

Engine Repair


Engine Disassembly and Component Inspection

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Engine Repair

Engine Wear


- engine performance is adversely affected by component wear
- carefully clean, inspect and measure all engine components during disassembly
- suspect components should be replaced or serviced



Engine Repair

Engine Oil and Coolant

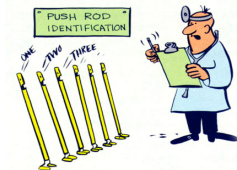
- Drain and inspect engine oil
 - condition of oil
 - evidence coolant
 - evidence of metal
- Drain and inspect coolant
 - condition of coolant
 - evidence of oil



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Identifying Components

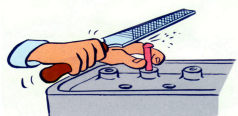
- identify all components for reassembly
- valve train components, lifters, pistons, rods, bearing caps, etc. should be reinstalled in their original location if the parts are reused without machining
- remember to maintain the order during cleaning and inspection



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Disassembling Cylinder Head

- compress the valve spring and remove the keeper hardware
- mushroomed valve stem tips dressed with a file to prevent valve guide damage
- carefully inspect the valve face and seats for evidence of burning or damage



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Ring Ridge Removal


- wear will create a lip at the top of the cylinder where the upper compression ring's travel reaches TDC
- a ridge reamer must be used to cut away the ridge or lip before the piston can be removed



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Cleaning Components

- Block and Cylinder Heads
 - remove core and oil galley plugs
 - remove bearings
 - cast iron components may be cleaned in hot tanks
 - aluminum components may be cleaned in cold tanks or special high pressure parts washers
- Camshafts and Crankshafts
 - hand clean in solvent tanks with soft brushes
- Pistons
 - carbon may be removed by carefully scraping components



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Removing Old Gasket Material

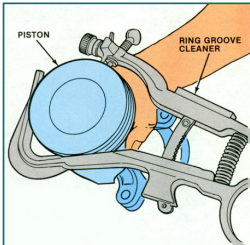
- Old gaskets may be removed
 - by carefully scraping
 - with special solvents
 - wire brushes (not for use on aluminum or soft components)
 - with special pads and die-grinders



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Cleaning Ring Grooves

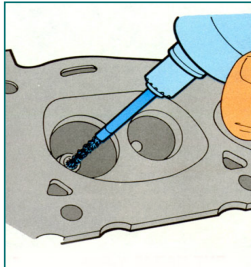
- Carbon can be cleaned from the ring grooves
 - with a ring groove cleaner
 - by carefully scraping the groove with a piece of the old ring or small picks



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Cleaning Valve Guides

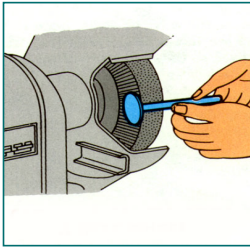
- valve guides must be cleaned before measuring
- a drill operated wire brush and solvent will remove varnish and carbon buildup



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Cleaning Valves

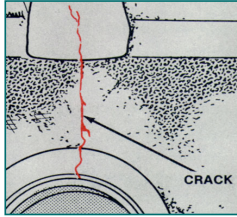
- carbon buildup on the valve head and stems should be removed with a wire wheel mounted on a bench grinder
- solvent can be used to remove varnish buildup on the valve stem



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Crack Detection

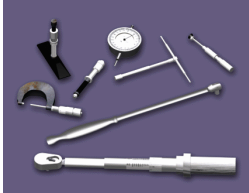
- Careful Visual Inspection
- Magnafluxing
 - iron powder is applied
- Magnetic Fluorescent Inspection
 - iron powder is applied within a liquid
 - cracks appear as white streaks under black lights
- Dye Penetrant
 - cleaner, dye and developer



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Measuring

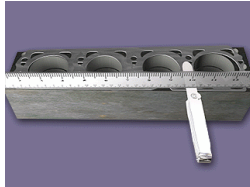
- accurate measurements are critical in proper diagnosis and repair of engines
- be certain your tools are accurate and you know how to use them



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Cylinder Head Flatness


- Variations in flatness should not exceed factory specifications
- 3 cylinder and V6 engines .003" in length and .002" across
- 4 cylinder and V8 engines .004" in length and .002" across
- 6 cylinder engines .005" in length and .002" across



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Valve Spring Inspection

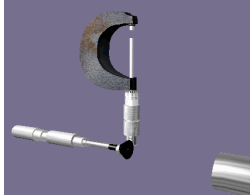
- Valve springs should be checked for
 - knicks, cracks, corrosion
 - squareness
 - free height
 - proper pressure at specified lengths



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Measuring Valve Guides


- valve guides should be measured to check for wear and to determine valve stem to guide clearance
- wear will be greatest at the top and bottom of the guide
- [Watch video](#)



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Valve Inspection


- valve stems should be measured to check for wear and to determine valve stem to guide clearance
- measure the margin
 - if the valve's margin is too narrow the valve will not be able to cool properly
- check the keeper grooves and hardware



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Timing Chain and Gears

- timing chains should be checked for stretching during disassembly by measuring timing chain deflection
- the timing gears should be checked for excessive wear



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Camshaft Inspection

- check journals for wear, pits and grooving
- check lobes for galling, chipping, scoring and abnormal wear
- measure lift
- check the condition of lifters and push-rods

The diagram illustrates two types of lifters: a 'Conventional Lifter' and a 'Roller Lifter'. The conventional lifter is shown with a blue lobe and a lift measurement. The roller lifter is shown with a blue lobe and a lift measurement, along with a 'Degrees of Derivation' measurement. Labels include 'Lobe Taper', 'Lift', and 'Degrees of Derivation'.

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Block Inspection

- main journal bearing bore misalignment should not exceed .0015" on most engines
- the journal bores should also be checked to see if they are within out of round specifications

The diagram shows a hand using a 'STRAIGHTEDGE' and a 'FEELER GAUGE' to inspect the main journal bearing bore in an engine block.

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Cylinder Inspection

- check for cylinder scoring, scuffing, cracking, pitting or discoloration
- minor damage can be corrected with honing and new rings
- major damage may require boring the cylinder oversize or a sleeve

The diagram shows a cross-section of a cylinder with 'SCORES' indicated by a yellow arrow pointing to a dark, damaged area on the cylinder wall.

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Cylinder Out of Round

- the cylinders should be checked to see if they are within out of round specifications
- the difference between the largest and smallest diameters equals the out of round

The diagram shows a circular cross-section of a cylinder with four measurement points: 'FRONT', 'REAR', 'LEFT', and 'RIGHT'. A 'DIAGONAL' measurement is also shown. The difference between the largest and smallest diameters is labeled as 'DIAGONAL'.

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Cylinder Taper

- cylinders must be checked for taper by measuring the the ring's travel at TDC and the ring's travel at BDC
- the cylinder's wear will be greatest at the top of the cylinder

The diagram shows a cross-section of a cylinder with measurements for 'CYLINDER BORE'. The top measurement is 3.685 IN. and the bottom measurement is 3.678 IN. The difference is labeled as 'CYLINDER BORE MEASUREMENTS' with 'TOP ... 3.685 IN.' and 'BOTTOM ... 3.678 IN.' and 'TAPER = 0.007 IN.'

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Piston Inspection


- piston head deposits
- ring groove wear
- excessive piston to cylinder wall clearance
- abnormal combustion
- scoring, scuffing or cracks
- diagonal wear patterns indicating connecting rod misalignment
- most pistons are marked with a notch or an arrow that points toward the timing chain or belt

The image shows a piston with a notch on its side, indicating the timing chain or belt.

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Measuring Piston Diameter

- piston diameter is measured at 90 degrees to the piston pin on the piston skirt
- check the service manual the specific engine you working with



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Ring Wear


- piston rings should be inspected for abnormal wear and are normally replaced any time the piston is removed
- the piston's ring grooves should also be checked for proper side clearance



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Connecting Rod Inspection

- fractures
- bent rods
- carefully inspect the piston and connecting rod bearing for signs of rod misalignment
- bearing bore out of round and taper
- rod nut and bolt damage
- check the piston pin for scoring and excessive wear



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Crankshaft Inspection

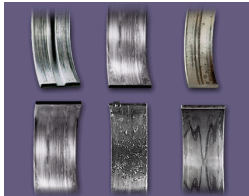
- cracks
- grooves caused by oil seals
- crankshaft key-way condition
- check all threaded bolt holes
- check journals for nicks, burrs, grooves and scoring
- check journals for taper and out of round



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Bearing Damage

- Causes of bearing damage in order of frequency
 - dirt
 - misassembly
 - misalignment
 - insufficient lubrication
 - overloading
 - stress



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Bearing Inspection

- Foreign particles embedded in babbitt
- Foreign particles in back on the back of the bearing
- Surface fatigue
- Bearing cap shift
- Bent or twisted connecting rod
- Out of round bearing bore
- Misshaped Journal
- Misaligned (bent) crankshaft
- Main bearing bore misalignment
- Excessive journal fillets
- Insufficient bearing crush
- Excessive crush
- Insufficient Lubrication
- Excessive heat
- Cavitation

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Oil Pump Inspection

- cover wear
- housing wear
- inner rotor
- outer rotor
- check relief valve spring tension
- normally replaced as a unit and not serviced

