt rods. Do not file rods or bearing caps. Rods furnished Standard and .010" undersize.

Installing Rods:—Lower bearings offset. Install rods with short side of bearing toward nearest main bearing (toward front of engine for #1 and 3, toward rear for #2 and 4) with oil squirt hole in rod toward right (away from camshaft) on all rods.

CRANKSHAFT:—Three main bearing type.
Journal Diameters—2.334" all bearings.
Bearing Type—Removable slip-in steel-backed, babbitt-lined type. Bearings furnished Standard and .010" undersize. **Clearance**—.001-.0025".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file bearing caps.

End Thrust:—Taken by #1 front bearing. Adjustable by adding or removing shims between crankshaft thrust washer and shaft. **Endplay**—.004-.006".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearing Type—Removable bushing (front), machined in crankcase (all others).
Bearing Clearance—.002-.0035".

End Thrust:—Taken by thrust plate behind camshaft sprocket and spring-loaded plunger in forward end of camshaft bearing against thrust stud on chain case cover. NOTE—Make certain that plunger and spring in place when replacing chain case cover.

Timing Chain:—Link Belt. Width 1¼". Pitch ½". Length 47 links or 23½".

Camshaft Setting:—With #1 piston on top dead center, mesh chain so that timing marks on sprockets are adjacent and in line with straightedge across shaft centers.

VALVES:—	Head Diam.	Stem Diam.	Length
Intake	1 17/32"	.373"	5¾" (overall)
Exhaust	1 15/32"	.3725"	5¾" (overall)

	Seat Angle	Lift	Stem Clearance
Intake	45°	23/64"	.0015-.00325"
Exhaust	45°	23/64"	.002-.00375"

NOTE—Separate valve seat inserts not used.

Valve Guides:—Removable. Installed with taper end up. Remove old guides from above and press in new guides until lower end extends ¾" below valve spring seat recess in block.

Valve Springs:—Free length 2.684". Cylindrical dampener installed within each spring at upper end.

	Spring Pressure	Length
Valve Closed	59.5 lbs.	2.165"
Valve Open	100 lbs.	1.814"

Valve Lifters:—Mushroom type. Guide holes reamed directly in block. Serviced by reaming guide hole and installing lifters furnished .005", .010", .020" oversize. **Clearance**—.0007-.001".

VALVE TIMING

Tappet Clearance:—.014" all valves, engine cold.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 9° BTDC. Close 50° ALDC.
Exhaust Valves—Open 47° BLDC. Close 12° ATDC.
To Check Timing—Set tappet clearance #4 intake valve at .020" (cold). This valve should begin to open with piston 9° or .039" before top dead center when flywheel marked 'I.O.' lines up with pointed end of indicator screw in inspection hole in top left surface of flywheel housing (¼" variation of mark permissible). Reset tappet clearance at .014".

LUBRICATION

LUBRICATION:—Pressure type. Gear type oil pump mounted on outer left side of crankcase.
Oil Pump Installation Note—Turn engine over until 'TC.IGN' mark on flywheel lines up with indicator (inspection hole in top left surface of flywheel housing) with #1 piston on compression stroke, turn distributor shaft so that rotor is at #1 segment in distributor cap, mesh oil pump gear so that distributor not disturbed when coupling engaged.

Normal Oil Pressure:—30 lbs. at 30 M.P.H.

Oil Pressure Regulator:—Located under plug on oil pump cover. Opens at 30 lbs. Adjustable by adding or removing shims within plug above spring.

Oil Pressure Gauge:—King-Seeley Electric. K-S No. 7047 (dash unit), No. 6425 (engine unit).
See Miscellaneous Section for complete data.

Crankcase Capacity:—4 quarts.

COOLING

COOLING SYSTEM:—**Water Capacity**—11¾ qts.

Water Pump:—New packless type with ball-bearing shaft. ***See Water Pump Section for complete data.***
Removal—Drain water, remove fan belt and fan blades, loosen radiator mounting nuts, take out mounting bolts and lift pump out.

Thermostat:—Harrison. In outlet elbow on head.
Setting—Starts to open 140-147°F. Fully open 170°F.

Temperature Gauge:—King-Seeley Electric. K-S No. 7041 (dash unit), No. 7000 (engine unit).
See Miscellaneous Section for complete data.

CLUTCH

CLUTCH:—**Long Model 8½CB-CS6 (with Borg & Beck or Long Driven Member).** Single plate, dry disc type.
See Clutch Section for complete data.
Facings—Molded type, 2 required. Inside Diam. 5⅛" (Borg & Beck), 6" (Long); Outside Diam. 7⅞" (Borg & Beck), 8½" (Long); Thickness .125" (all).

Adjustment:—Pedal free movement must be ¾-1" (providing 1/16" clearance between release levers and release bearing). To adjust, loosen locknut, turn clevis on rear end of clutch fork cable.

Removal:—Remove transmission (see Transmission Removal below) and flywheel bell housing, take out mounting screws on clutch cover rim, lift clutch assembly and driven plate out.

TRANSMISSION

TRANSMISSION:—**Warner Model AS3-T84D.** Constant-mesh, synchro-mesh, helical gears (Second & High), sliding spur gear (Low & Reverse).
See Transmission Section for complete data.

Removal:—Remove front seat cushion and cover door trim; disconnect gear shift lever at retaining collar, and accelerator pedal from rubber socket, remove toeboards, loosen radiator mounting nuts and brace rod, disconnect propeller shaft at front universal, remove bell housing hand hole cover and disconnect clutch throw-out bearing retracting spring. Remove lower nuts on mounting bolts at rear of transmission, jack up rear of engine (See that fan blades do not damage radiator) to clear frame cross-member, remove transmission mounting bracket, remove bell housing to transmission case bolts, pull transmission straight back and lift out.

UNIVERSALS

UNIVERSAL JOINTS:—**Detroit Series 4100.** Needle bearing, ball-and-trunnion type. 2 used.
See Universals Section for complete data.

REAR AXLE

REAR AXLE:—**Own Model 39.** Semi-floating, spiral bevel gear type with Hotchkiss drive.
See Rear Axle Section for complete data.
Ratio—4.3-1 Std., 4.55-1 Deluxe.
Backlash—.004-.008". Shim adjustment.

Removal:—Hoist rear of car, disconnect brake tube and cables, shock absorbers, spring U bolts and rear shackles, pull assembly out.

Wheel Bearing Adjustment:—To adjust, remove wheel, hub assembly, oil seal, and bearing retainer. Remove shims from between retainer and backing plate. **Endplay**—.004-.006" (total both shafts).

SHOCK ABSORBERS

SHOCK ABSORBERS:—**Monroe.** Model 637509—frt., 637508—rear (Std. control), 637645—frt., 637644—rear (H.D. control). Direct acting, hydraulic type.

FRONT SUSPENSION

Front Suspension:—Front axle Own Model 39. Conventional 'I' beam section with Reverse-Elliott ends.
Kingpin Inclination—7½° crosswise.
Camber—2°. Not adjustable.
Caster—3°. Adjustable by using wedge shims between spring and spring pad on axle.
Toe In—1/16-⅛". Adjustable by loosening tie rod clamp bolts and turning tie rod.
Steering Geometry (Toe out on Turns)—Inner wheel turned 23°15', outer wheel 20°.

STEERING GEAR

Steering Gear: Gemmer Model 120. Worm-and-Sector
See Steering Gear Section for complete data.

BRAKES

BRAKES:—**Service**—Wagner-Lockheed Hydraulic, Single Anchor type. Hand lever applies rear wheel service brakes.
See Brake Section for complete data.
Drums—Alloy cast-iron. Diameter 9".
Lining—Moulded type. Width 1¾", Thickness 3/16", Length per wheel 18".
Clearance—.010" toe, .006" heel for each shoe.

Hand Brake:—See Service Brakes above.

IGNITION TIMING

IGNITION TIMING:—

	Flywheel Deg.	Piston Pos.
Pass. Cars (All heads)	At TDC	.0000" TDC
Pick-up & Panel (later)	4° BTDC	.0066" BTDC
Panel Dlvry. (first 5.7-1)	5° ATDC	.0103" ATDC

Timing—With #1 piston on compression, turn engine over until piston reaches firing position (see above) with flywheel mark 'TC-IGN' or 'IGN' centered in inspection hole in front face of engine right rear support. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open (eliminate backlash in drive gears by pressing on rotor in clockwise direction), tighten clamp bolt, see that rotor is at #1 terminal in distributor cap. NOTE—Ignition mark on First Panel Delivery on top of flywheel housing on left side.

CARBURETOR

CARBURETION:—Carburetor—Carter Model WO Type 450-S (Pass. Cars), Tillotson Model U-1B (Pick-up & Panel Delivery). 1⅛" downdraft type.

For complete data, refer to Carburetor Index.

Idle Adjustment—If preliminary adjustment required (to warm up engine), turn idle adjusting screw in until just seated, then turn screw out 1¼ turns (Carter), ¾ turn (Tillotson); start engine and run until warm. With engine warm, set throttle stopscrew for slightly faster than normal idling speed, turn idle adjusting screw out until engine begins to roll, then turn screw in until engine fires smoothly. Recheck adjustment and set throttle stopscrew for 8 MPH idle speed pulling in high gear. NOTE—Tillotson carburetor does not have High Speed adjustment.

Accelerating Pump (Carter & Tillotson)—No adjustment required.

Float Level (Carter)—⅜" from top of float (free end) to gasket seat on cover with needle valve seated (do not compress spring in valve stem).

Float Level (Tillotson)—Fuel level 13/16" below top edge (gasket seat) of bowl with engine running.

CARB. EQUIPMENT

Air Cleaner:—AC #1529478 oil-wetted type Std. Heavy duty oil-bath type optional.

Fuel Pump:—AC Type AF #1523306. Diaphragm type.

For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge:—King-Seeley Electric. K-8 Nos. 7855—first, 8112—later (Dash Unit), No. 7695 (Tank Unit). **Note**—Dials on first dash units have ivory lines, later units have ivory dots.

For complete data, refer to Carburetion Equip. Index.

BATTERY

BATTERY:—National Type HT-13. 6 volt, 13 plate, 77 ampere hour capacity (20 hour rate).

NOTE—When USL battery used, specifications same as for 1939 models (Type A-13).

Starting Capacity—90 amperes for 20 minutes.

Zero Capacity—300 amperes for 1.7 minutes.

Grounded Terminal—Negative (—) grounded to front frame cross-member. **Engine Ground**—Strap connector at front engine mounting on left side.

Location—On right side in engine compartment.

Dimensions—Length 9". Width 7". Hgt. 8 9/16".

(Pick-up Battery) Auto-Lite Type AB-13. 6 volt, 13 plate, 80 AH. Capacity (20 hour rate).

Starting Capacity—96 amperes for 20 minutes.

Zero Capacity—300 amperes for 2.0 minutes.

Dimensions—Length 9". Width 7". Hgt. 8⅝".

Grounded Terminal & Location—See above.

STARTER

Auto-Lite Model MZ-4064 & MZ-4082 (Pass. Cars & Pick-up), MZ-4049 & MZ-4083 (Panel Delivery), Armature No. MZ-2089.

Drive—Special Outboard Bendix #RC10HD.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—185 RPM, 150-175 amperes, 5 volts (Pass. Car & Pick-up), 216 RPM. 135-150 amperes, 5.35 volts (Panel Delivery).

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs	4300	5.5	70
2.65 " "	1325	5.0	200
4.95 " "	750	4.5	300
7.65 " "	220	4.0	400
7.8 " "	Lock	3.0	420
11.8 " "	Lock	4.0	560

Removal:—Starter flange mounted on right front face of rear motor support. To remove, take out two flange capscrews and one capscrew in bracket at commutator end, remove starter and switch.

Starting Switch (MZ-4064, 4082):—SW-3737S. Mounted on starter, cable operated by button on instrument panel. Pull required to close switch should be 2.3 lbs. min. (at right angles to hole at end of lever). **(MZ-4049, 4083)**—SS-4001. Magnetic switch mounted on starter, controlled by pushbutton on instrument panel. ***See article in Electrical Equipm't Section.***

GENERATOR

PASSENGER CARS

Auto-Lite Model GCJ-4811-A. (Passenger Cars). Armature GCJ-2006-F. Third brush control in conjunction with vibrating type Voltage Regulator.

Maximum Charging Rate—25 amperes (cold), 8.0 volts, 2500 RPM. Actual charging rate controlled by voltage regulator and dependent on battery condition. See Regulator data below.

Charging Rate Adjustment—See Regulator data. Third brush setting 2 commutator bars minus 2 mica strips minimum, 2 bars minus 1 mica strip maximum from insulated (nearest) main brush. Setting adjustable by removing commutator cover band and moving third brush by hand counter-clockwise to increase, clockwise to decrease output.

Cold Amperes	Volts	R.P.M.	Performance Data Hot Amperes	Volts	R.P.M.
0	6.4	760	0	6.4	850
4	6.65	920	4	6.7	1020
8	6.9	1080	8	7.0	1240
12	7.2	1240	12	7.3	1400
16	7.45	1400	16	7.6	1650
20	7.7	1580	20	7.9	2100
25	8.0	2500	22	8.0	2700

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—53 ozs. max. (new brushes).

Field Current—1.9-2.1 amperes at 6.0 volts.

Motoring Current—4.0-4.4 amperes at 6.0 volts.

Removal:—Conventional pivot mounting at right front of engine. To remove, take out mtg. bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, swing generator out until fan can be turned with belt stationary.

GENERATOR

PICK UP & PANEL DELIVERY

Auto-Lite GAM-4504-B. Armature GAM-2055. Third brush control.

Maximum Charging Rate—16.5 amperes (cold), 8.0 volts, 1950 RPM.

Charging Rate Adjustment—Remove commutator cover band, shift third brush by hand counter-clockwise to increase, clockwise to decrease output.

Cold Amperes	Volts	R.P.M.	Performance Data Hot Amperes	Volts	R.P.M.
0	6.4	720	0	6.4	720
4	6.8	880	4	6.9	900
8	7.2	1050	8	7.4	1160
12	7.6	1280	12	7.95	1700
16.5	8.0	1950	12.5	8.0	2000

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—18-22 ozs. (all brushes).

Field Current—3.89-4.31 amperes at 6.0 volts.

Motoring Current—4.08-4.52 amperes at 6.0 volts.

Removal & Belt Adjustment:—Same as above.

GENERATOR

SPECIAL EQUIPMENT

Auto-Lite GCS-4809-A. Armature GCS-2049F. Third third brush control type in conjunction with non-vibrating type two-charge Regulator. ***See Willys 48 (1939) article (preceding) for complete data***

REGULATOR

PASSENGER CARS

Auto-Lite Model VRR-4004-A (with GCJ-4811A Gen.) Voltage Regulator. Vibrating type.

For complete data, refer to Electrical Equipment Index.

Cutout Relay

Cuts In—6.4-6.6 volts.

Cuts Out—4.1-4.8 volts (approx. 4-6 amps. disch.).

Contact Gap—.015" minimum.

Air Gap—.031-.034" (hinge end of core with contacts open).

Voltage Regulator

Setting—7.3-7.6 volts at 70°F.

To Check (without breaking seal)—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at speed of 30 MPH. charging battery until voltage is constant. Voltmeter reading should be within limits of 7.3-7.6 volts (Cold—70°), 7.19-7.49 volts (Hot 110°F). See Electrical Equip. Sect.

To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.

Contact Gap—.012" min. (armature against stop).

Air Gap—.043-.052" with contacts just opening.

CUTOUT RELAY

PICK UP & PANEL DELIVERY

Auto-Lite Model CB-4025. (With GAM-4504B Gen.).

For complete data, refer to Electrical Equipment Index.

Cuts In—6.5-7.25 volts. **Cuts Out**— .5-2.5 ampere discharge current (after charging at 15 amperes). **Contact Gap** .015-.045". **Air Gap** .010-.030" (closed).

REGULATOR

SPECIAL EQUIPMENT

Auto-Lite Model TC-4317A (With GCS-4809A Gen.). Two-charge non-vibrating current regulator (in case with Cutout Relay). Same as used on 1939 Commercial Models. ***See Willys Model 48 (1939) article (preceding) for data on this model.***

LIGHTING

LIGHTING:—Headlamps—Corcoran-Brown pre-focused double filament type with upper and lower beams controlled by Beam Selector Foot Switch. **Headlamp Adjustment**—Aim upper beam straight ahead (hot spot center at lamp center height at 25'). **Beam Indicator**—Red jewel in upper edge of speedometer dial. Lighted when upper beams in use.

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ENGINE

CONTINUED FROM PRECEDING PAGE

sprocket and spring-loaded plunger in forward end of camshaft bearing against thrust stud on cover.

Timing Chain:—Link-Belt #82 (Willys #S-40936). Width 1". Pitch ½". Length 23½" or 47 links.

Camshaft Setting:—With #1 piston on top dead center, mesh chain so that timing marks on sprockets are adjacent and in line with a straightedge across the shaft centers.

VALVES:	Head Diam.	Stem Diam.	Length
Intake	1 17/32"	.372"	5 13/64" (5¾" overall)
Exhaust	1 15/32"	.371"	5 13/64" (5¾" overall)

	Seat Angle	Lift	Stem Clearance
Intake	45°	21/64"	.002-.004"
Exhaust	45°	21/64"	.003-.005"

NOTE—Exhaust valve seat inserts are used.

Valve Guides:—Removable. Installed with taper end up. Remove old guides from above and press in new guides until lower end extends ¾" below valve spring seat recess in block. Exhaust guide longer

Valve Springs:—Free length 2 11/16".

	Spring Pressure	Length
Valve Closed	46½ lbs.	2¼"
Valve Open	85½ lbs.	1 15/16"

Valve Lifters:—Mushroom type. Guide holes reamed directly in block. Serviced by reaming guide hole and installing lifters furnished .005", .010", .020" oversize. **Clearance**—.0007-.001".

VALVE TIMING

Tappet Clearance: .014" All Valves, Engine Cold (except first Panel Delivery with 440P Engine), .004" Intake, .006" Exhaust, Warm (First Panel Delivery). NOTE—Remove hand hole in left front fender splash shield for valve adjustment.

Valve Timing (440 Engine): See Camshaft Setting. NOTE—Does not apply to First Panel Delivery.
Intake Valves—Open 9° BTDC. Close 50° ALDC.
Exhaust Valves—Open 47° BLDC. Close 12° ATDC.
To Check Timing—Set tappet clearance #1 intake valve at .020". This valve should open with piston 9° or .039" before top dead center when flywheel mark 'I.O.' centered in inspection hole in right front face of rear motor support (¼" variation permissible. Reset tappet clearance at .014" Cold.

Valve Timing (440P Engine): See Camshaft Setting. NOTE—Applies only to First Panel Delivery
Intake Valves—Open TDC. Close 45° ALDC.
Exhaust Valves—Open 40° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #1 intake valve at .010" (cold). This valve should open with piston on top dead center when flywheel mark 'T.C. I.O.1-4' lines up with pointed end of inspection plate screw in inspection hole on left top face of flywheel housing. Reset tappet clearance at .004" warm.

LUBRICATION

LUBRICATION:—Pressure system. Gear type oil pump mounted on outer left side of crankcase.
Oil Pump Installation Note—Turn engine over until 'IGN' mark on flywheel lines up with indicator (inspection hole in top right surface of flywheel housing) with #1 piston on compression stroke, turn distributor shaft so that rotor is at #1 segment in distributor cap, mesh oil pump gear so that distributor not disturbed when coupling engaged.
Normal Oil Pressure:—75 lbs. (on gauge) at 30 MPH.
Oil Pressure Regulator:—Under plug on oil pump cover. Opens at 40 lbs. Adjustable by adding or removing shims within plug above spring.
Oil Pressure Gauge:—King-Seeley Electric. K-S No. **Dash Unit**—6275 (First Panel Delivery), 7860 (Other Models—with Ivory Lines), 8115 (Other Models—with Ivory Dots). **Engine Unit**—No. 6425 (All).
See Miscellaneous Section for complete data.
Crankcase Capacity—4 quarts.

COOLING

Water Capacity: 11 qts. (First Panel Delivery only), 11¾ qts. (All Other Models).
Water Pump:—Ball-bearing, packless type.
See Water Pump Section for complete data.
Removal—Drain water, remove fan belt and fan blades, loosen radiator mounting nuts, take out mounting bolts and lift pump out.
Thermostat:—Harrison. In outlet elbow on head. Starts to open 148-155°. Fully open at 173° F. NOTE Not used on First Pick-Up and Panel Delivery.
Temperature Gauge:—King-Seeley Electric. K-S No. **Dash Unit—No. 6632 (First Panel Delivery), 7140 (Later Panel Delivery), 7850 (Other Models—with Ivory Lines), 8110 (Other Models—with Ivory Dots). Engine Unit**—No. 5700 (First Panel Delivery with 6632 Dash Unit), No. 7000 (All Other Models).
NOTE—Engine Unit No. 5700 serviced by No. 7000 Dash Unit No. 6632 must also be replaced by No. 7140 when No. 7000 Engine Unit installed.
See Miscellaneous Section for complete data.

CLUTCH

CLUTCH:—Atwood Model TP 28-7 (Pass. Cars), Rockford UCLA-13-1098 (Pick-up & Panel Delivery). Single plate, dry disc type. No adjustment for wear required. NOTE—Borg & Beck driven member used
See Clutch Section for complete data.
Facings—Molded type (Pass. Car), Molded & Woven type (Pick-up & Panel Delivery). Inside Diam. 5⅛". Outside Diam. 7⅞". Thickness .125".

Adjustment:—Pedal free travel must be ¾-1" (providing 1/16" clearance between release bearing and release levers). To adjust, loosen locknut, turn clutch fork connecting cable.

Removal:—Remove Transmission (see Transmission Removal below) and flywheel bell housing, take out mounting screws in clutch cover, lift clutch out.

TRANSMISSION

TRANSMISSION:—Warner Model AS3-T84D (Speedway Pass. Cars, Pick-up & Panel Delivery), AS4-T84F (Deluxe Pass. Cars with Steering Column Gearshift). Constant-mesh, synchro-mesh, helical gears (Second & High), sliding spur gears (Low & Reverse). ***See Transmission Section for complete data.***

Transmission Control:—Own remote control type mounted on steering column. Std. on Deluxe Pass.
See Transmission Section for complete data.

Removal:—Cover front seat cushion and door trim. On Deluxe Pass. Cars, disconnect control rods at transmission. On all other models, disconnect gearshift lever at retaining collar. Disconnect accelerator pedal from rubber socket, remove toeboards, disconnect propeller shaft at front universal, remove bell housing hand hole cover and disconnect clutch throw-out bearing retracting spring. Remove lower nuts on engine mounting bolts at rear of transmission, jack up rear of engine (Caution—see that fan blades do not damage radiator) to clear frame cross-member, remove transmission mounting bracket, remove bell housing-to-transmission bolts, pull transmission straight back and lift out.

UNIVERSALS

UNIVERSAL JOINTS:—Detroit Series 4100. Needle bearing, Ball-and-trunnion type. Two used.
See Universals Section for complete data.

REAR AXLE

REAR AXLE:—Own Model 440 (Pass. Cars), Spicer (Salisbury) Model 21-1 (Pick-up & Panel Delivery). Semi-floating, spiral bevel gear type with Hotchkiss drive. ***See Rear Axle Section for complete data.***
Ratio—4.3-1 (Speedway), 4.55-1 (Deluxe), 4.7-1 (Pick-up), 5.1-1 (Panel Delivery).
Backlash—.004-.008". Shim adjustment.
Removal:—Hoist rear of car. Disconnect drive shaft at rear universal, brake tube and cables, shock absorbers, spring U-bolts, rear spring shackles. Pull axle assembly out toward rear.
Wheel Bearing Adjustment:—To adjust, remove wheel, hub assembly, oil seal and bearing retainer. Remove shims from between retainer and backing plate to decrease endplay. **Endplay**—.004-.006"

SHOCK ABSORBERS

SHOCK ABSORBERS:—Monroe or Gabriel (Pass. Cars), Monroe (Pick-up & Panel Delivery). Direct acting

FRONT SUSPENSION

Front Suspension:—Own Model 440 Front Axle. Conventional type with 'I' beam section and Reverse-Elliott ends.
Kingpin Inclination—7½° crosswise.
Caster—3°. Adjustable by installing wedge shims between spring and spring pad on axle.
Camber—2°. Not adjustable.
Toe-In—1/16-⅛". Adjustable by loosening tie rod clamp bolts and turning tie rod.
Steering Geometry (toe-out on turns)—With outer wheel turned 20°, inner wheel should turn 23°15'.

STEERING GEAR

Steering Gear: Passenger Cars—Gemmer Model 250. Worm-and-Roller type. **Pickup & Panel Delivery**—Gemmer Model 120. Worm-and-Sector type.
See Steering Gear Section for complete data.

BRAKES

BRAKES (PASS. CARS):—Service—Bendix (Lockheed) Hydraulic, double anchor type. Hand lever applies rear wheel service brakes.
See Brake Section for complete data.
Drums—Alloy cast iron. Diameter 9".
Lining—Molded type. Width 1¾". Thickness 3/16". Length 18⅝" per wheel.
Clearance—.010" toe, .005" heel for each shoe.
Hand Brake:—See Service Brakes above.

BRAKES

BRAKES (PICK-UP & PANEL DELIVERY):—Service. Bendix Mechanical, Duo-servo, Single Anchor. Hand lever applies all service brakes.
See Brake Section for complete data.
Drums—9" Pressed Steel (Pick-up), 11" alloy iron (Panel Delivery).
Lining—Molded & Woven type (Pick-up), Molded (Panel Delivery). Width 1¾". Thickness 3/16". Length per wheel 19 3/16" (Pick-up), 23 15/16" (Panel Delivery).
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes above.

CARBURETOR

CARBURETION:—Carburetor—Carter Type WO Model 507-S (No. 229 cast on face of flange). 1¼" single barrel, downdraft type.

For complete data, refer to Carburetor Index.

Idle Adjustment—If preliminary adjustment required (to warm up engine), turn idle adjusting screw in until just seated, then turn screw out 1¼ turns, start engine and run until warm. With engine warm, set throttle stopscrew for slightly faster than normal idling speed, turn idle adjusting screw out until engine begins to roll, then turn screw in until engine fires smoothly. Final setting should be 1-1½ turns open. Adjust throttle stopscrew for 8 MPH idle speed pulling in high gear.

Accelerating Pump—No seasonal adjustment.

Float Level—⅜" from top of float to gasket seat on cover with needle valve seated (invert to check—do not compress spring in valve stem).

Metering Rods & Jets—***See Carter Jet Table in Carburetor Section for complete data.***

Fast Idle:—Choke valve inter-connected to throttle valve to open throttle to fast idle position with choke valve in use.

CARB. EQUIPMENT

Air Cleaner:—AC #1529870 oil-wetted type Std., #1529769 heavy duty oil-bath type Optl. Replacement Filter Element Assembly Type #1 (Std.). Type #9 (heavy duty).

Fuel Pump:—AC 'AF' No. 1537320. Exchange Pump Type 538. Diaphragm type.

For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge:—King-Seeley Electric type. K-S Nos.

Dash Unit—No. 8186 (1941—except Panel Delivery), 40140 (1942—except Panel Delivery), 8895 (1941-42 Panel Delivery).

Tank Unit—No. 8318 (1941-42 except Panel Delivery), No. 8484 (1941-42 Panel Delivery).

For complete data, refer to Carburetion Equip. Index.

BATTERY

BATTERY:—Auto-Lite, Type AB-13. 6 volt, 13 plate, 80 ampere hour capacity (20 hour rate).

Starting Capacity—96 amperes for 20 minutes.

Zero Capacity—300 amperes for 2.0 minutes.

Grounded Terminal—Negative (—) grounded to front frame cross-member. **Engine Ground**—Strap connector at front engine mounting on left side.

Dimensions—Length 8 15/16". Width 7". Hght. 8⅝".

Location—In engine compartment on right side.

STARTER

STARTER:—Auto-Lite. For each model as follows:

Americar, Plainsman, Pickup (Early 1941)..MZ-4093
Americar, Plainsman, Pickup (Late 1941)....MZ-4099
Americar, Pickup (1942).....MZ-4109
Panel Delivery (Early 1941).....MZ-4049
Panel Delivery (Late 1941 & 1942).....MZ-4100

Armature—Auto-Lite No. MZ-2089 (All Models).

Drive—Two types used: Special Outboard Bendix No. RC10HD (MZ-4049 & MZ-4093), Special Barrel Type Bendix No. A-2233 (MZ-4099, MZ-4100, MZ-4109).

NOTE—Later type Bendix, No. A-2233, can be used in servicing starters originally equipped with the No. RC10HD Bendix Drive.

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—185 RPM, 150-175 amps., 5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 "	2500	5.5	100
2.65 "	1325	5.0	200
4.95 "	750	4.5	300
7.65 "	220	4.0	400
7.8 "	Lock	3.0	420
11.8 "	Lock	4.0	560

Removal:—Starter flange mounted on right front face of rear motor support. To remove, take out two flange capscrews and one capscrew in bracket at commutator end, remove starter and switch as an assembly.

Starting Switch (MZ-4093, 4099, 4109): Auto-Lite No. SW-3737S. Mounted on starter and cable operated by button on instrument panel. Pull required to close switch should be 2.3 lbs. min. (at right angles to hole at end of lever).

(MZ-4049, 4100)—Auto-Lite No. SS-4001. Magnetic switch mounted on starter and controlled by push-button on instrument panel.

For complete data, refer to Electrical Equipment Index.

GENERATOR

STANDARD

GENERATOR:—Auto-Lite GCJ-4811-A. Armature GCJ-2006-F. Third brush control in conjunction with vibrating type voltage regulator. Ventilated by fan on drive pulley.

Maximum Charging Rate—25 amperes (cold), 8.0 volts, 2500 RPM. Actual charging rate controlled by voltage regulator and dependent on battery condition. See Regulator data below. When checking generator output, ground 'F' terminal to eliminate regulator action.

Charging Rate Adjustment—See Regulator data. Third brush setting 2 commutator bars minus 2 mica strips minimum, 2 bars minus 1 mica strip maximum from insulated (nearest) main brush. Setting adjustable by removing commutator cover band and moving third brush by hand counter-clockwise to increase, clockwise to decrease output. Maximum output given above must not be exceeded.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	760	0	6.4	850
4	6.65	920	4	6.7	1020
8	6.9	1080	8	7.0	1240
12	7.2	1240	12	7.3	1400
16	7.45	1400	16	7.6	1650
20	7.7	1580	20	7.9	2100
25	8.0	2500	22	8.0	2700

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.9-2.1 amperes at 6.0 volts.
Motoring Current—4.0-4.4 amperes at 6.0 volts.

Removal:—Conventional pivot mounting at right front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Loosen pivot and clamp bolts, swing generator out until fan can be turned with belt stationary.

GENERATOR

SPECIAL EQUIPMENT

SPECIAL GENERATOR (PICK-UP & PANEL DELIVERY):—Auto-Lite GCS-4109A-5, Armature GCS-2049-F. Used with Two-charge (non-vibrating) Regulator Model TC-4317-A. If this equipment used on 1941-42 models, ***refer to 1939 Willys Model 48 article (preceding) for data on this model.***

REGULATOR

REGULATOR:—Auto-Lite VRR-4004A. Voltage type. In single case on engine side of dash.

For complete data, refer to Electrical Equipment Index.

Cutout Relay

Cuts In—6.4-6.6 volts.
Cuts Out—4.1-4.8 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator

Setting—7.3-7.6 volts at 70° F. See Electrical Equipment Section for settings at other temperatures.
To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal (use short heavy leads), voltmeter between 'B' terminal and ground. Operate generator at speed equivalent to 30 MPH., charging fully charged battery, until voltage is steady. Voltage reading should agree with setting given above.
To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

LIGHTING

LIGHTING:—**Headlamps**—Corcoran-Brown pre-focused double filament type with upper and lower beams controlled by Beam Selector Switch on toeboard.
Headlamp Adjustment—With upper beam lighted and car 25' from screen, aim each headlamp so that beams centered on vertical line directly ahead of lamp center, and upper edge at horizontal line at lamp-center height, with lamp door and lens in place. To adjust, remove door and lens, turn 3 adjusting screws on reflector rim.
Beam Indicator—Red jewel in upper edge of speedometer dial. Lighted when upper beams in use.

Switches

Lighting—Douglas No. 5864.
Beam Selector—Douglas.
Instrument—Douglas.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-21	2320
Parking	1.5	55
Instrument, Beam Ind.	1	51
Stop & Tail	21-3	1158
Dome, License Plate	3	63

MISC. ELECTRICAL

FUSES:—Lighting—20 ampere. On lighting switch.
Overdrive Control Relay—20 ampere. On Overdrive Control Relay.

HORN:—Schwarze. Vibrating, disc type.
Horn Current—8 amperes.

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CLUTCH

CLUTCH:—Atwood Model TP28-7 (Americar), TP28-7-1 (Pick-up & Panel Delivery). Single plate, dry disc type with new hydraulic type dampener.

NOTE—Atwood Driven Member with hydraulic type dampener used on all Passenger Cars and some 1941 Pick-up and Panel delivery. Borg & Beck Driven Member used on some 1941 and all 1942 Pick-up and Panel Delivery.

See Clutch Section for complete data.

Facings—Moulded, 2 required. Inside Diameter 5⅛". Outside Diameter 7⅞". Thickness .125".

Adjustment:—Pedal free travel ¾-1" (provides 1/16" clearance between release bearing & release levers). To adjust, change length of clutch fork connecting cable.

Removal:—Remove Transmission (see below) and flywheel bell housing. Take out mounting screws in clutch cover. Remove clutch assembly.

TRANSMISSION

TRANSMISSION:—Warner. Model AS5-T84G. All helical gear type with synchro-mesh (second and high), sliding gear (low & reverse). Overdrive with electrical 'kick-down' control Std. on Plainsmen, Optl. on other Americar models.

NOTE—Pick-up and Panel Delivery transmission equipped with shielded bearing on main drive gear.

See Transmission Section for complete data.

Transmission Control:—Mechanical steering col. shift.

See Transmission Section for complete data.

Removal:—Disconnect accelerator pedal from rubber socket, remove toeboards. Disconnect control rods at transmission and front universal. Remove bell housing hand hole cover and disconnect the clutch throw-out bearing retracting spring. Remove lower nuts on engine mounting bolts at rear of transmission, jack up rear of engine (CAUTION—See that fan blades do not damage radiator) to clear frame cross-member. Remove transmission mounting bracket and bell housing-to-transmission case bolts. Pull transmission straight back and lift out. **Overdrive Removal**—Same as above plus the following: Disconnect solenoid wires and overdrive control cable at transmission. Remove overdrive rear support by taking out bolts at frame ends. NOTE—When installing overdrive rear support, install equal number of shims between frame and each end of support until bottom of overdrive case just touches rubber insulator, then remove shims equal to 3/16" thickness from each end of support to give proper compression of insulator.

OVERDRIVE

Warner Type R7. Overdrive with electrical "kick-down" control. Used with special Overdrive Transmission as Optl. Equipment on 1941-42 Passenger Car models.

See Transmission Section for complete data.

Overdrive Solenoid—Delco-Remy No. 1569.

Throttle Switch—Cole-Hersee No. 9016. Adjust position of switch on bracket so that switch plunger just contacts end of accelerator rod (max. clearance 1/32") when carburetor throttle is wide open.

Overdrive Relay—Auto-Lite Model HR-4201AS.

Removal: Same as standard transmission (above) except that lock-out control and wires on transmission solenoid must be disconnected first.

UNIVERSALS

UNIVERSAL JOINTS:—Detroit Series 4100. Ball-and-trunnion type with needle bearings. 2 used.

See Universals Section for complete data.

REAR AXLE

PASSENGER CARS

REAR AXLE (AMERICAR PASS. CARS):—Own Model 441 (1941), 442 (1942). Semi-floating, hypoid gear type with Hotchkiss drive.

See Rear Axle Section for complete data.

Ratio—4.44-1 Std. No Optl. ratios.
Backlash—.006-.008". Shim adjustment.

Removal:—Hoist rear of car. Disconnect rear universal, brake tube and cables, shock absorbers, spring U-bolts, rear spring shackles. Pull assembly to rear.

Wheel Bearing Adjustment:—To adjust, remove wheel, hub assembly, oil seal and bearing retainer. Remove shims from between retainer and backing plate to decrease endplay. **Endplay**—.004-.006" total.

REAR AXLE

PICK UP & PANEL DELIVERY

REAR AXLE (PICK-UP & PANEL DELIVERY):—Spicer (Salisbury) Model 21-1 (1941 All Trucks, 1942 First 500 Trucks), Model 41-4 (1942 After first 500 Trucks). Semi-floating, spiral bevel gear (Model 21-1), hypoid gear (Model 41-4) type with Hotchkiss drive.

See Rear Axle Section for complete data.

Ratio—4.9-1 (Model 21-1), 4.82-1 (Model 41-4).
Backlash—.006-.008". Shim adjustment.

Removal & Wheel Bearing Adjustment:—Same as for Americar passenger cars (see data above).

SHOCK ABSORBERS

SHOCK ABSORBERS:—Monroe. Hydraulic (permanently sealed assembly), direct acting, adjustable type. Part No. for each model as follows:

	Front		Rear	
	Monroe No.	Willy	Monroe	Willys
Std.①	639022	11422	639008	11425
Hvy. Dty.①	639187	11429	639188	11430
Comm'l.②	639187	11429	639537	11434

①—Passenger Car. ②Pick-up & Panel Delivery.

See Shock Absorber Section for complete data.

FRONT SUSPENSION

Front Suspension:—Own Model 441 (1941), 442 (1942) Front Axle. Conventional 'I' beam section with Reverse-Elliott ends.

Kingpin Inclination—7½° crosswise.

Caster—3°. Adjustable by installing wedge shims between spring and spring pad on axle.

Camber—2°. Not adjustable.

Toe In—1/32-5/32". Adjustable by loosening tie rod clamp bolts and turning tie rod.

Steering Geometry (toe-out on turns)—With outer wheel turned 20°, inner wheel should turn 23°15'. Not adjustable (check for bent steering arms).

STEERING GEAR

Steering Gear: Ross Model T-12. Cam-and-Twin Lever type.

See Steering Gear Section for complete data.

BRAKES

BRAKES (ALL MODELS):—Service. Bendix (Lockheed) hydraulic, double anchor type. Hand lever applies rear wheel service brakes.

See Brake Section for complete data.

Drums—Nickel chromium alloy iron. Diameter 9".

Lining—Moulded type. Width 1¾". Thickness 3/16". Length per wheel 18⅝ (1941), 16 53/64" (1942).

Clearance—.008" toe (top), .005" heel, for each shoe.

Braking Power—43% rear wheels, 57% front.

Hand Brake:—See Service Brakes above.

rock shaft back and forth until drive lug on end of shaft enters slot in drive coupling, push distributor down into place and install hold-down screw. Check Ignition Timing.

CAUTION—If Oil Pump removed, refer to Oil Pump Installation directions in Willys Shop Notes.

IGNITION TIMING

Std. Setting	Flywheel Degs.	Piston Position
Regular Fuel	5° BTDC	.010" BTDC.
Low Octane Fuel	At TDC	.000" TDC.

NOTE—Set timing as specified in accordance with Octane Rating of fuel customarily used.

►**Timing Mark Change**—Flywheel marked "5°" (replacing "IGN/") starting Engine No. 175402.

Timing—With #1 piston on compression, turn crankshaft until piston reaches firing position (see Timing Table above), with flywheel mark "IGN" (5° BTDC setting) or "TC" (At TDC setting) centered in inspection hole in right front face of flywheel housing below starter. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open (press rotor clockwise to eliminate backlash), tighten clamp bolt. See that rotor is at #1 segment in distributor cap and check spark plug cable connections (see diagram).

Timing (Using Timing Light—Engine Idling)—This method recommended by manufacturer. Direct timing light on flywheel, idle engine (engine must be warm), adjust distributor (as directed above) until timing mark is centered in inspection hole.

CARBURETOR

Carter WO Type 636SA superseding 596S & 636S. 1⅛" Single Barrel, downdraft, with manual choke control (interconnected with throttle to provide fast idle).

NOTE—Carburetor may be identified by Casting Number 458 (596S), 505 (636S) on face of flange.

See Carburetor Section for complete data.

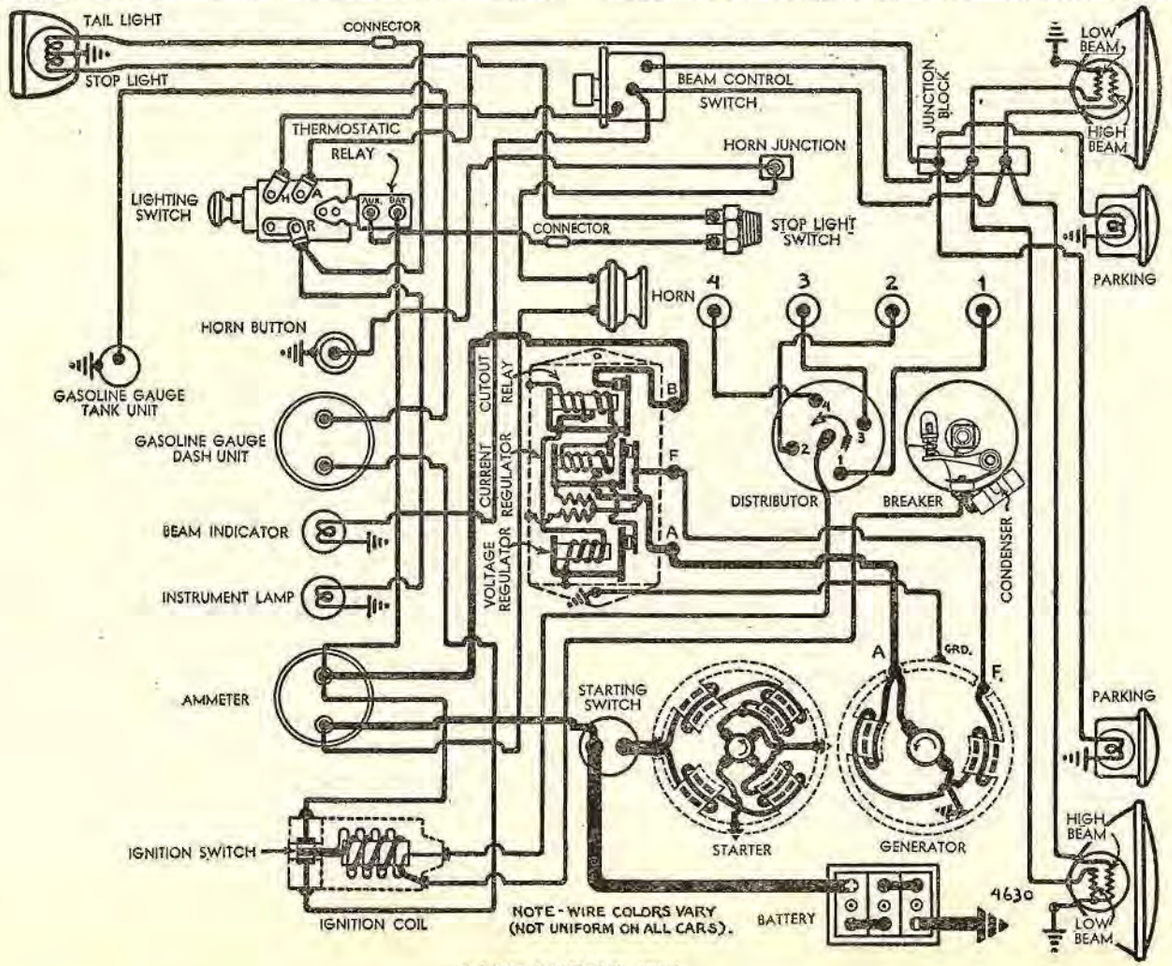
Idle Adjustment—With engine warm (choke valve wide open and fast idle inoperative), set throttle stopscrew for idling speed of 600 Engine RPM or 8 MPH. Turn idle adjusting screw out until engine begins to roll, then turn screw in until engine fires smoothly. Final setting of idle screw should be 1-2 turns open. Recheck idle speed.

Accelerating Pump—No seasonal adjustment.

Float Level—⅜" from top of float at free end to machined surface (gasket seat) on cover with valve seated. To check, invert assembly and allow float to hang freely. Do not compress spring in valve stem.

Metering Rods & Jets—***See Carter Jet Table in Carburetor Section for complete data.***

Fast Idle: Choke valve interconnected with throttle valve to open throttle to fast idle position when choke in use. No adjustment required.



LATER CIVILIAN JEEP

CARB. EQUIPMENT

Governor (Special Equip.): King-Seeley "Handy" Model 26510-400 (CJ-2A), 26510-354 (CJ-3A) Monarch or Novi Governors. Centrifugal types. Mounted on left front corner of cylinder head and driven by special belt from the crankshaft.

Setting—1000 to 2600 RPM of engine in steps of 200 RPM (in accordance with position of dash control lever which has nine settings).

Adjustment—***See Willys Shop Notes for directions.***

Air Cleaner: Oakes Model No. 613300. Oil-bath type. **Servicing**—Clean and refill oil reservoir to indicated level with same grade engine oil used in crankcase at 2000 mile intervals (when crankcase drained), or more often if required by operating conditions (twice daily for extremely dust field conditions).

Fuel Pump: AC Type AF No. 1538886 Diaphragm type (Std.), AC Type AM No. 1537409 (CJ-2A), No. 1539353 (CJ-3A) combination fuel-and-vacuum pump.

Replacement Pump—AC No. 572 (1538886), 7409 or 9306 (1537409), 9353 (1539353).

See Carburetion Equipment Section for data.

Pressure—3 lbs. (4½ lbs. max. at 1800 RPM).

Gasoline Gauge: Auto-Lite (Motometer) elec. type.

Dash Unit—Auto-Lite No. NG-10764D.

Tank Unit—Auto-Lite No. NG-10762T.

See Carburetion Equipment Section for data.

CRANKCASE VENTILATOR

Sealed Positive Ventilation Type. Consists of Air Intake Pipe from Air Cleaner to Crankcase Oil Filler (Oil Filler Cap has gasket and must seat tightly to prevent air leaks at this point) and Air Outlet Pipe from Valve Chamber Cover to Intake Manifold. There is a Vacuum Valve at the manifold connection and this valve must close at idling speed for satisfactory engine idling performance.

Servicing—Make certain that connecting pipes are tight and that oil filler cap gasket seals cap tightly. Remove and clean control valve when tuning engine or whenever system does not operate satisfactorily.

Vacuum Control Valve: Remove control valve by disconnecting pipe at valve chamber cover and unscrewing valve from manifold, clamp valve in vise and remove top of housing, withdraw valve and spring. Clean valve and valve seat thoroughly. Reassemble and re-install unit.

CONTINUED ON NEXT PAGE

ENGINE

CONTINUED FROM PRECEDING PAGE

diameter and is diamond-bored and tin-plated.
Pin Fit in Piston—.0001-.0005" clearance or light thumb push fit with piston and pin at 70°F.

Replacement Pins: No oversizes are available.

CONNECTING ROD: Length—9.1845-9.1905". **Weight**—39.41 ozs.

Crankpin Journal Diameter—1.9385-1.9375". *See "Original Bearing Sizes" in Willys Special Data.*

Lower Bearing—Steel-backed, babbitt-lined, replaceable type. **CAUTION**—Oil spray hole in upper half of bearing must line up with oil spray hole in rod.

Clearance—.0005-.0025". **Sideplay**—.004-.010".

Bearing Adjustment: None (no shims). Replace bearings. Do not file connecting rods or bearing caps. *See Willys Shop Notes for "Palnut" installation.*

NOTE—Replace bearings when clearance exceeds .005" or sideplay exceeds .013".

Replacement Bearings: Furnished Standard & .010", .020", .030" Undersize.

Installing Rods: Lower bearing offset. Install rods with short side of bearing toward nearest main bearing or toward front of engine (#1, 3), toward rear (#2, 4). Oil spray hole in lower end of rod toward right of engine (away from camshaft) on all rods.

CRANKSHAFT: Three bearing type with integral counterweights (up to Jeep Engine Number 55137), removable counterweights (after above no.).

Journal Diameters—2.3340" (all bearings). *See "Original Bearing Sizes" in Willys Shop Notes.*

Bearings—Steel-backed, babbitt-lined, replaceable type. Bearing shells are dowelled in bearing caps and crankcase.

Clearance—.001-.0025" (.0005-.001" new).
NOTE—Replace bearings when clearance exceeds .006" or when endplay exceeds .018".

Bearing Adjustment: None (no shims). Replace bearings. Do not file bearing caps. *See Crankshaft Servicing instructions in Willys Shop Notes.*

NOTE—Engine must be removed from chassis for bearing replacement and crankshaft servicing. *See Engine Removal Instructions in Willys Shop Notes.*

Replacement Bearings: Furnished Standard & .010", .020", .030" Undersize.

End Thrust: Taken by flanged faces of #1 (front) bearing. Adjustable by adding or removing shims between crankshaft sprocket thrust washer and sprocket. NOTE—Crankshaft sprocket must be removed with a gear puller in order to make endplay adjustments. Adjusting shims furnished .002", .004", .010" and .030" thick.

Endplay—.004-.006".

FLYWHEEL: Removal—*See Willys Special Data.*

CAMSHAFT: Four bearing. Non-adjustable chain drive (first), helical gear drive (later).
Journal Diameters—#1, 2.188"; #2, 2¼"; #3, 2 3/16"; #4, 1¾".
Bearings—Removable steel-backed, babbitt-lined bushing (front), machined in crankcase (all others).
Clearance—.002-.0035". Service limit .006" (front), .008" (all others).
Camshaft Removal—*See Willys Shop Notes for data.*

End Thrust (for Engines with Timing Chain Drive): End thrust taken by thrust washer behind camshaft sprocket and spring loaded plunger in forward end of camshaft which bears against stationary thrust pin on chain case cover. NOTE—Make certain that plunger and spring are in place when installing chain case cover.

End Thrust (for Engines with Timing Gear Drive): Taken by thrust plate assembled behind gear with a spacer assembled behind plate. If required, a thin shim can be installed behind spacer if too little clearance, or spacer can be dressed to provide greater clearance.
Endplay—.003-.0055".

►**Timing Case Cover (& Front Oil Seal) Change:** *See "Crankshaft & Main Bearings" in Willys Shop Notes.*

►**Timing Chain (to Jeep Engine Number 44417):** Link-Belt, non-adjustable. Width 1". Pitch ½". Length 23½" or 47 links.

►**Timing Gears (after Jeep Engine Number 44417):** Crankshaft gear cast iron. Camshaft gear Fibre with steel hub.

►**NOTE—Jeep Engine with Timing Gears carry engine mark "J" ahead of engine number.**

Timing Gear Backlash—.000-.002".

Camshaft Setting (First Cars with Timing Chain): With #1 piston on top dead center, mesh chain with marks on sprockets adjacent and in line with a straightedge across the shaft centers.

NOTE—Camshaft sprocket mounting screw holes offset to insure correct position of sprocket on shaft.

Later Cars (With Timing Gears)—Mesh gears with marked tooth of camshaft gear opposite marked space between gear teeth on crankshaft gear.

VALVES:	Head Diam.	Stem Diam.	Length
Intake	1 17/32"	.373"①	5 3/4"
Exhaust	1 15/32"	.3725"②	5 13/16"

①—.372-.373". ②—.371-.372" (1950 Models).

	Seat Angle	Lift	Stem Clearance
Intake	45°	23/64"	.0015-.00325"
Exhaust	45°	23/64"	.0025-.0045"

Valve Guides: Removable type. Remove guides from above with puller, install new guides with driver or press guides down in place to following dimensions:
Intake Guide—Top of guide 1 5/16" below top face of block. The shorter smaller-diameter section end of the guide should be up.
Exhaust Guide—Top of guide 1" below top face of block. Taper end (counter-bored end) of guide should be up.

Valve Springs: Install springs with closed-coil end up toward cylinder block. Spring free length 2½".

	Spring Pressure	Spring Length
Valve Closed	53 lbs.	2 7/64"
Valve Open	120 lbs.	1 3/4"

Valve Lifters: Mushroom type operating in reamed holes in block. Serviced by installing oversize lifters. Lifters furnished .004" Oversize.

Lifter Diameter—.6240-.6245".

Lifter Clearance—.0005-.002".
NOTE—Camshaft must be removed for lifter removal.
See Camshaft Removal instructions in Willys Shop Notes.

VALVE TIMING

Tappet Clearance: .016" All Valves, Hot or Cold.
NOTE—Tappet adjusting screws are "self-locking" type (no locknuts).

Valve Timing: See Camshaft Setting (above).
Intake Valves—Open 9° BTDC. Close 50° ALDC.
Exhaust Valves—Open 47° BLDC. Close 12° ATDC.

►**Timing Mark Change (starting CJ-2A Jeep Engine No. 175402)**—Flywheel marked "5°" (for 5° BTDC.) and "T.C." (top dead center). "I.O." mark not carried and intake opening point on these engines must be estimated.

Valve Timing Check—Set tappet clearance #1 intake valve at .020". This valve should open with #1 piston 9° or .039" before top dead center with flywheel mark "I.O." centered in inspection hole on right front face of flywheel housing below starter. Reset tappet clearance to .016" running clearance.

LUBRICATION

Engine Oiling System: Pressure to main and connecting rod bearings, camshaft bearings, and timing chain or timing gears. Oil pump mounted externally on left hand side of crankcase.
Crankcase Capacity—4 qts. (refill), 5 qts. (dry or whenever oil filter drained).

Normal Oil Pressure—40-50 lbs. (35 lbs. at 30 MPH., 10 lbs. at idling speed of 600 RPM).

NOTE—On first Universal Jeep, 50 lbs. gauge pressure equivalent to 25 lbs. actual pressure (oil pressure relief valve opens at 25 lbs.).

►**Oil Pressure Regulator (Early Universal Jeep)**—Under plug on oil pump cover. Opens at 25 lbs. (50 lbs. gauge pressure). Adjustable by adding or removing shims located above spring in plug.

►**Oil Pressure Regulator (Later Universal Jeep)**—Under plug on side of pump housing. Opens at 35 lbs. Adjustable by adding or removing shims located above spring in plug.

►**Oil Pump (up to Jeep Engine Number 44417):** Planetary gear type mounted on left side of crankcase.
Oil Pump Servicing—*See Willys Shop Notes.*

►**Oil Pump (after Jeep Engine Number 44417):** Rotor type pump mounted on left side of crankcase.
Oil Pump Servicing— *See Willys Shop Notes.*

Oil Filter: Purolator. On cylinder head bracket at right front corner of cylinder head with oil outlet connected to top of timing chain cover.
CAUTION—Filter should be drained at each crankcase oil change (2000 mile intervals) and filter element replaced at 8000 mile intervals for normal service.

Oil Pressure Gauge: Auto-Lite No. G-10763. Bourden tube type (not electric).

COOLING

Cooling System: Pressure type with pressure valve (relief valve) in filler cap.
Capacity—11 quarts with standard radiator.
NOTE—Special "Hot Climate" radiator Optl.
Pressure Valve—AC No. 846709 (Radiator Filler Cap). Opens at 3¾ lbs. (3¼-4¼ lbs.).

Water Pump: Centrifugal, packless, ball bearing type. *See Water Pump Section for complete data.*

Pump Removal—Loosen drive belt adjustment and remove belt, disconnect hose, remove pump mount-

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REAR AXLE

FULL-FLOATING TYPE
CJ-2A UP TO SERIAL NO. 13453

Spicer (Salisbury) Model 23-2. Full-floating, hypoid gear type with Hotchkiss Drive. NOTE—This axle used on first Universal Jeep models.

See Rear Axle Section for complete data.

Ratio—5.38-1 Std.

Backlash—.005-.007". Shim adjustment.

Removal: Support rear end of car securely with a chain hoist and support placed under frame ahead of rear springs, remove rear wheels. Disconnect rear shock absorbers, rear brake line (at frame connection), and propeller shaft by removing universal joint "U" bolts at axle end of shaft. Place support jacks under axle housing so that springs relieved of weight, remove nuts on spring center clip "U" bolts, remove pivot bolts at front end of springs and lower the springs, remove axle assembly from beneath the car.

INSTALLATION CAUTION—Bleed brake lines after axle re-installed and brake lines connected.

Spring Shackle & Pivot Pin Installation—*See "Spring Shackles" in Willys Shop Notes.*

Axle Shaft Removal: Remove six capscrews and washers holding axle shaft driving flange on wheel hub, thread two of these screws into "extra" holes (between regular mounting screw holes) and turn screws up evenly to pull axle shaft out, withdraw axle shaft from housing.

Wheel Bearing Adjustment: Remove the six axle shaft flange screws, turn two of these screws into "extra" holes in flange to start shaft, withdraw axle shaft. Adjust bearings in same manner as front wheels (above). When re-installing axle shaft, make certain that gasket installed under flange.

REAR AXLE

SEMI-FLOATING TYPE
CJ-2A AFTER SERIAL NO. 13453 & ALL CJ-3A

Spicer (Salisbury) Model 23-1 or 41-2. Semi-floating, hypoid gear type with Hotchkiss Drive.

See Rear Axle Section for complete data.

Ratio—5.38-1.

Backlash—.004-.008". Shim adjustment.

Removal: Support rear end of car securely with a chain hoist and supports placed under frame ahead of rear springs. Remove wheels. Disconnect rear shock absorbers, rear brake line (at frame connection), and rear brake cables and conduits. Disconnect propeller shaft at rear universal joint. Place support jacks under axle housing so that springs relieved of all weight, remove nuts on spring center clip "U" bolts, remove pivot bolts on front end of springs and lower springs, remove axle assembly from beneath car.

INSTALLATION CAUTION—Bleed brake lines after axle re-installed and brake lines connected.

Spring Shackle & Pivot Pin Installation—*See "Spring Shackles" in Willys Shop Notes.*

Axle Shaft Removal: Remove wheel, hub cap, and axle shaft nut. Use wheel puller to remove wheel hub. Disconnect brake line at wheel cylinder and parking brake cable. Take out bolts mounting backing plate, remove dust shield, oil seal and brake backing plate (CAUTION—Do not lose wheel bearing adjusting shims located between backing plate and axle housing flange). Pull axle shaft and bearing assembly out of the housing.

Wheel Bearing Adjustment: Bearing endplay controlled by shims between backing plate and axle housing flange. To adjust, remove wheel hub and backing plate (see Axle Shaft Removal above), add or remove shims between backing plate and housing flange for correct endplay. NOTE—In original production, shims used only at **left** hand end of axle housing. Shims may be installed at right hand end of axle housing, if required, for correct clearance with new axle shaft.

Endplay—.003-.005".

SHOCK ABSORBERS

Delco—Model 1030-K (Front), 1031-K (Rear).

Monroe—Model K-11436 (Front & Rear).
Direct acting, hydraulic types. Shock absorbers on first cars are adjustable.

Adjustment: Remove mounting bolt at lower end, fully collapse shock absorber by pressing up on lower end until adjusting key within unit engages slot in adjusting plate (can be determined by feel), turn unit in clockwise direction until limit of adjustment is reached (full range of adjustment is four turns), back off adjustment by turning unit counter-clockwise **exactly two turns** for standard setting. CAUTION—See that adjusting key does not slip out of engagement with slot while making adjustment.

NOTE—Later type shocks not adjustable.

Refilling: Requires dismantling of unit. ***See Shock Absorber article in Shock Absorber Section for data.***

NOTE—Later type shocks not refillable.

FRONT SUSPENSION

Front Axle: Spicer (Salisbury) Model 25. Special full-floating driving unit. ***See Front Axle data (above).***

Front Suspension: Special front-wheel drive unit with semi-elliptic springs. Steering knuckle mounted on taper roller bearings carried on two stub shafts in spindle housing.

Endplay—.001-.003".

Steering Knuckle Bearing Servicing & Adjustment: ***See Front Axle data (above).***

Kingpin Inclination—7½° crosswise.

Caster—3°. No adjustment. If caster incorrect, check entire front end and correct by installing new parts.

Camber—1½°. No adjustment. Correct by installing new parts. Do not attempt to correct camber by cold bending or heating of parts.

Toe In—3/64-3/32" (1/32" each wheel). To adjust, first set each front wheel straight ahead (see Note below), then set toe in by shortening each tie rod approximately ½ turn. This procedure necessary to maintain correct position of steering idler arm.

NOTE—To set front wheels straight ahead, first set tie rod end of steering bell crank (idler lever on frame front cross-member) exactly at right angles to front axle. Check front wheels by using a straight edge or sighting along rear and front wheels. Adjust each tie rod (loosen end clamp bolts and turn rod) until front wheels are exactly straight ahead. Then make toe in adjustment as directed above. Tie rod lengths between ball end centers should be 20⅞" (left), 25⅝" (right).

Steering Geometry—With inner wheel turned 20°, outer wheel should be turned exactly 18°30'.

STEERING GEAR

Steering Gear: Ross Model T-12, Cam-and-Twin Lever type.

See Steering Gear Section for complete data.

BRAKES

Service Brakes: Bendix (Lockheed) Four wheel, Hydraulic, Double anchor type. Hand lever applies independent brake on drive shaft at rear of transfer case.

See Brake Section for complete data.

Drum Diameter—9".

Lining—Width 1¾". Thickness .206-.216". Length per shoe 10 7/32" (forward shoes), 6 39/64" (rear shoes). NOTE—Manufacturer recommends use of new or replacement shoe assemblies with factory-installed linings.

Clearance—.008" toe, **.005"** heel, for each shoe.

Hand Brake: Mechanical type. Two-shoe, internal expanding type with drum mounted on drive shaft at rear of transfer case.

Drum Diameter—8".

Lining——Woven type. Width 1¾". Thickness .206-.216". Length per shoe 8⅛".

Hand Brake (Adjustment for Wear)—Make certain that hand brake cable and linkage operate freely. Lubricate if sticking or binding is evident. Place brake handle on instrument panel in "off" position. Rotate brake drum until one pair of adjusting holes (three pairs located on back face of drum) is opposite the adjusting screws (notched wheels) within the brake. Insert a screwdriver or adjusting tool through each hole and turn each adjusting screw equally until the brake shoes are snug against the drum (NOTE—with tool against edge of hole as a fulcrum, move outer end of tool out away from center of driveshaft to expand shoes). **Back off each adjusting screw 7 notches** to provide correct shoe clearance.

Linkage Adjustment—When brake shoes replaced or major adjustment required, check and adjust brake operating lever and cable as follows:

Brake Lever—The lever position is determined by adjustment of cam and will not change when new shoes or linings installed. Check clearance between closest point on lever and brake backing plate with brakes "off." This clearance should be 3/32". Adjust the special lever ball nut as required.

Brake Cable—Disconnect cable (remove clevis pin at brake operating lever. Place brake handle in "off" position. Make certain that brake operating lever position is correct (see above). Adjust clevis on brake operating lever end of cable so that clevis pin can just be inserted without changing position of brake handle or brake operating lever.

IGNITION TIMING

Std. Setting—	Flywheel Degrees	Piston Pos.
All Engines	5° BTDC.	.010" BTDC.

►**Timing Mark Change**—Flywheel marked "5°" (replacing "IGN/") starting 4-63 Engine No. 51379.

Timing (Using Timing Light—Engine Idling)—This method recommended by manufacturer. Direct timing light at flywheel through inspection hole in front face of housing below starter, idle engine (engine must be warm), adjust distributor (as directed above) until timing mark is centered in inspection hole.

CARBURETOR

CARTER

Carter WA-1 No. 613S. 1¼", Single Barrel, Downdraft type with manual choke control.

Casting Number on Flange—485.

Carter YF Type 738S, 1¼" Single barrel downdraft type with manual choke control and "Diaphragm" type accelerating pump and metering rod control.

See Carburetor Section for complete data.

►*STUMBLE CORRECTION (738S, 768S, SA, 832S, CARBURETORS)—See "Carter YF" in Carburetor Section for complete data.*

Settings (Idle Setting, Float Level, and Accelerating Pump): ***See Tune-Up data.***

Metering Rods & Jets—*See Carter Jet Table in Carburetor Section for complete data.*

ZENITH

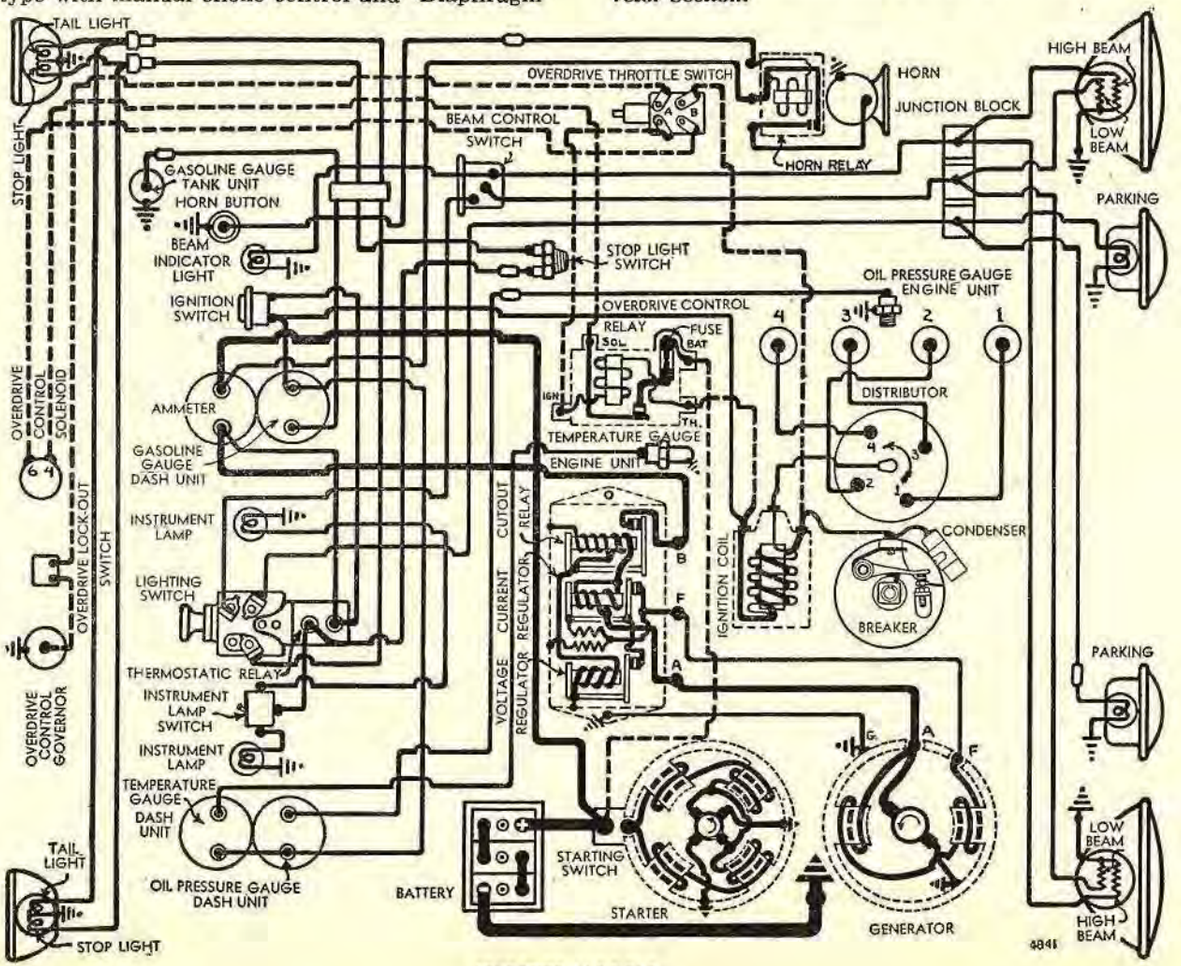
Zenith Model 228AV10 & 28BV10—Single barrel, downdraft with manual choke control.

Outline No.—(228AV10) 10760, (28BV10) 10569-A. On round metal tag riveted on top of float bowl cover. Use in ordering parts.

See Carburetor Section for complete data.

Settings (Idle Setting, Float Level, and Accelerating Pump): ***See Tune-Up data.***

Metering Jets—*See Zenith Jet Specifications in Carburetor Section.*



JEEPSTER MODELS

CARB. EQUIPMENT

Fast Idle: Interconnected linkage by which choke valve lever opens throttle to fast idle position when carburetor choked for starting.

Setting—No adjustment required.

Air Cleaner: Oakes Model 616615 Oil-wetted type Std., Model X616150 Oil-bath type Optl.

Servicing (Oil-wetted type)—Clean filter element and re-oil at 2000 mile intervals or more often if required by operating conditions.

Servicing (Oil-bath type)—Clean filter and fill with same oil used in engine crankcase at 2000 mile intervals (at oil change). Capacity approx. 1¼ pts.

Fuel Pump: AC No. 1537409 (1946-48), No. 1539306 (1949). Combination fuel-and-vacuum pump.

Replacement Pump—AC No. 7409 or 9306 (for 1537409), 9306 (for 1539306).

See Carburetion Equipment Section for data.

Pressure—3 lbs. (4½ lbs. max. at 1800 RPM).

Gasoline Gauge: King-Seeley Electric Type.

Dash Unit—King-Seeley No. 42570.

Tank Unit—King-Seeley No. 41285.

See Carburetion Equipment Section for data.

CRANKCASE VENTILATOR

Sealed Positive Ventilation type. Air Intake Pipe (from air cleaner to oil filler pipe) furnishes clean air to crankcase and Air Outlet Pipe (from valve chamber cover to intake manifold) allows fumes from crankcase to be sucked into intake manifold. There is a vacuum control valve at the manifold connection and this valve **must close at idling speed**

Servicing—Make certain that connecting pipes are tight and that oil filler cap gasket seals cap tightly. Remove and clean vacuum control valve when tuning engine or if system operating incorrectly.

Vacuum Control Valve—Remove control valve by disconnecting pipe at valve chamber cover and unscrewing valve from manifold. Disassemble valve by clamping in vise and removing top, withdraw valve and spring. Clean valve and valve seat thoroughly,

BATTERY

Auto-Lite PN-15. 6 volt, 15 plate, 100 Amp. Hr.

Starting Capacity—120 amperes for 20 minutes.

Grounded Terminal—Negative (—) terminal.

Engine Ground—At right front engine mounting.

Location—On right side of dash under hood.

STARTER

Auto-Lite Model MZ-4137. Armature MZ-2214.

Drive—Overrunning clutch and manual pinion shift

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—160 RPM., 150-175 amps., 5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
2.55 "	1325	5.0	200
7.65 "	220	4.0	400
7.8 "	Lock	3.0	420

Starter Removal—Flange mounted on right front face of flywheel housing. To remove, disconnect starting linkage and battery cable, take out two flange mounting capscrews and bolt in bracket at commutator end.

Starting Switch—Auto-Lite SW-2677A. Mounted on starter and operated by pinion shift lever.

See Electrical Equipment Section for complete data.

CONTINUED ON NEXT PAGE

ENGINE

CONTINUED FROM PRECEDING PAGE

Valve Lifters: Mushroom type. In reamed holes in block. Service by installing .004" oversize lifters.
NOTE—Camshaft must be removed for lifter removal. *See Camshaft Removal in Willys Shop Notes.*
Lifter Diameter—.6240-.6245". **Clearance** .0005-.002".

VALVE TIMING

Tappet Clearance: .016" All Valves, Hot or Cold.
NOTE—Tappet adjusting screws are self-locking
Valve Timing—See Camshaft Setting above.
Intake—Open 9° BTDC. Close 50° ALDC.
Exhaust—Open 47° BLDC. Close 12° ATDC.
►**Timing Mark Change (starting 4-63 Engine Number 51379)**—Flywheel marked "5°" (for 5° BTDC.) and "T.C." (top dead center). "I.O." mark not carried and intake opening point must be estimated.
Valve Timing Check—Set tappet clearance #1 intake valve at .020". This valve should open with #1 piston 9° or .039" BTDC. with flywheel mark "I.O." centered in inspection hole in right front face of flywheel housing. Reset tappet clearance at .016".

LUBRICATION

Engine Oiling System: Pressure to crankshaft, conrod, and camshaft bearings, and to timing gears.
Crankcase Capacity—4 qts. refill.
Normal Oil Pressure—35 lbs. at 30 MPH. (10 lbs. idling at 600 RPM).
Oil Pressure Regulator—Opens at 35 lbs. Located under plug on side of pump housing. Adjustable by adding or removing shims above spring within plug.
Oil Pump: New rotor type pump mounted externally on left side of crankcase.
Oil Pump Servicing—*See Willys Shop Notes.*
Oil Pressure Gauge: King-Seeley Electric type.
Dash Unit—King-Seeley No. 42565.
Engine Unit—King-Seeley No. 40767.
See Miscellaneous Section for complete data.

COOLING

Cooling System: Pressure type, relief valve in cap.
Capacity—11 quarts.
Pressure Valve—AC No. 846709 (Filler Cap). Opens at 3¾ lbs. (3¼-4¼ lbs.).
Water Pump: Centrifugal, belt-driven, packless type.
See Water Pump Section for complete data.
Removal—Loosen drive belt adjustment, remove belt, disconnect hose. Remove pump mounting screws and lift out pump and fan assembly.
Thermostat: Harrison. In outlet on cylinder head. Starts to open at 145-155°F. Fully open at 170°F.
Temperature Gauge: King-Seeley Electric type.
Dash Unit—King-Seeley No. 42575.
Engine Unit—King-Seeley No. 7000.
See Miscellaneous Section for complete data.

CLUTCH

Auburn (Atwood) Model 8501-19. Single plate, dry disc type with Borg & Beck 11735 Driven Member.
NOTE—Model 8501-19 has neoprene driving lug inserts and Return Clip Springs.
See Clutch Section for complete data.
►**Clutch Facing Change & Return Clip Spring Installation to correct Clutch Chatter & Noise**—*See "Auburn Clutch" in Clutch Section.*
Facings—Moulded type. I.D. 5⅛" (5.094-5.156"), O.D. 8½" (8.520-8.480"). Thickness ⅛" (.132-.138").
Pedal Adjustment: Free travel 3/4" (provides 1/16" clearance between release levers and bearing). To adjust, loosen locknut and turn adjusting nut on connector link at clutch fork, tighten locknut.
Removal: Remove transmission (see Transmission Removal below), remove flywheel bell housing. Mark clutch pressure plate and flywheel to insure reinstallation in same position. Take out mounting screws in clutch cover flange (turn all screws out evenly), remove clutch and driven member.

TRANSMISSION

Without Overdrive.....**Warner AS1-T96E**
4-63 with Overdrive.....**Warner AS12-T96**
VJ-2 & VJ-3 with Overdrive.....**Warner AS18-T96**
Three-speed, helical gear type. Constant-mesh, (Second & High), slding gear (Low & Reverse).
See Transmission Section for complete data
Transmission Control: Remote control type with gearshift lever mounted on steering column.
See Transmission Section for complete data
Removal: Disconnect shift rods at transmission. On Overdrive cars, disconnect wires from solenoid and rail switch, disconnect overdrive control cable and conduit, remove rubber mounted saddle support at rear end of overdrive, take off overdrive governor assembly. Disconnect front universal joint at transmission. Support engine weight on jack under flywheel bell housing, remove frame cross-member with rubber insulators attached. Place jack under engine to support engine. Back out four screws holding transmission to bell housing approximately ¾". Pull transmission back to bolt heads which will provide opening between the two housings and relieve pressure on clutch release fork in bell housing. Using a long screwdriver through opening in side of bell housing, pry the clutch release fork from engagement with clutch release bearing carrier. Remove four transmission attaching screws, and pull transmission back until clutch shaft clears bell housing and remove the assembly.

OVERDRIVE

Warner Type R10B (part of AS12-T96 & AS18-T96 Transmission Assemblies). New solenoid operated, governor controlled with throttle "kick-down".
See Transmission Section for complete data.
►*NOTE*—Beginning Serial No. 91904 (4-63) & All VJ-3 Cars, Overdrive is new "centered ring gear" type with one rear bearing only (2 used previously).
Control Relay—Auto-Lite Model HRT-4001.
Overdrive Governor—Auto-Lite Model TGE-4002.
Transmission Solenoid—Delco-Remy 1118132.
Removal: Remove as a unit with transmission. Removal instructions same as for regular transmission (above) after governor and solenoid wires and lockout control disconnected and overdrive case-to-cross-member bolts removed.

UNIVERSALS

1949-50 MODELS

Spicer Model 1261-102X (Front—All Models), 1278-101X (Rear—All Models without Overdrive & First Cars with Overdrive), 1268-111X (Rear—Later models with Overdrive). Needle roller bearing type.
See Universals Section for complete data.

1946-48 MODELS

Detroit Series 4100. Ball & Trunnion type.
See Universals Section for complete data.

REAR AXLE

Spicer (Salisbury) Model 23-1. Semi-floating, Hypoid Gear type with Hotchkiss Drive.
See Rear Axle Section for complete data.
Ratio—4.88-1 Std., 4.56-1 & 5.38-1 Optl.
Backlash—.004-.008" Shim adjustment.
Removal: Support rear end of car securely, remove rear wheels, disconnect rear shock absorbers, rear brake line (at frame connection on right side), rear brake cables, and propeller shaft at rear universal joint. Place support jacks under axle housing so that springs relieved of weight, remove nuts on spring "U" bolts, remove pivot bolt at front end of springs and lower springs, remove axle assembly
Axle Shaft Removal: Remove the wheel & hub assembly (use wheel puller), disconnect brake line at wheel cylinder, remove nuts on bolts holding backing plate and brake assembly on housing, remove dust shield, oil seal, and backing plate (with brake assembly). CAUTION—Do not lose bearing adjusting shims located between backing plate and flange on axle housing. Remove axle shaft and bearing.
Wheel Bearing Adjustment—Endplay .003-.005". Adjust by adding or removing shims between backing plate and axle housing flange (at each wheel). See axle shaft removal (above).
NOTE—Shims installed on **left hand** end of axle housing only in production. Shims can be installed on right hand end of axle housing, if necessary, for correct endplay.

SHOCK ABSORBERS

Delco—Model 1030-C (Front), 1031-Q (Rear).
Monroe—Model K-18004 (Front), K-18005 (Rear).
Direct acting, hydraulic, adjustable (first cars).
NOTE—Shock absorbers are sealed and cannot be refilled or serviced.

FRONT SUSPENSION

Planadyne Type. Independent, linked parallelogram type with transverse spring.
►**Replacement Spring Caution:** *See Willys Front Suspension for recommended replacement springs.*
See Front Suspension Section for complete data.
Kingpin Inclination—5½° crosswise.
Caster—1° No adjustment.
Camber—1½° (1¼-1¾°).
Toe In—1/8-3/16".
►*See Willys Front Suspension for Toe In adjustment.*

STEERING GEAR

Ross T-12, No. 13108. Cam-and-Twin Lever type.
See Steering Gear Section for complete data.

BRAKES

Service Brakes: Bendix (Lockheed) Hydraulic, self-centering. Hand lever applies rear wheel brakes.
See Brake Section for complete data.
Drums—Chrome-nickel type. Diameter 9.948".
Lining—Molded type. Width 1¾". Thick .182-.192" Length per wheel 19".
Clearance—.008" Toe, .005" Heel each shoe.
NOTE—No anchor pin adjustment provided. Brake shoes should be centralized by hard brake application (and then released) before adjustments made.
Hand Brake: See Service Brakes above.
Adjustment—Tighten link rod adjustment at lever on cross-member for slight drag with hand lever set two-notches "on" (must be free when released).

MISC. MECHANICAL

Windshield Wiper: Vacuum type, cable operated.
See Miscellaneous Section for data.

Vacuum Advance—VC-4010

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	3½"
2°	4°	5¾"
5°	10°	9¼"
8°	16°	12¾"
10°	20°	15"

Vacuum Advance—VC-4010A & IAT-2023LD

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	4¾"
1°	2°	5⅜"
3°	6°	6¾"
4°	8°	7⅞"
5°	10°	8"

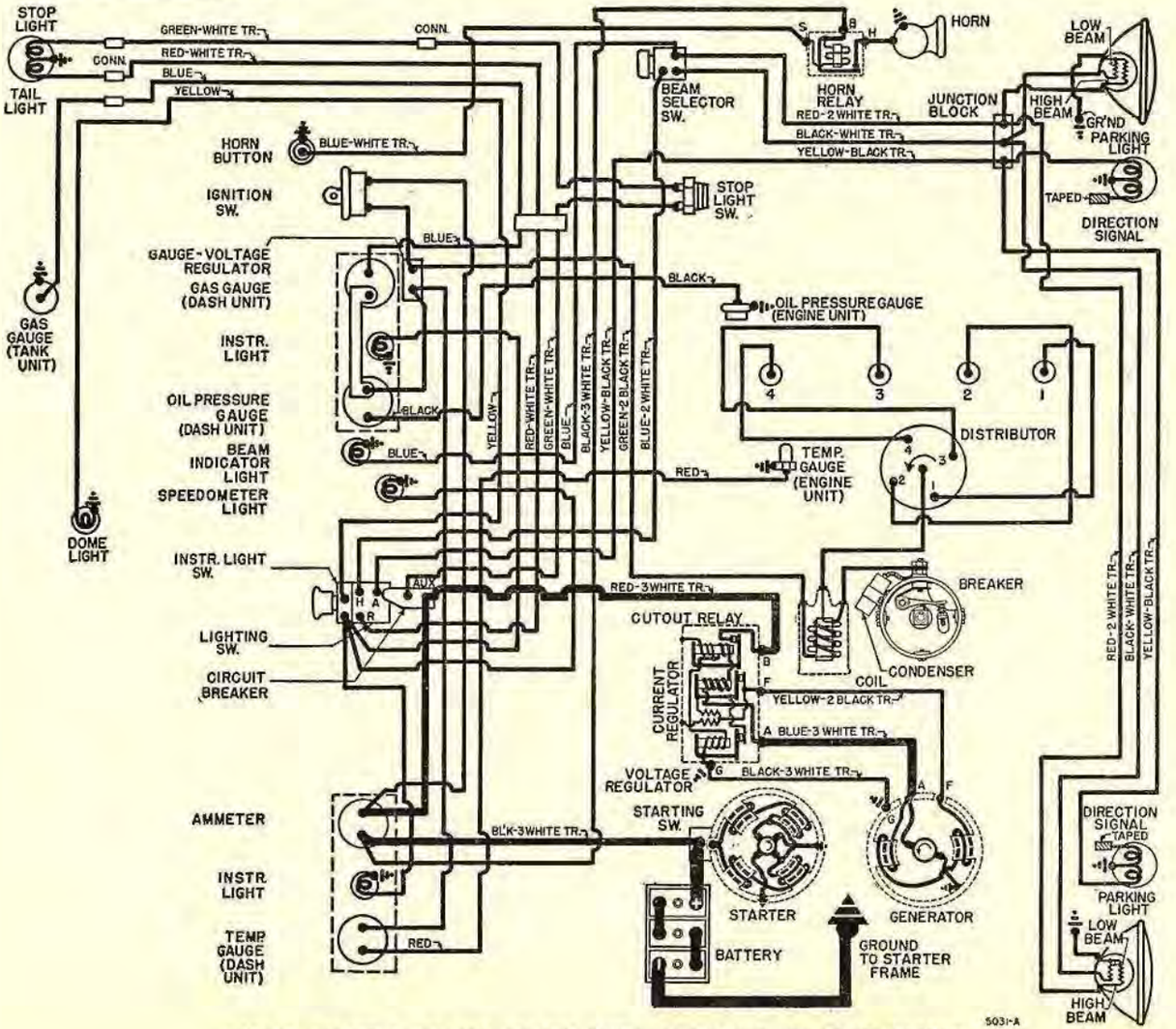
Distributor Removal: On right side of engine. To remove, disconnect vacuum line, take out hold-down screw in mounting plate.

Installation Note—If crankshaft has been turned with distributor off engine, install distributor as follows: Turn crankshaft to #1 cylinder firing position (see Timing), turn distributor shaft until rotor is at #1 segment (see diagram), install distributor on engine, rocking shaft slightly to engage drive coupling, push distributor down into place, install hold-down screw, check ignition timing.

CAUTION—If oil pump has been removed, see Oil Pump Installation under "Oil Pump" in Willys Shop Notes.

IGNITION TIMING

2-WD & 4-WD Std. Setting.....5° BTDC.
473-HT & 473-4WD Std. Setting.....At TDC.
2-WD & 4-WD NOTE—Setting for Low Octane Fuel —At TDC.



1950-51 473-HT & 473-4WD TRUCKS WITH HURRICANE "F" HEAD ENGINE

Timing Marks—Flywheel mark "IGN/" (5° BTDC) or "TC/" (TDC) centered in inspection hole in right front face of housing below starter (remove inspection hole cover).

►**Timing Mark Change**—Flywheel marked "5°" (replacing "IGN/") starting 2T Engine No. 13887, 4T Engine Number 14251.

Timing (Engine not Running)—With #1 piston on compression, turn engine over until piston reaches firing position (see settings above) with flywheel mark "IGN/" (5° BTDC setting), or "TC/" (TDC setting) centered in inspection hole in right front face of housing, loosen advance arm clampscrew, rotate distributor until contacts begin to open, tighten clampscrew, see that rotor at #1 segment in distributor cap (see diagram), check spark plug cable connections.

Timing Using Timing Light—Engine Running)—This method recommended by manufacturer. Direct timing light through inspection hole at flywheel, idle engine (engine must be warm), adjust distributor (as directed above) until "IGN/" (5° BTDC setting) or "TC/" (TDC setting) mark centered in inspection hole.

CARBURETOR

(2-WD & 4-WD) Carter WO Type 636SA superseding 636S. 1" single, downdraft type with manual choke **(473-HT & 473-4WD) Carter YF Type (Early 1950) 768S, SA. (Late 1950-51) 832S, SA, SB.** 1¼" Single, downdraft type with manual choke control.
See Carburetor Section for complete data.

►***STUMBLE CORRECTION (738S, 768S, SA, 832S, CARBURETORS)—See "Carter YF" in Carburetor Section for complete data.***

►**"YF" 768S Carburetor conversion to 768SA**—*See "Carter YF Downdraft" in Carburetor Section.*

Settings (Idle Setting, Float Level, and Accelerating Pump): *See Tune-Up data.*
Metering Rods & Jets: *See Carter Jet Table in Carburetor Section.*

Fast Idle: Interconnected linkage by which choke valve lever opens throttle to fast idle position when carburetor choked for starting.
Setting (636S, SA)—No adjustment required.
Setting (768S, SA)—Lip on fast idle arm should contact boss on body with choke valve wide open. Adjust by bending connector rod at offset.

CARB. EQUIPMENT

Fuel Pump: AC (2-WD & 4-WD) No. 1539106, (473-HT & 473-4WD) No. 1539562. Combination fuel-and-vacuum pumps.
Replacement Pump: AC No. 9106 or 9307 (1539106).
Pressure—4½ lbs. max. at 1800 Eng. RPM.
See Carburetion Equipment Section for complete data.

Gasoline Gauge: King-Seeley electric. NOTE—Gauge on 473-HT & 4WD has voltage regulator.
Dash Unit—King-Seeley No. (2-WD & 4-WD) 42570, (473-HT & 4WD) 45534.
Tank Unit—King-Seeley No. (2-WD & 4-WD) 41285, (473-HT & 4WD) 44506.
Gauge Voltage Regulator (473-HT & 4WD)—*See Misc. Electrical.*
See Carburetion Equipment Section for complete data.

Air Cleaner: (2-WD & 4-WD) Oakes-Donaldson Model 616150-E653, (473-HT & 4WD) Houdaille-Hershey Model XO-994. Oil-bath type.

CONTINUED ON NEXT PAGE

Engine Unit—King Seeley No. (2-WD & 4-WD) 40767, (473-HT & 4WD) 44030.
Gauge Voltage Regulator (473-HT & 4WD)—*See Misc. Electrical.*
See Miscellaneous Section for complete data.

COOLING

Cooling System: Pressure type with pressure valve
Pressure Valve—Radiator Filler Cap. Opens at 3¾ lbs. (3¼-4¼ lbs.).
Capacity—11 qts.

Water Pump: Centrifugal, packless, ball bearing type.
See Water Pump Section for complete data.
Removal—Loosen and remove drive belt, disconnect hose. Remove pump mounting screws, lift out pump
Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat: Harrison. In outlet elbow on cylinder head. Starts to open at 148-155°F.

Temperature Gauge: King-Seeley electric. Gauge on 473-HT & 4WD has special voltage regulator.
Dash Unit—King-Seeley No. (2-WD & 4-WD) 42565, (473-HT & 4WD) 45545.
Engine Unit—King-Seeley No. (2-WD & 4-WD) 7000, (473-HT & 4WD) 44200.
Gauge Voltage Regulator (473-HT & 4WD)—*See Misc. Electrical.*
See Miscellaneous Section for complete data.

CLUTCH

Auburn Model (2-WD & 4-WD) 8501-23, (473-HT & 473-4WD) 8501-36. With Borg & Beck Driven Member. Single plate, dry disc type.
See Clutch Section for complete data.

►**2-WD & 4-WD Clutch Facing Change & Return Spring Clip Installation to correct Clutch Chatter & Noise.** *See "Auburn Clutch" in Clutch Section.*

Facings—Molded (flywheel side), Woven (pressure plate side). I. D. 5⅛". O. D. 8½". Thickness .135"

Pedal Adjustment: Pedal free travel ¾" (gives 1/16" clearance between release bearing and clutch levers). To adjust, loosen locknut and turn adjusting nut on connector link at clutch fork.

Removal: Remove transmission (see Transmission Removal), remove flywheel bell housing. Mark pressure plate and flywheel to insure correct re-installation, take out mounting screws in clutch cover flange (turn all screws out evenly), remove clutch assembly and driven member.

TRANSMISSION

MODELS 2-WD & 473-HT

Warner Model AS1-T90E (2-WD before Serial No. 22536), AS39-T96 (473-HT). Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse).
See Transmission Section for complete data.

Transmission Control (2-WD Before Serial No. 22536). Remote control type with gearshift lever on steering column.
See Transmission Section for complete data.

Removal: Disconnect shift rods at transmission. Disconnect front universal joint at transmission. Support engine weight on jack under flywheel bell housing, remove frame cross-member with rubber insulators attached. Place jack under engine to support engine. Back out four capscrews holding engine to transmission to bell housing approximately ¾". Pull transmission back to bolt heads which will provide opening between the two housings and relieve pressure on the clutch release fork in bell housing. Using a long screw driver through opening in side of bell housing, pry the clutch release fork from engagement with clutch release bearing carrier. Remove four transmission attaching screws and pull transmission back until clutch shaft clears bell housing and remove assembly.

MODELS 4-WD & 473-4WD

Warner Model AS3-T90A (4-WD before Serial No. 34787), AS1-T90C (4-WD after No. 34787 & 473-4WD). Constant-mesh, synchro-mesh, helical gears (Second & High), sliding gear (Low & Reverse).
See Transmission Section for complete data.

Transfer Case: Spicer Model 18.. Two-speed auxiliary transmission and front-wheel drive unit mounted on rear of transmission case. Separate control levers provided for Low-High range (right hand lever), and front-wheel drive (left hand lever).
See Transmission Section for complete data.

Transmission Control (4-WD before Serial No. 34787). Remote control type with gearshift lever on steering column.
See Transmission Section for complete data.

Removal: *See Universal Jeep Models Transmission Removal Instructions.*

UNIVERSALS

MODELS 2-WD & 473-HT

Detroit Ball-and-Trunnion Type. Two used (First Trucks), three used (Later Trucks). NOTE—Later trucks have two propeller shafts with support bearing and intermediate universal at cross-member.
See Universals Section for complete data.

MODELS 4-WD & 473-4WD

Front & Rear Drive Propeller Shaft Joints: Spicer

	Transmission End	Axle End
Front Drive	1261-102X	1268-104X
Rear Drive	1261-102X	1268-101X

Front Axle Shaft Joint: Bendix Constant-velocity type. One joint used at outer end of each shaft

Power Take-off Propeller Shaft Joints: Detroit Ball-and-trunnion type. Three used (additional joint at intermediate support bearing on cross-member.
See Universals Section for complete data.

FRONT AXLE

TRUCK MODELS 4-WD & 473-4WD

Spicer (Salisbury) Model 25. Full-floating, hypoid gear type. Differential assembly (ring and pinion gear assembly) is same as Spicer Rear Axle.
See Spicer (Salisbury) Full Floating Rear Axle in Rear Axle Section for complete data.
Ratio—5.38-1.
Backlash—.005-.007". Shim adjustment.
Removal: *See Universal Jeep Models Front Axle Removal Instructions.*
Wheel Bearing Adjustment: *See Universal Jeep Model "Front Axle" for Wheel Bearing Adjustment.*

REAR AXLE

Timken Model No. 51540. Semi-floating, spiral bevel gear type with Hotchkiss Drive.
See Rear Axle Section for complete data.
Ratio—5.38-1 Std. Optl. Ratios (2-WD only) 4.88-1 and 6.17-1.
Backlash—.004-.018". Shim adjustment.
Removal: Support rear end of truck securely, remove rear wheels, disconnect rear shock absorbers, rear brake line (at frame connection on right side), rear brake cables and propeller shaft at rear universal. Place support jacks under axle housing to relieve springs of weight, remove nuts on spring "U" bolts, remove pivot bolt at front end of springs, lower springs to floor. Remove axle assembly.
Axle Shaft Removal: Remove wheel and hub assembly (use wheel puller), remove nuts on bolts holding backing plate and brake assembly, remove dust shield, oil seal, and backing plate. Remove axle shaft and wheel bearing. CAUTION—Do not lose bearing adjusting shims.
Wheel Bearing Adjustment—Endplay .003-.005". Adjust by adding or removing shims between backing plate and flange on axle housing. See axle shaft removal above for dismantling instructions.
NOTE—Shims installed on **left hand** end of axle housing only in production. Shims can be installed on right hand end of axle housing, if necessary.

SHOCK ABSORBERS

Gabriel. Hydraulic, direct acting, adjustable type. **(473-HT & 4WD)**—Willys No. 647504 (Front), 647505 (Rear).

FRONT SUSPENSION

Front Axle (2-WD & 473-HT): "I" beam type with Reverse-Elliott ends.
Front Axle (4-WD & 473-4WD): See "Front Axle."
Front Suspension: Conventional with semi-elliptic springs.
►**Steering Knuckle Bearing Servicing & Adjustment (Front-drive Trucks)**—*See "Front Axle" on Universal Jeep CJ-2A & CJ-3A car page.*
Kingpin Inclination—7½° crosswise.
Caster—(2-WD) 4 ¾°, (473-HT) 3°, (4-WD & 473-4WD) 3°.
Camber—(2-WD & 473-HT) 1°, (4-WD & 473-4WD) 1½°.
Toe-In—(All Models) 3/64-3/32".

STEERING GEAR

Ross Model T12, No. TA-13018, Cam-and-Twin Lever
See Steering Gear Section for complete data.

BRAKES

Service Brakes: Bendix (Lockheed) Hydraulic, self-centering, type. Hand lever applies rear wheel service brakes.
See Brake Section for complete data.
Drums—Chrome-nickel type. Diameter 11".
Lining—Moulded type (all shoes). Width 2". Thickness .182-.192". Length per wheel 22 1/16".
Clearance—.008" toe, .005" heel, for each shoe.
NOTE—No anchor pin adjustment provided. Brake shoes should be centralized by hard brake application (and then released) before adjustments are made.
Braking Power—56% front, 44% rear.
Hand Brake: See service brakes above.
Adjustment—Tighten link rod adjustment (cable equalizer connector) at brake lever on frame cross-member for slight drag with hand lever set two notches "on". Release hand lever and make certain that brakes free of any drag.

MISC. MECHANICAL

Windshield Wiper: Vacuum type, cable operated.
See Miscellaneous Section for data.

distributor on engine, rocking shaft slightly to engage drive coupling, push distributor down into place, install hold-down screw, check ignition timing.

CAUTION—If oil pump has been removed, see Oil Pump Installation under "Oil Pump" in Willys Shop Notes.

IGNITION TIMING

Std. Setting.....At Top Dead Center

NOTE—See Octane Selector Setting to compensate for special fuel and operating conditions.

Timing Marks—Line on rim of vibration dampener and pointer on timing gear cover. Flywheel also marked ('TC' on flywheel in line with horizontal center-line of inspection hole, right front face of housing.

Timing (Engine not Running)—With #1 piston on compression, turn engine until piston reaches firing position (TDC) with line on vibration dampener aligned with pointer on right side of timing gear cover. Loosen vacuum control link screw in distributor quadrant, center pointer on scale, tighten screw. Loosen clampscrew on hold-down plate, rotate entire distributor assembly until contacts begin to open, tighten clampscrew, see that rotor at #1 segment in distributor cap, check spark plug connections.

Timing (Using Timing Light—Engine Idling)—This method recommended by manufacturer. Direct timing light at vibration dampener, idle engine (engine must be warm), adjust distributor (as directed above) until timing mark lines up with pointer.

Octane Selector Setting—If engine pings on heavy pull, loosen vacuum control link screw at distributor quadrant, retard spark slightly by rotating distributor counter-clockwise. For High Octane Fuel, spark can be advanced by rotating distributor clockwise.

CARBURETOR

CARTER WA-1

Carter WA1 No. 6458. 1¼" Single Barrel, Downdraft type with manual choke control.

See Carburetor Section for complete data.

►**Carburetor Jet Calibration Production Change**—*See "Carter WA-1" in Carburetor Section.*

Settings (Idle Setting, Float Level, and Accelerating Pump): *See Tune-Up data.*

Metering Rods & Jets—*See Carter Jet Table in Carburetor Section.*

Fast Idle: Interconnected linkage by which choke valve lever opens throttle to fast idle position when carburetor choked for starting.

Setting—No adjustment required.

ZENITH

Zenith Model 228AV10—Single barrel, downdraft type with manual choke control.

Outline No.—10760. On round metal tag riveted on top of float bowl cover. Use in ordering parts.

See Carburetor Section for complete data.

Settings (Idle Setting, Float Level, and Accelerating Pump): *See Tune-Up data.*

Metering Jets—*See Zenith Jet Specifications in Carburetor Section.*

Fast Idle: Fast idle cam serving as stop for throttle stopscrew is linked to choke valve lever and rotated to fast idle position when choke valve closed for cold starting.

Setting—No adjustment required.

CARB. EQUIPMENT

Fuel Pump: AC No. 1539245. Diaphragm type combination fuel-and-vacuum pump.

Replacement Pump—AC No. 9245.

See Carb. Equipment Section for complete data.

Pump Pressure—3½-4½ lbs. at 1800 Eng. RPM.

Gasoline Gauge: King-Seeley Electric type.

Dash Unit—King-Seeley No. (1948) 41310, (1949-50) 42570.

Tank Unit—King-Seeley No. 41248.

See Carb. Equipment Section for complete data.

Air Cleaner: AC No. 1544113 Oil-wetted type, Element #1.

Servicing (Oil-wetted Type)—Clean filter element and re-oil at 2000 mile intervals or more often if required by operating conditions.

CRANKCASE VENTILATOR

Sealed Positive Ventilation Type. Air intake pipe (from air cleaner to oil filler pipe) furnishes clean air to crankcase, air outlet pipe (from valve cover to manifold) allows fumes from crankcase to be sucked into intake manifold. Vacuum control valve at manifold connection **must close at idling speed** for satisfactory idling performance.

NOTE—Clean Vacuum Control Valve when engine tuned up.

Cleaning Vacuum Control Valve—Remove control valve by disconnecting pipe and unscrewing valve from manifold. Disassemble valve, withdraw valve and spring, clean valve and valve seat thoroughly.

Servicing—Make certain all connecting pipes tight and that oil filler cap gasket seals cap tightly. Remove and clean control valve when tuning engine or whenever system does not operate satisfactorily.

BATTERY

Auto-Lite PN-15 or Willard HW-1-100. 6 volt, 15 plate, 100 Ampere Hour capacity (20 hr. rate).

Starting Capacity—120 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.2 minutes.

Five-second Voltage—4.15 volts.

Grounded Terminal—Negative (—) grounded at starter.

Engine Ground—Strap at left front engine mount.

Location—Right hand side of dash in engine compt.

Dimensions—Lgth. 9". Width 6⅞". Hgt. 8⅝.

STARTER

Auto-Lite Model MZ-4137. Armature No. MZ-2214.

Drive—Overrunning clutch and positive pinion shift actuated by starting pedal.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—160 RPM., 150-175 amps., 5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
.65 "	2500	5.5	100
2.55 "	1325	5.0	200
4.95 "	750	4.5	300
7.65 "	220	4.0	400
7.8 "	Lock	3.0	420
11.8 "	Lock	4.0	560

Removal: On right front face of flywheel housing. To remove, disconnect pedal linkage and cables, take out flange mounting capscrews and bolt in bracket on cummutator end.

Starting Switch: Auto-Lite SW-2677A. Mounted on starter and operated by pinion shift lever.

See Electrical Equipment Section for complete data.

GENERATOR

Auto-Lite Model GDZ-4817A. Armature GDZ-2006F. Two brush (shunt) type with voltage and current regulation. Ventilated by fan on drive pulley.

Maximum Charging Rate—35 amperes, 8.0 volts (cold) with discharged battery (controlled by regulator).

Charging Rate Adjustment—None (see Regulator).

Performance Data

Cold Amperes	Cold Volts	Cold R.P.M.	Hot Amperes	Hot Volts	Hot R.P.M.
0	6.4	925	0	6.4	1000
5	6.65	1060	5	6.65	1150
10	6.85	1260	10	6.85	1290
15	7.05	1340	15	7.05	1430
20	7.3	1480	20	7.3	1590
25	7.55	1620	25	7.55	1750
30	7.8	1760	30	7.8	1980
35	8.0	1900	35	8.0	2250

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—35-53 ozs. (new brushes).

Field Current—1.60-1.78 amperes at 6.0 volts.

Motoring Current—4.2-4.6 amperes at 6.0 volts.

Removal: Conventional pivot mounting at right front of engine. To remove, take out two pivot bolts and clamp bolt, slip off drive belt.

Belt Adjustment: 1" deflection (thumb pressure) midway between generator and pump pulleys. To adjust, loosen all mounting bolts, pull generator away from engine.

REGULATOR

Auto-Lite Model VRP-4007C-2. Voltage & Current type. On right side in engine compartment.

See Electrical Equipment Section for complete data.

NOTE—Regulator cover sealed. Warranty void if seals broken.

Cutout Relay

Cuts In—6.4-7.0 volts (set to 6.4-6.6 volts).

Cuts Out—4.1-4.8 volts (approx. 4-6 amps. disch.).

Contact Gap—.015" minimum.

Air Gap—.031-.034" with contacts open (measured at hinge end of core).

Voltage Regulator

Setting—7.35 (7.2-7.5) volts at 70°F. See Electrical Equipment Section for data at other temperatures.

Checking (without breaking seal) & Adjustment—*See Electrical Equipment Section.*

Contact Gap—.012" min. (armature against stop pin).

Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked "35" on cover).

Checking (without breaking seal) & Adjustment—*See Electrical Equipment Section.*

Contact Gap & Air Gap—Same as Voltage Regulator.

CONTINUED ON NEXT PAGE

►**Excessive Oil Consumption Correction**—*See "Oiling System" in Willys Shop Notes.*

Crankcase Capacity—5 qts. refill.

Normal Oil Pressure—35 lbs. at 30 MPH., 10 lbs. with engine idling at 500 RPM.

►**Low Oil Pressure Correction**—If oil pressure less than 5 lbs. at idling speed with latest type oil gauge units installed (see Oil Gauge below), check main and connecting rod bearing clearance, oil pressure relief valve for sticking open, and timing gear jet oil hole size not greater than #54 drill.

Oil Pressure Regulator—Opens at 25 lbs. Located on oil pump housing. Adjustable by adding or removing shims from above spring within plug.

Oil Pump: Internal Rotor type. Mounted externally on left side of crankcase.

Oil Pump Servicing—*See Willys Shop Notes.*

Oil Pressure Gauge: King-Seeley Electric type.

►*CAUTION*—Gauge changed in production—correct Dash and Tank units must be used together.

Before Serial No. 13291

Dash Unit—King-Seeley No. 41305 (0-30-80 dial).
Engine Unit—King-Seeley No. 40767 (80 lb. type).

Beginning Serial No. 13291

Dash Unit—King-Seeley No. 42565 (0-20-50 dial).
Engine Unit—King-Seeley No. 40790 (50 lb. type).
See Miscellaneous Section for complete data.

Crankcase Ventilation: *See special data following "Carb. Equipment."*

COOLING

Cooling System: Pressure type with relief valve in radiator filler cap.

Capacity—8¾ qts. (9½ qts. with heater).

Pressure Valve—AC No. 846740. In filler cap. Opens at 3¾ lbs. (3¼-4¼ lbs.).

Water Pump: Centrifugal, packless type with special sealed ball bearing shaft (no lubrication required).
See Water Pump Section for complete data.

Removal—Loosen and remove drive belt, disconnect hose, remove pump mounting screws. Lift out pump and fan assembly.

Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat: Harrison. In outlet on cylinder head. Starts to open at 145-155°F. Fully open at 173°F.

Temperature Gauge: King-Seeley Electric type.

Dash Unit—King-Seeley No. (1948) 41315, (1949-50) 42575.

Engine Unit—King-Seeley No. 7000.
See Miscellaneous Section for complete data.

CLUTCH

Auburn Model 8501-19 with Borg & Beck Driven Member. Single plate, dry disc type.
NOTE—Clutch has neoprene driving lug inserts and Return Clip Springs for quieter operation.
See Clutch Section for complete data.

►**Clutch Return Clip Spring Installation to correct disengagement noise**—*See "Auburn Clutch" in Clutch Section.*

Facings—Molded (flywheel side), woven (pressure plate side). I.D. 5⅛". O.D. 8½". Thickness .132-.138".

Pedal Adjustment: Pedal free travel 1" (provides 1/16" clearance between release bearing and clutch levers). To adjust, loosen locknut and turn adjusting nut on connector link at clutch fork, tighten locknut.

Removal: Remove transmission (see Transmission Removal), remove flywheel bell housing. Mark pressure plate and flywheel to insure correct re-installation, take out mounting screws in clutch cover flange (turn all screws out evenly), remove clutch assembly and driven member.

TRANSMISSION

Warner Model AS20-T96 (with Overdrive). Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all helical gear type.
See Transmission Section for complete data.

Transmission Control: Remote control type with gearshift lever on steering column.
See Transmission Section for complete data.

Removal: Remove floor boards, take off bell housing inspection cover, disconnect clutch throw-out bearing retracting spring. Disconnect transmission control rods and speedometer cable at transmission case. Disconnect propeller shaft at universal joints and remove shaft. Support engine with jack placed under bell housing, remove rear engine support bolts from cross-member under transmission case, raise rear end of engine so that transmission clears cross-member (CAUTION—use care that fan blades do not damage radiator). Remove transmission to bell housing bolts, pull transmission straight back to clear clutch shaft, remove from car.

OVERDRIVE

Warner Type R10B (part of AS20-T96 Transmission). New solenoid operated, governor controlled type overdrive (no centrifugal pawls) with throttle operated "kick-down."
NOTE—1949-50 Overdrive is new "centered ring gear type" with one rear bearing (two used in 1948).
See Transmission Section for complete data.

Control Relay—Auto-Lite Model HRT-4001.
Overdrive Governor—Auto-Lite Model TGE-4002.

Transmission Solenoid—Delco-Remy Model 1118132

Removal: Remove as a unit with the transmission. Removal instructions same as for regular transmission (above) after governor and solenoid wires and lock-out control cable disconnected, and overdrive case-to-cross-member bolts removed.

UNIVERSALS

1948—TO SERIAL NO. 11494

Spicer Model 1261-102X (Front), 1268-111X (Rear). Needle roller bearing type.
See Universals Section for complete data.

1948-50—AFTER SERIAL NO. 11494

Detroit Universals Series 4100. Ball-and-trunnion type.
See Universals Section for complete data.

REAR AXLE

Spicer (Salisbury) Model 23-1. Semi-floating, Hypoid Gear type with Hotchkiss drive.
See Rear Axle Section for complete data.
Ratio—5.38-1 Std., 4.88-1 Optl.
Backlash—.004-.009". Shim adjustment.

Removal: Support rear end of car securely, remove rear wheels, disconnect rear shock absorbers, rear brake line (at frame connection on right side), rear brake cables, and propeller shaft at rear universal joint. Place support jacks under axle housing so that springs relieved of weight, remove nuts on spring "U" bolts, remove pivot bolt at front end of springs, lower springs. Remove axle assembly from beneath car.

Axle Shaft Removal: Remove wheel and hub assembly (use wheel puller), disconnect brake line at wheel cylinder, remove nuts on bolts holding backing plate and brake assembly on housing, remove dust shield, oil seal, and backing plate (with brake assembly).

CAUTION—Do not lose bearing adjusting shims located between backing plate and flange on housing. Remove axle shaft and wheel bearing.

Wheel Bearing Adjustment—Endplay .003-.007". Adjust by adding or removing shims between backing plate and axle housing flange at each wheel. See axle shaft removal (above).

SHOCK ABSORBERS

Monroe or Gabriel—Direct acting, hydraulic type.

NOTE—Shock absorbers are sealed and cannot be dismantled for servicing or refilling.

FRONT SUSPENSION

►**Replacement Spring Caution**—*See Willys Front Suspension for recommended replacement springs.*

Planadyne Type. Independent, linked parallelogram type with transverse spring (spring acts as lower control arm).
See Front Suspension Section for complete data.

Kingpin Inclination—5° crosswise.

Caster—1° No adjustment.

Camber—1½°. (1¼-1¾° limits).

Toe-In—1/8-3/16".

►*See Willys Front Suspension for Toe-in adjustment procedure.*

STEERING GEAR

Ross Model T-12. Cam-and-Twin Lever type.
See Steering Gear Section for complete data.

BRAKES

Service Brakes: Bendix (Lockheed) Hydraulic, self-centering type. Hand lever applies rear wheel service brakes.

NOTE—These self-centered brakes do not have anchor pin adjustment.
See Brake Section for complete data.

Wheel Cylinders—Diameter: Front 1", Rear 7/8".

Drums—Chrome-nickel type. Diameter 10".

Lining—Moulded type (all shoes). Width 1.760". Thickness .182-.192". Length per shoe: 10 11/16" forward shoe, 8 5/16" reverse shoe.

Clearance—.008" toe, .005" heel, for each shoe.

NOTE—No anchor pin adjustment provided. Brake shoes should be centralized by hard brake application (and then released) before adjustments are made.

Hand Brake: See Service Brakes (above).

Adjustment—Tighten link rod adjustment (cable equalizer connector) at brake lever on frame cross-member for slight drag with hand lever set two notches "on". Release hand lever and make certain that brakes free of any drag.

MISC. MECHANICAL

Windshield Wipers: Vacuum type, cable operated.
See Miscellaneous Section for data.

Vacuum Spark Control: Auto-Lite Type VC-4010. (IGW-4129 & IGW-4189 Distr.), VC-4010A (IGW-4189A Distr.), IAT-2023LD (IAT-4008 Distr.).

Separate unit mounted on hold-down plate, linked to advance plate. Provides additional advance at speeds above idling except when engine accelerated or operated with wide open throttle when spark retarded by return spring.

Vacuum Advance—VC-4010

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	3½"
2°	4°	5¾"
5°	10°	9¼"
8°	16°	12¾"
10°	20°	15"

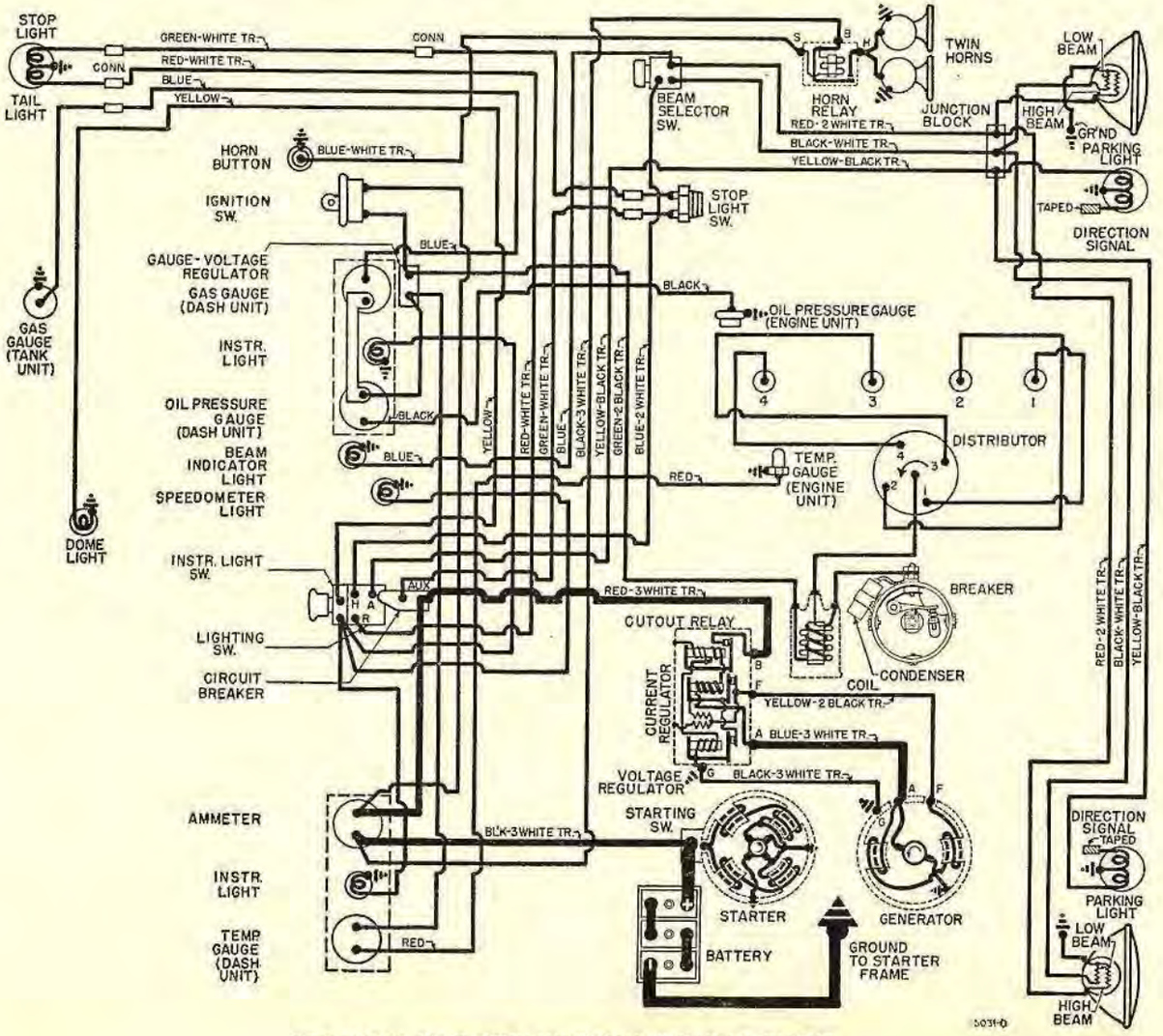
Vacuum Advance—VC-4010A & IAT-2023LD

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	4¾"
1°	2°	5⅞"
3°	6°	6¾"
4°	8°	7⅞"
5°	10°	8"

Distributor Removal: On right side of engine. To remove, disconnect vacuum line, take out hold-down screw in mounting plate.

Installation Note—If crankshaft has been turned with distributor off engine, install distributor as follows: Turn crankshaft to #1 cylinder firing position (see Timing), turn distributor shaft until rotor is at #1 segment (see diagram), install distributor on engine, rocking shaft slightly to engage drive coupling, push distributor down into place, install hold-down screw, check ignition timing.

CAUTION—If oil pump has been removed, see Oil Pump Installation under "Oil Pump" in Willys Special Data.



1950 MODEL 4X473 WITH HURRICANE "F" HEAD ENGINE

IGNITION TIMING

4x4-63 Std. Setting.....5° BTDC
4x473 Std. Setting.....At TDC

Timing Marks—Flywheel mark "5°" (or "TC/" (TDC setting) centered in inspection hole in right front face of housing below starter (remove inspection hole cover).

Timing (Engine not Running)—With #1 piston on compression, turn engine over until piston reaches firing position (see settings above) with flywheel mark "5°" (or "TC/" (TDC setting) centered in inspection hole in right front face of housing, loosen advance arm clampscrew, rotate distributor until contacts begin to open, tighten clampscrew, see that rotor at #1 segment in distributor cap (see diagram), check spark plug cable connections.

Timing Using Timing Light—(Engine Running)—This method recommended by manufacturer. Direct timing light through inspection hole at flywheel, idle engine (engine must be warm), adjust distributor (as directed above) until "5°" (or "TC/" (TDC setting) mark centered in inspection hole.

CARBURETOR

Carter (4x4-63) WO Type 636SA, (4x473) YF Type 768S, SA (Early 1950), 832S, SA, SB (Late 1950-51). 1" (WO), 1¼" (YF) Single barrel, downdraft type with manual choke control.

►***STUMBLE CORRECTION (738S, 768S, SA, 832S, CARBURETORS)—See "Carter YF" in Carburetor Section for complete data.***

See Carburetor Section for complete data.

►**768S Carburetor conversion to 768SA—*See "Carter YF Downdraft" in Carburetor Section.***

Settings (Idle Setting, Float Level, and Accelerating Pump): ***See Tune-Up data.***

Metering Rods & Jets—*See Carter Jet Table in Carburetor Section for complete data.*

Fast Idle: Interconnected linkage by which choke valve lever opens throttle to fast idle position when carburetor choked for starting.

Setting (WO)—No adjustment required.

Setting (YF)—Lip on fast idle arm should contact boss on body with choke valve wide open. Adjust by bending connector rod at offset.

CARB. EQUIPMENT

Air Cleaner: (4x4-63) Oakes-Donaldson No. 613300-E653, (4x473) Houdaille-Hershey XO-944. Oil-bath **Servicing (Oil-bath Type)**—Clean filter and fill to Oil level mark with same oil used in engine crankcase at 2000 mile intervals (when engine oil changed) or more often if required by operating conditions.

Fuel Pump: AC Nos. (4x4-63) 1539393, (4x473) 1539562 combination fuel-and-vacuum pump.

Pressure—4½ lbs. maximum.

See Carburetion Equipment Section for complete data.

Gasoline Gauge: King-Seeley electric. Model 4x473 has special gauge voltage regulator.

Dash Unit—King-Seeley No. (4x4-63) 42570, (4x473) 45534.

Tank Unit—King-Seeley No. (4x4-63) 41285, (4x473) 44506.

Gauge Voltage Regulator (4x473)—*See Misc. Electrical.*

See Carburetion Equipment Section for complete data.

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Oil Pressure Regulator—Under plug on side of pump housing. Opens at 35 lbs. Adjustable by adding or removing shims located above spring in plug.

Oil Pump: Rotor type pump mounted on left side of crankcase.

Oil Pump Servicing—*See Willys Special Data.*

Oil Filter: Purolator. On cylinder head bracket at right front corner of cylinder head with oil outlet connected to top of timing chain cover.

CAUTION—Filter should be drained at each crankcase oil change (2000 mile intervals) and filter element replaced at 8000 mile intervals for normal service.

Oil Pressure Gauge: King-Seeley electric. 4x473 has special gauge voltage regulator.

Dash Unit—King-Seeley No. (4x4-63) 42565, (4x473) 45537.

Engine Unit—King Seeley No. (4x4-63) 40767, (4x473) 44030.

Gauge Voltage Regulator (4x473)—*See Misc. Electrical.*

See Miscellaneous Section for complete data.

COOLING

Cooling System: Pressure type with pressure valve (relief valve) in filler cap.

Capacity—11 qts.

Pressure Valve—Radiator Filler Cap. Opens at 3¾ lbs. (3¼-4¼ lbs.).

Water Pump: Centrifugal, packless, ball bearing type. *See Water Pump Section for complete data.*

Removal—Loosen and remove drive belt, disconnect hose. Remove pump mounting screws, lift out pump and fan assembly.

Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat: Harrison. In outlet elbow on cylinder head. Starts to open at 145-155°F. Fully open at 170°F.

Temperature Gauge: King-Seeley electric. 4x473 has special gauge voltage regulator.

Dash Unit—King-Seeley No. (4x4-63) 42575, (4x473) 45545.

Engine Unit—King-Seeley No. (4x4-63) 7000, (4x473) 44200.

Gauge Voltage Regulator (4x473)—*See Misc. Electrical.*

See Miscellaneous Section for complete data.

CLUTCH

Auburn Model 8501-19 (4x4-63), 8501-36 (4x473) with Borg & Beck Driven Member. Single plate, dry disc type.

See Clutch Section for complete data.

►**Clutch Facing Change & Return Clip Spring Installation to correct Clutch Chatter & Noise**—*See "Auburn Clutch" in Clutch Section.*

Facings—Molded (flywheel side), Woven (pressure plate side). I. D. 5⅛". O. D. 8½". Thickness .132-.138".

Pedal Adjustment: Pedal free travel 1¼" (for 1/16" clearance between release bearing and clutch levers). To adjust, loosen locknut and turn adjusting nut on connector link at clutch fork, tighten locknut.

Removal: Remove transmission (see Transmission Removal), remove flywheel bell housing. Mark pressure plate and flywheel to insure correct re-installtion, take out mounting screws in clutch cover flange (turn all screws out evenly), remove clutch assembly and driven member.

TRANSMISSION

Warner Model (4x4-63) AS3-T90C, (4x473) AS1-T90C.

Three-speed type. Constant-mesh, synchro-mesh, helical gears (Second & High), sliding spur gear (Low & Reverse).

See Transmission Section for complete data.

Transfer Case: Spicer Model 18. Two speed auxiliary transmission and front wheel drive unit mounted on rear of transmission case. Separate control levers provided for Low-High range (right hand lever), and front wheel drive engagement (left hand lever).

See Transmission Section for complete data.

Removal: Transmission and transfer case are removed as an assembly. Disconnect front and rear propeller shaft at front and rear universals. Disconnect speedometer cable at transfer case, brake cable, transmission shift rods at transmission case levers (remote control type) or remove shift levers (floor mounted gear shift), and clutch release cable at cross-shaft bell-crank. Place support jacks under engine and transmission, remove transfer case rubber snubber bolt nut (on right side) and rear mounting bolt nuts at cross-member under transmission case. Remove floor board inspection plate. Drain radiator and loosen upper radiator hose. Remove transfer case shift lever pivot pin screw, remove pin and levers. Remove bolts holding center cross-member at frame side rails and remove cross-member. (CAUTION—with cross-member removed, engine and transmission weight will rest on jacks). Remove bolts holding transmission on bell housing, force transmission to right until ball stud end can be disengaged from end of clutch control cross-shaft. Lower support jacks under engine and transmission and slide transmission and transfer case assembly to rear until clutch shaft clears bell housing, remove assembly from beneath car.

UNIVERSALS

Front & Rear Drive Propeller Shaft Joints: Spicer needle roller bearing types as follows:

	Transmission End	Axle End
Front Drive	1261-102X	1268-104X
Rear Drive	1261-102X	1268-101X

Front Axle Shaft Joint: Bendix or Rzeppa Constant-velocity type. One joint used at outer end of each shaft.

Removal: See Front Axle (below).

FRONT AXLE

Spicer (Salisbury) Model 25—Full-floating, hypoid gear type. Differential assembly (ring and pinion gear assembly) is identical with Spicer Model 23-2 Full-floating Rear Axle and is serviced in same manner.

See Spicer (Salisbury) Full-floating Rear Axle in Rear Axle Section for complete data.

Ratio—5.38-1.

Backlash—.005-.007". Shim adjustment.

Removal: *See Universal Jeep Models CJ-2A & CJ-3A Front Axle Removal instructions.*

Wheel Bearing Adjustment: *See Universal Jeep Models CJ-2A & CJ-3A "Front Axle" for instructions.*

REAR AXLE

Spicer (Salisbury) Model 41-2. Semi-floating, Hypoid gear type with Hotchkiss drive.

See Rear Axle Section for complete data.

Ratio—5.38-1.

Backlash—.004-.008". Shim adjustment.

Removal: Support rear end of truck securely, remove rear wheels, disconnect rear shock absorbers, rear brake line (at frame connection on right side), rear brake cable and propeller shaft at rear universal. Place support jacks under axle housing to relieve springs of weight, remove nuts on spring "U" bolts, remove pivot bolt at front end of springs, lower springs to floor. Remove axle assembly.

Axle Shaft Removal: Remove wheels and hub assembly (use wheel puller), remove nuts and bolts holding backing plate and brake assembly, remove dust shield, oil seal, and backing plate. Remove axle shaft and wheel bearing. CAUTION—Do not lose bearing adjusting shims.

Wheel Bearing Adjustment—Endplay .003-.005". Adjust by adding or removing shims between backing plate and flange on axle housing. See axle shaft removal above for dismantling instructions.

NOTE—Shims installed on **left hand** end of axle housing only in production. Shims can be installed on right hand end of axle housing if necessary, for correct end play.

SHOCK ABSORBERS

Gabriel or Monroe—Hydraulic, direct acting, adjustable type. NOTE—Shock absorbers are sealed and cannot be dismantled for servicing or refilling.

See Shock Absorber Section for complete data.

FRONT SUSPENSION

Conventional type with semi-elliptic springs. *See FRONT AXLE data above.*

Steering Knuckle Bearing Servicing & Adjustment *See Universal Jeep Models CJ-2A, CJ-3A "Front Axle" for instructions.*

Kingpin Inclination—7½° (All).

Caster—3° **Camber**—1½°. **Toe-In**—3/64-3/32".

STEERING GEAR

Ross Model T12, No. TA-13018—Cam-and-Twin Lever.

See Steering Gear Section for complete data.

BRAKES

Service Brakes: Bendix (Lockheed) Four Wheel Hydraulic, self-centering type. Hand lever applies rear wheel service brakes.

See Brake Section for complete data.

Drum Diameter—11".

Lining—Molded type. Width 2", Thickness 3/16". Length per wheel 22 1/16".

Clearance—.008" toe, .005" heel for each shoe.

NOTE—On self-centering type brakes, centralize shoes by hard brake application before making adjustment.

Hand Brake: See Service brakes above.

MISC. MECHANICAL

Windshield Wiper: Vacuum type, cable operated.

See Miscellaneous Section for data.

Vacuum Spark Control Unit: Auto-Lite No. VC-4010A (IGW-4189A Distr.), IAT-2023LD (IAT-4008 Distr.). Separate unit linked to advance plate.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	4¾"
1°	2°	5⅜"
3°	6°	6¾"
4°	8°	7⅜"
5°	10°	8"

Installation Note—If crankshaft has been turned with distributor off engine, install distributor as follows: Turn crankshaft to #1 cylinder firing position (see Timing), turn distributor shaft until rotor is at #1 segment (see diagram), install distributor on engine, rocking shaft slightly to engage drive coupling, push distributor down into place, install hold-down screw, check ignition timing.

CAUTION—If oil pump has been removed, see Oil Pump Installation under "Oil Pump" in Willys Special Data.

IGNITION TIMING

Standard Setting ..... **TDC**

Timing Marks—Flywheel mark "TC/" centered in inspection hole in right front face of housing under starter (remove inspection hole cover).

Timing (Engine not Running)—With #1 piston on compression, turn engine over until piston reaches firing position with flywheel mark "TC/" centered in inspection hole in right front face of housing, loosen advance arm clampscrew, rotate distributor until contacts begin to open, tighten clampscrew, see that rotor at #1 segment in distributor cap (see diagram), check spark plug cable connections.

Timing Using Timing Light—(Engine Running)—This method recommended by manufacturer. Direct timing light through inspection hole at flywheel, idle engine (engine must be warm), adjust distributor (as directed above) until "TC/" mark centered in inspection hole.

CARBURETOR

Carter YF. No. 768S (Early 1950), 768SA (Later 1950), 832S, SA, SB (Late 1950-51). 1¼" Single barrel downdraft type with manual choke control and "Diaphragm" type accelerating pump and metering rod control.

Casting No. on flange—630.

See Carburetor Section for complete data.

►***STUMBLE CORRECTION (738S, 768S, SA, 832S, CARBURETORS)—See "Carter YF" in Carburetor Section for complete data.***

►**768S Carburetor conversion to 768SA**—***See "Carter YF Downdraft" in Carburetor Section.***

Settings (Idle Setting, Float Level, and Accelerating Pump): ***See Tune-Up data.***

Metering Rods & Jets—***See Carter Jet Table in Carburetor Section for complete data.***

Fast Idle: Interconnected linkage by which choke valve lever opens throttle to fast idle position when carburetor choked for starting.

Setting—Lip on fast idle arm should contact boss on body with choke valve wide open. Adjust by bending connector rod at offset.

CARB. EQUIPMENT

Air Cleaner: (Std.) Houdaille-Hershey No. 620300 Oil-wetted type. (Optl.) Oil-bath type.

Servicing (Oil-wetted type)—Clean filter element and re-oil at 2000 mile intervals or more often if required by operating conditions.

Servicing (Oil Bath type)—Clean filter and refill with same grade oil as used in engine at 2000 mile intervals (at oil change). Capacity approx. 1¼ pts.

Fuel Pump: AC. No. 1539562 fuel-and-vacuum pump. **Pressure**—3 lbs. (4½ lbs. max. at 1800 RPM.)

See Carburetion Equipment Section for data.

Gasoline Gauge: King-Seeley "CV" (Constant Voltage) type with voltage regulator.

Dash Unit—King-Seeley No. (First Cars) 45534, (Later Cars) 45727.

Tank Unit—King-Seeley No. 44506 (all).

See Carburetion Equipment Section for complete data.

BATTERY

Auto-Lite Type PN-15—6 Volt, 15 Plate, 100 Ampere Hour capacity (20 hour rate).

Starting Capacity—120 amperes for 20 minutes.

Grounded Terminal—Negative (—) grounded at starter.

Location—Right hand side of dash in engine compt.

STARTER

Auto-Lite Model MZ-4137 (First), MZ-4162 (Later).

Armature—Auto-Lite No. MZ-2214 (MZ-4137), MZ-2330 (MZ-4162).

Drive—Overrunning clutch and positive pinion shift actuated by starting pedal.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—160 RPM., 150-175 amps., 5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	65
2.55 "	1325	5.0	200
7.65 "	220	4.0	400
7.8 "	Lock	3.0	420

Removal: On right front face of flywheel housing. To remove, disconnect pedal linkage and cables, take out flange mounting capscrews and bolt in bracket on commutator end.

Starting Switch: Auto-Lite No. SW-2677A. Mounted on starter and operated by pinion shift lever.

See Electrical Equipment Section for complete data.

GENERATOR

Auto-Lite Model GDZ-4817A (First Cars), GDZ-6001D (Later Cars). Two-brush type with voltage and current regulation.

Armature No.—Auto-Lite GDZ-2006F (GDZ-4817A). GGY-2006F (GDZ-6001D Generator).

Maximum Charging Rate—35 amperes, 8.0 volts (cold) with discharged battery (controlled by regulator).

Charging Rate Adjustment—None (see Regulator).

Performance Data

Cold Amperes	Cold Volts	Cold R.P.M.	Hot Amperes	Hot Volts	Hot R.P.M.
0	6.4	925	0	6.4	1000
5	6.65	1060	5	6.65	1150
10	6.85	1200	10	6.85	1290
15	7.05	1340	15	7.05	1430
20	7.3	1480	20	7.3	1590
25	7.55	1620	25	7.55	1750
30	7.8	1760	30	7.8	1980
35	8.0	1900	35	8.0	2250

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—35-53 ozs. (new brushes).

Field Current—1.6-1.8 amperes at 6.0 volts.

Motoring Current—4.2-4.6 amperes at 6.0 volts.

Removal: Conventional pivot mounting at right front of engine. To remove, take out two pivot bolts and clamp bolt, slip off drive belt.

Belt Adjustment: 1" deflection (thumb pressure) midway between generator and pump pulleys. To adjust, loosen all mounting bolts, pull generator away from engine.

REGULATOR

Auto-Lite Model VRP-6003-A. Voltage-Current Type. Regulator case mounted on right side in engine compartment. Consists of Cutout Relay and vibrating type Voltage and Current Regulator units. NOTE—Regulator cover sealed. Warranty void if seals broken.

See Electrical Equipment Section for complete data.

Cutout Relay

Cuts In—6.4-7.0 volts (set to 6.4-6.6 volts).

Cuts Out—4.1-4.8 volts (approx. 4-6 amps. disch.).

Contact Gap—.015" minimum.

Air Gap—.031-.034" with contacts open measured at hinge end of core.

Voltage Regulator

Setting—7.35 volts (7.2-7.5) at 70°F. See Electrical Equip. Section for settings at other temperatures.

Checking (without breaking seals) & Adjustment—***See Electrical Equipment Section.***

Contact Gap—.012" min. (armature against stop pin).

Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked "35" on cover).

Checking (without breaking seals) & Adjustment—***See Electrical Equipment Section.***

Contact Gap & Air Gap Same as Voltage Regulator.

LIGHTING

Headlamps: Corcoran-Brown "Sealed Beam" type. Upper and lower beams controlled by Beam Selector Switch on toeboard.

See Electrical Equipment Section for complete data.

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LUBRICATION

Engine Oiling System: Pressure to main and connecting rod bearings, camshaft bearings, and timing chain or timing gears. Oil pump mounted externally on left hand side of crankcase.
Crankcase Capacity—4 quarts.
Oil Pressure—25 lbs. Actual—35 lbs. Gauge at 30 MPH.
Oil Pressure Regulator—Under plug on side of pump housing. Opens at 35 lbs. Adjustable by adding or removing shims located above spring in plug.

Oil Pump: Rotor type pump mounted on left side of crankcase.
Oil Pump Servicing—*See Willys Special Data.*

Oil Pressure Gauge: King-Seeley "CV" (Constant Voltage) electric type with gauge voltage regulator.
Dash Unit—King-Seeley No. (First Cars) 45537. (Later Cars) 45729.
Engine Unit—King-Seeley No. 44030 (all).
See Miscellaneous Section for complete data.

COOLING

Cooling System: Pressure type with pressure valve (relief valve) in filler cap.
Capacity—11 qts.
Pressure Valve—Radiator Filler Cap. Opens at 3¾ lbs. (3¼-4¼ lbs.).

Water Pump: Centrifugal, packless, ball bearing type.
See Water Pump Section for complete data.
Removal—Loosen and remove drive belt, disconnect hose. Remove pump mounting screws, lift out pump and fan assembly.
Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat: Harrison. In outlet elbow on cylinder head. Starts to open at 145-155°F. Fully open at 170°F.

Temperature Gauge: King-Seeley "CV" (Constant Voltage) electric type with gauge voltage regulator.
Dash Unit—King-Seeley No. (First Cars) 45545, (Later Cars) 45734.
Engine Unit—King-Seeley No. 44200 (all).
See Miscellaneous Section for complete data.

CLUTCH

Auburn Model 8501-36 with Borg & Beck Driven Member. Single plate, dry disc type.
NOTE—Clutch has neoprene driving lug inserts and Return Clip Springs for quieter operation.
See Clutch Section for complete data.
Facings—Molded (flywheel side), woven (pressure plate side). I.D. 5⅛". O.D. 8½". Thickness .132-.138"

Pedal Adjustment: Pedal free travel 1" (provides 1/16" clearance between release bearing and clutch levers). To adjust, loosen locknut and turn adjusting nut on connector link at clutch fork, tighten locknut.

Removal: Remove transmission (see Transmission Removal below), remove flywheel bell housing. Mark clutch pressure plate and flywheel to insure re-installation in same position. Take out mounting screws in clutch cover flange (turn all screws out evenly), remove clutch and driven member.

TRANSMISSION

Warner. Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all helical gear

Car Model	Warner Transmission
473-SW, SD, VJ (No Overdrive)	AS37-T96
473-SW (With Overdrive)	AS28-T96
473-VJ (With Overdrive)	AS30-T96

Transmission Control (473-SW, SD, VJ): Remote control type with gearshift lever on steering column.
See Transmission Section for complete data.

Removal: Remove floor boards, take off bell housing inspection cover, disconnect clutch throw-out bearing retracting spring. Disconnect transmission control rods and speedometer cable at transmission case. Disconnect propeller shaft at universal joints and remove shaft. Support engine with jack placed under bell housing, remove rear engine support bolts from cross-member under transmission case, raise rear end of engine so that transmission clears cross-member. Remove transmission to bell housing bolts, pull transmission straight back to clear clutch shaft, remove from car.

OVERDRIVE

Warner Type R10 (part of AS28-T96 & AS30-T96 Transmissions). Solenoid operated, governor controlled type with throttle operated "kick-down." Overdrive is new "centered ring gear" type.
See Transmission Section for complete data.
Control Relay—Auto-Lite Model HRT-4001.
Overdrive Governor—Auto-Lite Model TGE-4002.
Transmission Solenoid—Delco-Remy Model 1118132.

Removal: Remove as a unit with the transmission. Removal instructions same as for regular transmission (above) after governor and solenoid wires and lock-out control cable disconnected, and overdrive case-to-cross-member bolts removed.

UNIVERSALS

Detroit Series 4100. Ball-and-trunnion type.
See Universals Section for complete data.

REAR AXLE

Spicer (Salisbury) Model 23-1. Semi-floating, Hypoid Gear type with Hotchkiss drive.
See Rear Axle Section for complete data.

Ratio—	Without Overdrive	With Overdrive
473-SW, SD	4.88-1	5.38-1
473-VJ	4.56-1	4.88-1

Backlash—.004-.009". Shim adjustment.

Removal: Support rear end of car securely, remove rear wheels, disconnect rear shock absorbers, rear brake line (at frame connection on right side), rear brake cables, and propeller shaft at rear universal joint. Place support jacks under axle housing so that springs relieved of weight, remove nuts on spring "U" bolts, remove pivot bolt at front end of springs, lower springs. Remove axle assembly from beneath car.

Axle Shaft Removal: Remove wheel and hub assembly (use wheel puller), disconnect brake line at wheel cylinder, remove nuts on bolts holding backing plate and brake assembly on housing, remove dust shield, oil seal, and backing plate (with brake assembly). CAUTION—Do not lose bearing adjusting shims located between backing plate and flange on housing. Remove axle shaft and wheel bearing.
Wheel Bearing Adjustment—Endplay .003-.007". Adjust by adding or removing shims between backing plate and axle housing flange at each wheel. See axle shaft removal (above).

SHOCK ABSORBERS

Willys Nos.	Front	Rear
473-SW, SD	647502	647503
473-VJ	648203	647506

Monroe or Gabriel direct acting, hydraulic type.

FRONT SUSPENSION

Planadyne Type. Independent, linked parallelogram type with transverse spring (spring acts as lower control arm).
See Front Suspension Section for complete data.
Kingpin Inclination—5° crosswise.
Caster—1° No adjustment.
Camber—1½°. (1¼-1¾° limits).
Toe-In—1/16-1/8".
►*See Willys Front Suspension for Toe-in adjustment procedure.*

STEERING GEAR

Ross Model T-12. Cam-and-Twin Lever type.
See Steering Gear Section for complete data.

BRAKES

Service Brakes: Bendix (Lockheed) Hydraulic, self-centering type. Hand lever applies rear wheel service brakes.
NOTE—These self-centered brakes do not have anchor pin adjustment.
See Brake Section for complete data.
Drums—Chrome nickle. Diameter 10".
Lining (473-SW, SD, VJ)—Molded type. Width 1.760", Thickness 3/16". Length per shoe—10 11/16" (forward shoe—all wheels), 8 15/16" (rear shoe—all wheels).
Clearance—.008" toe, .005" heel, for each shoe.
NOTE—No anchor pin adjustment provided. Brake shoes should be centralized by hard brake application (and then released) before adjusting.

Hand Brake: See Service Brakes (above).
Adjustment—Tighten link rod adjustment (cable equalizer connector) at brake lever on frame cross-member for slight drag with hand lever set two notches "on". Release hand lever and make certain that brakes free of any drag.

MISC. MECHANICAL

Windshield Wipers: Vacuum type, cable operated.
See Miscellaneous Section for data.

Distributor Removal: On right side of engine. To remove, disconnect vacuum line, take out hold-down screw in vacuum unit mounting bracket.
Installation Note—If crankshaft has been turned with distributor off engine, install distributor as follows: Turn crankshaft to #1 cylinder firing position (see Timing), turn distributor shaft until rotor opposite #1 segment in cap (see diagram), install distributor on engine, rocking shaft slightly to engage drive coupling, push distributor down into place, install hold-down screw, check timing.
CAUTION—If oil pump has been removed, see Oil Pump data in Willys Special Data.

IGNITION TIMING

Std. Setting.....At Top Dead Center
NOTE—See Octane Selector Setting to compensate for special fuel and operating conditions.
Timing Marks—Line on rim of vibration dampener and pointer on timing gear cover. Flywheel also marked ('TC' on flywheel in line with horizontal center-line of inspection hole, right front face of housing.
Timing (Engine not Running)—With #1 piston on compression, turn engine until piston reaches firing position (TDC) with line on vibration dampener aligned with pointer on right side of timing gear cover. Loosen vacuum control link screw in distributor quadrant, center pointer on scale, tighten screw. Loosen clampscrew on hold-down plate, rotate entire distributor assembly until contacts begin to open, tighten clampscrew, see that rotor at #1 segment in distributor cap, check plug connections.
Timing (Using Timing Light—Engine Idling). This method recommended by manufacturer. Direct timing light at vibration dampener, idle engine (engine must be warm), adjust distributor (as directed above) until timing mark lines up with pointer.
Octane Selector Setting—If engine pings on heavy pull, loosen vacuum control link screw at distributor quadrant, retard spark slightly by rotating distributor counter-clockwise. For High Octane Fuel, spark can be advanced by rotating distributor clockwise.

CARBURETOR

Zenith Series 31, Assy. No. 11119. 1¼", Single barrel, downdraft type with manual choke control.
See Carburetor Section for complete data.

Settings (Idle Setting, Float Level, and Accelerating Pump): ***See Tune-Up data.***
Metering Jets—***See Zenith Jet Specifications in Carburetor Section.***

Fast Idle: Fast idle cam serving as stop for throttle stopscrew is linked to choke valve lever and rotated to fast idle position when choke closed for starting.
Setting—No adjustment required.

CARB. EQUIPMENT

Fuel Pump: AC No. 1539245. Diaphragm type combination fuel-and-vacuum pump.
Replacement Pump—AC No. 9245.
Pump Pressure—3½-4½ lbs. at 1800 Eng. RPM.
See Carb. Equipment Section for complete data.

Gasoline Gauge: King-Seeley "CV" (Constant Voltage) electric type with voltage regulator.
Dash Unit—King-Seeley No. (First Cars) 45534, (Later Cars) 45727.
Tank Unit—King-Seeley No. 44506 (all).
See Carburetion Equipment Section for complete data.

Air Cleaner: AC 1544113 Oil-wetted type, Element #1.
Servicing (Oil-wetted Type)—Clean filter element and re-oil at 2000 mile intervals or more often if required by operating conditions.

CRANKCASE VENTILATOR

Sealed Positive Ventilation Type. Air intake pipe (from air cleaner to oil filler pipe) furnishes clean air to crankcase, air outlet pipe (from valve cover to manifold) allows fumes from crankcase to be sucked into intake manifold. Vacuum control valve at manifold connection **must close at idling speed** for satisfactory idling performance.
NOTE—Clean Vacuum Control Valve when engine tuned up.
Cleaning Vacuum Control Valve—Remove control valve by disconnecting pipe and unscrewing valve from manifold. Disassemble valve, withdraw valve and spring, clean valve and valve seat thoroughly.
Servicing—Make certain all connecting pipes tight and that oil filler cap gasket seals cap tightly. Remove and clean control valve when tuning engine or whenever system does not operate satisfactorily.

BATTERY

Auto-Lite PN-15 or Willard HW-1-100. 6 volt, 15 plate, 100 Ampere Hour capacity (20 hr. rate).
Starting Capacity—120 amperes for 20 minutes.
Grounded Terminal—Negative (—) grounded at starter.
Engine Ground—Strap at left front engine mount.
Location—Right hand side of dash in engine compt.

STARTER

Auto-Lite Model MZ-4137 (First cars), MZ-4162 (Later Cars. Armature No. MZ-2214 (for MZ-4137).
NOTE—Serial Nos. at which starter changed: (673-SW) No. 13233, (673-VJ) No. 11286.
Armature—Auto-Lite MZ-2214 (MZ-4137), MZ-2330 (MZ-4162).
Drive—Overrunning clutch and positive pinion shift actuated by starting pedal.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—160 RPM., 150-175 amps., 5 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.5	70
2.55 "	1325	5.0	200
7.65 "	220	4.0	400
7.8 "	Lock	3.0	420
4.4 "	Lock	2.0	280

Starting Switch: Auto-Lite SW-2677A. Mounted on starter and operated by pinion shift lever.
See Electrical Equipment Section for complete data.

GENERATOR

Auto-Lite Model GDZ-4817A (First cars), GDZ-6001D (Later cars). Two brush (shunt) type with voltage and current regulation.
NOTE—Serial Nos. at which generator changed: (673-SW) No. 13233. (673-VJ) No. 11286.
Armature—Auto-Lite No. GDZ-2006F (GDZ-4817A), GGY-2006F (GDZ-6001D).
Maximum Charging Rate—35 amperes, 8.0 volts (cold) with discharged battery (controlled by regulator).
Charging Rate Adjustment—None (see Regulator).

Performance Data

Cold Amperes	Volts	R.P.M.	Hot Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
5	6.65	1060	5	6.65	1150
10	6.85	1200	10	6.85	1290
15	7.05	1340	15	7.05	1430
20	7.3	1480	20	7.3	1590
25	7.55	1620	25	7.55	1750
30	7.8	1760	30	7.8	1980
35	8.0	1900	35	8.0	2250

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—35-53 ozs. (new brushes).
Field Current—1.60-1.78 amperes at 6.0 volts.
Motoring Current—4.2-4.6 amperes at 6.0 volts.

Belt Adjustment: 1" deflection (thumb pressure) midway between generator and pump pulleys. To adjust, loosen all mounting bolts, pull generator away from engine.

REGULATOR

Auto-Lite Model VRP-6003A. Voltage & Current type. On right side in engine compartment.
See Electrical Equipment Section for complete data.
NOTE—Regulator cover sealed. Warranty void if seals broken.

Cutout Relay

Cuts In—6.4-7.0 volts (set to 6.4-6.6 volts).
Cuts Out—4.1-4.8 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open (measured at hinge end of core).

Voltage Regulator

Setting—7.35 (7.2-7.5) volts at 70°F. See Electrical Equipment Section for data at other temperatures.
Checking (without breaking seal) & Adjustment—***See Electrical Equipment Section.***
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—34-36 amperes (marked "35" on cover).
Checking (without breaking seal) & Adjustment—***See Electrical Equipment Section.***
Contact Gap & Air Gap—Same as Voltage Regulator.

LIGHTING

Headlamps: Corcoran-Brown "Sealed Beam" type. Upper and lower beams controlled by Beam Selector Switch on toeboard.
See Electrical Equipment Section for complete data.
Adjustment—Aim upper beam straight ahead with hot spot center 3" below lamp center height at 25 ft.
Beam Indicator—On left side of instrument panel (above Radio). Lighted when upper beams in use.

Switches

Lighting—Willys No. 800369 (First Cars), 801274 (Later Cars). NOTE—No. 801274 has instrument light and dome light control by rotating switch knob.
Beam Selector—Willys No. 801903.

MISC. ELECTRICAL

LIGHTING CIRCUIT BREAKER: 30-ampere type. Mounted on lighting switch. Vibrating thermostatic type. Protects lighting circuits by vibrating to limit current. No adjustment.

FUSES: Overdrive—20 ampere. On control relay.

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levers). To adjust, loosen locknut and turn adjusting nut on connector link at clutch fork, tighten locknut.

Removal: Remove transmission (see Transmission Removal), remove flywheel bell housing. Mark pressure plate and flywheel to insure correct re-installation, take out mounting screws in clutch cover flange (turn all screws out evenly), remove clutch assembly and driven member.

TRANSMISSION

Warner Model (673-SW) AS28-T96, (673-VJ) AS30-T96. Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all helical gear type.

See Transmission Section for complete data.

Transmission Control: Remote control type with gear-shift lever on steering column.

See Transmission Section for complete data.

Removal: Remove floor boards, take off bell housing inspection cover, disconnect clutch throw-out bearing retracting spring. Disconnect transmission control rods and speedometer cable at transmission case. Disconnect propeller shaft at universal joints and remove shaft. Support engine with jack placed under bell housing, remove rear engine support bolts from cross-member under transmission case, raise rear end of engine so that transmission clears cross-member (CAUTION—use care that fan blades do not damage radiator). Remove transmission to bell housing bolts, pull transmission straight back to clear clutch shaft, remove from car.

OVERDRIVE

Warner Type R10 (part of Transmission Assy.). New solenoid operated, governor controlled type overdrive (no centrifugal pawls) with throttle operated "kick-down."

See Tranmission Section for complete data.

Control Relay—Auto-Lite Model HRT-4001.
Overdrive Governor—Auto-Lite Model TGE-4002.
Transmission Solenoid—Delco-Remy Model 1118132

Removal: Remove as a unit with the transmission. Removal instructions same as for regular transmission (above) after governor and solenoid wires and lock-out control cable disconnected and overdrive case-to-cross-member bolts removed.

UNIVERSALS

Detroit Universals Series 4100. Ball-and-trunnion type.

See Universals Section for complete data.

REAR AXLE

Spicer (Salisbury) Model 23-1. Semi-floating, Hypoid Gear type with Hotchkiss drive.

See Rear Axle Section for complete data.

Ratio—4.88-1 (without O.D.), 5.38-1 (with O.D.).
Backlash—.004-.009". Shim adjustment.

Removal: Support rear end of car securely, remove rear wheels, disconneet rear shock absorbers, rear brake line (at frame connection on right side), rear brake cables, and propeller shaft at rear universal joint. Place support jacks under axle housing so that springs relieved of weight, remove nuts on spring "U" bolts, remove pivot bolt at front end of springs, lower springs. Remove axle assembly from beneath car.

Axle Shaft Removal: Remove wheel and hub assembly (use wheel puller), disconnect brake line at wheel cylinder, remove nuts on bolts holding backing plate and brake assembly on housing, remove dust shield, oil seal, and backing plate (with brake assembly). CAUTION—Do not lose bearing adjusting shims located between backing plate and flange on housing. Remove axle shaft and wheel bearing.
Wheel Bearing Adjustment—Endplay .003-.007". Adjust by adding or removing shims between backing plate and axle housing flange at each wheel. See axle shaft removal (above).

SHOCK ABSORBERS

Monroe or Gabriel. Direct acting, hydraulic type.

	Front - —Willys No. — Rear
673-SW	647502 — 647503
673-VJ	648203 — 647506

NOTE—Shock absorbers are sealed and cannot be dismantled for servicing or refilling.

FRONT SUSPENSION

Planadyne Type. Independent, linked parallelogram type with transverse spring (spring acts as lower control arm).

See Front Suspension Section for complete data.

Kingpin Inclination—5° crosswise.
Caster—1° No adjustment.
Camber—1°.
Toe-In—1/16-1/8".
►*See Willys Front Suspension for Toe-in adjustment procedure.*

STEERING GEAR

Ross Model T-12. Cam-and-Twin Lever type.

See Steering Gear Section for complete data.

BRAKES

Service Brakes: Bendix (Lockheed) Hydraulic, self-centering type. Hand lever applies rear wheel service brakes.
NOTE—These self-centered brakes do not have anchor pin adjustment.

See Brake Section for complete data.

Wheel Cylinders—Diameter: Front 1", Rear 7/8".
Drums—Chrome-nickel type. Diameter 10".
Lining—Moulded type (all shoes). Width 1.760". Thickness .182-.192". Length per shoe: 10 11/16" forward shoe, 8 5/16" reverse shoe.
Clearance—.008" toe, .005" heel, for each shoe.
NOTE—No anchor pin adjustment provided. Brake shoes should be centralized by hard brake application (and then released) before adjustments made.

Hand Brake: See Service Brakes (above).
Adjustment—Tighten link rod adjustment (cable equalizer connector) at brake lever on frame cross-member for slight drag with hand lever set two notches "on". Release hand lever and make certain that brakes free of any drag.

MISC. MECHANICAL

Windshield Wipers: Vacuum type, cable operated.

See Miscellaneous Section for complete data.