

5.7L (VIN 8) ENGINE SPECIFICATIONS

Description	English	Metric
General Information		
Type	90 ° V8 Dual Over Head Cam (DOHC)	
Displacement	350	5.7 (3500)
Number of Cylinders	8	
Bore	4.000	101.6mm
Stroke	3.480	88.39mm
Compression ratio		
1984-89 vehicles	9.0:1	
1990-91 vehicles	10.25:1	
Cylinder Bore		
Diameter		
1984-89 vehicles	3.9995-4.0025 in.	101.59-101.66mm
1990-91 vehicles	4.0000-4.0021 in.	101.60-101.65mm
Out-of-round (max.)		
Production		
1984-89 vehicles	0.010 in.	0.254mm
Service		
1984-89 vehicles	0.020 in.	0.508mm
Radial Cylindricity		
1990-91 vehicles	0.00085 in.	0.02159mm
Taper (max.)		
1984-89 vehicles		
Production Thrust Side	0.005 in.	0.127mm
Production Relief Side	0.010 in.	0.254mm
Service	0.010 in.	0.254mm
Total Taper & Out-of-Round		
1990-91 vehicles	0.0025 in.	0.0635mm
Piston		
Clearance		
Production		
1984-86 vehicles	0.025-0.035 in.	0.635-0.889mm
1987-89 vehicles	0.0007-0.0017 in.	0.0178-0.0432mm
1990-91 vehicles	0.0027 in.	0.0686mm
Service (max.)		
1984-86 vehicles	0.0045 in.	1.143mm
1987-89 vehicles	0.0025 in.	0.0635mm
1990-91 vehicles	0.0027 in.	0.0686mm
Piston Rings		
Compression		
Groove Clearance		
Production 1st		
1984-86 vehicles	0.0012-0.0032 in.	0.0305-0.0813mm
1987-89 vehicles	0.0012-0.0029 in.	0.0305-0.0737mm
1990-91 vehicles	0.0012-0.0039 in.	0.0305-0.0991mm
Production 2nd		
1984-86 vehicles	0.0012-0.0032 in.	0.0305-0.0813mm
1987-89 vehicles	0.0012-0.0029 in.	0.0305-0.0737mm
1990-91 vehicles	0.0012-0.0039 in.	0.0305-0.0991mm
Service		
1984-89 vehicles (high limit production plus)	0.001 in.	0.025mm

TORQUE SPECIFICATIONS

Component	ft. lbs.	Inch lbs.	Nm
Rocker Arm Cover			
VIN 8 Engines			
1984 vehicles		50	6
1985-87 vehicles		80-120	9-13
1988 vehicles		60-90	7-10
1989-91 vehicles		89	10
VIN P & 5 Engines			
1992 vehicles		90	10
1993-95 vehicles		100	11
1996 vehicles		106	12
Camshaft Cover			
VIN J Engines			
Camshaft Cover Bolts			
24 M8 bolts (3 times)	15		20
3 M6 screws (3 times)		89	10
Coolant outlet cover screws		89	10
Fresh air pipe bracket-to-injector housing bolt	19		26
Upper EGR pipe bolts		89	10
Cable hold-down clamp-to-plenum screws		18	2
Throttle body screws		53	6
Power steering pump bolts	24		33
Thermostat Housing			
VIN 8 Engines			
1984-89 vehicles	18-23		24-31
1990-91 vehicles	25		34
VIN J Engines			
Hose clamp screws		35	4
Thermostat housing bracket bolts	18		25
VIN P & 5 Engines			
		89	10
Intake Manifold			
VIN 8 Engines			
1984 vehicles	35		47
1985-88 vehicles	25-45		34-61
1989 vehicles	35		47
1990-91 vehicles			
All bolts except nos. 1 & 4	35		47
Bolt no. 1 & 4	45		61
VIN J Engines			
MAP sensor bracket-to-plenum screws		89	10
Throttle body-to-plenum screws	19		26
Throttle body extension-to-plenum screws		53	6
Ignition module-to-plenum screws		89	10
Intake plenum bolts	19		26
VIN P & 5			
Step 1 (all vehicles)		71	8
Step 2 (1992 vehicles)	19		26
Step 2 (1993-96 vehicles)	35		48

TORQUE SPECIFICATIONS

Component	ft. lbs.	Inch lbs.	Nm
Exhaust Manifold			
VIN 8 Engines			
1984-88 vehicles	20		27
1989-91 vehicles			
Exhaust manifold bolts	19		26
Front crossover pipe-to-manifold flange nuts	15		20
VIN J Engines			
1990-91 vehicles			
Stud	11		15
Manifold rear bolts	11		15
Exhaust pipe flange bolts	15		20
Manifold front bolts and stud nut	11		15
1992-95			
Manifold bolts	18		25
Rear manifold bolts, spacers and nuts	18		25
Catalytic converter bolts	17		23
VIN P & 5 Engines			
1993 vehicles	26		35
1994 vehicles	35		47
1995 vehicles	26		35
1996 vehicles	30		40
Radiator			
VIN 8			
Automatic transmission oil cooler line fittings	20		27
VIN J, P & 5			
Upper support-to-front side member nuts and bolts	18		25
Fan shroud-to-upper support screws		80	9
Accumulator bracket-to-upper support retainers		80	9
Oil cooler line fittings		89	10
Fan			
VIN 8 & J Engines			
		89	10
VIN P & 5			
1992 vehicles		89	10
1993-96 vehicles			
Lower fan-to-shroud bolts		89	10
Impact bar-to-front extension and front crossmember bolts		20	27
Fan assembly-to-fan shroud bolts and screws		89	10
Water Pump			
VIN 8 Engines			
1984-88 vehicles	25-35		33-47
1989-91 vehicles			
Heater hose-to-pump fitting	27		37
Water pump-to-block bolts	30		40
VIN J Engines			
Water pump and A/C compressor bolts	20		27
Alternator mounting bolts	39		52
Alternator bracket bolts	20		27
Belt tensioner-to-cylinder case bolt	45		60
VIN P & 5 Engines			
	30		41

TORQUE SPECIFICATIONS

Component	ft. lbs.	inch lbs.	Nm
Cylinder Head			
VIN 8 Engines			
Long cylinder head bolts	60-75		81-101
Short cylinder head bolts	55-65		74-88
VIN J Engines			
1st pass	45		60
2nd pass	74		100
3rd pass	118		160
Fixed guide bolt	19		26
VIN P & 5 Engines			
Cylinder head bolts, using 3 passes	65		88
Oil Pan			
VIN 8 Engines			
1984-85 vehicles		80	9
1986 vehicles			
Oil pan-to-crankcase nuts	14		19
Oil pan studs		80	9
1987-88 vehicles			
Oil pan-to-crankcase nuts	16		22
Corner oil pan-to-crankcase studs		15	2
Oil pan-to-case studs	8		11
1989-91 vehicle	16		22
VIN J Engines			
Oil pan front screws		106	12
Oil pan bolts	23		31
Left and right front crossmember rear brace to front crossmember bolts	59		80
Left and right front crossmember rear brace to front side member bolts	46		62
Engine mounts-to-front crossmember bolts	40		54
AIR pipe bracket-to-oil pan bolts		89	10
Oil level sensor	18		25
Left and right wiring harness heat shield bolts		89	10
Clutch housing cover bolts	80		9
VIN P & 5 Engines			
Corner bolts or stud and nuts			
1992 vehicles	17		23
1993-96 vehicles	15		20
Remaining bolts and studs	8		11
Oil level sensor	16		22
Knock sensor shield nuts		75	8.5
Oil filter adapter retainers	17		23
Oil Pump			
VIN 8 Engines			
Oil pump-to-rear bearing cap bolt	80		108
VIN J Engines			
Oil pump bolts	19		26
VIN P & 5 Engines			
Oil pump bolts	65		88
Baffle nuts	25		34

TORQUE SPECIFICATIONS

Component	ft. lbs.	inch lbs.	Nm
Crankshaft Damper			
VIN 8 Engines	60		81
VIN J Engines	148		200
VIN P & 5 Engines			
Crankshaft hub bolt	70-75		95-102
Balancer bolts/screw	60		81
Timing Chain Cover			
VIN 8 Engines		80	9
VIN J Engines			
Front cover attaching bolts	19		26
Stud nuts	21		28
VIN P & 5 engines		100	11
Timing Chain & Sprockets			
VIN 8 Engines			
Camshaft sprocket bolts	20		27
VIN J Engines			
Primary chain guide bolts		89	10
VIN P & 5 Engines			
Water pump driveshaft retainer bolts		108	12
Camshaft sprocket bolts	21		28
Rear Main Seal			
VIN 8, P & 5 Engines			
1984-85 vehicles			
Rear main bearing cap bolts	10-12		14-16
Flywheel			
Flywheel retaining bolts	74		100

5.7L (VIN 8) ENGINE SPECIFICATIONS

Description	English	Metric
Piston Rings cont.		
Gap		
Production 1st		
1984-89 vehicles	0.010-0.020 in.	0.254-0.508mm
1990-91 vehicles	0.010-0.030 in.	0.254-0.762mm
Production 2nd		
1984-89 vehicles	0.010-0.025 in.	0.254-0.635mm
1990-91 vehicles	0.013-0.027 in.	0.330-0.686mm
Service		
1984-89 vehicles (high limit production plus)	0.001 in.	0.025mm
Oil		
Groove Clearance		
Production		
1984-86 vehicles	0.002-0.007 in.	0.051-0.178mm
1987-89 vehicles	0.002-0.008 in.	0.0051-0.203mm
1990-91 vehicles	0.0012-0.0039 in.	0.0305-0.0991mm
Service		
1984-89 vehicles (high limit production plus)	0.001 in.	0.025mm
Gap		
Production		
1984-89 vehicles	0.015-0.055 in.	0.381-1.397mm
1990-91	0.010-0.040 in.	0.254-1.016mm
Service		
1984-89 vehicles (high limit production plus)	0.001 in.	0.025mm
Piston Pin		
Diameter		
1984-86 vehicles	0.9270-0.9273 in.	23.546-23.553mm
1987-91 vehicles	0.9269-0.9271 in.	23.543-23.548mm
Clearance		
Production		
1984-89 vehicles	0.00025-0.00035 in.	0.00635-0.0089mm
Service (max.)	0.001 in.	0.025mm
Fit in rod		
1986-89 vehicles	0.0008-0.0016 in.	0.0203-0.0406mm
Crankshaft and Connecting Rods		
Main Journal		
Diameter		
#1	2.4484-2.4493 in.	62.1894-62.2122mm
#2, 3 & 4	2.4481-2.4490 in.	62.1818-62.2046mm
#5	2.4479-2.4488 in.	62.1766-62.1995mm
Taper (max.)		
Production	0.0002 in.	0.0508mm
Service	0.0010 in.	0.0254mm
Out-of-Round		
Production	0.0002 in.	0.0508mm
Service	0.0010 in.	0.0254mm
Main Bearing Clearance		
Production		
#1	0.0008-0.0020 in.	0.0203-0.0508mm
#2, 3 & 4		
1984-89 vehicles	0.0011-0.0023 in.	0.0279-0.0584mm
1990-91 vehicles	0.0011-0.0033 in.	0.0279-0.0838mm

5.7L (VIN 8) ENGINE SPECIFICATIONS

Description	English	Metric
Crankshaft and Connecting Rods cont.		
#5		
1984-89 vehicles	0.0017-0.0032 in.	0.0432-0.0813mm
1990-91 vehicles	0.0017-0.0042 in.	0.0432-0.1067mm
Service		
#1	0.001-0.0015 in.	0.025-0.0381mm
#2, 3 & 4	0.001-0.0025 in.	0.025-0.0635mm
#5	0.0025-0.0035 in.	0.0635-0.0889mm
Crankshaft End Play	0.002-0.006 in.	0.0508-0.1524mm
Crankpin	0.0003 in.	0.008mm
Diameter	2.0988-3.0998 in.	53.309-78.735mm
Taper (max.)		
Production	0.0003 in.	0.008mm
Service	0.001 in.	0.0254mm
Out-of-Round		
Production	0.0002 in.	0.0508mm
Service	0.0010 in.	0.0254mm
Rod Bearing Clearance		
Production	0.0013-0.0035 in.	0.0330-0.0889mm
Service (max.)	0.0035 in.	0.0889mm
Rod Side Clearance	0.006-0.014 in.	0.1524-0.3556mm
Camshaft		
Lobe lift		
Intake		
1984-89 vehicles	0.2713-0.2753 in.	5.52-6.99mm
1990-91 vehicles	0.2730-0.2770 in.	6.93-7.04mm
Exhaust		
1984-89 vehicles	0.280-0.284 in.	7.112-7.214mm
1990-91 vehicles	0.2836-0.2876 in.	7.203-7.305mm
Journal Diameter	1.8682-1.8692 in.	47.452-47.478mm
Camshaft End Play	0.004-0.012 in.	0.102-0.305mm

5.7L (VIN 8) ENGINE SPECIFICATIONS

Description	English	Metric
Valve System		
Lifter		Hydraulic
Rocker arm ratio		1.50:1
Face angle		45°
Seat angle		46°
Seat runout (max.)	0.002 in.	0.050mm
Seat width		
Intake	0.0312-0.0625 in.	0.7925-1.5875mm
Exhaust	0.0625-0.0937 in.	1.5875-2.3799mm
Stem clearance		
Production		
Exhaust	0.0010-0.0027 in.	0.0254-0.0686mm
Intake	0.0010-0.0027 in.	0.0254-0.0686mm
Valve spring		
Free length	2.03 in.	51.56mm
Pressure Lbs. @ In.		
Closed		
Intake	76-84 lbs. @ 1.70 in.	338-374 N @ 43.2mm
Exhaust	76-84 lbs. @ 1.61 in.	338-374 N @ 40.89mm
Open		
Intake	194-206 lbs. @ 1.25 in.	863-917 N @ 31.75mm
Exhaust	194-206 lbs. @ 1.16 in.	863-917 N @ 29.46mm
Installed height		
Intake	1.718 in.	43.64mm
Exhaust	1.594 in.	40.49mm
Damper		
Free length	1.86 in.	47.24mm
Approximate # of coils		4

5.7L (VIN J) ENGINE SPECIFICATIONS

Description	English	Metric
General Information		
Type	90 ° V8 OverHead Valve (OHV)	
Displacement	350	5.7 (3500)
Number of Cylinders	8	
Bore	3.897 in.	99.0mm
Stroke	3.661 in.	93.0mm
Compression ratio	11.0:1	
Cylinder Bore		
Diameter	3.897-3.898 in.	98.988-99.012mm
Piston Rings		
Compression		
Groove Clearance		
1st (upper)	0.002-0.003 in.	0.050-0.085mm
2nd (lower)	0.002-0.003 in.	0.050-0.085mm
Gap		
1st (upper)	0.016-0.026 in.	0.40-0.65mm
2nd (lower)	0.031-0.039 in.	0.80-1.0mm
Oil		
Groove		
Clearance	0.001-0.002 in.	0.020-0.055mm
Gap	0.012-0.024 in.	0.30-0.60mm
Piston Pin		
Diameter	0.9841-0.9843 in.	24.995-25.000mm
Fit in piston	0.0002-0.0007 in.	0.006-0.018mm
Fit in rod	0.0005-0.0009 in.	0.012-0.022mm
Crankshaft and Connecting Rods		
Main Journal		
Diameter	2.755-2.756 in.	69.98-70.00mm
Taper	0.0002 in.	0.006mm
Out-of-Round	0.0003 in.	0.008mm
Main Bearing Clearance	0.0007-0.0023 in.	0.018-0.0585mm
Crankshaft End Play	0.0096-0.014 in.	0.25-0.27mm
Rod Journal		
Diameter	2.0993-2.100 in.	53.321-53.340mm
Taper	0.0002 in.	0.006mm
End Play	0.0003 in.	0.008mm

5.7L (VIN J) ENGINE SPECIFICATIONS

Description	English	Metric
Camshaft		
Lobe lift (+/- 0.002 in. (0.051mm))		
Intake	0.3898 in.	9.9mm
Exhaust	0.3898 in.	9.9mm
Journal Diameter	1.140-1.141 in.	28.96-28.98mm
Camshaft End Play	0.0055-0.0138 in.	0.14-0.35mm
Valve System		
Lifter		Hydraulic
Face angle		45°
Seat angle		44°
Seat runout	0.003937 in.	0.10mm
Seat width		
Intake	0.0569-0.0734 in.	1.446-1.863mm
Exhaust	0.0569-0.0734 in.	1.446-1.863mm
Stem clearance		
Intake	0.0012-0.0026 in.	0.030-0.065mm
Exhaust	0.0014-0.0030 in.	0.035-0.075mm
Valve spring		
Inner Spring		
Free length	1.54 in.	39.2mm
Installed height	1.18 in.	30.0mm
Pressure Lbs. (N) @ In. (mm)		
Closed	34.2-37.8 lbs. @ 1.18 in.	152-168 N @ 30.0mm
Open	75.5-81.8 lbs. @ 0.79 in.	336-364 N @ 20.0mm
Outer Spring		
Free length	1.71 in.	43.5mm
Installed height	1.34 in.	34.0mm
Pressure Lbs. (N) @ In. (mm)		
Closed	64.1-76.4 lbs. @ 1.34 in.	285-340 N @ 34.0mm
Open	146.8-166.4 lbs. @ 0.95 in.	653-740 N @ 24.0mm

5.7L (VIN P & 5) ENGINE SPECIFICATIONS

Description	English	Metric
General Information		
Type	90 ° V8 Over Head Valve (OHV)	
Displacement	350	5.7 (3500)
Number of Cylinders	8	
Bore	4.000	101.6mm
Stroke	3.480	88.39mm
Compression ratio		
1992 vehicles	10.2:1	
1993-96 vehicles	10.5:1	
Cylinder Bore		
Diameter		
1995-96 vehicles	4.0007-4.0017 in.	101.618-101.643mm
Out-of-round (max.)		
Production	0.001 in.	0.02mm
Service	0.002 in.	0.05mm
Taper (max.)		
Production Thrust Side	0.0005 in.	0.012mm
Production Relief Side	0.0010 in.	0.025mm
Service	0.0010 in.	0.025mm
Piston		
Clearance		
Production		
1992 vehicles	0.0007-0.0021 in.	0.018-0.053mm
1993-96 vehicles	0.0010-0.0027 in.	0.025-0.068mm
Service (max.)	0.0027 in.	0.068mm
Piston Rings		
Compression Ring		
Groove Clearance		
Production Top		
1992-94 vehicles	0.0012-0.0032 in.	0.030-0.081mm
1995-96 vehicles	0.0019-0.0035 in.	0.050-0.090mm
Production 2nd		
1992-94 vehicles	0.0012-0.0032 in.	0.030-0.081mm
1995-96 vehicles	0.0019-0.0035 in.	0.050-0.090mm
Service Limit	0.0042 in.	0.107mm
Gap		
Production Top	0.010-0.020 in.	0.25-0.50mm
Production 2nd	0.018-0.026 in.	0.46-0.66mm
Service Limit	0.035 in.	0.88mm
Oil Ring		
Groove Clearance		
Production	0.002-0.007 in.	0.051-0.178mm
Service Limit	0.008 in.	0.20mm
Gap		
Production	0.010-0.030 in.	0.25-0.76mm
Service Limit	0.065 in.	1.65mm
Piston Pin		
Diameter	0.9270-0.9271 in.	23.546-23.548mm
Clearance in Piston		
Production	0.0005-0.0008 in.	0.0127-0.0203mm
Service Limit (max.)	0.001 in.	0.025mm
Fit in rod	0.0008-0.0016 in.	0.021-0.040mm

5.7L (VIN P & 5) ENGINE SPECIFICATIONS

Description	English	Metric
Crankshaft		
Main Journal		
Diameter		
#1	2.4484-2.4493 in.	62.1894-62.2122mm
#2, 3 & 4	2.4481-2.4490 in.	62.1818-62.2046mm
#5	2.4481-2.4488 in.	62.1770-62.1200mm
Taper (max.)		
Production	0.0002 in.	0.0508mm
Service	0.0010 in.	0.0254mm
Out-of-Round		
Production	0.0002 in.	0.0508mm
Service	0.0010 in.	0.0254mm
Main Bearing Clearance		
Production		
#1	0.0008-0.0020 in.	0.0203-0.0508mm
#2, 3 & 4	0.0011-0.0020 in.	0.028-0.051mm
#5	0.0017-0.0032 in.	0.043-0.081mm
Service		
#1	0.0010-0.0015 in.	0.025-0.0381mm
#2, 3 & 4	0.0010-0.0025 in.	0.025-0.0635mm
#5	0.0025-0.0035 in.	0.0635-0.0889mm
Crankshaft End Play	0.001-0.007 in.	0.03-0.17mm
Crankshaft Runout (at rear flange)	0.0015 in.	0.038mm
Connecting Rod		
Connecting Rod Journal Diameter		
1992-94 vehicles	2.0893-2.0998 in.	53.068-53.334mm
1995-96 vehicles	2.0978-2.0998 in.	53.284-53.334mm
Taper		
Production		
1992-94 vehicles	0.0005 in.	0.013mm
1995-96 vehicles	0.0003 in.	0.007mm
Service Limit	0.0010 in.	0.025mm
Out-of-round (max.)		
Production		
1992-94 vehicles	0.0005 in.	0.013mm
1995-96 vehicles	0.0003 in.	0.007mm
Service Limit	0.0010 in.	0.025mm
Rod Bearing Clearance		
Production	0.0013-0.0035 in.	0.033-0.088mm
Service Limit	0.0030 in.	0.076mm
Rod Side Clearance	0.006-0.014 in.	0.16-0.35mm
Camshaft		
Journal Diameter		
1992-94 vehicles	1.8682-1.8692 in.	47.452-47.477mm
1995-96 vehicles	1.8677-1.8697 in.	47.440-47.490mm
Camshaft End Play	0.004-0.012 in.	0.11-0.30mm
Lobe lift (+/- 0.002 in. (0.050mm))		
Intake		
1992-94 vehicles	0.300 in.	7.62mm
1995-96 vehicles	0.279 in.	7.09mm
Exhaust		
1992-94 vehicles	0.300 in.	7.62mm
1995-96 vehicles	0.2861 in.	7.26mm

5.7L (VIN P & 5) ENGINE SPECIFICATIONS

Description	English	Metric
Valve System		
Lifter		Hydraulic
Rocker arm ratio		1.50:1
Face angle		45°
Seat angle		46°
Seat runout (max.)	0.002 in.	0.050mm
Seat width		
Intake		
1992-94 vehicles	0.030-0.050 in.	0.76-1.27mm
1995-96 vehicles	0.040-0.065 in.	1.02-1.65mm
Exhaust		
1992-94 vehicles	0.060-0.080 in.	1.52-2.03mm
1995-96 vehicles	0.065-0.098 in.	1.65-2.49mm
Stem clearance		
Production		
Intake	0.0011-0.0027 in.	0.027-0.069mm
Exhaust	0.0011-0.0027 in.	0.027-0.069mm
Service		
Intake		
1992-94 vehicles	0.0037 in.	0.093mm
1995-96 vehicles	0.0037 in.	0.093mm
Exhaust		
1992-94 vehicles	0.0047 in.	0.119mm
1995-96 vehicles	0.0047 in.	0.119mm
Valve spring		
Free length		
1992-94 vehicles	2.01 in.	51.1mm
1995-96 vehicles	2.02 in.	51.3mm
Pressure		
Closed		
1992-94 vehicles	81-89 lbs. @ 1.78 in.	360-395 N @ 45.2mm
1995-96 vehicles	76-84 lbs. @ 1.70 in.	338-374 N @ 43.2mm
Open		
1992-94 vehicles	252-272 lbs. @ 1.306 in.	1121-1208 N @ 33.1mm
1995-96 vehicles	187-203 lbs. @ 1.27 in.	832-903 N @ 32.3mm
Installed height		
Intake		
1992-94 vehicles	1.78 in.	45.2mm
1995-96 vehicles	1.70 in.	43.2
Exhaust		
1992-94 vehicles	1.78 in.	45.2mm
1995-96 vehicles	1.70 in.	43.2
Valve Lift		
Intake		
1992-94 vehicles	0.450 in.	11.43mm
1995-96 vehicles	0.418 in.	10.62mm
Exhaust		
1992-94 vehicles	0.450 in.	11.43mm
1995-96 vehicles	0.430 in.	10.92mm

1990 Chevrolet CORVETTE

Submodel: | Engine Type: V8 | Liters: 5.7

Fuel Delivery: FI | Fuel: GAS

Now that you have determined that your engine is worn out, you must make some decisions. The question of whether or not an engine is worth rebuilding is largely a subjective matter and one of personal worth. Is the engine a popular one, or is it an obsolete model? Are parts available? Will it get acceptable gas mileage once it is rebuilt? Is the car it's being put into worth keeping? Would it be less expensive to buy a new engine, have your engine rebuilt by a pro, rebuild it yourself or buy a used engine from a salvage yard? Or would it be simpler and less expensive to buy another car? If you have considered all these matters and more, and have still decided to rebuild the engine, then it is time to decide how you will rebuild it.

NOTE: The editors feel that most engine machining should be performed by a professional machine shop. Don't think of it as wasting money, rather, as an assurance that the job has been done right the first time. There are many expensive and specialized tools required to perform such tasks as boring and honing an engine block or having a valve job done on a cylinder head. Even inspecting the parts requires expensive micrometers and gauges to properly measure wear and clearances. Also, a machine shop can deliver to you clean, and ready to assemble parts, saving you time and aggravation. Your maximum savings will come from performing the removal, disassembly, assembly and installation of the engine and purchasing or renting only the tools required to perform the above tasks. Depending on the particular circumstances, you may save 40 to 60 percent of the cost doing these yourself.

A complete rebuild or overhaul of an engine involves replacing all of the moving parts (pistons, rods, crankshaft, camshaft, etc.) with new ones and machining the non-moving wearing surfaces of the block and heads. Unfortunately, this may not be cost effective. For instance, your crankshaft may have been damaged or worn, but it can be machined undersize for a minimal fee.

So, as you can see, you can replace everything inside the engine, but, it is wiser to replace only those parts which are really needed, and, if possible, repair the more expensive ones. Later in this section, we will break the engine down into its two main components: the cylinder head and the engine block. We will discuss each component, and the recommended parts to replace during a rebuild on each.

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There are two basic types of cylinder heads used on today's automobiles: the Overhead Valve (OHV) and the Overhead Camshaft (OHC). The latter can also be broken down into two subgroups: the Single Overhead Camshaft (SOHC) and the Dual Overhead Camshaft (DOHC). Generally, if there is only a single camshaft on a head, it is just referred to as an OHC head. Also, an engine with an OHV cylinder head is also known as a pushrod engine.

Most cylinder heads these days are made of an aluminum alloy due to its light weight, durability and heat transfer qualities. However, cast iron was the material of choice in the past, and is still used on many vehicles today. Whether made from aluminum or iron, all cylinder heads have valves and seats. Some use two valves per cylinder, while the more hi-tech engines will utilize a multi-valve configuration using 3, 4 and even 5 valves per cylinder. When the valve contacts the seat, it does so on precision machined surfaces, which seals the combustion chamber. All cylinder heads have a valve guide for each valve. The guide centers the valve to the seat and allows it to move up and down within it. The clearance between the valve and guide can be critical. Too much clearance and the engine may consume oil, lose vacuum and/or damage the seat. Too little, and the valve can stick in the guide causing the engine to run poorly if at all, and possibly causing severe damage. The last component all cylinder heads have are valve springs. The spring holds the valve against its seat. It also returns the valve to this position when the valve has been opened by the valve train or camshaft. The spring is fastened to the valve by a retainer and valve locks (sometimes called keepers). Aluminum heads will also have a valve spring shim to keep the spring from wearing away the aluminum.

An ideal method of rebuilding the cylinder head would involve replacing all of the valves, guides, seats, springs, etc. with new ones. However, depending on how the engine was maintained, often this is not necessary. A major cause of valve, guide and seat wear is an improperly tuned engine. An engine that is running too rich, will often wash the lubricating oil out of the guide with gasoline, causing it to wear rapidly. Conversely, an engine which is running too lean will place higher combustion temperatures on the valves and seats allowing them to wear or even burn. Springs fall victim to the driving habits of the individual. A driver who often runs the engine rpm to the redline will wear out or break the springs faster than one that stays well below it. Unfortunately, mileage takes it toll on all of the parts. Generally, the valves, guides, springs and seats in a cylinder head can be machined and re-used, saving you money. However, if a valve is burnt, it may be wise to replace all of the valves, since they were all operating in the same environment. The same goes for any other component on the cylinder head. Think of it as an insurance policy against future problems related to that component.

Unfortunately, the only way to find out which components need replacing, is to disassemble and carefully check each piece. After the cylinder head(s) are disassembled, thoroughly clean all of the components.

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The first step for any assembly job is to have a clean area in which to work. Next, thoroughly clean all of the parts and components that are to be assembled. Finally, place all of the components onto a suitable work space and, if necessary, arrange the parts to their respective positions.

[OHV Engines](#)

1. Lightly lubricate the valve stems and insert all of the valves into the cylinder head. If possible, maintain their original locations.
2. If equipped, install any valve spring shims which were removed.
3. If equipped, install the new valve seals, keeping the following in mind:
 - If the valve seal presses over the guide, lightly lubricate the outer guide surfaces.
 - If the seal is an O-ring type, it is installed just after compressing the spring but before the valve locks.
4. Place the valve spring and retainer over the stem.
5. Position the spring compressor tool and compress the spring.
6. Assemble the valve locks to the stem.
7. Relieve the spring pressure slowly and insure that neither valve lock becomes dislodged by the retainer.
8. Remove the spring compressor tool.
9. Repeat Steps 2 through 8 until all of the springs have been installed.

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Before disassembling the cylinder head, you may want to fabricate some containers to hold the various parts, as some of them can be quite small (such as keepers) and easily lost. Also keeping yourself and the components organized will aid in assembly and reduce confusion. Where possible, try to maintain a components original location; this is especially important if there is not going to be any machine work performed on the components.

1. If you haven't already removed the rocker arms and/or shafts, do so now.
2. Position the head so that the springs are easily accessed.

Fig. 1: When removing an OHV valve spring, use a compressor tool to relieve the tension from the retainer



3. Use a valve spring compressor tool, and relieve spring tension from the retainer.

NOTE: Due to engine varnish, the retainer may stick to the valve locks. A gentle tap with a hammer may help to break it loose.

Fig. 2: A small magnet will help in removal of the valve locks

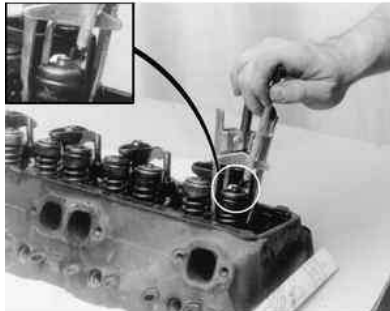


Fig. 3: Be careful not to lose the small valve locks (keepers)



4. Remove the valve locks from the valve tip and/or retainer. A small magnet may help in removing the locks.
5. Lift the valve spring, tool and all, off of the valve stem.

Fig. 4: Remove the valve seal from the valve stem — O-ring type seal shown

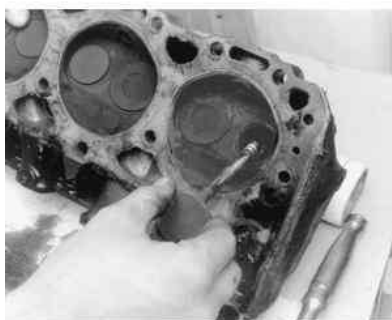


Fig. 5: Removing an umbrella/positive type seal



6. If equipped, remove the valve seal. If the seal is difficult to remove with the valve in place, try removing the valve first, then the seal. Follow the steps below for valve removal.

Fig. 6: Invert the cylinder head and withdraw the valve from the valve guide bore



7. Position the head to allow access for withdrawing the valve.

NOTE: Cylinder heads that have seen a lot of miles and/or abuse may have mushroomed the valve lock groove and/or tip, causing difficulty in removal of the valve. If this has happened, use a metal file to carefully remove the high spots around the lock grooves and/or tip. Only file it enough to allow removal.

8. Remove the valve from the cylinder head.
9. If equipped, remove the valve spring shim. A small magnetic tool or screwdriver will aid in removal.
10. Repeat Steps 3 through 9 until all of the valves have been removed.

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Now that all of the cylinder head components are clean, it's time to inspect them for wear and/or damage. To accurately inspect them, you will need some specialized tools:

- A 0–1 in. micrometer for the valves
- A dial indicator or inside diameter gauge for the valve guides
- A spring pressure test gauge

If you do not have access to the proper tools, you may want to bring the components to a shop that does.

Valves

The first thing to inspect are the valve heads. Look closely at the head, margin and face for any cracks, excessive wear or burning. The margin is the best place to look for burning. It should have a squared edge with an even width all around the diameter. When a valve burns, the margin will look melted and the edges rounded. Also inspect the valve head for any signs of tulipping. This will show as a lifting of the edges or dishing in the center of the head and will usually not occur to all of the valves. All of the heads should look the same, any that seem dished more than others are probably bad. Next, inspect the valve lock grooves and valve tips. Check for any burrs around the lock grooves, especially if you had to file them to remove the valve. Valve tips should appear flat, although slight rounding with high mileage engines is normal. Slightly worn valve tips will need to be machined flat. Last, measure the valve stem diameter with the micrometer. Measure the area that rides within the guide, especially towards the tip where most of the wear occurs. Take several measurements along its length and compare them to each other. Wear should be even along the length with little to no taper. If no minimum diameter is given in the specifications, then the stem should not read more than 0.001 in. (0.025mm) below the specification. Any valves that fail these inspections should be replaced.

Fig. 1: Valve stems may be rolled on a flat surface to check for bends

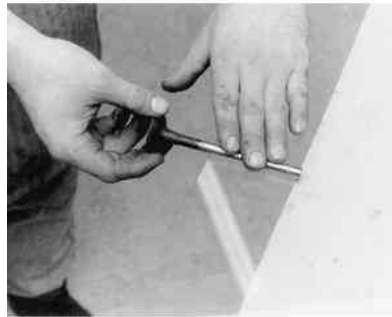
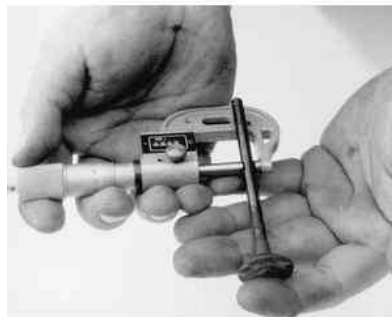


Fig. 2: Use a micrometer to check the valve stem diameter



Springs, Retainers and Valve Locks

The first thing to check is the most obvious, broken springs. Next check the free length and squareness of each spring. If applicable, insure to distinguish between intake and exhaust springs. Use a ruler and/or carpenter's square to measure the length. A carpenter's square should be used to check the springs for squareness. If a spring pressure test gauge is available, check each spring's rating and compare to the specifications chart. Check the readings against the specifications given. Any springs that fail these inspections should be replaced.

The spring retainers rarely need replacing, however they should still be checked as a precaution. Inspect the spring mating surface and the valve lock retention area for any signs of excessive wear. Also check for any signs of cracking. Replace any retainers that are questionable.

Valve locks should be inspected for excessive wear on the outside contact area as well as on the inner notched surface. Any locks which appear worn or broken and its respective valve should be replaced.

Fig. 3: Use a caliper to check the valve spring free-length

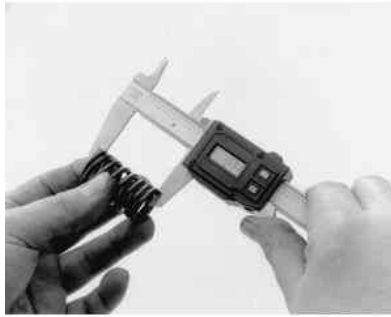
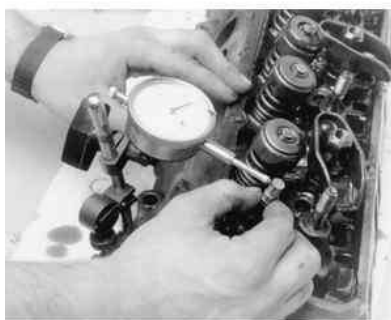


Fig. 4: Check the valve spring for squareness on a flat surface; a carpenter's square can be used



Fig. 5: A dial gauge may be used to check valve stem-to-guide clearance; read the gauge while moving the valve stem



Cylinder Head

There are several things to check on the cylinder head: valve guides, seats, cylinder head surface flatness, cracks and physical damage.

VALVE GUIDES

Now that you know the valves are good, you can use them to check the guides, although a new valve, if available, is preferred. Before you measure anything, look at the guides carefully and inspect them for any cracks, chips or breakage. Also if the guide is a removable style (as in most aluminum heads), check them for any looseness or evidence of movement. All of the guides should appear to be at the same height from the spring seat. If any seem lower (or higher) from another, the guide has moved. Mount a dial indicator onto the spring side of the cylinder head. Lightly oil the valve stem and insert it into the cylinder head. Position the dial indicator against the valve stem near the tip and zero the gauge. Grasp the valve stem and wiggle towards and away from the dial indicator and observe the readings. Mount the dial indicator 90 degrees from the initial point and zero the gauge and again take a reading. Compare the two readings for a out of round condition. Check the readings against the specifications given. An Inside Diameter (I.D.) gauge designed for valve guides will give you an accurate valve guide bore measurement. If the I.D. gauge is used, compare the readings with the specifications given. Any guides that fail these inspections should be replaced or machined.

VALVE SEATS

A visual inspection of the valve seats should show a slightly worn and pitted surface where the valve face contacts the seat. Inspect the seat carefully for severe pitting or cracks. Also, a seat that is badly worn will be recessed into the cylinder head. A severely worn or recessed seat may need to be replaced. All cracked seats must be replaced. A seat concentricity gauge, if available, should be used to check the seat run-out. If run-out exceeds specifications the seat must be machined (if no specification is given use 0.002 in. or 0.051mm).

CYLINDER HEAD SURFACE FLATNESS

After you have cleaned the gasket surface of the cylinder head of any old gasket material, check the head for flatness.

Fig. 6: Check the head for flatness across the center of the head surface using a straightedge and feeler gauge

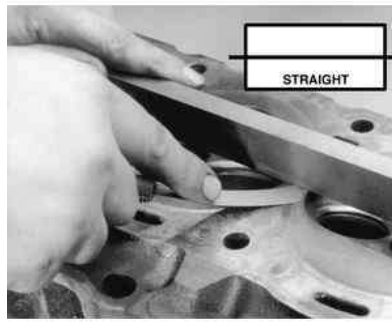


Fig. 7: Checks should also be made along both diagonals of the head surface



Place a straightedge across the gasket surface. Using feeler gauges, determine the clearance at the center of the straightedge and across the cylinder head at several points. Check along the centerline and diagonally on the head surface. If the warpage exceeds 0.003 in. (0.076mm) within a 6.0 in. (15.2cm) span, or 0.006 in. (0.152mm) over the total length of the head, the cylinder head must be resurfaced. After resurfacing the heads of a V-type engine, the intake manifold flange surface should be checked, and if necessary, milled proportionally to allow for the change in its mounting position.

CRACKS AND PHYSICAL DAMAGE

Generally, cracks are limited to the combustion chamber, however, it is not uncommon for the head to crack in a spark plug hole, port, outside of the head or in the valve spring/rocker arm area. The first area to inspect is always the hottest: the exhaust seat/port area.

A visual inspection should be performed, but just because you don't see a crack does not mean it is not there. Some more reliable methods for inspecting for cracks include Magnaflux, a magnetic process or Zyglo, a dye penetrant. Magnaflux is used only on ferrous metal (cast iron) heads. Zyglo uses a spray on fluorescent mixture along with a black light to reveal the cracks. It is strongly recommended to have your cylinder head checked professionally for cracks, especially if the engine was known to have overheated and/or leaked or consumed coolant. Contact a local shop for availability and pricing of these services.

Physical damage is usually very evident. For example, a broken mounting ear from dropping the head or a bent or broken stud and/or bolt. All of these defects should be fixed or, if unrepairable, the head should be replaced.

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Many of the procedures given for refinishing and repairing the cylinder head components must be performed by a machine shop. Certain steps, if the inspected part is not worn, can be performed yourself inexpensively. However, you spent a lot of time and effort so far, why risk trying to save a couple bucks if you might have to do it all over again?

Valves

Any valves that were not replaced should be refaced and the tips ground flat. Unless you have access to a valve grinding machine, this should be done by a machine shop. If the valves are in extremely good condition, as well as the valve seats and guides, they may be lapped in without performing machine work.

It is a recommended practice to lap the valves even after machine work has been performed and/or new valves have been purchased. This insures a positive seal between the valve and seat.

LAPPING THE VALVES

NOTE: Before lapping the valves to the seats, read the rest of the cylinder head section to insure that any related parts are in acceptable enough condition to continue.

NOTE: Before any valve seat machining and/or lapping can be performed, the guides must be within factory recommended specifications.

1. Invert the cylinder head.
2. Lightly lubricate the valve stems and insert them into the cylinder head in their numbered order.
3. Raise the valve from the seat and apply a small amount of fine lapping compound to the seat.
4. Moisten the suction head of a hand-lapping tool and attach it to the head of the valve.
5. Rotate the tool between the palms of both hands, changing the position of the valve on the valve seat and lifting the tool often to prevent grooving.
6. Lap the valve until a smooth, polished circle is evident on the valve and seat.
7. Remove the tool and the valve. Wipe away all traces of the grinding compound and store the valve to maintain its lapped location.

WARNING

Do not get the valves out of order after they have been lapped. They must be put back with the same valve seat with which they were lapped.

Springs, Retainers and Valve Locks

There is no repair or refinishing possible with the springs, retainers and valve locks. If they are found to be worn or defective, they must be replaced with new (or known good) parts.

Cylinder Head

Most refinishing procedures dealing with the cylinder head must be performed by a machine shop. Read the sections below and review your inspection data to determine whether or not machining is necessary.

VALVE GUIDE

NOTE: If any machining or replacements are made to the valve guides, the seats must be machined.

Unless the valve guides need machining or replacing, the only service to perform is to thoroughly clean them of any dirt or oil residue.

There are only two types of valve guides used on automobile engines: the replaceable-type (all aluminum heads) and the cast-in integral-type (most cast iron heads). There are four recommended methods for repairing worn guides.

- Knurling
- Inserts
- Reaming oversize
- Replacing

Knurling is a process in which metal is displaced and raised, thereby reducing clearance, giving a true center, and providing oil control. It is the least expensive way of repairing the valve guides. However, it is not necessarily the best, and in some cases, a knurled valve guide will not stand up for more than a short time. It requires a special knurlizer and precision reaming tools to obtain proper clearances. It would not be cost effective to purchase these tools, unless you plan on rebuilding several of the same cylinder head.

Installing a guide insert involves machining the guide to accept a bronze insert. One style is the coil-type which is installed into a threaded guide. Another is the thin-walled insert where the guide is reamed oversize to accept a split-sleeve insert. After the insert is installed, a special tool is then run through the guide to expand the insert, locking it to the guide. The insert is then reamed to the standard size for proper valve clearance.

Reaming for oversize valves restores normal clearances and provides a true valve seat. Most cast-in type guides can be reamed to accept an valve with an oversize stem. The cost factor for this can become quite high as you will need to purchase the reamer and new, oversize stem valves for all guides which were reamed. Oversizes are generally 0.003 to 0.030 in. (0.076 to 0.762mm), with 0.015 in. (0.381mm) being the most common.

To replace cast-in type valve guides, they must be drilled out, then reamed to accept replacement guides. This must be done on a fixture which will allow centering and leveling off of the original valve seat or guide, otherwise a serious guide-to-seat misalignment may occur making it impossible to properly machine the seat.

Replaceable-type guides are pressed into the cylinder head. A hammer and a stepped drift or punch may be used to install and remove the guides. Before removing the guides, measure the protrusion on the spring side of the head and record it for installation. Use the stepped drift to hammer out the old guide from the combustion chamber side of the head. When installing, determine whether or not the guide also seals a water jacket in the head, and if it does, use the recommended sealing agent. If there is no water jacket, grease the valve guide and its bore. Use the stepped drift, and hammer the new guide into the cylinder head from the spring side of the cylinder head. A stack of washers the same thickness as the measured protrusion may help the installation process.

VALVE SEATS

NOTE: Before any valve seat machining can be performed, the guides must be within factory recommended specifications.

NOTE: If any machining or replacements were made to the valve guides, the seats must be machined.

If the seats are in good condition, the valves can be lapped to the seats, and the cylinder head assembled. See the valves section for instructions on lapping.

If the valve seats are worn, cracked or damaged, they must be serviced by a machine shop. The valve seat must be perfectly centered to the valve guide, which requires very accurate machining.

CYLINDER HEAD SURFACE

If the cylinder head is warped, it must be machined flat. If the warpage is extremely severe, the head may need to be replaced. In some instances, it may be possible to straighten a warped head enough to allow machining. In either case, contact a professional machine shop for service.

CRACKS AND PHYSICAL DAMAGE

Certain cracks can be repaired in both cast iron and aluminum heads. For cast iron, a tapered threaded insert is installed along the length of the crack. Aluminum can also use the tapered inserts, however welding is the preferred method. Some physical damage can be repaired through brazing or welding. Contact a machine shop to get expert advice for your particular dilemma.

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Anything that generates heat and/or friction will eventually burn or wear out (for example, a light bulb generates heat, therefore its life span is limited). With this in mind, a running engine generates tremendous amounts of both; friction is encountered by the moving and rotating parts inside the engine and heat is created by friction and combustion of the fuel. However, the engine has systems designed to help reduce the effects of heat and friction and provide added longevity. The oiling system reduces the amount of friction encountered by the moving parts inside the engine, while the cooling system reduces heat created by friction and combustion. If either system is not maintained, a break-down will be inevitable. Therefore, you can see how regular maintenance can affect the service life of your vehicle. If you do not drain, flush and refill your cooling system at the proper intervals, deposits will begin to accumulate in the radiator, thereby reducing the amount of heat it can extract from the coolant. The same applies to your oil and filter; if it is not changed often enough it becomes laden with contaminants and is unable to properly lubricate the engine. This increases friction and wear.

There are a number of methods for evaluating the condition of your engine. A compression test can reveal the condition of your pistons, piston rings, cylinder bores, head gasket(s), valves and valve seats. An oil pressure test can warn you of possible engine bearing, or oil pump failures. Excessive oil consumption, evidence of oil in the engine air intake area and/or bluish smoke from the tailpipe may indicate worn piston rings, worn valve guides and/or valve seals. As a general rule, an engine that uses no more than one quart of oil every 1000 miles is in good condition. Engines that use one quart of oil or more in less than 1000 miles should first be checked for oil leaks. If any oil leaks are present, have them fixed before determining how much oil is consumed by the engine, especially if blue smoke is not visible at the tailpipe.

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A noticeable lack of engine power, excessive oil consumption and/or poor fuel mileage measured over an extended period are all indicators of internal engine wear. Worn piston rings, scored or worn cylinder bores, blown head gaskets, sticking or burnt valves, and worn valve seats are all possible culprits. A check of each cylinder's compression will help locate the problem.

NOTE: A screw-in type compression gauge is more accurate than the type you simply hold against the spark plug hole. Although it takes slightly longer to use, it's worth the effort to obtain a more accurate reading.

1. Make sure that the proper amount and viscosity of engine oil is in the crankcase, then ensure the battery is fully charged.
2. Warm-up the engine to normal operating temperature, then shut the engine **OFF**.
3. Disable the ignition system.
4. Label and disconnect all of the spark plug wires from the plugs.
5. Thoroughly clean the cylinder head area around the spark plug ports, then remove the spark plugs.
6. Set the throttle plate to the fully open (wide-open throttle) position. You can block the accelerator linkage open for this, or you can have an assistant fully depress the accelerator pedal.

Fig. 1: A screw-in type compression gauge is more accurate and easier to use without an assistant



7. Install a screw-in type compression gauge into the No. 1 spark plug hole until the fitting is snug.
WARNING
Be careful not to crossthread the spark plug hole.
8. According to the tool manufacturer's instructions, connect a remote starting switch to the starting circuit.
9. With the ignition switch in the **OFF** position, use the remote starting switch to crank the engine through at least five compression strokes (approximately 5 seconds of cranking) and record the highest reading on the gauge.
10. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes and/or time as the first.
11. Compare the highest readings from each cylinder to that of the others. The indicated compression pressures are considered within specifications if the lowest reading cylinder is within 75 percent of the pressure recorded for the highest reading cylinder. For example, if your highest reading cylinder pressure was 150 psi (1034 kPa), then 75 percent of that would be 113 psi (779 kPa). So the lowest reading cylinder should be no less than 113 psi (779 kPa).
12. If a cylinder exhibits an unusually low compression reading, pour a tablespoon of clean engine oil into the cylinder through the spark plug hole and repeat the compression test. If the compression rises after adding oil, it means that the cylinder's piston rings and/or cylinder bore are damaged or worn. If the pressure remains low, the valves may not be seating properly (a valve job is needed), or the head gasket may be blown near that cylinder. If compression in any two adjacent cylinders is low, and if the addition of oil doesn't help raise compression, there is leakage past the head gasket. Oil and coolant in the combustion chamber, combined with blue or constant white smoke from the tailpipe, are symptoms of this problem. However, don't be alarmed by the normal white smoke emitted from the tailpipe during engine warm-up or from cold weather driving. There may be evidence of water droplets on the engine dipstick and/or oil droplets in the cooling system if a head gasket is blown.

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Check for proper oil pressure at the sending unit passage with an externally mounted mechanical oil pressure gauge (as opposed to relying on a factory installed dash-mounted gauge). A tachometer may also be needed, as some specifications may require running the engine at a specific rpm.

1. With the engine cold, locate and remove the oil pressure sending unit.
2. Following the manufacturer's instructions, connect a mechanical oil pressure gauge and, if necessary, a tachometer to the engine.
3. Start the engine and allow it to idle.
4. Check the oil pressure reading when cold and record the number. You may need to run the engine at a specified rpm, so check the specifications chart located earlier in this section.
5. Run the engine until normal operating temperature is reached (upper radiator hose will feel warm).
6. Check the oil pressure reading again with the engine hot and record the number. Turn the engine **OFF**.
7. Compare your hot oil pressure reading to that given in the chart. If the reading is low, check the cold pressure reading against the chart. If the cold pressure is well above the specification, and the hot reading was lower than the specification, you may have the wrong viscosity oil in the engine. Change the oil, making sure to use the proper grade and quantity, then repeat the test.

Low oil pressure readings could be attributed to internal component wear, pump related problems, a low oil level, or oil viscosity that is too low. High oil pressure readings could be caused by an overfilled crankcase, too high of an oil viscosity or a faulty pressure relief valve.

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Before you begin assembling the engine, first give yourself a clean, dirt free work area. Next, clean every engine component again. The key to a good assembly is cleanliness.

Mount the engine block into the engine stand and wash it one last time using water and detergent (dishwashing detergent works well). While washing it, scrub the cylinder bores with a soft bristle brush and thoroughly clean all of the oil passages. Completely dry the engine and spray the entire assembly down with an anti-rust solution such as WD-40 or similar product. Take a clean lint-free rag and wipe up any excess anti-rust solution from the bores, bearing saddles, etc. Repeat the final cleaning process on the crankshaft. Replace any freeze or oil galley plugs which were removed during disassembly.

Crankshaft

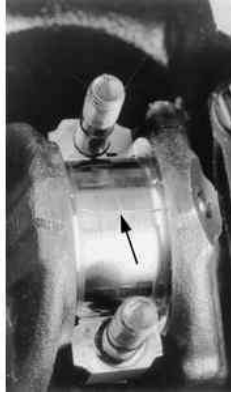
1. Remove the main bearing inserts from the block and bearing caps.
2. If the crankshaft main bearing journals have been refinished to a definite undersize, install the correct undersize bearing. Be sure that the bearing inserts and bearing bores are clean. Foreign material under inserts will distort bearing and cause failure.
3. Place the upper main bearing inserts in bores with tang in slot.

NOTE: The oil holes in the bearing inserts must be aligned with the oil holes in the cylinder block.

4. Install the lower main bearing inserts in bearing caps.
5. Clean the mating surfaces of block and rear main bearing cap.
6. Carefully lower the crankshaft into place. Be careful not to damage bearing surfaces.
7. Check the clearance of each main bearing by using the following procedure:

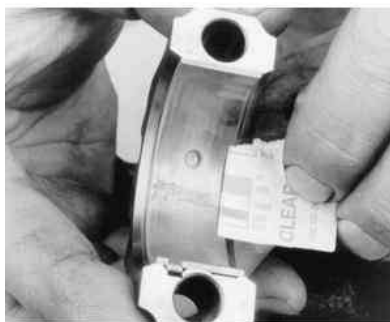
- A. Place a piece of Plastigage® or its equivalent, on bearing surface across full width of bearing cap and about $\frac{1}{4}$ in. off center.

Fig. 1: Apply a strip of gauging material to the bearing journal, then install and torque the cap



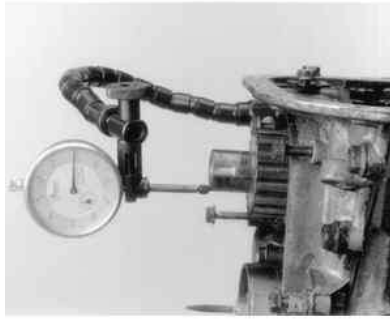
- B. Install cap and tighten bolts to specifications. Do not turn crankshaft while Plastigage® is in place.
- C. Remove the cap. Using the supplied Plastigage® scale, check width of Plastigage® at widest point to get maximum clearance. Difference between readings is taper of journal.

Fig. 2: After the cap is removed again, use the scale supplied with the gauging material to check the clearance



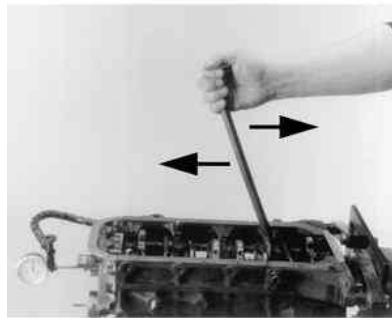
- D. If clearance exceeds specified limits, try a 0.001 in. or 0.002 in. undersize bearing in combination with the standard bearing. Bearing clearance must be within specified limits. If standard and 0.002 in. undersize bearing does not bring clearance within desired limits, refinish crankshaft journal, then install undersize bearings.
8. Install the rear main seal.
 9. After the bearings have been fitted, apply a light coat of engine oil to the journals and bearings. Install the rear main bearing cap. Install all bearing caps except the thrust bearing cap. Be sure that main bearing caps are installed in original locations. Tighten the bearing cap bolts to specifications.
 10. Install the thrust bearing cap with bolts finger-tight.
 11. Pry the crankshaft forward against the thrust surface of upper half of bearing.
 12. Hold the crankshaft forward and pry the thrust bearing cap to the rear. This aligns the thrust surfaces of both halves of the bearing.
 13. Retain the forward pressure on the crankshaft. Tighten the cap bolts to specifications.
 14. Measure the crankshaft end-play as follows:

Fig. 3: A dial gauge may be used to check crankshaft end-



- A. Mount a dial gauge to the engine block and position the tip of the gauge to read from the crankshaft end.
- B. Carefully pry the crankshaft toward the rear of the engine and hold it there while you zero the gauge.

Fig. 4: Carefully pry the crankshaft back and forth while reading the dial gauge for end-play



- C. Carefully pry the crankshaft toward the front of the engine and read the gauge.
 - D. Confirm that the reading is within specifications. If not, install a new thrust bearing and repeat the procedure. If the reading is still out of specifications with a new bearing, have a machine shop inspect the thrust surfaces of the crankshaft, and if possible, repair it.
15. Rotate the crankshaft so as to position the first rod journal to the bottom of its stroke.

Pistons and Connecting Rods

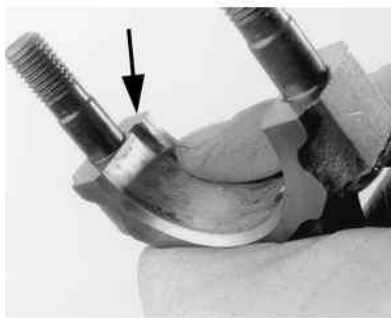
1. Before installing the piston/connecting rod assembly, oil the pistons, piston rings and the cylinder walls with light engine oil. Install connecting rod bolt protectors or rubber hose onto the connecting rod bolts/studs. Also perform the following:
 - A. Select the proper ring set for the size cylinder bore.
 - B. Position the ring in the bore in which it is going to be used.
 - C. Push the ring down into the bore area where normal ring wear is not encountered.
 - D. Use the head of the piston to position the ring in the bore so that the ring is square with the cylinder wall. Use caution to avoid damage to the ring or cylinder bore.
 - E. Measure the gap between the ends of the ring with a feeler gauge. Ring gap in a worn cylinder is normally greater than specification. If the ring gap is greater than the specified limits, try an oversize ring set.

Fig. 5: Checking the piston ring-to-ring groove side clearance using the ring and a feeler gauge



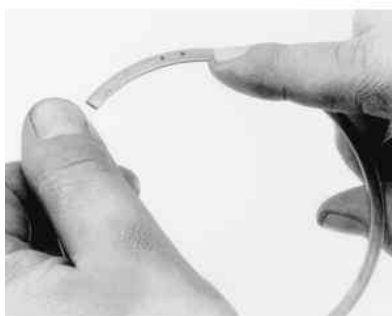
- F. Check the ring side clearance of the compression rings with a feeler gauge inserted between the ring and its lower land according to specification. The gauge should slide freely around the entire ring circumference without binding. Any wear that occurs will form a step at the inner portion of the lower land. If the lower lands have high steps, the piston should be replaced.

Fig. 6: The notch on the side of the bearing cap matches the tang on the bearing insert



2. Unless new pistons are installed, be sure to install the pistons in the cylinders from which they were removed. The numbers on the connecting rod and bearing cap must be on the same side when installed in the cylinder bore. If a connecting rod is ever transposed from one engine or cylinder to another, new bearings should be fitted and the connecting rod should be numbered to correspond with the new cylinder number. The notch on the piston head goes toward the front of the engine.
3. Install all of the rod bearing inserts into the rods and caps.

Fig. 7: Most rings are marked to show which side of the ring should face up when installed to the piston



4. Install the rings to the pistons. Install the oil control ring first, then the second compression ring and finally the top compression ring. Use a piston ring expander tool to aid in installation and to help reduce the chance of breakage.

Fig. 8: Install the piston and rod assembly into the block using a ring compressor and the handle of a hammer



5. Make sure the ring gaps are properly spaced around the circumference of the piston. Fit a piston ring compressor around the piston and slide the piston and connecting rod assembly down into the cylinder bore, pushing it in with the wooden hammer handle. Push the piston down until it is only slightly below the top of the cylinder bore. Guide the connecting rod onto the crankshaft bearing journal carefully, to avoid damaging the crankshaft.
6. Check the bearing clearance of all the rod bearings, fitting them to the crankshaft bearing journals. Follow the procedure in the crankshaft installation above.
7. After the bearings have been fitted, apply a light coating of assembly oil to the journals and bearings.
8. Turn the crankshaft until the appropriate bearing journal is at the bottom of its stroke, then push the piston assembly all the way down until the connecting rod bearing seats on the crankshaft journal. Be careful not to allow the bearing cap screws to strike the crankshaft bearing journals and damage them.
9. After the piston and connecting rod assemblies have been installed, check the connecting rod side clearance on each crankshaft journal.
10. Prime and install the oil pump and the oil pump intake tube.
11. Install the auxiliary/balance shaft(s)/assembly(ies).
12. Install the camshaft.
13. Install the lifters/followers into their bores.
14. Install the timing gears/chain assembly.
15. Install the cylinder head(s) using new gaskets.
16. Assemble the rest of the valve train (pushrods and rocker arms and/or shafts).

1990 Chevrolet CORVETTE

Submodel: | Engine Type: V8 | Liters: 5.7

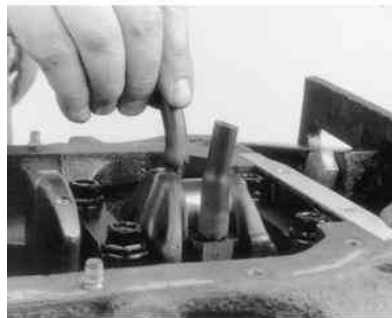
Fuel Delivery: FI | Fuel: GAS

The engine disassembly instructions following assume that you have the engine mounted on an engine stand. If not, it is easiest to disassemble the engine on a bench or the floor with it resting on the bell housing or transmission mounting surface. You must be able to access the connecting rod fasteners and turn the crankshaft during disassembly. Also, all engine covers (timing, front, side, oil pan, whatever) should have already been removed. Engines which are seized or locked up may not be able to be completely disassembled, and a core (salvage yard) engine should be purchased.

If not done during the cylinder head removal, remove the pushrods and lifters, keeping them in order for assembly. Remove the timing gears and/or timing chain assembly, then remove the oil pump drive assembly and withdraw the camshaft from the engine block. Remove the oil pick-up and pump assembly. If equipped, remove any balance or auxiliary shafts. If necessary, remove the cylinder ridge from the top of the bore. See the cylinder ridge removal procedure earlier in this section.

Rotate the engine over so that the crankshaft is exposed. Use a number punch or scribe and mark each connecting rod with its respective cylinder number. The cylinder closest to the front of the engine is always number 1. However, depending on the engine placement, the front of the engine could either be the flywheel or damper/pulley end. Generally the front of the engine faces the front of the vehicle. Use a number punch or scribe and also mark the main bearing caps from front to rear with the front most cap being number 1 (if there are five caps, mark them 1 through 5, front to rear).

Fig. 1: Place rubber hose over the connecting rod studs to protect the crankshaft and cylinder bores from damage



WARNING

Take special care when pushing the connecting rod up from the crankshaft because the sharp threads of the rod bolts/studs will score the crankshaft journal. Insure that special plastic caps are installed over them, or cut two pieces of rubber hose to do the same.

Fig. 2: Carefully tap the piston out of the bore using a wooden dowel



Again, rotate the engine, this time to position the number one cylinder bore (head surface) up. Turn the crankshaft until the number one piston is at the bottom of its travel, this should allow the maximum access to its connecting rod. Remove the number one connecting rods fasteners and cap and place two lengths of rubber hose over the rod bolts/studs to protect the crankshaft from damage. Using a sturdy wooden dowel and a hammer, push the connecting rod up about 1 in. (25mm) from the crankshaft and remove the upper bearing insert. Continue pushing or tapping the connecting rod up until the piston rings are out of the cylinder bore. Remove the piston and rod by hand, put the upper half of the bearing insert back into the rod, install the cap with its bearing insert installed, and hand-tighten the cap fasteners. If the parts are kept in order in this manner, they will not get lost and you will be able to tell which bearings came from what cylinder if any problems are discovered and diagnosis is necessary. Remove all the other piston assemblies in the same manner. On V-style engines, remove all of the pistons from one bank, then reposition the engine with the other cylinder bank head surface up, and remove that bank's piston assemblies.

The only remaining component in the engine block should now be the crankshaft. Loosen the main bearing caps evenly until the fasteners can be turned by hand, then remove them and the caps. Remove the crankshaft from the engine block. Thoroughly clean all of the components.

1990 Chevrolet CORVETTE

Submodel: | Engine Type: V8 | Liters: 5.7

Fuel Delivery: FI | Fuel: GAS

A thorough overhaul or rebuild of an engine block would include replacing the pistons, rings, bearings, timing belt/chain assembly and oil pump. For OHV engines also include a new camshaft and lifters. The block would then have the cylinders bored and honed oversize (or if using removable cylinder sleeves, new sleeves installed) and the crankshaft would be cut undersize to provide new wearing surfaces and perfect clearances. However, your particular engine may not have everything worn out. What if only the piston rings have worn out and the clearances on everything else are still within factory specifications? Well, you could just replace the rings and put it back together, but this would be a very rare example. Chances are, if one component in your engine is worn, other components are sure to follow, and soon. At the very least, you should always replace the rings, bearings and oil pump. This is what is commonly called a "freshen up".

[Cylinder Ridge Removal](#)

Because the top piston ring does not travel to the very top of the cylinder, a ridge is built up between the end of the travel and the top of the cylinder bore.

Pushing the piston and connecting rod assembly past the ridge can be difficult, and damage to the piston ring lands could occur. If the ridge is not removed before installing a new piston or not removed at all, piston ring breakage and piston damage may occur.

NOTE: It is always recommended that you remove any cylinder ridges before removing the piston and connecting rod assemblies. If you know that new pistons are going to be installed and the engine block will be bored oversize, you may be able to forego this step. However, some ridges may actually prevent the assemblies from being removed, necessitating its removal.

There are several different types of ridge reamers on the market, none of which are inexpensive. Unless a great deal of engine rebuilding is anticipated, borrow or rent a reamer.

1. Turn the crankshaft until the piston is at the bottom of its travel.
2. Cover the head of the piston with a rag.
3. Follow the tool manufacturers instructions and cut away the ridge, exercising extreme care to avoid cutting too deeply.
4. Remove the ridge reamer, the rag and as many of the cuttings as possible. Continue until all of the cylinder ridges have been removed.

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Submodel: | Engine Type: V8 | Liters: 5.7

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Now that the engine block and all of its components are clean, it's time to inspect them for wear and/or damage. To accurately inspect them, you will need some specialized tools:

- Two or three separate micrometers to measure the pistons and crankshaft journals
- A dial indicator
- Telescoping gauges for the cylinder bores
- A rod alignment fixture to check for bent connecting rods

If you do not have access to the proper tools, you may want to bring the components to a shop that does.

Generally, you shouldn't expect cracks in the engine block or its components unless it was known to leak, consume or mix engine fluids, it was severely overheated, or there was evidence of bad bearings and/or crankshaft damage. A visual inspection should be performed on all of the components, but just because you don't see a crack does not mean it is not there. Some more reliable methods for inspecting for cracks include Magnaflux, a magnetic process or Zyglol, a dye penetrant. Magnaflux is used only on ferrous metal (cast iron). Zyglol uses a spray on fluorescent mixture along with a black light to reveal the cracks. It is strongly recommended to have your engine block checked professionally for cracks, especially if the engine was known to have overheated and/or leaked or consumed coolant. Contact a local shop for availability and pricing of these services.

Engine Block

ENGINE BLOCK BEARING ALIGNMENT

Remove the main bearing caps and, if still installed, the main bearing inserts. Inspect all of the main bearing saddles and caps for damage, burrs or high spots. If damage is found, and it is caused from a spun main bearing, the block will need to be align-bored or, if severe enough, replacement. Any burrs or high spots should be carefully removed with a metal file.

Place a straightedge on the bearing saddles, in the engine block, along the centerline of the crankshaft. If any clearance exists between the straightedge and the saddles, the block must be align-bored.

Align-boring consists of machining the main bearing saddles and caps by means of a flycutter that runs through the bearing saddles.

DECK FLATNESS

The top of the engine block where the cylinder head mounts is called the deck. Insure that the deck surface is clean of dirt, carbon deposits and old gasket material. Place a straightedge across the surface of the deck along its centerline and, using feeler gauges, check the clearance along several points. Repeat the checking procedure with the straightedge placed along both diagonals of the deck surface. If the reading exceeds 0.003 in. (0.076mm) within a 6.0 in. (15.2cm) span, or 0.006 in. (0.152mm) over the total length of the deck, it must be machined.

CYLINDER BORES

The cylinder bores house the pistons and are slightly larger than the pistons themselves. A common piston-to-bore clearance is 0.0015–0.0025 in. (0.0381mm–0.0635mm). Inspect and measure the cylinder bores. The bore should be checked for out-of-roundness, taper and size. The results of this inspection will determine whether the cylinder can be used in its existing size and condition, or a rebore to the next oversize is required (or in the case of removable sleeves, have replacements installed).

Fig. 1: Use a telescoping gauge to measure the cylinder bore diameter — take several readings within the same bore



The amount of cylinder wall wear is always greater at the top of the cylinder than at the bottom. This wear is known as taper. Any cylinder that has a taper of 0.0012 in. (0.305mm) or more, must be rebored. Measurements are taken at a number of positions in each cylinder: at the top, middle and bottom and at two points at each position; that is, at a point 90 degrees from the crankshaft centerline, as well as a point parallel to the crankshaft centerline. The measurements are made with either a special dial indicator or a telescoping gauge and micrometer. If the necessary precision tools to check the bore are not available, take the block to a machine shop and have them mike it. Also if you don't have the tools to check the cylinder bores, chances are you will not have the necessary devices to check the pistons, connecting rods and crankshaft. Take these components with you and save yourself an extra trip.

For our procedures, we will use a telescoping gauge and a micrometer. You will need one of each, with a measuring range which covers your cylinder bore size.

1. Position the telescoping gauge in the cylinder bore, loosen the gauges lock and allow it to expand.

NOTE: Your first two readings will be at the top of the cylinder bore, then proceed to the middle and finally the bottom, making a total of six measurements.

2. Hold the gauge square in the bore, 90 degrees from the crankshaft centerline, and gently tighten the lock. Tilt the gauge back to remove it from the bore.
3. Measure the gauge with the micrometer and record the reading.
4. Again, hold the gauge square in the bore, this time parallel to the crankshaft centerline, and gently tighten the lock. Again, you will tilt the gauge back to remove it from the bore.
5. Measure the gauge with the micrometer and record this reading. The difference between these two readings is the out-of-round measurement of the cylinder.
6. Repeat steps 1 through 5, each time going to the next lower position, until you reach the bottom of the cylinder. Then go to the next cylinder, and continue until all of the cylinders have been measured.

The difference between these measurements will tell you all about the wear in your cylinders. The measurements which were taken 90 degrees from the crankshaft centerline will always reflect the most wear. That is because at this position is where the engine power presses the piston against the cylinder bore the hardest. This is known as thrust

wear. Take your top, 90 degree measurement and compare it to your bottom, 90 degree measurement. The difference between them is the taper. When you measure your pistons, you will compare these readings to your piston sizes and determine piston-to-wall clearance.

Crankshaft

Inspect the crankshaft for visible signs of wear or damage. All of the journals should be perfectly round and smooth. Slight scores are normal for a used crankshaft, but you should hardly feel them with your fingernail. When measuring the crankshaft with a micrometer, you will take readings at the front and rear of each journal, then turn the micrometer 90 degrees and take two more readings, front and rear. The difference between the front-to-rear readings is the journal taper and the first-to-90 degree reading is the out-of-round measurement. Generally, there should be no taper or out-of-roundness found, however, up to 0.0005 in. (0.0127mm) for either can be overlooked. Also, the readings should fall within the factory specifications for journal diameters.

If the crankshaft journals fall within specifications, it is recommended that it be polished before being returned to service. Polishing the crankshaft insures that any minor burrs or high spots are smoothed, thereby reducing the chance of scoring the new bearings.

Pistons and Connecting Rods

PISTONS

The piston should be visually inspected for any signs of cracking or burning (caused by hot spots or detonation), and scuffing or excessive wear on the skirts. The wrist pin attaches the piston to the connecting rod. The piston should move freely on the wrist pin, both sliding and pivoting. Grasp the connecting rod securely, or mount it in a vise, and try to rock the piston back and forth along the centerline of the wrist pin. There should not be any excessive play evident between the piston and the pin. If there are C-clips retaining the pin in the piston then you have wrist pin bushings in the rods. There should not be any excessive play between the wrist pin and the rod bushing. Normal clearance for the wrist pin is approx. 0.001–0.002 in. (0.025mm–0.051mm).

Fig. 2: Measure the piston's outer diameter, perpendicular to the wrist pin, with a micrometer



Use a micrometer and measure the diameter of the piston, perpendicular to the wrist pin, on the skirt. Compare the reading to its original cylinder measurement obtained earlier. The difference between the two readings is the piston-to-wall clearance. If the clearance is within specifications, the piston may be used as is. If the piston is out of specification, but the bore is not, you will need a new piston. If both are out of specification, you will need the cylinder rebored and oversize pistons installed. Generally if two or more pistons/bores are out of specification, it is best to rebore the entire block and purchase a complete set of oversize pistons.

CONNECTING ROD

You should have the connecting rod checked for straightness at a machine shop. If the connecting rod is bent, it will unevenly wear the bearing and piston, as well as place greater stress on these components. Any bent or twisted connecting rods must be replaced. If the rods are straight and the wrist pin clearance is within specifications, then only the bearing end of the rod need be checked. Place the connecting rod into a vice, with the bearing inserts in place, install the cap to the rod and torque the fasteners to specifications. Use a telescoping gauge and carefully measure the inside diameter of the bearings. Compare this reading to the rods original crankshaft journal diameter measurement. The difference is the oil clearance. If the oil clearance is not within specifications, install new bearings in the rod and take another measurement. If the clearance is still out of specifications, and the crankshaft is not, the rod will need to be reconditioned by a machine shop.

NOTE: You can also use Plastigageto check the bearing clearances. The assembling section has complete instructions on its use.

Camshaft

Inspect the camshaft and lifters/followers as described earlier in this section.

Bearings

All of the engine bearings should be visually inspected for wear and/or damage. The bearing should look evenly worn all around with no deep scores or pits. If the bearing is severely worn, scored, pitted or heat blued, then the bearing, and the components that use it, should be brought to a machine shop for inspection. Full-circle bearings (used on most camshafts, auxiliary shafts, balance shafts, etc.) require specialized tools for removal and installation, and should be brought to a machine shop for service.

Oil Pump

NOTE: The oil pump is responsible for providing constant lubrication to the whole engine and so it is recommended that a new oil pump be installed when rebuilding the engine.

Completely disassemble the oil pump and thoroughly clean all of the components. Inspect the oil pump gears and housing for wear and/or damage. Insure that the pressure relief valve operates properly and there is no binding or sticking due to varnish or debris. If all of the parts are in proper working condition, lubricate the gears and relief valve, and assemble the pump.

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Submodel: | Engine Type: V8 | Liters: 5.7

Fuel Delivery: FI | Fuel: GAS

Almost all engine block refinishing must be performed by a machine shop. If the cylinders are not to be rebored, then the cylinder glaze can be removed with a ball hone. When removing cylinder glaze with a ball hone, use a light or penetrating type oil to lubricate the hone. Do not allow the hone to run dry as this may cause excessive scoring of the cylinder bores and wear on the hone. If new pistons are required, they will need to be installed to the connecting rods. This should be performed by a machine shop as the pistons must be installed in the correct relationship to the rod or engine damage can occur.

Fig. 1: Use a ball type cylinder hone to remove any glaze and provide a new surface for seating the piston rings



Pistons and Connecting Rods

Only pistons with the wrist pin retained by C-clips are serviceable by the home-mechanic. Press fit pistons require special presses and/or heaters to remove/install the connecting rod and should only be performed by a machine shop.

All pistons will have a mark indicating the direction to the front of the engine and the must be installed into the engine in that manner. Usually it is a notch or arrow on the top of the piston, or it may be the letter F cast or stamped into the piston.

Fig. 2: Most pistons are marked to indicate positioning in the engine (usually a mark means the side facing the front)



C-CLIP TYPE PISTONS

1. Note the location of the forward mark on the piston and mark the connecting rod in relation.
2. Remove the C-clips from the piston and withdraw the wrist pin.

NOTE: Varnish build-up or C-clip groove burrs may increase the difficulty of removing the wrist pin. If necessary, use a punch or drift to carefully tap the wrist pin out.

3. Insure that the wrist pin bushing in the connecting rod is usable, and lubricate it with assembly lube.
4. Remove the wrist pin from the new piston and lubricate the pin bores on the piston.
5. Align the forward marks on the piston and the connecting rod and install the wrist pin.
6. The new C-clips will have a flat and a rounded side to them. Install both C-clips with the flat side facing out.
7. Repeat all of the steps for each piston being replaced.

1990 Chevrolet CORVETTE

Submodel: | Engine Type: V8 | Liters: 5.7
Fuel Delivery: FI | Fuel: GAS

Most engine overhaul procedures are fairly standard. In addition to specific parts replacement procedures and specifications for your individual engine, this section is also a guide to acceptable rebuilding procedures. Examples of standard rebuilding practice are given and should be used along with specific details concerning your particular engine.

Competent and accurate machine shop services will ensure maximum performance, reliability and engine life. In most instances it is more profitable for the do-it-yourself mechanic to remove, clean and inspect the component, buy the necessary parts and deliver these to a shop for actual machine work.

Much of the assembly work (crankshaft, bearings, piston rods, and other components) is well within the scope of the do-it-yourself mechanic's tools and abilities. You will have to decide for yourself the depth of involvement you desire in an engine repair or rebuild.

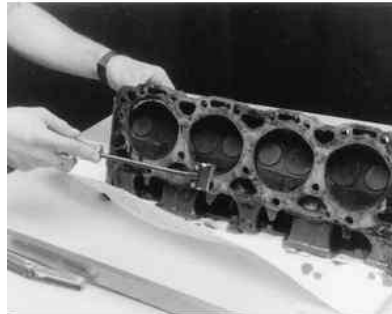
1990 Chevrolet CORVETTE

Submodel: | Engine Type: V8 | Liters: 5.7

Fuel Delivery: FI | Fuel: GAS

Before the engine and its components are inspected, they must be thoroughly cleaned. You will need to remove any engine varnish, oil sludge and/or carbon deposits from all of the components to insure an accurate inspection. A crack in the engine block or cylinder head can easily become overlooked if hidden by a layer of sludge or carbon.

Fig. 1: Use a gasket scraper to remove the old gasket material from the mating surfaces



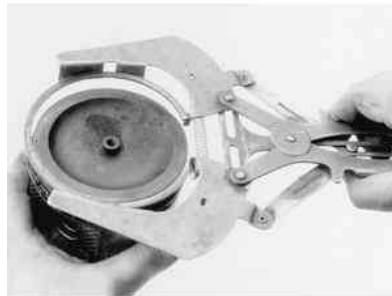
Most of the cleaning process can be carried out with common hand tools and readily available solvents or solutions. Carbon deposits can be chipped away using a hammer and a hard wooden chisel. Old gasket material and varnish or sludge can usually be removed using a scraper and/or cleaning solvent. Extremely stubborn deposits may require the use of a power drill with a wire brush. If using a wire brush, use extreme care around any critical machined surfaces (such as the gasket surfaces, bearing saddles, cylinder bores, etc.). **USE OF A WIRE BRUSH IS NOT RECOMMENDED ON ANY ALUMINUM COMPONENTS.** Always follow any safety recommendations given by the manufacturer of the tool and/or solvent. You should always wear eye protection during any cleaning process involving scraping, chipping or spraying of solvents.

An alternative to the mess and hassle of cleaning the parts yourself is to drop them off at a local garage or machine shop. They will, more than likely, have the necessary equipment to properly clean all of the parts for a nominal fee.

CAUTION

Always wear eye protection during any cleaning process involving scraping, chipping or spraying of solvents.

Fig. 2: Use a ring expander tool to remove the piston rings



Remove any oil galley plugs, freeze plugs and/or pressed-in bearings and carefully wash and degrease all of the engine components including the fasteners and bolts. Small parts such as the valves, springs, etc., should be placed in a metal basket and allowed to soak. Use pipe cleaner type brushes, and clean all passageways in the components. Use a ring expander and remove the rings from the pistons. Clean the piston ring grooves with a special tool or a piece of broken ring. Scrape the carbon off of the top of the piston. You should never use a wire brush on the pistons. After preparing all of the piston assemblies in this manner, wash and degrease them again.

Fig. 3: Clean the piston ring grooves using a ring groove cleaner tool, or . . .



Fig. 4: . . . use a piece of an old ring to clean the grooves. Be careful, the ring can be quite sharp



WARNING

Use extreme care when cleaning around the cylinder head valve seats. A mistake or slip may cost you a new seat.

When cleaning the cylinder head, remove carbon from the combustion chamber with the valves installed. This will avoid damaging the valve seats.

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Submodel: | Engine Type: V8 | Liters: 5.7

Fuel Delivery: FI | Fuel: GAS

Aluminum has become extremely popular for use in engines, due to its low weight. Observe the following precautions when handling aluminum parts:

- Never hot tank aluminum parts (the caustic hot tank solution will eat the aluminum).
- Remove all aluminum parts (identification tag, etc.) from engine parts prior to the tanking.
- Always coat threads lightly with engine oil or anti-seize compounds before installation, to prevent seizure.
- Never overtighten bolts or spark plugs especially in aluminum threads.

When assembling the engine, any parts that will be exposed to frictional contact must be prelubed to provide lubrication at initial start-up. Any product specifically formulated for this purpose can be used, but engine oil is not recommended as a prelube in most cases.

When semi-permanent (locked, but removable) installation of bolts or nuts is desired, threads should be cleaned and coated with Loctite(r) or another similar, commercial non-hardening sealant.

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Submodel: | Engine Type: V8 | Liters: 5.7
Fuel Delivery: FI | Fuel: GAS

Fig. 1: Damaged bolt hole threads can be replaced with thread repair inserts

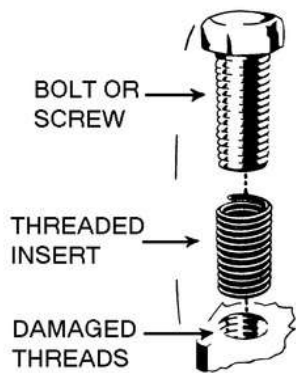


Fig. 2: Standard thread repair insert (left), and spark plug thread insert

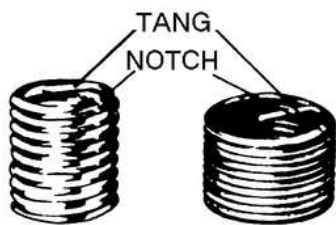


Fig. 3: Drill out the damaged threads with the specified size bit. Be sure to drill completely through the hole or to the bottom of a blind hole



Fig. 4: Using the kit, tap the hole in order to receive the thread insert. Keep the tap well oiled and back it out frequently to avoid clogging the threads

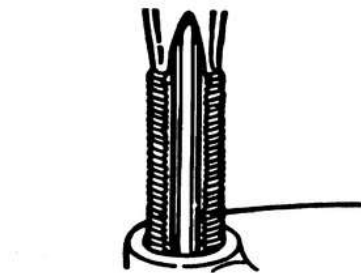
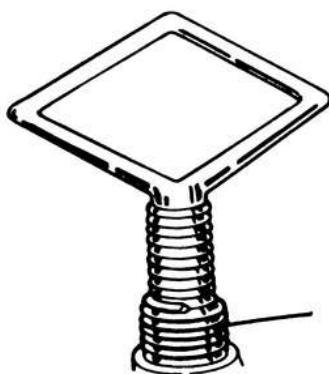


Fig. 5: Screw the insert onto the installer tool until the tang engages the slot. Thread the insert into the hole until it is $\frac{1}{4} - \frac{1}{2}$ turn below the top surface, then remove the tool and break off the tang using a punch



Several methods of repairing damaged threads are available. Heli-Coil(r) (shown here), Keenserts(r) and Microdot(r) are among the most widely used. All involve basically the same principle — drilling out stripped threads, tapping the hole and installing a prewound insert — making welding, plugging and oversize fasteners unnecessary.

Two types of thread repair inserts are usually supplied: a standard type for most inch coarse, inch fine, metric coarse and metric fine thread sizes and a spark lug type to fit most spark plug port sizes. Consult the individual tool manufacturer's catalog to determine exact applications. Typical thread repair kits will contain a selection of prewound threaded inserts, a tap (corresponding to the outside diameter threads of the insert) and an installation tool. Spark plug inserts usually differ because they require a tap equipped with pilot threads and a combined reamer/tap section. Most manufacturers also supply blister-packed thread repair inserts separately in addition to a master kit containing a variety of taps and inserts plus installation tools.

Before attempting to repair a threaded hole, remove any snapped, broken or damaged bolts or studs. Penetrating oil can be used to free frozen threads. The offending item can usually be removed with locking pliers or using a screw/stud extractor. After the hole is clear, the thread can be repaired, as shown in the series of accompanying illustrations and in the kit manufacturer's instructions.

1990 Chevrolet CORVETTE

Submodel: | **Engine Type:** V8 | **Liters:** 5.7

Fuel Delivery: FI | **Fuel:** GAS

The tools required for an engine overhaul or parts replacement will depend on the depth of your involvement. With a few exceptions, they will be the tools found in a mechanic's tool kit (see Section 1 of this manual). More in-depth work will require some or all of the following:

- A dial indicator (reading in thousandths) mounted on a universal base
- Micrometers and telescope gauges
- Jaw and screw-type pullers
- Scraper
- Valve spring compressor
- Ring groove cleaner
- Piston ring expander and compressor
- Ridge reamer
- Cylinder hone or glaze breaker
- Plastigage®
- Engine stand

The use of most of these tools is illustrated in this section. Many can be rented for a one-time use from a local parts jobber or tool supply house specializing in automotive work.

Occasionally, the use of special tools is called for. See the information on Special Tools and the Safety Notice in the front of this book before substituting another tool.

1990 Chevrolet CORVETTE

Submodel: | Engine Type: V8 | Liters: 5.7

Fuel Delivery: FI | Fuel: GAS

To properly rebuild an engine, you must first remove it from the vehicle, then disassemble and diagnose it. Ideally you should place your engine on an engine stand. This affords you the best access to the engine components. Follow the manufacturer's directions for using the stand with your particular engine. Remove the flywheel or flexplate before installing the engine to the stand.

Now that you have the engine on a stand, and assuming that you have drained the oil and coolant from the engine, it's time to strip it of all but the necessary components. Before you start disassembling the engine, you may want to take a moment to draw some pictures, or fabricate some labels or containers to mark the locations of various components and the bolts and/or studs which fasten them. Modern day engines use a lot of little brackets and clips which hold wiring harnesses and such, and these holders are often mounted on studs and/or bolts that can be easily mixed up. The manufacturer spent a lot of time and money designing your vehicle, and they wouldn't have wasted any of it by haphazardly placing brackets, clips or fasteners on the vehicle. If it's present when you disassemble it, put it back when you assemble, you will regret not remembering that little bracket which holds a wire harness out of the path of a rotating part.

You should begin by unbolting any accessories still attached to the engine, such as the water pump, power steering pump, alternator, etc. Then, unfasten any manifolds (intake or exhaust) which were not removed during the engine removal procedure. Finally, remove any covers remaining on the engine such as the rocker arm, front or timing cover and oil pan. Some front covers may require the vibration damper and/or crank pulley to be removed beforehand. The idea is to reduce the engine to the bare necessities (cylinder head(s), valve train, engine block, crankshaft, pistons and connecting rods), plus any other 'in block' components such as oil pumps, balance shafts and auxiliary shafts.

Finally, remove the cylinder head(s) from the engine block and carefully place on a bench. Disassembly instructions for each component follow later in this section.

1990 Chevrolet CORVETTE

Submodel: | Engine Type: V8 | Liters: 5.7
Fuel Delivery: FI | Fuel: GAS

Make the first miles on the new engine, easy ones. Vary the speed but do not accelerate hard. Most importantly, do not lug the engine, and avoid sustained high speeds until at least 100 miles. Check the engine oil and coolant levels frequently. Expect the engine to use a little oil until the rings seat. Change the oil and filter at 500 miles, 1500 miles, then every 3000 miles past that.

1990 Chevrolet CORVETTE

Submodel: | Engine Type: V8 | Liters: 5.7
Fuel Delivery: FI | Fuel: GAS

Now that you have just gone through all of that hard work, keep yourself from doing it all over again by thoroughly maintaining it. Not that you may not have maintained it before, heck you could have had one to two hundred thousand miles on it before doing this. However, you may have bought the vehicle used, and the previous owner did not keep up on maintenance. Which is why you just went through all of that hard work. See?

[5.7L \(VIN 8\) ENGINE SPECIFICATIONS](#)

[5.7L \(VIN 8\) ENGINE SPECIFICATIONS](#)

[5.7L \(VIN 8\) ENGINE SPECIFICATIONS](#)

[5.7L \(VIN 8\) ENGINE SPECIFICATIONS](#)

[5.7L \(VIN J\) ENGINE SPECIFICATIONS](#)

[5.7L \(VIN J\) ENGINE SPECIFICATIONS](#)

[5.7L \(VIN P & 5\) ENGINE SPECIFICATIONS](#)

[5.7L \(VIN P & 5\) ENGINE SPECIFICATIONS](#)

[5.7L \(VIN P & 5\) ENGINE SPECIFICATIONS](#)

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1990 Chevrolet CORVETTE

Submodel: | Engine Type: V8 | Liters: 5.7

Fuel Delivery: FI | Fuel: GAS

Now that the engine is installed and every wire and hose is properly connected, go back and double check that all coolant and vacuum hoses are connected. Check that you oil drain plug is installed and properly tightened. If not already done, install a new oil filter onto the engine. Fill the crankcase with the proper amount and grade of engine oil. Fill the cooling system with a 50/50 mixture of coolant/water.

1. Connect the vehicle battery.
2. Start the engine. Keep your eye on your oil pressure indicator; if it does not indicate oil pressure within 10 seconds of starting, turn the vehicle off.

WARNING

Damage to the engine can result if it is allowed to run with no oil pressure. Check the engine oil level to make sure that it is full. Check for any leaks and if found, repair the leaks before continuing. If there is still no indication of oil pressure, you may need to prime the system.

3. Confirm that there are no fluid leaks (oil or other).
4. Allow the engine to reach normal operating temperature (the upper radiator hose will be hot to the touch).
5. If necessary, set the ignition timing.
6. Install any remaining components such as the air cleaner (if removed for ignition timing) or body panels which were removed.