6 mounting screws in clutch cover (when installing, use 2 long shank mounting screws in 2nd hole on each side of locating dowel), remove clutch.

TRANSMISSION

TRANSMISSION (STD.):—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:—Oldsmobile 'Handi-shift' type.
See Transmission Section for complete data.

Removal:—Disconnect shift and selector rods from levers at transmission, speedometer cable, rear universal and slide slip yoke and propeller shaft to rear. Remove four transmission mounting capscrews, pull transmission straight back and remove.

HYDRA-MATIC DRIVE

HYDRA-MATIC DRIVE (OPTL.):—Own Make—Consists of fluid coupling & automatic transmission.

Lubrication—Check fluid level in transmission every month or every 1000 miles. Drain and refill after first 5000 miles and every 10,000 miles thereafter. Use only "Oldsmobile Hydra-Matic Fluid."

Capacity—Approx. 9½ qts. (10 if dismantled).

Checking Fluid Level—Clean all sand, lint, and dirt away from sheet metal cover in floor under right front corner of front compt. rug. Run engine several minutes (1941), for 30 seconds (1942). Stop engine, wait 1 minute. Remove sheet metal cover from floor for access to dip stick. Measure level with dip stick, add fluid until level is at "FULL" mark.

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

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

Removal: *See Hydra-Matic Drive in Transmission Section.*
See Transmission Section for complete data.

UNIVERSALS

UNIVERSAL JOINTS:—Mechanics 2C or 2CR (new type). Roller bearing types. Two used.
See Universals Section for complete data.
NOTE—Slip joint formed at rear of transmission ahead of front U-joint (driveshaft 1 piece type).

REAR AXLE

REAR AXLE:—Own Make. Semi-floating, hypoid gear type with torque taken through 2 support arms.
See Rear Axle Section for complete data.

Ratios—	Std. Transmission		Hydra-Matic	
	Std.	Mountain Plains	Std.	Mount.
	1941 Models		1941	
68	4.1-1	4.3-1	3.9-1	3.42-1
78	4.3-1	4.55-1	3.9-1	3.42-1
98	4.3-1	4.55-1	3.9-1	3.42-1
	1942 Models		1942	
68	3.9-1	4.3-1	3.6-1	3.42-1
78	4.3-1	4.55-1	3.9-1	3.42-1 — 3.9-1
98	4.3-1	4.55-1	3.9-1	3.6-1 — 3.9-1
Sta. Wag.	4.3-1		3.9-1	

NOTE—Ring and pinion gear ratio (41-10, etc.) stamped on top side of differential carrier.
Backlash—.004-.008". Screw adjustment.

Removal:—Disconnect drive shaft at rear universal (do not disengage spline joint at transmission), remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.

Axle Shaft Removal:—Hoist rear end, remove wheel, brake drum, backing plate mounting nuts, static collector and loosen bearing retainer (do not move backing plate or brake line may be damaged). Pull shaft and bearing with puller J-942 (do not allow shaft to drag on oil seal), replace 1 backing plate nut.
Wheel Bearing Adjustment—None.

Rear Suspension:—Quadri-coil type (support arms).
See Rear Axle Section for complete data.

SHOCK ABSORBERS

SHOCK ABSORBERS:—Delco. FRONT—Model 1947-C (right), D (left). RIGHT REAR—2105-E (78, 98), G (68). LEFT REAR—2105-F (78, 98), H (68). Double acting (parallel cylinder type rear), hydraulic.

FRONT SUSPENSION

Front Suspension:—Independent, linked parallelogram type with coil springs.
See Front Suspension Section for complete data.
Kingpin Inclination—4°51'10".
Caster—0-¾° Negative. Adjustable.
Camber—Negative ¼° to Positive ¾°. Adjustable.
Toe In—1/16-⅛". Adjust each tie rod equally.
Steering Geometry—Inner wh'l 23° ± ½°. Outer 20°.

STEERING GEAR

Steering Gear: Saginaw Worm-and-Roller type with steering linkage with 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 wheel service brakes.
See Brake Section for complete data.
Wheel Cylinder Bore—Front Wheel 1 3/32" (1941) 1⅛" (1942). Rear Wheel 1" (1941-42).
Lining (1941)—Molded. Width 1¾" (68), 2" (78, 98). Thickness 3/16". Length per shoe: 9 11/32" (Primary), 11 31/32" (Secondary Shoe).
Lining (1942)—Molded. Width: Front wheel 2" (68), 2¼" (78, 98). Rear Wheel 1¾" (68), 2" (78 & 98). Thickness 3/16". Length per shoe: 9 11/32" (Primary), 11 31/32" (Secondary Shoe).
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 Conv. Top: (1941) Vacuum Power. **(1942)**—Electric type.
See Miscellaneous Section for complete data.

CONTINUED FROM PRECEDING PAGE

BATTERY

Delco Type 15E-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 (—) to Starter.

Location—On left side in engine compartment.

Police Battery Delco Model 19E-1. 6 volt, 19 plate, 130 Ampere Hour Capacity (20 hour rate).
Grounded Terminal and Location—Same as above.

STARTER

Delco-Remy Nos.	Type
1107034 ('46), 1107066 ('47-48)	Foot Operated
1107930 (Hydra-Matic & RHD Cars)	Pushbutton
1107050 ('46-47 Optional)	Pushbutton

Armature No.—Delco-Remy No. 1867897 (all mod.).

Drive—Overrunning clutch type, with pinion shift, manual (1107034, 66), solenoid (1107050, 930).

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—24-28 ounces each.

Cranking Engine—100 RPM., 125-135 amperes, 5 volts (for Summer Temperatures).

Performance Data—1107034, 50, 66

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

Performance Data—1107930

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 mounting screws.

Starting Switch (1107034, 66): Delco-Remy No. 820052. On starter. Operated by pedal pionion shift lever. **(1107050, 1107930)**—Delco-Remy Solenoid Switch No. 1118021. On starter. Controlled by Pushbutton Switch No. 1996009 on instrument panel (and Neutral Safety Switch No. 1997761 on Hydra-Matic Cars).
See Electrical Equipment Section for complete data.
Safety Switch Adjustment—Place Selector Lever in "N" (neutral) position, loosen safety switch bracket locking screw, adjust switch so clearance between lever and stop is 1/16-3/32".

GENERATOR

Delco-Remy 1102664 (Std.), 1102680 (Hydra-Matic). Armature No. 1879002. Two brush (shunt) types with voltage and current regulation. Ventilated by fan.

Pulley Note—Cars with Std. Trans. (1102664 Gen.) have regular 3 9/16" pulley. Hydra-Matic Drive cars (1102680 Gen.) have smaller 3 1/16" pulley to compensate for lower engine speed (max. output reached at approx. 110 Eng. RPM. less). NOTE—This pulley can be installed on cars with 3.9-1 Axle ratio

Charging Rate Adjustment—None. Charging rate controlled by Voltage Regulator, maximum output by Current Regulator. See Regulator data below.

Maximum Charging Rate—33 amperes, 7¾ volts, 2400 RPM (hot operating tem.) at 21 MPH car speed and above (Current Regulator setting) with load or discharged battery. Actual charging rate controlled by Voltage Regulator (dependent on battery).

Performance Data—Cold

	Amperes①	Volts	R.P.M.
1102664, 80	30	8.0	1750

①—Not maximum output. See Current Regulator.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—25 ozs. 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:—Check with straightedge across pulleys. Belt deflection should be ¾" inward.

REGULATOR

Delco-Remy Model 1118242. Single Core Type. Vibrating type Voltage and Current Regulators in a single case with Cutout Relay.
See Electrical Equipment Section for complete data.
CAUTION—Check generator for grounded field coils and leads before changing regulator settings

Cutout Relay

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

Voltage Regulator

Setting—7.2-7.4 volts hot (at operating temp.). Regulator over-compensated for temperature. Should be checked with cover in place and hot.
Checking & Adjusting—*See Electrical Equip. Section.*
Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator

Setting—34-36 amperes hot (at operating temp.).
Checking & Adjusting—*See Electrical Equip. Section.*
Air Gap—.080" (check same as Voltage Regulator).

LIGHTING

Headlamps: Guide "Sealed Beam" type.
See Electrical Equipment Section for complete data.
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Small red indicator in upper edge of speedometer. Lighted when Upper Beams in use.

Direction Signal: *See Electrical Equipment Section.*

Switches

Lighting—(1946—66, 1946-47—76) Delco-Remy Nos. 1995026 (1995027 for RHD cars).
(1947—66) Delco-Remy 1995033 (1995034 for RHD).
(1948—66) Delco-Remy 1995036 (1995037 for RHD).
(1948—76) Delco-Remy 1995038 (1995039 for RHD).

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	4030
Parking, Rear License	3	63
Dir. Signal & Parking	21-3	1154
All Indicators	1	51
Instrument, Glove C., Clock	1½	55
Stop & Tail	21-3	1154
Dome (exc. Sta. Wg. & Conv.)	15	88
Dome (Station Wagon)	6	81
Dome (Convertible)	1½	55
Trunk & Under-hood	6	81
Back-up	32	1133L

MISC. ELECTRICAL

THERMOSTATIC RELAY: On lighting switch. Contacts remain closed with 30 ampere current, open in 3 minutes with 42 amps. current@70°F. Limits current to 18 amps. with dead short-circuit. Not adj

FUSES: Dome & Stop Lights—On lighting switch. ('46-47) SFE 9 ampere. ('48) SFE 14 ampere.

Dome & Tail (1948 Convertible)—3AG 20 ampere. In body feed wire to tail and dome lights.

Glove Box & Under-hood light—1AG 5 ampere.

Direction Signal—SFE 9 ampere. In Flasher to Ignition Switch wire.

Electric Clock—1AG 2 ampere. In feed wire.

Cigar Lighter—1AG 30 and 3AG 30 ampere.

Radio—3AG 15 ampere.

Back Up Light—SFE 9 ampere.

HORNS: Delco-Remy No. Low Note: (1946-47) 1999607, (1948) 1999617, High Note: (1946-47) 1999608, (1948) 1999618. Vibrator type operated by relay.

Type	Current (at 6 volts)	Air Gap
1999607, 617 (Low)	19-21 amperes	.047-.052"
1999608, 618 (High)	18-20 amperes	.039-.044"

Horn Relay:—Delco-Remy No. 1116775.

Contact Gap—.025". **Air Gap**—.015" (closed).

Contacts Close—2.75-4.0 volts.

ENGINE

ENGINE SPECIFICATIONS: 6 cylinder, "L" head type.
Bore—3½". **Stroke**—4⅛".
Displacement—238.1 cubic ins. **Rated HP**—29.4.
Developed Horsepower—100 at 3400 RPM.
Compression Ratio—6.5-1 cast-iron head.
Compression & Vacuum Reading—*See Tune-up data.*

OIL PAN REMOVAL: *See Oldsmobile Shop Notes.*

TIGHTENING TORQUES (Torque Indicating Wrench Data)—*See Oldsmobile Shop Notes.*

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

PISTONS: Aluminum alloy, T-slot, cam ground, electro-plated type.
Weight—17.37 ozs. **Length**—4 1/32".
Removal—Pistons and rods removed from above.

Clearance—Top land .023-.028". Skirt clearance Top .0025", Bottom .00075". Fitted for .0005-.0010" clearance on thrust surface. See Fitting New Pistons.

Replacement Pistons: Finished pistons (pins fitted) .003", .005", .010", .015", .030" oversize.

Fitting New Pistons: Check piston for size with micrometer (pin removed) 90° from pin bosses ⅜" below lower ring groove and ⅜" from bottom of skirt. Insert .002" x ½" feeler between piston (pin removed) and cylinder wall on valve side with piston inverted and T-slot on opposite side from feeler. Pull to withdraw feeler must be 4 to 11 lbs. (piston and block at 70°—low limit below 70°, high above).

Installing Pistons: Mark "V-S" on head toward valves (slot away from valves). Pin hole offset 3/32" to left.

PISTON RINGS: 2 coated compression (install with mark TOP up), 2 oil control rings, all above pin.

Ring	Width	End Gap	Side Clearance
Compr.	.0925-.0935"	.008-.018"	.001-.003"
Oil Contr.	.1860-.1865"	.007-.015"	.001-.0025"

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

ENGINE

CONTINUED FROM PRECEDING PAGE

PISTON PIN: Diameter—.8554-.8557". **Lgth.**—3 5/32". Pin locked in one piston boss by lockscrew (opposite end slotted). Pin bosses are plated and must not be reamed. Standard size pins only serviced.
Pin Fit in Piston—.0001" tight to .0002" loose (plain boss end), .0003-.0006" tight (lock boss end).
Pin Fit in Rod Bushing—.0003-.0006" clearance.
Pin Fitting, Removal, and Installation—*See "Piston Pins" in Oldsmobile Shop Notes.*

CONNECTING ROD: Length 7 13/16". Weight 29 ozs.
Crankpin Journal Diameter—2.123-2.124".
Lower Bearing Diameter—2.1245-2.1255".
Lower Bearing—Removable steel-backed, Durex-babbitt overlay bearing shells.
Clearance—.0005-.0025". **Sideplay**—.0055-.0105".

Bearing Adjustment: None (no shims). Replace bearings.

Installing Rods: Oil spit hole at lower end toward valves and grooves on rod and cap bolt boss (part number side) matched. Special ground cap bolts with self-locking nuts used. Tighten to 45-50 ft. lbs.

CRANKSHAFT: 4 bearing, 7 integral counterweights.
Journal Diameters—#1, 2.478-2.479"; #2, 2.5405-2.5415"; #3, 2.6655-2.6665"; #4, 2.6855-2.6865".
Bearings—Removable steel-backed, Durex-babbitt overlay bearing shells. Front bearing has oil groove (to front) for thrust plate lubrication.
Clearance—.0005-.002" (rear), .001-.003" (all others).

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. NOTE—9/16" cap bolts used on rear bearing, ½" on others (heads alike).
Bearing Removal—*See "Crankshaft & Main Bearings" in Oldsmobile Shop Notes.*

End Thrust:—At #1 bearing. **Endplay**—.004-.008". *See "Crankshaft & Main Bearings" in Oldsmobile Shop Notes.*

Rear Main Bearing Oil Seal Installation: *See "Crankshaft & Main Bearings" in Oldsmobile Shop Notes.*

CAMSHAFT: 4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 1.9975-1.9980"; #2, 1.9350-1.9355"; #3, 1.8725-1.8730"; #4, 1.8100-1.8105".
Reamed Bushing Diameters—#1, 1.9995-2.001", #2, 1.937-1.9385"; #3, 1.8745-1.876"; #4, 1.812-1.8135".
Bearings—Bronze bushings. **Clearance** .0015-.0035".

End Thrust:—Forward thrust taken by flange on front engine support plate, rear thrust by flange on shaft bearing against front of engine block.

Timing Chain: Link-Belt. Width 1". Pitch .500". Length 47 links or 23½".

Camshaft Setting—Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers (or use Tool HM-408-0).

VALVES:	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3415-.3425"	5 51/64"
Exhaust	1 27/64"	.3410-.3418"	5 51/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.303"	.00175-.00375"
Exhaust	45°	.298"	.00245-.00425"

Valve Guides:—Intake and exhaust guides same. Press guides in so top end ⅞" below top of block. (Tool J-1042 positions guide correctly in block). Ream to .34425-.34525" inside diam. (not tapered). **Length**—3 7/32".

Valve Springs:—Same spring used on both valves and on 6&8 engines. Damper on top of each spring. Free length 2⅝".

	Spring Pressure	Spring Length
Valve Closed	55 lbs.	2¼"
Valve Open	100 lbs.	1 15/16"

Valve Lifters:—Mushroom type. Diam. .6235-.6240". Lifter holes in block have bearing-ized finish (if worn, fit oversize lifter without reaming hole when possible, to preserve finish). Furn. .001", .002", .005", .010" OS. **Clearance** .0005-.0008". NOTE—Use only 1⅛" diam. face lifter (to clear fuel pump eccentric).

VALVE TIMING

Tappet Clearance:—.008" Int., .011" Exh. Hot & idling. NOTE—Self-locking tappet screws used.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 5° BTDC. Close 45° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
Valve Timing Check—With .0124" tappet clearance, #1 intake valve should open with piston 5° (.0163") BTDC with flywheel TDC mark (steel ball insert) approx. 2 teeth before indicator (hole on left front face of housing). Reset tappet clearance at .008" hot.

LUBRICATION

Engine Oiling System: Pressure to main, connecting rod, and camshaft bearings, piston pins, and timing chain. Oil pump mounted externally on right side of engine.
Crankcase Capacity—5 quarts.
Normal Oil Pressure—30 lbs.
Oil Pressure Regulator—On oil pump. Opens at 30 lbs. Non-adjustable type.

Oil Pump: Gear type on right side of crankcase.
Oil Pump Assembly & Installation—*See "Oil Pump" in Oldsmobile Shop Notes.*

Oil Pressure Gauge: AC No. ('46-47) 1506797, ('48) 1507034.

Crankcase Ventilation: Filter element in oil filler cap (inlet breather). Outlet pipe on right side of engine.
Servicing—Wash and re-oil filter element every 2000 miles or oftener as required in dusty areas.

COOLING

Cooling System: Positive circulation with water pump on front of engine and water distributing tube in cylinder block. Pressure valve (relief valve) used in filler cap on 1947-48.
Capacity—18½ quarts.
Pressure Valve—AC No. 850501. Filler Cap Opens at 4 lbs. (3¼-4¼ lbs.).

Radiator Core Removal: *See Oldsmobile Shop Notes.*

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

Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open 152°F. Fully open 173°F.

Temperature Gauge: AC Electric type.
Dash Unit—('46-47) 1511652, ('48) 1512059.
Engine Unit—('46-47) 1510772, ('48) 1512015.
See Miscellaneous Section for complete data.

CLUTCH

Borg & Beck Model 9A7 with Borglite driven member. Single plate, dry disc type with steel and asbestos composition pressure plate oil baffle and clutch release bearing lubrication fitting. Cover No. 924. *See Clutch Section for complete data.*

Release Bearing Lubrication:—*See Oldsmobile Special Data.*
Facings—Spiral wound (spirally grooved) molded woven, 2 used. Inside Diam. 6", O.D. 9¼". ⅛" thick.
Pedal Adjustment:—Free travel 1-1¼". Turn link at fork in or out of clevis on auxiliary shaft.
Removal:—Remove transmission (see data below), clutch underpan and take out 6 mounting screws in clutch cover (when installing, use 2 long shank mounting screws in 2nd hole on each side of locating dowel), lower clutch assembly out.

TRANSMISSION

STANDARD

Own Make. All helical gear. Constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse).
See Transmission Section for complete data.
Transmission Control:—Oldsmobile 'Handi-shift' type.
See Transmission Section for complete data.
Removal:—Disconnect shift and selector rods from levers at transmission, speedometer cable, rear universal and slide slip yoke and propeller shaft to rear. Remove four transmission mounting capscrews, pull transmission straight back and remove.

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 at each 1000 mile lubrication period or every 2000 miles. Drain and refill every 25,000 miles. Use only Oldsmobile Hydra-Matic Drive Fluid.
Capacity—11 qts. (when drained and refilled with unit in car). Approximately 12 qts. (when refilling after the unit has been removed and completely rebuilt).
Checking Fluid Level—Engine must be running at slow idle. Raise floor mat, take off cover in floor above transmission, lift out combination filler cap and dip stick. Add fluid until level is at "FULL" mark with engine idling.
►*CAUTION—Engine must be running at slow idle speed when checking Hydra-Matic Drive Fluid Level.*
Hydra-Matic Linkage Adjustment—*See Hydra-Matic Drive article in Transmission Section.*
Removal: *See Hydra-Matic Drive article in Transmission Section.*

UNIVERSALS

Mechanics 2C or 2CR types. Roller bearing types. *See Universals Section for complete data.*
NOTE—Slip joint formed at rear of transmission ahead of front U-joint (driveshaft 1 piece type).
►**1947-48 CAUTION**—Rear universal companion nut controls rear axle pinion bearing "pre-load" (must be adjusted whenever nut is loosened). *See 1947-48 Oldsmobile in Rear Axle Section.*

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 com-

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Rotation—Counter-clockwise viewed from above.

Distr. Degrees	Automatic Advance Distr. R.P.M.	Eng. Degrees	Eng. R.P.M.
Start	250	3.0	500
3.5	500	7.0	1000
12.0	1600	24.0	3200

Vacuum Spark Control: Delco-Remy No. 1116036—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".

Vacuum Advance		
Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	6.5-8.5"
6°	12°	14.0-16"①

①—At .125" travel.

Octane Selector—Adjustment permits 10° advance or retard from center '0' position. See Ign. Timing.

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

IGNITION TIMING

Std. Setting	Flywheel Degrees	Piston Position
Std. Trans. Cars	2° BTDC	.002" BTDC.
Hydra-Matic Trans.		.001" BTDC.

NOTE—Modify this setting for special fuel and altitude conditions. See Octane Selector Setting.

Timing (With Synchroscope)—Recommended method. Loosen hold-down screw in advance arm, center Octane Selector scale ('0' at indicator line), tighten hold-down screw. Clip synchroscope lead to #1 spark plug, direct synschroscope light on flywheel through inspection hole in left front face of housing above starter. Idle engine, loosen advance arm clamp bolt, rotate distributor until ignition mark (steel ball insert) on flywheel lines up with indicator on housing, tighten clamp bolt, check Octane Selector setting (below).

NOTE—On cars with Hydra-Matic drive, use dial indicator and set distributor so contacts open with piston .001" before top dead center.

Timing (Without Synchroscope)—Turn engine over to firing position for #1 piston with steel ball insert in flywheel at indicator in inspection hole in left front face of flywheel housing (or with piston .001" BTDC. on cars with Hydra-Matic drive). Loosen hold-down screw in advance arm, center pointer on scale ('0' mark at indicator), tighten hold-down screw. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt and check Octane Selector setting.

Octane Selector Setting: Set for a slight ping when accelerating engine with wide open throttle at speeds below 15 MPH. To adjust, loosen distributor hold-down screw, rotate distributor clockwise toward 'Adv' end of scale (if no ping noted), counter-clockwise toward 'Ret' end of scale (if ping too severe) by steps until performance correct.

CARBURETOR

CARTER WDO

Car Model	Carter WDO No.
'46-48 Synchro-Mesh Tr.	503S, SA
'46-Part '47 Hydra-Matic	480S, SA
'48 Hydra-Matic	650S, SA

1⅛" Dual barrel downdraft type with Carter Climatic Control.

Casting No. on Flange—(480S, SA; 503S, SA) 342, (650S, SA) 540.

See Carburetor Section for complete data.

►**480S, 503S, 650S Carburetor Change to improve Warm Engine Starting**—*See 1946-47-48 Oldsmobile Eight (Carter WDO carburetors) in Carburetor Section.*

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

Metering Rods & Jets—*See Carter Downdraft Jet Specification Table in Carburetor Section.*

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

Throttle Cracker Adjustment: Must be set for correct throttle opening for starting. To adjust, disconnect starter cable at starter switch (for foot operated starters), disconnect coil lead to distributor (for solenoid operated starters), depress starter pedal or pushbutton to full down position (engine will be turning over on solenoid starter cars) to fully mesh starter pinion, loosen locknut and turn adjusting screw on accelerator bell-crank (screw contacts lug on lever linked to starter pinion shift lever) so that clearance between throttle stopscrew and highest step of fast idle cam is .105-.125" (⅛").

Fast Idle: Carter Dual (WDO) Carburetor type.

See Carburetion Equipment Section for complete data.

Setting—.015" opening between edge of throttle valve and bore of carburetor (side opposite port) with choke valve tightly closed.

Automatic Choke: Carter Climatic Control (Dual carbs.).

See Carburetion Equipment Section for complete data.

Setting—Mark on thermostat case centered on housing scale (503S, SA), 2 Notches Rich (480S, SA; 650S, SA).

CARBURETOR

CARTER WCD

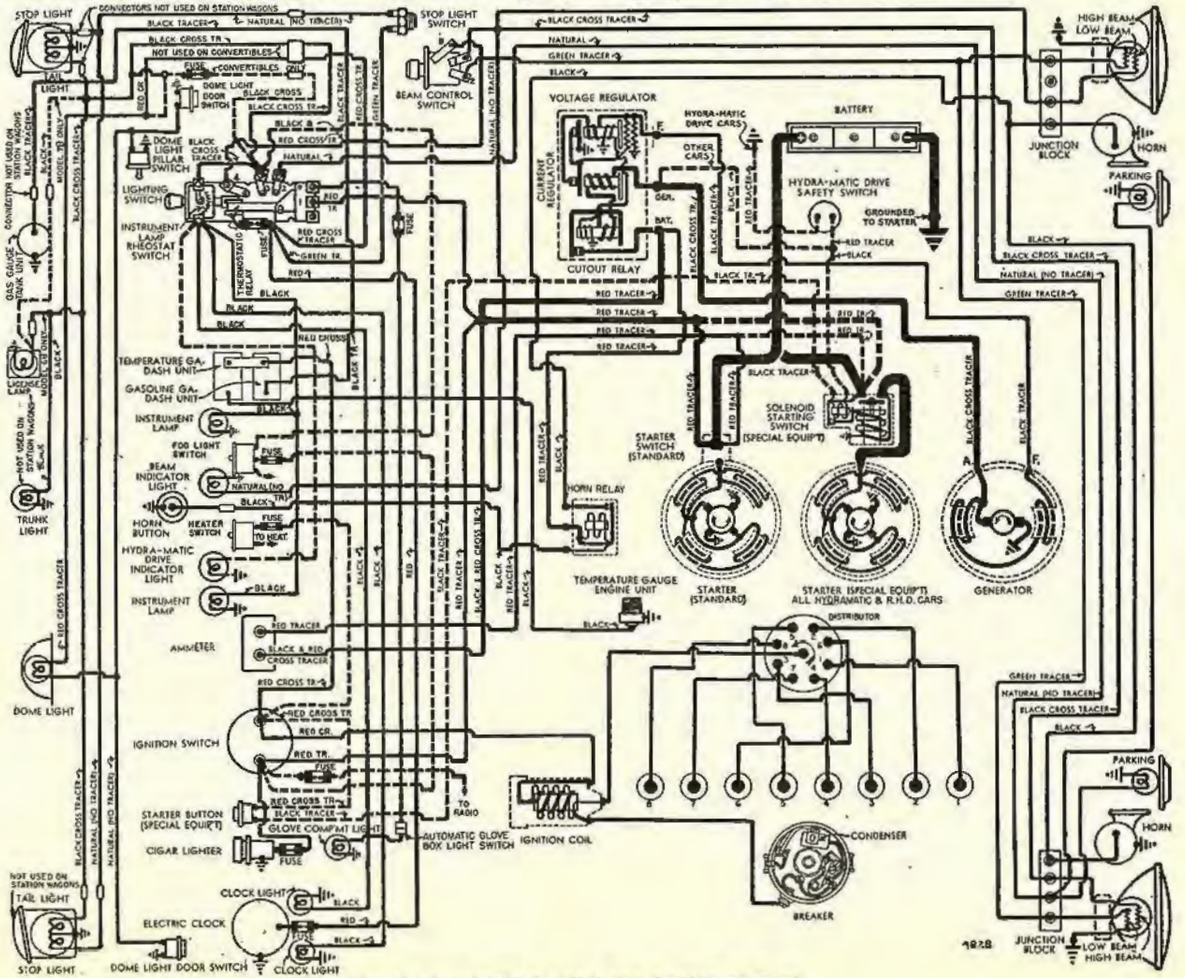
►PART PRODUCTION 1947 HYDRA-MATIC

Carter WCD, No. 665S. 1¼" dual barrel downdraft type with Carter Climatic Control.

See Carburetor Section for complete data.

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

Metering Rods & Jets—*See Carter Downdraft Jet Specification Table in Carburetor Section.*



1948 OLDSMOBILE 8 DYNAMIC SERIES 68 & 78

CONTINUED FROM PRECEDING PAGE

Voltage Regulator

Setting—7.2-7.4 volts hot (at operating temp.). Regulator over-compensated for temperature. Should be checked with cover in place and hot.

Checking & Adjustment—*See Electrical Equipment Section.*

Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator

Setting—34-36 amperes hot (at operating temp.).

Checking & Adjustment—*See Electrical Equipment Section.*

Air Gap—.080" (check same as Voltage Regulator).

LIGHTING

Headlamps: Guide "Sealed Beam" type.

See Electrical Equipment Section for complete data.

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

Beam Indicator—Small red indicator in upper edge of speedometer. Lighted when Upper Beams in use.

Direction Signal: *See Electrical Equipment Section.*

Switches

Lighting—(1946-47—68, 78) D-R No. 1995026.
(1946-47—98) Delco-Remy No. 1995025.
(1948—68, 78) Delco-Remy No. 1995036.
(1948—98) Delco-Remy No. 1995030.

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

Beam Selector—Delco-Remy No. 1997008.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	4030
Parking, Rear License	3	63
Dir. Signal & Parking	21-3	1154
All Indicators	1	51
Instrument (Dynamic)	1½	55
Instrument (Futuramic)	1	51
Ign. Key (Futuramic Conv.)	1	51
Glove Compt., Clock	1½	55
Stop & Tail	21-3	1154
Dome (exc. Sta. Wg. & Conv.)	15	88
Dome (Station Wagon)	6	81
Dome (Convertible)	1½	55
Trunk & Under-hood	6	81
Back-Up	32	1133L

MISC. ELECTRICAL

THERMOSTATIC RELAY: On lighting switch. Contacts remain closed with 30 ampere current, open in 3 minutes with 42 amps. current@70°F. Limits current to 18 amps. with dead short-circuit. Not adj

FUSES: Dome & Stop Lights—On lighting switch. ('46-47) SFE 9 ampere. ('48) SFE 14 ampere.
Dome & Tail (1948 Convertible)—3AG 20 ampere. In body feed wire to tail and dome lights.
Glove Box & Under-hood Light—1AG 5 ampere.
Direction Signal—SFE 9 ampere. In Flasher to Ignition Switch wire.
Electric Clock—1AG 2 ampere. In feed wire.
Cigar Lighter—1AG 30 and 3AG 30 ampere.

HORNS: Delco-Remy No. Low Note: (1946-47) 1999607, (1948) 1999617, High Note: (1946-47) 1999608, (1948) 1999618. Vibrator type operated by relay.

Type	Current (at 6 volts)	Air Gap
1999607, 617 (Low)	19-21 amperes	.047-.052"
1999608, 618 (High)	18-20 amperes	.039-.044"

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

ENGINE

ENGINE SPECIFICATIONS: 8 cylinder, "L" head type.
Bore—3¼". **Stroke**—3⅞".
Displacement—257.1 cubic ins. **Rated HP**—33.8.
Developed Horsepower—(Dynamic) 110 at 3600 RPM. (Futuramic)—115 at 3600 RPM.
Compression Ratio—(Dynamic) 6.5-1, (Futuramic) 7.0-1. Std. Cast iron heads.
Compression & Vacuum Reading—*See Tune-up data.*

OIL PAN REMOVAL: *See Oldsmobile Shop Notes.*

TIGHTENING TORQUES: *See Oldsmobile Shop Notes.*

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

PISTONS: Aluminum alloy, T-slot, cam ground, electro-plated type.
Weight—16 ozs. (stripped). **Length**—3 15/16".
Removal—Pistons and rods removed from above.
Clearance—Top land .023-.028". Skirt clearance Top .00205", Bottom .00155". Fitted for .0013-.0018" clearance on thrust surface. See Fitting New Pistons.

Replacement Pistons: Finished pistons (pins fitted) .003", .005", .010", .015", .030" oversize.

Fitting New Pistons: Check piston for size with micrometer (pin removed) 90° from pin bosses ⅜" below lower ring groove and ⅜" from bottom of skirt. Insert .002" x ½" feeler between piston (pin removed) and cylinder wall on valve side with piston inverted and T-slot on opposite side from feeler. Pull to withdraw feeler must be 4 to 11 lbs. (piston and block at 70°—low limit below 70°, high above).

Installing Pistons: Mark "V-S" on head toward valves (slot away from valves). Pin hole offset 3/32" to left.

PISTON RINGS: 2 compression (coated type—install with mark TOP up), 2 oil control, all above pin.

Ring	Width	End Gap	Side Clearance
Compr.	.0925-.0935"	.009-.014"	.001-.0025"
Oil Contr.	.1860-.1865"	.009-.014"	.001-.0025"

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

PISTON PIN: Diameter—.8554-.8557". **Lgth.**—2 31/32". Pin locked in one piston boss by lockscrew (opposite end slotted). Pin bosses are plated and must not be reamed. Standard size pins only serviced.
Pin Fit in Piston—.0001" tight to .0002" loose (plain boss end), .0003-.0006" tight (lock boss end).
Pin Fit in Rod Bushing—.0003-.0006" clearance.
Pin Fitting, Removal and Installation—*See "Piston Pins" in Oldsmobile Shop Notes.*

CONNECTING ROD: Length 7 13/16". Weight 28 ozs.
Crankpin Journal Diameter—2.123-2.124".
Lower Bearing Diameter—2.1245-2.1255".
Lower Bearing—Removable steel-backed, Durex-babbitt overlay bearing shells.
Clearance—.0005-.0025". **Sideplay**—.0055-.0105".

Bearing Adjustment: None (no shims). Replace bearings.

Installing Rods: Oil spit hole at lower end toward valves and grooves on rod and cap bolt boss (part number side) matched. Special ground cap bolts with self-locking nuts used. Tighten to 45-50 ft. lbs.

CRANKSHAFT: 5 bearing, 8 integral counterweights.
Journal Diameters—#1, 2.478-2.479"; #2, 2.5405-2.5415"; #3, 2.603-2.604"; #4, 2.6655-2.6665"; #5, 2.6855-2.6865".
Bearings—Removable steel-backed, Durex-babbitt overlay bearing shells. Front bearing has oil groove (to front) for thrust plate lubrication.
Clearance—.0005-.002" (rear), .001-.003" (all others).

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps. NOTE—9/16" cap bolts used on rear bearing, ½" on others (heads alike).
Bearing Removal—*See "Crankshaft & Main Bearings" in Oldsmobile Shop Notes.*

End Thrust:—At #1 bearing. **Endplay**—.004-.008". *See "Crankshaft & Main Bearings" in Oldsmobile Shop Notes.*

Rear Main Bearing Oil Seal Installation: *See "Crankshaft & Main Bearings" in Oldsmobile Shop Notes.*

CAMSHAFT: 5 bearing, Non-adjustable chain drive.
Journal Diameters—#1, 2.0600-2.0605"; #2, 1.9975-1.9980"; #3, 1.9350-1.9355"; #4, 1.8725-1.8730"; #5, 1.8100-1.8105".
Reamed Bushing Diameters—#1, 2.0620-2.0635"; #2, 1.9995-2.001"; #3, 1.9370-1.9385; #4, 1.8745-1.876"; #5, 1.812-1.8135".
Bearings—Bronze bushings. **Clearance** .0015-.0035".

End Thrust:—Forward thrust taken by flange on front engine support plate, rear thrust by flange on shaft bearing against front of engine block.

Timing Chain:—Link-Belt. Width 11/16". Pitch .500". Length 47 links or 23½".

Camshaft Setting—Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers (or use Tool HM-408-0).

VALVES:	Head Diameter	Stem Diameter	Length
Intake	1 9/16"	.3415-.3425"	5 51/64"
Exhaust	1 27/64"	.3410-.3418"	5 51/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.286"	.00175-.00375"
Exhaust	45°	.314"	.00245-.00425"

Valve Guides:—Intake and exhaust guides same. Press guides in so top end ⅞" below top of block. (Tool J-1042 positions guide correctly in block). Ream to .34425-.34525" inside diam. (not tapered).

Valve Springs:—Same spring used on both valves and on 6&8 engines. Damper on top of each spring. Free length 2⅝".

	Spring Pressure	Spring Length
Valve Closed	55 lbs.	2¼"
Valve Open	100 lbs.	1 15/16"

Valve Lifters:—Mushroom type. Diam. .6235-.6240". Lifter holes in block have bearing-ized finish (if worn, fit oversize lifter without reaming hole when possible, to preserve finish). Furn. .001", .002", .005", .010" OS. **Clearance** .0005-.0008". NOTE—Use only 1⅛" diam. face lifter (to clear fuel pump eccentric).

VALVE TIMING

Tappet Clearance:—.008" Int., .011" Exh. Hot & idling. NOTE—Self-locking tappet screws used.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open at TDC. Close 35° ALDC.
Exhaust Valves—Open 45° BLDC. Close 10° ATDC.
Valve Timing Check—With .0124" tappet clearance #1 intake valve should open with piston at top dead center (flywheel mark 'TDC/'—NOT STEEL BALL INSERT) aligned with pointer in housing above starter. Reset tappet cl. at .008" hot & idling.

LUBRICATION

Engine Oiling System: Pressure to main, connecting rod, and camshaft bearings, piston pins, and timing chain. Oil pump mounted externally on right side
Crankcase Capacity—6 quarts.
Normal Oil Pressure—30 lbs.
Oil Pressure Regulator—On oil pump. Opens at 30 lbs. Non-adjustable type.

Oil Pump: Gear type on right side of crankcase.
Oil Pump Assembly & Installation—*See "Oil Pump" in Oldsmobile Shop Notes.*

Oil Pressure Gauge: (1946-47) AC No. 1506797.
(1948)—AC No. 1507304 (68, 78), 1507124 (98).

Crankcase Ventilation: Filter element in oil filler cap (inlet breather). Outlet pipe on right side of engine.

COOLING

Cooling System: Positive circulation with water pump on front of engine and water distributing tube in cylinder block and ('47-48) pressure valve in filler cap.

►**1948 Radiator Shroud**—Used on all Eight cylinder models to maintain proper water temperature for high altitude and extreme hot weather driving.

►**Radiator Shroud #555107 for Installation on the 1946-47 Eights**—This 1948 68 & 78 type shroud can be installed. *See "Cooling System" in Oldsmobile Shop Notes.*

Capacity—20½ quarts.
Pressure Valve—AC No. 850501. Radiator filler cap. Opens at 4 lbs. (3¼-4¼ lbs.).

Radiator Core Removal: *See Oldsmobile Shop Notes.*

Water Pump: Packless, sealed ball-bearing shaft.
See Water Pump Section for complete data.
Futuramic Note—Water pump on these engines has been lowered.

Thermostat:—Harrison. In cylinder head outlet.
Setting—Starts to open 152°F. Fully open 173°F.

Temperature Gauge: AC Electric type.
Dash Unit—(1946-47) AC No. 1511652.
(1948) AC No. 1512059 (68, 78), 1511943 (98).
Engine Unit—AC ('46-47) 1510772, ('48) 1512015.
See Miscellaneous Section for complete data.

CLUTCH

Borg & Beck Model 10A7 with Borglite driven member. Cover marked #927. Single plate, dry disc type
See Clutch Section for complete data.

Release Bearing Lubrication:—*See Oldsmobile Special Data.*
Facings—Spiral wound (spirally grooved) molded woven, 2 used. Inside Diam. 7". O.D. 10". ⅛" thick.

Pedal Adjustment:—Free travel 1-1¼". Turn link at fork in or out of clevis on auxiliary shaft.

Removal:—Remove transmission (see below), clutch underpan and reinforcing plate. Take out 6 mounting screws in clutch cover (when installing, use 2 long shank mounting screws in 2nd hole on each side of locating dowel), remove clutch. *For Clutch Housing Re-inforcing Plate data refer Olds Shop Notes.*

TRANSMISSION

STANDARD

Own Make. All helical gear. Constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse).
See Transmission Section for complete data.

Transmission Control:—Oldsmobile 'Handi-shift' type.
See Transmission Section for complete data.

Removal: Disconnect shift and selector rods from levers at transmission, speedometer cable, rear universal and slide slip yoke and propeller shaft to rear. Remove four transmission mounting capscrews, pull transmission straight back and remove.

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 at each 1000 mile lubrication period or every 2000 miles. Drain and refill every 25,000 miles. Use only Oldsmobile Hydra-Matic Drive Fluid.
Capacity—11qts. (when drained and refilled with unit in car). **Approximately 12 qts.** (when refilling after unit removed and completely rebuilt.
Checking Fluid Level—Engine must be running at slow idle. Raise floor mat, take off cover in floor above transmission, lift out combination filler cap & stick, fill to "FULL" mark (engine idling).
►*CAUTION—Engine must be running at slow idle speed when checking Hydra-Matic Drive Fluid Level.*
Hydra-Matic Linkage Adjustment—*See Hydra-Matic Drive article in Transmission Section.*

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

UNIVERSALS

Mechanics 2C or 2CR types. Roller bearing types.
See Universals Section for complete data.
NOTE—Slip joint formed at rear of transmission ahead of front U-joint (driveshaft 1 piece type).

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

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 "preload." No setscrews are used.
See Rear Axle Section for complete data.

1946-47 Rear Axle Ratios
Ratio—Std.: 4.55-1 (98), 4.3-1 (for 68 and 78).
Hydra-Matic: 3.42-1 (68), 3.63-1 (78), 3.9-1 (98).
Optional: 3.9-1 or 4.55-1.

1948 Rear Axle Ratios
Ratios (Std. Trans.)—(68, 78, 98) 43:10 (4.3-1), (68 Sta. Wgn & Optl. on 68 Conv.) 41:9 (4.55-1).
Ratios (With Hydra-Matic Drive)—(68, 78) 40:11 (3.64-1), (98) 39:10 (3.9-1), (68 Sta. Wgn & Conv. & Optl. on 68, 78) 39:10 (3.9-1).

►**Rear Axle Ratio Marking**—Ratio (43:10 etc.) and date stamped on right lower side of carrier.
Backlash—('46) .004-.008", ('47-48) .004-.006". Screw adjustment.

Removal: Disconnect drive shaft at rear universal (do not disengage spline joint at transmission), remove axle shafts and carrier flange capscrews.

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

Axle Shaft Removal: Hoist rear end, remove wheel, brake drum, backing plate mounting nuts, static collector and loosen bearing retainer (do not move backing plate or brake line may be damaged). Pull shaft and bearing with puller J-942 (do not allow shaft to drag on oil seal), replace 1 backing plate nut.
Wheel Bearing Adjustment—None.

Rear Suspension: Coil spring type with support arms.
See Rear Axle Section for complete data.

SHOCK ABSORBERS

Delco. Two types are used. FRONT—Model 1947-C (right), D (left). RIGHT REAR—2105-E (78, 98), G (68). LEFT REAR—2105-F (78, 98), H (68). Double acting (parallel cylinder type rear), hydraulic.

FRONT SUSPENSION

Front Suspension:—Independent, linked parallelogram type with coil springs.
See Front Suspension Section for complete data.
Kingpin Inclination—4° 51' 10".
Caster—0-¾° Negative. Adjustable.
Camber—Negative ¼° to Positive ¾°. Adjustable.
Toe In—1/16-⅛". Adjust each tie rod equally.
Steering Geometry—Inner wh'l 23°±½°. Outer 20°.

STEERING GEAR

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

BRAKES

Service Brakes: 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 1⅛". Rear 1".
Drums—Cast-iron lined steel. Diameter 11".
Lining—Molded. Width: Front wheel 2" (68), 2¼" (78, 98). Rear 1¾" (68), 2" (78, 98). Thick. 3/16". Length 9 11/32" (primary), 11 31/32" (secondary).
Clearance—.015" at both ends of secondary (rear) shoe with primary shoe forced out against drum.

Hand Brake:—See Service Brakes above.

MISC. MECHANICAL

Power Operated Convertible Tops, Windows, & Front Seat: Hydro-Lectric type (motor driven pump).
Futuramic Note—Power operated windows and front seat adjustment optional on 2-Door & 4-Door
See Miscellaneous Section for complete data.

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Performance Data

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

①—Ineludes current draw of starter switch.

Starting Switch: Delco-Remy Solenoid Switch No. 1118136 (no relay used) mounted on starter and controlled by Pushbutton Switch No. 1996038 (1949), 1996046 (1950), (and Neutral Switch No. 1997849 on Hydra-Matic cars).

►*CAUTION*—Overrunning clutch pinion clearance must be adjusted whenever solenoid removed. ***See Electrical Equipment Section for complete data.***

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

GENERATOR

Delco-Remy 1102706 (Std.), 1102707 (Hydra-Matic). Armature No. 1880550. Two brush (shunt) types with voltage and current regulation. Ventilated by fan.

Charging Rate Adjustment—None. See Regulator.

Maximum Charging Rate—40 amperes min. reached at car speed of 22 MPH. Actual charging rate controlled by regulator.

Performance Data

	Amperes	Volts	R.P.M.
Cold	40①	8.0	1900

①—Not maximum output. See Current Regulator.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—25 ozs. each.

Field Current—1.9-2.05 amperes at 6.0 volts.

Belt Adjustment: Check with straightedge across pulleys. Belt deflection should be ¾".

REGULATOR

Delco-Remy 1118300. Voltage & Current Regulator.

►***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 or High Voltage.

Cutout Relay

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

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

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. Check with cover in place and regulator hot.

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

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

Current Regulator

Setting—40-46 amperes hot (set to 42 amps. 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.***

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

Beam Indicator—Small red indicator in upper edge of speedometer. Lighted when Upper Beams in use.

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

Direction Signal Indicators—Left & Right Turn Indicator located at either end of instrument cluster. Lights when direction signal on same side of car operating (Stop Light flashes at rear).

Switches

Lighting—Delco-Remy No. 1995030.

Instrument—Part of Lighting Switch (Rheostat operated by turning light switch knob).

Beam Selector—Delco-Remy No. 1997008.

Directional Signal—Delco-Remy No. (1949) 1995542, (1950) 1995554.

Stop Light—Delco-Remy No. 1997725.

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.

FUSES: Dome & Stop—SFE 14 amp. On light switch.

Dome & Tail (Convertible only)—AGC 20 ampere. In body feed wire to dome and tail lights.

Glove Box & Under-hood Light—AGA 5 amp. each.

Direction Signal—SFE 9 ampere. In Flasher to Ignition Switch wire behind instrument panel.

Electric Clock—AGA 2 ampere. In feed wire.

Cigar Lighter—AGC 30 ampere.

HORNS: Delco-Remy No. (1949) 1999617, (1949-50) 1999647 (welded type) **Low Note. Delco-Remy No. (1949) 1999618, (1949-50) 1999648** (welded type) **High Note.** Vibrator type operated by relay.

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).

ENGINE

ENGINE SPECIFICATIONS: Big Six. 6 cylinder, "L" head.

Bore—3 17/32". **Stroke**—4 3/8".

Displacement—257 cubic ins. **Rated HP.**—29.9.

Developed Horsepower—105 at 3400 RPM.

Compression Ratio—6.5-1 cast-iron head.

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

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

CYLINDER HEAD INSTALLATION: ***See Oldsmobile Special Data.***

OIL PAN REMOVAL: ***See Oldsmobile Special Data.***

PISTONS: Aluminum alloy, T-slot, cam ground, oxalic sulphuric acid coated type.

Weight—('49) 18.24 ozs., ('50) 18.05 ozs. (stripped).

Length—4 1/32".

Removal—Pistons and rods removed from above.

Clearance—Top Land .023-.028". Skirt clearance Top .0025", Bottom .00075". See Fitting New Pistons following.

Replacement Pistons: Finished pistons (pins fitted) .003", .005", .010", .015", .030" oversize.

Fitting New Pistons: Check piston for size with micrometer (pin removed) 90° from pin bosses ⅜" below lower ring groove and also ⅜" from bottom of skirt. Taper should be .0004" max. (larger diameter at the bottom). Then check clearance by inserting .0015 x ½" feeler between piston (pin removed) and cylinder wall on valve side with piston inverted and T-slot on opposite side from feeler. Pull to withdraw feeler should be 7 to 20 lbs.

Installing Pistons: Mark "V-S" on piston head toward valves.

PISTON RINGS: 2 coated compression (install with mark TOP up), 2 oil control rings, all above pin.

Ring	Width	End Gap	Side Clearance
Comp. (#1,2)	.0925-.0935"	①	.001-.003"
Oil (#3.4)	.1860-.1865"	.007-.016"	.001-.0025"

①—(1949) .007-.017". (1950) .008-.018".

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

PISTON PIN: Diameter .8554-.8557". Length 3 5/32". Pin locked in one piston boss by lockscrew (opposite end slotted). Piston bosses may be reamed for installation of oversize pins.

Pin Fit in Piston—.0001" tight to .0002" loose (plain boss end), .0003-.0006" tight (lock boss end), or a tight wring fit (with solid end of pin in boss, pin should just be able to be turned with 6" drift in pin lock screw hole—test each boss).

Pin Fit in Rod Bushing—.0003-.0006" clearance, or suck fit (pin holds on own weight but can be pushed through with slight thumb pressure).

Replacement Pins: Std., .001", .003" oversize.

Piston Pin Removal and Installation—*See "Piston Pins" in Oldsmobile Special Data.*

CONNECTING ROD: Length 7 13/16". **Wgt. 30.72 oz.**

Crankpin Journal Diameter—2.353-2.354".

Lower Bearing Diameter—2.3570-2.3575".

Lower Bearing—Removable steel-backed, Durex-babbitt overlay. No shims.

Clearance—.0005-.0025". **Sideplay**—.0055-.0105".

Bearing Adjustment: None (no shims). Replace bearings. Do not file rods or caps.

Installing Rods: Oil spit hole at lower end toward valves and grooves on rod and cap bolt boss (part number side) matched. Special ground cap bolts with self-locking nuts used. Tighten to 45-50 ft. lbs.

CRANKSHAFT: 4 bearing, 7 integral counterweights.

Journal Diameters—#1, 2.478-2.479"; #2, 2.5405-2.5415"; #3, 2.6655-2.6665"; #4, 2.6855-2.6865".

Bearings—Removable, steel-backed, Durex-babbitt overlay bearing shells. Front bearing has oil groove (to front) for thrust plate lubrication.

Clearance—.0005-.002" (rear), .001-.003" (others).

Bearing Adjustment: None (no shims). Replace bearings. Do not file caps. *NOTE*—9/16" cap bolts used on rear bearing, ½" on others (heads are alike).

Bearing Removal—*See "Crankshaft & Main Bearings" in Oldsmobile Special Data.*

End Thrust: At No. 1 bearing. **Endplay**—.004-.008". ***See "Crankshaft & Main Bearings" in Oldsmobile Special Data for thrust collar and plate data.***

Rear Main Bearing Oil Seal Installation: ***See "Crankshaft & Main Bearings" in Oldsmobile Special Data.***

FLYWHEEL: Removal & Installation—*See Oldsmobile Special Data.*

CAMSHAFT: 4 bearing. Non-adjustable chain drive.

Journal Diameters (1949)—No. 1, 1.9974-1.9981"; No. 2, 1.9349-1.9351"; No. 3, 1.8724-1.8731"; No. 4, 1.8099-1.8106".

Journal Diameters (1950)—No. 1, 1.9974-1.9979"; No. 2, 1.9349-1.9354"; No. 3, 1.8724-1.8729"; No. 4, 1.8099-1.8104".

Reamed Bushing Diameters—#1, 1.9995-2.001"; #2, 1.937-1.9385"; #3, 1.8745-1.876"; #4, 1.812-1.8135".

Bearings—Steel backed copper lead bronze bushings.

ENGINE

CONTINUED FROM PRECEDING PAGE

Clearance—.0014-.0036" (1949), .0016-.0036" (1950).

End Thrust: Forward thrust taken by flange on front engine support plate, rear thrust by flange on shaft bearing against front of engine block.

Timing Chain: Link-Belt. Width 15/16". Pitch .500". Length 47 links or 23½".

Camshaft Setting: Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers (or use Tool HM-408-0).

VALVES	Head Diam.	Stem Diam.	Length
Intake	1.745-1.755"	.3415-.3425"	5.7695-5.8095"
Exhaust	1 27/64"	.3410-.3418"	5 51/64"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.310"	.0022-.0042"
Exhaust	45°	.308"	.0029-.0047"

Valve Guides: Intake and exhaust guides same. Press guides in until top end ⅞" below top of block, Tool J-952 positions guide correctly in block. Ream to .34425-.34525" inside diameter (not tapered).

Length—3 7/32".

Valve Springs: Intake and exhaust springs the same. Damper installed on top of each spring. Free length 2⅝".

	Spring Pressure	Spring Length
Valve Closed	55 ± 3 lbs.	2 1/4"
Valve Open	100±3 lbs.	1 15/16"

Valve Lifters: Mushroom type with self-locking screws. Body Diameter .6235-.6240". Head Diam. 1.125-1.140".

Clearance—.0005-.0008".

Replacement Lifters—.001", .002", .005", .010" O. S.

NOTE—Lifter holes in block have "Bearingized" finish. If holes worn, fit oversize lifter without reaming hole when possible to preserve finish.

VALVE TIMING

Tappet Clearance: .008" INT., .011" EXH. Hot & idling.

NOTE—Self-locking tappet screws used.

Valve Timing: See camshaft setting above.

Intake Valves—Open 5° BTDC. Close 45° ALDC.

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

Valve Timing Check—With .0125" tappet clearance #1 intake valve should open with piston 5° (.010") BTDC. with flywheel steel ball insert (TDC mark) approx. 2 teeth before indicator (hole on left front face of housing). Reset tappet clearance at .008" hot.

LUBRICATION

Engine Oiling System: Pressure to main, connecting rod, and camshaft bearings, piston pins and chain.

Crankcase Capacity—5 quarts.

Normal Oil Pressure—28-33 lbs. (1949), 40 lbs. (1950) at 30 MPH.

Oil Pressure Regulator—On oil pump. Opens at 30 lbs. (1949), 40 lbs. (1950). Non-adjustable.

Oil Pump: Gear type on right side of crankcase.

Oil Pump Assembly & Installation—*See "Oil Pump" in Oldsmobile Special Data.*

Oil Pressure Gauge: AC No. 1507124. Not electric.

Crankcase Ventilation: Filter element in oil filler cap (inlet breather). Outlet pipe on right side of engine.

COOLING

Cooling System: Pressure type with pressure valve and vacuum valve (relief valve) in filler cap. Water distribution tube installed in block. Re-circulation of water through engine (with thermostat closed) permitted by fixed by-pass from cylinder head through block to pump inlet.

Capacity—18½ quarts.

Pressure Valve—AC No. 850501 Filler Cap. Opens at 4 lbs. (3¼-4¼ lbs.).

Radiator Core Removal: *See Oldsmobile Special Data.*

Water Pump: Packless, sealed ball-bearing shaft.

See Water Pump Section for complete data.

Thermostat: Harrison. In cylinder head water outlet.

Setting—Starts to open 152°F. Fully open 173°F.

Temperature Gauge: AC Electric.

Dash Unit—AC No. 1512168.

Engine Unit—AC No. 1512015.

See Miscellaneous Section for complete data.

CLUTCH

Borg & Beck Model 10A7 (Borglite driven member). Single plate, dry disc type with pressure plate oil baffle and release bearing lubrication fitting.

Clutch Cover No.—927 stamped on cover.

See Clutch Section for complete data.

Clutch Release Bearing Lubrication—*See Oldsmobile Special Data.*

Facings—Spiral wound (spirally grooved) molded woven, 2 used. Inside Diam. 7". O. D. 10". ⅛" thick.

Pedal Adjustment: Free travel (1949) ⅞-1¼", (1950) 1-1¼". Turn link at fork in or out of clevis on auxiliary shaft.

Removal: Remove transmission (see data below), clutch underpan and take out 6 mounting screws in clutch cover (when installing, use 2 long shank mounting screws in 2nd hole on each side of locating dowel), lower clutch assembly out.

TRANSMISSION

STANDARD

Own Make. All helical gear, constant-mesh, synchro-mesh (2nd & high), sliding gear (low & reverse).

See Transmission Section for complete data.

Transmission Control: Oldsmobile "Handi-shift".

See Transmission Section for complete data.

Removal: Disconnect shift and selector rods from levers at transmission, speedometer cable, rear universal and slide slip yoke and propeller shaft to rear. Remove 4 transmission mounting capscrews, pull transmission straight back and remove.

HYDRA-MATIC DRIVE

OPTIONAL EQUIPMENT

Own Make. Consists of Fluid Coupling and automatic self-shifting four-speed transmission.

►*HYDRA-MATIC PRODUCTION CHANGE*—Late production cars have modulated throttle pressure.

See Transmission Section for complete data including Testing & Trouble Shooting.

►*NOTE—Different Hydra-Matic Transmissions used and can be distinguished by Serial No. Plate Color and Prefix as follows:*

Car Model	Prefix (& Plate Color)
1949 Six	08-(Black)
1950 Six (First Cars)	S- (Aluminum)
1950 Six (Later "Whirlaway") ①	B- (Orange)

①—Beginning No. 6A108158H.

►*CAUTION*—"Whirlaway" transmissions not interchangeable with earlier transmissions.

Lubrication—Check fluid level in transmission every 2000 miles. Drain and refill after first 15000 miles and every 25,000 miles thereafter. Use only "Oldsmobile Hydra-Matic Drive Fluid."

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

Capacity—Approx. 11 qts. (1949), Approx. 10½ qts. (1950).

Checking Fluid Level—Raise front floor mat at right side, remove sheet metal cover in floor, clean opening of lint, sand, etc. Set hand brake, start engine and let engine idle, move control lever to "DR" position. Take out dip stick, wipe dry and replace stick, remove stick quickly and check level. Level should be at "FULL" mark, add fluid to bring up to "FULL" if required with engine idling.

►*CAUTION—Engine must be idling 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 2C or 2CR. Roller bearing types.

See Universals Section for complete data.

NOTE—Slip joint formed at rear of transmission ahead of front U-joint (one-piece driveshaft used).

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

REAR AXLE

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

►*CAUTION*—Do not use "76" series carrier and axle housing on "88" and "98" series cars. New support used on "88" and "98" series rear axles.

►*NOTE*—Rear universal companion nut controls pinion bearing "pre-load."

See Rear Axle Section for complete data.

Standard Ratios

41:10 (4.1)—Std. exc. Convertible & Sta. Wagon.

43:10 (4.3)—Std. on Convertible & Station Wagon. Optional Hilly Ratio Domestic Cars, & Export Cars.

39:10 (3.9)—Optional on Export Cars.

Hydra-Matic Ratios

40:11 (3.64)—Std. exc. Convertible & Station Wagon. Optional on Export Cars.

39:10 (3.9)—Std. on Convertible and Station Wagon. Optional Hilly Ratio Domestic Cars and Export Cars.

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FRONT END SHEET METAL ASSEMBLY REMOVAL, HOOD REMOVAL: *See Oldsmobile Special Data.*

MODEL IDENTIFICATION

SERIAL NUMBERS: On left front door hinge post.

1949 Numbers—First number 1001 with prefix 498M or 499M, A, etc. as follows:

1950 Numbers—First number 1001 with prefix **(88 Series) 508M** or **(98 Series) 509M**, A, etc., as shown below.

1951 Numbers—First number 1001 with prefix **(88 Series) 517M, (Super 88 Series) 518M** or **(98 Series) 519M**, A, etc., as shown below.

Serial Number Prefix Identification. First two numbers **49** (1949), **50** (1950), **51** (1951) indicate year, third number indicates series, letter indicates assembly plant: **M**—Lansing, **A**—Atlanta, **B**—Framingham, **K**—Kansas City, **L**—Linden, **C**—South Gate, **W**—Wilmington.

ENGINE NUMBER (1949): Stamped on front face of left cylinder bank just below cylinder head and is prefixed by the digit '8', indicating number of cylinders, and a letter indicating compression ratio. ('A' for 7.25-1 & 'C' for 7.5-1).

ENGINE NUMBER (1950-51): Stamped on machined pad on left side of block between #5 & #7 exhaust port, and is prefixed by the digit '8', indicating number of cylinders, and a letter indicating compression ratio. ('A' for 7.25-1 & 'C' for 7.5-1).

1949 Numbers—8A1001 up.

1950 Numbers—194001 Up. Suffix letter "H" indicates Hydra-Matic Transmission.

1951 Numbers—1001 Up. Suffix letter "B" indicates Synchro-mesh Transmission.

TUNE-UP

COMPRESSION PRESSURE: 136 lbs. at cranking spd.

VACUUM READING: Steady 17" min. at idling speed.

FIRING ORDER: 1-8-7-3-6-5-4-2 (Cyl. Nos. 1-3-5-7 Left Bank, 2-4-6-8 Right Bank, front-to-rear). See wiring diagram.

SPARK PLUG GAPS: .030".
Plugs—AC No. 46-5

DISTRIBUTOR: Breaker Gap—.016-.021" (new points), .012-.0175" or .015" preferred (used points).

►***CAUTION—Set new points at .016-.021" to allow for wearing in of rubbing block.***

Cam Angle—22°. Test limits with .016" gap 21-30°. ***See "Delco-Remy Cam Angle" in Electrical Equipment Section.***

Breaker Arm Spring Tension—19-23 ozs.

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

Condenser Capacity—.18-.23 microfarad.

IGNITION TIMING: 2½° BTDC.
Timing Procedure—***See Ignition Timing.***

Pulley Mark (1949)—Pointer on left front side of engine and two steel balls on outer surface of balancer. (See CAUTION below).

Pulley Mark (1950-51)—Pointer on left front side of engine and machined slot in outer surface of balancer (See CAUTION below).

CAUTION—Ignition timing very sensitive and must be set exactly between steel balls or edges of slot. If spark must be retarded to eliminate spark knock, do not retard more than is required.

CARBURETION: 1949 Carter WGD-714S, SA.

Idle Setting—Both screws ½-1 turn open. Turning screws out gives richer mixture.

Idle Speed—(Standard) 425 RPM.

Idle Speed—(Hydra-Matic) 350 RPM. with selector lever in "Dr" position.

Float Level—¼" from top of float to lower face of bowl cover with needle valve seated.

Accelerating Pump—No seasonal adjustment.

Choke Setting—Centered.

CARBURETION: 1949-50 Rochester Model AA.

Idle Setting—Approximately 1 turn open. Turning screws out gives richer mixture.

Idle Speed—(Synchro-mesh) 425 RPM. or 6 MPH.

Idle Speed—(Hydra-Matic) 350 RPM. with selector lever in "Dr" position.

Float Level—23/32" from top of seam on free end to gasket seat on cover with cover assembly inverted and needle seated.

Float Tension—Bend float tang against spring to decrease amount of drop; bend away from spring to increase drop. Tension is correct when the bottom edge of float is suspended freely from cover and is 1/8" above the power stem.

Accelerating Pump Adjustment—3 holes in pump shaft lever. Outer hole (minimum stroke), Center **Recommended Setting**—**(1949)** Outer hole (minimum stroke); **(1950)** Middle hole (medium stroke).

Choke Setting—Centered on index.

CARBURETION: 1951 Rochester Model BB.

Idle Setting—Approximately 1½ turns open. Turning screw out gives richer mixture.

Idle Speed—(Synchro-mesh) 425 RPM. or 6 MPH.

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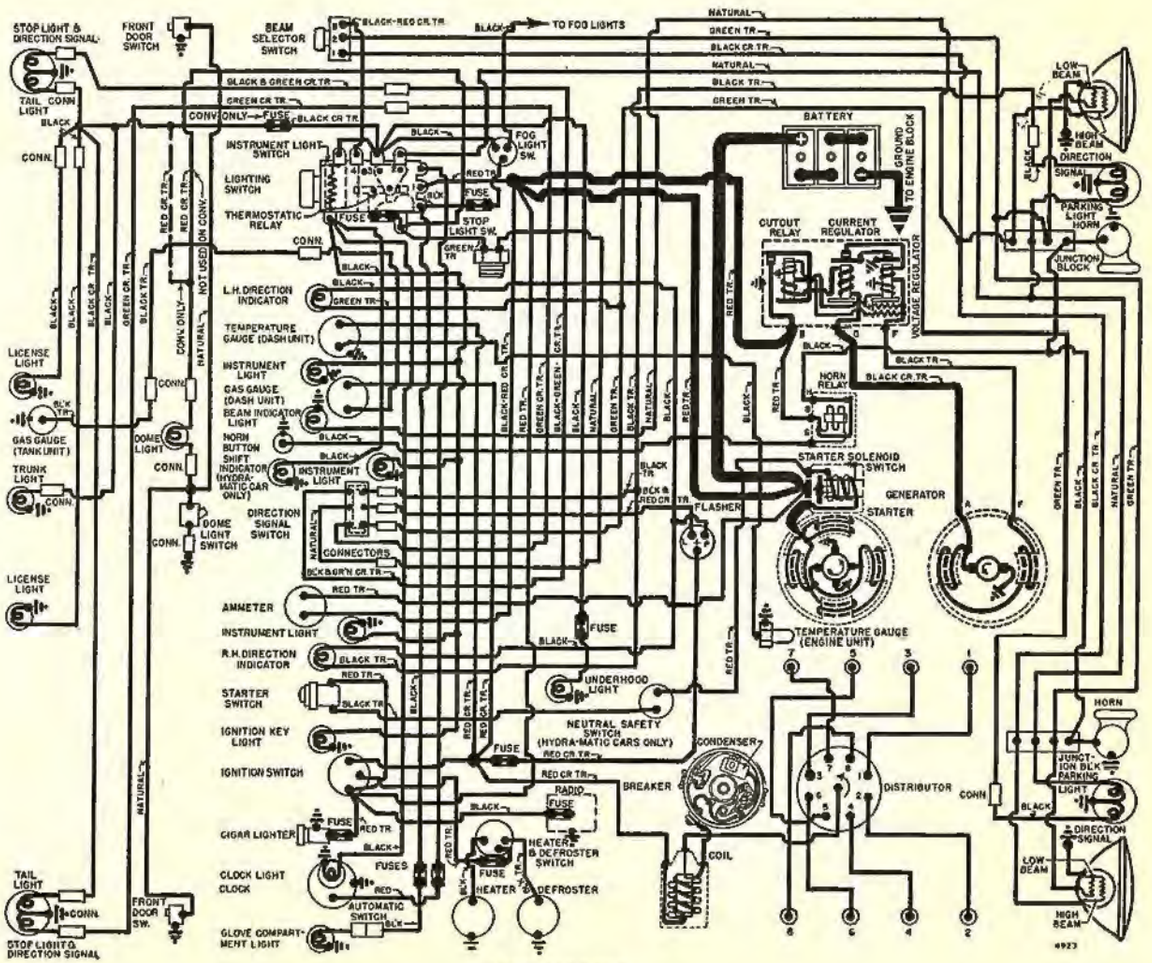

1949 MODELS

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REGULATOR

Delco-Remy Current & Voltage Regulator No. 1118300 (for Gen. No. 1102704); 1118725 (for Gen. No. 1102771).

►***IDENTIFICATION NOTE***—Red daub of paint around lower mounting screw hole on Regulator No. 1118300; None on Regulator No. 1118725.

►***REGULATOR CAUTION—Use only regulator specified for generator. In an emergency, Regulator No. 1118300 can be used with Gen. No. 1102771. DO NOT USE REGULATOR NO. 1118725 WITH GEN. NO. 1102704.***

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 or High Voltage.

Cutout Relay

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

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

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. Check with cover in place and regulator hot.

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

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

Current Regulator

Setting—(1118300) 40-46 amperes (hot) set to 42 amps. hot; (1118725) 45-51 amperes (hot) set to 47 amps. hot.

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

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

LIGHTING

Headlamps: Sealed Beam. ***See Electrical Equip. Section.***

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

Directional Signal Indicators—Left & Right Turn Indicator located at either end of instrument cluster. Lights when directional signal on same side of car operating (Stop Lights flash at rear).

Switches

Lighting—Delco-Remy No. 1005030.

Instrument—Part of Lighting Switch (Rheostat operated by turning light switch knob).

Beam Selector—Delco-Remy No. 1997008.

Directional Signal—Delco-Remy No. (1949) 1995542, (1950) 1995554, (1951) 1995559.

Stop Light—Delco-Remy No. (1949-50) 1997725, (pressure type in brake line). (1951) 1997901, (mechanical type mounted on toe-board).

Back-Up Light—(1951 Synchro-mesh cars) Delco-Remy No. 1997893.

Back-Up Light—(1951 Hydra-Matic cars) Delco-Remy No. 1997875. Combined with Neutral Safety Switch.

MISC. ELECTRICAL

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

FUSES: Dome & Stop—SFE 14 amp. On light switch.

Dome & Tail (Convertible only)—AGC 20 ampere. In body feed wire to dome and tail lights.

Glove Box & Under-hood Light—AGA 5 amp. each.

Directional Signal—SFE 9 ampere. In Flasher to Ignition Switch wire behind instrument panel.

Electric Clock—AGA 2 ampere. In feed wire.

Cigar Lighter—AGC 30 ampere.

HORNS: Delco-Remy No. (1949) 1999617, (1949-50) 1999647 (welded type) **Low Note.** Delco-Remy No. (1949) 1999618, (1949-50) 1999648 (welded type) **High Note.** Vibrator type operated by relay.

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).

ENGINE

ENGINE SPECIFICATIONS: Rocket Engine. New 90° V8 with Overhead Valves. Both cylinder blocks and crankcase cast Enbloc.

Bore—3 3/4". Stroke—3 7/16".

Displacement—303 cubic inches. Rated HP.—45.

Developed Horsepower—135 at 3600 RPM.

Compression Ratio—(1949-50) 7.25-1, (1951) 7.5-1. 1951 Cylinder Head identified by a figure "2" stamped on center exhaust port.

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

CYLINDER HEAD & TIGHTENING TORQUES: ***See Oldsmobile Special Data.***

OIL PAN REMOVAL: ***See Oldsmobile Special Data.***

PISTONS: Aluminum alloy, three-ring, auto-thermic steel-strut, slipper skirt, cam ground, tin plated.

Length—4". Weight—19.88 ozs. (stripped).

Removal—Pistons and rods removed from above.

►*CAUTION*—When removing more than one piston assembly, stamp cylinder number on piston, connecting rod, and cap, before loosening assembly.

Clearance—Top land .032-.036". Skirt clearance .0005-.001" measured ⅛" from bottom of skirt with piston pin removed.

Fitting New Pistons: Insert .0015" x ½" x 12" feeler between piston (pin removed) and cylinder wall at right angles to pin hole. Pull to withdraw feeler should be 10 to 18 lbs.

►*CAUTION*—Allow rebored cylinders to cool to normal room temperature before fitting pistons.

Installing Pistons: Mark "F" cast on each side of pin hole on front side of piston. Install pistons 1, 3, 5, 7 in left bank, 2, 4, 6, 8 in right bank with letter "F" toward front on all pistons.

PISTON RINGS: Two coated (Top ring chrome plated on 1951 engines) compression rings, one slotted oil ring, all above pin. Oil ring groove drilled.

Ring	Width	End Gap	Side Clearance
Comp. (#1,2)	.077-.078"	.008-.020"	.001-.003"
Oil (#3)	.1860-.1865"	.008-.020"	.0018-.0033"

Installing Rings—Compression rings installed with step on inner edge UP. Oil rings marked TOP installed with mark UP.

PISTON PIN: Diameter—.9803-.9807". **Length**—3" (1949); 3 1/64" (1950-51). Floating type with lock ring at each end. 1949 rods are rifle drilled for pin lubrication. Rods in LATER engines are not drilled.

►*CAUTION*—Discard old lock rings and install new service type lock rings when installing pins.

Pin Fit in Piston—.0000-.0002" loose. Pin should NOT fall through piston of own weight. Pin can be tapped in place using brass drift. Pin hole out-of-round .0005" max. Hone pin hole and install oversize pin.

Pin Fit in Rod Bushing—.0003-.0005" loose.

►*CAUTION*—If rod bushing replaced, align oil hole in bushing and rod for pin lubrication, finish to size with Piston Pin Bushing Honing Tool No. KMO-754. Standard bushing diameter .9807-.9811".

Replacement Pins: Std. size, and .001", .003", oversize.

CONNECTING ROD: Length 6.625". Weight 29.54 ozs. Rifle drilled in 1949 engines for piston pin lubrication. Not drilled in later engines.

►*CAUTION*—Use Guide Tool No. BT-22 over rod bolts to prevent damaging crankpin journals when removing and installing piston and rod assemblies.

Crankpin Journal Diameter—2.2488-2.2498.

Lower Bearing—Removable, steel-backed, Durex-babbitt overlay. No shims.

Clearance—.0009-.0029". **Sideplay**—.002-.011".

Bearing Adjustment: None (no shims). Replace bearings. Do not file rods or caps.

NOTE—Tang on bearing insert must seat in notches in cap and rod.

►**Installing Rods:** *CAUTION*—Rods have plain side and boss side (two machined bosses at lower end). Install rods **#1, 3, 5, 7, with plain side to front,** and **#2, 4, 6, 8, with boss side to front** (NOTE—Pistons marked "F" on front side). Caps offset and cannot be installed incorrectly. Groove on rod and cap and pads for numbering caps and rods are on same side.

►*CAUTION*—Misaligned rods must be replaced, straightening rods in field not recommended.

NOTE—Oil spit hole for lubrication of opposite cylinder wall provided in rod above cap joint.

CRANKSHAFT: 5 bearing, 6 integral counterweights.

Journal Diamters #1, 2, 3, 4, 2.498-2.499"; **#5,** 2.623-2.624".

Bearings—Removable, steel-backed, Durex-babbitt overlay bearing shells. Rear bearing flanged.

Clearance—.002-.0035" (rear), .0005-.003" (others).

►*REAR BEARING SHELLS*—Marked with letter on backside of bearing tang. **Use same size bearing (indicated by letter on tang) when replacing bearing.** Rear bearings are selective fit during manufacture, 3 sizes used: "M" Medium, "T" Thin, "H" Heavy.

Bearing Adjustment: None (no shims). Replace bearings. Do not file caps.

NOTE—#1, 2, 3, 4, bearing caps numbered. Install with numbers toward right hand cylinder bank.

Bearing Removal—Bearing shells can be removed and installed without removing crankshaft.

End Thrust: Taken by flanges on rear main bearing.

Endplay—.004-.008".

Crankshaft Front Oil Seal and Rear Main Bearing Oil

ENGINE

CONTINUED FROM PRECEDING PAGE

Seal Installation: *See "Crankshaft & Main Bearings" in Oldsmobile Special Data.*

CAMSHAFT: 5 bearing, coated (Parco-Lubrited) shaft
Camshaft Removal & Installation—*See Oldsmobile Special Data.*
Journal Diameters (1949)—1.8724-1.8731"; (1950-51) 1.8724-1.8729".
Reamed Bushing Diameters—1.8745-1.8760" (all).
Bearings—Steel-backed, babbitt bushings.
Clearance—.0014-.0036".

End Thrust (1949): Forward thrust taken by thrust plate on front of engine, rear thrust at front of cylinder block.

►*CAUTION*—Thrust plate seals off two oil galleys and must be installed flat to prevent low oil pressure at idling speeds. 1/16" hole in plate at right galley provides lubrication for chain, sprockets, fuel pump

End Thrust (1950-51): Forward thrust taken by plunger and spring on front of engine, rear thrust at front of cylinder block.

►*CAUTION*—Two main galley oil holes in block sealed by hex head bolt. A small hole in bolt for right hand galley provides lubrication to timing chain sprocket, fuel pump eccentric and lever.

Timing Chain:	Link-Belt (Std.)	Morse (Optl.)
Width	11/16"	7/8"
Pitch	.500"	.375"
Length (Links)	48	64

►*NOTE—Link-Belt and Morse chains not interchangeable unless sprockets also changed.*

Camshaft Setting: Mesh chain with sprocket marks adjacent and in line with a straightedge across the shaft centers (or use Tool BT-11).
NOTE—Fuel pump eccentric bolted to front end of camshaft ahead of sprocket. Assemble with "0" mark to front, machined step against sprocket.

VALVES:	Head Diam.	Stem Diam.	Length
Intake	1 3/4"	.3417-.3425"	4.907-4.927"
Exhaust	1.432-1.442"	.3930-.3938"	4.931-4.951"

	Angle	Lift	Clearance
1949 Models			
Intake	45°	.330"	.0017-.0035"
Exhaust	45°	.330"	.0022-.0040"
1950-51 Models			
Intake	45°	.333"	.0022-.0042"
Exhaust	45°	.333"	.0027-.0045"

►**Intake Valve Rubber Seals**—Installed in second groove from end of valve stem between lock retainer and valve stem. Always use new rubber seals.

Valve Guides: Intake guides tapered on lower end. Press guides in head until top end 53/64-27/32" above face of valve spring seat (Tool BT-13 positions guide correctly in head). Inside ream diameter .34425-.34525" Intake (1949); .3447-.3457" Intake (1950-51). .39605-.39705" Exhaust (1949); .3965-.3975" Exhaust (1950-51).

Valve Springs: Intake and exhaust springs are alike. Dampers used on lower end of all springs.
Free Length—2 3/32".

	Spring Pressure	Spring Length
Valve Closed	62-68 lbs.	1.777"
Valve Open	136-146 lbs.	1.447"

►*CAUTION*—Lower end of damper and spring must seat in recess in head.

Valve Lifters: New hydraulic type maintaining zero tappet clearance in service. Production lifters fitted in five sizes: std., .001", .002", .003" or .005" oversize with identification number (except standard which is unmarked) etched on lifter body and cylinder block carries size mark on rail under push rod cover.
Clearance—.0005-.0018", selective fit.
Use proper size lifter when replacing valve lifters. *See Miscellaneous Section for complete data.*
Valve Lifter Removal—*See Oldsmobile Special Data.*

Rocker Arms: New rocker arm and shaft assemblies mounted on each cylinder head. Intake rocker arms identified by brass pin in oil lead.
Rocker Arm Shaft Disassembly and Reassembly—*See Oldsmobile Special Data.*

►*CAUTION*—Steel plain finish push rods (alike for all valves) used on domestic engines. Longer copper finish push rods (for thicker head gaskets) used on export engines only.

VALVE TIMING

Tappet Clearance: None in service (hydraulic type lifters which maintain zero clearance).

Valve Timing: *See Camshaft Setting above.*
Intake Valves—Open 14° BTDC. Close 50° ALDC.
Exhaust Valves—Open 50° BLDC. Close 14° ATDC.
Valve Timing Check—#1 intake valve opens 14° before top dead center (#1 piston .060" before top dead center) with zero tappet clearance.

LUBRICATION

Engine Oiling System: Pressure to main bearings, camshaft bearings, connecting rod lower bearings, hydraulic valve lifters (right cylinder bank from main oil galley on right side, left bank from left oil galley from front main bearing); and to rocker arms (hollow shafts, left shaft fed from #2 camshaft bearing, right shaft from #4 camshaft bearing. Timing chain, sprockets, fuel pump lever and eccentric lubricated by metered hole in camshaft thrust plate over front end of right main oil galley. Distributor drive gear lubricated by metered hole in plug in rear end of left oil galley.

►*CAUTION*—See "Oil Filter" below.

Crankcase Capacity—5 quarts.

Normal Oil Pressure—40 lbs. at 30 MPH.

Oil Pressure Regulator—Located on oil pump. Opens at 40 lbs. Non-adjustable.

Oil Pump: Gear type. Located in crankcase and attached to rear main bearing cap by three bolts.
NOTE—Pump can be removed and installed without disturbing distributor drive (flat on upper end of oil pump shaft engages flat on distributor drive gear).

Oil Filter: AC PF-122 full-flow type optional. On lower right side of crankcase at rear.

►*CAUTION*—If oil filter (or pad cover if filter not used) replaced, use a new gasket (coat both sides with POB No. 5 Sealer) and tighten bolts to 35-40 ft. lbs. Oil filter (or pad) mounted externally on lower right side of crankcase at rear. Oil filter is full flow type (all oil from pump delivered to oil filter) requires pad when filter not used to return oil to main oil galley.

Oil Pressure Gauge: AC No. 1507124. Not electrical.

Crankcase Ventilation: Air intake in oil filler cap (oil-wetted type cleaner) with outlet connection to a ventilating baffle at rear of block above right bank. Outlet pipe push fit at ventilator and extends down below right rear corner of engine.
Servicing—Wash and re-oil filter element in cap every 2000 miles (oftener in dusty areas).

COOLING

Cooling System: Pressure type with pressure valve and vacuum valve (relief valves) in filler cap. Two by-passes for water re-circulation with thermostat closed: 1) internal passage from cylinder head through block to pump inlet; 2) (1949-50) external tube from water outlet (cast as part of intake manifold) to pump inlet. (1951) internal by-pass, eliminating external by-pass previously used.
Capacity—21½ qts.
Pressure Valve—AC No. 850549 Radiator Cap. Opens at 7 lbs.

Water Pump: Packless, sealed ball-bearing shaft. Pump mounted in front engine cover casting.
See Water Pump Section for complete data.
Removal—Take off fan and two fan pulleys. Remove six pump mounting bolts (4 to engine cover, 2 to block). Remove pump. NOTE—When installing pump, coat one side of pump housing gasket with gasket cement, dip four bolts in CP No. 9 Sealer.
Fan Belt Adjustment—Loosen idler pulley attaching screws and place tool J-4139 over idler pulley attaching bolt and under bracket. Attach torque wrench to tool J-4139 and tighten belt to 25 ft. lbs.
Generator Belt Adjustment—*See GENERATOR.*

Thermostat: Harrison. In water outlet (integral with intake manifold casting).
Setting—Starts to open 152°F. Fully open 173°F.

Temperature Gauge: AC Electric.
Dash Unit—AC No. (1949-50) 1512168, (1951) 1512275.
Engine Unit—AC No. 1512015.
See Miscellaneous Section for complete data.

CLUTCH

Long 11CF-10½ TI—Semi-centrifugal, single plate, dry disc type.
See Clutch Section for complete data.
Facings—Woven type. I.D. 7", O.D. 10½", Thick. .137".

Pedal Adjustment: Pedal free travel ⅞-1¼" (1949); 1-1¼" (1950-51). Adjust by turning nut on connector rod at clutch fork.

Removal: Remove transmission (see Transmission), remove right and left splash pans, engine breather pipe, and right and left lower flywheel housing bolts. Install Engine Rear Support Tool BT-28, entering pilot supports into lower housing bolt holes. Remove engine rear mount bolts at clutch housing, and remove frame cross-member by removing three bolts at each end. Remove clutch housing by removing eight bolts holding housing to flywheel housing. Remove clutch assembly from flywheel.

TRANSMISSION

SYNCHRO-MESH

Own Make. Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all helical gear type with remote shift control.

►*1951 NOTE*—Different shifting arrangement used

CONTINUED ON NEXT PAGE

ORIGINAL BORE & PISTONS

CONTINUED FROM PRECEDING PAGE

PISTON & BORE MARKING (FOR SIZE VARIATION)

AA—.00025" Under Nominal Size.
A—Nominal Size
BB—.00025" Over Nominal Size.
B—.0005" Over Nominal Size.
CC—.00075" Over Nominal Size.
C—.001" Over Nominal Size.
DD—.00125" Over Nominal Size.
D—.0015" Over Nominal Size.

NOMINAL SIZE

Bore	Piston	Bore
3 3/16"	3.18575-3.18600"	3.18725-3.18750"
3 1/4"	3.24850-3.24875"	3.24975-3.25000"
3 7/16"	3.43600-3.43625"	3.43725-3.43750"
3 1/2"	3.49875-3.49900"	3.49975-3.50000"

►**.020" Oversize Bore Engines**—Marked by ★ following engine serial number.

PISTONS

1938-51 MODELS

REPLACEMENT ALUMINUM ALLOY & CAST IRON PISTONS:—Finished aluminum alloy or cast-iron replacement pistons are stamped on head with decimal figure (.005, .010, etc.) indicating nominal oversize and one or two letters (AA, A, BB, B, CC, C, DD, D) which indicates the actual size variation (in .00025" steps) of the piston from indicated nominal oversize. See oversizes listed below and size variations for each letter (in table).

NOTE—This system of marking makes it possible to order a finished piston (using number and letter) for any particular bore size within these limits.

Piston Oversizes (Figures Stamped on Piston Head) Furnished for all engines as follows:

Super Eight (1938-39)—Standard size and .003", .005", .010", .015", .020", .025", .030", .035", and .045" oversize. NOTE—Factory reground cylinder blocks with Pistons, Pins, and Rings fitted available for replacement service.

Twelve—Standard size and .003", .005", .010", .015", .020", .030", and .045" oversize.

All Other Engines—Standard size and .005", .020", .030", .040" oversize.

PISTON MARKING (FOR SIZE VARIATION)

(Letters Stamped on Piston Head)

For All Models and Piston Oversizes

AA—.00025" Under marked size.
A—Same as marked size.
BB—.00025" Over marked size.
B—.0005" Over marked size.
CC—.00075" Over marked size.
C—.001" Over marked size.
D—.00125" Over marked size.
DD—.0015" Over marked size.

PISTON RINGS

1940-51 MODELS

TRIPLE ACTION PISTON RING SETS: Service Sets.—These rings furnished in packaged sets for all models and should be installed on **aluminum pistons only** as directed below. CAUTION—Do not use these rings with Cast Iron pistons.

Oil Ring—Spring expander type oil ring used consisting of top and bottom rails with a spring assembled between two rails. Two tabs in each rail engage a loop in spring expander when assembly installed in ring groove. Install ring on piston as follows: Place lower rail with locking tabs up (45° to right of thrust face or left side of piston) on piston slightly below lower ring groove. Insert spring expander in oil ring groove with end gap centered on thrust or left side of piston. Install upper rail in ring groove with locking tabs down so as to engage first loop in spring to left of spring end gap. Move lower rail up into ring groove with tabs in rail engaging first loop in spring expander to right of spring end gap. Press upper and lower rails down firmly on spring so that rails are properly seated on spring and are free in groove.

#2 Compression Ring—Assemble ring in #2 ring groove with groove on outer edge down.

Top Compression Ring—Assemble ring in top ring groove with groove on inner edge up.

PISTON PINS

SIX & EIGHT CYLINDER (1937-48)
SUPER & CUSTOM EIGHT (1940-48)

PISTON PIN BUSHING: Split type pin bushing is used in connecting rod. Each half of bushing installed on opposite side of rod with an opening formed between inner ends which opens into rifle-drilled oil passage in rod. Bushing must be expanded to tight fit in rod with a burnishing tool and then reamed to size for correct fit (see car page for fitting data). Car manufacturer recommends use of ST-5008 burnisher and ST-5008 reamer tools. CAUTION—Bushing halves must be installed in rod so that oil hole for pin lubrication opens into oil groove formed between bushings (bushing must not extend over oil passage in rod or piston pin will not be properly lubricated).

NOTE—Check diameter of pilot end of Burnisher & Reamer Tool ST-5008 (should be .861" for 1939 & later type bushings—if necessary, grind pilot end to this specification).

1949-51 MODELS

PISTON PIN BUSHING INSTALLATION: Two-piece bushing used in rod. Use Piston Pin Bushing Replacement Set J-2555 (consists of: Remover, Replacer, Plate, Burnisher), and Piston Pin Bushing Reamer J-874-18. Press old bushings out with Remover and arbor press. *(CAUTION*—Each half of bushing must be installed and burnished separately so that oil channel formed between inner ends of bushing halves will not close up). Install one half of bushing flush with outer end of rod, then using Plate of tool under end of rod, push Burnisher through from **inner end** of bushing. Install second half of bushing and burnish in place from inner end working through bushing half already in place. Ream bushing for size-to-size fit with piston pin using Reamer J-874-18. Check pin fit as follows:

Piston Pin Fit in Rod Bushing—With lower bearing inserts and cap installed on rod, insert piston pin in rod, clamp pin in vise with lead jaws placing rod in horizontal position. Rod should hold in this position, but should fall down of own weight when tapped down by hand.

CRANKSHAFT & MAIN BEARINGS

ALL MODELS

1949-51 MODELS

CRANKSHAFT FRONT SEAL: Installed on front end behind timing chain cover. To replace seal remove radiator core, vibration dampener (puller J-2636 for fluid type dampener), and timing chain cover. Remove old seal and install new seal over end of shaft. Place cover aligning arbor over end of shaft, install cover and tighten cover screws. Insert feeler gauge between arbor and hole in cover, run gauge around arbor, if clearance not uniform, loosen cover screws and shift cover until clearance uniform.

CONNECTING ROD & BEARINGS

1939-47 "110" 6 & "120" 8 MODELS

CONNECTING ROD PALNUTS: Special patented self-locking locknuts used on connecting rod bolt nuts in place of cotter pins. To install, turn regular connecting rod bolt nut and tighten to desired tension (refer to the Tightening Specifications—Torque Wrench data—on preceding page). Turn 'palnut' on bolt with smooth face toward regular nut until it contacts nut, then tighten 'palnut' ¼-1/3 additional turn to lock it in place.

CAMSHAFT & BEARINGS

1938 MODELS

CAMSHAFT & OIL PUMP GEAR CHANGE (SIX & '120' 8):—Late cars with suffix letter 'B' following engine number have forged steel camshaft (first cars with suffix letter 'A' had cast alloy iron type camshaft same as 1937 cars). **Oil pump drive gear must be same material as Camshaft.** Both type gears furnished for service. Note engine suffix letter when replacing oil pump drive gear.

1948 EIGHT & SUPER EIGHT

CAMSHAFT CHANGE (PART NO. 412581): This late type camshaft used on engines marked with letters "E" or "CE" following engine number. Only change over earlier shaft is in cam lobe contour resulting in reduced tappet noise.

►***CAUTION—Tappet clearance for this camshaft is .007" Intake, .010" Exhaust, Hot.***

TAPPET CLEARANCE

1948 EIGHT & SUPER EIGHT

TAPPET CLEARANCE (FOR EARLY CAMSHAFT): .006" Intake, .008" Exhaust, Hot. ***For engines WITHOUT code letters "CE" or "E" following Engine Number.*** This setting reduced from production setting of .007" Intake and .010" Exhaust to reduce tappet noise. This setting does not affect operating performance of engine.

TAPPET CLEARANCE (FOR LATE CAMSHAFT PART NO. 412581): .007" Intake, .010" Exhaust, Hot. ***For engines WITH code letters "CE" or "E" following engine Number.*** This camshaft has redesigned cam contours which hold tappet noise to a minimum and do not require reduced clearances recommended for early type camshaft.

VALVE SYSTEM

1938 MODELS

VALVE LIFTERS (SIX & "120" 8): First cars with suffix letter 'A' following engine number have cast alloy iron camshaft and use steel valve lifters. Late cars with suffix letter 'B' have forged steel camshaft and chilled iron lifters. **Never use steel lifters with steel camshaft.** Either type lifter can be used on cast alloy iron camshafts. Note engine suffix letter when replacing valve lifters.

1940-47 SUPER 8 MODELS
1948 CUSTOM EIGHT

VALVE LIFTER CHECK: Clearance check after Grinding Valves. Hydraulic valve lifters should be checked for proper clearance (take-up reserve) as part of valve grinding operation. Check clearance as follows: Empty oil out of hydraulic unit and tappet body, bottom plunger using a screwdriver or valve gauge Tool ST-2031, clearance between end of valve stem and end of hydraulic plunger with valve seated should be .030-.070" (Go-No-Go gauge Tool ST-2032 may be used to check clearance). If clearance less than .030", grind off end of valve stem until proper clearance is secured. ***Refer to the Wilcox-Rich "Zero-Lash" Hydraulic Valve Lifter article in the Miscellaneous Section for Valve Lifter Servicing.***

1949-50 SUPER & CUSTOM EIGHT
1951 "300" & "400"

HYDRAULIC VALVE LIFTER CHECK: When valves ground or new valves installed, mechanical clearance at valve lifters should be checked as follows: With valves out, lift out hydraulic take-up assemblies from tappet bodies (keep assemblies in order so that they can be re-installed in same position). Install valves without springs, set #1 piston at top of compression stroke placing tappets for this cylinder on heel of cam. Check valves for #1 cylinder by inserting Plug Gauge of Hydraulic Tappet Gauge Set J-4540 (Super 8), J-2553 (Custom 8) in tappet body. Check clearance between gauge plug and valve stem (with valve held down on seat) using feeler gauge supplied with gauge set.

Clearance should be .030" to .070". If under .030", grind off end of valve stem with valve refacer.

►**NOTE**—Feeler Gauge marked "GO" and "NO GO." *CAUTION*—When checking other valves, make certain piston for that cylinder at top of compression stroke.

Hydraulic Valve Lifter Cleaning & Testing—After making check above, hydraulic take-up assemblies should be cleaned and tested before re-installing. ***See Wilcox-Rich "Zero-Lash" Valve Lifters in Miscellaneous Section.***

OIL PAN

1948 EIGHT & SUPER EIGHT

7 QUART OIL PAN: Engines with this pan marked "CD", "CE", "D", or "E" following Engine Number. This pan has 1 quart greater capacity (6 quart pan used on unmarked engines). This pan is deeper and required following different parts:
412640—Oil Pan Assembly.
412643—Oil Strainer Bearing and Bracket Assembly.
412642—Oil Strainer Bracket.
412641—Oil Strainer Suction Tube.
412644—Oil Level Indicator Assembly (has "7 Qt." mark on dip stick).

OIL PAN REMOVAL

1949-51 MODELS

OIL PAN REMOVAL: Place car to position hoist over engine. Disconnect steering idler lever support from frame side rail and lower steering linkage. Remove flywheel housing lower cover and take out oil pan screws. Lower oil pan and if necessary, rotate crankshaft to place counterweights up for clearance (use pry bar at flywheel housing engaging teeth on flywheel). If pan requires additional clearance, attach hoist to front of engine (do not disturb front engine support bolts), raise engine just enough to relieve load on support, pan should then come out.

OIL PUMP

1939-51 SIX & EIGHT

OIL PUMP INSTALLATION: Install pump so driving slot as near parallel as possible to center-line of camshaft with distributor rotor in line with #1 segment in cap. Punch mark on pump gear should be at the bottom ('110' Six), at the top ('120' Eight, and for '160' and '180' Super Eight Models). Check ignition timing after pump installed on car.

1949-51 MODELS

OIL PUMP: Removal—Set engine in firing position for #1 cylinder (6° BTDC.), remove distributor cap and mark rotor position on distributor housing. With pump cover off, mark pump driving gear position on pump body (check to this mark when re-assembling since pump must be rotated 180° on some cars to clear frame when removing pump from engine).

Oil Pump Installation: Correct engaging position of pump drive is with driving blade in pump drive gear parallel to camshaft and punch mark on end of drive gear at top. Re-assemble to marks made when removing pump (see above—engine in firing position for #1 cylinder). If pump does not engage slot in distributor shaft, remove pump and turn pump drive gear one tooth and re-install (making certain distributor rotor at #1 firing position).

RADIATOR

CLIPPER MODELS

RADIATOR CORE REMOVAL: The radiator core can be removed without removal of Front End Assembly as follows: Remove pan from between Radiator Core and Radiator Grille, loosen radiator core mounting bolts, lift core out of car. CAUTION—Do not damage fan blades when lifting core out of car.

CLUTCH NOTES

1939-40 MODELS

CLUTCH LINKAGE SERVICING (MODELS 1700, 1; 1800,1):—Clutch pedal linkage on these models allows pedal to move downward as wear develops and clearance at ends of rods increases. Pedal position must be checked to see that pedal travel sufficient to allow complete clutch disengagement. Note that this condition is just the reverse of pedal tending to come up due to lining wear on clutch plate.

Clutch Linkage Replacement—New 1941 design clutch pedal linkage can be installed on these cars. Car manufacturer recommends that 1941 design linkage be installed where linkage requires repair or replacement. Available under following part number: Clutch Relay Equipment Part No. 377473 (1700, 1800), 277494 (1701, 1801). NOTE—1941 design linkage installation same as for 1939 and 1940 models. A flat washer Pc. No. 24595 (included with above equipment) must be installed between face of pedal extension and shoulder on stud to prevent stud being drawn into chamfered hole. This hole in pedal extension was chamfered on 1939 and 1940 models on both sides.

1949-51 MODELS

CLUTCH PEDAL OVER-CENTER SPRING: New adjustable type over-center (booster) spring. Adjustment provided at spring eye-bolt nut (front end of spring) and by turn buckle type pedal-to-relay lever link (controls over-center point). To adjust, proceed as follows:

Clutch Pedal Linkage Adjustment: Check over-center eye bolt (should be 1 5/8" from end of bolt to head of nut—adjust if necessary). Back off locknut and adjusting nut on rod at throwout lever and unhook pedal retracting spring from throwout lever. Adjust pedal-to-relay lever link turnbuckle so that over-center spring will pull pedal down after pedal moved down one inch from toeboard (make certain throwout lever does not contact adjusting nut and locknut backed off above). Hook pedal retracting spring to throwout lever. Adjust pedal for 1¼-1⅜" free play at pedal pad. Check over-center spring hold-in position by pulling pedal to floor and hooking spring at bend in pedal arm. Adjust eye bolt nut to hold pedal down with seven lbs. pull on scale.

IGNITION NOTES

Resistor Type Plugs—Auto-Lite Resistor Type Plugs now available. Comparable to production plugs as follows:

Resistor Plugs	Production Plugs
Auto-Lite PR-4	Auto-Lite P-4
" "	AC-104
" "	Champion Y4A
Resistor Plugs	**Special Service Plugs**
Auto-Lite PR-6 (See Note)	Auto-Lite P-6
" "	AC-106
" "	Champion Y6

►**PR-6 NOTE**—One step hotter plug and heat range is comparable to special service plugs listed above.
►*CAUTION*—When installing resistor type plugs, use the type in which the heat range is comparable to that of the plugs which are being replaced.
Resistor Type Plugs Gaps—.035-.040".

STARTER
DELCO-REMY
1938-39 MODELS

Delco-Remy Model 739-F. Armature No. 1866105.
Drive—Outboard Barrel Type Bendix No. A-1718.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ounces each.
Cranking Engine—125 RPM., 150 amperes, 5 volts.

Performance Data—Delco-Remy

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

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws, lift out starter and switch assembly.
Starting Switch: Delco-Remy 1539 magnetic switch mounted on starter and controlled by pushbutton on dash.
For complete data, refer to Electrical Equipment Index.

STARTER
AUTO-LITE
1939 MODELS

Auto-Lite Model MAW-4018. Armature MAW-2006.
See 1939 Packard "120" Eight for data on this starter.

GENERATOR
DELCO-REMY
1938-39 MODELS

Delco-Remy Model 1100005. Armature No. 1866789. Fixed third brush with external vibrating voltage regulator. Air-cooled by fan on drive pulley.
NOTE—Third brush is clamped in position for maximum safe output and should not be disturbed.
Charging Rate Adjustment—Adjusted by changing Voltage Regulator setting. See Regulator data.
Maximum Charging Rate—As shown in table below. To check charging rate, connect test ammeter in line at 'BAT' terminal on regulator, connect voltmeter between 'GEN' terminal and ground, ground 'F' terminal to eliminate regulator action.
NOTE—Do not operate generator on open-circuit.

Performance Data—Delco-Remy

	Amperes	Volts	R.P.M.
Cold	26-30	8.0	3400
Hot	25-28	8.0	3600

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—22-26 ounces (main), 16-20 ounces (third brush).
Field Current—2.3-2.6 amperes at 6.0 volts.
Motoring Current—4.5 amperes at 6.0 volts.
Belt Adjustment:—Swing generator out until 25 lb. reading secured on scale hooked to clamp bolt lug parallel to clamp link or until belt deflection midway between generator and pump pulley is ½" with thumb pressure.

GENERATOR
AUTO-LITE
1939 MODELS

Auto-Lite Model GCJ-4807A-2 Std., GCJ-4810A-2 with Tachometer Drive. Third brush control type
See 1939 Packard "120" Eight for data on these generators.

REGULATOR
DELCO-REMY
1938-39 MODELS

Delco-Remy Model 5827. Double Core Type Voltage Regulator (With 'IGN' Terminal). Cutout Relay and vibrating type Voltage Regulator in single case.
NOTE—Model 5860 (no 'IGN' terminal) used for replacement.
For complete data, refer to Electrical Equipment Index.

Cutout Relay—Delco-Remy
Cuts In—6.9-7.6 volts, 850 R.P.M. (Gen).
Cuts Out—0-3 ampere discharge.
Contact Gap—.020". **Air Gap**—.020" (closed).

Voltage Regulator—Delco-Remy
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.
Adjustment—Disconnect lead on 'IGN' terminal of regulator, connect jumper between this terminal and 'BAT' terminal, connect test ammeter in charging line at 'BAT' terminal, connect voltmeter between 'IGN' terminal and ground. Operate generator at 2800-3000 R.P.M., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set), adjust regulator by bending spring hanger at lower end of armature spring slightly to secure setting given above.
Contact Gap—.020". **Contact Spr. Tension**—2.7-3.5 oz.
Air Gap—.063" between armature and center of core with armature down. .010" between fiber bumper and stop with armature up.

REGULATOR
AUTO-LITE
1939 MODELS

Auto-Lite Model VRD-4001-B. Consists of Cutout Relay and Voltage Regulator in case on dash.
See 1939 Packard "120" Eight for data on this regulator.

LIGHTING

LIGHTING:—**Headlamps.** Hall Flex-beam type with pre-focused bulbs. Asymetrical passing beam (lower beam left hand headlamp, upper beam right hand headlamp) controlled by beam selector switch on toeboard.
Headlamp Adjustment—With tires properly inflated, car loaded to rated capacity, 25' from screen, aim left hand headlamp so hot spot centered on lamp vertical center-line with upper edge at horizontal lamp center-line. Aim right hand headlamp for same height but with left edge of hot spot at lamp vertical center-line (entire hot spot to right of center-line).
Beam Indicator—In upper edge of speedometer dial. Lighted when upper beams (Country Driving) lighted.

Switches
Lighting—D-R #1994504 (1938), #1994507 (1939).
Beam Selector—D-R #1997001 ('38), #1997002 ('39).

MISC. ELECTRICAL

THERMOSTATIC RELAY:—On lighting switch, protects lighting circuits. Remains closed with 25 amperes but opens in 2 minutes with 38 amperes. Not adjustable.
FUSES:—**Dome, Stop Light and Accessories**—Two 20 ampere. On back of lighting switch.
Instrument and Tail Light—20 ampere. In connector in switch lead near lighting switch.
Clock—2 ampere (Borg), 1 ampere (Western).
HORNS: Sparton Model 1-E-30 (1938), H-32 (1939) Vibrator type. Twin Horns operated by relay.
Air Gap—.032-.035" (low note—long horn), .026-.030" (high note—short horn).
Horn Current—22-25 amperes (total).
Horn Relay: R-B-M Model 790 (1938), Model 4760 (1939).
Closing Voltage—2.75-4.0 (1938), 3.5-4.5 volts ('39).

ENGINE

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head.
Bore—3½". **Stroke**—4¼".
Displacement—245.3 cu. ins. **Rated HP.**—29.4.
Developed Horsepower—100 HP. (Std. 6.52-1 head), 103-105 HP. (6.85-1, 7.05-1 Hds.) at 3600 RPM.
Compression Ratio & Pressure—***See Tune-Up data.***
See Packard Shop Notes for Cylinder Head Identification, Replacement, and Installation data.
Vacuum Reading—Steady 18-20" idling at 6 M.P.H.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground.
Weight—19.5 ozs. (stripped), 26 ozs. (with rings and pin) and equal within 4 grams. **Length**—3⅞".
Removal—Piston and rods removed from above.
Clearance—.0005-.001" skirt. See Fitting Pistons.
Original Bore & Piston Sizes, Replacement Pistons:—***See Packard Shop Notes for complete data.***
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves.

PISTON RINGS:—2 compression (Perfect Circle #70), one oil control (X-90) per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Comp. #1	.123-.1240"	.007-.017"	.0025-.003"
Comp. #2	.123-.1240"	.007-.017"	.0025-.003"
Oil Contr.	.186-.1865"	.007-.015"	.0015"

Replacement Rings:—Furnished standard and .005", .010", .020", .030", and .040" oversize.

PISTON PIN:—**Diameter**—⅞". **Length**—3 1/64"
Pin floats in piston and rod, held by locking rings. Furnished Std. and .003", .006" oversize.
Pin Fit in Piston—Finger push fit with piston heated to 160° F.
Pin Fit in Rod Bushing—Finger push fit at 70° F.

CONNECTING ROD: Lgth.—7 11/16". **Wt.**—31.6 ozs. (1938) 33 ozs. ('39).
1939 CHANGE—After Eng. No. B-4607, bearings are .010" thicker and rod holes .020" larger diameter. Rods with large hole marked '330613' on web at lower end. Use only thicker bearing shells (marked by inked star) in these rods.
Upper Bearing (Piston Pin Bushing)—Split type.
See Packard Shop Notes for complete data.
Crankpin Journal Diameter—2.094".
Lower Bearing—Interchangeable steel-backed, babbitt-lined type. Bearings furnished std. and .001", .002", .003", .015" undersize. NOTE—Bearing shells marked with inked star, must be used with new rods marked '330613' on web at lower end.
Clearance—.0005-.0015". **Sideplay**—.004-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Tighten bolt nuts to 715-725 in. lbs. ***See Packard Shop Notes for 'Palnut' installation data on 1939 engines.***
Installing Rods:—Oil squirt hole to camshaft.

CRANKSHAFT:—4 bearing, integral counterweights with rubber friction disc vibration damper
Journal Diameters—2.7465".
Bearing Type—Interchangeable babbitt-lined steel

ENGINE

CONTINUED FROM PRECEDING PAGE

shell type. Bearings furnished standard and .001" and .002" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings (upper half can be 'rotated' in place). Do not file caps. Tighten bolt nuts to 980-1020 in. lbs.
End Thrust:—Taken by #1 bearing.
Endplay—.003-.008".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
IMPORTANT NOTE—2 types of camshafts used:
1938—Cast Alloy Iron on engines with letter "A" following engine number. Use only cast alloy oil pump drive gear with this camshaft.
1938—Forged Steel on engines with letter "B" following engine number. Use only chilled iron valve lifters (DO NOT USE STEEL LIFTERS). Oil pump drive gear must be of same material as shaft.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.002-.004".
Timing Chain: Morse 1866 RX (1938), 3682-R ('39). Width 1¼", Pitch .375", Lgth. 21¾" or 58 links.
Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with a straightedge across the shaft centers.
See Packard Shop Notes for Radiator & Fender (unit) removal for work on front end of engine.

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1.575"	.34025"	5⅝"
Exhaust	1 13/32"	.34025"	5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.317-.319"	.001-.003"
Exhaust	45°	.3165-.3185"	.003-.005"

Valve Guides:—New type. Press in block so upper end 31/32" below valve seat and finish-ream to size.
Valve Springs:—Intake and exhaust springs interchangeable.

	Spring Pressure	Length
Valve Closed	47-52 lbs.	1⅝"
Valve Open	114-124 lbs.	1 5/16"

NOTE—Serrated washer installed on top of spring.
Valve Lifters:—Mushroom type. Remove from below with camshaft out. Service by reaming (work through valve guide) and installing oversize lifter. Furnished .001", .002", .005" oversize.
NOTE—Chilled-iron or Steel valve lifters furnished for service. ***Refer to Packard Shop Notes for Valve Lifter Note for proper type to use with 1938 Camshafts.***

VALVE TIMING

Tappet Clearance:—.007" Intake, .010" Exh. (hot).
NOTE—Remove right front fender plate for adj. to valves.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 1° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #1 exhaust valve at .015". This valve should close with piston 5° or .0103" past top dead center when 5° point on flywheel (midpoint between second and third graduations after top dead center mark '#1 UP DC.') lines up with pointer on housing in inspection hole in left front face of flywheel housing below starter. Permissable variation 3 graduations either side of mark. Reset tappet clearance at .010" warm.

LUBRICATION

LUBRICATION:—Gear type pump (right of engine).
See Packard Shop Notes for Oil Pump Installation and Oil Pump Drive Gear Type for use with 1938 Camshafts.
Crankcase Capacity—6 qts. (1938), 5 qts. ('39) refill.
Normal Oil Pressure:—35 lbs. at 30 M.P.H. (warm oil).
Oil Pressure Regulator:—Mounted on pump cover. Not adjustable. Replace spring if pressure less than 5 to 8 lbs. at 2".

COOLING

COOLING SYSTEM: Capacity—15 qts. ('38), 15.2 ('39).
Water Pump:—Packless type with ball-bearing shaft.
See Water Pump Section for complete data.
Thermostat: Sylphon inside top radiator tank (part of shutter thermostat assembly). Assembly changed during 1938, first type 165° used on early '38 cars, 150° type on later '38 & '39 cars.
HEATER NOTE—Cylinder head thermostat available for cars with water heater. Use only on cars with 150° shutter assembly. Remove thermostat in summer.
Setting (with Cover Mark '165')—Starts to open 150°. Fully open 160-165°. Sylphon marked 13680.
Setting (with Cover Mark '150')—Starts to open 135°. Fully open 150°. Sylphon marked 14480.
Setting (Heater—Cyl. head outlet type)—Marked 162° on strap. Starts to open 160-165°. Fully open 185°
Adjustment—Pull back on shutter pullrod to close shutters, tighten nut on rod to remove all slack, then tighten 1 turn additional for pre-load.

CLUTCH

CLUTCH:—**Long Model 9½ CF-CS.** Semi-centrifugal, single plate, dry disc type.
See Clutch Section for complete data.
Facings—Woven (US Asbestos 733 (1938), 1133G ('39). 2 required. I. D. 6". O. D. 9½". Thickness .125".
Adjustment—Adjust nut on pedal rod (at clutch fork) for 1½-2" pedal free movement.
See Packard Shop Notes for 1941 design clutch linkage which may be installed on these cars to correct wear.
Removal:—Remove Transmission (see Transmission Removal following). Disconnect and remove pedal rod, clutch throw-out bearing. Remove clutch cover capscrews, remove clutch from below.

TRANSMISSION

TRANSMISSION: Own Make. (1938)—Helical gear type with synchronizer for second and high speeds. (1939)—New type with constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur gear for reverse). Synchro-mesh (second and high).
See Transmission Section for complete data.
Transmission Control:—Own Remote Control type.
See Transmission Section for complete data.
Removal:—Disconnect shifter rods, speedometer cable, ground strap at transmission case. Disconnect drive shaft at front universal and block shaft up against floorpan. Support rear end of engine, unbolt cross-member from frame (on cars with Econo-Drive remove cross-member at rear with stabilizer, disconnect wires at solenoid). Disconnect hand brake cable at equalizer, remove flywheel housing lower cover, clutch throwout retracting spring. Take out transmission-to-bell housing mounting screws and remove assembly.

OVERDRIVE

OVERDRIVE (ECONO-DRIVE) 1939: Warner Model AS9-R6 overdrive unit with electrical control.
See Transmission Section for complete data.
►**Overdrive Change—New Reverse Switch added on later cars (should be installed on early cars):** ***See Warner R6 Overdrive Control in Transmission Section.***
Overdrive Solenoid—Delco-Remy Model 1569.
Throttle Switch—R-B-M. Adjust for .046" clearance between switch plunger and accelerator pedal tappet screw with throttle valve wide open (see that pedal has sufficient over-travel to close switch).
Control Relay—R-B-M Model 4780. No fuse used.

UNIVERSALS

UNIVERSAL JOINT:—**Mechanics. Model 2C (Std.), 3C** (With Econo-Drive). Needle bearing type. 2 used.
See Universals Section for complete data.
CAUTION—Do not loosen universal flange nut on first '39 cars (nut controls overdrive rear bearing pre-load). On later '39 cars (with 'M' stamped on flange), bearing pre-load controlled by spring washer and nut should be kept tight.

REAR AXLE

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive.
See Rear Axle Section for complete data.
Ratio—4.54-1 Std., 4.7-1 with Econo-Drive trans'm. Optl. ratios 4.36-1, 4.54-1, 4.7-1.
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.
Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. **Endplay**—.002-.005" ('38), .004"-.007" ('39).

SHOCK ABSORBERS

Delco. Model 1966-A, B ('38 front), D ('39 right frt.), C ('39 left frt.), 1751-L, M ('38 rear), Z ('39 right rear), M ('39 left rear). Hydraulic, double acting type.
Fifth Shock Absorber (Stabilizer):—Houdaille Model NFT. Double acting, hydraulic, adjustable type.

FRONT SUSPENSION

Front Suspension:—Independent 'Safe-T-fleX' type
See Front Suspension Section for complete data.
NOTE—Frame height must be set first.
Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 18¾" (load car until figure correct).
Kingpin Inclination—1°54' crosswise.
Camber—½° (±) ½° ('38), ½° plus ¾°, minus 0° ('39). Adj.
Caster—1½° plus or minus ½°. Shim adjustment.
Toe In—1/32-1/16" at hub height. Adjust both tie rods equally (must be equal after adjustment).

STEERING GEAR

Steering Gear: Packard (Gemmer design Model 330) Worm-and-Roller type with center steering. Refer to Gemmer Model 330 article.
See Steering Gear Section for complete data.

BRAKES

BRAKES:—**Service.** Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment. Hand lever applies rear service brakes.
See Brake Section for complete data.
Drums—Centrifuse. Diameter—11".
Lining—Marshall #2201 (all shoes). Width 1¾". Thickness 3/16". Length 12" per shoe.
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes (above).

CONTINUED FROM PRECEDING PAGE

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5300	5.5	65
2.75 "	1630	5.0	200
5.5 "	970	4.5	300
8.7 "	600	4.0	400
12.0 "	300	3.5	500
16.5 "	Lock	3.0	640
25.0 "	Lock	4.0	880

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch:—Model SS-4001. Magnetic type. Mounted on starter and controlled by pushbutton on instrument panel.

For complete data, refer to Electrical Equipment Index.

STARTER

1939 MODELS

Auto-Lite Model MAW-4018. Armature MAW-2006.

Drive—Outboard Barrel Type Bendix No. A-1718.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—125 RPM., 175 amperes, 5.1 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4900	5.5	65
2.75 "	1480	5.0	200
8.50 "	400	4.0	400
11.5 "	Lock	3.0	505

Removal & Starting Switch: Same as "1938 Models"

GENERATOR

Auto-Lite Model GCJ-4807A-2 Std., GCJ-4810A-2 with Tachometer Drive. Third brush control type with external vibrating Voltage regulation. Ventilated by fan on drive pulley.

Armature—GCJ-2006 (GCJ-4807A-2), GCJ-2092 (GCJ-4810A-2).

Maximum Charging Rate—30.5 amperes (cold), 25.5 (hot), 8.0 volts. To check generator output, connect ammeter in charging line at regulator 'B' terminal, ground 'F' terminal to eliminate regulator action. Operate generator charging battery (do not run on open-circuit).

Charging Rate Adjustment—Third brush set for maximum output (1 comm. bar min., 1 comm. bar plus 1 mica strip max. from nearest or insulated main brush) and setting should not be exceeded.

Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	800	0	6.4	840
8	6.85	1025	8	6.9	1100
16	7.25	1330	16	7.4	1520
24	7.7	1900	24	7.9	2460
30	8.0	3200			

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

Belt Adjustment:—Swing generator out until 25 lb. reading secured on scale hooked to clamp bolt lug parallel to clamp link or until belt deflection midway between generator and pump pulley is ½" with thumb pressure.

REGULATOR

Auto-Lite Model VRD-4005A (first 5650 1938), Model VRD-4001B (late '38 & all 1939). Consists of cutout relay and voltage regulator in case.

For complete data, refer to Electrical Equipment Index.

Cutout Relay

Cuts In—6.4-7.0 volts Cold, 710 RPM (Gen.).

Cuts Out—.5-3.0 amperes discharge.

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 seal)—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. Voltmeter reading should be between limits of 7.21-7.83 volts.

To Adjust (with cover removed)—Change regulator armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section.

Contact Gap—.010-.020" (armature against stop pin).

Air Gap—.0595-.0625" with contacts just opening.

LIGHTING

LIGHTING:—Headlamps. Hall Flex-beam type with pre-focused bulbs. Asymetrical passing beam (lower beam left hand headlamp, upper beam right hand headlamp) controlled by beam selector switch.

Headlamp Adjustment—With tires properly inflated, car loaded to rated capacity, 25' from screen, aim left hand headlamp so hot spot centered on lamp vertical center-line with upper edge at horizontal lamp center-line. Aim right hand headlamp for same height but with left edge of hot spot at lamp vertical center-line (entire hot spot to right of center-line).

Beam Indicator—In upper edge of speedometer dial. Lighted when upper beams (Country Driving) lighted.

Switches

Lighting—D-R #1994504 ('38), #1994507 ('39).

Foot Selector—D-R #1997001 ('38), #1997002 ('39).

MISC. ELECTRICAL

THERMOSTATIC RELAY:—On lighting switch, protects lighting circuits. Remains closed with 25 amperes but opens in 2 minutes with 38 amperes. Not adjustable.

FUSES:—Dome, Stop Light & Accessories—Two 20 ampere. On back of lighting switch.

Instrument & Tail Light—20 ampere. In connector in switch lead near lighting switch.

Clock—2 ampere (Borg), 1 ampere (Western).

HORNS: Sparton Model 1-E-30 (1938), H-32 (1939). Vibrator type, Air tone, Twin horns operated by relay.

Air Gap—.032-.035" (low note—long horn), .026-.030" (high note—short horn).

Horn Current—22-25 amperes (total).

Horn Relay: R. B. M. Model 790 ('38), Model 4760 ('39).

ENGINE

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.

Bore—3¼". **Stroke**—4¼".

Displacement—282.04 cu. ins. **Rated HP.**—33.8.

Developed Horsepower—120 HP. (Std. 6.41-1 hd) at 3800 R.P.M.

Compression Ratio & Pressure: *See Tune-Up data.*

Vacuum Reading—Steady 18-21" idling at 6 M.P.H.

See Packard Shop Notes for Cylinder Head data.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground.

Weight—16⅞ ozs. (stripped), 22¾ ozs. (with rings and pin) and equal within 4 grams. **Length**—3⅞".

Removal—Pistons and rods removed from above.

Clearance—.0015" Skirt (1938), .0005-.001" ('39). See Fitting New Pistons.

Original Bore & Pistons Sizes, Replacement Pistons:—*See Packard Shop Notes for complete data.*

Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.

Installing Pistons:—Slot toward valves.

PISTON RINGS:—2 compression (Perfect Circle #70), one oil control (#X90-85) per piston, above pin.

Ring	Width	End Gap	Side Clearance
Comp. #1	.123-.1240"	.007-.017"	.0025-.003"
Comp. #2	.123-.1240"	.007-.017"	.0025-.003"
Oil Contr.	.186-.1865"	.007-.015"	.0015-.002"

NOTE—Install #1 and #3 ring with gap away from valves, #2 compression ring gap toward valves.

Replacement Rings:—Furnished standard and .005", .010", .020", .030", and .040" oversize.

PISTON PIN:—Diameter—⅞". **Length**—2 51/64".

Pin floats in piston and rod, held by locking rings. Furnished std. and .003", .006" oversize.

Pin Fit in Piston—Finger push fit with piston heated to 160°F.

Pin Fit in Rod Bushing—Finger push fit at 70°F.

CONNECTING ROD: Lgth. 7 11/16". **Wt.** ('38) 31.6 ozs., ('39) 33.

1939 CHANGE—After Engine No. B-303053, bearings are .010" thicker and rod hole .020" larger diameter. Rods with large hole marked '330613' on web at lower end. Use only thicker bearing shells (marked by inked star) in these rods.

Upper Bearing (Piston Pin Bushing)—Split type. ***See Packard Shop Notes for complete data.***

Crankpin Journal Diameter—2.094".

Lower Bearing—Interchangeable steel-backed, babbitt-lined type. Bearings furnshed std. and .001", .002", .003", .015" undersize. NOTE—.010" thicker bearing shells (marked by inked star) should be used on rods marked '330613' on web at lower end.

Clearance—.0005-.0015". **Sideplay**—.004-.010".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. Tighten bolt nuts to 715-725 in. lbs. ***See Packard Shop Notes for 'Palnut' installation data.***

Installing Rods:—Oil squirt hole to camshaft.

CRANKSHAFT:—5 bearing, integral counterweights with rubber friction disc vibration dampener.

Journal Diameters—2.7465" all bearings.

Bearing Type—Interchangeable babbitt-lined steel shell type. Bearings furnished standard and .001" and .002" undersize. **Clearance**—.001-.003".

Bearing Adjustment:—None (no shims). Replace bearings (upper half can be 'rotated' in place). Do not file caps. Tighten bolt nuts to 980-1020 in. lbs.

End Thrust:—Taken by #3 bearing.

Endplay—.003-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive. IMPORTANT NOTE—2 types of camshafts used: **1938—Cast Alloy Iron** on engines with letter "A" following engine number. Use only cast alloy oil pump drive gear with this camshaft.

1938—Forged Steel on engines with letter "B" following engine number. Use only chilled iron valve lifters (DO NOT USE STEEL LIFTERS). Oil pump drive gear must be of same material as shaft.

Bearing Type—Steel-backed, babbitt-lined.

Clearance—.001-.003".

End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.002-.004".

Timing Chain: Morse 1866 RX ('38) 3682-R ('39) Width 1¼". Pitch .375". Length 21¾" or 58 links.

Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in

ENGINE

CONTINUED FROM PRECEDING PAGE

line with a straightedge across shaft centers with #1 piston on top dead center.
See Packard Shop Notes for Radiator & Fender (unit) removal for work on front end of engine.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	34025"	5⅝"
Exhaust	1 13/32"	34025"	5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.317-.319"	.001-.003"
Exhaust	45°	.3165-.3185"	.003-.005"

Valve Guides:—New type. Press in block so that upper end 31/32" below valve seat and finish-ream to size.
Valve Springs:—Intake and exhaust springs interchangeable.

	Spring Pressure	Length
Valve Closed	47-52 lbs.	1 5/8"
Valve Open	114-124 lbs.	1 5/16"

NOTE—Serrated washer on top of each spring.
Valve Lifters:—Mushroom type. Remove from below with camshaft out. Service by reaming (work through valve guide) and installing oversize lifter. Furnished .001", .002", .005" oversize.
NOTE—Chilled-iron or Steel valve lifters furnished for service. *Refer to Packard Shop Notes for Valve Lifter Note for proper type to use with 1938 Camshafts.*

VALVE TIMING

Tappet Clearance:—.007" Intake, .010" Exh. (hot).
NOTE—Remove right front fender apron for access to valves.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 1° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Timing—Set tappet clearance #1 exhaust valve at .015". This valve should close with piston 5° or .0103" past top dead center when 5° point on flywheel (midpoint between second and third graduations after top dead center mark '#1 UP DC.') lines up with pointer on housing in inspection hole in left front face of flywheel housing below starter. Permissible variation 3 graduations either side of mark. Reset tappet clearance at .010" warm.

LUBRICATION

LUBRICATION:—Pressure system with gear type oil pump mounted on right side of engine.
See Packard Shop Notes for Oil Pump installation.
Normal Oil Pressure:—35 lbs. at 30 M.P.H. (warm oil).
Oil Pressure Regulator:—Mounted on pump cover. Not adjustable. Replace spring if pressure less than 5 to 8 lbs. at 2".
Crankcase Capacity:—6 quarts (refill).

COOLING

COOLING SYSTEM: Capacity—16 qts. ('38), 15 qts. ('39).
Water Pump:—Packless type with ball-bearing shaft.
See Water Pump Section for complete data.
Removal—With water drained and fan belt removed, disconnect pump hose, remove pump mounting capscrews, and lift pump assembly off.
Thermostat: Sylphon inside top radiator tank (part of shutter thermostat assembly). Assembly changed during 1938, first type 165° used on early '38 cars, 150° type on later '38 and 1939 cars.
HEATER NOTE—Cylinder head thermostat available for cars with water heater. Use only on cars with 150° shutter assembly. Remove thermostat in summer.
Setting (with Cover Mark '165')—Starts to open 150°. Fully open 160-165°. Sylphon marked 13680.
Setting (with Cover Mark '150')—Starts to open 135°. Fully open 150°. Sylphon marked 14480.
Setting (Heater—Cyl. head outlet type)—Marked 162° on strap. Starts to open 160-165°. Fully open 185°
Adjustment—At room temperature with thermostat sylphon closed, pull back on shutter pullrod to close shutters, tighten nut on rod to remove all slack, then tighten 1 turn additional for pre-load.

CLUTCH

CLUTCH:—Long Model 10 CF-CL Semi-centrifugal, single plate, dry disc type.
See Clutch Section for complete data.
Facings—Woven (US Asbestos 1133G), 2 required. Inside Diam. 6". Outside Diam. 10". Thickness .125".
Adjustment—Adjust nut on pedal rod (at clutch fork) for 1½-1¾" pedal free movement.
See Packard Shop Notes for 1941 design clutch linkage which may be installed on these cars to correct wear.
Removal (1938): Remove transmission (see Trans. Removal following). With clutch pedal depressed, insert wedge (ST-879) between each throwout finger and cover (assembly can only be removed when in partially released position). Remove clutch shifter bearing, pedal rod and cover capscrews (remove assembly from below).
Removal (1939): Remove transmission (see Trans. Removal following). Remove clutch throwout bearing, pedal rod, and mounting screws in clutch cover flange, remove clutch from below.

TRANSMISSION

TRANSMISSION: Own Make. (1938)—Helical gear type with synchronizer for second and high speeds. (1939)—New type with constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur gear for reverse). Synchro-mesh (second and high).
See Transmission Section for complete data.
Transmission Control:—Own remote control type.
See Transmission Section for complete data.
Removal:—Disconnect shifter rods, speedometer cable, ground strap at transmission case. Disconnect drive shaft at front universal and block shaft up against floorpan. Support rear end of engine, unbolt cross-member from frame (on cars with Econo-Drive remove cross-member at rear with stabilizer, disconnect wires at solenoid). Disconnect hand brake cable at equalizer, remove flywheel housing lower cover, clutch throwout retracting spring. Take out transmission-to-bell housing mounting screws and remove assembly.

OVERDRIVE

OVERDRIVE (ECONO-DRIVE) 1939: Warner Model AS9-R6 overdrive unit with electrical control.
See Transmission Section for complete data.
►**Overdrive Change—New Reverse Switch added on later cars (should be installed on early cars):** *See Warner R6 Overdrive Control in Transmission Section.*
Overdrive Solenoid—Delco-Remy No. 1569.
Throttle Switch—R-B-M. Adjust for .046" clearance between switch plunger and accelerator pedal tappet screw with throttle valve wide open (see that pedal has sufficient over-travel to close switch).
Control Relay—R-B-M. Model 4780. No fuse used.

UNIVERSALS

UNIVERSAL JOINTS: (1938) Detroit. Series 5150. Cross type with roller bearings. (1939)—Mechanics Model 3C. Needle bearing type. Two used.
1938 NOTE—Drive Shaft Intermediate Bearing #1602 is self-aligning type.
See Universals Section for complete data.

REAR AXLE

REAR AXLE:—Own Make. Semi-floating hypoid gear type with Hotchkiss drive.
See Rear Axle Section for complete data.
Ratios (1938)—4.36-1 (1601), 4.7-1 (1601A, 2), 4.09-1, 4.54-1 optional.
Ratios (1939)—4.36-1 Std., 4.54-1 with Overdrive, Long wheelbase—4.7-1 Std. 4.9-1 with Overdrive. Optional ratios—4.36-1, 4.54-1, 5.22-1.
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.
Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate.
Endplay—(1938) .002-.005", ('39) .004-.007".

SHOCK ABSORBERS

SHOCK ABSORBERS: (1938)—Houdaille Model OBBDI (frt.), OBBCP (rear); (1939)—Delco Model 1966-D (right frt.), 1966-C (left frt.), 1751-Z (right rear), 1751-M (left rear). Double acting, hydraulic types.
Fifth Shock Absorber (Stabilizer):—Houdaille Model NFT. Double acting, hydraulic, adjustable type.

FRONT SUSPENSION

Front Suspension:—Independent 'Safe-T-fleX' type
See Front Suspension Section for complete data.
NOTE—Frame Height must be set first before checking Caster and Camber.
Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 19¼" (load car for correct figure).
Kingpin Inclination—1°54' crosswise.
Camber—½° (±) ½° ('38), ½° plus ¾°, minus 0° ('39). Adj.
Caster—1½° (±) ½° ('38), 1½° ('39-1701), 0° ('39-1702), ± ½°.
Toe In (1938)—1/32-1/16". (1939)—0" (plus 1/16", minus 0") at hub height. Adjust tie rods equally (lengths must be equal after adjustment).

STEERING GEAR

Steering Gear: Packard (Gemmer design Model 330) Worm-and-Roller type with center steering. Refer to Gemmer Model 330 article.
See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service. Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment. Hand lever applies rear service brakes.
See Brake Section for complete data.
Drums—Centrifuse. Diameter—12".
Lining ('38)—Primary (Raybestos #451). Secondary (U. S. Asbestos No. 589-F). Width 1¾" (1601), 2¼" (1601A, 2). Thickness 3/16". Length 13" per shoe.
Lining ('39)—Marshall #2201 (1701), US Asb. #714—primary, #589—secondary (1701A,2). Width 1¾" (1701), 2¼" (1701A,2), Thickness 3/16". Length 13"
Clearance—.010" at heel and toe of each shoe.
Hand Brake:—See Service Brakes (above).

NOTE—Vibration dampener marked #1 UP D.C. at #1 TDC point with 15-1° graduations each side.

To Set Timing—Loosen thumbnut, set Fuel Compensator at 'O'. With #1 piston on compression, turn engine over until it reaches firing position (see table above), stop when correct line on vibration damper at front of engine lines up with pointer. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt, see that rotor is opposite #1 segment in distributor cap.

NOTE—If neon timing light used, idle engine below 500 R.P.M.

Fuel Compensator Setting—Provides manual adjustment at distributor for octane rating of fuel used. After ignition set as above, road test car to give a slight 'ping' pulling heavy load. Adjusted by loosening thumbnut and advancing or retarding pointer on scale. Adjustment permits 10° advance or retard from center '0' position.

CARBURETOR

CARBURETION:—Carburetor—Stromberg Model EE-23. 1¼" dual downdraft type with integral automatic choke and fast idle. Marked 10-28.
For complete data, refer to Carburetor Index.

Idle Adjustment—With engine warm, choke valve wide open, engine idling at hot or slow idling speed, set throttle stopscrew so that engine idles at 350 R.P.M. or 7 M.P.H. Turn inner idling adjusting screw in until engine begins to lag or miss, then turn screw out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Repeat with outer idling adjusting screw. Readjust throttle stopscrew for correct idling speed.

Accelerating Pump Setting—Adjusted by changing position of pump link rod in throttle valve lever. Inner Hole (Min. stroke)—Summer temperatures. Outer Hole (Max. stroke)—Winter temperatures.

Fast Idle & Automatic Choke:—Integral type.
For complete data, refer to Carburetion Equip. Index.

CARB. EQUIPMENT

Air Cleaner: AC #1528584 oil bath type.
NOTE—#1528066 oil vent cleaner (in oil filler cap).

Fuel Pump:—AC. Type F #1523196. Combination fuel-and-vacuum pump.
For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge: Auto-Lite (Motometer design) Electric NG-8673-D (dash unit), 8647-T (tank).
For complete data, refer to Carburetion Equip. Index.

BATTERY

BATTERY:—Prest-O-Lite, Hi-Level, Type HR4-21. 6 volt, 21 plate, 150 AH. capacity (20 hr. rate).
Starting Capacity—175 amperes for 20 minutes.
Zero Capacity—300 amperes for 6.3 minutes.
Grounded Terminal—Positive (+) terminal. Grounded to left rear leg of frame 'X' member. Motor ground on rear motor support.
Dimensions—Length 13", Width 7". Height 9⅛".
Location—Under front seat on left side.

STARTER

Auto-Lite Model MAX-4014. Armature MAW-2090.
Drive—Outboard Barrel Type Bendix Model A-1729.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—125 RPM., 160 amperes, 5.2 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5300 Min.	5.5	65
2.75 "	1630	5.0	200
5.5 "	970	4.5	300
8.7 "	600	4.0	400
12.0 "	300	3.5	500
16.5 "	Lock	3.0	640
25.0 "	Lock	4.0	880

Removal:—Starter sleeve mounted in left front face of flywheel housing. To remove, take out pilot mounting screw in flywheel housing.

Starting Switch: Auto-Lite SS-4001. Magnetic type, on starter controlled by switch on instrument panel.
For complete data, refer to Electrical Equipment Index.

Auto-Lite SS-4001 Specifications

Closes with terminal voltage of 4 volts or less and will remain closed until voltage drops to .75-2.0 volts. Current draw 3 amperes at 6.0 volts.

GENERATOR

Auto-Lite Model GCO-4803A. Armature GCO-2006F. Two brush (shunt) type with external current and voltage regulat'n. Ventilated by fan on drive pulley.

Maximum Charging Rate—28 amperes (cold), 8.0 volt, 1850 R.P.M., and above, with load or discharged battery (Current Regulator Setting). Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Charging Rate Adjustment—No adjustment on generator. See Regulator Section below for Voltage and Current Regulator settings.

Performance Data

Cold			Hot		
Amps.	Volts	R.P.M.	Amps.	Volts	R.P.M.
0	6.4	825	0	6.4	900
4	6.6	940	4	6.6	1025
8	6.85	1050	8	6.85	1160
12	7.1	1175	12	7.1	1310
16	7.3	1300	16	7.3	1475
20	7.55	1450	20	7.55	1660
24	7.8	1610	24	7.8	1880
28	8.0	1850	28	8.0	2200

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (new brushes).
Field Current—1.47-1.63 amperes at 6.0 volts.
Motoring Current—3.94-4.36 amperes at 6.0 volts.

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

Belt Adjustment:—With mounting bolts loose, swing generator away from engine until reading on scale attached to clamp bolt is 40 lbs., or belt deflection (thumb pressure) midway between fan and generator pulleys is ½-¾".

REGULATOR

Auto-Lite Model VRB-4008-C. Voltage-Current Type. Consists of Cutout Relay, vibrating Voltage Regulator and vibrating Current Regulator in case on dash.
NOTE—Regulator cover is sealed. Serviced on exchange basis if seals not broken. Cover must be removed to make adjustments.
For complete data, refer to Electrical Equipment Index.

Cutout Relay

Cuts In—6.4-7.0 volts Cold.
Cuts Out—.5 ampere Min., 3.0 amperes Max. Cold.
Contact Gap—.015" minimum.
Air Gap—.034" Min., .038" Max. with contacts open. Measure at hinge end of core.

Voltage Regulator

Setting—7.5-7.8 volts at 70°F (Before Serial No. 8R-000001), 7.3-7.6 volts at 70°F (After 8R-000001). **See Electrical Equipment Section for complete settings and changes.**

To Check—Connect ammeter in charging line at 'B' terminal on regulator (use short heavy leads). Connect voltmeter between 'B' and 'GD' terminals. Operate generator, charging fully charged battery, at speed equivalent to 30 M.P.H. car speed until voltage is constant. Voltage should then be within limits of 7.4-7.8 volts (units before 8R-000001), 7.21-7.83 volts (after #8R-000001). See Setting above.

To Adjust—Change regulator armature spring tension by bending lower spring hanger. See Electrical Equipment Section for complete instructions.

Contact Gap—.010" Min., .020" Max. with armature against stop pin.

Air Gap—.0595-.0625" with contacts just opening.

Current Regulator

Setting—27-29 amperes (marked '28' on cover).

To Check—Connect ammeter and voltmeter as directed for Voltage Regulator test. Operate generator at 30 M.P.H. car speed, add load (use bank of headlamp bulbs or turn on car lights and discharge battery) so that generator will charge at peak rate and bring Current Regulator into action. Charging current should not exceed 28 amperes. If more than slight excess is noted, Regulator is defective.

To Adjust—Change regulator armature spring tension by bending lower spring hanger. See Electrical Equipment Section for complete instructions.

Contact Gap & Air Gap—Same as for Voltage Regulator.

LIGHTING

LIGHTING:—Headlamps—Hall, Flex beam, pre-focused type with special non-interchangeable lenses marked 'Left' and 'Right.' 'Passing' beam (upper beam right hand headlamp, lower beam left hand headlamp). Foot control switch gives 'Country Driving' beam with lighting switch in second (City) position, and 'Passing' beam with lighting switch in third (Country Driving) position.

Headlamp Adjustment—With car fully loaded, tires properly inflated, on level floor 25' from screen, and upper beams lighted (switch in 'Country Driving' position), aim left headlamp so that hot spot is centered on vertical lamp-center-line with top cut-off at lamp center height horizontal line. Aim right headlamp for same height but with left edge of hot spot at vertical lamp-center-line (entire hot spot to right of this line). Right headlamp may be turned slightly more toward right if this setting provides a passing beam which is too blinding. Adjust by loosening nut on mounting bracket under lamp.

Headlamp Beam Indicator—Separate beam indicator for each beam position (1—Park, 2—City, 3—Drive, 4—Pass), located on instrument panel.

Switches

Lighting—Delco-Remy Model 1994505.
Foot Selector—Delco-Remy Model 1997001.

CONTINUED ON NEXT PAGE

MODEL IDENTIFICATION

SERIAL NUMBER:—On front of dash (Use Engine No.).

ENGINE NUMBER:—First number B-500001. Stamped on boss on upper left hand side of cylinder block.

TUNE-UP

COMPRESSION :—Ratio—6.45-1 Std., 6.85-1 Optl. HC. 6.20-1 Optl. LC. NOTE—Heads marked 242511 (6.45-1), 335618 (6.85-1), 338960 (6.20-1).

Pressure—110 lbs. (Std. 6.45-1 Hd.), 118 lbs. (Optl. 6.85-1 Hd.) at 125 RPM. cranking speed.

VACUUM READING: Steady 18-19" idling at 6 MPH.

FIRING ORDER: 1-6-2-5-8-3-7-4. See diagram.

SPARK PLUGS: AC No. 104 or Champion Y-4. 10 mm. Gaps—.028". Limits .026-.030".
NOTE—If colder plug required use AC No. 103S or Champion early Y-4. Do not tighten these small plugs excessively. Tightening tension 50 in. lbs.

IGNITION: See Coil, Condenser, and Distributor.
Breaker Gap—.015". Limit .017" maximum.
Cam Angle—27° Closed with .017" Breaker gap.
Automatic Advance—10½° max. at 1600 RPM(distr)
Vacuum Advance—5½° (distr.) with 16" vacuum.

IGNITION TIMING See Ignition Timing.
Std. Setting 7-8½°BTDC. Vibration dampener mark (correct degree mark ahead of #1UP.DC) aligned with pointer at front of engine. ***See Ignition Timing for Settings on engines with optional heads.***

CARBURETION: See Carburetor & Carb. Equipment.
Idle Setting—Set idle adjusting screws midway between 'miss' and 'roll' points. Idle speed 6 MPH.
Float Level—Fuel level 5/8" below edge of bowl.
Accelerating Pump—Inner Hole (Summer), outer (Winter).
Fuel Pump Pressure: 4 lbs. maximum.

MANIFOLD HEAT CONTROL:—Thermostatic coil type. See that manifold valve operates freely (valve must not stick or bind). Do not oil control.

VALVES: See Valve Timing.
Tappet Clearance—.006" Intake, .008" Exh., hot.

STARTING: See Battery, Starter, Generator, Regulator.

IGNITION

Ignition Switch:—Mitchellock Model 24-B, No. 8060.
Ignition Lock—Briggs & Stratton. Mitchell #6760.

COIL: Auto-Lite Model No. CE-4633. Service Coil (less switch & cable) CE-3224LS. On cylinder head.
Ignition Current—½ ampere idling, 2½ stopped.

CONDENSER: Auto-Lite Part No. IG-2671G.
Capacity—.20-.25 microfarad..

DISTRIBUTOR: Auto-Lite Model IGT-4006-A. Single breaker, 8 lobe cam, full automatic advance type with Vacuum Spark Control and Fuel Compensator.
Breaker Plate Identification—Maximum vacuum advance limited by slot and marked by number (#5½) on plate.
Breaker Gap—.015". Limit .017" Max.
Cam Angle or Dwell—27° clsd., 18° open (.017" gap).
Breaker Arm Spring Tension—18-20 ozs.
Rotation—Clockwise viewed from the top.

Automatic Advance

Distributor Degrees	R.P.M.	Engine Degrees	R.P.M.
Start	300	0	500
2½	500	5	1000
5	700	10	1400
7½	1100	15	2200
10½	1600	21	3200

Vacuum Spark Control—Integral type. Mounted on distributor cup and linked 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.

Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG).
Start	0	7"
2	4	10¼"
4	8	13½"
5½	11	16"

Fuel Compensator—Manual adjustment at distributor providing 10° advance or retard from center '0' position. See Ignition Timing for setting.

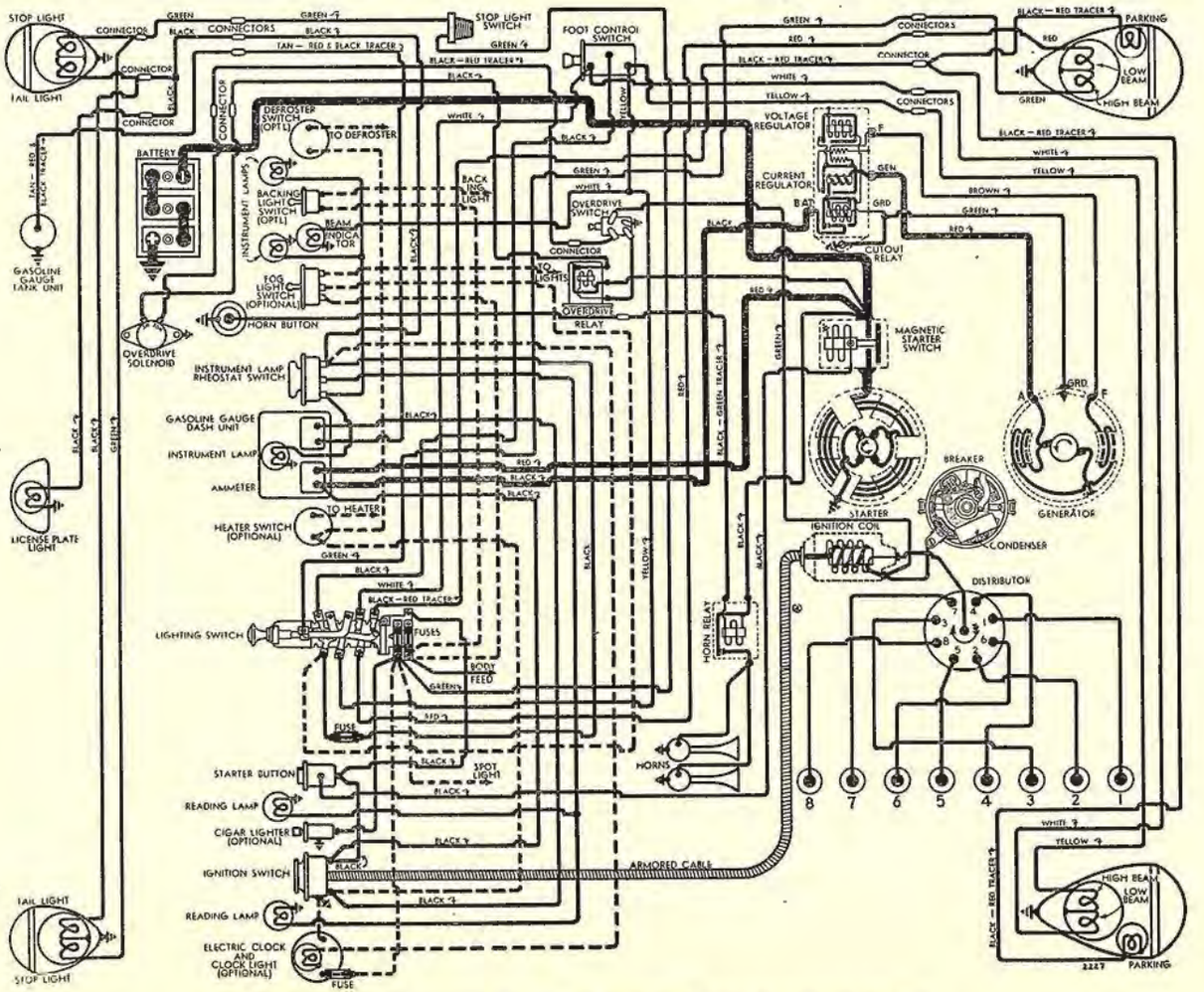
Distributor Removal:—Mounted on cylinder head. To remove, disconnect vacuum line, take out hold-down screw in advance arm.

IGNITION TIMING

IGNITION TIMING:—Standard setting (for 76 Octane fuel) as follows. See Fuel Compensator Setting.

	Flywheel Degrees	Piston Position
Std. 6.45-1 Head	7-8½° BTDC	.0230-.0338" BTDC
Optl. HC. 6.85-1	5-6½° BTDC	.0117-.0199" BTDC
Optl. LC. 6.20-1	8-9½° BTDC	.0299-.0421" BTDC

NOTE—Vibration dampener marked #1 UP D.C. at #1 TDC. point with 15 - 1° graduations each side.
Timing—Loosen thumbnut, set Fuel Compensator pointer at '0', tighten thumbnut. With #1 piston on compression, turn engine over until piston



See Transmission Section for late 1939 type Overdrive Control Wiring

CONTINUED FROM PRECEDING PAGE

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-32	2330
Headlamps (Export)	32-21	1104
Parking, Fender	1½	55
Instr., Clock, Reading	1½	55
Beam & Heater Indicators	1	51
Stop & Tail	21-3	1158
Stop (Trunk Rack Equip.)	15	87
Tail (Trunk Rack Equip.)	3	63
License Plate, Courtesy	3	63
Dome	6	81
Fog Light	32	1321
Spotlight	32	1323

MISC. ELECTRICAL

THERMOSTATIC RELAY:—On lighting switch, protects lighting circuits. Remains closed with 25 amperes but opens in 2 minutes with 38 amperes. Not adjustable.

FUSES:—Dome, Stop Light & Accessories—Two 20 ampere. On back of lighting switch.
Instrument & Tail Light—20 ampere. In connector in switch lead near lighting switch.
Clock—2 ampere (Borg), 1 ampere (Western).

HORNS:—Sparton Model H-32. Vibrator type, Air tone, Twin horns operated by relay.
Air Gap—.032-.035" (low note—long horn), .026-.030" (High note—short horn).
Horn Current—22-25 amperes (total).

Horn Relay:—R-B-M Model 4760. NOTE—Relay not adjustable (cover welded on).
Closing Voltage—3.5-4.5 volts.

ENGINE

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head.
Bore—3 3/16". **Stroke**—5".
Displacement—320 cu. ins. **Rated HP.**—32.5.
Developed Horsepower—130 HP. (Std. Hd.), 135 HP. (Optl. HC. Hd.) at 3200 R.P.M.
Compression Ratio—6.45-1 Standard, 6.85-1 Optl. H.C., 6.20-1 Optl. L.C.
Compression Pressure—110 lbs. (Std. 6.45-1 hd.), 118 lbs. (Optl. 6.85-1 hd.) at 125 R.P.M.
Vacuum Reading—Steady 18-19" idling at 6 MPH.
See Packard Shop Notes for Cylinder Head data and Block Removal instructions.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground.
Weight—17¾ ozs. (stripped), 24 ozs. (with rings and pin) and equal within 4 grams. **Length**—4¼".
Removal—Pistons from above, rods from below.
Clearance—.0005-.001" skirt. See Fitting Pistons.

Original Bore & Pistons Sizes, Replacement Pistons:—*See Packard Shop Notes for complete data.*

Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler must be 12-14 lbs.

Installing Pistons:—Slot toward valves.

PISTON RINGS:—#1 compression (plain), #2 compression (#70 Perfect Circle), #3 oil (P-C #85), #4 oil (P.C. #X-90) rings per piston, all above pin.

Ring	Width	End Gap	Side Clearance
Comp. #1 & 2	.123-.1240"	.007-.017"	.003"
Comp. #3	.123-.1240"	.007-.015"	.003"
Oil Contr.	.186-.1865"	.007-.015"	.0015"

Replacement Rings:—Standard and .003", .005", .010", .015", .020", .025", .030", .035" & .045" oversize.

PISTON PIN:—**Diameter**—⅞". **Length**—2 47/64". Pin floats in piston and rod, held by locking rings.
Pin Fit in Piston—Finger push fit with piston heated to 160° F.
Pin Fit in Rod Bushing—Finger push fit at 70° F.
Replacement Pins:—Std. and .003", .006" oversize.

CONNECTING ROD:—**Length** 10⅞". **Weight** 40-40.125 ozs. (with bearings).
Crankpin Journal Diameter—2.1875".
Lower Bearing—Copper lead alloy, interchangeable type. Furnished .001", .002", .003", .015" undersize.
Clearance—.0007-.00125". **Sideplay**—.005-.008".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or bearing caps. Tighten rod bolt nuts to 550-570 in. lbs.
Installing Rods:—Oil hole toward camshaft.

CRANKSHAFT:—9 bearing, 8 bolted counterweights with rubber friction disc vibration dampener.
Journal Diameters—2.625".
Bearings—Removable steel-backed, babbitt-lined, shimless type. Bearing shells doweled in block and cap. Dowel in cap is flanged (seats between bearing and cap) and hollow (for bearing lubrication).
Clearance—.001-.002".
Bearing Adjustment:—None (no shims). Replace bearings (requires removal of crankshaft).
End Thrust:—Taken by #7 bearing. **Endplay**.003-.005".

CAMSHAFT:—8 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.0015-.0035".
End Thrust:—Taken by thrust plate assembled in back of camshaft sprocket. **Endplay**—.003-.006".
Timing Chain:—Morse No. 3682-KX. Width 1½". Pitch .375". Length 26¼" or 70 links.
Camshaft Setting:—Install chain and sprockets together with marks adjacent and in line with a straightedge across the shaft centers.
See Packard Shop Notes for Radiator & Fender (unit) removal for work on front of engine.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3405"	7 13/32"
Exhaust	1 15/32"	.3405"	7 13/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	.358"	.0025-.004"
Exhaust	45°	.358"	.004-.006"

Valve Guides:—New type. Press guides in block so top is 1 1/32" below valve seat and finish-ream.

Valve Rocker Arms:—Consist of pivoted arms mounted on bracket on crankcase which transmit motion from cam to valve pushrod (valve lifter).
Removal—Take out screws in bracket on right side of crankcase, withdraw bracket assembly.

Valve Lifters (Tappets):—Removable from above with valve springs removed. Operate in individual guides held in place by bottom face of cylinder block (remove block to remove guides).

Valve Springs:	Spring Pressure	Spring Length
Valve Closed	68-78 lbs.	3 1/16"
Valve Open	154-164 lbs.	2 45/64"

NOTE—Serrated washer on top of each spring.

VALVE TIMING

Tappet Clearance:—.006" Int., .008" Exh. (warm).
NOTE—Remove right front fender plate for adj.

Valve Timing.:—See Camshaft Setting (above).
Intake Valves—Open 26° BTDC. Close 69° ALDC.
Exhaust Valves—Open 61° BLDC. Close 34° ATDC.
To Check Timing—Set tappet clearance #1 exhaust valve at .005" (or .010", then insert .005" feeler). Turn engine over until pointer over damper (at front of engine) lines up with a point 1 1/16" (plus or minus 11/32") past '1-UPDC' mark (feeler should withdraw with finger pull). Valve closes 34° or .5176" ATDC. Reset tappet clearance at .008" warm.

LUBRICATION

LUBRICATION:—Gear type oil pump in crankcase.
Normal Oil Pressure:—55-60 lbs. max., 5 lbs. min. idling (SAE #20 oil, engine warm or 150° F.).
Oil Pressure Regulator:—Located under plug on left side of crankcase. To adjust, remove acorn nut, turn slotted screw.
Relief Valves—Non-adjustable relief valve located in regulator housing opens at 17 lbs. back-pressure in filter and cooler to by-pass oil to manifold. By-pass valve in oil filter opens at 7-8 lbs.
Crankcase Capacity:—7½ quarts.

COOLING

COOLING SYSTEM:—**Water Capacity**—22 quarts.
Water Pump:—New ball-bearing, packless type.
See Water Pump Section for complete data.

Thermostat:—In top radiator tank. Operates shutters.
Setting—Starts to open 135° F. Fully open 150° F.
NOTE—Install 162° cylinder head thermostat for use with heaters. Remove in summer.
Adjustment—Pull back on the shutter pullrod to close shutters, tighten nut to remove all slack in rod, then tighten one turn additional for pre-load.

CLUTCH

CLUTCH:—**Long Model 11CFS-CI.** Semi-centrifugal, single plate, dry disc type (riveted assembly).
See Clutch Section for complete data.
Facings—Woven (US Asbestos #1133G), 2 required. Inside Diam. 6½". Outside Diam. 11". Thickness .125".
Adjustment—Adjust nut on pedal rod (at clutch fork) for 1½-2" pedal free movement.
Removal:—Remove transmission (see Transmission Removal below), remove flywheel bell housing by taking out 4 screws and removing nuts on 4 studs. Remove mounting screws in clutch cover flange

TRANSMISSION

TRANSMISSION:—**Own Make.** New type with constant-mesh, helical, ball-bearing mounted low-speed gear (sliding gear for reverse). Synchro-mesh (second and high).
See Transmission Section for complete data.

Transmission Control:—Own remote control type.
See Transmission Section for complete data.

Removal:—Disconnect shifter rods, speedometer cable, ground strap at transmission case. Disconnect drive shaft at front universal joint and block shaft up against floorpan. Support rear end of en-

MODEL IDENTIFICATION

SERIAL NUMBER:—On front of dash (use Engine No.).

ENGINE NUMBER: On block left side below distributor. First number A-600001 ('38), B-600001 ('39).

TUNE-UP

COMPRESSION: Ratio—6.4-1 Std. '38. 6.3-1 Std. '39. High Compression 7.0-1 and Low Compression 6.0-1 heads optional. Carry 'HC' or 'LC' marks on head. **Pressure**—110 lbs. (Std.), 119 (HC) at 125 RPM.

VACUUM READING:—Steady 18-20" at 8 MPH.

FIRING ORDER: 1R-6L-5R-2L-3R-4L-6R-1L-2R-5L-4R-3L with cylinder banks right (R) and left (L) as viewed from driver's seat and #1 cylinder nearest radiator. Spark plugs not connected in this order on distributor cap (see diagram).

SPARK PLUGS: AC No. 104 or Champion Y-4. 10 mm. **Gaps**—.028". Limits .026-.030".
NOTE—If colder plug required use AC No. 103S or Champion Early Y-4. Do not tighten these small plugs excessively. Tightening tension 50 in. lbs.

IGNITION: See Coil, Condenser, and Distributor.
Breaker Gap—.020". **Cam Angle**—40° Closed.
Synchronization—Set movable contacts to open 33½° after stationary contacts.
Automatic Advance—10° max. at 1400 RPM (for IGO-4001A Distr., 8° max. at 1200 RPM (IGO-4002A).

IGNITION TIMING: See Ignition Timing.
Std. Setting—6-8° BTDC (for standard cyl. head), 4-6° BTDC (for HC hd.). Vibration dampener mark (correct graduation ahead of #1R-UDC) aligned with pointer at front of engine. Movable contacts should open 33½° after this point.

CARBURETION: See Carburetor & Carb. Equipment.
Idle Setting—Set idle adjusting screws midway between "miss" and "roll" points. Idle speed 8 MPH.
Float Level—Fuel level 9/16" below edge of bowl.
Fuel Pump Pressure: 4½ lbs. maximum.

VALVES: See Valve Timing.
Tappet Clearance None in service, hydraul. take-up.

STARTING: See Battery, Starter, Generator, Regulator.

IGNITION

Ignition Switch:—Mitchellock Model 24-B, No. 7648.
Ignition Lock—Briggs & Stratton. Mitchell #6760.

COIL: Auto-Lite Model CE-1203. Two Coil Unit. Service Coil (less switch & cable) CE-3186FS. Mounted at front of the engine.
Ignition Current—½ ampere idling, 2½ amperes stopped for each coil.

CONDENSER: Auto-Lite No. IG-2671-E, IG-2671-A (one of each used). **Capacity**—.20-.25 microfarad.

DISTRIBUTOR: Auto-Lite Model IGO-4002A (Std. hd.), IGO-4001A (HC head). Double breaker, 6 lobe cam, full automatic advance type.
Firing Interval—Movable contacts open 33½° after fixed set (firing interval 33½-26½-33½ distributor degrees caused by 67° included angle between banks.
Breaker Gap—.020". Limits .018-.022".
Cam Angle or Dwell—40° closed, 20° for each set of contacts (operate independently).
Breaker Arm Spring Tension—16-20 ozs.
Rotation—Counter-clockwise viewed from the top.

Automatic Advance—IGO-4002A

Distributor Degrees	Distributor R.P.M.	Engine Degrees	Engine R.P.M.
Start	300	0	600
2	525	4	1050
4	750	8	1500
6	975	12	1950
8	1200	16	2400

Automatic Advance—IGO-4001A

Start	300	0	600
2	515	4	1030
4	730	8	1460
6	950	12	1900
8	1175	16	2350
10	1400	20	2800

Removal:—Distributor mounted between cylinder banks at front of engine. To remove, take off distributor cap and cable conduit assembly, take out screws in mounting bracket.

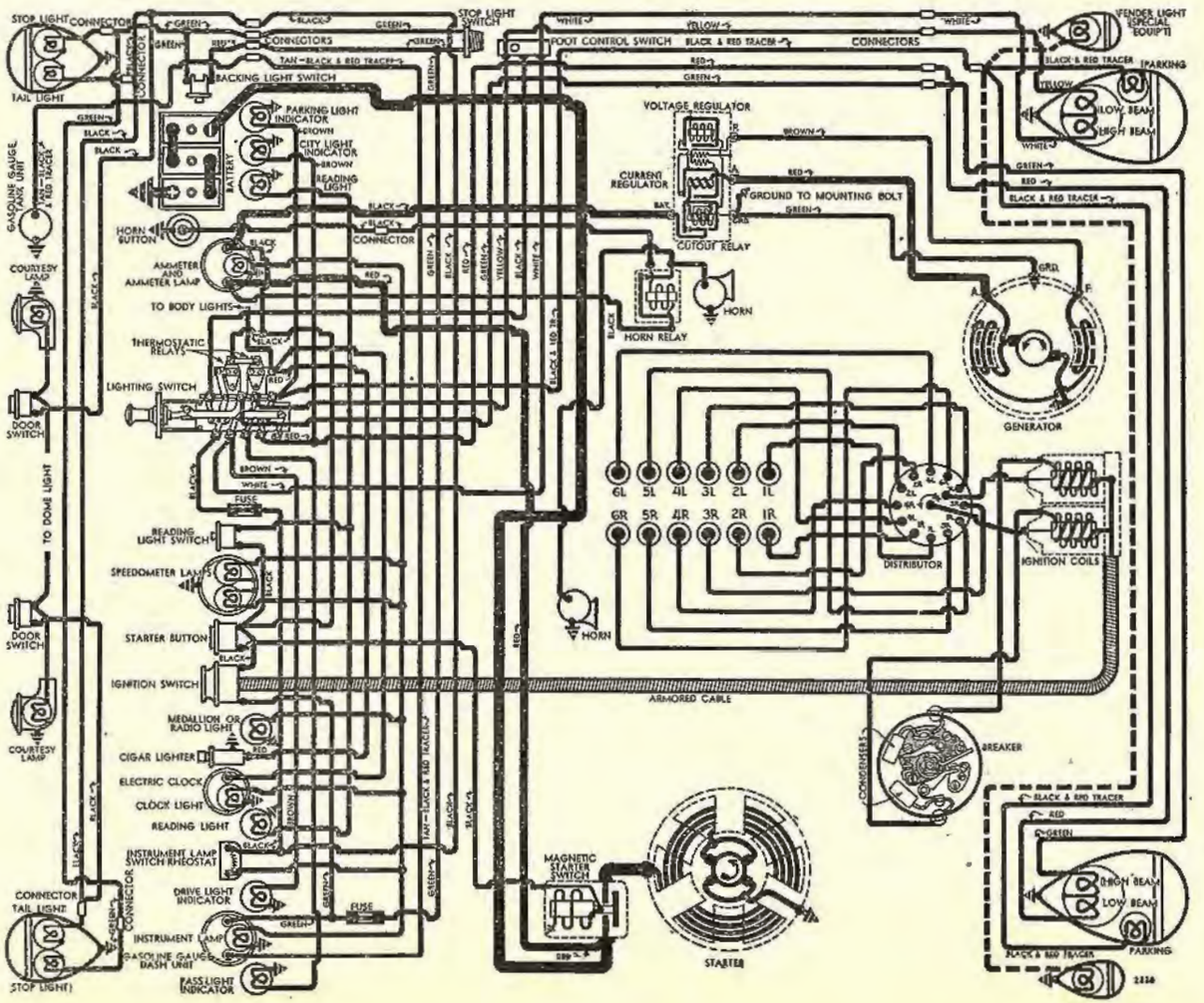
IGNITION TIMING

IGNITION TIMING:—Settings for all engines as follows:

	Flywheel Degrees	Piston Position
Std. & LC hds.	6-8° BTDC	.0145-.0255" BTDC
High Comp. hd.	4-6° BTDC	.0063-.0145" BTDC

NOTE—Vibration dampener at front of engine marked '#1R-UDC' (top dead center #1 piston, right hand bank), '#6L-UDC' (top dead center #6 piston, left hand bank), with fifteen 1° graduations before each of these marks.

Timing (Stationary Contacts)—With #1R piston (front cylinder, right bank) on compression, turn engine over until piston reaches firing position (see table above), stop when correct graduation on vibration dampener at front of engine lines up with pointer on chain case cover. Loosen clampscrew on mounting bracket, rotate distributor until stationary contacts (mounted directly on breaker plate)



begin to open, tighten clampscrew. Then synchronize movable contacts.

Synchronization of Movable Contacts (On Engine)—Turn engine over exactly 67° to firing position of piston #6L (rear piston, left bank), stop when correct graduation on vibration dampener lines up with pointer. Loosen lockscrews on movable subplate (on which second set of contacts mounted), shift plate until contacts begin to open, tighten lockscrews.

Synchronization (Other Methods)—Set movable contacts to open exactly 33½° after fixed set. Firing intervals are irregular 33½-26½-33½ distributor degrees.

CARBURETOR

CARBURETION:—Carburetor—Stromberg Model EE-3. 1½" Duplex or double barrel type.
For complete data, refer to Carburetor Index.
Idle Adjustment—With engine warmed up so that Automatic Choke and Fast Idle inoperative, set throttle lever stopscrew so that engine idles at 6 MPH., turn idle adjusting screw for each barrel (in succession) out until engine begins to roll, then turn screw in slowly until engine fires smoothly. Final setting should be approximately 1-1⅛ turns of screw out from inner seated position. Readjust throttle stopscrew for correct idle speed.

Accelerating Pump—Two holes provided in throttle lever for pump link engagement as follows:
Outer Hole (Max.)—Normal weather and fuel.
Inner Hole (Min.)—Hot weather, high-test fuel.

Fast Idle:—Integral (built-in carburetor).
For complete data, refer to Carburetion Equip. Index.
Setting—With choke valve closed, turn fast idle adjusting screw in until it contacts fast idle cam lug, then turn screw in additional 6¾ turns.

Automatic Choke:—Stromberg Model C (separate unit).
For complete data, refer to Carburetion Equip. Index.
Setting—Pointer should line up with punchmark on thermostatic coil case (16 notches rich from '0' mark). NOTE—Setting may be varied 4 graduations either way for best performance.

CARB. EQUIPMENT

Air Cleaner:—AC #1528519 oil-wetted type Std.

Fuel Pump:—AC Type I #1521778 combination fuel-and-vacuum pump. Diaphragm type.
For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge:—Motometer (Auto-Lite) Electric. Dash Unit: NG-8673D (1938), NG-9045D (for 1939). Tank Unit: NG-8648T (1938 and 1939).
For complete data, refer to Carburetion Equip. Index.

BATTERY

Prest-O-Lite Hi-Level Type Model HR4-21. 6 volt, 21 plate, 150 A.H. capacity (20 hr. rate).

Starting Capacity—175 amperes for 20 minutes.

Zero Capacity—300 amperes for 6.3 minutes.

Grounded Terminal—Positive (+) grounded to frame 'X' member. **Engine Ground**—Strap connector at right hand rear engine mounting.

Dimensions—Length 13". Width 7". Height 9⅛".

Location—Under left front seat.

Export Battery—Willard Type SR-5-153. 6 volt, 19 plate, 153 A.H. capacity (20 hr. rate).

Starting Capacity—180 amperes for 20 minutes.
Zero Capacity—300 amperes for 6.6 minutes. Five second voltage 4.5 volts.
Dimensions—Length 13". Width 7 1/16". Height 9 5/16".

STARTER

Owen-Dyneto Model DN-1389. Armature No. 13409.
Drive—Outboard Bendix Model RCD-10FXTD.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—56-60 ozs. (new brushes).
Cranking Engine—125 RPM., 130 amperes, 5.6 volts.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	3000	6.0	50
5.8 "	850	5.2	200
11.4 "	520	4.8	300
17.0 "	340	4.5	400
23.0 "	220	4.2	500
26.6 "	140	4.0	600
39.0 "	Lock	3.6	810

Removal:—Sleeve mounted on right front face of flywheel housing. To remove, take out pilot mounting screw in housing.

Starting Switch: Auto-Lite SS-4001. Magnetic type. Mounted on starter, controlled by switch on instrument panel.
For complete data, refer to Electrical Equipment Index.

GENERATOR

Auto-Lite Model GCE-4803A. Armature No. GBX-2035F. Two brush, straight shunt type with vibrating voltage and current regulation. Ventilated by fan on drive pulley.

Maximum Charging Rate—30 amperes (cold), 8.0 volts, 1400 RPM. and above (with discharged battery or load). Actual charging rate controlled by regulator and dependent on battery condition.

Charging Rate Adjustment—No adjustment at generator. See Regulator data below.

Performance Data

Cold			Hot		
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

NOTE—30 amperes is Current Regulator setting.

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:—Special pivot mounting at left front of engine. To remove, take out pivot and clamp bolts.

Belt Adjustment:—Swing generator out until 70-80 lb. reading secured on spring scale hooked to clamp bolt lug parallel to slot or until deflection midway between generator and water pump pulleys is ½-¾" with thumb pressure. NOTE—Replace both drive belts together as a matched set.

REGULATOR

Auto-Lite Model VRB-4008AP. Consists of Cutout Relay, vibrating Voltage Regulator and Current Regulator 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, 700 R.P.M. Cold.

Cuts Out—.5-3.0 amperes discharge current.

Contact Gap—.015" Minimum.

Air Gap—.034-.038" with contacts open, measured at hinge end of core.

Voltage Regulator

Setting—7.3-7.6 volts at 70°F. (Regulator Serial No. 8R-000001 Up). ***See Electrical Equipment Section for settings and changes on units before this Serial Number.***

To Check (without breaking seals)—Connect ammeter in charging line at regulator 'B' terminal, voltmeter between 'B' and 'GD' terminals. Operate generator, charging fully charged battery, at speed equivalent to 30 M.P.H. until voltage is steady. Voltage should be within limits of 7.21-7.83 volts.

To adjust (with cover removed)—Change armature spring tension by bending lower spring hanger slightly. See Electrical Equipment Section for complete adjustment directions.

Contact Gap—.010-.020" (armature against stop pin).

Air Gap—.0595-.0625" with contacts just opening.

Current Regulator

Setting—29-31 amperes (marked '30' on cover).

To Check (without breaking seals)—Connect test meters as for voltage test (above). Operate generator at 30 M.P.H., add load (use bank of headlamp bulbs or turn on car lights and discharge battery) so that generator charges at peak rate and Current Regulator operates. Charging current should not exceed 30 amperes (if more than slight excess noted, regulator is defective).

Adjustment, Contact Gap, Air Gap—Same as for Voltage Regulator (above).

LIGHTING

LIGHTING:—Headlamps—Hall Flex-beam type with pre-focused bulbs. Asymetrical passing beam (lower beam left hand headlamp, upper beam right hand headlamp) controlled by Beam Selector Switch on toeboard.

Headlamp Adjustment—With tires properly inflated, car loaded to rated capacity, 25' from screen with upper beams lighted, aim left hand headlamp so that hot spot centered on lamp vertical centerline and upper edge at horizontal line at lamp center height. Aim right hand headlamp for same height but with left edge of hot spot at lamp vertical center-line (entire hot spot to right of this line).

Beam Indicators—Four used (1 & 2 in Water Temperature gauge dial, 3 & 4 in Oil Pressure gauge dial). Lighted when following lights in use:
1. **Park**—Parking or Fender lights.
2. **City**—Headlamp lower beam.
3. **Drive**—Headlamp upper beam.
4. **Pass**—Headlamp asymetrical passing beam.

CONTINUED ON NEXT PAGE

Removal:—Remove transmission (see Transmission Removal following), take out cover mounting screws (release pressure evenly), lift assembly out. Align '0' marks on flywheel and cover when reassembling.

TRANSMISSION

TRANSMISSION:—Own Make. Helical gear type with synchronizer for second and high speeds.
See Transmission Section for complete data.

Transmission Control (1939): Own Steering Col. Shift.
See Transmission Section for complete data.

Removal:—Remove ground cable, speedometer cable, propeller shaft, light switch, two stud nuts (case bracket to rubber support) at each side, hand brake cable at equalizer, left stabilizer link, clutch pedal pull-rod, and pedal spring. Support engine at rear. Remove right brace rod (rear only), lower cross-member, and bell housing nuts and capscrews. Jack up rear of engine, remove two bolts on each side (holding vertical support members to frame), remove support members, pull transmission back.

UNIVERSALS

UNIVERSAL JOINTS:—Spicer Model 1351-10X (front), 1358-18X (rear). Needle bearing type, 2 used.
See Universals Section for complete data.

REAR AXLE

REAR AXLE:—Own Make. 'Angle-Set', semi-floating, hypoid gear type with Hotchkiss drive.
See Rear Axle Section for complete data.

Ratio—4.41-1 (std.), 4.69-1, 4.06-1 (optl.).

Backlash—.003-.005". Screw adjustment.

Removal:—Remove wheel, hub, brake assembly, wheel bearing and axle shaft. Disconnect rear universal joint at flange, drop drive shaft, remove differential from housing by removing housing bolt nuts (below), and locknut on stud (at top). Remove carrier.

Wheel Bearing Adjustment—Controlled by shims between outer race of inner bearing and shoulder in housing. Remove wheel, hub and brake assembly, wheel bearing and axle shaft. Add or remove shims adjust each wheel independently.

Endplay—.003" (plus or minus .001") at each wheel.

SHOCK ABSORBERS

SHOCK ABSORBERS: Delco Double Acting Types. Models 1952-A (right front), 1952-B (left front), 2006-G (right rear), 2006-H (left rear).

FRONT SUSPENSION

Front Suspension:—Packard Safe-T-fleX type with coil springs.
See Front Suspension Section for complete data.

NOTE—Frame Height must be set first before checking Caster and Camber.

Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 20½" (load car for correct figure).

Kingpin Inclination—1½° crosswise.

Camber—1° plus or minus ¼°. Adjustable.

Caster—0° (½° reverse max.). Shim adjustment.

Toe In—1/32-⅛". Adjust by turning tie rods equally (check for equal lengths after adjustment).

STEERING GEAR

Steering Gear: Packard (Gemmer design Model 375) Worm-and-Roller type with push-pull adjustments and center steering. See Gemmer Model 375 article.
See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service—Bendix hydraulic, duo-servo, single anchor type with Vacuum Power operation. Hand lever applies rear service brakes.
See Brake Section for complete data.

Drum—Centrifuse. Diameter—14".

Lining—Primary (Raybestos No. 451). Secondary (U.S. Asbestos No. 589). Width 2¾". Thickness ¼". Length 15" per shoe.

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

Hand Brake:—See Service Brakes.

Vacuum Power Unit:—Bendix internal valve type.
See Brake Section for complete data.

CONTINUED FROM PRECEDING PAGE

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Front Turn Indic. & Fender	21-3	1158
Instr., Speed'mtr., Clock	1½	55
Front Reading, Radio, Trunk	1½	55
Glove Comp't., Rear Radio	1	51
Beam, Heater & Defrost Indic.	1	51
Dome and Rear Reading	6	81
Stop & Tail	21-3	1158
Rear License	3	63
Fog Light	32	1321
Spot Light	32	1323
Backing Light	15	87

MISC. ELECTRICAL

THERMOSTATIC RELAY:—Delco-Remy. On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70°F. Not adj.

FUSES:—Dome, Stop Light and Accessories—Two 20 ampere. Mounted on back of lighting switch.
Instrument and Tail Light—20 ampere. In connector in tail light lead near light switch.
Clock—2 ampere. In feed wire.
Radio—14 ampere. In feed wire.
Overdrive—30 ampere. In relay lead near starter.
Windshield Wiper—14 ampere. On dynamic breaker to right of wiper motor.

HORNS:—Sparton Model H-32. Vibrator type, Air tone, Twin horns operated by horn relay.
Air Gap—.032-.035" (low note—long horn), .026-.030" (high note—short air column).
Horn Current—22-25 amperes (total).
Horn Relay:—R-B-M Model 4760.
NOTE—Relay not adjustable (cover welded on).
Closing Voltage—3.5-4.5 volts.

ENGINE

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type.
Bore—3½". **Stroke**—4¼".
Displacement—245.3 cu. ins. **Rated HP**—29.4.
Developed Horsepower—100 HP (Std. 6.39-1 head), 103-105 HP (Optl. 6.71-1 head) at 3200 RPM.
Compression Ratio and Pressure:—As follows: 6.39-1 Std. cast-iron head—110 lbs. at 125 RPM. 6.71-1 Optl. HC cast-iron hd.—118 lbs. at 125 RPM.
Vacuum Reading—Steady 18-21" idling at 6 MPH.
See Packard Shop Notes for Cylinder Head data.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground type.
Weight—20¼ ozs. (stripped), 26½ (with rings & pin).
Length—3⅞".
Removal—Pistons and rods removed from above.
Clearance—.0005-.001". See Fitting Pistons.
Original Bore & Piston Sizes, Replacement Pistons:—*See Packard Shop Notes for complete data.*
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves.

PISTON RINGS:—2 coated compression (Perfect Circle #200, No. 1 upper inner edge beveled, #70 No. 2), 1 oil cont. (X90-85 expander type), all above pin.

Ring	Width	End Gap	Side Clearance
Comp. (#1)	.0930-.0935"	.007-.017"	.0025-.003"
Comp. (#2)	.1240-.1235"	.007-.017"	.0025-.003"
Oil Cont.	.1860-.1865"	.007-.015"	.0015-.002"

Replacement Rings:—Furnished standard size and .005", .010", .020", .030", .040" oversize.

PISTON PIN:—Diameter—⅞". **Length**—3 1/64".
Pin floats in piston and rod, held by locking rings. Pins furnished Std. and .003", .006" oversize.
Pin Fit in Piston—Finger push fit (piston at 160°).
Pin Fit in Rod Bushing—Finger push fit at 70° F.

CONNECTING ROD:—Length 7 11/16". **Weight** 31.60 ozs.
Upper Bearing (Piston Pin Bushing)—Split type.
See Packard Shop Notes for complete data.
Crankpin Journal Diameter—2.094".
Lower Bearing—Interchangeable steel-backed, babbitt-lined. Bearings furnished standard and .001", .002", .003", .015" undersize.
Clearance—.0005-.0015". **Endplay**—.004-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. *See Packard Shop Notes for 'Palnut' installation data.*
Installing Rods:—Oil squirt hole toward camshaft.

CRANKSHAFT:—4 bearings, 6 integral counterweights and rubber friction disc vibration damper.
Journal Diameters—2.7465".
Bearings—Interchangeable steel-backed, babbitt-lined. Furnished std., .001", .002" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings (upper half can be 'rotated' in or out).
End Thrust:—Taken by front (#1) bearing.
Endplay—.003-.008".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.002-.004".
Timing Chain:—Morse Type C-3682R (#1525) or Ramsey. Width 1¼". Pitch .375". Length 21¾" or 58 links. Same as 1939.
Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with a straightedge across the shaft centers. *See Packard Shop Notes for Radiator & Fender (unit) removal for work on front end of engine.*

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.34025"	5⅝"
Exhaust	1⅜"	.34025"	5⅝"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.318"	.001-.003"
Exhaust	45°	.3175"	.003-.005"

Valve Guides:—Pressed in block from above with upper end 31/32" below valve seat. Exhaust guides counter-bored on upper inner diameter.

Valve Springs:—Intake and exhaust springs interchangeable.

	Spring Pressure	Length
Valve Closed	47-52 lbs.	1⅝"
Valve Open	114-124 lbs.	1 5/16"

NOTE—Serrated washer installed on top of spring.

Valve Lifters:—New larger (diameter ⅝") mushroom type. Remove from below with camshaft out. Service by reaming (work through valve guide using ST-5144—23/32") and installing oversize lifters furnished .001", .002", .005" oversize.
Diameter—.6235-.6240". **Clearance**—.0003-.0012".
NOTE—1939 tool (ST-5101) cannot be used.

VALVE TIMING

Tappet Clearance:—.007" Int., .010" Exh. (hot & idling). NOTE—Self-locking tappet screw used. Remove right front fender plate for access to valves.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 1° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
To Check Timing—With .0125" tappet clearance #1 intake valve should open with #1 piston 1° or .0004" BTDC when 1° point on flywheel (½ graduation before '1 UP DC' mark) lines up with pointer in inspection hole in flywheel housing below starter (left side). Permissible variation plus or minus 2 graduations. Reset tappet cl. at .007" (hot & idling).

LUBRICATION

LUBRICATION:—Gear type pump on right of engine.
See Packard Shop Notes for Oil Pump installation.
Normal Oil Pressure:—45 lbs. at 45 MPH.
Oil Pressure Relief Valve:—Mounted on pump cover. Not adjustable. Spring pressure should be 14 lbs. plus or minus 2 ounces at 1⅞".
Crankcase Capacity:—5 quarts (refill).

COOLING

COOLING SYSTEM:—Capacity—17 quarts.
Water Pump:—Packless type with ball-bearing shaft.
See Water Pump Section for complete data.
Removal—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump.
Thermostat:—Harrison. In cylinder head outlet. Starts to open at 145° F.

CLUTCH

CLUTCH:—Long Model 9½ CF-CS. Semi-centrifugal, single plate, dry disc type.
NOTE—Borg & Beck Model 10A7 (marked #948) Single plate, dry disc type with 'Borglite' driven member used after Engine No. 17621 to No. 28824.
See Clutch Section for complete data.
Facings (Long)—Spiral or chevron wound woven, US Asbestos No. 1133G, 2 used. Inside Diam. 6". Outside Diam. 9½". Thickness .125".
Adjustment:—Adjust nut on pedal rod (at clutch fork) for 1½-2" pedal free movement.
See Packard Shop Notes for 1941 design clutch linkage which may be installed on these cars to correct wear.
Removal:—Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect and remove pedal rod, clutch throw-out bearing. Remove clutch cover screws and remove assembly from below.

TRANSMISSION

TRANSMISSION:—Own Make. Constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur gear for reverse). Synchro-mesh (second and high).
See Transmission Section for complete data.

Transmission Control:—Own Remote Control type.

See Transmission Section for complete data.

Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, overdrive cable and solenoid wires (if used), front universal (block drive shaft up against floor pan) and rubber bearing at rear of overdrive. Support rear of engine with jack and unbolt cross member (at frame ends and flywheel housing lower cover). Disconnect clutch retractor spring and fore and aft restraint rod. Take out transmission-to-flywheel housing mounting screws and remove assembly from car.

OVERDRIVE

Econo-Drive Transmission:—New Warner-Packard type (Warner model AS1-R9) overdrive unit with electrical control. Optional equipment on all cars.

See Transmission Section for complete data.

Overdrive Solenoid—Delco Remy Model 1118005.

Overdrive Indicator Light—In light switch knob. Lighted when overdrive is ready to engage (light goes out when accelerator pedal released so that overdrive can engage).

Throttle Switch—Cole-Hersee, Packard No. 347496. Adjust tappet screw on throttle lever to just contact switch plunger with carburetor throttle valve in wide open position.

Lock-out Switch—Ark-less or Soreng-Manegold, Packard No. 354820 or 347641.

Control Relay—Delco-Remy Model 1116801.

Governor Switch—Bendix, Packard No. 347478 Std.

See Warner (Packard) Overdrive Control article in Transmission Section for Optional Switches.

UNIVERSALS

UNIVERSAL JOINTS:—**Mechanics.** Model 2C (Std.), 3C (with Econo-Drive). Needle bearing type. 2 used.

See Universals Section for complete data.

CAUTION—Rear universal flange controls pinion bearing pre-load. See Packard Rear Axle article in Rear Axle Section for complete data.

REAR AXLE

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive. Cover welded.

NOTE—Axle bearings not interchangeable with 1700 cars.

See Rear Axle Section for complete data.

Ratio—4.36-1 Std., 4.55-1 with Econo-Drive trans'm.

Backlash—.003-.005". Screw adjustment.

Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.

Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims (endplay up to .050" can be adjusted at one wheel).

Endplay—.004-.007".

SHOCK ABSORBERS

SHOCK ABSORBERS:—	**Front**	**Rear**
Domestic	Delco 2206-A,B	Monroe 347416
Exp. & Spec.	Delco 2206-A,B	Delco 1130-W

Front shocks are parallel cylinder type. Rear shocks are direct acting (adjustable type Delco).

NOTE—No Fifth Shock Absorber used.

FRONT SUSPENSION

Front Suspension:—Independent 'Safe-T-fleX' type with coil springs.

See Front Suspension Section for complete data.

NOTE—Frame height must be set first before checking Caster and Camber.

Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 18⅝" (load car until figure correct).

Kingpin Inclination—1°54' crosswise.

Camber—Pos. ½° (plus ¾°, minus 0°). Adjustable.

Caster—Pos. 1½° ± ½°. Shim adjustment.

Toe In—0" (+1/16", —0") at hub height. Turn both tie rods equally (must be equal after adjusting).

Steering Geometry (Toe-out on Turns)—Inner wheel turned 23°. Outer wheel 20°.

STEERING GEAR

Steering Gear: Packard (Gemmer design Model 330) Worm-and-Roller type with center steering. Refer to Gemmer Model 330 article.

See Steering Gear Section for complete data.

BRAKES

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.

Drums—Centrifuse. Diameter—11".

Lining—Moulded. Width 1¾". Thickness 3/16". Length per shoe 10⅝" (primary), 12" (secondary).

Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.

Hand Brake:—See Service Brakes (above).

MISC. MECHANICAL

WINDSHIELD WIPER:—**Stewart-Warner Series 645.** Electric type. 14 ampere fuse mounted on dynamic breaker (behind instrument panel to right of wiper motor).

See Miscellaneous Section for complete data.

face of flywheel housing below starter). Loosen thumbnut, set Fuel Compensator pointer at '0' (center graduation on scale), tighten thumbnut. With #1 piston on compression, turn engine over until piston reaches firing position (see table above), stop when correct graduation on flywheel lines up with pointer. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt, see that rotor opposite #1 segment in distributor cap, check Fuel Compensator setting.

Timing (Neon Timing Light)—White mark provided on flywheel to indicate timing range (leading edge of mark 8° BTDC). Idle engine and adjust distributor as directed above.

Fuel Compensator Setting—Should be set for slight ping when accelerating with wide open throttle. To adjust, loosen thumbnut, rotate distributor counter-clockwise (if ping too severe), clockwise (if no ping noted), tighten thumbnut and recheck performance.

CARBURETOR

CARBURETION:—Carburetor—Stromberg EE-16, No. A-18341 (code marked 10-33A on upper main body flange or float bowl cover. 1" Duplex double 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 6 MPH idle speed. Adjust idle adjusting screw (one for each barrel) in succession until engine fires smoothly (2-2½ turns open for each screw—turn screws in for leaner mixture). Readjust idle speed.

Accelerating Pump—Not adjustable.

Float Level—Fuel level 15/32" below top edge of bowl.

Fast Idle:—Stromberg EE-16 carburetor type.

For complete data, refer to Carburetion Equip. Index.

Fast Idle Setting—Turn screw in to contact lowest step of fast idle cam, then back out ½ turn.

Automatic Choke:—Stromberg EE-16 carburetor type.

For complete data, refer to Carburetion Equip. Index.

Choke Setting—4 Notches Rich ('V' on scale centered on mark on housing). May be varied 2 notches.

Throttle Guard (Cars with Econo-Drive):—Vacuum operated throttle kicker to prevent engine stalling when operating below 20 MPH.

For complete data, refer to Carburetion Equip. Index.

CARB. EQUIPMENT

Air Cleaner:—AC # 1529339 oil-wetted type standard. Heavy duty oil-bath type optl. Crankcase filler tube cap equipped with copper mesh cleaner.

Fuel Pump:—AC Type AH #1537067 diaphragm type.

For complete data, refer to Carburetion Equip. Index.

Gasoline Gange:—Stewart (Stewart-Warner) Electric.

For complete data, refer to Carburetion Equip. Index.

BATTERY

Willard Type, Model SW-2-113. 6 volt, 17 plate, 113 ampere hour capacity (20 hour rate).

Starting Capacity—134 amperes for 20 minutes.

Zero Capacity—300 amperes for 4.2 minutes.

Grounded Terminal—Positive (+) grounded to the frame 'X' member. **Engine Ground**—Strap connector between transmission cover bolt and frame.

Dimensions—Length 10 5/16". Width 7 1/16". Height 8 13/16".

Location—Under left front seat.

STARTER

Auto-Lite Model MAW-4018. Armature MAW-2006.

Drive—Outboard Barrel Type Bendix No. A-1718.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—125 RPM, 175 amperes, 5.1 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
11.5 " "	Lock	3.0	505
18.0 " "	Lock	4.0	670

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws, lift out starter and switch assembly.

Starting Switch: Auto-Lite SS-4001 Magnetic type. Mounted on starter, controlled by switch on instrument panel. ***See article in Electrical Equipment Section.***

GENERATOR

Auto-Lite Model GEA-4801-A. Armature No. GDZ-2006F. Two brush with current-voltage control.

Charging Rate Adjustment—No adjustment at generator. Charging rate controlled by Voltage Regulator and maximum output by Current Regulator.

Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1570 RPM 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	Volts	R.P.M.	Hot 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	1560
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 pivot and clamp bolts.

Belt Adjustment:—Swing generator out until 25 lb. reading secured on scale hooked to clamp bolt lug parallel to clamp link or until belt deflection midway between generator and water pump pulley is ½" with thumb pressure.

REGULATOR

Auto-Lite Model VRB-4012B-1 (First Cars), VRP-4002A, VRP-4201A-1 (Later Cars). Current-voltage Type. Mounted in single case on engine side of 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—6.4-7.0 volts (VRB), 6.4-6.6 volts (VRP).

Cuts Out—.5-3.0 ampere discharge (VRB), 4.1-4.8 volts with approx. 4-6 ampere discharge (VRP-4002A), 4.8-5.6 volts with approx. 7-8 ampere disch. (VRP-4201A-1).

Contact Gap—.015" minimum.

Air Gap—.034-.038" (VRB & VRP-4201A-1), .031-.034" (VRP-4002A) with contacts open.

Voltage Regulator

Setting—7.3-7.6 volts (VRB), 7.2-7.5 volts (VRP), 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 within limits of 7.36-7.66 volts (VRB), 7.2-7.5 volts (VRP) 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—.010-.020" (VRB), .012" Min. (VRP) with armature against stop pin.

Air Gap—.0595-.0625" (VRB), .048-.052" (VRP) 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 operates. Charging current should not exceed 34-36 amperes. If more than slight excess noted, regulator is defective.

Adjustment & Contact Gap—Same as for Voltage Regulator (above).

Air Gap—.0595-.0625" (VRB), .034-.038" (VRP-4002A before No. 5U-000001 & All VRP-4201A-1), .048-.052" (VRP-4002A after above No.).

LIGHTING

LIGHTING:—Headlamps—Hall '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—Tell-tale light on speedometer face. Lighted whenever Country (upper) beam in use.

Switches

Lighting—Delco-Remy 1995011.

Beam Selector—R-B-M No. 1050D or Delco-Remy No. 1997001 (LHD), 1997002 (RHD).

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front universal (block drive shaft up against floor pan) and rubber bearing at rear of overdrive. Support rear of engine with jack and unbolt cross member (at frame ends and flywheel housing lower cover). Disconnect clutch retractor spring and fore and aft restraint rod. Take out transmission-to-flywheel housing screws, remove assembly.

OVERDRIVE

Econo-Drive Transmission:—New Warner-Packard type (Warner model AS1-R9) overdrive unit with electrical control. Optional equipment on all cars.
See Transmission Section for complete data.

Overdrive Solenoid—Delco Remy Model 1118005.

Overdrive Indicator Light—In light switch knob. Lighted when overdrive is ready to engage (light goes out when accelerator pedal released so that overdrive can engage).

Throttle Switch—Cole-Hersee, Packard No. 347496. Adjust tappet screw on throttle lever to just contact switch plunger with carburetor throttle valve in wide open position.

Lock-out Switch—Ark-less or Soreng-Manegold, Packard No. 354820 or 347641.

Control Relay—Delco-Remy Model 1116801.

Governor Switch—Bendix, Packard No. 355075 Std.

See Warner (Packard) Overdrive Control article in Transmission Section for Optional Switches.

UNIVERSALS

UNIVERSAL JOINTS:—Mechanics Model 3C. Needle bearing type.
See Universals Section for complete data.

CAUTION—Rear universal flange controls pinion bearing pre-load. See Packard Rear Axle article in Rear Axle Section for complete data.

REAR AXLE

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

Ratio—1801—4.09-1 Std., 4.36-1 with Econo-Drive transmission. 1801A Comm'l—4.7-1 Std.

Backlash—.003-.005". Screw adjustment.

Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.

Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims

Endplay—.004-.007".

SHOCK ABSORBERS

SHOCK ABSORBERS:—Delco

	Front	Rear
1801 Domestic	2206-A,B	1001-V
1801 Exp. & Spec.	2206-A,B	1130-W
1801A Comm'l	1966-C,D	1751-M,Z

Parallel cylinder type (2206-A,B), Direct Acting (1001-V). Direct Acting Adjustable (1130-W), Double Acting (1966-C,D & 1751-M,Z).

Fifth Shock Absorber (Stabilizer):—Houdaille Model NFT. Double acting, hydraulic, adjustable type.

FRONT SUSPENSION

Front Suspension:—Independent 'Safe-T-fleX' type with coil springs.
See Front Suspension Section for complete data.

NOTE—Frame height must be set first.

Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line should be 18¾" (1801), 19¼" (1801A). Load car until this figure correct.

Kingpin Inclination—1°54' crosswise.

Camber—Pos. ½° (plus ¾°, minus 0°). Adjustable.

Caster—Pos. 1½° ± ½°. Shim adjustment.

Toe In—0" (+1/16", —0") at hub height. Turn both tie rods equally (must be equal after adjusting).

Steering Geometry (Toe-out on Turns)—Inner wheel turned 22°50'. Outer wheel 20°.

STEERING GEAR

Steering Gear: Packard (Gemmer design Model 330) Worm-and-Roller type with center steering. Refer to Gemmer Model 330 article.
See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service. Bendix hydraulic, duo-servo, single anchor type (no eccentric adjustment on 1801). Hand lever applies rear wheel service brakes.

NOTE—Brakes on 1801A Heavy Duty Ambulance same as on Model 1803A (see next page).
See Brake Section for complete data.

Drums—Centrifuse. Diameter—12".

Lining—Moulded. Width 1¾" (1801), 2¼" (1801A). Thickness 3/16". Length per shoe—13" (except 1801 primary), 11½" (1801 primary).

Clearance—1801—.015" at both end of secondary shoe with primary shoe forced out against drum. **1801A**—.010" at heel and toe of each shoe.

Hand Brake:—See Service brakes (above).

MISC. MECHANICAL

WINDSHIELD WIPER:—Stewart-Warner Series 645. Electric type. 14 ampere fuse mounted on dynamic breaker (behind instrument panel to right of wiper motor).
See Miscellaneous Section for complete data.

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LIGHTING

LIGHTING:—Headlamps—Hall '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—Tell-tale light on speedometer face. Lighted whenever Country (upper) beam in use.

Switches

Lighting—Delco-Remy 1995011.
Beam Selector—Delco-Remy 1997001, 2 (RHD).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Front Turn Indic. & Fender	21-3	1158
Instr., Speed'mtr., Clock	1½	55
Front Reading, Radio, Trunk	1½	55
Glove Comp't., Rear Radio	1	51
Beam, Heater & Defrost Indic.	1	51
Dome and Rear Reading	6	81
Rear Quarter & Vanity Cabinet	3	63
Stop & Tail	21-3	1158
Rear License	3	63
Fog Light	32	1321
Spot Light	32	1323
Backing Light	15	87

MISC. ELECTRICAL

THERMOSTATIC RELAY:—Delco-Remy. On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70°F. Not adj.

FUSES:—Dome, Stop Light and Accessories—Two 20 ampere. Mounted on back of lighting switch.
Instrument and Tail Light—20 ampere. In connector in tail light lead near light switch.
Clock—2 ampere. In feed wire.
Radio—14 ampere. In feed wire.
Overdrive—30 ampere. In relay lead near starter.

HORNS:—Sparton Model H-32. Vibrator type, Air tone, Twin horns operated by horn relay.
Air Gap—.032-.035" (low note—long horn), .026-.030" (high note—short air column).
Horn Current—22-25 amperes (total).

Horn Relay:—R-B-M Model 4760.
NOTE—Relay not adjustable (cover welded on).
Closing Voltage—3.5-4.5 volts.

ENGINE

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type.
Bore—3½". Stroke—4⅝".
Displacement—356 cu. ins. Rated HP—39.2.
Developed Horsepower—160 at 3600 RPM (Std. hd.).
Compression Ratio—6.45-1 Std. 6.85-1 Optl. CI hds.
Compression Pressure—118 lbs. at cranking speed for standard head.
Vacuum Reading—18½" steady idling at 6 MPH.

PISTONS:—Nelson Bohnalite, aluminum alloy, autothermic, strut type, tin plated, cam ground.
Weight—20¼ ozs. (stripped), 26½ (with rings & pin).
Length—3⅞".
Removal—Pistons and rods removed from above.
Clearance—.0005-.001". See Fitting Pistons.
Original Bore & Piston Sizes, Replacement Pistons:— ***See Packard Shop Notes for complete data.***

Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves.

PISTON RINGS:—2 coated compression (Perfect Circle #200, No. 1 upper inner edge beveled, #70 No. 2), 1 oil cont. (X90-85 expander type), all above pin.

Ring	Width	End Gap	Side Clearance
Comp. (#1)	.0930-.0935"	.007-.017"	.0025-.003"
Comp. (#2)	.1240-.1235"	.007-.017"	.0025-.003"
Oil Cont.	.1860-.1865"	.007-.015"	.0015-.002"

Replacement Rings:—Furnished standard and .005", .010", .020", .030" and .040" oversize.

PISTON PIN:—Diameter—⅞. Length—3 1/64".
Pin floats in piston and rod, held by locking rings. Furnished standard and .003", .006" oversize.
Pin Fit in Piston—Finger push fit with piston heated to 160°F.
Pin Fit in Rod Bushing—Finger push fit at 70°F.

CONNECTING ROD:—Length—9¼". Weight—42.0 ozs.
Upper Bearing (Piston Pin Bushing)—Split type. ***See Packard Shop Notes for complete data.***
Crankpin Journal Diameter—2.250".
Lower Bearing—Interchangeable steel-backed, babbitt lined type. Bearings furnished std. and .001", .002", .003", .015" undersize.
Clearance—.0005-.0015". **Sideplay**—.004-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
Installing Rods:—Oil squirt hole to camshaft.

CRANKSHAFT:—9 bearing type with 8 bolted-on counter-weights. Vibration dampener on front end.
Journal Diameters—2.7465".
Bearings—Interchangeable steel-backed, babbitt-lined. Furnished std., .001", .002" undersize.
Clearance—.001-.003".
Bearing Adjustment:—None (no shims). Replace bearings (upper half can be 'rotated' in or out). Do not file caps.
End Thrust:—Taken by #5 bearing. Endplay .003-.008".

CAMSHAFT:—8 bearing. Non-adjustable chain drive.
Bearing Type—Steel-backed, babbitt-lined.
Clearance—.001-.003".
End Thrust:—Taken by thrust plate behind camshaft sprocket. **Endplay**—.002-.004".
Timing Chain:—Morse Type C-3682R (#765) or Ramsey. Width 1¼". Pitch ⅜". Length 62 links or 23¼".
Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with a straightedge across the shaft centers. ***See Packard Shop Notes for Radiator & Fender (unit) removal for work on front end of engine.***

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 43/64"	.34025"	6 3/16"
Exhaust	1 7/16"	.34025"	6 3/16"

	Seat Angle	Lift	Side Clearance
Intake	30°	.340"	.001-.003"
Exhaust	45°	.340"	.003-.005"

Valve Guides:—Straight reamed type pressed in block from above. Install with stepped end up (Intake), down (Exh) & top of guide 31/32" below valve seat.

Valve Springs:—Washer used on top of each spring.

	Spring Pressure	Length
Valve Open	147-157 lbs.	1 13/32"

Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters (mushroom type). Remove from below with camshaft out. Service by reaming (use tool ST-5101, work through valve guide hole) and installing lifters furnished .001", .002", .005" oversize. ***See Miscellaneous Section for complete data.***
Diameter .7177-.7182". **Clearance** .0002" selective. ***See Packard Shop Notes for Valve Lifter Clearance check when grinding valves.***

VALVE TIMING

Tappet Clearance:—None in service (hydraulic type lifter). ***See Valve Servicing in Packard Shop Notes.***
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 4° BTDC. Close 51° ALDC.
Exhaust Valves—Open 49° BLDC. Close 10° ATDC.
To Check Timing—#1 exhaust valve closes 10° or .0438" after top dead center with hydraulic lifter dry (oil drained) and built up with shim stock for zero tappet clearance.

LUBRICATION

LUBRICATION:—Pressure (pump on right of engine). ***See Packard Shop Notes for Oil Pump installation.***
Normal Oil Pressure:—50 lbs. at 45 MPH.
Oil Pressure Relief Valve:—Mounted on pump cover. Not adjustable. Spring pressure should be 17½-18½ lbs. at 1⅞".
Oil Pressure Gauge: Stewart-Warner electric type.
Crankcase Capacity: 7 quarts.

COOLING

COOLING SYSTEM:—Capacity—20 quarts.
Water Pump:—Packless type with ball-bearing shaft. ***See Water Pump Section for complete data.***
Removal—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump.
Thermostat:—Harrison. In radiator top tank. Operates radiator shutters. Starts to open 145° F.

CLUTCH

CLUTCH:—Long Model 11CFS-CI. Semi-centrifugal, single plate, dry disc type (riveted assembly).
NOTE—Borg & Beck Model 11A6 (marked #944) Single plate dry disc type with 'Borglite' driven member used after Engine No. 501609 to No. 503811. ***See Clutch Section for complete data.***
Facings (Long)—Ammco No. 8263M1, 2 used. Inside Diam. 6½". Outside Diam. 11". Thickness .125".
Adjustment:—Adjust nut on pedal rod (at clutch fork) for 1¾-2¼" pedal free movement.
Removal:—Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect and remove pedal rod, clutch throw-out bearing. Remove clutch cover screws and remove assembly from below.

TRANSMISSION

TRANSMISSION:—Own Make. Constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur gear reverse). Synchro-mesh (second & high). ***See Transmission Section for complete data.***
Transmission Control:—Own Remote Control type. ***See Transmission Section for complete data.***

Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, overdrive cable and solenoid wires (if used), front universal (block drive shaft up against floor pan) and rubber bearing at rear of overdrive. Support rear of engine with jack and unbolt cross member (at frame ends and flywheel housing lower cover). Disconnect clutch retractor spring and fore and aft restraint rod. Take out transmission-to-flywheel housing screws, remove assembly.

OVERDRIVE

Econo-Drive Transmission:—New Warner-Packard type (Warner Model AS1-R9A) overdrive unit with electrical control. Optional.

See Transmission Section for complete data.

Overdrive Solenoid—Delco Remy Model 1118005.

Overdrive Indicator Light—In light switch knob. Lighted when overdrive is ready to engage (light goes out when accelerator pedal released so that overdrive can engage).

Throttle Switch—Cole-Hersee, Packard No. 347496. Adjust tappet screw on throttle lever to just contact switch plunger with carburetor throttle valve in wide open position.

Lock-out Switch—Ark-less or Soreng-Manegold, Packard No. 354820 or 347641.

Control Relay—Delco-Remy Model 1116801.

Governor Switch—Bendix, Packard No. 355075 Std.

See Warner (Packard) Overdrive Control article in Transmission Section for Optional Switches.

UNIVERSALS

UNIVERSAL JOINTS:—Mechanics Model 3C. Needle bearing type. 2 used.

See Universals Section for complete data.

CAUTION—Rear universal flange controls pinion bearing pre-load. See Packard Rear Axle article in Rear Axle Section for complete data.

REAR AXLE

REAR AXLE:—Own Make. Semi-floating, hypoid gear type with Hotchkiss drive and special Ring Gear Support Roller. Cover is welded in place.

See Rear Axle Section for complete data.

Model	Ratios:— Std.	Econ-Dr.	Optl.
1803, 1806	3.92-1	4.36-1	4.09-1
1804, 1807	4.09-1	4.36-1	4.36-1
1805, 1808	4.36-1	4.54-1	4.54-1
1803A	4.54-1	4.7-1	4.7-1

Backlash—.003-.005". Screw adjustment.

Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.

Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims (endplay up to .050" can be adjusted at one wheel).

Endplay—.004-.007".

SHOCK ABSORBERS

SHOCK ABSORBERS:—	Front	Rear
1803,6	Delco 2206-A,B	Monroe 351194
" " Export	Delco 2206-A,B	Delco 1130-W
1804,5,7,8	Delco 1966-C,D	Delco 2007-G,H
1803A Comm'l	Delco 1966-C,D	Delco 1751-M,Z

Parallel cylinder type (2206-A,B). Double acting type (1966-C,D; 2007-G,H; 1751-M,Z). Direct acting type (Monroe 351194). Direct acting adjustable type (Delco 1130-W).

Fifth Shock Absorber (Stabilizer):—Houdaille Model NFT. Double acting, hydraulic, adjustable type.

FRONT SUSPENSION

Front Suspension:—Independent 'Safe-T-fleX' type with coil springs.

See Front Suspension Section for complete data.

NOTE—Frame height must be set first.

Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 19¼" (load car until figure correct).

Kingpin Inclination—1°54' crosswise.

Camber—Pos. ½° (plus ¾°, minus 0°). Adjustable.

Caster—Neg. 1° ± ½° (except 1803A). Pos. 2½° ± ½° (1803A Comm'l).

Toe In—0" (+1/16", —0") at hub height. Turn both tie rods equally (must be equal after adjusting). **Steering Geometry**—Inner wheel turned 22°50' 1803,6), 22°30' (1804,7), 22°20' (1805,8). Outer 20°.

STEERING GEAR

Steering Gear: Packard (Gemmer design Model 330) Worm-and-Roller type with center steering. Refer to Gemmer Model 330 article.

See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service. Bendix hydraulic, duo-servo, single anchor type with eccentric adjustment (except 1803,6). Hand lever applies rear service brakes.

See Brake Section for complete data.

Drums—Centrifuse. Diameter 12".

Lining—Moulded. Width 2" (1803,6), 2¼" (1804,5,7, 8), 2½" (1803A). Thickness 3/16". Length per shoe 13" (except 1803,6 primary shoe which is 11½").

Clearance—All except 1803,6—.010" at heel and toe of each shoe. 1803,6—.015" at both ends of secondary shoe with primary shoe forced out against drum

Hand Brake:—See Service brakes (above).

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Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—25 ozs. each.
Field Current—1.67-1.82 amperes at 6.0 volts.
Removal:—Generator pivot mounted at left front of engine. To remove, take out pivot and clamp bolts.
Belt Adjustment:—50 lbs. tension on spring scale hooked to generator frame, or ½" thumb-pressure deflection midway between gen. and pump pulleys.

GENERATOR

SPECIAL EQUIPMENT

Taxicab Generator: Auto-Lite GEB-4802C-2 with VRP-4002D Regulator. ***Refer to 1941-42 Packard '120' pages following for complete data on these units.***

REGULATOR

AUTO-LITE

Auto-Lite Model VRP-4002C. 3-unit Current-Voltage type. In case on left side of engine dash.
For complete data, refer to Electrical Equipment Index.
NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay—Auto-Lite

Cuts In—6.4-6.6 volts. 920 RPM (cold).
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—Auto-Lite

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—Auto-Lite

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.
Adjustment, Contact Gap, Air Gap—Same as given for Voltage Regulator (above).

REGULATOR

DELCO-REMY

Delco-Remy Model 1118202. Single Core Current Voltage Regulator. In case on dash.
For complete data, refer to Electrical Equipment Index.
CAUTION—Check generator for grounded field coils and leads before changing regulator settings to correct High Charging Rate or High Voltage.

Cutout Relay—Delco-Remy

Cuts In—6.3-6.7 volts hot, 900 RPM.
Cuts Out—0-4.0 ampere discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with contacts just closed).

Voltage Regulator—Delco-Remy

Setting—7.2-7.4 volts hot (operating temperature). Should be checked with cover in place and hot.
To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). With regulator hot (150°F.), decrease generator speed until cutout relay contacts open, then increase speed to 2800 RPM. and check hot voltage setting (above).
To Adjust—Change regulator armature spring tension slightly by bending hanger at lower end of one spring only. If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for other (2nd.) spring adjustment.
Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator—Delco-Remy

Setting—34-36 amperes hot (at operating temp.).
To Check—Remove regulator cover, connect short jumper between Voltage Regulator frame and upper contact support bracket (to short out Voltage Regulator), connect ammeter in charging line at regulater 'BAT' terminal, turn on car lights and accessories. Operate generator and increase speed until output remains constant. With regulator hot (150°F), current reading should agree with setting (above).
To Adjust—Same as for Voltage Regulator (above).
Air Gap—.080" (check same as Voltage Regulator).

LIGHTING

LIGHTING:—**Headlamps**—Hall 'Sealed Beam' type.
For complete data, refer to Electrical Equipment Index.
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center hght.).
Beam Indicator—Red light on left side of speedometer. Lighted when Upper Beams in use.

Switches

Lighting—Delco-Remy No. 1995011 (Std.), 1995019 (With Econo-drive—has dimmer switch for Econo-drive Indicator light controlled by switch knob).
Beam Selector—Delco-Remy No. 1997001 (LHD cars), 1997002 (RHD cars).

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Front Fender	21-3	1154
Instr., Speed'mtr., Clock	1½	55
Front Reading, Econo Dr. Ind.	1½	55
Glove Compt., Beam Indicator	1	51
Stop & Tail	21-3	1154
Rear License	3	63
Dome	6	81

MISC. ELECTRICAL

THERMOSTATIC RELAY:—**Delco-Remy.** On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70°F. Not adj.
FUSES:—**Stop Light, Cigar Lighter & Accessories**—Two 20 ampere. On back of lighting switch.
Instrument & Tail Light—20 ampere. In connector in lead near ammeter.
Clock—4 ampere. In lead near clock.
Econo-drive—30 ampere. In relay lead near starter.
Windshield Wiper—No fuse (circuit- breaker).
HORNS:—**Sparton.** Vibrator type, air tone, twin horns
Horn Current—22-25 amperes (total both horns).
Horn Relay:—R-B-M Model 6006.
Contacts Close—3-4 volts (with relay upright).

ENGINE

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type.
Bore—3½". **Stroke**—4¼".
Displacement—245 cu. ins. **Rated HP**—29.4.
Developed Horsepower—100 at 3600 RPM (Std. hd.).
Compression Ratio and Pressure—As follows:
6.39-1 Std. cast-iron head—110 lbs. at 125 RPM.
6.71-1 Optl. HC cast-iron hd.—118 lbs. at 125 RPM.
See Packard Shop Notes for Cylinder Head data.
Vacuum Reading—18-20" steady idling at 6 MPH.

PISTONS:—Aluminum alloy, autothermic, strut type, tin plated, cam ground type. **Length**—3⅞".
Weight—20¼ ozs. (stripped), 26¾ (with rings & pin).
Removal—Pistons and rods removed from above.
Clearance—.0005-.001". See Fitting New Pistons.
Original Bore & Piston Sizes, Replacement Pistons:—***See Packard Shop Notes for sizes and markings.***
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves.

PISTON RINGS:—2 Ferrox coated compression rings (Perfect Circle—#1 K-200 upper inner edge beveled, #2 K-70 lower outer edge grooved), 1 oil control (X-90 'C' wall) ring, all above pin. CAUTION—Use 'K' type rings only (have greater wall thickness than S.A.E. type). ***See Packard Shop Notes for Replacement (Triple Action) Piston Ring installation data.***

Ring	Width	End Gap	Side Clearance
Comp. (#1)	.0930-.0935"	.007-.017"	.0025-.003"
Comp. (#2)	.1240-.1235"	.007-.017"	.0025-.003"
Oil Control	.1865-.186"	.007-.015"	.0015-.002"

Replacement Rings:—.005", .010", .020", .030", .040" O.S. Triple Action (packaged sets) std. & .020" oversize.

PISTON PIN:—**Diameter**—.875". **Length**—3 1/64". Pin floats in piston and rod, held by locking rings.
Pin Fit in Piston—Finger push fit (piston at 160°).
Pin Fit in Rod Bushing—Finger push fit at 70° F.
Replacement Pins:—Std. and .003", .006" oversize.

CONNECTING ROD:—**Length** 7 11/16". **Weight** 31.6 ozs.
Upper Bearing (Piston Pin Bushing)—Split type.
See Packard Shop Notes for servicing data.
Crankpin Journal Diameter—2.094".
Lower Bearing—Shimless, precision, steel backed, babbitt lined type. Bearings furnished standard and .001", .002", .003", .015" undersize.
Clearance—.0005-.0015". **Endplay**—.004-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
See Packard Shop Notes for 'Palnut' installation data.
Installing Rods:—Oil squirt hole toward camshaft.

CRANKSHAFT:—4 bearings, 6 integral counterweights
Journal Diameters—2.7465".
Bearings—Interchangeable, shimless, precision, steel-backed, babbitt lined type. Furnished standard size and .001", .002" undersize.
Clearance—.0005-.0015".
Bearing Adjustment:—None (no shims). Replace bearings (upper halves can be 'rotated' in and out).
End Thrust:—Taken by front (#1) bearing.
Endplay—.003-.008".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
See Packard Shop Notes for Radiator & Fender assembly (unit) removal for work on front end of engine.

ENGINE

CONTINUED FROM PRECEDING PAGE

Bearings—Shimless, precision, steel backed, babbitt lined type. **Clearance**—.001-.003".

End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.0025-.006".

Timing Chain:—Morse Type C-3682R (No. 1525) or Ramsey. Width 1¼". Pitch .375". Length 21¾" or 58 links.

Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with straightedge across shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 19/32"	33975"	5.619"
Exhaust	1⅜"	33975"	5.619"

	Seat Angle	Lift	Stem Clearance
Intake	30°	318"	.002-.003"
Exhaust	45°	3175"	.004-.005"

Valve Guides:—Pressed in block from above with upper end 31/32" below valve seat. Exhaust guides counter-bored on upper inner diameter to ⅜" diameter and ⅜" deep.

Valve Springs:—Intake and exhaust springs interchangeable.

	Spring Pressure	Spring Length
Valve Closed	47-52 lbs.	1⅝"
Valve Open	114-124 lbs.	1 5/16"

NOTE—Serrated washer installed on top of springs.

Valve Lifters:—Mushroom type. Remove from below with camshaft out. Lifters furnished .001", .002", .005" oversize. Use Tool S.T. 5144 (piloted in valve guide) and ream for .005" oversize lifters. **Diameter**—.6235-.6240". **Clearance**—.0003-.0012".

VALVE TIMING

Tappet Clearance:—.007" Intake, .010" Exh. (warm & idling). NOTE—Self-locking tappet screw used. Remove right front fender plate for access to valves.

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 1° BTDC. Close 39° ALDC.

Exhaust Valves—Open 45° BLDC. Close 5° ATDC. With tappet clearance of .0125" Intake, .015" Exh.

Valve Timing Check—With .0125" tappet clearance #1 intake valve should open with #1 piston 1° or .0004" BTDC with 1st graduation before top dead center mark '#1 UP.DC' on vibration damper lined up with pointer (permissable variation 4° either way). Reset tappet clear. .007" (hot & idling).

LUBRICATION

LUBRICATION:—Pressure (pump on right of engine). *See Packard Shop Notes for Oil Pump installation.*

Normal Oil Pressure:—40 lbs. at 45 MPH.

Oil Pressure Relief Valve:—Mounted on pump cover. Not adjustable. Spring pressure 14 lbs. ± 2 oz. @ 1⅞".

Crankcase Capacity:—5 quarts.

COOLING

COOLING SYSTEM:—**Capacity**—15 quarts.

Pressure Valve—In filler cap. Opens at 4½ lbs. (Std.), 12 lbs. (with Air Conditioning equipment).

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

Removal—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump.

Thermostat:—Bishop & Babcock. In head outlet. **Setting**—Starts to open at 147½° F.

CLUTCH

CLUTCH:—Long Model 9½CF-CS, 11CFS-CI (Early Taxi), 11CF-CI (Late Taxi). Semi-centrifugal, single plate, dry disc types. NOTE—11CFS-CI (Early Taxi) is a riveted assembly. *See Clutch Section for complete data.*

Facings—Woven (U.S. Asbestos No. 1133-G), 2 used. I.D. 6", 6½" (Taxi). O.D. 9½", 11" (Taxi). Thick. ⅛".

Adjustment:—Adjust nut on pedal rod (at clutch fork) for 1½-1¾" free travel (2" when equipped with Electromatic Clutch).

Removal:—Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect and remove pedal rod, clutch throw-out bearing. Remove clutch cover screws (release tension evenly) and lower assembly out.

ELECTROMATIC CLUTCH

ELECTROMATIC CLUTCH: Vacuum type with electrical control. Optional on all models.
Control Solenoid—Auto-Lite SSD-4001.
Control Relay—Auto-Lite HRH-4001.
See Clutch Section for complete data.

TRANSMISSION

TRANSMISSION:—Own Make. Constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur reverse gear). Synchro-mesh (second & high). *See Transmission Section for complete data.*

Transmission Control:—Own Remote Control type. *See Transmission Section for complete data.*

Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, overdrive cable and solenoid wires (if used), front universal (block drive shaft up against floor pan) and rubber bearing at rear of overdrive. Support rear of engine with jack and unbolt cross member (at frame ends and flywheel housing lower cover). Disconnect clutch retractor spring and fore and aft restraint rod. Take out transmission-to-flywheel housing screws, remove assembly.

OVERDRIVE

OVERDRIVE: Warner Type R9 (Kick-down). Model AS2-R9 overdrive unit with electrical control. *See Transmission Section for complete data.*

Overdrive Solenoid—Delco-Remy Model 1118005.
Overdrive Indicator Light—Green light on right side of speedometer dial. Lighted whenever overdrive is ready to engage (light goes out when accelerator pedal is released so that overdrive can engage).
Throttle Switch—Cole-Hersee. Packard No. 347496. Adjust tappet screw on throttle lever to just contact switch plunger with throttle valve wide open.
Governor Switch—Bendix No. 364782.
Control Relay—Delco-Remy Model 1116801.

Removal: Procedure same as for regular transmission (see above) plus the following: Disconnect control cable, solenoid wires, and overdrive rear mounting.

UNIVERSALS

UNIVERSAL JOINTS:—Detroit-Universal Series 4251 (4200 front, 5150 rear). Front joint is ball & trunnion type with roller bearings (takes slip or end travel—no slip joint used). Rear joint is roller bearing type with cross. *See Universals Section for complete data.*

►*CAUTION*—Rear universal flange controls pinion bearing pre-load. *For complete data, refer to the Rear Axle Section for Packard Rear Axle article.*

REAR AXLE

REAR AXLE:—Own Make. Semi-floating, Hypoid gear type with Hotchkiss drive. Cover welded in place. *See Rear Axle Section for complete data.*
Ratio—4.3-1 Std. 4.55-1 with Overdrive.
Backlash—.003-.005". Screw adjustment.

Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.
Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims (endplay up to .050" can be adjusted to desired .006" at one wheel). **Endplay**—.004-.007".

SHOCK ABSORBERS

SHOCK ABSORBERS:—	Front	Rear
Domestic	Delco 1966-C,D	Monroe 364630
Export	Delco 1966-C,D	Delco 1130-W

Front shocks are double acting type. Rear shocks are direct acting (adjustable type Delco).

FRONT SUSPENSION

Front Suspension:—Independent 'Safe-T-fleX' type (parallelogram type—coil springs & torque arms). *See Front Suspension Section for complete data.*
NOTE—Frame height must be set first before checking Caster and Camber.
Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 17⅝" (load car until figure correct).
Kingpin Inclination—2½° crosswise.
Camber—Pos. ½° (plus ¾°, minus 0°). Adjustable.
Caster—Pos. ½° ± ½°. Shim adjustment.
Toe In—0" (+ 1/16", — 0") at hub height. Turn both tie rods equally (rod lengths equal within ½").
Steering Geometry—Inner wheel 23½°. Outer 20°.

STEERING GEAR

Steering Gear: Packard (Gemmer design Model 330) Worm-and-Roller type with center steering. Refer to Gemmer Model 330 article. *See Steering Gear Section for complete data.*

BRAKES

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.*
Drums—Centrifuse. Diameter 11".
Lining—Molded (Marshall 2201). Width 1¾". Thick. 3/16". Length 10⅝" (primary shoe), 12" (secondary).
Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.

Hand Brake:—See Service Brakes above.

MISC. MECHANICAL

WINDSHIELD WIPER:—Stewart-Warner Series 645-E. Electric type. NOTE—'Klixon' type circuit-breaker mounted on unit (no fuse used). *See Miscellaneous Section for complete data.*

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

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Maximum Charging Rate—32-34 amperes, 8.0 volts hot. Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data (Delco-Remy)

	Amperes	Volts	R.P.M.
Cold	30①	8.0	1750

①Not maximum output. See Current Regulator.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—25 ozs. each.

Field Current—1.67-1.82 amperes at 6.0 volts.

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

Belt Adjustment:—50 lbs. tension on spring scale hooked to generator frame, or ½" thumb-pressure deflection midway between gen. and pump pulleys.

REGULATOR

AUTO-LITE

Auto-Lite Model VRP-4002-C. Current—Voltage type. In case on left side of engine dash.

For complete data, refer to Electrical Equipment Index.

NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay

Cuts In—6.4-6.6 volts, 920 generator RPM (cold).

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.

REGULATOR

DELCO-REMY

Delco-Remy Model 1118202. "Single Core" Current Voltage Regulator. In case on dash.

For complete data, refer to Electrical Equipment Index.

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

Cutout Relay

Cuts In—6.2-6.7 volts at 800 RPM (cold).

Cuts Out—0-4.0 ampere discharge current.

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

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

Voltage Regulator

Setting—7.2-7.4 volts hot (operating temperature). Regulator over-compensated for temperature. Should be checked with cover in place and hot.

To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at 2800 RPM., adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). With regulator hot (150°F), decrease generator speed until cutout relay contacts open, then increase speed to 2800 RPM. and check hot voltage setting (above).

To Adjust—Change regulator armature spring tension slightly by bending hanger at lower end of one spring only. If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for other (2nd) spring adjustment.

Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator

Setting—34-36 amperes hot (at operating temp.).

To Check—Remove regulator cover, connect short jumper between Voltage Regulator frame and upper contact support bracket (to short out Voltage Regulator), connect ammeter in charging line at regulator 'BAT' terminal, turn on car lights and accessories. Operate generator and increase speed until output remains constant. With regulator hot (150°F), reading should agree with setting (above).

To Adjust—Same as for Voltage Regulator (above).

Air Gap—.080" (check same as Voltage Regulator).

LIGHTING

LIGHTING:—Headlamps—Hall 'Sealed Beam' type.

For complete data, refer to Electrical Equipment Index.

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

Beam Indicator—Red light on left side of speedometer. Lighted when Upper beams in use.

Direction Signal—***Refer to Electrical Equip. Index.***

Switches

Lighting—Delco-Remy No. 1995021 (Clipper), No. 1995011 (Conv. Coupe).

Beam Selector—Delco-Remy No. 1997002.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Front Dir. Sig. & Park	21-3	1154
Rear Dir. Signal	21	1129
Beam Indic., Glove Compt.	1	51
Instr., Speedometer Pointer	1½	55
Clock, Map Light	1½	55
Aero-Drive, Direct. Indic.	1½	55
Stop & Tail	21-3	1154
Rear License	3	63
Dome & Courtesy	6	82

MISC. ELECTRICAL

THERMOSTATIC RELAY:—Delco-Remy. On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. at 70° F. Not adj.

FUSES:—Stop Light, Cigar Lighter, Accessories—Two 20 ampere fuses on back of lighting switch.

Instrument & Tail Light—20 ampere. In socket in tail lamp lead near lighting switch.

Clock—3 ampere. In feed wire near clock.

Aero-Drive & Electro-Matic Clutch—Separate 30 ampere fuses. In feed wire from starter switch.

Direction Signal—9 ampere. In feed wire to flasher.

Windshield Wiper No fuse (Klixon circuit breaker).

HORNS:—Sparton. Vibrator type, air tone, twin horns

Horn Current—22-25 amperes (toal both horns).

Horn Relay:—R-B-M Model 6006.

Contacts Close—3-4 volts (with relay upright).

ENGINE

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type.

Bore—3½". Stroke—4¼".

Displacement—245 cubic inches. **Rated HP**—29.4.

Developed Horsepower—105 at 3600 RPM.

Compression Ratio—6.71-1 cast-iron head. No Optl.

Compression Pressure—118 lbs. at 125 RPM.

Vacuum Reading—18-20" steady idling at 6 MPH.

See Packard Shop Notes for Cylinder Head data.

PISTONS:—Aluminum alloy, autothermic, strut type, tin plated, cam ground type. **Length**—3⅞".

Weight—20¼ oz. (stripped), 26¾ (with rings & pin).

Removal—Pistons and rods removed from above.

Clearance—.0005-.001". See Fitting New Pistons.

Original Bore & Piston Sizes, Replacement Pistons:—***See Packard Shop Notes for sizes and markings.***

Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.

Installing Pistons:—Slot toward valves.

PISTON RINGS:—Three 'K' type rings, all above pin. #1 Comp. (K-200), #2 Comp. (K-70), #3 Oil Control (X-90 'B' wall). CAUTION—Use 'K' type rings only (have greater wall thickness than S.A.E. type rings). ***Refer to Packard Shop Notes for Replacement (Triple Action) Piston Ring installation data.***

Ring	Width	End Gap	Side Clearance
Comp. (#1)	.093-.0935"	.007-.017"	.0025-.003"
Comp. (#2)	.124-.1235"	.007-.017"	.0025-.003"
Oil Control	.1865-.186"	.007-.015"	.0015-.002"

Replacement Rings:—.005", .010", .020", .030", .040" O. S. Triple Action (packaged sets) std. & .020" oversize.

PISTON PIN:—Diameter—.875". **Length**—3 1/64". Pin floats in piston and rod, held by locking rings.

Pin Fit in Piston—Palm push fit (piston at 160°F.).

Pin Fit in Rod Bushing—Finger push fit at 70° F.

Replacement Pins:—Std. and .003", .006" oversize.

CONNECTING ROD:—Length 7 11/16". Weight 31.6ozs.

Upper Bearing (Piston Pin Bushing)—Split type.

See Packard Shop Notes for Piston Pin servicing data.

Crankpin Journal Diameter—2.094".

Lower Bearing—Shimless, precision, steel backed, babbitt lined type. Bearings furnished standard and .001", .002", .003", .015" undersize.

Clearance—.0005-.0025". **Endplay**—.004-.010".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.

See Packard Shop Notes for 'Palnut' installation data.

Installing Rods:—Oil squirt hole toward camshaft.

CRANKSHAFT:—4 bearings, 6 integral counterweights.

Journal Diameter—2.7465".

Bearings—Interchangeable, shimless, precision, steel-backed, babbitt lined type. Furnished stand-

ENGINE

CONTINUED FROM PRECEDING PAGE

ard size and .001", .002" undersize.
Clearance—.0005-.0025".

Bearing Adjustment:—None (no shims). Replace bearings (upper halves can be 'rotated' in and out).

End Thrust:—At front bearing. **Endplay** .003-.008".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Bearings—Shimless, precision, steel-backed, babbitt lined type. **Clearance**—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.0025-.006".

Timing Chain:—Morse C-3682R (No. 1525) or Ramsey. Width 1¼". Pitch .375". Length 21¾" or 58 links.

Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with straightedge across shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 19/32"	33975"	5.619"
Exhaust	1⅜"	33975"	5.619"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.318"	.002-.003"
Exhaust	45°	.3175"	.004-.005"

Valve Guides:—Pressed in block from above with upper end 31/32" below valve seat. Exhaust guides counter-bored on upper inner diameter to ⅜" diameter and ⅜" deep.

Valve Springs:—Intake and exhaust springs interchangeable. Anti-rotation washer installed on top of springs.

	Spring Pressure	Spring Length
Valve Closed	52-57 lbs.	1 5/8"
Valve Open	119-129 lbs.	1 5/16"

Valve Lifters:—Mushroom type. Remove from below with camshaft out. Lifters furnished .001", .002", .005" oversize. Use Tool S.T. 5144 (piloted in valve guide) and ream for .005" oversize lifters.
Diameter—.6235-.6240". **Clearance**—.0003-.0012".

VALVE TIMING

Tappet Clearance:—.007" Intake, .010" Exh. (warm & idling). NOTE—Self-locking tappet screws used. Remove right front fender plate for access to valves.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 1° BTDC. Close 39° ALDC.
Exhaust Valves—Open 45° BLDC. Close 5° ATDC.
With tappet clearance of .0125" Intake, .015" Exh.
Valve Timing Check—With .0125" tappet clearance #1 intake valve should open with #1 piston 1° or .0004" BTDC with 1st graduation before top dead center mark '#1 UP.DC' on vibration damper lined up with pointer (permissible variation 4° either way). Reset tappet clearance .007" (hot & idling).

LUBRICATION

LUBRICATION:—Pressure (pump on right of engine).
See Packard Shop Notes for Oil Pump Installation.
Normal Oil Pressure:—40 lbs. at 45 MPH.
Oil Pressure Relief Valve:—Mounted on pump cover. Not Adj. Spring pressure 14 lbs. ± 2 ozs. at 1⅞".
Oil Pressure Gauge:—Stewart-Warner electric type.
Crankcase Capacity:—5 quarts.

COOLING

COOLING SYSTEM:—**Cap.** 15 qts. (Clipper), 14 (Others).
See Packard Shop Notes for Radiator Core Removal.
Pressure Valve—In filler cap. Opens at 4½ lbs. (Std.), 12 lbs. (with Air Conditioning equipment).
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 147½°F.

CLUTCH

CLUTCH:—**Long Model 9½CF-CS (Std.), 10CF-CI (with Electromatic Clutch), 11CF-CI (Taxi).** Semi-centrifugal, dry disc types.
See Clutch Section for complete data.
Facings—Woven (U. S. Asbestos No. 1133-G), 2 used. Inside Diam. 6" (9½CF, 10CF), 6⅝ (11CF). Outside Diam. 9½" (9CF), 10" (10CF), 11" (11CF). Thick. ⅛".
Pedal Adjustment:—1½-1¾" (Std.), 2" (with Electromatic Clutch) free travel. Adjusting nut (with locknut) at clutch fork end of connector link.
Removal:—Remove transmission (see below). Disconnect pedal linkage, remove throw-out bearing. Remove cover mounting screws evenly, remove clutch.

ELECTROMATIC CLUTCH

ELECTROMATIC CLUTCH:—Vacuum type with electrical control. Optl. on all models.
See Clutch Section for complete data.
Control Solenoid—Auto-Lite SSD-4001.
Control Relay—Auto-Lite HRH-4001.
Control Governor ('42)—Auto-Lite TGC-4001.

TRANSMISSION

TRANSMISSION:—**Own Make.** Helical, constant-mesh (low speed gear), constant-mesh, synchro-mesh (second and high). Sliding spur (reverse gear).
See Transmission Section for complete data.
Transmission Control:—Steering column mech. shift.
See Transmission Section for complete data.
Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, and ground strap at transmission. Disconnect front universal, block drive shaft up for clearance. Support rear of engine with jack, unbolt frame cross-member carrying rear engine mountings, remove flywheel housing lower cover, disconnect stabilizer (transmission to X-member). Take out transmission to flywheel housing screws, withdraw transmission.

OVERDRIVE

Aero-Drive Transmission:—Warner-Packard type (Warner Model AS2-R9) overdrive unit with electrical control. Optional equipment on all cars.
See Transmission Section for complete data.
►**Overdrive Lock-up in Reverse Correction for Clipper:** Install 1948 Safety Switch (Kit No. 394484).
See 1948 Packard Car Pages for Overdrive Safety Switch description and Car Wiring Diagram showing Overdrive Circuit with Safety Switch installed.
Overdrive Solenoid—Delco-Remy Model 1118005.
Overdrive Indicator Light—Green light on right side of speedometer dial. Lighted whenever overdrive is ready to engage (light goes out when accelerator pedal is released so that overdrive can engage).
Throttle Switch—Cole-Hersee. Packard No. 347496. Adjust tappet screw on throttle lever to just contact switch plunger with throttle valve wide open.
Governor Switch—Packard No. 367335, or Packard No. 377787 (with Electromatic Clutch).
Control Relay—Delco-Remy Model 1116823.
Removal: Procedure same as for regular transmission (see above) plus the following: Disconnect control cable, solenoid wires, and overdrive rear mounting.

UNIVERSALS

UNIVERSAL JOINTS:—**Mechanics Type 3CR (Clipper), Detroit Universal Series 4251 (Others).**
See Universals Section for complete data.
►*CAUTION*—Rear universal flange nut controls pinion bearing pre-load (must be adjusted whenever nut is loosened). *Refer to Rear Axle Section for 'Packard Rear Axle' article for complete data.*

REAR AXLE

REAR AXLE:—**Own Make.** Semi-floating, hypoid gear type with Hotchkiss drive. Cover welded in place.
See Rear Axle Section for complete data.
Ratio—4.3-1 Std. 4.55-1 with Aero-Drive.
Backlash—.003-.005". Screw adjustment.
Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.
Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims (endplay up to .050" can be adjusted to desired .006" at one wheel). **Endplay**—.004-.007".

SHOCK ABSORBERS

SHOCK ABSORBERS:—	Front	Rear
Clipper	Delco 1946-J,K	Monroe 371195
Conv. Coupe	Delco 1966-C,D	Monroe 364630
Taxi	Delco 1966-C,D	Delco 1021-V

Fifth Shock Absorber (Stabilizer):—Monroe 956790. Direct acting type. Used on Clipper models only.

FRONT SUSPENSION

Front Suspension (Clipper):—New type Packard Safe-T-fleX (parallelogram type with upper & lower support arms & coil springs—no torque arms).
Other Models—Packard Safe-T-fleX type. Parallelogram type with coil springs and torque arms.
See Front Suspension Section for complete data.
Kingpin Inclination—5°35' (Clipper), 2½°(Others).
Caster—Neg. 1°±½° (Clipper), ¼°±½° (Others).
Camber—0° ± ½° (Clipper), 0° + ¾° — ¼° right wheel, Min. 0° +1° —0° left wheel (Others).
Toe In—0-1/16" measured 10" up from floor.
Steering Geometry Inner wheel 23°±½°. Outer 20°

STEERING GEAR

Steering Gear: Packard (Gemmer design Model 330). Worm-and-Roller type with idler arm on right frame rail (Clippers), center steering (Others). Refer to Gemmer Model 330 article.
See Steering Gear Section for complete data.

BRAKES

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.
Drums—Centrifuse. Diameter 12"(front), 11"(rear).
Lining—Moulded (Marshall 2201-H-8). Width 1¾". Thickness 3/16". Length: Primary shoe 11½" (front) 10⅝" (rear). Secondary 13" (front), 12" (rear).
Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.
Hand Brake:—See Service Brakes above.

MISC. MECHANICAL

WINDSHIELD WIPER:—**Stewart-Warner Series 645-H (Clipper), 645-E (Others).** Electric type. 'Klixon' circuit-breaker mounted near wiper motor.
See Miscellaneous Section for complete data.
Power Operated Convertible Top: Vacuum Power type.
See Miscellaneous Section for complete data.

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Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws, lift out starter and switch assembly.

Starting Switch: Auto-Lite SS-4017('41), SS-4025('42) Magnetic type. Mounted on starter and controlled by instrument pushbutton switch RBM 5350 (1941), by Carter Car Starter 192-11U('41 Clip'r, All 1942—accelerator pedal starting). *See Auto-Lite Magnetic Starter Control and Carter Car Starter articles in Electrical Equipment Section for data.*

GENERATOR

Auto-Lite GDZ-4801F ('41-42), GDZ-4801G ('41), Armature GDZ-2006F (Std.); GEB-4802C-2, Armature GEB-2006F (Taxicab & Police). Two brush (shunt) types with voltage and current regulation.
Charging Rate Adjustment—None. See Regulator.
Maximum Charging Rate—35 amperes, 8.0 volts hot. Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data—GDZ-4801F

Cold Amperes	Volts	R.P.M.	Hot 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

Performance Data—GEB-4802C-2

0	6.4	560	0	6.4	620
5	6.6	640	5	6.6	700
10	6.8	720	10	6.8	800
15	7.1	800	15	7.1	910
20	7.3	880	20	7.3	1040
25	7.5	980	25	7.5	1170
30	7.8	1080	30	7.8	1340
*35	8.0	1200	35	8.0	1520

*—Current Regulator setting.

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (GDZ Gen.), 64-68 ozs. (GEB Generator) with new brushes.
Field Current—1.60-1.78 amperes at 6.0 volts (all).
Motoring Current—4.16-4.60 amperes (GDZ Gen.), 4.0-4.5 amperes (GEB Generator) at 6.0 volts.

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

Belt Adjustment:—50 lbs. tension on spring scale hooked to generator frame, or ½" thumb-pressure deflection between generator and pump pulleys.

REGULATOR

Auto-Lite Model VRP-4002C (GDZ Gen.), VRP-4002D (GEB Gen.). Current-Voltage type on dash. *For complete data, refer to Electrical Equipment Index.* NOTE—Regulator cover sealed. Warranty void if seals broken.

Cutout Relay

Cuts In—6.4-6.6 volts, 920 generator RPM (cold).
Cuts Out—4.1-4.8 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" Min. **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 seals) & Adjustment—*See Electrical Equipment Section for complete data.*
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 seals) & Adjustment—*See Electrical Equipment Section for complete data.*
Contact & Air Gap—Same as for Voltage Regulator.

LIGHTING

LIGHTING:—**Headlamps**—Hall 'Sealed Beam' type. *For complete data, refer to Electrical Equipment Index.*
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Red light on left side of speedometer. Lighted when Country (Upper) beams in use.
Direction Signal ('42)—*See Electrical Equip. Section.*

Switches

Lighting—Delco-Remy 1995021 (Clipper), 1995011 (Others), 1995019 (Others—with Overdrive, equipped with Overdrive Indic. Light dimmer rheostat which is controlled by light switch knob).
Beam Selector—Delco-Remy 1997001 or 1997002.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Front Dir. Sig. & Park	21-3	1154
Rear Dir. Signal	21	1129
Beam Indic., Glove Compt.	1	51
Instr., Speedometer Pointer	1½	55
Clock, Map Light	1½	55
Direction & Ovd. Ind.	1½	55
Stop & Tail	21-3	1154
Rear License	3	63
Dome & Courtesy	6	.81 ('41), 82 ('42)

MISC. ELECTRICAL

THERMOSTATIC RELAY:—**Delco-Remy.** On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70° F. Not adj.

FUSES:—**Stop Light, Cigar Lighter and Accessories**—Two 20 ampere. On back of lighting switch.
Instrument & Tail Light—20 ampere. In connector near ammeter, or on Clipper instrum't light switch.
Overdrive & Electro-matic Clutch—Separate 30 ampere fuses. In feed wire from starter switch.
Clock—3 amp. ('41), 4 amp. ('42). In feed wire.
Direction Signal—9 ampere. In feed wire to flasher.
Windshield Wiper—No fuse (circuit-breaker).

HORNS:—**Sparton**—Vibrator type, air tone, twin horns operated by relay.
Horn Current—22-25 amperes (total both horns).
Horn Relay:—R-B-M Model 6006.
Contacts Close—3-4 volts (with relay upright).

ENGINE

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type.
Bore—3¼". **Stroke**—4¼".
Displacement—282 cu. ins. **Rated HP**—33.8.
Developed Horsepower—120 HP (for 1941 engines) 125 HP ('41 Clipper, All '42) at 3600 RPM.
Compression Ratio and Pressure—As follows:
6.41-1 (Std. '41) .....110 lbs. at 125 RPM
6.85-1 ('41 Clpr., '42, Optl. '41).....118 lbs. at 125 RPM
See Packard Shop Notes for Cylinder Head data.
Vacuum Reading—18-20" steady idling at 6 MPH.

PISTONS ('41-42 ALUMINUM): Aluminum alloy, autothermic strut, cam ground, tin plated. **Length** 3⅞". **Weight**—17¼ oz. (stripped), 23⅛ (with rings & pin).
Removal—Pistons and rods removed from above.
Clearance—.0005-.001". See Fitting New Pistons.
Original Bore & Piston Sizes, Replacement Pistons:—*See Packard Shop Notes for sizes and markings.*
Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
Installing Pistons:—Slot toward valves.

PISTONS ('42 CAST IRON): Cast iron, cam ground pistons used on later cars. NOTE—Engines with cast-iron pistons carry suffix 'C' after Engine No.
Length—3 11/16".
Weight—22¾ oz. (stripped). 28⅝ (with rings & pin).
Removal—Pistons and rods removed from above.
Clearance—.0013-.0035" for Skirt.
Original Bore & Piston Sizes, Replacement Pistons:—*See Packard Shop Notes for sizes and markings.*

PISTON RINGS:—2 Ferrox coated compression rings (Perfect Circle—#1 K-200 upper inner edge beveled, #2 K-70 lower outer edge grooved), 1 oil control (X-90, 'C' wall '41, 'B' wall '42). CAUTION—Use 'K' type rings only (have greater wall thickness than S.A.E. type). *See Packard Shop Notes for Replacement (Triple Action) Piston Ring installation data.*

Ring	Width	End Gap	Side Clearance
Comp. (#1)	.0925-.0935"	.007-.017"	.0025-.003"
Comp. (#2)	.1240-.1235"	.007-.017"	.0025-.003"
Oil Control	.1865-.186"	.007-.015"	.0015-.002"

Replacement Rings:—.005", .010", .020", .030", .040" O.S. Triple Action (packaged sets) std. & .020" oversize.

PISTON PIN:—**Diameter**—.875". **Length**—2 51/64". Pin floats in piston and rod, held by locking rings.
Pin Fit in Piston—Palm push fit with piston heated to 160°F. (Al. Pistons), palm push fit in piston at 100° or press fit of 80-130 lbs. per sq. in (C. I. Pistons).
Pin Fit in Rod Bushing—Finger push fit at 70° F.
Replacement Pins:—Std. and .003", .006" oversize.

CONNECTING ROD:—**Length** 7 11/16". **Weight** 31.6 ozs.
Upper Bearing (Piston Pin Bushing)—Split type. *See Packard Shop Notes for servicing data.*
Crankpin Journal Diameter—2.094".
Lower Bearing—Shimless, precision, steel backed, babbitt lined type. Bearings furnished standard and .001", .002", .003", .015" undersize.
Clearance—.0005-.0025". **Endplay**—.004-.010".
Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps. *See Packard Shop Notes for 'Palnut' installation data.*
Installing Rods:—Oil squirt hole toward camshaft.

CRANKSHAFT:—5 bearings, 8 integral counterweights
Journal Diameter—2.7465".
Bearings—Interchangeable, shimless, precision, steel-backed, babbitt lined type. Furnished standard size and .001", .002" undersize.
Clearance—.0005-.0025".
Bearing Adjustment:—None (no shims). Replace bearings (upper halves can be 'rotated' in and out).
End Thrust:—By #3 bearing. **Endplay**—.003-.008".

CAMSHAFT:—5 bearing. Non-adjustable chain drive. *See Packard Shop Notes for Radiator & Fender assembly (unit) removal for work on front end of engine.*
Bearings—Shimless, precision, steel backed, babbitt lined type. **Clearance**—.001-.003".
End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.0025-.006".
Timing Chain: Morse Type C-3682R or Ramsey. **Width** 1¼". **Pitch** .375". **Length** 21¾" or 58 links.

ENGINE

CONTINUED FROM PRECEDING PAGE

Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with straightedge across shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 31/64"	.33975"	5.619"
Exhaust	1⅜"	.33975"	5.619"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.318"	.002-.003"
Exhaust	45°	.3175"	.004-.005"

Valve Guides:—Pressed in block from above with upper end 31/32" below valve seat. Exhaust guides counter-bored on upper inner diameter to ⅜" diameter and ⅜" deep.

Valve Springs: Intake & Exhaust interchangeable.

Pressure—	1941	1942	Length
Closed	47-52 lbs.	52-57 lbs.	1 5/8"
Open	114-124 lbs.	119-129 lbs.	1 5/16"

NOTE—Serrated washer installed on top of springs.

Valve Lifters:—Mushroom type. Remove from below with camshaft out. Lifters furnished .001", .002", .005" oversize. Use Tool S.T. 5144 (piloted in valve guide) and ream for .005" oversize lifters. **Diameter—.6235-.6240". Clearance—.0003-.0012".**

VALVE TIMING

Tappet Clearance:—.007" Intake, .010" Exh. (warm & idling). NOTE—Self-locking tappet screw used. Remove right front fender plate for access to valves.

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 1° BTDC. Close 39° ALDC.

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

For .0125" Intake, .015" Exhaust tappet clearance.

Valve Timing Check—With .0125" tappet clearance #1 intake valve should open with #1 piston 1° or .0004" BTDC with 1st graduation before top dead center mark '#1 UP.DC' on vibration damper lined up with pointer (permissable variation 4° either way). Reset tappet clear. .007" (hot & idling).

LUBRICATION

LUBRICATION:—Pressure (pump on right of engine). *See Packard Shop Notes for Oil Pump installation.*

Normal Oil Pressure:—40 lbs. at 45 MPH.

Oil Pressure Relief Valve:—Mounted on pump cover. Not adjustable. Spring pressure 14 lbs. ± 2 oz. @ 1⅞".

Oil Pressure Gauge ('42): Stewart-Warner Electric.

Crankcase Capacity: 6 qts. ('41), 5½ qts. ('42).

COOLING

COOLING SYSTEM:—**Capacity**—17 quarts.

Pressure Valve—In filler cap. Opens at 4½ lbs. (Std.), 12 lbs. (with Air Conditioning equipment).

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

Removal—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump.

Thermostat:—Harrison. In cylinder head outlet.

Setting—Starts to open 147½° (135° for radiator shutter thermostat used on 1901A).

CLUTCH

CLUTCH:—**Long Model 10CF-CI.** Semi-centrifugal, single plate, dry disc type. *See Clutch Section for data.*

Facings—Woven (Pass.—US Asbestos 1133 G, Com'l. —Hycoe DV3112A), 2 required. Inside Diameter 6". Outside Diameter 10". Thickness .125".

Adjustment:—Adjust nut on pedal rod (at clutch fork) 1½-1¾" free travel (2" Electromatic Clutch).

Removal:—Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect and remove pedal rod, clutch throw-out bearing. Remove clutch cover screws (release tension evenly) and lower assembly out.

ELECTROMATIC CLUTCH

ELECTROMATIC CLUTCH: Vacuum electric type Optl. *See Clutch Section for complete data.*

TRANSMISSION

TRANSMISSION:—Own Make. Constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur reverse gear). Synchro-mesh (second & high). *See Transmission Section for complete data.*

Transmission Control:—Own Remote Control type. *See Transmission Section for complete data.*

Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, overdrive cable and solenoid wires (if used), front universal (block drive shaft up against floor pan) and rubber bearing at rear of overdrive. Support rear of engine with jack and unbolt cross member. Disconnect clutch retractor spring & fore and aft restraint rod. Take out transmission-to-flywheel housing screws, remove assembly.

OVERDRIVE

OVERDRIVE: Warner Type R9 (Kick-down). Model AS2-R9 overdrive unit with electrical control. *See Transmission Section for complete data.*

►**Overdrive Lock-up in Reverse Correction for Clipper:** Install 1948 Safety Switch (Kit No. 394484). *See 1948 Packard Car Pages for Overdrive Safety Switch description and Car Wiring Diagram showing Overdrive Circuit with Safety Switch installed.*

Overdrive Solenoid—Delco-Remy Model 1118005.

Overdrive Indicator Light—Green light on right side of speedometer dial. Lighted whenever overdrive is ready to engage (light goes out when engaged).

Throttle Switch—Cole-Hersee. Packard No. 347946. Adjust tappet screw on throttle lever to just contact switch plunger with throttle valve wide open.

Governor Switch—Bendix No. 364782 (1941), Packard #367335 '42, 377787 '42 Electromatic Clutch.

Control Relay Delco-Remy 1116801 '41, 1116823 '42.

Removal: Procedure same as for regular transmission (see above) plus the following: Disconnect control cable, solenoid wires, and overdrive rear mounting.

UNIVERSALS

UNIVERSAL JOINTS: Mechanics 3CR. Needle bearings. *See Universals Section for complete data.*

►*CAUTION*—Rear universal flange controls pinion bearing pre-load. *For complete data, refer to the Rear Axle Section for Packard Rear Axle article.*

REAR AXLE

REAR AXLE:—**Own Make.** Semi-floating, Hypoid gear type with Hotchkiss drive. Cover welded in place. *See Rear Axle Section for complete data.*

Ratios—	Std.	Overdrive	Optional
'41 Clpr., Others	4.09-1	4.36-1	
'42 Clipper	4.1-1	4.3-1	
Long WB	4.7-1	4.9-1	5.22-1

Backlash—.003-.005". Screw adjustment.

Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.

Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims (endplay up to .050" can be adjusted to desired .006" at one wheel). **Endplay—.004-.007".**

SHOCK ABSORBERS

SHOCK ABSORBERS:	Front	Rear
'41 Clipper	Delco 1946-J, K	Monroe 371196
'42 Clipper	Delco 1946-J, K	Delco 1020-V
'42 Clipper	Delco 1946-J, K	Monroe 379465
Others	Delco 1966-C, D	Delco 1021-V
Long WB Exp.	Delco 1966-C, D	Delco 1130-W

Double acting (Front), Direct acting (Rear).

Fifth Shock Absorber (Stabilizer): Clipper: Monroe 373935 '41, 956790 '42. Others: Houde NFT.

FRONT SUSPENSION

Front Suspension:—Independent 'Safe-T-fleX' type (parallelogram type—coil springs & torque arms). **NOTE—No torque arms used on Clipper Suspension.** *See Front Suspension Section for complete data.*

NOTE—Frame height must be set first before checking Caster and Camber.

Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 18⅛" (1901), 18¾" (1901A), equal on both sides within 1/16-5/16" (1942 except Clipper) with car loaded.

	Kingpin Incl.	Caster	Camber
1941	2½°	½° ± ½°	½° (½-1¼°)
1942	2½°	¼°	0° (—¼° + ¾°)
Clipper	5°35'	Neg 1° ± ½°	0° ± ½°

Toe In—0-1/16" measured 10" up from floor.

Steering Geometry—With the outer wheel turned 20°, inner wheel 23½° (1941-42), 23° ± ½° (Clipper).

STEERING GEAR

Steering Gear: Packard (Gemmer design Model 330). Worm-and-Roller type with idler arm on right frame rail (Clippers), center steering (Others). Refer to Gemmer Model 330 article. *See Steering Gear Section for complete data.*

BRAKES

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.*

►**Model 1901A Note**—*Refer to 1941-42 Super Eight pages following for all brake data on these models.*

Drums—Centrifuse. Diameter 12".

Lining—Molded (Marshall 2201). Width 1¾". Thick. 3/16". Length 11½" (primary shoe), 13" (secondary).

Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.

Hand Brake:—See Service Brake (above).

MISC. MECHANICAL

WINDSHIELD WIPER: Stewart-Warner No. 645-H (Clipper), 645-E (Others). Electric type. 'Klixon' circuit breaker mounted on or near wiper motor. *See Miscellaneous Section for complete data.*

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

Power Window Regulators: Hydro-Electric type. *See Miscellaneous Section for complete data.*

Window Lift Relay—Auto-Lite No. HRD-4001.

CONTINUED FROM PRECEDING PAGE

Performance Data

Torque	**R.P.M.	Volts	Amperes
0 ft. lbs.	2695	5.5	77
33.5 "	Lock	3.0	652
45.9 "	Lock	4.0	906

**—Pinion shaft R.P.M.

Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws, lift out starter and switch assembly.

Starting Switch: Auto-Lite SS-4205 Solenoid type. Mounted on starter and controlled through relay by pushbutton switch RBM 5380 (1941), by Carter Car Starter No. 192-11U (1942—accelerator pedal starting). *See Auto-Lite Solenoid Starter Control and Carter Car Starter in Electrical Equip. Section.*

GENERATOR

Auto-Lite Mod. GEA-4802A-1. Armature GDZ-2006F. Two-brush type with Current-Voltage control.

Charging Rate Adjustment—None. See Regulator.

Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1570 RPM and above with load or discharged battery (Current Regulator setting).

Performance Data Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	850	0	6.4	865
4	6.6	950	4	6.6	975
8	6.75	1050	8	6.75	1075
12	6.95	1150	12	6.95	1180
16	7.1	1250	16	7.1	1300
20	7.3	1345	20	7.3	1425
24	7.5	1440	24	7.5	1560
28	7.7	1540	28	7.7	1695
32	7.85	1635	32	7.85	1850
35	8.0	1700	35	8.0	1970

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 pivot and clamp bolts.

Belt Adjustment:—Swing generator out until 50 lb. reading secured on scale hooked to clamp bolt lug parallel to clamp link or until belt deflection midway between generator and pump pulleys is ½".

REGULATOR

Auto-Lite Model VRP-4002-C. Current-Voltage Type. Mounted in single case on engine side of dash. *For complete data, refer to Electrical Equipment Index.* NOTE—Regulator cover sealed. Warranty void if seals broken.

Cutout Relay

Cuts In—6.4-6.6 volts, 780 generator RPM (cold).

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.

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 steady. Voltage should agree with setting.

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.

Adjustment, Contact Gap, Air Gap—Same as for Voltage Regulator (above).

LIGHTING

LIGHTING:—Headlamps—Hall 'Sealed Beam' type. *For complete data, refer to Electrical Equipment Index.*

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

Beam Indicator—Red light on left side of speedometer. Lighted when Country (upper) beam in use.

Direction Signal ('42)—*See Electrical Equip. Section.*

Switches

Lighting—Delco-Remy 1995021 (Clipper), 1995011 (Others), 1995019 (Others—with Overdrive, equipped with Overdrive Indic. Light dimmer rheostat which is controlled by light switch knob).

Beam Selector—Delco-Remy 1997001 or 1997002.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps		Sealed Beam
Front Dir. Sig. & Park	21-3	1154
Rear Dir. Signal	21	1129
Beam Indic., Glove Compt.	1	51
All Other Instrument Lights	1½	55
Stop & Tail	21-3	1154
Rear License	3	63
Dome & Courtesy	6	81 ('41), 82 ('42)

MISC. ELECTRICAL

THERMOSTATIC RELAY:—Delco-Remy. On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. @ 70° F. Not adj.

FUSES:—Stop Light, Cigar Lighter and Accessories—Two 20 ampere. On back of lighting switch.

Instrument & Tail Light—20 ampere. In connector near ammeter, or on Clipper instrum't light switch.

Overdrive & Electro-matic Clutch—Separate 30 ampere fuses. In feed wire from starter switch.

Clock—3 amp. ('41), 4 amp. ('42). In feed wire.

Direction Signal—9 ampere. In feed wire to flasher.

HORNS:—Sparton—Vibrator type, air tone, twin horns operated by relay.

Horn Current—33-36 amperes (total both horns).

Horn Relay:—R-B-M Model 6006.

Contacts Close—3-4 volts (with relay upright).

ENGINE

ENGINE SPECIFICATIONS:—8 cylinder, 'L' head type.

Bore—3½". **Stroke**—4⅜".

Displacement—356 cu. ins. **Rated HP**—39.2.

Developed Horsepower 160 '41, 165 '42 at 3600 RPM.

Compression Ratio and Pressure—As follows:

6.45-1 iron (Std. '41) ..... 110 at 125 RPM

6.85-1 iron (Std. '42, Optl. '41) ..... 133 at 300 RPM

See Packard Shop Notes for Cylinder Head data.

Vacuum Reading—18½" steady idling at 6 MPH.

PISTONS:—Aluminum alloy, autothermic, strut type, tin plated, cam ground type. **Length**—3⅞".

Weight—20¼ ozs. (stripped), 26¾" (with rings&pin).

Removal—Pistons and rods removed from above.

Clearance—.0005-.001". See Fitting New Pistons.

Original Bore & Piston Sizes, Replacement Pistons:—*See Packard Shop Notes for sizes and markings.*

Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.

Installing Pistons:—Slot toward valves.

PISTON RINGS:—2 Ferrox coated compression rings (Perfect Circle—#1 K-200 upper inner edge grooved, #2 K-70 lower outer edge grooved), 1 oil control (X-90 'C' wall) ring, all above pin. CAUTION—Use 'K' type rings only (have greater wall thickness than S.A.E. type). *See Packard Shop Notes for Replacement (Triple Action) Piston Ring installation data.*

Ring	Width	End Gap	Side Clearance
Comp. (#1)	.0930-.0935"	.007-.017"	.0025-.003"
Comp. (#2)	.1240-.1235"	.007-.017"	.0025-.003"
Oil Control	.1865-.186"	.007-.015"	.0015-.002"

Replacement Rings:—.005", .010", .020", .030", .040" O.S. Triple Action (packaged sets) std. & .020" oversize.

PISTON PIN:—Diameter—.875". **Length**—3 1/64". Pin floats in piston and rod, held by locking rings.

Pin Fit in Piston—Palm push fit (piston at 160°F.).

Pin Fit in Rod Bushing—Finger push fit at 70° F.

Replacement Pins:—Std. and .003", .006" oversize.

CONNECTING ROD: Length 9¼". **Weight** 39 ozs.

Upper Bearing (Piston Pin Bushing)—Split type. *See Packard Shop Notes for servicing data.*

Crankpin Journal Diameter—2.250".

Lower Bearing—Shimless, precision, steel backed, babbitt lined. Furn. Std., .001", .002", .003", .015" US. **Clearance**—.0005-.0025". **Endplay**—.004-.010".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.

Installing Rods:—Oil squirt hole toward camshaft.

CRANKSHAFT:—9 bearings, 8 bolted counterweights

Journal Diameter—2.7465".

Bearings—Interchangeable, shimless, precision, steel-backed, babbitt lined type. Furnished standard, .001", .002" undersize. **Clearance**—.0005-.0025".

Bearing Adjustment:—None (no shims). Replace bearings (upper halves can be 'rotated' in and out).

End Thrust:—By #5 bearing. **Endplay**—.003-.008".

CAMSHAFT:—8 bearing. Non-adjustable chain drive. *See Packard Shop Notes for Radiator & Fender Assembly (unit) removal for work on front end of engine.*

Bearings—Shimless, precision, steel-backed, babbitt lined type. **Clearance**—.001-.003".

End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.0025-.006".

Timing Chain:—Morse Type C-3682R (No. 765). Width 1¼". Pitch .375". Length 62 links or 23¼".

Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with a straightedge across the shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1.670"	.33975"①	6.212"②
Exhaust	1 7/16"	.33975"①	6.212"②

	Seat Angle	Lift	Stem Clearance
Intake	30°	.340"	.001-.003"
Exhaust	45°	.340"	.003-.005"

①—For '42: .34025". ②—For '42: 6.224".

Valve Guides:—Pressed in block from above with upper end 31/32" below valve seat. Exhaust guides upper end counterbored to ⅜" diameter, ⅜" deep.

Valve Springs:—Washer used on top of each spring.

Pressure	1941	1942	Length
Closed	55-61 lbs.	60-66 lbs.	1 3/4"
Open	130-140 lbs.	135-145 lbs.	1 13/32"

Valve Lifters:—Wilcox-Rich 'Zero-lash' type hydraulic lifters (mushroom type). Remove from below with camshaft out. Lifters furnished .001", .002", .005" oversize. Use Tool S.T. 5101 (piloted in valve guide) and ream for .005" oversize lifters.

ENGINE

CONTINUED FROM PRECEDING PAGE

See Packard Shop Notes for Valve Lifter Clearance check when grinding valves.

Diameter .7177-.7182". **Clearance** .0002" selective.
See Miscellaneous Section for complete data.

VALVE TIMING

Tappet Clearance:—None in service (hydraulic type lifter). *See Valve Servicing in Packard Shop Notes.*

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 4° BTDC. Close 51° ALDC.

Exhaust Valves—Open 49° BLDC. Close 10° ATDC.

Valve Timing Check—#1 exhaust valve close 10° after top dead center (#1 piston .0438" ATDC) with hydraulic lifter dry (all oil drained out) and built up with feeler stock for zero tappet clearance.

LUBRICATION

LUBRICATION:—Pressure (pump on right of engine). *See Packard Shop Notes for Oil Pump Installation.*

Normal Oil Pressure:—50 lbs. at 45 MPH.

Oil Pressure Relief Valve:—On pump cover. Not adjustable. Spring pressure 17½-18½ lbs. at 1⅞".

Oil Pressure Gauge: Stewart-Warner Electric type.

Crankcase Capacity:—7 quarts.

COOLING

COOLING SYSTEM:—Capacity—20 quarts.

Pressure Valve—In filler cap. Opens at 7 lbs. (Std.), 12 lbs. (with Air Conditioning equipment).

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

Thermostat:—Harrison. In cyl. head outlet (Clipper). In radiator top tank operating shutters (Others). **Setting**—Std.: Starts to open 162° F (Clipper), 135° (Others). Alcohol Anti-Freeze: 147°F (Clipper). For heater use 162°F cyl. head outlet type for all models.

CLUTCH

CLUTCH: Long Model 11CF-CI (Late '41, All '42), Model 11CFS-CI (Early 1941). Semi-centrifugal, single plate, dry disc types. NOTE—Early 1941 (11CFS-CI) are riveted assemblies and cannot be dismantled. *See Clutch Section for complete data.*

Facings—Woven (U.S. Asbestos No. 1133-G), 2 used. Inside Diam. 6⅝". Outside Diam. 11". Thick. .125".

Pedal Adjustment:—1¾-2¼" (Std.), 2" (with Electromatic Clutch) free travel. Adjusting nut (with lock-nut) at clutch fork end of connector link.

Removal:—Remove transmission (see below). Disconnect pedal linkage, remove throw-out bearing. Remove cover mounting screws evenly, remove clutch.

ELECTROMATIC CLUTCH

ELECTROMATIC CLUTCH: Vacuum electric type Optl. *See Clutch Section for complete data.*

TRANSMISSION

TRANSMISSION:—Own Make. Constant-mesh, helical, ball-bearing mounted low speed gear (sliding spur reverse gear). Synchro-mesh (second & high). *See Transmission Section for complete data.*

Transmission Control:—Own Remote Control type. *See Transmission Section for complete data.*

Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, and ground strap at transmission. Disconnect front universal, block drive shaft up for clearance. Support rear of engine with jack, unbolt frame cross-member carrying rear engine mountings, remove flywheel housing lower cover, disconnect stabilizer (transmission to X-member). Take out transmission to flywheel housing screws, withdraw transmission.

OVERDRIVE

OVERDRIVE: Warner Type R9 (Kick-down). Model AS1-R9A overdrive unit with electrical control. *See Transmission Section for complete data.*

►**Overdrive Lock-up in Reverse Correction for Clipper:** Install 1948 Safety Switch (Kit No. 394484). *See 1948 Packard Car Pages for Overdrive Safety Switch description and Car Wiring Diagram showing Overdrive Circuit with Safety Switch installed.*

Overdrive Solenoid—Delco-Remy Model 1118005.

Overdrive Indicator Light—Green light on right side of speedometer dial. Lighted whenever overis ready to engage (light goes out when engaged).

Throttle Switch—Cole-Hersee, Packard No. 347496. Adjust tappet screw on throttle lever to just contact switch plunger with throttle valve wide open.

Governor Switch—Bendix No. 364782 (1941), Packard #367335 '42, 377787 '42 Electromatic Clutch.

Control Relay Delco-Remy 1116801 '41, 1116823 '42.

Removal: Procedure same as for regular transmission (see above) plus the following: Disconnect control cable, solenoid wires, and overdrive rear mounting.

UNIVERSALS

UNIVERSAL JOINTS: Mechanics 3CR or 3C (front shaft Long Whbse. Cars). Needle bearing types. *See Universals Section for complete data.*

►*CAUTION*—Rear universal flange controls pinion bearing pre-load. *For complete data, refer to the Rear Axle Section for Packard Rear Axle article.*

REAR AXLE

REAR AXLE:—Own Make. Semi-floating, Hypoid gear type with Hotchkiss drive and special Ring Gear Support Roller. Cover welded in place. *See Rear Axle Section for complete data.*

Model	Axle Ratio:	Standard	Overdrive
1903, 6		3.92-1	4.36-1
1904, 7; 2004, 7		4.09-1	4.36-1
1903A		4.54-1	4.7-1
1903AB		5.12-1	
1905 ,8; 2005, 8		4.36-1	4.54-1
2003, 6, 2023		3.92-1	4.09-1

Backlash—.003-.005". Screw adjustment.

Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.

Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims **Endplay—.004-.007".**

SHOCK ABSORBERS

SHOCK ABSORBERS:	Front	Rear
Clipper	Delco 1946-J, K	Monroe 371197
1903 Coupe, 1906	Delco 1966-C, D	Monroe 364725
1903 Sedans	" "	Monroe 362710
2023 Conv. Coupe	" "	Monroe 371197
All Others	" "	Delcoe 1021-V
Exp't (exc. Clip'r)	" "	Delcoe 1130-W

Double acting (Front), Direct Acting (Rear).

Fifth Shock Absorber (Stabilizer): Monroe 956790 direct acting type (Clipper), Houde NFT (Others).

FRONT SUSPENSION

Front Suspension:—Independent 'Safe-T-fleX' type (parallelogram type—coil springs & torque arms). **NOTE**—No torque arms used on Clipper Suspension. *See Front Suspension Section for complete data.*

NOTE—Frame height must be set first before checking Caster and Camber.

Frame Height—With car on level floor, distance from floor to top of frame side rail at front wheel center-line 18¾" (1903,4,5,6,7,8), 19¼" (1903A, 3AB). equal on both sides within 1/16-5/16"(1942 models except Clipper). Load car until figure correct.

	Kingpin Incl.	Caster	Camber
1941	2½°	Neg. ¾° ± ½°①	½° (½-1¼°)
1942	2½°	Neg. 1¼° ± ½°	0°②
Clipper	5°35'	Neg. 2° ± ½°	0° ± ½°

①—Caster 2½° ± ½° for 1903A (Long Wheelbase).
②—Limits—¼° to +¾° Right, 0° to + 1° Left.

Toe In—0-1/16" measured 10" up from floor.

STEERING GEAR

Steering Gear: Packard (Gemmer design Model 330). Worm-and-Roller type with idler arm on right frame rail (Clippers), center steering (Others). Refer to Gemmer Model 330 article. *See Steering Gear Section for complete data.*

BRAKES

BRAKES: Service. (1903,6; 2023 & Clipper) Bendix hydraulic, duo-servo, single anchor type **without eccentric** adjustment. **(All Others)** Bendix hydraulic, duo-servo, single anchor **with eccentric** adjustment. Hand lever applies rear service brakes on all cars. *See Brake Section for complete data.*

Drum—Centrifuse. Diameter 12".

Lining—Moulded type. Marshall 2201.

1941 Models

Model	Width	Thick-ness	Length per Shoe Primary	Secondary
1903,6	2"	3/16"	11½"	13"
1904,5,7,8	2¼"	3/16"	13"	13"
1901A①	2¼"	3/16"	13"	13"
1901A②	2½"	3/16"	13"	—
1901A②	2¼"	3/16"	—	13"
1903A①	2½"	3/16"	13"	13"
1903AB③ Front	2½"	3/16"	13"	13"
1903AB③ Rear	2¾"	¼"	15"	15"

①—Hearse & Ambulance. ③—Airport Limousine.
②—Heavy Duty Ambulance 4194HD, 4194HDF.

1942—Moulded (Marshall 2201-H-8). Thick 3/16". Width 2" (All wheels 2023, Rear wheels Clipper), 2¼" (All Others). Length per shoe: Primary 13" (2004,5,7,8), 11½" (Others). Secondary 13" (All). **Clearance—(Clipper & 1903, 6; 2023)**—.015" at both ends of secondary shoe with primary shoe forced out against drum. **All Others**—.010" at heel and toe of each shoe.

Hand Brake:—See Service Brakes (above).

MISC. MECHANICAL

WINDSHIELD WIPER:—Stewart-Warner Series 645-H (Clipper), 645-E (Others). Electric type. 'Klixon' circuit breaker mounted on or near wiper motor. *See Miscellaneous Section for complete data.*

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

Power Window Regulators: Hydro-Electric type. *See Miscellaneous Section for complete data.*

Window Lift Relay—Auto-Lite No. HRD-4001.

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GENERATOR

DELCO-REMY

Delco-Remy Model 1102682. Armature No. 1879002. Two brush (shunt) type with voltage and current regulation. Ventilated by fan on drive pulley.

Charging Rate Adjustment—None. Charging rate controlled by Voltage Regulator, maximum output controlled by Current Regulator. See Regulator.

Maximum Charging Rate—34-36 amperes, 8.0 volts hot. Actual charging rate controlled by Voltage Regulator and dependent on battery condition.

Performance Data (Delco-Remy)

	Amperes	Volts	RPM.
Cold	30①	8.0	1750

①Not maximum output. See Current Regulator.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—25 ozs. each.
Field Current—1.75-1.9 amperes at 6.0 volts.

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

Belt Adjustment: 50 lbs. tension on spring scale hooked to generator frame, or ½" thumb-pressure deflection midway between generator and pump pulleys.

REGULATOR

AUTO-LITE

Auto-Lite Model VRP-4002C (GDZ-4801F Gen.), Model VRP-4002D (GEB-4802C-2 Taxi Generator).

SEE 1946-47 PACKARD 8 CAR PAGES FOR DATA

REGULATOR

DELCO-REMY

Delco-Remy Model 1118202 (1946), 1118278 (1946-47). Single Core Type. Vibrating type Voltage and Current Regulators in case with Cutout Relay.
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 or High Voltage.

Cutout Relay

Cuts In—6.2-6.7 volts at 800 RPM (cold).
Cuts Out—0-4.0 ampere discharge current.
Contact Gap—.020" (same for both sets).
Air Gap—.020" (with contacts just closed).

Voltage Regulator

Setting—7.2-7.4 volts hot (operating temperature). Regulator over-compensated for temperature. Should be checked with cover in place and hot.

To Check—Connect ammeter in charging line at regulator 'BAT' terminal, voltmeter between this terminal and ground. Operate generator at 2800 RPM, adjust charging rate to 8-10 amperes (use variable rheostat or AVR set). With regulator hot (150°F), decrease generator speed until cutout relay contacts open, then increase speed to 2800 RPM and check hot voltage setting (above).

To Adjust—Change regulator armature spring tension slightly by bending hanger at lower end of **one spring only.** If further adjustment required, see Single Core Regulator article in Electrical Equipment Section for other (2nd) spring adjustment.
Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator

Setting—34-36 amperes hot (operating temp.).
To Check—Remove regulator cover, connect short jumper between Voltage Regulator frame and upper contact support bracket (to short out Voltage Regulator), connect ammeter in charging line at regulator 'BAT' terminal, turn on car lights and accessories. Operate generator and increase speed until output remains constant. With regulator hot (150°F), reading should agree with setting (above).
To Adjust—Same as for Voltage Regulator (above).
Air Gap—.080" (check same as Voltage Regulator).

LIGHTING

Headlamps: Hall "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 (hot spot center 3" below lamp center height at 25 ft.).
Beam Indicator—Red light on left side of speedometer dial. Lighted when Country (upper) beams in use.

Direction Signal: *See Electrical Equipment Section.*
Direction Signal Indicator—Illuminated arrows on face of speedometer dial. Right or Left arrow lighted when direction signal on same side operating.

Switches

Lighting—Delco-Remy No. 1995021.
Beam Selector—Delco-Remy No. 1997008.

MISC. ELECTRICAL

THERMOSTATIC RELAY: Delco-Remy. On lighting switch. Contacts remain closed with 30 amperes but open in 3 minutes with 42 amperes at 70°F. Not adjustable.

FUSES: Auxiliary (Stop Light, Cigar Lighter, Body Lights, Accessories)—SFE 20 ampere. Two fuses on lighting switch.
Instrument & Tail Light—SFE 20 ampere. On Panel Light Switch.
Clock—SFE 4 ampere. In clock lead near clock.
Overdrive—SFE 30 ampere. In relay lead.
Direction Signal—9 ampere. In flasher lead.

HORNS: Sparton. Vibrator type, air tone, twin horns operated by relay.
Horn Current—22-25 amperes.

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

ENGINE

ENGINE SPECIFICATIONS: 6 cylinder, 'L' head type.
Bore—3½". **Stroke**—4¼".
Displacement—245 cubic inches. **Rated H.P.** 29.4.
Developed Horsepower—105 at 3600 RPM.
Compression Ratio—6.71-1 (before Eng. #F-35000), 7.0-1 (after Eng. #F-35000). Std. Cast Iron head.
Compression & Vacuum Reading—*See Tune-up data.*

ORIGINAL BORE & PISTONS: *See Packard Shop Notes*

TIGHTENING TORQUES: *See Packard Shop Notes.*

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

PISTONS: Aluminum alloy, Autothermic strut type.
Length—3⅞".
Weight—20¼ ozs. (stripped), 26¾ ozs. (complete).
Removal—Pistons and rods removed from above.
Clearance—.0005-.001". See Fitting New Pistons.

Replacement Pistons: *See Packard Shop Notes.*

Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.

Installing Pistons:—Slot toward valves.

PISTON RINGS: Two compression rings (No. 200 top groove, No. 70 second groove), one oil control ring (No. 86) per piston, all above pin. Oil ring groove has twelve 5/32" oil drain holes.

Ring	Width	End Gap	Side Clearance
Compr. (#1)	.093-.0935"	.007-.017"	.0025-.003"
Compr. (#2)	.1235-.124"	.007-.017"	.0025-.003"
Oil Contr.(#3)	.186-.1865"	.007-.015"	.0025-.003"

NOTE—Oil Ring (Perfect Circle No. 86) has coil spring type expander spring.

Replacement Rings:—.005", .010", .020", .030", .040" O. S. Triple Action (packaged sets) std. & .020" oversize.
See Packard Shop Notes for Piston Ring data.

PISTON PIN: Diameter .875". Length 3 1/64". Pin floats in piston and rod, held by locking rings.
Pin Fit in Piston—Palm push fit with piston at 160°F. (heat in water).
Pin Fit in Rod Bushing—Finger push fit at 70° F.
Piston Pin & Connecting Rod Bushing Servicing—*See Packard Shop Notes.*

Replacement Pins:—Std. and .003", .006" oversize.

CONNECTING ROD: Length 7 11/16". Wgt. 31.6 ozs. (before Eng. #F-35000), 35.4 ozs. (beginning Eng. #F-35000).
Upper Bearing (Piston Pin Bushing)—Split type.
See Packard Shop Notes for Piston Pin servicing data.
Crankpin Journal Diameter—2.094" (before Eng. #F-35000), 2.250" (beginning Eng. #F-35000).
Lower Bearing—Shimless, precision, steel backed, Moraine Durex "300" (copper nickel matrix with babbitt overlay) lined type.
Clearance—.0005-.0025".
Endplay—.004-.010" (before Eng. #F-35000), .003-.011" (beginning Eng. #F-35000).

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps.
See Packard Shop Notes for 'Palnut' installation data.

Replacement Bearings: Furnished Std. size and .001", .002", .003", .015" Undersize.

Installing Rods:—Oil squirt hole toward camshaft.

CRANKSHAFT: Four bearing type with integral counterweights and vibration dampener on forward end.
Bearings—Interchangeable, shimless, precision type steel-backed, Moraine Durex "300" (copper nickel matrix with babbitt overlay) lined type.
Journal Diameter—2.7465". **Clearance**—.0005-.0025".

Bearing Adjustment:—None (no shims). Replace bearings (upper halves can be 'rotated' in and out).

Replacement Bearings: Furnished Std. size and .001", .002" Undersize.

End Thrust: Taken by front bearing. **Endplay** .003-.008".

CAMSHAFT: Four-bearing type. Driven by non-adjustable chain (two-sprocket drive).
Bearings—Shimless, precision, steel-backed, babbitt lined type. **Clearance**—.001-.003".

End Thrust:—Taken by thrust plate in back of camshaft sprocket.
Endplay—.0025-.006" (before Eng. #F-35000), .004-.006" (beginning Eng. #F-35000).

Timing Chain: Morse or Ramsey. Width 1¼". Pitch .375". Length 21¾" or 58 links.

ENGINE

CONTINUED FROM PRECEDING PAGE

Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with straightedge across shaft centers.

VALVES:	Head Diameter	Stem Diameter	Length
Intake	1 19/32"	33975"①	5.619"
Exhaust	1 3/8"	33975"②	5.619"

①—.3417" (beginning Eng. #F-35000).
②—.3398" (beginning Eng. #F-35000).

	Seat Angle	Lift	Stem Clearance
Intake	30°	.318"	.0015-.0035"①
Exhaust	45°	.3175"	.0035-.0055"②

①—.0005-.0031" (Beginning Eng. #F-35000).
②—.0024-.005" (beginning Eng. #F-35000).

Valve Guides:—Pressed in block from above with upper end 31/32" below valve seat. Exhaust guide upper end counterbored to ⅜" diameter, ⅜" deep.

Valve Springs:—Intake and exhaust springs interchangeable. Anti-rotation washer installed on top of springs.

Springs—Before Eng. #F-35000

	Spring Pressure	Spring Length
Valve Closed	52-57 lbs.	1 5/8"
Valve Open	119-129 lbs.	1 5/16"

Springs—After Eng. #F-35000

Valve Closed	60-66 lbs.	1 3/4"
Valve Open	135-145 lbs.	1 3/32"

Valve Lifters:—Mushroom type. Remove from below with camshaft out. Lifters furnished .001", .002", .005" oversize. Use Tool S.T. 5144 (piloted in valve guide) and ream for .005" oversize lifters. **Diameter—.6235-.6240". Clearance—.0003-.0012".**

VALVE TIMING

Tappet Clearance:—.007" Intake, .010" Exh. (warm & Idling). NOTE—Tappet screws are self-locking type.

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 1° BTDC. Close 39° ALDC.

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

With tappet clearance of .0125" Intake, .015" Exh.

Valve Timing Check—With .0125" tappet clearance #1 intake valve should open with #1 piston 1° or .0004" BTDC with 1st graduation before top dead center mark '#1 UP.DC' on vibration damper lined up with pointer (permissible variation 4° either way). Reset tappet clearance .007" (hot & idling).

LUBRICATION

Engine Oiling System: Full pressure system (pressure to main and connecting rod bearings, camshaft bearings, piston pins, valve lifters, and timing chain). Oil pump mounted externally on right side of crankcase.

Crankcase Capacity—5 quarts.

Normal Oil Pressure—40 lbs. at driving speeds.

Oil Pressure Regulator—On oil pump cover. Not adjustable. Pressure regulator spring tension should be 14 lbs. ± 2 oz. at 1⅞".

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

Oil Pump Installation—*See Packard Shop Notes.*

Oil Filter: Special equipment.

Servicing—Renew filter cartridge at 8000-10000 mile intervals.

Oil Pressure Gauge:—Stewart-Warner electric type.

COOLING

Cooling System: Pressure type with pressure valve (relief valve) in radiator filler cap. Water pump mounted on front of engine with fan belt drive.

Capacity—14 quarts.

Radiator Core Removal—*See Packard Shop Notes.*

Pressure Valve—In filler cap. Opens at 4½ lbs. (Passenger Cars), 7 lbs. (Taxicab).

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

Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat:—Bishop & Babcock. In cyl. head outlet. **Setting**—Starts to open at 145-150°F. (Std. Type), 160-165°F. (Optl. High Reading Type).

CLUTCH

Long Model 9½CF-CS (Std.), 11CF-CI (Taxicab). Single plate, semi-centrifugal, dry disc type. *See Clutch Section for complete data.*

Facings—Woven (US Asbestos type), 2 required. **Pass. Cars:** I.D. 6". O.D. 9½". Thickness .125" (⅛"). **Taxicab:** I.D. 6⅝". O.D. 11". Thickness .125" (⅛").

Pedal Adjustment:—1½-1¾" (Std.), 2" (with Electromatic Clutch) free travel. Adjusting nut (with locknut) at clutch fork end of connector link.

Removal:—Remove transmission (see below). Disconnect pedal linkage, remove throw-out bearing. Remove cover mounting screws evenly, remove clutch.

ELECTROMATIC CLUTCH

Electromatic Clutch—Vacuum electric type. Optl. *See Clutch Section for complete data.*

TRANSMISSION

Own Make—3 Speed type. Helical, constant-mesh (low speed gear), constant-mesh, synchro-mesh (second and high). Sliding spur (reverse gear). *See Transmission Section for complete data.*

Transmission Control: Steering col. mechanical shift. *See Transmission Section for complete data.*

Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, and ground strap at transmission. Disconnect front universal, block drive shaft up for clearance. Support rear of engine with jack, unbolt frame cross-member carrying rear engine mountings, remove flywheel housing lower cover, disconnect stabilizer (transmission to X-member). Take out transmission to flywheel housing screws, withdraw transmission.

OVERDRIVE

►*INSTALLATION OF R11 OVERDRIVE (To replace original R9 Assembly)—See "Warner R11 Overdrive" in Transmission Section for complete data.*

Warner Model AS2-R9 ("Econo-drive" used with Packard Transmission). Electric solenoid operated type (no centrifugal pawls) with Governor control and throttle operated "kick-down." *See Transmission Section for complete data.*

►**Overdrive Lock-up in Reverse Correction for Clipper:** Install 1948 Safety Switch (Kit No. 394484). *See 1948 Packard Car Pages for Overdrive Safety Switch description and Car Wiring Diagram showing Overdrive Circuit with Safety Switch installed.*

Overdrive Indicator Light—Green light on right side of speedometer dial. Lights when overdrive is ready to engage (at car speed of 22 MPH), goes out when accelerator pedal released for engagement.

Overdrive Relay—Delco-Remy No. 1116823.

Removal: Disconnect control cable and all leads to solenoid, governor, and lockout switch. Free mounting at rear of overdrive case. Then remove overdrive & transmission. See Transmission Removal

UNIVERSALS

Mechanics Type 3CR. Needle bearing type, 3 used. *See Universals Section for complete data.*

►*CAUTION*—Rear universal flange nut controls rear axle pinion bearing pre-load which **must be adjusted whenever nut is loosened.** *See Packard Rear Axle article in Rear Axle Section for complete data.*

REAR AXLE

Own Make—Hypoid Gear Type. Semi-floating type with Hotchkiss drive. Rear cover welded in place. *See Rear Axle Section for complete data.*

►*REAR AXLE OIL SEAL LEAKAGE CORRECTION—See "Packard Rear Axle" in Rear Axle Section for complete data.*

Ratio—4.3-1 (std.), 4.54-1 (with Overdrive & Taxi).

Backlash—.003-.005". Screw adjustment.

Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.

Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims (endplay up to .050" can be adjusted to desired .006" at one wheel). **Endplay**—.004-.007".

SHOCK ABSORBERS

Delco Model 1946-J,K (front), Model 1040-V (rear). Hydraulic, double acting (front), direct (rear).

Fifth Shock Absorber (Stabilizer):—Monroe 956790 direct acting type (in one end of stabilizer bar).

FRONT SUSPENSION

Front Suspension: Clipper Type Packard Safe-T-Flex, independent, linked parallelogram type. *See Front Suspension Section for complete data.*

Kingpin Inclination—5°35' crosswise.

Caster—Negative 1° plus or minus ½°.

Camber—0° plus or minus ¼°.

Toe In—0-1/16" measured 10" up from floor.

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

STEERING GEAR

Steering Gear: Own Make (same design as the Gemmer 335) Worm & Roller, "push-pull" adjustment. *See Steering Gear Section for complete data.*

BRAKES

Service: Bendix Hydraulic, 4-wheel, Duo-Servo, Single anchor type **without eccentric adjustment.** Hand lever applies rear wheel service brakes. *See Brake Section for complete data.*

Drums—Centrifuse type. Diameter: Passenger Car 12" (front), 11" (rear). Taxicab: 12" (all wheels).

Lining—Primary: Marshall 2201H-8. **Secondary:** Marshall B-50 (Pass. Car), Marshall 9017 (Taxicab). Thickness 3/16". Width 2" (Taxi rear wheels), 1¾" (all shoes Pass. Cars, front wheels Taxi). Length per shoe: **Front Wheels** Primary 11½", Secondary 13" **Rear Wheels**—Primary 10⅝" (Pass. Cars), 11½" (Taxi). Secondary 12" (Pass. Car), 11½" (Taxi).

Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.

Hand Brake:—See Service Brakes above.

MISC. MECHANICAL

WINDSHIELD WIPER: Stewart-Warner Type 645-H. Electric type. "Klixon" type circuit breaker mounted near wiper motor. *See Miscellaneous Section for complete data.*

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erator 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.

LIGHTING

Headlamps: Hall "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 (hot spot center 3" below lamp center height at 25 ft.).

Beam Indicator—Red light on left side of speedometer dial. Lighted with upper beam "on".

Direction Signal: *See Electrical Equipment Section.*

Direction Signal Indicator—Illuminated arrows on face of speedometer dial. Right or Left arrow lighted when direction signal on same side operating.

Switches

Lighting—Delco-Remy No. 1995021.

Beam Selector—Delco-Remy No. 1997008.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	40-30 watts	Sealed Beam
Parking & Frt. Direc. Sig.	21-3	1154
Rear Direc. Sig.	21	1129
Direc. Sig. Indicator	1½	55
Beam Ind., Glove Compt.	1	51
Instrument, Map Light	1½	55
Clock & Speedometer ('46)	1	51
Clock & Speedometer ('47)	1½	55
Overdrive Indicator	1½	55
Courtesy, Dome	6	82
Stop & Tail	21-3	1154
Rear License	3	63

MISC. ELECTRICAL

THERMOSTATIC RELAY: Delco-Remy. On lighting switch. Contacts remain closed with 30 amperes, open in 3 minutes with 42 amps. at 70° F. Not adj.

FUSES: Auxiliary (Stop Light, Cigar Lighter, Body Lights, Accessories)—SFE 20 ampere. Two fuses on lighting switch.

Instrument & Tail Light—SFE 20 ampere. On Panel Light Switch.

Clock—SFE 4 ampere. In clock lead near clock.

Overdrive—SFE 30 ampere. In relay lead.

Direction Signal—9 ampere. In flasher lead.

HORNS: Sparton. Vibrator type, air tone, twin horns operated by relay.

Horn Current—22-25 amperes.

Horn Relay: Delco-Remy No. 1116775.

Contact Gap—.025". **Air Gap**—.015" (closed).

Contacts Close—2.75-4.0 volts.

ENGINE

ENGINE SPECIFICATIONS: Eight cylinder "L" head type. **Bore**—3¼". **Stroke**—4¼".

Displacement—282 cubic ins. **Rated HP.**—33.8.

Developed Horsepower—125 at 3600 RPM.

Compression Ratio—6.85-1 Std. cast iron head.

Compression & Vacuum Reading—*See Tune-up data.*

ORIGINAL BORE & PISTONS: *See Packard Shop Notes*

TIGHTENING TORQUES: *See Packard Shop Notes.*

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

PISTONS: Aluminum alloy, autothermic strut type. **Length** 3⅞".

Weight—17¼ ozs. (stripped), 23⅛ (with rings&pin).

Removal—Pistons and rods removed from above.

Clearance—.0005"-.001". See Fitting New Pistons.

Replacement Pistons: *See Packard Shop Notes.*

Fitting New Pistons:—Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.

Installing Pistons:—Slot toward valves.

PISTON RINGS: Two compression rings (No. 200 top groove, No. 70 second groove), one oil control ring (No. 86) per piston, all above pin. Oil ring groove has twelve 5/32" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. (#1)	.0925-.0935"	.007-.017"	.0025-.003"
Comp. (#2)	.1240-.1235"	.007-.017"	.0025-.003"
Oil Control	.1865-.186"	.007-.015"	.0025-.003"

NOTE—Oil Ring (Perfect Circle No. 86) has coil spring type expander spring.

Replacement Rings:—.005, .010", .020", .030", .040" O.S. Triple Action (packaged sets) std. & .020" oversize. *See Packard Shop Notes for Piston Ring data.*

PISTON PIN: Diameter .875". Length 2 51/64". Pin floats in piston and rod, held by locking rings. **Pin Fit in Piston**—Palm push fit with piston at 160°F. (heat in water).

Pin Fit in Rod Bushing—Finger push fit at 70°F. **Piston Pin & Connecting Rod Bushing Servicing**—*See Packard Shop Notes.*

Replacement Pins:—Std. and .003", .006" oversize.

CONNECTING ROD: Length 7 11/16". Weight 31.6 oz. **Upper Bearing (Piston Pin Bushing)**—Split type. *See Packard Shop Notes for servicing data.*

Crankpin Journal Diameter—2.094".

Lower Bearing—Shimless, precision, steel backed, Moraine Durex "300" (copper nickel matrix with babbitt overlay) lined type.

Clearance—.0005-.0025". **Endplay**—.004-.010".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file rods or caps

See Packard Shop Notes for 'Palnut' installation data.

Replacement Bearings: Furnished Std. size and .001", .002", .003", .015" Undersize.

Installing Rods:—Oil squirt hole toward camshaft.

CRANKSHAFT: Five bearing type with integral counterweights and vibration dampener on forward end. **Journal Diameter**—2.7465".

Bearings—Interchangeable, shimless, precision type steel-backed, Moraine Durex "300" (copper nickel matrix with babbitt overlay) lined type. **Clearance**—.0005-.0025".

Bearing Adjustment:—None (no shims). Replace bearings (upper halves can be 'rotated' in and out).

Replacement Bearings: Furnished Std. size and .001", .002" Undersize.

End Thrust:—By #3 bearing. **Endplay**—.003-.008".

CAMSHAFT: Five bearing type. Non-adjustable (two sprocket) chain drive.

Bearings—Shimless, precision, steel backed, babbitt lined type. **Clearance**—.001-.003".

End Thrust:—Taken by thrust plate in back of camshaft sprocket. **Endplay**—.0025-.006".

Timing Chain: Morse or Ramsey. Width 1¼". Pitch .375". Length 21¾" or 58 links.

Camshaft Setting:—Install chain and sprockets together with '0' marks on sprockets adjacent and in line with straightedge across shaft centers.

VALVES:	Head Diameter	Stem Diameter	Length
Intake	1 31/64"	.33975"	5.619"
Exhaust	1⅜"	.33975"	5.619"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.318"	.0015-.0035"
Exhaust	45°	.3175"	.0035-.0055"

Valve Guides:—Pressed in block from above with upper end 31/32" below valve seat. Exhaust guides counter-bored on upper inner diameter to ⅜" diameter and ⅜" deep.

Valve Springs:—Intake and exhaust springs interchangeable. Anti-rotation serrated washer installed on top of springs.

	Spring Pressure	Spring Length
Valve Closed	52-57 lbs.	1 5/8"
Valve Open	119-129 lbs.	1 5/16"

Valve Lifters:—Mushroom type. Remove from below with camshaft out. Lifters furnished .001", .002", .005" oversize. Use Tool S.T. 5144 (piloted in valve guide) and ream for .005" oversize lifters.

Diameter—.6235-.6240". **Clearance**—.0003-.0012".

VALVE TIMING

Tappet Clearance:—.007" Intake, .010" Exh. (warm & idling). NOTE—Self-locking tappet screw used.

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 1° BTDC. Close 39° ALDC.

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

Above figures correct with .0125" Intake, .015" Exhaust tappet clearance.

Valve Timing Check—With .0125" tappet clearance #1 intake valve should open with #1 piston 1° or .0004" BTDC with 1st graduation before top dead center mark '#1 UP.DC' on vibration damper lined up with pointer (permissible variation 4° either way). Reset tappet clearance .007" (hot & idling).

LUBRICATION

Engine Oiling System: Full pressure system (pressure to main and connecting rod bearings, camshaft bearings, piston pins, valve lifters, and timing chain). Oil pump mounted externally on right side of crankcase.

Crankcase Capacity—5½ quarts.

Normal Oil Pressure—40 lbs. at driving speeds.

Oil Pressure Regulator—On oil pump cover. Not adjustable. Pressure regulator spring tension should be 14 lbs. ± 2 oz. at 1⅞".

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

Oil Pump Installation—*See Packard Shop Notes.*

Oil Filter: Special equipment.

Servicing—Renew filter cartridge at 8000-10000 mile intervals.

COOLING

Cooling System: Pressure type with pressure valve (relief valve) in radiator filler cap. Water pump mounted on front of engine with generator & fan belt drive.

Capacity—17 quarts.

Radiator Core Removal—*See Packard Shop Notes.*

Pressure Valve—In filler cap. Opens at 4½ lbs.

Water Pump:—Packless, sealed ball-bearing type.

See Water Pump Section for complete data.

Removal—Remove fan belt, disconnect pump hose, take out pump mounting screws, lift out pump.

Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat:—Harrison. In cylinder head outlet.

Setting—Starts to open at 145-150°F. (Std. Type), 160-165°F. (Optl. High Reading Type).

CLUTCH

Long Model 10CF-CI. Single plate, semi-centrifugal, dry disc type.

See Clutch Section for complete data.

Facings—Woven (US Asbestos) type, 2 required. I.D. 6". O.D. 10". Thickness .125" (⅛").

Adjustment:—Adjust nut on pedal rod (at clutch fork) for 1½-1¾" free travel (2" on cars with Electromatic Clutch).

Removal:—Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect and remove pedal rod, clutch throw-out bearing. Remove clutch cover screws (release tension evenly) and lower assembly out.

ELECTROMATIC CLUTCH

Electromatic Clutch—Vacuum type actuation with electrical control. Optl. on all models.

See Clutch Section for complete data.

TRANSMISSION

Own Make. Helical gear, constant-mesh, synchro-mesh (Second & High), constant-mesh (Low). Sliding spur gear (Reverse). Low & Second speed gears are ball bearing mounted.

See Transmission Section for complete data.

Transmission Control: Remote control type with shift lever mounted on steering column.

See Transmission Section for complete data.

Removal:—Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, overdrive cable and solenoid wires (if used), front universal (block drive shaft up against floor pan) and rubber bearing at rear of overdrive. Support rear of engine with jack and unbolt cross member (at frame ends and transmission case), disconnect clutch retractor spring and fore-and-aft restraint rod. Take out transmission-to-housing mounting screws, remove transmission assembly.

OVERDRIVE

►*INSTALLATION OF R11 OVERDRIVE (To replace original R9 Assembly)—See "Warner R11 Overdrive" in Transmission Section for complete data.*

Warner Model AS2-R9 ("Econo-drive" used with Packard Transmission). Electric solenoid operated type (no centrifugal pawls) with Governor control and throttle operated "kick-down."

See Transmission Section for complete data.

►**Overdrive Lock-up in Reverse Correction for Clipper:** Install 1948 Safety Switch (Kit No. 394484). *See 1948 Packard Car Pages for Overdrive Safety Switch description and Car Wiring Diagram showing Overdrive Circuit with Safety Switch installed.*

Overdrive Indicator Light—Green light on right side of speedometer dial. Lights when overdrive is ready to engage (at car speed of 22 MPH), goes out when accelerator pedal released momentarily to engage overdrive.

Overdrive Relay—Delco-Remy No. 1116823.

Removal: Disconnect control cable and all leads to solenoid, governor, and lockout switch. Free mounting at rear of overdrive case. Then remove overdrive and transmission assembly as directed in Transmission removal (above).

UNIVERSALS

Mechanics Type 3CR. Needle bearing type, 2 used.

See Universals Section for complete data.

►CAUTION—Rear universal flange nut controls rear axle pinion bearing pre-load which **must be adjusted whenever nut is loosened.** *See Packard Rear Axle article in Rear Axle Section for complete data.*

REAR AXLE

Own Make. Semi-floating, hypoid gear type with Hotchkiss Drive.

See Rear Axle Section for complete data.

►*REAR AXLE OIL SEAL LEAKAGE CORRECTION—See "Packard Rear Axle" in Rear Axle Section for complete data.*

Ratio—4.1-1 (Std.), 4.3-1 (With Overdrive).

Backlash—.003-.005". Screw adjustment.

Removal:—Remove wheel, hub, and brake backing plate assembly. Withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove carrier-to-housing bolt nuts, withdraw carrier.

Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. Unbolt backing plate and clips holding brake tube to housing. Add or remove shims (endplay up to .050" can be adjusted to desired .006" at one wheel). **Endplay**—.004-.007".

SHOCK ABSORBERS

Delco Model 1946-J,K (front), Model 1040-V (rear). Hydraulic, double acting (front), direct (rear).

Fifth Shock Absorber (Stabilizer):—Monroe 373935. Direct acting, hydraulic (built-in rear stabilizer).

FRONT SUSPENSION

Front Suspension: Clipper Type Packard Safe-T-Flex, independent, linked parallelogram type with coil springs.

See Front Suspension Section for complete data.

Kingpin Inclination—5°35' crosswise.

Camber—0° plus or minus ¼°.

Caster—Neg. 1° plus or minus ½°. Adjustable.

Toe In—0" (plus 1/16", minus 0") at hub height. Adjust by turning adjuster at outer end of each tie rod equally.

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

STEERING GEAR

Steering Gear: Own Make (same design as Gemmer Model 335) Worm & Roller with "push-pull" adjustment.

See Steering Gear Section for complete data.

BRAKES

Service: Bendix Hydraulic, 4-wheel, Duo-Servo, Single anchor type **without eccentric adjustment.** Hand lever applies rear wheel service brakes.

See Brake Section for complete data.

Drums—Centrifuse. Diameter 12".

Lining—Marshall 2201H-8 (primary shoe), Marshall B-50 (secondary). Width 1¾". Thickness 3/16". Length per shoe 11½" (primary), 13" (secondary).

Clearance—.015" at both end of secondary shoe with primary shoe forced out against drum.

Hand Brake:—See Service Brake (above).

MISC. MECHANICAL

WINDSHIELD WIPER: Stewart-Warner Type 645-H. Electric type. NOTE—'Klixon' type circuit-breaker mounted on unit (no fuse used).

See Miscellaneous Section for complete data.

IGNITION TIMING

Std. Setting—As given below. See Fuel Compensator Setting for service and fuel corrections.

	Flywheel Degrees	Piston Position
All Engines	4° BTDC	.0070" BTDC.

Timing Mark—Vibration dampener at front of engine marked '#1 UP.DC' at top dead center for #1 piston with 15 (1°) graduations before this mark.
Timing—Loosen thumbnut, set Fuel Compensator pointer at '0', tighten thumbnut. With #1 piston on compression, turn engine over until piston reaches firing position (see table above) with 4th graduation ahead of #1UP.DC mark in line with pointer on chain case cover. Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt, see that rotor opposite #1 segment in distributor cap, check Fuel Compensator setting (following).
Timing (Neon Timing Light)—Mark 4th graduation ahead of #1UP.DC mark on vibration dampener with white paint, clip neon timing light at #1 spark plug and direct light on vibration dampener, idle engine below 500 RPM and adjust distributor as directed above until mark in line with pointer on chain case cover.
Fuel Compensator Setting—Should be set for slight ping when accelerating with wide open throttle. To adjust, loosen thumbnut, rotate distributor counter-clockwise (if ping too severe), clockwise (if no ping noted), tighten thumbnut and recheck performance.

CARBURETOR

Carter Type WDO, Model 531S, SA. 1¼" Dual downdraft type with Carter Climatic Control.
See Carburetor Section for complete data.
Casting Numbers—377 (531S), 564 (531SA).
►*CARBURETOR RECOMMENDED CHANGES (for better Low Speed Performance and Increased Gas Mileage)—See "Carter WDO" in Carburetor Section for complete data.*
Idle Setting—With engine warm (fast idle inoperative), set throttle stopscrew for 6 MPH idle speed. (Std.), 8-10 MPH. (Cars with Electromatic Clutch) Adjust both idle screws (1 for each barrel, adjust alike) for smooth idling performance (turn screws in for leaner mixture, correct setting 1 to 2 turns open for each screw. Recheck idle speed.
Accelerating Pump—Pump arm under dust cover at top of carburetor has two holes for pump link engagement. Set as follows:
Inner Hole (min. stroke)—Normal setting.
Outer (max. stroke)—If greater charge required.
Float Level—5/32" from top of float to bowl cover with valve seated (remove gasket & 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—Adjust fast idle screw for .023-.028" throttle opening (Gauge T109-189) with choke closed.
Automatic Choke:—Carter Climatic Control.
See Carburetion Equipment Section for data.
Setting—Set thermostat coil housing at index.

CARB. EQUIPMENT

Air Cleaner: AC. Oil-wetted type Std., Heavy duty Oil-bath type Optl.
Servicing (Oil-wetted type)—Wash and re-oil filter element whenever crankcase oil changed (1000-2000 mile intervals for normal service).
Servicing (Oil-bath type)—Clean filter element, clean and refill oil reservoir with SAE No. 50 engine oil (Summer), SAE No. 30 (Winter) to level of indicator line on case (approx. 1 pint) whenever crankcase oil changed (1000-2000 mile intervals).
Oil Filler Cap (Crankcase Ventilator Filter)—Wash filter element in filler cap and re-oil when servicing air cleaner.
Fuel Pump: AC. Type AH. Diaphragm type fuel pump. Exchange Pump AC No. 545.
See Carburetion Equipment Section for data.
Pressure—4-4¾ lbs. max.
Gasoline Gauge:—Stewart (Stewart-Warner) electric.
See Carburetion Equipment Section for data.

BATTERY

Auto-Lite Type PN-17ZR. 6 Volt, 17 Plate, 120 Ampere Hour Capacity (20 hour rate).
Starting Capacity—138 amperes for 20 minutes.
Zero Capacity—300 amperes for 4.1 minutes. Five second voltage 4.35 volts.
Grounded Terminal—Positive (+) to frame.
Dimensions—Length 19⅜". Width 4". Hght. 9 3/16".
Location—On left side in engine compartment.

STARTER

Auto-Lite Model MAX-4052. Armature MAW-2069.
Drive—Overrunning clutch (solenoid pinion shift) through reduction gears.
Rotation—Clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque	RPM①	Volts	Amperes
0 ft. lbs.	2700	5.5	77
33.5 "	Lock	3.0	650
45.9 "	Lock	4.0	900

①—Pinion shaft RPM. (reduction gear drive).
Removal:—Flange mounted on left front face of flywheel housing. To remove, take out flange mounting screws, lift out starter and switch assembly.
Starting Switch: Auto-Lite Model SS-4205 Solenoid type. Mounted on starter and controlled by Carter Car Starter Model 192-11U mounted on carburetor (accelerator pedal starting). *See Electrical Equipment Section for Auto-Lite Solenoid Switches and Carter Car Starter.*

GENERATOR

Auto-Lite Model No. GEA-4802A-1. Armature No. GDZ-2006F. Two brush type with Current and Voltage control. Air cooled by fan on pulley.
Charging Rate Adjustment—None. See Regulator.
Maximum Charging Rate—35 amperes (hot or cold), 8.0 volts, 1700 RPM 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	850	0	6.4	865
4	6.6	950	4	6.6	975
8	6.75	1050	8	6.75	1075
12	6.95	1150	12	6.95	1180
16	7.1	1250	16	7.1	1300
20	7.3	1345	20	7.3	1425
24	7.5	1440	24	7.5	1560
28	7.7	1540	28	7.7	1695
32	7.85	1635	32	7.85	1850
35	8.0	1700	35	8.0	1970

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 pivot and clamp bolts.
Belt Adjustment:—Swing generator out until 50 lb. reading secured on scale hooked to clamp bolt lug parallel to clamp link or until belt deflection midway between generator and water pump pulley is ½" with thumb pressure.

REGULATOR

Auto-Lite Model VRP-4002C. Voltage-Current Type. Vibrating type Voltage and Current Regulators in case with Cutout Relay.
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, 780 RPM (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.

LIGHTING

Headlamps: Hall "Sealed Beam" type. Upper and lower beams controlled by Beam Selector Switch on toeboard.
See Electrical Equipment Sectinn for complete data.
Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height at 25 ft.).
Beam Indicator—Red light on left side of speedometer. Lighted when Upper beams in use.

CONTINUED ON NEXT PAGE

Setting—Starts to open at 145-150°F. (Std. Type), 160-165°F. (Optl. High Reading Type).

CLUTCH

Long Model 11CF-CI. Single plate, semi-centrifugal, dry disc type.

See Clutch Section for complete data.

Facings—Woven type (US Asbestos), 2 required. I.D. 6". O.D. 11". Thickness .125" (⅛").

Pedal Adjustment: 1¾-2¼" (Std.), 2" (with Electromatic Clutch) pedal free travel. Adjusting nut (with locknut) located on clutch fork end of connecting link.

Removal: Remove Transmission (see Transmission Removal below), disconnect pedal linkage, remove throw-out bearing. Remove clutch cover mounting screws evenly to relieve spring pressure, remove clutch and driven member.

ELECTROMATIC CLUTCH

Electromatic Clutch—Vacuum type actuation with electrical control. Optl. on all models.

See Clutch Section for complete data.

TRANSMISSION

Own Make. Helical gear, constant-mesh, synchromesh (Second & High), constant-mesh (Low), sliding spur gear (Reverse). Constant-mesh gears (Low & Second) are ball-bearing mounted.

See Transmission Section for complete data.

Transmission Control: Remote control type with shift lever mounted on steering column.

See Transmission Section for complete data.

Removal: Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, and ground strap at transmission. Disconnect front universal joint, block drive shaft up for clearance. Support engine with jack, unbolt frame cross-member carrying rear engine mountings and remove cross-member. Remove flywheel housing lower cover, disconnect stabilizer rod (from transmission to X-member). Take out transmission-to-housing mounting screws, pull transmission straight back and remove from car.

OVERDRIVE

►*INSTALLATION OF R11 OVERDRIVE (To replace original R9 Assembly)—See "Warner R11 Overdrive" in Transmission Section for complete data.*

Warner Model AS1-R9A ("Econo-drive" used with Packard Transmission). Electric solenoid operated type (no centrifugal pawls) with Governor control and throttle operated "kick-down."

See Transmission Section for complete data.

►**Overdrive Lock-up in Reverse Correction for Clipper:** Install 1948 Safety Switch (Kit No. 394484). *See 1948 Packard Car Pages for Overdrive Safety Switch description and Car Wiring Diagram showing Overdrive Circuit with Safety Switch installed.*

Overdrive Indicator Light—Green light on right side of speedometer dial. Lights when overdrive is ready to engage (at car speed of 22 MPH), goes out when accelerator pedal released momentarily to engage overdrive.

Overdrive Relay—Delco-Remy No. 1116823.

Removal: Disconnect control cable and all leads to solenoid, governor, and lockout switch. Free mounting at rear of overdrive case. Then remove overdrive and transmission assembly as directed in Transmission removal (above).

UNIVERSALS

Mechanics Type 3CR. Needle bearing type, 2 used.

See Universals Section for complete data.

►*CAUTION*—Rear universal flange nut controls rear axle pinion bearing pre-load which **must be adjusted whenever nut is loosened.** *See Packard Rear Axle article in Rear Axle Section for complete data.*

REAR AXLE

Own Make. Semi-floating, hypoid gear type with Hotchkiss Drive. NOTE—Ring gear has special Support Roller. Housing cover is welded in place.

See Rear Axle Section for complete data.

►*REAR AXLE OIL SEAL LEAKAGE CORRECTION—See "Packard Rear Axle" in Rear Axle Section for complete data.*

►**Pinion Bearing Spacer**—*CAUTION*—1/16" spacer used on some 2103, 2106, 2126 cars. *See 1946-47 Packard in Rear Axle Section.*

Ratio—3.92-1 (Std.), 4.09-1 (With Overdrive).

Backlash—.003-.005". Screw adjustment.

Removal: Remove wheel, hub, and brake backing plate assembly, withdraw axle shafts. Disconnect rear universal joint and drop drive shaft. Remove axle carrier mounting bolt nuts, withdraw carrier assembly.

Wheel Bearing Adjustment—Endplay controlled by shims between flanged end of housing and brake backing plate. To adjust endplay, unbolt backing plate and clips holding brake tube to housing, add or remove shims.

Endplay—.004-.007"

SHOCK ABSORBERS

Delco No. 1946-J,K (front), Monroe No. 18096 (rear), Hydraulic, double acting (front), direct (rear). EXPORT CARS—Used Delco 1040-V (direct) rear.

Fifth Shock Absorber (Stabilizer): Monroe Model 373935 Direct acting type (built-in one end of stabilizer bar).

FRONT SUSPENSION

Front Suspension (Clipper):—New type Packard Safe-T-fleX (parallelogram type with upper & lower support arms and coil springs—no torque arms)

See Front Suspension Section for complete data.

Kingpin Inclination—5°35' crosswise.

Caster—Negative 1° plus or minus ½°.

Camber—0° plus or minus ¼°.

Toe In—0-1/16" measured 10" up from floor.

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

STEERING GEAR

Steering Gear: Own Make (same design as Gemmer Model 335) Worm & Roller with "push-pull" adjustment.

See Steering Gear Section for complete data.

BRAKES

Service: Bendix Hydraulic, 4-wheel, Duo-Servo, Single anchor type **without eccentric adjustment.** Hand lever applies rear wheel service brakes.

See Brake Section for complete data.

Drums—Centrifuse type. Diameter 12".

Lining—Marshall 2201H-8 (primary),) B-50 (secondary). Width 2¼" (front wheels), 2" (rear wheels). Thickness 3/16". Length per shoe 11½" (primary), 13" (secondary).

Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.

Hand Brake: See Service Brakes above.

MISC. MECHANICAL

WINDSHIELD WIPER: Stewart-Warner Type 645-H. Electric type. NOTE—"KLIXON" type circuit breaker mounted near wiper motor.

See Miscellaneous Section for complete data.

CONTINUED FROM PRECEDING PAGE

Idle engine below 600 RPM., adjust distributor (as directed above) until mark lines up with pointer.

Fuel Compensator Setting—Should be set for slight ping when accelerating engine with wide open throttle. To adjust, loosen vacuum unit link screw in distributor quadrant (Auto-Lite Distributors), advance arm hold-down screw (Delco-Remy Distributors), rotate distributor one graduation at a time counter-clockwise (if ping too severe), clockwise (if no ping), until correct performance secured.

CARBURETOR

Eight.....**Carter WDO, No. 644S or SA.**
Super Eight.....**Carter WDO, No. 643S or SA.**
1¼" dual barrel downdraft types with Carter Climatic Control.
Casting No.—377 (643S), 561 (643SA, 644S, SA).
See 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.***

Fast Idle: Carter Dual (WDO) Carburetor type.
See Carburetion Equipment Section for complete data.
Setting—.026" (643S, SA), .020" (644S, SA) throttle opening with choke valve closed. Adjust by turning fast idle screw on high step of fast idle cam.

Automatic Choke: Carter Climatic Control (Dual Carburetors).
See Carburetion Equipment Section for complete data.
Setting—Centered (at index).

CARB. EQUIPMENT

Fuel Pump (Fuel-&-Vacuum): AC Type AJ. No. 1523867 or 1523629.

Replacement Pump—AC No. 508.

Pressure—4-4¾ lbs.
See Carburetion Equipment Section for complete data.

Gasoline Gauge: King-Seeley Electric.
Dash Unit—K-S No. 41635.
Tank Unit—K-S No. 41676 (Eight), 41678 (Super 8).
See Carburetion Equipment Section for complete data.

Air Cleaner (std.—oil wetted): AC No. 1544180 (Type #6 element).
Optl. (oil-bath)—AC Element #14.
Servicing (oil-wetted type)—Wash and re-oil filter element every 1000 to 2000 miles whenever crankcase oil is changed.
Servicing (oil bath type)—Clean filter element, clean and refill oil reservoir with SAE No. 50 engine oil (Summer), No. 30 (Winter) to level of indicator line on case (approx. 1 pint) every 5000 miles or oftener if required.

BATTERY

Auto-Lite Type PN-15ZR or Willard SW-1D-100.
6 volt, 15 plate, 100 amp. hr. capacity (20 hr. rate).
Starting Capacity—120 amperes (Auto-Lite), 122 amperes (Willard) for 20 minutes.

Grounded Terminal—Positive (+) to frame.

Location—Left side in engine compartment.

STARTER
AUTO-LITE

Auto-Lite Model MCL-6003. Armature No. MCH-2021
Drive—Outboard Barrel Type Bendix No. A-1915.
Rotation—Counter-clockwise at commutator end.
Cranking Engine—175-225 amperes.
Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data (Auto-Lite)

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4900	5.0	65
8.0 ft. lbs.	Lock	2.0	4.0

Removal: On left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch: Auto-Lite Model SS-4017 Magnetic Switch on starter controlled by Carter Car Starter No. 192-11U on carburetor (accelerator control).
See Electrical Equipment Section for complete data.

STARTER
DELCO-REMY

Delco-Remy Model 1107943. Armature No. 1910938.
Drive—Outboard Barrel Type Bendix No. A-1792.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—24-28 ozs. each.
Cranking Engine—175-225 amperes.

Performance Data (Delco-Remy)

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

Removal: Same as Auto-Lite data (above).

Starting Switch: Delco-Remy Model 1452 Magnetic Switch on starter controlled by Carter Car Starter No. 192-11U on carburetor (accelerator control).
See Electrical Equipment Section for complete data.

GENERATOR
AUTO-LITE

Auto-Lite Model GDZ-4801F or GDZ-4801T. Arm. GDZ-2006F. 2 brush with voltage & current regulation.

Maximum Charging Rate—35 amperes, 8.0 volts.
Charging Rate Adjustment—None. See Regulator.

Performance Data (Auto-Lite)

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
10	6.85	1200	10	6.85	1290
20	7.3	1480	20	7.3	1590
30	7.8	1760	30	7.8	1980
*35	8.0	1900	35	8.0	2250

*—Current Regulator Setting.

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 strap screw and mounting bolts.

Belt Adjustment: ¼" belt deflection between fan and generator. Loosen adjusting strap screw, pry generator out for ¼" setting, tighten screw.

GENERATOR
DELCO-REMY

Delco-Remy Models 1102699 or 1102705.
Armature No.—Delco-Remy No. 1879002.
2 brush with voltage and current regulation.
Maximum Charging Rate—35 amperes at 8.0 volts.
Charging Rate Adjustment—None. See Regulator.

Performance Data (Delco-Remy)

	Amperes	Volts	R.P.M.
Cold	30①	8.0	1750

①—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 & Belt Adjustment: See Auto-Lite (above).

REGULATOR
AUTO-LITE

Auto-Lite Model VRP-4402A. Voltage-current type.
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, 920 RPM. (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.
Checking (without breaking seals) & Adjustment—***See Electrical Equipment Section for complete data.***
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 for complete data.***
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

REGULATOR
DELCO-REMY (FIRST CARS)

Delco-Remy 1118278 Single Core Voltage & Current type.
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 or High Voltage.

Cutout Relay

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

Voltage Regulator

Setting—7.2-7.4 volts hot (operating temperature). Regulator over-compensated for temperature. Should be checked with cover in place and hot.
Checking & Adjustment—***See Electrical Equip. Section.***
Air Gap—.070" between center of core and armature with contacts just closing (press down on armature to open contacts, release pressure, check gap at point where contacts just close).

Current Regulator

Setting—34-36 amperes hot (operating temp.).
Checking & Adjustment—***See Electrical Equip. Section.***
Air Gap—.080" (check same as Voltage Regulator).

REGULATOR
DELCO-REMY (LATER CARS)

Delco-Remy Model 1118331. (For 1102705 Generator).
See "1949-50 Packard Eight" for complete data.

CONTINUED FROM PRECEDING PAGE

Oil Pressure Gauge: King-Seeley Electric.
Dash Unit—K-S No. 41640.
Engine Unit—K-S No. 40767.
See Miscellaneous Section for complete data.
Crankcase Ventilation: Oil-wetted type filter element in oil filler cap (air intake). Outlet pipe in valve compartment cover at rear.

COOLING

Cooling System: Pressure type with pressure relief valve in filler cap and fan belt driven pump.
Capacity—18 qts. (Eight), 20 qts. (Super 8), with 2 quarts additional for heater and defroster.
Pressure Valve—AC 850005 Filler Cap. Opens 7 lbs.
Water Pump: Centrifugal, belt-driven, packless type.
See Water Pump Section for complete data.
Belt Adjustment—*See Generator Belt Adjustment.*
Thermostat: In cylinder head outlet.
Setting (std.)—Starts to open 145-150°F.
Setting (Optl. High Reading)—Starts to open 160-165°F. or 175-180°F.
Temperature Gauge: King-Seeley Electric.
Dash Unit—K-S No. 41645.
Engine Unit—K-S No. 41085.
See Miscellaneous Section for complete data.

CLUTCH

Long 10CF-TI (Eight), 11CF-10½TI (Super Eight). Single plate, semi-centrifugal, dry disc type.
See Clutch Section for complete data.
Facings—Woven (U. S. Asbestos). Thickness .125". I.D. 6¾" (8), 7" (Super 8). Outside Diameter 10" (8), 10½" (Super 8).
Pedal Adjustment: 1¼-1½" free travel. Adjusting nut on rod between relay lever and throwout lever.
Removal: Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect throwout linkage and remove throwout bearing. Remove clutch cover screws (release tension evenly), lower assembly out of car.

ELECTROMATIC CLUTCH

Electromatic Clutch: Vacuum type clutch actuation with electrical control. Optional equipment.
See Clutch Section for complete data.

TRANSMISSION

Own Make. Helical gear, constant-mesh, synchro-mesh (Second & High), constant-mesh (Low). Sliding spur gear (Reverse). Low & Second speed gears are ball bearing mounted.
See Transmission Section for complete data.
Transmission Control: Steering column type.
See Transmission Section for complete data.
Removal: Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, front universal (block driveshaft up against floor pan). Support rear of engine with jack and unbolt cross member (at frame ends and transmission), Disconnect clutch retractor spring and fore-and-aft restraint rod. Take out transmission-to-housing mounting screws, remove transmission.

OVERDRIVE

1948 WARNER R9

►*INSTALLATION OF R11 OVERDRIVE (To replace original R9 Assembly)—See "Warner R11 Overdrive" in Transmission Section for complete data.*
Warner Model AS2-R9 (Eight), AS1-R9A (Super Eight). Optl. equipment used with Packard transmission. Overdrive is solenoid operated type no centrifugal pawls) with Governor Control and throttle operated "kick-down".
See Transmission Section for complete data.
►**Overdrive Short-Circuit Correction**—Disconnect Plug under car (as shown in wiring diagram) discontinued on Late 1948 Cars to avoid short circuits at this point due to water and corrosion. On earlier cars Plug can be removed and wires spliced, soldered, taped and shellacked to prevent short circuits.
►**Overdrive Safety Switch**—Mounted at lower end of steering column and operated by first and reverse shift lever when in reverse position to open circuit between battery and overdrive relay (see wiring diagram). Switch has two extra terminals to operate back-up light. **1947 & Earlier Clipper Models**—To prevent overdrive lock-up when car shifted to reverse, install Safety Switch (Kit No. 394484).
Overdrive Indicator Light—Next to high beam indicator under speedometer. Lights when overdrive ready to engage (22 MPH and up), goes out when accelerator pedal released to engage overdrive.
Overdrive Relay—D-R 1116823, Packard 347943.
Throttle Kick-down Switch—Packard No. 347496.
Safety (Rev. Lock-out) Switch—Packard 403303.
Lock-out Switch—Packard No. 354820.
Removal: See R11 Overdrive (following).

OVERDRIVE

1949 WARNER R11

Warner Model (Eight) AS3-R11, (Super Eight) AS4-R11. Optl. equipment used with Packard transmission. New simplified solenoid operated overdrive
►**Series 2200 Note**—Started part production with Engine Serial No. G-272006 (Eight), G-424978 (Super 8). Started full production with Engine Serial No. G-285157 (Eight), G-427710 (Super Eight).
See Transmission Section for complete data.
►**Early R11 Overdrive Failure to Engage Correction**—*See "Warner R11 Overdrive" in Transmission Section.*
Overdrive Solenoid—Packard No. 403942.
Governor—Packard No. 418447.
Control Relay—Packard No. 403940.
Kick-down Switch—Packard No. 403945.
Lock-out Switch—Packard No. 354820.
Removal: Disconnect control cable and all leads to solenoid and governor. Free mounting at rear of overdrive case. Then remove overdrive and transmission (see Transmission Removal above).

UNIVERSALS

Mechanics Type 3CR (Type 3C used at front on Long WB. Cars with 3 universals). Needle bearing.
See Universals Section for complete data.
►CAUTION—Rear universal flange nut controls rear axle pinion bearing pre-load which **must be adjusted whenever nut is loosened.** *See Packard Rear Axle article in Rear Axle Section for complete data.*

REAR AXLE

Own Make. Semi-floating, hypoid gear type with Hotchkiss Drive.
Model 2222 (141" WB. 7-Pass. Sedan) Note—Axle is Custom 8 type with Ring Gear Idler Roller.
See Rear Axle Section for complete data.
►*REAR AXLE OIL SEAL LEAKAGE CORRECTION—See "Packard Rear Axle" in Rear Axle Section for complete data.*
Ratio—Std.: 3.9-1 (39-10). OD.: 4.1-1 (41-10).
NOTE—Some cars without Overdrive use 4.1-1 ratio.
2222 NOTE—Std. Ratio 4.09-1 (45-11).
Backlash—.004-.006". Screw adjustment.
Removal: Remove axle shafts (see Removal below). Disconnect rear universal (wire trunnions), wire or prop propeller shaft up against floor pan with 2 x 4 inserted inside frame X-member. Drain differential, replace drain plug. Clean off housing, take off carrier lock nuts, lift carrier out.
Axle Shaft Removal: Remove wheel, brake drum (use screw type puller KMO-476—do not use knock-out type puller or thrust block may be damaged). Disconnect brake line at wheel cylinder. Remove nuts at oil seal guard and take off seal guard, gasket, retainer, oil seal, brake support plate, and bearing shims. Remove axle shaft and bearing using Puller
Wheel Bearing Adjustment: Endplay controlled by shims between flanged end of housing and brake backing plate. Add or remove shims (furnished .005", .007", .020" thick) at one wheel for .050" or under, at both wheels if over .050" to secure .004-.007" endplay.
Endplay—.004-.007".

SHOCK ABSORBERS

Delco Model 1946-J, K (front), Model 1040-V (rear). Double acting (front), direct acting (rear).
Fifth Shock Absorber (Stabilizer): Monroe 373935. Direct acting, hydraulic (built-in rear stabilizer).

FRONT SUSPENSION

Front Suspension: Packard Clipper Safe-T-Flex, independent, linked parallelogram type with coil springs and double acting shock absorbers.
See Front Suspension Section for complete data.
Kingpin Inclination—5°50' crosswise.
Caster—Neg. 1° ± ½°. Eccentric adjustment.
Camber—0° ± ¼°. Eccentric adjustment.
Toe In—0" (plus 1/16", minus 0"). Adjust by turning adjuster at outer end of each tie rod equally.

STEERING GEAR

Packard—Gemmer Model 335—"3-tooth" Worm-and-Roller type with "push-pull" adjustment.
See Steering Gear Section for complete data.

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—Front 1 1/16" (1" on 7-pass.), Rear 15/16".
Drums—12" centrifuse type.
Lining—Marshall 2201H-8 (primary shoe), Marshall B-50 (secondary). Width 1¾". Thickness 3/16". Length per shoe 11½" (primary), 13" (secondary).
Model 2222 7-Pass. Note—Lining width 2¼" all shoes except 2" on rear wheel secondary shoe.
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 Tops, Windows & Front Seat: Hydro-Lectric type (hydraulic actuation with motor-driven pump supplying oil under pressure for power cylinders).
See Miscellaneous Section for complete data.

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Vacuum Advance

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	7"
1°	2°	8⅝"
3°	6°	12"
4°	8°	13½"
5½°	11°	16"

Distributor Removal: On left side of engine. Disconnect vacuum line, take out hold-down screw, lift off.

IGNITION

Std. Setting ..... **6° BTDC.**
NOTE—Modify this setting for special fuel and altitude conditions. See Fuel Compensator Setting.

Vibration Dampener Mark—"#1UP.DC" with fifteen 1° graduations ahead of mark.

Timing—Set Fuel Compensator at "0". With #1 piston on compression, turn engine over until piston reaches firing position with correct mark on dampener in line with pointer on chain case cover (see table above). Loosen advance arm clamp bolt, rotate distributor until contacts begin to open, tighten clamp bolt. Check spark plug connections (see diagram), see that rotor opposite #1 segment in cap. Check Fuel Compensator Setting.

Timing (with Neon Timing Light)—Mark 6th line ahead of "#1UP.DC" mark on vibration dampener with white paint, clip timing light to #1 spark plug. Idle engine below 500 RPM., adjust distributor (as directed above) until mark lines up with pointer.

Fuel Compensator Setting—Should be set for slight ping when accelerating with wide open throttle. To adjust, loosen thumbnut, rotate distributor counterclockwise (if ping too severe), clockwise (if no ping noted), tighten thumbnut and recheck performance.

CARBURETOR

Carter WDO, No. 531S (Early), 531SA (Later). 1¼" Dual barrel downdraft type with Carter Climatic Control.

Casting No. on Flange—377 (for 531S), 564 (531SA). *See Carburetor Section for complete data.*

►**Production Change 531S to 531SA.** New metering rods used in 531SA carburetors for smoother performance during warm up and slow speeds (and improved gas mileage). Can be installed in 531S carburetors. *See Carter WDO Vacumeter Carburetor article 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: Carter Dual (WDO) Carburetor type.
See Carburetion Equipment Section for complete data.
Setting—Adjust fast idle screw for .023-.028" throttle opening (Gauge T109-189) with choke closed.

Automatic Choke: Carter Climatic Control (Dual Carburetors).
See Carburetion Equipment Section for complete data.
Setting—Centered (at index).

CARB. EQUIPMENT

Fuel Pump (Fuel-&-Vacuum): AC Type AH. No. 1539116.
Replacement Pump—AC No. 9116.
Pressure—4-4¾ lbs.
See Carburetion Equipment Section for complete data.

Gasoline Gauge: King-Seeley Electric.
Dash Unit—K-S No. 41635.
Tank Unit—K-S No. 41678.
See Carburetion Equipment Section for complete data.

Air Cleaner (std.—oil bath): AC No. 1542318.
Element—AC No. 14.
Servicing (oil bath type)—Clean filter element, clean and refill oil reservoir with SAE No. 50 engine oil (Summer), No. 30 (Winter) to level of indicator line on case (approx. 1 pint) every 5000 miles or oftener if required.

BATTERY

Auto-Lite Type PN-17ZR. 6 Volt, 17 Plate, 120 Ampere Hour Capacity (20 hour rate).

Starting Capacity—138 amperes for 20 minutes.

Zero Capacity—300 amperes for 4.1 minutes. Five second voltage—4.3 volts.

Grounded Terminal—Positive (+) to frame.

Dimensions—Length 19¼". Width 4". H. 8 29/32".

Location—On left side in engine compartment.

STARTER

Auto-Lite Model MAX-4052. Armature MAW-2069.
Drive—Overrunning clutch (solenoid pinion shift) through reduction gears.
Rotation—Clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—200-250 amperes.

Performance Data

Torque	RPM①	Volts	Amperes
0 ft. lbs.	2560	5.5	70
13.0 "	Lock	2.0	410

①—Pinion Shaft RPM. (reduction gear drive).

Removal: On left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch: Auto-Lite Model SS-4205 Solenoid Switch on starter controlled by Carter Car Starter No. 192-11U on carburetor (accelerator pedal control).
See Electrical Equipment Section for complete data.

GENERATOR

Auto-Lite GDZ-4801G or GDZ-4801V. Arm. GDZ-2006F.
2 brush with voltage and current regulation.
Maximum Charging Rate—35 amperes, 8.0 volts.
Charging Rate Adjustment—None. See Regulator.

Performance Data

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
10	6.85	1200	10	6.85	1290
20	7.3	1480	20	7.3	1590
30	7.8	1760	30	7.8	1980
35①	8.0	1900	35	8.0	2250

①—Current regulator setting. See Regulator data.

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 strap screw and mounting bolts.

Belt Adjustment: ¼" belt deflection between fan and generator. Loosen adjusting strap screw, pry generator out for ¼" setting, tighten screw.

REGULATOR

Auto-Lite VRP-4402A or B. Voltage-current type.
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, 920 RPM. (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.
Checking (without breaking seals) & Adjustment—*See Electrical Equipment Section for complete data.*
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 for complete data.*
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

LIGHTING

Headlamps: Hall "Sealed Beam" type.
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—Left hand indicator below speedometer. Lighted when Upper Beam "on".

Direction Signal: Optl. *See Electrical Equip. Section.*
Direction Signal Indicator—Below speedometer. Flashes when Signal in use.

Switches

Lighting—Packard No. 393563.
Beam Selector—Delco-Remy No. 1997008.
Instrument—Packard No. 393565.
Map Light—Packard No. 396675.
Courtesy Light (Door Switch)—Packard 393517.
Dome Light—Packard No. 399289.

MISC. ELECTRICAL

CIRCUIT BREAKERS: Vibrating, thermostatic types. Packard No. 410047 (Lighting), 393746 (Accy.).
Lighting—On lighting switch, 30 ampere.
Accessory (Stop & Body Lights)—Behind instrument panel above Clock. 30 ampere.
Hydro-Lectric Power (Convertible)—On engine side of dash on pump upper bracket.

FUSES: Clock—SFE 2 ampere in lead near Clock.
Direction Signal—SFE 9 ampere. In Flasher feed wire above speedometer.
Overdrive—SFE 30 ampere. In lead from Starter to Overdrive Safety Switch.
Electromatic Clutch—9 ampere. In lead from Ignition Switch to Electromatic Switch.
Radio—SFE 14 ampere in cable at left of radio.
Heater—SFE 30 ampere. In cable under clock.

HORNS: Sparton. Dual horns operated by relay.
Horn Current—22-25 amperes.

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

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OVERDRIVE

1948 WARNER R9

Warner Model AS1-R9A. Optl. equipment used with Packard Transmission. Overdrive is solenoid operated type (no centrifugal pawls) with Governor Control and throttle operated "kick-down". A new Overdrive Safety Switch is used.
See Transmission Section for complete data.

►**Overdrive Short-Circuit Correction**—Disconnect Plug under car (as shown in wiring diagram) discontinued on Late 1948 Cars to avoid short circuits at this point due to water and corrosion. On earlier cars Plug can be removed and wires spliced, soldered, taped and coated with shellac to prevent short circuits.

►**Overdrive Safety Switch**—Mounted at lower end of steering column and operated by first and reverse shift lever when in reverse position to open circuit between battery and overdrive relay (see wiring diagram). Switch has two extra terminals to operate back-up light. **1947 & Earlier Clipper Models**—To prevent overdrive lock-up when car shifted to reverse, this Safety Switch (Kit No. 394484) can be installed.

Overdrive Indicator Light—Next to high beam indicator under speedometer. Lights when overdrive ready to engage (22 MPH and up), goes out when accelerator pedal released to engage overdrive.

Overdrive Relay—D-R 1116823, Packard 347943.
Throttle Kick-down Switch—Packard No. 347496.
Safety (Rev. Lock-out) Switch—Packard 403303.
Lock-out Switch—Packard No. 354820.

Removal: Disconnect control cable and all leads to solenoid and governor. Free mounting at rear of overdrive case. Then remove overdrive and transmission (see Transmission Removal above).

OVERDRIVE

1949 WARNER R11

►*INSTALLATION OF R11 OVERDRIVE (To replace original R9 Assembly)—See "Warner R11 Overdrive" in Transmission Section for complete data.*
Warner Model AS4-R11. Optl. equipment used with Packard transmission. New simplified solenoid operated overdrive.

►**Series 2200 Note**—Started part production with Engine Serial No. G-610359. Started full production with Engine Serial No. G-611500.
See Transmission Section for complete data.

►**Early R11 Overdrive Failure to Engage Correction**—*See "Warner R11 Overdrive" in Transmission Section.*
Overdrive Solenoid—Packard No. 403942.
Governor—Packard No. 418447.
Control Relay—Packard No. 403940.
Kick-down Switch—Packard No. 403945.
Lock-out Switch—Packard No. 354820.

Removal: Disconnect control cable and all leads to solenoid and governor. Free mounting at rear of overdrive case. Then remove overdrive and transmission (see Transmission Removal above).

UNIVERSALS

Mechanics Type 3CR (Type 3C used at front on Long Wheelbase Cars with 3 Universals). Needle bearing type.

NOTE—One-piece shaft used on cars without Overdrive.
See Universals Section for complete data.

►CAUTION—Rear universal flange nut controls rear axle pinion bearing pre-load which **must be adjusted whenever nut is loosened.** *See Packard Rear Axle article in Rear Axle Section for complete data.*

REAR AXLE

Own Make. Semi-floating, hypoid gear type with Hotchkiss drive and Ring Gear Idler Roller.
See Rear Axle Section for complete data.

►*REAR AXLE OIL SEAL LEAKAGE CORRECTION—See "Packard Rear Axle" in Rear Axle Section for complete data.*

Ratio—Std. 3.92-1 (47-12). OD.: 4.09-1 (45-11).
NOTE—2226 (148" WB.) Std. Ratio 4.09-1 (45-11).

Backlash—.004-.006". Screw adjustment.

Removal: Remove axle shafts (see Removal below). Disconnect rear universal (wire trunnions), wire or prop propeller shaft up against floor pan with 2 x 4 inserted inside frame X-member. Drain differential, replace drain plug. Clean off housing, take off carrier lock nuts, lift carrier out.

Axle Shaft Removal: Remove wheel, brake drum (use screw type puller KMO-476—do not use knock-out type puller or thrust block may be damaged). Disconnect brake line at wheel cylinder. Remove nuts at oil seal guard and take off seal guard, gasket, retainer, oil seal, brake support plate, and bearing shims. Remove axle shaft and bearing using Puller J-2552 (do not drag shaft on inner oil seal). Use Tool J-943-B to remove inner oil seal.

Wheel Bearing Adjustment: Endplay controlled by shims between flanged end of housing and brake backing plate. Add or remove shims (furnished .005", .007", .020" thick) at one wheel for .050" or under, at both wheels if over .050" to secure .004-.007" endplay.
Endplay—.004-.007".

SHOCK ABSORBERS

Delco No. 1946-J, K (front), Monroe No. 18096 (rear). Hydraulic, double acting (front), direct (rear).
Fifth Shock Absorber (Stabilizer): Monroe 373935. Direct acting, hydraulic (built-in rear stabilizer).

FRONT SUSPENSION

Front Suspension: Packard Clipper Safe-T-Flex, independent, linked parallelogram type with coil springs and double acting shock absorbers.
See Front Suspension Section for complete data.
Kingpin Inclination—5°50′ crosswise.
Caster—Neg. 2° ± ½°. Eccentric adjustment.
Camber—0° ± ¼°. Eccentric adjustment.
Toe In—0" (plus 1/16", minus 0"). Adjust by turning adjuster at outer end of each tie rod equally.

STEERING GEAR

Packard—Gemmer Model 335—"3-tooth" Worm-and-Roller type with "push-pull" adjustment. See Gemmer.
See Steering Gear Section for complete data.

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—Front 1". Rear 15/16". For Model 2226 7-Pass. 1¼" front, 1⅛" rear.
Lining—Marshall 2201H-8 (primary shoe), Marshall B-50 (secondary). Width 2¼" (front wheel), 2" (rear). Length per shoe 11½" (primary), 13" (secondary). Thickness 3/16".
Model 2226 7-Pass. Note—Marshall 9017 (secondary). All shoes 13" long, 2½" wide.
Clearance—.015" at both ends of secondary shoe
Hand Brake: See Service Brakes above.

MISC. MECHANICAL

Power Operated Convertible Tops, Windows & Front Seat: Hydro-Lectric type (hydraulic actuation with motor-driven pump supplying oil under pressure for power cylinders).
See Miscellaneous Section for complete data.

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Distributor Removal: On left side of engine. Disconnect vacuum line, take out hold-down plate screw, lift off.

IGNITION

DELCO-REMY

IGNITION SWITCH: Mitchellock Type 24.

COIL: Delco-Remy No. 1115376.
Location—Left side of engine above distributor.
Ignition Current—2.75 amperes idling, 4.5 stopped.

CONDENSER: Delco-Remy Part No. 1869704.
Capacity—.20-.25 microfarad.

DISTRIBUTOR: Delco-Remy Model 1110811. Automatic advance type with Vacuum Spark Control and Fuel Compensator.
Breaker Gap—.017". Limits .013-.018".
Cam Angle—Test limits with .016" gap—21-30°.
See "Delco-Remy Cam Angle" in Electrical Equipment Section.
Breaker Arm Spring Tension—17-20 ounces.
Rotation—Counter-clockwise viewed from above.

Automatic Advance (Delco-Remy)

Degrees	Distr. R.P.M.	Degrees	Eng. R.P.M.
Start	300	2	600
4	600	8	1200
9	1600	18	3200

Fuel Compensator: 10° advance or retard adjustment at distributor. See Ignition Timing.

Vacuum Spark Control: Delco-Remy 1116041. Integral type mounted on distributor and 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 in unit. Plunger Travel—5/32" max.

Vacuum Advance (Delco-Remy)

Distr. Degrees	Eng. Degrees	Vacuum (" of HG)
Start	0°	5-7"
7°	14°	13.0-15.0"

Distributor Removal: Same as for Auto-Lite (above)

IGNITION TIMING

Std. Setting ..... **6° BTDC.**
NOTE—Modify this setting for special fuel and altitude conditions. See Fuel Compensator Setting.
Vibration Dampener Mark—"#1UP.DC" with fifteen 1° graduations ahead of mark.

Timing—With #1 piston on compression, turn engine over until piston reaches firing position with correct mark on dampener in line with pointer on chain case cover, (see table above). Loosen vacuum unit link screw in distributor quadrant. (Auto-Lite distributors), or hold-down screw in advance arm (Delco-Remy distributors), rotate distributor until contacts begin to open, tighten serew.

Timing (with Neon Timing Light)—Mark 6th line ahead of "#1UP.DC" mark on vibration dampener with white paint, clip timing light to #1 spark plug. Idle engine below 600 RPM., adjust distributor (as directed above) until mark lines up with pointer.
Fuel Compensator Setting—Should be set for slight ping when accelerating engine with wide open throttle. To adjust, loosen vacuum unit link screw in distributor quadrant (Auto-Lite Distributors), advance arm hold-down screw (Delco-Remy Distributors), rotate distributor one graduation at a time counter-clockwise (if ping too severe), clockwise (if no ping), until correct performance secured.

CARBURETOR

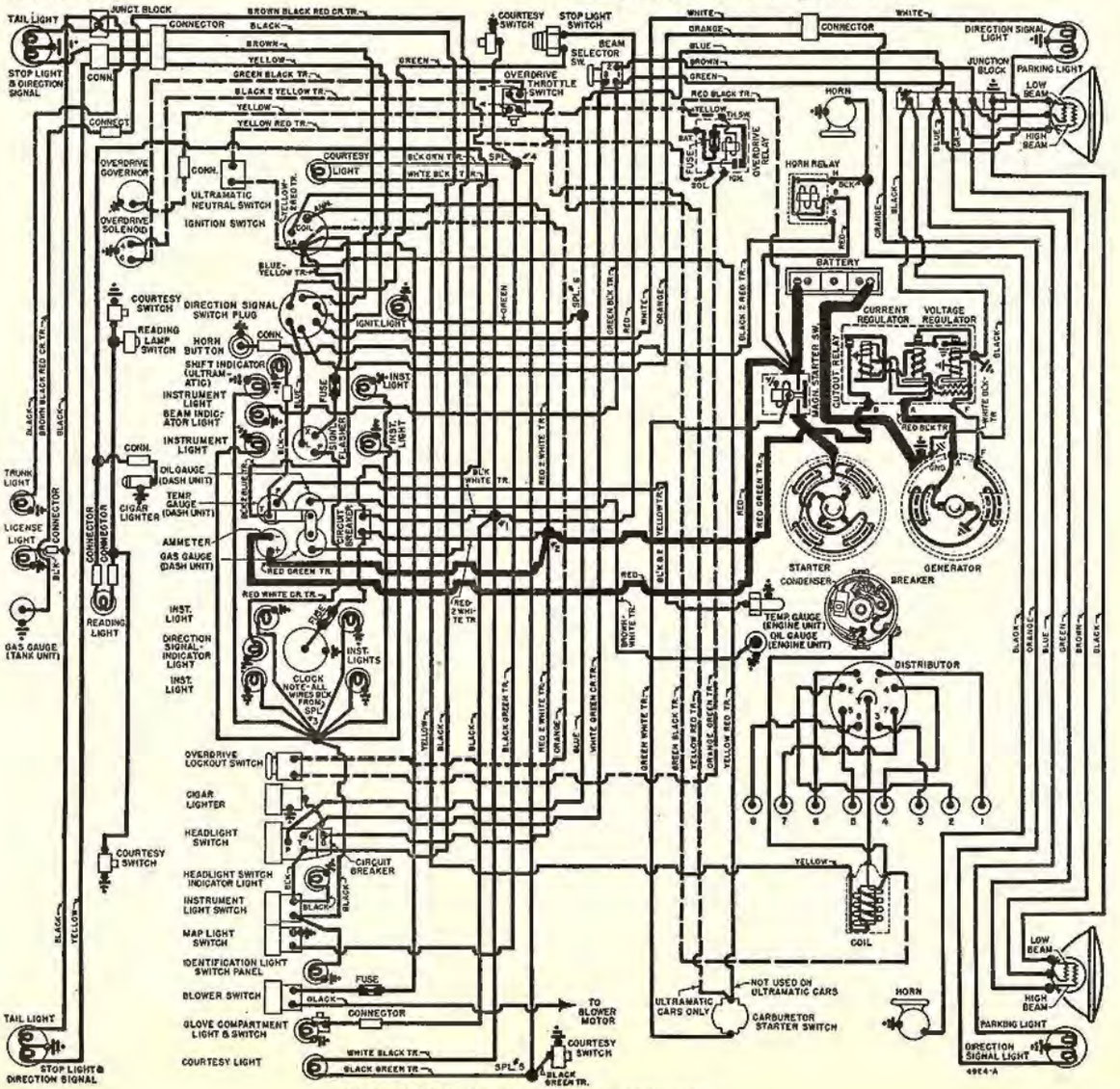
Eight (First Cars).....**Carter WDO, No. 644SA.**
Eight (Later Cars).....**Carter WGD, No. 728S & SA**
Super Eight.....**Carter WDO, No. 643SA.**
1¼" dual barrel downdraft types with Carter Climatic Control.
Casting No. on Flange—(WDO) 561, (WGD) 615.
See Carburetor Section for complete data.

Settings (Idle Setting, Float Level, and Accelerating Pump): *See Tune-Up data.*
►**WGD Carburetor Jet Production Changes**—*See Carter "WGD" Carburetor in Carburetor Section.*
Metering Rods & Jets—*See Carter Jet Table in Carburetor Section.*

Fast Idle (WDO: Carter Dual (WDO) Carburetor.
See Carburetion Equipment Section for complete data.
Setting—.026" (643SA), .020" (644SA) throttle opening with choke valve closed. Adjust by turning fast idle screw on high step of fast idle cam.

Fast Idle (WGD): Carter Dual (WGD) Carburetor.
See Carburetion Equipment Section for complete data.
Setting—.026" throttle opening with choke valve closed (throttle must be opened first). Adjust by bending choke connector rod at lower angle.

Automatic Choke: Carter Climatic Control (Dual Carburetors).
See Carburetion Equipment Section for complete data.
Setting—(WDO) Centered. (WGD 728S) 2½ points lean. (WGD 728SA) 2 points lean.



CARS WITH DELCO-REMY EQUIPMENT

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FUSES: Clock—SFE 3 ampere in lead below Clock.
Direction Signal—SFE 9 ampere. In Flasher feed wire above Ash Tray.
Overdrive—SFE 30 ampere. On Overdrive Relay (at BAT terminal) on engine side of dash.
Electromatic Clutch—9 ampere. In lead from Ignition Switch to Electromatic Clutch Switch.
Heater—SFE 30 ampere. In cable near Ign. Switch.

HORNS: Sparton. Dual horns operated by relay.
Horn Current—22-25 amperes.

Horn Relay: Delco-Remy No. 1116775.
Contacts Close—2.75-4.0 volts (set to 3.5 volts).
Contact Gap—.027". **Air Gap** .014" (contacts closed).

ENGINE

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

	Eight	Super 8
Bore	3½"①	3½"①
Stroke	3¾"	4¼"
Displacement	288 cu. ins.	327 cu. ins.
Rated HP.	39.2	39.2
Developed HP.	135 at 3600	150 at 3600

Compression Ratio—7.0-1 std. cast iron head.
Compression & Vacuum Reading—*See Tune-Up data.*
①—*For Original Bore Sizes, see Packard Special Data.*
►*.020" OVERSIZE BORE ENGINES: Marked by star following engine number.*
►*HYDRAULIC VALVE LIFTERS: On Super 8 Engines marked by "F" following engine number.*

OIL PAN REMOVAL: *See Packard Special Data.*

TIGHTENING TORQUES: *See Packard Special Data.*

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

PISTONS: Aluminum alloy, autothermic strut type. *Original Piston Sizes & Markings, See Packard Special Data.*
Length—3⅞".
Weight—19½ ozs. (stripped), 25½ (with rings & pin)
►**Cyl. Bore Taper Note**—Car manufacturer recommends cylinders be re-bored and new pistons installed if cylinder taper exceeds .007-.010". If necessary, new rings only can be installed (without reboring) for taper up to .014".
Removal—Pistons and rods removed from above.
Clearance—.0005-.001". See Fitting New Pistons.
►**Piston Skirt Expander Note**—Car manufacturer recommends skirt expanders be installed if cylinder diameter over .006" greater than piston skirt diameter (measured alongside upper end of piston skirt slot).

Replacement Pistons: *See Packard Special Data.*
NOTE—Check ring grooves for wear by installing new piston ring in groove—if .006" feeler can be inserted 1/16", wear excessive and piston should be replaced. Check top groove when testing.

Fitting New Pistons: Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
NOTE—Piston should hold in any portion of bore of own weight, but should move when one or two finger pressure applied to piston with cyl. bore vertical.

Install Pistons: Slot toward camshaft.

PISTON RINGS: Two compression rings (No. 200 top groove, No. 200 second groove), one oil control ring (No. 85) per piston, all above pin. Oil ring groove has twelve 5/32" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. (#1, 2)	.0930-.0935"	.0054-.0233"	.0025-.003"
Oil (#3)	.186-.1865"	.0054-.0213"	.0025-.003"

Installing Rings—End gaps must be between pin holes with #2 ring on same side as skirt slot, #1 and #3 ring on side opposite slot.
Replacement Rings: Std., .020", .030", .040" oversize.

PISTON PIN Diameter—7/8". **Length**—3 1/64".
Floating type retained by lock ring at each end. Split type bushing used in upper end of rod.
Pin Fit in Piston—Palm push fit with piston at 160°F. (heat piston in water only).
Pin Fit in Rod Bushing—Finger push fit at 70°F.
Piston Pin (Connecting Rod) Bushing Installation—*See "Piston Pins" in Packard Special Data.*

Replacement Pins: Std. and .003", .006" oversize.

CONNECTING ROD: Length 7 15/16" (8), 7 11/16" (Super 8).
Weight—35.8 ozs. (Eight), 35.4 ozs. (Super 8).
Crankpin Journal Diameter—2.250".
Lower Bearing—Shimless, precision, steel backed, Moraine Durex or Federal Mogul H-24.
Clearance—.0005-.0025". **Endplay**—.003-.011".

Bearing Adjustment: None (no shims). Replace bearings. Self-locking nuts used on cap bolts (tighten to 60-65 ft. lbs.).

Replacement Bearings: Std., .001", .002", .020" US.

Installing Rods: Oil squirt hole toward camshaft.

CRANKSHAFT: 5 bearing type with integral counterweights.
Vibration Dampener—Houde with Silicone fluid (8), Rubber Friction Disc (Super 8).
Dampener Removal Note—Use a Puller Tool No. J-2582 for Friction Disc Dampeners, or J-2636 for Fluid type Dampeners.
Journal Diameter—2.7465".
Bearings—Interchangeable, shimless, precision, steel-backed Moraine Durex or Federal Mogul H-24.
Clearance—.001-.003".

Bearing Adjustment: None (no shims). Replace bearings (upper halves can be rotated in and out).

Replacement Bearings: Std., .001", .002", .020" US.

Crankshaft Front Oil Seal: *See "Crankshaft & Main Bearings" in Packard Special Data.*

End Thrust: At #3 bearing. **Endplay**—.0035-.0085".

CAMSHAFT: 5 bearing. Non-adjustable chain drive.
Bearings—Steel-backed, babbitt-lined bushings.
Clearance—.001-.003".

End Thrust: Taken by thrust plate in back of camshaft sprocket. **Endplay**—.004-.006".

Timing Chain: Morse. Width 1¼". Pitch .375". Length 21¾" or 58 links.

Camshaft Setting: Install chain and sprockets together with "0" marks on sprockets adjacent and in line with straightedge across shaft centers.

VALVES:	Head Diameter	Stem Diameter	Length
Intake	1 43/64"	.3417"	5 7/8"
Exhaust	1 7/16"	.3398"	5 7/8"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.342"	.002"
Exhaust	45°	.342"	.004"

Valve Guides: Lubrite coated. Pressed in block from above with upper end 31/32" below top of block. Use Valve Guide Driver and Depth Gauge No. J-2577—properly positions guides when gauge seats on block. Ream guides after installation with 11/32" (.3437") reamer. Upper end of exhaust guide counterbored.
Valve Guide Removal Note—If guides to be removed with tappets in engine, use Valve Guide Remover Tool J-2580 to drive guide down to just clear tappet (with tappet on heel of cam). Score guide with chisel inserted through valve ports, then break off lower end, finally drive remainder of guide out. If tappets out, guide can be driven down and out without breaking.

Valve Springs: Intake and exhaust springs interchangeable. Anti-rotation serrated cup washers installed on top of spring and seats in recess in block.

	Spring Pressure	Spring Length
Valve Closed	60-66 lbs.	1 3/4"
Valve Open	135-145 lbs.	1 13/32"

Valve Lifters (Conventional): Mushroom type. Remove from below. **(Hydraulic Lifters)**—Wilcox-Rich "Zero-lash" type hydraulic lifters (mushroom type). Removed from below with camshaft out of engine. *See "Wilcox-Rich Type" in Miscellaneous Section for complete data.*
Diameter—.6235-.6240". **Clearance**—.0003-.0012".
Replacement Lifters—.001", .002", .005" oversize. Use Tool S.T. 5144 (piloted in valve guide) and ream for .005" oversize lifters.
Valve Lifter Clearance Check when Grinding Valves—*See "Valve System" in Packard Special Data.*

VALVE TIMING

►**VALVE TAPPET CLEARANCE: (Eight & Early Super 8)**—.007" Intake, .010" Exhaust, Hot. **(Late Super 8)—If Engine Number Code has letter "F" following Engine Number, engine is equipped with Hydraulic Valve Lifters.**

Valve Timing: See Camshaft setting above.
Intake Valves—Open 15° BTDC .Close 45° ALDC.
Exhaust Valves—Open 50° BLDC. Close 9° ATDC.
Above figures for .01267" Intake, .015" Exhaust tappet clearance.

Valve Timing Check (Convtl.): With .01267" tappet clearance #1 intake valve should open with #1 piston 10° BTDC. with 10th graduation before top dead center mark "1UP.DC" on vibration dampener aligned with pointer. Reset tappet clearance .007" Hot.
CAUTION—If valve over 8° before or after this point in opening, camshaft setting incorrect.

Valve Timing Check (Hydraulic Lifters): Check by turning tappet plunger for No. 8 exhaust valve with fingers. Turn engine over until this valve fully open, turn engine further until valve nearly closed (plunger should not turn), continue turning engine while attempting to turn plunger, until plunger "breaks loose" or turns. This should be approx. 9° after top dead center—check at timing mark on vibration dampener.
CAUTION—If valve over 8° before or after this point in closing, camshaft setting incorrect.

LUBRICATION

Engine Oiling System: Pressure to main and connecting rod bearings, camshaft bearings, piston pins, valve lifters, and timing chain.
Crankcase Capacity—7 quarts.
Normal Oil Pressure—40 lbs. Normal Driving.
Oil Pressure Regulator—On oil pump cover. Not adjustable. Pressure regulator spring tension should be 14 lbs. ±2 ozs. at 1⅞".

Oil Pump: Gear Type. On right side of crankcase.
Oil Pump Installation—*See Packard Special Data.*

Oil Filter: Optl. Replace cartridge at 8000-10000 miles or when oil shows signs of being dirty.

Oil Pressure Gauge: King-Seeley Electric.
Dash Unit—K-S No. 41640.
Engine Unit—K-S No. 40767.
See Miscellaneous Section for complete data.

Crankcase Ventilation: Oil-wetted type filter element in oil filler cap air intake). Outlet pipe in valve compartment cover at rear.

COOLING

Cooling System: Pressure type with pressure relief valve in filler cap and fan belt driven pump.
Capacity—18 qts. (Eight), 19 qts. (Super 8), with ½ quart additional for heater and defroster.
Pressure Valve—AC 850005 Filler Cap. Opens 7 lbs.

Water Pump: Centrifugal, belt-driven, packless type.
See Water Pump Section for complete data.
Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat: In cylinder head outlet.
Setting (std.)—Starts to open 148-150°F.
Setting (Optl. High Reading)—Starts to open 157-165°F. or 175-184°F.

Temperature Gauge: King-Seeley Electric.
Dash Unit—K-S No. 41645.
Engine Unit—K-S No. 41035 (1949), 42550 (1950).
See Miscellaneous Section for complete data.

CLUTCH

Long Eight 10CF-TI, (Super Eight) 11CF-10½TI. Single plate, semi-centrifugal, dry disc type.
See Clutch Section for complete data.
Facings—Woven (U.S. Asbestos). Thickness .125". Inside Diameter (Eight) 6¾", (Super Eight) 7". Outside Diameter (Eight) 10", (Super Eight) 10½".

Pedal Adjustment: 1¼-1⅜" free travel. Adjusting nut on rod at throwout lever.

►**Clutch Pedal Over-Center Spring:** New adjustable type. *See "Clutch Notes" in Packard Special Data for adjustment.*

Removal: Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect throwout linkage and remove throwout bearing. Remove clutch cover screws (release tension evenly), lower assembly out of car.

ELECTROMATIC CLUTCH

Electromatic Clutch: Vacuum type clutch actuation with electrical control. Optional equipment.
See Clutch Section for complete data.

TRANSMISSION

Own Make. Helical gear, constant-mesh, synchromesh (Second & High), constant-mesh (Low). Sliding spur gear (Reverse). Low & Second speed gears are ball bearing mounted.
See Transmission Section for complete data.

Transmission Control: Steering column type.
See Transmission Section for complete data.

Removal: Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, front universal (block driveshaft up against floor pan). Support rear of engine with jack and unbolt cross-member (at frame ends and transmission). Disconnect clutch retractor spring and fore-and-aft restraint rod. Take out transmission-to-housing mounting screws, remove transmission.

OVERDRIVE

Warner Model (Eight) AS3-R11, (Super Eight) AS4-R11. Optl. equipment used with Packard transmission. New simplified solenoid operated overdrive with Governor Control and throttle operated "kick-down".
See Transmission Section for complete data.

►**Early R11 Overdrive Failure to Engage Correction**—*See "Warner R11 Overdrive" in Transmission Section.*

Overdrive Solenoid—Packard No. 403942.
Governor—Packard No. 418447.
Control Relay—Packard No. 403940.
Kick-down Switch—Packard No. 403945.
Lock-out Switch—Packard No. 354820.

Removal: Disconnect control cable and all leads to solenoid and governor. Free mounting at rear of overdrive case. Then remove overdrive and transmission (see Transmission Removal above).

ULTRAMATIC DRIVE

OPTIONAL EQUIPMENT

Own Make. Torque Converter (with hydraulically operated Direct Speed Clutch) and hydraulically operated planetary unit with manual control.
See Transmission Section for complete data including Testing & Trouble Shooting.

►**Production Changes & Oil Leak Corrections**—*See "Ultramatic Drive" in Transmission Section.*

Linkage Adjustment on Ultramatic Drive Cars: *See Packard "Ultramatic Drive" in Transmission Section.*

Lubrication—Check fluid level every 1000 miles, drain and refill every 25,000 miles.
Recommended Fluid. Packard Ultramatic Drive or any Type "A" Automatic Transmission Fluid which has an AQ-ATF number embossed on container.
Capacity. Approximately 12 quarts.
Draining & Refilling. *See Packard "Ultramatic Drive" in Transmission Section.*
Checking Fluid Level. *CAUTION—Fluid must only be checked at normal operating temperatures and after engine has been idling at 800 RPM. for at least one minute with selector lever in "N" position.* Stop the engine, check level by removing dipstick from filler hole on left side of transmission (accessible from under car—release cap by turning ½ turn counter-clockwise). Add fluid as required to bring level up to FULL mark on dipstick.

Removal: *See "Packard Ultramatic Drive" in Transmission Section.*

UNIVERSALS

Mechanics 3CR or Spicer. Needle bearing types.
2301 Model (without Overdrive)—Use Spicer Number 1288-5101X universal joints front and rear.
NOTE—Cars without Overdrive use one-piece shaft.
See Universals Section for complete data.

►*CAUTION*—Rear universal flange nut controls rear axle pinion bearing pre-load which **must be adjusted whenever nut is loosened.** *See "Packard Rear Axle" in Rear Axle Section for complete data.*

REAR AXLE

Own Make. Semi-floating, hypoid gear type with Hotchkiss Drive.
Model 2322 (141" WB. 7 Pass. Sedan) Note—Axle is Custom 8 type with Ring Gear Idler Roller.
See Rear Axle Section for complete data.

Std. Ratios

Model	Std.	O.D. Cars	Ultramatic Cars
2301	3.9-1	4.1-1	3.9-1
2302, 2332	3.9-1	4.1-1	3.54-1
2322	4.09-1	4.36-1	3.92-1

Optl. Ratios

2301	4.1-1	4.3-1	4.1, 4.3-1
2302, 2332	4.1-1	——	3.9, 4.1-1

Backlash—.003-.005". Screw adjustment.

Removal: Remove axle shafts (see Removal below). Disconnect rear universal (wire trunnions), wire or prop propeller shaft up against floor pan with 2 x 4 inserted inside frame X-member. Drain differential, replace drain plug. Clean off housing, take off carrier lock nuts, lift carrier out.

Axle Shaft Removal: Remove wheel, brake drum (use screw type puller J-4153—do not use knock-out type puller or thrust block may be damaged). Disconnect brake line at wheel cylinder. Remove nuts at oil seal guard and take off seal guard, gasket, retainer, oil seal, brake support plate, and bearing shims. Remove axle shaft and bearing using Puller J-2552 (do not drag shaft on inner oil seal). Use Tool J-943-B to remove inner oil seal.

Wheel Bearing Adjustment: Endplay controlled by shims between flanged end of housing and brake backing plate. Add or remove shims (furnished .005", .007", .020" thick) at one wheel for .050" or under, at both wheels if over .050" to secure .004-.007" endplay.
Endplay—.004-.007".

SHOCK ABSORBERS

Delco Model 1946-J, K (front), Delco or Monroe (rear). Double acting (front), direct acting (rear).

Fifth Shock Absorber (Stabilizer) Super 8: Monroe direct acting, hydraulic (built-in rear stabilizer).

FRONT SUSPENSION

Front Suspension: Packard Clipper Safe-T-Flex, independent, linked parallelogram type with coil springs and double acting shock absorbers.
See Front Suspension Section for complete data.
Kingpin Inclination—5°50' crosswise.
Caster—Neg. 1° ± ½°. Eccentric adjustment.
Model 2322: Neg. 2° ± ½°.
Camber—0° ± ¼°. Eccentric adjustment.
Toe In—0" (plus 1/16", minus 0"). Adjust by turning adjuster at outer end of each tie rod equally.

STEERING GEAR

Packard—Gemmer Model 335. "3-tooth" Worm-and-Roller with "push-pull" adjustment. See Gemmer
See Steering Gear Section for complete data.

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—Diam. Front 1 1/16" (1" 7-Pass.), Rear wheels 15/16".
Drums—12" centrifuse type.
Lining—Marshall 4112 (primary shoe), Marshall 9051 (secondary). Width 1 3/4". Thickness 3/16". Length per shoe 11½" (primary), 13" (secondary).
Model 2322 7-Pass. Note—Lining width 2¼" front wheel shoes, 2" rear wheel shoes.
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 Tops, Windows & Front Seat: Hydro-Lectric type (hydraulic actuation with motor-driven pump supplying oil under pressure for power cylinders).
See Miscellaneous Section for complete data.

Windshield Wiper: Vacuum type, cable operated.
See Miscellaneous Section for complete data.

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ENGINE

ENGINE SPECIFICATIONS: 8 cylinder, "L" head type.
Bore—3½"①. **Stroke**—4⅝".
①—*For Original Bore Sizes, See Packard Special Data.*
►*.020" OVERSIZE BORE ENGINES: Marked by star following engine number.*
Displacement—356 cubic inches. **Rated HP.**—39.2.
Developed Horsepower—160 at 3600 RPM.
Compression Ratio—7.0-1 std. cast iron head.
Compression & Vacuum Reading—*See Tune-Up data.*

OIL PAN REMOVAL: *See Packard Special Data.*

TIGHTENING TORQUES: *See Packard Special Data.*

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

PISTONS: Aluminum alloy, autothermic strut type. *Original Piston Sizes & Markings, see Packard Special Data.*
Length—3⅞".
Weight—19½ ozs. (stripped), 25½ (with rings & pin).
►**Cyl. Bore Taper Note**—Car manufacturer recommends cylinders be re-bored and new pistons installed if cylinder taper exceeds .007-.010". If necessary, new rings only can be installed (without reboring) for taper up to .014".
Removal—Pistons and rods removed from above.
Clearance—.0005-.001". See Fitting New Pistons.
►**Piston Skirt Expander Note**—Car manufacturer recommends skirt expanders be installed if cylinder diameter over .006" greater than piston skirt diameter (measured alongside upper end of piston skirt slot).

Replacement Pistons: *See Packard Special Data.*
NOTE—Check ring grooves for wear by installing new piston ring in groove—if .006" feeler can be inserted 1/16", wear excessive and piston should be replaced. Check top groove when testing.

Fitting New Pistons: Insert .0015" feeler ½" wide between piston and cylinder wall on side opposite slot. Pull to withdraw feeler should be 12-18 lbs.
NOTE—Piston should hold in any portion of bore of own weight, but should move when one or two finger pressure applied to piston with cyl. bore vertical.

Install Pistons: Slot toward camshaft.

PISTON RINGS: Two compression rings (No. 200 top and second groove), one oil control ring (No. 85) per piston, all above pin. Oil ring groove has twelve 5/32" oil drain holes.

Ring	Width	End Gap	Side Clearance
Comp. (#1, 2)	.0930-.0935"	.0054-.0233"	.0025-.003"
Oil (#3)	.186-.1865"	.0054-.0213"	.0025-.003"

Installing Rings—End gaps must be between pin holes with #2 ring on same side as skirt slot, #1 and #3 ring on side opposite slot.
Replacement Rings: Std., .020", .030", .040" oversize.

PISTON PIN Diameter—7/8". **Length**—3 1/64".
Floating type retained by lock ring at each end. Split type bushing used in upper end of rod.
Pin Fit in Piston—Palm push fit with piston at 160°F. (heat piston in water only).
Pin Fit in Rod Bushing—Finger push fit at 70°F.
Piston Pin (Connecting Rod) Bushing Installation—*See "Piston Pins" in Packard Special Data.*
Replacement Pins: Std. and .003", .006" oversize.

CONNECTING ROD: Length 9¼". **Weight**—38.9 ozs.
Crankpin Journal Diameter—2.250".
Lower Bearing—Shimless, precision, steel backed, Moraine Durex or Federal Mogul H-24.
Clearance—.0005-.003". **Endplay**—.004-.012".

Bearing Adjustment: None (no shims). Replace bearings. Self-locking nuts used on cap bolts (tighten to 60-65 ft. lbs.).

Replacement Bearings: Std., .001", .002", .020" US.

Installing Rods: Oil squirt hole toward camshaft.

CRANKSHAFT: 9 bearing with bolted-on counterweights. Rubber friction disc dampener on front end.
Journal Diameter—2.7465".
Bearings—Interchangeable, shimless, precision, steel-backed Moraine Durex or Federal Mogul H-24.
Clearance—.001-.003".

Bearing Adjustment: None (no shims). Replace bearings (upper halves can be rotated in and out).

Replacement Bearings: Std., .001", .002", .020" US.

Crankshaft Front Oil Seal: *See "Crankshaft & Main Bearings" in Packard Special Data.*

End Thrust: At #5 bearing. **Endplay**—.003-.008".

CAMSHAFT: 8 bearing. Non-adjustable chain drive.
Bearings—Steel-backed, babbitt-lined bushings.
Clearance—.001-.003".

End Thrust: Taken by thrust plate in back of camshaft sprocket. **Endplay**—.004-.006".

Timing Chain: Morse. Width 1¼". Pitch .375" (⅜"). Length 23¼" or 62 links.

Camshaft Setting: Install chain and sprockets together with "0" marks on sprockets adjacent and in line with straightedge across shaft centers.

VALVES:	Head Diameter	Stem Diameter	Length
Intake	1 43/64"	.3417"	6 7/32"
Exhaust	1 7/16"	.3398"	6 7/32"

	Seat Angle	Lift	Stem Clearance
Intake	30°	.342"	.002"
Exhaust	45°	.342"	.004"

Valve Guides: Lubrite coated. Pressed in block from above with upper end 31/32" below top of block. Use Valve Guide Driver and Depth Gauge No. J-2577—properly positions guides when gauge seats on block. Ream guides after installation with 11/32" (.3437") reamer. Upper end of exhaust guide counterbored.
Valve Guide Removal Note—If guides to be removed with tappets in engine, use Valve Guide Remover Tool J-2580 to drive guide down to just clear tappet (with tappet on heel of cam). Score guide with chisel inserted through valve ports, then break off lower end, finally drive remainder of guide out. If tappets out, guide can be driven down and out without breaking.

Valve Springs: Intake and exhaust springs interchangeable. Anti-rotation serrated cup washers installed on top of spring and seats in recess in block.

	Spring Pressure	Spring Length
Valve Closed	60-66 lbs.	1 3/4"
Valve Open	135-145 lbs.	1 13/32"

Valve Lifters: Wilcox-Rich "Zero-lash" type hydraulic lifters (mushroom type). Remove from below with camshaft out of engine.
Diameter—.7177-.7182". **Clearance**—.0002" selective.
See Miscellaneous Section for complete data.
Replacement Lifters—.001", .002", .005" oversize. Use Tool S.T. 5101 (piloted in valve guide) and ream for .005" oversize lifters.
Valve Lifter Clearance Check when Grinding Valves—*See "Valve System" in Packard Special Data.*

VALVE TIMING

Tappet Clearance: None in service (hydraulic type lifters). See Valve Lifters above.

Valve Timing: See Camshaft Setting above.
Intake Valves—Open 4° BTDC. Close 51° ALDC.
Exhaust Valves—Open 49° BLDC. Close 10° ATDC.
Valve Timing Check—Check by turning tappet plunger for No. 8 exhaust valve with fingers. Turn engine over until this valve fully open, turn engine further until valve nearly closed (plunger should not turn), continue turning engine while attempting to turn plunger, until plunger "breaks loose" or turns. This should be 10° after top dead center—check at timing mark on vibration dampener.
CAUTION—If valve over 8° before or after this point in closing, camshaft setting incorrect.

LUBRICATION

Engine Oiling System: Pressure to main and connecting rod bearings, camshaft bearings, piston pins, valve lifters, and timing chain. Oil pump mounted externally on right side of engine.
Crankcase Capacity—7 quarts.
Normal Oil Pressure—50 lbs. Normal Driving.
Oil Pressure Regulator—On oil pump cover. Not adjustable. Pressure regulator spring tension should be 17½-18½ lbs. at 1⅞".

Oil Pump: Gear type. On right side of crankcase.
Oil Pump Installation—*See Packard Special Data.*

Oil Pressure Gauge: King-Seeley Electric.
Dash Unit—K-S No. 41640.
Engine Unit—K-S No. 40767.
See Miscellaneous Section for complete data.

Crankcase Ventilation: Oil-wetted type filter element in oil filler cap, air intake). Outlet pipe in valve compartment cover at rear.
Servicing—Wash filter element in gasoline and reoil when changing oil (1000-2000 miles).

COOLING

Cooling System: Pressure type with pressure relief valve in filler cap and fan belt driven pump.
Capacity—19 qts. Add ½ qt. for heater.
Pressure Valve—AC No. 850005 pressure cap. Opens at 7 lbs.

Water Pump: Centrifugal, belt-driven, packless type.
See Water Pump Section for complete data.
Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat: In cylinder head outlet.
Setting (std.)—Starts to open 145-150°F.
Setting (Optl. High Reading)—Starts to open 160-165°F. or 175-180°F.

Temperature Gauge: King-Seeley Electric.
Dash Unit—K-S No. 41645.
Engine Unit—K-S 41085 (1949), 42550 (1950).
See Miscellaneous Section for complete data.

CLUTCH

Long Model 11CF-T1. Single plate, semi-centrifugal, dry disc type.
See Clutch Section for complete data.
Facings—Woven (U.S. Asbestos). Thickness .125". Inside Diameter 7". Outside Diameter 11".
Pedal Adjustment: 1¼-1⅜" free travel. Adjusting nut on rod at throwout lever.
►**Clutch Pedal Over-Center Spring:** New adjustable type. *See "Clutch Notes" in Packard Special Data for adjustment.*

Removal: Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect throwout linkage and remove throwout bearing. Remove clutch cover screws (release tension evenly), lower assembly out of car.

ELECTROMATIC CLUTCH

Electromatic Clutch: Vacuum type clutch actuation with electrical control. Optional equipment.
See Clutch Section for complete data.

TRANSMISSION

Own Make. Helical gear, constant-mesh, synchro-mesh (Second & High), constant-mesh (Low). Sliding spur gear (Reverse). Low & Second speed gears are ball bearing mounted.
See Transmission Section for complete data.

Transmission Control: Steering column type.
See Transmission Section for complete data.

Removal: Disconnect shifter rods, speedometer cable, hand brake cable at equalizer, engine ground strap, front universal (block driveshaft up against floor pan). Support rear of engine with jack and unbolt cross-member (at frame ends and transmission). Disconnect clutch retractor spring and fore-and-aft restraint rod. Take out transmission-to-housing mounting screws, remove transmission.

OVERDRIVE

Warner Model AS4-R11. Optl. equipment used with Packard transmission. New simplified solenoid operated overdrive with Governor Control and throttle operated "kick-down".
See Transmission Section for complete data.

►**Early R11 Overdrive Failure to Engage Correction**—*See "Warner R11 Overdrive" in Transmission Section.*
Overdrive Solenoid—Packard No. 403942.
Governor—Packard No. 418447.
Control Relay—Packard No. 403940.
Kick-down Switch—Packard No. 403945.
Lock-out Switch—Packard No. 354820.

Removal: Disconnect control cable and all leads to solenoid and governor. Free mounting at rear of overdrive case. Then remove overdrive and transmission (see Transmission Removal above).

ULTRAMATIC DRIVE

STD. EQUIPMENT ON SERIES 2306 & 2333

Own Make. Torque Converter (with hydraulically operated Direct Speed Clutch) and hydraulically operated planetary unit with manual control.
See Transmission Section for complete data including Testing & Trouble Shooting.

►**Production Changes & Oil Leak Corrections**—*See "Ultramatic Drive" in Transmission Section.*

Linkage Adjustment on Ultramatic Drive Cars: *See Packard "Ultramatic Drive" in Transmission Section.*

Lubrication—Check fluid level every 1000 miles, drain and refill every 25,000 miles.

Recommended Fluid. Packard Ultramatic Drive or any Type "A" Automatic Transmission Fluid which has an AQ-ATF number embossed on container.

Capacity. Approximately 12 quarts.

Draining & Refilling. *See Packard "Ultramatic Drive" in Transmission Section.*

Checking Fluid Level. ***CAUTION—Fluid must only be checked at normal operating temperatures and after engine has been idling at 800 RPM. for at least one minute with selector lever in "N" position.*** Stop the engine, check level by removing dipstick from filler hole on left side of transmission (accessible from under car—release cap by turning ½ turn counter-clockwise). Add fluid as required to bring level up to FULL mark on dipstick.

Removal: *See "Packard Ultramatic Drive" in Transmission Section.*

UNIVERSALS

Mechanics 3CR or Spicer. Needle bearing types.
NOTE—Cars without Overdrive use one-piece shaft.
See Universals Section for complete data.

►*CAUTION*—Rear universal flange nut controls rear axle pinion bearing pre-load which **must be adjusted whenever nut is loosened.** *See "Packard Rear Axle" in Rear Axle Section for complete data.*

REAR AXLE

Own Make. Semi-floating, hypoid gear type with Hotchkiss drive and Ring Gear Idler Roller.
See Rear Axle Section for complete data.

Ratios—As follows:

Std. Ratios

Model	Std.	O.D. Cars	Ultramatic Cars
2306, 2333	3.92-1	4.09-1	3.54-1
2313	4.54-1	4.7-1	———

Optl. Ratios

2306, 2333	4.09-1	———	3.92-1

Backlash—.004-.006". Screw adjustment.

Removal: Remove axle shafts (see Removal below). Disconnect rear universal (wire trunnions), wire or prop propeller shaft up against floor pan with 2 x 4 inserted inside frame X-member. Drain differential, replace drain plug. Clean off housing, take off carrier lock nuts, lift carrier out.

Axle Shaft Removal: Remove wheel, brake drum (use screw type puller J-4153—do not use knock-out type puller or thrust block may be damaged). Disconnect brake line at wheel cylinder. Remove nuts at oil seal guard and take off seal guard, gasket, retainer, oil seal, brake support plate, and bearing shims. Remove axle shaft and bearing using Puller J-2552 (do not drag shaft on inner oil seal). Use Tool J-943-B to remove inner oil seal.

Wheel Bearing Adjustment: Endplay controlled by shims between flanged end of housing and brake backing plate. Add or remove shims (furnished .005", .007", .020" thick) at one wheel for .050" or under, at both wheels if over .050" to secure .004-.007" endplay.
Endplay—.004-.007".

SHOCK ABSORBERS

Delco Model 1946-J, K (front), Delco or Monroe (rear). Double acting (front), direct acting (rear).

Fifth Shock Absorber (Stabilizer) Super 8: Monroe direct acting, hydraulic (built-in rear stabilizer).

FRONT SUSPENSION

Front Suspension: Packard Clipper Safe-T-Flex, independent, linked parallelogram type with coil springs and double acting shock absorbers.
See Front Suspension Section for complete data.
Kingpin Inclination—5°50' crosswise (2°30' on 156" wheelbase hearse).
Caster—Neg. 2° ± ½°. Eccentric adjustment.
Camber—0° ± ¼°. Eccentric adjustment.
Toe In—0" (plus 1/16", minus 0"). Adjust by turning adjuster at outer end of each tie rod equally.

STEERING GEAR

Packard—Gemmer Model 335. "3-tooth" Worm-and-Roller with "push-pull" adjustment. See Gemmer.
See Steering Gear Section for complete data.

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—Front 1⅛". Rear 1" (1⅛" 156" WB.).
Drums: 12" centrifuse type.
Lining—Marshall 4112 (primary shoe). Marshall 9051 (secondary). Width 2¼" (front wheel), 2" (rear). Length per shoe 11½" (primary), 13" (secondary). Thickness 3/16".
156" WB. Hearse Note—Bonded lining used. All shoes 13" long, 2½" wide, 3/16" thick.
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 Tops, Windows & Front Seat: Hydro-Lectric type (hydraulic actuation with motor-driven pump supplying oil under pressure for power cylinders).
See Miscellaneous Section for complete data.

Windshield Wiper: Vacuum type, cable operated.
See Miscellaneous Section for complete data.

CONTINUED FROM PRECEDING PAGE

Automatic Choke: Carter Climatic Control (Dual Carburetors).

Setting—1 Point rich.

See Carburetion Equipment Section for complete data.

CARB. EQUIPMENT

Air Cleaner: ("200") AC No. 1544276 Oil-wetted type (Std.), No. 1544277 Oil-bath type (Optl.).

("300" & "400") AC No. 1554277 Oil-bath type Std.

Servicing (oil wetted type)—Wash and re-oil filter element every 1000 to 2000 miles whenever crankcase oil is changed.

Servicing (oil bath type)—Clean filter element, clean and refill oil reservior with SAE 50 engine oil (Summer), No. 20 (Winter) to level of indicator line on case (Approx. 1 pint) every 5000 miles or oftener if required.

Fuel Pump: (Fuel & Vacuum)—AC type CV No. 1539606.

Replacement Pump—AC No. 9590.

Pressure—4-4¾ lbs.

See Carburetion Equipment Section for complete data.

GASOLINE GAUGE: King-Seeley "CV" (Constant Voltage) type with voltage regulator.

Dash Unit—("200") K-S No. 45654; ("300" & "400") K-S No. 45607.

Tank Unit—(All Models) K-S No. 44510.

See Carburetion Equipment Section for complete data.

BATTERY

("200" & "300") **Auto-Lite Type 2L-100, Willard SW-2L-100,** 6 volt 17 plate, 100 ampere hr. capacity (20 hr. rate).

("400") **Auto-Lite Type 2FH-120, Willard HW-2F-120,** 6 volt 17 plate, 120 ampere hr. capacity (20 hr. rate).

Grounded Terminal—Positive (+) to engine at water pump.

Location—Left side of engine compartment.

STARTER

AUTO-LITE

(200, 300)—**Auto-Lite MCL-6003 (Early), MCL-6113 (Later). (400) MCL-6114.**

Armature—Auto-Lite MCH-2021 (MCL-6003), MCH-2028 (MCL-6113), MCH-2070 (MCL-6114).

Drive—(MCL-6003) Bendix Drive No. A-1915, (MCL-6113) Bendix Drive No. A-1792 (MCL-6114) Solenoid pinion shift.

Rotation—Counter-clockwise at commutator end.

Cranking Engine—175-225 amperes.

Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data (Auto-Lite)

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4900	5.0	65
8.0 "	Lock	2.0	410

Removal: On left front face of flywheel housing. To remove, take out flange mounting screws.

Starting Switch: (200, 300) Auto-Lite SS-4017 Magnetic type switch (400) Auto-Lite SSX-4102 solenoid pinion shift and switch. Controlled by Carter Car Starter No. 192-11U on carburetor (accelerator pedal starting.

See Electrical Equipment Section for complete data.

Ultramatic Drive Starter Safety Switch—Packard No. 421319. On left side of transmission case, connected in starter control circuit so that starter operative only with lever in "N" Neutral or "P" Parking.

DELCO-REMY

Delco-Remy Model 1107943. Armature No. 1910938.

Drive—Outboard barrel Type Bendix No. A-1792.

Rotation—Counter-clockwise at commutator end.

Cranking Engine—175-225 amperes.

Brush Spring Tension—24-28 ozs.

Performance Data (Delco-Remy)

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	5500	5.7	65
16 "	Lock	3.0	600

Removal: Same as for Auto-Lite (above).

Starting Switch: Delco-Remy Model 1452 Magnetic Switch on starter, controlled by Carter Car Starter No. 192-11U on carburetor (accelerator pedal control).

See Electrical Equipment Section for complete data.

Ultramatic Drive Starter Safety Switch—Packard No. 421319. On left side of transmission case. Connected in starter control circuit so that starter operative only with lever in "N" Neutral or "P" Parking.

GENERATOR

AUTO-LITE

Auto-Lite GGW-6003A. Armature GGW-2006F. Two brush type with current and voltage regulation.

Maximum Charging Rate—See table below.

Charging Rate Adjustment—None. See Regulator.

Performance Data

Amperes	Volts	Cold—R.P.M.—Hot	
0	6.4	870-970	950-1050
40	8.0	1800-2000	2150-2350

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—35-53 ozs. (new brushes).

Field Current—1.3-1.5 amperes at 5.0 volts (70°F).

Motoring Current—3.9-4.5 amperes at 5.0 volts (70°F) with field terminal grounded to frame.

Generator Charge Indicator: Red light on right side of instrument cluster. Lights when ignition turned on, goes out when generator begins to charge battery.

Belt Adjustment: Loosen two generator bracket-to-generator screw nuts two or three turns. Loosen the generator strap to generator screw and loosen the generator to water pump screw. Place tool J-4714 over the head of the generator bracket front screw and rotate the tool clockwise until the arm of the tool contacts the edge of the generator drive end plate. Using a torque wrench with a 7/8" socket over the tool, rotate the wrench clockwise and move the generator outward until 15 ft. lb. torque is indicated on the scale. The adjusting strap to generator screw should be tightened to hold the generator in this position while maintaining the 15 ft. lbs. torque. Tighten all screws previously loosened.

Removal: Pivot mounted at left front of engine. To remove, disconnect leads, take out adjusting strap screw and pivot bolts.

DELCO-REMY

Delco-Remy No. 1102745. Armature No. 1912599. Two brush type with current and voltage regulation.

Maximum Charging Rates—See table below.

Charging Rate Adjustment—None. See Regulator.

Performance Data (Delco-Remy)

	Amperes	Volts	R.P.M.
Cold	40	8.0	1950

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—28 ozs.

Field Current—1.90-2.05 amperes at 6.0 volts.

Generator Charge Indicator: Red light on right side of instrument cluster. Lights when ignition turned on, goes out when generator begins to charge battery.

Removal & Belt Adjustment: Same as Auto-Lite (above).

REGULATOR

AUTO-LITE

Auto-Lite VRP-4402C for GGW-6003A Generator. Current voltage type.

See Electrical Equipment Section for complete data.

NOTE—Regulator cover sealed. Warranty void if seal 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 (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 seals) & Adjustment—

See Electrical Equipment Section for complete data.

Contact Gap—.012" min. (armature against stop pin).

Air Gap—.048-.052" with contacts just opening.

Current Regulator

Setting—39-41 amperes (marked '40' on cover).

Checking (without breaking seals) & Adjustment—

See Electrical Equipment Section for complete data.

Contact Gap—.012" min. (armature against stop pin).

Air Gap—.048-.052" with contacts just opening.

DELCO-REMY

Delco-Remy 1118360 for 1102745 Generator. Voltage & current type.

►*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 or High Voltage.

Cutout Relay

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

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

ENGINE

CONTINUED FROM PRECEDING PAGE

with lifters in engine, use Valve Guide Remover Tool J-2580 to drive guide down to just clear tappet (with tappet on heel of cam). Score guide with chisel through valve ports, then break off lower end, finally driving remainder of guide out. If lifters out, guide can be driven down and out without breaking.

Valve Springs: Intake and exhaust springs interchangeable. Anti-rotation serrated cup washers installed on top of spring and seats in recess in block.

	Spring Pressure	Spring Length
Valve Closed	60-66 lbs.	1 3/4"
Valve Open	135-145 lbs.	1 13/32"

Valve Lifters ("200" Engine): Conventional mushroom type. Remove from below with camshaft out.

Diameter—.6236-.6239". **Clearance**—.0001-.0016".

Replacement Lifters—.001", .002", .005" Oversize. Use Tool ST-5144 (piloted in valve guide) to ream for .005" oversize lifter installation.

Valve Lifters ("300" & "400" Engines): Wilcox-Rich "Zero-Lash" hydraulic type (mushroom type body). Remove from below with camshaft out.

Diameter—.6236-.6239". **Clearance**—.0001-.0016".

Valve Clearance Check (When Grinding Valves):

See "Valve System" in Packard Special Data.

See Miscellaneous Section for complete data.

VALVE TIMING

VALVE TAPPET CLEARANCE: ("200" Engine)—.007" Intake, .010" Exhaust, Hot.

("300" & "400" Engine)—No adjustment required (hydraulic type lifters).

Valve Timing: See camshaft setting above.

"200" Engine Valve Timing

Intake Valves—Open 15° BTDC. Close 45° ALDC.

Exhaust Valves—Open 50° BLDC. Close 9° ATDC.

"300" & "400" Engine Valve Timing

Intake Valves—Open 15° BTDC. Close 43° ALDC.

Exhaust Valves—Open 53° BLDC. Close 4° ATDC. Above figures for .0125" intake, .015" exhaust tappet clearance, ("200" Engine).

Valve Timing ("200" Engine)—With .0125" tappet clearance #1 intake valve should be open, with #1 piston 10° BTDC, (10th graduation before top dead center mark "1UP.DC" on vibration dampener aligned with pointer). Reset tappet clearance to .007" Hot.

►*CAUTION*—If valve more than 8° before or after this point in closing, camshaft setting incorrect.

Valve Timing Check ("300" & "400" Engines)—Check by turning tappet plunger for No. 8 exhaust valve with fingers. Turn engine over until this valve fully open, turn engine further until valve nearly closed (plunger should not turn), continue turning engine while attempting to turn plunger, until plunger "breaks loose" or turns. This should be approx. 9° after top dead center—check at timing mark on vibration dampener.

►*CAUTION*—If valve more than 8° before or after this point in closing, camshaft setting incorrect.

LUBRICATION

Engine Oiling System: Pressure to main and connecting rod bearings, camshaft bearings, piston pins, valve lifters and timing chain.

Crankcase Capacity—7 qts.

Normal Oil Pressure—40 lbs., Normal driving.

Oil Pressure Regulator—On oil pump cover. Not Adjustable.

Oil Filter: Optl. (200), Std. (300 & 400). Replace cartridge every 8000 miles or when oil shows signs of being dirty.

Oil Pressure Indicator: Red light on left side of instrument cluster. Lighted when oil pressure less than 10 lbs. (lights when ignition turned on, goes out when pressure exceeds 10 lbs.).

Engine Unit—King-Seeley No. 47110 Pressure Switch. Contacts open when pressure exceeds 10 lbs. (remain closed at lower pressures).

Crankcase Ventilation: Oil-wetted type filter element in oil filler cap air intake. Outlet pipe in valve compartment at rear.

COOLING

Cooling System: Pressure type with pressure relief valve in filler cap and fan driven pump.

Capacity—20 qts., with 2/3 qts. additional for heater and defroster.

Pressure Valve—AC No. 850005 Cap. Opens at 7 lbs.

Water Pump: Centrifugal belt driven, packless type.

See Water Pump Section for complete data.

Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat: In cylinder head outlet.

Setting (Std.)—Starts to open 140°-156°F.

Setting (Optl. High Reading)—Starts to open 157°-165°F. or 175°-184°F.

Temperature Gauge: King-Seeley "CV" (Constant Voltage) type with Voltage regulator.

Dash Unit—K-S No. 45658.

Engine Unit—K-S No. 44215.

See Miscellaneous Section for complete data.

CLUTCH

Long ("200" Engine) 10CF-TI, ("300" Engine) 11CF-10½-TI. Single plate, semi-centrifugal, dry disc type.

See Clutch Section for complete data.

Facings—Woven (U.S. Asbestos). Thickness .125". Inside diameter ("200") 6¾", ("300") 7". Outside diameter ("200") 10", ("300") 10½".

Pedal Adjustment: 1¼-1½" free travel. Adjustment nut on rod at throw-out lever.

►**Clutch Pedal Over-Center Spring:** New adjustable type. *See "Clutch Notes" in Packard Special Data for Adjustment.*

Removal: Remove transmission (see Transmission Removal following) and flywheel housing lower cover. Disconnect throw-out linkage and remove throw-out bearing. Remove clutch cover screws (release tension evenly), lower assembly out of car.

TRANSMISSION

SYNCHRO-MESH

Own Make. Helical gear, constant-mesh, synchro-mesh (second & high), constant-mesh (low), sliding spur gear (reverse). Low & Second speed gears are ball bearing mounted.

See Transmission Section for complete data.

Transmission Control: Steering column type.

See Transmission Section for complete data.

Removal: Disconnect shifter rod, speedometer cable, hand brake cable at equalizer, engine ground strap, front universal (block driveshaft up against floor pan). Support rear of engine with jack and unbolt cross-member (at frame ends and transmission). Disconnect clutch retractor spring and fore-and-aft restraint rod. Take out Transmission-to-housing mounting screws, remove transmission.

OVERDRIVE

Warner Model AS6-R11. Optional equipment with Packard transmission. Solenoid operated overdrive with Governor Control and throttle operated "kick-down."

See Transmission Section for complete data.

Overdrive Solenoid—Packard No. 403942.
Governor—Packard No. 418447.
Control Relay—Packard No. 403940.
Kick-down Switch—Packard No. 403945.
Lock-out Switch—Packard No. 426453.

Removal: Disconnect control cable and all leads to solenoid and governor. Free mounting at rear of overdrive case. Then remove overdrive and transmission (see Transmission Removal above).

ULTRAMATIC TRANSMISSION

Own Make. Torque Converter (with hydraulically operated Direct Speed clutch) and hydraulically operated planetary unit with manual control.

See Transmission Section for complete data including Testing & Trouble Shooting.

Linkage Adjustment on Ultramatic Drive Cars: *See "Ultramatic Drive" in Transmission Section.*

Lubrication—Check fluid every 1000 miles, drain and refill every 25,000 miles.

Recommended Fluid. Packard Ultramatic Drive or any Type "A" Automatic Transmission Fluid which has an AQ-ATF number embossed on container.

Capacity. Approximately 12 qts.

Draining and Refilling. *See Packard "Ultramatic Drive" in Transmision Section.*

Checking Fluid Level. *CAUTION—Fluid must only be checked at normal operating temperatures and after engine has been idling at 800 RPM. for at least one minute with selector lever in "N" position.* Stop the engine, check level by removing dipstick from filler hole on left side of transmission (accessible from under car—release cap by turning ½ turn counter-clockwise). Add fluid as required to bring level up to FULL mark on dipstick.

Removal: *See Packard Ultramatic Drive in Transmission Section.*

UNIVERSALS

Mechanics, Universal Products or Spicer. Needle bearing type.

See Universals Section for complete data.

►*CAUTION*—Rear universal flange nut controls rear axle pinion bearing preload which **must be adjusted whenever nut is loosened.** *See "Packard Rear Axle" in Rear Axle Section for complete data.*

REAR AXLE

Own Make. Semi-floating, hypoid gear type with Hotchkiss Drive.

See Rear Axle Section for complete data.

►*REAR AXLE OIL SEAL LEAKAGE CORRECTION—See "Packard Rear Axle" in Rear Axle Section for complete data.*

Ratios

Model	Std.	O.D. Cars	Ultramatic Cars
200	3.9-1	4.1-1	3.9-1
300	3.9-1	4.1-1	3.54-1
400	——	——	3.54-1

Backlash—.003-.005". Screw adjustment.

Removal: Remove axle shafts (see Removal below). Disconnect rear universal (wire trunnions), wire or prop propeller shaft up against floor pan with 2x4 inserted inside frame X-member. Drain differential, replace drain plug. Clean off housing, take off carrier locknuts, lift carrier out.

Axle Shaft Removal: Remove wheel, brake drum (use screw type puller J-4153—do not use knock-out type puller or thrust block may be damaged). Disconnect brake line at wheel cylinder. Remove nuts at oil seal guard and take off seal guard, gasket, retainer, oil seal, brake support plate, and bearing shims. Remove axle shaft and bearing using Puller J-2552 (do not drag shaft on inner seal). Use Tool J-943-B to remove inner seal.

Wheel Bearing Adjustment: Endplay controlled by shims between flanged end of housing and brake backing plate. Add or remove shims (furnished .005", .007", .020" thick) at one wheel if .050" or under. At both wheels if over .050" to secure .004-.007" endplay.

Endplay—.004-.007".

SHOCK ABSORBERS

Direct acting hydraulic type. Front shock absorbers are inside front suspension coil springs.

200 Series—Packard No. (Front) 419680, (Rear) 419904.

300 Series—Packard No. (Front) 419682, (Rear) 433131.

400 Series—Packard No. (Front) 419690, (Rear) 426559.

FRONT SUSPENSION

Front Suspension: Packard Broad-Beam Suspension, independent, linked parallelogram type with coil springs and double acting shock absorbers.

See Front Suspension Section for complete data.

King Pin Inclination—5°50′ crosswise.

Caster—Neg. 1°±½°. Eccentric adjustment.

Camber—0°±½°. Eccentric adjustment.

Toe-In—0" (plus 1/16", minus 0"). Adjust by turning adjuster at outer end of each tie rod equally.

STEERING GEAR

Packard-Gemmer Model 335. Worm & 3-tooth Roller type with "push-pull" adjustments.

See Steering Gear Section for complete data.

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—Diam. Front 1⅛", Rear Wheels 1".

Drums—12" Centrifuse type.

Lining—Marshall 4112 (Primary Shoes), Marshall 9051 (Secondary Shoes). Width—see table below. Thiekness 3/16". Length per shoe 11½" (Primary), 13" (Secondary).

Lining Width	Front Wheels	Rear Wheels
200	1¾"	1¾"
300 & 400	2¼"	2"

Clearance—.015" at both ends of secondary shoe with primary shoe forced out against drum.

Hand Brake: See Service Brake above.

MISC. MECHANICAL

Windshield Wiper: Vacuum type, cable operated.

See Miscellaneous Section for complete data.

compression, turn engine over until flywheel mark 'IGN/4' lines up with indicator on housing (mark is 5° before top dead center mark 'UDC/4'), loosen advance arm clamp bolt, rotate distributor until stationery contacts (mounted directly on breaker plate) begin to open, tighten clamp bolt, then check sychronization.

Synchronization (Movable Contacts)—Turn engine over 90° or ¼ revolution to firing position for piston #1, stop when flywheel mark 'IGN./1-8' lines up with indicator (mark is 5° before top dead center mark 'UDC./1-8'), loosen lockscrews on movable sub-plate, turn eccentric adjusting screw until contacts begin to open, tighten lockscrews, check spark plug connections.

Synchronization (Using Tool)—Use special synchronizing tool, Delco-Remy Part No. 1838182, and follow complete directions in Equipment Section.

CARBURETOR

CARBURETION:—Carburetor—Stromberg Mod. **EE-3**, 1½" dual downdraft type.

For complete data, refer to Carburetor Index.

NOTE—Do not adjust carburetor until engine is warmed up so that choke valve is wide open and engine idling at hot or slow idling speed.

Idle Adjustment—Adjust each screw individually with engine idling on four cylinders (ground #1, 2, 7, 8 plug cables when adjusting inner screw, #3, 4, 5, 6 while adjusting outer screw). Turn screw in until engine begins to lag or miss, then out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Repeat with other adjusting screw in the same manner. Adjust throttle stopscrew so that idle speed is 37-39 explosions in 15 seconds (checked by removing plug in exhaust manifold).

Accelerating Pump Setting—Adjusted by changing position of pump link rod in throttle valve lever.
Inner Hole (Min. stroke)—Summer temperatures.
Outer Hole (Max. stroke)—Winter temperatures.

Fast Idle:—Stromberg type. See special article in Carburetion Section.

For complete data, refer to Carburetion Equip. Index.

Automatic Choke:—Stromberg Type 'C' No. A-17630.

For complete data, refer to Carburetion Equip. Index.

CARB. EQUIPMENT

Air Cleaner:—AC. oil-wetted type standard.

Fuel Pump:—AC. Type D #1522112. Diaphragm type.

For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge:—Motometer Electric. Dash unit—NG-8440D (1937). Tank Unit—NG-7741T (all).

For complete data, refer to Carburetion Equip. Index.

BATTERY

Willard Type WH-4-17, or RH-4-17 (Export). 6 volt, 17 plate, 136 amp. hour capacity (20 hour rate).
Starting Capacity—160 amperes for 20 minutes.
Zero Capacity—300 amperes for 5.4 minutes.
Grounded Terminal—Positive (+) term. grounded to transmission cover bolt.
Location—Left hand side under front floor.

STARTER

Owen-Dyneto Model DI-1314. Armature No. 16437.
Drive—Bendix Type RCD11FXT-10.
Cranking Engine—100-105 R.P.M., 175 amperes at 5.35 volts.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—56-60 ounces each.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4500	6.0	60
2 "	1600	5.5	130
3.6 "	1200	5.35	170
7.4 "	800	5.05	250
14.4 "	400	4.5	400
28.0 "	Lock	3.5	650
29.24 "	Lock	3.6	720

Removal:—Starter flange mounted on left front face of flywheel housing. To remove, take out three flange mounting capscrews.

Starting Switch:—Startix Type 'D'. Automatic starting switch and Startix circuit controller (anti-backfire unit), controlled by ignition switch.

See Electrical Equipment Section for complete data.

GENERATOR

Owen-Dyneto Model CO-1309. Armature No. 23691. Air-cooled. Third brush control type with Battery Charge Regulator (two-step charging rate).
Charging Rate Adjustment—Third brush shifted through rack-and-pinion control by slotted adjusting screw on commutator end plate. To adjust, turn adjusting screw to right or clockwise to increase, and to left or counter-clockwise to decrease charging rate.
Maximum Charging Rate—32 amperes (cold), 8.0 volts, 1900 R.P.M., 20-25 M.P.H.

Performance Data—Regulator Inoperative

Cold			Hot		
Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	7.0	580	0	7.3	625
5	7.2	630	5	7.5	700
10	7.5	700	10	7.7	800
15	7.7	790	15	7.9	930
20	7.9	910	20	8.0	1100
25	8.0	1080	25	8.0	1380
30	8.0	1380	28	8.0	2000
32	8.0	1900			

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—20-22 ozs. (main), 12-14 ozs. (third).
Field Current—3.5-3.7 amperes at 6.0 volts.
Motoring Current—16.7-18 amperes at 6.0 volts (½ ampere more if relay and regulator in circuit).
Field Fuse—5 ampere capacity in knurled plug in side of regulator case.

Removal:—Generator cradle mounted at left front of engine with fan belt drive (double Vee belt). To remove, slack off drive belt, disconnect water pump drive coupling, loosen mounting clamp band.

Belt Adjustment:—To adjust, loosen clamp bolt on fan bracket, turn eccentric shaft spindle until 10 lb. pull on belt midway between pulleys causes 1" deflection, tighten clamp bolt. Additional range of adjustment secured by taking bracket off engine and moving bracket up until mounting bolts engage lower holes.

REGULATOR

Owen-Dyneto 40300 Battery Charge Regulator. Consists of Cutout Relay and Battery Charge Regulator in a single case on the generator field frame.

For complete data, refer to Electrical Equipment Index.

Cutout Relay

Cuts In—6.8-7.2 volts, 600 R.P.M., 8 M.P.H.
Cuts Out—0-2.5 amperes discharge current.
Contact Gap—.030-.032".
Air Gap—.020-.025" with contacts closed.

Battery Charge Regulator

Setting—8.2 volts (cold), 7.8 volts (hot)—contact opening point.
Regulator Resistance—1.85 ohms.

LIGHTING

LIGHTING:—Headlamps—Guide Multi-beam, Prefocused, Cross-beam type with special non-interchangeable lenses. Headlamps aimed straight ahead with lenses removed. Asymetrical passing beam (upper beam left hand headlamp, lower beam right hand headlamp), controlled by foot selector switch with lighting switch in 'Country Driving' position.
Driving Lamp—Mounted on right of radiator. Controlled by separate switch on instrument panel with Red indicator lamp lighted with driving lamp 'on'. Lighted with lighting switch in 'Country Driving' position except when Driving Lamp Switch turned off.
Passing Lamp—Mounted at left of radiator. Controlled by separate switch on instrument panel with Green indicator lamp lighted with passing lamp 'on'. Lighted with lighting switch in 'City Driving' position or with foot selector switch in passing position (see Headlamps above) except when Passing Lamp Switch turned off.

Switches

Lighting—Delco-Remy Model 479-M.
Instrument Lamps—Delco-Remy Model 1411.
Foot Selector—Delco-Remy Model 471-Z.

MISC. ELECTRICAL

FUSES:—Electric Clock—5 ampere on back of clock.
Generator Field—5 ampere in regulator case.

CURRENT LIMIT RELAY: Delco-Remy 410-N. 2 units used. Vibrating type. Starts to operate with current load of 35-40 amperes, limiting load to 5-22 amps.
Horn Relay:—Model 266-TK. Requires .25 amperes to close contacts. Current draw .8 amperes.
Contact Gap—.012-.030".
Air Gap—.015-.030" with contacts closed.
Spring Tension—5 ounces minimum measured at brass button.

HORNS:—Klaxon Model K-33-S. Type 2051 (low note), 2052 (high note). Vibrator type, blended tone, twin horns operated by horn relay.

Horn Type	Current at 6 volts	Air Gap
2051 (low note)	11-13	.042-.046"
2052 (high note)	10-12	.032-.036"

Contact Gap—.015-.025".
Air Gap—.012-.017" with contacts closed.

ENGINE

ENGINE SPECIFICATIONS:—8 cylinder, In Line, 'L' hd.
Bore—3½". **Stroke**—5".
Displacement—385 cubic inches.
Rated Horsepower—39.2 (AMA).
Developed Horsepower—150 at 3400 R.P.M.
Compression Ratio—6.4-1 Std. aluminum head, no optional ratios.
Compression Pressure—148 lbs. at 2500 R.P.M. or 75-80 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 19-20" with engine idling.

PISTONS:—Bohn, Bohnalite aluminum alloy, Invar strut, split skirt type or Lynite aluminum alloy, 'T' slot type with Anodic finish (special hard oxide bearing surface). **Length**—4¼".

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CARBURETOR

CARBURETION:—Carburetor—Stromberg Model EX-32, 1½" downdraft type. One carburetor used for each bank of cylinders (throttles must be synchronized.)
For complete data, refer to Carburetor Index.
NOTE—Do not adjust carburetors until engine is warmed up so that choke valve is wide open and engine idling at hot or slow idling speed.

Idle Adjustment—Adjust one carburetor at a time. Cut out the six cylinders of the other bank by grounding the high tension lead of the coil firing that bank. Turn idle adjusting screw in until engine begins to lag or miss, then turn screw out until engine begins to roll, finally turn screw in slowly until engine fires smoothly. Then check idling speed by taking out plug in exhaust manifold and counting explosions or form small gap by disconnecting one high tension lead at spark plug and count sparks. Adjust throttle lever stopscrew so that there are 37-39 explosions in 15 seconds. Recheck idle adjusting screw setting (this must be reset if idling speed has been changed. After adjusting each carburetor, connect both coils, idle engine on all twelve cylinders and check throttle valve synchronization (see article in Carburetion Section).

Accelerating Pump Setting—Adjusted by changing position of pump link rod in throttle valve lever. Inner Hole (Min. stroke)—Summer temperatures. Outer Hole (Max. stroke)—Winter temperatures.

Fast Idle:—Stromberg type. See special article in Carburetion Section.
For complete data, refer to Carburetion Equip. Index.

Automatic Choke:—Stromberg Type 'C' No. A-16090.
For complete data, refer to Carburetion Equip. Index.

CARB. EQUIPMENT

Air Cleaner:—AC. oil-wetted type standard, oil-bath heavy duty type optional.

Fuel Pump:—AC. Type D #1523010. Diaphragm type.
For complete data, refer to Carburetion Equip. Index.

Gasoline Gauge:—Motometer Electric. Dash unit—NG-8440D (1937). Tank Unit—NG-7741T (all).
For complete data, refer to Carburetion Equip. Index.

BATTERY

Willard Type WH-5-19 or RH-5-19 (Export). 6 volt, 19 plate, 153 amp. hour (20 hour rate).
Starting Capacity—180 amperes for 20 minutes.
Zero Capacity—300 amperes for 6.6 minutes.
Grounded Terminal—Positive (+) terminal.
Location—Left hand side under front floor.

STARTER

Owen-Dyneto Model DI-1313. Armature No. 16437.
Drive—Bendix Type RCD11FXT-10.
Cranking Engine—100-105 R.P.M., 175 amperes at 5.35 volts.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—56-60 ounces each.

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4500	6.0	60
2 "	1600	5.5	130
3.6 "	1200	5.35	170
7.4 "	800	5.05	250
14.4 "	400	4.5	400
28.0 "	Lock	3.5	650
29.24 "	Lock	3.6	720

Removal:—Starter flange mounted on right front face of flywheel housing. To remove, take out three flange mounting capscrews.

Starting Switch:—Startix Type 'D' Automatic starting switch and Startix circuit controller (anti-backfire unit), controlled by ignition switch.
See Electrical Equipment Section for complete data.

GENERATOR

Owen-Dyneto Model CO-1309. Armature No. 23691. Air-cooled. Third brush control type with Battery Charge Regulator (two-step charging rate).
Charging Rate Adjustment—Third brush shifted through rack-and-pinion control by slotted adjusting screw in commutator end plate. To adjust, turn adjusting screw to right or clockwise to increase, and to left or counter-clockwise to decrease charging rate.
Maximum Charging Rate—32 amperes (cold), 8.0 volts, 1900 R.P.M., 25-30 M.P.H.

Performance Data—Regulator Inoperative

Cold			Hot		
Amps	Volts	R.P.M.	Amps	Volts	R.P.M.
0	7.0	580	0	7.3	625
5	7.2	630	5	7.5	700
10	7.5	700	10	7.7	800
15	7.7	790	15	7.9	930
20	7.9	910	20	8.0	1100
25	8.0	1080	25	8.0	1380
30	8.0	1380	28	8.0	2000
32	8.0	1900			

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—20-22 ozs. (main), 12-14 ozs. (third).
Field Current—3.5-3.7 amperes at 6.0 volts.
Motoring Current—16.7-18 amperes at 6.0 volts (½ ampere more if relay and regulator in circuit).
Field Fuse—5 ampere capacity in knurled plug in side of regulator case.

Removal:—Generator cradle mounted on left front of engine with fan belt drive (double Vee belt). To remove, slack off drive belt, disconnect water pump drive coupling, loosen mounting clamp band.

Belt Adjustment:—To adjust, loosen clamp bolt on fan bracket, turn eccentric shaft spindle until 10 lb. pull on belt midway between pulleys causes 1" deflection, tighten clamp bolt. Additional range of adjustment secured by taking bracket off engine and moving bracket up until mounting bolts engage lower holes.

REGULATOR

Owen-Dyneto 40300 Battery Charge Regulator. Consists of Cutout Relay and Battery Charge Regulator in a single case on the generator field frame.
For complete data, refer to Electrical Equipment Index.

Cutout Relay
Cuts In—6.8-7.2 volts, 600 R.P.M., 8 M.P.H.
Cuts Out—0-2.5 amperes discharge current.
Contact Gap—.030-.032".
Air Gap—.020-.025" with contacts closed.

Battery Charge Regulator
Setting—8.2 volts (cold), 7.8 volts (hot)—contact opening point.
Regulator Resistance—1.85 ohms.

LIGHTING

LIGHTING:—Headlamps—Guide Multi-beam, Prefocused, Cross-beam type with special non-interchangeable lenses. Headlamps aimed straight ahead with lenses removed. Asymetrical passing beam (upper beam left hand headlamp, lower beam right hand headlamp), controlled by foot selector switch with lighting switch in 'Country Driving' position.
Driving Lamp—Mounted on right of radiator. Controlled by separate switch on instrument panel with Red indicator lamp lighted with driving lamp 'on'. Lighted with lighting switch in 'Country Driving' position except when driving lamp switch turned off.
Passing Lamp—Mounted on left of radiator. Controlled by separate switch on instrument panel with Green indicator lamp lighted with passing lamp 'on'. Lighted with lighting switch in 'City Driving' position or with foot selector switch in passing position (see Headlamps above) except when passing lamp switch turned off.

Switches
Lighting—Delco-Remy Model 479-M.
Instrument Lamps—Delco-Remy Model 1411.
Foot Selector—Delco-Remy Model 471-Z

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-32	2330
Stop and Backing	21	1129
Driving and Passing	32	1323**
Driving and Passing Pilots	3	64
License Plate	3	63
Instrument Panel, Parking	1½	55
Tail, Dome & Corn., Smok. Cab.	6	81

** This bulb Pre-focused, single contact type.

MISC. ELECTRICAL

FUSES:—Electric Clock—5 ampere on back of clock.
Generator Field—5 ampere in regulator case.

CURRENT LIMIT RELAY: Delco-Remy 410-N. 2 units used. Vibrating type. Starts to operate with current load of 35-40 amperes, limiting load to 5-22 amperes.
Contact Gap—.012-.030".
Air Gap—.015-.030" with contacts closed.
Spring Tension—5 ounces minimum measured at brass button.

HORNS:—Klaxon Model K-33-S. Type 2051 (low note), 2052 (high note). Vibrator type, blended tone, twin horns operated by horn relay.

Horn Type	Current at 6 volts	Air Gap
2051 (low note)	11-13	.042-.046"
2052 (high note)	10-12	.032-.036"

Horn Relay:—Model 266-TK. Requires .25 amperes to close contacts. Current draw .8 amperes.
Contact Gap—.015-.025".
Air Gap—.012-.017" with contacts closed.

ENGINE

ENGINE SPECIFICATIONS:—12 cylinder, 80° included angle Vee, 'L' head type. Cylinders cast en bloc for each bank.
Bore—3½". **Stroke**—4".
Displacement—462 cubic inches.
Rated Horsepower—58.8 (AMA).
Developed Horsepower—185 at 3400 R.P.M.
Compression Ratio—6.4-1 Std. aluminum head. No. optional ratios.
Compression Pressure—140 lbs. at 2500 R.P.M. or 80-85 lbs. at cranking speed.
Vacuum Reading—Gauge should show steady reading of 19-20" with engine idling.

PISTONS:—Bohn, Bohnalite aluminum alloy, Invar strut, split skirt type or Lynite aluminum alloy, 'T' slot type with Anodic finish (special hard oxide

ENGINE

CONTINUED FROM PRECEDING PAGE

bearing surface). **Length**—4¼". **Weight**—22.70-22.82 ozs. (stripped).

Removal—Pistons and rods removed from above.

Clearance—Top .025" (Bohn), .035" (Lynite), Bottom .002". See Fitting New Pistons.

Replacement Pistons:—Pistons furnished in standard oversizes of .002", .004", .010", .020".

Fitting New Pistons:—Pistons should be snug on .0015" feeler and locked on .002" feeler.

Installing Pistons:—Slot should be toward left on both banks (viewed from driver's seat).

PISTON RINGS (1937-38):—Four rings per piston, two compression (one stepped ring, one plain), two oil control, all above pin. Both oil ring grooves drilled radially with oil drain holes.

Ring	Width	End Gap	Side Clearance
Compression	.1235"	.020-.025"	.001-.002"
Oil Control	.1545"	.013-.021"	.001-.002"

PISTON PIN:—Diameter—.8749-.8751".

Length—3.031-3.041".

Pin floats in piston and rod. Held by retaining rings. Pin hole in rod is bronze-bushed.

Pin Fit in Piston:—Thumb push fit at 70° F.

Pin Fit in Rod Bushing:—.0004-.0006" clearance.

CONNECTING ROD:—Weight—35.62 ounces.

Length—9.936-9.939" (center-to-center).

Crankpin Journal Diameter—2.126-2.1265".

Lower Bearing—Centrifugally-cast, babbitt-lined type. No shims used.

Clearance—.001-.0025". Sideplay .006-.009".

Bearing Adjustment:—None (no shims). Replace rods. Do not file caps. Bearings .010" and .020" undersize furnished for service.

NOTE—Oil spray holes are drilled in both sides of connecting rod lower bearing upper half. Rods are installed at factory with chamfer in crankpin bore next to crankshaft cheek (rods mounted side by side).

CRANKSHAFT:—7 bearing. Integral counterweights.

Journal Diameters—2½" all bearings.

Bearing Type—Removable bronze-backed, babbitt-lined. No shims used.

Clearance—.0015-.003".

Bearing Adjustment:—None (no shims). Replace bearings. Do not file caps.

End Thrust:—Taken by front bearing. Endplay .002-.004" Adjustable by adding or removing shims.

CAMSHAFT:—4 bearing. Non-adjustable chain drive.

Bearing Type—Steel-backed, babbitt-lined.

Clearance—.002". Endplay .003-.009".

Timing Chain:—Whitney CLG-206. Width 1½". Pitch ½". Length 26½" or 53 links.

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

NOTE—Special puller tool necessary to install timing chain. Install timing chain 'endless.'

VALVES:—

	Head Diameter	Stem Diameter	Length
Intake	1 21/32"	.3725-.3735"	4¾"
Exhaust	1 9/16"	.3715-.3725"	4¾"

	Seat Angle	Lift	Stem Clear.
Intake	45°	.324"	.0015-.0025"
Exhaust	45°	.324"	.0025-.0035"

Valve Springs:—Install springs with small end up. Flat coil spring type dampener installed on all springs at top.

	Spring Pressure	Length
Valve Closed	60-65 lbs.	2 3/32"
Valve Open	120-128 lbs.	1 25/32"

Valve Lifters: Wilcox-Rich 'Zero-Lash' type hydraulic lifters.

See Miscellaneous Section for complete data.

NOTE—Hydraulic lifters have been redesigned. Service instructions as given for previous types apply to the new type but new type lifters are not interchangeable in part or as a unit with previous lifters. Lifters used on eight and twelve cylinder engines not interchangeable (longer body used on eight). Cannot be adapted to eight engine as previously (by changing plunger cap).

VALVE TIMING

Tappet Clearance:—None in service. See data above on hydraulic valve lifters.

Valve Timing:—See Camshaft Setting above.

Intake Valves—Open 19° BTDC. Close 69° ALDC.

Exhaust Valves—Open 56° BLDC. Close 28° ATDC.

To Check Valve Timing—Remove #1 intake hydraulic valve lifter, pull out plunger, remove spring, wash lifter assembly in gasoline to remove all oil, replace plunger, install lifter in bracket, check clearance between end of plunger and valve stem (valve closed—clearance will be about .070"). Insert sufficient filler stock to take up all except .004" clearance, turn engine over with #11 piston on compression, stop when flywheel mark 'IN.OP.#1/' lines up with indicator on housing, #1 intake valve should begin to open at this point. Remove feeler stock, reassemble hydraulic valve lifter.

LUBRICATION

LUBRICATION:—Pressure. Gear type oil pump located in crankcase.

Normal Oil Pressure:—45 lbs. at 53 M.P.H.

Oil Pressure Relief Valve:—Located at oil pump. Operates at 50 lbs. Adjustable by adding or removing spacing washers.

Oil Temperature Regulator:—Harrison Radiator Co. type.

Crankcase Capacity:—11 qts. (refill).

CLUTCH

CLUTCH:—Long Model 12CB-CL. Single plate, dry disc type. See article in Clutch Section for relining and assembling directions. No adjustment for wear required.

See Clutch Section for complete data.

Facings—Moulded type, 2 required. Inside diameter 7". Outside diameter 12". Thickness .137".

Adjustment—Free movement of clutch pedal must be ¾-1¼". Screw adjustment provided at bell housing. Pedal must have free clearance at underside of toeboard.

Removal:—Remove transmission (see Transmission Section below), remove clutch housing, take out mounting screws in clutch cover mounting flange on flywheel.

TRANSMISSION

TRANSMISSION:—Warner with Overdrive. Model AS1-T82A (1937-38). Constant mesh, synchro-mesh (second and high), sliding helical gear (low and reverse).

See Transmission Section for complete data.

Removal:—Disconnect drive shaft at front universal, take out transmission mounting bolts, pull transmission straight back.

OVERDRIVE

OVERDRIVE (1937-38): Warner Type R1. Model AS1-T82A transmission and overdrive unit.

See Transmission Section for complete data.

UNIVERSALS

UNIVERSAL JOINTS:—Detroit Series 5350. Roller bearing type. 2 used.

See Universals Section for complete data.

REAR AXLE

REAR AXLE:—Own Make. Semi-floating, hypoid gear type with Hotchkiss drive.

Ratio—4.58-1.

Backlash—.002-.003". Shim adjustment.

FRONT SUSPENSION

Front Suspension:—Conventional axle with Reverse-Elliott ends and semi-elliptic springs.

Kingpin Inclination—8° crosswise.

Caster—1°. Adjust by inserting wedge shims between spring and spring pad on axle.

Camber—1° (plus or minus ½°). Wheel felloe at top of wheel should be not more than 15/32" or less than 5/32" outside felloe at bottom. No adjustment provided.

Toe In—¼". Adjusted in usual manner by loosening clamp bolts and turning tie rod.

Steering Geometry—Inner wheel turned 40°, outer wheel 30°.

STEERING GEAR

Steering Gear: Ross Model 660. Cam-and-Lever type.

See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service—Stewart-Warner mechanical four wheel type with vacuum power operation. Hand lever applies all four service brakes.

See Brake Section for complete data.

Drum Diameter—16".

Lining—Moulded type. Width 2¼". Thickness ¼". Length per wheel 38".

Clearance—.009" (front wheels), .012" (rear wheels), at heel and toe of each shoe.

Hand Brake Adjustment:—See Service Brakes.

Power Unit:—Bendix vacuum power unit.

See Brake Section for complete data.

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Performance Data—MAW-4016

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
11.5 "	Lock	3.0	505
18. "	Lock	4.0	670

Removal:—Flange mounted on left front face of flywheel housing. Remove cables, 2 clips on starter linkage, oil filter lines, 2 mounting bolts. Lift off.
Starting Switch: Auto-Lite SW-2813. On starter. Manually operated by starter pedal (pinion shift).
For complete data, refer to Electrical Equipment Index.

GENERATOR

ROAD KING—FIRST CARS

Auto-Lite Model GBM-4606C-1. Arm. GBM-2065F. Third brush control type used with Cutout Relay.
Charging Rate Adjustment—Remove commutator cover band, shift third brush by hand counter-clockwise to increase, or clockwise to decrease charging rate (brush held in position by friction).
Commutator Bar Method—Set third brush four commutator bars from nearest main brush.
Maximum Charging Rate—18 amperes (cold), 15.2 (hot), 8.3 volts, 2500 RPM.

Performance Data

Cold Amps.	Cold Volts	Cold R.P.M.	Hot Amps.	Hot Volts	Hot R.P.M.
0	6.4	800	0	6.4	850
4	6.8	950	4	6.9	1050
8	7.25	1125	8	7.4	1250
12	7.7	1375	12	7.9	1680
16	8.1	1800	15.2	8.3	2500
18	8.3	2400			

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—50-60 ozs. (new brushes).
Field Current—3.80-4.20 amperes at 6.0 volts.
Motoring Current—5.7-6.3 amperes at 6.0 volts.
Removal:—Pivot mounted at left front of engine. To remove, take out pivot bolts and clamp bolt.
Belt Adjustment:—Swing generator away from engine until 40-50 lb. reading secured on scale attached to generator frame.

GENERATOR

ROAD KING & DELUXE MODELS

Auto-Lite Model GDF-4801A. Armature No. GDF-2006F. Third brush type with Voltage Regulator.
Charging Rate Adjustment—Disconnect wire on generator at 'F' terminal, ground terminal. Connect ammeter in line at 'A' terminal. Connect voltmeter between 'A' terminal and ground. Shift third brush by hand counter-clockwise to increase or clockwise to decrease charging rate until output is 28-32 amperes at 8.0 volts, generator at room temp. 70° F. Actual charging rate controlled by regulator.
Commutator Bar Method—Set third brush 2-2⅛ commutator bars from nearest main brush.

Performance Data

Cold Amperes	Cold Volts	Cold R.P.M.	Hot Amperes	Hot Volts	Hot R.P.M.
0	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 & Belt Adjustment: Same as given above.

GENERATOR

SPECIAL EQUIPMENT

Auto-Lite Model GCE-4804-B. Armature Number GBX-2006AF. 2 brush type (current-voltage control).
Wiring Note—*Internal wiring for GCE generator & VRB regulator same as shown on '39 Dodge 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.

Performance Data

Cold Amperes	Cold Volts	Cold R.P.M.	Hot Amperes	Hot Volts	Hot 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.

CUTOUT RELAY

ROAD KING—FIRST CARS

Auto-Lite Model CB-4014 (P7 for GBM Generator). Mounted on generator.
For complete data, refer to Electrical Equipment Index.
Cuts In—6.5-7.25 volts.
Cuts Out—.5-2.5 amperes discharge current.
Contact Gap—.015-.045".
Air Gap—.010-.030" with contacts closed.

REGULATOR

ROAD KING & DELUXE MODELS

Auto-Lite Model VRD-4002B (for GDF Generator) Voltage Regulator. In case on dash.
For complete data, refer to Electrical Equipment Index.

Cutout Relay

Cuts In—6.4-7.0 volts Cold.
Cuts Out—.5 ampere min., 3.0 amperes max. cold.
Contact Gap—.015" minimum.
Air Gap—.034" min., .038" max. 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 'BAT' terminal on regulator, connect voltmeter between 'BAT' terminal and ground. Operate generator at speed equivalent to 30 M.P.H., charging fully charged battery until voltage is constant. Voltmeter reading should be within limits of 7.3-7.7 volts (cold—70°F), 7.1-7.4 volts (hot—140°F). See Regulator Setting above.
To Adjust (with cover removed)—Change regulator armature spring tension slightly by bending lower spring hanger. Check setting as directed above.
Contact Gap—.010-.020" (armature against stop pin)
Air Gap—.0595-.0625" with contacts just opening.

REGULATOR

SPECIAL EQUIPMENT

Auto-Lite Model VRB-4004A (for GCE Generator) Current-Voltage Regulator. In case on dash.
For complete data, refer to Electrical Equipment Index.

Cutout Relay & Voltage Regulator

Same as VRD-4002B regulator (see data above).

Current Regulator

Setting—29-31 amperes (marked '30' on 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 so that generator charges at peak rate and Current Regulator operates. Current should not exceed setting.
Adjustment, Contact Gap, Air Gap—Same as for Voltage Regulator (see above).

LIGHTING

LIGHTING:—Headlamps—Corcoran-Brown pre-focused type. Upper and lower beams controlled by foot switch on toeboard with light switch on.
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 4" below lamp center hght.).
Beam Indicator—Red light on instrument panel above speedometer. Lighted with upper beams on.

Switches

Lighting—Chrysler No. 853295 or 852535.
Beam Selector—Chrysler No. 853323 or 659512.
Instrument—Chrysler No. 695943.
Stop Light—Chrysler No. 677112.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	32-32	2331
Stop and Tail	21-3	1158
Parking, Instrument	1½	55
Beam Indic., Ign. Switch	1	51
Dome	15	87
Rear License	3	63

MISC. ELECTRICAL

FUSES:—Lighting. 20 ampere. On light switch.
Horn—20 ampere in connector at starter on single horns. 30 amp. on relay for duals.
Clock—2 ampere (when factory equipped).
HORNS:—Single. Klaxon Model K-16 Type 2016. Std.
Dual—Auto-Lite HH or HL-4001 (low pitch), HH or HL-4002 (high pitch), operated by horn relay.
Horn Relay:—Auto-Lite Model HR-4101. 30 ampere fuse mounted on base. **Contacts Close**—2.5-3.5 volts. **Contact Gap**—.026". **Air Gap**—.012-.017" (closed).

ENGINE

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type.
Bore—3⅛". **Stroke**—4⅜". **Displacement**—201.3 cu.ins.
Rated Horsepower—23.44 (A.M.A.).
Developed Horsepower—82 @ 3600 RPM. (Std. 6.7-1 hd.). 86 @ 3600 RPM. (Opti. 7.0-1 Al. hd.).
Compression Ratio & Pressure—As follows:

Ratio	Pressure at 1000 RPM.	At 100 RPM.
6.7-1 Std. C.I. head	140-150 lbs.	Approx. 113 lbs.
7.0-1 Opti. Al. head	150-160 lbs.	Approx. 117 lbs.

Vacuum Reading—Steady 18-21" idling at 6 M.P.H.
PISTONS:—Aluminum alloy, U-slot, Cam-ground, with Anodic finish. **Length 3 11/16". Weight 14.56 ozs.**
Removal—Pistons and rods removed from above.
Clearance—Top .021". Skirt .0001-.0011".
Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*
Fitting New Pistons:—Use micrometers. Check piston at bottom of skirt at right angles to pin bosses. With piston and wall dry, piston should pass through bore of own weight with slight drag (pin removed).

ENGINE

CONTINUED FROM PRECEDING PAGE

Installing Pistons:—Slot away from camshaft.

PISTON RINGS:—Four rings, all above pin—#1 Compression (upper inner edge beveled), #2 Comp. (lower edge stepped), #3 & 4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Comp. (Top)	1/8"	.007-.015"	.002 -.004"
Comp. (#2)	1/8"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.0015-.003"

Replacement Rings:—Furnished Std. and .005", .010", .015", .020", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—Diameter—55/64". Length—2 5/8". Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit. Piston 100°F.
Pin Fit in Rod Bushing—Thumb push fit at 70°F.
Replacement Pins:—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—Weight 29.13 oz. Length 7 15/16".
Crankpin Journal Diameter—1.9365-1.9375". *See "Original Bearing Sizes" in Chrysler Special Data.*
Lower Bearing—Removable steel-backed, babbitt-lined. Furnished Std. & .002", .010", .012" undersize. **Clearance**—.0005-.0025". **Sideplay**—.0055-.0115".
Bearing Adjustment:—None (no shims). Install bearings with boss engaging groove in rod and cap.
Installing Rods:—Wide portion of bearing to rear (#1, 3, 5), to front (#2, 4, 6). Oil hole to camshaft.

CRANKSHAFT:—4 bearing type with 7 counterweights.
Journal Diameters—2.499-2.500". *See "Original Bearing Sizes" in Chrysler Special Data.*
Bearing Type—Removable, precision type steel-backed, babbitt-lined. **Clearance**—.001-.002".
Bearing Adjustment: None (no shims). Replace bearings.
Replacement Bearings & Bearing Caps: *See Chrysler Shop Notes for complete data.*
End Thrust:—Taken by flange faces on rear (#4) bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive.
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 1/4".
Bearing Type—Removable, Steel-backed, babbitt-lined bushings (except #4 machined in block). **Clearance**—.001-.003" (#1), .0015-.0035" (all others).
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse Type 1866-N, No. 2661. Width 1". Pitch .500". Length 24" or 48 links.
Camshaft Setting:—Mesh chain with sprockets turned so that '0' marks are adjacent and in line with a straightedge across the shaft centers.

VALVES:—	Head Diameter	Stem Diameter	Length
All valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Shop Notes for Exh. Valve Seat Insert data.
Valve Guides:—Remove from above. Press new guides in (tapered end up) so top 7/8" below top of block, then finish ream to .342-.343" Int., .344-.345" Exh.
Valve Springs:—Free length 2 3/32". Limit of compression 1 9/32".

	Spring Pressure	Length
Valve Closed	34-38 lbs.	1 3/4"
Valve Open	77-83 lbs.	1 7/16"

Valve Lifters:—Mushroom type. Ream holes from above (pilot in valve stem guide) for new lifters .001", .008", .030", .060" oversize. Stem Diam. 3/8".

VALVE TIMING

Tappet Clearance:—.006" Int., .008" Exh. (hot). .002" additional exhaust clearance recommended for sustained high speed driving. NOTE—Tappet screws self-locking type. Remove right front wheel and housing panel for access to valves.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
To Check Timing—Set tappet clearance #6 intake valve at .011". This valve should open with piston 6° (.0153") past top dead center when 6° ATDC. mark on crankshaft pulley at front of engine lines up with pointer. Reset tappet cl. .006" (hot).

LUBRICATION

LUBRICATION:—Gear type pump (right of engine).
Normal Oil Pressure:—30-45 lbs. at 30 M.P.H.
Oil Pressure Relief Valve:—Under cap below starter. Opens at 40-45 lbs. To increase pressure use heavy (green) spring, to decrease use light (red) spring.
Crankcase Capacity:—5 quarts (refill).

COOLING

COOLING SYSTEM:—Capacity—14 quarts.
Radiator Core Removal—*See Chrysler Shop Notes.*
Water Pump:—Packless type.
See Water Pump Section for complete data.
Thermostat:—Bishop & Babcock. In head outlet. **Setting**—Start to open 157-162°F. Fully open 183°.
Temperature Gauge:—Motometer (Auto-Lite) No. H-9008. *See article in Miscellaneous Section for data.*

CLUTCH

CLUTCH:—Borg & Beck Model 9A6, 11A6 (P-7 Taxi). Single plate, dry disc type. Marked #918 (9A6), 931 (11A6) on cover. Pressure plate oil-baffle and new Over-center return spring (hooked to pedal) *See Clutch Section for complete data.*
Facings—Woven & compressed, 2 required. Inside Diam. 5 5/8" (9A6), 6 1/2" (11A6). Outside Diam. 9 1/4" (9A6), 11" (11A6). Thick. .133" (9A6), .125" (11A6). NOTE—Spiral grooved type facings used on 11A6.
Adjustment:—Pedal should just clear toeboard (adjust stopscrew on lower end) and have 1" free movement (adjust nut on link rod at clutch fork).
Removal:—Remove floor board, unhook clutch fork pull-back spring and take out clevis pin in connecting link. Remove transmission (see Transmission Removal below), remove housing underpan, mark cover & flywheel, remove clutch cover bolts evenly.

TRANSMISSION

TRANSMISSION:—Own Make. All helical gear, constant-mesh, synchro-mesh (second & high), sliding gear (low & reverse) with steering column gear shift (P8). *See Transmission Section for data.*
Transmission Control (P-8):—Remote control type. *See Transmission Section for complete data.*
Removal:—Remove floor boards, disconnect battery ground cable, speedometer cable, front and rear universal joints (see Chrysler Shop Notes for Propeller Shaft Center Bearing on 7 Pass. models), free hand brake cable at clevis, disconnect gear shifter rod and selector cable at transmission case (P-8 only). Remove mounting stud nuts, take out cover capscrews and lift off cover assembly (with shift lever on P-7), install two pilot studs in upper mounting stud holes, withdraw transmission.

UNIVERSALS

UNIVERSAL JOINTS:—Detroit-Universal Series 4200. Ball and trunnion type with roller bearings.
See Universals Section for complete data.
Propeller Shaft Center Bearing:—On 7 pass. sedans.
See Chrysler Shop Notes for servicing.

REAR AXLE

REAR AXLE:—Own Make. Semi-floating, hypoid gear type with Hotchkiss drive.
See Rear Axle Section for complete data.
Ratio—3.54-1 (P-7 Econ.). 3.73-1 (P-7 Spec., P-8 Econ.). 3.9-1 (P-7 Std., P-8 Coupe). 4.1-1 (P-8 Sedan). 4.3-1 (P-7, 8 with 18" or 20" tires, P-8 7 pass.).
Backlash—.006-.010". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal, remove axle shafts (see below), remove capscrews on carrier flange, pull carrier assembly out.
Axle Shaft Removal—Remove wheel, hub and drum assembly (use screw type hub puller), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate & oil seal, pull shaft & bearing.
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed check endplay with dial indicator. To adjust, remove backing plate (see above), add or remove shims equally (at both sides). **Endplay**—.003-.008".

SHOCK ABSORBERS

SHOCK ABSORBERS:—Delco. Direct acting type. Domestic—Front 1110-C. Rear 1111-T, W (20" wh.). Exp.—Front 1114-C. Rear 1115-T, W (20" wh.). Adj. Exp.—Front 1134-E. Rear 1130-W, Y (20" wh.). Adj.

FRONT SUSPENSION

Front Suspension:—Independent, linked parallelogram type with coil springs.
See Front Suspension Section for complete data.
Kingpin Inclination—5 1/4-6 1/2° (4 3/4-6°—7 pass.).
Caster—Minus 1/4° to Plus 1 1/2° (plus 1/2-2 1/2° 7 pass).
Camber—0° preferred. Limits minus 1/4° to plus 1/2°. Minus 1/4° to Plus 3/4° (7 passenger).
Toe In—1/16" (0-1/8"). Set long tie rod to 31 11/16" (between ball centers). Adjust short rod only.
Steering Geometry—Outer wheel 20°. Inner 22°30'.

STEERING GEAR

Steering Gear: Chrysler (Gemmer design Model 300) Worm-and-Roller type. See Gemmer 300 article. NOTE—RHD cars equipped with Gemmer Mod. 305.
See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service. Lockheed hydraulic, double anchor type. Hand lever applies independent shaft brake.
See Brake Section for complete data.
Wheel Cylinders—Stepped or two-stage bore type.
Drum—Centrifuse. Diameter 10", 11" (7 pass.).
Lining—Moulded type. Width 2". Thickness 13/64". Length per shoe, Front 10 9/32", 11 15/32" (7 Pass.), Rear 7 11/16", 7 31/32" (7 Pass.).
Clearance—.012" toe, .006" heel, for each shoe.
Hand Brake:—On drum at rear of transmission.
Adjustment—*See Chrysler Shop Notes for data.*
Drum—Cast-Iron. Diameter—6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

MISC. MECHANICAL

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

ENGINE

CONTINUED FROM PRECEDING PAGE

PISTON RINGS:—4 rings, all above pin—#1 Compression (upper inner edge beveled), #2 Comp. (lower outer edge stepped), #3 & 4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Comp. (Top)	1/8"	.007-.015"	.002-.004"
Comp. (#2)	1/8"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.001-.0025"

Replacement Rings:—Std. & .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter**—55/64". **Length**—2 5/8". Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Thumb push fit. Piston 100° F.
Pin Fit in Rod Bushing—Thumb push fit at 70°F.
Replacement Pins:—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight**—30.7 ozs. (with bearings and bolts). **Length**—7 15/16".
Crankpin Journal Diameter—1.9365-1.9375". *See "Original Bearing Sizes" in Chrysler Special Data.*
Lower Bearing—Removable, precision type, steel-backed babbitt.
Clearance—.0005-.0025". **Sideplay**—.0055-.0115".
Bearing Adjustment:—None (no shims). Install bearings with boss engaging groove in rod and cap.
Replacement Bearings: *Refer to Chrysler Shop Notes.*
Installing Rods:—Wide portion of bearing to rear (#1, 3, 5), to front (#2, 4, 6). Oil hole to camshaft.

CRANKSHAFT:—4 bearing type with 7 counterweights.
Journal Diameters—2.499-2.500". *See "Original Bearing Sizes" in Chrysler Special Data.*
Bearing Type—Removable, precision type, steel-backed, babbitt-lined. **Clearance**—.001-.002".
Replacement Bearings & Bearing Caps: *See Chrysler Shop Notes for complete data.*
End Thrust:—Taken by flange faces on rear (#4) main bearing. **Endplay**—.003-.007".

CAMSHAFT:—4 bearing. Non-adjustable chain drive. *See Chrysler Shop Notes for camshaft removal.*
Journal Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 1/4".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block).
Clearance—.001-.003" (#1), .0015-.0035" (all others).
End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".
Timing Chain:—Morse Type 1883-N, No. 2661. Width 1". Pitch .500" (1/2"). Length 24" or 48 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
All valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	5/16"	.001-.003"
Exhaust	45°	5/16"	.003-.005"

See Chrysler Shop Notes for Exh. valve seat insert data.
Valve Guides:—Remove from above. Press new guides in (stepped end down) with upper end 7/8" below top of block (use Tool CM-83), then finish ream to .342-.343" Intake, .344-.345" Exhaust.
Valve Springs:—Install with closely coiled ends to top.

Free length 2 3/32".	Spring Pressure	Length
Valve Closed	34-38 lbs.	1 3/4"
Valve Open	77-83 lbs.	1 7/16"

Valve Lifters:—Mushroom type (remove from below). Stem diam. 5/8". Ream holes from above (pilot in valve stem guide). Oversizes .001", .008", .030", .060". **Clearance in block**—.000-.001".

VALVE TIMING

Tappet Clearance:—.006" Int., .008" Exh. (hot & idling). .002" addt'l exh. clearance desirable for sustained high speeds. NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel, lower housing panel and pump shield for access.
Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 6° ATDC. Close 46° ALDC.
Exhaust Valves—Open 42° BLDC. Close 8° ATDC.
Valve Timing Check—With .011" (cold) tappet clearance, #6 intake valve should open with #6 piston 6° or .0153" ATDC with 6th graduation after DC mark on crankshaft pulley aligned with pointer on chain cover. Reset tappet clearance .006" (hot).

LUBRICATION

LUBRICATION:—Pressure (pump on right of engine). *See Chrysler Shop Notes for oil pump removal.*
Normal Oil Pressure:—30-45 lbs. @ 30 MPH, 15 idling.
Oil Pressure Relief Valve:—Under plug below starter. Opens at 40-45 lbs. To increase pressure use heavy (green)spring, to decrease use light (red) spring.
Crankcase Capacity:—5 quarts (refill).

COOLING

COOLING SYSTEM:—**Capacity**—14 quarts.
See Chrysler Shop Notes for radiator core removal.
Water Pump:—Packless type with belt drive.
See Water Pump Section for complete data.
Removal—Drain water. Remove fan belt. Disconnect pump inlet hose. Remove pump mounting stud nuts and lockwashers and move pump and fan assembly against radiator core. Remove 3 pump mounting studs. Lift pump and fan out.
Thermostat:—Bishop & Babcock or Fulton (Fulton only on P9). Starts to open 157-162°F. Fully open 183°.
Temperature Gauge:—Motometer (A-L) Type H-9334.
See Miscellaneous Section for complete data.

CLUTCH

CLUTCH:—**Borg & Beck Model 9A7, 11A6 (Taxi) with 'Borglite' member. #926 or #955 (9A7), #931 (11A6)**
See Clutch Section for complete data.
Facings—Spiral wound moulded woven, 2 used. Inside Diam. 6" (9A7), 6 1/2" (11A6). Outside Diam, 9 1/4" (9A7), 11" (11A6). Thickness 1/8" (all).
Adjustment:—Pedal should just clear toeboard (adjust stopscrew on lower end) and have 1" free movement (adjusting nut on link rod at clutch fork).
Removal:—Remove release fork pull-back spring, Transmission (see following) and housing underpan. Disconnect release fork from pivot and pull out as far as possible. Mark cover and flywheel, remove clutch cover screws evenly, lower assembly out.

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:—Steering column shift Std.
See Transmission Section for complete data.
Removal:—Remove propeller shaft (loosen comp. flange nut if transmission to be disassembled—See Chrysler Shop Notes for Propeller Shaft Center Bearing Removal on 7 pass.). Disconnect speedometer cable, battery ground cable, hand brake cable, and gear shift rod and cable at transmission. Remove mounting stud nuts and lockwashers. Pull unit back, lower and remove from under car.

UNIVERSALS

UNIVERSAL JOINTS:—**Detroit-Universal Series 4200** (3 & 5 pass.), Series 7200 (7 pass.). Roller bearings
See Universals Section for complete data.
Propeller Shaft Center Bearing:—Used on 7 passenger sedans. *See Chrysler Shop Notes for servicing.*

REAR AXLE

REAR AXLE:—Own Make. Semi-floating, hypoid gear
See Rear Axle Section for complete data.
Ratio—3.54-1 (P9 Econ.). 3.73-1 (P9 Spec., P10 Econ.). 3.9-1 (P9 Std., P10 Coupe). 4.1-1 (P10 Sedan). 4.3-1 (P9, 10—18 or 20" whls.; P10 7 Pass.).
Backlash—.006-.010". Screw adjustment.
Removal:—Disconnect drive shaft at rear universal. Remove axle shafts (see below) and capscrews on carrier flange. Pull carrier assembly out.
Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (Tool C-158). NOTE—Use Tool C-358 to pull oil washer, C-201, 2 to install.
Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed, check endplay with dial indicator. To adjust, remove backing plate, add or remove shims at both wheels equally. **Endplay**—.003-.008".

SHOCK ABSORBERS

SHOCK ABSORBERS:—**Domestic**—Delco Direct Acting. **Export**—Delco Direct Acting or Delco Adjustable

FRONT SUSPENSION

Front Suspension:—Independent, linked parallelogram type with coil springs.
See Front Suspension Section for complete data.
Kingpin Inclination—4 3/4° to 6°.
Camber—Pos. 1/4°. Limits 0° to Pos. 3/4°.
Caster—Neg. 1° to Pos. 1°. Not adjustable.
Toe In—1/16" (0-1/8"). Turn both rods equally.
Steering Geometry—Outer wheel 20°, Inner 22°.

STEERING GEAR

Steering Gear: Chrysler (Gemmer design Model 300) Worm-and-Roller type. See Gemmer 300 article. NOTE—7 Pass. equipped with Gemmer Model 305.
See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service. Lockheed hydraulic, double anchor type. Hand brake applies independent shaft brake.
See Brake Section for complete data.
Wheel Cylinders—Stepped or two-stage bore type.
Drums—Centrifuse. Diameter—10", 11" (7 pass.).
Lining—Molded. Width 2". Thickness 13/64".
Length per shoe: Front—10 5/16", 11 15/32" (7 pass.), Rear—7 11/16", 7 31/32" (7 passenger).
Clearance—.012" toe, .006" heel, for each shoe.
Hand Brake:—On drum at rear of transmission.
Adjustment—*See Chrysler Shop Notes for data.*
Drum—Cast-iron. Diameter—6".
Lining—Width 2". Thick. 5/32". Length 17 1/16".

MISC. MECHANICAL

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

CONTINUED FROM PRECEDING PAGE

IGNITION TIMING

IGNITION TIMING: Flywhl. Degrees Piston Position
All cyl. heads.....0° at TDC.....0000" at TDC
NOTE—Crankshaft pulley marked 'DC' at TDC point with 15 (1°) graduations on either side.
Timing (Using Timing Light)—Connect timing light between distributor primary terminal and battery terminal on generator regulator. Set #1 or #6 piston in firing position (see setting above) with correct mark on crankshaft pulley aligned with pointer on chain case cover. Loosen lock-plate hold-down screw, center pointer on scale, tighten screw. Loosen lock-plate clamp bolt, rotate distributor until timing light just goes out, tighten clamp bolt. Check Manual Adjustment (following).
Timing (Using Synchroscope)—Tool C-374. Clip lead to #1 spark plug, direct light on crankshaft pulley (mark correct graduation with paint), idle engine and adjust distributor (as above) until mark appears in line with pointer.
Manual Adjustment—Set to give slight ping from 10-30 MPH accelerating with wide open throttle from 10 MPH. To adjust, loosen lock-plate hold-down screw, move plate (not more than 4° or .007" before or after initial setting above).

CARBURETOR

CARBURETION:—Carburetor—Carter (Ball & Ball) Models D6A2 (Std.), D6C2 (with Automatic Choke).
Economy Carburetor—Carter (Ball & Ball) Model B6P1. 1¼" single barrel, downdraft type.
For complete data, refer to Carburetor Index.
Settings (Idle Setting, Float Level, and Accelerating Pump): *See Tune-Up data.*
Metering Jet—*See Carter (B&B) Jet Tables in Carburetor Section for complete data.*
NOTE—If lean metering jet (High Altitude calibration) used at lower altitudes for increased economy, speed and power are reduced (not recommended).
Fast Idle:—D6A2 & D6C2 only. Not adjustable.
Automatic Choke:—Sisson AC-758B (on optl. D6C2).
For complete data, refer to Carburetion Equip. Index.

CARB. EQUIPMENT

Air Cleaner:—AC #1529937 heavy duty oil-bath type.
Fuel Pump:—AC diaphragm type pump. Replacement Exchange Pump No. 505.
For complete data, refer to Carburetion Equip. Index.
Gasoline Gauge:—Auto-Lite electric. No. NG-9651D (dash unit), No. 9329T (tank unit).
For complete data, refer to Carburetion Equip. Index.

BATTERY

BATTERY:—Auto-Lite CF-1-13 (P11), CF-1-13R (P12). 6 volt, 13 plate, 90 ampere hour (20 hour rate).
Starting Capacity—114 amperes for 20 minutes.
Grounded Terminal—Positive (+) to engine.
Location—Under hood in left fender shield.

STARTER

Car Model	Auto-Lite Model	Armature Number
P11, P12	MZ-4089 or MZ-4089A	MZ-2108
P11, P12 Can.	MAW-4019 or MAW-4019A	MAW-2030

Drive—Overrunning clutch (manual pinion shift).
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).
Cranking Engine—150-175 amperes, 5.1 volts.

Performance Data—MZ Starters

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

Performance Data—MAW Starters

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4900	5.5	65
2.75 "	1480	5.0	200
8.50 "	400	4.0	400
11.5 "	Lock	3.0	505

Removal:—Flange mounted on left front face of flywheel housing. Disconnect wires (tape battery lead). Remove oil filter tubes, filter and 2 starter bolts.
Starting Switch:—A-L SW-2813. On starter. Manually operated by starter (pinion shift) pedal.
For complete data, refer to Electrical Equipment Index.

GENERATOR

Auto-Lite Model GDZ-4801B (Std.), Models GEB-4801A, GEG-4818A (City Police & Taxicab), GEG-4818B (State Police). Two brush. With current and voltage regulation. Ventilated.
Armature Nos.—No. GDZ-2006F (GDZ-4801B), GEB-2006F (GEB-4801A), GEG-2006F (GEG-4818B).
Charging Rate Adjustment: None. See Regulator.
Maximum Charging Rate—35 amperes (GDZ Gen.), 40 amperes (GEG Gen.), 8.0 volts, 2200 Gen. RPM (GDZ), 1680 RPM (GEG), at approx. 24 MPH (GDZ)

Cold Performance Data—GDZ-4801B Hot

Amperes	Volts	R.P.M.	Amperes	Volts	R.P.M.
0	6.4	925	0	6.4	1000
10	6.85	1200	10	6.85	1290
20	7.3	1480	20	7.3	1590
30	7.8	1760	30	7.8	1980
35①	8.0	1900	35	8.0	2250

Performance Data—GEB-4801A

0	6.4	560	0	6.4	600
8	6.8	700	8	6.8	750
16	7.2	845	16	7.2	930
24	7.6	1000	24	7.6	1140
32①	8.0	1150	32	8.0	1400

Performance Data—GEG-4818A, B

0	6.4	780	0	6.4	820
10	6.8	960	10	6.8	990
20	7.2	1130	20	7.2	1170
30	7.6	1310	30	7.6	1380
40①	8.0	1520	40	8.0	1680

①—Current regulator setting. See Regulator data.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—53 ozs. max. (GDZ Gen.), 64-68 ozs. (GEB & GEG Gen.) with new brushes.
Field Current—1.60-1.78 amperes at 6.0 volts (all).
Motoring Current—4.16-4.60 amperes (GDZ Gen.), 4.5 amps. (GEB), 4.7-5.2 amps. (GEG) at 6.0 volts.
Removal:—Pivot mounted at left side of engine at front. To remove, take out pivot and clamp bolts.
Belt Adjustment:—Loosen pivot and clamp bolts, pull out on generator until belt is snug or 40-50 lbs. tension secured on scale attached to field frame.

REGULATOR

Auto-Lite Regulator Positive Grd.	Neg. Ground	Generator Model
VRP-4001A	VRP-4005A	GDZ-4801-A, B
VRP-4001B	VRP-4005B	GEB-4801-A
VRP-4001F	VRP-4005E	GEG-4818-A, B

Current-Voltage types in single case on dash.
For complete data, refer to Electrical Equipment Index.
NOTE—Regulator case cover sealed. Serviced on exchange basis if seals not broken (to remove cover).

Cutout Relay
Cuts In—6.4-6.6 volts at approx. 1000 gen. RPM (VRP-4001A,5A), 600 RPM (1B,5B), 820 RPM (1F,5E).
Cuts Out—4.1-4.8 volts (approx. 4-6 amps. disch.).
Contact Gap—.015" Min. **Air Gap**—.031-.034" with contacts open (measure 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 seals) & Adjustment: *See Electrical Equipment Section.*
Contact Gap—.012" min. (armature against stop pin).
Air Gap—.048-.052" with contacts just opening.

Current Regulator

Regulator	Setting	Cover Mark
VRP-4001A & 5A	34-36 amperes	'35'
VRP-4001B & 5B	31-33 amperes	'32'
VRP-4001F & 5E	39-41 amperes	'40'

Checking (without breaking seals) & Adjustment: *See Electrical Equipment Section.*
Adjustment, Contact Gap, Air Gap—Same as for for Voltage Regulator (above).

LIGHTING

LIGHTING:—Headlamps—Corcoran-Brown 'Sealed Beam' type. *For data refer to Elec. Equip. Index.*
Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Red light on upper edge of panel above speedometer. Lighted with upper beams on.
Direction Signal—*Refer to Electrical Equip. Index.*

Switches
Lighting—Plymouth No. 863823.
Beam Selector—Plymouth No. 859974.
Instrument—Plymouth No. 853371.
Direction Signal—Plymouth No. 865763.

MISC. ELECTRICAL

FUSES:—Lighting—30 amp. On back of light switch. **Direction Signal (late cars)**—30 amp. Behind instr. panel in wire from ign. switch to flasher.
HORNS: Auto-Lite or Delco-Remy types as follows:
Single Delco-Remy 1999911, 18, 21, or 24 (6 volt), D-R 1999912 (12 volt), or Auto-Lite HA-4001 (6 volt).
Dual—Auto-Lite Horn Set HO-5005, HO-5007, or HT-5005. HO-5003 (Canada). Low Note Auto-Lite HA-4028 or HA-4030, High Note HA-4029 or HA-4031.
Current Draw—Approx. 7 amps. single, 35-40 dual.
Horn Relay:—Auto-Lite Model HRC-4001 (no fuse).
Contacts Close—1.5-3.0 volts. **Open**—.5 volt.
Contact Gap—.026". **Air Gap**—.016-.020" (closed)

ENGINE

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type.
Bore—3⅛". **Stroke**—4⅜".
Displacement—201.3 cu. ins. **Rated HP**—23.44.
Developed Horsepower—87 HP at 3800 RPM.
Compression Ratio—6.7-1 cast-iron head std.
Compression & Vacuum Reading—*See Tune-Up data.*
See Chrysler Shop Notes for Engine Removal directions.
PISTONS:—Two types used optionally: (1)—Aluminum alloy, U-slot type, or **(2)**—Steel-banded, aluminum alloy and steel. Both types cam ground & tin coated.
Length—3 11/16" (Al.), 3 5/16" (steel-banded).
Weight—14.4 ozs. (Al.), 14.5 ozs. (steel-banded).
Removal—Pistons and rods removed from above.
Clearance—Top land .028" (U-slot), .031" (steel banded). Skirt .0001-.0011" (U-slot), .001-.002" (steel).

ENGINE

CONTINUED FROM PRECEDING PAGE

Original Bore & Piston Sizes, Replacement Pistons:—*See Chrysler Shop Notes for sizes and markings.*

Fitting New Pistons:—Check piston size with micrometer at bottom of skirt at right angles to pin bosses. With piston and wall dry, piston should pass through bore of own weight (pin removed) with slight drag at normal room temperature (70° F.).

Installing Pistons:—Slot away from valves (U-slot). Strut toward front of engine (steel-banded type).

PISTON RINGS:—4 rings, all above pin—#1 Compression (upper inner edge stepped), #2 Comp. (lower outer edge stepped), #3 and #4 (slotted oil rings).

Ring	Width	End Gap	Side Clearance
Compr. (Top)	3/32"	.007-.015"	.0025-.004"
Compr. (#2)	1/8"	.007-.015"	.0015-.0035"
Oil Control	5/32"	.007-.015"	.001-.0025"

Replacement Rings:—Std. & .003", .005", .010", .015", .020", .023", .025", .030", .040", .050", .060" oversize.

PISTON PIN:—**Diameter—55/64". Length—2⅝".** Floating type. Pin hole in rod bronze bushed.

Pin Fit in Piston—Thumb push fit (piston at 100°).

Pin Fit in Rod Bushing—Thumb push fit at 70° F.

Replacement Pins:—Std. & .003", .005", .008" oversize.

CONNECTING ROD:—**Weight 31.52 ozs.** (with bearings and bolts). **Length—7 15/16".**

Crankpin Journal Diameter—1.9365-1.9375". *See "Original Bearing Sizes" in Chrysler Special Data.*

Lower Bearing—Removable, precision type, thin babbitt. **Clearance .0005-.0015". Sideplay .0055-.0115".**

Bearing Adjustment:—None (no shims). Replace bearings. *See Chrysler Shop Notes for instructions.*

Replacement Bearings:—*See Chrysler Shop Notes.*

Installing Rods:—Wide portion of bearing to rear (#1, 3, 5) to front (#2, 4, 6). Oil hole to camshaft.

CRANKSHAFT:—4 bearings, 7 integral counterweights.

Journal Diameters—2.499-2.500". *See "Original Bearing Sizes" in Chrysler Special Data.*

Bearing Type—Removable, precision type, thin babbitt on steel. **Clearance—.001-.002".**

Replacement Bearings & Bearing Caps: *See Chrysler Shop Notes for complete data.*

End Thrust:—Taken by flange faces on rear (#4) main bearing. **Endplay—.003-.007".**

CAMSHAFT: *CAUTION—2 types (See Valve Timing). See Chrysler Shop Notes for Camshaft Removal.*

Bearing Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1¼".

Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block). **Clearance—.0015-.0035".**

End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay—.002-.006".**

Timing Chain:—Morse Type 1883N, No. 2661. Width 1". Pitch .500" (½"). Length 24" or 48 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
All Valves	1 15/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	⅜"	.001-.003"
Exhaust	45°	⅜"	.003-.005"

See Chrysler Shop Notes for Exhaust Valve Seat Inserts.

Valve Guides:—Remove from above. Press new guides in (stepped end down) with upper end ⅞" below top of block, ream to **.342-.343" Int., .344-.345" Exh.**

Valve Springs:—Install with closely coiled end to top.

Free length 2".	Spring Pressure	Length
Valve Closed	40- 45 lbs.	1¾"
Valve Open	107-115 lbs.	1⅜"

Valve Lifters:—Mushroom type (remove from below). Stem diam. ⅝". Ream holes from above (pilot in valve guide). Oversizes .001", .008", .030" & .060". **Lifter Clearance in Block—.000-.001".**

VALVE TIMING

Tappet Clearance:—.008" Intake, .010" Exh. (hot and idling), .002" additional exh. clearance desirable for sustained high speeds. NOTE—Tappet screws self-locking (no locknuts). Remove right front wheel and lower wheel housing panel for access to valves.

Valve Timing:—See Camshaft Setting above.

Engine Numbers 1001 to 150391

Intake Valves—Open 12° BTDC. Close 44° ALDC.

Exhaust Valves—Open 50° BLDC. Close 6° ATDC.

Engine Number 150392 and Up

Intake Valves—Open 9° BTDC. Close 47° ALDC.

Exhaust Valves—Open 47° BLDC. Close 9° ATDC.

Valve Timing Check—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston **12° or .060" (up to Engine No. 150391), 9° or .0343" BTDC (Engine No 150392 and Up)** with 12th graduation (first cars), 9th graduation (later cars) before DC mark on crankshaft pulley aligned with pointer on cover. Reset tappet clear .008" hot.

LUBRICATION

LUBRICATION:—Pressure (pump on right of engine). *See Chrysler Shop Notes for Oil Pump Removal.*

Normal Oil Pressure:—30-45 lbs. at 30 MPH and above.

Oil Pressure Relief Valve:—Under plug below starter. Opens at 40-45 lbs. Spring painted red, green or unmarked. If spring replaced, use same color spring.

Crankcase Capacity:—5 quarts (refill).

COOLING

COOLING SYSTEM:—**Capacity 14 qts.** *See Chrysler Shop Notes Radiator Core Removal & Water Distrib. Tube data.*

Water Pump:—Packless type with grease fitting. *See Water Pump Section for complete data.*

Thermostat:—Bishop & Babcock or Fulton (Fulton only on P11). Starts to open 157-162° F. Fully open 183°.

CLUTCH

CLUTCH:—**Borg & Beck Model 9A7, 11A6 (Taxi) with 'Borglite' driven member. #955 (9A7), #931 (11A6)** *See Clutch Section for complete data.*

Facings—Molded-Woven, 2 used. I.D. 6" (9A7), 6½" (11A6). O.D. 9¼" (9A7), 11" (11A6). Thickness ⅛".

Adjustment:—Pedal should just clear toeboard (adjust stopscrew an lower end of pedal & have 1" free travel (adjusting nut on connector link at fork).

Removal:—Remove release fork pull-back spring, transmission (see Transmission) and housing underpan. Disconnect release fork from pivot, pull out release bearing and sleeve. Mark cover and flywheel. Take out cover screws evenly, remove assembly.

TRANSMISSION

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

Transmission Control:—Steering column shift. Manual type Std. Power Shift (vacuum type) Optl. *See Transmission Section for complete data.*

Removal:—Jack up front end of car, disconnect front universal (loosen companion flange nut if disassembling transmission—see Chrysler Shop Notes for Propeller Shaft Center Bearing Removal on 7 pass.). Disconnect speedometer cable, hand brake cable, gear-shift rods, vacuum and air hose (if Power Shift used). Remove trans.-to clutch housing capscrews and nuts. Pull unit to rear, down and out of car.

UNIVERSALS

UNIVERSAL JOINTS:—**Detroit-Universal Series 4200 (3 & 5 pass.), Series 7200 (7 pass.).** Roller bearings, *See Universals Section for complete data.*

Propeller Shaft Center Bearing:—Used on 7 passenger sedans. *See Chrysler Shop Notes for servicing.*

REAR AXLE

REAR AXLE:—**Own Make.** Semi-floating, Hypoid gears *See Rear Axle Section for complete data.*

Ratio—3.73-1 (P11, 12 Econ.), **3.9-1** (P11 Coupe), **4.1-1** (P11 Sedan, P12 Coupe exc. Conv.), **4.3-1** (P12 5 & 7 pass. Sedans, Conv. Coupe), **4.56-1** (P11, 12 6.00x18" tires). **Backlash** .006-.010". Screw adjustmet.

Removal:—Disconnect rear universal, remove axle shafts (see below) and carrier assembly cap screws.

Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and bearing (using Tool C-158).

Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed, check endplay with dial indicator. To adjust, remove backing plate (see above), add or remove shims (furnished .010", .0125", .015", .030" thick) equally at both wheels. **Endplay—.003-.008"**

SHOCK ABSORBERS

SHOCK ABSORBERS: Delco. Direct acting type.

FRONT SUSPENSION

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

Kingpin Inclination—4¾° to 6°.

Camber—Positive ¼°. Limits 0° to Pos. ¾°.

Caster—Negative 1° to Positive 1°. Not adjustable.

Toe In—1/16" (0-⅛"). Turn both rods equally.

Steering Geometry—Inner wheel 22°0'. Outer 20°.

STEERING GEAR

Steering Gear: Chrysler (Gemmer design Model 305, 335 on 7 passenger) Worm-and-Roller with 'push-pull' adjustments. See Gemmer Model 305, 335 *See Steering Gear Section for complete data.*

BRAKES

BRAKES:—**Service.** Lockheed hydraulic, double anchor type. Hand lever applies independent shaft brake. *See Brake Section for complete data.*

Drums—10" centrifuse, 11" (7 passenger).

Lining—Molded asbestos. 2" wide, 13/64" thick. Length per shoe: Front—10 5/16", 11 15/32" (Seven passenger); Rear—7 11/16", 7 31/32" (7 passenger). **Clearance**—.012" Toe (top), .006" Heel, for each shoe.

Hand Brake:—On drum at rear of transmission.

Adjustment—*See Chrysler Shop Notes for instructions.*

Drum—Cast-iron. Diameter 6".

Lining—Width 2". Thick. 5/32". Length 17 1/16".

MISC. MECHANICAL

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

CONTINUED FROM PRECEDING PAGE

Cutout Relay

Cuts In—6.4-6.6 volts at approx. 1000 gen. RPM.
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 Regulater (above).

Contact Gap & Air Gap—Same as Voltage Regulator.

LIGHTING

LIGHTING:—Headlamps—Corcoran-Brown 'Sealed Beam' type. *For data, refer to Elec. Equipment Index.*

Headlamp Adjustment—Aim upper beam straight ahead (hot spot center 3" below lamp center height).
Beam Indicator—Small red light on instrument panel above speedometer. Lighted with upper beams on.
Direction Signal—*Refer to Electrical Equip. Index.*

Switches

Lighting—Plymouth No. 863823 or No. 910507 (with Lighting Circuit Breaker).
Beam Selector—Plymouth No. 859974.
Instrument—Plymouth No. 976098.
Dome Light—Plymouth No. 317180 (Pillar Switch), No. 882943 (Door Switch).
Stop Light—Plymouth No. 677112.
Direction Signal—Plymouth No. 938926.

Bulb Specifications

Position	Candlepower	Mazda No.
Headlamps	Sealed Beam	
Parking (without Dir. Signal)	3	63
Front Dir. Signal & Parking	21-3	1158
Instrument	6	81
Beam & Dir. Ind., Ign. Sw.	1	51
Tail (without Direct. Signal)	3	63
Rear Direct. Signal & Tail	21-3	1158
Stop Light	21	1129
Rear License	3	63
Reading or Dome	15	87

MISC. ELECTRICAL

FUSES:—Lighting—30 amp. On back of light switch.
Clock—2 ampere. In clock lead connector.
Direction Signal—9 ampere. In fuse connector in wire from ignition switch to flasher.

HORNS:—Dual. Auto-Lite HA-4028 (low pitch), HA-4029 (high pitch) or horn set HO-5005 or HT-5001.
Current Draw—35-40 amperes.
NOTE—Horns connected through ignition switch and are operative only with ignition switch 'on'.

Horn Relay:—Auto-Lite Model HRL-4001.
Contacts Close—1.5-3.0 volts. **Open**—.5 volt.
Contact Gap—.026". **Air Gap**—.016-.020" (closed).

ENGINE

ENGINE SPECIFICATIONS:—6 cylinder, 'L' head type.
Bore—3 1/4". **Stroke**—4 3/8".
Displacement—217.8 cubic inches. **Rated HP**—25.35.
Developed Horsepower—95 at 3400 RPM.
Compression Ratio—6.8-1 cast-iron head standard.
Compression Pressure—160-170 lbs. at 1000 RPM or 125-135 lbs. at cranking speed. Variation 10 lbs. max.
Vacuum Reading—18-21" steady idling at 6 MPH.
Refer to Chrysler Shop Notes for Engine Removal data.

PISTONS:—Cast-Iron, cam ground, ribbed, coated, lightweight type. **Length**—3 1/2".
Removal—Pistons and rods removed from above.
Clearance—Top land .021". Skirt .0008-.0018".

Original Bore & Piston Sizes, Replacement Pistons:—*Refer to Chrysler Shop Notes for sizes and markings.*

Fitting New Pistons:—Check piston size with micrometer at bottom of skirt 90° from pin bosses. With piston and wall dry and clean, insert .0015"x1/2" feeler between cylinder wall and piston (piston inverted, pin removed) with feeler 90° from pin bosses. Feeler pull 10-15 lbs. (with piston and block at 70°F).

PISTON RINGS:—4 rings, all above pin. #1 & 2 Compression (upper inner edge stepped). #3 & 4 Oil (slotted).

Ring	Width	End Gap	Side Clearance
Compression	3/32"	.007-.015"	.0025-.004"
Oil Control	5/32"	.007-.015"	.001-.0025"

Replacement Rings:—*Refer to Chrysler Shop Notes.*

PISTON PIN:—Diameter—55/64". **Length**—2 3/4". Floating type. Pin hole in rod bronze bushed.
Pin Fit in Piston—Loose thumb push fit at 70°F. Pin should fall out if piston jarred.
Pin Fit in Rod Bushing—Thumb push fit at 70°F.

Replacement Pins:—Standard and .003, .008" oversize.

CONNECTING ROD:—Length—7 15/16".
Crankpin Journal Diameter—2.0615-2.0625". *See "Original Bearing Sizes" in Chrysler Special Data.*
Lower Bearing—Removable, precision type, thin babbitt. **Clearance** .001-.002". **Sideplay** .005-.011".

Bearing Adjustment:—*Refer to Chrysler Shop Notes for bearing removal and fitting data.*

Replacement Bearings: *See Chrysler Shop Notes.*

Installing Rods:—Wide portion of bearing to rear (#1, 3, 5), to front (#2, 4, 6). Oil hole to camshaft.

CRANKSHAFT:—4 bearings, 7 integral counterweights with new impulse neutralizer (vibration dampener).
Journal Diameters—2.4995-2.5005". *See "Original Bearing Sizes" in Chrysler Special Data.*
Bearing Type—Removable, precision type, thin babbitt on steel. **Clearance**—.001-.002".

Bearing Adjustment:—*Refer to Chrysler Shop Notes for bearing removal, adjustment, & Crankshaft Oil Seals.*

Replacement Bearings & Bearing Caps: *See Chrysler Shop Notes for complete data.*

End Thrust:—Taken by flange faces on rear (#4) main bearing. **Endplay**—.003-.007" (.003" desired).

CAMSHAFT:—4 bearing. Non-adjustable chain drive. *Refer to Chrysler Shop Notes for Camshaft Removal.*
Bearing Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 1/4".
Bearing Type—Removable steel-backed, babbitt-lined bushings (except #4 machined in block). **Clearance**—.0015-.0035".

End Thrust:—Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".

Timing Chain:—Morse Type 1883N, No. 2661. Width 1". Pitch .500" (1/2"). Length 24" or 48 links.

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

VALVES:—	Head Diameter	Stem Diameter	Length
Intake	1 17/32"	.340-.341"	4 25/32"
Exhaust	1 13/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	3/8"	.001-.003"
Exhaust	45°	3/8"	.003-.005"

Refer to Chrysler Shop Notes for Exhaust Valve Seat Insert servicing and replacement data.

Valve Guides:—Remove from above. Press new guides in (stepped end down) with upper end 7/8" below top of block, ream to .342-.343" Int., .344-.345" Exh.

Valve Springs:—Install with closely coiled end to top.

Free length 2".	Spring Pressure	Length
Valve Closed	40-45 lbs.	1 3/4"
Valve Open	107-115 lbs.	1 3/8"

Valve Lifters:—Mushroom type (remove from below). Stem diam. 5/8". Ream holes from above (pilot in valve guide). Oversizes .001", .008", and .030".
Lifter Clearance in Block—.000-.001".

VALVE TIMING

Tappet Clearance:—.008" Intake, .010" Exh. (hot and idling), .002" additional exh. clearance desirable for sustained high speeds. NOTE—Tappet screws self-locking. Remove right front engine inspection shield between fender and frame for access to valves.

Valve Timing:—See Camshaft Setting above.
Intake Valves—Open 12° BTDC. Close 44° ALDC.
Exhaust Valves—Open 50° BLDC. Close 6° ATDC.
Valve Timing Check—With .014" (cold) tappet clearance #6 intake valve should open with #6 piston 12° or .061" BTDC with 12th graduation before DC mark on impulse neutralizer aligned with pointer on chain case cover. Reset tappet clearance at .008" hot.

LUBRICATION

LUBRICATION:—Pressure (pump on right of engine). *Refer to Chrysler Shop Notes for Oil Pump Removal.*

Normal Oil Pressure:—30-45 lbs. above 30 MPH.

Oil Pressure Relief Valve:—Under plug below starter. Opens at 40-45 lbs. Spring painted red, green, or unmarked. If spring replaced, use same color spring.

Crankcase Capacity:—5 quarts (refill).

COOLING

COOLING SYSTEM:—Capacity—15 quarts.
Refer to Chrysler Shop Notes for Radiator Core Removal and Water Distribution Tube servicing.

Water Pump:—Packless type with grease fitting.
See Water Pump Section for complete data.

Thermostat:—Bishop & Babcock or Fulton (Fulton on P14S). Starts to open 157-162°F. Fully open 183°. NOTE—By-pass thermostat on P14C must be installed with 2 by-pass ports to front, 2 to rear.

Temperature Gauge—Auto-Lite (Motometer) Vapor tension type. Auto-Lite Part No. H-9912.
See Miscellaneous Section for complete data.

CLUTCH

CLUTCH:—Borg & Beck 9A7 (Std.), 11A6 (Taxi) with 'Borglite' driven member. #955 or 926 (9A7), 931 (11A6) stamped on cover. Single plate, dry disc types.
See Clutch Section for complete data.

Facings—Spiral woven, 2 used. I.D. 6" (9A7), 6½" (11A6). O.D. 9¼" (9A7), 11" (11A6). Thickness ⅛".

Adjustment:—Pedal should just clear toeboard (adjust stopscrew on lower end of pedal) and have 1" free travel (adjusting nut on connector link at fork). NOTE—Do not disturb turnbuckle on pedal link (controls pedal over-center spring tension).

Removal:—Remove transmission (see below), release fork pull-back spring and housing underpan. Disconnect release fork from pivot, pull out release bearing and sleeve. Mark cover and flywheel. Take out cover screws evenly, lower assembly out.

TRANSMISSION

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

Transmission Control:—Steering column shift. Manual type Std. Power Shift (vacuum type) Optl.
See Transmission Section for complete data.

Removal:—Jack up front end of car. Remove propeller shaft (loosen mainshaft flange nut if transmission to be dismantled). Disconnect speedometer cable, hand brake cable at brake band, gearshift rods, vacuum and air hose (if Power Shift used). Remove transmission-to-clutch housing capscrews. Pull transmission to rear and lower out of car.

NOTE—When installing transmission, use pilot studs to prevent springing clutch plate.

UNIVERSALS

UNIVERSAL JOINTS:—Detroit-Universal Series 4200. Ball and trunnion type with roller bearings.
See Universals Section for complete data.

REAR AXLE

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

Ratio—4.1-1 Suburban, 3.9-1 All other models.

Backlash—.006-.010". Screw adjustment.

Removal:—Hoist rear end of car, remove rear wheels. Disconnect brake hose at frame bracket, lower ends of shock absorbers and rear universal. Support axle housing, remove rear spring hold-down clips and withdraw assembly from car. NOTE—Carrier can be removed without taking out housing by removing axle shafts, disconnecting rear universal and removing carrier screws.

Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-319), block brake pedal, disconnect brake line at wheel cylinder, take off backing plate with oil seal, pull shaft and wheel bearing (use Tool C-158).

Wheel Bearing Adjustment:—Shims between backing plate and axle housing. With wheel and hub removed, check endplay with dial indicator. To adjust, remove backing plate (see above), add or remove shims (furnished .010", .0125", .015", .030" thick) equally at both wheels. **Endplay—.003-.008".**

SHOCK ABSORBERS

SHOCK ABSORBERS:—Own make, direct acting hydraulic (same as Delco design). NOTE—Delco Direct acting, adjustable, shock absorbers used for export.

FRONT SUSPENSION

Front Suspension:—Independent, linked parallelogram type with coil springs and direct acting shocks.
See Front Suspension Section for complete data.
Kingpin Inclination—4¾° to 6°.
Camber—Positive ¼°. Limits 0° to Pos. ¾°.
Caster—Negative 1° to Positive 1°. Not adjustable.
Toe In—0-1/16". Turn both tie rods equally
Steering Geometry Inner wheel 22° ± 1°. Outer 20°.

STEERING GEAR

Steering Gear: Chrysler (Gemmer design 305) Worm-&-Roller with 'push-pull' adjustments. See Gemmer.
See Steering Gear Section for complete data.

BRAKES

BRAKES:—Service. Lockheed hydraulic, double anchor type. Hand lever applies independent shaft brake.
See Brake Section for complete data.
Wheel Cylinders—Stepped or two-stage bore type.
Drums—Centrifuse. Diameter 10".
Lining—Molded asbestos. Width 2". Thick, 13/64".
Length per shoe: Front 10 5/16", Rear 7 11/16".
Clearance—.012" Toe (top), .006" Heel, for each shoe.
Braking Power—60% front wheels, 40% rear.

Hand Brake:—On drum at rear of transmission.
Adjustment—*See Chrysler Shop Notes for instructions.*
Drum—Cast-iron. Diameter 6".
Lining—Woven asbestos. Width 2". Thickness 5/32".
Length 16 11/16".

MISC. MECHANICAL

WINDSHIELD WIPER:—Auto-Lite EWH-5001, 5003 (Conv. Coupe). Electric type with circuit-breaker.
See Miscellaneous Section for complete data.
Circuit Breaker—Vibrating, thermostatic type Starts to operate with current of 12 amperes.
Power Operated Convertible Top: Vacuum Power type.
See Miscellaneous Section for complete data.

Manual Adjustment—Provides for minor changes in ignition timing at distributor. See Ignition Timing.

Distributor Removal: Mounted on left side of crankcase. To remove, disconnect vacuum line, take out hold-down screw in lock plate. **Installation Note**—Install distributor with #1 piston in firing position.

IGNITION TIMING

Std. Setting—Initial setting (for regular non-premium fuel) as shown below. See Manual Adjustment (following) for Final Setting.

	Flywheel Degrees	Piston Position
All Engines	0° at TDC	.000" TDC

NOTE—Impulse neutralizer marked 'DC' at TDC. with 15 (1°) graduations on either side.

Timing (Using Timing Light)—Connect timing light between distributor primary terminal and battery terminal on generator regulator. Set #1 or #6 piston in firing position (see setting above) with correct mark on impulse neutralizer aligned with pointer on chain case cover. Loosen lock-plate hold-down screw, center pointer on scale, tighten screw. Loosen lock-plate clamp bolt, rotate distributor until timing light just goes out, tighten clamp bolt. Check Manual Adjustment (following) for final setting.

Timing (Using Synchroscope)—Tool C-374. Clip lead to #1 spark plug, direct light on impulse neutralizer (mark correct graduation with paint), idle engine, adjust distributor as directed above until mark aligned with pointer on chain case cover.

Manual Adjustment—Set to give slight ping from 10-30 MPH accelerating with wide open throttle. To adjust, loosen lock-plate hold-down screw, move plate (not more than 4° or .007" before or after initial setting) counter-clockwise (if no ping), clockwise (if ping too severe), tighten screw.

CARBURETOR

CARTER (B&B)

Carter (B&B) Model D6G1 (Std.), B6V1 or B6W1 (Econ. Models). 1½" (D6G1), 1¼" (B6V1, W1) 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 Jet—*See Carter (B&B) Jet Tables in Carburetor Section for complete jet data.*

CARBURETOR

CARTER W1

Carter W1, No. 574S. 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 Rod & Jet—*See Carter Jet Table in Carburetor Section for complete data.*

CARBURETOR

STROMBERG

Stromberg Model BXV-3. Stromberg No. 380220. Code No. 3-84. 1½" single barrel, downdraft type.

See Carburetor Section for complete data.

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

Metering Jet—*See Stromberg Jet Table in Carburetor Section for complete jet data.*

CARB. EQUIPMENT

Fast Idle: Throttle opened to fast idle position when choke valve closed. Not used on Economy carb.

Automatic Choke: Sisson type Optl.

See Carburetion Equipment Section for data.

Air Cleaner: AC No. 1543851 Heavy duty oil-bath type. Filter Element AC No. 1544091.

Servicing—Wash filter element in kerosene, drain and clean oil reservoir and refill to indicated level mark with 1 pint SAE No. 50 engine oil (SAE No. 20W for temperatures below freezing) at 1000 mile or 30 day intervals, or more often if required.

Oil Filler Cap (crankcase Ventilator) Air Cleaner: Wash filter element in cap in kerosene and re-oil by dipping in SAE No. 50 engine oil at 1000 mile or 30 day intervals or more often if required.

Crankcase Ventilator Outlet Air Cleaner—Special equipment for cars operating in dusty regions. Servicing same as given for Oil Filler Cap Cleaner.

Fuel Pump: AC No. 1539042 or Carter No. M594S. Diaphragm type fuel pump.

Replacement Pump—AC No. 577 (for 1539042).

Pressure—3½-5½ lbs.

See Carburetion Equipment Section for data.

Fuel Tank Filter: New Oillite metal filter in tank.

Servicing—If more than 2 pints water in tank, fuel will not pass filter. Remove filler cap and drain plug, draining tank. Disconnect fuel line at some point between pump and tank, blow out line and filter with air, increasing pressure as filter is cleaned. Flush tank with clean gasoline.

Gasoline Gauge: Auto-Lite Electric type. Dash Unit No. NG-10878D, Tank Unit No. NG-10862T.

See Carburetion Equipment Section for data.

BATTERY

Auto-Lite Type 1M-100D or Willard WT-1-15C (Orig. Equip.), Auto-Lite Type PN-15 or Willard HW-1-100 (Replacement). 6 volt, 15 Plate, 100 Ampere Hour Capacity (20 hour rate).

Starting Capacity—120 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.2 minutes (Auto-Lite), 3.3 minutes (Willard). Five second voltage 4.15 volts (Auto-Lite), 4.2 volts (Willard).

Grounded Terminal—Positive (+) to engine.

Location—In left fender shield under engine hood.

Dimensions—Length 9 3/32" (A-L), 9" (W). Width 7⅛" (A-L), 7" (W). Height 8⅝" (A-L), 8¾" (W).

STARTER

Auto-Lite Model MZ-4133 (U.S.), MAW-4041 (Can.).

Armature—Auto-Lite No. MZ-2108 (MZ-4133 Starter), MAW-2030 (MAW-4041 Starter).

Drive—Outboard Barrel Type Bendix No. A2089.

Rotation—Counter-clockwise at commutator end.

Brush Spring Tension—42-53 ozs. (new brushes).

Cranking Engine—150-175 amperes, 5.1 volts.

Performance Data—MZ-4133

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

Performance Data—MAW-4041

Torque		R.P.M.	Volts	Amperes
0	ft. lbs.	4900	5.5	65
.60	"	3300	5.5	100
2.75	"	1480	5.0	200
5.45	"	820	4.5	300
8.50	"	400	4.0	400
11.55	"	110	3.5	500
11.5	"	Lock	3.0	505
18.0	"	Lock	4.0	670

Removal: Disconnect wires (tape battery lead), remove mounting bolts, withdraw starter (not necessary to disturb oil filter or oil lines).

Starting Switch: Auto-Lite Model SST-4001. Magnetic type mounted on left front fender shield and controlled by pushbutton on instrument panel.

See Electrical Equipment Section for complete data.

GENERATOR

STANDARD

Auto-Lite Model GDZ-4801A, Armature GDZ-2006F. Two brush (shunt) type with voltage and current regulation. Ventilated by fan on drive pulley.

Charging Rate Adjustment—None. See Regulator.

Maximum Charging Rate—35 amperes, 8.0 volts, 2200 gen. RPM or approx. 25 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	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
35①	8.0	1900	35	8.0	2250

①—Current regulator setting. See Regulator data.

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 side of engine at front. To remove, take out pivot and clamp bolts.

Belt Adjustment: Loosen pivot and clamp bolts, pull out on generator until belt is snug (40-50 lbs. tension secured on scale attached to field frame) or ¼" belt deflection between generator and pump

GENERATOR

SPECIAL EQUIPMENT

Auto-Lite GEG-4823A or GEG-4823B. Armature No. GEG-2006F. Two brush (shunt) type with voltage and current regulation. Ventilated.

SEE CHRYSLER 8 C39 PAGE FOR ALL DATA.

REGULATOR

Std. (for "GDZ" Gen.)—Auto-Lite VRP-4001A, VRP-4401A, VRP-4501A, VRP-4503A.

Spec. Equip. (for "GEG" Gen.)—Auto-Lite VRP-4001F, VRP-4401B, VRP-4501C (VRP-4005E for negative ground). Vibrating voltage and current regulators with Cutout Relay.

See Electrical Equipment Section for complete data.

NOTE—Regulator case cover is sealed. Serviced on exchange basis if seals not broken (to remove cover).

CONTINUED ON NEXT PAGE

VALVE TIMING

Tappet Clearance: .008" Intake, .010" Exhaust, Hot. NOTE—Tappet screws self-locking type.

Valve Timing: See Camshaft Setting above.
Intake Valves—Open 12° BTDC. Close 44° ALDC.
Exhaust Valves—Open 50° BLDC. Close 6° ATDC.
Valve Timing Check—With .014" tappet clearance (Cold), #6 intake valve should open with #6 piston 5° to 17° or .011" to .122" BTDC with 5th to 17th graduation before DC mark on impulse neutralizer aligned with pointer on chain case cover. Reset tappet clearance to running clearance .008" Hot.

LUBRICATION

Engine Oiling System: Pressure to main and connecting rod bearings, camshaft bearings, and timing chain. New "Rotor" type oil pump.
Crankcase Capacity—5 qts. (refill).
Normal Oil Pressure—40-45 lbs. above 30 MPH.
Oil Pressure Regulator—Under plug on left side of crankcase (below starter). Opens at 40-45 lbs. Adjustable by replacing spring (Std. spring Unpainted, Lighter spring—Red, Heavier spring—Green). CAUTION—Install replacement spring of same color as original spring.

Oil Pump: New "Rotor" type on right side of engine.
Servicing—*See "Oil Pump" in Chrysler Shop Notes.*

Oil Filter: On left side of engine above starter.
Servicing—Replace filter at 8000 mile intervals.

Oil Pressure Gauge: Auto-Lite No. G-10875 (not elec).

COOLING

Cooling System: Positive circulation with water pump on front of engine and water distribution tube in cylinder block. Special Deluxe model has by-pass type thermostat (with bypass between outlet on cylinder head and pump inlet) for re-circulation of water through engine with thermostat closed.
Capacity—15 quarts.

Radiator Core Removal & Water Distribution Tube Servicing: *See "Cooling System" in Chrysler Shop Notes.*

Water Pump: Packless type with grease fitting.
See Water Pump Section for complete data.
Removal—Drain cooling system, loosen generator mounting bolts and remove fan belt. Disconnect water inlet hose at pump (and by-pass hose connection on Special Deluxe models). Remove pump mounting capscrews, lift out pump and fan.

Thermostat: In cylinder head water outlet connection. NOTE—By-pass type on Special Deluxe.
Setting—Starts to open at 157-162°F. Fully open at 183-187°F.

Temperature Gauge: Auto-Lite H-11002. Not electric.

CLUTCH

Borg & Beck.....9A7 (Std.), 10A7 (Fleet), 11A6 (Taxi)
Auburn (1948 Part Production).....Model 9251-11

Clutch Identification: 3 pressure plate springs used on Auburn, 9 springs on Borg & Beck.

Borg & Beck Nos. 926 (9A7), 957 (10A7), 931 (1946-47 11A6), 957 (1948 11A6).
See Clutch Section for complete data.
Facings (Borg & Beck)—Woven, 2 required.

	Inside Diam.	Outside Diam.	Thickness
9A7	6"	9¼"	.125" (⅛")
10A7	7"	10"	.125" (⅛")
11A6	6½"	11"	.125" (⅛")

Pedal Adjustment: Set pedal to just clear toeboard (stopscrew on lower end of pedal) and set for 1" free travel (adjust nut on connector link at fork). NOTE—Do not disturb turnbuckle on pedal link.
Clutch Over-Center Spring—*See "Clutch Notes" in Chrysler Shop Notes for setting procedure.*

Removal: Remove Transmission (see Transmission Removal below), remove release fork pull-back spring and clutch housing underpan. Disconnect release fork from pivot, withdraw release bearing and sleeve from housing. Mark clutch and flywheel (to insure correct re-installation), remove all clutch cover mounting screws evenly, remove clutch cover assembly and driven member through opening at bottom of housing.

TRANSMISSION

Own Make. All helical gear, constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse).
See Transmission Section for complete data.
►*HARD SHIFTING CORRECTION—See "Chrysler, DeSoto, Dodge & Plymouth Synchro-Mesh" in Transmission Section for complete data.*

Transmission Control: Remote control type with gearshift lever mounted on steering column.
See Transmission Section for complete data.

Removal: Jack up front end of car. Disconnect front universal by taking out bolts in shaft flange (if transmission to be dismantled, loosen flange retaining nut), and rear universal by removing bearing caps on rear axle yoke (wire bearing cups in place to prevent loss of bearing rollers). Disconnect speedometer cable, hand brake cable at brake band, gearshift control rod and selector rod at transmission case. Remove transmission mounting screws in clutch housing, pull transmission straight back to free clutch shaft, then lower transmission and remove from beneath car.
NOTE—When installing transmission, use pilot studs installed in upper mounting screw holes to maintain alignment and prevent springing clutch driven member.

UNIVERSALS

Detroit Universal Series 4283 (Early), 4200 (Late). 4283 is ball & trunnion front, cross type rear. 4200 is ball & trunnion front and rear.
See Universals Section for complete data.

REAR AXLE

Own Make. Semi-floating, hypoid gear type with Hotchkiss Drive.
See Rear Axle Section for complete data.
Ratio (Std.)—3.9-1 (exc. Sta. Wgn.), 4.1-1 (Sta. Wgn).
Ratio (Optl.)—3.54-1, 3.73-1, 4.1-1, 4.3-1, 4.56-1 & 4.78-1 (Export).
Backlash—.006-.010". Screw adjustment.

Removal: Hoist rear end of car. Remove rear wheels. Disconnect brake hose at frame bracket, disconnect lower end of shock absorbers. Disconnect propeller shaft by removing capscrews from bearing caps on rear axle yoke (wire bearing caps in place to prevent loss of bearing rollers). Support axle housing, remove rear spring "U" bolts, lower axle assembly and remove from beneath car.
NOTE—Carrier assembly can be removed without disturbing axle housing by removing axle shafts and taking out carrier-to-housing mounting screws.
Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-675), block brake pedal, disconnect brake line at wheel cylinder, remove axle shaft key, install sleeve (Tool C-745) in oil seal, remove brake support (oil seal mounted in support), pull shaft and bearing (use C-499 puller). NOTE—Use Puller C-293-E to remove bearing from shaft, puller C-748 or C-358 to remove inner oil seal, drift C-201 to install seal.

Axle Shaft Oil Seal: New leather type mounted on brake support (backing plate).
Oil Seal Servicing—*See "Rear Axle" in Chrysler Shop Notes.*

Wheel Bearing Adjustment: Shims between backing plate and axle housing. With wheel and hub removed, check endplay with dial indicator. To adjust, remove backing plate (see above), add or remove shims (furnished .010", .0125", .015", .030" thick) equally at both wheels. **Endplay**—.003-.008".

SHOCK ABSORBERS

Delco—Model 1030-C (Front), 1031-T (Rear).
Monroe—Model K-11148 (Front), K-11149 (Rear).

FRONT SUSPENSION

Front Suspension: Independent, linked parallelogram type with coil springs and direct acting shock absorbers.
See Front Suspension Section for complete data.
Kingpin Inclination—4¾° to 6° crosswise.
Camber—Positive ¼°. Limits 0° to Pos. ¾°.
Caster—Negative 1° to Positive 1°. No adjustment.
Toe In—0" (0-1/16"). Adjust by turning both tie rods equally.
Steering Geometry—Inner wheel 22½°. Outer 20°.

STEERING GEAR

Own Make. Worm-and-roller type with "push-pull" adjustments. Same as Gemmer design Model 305. NOTE—See Gemmer Model 305 article for data.
See Steering Gear Section for complete data.

BRAKES

Service: Chrysler "Safe-guard" Lockheed Hydraulic type as follows:
Front Wheels—Two-cylinder type (front shoe anchored at bottom and actuated by upper cylinder, rear shoe anchored at top and actuated by lower cylinder).
Rear Wheels—Double anchor type with single double-acting wheel cylinder.
See Brake Section for complete data.
►**Brake Squeek Correction**—*See "Chrysler Brakes" in Brake Section.*
Wheel Cylinders—Single acting type (front), double acting type with straight (1⅛") bore (rear).
Drums—Centrifuse type. Diameter 10".
Lining—Molded Asbestos. Width 2". Thick. 13/64". Length per wheel 21" (front wheels), 18½" (rear wheels).
Clearance—.006" at each end of all brake shoes.

Hand Brake: Independent type. Hand lever actuates band on drum at rear of transmission.
Drum Diameter—6". Cast-iron.
Lining—Width 2". Thickness 5/32". Lgth. 16 11/16".
Clearance—.015-.020" around band.
Adjustment—*See Chrysler Shop Notes.*

MISC. MECHANICAL

CONVERTIBLE TOP CONTROL: Vacuum power type.
See Miscellaneous Section for complete data.

CONTINUED FROM PRECEDING PAGE

Cutout Relay

Cuts In (VAV, VRP)—6.4-7.0 volts (set to 6.4-6.6 volts).

Cuts In (VBA)—6.35-6.75 volts (set to 6.4-6.6 volts).
Cuts Out (All)—4.1-4.8 volts (approx. 4-6 amps. dis.)
Contact Gap (All)—.015" minimum.
Air Gap (All)—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator

Setting (VAV, VRP)—7.2-7.5 volts at 70° F. **(VBA)**—7.0-7.2 volts at 70°F. See Electrical Equipment Section for settings at other temperatures.
Checking (without breaking seals) & Adjustment—*See Electrical Equipment Section.*
Contact Gap (VRP)—.012" min. (arm against stop).
Air Gap (All)—.048-.052" with contacts just opening.

Current Regulator **Setting**
VRP-4401-B & 3-A 39-41

►**(Temperature Compensated Regulators)** **Nominal Setting**
VAV-4404-A, VBA-4101-A & 4-A 50
VAV-4404-B, VBA-4101-B & 4-B 45
VRP-4503-A 35
VRP-4503-B 40

►*CAUTION*—Nominal setting is approx. setting at 70°F. room temperature after regulator has been run (will be higher started cold). See Electrical Equip. Section for settings at various temperatures.
Checking (without breaking seals) & Adjustment—*See Electrical Equipment Section.*
Contact Gap (VRP)—.012" min. (arm against stop).
Air Gap (All)—.048-.052" with contacts just opening.

LIGHTING

Headlamps: Corcoran-Brown "Sealed Beam" type with new "Bull's-eye lens."
See Electrical Equipment Section for complete data.
Beam Indicator—On speedometer dial. Lighted when upper beams "on."

Direction Signal: *See Electrical Equipment Section.*
Direction Signal Indicator—On speedometer dial. Flashes when direction signal operating.

Switches

Lighting—Plymouth No. 1300600.
Beam Seleetor—Plymouth No. 1253460.
Instrument—Plymouth No. 1244997.
Map Light—Plymouth No. 625616.

MISC. ELECTRICAL

CIRCUIT BREAKER: 30 ampere. On back of instrument panel above headlight switch.

FUSES: Clock—2 ampere. In clock lead connector. **Radio**—14 ampere. In fuse connector at radio.

HORNS: Auto-Lite Model HW-4201 (Low Pitch), HW-4202 (High Pitch). Dual horns operated by relay.

Horn Relay: Auto-Lite HRL-4103 or 4104. Connected thru ignition switch, operates only with ignition on.
Contact Close—1.5-3.0 volts (seal to core with 4 V).
Contacts Open—.5 volt min. (open from seal).
Contact Gap—.026". **Air Gap**—.016-.020" (armature air gap with contacts closed but not sealed), .015-.018" (gap between armature leg and yoke with armature sealed to core).

ENGINE

ENGINE SPECIFICATIONS: 6 cylinder, "L" hd. type.
Bore—3¼". **Stroke**—4⅜".
Displacement—217.8 cu. ins. **Rated H.P.**—25.35.
Developed Horsepower—97 at 3600 RPM.
Compression Ratio—7.0-1 Std. Cast Iron Head.
Compression & Vacuum Reading—*See Tune-up data.*

OIL PAN & ENGINE REMOVAL: *See Chrysler Special Data.*

TIGHTENING TORQUES & CYLINDER HEAD: *See Chrysler Special Data.*

PISTONS: Aluminum alloy, "U" slot, cam ground type. NOTE—Piston skirt is elliptical (.010-.012" smaller diameter across pin bosses than across thrust faces), and tapered (.0005-.0015" smaller diameter at top of skirt than at bottom).
Length—3 11/16". **Weight**—16.0 ozs. (stripped).
Removal—Pistons and rods removed from above.
Clearance—.028"-.032" (Head & Ring Lands), .0002-0012" (Skirt—across thrust faces and ¾" up from bottom). See Fitting New Pistons.

Fitting New Pistons: Measure piston size with micrometer across thrust faces (right angles to pin bosses) ¾" up from bottom of skirt with piston at 70°F. To fit pistons, with cylinder wall and piston dry and clean and at 70°F., invert piston in cylinder bore. Piston should have slight drag but should pass slowly through bore of own weight.

Replacement Pistons: .005", .020", .030", .040", .060" OS. *See "Pistons" in Chrysler Special Data.*

Installing Pistons: "U" slot away from valves.

PISTONS RINGS: Two compression (top ring chrome-plated), two slotted oil control, coated rings per piston, all above pin. Oil ring grooves drilled for oil drainage.

Ring	Width	End Gap	Side Clearance
Compr. (#1)	3/32"	.007-.015"	.0025-.004"
Compr. (#2)	3/32"	.007-.015"	.002-.0035"
Oil Contr. (#3,4)	5/32"	.007-.015"	.001-.0025"

Installing Rings—#1 Compr. with step on inner edge up. #2 Compr. with step on inner edge up or if step on outer edge, install with step down.

Replacement Rings: .005" .020" .030" .040" .050" .060" OS. *See "Piston Rings" in Chrysler Special Data.*

PISTON PIN: Diameter—55/64". **Length**—2¾". Pin floats in piston and rod, held by lock rings.
Pin Fit in Piston—.0000-.0005". Thumb push fit with piston heated to 130°F.
Pin Fit in Rod Bushing—.0001-.0002". Tight thumb push fit at normal room temp. (70°F.).

Replacement Pins: Std., .0006", .003", .008", Oversize.

CONNECTING ROD: Length—7 15/16". **Weight**—31.06 ozs. (with bolts, less bearings).
NOTE—Pin hole in rod bronze bushed.
Crankpin Journal Diameter—2.0615-2.0625". *See "Original Bearing Sizes" in Chrysler Special Data.*
Lower Bearing—Removable, prescision type, steel-backed, thin babbitt-lined. No shims.
Clearance—.0005-.0015". **Sideplay**—.006-.011".

Bearing Adjustment: None (no shims). Replace bearings. Do not file rods or caps.

Replacement Bearings: .001", .002", .010", .012" U.S.

Installing Rods: Wide portion of bearing to rear (#1, 3, 5), to front (#2, 4, 6). Oil hole to camshaft.

CRANKSHAFT: 4 bearings, 7 integral counterweights, with vibration dampener on front end.
Journal Diameters—2.4995-2.5005". *See "Original Bearing Sizes" in Chrysler Special Data.*
Bearings—Removable, precision type, steel-backed, thin babbitt-lined. No shims.
Clearance—.0005-.0015".

Bearing Adjustment: None (no shims). Replace Bearings. Do not file bearing caps.

Replacement Bearings: .001", .002", .010", .012" U.S.

End Thrust: Taken by flanged faces of #4 (rear) main bearing. **Endplay**—.003-.007".

Crankshaft Front & Rear Oil Seals: *See "Crankshaft and Main Bearings" in Chrysler Special Data.*

CAMSHAFT: 4 bearing. Non-adjustable chain drive.
Bearing Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 1/4".
Bearings—Removable, steel-backed, babbitt-lined bushings (except #4—machined in crankcase).
Clearance—.001-.003".

Camshaft Removal: *See "Camshaft & Bearings" in Chrysler Special Data.*

End Thrust: Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".

Timing Chain: Width 1". Pitch .500" (½"). Length 24" or 48 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 17/32"	.340-.341"	4 25/32"
Exhaust	1 13/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	3/8"	.001-.003"
Exhaust	45°	3/8"	.002-.004"

Exhaust Valve Seat Insert Servicing—*See "Valve System" in Chrysler Special Data.*

Valve Guides: Remove from above. Press new guides in with stepped end down and upper end 7/8" below top of block, ream guides to inside diameter of .342-.343" (Intake), .344-.345" (Exhaust).

Valve Springs: Install with close-coil end to top.

Free Length 2".	Spring Pressure	Spring Length
Valve Closed	40-45 lbs.	1¾"
Valve Open	107-115 lbs.	1⅜"

Valve Lifters: Mushroom type (remove from below with camshaft out of engine). Stem diameter ⅝". Service by reaming lifter holes (work from above piloting reamer in valve guide) and installing oversize lifters furnished .001", .008", .030" Oversize.

VALVE TIMING

Tappet Clearance: .008" Intake, .010" Exhaust, Hot. NOTE—Tappet screws self-locking type.

Valve Timing: See Camshaft Setting above.

Intake Valves—Open 12° BTDC. Close 44° ALDC.

Exhaust Valves—Open 50° BLDC. Close 6° ATDC.
Valve Timing Check—With .014" tappet clearance (Cold), #6 intake valve should open with # 6 piston 5° to 17° or .011" to .0125" BTDC with 5th to 17th graduation before DC mark on impulse neutralized aligned with pointer on chain case cover. Reset tappet clearance to running clearance .008" Hot.

LUBRICATION

Engine Oiling System: Pressure to main and connecting rod bearings, camshaft bearings, and timing chain. "Rotor" type oil pump.
Crankcase Capacity—5 qts. (refill).
Normal Oil Pressure—40-50 lbs. at 20 MPH.
Oil Pressure Regulator—Under plug on left side of crankcase (below starter). Opens at 40-45 lbs. Ad-

justable by replacing spring (Std. spring Unpainted, Lighter spring—Red, Heavier spring—Green).
CAUTION—Install replacement spring of same color as original spring.
Oil Pump: "Rotor" type on right side of engine.
Servicing—*See "Oil Pump" in Chrysler Special Data.*
Oil Filter: On left side of engine above starter.
Servicing—Replace filter at 8000 mile intervals.
Oil Pressure Gauge: Auto-Lite No. 11678A (not elec.).

COOLING

Cooling System: Positive circulation with pump on front of engine, by-pass thermostat, and water distribution tube in cylinder block behind pump.
Capacity—15 quarts.
Water Distribution Tube Servicing: *See "Cooling System" in Chrysler Special Data.*
Radiator Core Removal: *See "Radiator" in Chrysler Special Data.*
Water Pump: Packless type with grease fitting.
See Water Pump Section for complete data.
Removal—Drain cooling system, remove fan belt, disconnect hoses at pump, remove pump mounting studs, lift fan and pump off.
Belt Adjustment—*See Generator Belt Adjustment.*
Thermostat: In cylinder head water outlet.
INSTALLATION NOTE—Install thermostat with 2 ports facing front, and 2 ports facing rear.
Setting—Starts to open 157-162°F. Fully open 183°F.
Temperature Gauge: Auto-Lite No. 11680A. Not elect.

CLUTCH

Borg & Beck Model 9A7 or Auburn Model 9251-17. Single plate, dry disc types.
BORG & BECK NOTE—Cover Assy. marked 924 (Std.), 964 (Special Equipment).
See Clutch Section for complete data.
Facings (Borg & Beck)—Molded woven type. I.D. 6", O.D. 9¼". Thickness .125".
Facings (Auburn)—Molded type. I.D. 6⅛", O.D. 9⅛. Thickness .125".
Pedal Adjustment: Set pedal to just clear toeboard (stopscrew on lower end of pedal) and set for 1" free travel (adjust nut on connector link at fork).
NOTE—Do not disturb turnbuckle on pedal link.
Clutch Over-Center Spring—*See "Clutch Notes" in Chrysler Special Data for setting procedure.*
Removal: Remove Transmission (see Transmission Removal below), remove release fork pull-back spring and clutch housing underpan. Disconnect release fork from pivot, withdraw release bearing and sleeve from housing. Mark clutch and flywheel (to insure correct re-installation), remove all clutch cover mounting screws evenly, remove clutch cover assembly and driven member through opening at bottom of housing.

TRANSMISSION

Own Make. All helical gear, constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse).
See Transmission Section for complete data.
►*HARD SHIFTING CORRECTION—See "Chrysler, DeSoto, Dodge & Plymouth Synchro-Mesh" in Transmission Section for complete data.*
Transmission Control: Remote control type with gearshift lever mounted on steering column.
See Transmission Section for complete data.
Removal: Jack up front end of car. Disconnect front universal by taking out bolts in shaft flange (if transmission to be dismantled, loosen flange retaining nut), and rear universal by removing bearing caps on rear axle yoke (wire bearing cups in place to prevent loss of bearing rollers). Disconnect speedometer cable, hand brake cable at brake band, gearshift control rod and selector rod at transmission case. Remove transmission mounting screws in clutch housing, pull transmission straight back to free clutch shaft, then lower transmission and remove from beneath car.
NOTE—When installing transmission, use pilot studs installed in upper mounting screw holes to maintain alignment and prevent springing clutch driven member.

UNIVERSALS

Detroit Universal Series 4200—Ball-and-Trunnion type (front & rear).
See Universals Section for complete data.

REAR AXLE

Own Make. Semi-floating, hypoid gear type with Hotchkiss Drive.
See Rear Axle Section for complete data.
Ratio (P17)—3.73-1 Std., 3.9-1 Optl.
(P18)—3.9-1 Std., 4.1-1 Optl.
(Station Wagon)—4.1-1 Std.
Backlash—.006-.010". Screw adjustment.
Removal: Hoist rear end of car. Remove rear wheels. Disconnect brake hose at frame bracket, disconnect lower end of shock absorbers. Disconnect propeller shaft by removing capscrews from bearing caps on rear axle yoke (wire bearing caps in place to prevent loss of bearing rollers). Support axle housing, remove rear spring "U" bolts, lower axle assembly and remove from beneath car.
NOTE—Carrier assembly can be removed without disturbing axle housing by removing axle shafts and taking out carrier-to-housing mounting screws.
Axle Shaft Removal—Remove wheel, hub, and drum assembly (use screw type hub puller—Tool C-675), block brake pedal, disconnect brake line at wheel cylinder, remove axle shaft key, install sleeve (Tool C-745) in oil seal, remove brake support (oil seal mounted in support), pull shaft and bearing (use C-499 puller). NOTE—Use Puller C-293-E to remove bearing from shaft, puller C-748 or C-358 to remove inner oil seal, drift C-201 to install seal.
Axle Shaft Oil Seal: New leather type mounted on brake support (backing plate).
Oil Seal Servicing—*See "Rear Axle" in Chrysler Special Data.*
Wheel Bearing Adjustment: Shims between backing plate and axle housing. With wheel and hub removed, check endplay with dial indicator. To adjust, remove backing plate (see above), add or remove shims (furnished .010", .0125", .015", .030" thick) equally at both wheels. **Endplay**—.003-.008".

SHOCK ABSORBERS

Hydraulic, direct acting, non-adjustable.

FRONT SUSPENSION

Front Suspension: Independent, linked parallelogram type with coil springs and direct acting shock absorbers.
See Front Suspension Section for complete data.
Kingpin Inclination—4¾° to 6° crosswise.
Camber—Pos. ¼°. Limits 0° to Pos. ¾° (¼-½° higher on left).
Caster—0° preferred. Limits Neg. 1° to Pos. 1°. No adjustment.
Toe In—0" (0-1/16"). Adjust by turning both tie rods equally.
Steering Geometry—Inner wheel 22½°. Outer 20°.

STEERING GEAR

Own Make. Worm-and-roller type with "push-pull" adjustments. Same as Gemmer design Model 305.
NOTE—See Gemmer Model 305 article for data.
See Steering Gear Section for complete data.

BRAKES

Service: Chrysler "Safe-guard" Lockheed Hydraulic type as follows:
Front Wheels—Two-cylinder type (front shoe anchored at bottom and actuated by upper cylinder, rear shoe anchored at top and actuated by lower cylinder).
Rear Wheels—Double anchor type with a single double-acting wheel cylinder.
See Brake Section for complete data.
►**Brake Squeek Correction**—*See "Chrysler Brakes" in Brake Section.*
Wheel Cylinders—Single acting type (front), double acting type with straight (1⅛") bore (rear).
Drums—Centrifuse type. Diameter 10".
Lining—Molded asbestos. Width 2", Thickness 13/64", Length per wheel 21" (Front Wheels), 18½" (Rear Wheels).
Clearance—.006" at each end of all brake shoes.
Hand Brake: Independent type. Hand lever actuates band on drum at rear of transmission.
Drum Diameter—6". Cast-iron.
Lining—Width 2", Thickness 5/32", Length 16 11/16".
Clearance—.015-.020" around band.
Adjustment—*See Chrysler Special Data.*

MISC. MECHANICAL

CONVERTIBLE TOP CONTROL: Hydro-Lectric type.
See Miscellaneous Section for complete data.
Windshield Wipers: (Exc. Conv't & Sta. Wgn.)—Vacuum controlled Link-and-Crank Arm type; **(Convt. & Sta. Wgn.)**—Vacuum Link-and-Chain type.
See Miscellaneous Section for complete data.

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Pump): *See Tune-Up data.*

Metering Jet—*See Carter (B&B) Jet Table in Carburetor Section for complete data.*

Fast Idle: Throttle opened to fast idle position when choke valve closed.

Automatic Choke: Sisson type Optl.

Setting—Choke can be adjusted by inserting a gauge pin through hole in automatic choke lever shaft and slot in base mounting flange (to position shaft) and adjusting corburetor choke valve lever so that choke valve is tightly closed.

See Carburetion Equipment Section for data.

CARB. EQUIPMENT

Air Cleaner: AC No. 1544640 Heavy duty oil-bath type. Filter Element AC No. 21.

Fuel Pump: (Std.)—AC No. 1539421 Diaphragm type. (Optl.)—AC No. 19539418 fuel & vacuum type.
Replacement Pump—AC No. 588 (for 1539421) No. 9418 (for 1539418).

Pressure—3-5 lbs.

See Carburetion Equipment Section for data.

Fuel Tank Filter: Oilite metal filter in tank.
Servicing—If more than 2 pints water in tank, fuel will not pass filter. Remove filler cap and drain plug, draining tank. Disconnect fuel line at some point between pump and tank, blow out line and filter with air, increasing pressure as filter is cleaned. Flush tank with clean gasoline.

Gasoline Gauge: Auto-Lite electric type.

Dash Unit—Auto-Lite No. (1950) 12095A or 12310A. (1951) 12327A.

Tank Unit—Auto-Lite No. 11538A. (Suburban) NG-11816T.

See Carburetion Equipment Section for data.

BATTERY

Willard HW-1-100-C or Auto-Lite Type 1M-100D. 6 volt, 15 plate, 100 ampere hour capacity (20 hour rate).

Starting Capacity—120 amperes for 20 minutes.

Zero Capacity—300 amperes for 3.2 minutes. Five second voltage 4.15 volts.

Grounded Terminal—Positive (+) to engine.
Location—In left fender shield under engine hood.
Dimensions—Length 9 3/32". Width 7 1/8". Height 8 5/8".

STARTER

U.S. Cars.....**Auto-Lite MCH-6101. Arm. MCH-2028**
Canada.....**Auto-Lite MAW-4041. Arm. MAW-2128**
Drive—Outboard Barrel Type Bendix No. A-2991.
Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—42-53 ozs. (new brushes).

Performance Data

Torque	R.P.M.	Volts	Amperes
0 ft. lbs.	4300	5.0	65
6.0 "	Lock	2.0	335

Starting Switch: Auto-Lite No. (1950) SST-4001, (1951) SST-4006. Magnetic type mounted on left front fender shield and controlled by turning ignition switch past "ON" position.

See Electrical Equipment Section for complete data.

GENERATOR

Year	Auto Lite No.
1950 (Early)	GGW-6001B
1950 (Late)	GGW-6001K①
1950 (Canada)	GDZ-4801A
1951	GGW-6001K①
1950 (Early) City Police & Taxi	GGU-6001A
1950 (Early) State Police	GGJ-6001B
1950 State Police	GEG-4823B
1950 State Police	GGU-6001E
1950-51 City Police & Taxi	GGU-6001G①
1950-51 City Police & Taxi	GGJ-6001F①
1950-51 State Police	GGU-6001H①
1950-51 State Police	GGJ-6001G①

①—Narrow Groove Pulley.
Armature—GGW-2006F (GGW type generators), GDZ-2006F (GDZ type generators), GGJ-2101F GGJ type generators), GGU-2006F (GGU type generators).

Two brush type current-voltage regulators.
Maximum Charging Rate—See table below.
Charging Rate Adjustment—None. See Regulator.

Performance Data (GGW-6001B, K)

Amperes	Volts	Cold—R.P.M.—Hot	
0	6.4	870-970	950-1050
45	8.0	1925-2125	2350-2550

Performance Data (GDZ-4801A)

Amperes	Volts	Cold—R.P.M.—Hot	
0	6.4	870-970	950-1050
35	8.0	1800-2000	2150-2350

Performance Data (GEG-4823B)

40	8.0	1550 Max.	———

Performance Data (GGJ-6001B, F, G)

0	6.4	600-700	650-750
50	8.0	1400-1600	1550-1750

Performance Data (GGU-6001A, E, G, H)

0	6.4	750-850	800-900
45	8.0	1450-1650	1650-1850

Performance Data (GGW-6001B)

0	6.4	870-970	950-1050
40	8.0	1800-2000	2150-2350

Rotation—Counter-clockwise at commutator end.
Brush Spring Tension—(GDZ, GGU, GGW) 35-53 ozs. (new brushes); (GGJ) 30-37 ozs. (new brushes); (GEG) 64-68 ozs. (new brushes).
Field Current—(GDZ, GGW) 1.6-1.8 amperes, (GEG) 1.6-1.78 amperes, (GGJ) 1.7-1.9 amperes, (GGU) 1.7-1.8 amperes, all at 6.0 volts.
Motoring Current—(GDZ) 4.2-4.6 amps., (GEG) 4.7-5.2 amps., (GGJ) 4.3-4.8 amps., (GGU) 5.5-6.5 amps., (GGW) 4.6-5.2 amps., all at 6.0 volts.

Belt Adjustment: Loosen pivot and clamp bolts, pull out on generator until belt is snug (40-50 lbs. tension secured on scale attached to field frame) or ¼" belt deflection between generator and pump).

REGULATOR

Auto-Lite Regulator No.	for Auto-Lite Gen. No.
VBA-4202A or ①VBA-4204A	GGJ-6001A, B, F, G
VAV-6001A or ①VAV-6002A	GGU-6001A, E, G, H
VRP-6004A	GGW-6001B, K
VBE-6001A	GGW-6001K
VRP-4501C	GEG-4823B
VRP-4503A	GDZ-4801A

①—For negative ground.

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 (VAV, VRP)—6.4-6.9 volts (set to 6.4-6.6 volts).

Cuts In (VBA, VBE)—6.3-6.8 volts (set to 6.4-6.6 volts).

Cuts Out (All)—4.1-4.8 volts (Approx. 4-6 amps. disch.).

Air Gap (All)—.031-.034" with contacts open (check at hinge end of core).

Voltage Regulator

Setting (VAV, VBA, VBE)—7.1-7.4 volts at 70°F. **(VRP)**—7.2-7.5 volts at 70°F. See Electrical Equipment Section for settings at other temperatures.
Checking (without breaking seals) & Adjustment—*See Electrical Equipment Section.*

Current Regulator

►**(Temperature Compensated Regulators)**

	Nominal Setting
VRP-4503A	35
VRP-6004A, 4501C	40
VAV-6001A, 6002A, VBE-6001F	45
VBA-4202A, 4204A	50

►*CAUTION*—Nominal setting is approx. setting at 70°F. room temperature after regulator has been run (will be higher started cold). See Electrical Equip. Section for settings at various temperatures.
Checking (without breaking seals) & Adjustment—*See Electrical Equipment Section.*
Air Gap (All)—.048-.052" with contacts just opening.

LIGHTING

Headlamps: Corcoran-Brown "Sealed Beam" type with new "Bull's-eye lens."
See Electrical Equipment Section for complete data.
Beam Indicator—On speedometer dial. Lighted when upper beams "on."

Direction Signal: *See Electrical Equipment Section.*
Direction Signal Indicator—On speedometer dial. Flashes when direction signal operating.

Switches

Lighting—Plymouth No. (1950) 1300600, (1951) 1370138.

Beam Selector—Plymouth No. (1950) 1253460, (1951) 1253003.

Instrument—Plymouth No. (1950) 1244997, (1951) 1370011.

MISC. ELECTRICAL

CIRCUIT BREAKER: 30 ampere. On back of instrument panel above headlight switch.

FUSES: Clock—2 ampere. In clock lead connector.
Radio—14 ampere. In fuse connector at radio.

HORNS: Auto-Lite No. (1950) HW-4201 (Low Pitch), **HW-4202** (High Pitch). (1951) **HW-4107** (Low Pitch), **HW-4108** (High Pitch). Dual horns operated by relay.

Horn Relay: Auto-Lite HRL-4103 or 4104. Connected thru ignition switch, operates only with ignition on.
Contact Close—1.5-3.0 volts (seal to core with 4 V).
Contacts Open—.5 volt min. (open from seal).
Contact Gap—.026". **Air Gap**—.016-.020" (armature air gap with contacts closed but not sealed), .015-.018" (gap between armature leg and yoke with armature sealed to core).

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ENGINE

ENGINE SPECIFICATIONS: 6 cylinder, "L" hd. type.
Bore—3¼". **Stroke**—4⅜".
Displacement—217.8 cu. ins. **Rated H.P.**—25.35.
Developed Horsepower—97 at 3600 RPM.
Compression Ratio—7.0-1 Std. Cast Iron Head.
Compression & Vacuum Reading—*See Tune-up data.*

ORIGINAL BORE & PISTONS: *See Chrysler Special Data.*

ORIGINAL BEARING SIZES: *See Chrysler Special Data.*

TIGHTENING TORQUES: *See Chrysler Special Data.*

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

PISTONS: Aluminum alloy, "U" slot, cam ground type. NOTE—Piston skirt is elliptical (.010-.012" smaller diameter across pin bosses than across thrust faces), and tapered (.0005-.0015" smaller diameter at top of skirt than at bottom).

Length—3 11/16". **Weight**—16.0 ozs. (stripped).

Removal—Pistons and rods removed from above.
Clearance—.028-.032" (Head & Ring Lands), .0002-.0012" (Skirt—across thrust faces and ¾" up from bottom). See Fitting New Pistons.

Fitting New Pistons: Measure piston size with micrometer across thrust faces (right angles to pin bosses) ¾" up from bottom of skirt with piston at 70°F. To fit pistons, with cylinder wall and piston dry and clean and at 70°F., invert piston in cylinder bore. Piston should have slight drag but should pass slowly through bore of own weight.

Replacement Pistons: .005", .020", .030", .040", .060" OS.

Installing Pistons: "U" slot away from valves.

PISTON RINGS: Two compression (top ring chrome-plated), two slotted oil control, coated rings per piston, all above pin. Oil ring grooves drilled for oil drainage.

Ring	Width	End Gap	Side Clearance
Compr. (#1)	3/32"	.007-.015"	.0025-.004"
Compr. (#2)	3/32"	.007-.015"	.002-.0035"
Oil Contr. (#3,4)	5/32"	.007-.015"	.001-.0025"

Installing Rings—#1 Compr. with step on inner edge up. #2 Compr. with step on inner edge up or if step on outer edge, install with step down.

Replacement Rings: .005" .020" .030" .040" .050" .060" OS.

PISTON PIN: Diameter—55/64". **Length**—2¾". Pin floats in piston and rod, held by lock rings.
Pin Fit in Piston—.0000-.0005". Thumb push fit with piston heated to 130°F.
Pin Fit in Rod Bushing—.0001-.0002". Tight thumb push fit at normal room temp. (70°F.).

Replacement Pins: Std., .0006", .003", .008" Oversize.

CONNECTING ROD: Length—7 15/16". **Weight**—31.06 ozs. (with bolts, less bearings).

►*THICK-WALL BEARING CAUTION*—Inspect "hollowed-out" section of crankshaft center counterbalance for stamped mark (M-1, M-2, R-1, R-2, etc.) indicating which main or connecting rod journal uses THICK-WALL BEARING. *See "Original Bearing Sizes" in Chrysler Special Data.*
Crankpin Journal Diameter—2.0615-2.0625". *See "Original Bearing Sizes" in Chrysler Special Data.*
Lower Bearing—Removable, precision type, steel-backed, thin babbitt-lined. No shims.
Clearance—.0005-.0015". **Sideplay**—.006-.011".
Bearing Adjustment: None (no shims). Replace bearings. Do not file rods or caps.
Replacement Bearings: .001", .002", .003", .010", .012" Undersize.

Installing Rods: Wide portion of bearing to rear (#1, 3, 5), to front (#2, 4, 6). Oil hole to camshaft.

CRANKSHAFT: 4 bearings, 7 integral counterweights, with vibration dampener on front end.
Journal Diameters—2.4995-2.5005". *See "Original Bearing Sizes" in Chrysler Special Data.*
Bearings—Removable, precision type, steel-backed, thin babbitt-lined. No shims.
Clearance—.0005-.0015".

►*THICK-WALL BEARING CAUTION*—Inspect "hollowed-out" section of crankshaft center counterbalance for stamped mark (M-1, M-2, R-1, R-2, etc.) indicating which main or connecting rod journal uses THICK-WALL BEARING. *See "Original Bearing Sizes" in Chrysler Special Data.*
Bearing Adjustment: None (no shims). Replace bearings. Do not file bearing caps.
Replacement Bearings: .001", .002", .003", .010", .012" Undersize.

End Thrust: Taken by flanged faces of #4 (rear) main bearing. **Endplay**—.003-.007".

CAMSHAFT: 4 bearing. Non-adjustable chain drive.
Bearing Diameters—#1, 2"; #2, 1 31/32"; #3, 1 15/16"; #4, 1 1/4".
Bearings—Removable, steel-backed, babbitt-lined bushings (except #4—machined in crankcase).
Clearance—.001-.003".

End Thrust: Taken by thrust plate behind camshaft sprocket hub. **Endplay**—.002-.006".

Timing Chain: Width 1". Pitch .500" (½"). Length 24" or 48 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 17/32"	.340-.341"	4 25/32"
Exhaust	1 13/32"	.340-.341"	4 25/32"

	Seat Angle	Lift	Stem Clearance
Intake	45°	3/8"	.001-.003"
Exhaust	45°	3/8"	.002-.004"

Valve Guides: Remove from above. Press new guides in with stepped end down and upper end 7/8" below top of block, ream guides to inside diameter of .342-.343" (Intake), .344-.345" (Exhaust).

Valve Springs: Install with close-coil end to top.

Free Length 2".	Spring Pressure	Spring Length
Valve Closed	40-45 lbs	1¾"
Valve Open	107-115 lbs	1⅜"

Valve Lifters: Mushroom type (remove from below with camshaft out of engine). Stem diameter ⅝". Service by reaming lifter holes (work from above piloting reamer in valve guide) and installing oversize lifters furnished .001", .008", .030" Oversize.

VALVE TIMING

Tappet Clearance: (1950) .008" Intake, .010" Exhaust; (1951) .010" Intake, .010" Exhaust. Hot.
NOTE—Tappet screws self-locking type.

Valve Timing: See Camshaft Setting above.
Intake Valves—Open 12° BTDC. Close 44° ALDC.
Exhaust Valves—Open 50° BLDC. Close 6° ATDC.
Valve Timing Check—With .014" tappet clearance (Cold), #6 intake valve should open with #6 piston 5° to 17° or .011" to .0125" BTDC with 5th to 17th graduation before DC mark on impulse neutralizer aligned with pointer on chain case cover. Reset tappet clearance to running clearance .008" Hot.

LUBRICATION

Engine Oiling System: Pressure to main and connecting rod bearings, camshaft bearings, and timing chain. "Rotor" type oil pump.

Crankcase Capacity—5 qts. (refill).

Normal Oil Pressure—30 to 50 lbs. above 30 MPH.

Oil Pressure Regulator—Under plug on left side of crankcase (below starter). Opens at 45 to 55 lbs. Adjustable by replacing spring (Std. spring Unpainted, Lighter spring—Red, Heavier spring—Green).

CAUTION—Install replacement spring of same color as original spring.

Oil Pump: "Rotor" type on right side of engine.

Oil Filter: On left side of engine above starter.

Servicing—Replace filter at 8000 mile intervals.

Oil Pressure Gauge: Auto-Lite No. (Early '50) 12096A, (Late '50) 12309A, (1951) 12324A. Not electrical.

COOLING

Cooling System: Positive circulation with pump on front of engine, by-pass thermostat, and water distribution tube in cylinder block behind pump.
Capacity—(1950) 15 qts., (1951) 13 qts.

Water Pump: Packless type with grease fitting.
See Water Pump Section for complete data.

Removal—Drain cooling system, remove fan belt, disconnect hoses at pump, remove pump mounting studs, lift fan and pump off.
Belt Adjustment—*See Generator Belt Adjustment.*

Thermostat: In cylinder head water outlet.
INSTALLATION NOTE—Install thermostat with 2 ports facing front, and 2 ports facing rear.
Setting—Starts to open 157-162°F. Fully open 183°F.

Temperature Gauge: Auto-Lite No. (Early '50) 12094A, (Late '50) 12307A, (1951) 12326A. Not electrical.

CLUTCH

Borg & Beck Model 9A7 or Auburn Model 9251-17. Single plate, dry disc types.
BORG & BECK NOTE—Cover Assy. marked 924 (Std.), 964 (Special Equipment).
See Clutch Section for complete data.
Facings—Molded woven type. I.D. 6", O.D. 9¼", Thickness .114" on .125" optional.

Facings (Auburn)—Molded type. I.D. 6⅛", O.D. 9⅛", Thickness .125".

Pedal Adjustment: Set pedal to just clear toeboard (stopscrew on lower end of pedal) and set for 1" free travel (adjust nut on connector link at fork). NOTE—Do not disturb turnbuckle on pedal link.

Removal: Remove Transmission (see Transmission Removal below), remove release fork pull-back spring and clutch housing underpan. Disconnect release fork from pivot, withdraw release bearing and sleeve from housing. Mark clutch and flywheel (to insure correct re-installation), remove all clutch cover mounting screws evenly, remove clutch cover assembly and driven member through opening at bottom of housing.

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