
ENGINE - 10

PARTS CATALOG,
SERVICE MANUAL &
SERVICE TIME
SCHEDULE CODE

		Page
10	Specifications	10-1
10	Torque Specifications	10-9
100.00	Engine	
	Removal and Installation	10-11
	Disassembly	10-21
	Assembly	10-30
101.01	Crankcase and Cylinder Head	10-43
101.03	Crankshaft and Flywheel	10-57
101.05	Connecting Rods and Pistons	10-63
101.06	Camshaft Drive	10-69
101.07	Valve Mechanism	10-71
101.15	Auxiliary Drives	10-75
102.01	Fuel Tank and Lines	10-77
102.02	Fuel Pump and Lines	10-81
102.04	Carburetor and Air Cleaner	10-83
102.21	Accelerator Linkage	10-89
102.26	Fuel Injection System	10-91
102.58	Exhaust and Emission Control System	10-105
103.01	Lubrication	10-115
104.01	Radiator and Fan	10-121
104.02	Water Pump and Ducts	10-123
10A	Service Tools	10-127

Engine: Specifications

10

Page 10-1

CYLINDER BLOCK-CON-RODS

DESCRIPTION	IN.	MM
Cylinder bore diameter Cylinder bores are graded into classes with 0.004" (0.01 mm) progression.	3.4015 to 3.4035	86.400 to 86.450
Auxiliary shaft bushing seats, diameters: --drive end --inside end.	1.5236 to 1.5248 1.3794 to 1.3805	38.700 to 38.730 35.036 to 35.066
Crankshaft main bearing seat diameter	2.1459 to 2.1465	54.507 to 54.520
Length of rear main bearing seat between thrust ring seats.	0.8716 to 0.8740	22.140 to 22.200
Big-end bearing housing diameter	1.9146 to 1.9152	48.630 to 48.646
Thickness of standard big-end bearing.	0.0603 to 0.0606	1.531 to 1.538
Range of undersize big-end bearings for service.	0.010, 0.020, 0.030, 0.040	0.254, 0.508, 0.762, 0.016
Big-end bearings: --fit clearance	0.0014 to 0.0034	0.036 to 0.086
Small-end bore diameter	0.9425 to 0.9438	23.939 to 23.972
Small-end bushing O.D.	0.9455 to 0.9465	24.016 to 20.041
Small-end bushing fit, interference	0.0017 to 0.0040	0.044 to 0.102
Small-end bushing ream bore, fitted Grade 1 Grade 2	0.8663 to 0.8664 0.8664 to 0.8665	22.004 to 22.007 22.007 to 22.010
Piston pin-small-end bushing fit: --clearance of new parts	0.0004 to 0.0006	0.010 to 0.016
Maximum misalignment between c/l's of connecting rod small-end and big-end: measured at 4.92" (125mm) from the shank	±0.0039	±0.10

PISTON – PINS – RINGS

DESCRIPTION	IN.	MM
Diameter of standard service pistons, measured at right angles to C/L of piston pin: –at 1.08" (27.5mm) from piston skirt edge		
Class A	3.3999 to 3.4003	86.360 to 86.370
Class C.	3.4007 to 3.4011	86.380 to 86.390
Class E.	3.4015 to 3.4019	86.400 to 86.410
Maximum difference in weight between pistons	±0.080z	±2.5g
Oversize piston range.	0.0079, 0.0157, 0.0236	0.2, 0.4, 0.6
Piston boss bore diameter		
Grade 1	0.8660 to 0.8661	21.996 to 21.999
Grade 2	0.8661 to 0.8662	21.999 to 22.002
Piston ring groove width		
Top groove	0.0604 to 0.0612	1.535 to 1.555
Center groove	0.0799 to 0.0807	2.030 to 2.050
Bottom groove	0.1562 to 0.1570	3.967 to 3.987
Standard piston pin diameter		
Grade 1	0.8658 to 0.8659	21.991 to 21.994
Grade 2	0.8659 to 0.8660	21.994 to 21.997
Oversize piston pin range for service	0.0079	0.2
Piston ring thickness		
– first: compression ring	0.0582 to 0.0587	1.478 to 1.490
– second: oil ring.	0.0779 to 0.0783	1.978 to 1.990
– third: oil ring with oilways and expander	0.1545 to 0.1553	3.925 to 3.947
Piston fit in bore, measured at right angle to pin, 1.08" (27.5mm) from piston skirt edge		
– clearance of new parts	0.0011 to 0.0019	0.030 to 0.050
Piston pin in boss: clearance of new parts	0.0001 to 0.0003	0.002 to 0.008
Piston ring fit (side clearance)		
– first: compression ring, clearance of new parts	0.0018 to 0.0030	0.045 to 0.077
– second: oil ring, clearance of new parts	0.0016 to 0.0028	0.040 to 0.072
– third: scraper ring, clearance of new parts	0.0011 to 0.0024	0.030 to 0.062
Ring end gap in bore:		
– first: compression ring	0.0118 to 0.0177	0.30 to 0.45
– second: oil ring.	0.0118 to 0.0177	0.30 to 0.45
– third: scraper ring.	0.0098 to 0.0157	0.25 to 0.40
Oversize piston ring range, for service	0.0079, 0.0157, 0.0236	0.2, 0.4, 0.6

Engine: Specifications

10

Page 10-3

CRANKSHAFT – MAIN BEARINGS

DESCRIPTION	IN.	MM
Main bearing journal standard diameter	1.9990 to 1.9997	50.775 to 50.795
Standard main bearing insert thickness	0.0722 to 0.0730	1.834 to 1.840
Main bearing inserts, for service.	0.01, 0.02, 0.03, 0.04	0.254, 0.508, 0.762, 1.061
Crankpin standard diameter	1.7913 to 1.7920	45.498 to 45.518
Main bearing-to-journal fit: – clearance of new parts	0.0019 to 0.0037	0.050 to 0.095
Length of rear main bearing journal, shoulder-to-shoulder	1.0620 to 1.0640	26.975 to 27.025
Rear main bearing seat thrust ring thickness	0.0909 to 0.0929	2.310 to 2.360
Thickness of oversize thrust rings	0.0959 to 0.0979	2.437 to 2.487
Crankshaft end play, thrust ring installed: – clearance of new parts	0.0021 to 0.0104	0.055 to 0.265
Max. misalignment of main bearing journals	0.0012*	0.03*
Max. misalignment of crankpins to main bearings journals	±0.014	±0.35
Max. out-of-round of crankshaft journals and crankpins, after grinding.	0.0002	0.005
Max. taper of crankpins and journals, after grinding	0.0002	0.005
Squareness of flywheel resting face to crankshaft centerline: – Max. allowable tolerance with dial indicator set laterally at a distance of about 1 11/32" (34mm) from crankshaft rotation axis.	0.0010	0.025
Flywheel: – parallel relationship of driven plate face to crank- shaft mounting face: max. allowable tolerance	0.0039	0.10
– squareness of above faces to rotation axis: max. allowable tolerance.	0.0039	0.10

*Total indicator reading

CYLINDER HEAD

DESCRIPTION	IN.	MM
Valve position	Overhead, inclined 18°	
Operation	Single ohc	
Drive	Toothed belt	
Valve guide bore	0.5492 to 0.5499	13.950 to 13.970
Outside diameter of valve guide.	0.5527 to 0.5534	14.040 to 14.058
Valve guide oversize on O.D., for service.	0.0079	0.2
Inside diameter of valve guides, fitted in cylinder head	0.3158 to 0.3165	8.022 to 8.040
Valve guide fit in head: – interference	0.0025 to 0.0043	0.063 to 0.108
Valve stem diameter	0.3139 to 0.3146	7.974 to 7.992
Valve stem fit in valve guide: – clearance of new parts	0.0012 to 0.0026	0.030 to 0.066
Valve seat angle in cylinder head.	45° ±5'	
Valve face angle.	45° 30' ±5'	
Valve head diameter		
intake	1.4173	36
exhaust	1.3031	33.1
Width of valve seats in cylinder head (contact surface): – intake and exhaust, about.	0.0787	2
Inside diameter of valve seats in cylinder head		
intake	1.1811	30
exhaust	1.0531	26.75
Lift on C/L of valve (without play)		
intake	0.3622	9.2
exhaust	0.3641	9.25
Diameter of tappet bores in head	1.4567 to 1.4577	37.000 to 37.025
Outside diameter of tappets	1.4557 to 1.4565	36.975 to 36.995
Fit clearance between tappets and bores in head.	0.0002 to 0.0020	0.005 to 0.050
Thickness of cap plates	0.1456 to 0.1850 (in 0.0019 progressions)	3.70 to 4.70 (in 0.05 progressions)

VALVE SPRINGS

	INNER SPRING	OUTER SPRING
Valve spring installed height (A) under		
a load of 85.7 lbs (38.9 kg)	—	1.417 in (36 mm)
32.8 lbs (14.9 kg)	1.220 in (31 mm)	—
Valve spring installed height under		
a load of 131 lbs (59.5 kg)	—	1.043 in (26.5 mm)
62 lbs (28.1 kg)846 in (21.5 mm)	—
Minimum permissible load, referred to height (A)	29.5 lbs (13.5 kg)	79 lbs (36 kg)

VALVE MECHANISM – CAMSHAFT

DESCRIPTION	IN.	MM
Diameter of bearing bores in head:		
– drive end	1.1807 to 1.1816	29.989 to 30.014
– intermediate, drive side	1.8890 to 1.8900	47.980 to 48.005
– middle	1.8968 to 1.8976	48.180 to 48.205
– intermediate, flywheel side	1.9047 to 1.9057	48.380 to 48.405
– flywheel end	1.9126 to 1.9136	48.580 to 48.605
Diameter of camshaft journals:		
– drive end	1.1787 to 1.1795	29.944 to 29.960
– intermediate, drive side	1.8872 to 1.8878	47.935 to 47.950
– middle	1.8951 to 1.8957	48.135 to 48.150
– intermediate, flywheel side	1.9030 to 1.9035	48.335 to 48.350
– flywheel end	1.9108 to 1.9114	48.535 to 48.550
Fit between bores in head and camshaft journals:		
– fit clearance	0.0012 to 0.0028	0.030 to 0.070
Cam lift: – Inlet	0.362	9.2
– Exhaust	0.364	9.25
Valve clearance:		
– Inlet opens		12° B.T.D.C.
– Inlet closes		52° A.B.D.C.
– Exhaust opens		52° B.B.D.C.
– Exhaust closes		12° A.T.D.C.

VALVE MECHANISM – TAPPETS

Standard tappet bore diameter	1.417 to 1.418	37.000 to 37.025
Standard tappet O.D.	1.456 to 1.457	36.975 to 36.995
Tappet fit clearance.	0.0001 to 0.0019	0.005 to 0.050
Shim thickness	0.146 to 0.185 in 0.002 steps	3.70 to 4.70 in 0.05 steps
Valve clearance		
– for checking	Inlet024
valve timing	Exhaust.027
– for general operation	Inlet011 to .014
adjusted cold	Exhaust.015 to .018
		0.60
		0.65
		0.28 to 0.35
		0.38 to 0.46

AUXILIARY SHAFT

DESCRIPTION	IN.	MM
Diameter of bushing bores in crankcase:		
– drive end.	1.5236 to 1.5248	38.700 to 38.730
– inside end.	1.3794 to 1.3805	35.036 to 35.066
Inside diameter of bushings finished in bores:		
– drive end.	1.4041 to 1.4049	35.664 to 35.684
– inside end.	1.2598 to 1.2606	32.000 to 32.020
Diameter of shaft journals:		
– drive end.	1.4013 to 1.4023	35.593 to 35.618
– inside end.	1.2575 to 1.2583	31.940 to 31.960
Fit between bushings and bores in crankcase.	interference fit at all times	
Fit between bushings and shaft journals:		
– fit clearance		
drive end.	0.0017 to 0.0036	0.044 to 0.091
inside end	0.0016 to 0.0031	0.040 to 0.080

FUEL SYSTEM (VEHICLES WITH CARBURETOR)

Carburetor

Type 2-barrel downdraft with vacuum controlled secondary, mechanical and vacuum accelerator pumps, and an automatic choke

Float level 0.266 to 0.285 in. (6.75 to 7.25 mm)

Fuel Pump

Type Mechanical

Capacity equal to or greater than 19.8 gal./hr. (75 L/hr.)

Control lever stroke 0.098 in. (2.5 mm)

Fuel pressure at 4000 RPM 3.5 to 4.3 psi

FUEL SYSTEM (VEHICLES WITH FUEL INJECTION)

Fuel Injection System

Type Bosch L-Jetronic with Lambda sensor

System test pressure 33 to 39 psi (2.3 to 2.7 bar)

Fuel Pump

Type Electric

Fuel pressure 39 to 45 psi (2.7 to 3.2 bar)

LUBRICATION

Oil Pump

Type	gear
Pump Drive	by auxiliary shaft
Oil pressure relief valve	built into oil pump
Clearance between gears upper side and cover mating face	0.0008 to 0.0041 in. (0.020 to 0.105 mm)
Clearance between gears and pump housing inside wall . . .	0.004 to 0.007 in. (0.11 to 0.18 mm)
Play between drive and driven gears	0.0059 in. (0.15mm)
Full flow oil filter with by-pass	disposable cartridge type
Low oil pressure indicator sending unit	electric
Oil pressure at 212° F (100° C)	49.7 to 71 psi (3.5 to 5 kg/cm ²)

COOLING SYSTEM

Water Pump

Type	centrifugal, vane type
Pump Drive	Vee belt
Fit between impeller vanes and pump housing	0.031 to 0.051 in. (0.8 to 1.3mm)
Radiator cooling fan drive	electric motor
Cooling fan control	radiator mounted temperature switch
cut-in temperature	92 ± 2° C (198° F)
cutout	87 ± 2° C (189° F)
Thermostat	
– begins opening at	172.4° to 183.2° F (78° to 84° C)
– maximum opening at	194° to 201° F (90° to 94° C)
– travel of valve	0.295 in (7.5mm)
Water temperature indicator	electric (gauge)
Radiator cap valve opening pressure	11 psi (0.8 kg/cm ²)
Radiator overflow recovery	plastic expansion tank

Engine

10

Page 10-9

TORQUE SPECIFICATIONS

DESCRIPTION	THREAD	TORQUE FIGURE		
		N·m	Kgm	Ft. Lb.
ENGINE				
Bolt, main bearing cap	M 10 x 1.25	80	8.2	59
Bolt, engine breather	M 8	24.4	2.5	18
Bolt, cylinder head to crankcase — 19 mm hex — 17 mm hex	M 12 x 1.25 M 10 x 1.25	See torque procedure on pg. 10-48 See torque procedure on pg. 10-51		
Nut, cylinder head to crankcase stud	M 12 x 1.25	93	9.5	69
Bolt, cylinder head extension to cylinder head	M 8	20	2	14
Nut, intake and exhaust manifold to cylinder head	M 8	27	2.8	20
Nut, connecting rod bolt	M 9 x 1	51	5.2	38
Bolt, self-locking, flywheel to crankshaft	M 10 x 1.25	83	8.5	61
Bolt, camshaft sprocket	M 10 x 1.25	83	8.5	61
Nut, bearing to belt tensioner support	M 10 x 1.25	44	4.5	33
Bolt, oil pump shaft drive gear	M 10 x 1.25	83	8.5	61
Nut, drive pulley on crankshaft	M 20 x 1.5	137	14	101
Bolt, alternator lower support to crankcase	M 10 x 1.25	49	5	36
Nut, alternator to lower support	M 10 x 1.25	49	5	36
Nut, self-locking nylon lined, alternator to upper support	M 10 x 1.25	49	5	36
Bolt, air pump to support	M 9	29	3	22
Bolt, air pump support to cylinder head extension	M 8	29	3	22
Bolt, water pump to crankcase	M 8	29	3	22

DESCRIPTION	THREAD	N•m	TORQUE FIGURE	
			Kgm	Ft. Lb.
Bolt, A/C compressor support to crankcase	M 10 x 1.25	49	5	36
Bolt, front bracket to A/C compressor	M 10 x 1.25	49	5	36
Bolt, rear bracket to A/C compressor	M 10 x 1.25	49	5	36
Spark plugs	M 14 x 1.25	37	3.8	27
ENGINE MOUNTS				
Bolt, crosspiece to body	M 10 x 1.25	59	6	43
Bolt, rubber mount to engine	M 8	14.5	1.5	11
Bolt, rubber mount to transmission	M 8	24.4	2.5	18
Nut, rubber mount to transmission	M 8	24.4	2.5	18
Bolt, rubber mount to crosspiece	M 8	24.4	2.5	18
Bolt, engine reaction rod	M 8	24.4	2.5	18